

Project Manual

L'Oreal USA Products NLR Boiler Replacement

11500 Maybelline Rd
North Little Rock, Arkansas 72117

Construction Documents

Project Number: **2025-024**
Issue Date: **04-11-2025**



This page was intentionally left blank for duplex printing.

SECTION 00 01 05

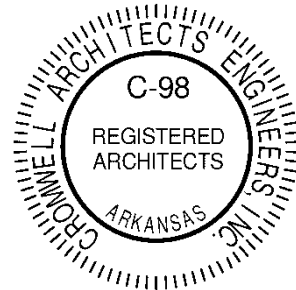
CERTIFICATIONS

I hereby certify that the architectural portions of work included in these plans and specifications, except as otherwise indicated by other registered professionals, have been prepared by me or under my direct supervision, and that I have coordinated the architectural portions with those portions sealed by other registered professionals.

Dan K. Fowler, AIA, Architect
Principal

CROMWELL ARCHITECTS
ENGINEERS, INC.
Architects Engineers
1300 East 6th Street
Little Rock, Arkansas 72202

04-11-2025
Date

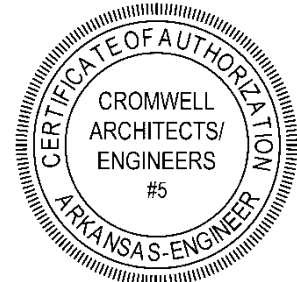


I hereby certify that the electrical portions of work included in these plans and specifications, except as otherwise indicated, have been prepared by me, or under my direct supervision.

Albert Ogenche, PE
Electrical Engineer

CROMWELL ARCHITECTS
ENGINEERS, INC.
Architects Engineers
1300 East 6th Street
Little Rock, Arkansas 72202

04-11-2025
Date

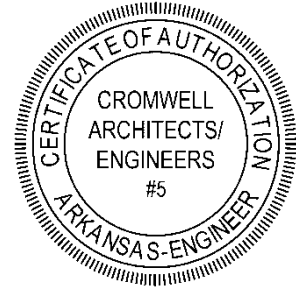
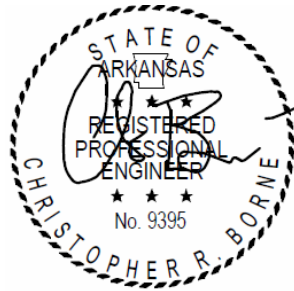


I hereby certify that the mechanical portions of work included in these plans and specifications, except as otherwise indicated, have been prepared by me, or under my direct supervision.

Christopher R. Borné, PE
Mechanical Engineer

CROMWELL ARCHITECTS
ENGINEERS, INC.
Architects Engineers
1300 East 6th Street
Little Rock, Arkansas 72202

04-11-2025
Date



SECTION 00 01 10
TABLE OF CONTENTS

PROCUREMENT AND CONTRACTING REQUIREMENTS

DIVISION 00 -- PROCUREMENT AND CONTRACTING REQUIREMENTS

- 00 01 05 - Certifications Page
- 00 01 10 - Table of Contents

SPECIFICATIONS

DIVISION 01 -- GENERAL REQUIREMENTS

- 01 10 00 - Summary
- 01 30 00 - Administrative Requirements
- 01 32 16 - Construction Progress Schedule
- 01 35 23 - Owner Safety Requirements
 - L'Oreal EHS-001-32 - Prevention of Noise Pollution
 - L'Oreal EHS-001-38 - EHS Assessment of Industrial Contractors
 - L'Oreal EHS-002-18 - Prevention of Electrostatic Risk
 - L'Oreal EHS-002-20 - TI - Manufacturing, Filling, Packing, and Storage of Flammable Liquids
 - L'Oreal EHS-002-27 - TI - Manufacturing, Filling, and Packing of Cosmetic Powders
 - L'Oreal EHS-301-01 - GP - Powered Industrial Trucks
 - L'Oreal EHS-301-10 - GP - Energy Management
 - L'Oreal EHS-301-36 - PG - Lone Work Management
 - L'Oreal EHS-302-10 - TI - Reduction of Energy Consumption
 - L'Oreal EHS-302-17 - Use of Aerosols
 - L'Oreal EHS-302-19 - Prevention and Protection Against Explosion Risks
 - L'Oreal EHS-302-57 - Fire Protection Guide
 - L'Oreal EHS-INS-002 - Management of Internal and External Worksites
 - L'Oreal EHS-INS-003 - Lifting Operations
 - L'Oreal EHS-INS-004 - Excavation Work
 - L'Oreal EHS-INS-005 - Work at Height
 - L'Oreal EHS-INS-007 - Environmental and Climate Adaptation Analysis for the Site
 - L'Oreal EHS-INS-008 - EHS Management of External Contractors
 - L'Oreal EHS-INS-011 - Prevention of Physical Risks Linked to Ergonomics at Workstation
 - L'Oreal EHS-INS-012 - Noise Risk Prevention
 - L'Oreal EHS-INS-017 - Prevention of Slips, Trips, and Falls
 - L'Oreal EHS-INS-018 - Confined Spaces
 - L'Oreal EHS-INS-020 - Hazardous Energies
 - L'Oreal EHS-INS-021 - Man-Machine Interface
 - L'Oreal EHS-INS-023 - Lockout Tagout
 - L'Oreal EHS-INS-030 - Management and EHS Validation of Equipment
 - L'Oreal EHS-INS-036 - Control of Chemical Risks to Health
 - L'Oreal EHS-PRO-016 - Water Management
- 01 40 00 - Quality Requirements
- 01 42 16 - Definitions
- 01 50 00 - Temporary Facilities and Controls
- 01 51 00 - Temporary Utilities
- 01 52 13 - Field Offices and Sheds
- 01 55 00 - Vehicular Access and Parking
- 01 57 21 - Indoor Air Quality Controls

- 01 60 00 - Product Requirements
- 01 60 01 - Substitution Request Form
- 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions
- 01 70 00 - Execution and Closeout Requirements
- 01 78 00 - Closeout Submittals
- 01 79 00 - Demonstration and Training
- 01 91 13 - General Commissioning Requirements

DIVISION 07 -- THERMAL AND MOISTURE PROTECTION

- 07 52 05 - Roofing System Modifications

DIVISION 23 -- HEATING, VENTILATING, AND AIR-CONDITIONING (HVAC)

- 23 05 10 - Basic HVAC Requirements
- 23 05 48 - Vibration and Seismic Controls for HVAC
- 23 05 53 - Identification for HVAC Piping and Equipment
- 23 05 93 - Testing, Adjusting, and Balancing for HVAC
- 23 07 16 - HVAC Equipment Insulation
- 23 07 19 - HVAC Piping Insulation
- 23 08 00 - Commissioning of HVAC Systems
- 23 09 13 - Instrumentation and Control Devices for HVAC
- 23 21 13 - Hydronic Piping
- 23 21 14 - Hydronic Specialties
- 23 22 14 - Steam and Condensate Heating Specialties
- 23 52 13 - Electric Boilers

DIVISION 26 -- ELECTRICAL

- 26 05 05 - Selective Demolition for Electrical
- 26 05 19 - Low-Voltage Electrical Power Conductors and Cables
- 26 05 26 - Grounding and Bonding for Electrical Systems
- 26 05 29 - Hangers and Supports for Electrical Systems
- 26 05 33.13 - Conduit for Electrical Systems
- 26 05 33.16 - Boxes for Electrical Systems
- 26 05 53 - Identification for Electrical Systems
- 26 05 73 - Power System Studies
- 26 24 13 - Switchboards

DIVISION 27 -- COMMUNICATIONS

- 27 05 29 - Hangers and Supports for Communications Systems
- 27 05 33.13 - Conduit for Communications Systems

END OF SECTION

SECTION 01 10 00
SUMMARY

PART 1 GENERAL

1.01 PROJECT

- A. Project Name: L'Oreal New Boiler Replacement.
- B. Owner's Name: L'Oreal USA.
 - 1. Owner Contact: Andrew Goldie; 11500 Maybelline Road, North Little Rock, Arkansas 72117; andrew.goldie@loreal.com.
- C. Architect Engineer's Name: Cromwell Architects Engineers.
- D. Scope of alterations work is indicated on drawings.

1.02 CONTRACT DESCRIPTION

- A. Contract Type: A single prime contract based on a Stipulated Price as described in the Owner-Contractor Agreement.

1.03 OWNER OCCUPANCY

- A. Owner intends to continue to occupy adjacent portions of the existing building during the entire construction period.
- B. Owner intends to occupy the Project upon Substantial Completion.
- C. Cooperate with Owner to minimize conflict and to facilitate Owner's operations.
- D. Schedule the Work to accommodate Owner occupancy.

1.04 CONTRACTOR USE OF SITE AND PREMISES

- A. Construction Operations: Limited to areas as directed by Owner.
 - 1. Locate and conduct construction activities in ways that will limit disturbance to site.
- B. Arrange use of site to allow:
 - 1. Owner occupancy.
 - 2. Work by Others.
 - 3. Work by Owner.
- C. To the greatest extent possible, select means, methods, materials and techniques that will minimize noise and odors and that will not adversely affect occupants. Immediately comply with requests of Owner's representative to stop any such activity and take action to resolve the issue.
- D. Provide access to and from site as required by law and by Owner:
 - 1. Emergency Building Exits During Construction: Keep all exits required by code open during construction period; provide temporary exit signs if exit routes are temporarily altered.
 - 2. Do not obstruct roadways, sidewalks, or other public ways without permit.
- E. Utility Outages and Shutdown:
 - 1. Do not disrupt or shut down life safety systems, including but not limited to fire sprinklers and fire alarm system, without 7 days notice to Owner and authorities having jurisdiction.
 - 2. Existing Utility Interruptions: Do not interrupt utilities serving facilities occupied by Owner or others unless permitted under the following conditions and then only after arranging to provide temporary utility services according to requirements indicated:
 - a. Notify Architect Engineer and Owner not less than 2 days in advance of proposed utility interruptions.
 - b. Do not proceed with utility interruptions without Owner's written permission.
 - 3. Prevent accidental disruption of utility services to other facilities.

1.05 TIME RESTRICTIONS

- A. Coordinate work schedule for system down times with Owner.

1.06 WORK SEQUENCE

- A. Coordinate construction schedule and operations with Owner.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 30 00
ADMINISTRATIVE REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General administrative requirements.
- B. Submittals for review, information, and project closeout.
- C. Administrative and procedural requirements for submitting Shop Drawings, Product Data, Samples, and other submittals.

1.02 RELATED REQUIREMENTS

- A. Section 01 32 16 - Construction Progress Schedule: Form, content, and administration of schedules.
- B. Section 01 60 00 - Product Requirements: Product Options and Substitution Requirements.
- C. Section 01 70 00 - Execution and Closeout Requirements: Additional coordination requirements.
- D. Section 01 78 00 - Closeout Submittals - Closeout Submittals Project record documents, operation and maintenance data, warranties and bonds.
- E. Other Sections for specific requirements for submittals in those Sections.

1.03 REFERENCE STANDARDS

- A. AIA G716 - Request For Information; 2004, or approved equivalent.
- B. AIA G810 - Transmittal Letter; 2001.

1.04 GENERAL ADMINISTRATIVE REQUIREMENTS

- A. Comply with requirements of Section 01 70 00 - Execution and Closeout Requirements for coordination of execution of administrative tasks with timing of construction activities.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SUBMITTALS

- A. Submit to the Owner such shop drawings, data, and schedules as are required by the specifications. Submittals shall be coordinated by the Contractor and prepared by a person thoroughly competent and qualified to prepare submittals and shop drawings. Incomplete or poorly prepared submittals and shop drawings are subject to being returned to the Contractor to be redrawn and resubmitted.

3.02 CONTRACTOR'S REVIEW

- A. Review each submittal and check for coordination with other Work of the Project and for compliance with the Contract Documents. Note corrections and field dimensions. Mark with approval stamp before submitting to Owner.
- B. Coordinate submittals with the Project Construction Schedule.
- C. Do not indicate "By Others," or words to that effect. Coordinate to indicate the Work of the appropriate trade(s).

3.03 SUBMITTALS FOR PROJECT CLOSEOUT

- A. Submit Consent of Surety.
- B. Submit Correction Punch List for Substantial Completion.
- C. Submit Final Correction Punch List for Substantial Completion.
- D. See Section 01 78 00 - Closeout Submittals for additional project record documents requirements.

- E. When the following are specified in individual sections, submit them at project closeout:
 - 1. Project record documents.
 - 2. Operation and maintenance data.
 - 3. Warranties.
 - 4. Bonds.
 - 5. Other types as indicated.
- F. Submit for Owner's benefit during and after project completion.

END OF SECTION

SECTION 01 32 16
CONSTRUCTION PROGRESS SCHEDULE

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Preliminary schedule.
- B. Construction progress schedule, bar chart type.

1.02 REFERENCE STANDARDS

- A. AGC (CPSM) - Construction Planning and Scheduling Manual; 2004.

1.03 SUBMITTALS

- A. Within 10 days after date established in Notice to Proceed, submit preliminary schedule defining planned operations for the first 60 days of Work, with a general outline for remainder of Work.
- B. If preliminary schedule requires revision after review, submit revised schedule within 10 days.
- C. Within 20 days after review of preliminary schedule, submit draft of proposed complete schedule for review.
 - 1. Include written certification that major contractors have reviewed and accepted proposed schedule.
- D. Within 10 days after joint review, submit complete schedule.
- E. Submit updated schedule with each Application for Payment.

1.04 SCHEDULE FORMAT

- A. Listings: In chronological order according to the start date for each activity. Identify each activity with the applicable specification section number.
- B. Diagram Sheet Size: Maximum 22 x 17 inches or width required.
- C. Scale and Spacing: To allow for notations and revisions.
- D. Programs: Use MS Project for project schedule.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PRELIMINARY SCHEDULE

- A. Prepare preliminary critical path schedule in the form of a Gantt Chart.

3.02 CONTENT

- A. Show complete sequence of construction by activity, with dates for beginning and completion of each element of construction.
- B. Identify each item by specification section number.
- C. Identify work of separate stages and other logically grouped activities.
- D. Provide sub-schedules to define critical portions of the entire schedule.
- E. Show accumulated percentage of completion of each item, and total percentage of Work completed, as of the first day of each month.
- F. Provide separate schedule of submittal dates for shop drawings, product data, and samples, and dates reviewed submittals will be required from Architect Engineer. Indicate decision dates for selection of finishes.
- G. Coordinate content with schedule of values specified in Section 01 20 00 - Price and Payment Procedures.
- H. Provide legend for symbols and abbreviations used.

3.03 BAR CHARTS

- A. Include a separate bar for each major portion of Work or operation.
- B. Identify the first work day of each week.

3.04 REVIEW AND EVALUATION OF SCHEDULE

- A. Evaluate project status to determine work behind schedule and work ahead of schedule.
- B. After review, revise as necessary as result of review, and resubmit within 10 days.

3.05 UPDATING SCHEDULE

- A. Maintain schedules to record actual start and finish dates of completed activities.
- B. Indicate progress of each activity to date of revision, with projected completion date of each activity.
- C. Update diagrams to graphically depict current status of Work.
- D. Identify activities modified since previous submittal, major changes in Work, and other identifiable changes.
- E. Indicate changes required to maintain Date of Substantial Completion.
- F. Submit reports required to support recommended changes.
- G. Provide narrative report to define problem areas, anticipated delays, and impact on the schedule. Report corrective action taken or proposed and its effect including the effects of changes on schedules of separate contractors.

3.06 DISTRIBUTION OF SCHEDULE

- A. Distribute copies of updated schedules to Contractor's project site file, to subcontractors, suppliers, Architect Engineer, Owner, and other concerned parties.
- B. Instruct recipients to promptly report, in writing, problems anticipated by projections indicated in schedules.

END OF SECTION

SECTION 01 35 23
OWNER SAFETY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Security measures including entry control, miscellaneous restrictions, and general procedures.

1.02 RELATED REQUIREMENTS

- A. Section 01 50 00 - Temporary Facilities and Controls: Temporary lighting.

1.03 SECURITY PROGRAM

- A. Protect Work, existing premises and Owner's operations from theft, vandalism, and unauthorized entry.
- B. Initiate program in coordination with Owner's existing security system at project mobilization.
- C. Maintain program throughout construction period until directed by Architect Engineer.
- D. Allow any Federal, State or Local inspector, acting in their official capacity, access to the project site.

1.04 ENTRY CONTROL

- A. Restrict entrance of persons and vehicles into Project site .
- B. Allow entrance only to authorized persons with proper identification.
- C. Maintain log of workers and visitors, make available to Owner on request.
- D. Owner will control entrance of persons and vehicles related to Owner's operations.
- E. Coordinate access of Owner's personnel to site in coordination with Owner's security forces.

1.05 RESTRICTIONS

- A. Do no work on Sundays.

1.06 OWNER SAFETY REQUIREMENTS - SEE ATTACHMENTS

- L'Oreal EHS-001-32 - Prevention of Noise Pollution
- L'Oreal EHS-001-38 - EHS Assessment of L'Oreal Industrials Contractors
- L'Oreal EHS-002-18 - Prevention of Electrostatic Risk
- L'Oreal EHS-002-20 - TI - Manufacturing Filling, Packing and Storage of Flammable Liquids
- L'Oreal EHS-002-27 - TI - Manufacturing, Filling and Packing of Cosmetic Powders
- L'Oreal EHS-301-01 - GP - Powered Industrial Trucks
- L'Oreal EHS-301-10 - GP - Energy Management
- L'Oreal EHS-301-36 - PG - Lone Work Management
- L'Oreal EHS-302-10 - TI - Reduction of Energy Consumption
- L'Oreal EHS-302-17 - Use of Aerosols
- L'Oreal EHS-302-19 - Prevention and Protection Against Explosion Risks
- L'Oreal EHS-302-57 - Fire Protection Guide
- L'Oreal EHS-INS-002 - Management of Internal and External Worksites
- L'Oreal EHS-INS-003 - Lifting Operations
- L'Oreal EHS-INS-004 - Excavation Work
- L'Oreal EHS-INS-005 - Work at Height
- L'Oreal EHS-INS-007 - Environmental Analysis and Climate Change Adaptation Analysis for the Site
- L'Oreal EHS-INS-008 - EHS Management of External Contractors

L'Oreal EHS-INS-011 - Prevention of Physical Risks Linked to Ergonomics at the Workstation

L'Oreal EHS-INS-012 - Noise Risk Prevention

L'Oreal EHS-INS-017 - Prevention of Slips, Trips, and Falls

L'Oreal EHS-INS-018 - Confined Spaces

L'Oreal EHS-INS-020 - Hazardous Energies

L'Oreal EHS-INS-021 - Man-Machine Interface

L'Oreal EHS-INS-023 - Lockout Tagout

L'Oreal EHS-INS-030 - Management and EHS validation of equipment

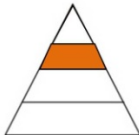
L'Oreal EHS-INS-036 - Control of Chemical Risks to Health

L'Oreal EHS-PRO-016 -Water Management

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

EHS-001-32 A		Issue A	SEPTEMBER 2013
L'ORÉAL GROUP EHS			EHS GENERAL PROCEDURE
<u>Issuer:</u> L'Oréal Group EHS		Prevention of noise pollution	
<u>Distribution:</u> L'Oréal Group EHS			
CONTENTS 1 - PURPOSE 2 - SCOPE 3 - RESPONSIBILITIES 4 - DESCRIPTION 4.1 - Installation design 4.2 - Mapping 4.3 - Limit values 4.4 - Reduction at the source			

1 - PURPOSE

The object of this General Procedure is to describe the organisation put in place in order to prevent environmental noise pollution due to the noise generated by activities on the site.

2 - SCOPE

This noise may be a source of irritation or even pollution for neighbouring inhabitants. This noise may be created by fixed sources (e.g.: fan, compressor, etc.) or mobile sources (trucks, forklifts, etc.).

The reduction of the environmental noise generated by our activities applies to all the personnel on the site.

This document applies to all the production plants and distribution centres of the L'Oréal Group.

In case of differences in requirements between local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3 - RESPONSIBILITIES

The ETNEHS manager is responsible for the mapping of the noise levels at the property limits and the design and implementation of technical measures to reduce the noise levels at the property limits

The heads of department are responsible for the design and implementation of organisational and behavioural measures for reducing noise levels at the limits of the property

4 - DESCRIPTION

4.1 - Installation design

Any new installation likely to have a significant impact on the noise levels at the property limits must be designed with the objective of reducing this impact as much as possible.

If no sufficient technical solution is available, the installation must be placed in a location where it does not constitute a source of noise irritation or pollution to neighbouring inhabitants.

4.2 - Mapping (applicable to factories only)

A measurement of the noise levels at the limits of the property adjoining sensitive areas (living areas, schools, hospitals, etc.) must be taken in order to obtain the emission levels during the day and during the night. The emission levels correspond to the difference between the level obtained when the site is operating normally and the level obtained when the site is shut down (or corresponding to a measurement taken far enough away from the site so as not to be disrupted by the site's activities).

This measurement must be repeated after each significant modification (e.g.: extension of the site, installation of new loud technical equipment on the outside, modification of the product delivery or shipping times, significant modification to the human environment on the site, etc.) likely to significantly change the sound limits at the limits of the property.

The measurement must be done by a specialised external company. Based on these measurements, a mapping must be done.

4.3 - Limit values

The emission levels must be below 5dBA during the day and 3dBA during the night.

4.4 - Reduction at the source

In case of detection of an environmental noise above the applicable standard, noise reduction levels must be taken in accordance with the following principles, in order of priority:

1. Replacement of the noisy equipment with less noisy equipment or modification of the work organisation
2. Soundproofing of the noisy equipment

The action plans must be monitored by the site's EHS.

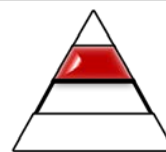
ASSOCIATED EHS DOCUMENTS:

This General Procedure comes under the following Processes:

- *EHS-000-05 Manufacturing*
- *EHS-000-06 Packaging*
- *EHS-000-18 Metrology*

This page was intentionally left blank for duplex printing.

EHS Management of Industrial Contractors

GENERAL
PROCEDURE**Object :** Modification of EHS-001-38 D**Issuer :** L'OREAL Group EHS**Diffusion :** L'OREAL Group EHS**Content of modifications :**

- ZT sites have to have a follow-up within 1 month after the initial audit and a follow up audit within 6 months after the initial audit
- Check in case of new activity

CONTENT

1. PURPOSE.....	2
2. SCOPE OF APPLICATION	2
3. RESPONSABILITIES	2
4. DESCRIPTION	3
4.1. OVERVIEW OF THE PROCESS	3
4.2. SELECTING THE CONTRACTOR SITES TO QUALIFY.....	4
4.3. CONTRACTING THE AUDITOR	4
4.4. PERFORMING THE EHS AUDIT	5
4.5. CLASSIFICATION OF THE 3PL.....	8
4.6. REFERENCING INDUSTRIAL CONTRACTORS	11
4.7. FOLLOW-UP AND MONITORING OF THE AUDIT PROGRAM	11
5. ASSOCIATED EHS DOCUMENTS	12
6. APPENDIXES	13
6.1. APPENDIX 1: AUDIT PROTOCOL.....	13
6.2. APPENDIX 2 : EHS QUESTIONNAIRE	22
6.3. APPENDIX 3: CHECK LIST OF EHS REQUIREMENTS TO VERIFY DURING WOB PROCESS	23



1. PURPOSE

This document describes the objectives and approach in order to EHS qualify and contract an industrial contractor.

A contractor site is a site operated by a company commissioned by L'Oreal for manufacturing and/or packaging activities of semi-finished products or finished products. It includes contractors performing wall-to-wall activities within a L'Oreal manufacturing plant.

An EHS audit is compulsory for qualification purposes when the site handles and/or manufactures hazardous products on behalf of L'Oréal. Below is a non-exhaustive list of activities for which an EHS audit is necessary:

- Processing and/or packaging of flammable liquids (e.g., alcohol, ethyl acetate, etc...)
- Manufacturing of cosmetic powders
- Manufacturing of colouring or decolouring products (e.g., containing ammonia, hydrogen peroxide, sodium persulphate, potassium persulphate or ammonium persulphate)
- Storing, manufacturing and/or packaging of flammable aerosols
- Handling of highly toxic substances (e.g., carcinogenic, mutagenic or toxic for reproduction)

The following terminology is used in the rest of the document:

- Contractor: the company contracted or to be contracted.
- Contractor site: the site operated by the contracted company to be audited and qualified
- Auditor: the company responsible for carrying out the EHS audits and proposing a qualification level for the Contractor
- Purchasing Department: the department responsible for selecting and contracting industrial contractors
- Factory: the L'Oreal entity responsible for paying for the audit, as decided by the Purchasing Department.
- Zone EHS Director: the EHS Manager responsible for the Zone or Division of the Factory
- Group EHS: the EHS Department at Corporate level
- QEHS Audit Group Manager: responsible for monitoring the audit program

2. SCOPE OF APPLICATION

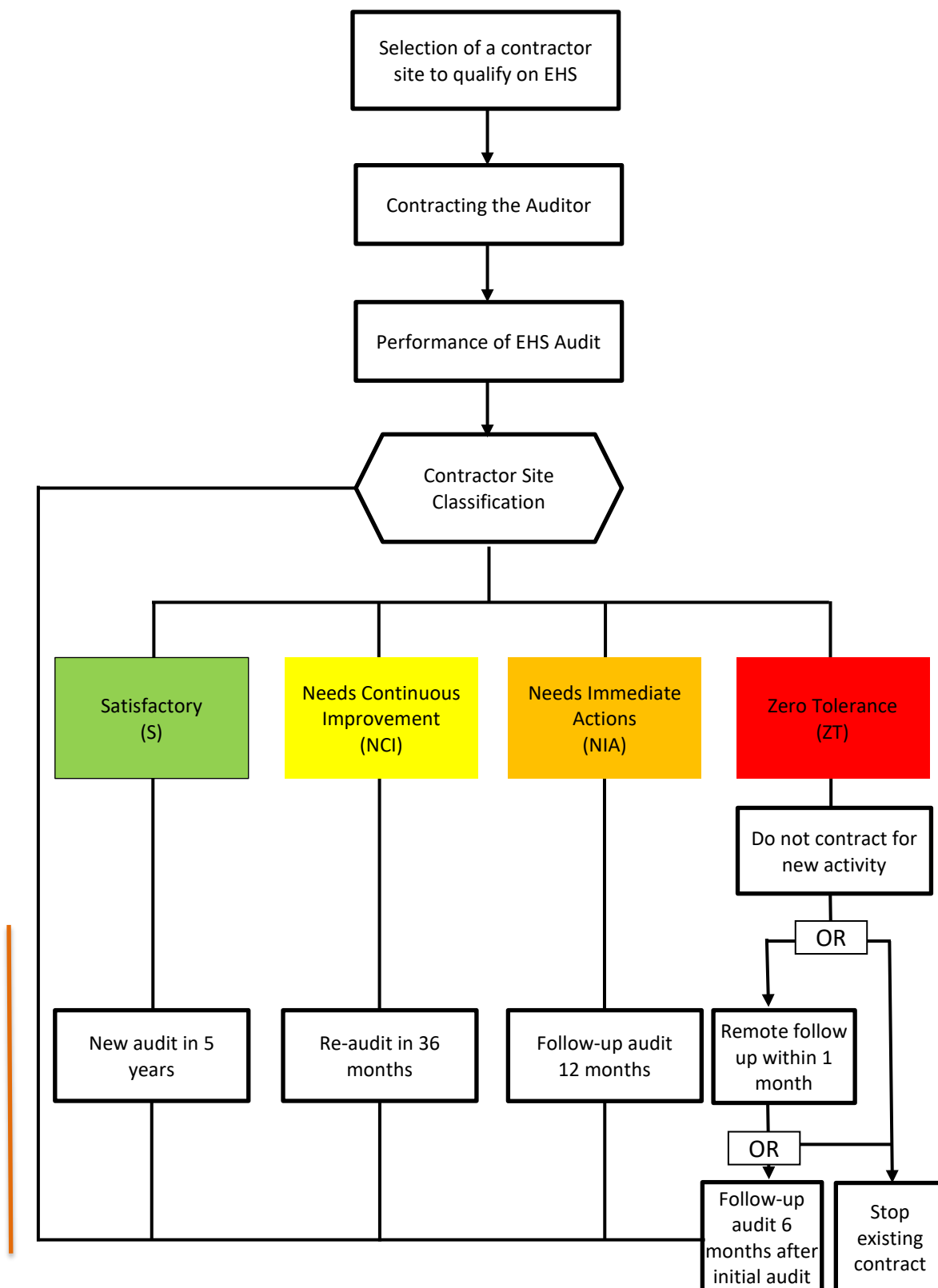
This procedure applies to the Purchasing Department and Factories.

3. RESPONSABILITIES

The Zone EHS Directors and the Purchasing Department are responsible for implementing this procedure

4. DESCRIPTION

4.1. Overview of the process



4.2. Selecting the contractor sites to qualify

The contractor sites to qualify are selected at the last quarter of each year by the purchasing department.

A contractor site subjected to EHS audit (see criteria in Section 1) shall be selected for auditing during the year if meeting one of the following criteria:

- New contractor site not already contracted by us
- Existing contractor site which we intend to contract for a new activity
- Existing contractor site which has never been qualified on EHS
- Existing contractor sites classified ZT, S, NCI or NIA that need to be subjected to a re-audit or follow-up audit during the year.

Twice a year the Purchasing Departments will organize a meeting with the Zone EHS Directors and to review the supplier panel and manage the audit program. This program will be sent to the Group QPEHS Audit Manager for WW consolidation and communication to the Auditor.

4.3. Contracting the Auditor

The following information should be provided to the Auditor for each Contractor site, so they can send a proposal:

- Name of the Contractor and location of site (country, state, town) to be audited
- Nature and volume (number of pallets) of activities to be subcontracted
- Period wished for the audit (Quarter 1, 2, 3 or 4)
- Classification of the site (S, NCI, NIA, ZT or new site)
- Nature of the audit: full audit, re-audit or follow-up audit
- Identification of the entity paying for the audit.

In case a new Contractor site is to be included in the program during the year, the Auditor can be directly contacted by the Purchasing Department.

For sites classified S or NCI subjected to re-audits during the year, as confirmed by the Zone EHS Directors and the Purchasing Department, the Auditor will organize this re-audit. The Auditor will send a proposal to the L'Oréal designated contact, and liaise with the Contractor site to plan and realize the audit.

For sites classified ZT or NIA subjected to a remote follow up / follow-up audit during the year, the Auditor will directly send the proposal to the audited Contractor site. In order to avoid conflict of interest, the proposal shall set out that payment for the follow-up audit shall occur in advance.

4.4. Performing the EHS Audit

4.4.1. Objectives

The audit should allow identifying the EHS issues which can either lead to a business discontinuity or have an impact on the reputation of L'Oreal.

Findings identified are classified in 4 categories as follows:

Level 1	Finding associated with a risk of impact on L'Oréal reputation or could lead to multiple serious injuries/illness or a fatality.
Level 2	Finding associated with a risk of business impact
Level 3	Regulatory finding, not associated with a risk of impact on L'Oreal reputation or business impact
Level 4	Finding not connected with regulation and not associated with a risk of impact on L'Oréal reputation or business impact

Some examples of findings are presented below:

- A risk of administrative sanction (e.g., site closure or large fine) due to non-compliances against applicable EHS regulations
- A risk of accident which could lead to severe injuries or lead to business discontinuity (e.g., destruction of production facilities)
- A risk of environmental impact which could lead to reputational issues (e.g., discharge of toxic products into a river)

The assessment should focus on significant issues only, likely to lead to the consequences described above. The assessment is not therefore to be considered as a detailed inspection or a thorough regulatory compliance audit.

Moreover, the assessment should mainly be performed against applicable or near-future regulations. Good practices can be taken into consideration when there is a lack of regulation to control a specific risk that could lead to a multiple serious accident/illness or a fatality event. applicable to L'Oréal sites. However, some good practices may derive directly from these standards and may be retained when they help control a significant risk not properly controlled by following the local regulation. As illustrated in the examples above, the severity of some issues should be appreciated taking into account the local regulatory context and may then be ranked differently from one country to another. This is why the involvement of local auditor(s) knowing the language and local regulations and enforcement practices is preferable.

4.4.2. Scope of work

The scope of work should cover the following elements:

EHS Management	Occupational Health & Safety
EHS / Integrated permits EHS training EHS regulatory tracking Accident management Management of occupational illnesses	Asbestos containing materials Machine safety Lifting equipment safety Electrical safety Emergency preparedness Hazardous works Works by subcontractors on site Exposure to indoor noise and vibrations Exposure to hazardous chemicals Vehicle (e.g., forklift truck) and pedestrian safety
Fire Safety	Environment
Process safety management Fire protection Emergency preparedness	Air emissions Wastewater discharge Waste management Storage of hazardous materials Water supply Energy supply Use of ozone depleting substances Presence of PCB Management of radioactive materials Soil and groundwater contamination Environmental noise

The appendix 1 presents an audit protocol for each topic.

4.4.3. Performance of the audit

Who	Task	Comment
	1 - PREPARATION	
Zone Directors and Purchasing Department	- Review the supplier panel and manage the audit program - Inform Group QPEHS Audit Manager of the audit program	
Group QPEHS Audit Manager	- Consolidate all the zones audit program - Contacts the Auditor to give the green light for them to contact the Site	

Who	Task	Comment
Auditor	Manage the Audit Program - Send proposal to L'Oréal designated contact for new sites or previously audit sites that were Satisfactory or NCI. Send proposals to contractor site for Purchase Order for those sites previously ZT or NIA. - Contacts the Contractor site to inform about the audit - Contacts the Contractor Site to organize the logistics and ask key questions to prepare the agenda - Send a documentation request list and agenda at least 2 weeks before the audit	During the initial call, the Auditor needs to clarify the site EHS organization, what hazardous activities are performed on site (e.g., storage of aerosols), PPE's to bring and whether there is some access restraints
2 - EXECUTION		
Auditor	Opening meeting	Remind about the objective of the audit Verify availability of auditees and documentation
Auditor	Review of EHS topics	Following the audit protocol in Appendix 1
Auditor	Close-out meeting	List the main issues identified, but do not disclose the level of the findings identified.
3- REPORTING		
Auditor	Sends the Draft report to Zone EHS Directors for comments	The report highlights the Contractor site classification, the next steps and contains a description of the findings, corresponding level and recommendations.
Auditor	Issue the Final report to the Group QPEHS Audit Manager, the Zone EHS Directors, the Purchasing Department and to the Contractor Site	
Group QPEHS Audit Manager	Archive the results and audit report on WW Audit platform	Results are available on the platform
4- Follow up		
Auditor	- Liaise with Contractor site to follow up action plan - Organise when requested the remote follow up within 1 month (ZT) - Organise when requested the follow up audit within 12 months (NIA) (→ contact, submit quote, get order and payment from Contractor site and plan the audit) - Organise when requested the follow up audit within 6 months (ZT) (→ contact, submit quote, get order and payment from Contractor site and plan the audit)	

4.5. Classification of the 3PL

4.5.1. Methodology

The classification of a Contractor Site depends on the number of Level 1 and Level 2 findings identified:

CLASSIFICATION	CRITERIA
S Satisfactory	No Level 1 or Level 2 finding.
NCI Need Continuous Improvement	Less than 5 Level 2 findings, and no Level 1 finding or 1 or 2 Level 2 repeat findings and no Level 1 repeat finding
NIA Need Immediate Action	At least 5 Level 2 findings or one Level 1 finding. or 3 or 4 Level 2 repeat findings and no Level 1 repeat finding
ZT Zéro Tolerance	At least two Level 1 findings or At least one Level 1 repeat finding

A repeat finding is a finding identified during the previous audit which has not been closed or upgraded. An initial Level 1 and/or Level 2 finding may be upgraded to Level 3 or even Level 4 as a result of a re-audit or follow-up audit if the controls put in place since the previous audit, even if not allowing closing the finding, are sufficient to justify this upgrade.

The methodology for classification can also be summarized by the following tables:

Total number of findings (including repeat findings)		Number of Level 1 findings		
		0	1	>1
Number of Level 2 findings	0	S	NIA	ZT
	<5	NCI	NIA	ZT
	≥5	NIA	NIA	ZT

Total number of repeat findings		Number of Level 1 repeat findings		
		0	1	>1
Number of Level 2 repeat findings	0	S	ZT	ZT
	1 or 2	NCI	ZT	ZT
	3 or 4	NIA	ZT	ZT
	≥5	ZT	ZT	ZT

4.5.2. Consequences

This classification gives rise to the following actions:

Result	Action from the Purchasing Department	Action from the Auditor	Next steps
S Satisfactory	Letter announcing the result and encouraging to pursue the improvement actions.		Full audit within 5 years
NCI Need Continuous Improvement	Letter announcing the result with request to send an action plan within 30 days.	The auditor asks for the action plan to the supplier when sending the report. Receipt and review of the Priority 2 actions plan. The review aims at determining whether the actions proposed by the supplier within the next 3 years allows reclassifying the site from NCI to S. In case no action plan is received within 30 days, the Auditor directly requests the Contractor before the deadline, copy the purchasing department. In case no action plan is then received in a reasonable time, the site will be declassified as NIA.	Re-audit within 3 years, paid by L'Oreal. If at least 3 Level 2 findings identified during the previous audit have not been closed or upgraded, then the site classification is downgraded to NIA.
NIA Need Immediate Action	Letter announcing the results and requirement for sending an action plan within 30 days and the needs for a follow-up audit within one year maximum. The purchasing department contacts the Auditor once the Contractor has been informed.	The Auditor asks for the action plan to the Contractor when sending the report. Receipt and review of the level 1 and 2 actions. The review aims at determining whether the actions proposed by the Contractor within one year allows reclassifying the site from NIA to NCI or S. Once the Contractor has been contacted by the purchasing department for the follow-up audit, the Auditor will contact the Contractor to arrange for the follow-up audit.	Follow-up audit within 1 year, paid by the Contractor. If the Level 1 and/or if at least 5 Level 2 findings identified during the previous audit have not been closed or upgraded, then the site classification is downgraded to ZT. If no repeat Level 1 finding and at least 3 Level 2 repeat findings are identified, the site remains classified as NIA. In order to avoid any conflict of interest, the Auditor will have to ask for full payment in advance to the Contractor.

Result	Action from the Purchasing Department	Action from the Auditor	Next steps
ZT Zero Tolerance	Contracting a new site will be not possible as long as the site remains classified ZT. In case of existing site, contracting for a new activity or increasing existing activity will not be possible as long as the site is classified ZT. The purchasing department can decide after approval from the Zone EHS Director either to stop the process with the subcontractor either on a remote follow-up no later than 1 month after the initial audit in order to check an action plan is established and corrective actions have been started / planned and a follow up audit within 6 months after the initial audit. In case the remote follow up is not satisfying, a meeting with zone EHS director have to be set up in order to validate the strategy with the subcontractor. In case the follow up audit confirms the ZT ranking then exit should be confirmed and implemented as soon as contractually possibly. In case of significant penalties in case of anticipated breach of contract, as a minimum the quantity of products stored must not be increased until exit is possible. In case no follow-up audit is performed within 6 months after the initial audit, the site is deemed as being unqualified and should therefore be subjected to a new audit in case it is decided to contract the site.	In case a follow-up audit is decided, the measures to be followed by the Auditor are the same as for a NIA site. Some corrective actions as agreement from authorities can require more than 6 months to be closed, in this case, the auditor will have to make sure required steps have been done and that the initial timing will be respected.	A ZT site can be subjected to a follow-up audit after the initial audit, paid by the Contractor. This needs to be decided by the Purchasing Department If at least one Level 1 finding from the previous audit is not closed or upgraded, the site will remain classified as ZT

4.6. Referencing industrial contractors

4.6.1. New contractors

1. Preselection of contractor on their ability to meet the needs
2. Initiate the Welcome On Board (WOB) process, including
 - The EHS questionnaire to capture whether they will handle and/or manufacture hazardous products on behalf of l'Oréal (Appendix 2)
 - And the Check list of EHS requirement (Appendix 3)
3. Supplier will submit their answers.
4. Purchasing department will liaise with Zone EHS Director to analyse the supplier's answers and decide accordingly whether an EHS audit needs to be organised.
5. Plan accordingly the EHS Audit.
6. Referencing can pursue after receiving audit results

4.6.2. Modification of existing contracts

In case the contractor's activity didn't require an EHS audit, check if the new activity requires one. In such case, apply this procedure.

4.7. Follow-up and monitoring of the audit program

The Auditor will carry out a monthly monitoring of the auditing program listing all the audited Contractor sites and Contractor sites to be audited. For each audited site, the Auditor will provide:

- Name of Contractor and Site
- Recap of audits (dates) and status (initial audit, re-audit, follow-up audit, new full audit)
- Activities subcontracted (flammable aerosols or other products)
- Number of Level 1 and 2 findings and repeat findings
- The last score (ZT, NIA, NCI or S)
- The deadline for the next audit
- The Factory
- Information on next audit if forecasted (planned date, Order status (bid submitted, waiting for Order, Order received))

These recaps will be communicated to the QPEHS Audit Manager.

The QPEHS Audit Manager will upload and maintain the EHS audit classification in the WW audit platform.

5. Associated EHS documents

This General procedure comes under the Processes EHS-300-16 Purchasing and EHS-000-17 Audit and Inspections. It is also associated with the Purchasing General Procedure CM-WW-P01B.

6. APPENDIXES

6.1. Appendix 1: Audit protocol

The following presents the key aspects to review for each topic. This list is not exhaustive and the auditors should use their experience to assess significant issues, in light of what is described in section 2 of this document.

6.1.1. Environment

Environmental management

- Assess whether the environmental resources (e.g., environmental manager) on site are sufficient and qualified
- Determine whether an environmental management system has been implemented

Permitting

- Review whether the permits to operate or integrated permits are up-to-date and properly held on site.
- Review the potential new projects in light of potential permitting issues (e.g. storage of new products not covered by the current permit, etc.)

Air emissions

- Review whether air permits are up-to-date
- Review whether air emissions are properly stacked and treated as required
- Determine whether air emissions comply with applicable limit values
- Assess whether air emissions can create an off-site impact (e.g., emission of black fumes, emission of toxic materials in significant quantity, etc.)

Wastewater discharge

- Review whether wastewater discharge permits have been obtained and are up-to-date
- Review whether wastewater is properly drained (e.g., segregation of process wastewater, sanitary wastewater and rainwater) and treated as required
- Determine whether wastewater discharge complies with applicable limit values
- Assess whether wastewater discharge can create an off-site impact (e.g., discharge of toxic materials in significant quantity into a river, etc...)

Water supply

- Review whether water supply permits are up-to-date
- Determine whether the site complies with the applicable water consumption limit values
- Assess whether the site has a significant impact on water resources

Energy supply

- Determine the direct and indirect sources of energy (e.g., coal, fuel oil, gas) used by the site

- Determine whether these sources are subjected to regulations restraining their usage
- Determine whether there are discontinuities in energy supply (e.g., electricity) and how the site is protected against that (e.g., back-up generator)

Storage of hazardous materials

- Review any past incident in relation to spillage
- Observe whether the loading/unloading areas and the storage areas are properly equipped to prevent the risks of spillage into the environment (e.g., secondary containment)
- Determine whether a spill control procedure is in place and whether the employees handling chemicals are properly trained in case of spillage

Waste management

- Review that the waste permits are up-to-date
- Review whether there is proper traceability of waste disposal until the final destination of waste
- Determine whether the off-site disposal facilities are properly licensed
- Assess whether there is a risk of current or future liability or off-site impact associated with on-site or off-site waste disposal

Asbestos materials

- Assess whether there is a risk of presence of asbestos materials on site which employees can be exposed to and how the identified materials are managed (identification, conditions assessment, information of the employees and external companies working in the area, etc.)
- Should it be the case, review the asbestos management plan to remove or confine these materials

PCB

- Review whether the site has identified the presence of PCB on site (e.g., in transformers, in capacitors, etc.)
- Should PCB is present on site, determine whether this is acceptable by law
- Review whether the equipment containing PCB are properly equipped with secondary containment

Ozone Depleting Substances (ODS)

- Determine whether the site only uses authorized ODS
- Should it be not the case, determine whether a replacement plan has been defined

Radioactive materials

- Determine whether radioactive materials are used on site and for what purpose

- If radioactive materials are used on site, determine whether competent people are qualified to manage and handle these materials, including radioactive waste
- Review the storage condition of radioactive materials and waste

Noise

- Determine whether the site is the source of significant noise or vibrations that could lead to off-site impacts (e.g., complaints)
- Determine whether the site complies with regulations with regards to environmental noise and vibrations

Soil and groundwater contamination

- Assess whether a soil and/or groundwater contamination due to past or present activities is present or likely to be present on site
- Assess whether this contamination could trigger significant liabilities
- Assess whether this contamination could lead to significant off-site impacts

6.1.2. Occupational Health and Safety

H&S management

- Determine whether employees H&S representatives have been nominated as required
- Assess whether the H&S resources (e.g., H&S manager) on site are sufficient and qualified
- Determine whether a H&S management system has been implemented
- Review the H&S training program
- Review the accident and occupational illnesses reporting and investigation process

Industrial hygiene

- Assess the risks of exposure to chemicals and dust for site employees
- Assess the level of indoor noise and vibrations the employees are exposed to
- Determine whether the controls put in place are sufficient

Physical risks

- Assess the risks of collision between vehicles (e.g., forklift trucks) and pedestrians
- Assess whether machines and tools used on site present significant risks for employees
- Assess whether lifting equipment used on site are properly maintained and used by trained employees
- Assess whether electrical installations are properly maintained by qualified electricians
- Review the control of hazardous works performed by employees or subcontractors, such as hot/cold work, confined space entry, work at height, digging works.

- Review the processes in place to manage works performed by subcontractors on site

6.1.3. Fire and process safety

Fire protection

- Determine whether fire and explosion risks have been properly identified by site management (e.g., ATEX study in Europe)
- Assess whether chemicals are properly stored and handled on site to prevent the risks of fire
- Assess whether sufficient controls have been put in place to prevent the risk (e.g., non-sparking tool and ex-proof electrical equipment used in explosive risk areas) or mitigate the consequences of a fire or explosion (e.g., extinguishers, fire hoses, sprinklers, fire walls, etc.), in compliance with regulation or good practices

Process safety

- Determine whether manufacturing processes using hazardous substances have been subjected to risk studies
- Assess whether the level of risk control on manufacturing processes is sufficient (including training of employees)

Emergency preparedness

- Determine whether the site has drafted and communicated an emergency plan
- Review the quality of this emergency plan (e.g., does it include the communication to authorities)
- Assess whether the resources (e.g., alarm, emergency team) involved in case of emergency sufficient and qualified
- Assess whether the employees are properly trained to react in case of emergency

6.1.4. Specific risks

L'Oreal may subcontract operations associated with products presenting specific risks. The present section aims at presenting these risks and how to assess them during the audit. A number of elements helping to assess if the risks are under control are listed. The exhaustive verification of all these elements is not compulsory, the auditor needing to use his/her experience to assess the control of risks before all.

Aerosols

Description of risks

Specific risks related to the handling and storage of aerosols are a permanent concern for L'Oreal. A can of aerosol contains a bulk that is made available to the user in the form of fine droplets (aerosol spray) that are forced through a thin nozzle by a gas under pressure (propellant). The aerosols of L'Oreal have, by their nature, specific ignition hazards that are characterised by the fact that, in the majority of cases:

- The propellants are liquefied combustible gases
- The bulk is itself alcohol based and therefore flammable

A tremendous amount of heat is given off by the combustion of aerosols.

All aerosols are individually tested in order to ensure that they are capable of resisting an increase in internal pressure when they are heated up to 50°C, or 55°C, depending on local rules.

When an aerosol is heated above this temperature, the increase in pressure inside the container can be such that it causes the container to burst and thus to instantaneously liberate alcohol vapors and / or combustible gases. In general, a volume of around 2 meters diameter of flammable atmosphere can then be formed. If ignited, this area could cause the instantaneous creation of a fireball, capable of burning anyone in its vicinity.

The bursting of the container may occur through the unsetting of the valve or of the bottom which may cause a small opening. In the event of ignition, the progressive combustion of flammable materials can then cause a phenomenon comparable to a small fuse and the ignited aerosol can be propelled and transfer the fire over considerable distances, reaching up to tens of meters (sometimes up to more than 100 meters).

It is also important to mention that numerous other cases of the liberation into the atmosphere of flammable gases contained in aerosols can occur by a container bursting, for example when a materials handling machine runs over an aerosol can that has fallen and been left on the ground, when a materials handling machine strikes a pallet of aerosols or when aerosol boxes fall from a pallet rack. It has also been observed that, after boxes have fallen or when loads are placed on aerosol boxes or pallets, the deformation of the boxes can have an effect on the overcaps and then set off the aerosol valves liberating, in this manner, flammable gases.

Due to both the considerable heat given off and the projection of aerosols, fire fighting services encounter difficulties in directly fighting aerosol fires and intervening in the area where the fire occurs.

In addition, these fires have a fearsome character due to the aerosols bursting in close succession and the noise that this causes.

Risk assessment

The following points should be verified during the assessment, beyond the local regulations:

- In order to prevent secondary debris from explosion, aerosol storage areas should be either separated by a wall or by a grid from other areas
- Storage of aerosols in stack should be avoided
- Racks containing aerosols should be equipped with sprinkler system compliant with the NFPA 30B Code or equivalent, at each level
- The aerosol storage areas should be equipped with smoke detection systems
- Employees handling aerosols (e.g., forklift truck drivers) should be aware of their risk and how to react in case of emergency
- Forklift trucks handling pallets of aerosols should be equipped with forks that cannot generate sparks
- The facility containing aerosols should be constructed in non-combustible materials
- No aerosol can or pallet should be left lying on ground

- Storage pallets should be stored in a stable position
- Sufficient ventilation should be present in confined spaces where aerosols are used (e.g., filling areas)
- Smoking prohibition should be strictly enforced on all the areas where aerosols are present.

Bleaches

Description of risks

Bleaches are constituted by a mixture of sodium persulphate, potassium persulphate and/or ammonium persulphate, as well as additives. The persulphates are strong oxidizers, which then may trigger fire in presence of flammable materials. They also react violently in contact of reductive substances. Auto-ignition temperature is 100°C. Persulphates also decompose in presence of water. The presence of organic substances will trigger exothermic reaction depending on temperature, volume and time. Ammonium persulphate is known to be the most unstable substance of the three persulphates. Persulphates also decompose in contact with metals such as aluminium. At last, persulphates are sensibilizing agents. Some users of these substances and bleaches are known to have suffered from allergic skin reaction and asthma.

The additives used to make bleaches are either mineral or organic powders. Risks posed by organic powders depend on their minimum energy emission (energy input necessary to ignite a cloud of powders), their auto-ignition temperature and their lower and upper explosive limits (concentrations within which a cloud of powder can explode). As a consequence, the use of organic powders is subjected to the ATEX Directive.

As a consequence of mixing organic powders and persulphates to form bleaches, the finished product may be unstable depending on storage temperature, volume and time. In order to avoid risks, manufacturing, storage and transportation activities shall be performed under very strict controlled conditions.

Risk assessment

The following points should be verified during the assessment, beyond the local regulations:

Reception and storage of raw materials

- Check whether management and operators are trained on the risks, precautions and emergency measures taken in relation with persulphates and organic powders
- Verify whether the storage of persulphates is segregated from the storage of incompatible substances such as reductive substances, metals, flammable substances, organic powders and water.
- Check whether a sprinkler system is installed at the persulphate storage area, compliant with NFPA 430 or 432 standard or equivalent (standard used for fertilizer storage areas).
- Check whether material safety data sheet of all the materials entering into the bleaches are readily available and precautions recommended in the MSDS implemented
- Verify the emergency measures in case of fire and spillage of persulphate.

Weighing operations

- Check whether management and operators are trained on the risks, precautions and emergency measures taken in relation with persulphates and organic powders
- A complete ATEX study shall be performed on the weighing operations and weighing booths of organic powders shall be made compliant with the recommendations of this study.
- Check whether sufficient precautions are taken to avoid contact of persulphates with operators (e.g., linear flow booth, regular cleaning, complete personal protection, etc.).

Processing operations

- Check whether management and operators are properly trained on the risks, precautions and emergency measures taken in relation with the raw materials and bleaches
- Check whether complete process safety studies are available for each bleach formula and if they clearly identify the critical temperature, volume and time values not too exceed during processes and storage
- Check whether the process safety studies identify the prevention measures to be taken to avoid an accident
- Check whether these prevention measures are implemented and include as a minimum the monitoring of temperature during the process with a first threshold triggering the stoppage of the process and a higher threshold triggering the sprinkler system
- Check whether risk analysis associated with process equipment have been performed and include the exhaust and filtering system
- A complete ATEX study shall be performed on the processing operations (including exhaust and filtering systems) and the equipment shall be made compliant with the recommendations of this study.
- Check whether operators are properly protected against contact with the raw materials and products. Visual signs of the result of insufficient protection level can be witnessed through presence of dry redness on skin for instance.
- An emergency plan should be developed in relation to the risks presented by persulphates and bleaches and regularly tested
- The room should be equipped with a sprinkler system allowing to completely drowning the process in case of fire
- Check whether measures have been implemented to limit the consequences of an explosion
- Check the maintenance operations, with a specific focus on the exhaust and filtering systems.

- The level of housekeeping and cleanliness in the room should be of very high standard
- Check whether precautions are taken to avoid health and explosion/fire risks during cleaning and maintenance operations
- Verify the waste management procedure: wastes should be handled, stored and transported in a safe way given their hazards, certified contractors should be used to dispose of hazardous waste and should be audited.

Storage of bleaches

- Check whether management and operators are properly trained on the risks, precautions and emergency measures taken in relation with the bleaches
- The conditions (temperature, volume and time) of storing bleaches shall be clearly defined and controlled.

Transportation of bleaches

The transportation of bleaches shall respect the hazardous transportation regulation concerning oxidizers. Specific precautions shall be taken to ensure that the products are transported in a safe package and under safe conditions. Check whether a safety advisor as per hazardous transportation regulation has been designated and is properly qualified.

Packaging

The site may or may not condition bleaches. Should it be the case, the following precautions shall be reviewed:

- No contact is made with the product in case of intervention in the packaging line or of sensitive operations (e.g., closing a package). This is ensured by proper PPE wearing.
- A sufficient extraction system is installed in the filling booths
- Management and operators should be properly trained on the risks, precautions and emergency measures taken in relation with the bleaches.

Cosmetic Powders

Description of risks

The cosmetic powders, such as eye shadows, blushes or free and compact powders, are combustible powdered products that are capable of causing fires and, under certain conditions, explosions. These risks are particularly high when powdered products are heated or used in the presence of energy sources. For these reasons, it is indispensable to ensure cosmetic powder production operations and, in particular, milling operations, are properly controlled.

Virtually all of L'Oréal's cosmetic powders are combustible. Cosmetic powders in layers or the raw materials used in their formulation are therefore capable of leading to fires when they are ignited or to explosions through ignition of a cloud.

These cosmetic powders or the raw materials used in their formulation, are, like all powdered products, solid particles with very small dimensions, which settle under the effect of their own

weight but which can remain in suspension in the air for a certain time, thus forming clouds. The particle size is therefore a particularly important characteristic since it influences the ability of the powders to form stable clouds, but it does not constitute a necessary and sufficient criterion to exclude the explosive nature of a powder.

The ease of ignition of powdered products is determined by the minimum values of the following characteristics:

- ignition energy (MIE : Minimum Ignition Energy)
- auto-ignition temperature in layers or in clouds,
- flammable limits.

Risk assessment

The following points should be verified during the assessment, beyond the local regulations:

- Are all persons who work in cosmetic powder production installations receiving prior training covering the risks linked to the use of powders?
- Are the production equipment and the whole production circuit containing powders leak tight?
- Is the extracted air purified in a dust collector?
- Are the extraction fans located in fresh air, downstream of the air/dust filter (in order to avoid contact between dusts / fan blades)?
- Is the dust collector protected against explosions?
- Is the general ventilation of the workshop designed to avoid dusts forming clouds?
- Is the workshop where cosmetic powders are used maintained clean at all times?
- Is a fire permit required for all hot work?
- Is smoking prohibited in the powder manufacturing premises?
- Is the electrical equipment appropriate for use in explosive dust atmospheres?
- Are all of the metal parts of the installation connected together in order to ensure equipotentiality of masses and proper earthing?
- Are packaging components conductors of static electricity preferably used?
- Do the dividing walls between the production premises and the remainder of the building have a 2 hour fire rating?
- Are the premises equipped with a sprinkler system?
- Is preventive maintenance programme put in place as well as documentary traceability?

6.2. Appendix 2 : EHS questionnaire

The following questionnaire will be send to the supplier to capture whether the site handles and/or manufactures hazardous products on behalf of L'Oréal.
Decision to order an EHS audit will be taken with the Zone EHS director.

L'Oreal EHS QUESTIONNAIRE		
Instructions: Fill in the light red boxes		
Supplier Name:		Internal L'Oreal reference : SAP or SRM PO# : 4XXXXXXX
Manufacturing site address:		
Manufacturing site state/province:		
Manufacturing site country:		
Site EHS contact name:		
Site EHS contact email:		
Account manager name:		
Account manager email:		
Size of facility (indicate M ² or Square feet):		
Number of employees:		
MANUFACTURING ACTIVITIES		
1) To manufacture items for L'Oréal, do you handle the following: Processing and/or packaging and/or storage of flammable liquids (e.g., alcohol, ethyl acetate,	Yes/No Click here	Comments, if applicable
1a) If yes, what is the minimum and maximum volume of flammable liquid that is stored at your facility?		
1b) If yes, what is the minimum and maximum volume of flammable liquid that is used in processing at your facility?		
2) To manufacture items for L'Oréal, do you handle the following: Manufacturing of cosmetic powders (concerned by ATEX)	Click here	indicate lowest EMI (minimum ignition energy)
3) To manufacture items for L'Oréal, do you handle the following: Manufacturing of coloring or decoloring products (e.g., containing ammonia, hydrogen peroxide, sodium persulphate, potassium persulphate or ammonium persulphate)	Click here	
4) To manufacture items for L'Oréal, do you handle the following: Storing, manufacturing and/or packaging of flammable aerosols	Click here	
5) To manufacture items for L'Oréal, do you handle the following: Handling of highly toxic substances (e.g., carcinogenic, mutagenic or toxic for reproduction)	Click here	
6) To manufacture items for L'Oréal, do you handle other Hazards to be commented	Click here	precise if other hazards
If Hazards are involved in the process or material handled to manufacture items for l'Oréal, an EHS audit will be requested. Thanks to send back the "SUBCONTRACTOR - AGREEMENT AUDIT REQUEST - EHS"		
AUDITS/GOVERNMENT REGULATION		
7) Has your facility had the following audits in the last year and have you maintained your certifications? Please attach a copy of the summarized results.	Yes/No	
2a) OSHA VPP	Click here	
2b) OHSAS 18001	Click here	
2c) ISO 14001	Click here	
8) Have you received any governmental citations due to lack of code compliance?	Click here	

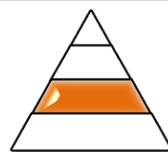
6.3. Appendix 3: Check list of EHS requirements to verify during WOB process

[Link for the document EHS-003-02](#)

This page was intentionally left blank for duplex printing.



Prevention of Electrostatic Risks



**EHS TECHNICAL
INSTRUCTIONS**

Object : Cancels and supersedes TI EHS-002-18 B

Issuer : L'OREAL GROUP EHS

Distribution : L'OREAL GROUP EHS

Modifications from the version B

CONTENTS

1. PURPOSE	2
2. SCOPE.....	2
3. RESPONSIBILITIES.....	2
4. DESCRIPTION	3
4.1. General hierarchy of controls for electrostatic risk management.....	3
4.2. Prevention and protection	3
4.3. Materials and Equipment	4
4.4. Friction reduction	6
4.5. Verifications.....	6
5. SPECIFIC CASE OF COSMETIC POWDERS.....	7
6. ASSOCIATED EHS DOCUMENTS.....	7



1. PURPOSE

The object of this technical instruction is to define the technical measures to be established and maintained in order to prevent the risks of ignition due to static electricity in areas where explosive atmosphere may appear (i.e. in sites, workshops, or rooms where the specific risk is associated with the presence of flammable liquids, aerosols, cosmetic powders, etc.)

2. SCOPE

This technical instruction applies to all production plants and all the distribution centers of the L'Oréal Group.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3. RESPONSIBILITIES

Responsibilities in terms of fire prevention and protection are defined in GP *EHS-301-20 Prevention of Fire Risk*.

4. DESCRIPTION

4.1. General hierarchy of controls for electrostatic risk management

The following is the preferred approach to control electrostatic hazards in the storage and handling of flammable and explosive materials.

- 1) Permanent grounding of equipment (permanent and mobile)
- 2) Conductive flooring
- 3) Use of adapted equipment and clothes
- 4) Use of bonding, as needed, to ensure equalization of electrical potential between two objects
- 5) Dissipation of static electricity prior to entering the high risk areas eg ATEX areas
Monitoring and control of % relative humidity in ATEX or equivalent areas (final protection barrier in the range of 40 to 60%)

4.2. Prevention and protection

Electrostatic discharges can be generated which can ignite flammable or explosive atmosphere resulting in an explosion or fire.

The following actions are mandatory:

- A risk assessment is required for all potentially flammable and explosive areas. This is to include the storage, handling and disposal of these materials. This must include Detailed SHAPS on employee job activities.

ATEX or equivalent areas:

- All employees working in an ATEX zone or with equipment transferring flammables and explosive materials must have specific training on the comprehension of the risk involved and the protective measures put in place.
- All employees working in an ATEX zone or with equipment transferring flammable or explosive materials must be involved in a job activity risk assessment for their work. This risk assessment is to be reviewed and updated with all concerned employees annually
- Work clothes and Personal Protective Equipment (PPE) must be provided that meets ATEX or equivalent requirements, as needed.

- In ATEX areas, operators and visitors must wear "electrostatic conductive" safety shoes that meet the requirements of EN ISO 20346 or equivalent.
- The entry of persons into rooms where explosive atmospheres may appear must occur after a check of the conductivity of their shoes. This check must be done very regularly in order to guarantee the effectiveness of the equipment (for example, when coming on duty).
- The clothing used must be recognized as "electrostatic conductive" by the supplier. If no such certification is given, clothing must contain over 60% cotton fibers in order to avoid the accumulation of electrostatic charges. Work clothing must not be removed in a potentially flammable atmosphere. This clothing must be produced with a material that does not "stick" to the skin in case of combustion and must be flame-retardant. The gloves used must be "electrostatic conductive".

4.3. Materials and Equipment

The following requirements are mandatory for the control of the build of and dissipation of electrostatic discharges.

- The packaging, hoses, bags, containers, and pipes must be made of conductive materials: $\rho_v < 10^8 \Omega\text{m}$ or $\rho_s < 10^8 \Omega$. Packaging must be grounded before each loading or unloading operation. In case packaging is made of non-conductive materials, a risk assessment is required and has to take into account "NFPA 30 Flammable and combustible liquids code" and "NFPA 77 Recommended Practice for Static Electricity" requirements as follows:

NFPA 30:

- Class I flammable liquids (liquids with flash point less than 37.8 °C) should not be stored in nonconductive containers unless a fire protection system is provided and developed according to NFPA guidelines.
- Fill pipes that enter the top of a tank shall terminate within 150 mm of the bottom of the tank. Fill pipes shall be installed or arranged so that vibration is minimized.
- Filters, pumps, wire screens, and other devices that can produce static electric charges through turbulence shall be so located to allow a minimum of 30 seconds of relaxation time prior to discharging cargo into the compartment.
- Avoid splash filling and upward spraying of liquid where bottom filling is used.
- Employ reduced fill rates at the start of filling through downspouts, until the end of the spout is submerged. Some consider 0.9 m/sec to be a suitable precaution



NFPA 77:

- Containers should be bottom-filled if possible.
 - Filling rates should be similar to those normally used for drum filling, about 225 L/min or less, unless the container is inerted.
 - If the fill pipe does not extend close to the bottom and the vessel is not inerted, a slow start velocity of 1 m/sec or less should be used until the fill pipe is submerged to about 150mm.
 - Refilling a vessel that could contain flammable vapors from a previous product should not be permitted.
 - Minimize handling of nonconductive vessels filled with any type of liquid that can generate charge on the outside of the surface of the vessel.
 - Nonconductive containers should not be used where ignitable ambient vapors are present
- Piping materials must be static electricity conductive to prevent the formation of electrostatic discharges due to friction of liquids or powders on the walls of the system.
 - In the case of a pipe or a hose made of "electrostatic" conductive materials, the resistance between the two ends must be lowered to less than $10^6\Omega$.
 - The equipment used for handling flammable liquids and powders must be recognized "electrostatic" conductive and spark-proof according to local requirements.
 - Particular attention must be paid when sealing metal piping using Teflon tape. The use of this tape can create electric insulation between the connected pipes. Every time this type of insulating tape is used, the electrical conductivity of metal piping must be checked and guaranteed.
 - A risk assessment is required for all storage areas of flammable and explosive materials to identify risk mitigation measures. Racks and storage cabinets must be grounded.
 - The grounding of rolling or mobile equipment cannot be done using flexible braids that rub on the floor during movement. A contact fault between the braid and the floor (due, for example, to excessive travelling speed) may generate sparks due to an accumulation of electrostatic charges.
 - The installation of metal chains dragging on the floor can be tolerated, subject to rigorous, monitored maintenance. This device may not be installed on equipment moving at more than 8 km/h. The chains must be made of spark-proof metal (aluminum, bronze, copper-beryllium, austenitic stainless steel).



- Conductive materials must be used for the seat cover and for tires of the forklift trucks.
- The forks on handling equipment must conduct static electricity ($R < 10^6 \Omega$). This is important for forks with an anti-slip cover made from synthetic materials. A resistance measurement must be made very regularly on this equipment, notably when dirt accumulates regularly (oils, raw materials, silicon).
- Handles on the access doors to the room where explosive atmospheres can occur must be grounded in order to permit the discharge of any electrostatic energy of staff entering the room.
- The operation for equipment (mainly mobile equipment) may generate a spark. These operations should take place outside of a potentially explosive atmosphere or, where not possible, the equipment must be grounded.

4.4. Friction reduction

The handling of flammable liquids and powders requires special precautions in order to reduce friction generating electrostatic charges. It is thus important to:

- Reduce as much as possible the flow speed of liquids or powders to a few meters per second (maximum 6m/s for powders)
- Eliminate the drop height by introducing by tank bottom for liquids or by using spring-mounted tables for powders, for example
- Limit sprinkling as much as possible and favor filling against the wall.

4.5. Verifications

The bonding and grounding of all equipment must be checked annually and recorded.

The following must be checked for deterioration on a monthly basis.

- Protective shoes
- Work clothing
- Grounding braids of equipment, etc.
- Forks on forklift trucks (anti-static)

In addition, work clothes must respect the manufactures instructions on washing and cleaning.



The floor in premises where explosive atmospheres may occur must be conductive and certified electrostatic. The floor's resistance must be checked frequently, as it can change based on wear and soiling or the washing products used.

Visual light systems are recommended to show permanently that the earth connection is good.

The % relative humidity in the air must be permanently measured in all ATEX areas in a location representative for sampling. Where needed several monitors should be used. It must be maintained in the range 40 to 60%. Suggested target is 50-55% to allow for deviation. This range is set to minimize microbial growth (approved by Corporate Quality) and as a safety barrier to ensure that in the failure of other barriers, any electrostatic discharge should be dissipated.

Possible solutions include the use of HVAC systems with humidity control or only measuring the % relative humidity and taking appropriate additional action as determined by risk assessment by a process safety/ATEX expert.

All of safety barriers identified in this and previous sections must be in place and checked regularly.

5. SPECIFIC CASE OF COSMETIC POWDERS

In addition to all upper requirements, a specific risk assessment must be realized by an external contractor for manufacturing and packaging of cosmetic powders

6. ASSOCIATED EHS DOCUMENTS

This Technical Instruction comes under General Procedure *EHS-001-20 Prevention of Fire Risk*.

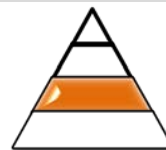
This Technical Instruction is also associated with the following Technical Instructions:

- *EHS-302-17 Manufacturing packaging and storage of aerosols*
- *EHS-002-20 Manufacturing packaging and storage of flammable liquids*
- *EHS-002-27 Manufacturing and packaging of cosmetic powders*

This page was intentionally left blank for duplex printing.



Manufacturing, filling, packing and storage of flammable liquids



EHS TECHNICAL INSTRUCTIONS

Object : Cancels and supersedes TI EHS-002-20A

Issuer : L'OREAL GROUP EHS

Distribution : L'OREAL GROUP EHS

Modifications: modifications from the Version A

CONTENTS

1. PURPOSE.....	2
2. SCOPE	2
3. RESPONSIBILITIES	2
4. DESCRIPTION.....	3
4.1. Operating conditions	3
4.2. Precautions of use	4
4.3. Operating precaution regarding the formation of explosive atmospheres	5
4.4. Special cases of operation	6
4.5. Employment of powder in the presence of a flammable liquid	11
5. ASSOCIATED EHS DOCUMENTS	12

APPENDICES

Appendix 1: Figure 1

Appendix 2: Figure 2



1. PURPOSE

The object of this technical instruction is to define the technical measures to be established and maintained in order to prevent risks of fire and explosion in the sites, workshops, or premises where the specific risk is associated with the presence and use of flammable liquids.

Are considered as flammable liquids all products described by logical diagrams of the appendix 1 of the General Procedure *EHS-001-20 Prevention of Fire Risk*.

2. SCOPE

This technical instruction applies to the factories and distribution centres of the L'Oréal Group that have flammable liquid manufacturing, filling, packing and storing activities.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3. RESPONSIBILITIES

Responsibilities in terms of fire prevention and protection are defined in GP *EHS-001-20 Prevention of Fire Risk*.



4. DESCRIPTION

4.1. Operating conditions

4.1.1. Training

The personnel involved must receive safety training specific to the dangers of handling flammable liquids.

4.1.2. Safety validation

The various equipment and operating methods for manufacturing flammable liquids must undergo a Safety Validation by the ETNEHS.

4.1.3. Maintenance of the installation

The fire prevention and protection equipment of the ATEX or NEC 500 / 505 Class 1 zone must have an appropriate maintenance programme supervised by the ETNEHS.

This periodic maintenance programme must take into account the notion of preventive maintenance and be the subject of a record for each operation performed.

All Important Elements for Safety (**EIPS** listed during the risk assessment) must undergo this preventive maintenance.

For all work taking place inside a room, strict compensatory measures must be defined in the prevention plan and in the hot work permit (see *EHS-000-22 Maintenance and Works*), if the latter is necessary:

- Absence of flammable liquid in the immediate work zone
- Explosimeter measurements before and during the maintenance operations in the work zone (in a possible environment of possible presence of flammable vapour or gas)
- Controlled fire response equipment
- Marking of works
- Before an intervention through hot spots on piping that contained flammable liquids, this piping must be rinsed with water in order to eliminate the flammable liquids and residual vapours.
- Provide for constant monitoring by an ESI or a designated person
- Provide for the readiness of the fire response equipment

In order to permit proper identification of the elements of the installation presenting risks:

- The fixed piping must be indelibly identified with the name of the flammable liquid clearly written, the direction of flow of the liquid, and the danger symbol for flammable liquids, particularly during arrivals at the tanks.
- Vent outputs must be marked.



At the end of the works, it must be verified that the safety level existing before the start of the works has been maintained and that operation can resume as normal. Monitoring must be done again for at least two hours after the end of the works in order to avoid any fire outbreak.

4.2. Precautions of use

Maximum amount of operations employing flammable liquids should be carried out in a closed circuit in order to limit, or even eliminate, the emission of flammable vapours outside the production equipment and devices. This is particularly important during the filling of tanks.

4.2.1. Distribution through fixed piping

Transfer of flammable liquid pushed by compressed air is prohibited.

Regardless of the valves actuated, the piping must be equipped with two manual quick-access closing valves (one inside the room, the other outside). They are intended to secure the installation in case of a failure of the actuated valves or during intervention on these networks. By design, these valves must be fire resistant and equipped with a logging system.

They must appear in the list of Important Elements for Safety (**EIPS**) and be regularly monitored.

4.2.2. Filling of tanks

When the use of flammable liquids involves large quantities, the supply of the tanks through fixed piping from a bulk storage tank outside the building should be favoured.

Introduction of flammable liquid through manhole is forbidden. The use of an airlock is mandatory for an introduction by "tank top".

During introductions under vacuum, it should not lead to boiling of the present flammable liquid.

The use of pneumatic pumps with membranes is prohibited, unless the pumps are equipped with a shut-off device activating in case of penetration of a membrane.

4.2.3. Excess pressure

The resistance of the piping to excess pressure must be verified by any suitable means (tests, visual inspection during Safety Validations, etc.).



The attachment of the hoses on the connections must be done using crimped connections. The use of flexible metal collars equipped with a tightening screw is not permitted.

A hose maintenance programme must be developed.

The installations must be equipped with devices limiting the effects of "water hammers".

Compressed air may only be used in the drying of installations after washing, only in the absence of flammable liquids. Devices for connection, distribution, and introduction of compressed air must be designed so that:

- No confusion is possible with the use of nitrogen
- In case of a leak of the closure system, there is no risk of an unwanted introduction of air.

4.2.4. Sampling methods

A system preventing the introduction of electrostatic charges by the sampling tool must be used. This tool must be created from spark-proof material.

- The sampling is placed on the pipe at the bottom of the tank. It is normally in an automatically closed position.
- In the exceptional situation of a sampling "tank top", this operation must be the object of a work permit delivered by the ETNEHS.

4.2.5. Recovery of small leaks

It must be ensured that the equipment used for the recovery of spreading flammable liquids has anti-static and non-combustible properties, including absorbent products.

4.3. Operating precaution regarding the formation of explosive atmospheres

4.3.1. Restriction of access

Safety signs must be posted at each access point of the room in order to reduce the number people entering it to the absolute minimum necessary and remind them of the risks associated with flammable liquids.

Similarly, in rooms that are zoned according to the ATEX Directives or NEC 500 / 505 Class 1, the defined zones must have signage in accordance with the regulations. People accessing these rooms must check, periodically based on the operating conditions, the electrostatic conductivity of their shoes and/or bracelets. See TI *EHS-002-18 Prevention of Electrostatic Risk*. The room must be closed during all the operation.

4.3.2. Inerting

Inerting is mandatory for:



- Tanks where contents have a source of energy,
- Tanks where manufacturing operations take place.

See TI *EHS-002-19 Prevention and Protection against explosions* in the **Inerting** section of § 4.2.1 and IRI 239 *Guide to best practices in inerting*.

4.3.3. Mobile electrical equipment used

Mobile electrical equipment used in zones with a risk of Explosive Atmospheres must meet the same requirements as fixed electrical equipment in TI *EHS-002-19 Prevention and Protection against Explosion risk*.

The PIT's and AGV circulating in rooms that may present Explosive Atmospheres, being subjected to a precise zoning, will be secured as per *GP EHS-301-01* and *GP EHS-001-40*.

In case of technical difficulties in obtaining equipment adapted to use in zone 1 (for example, touch screens), zone 2 equipment must be used if their set-ups and operations are strictly limited to a part of the room remaining zone 2.

This possibility must remain exceptional and must be submitted to the factory's Technical Division for approval.

4.3.4. Tools

All tools used in the zone must be equipped with a spark-proof coating (austenitic stainless steel, bronze, copper-beryllium) and an indicator of its wear.

4.3.5. Controls and verifications

An annual audit of the electrical installations must be performed by an outside authorised body according to the nature of the controls.

Explosimeter probes must be checked and calibrated regularly according to a frequency indicated by the manufacturer.

4.4. Special cases of operation

In these two particular cases described in § 4.4.1 and 4.4.2, requirements in § 4.4.3, 4.4.4 et 4.4.5 apply.

4.4.1. Introduction of flammable liquids in the manufacturing of non-flammable liquids

The introduction of flammable liquids and the associated operating conditions in non-flammable liquid manufacturing rooms must not, at any time, generate:

- An intermediate flammable phase (Flash pt < 60°C)
- A flammable atmosphere in the roof of the tank.



A specific risk analysis must be performed for these operations as well as zoning according to Directive 99/92 EC for the EEC or NEC 500 / 505 Class 1.

Flammable liquids may be distributed through fixed piping from bulk storage, provided that:

- The liquid is delivered by pumping and not by gravity.
- This distribution line has its own pump.
- The liquid is distributed using a self-sealing distribution device, when it is no longer actually actuated by the operator.
- The start-up of the pump is ordered through the use of the distribution system.
- An emergency shut-off button for the pumping system is on the installation.
- The installation has a manual sealing valve located outside the perimeter of use.
- The volume of the bulk storage does not exceed the containment capacity described in § 4.4.4.

4.4.2. Manufacturing flammable liquids outside the manufacturing room

The manufacturing of flammable liquids outside the flammable liquid manufacturing room can only be done under very specific conditions and when there are no other possibilities.

Such manufacturing must be limited to a unit volume of 265 litres (70 gallons). Manufacturing of a volume less than 25 litres is not affected by the application of this document, **but a risk analysis must be conducted, as it is not devoid of risk.**

The manufacturing processes employed must systematically undergo a risk analysis. A zoning must be established, within the meaning of ATEX 99/92 EC for the EEC or NEC 500 / 505 Class 1 for other countries, in order to identify the nature of the zone involved as well as its significance. In this case, the electrical and mechanical equipment intended to be employed in the identified zones must comply with the requirements of ATEX 99/92 EC or NEC 500 / 505 Class 1. By default, the zoning proposed in figure 2 may be applied.

These operations may only be performed if the workshop has general ventilation.

As far as possible, the process must be designed in order to avoid emissions of flammable vapours (condenser, closed system); otherwise, an adapted ventilation study must permit a channelling of the flammable vapours as close as possible to the emission points. This technique offers the possibility of reducing the volume or modifying the nature of the zones identified by the application of ATEX 99/92 EC for the EEC or NEC 500 / 505 Class 1.



In the case of applications of spot ventilation (extraction of flammable vapours), the air flow may be set to $0.3 \text{ m}^3 \cdot \text{min}^{-1} \cdot \text{m}^{-2}$.

Before the validation of the process, LIL measurements must demonstrate that the values reached during normal operation never exceed 20% of the LIL.

The manufacturing equipment (tanks, skid) must take into account the recommendations required by this document for manufacturing flammable liquids.

The protection of personnel in relation to the effects of an explosion must be based on compliance with the *TI Prevention and Protection against Explosions*. The use of inerting, in compliance with the requirements of document IRI 239, Guide to best practices in inerting, may simplify the choice of electrical or mechanical equipment by modifying the classification of ATEX or NEC 500 / 505 Class 1. For example, a roof of a tank containing flammable liquids is classified zone 0, and its inerting downgrades it to zone 2.

4.4.3. Mobile containers

The maximum unit volume of flammable liquids authorised to be introduced in manufacturing non-flammable liquids, in mobile containers, is limited to 1000 l.

By design, the containers allow the flow of electrostatic charges (warp strands stainless trailing on the ground required, static conductive wheels etc.) and the grounding of the systems.

The containers must be sealed to emissions of vapours and must be equipped with flame protection safety vents with pressure compensation (these vents are not considered vapour emission points). They are equipped with a safety valve or a rupture disk.

Containers must not have any power source installed (mechanical, electrical, thermal), such as heating systems, agitators, etc. The sky tank is considered in Zone 0, hence it is inerted and contains no instrumentation with the exception of high reed Compatible Zone 0.

If the handling conditions require the presence of power sources, it is imperative to perform a specific risk analysis and determine a zoning according to Directive 99/92 EC for the EEC or NEC 500 / 505 Class 1 for other countries. In this case, the definition of the electrical and mechanical equipment intended to be employed in identified zones must comply with the requirements of Directive 99/92 EC or NEC 500 / 505 Class 1.

Containers equipped with an opening in the lower part (valve, drain plug, etc.) must have a series of two closure systems:

- A quarter-turn valve and a screw top,
- A quarter-turn valve and a double-plug quick connection.



Valves, plugs, and other devices that are maintained with manual tightening clamps (tri-clamps) are prohibited on flammable liquid containers.

These two closure systems must have fire resistance (seals, valve, trim).

In the case of inerted containers, verify the presence and effectiveness of the following elements:

- A pressure gauge or a system making it possible to determine the pressure within the containers,
- A safety valve,
- A device preventing an operator's head from entering the container,
- A dogging device for a possible manhole.

Openings must be protected from mechanical shocks and all risks of perforation, particularly by the fork of the handling equipment. For example, openings can be positioned at 90° in relation to the forking areas.

By design, the containers must be stable and may not move independently.

4.4.4. Area of employment

Secondary containment areas

The employment of these containers as well as all transfer devices (pumps, hoses, etc.) must be done in a secondary containment area. This secondary containment area (drained or not) must be sized to receive the container's full volume. The surface area of the secondary containment area must be as low as possible and included in zone 2 of the classification diagrams required by Directive 99/92 EC for the EEC or NEC 500/505 Class 1.

The secondary containment area must be designed in a manner that does not promote the accumulation, in the form of confined water, of flammable vapours heavier than air. If the risk of accumulation is present, ventilation of the secondary containment area must be provided for.

Prevention of explosive atmospheres

The zonings proposed in appendices 1 and 2 take into account two volume limits for containers:

- Container up to 265 litres
- Container up to 1,000 litres

The surface areas of the zones must be sized for ventilated workshops according to the requirements of document SI-01. The installation of vapour extraction at the emission points may significantly reduce the surface areas of these zones.

Specific studies may be undertaken on a case-by-case basis.



The electrical and mechanical equipment installed in these zones must comply with the requirements of Directive 99/92 EC or NEC 500 / 505 Class 1.

The surface area affected by the zoning must be marked and indicated with suitable signage (ATEX or NEC 500 / 505 Class 1).

Fire prevention

The fire protection measures must be based on:

- The existing sprinkler system
- The installation, near these zones, of an expansion foam fire hose station enhanced with a synthetic, multi-expansion, versatile AFFF foam compound, AR (Alcohol resistant)
- The presence of BC dry chemical extinguishers compatible with the use of foams
- A set of equipment for recovering drips and liquids spreading out
Absorbent products must be "anti-static" and adapted for use on flammable liquids.

4.4.5. Handling and transfer

Flammable liquids must be packaged in containers appropriate for storage and transport of flammable liquids.

Flammable liquids must always be transported in closed containers not presenting any point of emission of vapour or product likely to give rise to a zoning, outside the container, within the meaning of Directive 99/92 EC for the EEC or NEC 500 / 505 Class 1 for other geographical regions.

A risk analysis must be established, within the meaning of ATEX 99/92 EC for the EEC or NEC 500 / 505 Class 1 for other countries, in order to identify the nature of the zone involved as well as its significance. In this case, the electrical and mechanical equipment intended to be employed in the identified zones must comply with the requirements of ATEX 99/92 EC or NEC 500 / 505 Class 1.

Regardless of the choice of the transfer method used:

- Elimination of vapour emissions must be sought (use of, for example, flame protection safety vents with pressure compensation, condensers, nitrogen pressurisation, valve boxes, or extraction through ventilation).
- The transfer of flammable liquids must be done through suction
- Flammable liquids are never transferred by pressurization with compressed air.

Introduction by "tank bottom" under vacuum, with compensation under nitrogen, must be done using an anti-return device preventing the draining of the tank in case of a loss of the vacuum.



The use of nitrogen for inerting, pressurisation, or compensation must take the risk of anoxia into account. The employment must comply with the recommendations of document IRI 239 Guide to best practices in inerting.

Measures to prevent static electricity must be taken in accordance with TI *EHS-002-19 Prevention and Protection against Explosions* and TI *EHS-002-18 Prevention of Electrostatic Risk* and are subject to verification of their implementation. They must be applied on all volumes involved in the zonings (Zones 0, Zone 1, Zone 2). The ground may be made conductive, locally, through the use of metal plates (austenitic stainless steel) or static electricity conducting grating connected to the ground.

The prevention of overflows during filling must be taken into account in accordance with TI *EHS-002-19 Prevention and Protection against Explosions*.

The use of pneumatic pumps with membranes is prohibited, unless the pumps are equipped with a shut-off device activating in case of penetration of a membrane.

Within a manufacturing workshop, two areas for handling or transferring flammable liquids may not be less than 10 m from each other.

The transfer of bulk from a tank to a mobile tank is the first step and takes place in the manufacturing of flammable liquids premises which is protected according to ATEX 99/92 in the EEC or NEC 500 / 505 Class 1 for other countries. If the bulk is transferred at room temperature, the tank should be at the atmospheric pressure and the vents of the mobile tank are in the local ATEX and are deprived of flame arrestor.

If the transfer is hot, the vent of the mobile tank must be connected to the vent line or to a local extraction. The analysis of the residual concentration of O₂ in the air tank is prohibited. For the system overflows protection (high level sensor reed Compatible Zone 0) must have a small diameter nozzle for connection, and no open lid.

When the mobile tank is moved to a local which is not protected ATEX, vents should be closed.

In order to wash the tank, it must be emptied on line by pressurization with nitrogen. A "washing ball" is introduced through a nozzle. Washing removes the formation of possible explosive atmosphere from the residual flammable bulk. The operator can perform a visual inspection of the interior cleanliness of the tank by opening the manhole.

4.5. Use of powder in the presence of a flammable liquid

The employment of powder, in the presence of flammable liquids or in the roof of the tank must be done systematically as follows:



- The formation of a cloud of powder must be avoided during handling and decanting operations. According to the quantities employed, various types of tools or techniques may be chosen (ladle, screw pump, peristaltic pump, annular sensor).
- Equipment in direct or indirect contact with the powders must conduct of static electricity.
- Equipotentiality among the equipment must be achieved as well as grounding (in accordance with the recommendations of TI EHS-002-18 Prevention of Electrostatic Risk).
- The operator must comply with the prevention measures with regard to electrostatic discharges in accordance with the recommendations of TI EHS-002-18 Prevention of Electrostatic Risk.

The employment of powders in an enclosure containing a flammable roof of the tank must be done under inerting. The introduction of powder must be done using an inerted airlock. An introduction through suction at the bottom of the tank may be considered to the extent that the inerting conditions are guaranteed.

5. ASSOCIATED EHS DOCUMENTS

This Technical Instruction comes under General Procedure *EHS-001-20 Prevention of Fire Risk*.

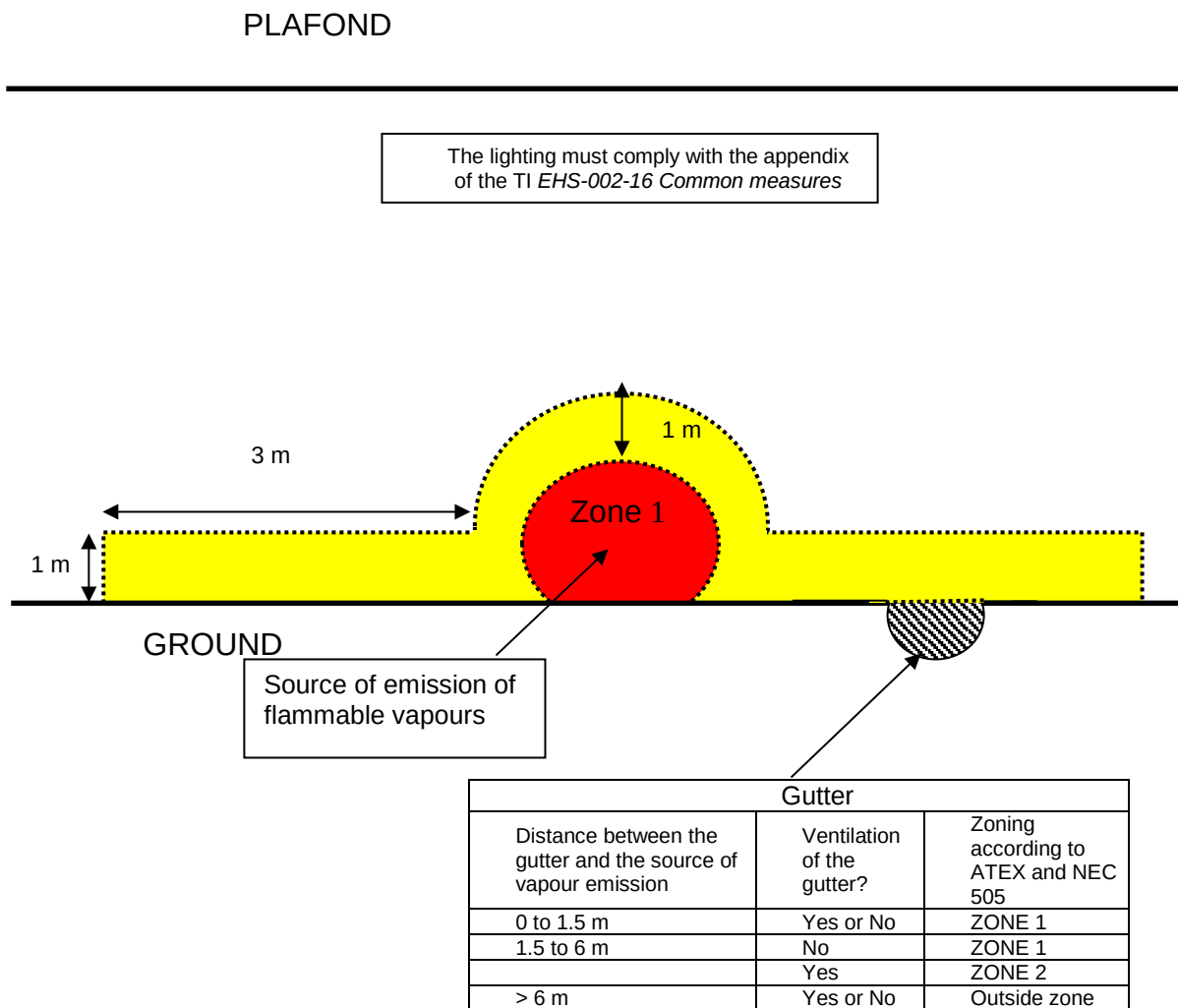
This Technical Instruction is also associated with the following Technical Instructions:

- EHS-002-18 Prevention of Electrostatic risk
- EHS-002-19 Prevention and Protection against Explosions



APPENDICES

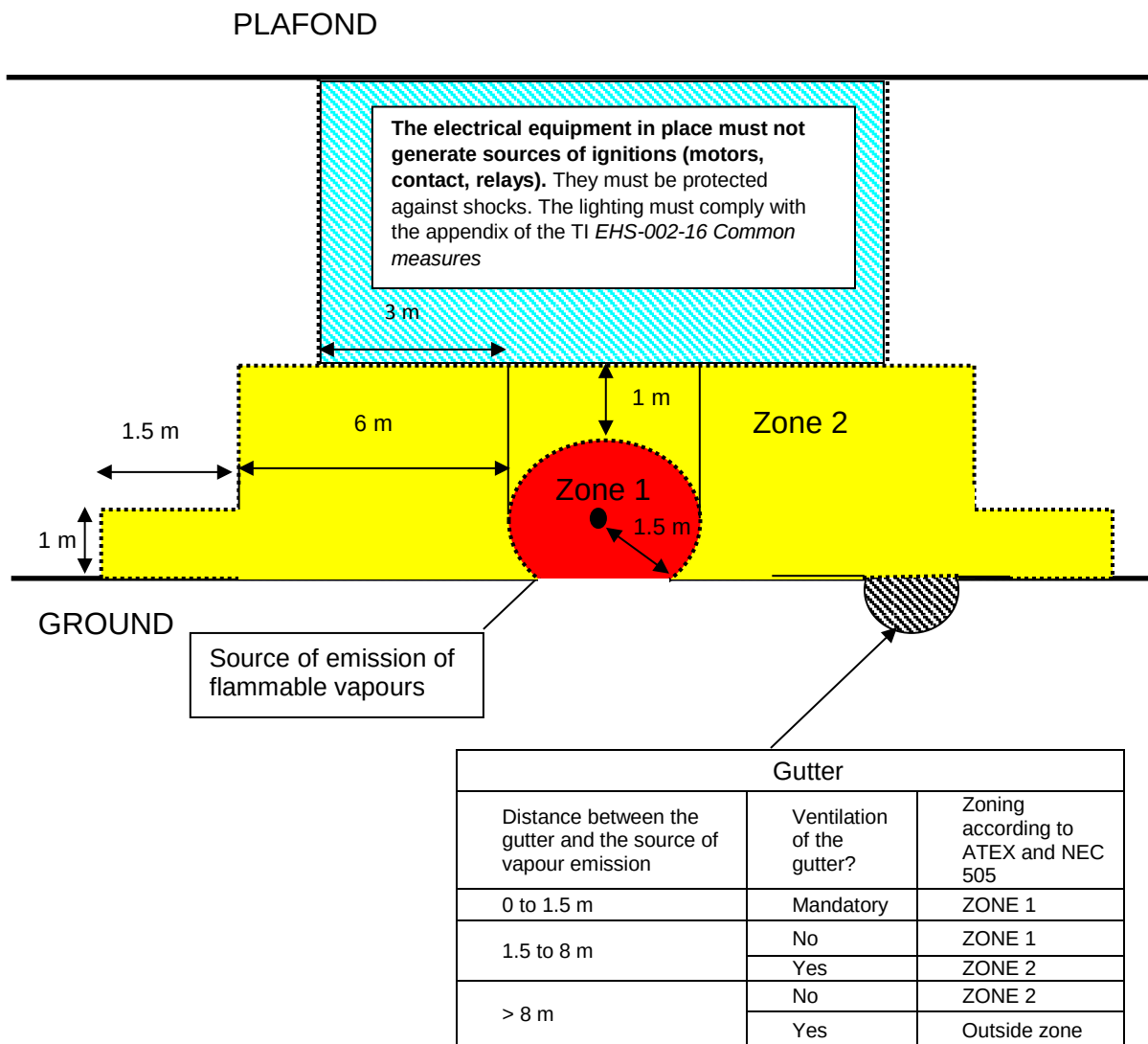
Appendix 1: Figure 1



Zoning applicable for transfers and handling of flammable liquids, in mobile containers, limited to a volume of 265 litres.



Appendix 2: Figure 2



Zoning applicable for:

- Transfers and handling of flammable liquids, in mobile containers, limited to a volume of 1000 litres.
- Manufacturing of flammable liquids outside suitable rooms limited to a volume of 265 litres

EHS-002-27 A	Issue A	SEPTEMBER 2013
L'ORÉAL GROUP EHS		EHS TECHNICAL INSTRUCTIONS
Issuer: L'Oréal Group EHS	Manufacturing, filling and packing of cosmetic powders	
Distribution: L'Oréal Group EHS	Cancels and supersedes RIO 27 and RIS 41	
CONTENTS 1 – PURPOSE 2 – SCOPE 3 – RESPONSIBILITIES 4 – DESCRIPTION 4.1- <u>Operating conditions</u> 4.1.1 – <u>Training</u> 4.1.2 – <u>Safety validation</u> 4.1.3 – <u>Maintenance of the installation</u> 4.2- <u>Precautions of use</u> 4.2.1 – <u>Powder quantities</u> 4.2.2 – <u>Sealing of manufacturing equipment</u> 4.2.3 – <u>Handling of powders</u> 4.2.4 – <u>Local extraction</u> 4.2.5 – <u>Ventilation of the manufacturing room</u> 4.3- <u>Cleanliness and cleaning of rooms</u> 4.4 – <u>Operating precaution on the formation of explosive atmospheres</u> 4.4.1 – <u>Restriction of access</u> 4.4.2 – <u>Inerting</u> 4.4.3 – <u>Mobile electrical equipment used</u> 4.4.4 – <u>Tools</u> 4.4.5 – <u>Controls and verifications</u> 4.5- <u>Special case of air jet mills</u>		

1 – PURPOSE

The object of this technical instruction is to define the technical measures to be established and maintained in order to prevent risks of fire and explosion in the sites, workshops, or premises where the specific risk is associated with the presence of cosmetic powders.

2 – SCOPE

This instruction applies to the Group's factories that have cosmetic powder manufacturing and packaging activities.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3 – RESPONSIBILITIES

The ETNEHS manager is responsible for the proper operation of fire extinguishing equipment and alarm systems.

It is also responsible for evacuation drills, emergency plans, and response team training.

The Department Manager must take the specific risks associated with cosmetic powders into account in all risk assessments conducted within his or her sector.

He or she must also ensure that the training for employees directly reporting to him or her takes into account the risks associated with powders and the action to be taken in the event of an incident.

4 – DESCRIPTION

4.1- Operating conditions

4.1.1 – Training

The manufacturing personnel involved must receive safety training specific to the dangers of employment of powdered substances.

4.1.2 – Safety validation

The various manufacturing equipment of the room and operating methods for manufacturing cosmetic powders must undergo a Safety Validation by the ETNEHS. Installations located within the EU must comply with Directives 94/9 EC (ATEX Directive) and 99/92 EC (Directive on protection of workers potentially at risk from explosive atmospheres).

4.1.3 – Maintenance of the installation

The fire prevention and protection equipment of the ATEX or NEC 505 zone must have an appropriate maintenance programme supervised by the ETNEHS.

This periodic maintenance programme must take into account the notion of preventive maintenance and be the subject of a record for each operation performed.

In the case of sites, workshops, and rooms employing powders, all Important Elements for Safety (**EIPS** listed during the risk assessment) must undergo this preventive maintenance.

To the extent possible, the elements of the installation should be removable in order to perform these potentially hazardous operations in rooms not presenting risks.

In the event that the work must take place inside of the room, compensatory measures must be provided for during the establishment of the **prevention plan** and the **hot work permit** (see *EHS-000-22 Maintenance and Works*), if the hot work permit is necessary:

- Absence of powder in the immediate work zone
- Controlled fire response equipment
- Marking of works
- Provide for constant monitoring by an ESI or a designated person
- Provide for the readiness of the fire response equipment.

At the end of the works, it must be verified that the safety level existing before the start of the works has been maintained and that operation can resume as normal. Monitoring must be done again a few hours after the end of the works in order to avoid any fire outbreak.

4.2- Precautions of use

4.2.1 – Powder quantities

Weighed quantities of raw materials must be reduced to the absolute necessary minimum in the workshop. Similarly, the quantities of milled powders before packaging must correspond to the work in progress.

4.2.2 – Sealing of manufacturing equipment

The sealing of the equipment and the entire manufacturing sequence containing powders must be monitored and maintained on a regular basis. The pressure inside of an enclosure must be lower than the pressure of the surrounding area.

If the transport of powders is pneumatic in the manufacturing sequence, preference should be given to transporting them by suction. In case of a loss of sealing of a part of the sequence, there must be no emission outside of the sequence.

4.2.3 – Handling of powders

Powders should not be sprinkled, and the height of the drop must be limited at any time of the pouring (use of a spring table).

4.2.4 – Local extraction

Collection must be done as close as possible to the emission points of the powders in order to minimise the size of the cloud and as far as possible from the fresh air inlets. The speed at the collection points must be optimal for 0.5 m.s^{-1} ($\approx 100 \text{ ft.min}^{-1}$). This generally prevents the formation of clouds in the manufacturing room. The extracted air must be cleaned in a dust collector protected against explosions.

4.2.5 – Ventilation of the manufacturing room

The general ventilation of the workshop makes it possible to avoid the agitation of the dust.

The speed must be 15 m.s^{-1} to 25 m.s^{-1} in the dust exhaust ducts towards the dust collector in order to greatly reduce the formation of deposits on the inside. These speeds must be checked periodically.

The inside of the dust exhaust ducts leading to the dust collector must be checked at least once per year and cleaned if necessary. The state of clogging of the dust exhaust ducts may be evaluated on a continuous basis by measuring the changes in speed and pressure within them.

The local use a fan is strictly forbidden.

4.3- Cleanliness and cleaning of rooms

In order to avoid the accumulation of emitted dust in the form of deposits and facilitate the cleaning of the rooms, the floors and walls are smooth, levelled, and sealed.

Similarly, corners must be replaced with curves. The workstation must be cleaned by strong suction after each manufacture. The workshop must be cleaned every time that the dust accumulations become visible on the equipment, floor, or other structures.

Note that the use of compressed air blowers is prohibited in the room, as they might blow the dust deposits back into the air.

4.4 – Operating precaution on the formation of explosive atmospheres

4.4.1 – Restriction of access

Safety signs must be posted at each access point of the room in order to reduce the number people entering it to the absolute minimum necessary and remind them of the risks associated with powdered substances.

Similarly, in rooms that are zoned according to the ATEX Directives or NEC 505 Class 1, the defined zones must have signage in accordance with the regulations. People accessing these rooms must check, periodically based on the operating conditions, the electrostatic conductivity of their shoes and/or bracelets. See TI *EHS-002-18 Prevention of Electrostatic Risk*.

4.4.2 – Inerting

The technique of inerting is employed in order to prevent the formation of explosive atmospheres in the manufacturing installation for cosmetic powders with an MIE less than or equal to 10 mJ.

See TI *EHS-002-19 Prevention and Protection against Explosions in the Inerting* section of § 4.2.1 and IRI 239 *Guide to best practices in inerting*.

4.4.3 – Mobile electrical equipment used

Mobile electrical equipment used in zones with a risk of Explosive Atmospheres must meet the same requirements as the fixed electrical equipment described in § 4.3 of TI *EHS-002-19 Prevention and Protection against Explosions*.

Equipment placed in a membrane preventing the penetration of dust must have a protection index of IP6 for this membrane (see **appendix 1** of TI *EHS-002-19 Prevention and Protection against explosions*).

The quality of the dust filters used on the washing machines and vacuum systems used in the areas of employment of powders must be **HEPA** (High Efficiency Particulate Air) or **VHE** (Very High Efficiency).

The forks of the handling equipment must be covered with a spark-proof coating (austenitic stainless steel), which must have a wear indicator. The forklift trucks must be designed to move in ATEX 22 zone areas.

4.4.4 – Tools

Tools must be made of materials that do not produce sparks upon impact.

In order to eliminate the risk of leaving a tool or a removable part inside the equipment, it is important to define tools dedicated to these various operations as well as a method of storage permitting verification of their presence before any start-up of the installation.

4.4.5 – Controls and verifications

An annual audit of the electrical installations must be performed by an outside authorised body according to the nature of the controls.

4.5- Special case of air jet mills

The use of air jet mills must be done on condition of strictly complying with the following rules, in addition to the safety rules applicable to any equipment:

- Slave the compressed air inlets to the operation of the extractor.
- Install safety valves or equivalent equipment on the compressed air systems between the last pressure-reducing valves and the first components of the mill.
- Install dump valves, rupture disks, or equivalent equipment on large-volume enclosures (filtration housing, cyclone separator, etc.). The pressures that the various components of the installation can withstand (pressures that must appear on the components) must be greater than the adjustment pressures of the safety elements.
- This must be true particularly for any access panels, which must not be able to suddenly open completely.
- Do not install any elements likely to interrupt the flow of air into the mill between its compressed air supply and its outlet to the open air.
- Isolate the milled powder collection system from the rest of the mill with a compartmentalised cellular rotary valve preventing the transmission of the pressure before the filters.
- For milling powders with risks of explosion, install explosion vents channelled towards the outside and specially sized.

ASSOCIATED EHS DOCUMENTS:

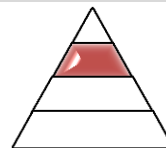
This Technical Instruction comes under General Procedure *EHS-000-21 Prevention of Fire Risk Operation*.

This Technical Instruction is also associated with the following Technical Instructions:

- *EHS-002-18 Prevention of Electrostatic risk*
- *EHS-002-19 Prevention and protection against explosions*



Powered Industrial Trucks



**GENERAL
PROCEDURE**

Object: Cancels and supersedes EHS-301-01 A

Issuer : L'OREAL GROUP EHS

Distribution : GROUP

Modifications:

- Integration of Very Narrow Aisle requirements
- Addition of risk assessment requirements for falling liquids
- Additional safety rules for managing pedestrian/PIT interaction in loading/unloading bays

CONTENT

1.	PURPOSE.....	2
2.	SCOPE	2
3.	RESPONSIBILITES.....	2
4.	DESCRIPTION	3
4.1.	DÉFINITIONS.....	3
4.2.	GENERAL RULES.....	4
4.3.	PIT DRIVING PERMIT.....	5
4.4.	ASSESSMENT OF THE RISKS AND PEDESTRIAN SAFETY	7
4.5.	VERY NARROW AISLE OPERATIONS (VNA)	10
4.6.	TRAINING: "PEDESTRIANS", "PIT DRIVING PERMIT.....	10
4.7.	GENERAL ASPECTS, STORAGE AREAS AND LOADING/UNLOADING AREAS.....	10
4.8.	USE OF PITS EXPLOSIVE ATMOSPHERES.....	12
5.	ASSOCIATED EHS DOCUMENTS	13
	APPENDIX: REQUIREMENTS PERTAINING TO TRAINING AND THE "PIT DRIVING PERMIT"	14



1. PURPOSE

The object of this procedure is to formulate the rules of use of powered industrial truck in the Group's sites.

It does not apply to motor vehicles without driver - Auto Guided Vehicle (AGV) or LGV (Laser Guided Vehicle) - concerned by the General Procedure EHS-001-40.

2. SCOPE

This general procedure applies to all production plants, distribution centres, R&I sites and administrative sites of the L'Oréal Group.

In case of different requirements between the local regulations and the rules imposed by this document, the strictest requirements are to be applied.

3. RESPONSIBILITES

The Manager of each site that uses powered industrial truck (PIT) is responsible for putting in place a program to reduce incidents and accidents. This program includes the identification of deviations in terms of the requirements of this document and the compilation of action plans to address these deviations. All the action plans should be approved by the DO-EHS.

The ETNEHS is responsible for the EHS decision taken in the EHS approval of the PITs as well as for the PIT maintenance programs.

The Department Managers must take into account the specific risks associated with the use of PIT in all risk assessments conducted within his or her sector.

He or she must also ensure that the training for employees directly reporting to him or her takes into account the risks associated with the use of PIT and the action to be taken in the event of an incident.



4. DESCRIPTION

4.1. Définitions

A. Powered Industrial Truck (PIT):

There are 2 categories of PIT:

- Category 1 (PIT 1): This category includes all equipment with ride-on (seated or standing) or accompanied operator that allows loads to be lifted more than 1m high.
- Category 2 (PIT 2): This category includes equipment with ride-on or accompanied operator that do not allow for loads to be lifted more than one meter when the PIT is moving. The "pickers" (including ride-on operator) used in the distribution centres for picking activities also fall into this category. This definition also includes those PITs that pull containers/vessels and the vehicles used as "small trains".
- Temporary employee: Any person made available to L'Oréal by a temporary employment agency. This person benefits from an employment contract with the temporary employment agency and not with L'Oréal. In countries where written contracts or tacit agreements are not used, this refers to any person employed by another organization and that works for or on a L'Oréal site under the direct management of a L'Oréal manager.
- Sub-contractor: Any person working for an external company offering direct or indirect services to the L'Oréal site and supplying these services under the direction of a manager appointed by an external company.
- Pedestrian: Any person walking around and not travelling on motorized equipment. Specifically, any user of a driven PIT, who gets off the PIT, then becomes a pedestrian.



4.2. General rules

The PITs should comply with the local legal requirements, should have manufacturing plates showing the type, the manufacturer and the local certification authorities. No modification should be made without the written authorization of the manufacturer of the PIT in question.

In case of use in locations with a risk of explosion, see section 4.7.

The use of internal combustion PITs is forbidden.

The PITs used for overhead operations should be fitted with operator protection against falling objects. Based on a risk evaluation, additional protection may be required if the original protection seems inadequate.

The ride-on PITs should also be fitted with side protections to protect the operator.

PIT used on loading and/or unloading bays will be equipped with blue light system to ensure their visibility at any time by people working in this area.

All operations of the trucks must be done in normal operating mode as defined by the truck manufacturer, guaranteeing operator visibility in the direction of travel. Reverse mode is reserved for manoeuvring and short distances.

All movements, with or without load, will be operated with the fork between 15 cm and 20 cm above the ground.

The speed of the PIT should be electrically or mechanically limited to a maximum of 8 km/h when the forks are less than 50 cm from the floor, and to 2 km/h (including manufacturer tolerances) with the forks more than 50 cm from the floor.

All the front loading powered forklift trucks should have an integrated (or added) safety belt system.

All the PITs must be fitted with ABC-type mobile extinguishers or equivalent. The objective is not to encourage the employees to fight fires, but to provide trained employees with additional measures to deal with fire starts.



4.3. PIT driving permit

All the PIT drivers should be in possession of a "PIT driving permit" issued by the site manager according to the requirements described in appendix.

All the PIT 1 drivers must be L'Oréal employees with a L'Oréal employment contract (not temporary employees). The absence of temporary employees on these stations aims to reduce the risks created by working in an environment that may: be unfamiliar, have high levels of co-activity, several possible interactions with pedestrians, or that requires the occasional use of certain PITs or even the transporting of hazardous raw materials or aerosols.

However, the employment of temporary workers and subcontractors as PIT 1 drivers can be allowed under the following specific conditions:

- A. The temporary worker or subcontractor is medically fit to drive a PIT (the required minimum criteria are general vision test and a depth perception test)
- B. They have valid suitable PIT driving permit that is delivered by the local authorities or an approved company. The training must include both theory and practical training
- C. They have followed training for L'Oréal PIT/pedestrian rules for the site, given by the site EHS team.
- D. They have followed training for L'Oréal specific Group training "PIT Drivers Good Practices" given by the line manager.
- E. They have been observed and tested, by the direct line manager, to ensure that they have understood the L'Oréal rules and good practices and is capable of following them. This evaluation must be documented.
- F. Once the PIT driver has successfully passed the trainings and tests they can be given a site PIT driving license by the Site Director but only for the duration of his work contract.
- G. The temporary worker or sub-contractor is continuously employed by L'Oréal and supervised by L'Oréal.



If they temporary worker or sub-contractor is absent from a L'Oréal site for up to 2 (two) months the driver must fulfill the following conditions:

- Condition B: valid suitable PIT driving permit,
- Condition E: documented evaluation, by the direct line manager,
- Condition F: site PIT driving license by the Site Director.

If they temporary worker or sub-contractor is absent from a L'Oréal site for more than 2 (two) months the driver must fulfill the following conditions:

- Condition B: valid suitable PIT driving permit,
- Condition C: L'Oréal PIT/pedestrian rules for the site,
- Condition D: L'Oréal specific Group training "PIT Drivers Good Practices",
- Condition E: documented evaluation, by the direct line manager,
- Condition F: site PIT driving license by the Site Director.

All the temporary employees and subcontractors required to operate a PIT 2 must fulfill the following conditions:

- Condition C: L'Oréal PIT/pedestrian rules for the site,
- Condition D: L'Oréal specific Group training "PIT Drivers Good Practices",
- Condition E: documented evaluation, by the direct line manager,
- Condition F: site PIT driving license by the Site Director.

At the end of each temporary assignment requiring the use of a PIT 1 or 2, a written assessment by the direct supervisor and the department manager must be done (this assessment will be provided as prerequisite to any new mission).

The permanent sub-contractors (such as those collecting the waste) using their own PIT will adhere to the same conditions (described in appendix) of the allocation of a "PIT driving permit". The Group EHS training material "good practices for PIT drivers" should be included in the prevention plan.

An individual license or certification will be required for each type (model) of PIT. Employees that have not operated a PIT for a period of 1 year or longer in a L'Oréal installation should repeat the theory and practical tests.

The direct supervisors of the PIT drivers should have completed the necessary theoretical and practical training (including tests) (provided that they are medically fit) for the operation of each type of PIT under their supervision. The objective of this training is not to train them, but to make them more informed and aware of the activities and restrictions facing the operators in their charge. After having passes the initial theory and practical tests, the supervisors will undergo at least refresher training relating to the theoretical section. They will



also have completed the Group EHS training "good practices for PIT trucks drivers".

4.4. Assessment of the risks and pedestrian safety

In all cases, the pedestrians will take priority over the PITs.

For the sites that use AGVs, the order of priority will be as follows:

- 1) AGV
- 2) Pedestrians
- 3) PIT.

Loading bay and reception area remain with high potential risk of cohabitation between PIT and pedestrian at the same time. In order to manage this interaction and minimize the risk of injury, site must implement one of the following actions:

- 1) All pedestrians are banned
- 2) Time separation between pedestrian and PIT use. For example, at any one time area is used only by pedestrian or PIT.
- 3) Put in place a collision warning system

The wearing of safety shoes with built-in toe protectors is compulsory for L'Oréal employees, temporary employees, visitors and operators from external companies in the logistics or production areas of all the factories and distribution centres.

All the visitors and operators from external companies must therefore be informed that they must either bring their own safety shoes with built-in toe protectors, or wear the shoes provided by the site.

External protective ends are not acceptable.

There is no exception to this rule: any person not wearing safety shoes with built-in toe protectors will not be allowed to visit or work in areas that require the use of safety shoes.

The use of safety shoes in all other areas of the factories and the distribution centres must be defined by the Group, the Zone, the Division or the site after a risk/SHAP analysis.

A detailed SHAP for each zone of interaction between PIT/pedestrians must be carried out and updated every year.

It will be done along with the personnel of the zones in question

It will identify all the appropriate rules for managing the potential risk of collision between PIT and pedestrians

It will assess the exceptions to the general rules given below and will identify the rules and conditions to be put in place.



By default, and wherever possible, the sites are required to establish and apply the 5-meter rule:

- a) No moving object (other PIT, etc.) or pedestrian should be closer than 5 meters from a PIT carrying out a storage or removal from storage operation (inserting or removing a pallet in a pallet rack above the 1st level (= above the floor +1)).
- b) No pedestrian, if not physically protected against collision risks, should be closer than 5 meters from a moving PIT.
- c) No other PIT should be closer than 5 meters from a PIT changing direction, carrying out a manoeuvre or a stacking / unstacking operation of 2 pallets.

In this case a), the 5 meter rule must be applied without exception.

The exceptions to case b) and c), as well as the corresponding risk management measures must be approved by the Site Manager (using the detailed SHAP conducted).

A list of these exceptions to the 5 meter rule and the corresponding risk reduction measures must be kept up to date by the site.

Any deviation from the 5 meter rule must be clearly communicated to all employees and visitors if required in order to ensure their safety at all times.

A list of these exceptions and corresponding risk reduction measures must be kept up to date by the site and must be clearly communicated to all the employees and visitors in order to ensure their safety at all times.

All the sites are required to publish the rules and responsibilities for the pedestrians and the PIT drivers, including the site's traffic diagrams. A summary of these rules must be clearly and visually displayed in the working areas.

The pedestrian pathways should be set out/designed to eliminate the possibility of contact between the pedestrians and the PITs. Lines painted on the floor without physical separations are not an acceptable solution inside the buildings, except if the flow of PITs and pedestrians is managed in such a way that both cannot be in the same place at the same time.

The exits of the offices that lead onto passages that could be used by a must be physically protected by a physical barrier.

Crossings between pedestrian pathways and trucks must be clearly marked on the floor. If necessary, additional measures must be put in place (mirror, STOP sign, etc.).

Workstations that are not directly linked to the storage activities of the PIT drivers are forbidden in the pallet rack areas and on the docks. Workstations (that are directly linked to the storage activities of PIT operators) in the pallet



rack area and on the docks must be physically protected against collisions with a PIT and risks of a load carried by a PIT falling off. They must be approved by the EHS department.

All employees and visitors in the storage operations areas are required to wear high visibility clothing (high-visibility vest or equivalent).

Stacked pallets (one on top of the other) should be transported with their wide side perpendicular to the fork of the PIT, whenever possible. For the Euro pallet (800 mm x 1200 mm), this means that the 1200 mm side. Stacked pallets could be handled by the smallest side provided that the load and the pallet are in good condition and stable. In all cases, the pallet will be centred on the fork of the PIT.

Only pallets in good condition should be accepted and used. A pallet management system is required, including the regular inspection of pallets to detect any edges (nails), defects and structural faults.

Suitable gloves should be worn for handling and cutting operations. The use of visible blade knives (including retractable blades) is forbidden. Only safety knives (hidden blade) recognised by the industry or other low-risk cutting techniques should be used.

An assessment of the risks/specific SHAP should be conducted in order to identify the suitable rules for managing the risk of stumbling over the forks of a PIT.

4.5. Very Narrow Aisle Operations (VNA)

The following requirements are applicable to all sites that have and use narrow aisles.

- 1) Only one (1) PIT to be allowed in the VNA aisle at any time.
- 2) 5 m rule to be applied at all times.
- 3) Speed limitation to 8km/h within the aisle
- 4) Automatic systems for slowing down the VNA PIT (Powered Industrial Truck) on entering and exiting aisles (1.6 - 2 km/h) or detecting the presence of another truck or pedestrian in the aisle. (In the interim period - not exceeding end Q1 2018 - other controls, determined by risk assessment, are acceptable to minimize the risk.
- 5) Driver - permanent employee only
- 6) Requirement for site driving licenses and specific training (L'Oréal Group H&S training module "Good Practices for PIT Drivers" is mandatory for all PIT drivers & re-done on an annual basis – see EHS 301 01A appendix for details)

Scope GROUP ✓	Operations ✓	Administrative Sites ✓	R&I ✓	October 2016

- 7) No picking operations are allowed in the VNA aisles by PIT 2s or pedestrian pushed carts/trolleys unless under strict controlled condition where no VNA trucks are allowed in the picking aisle and the adjacent aisle. This condition must be documented on the SHAP.
- 8) Site risk assessments for VNA PIT and pedestrian activities.
- 9) All VNA PITs must stop before entering and exiting the VNAs. This requirement should be part of the training for all VNA drivers and visually communicated at the entrance and exit to each aisle, for example physical STOP marking on the floor, rack signage, lights etc. Each site must identify the most appropriate method of controlling this requirement
- 10) Good visibility at entry and exit of the aisles or a visual indication to identify if another FLT is in the aisle or not. Forks must be lowered on entering or exiting the aisle.
- 11) No person (pedestrian) is allowed to enter a VNA aisle unless via specific permit – and at these times the aisle will be closed to all FLTs.

4.6. Training: "Pedestrians", "PIT driving permit"

The training should be offered in the appropriate language for the person in question. See appendix 1 for the minimum requirements relating to the training and the "PIT driving permit".

New employees (L'Oréal and temporary) and any person working in the areas where PITs are operating must receive awareness training. This training will focus especially on the fact of never being in the axis of a PIT. This training should be repeated at least every 2 years.

The Group EHS training in "the good practices for PIT drivers" must be renewed every year and updated as needed.

The PIT driving permit must be carried on the person at all times.

4.7. General aspects, Storage areas and loading/unloading areas

A check-list of the critical points of the PITs must be used by operators before taking up their post. Problems must be reported to the supervisor immediately. The logbook must be kept on the PIT permanently and must be systematically reviewed by management.

Any drums placed on a pallet should be secured: If they are not wrapped, they should be lashed together and centred to minimize the risk of falling during transport.



The PITs should be inspected regularly by an external company or an experienced l'Oréal technician with the required training and knowledge to carry out this type of maintenance. The maintenance should be documented. An EHS validation will be required once a year and a visual inspection every 6 months.

Stack storage will be designed according to General Procedure EHS-301-16 Storage at height. Their height should ensure the stability of the stack and the visibility of people working in the area.

The pallet racks, used in accordance with General Procedure EHS-301-16 Storage at height, should be inspected each year by a certified company and all the necessary repairs must be carried out.

The pallet racks will be included in the EHS validation program.

The pallet racks will be subject to regular audits during which the state of the pallet rack, the pallets and the wrapping of the latter from the second storage level up will be checked.

The instructions directing the use of the pallet racks should be displayed in visible locations. These must include at least:

- the type(s) of pallets that can be placed in the pallet rack
- the maximum authorized load per cell
- the maximum loading height of the pallets according to the height of the cells
- the identification of the zones and the hazardous products
- the obligation to maintain the service and circulation paths as well as the pedestrian pathways (cleanliness, condition of the floor, etc.).

Picking operations should be avoided in overhead storage areas. In all cases, preparation is forbidden in the stacked storage areas.

If picking has to be done in a pallet rack, it should be limited to the lower levels and must be subject to a detailed risk analysis taking into account at least the following elements:

- the railings at head-height must be protected in order to minimize injuries to the head.
- a metal grille or a vertical net should be installed in the centre of the pallet rack in order to protect against falling objects.
- compulsory training for the preparer.

Suitable control systems to prevent the trucks and trailers at dock from moving during loading or unloading should be put in place. Automated systems such as an automatic truck or trailer wheel or axle locking system are preferable (Wheel lock system or equivalent).



If this is not possible:

- the wheels of the truck or trailer disconnected from the truck should be blocked using a mechanical system (type wheel chock easily manipulated) equipped with a visual control indicating its functioning.
- a procedure will be implemented to ensure that the vehicle is unable to be used (for example, collecting the keys from the driver).

If one of the safety systems fails (Wheel Lock system, mechanical immobilizer system of the truck or trailer equipped with a light indicator, traffic lights, etc.) then the use of loading / unloading must be prohibited until the problem is resolved. There will be no exceptions to this rule. It is applicable regardless of the lifting equipment used for loading or unloading the truck or trailer (electric pallet truck, manual, PIT).

Before loading / unloading each truck or trailer, a visual inspection of safety equipments will be carried out and documented by the fork lift driver to ensure they are in place and operating properly.

When parking on a parking lot, any trailer disconnected from the truck must be equipped with a trailer jack (correctly positioned according to the supplier's instructions). This trailer jack is stable, easy to handle and storable (wheels, cranks, etc.).

4.8. Use of PITs explosive atmospheres

PITs and the handling equipment used or likely to be used in explosive atmospheres must comply with the following standards:

- in Europe, ATEX 94/9/EC and ATEX 1999/92/EC
- in North America, NEC 500/505
- in other countries, ATEX 94/9/EC and 1999/92/EC or NEC 500/505

The PITs must be technically suitable for safe use in these areas. A compliance certificate will guarantee that they can be used in ATEX or NEC 500/505 category areas.

In certain cases listed below, safe PITs will be authorized to operate:

- in distribution centres, for the transporting of flammable aerosol type FGs or flammable liquids
- in factories, for the transporting of flammable aerosol type FGs or flammable liquids and the transporting of flammable liquid or powder raw materials or fluids
- in the areas adapted for flammable liquids, provided that these are designed in accordance with the General Procedure EHS-001-20 and the



relevant Technical Instructions, with the ventilation working and an interior zoning to specify the circulation areas for the PITs.

In the case of alarm from the explosion measuring system or the development of a dangerous situation identified in the SHAP (spillage of flammable liquids, etc.), the entry of safe PITs to the premises will be forbidden and the PITs already present will be abandoned as is and without any maneuvering by the operator.

The safe PITs will be equipped with:

- Alternative current engines
- Stainless steel chain lengths (at least 2) dragging on the floor to discharge any static electricity
- Peripheral apron to prevent driving over an object (space between the apron and the floor: 3 cm)
- Anti-piercing fork (two arms - ISO certified): model CARGO SAVER from VETTER. Depending on the use, the arms of the fork may be given an electrostatic conducting non-slip coating.
- Certain electrical components (fuse boxes, connectors, etc.) may be built into IP 67 boxes (as per truck supplier ADR)
- In the case where there is a risk of the contents sliding on the fork (barrel, container or metal pallet), the arms of the fork will be fitted with a static electricity conducting non-slip device.

These measures can be "retrofitted" to equipment already in use (AC/DC engines) by the AS departments of the PIT suppliers. For new equipment, the Group's Purchasing Department has identified a reference of a safe PIT for each of our PIT suppliers.

All the PITs operating in explosive atmospheres must be subject to:

- a maintenance operation every 6 months
- a safety audit every 2 years

5. ASSOCIATED EHS DOCUMENTS

This General Procedure falls under the Process EHS-000-08 Transfer and Storage and is linked to the General Procedures EHS-301-16 Storage at height and eventually EHS-001-40 AGV.



APPENDIX: Requirements pertaining to training and the "PIT driving permit"

The training should be carried out in accordance with the available good practice codes. In countries where legal requirements in terms of training are applicable, the trainers must be approved by the certified authorities and must comply with the legal requirements and those from L'Oréal. Qualified trainers can include the manufacturer or the supplier of the equipment.

The requirements relating to the training and the "PIT driving permit" must include the following points:

- Basic training (theory and practical)

This training must cover the skills and knowledge required to use a PIT safely and effectively.

For PIT 1, this training must be given by a recognised external expert company that will issue a certificate (license) at the end of the training.

For PIT 2, this training can be done internally by a trained, experienced person appointed by the site manager. Training specific to the workstation must include::

- This training must be adapted to the requirements of each site and must include:
- the tasks to be carried out, such as loading and unloading operations of certain types of raw materials or finished products.
- safety equipment specific to PITs and the checks to be done before use.
- the knowledge of the principles of use and control of PITs, including any possible attachments to be used.
- routine and maintenance inspections of the PITs in accordance with the user manual or the instructions published by the manufacturer.
- the importance for the operators to keep their head, arms and legs within the protected confines of the PITs.
- the rules specific to the site relating to the safety of the PITs and pedestrians, including:
- the necessary measures to be taken to ensure the safe use of PITs in the workplace.
- the organization of the pallet racks (maximum load per cell, authorized positions depending on the type of load, etc.)
- the storage rules (number of pallets per pile depending on their category, storage of hazardous products, etc.).
- the risks related to the handling of certain loads (alcohols, acids, aerosols, etc.).
- the requirement that any PIT not in use must have the fork in the lowered position, the control systems neutralized, the power setting at 0 and the handbrake engaged.



- the instructions on the speed limits and the safety systems put in place to prevent incidents.
- the protective measures in case of incident.
- the circulation plan.
- Group EHS training in “good practices for PIT drivers”
- The risks related to the interaction with the AGVs

The knowledge and understanding of the elements above must be confirmed by practical and theory testing.

A "PIT driving permit" may be issued by the site manager if the employee/temporary worker is/has:

- Medically suitable to drive a PIT (the minimum: general eye test and a depth perception test) – checked annually.
- Completed the theoretical and practical training (theory repeated every 2 years)
- Passed the training tests.
- Completed the Group EHS training in “the good practices for PIT drivers” (renewed every year or after an absence of more than 2 months)

The "PIT driving permit" should indicate the name of the person, the list of the PITs that the person is qualified to operate and the start date and renewal date of the permit. During the first two months following the issuing of this permit, the operator must be re-assessed periodically by his direct supervisor. At the end of this period, the supervisor will determine whether the operator has correctly applied the training received and can be considered to be a safe operator. If this is not the case, the "PIT driving permit" will be withdrawn and the operator will undergo new training. Records are kept in the employees file.

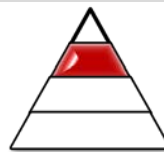
An individual license or certification will be required for each type (model) of PIT. Reconversion training is required for operators that have to use a PIT for which they are not specifically trained.

The supervisors must constantly measure the performance of the operators to check whether they need to renew their training. They must regularly audit the compliance with the "good practices for PIT drivers" and must carry out MESUR inspections with the PIT drivers. For the supervisors, the theoretical training and the good practices must be renewed every 2 years.

Indicators to be taken into consideration for the renewal of the training or questioning the skills of an operator are near-misses, accidents, or dangerous practices.

The case of operators that are occasional users, that have not used PIT for a long time, or the case of changes in working environment or practices must be considered to present specific risks.

This page was intentionally left blank for duplex printing.

**Energy Management****General Procedure
EHS****Object :** Cancels and supersedes general procedure EHS-001-10 A**Issuer :** L'OREAL GROUP EHS**Distribution :** L'ORÉAL GROUP EHS**CONTENTS**

1. PURPOSE	2
2. SCOPE.....	2
3. RESPONSIBILITIES.....	2
4. GLOSSARY.....	3
5. DESCRIPTION	3
5.1. General Principles.....	3
5.2. Mapping of the distribution system and monitoring of consumption	3
5.3. Mapping of energy consumption	4
5.4. Energy consumption reduction program	4
5.5. Renewable energy management	5
6. ASSOCIATED EHS DOCUMENTS.....	5



1. PURPOSE

The object of this General Procedure is to describe the organisation put in place in order to ensure the management of energy (electricity, gas, fuel, steam, biomass, geothermal, solar, wind, etc.) by the factories and the distribution plants, as well as to implement a policy to reduce energy consumption.

The objectives of this procedure are to ensure that:

- the internal distribution circuits are known
- the quantity of energy used is monitored and analyzed regularly per type of use;
- a programme to reduce energy consumption is put in place
- a renewable energies deployment program is implemented

In the event of differences between local regulations and the rules set out in this document, the most stringent requirements shall apply.

2. SCOPE

All types of energy sources are taken into consideration in this procedure: provided by an external grid, on-site or off-site energy production, etc.

This procedure does not cover the operation and the maintenance of energy production and distribution equipment, nor does it cover the operation and maintenance of the various equipment that consumes energy.

This general procedure applies to all L'Oréal Group sites.

3. RESPONSIBILITIES

The responsibilities set out below are in line with EHS 000 01.

The Site Manager is responsible for defining the objectives and targets for reducing energy consumption, in agreement with the DOEHS.

The heads of department are responsible for monitoring the energy consumption meters for each zone and for the specific training of personnel in energy management.

The EHS Steering Committee of the site is responsible for monitoring the progress of the objectives and of the consolidated energy consumption reduction plan.

For the plants, the EHS UP Pilot Committee is responsible for monitoring progress of targets and the energy consumption reduction plan for the UP.

The ETNEHS manager is responsible for:

- The mapping and update of power supply networks;
- The mapping and update of energy consumption;



- The monitoring of the energy consumption for the site according to the source
- The maintenance of the meters
- The general training of personnel relating to energy management
- The renewable energies deployment
- The general training course of site staff setting out the principles to be complied with for good energy management. If necessary, (special equipment, etc.) this training course will be complemented by specific training provided under the responsibility of the supervisor.

4. GLOSSARY

Acronyms are available into the “EHS Group glossary”

5. DESCRIPTION

5.1. General Principles

Energy management relies on a detailed knowledge of the sources and the consumptions according to use.

The following energy management structure is applied by order of priority:

- Reduced consumption
- Energy recovery
- Renewable energy

The solutions offering the best overall performance in terms of the environment are prioritized. The use of renewable energies, with a low impact in terms of the greenhouse effect, are given priority over fossil fuels (e.g. coal, fuel oil, gas, etc.).

General training to explain the principles of optimal energy management must be offered to the personnel on the site by the ETNEHS manager. This training will be complemented by specific training offered by management.

5.2. Mapping of the distribution system and monitoring of consumption

The energy distribution system must be mapped, and sorted by type of energy. The map of the circuits must be updated whenever a modification is made.

Consumption must be monitored by type of energy (grid electricity, electricity produced on site, gas, fuel oil, steam, etc.).

Consumption will preferentially be monitored using a meter. At least one primary meter must be found at the site supply point, displaying the total consumption at this source. The meters must be read at least every month.

Meters must be maintained and calibrated regularly to ensure the reliability of the reading.



5.3. Mapping of energy consumption

For each type of energy, a mapping of the uses must be compiled, and must contain at least the following elements:

- Energy consumed for the heating or cooling of buildings
- Energy consumed for lighting by zone
- Energy consumed by utilities (such as air compressor, cooling units, boilers, etc.) by zone
- Other energy consumed by production equipment (manufacturing, packaging) by zone

The sum of the consumption of all the uses listed above must be equal to at least 80% of the site's overall consumption. The quantification of the uses must be done over one calendar year, based on regular monitoring or calculations. This mapping must be updated every year.

A monthly monitoring by meter must be put in place for each UP and for each utility, and for significant consumptions (see instruction *EHS-002-10 Reduction of energy consumptions*).

This meter must be maintained in the same way as the general meter (see next section).

5.4. Energy consumption reduction program

For any new project (new equipment, new installation, renovation of installations or buildings etc.), the priority objective should be the reduction of energy consumption.

In the context of existing activities, an objective for the reduction of all types of energy consumption (electricity, whether renewable or not, fuel, gas, etc.) must be compiled by the site's management.

This objective must be submitted to the DO EHS who ensures the consistency between Zone/Division objectives and approves them. Once approved, the objective must be sent to the Group's EHS Department, and displayed and communicated to personnel.

For any other use representing more than 10% of the site's total consumption as shown by the site's energy use map, a target, in line with the site's general objective, must be defined.

If relevant, these targets must be broken down according to zone. A monthly monitoring of the site's performance and of each zone in terms of the objectives and targets must be done during the site's EHS steering committee meetings, and by the UP EHS steering committee meetings for the factories, and communicated to the personnel.

Based on the objectives and targets defined, a plan to reduce energy consumption, defining actions, responsibilities, resources and time frames, must be implemented involving each concerned senior manager.



The energy management hierarchy principles must be applied to set this action plan.

The technical measures developed in instruction *EHS-002-10 Reduction of energy consumption* will be followed for the implementation of the energy consumption reduction program.

5.5. Renewable energy management

The site must study the possibility of substituting existing energy sources with renewable sources (photo-voltaic and thermal solar, wind, biomass, geothermal, etc.). This study should be formalised by a technical-economic study.

6. ASSOCIATED EHS DOCUMENTS

This General Procedure comes under the following Processes:

For the Operations:

- EHS-000-04 Acceptance
- EHS-000-05 Manufacturing
- EHS-000-06 Packaging
- EHS-000-07 Co-packing, preparation of orders, return
- EHS-000-08 Transfer and Storage
- EHS-000-10 Administrative activities
- EHS-000-11 Shipping

For the Group:

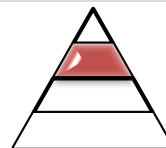
- EHS-300-20 Facilities and Utilities
-

This General Procedure is also linked to Technical *Instruction EHS-002-10 Reduction of energy consumption*.

This page was intentionally left blank for duplex printing.



Lone Work Management



**EHS GENERAL
PROCEDURE**

Object : Creation

Issuer : L'OREAL GROUP EHS

Distribution : L'OREAL GROUP EHS

CONTENTS

1. PURPOSE.....	2
2. SCOPE OF APPLICATION.....	2
3. RESPONSIBILITIES.....	2
4. DESCRIPTION.....	3
4.1. Definition.....	3
4.2. Background.....	3
4.3. Risk evaluation.....	3
4.4. Elimination / reduction of lone work.....	4
4.5. Case of intervention of an external company	5
5. ASSOCIATED EHS DOCUMENTS	6



1. PURPOSE

The purpose of this general procedure is to alert Management regarding the identification of lone work, provide a framework for the management of risks in this situation, identify the responsibilities of each stakeholder, and describe the actions towards risk reduction.

It concerns any staff member whose partial or total activities on a L'Oreal site imply carrying out tasks as a lone worker, as defined in this procedure.

2. SCOPE

This general procedure applies to production plants, distribution centres, R&I sites, and administrative sites of the L'Oreal Group.

The situations concerned are all the work phases corresponding to the concept of lone work as defined in this procedure.

In case of differences between the local regulations and the rules imposed in this document, the most limiting requirements are applied.

3. RESPONSIBILITIES

The Site Manager is responsible for the site compliance with the regulations relating to employee safety when working alone, as well prevention and protection of these site workers.

The ETNEHS Manager, or equivalent, coordinates:

- Identification of lone work situations
- Through workstations risk analysis, prevention plans during the interventions of external companies and work permits when required;
- Lone worker procedures specific to his/her site, (these procedures must include emergency situations) ;
- Definition of the equipment necessary to lone work situations, and the implementation of a maintenance and inspection plan for this equipment.

He/She must also make sure that the staff intervening as lone workers is specifically trained. The Department Heads must include lone work situations in all the risk evaluations performed in their department and make sure that the associated procedures are carried out properly. They must also guarantee the training and skills of their direct reports.

In case of regular lone work, a medical clearance will be requested.



4. DESCRIPTION

4.1. Definition

The notion of lone work is defined as the performance on a L'Oreal site of a task in a work environment where the person cannot be seen or heard directly by others and has little probability to receive a visit. Tasks exceeding one hour are automatically part of this definition.

4.2. Background

Lone work is not dangerous as such, but may increase the consequences of an accidental event due to the difficulty to warn others. Work situations - including administrative ones- must be taken into account, as a minimum, in the 9pm – 7am time range and during weekends and holidays.

4.3. Risk evaluation

Workstations risk analysis must consistently take into account the notion of lone work for the activities performed by each employee.

These risk evaluations must take into account, as a minimum, the following:

- Work environment – location, safety, access;
- Circumstances – nature of work / tasks to carry out, special circumstances;
- Individuals concerned – indication of potential or actual risks associated with the individuals;
- Records – prior accidents in similar circumstances.

Any workstation which fits the definition of lone work must be the object of a risk evaluation.

Example on how to apply this procedure:

- Considered as lone work: A treatment plant operator is a lone worker when he is the only one conducting his installation, even if he is only performing administrative tasks in an office.
- Not considered as lone work: An employee working alone in an office is not a lone worker if this office is located in a building in which other employees are present and therefore likely to visit their colleagues regularly.



An employee, whose activity does not qualify him/her as a lone worker, is not a lone worker when he goes alone from point A to point B on a site.

4.4. Elimination / reduction of lone work

4.4.1. Risks of accidents or occupational diseases

Whenever reasonably possible, lone work should be avoided.

The following order should be followed:

- Eliminating lone work
- Reducing the frequency or length of lone work, via organizational measures such as change of shift, task optimization, phone contact, etc.
- Making available collective means such as operations video surveillance may be considered, taking into account the legal obligations associated with this type of device;
- Making available the following individual means:
 - Various alarm systems can be supplied such as alarm devices for lone workers (DATI). These devices should be selected according to each site specific conditions and adapted to them (automatic man down alarm, loss of motion detectors). They can, if necessary, include voluntary alarm systems.
 - A vocal communication system (which may be incorporated to DATI) must be provided to be able to clear up immediately any doubt in case of an alarm going off.
 - An anti-aggression system for the staff likely to be in contact with the outside (site or store security, etc.)
- Specific training to the staff susceptible to perform tasks as a lone worker, including:
 - Identification of lone work situations;
 - Knowledge and control of risks and operational procedures associated with the tasks to perform;
 - Control of specific equipment used in the context of lone work management;
 - Knowledge of emergency procedures in the context of lone work.



4.4.2. Emergency Situations Management

Specific procedures for emergency situations management of lone workers must be established.

These procedures describe in particular the human and material means made available for the identification of emergency situations, doubt removal, and emergency services intervention when necessary.

If necessary, these procedures include emergency situations outside of the site operating hours and describe the ad hoc rescue services implemented to ensure the intervention happens as soon as possible.

Drills are carried out regularly to test the efficiency of these emergency management measures.

4.4.3. Documentation

4.4.3.a Lone Work Management

All procedures regarding lone work interventions are documented, updated and communicated to the staff concerned (employees, temporary workers, subcontractors).

This communication is recorded.

4.4.3.b Management of equipment specific to lone work

Operational procedures specific to the maintenance, upkeep and inspection of equipment involved in the management of lone work situations must be established. A documented maintenance plan must be established for the equipment concerned.

4.5. Case of intervention of an external company

In case of intervention by an external company, the prevention plan will include the identification of lone work situations (also during the phases of travel on site). Compensatory measures will apply to employees of external companies the same way as to L'Oreal employees.

L'Oreal will make available the equipment necessary to the implementation of operational procedures for lone work interventions, as long as it does not go against local legislation.

The borrowed equipment will be consistently tested before usage. The test will be recorded. The person will be trained to its usage. This training will be recorded as well.

Work permits specific to the interventions should, when necessary, indicate the compensatory measures taking into account lone work conditions. For certain



works, such as work at height or work in a confined space, lone work cannot be tolerated.

Training to instructing parties, desk officers and persons authorized to deliver work permits must include concepts of identification, prevention, contractors' protection and management of emergency situations including lone workers.

5. ASSOCIATED EHS DOCUMENTS

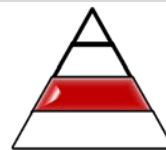
The present Instruction Technique is associated with the following Processes:

- EHS-000-04 Receipts
- EHS-000-05 Processing
- EHS-000-06 Filling and Packing
- EHS-000-07 Co-packing, order preparation and returns
- EHS-000-08 Transfer and storage
- EHS-000-09 Control
- EHS-000-10 Administrative activities
- EHS-000-11 Shippings
- *EHS-000-22 Maintenance and work.*

It is also associated with General Procedures *EHS-001-05 Risk assessment and EHS-301-29 EHS Organization during operations by external companies.*



Reduction of energy consumption



EHS technical instruction

Object : Cancels and supersedes technical instruction EHS-002-10 A

Issuer : L'OREAL GROUP EHS

Distribution : L'OREAL GROUP EHS

CONTENTS

1. PURPOSE.....	2
2. SCOPE	2
3. RESPONSABILITES	2
4. DESCRIPTION.....	3
4.1. Energy management	3
4.2. Lighting.....	3
4.3. Compressed air	4
4.4. Cooling Units.....	5
4.5. Heating	5
4.6. Office equipment	6
4.7. Heat recovery.....	6
5. RELATED EHS DOCUMENTS.....	6



1. PURPOSE

The aim of this technical instruction is to define the measures to be implemented to reduce energy consumption. The application of these measures is recommended for existing sites and is compulsory for new sites or the extension of existing sites.

2. SCOPE

This technical instruction applies to all the L'Oréal Group activities that use energy.

3. RESPONSIBILITES

The ETNEHS manager is responsible for:

- The installation and maintenance of lighting installations
- Optimising the energy efficiency of compressed air production installations
- Optimising the energy efficiency of cooling units
- Optimising the energy efficiency of heating installations
- Setting up heat recovery systems

The Heads of Department are responsible for:

- Optimising the energy efficiency of installations that consume electricity
- Managing the use of lighting installations
- Optimising the energy efficiency of installations that use compressed air
- Managing temperatures in the premises
- Optimising the energy efficiency of office equipment



4. DESCRIPTION

4.1. Energy management

Energy management must take into account the following instructions:

- In the specifications, stipulate the request for selecting equipment with good energy performance and request high-output motors
- Adapt the speed of the electrical motors by fitting them with electronic speed governors
- Ensure that the power factor is at least equal to 0.93
- Initiate a CTM (Centralised Technical Management) system to recover all the technical data from the Production Centre
- Design new buildings and enforce the optimisation of energy consumption for as long as they are used

4.2. Lighting

The management of lighting must include the following principles:

- Measurement of the lighting in all the work areas at least every 3 years and whenever significant modifications are made
- Adapting the efficiency of the lighting according to requirements, in accordance with regulations and the standards of the Group
- Selecting the lighting methods that use the least amount of energy
- Selecting the lighting technologies that have the smallest impact on the environment waste management)
- Reducing the operating times to what is strictly required
- Use high quality reflectors
- Install automatic lighting systems (e.g. automatic lighting and switch-off systems in low frequency areas such as toilets, corridors, storage areas, boiler rooms, etc. and outside areas)
- In existing facilities, reduce the number of lighting fixtures to the necessary minimum.
- Consider the technology of "lighting tubes" known as "skylights"
-

For example, the following actions could be implemented to optimise the management of light fittings that include power sources (bulbs) and transformers (ballasts):

- Implement a lighting standardization and replacement program using high performance systems (Install LED lights).
- If it is not possible to install LED, install high frequency electronic ballasts when renovating lighting.



4.3. Compressed air

Take into account the following actions in order to optimise the energy consumption related to the production and the use of compressed air:

- **Cleaning air filters**

Follow a regular schedule to check the condition of the filters.

Prioritise preventive maintenance.

- **Shut down the compressors when production is halted**

Install shut-down valves on each processing line and train operators to cut off the air supply during breaks, lunch breaks and when the line is not in production. If air needs to be kept compressed for certain instruments, consider a smaller, local compressor, which will reduce wear and tear on the larger compressors, provided that it is economically viable.

- **Check the air intake from the outside**

Configure the outside air intakes of the buildings in such a way that they are far away from any hot or humid air extraction outlets.

- **Check the correct dimensioning of the pipes / hoses**

- **Produce compressed air at the lowest possible pressure**

- **Install variable speed compressors to optimise the operation of certain compressors.**

- **Cascade the various compressors in order to better monitor demand**

Ensure that the compressor has reached its maximum level of performance before starting the second, third, etc.

- **Check the compressed air leaks**

Twice a year, check that there are no leaks on the lines (generally these leaks come from under-performing connections and connectors, faulty valves or cracks in the rubber or plastic hoses). These leaks can be detected using an ultrasound detector. The leaks must be listed and monitored until repairs have been done.

- **Investigate alternatives to the use of pneumatic tools**

Check and identify those pneumatic tools that could be replaced with electric tools.

- **Remove compressed air guns from use; if this is not possible, use only according to demand; otherwise, reduce the working pressure**



4.4. Cooling Units

Take into account the following actions in order to optimise the energy consumption related to the management of cooling units:

- **Schedule correct maintenance of the cooling equipment during their lifetime, according to the recommendations of the manufacturer**

Some of the maintenance operations that should be given special attention are: clogging of the exchange surfaces, maintaining the quality of the coolant, the heat transfer medium and the chilled water, the limiting of emissions from the coolant, correct pressure levels, correct temperature differences, overheating within defined tolerance levels, correct insulation of the cooling systems.

- **Consider cold storing**

Firstly, define the requirements in terms of cooling, temperature to be reached or maintained within the area to be cooled and cooling power to be used. It is economically recommendable.

4.5. Heating

Take into account the following actions in order to optimise the energy consumption related to the management of heating systems:

- **Select the suitable heating method**
- **Determine the size of boilers in accordance with site needs**
- **Keep the temperature of the working areas to 19°C maximum**

Keep heaters away from objects in order to not alter their heating capacities.

Reduce or shut down the heating in case of prolonged absence.

- **Apply preventive monitoring and maintenance schedules to the boiler and to the heat distribution and condensation recovery distribution systems.**

Specifically, bleed valves must be thermally tested once a year. They must be identified on the plans and must be included in maintenance programmes.

- **Carry out an inspection of the circuits, in order to detect any steam leaks that must be repaired, specifically the bleed valves of the low points**
- **Ensure the correct dimensioning of the boilers according to the factory's requirements**

Carry out a diagnosis and check the adequacy between the installation and the requirements.

- **Keep the boiler clean**

Large boilers and those using fuels that are prone to clogging, must be fitted with a blower system to remove soot from the sides exposed to flames during operation.

The use of brushes is recommended.

- **Check that there are no water leaks**

Check that the make-up water meter is not permanently running. Seal leaks as quickly as possible.

Check the state of the insulation.

- **Consider replacing old boilers with higher output boilers**



- Consider the possibility of having an independent domestic hot water production system (possibly using solar energy), to allow the boiler used for heating to be shut-down during summer
- Include the production and distribution of thermal energy on the CTM

4.6. Office equipment

Take into account the following actions in order to optimise the energy consumption related to the management of office equipment:

- Based on the activity, estimate the times that operation is required of the equipment
- Check the suitability of the equipment with the requirements: capacity of photocopiers, screen dimensions, shared use of printers, etc.
- Check the selection criteria when new equipment is acquired: take the energy criterion into account

Computers to be placed in "sleep" mode or shut down (recommended) when not in use.

- At night, all equipment to be shut down (computers, screens, printers, etc.)

4.7. Heat recovery

As part of the energy consumption reduction plan, the site must investigate the possibilities of heat recovery. For example:

- Use of heat exchanger to recover the calories from boiler smoke
- Recovery of the calories from the factory effluents
- If compressors are water-cooled, investigate means of recovering the heat from the cooling water circuit

Consider the installation of a heat recovery system on the compressors for heating the building and on that of the process water.

- Use of a heat pump

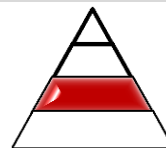
The use of a heat pump when heating and cooling requirements are high, simultaneous and constant.

5. RELATED EHS DOCUMENTS

This Technical Instruction falls under General Procedure *EHS-301-10 Energy management*.



Use of aerosols



EHS TECHNICAL INSTRUCTION

Object : Cancels and supersedes RIO 17, les RIS 20, 48 et 49 and TI EHS 002 17 A

Issuer : L'OREAL GROUP EHS

Distribution : L'OREAL GROUP EHS

Modifications from the version A

CONTENTS

1. PURPOSE.....	2
2. SCOPE	2
3. RESPONSIBILITIES	2
4. DESCRIPTION.....	3
4.1. Management of aerosol risk	3
4.2. Manufacturing of aerosols.....	5
4.3. Storing and handling aerosols.....	6
5. ASSOCIATED EHS DOCUMENTS	11



1. PURPOSE

The object of this technical instruction is to define the technical measures to be established and maintained in order to prevent risks of fire and explosion in the sites, workshops, or premises where the specific risk is associated with the use of aerosols.

2. SCOPE

This technical instruction applies to the Group's sites that have aerosol manufacturing and/or storing activities.

It also defines the Group's obligations towards Storage and Finishing service providers storing or handling aerosols.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3. RESPONSIBILITIES

Responsibilities in terms of fire prevention and protection are defined in GP *EHS-001-20 Prevention of Fire Risk*.



4. DESCRIPTION

4.1. Management of aerosol risk

All sites manufacturing or storing aerosols will need to establish a detailed SHAP of the different activities involving aerosols. This detailed SHAP will be reviewed at least once a year.

This analysis will include as a minima the specific following risks:

- Creation of a flammable atmosphere
 - Crushing of a case on the ground by a handling machine
 - Fall from height of aerosols (when aerosol boxes fall from a pallet handling machine for example)
 - Piercing of aerosols by the forks of a handling machine hitting cardboard boxes
 - Accidental spraying. After some cardboard boxes have fallen or when loads are placed on top of aerosol pallets or boxes, it was observed that the deformation of the cardboard boxes could impact the covers and then action the aerosol valves, thus liberating the flammable gases.
 - Defective aerosols
 -
- Exposure to a heat source
 - Reminder: the following shows on all the aerosol cans: "Do not expose to a temperature superior to 50°C".
 - When an aerosol finished prodcut (FP) is heated above this temperature, the pressure increase inside the can can be such as to provoke the bursting of the can and thus the instantaneous liberation of alcohol vapors and/or flammable gases. Generally speaking, a volume of a diameter of about 2 meters of flammable atmosphere can then be created. Its combustion would create immediately within this volume a ball of fire likely to burn any person being there.
- Missile effect in case of fire
 - It is possible that the bursting of the case is due to the push-out force on the valve or bottom and only provokes a small opening. In case of combustion, the progressive combustion of flammable materials can then provoke a phenomenon similar to a small rocket and the flammed aerosol may be propelled and transfer fire on significant distances, reaching potentially tens of meters (sometimes up to more than 100 meters).
- ...



4.1.1. Classification and identification of aerosols

For each aerosol FP, the category according to the GHS classification is determined by R&I during the officialization. It is given based on ELIXPEDIA date (Group data management).

There are three categories of aerosols according to this classification:

- Category 1: highly flammable aerosols
- Category 2: flammable aerosols
- Category 3: non-flammable aerosols

(see flowchart in appendix)

The classification into categories gives an indication of the power of a fire involving aerosols and the risk that the disaster will spread.

This risk is high for category 1 and 2 aerosols, like deodorants, hairsprays, and sprays; it is lower for category 3 aerosols, shaving creams, shaving gels and water misters for example.

In order to directly inform all operators of sites needing to handle aerosols, the indication of the category to which an aerosol FP belongs must appear on each packaging standard in addition to "AEROSOLS".

Similarly, the information about this category must be provided throughout the Supply Chain to the primary and commercial distribution centres.

It is also necessary for customers and service providers of L'Oréal needing to store our aerosol products.

Watch out for a risk of confusion between the old concept of "level of aerosol" used before and the concept of "category of aerosol" used now within the GHS rules.

A training on this important change must be given to anyone handling aerosols.

In order to reduce the risk of confusion, the concept of "level of aerosol" currently used in the different databases must be progressively removed from these databases.

4.1.2. Evacuation of premises

The entire staff is trained in the use of extinguishers and the special risks associated with intervention in aerosol fires. Intervention is not authorised for persons who have not been trained.

In the event of evacuation of the building, the assembly points must be situated so as to permit the complete evacuation of the site without requiring the staff to congregate in an area that could be reached by projections of aerosols.



4.1.3. Management of defective aerosols and aerosol waste

Special attention must be given to defective aerosols and aerosol waste. Its elimination must be done under safe, controlled conditions (collection to be specified for each site). The defective aerosols are stored outside of the building. A possible solution is to isolate it from the building at a distance of 20 metres and place it within a volume fully covered with wire mesh.

4.1.4. Exposure to heat

During the packaging of aerosols, including for co-packing operations, it is forbidden to use equipment which would expose the aerosols at a temperature superior to 50°C (in particular shrinkwrapping, heat shrinking, etc.) – there are some alternative cold techniques.

In order to prevent the risk of bursting of aerosol cans due to heat, the temperature is managed so as to remain below 50°C (during manufacturing, each aerosol was tested individually at this temperature).

For example

- Aerosols are placed in storage in such a way that they are never in direct contact with a heating vent or in its immediate vicinity. In hot countries, attention must also be given to risks associated with storage positions directly under roofs that are not thermally insulated.
- Aerosol pallets being received or shipped are not exposed to the sun under conditions causing their heating (directly or behind a pane of glass).

4.2. Manufacturing of aerosols

The aerosol manufacturing premises are premises where explosive atmospheres may appear. As such, all electrical, electronic, and mechanical materials and equipment must be adapted to these areas and must not produce any mechanical, electrical, or electrostatic sparks. They must meet the requirements of § 4.2 of TI *EHS-302-18 Electrostatic Risks*.

The gas filling units for aerosols require thorough maintenance as well as special verification of the condition of the fixed pipes or hoses containing gas as well as all of the safety equipment.

At the end of their production, all of the aerosol FPs are tested individually in order to ensure their ability to withstand the elevation of their internal pressure when they are heated to 50°C (or 55°C according to local regulations).



In order to reduce the risk of spreading of a potential fire, category 1 or 2 aerosols must all be grouped in sealed cardboard boxes (wet cardboard reduces the heat transmission to aerosols).

The pallets are laminated near the packaging lines in order to reduce the risk of falling standards.

To facilitate the penetration of the water provided by sprinklers or fire nozzles to prevent the ignition of aerosol pallets, pallets are laminated:

- on the four sides
- and not on the top surface. This last instruction only applies to category 1 and 2 aerosols (irrelevant for category 3 aerosols)

4.3. Storing and handling aerosols

4.3.1. General information

Only category 3 aerosols can be stored with the other FPs in the all-product storage areas of the sites.

Category 3 aerosols may also be stored with category 1 and 2 aerosols in specific storage areas of the distribution centres.

In order to ensure good stability of the pallet storage and to be able to bring the discharge of extinguishing water closer to each stored pallet, storage in piles is not authorised for aerosol pallets.

Except if the dock area is sufficiently protected (high-expansion foam), stacked pallets must not be kept more than 4 hours on the dock awaiting loading or after the unloading a truck. These rules apply to 100% aerosol pallets and not to mixed pallets.

Management of storage risk

- Risk of an aerosol being run over

Aerosols on the ground could be crushed by forklift trucks and cause a fire to start immediately.

Therefore no aerosol should be left on the ground (damaged boxes, customer returns, quality samples, etc.).

- Risk of an aerosol being pierced

To avoid the risk of an aerosol being pierced due to lack of visibility at height, a formal risk analysis will allow to decide on the maximum storage height of category 1 or 2 aerosols.

Technical devices like end of forks cameras and level preselectors are preferred. In the absence of these supporting devices, the maximum pallet storage height is limited to 6m50.



Also to avoid the risk of releasing flammable products into the atmosphere, the effect of perforation by handling truck forks must be limited by the use of “anti-piercing” forks

For sites not equipped with such forks yet, the following measures will be implemented:

- Rounding the ends of the forks
- Anti-spark forks

Or use of a pallet truck without fork elevation.

- Risk linked to handling or storage of an aerosol pallet

Special attention must be paid to the stability of pallets while handling them. This aspect is even more important for aerosols. Because the speed of the EMF is limited to 8 km/h on L'Oreal sites, transfer of stacked pallets by the 80 side is authorized.

Stored pallets must always be properly established and stable in order to prevent falling boxes. Such a fall could cause the release of flammable products by bursting containers or activating their valves.

The trucks used to handle aerosol pallets must not generate mechanical, electrical or electrostatic sparks. They will comply with the definition of secured EMF from the GP EHS-301-01 (§ 4.7).

A detailed SHAP must be completed for the use of AGVs looking in particular the measures necessary to control explosion/fire risks. The SHAP must be shared with the Zone/Division EHS Director.

- Risk linked to a damaged aerosol

The procedure and the technical means for collecting and ensuring the safety of these aerosols must be defined.

The sites must be equipped with a LEL (lower explosive limit) portable measuring device in order to be able to check the atmosphere in case of accident. If the result of the measurement is greater than 20% of the LEL, the area must be evacuated until the circulation of air has brought the concentration down below 20%

All pallets covered with a film and susceptible to contain defective aerosols and therefore gas must be controlled before handling – never remove the film around the pallet before performing the following operations:

- Control of the atmosphere near the pallet
- Piercing of the film above the pallet (when appropriate)
- New control of the atmosphere



- Begin removing the film from the bottom of the pallet (propellant heavier than air)

In the event of falls or damages of aerosols or aerosol boxes, the operator must not make any manoeuvres, even switching off the ignition (in case aerosol containers could have been perforated).

Indeed the fork-lift truck must remain in its current state at the time of the explosion, as each movement of the fork-lift truck and each tipping of the mast could generate sparks whose energy is largely sufficient to ignite the gases. The power cut is also a source of a dangerous spark.

The operator must be trained to execute the following tasks in order:

- Leave the fork-lift truck in its current state (do not cut power)
- Call or have someone call the Safety Department, using a method with no risk of igniting the flammable atmosphere possibly formed. These alarms are arranged in such a way as to permit a quick alert.
- Prohibit access to the area for other fork-lift trucks
- Prepare to take action with the fork-lift truck's extinguisher if a fire breaks out (the conditions in which an operator may intervene must be clearly defined).

- Risk linked to storage in a confined space

In order to avoid the accumulation of gas in case of an aerosol leak, aerosol pallets must be stored in a ventilated area (natural or forced ventilation – see EHS 002 21).

4.3.2. Case of factories

Only category 3 aerosols can be stored with the other FPs in the all-product storage areas of the factories.

Considering the specific risks presented by category 1 or 2 aerosols, the following rules are imperative – only apply to category 1 or 2 aerosols.

- All aerosol pallets leave the factory's production buildings once they exit the line before quality control.
- The shipping dock through which the aerosols are shipped is placed in such a way to reduce as much as possible the distance that the aerosol pallets need to travel within the factory's premises.
- A high-volume ABC mobile extinguisher is placed nearby.
- The trailer in the process of loading must be a cargo trailer (with solid sides).

In case of a fire, a system isolates the trailer to reduce the risks of spreading to the rest of the factory (for example, a mesh door made with a minimum 3 mm steel wire and



maximum 5 cm meshes or a fire door). This separation must be able to be cooled very much. The system is designed in such a way as to prevent an operator from becoming stuck.

- Aerosols can only remain at the production site on the condition that they are removed from the production buildings and placed in aerosol storage areas that met the isolation conditions described in § 4.4 of *TI EHS-002-21 Partitioning*. The flows and loadings of trucks leaving the factory are organised in such a way that the aerosol pallets never have to re-enter the factory's buildings or be in trucks that would be docked in a building of the site other than the one reserved for aerosols. Aerosols are loaded last into trucks leaving the site.
- The case of aerosol returns (quality issue for example) must be the object of a preestablished procedure.

4.3.3. Case of all-product distribution centres

Category 1 or 2 aerosol stocks must be isolated by occupying specific buildings that meet the isolation conditions described in *TI Partitioning EHS-002-21*. The presence of category 1 or 2 aerosols is not permitted in all-product primary distribution centres storage.

The flows and loadings of the trucks are organised in such a way that the category 1 or 2 aerosol pallets never need to enter the building of the all-product primary distribution centres.

It is best that trucks that would be docked in a building other than that of the aerosol storage contain no category 1 or 2 aerosol. This recommendation aims at avoiding to bring aerosols in an unprepared environment. However it is sometimes difficult to follow due to organization or to allow the correct loading of the truck (respect of axle load in particular).

In case this recommendation cannot be respected, a specific risk analysis will define the means to be implemented on the dock area receiving trucks that may contain aerosols (departure from all-product distribution centres and arrival at commercial distribution centres).

4.3.4. Case of commercial distribution centres

- The quantity of category 1 or 2 aerosol pallets present in the Commercial distribution centres is strictly limited to the base stock. The base stock is defined as the proper amount of stock necessary to cover the replenishment time.
In order to achieve this goal, all aerosols are delivered in flows towards the Commercial distribution centres. This applies to both standard products and products in launch or promotion.
- The maximum quantity of category 1 or 2 aerosol storage permitted in the Commercial distribution centres will be:



- Inferior to 150 tons of liquid + gas, for the distribution centres located in the European Union (this quantity corresponds to the low threshold of the Seveso 3 instruction).
- Inferior to 500 pallets in other distribution centres.

Any deviation from this last rule must be the object of a formal authorization from the Zone/Division Operations Director.

- The aerosol base stock area must meet the conditions of § 4.4.3 of TI *EHS-002-21 Partitioning*. In order to optimise the unused locations and ensure they are profitably made use of, the storage of products other than aerosols in this zone is authorised, under certain conditions:
 - As soon as one enters the aerosol zone, the storage and handling operations for all products must be carried out in strict accordance with all of the precautions and recommendations stipulated in this document for the handling of aerosols.
 - The storage of category 1, 2 or 3 flammable liquids is prohibited (according to the GHS regulations).
 - As a priority, one will store in these locations:
 - Category 3 aerosols (shaving foam, for example)
 - Products with low turnover, so as to minimize the activity in the area.
- The circulation of aerosol pallets through the rest of the distribution centres must also be limited as much as possible. For example, a good solution involves setting up a special receiving dock in the aerosol storage area.

Case of selective picking (unit or inner container): Selective picking in limited quantity (by the unit or by the "inner container", not by the box) can be performed in the regular picking area provided that the following requirements are respected:

- No more than one picking line per reference can be set up in the picking area
- The sides of the picking lines (or groups of corresponding lines) are permanently fitted with fencing (minimum 3 mm steel wire forming maximum 5 cm meshes).

Case of distribution centres storing less than 15 aerosol pallets: For distribution centres needing to store a limited quantity of aerosol pallets (never more than 15), alternative solutions can be put into place to control the risks:

- As soon as they are received, aerosol pallets are placed in individual mesh cages (minimum 3 mm steel wire and maximum 5 cm meshes). These cages are stored on the first level of the racks, protected by a sprinkler unit. They are continuously closed and opened only when picking must be performed.
- Aerosol storage positions are prepared on the first level of the racks. They are chosen in order to reduce the circulation of unprotected pallets in the distribution centre. These positions are completely enclosed by grating (minimum 3 mm steel wire and maximum 5 cm meshes). They are opened only to perform picking. They are protected by a sprinkler unit.

4.3.5. Case of buildings and shops

L'ORÉAL EHS-302-17 A	Scope GROUP 	Operations 	Administrative Sites 	R&I 	March 2017

In the event of storage in small quantity in buildings or shops, the storage conditions must be submitted, on a case-by-case basis, by the EHS Zone/Division Director and the Group Property Management team.

4.3.6. Case of service providers (outside L'Oreal buildings)

The risks associated with the handling, overpacking, and/or storage of aerosols (all categories) should be communicated in writing to the service providers (3PL or copacking).

The L'Oréal documents describing the safety measures adopted within the Group to control these risks will also be communicated to them in writing for information purposes.

It is up to the service providers (3PL or copacking) to adapt them to their own specific needs. Arrangements other than those described in this document can be used provided that they ensure a level of risk control that they deem sufficient.

These activities will at least comply with the local regulations and be audited by an expert third party according to the General Procedures *EHS-001-37 and 38*.

5. ASSOCIATED EHS DOCUMENTS

This Technical Instruction comes under General Procedure *EHS-001-20 Prevention of Fire Risk Operation*.

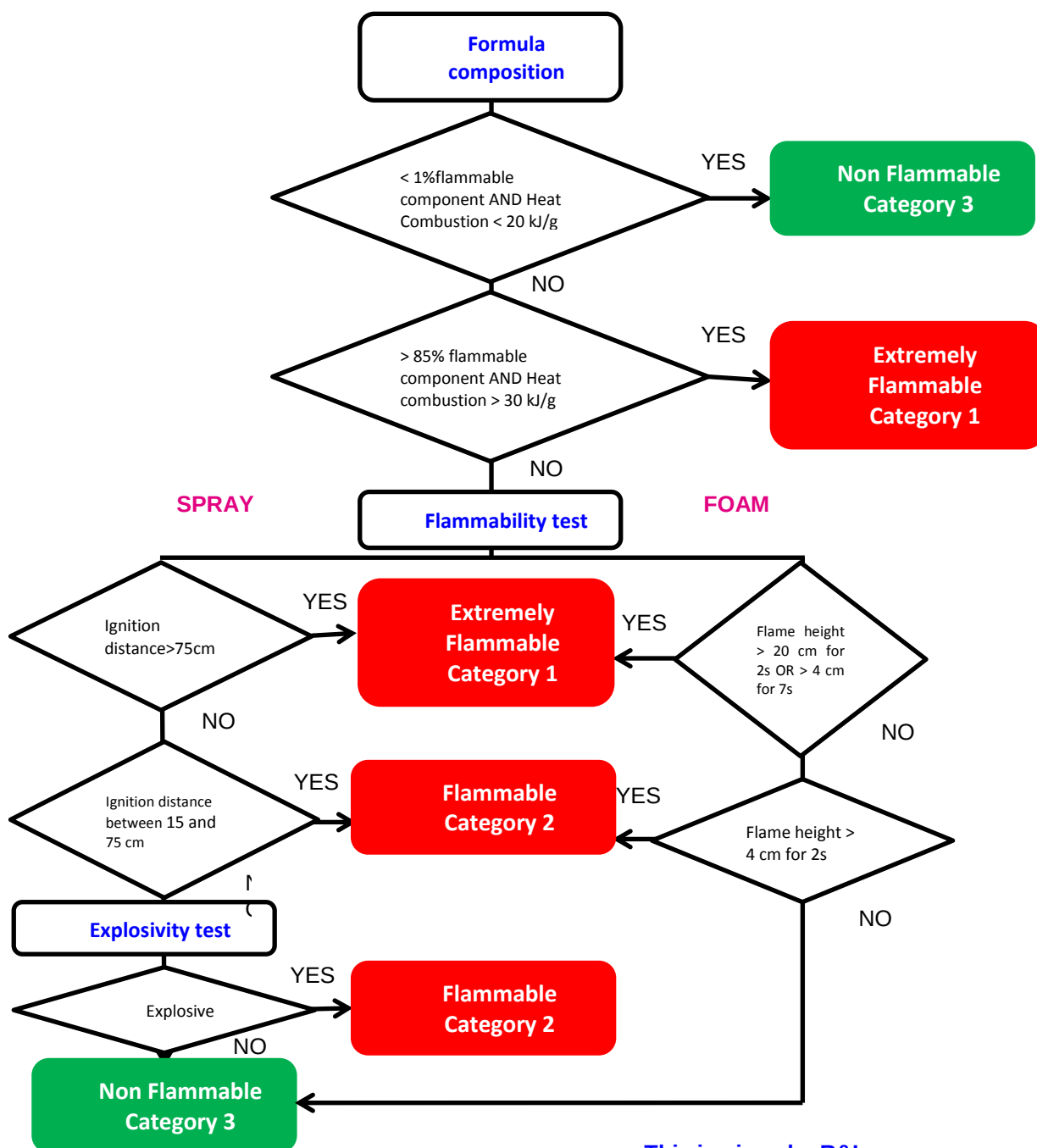
This Technical Instruction is also associated with the following Technical Instructions:

- *EHS-302-18 Prevention of Electrostatic risk*
- *EHS-302-19 Prevention and protection against explosions*
- *EHS-002-21 Partitioning*



Appendix on forks is missing (do not mention the manufacturer)

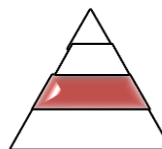
Flowchart of aerosol category definition



This is given by R&I

- Information available on « formule de principe » and « officialisation »
- Through « Aerosol panel to be used »
- Panel A (A1, A2, A3 or A4)
- = Category 1
- Panel B (B1, B2, B3 or B4)
- = Category 2
- Panel C (C1, C2, C3, C4, C5 or C6)
- = Category 3

Prevention and protection against explosion risks



**INSTRUCTIONS
TECHNIQUES EHS**

Object : cancels and replaces EHS-002-19 A

Adding § operations to transfer powders into flammable liquid.

Scope extended to Group

Emission : EHS Group

Diffusion : L'Oréal EHS

SOMMAIRE

1. PURPOSE	2
2. SCOPE.....	2
3. RESPONSIBILITIES	2
4. DESCRIPTION	3
4.1 Common measures to powders and flammable liquids.....	3
4.2 Case of flammable liquids.....	5
4.3 Case of cosmetic powders	10
5. ASSOCIATED EHS Documents:	17
6. APPENDICES	18
6.1 Appendix 1 : Definitions	18
6.2 Appendix 2 : Logical diagram of protection of isolated parts of the manufacturing installations for cosmetic powders.....	21

	Scope GROUP 	Operations ✓	Administrative Sites ✓	R&I ✓	February 2019

1. PURPOSE

The object of this technical instruction is to define, during the design or modification of sites, workshops, and rooms where explosive atmospheres may appear, the specific prevention and protection measures associated with the presence of flammable liquids, cosmetic powders, and aerosols.

2. SCOPE

This technical instruction applies to all the Group's factories, R&I and DG sites.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3. RESPONSIBILITIES

Responsibilities in terms of prevention and protection against fire are defined in GP *EHS-001-20 Prevention of Fire Risk Design*.



4. DESCRIPTION

4.1 Common measures to powders and flammable liquids

Regardless of the specific risk (risk associated with the presence of flammable materials: flammable liquids, powders, etc.), the manufacturing or storage rooms where explosive atmospheres may appear, facilities must comply with:

- The European directives and especially Directives 94/9 EC (ATEX - explosive atmospheres) and 99/92 EC (Directive on the protection of workers potentially at risk from explosive atmospheres) in the European Community,
- Technical recommendations N.E.C. 505 (National Electrical Code) Class I in the USA,
- For other countries, one of the two previously mentioned Directives.

For any modification of a skid, renewal, improvement, change of formula and production of a new formula, the initial risk evaluation (such as HAZOP or equivalent) must be updated to take into account the risks associated with these changes.

4.1.1 Identification

The manufacturing or storage rooms where explosive atmospheres may appear must be identified with clear, visible signage.

Similarly, these areas where explosive atmospheres may occur must appear clearly on maps of the site.

4.1.2 Constructive measures

The coating on the room's floor must be made of material that does not cause sparks in the event of accidental impacts.

The room's floor must be electrostatic conductive. The floor's grounding resistance R must be between: $25 \cdot 10^3 \Omega$ et $10^6 \Omega$.

- $25 \cdot 10^3 \Omega$ being the minimum value of the floor's grounding resistance to protect workers against electrocution
- $10^6 \Omega$ being the maximum value of the electrostatic conductive floor's grounding resistance

The measurements of the surface resistance and the grounding resistance may be performed according to the following standards:

- EN 61340-4-1 - Part 4 – Section 1 “Electrostatic behaviour of floor coatings and finished floors”,
- NFPA 77 “Recommended Practice on static electricity”



Most concrete floors fall within these values. Special resins that make it possible to obtain attractive properties with regard to maintenance and aesthetics while maintaining the "electrostatic conductive" characteristics can be used."

The materials making up the floors must be non-combustible or fire-resistant (case of resins applied on the floors).

4.1.3 Design and protection of equipment

The only electrical equipment installed in the room must be equipment that technically could not be installed outside of the room, i.e. in the exterior volume located more than 1.5m from the openings.

Electrical equipment must have marking easily identifying whether this equipment is properly designed for operation in explosive atmospheres as well as the corresponding certificate.

Mechanical equipment must not heat up beyond the class permitted for electrical equipment (actions in the design, preventive maintenance, etc.) or cause sparks through friction.

The various elements of the installation in contact with liquids and powders (piping, devices, containers, etc.) must be static electricity conductive both outside and inside.

All metal parts of the installation must be connected to each other in order to ensure the equipotentiality of the masses and groundings. This measure also applies to moving parts of devices (agitator shaft, rotor).

Grounding must be done using cables, braids, or copper wires for fixed equipment and by braids in austenitic stainless steel for mobile equipment.

Sizing of conductor for grounding	
Cables and copper braids	Conductor with minimum section of 2,5 mm ²
Copper wires	Conducteur with minimum diameter of 4 mm

Grounding of equipment	Resistor of grounding (ohm)
All-metal system	$R < 10 \text{ ohms}$
Metal system involving conductive "Electro - static"	$R < 10^6 \text{ ohms}$
Non-metallic system, but conductive electro-static"	$R < 10^6 \text{ ohms}$

Insulation system

Grounding not possible. Prohibited system

In addition, installations must be protected against risks associated with lightning: direct or indirect risks, particularly through grounding. This protection requires the performance of special studies specified to each site. Depending on the case, this study may be required by local regulations.

The fluid heating system of the premises must be heated outside of it

4.2 Case of flammable liquids

Are considered in this part as flammable liquids all products described by logical diagrams of the appendix 1 of the General Procedure EHS-001-20 *Prevention of Fire Risk Design*.
Conception des cuves – cas général

4.2.1 Design of tanks

General case

All modifications made to skids, including renewal and modernisation, must comply with the requirements of manufacturing Excellence in Production.

Risk assessments must also take into account:

- a) Protection against temperature increase

Measures must be taken to avoid the formation of ATEX (increases in temperature, maintain a temperature below FP less 10°C). Otherwise EHS-001-20 must be applied.

- b) Protection against corrosion

Compatibility among the various elements of the installation and any potentially aggressive products, particularly for the attack of the seals, must be ensured.

- c) Anti-overflow protection

The manufacturing tanks for flammable liquids must have a "very high" level automatically interrupting the filling of the tank.

- d) Protection against impacts



Equipment must be protected against mechanical impacts likely to cause liquid leaks. Similarly, equipment used in the construction or installation of tanks must not generate sparks during an impact (bronze, austenitic stainless steel, etc.)

Examples of elements to be protected:

- Fixed tank bottom
- Drain hole of tanks
- Level tubes

e) Protection against fire and explosion

Each tank must be individually protected with a flame arrester device positioned on vents in order to prevent:

- A flame initiated outside of the buildings from spreading to the tanks,
- The fire of one tank from spreading to neighbouring tanks

If an explosion vent is installed on a tank, it must:

- Be the subject of a special study
- Rule NFPA 68 must be used for the sizing of explosion vents
- Be connected to the outside of the building.

f) Inerting

The introduction of an inert gas in sufficient proportion in an atmosphere charged with flammable vapours causes a decrease in the oxygen concentration and makes ignition impossible.

It is mandatory for:

- Tanks where manufacturing operations are carried out.
- Tanks and containers that have energy sources,

There are various inerting methods according to the technologies used and the devices present in the process.

At ordinary temperature and pressure, the ignition of ethyl alcohol vapours is no longer possible for an oxygen content less than 10.6% in volume. The technical provisions for implementing inerting are indicated in document IRI 239. At minimum, inerting operations must comply with the following operating conditions:

- The Limiting Oxygen Concentration (LOC), within enclosures, must be less than or equal to 8% (in volume) with the aim being 6%.



- It is guaranteed by a monitoring during the whole process (within fixed manufacturing tanks only)
- Inerting must be employed only if the workshop's general ventilation is operating.

In most cases, inerting must be done by replacing the oxygen with nitrogen. This gas must be employed with vigilance in strict compliance with the operating procedures and the safety instructions in order to avoid the risk of anoxia.

Containers intended to hold nitrogen or other inert gases for pressurisation or inerting purposes must have:

- In the exceptional case of needing to open the tank, a device preventing an operator's head from entering the container
- A pressure gauge or a system making it possible to determine the pressure within the containers
- A safety valve.

The employment of an inerting technique must systematically undergo a risk analysis that determines the prevention and protection measures to be implemented with regard to the risk of anoxia.

If the risk assessment demonstrates that an oxygen concentration inferior to 19,5 % may be reached in a workshop, the room must be equipped with oxygen detectors with an audible and visual alarm when the threshold of 19,5% is reached.

The triggering of the alarm must cause:

- An increase in the flow rate of the ventilation,
- The evacuation of the premises,
- The cutting of inert gas supplies.

In case there is no inerting, the sky tank is considered Zone 0 according to 99/92 EC Directive and NEC505 Class1. The only instrumentation present in the sky tank must be a pressure sensor and a high level sensor compatible with Zone 0.

The opening of the manhole (locking cylinder) is conditioned to the pressure in the vessel (total pressure = 0 bar) and the state "cleaned" of the vessel (the cycle only after CIP). This is controlled either by servo-control or by a procedure.

4.2.2 Other equipment used

The electrical equipment to be used in manufacturing and storage of flammable liquids rooms must correspond to the requirements for electrical equipment than can be used in explosive atmospheres.

In Europe, the standard EN 50-014 defines 6 classes of maximum temperature levels from T1 to T6.



Flammable liquids commonly used in manufacturing must have a self-ignition temperature around 400°C. The electrical equipment must therefore be classified T2, i.e. not presenting a hot spot greater than 300°C.

In the USA, the OSHA rule 1910.307 must be followed.

In the other countries, refer to one of the previously mentioned standards.

4.2.3 Ventilation

In order to eliminate the residual flammable vapours, an air outlet must be installed for the room

In practice, these objectives may be achieved through ventilation with two extraction flow rates:

- A first air flow rate of two renewals per hour in continuous operation. Nevertheless, during periods of operational shutdown of the room (nights and weekends), this air flow rate may be reduced to one renewal per hour.
- A second air flow rate of ten renewals per hour triggered by explosimeter probes.

The room's operation is slaved to the detection of an air flow in the exhaust duct that guarantees the specific flow.

Regardless of its automatic operation, the ventilation must be equipped with an easily accessible manual control that must be located outside of the rooms. In any case, the air extracted from the manufacturing room may not be reused for other rooms.

The recycling of air may be authorised only under certain conditions:

- In the absence of activity and human presence in the volume involved in the recycling
- The vapour concentration must not exceed 25% of the AEV
- The minimum oxygen concentration must be 19.5%

Air Flow

In order to avoid any leakage of flammable vapour outside of the manufacturing room, there should be no air flow at its start towards other rooms (storage areas, packaging workshops, instrumentation and control rooms of the flammable liquid workshops, etc.).

The air extraction source must therefore be able to ensure an air flow from non-ATEX zones towards ATEX zones.

Extraction and blowing of air in the room



The position of the ventilation openings must take into account the density of the flammable liquid's vapours.

For ethyl alcohol, heavier than air, the blowing of air must be done, generally, in the upper part, and the extraction in the lower part. Nevertheless, according to the configuration and equipment of the room, intermediate distributions may be more suitable (for example, blowing distributed between 75% in the upper part and 25% in the lower part). A special study can be conducted in order to define the best measures.

The exhaust outlets must be strategically distributed in the room, particularly near foreseeable sources of vapour emissions. Their location must also permit effective sweeping of the entire room. Note that the operation of the ventilation is completely effective only if the room remains closed (closing of doors, windows, outlets, etc.).

Ventilation room

Each manufacturing room fitted to flammable liquids is equipped with its own ventilation system.

The ventilation room is constructed with 2h fire resistant walls. This measure also applies to floor and ceiling in case fire can spread out.

If the ventilation ducts go out of the manufacturing room :

- They are equipped with fire damper at their exit
- They are isolated from the manufacturing rooms by 2h fire resistant protections. (such as in flocking ducts or encasing them with an incombustible material (plaster)).

The rooms where ventilation ducts are present are themselves constructed with 2-hours fire resistant walls.

Air inlet and outlet openings outside of the room

Fresh air inlets must be far from all sources of pollution, such as extracted air outlets, smoke ducts, etc. The direction of the dominant vents must be taken into account for the orientation of the fresh air inlets and the air extraction. The discharge points must be placed to avoid nearby openings in a way that promotes good dilution of vapours in the atmosphere. Their installation must comply with the rules in effect in each country (VOC discharge authorisation, for example).

4.2.4 Fire detection

Fixed explosimeter probes, suitable for the operating conditions, must be installed in the room. These probes are auto-controlled. In case of malfunction, an alarm is raised.



Note that in case of use of silicone-derived products in the room, explosimeter probes using "catalytic" technology may not be used. The catalytic combustion of silicone derivatives on the detectors must deposit a layer of silica on them that quickly changes the measurement of the LEL

Explosimeter probes must be checked and calibrated regularly according to a frequency indicated by the manufacturer.

These probes must be located on the lower part (alcohol vapours heavier than air) and, for example, near exhaust openings.

The reaching of the first threshold, set to 25% of the Lower Explosive Limit at maximum, must trigger:

- The stopping of EMF/AGV present in the room,
- The increase in the air extraction flow rate in the room at its maximum value
- The triggering of a visual and audible alarm in the manufacturing room as well as in another room of the site where a continuous human presence makes it possible to react to the alarm.

The reaching of the second threshold, set to 40 % of the Lower Explosive Limit at maximum, must trigger:

- The shutdown of all of the room's electrical equipment, except the lighting and the ventilation,
- The shutdown of any input or output of flammable liquid in the room. Note that processes employing products that present risks of solidification, in case of a loss of agitation, are the subject of a special analysis. A securing of the installation, in downgraded mode, must be studied based on constraints associated with the process and the environment.

The reaching of the third threshold, set to 60 % of the Lower Explosive Limit at maximum, must trigger:

- The injection of medium expansion foam on the floor of the room, after a maximum delay of 15 minutes,
- The shutdown of the ventilation.

The staff evacuation scenarios must be formalized.

4.3 Case of cosmetic powders

4.3.1 Design of the manufacturing installation



In order to avoid the risk of heating of powders through contact with hot surfaces, the temperature of the equipment, both internal and external, must remain substantially lower than the lowest of the self-ignition temperatures of the powders present.

Given the currently known value of this temperature, the maximum surface temperature of the equipment to be used in the manufacturing room must not exceed 85°C (see definition and calculation by reference to electrical equipment in **appendix 1**).

The preceding condition corresponds to electrical equipment of temperature class T6. In the event that this type of equipment is not available (case of high- power electrical motors generally of class T4), it is possible to use electrical equipment of a class lower than T6, provided that the following are limited through constructive measures:

- The possibility of formation of a layer of powder on the surface (for example, the vertical positioning of the motors or the casing).
- The heating of the motors (for example, through a check of the temperature using a probe or through over-sizing of the motors),

The building will be subjected to zoning according to the manufacturing conditions.

The electrical equipment must be suitable for dust explosive atmospheres according to zoning.

Enveloppes used to prevent dust penetration have a IP6 protection index (see definitions in **appendix 1**).

In order to limit the risk of self-heating of the powders, the mechanical shaking of devices decreases the deposits formed on their internal walls. This method is effective for hoppers, cyclones, etc, but must not in any case generate a dust cloud.

The devices are then likely to generate vibrations and must, just like mills, be isolated from the building by anti-vibration systems.

The height of the storage, supply, or assay hoppers must be no greater than 1m as the auto-ignition temperature lowers while the layer of dust increases. See table below.

Example of the evolution of a dust auto-ignition temperature tested according to the thickness of the layer	
Thickness of the layer (cm)	Auto-ignition temperature (°C)
10	110
30	95
100	80

In order to limit load losses and the deposit of powder inside of the piping, the horizontal parts and the piping lengths must be limited as much as possible.

Similarly, elbows, variations in form or the area of the section, valves, or any other equipment constituting an obstacle must be reduced to the minimum strictly necessary.



90° elbows must have a radius of curvature equal to, at minimum, 10 times the diameter of the piping.

The diameters must be perfectly suited to the recommended flow rates and speeds.

The possibility of metallic objects (screws, nails, etc.) entering the mixer- grinders must be integrated into the risk assessment in order to define control methods.

4.3.2 Isolation of parts of the installation

The devices and piping of the manufacturing sequence as well as the related installations must be protected against explosion, i.e. against the spreading of flames and pressure waves.

For this purpose, the area must be segmented into parts, which will be isolated from each other during an explosion by a suitable explosion isolation system.

Isolation by passive mechanical systems

These systems make it possible to permanently isolate two parts.

This type of valve must be used, preferably, in order to isolate the milling equipment.

Isolation by active mechanical systems

These systems are designed to react once a combustion in its initial phase has been detected by confining it mechanically.

The explosion is then localised in a specific area.

These are generally explosion isolation valves installed in long piping.

Isolation by active chemical systems

As soon as the first phase of the explosion has been detected on either end of the piping, an extinguishing agent, contained in a container, is injected into the centre of the piping.

Its operating principle is very similar to that of the explosion suppressor. It acts by absorbing the heat energy produced, thus making the expansion of the explosion impossible.

4.3.3 Protection against explosion of parts of the installation

Once the manufacturing installation is segmented, each part must be considered isolated. For each of them, the degree of resistance with regard to the effects of an explosion must be evaluated, according to the logical diagram in appendix 2.



Some isolated parts may present sufficient resistance to support the maximum explosion pressure. In this case, they are protected against explosion by construction. This is the case of new small-volume devices. For isolated parts unable to withstand the explosion overpressure over their surface, another mode of protection against explosion must be chosen.

This protection must also take into account the protection of operators during the RM loading phases. For that purpose, the equipment must be designed so that the operator cannot be exposed to the effects of an explosion, either by preventing the explosion from occurring or by having a physical screen.

Resistance to maximum explosion pressure

Resistance to the maximum explosion pressure (estimated at 10 bars) is the appropriate mode of protection for new and small equipment (<0.5 m³). It is also possible to install this piping capable of resisting the maximum explosion pressure.

Explosion discharge

In the event that the isolated part does not resist the maximum explosion pressure, the overpressure and the flame jet produced by the explosion must be evacuated outside of the workshop.

In case of an explosion inside of an enclosure, the overpressure must be released to the open air using an opening sized based on:

- The force of the explosion
- The volume or internal surface of the enclosure
- The maximum pressure allowable by its weakest point
- The opening pressure of the explosion discharge

In normal operation, this opening must be blocked by explosion vents designed to operate once (tear membranes) or repeatedly (valves, traps, covers, etc.).

The explosion vents must be designed to operate at a defined opening pressure, which, as a general rule, corresponds to half of the maximum pressure allowable by the weakest point of the isolated part to be protected.

All of its other parts must support the pressure build-up generated by the explosion at the moment of the discharge, without being vented or losing their sealing.

The explosion vents must comply with the local rules in effect, but rule NFPA 68 "Guide for Venting of Deflagrations" remains the most used method of calculation. The weight of the vents must be as low as possible in order to limit inertia at the opening.



The vents must be placed as close as possible to the points where the initiation of the explosion is expected. They must be equipped with opening detectors, the operation of which must automatically result in the shutdown of the mill of the line(s) involved. These opening detectors must also permit verification of the good condition of the explosion vents before the start-up of the manufacturing lines. Discharge lines must be used in order to permit discharge to outside the room:

- They must be as short as possible, straight, and, as a general rule, less than 3 metres in length.
- Their resistance to pressure must be the same as that of the devices and their section identical to that of the reducing valve nozzles.

The length of these ducts will increase the pressure build-up in the enclosure at the moment of the discharge. This parameter must therefore be taken into account in the sizing of the explosion vents. The position of the discharge ducts must take into account the probability of projection of unburned gases and the flame. To do this, they must lead to the roof or, if this is not possible, an open side of the building (10 to 15 metres without obstacles in the vent's discharge axis), free of any passage and as high as possible to avoid obstacles. Similarly, entry of rainwater must be avoided without decreasing the effectiveness of the vent.

Sufficient in itself, this protection method is the simplest with regard to its installation technique and its maintenance.

Explosion discharge coupled with a flame arrester

In the event that an obstacle is less than 10 metres from the evacuation of the overpressure and the flame jet, the explosion discharge must be coupled with a flame arrester. However, if the flame arrester extinguishes the flame, it must not stop the release of hot gases under pressure.

The obstacle in question must be able to support the pressure effect. The installation of this protection device must meet a few safety conditions:

The evacuation must be done towards an open side over 2 to 3 metres.

The equipment and the piping on which these systems are installed must resist at least 1 bar of overpressure.

The cleaning of the flame arrester device must be performed very regularly in order to avoid its obstruction

Inerting

The technique of inerting may be used in the cosmetic powder manufacturing rooms.



Inerting is a means of prevention and protection against fires and explosions, particularly adapted to the employment of powdered substances with an MIE less than or equal to 10 mJ.

The same requirements as those described in the section *Inerting* of § 4.2.1 must be respected.

Explosion overpressure

In the event that the evacuation of flame jets and combustion gases is impossible outside of the room, an explosion overpressure system must be used, as explosion discharge in the room itself is strictly prohibited.

These systems must be designed to detect combustion in its original phase in order to stop it with extinguishing products before destructive pressures have developed.

It is an expensive system that requires maintenance and continuous verification. It should be used when all other methods are ineffective.

Equipment housing or casing

Devices whose protection cannot be ensured with the previously cited means may be protected with casing devices or through their installation, isolated, in the specific rooms.

These devices are above all intended to protect the operator from the effects of a fire ball created by the explosion of a cloud of powder.

The protection provided by these casing devices or these specific rooms is based on the employment of one of the means of protection cited in the preceding paragraphs.

4.3.4 Ventilation and extraction

The general ventilation of the workshop must be designed to avoid the agitation of dust.

The local use of a fan is forbidden.

Local extraction fans must be located in clean air, downstream of the air/dust filter (in order to avoid dust/fan blade contact).

The filter tubes must be anti-static and fire retardant. In the event that the local rules provide for it, a certificate of compliance must indicate the volume resistivity values.

The dust collector must be protected against explosions. It must be installed outside of the work rooms, preferably outside of the buildings, in a shelter isolated against noise.

4.3.5 Operations to transfer powders into flammable liquids



Operations involving the transfer of combustible powders, when the recipient contains large amounts of solvent or other liquid, or when residue remains from the previous operation, or in the presence of residue from an intermediate washing operation, must be carefully evaluated to check whether the risk of a possible hybrid explosive atmosphere exists. This evaluation can be carried out in the following stages.

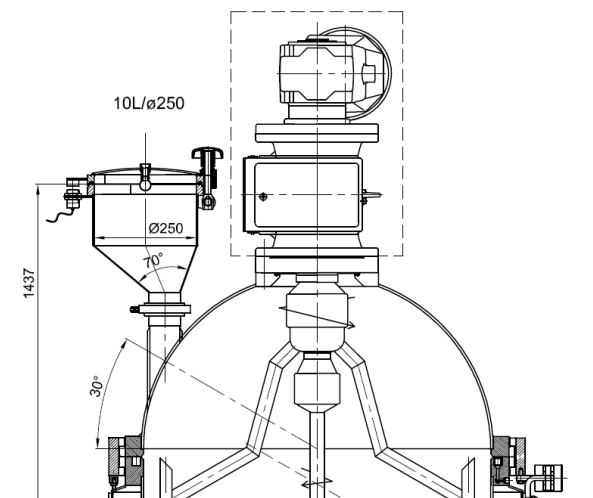
Basic rules

The process must be studied in order to avoid the transfer of powder into a flammable environment.

- Performance of an intermediate phase
- Or, introduce the powder into a tank first (avoiding the formation of a cloud), then introduce the flammable liquid by suction at the base of the tank.

In case of a Flash Point in the environment of $< 60^{\circ}\text{C}$, the risk of a hybrid explosive atmosphere must always be taken into account. In addition to all action taken to reduce possible sources of combustion (for example: adequate ATEX components, adequate earthing, maintenance, etc.), all operations must be carried out in inerting conditions. To avoid disturbing the inerting in a main tank by introducing a powder, it is possible to suck the powder into an annexe and then render it inert and transfer the powder by depression from the main tank.

The use of an airlock or “perfume bowls” can also be a solution for introducing a powder or a small amount of liquid, such as perfume, or other, into the inerted tank, without disturbing the inert conditions.





Measurements are carried out by the bowl supplier to show that the introduction of air during this phase does not lead to a loss of inerting in view of the very low volumes of air introduced.

The bowl is fitted with a vent with a detected manual valve, a lid opening safety sensor, a cleaning input with CIP ball and an automatic connection butterfly valve on the dome of the tank.

In the case of powders, care must be taken with the angle of the hopper to avoid doming.

Performance of an intermediate phase, creating a 5% mixture of the perfumes with other raw materials as a pre-mix to raise the FP above 60°C is a solution to limit risks. In this case, the MIE to use would no longer be a few mJ but several joules (equivalent to use of a flame). This results in a reduction of the electrostatic impact.

Where the Flash Point of an environment is > 60°C:

- If the MIE of the combustible dust is > 100 mJ, a minimum safety gap of > 10°C compared to the FP can be considered sufficient to avoid inerting conditions. All action must be taken to reduce possible sources of combustion (for example: adequate ATEX components, adequate earthing, maintenance, etc.).
- If the MIE of the combustible dust is < 100 mJ, a minimum safety gap of > 30°C compared to the FP is necessary to avoid inerting conditions. All action aimed at reducing possible sources of combustion (for example: adequate ATEX components, adequate earthing, maintenance, etc.) must be taken.

Working at flash point temperature less 30°C corresponds to 20% of the lower explosive limit (LEL). In the case of a hybrid mix physico-chemical safety parameters evolve and are more limiting, resulting in the requirement of working at lower temperature ranges.

5. ASSOCIATED EHS Documents:

This Technical Instruction comes under General Procedure *EHS-001-20 Prevention of Fire Risk Design*.

This Technical Instruction is also associated with the following Technical Instructions:

- EHS-002-20 Manufacturing packaging and storage of flammable liquids
- EHS-002-27 Manufacturing and packaging of cosmetic powders.



6. APPENDICES

6.1 Appendix 1 : Definitions

Minimum ignition energy

Corresponds to the minimum amount of energy required for a cloud of powdered product to ignite. The minimum ignition energy (MIE) must be determined according to the modified Hartman tube method (Standards: IEC - 1241-2-3, EN – 13821, ASTM – E 2019 – 03).

In the case of hybrid mixtures (dust and flammable vapours) obtained, for example, during the pulverisation of flammable binders, the mixture's MIE may be less than the respective MIEs of the components.

Maximum explosion pressure

This is the maximum value that the pressure may reach, developed by the explosion of a cloud inside of a closed enclosure. It is associated with the concentration and the nature of the powdered product, but it is independent of the volume of the enclosure where the explosion takes place. Its determination is defined by Standard ISO 6184.

Explosive/flammable atmosphere

An atmosphere is explosive when the proportions of powdery products in the air are such that a flame, a spark, an excessive temperature produce an explosion. The danger really exists.

An explosive atmosphere is an atmosphere that can become explosive. The danger exists in the potential state.

Surface temperature of the material

From the self-ignition temperature of the powdery product under consideration, it is possible to determine the maximum permissible surface temperature of the material and its temperature class.

This temperature is the lowest of the two following values:

- For layers of powdery material, the temperature of the material must not exceed a temperature of 75 ° C lower than the layer ignition temperature.
- For clouds of powdery material, the temperature of the material must not exceed a temperature equal to 2/3 of the cloud ignition temperature in ° C.



International Standard IEC 1241-1 gives the following correspondence for electrical equipment:

Maximum surface temperature of material in °C	Class of material temperature
450	T1
300	T2
200	T3
135	T4
100	T5
85	T6

Enclosed Electrical Equipment (International Standard IEC 529)

The protection against the introduction of solid and liquid foreign bodies into the enclosure of electrical equipment is defined in the table below. The guaranteed degree of protection is symbolized by the letters IP followed by two numbers:

- the 1st digit (from 0 to 6) indicates the degree of protection against the penetration of solid bodies according to their size,
- the 2nd digit (from 0 to 8) indicates the degree of protection against liquids, water being the reference liquid.

Protection index of electrical equipment IP	1 st digit Material protected against the introduction of solids	2 nd digit Material protected against the introduction of liquids
0	not protected	not protected
1	solids >50 mm	vertical waterfalls
2	solids >12 mm	waterfalls at 15°
3	solids > 2,5 mm	rain at 60°
4	solids > 1 mm	splashing water
5	dust	water jets
6	dustproof	shipping seas
7		temporary immersion



8		prolonged immersion

The IP 5 material has a partial seal against fine dust (no deposits harmful to the operation of the motors).

The IP 6 material is totally dust-proof (tightness verified by the complete disassembly of the material).

Note: The electrical equipment must have a degree of protection against water penetration equal to 5 (use of RIA). It is therefore IP 65 or IP 55.

Other modes of protection of electrical equipment

Intrinsically safe protection (abbreviation **i** of International Standard IEC 79-11)

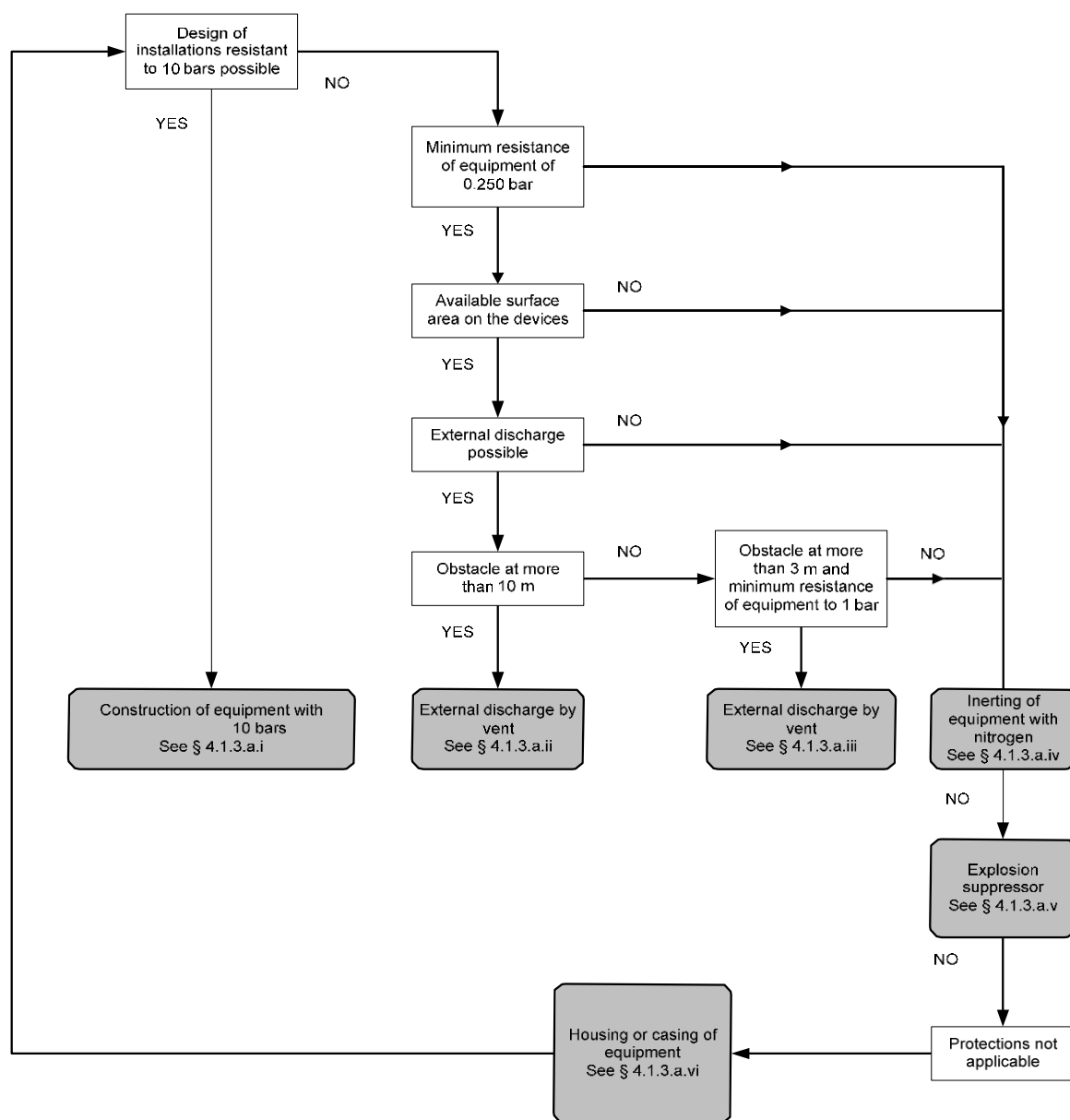
In intrinsically safe **i** circuits, no spark or thermal effect, produced under the specified test conditions (which cover normal operation and specified fault conditions), are capable of causing ignition in a given explosive atmosphere.

Enhanced safety protection (abbreviation **e** of International Standard IEC 79-7)

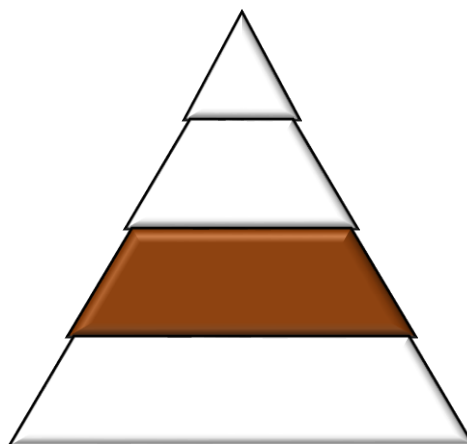
The protection mode **e** defines the measures to be applied to avoid, with a high safety factor, the possibility of excessive temperature and the appearance of arcs or sparks inside and on the external parts of an electrical equipment that does not produce any in normal operation.



6.2 Appendix 2 : Logical diagram of protection of isolated parts of the manufacturing installations for cosmetic powders



This page was intentionally left blank for duplex printing.



FIRE Protection Guide

EHS-302-57 A

EHS Technical Instruction *Instruction Technique EHS*

This Guide will apply to all L'Oréal entities and will replace 9 procedures and instructions:

- EHS 001-21 PG Prevention of Fire Risk: Operation
- EHS-301-20 PG Fire Risk Prevention
- EHS 002-21 IT Partitioning
- EHS 002-24 IT Technical specifications for fire protection of factories
- EHS 002-25 IT Technical specifications for fire protection of distribution centers
- EHS-002-26 IT Fire Protection adapted to specific risks
- EHS-002-36 IT Work Using Hot points
- EHS-302-16 IT Common measures
- EHS-302-23 IT Fire prevention Design: Basic measures

These documents currently comprise of 150 pages.

Written by Frederic BAZIN

L'ORÉAL



1 – PEOPLE - SAFETY FIRST	6
2 – SCOPE & RESPONSIBILITIES	7
3 – PRINCIPAL REMINDERS REGARDING FIRE	10
3.1 – FIRE TRIANGLE	10
3.2 – THE FIRE PROPAGATION	10
3.3 – EXPLOSIONS AND EXPLOSIVE ATMOSPHERES (ATEX)	13
4 – TYPOLOGY OF FIRES	14
4.1 - CLASS A – SOLID EMBER FIRES	14
4.2 - CLASS B – FIRES INVOLVING FLAMMABLE LIQUIDS	14
4.2.1 - FLASH POINT	14
4.2.2 - FIRE POINT	15
4.2.3 – PHYSICAL AND CHEMICAL CHARACTERISTICS	16
4.3 - CLASS C – GAS FIRES	18
4.3.1 - EXPLOSIONS	18
4.3.2 – IGNITED LEAKS	19
4.3.3 – CASE OF LPG (LIQUID PETROLEUM GAS)	19
4.4 - CLASS D – METAL FIRES	20
4.5 - CLASS E – ELECTRICAL FIRES	20
4.6 - FIRES DUE TO COMBUSTIBLE POWDERS	20
5 - RULES APPLICABLE WITHIN THE GROUP	22
5.1- ACTIVITIES	23
5.2- CLASS OF GOODS	23
6 – PARTITIONING	25
6.1 – BUILDING ELEMENTS	25
6.2 INDEPENDENT BUILDINGS	27
6.3 FIRE DOOR	28
6.4 SMOKE VENTS	29
6.5 BLOCKS METHODOLOGY & LIKELY REASONABLE LOSS (LRL)	30
6.5.1 IDENTIFICATION OF THE BLOCKS	30
6.5.2 FIRE PROTECTION ASSESSMENT PER BLOCKS	31

6.5.3 SELECTION AND ASSESSMENT OF THE SCENARIOS	32
6.5.4 BLOCK CONSOLIDATED REPORT	33

7 – CONTAINMENT **34**

7.1 – CONTAINMENT CAPACITY	34

7.2 –CONTAINMENT CONSTRUCTION	35

7.3 – FLAMMABLE LIQUIDS MISCIBLE OR NOT	36

8 – FIRE PROTECTION INSTALLATIONS AND DEVICES **40**

8.1 – SMOKE DETECTION	40

8.2 – MOBILE FIREFIGHTING EQUIPMENT	41

EXTINGUISHERS:	41

HYDRANTS:	41

FIRE HOSES:	41

8.3 – SPRINKLER SYSTEM	42

8.3.1 – WATER STORAGE	43

8.3.2 – THE WATER SOURCE	44

8.3.3 – BURIED SYSTEM	47

8.3.4 – VALVE ROOMS	48

8.3.5 – SPRINKLER NETWORK	48

8.3.6 – ALARM TRANSFER CONTROL UNIT	49

8.4 – FOAM SYSTEM	50

8.5 – GAS SYSTEM	52

9 – ROUTINES AND VERIFICATIONS **53**

9.1 HOT WORK PERMIT	53

9.2 FIRE PROTECTION IMPAIRMENT	57

9.3 FIRE ROUTINES	58

9.4 FIREFIGHTING EQUIPMENT MAINTENANCE	60

10 – TECHNICAL SPECIFICATIONS FOR THE FIRE PROTECTION **62**

A – OFFICES & FALSE CEILINGS	64

B – TECHNICAL ROOMS & LABORATORIES	65

C – STORAGE CLASS IV PRODUCTS IN RACKS	67

D – STORAGE PLASTIC GROUP A MATERIALS (MP/AC/PF)	70

E – STORAGE OF FLAMMABLE & COMBUSTIBLE LIQUIDS: FROM 0,05 L TO 10 TONS	77

F – DOCKS & SHIPPING AREAS	84

G – CANOPY & WASTE AREAS:	89

H- PROCESS & WEIGHING AREA	93
H.1 – WEIGHING AREA WITH NO FLAMMABLE OR COMBUSTIBLE LIQUIDS	93
H.2 - WEIGHING AREA WITH FLAMMABLE OR COMBUSTIBLE LIQUIDS	93
H.3 – PROCESS ROOM WITH NO FLAMMABLE OR COMBUSTIBLE LIQUIDS	94
H.4 – PROCESS ROOM WITH FLAMMABLE OR COMBUSTIBLE LIQUIDS (ATEX)	94
I – PACKAGING ROOMS	97
I.1 - NO FLAMMABLE OR COMBUSTIBLE LIQUIDS	97
I.2 - WITH FLAMMABLE OR COMBUSTIBLE LIQUIDS	97
J – STORAGE OF FLAMMABLE & COMBUSTIBLE FINISHED PRODUCTS	98
K - OUTDOOR STORAGE TANKS – FLAMMABLE LIQUIDS & DUMPING	103
L – STORAGE OF AEROSOLS	105
M – STORAGE OF OXIDISERS – RAW MATERIALS & FINISHED PRODUCTS	111
N - AUTOMATED STORAGE & BATTERIES	114

**Glossary**

AFFF	Aqueous Film Forming Foam
APSAD	<i>Assemblée Plénière des Sociétés d'Assurances Dommages</i> (French Plenary Assembly of Damage Insurance Companies)
ATEX	Explosive atmosphere
BLEVE	Boiling Liquid Expanding Vapour Explosion
CLEARANCE	Distance between the sprinkler deflector and the top of the pallet
CMDA	Sprinkler Control Mode / Density Area
CMSA	Sprinkler Control Mode / Specific Application (grosses gouttes)
CNPP	<i>Centre National de Prevention et de Protection</i> (French National Prevention and Protection Centre)
ESFR	Early Suppression Fast Response
FM	Factory Mutual
IRAS	In-rack Automatic Sprinkler
LPG	Liquid Petroleum Gas
K Factor	q (flow rate l/min) = $K \times \sqrt{p}$ (Sprinkler head pressure in bar)
NEC	National Electric Code – NFPA 70
NFPA	National Fire Protection Association
RIA	<i>Robinet Fire Armé</i> (fire hose station)
TNO	<i>Nederlandse Organisatie voor Toegepast</i> (Netherlands Organisation for Applied Scientific Research)
TUV	<i>Technischer Überwachungs Verein</i> (German Technical Surveillance Organisation)
UL	Underwriter Laboratory
USD	<i>Unité de Storage et de Dosage</i> (storage and metering unit)
VNA	<i>Very Narrow Aisle</i>

1 – PEOPLE - SAFETY FIRST

Fire constitutes not just a major threat but also one of the most probable threats that companies are likely to face.

The direct or indirect consequence of a fire is far reaching and often leads to companies going out of business (in 30% of cases).

Injuries to people (asphyxia caused by smoke, burns, injuries, etc.), the direct (effect of flames) or indirect destruction (migration of smoke) of property, environmental damage (pollution of water and air), damage to the image of the company and business interruption are all factors that contribute to implementing a policy based on two simultaneous approaches:

- **Preventive measures.** These encompass all of the measures taken to prevent a fire start occurring in the different activity areas of the company.
- **Protective measures.** These encompass all of the measures put in place to stop or restrict the propagation of any fire start. These measures may be:
 - Of an organisational nature (instructions, etc.).
 - Comprised of firefighting installations, whether mobile (extinguishers) or fixed (sprinklers, foam generators, etc.).
 - Comprised of construction measures, such as fireproof walls, compartmentalisation, distancing of buildings presenting a risk, etc.

Within the L'Oréal group, one fire starts every two weeks and 50 % of these fires are stopped by employees and the emergency response team.

It is the reason why training and retraining of personnel represent some of the most important and efficient actions that can be taken with regard to fire risks, both in terms of prevention (raising awareness, etc.) and in terms of protection (response teams, etc.).

On top of local regulations, all our employees must be trained on fire prevention measures and fire protection equipment.

First-aider training is mandatory for emergency teams with refresher courses taken every 3 years at least.

Emergency drills are also mandatory once a year to ensure all employees complete this exercise. **Exit of our people must be secured with staircase fire wall.**

2 – SCOPE & RESPONSIBILITIES

This document applies to all L'Oréal facilities:

- new constructions,
- major redeployments requiring the extension or the modification of the existing fire protection facilities,
- facilities with no fire protection
- facilities with fire protection not adapted to the risk or recognised as unreliable,

This document does not apply retroactively to existing sites in which the fire protection facilities correspond to the following criteria:

- facilities designed in accordance with a recognised standard (e.g. APSAD, VDS, NFPA),
- facilities appropriate to the risks,
- performance and reliability maintained and recognised.

The EHS Zone Director or Corporate EHS should be contacted for specific cases.

Within the framework of keeping abreast of regulations, or before any factory or distribution construction or redeployment project, the organisations responsible for implementing this document must carry out **a precise and exhaustive regulatory inventory in order to determine if preventive and fire protection measures are fixed and imposed by a regulatory or normative framework.**

- **Insurer expectations**

Compared to local regulations that are mandatory, insurer's recommendations is advice only, given to better secure our facilities:

- Insurers carry the entire cost of loss from property damage, fire, explosion, natural hazards, . . .
- In case of major loss, insurers will pay the renewal value of buildings, stocks, assets and also business interruption during the cessation of activities.
- Insurers need complete visibility in order to correctly assess risk and loss scenarios. EML = Estimated Major Loss).
- Insurers classify all our facilities based on the loss scenario and request regular visits to the major facilities.
- Insurers make a report during their visit with recommendations to reduce the impact of loss. Some recommendations are high priority.
- The support from the insurer is invaluable in getting the best advice regarding fire protection and prevention and alignment with NFPA standards. Insurance reports are also sometimes requested by local authorities.
- Insurers are involved in major projects to implement the best fire protection at the design stage.
- **If some major recommendations to reduce loss are not implemented, it can have a significant impact on the global insurance premium for the group.**

- **Site Manager responsibilities**

- Include fire risk, in-site risk assessment (SHAP) and also new projects and major alterations (see diagram on the next page).
- Implement fire prevention and protection measures to reduce risk.
- Check fire protection and prevention efficiency.
- Make sure that fire protection is aligned with NFPA standards and local regulations.
- Operating permit is updated based on site changes.

- **EHS Zone Director responsibilities**

The EHS Zone Director supports all his sites regarding fire expertise, risk assessment, fire protection and prevention measures.

He is also the point of contact for new projects, major changes and makes sure that local teams are aware of the group's expectations.

- **Local ETN EHS responsibilities**

The ETN EHS Manager sets efficient organization to secure the site:

- Local regulations regarding fire protection.
- Risk assessment and also any projects with fire protection impact.
- Makes sure that the fire protection is adequate for the potential risks.
- Maintenance controls for all fire protection equipment: extinguishers, fire hoses, smoke detectors, fire pumps, alarms... guarantee that all fire equipment is working well.
- Efficiency of fire prevention: emergency team, drills ...
- Keep updated documents and technical specifications: sprinkler, partitioning map,
- Hot work permit management and control
- Fire protection impairment procedure
- Report any fire incident

Maintenance of sprinkler system can be done by contractors.

However, it is still very important to keep control and have trained personnel even if all maintenance tasks are done externally.

- **Emergency team**

The Emergency Response team (ERT) has been nominated, trained and performs regular training exercises according to local regulations a minimum of twice a year.

In case of a fire emergency, individuals in charge of managing the evacuation of rooms and identification at the gathering point, have been designated and trained.

Evacuation drills are carried out and all employees must participate at least once a year.

Second Emergency response team role is:

- To intervene in case of accident
- To use fire-fighting resources / only staff authorized to use the indoor fire hydrants
- To secure the site
- To receive and guide emergency teams to the site of the incident.

- To guide people to exit doors and make sure that all employees have evacuated.

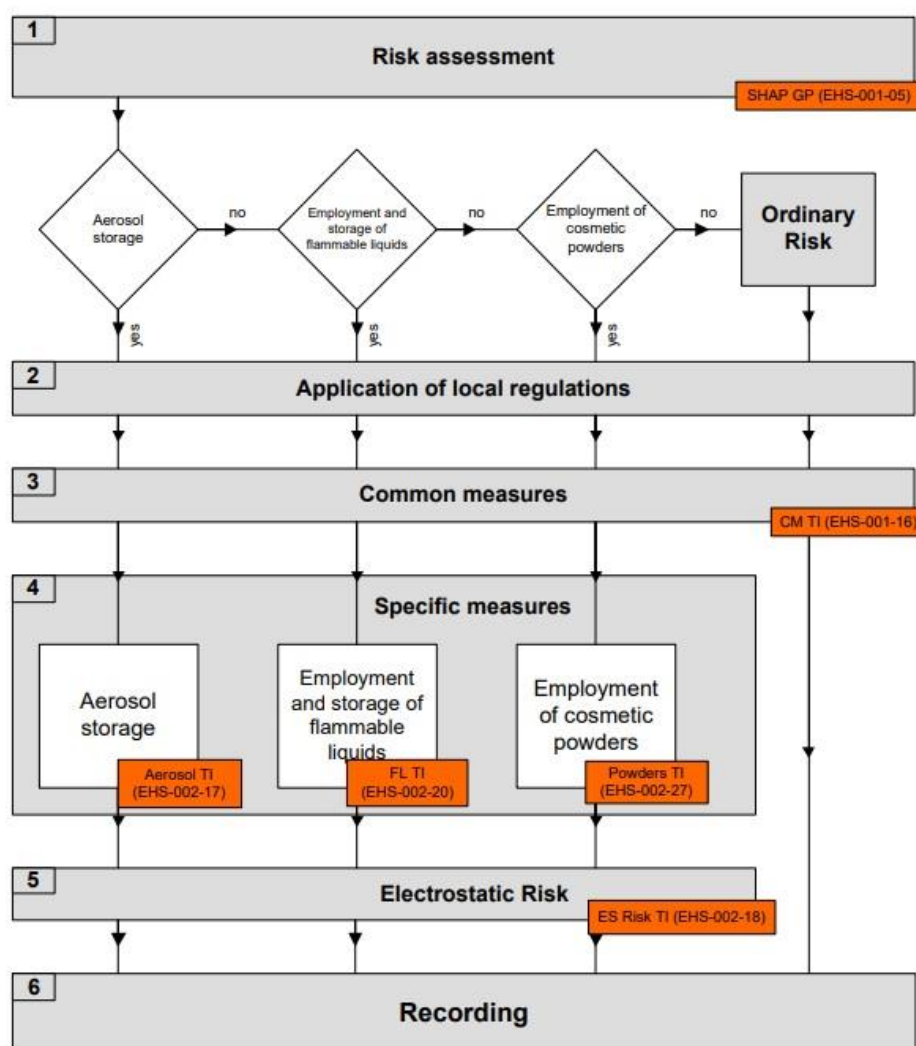
Work station training given to staff must include details of the fire risks at the work station and preventive and protection resources available to staff.

- **Site Department Managers responsibilities**

Each department manager must be aware of fire risks in his department and is responsible for employee training.

He is able to analyze and implement measures, in case of emergency, to secure his team.

The risk assessment graph below introduces key elements and is also a document for consideration.

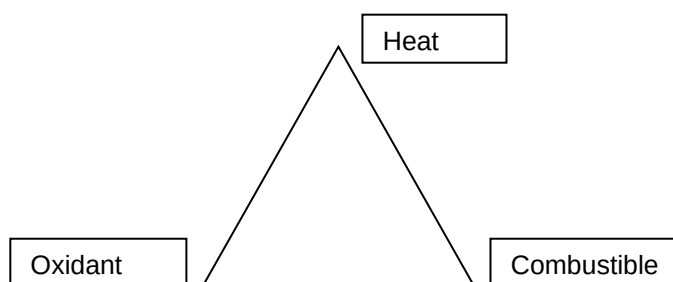


3 – PRINCIPAL REMINDERS REGARDING FIRE

3.1 – FIRE TRIANGLE

A fire is the manifestation of a combustion reaction. It is an exothermic oxidation reaction that occurs between a combustible and an oxidant (O₂ for example).

The “fire triangle” is generally cited as a model to illustrate a combustion reaction:



For the combustion reaction to happen, the simultaneous presence of the three elements on the apexes of the triangle has to be assured.

If one of the elements is absent or removed, then the combustion reaction cannot take place or stops (extinction action).

This simple approach makes it possible to understand the preventive actions or protection actions that can be implemented within the framework of fire risk.

3.2 – THE FIRE PROPAGATION

A fire spreads step by step under the action of heat transfer. This raises the temperature of nearby combustibles and thereby causes their ignition. Under certain conditions (for example, in confined non-ventilated spaces), the temperature can increase very rapidly leading to a virtually spontaneous combustion of any combustibles located in the area. This phenomenon is known as “Flashover” and its effects are destructive for the people and property affected.

This transfer of heat can take place in a simultaneous or separate manner.

3.2.1 - Conduction

This mode of transfer concerns solids or fluids at rest. Heat is transmitted by direct contact, from the hottest parts to the coldest parts. The energy transferred by conduction depends on the thermal conductivity of the materials concerned. Conductivity is high in metallic materials.

The fire may propagate rapidly and at a distance, particularly through non-combustible partitions (walls), when these have metallic structures (cluster of pipes, cable routes, steel

frames, etc.) passing through them, these can then heat up combustibles located on the other side of the partition.

In the case of metal frames, conduction very rapidly affects their mechanical strength and contributes, through expansion effects, to the rapid ruin of the structures.

3.2.2 - Radiation

Energy is transmitted in the form of electromagnetic or “thermal” radiation, consequently without direct contact between the initial combustion area and any potential combustibles located at a distance.

The ignition, at distance, of combustibles not reached by the flames, can therefore be explained by this effect.

In theory, the quantity of energy emitted by radiation (or heat flux) decreases inversely as a function of the square of the distance.

In practical terms, one may consider that most materials can ignite, in the presence of an ignition flame, when they are subject to a flux of 20 kW/m².

Reference values relative to thermal effect thresholds

3 kW/m²	Threshold for irreversible effects on humans, delimiting the “significant danger area”
5 kW/m²	Threshold for the destruction of windows
8 kW/m²	Threshold for domino effects; corresponds to the threshold for serious damage to structures
16 kW/m²	Threshold for prolonged exposure of structures; corresponds to the threshold for very serious damage to structures, not including concrete structures
20 kW/m²	Threshold for the resistance of concrete for several hours; corresponds to the threshold for very serious damage to concrete structures
200 kW/m²	Threshold for ruining concrete within tens of minutes

An order of magnitude may be given for several characteristic fires (flux at 1 m):

BLEVE (Boiling Liquid Expanding Vapour Explosion) : 300 – 400 kW/m²

Aerosol cans : 100 – 130 kW/m²

Liquid hydrocarbons : 70 – 80 kW/m²

Storage : 40 – 50 kW/m²

This heat transfer method has led to the establishment of a concept of separation distance between different buildings or sensitive areas in order to limit the thermal effects and therefore the propagation of the fire.

3.2.3 - Convection

Thermal energy is transferred by the movement of hot gas masses from the combustion area towards the surrounding air. These hot gases (600 – 800°C) have a lower density than the surrounding air and, as a result, upward movements are created.

The hot gases then accumulate in the upper part of buildings, creating “hot air spaces” and convolutions that contribute to propagating the fire very rapidly over large areas. This phenomenon is very frequent in storage sites where the upper parts of pallet racks are located underneath the roof, which can lead to generalised blazes of these areas. Tests carried out by Underwriter Laboratories show that the rate of displacement of smoke can reach 140 km/h.

These hot gases or “convection currents” constitute both the flames at the level of the combustion area and the smoke charged with combustion products and particles.

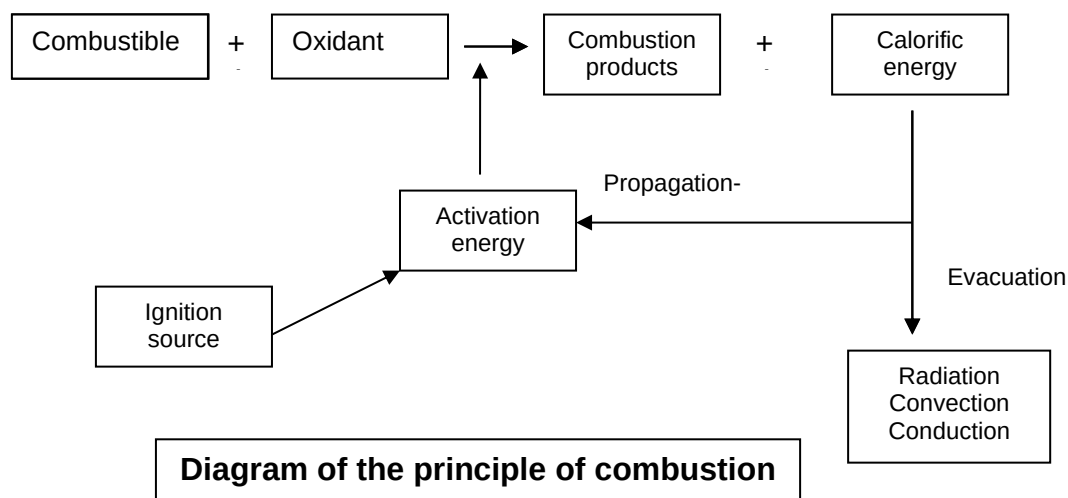
These convection currents are responsible, in most cases, for the asphyxia and death of people either:

- by inhalation of toxic gases from the combustion (CO),
- by inhalation of hot gases (several hundreds of degrees), leading to sudden death,
- by burns.

Smoke charged with particles and corrosive products (HCl, for example) render the evacuation of people difficult by reducing visibility and by the respiratory difficulties that they induce even over distances far from the initial combustion area.

In the same way, such smoke can contaminate, through migration and stratification, areas not affected by the fire and cause loss to materials and property or damage structures through the effects of corrosion on building elements (concrete, metal frames).

It is fundamental to be able to evacuate the smoke and hot gases from a fire as quickly as possible by the appropriate devices provided (smoke vents, extractors, etc.) in order to limit the propagation of the blaze and its consequences on people and equipment.



3.3 – EXPLOSIONS AND EXPLOSIVE ATMOSPHERES (ATEX)

An explosion is a very strong combustion that is characterised by a sudden increase in temperature and pressure.

The energy released in this way is characterised by the propagation of a pressure wave that may, according to the surrounding conditions, project materials and release heat, particularly in the form of a flash.

“The probability that an explosive atmosphere forms in the presence of flammable substances depends on the degree of flammability of the mixture of these substances with air. An explosive atmosphere is present when the necessary degree of dispersion is reached and the concentration of flammable substances in the air lies within the explosiveness limits”. By their nature, gases and vapours have a sufficient degree of dispersion. Solid combustibles, in a finely divided state in the form of powders and dispersed in the air, can produce explosive atmospheres.

The effects of an explosion on a person (“blast effect”) is felt in the same way as those encountered during fires, but the effects of the pressure wave can be the cause of serious trauma particularly on the eardrums, or even lead to death if the respiratory organs are affected. In the same way, the effects of the pressure wave and possibly also the shock wave, according to the conditions, may affect the strength of structures by leading to ruptures of walls, fissures and projections.

The prevention and protection of explosive atmospheres is approached similarly by many countries and use the following regulatory codes:

- Directive 1999/92/CE (ATEX Directive) for the European Community,
- NEC 505 for the USA.

Reference values relative to the threshold for very high-pressure effects

20 hPa	Threshold for significant destruction of windows
50 hPa	Threshold for light damage to structures Threshold for lethal effects to humans delimiting the “area of significant danger for human life”
140 hPa	Threshold for serious damage to structures Threshold for lethal effects on humans delimiting the “area of serious danger to human life”
200 hPa	Threshold for domino effects Threshold for lethal effects on people delimiting the “area of very serious danger to human life”
300 hPa	Threshold for very serious damage to structures

4 – TYPOLOGY OF FIRES

A fire classification exists, based on the physical and chemical characteristics of the combustibles concerned and their mode of combustion:

4.1 - CLASS A – SOLID EMBER FIRES

This concerns solid combustible fires, which are characterised by the presence of embers (paper, wood, plastics, pallets, packaging, etc.).

Such combustibles require an initial input of thermal energy to raise their temperature and decompose by pyrolysis in the form of combustible gases that then start combustion reactions. Depending on the compactness and the layout of the combustibles, they can present significant thermal inertia (storage of pallets). The propagation of these fires is step by step and it may be very rapid in vertical “pallet rack” type layouts.

The extinction of these fires necessitates a massive cooling of the combustible by water spray, which is typically the application of sprinkler systems.

They can also be put out by a suffocating effect (elimination of oxygen) with class A, B or C powders or extinguishing foams.

4.2 - CLASS B – FIRES INVOLVING FLAMMABLE LIQUIDS

The combustion of flammable liquids involves the combustion of the vapours emitted by the liquid concerned.

Flammable liquids are characterised by the notions of flash point and fire point. These values are generally used to establish flammable liquid classifications in regulatory fields.

4.2.1 - Flash point

The flash point is the temperature at which a liquid emits sufficient vapours so that, in the presence of a pilot flame, they burst into flames in the atmosphere in the form of a flash, without however establishing a permanent combustion regime.

Different protocols are used to determine such flash points (open cup or closed cup). The physical and chemical characteristics of the products, particularly their viscosity, influence the results of these tests (reproducibility and repeatability).

4.2.2 - Fire point

The fire point is the temperature at which a liquid emits sufficient vapours so that, in the presence of a pilot flame, they burst into flames in the atmosphere and establish a permanent combustion regime.

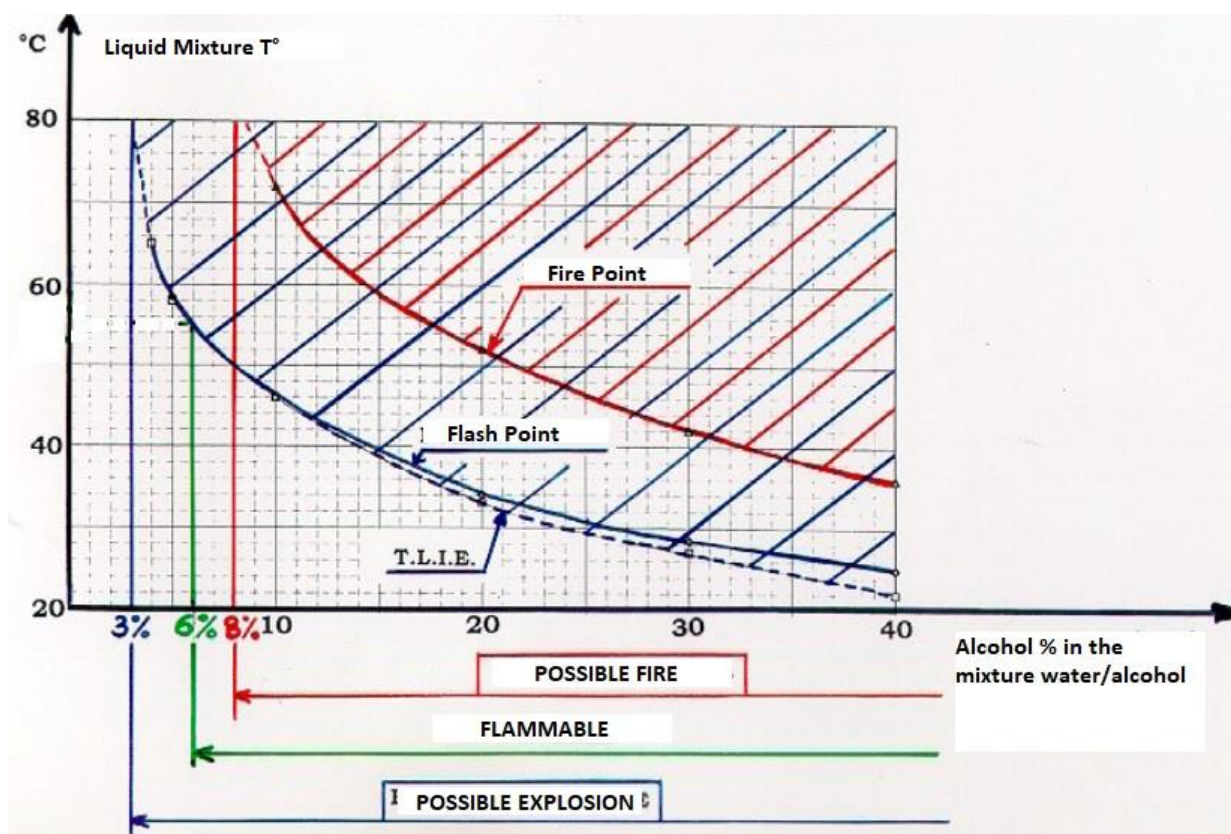
FLAMMABILITY OF WATER/ALCOHOL MIXTURES

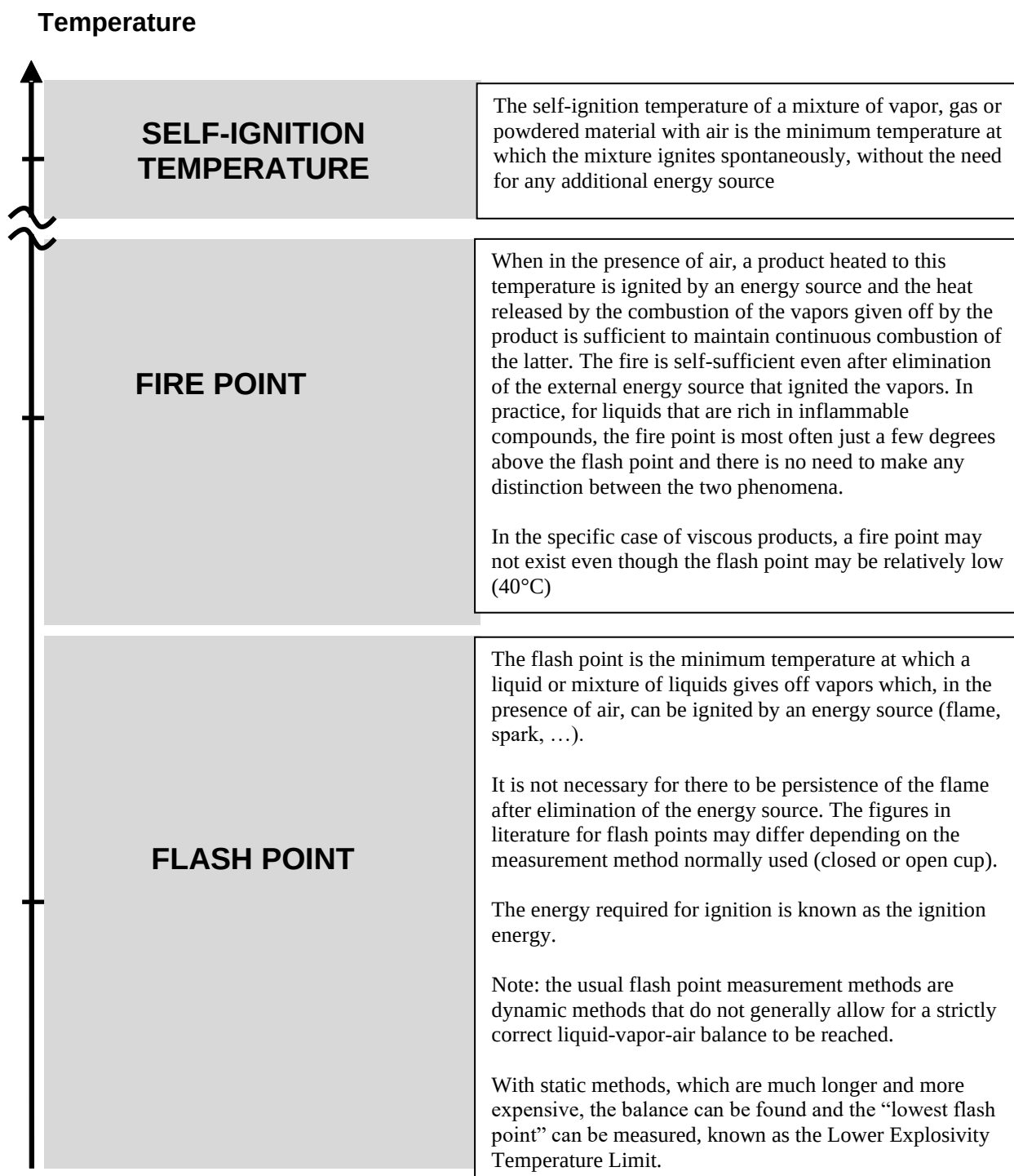
- Fire point: defined by standard ISO 2592 (or ONU L2)
- Flash point: defined by standard ISO 1523 or NF M07011
- TLIE: defined by standard ISO 1516

The following graph shows that:

- water-ethanol mixtures containing less than 3% alcohol never result in the formation of flammable atmospheres
- water-ethanol mixtures containing less than 8% alcohol never result in the start of a fire in which the whole mass of product would burn after ignition of the vapors
- the LEL is identical, or very close, to the flash point measured
- when both exist, flash point and fire point differ by 10 to 25°C depending on concentrations.

This graph is given as an indication only. It must not be used in the case of solutions with weak alcohol content, without measurements being taken. The presence of other components in these solutions (other than water and alcohol) may, of course, lead to different results. NB green line should be at 60°C.





4.2.3 – Physical and chemical characteristics

Generally speaking, fires involving flammable liquids are violent and very energetic, which propagate very rapidly, particularly in the form of slicks that can migrate over a large distance (for example, a 200-litre drum can produce an 80 m² slick).

In case of fire, ventilation must be stopped and activated through smoke detectors.

The physical and chemical characteristics of flammable liquids are determining factors with regard to the virulence of the fire, its propagation conditions and the means of extinction to employ.

One may cite:

4.2.3.1 - Miscibility with water

There are two families of flammable liquids:

- **Flammable liquids miscible with water**, such as alcohols, ethers, ketones, etc.

When these fires are in the form of thin slicks (several millimetres thick), they can be put out with water through a simple dilution effect. Beyond this, they necessitate the use of specific foams (AR: Alcohol Resistant), because conventional foams are destroyed by these polar chemical products.

The conditions for applying these AR foams are strict. They imply the respect of an Application Rate ("TA" in French), which is specific to the combustible (quantity of foaming solution produced per square metre of burning surface per minute) and a mode of projection of the foam (soft, indirect projection) avoiding any destruction of the foam by a sudden contact with the flammable liquid.

- **Flammable liquids not miscible with water**, which is the most general case of flammable liquids (oils, fuels, solvents, etc.). They cannot be put out by dilution effect.

Moreover, they generally have densities lower than that of water, which means they float on the surface of any water sprayed by the means of extinction and, as a result, they can form very extensive burning slicks and thus propagate the blaze. Their extinction necessitates the use of foams or foaming solutions (AFFF doped sprinkler systems).

NB: When designing a fire protection installation, the sizing of the pipes and the choice of the foam concentrate must be established, as a priority, in the presence of flammable liquids miscible with water (application rate higher than on miscible liquids, Alcohol Resistant foam concentrate and method of foam projection).

4.2.3.2 - Viscosity

The viscosity of flammable liquids is an important parameter in the conditions of combustion and propagation of these products.

Generally speaking, high viscosity flammable liquids do not have a fire point and they flow with difficulty, thus hindering the formation of burning slicks.

In certain cases, their combustion can be assimilated to class A fires and they are considered as such.

4.2.3.3 – Surface tension and interfacial tension

The physical and chemical characteristics, specific to the liquid considered, determine the efficiency or the failure of a foam applied to an inflammable liquid. One may cite, for example:

- Absence of AFFF effect on flammable liquids miscible with water due to the absence of interfacial tension between the water and the flammable liquid.
- The AFFF effect manifests itself on flammable liquids not miscible with water uniquely under precise conditions of surface and interfacial tension between the foam forming solution and the flammable liquid.

Combating flammable liquids fires remains a complex field. Nevertheless, several simple rules that enable this problem to be understood may be cited:

- It is the extent of the surface of the flammable liquid on fire that is damaging and not the volume of liquid involved. The role played by containment areas, whether with a drainage system or not, is crucial in reducing or controlling the burning surfaces.
- While extinguishing the fire and after the flames have been abated, it is vital to prevent the re-ignition of the flammable vapours emitted by the slick of liquid, by blocking the emission of such vapours either by the use of foam spread over the surface of the slick, or by the confinement of the liquid in a drained containment area
- In the case of fires involving small surface areas (several m² at the most), extinguishing agents such as carbon dioxide, ABC dry chemical powders or BC powders may be used. Beyond this, only the use of aqueous foams can both guarantee the extinction and prevent the re-ignition of slicks of flammable liquids. One may also use foam as a preventive measure on spillages in order to prevent the ignition of the slick formed.
- The splitting of the combustible and the nature of its packaging (resistance of the filling and packing to heat) can influence the slick creation conditions (for example: nail varnishes packed in small volume glass bottles are not considered, in terms of fire engineering, flammable liquids but as class IV combustibles according to the NFPA classification).

4.3 - CLASS C – GAS FIRES

In this class of fires, the combustible is made up of molecules of gas that disperse in an oxidising atmosphere.

Generally, fires involving gases take two forms:

4.3.1 - Explosions

Initially, the gas is dispersed in an oxidising atmosphere then an ignition source ignites the gaseous mixture. An explosion occurs through the rapid propagation of the flame front in the reaction medium, thereby generating a considerable pressure wave and heat flash. Such explosions are violent and destructive.

One may cite, for example, a numerical model defining the equivalence between the quantities of gas and trinitrotoluene (TNT) brought into play during an explosion. In the most damaging cases, the explosion of 1 kg of butane gas can lead to destructive effects equivalent to the explosion of 1 kg of trinitrotoluene.

Preventive measures (ventilation and reduction of ignition sources) are the most efficient under these conditions, because the rate of combustion reactions does not enable highly efficient extinction systems to be put in place (possibly for small volumes $< 1 \text{ m}^3$ by the use of an explosion suppressor).

In case of fire, ventilation must be stopped and activated through smoke detectors.

If this scenario is of concern, it is imperative to design the areas concerned using a “weak wall or discharge vent” approach, which enables any increase in pressure and, consequently, its destructive effects to be limited.

4.3.2 – Ignited leaks

These are the most frequently encountered cases, where the gas escapes out of a pipe or vessel via an orifice (leak, defective joint, fissure, etc.). The ignition of the jet of gas forms a diffusion flame at the emission point of the gas known as an “anchored flame”. This flame may, in turn, propagate the fire by creating secondary combustion areas or by leading to a BLEVE if it heats up a vessel containing LPG.

Extinction may be achieved easily by means of ABC or BC dry chemical powder extinguishers, but an ignited gas leak must never be put out without being certain of the gas supply having been cut off. In this specific case, the gas can continue to escape and build up, thus forming an explosive cloud.

If any doubt exists as to the possibilities of cutting off the gas supply, the flame should be allowed to burn, while at the same time cooling the surroundings, thus avoiding the propagation of the blaze.

4.3.3 – Case of LPG (Liquid Petroleum Gas)

LPG can lead to two types of fire:

- **Pool fires**

A massive spillage of LPG can form a slick of liquid on the ground that will act the same as a flammable liquid fire, but with a much more rapid or even explosive combustion kinetic. The means of protection and extinction are, for the most part, similar to those employed for flammable liquids (spreading of foam, remote containment in burning pits, etc.).

It should be noted that extensive spraying of water on an LPG slick promotes the evaporation of gas by providing heat, and it is preferable to employ aqueous foams that cut down the emission of vapours and limit heat input to the LPG slick (the evaporation of one kilogram of LPG forms a gas cloud of 8 m^3 of explosive mixture).

- **BLEVE (Boiling Liquid Expanding Vapor Explosion)**

A BLEVE occurs when a sealed LPG vessel is heated beyond the boiling point of the LPG, thereby provoking an increase in pressure, which leads to the vessel bursting. This causes an instantaneous vaporisation of the gas, which forms a fire ball characterised by a very high thermal radiation and a considerable pressure wave.

Accidentology demonstrates the devastating and dramatic nature of these accidents. On a lesser scale, aerosol generator storage fires illustrate the virulence of these blazes (the radiated fluxes at 3 metres are around 100 to 130 KW). The means of protection consist of cooling and depressurising the structures concerned.

4.4 - CLASS D – METAL FIRES

This class concerns metal fires.

4.5 - CLASS E – ELECTRICAL FIRES

Electrical fires represent an atypical classification of fires in so far as the thermal energy is released either by the electrical arcing produced by short circuits or by heating of the conductor due to Joule effects. They are transformed rapidly into Class A fires by involving the insulating materials of conductors or surrounding combustible materials.

The extinction of these fires necessitates an obligatory cut off of the electrical power, after which they can be dealt with the same as Class A fires. In a general, the use of carbon dioxide extinguishers enables a rapid and clean extinction of the blaze without causing damage to neighbouring equipment.

The use of water presents risk of electrocution to people and it may only be used in sprayed form and with a controlled application. Generally, water spray extinguishers can be employed on a maximum electrical voltage of 1000 volts; this characteristic is marked on the body of the extinguisher. It can produce a short circuit of the electrical components and requires a very thorough cleaning and drying out of the installations.

The use of extinguishing powders is strongly advised against, due to the fact that they penetrate the electrical components. Only ABC dry chemical powders can be used efficiently.

It should be noted that these fires produce huge amounts of smoke, which can have significant corrosive and toxic properties due to the presence of halogens in electrical insulators, which lead to the production of hydrochloric acid (among other things). These corrosive characteristics cause significant corrosion to structures (concrete, metal reinforcement, protective boarding) and to equipment.

4.6 - FIRES DUE TO COMBUSTIBLE POWDERS

Combustible powders can typically lead to two types of fire:

- **Explosion of dust clouds.** When clouds of combustible dust are formed, they can produce explosions comparable to those of gas clouds.

- **Self-heating powder storages.** The accumulation of combustible powders in layers may lead to a spontaneous ignition phenomena of these powders, without input of energy from an external source. This phenomenon is especially critical with compositions of hair bleaching powders, which consist of mixtures of oxidising compounds and oxidants with combustibles. These fires act the same as Class A fires and are dealt with as such.

Summary table of extinguishing agents as a function of fire classes
(given as an indication)

Fire	Water	Doped water		Foam	Powder		Gas
		AFFF	AFFF - AR		ABC	BC	
Class A	YES	YES	YES	YES	YES	NO	NO
Class B Miscible with water	NO	NO	Yes, under certain conditions	YES	YES*	YES	YES
Class B Not miscible with water	NO	YES	YES	YES	YES*	YES	YES
Class C	NO	NO	NO	Yes, under certain conditions	YES	YES	NO
Class D	Not applicable Specific to metals on fire						
Class E	Yes, under certain conditions				YES	NO	YES

* ABC dry chemical powders break down foams, so they are therefore not compatible

5 - RULES APPLICABLE WITHIN THE GROUP

The requirements in terms of fire protection are based on several types of rules and frames of reference.

One may distinguish:

- **Regulatory requirements.** These are generally specific to a country or a group of countries. They have legal force and their application is obligatory. They include laws, codes, directives, standards, etc.
- **Rules of a contractual nature.** These rules are applied within the framework of contractual relations between 2 parties. Typically, this includes fire protection rules decreed by insurance companies (NFPA, FM, APSAD, etc.).
- **Rules and recommendations drawn up by professional organisations.**
- **Internal rules** specific to the company. Within the L'OREAL Group, these include specifications, guides, etc.

Independent of the regulatory requirements specific and applicable to each country, **the fire protection rules applied within the L'OREAL Group follow the recommendations of**

NFPA (National Fire Protection Association)

NFPA 11:	Standard for Low, Medium and High Expansion Foam Systems
NFPA 13:	Standard for the Installation of Sprinkler Systems
NFPA 14:	Standard for the Installation of Standpipe and hose systems
NFPA 16:	Standard for the Installation of Foam-Water Sprinkler
NFPA 20:	Standard for the Installation of Stationary Pumps
NFPA 22:	Standard for Water Tanks for Private Fire Protection
NFPA 24:	Standard for the Installation of Private Fire Service Mains and Their Appurtenances
NFPA 30:	Flammable and Combustible Liquids
NFPA 30B:	Code for the Manufacture and Storage of Aerosols
NFPA 80:	Fire doors

If the local rules and regulations set out in this document have different requirements, the most restrictive requirements shall apply.

The equipment to be used must comply with the NFPA rules or be approved by the FM, UL or by any other recognised competent authority.

These rules describe specific fire protection technical solutions developed by the L'OREAL Group on very specific subjects (aerosol generator fires, flammable liquids, etc.). Studies specific to a fire protection project must be validated by the Corporate H&S when the project is reviewed.

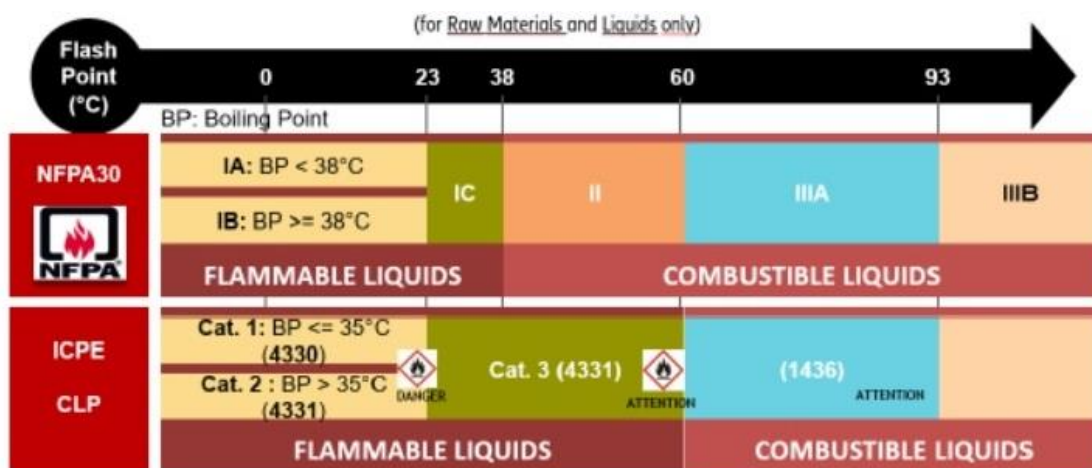
5.1- ACTIVITIES

Activity	NFPA Rule 13	Example of zone
Ordinary Hazard Group I	§ 5.3.1	Offices
Ordinary Hazard Group II	§ 5.3.2	Filling and packing
Extra Hazard Group I	§ 5.4.1	Production, DC without flammables
Extra Hazard Group II	§ 5.4.2	Production of flammable bulks, DC with flammables

5.2- CLASS OF GOODS

Class	NFPA Rule 13	Example of packaging components
Class I	§ 5.6.3.1	Glass bottles, on wooden pallets, unwrapped pallet.
Class II	§ 5.6.3.2	Glass bottles, in boxes, on wooden pallets, unwrapped pallet.
Class III	§ 5.6.3.3	Glass bottles, with plastic caps, in boxes, on wooden pallets with plastic wrapping.
Class IV	§ 5.6.3.4	Glass bottles, with plastic caps and spacers, on wooden pallets, with plastic wrapping. <i>(The plastic material represents less than 15 % of the total weight of the pallet. Beyond this, a "plastic" classification is applied)</i>
Plastics Class A: polyethylene, polypropylene, etc		The filling and packing articles used in the L'OREAL Group correspond to this classification
Level 2 and 3 aerosols (Cat 1&2)	NFPA 30 B	
Level 1 Aerosols (cat 3)		These aerosols are managed the same as Class IV finished products
Flammable liquids	NFPA 30	- a liquid, miscible with water or not, which has a flash point below or equal to 60°C and a fire point. - a liquid, miscible with water or not, which has a flash point below or equal to 93°C and a fire point, which is filled and packed in plastic containers with a unitary volume greater than 3.8 litres. - Some specific cases are managed as class IV.

10 pallets with a classification of IV or higher are authorised per water station, if these pallets are spread out in a homogeneous manner in the storage areas (for example, flammable liquids and plastics).



Specific cases:

The cases cited hereafter concern flammable liquids which, because of their physical and chemical characteristics, their filling and packing or the quantities stored, have a fire behaviour (particularly in regards to the propagation conditions) that is similar to that of Class IV combustibles.

- Liquid, miscible with water or not, which has a flash point below 60°C and a fire point but whose viscosity is above 10 000 centipoises or whose rheological behaviour (thixotropic properties) do not favour the formation of a slick. **The EHS Zone Director or Corporate EHS may be consulted in the event of assessment difficulties.**
- Liquid, miscible with water or not, which has a flash point below 93°C but no fire point,
- Flammable liquid, in an individual container, limited to a volume of 0.5 litres, up to a limit of 10 pallets uniformly spread out over a maximum area of 3700 m² (area corresponding to a sprinkler station according to the NFPA).

6 – PARTITIONING

PARTITIONING or INDEPENDANT BUILDINGS ARE THE BEST PROTECTION TO AVOID FIRE PROPAGATION.

Maximum cells of 10,000 m² are required to limit loss impact.

Any deviation in the compartmentalization or smoke vents must be validated by the Zone EHS Director or corporate team.

6.1 – BUILDING ELEMENTS

Building elements must assure resistance to fire and its effects (heat, migration of smoke, etc.) for a determined time, corresponding to the performance level (mechanical strength, leak tightness, insulation, etc.) that they have to assure.

Fire resistance is generally fixed in a regulatory manner and it is evaluated in hours or fractions of hours.

The conditions for determining fire resistance are defined by standardised experimental programmes in which the element considered is subjected, under its normal operating conditions, to the effects of a standardised thermal programme (ISO 834 curve), which reproduces the rise in temperature of a fire.

By increasing order of performance, one may distinguish:

- Fire stability (SF or R)**

Time during which the mechanical resistance under load is assured.

- Flame arrestor (PF or E)**

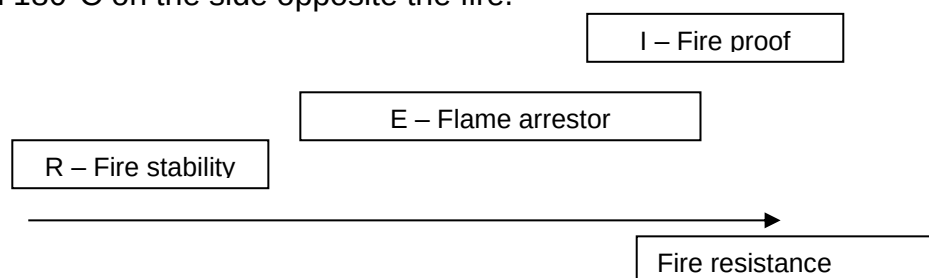
Time during which

- the mechanical resistance under load is assured.
- the leak tightness against flames and hot and toxic gases is assured.

- Fire Resistance (CF or I)**

Time during which

- the mechanical resistance under load is assured.
- the leak tightness against flames and hot and toxic gases is assured,
- the thermal insulation of the element does not exceed an average of between 140°C and 180°C on the side opposite the fire.



M Classification takes into account only combustible criteria.



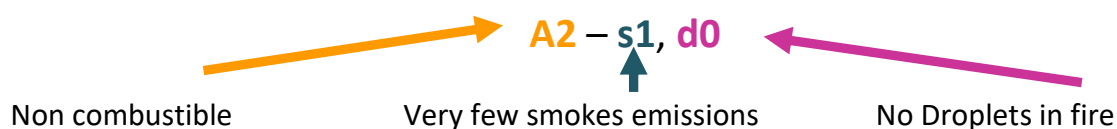
Any combustible panels with Polystyrene and Polyurethane are forbidden.
Only M0 panels (example: rockwool) are allowed.

M0 Non combustible	glass, concrete, brick, plaster, steel, aluminum, ceramic products, rock wool, sheet metal, ...
M1 Very hardly flammable	fireproof wood, cardboard, plasterboard, PVC cladding, etc.
M2 Hardly flammable	asphalt, chipboard, rigid PVC, ...
M3 Moderately flammable	untreated wood, wool, some PVC and polystyrene, ...
M4 Highly flammable	cardboard, polyurethane, polystyrene, polyethylene, cellulose acetate...

Euroclass and M classification

SBI Tests - NF EN 13501-1			Requirement
A1			Non combustible
A2	s1	d0	M0
A2	s1	d1	M1
A2	s2 s3	d0 d1	
B	s1 s2 s3	d0 d1	
C	s1 s2 s3	d0 d1	M2
D	s1 s2 s3	d0 d1	M3
Other classes except E -d2 and F			M4 (no droplet)
			M4

Euroclass classification takes into account 3 criteria (type of material, smoke produced and droplets) such as the example below for rock wool panels:





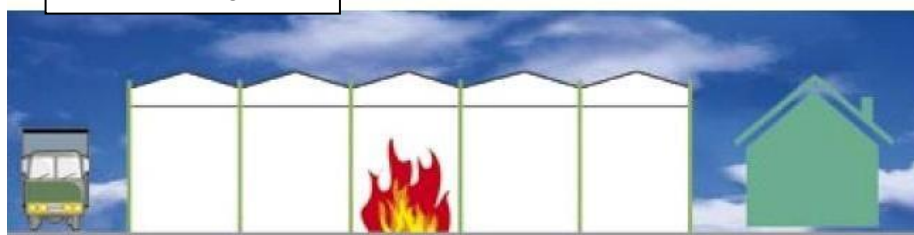
6.2 INDEPENDENT BUILDINGS

- Distance between independent buildings must be enough to avoid any fire propagation or radiation. Ensuring also, that all the firefighting equipment is working properly such as sprinklers and fire hoses. This equipment helps to protect the buildings.
- The table below indicates the distance between buildings needed, based on the type of construction. Space between buildings must be free with no storage areas.

Type of External Wall	Distance between buildings
Openings > 50% in the fire wall Or Combustible walls (sandwich panels, wood...)	30 meters
Openings < 50% in the fire wall Or Non-combustible walls (steel panels)	20 meters



No Partitioning

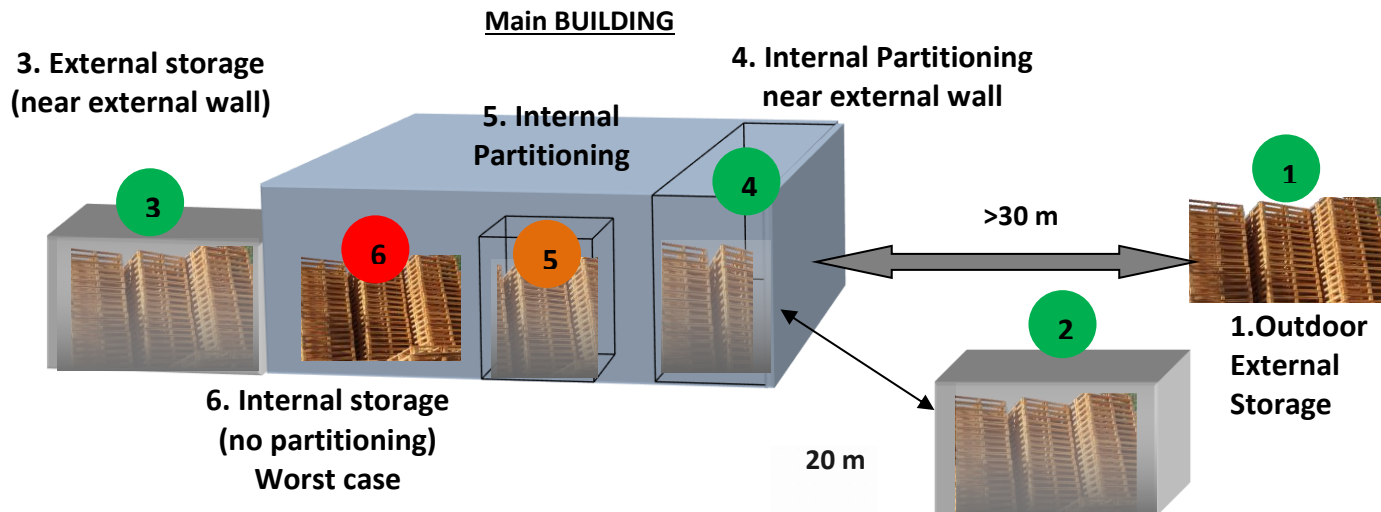


Good Partitioning

This distance between buildings:

- Can be reduced, based on the type of construction materials and also fire protection (fire wall, water curtain), providing that the thermal flow impact of 3kW/m² is contained within the site.
- In all cases, it cannot be less than 20 meters.

This shows the ideal scenario at 30m from the main building (case #1) to worst case scenario inside the building (case #6).



6.3 FIRE DOOR

Fire doors are intended to assure the continuity of the fireproof rating of the partitions (generally, fireproof walls) in which they are inserted. They have a dual function:

- To enable communication between 2 areas separated by a fireproof wall. This point is vital when taking into account the evacuation of personnel in the event of fire.
- To ensure the continuity of the fireproof rating of a partition in order to prevent the propagation of a fire from one compartment to another.
- Fire door must be REI 120.

The fireproof rating of a fire door (EI: Integrity & Insulation) must be identical to that of the partition into which it is inserted. NFPA 80 also gives advice regarding fire doors.

The fire door must be approved by a recognised organisation or body (FM, UL, CNPP, TUV, etc.). The authorisation must be displayed on a part of the door that is easy to check.

The technology of the door (sliding on a rail or roll down type) must be taken into account for maintenance operations and for the long-term reliability of the device. When conditions allow, it is preferable to use rail sliding doors.

The evacuation of the premises by personnel must be taken into account in the arrangement of the fire doors. Fire doors for pedestrians must be installed if conditions require it, (fire doors that are easy to open and close by one person, for example).

When it is not possible to use a single door with the desired fireproof rating, devices can be put in place to allow the use of a lower fireproof rated door. For example, two doors with a 1- hour fireproof rating, positioned on either side of the partition, can provide an overall fireproof rating of 2 hours.

If flammable liquids are present, the fireproof doors must be adapted to maintain the containment of the area (to prevent the passage of a slick of flammable liquid underneath them, by using for example, gutters, containment barriers, etc.).

The closing of the fire doors must be remotely controlled:

- By fuses located on either side of the door or smoke detectors on both sides.
- By an electro-magnetic vacuum extractor remotely controlled by the sprinkler system (water flow indicator) or fire detectors placed on either side of the door.
- By a manual device.
- No obstructions stopping the door from closing properly in case of a fire alert.



Fire doors must be also implemented when there are conveyors through the fire wall.

Otherwise, the integrity of the wall will be lost.

**FIRE DOORS MUST BE TESTED REGULARLY
AND ROUTINELY CHECKED TO BE FREE
FROM OBSTRUCTION**

6.4 SMOKE VENTS

Evacuation of smoke is key to protecting people and avoiding contamination. For this reason, smoke vents must be implemented.

The installation of smoke vents must comply with the country standards or guidelines. Failing this, a specific engineering study must be carried out.

The smoke vents must have automatic and manual opening.
The opening devices must not enable the vents to be used as a means of ventilation.
The smoke vents must be equipped with a device to stop people falling (bars, mesh).

The effective area of the vents installed in each smoke zone must not be less than 2 % of the surface area of the smoke zone.

The effective area of each vent must be between 0.5 and 6 m².

The vents in each smoke zone may be triggered:

- by fuse. The break temperature of the vent fuses must be:
 - at least 30°C higher than that of the roof sprinklers (for example: an installation with sprinkler heads calibrated at 68°C will have fuses calibrated at 98°C)
 - 180°C if the sprinkler is the ESFR type.

- manually, by a pneumatic control using a copper-based system, installed close to an emergency exit (the pneumatic control pipes must not be heat sensitive, so stopping them melting and being pierced by the combustion gases).

The vents installed in areas intended for storing aerosols must be equipped with mesh that prevents the projection of aerosol containers in the event of fire.

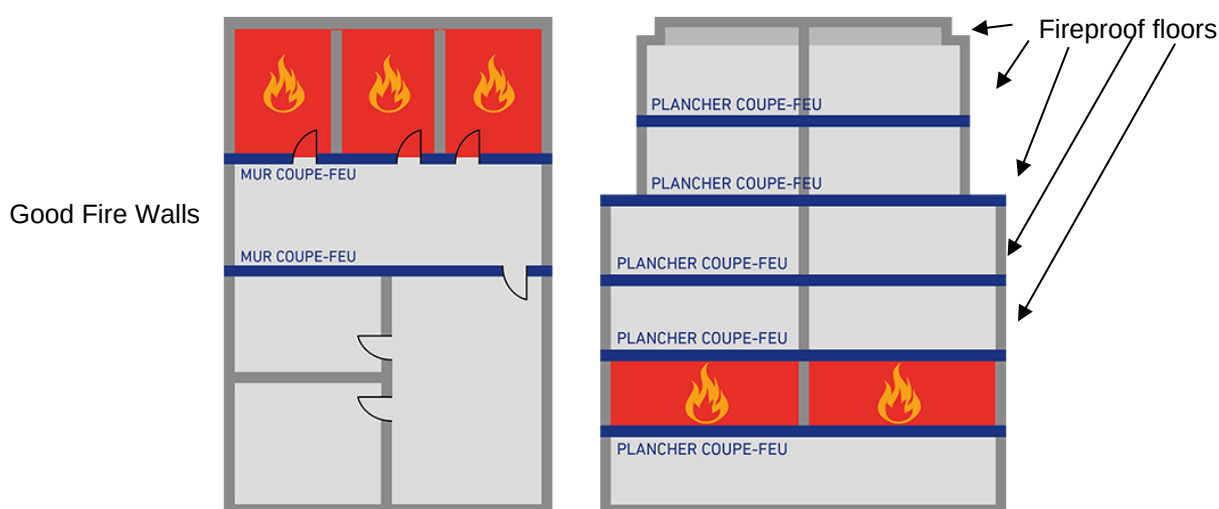
The surface area of each smoke zone must comply with local regulations, with a maximum of 1600 m² and be square in shape, if possible. The smoke zones must be delimited by smoke zone screens, made out of non-combustible materials (including the fastenings), with a minimum height of 2 metres.

6.5 BLOCKS METHODOLOGY & LIKELY REASONABLE LOSS (LRL)

The determination of the largest **Likely Reasonable Loss (LRL)** or EML for insurers (Estimated Maximum Loss) for each industrial site is based on scenarios, identified using a GHAP type approach, but we are only interested in scenarios for which the causes are internal to the site, the consequences of which would lead to significant damage to property, and also consequential loss of production.

The purpose of this LRL method is to describe the specific steps:

- Identify the blocks and fire protection
- Select the scenarios.
- Carry out an economic assessment of the consequences of the selected scenarios, based on the value of the assets, in the case of damage to property, and on the BCP plans, in the case of loss of production.
- Take the existing means of protection into account, in order to assess reasonably the likely consequence of a fire or explosion.
- Classify the scenarios by the amount of loss quantum in such a way as to allow a consolidation of the largest LRL per site.



6.5.1 Identification of the blocks

The existence of free space or the presence of ordinary dividing walls and/or fire walls and/or

a mix of wall/fireproof frame, are of key importance when assessing the LRL. These arrangements prevent the propagation of a fire providing they meet certain minimum criteria. The identification of these spaces or these walls enables the site to be broken down into blocks.

If there is no wall or free space recognised as a fire cut off, according to the characteristics defined below, the whole site will be considered as a single Block.

CHARACTERISTICS OF A FIRE SEPARATION WALL:

- Must be able to stop the fire spreading, with fire protection measures in good working order,
- The material component of the wall must provide a fire performance in accordance with the official technical requirements (R,E,I) of at least 2 hours eg, concrete, brick, sprayed wall, 20 cm breezeblocks...),
- Openings provided, with standard fire cut off doors/flaps and in compliance with the NFPA or locals standards, and having the same fire cut off criteria as the walls they are inserted into,
- Absence of obstacles in the passage of the openings,
- The roof to overhang by 1 meter, or an equivalent and effective alternative,
- Stairwells / service lifts must be compartmentalized and provided with fire cut off doors/flaps
- Appropriate walls to contain the fire and resist structural damage.
- Pipes / extractors of air or dust must be protected or equipped with explosion vents connected to the outside of the Block,
- Distance between the ground and the bottom of the upper floor windows > 2.8 times the height of the windows

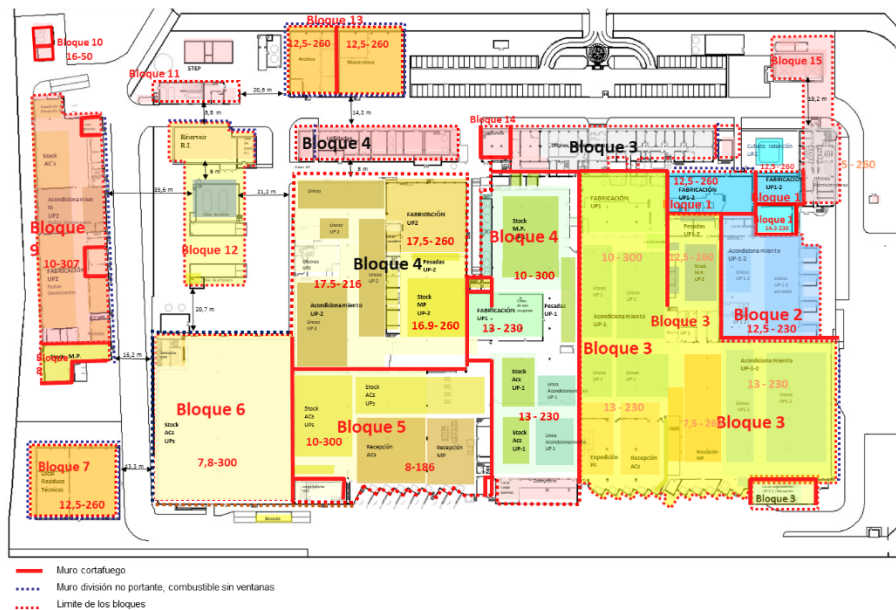
6.5.2 Fire Protection assessment per Blocks

Each block identified must have all the requirements of prevention and protection according to the criteria below.

The Insurer's report provides all the information needed to estimate the level of protection.

- **Automatic protection with sprinklers:** % of the LRL block is in accordance with the applicable NFPA standards.
- **Automatic protection with high expansion foam:** % of the specific areas (ADF rooms, storage of flammable liquids) are protected in accordance with the applicable standards (L'Oréal standards, NFPA)
- **Automatic Fire Detection:** % of the LRL Block is provided with fire detection in accordance with the applicable standards.
- **First Intervention Team:** % of employees are trained for management in emergency situation (fire, explosion). Practical retraining every 3 years.

- **Second Intervention Team:** Practical training of the second intervention team. Attendance of some members of the second intervention team inside the LRL Block during the production periods.



6.5.3 Selection and assessment of the scenarios

The selection of scenarios, known as “LRL scenarios”, are based on the following principles:

- Scenarios (GHAP) that are not very frequent, for which the means of control (prevention, detection, protection) are brought into play and may be subject to failure. Consider, for example, a spillage and spread of alcohol, a fire starting and the possible consequences, depending on the efficiency of the means of detection / protection.
- A brainstorming session should be carried out (based on the GHAP model) by a Management Committee which includes the most experienced technicians.
- Natural hazard scenarios to be part of the study.
- Any fire scenario that occurs within a given block should not extend beyond that block.
- Scenarios of external origin such as “falling aircraft”, “malicious intent” or “natural events” should not be taken into account in the evaluation of the LRL.
- For each block of the plant, scenarios are identified that lead to damage to property and/or significant interruptions to production. The material loss is important. This includes the damage by smoke and by sprinkler water. The loss of production resulting from a material damage is important, even though the material damage itself is not important.
- For a given scenario, the Likely Reasonable Loss depends on the efficiency of the means of protection. This efficiency determines both the extent of the damage and the resulting production interruption time.
- For each LRL scenario, the property damage is valued at the new replacement cost of an identical item of property, by the DAF.
- Property is taken to mean, buildings, fixtures and fittings, embellishments, fixed or mobile equipment - whether owned or rented, stocks in any condition, consumable materials, etc.

Apart from stocks, the damaged property in each of the scenarios studied must be valued as the identical replacement cost as new, on the day of accident (including transport costs, assembly and tests etc., but not including any supplementary conveyancing costs or

emergency assembly costs). If an item of equipment is no longer listed in the manufacturer's catalogue, it should be valued at the cost of a similar item in the catalogue with an identical output.

For each LRL scenario selected, the extent of the loss is linked to the efficiency of the detection and protection.

The duration of interruption time following a scenario is determined by taking into account the extent of the damage within a block. The time required to repair any damage caused by smoke or extinguishing water should also be taken into account in assessing this time.

The smoke generated during a fire can cause very significant damage a long way from the original combustion area.

This damage can occur in two ways:

- **Through deposits on the installations.** These deposits, which are products of combustion, are due to particles and aerosols contained in the smoke.
- **Through corrosion of metallic materials.** This phenomenon of corrosion is particularly accentuated by the presence of chlorinated derivatives from the combustion of plastics (polyvinyl chloride, electrical cables, packaging, etc.). These derivatives form hydrochloric acid, which then reacts on the structures and the metallic equipment. This type of corrosion can appear a very long time after the blaze.
If a fire occurs, it is imperative to have a diagnosis carried out as quickly as possible (determination of chlorides by smear), which aims to assess the impact of the smoke on the installations.

Conservation measures are taken immediately after the extinction of the fire (drying, rinsing and decontamination). These measures are especially important if the affected installations are sensitive and strategic (filling and packing line, production skid, etc.).

Companies specialised in this area of intervention should be identified and called upon in the event of a fire.

6.5.4 Block consolidated report

This report will include:

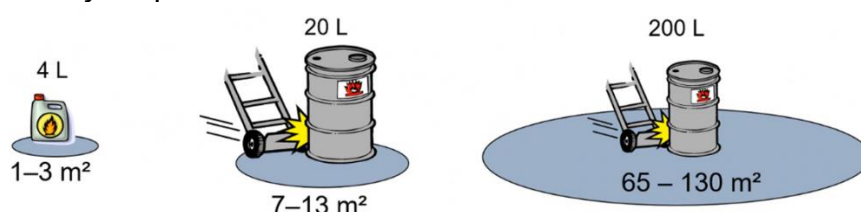
- The description of the site, the compartmentalisation (blocks)
- The means of prevention / protection in place per block classified by level
- The value per block
- Site strategy or BCP based on the risks/scenarios identified

7 – CONTAINMENT

Water used to fight fire must be recovered in order to prevent any soil, sewer or water course pollution.

The design of the containment facilities must comply with local regulations in the case of productions employing flammable liquids.

Particular attention must be paid when flammable liquids are present because, in this case, remote containment may be required. Nevertheless, if the regulations so permit, flammable liquids may be placed in a non-remote containment, if this is covered with foam.



An efficient containment is able to avoid spillage.

7.1 – CONTAINMENT CAPACITY

The volume of water used for firefighting may be estimated from the following table:

Estimation of the volume of water for firefighting as a function of the operating time and the flow rate of the fire protection installations		
	Spray	ESFR
Operating time motor pump unit	120 minutes	60 minutes
Post hydrants and fire hose station (if not supplied by the motor pump unit)	240 m ³	60 m ³
Foam installation (if not supplied by the motor pump unit)	For 10 minutes for sprinklers and foam generators	

Example of the theoretical calculation of the capacity of a factory containment Case N°1: The post hydrants are not supplied by the motor pump unit			
Areas protected (most demanding situation)	Densities applied	Operating times	Volume of water produced in m ³
Storage area for plastic packaging	Roof system 12.2 l / min / m ² x 279 m ²	120 minutes	409

(§.15.4.3)	Intermediate system 114 l / min per sprinkler for 14 sprinklers	120 minutes	192
Post hydrants	2 simultaneous post hydrants, each of 1000 l / min	120 minutes	240
Volume of the containment in m ³			841

Example of the theoretical calculation of the capacity of a factory containment Case N°2: The post hydrants are supplied by the motor pump unit			
Areas protected (Most penalising case)	Flow rates applied	Operating times	Volume of water produced in m ³
Flow rate of the motor pump unit	450 m ³ / h	120 minutes	900
Volume of the containment in m ³			900

However, it is likely that the public authorities (usually the fire brigade) take into account;

- the nature and the quantity of products stored,
- the means of extinction that they intend to use,
- the estimated time to put out the fire.

They may then require a much higher containment capacity. Prior consultation with the fire brigade and the relevant administrative authorities is therefore indispensable in order to define the containment capacity.

7.2 –CONTAINMENT CONSTRUCTION

The containment facility must be constructed:

- **Preferentially** within the areas in question, by forming a complete outer sill or a leak tight sink hole.
- By the creation of a remote cistern into which all of the firefighting water is channelled. This cistern, which can only be drained by a specific pumping action, must be leak tight and isolated from the public mains and sewage systems.
- By the use of separate bay areas, by installing a shutter on the storm water system, which will be closed in the event of a fire, providing the local fire brigade give their approval.
- By mobile devices such as barriers laid out on the surface or built into the ground.

- By a combination of the previous solutions

In all cases, the triggering of the shutter must be remotely controlled by the triggering of the sprinklers and be able to be manually disengaged and put into operation. It must be located more than 10 m from the buildings, so that it is easily accessible in the event of a fire.

It is preferable to opt for a solution that does not require any human intervention.

7.3 – FLAMMABLE LIQUIDS MISCIBLE OR NOT



In France, local regulations set a maximum cell of 3,500 m² for flammable liquid storage.

As stated previously, spillage is the main risk and would be out of control using sprinklers. For this reason, NFPA 30 requires a containment for any miscible liquid with a flash point <93°C and with a unit volume above 38 litres.

For all non-miscible liquids, containment is also requested to manage spillage impact.

Liquid miscibility is a key factor to designing the active and passive protection:

- For miscible liquids, sprinkler water will dilute flammable liquids and reduce the heat of the fire.
- For non-miscible liquids (such as oil for example), the liquids will be above the sprinkler water and it will be difficult to manage the fire. For this reason, a foam system must be used to limit the spread and to create a layer to avoid mixing flammable vapors and oxygen.

Sprinkler standards such as NFPA or FM Data Sheet request drainage systems or containment.

Drains must not be connected to wasted water. An external container, designed for this purpose only, is needed.

If it is too complex to have a containment system or efficient drainage, a foam extinction system must be implemented.

A foam system must be able to run for at least 20 minutes to cover all the flammable spillage. This volume has to be included in the containment. Foam is also a way to reduce the volume of sprinkler water required, (which on average is for a 2-hour period).

Building design must take into account the foam that will potentially cover the whole area. It means that walls and dykes must be efficient to keep the foam and the liquids inside the area without spreading.

Foam must be provided as soon as 4 sprinkler heads trigger. Foam must also be provided less than 30 seconds after the sprinklers trigger. (Reference A.7.1.6 of NFPA 15 version 2017).

The means ensuring containment, to avoid any leakage:

- Thresholds, walls, angles or ramps of sufficient height,
- Removable barriers of sufficient height,
- Sealing floor drains.

Drainage systems are :

- Large drainage pipes designed to evacuate the flow to an external containment/tank
- Large syphon to also evacuate the flows.
- Minimum 1% slope of the area is required to evacuate the water to the drainage.

The following formula can help to design an efficient drainage system:

The drainage pipe or trench must evacuate 150% of the generated water flow.

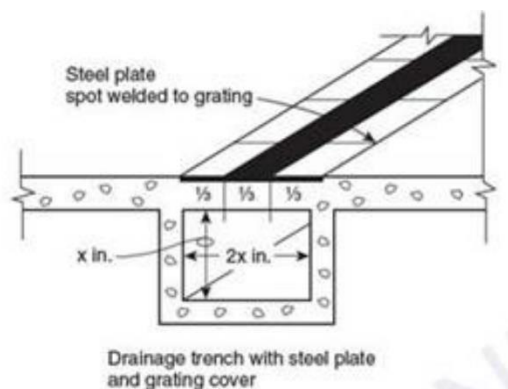


FIGURE A.4.4.4 Drainage Trench Detail.

$$\text{Flow } F = 1,5 \times D \times A$$

F: Drainage flow in l/min

D: Sprinkler or deluge flow (in l/min/m²)

A: Area to be managed by the drainage (in m²)

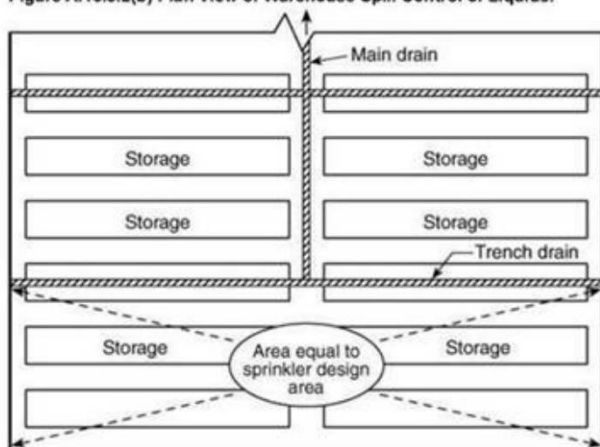
The drainage trench must be designed as follows:

Width of the trench must be double the height of the trench.

The drainage trench must also be covered by a full metal plate covering 66% of the length. Only 33% of the drainage trench should be covered by a metal grid. This provision will limit the height of the fire inside the trench.

In the case of an intermediate drainage trench connected to a main drainage pipe, the flow F' is calculated in this way:

Figure A.16.8.2(b) Plan View of Warehouse Spill Control of Liquids.



Main Flow F' of Main Drain:

$$\text{Flow } F' = 1,5 \times d \times D \times A^{0,5}$$

F': drainage flow in l/min

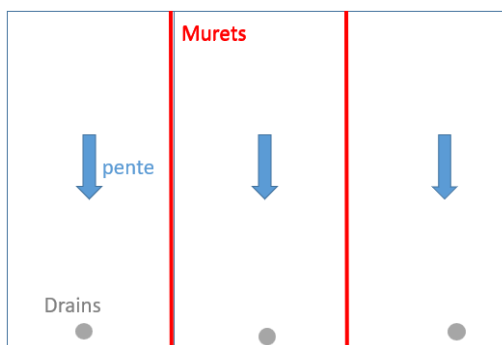
d: distance between drainage trench (in m)

D: sprinkler or deluge flow (in l/min/m²)

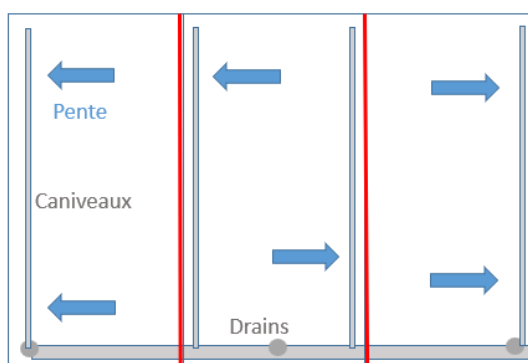
A: area concerned managed by the drainage (in m²)

Please find below some examples of drainage configurations:

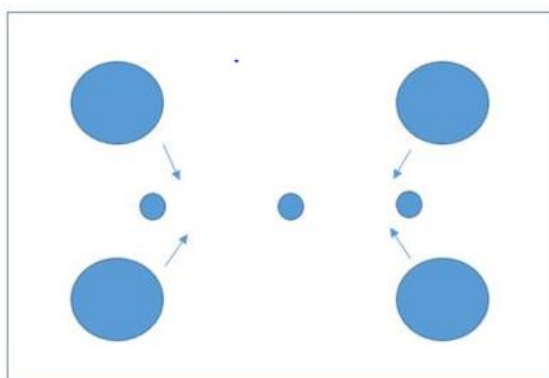
1. One drainage trench only, close to the wall / 3 independent cells:



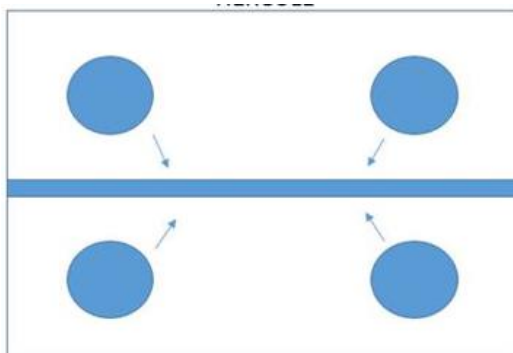
2. If the slope is insufficient to reach the main drain close to the wall, intermediate drainage trenches will be created in each of the 3 cells.



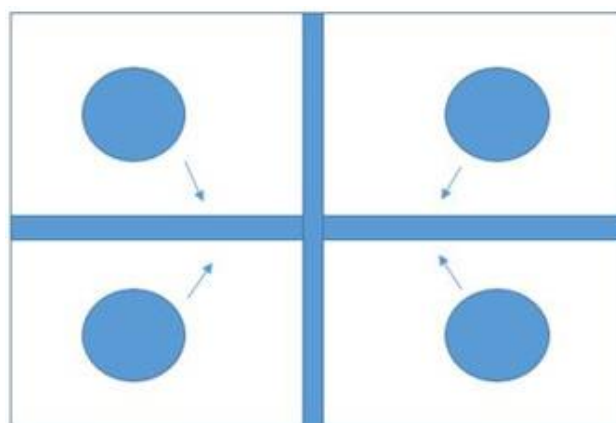
3. A drainage system capable of collecting the total flow from the 4 tanks in the area:



4. A drainage system capable of collecting the total flow from the 4 tanks, when the direction of flow is important:



5. The room is divided into 4 cells to manage the independent flow of each of the 4 tanks.



Reference:

NFPA 30 version 2021: 9.13 and 16.8 figure 16.8.1. and 4.4 of code NFPA 15 version 2017 also 2.6 of code NFPA 16 version 2019.

FM DS 7-29 version 2019 : 2.2.2 and figure Table 2.2.2.1 A and Table 2.2.2.1 B also FM DS 7-83.



8 – FIRE PROTECTION INSTALLATIONS AND DEVICES

Fire protection involves deploying a whole series of measures that enable any fire start to be extinguished or to limit and control its spread.

These means are activated as soon as there is a fire start and they are intended to transmit an alarm and/or to extinguish the fire through the projection of an extinguishing agent. They include:

- sprinkler systems, (water, doped water)
- foam installations,
- gas installations,
- powder installations.
- detectors

8.1 – SMOKE DETECTION

Fire detection installations that may be based on different technologies (detection of flames, smoke, heat, etc.). They are designed to detect a fire start, transmit an alarm and, in some cases, if necessary, trigger a fixed extinguishing system (extinction by gas, foam or powder).

A fire detection system must be installed in the following cases:

- Regulatory or normative obligation: ionization smoke alarms are forbidden in some countries.
- In all areas that do not have a fire protection installation,
- In all areas where an early detection of a fire start is necessary with regard to the specific functions of such areas or the equipment that is present (computer rooms, control rooms, clean rooms etc.).
- Different technologies can be used: Vesda, laser, bluetooth systems, . . .

The criteria for defining the fire detection installation are evaluated on the basis of specific engineering studies and according to the regulatory and normative constraints.

In all cases, a fire detection installation must transfer the alarm to a structure where there is a permanent human presence. This structure must then manage the necessary alert procedures.

Smoke detectors will always detect fire earlier than sprinkler systems. If emergency teams are efficient and trained, the fire can be managed easily (it means that emergency teams are available 24/7).

8.2 – MOBILE FIREFIGHTING EQUIPMENT

Extinguishers:

The layout density of the extinguishers must be determined according to local regulations, the existing risks, or according to NFPA Rule 10. The distance that needs to be covered to reach the closest extinguisher must be no more than 25 metres (according to, for example, NFPA Rule 10).

Areas in which the combustibles are Class “A” (solid combustibles) are protected by Class “A” and “B” water spray extinguishers. The use of ABC dry chemical extinguishers is only authorised in areas that are easy to clean and in which the consequences, with regard to corrosion of the equipment, are negligible.

Areas in which the combustibles are Class “B” (combustible liquids) and “C” (gases) must be protected by “BC” dry chemical extinguishers. The powder in these extinguishers must be compatible with the use of foam.

The use of Class “ABC” dry chemical extinguishers is possible but it breaks down the foam that may be used to put out flammable liquid fires.

“Class E” electrical fires concerning low voltages (220 volts) may also be put out with Class “A” and “B” water spray extinguishers. Generally speaking, water spray extinguishers may be used on a maximum electrical voltage of 1000 volts, this characteristic is detailed on the body of the extinguisher.

Occasionally carbon dioxide extinguishers may be used on small volumes of electrical or electronic equipment or any other fragile and difficult to clean installations.

Lifting trucks must be equipped with “ABC” dry chemical extinguishers.

Hydrants:

Each building must be protected by a hydrant network system/loop with valves to enable separate parts of the loop to be closed.

These hydrants must be located at a minimum distance of 12 metres from the buildings and spaced apart by 150 metres at the most. This distance must be approved by the local authorities.

The hydrants must be of the “reversible” type.

The available flow rate of the post hydrants must be:

- 120 m³/h, equivalent to 2 hydrants open at the same time
- Minimum 1 bar pressure

The supply to the post hydrants must be assured either by the water source, or by the mains.

Fire Hoses:

The fire hose station system must be supplied by a water source or by the mains.

This system must be sized to provide a minimum flow rate of 30 m³/h, equivalent to 3 fire hose stations in simultaneous operation (3 x 10m³/h).

The fire hose stations must be of the “semi-rigid” type, DN 20 for offices and DN 40 for the remainder of the installations and must have at least 20 metres of hose.

It is preferable to use fire hose stations with crimped connections (fire hose – pipe connections). The spacing of the fire hose stations must be 50 metres, at most, and the radius of action of the jets must intersect, two by two. This condition is not obligatory for foam fire hose stations.

The maximum pressure in the system of fire hose stations is limited to 7 bars.

It may be lowered if the flow rate conditions are assured, in order to ensure correct use by users.

If fed by a motor pump unit, the installation must be equipped with a pressure reducer.

Each fire hose station must be equipped with a multi position “spray – stream” diffuser.

Each fire hose station must be mechanically protected against collisions by trucks.

Fire hose stations installed in areas with flammable liquids must be equipped to produce low or medium expansion foam (according to the installation constraints).

The choice between the production of low or medium expansion foam depends on the layout conditions:

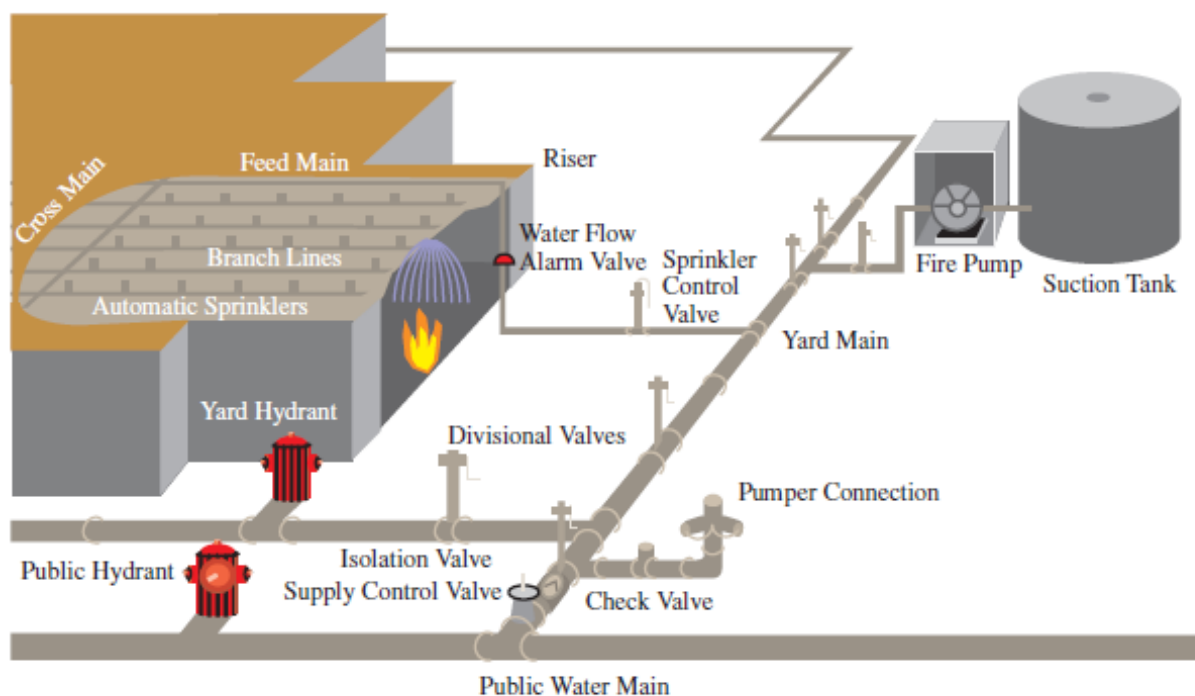
- Low expansion foam is used when significant range of the projection of the foam (7 to 8 m or more) is sought.
- Medium expansion foam offers a shorter range (3 to 4 m) but the foam formed consumes less water and it does not cause any mechanical damage (gentler projection).

The fire hose station must be equipped with a foam concentrate metering and storage system (FireDos system).

8.3 – SPRINKLER SYSTEM

The sprinkler system comprises of the following elements:

- A water source intended to supply, for a given time, pressure and flow rate, the sprinkler system and depending on the given situation, the post hydrants and fire hose stations. It includes water tank, diesel pump and jockey pump.
- A buried system
- Valve rooms
- Sprinkler systems
- An alarm transfer control unit



8.3.1 – Water Storage

The water storage, supplied by the mains network, is sized according to the results of the protection system hydraulics study (including the post hydrants if necessary) for a duration of 2 hours (Spray sprinkler systems) or 1 hour (ESFR sprinkler systems).

Although an estimate may be given, the **volumes cited below are a maximum indicative value and they take into account the water demand of the flammable liquid protection systems (sprinklers, foam installations) and aerosol storage areas (important intermediate systems):**

For installations with Spray sprinklers (for information only):

- 700 m³ (system without post hydrants) or
- 900 m³ (system including the supply of post hydrants (120 m³/h) and fire hose stations).

For installations with ESFR sprinklers (for information only):

- 800 m³ (system without post hydrants) or
- 900 m³ (system including the supply of post hydrants and fire hose stations).

The design of the water storage must comply with NFPA Rule 22, supplemented by the requirements given below:

Its filling time must not exceed 8 hours.

The water storage, made out of bolted steel with an epoxy or similar coating, must preferably be raised. The interior of the storage unit must be equipped with a geomembrane. This must be installed on a concrete apron, on ground capable of supporting the weight of the filled water storage.

In certain cases, the water storage may be buried

The water storage must be equipped with the following elements:

- a double heating pin with a convection chamber for aerial metal storage units, if the climatic conditions require it
- a water level indicator
- a low water level alarm
- a low temperature alarm
- a suction pipe with an anti-vortex plate.

If the upper part of the water storage can be accessed, the following must be provided:

- A means of access secured against falls from height and the access to which is locked.
- Protection against the risk of falls from height from the top of the water storage.

If the interior of the water storage is accessed via a manhole located on the upper part of the storage unit, the following must be provided:

- A manhole of sufficient diameter to evacuate a person in difficulty.
- A mechanical system enabling the attachment of a device ensuring the safety of a person accessing the interior.

In certain cases, the mains supply may constitute the water source (connection to the town's water network).

This must be reliable and of sufficient dimension to supply the sprinkler systems and, if necessary, the post hydrants and the fire hose stations for at least two hours during the most unfavourable period.

A direct connection to the mains supply requires compliance with local regulations, particularly with regard to health and safety.

The connection to the mains supply must be made:

- with a backflow preventer
- with a device that prevents the depressurisation of the mains supply, if the use of a booster is necessary.

8.3.2 – The Water Source

The water source facility must be installed at a minimum distance of 15 metres from the buildings if the materials employed for its construction are non-combustible. **If these conditions (distance and materials) cannot be met, it must be isolated by a construction with a 2-hour fire proof rating.**

If the water source facility is installed inside the building that it is designed to protect, its construction (walls, floor and roof) must have a 2-hour fireproof rating.

The construction must be non-combustible with a concrete floor.

The facility must be equipped with the following equipment:

- A sprinkler protection with a density of 10 l./min/m².
- A “fire” alarm given by a water flow indicator test device.
- The facility must remain closed with a transferred intrusion alarm.
- A ventilation device, if necessary, activated by the motor pump unit. The ventilation surface must be in accordance with the standards of the manufacturer of the motor pump unit, but it must not be less than 1 m². This device must enable the facility to be swept efficiently.
- A low temperature alarm.
- A heating device to prevent freezing
- Emergency lighting
- A telephone.

The water source facility must be equipped with reliable and simple devices that prevent, if there is a spillage of fuel, accidental pollution of the ground or the water evacuation network.

Suitable technical and/or organisational measures must be taken in order to avoid the formation of explosive atmospheres within the facility, whether in normal operating situations or in accidental scenarios (for example, fuel leakage onto a hot element of the motor pump unit, a rise in temperature of the fuel above its flash point, etc).

Motor pump unit

The motor pump unit comprises of a “horizontal” pump driven by a diesel engine. The motor pump unit must be in compliance with NFPA Rule 20.

It must be sized to supply the sprinkler system, the foam installation, the fire hose stations and the exterior post hydrants if necessary.

The motor pump unit must be loaded. This means that the volume of “useful” water is at a level equal to or above the axis of the pump. If this is not the case, an “angle drive” type pump must be installed (this is the case for storage units buried in concrete located underneath the pump room).

The materials installed must be FM or UL approved, and compliant with regards to mechanical risks, burns, electrical risks, high pressure risks, sound risks, vibration risks, etc.

In case of strategic location (to be assessed and validated with Corporate H&S), a second pump could be implemented as a backup. It could also be electrical if a generator is able to start the pump.

The flow rate and pressure characteristics are:

For Spray installations:

- 340 m³/hour at 8.6 bars for the sprinkler system and fire hose station
- 450 m³/hour at 8.6 bars for the sprinkler system, fire hose station and post hydrants

For ESFR installations

- 560 m³/hour at 8.6 bars for the sprinkler system and fire hose station
- 680 m³/hour at 8.6 bars for the sprinkler system, fire hose station and post hydrants.

If the use of foam is envisaged, the water supply must be ensured either by an appropriately sized “sprinkler” pump, or by a specific pump, which also meets these characteristics.

The motor pump unit must be equipped as follows:

- a non-return valve at the pump outlet,
- a lagged exhaust pipe,
- a test device, with a flow rate meter of sufficient dimension for 150 % of the nominal flow rate of the pump, with a return into the water storage. The flow rate meter, enabling the flow rate/pump pressure curve to be easily traced, must be mounted on the wall of the room and visible when the operational tests are carried out,
- The cooling water for the motor pump unit must be in a closed circuit with the water storage,
- The circulation of the cooling water for the motor pump unit must be controlled by a water flow indicator or by any other reliable visual device,
- A cut off valve positioned after the non-return valve,
- A cut off valve of the “guillotine” type between the pump and the water storage. The feed pipe of the motor pump unit from the water storage must have a minimum diameter of:
 - 200 mm for pumps of 340 m³/h,
 - 250 mm to ensure the supply of pumps with flow rates of 450 m³/h and 680 m³/h.
- In certain cases, a safety valve (on the outlet side) is necessary on the motor pump unit,
- A fuel tank with:
 - An autonomy of 8 hours
 - A containment
 - A breather vent leading to the exterior of the room. The exterior outlet must be secured (zone 1 according to the ATEX and NEC 505)
 - A low fuel level detection device
 - An exterior filling point equipped with a safety valve
 - A flameproof vent.

The motor pump unit must be managed by an approved control unit, equipped with the following technical alarms:

- Insufficient oil pressure
- Overheating of the unit
- Start-up failure
- Over-speeding
- Battery failure
- Battery charging failure
- Low fuel tank level

The Jockey Pump.

The “jockey” pump, used for maintaining pressure, comprises of an electrically driven pump:

- Flow rate around 5 m³/h

- Minimum pressure of 10 bars
- A control unit
- It is key to measuring the working time of the jockey pump or water consumption, to detect any leakage in the sprinkler system.

8.3.3 – Buried System

The sprinkler systems are supplied from the pumping room by a DN 250 minimum buried system. The buried system must be located at a depth that ensures it is “frost free” (depending on the country where it is installed).

The buried system must be made of:

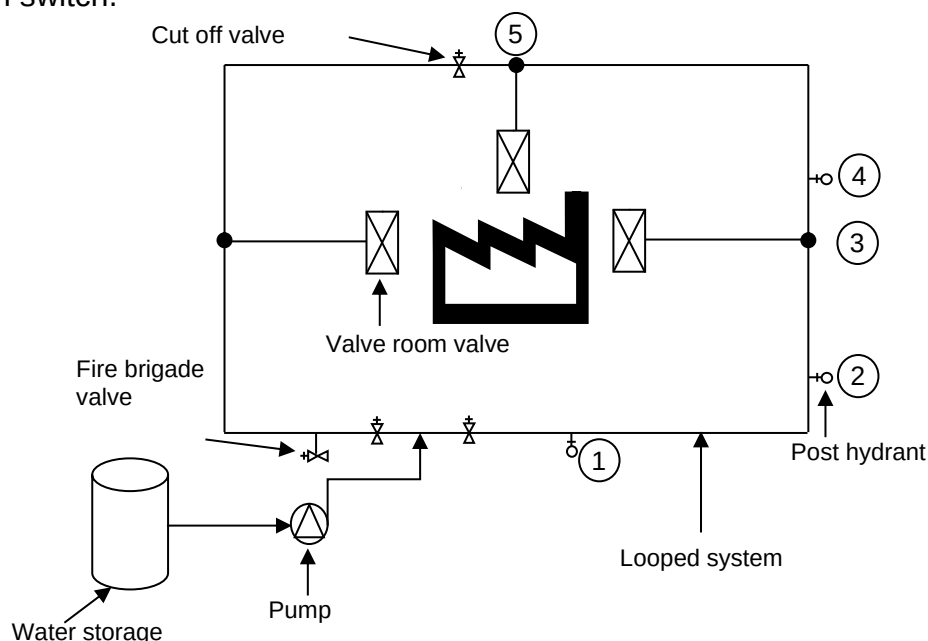
- Cast iron (any uncoupling is avoided by the installation of tie rods, a block of concrete at the angles, or any other suitable device. This device must be designed in accordance with the nature of the ground and suitable for a minimum pressure of 14.5 bars).
- or
- FM approved organic material (PVC, polyethylene, polyester), capable of withstanding a pressure of 14.5 bars.

It is preferable that the buried system is looped.

The buried system must be looped if it supplies the exterior post hydrants.

NB: If post hydrants are used with the pipes directly connected by personnel, the risks linked to high pressure must be taken into account (pressure restrictor, for example).

Cut off valves must be installed between each block of 5 elements (an element is defined as a post hydrant or a pipe supplying a unit). These cut off valves are controlled in the open position by a position switch.



A “fire brigade” connection with a non-return valve must be installed in the loop in order to allow the fire brigade to re-supply the sprinkler system with water.

8.3.4 – Valve Rooms

Each zone protected by a sprinkler system must be supplied from a valve room.

A valve room according to NFPA Rule 13 supplies a zone with a maximum surface area of 3700 m².

The roof sprinkler systems and the intermediate sprinkler systems must be supplied from separate valve rooms.

The valve rooms must be located against the building facade and be accessible from the exterior of the building. They must be equipped with a wall mounted cut off valve equipped with a position switch (open or closed position). The valves must be installed in a building façade made out of non-combustible material, in order to ensure the operator is protected from thermal radiation.

Specific stations for areas at risk (flammable liquid storage areas, aerosol storage areas, etc.) must, in addition, be installed on the exterior of these areas.

The valve rooms must be connected to a cut off valve located on the branch connection of the buried system. The valve must be located at a distance of 10 to 12 metres from the building and be equipped with a position switch (open or closed).

Each valve room must be:

- equipped with a hydraulically-operated mechanical sprinkler alarm, located on the exterior façade. In the event of water flow an alarm is sent to the alarm control unit.
- equipped with a DN 50 test pipe with recycling of water in accordance with RIS 17.
- equipped with a cut off valve downstream of the station, enabling interventions on the station without having to completely drain the sprinkler system.

8.3.5 – Sprinkler Network

The sprinkler systems must be supplied, from the valve rooms, by collectors and range pipes.

The collectors are interconnected by “Victaulic” type flexible joints.

The collectors (diameter, in general, greater than 50 mm) must be supported by FM or UL approved supports, with at least two supports between two “Victaulic” joints.

The range pipes must be screwed onto and suspended from a support for each pipe element.

The supports must be of sufficient dimension to support 5 times the weight of the pipe filled with water, increased by 115 kg (safety coefficient).

The effects of any water hammering phenomena likely to occur must be taken into account when calculating and sizing the supports.

The installer must provide an attestation or a load calculation to demonstrate that the fastenings on the building structure can support this weight.

The distance between the supports is:

- 3.60 metres for pipes less than 40 mm (1 1/4").
- 4.60 metres at the most for pipes greater than or equal to 40 mm (1 1/2").
- The collectors are equipped with "fixed points" around every 30 metres.

The pipes must be protected by a rust proofing paint (preferably red) and labelled.

Each sprinkler system must be equipped with a test pipe, installed at the most unfavourable hydraulic point.

The test pipe must be equipped:

- With a "quarter turn" valve
- With an output calibrated and sized for the flow rate of a single sprinkler. This test output must be labelled and plugged with a cap secured by a small chain.

In the case of a seismic risk, the installations must be sized accordingly and provided with restricting elements to limit any movement of the pipes.

8.3.6 – Alarm Transfer Control Unit

The alarm control unit is installed in the security control room in a place where there is a permanent human presence. If there is no security control room, the alarms must be transmitted to a remote monitoring service.

The control unit must be equipped with the following alarms:

- Low water level
- Low water temperature
- Low source room temperature
- Source room fire alarm
- Motor pump unit in manual or stop position
- Battery charging failure
- Start-up failure
- Technical motor pump unit failure (oil temperature, excessive speed, etc., low fuel level, motor pump unit overheating)
- Source room intrusion alarm
- Station water flow alarm (fire alarm)
- "Closed" position of the cut off valves
- "Closed" position of the station valves
- Start-up of the motor pump unit

The autonomy of the control unit, in the event of failure of the power supply, must be 72 hours.
The control unit must comply with NFPA Rule 13 or be FM approved.

8.4 – FOAM SYSTEM

- Installations employing foam (doped systems, low, medium and high foam expansion installations) may only be approved and accepted after a “full scale test” has been carried out according to the design specifications of the installation. These tests must be renewed at least every 3 years, as part of the performance checks carried out on the installations.
- The leak tightness of the installations must be checked by a hydrostatic pressure test at 14 bars for 2 hours.
- The foam installations must, preferably, have their own foam concentrate and metering and storage system.

If this is shared with a doped sprinkler system, it must be ensured that under the minimum or least favourable flow rate conditions, the concentrations and the application rates are guaranteed.

For each installation, an “emulsifier concentration as a function of water flow” curve must be traced under the most unfavourable hydraulic conditions (minimum and maximum flow rate of the installation). This curve must be established every year during maintenance work.

- The foam concentrate metering systems that supply the doped sprinkler systems must ensure a correct concentration of emulsifier based on a minimum flow rate equivalent to 4 sprinkler heads in operation in accordance with NFPA Rule 30 § 6-8-2-8.
- The foam concentrates employed must be approved in accordance with recognised normative frames of reference. They must be analysed periodically in accordance with the manufacturer's instructions.

The brand names, references and dates of manufacture and ‘use by’ must be clearly displayed in the storage areas.

Dosing systems like ‘bladder tank’ are forbidden due to risk of leakage of the membranes.

FireDos© systems are much more reliable and can deliver more foam if needed.

The foam concentrate used must be of the synthetic, multi-foaming and polyvalent type (adapted to flammable liquids soluble in water).

Type AFFF / AR: 3 %* - 6 %**
or AFFF / AR: 3 % *- 3 %**.

AFFF: Aqueous film forming foam - AR: Alcohol Resistant

* (concentration in volume of use on flammable liquids not soluble in water)

** (concentration in volume of use on flammable liquids soluble in water)

The concentration of use is ideally 3 %.

The foam concentrate must be biodegradable and non bio-accumulative.

Identification of emulsifiers

AFFF / AR : 3 % - 6%

Aqueous film
forming foam

Alcohol Resistant
May be used on fires of
liquids soluble in water

Concentration of use on
fires of flammable
liquids soluble in water

Concentration of use on
fires of flammable liquids
not soluble in water

■ WE ENSURE SAFETY – IN FIREFIGHTING WITH FOAM.

More than 20 years ago, FireDos developed a proportioner for fire extinguishing systems, setting a global standard:

The purely mechanical system is characterized by a constant proportioning rate across a wide

extinguishing water flow rate and pressure range, guaranteeing maximum reliability. Beyond this, testing the proportioning rate can be done without producing premix: an environmentally friendly and cost-saving solution.

■ THE FIREDOS PRODUCT CONCEPT: PURELY MECHANICAL, AT A CONSTANT PROPORTIONING RATE.

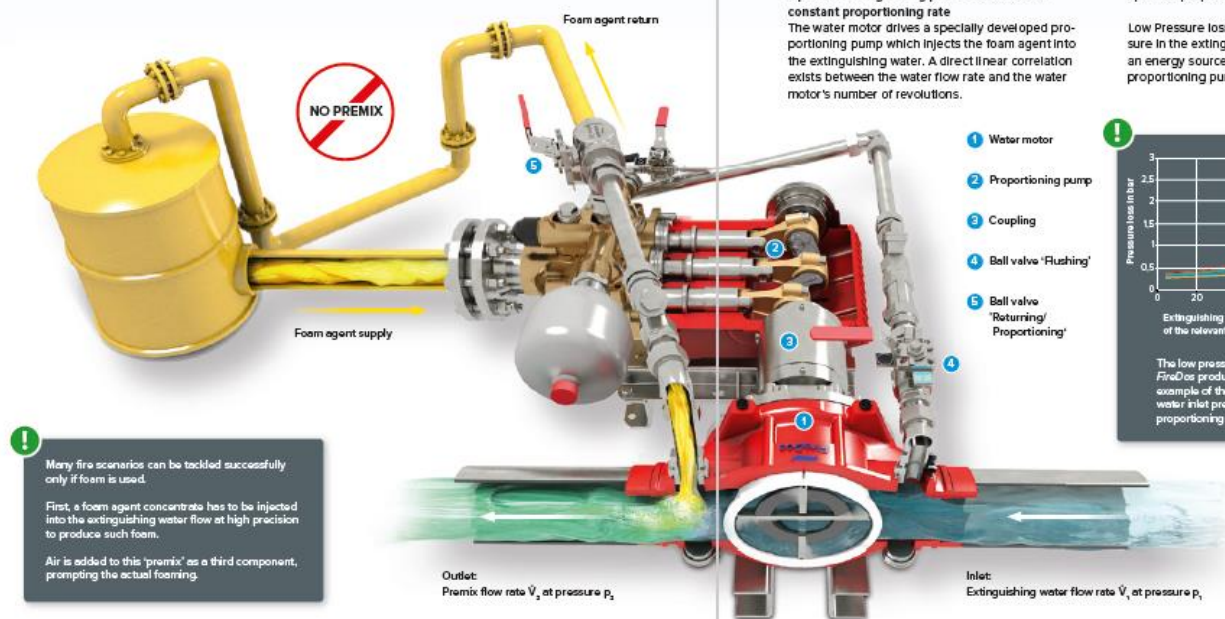
Reliable and made-to-last
The FireDos proportioner is driven solely by the extinguishing water flow. No further energy source is required. The purely mechanical construction means FireDos proportioners are reliable and provide a long service life.

Optimum extinguishing performance due to constant proportioning rate
The water motor drives a specially developed proportioning pump which injects the foam agent into the extinguishing water. A direct linear correlation exists between the water flow rate and the water motor's number of revolutions.

The proportioning pump is directly connected to the water motor via a coupling.

As extinguishing water flows increase through the water motor, the more foam agent is injected. This way, the volume ratio which is referred to as the 'proportioning rate' always stays constant, allowing optimum proportioning as water flow rates change.

Low Pressure loss: Only a small portion of the pressure in the extinguishing water line is consumed as an energy source to drive the water motor and the proportioning pump.



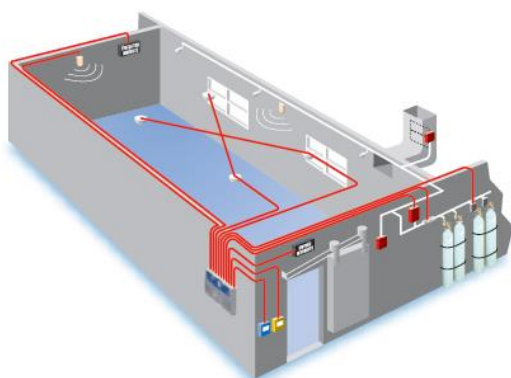
8.5 – GAS SYSTEM

The use of sprinklers in computer rooms or electrical rooms is not ideal with regards to damage to electrical equipment.

The best option is to have a back-up room and smoke detectors.

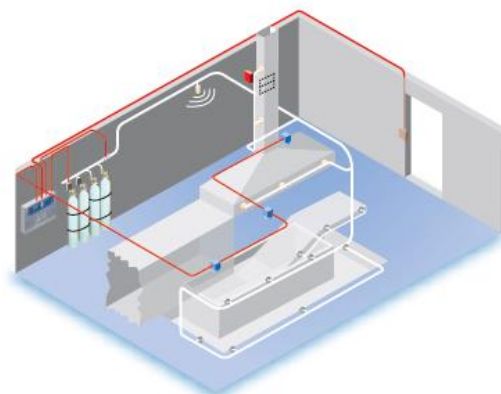
Specific case: If requested by the DIT (IT and Technology Department), a gas extinguishing system could be installed, in addition to the sprinkler system, in accordance with the following requirements:

- Implementation of a recognised frame of reference (NFPA, APSAD, etc.).
- The installations must be subject to an acceptance procedure under real operating conditions.
- Use of 'no risk' gas such as Inergen, Argo 55 and Novec 1230.
- CO₂, FM200 or halogenic gas is forbidden.
- Servicing must be ensured regularly and the performance evaluated at least once a year (leak tightness tests of the rooms).
- Personnel involved in maintenance or equipment installation must be given specific training on the risks of damaging the leak tightness of the rooms (routing or passing of cables through walls, etc.).
- Persons who intervene in areas protected by gas protection installations must be given specific training on the risks linked to the use of gas extinguishers and in particular:
 - Risks of asphyxia (by CO₂ amongst others)
 - Evacuation of the premises



Noyage total

Gas in the full room



Gas only in the panels

9 – ROUTINES and VERIFICATIONS

9.1 HOT WORK PERMIT

The establishment of **a one-day** fire permit applies to all types of projects or interventions, whether civil engineering works, building works, process utilities, installation of production equipment, etc., for which work with hot spots is necessary.

The best solution is always to avoid such work or to carry it out as far away from a building as possible.

Hot work is a task that can generate sparks or heat up materials: cutting with a flashlight, grinding, welding, brazing and any operation that generates an open flame.

Hot work on installations where there is a risk of explosion, such as tanks containing flammable materials, must be subject to specific additional prevention and monitoring measures => do local risk assessment.

- Hot work procedure:

Hot work must be managed by a procedure describing on what basis a fire permit is to be issued, this is then posted on the building site and communicated to all personnel

The ETNEHS manager is responsible for managing the work and must sign the fire permit. He can delegate the signing to a trained person with knowledge of the fire permit procedure.

A list of trained people will be archived and reviewed annually.

The people involved in the fire permits are:

Ordering party

This is the ETNEHS manager, or the project manager in the case of a large project, or a competent and trained person designated by them. A person may not issue a fire permit for themselves. This may require two people, authorized to issue fire permits, to be present on site.

Person in charge of the work

This is the person in charge of carrying out hot work. The person in charge of the work cannot operate without a formal fire permit issued by the client.

Supervisor

This is the person who, according to the regulation, defined by the fire permit, ensures the surveillance of the intervention zone, or any other zone potentially impacted following the start of work during a given period.

- Hot work assessment

The ordering party takes the information relative to the intervention zone:

- Name of the participants
- Presence of flammable products,
- ATEX zone
- Nature of adjacent installations or premises, etc.
- The co-activity of the site must be taken into account.
- Verification of the equipment used.
- Visit of the worksite and posting of the work permit on the worksite.

Consideration of the safety requirements of the work area:

- Consignment, emptying of tanks, degassing, inerting,
- Atmosphere control, ventilation,
- Additional watering
- Sealing of openings and gaps
- Installation of extinguishing and alarm means appropriate to the work in progress. At least 1 9L water fire extinguisher in place

Cleaning of the work area:

- Marking of the area
- Removal of flammable materials and products (cardboard, rags, wood, plastics, etc.)
- Elimination of waste,
- Setting up of protection for combustible or flammable elements remaining in the work area: Setting up of fireproof tarpaulins,
- Ventilation of the room if work is carried out using hot spots in the maintenance workshop.

		HOT WORK PERMIT for 1 day Maximum					
Permit Validator/Ordering Party:		Permit Issuer:					
Field of application: ☐ Q ☐ S ☐ H ☐ E ☐ P							
Upstream Impact:							
Downstream Impact:							
DESCRIPTION OF HOT WORK							
Workday: / / 20		Work location:					
Type of work:				Company Name:			
TOOLS AND EQUIPMENT USED							
☐ Drill		☐ Disc machine		☐ TIG welding station		☐ Oxyacetylene flashlight	
☐ Circular saw		☐ Arc welder		☐ Welding lamp		☐ Butane/propane flashlight	
☐ Grinder		☐ MIG-MAG welding station		☐ Soldering iron		☐ Other:	
HAZARDS IDENTIFIED IN THE WORK ENVIRONMENT							
☐ Flammable materials		☐ Dust		☐ ATEX zone			
☐ Combustible materials, specify:		☐ Electrical installation in proximity		☐ Absence of combustible and flammable elements			
☐ Gases		☐ Opening, crack, gap		☐ Clean, non-combustible floor (concrete...)			
				☐ Hazards in adjacent premises, specify:			
POSSIBLE PROPAGATION MODES							
☐ Convection		☐ Projections		☐ Conduction		☐ Radiation	
						☐ Naked Flame	
PREVENTION MEASURES							
☐ 		☐ 		☐ 		☐ 	
☐ 		☐ 		☐ 		☐ 	
☐ 							
1. BEFORE WORK				2. DURING WORK			
☐ Move combustible substances away to at least 10 meters				☐ Monitor the points of fall of dangerous incandescent projections up to ten meters away			
☐ Implement: ☐ 1 fireproof tarp ☐ 1 protective curtain				☐ Place heated objects on heat-safe surfaces.			
☐ Drain - ☐ Clean - ☐ Remove Dust the work area				☐ Presence of a permanent supervisor is mandatory			
☐ Lock Out- Tag Out (energy source, product flow...)							
☐ Degasification (pipes, tanks, cisterns...)				3. AFTER WORK			
☐ Remove Yellow visibility vests				☐ Restart the detection / extinction system			
☐ Ensure filling / inerting (water, nitrogen...)				☐ Inspect the work area, adjoining areas and surroundings that may be affected by sparks or heat transfer			
☐ Isolate piping / Clear the path of the piping				☐ Close Lock Out- Tag Out (energy source, product flow...)			
☐ Seal openings, gaps, cracks				☐ Clean the work area			
☐ Isolate detection / extinguishing system							
☐ Lock Out – Tag Out of the existing ATEX zone following the safety measures taken, detail them:				☐ Notify the safety guard house of the END of hot work.			
☐ Mark out the area of intervention				COMMENTS:			
☐ Check that the tools and equipment are in perfect condition (hoses, oxyacetylene station, protective casing, disc ...)							
☐ Have within immediate reach the means of alert: mobile / DECT / red phone							
☐ Have within immediate reach extinguishing means: ☐ 1 fire extinguisher 6L minimum + ☐ sprinkler + ☐ RIA							
☐ Notify the safety guard house of the start of hot work.							
AUTHORIZATIONS TO START WORK							
	Name	Signature	Phone Number	Time	Comments		
Ordering Party or Area Manager/Supervisor							
Person in charge of the work							
EHS							
Time End of hotwork		H					
Firewatch		30'	1h	2h			
Security guard or Supervisor	Name						
	Signature						
	Time						
IN CASE OF EMERGENCY, CALL : 50 18 / 01 48 79 50 18							

- Hot work permit and controls

The issuing of a fire permit is mandatory on any construction site for any work with hot spots. It is established and signed by the ordering parties.

Its validity is indicated on the document and is limited to the duration of the work and cannot exceed one day. It must be re-evaluated as soon as one of its components has changed:

- Location of the intervention
- Work environment
- Work process
- Nature of the work
- Personnel (when there is a change of post)

Depending on the location and the nature of the hot work, a surveillance may be set up during the execution of the work. If this is the case, this point must be formally specified when drawing up the fire permit, indicating the name of the person in charge of supervision.

A firewatch must be done:

- 30 minutes continuously from the end of the work.
- A thermal camera scan of the area is a good practice to avoid any hot spots.
- Regular visits for the following two hours. Most disasters are due to smoldering fires that can restart more than 2 hours after the end of the work.
- The work must therefore be planned in such a way that this monitoring can be carried out, even if the work site is stopped due to working hours.
- The monitoring phases will be included and recorded in the fire permit.

For information below, FM Global have more requirements for firewatch control:

	Non-Combustible buildings (M0, rockwool, steel)		Combustible buildings (wood, polyurethane panels, plastic)		Complex buildings (false ceilings, limited space, . . .)	
	Continuous control	Additional Firewatch	Continuous control	Additional Firewatch	Continuous control	Additional Firewatch
No-risk activities	30'	0	1h	3h	1h	5h
Offices	1h	1h	1h	3h	1h	5h
Production areas	1h	2h	1h	3h	1h	5h
Warehouse & Storage areas	1h	2h	1h	3h	1h	5h
High-risk activities (process areas)	1h	3h	1h	3h	1h	5h



9.2 FIRE PROTECTION IMPAIRMENT

Notice must be given below for each halt of the fire protection system such as sprinkler protection.

The insurer must be notified of the shutdown and restart.

Additional preventative measures will be put in place during this period.

L'ORÉAL®



Fire Protection System Impairment Notification & Restoration Form

From:

Send To:

Name:		• Allianz Risk Consulting
Company:		E-mail: impairments@allianz.com
Local Name:		• Frédéric BAZIN
Street Address:		frederic.bazin@loreal.com
City, State/Region:		• Corinne PROVOT
Postal Code:		corinne.provot@loreal.com
Country:		• and your Zone/Division EHS
Telephone:		Director
E-mail:		

Please complete Part A for initial impairment notification and Part B after restoration.

Part A – Impairment Notification

Notification should be submitted only for impairments exceeding 10 continuous hours. Notify at least 48 hours prior to a planned impairment and as soon as possible for an emergency (unplanned) impairment.

Impairment Type:	Planned ☐ Emergency ☐
System(s) / Equipment Impaired:	
Area(s) Affected:	
Reason for Impairment:	
Impairment Date (dd/mm/yy) & Time:	
Anticipated Restoration Date (dd/mm/yy) & Time:	

Precautions Taken: (answer all applicable questions)	Yes	No
1. Have managers, supervisors, security & other relevant staff been notified of impairment, increased fire risk, and necessary precautions?	☐	☐
2. Have all hazardous operations, including hot work, flammable liquid use, etc., been prohibited in the area?	☐	☐
3. Has smoking been prohibited in the area?	☐	☐
4. Has temporary fire protection (i.e. fire extinguishers, hoses, etc.) been provided? (comment below)	☐	☐
5. Is affected area continuously occupied or has a continuous fire watch been provided?	☐	☐
6. Has the fire brigade / department been notified?	☐	☐
7. Has the alarm monitoring company been notified?	☐	☐
8. Will work be continuous until protection is restored?	☐	☐
Comments:		

Part B – Impairment Restoration

Restoration Date (dd/mm/yy) & Time:	
Comments:	

30-Jan-2013 English (UK)

9.3 FIRE ROUTINES

Preventive actions and routines are essential for the good maintenance of the fire protection of sites.

The 2 lists below give the essential elements to be taken into account during the design and operation

Building recommendations	Yes/No
Use of non-combustible materials (M0) or FM Global approved for buildings.	
Use of non-combustible roof skylights and avoid light strips.	
Avoid lights above storage at risk that could create a fire (preferably use LED lights)	
Fire Exit routes must be secured and fireproofed to make sure that personnel can exit safely	
All buildings are equipped with an evacuation alarm system, audible, visible (Different from the sound of any other alarms in the facility).	
Implementation of extinguishers, also in Powered Industrial Trucks	
Implementation of a water tank and an approved FM Global pump.	
Sprinkler protection for 100 % of the areas at risk: - Buildings if they are combustible. - Stocks: raw materials, finished products, flammables, aerosols, pallets, oil,	
To avoid sprinkling flammable or combustible areas, they must be located a minimum of 30 meters away from buildings. Example: idle pallets + flammable liquids, . . .	
Fill all holes in walls: rockwool + plaster board can be used. Eg, for electric cables.	
Isolate the aerosol room in a bunker / Isolate the flammable liquids room in a fireproof room with remote drainage & containment.	
Create independent rooms /buildings to reduce risk (blocks methodology) The communication between each separate area is possible with fire doors.	
Collect all the safety data sheets about the products (raw materials and finished goods). Flash points/fire points /type of containers/volumes are important to calculate an effective sprinkler protection.	
The structure of the roof has to be strong enough to support a sprinkler network and to withstand snow, rain, tornadoes, . . .	
Plant to be built above the flood zone, consult an elevation map of the site.	
Carry out an explosive atmosphere study (EX), in order to make the buildings and materials appropriate. Eg for powder use/storage	
Implement a seismic cut off valve for gas if in an earthquake area.	
Have efficient drainage on the roof to evacuate water. The roof should be cleaned monthly.	
Have an access road to the plant at all times, which is reliable in all weathers.	
Dry transformers are preferable to oil transformers. Implement two independent main electricity sources to secure the supply.	
Implementation of smoke and heat detectors in the uncontrolled areas.	
Boilers: it is preferable to use gas than fuel. If choosing fuel, the boiler room must be protected by sprinklers.	
Computer rooms must be protected and data copies must be made.	
Ventilation has to be controlled and stopped if a fire is detected. This avoids the risk of spreading and smoke penetrating the entire factory.	
Loading areas for forklifts and electrical cupboards will be located away from stock and combustibles materials.	

Fire Management recommendations	Yes/No
Lock all the sprinkler/fire valves in the open position.	
Use a valve checklist and do routine checks each week	
Run the sprinkler pump for 30 minutes minimum each week and register the test. Also check the jockey pump => network leak detection.	
Open and close the fire doors each month. Register the results.	
Use and knowledge of hot work permit. You must have continuous control 30' after the work is completed and make regular checks, spaced over the following two hours	
Have in place an intervention team with an updated list of trained people and all the tasks required to control and fight fire. Practise a drill once a year.	
Training each year in the use of extinguishers, knowledge of allocated tasks, . . . At least 50% of the total number of employees on site must be trained.	
Organise a factory visit with the fire department, explain all the areas and the main risks, combustible materials, etc. . .	
Include Corporate or the EHS Zone Director in all new projects.	
Write a business continuity plan based on all the scenarios of the GHAP or in the insurers report.	
Layouts and drafts, especially for electrical parts, sprinklers and fire equipment, have to be updated.	
Assess the risks with an ATEX study + housekeeping, avoid static electricity, bonding and grounding of equipment.	
Preventive Maintenance: - Infrared thermography once a year - Control electrical circuit breakers - Oil analysis for transformers. - Maintenance for boiler and safety tests. - Vibratory analysis.	
Do mandatory controls (book and schedule visits): - Electrical equipment, cupboards, automatic doors. - High pressure devices - Lifting devices, forklifts, elevators, ladders... - Boilers, compressors, generators, . . . - Sprinkler equipment, extinguishers, smoke detection, alarms, . . .	
Knowledge of the « Impairment » procedure (See above)	
Loss prevention tour each month (housekeeping, storage areas, extinguisher-access, exit door access, fire equipment in place, fire hoses, . . .)	
Use safety bottles etc in the manufacturing area for flammable liquids (steel bottles are preferable to plastic bottles, safety cabinets, . . .). IBCs for flammable liquids are forbidden.	
Basements and roof spaces are to be avoided. Clean regularly and avoid inaccessible areas in which dirt/dust can accumulate (framework elements, corners, gutters, trenches ...). Avoid rounded nooks, grooved baseboards, for example.	
The charging of battery-operated scooters or hoverboards is forbidden inside offices.	

9.4 FIREFIGHTING EQUIPMENT MAINTENANCE

Testing, maintenance and verification operations are carried out according to the recommendations of the installers and suppliers of the various materials.

Independent of these recommendations, the fire protection installations are monitored and maintained according to the tables given below.

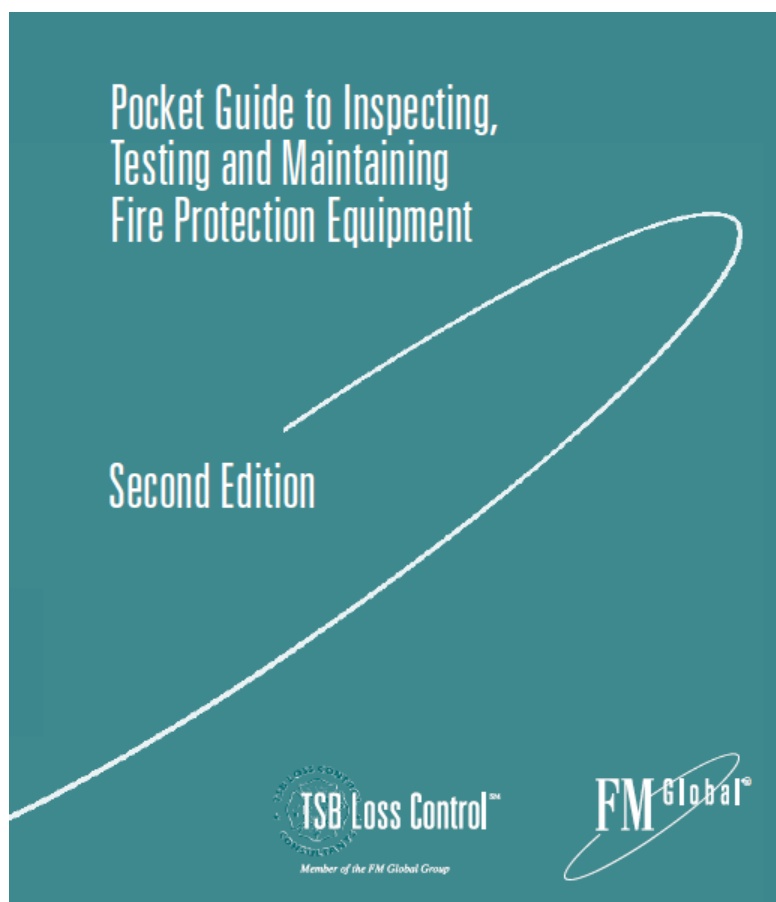
Circuits and sprinkler systems are subject to risks of corrosion and silting up, the consequences of which are the installations being disabled.

Regular checks and maintenance of the systems enable any degradation to be anticipated. In certain cases, destructive checks are carried out on the pipes in order to evaluate the extent of corrosion (every 30 years). In order to facilitate this operation and avoid the system being disabled, removable and replaceable liners can be used, enabling metallographic analyses to be carried out. These are carried out using the same materials as the sprinkler system components.

The frequency of the controls depends on the physical and chemical characteristics of the water used in the system and the materials employed. A control at least every 5 years is desirable.

This useful pocket guide can be downloaded

<https://www.fmglobal.com/~media/shamrock/p0418.pdf>



The controls highlighted in Yellow are mandatory.

	Control	Frequency	Who does the control
Extinguishers	Visual Control (<i>presence, condition, label</i>)	Quarterly	Qualified people
	Functional check	Yearly	Installer or qualified organization
Fire Hoses	Visual Control	Monthly	Competent person
	Fuller check and test	Yearly	Installer or qualified organization
	Full Verification (<i>verification, functional test, dismantling</i>)	Every 5 years	Installer or qualified organization
Smoke detectors	Visual Control (<i>Sensors, wiring, battery</i>)	Monthly	Qualified people
	Detector Test with alarm	Twice a Year	Installer or qualified organization
Gas Suppression System	Visual Control (<i>system indication and fault signals</i>)	Daily	Qualified people
	Verification (<i>quantity of gas, integrity of the room, closing of the doors, ...</i>)	Monthly	Qualified people
	Full Control by supplier	Yearly	Installer or qualified organization
Sprinklers	Pump start min 30' /week	Weekly	Competent person
	Full Control by supplier	Twice a Year	Installer or qualified organization
	Batteries	Yearly	Designated person
	Carry out sprinkler pump curve to assess pump performance	Yearly	Installer or qualified organization
	Water Tank integrity (remove water or use qualified divers)	Every 5 years	Installer or qualified organization
	Thickness control, rust test and replace pipes if needed	Every 30 years	Installer or qualified organization
Safety Glass Breaker	Visual Control	Monthly	
	Control by supplier	Yearly	
Safety Lighting	Beaconing light signals	Twice a Year	Competent person
	Test battery	Yearly	Designated person
Smoke Vents	Control	Yearly	Competent person
	Test open & close	Monthly	Competent person
Fire Doors	Visual Control and test	Quarterly	Competent person
	Control by supplier	Yearly	Installer or qualified organization

10 – TECHNICAL SPECIFICATIONS FOR THE FIRE PROTECTION

The areas to be protected are:

- Office areas (including laboratories and canteens)
- Boutiques, laboratories, showroom
- Technical equipment and service rooms
- Storage areas for finished goods and raw materials (Plastic, aerosols, flammable liquids, oxidisers).
- Manufacturing areas
- Filling and packing areas
- False ceilings and raised floors
- Canopies, waste water treatment & discharging areas
- Exterior storage of flammable liquids in vessels

In all cases, an analysis of the regulatory texts must be carried out as several rooms may be subject to regulatory requirements (for example: boiler room, transformer, storage, etc.).

The major risk is in the protection of flammable liquids and several important points must be remembered (Chapter E):

Any plastic/glass container of flammable liquid > 230 litres cannot be protected by an effective sprinkler system. It is important to compartmentalize the risk with a retention.

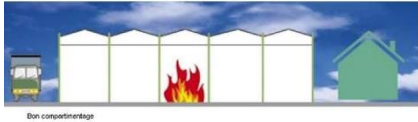
Specific case of HID “High Intensity Discharge” lighting bulbs are commonly used for lighting at industrial sites (factories and storage facilities) and for roadways.

This term (HID) covers 3 types of bulb:

- metal halide bulb
- mercury vapour bulb
- high pressure sodium vapour bulb

For these HID bulbs, the risk of the glass bulb shattering exists for a variety of reasons (age in particular), with projections of extremely hot glass particles and metal that could reach combustible products and set them on fire. Metal halide bulbs and mercury vapour bulbs have the highest risk of shattering. To prevent this type of risk, the presence of HID lighting used at the site must be identified and indicated on a map.

In addition, the lamps concerned must be “closed”, meaning that if the bulb explodes the shattered pieces are contained in a glass casing or grill. If the lamps are “open” the bulbs used must have a Teflon coating to prevent fragmentation of the bulb and the projection of debris.



Protection Overview per activity

Offices & False ceilings
§ A – page 60

Technical Rooms &
Labs
§ B – page 61

Class IV storage for
raw materials (MP/AC)
and finished products
§ C – page 63

Materials (MP/AC/PF)
Plastic Group A storage
§ D – page 66

Raw Materials /
Flammable &
Combustible products
§ E – Page 73

Docks and shipping
areas
§ F – Page 79

Canopies – pallet
storage - Wastes
§ G – Page 84

Weighting and process
areas
§ H – Page 89



Filling & Packing lines
§ I – Page 93

Flammable finished
products
§ J – Page 94

Aerosols
§ K – Page 99

External flammable
storage in tanks &
disposal
§ L – Page 101



Oxidizer storage
§ M – Page 107

Drainage
Chapter 7 – Page 30

Automated Storage /
Battery
§ N – Page 110



A – OFFICES & FALSE CEILINGS

Design Requirements:

This concerns hidden spaces, such as attics and false ceilings.

The use of flexible hoses is acceptable providing the pressure loss of the materials is taken into account in the calculation notes and that the fixing and bending radius are respected according to the manufacturer's instructions.

Charging of electric scooters, hoverboards or any other electrical equipment with a battery is forbidden inside offices as the sprinkler protection system is unable to manage this type of fire.

Risk Classification: Light Hazard LH (Admin sites) and OH 1 (industrials sites)

Attics correspond to this classification, except if they are completely free of combustible materials or if the combustible load is less than 10 kJ / m² (approximately 15 electrical cables maximum).

Some false ceilings, considered as technical galleries with cable passages, should be treated as technical rooms.

Sprinkler Protection: Ceiling protection CMDA (12 m²/ spk) and CMDA Extended Coverage allowed (up to 37 m² / spk) with no obstruction.

CMDA Mode	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Admin Offices		CMDA: LH 4,1 l/min/m ² @ 140 m ²	No	NFPA 13 - V. 2019 : figure 19.3.3.1.1
False Ceilings in Admin Sites				
False Ceilings in Industrial Sites		CMDA: OH 1 6,1 l/min/m ² @ 140 m ²		

Vigilance must be taken regarding significant obstructions, particularly in the false ceilings.

B – TECHNICAL ROOMS & LABORATORIES

These premises include the following:

- Battery charging rooms
- Electrical rooms (Electrical panels, transformer room, etc... according to local regulations)
- Laboratories
- Air and water treatment rooms
- Compressed air production rooms
- Boiler room
- Maintenance rooms.
- Computer rooms: sprinkling of the premises and rigorous management of computer backups. The best option is partitioning, fire detection and data backup. Where another protection is envisaged (automatic extinguishing system by inert gas for example), a risk analysis will be carried out beforehand to ensure that people will not be exposed to the risk of anoxia

Design Requirements:

- All the technical rooms must have at least a fire detection system and in a compartmentalized 2-hour fireproof cell.
- A vulnerability study of the electrical cabinets is a good practice in order to prioritize the protection of strategic cabinets.
- Dry transformers are preferable.
- All oil transformers will be equipped with DGPT2 type safety devices. Each transformer will be in a compartmentalized, properly ventilated, 2-hour fireproof cell. The oil transformers must be contained. The sprinkler protection of the transformers must be studied on a case-by-case basis.
- The main electrical panel must be separated from the transformers in a dedicated fireproof compartmentalized cell.
- The capacitor banks must be insulated.
- Electrical cable passages must be caulked with non-combustible FM approved materials (or plaster and rock wool).
- Any sprinkler system located in an electrical room must be equipped with a device ensuring the safety of people (isolation valve and draining system or pre-action system).
- For gas boiler rooms, when the sprinkler system is switched on, the gas supply to the boiler room is cut off.
- No combustible core sandwich panels are permitted for equipment rooms.
- The laboratories will have 90-minute fireproof cabinets with retention, meeting the NF EN 14470-1 standard for the storage of any flammable and combustible liquid in limited quantities.



Risk Classification: Ordinary Hazard OH 2

Sprinkler Protection: Ceiling sprinkler CMDA: OH 2

CMDA Mode	Limits	Ceiling protection	In rack Protection IRAS	NFPA Standard reference
Technical rooms		CMDA: OH 2 8,2 l/min/m ² @ 140 m ²	No	NFPA 13 - V. 2019: figure 19.3.3.1.1
Laboratories				
Electrical cable trays		CMDA: EH1 12,2 l/min/m ² @ 232 m ² Or Deluge: 6,1 l/min/m ² for the protected area or in worst case 30 meters.	No	NFPA 13 - V.2019: 26.27.1.3 NFPA15 – V. 2017 – 7.2.2.1

NOTE: if the local authorities refuse to sprinkle the electrical rooms, a fire detection system must be installed in a compartmentalized 2-hour fireproof room.

C – STORAGE CLASS IV PRODUCTS IN RACKS

The sprinkler protection below applies to Class IV materials such as packaging materials (AC) or noncombustible / flammable raw materials (MP) or noncombustible / flammable finished goods (PF).

Risk Classification: Class IV

Two Classifications below are considered:

- Class IV packaged with plastic film
- Class IV packaged with no film

They correspond to a greater or lesser difficulty presented by these goods during a fire. Filmed packages require a more consistent sprinkler protection in terms of water density (25%).

The extinguishing water has an effective wetting power for firefighting on boxed goods unlike filmed packages where the extinguishing water will tend to run off rather than control the fire.

Global requirements:

Regardless of the quantities stored, the fire protection of these storage racks is carried out according to one of the following options, depending on the location and/or operating constraints.

- Building height
- Storage height
- Clearance to ceiling
- 7.6 m is the height above which mechanical stops in chimneys are mandatory.
- Roof slope < 16.7% for ESFR mode
- Clearance from 1 to 3 meters
- Type of goods
- Type of packaging
- Width of aisles greater than or equal to 2.40 meters
- Open decking of racks at 50% or more.

Sprinkler Protection of racked storage of filmed Class IV packaged articles**Design Requirements:** Open decking to allow water through the racks**Risk Classification:** Filmed class IV goods**Sprinkler Protection:** Ceiling sprinkler + in rack protection IRAS

Mode ESFR :	Limits	Ceiling protection	In rack Protection IRAS	NFPA Standard ref
Class IV filmed or not	Building h: 7,6 m Storage h: 6,1 m	12 x Up/Pdt K200 @ 3,4 b Up/Pdt K240 @ 2,4 b	No	NFPA 13 - V. 2019 : table 23.5.1
	Building h: 9,1 m Storage h: 7,6 m	Pdt K 320 @ 1,7 b Pdt K360 @ 1 b		
	Building h: 12 m Storage h: 9,1 m	12 x Pdt K240 @ 3,6 b Pdt K 320 @ 2,8 b		
	Building h: 12 m Storage h: 11 m	Pdt K360 @ 1,7 b		
	Building h: 14 m Storage h: 12 m	12 x Pdt K320 @ 2,8 b Pdt K360 @ 2,8 b		
	Building h >12,2 m Storage h >7,60 m	Designed on the basis of 12 heads in K corresponding to the residual fictitious height above the IRAS level (at 9.20 or 12.2 m)	6 IRAS heads: 1 IRAS at 9.10 m or 12.2 m with K200 at 250 l/min (at 9.10m) OR With K320 at 455 l/min (at 12.2 m)	NFPA 13 - V. 2019 : 25.8.2 option 2

Pdt : Pendent / Up : Upright

Mode CMSA :	Limits	Ceiling protection	In rack Protection IRAS	NFPA Standard reference
Class IV Filmed or not	Building h: 7,6 m Storage h: 6,1 m	15 x Up K160 @ 3,4 b Up K 240 @ 1,5 b Pdt K280 @ 1,1 b	No	NFPA 13 - V. 2019 : table 22.4
	Building h: 9,1 m Storage h: 7,6 m	15 x Up K240 @ 1,5 b Pdt K 280 @ 1,1 b Pdt K360 @ 0,7 b		

Several solutions are suggested by table 25.2.3.2.1 for storage height up to 7.60 m with an IRAS network level.

Mode CMDA:	Limits	Ceiling protection	In rack Protection IRAS	NFPA Standard reference
Class IV filmed	Building h: 9,1 m Storage h: 7,6 m	15,9 l/min/m ² @ 185 m ² (head 141°) 18,5 l/min/m ² @ 185 m ² (head 68°C)	2 x 7 spk at 115 l/min with: 1 IRAS all levels	NFPA 13 - V. 2019: table 25.2.3.2.1 + figure 25.2.3.2.3.1 g)
Class IV filmed	Building h: unlimited Storage h > 7,6 m	15,1 l/min/m ² @ 185 m ² (head 68°) 18,3 l/min/m ² @ 185 m ² (head 141°C)	2 x 7 spk at 115 l/min: 1 IRAS every 3 rd level, 4th level and every 2 additional levels	NFPA 13 - V. 2019: table 25.2.3.3.1 + figure 25.9.2.2.2.1 h)
			2 x 7 spk at 115 l/min: 1 IRAS every 4th level and every 2 additional levels	NFPA 13 - V. 2019: table 25.2.3.3.1 + figure 25.9.2.2.2.1 i)
		17,9 l/min/m ² @ 185 m ² (head 68°C) 22,8 l/min/m ² @ 185 m ² (head 141°C)	2 x 7 spk at 115 l/min: 1 IRAS every 3rd level, 4th level and every 2 additional levels	NFPA 13 - V. 2019: table 25.2.3.3.1 + figure 25.9.2.2.2.1 h)
			2 x 7 spk at 115 l/min: 1 IRAS every 4th level and every 2 additional levels	NFPA 13 - V. 2019: table 25.2.3.3.1 + figure 25.9.2.2.2.1 i)
Class IV Not filmed	Building h: 9,8 m Storage h: 6,7 m	20,2 l/min/m ² @ 185 m ² (head 141°C) 23,2 l/min/m ² @ 185 m ² (head 68°C)	No	NFPA 13 - V. 2019: table 21.4.1.2 + figure 21.4.1.2.d)

The **CMDA mode is the most restrictive** and solutions with the addition of an intermediate in-rack sprinkler are given by the code, beyond 7.60 m of storage height. The sizing of the pump unit takes into account the combination of the under-roof protection and the IRAS protection.

D – STORAGE PLASTIC GROUP A MATERIALS (MP/AC/PF)

The following protection schemes are applicable to goods classified in Plastic Group A, concerning essentially Packaging Articles (CA) or Raw Materials (RM) or Finished Products (FP).

Risk Classification: Plastic Group A

The following classifications should be considered

- Exposed Unwrapped, not filmed = plastic containers in boxes
- Exposed Filmed = pallet with the above items and filmed
- Exposed (implied unboxed) = plastic containers without cardboard

There is a greater or lesser difficulty presented by these goods during a fire. The more the packages are "plasticized", the higher the sprinkler protection will need to be in terms of water density.

The extinguishing water has an effective wetting power for firefighting on insulated goods, unlike filmed or non-insulated packages with directly exposed plastic where the extinguishing water will tend to run off rather than control the fire.

General Conditions

Regardless of the quantities stored, the fire protection of these storage racks is carried out according to one of the following options, depending on the constraints of implementation and/or operation.

- Height of the building
- Storage height
- Clearance to ceiling
- 7.6 m is the height above which mechanical stops are mandatory
- Roof slope < 16.7% for ESFR mode
- Clearance from 1 to 3 meters
- Type of goods
- Type of packaging
- Aisle width greater than or equal to 2.40 meters
- 50% or more open decking.
- The sizing criteria of the sprinkler system to be used will be the greater of the values between the section relating to storage in racks and the section of storage in reception and shipping areas.

BOXED = in carton

CASE #1: Sprinkler Protection for in-rack storage of plastics, Group A, boxed**Design Requirements:** No solid barriers in rack**Risk Classification:** Group A Exposed Unwrapped, not filmed**Sprinkler Protection:** Ceiling Protection + in-rack IRAS

Mode ESFR	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A, boxed (no film)	Building h: 7,6 m Storage h: 6,1 m	12 x Up/Pdt K200 @ 3,4 Up/Pdt K240 @ 2,4 b	No	NFPA 13 - V. 2019: table 23.6.1
	Building h: 9,1 m Storage h: 7,6 m	Pdt K 320 @ 1,7 b Pdt K360 @ 1 b		
	Building h: 12 m Storage h: 9,1 m	12 x Pdt K240 @ 3,6 b		
	Building h: 12 m Storage h: 11 m	12 x Pdt K240 @ 3,6 b Pdt K360 @ 1,7 b		
	Building h: 14 m Storage h: 12 m	12 x Pdt K320 @ 2,7 b Pdt K360 @ 2,7 b		
	Building h: 15,2 m Storage h: 13,7 m	10 x Pdt K320 @ 4,5 b 10 x Pdt K360 @ 3,5 b 10 x Pdt K360 @ 5,2 b 10 x Pdt K400 @ 2,8 b 9 x Pdt K480 @ 3,8 b		FM DS 08-09 V-2020: table 17b
	Building h: 16,8 m Storage h: 15,2 m	9 x Pdt K400 @ 5,5 b 9 x Pdt K480 @ 3,8 b		
	Building h: > 12,2 m Storage h: > 7,60 m	Sized on the basis of 12 K-heads corresponding to the fictitious residual height above the IRAS level (at 9.20 or 12.2 m)	6 IRAS heads with 1 IRAS at 9.10 m or 12.2 m with K200 at 380 l/min (at 9.10 m) OR With K320 at 455 l/min (at 12.2 m)	NFPA 13 - V. 2019: 25.8.2 option 2

Pdt : Pendent Up : Upright



Mode CMSA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A boxed (no film)	Building h: 7,6 m Storage h: 6,1 m	15 x Up K160 @ 3,4 b Up K 240 @ 1,5 b Pdt K280 @ 1,1 b	No	NFPA 13 - V. 2019 : table 22.5
	Building h: 9,1 m Storage h: 7,6 m	15 x Up K240 @ 1,5 b Pdt K 280 @ 1,1 b Pdt K360 @ 0,7 b		
	Building h: 12 m Storage h: 11 m	15 x Pdt K360 @ 1,6 b		

Mode CMDA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A boxed (no film)	Building h: 8,2 m Storage h: 6,1 m	24,5 l/min/m ² @ 185 m ²	No	NFPA 13 - V. 2019 : table 21.5.1.1
	Building h: 9,1 m Storage h: 7,6 m	32,6 l/min/m ² @ 185 m ²		
Plastic Group A boxed (no film)	Building h: 7,6 m Storage h: 6,1 m	12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019 : figure 25.9.3.1 b)
		18,3 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels	NFPA 13 - V. 2019 : figure 25.9.3.1 b)
	Building h: 9,1 m Storage h: 6,1 m	12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 1st and 3rd level OR every 2nd and 3rd level OR every 3rd level	NFPA 13 - V. 2019 : figure 25.9.3.1 c) according to the spacing between spk IRAS
		18,3 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels	NFPA 13 - V. 2019 : figure 25.9.3.1 c)

Mode CMDA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A boxed (no film)	Building h: 9,1 m Storage h: 7,6 m	12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels	NFPA 13 - V. 2019 : figure 25.9.3.1 d)
	Building h: 9,1 m Storage h: 7,6 m	18,3 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019 : figure 25.9.3.1 d)
	Building h: 11 m Storage h: 7,6 m	12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels	NFPA 13 - V. 2019: figure 25.9.3.1 e) depending on the spacing between spk IRAS

Beyond 7.60 m, the only solution without a solid barrier in rack is the following:

MODE CMDA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A boxed (no film)	Building h: Unlimited Storage h >7,60 m	18,3 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels (3 m) with 1 head between loads in the longitudinal stack	NFPA 13 - V. 2019 : figure 25.9.4.2.1 c)

CASE #2: Sprinkler Protection for storage of exposed/filmed Group A materials**Design Requirements:** No solid barriers in rack**Risk Classification:** Plastic Group A Exposed or filmed**Sprinkler Protection:** Ceiling Protection + in-rack IRAS

Mode ESFR	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A exposed	Building h: 7,6 m Storage h: 6,1 m	12 x Pdt K200 @ 3,4 b	No	NFPA 13 - V. 2019 : table 23.6.1
	Building h: 9,1 m Storage h: 7,6 m	Pdt K240 @ 2,4 b		
	Building h: 11 m Storage h: 9,1 m	12 x K240 @ 3,6 b		
	Building h: 12 m Storage h: 11 m	K320 @ 3,4 b K360 @ 2,4 b		
	Building h > 12,2 m Storage h > 7,60 m	Sized on the basis of 12 K-heads corresponding to the fictitious residual height above the IRAS level (at 9.20 or 12.2 m)	Accumulation of 6 + 6 heads of the adjacent IRAS rack with : 1 IRAS at 9.10 m or 12.2 m with K320 at 455 l/min.	NFPA 13 - V. 2019 : 25.8.2 option 2

Mode CMSA	Limits	Ceiling protection	In rack Protection IRAS	NFPA Standard reference
Plastic Group A exposed	Building h: 7,6 m Storage h: 6,1 m	15 x Up K 160 @ 3,4 b Up K 240 @ 1,5 b	No	NFPA 13 - V. 2019: table 22.5
	Building h: 9,1 m Storage h: 7,6 m	15 x Up K240 @ 1,5 b		

Mode CMDA	Limits	Ceiling protection	In rack Protection IRAS	NFPA Standard reference
Plastic Group A exposed	Building h: 6,1 m Storage h: 3,1 m	32,6 l/min/m ² @ 230 m ²	No	NFPA 13 - V. 2019: table 21.5.3
Plastic Group A exposed	Building h: 7,6 m Storage h: 6,1 m	24,5 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019: figure 25.9.3.3 e)
		18,3 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019: figure 25.9.3.3 f)
	Building h: 9,1 m Storage h: 6,1 m	32,6 l/min/m ² @ 140 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019: figure 25.9.3.3 g)
		24,5 l/min/m ² @ 140 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019: figure 25.9.3.3 h)
		12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every level	NFPA 13 - V. 2019: figure 25.9.3.3 i)

The proposed solutions are the most flexible offered by the code without intermediate in-rack sprinklers. Other solutions are possible in CMSA and CMDA mode. The CMDA mode is the most restrictive and solutions with the addition of intermediate networks are given by the code, in particular beyond 7,60 m of storage height.

Several solutions are proposed by figures 25.9.3.3 a) up to 25.9.3.3 k).

Mode CMDA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A exposed	Building h: 11 m Storage h: 7,6 m	32,6 l/min/m ² @ 140 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 3 levels	NFPA 13 - V. 2019 : figure 25.9.3.3 j)
		12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels	NFPA 13 - V. 2019 : figure 25.9.3.3 k)
		12,2 l/min/m ² @ 185 m ²	2 x 7 spk at 115 l/min: 1 IRAS every 2 levels	NFPA 13 - V. 2019 : figure 25.9.3.1 e) depending on the spacing between spks IRAS

Note: NFPA 13 code has evolved significantly on the protection of group A plastics, exposed, for storage heights greater than 7.6 m, removing options that were previously possible in CMDA mode.

Chapter 25 of the NFPA 13 code offers many available options, including 3 so-called, alternative, options that are particularly useful in the case of retrofitting (with the installation of solid barriers).

E – STORAGE OF FLAMMABLE & COMBUSTIBLE LIQUIDS: FROM 0,05 L TO 10 TONS

Why it is so difficult to protect:

Because of its potential seriousness in the event of an involvement, the protection of flammable liquids and combustible liquids is a major challenge for the L'Oréal group.

Sprinkler protection systems are sized according to the goods to be protected, based on the density of water to be applied to a limited area (186 to 279 m²) called the involved area. If the fire spreads beyond this involved area, the sprinkler protection will fail.

However, this involved area would easily be exceeded if certain plastic containers (type IBC plastic of 1,000 litres), containing large quantities of flammable liquids were involved. This type of container cannot be protected by sprinklers (for Flash Points < 93°C, with a fire point).

The major objective is to limit the size of the spillage to prevent spread to other areas which, if happened, would definitely defeat the sprinkler system.

The L'Oréal group prohibits all storage of flammable liquids (Flash Point < 60°C) in plastic IBCs.

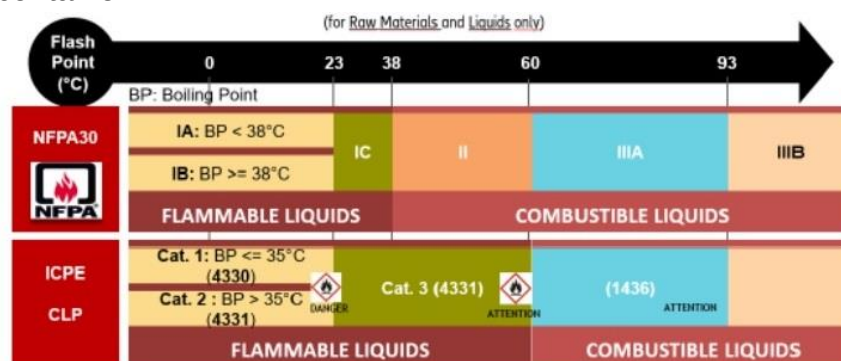
Metal containers are preferred as they are more easily protected. Plastic containers should, if possible, be limited to drum sizes of 230 litres or less.

4 key criteria to be considered:

It is imperative to be aware of the regulatory requirements of each country and to apply them whenever they are more restrictive than this document (e.g., regulatory storage height limits differing from those authorized by the NFPA or FM code).

To properly design and define the right protection, this information is key:

1. Flash Point => know the risk classification (see table below)
2. Fire Point => if no fire point, the liquid can be downgraded in terms of risk. UN Protocol L2 and iso2592 are able to define the fire point.
3. Type of container (metal, stainless steel, plastic, glass...)
4. Volume of the container



Building requirements:

These requirements apply when the total amount of flammable products stored, exceeds a few kilos but does not exceed 10 tons. In this case, the flammable liquid products can be stored in the volume of ordinary stock with the following restrictions:

- Partitioning: a special area is systematically and exclusively dedicated to flammable liquids. This area is efficiently ventilated (natural or forced ventilation).
- The "flammable liquids" zone is separated from the rest of the ordinary stock by a non-combustible screen (plasterboard or metal). The part of the rack adjacent to the partition wall is protected in the same way as the rack containing the flammable products (only concerns the installation of sprinkler systems)
- Specific fire rated cupboards can be used or FM approved 2h fireproof containers (e.g. DENIOS®) to isolate a small amount of drums. These cupboards/containers have their own containment.



- The whole area is contained. The retention can be made up of mobile, tilting or embedded devices in the ground. The surface area of the retention area is not greater than the surface area involved.
- The only solution is to isolate these plastic IBCs in an independent bunker and to supply them one by one in FM approved retention systems (eg. MINIMAX® or VIKING®).
- Schutz provides some FM approved IBCs but they are not validated by L'Oréal as they are still plastic containers.
- Material filling is prohibited.



Specific case: Storage above 10 tons:

Flammable liquids are stored in a special room dedicated to flammable liquids. This room is ventilated and specifically set aside for retention:

- Interior insulated room with walls (walls and roof) fireproof for 2 hours, protected by a fire protection installation according to options 1 or 2 above and preferably coupled with an external containment. The room has a smoke outlet to the outside.
- Isolated room outside but separated by less than 30 meters from the rest of the buildings, protected by a fire protection system according to options 1 or 2 above and by a wall with a 2-hour fire rating. The room is in retention.
- Isolated outdoor room separated by more than 30 meters from the rest of the buildings and without a fixed fire protection system. The room is in retention.

Protection requirements:

Regardless of the quantities stored, the fire protection of these storage racks is carried out according to one of the following options, depending on the constraints of implementation and/or operation.

- Height of the building
- Height of storage
- Type and volume of containers
- Type of flammable and combustible liquid class according to NFPA or FM definition
- Aisle width greater than 2.40 meters
- Depending on the country, storage height limits are regulated.

In order to limit the spread of fire by the uncontrolled flow of an ignited slick of flammable liquid, a remote drainage system, allowing the slick to be evacuated to a dedicated external tank will be implemented as soon as the liquids have a flash point of < 93°C and a unit volume of > 38 litres (see chapter on Retention)

In the case of storage in an existing building without the possibility of integrating a drainage system, the slick will be retained in the area and covered by foam. The area should not exceed the surface area of the installed sprinkler system and in no case exceed 465 m².

In the case of a foam system used as a compensatory measure to drainage, the area's under-roof sprinkler and IRAS systems will be systematically doped with foam to avoid destroying the foam mat.

If the storage of combustible liquids (flash point > 93°C) is authorized for plastic IBCs, the associated protection scheme will be restrictive. This must be presented and discussed with the insurer and the EHS Corporate.

For metal containers (IBCs or drums), containers equipped with a valve or an equivalent element such as a fusible plug are to be preferred, as these elements avoid possible pressure increase in the containers. The cooling water requirements of these containers will be taken into account in the sizing of the fire protection.



Fire door and
dyke to avoid or
contain spillage of
flammable liquids

Protection Summary:

Volume

Sprinkler Protection for miscible liquids stored in metal containers, in racks

1 000 l

230 l

19 l

3,8 l

0,5 l

24,4 @ 279 + IRAS every level (layout 5)
With valve24,4 @ 279 + IRAS every
level (layout 4)
With valve

18,3 @ 279 + IRAS every level (layout 5)

12,2 @ 279 + IRAS every 2
levels (layout 4)

12,2 @ 279 + IRAS every level (layout 3)

12,2 @ 186 + IRAS every 2
levels (layout 4)

24,4 @ 186 + IRAS (layout 2)

12,2 @ 186 + IRAS every 2
levels (layout 4)

24,4 @ 186 + IRAS (layout 2)

12,2 @ 186 + IRAS every 2
levels (Layout 4)

Volume

1 000 l

230 l

19 l

3,8 l

0,5 l

Sprinkler Protection for miscible liquids stored in plastic/glass containers, in racks

Scheme B

Scheme B

Group A Plastic

Scheme B

Class IV

Scheme A

Class IV

23
IA

IB/IC

38
II60
IIIA93
IIIB

Flash Point (°C)

CASE #1: Sprinkler protection for in-rack storage of flammables in metallic containers only (metallic IBC of 1 000 litres and/or metal drums of 230 litres)

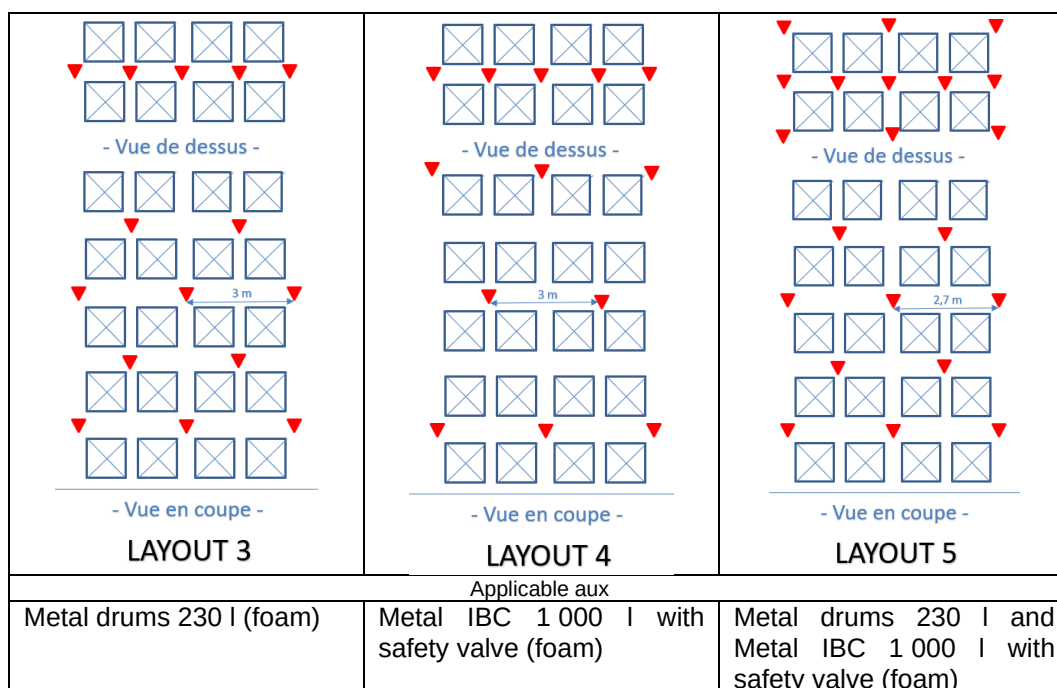
General requirements: No solid barriers in racks.

Risk Classification: applicable to the class of miscible flammable and combustible liquids according to NFPA or FM definition. Storage of immiscible liquids will involve foam systems of the proposed IRAS and under-roof protection.

Sprinkler Protection: Ceiling protection + in-rack IRAS

	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard
Metal Drums 230 l	Building h: 9,1 m Storage h: 7,6 m	Sprinkler CMDA: 16,3 l/min/m ² @ 279 m ² <u>or</u> 12,2 l/min/m ² @ 279 m ² water + foam	3 x 6 spk, 115 l/min Layout 5 (water) or layout 3 (water+foam)	NFPA 30 - V. 2021: table 16.5.2.1 (water) or 16.5.2.3 (water + foam)
Metal IBC 1 000 l With safety valve	Building h: 9,1 m Storage h: 7,6 m	Sprinkler CMDA: 24,4 l/min/m ² @ 279 m ² <u>or</u> 12,2 l/min/m ² @ 279 m ² water + foam	3 x 6 spk, 115 l/min Layout 5 (water) or layout 4 (water+foam)	NFPA 30 - V. 2021: table 16.5.2.1 (water) or 3 (water + foam)

The proposed "envelope" specification applies to the most restrictive classes IB, IC, II, IIA (Pe < 93°C). A single class of liquids IIIB (Pe > 93°C) can be optimized for sizing.



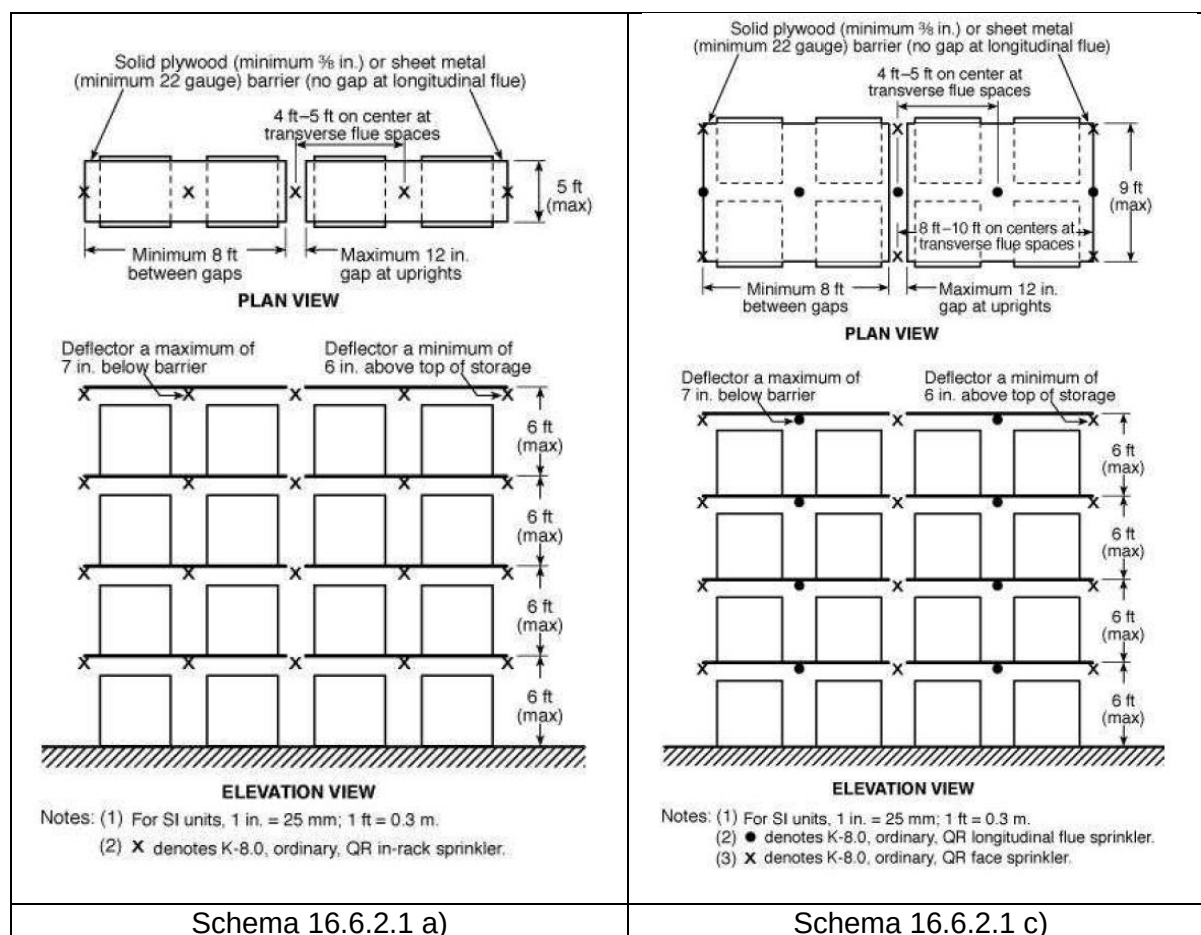
CASE #2: Sprinkler protection for in-rack storage of plastic containers of flammables (drums of 230 litres MAXIMUM).

General requirements: Solid barriers in rack.

Risk Classification: applicable to the class of miscible flammable and combustible liquids according to NFPA or FM definition. Storage of immiscible liquids will involve foam systems of the proposed IRAS and under-roof protection.

Sprinkler Protection: Ceiling protection + in-rack IRAS

	Limits	Ceiling Protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Drums 230 l	Building h: 9,1 m Storage h: 7,6 m	Sprinkler CMDA: 18,3 l/min/m ² @ 270 m ² water + foam	2 x 4 spk, 220 l/min Schema 16.6.2.1 a) (single rack) and/or c) (double rack)	NFPA 30 - V. 2021: table 16.5.2.7 + 16.6.2 Scheme B



CASE #3: Sprinkler Protection of a mixed storage of plastic drums, metal drums and metal IBCs

A mix of plastic and metal drums is possible with the application of a ceiling sprinkler system with the highest water demand possible.

The optimal design consists of placing the liquids in plastic containers in the lower part of the rack, separated from the metal containers by a solid deck/barrier. The upper part of the rack is protected by the ceiling sprinkler system and perforated racks and the application of the IRAS protection adapted to the volume to be protected.

Rack Upper part	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Metal Drums 230 l	Building h: 9,1 m Storage h: 7,6 m	Sprinkler CMDA : 18,3 l/min/m ² @ 270 m ²	3 x 6 spk, 115 l/min Layout 5 (water) or layout 3 (water + foam)	NFPA 30 - V. 2021 :table 6.5.2.1 (water) or 16.5.2.3 (water + foam)
Metal IBC 1 000 l With safety valve	Building h: 9,1 m Storage h: 7,6 m	Sprinkler CMDA : 24,4 l/min/m ² @ 279 m ² or 12,2 l/min/m ² @ 279 m ² water + foam	3 x 6 spk, 115 l/min Layout 5 (water) or layout 4 (water + foam)	NFPA 30 - V. 2021 : table 16.5.2.1 (water) or 3 (water + foam)

Rack Lower part	Limits	Ceiling protection	In-rack , IRAS	NFPA Standard reference
Plastic Drums 230 l	Building h: 9,1 m Storage h: 7,6 m	Sprinkler CMDA 18,3 l/min/m ² @ 270 m ² water + foam	2 x 4 spk, 220 l/min As per fig. 16.6.2.1 a)(single rack) and/or c) (double rack)	NFPA 30 - V. 2021 : table 16.5.2.7 + 16.6.2 Scheme B

For all the above proposals:

The hydraulic calculation is based on the cumulative operation of the ceiling protection and in-rack sprinkler system.

F – DOCKS & SHIPPING AREAS

Design Requirements: Storage - Stacking on the ground

- The main constraint is the large distance between the top of the packages and ceiling in these areas. The notion of clearance to ceiling must be taken into account in the case of CMDA sprinklers with a maximum clearance of 6.10 m under the ceiling.
- The sizing criteria for the sprinkler system, to be taken into account, will be the greater of the design values between the section relating to storage in racks and the section on storage in reception and dispatch areas.
- If flammable liquids or aerosols are present, a specific study must be carried out.

Risk Classification: The highest risk classification defines the whole protection system: Plastic, Class IV, flammable finished products, etc

Sprinkler Protection: ceiling sprinkler

For Group A Plastics, exposed or boxed

Mode ESFR	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Plastic Group A boxed (no film)	Building h: 7,6 m Storage h: 6,1 m	12 x Up/Pdt K200 @ 3,4 Up/Pdt K240 @ 2,4 b	None	NFPA 13 - V. 2019 : table 23.4.2 – Ground stacking
	Building h: 9,1 m Storage h: 7,6 m	Pdt K 320 @ 1,7 b Pdt K360 @ 1 b		
	Building h: 12 m Storage h: 9,1 m	12 x Pdt K240 @ 3,6 b		
	Building h: 12 m Storage h: 11 m	12 x Pdt K240 @ 3,6 b Pdt K360 @ 1,7 b		
	Building h: 14 m Storage h: 12 m	12 x Pdt K320 @ 2,7 b Pdt K360 @ 2,7 b		
	Building h: 15,2 m Storage h: 13,7 m	10 x Pdt K320 @ 4,5 b 10 x Pdt K360 @ 3,5 b 10 x Pdt K360 @ 5,2 b 10 x Pdt K400 @ 2,8 b 9 x Pdt K480 @ 3,8 b		FM DS 08-09 V- 2020 : table 17b
	Building h: 16,8 m Storage h: 15,2 m	9 x Pdt K400 @ 5,5 b 9 x Pdt K480 @ 3,8 b		

Pdt : Pendent

Up : Upright

Mode CMSA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard
Plastic Group A boxed (no film)	Building h: 9,1 m Storage h: 6,1 m	CMSA : 15 heads x Up K160 @ 3,4 b Up K 240 @ 1,5 b Pdt K280 @ 1,1 b Pdt K360 @ 0,7 b	No	NFPA 13 - V. 2019: table 22.2 Ground stacking
	Building h: 9,1 m Storage h: 7,6 m	CMSA : 15 heads x Up K240 @ 1,5 b Pdt K 280 @ 1,1 b Pdt K360 @ 0,7 b		
	Building h: 11 m Storage h: 9,1 m	CMSA : 15 heads x Pdt K 280 @ 1,7 b		
	Building h: 12 m Storage h: 11 m	CMSA : 15 heads x Pdt K 280 @ 2,1 b Pdt K360 @ 1,6 b		

Mode CMDA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard
Plastic Group A boxed (no film)	Building h: 6,1 m Storage h: > 1,5 m < 3,6 m	CMDA : 20,4 l/min/m ² @ 230 m ²	No	NFPA 13 - V. 2019 : table 21.3.3.b) C : (2) Non- expanded, stable, boxed
	Building h: 9,7 m Storage h: > 1,5 m < 3,6 m	CMDA : 24,5 l/min/m ² @ 230 m ²		
	Building h: 7,6 m Storage h: >6,1 m	CMDA : 24,5 l/min/m ² @ 230 m ²		
	Building h: 9,1 m Storage h: > 6,1 m	CMDA : 24,5 l/min/m ² @ 230 m ²		
	Building h: 9,1 m Storage h: 7,6 m	CMDA : 34,6 l/min/m ² @ 230 m ²		
	Building h: 11 m Storage h: 7,6 m	CMDA : 34,6 l/min/m ² @ 230 m ²		

Mode ESFR	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard
Exposed Plastic Group A	Building h: 7,6 m Storage h: 6,1 m	ESFR : 12 heads x Pdt K200 @ 3,4 b Pdt K240 @ 2,4 b	No	NFPA 13 - V. 2019 : table 23.4.2
	Building h: 9,1 m Storage h: 7,6 m			
	Building h: 12 m Storage h: 9,1 m	ESFR : 12 heads x Pdt K240 @ 3,6 b Pdt K320 @ 3,4 b Pdt K360 @ 3,4 b		
	Building h: 12 m Storage h: 11 m			

Mode CMSA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Exposed Plastic Group A	Building h: 9,1 m Storage h: 6,1 m	CMSA : 15 heads x Up K160 @ 3,4 b	No	NFPA 13 - V. 2019 : table 22.3
	Building h: 9,1 m Storage h: 7,6 m	CMSA : 15 heads x K240 @ 1,5 bars		

Mode CMDA	Limits	Ceiling protection	In-rack Protection IRAS	NFPA Standard reference
Exposed Plastic Group A	Building h: 6,1 m Storage h: > 1,5 m < 3,6 m	CMDA : EH2 (IF 25% down K160) 12,2 l/min/m ² @ 174 m ²	No	NFPA 13 - V. 2019 : table 21.3.3.b) E (2) : Non- expanded, stable, exposed
	Building h: 9,7 m Storage h: > 1,5 m < 3,6 m	CMDA : 28,5 l/min/m ² @ 230 m ²		
	Building h: 7,6 m Storage h: > 6,1 m	CMDA : 28,5 l/min/m ² @ 230 m ²		
	Building h: 9,1 m Storage h: > 6,1 m	CMDA : 34,6 l/min/m ² @ 230 m ²		
	Building h: 9,1 m Storage h: 7,6 m	CMSA : 34,6 l/min/m ² @ 230 m ²		
	Building h: 11 m Storage h: 7,6 m	CMSA : 44,8 l/min/m ² @ 230 m ²		

Class IV products:

Mode ESFR	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
	Building h: 7,6 m Storage h: 6,1 m	ESFR : 12 x Up/Pdt K200 @ 3,4 b Up/PDt K240 @ 2,4 b Pdt K320 @ 1,7 b Pdt K360 @ 1 b	No	NFPA 13 - V. 2019 : table 23.3.1
	Building h: 9,1 m Storage h: 7,6 m			

Classe IV filmed	Building h: 11 m Storage h: 9,1 m	ESFR: 12 x Up/Pdt K200 @ 5,2 b Up/Pdt K240 @ 3,6 b Pdt K320 @ 2,4 b Pdt K360 @ 1,4 b		
	Building h: 12 m Storage h: 11 m	ESFR: 12 x Pdt K240 @ 3,6 b Pdt K320 @ 2,7 b Pdt K360 @ 1,7 b		
	Building h: 14 m Storage h: 12 m	ESFR: 12 x Pdt K320 @ 2,7 b Pdt K360 @ 2,7 b		

Mode CMSA	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Classe IV filmed	Building h: 9,1 m Storage h: 6,1 m	CMSA: 15 x Up K160 @ 3,4 b Up K 240 @ 1,5 b Pdt K280 @ 1,1 b Pdt K360 @ 0,7 b	No	NFPA 13 - V. 2019 : table 22.2
	Building h: 9,1 m Storage h: 7,6 m	CMSA: x 15 Up K240 @ 1,5 b Pdt K 280 @ 1,1 b Pdt K360 @ 0,7 b		
	Building h: 11 m Storage h: 9,1 m	CMSA: x 15 Pdt K 280 @ 1,7 b		
	Building h: 12 m Storage h: 11 m	CMSA: x 15 Pdt K 280 @ 2,1 b Pdt K360 @ 1,6 b		

Mode CMDA	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Classe IV filmed	Building h: 12,2 m Storage h: 6,1 m	CMDA : 24,5 l/min/m ² @ 185 m ²	No	NFPA 13 - V. 2019 : 21.2.3.5

Finished products Flammables liquids:

Mode ESFR	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Miscible products and non- miscible products in boxes < or = 3,8 litres	Building h: 9,1 m Storage h: 2,4 m	ESFR : 12 x Pdt K>or=202 @ 3,45 b	No	NFPA 30 - V. 2020 : table 16.5.2.8
Miscible products in cartons (perfume) < or = 500 ml	Building h: 9,1 m Storage h: 3,7 m	ESFR: 12 x Pdt K202 @ 3,4 b Pdt K235 @ 2,4 b 25 x Pdt/Up K161 @ 3,5 b Pdt/Up K202 @ 2,3 b Pdt /Up K 235 @ 1,6 b Pdt/Up K 363 @ 0,7 b	No	FM DS 07-29 - V. 2019 : table 2.4.7.3.2
	Building h: 9,1 m Storage h: 2,4 m	ESFR: 15 x Pdt/Up K161 @ 3,5 b Pdt/Up K202 @ 2,3 b Pdt/Up K 235 @ 1,6 b Pdt/Up K 363 @ 0,7 b		
	Building h: 9,1 m Storage h: 1,5 m	ESFR: 20 x Pdt/Up K161 @ 2 b Pdt/Up K202 @ 1,2 b Pdt/Up K 235 @ 0,9 b Pdt/Up K 363 @ 0,5 b		
Miscible products in boxes (perfume) < or = 180 ml	Building h: 9,1 m Storage h: 4,6 m	ESFR: 12 x Pdt K202 @ 3,4 b Pdt K235 @ 2,4 b Pdt K 310 @ 1,7 b Pdt K 363 @ 1,4 b	No	FM DS 07-29 - V. 2019 : table 2.4.7.3.2

Mode CMDA	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Miscible products in boxes (perfume) < or = 250 ml	Building h: 11,4 m Storage h: 1,5 m	CMDA: sprinkler density 19,1 @ 186 m ²	No	NFPA 30 - V. 2021 : table 16.5.2.12

G – CANOPY & WASTE AREAS:

Design Requirements:

- The best solution is to isolate the waste area as far as possible from the production buildings and not to protect it. The distance to the protective buildings depends on several criteria. A table showing the distance to buildings is provided at the end of this section.
- In areas where there is a risk of frost, the sprinkler systems are placed under air.
- If flammable liquids or aerosols are present, a specific study must be carried out.

Risk Classification: Storage - According to the most unfavorable class of goods (based on 15 pallets).

Sprinkler Protection: Ceiling sprinkler

Refer to the proposed solutions, section F (page 79), for storage in the docks/receiving/shipping area and apply a 30% increase over the suggested specification, in area involved, for an air sprinkler system.

SPECIFIC CASE OF PALLET STORAGE

Design Requirements:

- The best solution is to isolate the pallets outside or in a room intended for this purpose, as far away from the buildings as possible and unprotected. The distances to be respected are specified in the attached table from FM DS 08-24 V. 2015.
- In areas where there is a risk of frost, the sprinkler networks are placed under air.
- Islanding and distance rules are required for the case of stacks of wooden pallets: no more than 4 grouped stacks of pallets, stacked to a height of less than 1.80 m per stack (12 European pallets of 15 cm) in the case of protected floor storage in CMDA OH2 mode.
- For the interior storage of plastic pallets, it must be ensured in a compartmentalized room with a 3-hour firewall with at least one of the walls facing the outside. The metal structure must have a 1-hour fireproofing or be protected.
- Stacking and spacing rules are required for plastic pallet stacks: no more than 2 grouped stacks of pallets stacked to a height of less than 1.20 m per stack in the case of protected floor storage in CMDA OH2 mode.
- Each stack is separated from other pallet stacks by a clear distance of 2.40 m. Each stack is separated from any storage of goods by a distance of 7.60 m.

Risk Classification: Storage of 2 types of pallets: wood and plastic.

Sprinkler Protection: Ceiling sprinkler

Depending on the mode of protection, the dedicated storage of pallets must respect the following table:

Mode ESFR	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Wood Pallets – In-rack storage or on the floor	Building h: 9,1 m Storage h: 7,6 m	12 x Pdt K200 @ 3,4 b Pdt K240 @ 2,4 b Pdt K320 @ 1,7 b Pdt K360 @ 1 b	No	NFPA 13 - V. 2019 : table 20.14.1.2 c)
	Building h: 11 m Storage h: 9,1 m	12 x Pdt K240 @ 3,6 b Pdt K320 @ 2,7 b Pdt K360 @ 1,7 b		
Wood Pallets Storage on the floor	Building h: 9,1 m Storage h: 6,1 m	12 x Up K200 @ 3,4 b Up K240 @ 2,4 b		
Plastic Pallets Storage on the floor	Building h: 9,1 m Storage h: 7,6 m	12 x Pdt K200 @ 3,4 b Pdt K240 @ 2,4 b	No	NFPA 13 - V. 2019 : table 20.14.2.2.3
	Building h: 12 m Storage h: 11 m	12 x Pdt K240 @ 3,6 b		

Mode CMSA	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Wood Pallets Storage on the floor	Building h: 9,1 m Storage h: 6,1 m	CMSA water : 15 x Up K160 @ 1,7 b Up K240 @ 1 b Pdt K280 @ 1,1 b	No	NFPA 13 - V. 2019 : table 20.14.1.2.b)
		CMSA air : 25 x Up K160 @ 1,7 bars Up K240 @ 1 bars		

Mode CMDA	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Wood Pallets Storage on the floor	Building h: not specified H stockage < 1,80 m Max 4 stacks	CMDA : OH2 8,2 l/min/m ² @ 140 m ² with 4 piles max of 1,80 m and 2,40 m between piles or 7,6 m / stock (*)	No	NFPA 13 – V. 2019 : 20.14.1.2 (4) and figure 19.3.3.1.1
	Building h: 6,1 m Storage h: Up to 1,80 m	CMDA : 8,2 l/min/m ² @ 280 m ² (*) With K > or = 115 (*) : Surface reduced to 186 m ² if K > or = 160 or if K 115 with spk at high temperature		NFPA 13 - V. 2019 : table 20.14.1.2.a)
	Building h: 9,1 m Storage h: Up to 2,40 m	CMDA : 18,3 l/min/m ² @ 230 m ² With K > or = 160		
Wood Pallets – In rack storage or on the floor	Building h: 9,1 m Storage h: Up to 3,70 m	CMDA : 24,5 l/min/m ² @ 325 m ² With K > or = 160		
	Building h: 9,1 m Storage h: Up to 3,70 m	CMDA : 24,5 l/min/m ² @ 325 m ² With K > or = 160		
	Building h: 9,1 m Storage h: Up to 6,10 m	CMDA : 24,5 l/min/m ² @ 420 m ² With K > or = 160		
Plastic Pallets Storage on the floor	Building h: not specified Storage h: Up to 1,20 m / pile Max 2 stacks	CMDA : 8,2 l/min/m ² @ 140 m ² with 2 piles max of 1,20 m and 2,40 m between piles or 7,6 m / stock (**)		
	Building h: 6,8 m Storage h: Up to 3,70 m	CMDA : 24,5 l/min/m ² @ surface of the room fireproof 3 h		

(*): The storage mode of wooden pallets allows a grouping of 4 stacks of pallets piled up to a height of 1,80 m forming a pile of pallets of 4 stacks. Each pile is separated from the other piles of pallets by a free distance of 2,40 m. Each stack is separated by a distance of 7.60 m from any storage of goods.

(**): The plastic pallet storage mode allows a grouping of 2 stacks of pallets stacked up to a height of 1.20 m forming a stack of pallets of 2 piles. Each stack is separated from the other pallet stacks by a free distance of 2.40 m. Each stack is separated by a distance of 7.60 m from any storage of goods.

FM approved large orifice heads	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Plastic Pallets Storage on the floor- Water Network	Building h: 7,5 m Storage h: 6 m	12 x Pdt, QR, K200 @ 3,5 b 15 x Pdt, SR, K160 @ 1,7 b Up, SR, K 160 @ 1,7 b	No	FM DS 08-24 - V. 2015 : table 3
	Building h: 9 m Storage h: 6 m	12 x Pdt, QR, K200 @ 3,5 b 15 x Pdt, SR, K160 @ 1,7 b Up, SR, K 160 @ 1,7 b		
	Building h: 9 m Storage h: 7,5 m	12 x Pdt, QR, K200 @ 3,5 b		
	Building h: 10,5 m Storage h: 9 m	12 x Pdt, QR, K200 @ 5,2 b		
	Building h: 12 m Storage h: 10,5 m	12 x Pdt, QR, K200 @ 5,2 b		

	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Plastic Pallets Storage on the floor – Air Network	Building h: 7,5 m Storage h: 6 m	25 x Up, SR, K 160 @ 1,7 b	No	FM DS 08-24 - V. 2015 : table 3
	Building h: 9 m Storage h: 6 m	25 x Up, SR, K 160 @ 1,7 b		

Wooden pallets are to be considered as exposed Group A plastic goods. The tables for exposed Group A plastics are applicable to wooden pallets.

Extract FM DS 08-24

Table 1. Separation Distances for Outdoor Storage of Idle Pallets

Exposed Wall Category	Separation Distance, ft (m)					
	≤50 Pallets		51 to 200 Pallets		>200 Pallets	
	Wood & FM Approved	Plastic	Wood & FM Approved	Plastic	Wood & FM Approved	Plastic
Combustible	15 (4.5)	30 (9)	40 (12)	80 (24)	90 (27)	150 (45)
Noncombustible	12 (3.7)	15 (4.5)	30 (9)	40 (12)	50 (15)	100 (30)
1-hr	4 (1.2)	8 (2.4)	12 (3.7)	24 (7.4)	20 (6)	40 (12)
2-hr	3 (1)	6 (2)	10 (3)	20 (6)	15 (4.5)	30 (9)
3-hr	3 (1)	3 (1)	8 (2.5)	16 (5)	13 (4)	26 (8)
4-hr	3 (1)	3 (1)	3 (1)	3 (1)	3 (1)	3 (1)

Note: Separation distances of 3 ft (1 m) are recommended for access only with a 4-hr wall.

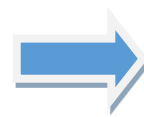
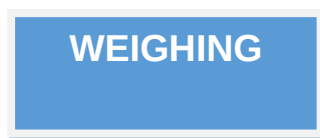
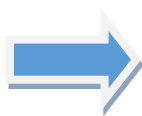
Table 2. Safe Separation Distances for Adjacent Piles of Pallets Stored Outdoors

Separation Distance, ft (m)					
≤50 Pallets		51 to 200 Pallets		>200 Pallets	
Wood & FM Approved	Plastic	Wood & FM Approved	Plastic	Wood & FM Approved	Plastic
15(4.5)	30 (9)	40 (12)	80 (24)	90 (27)	150 (45)

H- PROCESS & WEIGHING AREA

RAW MATERIALS

- Flammables
- Combustibles
- With no flash point



Production/
Working
Order (OF)

Design Requirements: Each weighing box will be protected internally by sprinkler heads.

H.1 – Weighing Area with no Flammable or Combustible Liquids

- **Risk Classification:** Extra Hazard 1
- **Sprinkler Protection:** Ceiling sprinkler CMDA 12 l/min/m² @ 232 m²

H.2 - Weighing Area with Flammable or Combustible Liquids

- **Risk Classification:** Extra Hazard 2
- **Sprinkler Protection:** Ceiling sprinkler CMDA 16,3 l/min/m² @ 232 m²

The raw material areas in the weighing areas will preferably have drains. In the case of weighing in areas without drains, PM flammable and combustible liquids will be placed in metal containers with 3 sides FM 6086 approved (ex: MINIMAX® or VIKING®).

In the case of the presence of weighed OFs, the automatic fire protection will be sized on the basis of that of the flammable or combustible PM (see section E, storage of flammable or combustible PM).

An additional solution accepted only in the case of a compliance of an existing room with-drains: Sprinkler under roof CMDA under water 12,2 l/min/m² on 232 m² water + foam.

An additional solution accepted only in the case of a compliance of an existing room with retention: Sprinkler under roof CMDA under water 12,2 l/min/m² water + foam on the surface of the workshop.

Synthesis:

Weighing area	Risk Classification	Sprinkler Protection	NFPA Standard
No flammable liquids	Extra Hazard 1 EH 1	Ceiling Sprinkler CMDA 12 l/min/m ² @ 232 m ²	NFPA 13 - V. 2019 : 4.3.5 + Fig. 19.3.3.1.1
With flammable liquids	Extra Hazard 2 EH 2	Ceiling Sprinkler CMDA 16,3 l/min/m ² @ 232 m ² + Drainage	NFPA 13 - V. 2019 : 4.3.6 + Fig. 19.3.3.1.1

H.3 – Process Room with no Flammable or Combustible Liquids

- **Design Requirements:** None
- **Risk Classification:** Extra Hazard 1
- **Sprinkler Protection:** Ceiling sprinkler 12 l/min/m² @ 232 m²

H.4 – Process Room with Flammable or Combustible Liquids (ATEX)

- **Design Requirements:** A room using flammable or combustible liquids must have a 2-hour fire proofing on all 6 sides equipped with an adapted deported drainage system (Please refer to the supplementary section of the report referring to drainage).

The important criteria for the design of the protection concern:

- The floor area of the workshop,
- The height of the room,
- The volume of the manufacturing skids,
- The drainage system.

The drainage system is inseparable from the fire protection system.

The absence of a drainage system will be compensated for by the implementation of a foam protection system on the floor, based on low or medium expansion foam, with a height to be reached within a required time (20 cm in 2 minutes in accordance with § 6.13.3.1 of NFPA 11 - V.2016). High expansion foam, if used, must take into account the total flooding of the room.

At the level of the fire doors, the management of the liquid spillage will be ensured by the implementation of removable barriers, preferably FM 4985 approved, or drainage gutters on the drainage system to prevent liquids from flowing outside of the firewall.

The underneath of the mezzanines of the manufacturing skids will be protected, the protection will be integrated into the calculation of the installation, in addition to the needs under the roof.

IMPORTANT: The case of process areas containing large capacity storage of interior tanks of flammable liquids (e.g.: maturation tanks in the perfume or aerosol sector), will be treated on a case-by-case basis, by a study with the involvement of the insurer.

- **Risk Classification:** Extra Hazard 2 (EH 2)
- **Sprinkler Protection:** Several solutions are possible according to the criteria described below.

1 - **Deluge system with water + foam** 12 l/min/m² for the whole area of the process.
The deluge network will be controlled by a triple IR type detection or pilot network.

2 - **Sprinkler water + foam** at the ceiling CMDA 16,3 l/min/m² for the maximum area with drainage system (*).

(*) The absence of drainage implies that the total surface of the workshop is taken into account.

According to the following criteria, solutions will be applied:

If the area to protect > 465 m², Solution 1 applies - beware, over a large surface, the need may become significant and the source or the pump insufficient. In this case, the fire partitioning of these process areas must be considered.

If the area to protect < 465 m², both solutions 1 or 2 can be considered.

An additional solution accepted by insurers, only in the case of a retrofit of an existing room: CMDA ceiling sprinkler network under water 12,2 l/min/m² on the surface of the area + foam system on the floor, low or medium expansion foam.

In order to control any puddle fire on the ground, an application rate of 8 l/min/m² will be taken as a sizing reference for low expansion foam (Reference FM DS 04-12 version 2013). A 20 cm carpet in 2 minutes will be the target when using medium expansion foam.

In the case of a deluge system, all heads will be activated simultaneously. The delay of the arrival of the foaming solution will be less than 30 seconds after detection (Reference A.7.1.6 of NFPA 15 version 2017). In the case of CMDA sprinkler protection, the heads will be activated progressively in accordance with the ignited pool. It is expected that all sprinkler heads will be activated eventually.



Note: The highest water demand must be covered by the pump.

Process Rooms	Risk Classification	Sprinkler Protection	NFPA Standard
No Flammable liquids	Extra Hazard 1 EH 1	Sprinkler ceiling CMDA water 12,2 l/min/m ² over the largest surface, with drains, of the workshop	NFPA 13 - V. 2019 : 4.3.5 + Fig. 19.3.3.1.1
With Flammable liquids	Extra Hazard 2 EH 2	Deluge water + foam over the whole area of the workshop. + Drainage + Sprinkler heads below platforms	FM DS 7-32- V. 2020: table 2.4.3 FM DS 7-14 V. 2019 : 2.3.2.2
		Sprinkler ceiling CMDA water + foam 16,3 l/min/m ² on the largest drained surface of the workshop + Drainage + Sprinkler heads below platforms	NFPA 13 - V. 2019 : 4.3.6 + Fig. 19.3.3.1.1

I – PACKAGING ROOMS

I.1 - No Flammable or Combustible Liquids

- **Design Requirements:** None
- **Risk Classification:** Extra Hazard 1
- **Sprinkler Protection:** Ceiling sprinkler 12 l/min/m² @ 232 m²

I.2 - With Flammable or Combustible Liquids

- **Design Requirements:** None
- **Risk Classification:** Extra Hazard 2 (EH2) due to combustible or flammable bulks stored in metal containers.
- **Sprinkler Protection:** Ceiling sprinkler 16,3 l/min/m² @ 232 m²

An additional solution accepted only in the case of a retrofit of an existing room: CMDA ceiling sprinkler network under water + foam 12,2 l/min/m² over the surface of the workshop.

Packaging Rooms	Risk Classification	Sprinkler Protection	NFPA Standard
No Flammable liquids	Extra Hazard 1 EH 1	Sprinkler ceiling CMDA water 12,2 l/min/m ² @ 232 m ²	NFPA 13 - V. 2019 : 4.3.5 + Fig. 19.3.3.1.1
With Flammable liquids	Extra Hazard 2 EH 2	Deluge system water + foam covering the whole workshop area 16,3 l/min/m ² @ 232 m ²	NFPA 13 - V. 2019 : 4.3.5 + Fig. 19.3.3.1.1
		Sprinkler ceiling CMDA water + foam 16,3 l/min/m ² on the largest drained surface of the workshop	NFPA 13 - V. 2019 : 4.3.6 + Fig. 19.3.3.1.1

The area will be equipped with fire hose means, doped with emulsifier/foam.

J – STORAGE OF FLAMMABLE & COMBUSTIBLE FINISHED PRODUCTS

General Requirements

Regardless of the quantities stored, the fire protection of these storage racks is carried out according to one of the following options depending on the following implementation and/or operating constraints:

- Height of the building
- Building slope limited to 16.9%.
- Height of storage
- Type and volume of containers
- Type of class of flammable and combustible liquids
- Width of aisles greater than 2.40 meters
- Minimum clearance 1 meter
- Minimum width of the longitudinal chimney: 15 cm
- Depending on the country, storage height limits are regulated
- Depending on the country, retention zones are imposed, even though the codes do not require it (ICPE 1510 requirement in France: retention of 500 m² maximum).

The most flexible overall solution will be suggested as a priority, ie. protection limited to the ceiling without intermediate in-rack networks.

Under NFPA 30, no puddle management system (neither drainage nor barriers) is required due to unit volume < 38 litres.

The following protection options are available:

Case #1: Sprinkler protection of flammable liquids, stored in racks, unit volume less than or equal to 180 ml, in glass or plastic containers and boxed.

Design Requirements: No Solid barriers in the rack

Risk Classification: applicable to the class of finished products with and without characteristics of flammable and combustible liquids.

Sprinkler protection: Sprinkler ESFR at ceiling.

ESFR	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Flammable finished products in glass or plastic containers with unit volume < or = 180 ml. Boxed	Building h: 9,1 m Storage h: 7,6 m	Sprinkler ESFR, 12 x K 363 @ 1,4 b Or 12 x K 310 @ 1,7 b	No	NFPA 30 - V. 2021 : table 16.5.2.16
	Building h: 12,2 m Storage h: 10,6 m	Sprinkler ESFR, 12 x K 363 @ 2,8 b Or 12 x K 310 @ 3,1 b	No	NFPA 30 - V. 2021 : table 16.5.2.16

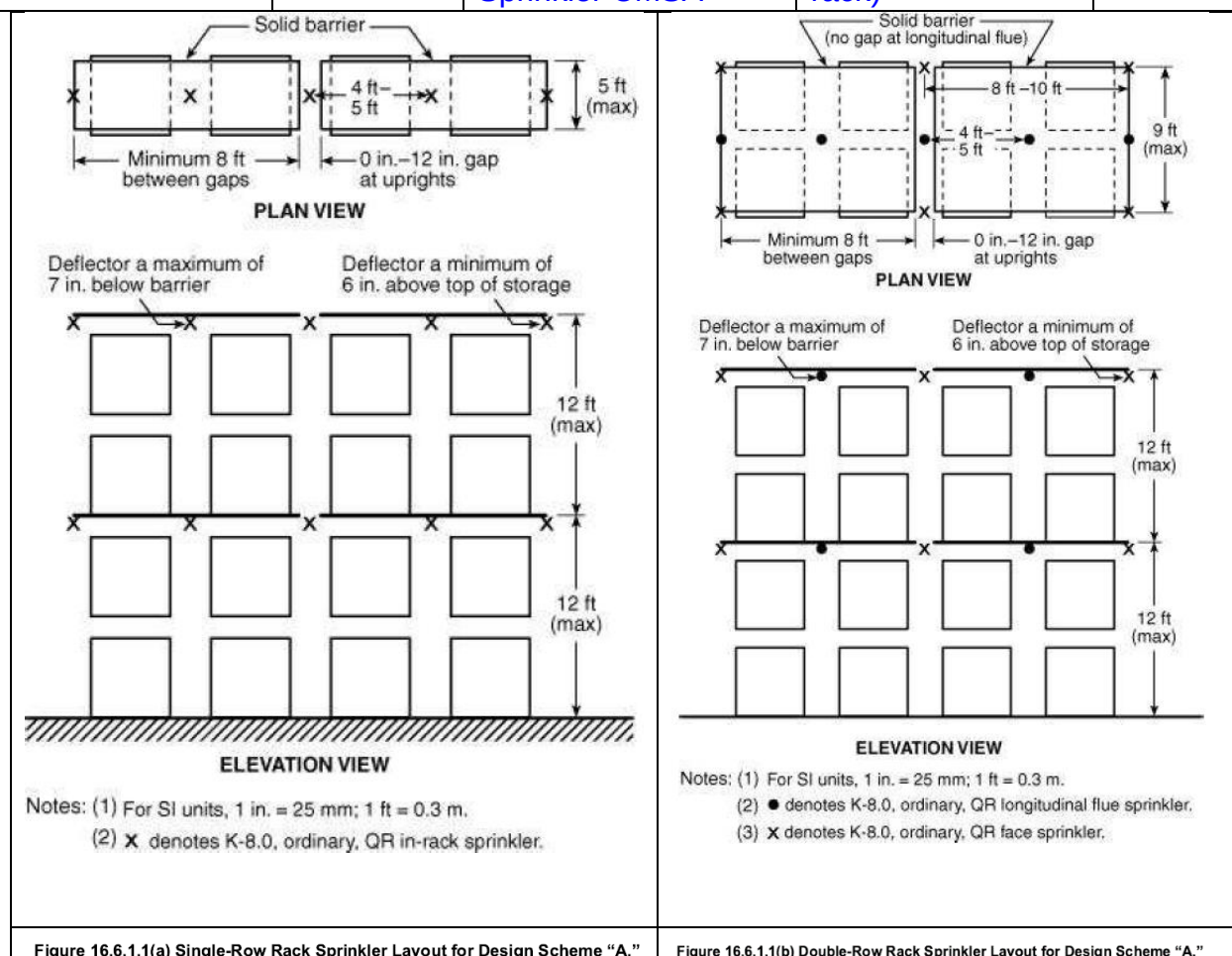
Case #2: Sprinkler protection of flammable liquids, stored in racks, unit volume between 180 ml and 500 ml, in glass or plastic containers and boxed.

Design Requirements: Solid barriers in the rack **every 2 levels** (where in-rack sprinklers are situated).

Risk Classification: applicable to the class of miscible flammable and combustible liquids. Storage of immiscible liquids will involve the foaming of the proposed ceiling and IRAS protection.

Sprinkler protection: Ceiling sprinkler protection + in-rack sprinkler

	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Flammable finished products in glass or plastic containers with unit volume < or = 500 ml Boxed	Building h: unlimited Storage h: unlimited	Sprinkler CMDA 8 l/min/m ² @ 270 m ² or Sprinkler ESFR or Sprinkler CMSA	2 x 4 spk, 220 l/min Scheme. 16.6.1.1 a) (simple rack) and/or c) (double rack)	NFPA 30 - V. 2021: table 16.5.2.7 + 16.6.1 <u>Scheme A</u>



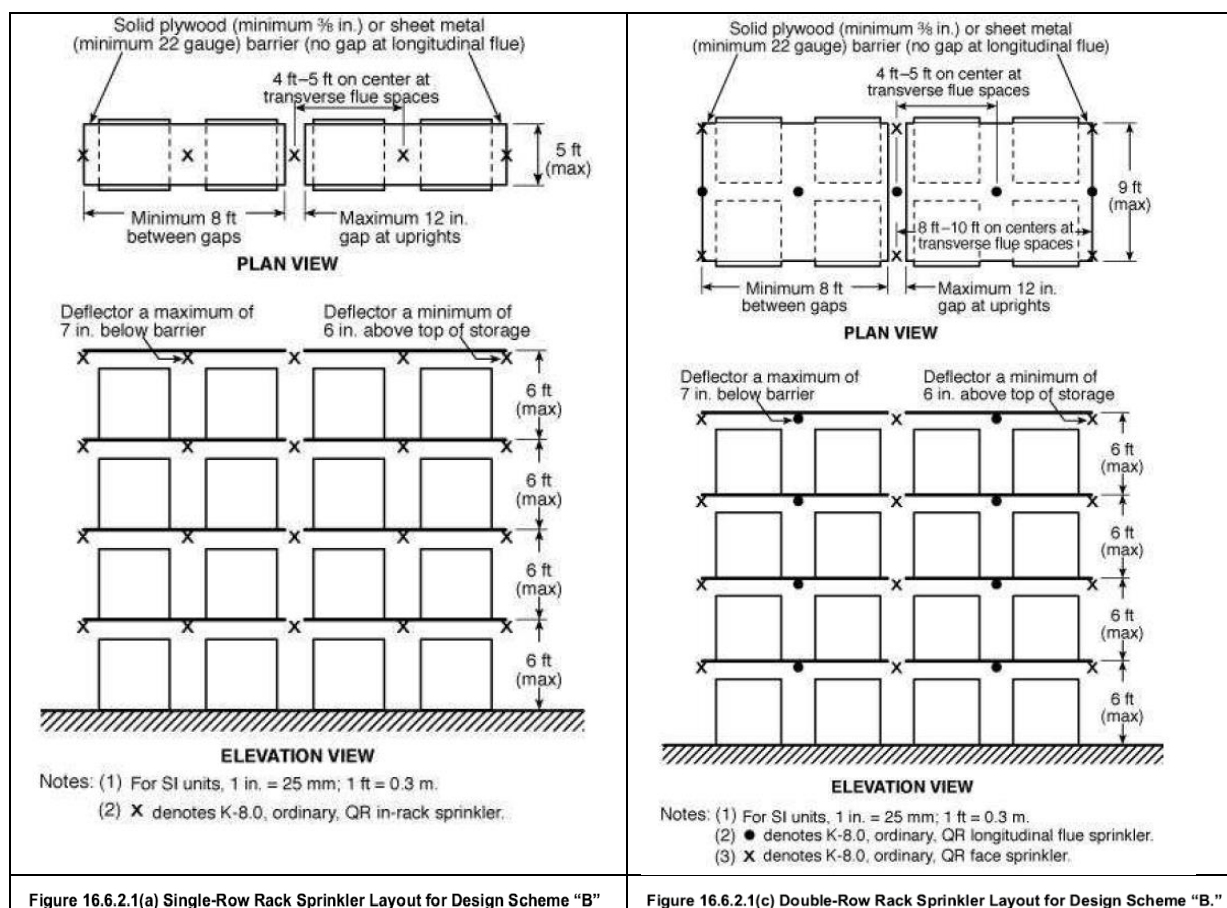
Case #3: Sprinkler protection of flammable liquids, stored in racks, unit volume between 500 ml and 3.8 l, in glass or plastic containers and boxed.

Design Requirements: Solid barriers in the rack at **every level** (where in-rack sprinklers are situated).

Risk Classification: applicable to the class of miscible flammable and combustible liquids. Storage of immiscible liquids will involve the foaming of the proposed ceiling and IRAS protection.

Sprinkler protection: Ceiling sprinkler protection + in-rack sprinkler.

	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Flammable finished products in glass or plastic containers with unit volume < or = 3,8 l Boxed	Building h: unlimited Storage h: unlimited	Sprinkler CMDA 8 l/min/m ² @ 270 m ² or Sprinkler ESFR Or Sprinkler CMSA	2 x 4 spk, 220 l/min Scheme. 16.6.2.1 a) (simple rack) and/or) c)(double rack)	NFPA 30 - V. 2021 : table 16.5.2.7 + 16.6.2 <u>Scheme B</u>



Case #4: Sprinkler protection for mixed storage

If the storage of flammable liquids in a rack does not extend to the full height of the rack, the protection of the goods stored above the top solid barrier must meet the requirements of NFPA 13 protection appropriate to the worst-case goods stored, based on the total height of the rack, regardless of the height of storage above the last solid horizontal barrier.

If flammable liquid storage is adjacent to racks dedicated to non-flammable goods, the flammable sprinkler protection scheme and solid barrier principle must be extended by at least 2.4 m and must apply to the adjacent racks.

A flammable liquid storage can implement Scheme A and Scheme B depending on the different unit quantities of flammable liquids.

NOTE :

The hydraulic calculation is based on the non-cumulative operation of the ceiling protection and the intermediate in-rack networks, taking into account the highest of the 2 needs (specific to products with a capacity strictly inferior to 3.8 l).

The motor pump unit is sized according to the water demand of the roof network + the intermediate networks + the fire hydrants + the external fire hydrants, if they are supplied by the motor pump unit.

K - OUTDOOR STORAGE TANKS – FLAMMABLE LIQUIDS & DUMPING

Risk Classification: Flammable liquids

Building requirements:

- Unloading truck positioned in a retention area possibly drained to a remote point.
- A heat flow study must be carried out, as close as possible to the unloading or storage areas, to protect all the equipment.
- Optimal distance: considering the scenario of a fire on the largest of the retention areas, the park will be located, preferably, at a distance equivalent to the thermal effect zones of 8 kW/m².
- Minimum distance: more than 30m from buildings or installed water curtains/cooling rings.

Sprinkler Protection: Deluge system on the exposed surface of the tanks and medium expansion foam on the retention tank

The deluge network is controlled by a network of pilot heads or an automatic fire detection system of the 3IR type.

Low or medium expansion foam on the retention tray.

The application of low or medium expansion foam will be implemented with the objective of establishing an application rate of 6.5 l/min/m² on the surface of the retention.



	Risk Classification	Sprinkler Protection	NFPA Standard
Tanks	Flammable liquids	Deluge network with water + foam and an application rate of 10.2 l/min/m ² on the envelope surface of the tanks to be protected 1 sprinkler ring every 3.7 m vertically	NFPA 15 - V. 2019
Metal structures of the tanks	Flammable liquids	Deluge network with water + foam and an application rate of 10.2 l/min/m ² on the envelope surface of the beams and metal structure.	NFPA 15 - V. 2019
Transfer pumps	Flammable liquids	Doped deluge network water + foam and an application rate of 20.4 l/min/m ² on the projected surface on the ground (foundation + 1.5 m on each side) of the pumps	NFPA 15 - V. 2019
Retention / Discharge area	Flammable liquids	Network with low or medium expansion foam generators with an application rate of 6.5 l/min/m ² on the retention surface	NFPA 11 – V. 2016

The size of the fire diesel pump must cover the cumulative need of flow for the protection of all the tanks, pumps, metallic supporting structures, retention and the tanks close to dangerous liquids or workshops and buildings, if applicable.

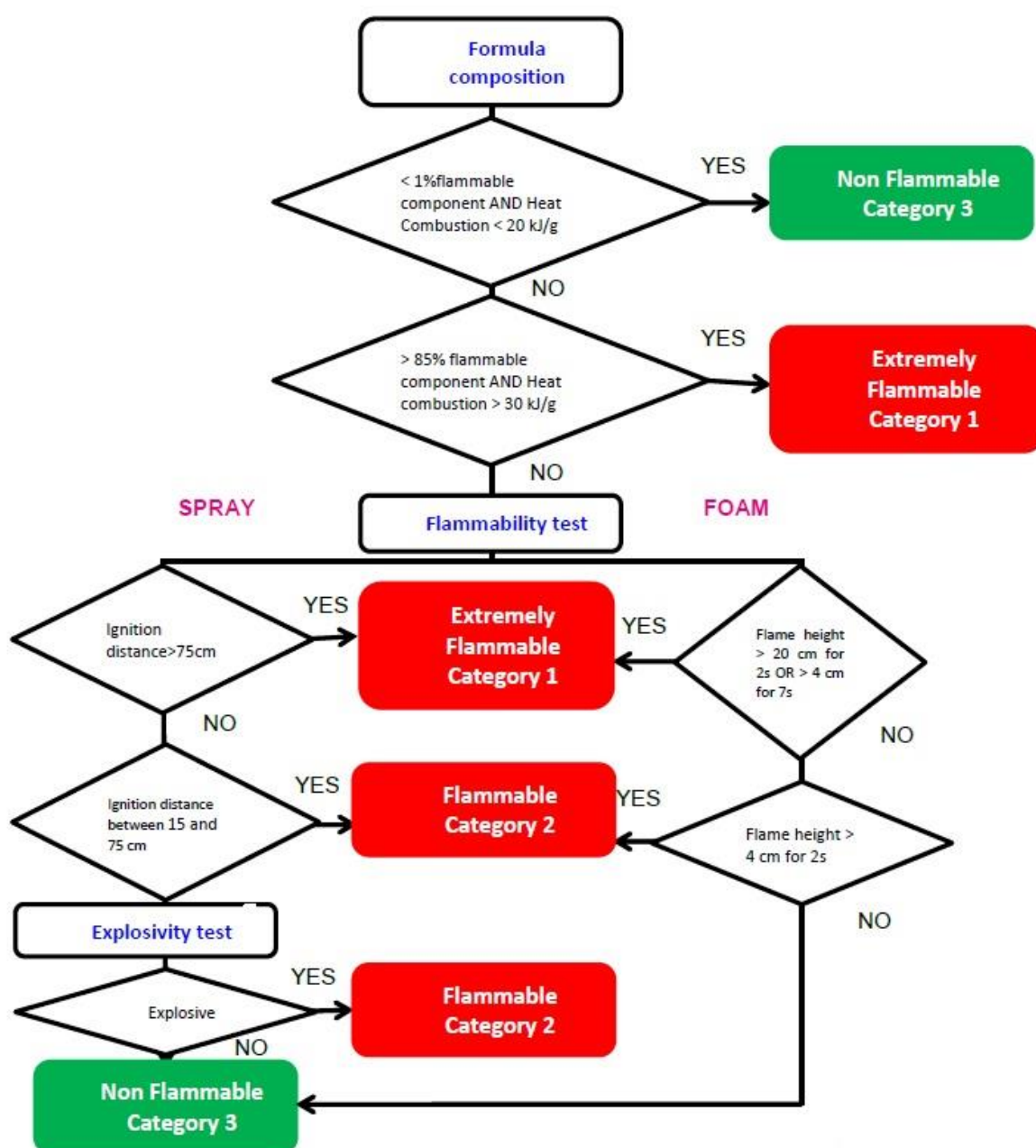
L – STORAGE OF AEROSOLS

Global requirements

Aerosols are classified according to the equivalence table, based on their hazard associated with their heat of combustion:

Reference NFPA 30 B	Combustion heat	Classification CLP / GHS
Level 1	<20 kJ/g	Category 3
Level 2	20 kJ/g < x < 30 kJ/g	Category 2
Level 3	>30 kJ/g	Category 1

Note: for the remainder of this chapter, the levels shown are exclusively as defined in NFPA 30 B.



Level 1 aerosols, the least hazardous, are considered Class III goods under NFPA 13. Pallets of Level 1 aerosols are allowed in the Class IV finished goods storage area without additional precautions.

The protection options developed below apply to:

- Metal aerosols up to 1 l (33.8 fl oz)
- Plastic aerosols up to 118 ml (4 fl oz)
- Plastic aerosols larger than 118 ml (4 fl oz) and smaller than 1l (33.8 fl oz)

The storage of level 2 and 3 aerosols is prohibited in a basement and in any automated storage. Dedicated aerosol storage is incompatible with the presence of flammable or combustible liquids.

Sending aerosols by air freight must be the last possible solution and must comply with IATA rules. Priority is given to rail or road.

Level 2 aerosols in containers with a net weight of less than 28 g (1 oz) are considered as Group A Plastic, cardboard, unexpanded goods.

4 or 5-sided filmed storage is to be considered as non-wrapped aerosols. Plastic aerosols may not be filmed but only packed in cartons.

The proposed options are based on the highest risk, i.e. level 3.

The storage of level 2 and 3 aerosols in quantities greater than 15 pallets is only authorized in a bunker, i.e. a dedicated aerosol cell defined as follows:

- In order to avoid any penetration of the walls by the missile effect of the aerosols, several technical solutions must be validated:
 - Cell integrated in the building: 4-hour fireproof cell with an associated 3-hour fireproof door
 - Independent cell adjoining the building: 2-hour fireproof cell with an associated 2-hour fireproof door.
 - Grid system for all walls/ceilings to avoid any missile effect of the aerosols.
- The fire door is controlled by the automatic fire detection system, by the sprinkler system and by thermal fuses. A manual proximity exit buttons provided.
- Access design based on the labyrinth principle is an excellent practice.
- Non-combustible and independent roof. The installation of an under-roof mesh/grid should be considered to avoid roof penetration.
- One side of the bunker should be accessible from the outside.
- An automatic fire detection system (early detection of smoke and flames) should be implemented and transferred to a permanent monitoring location.

Regardless of the quantities stored, the fire protection of these storage racks is carried out according to one of the following options, depending on the location and/or operating constraints.

- Flat roof

- Type and volume of containers
- Type of level of aerosols
- Aisle width greater than 2.40 meters
- Minimum clearance 1 meter
- Minimum width of the longitudinal chimney: 15 cm

The storage of level 2 and 3 aerosols in quantities of less than 15 pallets is authorized in traditional racks only on the principle of a gridded rack cell dedicated to this purpose with:

- A screened cabinet is a priority to avoid the missile effect in offices or labs.
- The adapted sprinkler protection as Scheme A (see Option 2 below)
- Mesh in the longitudinal chimney of a double rack, on the side faces of each rack bay as well as on the front face of the rack on the basis of a removable mesh face.
- Closed front side of the rack when not in use for picking.
- Mesh size up to 50 mm with a minimum thickness of 2.9 mm woven steel wire.



Case #1: Sprinkler protection of racks of aerosols, packaged in boxes and plastic film, in a building with a maximum height 9,1m.

Building requirements: No solid barriers in racks

Risk Classification: Applicable to Level 2 and Level 3 filmed/boxed aerosols.

Sprinkler Protection: ESFR ceiling protection + in-rack sprinkler

ESFR	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Level 2 and Level 3 filmed/boxed aerosols	Building h: 9,1 m Storage h: 7,6 m	Sprinkler ESFR, 12 x K 360 @ 1,7 b Or 12 x K 320 @ 3,1 b	12 heads (6x2) x 170 l/min if 2 levels 18 heads (6x3) x 170 l/min if >= 3 levels See 6.4.2.7.k)	NFPA 30B - V. 2019: table 6.4.2.7 k)

The proposed "envelope" specification can be optimized according to the aerosol levels present or in case of absence of encapsulation of the pallets. CMDA solutions are possible inducing the constraint of autonomy of the water source reserve over an operation of 2 hours instead of one hour for ESFR solutions.

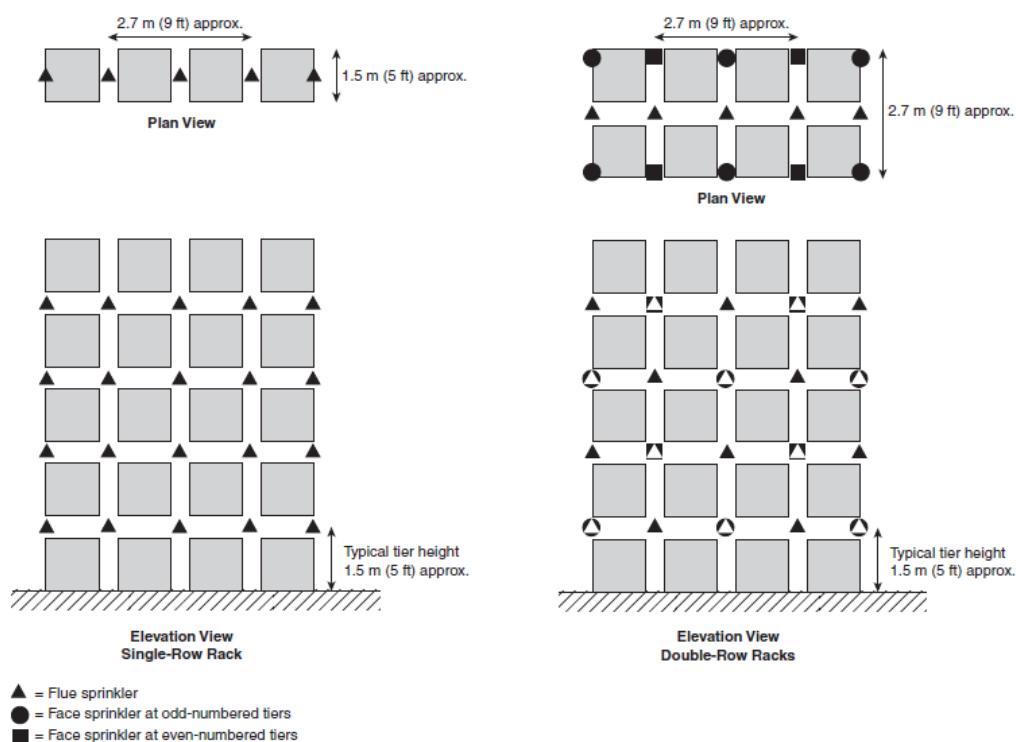
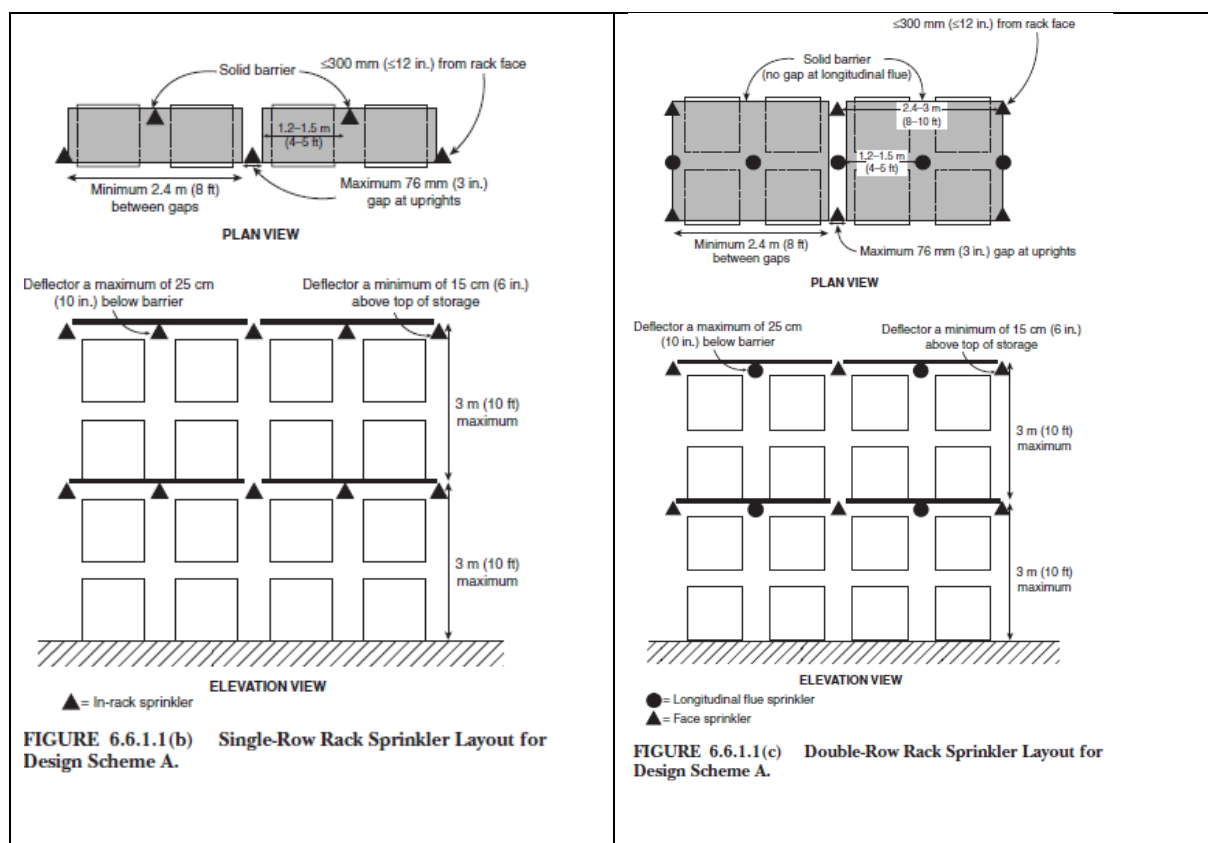


FIGURE 6.4.2.7(e) In-Rack Sprinkler Layout, Uncartoned Level 2 and Level 3 Aerosol Products, Racks up to 7.6 m (25 ft) High Storage.

Case #2: Sprinkler protection for unlimited storage height**Building requirements:** Solid barriers in rack every 2 levels (Scheme A)**Risk Classification:** Applicable to Level 2 and Level 3 filmed/boxed aerosols.**Sprinkler Protection:** ESFR or CMDA sprinkler ceiling protection + in-rack sprinkler

CMDA	Limits	Ceiling protection	In-rack Protection	NFPA Standard reference
Level 2 and Level 3 filmed/boxed aerosols or not filmed	Building h: Unlimited Storage h: Unlimited	Sprinkler ESFR or CMDA	Scheme A Metallic Aerosols: 8 heads (4x2) x 220 l/min Plastic Aerosols: 14 heads (7x2)	NFPA 30B - V. 2019: table 6.4.2.7 g)

Scheme A (solid decking every 2 levels) offers a universal solution, regardless of the criteria.



In the case of a bunker dedicated to aerosols, the cell acts as a retention area.

In the case of a storage of 15 pallets maximum, in gridded racks, in a conventional warehouse, each zone of cells dedicated to aerosols should be in total retention via vertical metal barriers in the longitudinal space of the double racks (for the single racks, along a wall made of non-combustible materials) and removable transverse barriers lowering automatically across the aisles (generally "at the head of racks").

The retention height should be able to contain the entire volume of liquid stored and the volume of fire extinguishing water discharged by the sprinkler system.

NOTE:

The hydraulic calculation is based on the non-cumulative operation of the under-roof protection and the intermediate networks, taking into account the higher of the 2 needs.

The motor-driven pump unit is sized according to the water demand of the roof network + intermediate networks + fire hydrants + external fire hydrants, if they are supplied by the motor-driven pump unit.

M – STORAGE OF OXIDISERS – RAW MATERIALS & FINISHED PRODUCTS

Building requirements:

NFPA 400 code requirements are:

An automatic fire detection system is required, whenever there is storage of flammable solids or liquids, in addition to the sprinkler protection in place.

NFPA 400 defines the different classes of oxidizers by product.

The classification of oxidizers is provided at the end of this section.

Depending on the class (1, 2, 3 or 4), the additional requirements applicable are respectively as follows:

Class 1:

- Separation of Class IV (or more restrictive) and incompatible goods must be provided by a solid non-combustible barrier or a sufficient distance of 2.40 m between these goods.
- It is forbidden to store Class IV (or more restrictive) goods in the area above Class 1 oxidizers
- The storage height of these products is limited to 6.1 m.
- The storage of Class I - II - III goods in the area above oxidizing products is allowed.

Class 2:

- Separation of goods (regardless of class) from incompatible goods must be provided by a solid non-combustible barrier or a sufficient distance of 3.70 m between these goods.
- In particular, it is forbidden to store goods in the area above Class 2 oxidizers.
- The storage height of these products is limited to 4.9 m.

Stronger requirements are required for classes 3 and 4 (This does not concern L'Oréal).

Risk Classification:

Bleaching products contain solid oxidizers in the form of powders or pastes in plastic bags. Some solid oxidizing products found in the finished products, in proportions of varying importance are:

- potassium persulfate
- sodium persulfate
- magnesium peroxide

According to the classification of NFPA 400, these are exclusively Class 1 solid oxidizing products. Nevertheless, it is advisable to check the class of the oxidizer in question (raw materials or finished products) on a case-by-case basis.

The rules for assimilating oxidants to "dry" goods are as follows and can be used as a basis for sizing the sprinkler protection to be provided:

Oxidizer	Liquid/ Solid	Type of containers/packaging	NFPA 13 equivalent
Class 1	S/L	incombustibles, whether or not wrapped in film or contained in paper bags	Class I
	S/L	non-combustible with combustible packaging	Class II
	L	plastics with capacity $\leq 18,9$ l	Class I
	L	plastics with capacity $> 18,9$ l	Class II
	S	plastics with capacity $\leq 3,8$ l	Class IV
	S	plastics with capacity $> 3,8$ l	Plastic Group A Unexpanded

S: Solid, L: Liquid, S/L: Solid or Liquid

SPRINKLER Protection: Smoke detection + ceiling sprinkler CMDA

Class 1:

Ceiling Sprinkler + in rack sprinkler applicable to the equivalent class under NFPA 13.

Class 2:

Ceiling sprinkler 12,2 l/min/m² @ 186 m² (high temperature heads) + in-rack sprinkler network at each level in the longitudinal stack.

Mode CMDA	Limits	Ceiling sprinkler protection	In-rack sprinkler protection	NFPA Standard
Class 1 Oxidizer	Storage height max: 6,1 m	CMDA: according to the class of equivalent goods above	No	NFPA 13 - V. 2019
Class 1 Oxidizer	Storage height max: 4,9 m	CMDA: 12,2 l/min/m ² @ 186 m ²	At each level in chimney. Calculation: 6 spk heads per level	NFPA 400 – Table 15.3.2.3.2.10B

OXYDIZERS CLASSIFICATION

G.2.2 Class 1 Oxidizers. The following are typical Class 1 oxidizers:

- (1) All inorganic nitrates (unless otherwise classified)
- (2) All inorganic nitrites (unless otherwise classified)
- (3) Ammonium persulfate
- (4) Barium peroxide
- (5) Calcium hypochlorite (nominal 80 percent, maximum 81 percent) blended with magnesium sulfate heptahydrate (nominal 20 percent, minimum 19 percent) having an available chlorine of less than or equal to 66 percent and a total water content of at least 17 percent
- (6) Calcium peroxide
- (7) Hydrogen peroxide solutions (greater than 8 percent up to 27.5 percent)
- (8) Lead dioxide
- (9) Lithium hypochlorite (39 percent or less available chlorine)
- (10) Lithium peroxide
- (11) Magnesium peroxide
- (12) Manganese dioxide
- (13) Nitric acid (40 percent concentration or less)
- (14) Perchloric acid solutions (less than 50 percent by weight)
- (15) Potassium dichromate
- (16) Potassium monopersulfate (45 percent KHSO₅ or 90 percent triple salt)**
- (17) Potassium percarbonate
- (18) Potassium persulfate
- (19) Sodium carbonate peroxide
- (20) Sodium dichloro-s-triazinetriene dihydrate (sodium dichloroisocyanurate dihydrate)
- (21) Sodium dichromate
- (22) Sodium perborate (anhydrous)
- (23) Sodium perborate monohydrate
- (24) Sodium perborate tetrahydrate
- (25) Sodium percarbonate
- (26) Sodium persulfate
- (27) Strontium peroxide
- (28) Trichloro-s-triazinetriene [trichloroisocyanuric acid (TCCA; trichlor), all physical forms]
- (29) Zinc peroxide

G.2.4 Class 3 Oxidizers. The following are typical Class 3 oxidizers:

- (1) Ammonium dichromate
- (2) Calcium hypochlorite (over 48 percent by weight unless covered by other formulations in G.1.2)**
- (3) Calcium hypochlorite (over 50 percent by weight unless covered in other formulations in Section G.2)
- (4) Calcium hypochlorite (over 50 percent by weight)
- (5) Chloric acid (10 percent maximum concentration)
- (6) Hydrogen peroxide solutions (greater than 52 percent up to 91 percent)
- (7) Mono-(trichloro)-tetra-(monopotassium dichloro)-penta-s-triazinetriene
- (8) Nitric acid, fuming (more than 86 percent concentration)
- (9) Perchloric acid solutions (60 percent to 72 percent by weight)
- (10) Potassium bromate
- (11) Potassium chlorate
- (12) Potassium dichloro-s-triazinetriene (potassium dichloroisocyanurate)
- (13) Potassium perchlorate (99 percent)**
- (14) Potassium permanganate (greater than 97.5 percent)**
- (15) Sodium bromate
- (16) Sodium chlorate
- (17) Sodium chlorite (over 40 percent by weight)

G.2.3 Class 2 Oxidizers. The following are typical Class 2 oxidizers:

- (1) Ammonium nitrate prill (99 percent)**
- (2) Barium bromate
- (3) Barium chlorate
- (4) Barium hypochlorite
- (5) Barium perchlorate
- (6) Barium permanganate
- (7) 1-Bromo-3-chloro-5,5-dimethylhydantoin (BCDMH)
- (8) Calcium chlorate
- (9) Calcium chlorite
- (10) Calcium hypochlorite (48 percent or less by weight unless covered by other formulations in G.1.2)**
- (11) Calcium hypochlorite (50 percent or less by weight unless covered by other formulations in Section G.2)
- (12) Calcium perchlorate
- (13) Calcium permanganate
- (14) Calcium peroxide (75 percent)**
- (15) Chromium trioxide (chromic acid)
- (16) Copper chlorate
- (17) Halane (1,3-dichloro-5,5-dimethylhydantoin)
- (18) Hydrogen peroxide (greater than 27.5 percent up to 52 percent)
- (19) Lead perchlorate
- (20) Lithium chlorate
- (21) Lithium hypochlorite (more than 39 percent available chlorine)
- (22) Lithium perchlorate
- (23) Magnesium bromate
- (24) Magnesium chlorate
- (25) Magnesium perchlorate
- (26) Mercurous chlorate
- (27) Nitric acid (more than 40 percent but less than 86 percent)
- (28) Nitrogen tetroxide
- (29) Perchloric acid solutions (more than 50 percent but less than 60 percent)
- (30) Potassium perchlorate
- (31) Potassium permanganate
- (32) Potassium peroxide
- (33) Potassium superoxide
- (34) Silver peroxide
- (35) Sodium dichloro-s-triazinetriene anhydrous (sodium dichloroisocyanurate anhydrous)**
- (36) Sodium chlorite (40 percent or less by weight)
- (37) Sodium perchlorate
- (38) Sodium perchlorate monohydrate
- (39) Sodium permanganate
- (40) Sodium peroxide
- (41) Sodium persulfate (99 percent)**
- (42) Strontium chlorate
- (43) Strontium perchlorate
- (44) Thallium chlorate
- (45) Urea hydrogen peroxide
- (46) Zinc bromate
- (47) Zinc chlorate
- (48) Zinc permanganate

G.2.5 Class 4 Oxidizers. The following are typical Class 4 oxidizers:

- (1) Ammonium perchlorate (particle size greater than 15 microns)
- (2) Ammonium permanganate
- (3) Guanidine nitrate
- (4) Hydrogen peroxide solutions (greater than 91 percent)
- (5) Tetranitromethane

N - AUTOMATED STORAGE & BATTERIES

Complex systems to be protected

The coming years will bring many innovations to our distribution centers, enabling more flexibility, faster delivery to our customers and also to increase storage capacity in smaller spaces.

We are talking about VNA (Very Narrow Aisle), Shuttle, Mini-load, Kardex, Scallog, Autostore, etc...



It will also be increasingly complex to properly protect this equipment for the following reasons:

- Li-Ion batteries will power these systems but the quality of these batteries will become less and less acceptable with the increase in fire risks.
- The study of hydrogen forklifts shows a complexity and technology that is controlled by the suppliers.
- Many plastic crates are used which provide the heat load in the event of fire.
- Optimized racking systems with little space and not designed to support intermediate sprinklers.
- A complexity to intervene for firefighters or intervention teams in systems not intended for it.
- Suppliers are more and more innovative but forget about protection: example Ocado who built an Autostore in the UK which burnt down.
- Flammable products and aerosols that cannot be stored in this kind of configuration.
- At present there is no defined fire protection for this type of technology so it must be studied on a case-by-case basis.
- Sprinkler systems in VNA Storage will be managed as shuttle or compact storage with no space between racks.
- Kardex systems can store flammable liquids under certain conditions to be validated and studied with the Corporate Health & Safety department. It is required to have a smoke detector inside the Kardex system that switches off the motor in case of a

problem and sprinkler protection inside the Kardex system.

Some additional requirements for forklifts/electrostatic risks are included in EHS-002-18 & EHS 301-01.

Nevertheless, we can issue some recommendations:

- Partitioning design of these storages to involve minimum surfaces in case of a problem
- Implement systems with certified batteries (see below)
- **Flammable finished products and category 1&2 aerosols should not be stored in these systems.**
- Data Sheet FM 8.34 is the current reference document that addresses protection in this type of storage.
- Plan, from the design stage with the supplier, to integrate sprinklers inside the storage and have a structure resistant to this load.
- Provide heat or smoke detection systems such as Vesda to detect overheating as soon as possible.
- Provide means of intervention inside the equipment.
- Always provide a fire extinguisher for each forklift / powered industrial truck

Different type of batteries to supply power

Lead battery	Li-ION Battery	Hydrogen
Long charging time: 7 to 8 hours and partial charging not possible. Need to have large batteries to cope.	Partial charging possible and quick charge, in 1h20 to 100%: well validated with electrical network	Solution not yet developed and under study at L'Oréal.
Lifetime: 1200 charge cycles	3000 charge cycles	Several constraints: - Obligatory partnership with Air Liquide and battery supplier who are the experts - High technology: tank at more than 350 bars. - Important investment - Profitable fleet for min 60 to 80 forklifts - Expensive energy - Possible subsidies - FM data sheet 7.39 & ICPE 4715
2 batteries needed for 3 stations	1 battery for 3 stations	
Handling risk: heavy battery	No change of battery	
Charging room required if P>50 kW (8 to 10 carts)	Charging room if P>600 kW (40-50 forklifts)	
Environmental risks and gas release	Recycling of batteries at end of life to be taken into account.	
Average efficiency	Better electrical efficiency (-20%): energy recovery when braking	
Extensive maintenance	Little maintenance, except problems are often electronic and require supplier intervention.	
Price includes 2 batteries	Equivalent forklift price because only one battery is needed	
ATEX or Reinforced Safety trolley possible. Standard EN 1755	EN 1755 standard not validated for the moment for Li-Ion battery	

Li-Ion Battery technology

Firstly, there are several lithium battery technologies and chemistries depending on 3 important criteria: size, weight and efficiency of the battery.

The table below shows the main Li-ion battery chemistries on the market (including phone, laptop and car batteries):

Cathode Material	Energy density		Thermal Stability
	Massive (Wh/kg)	Volumetric (Wh/L)	
Cobalt oxide	195	560	Bad
Nickel Cobalt Aluminium (NCA)	220	600	Medium
Nickel Cobalt Manganese (NMC)	205	580	Medium
Manganese oxide	150	420	Good
Lithium Iron Phosphate (LFP)	30-130	333	Very Good

Lithium Iron Phosphate (LFP) is much less energy dense. Therefore an LFP battery will be heavier and bigger than another battery of equivalent capacity (this battery is not used for cars or mobile phones).

Moreover, the LFP technology is safer because its degradation temperature is higher than other technologies, and this degradation does not lead to thermal runaway.

The LFP battery is therefore recommended for forklifts that do not have this weight constraint. Finally, it does not contain Cobalt, which is an element extracted in the Republic of Congo in conditions that do not respect our ethics.

The UL 28.20 and UN 38.3 standards are a guarantee of safety: the battery will remain safe even in case of abuse such as extreme temperature cycles, forced overloads, drops, short circuits, etc.

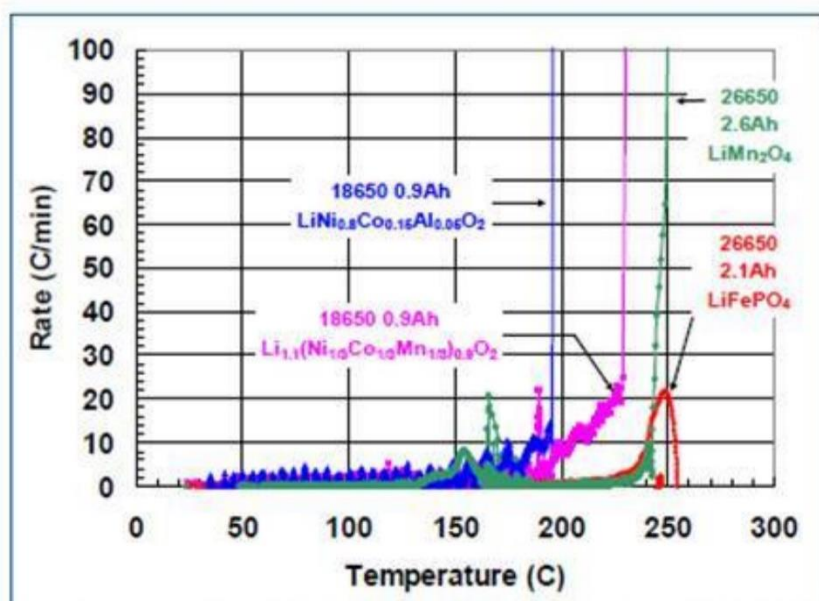


FIG. 7. Onset of self-heating in thermal ramp experiment on Li-ion cells. LiFePO₄ olivine cathodes show the greatest reduction in self-heating rate and increased onset temperature for runaway. (From Ref. 24)

The LFP in red has the highest degradation temperature but this degradation stops quickly and does not lead to thermal runaway,
The most important thing is to protect the cells as much as possible.
A Li-ion battery is composed of several cells.

When a cell reaches a certain temperature (usually around 130-150°C), exothermic chemical reactions occur between the electrodes and the electrolyte, which further increase the temperature.

If the heat produced cannot be dissipated sufficiently by the cell, the reactions accelerate, causing a rapid rise in temperature, which can lead to the phenomenon of thermal runaway.

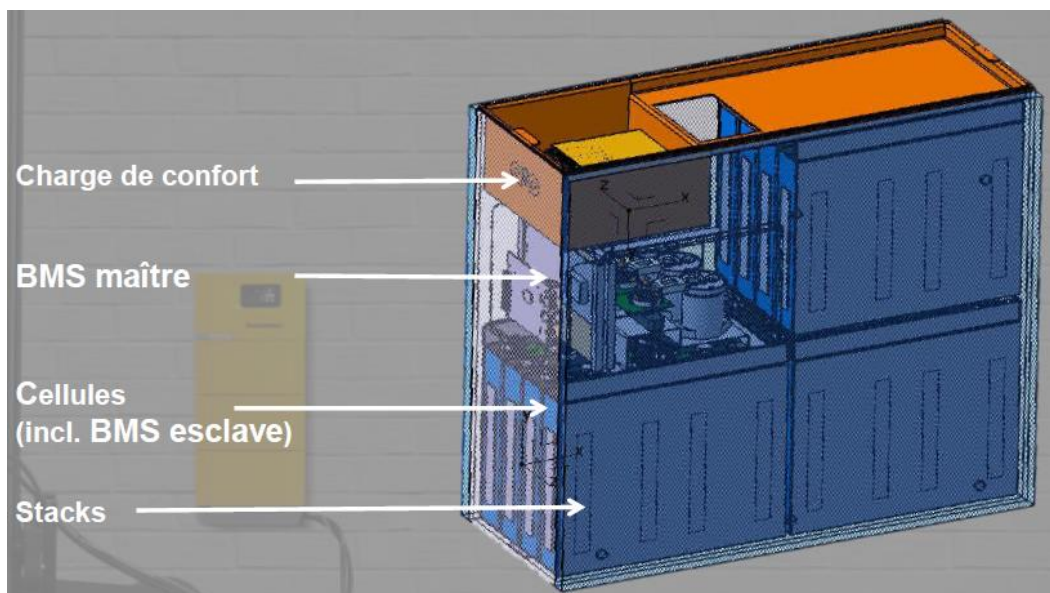
This reaction will lead to a strong generation of flammable gases inside the battery concerned and these gases will be evacuated either by a vent, provided for this purpose or by the explosion of the battery casing. The metals then melt and burn.

Batteries have a low capacity to dissipate heat and are therefore highly susceptible to thermal runaway.

The pressure generated by the vaporization of the electrolyte can then lead to mechanical failures inside the cell that can cause the rupture of its outer shell.

This loss of containment is then at the origin of the leakage of the electrolyte, a toxic, flammable and corrosive product, in liquid but also gaseous form. The vapors thus generated and mixed with the air can then form an explosive atmosphere (ATEX) which is toxic and corrosive containing phosphorus, fluorine and lithium.

In the case of external heating, thermal runaway is inevitable, regardless of the battery's electrical state of charge, if the external heating source is not interrupted in time.



Internal fuses must be present so they can be cut in case of too high a temperature (PTC).

The envelope of the batteries is also to be taken into account and especially its resistance and fire resistance: IP54 shells and resistance to strong compressions.

To save money, some manufacturers reduce the number of protections within the cells and the quality of the protection. This increases the risks if there is a problem with one of them.

BMS (Battery Management System)

This is an electronic card that continuously manages the charge, and possibly the discharge, of the cells and checks certain operating parameters (discharge intensity, minimum voltage, pack temperature, etc.).

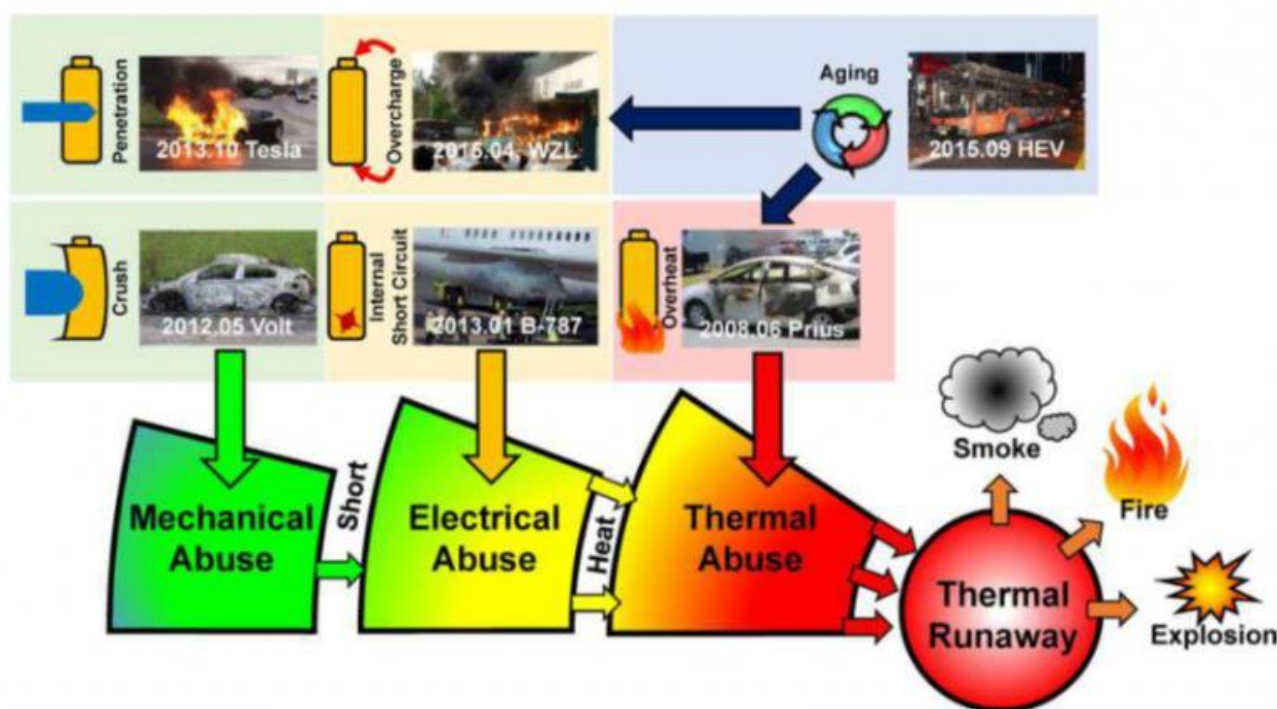
The purpose of the BMS is to cut the cell as soon as a parameter is not correct. Some even make it possible to read all this information on a smartphone (called Smart BMS). The BMS greatly limits the risk of runaway and must control at least:

- T° of each cell and of the whole
- Voltage of each cell and of the whole
- Management of cell protection by fuse
- Charge and discharge time / Residual capacity

There are also, some manufacturers who do not hesitate to use much simpler cards that only manage the charge (and not the discharge), and do not control all the internal parameters of the pack.

Each missing feature creates a greater risk if a cell fault occurs, causing a thermal runaway and gas release.

The causes of thermal runaway can be multiple: too high voltage, overload, overcurrent, short circuit inside the cell, or outside, too high temperature, physically damaged pack, charging after over-discharging...



Prevention measures:

Conventional fire extinguishers are fairly ineffective against these types of fires. You need at least a type D extinguisher (for metal fires), but even these have rather limited capabilities on this type of fire.

The company Eurofeu recommends the following, for these LithEx extinguishers dedicated to lithium fires.

- **Have a smoke detector near your charging location, as well as a fire blanket and fire extinguisher.**
- **Possibly put timers on the chargers to make sure you turn off the charge during shifts when no one is around.**
- **Remove all flammable or combustible objects 3m around the charging area.**
- **Buy equipment with UN 38.3 and UL 25.80 standards**
- **Avoid Cobalt in your battery.**
- **Check the source of the BMS, the elements controlled by the BMS as well as the installation of an independent fuse per cell.**
- **Do not exceed the maximum charging currents authorized by the manufacturer and have the battery charging equipment checked.**
- **If your equipment has suffered a major impact have it checked by the manufacturer**

General Requirements for Sprinkler protection:

Regardless of the quantities stored, the fire protection of the storage racks is carried out according to one of the following options, depending on the constraints of implementation and/or operation.

- Height of the building generally higher than 14 m up to 16.7 m and beyond
- Slope of the building limited to 16.9%.
- Height of storage
- Type and volume of containers
- Type of class of flammable and combustible liquids: limited to class IB finished products with a unit volume of less than 180 ml
- Width of aisles less than 2.40 meters with a specific criterion of 1.10 m (VNA)
- Minimum clearance 1 meter
- Minimum width of the longitudinal chimney: 15 cm

The aisle width determines the type of rack storage to be considered:

Rack aisle width	Type of storage to consider
< or = 1,1 m	Multiple Racks
> 1,1 m	Double or Single Racks

The most flexible envelope solution will be suggested as a priority, i.e. protection limited to the ceiling protection without intermediate in-rack networks.

Sprinkler Protection of storage in high racks, packaged finished products, without flammable or combustible characteristics, whatever the unit volume, packed in glass or plastic.

Building requirements: no solid barriers in rack

Risk Classification: Applicable to the class of finished products with no flammable or combustible characteristics, similar to exposed plastic Group A.

Sprinkler Protection: ESFR ceiling protection alone or ESFR ceiling protection with intermediate in-rack network at 9.10 m or 12 m without accumulation of hydraulic requirements

ESFR	Limits	Ceiling Protection	In-rack sprinkler Protection	NFPA Standard
Non-flammable and non-combustible finished products in boxes	Building h: > 14 m and < 16,8 m Storage h: > 13 and up to 15,2 m Minimum Aisle Width 1,80 m	Sprinkler ESFR, 9 x K 480 @ 3,8 b	No	FM DS - V. 2019: table 17b
	Building h: > 16,7 m Storage h: > 15,7 m Aisle Width < or = à 1,10 m	Sprinkler ESFR, Valid to cover the height between IRAS and roof 12 x K required @ pressure required according to table 23.6.1	Sprinkler ESFR at 9,1 m: 6 x 250 l/min (K200) or at 12,2 m: 6 x 455 l/min (K200)	NFPA 13 - V. 2019: 25.8.2 option 2 + scheme 25.8.2.4 f) + table 25.8.2.6 and table 25.8.2.7

The proposed "envelope" specification provides flexibility because of the absence of intermediate networks. Option 25.8.2 of NFPA 13 is interesting because it does not require cumulative ceiling protection and IRAS hydraulics, thus limiting the water source to the greater of the 2 hydraulic requirements.

NOTE:

The hydraulic calculation is based on the non-cumulative operation of the ceiling protection and the intermediate networks, taking into account the higher of the 2 needs.

The motor-driven pump unit is sized according to the water demand of the roof network + intermediate networks + fire hydrants + external fire hydrants, if they are supplied by the motor-driven pump unit.

Sprinkler Protection of storage in high racks, packaged finished products, with flammable or combustible characteristics => Chapter J Case#2 and Case#3

Ensure that aisles are of sufficient width (> 1,1 meter) otherwise it will make protection difficult.



EHS Management System



Management of Internal and External Worksites

EHS-INS-002 A

06/2024

Cancels and supersedes:
EHS-301-29, EHS-002-11,
EHS-002-13, EHS-002-14,
EHS-002-15

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

creation

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

CONTENTS

1	AIM	3
2	SCOPE	3
3	ROLES, RESPONSIBILITIES AND TRAINING	3
3.1	The site/entity director:	3
3.2	The EHS site/entity director (or their designated representative):	3
3.3	The order giver	4
3.4	The geographical manager.....	5
3.5	The manager of external companies	5
4	MANAGEMENT OF WORK OF EXTERNAL COMPANIES	6
4.1	Selection of external companies	7
4.2	The order	7
4.3	Prevention plan	7
4.4	EHS training.....	9
4.5	Authorization of work	10
4.6	EHS specific work permits.....	11
4.7	Specific case of subcontractors with premises on site	11
4.8	Monitoring	12
4.9	Acceptance of work.....	12
5	MAIN PROJECTS	12
6	MANAGEMENT OF WORK OF INTERNAL (L'ORÉAL) EMPLOYEES	13
7	ASSOCIATED EHS DOCUMENTS.....	14
8	APPENDICES	15
8.1	Appendix 1: EHS information package from an external company	15
8.2	Appendix 2. Prevention plan.....	16
8.3	Appendix 3: Authorization of work	23
8.4	Appendix 4: Safety questions by topic	26

1 AIM

The purpose of this general instruction is to describe the EHS organization in case of interventions by internal L'Oréal employees/technicians and external companies contracted by L'Oréal, in order to control the risk of accidents and impacts on the environment.

The internal worksite means L'Oréal's workplace where employees hired by L'Oréal are managed by L'Oréal staff and carry out various jobs, including hazardous work requiring a work permit.

Outside companies within the meaning of this instruction, are companies contracted by L'Oréal for specific tasks, excluding intellectual services (e.g., construction, security, maintenance, cleaning, inspection, etc.).

Temporary staff hired by an agency and working under the direct responsibility of L'Oréal are excluded as they must be treated as L'Oréal employees.

This instruction does not apply to companies engaged in manufacturing, packaging, storage and transport activities.

2 SCOPE

This instruction applies to all L'Oréal sites.

3 ROLES, RESPONSIBILITIES AND TRAINING

3.1 The site/entity director:

- ensures the implementation and respecting of this instruction within their site/entity
- may formally delegate to the EHS site/entity director their responsibility for the validation of prevention plans
- lists the order giver and geographical managers

3.2 The EHS site/entity director (or their designated representative):

- organizes general EHS training for employees of external companies
- approves and signs all prevention plans
- supports the order giver during the risk analysis in case of hazardous work requiring a permit:
 - o work at height
 - o confined space

- o hot work
 - o excavation work
 - o lifting work
 - o intervention on medium and high voltage electrical installations
 - o work in an area at risk of explosion) or complex activities
- approves and signs specific permits for hazardous work
- participates in weekly follow-up meetings
- visits daily areas of intervention involving dangerous operations and records deviations
- draws up a list of order givers and organizes their training

3.3 The order giver

The order giver is the person who assigns an external company to work on the site. To be qualified, an order giver must have undergone training organized by the EHS site/entity director on their role and responsibilities. Each site must have a document defining the roles and responsibilities of the order giver. Regardless of the size of the site there must be a trained order giver, who:

- carries out the risk analysis (common inspection) with external companies
- develops and signs the prevention plan(s) with the external company(ies) and has it validated and signed by the EHS
- develops and signs work authorizations with external companies and the geographical manager
- verifies the adequacy and validity of qualifications and authorizations, of each employee of contractors, required by local legislation and/or L'Oréal requirements, (e.g. medical certificates, safety training etc.) **LIFE 1**
- develops, signs and has validated by the EHS, specific permits for hazardous work. The geographical manager and the representative of the external company also sign the specific permits
- conducts daily briefings, weekly meetings and daily visits
- is present on site during the intervention (except non-hazardous interventions described in the annual prevention plan such as routine cleaning, security, etc.)
- is present on site in the event of hazardous work at night or outside normal site operations.
- ensures documents relating to the site are posted on the intervention area
- in the exceptional case of equipment loan, draws up a loan agreement and ensures it is signed by the site director and the representative of the external company
- ensures the workplace is fenced off and adequate safety signs are in place

- validates the end of work with the representative of the external company, checks there is no residual risk, the intervention area is clean, and all equipment is operational
- it is the responsibility of the order giver and the EHS site/entity director to make sure that waste associated to the worksite is measured, controlled, and treated according to the Group standard. Please refer to Appendix 7.4.11 for waste management

TRAINING	WHEN	BY WHO
• Roles and responsibilities (legal) • Writing prevention plans • Risk analysis (co-activity) • Checking contractor's qualifications and authorizations • Writing work authorizations • Writing specific permits • Follow-up and validation of the end of the work	• Initial training before the first prevention plan • Supported by the site expert during the first prevention plan • Repeated annually	The EHS site expert on the management of external companies

3.4 The geographical manager

The geographical manager is the person responsible for the sector in which the operations will take place. They:

- sign and participate in the preparation of the work authorization and prevention plan
- authorize the start of work, taking the co-activity into account
- are responsible for managing co-activity between external companies and employees in their sector.

TRAINING	WHEN	BY WHO
• Roles and responsibilities (legal) • Risk analysis (co-activity) • Writing specific permits	• Initial training before the first work permit. • Supported by the site expert during the first work authorizations.	The EHS site expert on the management of external companies.

3.5 The manager of external companies

The person delegated by the external company to draw up and sign a prevention plan. They:

- must be trained by the site EHS expert regarding general safety rules of the site and management of works carried out by external companies
- write the operating procedure for the intervention
- carry out the risk analysis (common inspection) with the order giver
- prepare and sign the prevention plan

- provide work equipment (portable or stationary machinery, construction machinery, scaffolding, ladders, etc.) and ensure that it complies with the regulations in force and can be used safely, and provide the necessary supporting documents
- ensure that their employees are qualified to carry out their tasks and provides the necessary documents and authorizations
- use the prevention plan to explain the hazards and prevention measures implemented to the operators under their responsibility (including those of its subcontractors), and ensure the traceability of this training **LIFE 2**
- ensure that their employees and subcontractors comply with the EHS instructions/procedures of the site
- sign and take part in the drawing up of the work authorization(s) and specific permits with the order giver and the geographical manager. The work authorization and specific permits can be signed by a person from the external company present on site at the time of the risk analysis
- immediately report any risky situations
- participate in weekly meetings
- validate (or a person from the external company) the end of work with the order giver, check there is no residual risk, the intervention area is clean, and all equipment is operational (if applicable)

TRAINING	WHEN	BY WHO
• Roles and responsibilities (legal) • Risk analysis (co-activity) • Writing specific permits	• Initial training before the first work permit. • Supported by the site expert during the first work authorizations.	The EHS expert of the site on management of external companies.

4 MANAGEMENT OF WORK OF EXTERNAL COMPANIES

Some operations are not initiated by L'Oréal, such as the delivery of works and the operations of electricity distribution companies, etc. In these cases, the instruction will not be followed in its entirety. In such circumstances, EHS instructions adapted to each case must be put in place.

The flowchart below describes the various steps to be followed in order to control EHS aspects as effectively as possible:



4.1 Selection of external companies

To be selected, an external company must comply with EHS requirements. To do so, the external company must complete a company's EHS selection file.

The selection of the external company is based primarily on the EHS elements provided in the company's EHS selection file, its reputation, financial health and any history of previous interventions.

Updated every 3 years.

4.2 The order

Once the company is selected, the order will be placed with reference to the quote.

4.3 Prevention plan

A prevention plan must be drawn up for any type of intervention **LIFE 2** (excluding intellectual services), whether hazardous or not, and whatever the duration, based on a risk assessment. It must include all the contractors and subcontractors associated with this intervention.

Before starting any work, the EHS site/entity director and order giver must do an assessment of the risks related to the work, including the risks of co-activity with other companies involved. This assessment must be carried out in the presence of a representative of the company concerned. It must include a site visit.

The company representative must select the group of hazards to be assessed in relation to the tasks to be carried out.

For each hazard identified, adequate prevention measures must be put in place.

It must follow the process and contain all the information on the prevention plan form in Appendix 1.

If some companies regularly work on the site (security, gardening, routine electrical work, etc.) an annual prevention plan can be signed.

The prevention plan must be updated in case of:

- a new task not described in the prevention plan.
- a new contractor or subcontractor
- modification of the duration and/or organization of the work

WHO	WHAT	HOW
Operating procedures		
External company manager	Details of different phases/tasks of the intervention	Appendix of EHS-INS-002
↓		
Prevention plan/Risk assessment		
External company manager Order giver	Risk identification for each task. Co-activity risk identification. Definition of risk means of control. Definition of who is responsible for putting in place each means of control.	Appendix of EHS-INS-002 & EHS-PRO-003 & EHS-FORM-001
↓		
Common inspection		
External company manager Order giver	Where the intervention will take place Complete the risk assessment	Appendix of EHS-INS-002 & EHS-PRO-003 & EHS-FORM-001
↓		
Validation		
External company manager Order giver EHS	Signing of the prevention plan by all stakeholders	Appendix of EHS-INS-002
↓		
Distribution and training		
External company manager Order giver	Training of contractors Distribution of the prevention plan	Appendix of EHS-INS-002

4.4 EHS training

All employees of external companies and their subcontractors receive general EHS training as well as training on the specific risks associated with the intervention area **LIFE 1** (ATEX, traffic, etc.)

This training is renewed every year.

In the case of a new EHS rule or a modification of an existing EHS rule, each employee must receive additional training.

A test must be taken at the end of the EHS training to verify that the main points have been understood.

This EHS training must be registered.

An employee of an external company **CANNOT** enter the site and start working if:

-They have not completed the general EHS training

-They are not listed on the prevention plan

4.5 Authorization of work

Before the start of each intervention by a contractor an authorization of work is issued **LIFE 1** (Appendix 3).

WHO	WHAT	HOW
External company manager Order giver Geographical manager EHS site/entity director for specific work permits	Write a work authorization linked to a prevention plan	See Appendices or Digital prevention plan tool
	↓	
	Identification of the risks associated with the day's work If presence of specific risks as per Chapter 8.2.5, draw up specific work permits with EHS validation	
	↓	
	Definition of means of risk control	
	↓	
	Validation of the authorization of work	
	↓	
	Distribution and communication	

Work authorizations can be validated for up to 7 days but must be reviewed and signed by the order giver every day. Access to the intervention area is subject to the daily signing of the work authorization.

A work authorization is not required for companies that are permanently present on the site and carry out routine tasks (e.g., security guards, cleaning staff, etc.); however, it is necessary when these companies carry out hazardous work requiring a specific work permit, or work involving hazardous energies.

4.5.1 Co-activity management

Where at least two companies are present simultaneously on the same project or within the same area, their activities must be coordinated so that the activities of one company do not create significant risks for others.

These aspects regarding the coordination between companies must be included in prevention plans.

4.5.2 Work outside working hours

In order to manage unplanned interventions outside of working hours, a stand-by system must be set up for the order giver and the EHS site/entity director (if necessary, to validate specific work permits).

In case of dangerous interventions at night or outside the periods of activity of the site (weekends, public holidays, etc.), the order giver must be permanently present on site.

Early-morning or late-evening interventions by permanent external companies/services such as housekeeping, canteens, etc. are carried out on the basis of an annual prevention plan with an appointed order giver.

4.5.3 Loan of equipment:

In exceptional cases, equipment owned by L'Oréal can be used by external companies only if:

- a loan agreement is signed between the two companies (the site director or his representative for L'Oréal and the representative of the external company)
- the equipment is validated EHS Green
- operators are trained to use the equipment

4.6 EHS specific work permits.

In order to control specific risks, the order giver must prepare specific work permits for each type of hazardous work (list not exhaustive):

- Work on medium or high voltage electrical installations
- LOTO (fluids, electricity, gas, hydraulics)
- Hot work (EHS-FORM-021)
- Work at height (EHS-FORM-024)
- Work in confined space (EHS-FORM-026)
- Excavation work (EHS-FORM-025)
- Lifting work
- Mechanized handling work (EHS-FORM-023)
- Work in an area that presents a risk of explosion (e.g., ATEX area)

Specific work permits are validated and signed by the EHS site/entity director or his representative.

4.7 Specific case of subcontractors with premises on site

This scenario must be avoided as much as possible (internal control, dependence, etc.).

Subcontractors must be regularly audited (twice a year minimum).

L'Oréal employees must not be authorized to use equipment belonging to the subcontractor.

Equipment belonging to the subcontractor must not be validated by L'Oréal.

4.8 Monitoring

Regular visits to the work area must be carried out by the order giver:

- at least every 2 hours for construction sites where work requiring specific permits is carried out.
- daily for others work areas.

These visits are aimed at checking that the safety rules are obeyed by the operating companies.

The results of these visits must be recorded. Any discrepancies will result in an EHS event being issued, which will be dealt with accordingly and may have an impact on the company's EHS performance.

The site visits may be organized according to theme (e.g., management of dangerous activities, machine and pedestrian traffic, etc.) and/or according to site areas.

The order giver can carry out these visits on the basis of specific questions. To ensure consistency between visits on the same site, it is recommended that a site-specific visit protocol be drawn up by the EHS site/entity director using the questions in Appendix 4.

The order giver and the geographical manager have the authority to stop work immediately if an unacceptable risk is identified. The order giver must then inform the manager of the external company.

4.9 Acceptance of work

Acceptance of work will be carried out by the client (ordering company).

During acceptance, it will be checked that there is no residual risk, that the work area is clean, and all equipment is operational.

5 MAIN PROJECTS

For sites with multi-LIFE activities, high risk projects such as construction, industrial process improvement, production equipment installation (e.g. skid/platform), whose volume of activities does not exceed one of the thresholds required by EHS-INS-001 "EHS Organization of Major Projects", are required to appoint an EHS officer dedicated exclusively to the project, with defined roles and responsibilities.

The EHS Officer

The EHS officer is the person representing L'Oréal who is responsible for the EHS management of contractors. The EHS officer can be an internal or external resource under contract with L'Oréal. They are managed by and report to the EHS site/entity director.

The EHS officer has a key role to play in ensuring that risks are kept under control during work carried out by external contractors. They are present on site during all phases of the work, as defined in the project's general prevention plan.

They have the authority to stop the project if the EHS rules are not respected, and to stop the project if a significant EHS problem is identified.

The EHS officer must be trained and experienced:

- At least 3 years' experience supervising work on construction sites as an EHS coordinator/officer or equivalent
- Possess the necessary regulatory certificates to perform the role, where applicable. If not required, the EHS officer must demonstrate their qualifications through detailed EHS training as part of previous assignments
- First aid and fire response training
- Languages spoken must be at least the local language and English

Their tasks on site are defined in the project's general prevention plan:

- Carry out construction risk analysis with external contractors
- Validate prevention plans drawn up by external contractors
- Continuously monitor work, from start to finish, to ensure that risks are kept under control and that EHS rules are applied at all times
- Be responsible for training all EHS representatives and operators in the EHS rules applicable to the project
- Issue and approve hazardous work permits (specific permits such as fire permits)
- Ensure that instructions are passed on
- Prepare the various models of EHS documents to be used during the project (prevention plan, hazardous work permits, daily briefing, site visit reports, etc.)
- Monitor EHS performance of external contractors

In case of major projects which cover daily extended hours, week-ends and nights, the site must insure adequate number EHS officers to cover hours working of contractor.

6 MANAGEMENT OF WORK OF INTERNAL (L'ORÉAL) EMPLOYEES

The internal (L'Oréal) employees carrying out work on L'Oréal premises must be qualified, trained, and familiar with the risk assessments related to their specific work.

L'Oréal employees, such as technicians can only be managed by L'Oréal management staff; supervision cannot be outsourced to an external company.

All maintenance and service work that is not classified as hazardous is carried out based on standard work instructions.

Any hazardous work to be carried out by a L'Oréal employee must follow a specific work authorization process. **LIFE 1**

Each site must maintain a list of all identified hazardous works carried out by L'Oréal employees, which are executed based on a specific permit to work.

The work authorization process must be the same as for external companies and must include all parties: the order giver, area manager, EHS validation, and the employees carrying out the work.

It is forbidden for one person to act as order giver, area responsible, worker executing the work and EHS staff, it must be minimum 2 persons to validate the permit.

7 ASSOCIATED EHS DOCUMENTS

This Instruction is linked to the following procedures and instructions:

- EHS-PRO-008 EHS Incident Management
- EHS-INS-003 Lifting Operations
- EHS-INS-004 Excavation Work
- EHS-INS-005 Work at Height
- EHS-INS-018 Operations in Confined Spaces
- EHS-INS-048 Worksite Electrical Safety
- EHS-INS-023 Lockout/Tagout
- EHS-FORM-023 Mechanized Handling Work Permit

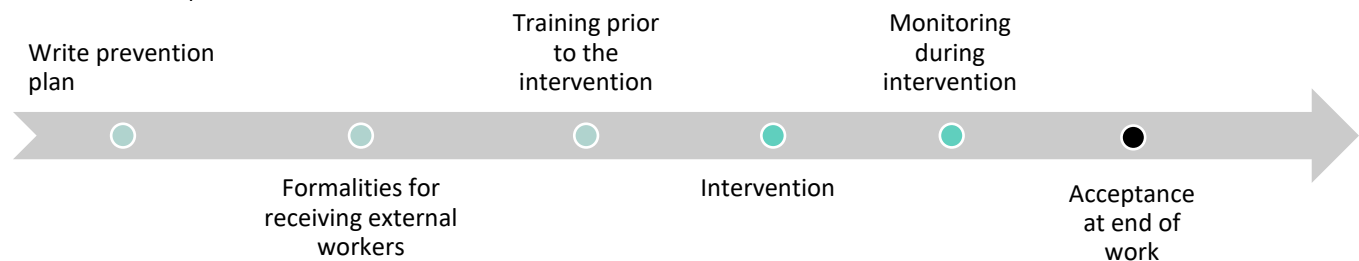
This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.

8 APPENDICES

8.1 Appendix 1: EHS information package from an external company

A - L'Oréal site:

The site describes the work to be carried out, services required and informs the external company of the timing/schedule for the stages of the intervention and the planned commitment, as follows:



During urgent/emergency work the prevention plan can be written the same day of the intervention, as an exception. Formalities and training must also be included.

B – External company:

The external company addresses the following criteria:

- Company activity and areas of professional competence
- Indicate the number of employees in the company (permanent contract, fixed-term contract, % of temporary workers)
- Provide a list of subcontractors likely to be used for interventions in our company and specify the activity(ies) they will perform. Second-level subcontractors are forbidden
- Provide a list of persons authorized to draw up and sign a prevention plan (including common inspection), work authorizations and specific work permits (fire, work at height, etc.)
- Provide a valid proof of insurance
- Provide a copy of the company's EHS policy.
- Certifications (e.g. ISO 14001, ISO 50001, ISO 45001 etc.)
- Describe the EHS training provided to employees, and how often (fire, first aid, forklift operator, etc.)
- Provide a copy of the company's annual EHS action plan
- Provide the safety results for the last five years (frequency rate, severity rate and number of accidents)
- Provide the names of the people likely to be working on the site (including subcontractors) and indicate the authorizations, qualifications, and medical skills required.
- Indicate whether any personnel likely to be on site do not speak the local language.
- Provide a list of complaints from associations relating to environmental pollution.
- Indicate if the company carries out EHS audits and accident analyses. If so, attach a copy of previous reports.
- Equipment used complies with regulations.
- Other (please specify):

8.2 Appendix 2. Prevention plan

Prevention plan # _____

(Allocated by the EHS & FACALITY Manager)

INFORMATION RELATING TO THE OPERATION

OPERATION

Nature of the operation: _____

Location of the operation: _____

Projected duration: _____

Start date: ____ / ____ / ____ at ____ o'clock

(hours/12 months)

End date: ____ / ____ / ____ at ____ o'clock

USER COMPANY

Company name: _____

Address: _____

represented by: _____

Operations Manager: _____ Department Manager: _____

Representative of the EHS consulting organization: _____

EHS & FACALITY Manager: _____

Site Physician: _____ Safety Manager: _____

EXTERNAL COMPANY

Company name: _____

Address: _____

External company represented by: _____

Number of operators: _____ (not including sub-contractors)

Representative of the EHS consulting organization: _____

Site physician: _____

To be completed by the operating company when sub-contracting part of the operation

Name and references of the sub-contractors employed by the operating company <i>(note the number of employees representing each of the sub- contractors)</i> <i>(attach a list with the names of the sub-contracting personnel)</i>	Nature of the sub-contracted work <i>(specify when it will be carried out)</i>

Total number of operators: _____ (personnel from external company) + _____ (sub-contractors)

= _____ (attach list of names in appendix)

PRIOR COMMON INSPECTION OF THE LOCATION OF OPERATIONS		
Date of prior common inspection of the location of operations, the installations present and the equipment _____ _____ made available to the external company: _____ / _____ / _____		
The Manager _____ of the department involved in the operations is a participant in the inspection?	YES	NO
The Safety Manager _____ must participate in the compilation of the Prevention Plan.		
Name of the Safety Manager: _____		
Equipment _____ is made available to the operating company?	YES	NO
If so, specify: _____ (nature of the equipment, distribution of maintenance costs)		

Cloakrooms have been reserved?	YES	NO
If so, specify: _____		
The sectors of operation of the external company have been determined?	YES	NO
Specify: _____		

The dangerous areas have been or will be marked out (before the start of work)?	YES	N/A
If so, specify: _____		

The paths to access the location of the operation, bathrooms, cloakrooms and restaurant are indicated?	YES	NO
(If access to the cloakrooms and/or restaurant has not been provided, delete the corresponding phrase)		

SAFETY INSTRUCTIONS FOR EXTERNAL COMPANIES		
The representative _____ comments on and submits to the representative of the external company, a document giving the safety instructions for external companies. The representative of the external company must sign it and include the phrase "read and approved". This document must be duplicated and attached as an Appendix to each prevention plan.		
DESCRIPTION OF THE OPERATION		
BREAKDOWN OF THE ACTIVITY	EQUIPMENT USED	If the equipment is not suitable: proposed corrective measures
The entry of chemical products on the site _____ must correspond to the absolute minimum required by the operations. These products and their quantities must be listed below: The Safety Data Sheets of these products must be attached in the Appendix.		
COMPETITOR	QUANTITY	Nature of the corresponding work
Any product not mentioned in this table is forbidden to enter the site, even if in storage in vehicles. The presence of asbestos in any form whatsoever is strictly forbidden. A certificate proving the absence of asbestos in the construction materials used may be required.		

RISKS OF INTERFERENCE AND PREVENTION MEASURES

RISKS IDENTIFIED		PREVENTION MEASURES	
	RESPONSIBILITY OF:		RESPONSIBILITY OF:
	Ordering. Co. Ext. Co.		Ordering. Co. Ext. Co.
I – CIRCULATION			
Site access	( ) ( )	.....	( ) ( )
Falls	( ) ( )	.....	( ) ( )
Impacts	( ) ( )	.....	( ) ( )
Collisions	( ) ( )	.....	( ) ( )
Obstacles	( ) ( )	.....	( ) ( )
II – CIRCULATION ON LEVELS			
Level changes	( ) ( )	.....	( ) ( )
Excavations	( ) ( )	.....	( ) ( )
Stairs	( ) ( )	.....	( ) ( )
Steel structures	( ) ( )	.....	( ) ( )
Roofs	( ) ( )	.....	( ) ( )
Ceilings	( ) ( )	.....	( ) ( )
Ladders	( ) ( )	.....	( ) ( )
Scaffolding	( ) ( )	.....	( ) ( )
Other	( ) ( )	.....	( ) ( )
III – HANDLING			
Handling of loads	( ) ( )	.....	( ) ( )
Self-propelled trucks	( ) ( )	.....	( ) ( )
Mobile cranes	( ) ( )	.....	( ) ( )
Lifting equipment	( ) ( )	.....	( ) ( )
Goods lifts	( ) ( )	.....	( ) ( )
Lifting tables	( ) ( )	.....	( ) ( )
Overhead storage	( ) ( )	.....	( ) ( )
Loading/Unloading	( ) ( )	.....	( ) ( )
IV – PHYSICAL ENVIRONMENT			
Noise	( ) ( )	.....	( ) ( )
Lighting	( ) ( )	.....	( ) ( )
Heat	( ) ( )	.....	( ) ( )
Cold	( ) ( )	.....	( ) ( )
Dust	( ) ( )	.....	( ) ( )
Humidity	( ) ( )	.....	( ) ( )
Radiation	( ) ( )	.....	( ) ( )
V - TOOLS			
Portable, electrical, pneumatic			
Drill	( ) ( )	.....	( ) ( )
Grinder	( ) ( )	.....	( ) ( )
Cutter	( ) ( )	.....	( ) ( )
Pneumatic hammer	( ) ( )	.....	( ) ( )
Dowel driver	FORBIDDEN	.....	( ) ( )
Oxy-cutting	( ) ( )	.....	( ) ( )
Welding	( ) ( )	.....	( ) ( )

RISKS OF INTERFERENCE AND PREVENTION MEASURES

RISKS IDENTIFIED		PREVENTION MEASURES	
		RESPONSIBILITY OF	
	Ordering. Co.	Ext. Co.	Ordering. Co. Ext. Co.
VI – CHEMICAL PRODUCTS			
Toxic	()	()	 () ()
Corrosive	()	()	 () ()
Inflammable	()	()	 () ()
Radioactive	()	()	 () ()
Biological	()	()	
VII – USE OF GAS			
Risk of asphyxiation	()	()	 () ()
Risk of explosion	()	()	 () ()
Toxic risk	()	()	 () ()
VIII – ELECTRICITY			
Operations on low voltage	()	()	 () ()
Operations on high voltage	()	()	 () ()
Proximity of overhead lines	()	()	 () ()
Proximity of buried lines	()	()	 () ()
IX – MOVING PARTS			
Conveyor belt	()	()	 () ()
Machines	()	()	 () ()
Projections	()	()	 () ()
Breakdowns	()	()	 () ()
Unscheduled start-up	()	()	
Falling objects	()	()	
X – OTHER RISKS			
Work with hot points	()	()	 () ()
Overhead work	()	()	 () ()
Work in confined spaces	()	()	 () ()
Overhead fluid circuits	()	()	 () ()
Type:			 () ()
Buried fluid circuits	()	()	 () ()
Type:			 () ()
Lockout	()	()	 () ()
Type of floor	()	()	 () ()
Loan of equipment	()	()	 () ()

EMERGENCY ORGANIZATION

General Principle: availability to the operators of the emergency organization system of _____
 _____ has an emergency number strictly reserved for serious situations (serious accident or incident, fire): _____

This number can be called from any telephone extension.

In situations that do not constitute an emergency (harmless incident or accident), the operators involved must call the closest person _____ who will put them in contact with the head of the relevant department.

In the event of evacuation (siren), an evacuation manager will guide all the personnel in their sector, including those from external companies, towards the collection point located outside the buildings (close to the security station).

Specific case: isolated operator.

Wherever possible, no person may work in isolation (in other words: alone, night work, outside of operating hours _____, in an isolated location, without immediate assistance available, etc.).

It remains the responsibility of the external company involved to take all the necessary measures to ensure that none of their employees work in isolation or in a location without immediate assistance available.

If the manager of the external company intends to have one of its employees working in isolation, they must complete the two paragraphs below:

* **Specify the reason for the isolation, its duration, the specific times (start and end), the location where the work is carried out:**

* **Consequent preventive organization:**

ORGANIZATION OF PERSON IN CHARGE

To be specified in the event of participation of employees of one company (possibly participation of employees _____) in operations carried out by another:

SPECIFIC MEASURES FOR THE PROTECTION OF THE ENVIRONMENT

Type of waste generated:

Storage method:

Removal method:

SPECIAL MEDICAL MONITORING

List of workstations likely to require special medical monitoring due to risks related to work carried out.

- _____:
- **Operating company:** _____
- **Other:** _____
(it is possible that another external company working on the same operation is involved with this type of workstation)

PERIODIC MEETINGS AND INSPECTIONS

Due to the duration or the risks inherent in the operation,
periodic inspections and meetings are scheduled?
Frequency: _____

YES

NO

(Sum of the total hours of all operators), the periodic meetings and inspections are at least quarterly.

Date of the next inspection: ____ / ____ / ____

At each new inspection, the prevention plan will be updated.

This inspection must:

- be indicated at least 3 days in advance to the safety representative and the representative of the EHS consulting agency
- be accompanied by an update of this prevention plan
- lead to new information being given to the employees involved

MODIFICATION OF THE OPERATING CONDITIONS

In the event of modification of the operating conditions regardless of what they are, the company responsible for these modifications undertake to notify the other company accordingly.
If necessary, this prevention plan will be updated as a result.

SPECIFICS INHERENT TO THE EXTERNAL COMPANY

The operating company undertakes:

- to inform its personnel, including the personnel of the sub-contracting companies used, on the location of the operation (the same will apply for any new operator arriving during the operation):
 - of the dangers to which they are exposed
 - of the preventive measures defined as a result
 - of the circulation paths to be used
 - of the emergency exits and any emergency equipment available
 - of all the instructions to be followed that are listed in this prevention plan
- to inform the Manager _____ of the arrival of any new operator
- to apply and ensure the application of the measures defined in this plan and its appendices
- to communicate any necessary information to their own site physician, representative of the EHS consulting agency, etc.
- to inform the Manager _____ of the end of operations and obtain his notification before departure.

SPECIFICS INHERENT TO _____

The representative _____ undertakes to:

- compile a prevention plan for each of the external companies (except their sub-contractors) involved in this operation
- attach a list of the external companies involved in this operation
- advise in writing of the inspection of the work at the start of work (to be done from the start of the operation).

AVAILABILITY	
This prevention plan is available and will be communicated at their request to: ➤ the representative of the EHS consulting organization (CHSCT, etc.) ➤ the site physician ➤ the site inspector ➤	
SIGNATURE	
_____ and the operating company state their approval of all of the above. This prevention plan is valid for the operation described on the first page, which will begin at the earliest on the date of signature below. Signed at: _____ on: ____ / ____ / ____ in duplicate, one of which is given to the representative of the external company.	
For: Name of the Representative: Signature: <i>(preceded by the phrase "read and accepted")</i> Department Manager: <i>(name and signature)</i> EHS & FACILITY Manager: <i>(name and signature)</i> Safety Manager: <i>(name and signature)</i> Representative of the EHS consulting organization (CHSCT, etc.):	For: Name of the Representative: Signature: <i>(preceded by the phrase "read and accepted")</i> Local Site Manager: Signature: <i>(preceded by the phrase "read and accepted")</i>

8.3 Appendix 3: Authorization of work

N°			
AUTHORIZATION for WORK SURVEY of the WORK SITE / JOB			
Job / Work site definition	Name of the external contractor doing the work		
	Description of the work to be performed		
	Identification of the work site		
	Name & tel.number of the Contract Giver	Name :	Tel.Number
Prevention plan / Risk analysis	Specific Prevention plan to this work		N°
	Annual Prevention plan		N°
	+ Specific identified risks linked to this work-site / co-activity	Preventive measures / associated procedures (to be given)	
	1	1	
	2	2	
	3	3	
	4	4	
	5	5	
6	6		
7	7		

Isolation & Permits 1st day	Work needing an isolation										
	NO		Concerned utilities								
	YES		1		2						
			3		4						
Isolation & Permits 1st day	Other work permits necessary for this work										
	NO		Hot point		Work in height		Work/visit on roof				
			Confined space		Hazardous area		Excavation				
Start of Work	Work authorized (7 days max)		from		Date:		until		Date:		
					Time:				Time:		
	Signature Contract giver		Nom & signat. Geographical manager		Nom & signat. Rep.Outside company		Nom & signat. ETNEHS (when necessary)				
Start of Work	Nom & signat. of all workers involved in the job										
Should the work be lasting more than 1 day, to be valid, this permit must be validated every day											
It is strictly forbidden to start working on the zone before this permit is validated											
Days after			Day 2	Day 3	Day 4	Day 5	Day 6	Day 7			
	Date:										
	Permit	NO									
		Hot point									
		Work in height									
		Work/visit on roof									
		Confined space									
		Hazardous area									
		Excavation									
	Isolations	NO									
Utility #1											
Utility #2											
Utility #3											
Utility #4											
Sign.	Contract Giver										
	Geographical manager										

8.4 Appendix 4: Safety questions by topic

8.4.1 Traffic rules

- Is the speed limit for site machinery respected?
- Are the traffic rules in place respected by pedestrians and site machinery?
- Are pedestrians more than 5 meters away from machinery in operation?
- Are work areas closed to pedestrians and machinery traffic areas well marked?
- Are the traffic areas sufficiently lit at night?

8.4.2 General maintenance

- At the end of the day, are tools and portable machinery stored away by the various operators?
- At the end of the day, are site vehicles parked in the parking area provided?
- Are the keys removed from the ignition of the vehicles parked at the end of the day?
- Are the tanks and barrels containing liquid products and pollutants placed in the retention area?
- Are the traffic lanes clear of all obstacles?
- Are the wheels and the undercarriages of the site vehicles cleaned in the area provided before leaving the site?
- In the event of a prolonged dry spell, are the traffic lanes being sprayed with water?

8.4.3 Safety guidelines for lifting operations, cranes and slings

- Are the cranes stable, taking into consideration climatic conditions?
- Are the weights of the loads lifted by the cranes and other hoisting equipment less than the maximum lifting weight indicated on the machines?
- Is the operating radius of the cranes marked and secured (e.g. no power lines or people within this operating radius)?
- Is the maximum weight supported by the slings widely known to all?
- Have slings in bad condition been removed from use?
- Are the slings subject to periodic inspections?

8.4.4 Scaffolding

- Has the used scaffolding been checked by the inspection agency?
- Has a sticker been placed on the equipment to prove this?
- Has the stability of the scaffolding been checked during the day by a qualified person?
- Has this inspection been recorded?
- Can the scaffolding calculation notes be produced by a manager of the company in question?
- Is the scaffolding stable and in good condition?
- Is the maximum weight that can be supported by the scaffolding clearly displayed and obeyed?

- Are the platforms on the scaffolding fitted with safety ramps at the top, mid-height and bottom?
- Are these safety ramps securely assembled?
- Are the platforms strong and in good condition?
- Is the scaffolding erected at the correct height for the work to be carried out?
- Is the scaffolding erected at a safe distance from power lines?
- Have the people working on the scaffolding received specific training?
- Is there a notice on the scaffolding prohibiting the use of the structure by an unqualified person?

8.4.5 Manual carrying of loads

Are the loads carried manually below 25 kg for men and 15 kg for women?

Are loads carried manually in an ergonomic manner?

8.4.6 Prevention of falls

- Are high-level working platforms properly secured with the use of physical barriers?
- Are the ladders in good condition and are they designed in accordance with good practices?
- Are the ladders stable when positioned?
- Is unauthorized access to the fixed ladders restricted by a physical barrier?
- Are the stairs fitted with safety ramps?
- Are operations carried out on the roof done under safe conditions: working with a lifeline or the roof protected by solid physical barriers, and skylights and other openings identified and secured?
- Are holes and pits in the floor and ground properly marked and their access secured by visible barriers that have been placed at a safe distance?
- Are operations done on partially secured platforms carried out using a harness?
- Are the harnesses in good condition and inspected periodically?
- Is work on mobile platforms carried out with the support of a person on the ground?

8.4.7 Personal protective equipment

- Is the following equipment worn: helmet, safety shoes, fluorescent jacket?
- For operations requiring additional personal protection equipment, is it used (e.g. sound-proof helmet in case of noisy work, harness for overhead work on unsecured platform, suitable safety glasses in case of work that may cause projections into the eyes, suitable gloves in the event of handling products and materials that present chemical risks, hot materials, sharp equipment, etc.)?
- Is the personal protection equipment that is not being worn stored in a protected location?
- Is the personal protection equipment maintained in good condition?

8.4.8 Management of hazardous work

8.4.8.1 Entry into confined spaces

- Are entries into confined spaces on the site carried out by trained operators?
- Have all entries into confined spaces on the site been cleared by a prior permit to enter a confined space?
- Are the safety instructions described on the permit to enter a confined space complied with?

8.4.8.2 Work at hot points

- Are operations using hot points on the site carried out by trained operators?
- Are operations using hot points that take place on the site outside of the stipulated areas cleared by the prior issuing of a fire permit?
- Are the safety instructions described on the fire permit complied with?

8.4.8.3 Overhead work

- Are overhead operations on the site carried out by trained operators?
- Have all overhead operations carried out on the site been cleared by a prior overhead work permit?
- Are the safety instructions described on the overhead work permit complied with?

8.4.8.4 Excavation work

- Are excavation operations on the site carried out by trained operators?
- Are excavations that take place on the site outside of the stipulated areas cleared by the prior issuing of an excavation permit?
- Are the safety instructions described on the excavation permit complied with by the operators?

8.4.8.5 Prevention of fire

- Are the gas cylinders stored in a stable manner, chained, and with their caps on?
- Are fire extinguishers placed in visible locations on the sites and are they properly marked?
- Is there at least one suitable type of fire extinguisher available per work area (e.g., one extinguisher per platform)?
- Are flammable and fuel products (oils, solvents, boxes, etc.) stored in separate areas?
- Is there at least one person on the site that has been trained in the use of fire extinguishers (apart from the EHS coordinator)?

8.4.8.6 Electrical safety Portable electrical equipment

- Is the portable electrical equipment used on the site at least category 2 (fitted with double insulation to protect against penetration of solid matter or water) or category 3

(very low voltage connection, maximum of 50V) in case of work carried out in a damp or confined environment?

- Are the portable electrical equipment and their connections in good condition?
- Are all the conductor wires present on the site protected against the risk of crushing that could lead to deterioration?
- Are the electrical wires that have to cross over vehicle traffic areas either buried, or protected using dimensioned protection housings in order to be able to carry the maximum allowable load?

8.4.8.7 Work on or close to electrical installations or equipment

- Are the live operations limited to qualified personnel carrying out measurement and verification operations on low voltage or very low voltage installations (below 50 V AC or 120 V DC)?
- Are electrical lockout measures systematically implemented prior to any work on electrical installations or equipment?
- Is the electrical lockout done by a qualified person?
- Is access to the electrical work areas marked and reserved for qualified personnel?
- Is work on electrical equipment and installations carried out while wearing suitable personal protection equipment?
- Have additional protection devices been put in place (covers, personal protection equipment, insulating tools) in order to prevent any accidental contact with exposed current-carrying parts?
- Are the personnel working close to live electrical installations aware of the risks and trained in the precautions to be taken?

8.4.9 Safety of equipment

- Is the equipment in a good general condition?
- Does the equipment comply with the regulations in effect?
- Is the equipment used suitable for the intended use?
- Can the representatives of the operating companies prove the existence of a preventive maintenance program for each of the pieces of equipment used?
- Does the user of the equipment inspect the essential safety devices before the first use of the working day?
- Do the operators complete a daily inspection check list for the site machines?
- Are safety belts worn when the site machines are operated?
- Is the fixed equipment fitted with protective covers and emergency shut-down buttons?
- Are the site machines fitted with brakes and tires in good condition, headlights, and audible reverse alarms?
- Are the lifting platforms fitted with a properly secured platform and suitable safety systems (emergency shut-down button, wheel blocks, etc.)?

- Are the goods elevators kept in good working condition and fitted with suitable safety systems?

8.4.10 Hygiene conditions

- Is the smoking ban obeyed?
- Is the ban on the use of alcohol and drugs obeyed?

8.4.11 Management of waste

- Has a waste area been created on the site, under the responsibility of the prime contractor?
- Is the waste sorted by nature and waste code?
- Is hazardous waste stored in accordance with the appropriate safety rules?
- Is the waste weighed, tracked, and reported through the relevant EHS reporting tool?
- Are the transport and treatment companies selected and contracted by the project management, under the supervision of the project owner, with priority given to the site's usual waste service providers?
- Is the waste treatment hierarchy respected? (Priority is given to waste reduction, followed by reuse or recycling (material recovery). If there is no available reuse/recycling route in the site's area, energy recovery is always preferred to non-recovery routes. Landfill is avoided)
- Is the ban on the burning and the burying of waste on the site obeyed?



EHS Management System



Lifting Operations

EHS-INS-003 A

06/2024

Cancels and supersedes: EHS-002-40 Lifting Operations.

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Update and substitution of EHS-002-40

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

CONTENTS 2

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 3

4.1 Preparation of the site 3

4.2 Execution of works..... Error! Bookmark not defined.

4.3 Equipment 7

4.4 Staff training..... 8

5 ASSOCIATED DOCUMENTS 8

1 AIM

The aim of this technical instruction is to define the technical and organizational measures to be implemented during lifting operations.

2 SCOPE

This general instruction applies to all L'Oréal sites.

In case of differences in requirements between local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3 RESPONSIBILITIES

The EHS and Facility Director of the site/entity or equivalent, or their delegate, is responsible for the distribution of this instruction to all parties involved and for verifying its application.

The order giver is responsible for the application of this instruction.

4 DESCRIPTION

4.1 Preparation of the site

4.1.1 Identification of lifting operations

Lifting operations include all operations aimed at lifting or lowering a load using equipment such as cranes, hoists, etc. as well as their associated accessories (slings, hooks, chains, shackles, etc.).

Certain operations involve at least one of the following conditions:

- Use of mobile lifting devices for occasional operations
- Use of temporary lifting devices
- Lifting of inclined loads
- Use of several lifting devices at the same time
- Lifting during which the operator cannot see the load
- Operation requiring assistance for the guiding of a load
- Lifting of loads without a defined hook point
- Use of equipment not specifically dedicated to the lifting of loads
- Lifting close to buildings or installations considered to be dangerous (flammable product stores, transmission towers, etc.)
- Use of lifting devices at more than 75% of their load capacity.

4.1.2 Risk Assessment

A risk assessment must be carried out for any lifting operation. This must take into account the following risks:

- Use of machines
- The erection and dismantling of lifting devices when required
- Influence of the climatic conditions
- Flatness and resistance of the floors on which the lifting devices are used
- Presence of overhead networks within the work perimeter
- Stabilization of the load
- Use of accessories
- Moving of loads and risk of collisions
- Environment of the lifting operations (proximity of buildings and other structures)
- Falling loads

Obstacles such as overhead networks likely to be touched by lifting equipment are secured before lifting work begins. **LIFE 1**

The result of the risk assessments and the resulting instructions must be formally distributed to the operators carrying out the lifting operations and operating in the zones in question.

In the presence of overhead networks or any other identified hazard, work may not begin without a formal authorization specifying the securing of networks and other installations presenting hazards, as well as the duration for which these networks must be secured.

4.1.3 Lifting plan

Before any lifting operation, a lifting plan must be compiled by a skilled and authorized person. This lifting plan must contain:

- the assessment of the specific risks relating to the operation, including weather conditions at the time of the operation and the operation's environment
- the step-by-step description of the lifting method
- the identification of the lifting zone and the measures taken to restrict access, such as the installation of barriers, markings, etc.
- the consideration of co-activities in the area and description of measures taken to generate simultaneous operations
- the description of the type, weight, size, shape, and center of gravity of the load
- the methods of slinging, hooking and unhooking the load, as well as identification of load anchoring points where necessary
- the proximity of hazards and obstacles on the load's path described on a plan (including consideration of mobile elements of lifting devices such as cranes)

- the consideration fall hazards and the integrity of the load and installations in the area
- the list of certified and inspected equipment that must be used depending on the location, conditions, and the loads intended for the operation.
- the list of people involved in the operation with a description of their roles and responsibilities, including the communication methods required for carrying out the operation (when more than one person is involved)
- the list of the qualifications required for all operations involved in the lifting operation
- the lifting plan is drawn up to cover the duration of the lifting operation. A daily review of the conditions defined in the lifting plan and the measures described in it (weather conditions, state of equipment, etc.) is conducted. Any deviations noted result in the plan being updated, and the updates sent to the relevant people.

4.1.4 Work permit

A work permit for lifting must be issued before any lifting operation. It is valid for a maximum duration of one day, formally distributed to the operators carrying out the lifting operations, and available at the work area for the project duration of the lifting operation. It includes a risk assessment and safety instructions.

The safety instructions must, as a minimum, include a formal prohibition on the presence of people under loads, between a load and a fixed element, or in the projected path of the loads when operations are in progress, including people inside the building. **LIFE 1**

4.1.5 Supervision

A trained supervisor is appointed to coordinate and direct all lifting operations. This supervisor, trained and possessing the necessary expertise and experience, will be present on the site for the duration of the operation. If necessary, several supervisors will be appointed for the same operation.

The supervisors are involved in the development phase of the lifting plans. They guarantee the application of the prevention measures defined, and their updates when required.

4.2 Execution of works

4.2.1 Preparatory meeting

Before any special lifting operation, a preparatory meeting will be held to review:

- the risk assessment
- the lifting plan and all related documents and information
- the specific prevention measures required for the operation
- the requirements for securing overhead networks, if necessary

The order giver or their representative will lead this meeting with the support of the EHS team, which will also include the managers of the teams involved, and the supervisor in charge of the operation.

A review of the prevention measures implemented in accordance with the lifting plan must be carried out on the operation site.

4.2.2 Execution of lifting operations

The supervisor ensures that all the roles and responsibilities defined in the lifting plan are clearly allocated to each member of the team in charge.

The communications method, as defined in the lifting plan, must be applied as soon as the operation involves more than one person. Only the appointed person will be able to transmit instructions to the operator in charge of the lifting. The operator must obey any shut-down signal regardless of the person issuing it.

A copy of the lifting plan must be available at the work area for the projected duration of the lifting operation.

Any deviation from the prevention and protection measures listed above will only be possible after consultation with the person responsible for defining the lifting plan. If these measures are modified, a risk analysis must be repeated. Medium, high and very high risks will be subject to management measures designed to reduce the level of risk to as low as possible before work begins.

4.2.3 Slings

If the load has several anchoring points (ring type), the use of a hook sling, fitted with safety lanyards, is recommended wherever possible.

The slinging methods are reviewed before carrying out the lifting operations **LIFE 2**

If the load has no anchoring points, use either mobile loading equipment (clamps, vacuum suction cups, electromagnets, etc.), or load the sling from below.

In all cases:

- The documentation relating to the capacity of the lifting devices must be consulted and must guarantee the safe completion of the operation.
- The slinging angle (the angle formed by the sling in relation to the horizontal) must never be less than 45° and must be taken into account in the lifting plan. To this effect, the load tables provided by the manufacturer must be available on site.

An inspection of the load must be carried out to determine the presence of any sharp edges that may cause damage to the slings during the operation. **LIFE 2** If necessary, the slings must be protected using a PVC cover or removable sleeves. Protectors may also be placed directly onto the load, ensuring they are well secured.

During sling tensioning, the risk of crushing will be managed by preventing any contact between the operator and the lifting accessories.

Lifting of loads must be carried out step-by-step, to ensure that the slinging correctly takes account of the center of gravity (risk of uncontrolled load movement).

4.3 Equipment

All devices and accessories used to carry out the lifting operations must be: **LIFE 1**

- identified individually
- listed in a register available on the site
- compliant with regulations
- checked by an external agency

A daily inspection of machine condition must be carried out by the operator. A record of this inspection is kept.

Lifting accessories (slings, hooks, shackles, etc.) are visually inspected before each use by the people using them.

Each accessory must display the maximum safe load that it can carry. Hooks must be fitted with safety catches.

No paint or adhesive tape may be applied to an accessory to ensure that any potential defect is visible.

All slings are fitted with an ID plate or a permanent ring indicating the maximum lifting capacity. In addition to a visual inspection before use, the slings must be inspected periodically, or after any abnormal situation that may have weakened them (impacts, overloads, contact with chemicals, etc.), by a specialist agency.

Any equipment deemed to be defective must be removed immediately from the site or placed in a dedicated area with restricted access to await repair or destruction. **LIFE 2**

Specific attention must be paid to the storage of lifting devices and their accessories in order to prevent deterioration.

4.4 Staff training

Personnel responsible for drawing up lifting plans and for scheduling, supervising, or executing lifting operations must have received specific training in the risks associated with this type of operation. Personnel responsible for carrying out lifting operations must be qualified. **LIFE 1**

Operators of machines used for lifting operations must have the necessary operating permits in accordance with the local legislation, and must have received specific training in the operation of the equipment concerned. **LIFE 1**

The site reception issued to each operator on the site must list:

- the risks associated with the lifting operations
- the instructions for the lifting operations
- procedures for the development and consultation of the lifting plans.

Personnel directly involved in the execution of lifting operations must be able to justify specific training including, depending on the type of operation:

- Knowledge of procedures for drawing up and consulting lifting plans
- Knowledge of the equipment required for operations, including personal protective equipment.

5 ASSOCIATED DOCUMENTS

- EHS-INS-001: EHS Organization During Operations by External Companies for a Major Project

This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.



EHS Management System



Excavation Work

EHS-INS-004 A

06/2024

Cancels and supersedes: EHS-002-41
Excavation Work.

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Update and substitution of the EHS-002-41

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

CONTENTS 2

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 3

4.1 Preparation of the site 3

4.2 Execution of works..... 5

4.3 Equipment 7

4.4 Staff training & competence..... 7

5 ASSOCIATED DOCUMENTS 7

1 AIM

The aim of this technical instruction is to define the technical, organizational, and authorizational measures to be implemented during excavation operations.

2 SCOPE

This instruction applies to all L'Oréal sites.

In case of differences in requirements between local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3 RESPONSIBILITIES

The EHS and Facility Director or equivalent of the site/entity or their delegate is responsible for the distribution of this instruction to all parties involved as well as for verifying its application.

The project owner is responsible for the application of this instruction.

4 DESCRIPTION

4.1 Preparation of the site

A communication plan is drawn up before, during and at the end of works, to inform employees affected by the work.

4.1.1 Identification of the excavation operations

Excavation work will include any cavities, trenches, or artificial depressions at least 50cm below ground level.

Excavations deeper than 5 meters will be referred to as "deep excavations" and will require specific prevention measures.

4.1.2 Risk assessment

A risk assessment must be carried out before work begins covering the creation, operation, and closure phases of the excavation. The following risks will be taken into consideration:

- Use of machines
- Burying

- Presence of buried networks within the work perimeter
- Means of access/evacuation
- Falls from above
- Objects falling inside the excavation
- Presence of overhead high-voltage cables if construction machinery is used

For any deep excavation work (more than 5 meters) or work involving the implementation of side reinforcement measures (excavations deeper than 1.2 meters and with a width of less than 2/3 of the depth), a specialist civil engineer or similar must carry out a risk assessment during the design phase, to include:

- the risk of collapse of the excavation perimeter
- a study of the physical and mechanical stresses and the soil composition
- a review of the stability calculation notes indicating the intended protective measures (angle of the slope, shoring, grading, sheeting, buttress struts)
- the requirements for the implementation of a water drainage or pumping system
- the instructions regarding the means of access and exit
- the presence of building foundations or other structures close by

The result of the risk assessments and the resulting instructions must be formally distributed to the operators carrying out the excavation and working within it.

4.1.3 Work permit

An excavation work permit is issued prior to any excavation work, valid for one day. It is issued based on a risk assessment and includes, at least, the following safety instructions: **LIFE1**

- Installation of barriers preventing access by unauthorized persons placed at 1.5 meters from the edge of any excavation deeper than 1.2 meters
- No vehicle can be driven or parked closer than 3 meters from the edge
- The presence of buried piping, utilities or electric cables must be checked before issuing the permit

The excavation work permit must take into account at least the following aspects:

- Flooding of the excavation
- Presence of building foundations or other structures close by
- Presence of buried piping and cable networks in the area
- Possibility of contaminated soil (dangerous substances, munitions)
- Co-activity in the zone in question involving a risk of landslides or burying

The permit will be issued for a maximum of one day and must be renewed if the duration of the work exceeds this period.

Excavations likely to be affected by meteorological conditions will be subject to a daily inspection during which the validity of the current permit will be reviewed.

Only persons with a recognized and relevant competence must carry out the inspection and write the report. Inspections must take place at the following timing and frequency:

- After any event likely to affect the strength or stability of the excavation (flooding, earthquakes etc.)
- Before the start of every shift
- After an accidental fall of any material

4.2 Execution of works

4.2.1 Preparatory meeting

Before any excavation operation, a preparatory meeting will be held to review:

- the risk assessment
- prevention measures and instructions put in place
- the documents relating to the nature of the soil and the level of the water table if necessary
- the documents relating to the presence of buried piping and cables (water, gas, electricity, etc.)
- the requirements for securing necessary buried networks, if needed (lockout, draining)

The project owner or their representative will lead this meeting, in which the managers of the operating teams will participate.

The necessary work permits will be prepared during this meeting. They will be validated at the location of the excavation after inspection and validation of the preventative and protective measures in place.

4.2.2 Execution of excavations

In case of presence of underground piping (e.g., gas, chemical pipes, etc.) and cable networks (electrical, telephone, etc.), the work cannot start without formal authorization stating that the networks will not be affected by the excavation work. **LIFE1**

For excavations that require a work permit, the documents indicating the nature of the soil, the level of the water table and the instructions to be followed must be available on the site of the excavation.

Any deep excavation or an excavation requiring the implementation of side reinforcement measures (excavations deeper than 1.2 meters and with a width of less than 2/3 of the depth), must by default, have a system designed by a specialist engineer to prevent collapse.

This system may be:

- implementation of shoring
- graded construction
- shielding
- implementation of buttress struts
- sloping sides (angle to be defined according to the make-up of the soil)

Drainage will be provided in case of the risk of water seepage or streams inside the excavation.

4.2.3 Operations inside the excavations

Access

Access to the excavations is forbidden until the prescribed protective measures have been implemented.

- The trenches will be fitted with access points at least every 15 meters.
- The access ladders into the excavation must be secured (fixed) and must exceed ground level by one meter. They may not be longer than 5 meters.
- For access into deep excavations, specific measures must be designed and implemented. Initially the use of stairways will be considered and, if that is not possible, ladders will be used. In the latter case, landings will be installed bearing in mind that the maximum length of the ladders must not exceed 5 meters.

Prevention of falls and landslides

No equipment may be stored less than 1.2 meters from the edge of any excavation.

No vehicle present on the site may be driven closer than 3 meters from the edge of the excavation site. Warning signs and barriers must be in place. Where a vehicle is tipping materials into the excavation, stop blocks must be placed behind its wheels.

Signs preventing access by unauthorized persons must be placed 1.5 meters from the edge of any excavation deeper than 1.2 meters.

Any excavation deeper than 1.2 meters that requires specific means of access (ladders, stairways) must be fitted with rigid barriers around its entire perimeter to prevent persons from falling. These barriers must have a minimum height of 1 meter in order to prevent falling objects.

Passage over any excavation will require a structure allowing personnel to cross over. These structures must be equipped with rigid ramps and girders to ensure sufficient strength to prevent persons from falling.

Any deviation from the prevention and protection measures listed above will only be possible after consultation with the engineer in charge of the design and the risk assessment related to the excavation. In case of modification of these measures, a risk analysis will be repeated. The medium, high and very high risks will be subject to the implementation of management measures to reduce the level of risk to a maximum of low before the start of the work.

4.3 Equipment

All machines and tools used for excavations must comply with regulations and must be checked by an independent agency. Daily inspections of the machine's condition must be carried out by the driver.

4.4 Staff training & competence

When the services of a specialist civil engineer are required, the latter must have a qualification that is recognized in the country where the work is being carried out.

Any personnel responsible for the scheduling, supervision or execution of excavation operations must have been specifically trained in dealing with the risks associated with this type of operation.

The operators of the machines used for the excavation must have the necessary operating permits in accordance with the local legislation and must have been specifically trained in the operations of the equipment involved.

The site reception issued to each operator on the site must list:

- the risks related to the excavation work
- the instructions relating to the excavation work
- the instructions for the issuing of the excavation permit

Personnel directly involved in excavation operations must be able to demonstrate specific training, including, depending on the type of operation:

- Knowledge of the instructions for obtaining an excavation permit
- Knowledge of the obligatory equipment required for the operations, including personal protective equipment and hard hats.
- Clear instructions on working safely within the excavation.

5 ASSOCIATED DOCUMENTS

- EHS-INS-001: EHS Organization During Operations by External Companies for a Major Project
- EHS-INS-002: EHS Management of Internal and External Worksites

This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.

This page was intentionally left blank for duplex printing.



EHS Management System



Work at Height

EHS-INS-005 A

06/2024

Cancels and supersedes:
EHS-302-37 Work at Height

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Update and substitution of the EHS-302-37

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 3

4.1 Definitions 3

4.2 Work on and visits to the roof 4

4.3 High level work 5

4.4. Low level work 10

4.5. Equipment management 10

4.6. Staff training 11

5 ASSOCIATED DOCUMENTS 11

1 AIM

The aim of this instruction is to define the measures to be put in place and maintained to prevent the risk of falls during work at height.

2 SCOPE

This instruction applies to all types of activity, whether production, construction, etc., where work at height is involved.

Suppliers, carriers, subcontractors, service providers, and others entering L'Oréal sites must comply with the rules described in this instruction.

This instruction applies to all L'Oréal sites: production plants, distribution centers, administrative sites, R&I, academies and stores.

In the event of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3 RESPONSIBILITIES

As the risks associated with work at height are part of LIFE risks, the site/entity director must ensure that the site/entity strictly complies with the non-negotiable requirements of the LIFE risk directive and the requirements related to work at height.

The L'Oréal person responsible for the implementation of this instruction is the manager responsible for the related activities:

- Manager of the L'Oréal personnel working at height
- Order giver in the case of work at height by contractors

In the case of work at height during major projects, responsibility lies with the EHS coordinator.

4 DESCRIPTION

4.1 Definitions

Work at height refers to all tasks above the ground level. It includes all work activities where there it is necessary to control the risk of falling from a height liable to cause personal injury. This is regardless of the work equipment being used, the duration of the work at height involved or the height at which the work is performed.

The floor to be considered may be the ground floor or any higher floor level. The following tasks should also be considered as work at height:

- Visit or work on a roof
- Work on a scissor lift

- Work on a scaffold
- Work on an unprotected upper floor or platform (e.g., false ceiling). An unprotected upper floor or platform is one that is not provided with sufficient guards to protect against the risks of falling.

However, it does not include:

- slips, trips or falls on the same level which are covered by another specific instruction.
- falls on permanent stairs in the absence of structural or maintenance work.
- work carried out on the upper floor of a multi-storey building where there is no risk of falling (with the exception of separate activities such as using a stepladder).

It is required that:

- work is not carried out at height when it is reasonably practicable to perform the work safely at ground level (e.g., the assembly of components must be done at ground level)
- when work is carried out at height, suitable and sufficient measures to prevent must be taken, as far as possible, to prevent any person falling from a height liable to cause injury (e.g. the use of guardrails)
- suitable and sufficient measures must be taken to minimize the distance and consequences of a fall. Collective measures (e.g., airbags or safety nets) must take precedence over individual measures (e.g., safety harnesses)

Work at height can be divided into 3 categories:

- Work on or visits to a roof
- High level work: all work performed at more than 2m from ground level (height from feet to floor) using scaffolding, elevated platforms, ladders, etc.
- Low level work: all work performed at 2m or less from ground level on a ladder or equivalent

4.2 Work on and visits to the roof

Any work on or visit to a roof must be subject to specific prevention measures:

- Access to roofs must be via stairs or caged ladders. The cage itself must not start more than 2m from ground level, unless a minimum height is specified in the local legislation. In this case, the cage must start at the minimum height specified by local legislation. **LIFE1**
- Roof edges must be equipped with barriers or parapets of sufficient height (> 1m). If this is not technically possible, is it compulsory to work with a harness attached to a lifeline when working within one meter of the roof edge, under direct supervision **LIFE1**
- Walking and work areas on roofs must be sufficiently secure to prevent people or equipment from falling through. **LIFE1** Access to insufficiently secure areas must be physically prevented and have specific signage. **LIFE1**
- To prevent falls through skylights, prevention grids or equivalent must be used. **LIFE1**
- Access to roofs must be kept locked at all times. **LIFE1**

Only people (L'Oréal employees and contractors) authorized by the EHS manager or their representative may access roofs unaccompanied. This authorization is granted by the EHS manager on the basis of their experience and knowledge of the actual risks and control measures, and is granted in cases where frequent access to roofs is required. Unauthorized people (e.g., visitors) must always be accompanied by an authorized person when accessing or working on roofs.

Access for a lone person is only possible for a visit (not for work) under the following conditions:

- not a SHAP level 1 or 2 potential severity activity
- short duration (e.g. 15 minutes for a quick inspection)
- with a lone-worker device

Any access to a roof must be authorized:

- with a roof access permit, valid for a maximum of 1 day and issued by competent person (qualification based on expertise, training, or experience) from the site EHS department
- on a roof deemed safe (e.g., edges protected by barriers, insufficiently secure areas prohibited from access, walking areas sufficiently secure and skylights protected) **LIFE1**

4.3 High level work

4.3.1. Prevention

The risk of falling during high level work must be assessed during the preparation phase. Where the risk of falling cannot be avoided by carrying out operations at ground level, priority will be given to the use of scaffolding, scissor lifts or raised platforms, supplemented by the use of personal protection equipment where necessary.

The risks to consider are those involved in working at height, as well as those during the installation and dismantling of equipment.

The work area must be marked out to prevent access by any unauthorized person. **LIFE1**

The risk of falling objects must also be taken into account (fall protection system, marking, gripping).

The climatic conditions that may influence the safety conditions during the execution of overhead work must be taken into account to ensure the safety of the operators.

4.3.2. Collective protection

When working on a platform (e.g., fixed platform, mobile platform, scissor lift, etc.), the following guards must be provided:

- ✓ A top structural section located at a height of 1 meter above the floor of the platform
- ✓ An intermediate structural section located at between 40 and 50cm above the floor of the platform.
- ✓ A baseboard with a minimum height of 15cm. **LIFE1**

If it is impossible to install collective protection devices to prevent the possibility of falls, collective protections aimed at minimizing the consequences of a fall and its severity must be studied, such as the use of nets.

4.3.3. Personal protective equipment

If the implementation of a collective fall protection system is not sufficient to guarantee the safety of the operators during work at height above 2m, the use of a harness and hard hat with a strap is mandatory. **LIFE1**

The equipment can be designed to prevent falls by limiting mobility (use of a harness or lifeline restricting access to the fall zones), or by reducing the severity of the fall to a level ensuring the absence of injuries (use of a harness provided with a shock absorber). The use of these systems must comply with the following points:

- The anchoring points of the harnesses and the lifeline must correspond to the restrictions imposed by the configuration of the operations.
- The harnesses are designed to prevent falls by limiting mobility (use of a harness or lifeline restricting access to the fall zones), or by reducing the severity of the fall to a level ensuring the absence of injuries (use of a harness provided with a shock absorber). The stopping distances must guarantee that the fall is stopped before any obstacle is reached. The height of the free fall must not be able to exceed 1.2 meters. **LIFE1**
- If the operator needs to be moved, a double anchoring system compliant with the two points above must be implemented.
- Emergency procedures must be defined and allow quick rescue in the event of a fall in less than 15 minutes. **LIFE1**
- Hard hats must be worn at all times, both by the operator performing the work at height, and by any person supervising the work at height. **LIFE1**

4.3.4. Elevating platforms

The elevating platforms are present on the site in various forms (remote arm elevating platform, scissor platform, telescopic arm platform, etc.). Whether this equipment belongs to the company or are on lease, the same rules apply:

- Operators of this equipment must be trained and authorized. **LIFE1**
- A register of operators must be kept up to date and available on site. Operators must keep their operating permit available at all times.
- Platforms must be inaccessible when not in use.
- The assessment of the risks that accompany the use of platforms must specify the exclusion areas to be created around the equipment as well as the identification of the risks related to the obstacles located overhead, such as overhead power lines. The condition of the floor

in the operating area, as well as the climatic conditions and their development, must be taken into account at all times.

- Personnel operating this equipment must inspect it before work commences. This inspection must be recorded. **LIFE2**
- The wearing of a harness attached to the platform by means of a lanyard is compulsory. The harness must be adapted to ensure that the maximum height of the fall cannot exceed 1.2 meters and must be anchored to the guardrail. As long as the operator does not move away from the platform, the harness can be fitted with a single anchoring point.
- On an elevating platform, it is mandatory to wear a hard hat with a strap, and a harness attached to a sufficiently strong barrier on the elevating platform. **LIFE2** To achieve this, the guardrail must offer sufficient resistance.
- The operations carried out using the platform are done in the presence of a person on the ground with authorization to operate the platform if necessary.

4.3.5. Scaffolding

The scaffolding must be made of a rigid metallic material, be in perfect condition and fitted with baseboards and barriers. **LIFE1** Those fitted with wheels must have wheel locking systems.

This instruction covers two types of scaffolding:

- Fixed scaffolding
- Mobile scaffolding

The majority of the requirements for scaffolding management are the same for both types of equipment; however, some specifics are addressed in this document.

The scaffolding used on the sites is delivered with the manufacturer's technical instructions (e.g. erection, dismantling, storage) and the scaffolding's strength and stability calculation sheet corresponding to the intended conditions of use.

The scaffolding used on the site must comply with the following points:

- Equipment must only be erected, modified or dismantled by qualified persons and under the authorization of the EHS manager. **LIFE1**
- Work platforms must be secured by means of physical barriers and baseboards. **LIFE1**
- Risks associated with the presence of hazardous installations such as electrical lines, close to scaffolding are identified and corrective measures implemented. **LIFE1**
- Scaffolding must rest on firm ground. The base must be capable of supporting the weight of the scaffolding as well as that of the load likely to be placed on it. It must be vertically assembled (90° versus skyline) **LIFE1**
- Scaffolding must be attached to a permanent or safely stabilized structure. **LIFE1**
- Work platforms must be solid, with no gaps likely to cause people or objects to fall, and wide enough to allow for the passage of people and their equipment. **LIFE1**

- A system must be in place to transport the equipment required for the work. No equipment may be transported by workers between the different levels of the scaffolding.
- Access to the scaffolding must be secured. The various levels must be accessed using ladders located inside the structure. If internal ladders cannot be used, external ladders **can** be used, provided that they are attached to the structure. **LIFE1** Users of this means of access must be protected by the use of a harness either fitted with double lanyards or connected to a fall protection system where must be permanently fixed to prevent free falls of more than 1.2 meters.

Specifically for mobile scaffolding:

- The stabilizers must be in position and the wheels must be locked **LIFE1**.
- While the scaffolding is being moved on site, specific attention must be paid to ensure that:
 - o there are no obstacles or overhead hazards on the planned path
 - o the surface of the planned path is acceptable and there are no obstacles likely to cause displacement
 - o there are no persons or equipment present on the scaffolding **LIFE1**
 - o scaffolding is moved manually and at low speed
 - o instructions are given to move mobile scaffolding manually and at a low speed only on flat, horizontal ground **LIFE1**

Scaffolding management

Checks on scaffolding are carried out by specifically trained and accredited personnel at the time of commissioning or re-commissioning, after changes in configuration, replacement or major alterations to equipment components (e.g. following damage, impact, malfunction), and after a change of environment or use that may affect safety (change of activity). **LIFE1**

Checks on scaffolding are carried out by specifically trained and accredited personnel:

- after an interruption of service of the equipment for 1 month **LIFE2**
- at least every three months to check the state of conservation of the scaffolding **LIFE2**
- daily, with a visual check before using the scaffolding, carried out by trained employees **LIFE1**.

The initial check and the check after modification are carried out by the inspection agency.

Inspection of the scaffolding must cover the following points:

- The presence and the installation of collective protective equipment and the means of access
- The absence of permanent distortion or corrosion on scaffolding components

- The presence of all attachment, connecting, blocking, stabilization and securing elements
- The presence and condition of equipment to prevent falling objects (nets, etc.)
- The presence of information on permissible loads
- The use of the scaffolding in accordance with the safety instructions (load, stability, securing, etc.)

The valid inspection certificate must be displayed on any scaffolding in use. The check list of daily visual inspection is displayed on any scaffolding in use.

The scaffolding inspections are recorded, and these recordings are kept available on the site.

Any anomaly found during these inspections must result in the immediate cessation of the use of the equipment in question, as well as the blocking of access until the equipment is repaired or removed.

In the event of adverse weather conditions (e.g., storms, strong winds, snowstorms or hailstorms), the use of scaffolding is forbidden.

4.3.6. Ladders

The use of ladders for access to heights greater than two meters may be considered if it is technically impossible or impractical to use a safer alternative, such as an elevating platform or scaffolding, for short-duration operations that are not repetitive in nature.

In all cases, during their use:

- The equipment must be fixed or blocked and must rest on a flat and firm surface to ensure stability.
- When using ladders to access a higher level, the ladder must exceed the level of the surface to be reached by at least 1 meter.
- In order to be correctly positioned, the ladders must be set at an angle of approximately 70° with the floor.
- Sliding ladders must have an overlap of at least 1 meter.
- Their use must allow three points of contact at all times.
- The ladders and step ladders must have non-slip bases attached to the equipment (welded, riveted, attached, etc.) **LIFE1**
- A personal protection device must be used in addition if:
 - o it is impossible to maintain three points of contact at all times
 - o the task itself, or its duration involves a risk of falling (noted during the risk assessment)

Ladders not in use are kept locked at all times **LIFE2**

Locks can only be opened using a key or a special tool held by the EHS department.

4.3.7. Work at height permit

Any high level (>2m) work at height must be subject to the issuance of a work at height permit, with a risk assessment and safety instructions.

Safety instructions for ladders include, at least the following:

- The ladder must be fixed or blocked and rest on a flat and firm surface to ensure stability.
- The ladder must exceed the level of the surface to be reached by at least 1 meter
- Operators must maintain three points of contact with the ladder at all times
- Ladders must be positioned at an angle of approximately 70° with the floor **LIFE1**

The permit will only be valid for the projected work and will be issued for a maximum duration of one day. It will specify the nature of the work to be carried out, the date and the duration of the work, and the safety measures to follow based on the risk assessment related to the operation.

4.4. Low level work

4.4.1. Risk assessment

Low level work at height must be subject to a detailed risk assessment using SHAP. A risk assessment for working at height must first consider whether the work could be avoided.

Corrective actions must be defined if the level of risk is medium, high or very high and implemented within the timeframe specified by SHAP. When using a small platform or step, particular attention must be paid to protecting the operator from falling from behind.

4.4.2. Reduction of the use of ladders and stepladders

The use of ladders and stepladders during low level works must be subject to a reduction plan, irrelevant of the level of risk identified during the SHAP. **LIFE2**

Ladders or stepladders must never be used as permanent workstations. **LIFE1**

4.5. Equipment management

All equipment used to guarantee the safety of the operators during work at height must be checked:

- when the equipment is received on site (compliance certificate, visual inspection of the condition of the equipment)
- during the periodic EHS validation
- before each use by the operators

Any malfunction noted during these inspections must result in the immediate shut-down of the equipment in use. This equipment is then either removed from the site or moved to a restricted access area for repair or destruction.

4.6. Staff training

Employees involved in work at height must complete specific training which includes the safe use of the equipment and PPE to be used. **LIFE1**

This includes employees carrying out the erection, dismantling, acceptance, use and inspections of work at height equipment (ladders, scaffolding, elevating platforms, etc.). If this training expertise is not available on site, a qualified and recognized external specialist agency must be used to carry out these inspections.

This training must be renewed every year for employees working at high level (>2m high) or on roofs. The qualifications of contractors to design, build, dismantle, use or inspect work at height equipment (e.g., elevating platforms, scaffolding, ladders, etc.) must be systematically checked. **LIFE2**

L'Oréal employees and temporary workers performing high level work (>2m) and work on roofs must have a suitable level of health and fitness for the activity.

This can include an authorization by a licensed professional and/or regular medical examination in accordance with the local legislation. **LIFE2**

5 ASSOCIATED DOCUMENTS

- EHS-PRO-003 Risk Management
- EHS-INS-001 EHS Organization During Operations by External Companies for a Major Project
- EHS-INS-002 Management of Internal and External Worksites
- EHS-INS-017 Prevention of Slips, Trips and Falls Guide
- EHS-FORM-005 SCAN Tool LIFE

This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.

This page was intentionally left blank for duplex printing.



EHS Management System



Environmental and Climate Adaptation Analysis for the site

EHS-INS-007 A

12/2024

Cancels and supersedes: EHS-301-14
Environmental Analysis for the site

ISSUE : Corporate QEHS

CONTENT OF MODIFICATIONS:

Update and substitution of the EHS-301-14 Environmental Analysis for the site

- Simplification of scoring system to determine significant environmental aspect and alignment with [RAM methodology](#)
- Updated with ISO 14001 (2015) requirements for EMS (“process breakdown approach”)
- Updated by Amendment A1:2024 covering 31 standards with the launch of Climate Adaptation Analysis at site level

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text.

Requirements are highlighted in orange

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1	AIM.....	2

2	SCOPE	3
3	RESPONSIBILITIES	3
4	DEFINITIONS.....	4
5	CHARACTERIZATION OF THE SITE EXTERNAL CONTEXT	6
5.1	External context characterization	6
5.2	Incoming and Outgoing flows	7
5.3	Defining a list of processes on-site	7
5.4	Life cycle analysis for each process.....	8
6	EVALUATION OF CURRENT MEANS OF CONTROL IDENTIFIED.....	8
7	SCORING (SEVERITY X FREQUENCY).....	9
7.1	Severity Scoring for Environmental and Climate Adaptation Analysis.....	9
7.2	Probability scoring for Environmental and Climate Adaptation Analysis	12
7.3	Final Assessment for both Environmental and Climate Adaptation Analysis	12
8	ACTION PLAN.....	13
9	DASHBOARD	14
10	UPDATES.....	14
11	ASSOCIATED DOCUMENTS & LINKS	15
12	APPENDIX	15
12.1	Appendix 1 : Environmental Aspects examples	15
12.2	Appendix 2 : Environmental Impacts examples	16
12.3	Appendix 3 : Processes breakdown examples.....	17
12.4	Appendix 4 : Examples of aggravating factors for external context review.....	17
12.5	Appendix 5 : Environmental and Climate Adaptation Analysis Summary Diagram.....	18
12.6	Appendix 6 : Environmental Impact at Group Level (for Life Cycle perspective in impact identification)	21
12.7	Appendix 7 : Overview of completed Environmental Analysis tool for a Factory with 5 examples	21
12.8	Appendix 8 : List of significant climate hazards for L'Oréal factories with current, 2030, 2040 and 2050 RCP8.5 scenario by Munich RE, Water Risk Filter	21

1 AIM

This document describes the implementation of an Environmental and Climate Adaptation Analysis on your site, with a common approach for both pillars.

The **Environmental Analysis** is a tool for monitoring and improving environmental risk management of the site.

The **Climate Adaptation Analysis** is a tool for sites to assess, adapt, and respond to the impacts of climate-related hazards.

They both form the basis of a site's Environmental Management System (EMS), which is a component of the QEHS Management System required by the standard ISO 14001 Environnement, ISO 45001 Health & Safety and ISO 9001 Management Syt Qualité.

Integrating Environmental & Climate Adaptation Analysis into GHAP.

The Environmental and Climate Adaptation Analyses are essential inputs for site-level GHAP.

Ensure you include:

- All Significant Environmental Aspects (SEAs) with a RAM assessment of High (H) or Very High (VH) into GHAP with an Environmental Adaptation Plan.
- All Significant Climate Impacts (SCIs) with a RAM assessment of High (H) or Very High (VH) into GHAP with a Climate Adaptation Plan.

If these analysis are carried out later than the GHAP, site must ensure that the results of these tools are consistent with each other. If the site has an Energy Management System as part of an ISO 50001 certification, the Environmental Analysis must also be consistent with the Energy Review.

2 SCOPE

The completion and update of the **Environmental Analysis** and the **Climate Adaptation Analysis** are mandatory for all operated factories of the Group. **PLANET 1**

However, this document is applicable for all operated sites of the Group (including Administrative Sites, R&I and Distribution Centers) building their Environmental Management System (EMS) or undergoing ISO 14001 certification, also ISO 9001 and ISO 45001 certifications.

In the event of different requirements between local regulations (monitored at site level) and the rules imposed by this document, the stricter requirements apply. **PLANET**

3 RESPONSIBILITIES

The site Director is responsible for the EHS Management System and for the site's certifications (ISO 14001, ISO 9001, ISO 45001 or other).

The EHS manager is responsible for the preparation and annual update of the Environmental and Climate Adaptation Analysis of the site. She/He provides her/his expertise particularly on the characterization of the environment, regulations and action plans to prevent and/or reduce environmental/climate impacts.

The managers or representatives of each process on-site (described in this document) participate in the Environmental and Climate Adaptation Analysis, for example through annual meetings, in particular by identifying:

- Activities in their scope that cause environmental impacts.
- The sensitivity of their processes being impacted by Climate Change Hazard for L’Oreal Activity.
- The means of control that are deployed.

4 DEFINITIONS

- **Environment:** Surroundings in which an organization operates, including air, water, land, natural resources, flora, fauna, humans and their interrelationships (3.2.1 of the ISO 14001:2015 standard).
- **Process** : Following ISO 14001 Environmental Management System (EMS) “processes approach”, a process can be defined as a series of activities and actions that can be repeated consistently to produce a transformation into a product or service from a series of inputs to a defined output. On L’Oréal sites, it usually translates into different departments. Multiple activities can be associated to one single process. Examples of processes can be found in [Appendix 3](#).
- **Life cycle:** consecutive and interlinked stages of a product (or service) system, from raw material acquisition or generation from natural resources to final disposal, including, transportation, use and end-of-life treatment (3.3.3 of the ISO 14001 standard). **Some significant environmental impacts may occur during one of the life cycle stages.** Help on Life Cycle impact at Group level is provided in [Appendix 6](#).
- **Environmental aspect:** Element of an organization’s activities or products or services that interacts or can interact with the environment (3.2.2 of the ISO 14001:2015 standard). Environmental aspects are the “sources” at the origin of the impacts. **If it can have or has a significant impact on the environment, it will be significant (SEA).**

The environmental impact of the feature can be direct (pollution released into the atmosphere by fuel combustion) or indirect (electricity consumption involves how it was produced and transported).

In addition of the environmental aspects that it can directly control, the site determines if there are environmental aspects that it can influence through its whole value chain.

Examples of environmental aspects can be found in the [Appendix 1](#).

- **Environmental impact:** Change to the environment whether adverse or beneficial, wholly or partially resulting from an organization's environmental aspects (3.2.4 of the ISO 14001:2015 standard). Environmental impacts are the "effects" on the environment.

The environmental impact of the feature can be **direct** (pollution released into the atmosphere by fuel combustion) or **indirect** (electricity consumption involves how it was produced and transported).

Adverse environmental impact: any harmful effect on the environment – for example, degradation of soil, water or air, reduction of flora or fauna habitat or any action that makes the local environment socially unacceptable.

Beneficial environmental impact: beneficial effect on the environment – for example, improving water quality, air quality, increasing biodiversity and habitat protection, reducing greenhouse gases, or any action that protects and preserves land.

A list of environmental impacts is in the [Appendix 2](#).

- **Climate Hazard:** A climate hazard is an event or physical condition of the climate system that has the potential to cause harm to L'Oréal site. This could be a short-term event like a flood, or heatwave, or a longer-term condition like drought.

To assess the probability and intensity of these hazards, L'Oréal utilizes climate models from globally recognized institutions such as Aqueduct, Water Risk Filter, and Munich RE Insurance. These models provide insights into various hazards, projecting their potential risk from the present day through to 2050 under the RCP 8.5 scenario. **Examples of climate hazards:**

- Drought
- Wildfires
- Floods (coastal, riverine, pluvial)

L'Oréal analyzes each hazard's probability and intensity scores to determine which are most significant for each site. For the ones about Water Scarcity, L'Oréal is currently using the Water Risk Filter WRF approach. Only those with medium to very high scores, indicating a greater likelihood and potential severity of impact, are selected for further assessment. This prioritization process considers historical data, ensuring hazards that have impacted sites in the past are given due consideration. See Appendix 8.

- **Climate Impact:** This is the *actual harm or damage* that occurs when a climate hazard affects a vulnerable and exposed system. Understanding climate *impact* requires looking beyond just the hazard itself. We need to consider the specific vulnerabilities and exposures of the systems in harm's way to assess the true potential for negative consequences. This helps prioritize adaptation efforts where they are most needed. To accurately assess the potential risks posed by significant climate hazards, this procedure help sites to emphasizes a meticulous approach that involves analyzing each process and its detailed activities in relation to each relevant hazard.

- **Recommendations from Insurance Audits:** To track recommendations from other assessments, please, mention if the action is linked to Insurance Audits (e.g. AXA or Zurich RE reports) by mentioning its code.

5 CHARACTERIZATION OF THE SITE EXTERNAL CONTEXT

5.1 External context characterization

Conducting the Environmental and Climate Adaptation Analysis requires significant prerequisite knowledge of the site, its context and its issues.

This begins by characterizing the external issues and the environment in which the site is located and studying them, including characteristics **affected by the site or likely to affect the site as external issues can result in risks and opportunities for the site**. The site should determine which ones need to be addressed and managed.

In characterizing the external context, it is also important to determine:

- Interested parties that are relevant to the environmental management system;
- The relevant needs and expectations (i.e. requirements) of these interested parties;
- Which of these needs and expectations become compliance requirements.

Examples of external issues:

- a) external factors: regulatory, legal, cultural, social, political, financial, technological, economic, natural and competitive, at the international, national, regional or local level (examples: European circular economy policy and associated draft laws, regulations in favor of active mobility, changes in the price of energy, water, influence of a sanitary crisis...);
- b) environmental characteristics related to climate, air quality, land use, existing pollution, availability of natural resources and biodiversity, which may affect the activity of the site and/or the Group, or be affected by its environmental aspects. This characterization of the environment is carried out by listing the aggravating factors, which highlight the state, and therefore the sensitivity of the environment, in which the site is located. Examples of aggravating factors can be found in [Appendix 4](#).
- c) environmental characteristics increasing risk of potential natural hazard on or close to your site due to acceleration of climate change (examples : potential overflowing river near-by, extreme temperatures reached periodically, potential burning of forest near by...).

Elements for characterizing the site's environment can be found in **national public databases** (e.g., databases of former industrial sites, databases on polluted sites and soils, databases referencing sensitive and protected areas), **environmental insurance prevention visit reports** (reports currently available in BlueKangoo), climate change exposure (=occurrence likelihood) and adaptation recommendations (e.g. **ZURICH RE** for factories of the Group), the **environmental impact study** report conducted when the site was built, or in the **discharge agreement** to which the site is subject.

5.2 Incoming and Outgoing flows

It is recommended here to identify the major incoming and outgoing flows that enable the site to operate, in particular:

- Energy, including the main uses (heating, cooling, lighting, etc.), their sources (fossil gas, renewable gas, non-renewable electricity, renewable electricity, district heating network, etc.) and associated atmospheric emissions (SO₂, CO₂ emissions);
- Water flows, including the main uses (domestic, watering, processes, etc.), their sources (municipal water, rainwater, water collected from groundwater, etc.) and their discharges (off-site treatment, reclaim, treatment in a wastewater treatment plant on site, etc.);
- Incoming material flows and the main waste generated (cardboard, plastics, sludge, other, etc.), their treatment (reuse, recycling, incineration with energy recovery, etc.) and the associated transport (number of tipper rotations, associated CO₂ emissions)

Incoming flows can be classified according to the following categories: energy, water, raw materials and other chemical substances, consumables, equipment (including furniture), etc.

Outgoing flows can be classified according to the following categories: waste, effluents, air emissions, odors, noise, etc.

This balance sheet must take into account all scenarios:

- Normal situation
- Degraded situation: equipment under maintenance, shutdown...
- Accidental

5.3 Defining a list of processes on-site

The next step is to define the scope of your analysis by identifying relevant site processes.

Important note on extensivity of exercise:

For sites subjected to ISO 14001 certification or those pursuing renewable energy strategies, leverage the existing Environmental Management System (EMS) processes for consistency. The goal is the review for each process the potential climate change impact it is exposed to or all key environmental impact of the different activities of each process. Please adjust extensivity of exercise based on your last ISO 14001 auditor recommendation on the topic if any.

For sites not subjected to ISO 14001 certification, organize site processes based on EMS and assess only the ones that are vital and critical for your site, including any recommendation mentioned in insurance report.

For both, include any recommendation mentioned in insurance report.

Example of EMS process split:

Realization Processes: Directly contribute to product/service creation (e.g., Fabrication).

Support Processes: Enable smooth operation of realization processes by providing resources (e.g., Quality Control, EHS).

Management Processes: Focus on policy setting, objective deployment, and organizational direction (e.g., Training).

5.4 Life cycle analysis for each process

The life cycle stages of a process for which the site has influence or control will be analyzed in the environmental analysis.

Example: a factory has generally no influence on product formulation and on the raw materials used, as this activity is the responsibility of another Group entity. The plant will therefore describe, on the basis of its level of knowledge, the issues related to this stage of the life cycle (e.g., resource reductions) and the means of control implemented (programs, objectives, tools, etc.) by the Group (cf. Annex "Environmental impacts at Group level").

On the other hand, the quantity of raw materials ordered for production may depend on the loss rate, which the plant can influence. These issues must therefore be integrated into both of the Analysis.

It is recommended to formalize the description of the life cycle stages in the same document as the Environmental Assessment (option provided in "Processes list" of Analysis Template), so as to check the impacts of a possible change on the control and influence of the site on these stages.

6 EVALUATION OF CURRENT MEANS OF CONTROL IDENTIFIED

For all Environmental Aspect / Impact pairs where the environmental impact is adverse, the means of control and good practices currently in place to reduce this impact must be listed. If the reduction of the environmental impact could be quantified (e.g. energy savings in kWh, waste reduction in kg...), it is recommended to note it.

For all Climate Hazard Category / Impact pairs where the impact on activity is adverse, the means of control and good practices currently in place to reduce this impact must be listed. If the reduction of the climate impact could be quantified (e.g. number of activity breakdown days saved, cost of activity breakdown saved, ...), it is recommended to note it. For all measures, you must ensure your measures meet these criteria:

1. Does your measure demonstrably improve health and safety?
2. Is it socially responsible and acceptable to communities?
3. Does it promote justice and equity for everyone?
4. Does it operate within planetary boundaries and respect biodiversity?

This evaluation of the means of control will allow a better scoring of significance of Climate Hazard listed based on severity and frequency of occurrence.

7 SCORING (severity x frequency)

Based on all information collected in the previous steps of this analysis, **taking into account current means of control efficiency**, severity and occurrence frequency must be assessed.

7.1 Severity Scoring for Environmental and Climate Adaptation Analysis

Severity must be assessed according to the below severity ranking table guidelines:

- *the environmental aspect only has to correspond to one condition of the severity level to be accounted within this level of severity.*
- *if environmental aspect fits in multiple severity level, choose the highest one.*
- *any environmental aspect corresponding to a PLANET 1 non conformity or event should be considered moderate effect at minimum.*
- *For Climate Adaptation Analysis, assessing Severity through a Business Lens also: When evaluating severity, consider the potential impact on your business operations. Specifically, estimate the duration of production downtime that the hazard could cause (in days and hours).*

SEVERITY SCORING FOR ENVIRONMENT AND CLIMATE ADAPTATION ANALYSIS

- the environmental aspect only has to correspond to one condition of the severity level to be accounted within this level of severity;
- if environmental aspect fits in multiple severity level, choose the highest one
- any environmental aspect corresponding to a PLANET 1 non conformity or event should be considered H at minimum, PLANET 2 M minimum.

Massive effect	1	Interest of public opinion, damage to global image in terms of environmental impact. <i>Example: Negative articles on the site in the local or national press.</i>	reputation scoring
		Major non-compliance with environmental regulation, risk of condemnation, impact on operations. <i>Example: Risk of temporary or permanent closure of a site.</i>	regulatory scoring
		Situation blocking the achievement of one or more quantified objectives of the Group's Sustainable Development programme or leading to a major non conformity to the Planet Risk programme (Planet 1). <i>Example: Landfill without regulatory constraints .</i>	group policy scoring
		Consumer Safety Issue - No compliance with regulations with significant repercussion for the Group - Loss of traceability with severe consequences for the Group - Irreparable damage to the Brand's image in terms of credibility and ethics on an extended scale - Finding A (see audit report)	quality scoring
		Massive environmental damage due to pairing between the intensity of the pollution or resource usage by the site with the vulnerability of the environment or lack of abundance of the resources surrounding the site.	physical environment scoring
Major effect	2	Interruption of production during 1 week	business scoring
		Mobilisation of a category of people (activity, associations, local residents), damage to image in terms of environmental impact. <i>Example: Complaints from an association of local residents brought to the attention of the local environmental authorities.</i>	reputation scoring
		Lack of knowledge of the degree of compliance, frequent or recurrent environmental regulatory non-compliance, formal notice, major fine, possible significant additional costs. <i>Example: Formal notice of a site by the environmental authorities.</i>	regulatory scoring
		Strong impact on the achievement of a quantified objective of the site Policy and/or the Group Sustainable Development programme. (Planet 2 ?) <i>Example: Exceeding the annual threshold of CO2 equivalent for refrigerant leaks</i>	group policy scoring
		Strong dissatisfaction of the consumer such that he does not purchase again - Non-compliance with regulations with significant repercussion for the site - Critical traceability failure with the site level consequences - Image of the Group and the Brand is altered in a limited area - Finding B (see audit report)	quality scoring
		Major environmental damage due to pairing between the intensity of the pollution or resource usage by the site with the vulnerability of the environment or lack of abundance of the resources surrounding the site.	physical environment scoring
		Interruption of production during 24h	business scoring

EHS-INS-007 A / Environmental and Climate Adaptation Analysis for the site

Moderate effect	3	Sensitivity of a category of people (regular relevant actions or complaints, request for information), potential effect on image in terms of environmental impact. <i>Example: Complaints (oral and/or written) from a local resident following odour nuisances linked to the site's activity that date back less than 5 years.</i>	reputation scoring
		One-off environmental non-compliance, action by the authorities, minor fine. <i>Example: Payment of a fine following regulatory non-compliance.</i>	regulatory scoring
		Moderate impact on the achievement of a quantified objective of the site Policy and/or the Group Sustainable Development programme or leading to a minor non conformity to the Planet Risk programme (Planet 2). <i>Example: Absence of action plan to reduce waste generation on site</i>	group policy scoring
		Consumer disappointment (consumer buys back anyway; commercial value of FG is impaired) - Controlled impact in terms of regulatory compliance - Good practices of traceability not respected - Event deemed to have no impact on brand image - Finding C (see audit report)	quality scoring
		Moderate environmental damage due to pairing between the intensity of the pollution or resource usage by the site with the vulnerability of the environment or lack of abundance of the resources surrounding the site.	physical environment scoring
Minor effect	4	Interruption of production during 8 hours	business scoring
		Low sensitivity (isolated, non-recurring previous complaints), no effect on image in terms of environmental impact. <i>Example: Complaints (oral and/or written) from a local resident following noise nuisance linked to the site's activity dating back more than 5 years.</i>	reputation scoring
		Regulatory compliance largely met, but close to a threshold (+/- 10%). <i>Example: Occasional exceedances of the imposed water withdrawal limit.</i>	regulatory scoring
		Low impact on the achievement of a quantified objective of the site Policy and/or the Group Sustainable Development programme.	group policy scoring
		Defects hardly noticeable by the consumer - Little impact on operating performance	quality scoring
		Minor environmental damage due to pairing between the intensity of the pollution or resource usage by the site with the vulnerability of the environment or lack of abundance of the resources surrounding the site.	physical environment scoring
		Interruption of production during less 1 hour	business scoring

No effect	5	Very low sensitivity. No complaints brought to the attention of the people on the site in terms of environmental impact.	reputation scoring
		No particular environmental constraint, environmental regulatory compliance largely respected.	regulatory scoring
		No impact on Group sustainable targets or non conformity to the Planet Risk programme.	group policy scoring
		No impact for the consumer and operating performance	quality scoring
		No environmental damage due to pairing between the intensity of the pollution or resource usage by the site with the vulnerability of the environment or lack of abundance of the resources surrounding the site.	physical environment scoring
		No interruption of the production	business scoring

7.2 Probability scoring for Environmental and Climate Adaptation Analysis

Probability (occurrence likelihood) is defined in the department RAM Matrix.

Increasing likelihood				
E	D	C	B	A
So unlikely that it can be assumed that no case will even occur	Very unlikely to occur (1 case/ 10 years)	Likely to occur one day or another (1 case/ 3 years)	Will occur several times (1 case/ year)	Likely to occur frequently (1 case/ week)

For Environmental Analysis, you are free to assess the likelihood by your expertise.

For Climate Adaptation Analysis, use the table below (provided in the “Probability for CAA”) to guide your assessment of the probability of each significant natural hazard affecting each site.

Baseline Probabilities: The table provides baseline probabilities based on data from Munich RE, WRF and other.

Adjustments: You may assess a higher probability than the baseline if your internal knowledge and context warrant it. However, you cannot assign a lower probability than the provided baseline.

To come : updated table with exposure for DCs, AS and R&I.

7.3 Final Assessment for both Environmental and Climate Adaptation Analysis

The confrontation between severity and frequency defines the significance according to [the RAM Matrix](#) :
 For both Environmental and Climate Adaptation Analysis: all Medium, High and Very High must be assessed as “**Significant**” (SEIs or SCIs for the site) so must be an input of GHAP (except all M) and be the **object of an action plan**.

Consequences					Increasing likelihood				
Severity	People	Environment	Assets	Reputation	E	D	C	B	A
					So unlikely that it can be assumed that no case will even occur	Very unlikely to occur (1 case/ 10 years)	Likely to occur one day or another (1 case/ 3 years)	Will occur several times (1 case/ year)	Likely to occur frequently (1 case/ week)
1	Multiple fatalities	Massive effect	Massive damage	Massive impact	L	H	H	VH	VH
2	One fatality or multiple major injuries	Major effect	Major damage	Major impact	L	M	H	VH	VH
3	A single major injury or health effect	Moderate effect	Moderate damage	Moderate impact	L	M	M	H	VH
4	Minor injury or health effect	Minor effect	Minor damage	Minor impact	L	L	M	M	H
5	No injury or health effect	No effect	No damage	No impact	L	L	L	L	L

8 ACTION PLAN

For Environmental and Climate Adaptation Analysis, the objective is to carry out the necessary actions so that the identified SEAs and SCIs. SEAs or SCI are priorities for the site. These with **H and VH** scores must be an input to the **GHAP**. These with **M, H, and VH** scores must lead to a **prevention or adaptation plan**.

M	H	VH
Significant Environmental Impacts (SEI)		
Significant Climate Impacts (SCI)		
Prevention Plan (Environment)		
Adaptation Plan (Climate Adaptation)		



Action plans must be put in place to reduce their impact through control measures by **M or L** risk scores, to ensure regulatory compliance, to align with the Group objectives, to have a better positive efficiency and align with the recommendations of Insurance Audits when relevant.

When developing climate adaptation measures, prioritize actions that directly reduce the potential severity of climate hazards on our business. Remember, we cannot alter the probability of these hazards, as they are driven by external climate change factors.

To track progress, please update the status of each action with “not started”, “on-going” and “closed”.

Special cases:

It may happen that the significance of a SEA depends, for example, on the design of the site itself or on an investment too high to be implemented. In this case, the monitoring plan of the SEA must be followed and updated in order to remain always the most adapted to the situation.

Some situation may need to be accounted in the site **Emergency Plan**.

9 DASHBOARD

Environmental and Climate Adaptation risks are top priorities for L'Oréal and regulators, driving new transparency requirements. To empower your success, we're introducing enhanced visualizations for seamless reporting and performance tracking.

10 UPDATES

These Analysis must be dynamic tools in order to always be representative of the current situation of the site and therefore relevant.

- It can be updated on an ad hoc basis, whenever there is a new development or change on the site (construction of an installation, building, installation of a new machine, shutdown of a machine, new management of landscaped areas, accident or incident, new material, change in the danger class of a chemical product, change of service provider, etc.), or whenever changes in the environment in which the site operates are likely to have consequences on its operation (passage into a protected area (Natura 2000 for example), etc.).
- It must be updated yearly, to review the ratings of SEAs and SCIs, for which actions have been carried out. On this occasion, in order to contribute to continuous improvement, the threshold of the ratings

may be lowered, so that the site can ensure a continuous improvement process through the priority actions that result from it. This step becomes more and more important as the years go by and the site's Environmental Management System matures.

A partial update can also be carried out according to specific needs, for example in the following cases :

- o Following an environmental audit (internal or external) or a corrective and preventive action
- o To prepare the management review.

11 ASSOCIATED DOCUMENTS & LINKS

Associated documents (available in Alexandria):

- EHS-FORM-013 Environmental and Climate Adaptation Analysis Tool
- EHS-INS-009 Risk Assessment Matrix (RAM)
- EHS-INS-047 A Management of Heatwaves in the workplace
- EHS-FORM-001 General Hazard Analysis Procedure (GHAP)
- EHS-FORM-002 Safety Hazard Analysis Procedure (SHAP)
- EHS-FORM-005 PLANET RISK and LIFE RISK Scantool
- AQR-001-53 Global Hazard Assessment Procedure – GHAP for Quality

Helpful links for information and action plan:

- [Bluekangoo](#) for environmental insurance reports e.g. AXA, Munich
- [LIME](#) for environmental incident reporting

12 APPENDIX

12.1 Appendix 1 : Environmental Aspects examples

Domains of aspects	Environmental aspects examples
Energies	Use of electricity, gas, fuel...
Emissions	Emissions of greenhouse gases, smokes, noise, odors...
Water	Water withdrawal
Discharges	Wastewater discharge, accidental spillage, pesticides spray...
Ressources	Use of RM, paper, furniture, electronic...
Waste	Waste generated and treated with recycling, incineration, destruction...

12.2 Appendix 2 : Environmental Impacts examples

Non exhaustive list, to adapt in case of specific impacts of the site

Types of impacts	Environmental impacts
Reduction of the resource availability	Reduction of energetic resources Reduction of water resources Reduction of natural resources Reduction of water access ...
Pollution, degradation	Air pollution Water, soil, subsoil pollution Damage to biodiversity Annoyance of the neighbourhood
Beneficial impacts Preservation	Preservation of energetic resources Preservation of water resources Preservation of natural resources Preservation of the environment

12.3 Appendix 3 : Processes breakdown examples

PROCESSES ON SITE

Process (examples are provided below, please update according to your ISO report / specific site processus mapping)	Description / Comments	Responsible
Human resources management		
Reception		
Manufacturing		
Equipment and premises		
Effluent and waste management		
Conditioning		
Control and release		
Shipping		
Emergency management		
Launch and planning		
Laboratory		
Purchasing		
Utilities		

12.4 Appendix 4 : Examples of aggravating factors for external context review

AIR

Highly polluted area
Population / sensitive area near or under prevailing winds
Special climate during certain seasons (heat, haze, climate change impacts, etc.)

SURFACE AND GROUNDWATER

Watershed with high water stress
High and/or frequent low water periods
Sensitive municipal wastewater treatment plant
Water table near the site and/or at a shallow depth
Catchment point near the site
Protection zone for drinking water catchment

SOIL AND SUBSOIL

Particularly permeable soil or flood zone
History of soil or subsoil pollution
Proximity to arable land

BIODIVERSITY

Proximity to protected areas (e.g. NATURA 2000 in Europe, natural parks)
Area hosting protected species
Site hosting breeding sites or resting places of species

NATURAL RESOURCES (to be adapted to the resource involved in the EA considered)

Non-renewable natural resources
Long-term renewable or restricted natural resources

NEIGHBORHOOD

Nearby sensitive area (hospital, nursing home, school, etc.)
Nearby urban residential area

LANDSCAPE

Landscape prescriptions
Proximity of a remarkable natural environment: marsh, peat bog, classified wooded area, etc.
Inter-municipal environmental management zone: Regional Natural Park, etc.
Tourism zone: hiking, mountain biking, canoeing, horseback riding, etc.

12.5 Appendix 5 : Environmental and Climate Adaptation Analysis Summary Diagram

This section serves as a reminder of the key methodology points for conducting your environmental and climate analysis:

Process Selection:

- Sites with ISO 14001, 9001, 45001, 18001 or Renewable Energy Strategies:
For consistency, leverage the existing Environmental Management System (EMS) processes.
- Sites without ISO 14001 or Renewable Energy Strategies:
Organize site processes based on the EMS framework (see examples below).
Focus your assessment: Analyze only the processes that are vital and critical to your site's operations.
- For both, include any recommendation mentioned in insurance report.
 - Examples of EMS Processes:
 - Realization Processes: Directly related to product/service creation (e.g., Fabrication).
 - Support Processes: Provide resources and enable the smooth functioning of realization processes (e.g., Quality Control, EHS).
 - Management Processes: Involve policy setting, objective deployment, and overall organizational direction (e.g., Training).

Action Planning and Implementation:

- Developing Action Plans: Create detailed action plans to reduce the impact of identified risks (SEIs and SCIs).
- Prioritize Elimination: First, explore options for eliminating high-priority risks.
- Control Measures: Focus on control measures that achieve "M" (Medium) or "L" (Low) risk scores.

Key Considerations:

- Ensure actions comply with regulations.
- Align with Group objectives and promote positive efficiency (see criteria below).
- Consider recommendations from Insurance Audits.
- Prioritize Nature-Based Solutions: Whenever possible, explore and incorporate nature-based solutions into your action plans.

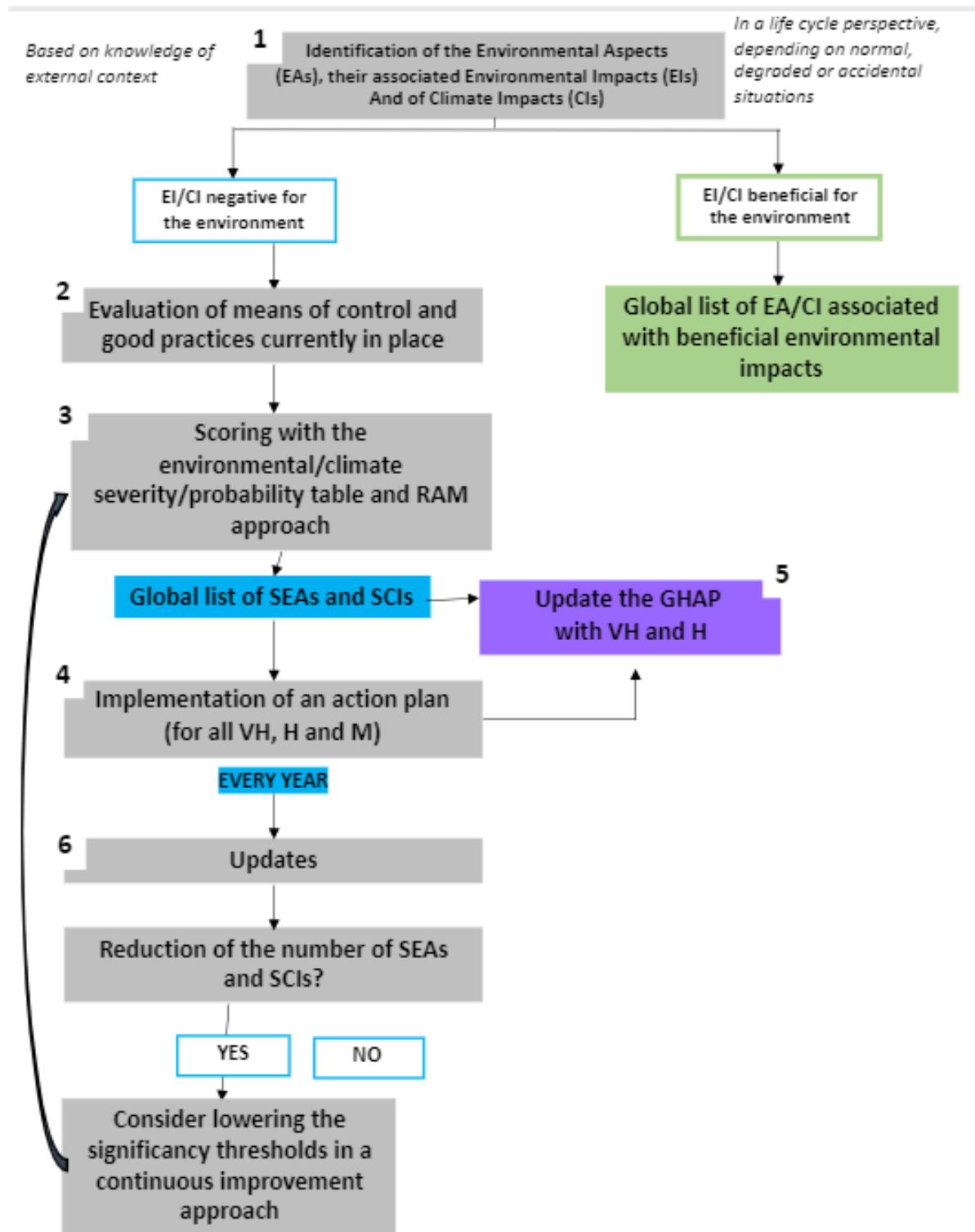
Climate Adaptation Focus:

- Prioritize actions that directly reduce the potential severity of climate hazards on business operations.
- Remember, climate adaptation centers on managing impact, as we cannot control the probability of hazards driven by external climate change.

Action Status & Tracking:

- Track the progress of each action.
- Ensuring Positive Efficiency (For all measures):
 - Before implementing any measure, confirm that it meets these essential criteria:
 - Improved Health & Safety: Does it demonstrably enhance health and safety?
 - Social Responsibility: Is it socially responsible and acceptable to surrounding communities?
 - Justice & Equity: Does it promote justice and equity for everyone involved?
 - Planetary Boundaries: Does it operate within planetary boundaries and respect biodiversity?

By following these guidelines, you can ensure a focused and impactful environmental and climate analysis that aligns with sustainability best practices.



12.6 Appendix 6 : Environmental Impact at Group Level (for Life Cycle perspective in impact identification)

...

12.7 Appendix 7 : Overview of completed Environmental Analysis tool for a Factory with 5 examples

...

12.8 Appendix 8 : List of significant climate hazards for L’Oréal factories with current, 2030, 2040 and 2050 RCP8.5 scenario by Munich RE, Water Risk Filter

Source	Natural Hazard	Scores retained	Definition

Munich RE	Earthquake	Zone 3: MM VIII Zone 4: MM IX and above	Probable maximum intensity (MM: modified Mercalli scale) with an exceedance probability of 10% in 50 years (equivalent to a return period“of 475 years) for medium subsoil conditions.																		
	Tropical Cyclone	Zone 5: ≥ 300 km/h	The Tropical cyclone hazard score is derived from globally consistent, basin-specific models for tropical cyclones, and is based on probable maximum wind intensities with a return period of 100 years																		
	Hail	Zone 3 Zone 4 Zone 5 Zone 6: High	Frequency and intensity of hailstorms. The hail zoning expresses the location-specific hail potential, which is derived from lightning frequency, drop length, evapotranspiration and temperature. The hail zoning is based on the representation of atmospheric conditions that can lead to a hailstorm and does not allow frequency (or return period) attributions for hailstorms of certain intensities and vice versa.																		
	Tornado	Zone 3: 2.1 – 10.0 Zone 4: > 10.0	The Tornado Zones are based on frequency and intensity interpolated from meteorological data (Unit: Tornadoes per 10,000 km² and year).																		
	Lightning	Zone 3 Zone 4: 10.1 - 20.0 Zone 5: 20.1 - 40.0 Zone 6: 40.1 - 80.0	Global frequency of lightning strokes per km² and year. Lightning frequency is determined by counting the total number of lightning flashes independently of whether they strike the ground or not																		
	River Flood (Defended)	Zone 100: year return period Zone 50: year return period	Areas threatened by extreme floods. JBA flood maps with return periods of 50, 100 and 500 years. Includes information on local flood protection measures.																		
	Flash Flood	Zone 2 Zone 3 Zone 4 Zone 5 Zone 6	Frequency and intensity of flash floods. The flash flood hazard score describes the hazard level, based on meteorological data, soil sealing information as well as terrain and hydrographic data (slope and flow accumulation). <table><tr><td>FEATURE</td><td>RIVER FLOOD</td><td>FLASH FLOOD</td></tr><tr><td>Onset</td><td>Gradual (days/weeks)</td><td>Rapid (minutes/hours)</td></tr><tr><td>Cause</td><td>Prolonged rain/snowmelt, dam failure</td><td>Intense rain, dam failure, etc.</td></tr><tr><td>Predictability</td><td>More predictable</td><td>Less predictable</td></tr><tr><td>Duration</td><td>Longer (days/weeks/months)</td><td>Shorter (hours)</td></tr><tr><td>Affected Area</td><td>Wide floodplain</td><td>Localized, various terrains</td></tr></table>	FEATURE	RIVER FLOOD	FLASH FLOOD	Onset	Gradual (days/weeks)	Rapid (minutes/hours)	Cause	Prolonged rain/snowmelt, dam failure	Intense rain, dam failure, etc.	Predictability	More predictable	Less predictable	Duration	Longer (days/weeks/months)	Shorter (hours)	Affected Area	Wide floodplain	Localized, various terrains
	FEATURE	RIVER FLOOD	FLASH FLOOD																		
	Onset	Gradual (days/weeks)	Rapid (minutes/hours)																		
	Cause	Prolonged rain/snowmelt, dam failure	Intense rain, dam failure, etc.																		
	Predictability	More predictable	Less predictable																		
	Duration	Longer (days/weeks/months)	Shorter (hours)																		
Affected Area	Wide floodplain	Localized, various terrains																			
Storm Surge (Defended)	Zone 100: year return period	Coastal areas threatened by storm surges for return periods 100, 500 and 1000 years, based on 30m FABDEM Digital Elevation Model (DEM). Does consider flood defenses.																			
Wildfire	Zone 2 Zone 3 Zone 4: High	The wildfire hazard zones describe potential wildfire hazard levels, which are mainly driven by physical drought/dryness conditions and the existence of burnable material, following an empirical approach. While the drought/dryness conditions are determined by temperature and precipitation as key parameters, a vegetation parameter is incorporated based on vegetation and landcover/land-use data. This does not allow frequency estimates for wildfire. The effects of wind, arson and fire-prevention measures are not considered.																			
Peak Ground Acceleration	Zone 7: 0.131 - 0.200 Zone 8: 0.201 - 0.350 Zone 9: 0.351 - 0.550 Zone 10: 0.551 - 0.900 Zone 11: 0.901 - 1.500 Zone 12: > 1.500	The Global Earthquake Model (GEM) Global Seismic Hazard Map (version update 2019) depicts the geographic distribution of the Peak Ground Acceleration (PGA) with a 10% probability of being exceeded in 50 years, computed for reference rock conditions (shear wave velocity, V _s of 760-800 m/s). The map was created by collating maps computed using national and regional probabilistic seismic hazard models developed by various institutions and projects, and by GEM Foundation scientists																			
Soil & Shaking	Class 4: stiff soil Class 5: soft soil Class 6: High, reclaimed land	The Soil and Shaking hazard shows underground conditions that influence earthquake intensity. This hazard score, which combines geological, soil and hydrological information, complements the interpretation of the earthquake perils by elaborating information about how fast earthquake waves move through the ground based on the soils natural composition and its impact on the area of interest.																			
Distance to Active Faults	Class: > 50000 m Class: 25001 - 50000 m Class: 5001 - 25000 m	The distance to active fault indicates how far the location is from the nearest active geological fault. The distance is calculated up to a maximum distance of 50																			

		Class: 1001 - 5000 m Class: 501 - 1000 m Class: 101 - 500 m Class: <= 100 m Class: 1001 - 5000 m Class: 501 - 1000 m Class: 101 - 500 m Class: <= 100 m	kilometers and the value is returned in meters. If the distance is further than 50 kilometers, the value -1 is returned
	Annual Water Stress	Zone 3: High (40-80%) Zone 4: Extremely High (>80%)	Baseline water stress measures the ratio of total water withdrawals to available renewable surface and groundwater supplies. Water withdrawals include domestic, industrial, irrigation, and livestock consumptive and nonconsumptive uses. Available renewable water supplies include the impact of upstream consumptive water users and large dams on downstream water availability. Higher values indicate more competition among users
	Landslide	Zone 3: Medium Zone 4: High	The Global Landslide Hazard Map presents a qualitative representation of global landslide hazard at a global scale. It is the combination of the The Global Landslide Hazard Map: Median Annual Rainfall-Triggered Landslide Hazard (1980-2018) and The Global Landslide Hazard Map: Earthquake-Triggered Landslide Hazard which has then been simplified to four categories, ranging from Very low to High landslide hazard.
	Heat Stress	High Medium to Extreme - SSP5-/ RCP8.5 2050	Heat Stress Index combines several temperature-related parameters and classifies the climatological heat stress situation on a scale ranging from 0 (very low) to 10 (very high).
	Precipitation	High Medium to Extreme - SSP5-/ RCP8.5 2050	Precipitation Stress Index combines several heavy-precipitation-related parameters and classifies climatological precipitation stress on a scale ranging from 0 (very low) to 10 (very high).
	Fire Weather	High Medium to Extreme - SSP5-/ RCP8.5 2050	Fire Weather Stress Index describes the potential influence of atmospheric conditions on a wildfire, based on the climate variables of temperature, wind, precipitation, and relative humidity on a scale ranging from 0 (very low) to 10 (very high).
	Drought Stress	High Medium to Extreme - SSP5-/ RCP8.5 2050	Drought Stress Index based on SPEI (Standardised PrecipitationEvapotranspiration Index) and dry-spell conditions. SPEI is a multiscalar drought index that is used to determine the onset, duration and magnitude of drought conditions in relation to normal conditions, where the climatic water balance over the second half of the 20th century is considered as reference conditions.
	Cold Stress	High Medium to Extreme - SSP5-/ RCP8.5 2050	Cold Stress Index combines several temperature-related parameters and classifies climatological cold stress on a scale ranging from 0 (very low) to 10 (very high)
Water Risk Filter	Water Scarsity	2,6 and above	WRF scenario 2020 2030 2050
	Water Quality	Free entry from user	Water Quality indicates whether water resources are fit for human use and ecosystems alike. Poor water quality – water pollution – can impact business indirectly by causing ecosystems destabilization or serious health issues as well as directly through increased operating costs, and as reduction in production or growth. This uses biological oxygen demand (BOD) as a widely used umbrella proxy for overall water quality; electrical conductivity (EC) as proxy for salinity balance and pH alteration; and nitrogen, to capture nutrient loading in water bodies.
	Water Reputation	Free entry from user	Water Reputational represents stakeholders' and local communities' perceptions on whether companies conduct business sustainably or responsibly with respect to water. This comprises four risk categories: cultural importance of water to local communities, freshwater biodiversity importance, media scrutiny/coverage of water-related issues, and risk of hydro-political conflicts in the river basins.
	Water Regulatory	Free entry from user	Water Regulatory is tied to the concept of good governance and that businesses thrive in a stable, effective and properly implemented regulatory environment. This comprises four risk categories: enabling environment, institutions & governance, management instruments, and infrastructure & finance.

After analysis of Munich RE report, the scores of sea level rise, volcanoes, tsunami and extratropical storms hazards on factories aren't significant to assess.

This page was intentionally left blank for duplex printing.



EHS Management System



EHS Management of External Contractors

EHS-INS-008 A

09/2023

ISSUE : Corporate EHS

CONTENT OF MODIFICATIONS:

Cancels and supersedes: EHS-001-37 EHS Management of Third-Party Distribution

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

CONTENTS

1	AIM.....	3
2	SCOPE	3
3	ROLES AND RESPONSIBILITIES.....	3
4	AUDIT OVERALL PROCESS	4
4.1	Audit application	4
4.2	Selection of an external contractor for qualification	5
4.3	Contract with the auditor.....	5
4.4	Performing an EHS audit	6
4.5	Classification.....	8
5	ASSOCIATED DOCUMENTS	11
6	APPENDICES.....	12
6.1	Appendix 1 : EHS requirements to include in contracts (not applicable to Waste providers)	12
6.2	Appendix 2: Types of production and services for co-packing & conversion	14
6.3	Appendix 3 : Waste disposal providers	14
6.4	Appendix 4 : Reporting of environment indicators for 3PL entities.....	14

1 AIM

This document describes the objectives and the approach to be adopted for an external contractor to be eligible, from an EHS point of view, to sign a contract with L'Oréal.

2 SCOPE

This procedure applies to external contractors who will be hired to work for L'Oréal, including: industrial contractors, Third-Party Logistic sites (3PL), co-packers and waste treatment providers.

An industrial contractor is a site operated by a company mandated by L'Oréal for manufacturing and/or packaging activities for semi-finished or finished products. This includes contractors who carry out permanent or temporary activities within a L'Oréal manufacturing plant.

A Third-Party Logistic site (3PL) is a warehouse operated by a third-party company for the receipt, storage, preparation and shipment of finished products.

Co-packing terminology includes repacking, conversion, co-packing or unpacking activities (see details in appendix 2).

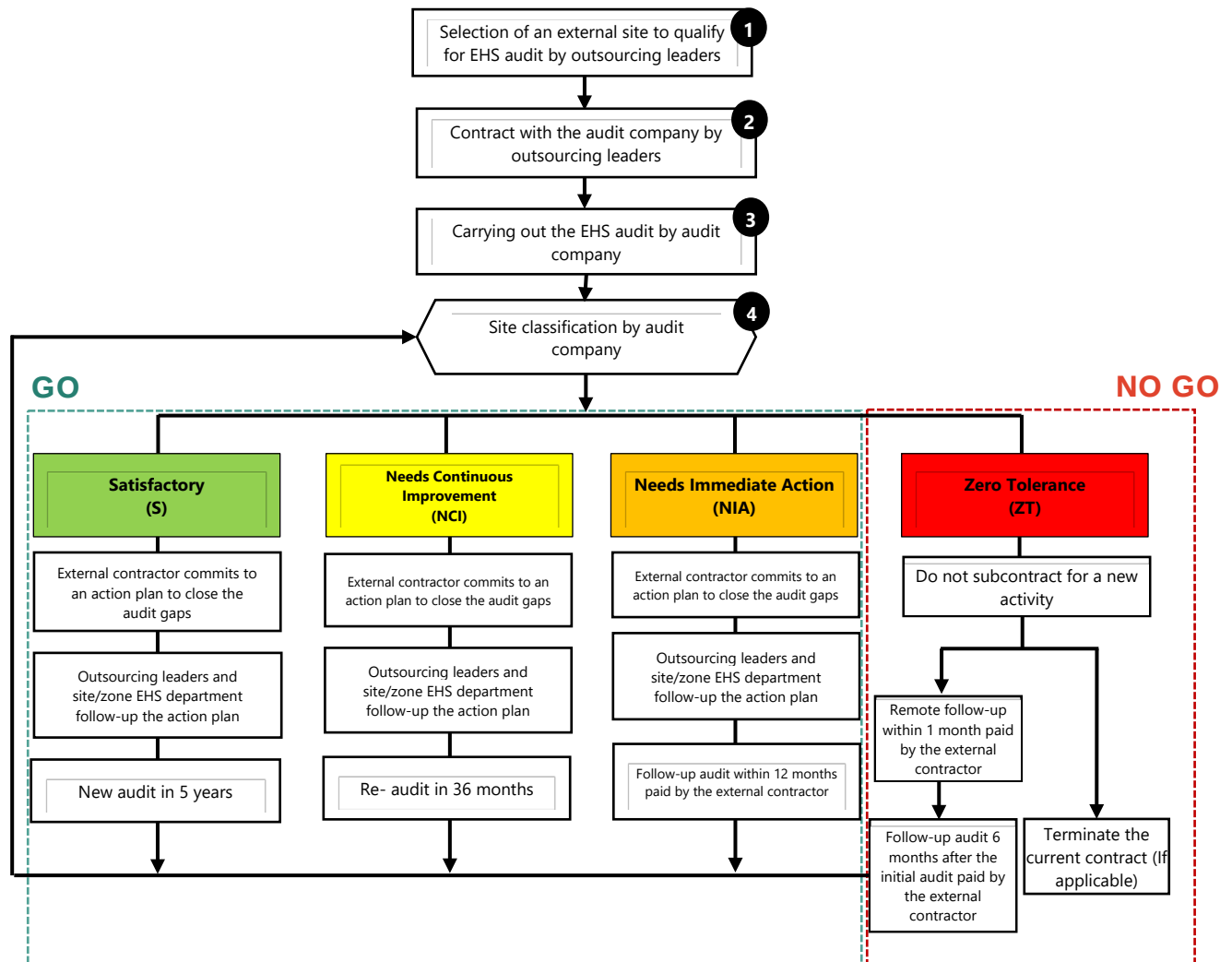
Waste treatment providers include those responsible for handling waste from flammable aerosols, solid or liquid flammable products and oxidants on behalf of L'Oréal.

3 ROLES AND RESPONSIBILITIES

Outsourcing leaders are the L'Oréal departments in overall charge of implementing this procedure in each of its areas with the support of the L'Oréal site/zone EHS department:

- For Industrial contractors: Purchasing departments
- For 3PL sites: Country Operations Director (DOP) and the Director of Supply Chain (DSC)
- For co-packers: DOP and the DSC
- For waste treatment providers: Site Managers, DOP or DSC

4 AUDIT OVERALL PROCESS



4.1 Audit application

4.1.1 Industrial contractor

An EHS audit is mandatory for qualification purposes when the site handles and/or manufactures hazardous products on behalf of L'Oréal. Here is a non-exhaustive list of activities for which an EHS audit is necessary:

- Handling, manufacturing and/or packaging of flammable liquids (alcohol, ethyl acetate, etc.)
- Handling, manufacturing and/or packaging of cosmetic powders
- Handling, manufacturing and/or packaging of coloring or bleaching products (e.g. containing ammonia, hydrogen peroxide, sodium persulfate, potassium persulfate or ammonium persulfate)
- Handling, manufacturing and/or packaging of flammable aerosols
- Handling highly toxic substances (e.g. carcinogenic, mutagenic and reprotoxic)

4.1.2 Third party logistic center

An EHS audit is mandatory for qualification when:

- L'Oréal employees are present on-site for an average of at least one day per week on average (full-time equivalent).
- The site is subcontracted as a storage capacity for, at least (at any given moment):
 - o 15 aerosol paletts OR
 - o 1,000 pallets of any other material

4.1.3 Co-packers

An EHS audit is mandatory for qualification purposes when:

- L'Oréal employees are present on-site for an average of at least one day per week (full-time equivalent).
- The site carries out a co-packing & conversion activity involving dangerous products (flammable products, aerosols, oxidizers, ...)

4.1.4 Waste disposal providers

An audit is mandatory for sites handling hazardous waste: flammable aerosols, solid or liquid flammable products and oxidants on behalf of L'Oréal.

For other types of waste, and particularly for non-hazardous finished goods, an audit is recommended. Whether or not it is carried out will depend on a risk analysis carried out by the L'Oréal person in charge of EHS.

4.2 Selection of an external contractor for qualification

An external contractor site, meeting the above selection criteria, should be selected for audit during the year if it meets one of the following criteria:

- New contractor site with whom we have not yet entered into a contract or a site with a contract now changing its activities
- Site of an existing contractor who has never been EHS qualified
- Existing contractor sites classified as Zero Tolerance (ZT), Satisfactory (S), Needs Continuous Improvement (NCI) or Needs Immediate Action (NIA) that are due for a re-audit or follow-up audit during the year.

The contractor sites to be qualified are selected in the last quarter of each year by the outsourcing leaders.

4.3 Contract with the auditor

The following information must be provided to the auditing company for each subcontracted site to enable them to send a proposal:

- Name of contractor and location of site (country, state, city) to be audited
- Nature of the activities and volume of the activities to be subcontracted
- Desired period for the audit (Quarter 1, 2, 3 or 4)

EHS-INS-008 A / EHS Management of External Contractors

- Site classification (S, NCI, NIA, ZT or new site)
- Nature of the audit: full audit, re-audit or follow-up audit
- Identification of the entity paying for the audit.

In the event that a new contractor site is to be included in the program during the year, the auditing company can be contacted directly by the outsourcing leaders.

For sites classified as S or NCI subject to re-audits during the year, confirmed by the area/division EHS directors and the outsourcing leaders, the auditing company will:

- Organize the re-audit
- Send a proposal to the designated L'Oréal contact
- Liaise with the contractor site to plan and conduct the audit.

For ZT or NIA classified sites subject to remote monitoring or a follow-up audit during the year, the auditor will send the proposal directly to the audited contractor site. In order to avoid any conflict of interest the proposal specifies that payment for the follow-up audit should be made in advance.

4.4 Performing an EHS audit

The audit must identify EHS issues that could lead to business interruption or impact L'Oréal's reputation.

4.4.1 Audit scope

The assessment should only cover significant issues that could have consequences, such as administrative penalties, accidents that could result in serious injury and/or cessation of activities, and incidents that could have serious impact on the environment and/or the Group's reputation.

The assessment should therefore not be viewed as a detailed inspection or in-depth audit of regulatory compliance. Furthermore, the assessment should be carried out mainly with regard to applicable or future regulations. Good practices can be taken into consideration when there are no regulations to control or when there is no specific risk likely to lead to multiple serious accidents/illnesses or death.

The assessment should not be made against L'Oréal standards as these only apply to L'Oréal sites. However, certain good practices may be derived directly from these standards and may be retained where they contribute to controlling a significant risk which is not adequately controlled by following local regulations.

The seriousness of certain problems must be assessed, taking into account the local regulatory context, which may be classified differently from one country to another. It is therefore preferable to use the services of one or more local auditors who are familiar with the language and the local

EHS-INS-008 A / EHS Management of External Contractors

enforcement regulations and practices. The EHS-FORM-008 must be used as the official audit template. However, additional questions can be asked according to each audit.

4.4.2 Audit implementation

Who	What	Comments
1 - PREPARATION		
Outsourcing leaders	Review the supplier information and manage the audit program Contact the audit company to plan the audit	
Group EHS Audit Manager	Coordinate the Group overall audit program	
Audit company	1-Manage the audit program 2-Send the proposal to the resource person designated by L'Oréal for new sites, new activities or sites classified as S or NCI during the previous audit. Send the proposals to the contractor sites classified ZT or NIA at the previous audit. 3-Contact the contractor site to inform them of the audit. 4-Contact the contractor site to organize the logistics and ask the key questions to prepare the agenda. 5-Send the list of documentation requests and the agenda at least 2 weeks before the audit	Key questions: EHS organization of the site, dangerous activities carried out on the site (e.g. use of flammable liquids), PPE to be brought, access restrictions, waste management. EHS-FORM-007 must be used for Industrial Contractors.
2 - CONDUCTING THE AUDIT		
Audit company	Opening meeting	Reminder of the audit objective Verification of the availability of the people to be audited and of the documentation
Audit company	Review of EHS topics	EHS-FORM-008 Audit Grid
Audit company	Closing meeting	List of the good practices and main gaps identified, do not disclose the level of findings identified.
3 - REPORT		
Audit company	Send draft report to outsourcing team/site EHS managers for comments.	The report: - focuses on the classification of the contractor site and the next steps - contains a description of the findings, the corresponding level and recommendations.
Audit company	Submit the final report to the Group QPEHS audit manager, zone EHS directors, outsourcing leaders and external contractor site.	The report is written on the L'Oréal Group audit platform and sent by email
Group EHS audit manager	Archive the results and the audit report on the global audit platform	The results are available on the Group platform
4 - FOLLOW-UP		
Audit company	ZT->Organize remote follow-up within 1 month (→contact, submit quote, obtain order and payment by contractor site and schedule audit) NIA->Organize the follow-up audit within 12 months (→contact, submit quote, obtain order and payment by contractor site and schedule audit) NCI->Organize the follow-up audit within 36 months (→contact, submit a quote, obtain the order and payment by L'Oréal and schedule audit)	For contractor sites with a ZT or NIA result, the continuation of audits must be validated with the zone / division EHS director and the outsourcing leaders.

	S->Organize the follow-up audit within 5 years (→contact, submit a quote, obtain the order and payment by L'Oréal and schedule audit)	

4.5 Classification

4.5.1 Methodology

Findings

The findings identified are classified into 4 categories according to the factors involved at each level.

	Impact on people		Impact on the business		Impact on the environment
Level 1	One or multiple fatalities	OR	Risk of critical impact on L'Oréal's reputation	OR	Critical and immediate environmental damage
Level 2	One or multiple severe injuries/illnesses		Risk of significant impact on L'Oréal's reputation		Significant environmental damage
Level 3	One or multiple minor injuries/illnesses		Regulatory finding not associated with a risk of impact on L'Oréal's reputation or business		Minor environmental damage that can be corrected
Level 4	No or minimum injuries/ illnesses		Observation unrelated to regulations and not associated with a risk of impact on L'Oréal's reputation or business		No or minimum environmental damage

The auditor must consider the situation of the external contractor and the controls in place in order to properly assess the level of findings.

Examples of possible findings:

- Risk of administrative sanction (e.g. closure of a site or significant fine) in the event of non-compliance with applicable EHS regulations.
- Risk of accident that could lead to serious injury or the cessation of activities (e.g. destruction of production facilities).
- A risk of impact on the environment which could lead to reputational problems (e.g. spillage of toxic products into a river).

Site classification

The classification of the contractor depends on the number of level 1 and level 2 findings identified:

CLASSIFICATION	CRITERIA
S Satisfactory	No level 1 or level 2 findings
NCI Needs Continuous Improvement	No level 1 findings and less than 5 (not included) level 2 findings
NIA Needs Immediate Action	No level 1 findings and more than 5 (included) level 2 findings OR One level 1 finding
ZT Zero Tolerance	At least two level 1 findings

A repeat finding is a finding identified during the previous audit that has not been resolved or improved. An initial level 1 and/or level 2 finding may be reclassified to level 3 or even level 4 following a re-audit or a follow-up audit if the controls put in place since the previous audit are sufficient to justify this reclassification.

Additionally, findings identified in the last audit may have a higher classification due to the lack of appropriate controls in place related to the same previous issue, such as a previous level 2 finding may be reclassified to a level 1, or a level 3 may be reclassified to a level 2, etc.

RESULT	ACTION	AUDITING COMPANY ACTION	NEXT STEPS
S Satisfactory	Letter announcing the results and encouraging further improvement actions.		Full audit within 5 years
NCI Needs Continuous Improvement	Letter announcing the results with request to send an action plan within 30 days.	Request an action plan from the contractor when sending the report. Receive and review the Priority 2 action plan to determine if the contractor's proposed actions, to be achieved within the next 3 years, will upgrade the contractor from NCI to S. If no action plan is received within 30 days, immediately request one from the contractor on the day of the deadline, with a copy to the outsourcing leaders. If no action plan is received within a reasonable time, the site will be downgraded to NIA	Re-audit within 3 years, paid for by L'Oréal. Additionally, findings identified in the last audit will have a higher classification due to the lack of appropriate controls in place related to the same previous issue, such as a previous level 2 finding may be reclassified to a level 1, or a level 3 may be reclassified to a level 2, etc.
NIA	Letter announcing the results, the obligation to send an action plan within 30 days, and the need for a follow-up Audit within a maximum period of one year.	Request an action plan from the contractor when sending the report. Receive and review the level 1 and 2 actions to determine if the	Follow-up audit within one year, paid for by the contractor. Additionally, findings identified in the last audit will have a

Needs Immediate Action	The outsourcing leaders contact the auditing company once the contractor has been informed.	contractor's proposed actions, to be achieved within one year, allow the site to be reclassified from NIA to NCI or S. Once the contractor has been contacted by the outsourcing leaders for the follow-up audit, the auditing company will contact the contractor to arrange it.	higher classification due to the lack of appropriate controls in place related to the same previous issue, such as a previous level 2 finding may be reclassified to a level 1, or a level 3 may be reclassified to a level 2, etc. In order to avoid any confusion, the auditor should request full payment, in advance, from the contractor.
ZT Zero Tolerance	<u>New site</u>: It will not be possible to enter into a contract with a new site as long as it remains ZT classified. <u>Existing site</u>: It will not be possible to sign a contract for a new activity or to increase an existing activity as long as the site is classified ZT. <u>Decision</u>: The outsourcing leaders, in agreement with the zone/division EHS director, can decide: - either to stop the process with the contractor - or to launch a remote follow-up within one month in order to verify that an action plan has been established, that corrective actions have been started/planned and a follow-up audit carried out 6 months after the initial audit. <u>Unsatisfactory remote monitoring</u>: A meeting with the zone/division EHS director must be organized in order to define the strategy with the contractor. <u>ZT classification confirmation following re-audit</u>: the exit must be confirmed and implemented as soon as contractually possible. In the event of significant penalties due to early termination of the contract, at a minimum, the quantity of products produced must not increase before exit is possible. Failure to conduct a follow-up audit within 6 months of the initial audit: the site is considered unqualified and must be re-audited if a decision is made to contract the site.	When a follow-up audit is decided, the measures to be followed by the auditing company are the same as for an NIA site. Certain corrective actions, such as the authorities' agreement, may last longer than 6 months. The auditor must therefore ensure that the necessary steps have been taken and that the implementation deadline initially proposed is respected.	A ZT site may be subject to a follow-up audit after the initial audit, at the expense of the contractor. This decision is up to the outsourcing leaders. If at least one level 1 finding from the previous audit is not resolved or improved, the site will remain ZT classified.

An EHS audit should be carried out for any new activity, regardless of whether the contractor's initial activities require one or not.

5 ASSOCIATED DOCUMENTS

This instruction is linked to the following records:

- EHS-FORM-007 Questionnaire on Hazardous Activities of Industrial Contractors
- EHS-FORM-008 EHS Audit Grid for External Contractors

This list is not exhaustive: the applicable documents are available online.

6 APPENDICES

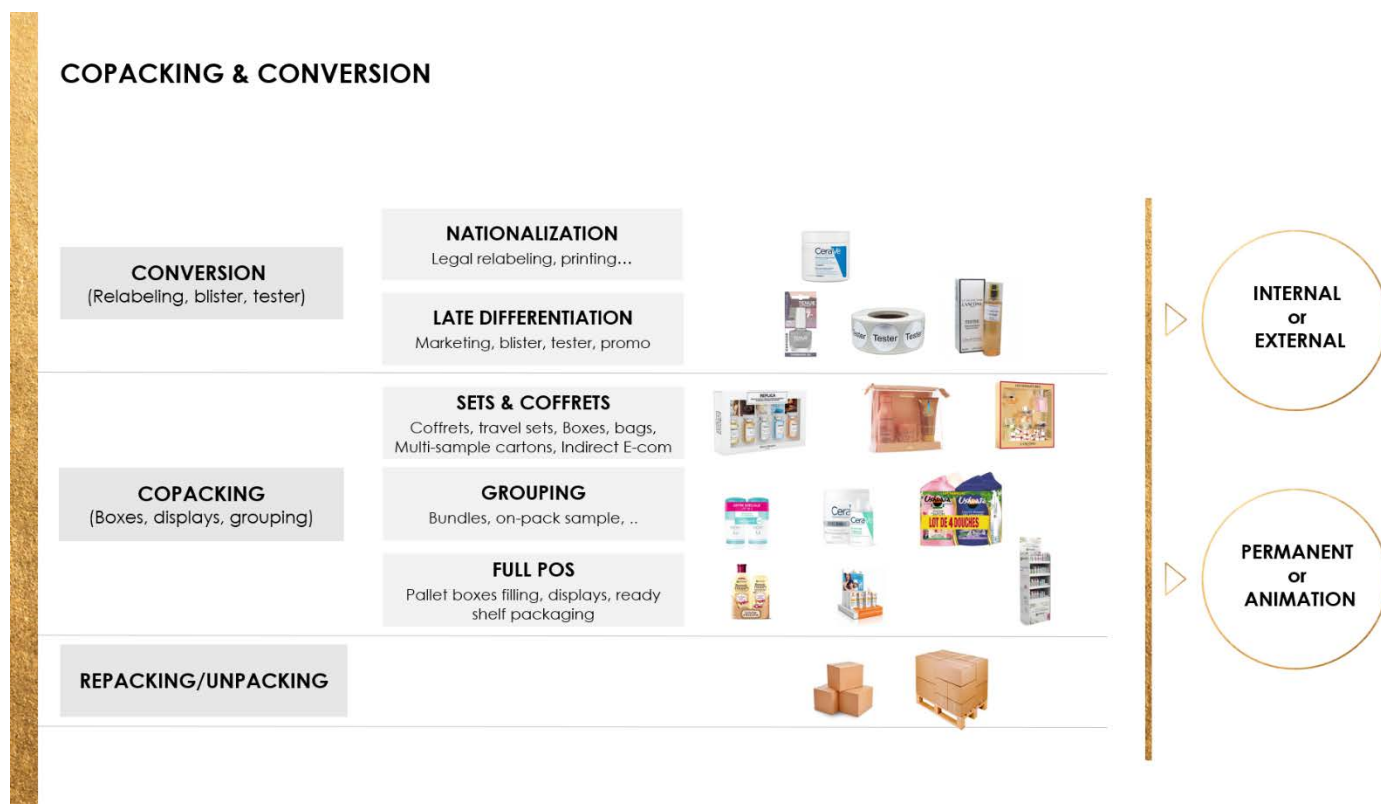
6.1 Appendix 1 : EHS requirements to include in contracts (not applicable to Waste providers)

	Regulatory compliance: EHS permits are obtained and up-to-date, monitoring of EHS regulations is in place.		Maintenance: an EHS preventive maintenance plan for the premises has been prepared and implemented. It covers, at minimum, the following elements: - maintenance of fire protection equipment - maintenance of emergency evacuation systems (e.g., alarm system) - maintenance of electrical installations - forklift maintenance
	Training: all employees, whether permanent, temporary or interim, receive on-site EHS training. Forklift drivers must have a local license or receive specific training to operate these trucks.		Investigation of accidents: lost-time work accidents are investigated. Statistics on work accidents with lost time are monitored by site management.
	Racks & pallets: - racks are regularly inspected, and maintained in good condition - pallets used for storage and transport are in good condition		Dangerous activities: all technical rooms containing electricity transformers, transformation or distribution facilities (transformers, meters, protective devices) are locked and only qualified electricians should have access. a lockout/tagout procedure is implemented during an intervention on equipment or an installation in order to avoid an explosion. permits for hazardous work (working in hot areas (e.g., welding), lifting work, excavation work, working at height, access to confined spaces) are issued by a qualified person before the work starts, whether it is carried out by site personnel or contractors, following the local legislations.
	PPE: each employee must have the appropriate personal protective equipment, depending on the risks identified during a risk analysis (safety shoes, high visibility vest, etc.). PPE should be provided free of charge.		Lone worker: lone worker risks have been identified and corrective measures taken
	General maintenance: an effective general maintenance program should be put in place to avoid any risk of falling, collision or obstruction in case of evacuation. No storage, even temporary, should be placed on service or traffic roads or in any emergency exits. In the event that the employer provides employees with catering areas, these must be clean, well-lit, in good condition and safe, and with access to drinking water.		Electrical safety: - electrical installations must comply with local regulations - electrical work is carried out by qualified electricians
	Environment: - a risk analysis is in place describing the appropriate controls to avoid any type of pollution (soil, air, water, etc.). These controls are in place and are properly maintained - secondary containment: the site is equipped with a system to retain fire extinguishing water on-site, or must demonstrate that it can protect the environment against this type of pollution - atmospheric emissions, wastewater discharges and noise at site boundaries are compliant with local regulations or, in the absence thereof, with L'Oréal minimum thresholds. - waste service providers responsible for collecting, transporting and treating waste are approved in accordance with local regulations. - if L'Oréal products must be discarded as waste, landfill is forbidden.		Aerosols: - in order to prevent secondary debris after an explosion, aerosol storage areas must be separated from other areas by a wall or grid. This is in addition to the local regulation requirements and the insurance of the 3PL company. The minimum requirement for L'Oréal is a 5*5cm steel grid (thickness 3mm) and a closed area (with door) - storage of aerosols in stacks should be avoided - forklifts used to handle aerosol pallets must be equipped with forks that cannot create sparks - no more than 4 hours of storage on the loading dock - the temperature of the aerosols does not exceed 50°C - sufficient ventilation should be present in confined spaces where aerosols are used - the facility containing aerosols should be constructed of non-combustible materials - no aerosol can or pallet should be left lying on the ground and storage pallets should be stored in a stable position

EHS-INS-008 A / EHS Management of External Contractors

	Emergency: - all buildings are equipped with an evacuation alarm which must be audible everywhere - evacuation drills are organized every year - emergency kits are available and first aid team members are trained - an emergency plan has been prepared for major accident risks (e.g., fire, etc.)		Pedestrian safety: - risks of encounters between forklifts and pedestrians are identified and corrective measures taken - all forklift drivers are locally licensed and follow the local legislation
	Firefighting: in the absence of sprinklers, the warehouses are equipped with smoke detection systems		Use and manufacture of flammable liquids (only for Industrial Contractors): - all equipment used in the manufacture and transfer of flammable liquids is made of conductive material and is grounded - an explosion risk analysis (e.g.: AtEx study in Europe) has been carried out and the means of prevention have been implemented - premises manufacturing with flammables are equipped with sufficient mechanical ventilation to prevent the formation of an explosive atmosphere (5 to 10 complete air changes per hour). - manufacturing rooms are protected by firewalls and fire doors - the building is protected against lightning - the manufacturing room is equipped with fixed extinguishing systems (foam or sprinkler system)
	Smoking prohibition must be strictly enforced in all areas where flammables or similar risks are present following a risk analysis.		Manufacture of cosmetic powders: (only for Industrial Contractors): - maintenance plan to keep the room clean at all times - dust emissions treated by filter - the risks of explosion are assessed (e.g., AtEx study in Europe) and preventive measures are taken. - all equipment used in the manufacture of cosmetic powders is made of conductive materials and grounded. - cosmetic powder manufacturing rooms are separated from other rooms by firewalls and fire doors - the cosmetic powder manufacturing rooms are equipped with fixed extinguishing systems (foam or sprinkler system)
	Manufacture of bleaching agents (only for Industrial Contractors): - separation of oxidants from combustible materials - the risks of explosion are assessed (e.g., AtEx study in Europe) and preventive measures are taken. - realization of a process safety study for each manufacturing tank and implementation of control measures. - all equipment used for the manufacture of bleaching agents must be made of conductive materials and earthed. - manufacturing rooms separated from other rooms by firewalls and fire doors. Fixed extinguishing equipment in place in the manufacturing room (foam or sprinkler system) - maintaining a high level of cleanliness and housekeeping in the room		Chemical risk: - drums of hazardous chemicals are provided with hazard labels in accordance with regulations. - chemically incompatible materials are isolated. Risks of exposure to hazardous chemicals are assessed and preventive measures are taken. - priority is given to reducing exposure at the source and to collective protection - chemical exposure levels are below regulatory limits. - rooms where hazardous chemicals are handled have adequate ventilation and first aid equipment (eyewash station, emergency shower and first aid/spill kit). - pregnant women are not exposed to carcinogenic, mutagenic or teratogenic substances. - entrances to rooms where there is a risk of exposure to chemicals are provided with appropriate signage. - storage areas for hazardous liquids are equipped with a retention
	Biological risk: - the risks of biological exposure are assessed and preventive measures are taken. - priority is given to reducing exposure at source and to collective protection. Biological exposure levels are below regulatory limits. - entrances to rooms where there is a risk of exposure to biological agents are provided with appropriate signage. - biological waste is sorted and managed by approved companies		Noise exposure: - the risks of exposure to noise are assessed and preventive measures are taken. - priority is given to reducing exposure at source and to collective protection. Noise exposure levels are below the regulatory exposure limits. - entrances to very noisy rooms are provided with adequate signage.
	Risks linked to products from other clients: L'Oréal must be informed of the specific risks associated with other clients' products		(only for Industrial Contractors):

6.2 Appendix 2: Types of production and services for co-packing & conversion



6.3 Appendix 3 : Waste disposal providers

According to the destruction of goods standards (finished products and materials):

- it may be necessary to have the destruction of the goods validated by a third party. In this case, the physical presence of a person designated by L'Oréal (employee or bailiff) on the premises during destruction is strictly forbidden for all destruction/recycling involving aerosols, flammable products and oxidizing finished products.
- a contract has been established directly between the contractor handling the waste and L'Oréal for the recycling/destruction of the goods. The contract reflects the actual work carried out by the contractor for L'Oréal.

6.4 Appendix 4 : Reporting of environment indicators for 3PL entities

3PL sites must provide the following information on a monthly basis to L'Oréal:

- Tonnage of L'Oréal Finished Goods sent to waste following a specific request from L'Oréal
- Tonnage of L'Oréal PLV sent to waste following a specific request from L'Oréal
- Tonnage of L'Oréal Finished Goods & PLV reused

- Tonnage of L'Oréal Finished Goods & PLV recycled
- Tonnage of L'Oréal Finished Goods & PLV incinerated with energy recovery
- Tonnage of L'Oréal Finished Goods & PLV incinerated without energy recovery
- Tonnage of L'Oréal Finished Goods & PLV landfilled for local regulatory constraints
- Tonnage of L'Oréal Finished Goods & PLV landfilled without local regulatory constraints

This information is necessary in order to have an exhaustive overview of wasted FG and the associated treatments (whether it is reused, recycled, incinerated with energy recovery, incinerated without energy recovery or landfilled).

See below the different definitions of the treatment to refer :

Reuse (tons) ,00	Total mass of Bulk, FG, POS & RM that are used again without having been transformed. They can however be prepared for reuse through various control, cleaning and/or repair steps. Finished Goods that are donated, for example to associations, are not waste and must not be reported here. Fill-in with 0, if no Bulk, FG, POS and RM have been reused.
Recycling (tons) ,00	Total mass of Bulk, FG, POS & RM whose material is reprocessed into a new product, material, or substance. Recycling includes, but is not limited to: ▪ Mechanical recycling processes, e.g.: common recycling of plastic, cardboard, paper, glass, and metal. ▪ Organic recycling processes, e.g.: off-site composting, or anaerobic digestion if the digestate is spread or composted. ▪ Regeneration processes, e.g., for oils and solvents. ▪ Chemical or enzymatic recycling processes for plastics, either by purification or depolymerization. ▪ Manufacturing of construction materials (bricks, roadbeds, tiles...) that recover the waste material. These processes can include heating steps but not incineration Fill-in with 0, if no Bulk, FG, POS and RM have been recycled.
Energy Recovery (tons) ,00	Total mass of Bulk, FG, POS & RM which is energetically recovered. The waste can either be directly recovered (i.e.: incineration) or it can first be pretreated and turned into a fuel or combustible substitute. Energy recovery includes, but is not limited to: ▪ Incineration with energy recovery (most common), ▪ Use as solid or liquid combustible substitutes for cement plants (e.g.: solid waste turned into RDF, liquid alternative fuels), ▪ All cases of pyrolysis, thermolysis and gasification, ▪ Anaerobic digestion if the digestate is not recycled. Fill-in with 0, if no Bulk, FG, POS and RM have been energetically recovered.

EHS-INS-008 A / EHS Management of External Contractors

Incineration without Energy Recovery (tons) ,00	Total mass of Bulk, FG, POS & RM incinerated by modifying the chemical structure, without energy recovery. Fill-in with 0, if no Bulk, FG, POS and RM have been incinerated without energy recovery.
Landfill (tons) ,00	Total mass of Bulk, FG, POS & RM sent to landfill, dumped in authorized locations according to the rules related to the pollution that it is likely to generate. Fill-in with 0, if no Bulk, FG, POS & RM have been sent to landfill. Note: Landfill without regulatory constraints is no longer authorized by the Group since the end of 2016 and landfill for local regulatory constraints should be avoided.
Of which landfill for local regulatory constraints (tons) ,00	Part of Bulk, FG, POS & RM sent to landfill due to local regulation that required a certain category of FG, POS or RM to be sent to landfill. This is limited to: ▪ Certain categories of regulated waste that must be treated in specialized landfills. ▪ Waste, if the site is in the regulatory duty to use imposed collection and treatment companies, which do not allow them to control their waste's destination. This does not include: ▪ Waste that is sent to landfill due to a lack of channel for its treatment in the site's region/country. ▪ Waste that is managed by the site's landlord, which does not allow them to control their waste's destination.



EHS Management System



Prevention of Physical Risks Linked to Ergonomics at the Workstation

EHS-INS-011 A

12/2024

Cancels and supersedes: EHS-301-22

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Cancels and supersedes: EHS-301-22

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**
PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1 AIM..... 3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 4

4.1 Workstation and equipment design 4

4.2 Risk assessment..... 4

4.3 Reduction of significant (unacceptable) risks..... 6

4.4 Group Ergonomic Attitude Roadmap 7

4.5 Training, awareness, and communication on risks..... 7

4.6 Declaration and recording of muscular and/or joint pain 8

5 ASSOCIATED DOCUMENTS 8

1 AIM

The purpose of this instruction is to outline the organizational measures to be implemented for preventing physical risks associated with workstation ergonomics and to ensure employees' well-being at work.

Physical activities (load carrying, computer work, laboratory tasks, shelf stacking etc.) can create risks and lead to musculoskeletal disorders (MSD).

Two types of risks can be identified: health-related risks associated with long-term exposure, such as the consequences of uncomfortable or extreme postures, their frequency, and the physical effort involved; workplace accident risks, which result from the immediate consequences of extreme postures, regardless of their frequency.

2 SCOPE

This instruction applies to all L'Oréal Group activities, including production plants, distribution centres, administrative sites, R&I, as well as stores and sales teams.

In case of different requirements existing between local regulations and the rules outlined in this document, the more stringent requirements must be followed.

3 RESPONSIBILITIES

The **Site Director or Departmental Manager** is responsible for implementing the Ergonomic Attitude program and promoting an ergonomic culture at the site or within the department. In line with group objectives, they set goals, prioritize actions, and measure their effectiveness during EHS steering committee meetings.

Departmental Managers must ensure that risks are taken into account in risk assessments and that staff receive the necessary training. They oversee action plans and communicate progress achieved.

The **EHS & Facilities Manager** or, depending on the organization, the EHS Manager, or if unavailable, the Line Manager, coordinates the Ergonomic Attitude program, communicates, and ensures the sharing of best practices at the site or within their area of responsibility.

The **ergonomics expert** provides expertise in ergonomics and shares best practices across the group.

4 DESCRIPTION

4.1 Workstation and equipment design

New workstations, new equipment and all modifications must undergo an ergonomic assessment to address risks related to workstation ergonomics from the design phase. This assessment must be conducted by trained experts in collaboration with the staff involved.

All new workstations must be free from extreme postures (in accordance with the Ergoeval grid). Following the installation of any new equipment, an ergonomic assessment must confirm that the workstation achieves an acceptable level (3 or lower in accordance with the Ergoeval grid). **LIFE 2**

ErgoCapt is one of the tools used to apply virtual reality for machine design ergonomics assessment. By inputting 3D drawings of machines (e.g., skid, packing, conveyors etc.) into the software, users can perform virtual operations using VR glasses. Wearable motion capture sensors record the postures involved in these operations. After inputting the estimated frequency and effort (Ergoeval grid) into the software, the workstation can be assessed following the same principles as Ergoeval.

This assessment is led by the project manager or engineer, with the involvement of the relevant future users such as operators and technicians. Suppliers may have other similar systems to assess ergonomic risks, which can also be accepted with confirmation from the site ergonomics expert.

At a minimum, anthropometric data must be used in conjunction with design drawings to assess the workstations requiring manual operations. By combining estimated frequency and effort (Ergoeval grid), the impact on joints and the level of ergonomics risk can be identified.

4.2 Risk assessment

Line managers must carry out a risk assessment related to the ergonomics of actual workstations. At a minimum, the line manager, the ergonomics expert (or an internal ergonomics officer), and the staff involved must participate in this assessment. **LIFE 2**

The risk assessment is carried out using the Group method, Ergoeval, and its adaptations (Ergofast), or equivalent*. This analysis considers biomechanical factors (posture, frequency, effort), as well as cognitive and organizational factors.

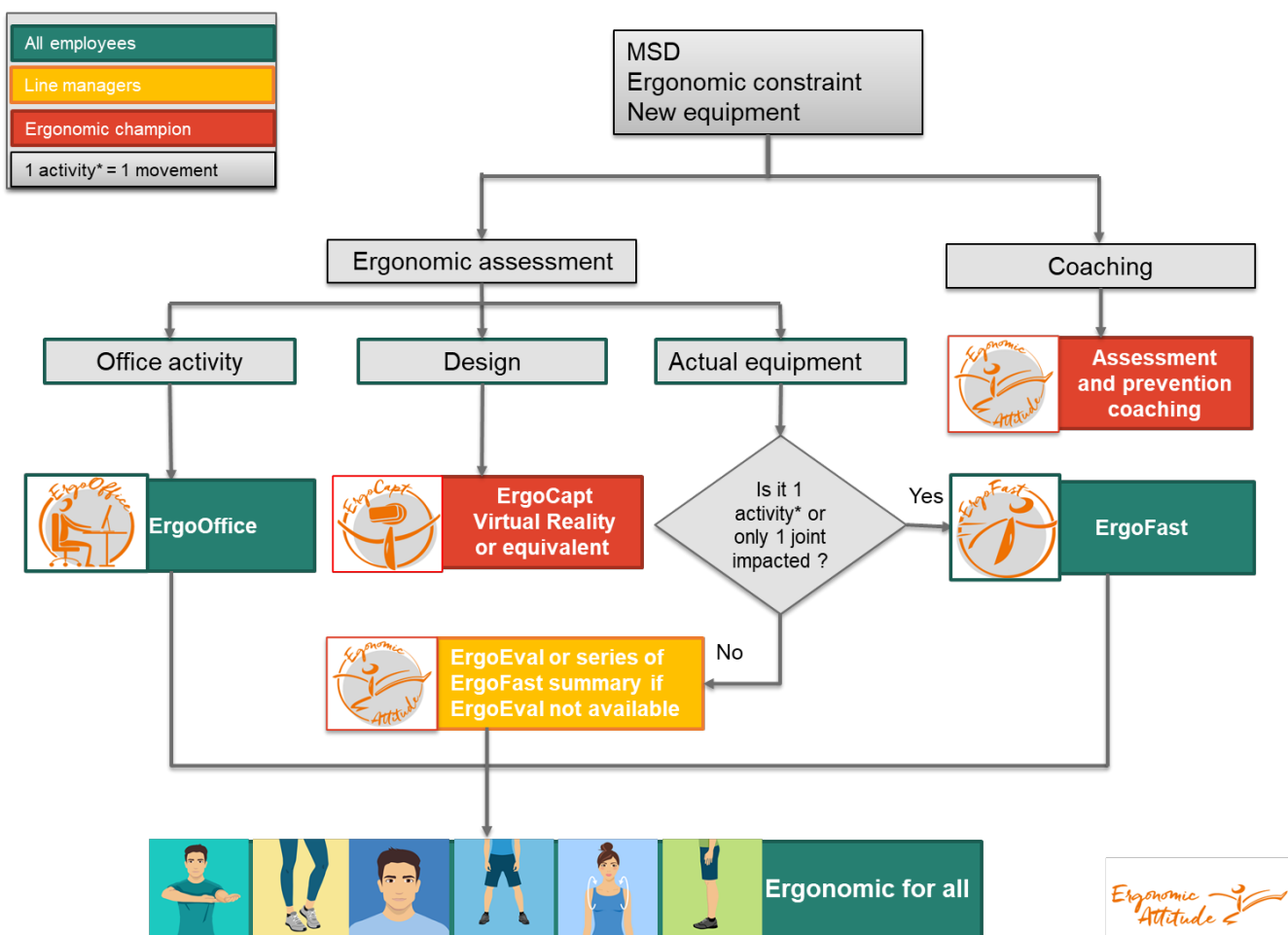
Computer workstations, including those in operational areas, must be assessed. Ergonomic equipment such as adjustable chairs and screens, should be provided based on the results of the assessment.

LIFE 2

This assessment can be conducted as a self-assessment using ErgoOffice, following coaching by an ergonomics expert, or with any equivalent tool for reviewing computer workstation ergonomics. The assessment evaluates the setup of the work furniture, equipment, display screens, and office accessories to ensure they meet ergonomic standards for individuals.

*By "equivalent", it refers to a method recognized either internationally or nationally. It must enable an assessment of a multitask activity, measure biomechanical factors (posture, frequency, and effort), evaluate staff perceptions, and identify long-term MSD risks (Ergoeval levels 4 and 5), as well as extreme postures with immediate effects.

Ergonomic risks assessment process



4.3 Reduction of significant (unacceptable) risks

Significant risk refers to workstations assessed at levels 4 or 5 according to the Ergoeval grid, as well as extreme postures affecting the upper limbs, neck, shoulders, back, or knees.

Significant ergonomic risks at workstations must be addressed through risk-reduction actions under the responsibility of the line manager, with support from the ergonomics expert and consideration of staff input. **LIFE 2**

It is essential to implement an action plan to ensure that all physical activities are acceptable for each employee. However, this alone is not sufficient, as Ergonomics also emphasizes the importance of preparing and maintaining the body to perform physical activities without injury.

Therefore, the ergonomics program consists of the following two components:

A. Reduction of biomechanical risk (posture, frequency, effort):

- Workstations showing significant risks (levels 4 or 5) must be improved to an acceptable level (3 or lower).
- Eliminate extreme postures (at least for the back and shoulders), regardless of the workstation's level or the frequency of these postures.

B. Individual prevention exercises:

- Prepare the body for physical activity by warming up all joints at the beginning of the shift or the workday.
- Perform regular muscular and joint recovery exercises, including stretching the joints and muscles most impacted.

To prevent injury, the type and frequency of individual prevention exercises are defined by the ergonomics expert. **These exercises must adhere exclusively and strictly to the Ergonomics for All program** and may be based on resources available on the Ergonomics for All intranet site:

<http://ergonomicsforall-dgo.loreal.wans/>

Individual prevention exercises are mandatory in situations involving extreme postures. **LIFE 2**

Managers are responsible for participating in, facilitating, and ensuring that the appropriate exercises are performed daily, except in cases of medical contraindication.

C. Management of Compensated Extreme Postures (PEC)

Certain extreme postures are challenging to eliminate given the available resources and current knowledge within the Group. An individual engaged in an activity with low frequency and low effort represents an acceptable level of long-term physical activity (level 3 ErgoEval matrix).

We have decided to exclude two types of extreme postures from our indicators if, and only if, they are compensated for by warm-ups and stretching exercises adapted to the work activity and defined in the Ergonomics for All training. Additionally, whenever possible, this compensation should include the use of a physical assistance device (e.g., an exoskeleton). These extreme postures are referred to as Compensated Extreme Postures (PEC).

The PECs excluded from the indicators are as follows:

- Extreme postures that cannot be eliminated with the resources and current knowledge available within the Group.
- Extreme postures with an hourly frequency of less than or equal to 3 and an effort (including possible weighting) of less than or equal to 3 kg.

A list of these PECs and their associated activities will be proposed by the sites and validated by the H&S Corporate team in cooperation with the zones.

The sites will record the PECs in parallel and must reintegrate them into the indicators as soon as a solution is found within the Group to eliminate them.

Finally, PECs are excluded from the Group indicators but remain part of the ergonomic analysis of the workstation.

4.4 Group Ergonomic Attitude Roadmap

The EHS-FORM-020 Group roadmap, structured into 4 levels, defines the stages and actions required to achieve ergonomic excellence.

Every December, the site or department carries out a self-assessment of the roadmap's requirements to identify improvement actions, which are then regularly monitored by the site EHS steering committee. The level achieved is recorded in the dedicated Graal form. **LIFE 2**

Progress on the roadmap and staff involvement are evaluated during health and safety, risk, and culture audits.

4.5 Training, awareness, and communication on risks

All employees must complete a specific training course on the prevention of risks associated with workstation ergonomics:

- Ergonomics expert: Training includes the Ergonomic Expert course, assessment methods (Ergoval), Ergonomics for All TTT, Proprioception TTT, and MSD early detection.
- Manager: Ergonomics for Managers training
- Employee: Ergonomics for All training, and Manual Handling training, if applicable

- Office staff with computer workstations: Computer Workstations: At Work and at Home E-learning (search training course number 1510 in the L’Oreal online learning system).

Specific training for staff at their workstations, provided under the responsibility of the line manager, must clearly address:

- The specific ergonomic risks and the methods to measure and manage them effectively.
- Individualized prevention exercises tailored to the staff member’s needs.

Regular communication on ergonomic risks and prevention measures must be implemented at each site.

The MESUR visit is a key opportunity to observe and correct ergonomic practices and to encourage employees to perform warm-up and recovery exercises.

Ergonomics must also be included as part of EHS days.

4.6 Declaration and recording of muscular and/or joint pain

All managers must encourage their staff to report any muscular and/or joint pain or discomfort as soon as it occurs, to help prevent MSDs.

When these pains or discomforts are confirmed by a certified physician or doctor, they must be recorded and analyzed to identify and eliminate their causes. **LIFE 2**

The work-relatedness of such cases must also be confirmed to ensure the proper declaration of occupational illnesses to the local authority, in compliance with local regulatory requirements.

Ergonomics indicators must be recorded in Graal every six and twelve months.

5 ASSOCIATED DOCUMENTS

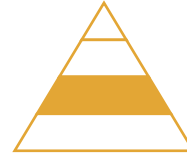
This instruction is related to the following processes:

- Ergonomics Roadmap: EHS-FORM-020
- Ergofast: EHS-FORM-017
- Assessment of Ergonomic Risks: Ergoeval software for ergonomics experts.

This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.



EHS Management System



Noise Risk Prevention

EHS-INS-012 A

06/2024

Cancels and supersedes: EHS-301-35 Noise Risk Prevention

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Update and substitution of the EHS-301-35

CONTENU DES MODIFICATIONS :

Mise à jour et remplacement de la procédure EHS-301-35

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS	
1	OBJECT..... 3
2	SCOPE 3
3	RESPONSIBILITIES 3
4	DESCRIPTION 4
4.1	General principles 4
4.2	Risk analysis..... 4
4.3	Risk management 7
4.4	Signage 9
4.5	Training 10
4.6	Acquisition of new equipment 10
4.7	Documentation and Data 10
5	ASSOCIATED DOCUMENTS 11

1 OBJECT

Sound is a phenomenon resulting from mechanical vibrations of the elastic medium in which it propagates (e.g., air). Noise is a sound that produces an annoying or unpleasant sensation, which can eventually lead to deafness when exposure to noise is repeated in an environment where sound levels are too high.

Sound is characterized by its frequency (measured in oscillations per second or Hertz, Hz) and its amplitude (measured in decibels, dB).

This document describes how noise risk is managed within the L'Oréal Group. Only the risk of occupational deafness is considered; non-auditory effects are not considered.

2 SCOPE

This instruction does not address the prevention of noise pollution related to the activity of a L'Oréal site outside the site perimeter. This issue is covered by procedure EHS-001-32 on noise prevention.

This instruction is applicable to all L'Oréal sites, but only those workplaces where the noise level of equipment exceeds 80 dBA are concerned (see appendix).

In the event of differing requirements between local regulations and the rules imposed by this document, the higher level of requirement is applied.

It should be noted that noise peak situations have been excluded from this document because they are unlikely to be triggered due to the nature of the equipment present on the Group's industrial sites. If a site uses impulsive equipment, a specific study must be undertaken. This document specifies the values and thresholds for instantaneous measurements, which are only applicable in the context of an 8-hour shift organization. In the event that a different shift length is applied locally, the applicability of the attached requirements must be reviewed with the help of an external expert.

Noise dosimetry in the workplace requires the application of different threshold values specified in the corresponding section.

3 RESPONSIBILITIES

The Site EHS Steering Committee is responsible for implementing all necessary measures to prevent employees from being affected by noise during their time on site.

Operations department heads are responsible for:

- organizing noise risk assessments
- organizing specific EHS training on noise risks and how to protect themselves from them
- selecting, with the help of the relevant Group departments, the machines that meet the requirements defined in this document
- ensuring compliance with safety instructions (e.g., wearing hearing protection)

The EHS Department is responsible for:

- carrying out or arranging noise exposure measurements as part of the risk assessment managed by the department heads
- providing appropriate hearing protection and training individuals on how to fit and use it
- organizing the measurement campaign of specific medical surveillance of employees exposed to noise, in collaboration with the medical department
- preparing and monitoring the noise reduction plan at the source

4 DESCRIPTION

4.1 General principles

Noise hazard prevention is based on the following principles, in descending order of priority:

1. Noise reduction at the source, either through the design/purchase of new, quiet equipment or through the modification of existing equipment and facilities
2. Installation of collective protection (e.g., soundproofing of all or part of a machine or workshop)
3. Reduction of the number of people exposed to noise by reorganizing the work **AND** the use of hearing protection (PPE)

4.2 Risk analysis

4.2.1 Identification of noise sources

Since new equipment must be designed to achieve a maximum of 80 dB(A) by design at the manufacturer's site, newly installed equipment must target a maximum sound pressure level of 80 dB(A) measured at 1m from the noise source and at a height of 1.6m.

Two measurements (at least) should be made at steady state for at least 2 minutes of nominal operation, but in some situations a longer time may be required to properly capture the average sound level.

One measurement point should be taken at the operator's desk (or console). The other measurement point should be selected by slowly walking around the equipment (skid or filling/packaging line) until the noisiest source is located by any appropriate means; the measurement should be taken 1 m from the source and at a height of 1.6 m. A bare minimum of 2 measurement points is required per line or per skid.

This risk assessment applies to all permanently occupied premises and also to temporarily occupied machine rooms.

The measurements described in this document must be utilized and eventually analyzed and rectified with the help of suppliers and/or acoustics experts in order to provide effective and sustainable solutions without compromising the operating conditions of the installations and the comfort of the operators.

4.2.2 Risk analysis approach

The risk assessment is conducted by estimating the noise levels using a noise measurement study.

The results of the measurements, surveys and action plans are integrated into the overall workplace risk assessment process.

Each site must conduct a noise measurement campaign every two years and review it following:

- changes in work practices
- changes in noise exposure
- changes in equipment layout
- emergence of new ways to reduce risks

This two-year period includes the full implementation of the noise abatement plan for all situations deemed equal to or greater than 85 dB(A).

A new campaign of acoustic measurements must be carried out locally:

- on each new piece of equipment or group of machines
- on any installation emitting noise in normal operation and having undergone a change of parts different from those of origin

Acoustic calibration of the measuring equipment must be carried out using an appropriate acoustic calibrator before and after each series of measurements.

Laboratory calibration of the measuring equipment must be performed every two years. Acoustic calibration equipment must be calibrated in a laboratory every year. These tasks should be performed by an accredited contractor or other approved service organization.

4.2.2.1 Noise mapping

Noise mapping is intended to:

- quickly assess and document noise levels in a workshop
- identify noise sources and their relative importance
- maintain a history of noise levels in a shop

Each noise map must be dated and include the following information:

- ✓ Designation of the standardized sound level meter (minimum class 2 with calibration at the beginning and end of the campaign)
- ✓ Brief description of the equipment (line or skid) studied (brand, serial number, date of commissioning, life span of the machines, etc.)
- ✓ Brief description of its neighbors (location in the factory on a plan, mention of the machines present in the immediate environment, specifying if they are in operation or not at the time of the measurement)
- ✓ Designation and description of the zones and points of measurement (captioned diagram of the machine and the points of measurement, taking of photographs)
- ✓ Description of the operating conditions of the machine or line studied
- ✓ Description of the activity around the machine studied at the time of the measurement (number of machines operating simultaneously, etc.)
- ✓ Description of the layout of the place where the machine is located (nature of the walls, ceiling and floor, distance between the walls, height of the ceiling, possible presence of acoustic panels)
- ✓ Literal description of the perceived noise of the identified sound sources (examples: low-pitched, high-pitched, shrill, metallic, muffled, whistling, aggressive, etc.)
- ✓ Any other conditions and data that may influence the measurements

Measurements must be conducted using, at minimum, a standardized Class 2 sound level meter, complete with its windscreen and all accompanying accessories. All precautions must be taken to ensure that the necessary equipment is available at the time of the start of the measurement campaign.

All measurements must be conducted using a tripod. However, circumstances in the field may necessitate exceptions to this requirement, which should be duly noted in the report.

Similarly, if the use of an extension cable during the measurements is deemed necessary, it is essential to calibrate the system with the cable attached to account for any potential losses.

Following the noise measurements, it may be decided to perform noise dosimetry measurements on specific facilities or groups of employees. This decision should be made by the site management, possibly with medical support, and with the agreement and input of the employees. The measurement provider should be consulted if necessary.

4.2.2.2 Dosimetry – audiometry - medical surveillance

Following the noise measurements, site management may decide to perform noise dosimetry measurements on specific facilities or groups of employees. This decision should be made with internal or external medical support and in consultation with the measurement provider, if applicable.

In addition to noise measurements and dosimetry, audiometric measurements are used to assess hearing loss for employees under enhanced medical surveillance, based on sound frequency. These measurements must be performed on medical advice by a competent service if the dosimetric measurements are greater than or equal to 85 dB(A) and must comply with local regulatory and normative requirements. The objective of this monitoring is the early diagnosis of any noise-induced hearing loss and the preservation of hearing function.

In the Group's factories, technical premises, Demi-Grands and pilot plants, it is mandatory to conduct audiometric measurements on every employee involved in work with noisy equipment, regardless of whether their contract is temporary or permanent.

Any employee exposed to a daily noise level of at least 80 dB(A) may request and receive audiometric tests. Reinforced medical monitoring for any hearing loss can then be implemented according to the procedures defined by the occupational physician, based on the employee's level of exposure. Similarly, individuals with pre-existing hearing issues and pregnant women should contact the site's medical service to receive appropriate measures to prevent hearing loss.

For exposure to sound levels below 80 dB(A), audiometric testing should only be scheduled if the hearing loss poses an occupational risk to the employee.

Periodic statistics on audiometric test results are provided to management to refine noise control action plans. These statistics consist of collective data, not individual data.

4.3 Risk management

4.3.1 Noise reduction

For situations measured beyond 80 dB(A), it is recommended to:

- assess the risk to workers' health

- provide information and training
- provide hearing protection upon request
- eliminate or reduce the risk of noise exposure where technically possible and at no cost

For situations above 85 dB(A), in addition to the above, it is necessary to: **LIFE 2**

- implement a formal program of measures to reduce noise exposure (excluding hearing protection) by addressing the source of the noise through equipment modification or soundproofing
- provide hearing protection, ensure its usage, and provide information and training
- designate areas where hearing protection must be worn

For work situations above 87 dB(A), due to the associated health risks, the detection of such sound pressure levels requires immediate and sustained corrective action, independent of any two-year action plan **LIFE 2**

A plan to reduce noise at its source, either through modifying equipment or soundproofing, is mandatory when the noise level in a room is greater than or equal to 85 dB(A).

Priority for noise treatment must be given to premises where occupancy is prolonged over several hours. Temporarily occupied premises should not be overlooked and should subsequently undergo noise remediation actions, based on specific analysis. In both cases, it is necessary to engage with suppliers of noisy equipment to identify the optimal compromises.

The threshold of 85 dB(A), considered as the value above which a noise reduction plan is mandatory, can be lowered by decision of the H&S Corporate Department, through successive noise reduction campaigns conducted throughout the Group.

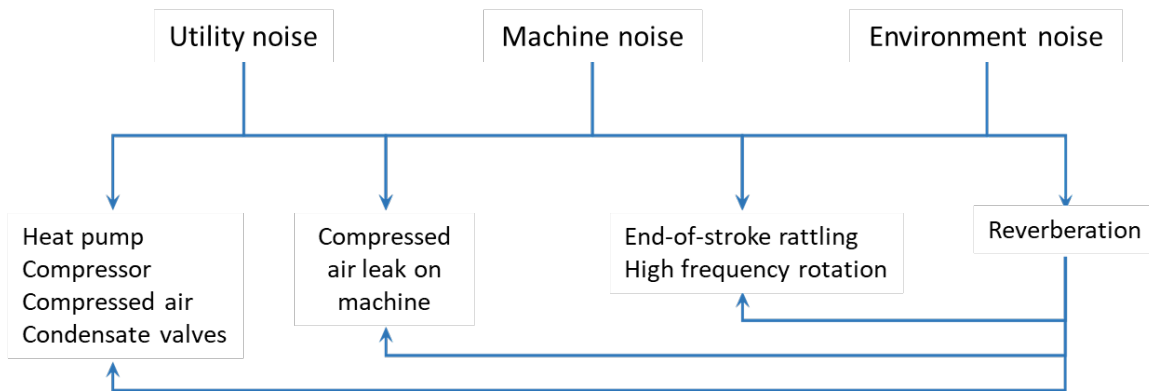
Noise reduction may be entrusted to a local acoustic engineering firm for measurements, problem identification, and recommendations for technical and organizational solutions.

Corrective actions must be jointly undertaken by the ETN and production teams for the parts relevant to them, such as utility noise and machine noise. It is advisable to involve these teams and the machine manufacturers to monitor any modifications made to the lines and any noise disturbances resulting from wear and tear of the parts.

Following remediation, new measurements should be taken, and if found to be below 85 dB(A), it can be concluded that the corrective actions have been effective.

Environmental noise, which is mainly due to the configuration of the site and the age and design of the buildings, must be addressed with the help of a specialized engineering firm in consultation with the Group's building/new construction departments.

The diagram below shows, by way of example, several types of noise pollution that may be encountered in professional premises.



4.3.2 Reduction of the number of co-workers exposed

If reduction at the source is not possible, another means of controlling the risk is to limit the number of individuals exposed through work reorganization.

4.3.3 Hearing protection

Standardized hearing protection is provided when the sound level is greater than 80 dBA. Hearing protection is recommended for levels between 80 and 85 dBA. Any person experiencing hearing discomfort must be provided with hearing protection, even if ambient noise levels are below 80 dBA. Hearing protection must be worn when the noise level is equal to or greater than 85 dB(A), as measured by a sound level meter and indicated on the site sound map. Hearing protection must be worn regardless of the duration spent in the facility, even temporarily, whenever noise sources are active for any reason.

As mentioned above, it is recommended that the expertise/assistance of an outside specialist be sought to fully address the resolution of situations that exceed 85 dB(A). This also applies to hearing protection, especially if the 87 dB(A) threshold is reached.

In all circumstances, it is the responsibility of the site management to ensure that the instructions for wearing hearing protection, whether standard or customized, are followed at all workstations where it is required, based on the above thresholds.

In addition, customized hearing protection for the most sensitive or exposed operators **must** also be considered on a site-wide basis.

4.4 Signage

Premises where the noise level is equal to or greater than 85 dB(A) must be marked at the entrance with signage indicating the requirement to wear hearing protection.

If a specific piece of equipment is solely responsible for exceeding the 85 dB(A) threshold, hearing protection must be worn only during its operation.

Example: If a high-pressure homogenizer (HHP) is the only equipment responsible for exceeding the 85 dB(A) threshold in a manufacturing plant, the HHP wording under the sign makes it mandatory to wear protection only when the HHP is in operation.

4.5 Training

Employees working in a space with a noise level greater than or equal to 80 dBA (for permanently occupied spaces) must receive documented awareness training, during which the following points must be addressed:

- The characteristics of noise: frequency, sound level, duration of exposure
- Anatomy and physiology of the ear: mechanism of deafness
- Health effects
- Safe work practices to minimize noise exposure
- Exposure limit values and preventive action values
- Hearing protection: where and how to obtain it, fit testing (demonstration), maintenance and reporting defects
- The right to and purpose of medical surveillance
- The results of workplace assessments and measurements
- The collective results of any health surveillance, undertaken in a format that prevents individual identification
- The corresponding action plans (PPE, soundproofing, signage, medical surveillance, etc.) and the role of each

Awareness-raising reminders must be given every two years, and training materials should be updated to take into account significant changes in the type of work performed or the work methods used.

4.6 Acquisition of new equipment

All new equipment must **aim for** a sound pressure level of less than 80 dB(A) measured at 1 m from the noise source and at a height of 1.6 m during FAT.

The selection of any machine that may expose individuals to noise must consider whether there are alternative processes, equipment and/or work methods that would eliminate the risk of noise exposure.

Maintenance of any new machine shall be in accordance with the manufacturer's recommendations.

4.7 Documentation and Data

Items to be documented when mapping a shop's noise are as follows:

- Inventory of rooms containing equipment emitting more than 80 dBA per unit (possibly based on FAT/SAT data from equipment)
- Measurement reports and noise maps obtained through acoustic measurement (see summary description of acoustic measurement report contents)
- Noise abatement plans
- Specific training materials and records

This information is shared with individuals exposed to noise through their work.

With regard to noise, reports and useful documents that can be used as reference for future actions or specific requests (e.g., noise sampling sheets per station/machine, noise maps) are archived for a minimum of 15 years.

All results should be entered into a dedicated Excel file, following the template provided, and returned upon request for integration and reporting in the Power BI application. See the Excel file EHS-FORM-015.

5 ASSOCIATED DOCUMENTS

This instruction falls under the EHS-MANUAL-001. The document EHS-FORM-015 is to be used for recording the measurements.

This list is not exhaustive: The applicable documents are available on the [Alexandria EHS Management System](#) website

This page was intentionally left blank for duplex printing.



EHS Management System



Prevention of Slips, Trips, and Falls

EHS-INS-017 A

12/2024

Cancels and supersedes: EHS-302-45 A
Prevention of Slips, Trips, and Falls...

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Cancels and supersedes: EHS-302-45 A Prevention of Slips, Trips and Falls...

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**
PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1	AIM.....	4
2	SCOPE	4
3	RESPONSIBILITES	4
4	GENERAL PRINCIPLES	5
5	RISK ASSESSMENT	5
6	SLIP PREVENTION	5
6.1	Prevent contamination from reaching the ground	6
6.2	Controlling contamination	6
6.3	Cleaning up contamination	7
6.4	Removing adverse environmental conditions	8
6.5	Controlling human factors	8
6.6	Floors	9
6.7	Shoes.....	11
7	TRIP PREVENTION.....	12
7.1	Design and maintenance	13
7.2	Maintenance	13
7.3	People and work systems	13
7.4	Environmental factors	14
8	PREVENTING FALLS ON STAIRS	14
8.1	Handrails	15
8.2	Stair nosing.....	15
8.3	Other physical considerations.....	15
9	SLIP, TRIP, AND FALL HAZARD SIGNAGE	16
9.1	Slip hazard signage	16
9.2	Signaling a trip hazard	16
9.3	Reporting a fall hazard.....	16
9.4	Entrances and doormats	16
9.5	Kitchens.....	17
9.6	Toilets and showers.....	17
9.7	Production areas	17

9.8 Ramps and tactile floor coverings 18

10 ASSOCIATED DOCUMENTS 18

11 APPENDICES..... 19

11.1 APPENDIX 1: Environmental and Human Factors Influencing Slip and Trip Hazards.....19

11.2 APPENDIX 2: Contaminants 20

11.3 APPENDIX 3 : Floors.....21

1 AIM

The purpose of this instruction is to assist sites in implementing best practices and to define the requirements necessary to prevent slip, trip, and fall hazards in passageways, work areas, and on stairs.

2 SCOPE

This Instruction applies to all L'Oréal Group sites.

In cases where local regulations differ from the rules imposed by this document, the more stringent requirements must be applied.

3 RESPONSABILITES

The EHS Manager is responsible for the following:

- Provision of training materials to managers, including the identification and prevention of slip, trip, and fall hazards.
- Conducting a slip, trip, and fall hazard SHAP.
- Proper design of aisles, stairs, equipment, and work areas to prevent slip, trip, and fall hazards.
- Proper care and maintenance of areas under the responsibility of the EHS and Facilities department.
- Selection, improvement, and maintenance (including cleaning) of floors.
- Advising on the choice of shoes to prevent slipping.
- Controlling risks related to adverse environmental conditions (both indoor and outdoor).
- Implementing a spill clean-up protocol.

The Heads of Service are responsible for the following:

- Specific training of staff, in particular on the identification and prevention of slip, trip, and fall risks, and the implementation of "LIFE communication" campaigns
- Contamination control (e.g., spill control)
- Adaptation of work systems to prevent slip, trip, and fall hazards
- Proper care and maintenance of areas under their responsibility
- Ensuring that staff under their responsibility wear appropriate, well-maintained footwear
- Control of risks linked to human factors

4 GENERAL PRINCIPLES

Slips, trips, and falls in passageways and work areas are the leading causes of accidents within the Group. Preventing these accidents requires the following measures:

Avoid risks as much as possible (e.g., through design modifications, changes in work organization, etc.).

Identify risks through a risk assessment process (e.g., SHAP analysis).

Reduce risks where possible.

Report risks that cannot be mitigated.

Educate staff about the risks of slips, trips, and falls.

All personnel must be aware of the consequences of accidents related to slips, trips, or falls. As part of their general and specific training, employees must be taught how to prevent these risks in accordance with these guidelines.

Each site is required to implement a slip and fall prevention program, which must be reviewed and updated annually. **LIFE 2**

5 RISK ASSESSMENT

Slip, trip, and fall hazards should be identified through a detailed SHAP analysis, which involves personnel and is partly based on observations. The detailed SHAP analysis must be updated whenever a material change occurs that could affect the level of risk.

The following factors should be considered during the detailed SHAP analysis:

- Use of the floor: frequency of use, purpose of the room or corridor, etc.
- Nature and frequency of potential contamination on the floor
- Elevation and slope of the ground
- Condition, maintenance, and treatment of the floor
- Footwear suitability and condition
- Feedback (lessons learned)
- Environmental factors: exterior and interior
- Human factors

Appendix 1 details the environmental and human factors to be considered when conducting the risk assessment.

6 SLIP PREVENTION

Most slip accidents involve some form of contamination between the ground surface and the foot. There are three types of contaminants that can create a slip hazard (see definitions in Appendix 2):

- Liquid contaminants

- Dry contaminants
- Semi-moist contaminants

To effectively prevent slips, the following measures should be taken in this order:

- Prevent contamination from reaching the ground
- Control contamination
- Remove or avoid working in adverse environmental conditions
- Improve the condition of the floor
- Inspect footwear

6.1 Prevent contamination from reaching the ground

To prevent contamination from reaching the ground:

- Identify potential sources of contamination, such as:
 - o spills
 - o leaks
 - o weather conditions
 - o work processes
 - o cleaning activities, etc.
- Take steps to prevent contamination from reaching the floor, including:
 - o plugging leaks
 - o modifying work processes
 - o replacing or upgrading equipment (e.g. improving seals)

6.2 Controlling contamination

If it is not possible to prevent contamination from coming into contact with the floor, physical and technical solutions can be implemented to reduce the amount of contamination and minimize risks.

Effective maintenance programs help reduce the likelihood of leaks.

Retention and drip pans can contain leaks and spills but must be emptied regularly.

Equipment and machinery should be kept away from traffic routes.

It is advisable to select flooring materials that retain their anti-slip properties even when contaminated. Install quality doormats at building entrances to minimize water entering the building.

Work processes can be revised to prevent contamination from reaching the ground. Simple changes, such as equipping containers with collection grooves and lids, equipping machines with dust collection and splash protection devices, providing trays for transport, scheduling cleaning activities outside of working hours, or modifying production line layouts, can further reduce risks.

6.3 Cleaning up contamination

If contamination is identified (e.g., due to a spill), the floor should be cleaned up as soon as possible. It is important to select the most appropriate cleaning method for the specific type of flooring. Ensure that consumables (e.g., wipes, absorbent granules, etc.) are readily available and regularly restocked.

Most slip accidents occur when floors are contaminated. Effective cleaning should remove contamination and reduce the risk of slipping. However, improper cleaning can worsen the situation by creating residues that make the floor even more slippery.

Additionally, wet cleaning processes can cause a floor to become slippery during and immediately after cleaning.

An effective system for addressing occasional spills should complement your regular cleaning procedures. All employees must be trained and informed about the proper actions to take in the event of a spill. Method 1 and Method 2 are examples of how to manage a simple beverage spill.

Method 1			
	Signal	Wet cleaning	Keep the signalization
Method 2			
	Signal	Clean with a cloth	Remove signalization

Your spill procedure must be suitable for both the type of contaminant and the flooring. It is essential to keep people away from shiny, wet floors. For example:

- Use a physical barrier to prevent access to the area.
- Clean in sections, leaving a dry passage for safe movement.

Do not rely solely on a warning sign to keep people away from shiny, wet floors.

6.4 Removing adverse environmental conditions

If there is a slip hazard due to cold, wet, or snowy weather, the following measures should be taken in outdoor areas where people are traveling:

- Ensure proper drainage.
- Choose surfaces that provide good slip resistance in wet conditions.
- Implement systems for clearing and sanding driveways and surfaces.
- Ensure adequate lighting for paths and walkways. Establish a maintenance system to identify and replace broken bulbs promptly.

The following steps can further reduce the likelihood of slipping or tripping:

- Ensure work and passage areas are properly illuminated by regularly monitoring lighting levels and replacing defective bulbs as needed.
- Reduce excessive noise levels, as loud environments can distract attention from surrounding hazards.
- Focus on areas with significant temperature variations, such as cold rooms, which can create slipping hazards.

6.5 Controlling human factors

Human factors refer to how people interact with their environment. The following measures can reduce the probability of slipping:

- Clear communication in the local language to ensure staff understand safety instructions, signs, and labels.
- Effective management of the local organization to prevent excessive stress or fatigue: "A place for everything and everything in its place". This includes implementing the Housekeeping of 5S Methodology to maintain order and cleanliness in work areas and defining Visible Fundamentals to ensure compliance.
- Specific training on slip prevention measures.
- Zero tolerance for shortcuts.
- Minimization of load-carrying tasks while walking.
- Raising awareness about the risks of running or rushing.
- Special precautions for individuals with disabilities (e.g., installation of handrails, construction of ramps instead of stairs, and better color contrast for changes in levels or surfaces, etc.).
- Communication of near-misses and accidents reported within the Group. This practice raises awareness that accidents can happen to anyone, even in sites with no apparent risk (e.g., administrative areas, shops, etc.).

6.6 Floors

6.6.1 Choice of floor

Floors can be categorized into two main types: soft floors and hard floors. Both types are available with raised surface patterns, often referred to as profiles. Appendix 2 provides examples of different floor categories.

To effectively manage slip risks, it is important to understand the characteristics of your flooring, including:

the effects of the wear and tear over time

changes in surface properties caused by the application of waxes and coatings

the possibility of modifying the surface to improve slip resistance

You need to select the appropriate flooring for your workplace:

- Choosing the right floor during the initial design phase or during renovations can significantly reduce the risk of slipping. Poor flooring choices can lead to increased costs, a higher risk of accidents, and challenges in ongoing management.
- It is possible to anticipate areas where floors may frequently become wet or contaminated, such as entrances or kitchens. In such cases, you should select flooring with a low slip potential.

It is important to seek professional advice to identify the most suitable flooring for your workplace. Establish the minimum in-service slip resistance required and consult your flooring supplier or manufacturer to ensure it is met. You will need to consider:

- the location of the floor
- the type of work carried out on the ground
- pedestrian traffic
- the type and amount of contamination likely to reach it
- other considerations, including cost, durability, load-bearing, weight, and environmental impact
- In the presence of liquid contaminants, the floor will need to have sufficient micro-roughness to separate the liquid and create solid-solid contact with the pedestrian's heel. The thicker the contaminant, the rougher the floor must be to have a low sliding potential.
- In the presence of dry contaminants, rougher flooring can prevent the risk of slipping.
- One or more slip resistance tests can be considered when choosing flooring depending on the use, environment, etc. At least one pendulum test (see Appendix 3) should be performed, which measures the coefficient of dynamic friction and is designed to replicate the impact of a pedestrian's heel.
- A specialist should be consulted when selecting the flooring according to the working environment, use, etc.

6.6.2 Floor treatment

It may be desirable to improve the slip resistance of the installed floor in the short to medium term rather than replace it immediately. Different types of treatment can be considered (see Appendix 2), including:

- acid pickling
- mechanical stripping
- paints and varnishes
- waxes
- anti-slip strips

Specialists should be consulted for the choice and application of the right type of treatment according to the use, environment, etc.

6.6.3 Effective floor cleaning

Different types of floors may require different cleaning techniques (e.g. wet mop, squeegee, vacuum cleaner, wet vacuum, cleaning machine, etc.). The most suitable technique will depend on the type of floor, the potential contaminant and the activity in the area. Appendix 4 presents the technique to follow when cleaning with a wet mop, which is the most commonly used method.

When choosing an effective cleaning system, ask flooring manufacturers and cleaning equipment suppliers for advice on the right cleaning methods for your floor and decide on the appropriate time to carry it out, such as outside working hours. You will need to:

- provide employees with adequate equipment and training
- ensure that employees understand what they are being asked to do and why. Take into account the possible language barrier
- supervise - check the use of proper equipment and cleaning methods

If a floor is replaced or modified, it may be necessary to change the cleaning system. Cleaners should be informed of changes to an area that may involve a change in cleaning practice.

It is important that cleaners are well trained and supervised to ensure that they understand how and why they need to clean certain areas using a specific technique.

If cleaners don't understand this, they may be tempted to take shortcuts that will save them effort but increase the likelihood of slipping. Involve cleaners as much as possible in the planning of cleaning systems. They will provide valuable information about the practical aspects of the job and will be more willing to stick to a protocol if they have been involved in developing it.

6.6.4 Floor maintenance

Regular maintenance of floors is necessary to preserve their anti-slip properties. Maintenance is particularly important in the event of damage, as floors can change over time and become rougher or smoother with wear, which may impair their slip resistance.

It is essential that local repairs to a floor area are carried out using a material that provides a level of slip resistance, even in the event of contamination, similar to that of the surrounding floor. This can be a challenge with tiled floors, as broken tiles are often replaced with tiles that look similar but have a different finish.

6.7 Shoes

6.7.1 Choice of shoes

Non-slip footwear should be used as a last resort. You should always try to find another solution. However, footwear can play an important role in preventing slipping, especially when floors cannot be kept dry or clean. The following rules must be observed when choosing shoes in case of an unavoidable risk of slipping:

- Wearing well-fitting shoes with reasonable heels and a good fit can reduce this type of accident.
- They must offer good slip resistance. Be cautious when choosing shoes based on brochure descriptions, as shoes labeled "slip-resistant" may not always perform as expected.

No single shoe is suitable for every environment. However, by selecting shoes with the appropriate sole, you can reduce the risk of slipping accidents.

Some footwear, such as open-toed shoes, sandals, flip-flops, high-heeled shoes, smooth-soled shoes, etc., is prohibited in industrial buildings (including demi-grand and pilot) and laboratories. To choose the right shoes for your situation, consider the following:

- Contaminants in your workplace
- Your flooring and its requirements for footwear: outdoor environments can be uneven; profiles may not interact effectively with certain sole designs.
- The designs and composition of the soles are important for grip. Generally, a flexible sole with dense designs is well-suited to liquid contaminants and indoor environments. Spaced-out designs are more effective in outdoor environments or with solid contaminants. It is therefore advisable to test the shoes in your environment.
- Other features required for your shoes: toe caps, midsoles, antistatic properties, etc.

When choosing new shoes, consider the following criteria:

- **Cost:** Don't base your decision solely on cost. Consider efficiency, comfort, and durability.
- **Slip resistance:** Communicate your requirements to your supplier or manufacturer, obtain and evaluate technical data for the footwear, and review samples.
- **Other safety features:** Do your shoes require any other safety features, e.g., a toe cap?
- **Size range:** Ensure a wide enough size range to outfit all your employees working in risky environments.
- **Visual appeal:** Shoes with visual appeal are more likely to be worn.

Always try out new shoes before giving them to staff.

Slip-resistant footwear in wet environments may not be effective in the presence of oils or solids. The soles must be free of residue or debris. If they are constantly clogged, it indicates that the design is not suitable for the working environment.

How do I conduct a test?

- **Where:** Problem areas.
- **Who:** Unbiased individuals and a comparison group to ensure reliable results.
- **Workforce:** A sample of people, e.g., 10% of employees or six employees per shoe style.
- **Duration:** Ideally for the life of the shoes; at least six weeks.
- **Consultation:** Discuss the trial with employees and provide clear information.
- **Follow-up:** Ensure the trial shoes are worn and cared for as usual; identify and address problems immediately; ask for feedback, e.g., via a questionnaire; record any slips or trips.
- **Analysis:** Collect data, communicate results to everyone, and implement the findings.

6.7.2 Shoe condition check

Choosing shoes is only the first step. If the wearing of specific shoes is mandatory, you must then carry out follow-up checks to ensure their effectiveness:

- Make sure employees wear and clean them.
- Replace worn shoes.

Consider the footwear of visitors and temporary staff as well.

7 TRIP PREVENTION

People stumble when their foot strikes an object they hadn't noticed. Tripping usually results in a loss of balance or a fall forward.

The toe detachment space is the distance between the toes and the ground during the pendulum phase of normal walking. If there is a drop or obstacle approximately the size of a person's toe lift, they may be susceptible to tripping. Studies have shown that the toe detachment space ranges between 8.7 mm and 21.9 mm for a healthy, working-age individual. Therefore, any obstacle **greater than or equal to 10 mm** can be considered a potential trip hazard. Some individuals may have a lower average toe lift space than others, particularly the elderly and those with reduced mobility.

To prevent tripping, consider the design and maintenance of driveways and pathways, along with any maintenance issues. Be mindful of additional objects introduced into the work environment, possibly to reduce another risk, that could create trip hazards, such as doormats, slippery floor warning signs, and loose cables.

7.1 Design and maintenance

Many trip hazards can be eliminated during the design and development phase by:

- avoiding single steps where possible
- eliminating unevenness or clearly marking it when unavoidable
- providing enough power outlets to minimize trailing cables
- ensuring that power socket protection and access are at ground level
- installing the floor correctly
- ensuring good lighting

Regular maintenance is important to prevent and correct trip hazards, including:

- irregular paving
- loose or damaged carpet
- potholes
- overgrown weeds

If repairs cannot be made immediately, report and isolate the hazard.

7.2 Maintenance

People trip over unexpected obstacles, so it's important to clear all obstacles from the ground. Consequently:

- Provide enough storage and trash cans
- Promote an orderly workplace
- Encourage IO communication among employees

If a temporary obstacle is unavoidable, e.g., during loading and unloading, you must have a system in place to warn people or, preferably, prevent access. This includes subcontractors.

7.3 People and work systems

Everyone is susceptible to tripping; however, some individuals, such as the elderly and the visually impaired, are at greater risk. Certain tasks, such as carrying, pushing, or pulling objects, can also prevent people from identifying hazards that might cause tripping.

Many solutions to prevent trips rely on employees adhering to work systems, such as:

- using the nearest outlet to avoid cables lying around
- cleaning up when leaving an area and complying with the storage system in the workplace

To ensure the consistent use of safe work systems, it is essential to provide quality training and supervision.

A well-planned cleaning and maintenance procedure is an effective way to identify and address some tripping hazards. However, these activities can also create temporary tripping hazards.

7.4 Environmental factors

The following measures can reduce the probability of tripping:

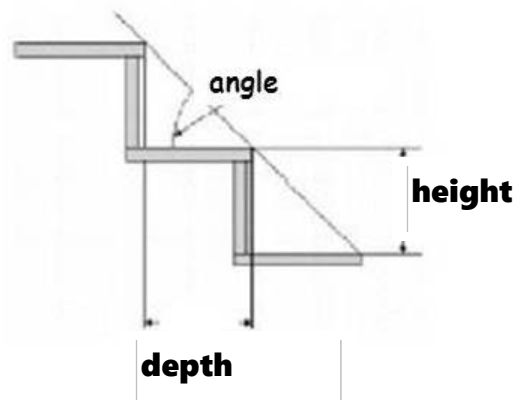
- Ensure that work and passage areas are well-lit by regularly monitoring lighting levels and replacing defective bulbs as needed.
- Reduce noise levels when they are excessively loud, as noisy environments can distract attention from surrounding hazards.
- Remove leaves and snow from the ground, as they can hide trip hazards.

8 PREVENTING FALLS ON STAIRS

These instructions specifically address the risk of falls associated with the use of stairs or steps. Falls from heights are covered in a separate document.

Stairs and steps are high-risk areas for pedestrians. A slip or trip on stairs can result in a serious injury. Accidents on stairs may be attributed to design and maintenance issues as well as human factors.

Design: Stair dimensions



Studies have shown that the physical dimensions of stairs play a critical role in accidents.

The uniformity of dimensions between the steps of a staircase is essential. Even minor variations in height or depth between adjacent steps can cause a person to trip and fall.

To reduce the risk of accidents, old stairs should be updated to meet current standards whenever the opportunity arises.

8.1 Handrails

Handrails are essential for preventing a loss of balance on stairs from resulting in a serious fall. Stairs should be equipped with handrails that are easy to hold, positioned correctly and set at the appropriate height: **LIFE 2**

- The upper part of the handrail must be positioned 900 mm to 1,000 mm above the line of stride or the ground or comply with local standards if they exist. **LIFE 2**
- Handrails should provide a firm support and allow for a secure grip.
- Stairs must have at least one handrail on one side if they are less than 1,000 mm wide (or adhere to the more stringent local regulations). For stairs wider than this, handrails must be installed on both sides.

8.2 Stair nosing

The end of a step is referred to as the stair nosing. It is essential that the stair nosing is clearly identifiable through good color contrast, allowing users to accurately gauge the edge of the step. **LIFE 2**

Ideally, the stair nosing should form a right angle. Rounded stair nosings make it more difficult to estimate the edge of the step. If a pedestrian's foot pivots on a rounded stair nosing – especially on steps with a small tread - the risk of slipping increases.

If the stair nosing is poorly defined or rounded, the probability of an accident is increased.

8.3 Other physical considerations

Stair surface

As with floors, it is essential to ensure that the surface of stair treads is non-slip under normal conditions of use. Consider their location (e.g., outdoors) and the potential for contamination.

If an anti-slip coating is necessary, the stair nosing must have the same level of slip resistance, and the coating should be applied to the end of the step.

Effective cleaning of stairs is just as important as cleaning floors to remove contamination. Like smooth floors, smooth stairs are slippery when cleaned with a damp mop. It is crucial to restrict access to the stairs until they are completely dry. Vacuum cleaner cables on stairs pose a trip hazard to both users and maintenance worker. Consider measures to prevent cables from being dragged across the stairs to avoid tripping risks.

Always remove any obstacles from the stairs, as people are just as likely to trip over objects on stairs as they are when walking on the ground.

Maintenance

Worn stair nosings or coverings can create slip or trip hazards. Carry out regular maintenance checks to ensure the stairs remain in good condition.

Lighting

Ensure the stairs are well-lit as poorly lit stairs can make safe navigation difficult.

Human factors

Human factors often contribute to accidents on stairs. People are at a higher risk of falling when they rush or are distracted, such as being late, using the phone, or talking to colleagues.

Carrying objects or using a phone on stairs also contributes to accidents because it can:

- prevent users from clearly seeing the edge of the steps or potential hazards, such as spills or obstacles
- prevent users from keeping a hand free to grasp the handrail in case of imbalance

Staff are informed that using stairs is prohibited when both hands are occupied carrying items (in such cases, an elevator must be used instead). **LIFE 2**

Similarly, staff are informed that using a telephone while on the stairs is strictly prohibited. **LIFE 2**

Vulnerable individuals, such as those who are visually impaired, may have difficulty safely navigating stairs. For example, they may not be able to see the edge of the steps if it is not clearly marked.

Minimize the risk of accidents related to human factors on stairs by ensuring that users are well-informed about the measures in place.

9 SLIP, TRIP, AND FALL HAZARD SIGNAGE

9.1 Slip hazard signage

Any identified slip hazards must be reported. The best approach is to install a physical barrier to prevent access to the affected area. This solution must be implemented whenever possible. In all cases, a visible sign must indicate the risk of slipping.

9.2 Signaling a trip hazard

Any identified trip hazards must be reported. The best approach is to prevent access to the area by installing a physical barrier and establishing an alternate route. In all cases, a visible sign must indicate the trip hazard.

9.3 Reporting a fall hazard

Users should be reminded, by means of a visible sign in the language of the site, to hold the handrail when using a staircase. **LIFE 2**

High-risk areas

Certain areas are more likely to pose a high risk of slips, trips, and falls. Careful design of these areas is essential to minimizing that risk.

9.4 Entrances and doormats

Entrances serve as the main transition between indoor and outdoor environments. A well-designed entrance can be essential for keeping contamination out of a building.

Effective design helps minimize potential problems, while poor design can create ongoing challenges that must be managed throughout the building's life cycle.

9.5 Kitchens

The consequences of a slip or trip in a kitchen can be severe, potentially leading to very serious injuries. However, it is possible to reduce the risk of accidents through good design. Poorly designed kitchens make it challenging for staff to effectively manage slip and trip hazards.

Kitchens are often hectic and noisy environments. Staff may act quickly while carrying trays, plates, or containers. Additionally, kitchens frequently experience spills of water, oil, and both cooked and uncooked food. All of these factors must be considered during the design process.

It is crucial to consult with the kitchen manager to fully understand how the kitchen will be used.

9.6 Toilets and showers

Toilet floors are often damp, yet it is still common to find soft flooring in these areas. As a result, slip-related accidents often occur.

Water contamination can originate from obvious sources, including splashing sinks, showering inlets and outlets, dripping wet hands, splashing urinals, and condensation. Completely eliminating contamination may not be possible, but good design can reduce the risk of contamination reaching the floor.

9.7 Production areas

A slip or trip in a production area can result in serious injury. However, it is possible to reduce the risk of accidents through good design. When designing or renovating a production area, it is essential to consult with key personnel to understand the specific working systems in that area. Consider human factors such as hectic and noisy environments, employees rushing, equipment being pushed or pulled, and people moving around the area.

Additionally, identify potential sources of dry and wet spills, and implement measures to eliminate or minimize them.

Floors

The floors in the production area must be suited to the process and potential contaminants. Both wet and dry contamination can cause slipping. Therefore, the more viscous the contamination, the rougher the floor needs to be to ensure good slip resistance. Refer to the contamination module for more details. Rough floors will retain their anti-slip properties only if they are cleaned in accordance with the manufacturers' instructions. It is essential that you provide this information.

Arrangement

Consider how employees will use the space. An efficient design minimizing distances between key areas can also reduce the risk of slips and trips.

- **Workstations:** Group equipment and workstations conveniently to minimize the need to carry items. This will reduce the risk of spills and contamination on the floor.
- **Pedestrian walkways:** Thoughtful and clear aisle design reduces the risk of tripping over obstacles or colliding with vehicles.
- **Storage:** Where will the deliveries be deposited? How, and when will they be stored? Deliveries left in aisles can create trip hazards. Cleaning equipment should be stored safely - out of the way but still easily accessible.
- **Equipment and machinery:** Select equipment and machinery that reduces the likelihood of contamination reaching the floor. For example, equipment with extraction devices, splash guards, integrated conveyors, or drip trays. Equipment must be properly maintained to prevent leaks.

9.8 Ramps and tactile floor coverings

Height differences are present in and around many buildings, including ramps installed to meet applicable accessibility regulations. Many slip-and-trip accidents occur in these areas.

Tactile surfaces are designed to provide physical cues to visually impaired individuals, helping them navigate their surroundings. However, if these surfaces are installed incorrectly, they can increase the risk of tripping.

10 ASSOCIATED DOCUMENTS

The applicable documents are available on the [Alexandria EHS Management System](#) website.

11 APPENDICES

11.1 APPENDIX 1: Environmental and Human Factors Influencing Slip and Trip Hazards

Outdoor environment

Outdoor environments are exposed to the elements. In some climates, this means that the surfaces can be:

- regularly moist
- covered with snow, leaves, or mud
- frozen

consequently increasing the risk of slipping.

The following factors can affect the risk of tripping, so you should consider them when assessing risk:

- Lighting: A poorly or excessively lit environment will make it difficult to identify tripping hazards.
- Noise: Noisy environments can distract attention from surrounding hazards.
- Leaves and snow: These can hide tripping hazards on the ground.

Indoor environment

There are two main components of the indoor environment to consider:

- the physical aspects of the building
- human aspects, in other words, the effect that the presence and activities of people have on the environment.

The following factors can affect the probability of slipping or tripping:

- Lighting: A poorly lit environment will make it difficult to identify potential hazards on the ground.
- Moisture: Floors can be wet and slippery, especially in humid environments.
- Noise: Noisy environments can distract attention from surrounding hazards.
- Temperature: Significant temperature variations, e.g., in cold rooms, can lead to slipping hazards.

Human factors

Human factors refer to how people interact with their environment. Human factors that can affect the risk of slips and trips include:

- Communication: The ability to understand safety instructions, signs, and labels.
- Fatigue: The effect of fatigue on the ability to perform a task.

- Personality: People's reaction to instructions, e.g., ignoring or taking risks.
- Capacity: Situations where demand exceeds a person's capacity, e.g., lack of training.
- Behavior: The way people act, e.g., rushing or taking shortcuts.
- Perception: The ability to process information about the environment, e.g., distraction.

Human factors are not always controllable, but many of them are predictable.

Note: Young employees, new hires, and employees with a poor understanding of the local language are more likely to have an accident in the workplace because they may not understand what they have been asked to do. Quality instructions and supervision are essential to avoid accidents.

Some activities may involve higher friction and increase the likelihood of slipping or tripping:

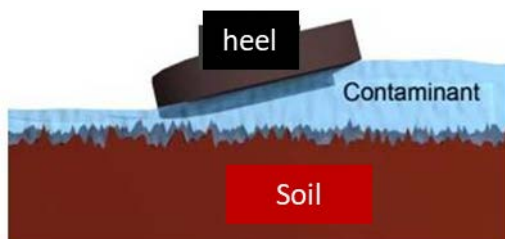
- Carrying: If you cannot see a hazard on the ground and lose your balance, you are more likely to fall.
- Push/Pull: These actions require a better grip, and you may not see a hazard on the ground.
- Rushing: When rushing, you require a better grip and have less reaction time.

Some people may be more likely to slip or trip than others, including:

- Older people: They are physically weaker, have a longer reaction time, and have a shorter toe detachment space.
- Persons with disabilities: Challenges will vary depending on the disability. They may have more difficulty maintaining their balance if they slip or trip.

11.2 APPENDIX 2: Contaminants

Liquid contaminants



Liquid contaminants are involved in most slips. A liquid contaminant reduces friction between the foot and the ground, typically occurring when the heel touches the ground. A liquid film then forms between the foot and the ground, preventing direct contact. The reduction in friction depends on the viscosity of the liquid and the finish of the floor surface. To maintain a low sliding potential, a floor must have sufficient micro-roughness to separate the liquid and create a solid-solid contact with the pedestrian's heel. The thicker the contaminant, the rougher the floor surface must be to achieve a low sliding potential.

Dry contaminants

There are three mechanisms by which liquid contaminants can reduce friction between the foot and the ground.

Slipping: Fine particles clump together, adhere to the shoe, and slide off with the person's foot. Only a small amount of the contaminant is needed for this to happen. Slipping is the highest-risk mechanism, especially on smooth floors. A rougher floor surface reduces the risk of slipping.

Separation: Slightly larger granular particles, such as flour, separate as the slide progresses. Separation is a less dangerous mechanism than slipping; however, it can still reduce friction enough to cause a slip.

Rolling: Large grainy, gritty, or sandy particles roll or move underfoot. This rolling can be enough to cause a slip. These particles are easier to see and remove.

11.3 APPENDIX 3 : Floors

Soft floors



Rubber

Vinyl

Linoleum

Resilient floors are also known as plastic floors. Below are the most common types of resilient floors.

Hard floors



Ceramic

Stone

Epoxy resin

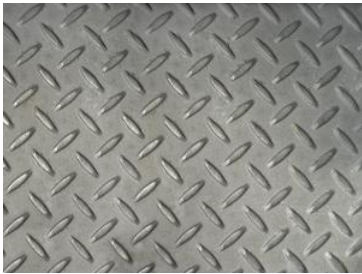


Wood

Metal

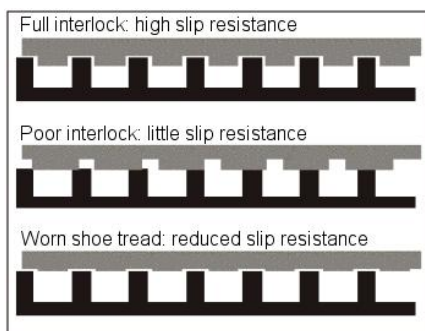
Cement

Profiled floors



Contrary to popular belief, adding a geometric pattern in relief, or profile, to a surface does not improve its slip resistance.

Profiles are commonly found on a variety of soft and hard floor materials.



How the interlock between the shoe sole and profile can affect slip resistance.

This is not usually the case. The friction improvement offered by adding a tread largely depends on the tread pattern, the pedestrian's sole pattern, and the level of wear on both the floor and the shoe sole.

Contoured surfaces can be very slippery and often contribute to accidents.

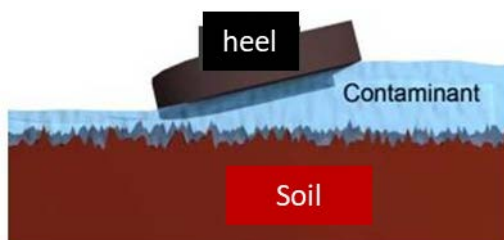
The diagram illustrates several possible interactions between a shoe sole and a contoured surface.

A profiled surface can have practical advantages beyond slip resistance. If a contoured surface is necessary, consider the surface finish and the level of slip resistance it is likely to provide for pedestrians.

Profiles can be more difficult to clean and maintain. Any improvement in slip resistance offered by the profile may be quickly lost due to surface wear. As with other floors, the slip resistance of profiled surfaces can be improved.

Floor Testing

Surface roughness



Why is surface roughness important? To have a low slip potential, a floor must have sufficient micro-roughness to separate a contaminant and create a solid-solid contact with the pedestrian's heel.

The thicker the contaminant, the rougher the floor must be to maintain a low sliding potential.

The Rz value is a measure of total surface roughness, calculated as the average of several roughness depth measurements. However, several other roughness

parameters can also be measured using surface roughness meters.

Surface micro-roughness

Why measure surface micro-roughness? The micro-roughness of a surface can provide an indication of the slip resistance of a floor when it is contaminated.

It is important to monitor floors because their sliding characteristics can change during installation and throughout their lifetime, especially due to pedestrian traffic, cleaning, and maintenance systems, etc.. Measuring surface micro-roughness is quick and easy, making it an ideal method for monitoring changes in surface finish.

This method can also be used to investigate incidents when used in conjunction with a slip assessment tool.

It is often possible to use a roughness meter in areas where traditional slip resistance tests cannot be performed or are likely to distort the results, such as on stairs.

It is important to know the slip resistance of your floor because there is a level of friction below which people tend to slip and above which they do not. To prevent slipping, it is essential to understand the level of slip resistance provided by your floors. There are two ways to measure slip resistance:

- Coefficient of friction tests: Direct measurement of the slip resistance of a floor
- Micro-roughness tests: Measurement of the physical roughness of a floor, which can indicate the potential for slipping when the floor is contaminated. However, micro-roughness measurements should not be used for floor specification; instead, data from a suitable coefficient of friction test should be used.

There are a number of friction tests, including:

- The Pendulum Test (SRT)
- The Ramp Test (Inclined Plane Method)
- The Slip Alteration Test
- A test with an FSC 2000 Tester
- The Tortus Test (B.C.R. Method)
- Others

The pendulum test is ideal because it is portable and can simulate the conditions of slipping accidents.



This test works in wet conditions because it generates a liquid film similar to that formed between a person sliding and the ground.

It can be used to accurately assess the sliding potential of clean, dry, or contaminated floors. This test is also effective for testing dry contaminants.

PTV	Slip Potential
0 - 24	High
25 - 35	Moderate
36+	Low

The results of the pendulum test are called Pendulum Test Values (PTV) or Slip Resistance Values (SRV). When the test is performed correctly, the PTVs should be interpreted as shown in the table. This table applies to pedestrians walking in a straight line on a flat surface. For other activities or inclined surfaces, the numbers in the table will vary. Two types of people are generally used: a pedestrian wearing shoes and a pedestrian walking barefoot. It is crucial to ensure that the appropriate type of pedestrian has been used for the test.

11.3.1 Cleaning technique with a damp mop

When cleaning a floor with a damp mop, the following instructions must be followed:

- Fill the bucket with water to the appropriate level.
- Add the correct amount of cleaning product according to the manufacturer's instructions. This is crucial: if the amount is insufficient, the solution will not remove contamination effectively. If excessive, a film may settle on the floor, making it slippery.
- Soak the mop thoroughly, then completely moisten the floor. Keep in mind that the floor can be slippery when wet, so ensure people stay away until it is dry.
- Allow the cleaning solution to sit for a few moments. Leave the solution on the floor as long as possible, even a minute can make a difference.
- If possible, use a well-wrung mop to remove dirty water. This method removes dirt and excess water from the floor.
- At this stage, the floor may still be wet and slippery. Speed up the drying time by using a dry mop.

EHS Management System



Operations in Confined Spaces

EHS-INS-018 A

06/2024

Cancels and supersedes:
EHS-002-38 Confined Areas

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Cancels and supersedes EHS-002-38 Confined Areas

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 4

4.1 Preliminary steps 4

4.2 Execution of the operation..... 5

4.3 Emergency plan 9

4.4 Staff training..... 9

5 ASSOCIATED DOCUMENTS 10

1 AIM

The aim of this instruction is to define the prevention and protection measures, particularly with regards to the risks of asphyxiation, to be put in place and maintained during operations in confined areas.

2 SCOPE

This instruction applies to all types of projects or operations - construction, production equipment installation, maintenance or reparation, industrial process enhancement, or other work - for which work in confined areas has been identified.

The rules described in this instruction must be followed by all people entering L'Oréal sites (suppliers, transporters, subcontractors, service providers, etc.).

This instruction applies to all sites within the L'Oréal Group.

In case of different requirements between the local regulations and the rules imposed by this document, the strictest requirements are to be applied.

3 RESPONSIBILITIES

In the case of a major project (see EHS-INS-001A), the project owner is responsible for managing the operations in confined areas, the access permits issued to the personnel, maintaining a list of personnel specifically trained and qualified to work in confined areas, and outlining procedures to be followed in case of an accident.

If the operations in confined areas are assigned to an outside company (see EHS-INS-002A) Management of Internal and External Worksites), and in all other cases, the EHS and Facility Director of the site/entity or equivalent, or their delegate, is responsible for managing the operations in confined areas, the access permits issued to the personnel, maintaining a list of personnel specifically trained and qualified to work in confined areas, and outlining the procedure to be followed in case of an accident.

4 DESCRIPTION

4.1 Preliminary steps

4.1.1 Identification of confined areas

Confined areas are totally or partially closed spaces. They are not designed or intended to be occupied by people, but can occasionally be occupied for carrying out work such as inspections, maintenance, repairs or construction.

They have restricted access and exits, such as ladders or stairways that are very steep, very long or very narrow.

Any type of object or equipment can limit access or prevent air from circulating freely. All confined spaces must be listed. **LIFE2**

Confined spaces may pose health and safety risks to anyone entering them due to:

- their design, construction, or placement
- their atmosphere, or insufficient natural or mechanical ventilation
- the materials or substances they contain
- other related dangers

In order to apply this instruction, it is important to be able to identify the confined areas likely to exist on the site, and on the work site in the case of major projects.

All confined areas with partial access (e.g., head access only), or complete access must be listed. The frequency of access and the risks identified for each confined area must be identified.

Each confined space must have a sign or a pictogram displayed to prevent access without written authorization. **LIFE2**

Access to confined spaces must be kept locked or not easily opened without a tool (except vessels). **LIFE1**

Any partial or total access into a confined area without written authorization will result in disciplinary action from the site management or a permanent exclusion from the site for personnel from external companies. All personnel from L'Oréal and external companies must be informed of this rule.

4.1.2 Risk assessment

The preparation and scheduling phase of exceptional and routine operations in confined areas must include a detailed risk analysis. This will take into account the following risks:

- Oxygen deficiency, which can be caused by:
 - o oxygen consumption by the worker
 - o combustion reactions (welding)
 - o chemical reagents (oxidation)
 - o biological reactions (fermentation)
- Substitution or replacement of oxygen by other gases or vapors, such as noble gases used to flush out oxygen in the event of fire or explosion risk
- Explosions and fires in oxygen-enriched atmospheres, which increase the level of flammability
- Toxic substances, to which operators may be exposed at high concentrations if ventilation is inadequate. These substances may come from residues (tanks), ongoing operations (welding, painting, etc.), or the confined area itself (silos, sewers, etc.), among other sources.
- Increased risk of electrocution due to proximity of space, humid, steam-saturated or water-containing atmosphere, or the presence of metal in the confined area
- Physical risks such as burial, which may be caused by the shape or content of the confined area
- Access to the work area due to the placement, dimensions, and means of access to the confined area. The entrance and exit of the confined area may result in a risk of falling, either for the operators, or for the emergency teams that may be called on to intervene.

4.1.3 Operational access procedures

A confined area access procedure, applicable to L'Oréal personnel, temporary personnel, or external companies, must be put in place and compliant with this instruction. **LIFE2** This must include:

- the preparation of the confined area before entry, including:
 - o washing and ventilation (see 4.2.3) of the enclosed area to ensure it contains only air
 - o LOTO of all hazardous energies and fluids/raw materials must be applied prior to entry into the confined space **LIFE1**
- the inspection of the atmosphere in the confined area to determine levels of oxygen and other potentially harmful gases, before and during the intervention
- personal protective equipment and emergency equipment which may become necessary
- the presence of a monitor

4.2 Execution of the operation

4.2.1 Organisation of operations

PERMITS

A confined space entry permit is issued to everyone who must enter a confined space. It is valid for a maximum of one day, specifying the work to be carried out, the date and duration of the work, and includes a risk assessment and safety instructions. Safety instructions must include, at least:

- the presence of a second person staying outside (monitor) for the duration of the intervention (portable gas meter ready for use)
- continuous oxygen monitoring during the intervention
- sufficient natural or mechanical ventilation, during entry into the confined space.
- correct and safe lighting **LIFE1**

The permit must be issued before any work is carried out by the EHS and Facility Director or their delegate, who must be formally authorized by the Director or someone appointed by the Director based on expertise, training, or experience. The permit must be displayed in the work area and issued only to personnel who are specially trained and qualified to work in confined areas.

Taking atmospheric measurements, defining an emergency plan, and appointing a monitor are strictly required steps before any permit can be issued.

The EHS & Facility Director, their delegate or the person appointed by the Director, must:

- be familiar with the assessment of risks associated with the work
- assess changes in entry conditions that may be generated by the result of operations carried out in the confined area
- know how to inspect and manage hazards
- check that it is safe to enter the confined area, taking atmospheric measurements into account
- authorize entry into the confined area by issuing a permit
- determine the end of operations in the confined area
- be familiar with, and approve the emergency plan
- Ensure the person authorizing the operation is present on the site for the duration of the work

OPERATORS

The operators are responsible for entry into the confined area and for the execution of the authorized operations. The responsibility of the operator includes the following:

- Familiarity with the potential risks
- Knowledge of how to manage the risks.
- Assessment of changes in entry conditions that may be generated by the result of operations carried out in the confined area.
- Knowledge of how to use the confined areas entry equipment and the personal protective equipment

- Assessment of the space of the enclosed area
- Knowledge of the conditions under which a confined area may be safely entered
- Knowledge of the corresponding emergency plan

MONITOR

The monitor is responsible for whatever is located outside the space, the inspection of the conditions that may affect it, the communication with the inside of the confined area (by visual or auditory contact, or any other method) and the access control of the confined area.

They remain outside the confined area and are present for the duration of the operation. The responsibility of the monitor includes the following:

- Knowledge of the potential risks and their effects on the operators
- Knowledge of the number and function of people present in the confined area at the same time
- Initiation of the evacuation and alerting of the emergency team
- Prevention of unauthorized entry
- Knowledge of the emergency plan.

4.2.2 Measurements

Atmospheric measurements must be taken before and during operations in confined areas, by a person trained in taking these measurements and interpreting the results. **LIFE1**

Measurements are taken from outside and include the oxygen concentrations, gas or flammable vapor concentrations, and the concentrations of toxic substances likely to be present.

The operator entering a confined space must have a calibrated portable oxygen analyzer with an audible alarm to warn of falling oxygen levels. **LIFE1**

These measurements are taken at the location of the planned operation:

- before each entry, use a device fitted with a probe and an electric or manual pump to take remote measurements, if possible
- once inside each location where the configuration of the space requires it, and at each location where oxygen could be displaced by the presence of other gases (noble gases), particularly whenever the characteristics of the atmosphere can change (interrupted work, confined area left without constant monitoring, change in the planned working procedure, etc.)
- continuously, if work is to be carried out in a confined area

The frequency and locations where the measurements are to be taken must be determined considering the following elements:

- Configuration of the confined area
- The presence of gases heavier or lighter than air. The measurements taken at a location may not reflect the situation elsewhere in the space
- The type of work to be carried out
- The possible changes in the conditions inside the space

In addition, the operator must have a portable oxygen monitor with an audible alarm to warn of falling oxygen levels.

The operator entering the confined space must be provided with a respiratory device (maintaining a 19.5% oxygen level) for evacuation, a gas detector suitable for the identified risks and a system for evacuation from the confined area, preferably leading to the outside (harness with lifeline, etc.). **LIFE1**

4.2.3 Washing and ventilation

After the space has been washed, and before the operation is carried out in the confined area (as well as throughout the operation), it is vital to ensure sufficient ventilation, whether natural or mechanical, depending on the requirements of the confined area. The ventilation can serve a dual purpose:

- To immediately remove all gases or vapors generated by the work (for example: gases created by welding operations)
- To allow sufficient fresh air to enter.
- If there is a malfunction of the ventilation system, the operation must be stopped. Air quality inside a confined area must never be improved by the addition of oxygen.

4.2.4 Visibility

The operator's visibility inside the confined area must allow safe access and completion of the work.

If lighting is used inside confined areas, it must not lead to additional risks. To ensure this, and depending on the risks identified, fireproof or low-voltage equipment must be used. The addition of such equipment must be considered to guarantee continued visualization of operators by the monitor.

4.2.5 Prevention of falls

The risk of falling must be managed during work execution, taking into account the access phases of operators and emergency teams, as well as the risks of inadvertent entry into confined areas (underground tanks, for example).

Access to confined areas must be marked once opened.

4.2.6 Personal Protective Equipment

The type and nature of the personal protective equipment depends on the nature of the work to be carried out and the assessment of the associated risks. The list of the required equipment is defined on the permit.

In all cases, the operator must be provided with a respiratory device for evacuation (mask), a gas detector suited to the nature of the risks identified, and a system that allows his evacuation from the confined area, preferably leading to the outside (harness with lifeline, etc.).

4.3 Emergency plan

An emergency plan must be formalized and presented to all persons involved during the entry into the confined area.

This emergency plan stipulates access to rescue workers, specifically trained for operations involving confined areas, the list of equipment necessary for the operations, and the description of the method used for rescuing the victims.

4.4 Staff training

All personnel, including all personnel entering the site (suppliers, transporters, subcontractors, service providers, etc.) must be familiar with the risks related to operations in confined areas and informed of the safety instructions applicable on the site.

All personnel, including company staff, temporary staff and external companies involved in all the operations or services linked to these instructions, are informed of their existence, and of the necessity to comply with them.

The training of the company's personnel, temporary personnel, and personnel from external companies involved in the entry into the confined area includes:

- the presentation of the operators involved in operations in confined areas
- the characteristics of the confined areas
- the potential dangers of the confined areas
- the description of the permit system
- the description of the emergency plan

The level of expertise and competence of the operators must be defined when the work is scheduled, and validated by the operator concerned before the work is carried out.

Operators and monitors of confined space entry must have received training and knowledge appropriate to the operations in which they are involved (use of PPE, risks associated with confined spaces and emergency plan). **LIFE1**

A rescue simulation must be executed to check the suitability of the equipment and the behavior of the rescue team.

5 ASSOCIATED DOCUMENTS

- EHS-INS-001: EHS Organization During Operations by External Companies for a Major Project
- EHS-INS-002: EHS Management of Internal and External Worksites
- EHS-FORM-026: Confined Space Entry Permit

This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.



EHS Management System



Hazardous Energies

EHS-INS-020 A

04/2024

Cancels and supersedes:

- EHS-301-18 - Prevention of Electrical Risks
- EHS-002-08 - Safety of Manufacturing Equipment
- EHS-002-09 - Precautions with Regards to Residual Pressure During Production Operations

ISSUE : Corporate EHS

CONTENT OF MODIFICATIONS:

Regrouping and simplification of 3 procedures

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET**

CONTENTS

CONTENTS 2

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 4

4.1 General Principles 4

4.2 Training 5

4.3 Personal Protective Equipment 5

4.4 Signs 5

4.5 Man-Machine Interface (MMI) 5

4.6 Prevention of Electrical Risks.....5

4.7 Residual Pressure.....8

4.8 Manufacturing Tanks 10

5 ASSOCIATED DOCUMENTS 13

1 AIM

This technical instruction describes the organization to be put in place to ensure that installations and machinery are used safely, taking into account the hazardous energies associated with them.

Machinery and installations include any equipment or physical system that uses energy likely to injure the user(s). This energy may be kinetic/mechanical (from mobile elements), electrical, thermal, hydraulic, pneumatic, magnetic or from radiation sources.

2 SCOPE

This technical instruction applies to all L'Oréal sites, including normal or abnormal use (running, shut-down, maintenance) of the installations and machinery.

Equipment category 1 with no energy is not covered in this instruction. This document does not cover chemical or biological risks due to the use of certain equipment.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements apply.

3 RESPONSIBILITIES

The Heads of Department are responsible for:

- Specific EHS training on the risks associated with hazardous energies
- The maintenance of the machinery and installations
- Compiling and displaying the safety instructions related to hazardous energies
- Compiling an action plan to reduce, to a minimum, interventions on machinery/installations in operation
- Awareness of the specific risks associated with hazardous energies during all interventions conducted within their sector

The EHS Manager is responsible for:

- General EHS training on the risks associated with hazardous energies
- Providing technical support to the heads of department when necessary

4 DESCRIPTION

4.1 General Principles

Hazardous energy is any source of energy (including electrical, mechanical, thermal, chemical, hydraulic, and pneumatic) that can be 'hazardous to workers', e.g., from a discharge of stored energy. Failure to control the unexpected release of energy can lead to machinery or installation-related injuries or fatalities.

Hazardous energies must be part of the site's risk assessment. Necessary actions to mitigate the risks must be established, taking into account the hierarchy of control measures as follows:

1. Elimination

The best and most effective way to reduce risks is to avoid hazards and their associated risks e.g., eliminate the need to go into an electrical substation by installing a remote monitoring system.

2. Substitution

Substitution involves the use of a less hazardous form of a substance or process. There are many examples of substitution such as the use of compressed air as an energy source rather than electricity to reduce electrical and fire risks.

3. Engineering controls

This involves controlling risks through engineering design rather than relying on preventative actions by employees. There are several ways of achieving these controls, for example by isolating equipment using an enclosure, barrier or guard, by insulating electrical or temperature risks, etc.

4. Administrative controls

These include the use of safety signs, markings and warning devices, as well as administrative controls e.g., reduction of exposure time, isolation/segregation, safe working systems, training, information, welfare, monitoring and supervision, etc.

5. Provision of personal protective equipment (PPE)

This measure must only be used as a last resort, as it only reduces the consequences associated with a specific risk.

Contact with hazardous elements will only be allowed if a lockout of the hazardous energies has been carried out beforehand, or where the risks have been deemed acceptable, or if a gripping tool is used instead of direct contact. Where it is not possible to lockout hazardous energies, the following measures must be implemented:

- Identification of the risks related to the operation
- Definition and implementation of the specific safety instructions
- Specific training for employees carrying out the operation

4.2 Training

General EHS training for employees must include a section on hazardous energies including, at least, the risks associated with general electrical safety, general preventive measures, man-machine interface (MMI) and Lock-Out/Tag-Out requirements (LOTO) as applicable.

4.3 Personal Protective Equipment

The wearing of personal protective equipment will be made compulsory, particularly after EHS validation of the equipment, in situations where a residual risk has not been eliminated by the use of collective protection.

4.4 Signs

When a risk cannot be physically eliminated by the use of collective protection but can be used safely, it must be indicated by a sign. This measure should only be used as a supplementary measure.

All signs must comply with current regulations. They must be clear and unambiguous for users. In all cases, specific training for operators, issued under the responsibility of the person in charge, must include the meanings and consequences of the signs.

4.5 Man-Machine Interface (MMI)

MMI requirements are covered in detail in EHS-INS-021.

4.6 Prevention of Electrical Risks

Design of electrical installations

Electrical installations must be designed in accordance with the standards in force in the country and must prevent the risk of:

- electrification and electrocution (direct or indirect contact with live bare parts)
- electrical fires (short-circuit, overvoltage, etc.).

A formal acceptance of the electrical installations by a qualified specialist must be carried out and recorded. The report must refer to the current regulations in force. **LIFE 2**

Electrical installations are designed to prevent :

- electrification and electrocution (direct or indirect contact with live parts)
- electrical fires (short-circuit, over-voltage, etc.)

Those installations are annually controlled and inspected (thermography, Visual, Infrared, etc..) **LIFE 1**

Electrical cabinets on worksites are equipped with:

- An earthing device;
- A differential protection device (rated at 30mA for cabinets powering mobile equipment such as portable electrical tools, lighting);
- A general cut-off control device;
- An emergency shut-down device;
- A device ensuring that they can only be opened using a key or a specific tool;
- Elements guaranteeing their sealing (stuffing box). **LIFE 1**

Management of the electrical installations

Site personnel must not be exposed to live conductors. The work equipment made available to personnel must indicate its electrical characteristics.

All electrical installations must be inspected periodically to ensure compliance with local regulations. In the absence of such regulations, installations will be checked for compliance with European or USA standards once a year.

Only qualified and approved electricians are authorized to work on electrical installations (transformers, meters, protective devices) and electrical cabinets. **LIFE 1**

Electrical cabinets must be fitted with a transparent protective screen (Plexiglass) to prevent any contact with the power bars.

A person qualified in the electrical field must be identified. This person must have the necessary skills to assess electrical risks and issue recommendations on means of prevention. This competence is based on appropriate training or qualifications. This person must ensure that new installations and equipment are approved, comply with local regulations and current standards and, undergo the necessary periodic checks.

Access to all technical rooms containing electrical transformation or distribution installations (transformers, meters, protective devices) must be kept locked at all times. **LIFE 1**

A system must be in place to ensure that all electrical cabinets are kept locked at all times. **LIFE 2**

Any hotspots identified in electrical equipment during inspection must be corrected immediately. A safety validation of electrical cabinets must be carried out by the EHS department. A cabinet showing a hotspot (indication of overload or overvoltage) must be stopped or temporarily validated depending on the result of a technical analysis.

A LOTO procedure is implemented before intervention on electrical installation to ensure that the work is done with hazardous energies off, except for tasks that need to be carried out on live

electrical parts (e.g., measurement and verification operations, etc...). LOTO on electricity and tasks on live electrical parts are only carried out by qualified and authorized electricians. **LIFE 1**

Operations on or near electrical installations

Any operation (manufacture, modification, maintenance, breakdown diagnosis, cleaning, etc.) on live electrical installations without adequate supervision is prohibited.

Operations on or near electrical installations may only be carried out by qualified and authorized electricians. Authorization is based on the suitability between the operations to be carried out, the danger posed by the electrical installations (e.g., voltage field, etc.) and the level of qualification of the electrician. It is only issued if medical fitness has been recognized by a competent doctor.

Each operation on or near an electrical installation is subject to a risk analysis. An indication must be given of the precautionary measures to be taken.

All work carried out at a distance of less than one meter on high/low voltage (>1,000 VA) is subject to a specific electrical work permit. **LIFE 1**

Work on or near low voltage electrical installations is only to be performed by qualified electricians (L'Oréal employees or subcontractors). **LIFE 2**

Suitable equipment (mats, tools, ladders etc.) and PPE, based on a risk assessment, must be provided to carry out interventions on or near electrical installations. **LIFE 1**

If operations on live electrical installations are subcontracted by the site, they must be carried out under maximum safety conditions:

- Appropriate training and qualification of operators
- Medical fitness of operators
- Authorization from the subcontracting company
- Prior analysis of risks
- Issue of a work permit indicating the precautionary measures to be taken
- Supply of suitable equipment and PPE

An instruction is enforced requiring that all the electrical wires:

- that are present on a worksite are protected against the risk of crushing that could lead to deterioration
- that have to cross over vehicle traffic areas on a worksite either are buried or protected using dimensioned protection housings in order to be able to carry the maximum allowable load.

LIFE 1

Accesses to the areas where electrical works are taking place on worksites are clearly marked out and identified. **LIFE 1**

4.7 Residual Pressure

A risk assessment must be carried out to identify the need to control residual pressure risks when working on pressure equipment (e.g., tanks, pipes, flexible hoses, etc....).

Personnel must be vigilant during operations that may present risks linked to the presence of undissipated residual pressure, including operations on packaging lines – compressed air, laboratory equipment, processing equipment, mobile storage containers, washing, utilities, flows, storage equipment etc.

Pressure vessels and tanks are equipped with a pressure relief valve, correctly calibrated. **LIFE 1**

Manholes in pressure vessels are equipped with interlocks or double opening systems to prevent them from being fully opened while under pressure. **LIFE 1**

If a manhole is opened, this check must consist of ensuring that the pressure indicated by the manometer installed on the tank itself is zero.

If a pipe (rigid or flexible) is to be disconnected, an inspection must be carried out either to:

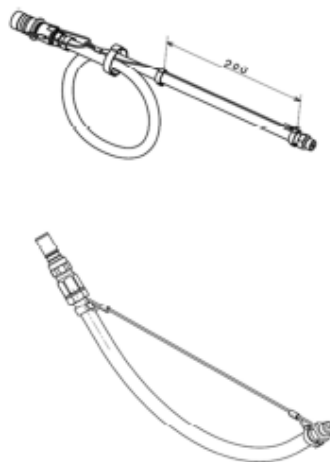
- Verify that a vent is open
- Check the manometer to ensure that the pipe is at air pressure (visible from the disconnection site, there must be no obstacle between the manometer and the connection to be removed).

LIFE 1

A formalized process must be put in place to ensure the operator carries out an inspection to confirm the absence of residual pressure before a closed container can be opened (e.g., instructions displayed on the manhole; manometer and opening or venting devices marked with the same colors). **LIFE 2**

When a mobile container/tank is moved/transported with the flexible hoses connected, there is a serious risk of injury if the flexible hoses fail. Therefore, all flexible pressurized hoses, connected to a mobile tank/container must be fitted with a flexible breakaway system that separates the flexible hose from the mobile tank before it breaks and holds the flexible hose in place (see photo below).

LIFE 1



Flexible breakaway type system

Sites are required to assess the risks associated with their current mobile container handling operations, including the connection/disconnection of flexible hoses. This assessment must include the risk of human error when flexible hoses are not disconnected prior to transportation by Power Industrial Truck (PIT).

The correct operation of residual pressure dissipation (airing) systems must be checked, especially when these systems are fitted with an accessory that could constitute an obstacle (filter, fire screen, condenser, silencer, etc.) and preventive maintenance of these systems must be implemented. Airing must be as direct as possible with minimal pressure drop.

Pressure-related safety systems (rupture disks, safety valves) and pressure-measuring devices (manometers) must be checked regularly in accordance with the technical requirements laid down by the manufacturer. Any solution that mechanically locks the opening devices, activated by operators when residual pressure is detected, must be considered as a priority.

For the packaging lines and laboratory equipment (including the cylinder or hopper), safety devices must operate to eliminate any residual pressure that could lead to a safety risk. This must be part of the EHS validation program along with regular checks to ensure correct operation.

4.8 Manufacturing Tanks

4.8.1 Heating tanks

It is strictly forbidden to heat tanks fitted only with a steam valve (whether or not these tanks are fitted with a fixed temperature gauge).

Any existing tank or one likely to be installed must be fitted with a processing dependent safety chain, with positive safety wiring, which includes:

- an auto-controlled temperature probe (double Pt 100 probe)
- secured signal control with a temperature setpoint that is inaccessible to the operator
- an on-off safety valve, usually closed
- an alarm to notify the operator

This applies as soon as the tank is fitted with a direct or indirect heating system.

If only the last requirement is not met by the tank, temporary conditional use of these tanks is possible. Specific instructions approved by the EHS must also be displayed on-site and must specify the precautions to be taken when using the tanks pending approval of compliance.

The results of periodic inspections to test the operating condition of the safety chain must be recorded. These results will be taken into account during the EHS inspection of the equipment in question.

4.8.2 Inspection of pressure tanks windows

A pressure tank is a tank that allows the internal pressure to be increased when certain conditions are met. Glass inspection windows on pressure tanks must undergo preventive maintenance in accordance with the following requirements:

- the glass and seals must be visually inspected annually
- the seals must be changed systematically each time they are dismantled, and at least every 2 years (to be adapted according to the aggressiveness of certain fluids)
- it is strictly forbidden for untrained personnel to carry out operations on the inspection windows. They must report any anomaly to their superior

All glass inspection windows fitted on the pressure tanks must be:

- made of boron silicate (identified in DIN 7080)
- in good condition:
 - o without scratches or chips, especially in the center or on the edges
 - o without any glass/metal contact, especially at the level of the window wiper
- correctly installed, the glass must not be subjected to:

- o mechanical shocks (e.g., contact with valve handles, impacts on the axis of the window wiper, etc.)
- o uncontrolled heating (e.g., halogen lamps left permanently switched on can easily reach temperatures in excess of 150°C)
- o excessive tightening

All glass that does not meet these requirements will be replaced with boron silicate glass.

Preventive maintenance and the replacement of inspection windows, if necessary, must be carried out by a qualified and documented person, i.e., the supplier of the inspection windows or any other person trained by this supplier in the removal and maintenance of inspection windows, or an expert.

Inspection windows of the 'fused glass/metal type' are compulsory for all new tanks. The 'fused glass/metal' option on existing tanks is left to the discretion of the site, on the basis of the risk analysis carried out and taking into account the fact that, for the same diameter, the field of vision is reduced.

4.8.3 Washing tanks

Fixed or mobile tanks

The washing and thermal disinfection of fixed or mobile manufacturing and storage tanks and their accessories involve risks associated with the use of steam, hot water and corrosive cleaning products, all of which can be projected onto an operator by agitation, splashing or pressure. These risks must be managed by:

- the systematic establishment of operational procedures for these operations. As with any operational procedure, these must be approved by EHS to ensure that the potential risks have been correctly identified and then eliminated or managed. These operating procedures must specify the personal protective equipment to be worn during washing.
- operator training to ensure strict compliance with these operating procedures. Particular care must be taken to prevent any variation in operating procedures (even to reach the standard set by the Quality department).

Pressure tanks

In addition to the risks mentioned above, pressure tank washing presents specific risks. To avoid overboiling of the liquid in the tank (due to incorrect temperature settings or a malfunction of a controller), the following rule must be followed:

During a washing operation, it is forbidden to use a process likely to heat the water in a pressure tank (or a connected structure) to a temperature higher than 100°C (e.g., double wall steam circulation).

LIFE 1

This restriction applies even if there is an outlet provided for use during the washing operating procedure (manhole, ventilation vent, tank bottom valve, etc.).

Substitution procedures often require equipment to be washed with water at a temperature above 60°C and therefore likely to cause significant burns if splashed. Apart from sudden depressurizations, these projection risks can be managed.

A risk assessment has been performed to identify the needs to control the risks during an intervention on a pressure equipment (e.g., tank, pipe, flexible hose, etc...). **LIFE 2**

The risks due to the use of steam, hot water and corrosive material for cleaning and thermal disinfection operations are managed by Operating Procedures validated by the EHS Department. **LIFE 2**

Specifically, the supply and draining equipment of washing or thermal disinfection water must be designed to prevent any projection, whether towards the operator doing the washing or towards another person carrying out other work in the workshop.

Manual washing

Some tanks (pressurized and non-pressurized) can be washed manually, and generally with hot water. This type of washing is a high-risk operation, so much more so if the temperature of the water is above 55°C. In order to limit these risks, it is forbidden:

- to use water with a temperature above 60°C and any thermostatic device producing hot water by mixing steam and water,
- to use high pressure washing equipment where the operating temperature exceeds 60°C or the jet pressure is likely to cause injury. **LIFE 2**

4.8.4 Other manufacturing equipment

In addition to the washing and thermal disinfection of tanks, the washing and thermal disinfection of other equipment is also dangerous. The following is also required:

- establishing EHS approved instructions
- specifying the personal protective equipment to be worn for each operation
- training the operators to be aware of the risks, explaining safety instructions to them and the reasons for wearing safety equipment.

In addition, in the case of manual washing:

- to ban washing with water over 60°C
- to ban the use of thermostatic devices that mix steam and water to produce hot water
- to ban the use of high-pressure washing equipment if the water jet is likely to cause injury.

5 ASSOCIATED DOCUMENTS

- EHS-INS-021: Man-Machine Interface
- EHS-INS-022: Maintenance Machine Tools
- EHS-INS-023: Lockout-Tagout

The Group EHS Management System documents are available on [Alexandria EHS Management System](#) website.

This page was intentionally left blank for duplex printing.



EHS Management System



Man-Machine Interface



EHS-INS-021

10/2023

Cancels and supersedes:
EHS-001-17 Man-Machine Interface,
EHS-002-07 Conveyors

ISSUE : Corporate EHS

CONTENT OF MODIFICATIONS:

Regrouping and simplification of the 2 documents above

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

CONTENTS

CONTENTS 2

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 4

4.1 General Principles 4

4.2 MMI Method 4

5 ASSOCIATED DOCUMENTS 16

1 AIM

This technical instruction describes the organization to be put in place to ensure that machinery is used safely. It is aimed at preventing accidents such as pinching, jamming, cuts, electrocution, burns, etc. generally associated with the use of machinery.

2 SCOPE

This technical instruction applies to all L'Oréal sites.

Equipment which does not use energy (e.g., ladders, manual lifts, fixed tanks without agitation or pressurization) is not covered by this procedure. In addition, this procedure does not cover chemical or biological risks involved with the use of certain equipment.

In case of different requirements between the local regulations and the rules imposed by this document, the more restrictive requirements are applied.

3 RESPONSIBILITIES

The Heads of Department are responsible for:

- Following the man-machine interface standards
- Taking into account the specific man-machine interface risks for all activities conducted within their sector
- Implementing the highest hierarchy of control possible as described within this document
- Compiling an action plan to reduce interventions on machinery in operation to a minimum
- Specific EHS training on man-machine interface related risks
- The maintenance of machinery within their sector

The EHS Manager is responsible for:

- EHS inspection and validation of equipment, when applicable
- General EHS training on the risks related to man-machine interface
- Providing technical support to heads of department as necessary

The machine user is responsible for:

- Following the man-machine interface standards
- Ensuring the EHS validation of machinery before use
- Applying the 'Do not touch' principle to avoid accident or injury

4 DESCRIPTION

4.1 General Principles

Man-Machine Interface or simply MMI means all activities related to the interaction between a user and a machine, whether for routine or non-routine activities (maintenance or shut-down).

Machines are any type of equipment that use energy likely to injure the user(s). This energy may be kinetic/mechanical (from mobile elements), electrical, thermal, hydraulic, pneumatic, magnetic or from radiation sources.

The 'Do not touch' principle

Under no circumstances must a person be placed in the line of fire of a machine or its moving parts whilst energized or has the potential to be energized. To be in the line of fire means "being in harm's way".

This principle signifies that contact is only permitted if hazardous energies have first been disabled or, where the risks have been deemed acceptable, that a gripping tool must be used instead of direct contact. In the latter case, all sites must have a list of activities subject to these conditions according to a risk analysis.

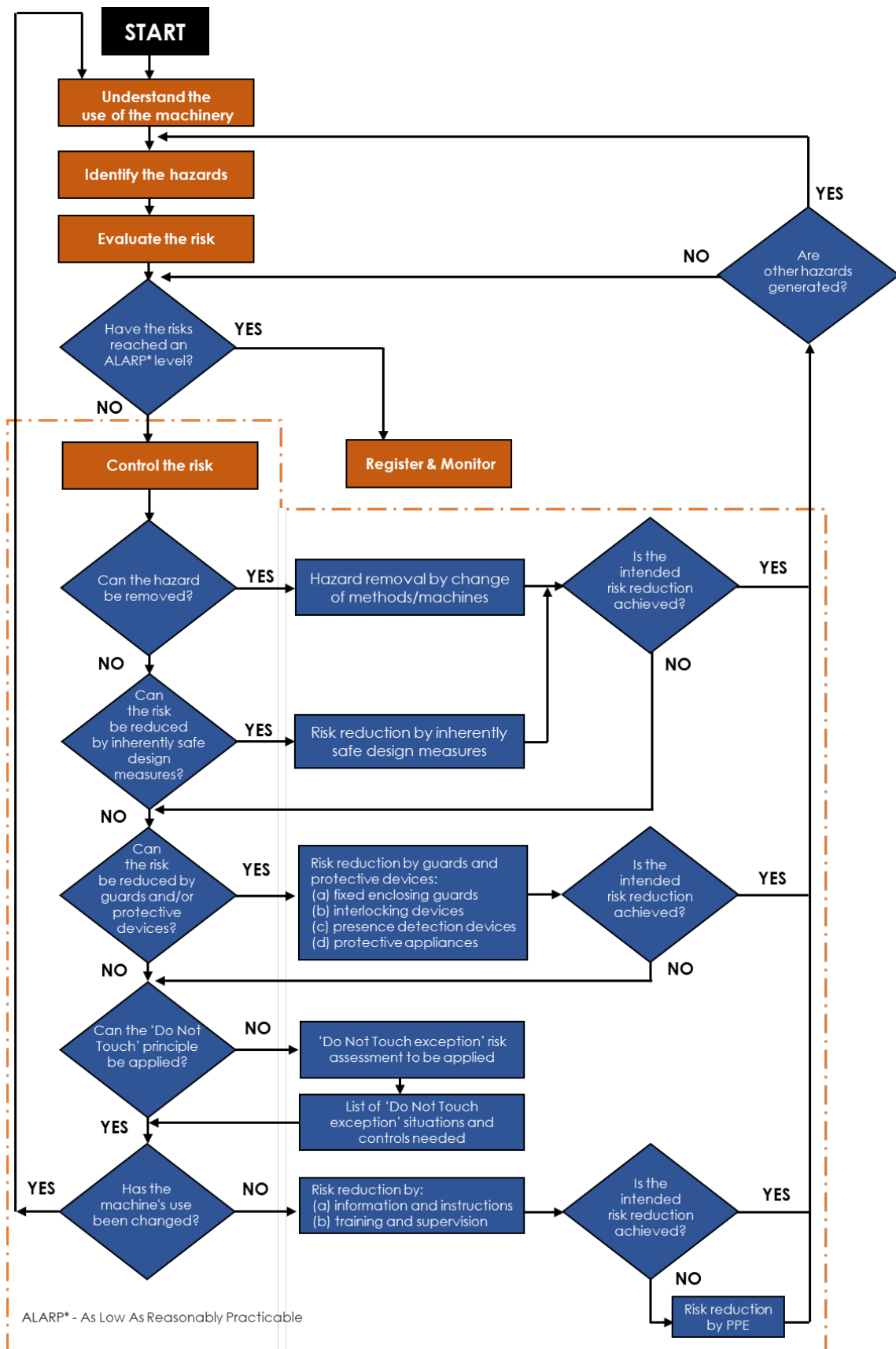
All measures must be taken to ensure that energy, likely to injure a person, has been deactivated before contact. If this is not carried out, a risk assessment, instructions and specific training must be issued. All sites must follow the application of the 'Do not touch' principle.

4.2 MMI Method

The MMI Method is the overall process to correctly manage machinery risks. It consists of identifying hazards associated with the machinery, evaluating the nature of a possible injury, its severity and the likelihood of occurrence for each hazard identified. This will enable a decision on whether the level of risk is acceptable or if risk reduction measures are needed.

This method consists of the following 5 steps also described in the flowchart below:

1. Understand the use of the machinery
2. Identify the hazards
3. Evaluate the risk
4. Control the risk
5. Register & monitor



The overall goal of this method is to reduce all MMI residual risks to a level called "as low as reasonably practicable" or simply "ALARP". This involves weighing a risk against the effort, time and money needed to control it. Thus, ALARP describes the level to which we expect to see workplace risks controlled.

A site risky analysis for MMI risks must be carried out and updated every year. The EHS validation process must take into account the requirements stipulated in this directive as part of the detailed assessment of a machine.

4.2.1 Understand the use of the machinery

Risk assessment begins by determining how the machine is used and how it interacts, taking into account all the phases of the machine's life. This means identifying the characteristics and performance of the machine or a series of machines in an integral process, as well as the people, environment and products involved.

Determining the use of the machinery and how it interacts must cover:

- identification of the machines subject to a risk analysis
- the different operating modes of the machinery and the different intervention procedures for the users, including interventions required by malfunction of the machine
- experience or ability of users including: operators, maintenance personnel, trainees and apprentices, and the general public
- not only operating the machine under normal conditions, but also covering activities such as setting, maintenance, cleaning or repair

4.2.2 Identify the hazards

After determining the use of the machinery, the essential step in any risk assessment is the systematic identification of reasonably foreseeable hazards (permanent hazards and those which can appear unexpectedly), hazardous situations and/or hazardous events during all phases of the machine's life cycle.

All reasonably foreseeable hazards, hazardous situations or hazardous events associated with the various tasks must then be identified. Examples of hazards are described on the following table.

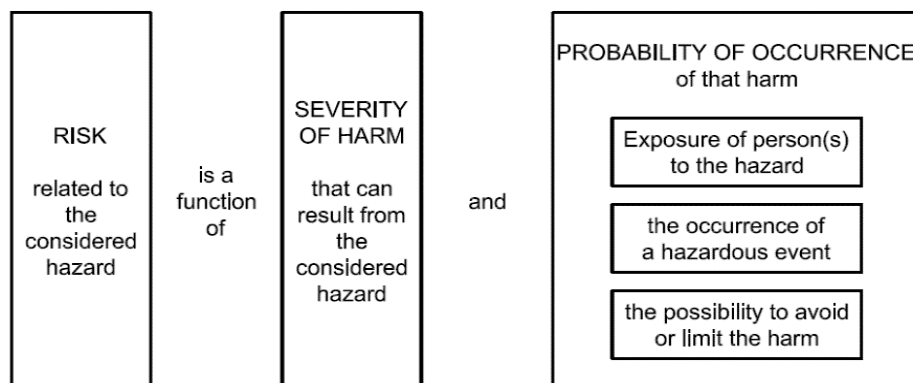
#	Hazard Group	Origin	Potential Consequences
1	Mechanical	– moving elements – rotating elements – stored energy – sharp edges – approach of a moving element to a fixed part	– being run over or being thrown – crushing – cutting or severing – drawing in or trapping – entanglement
2	Electrical	– arc – electromagnetic phenomena – electrostatic phenomena – live parts	– burns – chemical effects – effects on medical implants – electrocution
3	Thermal	– explosion – flame – objects with a high/low temperature – radiation from heat sources.	– burns – dehydration – frostbite – injuries by the radiation of heat sources – scalds
4	Vibration	– scraping surfaces – unbalanced rotating parts – vibrating equipment	– discomfort – lower back morbidity – trauma to the spine.
5	Radiation hazards	– ionizing radiation source – low frequency	– burns – damage to eyes and skin

4.2.3 Evaluate the risk

The objectives of risk evaluation are:

- determine the highest risk arising from each hazardous situation or credible accident scenario
- decide which, if any, hazardous situation requires further risk reduction, and
- determine whether the required risk reduction has been achieved without introducing further hazards or increasing other risks.

The risk associated with a particular hazardous situation related to the use of machines depends on the following elements:



- a) the severity of harm;
- The risk associated with the most probable severity of harm which could result from each identified hazard is taken into consideration, but the highest severity is also taken into account, even if the probability of such an occurrence is minimal.
 - It is important to consider the worst severity of harm that can realistically occur. The extent of the harm must also be considered e.g., one person or several people. In general, the lower the energy of the hazard, the lower the severity of the potential harm.
 - The severity of potential harm can also be related to the parts of the body that are involved, e.g., a hazard that causes crushing injuries is generally fatal if the whole body or head is involved.
- b) the probability of occurrence of harm, which depends on:
- the exposure of a person/people to a hazard: the need to access the hazard zone, the nature of access, the time spent in the hazard zone, the frequency of access.
 - the occurrence of a hazardous event: accident history, reliability and other data.
 - the technical or human possibility to avoid or limit the harm: the person's expertise, human factors such as fatigue, stress-related aspects, interaction between people, etc.

Training, experience and ability can affect risk; nevertheless, none of these factors are a substitute for eliminating the hazard, reducing the risk through inherently safe design measures or safeguarding, where such protective measures can be practically implemented.

4.2.4 Control the risk

The objective of risk control can be achieved by eliminating hazards, or by reducing, separately or simultaneously, each of the two elements that determine the associated risk:

- the severity of the harm caused by the hazard in question;
- the probability of occurrence of that harm.

Protective measures to reduce risks associated with work equipment are carried out in the following order, using the principle of the **RISOP** acronym:

1. **Remove the hazard.** The best and most effective way to reduce risks is to remove the hazard and its associated risks wherever possible.
2. **Inherently safe design measures.** To be preferably implemented during the design phase to avoid hazards and/or reduce risks to people using the machinery. It also covers design changes on the machine even after installation.
3. **Safeguarding and/or protective devices:**
 - a) Fixed enclosing guards
 - b) Interlocking devices
 - c) Presence detection devices
 - d) Protective appliances

e) 'Do not touch'

4. **Organizational measures**

a) Information and instructions

b) Training and supervision

5. **Personal protective equipment (PPE)**

4.2.4.1 Remove the hazard

Most hazard elimination decisions should take place when designing or selecting the equipment. Although eliminating the hazard is the ultimate goal, it can be difficult and is not always possible. The solution to eliminate risks may be to replace the machine with a less dangerous one, to change methods, or to use inherently safe design measures.

4.2.4.2 Inherently safe design measures

Inherently safe design measures are the first and most important step in the risk reduction process after removing the hazard. They enable hazards to be avoided or risks to be reduced through the appropriate choice of design features for the machine itself and/or for the interaction between exposed persons and the machine. They include: control systems, design provisions, automation, geometrical factors, physical aspects, etc.

Every machine (e.g., palletizers, compactors, shrink-wrappers, compressors, large fans, automated warehouses, automatic cartoning machines, etc....) is designed to ensure that there is no possibility of direct contact with potentially dangerous components that can create a risk of fatality (e.g., by installing fixed or mobile safety guards or light curtains). **LIFE 1**

In all cases, a machine's compliance with the principle of 'no possible direct contact with a dangerous element' is approved during the EHS validation following a detailed risk assessment. This validation is given by the EHS manager, after an inspection and before any use of a new machine or modification of an existing one. During validation, revalidation or risk analysis, it must be ensured that there is no risk of pinching, jamming, electrocution, burning, cutting or contusion of any part of the body. **LIFE 2**

Machine safety systems (with the exception of AGVs) where there is a risk of fatality are independent of the equipment's normal control system. **LIFE 1**

Machine safety systems on machines where there is risk of serious injury are independent from the process automated controller. **LIFE 2**

If a machine malfunctions, it must be possible to stop the machine immediately and safely, otherwise this could pose a risk to the operator or people working in the vicinity of the machine.

Machines presenting risks of serious injury are fitted with one or several emergency shut-down buttons. **LIFE 2**

When a line's control circuit passes via a controller, the safety device for opening the housing must not pass via the same controller.

Overriding the safety systems must be made impossible and is prohibited without a prior risk analysis and a specific formal authorization from the department head. **LIFE 1**

The machinery must be designed to avoid hazardous situations resulting from interruption or excessive fluctuation of the power supply. The following requirements must be met as a minimum:

- the machine's stop function must be maintained;
- all devices whose permanent operation is necessary for safety must function effectively to maintain safety (e.g., locking, clamping devices, cooling or heating devices, power-assisted steering on self-propelled mobile machinery);
- machine parts or workpieces and/or loads held by machinery which are liable to move as a result of potential energy must be restrained for the time necessary to allow them to be lowered safely.

Manual control devices must be designed and located according to the relevant ergonomic principles. They must be located out of reach of danger zones, with the exception of certain controls which, by necessity, are located in a danger zone, such as the emergency stop or teach pendant. The need to access danger zones should be minimized by locating maintenance, lubrication and adjustment points as far as possible outside danger zones.

A stop control device must be placed near each start control device. Where the start/stop function is provided by a hold-to-run control, a separate stop control device must be provided where a risk may result from the hold-to-run control device not issuing a stop command when released.

Whenever possible, control devices and control positions must be located so that the operator is still able to observe the working area or hazard zone.

Diagnostic systems to aid troubleshooting must be included in the control system, so that the protective measures do not have to be disabled. Such systems not only improve machine availability and maintainability, but also reduce the exposure of maintenance personnel to risks.

The use of failure-oriented components should always be considered, especially where there is no redundancy of protective measures. These are components whose predominant failure mode is known in advance, and which can be used in such a way that the effect of such a failure on the machine function can be predicted.

Only safety-related components (for example, certain sensors) of known reliability must be used.

4.2.4.3 Safeguarding and protective devices

Guards and protective devices are used to protect people when an inherently safe design measure cannot reasonably either remove hazards or sufficiently reduce risks. Complementary protective measures involving additional equipment (e.g., emergency stop equipment) may need to be implemented.

The exact choice of safeguard for a particular machine must be made on the basis of the risk assessment for that machine. When selecting a suitable safeguard for a particular type of machine or hazard zone, it should be remembered that a fixed guard is simple and should be used when operator access to a danger zone is not required during normal (trouble-free) operation of the machine.

The need for increased access frequency inevitably means the fixed guard is not replaced. In this case, another protective measure (interlocking movable guard, sensitive protective equipment, etc.) is required. A combination of protective measures can sometimes be required.

Guards and protective devices must:

- a) be of robust construction,
- b) not create any additional risk,
- c) not be easy to bypass or render inoperative,
- d) be located at an adequate distance from the danger zone
- e) cause minimum obstruction to the view of the production process
- f) interfere as little as possible with activities during operation or other phases of the machine's life, in order to reduce any incentive to override them.
- g) enable essential work to be carried out for the installation and/or replacement of tools and for maintenance by allowing access only to the area where the work has to be carried out — if possible, without having to remove the guard or disable the protective device.

When a safety guard protecting access to hazardous energy that could cause a fatal accident is opened, the operation of the associated machine is stopped, as well as all movements made accessible by the opening of the guard. The residual energy must be released. Additionally, it is impossible to restart the machine by the control buttons. **LIFE 1**

Safety distances to prevent upper limbs from reaching danger zones

Appendix 2 sets out the safety distances that must be maintained to prevent the machine's danger zones from being reached. Safety distances are appropriate for protective structures. They apply when distance alone is sufficient to reduce risks.

4.2.4.3.1 Fixed guards

A fixed guard has no moving parts and must be designed to prevent access to the hazardous machine parts. If the guard can be opened or removed, this should only be possible with the aid of a tool. It must be of sufficiently robust construction to withstand process stresses and environmental conditions.

Where perimeter fence guards are used, the guard must follow the contours of the machine wherever possible, thus minimizing the gap between the guard and the machine. For some machines, these guards may be adjustable depending on a risk analysis. They are adjusted for a particular operation but during the operation they remain fixed.

4.2.4.3.2 Interlocking devices

These are guards or protection devices that allow access to the dangerous areas of a machine only when the component is in a safe state. The advantages of interlocking guards are that they allow safe access to operate and maintain the machine without the need to dismantle the safety devices.

An interlocking guard must be connected to the machine controls in such a way that:

- the interlock prevents the machine from operating by interrupting the power supply until the guard is closed;
- either the guard remains locked until the risk of injury from the hazard has passed or opening the guard eliminates the hazard before access is possible.

Special care is needed with systems that have stored energy. This could be the momentum of a heavy moving part, stored pressure in a hydraulic or pneumatic system, or even the simple fact that a part is capable of moving under the influence of gravity even when the power is disconnected. In these situations, dangerous movement may continue, or be possible, with the guard open and these factors must be taken into account in the overall design. Braking devices (to stop movement when the guard is opened) or delay devices (to prevent the guard opening until the machinery is safe) may be needed.

All interlocking systems must be designed to minimize the risk of fail-to-danger and must not be easy to override. When a safety guard is opened (like interlocks), it must be impossible to restart the machine using the control buttons. This prevents access to hazardous energy which could cause serious injury. **LIFE 2**

4.2.4.3.3 Presence detection devices

A type of protective device which detects when an individual enters a risk area and stops the machine (e.g., certain photoelectric guards and pressure-sensitive mats). A presence-sensing device does not physically keep people away, but detects them when they approach a danger point. They must be

designed to stop the machine before injury occurs. They must be designed to reset themselves, so that the machine can only be restarted by following the normal procedure.

4.2.4.3.4 Protective appliances

Two-hand control devices

These are devices which require the operator to have both hands in a safe place (the location of the controls) before the machine can be operated. They are an option on machines that are otherwise very difficult to guard, but have the disadvantage of protecting only the operator's hands. It is therefore essential that the design does not allow any other part of the operator's body to enter the danger zone during operation. More importantly, they protect no-one but the operator.

When two-hand controls are used, the following principles must be followed:

- The controls must be located, separated and protected in such a way as to prevent them from being operated with one hand, with one hand and another part of the body, or from being easily bypassed.
- Dangerous parts can only be set in motion if the controls are operated within approximately 0.5 seconds of each other. Once the dangerous parts have been set in motion, it must not be possible to repeat the operation until both controls have been returned to their off position.
- The movement of dangerous parts must be stopped immediately or, where appropriate, stopped and reversed if one or both controls are released while there is still danger from the movement of the parts.
- The hand controls must be located at such a distance from the danger point that, on releasing the controls, it is not possible for the operator to reach the danger point before the movement of the dangerous parts is stopped or, where appropriate, stopped and reversed.

Hold-to-run control

This is a control which allows operation of the machinery only as long as the control is held in a set position. The control must automatically return to the stop position when released. Where the machinery runs at crawl speed, this speed must be kept as low as practicable.

4.2.4.4 Organizational measures

4.2.4.4.1 Information and instructions

It is mandatory to have in place a proper provision of information and written instructions for work equipment. This must cover:

- the way in which the work equipment can be used and under what conditions;
- any foreseeable difficulties that could arise, and instructions on how to deal with them;

- any conclusions drawn from experience using the work equipment, which must be either recorded or steps taken to make sure that all appropriate members of the workforce are aware of them.

In addition, there may be in-house instructions and information from training sessions. Employers must ensure that written instructions are available to everyone using the equipment. This includes supervisors, managers, employees, temporary workers and others e.g., maintenance staff who will need information such as maintenance instructions and manuals.

Information must be provided in writing or verbally where this is considered sufficient. This is the managers decision based on the unusual nature or complexity of the equipment or task. They must consider:

- the skill levels of the workers involved;
- their experience and existing training;
- the level of supervision required;
- the complexity and length of the task

Information and instructions, whether verbal or written, must be easy to understand and must be provided in an appropriate language for the user/purchaser. They must be logical, illustrated where appropriate and use standard symbols.

4.2.4.4.2 Training and supervision

All persons, including supervisors and managers, who use, or supervise, work equipment must receive adequate training for health and safety purposes, including the items below. This training must be practical and must be done on each machine in question.

- Evaluate the existing levels of competence and skills of all users of work equipment including temporary and agency workers
- compliance with the 'Do not Touch' principle involving, if necessary, the use of gripping tools
- evaluate the level of management or supervision needed
- carry out a formal analysis to determine the training required to enhance workers' levels of competence taking into consideration, for example, whether they work alone or under close supervision
- carry out training particularly when first recruited but also when:
 - o risks and tasks change
 - o new technology or equipment is introduced;
 - o the system of work changes.

4.2.4.5 Personal protective equipment (PPE)

The use of PPE for users of work equipment is the last stage to be considered in the hierarchy of protection after inherently safe design, safeguards, instructions and training. PPE must not be seen as a substitute for well-designed and properly safeguarded equipment.

However, there are many tasks and pieces of equipment where PPE is necessary for general protection e.g., the use of suitable gloves which fit properly and do not restrict operations. Some pieces of equipment can be so inherently dangerous that despite all the safeguards and training specialized PPE is absolutely essential.

The risk assessment must identify the PPE which should be used to protect against specific risks as well as general standards required for the use of work equipment.

4.2.5 Register & Monitor

Register

The documentation must demonstrate the procedure that has been followed and the results that have been achieved. This includes, when relevant, documentation of:

- a) the machinery for which the risk assessment has been made
- b) any relevant estimates that have been made (loads, strengths, safety factors, etc.)
- c) the hazards identified and the hazardous events considered in the risk assessment
- d) the risk reduction objectives to be achieved through protective measures
- e) the protective measures implemented to eliminate identified hazards or to reduce risk
- f) the result of the risk assessment and any forms completed

Monitor

The safety-related equipment, comprising of critical elements whose absence or malfunction would lead to a significant risk, must be identified and be subject to preventive maintenance, under the responsibility of the person in charge. The frequency of maintenance must be adapted to the criticality and the reliability of the equipment in question.

The machines and installations must undergo regular maintenance in order to maintain their level of safety. An action plan must be drawn up to eliminate maintenance operations on live machines as much as possible, under the responsibility of the person in charge.

Maintenance operations carried out on live machines that may present a risk of injury (e.g., handling, electrical work) are performed by qualified technicians and subject to a specific work permit, risk assessment and safety instructions. **LIFE 1**

Maintaining compliance with MMI requirements must be part of the site management system with involvement at all levels, and must include tools such as: SIO, MESUR, EHS Validation, etc.

5 ASSOCIATED DOCUMENTS

- EHS-FORM-027 - Man-Machine Interface (MMI) assessment
- EHS-INS-020 - Hazardous Energies
- EHS-INS-022 - Maintenance Machine Tools
- EHS-INS-023 - Lockout/Tagout

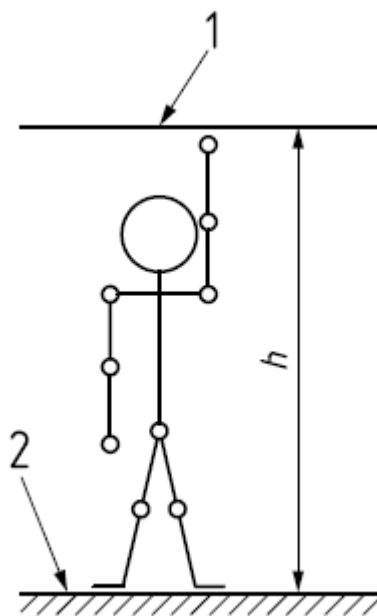
The Group EHS management system is available on [Alexandria EHS Management System](#) website.

Appendix 1: Safety distances to prevent upper limbs from reaching hazard zones

The distances apply only when sufficient risk reduction can be achieved by distance alone. All reasonably foreseeable access means shall be taken into account.

Height of the hazard zone

The height of the hazard zone, h , must be 2 700 mm or more. The height of the hazard zone, h , must be 2 500 mm or more when both the severity of harm and the probability of occurrence of harm caused by the hazard are low.



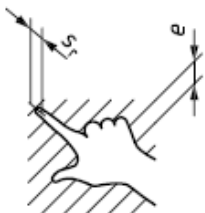
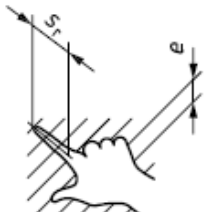
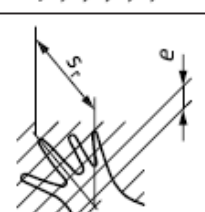
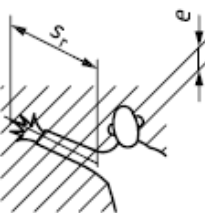
Key

- 1 hazard zone
- 2 reference plane
- h height of hazard zone

Reaching through openings

The following table shows the safety distances from the hazard zones. The opening dimension, “e”, corresponds to the side of a square opening, the diameter of a round opening and the narrowest dimension of a slotted opening. It should be used for openings not exceeding 120 mm. For openings larger than 120 mm the risk analysis must establish the necessary controls.

Dimensions in millimetres

Part of body	Illustration	Opening	Safety distance to hazard zone, s_r		
			Slot	Square	Round
Fingertip		$e \leq 4$	≥ 2	≥ 2	≥ 2
		$4 < e \leq 6$	≥ 10	≥ 5	≥ 5
Finger up to knuckle joint		$6 < e \leq 8$	≥ 20	≥ 15	≥ 5
		$8 < e \leq 10$	≥ 80	≥ 25	≥ 20
Hand		$10 < e \leq 12$	≥ 100	≥ 80	≥ 80
		$12 < e \leq 20$	≥ 120	≥ 120	≥ 120
		$20 < e \leq 30$	$\geq 850^a$	≥ 120	≥ 120
Arm up to junction with shoulder		$30 < e \leq 40$	≥ 850	≥ 200	≥ 120
		$40 < e \leq 120$	≥ 850	≥ 850	≥ 850

NOTE The bold lines within the table delineate that part of the body restricted by the opening size.

^a If the length of the slot opening is ≤ 65 mm, the thumb will act as a stop and the safety distance may be reduced to ≥ 200 mm.

This page was intentionally left blank for duplex printing.



EHS Management System



Lockout-Tagout

Lockout-Tagout

04/2024

Cancels and supersedes: EHS-001-19 –Lock-out Release

ISSUE : Corporate EHS

CONTENT OF MODIFICATIONS:

Indicates details of modifications made

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

CONTENTS 2

1 AIM.....3

2 SCOPE 3

3 RESPONSIBILITIES 3

4 DESCRIPTION 4

4.1 Design of Equipment and Installations..... 4

4.2 Organization 5

4.3 Training 9

4.4 Operations carried out by an external company 9

5 ASSOCIATED DOCUMENTS 10

1 AIM

This technical instruction describes the organization of the Lockout-Tagout (LOTO) requirements for servicing and maintenance operations carried out on all equipment or installations that may expose personnel to hazardous energies (electrical, mechanical, heat and pressure) or fluids (including raw materials).

2 SCOPE

This technical instruction applies to all L'Oréal sites.

LOTO requirements must be applied before any intervention is carried out on equipment that is subject to the release of hazardous energy, following a risk analysis, with the exception of tasks for which the LOTO requirements are not applicable.

Should local regulations and the rules imposed by this document differ in their requirements, the strictest are to be applied.

3 RESPONSIBILITIES

Each department head coordinates the management of the LOTO operations related to hazardous energies that take place in their department, in agreement with the EHS manager.

The department head is responsible for the appointment of the LOTO manager, and must also ensure that the training of the employees reporting to them covers the risks associated with operations on the equipment and what to do in the event of an incident.

The LOTO manager organizes, and is responsible for, the LOTO operations within a site/department.

4 DESCRIPTION

LOTO is an important part of workplace safety. It is essential to protect workers and employees around the machinery and equipment they operate, service and maintain.

This involves de-energizing electrical circuits, closing valves, neutralizing extreme temperatures and securing moving parts so hazardous energy is not re-introduced during equipment maintenance.

A LOTO operation is implemented before any intervention on hazardous installations. This ensures that hazardous energies are switched off before any work is carried out, with the exception of tasks that must be carried out on live electrical parts under specific, safe conditions (e.g., measuring and verification operations, etc...).

LOTO on electricity, and tasks on live electrical parts must only be carried out by qualified and authorized personnel.

For lockout and release operations to be effective and sufficient, they must form part of a general and structured approach, which must be part of an appropriate sequence, following a risk analysis, that takes into account the local context of the activity and the residual energies that might be present.

4.1 Design of Equipment and Installations

The effectiveness of a lockout depends above all on the devices built-in when the equipment was designed.

Fluid and energy disconnection points must be easily accessible. The equipment - lockable disconnect switch, lockable blowdown valve, etc. – and the appropriate instructions required for lockout operations should preferably be provided by the equipment designers.

For existing equipment that is not fitted out with such devices, compensatory measures must be implemented following a risk analysis. Particular attention must be paid to adapting the devices, used to secure the equipment, to the complexity of the equipment and the frequency of operations.

If a person accesses a piece of equipment, that person must be the only one who can restart the equipment.

In case of modification or relocation of a piece of equipment, a new risk analysis must be carried out. These changes (electrical wiring, piping, switches, etc.) must be updated on documentation (drawings, PID). The LOTO procedure must be updated before the equipment is restarted. **LIFE 1**

4.2 Organization

Where maintenance requires that normal guarding is removed, or access is required inside existing guarding, then additional measures are needed to prevent exposure to any mechanical, electrical or other hazards.

There must be clear company rules about the isolation procedures required, and the circumstances in which they apply, e.g., cleaning a mixing machinery may require isolation, even if it is not considered a maintenance task.

The basic rules, however, are that the power source (usually, but not exclusively, electrical energy), must be isolated, the isolator must be locked (e.g., with a padlock), and a sign must be displayed indicating that maintenance work is in progress.

Isolation requires the use of devices that are specifically designed for this purpose; not devices such as emergency stop buttons with keys or switches that may be fitted to the machine.

Any stored energy (hydraulic or pneumatic power, for instance) must be dissipated before any work starts.

LOTO equipment (lockable disconnection switch, lockable blowdown valve, etc.) is available and personal. Each person uses their own devices, to which they alone have the key. The lockout device must be removed by the person who locked it. **LIFE 1**

The maintenance and service tasks requiring LOTO have been identified. **LIFE 2**

LOTO specific procedures have been developed for each equipment. **LIFE 2**

4.2.1 Identification of operations subject to Lockout/Tagout release

Operations on site equipment subject to LOTO must be identified by means of a risk analysis carried out by, at least, the LOTO manager, the EHS manager and the equipment user.

A risk analysis specific to LOTO activities must comply with local regulations and the manufacturer's instructions and must make it possible to compile:

- A list of equipment servicing or maintenance operations subject to Lockout/Tagout procedures.
- A list of equipment servicing or maintenance operations not subject to Lockout/Tagout procedures.

The risk analysis must cover each operational stage of the lockout and the release of the lockout (see 4.2.3) specifying the precise measures to be implemented for each. It must also take into account and propose suitable prevention measures for:

- All the specifics of the operation (partial lockout, specific risks, etc.),

- All aspects of the safety of personnel, equipment, and the operating environment (proximity of another operation, etc.),
- The coordination of the supervision of the lockout and the removal of the lockout in the event of a change of station during the operation (supervision log, etc.).

4.2.2 Internal LOTO procedures

For operations on equipment that require LOTO, an operational procedure must be drawn up. It must be compiled based on the risk analysis and subject to revision if any modification to the equipment or its environment is carried out.

Maintenance or servicing operations presenting VH (Very High) or H (High) risk are subject to mandatory LOTO procedures. These operations must be listed, saved and updated when necessary.

The operational procedures must be displayed on, or close to, the equipment in question. Incorporating visual representations of the lockout points into these procedures is recommended.

Special case

An exact operational procedure must be drawn up following a specific risk analysis in the event that the equipment's hazardous energy sources cannot be locked out.

The risk analysis must determine whether the operation can be carried out with signaling alone; the other steps remain applicable.

The removal or cutting of a lockout by other people can only be carried out in very specific, exceptional cases, which must be described in an exact procedure. The EHS department must be present for this exceptional action.

Partial lockout affects only a portion of the energy, fluids or parts of the equipment. Partial lockout of equipment can only be implemented if it presents no risk to people.

In the case of partial lockout, it is essential to have first carried out a detailed risk analysis in order to identify the equipment that remains live and to ensure that there is no interaction between the various locked-out parts of the equipment and the parts that are not locked-out.

A LOTO procedure is implemented before an intervention on a hazardous installation to ensure that hazardous energies are switched off before any work is carried out, with the exception of tasks that need to be carried out on live electrical parts (e.g., measuring and verification operations, etc...). LOTO on electricity and tasks on live electrical parts must only be carried out by qualified and authorized personnel.

4.2.3 LOTO operational steps

For a given energy, the LOTO procedure generally involves the phases described above, the order and execution of which may be modified based on a risk analysis, depending on the specific features of the case in question. When locking out equipment, it is essential to follow these 8 steps in order to follow compliance and safety:

1. Systematically inform the employees concerned of your intention to lockout the equipment
2. Shut down the machine normally
3. Mark off the area of operation and appoint a person to supervise and co-ordinate the operations in progress
4. Review the written lockout procedure
5. Perform the Lockout/Tagout operations using specific Lockout/Tagout measures and following the instructions given in the operational procedure. These operations are broken down into several steps, the order of which depends on the risk analysis: **LIFE 1**
 - a. Separation
 - b. Lockout and signaling
 - c. Dissipation or retention
 - d. Verification and identification
 - e. Communication

The lockout devices must be listed and adapted to each piece of equipment on the site. On each piece of equipment, the lockout points must be clearly identified.

6. Ask the LOTO manager or their representative to check the lockout and the release in order to authorize first the operation and then the restarting of the equipment
7. Inform the operators of the end of the operation and the release of the equipment
8. Record the LOTO and the restarting of the equipment

Detailed description of step 5

a) Separation

Separation is an operation that involves acting on one or more devices to separate the equipment from its source(s) of energy or pressurized fluid(s). Separation (like dissipation) should take place as close as possible to the operating area in order to facilitate inspections.

b) Lockout and signaling

Lockout is an operation which consists of ensuring that the separation is maintained in such a way that it cannot be removed without voluntary action by an authorized person. This requires locking by means of a device that is difficult to neutralize and easily identifiable. These lockout devices must be specific, resistant and dedicated.

The lockout of equipment must take into account the different energies present (electrical, fluid, thermal, nuclear or mechanical) in order to create and maintain a safe situation.

Equipment lockout requires special operations which may overlap, the order of which is defined on the basis of a risk analysis related to the operations on the equipment, e.g., with a fluid lockout, prior electrical and/or mechanical lockouts are required. However, the circulation of a fluid may be necessary despite the lockout of the equipment (cooling liquid, etc.).

Signaling is an operation which consists of physically informing people of the state of the equipment (or part of the equipment) which is locked out and identifying the person who carried out the lockout. This is generally done using a label, a sign or the lockout device itself.

c) Dissipation or retention

This operation consists of eliminating potential or residual energies or removing fluids. It includes drainage, decontamination, neutralization, etc. (particularly of chemical products), e.g., discharge of a capacitor, relief of pressure, draining of a pipe containing a corrosive liquid, lowering of a press, etc.

Where dissipation is not possible, the energy can be contained or retained: e.g., mechanical blocking of a suspended mass.

d) Verification and identification

Verification is an operation which consists of ensuring there is no voltage, pressure, etc., on the equipment (done mainly through tests). This operation must be considered as an operation on a live or pressurized installation, etc., and therefore involves the implementation of the required safety measures.

Identification is an operation aimed at correctly identifying the locked-out equipment and the lockout devices involved, so that operations can be carried out on specific equipment (or part of it) and not on any other, and the people responsible for the lockout are clearly identified.

e) Communication

Communicate clearly and ensure that those concerned (including workers) are informed of the implementation of the LOTO and its conclusion.

Equipment re-start

Before a normal re-start phase, a transient phase is often required: this is the test phase, for which the safety measures put in place for the operations must sometimes be partially neutralized. Suitable compensatory measures must then be adopted.

Equipment can only be re-started when all risks have been removed, release from lockout is complete and checked (certification of release from lockout), and all protection has been replaced.

Once the re-start has been carried out, the personnel involved must be informed that the operating equipment is ready for use.

4.3 Training

All people applying the LOTO must have received appropriate training for the operations in which they are involved and must be competent, since the aim is for them to be able to organize or carry out operations on the working equipment in complete safety. In particular: **LIFE 1**

- Be able to assess the risks associated with hazardous energies and fluids and take the necessary measures
- Depending on the nature of the operation, be familiar with the work equipment concerned
- Know how to use protection correctly according to the risks encountered and the instructions, and assess the limits of the operation to be carried out.

Training of the people responsible for lockout/release must include theoretical sections as well as a presentation of practical applications in order to check that the safety principles relating to lockout/release operations have been properly understood.

Electrical lockout/release operations must be carried out by people specifically trained in electrical risks and operations on electrical installations.

All personnel must be familiar with the risks related to operations on equipment and the importance of the lockout/release procedures.

4.4 Operations carried out by an external company

In the case of operations carried out by an external company, the LOTO manager must be appointed from among the site's personnel. In the exceptional case where these skills are not present on site, this role may be taken on by personnel from the external company provided that their qualifications have been checked by the EHS manager.

The LOTO qualifications of an external company's lockout officer must be checked before work is carried out. They must have their own LOTO procedures and devices, but must nevertheless be trained in the procedures applicable on site.

In addition, a coordination and prevention plan must be drawn up and put in place to prevent the risks associated with co-activity.

5 ASSOCIATED DOCUMENTS

- EHS-INS-020 - Hazardous Energies
- EHS-INS-021 - Man-Machine Interface
- EHS-INS-022 - Maintenance Machine Tools

The Group EHS Management System documents are available on [Alexandria EHS Management System](#) website.

Appendix 1: Definitions

Summary Table with Examples of LOTO Operations (non-exhaustive list)

	ELECTRICAL	FLUID	MECHANICAL
SEPARATION	Isolation of all power and control circuits, including emergency standby supplies in a clearly visible manner	Blocking of all fluids or solids inlets, including "emergency" circuits in a clearly visible manner	Cutting the transmission of all forms of energy, including emergency energy and energy accumulators in a clearly visible manner
LOCKOUT	Locking by means of a tamper-proof locking device, the status of which is visible from the outside and which can only be opened using a specific tool adapted to each operator		
SIGNS	Clear and permanent information of the execution of the lockout system. Warning signs may be needed in dangerous areas		
DISSIPATION or RETENTION	Earthing and short-circuiting of the conductors. Discharge of the capacitors	Draining and cleaning (scrubbing, degassing). Constant ventilation if possible	Set to the lowest energy level by: - Shutting down mechanisms, including inertia flywheels - Ensuring stable mechanical balance (low dead point) or, if necessary, mechanical blocking Setting to atmospheric pressure or earthing and short-circuiting power and controls
VERIFICATION	No voltage difference between any of the conductors (including the neutral) or between the conductors and the earth. Earthing checks	Flow Pressure Possible specific inspection (atmosphere, pH, etc.) Implementation of collective and personal protection equipment	Inspect for: - Absence of voltage - Absence of pressure

Appendix 2: LOTO assessment

The following assessment is intended to help evaluate the implementation of a site/entity's overall LOTO program from a management point of view. It can be used as a reference and it does not eliminate the need to comply with the integrity of the technical instruction EHS-INS-023.

#		Topic	Compliance (Yes/No)	Risk level
1	PROGRAM/ POLICY	Does your site have a program and technical requirements in place for energy control and Lockout/Tagout?		
2		Is the Lockout/Tagout requirements stored and accessible to employees?		
3	PROCEDURES	Do you have instructions for machine-specific energy control?		
4		Where machines do not yet have lockout instructions, do you have generic pre-task plans and procedures?		
5		When you upgrade equipment, do you incorporate this into your lockout procedure?		
6	ISOLATION POINTS	Are labels clearly posted to mark energy isolation points?		
7		Do you mark your energy sources with energy source ID tags?		
8	TRAINING	Do you conduct LOTO training for authorized employees, assigned employees and contracted/other employees?		
9		Are your employees trained on the lockout devices specific to your facility?		
10		Do you maintain Lockout/Tagout training records?		
11	DEVICES	Do you have a documented equipment list or an asset management system?		
12		Are your padlocks standardized in terms of color, shape or size?		
13		Do you have appropriate lockout devices for each type of energy control point in your facility?		
14		Are the lockout devices easily accessible and close to the machinery?		
15		Does your facility have lockout warning signs and labels?		
16		Do you use lockout stations?		
17	MONITORING	Do you systematically monitor and annually review your Lockout/Tagout program?		



EHS Management System



Management & EHS Validation of Equipment

EHS-INS-030 A

09/2024

Cancels and supersedes: EHS-301-15, EHS-002-46

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Cancels and supersedes: EHS-301-15, EHS-002-46

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1	AIM.....	3
2	SCOPE	3
3	ROLES, RESPONSIBILITIES AND TRAINING.....	3
4	MAINTENANCE.....	3
5	VALIDATION	4
5.1	Procedure:	4
5.2	Basic file	7
5.3	EHS Inspection	7
6	UTILITY NETWORKS	10
6.1	Knowledge of utility networks.....	10
6.2	Inspection of utility networks.....	10
7	MACHINE-TOOLS	10
7.1	Definition.....	10
7.2	Politics.....	10
7.3	Risk assessment	10
7.4	Risk reduction	11
8	PROCESSING ORDERS.....	12
9	SAFETY CRITICAL EQUIPMENT (SCE)	12
10	ASSOCIATED EHS DOCUMENTS	13

1 AIM

The purpose of this instruction is to describe the EHS validation process for equipment used by L'Oréal and temporary staff. This ensures that the equipment complies with local regulations and L'Oréal rules and maintains the assurance of risk control over time for all EHS-validated equipment. It also informs the user of the identified risks.

2 SCOPE

This instruction is applicable to all sites within the L'Oréal Group.

3 ROLES, RESPONSIBILITIES AND TRAINING

The Site Manager is responsible for work equipment if they have not delegated it to one or more equipment managers.

Equipment managers must keep an up-to-date list of the equipment in their sector subject to EHS validation. They are responsible for the basic equipment file and for triggering the EHS validation procedure. They must follow the action plan linked to the results of the EHS examinations.

The EHS & Facility Manager or their designated representative is responsible for verifying the basic file and for any EHS decision that follows an EHS review of equipment. (These documents are accessible to all).

The person responsible for validation must possess the competencies listed below, validated by the site director and EHS:

- Risk analysis methods (e.g., SHAP, HAZOP, ERGOEVAL, etc.)
- Local regulations for work equipment and L'Oréal standards
- A perfect understanding of the validation process and the L'Oréal directives
- Technical skills including: Man-Machine Interface (MMI), Lockout/Tagout (LOTO), mechanical and electrical competence
- A good knowledge of processes and the use of equipment (e.g., skid, packaging, utilities, etc.)
- Be prepared to call in an expert, if necessary.

4 MAINTENANCE

All equipment on site must be subject to a maintenance plan that includes the following:

- Preventive maintenance
- Maintenance protocol
- Metrology (check and/or calibration planning and recording)

Maintenance must be carried out by trained internal or external personnel.

5 VALIDATION

5.1 Procedure:

EHS validation covers production equipment (manufacturing skids, packaging lines, etc.), laboratory, transport, maintenance and other equipment (utilities, forklifts, etc.).

Some of this equipment is subject to mandatory periodic checks which can be carried out by either internal or external bodies. The EHS validation of this equipment will, therefore, be based on the results of periodic regulatory checks, supplemented by verification of compliance with L'Oréal requirements. A L'Oréal validation label (outside category 3) will be affixed once these two levels of verification have been completed on category 2 and 4 equipment.

Verification of L'Oréal requirements can be subcontracted to an inspection body. In this case, the points to be checked must be explicitly included in the contract between L'Oréal and the inspection body. EHS must then study the inspection report submitted by the external body to verify these points have been checked and are compliant. They will then affix a L'Oréal validation.

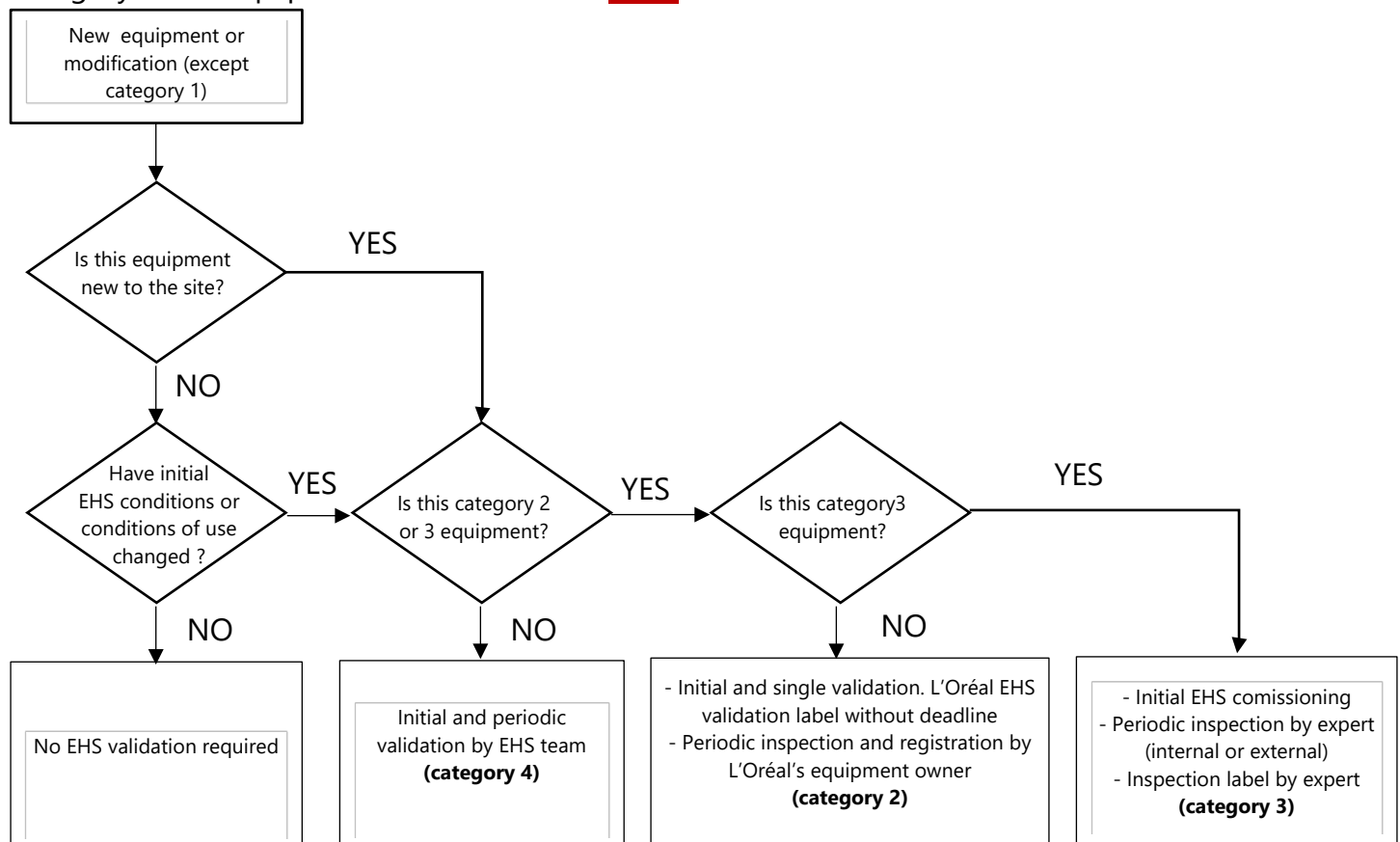
There are 4 categories of equipment:

Category	List of associated equipment
CATEGORY 1 No EHS validation needed if: • No dangerous moving parts • No risk of burns • No risk of radiation • No pressure or vacuum involved Category 1 defined by EHS team	Trimmer Paper shredder TV Printer Hand truck, etc.
CATEGORY 2 (defined list) 1.Initial and single validations. L'Oréal's EHS validation label without deadline 2.Periodic inspection and registration by L'Oréal's equipment owner. This part is supplemented with regular audits by the EHS team	Order preparer (shopper) Hand truck pallet Auto washer/washer Ladders (mobile)/stepladders/platform Adjustable table Laboratory equipment, laboratory oven, bath with thermostat, torquemeter
CATEGORY 3 (defined list) 1.Initial commissioning by EHS 2.Periodic inspection by an expert (internal or external). Inspection label issued by expert Inspection report checked by EHS team	Loading bay Utilities: boiler, cooling units, compressor, WWTP, demineralizer Lift, automatic door Hoods, local ventilation with articulated arm Wheel locks, racks, truck blocking system Retention barrier, life safety systems (fire extinguishing, LEL/O2 monitoring)
CATEGORY 4 Initial and periodic validation by EHS Non exhaustive list	Handling device: Trolley with counterweight, trolley with retractable strut, bi-directional trolley, front trolley, tri-directional trolley, stacker, bag handling machine, ride-on pallet truck, pallet truck with driver, electric pallet truck,

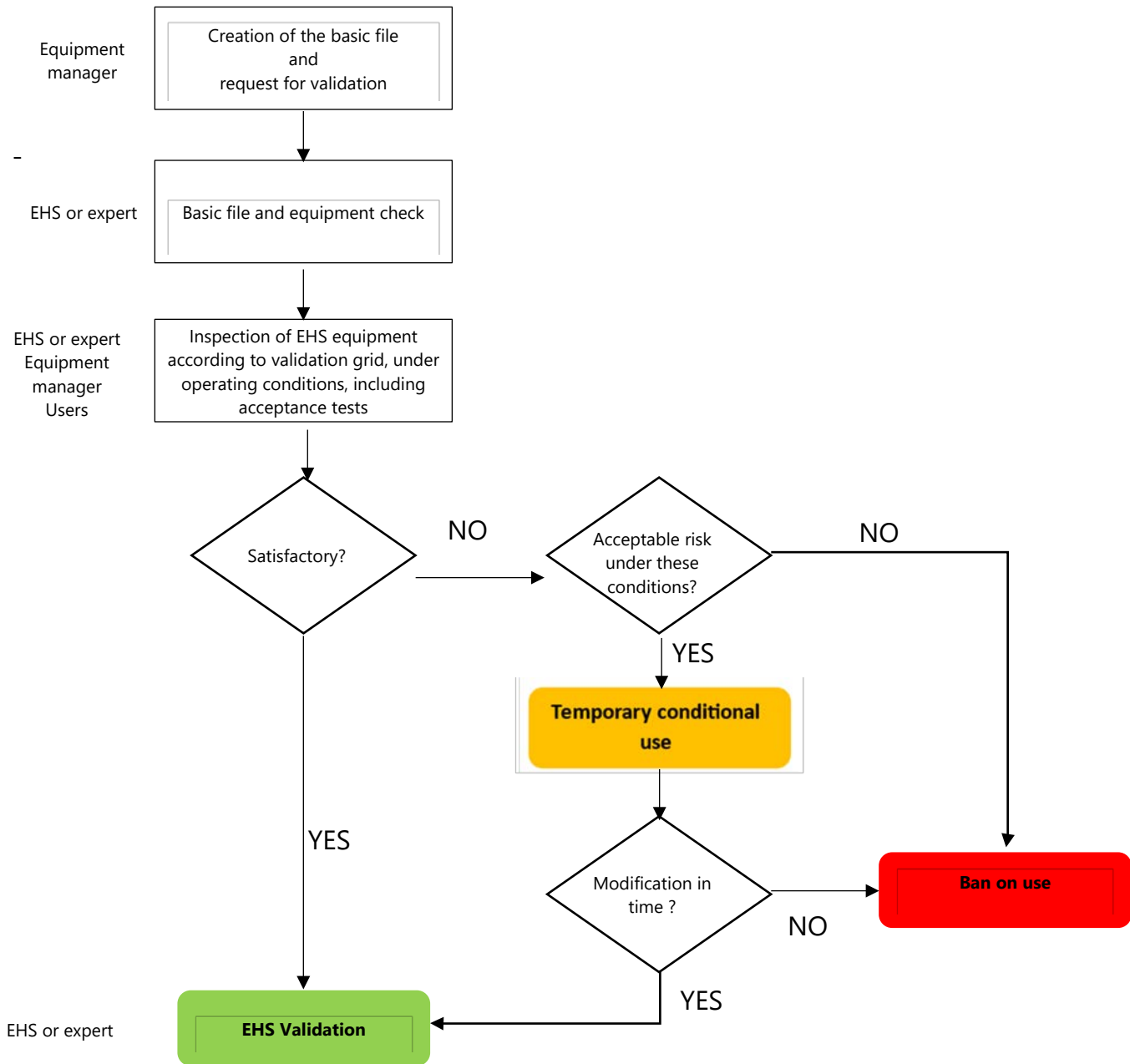
	stacking pallet truck, cobot, AGV, hoist, tank handling machine, vat clamp, Atex equipment Manufacturing: Double-walled tank, adjoining tank, manufacturing tank, storage tank, mobile transfer tank, buffer tank, extruder, melter, high pressure homogenizer, manufacturing skid, rotating vertical cabinet (e.g., Kardex). Packaging: Testing container, pallet packer, blister packaging machine, cellophane wrapping machine, coder, gluer, powder compactor, conveyor (all types), loader (all types), depucker, unstacker, dispenser (all types), tray packing machine, carton packing machine, glue machine, bagger, carton labeling machine, shrink-wrapping machine, filmer, shrink oven, jar orienting machine, palletizer, scale, filler (all types), jar returner, robot-handler, crimper, sleeving machine, sealer, boom handler, cutter platform. Others: Fixed or portable machine tool (band saw, lathe, milling machine, drill press, sander, grinder, etc.), equipment used in kitchens (if property of the site), levelling lift, press (all types), autoclave, grinder, waste compactor

Decision tree for EHS validation of equipment

All category 2 to 4 equipment is EHS validated **LIFE 1:**



Process of EHS validation:



5.2 Basic file

The basic file consists of a set of documents relating to the life of the equipment, from its design to its eventual dismantling.

In particular, this file contains the documents that must be drawn up and transmitted by the manufacturer, builder, designer, assembler, distributor or importer of the equipment.

The following documents must be available:

- The instruction manual or equivalent. This manual must include, as a minimum, instructions on equipment installation, commissioning, normal use, operating limits, adjustments and maintenance and a list of safety relevant equipment. The manual must include the drawings and diagrams required for the above-mentioned points.
- The declaration of regulatory compliance
- The maintenance program for safety devices (e.g. metrology of temperature sensors, pressure gauges, vents, etc.), except category 2.

These documents are mandatory for new work equipment. In the case of existing, sometimes old, equipment, the basic file, even if incomplete, will not block the EHS validation process.

5.3 EHS Inspection

The EHS inspection must take place under the following circumstances:

- 1) Each site determines the frequency of EHS equipment inspections, with a maximum interval of 2 years.
- 2) The item has a direct impact on the safety of the equipment (e.g., replacement of a safety device). The equipment manager contacts the EHS & Facility Manager for re-validation before the equipment is restarted.

During the EHS inspection of a piece of equipment, various EHS points that must be considered (non-exhaustive list):

- Man-machine interface (MMI)
- The application of the equipment must be compatible with the products to be manufactured (e.g., ATEX machine – flammable liquid)
- Hygiene (dust, noise and ergonomics) at the workstation
- Other relevant aspects linked to the risks analysis

The EHS inspection should consider all the operating conditions of the equipment (production, cleaning, washing, thermal disinfection, adjustments, maintenance, change in format, clearing of the line, etc.). During this phase of the EHS inspection, personnel assigned to the equipment are required to describe/demonstrate precisely the actual conditions under which interventions are carried out following malfunctions, etc.

The EHS inspection of a piece of equipment must be based on a reference framework containing:

- the local regulations
- L'Oréal rules
- the professional standards
- site specific rules
- results of the risk assessment at the workstation

Given the specific risks of a skid, its initial validation must be based on the results of a HAZOP analysis

To ensure that all these aspects are taken into account, the EHS or its designated representative must use an examination grid, based on the form EHS-FORM-014 Validation of Equipment Grid, supplemented by its specific features.

5.3.1 EHS Validation

This authorization means that, taking into account the results of the inspection and the specific operating instructions, the EHS level of the equipment is acceptable (risk level L) as evidenced by a green label affixed by the EHS.

If residual risks are present, the equipment manager defines the safety instructions. These instructions are validated by EHS and displayed at the workstation. Staff are trained in these instructions.

The label indicates, at least, the validation deadline for category 4.

No validation label is required for category 3 but a label issued by an external expert, giving a deadline, is required.

For category 2, an EHS label without a validation deadline must be affixed to the equipment.

After validation, the equipment manager must maintain the equipment in good condition and ensure that the maintenance plan, in particular with regard to the safety devices, is respected.

5.3.2 Temporary Conditional Use

Temporary conditional use is the authorization to operate a piece of equipment following an EHS review. This use is subject to time-limited operating conditions, and is marked by an orange label affixed by EHS.

It must be dated and clearly indicate the deadline by which residual risks must be eliminated. This deadline, set jointly by EHS and the equipment manager, entrusts the latter with the task of implementing the modifications required to eliminate these residual risks. These residual risks are displayed on the equipment as close as possible to the risk (pictograms or other signs), along with the means of preventing them.

Actions must be completed within 6 months. After this period, the equipment will be subject to an operating ban, evidenced by a red label.

Temporary operating conditions will be defined by the person responsible for the equipment and validated by the EHS.

Only employees who are aware of the residual risks and the necessary control measures will be able to operate the equipment. This is a mandatory requirement. The list of authorized employees must be visibly displayed near the equipment.

5.3.3 Ban on use

If the EHS examination of the equipment has revealed unacceptable uncontrolled risks (level H or VH or LIFE 1 risks), the ban of use of the equipment must be clearly visible by affixing an "Operation Refusal" type label. This signaling must be displayed on a red background. EHS must always be kept informed when equipment is decommissioned.

To ensure that the equipment cannot be used, it must be physically sealed off (total lockout: electricity, fluids, other energies) by the person responsible for the equipment.

6 UTILITY NETWORKS

6.1 Knowledge of utility networks

To enable correct identification, fixed piping must be indelibly identified with the color corresponding to the fluid and/or the name of the fluid clearly written, the direction of fluid flow, and where applicable, the fluid hazard symbol.

Up-to-date diagrams of all utility networks (electricity, water, gas, etc.) must be kept. In particular, underground cables and pipes must be indicated, and it is essential to locate the course of all utility networks within the site.

6.2 Inspection of utility networks

The EHS & Facility Manager of the site/entity must plan an annual inspection of the pipe supports.

The inspection must be carried out internally or by a contractor.

Utility networks must have an appropriate maintenance program that takes into account the importance of prevention.

Each operation carried out is recorded.

7 MACHINE-TOOLS

7.1 Definition

A machine tool is a motorized machine used for cutting and shaping metals and other materials (e.g., lathes, presses, drills, grinders, milling machines, etc.).

7.2 Politics

Depending on its industrial environment and local skills, each site must assess the relevance of having machine tools on its premises. At the very least, it is recommended to ban lathes and milling machines.

7.3 Risk assessment

Machine tools are classified as Category 4 equipment, and are therefore subject to initial and periodic EHS validation. Sample validation grids for drilling machines, lathes, grinders and milling machines can be found on EHS-FORM-014.

On manually operated machines such as machine tools, the most dangerous movements are rotation, cutting, shearing, sawing or pressing.

When identifying risks, the following must be considered:

- The work to be carried out with the equipment during normal use, as well as during assembly, maintenance, repair, breakdowns and removal of blockages
- The people who will be using the material (inexperienced workers, new arrivals, etc.)
- If casings or safety devices are poorly designed and not easy to use or are easily undone
- Type of energy supply

7.4 Risk reduction

In order to reduce risks, the following rules must be applied:

1-Employees:

- Restrict and control the number of trained and competent/qualified people. The use of machine tools by a technician must be specifically authorized for each machine.
- Educate and train employees:
 - o All persons using a machine tool must receive adequate training to ensure safety in its use, maintenance, supervision or management.
 - o Only authorized persons may use a machine tool.
 - o Training requirements include: avoidance of hazards, safe use of machine tools, wearing of appropriate PPE and what PPE should not be worn (do not wear gloves if there is a risk of entanglement)
- TAKE 2 training or similar is recommended for maintenance personnel.

2-Machine tools:

- Check compliance with local regulations in force (verification by a certified organization before the first commissioning).
- Protect the dangerous parts of the machines (fixed protective casings, protective casing fitted with safety devices (e.g. interlocks), adjustable protective casings limiting access to moving parts).
- Choose the appropriate controls, such as two-hand controls placed at a safe distance from dangerous areas; easily accessible and clearly identified stop and start buttons; and emergency stop controls within easy reach, etc.

3-Organization

- Display the procedure and the residual risks on or near the machine
- The 5S program must be implemented in workshops
- MESUR visits must be carried out regularly in workshops

4- The workshop/the room:

- Restrict access: locked to prevent access to unauthorized persons (personal badge required). A list of authorized persons can be displayed at the entrance.
- The workshop must be visible (windows).

5-Lathes and milling machines

- Trainees or temporary workers must not be authorized to use them.
- Technicians must have a certificate or diploma acquired externally.
- Even if in possession of a diploma/certificate, a theoretical and practical examination must be carried out with certified personnel (internal or external).
- It is forbidden to work alone on these machines.

8 PROCESSING ORDERS

This chapter applies to laboratories, demi-grands, pilots and factories.

Prior to any manufacturing, in addition to checking the EHS validation of the installation and the availability and condition of the personal protective equipment to be worn, it is necessary to ensure the EHS validation of the processing recipe.

EHS validation of manufacturing procedures:

The processing recipe is validated by the EHS & Facility Manager before any manufacturing starts. The objectives of this validation are to verify:

- that the raw materials, semi-finished, and finished products used are not likely to impact the administrative situation of the site
- that the various stages of the process are not likely, under the planned conditions of implementation (equipment, work environment, temperature, pressure, etc.), to cause unacceptable risks to personnel and the environment (uncontrolled exothermic reaction, fire, explosion, gas emissions or dangerous dust, etc.)
- that the degraded modes have been taken into account
- that the appropriate collective and individual protection measures are specified in order to prevent the risk of exposure to chemicals.

9 SAFETY CRITICAL EQUIPMENT (SCE)

Definition:

Safety Critical Equipment (SCE) is an individual piece of equipment, a control system, or an individual protection device whose failure could be the cause of an EHS incident (safety valve, vacuum breaker, gas detectors, etc.) that could result in serious harm to people, equipment and the environment.

Inventory

An inventory of the SCE must be updated annually.

Design of SCE

The design of the SCE must take into account the results of the fault tree analysis in which the SCE is considered.

Their operation must be independent of that of the main equipment (e.g. wiring of a critical thermometer for a process independent of the wiring used for the operation of the process).

Maintenance of SCE

The SCE must be subject to reinforced preventive maintenance and periodic audits to ensure compliance.

10 ASSOCIATED EHS DOCUMENTS

This instruction is linked to the following document:

- EHS-FORM-014 EHS Validation of Equipment Grid

This list is not exhaustive: the applicable documents are available on the [Alexandria EHS Management System](#) website.

This page was intentionally left blank for duplex printing.



EHS Management System



Control of Chemical Risks to Health

EHS-INS-036 A

06/2024

Cancels and supersedes:
EHS-301-47 A, EHS-002-28, EHS-002-29,
EHS-302-34, EHS-002-43

ISSUE: Corporate EHS

CONTENT OF MODIFICATIONS:

Complete revision of document EHS-301-47 A

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange.

LIFE Risks are indicated at the end of the requirement with the mention **LIFE 1** or **LIFE 2**

PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2**

CONTENTS

1	AIM	4
2	SCOPE	4
3	RESPONSIBILITIES	4
3.1	EHS Department:	4
3.2	Operational Managers	5
4	OCCUPATIONAL HEALTH AND CHEMICAL SAFETY PROGRAM	5
5	IDENTIFICATION OF CHEMICALS	6
5.1	Inventory of chemical products	6
5.2	Safety Data Sheet (SDS)	6
5.3	On site SDS management	7
6	INTRODUCTION OF A NEW RAW MATERIAL	7
7	CHEMICAL RISK ANALYSES	7
6.1	Risk analysis	7
6.2	Implementation of CMR	9
6.3	Risks associated with nanoparticles	9
6.3.1	Definition:	9
6.3.2	Analysis of risks related to the use of nanoparticles	9
6.3.3	Case of nanoparticles classified as CMR	10
6.4	Case of titanium dioxide TiO ₂	10
7	GENERAL MEASURES TO CONTROL CHEMICAL RISKS	10
7.1	General principles	10
7.2	Substitution of a hazardous substance	10
7.3	Collective Protective Equipment (CPE)	11
7.3.1	General information	11
7.3.2	Air requirements specific to nanoparticles	11
7.4	Personal Protective Equipment (PPE)	12
7.4.1	General	12
7.4.2	Special case of eye protection	13
7.4.3	Wearing of contact lenses	14
7.5	Treatment of accidental exposure	14
7.6	Employee training	15
8	EXPOSURE MONITORING AND MEDICAL SURVEILLANCE	15

8.1	General information	15
8.2	Sampling and measurement strategy for employee exposure.....	16
8.3	Interpretation of employee exposure analysis results	17
8.4	9.4 Medical surveillance.....	17
9	REGULATORY AND INTERNAL LABELING.....	17
9.1	Reception	18
9.2	Unloading.....	18
9.3	Repackaging	18
10	STORAGE.....	19
10.1	General provisions	19
10.2	Specific storage provisions according to the toxicity of the materials.....	19
10.2.1	Chemical substances concerned	19
10.2.2	Storage rules for CMR, lethal, toxic by inhalation, respiratory sensitizing products	20
10.2.3	Specific rules for the storage of strong acids and strong bases	21
11	ASSOCIATED DOCUMENTS.....	21
12	ANNEXES.....	23
12.1	SDS requirements under the European chemical regulation (REACH, CLP)	23
12.2	Annex 2 - Position on the use of CMR Category 2 chemicals	28
12.2.1	Summary	28
12.2.2	Characteristics of hazardous chemical agents.....	29
12.2.3	Organizational measures to justify low risk.....	30
12.2.4	Technical measures to justify low risk for Dangerous Goods, excluding CMR 1A and 1B.....	31
12.3	Annex 3: Special provisions in Europe concerning titanium dioxide	35
12.4	Annex 4: Consideration of self-classifications by suppliers.....	35
12.4.1	Background.....	35
12.4.2	Current situation	36
12.4.3	Position of L'Oréal H&S	36
12.5	Appendix 5 - Justification for Substitution or Non-Substitution.....	37
12.6	Appendix 6: Filtered Air Recirculating Chambers (FARC)	37
12.6.1	Advantages associated with filtered air recirculating chambers.....	37
12.6.2	Constraints associated with filtered air recirculating chambers	38
12.6.3	Energy efficiency of filtered air recirculating chambers.....	39
12.7	Appendix 7: Photos of Collective Protecting Equipment	41
12.8	Appendix 8: Information on the classification of RM 54426 for the protection of workers	41

1 AIM

This document outlines the guidelines for preventing and controlling risks associated with the handling of chemical materials in their liquid, solid, and gaseous forms, from their entry onto the site until they are handed over to the service providers responsible for waste treatment. These materials include:

- raw materials (RM)
- reagents
- mixtures
- samples
- consumables (detergents, cleaning and maintenance products, etc.)
- waste

These rules do not apply to the transportation of hazardous materials or goods, and do not cover fire and explosion risks, environmental impacts, or the use of radioelements.

Local documents should specify the management of chemical risks at the site concerned, taking into account the specific nature of its activities, and outline emergency measures applicable in the event of an accident (spills, voluntary ingestion or projection of chemical materials, etc.).

2 SCOPE

The content of this document is applicable to all L'Oréal sites excluding R&I assessment centers, boutiques and academies.

In case of discrepancy between local regulations and the rules contained in this document, the higher requirements are applied.

3 RESPONSIBILITIES

3.1 EHS Department:

Staff designated by site management and included in the EHS steering committee to manage health and safety issues in the workplace are responsible for:

- knowledge of local regulatory requirements, possibly through a qualified organization
- authorization for the introduction of any new hazardous materials
- mapping chemical risks and their assessment priorities, in partnership with the departments concerned
- the implementation of actions, tools, organizational measures, procedures and indicators aimed at reducing risks to an acceptable level
- managing and providing HR and the medical department with medical surveillance field data
- preparation/update of the chemical hygiene and safety program

- management and control of collective protective equipment
- selection, validation and control of personal protective equipment
- management of hazardous consumables

3.2 Operational Managers

Operational managers are responsible for:

- the inventory of hazardous chemicals in their department
- assessing the risk associated with the handling of chemicals in their own area
- management of safety data sheets (SDS)
- maintaining collective protective equipment with the departments concerned
- defining and implementing specific risk control measures for the receipt, unloading, storage, and transfer of hazardous materials
- defining local responsibilities for the management of reagents and hazardous samples
- providing appropriate training for personnel
- ensuring compliance with basic hygiene rules (wearing PPE, hand washing, etc.)

4 OCCUPATIONAL HEALTH AND CHEMICAL SAFETY PROGRAM

The program must include the following:

- objectives and action plans to prevent exposure to chemical hazards, consistent with the site's EHS policy
- planned and periodic targeted audits and visits
- exposure risk assessment and mapping
- communication and regular training of personnel on chemical risks and precautions
- management of undesirable events, including preventive and corrective actions (see EHS-PRO-008)
- traceability of the use of chemical materials in accordance with local regulations
- use of feedback (update of all risk analyzes, emergency procedures, etc.)
- recording of accidental exposures and management of corresponding corrective actions
- review of the chemical health and safety program each year by the EHS teams
- monitoring of local regulatory changes in the area of labor law by any means, including outsourced monitoring services
- integration of chemical risks in MESUR and 5S visits

5 IDENTIFICATION OF CHEMICALS

5.1 Inventory of chemical products

In order to keep its chemical risk assessments up to date, the site maintains a qualitative inventory of all chemical materials present on-site (raw materials, consumables, maintenance products, bulk laboratory reagents, etc.).

This inventory is revised periodically, at least once a year, as well as in case of changes in activities (major works, risk mapping, request from authorities, new chemical materials or activities, etc.). The chemical inventory must be in accordance with the conclusions of the Site@Risk Assessment EHS-FORM-006.

The inventory may:

- be categorized according to the H-hazard statements or the OHB classification (see below)
- mention the storage location(s) for each material
- mention the physical quantities stored at the date of the inventory for each material

OHB	Hazard Statements H / EUH
1	No H phrase or lack of documented risk (H00)
2	H302 <i>H303 H305</i> H312 <i>H313</i> H315 <i>H316</i> H319 <i>H320</i> H332 H333 H336 <i>EUH66</i>
3	H301 H304 H311 H317 H318 H331 H335 H341 H351 H362 H371 H373 <i>EUH029 EUH031 EUH070 EUH203 EUH204 EUH205 EUH206 EUH208</i>
4	H300 H310 H314 H330 H334 H340 H350 H360 H370 H372 <i>EUH071 EUH032</i> or unknown material (H0 not tested and H000 not specified)
5	OEL < 0.001 mg/m ³ (solid) or OEL < 1 ppm (liquid)

H statements specific to GHS

H statements specific to CLP

For greater clarity in the field, certain materials may be subject to reinforced labeling, as follows:

- CMR category 1A, 1B (H340, H350, H360) and CMR category 2 (H341, H351, H361)
- Materials with a minimum ignition energy or EMI of less than 10 mJ
- Nanomaterials
- Certain toxic materials (categories 1 and 2: H300, H310, H330, category 3: H301, H311, H331)

5.2 Safety Data Sheet (SDS)

SDSs indicate the main hazards, means of protection, and emergency measures to be taken when using chemical substances.

No chemical material (substance or mixture) must be used if the SDS is not available (or the risk assessment for it).

- SDSs must be:
 - o updated
 - o in a format that complies with local regulations
 - o in the local language, and report any discrepancies regarding RMs to the relevant department via AskMe
- The introduction or purchase of any new chemical material - hazardous or not - is only authorized after prior validation by the EHS department and possibly by an occupational health department.
- The SDS of chemical materials used by external companies should be included in the risk analysis before the work is performed (see EHS-INS-002).
- R&B makes material classification changes after consulting H&S if necessary.

5.3 On site SDS management

All sites must have an SDS management system covering all chemical substances used (RM, laboratory reagents, consumables, etc.).

In order to validate the introduction on site of a new chemical substance, the EHS analyses the SDS (see Annex 1).

Each employee using a chemical for the first time must be aware of the information contained in the SDS.

If an SDS is more than 3 years old, systematically ask the supplier if it has been revised.

6 INTRODUCTION OF A NEW RAW MATERIAL

In the case of the introduction of new, unknown chemical materials, the competent R&I department takes steps to determine their hazardousness before any implementation.

In this respect, biomass extracts, whether chemically modified or not, are subject at the time of their introduction to the same rules as synthetic products regarding the determination of their hazardousness by the competent R&I structures.

New raw materials introduced into the plants are validated beforehand by the competent R&I structures.

7 CHEMICAL RISK ANALYSES

6.1 Risk analysis

Chemical risk analyses cannot be performed using SHAP, as it is not suitable for chemical risks.

Chemical risk analyses must be performed using the CHERIE tool or an equivalent approved by H&S Corporate.

These analyses apply to the raw materials used, as well as to the products of potential chemical reactions when they are identified and their properties are known.

The chemical risk assessment must be reviewed in the event of significant changes (e.g., introduction of a new RM, a new process or equipment, change of manufacturing, etc.).

The frequency of review of the chemical risk analysis varies according to the hazard of the material:

- Materials with the phrases H340, H350, H360 (CMR categories 1A and 1B):
 - o For each single or repeated use over a quarter
 - o The validity of the risk analysis can be extended beyond one quarter if the conditions of use are unchanged
- Materials with H300, H301, H304, H310, H311, H314, H317, H330, H331, H334, H335, H341, H351, H361, H362, H370, H371, H372, H373, EUH029, EUH031, EUH032, EUH070, EUH071, EUH203, EUH204, EUH205, EUH206, EUH208, EUH302:
 - o For each single or repeated use over a one-year period
 - o The validity of the risk analysis may be extended beyond one year if the conditions of use are unchanged
- All solutions with a pH < 5.5 or pH > 9.0:
 - o For each single or repeated use over a one-year period
 - o The validity of the risk analysis may be extended beyond one year if the conditions of use are unchanged

The chemical risk assessment must cover the risks of exposure through the skin and by inhalation.

It takes into account the following parameters:

- The hazards and volatility of the material handled
- The process parameters (T°, incompatibilities)
- The unit quantities used
- Frequency and duration of use
- The number of people working in and around the study areas
- The mode of application (manual, closed machine, spraying, during maintenance or cleaning operations, etc.)
- The use of collective protection
- The use of individual protection

Special case of strong bases: If strong bases (soda, potash, etc.) are to be implemented, the assessment of chemical risks must prioritize the use of liquid forms rather than solid forms, irrespective of the nature of the solvent. The use of **a strong base in solid form in water is forbidden**, unless it can be demonstrated that this is unavoidable. In this case, a specific risk assessment and corrective measures are implemented. **LIFE 2**

The risk analyses take into account all the basic tasks performed by the employees on these strong bases, and in particular:

- reception
- weighing
- handling
- quality control
- disposal as waste
- maintenance operations
- cleaning phases

6.2 Implementation of CMR

Draw up a map of employees using carcinogenic, mutagenic and reprotoxic (CMR) materials on the site, include all staff concerned, both permanent and temporary, including contractors, in accordance with local regulations. CMRs implemented by service providers are managed through prevention plans.

Make the CMR location map available to occupational health staff to prevent exposure of sensitive populations (see H mentions of CMR materials in §4.2.1)

Update the mapping for both the quantities used and for the personnel concerned at each change of activity and at least once a year.

Sites affected by specific regulatory provisions for the use of hazardous chemical agents such as CMR 2 may refer to Annex 2, which allows for a reduction in the number of risk control actions to be implemented, provided that the low risk associated with the activities is justified.

6.3 Risks associated with nanoparticles

6.3.1 Definition:

According to the European Union recommendations of June 2022, "nanomaterial" is defined as a natural, accidentally formed or manufactured material consisting of solid particles that are present either individually or as identifiable constituent particles in aggregates or agglomerates, at least 50% of which comprise one or more external dimensions between 1 nm and 100 nm in numerical size distribution.

It is important to apply the local definition of nanomaterials, or failing that, to use the definition above.

6.3.2 Analysis of risks related to the use of nanoparticles

- On the basis of the inventory of chemical materials on the site, draw up a map of the employees concerned by the use of nanoparticles, taking as a reference the local VLEP in force for respirable dust.

- The risk analyses take into account everything that may have come into contact with nanometric particles – in particular containers – including during quality control, equipment maintenance or workstation cleaning.
- The risk analyses are reviewed at least once a year, or whenever there is a change in the conditions of use of nanoscale RM.

6.3.3 Case of nanoparticles classified as CMR

- In the case of a CMR 1A or 1B containing nanoscale particles, the CMR character prevails over the size, and the minimum frequency of risk analysis is quarterly.
- In the case of a CMR 2 containing nanoparticles, the CMR character prevails over the size and the frequency of risk analysis is annual.

6.4 Case of titanium dioxide TiO₂

Titanium dioxide is subject to special provisions due to frequent regulatory changes in Europe. For more information, see Appendix 3.

7 GENERAL MEASURES TO CONTROL CHEMICAL RISKS

7.1 General principles

A watch on changes in the classification of materials used in cosmetics is in place at Group level and allows the updating of data platforms such as MP-Indus for the factories or Formulation Center for R&I.

This regulatory monitoring must be completed locally, possibly with a regulatory monitoring service provider, to monitor changes in the classification of materials used that are not covered by the Group's approach (e.g., solvents, specific reagents, maintenance and cleaning products, etc.).

The monitoring process must be supplemented by changes in classification initiated by suppliers (see Appendix 4).

The monitoring of chemical products should lead to the application of the general principles of chemical risk prevention, described in the EHS-PRO-003 – Risk Assessment Procedure.

A detailed action plan must be defined to eliminate/replace/reduce the use of hazardous materials in the workplace.

7.2 Substitution of a hazardous substance

When formulating or developing control methods, a substitution study must be initiated and documented by the relevant R&I and Corporate departments to replace hazardous materials with non- or less hazardous materials.

Substitution of CMR 1A, 1B is mandatory, unless technically impossible, and attempts made must be justified.

The substitution of other hazardous chemical agents is a priority prevention measure. It applies in particular to CMR category 2 and to RM bearing the mentions H300 (fatal by ingestion), H310 (fatal by skin contact), H330 (fatal by inhalation), H331 (toxic by inhalation) and H334 (respiratory sensitizer). Substitution must also be applied, unless technically impossible, when using highly corrosive materials in solid form (e.g., soda, potash) which should preferably be used in solution.

In all cases:

- It is essential to carry out a risk analysis as described in this document.
- Be vigilant in the implementation of the resulting action plan through any means of information/dissemination deemed relevant.

It is necessary to justify at least annually the non-substitution of these materials by means of a form based on the content of Annex 5, which should be attached to the site's general risk assessment document (Document Unique in France).

7.3 Collective Protective Equipment (CPE)

7.3.1 General information

Collective protective equipment (CPE) is the first protective barrier between an operator and the material he is working with. It is essential that this barrier be effective.

The effectiveness of the collective protective equipment (ventilation, source capture, confined space work, etc.) must therefore be checked at least once a year by an authorized body.

The use of filtered air recirculating chambers (FARCs) should ensure that operators are not exposed to the materials used at any time and is subject to the application of all applicable regulations (see Appendix 6).

7.3.2 Air requirements specific to nanoparticles

Regardless of the nature of the tasks performed at the workstation, the capture of nanometric-sized particles should be carried out at the source, as for gases and vapors, in addition to the general ventilation of the premises.

Depending on the sectors in which nanometric materials may be used, implement the following measures:

Weighing rooms (factories, pilots, Demi-Grands):

- In the weighing rooms (factories, pilots, Demi-Grands), local extraction using articulated arms adapted to the capture of nanoparticles is used (see Annex 7). It must be associated with strict and traceable compliance with all current good practices, and with the conclusion of a risk analysis. This collective protection must be combined with suitable individual respiratory protection.

- The use of laminar flow booths meeting the requirements of the internal standard EOS-002-PESEE-001 offers an effective level of protection, provided that the good practices in force are scrupulously respected and documented. In these facilities, respirators are not required when handling powdered materials.

Manufacturing skids (factories, pilots, Demi-Grands) and small R&I facilities:

- Bottom feed is the rule.

A half extraction ring or a "Pouyès" extraction ring (EOS-002-Guidelines-005-Pouyes Ring-EN, see Appendix 7) is recommended for manhole introduction of small quantities.

For large quantities, the introduction from big-bags by means of a tight big-bag-tank connection is recommended.

In all cases, the wearing of suitable personal respiratory protection and a fit test are mandatory.

Laboratories:

- Nanoparticles must be handled under a fume hood. Laminar flow and filtered air recirculating chambers can also be used if they are maintained and checked every two years or according to local regulations.

Cleaning:

- The cleaning of work areas after the use of nanoscale powders is done using vacuum cleaners equipped with HEPA filters and/or by wet cleaning. All operators in this situation must wear appropriate personal respiratory protection.

7.4 Personal Protective Equipment (PPE)

7.4.1 General

Effective PPE that meets a chemical resistance standard (at a minimum, safety glasses, vests, waterproof and closed shoes, and gloves) is required when handling or being exposed to hazardous chemicals and consistent with the result of the risk assessment performed preliminarily. **LIFE 2**

Work clothes (See AQR-001-35G on clothing) can only be considered PPE if they meet a chemical resistance standard. Ordinary non-PEI work clothes provide no protection other than against soiling, and offer no resistance to chemicals.

Personal protective equipment (PPE) must be consistent with the results of the hazard analysis and exposure measurements.

Chemical protective clothing should meet at least the requirements of EN 13034 type 6 or equivalent (e.g. OSHA 1910.132 in the USA, to be completed with the suppliers' recommendations).

Only garments meeting EN13034 type 6 or equivalent are compatible with industrial laundering.

Select safety shoes that comply with NF EN ISO 20344 and NF EN ISO 20345 (or local equivalent).

In addition to the basic PPE listed above, implement the following practices:

- Be aware of the pictograms and H and P statements on RM package labels; consult the SDS for any PPE recommendations.
- Use disposable gloves that are resistant to chemical agents (EN ISO 374-1: 2016 + 16523 international standard), taking into account the sensitivity of some operators to the material they are made of. Limit the use of disposable gloves to 20 minutes per pair and change them as soon as a stain is detected.
- During the risk analysis, select the appropriate respiratory protection (organic vapor mask, FFP3 or P100 (or equivalent) particle mask, or multi-purpose mask), with or without forced ventilation (or positive pressure); check the validity date of the mask and perform a respiratory protection leak test before use.
- Wear long-sleeved, chemical resistant work clothes at all times when handling chemical agents.
- Supplement regular long-sleeved work clothes with appropriate PPE (sleeves and/or apron) according to the results of the risk analysis.
- Wear closed work clothes up to the torso, with the collar closed to cover the neck (AQR-001-35).
- Prohibit the wearing of work clothes in the cafeteria, break rooms, meeting rooms, or training rooms. In case of deviation from this rule, establish a risk analysis and implement appropriate preventive measures in accordance with the quality rules (AQR-001-04).
- Prohibit eating or drinking in manufacturing (weighing and processing), packaging, receiving, storage, and laboratory areas, in accordance with AQR-001-04.
- All persons must wash their hands thoroughly after handling any chemical.
- Apart from the laminar flow weighing cabinets that meet the requirements of the internal standard EOS-002-PESEE-001, powdered materials must be handled with an FFP3 or P100 mask or positive pressure PPE (equipped with an FFP3 or P100 filter).
- The use of liquid or solid materials must be subject to a risk analysis to determine what the operators are likely to be exposed to (organic vapors, mineral vapors, aerosols, etc.) and to choose the most appropriate mask for health protection.
- It is strictly forbidden to pipette or siphon a chemical product by mouth. **LIFE 1**

7.4.2 Special case of eye protection

Each site (factory, distribution center, or R&I center) conducts its own risk analysis and identifies situations in all areas that present risks to the eyes (e.g., liquid or solid eye splashes, lasers, etc.) in order to eliminate them or to define the type of safety glasses required.

Areas where eye protection is mandatory are clearly identified.

Safety glasses must be worn in all of the following areas:

- Areas where open sampling or filling of RM is being conducted
- Weighing areas
- Manufacturing and packaging areas
- Storage areas
- Maintenance shops

- Laboratories

Safety glasses suitable for employees who wear eyeglasses must be provided to avoid wearing safety glasses over regular glasses.

Personal protective equipment must be selected to be fully effective in all circumstances, including preventing liquid runoff from entering the eye. **LIFE 2**

In all cases, ensure that EN 166 is used as a minimum requirement with a class "F" for frames and a minimum class of 1F for lenses. For operations outside Europe, these classifications or their local equivalents are used as a minimum.

7.4.3 Wearing of contact lenses

Where permitted by local regulatory requirements and subject to favorable risk analysis findings, contact lenses may be worn at the workstation, both on the shop floor and in the laboratory, under the joint responsibility of the site and the employees, provided that precautions are taken to control the chemical risk prior to their use:

- Contact lens wearers must identify themselves to their manager and the medical department.
- Train lens wearers on the eye hazards associated with wearing contact lenses, and how to use the eye wash stations.
- Train all shop and laboratory personnel in contact lens emergency management.
- Include contact lens wear in the workplace exposure risk analysis.
- Resulting actions, including workstation adaptations, are carried out by the laboratory or shop team under the direction of the site manager.
- Empowerment and self-discipline of contact lens wearers in laboratories and workshops are essential to the implementation of the actions decided upon in the risk analysis.

If the risk analysis at the workstation concludes that contact lenses cannot be worn for reasons of operator safety, the employee concerned must wear glasses (safety glasses adapted to the eyesight, otherwise safety glasses and over glasses).

7.5 Treatment of accidental exposure

A procedure is put in place locally in case of accidental exposure to toxic raw materials. It includes a table recording the facts (date, person(s) affected, circumstances, duration of exposure, estimated severity, etc.). **LIFE 2**

In case of splashes on the body or in the eyes, the use of skin and eye rinsing kits must be preferred over rinsing with a safety shower supplied with water. For example, Diphoterine® or any other equivalent solution may be used. In situations where Diphoterine® is not available, safety showers and eyewash stations that are sanitary and in good working order are always available in areas where there is a risk of chemical exposure. **LIFE 2**

Employees are trained to use the equipment (kits, showers, etc.) **LIFE 2**

It is important to remember that in the event of a spill, it is necessary to intervene quickly (in less than one minute), whether on oneself or on other employees.

A telephone or alarm system is always available in areas where there is a risk of exposure to chemicals.

LIFE 2

Similarly, it should be verified during the risk analysis that firefighting, spill control, and personal protection equipment that can be used in the event of an incident (e.g., toxic leaks) is always available in the vicinity of areas where there is a risk of exposure to highly hazardous chemicals. **LIFE 2**

7.6 Employee training

All employees and service providers must be made aware of the chemical risks present on the site (e.g., recognition of hazard pictograms), of preventive measures (e.g., access control, use of CPEs, wearing of PPEs), and of the measures to be taken in the event of accidental events.

Specific instructions are provided to operators describing the safe handling of CMRs, and any containers that come into contact with such materials, from receipt to disposal as waste.

Hygiene procedures for the use of CMRs are provided to operators. In particular, anyone who has just handled a CMR must wash their hands thoroughly.

According to local regulatory requirements, employees and temporary workers who may be exposed to CMRs (H340, H350, H360, H341, H351, H361), lethal, inhalation toxic, and respiratory sensitizing chemical agents (H300, H310, H330, H331, H334) are trained in the required hygiene practices, taking into account the risks involved.

Each site includes in its training plan the mandatory regulatory training and the training required at the workstation to control chemical risks, with an update of knowledge at least every 2 years, with particular emphasis on:

- the use of all chemical materials, including CMRs
- the use of collective protective equipment (CPE) and PPE
- risk analysis at the workstation
- emergency measures for self, co-workers, contractors, premises, tools, and materials

8 EXPOSURE MONITORING AND MEDICAL SURVEILLANCE

8.1 General information

Atmospheric monitoring of workplaces is an annual requirement within the Group.

The exposure monitoring analyses are entrusted to a qualified and recognized service provider who defines and implements the sampling and measurement strategy together with the local EHS manager and/or a member of the site management committee.

The expertise of the selected service provider should be recognized by both the local authorities and by L'Oréal's local management, which in all cases remains the owner of and accountable to the authorities for the results of the analyses and the resulting actions.

In addition to the requirement to measure exposure to certain substances in accordance with local regulations, inhalation exposure to hazardous chemicals should be measured whenever a significant risk has been identified by the risk assessment.

Apart from regulatory exposure monitoring, it is advised that the sites conduct some diagnosis of their work situations to determine the necessary actions (external specific analyses, preventive and/or corrective actions). It is therefore recommended to have suitable equipment for assessing the presence of particles and/or molecules in the work atmosphere for an initial estimation before making any decisions.

In this respect, two references of particle counters are available:

- P-Trak Ultrafine Particle Counter 8525 from TSI
<https://tsi.com/products/indoor-air-quality-meters-instruments/indoor-air-quality-meters/p-trak-ultrafine-particle-counter-8525/>
- and Partector from Naneos
<http://www.naneos.ch/partector.html>

Also a reference of PID for molecular analysis:

- MiniRAE 3000 from RAE
<http://www.raefrance.fr/produit/mesure-cov-technologie-pid-minirae-3000/>

8.2 Sampling and measurement strategy for employee exposure

In the case of regulatory exposure monitoring with an external partner, the measurement methodology to be agreed upon with the provider can be summarized as follows, though not exhaustively:

- Identify the products to be monitored
- Provide the safety data
- Determine the quantities handled per operation and the frequency of operations
- Analyze the targeted workstations
- Choose the type of measurement to be carried out by matching them to the type of work performed
- Define the "target" individuals (people who are a priori exposed) by favoring the individual sampling technique
- Specify the sampling and measurement points, individual or collective

- Determine the time and number of samples to be taken according to the operations

In the absence of local standard values, the service provider proposes values from the literature for the planned measurements at the site.

8.3 Interpretation of employee exposure analysis results

Report any exceedance of the limits in the GHAP assessment and inform the site management committee.

Three possible atmospheric measurement situations:

1. Measurement below 10% of the reference value
2. Measurement between 10% and 100% of the reference value
3. Exceeding the reference value

Stop the activities if the measured value is higher than the reference value and allow them to resume only after all exposure prevention measures, including CPE and PPE, have been applied.

In situations 2 and 3, carry out corrective actions concerning the CPE before carrying out a new risk analysis and environmental monitoring.

The results of the measurements are documented and kept by the site.

8.4 9.4 Medical surveillance

The site/entity maintains a census of employees who use category 1 CMR materials and those who perform scent tests for any reason.

The site/entity establishes a system allowing it to trace the use of hazardous substances in accordance with local regulations, particularly for CMR 1A and 1B.

Depending on local regulatory requirements, the site management must determine the specific medical surveillance to be implemented according to employee exposure.

Each site verifies any prohibitions on the use of hazardous materials by the various categories of personnel.

All medical surveillance measures are coordinated by HR with the assistance of a medical service.

Pregnant women or women wishing to become pregnant are strongly encouraged to inform the site's medical department so that all measures can be taken to avoid exposure to materials that are incompatible with their condition.

9 REGULATORY AND INTERNAL LABELING

Any container containing a hazardous consumable, reagent or sample must be labeled according to local regulations. At a minimum, the label must include the name of the product and the associated hazards.

Sites located in countries with GHS - or CLP in Europe - implement the corresponding labeling and signage.

9.1 Reception

The department in charge of receiving hazardous materials ensures that safety rules are respected before any unloading, including:

- conformity of the transport documents and the transport labeling
- conformity of the labeling, the nature and the state of the packaging
- condition of the transport vehicle (e.g.: condition of the vent for volatile products)
- mandatory grounding for flammable products in bulk (refer to EHS-INS-033 for more detail)
- behavior and skills of the delivery person to ensure the safe unloading of the delivered products
- driver's possession of appropriate personal protective equipment in good condition, when required (e.g., for unloading bulk products)
- compatibility of the truck-tank connection with the unloading hose
- condition of pallets and drum supply tray
- in case of detected anomalies, the department in charge of supply and the EHS department are notified and appropriate measures are applied, including a possible refusal of unloading in case of serious breach of basic safety rules

Laboratory reagents are received in leak-proof packaging to prevent accidental spillage and their delivery is subject to the above rules in case of anomaly.

9.2 Unloading

Each site concerned drafts its own delivery/unloading management documents, in accordance with local regulations and the Group's safety rules, and trains its employees in their implementation.

Near the delivery/unloading areas, provide at least:

- an emergency telephone
- fire and spill fighting equipment
- personal protective equipment
- emergency treatment equipment for use in the event of an incident involving exposure to toxic materials (showers, Diphoterine® or equivalent, etc.)

9.3 Repackaging

Any chemical material (product, RM, consumable, reagent or sample) that is repackaged must be relabeled with the identifiers and safety information on the original label.

10 STORAGE

10.1 General provisions

The site has a mapping showing the location of all storage of hazardous products, in accordance with the site's emergency procedure.

It should be noted that the contents of this document do not apply to the management of accidental situations, including spills (see EHS-PRO-008).

The storage conditions for hazardous chemicals comply with the following rules:

- Storage of hazardous liquid products with retention according to local regulations. In the absence of local provisions, a specific risk analysis must be carried out taking into account the largest volumes.
- Chemically incompatible products are stored in separate areas, or even in different retention areas (see figure below).
- Flammable liquids are stored in dedicated areas equipped accordingly (see EHS-INS-027).
- In laboratories, a stainless-steel enclosure without a contactor may be sufficient for storage at room temperature. Refrigerated storage can be carried out in a stainless steel or conventional refrigerator containing a retention tank and without a contactor.

 Not compatible
 Compatible with caution
 Compatible

In case of multiple labeling,
consider the pictograms in the
order given by the table

10.2 Specific storage provisions according to the toxicity of the materials

10.2.1 Chemical substances concerned

The substances concerned bear the following hazard statements and pictograms (see section 2 of the SDS):



GHS08 and/or GHS06



CMR 1A, 1B bear the following phrases:

- May induce genetic defects. (H340; categories 1A&1B)
- May cause cancer. (H350; categories 1A&1B)
- May impair fertility or the unborn child (H360; Categories 1A&1B) + May impair fertility. (H360F) + May cause harm to the fetus. (H360D) + May cause harm to fertility. May cause harm to the fetus. (H360 FD) + May cause harm to fertility. May cause harm to the fetus. (H360Fd) + May cause harm to the fetus. Suspected of damaging fertility. (H360Df)

The most dangerous Fatal, Inhalation Toxicants carry the following phrases:

- Fatal if swallowed. (H300; categories 1&2)
- Fatal in contact with skin. (H310; categories 1&2)
- Fatal by inhalation. (H330 categories 1&2)
- Toxic by inhalation. (H331; category 3)

Respiratory Sensitizers carry the following phrase:

- May cause allergic or asthmatic symptoms or breathing difficulties by inhalation. (H334; category 1, subcategories 1A and 1B)

10.2.2 Storage rules for CMR, lethal, toxic by inhalation, respiratory sensitizing products

Access to storage areas for lethal, toxic by inhalation or respiratory sensitizing materials (H300, H310, H330, H331, H334) in small quantities is only allowed to trained and authorized persons and must be secured by various safe means such as badges, keys, locks, or code locks, etc.

Access to storage areas for CMR 1A, 1B (H340, H350, H360) materials in small quantities is authorized only for trained and authorized persons and must be secured by various safe means such as badges, keys, locks, or code padlocks, etc.

In the case of storage on pallets, the packaging of lethal, toxic by inhalation or respiratory sensitizing materials (H300, H310, H330, H331, H334) and CMR 1A, 1B materials (H340, H350, H360) must be closed at all times. The area must be a restricted area, and handling must only be performed by trained and authorized personnel.

The following rules apply for the storage of these chemicals:

- Specific retention area or pallets on individual retention
- Storage on the 2 lower levels from the ground
- Isolation volumes with no hazardous storage in the locations above or adjacent to them

A specific storage area is dedicated to CMR, lethal, toxic by inhalation, or respiratory sensitizing products that can be kept at room temperature, and another for those that must be kept cold, at the standard temperature of 6°C of a standard refrigerator.

The temperature or temperature range requirements and optimal conditions of use communicated by the equipment supplier (refrigerator or equivalent) for cold storage ($T^{\circ} \leq 6^{\circ}\text{C}$) of chemicals must be applied.

CMR, lethal, toxic by inhalation or flammable respiratory sensitizing products are stored under restricted access with flammables (see § 11.1).

All these products are stored on spill containment or in a spill containment bin for packages $\leq 1\text{kg}$.

The same dedicated storage areas are used to store expired CMR, lethal, toxic by inhalation, and flammable respiratory sensitizers, which have waste status, pending their dispatch for destruction in an appropriate channel.

10.2.3 Specific rules for the storage of strong acids and strong bases

The rules for the storage of strong acids and strong bases are as follows:

- separation of strong acids and strong bases in different non-contiguous reserved areas
- specific retention area or pallets on individual retention
- storage on the 2 lower levels from the ground
- isolation volumes without storage at risk in the areas above or adjacent to each other
- ventilation if storage indoors, with corrosion-resistant walls and floors

11 ASSOCIATED DOCUMENTS

This instruction refers to the following documents:

- AQR-001-35: Clothing
- EHS-FORM-05: SHAP Risk Assessment Method

EHS-INS-036 A / Control of Chemical Risks to Health

- EHS-PRO-003: Risk Analysis and Controls
- EHS-INS-028: Storage and Use of Ammonia Solutions
- EHS-INS-043: CHERIE Method for Assessing Chemical Risk to Health by Inhalation
- EHS-INS-27: Fire Prevention and Protection

Environmental procedures:

- Waste Management: EHS-PRO-013
- Retention and Soil and Water Pollution Prevention: EHS-INS-058

This list is not exhaustive: The applicable documents are available on the [Alexandria EHS Management System](#) website

12 ANNEXES

12.1 SDS requirements under the European chemical regulation (REACH, CLP)

Warning: The content of this annex is applicable to sites concerned by the application of the REACH Regulation, but all other sites may find it useful to read the SDSs applicable to them.

The requirements for SDSs are set out in Article 31 of the REACH Regulation for the sites concerned. A material is hazardous if it meets the hazard criteria of the CLP Regulation or criteria of equivalent concern (e.g., endocrine disruptor) or if it is assessed as PBT (persistent, bioaccumulative and toxic) or vPvB (very persistent, very bioaccumulative).

Case of substances:

An SDS is mandatory for:

- a substance that meets the criteria for classification as hazardous according to the CLP Regulation
- a substance assessed as PBT or vPvB
- a substance on the list of substances of concern

In case the substance is registered for a quantity above 10 tons/year, a chemical safety assessment should be performed by the registrant and a chemical safety report established. The objective is to assess the risks inherent in the manufacture and use of a substance and to ensure its safe use. Exposure scenarios should be annexed (extended SDS).

Case of mixtures:

An SDS is mandatory for a mixture that meets the criteria for classification as a hazardous product according to CLP for the sites concerned.

An SDS should be provided upon request for a mixture not classified as hazardous according to CLP, when it contains in individual concentration at least one substance:

- presenting a health or environmental hazard (non-gaseous mixture 1% by weight; gaseous mixture 0.2% by volume)
- carcinogenic category 2 or toxic for reproduction category 1A, 1B or 2, skin sensitizer category 1, respiratory sensitizer category 1, or having effects on reproduction, or via lactation, or PBT or vPvB or in the candidate list (non-gaseous mixture 0.1% by weight)
- for which there are workplace exposure limits according to Community provisions.

The 16 headings or chapters of the SDS are described as follows:

1 - Identification of a substance or mixture and supplier

1.1. Identification of a substance or mixture

Content of this section	What needs to be done
Case of a substance: Chemical name in local language Identification number (EC number or CAS number or Index number...) REACh registration number if applicable	For registered substances, if the registration number is incomplete and/or in case of inspection, the supplier may be asked to communicate the complete number to the control bodies Check if there is any exposure scenario in the appendix In addition, check that the information is consistent with the label upon receipt of the product

1.2 Relevant identified uses of the substance or mixture and uses advised against

Content of this section	What needs to be done
Identified uses (intended) Uses not recommended if applicable	Check that the intended use is listed in the area of use If there is no match, contact the supplier If an exposure scenario is included, check for consistency with the intended uses

1.3 SDS Supplier Information

Content of this section	What needs to be done
Identity or name of the manufacturer, importer, exclusive representative or distributor Full address and telephone number E-mail address of a competent person responsible for the SDS (a generic address is preferred)	Check that all relevant information is there Check that the name and address of the company are those mentioned on the label

1.4 Emergency phone numbers

Content of this section	What needs to be done
Phone number for emergency calls Information on availability, hours, days Supplier's own emergency information or that of a third party service provider	In addition, check that the emergency phone number is available for industrial health and safety and first aid

2 - Identification of dangers

2.1 Classification of a substance or mixture

Content of this section	What needs to be done
Physical hazards, adverse health and environmental effects according to CLP	Use information to Assess risks Draw up internal documentation to be made available to workers

2.2 Labeling elements

Content of this section	What needs to be done
In case of a hazardous substance or mixture classified by CLP Regulation Pictograms of the CLP system Signal words (hazard, caution) Hazard statements (H-phrase) Precautionary statements (P-phrase)	Ensure that this information is consistent with the information on the label. Use this information in the internal documentation made available to workers, in particular the workstation sheets and in the general chemical risk assessment

2.3 Other hazards

Content of this section	What needs to be done
Substance or mixture meets PBT or vPvB criteria, if applicable Possible hazards (e.g. formation of air contaminants, dust formation, explosion hazards, presence of sensitizers, hazards to soil organisms, photochemical ozone formation potential, ...) that do not lead to classification but may contribute to the overall hazards of the substance or mixture	Make sure to inform the relevant departments and carefully follow the regulatory process

3 - Composition and information on substances in the mixture

3.1 Substances

Content of this section	What needs to be done
- Chemical name of the main component of the substance and other components (impurities, stabilizing additives, individual components) contributing to the classification of the substance. - Identification information (EC number, CAS number...)	If a substance is on the candidate list of substances of Very High Concern (SVHC) for authorization, make sure the services concerned are informed and carefully follow the process (consultation, inclusion in Annex XIV, expiry date) http://echa.europa.eu/fr/candidate-list-table

3.2 Mixtures

Content of this section	What needs to be done
Information on hazardous components of the mixture: - Identification number (EC number, CAS number) - REACH registration number, if any, and REACH status of each component - Concentration or concentration range in the mixture - Classification according to CLP Regulation	This information is included for reporting to poison control centers

4 - First aid measures

Content of this section	What needs to be done
First aid to be given to the victim according to the route of exposure in case of: - inhalation, - skin contact, - splashing in the eyes, - ingestion. Symptoms, acute and delayed effects Any immediate medical attention and treatment required	Make sure SDSs are available to internal and external first aiders.

5 - Firefighting measures

Content of this section	What needs to be done
Information on actions to be taken in accordance with the substance or mixture on fire Information on special hazards	Verify that the extinguishing means in place are appropriate for the nature of the fires to be fought Inform the emergency services of the specific risks in order to take appropriate control or protection measures

6 - Actions to be taken in the event of a spill

Content of this section	What needs to be done
Measures to be taken to protect people, the environment and property to adapt them to the extent of the risk incurred and the industrial site concerned	Identify appropriate environmental and protective precautions and materials (containment, clean-up equipment, PPE) for first responders and other personnel present In addition: - Identify actions that could make the situation worse - Remind if necessary some of the previous sections (first aid) and the rules of hygiene

7 - Handling and storage

Content of this section	What needs to be done
Technical preventive measures (health protection, safety management, environmental protection) based on the product, product properties and exposures	Ensure that exposure scenarios, if available, do not provide conflicting handling and storage instructions In case of inconsistency, contact the supplier In addition: - Ensure that appropriate organizational and technical preventive measures are in place, depending on the hazards of the product and possible exposures - Ensure that the work and organizational procedures on the site are compatible with these measures

8 - Exposure controls and personal protection

8.1 Control parameters

Content of this section	What needs to be done
Occupational Exposure Limit Values (OELs) (regulatory or non regulatory) when they exist, as well as: Derived No Effect Levels (DNEL), Derived minimum effect levels (DMEL) Predicted No Effect Concentrations (PNEC)	Check if there is a locally recommended reference OEL In addition, ensure that : - the use of the substance or mixture does not entail any risk to the worker - the concentrations in the workplace are lower than the OEL indicated This can be done by measurements or by expert estimates, which must be documented in both cases

8.2 Exposure control

Content of this section	What needs to be done
Technical measures to prevent exposure to humans and the environment Measures for collective and individual protection Environmental protection measures	For the sites under REACH regulations: If exposure prevention measures are not listed in this section 8.2 or in the exposure scenario (ES), contact the supplier Ensure that the information in the ES, if available, is consistent with the information given in this section If inconsistent, contact the supplier If there is no ES, check this section for prevention and protection measures. In addition: - Make sure that the prevention measures and, if applicable, the collective protection means and personal protection equipment are in accordance with those indicated on the SDS - In case prevention measures, other than those indicated by the supplier are in place, verify that the results are equivalent or better than those of the supplier (specific expertise required)

9 - Physical and chemical properties

Data used by HSE, logistics and regulatory departments for ATEX analysis (creation of explosive atmosphere) and for storage and transport conditions (selection of containers).

10 - Stability and reactivity

Content of this section	What needs to be done
Information for the user on : - stability of the substance or mixture - dangerous reactions - conditions to avoid - possible hazardous decomposition products	Communicate information on hazardous reactions, incompatibilities and conditions to be avoided to users and in particular to physical logistics Pass on information on decomposition, hazardous reactions and conditions to avoid, to the fire/rescue department.☒ Additional: Some additional information is provided under other headings such as 7) Incompatibilities and storage conditions 9) Chemical/physical properties All information should be cross-referenced to check the consistency of all data

11 - Toxicological information

Content of this section	What needs to be done
Information on the toxicological effects from studies carried out and their results, leading to studies for the classification of the substance or mixture covered by the SDS according to 10 criteria : (a) acute toxicity (b) skin corrosion/skin irritation (c) serious eye damage/eye irritation (d) respiratory or skin sensitization (e) germ cell mutagenicity (f) carcinogenicity (g) reproductive toxicity (h) specific target organ toxicity - single exposure (i) specific target organ toxicity - repeated exposure (j) aspiration hazard	Carry out risk analyses at the workstation before using the substances or mixtures and check that the measures taken to avoid worker exposure to the hazards mentioned are consistent with the information contained in the SDS sections: 2) Hazard identification 4) First aid measures 6) Accidental release measures 7) Handling and storage 8) Exposure controls/personal protection 9) Physical and chemical properties 13) Disposal considerations 14) Transport information 15) Regulatory information In addition, check that the route(s) of exposure (oral, inhalation, skin contact) associated with the H phrases H370, H371, H372 and H373, is/are mentioned on the SDS . If this is not the case, ask the supplier

12 - Environmental information

Content of this section	What needs to be done
The effects of the chemical on the environment when released, what happens to it, how the chemical has been tested for toxicity, persistence and degradability, bioaccumulation potential and mobility in soil, as well as the results of the tests, the results of the PBT and vPvB assessment, if it was the results of the PBT and vPvB assessment, if this has been carried out as part of the chemical safety assessment.	The information in sections 2, 3, 4, 6, 7, 8, 9, 13, 14 and 15 should be consistent with the information provided in this section This information may be useful when dealing with spills and assessing waste handling practices, control and treatment provisions for releases (to air, land and the aquatic environment), accidental release measures, and transportation As part of the risk analysis, the impact on the proper functioning of existing risk management measures (e.g. biological effluent treatment plant) must be evaluated Caution. In case the agricultural application of sludge from effluent treatment is prohibited, the sludge disposal process along the treatment chain is to be evaluated (industrial and municipal WWTP)

13 - Disposal information

Content of this section	What needs to be done
Information on: - appropriate waste management of the substance or mixture - appropriate methods for handling waste of the substance, mixture or contaminated packaging.	Check for consistency with the classification in section 2 and with the exposure controls in section 8 In addition, waste disposal should be in accordance with local, national and European regulations

14 - Transport information

Content of this section	What needs to be done
Information on classification for transport / shipment by road (ADR), by inland waterways (ADN), by sea (IMDG) or by air (ICAO/IATA)	Transmit this information to the logistics and transport departments and to the safety advisors Verify the consistency of the information according to the mode of transport

15 - Legal information**15.1 - Specific regulations and legislation**

Content of this section	What needs to be done
Possible EU and national regulations, e.g.: - REACH (authorization/restriction) - Seveso - Persistent organic pollutants (POPs) - Explosive precursors For products placed on the market in Europe: - Table of occupational diseases - Reinforced medical surveillance - Work prohibited for certain categories of people	Check if the substance or mixture is subject to specific provisions (including authorization or restriction under REACH) and comply with these regulatory provisions. For example: if the directive 2012/18/EU, known as Seveso 3, is listed as the applicable regulation, it is necessary to check that the substance or mixture is taken into account in the accumulation of hazardous materials defining the site classification

15.2 - Chemical Safety Assessment

Content of this section	What needs to be done
If a chemical safety assessment has been performed, this should be indicated in this section	If the chemical safety assessment is not mentioned, an exposure scenario need not be sought

16 - Other information

Content of this section	What needs to be done
Information on changes from the previous version - If not mentioned in the previous sections, explanations of abbreviations and acronyms used, including full wording of hazard classes and categories (hazard statements, precautionary statements, H and P phrases) - Advice on appropriate worker training to ensure protection of human health and the environment - Where applicable, this section should include a list of annexed exposure scenarios	Check for significant changes from the previous version of the SDS

12.2 Annex 2 - Position on the use of CMR Category 2 chemicals**Warning**

The provisions contained in this appendix are mainly intended for French sites concerned by specific regulatory provisions for the use of hazardous chemical agents such as CMR 2.

The following measures are intended to reduce the number of risk control actions to be implemented, provided that the low risk associated with the activities is justified.

12.2.1 Summary

- CMR 2 are hazardous chemical agents to which the concept of low risk can be applied, unlike CMR 1A, 1B.
- The measurement of exposure at the workstation is part of the elements allowing the objectification of low risk and can in the first instance be the subject of internal provisions.
- The application of the above should support the risk analysis at the workstation and allows a pragmatic approach.

- This approach may subsequently give rise to an external service to support the conclusions of the risk analyses and the resulting actions.

12.2.2 Characteristics of hazardous chemical agents

All chemical materials, including those developed by R&I which are not classified because they do not carry a hazard phrase H, are at least subject to the application of French Decree 2001-1016, which requires the establishment of a "single document", to be reviewed annually.

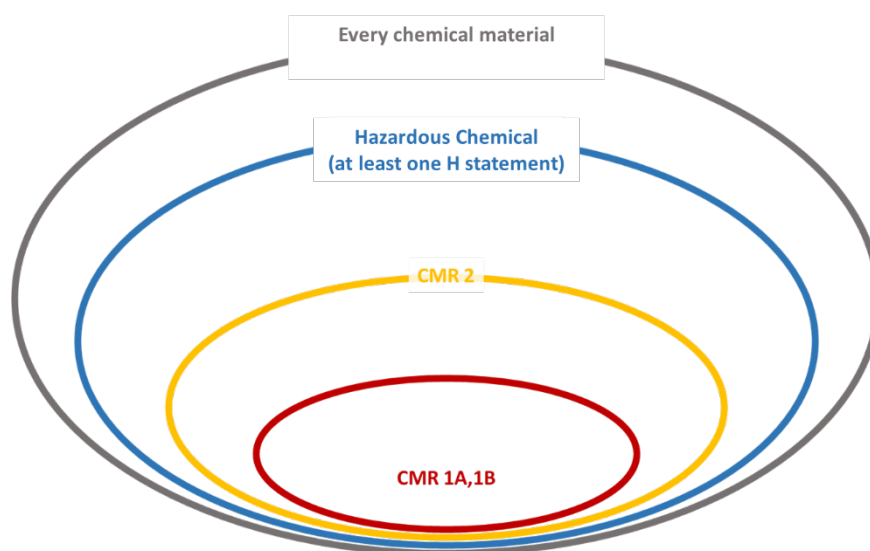
In this set of chemical materials, the hazardous chemical agents include all materials bearing at least one H-phrase.

CMR 2 are a sub-category of hazardous chemicals with suspected carcinogenicity, mutagenicity, or reproductive toxicity in humans and animals.

Unlike CMR 2, CMR 1A and 1B are also hazardous chemicals, but their carcinogenicity, mutagenicity, or reproductive toxicity characteristics are proven or, failing that, suspected in humans and animals.

In view of the above, it is useful to keep in mind that the CMR classification is nothing more than a scale of certainty of the effects induced by certain hazardous chemicals.

The classification of chemicals can be summarized graphically as follows:



Hazardous chemicals are subject to the requirements set out in Decree 2003-1254 and transcribed in Articles R. 4412-1 to R. 4412-93 of the French Labor Code.

Among the hazardous chemicals, the CMR 1A, 1B ("May cause cancer", "May cause genetic defects", "May damage fertility or the unborn child") are subject to the requirements mentioned in Decree 2001-1997; they are covered by all the above articles and very specifically by Articles R. 4412-58 to R.

4412-93 of the French Labor Code. Risk assessments concerning them should be carried out for each new use or at quarterly intervals for CMR 1A, 1B used on a regular basis.

A careful examination of the provisions of the Labor Code shows that among hazardous chemicals, CMR 2s may be subject to the same requirements as CMR 1A, 1Bs, particularly in terms of risk assessment at the workstation and traceability of implementation by operators.

However, it is accepted that the requirements associated with hazardous chemicals (including CMR 2) may be reduced compared to those applicable to CMR 1A, 1B if the results of risk assessments show that the quantities and conditions under which a hazardous chemical agent is used in the workplace present only a low risk to the health and safety of workers, and that the preventive measures in place are sufficient to reduce this risk.

It is important to remember that the low-risk justification provisions described below are only applicable to hazardous chemicals that are neither CMR 1A nor CMR 1B. CMR 1A and 1B are excluded from the concept of low risk and should be subject to all the provisions mentioned in Articles R. 4412-1 to R. 4412-93 of the Labor Code for the exposure routes that correspond to them, and in conclusion of the risk analyses of which they are the subject.

12.2.3 Organizational measures to justify low risk

The following elements should be put in place:

- A named organization, with described individual responsibilities and possible delegations
- Access to areas assessed as hazardous should be limited to the persons concerned, and a prevention plan should be drawn up for outside companies that are called upon to intervene
- Individual safety, health, and hygiene training is in place and updated, particularly with regard to the responsibilities of the entire hierarchy

The following additional elements contribute to the manifestation of low risk. However, their absence is not an obstacle to justifying the low risk:

- A medical service associated as a partner of the Management at all stages of the process
- A Social and Economic Committee at work permanently involved in all aspects of the demonstration of low risk
- A search for root or fundamental causes when analyzing accidental events
- A reference document system (technical monitoring in addition to regulatory monitoring, guides, etc.)

- An annual Occupational Health and Safety plan, supported by management and involving all parties

12.2.4 Technical measures to justify low risk for Dangerous Goods, excluding CMR 1A and 1B

12.2.4.1 General technical measures

With regard to technical measures, the following should be put in place:

- A map of the use of the RMs and reagents, including a minimum annual inventory of the RMs and reagents present on the site, with their updated SDSs in the local language
- A census of employees using the RMs and reagents, including temporary employees
- A traceability of the inputs and uses of RMs and reagents and their output, notably in the form of waste, using the documentation already available on site
- An annual risk assessment based on work situations
 - a) a priori
 - b) a posteriori by using previous analyses and exposure measurements

It is reminded that risk analyses should take into account all basic tasks carried out, and in particular, the reception, weighing, handling, quality controls, waste disposal, maintenance, and cleaning of equipment, as well as the cleaning of the work station.

- A policy of measuring exposure at the workplace

12.2.4.2 Measuring exposure at the workstation

Before considering workplace exposure measurements, it is important to establish the nature of the exposure risks through an analysis of the risks specific to the materials studied in their normal mode of use (accidental exposure mode excluded).

The oral route of exposure should be ruled out because it can only occur by accident, particularly in the case of spraying into the mouth.

In almost all cases, the cutaneous risk is present during the application of the materials because of the need for the operator in most cases to use their hands to apply the RM.

On the other hand, the risk by inhalation is only present when the material is in the state of particles or molecules that can be released into the breathable atmosphere.

If a material is in a physical state that prevents the release of particles or molecules, then an inhalation hazard is unlikely to be present.

It should be noted that since many materials are in the form of oils, butters, pastes, waxes, etc., an inhalation hazard is primarily represented by any substances dissolved in them which, because of their molecular weight, intrinsic vapor pressure, or boiling point, can be released from the matrix in which they are found. This is especially true when the material is heated to facilitate processing.

However, when a material is in a physical state for which the risk analysis and the absence of a binding or indicative OEL make it possible to conclude that no release of particles or molecules is possible under any circumstances, it is not necessary to carry out quantitative analyses of exposure by the respiratory route.

This applies in particular to certain retinol-based compounds (CMR 1B) which do not present any risks other than those that can be manifested by the cutaneous or oral route.

In the case of CMR 2 materials that may present a risk by inhalation, a risk analysis conducted on several references of the same RM (e.g. TiO₂) or on RMs that are very similar due to their composition (e.g., certain fragrances) often leads to similar exposure scores for the same family of RMs, provided that the implementation parameters, toxicological profiles and physicochemical characteristics are comparable.

In this case, it is possible, with the agreement of the service provider in charge of defining the sampling strategy during the controls, to carry out only one analytical measurement representative of the exposure at the workstation.

It should also be noted that the sites have the possibility of acquiring a certain autonomy in the verification of exposure at the workstation and no longer depend solely on external service providers.

Sites can obtain simple instruments such as a nucleus condensation particle counter (CNC) and a photoionization detector (PID) suitable for VOCs (Volatile Organic Compounds), which can be used to establish an initial diagnosis before calling on a subcontractor for more elaborate techniques (see §9.1).

The technical means of justifying the low risk should also be supplemented by the means of preventing collective and individual risks resulting from risk assessments, in sufficient quality and number to prevent the risks or contain their effects once they have occurred (collective protection, PPE, detectors, etc.).

The technical conditions for achieving "low risk" cannot, however, be dissociated from organizational measures, without which the technical conditions cannot be sufficient to justify the reduction of the regulatory provisions provided for by the Labor Code.

For information, flowcharts 13.2.4.2 A and 13.2.4.2 B at the end of this document provide schematic indications about the different situations that can be applied to the measurement campaigns and the

actions that must be taken as a result, both for CMR 1A, 1B on the one hand, and on the other hand for CMR 2 to which low risk conditions are applicable.

12.2.4.3 Risk assessment for CMR category 2

The risk analysis of DCAs - including CMR 2s - is part of the application of the "single document" decree and of the 2003-1254 "hazardous chemical agents" decree and must be carried out at least once a year if there are no changes in operating conditions.

Any change in operating conditions requires an updated risk analysis, or even a specific risk analysis. The CMR 2 risk control process must remain focused on the following steps, depending on the means and information available locally, and in particular from the HR, Occupational Medicine, UP, maintenance and purchasing teams, etc.:

- Inventory of the materials used, based on the movement of materials or any other relevant data
- Inventory of tasks performed with these materials
- Mapping of the materials used by any relevant means allowing to trace their path, as well as the premises, the equipment, and the operators or groups of operators involved
- Analysis of risks at the workstation
- Exposure measurements carried out internally (or possibly by an approved inspection body)
- CPE used for the implementation of CMR 2 and PPE recommended in the risk analyses
- Organizational measures (instructions, training, annual checks of the entire employee health protection system, in particular CPE, MESUR, etc.)

Exposure measurements complement the risk analyses mentioned above and complete their conclusions. These measurements can be carried out internally as indicated above. Four cases may arise:

- Low assessed risk and internal measurement below the accepted threshold of 10% of the TLV
- Low assessed risk and in-house measurement > 10% VLEP
- Assessed risk not low and in-house measurement < 10% VLEP
- Assessed risk not low and in-house measurement > 10 % VLEP.

The possible cases of risk analysis and measurement results for CMR 2 are summarized as follows:

		Risk assessed	
		Negligible	Not negligible
Internal measurement	Negligible		
	Not negligible		

If the low risk is confirmed by reliable and repeated internal measurements (green box), it is not necessary to have it confirmed by an approved control body.

As the risk analysis is carried out in a conservative way, it is possible that internal measurements allow to conclude that the exposure is lower than the one considered (blue box) and to correct the risk analysis. In this case, it may be useful to have this conclusion confirmed by an approved inspection body to confirm the low risk situation.

In the 2 other cases corresponding to internal measurements that are not low (grey boxes), the internal measurements must be completed by an approved inspection body after the corrective actions have been carried out.

If it is impossible to carry out internal measurements (e.g. no ELV available), it is necessary to objectivize the conclusions of the risk analysis by measurements carried out by an approved inspection body, especially after corrective actions have been carried out, before allowing operators to use the facilities again.

In the event that a CMR 2 becomes a CMR 1A or 1B, in particular as a result of new toxicological data, the application of the measures mentioned above must help to prove the absence of exposure prior to the change of classification.

The risk analysis, including the use of appropriate PPE and exposure controls, must allow to:

- decide on the tasks that may be assigned to pregnant women after validation by the occupational physician
- to keep the list of tasks that may be assigned to workers up to date, in accordance with French regulations and in particular with Decree D4154-1 of the Labor Code
- verify the adequacy between the recommendations resulting from the local monitoring service and their application in the field

12.3 Annex 3: Special provisions in Europe concerning titanium dioxide

Coded TiO₂ RM powders containing 1% or more of titanium dioxide are subject to additional European-specific labeling data EUH212, indicating "Caution! Hazardous respirable dust may be formed during use. Do not breathe this dust."

It should be noted that the EUH212 phrase is not yet included in all SDSs of the materials involved.

The hazard level or OHB is equal to 3 for materials classified as Carcinogen Cat. 2, H351 or nanoscale.

The OHB value = 2 is to be applied to non-nano and non-CMR TiO₂ based materials, and the materials concerned carry the mention EUH212 on their label.

These indications should be taken into account during the risk analysis prior to the use of these chemical materials.

12.4 Annex 4: Consideration of self-classifications by suppliers

12.4.1 Background

For reasons of differences in the way CMR thresholds are taken into account from one region of the world to another, this document is only intended for EHS entities in the European zone. Other areas have to take a position on how to manage self-classifications.

a) European chemical regulations REACH & CLP

Since the entry into force of the REACH (EC) No. 1907/2006 and CLP (EC) No. 1272/2008 chemical regulations, more and more substances used in cosmetic formulas appear to be classified as mutagenic, carcinogenic or toxic for reproduction through self-classification by manufacturers.

On the other hand, the competent authorities of the Member States establish harmonized classifications of compulsory application in Europe, which are listed in Annex VI of the CLP Regulation.

b) European cosmetic regulation (EC) n°1223/2009

The use of substances classified as CMR category 1A, 1B or 2, according to Annex VI of the CLP Regulation (harmonized classifications), is prohibited in cosmetic products, except in cases of derogation provided for by the Cosmetic Regulation, under Articles 15.2 and 15.1 respectively.

For example, the use of substances classified as CMR category 2 according to Annex VI of the CLP may be authorized on a case-by-case basis upon a favorable opinion from the SCCS, under article 15.1 of the cosmetic regulation. However, the cosmetic regulation does not rule on the case of substances self-classified as CMR category 1A, 1B or 2.

12.4.2 Current situation

The CLP Regulation sets the concentration limits for components classified as carcinogenic, mutagenic, or toxic to reproduction which determine the classification of a mixture as follows:

- H340 or H350 of category 1A and 1B: 0.1%
- H360 of category 1A and 1B: 0.3%
- H341 or H351 of category 2: 1.0%
- H361 of category 2: 3.0%

Mixtures classified as CMR (categories 1A, 1B and 2) are divided into two categories:

- Mixtures classified on the basis of components with a harmonized classification
- Mixtures self-classified by the industry

At present, the use of mixtures containing components classified as CMR category 1A and 1B is prohibited at Group level when these components are listed in Annex VI of the CLP Regulation (harmonized classification).

The use of mixtures containing self-classified CMR 1A and 1B components is treated on a case-by-case basis. The use of mixtures containing components classified as CMR category 2 is also dealt with on a case-by-case basis, regardless of whether the classification is harmonized, (pending the opinion of the SCCS [Scientific Committee on Consumer Safety]).

This situation is sometimes complicated to manage in the field due to the increasing number of cases to be dealt with, as well as the presence of several components classified in the same category (H340 1A/1B or H341, H350 1A/1B or H351, H360 1A/1B or H361) and at individual levels below their CLP threshold.

12.4.3 Position of L'Oréal H&S

Given the increase, since the entry into force of CLP, of the number of mixtures classified as CMR 1 or 2 on the one hand, and on the other hand the possible presence of one or more substances belonging to the same category H340 1A/1B or H341, H350 1A/1B or H351, H360 1A/1B or H361 (i.e. CMR 1A/1B and 2), whatever their content in the mixture, the following position has been adopted:

1. In the case of several CMR substances bearing the same H-phrase(s) present in the mixture, the principle of additivity of the contents should be applied for molecules with similar structures. For this purpose, the concentrations of substances with comparable patterns/structures should be added together and compared to the CLP threshold value corresponding to their class; if

necessary, internal expert advice should be sought to establish the final classification of the mixture.

2. In the case of substances in individual or cumulative concentrations close to the CLP cut-off value to within 0.01%, seek in-house expert advice if necessary to decide on the classification of the mixture.
3. Consider first of all the substitution of the substance(s) which could lead to the classification of the mixture as CMR 1A, 1B or 2.
4. If substitution is not technically possible, reduce as much as possible the exposure of workers using this type of mixture in the Group's laboratories, Demi-Grands, pilots and factories, by applying the prevention rules described in the local regulations and the corresponding Group documentation.
5. In terms of worker protection, substances classified as CMR in a harmonized manner are treated as those resulting from self-classification by one or more suppliers. As such, they should be subject to the provisions described in chapter 7 of this document. However, the Cosmetic Regulation does not address the case of substances self-classified as CMR category 1A, 1B or 2.

12.5 Appendix 5 - Justification for Substitution or Non-Substitution

	PROCESS OF SUBSTITUTION
I/ Identification of problem	
a) Product	
Trade name of product	
L'Oréal Code	
b) Substance at stake	
Chemical name	
CAS #	
II) Safety data of the product	
Hazard statements (SDS from supplier)	
Percentage of substance in the product	
III/ Justification	
Justify the reasons why substitution <u>is not</u> technically possible	
Justify the reasons why substitution <u>is</u> technically possible	

12.6 Appendix 6: Filtered Air Recirculating Chambers (FARC)

12.6.1 Advantages associated with filtered air recirculating chambers

- FARCs provide space-saving mobility of installation compared to "conventional" enclosures requiring connection to a hydraulic network, thus allowing the use of chemicals in areas with little or no ventilation and exhaust to the outside.

- FARC's have a high capacity to capture particles, including ultrafine ones, if equipped with HEPA (High Efficiency Particulate Air) filters.
- FARC's filters also have a high retention capacity for organic molecules due to the very large internal surface area of the activated carbon used for the filter lining (1000 to 2000 m²/g).
- The use of FARC's is suitable for activities in which repetitive tasks are carried out on chemical materials or finished products, such as analysis or Quality Assurance, provided that the list of materials used in FARC's has been validated by its supplier and that the maintenance of the filters and the installation is checked every 6 months in accordance with the regulations.

12.6.2 Constraints associated with filtered air recirculating chambers

- Containment certification using SF₆ (Sulfur Hexafluoride) gas cannot be provided on a filtered air recirculating chamber because this gas is not retained on the activated carbon filters; it is released into the breathing volume immediately after passing through the filters.
- It is necessary to be familiar with the chemical materials handled under the enclosures and to have them validated for compatibility with the filters by the manufacturer.
- It is not possible to deviate from the list of chemicals compatible with the filters that has been agreed upon with the manufacturer unless the filter is changed or a new enclosure is added that is compatible with the new substances to be handled.
- It is strongly advised against placing equipment in the enclosure that could disrupt the operation of the filters (heated or unheated water baths), as these become impregnated with water vapor, which impairs their retention capacity through saturation and reduction of the internal surface of the activated carbon.
- It is not possible to carry out chemical reactions that have to release large quantities of gas without efficient trapping because the enclosures and their filters cannot retain molecules as small as carbon dioxide or sulfur dioxide.
- The use of FARC's is not recommended for chemical synthesis activities that pose a risk of clogging the cooling column, or thermal runaway, with the possibility of glassware breakage, pressure rise, and exotherm in a short time. This is because there is a risk of exceeding the filtration capacities and releasing vapors into the breathing air downstream of the filters, or losing filtration capacities due to impregnation of the carbon.
- It is not advisable to carry out activities likely to cause a fire outbreak in a FARC because, in addition to not being ATEX-compliant, the activated carbons can add fuel load to the situation and aggravate the disaster.
- Hot reactions, i.e. at a temperature $\geq 40^{\circ}\text{C}$, are not recommended in the presence of activated carbon due to the risk of molecules being released by thermo-desorption under the effect of temperature. Small molecules such as methanol are the least well retained on activated carbon filters.
- In general, the use of FARC's is not recommended for hot reactions, exothermic reactions, or dangerous reactions for the reasons mentioned above, which can cause saturation/clogging of

the filters and release harmful small molecules (such as gas, methanol etc....) detrimental to human and environmental health.

- Between two visits from the supplier for maintenance (duration ≤ 6 months), the use of a FARC requires vigilance on the part of the users regarding the compatibility of contaminants that have accumulated on the filter during the previous months.
- The use of corrosive chemicals (H314 and/or H290), such as bases and acids, requires full consultation with the filter supplier and the use of suitable filters.
- CMRs without toxicity thresholds provided in the literature cannot be handled under FARCs when they are in the form of vaporizable liquids or sublimable solids because the existing leak detection systems are not sufficiently selective, sensitive or fast to avoid exposing handlers in case of overflow. This point necessitates the collection of the emissions with evacuation to the outside to prevent the consequences of any malfunction of the FARC.

12.6.3 Energy efficiency of filtered air recirculating chambers

According to experts in aerualics and the INRS, the energy efficiency of the FARCs is questionable when all costs are taken into account (e.g., production of carbon in Asia, transport of the filters, treatment of the filters as special waste).

According to the same experts, the choice of installing 'all fresh air' fume cupboards coupled with a heat recovery system before exhausting the used air should be the subject of a specific study in order to optimize the filtration efficiency/energy efficiency ratio.

Recommendations

In accordance with the opinions of the INRS and experts in aerualics, the use of filtered air recirculating chambers (FARCs) for handling chemicals is subject to the following recommendations:

- The use of a FARC requires, first of all, that a detailed preliminary risk analysis of the conditions of use be carried out. Additionally, all operators working in the vicinity of a FARC must be trained in its use and informed of the actions to be taken and the procedure to follow in the event of a problem, even a minor one.
- The use of a FARC can be considered for the implementation of powdered materials (or any other non-sublimable solid) regardless of their toxicity, provided that:
 - o validation by the FARC supplier confirms that the emitted particles will be safely retained by the filters (e.g., HEPA)
 - o periodic checks ensure the correct positioning of the filters in their joint plan
 - o monitoring of the clogging/saturation of the filters by regularly checking the pressure drop, or even by monitoring the absence of heating of the filters
 - o verification by measuring the TLVs for the compounds, if available, or otherwise the TLVs attributed to total dust or respirable dust
- To ensure optimal filtration of particles, including nanomaterials, FARCs should be equipped with filters of type F7 minimum (ISO 16890 standard) for pre-filtration and HEPA-H14 minimum or

- ULPA (EN 1822-1 standard) for high-efficiency filters, in accordance with the general procedure EHS-301-47A on chemical risk control
- The use of FARC's can only be considered for the handling of materials likely to emit vapors, i.e. all liquids and sublimable solids, under the following conditions:
 - o validation by the FARC supplier that the vapors or aerosols emitted will be safely captured by the activated carbon filters installed
 - o a risk analysis of the compatibility of the chemical materials (acids, bases, oxidants, etc.) or the processes implemented (hot, exothermic, dangerous reactions, etc.) with the filters installed
 - o periodic checks of the correct positioning of the filters in their gasket support
 - o regular maintenance (at least every 6 months) of the filters' performance
 - o verification by measurement of the OEL (Occupational Exposure Limit) for the compounds in use (e.g., solvents)
 - In general, the use of FARC's is subject to written validation by the supplier of the list of chemical materials that can be used under such a filter (ValiQuest) and compliance with maintenance requirements (verification of the filters and the installation every 6 months). This is particularly the case when formaldehyde is used in small quantities in repetitive tasks on biological tissues, provided that the supplier has feedback from the biannual filter saturation checks or even a system for continuous measurement of formaldehyde leakage through the filters.
 - The use of FARC's is to be prohibited for vaporizable liquids or sublimable solids CMR without toxicity thresholds provided in the literature, regardless of their 1A/1B or 2 category.
 - Furthermore, it is not recommended under the following conditions:
 - o Hot reactions, at temperatures $\geq 40^{\circ}\text{C}$ (risk of desorption of filters with release of methanol-type molecules toxic to health)
 - o Organic synthesis activities that can lead to decomposition or thermal runaway reactions (risk of saturation/clogging of filters and desorption of filters with the release of gases toxic to health)
 - o Presence of equipment that can generate water vapor (risk of saturation / clogging of filters)
 - o Presence of flammable liquid vapors that can generate an ATEX risk (increased combustion risk with activated carbon filters)
 - In conclusion, the use of FARC's is conceivable for activities involving the implementing materials validated by the supplier and used in a repetitive manner such as in Analysis or Quality Assurance. This approach helps avoid any risk of incompatibility between the materials and the processes on the one hand, and the activated carbon of the filters on the other hand, while also respecting the maintenance requirements described above.

12.7 Appendix 7: Photos of Collective Protecting Equipment

Shnorkel / ventilated arm



Pouyès ring



FARC



12.8 Appendix 8: Information on the classification of RM 54426 for the protection of workers

The classification of RM 54426 or SERICITE (INCI name: MICA) has recently been changed in the information systems to CMR 1 - May cause cancer (H350) due to the presence of quartz (CAS: 14808-60-7) up to 10% in the RM.

Its hazard level or OHB has been re-evaluated to 4 on a scale of 5 (previously OHB 1). The route of exposure affected by this potential hazard is inhalation.

This decision was made to protect the health of the Group's operators, particularly with regard to inhalation, which is the main route of exposure to this material.

The IARC is at the origin of the CMR 1 classification of quartz, however, this classification is not regulatory in Europe as it is not included in Annex VI of the CLP (self-classification). This implies that it is not taken into account by the cosmetic regulation, and the USA does not use the CMR 1 classification of SERICITE RM in the MSDSs intended for Europe for the final classification of formulas containing it.

The safety of consumer products containing RM with quartz in their composition is not the subject of this appendix. The measures taken by the national authorities of some countries, including France and the USA, for the protection of workers are in line with the IARC position on quartz. For example, France has established a binding limit value for quartz (respirable fraction) equal to 0.1 mg/m³, lower than that of benzene, a known carcinogen, equal to 3.25 mg/m³. In the USA, the CMR 1 classification for quartz is listed on prop 65, which lists carcinogenic and reprotoxic chemical substances prohibited in consumer goods.

The chemical risk management measures to be implemented on the various sites where SERICITE RM is used are those applicable to any CMR 1, mentioned in chapter 7 of this document.

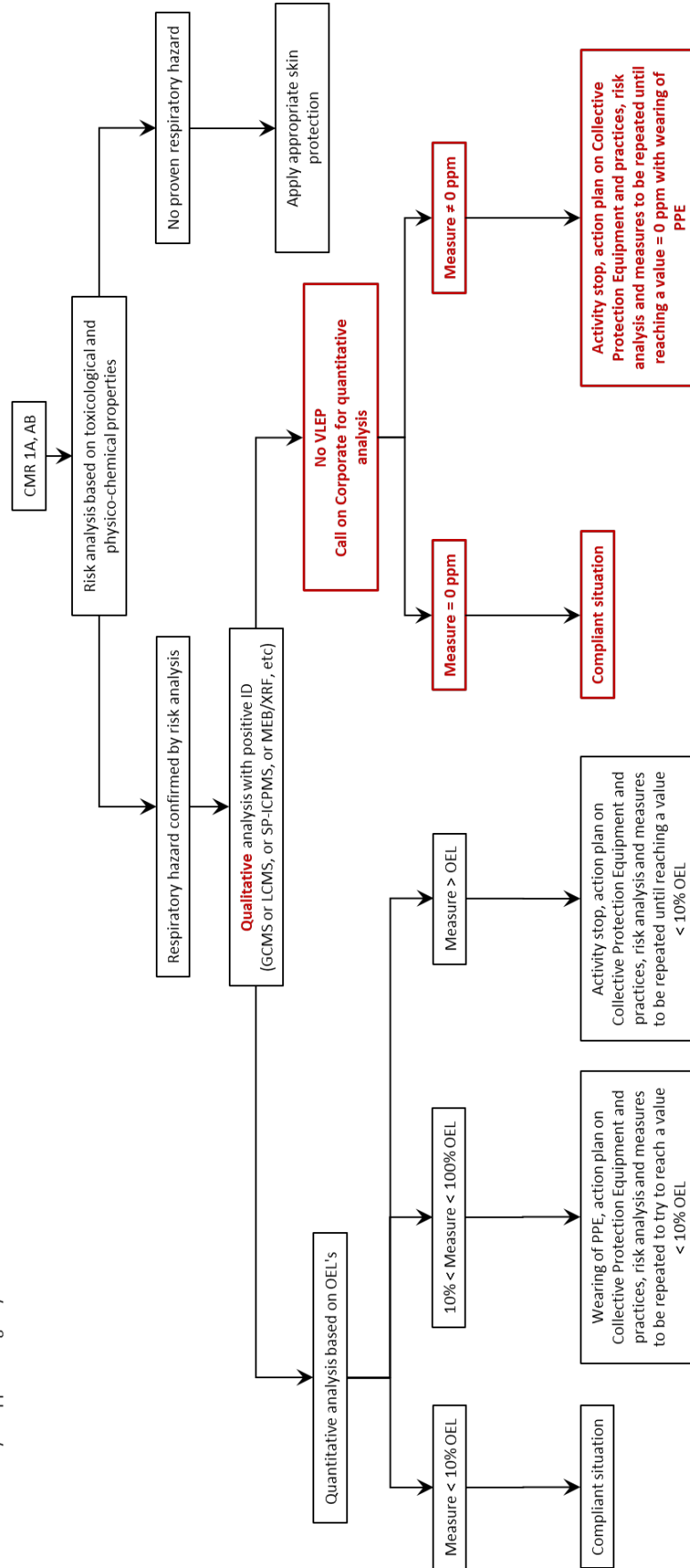
Additionally, the following good practices can be applied to minimize the odds of exposure when implementing RM 54426:

- The formulation of RM 54426 in the presence of a binder reduces the risk of exposure to airborne particles.
- Ventilation and particle capture must be effective at all workstation points.
- PPE must cover all parts of the body likely to be contaminated by the materials implemented.
- Operators must be trained to anticipate situations in which they may be exposed, including the phases of maintenance and cleaning of their installation.
- The effectiveness of operator protection can be checked using simple particle concentration measurement equipment before launching a campaign with a service provider.
- Compressed air should be used with care to avoid spreading material around the workstation.
- Particular attention must be paid to dust on floors.

Flowchart 13.2.4.2 A

This flowchart provides schematic indications of the different situations that can be applied to the measurement campaigns and the actions that must be taken as a result, both for CMR 1A, 1B

The following protocol applies to regulatory compliance measurements performed by an approved agency. The use of a particle detector or PID should not be considered for regulatory compliance measurements, but only to detect a hazardous situation prior to measurements by an approved agency.

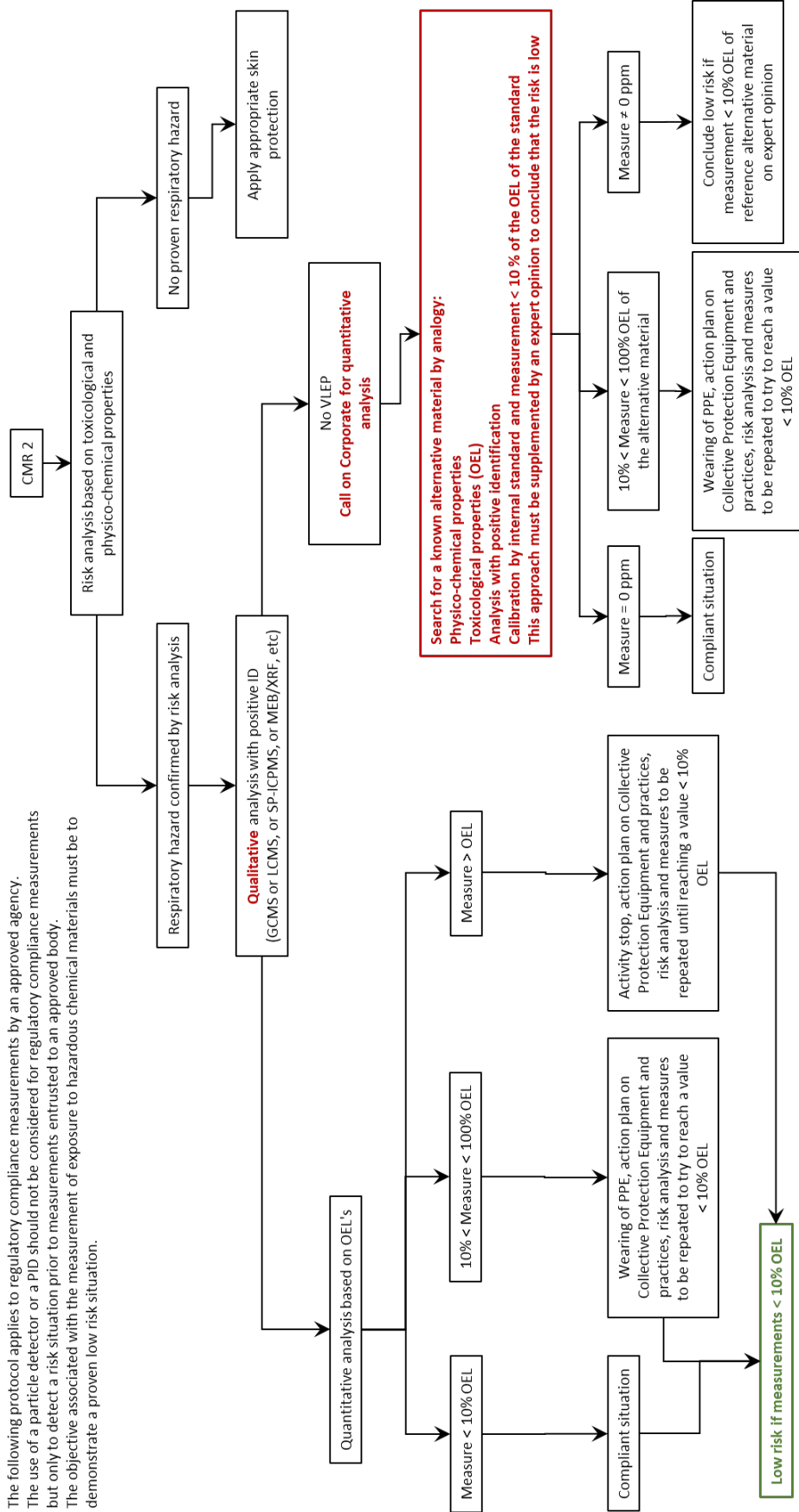


N.B.
Dust measurements must be carried out independently of specific CMR exposure measurements and must respect the 8-hour TLV of 4 mg/m³ for the inhalable fraction and 0.9 mg/m³ for the alveolar fraction (France only)

Flowchart 13.2.4.2

This flowchart provides schematic indications of the different situations that can be applied to the measurement campaigns and the actions that must be taken as a result for CMR 2, to which low risk conditions are applicable.

The following protocol applies to regulatory compliance measurements by an approved agency.
The use of a particle detector or a PID should not be considered for regulatory compliance measurements but only to detect a risk situation prior to measurements entrusted to an approved body.
The objective associated with the measurement of exposure to hazardous chemical materials must be to demonstrate a proven low risk situation.



N.B.

Dust measurements must be carried out independently of specific CMR exposure measurements and must respect the 8-hour OEL of 4 mg/m³ for the inhalable fraction and 0.9 mg/m³ for the alveolar fraction (France only)



EHS Management System



Water management on-site Gestion de l'eau sur site

EHS-PRO-016

02/2024

ENGLISH p. 2 to 9

Cancels and supersedes: EHS-301-12 A

FRANCAIS p. xx à xx

Annule et remplace : EHS-301-12 A

EMISSION / ISSUE : Corporate EHS

CONTENT OF MODIFICATIONS:

Indicate details of modifications made: /

CONTENU DES MODIFICATIONS :

Indiquer le détail des modifications apportées : /

Paragraphs modified or created since the previous publishing are marked by a vertical line to the left-hand side of the text or highlighted in grey.

Requirements are highlighted in orange

*PLANET Risks are indicated at the end of the requirement with the mention **PLANET 1** or **PLANET 2***

Les paragraphes modifiés ou créés depuis la précédente édition sont indiqués avec un trait vertical à gauche du texte ou grisés.

Les exigences sont surlignées en orange

*Les PLANET Risks sont indiqués à la fin de l'exigence avec la mention **PLANET 1** ou **PLANET 2***

CONTENTS

CONTENTS 2

1 AIM 3

2 SCOPE 3

3 RESPONSABILITIES 3

4 WATER SOURCES 4

5 DETAILED KNOWLEDGE OF WATER CHALLENGES IN THE REGION WHERE THE SITE OPERATES 5

6 IDENTIFICATION OF RISKS LINKED TO THE USE OF WATER AND TO WASTE WATER DISCHARGE 5

7 WATER WITHDRAWAL AND WATER CONSUMPTION 6

8 CATEGORIES OF WATER & WATER QUALITY 7

9 MAPPING OF THE WATER DISTRIBUTION SYSTEM 7

10 WATER VOLUMES MONITORING 8

11 PROTECTION AND MONITORING OF WATER SUPPLY QUALITY 8

12 COMMUNICATION 8

13 ASSOCIATED DOCUMENTS 9

1 AIM

A good knowledge of the water situation within the watershed where the site is located, of the water network of the site as well as an effective water monitoring are the first steps to understand where, how and when water is used on site, identify main water uses and understand potential water issues. This allows in a second step to set an efficient water withdrawal reduction program and targets to reduce water use and preserve the water resource.

The aim of this procedure is to describe the organisation and the processes put in place in order to ensure sustainable water management by L'Oréal operated sites. It requires:

- A knowledge of the water global situation around the site
- A knowledge of all water sources used on site
- The mapping of the water network
- The availability of operational water meters
- The monitoring of water volumes used on site.

In the event of differences in requirements between local regulations and the rules imposed by this document, the more restrictive requirements are applied.

For water reduction, reuse and recycling, please refer to procedure EHS-PRO-018 (Water Withdrawals reduction).

2 SCOPE

This general procedure applies to all sites operated by the L'Oréal Group.

3 RESPONSABILITIES

The EHS manager is responsible for:

- The preparation and updating of the mapping of the water supply network (EHS-INS-056)
- The preparation and updating of the mapping of water withdrawal and consumption,
- The monitoring of water volumes used for the site for each source,
- The maintenance of water meters,
- The general training of personnel relating to water management,
- The general training course of site staff setting out the principles to be complied with for good water management. If necessary (special equipment, etc.), this training course will be complemented by specific training provided under the responsibility of the supervisor.

The heads of zones or different activities (e.g. UP, laboratories, restaurant, etc) are responsible for the water management and monitoring within their zone and for the specific training of personnel in water management.

4 WATER SOURCES

Water sources allowed on-site are:

- Water from the municipal network
- Water from sources or wells located on-site
- Rainwater
- Reused water from a third party (other L'Oréal's site or other site from another company)

Water supply from the following sources needs to be authorized by DGO based on a global ecological assessment:

- Fresh water from the exploitation of sources or wells on site
- Used water from the recycling of third party waste water
- Rainwater from existing roofs on site.

Some restrictions may apply :

- Underground water: In the case of spring, well or drilling operation, the operator must regularly conduct hydro-geological studies in order to assess the level and quality of the renewal of the underground reserve to justify the responsible water use.
These studies establish the maximum volumes that can be pumped from the water table to maintain it.
- Rainwater: a global study establishing the benefit for the environment must have been conducted. In particular, the study must prove that the withdrawal of the rainwater or the diversion of rainwater cause no damage to surroundings ecosystems. Rainwater must be collected from existing roofs or buildings. The collection of rainwater must not lead to increased land artificialization. Please refer to EHS-INS-057.

5 Detailed knowledge of water challenges in the region where the site operates

The situation towards water within a watershed depends on the needs of the different human activities and the needs of natural ecosystems. Season, pluviometry, watercourses present in the watershed, renewability of the ground water, etc influence the availability of water.

The detailed knowledge of the local water challenges is essential for the prioritization of the site's actions to reduce its impact on local water resources and to minimize water risk on its activity. This includes:

- the local hydric stress,
- the origin / point of withdrawal of the water supply,
- the transport of the water to the site,
- the off site treatment of waste water leaving the site and
- the final discharge to the environment after on-site and/or off site treatment,
- all the restrictions concerning water use (e.g. water shortages, water limitation, water quality issues) must be applied.

➔ *The collected information is gathered and documented on-site in a dedicated auditable "site water context dossier".*

This knowledge is the base for the site's specific 2030 water roadmap and for the Business Continuity Plan (BCP) concerning water risk.

An internal scarcity index has been developed, based on several scientific parameters. It assesses the scarcity of a watershed, region or country's renewable water supply, and is available for all sites. The water stress index per site is informed annually in the EHS reporting tool by the Corporate Environment Team.

6 Identification of risks linked to the use of water and to waste water discharge

A detailed identification of water related risks must be done by the site, including but not limited to:

- The risk linked to the rupture or limitation of the site's fresh of the local water supply concerning water availability and quality including the original sourcing of the water and its infrastructure for the transport to the site,
- The risks of legal restrictions of water withdrawal,
- The risk of the pollution of water supplied to the site,
- The risk of malfunction of the industrial effluent treatment installations on site that might conduct to legal non compliances and/or pollution,

- The risk of disrupting systems downstream of the discharge (for example: the natural environment, public networks or the urban wastewater treatment plant) must be identified and reduced to a minimum), and
- Regulatory and/or reputational issues.

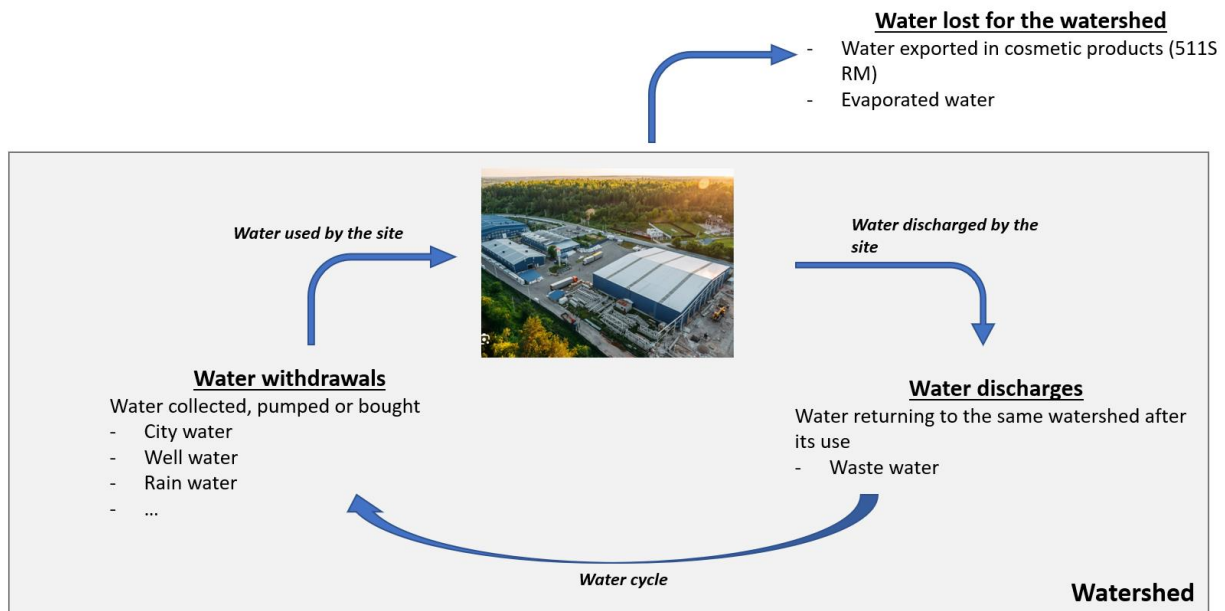
→ *The results of the risk analyses is documented on-site and integrated in the Business Continuity Plan (BCP).*

In areas with moderate to strong hydric stress, the site has an investment plan to control water risks.

7 Water withdrawal and water consumption

A distinction exists between water withdrawal and water consumption:

- Water withdrawal corresponds to all volumes of water entering the site, and bought / pumped from external sources, collected from rainwater or from groundwater.
- Water consumption is the difference between the withdrawals and the discharges. It then corresponds to all volumes of water that are evaporated or used in cosmetic products.



It is important to lower both water withdrawal and consumption, to lower the global pressure on the water resource and to lower the amount of water lost for the watershed.

Water can be reused or recycled on-site, in order to lower water withdrawals from the watershed.

8 Categories of Water & Water Quality

There are several different water categories:

- Fresh water for domestic use must have potable water quality.
- Demineralized water used for the cosmetic formula: The required quality characteristics of the demineralized water is governed by Quality definitions and procedures.
- Utility water: Soft water / recycled water, treated rain water for industrial uses: Regardless of the initial water source (city water, recycled water, rainwater, etc.), the quality of utility water for all industrial uses is defined and documented in EOS-002-UTILITIES-301 (Utilities water system).

Depending on the use of water, different qualities of water may be required. Their preparation requires tools, reagents and maintenance.

The choice of the quality of the water to use according to the need must be done following norms edicted by the Quality and/or must follow EOS-002-UTILITIES-301 (Utilities water system).

The devices for detecting changes in the quality (pollution) of the water entering the site are in place. The entry points must be subject to appropriate control and monitoring.

9 Mapping of the water distribution system

The water distribution and waste water circuits must be mapped by the EHS manager with the contribution of the responsible manager of the zone.

The map of the networks must show:

- All water supply points, including rainwater, reused water and recycled water,
- All water uses par zone of the site,
 - *E.g. boilers, water treatment plant, watering, sprinklers, laboratories, domestic uses, 511S prudction, etc.*
- Network equipments: valves, meters, any defeat devices, processing units, and any other important equipment,
- All water discharges points.

The map of the circuits must be updated whenever a modification is made.

Please refer to the technical instruction EHS-INS-056 (Mapping and monitoring of the water network).

The rainwater, domestic and industrial wastewater networks must be separated.

10 Water volumes monitoring

Volumes of water must be identified, regularly monitored and consolidated at a monthly level. The monitoring of water volumes will be preferably done with meters. Continuous automatic reading must be preferred. Otherwise, frequent readings must be organized.

For administrative sites only, in the absence of a water meter for municipal water supply, the site can identify the municipal water volume by using regular invoices or any other reliable method (validated by DGO-Environment).

The global water balance of the site must be equilibrated. A tolerance corresponding to the water meters precision range is allowed.

If this is not the case, the site must investigate the reasons of the differences. They can be explained by losses within the water circuit, poorly calibrated or poorly positioned water meters, etc. Corrective actions must be undertaken.

For Waterloop sites, a specific water balance must be available. It is described in the Waterloop procedure (EHS-PRO-019).

11 Protection and monitoring of water supply quality

For all entry points of each water source, following equipments must at least be installed: dam valve, water meter, disconnecter and filter (in case of incidents).

Tools to detect malfunctions of meters, of equipments, or leakages must be available on site.

Wells must be fitted with shut-down equipment to prevent any flow-back of pollution into the well.

12 Communication

Water indicators, water performance and improvement of water intensity must be displayed to all employees of the site, in order to raise awareness on water issues and on the efforts made by the site to lower its impact and enhance its performance.

These indicators must be updated monthly.

These indicators must include, but are not limited to:

- the total water withdrawal of the site

- the water withdrawals per main zones and activity of the site and main uses,
- progress made compared to targets set for main water uses.

13 Associated documents

- EHS-PRO-018: Water Withdrawals reduction
- EHS-PRO-019: Waterloop
- EHS-INS-056: Mapping and monitoring of the water network
- EHS-INS-057: Use conditions of rain and ground water
- EOS-002-UTILITIES-301: Utilities water system

This page was intentionally left blank for duplex printing.

SECTION 01 40 00
QUALITY REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Submittals.
- B. Quality assurance.
- C. References and standards.
- D. Testing and inspection services other than Code required special testing and inspections.
- E. Control of installation.
- F. Manufacturers' field services.
- G. Defect Assessment.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.
- B. Section 01 42 16 - Definitions.
- C. Section 01 60 00 - Product Requirements: Requirements for material and product quality.

1.03 REFERENCE STANDARDS

- A. ASTM C1021 - Standard Practice for Laboratories Engaged in Testing of Building Sealants; 2008 (Reapproved 2019).
- B. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for Use in Construction and Criteria for Testing Agency Evaluation; 2017.
- C. ASTM C1093 - Standard Practice for Accreditation of Testing Agencies for Masonry; 2019.
- D. ASTM D3740 - Standard Practice for Minimum Requirements for Agencies Engaged in the Testing and/or Inspection of Soil and Rock as Used in Engineering Design and Construction; 2019.
- E. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection, Testing, or Special Inspection; 2021.
- F. ASTM E543 - Standard Specification for Agencies Performing Nondestructive Testing; 2021.
- G. ASTM E699 - Standard Specification for Agencies Involved in Testing, Quality Assurance, and Evaluating of Manufactured Building Components; 2016.
- H. IAS AC89 - Accreditation Criteria for Testing Laboratories; 2020.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Design Data: Submit for the limited purpose of assessing conformance with information given and the design concept expressed in the contract documents, and for Owner's information.
- C. Test Reports: After each test/inspection, promptly submit copies of report to Owner, Architect Engineer and to Contractor.
- D. Manufacturer's Instructions: When specified in individual specification sections, submit published instructions for delivery, storage, assembly, installation, start-up, adjusting, and finishing, for the Owner's information. Indicate special procedures, perimeter conditions requiring special attention, and special environmental criteria required for application or installation.

1.05 QUALITY ASSURANCE

- A. Testing Agency Qualifications:

1. Prior to start of Work, submit agency name, address, and telephone number, and names of full time registered Engineer and responsible officer.
2. Submit copy of report of laboratory facilities inspection made by NIST Construction Materials Reference Laboratory during most recent inspection, with memorandum of remedies of any deficiencies reported by the inspection.
3. Qualification Statement: Provide documentation showing testing laboratory is accredited under IAS AC89.

1.06 REFERENCES AND STANDARDS

- A. For products and workmanship specified by reference to a document or documents not included in the Project Manual, also referred to as reference standards, comply with requirements of the standard, except when more rigid requirements are specified or are required by applicable codes.
- B. Conform to reference standard of date of issue current on date of Contract Documents, except where a specific date is established by applicable code.
- C. Obtain copies of standards where required by product specification sections.
- D. Maintain copy at project site during submittals, planning, and progress of the specific work, until Substantial Completion.
- E. Should specified reference standards conflict with Contract Documents, request clarification from Architect Engineer before proceeding.
- F. Neither the contractual relationships, duties, or responsibilities of the parties in Contract nor those of Architect Engineer shall be altered from the Contract Documents by mention or inference otherwise in any reference document.

1.07 TESTING AND INSPECTION AGENCIES AND SERVICES

- A. Contractor shall employ and pay for services of an independent testing agency to perform other specified testing and inspection, and as required for Contractor's own quality control.
- B. Employment of agency in no way relieves Contractor of obligation to perform Work in accordance with requirements of Contract Documents.
- C. Contractor Employed Agency:
 1. Testing agency: Comply with requirements of ASTM E329, ASTM E543, ASTM E699, ASTM C1021, ASTM C1077, ASTM C1093, and ASTM D3740.
 2. Inspection agency: Comply with requirements of ASTM D3740 and ASTM E329.
 3. Laboratory: Authorized to operate in the State in which the Project is located.
 4. Laboratory Staff: Maintain a full time registered Engineer on staff to review services.
 5. Testing Equipment: Calibrated at reasonable intervals either by NIST or using an NIST established Measurement Assurance Program, under a laboratory measurement quality assurance program.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 CONTROL OF INSTALLATION

- A. Monitor quality control over suppliers, manufacturers, products, services, site conditions, and workmanship, to produce Work of specified quality.
- B. Comply with manufacturers' instructions, including each step in sequence.
- C. Should manufacturers' instructions conflict with Contract Documents, request clarification from Architect Engineer before proceeding.
- D. Comply with specified standards as minimum quality for the Work except where more stringent tolerances, codes, or specified requirements indicate higher standards or more precise workmanship.
- E. Have Work performed by persons qualified to produce required and specified quality.

- F. Verify that field measurements are as indicated on shop drawings or as instructed by the manufacturer.
- G. Secure products in place with positive anchorage devices designed and sized to withstand stresses, vibration, physical distortion, and disfigurement.

3.02 TESTING AND INSPECTION

- A. See individual specification sections for other testing and inspection required.
- B. Limits on Testing/Inspection Agency Authority:
 - 1. Agency may not release, revoke, alter, or enlarge on requirements of Contract Documents.
 - 2. Agency may not approve or accept any portion of the Work.
 - 3. Agency may not assume any duties of Contractor.
 - 4. Agency has no authority to stop the Work.
- C. Contractor Responsibilities:
 - 1. Provide incidental labor and facilities:
 - a. To provide access to Work to be tested/inspected.
 - b. To obtain and handle samples at the site or at source of Products to be tested/inspected.
 - c. To facilitate tests/inspections.
 - d. To provide storage and curing of test samples.
 - 2. Arrange with Owner's agency and pay for additional samples, tests, and inspections required by Contractor beyond specified requirements.
- D. Re-testing required because of non-conformance to specified requirements shall be performed by the same agency on instructions by Architect Engineer.
- E. Re-testing required because of non-conformance to specified requirements shall be paid for by Contractor.

3.03 MANUFACTURERS' FIELD SERVICES

- A. When specified in individual specification sections, require material or product suppliers or manufacturers to provide qualified staff personnel to observe site conditions, conditions of surfaces and installation, quality of workmanship, start-up of equipment, test, adjust and balance of equipment as applicable, and to initiate instructions when necessary.
- B. Submit qualifications of observer to Architect Engineer 30 days in advance of required observations.
 - 1. Observer subject to approval of Architect Engineer.
- C. Report observations and site decisions or instructions given to applicators or installers that are supplemental or contrary to manufacturers' written instructions.

3.04 DEFECT ASSESSMENT

- A. Replace Work or portions of the Work not conforming to specified requirements.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 01 42 16
DEFINITIONS

PART 1 GENERAL

1.01 SUMMARY

- A. Other definitions are included in individual specification sections.

1.02 DEFINITIONS

- A. Furnish: To supply, deliver, unload, and inspect for damage.
- B. Install: To unpack, assemble, erect, apply, place, finish, cure, protect, clean, start up, and make ready for use.
- C. Product: Material, machinery, components, equipment, fixtures, and systems forming the work result. Not materials or equipment used for preparation, fabrication, conveying, or erection and not incorporated into the work result. Products may be new, never before used, or re-used materials or equipment.
- D. Project Manual: The volume that includes the procurement requirements (if any), the contracting requirements, and the specifications.
- E. Provide: To furnish and install.
- F. Supply: Same as Furnish.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 01 50 00
TEMPORARY FACILITIES AND CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary sanitary facilities.
- B. Temporary Controls: Barriers and enclosures.
- C. Security requirements.
- D. Vehicular access and parking.
- E. Field offices.

1.02 RELATED REQUIREMENTS

- A. Section 01 51 00 - Temporary Utilities.

1.03 REFERENCE STANDARDS

- A. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- B. ASTM E90 - Standard Test Method for Laboratory Measurement of Airborne Sound Transmission Loss of Building Partitions and Elements; 2009 (Reapproved 2016).

1.04 TEMPORARY UTILITIES - SEE SECTION 01 51 00

1.05 TEMPORARY SANITARY FACILITIES

- A. Provide and maintain required facilities and enclosures. Provide at time of project mobilization.
- B. Use of existing facilities is not permitted.
- C. Maintain daily in clean and sanitary condition.
- D. At end of construction, return facilities to same or better condition as originally found.

1.06 BARRIERS

- A. Provide barriers to prevent unauthorized entry to construction areas, to prevent access to areas that could be hazardous to workers or the public, to allow for owner's use of site and to protect existing facilities and adjacent properties from damage from construction operations and demolition.
- B. Protect non-owned vehicular traffic, stored materials, site, and structures from damage.

1.07 INTERIOR ENCLOSURES

- A. Provide temporary partitions and ceilings as indicated to separate work areas from Owner-occupied areas, to prevent penetration of dust and moisture into Owner-occupied areas, and to prevent damage to existing materials and equipment.
- B. Construction: Framing and reinforced polyethylene sheet materials with closed joints and sealed edges at intersections with existing surfaces:
 - 1. STC rating of 35 in accordance with ASTM E90.
 - 2. Maximum flame spread rating of 75 in accordance with ASTM E84.
- C. Paint surfaces exposed to view from Owner-occupied areas.

1.08 SECURITY

- A. Provide security and facilities to protect Work, existing facilities, and Owner's operations from unauthorized entry, vandalism, or theft.

1.09 VEHICULAR ACCESS AND PARKING

- A. Comply with regulations relating to use of streets and sidewalks, access to emergency facilities, and access for emergency vehicles.
- B. Coordinate access and haul routes with governing authorities and Owner.

- C. Provide and maintain access to fire hydrants, free of obstructions.
- D. Provide means of removing mud from vehicle wheels before entering streets.
- E. Provide temporary parking areas to accommodate construction personnel. When site space is not adequate, provide additional off-site parking.
- F. Existing parking areas located at areas designated by Owner may be used for construction parking.

1.10 FIELD OFFICES

- A. On-site field office is not required for this project.
 - 1. If requested by Contractor, Owner may provide designated space. Coordinate with Owner.

1.11 REMOVAL OF UTILITIES, FACILITIES, AND CONTROLS

- A. Remove temporary utilities, equipment, facilities, materials, prior to Date of Substantial Completion inspection.
- B. Clean and repair damage caused by installation or use of temporary work.
- C. Restore existing facilities used during construction to original condition.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 51 00
TEMPORARY UTILITIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Temporary Utilities: Electricity, lighting, heat, ventilation, and water.

1.02 TEMPORARY ELECTRICITY

- A. Cost of Electricity Used: By Owner.
- B. Connect to Owner's existing power service.
 - 1. Do not disrupt Owner's need for continuous service.
 - 2. Exercise measures to conserve energy.
- C. Provide temporary electric feeder from existing building electrical service at location as directed.
- D. Complement existing power service capacity and characteristics as required.
- E. Provide power outlets for construction operations, with branch wiring and distribution boxes located at each floor. Provide flexible power cords as required.
- F. Provide feeder switch at source distribution equipment and meter.
- G. Permanent convenience receptacles may be utilized during construction.
- H. Provide adequate distribution equipment, wiring, and outlets to provide single phase branch circuits for power and lighting.

1.03 TEMPORARY LIGHTING FOR CONSTRUCTION PURPOSES

- A. Provide and maintain lighting for construction operations to achieve a minimum lighting level of 2 watt/sq ft .
- B. Provide branch wiring from power source to distribution boxes with lighting conductors, pigtails, and lamps as required.
- C. Maintain lighting and provide routine repairs.
- D. Permanent building lighting may be utilized during construction.

1.04 TEMPORARY HEATING

- A. Cost of Energy: By Owner.
- B. Provide heating devices and heat as needed to maintain specified conditions for construction operations.
- C. Maintain minimum ambient temperature of 50 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.
- D. Owner's existing heat plant may be used.
 - 1. Exercise measures to conserve energy.
- E. Prior to operation of permanent equipment for temporary heating purposes, verify that installation is approved for operation, equipment is lubricated and filters are in place. Provide and pay for operation, maintenance, and regular replacement of filters and worn or consumed parts.

1.05 TEMPORARY COOLING

- A. Cost of Energy: By Owner.
- B. Provide cooling devices and cooling as needed to maintain specified conditions for construction operations.
- C. Maintain maximum ambient temperature of 80 degrees F in areas where construction is in progress, unless indicated otherwise in specifications.

1.06 TEMPORARY VENTILATION

- A. Existing ventilation equipment may not be used.

1.07 TEMPORARY WATER SERVICE

- A. Cost of Water Used: By Owner.
- B. Provide and maintain suitable quality water service for construction operations at time of project mobilization.
- C. Connect to existing water source.
 - 1. Exercise measures to conserve water.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

SECTION 01 55 00
VEHICULAR ACCESS AND PARKING

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Access roads.
- B. Parking.
- C. Existing pavements and parking areas.
- D. Construction parking controls.
- E. Flag persons.
- F. Flares and lights.
- G. Haul routes.
- H. Traffic signs and signals.
- I. Maintenance.
- J. Removal, repair.
- K. Mud from site vehicles.

PART 2 PRODUCTS

PART 3 EXECUTION

3.01 ACCESS ROADS

- A. Use of designated existing on-site streets and driveways for construction traffic is permitted.
- B. Tracked vehicles not allowed on paved areas.
- C. Extend and relocate as Work progress requires, provide detours as necessary for unimpeded traffic flow.
- D. Location as approved by Architect Engineer.
- E. Provide unimpeded access for emergency vehicles. Maintain 20 foot width driveways with turning space between and around combustible materials.
- F. Provide and maintain access to fire hydrants free of obstructions.

3.02 PARKING

- A. Arrange for temporary parking areas to accommodate use of construction personnel.
- B. When site space is not adequate, provide additional off-site parking.

3.03 CONSTRUCTION PARKING CONTROL

- A. Control vehicular parking to prevent interference with public traffic and parking, access by emergency vehicles, and Owner's operations.
- B. Prevent parking on or adjacent to access roads or in non-designated areas.

3.04 FLAG PERSONS

- A. Provide trained and equipped flag persons to regulate traffic when construction operations or traffic encroach on public traffic lanes.

3.05 FLARES AND LIGHTS

- A. Use flares and lights during hours of low visibility to delineate traffic lanes and to guide traffic.

3.06 HAUL ROUTES

- A. Confine construction traffic to designated haul routes.
- B. Provide traffic control at critical areas of haul routes to regulate traffic, to minimize interference with public traffic.

3.07 TRAFFIC SIGNS AND SIGNALS

- A. At approaches to site and on site, install at crossroads, detours, parking areas, and elsewhere as needed to direct construction and affected public traffic.

3.08 MAINTENANCE

- A. Maintain traffic and parking areas in a sound condition free of excavated material, construction equipment, Products, mud, snow, and ice.
- B. Maintain existing paved areas used for construction; promptly repair breaks, potholes, low areas, standing water, and other deficiencies, to maintain paving and drainage in original, or specified, condition.

3.09 REMOVAL, REPAIR

- A. Repair existing facilities damaged by use, to original condition.
- B. Remove equipment and devices when no longer required.
- C. Repair damage caused by installation.

3.10 MUD FROM SITE VEHICLES

- A. Provide means of removing mud from vehicle wheels before entering streets.

END OF SECTION

SECTION 01 57 21
INDOOR AIR QUALITY CONTROLS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Construction procedures to promote adequate indoor air quality after construction.

1.02 PROJECT GOALS

- A. Dust and Airborne Particulates: Prevent deposition of dust and other particulates in HVAC ducts and equipment.
 - 1. Cleaning of ductwork is not contemplated under this Contract.
 - 2. Contractor shall bear the cost of cleaning required due to failure to protect ducts and equipment from construction dust.
- B. Airborne Contaminants: Procedures and products have been specified to minimize indoor air pollutants.
 - 1. Furnish products meeting the specifications.
 - 2. Avoid construction practices that could result in contamination of installed products leading to indoor air pollution.

1.03 REFERENCE STANDARDS

- A. SMACNA (OCC) - IAQ Guidelines for Occupied Buildings Under Construction; 2007.

1.04 DEFINITIONS

- A. Adsorptive Materials: Gypsum board, acoustical ceiling tile and panels, carpet and carpet tile, fabrics, fibrous insulation, and other similar products.
- B. Contaminants: Gases, vapors, regulated pollutants, airborne mold and mildew, and the like, as specified.
- C. Particulates: Dust, dirt, and other airborne solid matter.
- D. Wet Work: Concrete, plaster, coatings, and other products that emit water vapor or volatile organic compounds during installation, drying, or curing.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Interior Finishes Installation Schedule: Identify each interior finish that either generates odors, moisture, or vapors or is susceptible to adsorption of odors and vapors, and indicate air handling zone, sequence of application, and curing times.
- C. Duct and Terminal Unit Inspection Report.

PART 2 PRODUCTS (NOT USED)

PART 3 EXECUTION

3.01 CONSTRUCTION PROCEDURES

- A. Prevent the absorption of moisture and humidity by adsorptive materials by:
 - 1. Sequencing the delivery of such materials so that they are not present in the building until wet work is completed and dry.
 - 2. Delivery and storage of such materials in fully sealed moisture-impermeable packaging.
 - 3. Provide sufficient ventilation for drying within reasonable time frame.
- B. Begin construction ventilation when building is substantially enclosed.
- C. If extremely dusty or dirty work must be conducted inside the building, shut down HVAC systems for the duration; remove dust and dirt completely before restarting systems.
- D. When working in a portion of an occupied building, prevent movement of air from construction area to occupied area.
- E. Use of HVAC equipment and ductwork for ventilation during construction is not permitted:

1. Provide temporary ventilation equivalent to 1.5 air changes per hour, minimum.
 2. Exhaust directly to outside.
 3. Seal HVAC air inlets and outlets immediately after duct installation.
- F. Do not store construction materials or waste in mechanical or electrical rooms.
- G. Prior to use of return air ductwork without intake filters clean up and remove dust and debris generated by construction activities.
1. Inspect duct intakes, return air grilles, and terminal units for dust.
 2. Clean plenum spaces, including top sides of lay-in ceilings, outsides of ducts, tops of pipes and conduit.
 3. Clean tops of doors and frames.
 4. Clean mechanical and electrical rooms, including tops of pipes, ducts, and conduit, equipment, and supports.
 5. Clean return plenums of air handling units.
 6. Remove intake filters last, after cleaning is complete.
- H. Do not perform dusty or dirty work after starting use of return air ducts without intake filters.
- I. Use other relevant recommendations of SMACNA (OCC) for avoiding unnecessary contamination due to construction procedures.

END OF SECTION

SECTION 01 60 00
PRODUCT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. General product requirements.
- B. Transportation, handling, storage and protection.
- C. Product option requirements.
- D. Substitution limitations and procedures.
- E. Procedures for Owner-supplied products.
- F. Maintenance materials, including extra materials, spare parts, tools, and software.

1.02 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Product quality monitoring.
- B. Section 01 60 01 - Substitution Request Form.
- C. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions: Requirements for VOC-restricted product categories.

1.03 REFERENCE STANDARDS

- A. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. Proposed Products List: Submit list of major products proposed for use, with name of manufacturer, trade name, and model number of each product.
 - 1. Submit within 15 days after date of Agreement.
 - 2. For products specified only by reference standards, list applicable reference standards.
- B. Product Data Submittals: Submit manufacturer's standard published data. Mark each copy to identify applicable products, models, options, and other data. Supplement manufacturers' standard data to provide information specific to this Project.
- C. Shop Drawing Submittals: Prepared specifically for this Project; indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.
- D. Sample Submittals: Illustrate functional and aesthetic characteristics of the product, with integral parts and attachment devices. Coordinate sample submittals for interfacing work.
 - 1. For selection from standard finishes, submit samples of the full range of the manufacturer's standard colors, textures, and patterns.
- E. Indicate utility and electrical characteristics, utility connection requirements, and location of utility outlets for service for functional equipment and appliances.

PART 2 PRODUCTS

2.01 NEW PRODUCTS

- A. Provide new products unless specifically required or permitted by the Contract Documents.
- B. DO NOT USE products having any of the following characteristics:
 - 1. Made outside the United States, its territories, Canada, or Mexico, unless specified in specifications, on Finish Schedule, or on drawings.
 - 2. Made using or containing CFC's or HCFC's.
 - 3. Containing lead, cadmium, asbestos.
- C. Where all other criteria are met, Contractor shall give preference to products that:
 - 1. If used on interior, have lower emissions, as defined in Section 01 61 16.
 - 2. If wet-applied, have lower VOC content, as defined in Section 01 61 16.

3. Have a published GreenScreen Chemical Hazard Analysis.
- D. Provide interchangeable components of the same manufacture for components being replaced.
- E. Wiring Terminations: Provide terminal lugs to match branch circuit conductor quantities, sizes, and materials indicated. Size terminal lugs to NFPA 70, include lugs for terminal box.
- F. Cord and Plug: Provide minimum 6 foot cord and plug including grounding connector for connection to electric wiring system. Cord of longer length is specified in individual specification sections.

2.02 PRODUCT OPTIONS

- A. Products Specified by Reference Standards or by Description Only: Use any product meeting those standards or description.
- B. Products Specified by Naming One or More Manufacturers and "No Substitutes" indicated: Use a product of one of the manufacturers named and meeting specifications, no options or substitutions allowed.
- C. Products Specified by Naming One or More Manufacturers with or without a Provision for Substitutions: Submit a request for substitution for any manufacturer not named.
- D. Products indicated in the color and finish schedules or drawing notes; including color, shade, hue, translucence, opacity, pattern, or texture; establish the Basis of Design. Use the Basis of Design. Submit a request for substitution for any product not indicated.

2.03 MAINTENANCE MATERIALS

- A. Furnish extra materials, spare parts, tools, and software of types and in quantities specified in individual specification sections.
- B. Deliver to Project site; obtain receipt prior to final payment.

PART 3 EXECUTION

3.01 SUBSTITUTION PROCEDURES

- A. Submit substitution requests by completing the form in Section 01 60 01 - Substitution Request Form. Use only this form; other forms of submission are unacceptable.
 1. Submit one electronic pdf file of request for substitution for consideration. Limit each request to one proposed substitution.
- B. Architect Engineer will consider requests for substitutions only within 30 days after date of Agreement.
- C. Products indicated in the color and finish schedules or drawing notes; including color, shade, hue, translucence, opacity, pattern, or texture; establish the Basis of Design. Use the Basis of Design. Submit a request for substitution for any product not named.
- D. Substitutions will not be considered for finishes and colors unless all finishes and colors are coordinated and submitted together.
- E. Document each request with complete data substantiating compliance of proposed substitution with Contract Documents.
- F. A request for substitution constitutes a representation that the submitter:
 1. Has investigated proposed product and determined that it meets or exceeds the quality level of the specified product.
 2. Agrees to provide the same warranty for the substitution as for the specified product.
 3. Agrees to coordinate installation and make changes to other Work that may be required for the Work to be complete with no additional cost to Owner.
 4. Waives claims for additional costs or time extension that may subsequently become apparent.
 5. Agrees to reimburse Owner and Architect Engineer for review or redesign services associated with re-approval by authorities.

- G. Substitutions will not be considered when they are indicated or implied on shop drawing or product data submittals, without separate written request, or when acceptance will require revision to the Contract Documents.
- H. Substitution Submittal Procedure (after contract award):
 - 1. Submit substitution requests by completing the form in Section 01 60 01 - Substitution Request Form. Use only this form; other forms of submission are unacceptable.
 - 2. Submit one electronic pdf file of request for substitution for consideration. Limit each request to one proposed substitution.
 - 3. Submit shop drawings, product data, and certified test results attesting to the proposed product equivalence. Burden of proof is on proposer.
 - 4. Architect Engineer will notify Contractor in writing of decision to accept or reject request.

3.02 OWNER-SUPPLIED PRODUCTS

- A. Owner's Responsibilities:
 - 1. Arrange for and deliver Owner reviewed shop drawings, product data, and samples, to Contractor.
 - 2. Arrange and pay for product delivery to site.
 - 3. On delivery, inspect products jointly with Contractor.
 - 4. Submit claims for transportation damage and replace damaged, defective, or deficient items.
 - 5. Arrange for manufacturers' warranties, inspections, and service.
- B. Contractor's Responsibilities:
 - 1. Review Owner reviewed shop drawings, product data, and samples.
 - 2. Receive and unload products at site; inspect for completeness or damage jointly with Owner.
 - 3. Handle, store, install and finish products.
 - 4. Repair or replace items damaged after receipt.

3.03 TRANSPORTATION AND HANDLING

- A. Package products for shipment in manner to prevent damage; for equipment, package to avoid loss of factory calibration.
- B. If special precautions are required, attach instructions prominently and legibly on outside of packaging.
- C. Coordinate schedule of product delivery to designated prepared areas in order to minimize site storage time and potential damage to stored materials.
- D. Transport and handle products in accordance with manufacturer's instructions.
- E. Transport materials in covered trucks to prevent contamination of product and littering of surrounding areas.
- F. Promptly inspect shipments to ensure that products comply with requirements, quantities are correct, and products are undamaged.
- G. Provide equipment and personnel to handle products by methods to prevent soiling, disfigurement, or damage, and to minimize handling.
- H. Arrange for the return of packing materials, such as wood pallets, where economically feasible.

3.04 STORAGE AND PROTECTION

- A. Designate receiving/storage areas for incoming products so that they are delivered according to installation schedule and placed convenient to work area in order to minimize waste due to excessive materials handling and misapplication.
- B. Store and protect products in accordance with manufacturers' instructions.
- C. Store with seals and labels intact and legible.

- D. Store sensitive products in weather tight, climate controlled, enclosures in an environment favorable to product.
- E. For exterior storage of fabricated products, place on sloped supports above ground.
- F. Provide bonded off-site storage and protection when site does not permit on-site storage or protection.
- G. Protect products from damage or deterioration due to construction operations, weather, precipitation, humidity, temperature, sunlight and ultraviolet light, dirt, dust, and other contaminants.
- H. Comply with manufacturer's warranty conditions, if any.
- I. Do not store products directly on the ground.
- J. Cover products subject to deterioration with impervious sheet covering. Provide ventilation to prevent condensation and degradation of products.
- K. Store loose granular materials on solid flat surfaces in a well-drained area. Prevent mixing with foreign matter.
- L. Prevent contact with material that may cause corrosion, discoloration, or staining.
- M. Provide equipment and personnel to store products by methods to prevent soiling, disfigurement, or damage.
- N. Arrange storage of products to permit access for inspection. Periodically inspect to verify products are undamaged and are maintained in acceptable condition.

END OF SECTION

SECTION 01 60 01

SUBSTITUTION REQUEST FORM

TO: L'OREAL USA (THROUGH A PRIME BIDDER OR TRADE CONTRACTOR)

ATTENTION: _____

SECTION	PARAGRAPH	DESCRIPTION

_____	_____	SPECIFIED ITEM: _____

_____	_____	PROPOSED SUBSTITUTE: _____

Attach complete description, designation, catalog or model number, spec data sheet, and other technical data, including laboratory tests if applicable. In addition to data, include a side-by-side comparison of each element of the specified product and the proposed substitution. The Owner and Architect Engineer must be able to clearly and quickly compare all aspects of the two products. Insufficient information for review may be cause for rejection of proposed substitution. Burdon of proof is proposer's responsibility.

Approved substitution will only be issued by Addendum or other official Modification.

FILL IN BLANKS BELOW:

1. Will substitution affect dimensions indicated on drawings? _____

2. Will substitution affect wiring, piping, ductwork, etc., indicated on drawings? _____

3. Differences between proposed substitution and specified item? _____

4. What affect will substitution have on other trade contractors? _____

5. What affect will substitution have on Project Construction Schedule? _____

6. If necessary, will the undersigned pay for Architect Engineer's cost, required to revise working drawings, caused by substitution? _____

7. Manufacturer's warranties of specified items and proposed items are:
[] Same [] Different (explain) _____

SUBMITTED BY:

| REVIEW COMMENTS

Firm: _____ | [] Incomplete Information

Address: _____ | [] Approved

_____ | [] Approved As Noted

Signature: _____ | (see attached copy)

Date: _____ | [] Not Approved

By: _____ Date: _____ | [] Received Too Late

Telephone: _____ | Remarks: _____

Fax: _____ | _____

This page was intentionally left blank for duplex printing.

SECTION 01 61 16

VOLATILE ORGANIC COMPOUND (VOC) CONTENT RESTRICTIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Requirements for Indoor-Emissions-Restricted products.
- B. Requirements for VOC-Content-Restricted products.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittal procedures.

1.03 DEFINITIONS

- A. Indoor-Emissions-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings.
 - 2. Interior adhesives and sealants, including flooring adhesives.
 - 3. Flooring.
 - 4. Composite wood.
 - 5. Products making up wall and ceiling assemblies.
 - 6. Thermal and acoustical insulation.
- B. VOC-Content-Restricted Products: All products in the following product categories, whether specified or not:
 - 1. Interior paints and coatings.
 - 2. Interior adhesives and sealants, including flooring adhesives.
- C. Interior of Building: Anywhere inside the exterior weather barrier.
- D. Adhesives: All gunnable, trowelable, liquid-applied, and aerosol adhesives, whether specified or not; including flooring adhesives, resilient base adhesives, and pipe jointing adhesives.
- E. Sealants: All gunnable, trowelable, and liquid-applied joint sealants and sealant primers, whether specified or not; including firestopping sealants and duct joint sealers.
- F. Inherently Non-Emitting Materials: Products composed wholly of minerals or metals, unless they include organic-based surface coatings, binders, or sealants; and specifically the following:
 - 1. Concrete.
 - 2. Clay brick.
 - 3. Metals that are plated, anodized, or powder-coated.
 - 4. Glass.
 - 5. Ceramics.
 - 6. Solid wood flooring that is unfinished and untreated.

1.04 REFERENCE STANDARDS

- A. 40 CFR 59, Subpart D - National Volatile Organic Compound Emission Standards for Architectural Coatings; U.S. Environmental Protection Agency; current edition.
- B. ASTM D3960 - Standard Practice for Determining Volatile Organic Compound (VOC) Content of Paints and Related Coatings; 2005 (Reapproved 2018).
- C. CAL (CDPH SM) - Standard Method for the Testing and Evaluation of Volatile Organic Chemical Emissions From Indoor Sources Using Environmental Chambers; 2017, v1.2.
- D. CARB (ATCM) - Airborne Toxic Control Measure to Reduce Formaldehyde Emissions from Composite Wood Products; California Air Resources Board; current edition.
- E. CARB (SCM) - Suggested Control Measure for Architectural Coatings; California Air Resources Board; 2007.
- F. CHPS (HPPD) - High Performance Products Database; Current Edition at www.chps.net/.
- G. CRI (GLP) - Green Label Plus Testing Program - Certified Products; Current Edition.

- H. GreenSeal GS-36 - Adhesives for Commercial Use; 2013.
- I. SCAQMD 1113 - Architectural Coatings; 1977 (Amended 2016).
- J. SCAQMD 1168 - Adhesive and Sealant Applications; 1989 (Amended 2017).
- K. SCS (CPD) - SCS Certified Products; Current Edition.
- L. UL (GGG) - GREENGUARD Gold Certified Products; Current Edition.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: For each VOC-restricted product used in the project, submit evidence of compliance.

1.06 QUALITY ASSURANCE

- A. Indoor Emissions Standard and Test Method: CAL (CDPH SM), using Standard Private Office exposure scenario and the allowable concentrations specified in the method, and range of total VOC's after 14 days.
 - 1. Wet-Applied Products: State amount applied in mass per surface area.
 - 2. Paints and Coatings: Test tinted products, not just tinting bases.
 - 3. Evidence of Compliance: Acceptable types of evidence are the following;
 - a. Current UL (GGG) certification.
 - b. Current SCS (CPD) Floorscore certification.
 - c. Current SCS (CPD) Indoor Advantage Gold certification.
 - d. Current listing in CHPS (HPPD) as a low-emitting product.
 - e. Current CRI (GLP) certification.
 - f. Test report showing compliance and stating exposure scenario used.
 - 4. Product data submittal showing VOC content is NOT acceptable evidence.
 - 5. Manufacturer's certification without test report by independent agency is NOT acceptable evidence.
- B. VOC Content Test Method: 40 CFR 59, Subpart D (EPA Method 24), or ASTM D3960, unless otherwise indicated.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Report of laboratory testing performed in accordance with requirements.
- C. Composite Wood Emissions Standard: CARB (ATCM) for ultra-low emitting formaldehyde (ULEF) resins.
 - 1. Evidence of Compliance: Acceptable types of evidence are:
 - a. Current SCS "No Added Formaldehyde (NAF)" certification; www.scs-certified.com.
 - b. Report of laboratory testing performed in accordance with requirements.
 - c. Published product data showing compliance with requirements.
- D. Testing Agency Qualifications: Independent firm specializing in performing testing and inspections of the type specified in this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. All Products: Comply with the most stringent of federal, State, and local requirements, or these specifications.
- B. Indoor-Emissions-Restricted Products: Comply with Indoor Emissions Standard and Test Method, except for:
 - 1. Composite Wood, Wood Fiber, and Wood Chip Products: Comply with Composite Wood Emissions Standard or contain no added formaldehyde resins.
 - 2. Inherently Non-Emitting Materials.
- C. VOC-Content-Restricted Products: VOC content not greater than required by the following:
 - 1. Adhesives, Including Flooring Adhesives: SCAQMD 1168 Rule.

2. Aerosol Adhesives: GreenSeal GS-36.
3. Joint Sealants: SCAQMD 1168 Rule.
4. Paints and Coatings: Each color; most stringent of the following:
 - a. 40 CFR 59, Subpart D.
 - b. SCAQMD 1113 Rule.
 - c. CARB (SCM).

PART 3 EXECUTION

3.01 FIELD QUALITY CONTROL

- A. Owner reserves the right to reject non-compliant products, whether installed or not, and require their removal and replacement with compliant products at no extra cost to Owner.
- B. Additional costs to restore indoor air quality due to installation of non-compliant products will be borne by Contractor.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 01 70 00
EXECUTION AND CLOSEOUT REQUIREMENTS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Examination, preparation, and general installation procedures.
- B. Requirements for alterations work, including selective demolition.
- C. Pre-installation meetings.
- D. Cutting and patching.
- E. Cleaning and protection.
- F. Starting of systems and equipment.
- G. Demonstration and instruction of Owner personnel.
- H. Closeout procedures, including Contractor's Correction Punch List, except payment procedures.
- I. General requirements for maintenance service.

1.02 RELATED REQUIREMENTS

- A. Section 01 10 00 - Summary: Limitations on working in existing building; continued occupancy.
- B. Section 01 30 00 - Administrative Requirements: Submittals procedures.
- C. Section 01 40 00 - Quality Requirements: Testing and inspection procedures.
- D. Section 01 50 00 - Temporary Facilities and Controls: Temporary interior partitions.
- E. Section 01 51 00 - Temporary Utilities: Temporary heating, cooling, and ventilating facilities.
- F. Section 01 78 00 - Closeout Submittals: Project record documents, operation and maintenance data, warranties and bonds.
- G. Section 01 79 00 - Demonstration and Training: Demonstration of products and systems to be commissioned and where indicated in specific specification sections
- H. Section 02 41 00 - Demolition: Demolition of whole structures and parts thereof; site utility demolition.
- I. Section 07 84 00 - Firestopping.
- J. Individual Product Specification Sections:
 - 1. Advance notification to other sections of openings required in work of those sections.
 - 2. Limitations on cutting structural members.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Demolition Plan: Submit demolition plan as specified by OSHA and local authorities.
 - 1. Indicate extent of demolition, removal sequence, bracing and shoring, and location and construction of barricades and fences. Include design drawings and calculations for bracing and shoring.
 - 2. Identify demolition firm and submit qualifications.
 - 3. Include a summary of safety procedures.
- C. Cutting and Patching: Submit written request in advance of cutting or alteration that affects:
 - 1. Structural integrity of any element of Project.
 - 2. Integrity of weather exposed or moisture resistant element.
 - 3. Efficiency, maintenance, or safety of any operational element.
 - 4. Visual qualities of sight exposed elements.
 - 5. Work of Owner or separate Contractor.
 - 6. Include in request:
 - a. Identification of Project.

- b. Location and description of affected work.
- c. Necessity for cutting or alteration.
- d. Description of proposed work and products to be used.
- e. Effect on work of Owner or separate Contractor.
- f. Written permission of affected separate Contractor.
- g. Date and time work will be executed.

D. Project Record Documents: Accurately record actual locations of capped and active utilities.

1.04 QUALIFICATIONS

A. For demolition work, employ a firm specializing in the type of work required.

1.05 PROJECT CONDITIONS

- A. Use of explosives is not permitted.
- B. Ventilate enclosed areas to assist cure of materials, to dissipate humidity, and to prevent accumulation of dust, fumes, vapors, or gases.
- C. Dust Control: Execute work by methods to minimize raising dust from construction operations. Provide positive means to prevent air-borne dust from dispersing into atmosphere and over adjacent property.
- D. Noise Control: Provide methods, means, and facilities to minimize noise produced by construction operations.
- E. Pollution Control: Provide methods, means, and facilities to prevent contamination of soil, water, and atmosphere from discharge of noxious, toxic substances, and pollutants produced by construction operations. Comply with federal, state, and local regulations.

1.06 COORDINATION

- A. Coordinate scheduling, submittals, and work of the various sections of the Project Manual to ensure efficient and orderly sequence of installation of interdependent construction elements, with provisions for accommodating items installed later.
- B. Notify affected utility companies and comply with their requirements.
- C. Verify that utility requirements and characteristics of new operating equipment are compatible with building utilities. Coordinate work of various sections having interdependent responsibilities for installing, connecting to, and placing in service, such equipment.
- D. Coordinate space requirements, supports, and installation of mechanical and electrical work that are indicated diagrammatically on Drawings. Follow routing shown for pipes, ducts, and conduit, as closely as practicable; place runs parallel with lines of building. Utilize spaces efficiently to maximize accessibility for other installations, for maintenance, and for repairs.
- E. In finished areas except as otherwise indicated, conceal pipes, ducts, and wiring within the construction. Coordinate locations of fixtures and outlets with finish elements.
- F. Coordinate completion and clean-up of work of separate sections.
- G. After Owner occupancy of premises, coordinate access to site for correction of defective work and work not in accordance with Contract Documents, to minimize disruption of Owner's activities.

PART 2 PRODUCTS

2.01 PATCHING MATERIALS

- A. New Materials: As specified in product sections; match existing products and work for patching and extending work.
- B. Type and Quality of Existing Products: Determine by inspecting and testing products where necessary, referring to existing work as a standard.
- C. Product Substitution: For any proposed change in materials, submit request for substitution described in Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 STRUCTURAL WORK

- A. Do not cut-and-patch structural work in a manner resulting in a reduction of load-carrying capacity or load/deflection ratio. Submit proposal and request and obtain Architect Engineer's approval before proceeding with cut-and-patch of structural work.

3.02 VISUAL/QUALITY LIMITATIONS

- A. Do not cut-and-patch work exposed to view, exterior and interior, in a manner resulting in noticeable reduction of visual qualities and similar qualities, as judged by Architect Engineer.
- B. Engage the original installer/fabricator or, if not available, an acceptable equivalent entity, to perform cutting and patching.
- C. Refinish entire surfaces to match adjacent finishes. For continuous surfaces, refinish to nearest intersection. For an assembly, refinish the entire unit.

3.03 LIMITATION ON APPROVALS

- A. Architect Engineer's approval to proceed with cutting and patching does not waive right to later require removal/replacement of work found to be cut-and-patched in an unsatisfactory manner, as judged by Architect Engineer.

3.04 EXAMINATION

- A. Verify that existing site conditions and substrate surfaces are acceptable for subsequent work. Start of work means acceptance of existing conditions.
- B. Verify that existing substrate is capable of structural support or attachment of new work being applied or attached.
- C. Examine and verify specific conditions described in individual specification sections.
- D. Take field measurements before confirming product orders or beginning fabrication, to minimize waste due to over-ordering or misfabrication.
- E. Verify that utility services are available, of the correct characteristics, and in the correct locations.
- F. Prior to Cutting: Examine existing conditions prior to commencing work, including elements subject to damage or movement during cutting and patching. After uncovering existing work, assess conditions affecting performance of work. Beginning of cutting or patching means acceptance of existing conditions.

3.05 PREPARATION

- A. Clean substrate surfaces prior to applying next material or substance.
- B. Seal cracks or openings of substrate prior to applying next material or substance.
- C. Apply manufacturer required or recommended substrate primer, sealer, or conditioner prior to applying any new material or substance in contact or bond.

3.06 PREINSTALLATION MEETINGS

- A. When required in individual specification sections, convene a preinstallation meeting at the site prior to commencing work of the section.
- B. Require attendance of parties directly affecting, or affected by, work of the specific section.
- C. Record minutes and distribute copies within two days after meeting to participants, with two copies to Architect Engineer, Owner, participants, and those affected by decisions made.

3.07 GENERAL INSTALLATION REQUIREMENTS

- A. Install products as specified in individual sections, in accordance with manufacturer's instructions and recommendations, and so as to avoid waste due to necessity for replacement.
- B. Accomplish the Work, including products, equipment, and systems; complete and functional; ready for operation.

- C. Make vertical elements plumb and horizontal elements level, unless otherwise indicated.
- D. Install equipment and fittings plumb and level, neatly aligned with adjacent vertical and horizontal lines, unless otherwise indicated.
- E. Make consistent texture on surfaces, with seamless transitions, unless otherwise indicated.
- F. Make neat transitions between different surfaces, maintaining texture and appearance.

3.08 ALTERATIONS

- A. Drawings showing existing construction and utilities are based on casual field observation and existing record documents only.
 - 1. Verify that construction and utility arrangements are as shown.
 - 2. Report discrepancies to Architect Engineer before disturbing existing installation.
 - 3. Beginning of alterations work constitutes acceptance of existing conditions.
- B. Keep areas in which alterations are being conducted separated from other areas that are still occupied.
 - 1. Provide, erect, and maintain temporary dustproof partitions of construction specified in Section 01 50 00 in locations indicated on drawings.
- C. Remove existing work as indicated and as required to accomplish new work.
 - 1. Remove rotted wood, corroded metals, and deteriorated masonry and concrete; replace with new construction specified.
 - 2. Remove items indicated on drawings.
 - 3. Relocate items indicated on drawings.
 - 4. Where new surface finishes are to be applied to existing work, perform removals, patch, and prepare existing surfaces as required to receive new finish; remove existing finish if necessary for successful application of new finish.
 - 5. Where new surface finishes are not specified or indicated, patch holes and damaged surfaces to match adjacent finished surfaces as closely as possible.
- D. Services (Including but not limited to HVAC, Plumbing, Fire Protection, Electrical, and Telecommunications): Remove, relocate, and extend existing systems to accommodate new construction.
 - 1. Maintain existing active systems that are to remain in operation; maintain access to equipment and operational components; if necessary, modify installation to allow access or provide access panel.
 - 2. Where existing systems or equipment are not active and Contract Documents require reactivation, put back into operational condition; repair supply, distribution, and equipment as required.
 - 3. Where existing active systems serve occupied facilities but are to be replaced with new services, maintain existing systems in service until new systems are complete and ready for service.
 - a. Disable existing systems only to make switchovers and connections; minimize duration of outages.
 - b. Provide temporary connections as required to maintain existing systems in service.
 - 4. Verify that abandoned services serve only abandoned facilities.
 - 5. Remove abandoned pipe, ducts, conduits, and equipment, including those above accessible ceilings; remove back to source of supply where possible, otherwise cap stub and tag with identification; patch holes left by removal using materials specified for new construction.
- E. Protect existing work to remain.
 - 1. Prevent movement of structure; provide shoring and bracing if necessary.
 - 2. Perform cutting to accomplish removals neatly and as specified for cutting new work.
 - 3. Repair adjacent construction and finishes damaged during removal work.
- F. Adapt existing work to fit new work: Make as neat and smooth transition as possible.

1. When existing finished surfaces are cut so that a smooth transition with new work is not possible, terminate existing surface along a straight line at a natural line of division and make recommendation to Architect Engineer.
 2. Where removal of partitions or walls results in adjacent spaces becoming one, rework floors, walls, and ceilings to a smooth plane without breaks, steps, or bulkheads.
 3. Where a change of plane of 1/4 inch or more occurs in existing work, submit recommendation for providing a smooth transition for Architect Engineer review and request instructions.
- G. Patching: Where the existing surface is not indicated to be refinished, patch to match the surface finish that existed prior to cutting. Where the surface is indicated to be refinished, patch so that the substrate is ready for the new finish.
- H. Refinish existing surfaces as indicated:
1. Where rooms or spaces are indicated to be refinished, refinish all visible existing surfaces to remain to the specified condition for each material, with a neat transition to adjacent finishes.
 2. If mechanical or electrical work is exposed accidentally during the work, re-cover and refinish to match.
- I. Clean existing systems and equipment.
- J. Remove demolition debris and abandoned items from alterations areas and dispose of off-site; do not burn or bury.
- K. Do not begin new construction in alterations areas before demolition is complete.
- L. Comply with all other applicable requirements of this section.

3.09 CUTTING AND PATCHING

- A. Whenever possible, execute the work by methods that avoid cutting or patching.
- B. See Alterations article above for additional requirements.
- C. Perform whatever cutting and patching is necessary to:
1. Complete the work.
 2. Fit products together to integrate with other work.
 3. Provide openings for penetration of mechanical, electrical, and other services.
 4. Match work that has been cut to adjacent work.
 5. Repair areas adjacent to cuts to required condition.
 6. Repair new work damaged by subsequent work.
 7. Remove samples of installed work for testing when requested.
 8. Remove and replace defective and non-conforming work.
- D. Execute cutting and patching including excavation and fill to complete the work, to uncover work in order to install improperly sequenced work, to remove and replace defective or non-conforming work, to remove samples of installed work for testing when requested, to provide openings in the work for penetration of mechanical and electrical work, to execute patching to complement adjacent work, and to fit products together to integrate with other work.
- E. Execute work by methods to avoid damage to other work, and which will provide appropriate surfaces to receive patching and finishing. At in place work (new or existing), minimize damage and restore to original or specified condition.
- F. Employ original installer to perform cutting for weather exposed and moisture resistant elements, and sight exposed surfaces.
- G. Cut rigid materials using masonry saw or core drill. Pneumatic tools not allowed without prior approval.
- H. Restore work with new products in accordance with requirements of Contract Documents.
- I. Fit work air tight to pipes, sleeves, ducts, conduit, and other penetrations through surfaces.

- J. At penetrations of fire rated walls, partitions, ceiling, or floor construction, completely seal voids with fire rated material in accordance with Section 07 84 00, to full thickness of the penetrated element.
- K. Patching:
 - 1. Finish patched surfaces to match finish that existed prior to patching. On continuous surfaces, refinish to nearest intersection or natural break. For an assembly, refinish entire unit.
 - 2. Match color, texture, and appearance.
 - 3. Make neat transitions. Where new work abuts or aligns with existing, perform a smooth and uniform transition.
 - 4. Repair patched surfaces that are damaged, lifted, discolored, or showing other imperfections due to patching work. If defects are due to condition of substrate, repair substrate prior to repairing finish.

3.10 PROGRESS CLEANING

- A. Maintain areas free of waste materials, debris, and rubbish. Maintain site in a clean and orderly condition.
- B. Remove debris and rubbish from pipe chases, plenums, attics, crawl spaces, and other closed or remote spaces, prior to enclosing the space.
- C. Broom and vacuum clean interior areas prior to start of surface finishing, and continue cleaning to eliminate dust.
- D. Collect and remove waste materials, debris, and trash/rubbish from site periodically and dispose off-site; do not burn or bury.

3.11 PROTECTION OF INSTALLED WORK

- A. Protect installed work from damage by construction operations.
- B. Provide special protection where specified in individual specification sections.
- C. Provide temporary and removable protection for installed products. Control activity in immediate work area to prevent damage.
- D. Provide protective coverings at walls, projections, jambs, sills, and soffits of openings.
- E. Protect finished floors, stairs, and other surfaces from traffic, dirt, wear, damage, or movement of heavy objects, by protecting with durable sheet materials.
- F. Prohibit traffic or storage upon waterproofed or roofed surfaces. If traffic or activity is necessary, obtain recommendations for protection from waterproofing or roofing material manufacturer.
- G. Remove protective coverings when no longer needed; reuse or recycle coverings if possible.

3.12 STARTING EQUIPMENT AND SYSTEMS

- A. Coordinate schedule for start-up of various equipment and systems.
- B. Notify Owner 7 days prior to start-up of each item.
- C. Verify that each piece of equipment or system has been checked for proper lubrication, drive rotation, belt tension, control sequence, and for conditions that may cause damage.
- D. Verify tests, meter readings, and specified electrical characteristics agree with those required by the equipment or system manufacturer.
- E. Verify that wiring and support components for equipment are complete and tested.
- F. Execute start-up under supervision of applicable Contractor personnel and manufacturer's representative in accordance with manufacturers' instructions.
- G. When specified in individual specification Sections, require manufacturer to provide authorized representative to be present at site to inspect, check, and approve equipment or system installation prior to start-up, and to supervise placing equipment or system in operation.

- H. Submit a written report that equipment or system has been properly installed and is functioning correctly.

3.13 DEMONSTRATION AND INSTRUCTION

- A. See Section 01 79 00 - Demonstration and Training.

3.14 ADJUSTING

- A. Adjust operating products and equipment to ensure smooth and unhindered operation.
- B. Testing, adjusting, and balancing HVAC systems: See Section 23 05 93 - Testing, Adjusting, and Balancing for HVAC.

3.15 FINAL CLEANING

- A. Execute final cleaning prior to final project assessment.
- B. Use cleaning materials that are nonhazardous.
- C. Remove all labels that are not permanent. Do not paint or otherwise cover fire test labels or nameplates on mechanical and electrical equipment.
- D. Clean equipment and fixtures to a sanitary condition with cleaning materials appropriate to the surface and material being cleaned.
- E. Clean filters of operating equipment.
- F. Remove waste, surplus materials, trash/rubbish, and construction facilities from the site; dispose of in legal manner; do not burn or bury.

3.16 CLOSEOUT PROCEDURES

- A. Make submittals that are required by governing or other authorities.
 - 1. Provide copies to Owner.

3.17 MAINTENANCE

- A. Provide service and maintenance of components indicated in specification sections.
- B. Maintenance Period: As indicated in specification sections or, if not indicated, not less than one year from the Date of Substantial Completion or the length of the specified warranty, whichever is longer.
- C. Examine system components at a frequency consistent with reliable operation. Clean, adjust, and lubricate as required.
- D. Include systematic examination, adjustment, and lubrication of components. Repair or replace parts whenever required. Use parts produced by the manufacturer of the original component.
- E. Maintenance service shall not be assigned or transferred to any agent or subcontractor without prior written consent of the Owner.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 01 78 00
CLOSEOUT SUBMITTALS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Project Record Documents.
- B. Operation and Maintenance Data.
- C. Warranties and bonds.

1.02 RELATED REQUIREMENTS

- A. Section 01 30 00 - Administrative Requirements: Submittals procedures, shop drawings, product data, and samples.
- B. Section 01 70 00 - Execution and Closeout Requirements: Contract closeout procedures.
- C. Individual Product Sections: Specific requirements for operation and maintenance data.
- D. Individual Product Sections: Warranties required for specific products or Work.

1.03 SUBMITTALS

- A. Project Record Documents: Submit documents to Owner including Consent of Surety with claim for final Application for Payment.
- B. Operation and Maintenance Data:
 - 1. For equipment, or component parts of equipment put into service during construction and operated by Owner, submit completed documents within ten days after acceptance.
 - 2. Submit one copy of completed documents 15 days prior to final inspection. This copy will be reviewed and returned after final inspection. Revise content of all document sets as required prior to final submission.
 - 3. Submit two sets of revised final documents in final form within 10 days after final inspection.
- C. Warranties and Bonds:
 - 1. For equipment or component parts of equipment put into service during construction with Owner's permission, submit documents within 10 days after acceptance.
 - 2. Make other submittals within 10 days after Date of Substantial Completion, prior to final Application for Payment.
 - 3. For items of Work for which acceptance is delayed beyond Date of Substantial Completion, submit within 10 days after acceptance, listing the date of acceptance as the beginning of the warranty period.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 PROJECT RECORD DOCUMENTS

- A. Maintain on site one set of the following record documents; record actual revisions to the Work:
 - 1. Drawings.
 - 2. Specifications.
 - 3. Addenda.
 - 4. Change Orders and other modifications to the Contract.
 - 5. Reviewed shop drawings, product data, and samples.
 - 6. Manufacturer's instruction for assembly, installation, and adjusting.
- B. Ensure entries are complete and accurate, enabling future reference by Owner.
- C. Store record documents separate from documents used for construction.
- D. Record information concurrent with construction progress.

- E. Specifications: Legibly mark and record at each product section description of actual products installed, including the following:
 - 1. Manufacturer's name and product model and number.
 - 2. Product substitutions or alternates utilized.
 - 3. Changes made by Addenda and modifications.
- F. Record Drawings and Shop Drawings: Legibly mark each item to record actual construction including:
 - 1. Measured depths of foundations in relation to finish first floor datum.
 - 2. Measured horizontal and vertical locations of underground utilities and appurtenances, referenced to permanent surface improvements.
 - 3. Measured locations of internal utilities and appurtenances concealed in construction, referenced to visible and accessible features of the Work.
 - 4. Field changes of dimension and detail.
 - 5. Details not on original Contract drawings.

3.02 OPERATION AND MAINTENANCE DATA

- A. Source Data: For each product or system, list names, addresses and telephone numbers of Subcontractors and suppliers, including local source of supplies and replacement parts.
- B. Product Data: Mark each sheet to clearly identify specific products and component parts, and data applicable to installation. Delete inapplicable information.
- C. Drawings: Supplement product data to illustrate relations of component parts of equipment and systems, to show control and flow diagrams. Do not use Project Record Documents as maintenance drawings.
- D. Typed Text: As required to supplement product data. Provide logical sequence of instructions for each procedure, incorporating manufacturer's instructions.

3.03 OPERATION AND MAINTENANCE DATA FOR MATERIALS AND FINISHES

- A. For Each Product, Applied Material, and Finish:
 - 1. Product data, with catalog number, size, composition, and color and texture designations.
 - 2. Information for re-ordering custom manufactured products.
- B. Instructions for Care and Maintenance: Manufacturer's recommendations for cleaning agents and methods, precautions against detrimental cleaning agents and methods, and recommended schedule for cleaning and maintenance.
- C. Moisture protection and weather-exposed products: Include product data listing applicable reference standards, chemical composition, and details of installation. Provide recommendations for inspections, maintenance, and repair.
- D. Additional information as specified in individual product specification sections.
- E. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.

3.04 OPERATION AND MAINTENANCE DATA FOR EQUIPMENT AND SYSTEMS

- A. For Each Item of Equipment and Each System:
 - 1. Description of unit or system, and component parts.
 - 2. Identify function, normal operating characteristics, and limiting conditions.
 - 3. Include performance curves, with engineering data and tests.
 - 4. Complete nomenclature and model number of replaceable parts.
- B. Where additional instructions are required, beyond the manufacturer's standard printed instructions, have instructions prepared by personnel experienced in the operation and maintenance of the specific products.
- C. Panelboard Circuit Directories: Provide electrical service characteristics, controls, and communications; typed.

- D. Include color coded wiring diagrams as installed.
- E. Operating Procedures: Include start-up, break-in, and routine normal operating instructions and sequences. Include regulation, control, stopping, shut-down, and emergency instructions. Include summer, winter, and any special operating instructions.
- F. Maintenance Requirements: Include routine procedures and guide for preventative maintenance and trouble shooting; disassembly, repair, and reassembly instructions; and alignment, adjusting, balancing, and checking instructions.
- G. Provide servicing and lubrication schedule, and list of lubricants required.
- H. Include manufacturer's printed operation and maintenance instructions.
- I. Include sequence of operation by controls manufacturer.
- J. Provide original manufacturer's parts list, illustrations, assembly drawings, and diagrams required for maintenance.
- K. Provide control diagrams by controls manufacturer as installed.
- L. Provide Contractor's coordination drawings, with color coded piping diagrams as installed.
- M. Provide charts of valve tag numbers, with location and function of each valve, keyed to flow and control diagrams.
- N. Provide list of original manufacturer's spare parts, current prices, and recommended quantities to be maintained in storage.
- O. Include test and balancing reports.
- P. Additional Requirements: As specified in individual product specification sections.

3.05 ASSEMBLY OF OPERATION AND MAINTENANCE MANUALS

- A. Assemble operation and maintenance data into durable manuals for Owner's personnel use, with data arranged in the same sequence as, and identified by, the specification sections.
- B. Where systems involve more than one specification section, provide separate tabbed divider for each system.
- C. Binders: Commercial quality, 8-1/2 by 11 inch three D side ring binders with durable plastic covers; 2 inch maximum ring size. When multiple binders are used, correlate data into related consistent groupings.
- D. Cover: Identify each binder with typed or printed title OPERATION AND MAINTENANCE INSTRUCTIONS; identify title of Project; identify subject matter of contents.
- E. Project Directory: Title and address of Project; names, addresses, and telephone numbers of Architect Engineer, Consultants, Contractor and subcontractors, with names of responsible parties.
- F. Tables of Contents: List every item separated by a divider, using the same identification as on the divider tab; where multiple volumes are required, include all volumes Tables of Contents in each volume, with the current volume clearly identified.
- G. Dividers: Provide tabbed dividers for each separate product and system; identify the contents on the divider tab; immediately following the divider tab include a description of product and major component parts of equipment.
- H. Text: Manufacturer's printed data, or typewritten data on 24 pound paper.
- I. Drawings: Provide with reinforced punched binder tab. Bind in with text; fold larger drawings to size of text pages.
- J. Arrangement of Contents: Organize each volume in parts as follows:
 - 1. Project Directory.
 - 2. Table of Contents, of all volumes, and of this volume.
 - 3. Operation and Maintenance Data: Arranged by system, then by product category.
 - a. Source data.

- b. Operation and maintenance data.
- c. Field quality control data.
- d. Photocopies of warranties and bonds.
- 4. Design Data: To allow for addition of design data furnished by Architect Engineer or others, provide a tab labeled "Design Data" and provide a binder large enough to allow for insertion of at least 20 pages of typed text.

3.06 WARRANTIES AND BONDS

- A. Obtain warranties and bonds, executed in duplicate by responsible Subcontractors, suppliers, and manufacturers, within 10 days after completion of the applicable item of work. Except for items put into use with Owner's permission, leave date of beginning of time of warranty until Date of Substantial completion is determined.
- B. Verify that documents are in proper form, contain full information, and are notarized.
- C. Co-execute submittals when required.
- D. Retain warranties and bonds until time specified for submittal.
- E. Manual: Bind in commercial quality 8-1/2 by 11 inch three D side ring binders with durable plastic covers.
- F. Cover: Identify each binder with typed or printed title WARRANTIES AND BONDS, with title of Project; name, address and telephone number of Contractor and equipment supplier; and name of responsible company principal.
- G. Table of Contents: Neatly typed, in the sequence of the Table of Contents of the Project Manual, with each item identified with the number and title of the specification section in which specified, and the name of product or work item.
- H. Separate each warranty or bond with index tab sheets keyed to the Table of Contents listing. Provide full information, using separate typed sheets as necessary. List Subcontractor, supplier, and manufacturer, with name, address, and telephone number of responsible principal.

END OF SECTION

SECTION 01 79 00
DEMONSTRATION AND TRAINING

PART 1 GENERAL

1.01 SUMMARY

- A. Demonstration of products and systems where indicated in specific specification sections.
- B. Training of Owner personnel in operation and maintenance is required for:
 - 1. All software-operated systems.
 - 2. HVAC systems and equipment.
 - 3. Plumbing equipment.
 - 4. Electrical systems and equipment.
 - 5. Items specified in individual product Sections.
- C. Training of Owner personnel in care, cleaning, maintenance, and repair is required for:
 - 1. Roofing, waterproofing, and other weather-exposed or moisture protection products.
 - 2. Finishes, including flooring, wall finishes, ceiling finishes.
 - 3. Fixtures and fittings.
 - 4. Items specified in individual product Sections.

1.02 RELATED REQUIREMENTS

- A. Section 01 78 00 - Closeout Submittals: Operation and maintenance manuals.
- B. Other Specification Sections: Additional requirements for demonstration and training.

1.03 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Training Plan: Owner will designate personnel to be trained; tailor training to needs and skill-level of attendees.
 - 1. Submit to Architect Engineer for transmittal to Owner.
 - 2. Submit not less than four weeks prior to start of training.
 - 3. Revise and resubmit until acceptable.
 - 4. Provide an overall schedule showing all training sessions.
 - 5. Include at least the following for each training session:
 - a. Identification, date, time, and duration.
 - b. Description of products and/or systems to be covered.
 - c. Name of firm and person conducting training; include qualifications.
 - d. Intended audience, such as job description.
 - e. Objectives of training and suggested methods of ensuring adequate training.
 - f. Methods to be used, such as classroom lecture, live demonstrations, hands-on, etc.
 - g. Media to be used, such as slides, hand-outs, etc.
 - h. Training equipment required, such as projector, projection screen, etc., to be provided by Contractor.
- C. Training Manuals: Provide training manual for each attendee; allow for minimum of two attendees per training session.
 - 1. Include applicable portion of O&M manuals.
 - 2. Include copies of all hand-outs, slides, overheads, video presentations, etc., that are not included in O&M manuals.
 - 3. Provide one extra copy of each training manual to be included with operation and maintenance data.
- D. Training Reports:
 - 1. Identification of each training session, date, time, and duration.
 - 2. Sign-in sheet showing names and job titles of attendees.
- E. Video Recordings: Submit digital video recording of each demonstration and training session for Owner's subsequent use.

1. Format: DVD Disc.
2. Label each disc and container with session identification and date.

1.04 QUALITY ASSURANCE

- A. Instructor Qualifications: Familiar with design, operation, maintenance and troubleshooting of the relevant products and systems.
 1. Provide as instructors the most qualified trainer of those contractors and/or installers who actually supplied and installed the systems and equipment.
 2. Where a single person is not familiar with all aspects, provide specialists with necessary qualifications.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 DEMONSTRATION - GENERAL

- A. Demonstrations conducted during system start-up do not qualify as demonstrations for the purposes of this section, unless approved in advance by Owner.
- B. Demonstration may be combined with Owner personnel training if applicable.
- C. Operating Equipment and Systems: Demonstrate operation in all modes, including start-up, shut-down, seasonal changeover, emergency conditions, and troubleshooting, and maintenance procedures, including scheduled and preventive maintenance.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.
 2. For equipment or systems requiring seasonal operation, perform demonstration for other season within six months.
- D. Non-Operating Products: Demonstrate cleaning, scheduled and preventive maintenance, and repair procedures.
 1. Perform demonstrations not less than two weeks prior to Substantial Completion.

3.02 TRAINING - GENERAL

- A. Conduct training on-site unless otherwise indicated.
- B. Owner will provide classroom and seating at no cost to Contractor.
- C. Provide training in minimum two hour segments.
- D. Training schedule will be subject to availability of Owner's personnel to be trained; re-schedule training sessions as required by Owner; once schedule has been approved by Owner failure to conduct sessions according to schedule will be cause for Owner to charge Contractor for personnel "show-up" time.
- E. Review of Facility Policy on Operation and Maintenance Data: During training discuss:
 1. The location of the O&M manuals and procedures for use and preservation; backup copies.
 2. Typical contents and organization of all manuals, including explanatory information, system narratives, and product specific information.
 3. Typical uses of the O&M manuals.
- F. Product- and System-Specific Training:
 1. Review the applicable O&M manuals.
 2. For systems, provide an overview of system operation, design parameters and constraints, and operational strategies.
 3. Review instructions for proper operation in all modes, including start-up, shut-down, seasonal changeover and emergency procedures, and for maintenance, including preventative maintenance.
 4. Provide hands-on training on all operational modes possible and preventive maintenance.
 5. Emphasize safe and proper operating requirements; discuss relevant health and safety issues and emergency procedures.
 6. Discuss common troubleshooting problems and solutions.

7. Discuss any peculiarities of equipment installation or operation.
 8. Discuss warranties and guarantees, including procedures necessary to avoid voiding coverage.
 9. Review recommended tools and spare parts inventory suggestions of manufacturers.
 10. Review spare parts and tools required to be furnished by Contractor.
 11. Review spare parts suppliers and sources and procurement procedures.
- G. Be prepared to answer questions raised by training attendees; if unable to answer during training session, provide written response within three days.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 01 91 13

GENERAL COMMISSIONING REQUIREMENTS

PART 1 GENERAL

1.01 SUMMARY:

- A. This section includes general requirements that apply to the implementation of the commissioning process without regard to specific systems, assemblies, and components.

1.02 RELATED REQUIREMENTS

- A. Section 23 08 00 - Commissioning of HVAC Systems

1.03 DEFINITIONS

- A. Commissioning Agent (CxA): An independent party, not otherwise associated with the A/E team members or the Contractor, oversees, though he/she may be hired as a subcontractor to them. The CxA directs the day-to-day commissioning activities.
- B. Commissioning Plan: An overall plan that provides the structure, schedule, and coordination planning for the commissioning process.
- C. Commissioning Process: A quality-focused process for enhancing the delivery of a project. The process focuses upon verifying and documenting that the facility and all of its systems and assemblies are planned, designed, installed, tested, and operated, and maintained to meet the Owner's Project Requirements.
- D. Datalogging: Monitoring flows, currents, status, pressures, etc. of equipment using stand-alone data loggers separate from the control system.
- E. Deferred Functional Tests: FPT's that are performed later, after substantial completion, due to partial occupancy, equipment, seasonal requirements, design or other site conditions that disallow the test from being performed.
- F. Deficiency: A condition in the installation or function of a component, piece of equipment or system that is not in compliance with the Contract Documents (that is, does not perform properly or is not complying with the design intent).
- G. Functional Performance Test (FPT): Test of the dynamic function and operation of equipment and systems using manual (direct observation) or monitoring methods. Functional testing is the dynamic testing of systems. Systems are tested under various modes, such as during low cooling or heating loads, high loads, component failures, unoccupied, varying outside air temperatures, fire alarm, power failure, etc. The systems are run through all the control system's sequences of operation and components are verified to be responding as the sequences state. Traditional air or water test and balancing (TAB) is not functional testing. TAB's primary work is setting up the system flows and pressures as specified, while functional testing is verifying that which has already been set up. The CxA develops the functional test procedures in a sequential written form, coordinates, oversees, and documents the actual testing, which is usually performed by the installing contractor or vendor. FPT's are performed after pre-functional checklists, startup, T&B, controls are complete. The subcontractor is responsible for reviewing, understanding, and performing the FPT's.
- H. Issues log: A formal and ongoing record of problems or concerns and their resolution that have been raised by members of the Commissioning Team during the course of the commissioning Process.
- I. Pre-functional Checklist (PFC): A list of items to inspect and elementary component tests to conduct to verify proper installation of equipment, provided by the CxA to the GC and Sub. Pre-functional checklists are primarily static inspections and procedures to prepare the equipment or system for initial operations (e.g., belt tension, oil levels OK, labels affixed, gages in place, sensors calibrated, etc.).
- J. Startup: The initial starting or activating of dynamic equipment, including executing pre-functional checklists.

- K. Test Procedures: The step-by-step process which must be executed to fulfill the test requirements. The test procedures are developed by the CxA with assistance and coordination from GC and subcontractors.
- L. Test Requirements: Requirements specifying what modes and functions, etc. shall be tested. The test procedures are not the detailed test procedures. The test requirements are specified in the Contract Documents.

1.04 ABBREVIATIONS:

- A. The following are common abbreviations used in the Specifications.
 - 1. A/E - Architect and Design Engineers
 - 2. CxA - Commissioning Authority
 - 3. CC - Controls Contractor
 - 4. EC - Electrical Contractor
 - 5. FPT - Functional Performance Test
 - 6. GC - General Contractor
 - 7. MC - Mechanical Contractor
 - 8. PFC - Pre-functional Checklist
 - 9. Subs - Subcontractors to General Contractor
 - 10. TAB - Test and Balance Contractor

1.05 DESCRIPTION

- A. Commissioning
 - 1. This project will have selected building systems commissioned. The commissioning process will be implemented by the Contractor, monitored by the CxA.
 - 2. Commissioning is a systematic process of ensuring that all building systems perform interactively according to the design intent and the Owner's operational needs. This is achieved by actual verification of performance. The commissioning process encompasses documentation, equipment startup, control system calibration, testing and balancing, performance testing and training. Commissioning during the construction phase is intended to achieve the following specific objectives according to the Contract Documents
 - a. Verify that applicable equipment and systems are installed according to the manufacturer's recommendations and to industry accepted minimum standards and that they receive adequate operational checkout by installing contractors.
 - b. Verify and document proper performance of equipment and systems.
 - c. Verify that O&M documentation is complete.
 - d. Verify that the Owner's operating personnel are adequately trained.
- B. The commissioning process does not reduce the responsibility of the system designers or installing contractors to provide a finished and fully functioning product in accordance with the Contract Documents.

1.06 COMMISSIONING TEAM

- A. Members appointed by contractor(s): Individuals, each having authority to act on behalf of the entity he or she represents, explicitly organized to implement the commissioning process through coordinated actions. The commissioning team shall consist of, but not be limited to representatives of each contractor, including project superintendent and subcontractors, installers, suppliers, and specialists deemed appropriate by the CxA.
- B. Members appointed by owner:
 - 1. CxA - An entity identified by the owner who leads, plans, schedules, and coordinates the commissioning team to implement the commissioning process. Owner will engage the contracted commissioning agents under a separate contract.
 - 2. Representatives of the facility user and operation and maintenance personnel.
 - 3. Architect and engineering design professionals.
- C. The Commissioning Team shall include the following members as applicable
 - 1. General Contractor Superintendent

2. General Contractor Project Manager
3. Contractor Quality Control Manager
4. Mechanical Subcontractor Representative
5. Plumbing Subcontractor Representative
6. Electrical Subcontractor Representative
7. Testing, Balancing, and Adjusting Subcontractor Representative
8. Instrumentation and Controls Subcontractor Representative
9. Equipment Manufacturer's Representatives
10. Owner's Representative

1.07 SCHEDULING

- A. The CxA will work with GC according to established protocols to schedule the commissioning activities. The CxA will review the Construction Schedule and verify the commissioning activities are properly scheduled. The GC will integrate all commissioning activities and associate those activities with the proper construction predecessors into the master schedule.

1.08 OVERVIEW OF THE COMMISSIONING PROCESS

- A. Commissioning Plan: The CxA will develop the commissioning plan. The commissioning plan provides guidance and further details the requirements in the execution of the commissioning process. The Specifications take precedence over the Commissioning Plan in the event of a conflict.
- B. Commissioning Process: The following narrative provides a brief overview of the typical commissioning tasks during construction and the general order in which they occur.
 1. Commissioning during construction begins with a meeting conducted by the CxA where the commissioning process is reviewed with the commissioning team members during a scheduled contractors' meeting.
 2. Additional meetings will be required throughout construction, scheduled by the CxA with necessary parties attending, to plan, coordinate, schedule future commissioning related activities, and resolve problems.
 3. Equipment documentation, including: Shop Drawings, installation instructions, detailed start up procedures are submitted to the CxA during the normal submittals process.
 4. The CxA will develop pre-functional checklists for the equipment included in the commissioning process. The checklists will be provided to the Contractor. The installing contractors will complete the checklists as the equipment is installed.
 5. In general, performance verification proceeds from component level to systems and intersystem levels with pre-functional checklists being completed before functional testing.
 6. The Subs, under their own direction, execute and document the pre-functional checklists before and during the start-up process with the GC and the CxA monitoring conformance.
 7. The CxA will visit the jobsite during construction to verify the pre-functional checklist are being completed and are current with the status of the project.
 8. Deficiencies identified by the CxA will be listed on the Commissioning Issues log and tracked to resolution.
 9. The CxA will maintain the issues log and distribute the log to the Commissioning team.
 10. Prior to commencement of functional testing, the Commissioning Team shall perform a systems activation inspection to ensure the systems are ready to be functionally tested.
 - a. The GC will ensure all Pre-functional Checklists are completed. The contractor shall identify any missing checklists and provide as necessary.
 - b. The CxA will verify all Pre-functional Checklists, TAB and startup are complete for systems prior to Functional testing.
 11. The CxA will prepare the Functional Testing protocols for execution with the assistance of GC and Subs.
 12. The GC will schedule the Functional Testing after the Pre-Functional Checklists, TAB and startup are complete and the Functional Testing protocols have been reviewed by the GC and Subs.

13. The CxA will document the Functional Testing process and results.
14. Items of non-compliance in material, installation or setup are noted for the Contractor to correct on the commissioning issues log. Non-complying systems will then be retested and functional performance verified by the GC and the CxA.
15. All functional performance tests are completed before Substantial Completion Date.
16. The CxA will review the O&M documentation for completeness.
17. The GC will review the training plan provided by the Subs. The GC and CxA will witness training session(s) to verify that acceptable training was provided. The GC shall record video and audio of all training for the Owner.

1.09 RESPONSIBILITIES

- A. The general responsibilities of various parties in the commissioning process are provided in this subsection. The specific responsibilities will be included in the commissioning plan.
- B. Owner's Responsibilities:
 1. Attend commissioning meetings as necessary.
 2. Review commissioning deficiency reports and participate in the resolution of deficiencies.
 3. Assign operation and maintenance personnel and schedule them to participate in commissioning team activities.
 4. Assist the GC in coordinating the training of owner's personnel.
- C. Architect/Engineer Responsibilities:
 1. Attend commissioning team meetings as needed.
 2. Provide copies of all project documents including plans, specifications, addenda, ASI, RFI responses, PR's, etc.
 3. Provide any design narrative and sequences documentation requested by the CxA. The designers shall assist in clarifying the operation and control of commissioned equipment in areas where the specifications, control drawings or equipment documentation is not sufficient for writing detailed testing procedures.
 4. Participate in the resolution of deficiencies identified during commissioning, according to the contract documents.
- D. Contractors Responsibilities:
 1. Facilitate the coordination of the commissioning and incorporate commissioning activities into the Master Project Schedule (MPS).
 2. Ensure that all subcontractors and vendors execute their commissioning responsibilities according the contract documents and the MPS.
 3. Provide copies of all submittals to the CxA as needed.
 4. Provide RFI documents related to the commissioned systems to the CxA as needed.
 5. Attend and participate in commissioning team meetings.
 6. Cooperate with the CxA for timely resolution of issues recorded on the issues log.
 7. Complete Pre-functional Checklist as work is completed and provide to the CxA for review and verification.
 8. Notify the CxA when systems are ready for startup and functional testing including completing and submitting system readiness checks.
 9. Provide assistance during the functional testing process including providing sufficient access to all equipment and components.
 10. Collect, compile, and submittal the Operations and Maintenance Manuals for approval prior to scheduling the Owner training sessions.
 11. Document owners training.
- E. Commissioning Authority (CxA) Responsibilities:
 1. Organize and lead the commissioning team.
 2. Coordinate the commissioning work and with the GC and Owner, help integrate commissioning activities into the Master Project Schedule.
 3. Plan and conduct commissioning team meetings.

4. Provide project-specific Pre-functional Checklist and Functional Performance Test procedures.
5. Review completed Pre-Functional Checklist and verify a minimum of 10% in the field prior to Functional Performance Testing.
6. Prepare and maintain the commissioning issues log.
7. Witness Functional Performance Testing of commissioned systems.
8. Verify the contractor has provided adequate training to the owner's personnel for the commissioned systems.
9. Develops and submits a final commissioning report at the end of project construction.

PART 2 PRODUCTS

2.01 TEST EQUIPMENT

- A. All testing equipment required to perform startup and initial checkout and required functional performance testing shall be provided by the contractor for the equipment being tested.
- B. Special equipment, tools, and instruments (only available from vendor, specific to a piece of equipment) required for testing equipment, according to these Contract Documents shall be included in the base bid price to the Contractor and shall be left on site for use by the Owner.
- C. Software: The commissioning team will use the online commissioning tool, CxAlloy Total Quality (TQ), for formal communication. CxAlloy TQ is available at [HTTP://www.cxalloy.com](http://www.cxalloy.com). This tool provides one location for the entire commissioning team to view, prepare, and maintain documents that include equipment lists, issues, field observations, checklists, functional performance test, and testing documentation. CxAlloy TQ features an easy-to-use and efficient data entry system that not only saves time and reduces errors leading directly to cost savings, but also encourages increased engagement from team members. Each commissioning team member will be assigned a user account that will be used to access the project. This account is access controlled. This software will allow the Owner to track its multiple projects through one integrated dashboard. The dashboard summary page will display current status information for issues equipment, checklists and tests. Tracking and monitoring deficiencies is one of the most defining tasks of any commissioning project. CxAlloy TQ, Quality Management Software uses checks and balances designed into its functionality, upon contract award, the project team and the Owner Representatives will be designated with access to all commissioning records and documented issues for the facility. The building will have a customized database for functional test results, Commissioning plans, site observations, equipment information, and other project data that can be accessed from any internet location in the world. CxAlloy captures all project activity, including user responses to issues. This can be used to compare timelines of issue resolution across a portfolio of projects. CxAlloy TQ serves as a central location for storing equipment data during the design and construction phases, aggregating all relevant issues, checklists, and documentation, performance specifications, O&M manuals, and nameplate data. All testing reports and other documentation provided to the CxA are stored in the files section. This section is a robust file management system that allows storage of documents of almost any type (Word, PDF, JPEG, TIFF, AUTOCAD, ETC.) in user-created folders. At the completion of the project, the data can be downloaded into an existing facility maintenance program. If none exists, the data can be seamlessly transferred to its sister software, CxAlloy Facility Maintenance (FM). The functional test achieves and facility information will provide the basis for continuous commissioning of each facility.

2.02 UTILITIES AND ACCESSORIES

- A. Provide utilities necessary to execute testing and commissioning, including electrical power, water, fuels, batteries, and other similar expendable items.
- B. Provide any equipment or device required for access, such as ladders, power lifts, and platforms.

PART 3 EXECUTIONS

3.01 COMMISSIONING COORDINATION MEETING

- A. Commissioning during the Construction Phase starts with a coordination meeting conducted by the Commissioning Authority wherein the commissioning process, activities, and each team member responsibilities are reviewed with the commissioning team members. Commissioning meetings will be conducted throughout construction to plan, coordinate, and schedule activities and address commissioning related issues.
- B. The CxA will prepare a commissioning plan and distribute to the commissioning team. This document outlines the commissioning process, commissioning team responsibilities, schedule for commissioning activities, commissioning documentation requirements, and Identification of systems and equipment to be commissioned. The Cx plan is intended to be a guide to the commissioning process for the project

3.02 SUBMITTALS

- A. The CxA will provide a list of submittal data needed for the Commissioning Process to the GC. The GC will provide the requested information to the CxA as it becomes available. Typically submittal data required includes: detailed manufacturer installation instructions, start-up, operating, and troubleshooting procedures, fan and pump curves, and performance data. This information is required for development of the Pre-Functional checklists

3.03 START-UP AND PRE-FUNCTIONAL CHECKLISTS

- A. The CxA will develop and provide pre-functional checklists for equipment included in the commissioning process. Pre-Functional checklists ensure the equipment and systems are properly installed and operational.
- B. Execution of Pre-Functional Checklists
 - 1. Cx team members will be required to use the software CxAlloy for completing pre-functional checklists and monitoring the ongoing issues log. Access to this software package will be provided to the Cx team members by the CxA. All documents will be stored electronically in the cloud for access via computer or tablet by all Cx team members. The issues log will be maintained by the CxA and updated when reported issues are closed and marked as completed.
 - 2. The Subs and vendors shall execute startup and provide the GC with the signed and dated copy of the completed factory start-up documentation and pre-functional checklist via CxAlloy. The CxA will verify 10 percent of the pre-function checklist.
 - 3. Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off.
 - 4. The GC and CxA shall witness the Start-up.
- C. Deficiencies: Any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully shall be listed at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the GC and the CxA within 2 days of test completion. The GC and CxA will review and monitor outstanding deficiencies. The GC and the subcontractor shall correct deficiencies and re-inspect or re-test, as applicable, at no extra cost to Owner.

3.04 FUNCTIONAL TESTING

- A. Objectives and Scope
 - 1. The CxA directs comprehensive system testing and documents all testing performance. This testing is conducted using functional performance test procedures developed by the CxA.
 - 2. The objective of functional testing is to demonstrate that each system is operating according to the Contract Documents. Functional testing facilitates bringing the systems to full dynamic operation. During the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.

3. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and conditions as power failure, freeze conditions, low oil pressure, no flow, equipment failure, etc. shall also be tested.
 4. Functional Performance testing will not be scheduled until all pre-functional checklists are completed and return to the CxA, the Certificate of Readiness has been provided to the CxA, TAB is complete and all control programming and check out is complete.
- B. Non-Conformance
1. Corrections of minor deficiencies identified may be made during the tests. In such cases, the deficiency and resolution will be documented.
 2. Every effort will be made to expedite the testing process and minimize unnecessary delays, while not compromising the integrity of the procedures.
 3. All deficiencies or non-conformance issues identified during the functional testing shall be corrected and retested at no additional cost to the owner.
 4. Abort functional performance test if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. Functional performance test may be aborted if the CxA determines the system is not sufficiently complete or ready for testing. The Contractor will reimburse the Owner for all cost associated with the effort lost due to re-testing due to test failures and aborted tests. Re-test only after all deficiencies identified during the original test have been corrected.

3.05 OPERATION AND MAINTENANCE MANUALS

- A. O&M Manuals
1. The contractor shall compile O&M manuals for every piece of equipment and building operating or electrical system being commissioned with the following format:
 - a. Format: 8 ½" x 11" 3 ring loose-leaf binders, 3-inch maximum, and electronic format that is compatible with the owner's system. Each binder shall be clearly labeled on the spine. Use as many binders as required. Do not overload binders. Dividers with permanently marked tabs of card stock shall separate each section and sub section. Tab labels shall not be hand written. A separate manual or chapter shall be provided for each system.
 2. Contractor shall submit two draft copies of the completed operating and maintenance manual to the architect/engineer and CxA for review within 60 calendar days after review of equipment shop drawings.
 3. Contractor shall provide approved O&M manuals prior to Owner training sessions.
- B. Commissioning Records
1. The GC shall compile, organize and index project commissioning data into labeled, indexed and tabbed, 3-ring binders and deliver to the CxA for review.
 2. Final Commissioning Report Details
 - a. The Final Commissioning Report shall include an executive summary, list of participants and roles, brief building description, overview of commissioning and testing scope and a general description of testing and verification methods. For each piece of commissioned equipment, the report shall contain
 - 1) Completed Pre-Functional Checklists and Functional Test Reports.
 - 2) Certified and approved factory start-up and testing reports.
 - 3) Records of all required tests and inspections for code compliance and Contract Document compliance, and documentation of approved permits and licenses to operate components of the systems.
 - 4) Training Plan, training procedure, and documentation used to support owners training.
 - b. All outstanding non-compliance items shall be specifically listed. Recommendations for improvement to equipment or operations, future actions, commissioning process changes, etc. shall be listed. Each non-compliance issue shall be referenced to the

specific functional test, inspection, trend log, etc. where the deficiency is documented. The functional performance and efficiency section for each piece of equipment shall include brief description of the verification method used (manual testing, BAS trend logs, data loggers, etc.) and include observations and conclusions from the testing.

3.06 TRAINING OF OWNERS PERSONNEL

- A. The GC shall coordinate the operator training. Training requirements are shown in each Section specifying commissioning and in Sections specifying items or systems to be commissioned. GC shall video all training of personnel.
- B. The CxA will review the content of the training plan and adequacy of the training of Owner personnel for commissioned equipment.
 - 1. Each Sub and vendor responsible for training shall submit a written training plan to the GC and CxA for review prior to training. The plan shall cover the following elements
 - a. Equipment included in training.
 - b. Intended audience
 - c. Location of training
 - d. Objectives
 - e. Subjects covered (description, duration of discussion, special methods, etc.)
 - f. Duration of training on each subject
 - g. Instructor for each subject
 - h. Methods (classroom lecture, video, site walk-through, actual operational demonstrations, written handouts, etc.)
 - i. Instructor and qualifications
 - 2. For the primary HVAC equipment, the Controls Contractor shall provide a short discussion of the control of the equipment during the mechanical or electrical training conducted by others.
 - 3. Electronic recording of the training sessions will be provided by the GC with recordings cataloged by the subcontractor and added to the O&M Manuals. The GC will witness the recording sessions.
- C. See additional training information in section 01 79 00.

3.07 DEFERRED TESTING

- A. Unforeseen Deferred Tests: If any check or test cannot be completed due to the building structure, required occupancy condition or other deficiency, execution of checklists and functional testing may be delayed upon approval of the CxA.

END OF SECTION

SECTION 07 52 05
ROOFING SYSTEM MODIFICATIONS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Cutting and patching of roofing to incorporate alterations or new Work. Extent of roofing system modification includes work as indicated on drawings and by provisions of this section
- B. Adding new roof membrane, flashing, insulation, cover board, and metal counter flashing to match existing roofing system.
- C. Schedule alteration work as required to maintain roof in a watertight condition.

1.02 ADMINISTRATIVE REQUIREMENTS

- A. Pre-installation Meeting: Conduct a pre-installation meeting one week prior to the start of the work of this section; require attendance by all affected trades.
- B. Roof modification work shall match existing. Work shall be acceptable to roof membrane manufacture and shall be compatible with existing roofing system. Warrant roof modification work for no case less than five (5) years from substantial completion. Installer shall be acceptable to roofing membrane manufacturer.

1.03 SUBMITTALS

- A. See Section 01 30 00- Administrative Requirements, for submittal procedures.
- B. Product Data for insulation, cover board, roof flashings, roofing membranes, metal flashings, sealants, adhesives, and fasteners.
- C. Insulation and cover board attachment.
- D. Base flashings and membrane terminations

1.04 PERFORMANCE REQUIREMENTS/QUALITY ASSURANCE

- A. Roofing installer to be approved in writing by existing roofing manufacturer to make repairs.
- B. The existing roofing system is a Siplast Paradiene 20/30FR membrane over coverboard and polyisocyanurate insulation metal deck. Contractor to provide test cuts as needed to verify complete makeup of the roofing system, including board thicknesses. The roof installer of the existing roofing system was Ketcher Roofing, Inc, North Little Rock, Arkansas, Phone Number (501)-372-5216, Hank Ketcher
- C. The existing roofing system has not been tested for asbestos containing materials (ACM). Contractor shall be responsible for testing for ACM's and if required retain services from an abatement company authorized by the State of Arkansas to remove and dispose of any asbestos containing materials and coordinate this work with the removal and replacement of the roofing system required for the Work.
- D. Perform work in accordance with NRCA Roofing and Waterproofing Manual and existing roofing manufacturer's written instructions. Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure.
- E. Single manufacturer to provide roofing membrane, insulation, cover board, membrane flashing, and roof accessories.
- F. Material Compatibility: Provide roofing materials that are compatible with one another and existing roofing system under conditions of service and application required, as demonstrated by roofing manufacturer based on testing and field experience.

1.05 DELIVERY, STORAGE, AND PROTECTION

- A. Deliver products in manufacturer's original containers, dry, undamaged, with seals and labels intact. Store and protect materials from damage and weather in accordance with manufacturer's printed instructions.

- B. Handle and store roofing materials and place equipment in a manner to avoid permanent deflection of deck
- C. Store products in weather protected environment, clear of ground and moisture.
- D. Store liquid materials in their original undamaged containers in a clean, dry, protected location and within the temperature range required by roofing system manufacturer. Protect stored liquid material from direct sunlight.
 - 1. Discard and legally dispose of liquid material that cannot be applied within its stated shelf life.

1.06 1.07 PROJECT CONDITIONS

- A. Coordinate the work with installation of associated roofing materials, and flashings s.
- B. Do not apply roofing membrane when environmental conditions are outside the ranges recommended by manufacturer.
- C. Do not apply roofing membrane during unsuitable weather.
- D. Do not apply roofing membrane when ambient temperature is below 40 degrees F.
- E. Do not apply roofing membrane to damp or frozen deck surface or when precipitation is expected or occurring.
- F. Do not expose materials vulnerable to water or sun damage in quantities greater than can be weatherproofed the same day.
- G. Safety Requirements:
 - 1. All application, material handling, and associated equipment shall conform to and be operated in conformance with OSHA safety requirements.
 - 2. Comply with federal, state, local and Owner fire and safety requirements.
 - 3. Maintain a crewman as a ground area guard whenever existing roofing materials are being removed or new materials being transported to the work area.
 - 4. Maintain fire extinguisher within easy access whenever power tools, and torches are being used.
 - 5. Torch Safety: Crew members handling torches shall be trained by an Authorized Certified Roofing Torch Applicator (CERTA) Trainer, be certified according to CERTA torch safety guidelines as published by the National Roofing Contractor's Association (NRCA), and follow torch safety practices as required by the contractor's insurance carrier. Designate one person on each crew to perform a daily fire watch. The designated crew member shall watch for fires or smoldering materials on all areas during roof construction activity, and for a minimum one hour period after roofing material application has been suspended for the day.

1.07 WARRANTY

- A. Correct defective Work within a five-year period after Date of Substantial Completion.
 - 1. Provide Installers Warranty to cover labor and materials for a period of five years from substantial completion, in which Installer agrees to repair or replace components of the modification to the roofing system that fail in materials or workmanship within specified warranty period. Failure includes roof leaks. See Example Warranty at the end of this section.

PART 2 PRODUCTS

2.01 MATERIALS

- A. General: Perform work in accordance with NRCA Roofing and Waterproofing Manual and manufacturer's instructions. Provide installed roofing membrane and base flashings that remain watertight; do not permit the passage of water; and resist specified uplift pressures, thermally induced movement, and exposure to weather without failure. The Roofing Manufacturer to provide a single source for all components of the roofing system. All systems of which are to be installed per manufacturer's recommendations and requirements.

- B. All Roofing components shall match existing and shall be acceptable to roofing manufacturer for application.
- C. Roof modification work shall be compatible with existing. Work shall be acceptable to the existing roof membrane manufacture. If the existing roofing warranty/bond is valid, new work shall be performed in accordance to the manufacturer's requirement in order not void any preexisting warranty/bond.
- D. Provide manufacturer's roofing system details to match existing roof system and penetration conditions. Also reference the NRCA Roofing and Waterproofing Manual as provided by National Roofing Contractors Association for applicable details for roof modifications.
- E. Roofing membrane, flashings, cover board and insulation shall match existing and shall be acceptable to roofing manufacturer.
 - 1. Polyisocyanurate Board Insulation to be ASTM C 1289, Type II, Class 1, Grade 2, minimum compressive strength of 20 psi, glass-fiber mat on both major surfaces and approved for application by the roofing manufacturer. Thickness and layers as required to match existing application. As approved by the roofing membrane manufacturer.
 - 2. Fiberglass-Mat Faced Gypsum Roof Board to meet ASTM Standard C1177: Georgia-Pacific Gypsum LLC; Dens Deck Roof Board or approved equal, ½ inch in thickness (for use as cover board over insulation). As approved by the roofing membrane manufacturer.
 - 3. Modified Bitumen Interply Sheet, Siplast Paradiene 20, cold applied, over cover board.
 - 4. Modified Bitumen Cap Sheet, Siplast Paradiene 30FR, cold applied, for use over interply.
 - 5. Base Flashing Membrane to be compatible with the roof membrane and as recommended in membrane manufacturer's published literature for application.
- F. Provide all necessary roof accessories required for application of work as approved by roofing membrane manufacturer.
 - 1. Factory-coated steel fasteners and metal plates meeting corrosion-resistance provisions in FMG 4470, designed for fastening membrane to substrate.
 - 2. Provide adhesives, pourable sealers, plastic cement, primers, cants, and other accessories as required by the roofing manufacturer for application
- G. Provide manufacturer's roofing system details to match existing roof system and conditions.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Existing roofing system has not been tested for asbestos containing materials (ACM). Contractor shall be responsible for testing for ACM's and if required retain services from an abatement company authorized by the State of Arkansas to remove and dispose of any asbestos containing materials and coordinate this work with the removal and replacement of the roofing system required for the Work.
- B. Schedule work as required to maintain roof in a watertight condition. Schedule removal and replacement of roofing to occur concurrently and under suitable weather conditions, as established by roofing materials manufacturer, to accomplish installation of new roof system and to limit exposure of the building. Remove no more roofing than can be covered with a roof system and sealed off completely in one work period.
- C. Install in accordance with manufacturer's instructions and as required to provide a weatherproof application, matching existing roofing system and conditions.
- D. The entire roofing repairs, including top finish membrane, shall be finished in one operation up to the line of termination at end of day's work unless otherwise permitted in writing by the roofing system manufacturer. Application of roofing shall immediately follow application of insulation as a continuous operation. Phased construction will not be permitted. Roofing membrane shall be installed according to membrane manufacturer's requirements and specifications.
- E. Comply with manufacturer's recommendations and Owner's safety requirements.

- F. Coordinate installing roofing system components so insulation and cover board will not be exposed to precipitation or left exposed at the end of the workday. Comply with manufacturer's written instructions for application. Install insulation and cover board with long joints of panels in continuous straight lines with end joints staggered between rows, abutting edges and ends between boards a minimum of 12 inches. Insulation shall have a solid bearing on deck and shall not cantilever over deck flutes. Insulation boards to have a minimum 1 ½" bearing on the deck flanges; whenever the installation pattern reduces this dimension, trim insulation board for proper bearing. Offset second layer from first so that joints between layers do not align vertically. Stagger new board joints with existing boards so that a continue vertical joint does not occur at the infill section. Fill gaps exceeding 1/4 inch with insulation. Secure insulation and cover board to substrate to meet wind uplift pressures by mechanically fastening to metal deck substrate.
- G. Install in accordance with manufacturer's instructions and as required to be compatible with existing roofing system. New roofing materials and flashings shall be installed in solvent-free adhesives with seams heat welded. Provide flashing system in accordance with Roofing Manufacturer's written recommendations. Comply with membrane roofing system manufacturer's written instructions for installing of complete roof system.
- H. SMANCA and NRCA Details: Conform work with details shown, and with applicable fabrication requirements of "Architectural Sheet Metal Manual" by SMANCA. Comply with installation details of "Roofing and Waterproofing Manual" by NRCA.
- I. Flashing and Stripping: Provide base flashing system at existing roof as recommended by roofing manufacturer.

3.02 FIELD QUALITY CONTROL

3.03 FINAL ROOF MODIFICATION INSPECTION: ARRANGE FOR ROOF MANUFACTURER'S TECHNICAL PERSONNEL TO INSPECT ROOFING REPAIR INSTALLATION ON COMPLETION TO VERIFY INSTALLATION MEET ALL INSTALLATION REQUIREMENTS AND WILL PROVIDE A WEATHER-TIGHT INSTALLATION.

3.04 ROOFING INSTALLER'S WARRANTY

- A. WHEREAS
 - 1. Name: _____
 - 2. Address: _____
 - a. herein called the "Roofing Installer," has performed roofing and associated work ("work") on the following project:
 - 1) Owner: _____
 - 2) Address: _____
 - 3) Building Name/Type: _____
 - 4) Address: _____
 - 5) Area of Work: _____
 - 6) Acceptance Date: _____
 - 7) Warranty Period: _____
 - 8) Expiration Date: _____
- 3. And Whereas Roofing Installer has contracted (either directly with Owner or indirectly as a subcontractor) to warrant said work against leaks and faulty or defective materials and workmanship for designated Warranty Period,
- 4. Now Therefore Roofing Installer hereby warrants, subject to terms and conditions herein set forth, that during Warranty Period he will, at his own cost and expense, make or cause to be made such repairs to or replacements of said work as are necessary to correct faulty and defective work and as are necessary to maintain said work in a watertight condition.
- 5. This Warranty is made subject to the following terms and conditions:
 - a. Specifically excluded from this Warranty are damages to work and other parts of the building, and to building contents, caused by:
 - 1) lightning;

- 2) peak gust wind speed exceeding 55 mph.
 - 3) fire;
 - 4) failure of roofing system substrate, including cracking, settlement, excessive deflection, deterioration, and decomposition;
 - 5) faulty construction of parapet walls, copings, chimneys, skylights, vents, equipment supports, and other edge conditions and penetrations of the work;
 - 6) vapor condensation on bottom of roofing; and
 - 7) activity on roofing by others, including construction contractors, maintenance personnel, other persons, and animals, whether authorized or unauthorized by Owner
- b. When work has been damaged by any of foregoing causes, Warranty shall be null and void until such damage has been repaired by Roofing Installer and until cost and expense thereof has been paid by Owner or by another responsible party so designated.
 - c. The Roofing Installer is responsible for damage to work covered by this Warranty but is not liable for consequential damages to building or building contents, resulting from leaks or faults or defects of work.
 - d. During Warranty Period, if Owner allows alteration of work by anyone other than Roofing Installer, including cutting, patching, and maintenance in connection with penetrations, attachment of other work, and positioning of anything on roof, this Warranty shall become null and void on date of said alterations, but only to the extent said alterations affect work covered by this Warranty. If Owner engages Roofing Installer to perform said alterations, Warranty shall not become null and void, unless Roofing Installer, before starting said work, shall have notified Owner in writing, showing reasonable cause for claim, that said alterations would likely damage or deteriorate work, thereby reasonably justifying a limitation or termination of this Warranty.
 - e. During Warranty Period, if original use of roof is changed and it becomes used for, but was not originally specified for, a promenade, work deck, spray-cooled surface, flooded basin, or other use or service more severe than originally specified, this Warranty shall become null and void on date of said change, but only to the extent said change affects work covered by this Warranty.
 - f. The Owner shall promptly notify Roofing Installer of observed, known, or suspected leaks, defects, or deterioration and shall afford reasonable opportunity for Roofing Installer to inspect work and to examine evidence of such leaks, defects, or deterioration.
 - g. This Warranty is recognized to be the only warranty of Roofing Installer on said work and shall not operate to restrict or cut off Owner from other remedies and resources lawfully available to Owner in cases of roofing failure. Specifically, this Warranty shall not operate to relieve Roofing Installer of responsibility for performance of original work according to requirements of the Contract Documents, regardless of whether Contract was a contract directly with Owner or a subcontract with Owner's General Contractor.
6. In Witness Whereof, this instrument has been duly executed this _____ day of _____, 20_____.
- a. Authorized Signature: _____
 - b. Name: _____
 - c. Title: _____

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 05 10
BASIC HVAC REQUIREMENTS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 PROJECT MANAGEMENT

- A. Drawings are diagrammatic, all offsets, fitting, valves and accessories are not shown. Refer to all drawings in the contract documents and plan work accordingly. Coordinate with all trades and crafts.
- B. In case of interference between trades, Architect Engineer will decide which work is to take precedence regardless of work that might be installed.

1.03 CODES, ORDINANCES, INSPECTIONS, AND PERMITS

- A. Execute and inspect Work in accordance with local and state codes, laws, ordinances, rules and regulations applicable to particular class of Work.
- B. Should any part of Drawings or specifications be found to be in conflict with applicable codes or ordinances, notify the Architect Engineer, in writing, 72 hours prior to receiving of bids. After the receiving of bids, any discovery of code violations shall be promptly reported to the Architect Engineer. Any work performed knowingly in violation of codes shall be corrected without additional expense to the Owner or his representative.
- C. All plumbing work shall comply with latest local codes and the the State in which the Project is located plumbing code.
- D. Arrange with County, City, or State, if City has no ordinances covering work, for complete inspection, paying all charges pertaining thereto. Give proper authority all requisite notice relating to work under such; afford Architect Engineer and all authorized inspectors every facility for inspection and be responsible for all violations of law. Upon completion of Work, have Work inspected, if required, obtaining certificate of inspection and approval from inspecting agency and deliver such certificate to Architect Engineer. Comply with Division 01.

1.04 COORDINATION

- A. Conduct multi-trade coordination and preinstallation meetings to establish bottom elevations of all piping, ductwork and conduit before fabrication and installation. Comply with Division 01.
- B. All equipment shall be installed in accordance with the manufacturer's recommendations. It is the contractor's responsibility to follow all installation requirements and guidelines provided in the manufacture's installation manual. If there is a conflict with regards to installation, the contractor shall stop work and notify the design Architect Engineer representative.

1.05 SUBMITTALS

- A. Comply with Division 01.
- B. Product Data: Include rated capacities, operating characteristics, furnished specialties, and accessories for plumbing fixtures, plumbing specialties, plumbing equipment, HVAC equipment, HVAC piping specialties, air distribution devices and others as may be requested.
- C. Shop Drawings: Miscellaneous steel for pipe support, duct support, pipe guides, anchors, and miscellaneous steel used for supporting any mechanical equipment.

1.06 SUBSTITUTIONS

- A. Comply with Division 01.
- B. Any proposed substitutions of equipment shall be accompanied by shop drawings showing revised equipment layouts, piping diagrams, ductwork drawings and/or wiring diagrams. Where substituted equipment furnished requires use of larger, more, or differently arranged

connections, such connections shall be installed to the complete satisfaction of Architect Engineer without additional cost to Owner.

- C. Should a substitution be accepted and subsequently proven unsatisfactory for the service intended within the warranty period, the Contractor shall replace this material or equipment with that as originally specified, or corrected as directed by Architect Engineer.

1.07 CLEAN UP

- A. Comply with Division 01.
- B. Do not allow waste material or rubbish to accumulate in or about job site.
- C. Any discoloration or other damage to parts of building, its finish or furnishings due to failure to properly clean or keep clean mechanical systems shall be repaired without cost to Owner.

1.08 EQUIPMENT START-UP AND SYSTEM COORDINATION

- A. Comply with Division 01.
- B. The Contractor shall be responsible for placing all equipment and system components into operation. Individual components shall be coordinated with other parts of Mechanical, Electrical, Plumbing and/or Fire Protection Systems to ensure that the entire project functions as designed and described by the contract documents.

1.09 CUTTING AND PATCHING

- A. Comply with Division 01.
- B. Provide all cutting and patching required to perform the mechanical work, when alteration, repair, renovation, or addition, to existing construction.

1.10 DEMOLITION

- A. Comply with Section 02 4100 - Demolition.

1.11 RECORD DOCUMENTS

- A. Comply with Division 01.

1.12 OPERATION INSTRUCTIONS

- A. Comply with Division 01.
- B. Printed instructions covering the operation and maintenance of each major item of equipment, shall be provided with close out documents. Provide 2 bound manuals containing complete repair parts lists, and operating service and maintenance instructions for all equipment provided.

1.13 INSTRUCTION

- A. Comply with Section 01 7900 - Demonstration and Training.

1.14 LOCAL SITE CONDITIONS

- A. Before bidding, make complete investigation at site in order to be informed as to location of utilities and as to conditions under which work is to be performed. Utility locations shown were obtained from surveys and/or local utility companies and are not to be assumed as being accurate.
- B. Make determination of soil conditions before bidding. These specifications and accompanying drawings in no way imply as to condition of soil to be encountered.

1.15 GUARANTY-WARRANTY

- A. This guarantee shall include capacity and integrated performance of component parts of various systems in strict accord with the true intent and purpose of these specifications. Conduct such tests as herein specified or as may be required by the Architect Engineer to demonstrate capacity and performance ability of various systems to maintain specified conditions.
- B. All materials and equipment shall be new and unused and shall carry a full year's warranty from time Owner accepts building or the date of substantial completion, whichever is earlier,

regardless of start-up date of equipment, unless a longer warranty period is specified under other sections.

1.16 EQUIPMENT CONNECTIONS AND INSTALLATION

- A. Each equipment item with drain connections, shall be provided with a properly-sized drain run to the nearest floor drain or as directed.
- B. Rough-in and make final connection to all equipment requiring same, furnished under other Divisions of these specifications or by the Owner.
 - 1. Provide necessary labor and materials, including stop valves, traps, pressure-reducing valves, etc. necessary. Trap and vent drainage connections as required.
 - 2. If equipment or fixtures to be furnished by Owner and/or Owner's vendor are not delivered prior to final acceptance, services shall be capped or plugged at walls or floor as directed, ready for future connection.
- C. No equipment or fixture shall be "roughed-in" until proper rough-in drawings are in the hands of the trade doing the work.
- D. Unless another form of vibration isolation is used, all equipment shall be mounted at least on neoprene pads.

1.17 ELECTRICAL

- A. Furnish and install all electrical interlock, control and other wiring, not covered specifically under the electrical plans and specifications, for proper operation and control of all equipment specified under this Division of the specifications.
- B. Supervise and coordinate all electrical work in connection with mechanical system.

1.18 EQUIPMENT FEATURES

- A. All belt driven fans shall include an automatic belt tensioner to maintain belt tension after start-up.

1.19 SEISMIC QUALIFICATION OF EQUIPMENT

- A. Provide manufacturer's certificate of compliance for the following equipment requiring seismic qualifications.
 - 1. Boilers

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION - NOT USED

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 05 48

VIBRATION AND SEISMIC CONTROLS FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 DESCRIPTION

- A. Intent:
 - 1. All equipment, piping, ductwork and electrical distribution as noted on the equipment schedule or in the specification shall be mounted using vibration isolators to prevent the transmission of vibration and mechanically transmitted sound to the building structure. Vibration isolators shall be selected in accordance with the weight distribution so as to produce reasonably uniform deflections.
 - 2. All isolators and isolation materials for the Project shall be of the same manufacturer and shall be certified by the manufacturer.
 - 3. It is the intent of the seismic portion of this specification to keep all life-safety, plumbing, mechanical and electrical building system components in place during a seismic event.
 - 4. All such systems shall be installed in strict accordance with seismic codes, component manufacturer's requirements and building construction standards. Whenever a conflict occurs between the manufacturer's requirements or construction standards, the most stringent shall apply.
 - 5. This specification is considered to be minimum requirements for seismic consideration and is not intended as a substitute for legislated, more stringent, national, state or local construction requirements (i.e. California Title 24, California OSHPD, Canadian Building Codes, or other requirements).
 - 6. Any variance or non-compliance with these specification requirements shall be corrected in an Architect Engineer approved manner and without additional expense to the Owner.
 - 7. Seismic restraints shall be designed in accordance with seismic design criteria as indicated on drawings and ASCE 7 chapter 13.
- B. The work in this section includes, but is not limited to the following:
 - 1. Vibration isolation for piping, ductwork and equipment.
 - 2. Equipment isolation bases.
 - 3. Flexible piping connections.
 - 4. Seismic restraints for isolated equipment.
 - 5. Seismic restraints for non-isolated equipment.
 - 6. Certification of seismic restraint designs and installation supervision.
 - 7. Certification of seismic attachment of housekeeping pads.
 - 8. All life-safety, plumbing, mechanical and electrical systems. Equipment buried underground is excluded but entry of services through the foundation wall is included.

1.03 RELATED SECTIONS

- A. Section 26 05 29 - Hangers and Supports for Electrical Systems: Vibration isolation and seismic restraint.

1.04 REFERENCE STANDARDS

- A. ASCE 7 - Minimum Design Loads and Associated Criteria for Buildings and Other Structures; Most Recent Edition Cited by Referring Code or Reference Standard.
- B. ASHRAE (HVAC) - ASHRAE Handbook - HVAC Applications; Most Recent Edition Cited by Referring Code or Reference Standard.
- C. FEMA 412 - Installing Seismic Restraints for Mechanical Equipment; 2002.
- D. FEMA 413 - Installing Seismic Restraints for Electrical Equipment; 2004.

- E. FEMA 414 - Installing Seismic Restraints for Duct and Pipe; 2004.
- F. FEMA E-74 - Reducing the Risks of Nonstructural Earthquake Damage; 2012.
- G. SMACNA (SRM) - Seismic Restraint Manual Guidelines for Mechanical Systems; 2008.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.

1.06 CODE AND STANDARDS REQUIREMENTS

- A. Applicable codes and standards are referenced on the drawings.
- B. ASCE 7, Chapter 13.

1.07 MANUFACTURER'S RESPONSIBILITY

- A. Manufacturer of vibration isolation and seismic control equipment shall have the following responsibilities:
 - 1. Determine vibration isolation and seismic restraint sizes and locations.
 - 2. Provide vibration isolation and seismic restraints as scheduled or specified.
 - 3. Provide calculations and materials if required for restraint of unisolated equipment.
 - 4. Provide installation instructions, drawings and trained field supervision to insure proper installation and performance.

1.08 RELATED WORK

- A. Supplementary Support Steel: Provide supplementary support steel for all equipment, piping, ductwork, etc. including roof mounted equipment, as required or specified.
- B. Attachments: Provide restraint attachment plates cast into housekeeping pads, concrete inserts, double sided beam clamps, etc. in accordance with the requirements of the vibration vendor's calculations.

PART 2 PRODUCTS

2.01 INTENT

- A. All vibration isolators and seismic restraints described in this section shall be the product of a single manufacturer.
 - 1. Mason Industries, www.mason-ind.com, products are the basis of these specifications; products of other manufacturers are acceptable provided their systems strictly comply with the specification and have the approval of the Architect Engineer.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Submittals and certification sheets shall be in accordance with paragraph Submittals.
 - 4. For the purposes of this project, failure is defined as the discontinuance of any attachment point between equipment or structure, vertical permanent deformation greater than 1/8 inch (3 mm) and/or horizontal permanent deformation greater than 1/4 inch (6 mm).

2.02 PRODUCT DESCRIPTIONS

- A. Vibration Isolators and Seismic Restraints:
 - 1. Type 1: Two layers of 3/4 inch (19 mm) thick neoprene pad consisting of 2 inches (50 mm) square waffle modules separated horizontally by a 1/16 inch (1.5 mm) gauge galvanized shim. Load distribution plates shall be used as required. Pads shall be equal to type Super W as manufactured by Mason Industries, Inc.
 - 2. Type 2: Bridge-bearing neoprene mountings shall have a minimum static deflection of 0.2 inch (5 mm) and all directional seismic capability. The mount shall consist of a ductile iron casting containing two separated and opposing molded neoprene elements. The elements shall prevent the central threaded sleeve and attachment bolt from contacting the casting during normal operation. The shock absorbing neoprene materials shall be compounded to bridge-bearing specifications. Mountings shall be UL listed for seismic restraint. Mountings shall be equal to type BR as manufactured by Mason Industries, Inc.

3. Type 3: Sheet metal panels shall be bolted to the walls or supporting structure by assemblies consisting of a neoprene bushing cushioned between 2 steel sleeves. The outer sleeve prevents the sheet metal from cutting into the neoprene. Enlarge panel holes as required. Neoprene elements pass over the bushing to cushion the back panel horizontally. A steel disc covers the inside neoprene element and the inner steel sleeve is elongated to act as a stop so tightening the anchor bolts does not interfere with panel isolation in 3 planes. Bushing assemblies can be applied to the ends of steel cross members where applicable. All neoprene shall be bridge bearing quality. Bushing assemblies shall be equal to type PB as manufactured by Mason Industries, Inc.
4. Type 4: A one piece molded bridge bearing neoprene washer/bushing. The bushing shall surround the anchor bolt and have a flat washer face to avoid metal to metal contact. Neoprene bushings shall be equal to type HG as manufactured by Mason Industries, Inc.
5. Type 5: Spring isolators shall be free standing and laterally stable without any housing and complete with a molded neoprene cup or 1/4 inch (6 mm) neoprene acoustical friction pad between the base plate and the support. All mountings shall have leveling bolts that shall be rigidly bolted to the equipment. Spring diameters shall be no less than 80% of the compressed height of the spring at rated load. Springs shall have a minimum additional travel to solid equal to 50% of the rated deflection. Submittals shall include spring diameters, deflection, compressed spring height and solid spring height. Mountings shall be equal to type SLF as manufactured by Mason Industries, Inc.
6. Type 6: Restrained spring mountings shall have an SLF mounting as described in Type 5, within a rigid housing that includes vertical limit stops to prevent spring extension when weight is removed. The housing shall serve as blocking during erection. Installed and operating heights are equal. A minimum clearance of 1/2 inch (12 mm) shall be maintained around restraining bolts and between the housing and the spring so as not to interfere with the spring action. Restraining Bolts shall have a neoprene bushing between the bolt and the housing. Limit stops shall be out of contact during normal operation. Since housings will be bolted or welded in position there shall be an internal isolation pad. Housing shall be designed to resist all seismic forces. Mountings shall be UL listed for seismic restraint. Mountings shall be equal to type SLR or SLRS as manufactured by Mason Industries, Inc.
7. Type 7: Spring mountings as in Type 5 built into a ductile iron or steel housing to provide all directional seismic snubbing. The snubber shall be adjustable vertically and allow a maximum of 1/4 inch (6 mm) travel in all directions before contacting the resilient snubbing collars. Mountings shall be UL listed for seismic restraint. Mountings shall be equal to type SSLFH as manufactured by Mason Industries, Inc.
8. Type 8: Air Springs shall be manufactured with upper and lower steel sections connected by a replaceable flexible nylon reinforced neoprene element. Air spring configuration shall be multiple bellows to achieve a maximum natural frequency of 3 Hz. Air Springs shall be designed for a burst pressure that is a minimum of three times the published maximum operating pressure. All air spring systems shall be connected to either the building control air or a supplementary air supply and equipped with three leveling valves to maintain leveling within plus or minus 1/8 inch (3 mm). Submittals shall include natural frequency, load and damping tests performed by an independent lab or acoustician. Air Springs shall be equal to type MT and leveling valves equal to type LV as manufactured by Mason Industries, Inc.
9. Type 9: Restrained air spring mountings shall have an MT air spring as described in Type 8, within a rigid housing that includes vertical limit stops to prevent air spring extension when weight is removed. The housing shall serve as blocking during erection. A steel spacer shall be removed after adjustment. Installed and operating heights are equal. A minimum clearance of 1/2 inch (12 mm) shall be maintained around restraining bolts and between the housing and the air spring so as not to interfere with the air spring action. Limit stops shall be out of contact during normal operation. Housing shall be designed to resist all seismic forces. Mountings shall be equal to type SLR-MT as manufactured by Mason Industries, Inc.

10. Type 10: Hangers shall consist of rigid steel frames containing minimum 1-1/4 inch (32 mm) thick neoprene elements at the top and a steel spring with general characteristics as in Type 5 seated in a steel washer reinforced neoprene cup on the bottom. The neoprene element and the cup shall have neoprene bushings projecting through the steel box. To maintain stability the boxes shall not be articulated as clevis hangers nor the neoprene element stacked on top of the spring. Spring diameters and hanger box lower hole sizes shall be large enough to permit the hanger rod to swing through a 30-degree arc from side to side before contacting the rod bushing and short circuiting the spring. Submittals shall include a hanger drawing showing the 30-degree capability. Hangers shall be equal to type 30N as manufactured by Mason Industries, Inc.
 - a. Type 10A: Hangers shall be as described in Type 10, but they shall be supplied with a combination rubber and steel rebound washer as the seismic upstop for suspended piping, ductwork, equipment and electrical cable trays. Rubber thickness shall be a minimum of 1/4 inch (6 mm). Submittals shall include a drawing of the hanger showing the installation of the rebound washer. Hangers shall be equal to type RW30N as manufactured by Mason Industries, Inc.
11. Type 11: Hangers shall be as described in Type 10, but they shall be precompressed and locked at the rated deflection by means of a resilient seismic upstop to keep the piping or equipment at a fixed elevation during installation. The hangers shall be designed with a release mechanism to free the spring after the installation is complete and the hanger is subjected to its full load. Deflection shall be clearly indicated by means of a scale. Submittals shall include a drawing of the hanger showing the 30-degree capability. Hangers shall be equal to type PC30N as manufactured by Mason Industries, Inc.
12. Type 12: Seismic Cable Restraints shall consist of galvanized steel aircraft cables sized to resist seismic loads with a minimum safety factor of two and arranged to provide all-directional restraint. Cables shall be pre-stretched to achieve a certified minimum modulus of elasticity. Cable end connections shall be steel assemblies that swivel to final installation angle and utilize two clamping bolts to provide proper cable engagement. Cables shall not be allowed to bend across sharp edges. Cable assemblies shall be UL listed for seismic restraint. At trapeze anchor locations piping shall be shackled to the trapeze. Cable assemblies shall be equal to type SCB at the ceiling and at the clevis bolt, equal to SCBH between the hanger rod nut and the clevis or equal to SCBV if clamped to a beam, all as manufactured by Mason Industries, Inc.
13. Type 13: Seismic solid braces shall consist of steel angles or channels to resist seismic loads with a minimum safety factor of 2 and arranged to provide all directional restraint. Seismic solid brace end connectors shall be steel assemblies that swivel to the final installation angle and utilize two through bolts to provide proper attachment. Seismic solid brace assembly shall have anchorage preapproval OPA number from OSHPD in the state of California verifying the maximum certified load ratings. At trapeze anchor locations piping shall be shackled to the trapeze. Solid seismic brace assemblies shall be equal to type SSB, SSBS or SSRF as manufactured by Mason Industries, Inc.
14. Type 14: Steel angles, sized to prevent buckling, shall be clamped to pipe or equipment rods utilizing a minimum of three ductile iron clamps at each restraint location when required. Welding of support rods is not acceptable. Rod clamp assemblies shall have an Anchorage Preapproval OPA Number from OSHPD in the State of California. At trapeze anchor locations piping shall be shackled to the trapeze. Rod clamp assemblies shall be equal to type SRC or UC as manufactured by Mason Industries, Inc.
15. Type 15: Pipe clevis cross bolt braces are required in all restraint locations. They shall be special purpose preformed channels deep enough to be held in place by bolts passing over the cross bolt. Clevis cross braces shall be UL listed for seismic restraint. Clevis cross brace shall be equal to type CCB as manufactured by Mason Industries, Inc.
16. Type 16: All-directional seismic snubbers shall consist of interlocking steel members restrained by a one-piece molded neoprene bushing of bridge bearing neoprene. Bushing shall be replaceable and a minimum of 1/4 inch (6 mm) thick. Rated loadings shall not exceed 1000 psi (70.3 kg/sq-cm). A minimum air gap of 1/8 inch (3 mm) shall be

incorporated in the snubber design in all directions before contact is made between the rigid and resilient surfaces. Snubber end caps shall be removable to allow inspection of internal clearances. Neoprene bushings shall be rotated to insure no short circuits exist before systems are activated. Snubbers shall be UL listed for seismic restraint. Snubber shall be equal to type Z-1225 as manufactured by Mason Industries, Inc.

17. Type 17: All-directional seismic snubbers shall consist of interlocking steel members restrained by shock absorbent rubber materials compounded to bridge bearing specifications. Elastomeric materials shall be replaceable and a minimum of 3/4 inch (19 mm) thick. Rated loadings shall not exceed 1000 psi (70.3kg/sq-cm). Snubbers shall be manufactured with an air gap between hard and resilient material of not less than 1/8 inch (3 mm) nor more than 1/4 inch (6 mm). Snubbers shall be installed with factory set clearances. The capacity of the seismic snubber at 3/8 inch (9 mm) deflection shall be equal or greater than the load assigned to the mounting grouping controlled by the snubber multiplied by the applicable G force. Submittals shall include the load deflection curves up to 1/2 inch (12 mm) deflection in the x, y and z planes. Snubbers shall have an anchorage preapproval OPA number from OSHPD in the state of California verifying the maximum certified horizontal and vertical load ratings. Snubbers shall be equal to type Z-1011 as manufactured by Mason Industries, Inc.
18. Type 18: Stud wedge anchors shall be manufactured from full diameter wire, not from undersized wire that is rolled to create the thread. The stud anchor shall also have a safety shoulder which fully supports the wedge ring under load. The stud anchors shall have an evaluation report number from the ICC Evaluation Service, Inc. verifying its allowable loads. Drill-in stud wedge anchors shall be equal to type SAS as manufactured by Mason Industries, Inc.
19. Type 19: Female wedge anchors are preferred in floor locations so isolators or equipment can be slid into place after the anchors are installed. Anchors shall be manufactured from full diameter wire, and shall have a safety shoulder to fully support the wedge ring under load. Female wedge anchors shall have an evaluation report number from the ICC Evaluation Service, Inc. verifying its allowable loads. Drill-in female wedge anchors shall be equal to type SAB as manufactured by Mason Industries, Inc.
20. Type 20: Vibration isolation manufacturer shall furnish integral structural steel bases. Rectangular bases are preferred for all equipment. Centrifugal refrigeration machines and pump bases may be T or L shaped where space is a problem. Pump bases for split case pump shall include supports for suction and discharge elbows. All perimeter members shall be steel beams with a minimum depth equal to 1/10 of the longest dimension of the base. Base depth need not exceed 14 inches (350 mm) provided that deflection and misalignment are limited to values that are acceptable to the . Height saving brackets shall be employed in all mounting locations to provide a base clearance of 1 inch (25 mm). Bases shall be equal to type WF as manufactured by Mason Industries, Inc.
21. Type 21: Vibration isolation manufacturer shall furnish rectangular steel concrete pouring forms for floating and inertia foundations. Bases for split case pumps shall be large enough to provide for suction and discharge elbows. Base depth shall be a minimum of 1/12 of the longest dimension of the base but not less than 6 inches (150 mm). The base depth need not exceed 12 inches (300 mm) unless specifically recommended by the base manufacturer for mass or rigidity. Forms shall include minimum concrete reinforcing consisting of 1/2 inch (12 mm) bars welded in place on 6 inches (150 mm) centers running both ways in a layer 1-1/2 inches (38 mm) above the bottom. Forms shall be furnished with steel templates to hold the anchor bolts sleeves and anchors while concrete is being poured. Height saving brackets shall be employed in all mounting locations to maintain a 1 inch (25 mm) clearance below the base. Wooden formed bases leaving a concrete rather than a steel finish are not acceptable. Base shall be equal to type BMK or K as manufactured by Mason Industries, Inc.
22. Type 22: Curb mounted rooftop equipment shall be mounted on spring isolation curbs. The lower member shall consist of a sheet metal or structural steel sections containing adjustable and removable steel springs that support the upper floating section. The upper

frame shall provide continuous support for the equipment and shall be captive so as to resiliently resist wind and seismic forces. All directional neoprene snubber bushings shall be a minimum of 1/4 inch (6 mm) thick. Steel springs shall be laterally stable and rest on 1/4 inch (6 mm) thick neoprene acoustical pads. Hardware shall be plated and the springs provided with a rust resistant finish. The curbs waterproofing shall consist of a continuous flexible flashing nailed over the lower curbs waterproofing. All spring locations shall have accessibility to adjust springs. Lower curbs shall have provision for 2 inch (50 mm) of insulation. The roof curbs shall be built to seismically contain the rooftop unit. The unit shall be solidly fastened to the top floating rail, and the lower section anchored to the roof structure. Curb shall be UL listed for seismic restraint. Curb shall be equal to type SRSC or RMSS as manufactured by Mason Industries, Inc.

23. Type 23: Flexible spherical expansion joints shall employ peroxide cured EPDM in the covers, liners and Kevlar® tire cord frictioning. Any substitutions shall have equal or superior physical and chemical characteristics. Solid steel rings shall be used within the raised face rubber flanged ends to prevent pullout. Flexible cable bead wire is not acceptable. Sizes 2 inches (50 mm) and larger shall have two spheres reinforced with a ductile iron external ring between spheres. Flanges shall be split ductile iron or steel with hooked or similar interlocks. Sizes 16 inches (400 mm) to 24 inches (600 mm) may be single sphere. Sizes 3/4 inch (19 mm) to 1-1/2 inches (38 mm) may have threaded two piece bolted flange assemblies, one sphere and cable retention. Connectors shall be rated at 250 psi (1.72 MPa) up to 170 degrees F (77 degrees C) with a uniform drop in allowable pressure to 215 psi (1.48 MPa) at 250 degrees F (121 degrees C) in sizes through 14 inches (350 mm). 16 inches (400 mm) through 24 inches (600 mm) single sphere minimum ratings are 180 psi (1.24 MPa) at 170 degrees F (77 degrees C) and 150 psi (1.03 MPa) at 250 degrees F (121 degrees C). Higher rated connectors may be used to accommodate service conditions. All expansion joints shall be factory tested to 150% of rated pressure for 12 minutes before shipment. Safety factors to burst and flange pullout shall be a minimum of 3:1. Concentric reducers to the above ratings may be substituted for equal ended expansion joints.
 - a. Expansion joints shall be installed in piping gaps equal to the length of the expansion joints under pressure. Control rods shall be used in unanchored piping locations. If control rods are used, they shall have 1/2 inch (12 mm) thick Neoprene washer bushings large enough in diameter to take the thrust at 1000 psi (70.3 kg/sq-cm) maximum on the washer area.
 - b. Submittals shall include two test reports by independent consultants showing minimum reductions of 20 DB in vibration accelerations and 10 DB in sound pressure levels at actual blade passage frequencies on this project. All expansion joints shall be installed on the equipment side of the shut off valves. Expansion joints shall be equal to type SAFEFLEX SFDEJ, SFEJ, SFDCR or SFU and Control Rods CR as manufactured by Mason Industries, Inc.
24. Type 24: Flexible stainless steel hose shall have stainless steel braid and carbon steel fittings. Sizes 3 inches (75 mm) and larger shall be flanged. Smaller sizes shall have male nipples.
 - a. Minimum lengths shall be as follows:
 - 1) Flanged:
 - (a) 3 inches x 14 inches (75 by 350 mm)
 - (b) 4 inches x 15 inches (100 by 375 mm)
 - (c) 5 inches x 19 inches (125 by 475 mm)
 - (d) 6 inches x 20 inches (150 by 500 mm)
 - (e) 8 inches x 22 inches (200 by 550 mm)
 - (f) 10 inches x 26 inches (250 by 650 mm)
 - (g) 12 inches x 28 inches (300 by 700 mm)
 - (h) 14 inches x 30 inches (350 by 750 mm)
 - (i) 16 inches x 32 inches (400 by 800 mm)
 - 2) Male Nipples:

- (a) 1/2 inch x 9 inches (12 by 225 mm)
 - (b) 3/4 inch x 10 inches (19 by 250 mm)
 - (c) 1 inch x 11 inches (25 by 275 mm)
 - (d) 1-1/4 inches x 12 inches (32 by 300 mm)
 - (e) 1-1/2 inches x 13 inches (38 by 325 mm)
 - (f) 2 inches x 14 inches (50 by 350 mm)
 - (g) 2-1/2 inches x 18 inches (64 by 450 mm)
- b. Hoses shall be installed on the equipment side of the shut-off valves horizontally and parallel to the equipment shafts wherever possible. Hoses shall be equal to type BSS as manufactured by Mason Industries, Inc.
- 25. Type 25: All-directional acoustical pipe anchor shall consist of two sizes of steel tubing separated by a minimum 1/2 inch (12 mm) thick 60 durometer neoprene. Vertical restraint shall be provided by similar material arranged to prevent vertical travel in either direction. Allowable loads on the isolation material should not exceed 500 psi (35.2 kg/sq-cm) and the design shall be balanced for equal resistance in any direction. All-directional anchors shall be equal to type ADA as manufactured by Mason Industries, Inc.
- 26. Type 26: Pipe guides shall consist of a telescopic arrangement of two sizes of steel tubing separated by a minimum 1/2 inch (12 mm) thickness of 60 durometer neoprene. The height of the guides shall be preset with a shear pin to allow vertical motion due to pipe expansion or contraction. Shear pin shall be removable and reinsertable to allow for selection of pipe movement. Guides shall be capable of plus or minus 1-5/8 inches (41 mm) motion, or to meet location requirements. Pipe guides shall be equal to type VSG as manufactured by Mason Industries, Inc.
- 27. Type 27: Split Wall Seals consist of two bolted pipe halves with minimum 3/4 inch (19 mm) thick neoprene sponge bonded to the inner faces. The seal shall be tightened around the pipe to eliminate clearance between the inner sponge face and the piping. Concrete may be packed around the seal to make it integral with the floor, wall or ceiling if the seal is not already in place around the pipe prior to the construction of the building member. Seals shall project a minimum of 1 inch (25 mm) past either face of the wall. Where temperatures exceed 240 degrees F (115 degrees C), 10 pounds per cubic foot (160 kg/cu. m) density fiberglass may be used in lieu of the sponge. Seals shall be equal to type SWS as manufactured by Mason Industries, Inc.
- 28. Type 28: The horizontal thrust restraint shall consist of a spring element in series with a neoprene molded cup as described in Type 5 with the same deflection as specified for the mountings or hangers. The spring element shall be designed so it can be preset for thrust at the factory and adjusted in the field to allow for a maximum of 1/4 inch (6 mm) movement at start and stop. The assembly shall be furnished with 1 rod and angle brackets for attachment to both the equipment and the ductwork or the equipment and the structure. Horizontal restraints shall be attached at the centerline of thrust and symmetrical on either side of the unit. Horizontal thrust restraints shall be equal to type WBI/WBD as manufactured by Mason Industries, Inc.
- 29. Type 29: Housekeeping pad anchors shall consist of a ductile iron casting that is tapered and hexagonal, smaller at its base than at its top. The upper portion shall have holes for rebar to pass through. The anchor shall be continuously threaded from top to bottom for the attachment of soleplates. Housekeeping pad anchors shall be attached to the structural slab using a stud wedge anchor. Housekeeping pad anchors shall be equal to type HPA and stud wedge anchor shall be equal to type SAS both as manufactured by Mason Industries, Inc.

PART 3 EXECUTION

3.01 GENERAL

- A. All vibration isolators and seismic restraint systems shall be installed in strict accordance with the manufacturer's written instructions and all certified submittal data.

- B. Installation of vibration isolators and seismic restraints shall not cause any change of position of equipment, piping or ductwork resulting in stresses or misalignment.
- C. No rigid connections between equipment and the building structure shall be made that degrades the noise and vibration control system herein specified.
- D. Do not install any equipment, piping, duct or conduit which makes rigid connections with the building unless isolation is not specified. "Building" includes, but is not limited to, slabs, beams, columns, studs and walls.
- E. Coordinate work with other trades to avoid rigid contact with the building.
- F. Any conflicts with other trades which will result in rigid contact with equipment or piping due to inadequate space or other unforeseen conditions should be brought to the Architect Engineer's attention prior to installation. Corrective work required by conflicts after installation shall be at no additional cost to the Owner.
- G. Bring to the Architect Engineer's attention any discrepancies between the specifications and the field conditions or changes required due to specific equipment selection, prior to installation. Corrective work required by discrepancies after installation shall be at no additional cost to the Owner.
- H. Correct all installations which are deemed defective in workmanship and materials at no additional cost to the Owner.
- I. Overstressing of the building structure shall not occur because of overhead support of equipment. Submit loads to the structural engineer of record for approval. Generally bracing may occur from:
 - 1. Flanges of structural beams.
 - 2. Panel points in bar joist construction.
 - 3. Cast in place inserts or wedge type drill-in concrete anchors.
- J. Type 12 cable restraints shall be installed slightly slack to avoid short circuiting the isolated suspended equipment, piping or conduit.
- K. Type 12 cable assemblies are installed taut on non-isolated systems. Type 13 seismic solid braces may be used in place of cables on rigidly attached systems only.
- L. At locations where Type 12 or Type 13 restraints are located, the support rods shall be braced when necessary to accept compressive loads with Type 14 braces.
- M. At locations where Type 12 cable restraints are installed on support rods with spring isolators, the spring isolation hangers shall be Type 10A.
- N. At all locations where Type 12 or Type 13 restraints are attached to pipe clevis's, the clevis cross bolt shall be reinforced with Type 15 braces.
- O. Drill-in concrete anchors for ceiling and wall installation shall be Type 18, and Type 19 female wedge type for floor mounted equipment.
- P. Vibration isolation manufacturer shall furnish integral structural steel bases as required. Independent steel rails are not permitted on this project.
- Q. Hand built elastomeric expansion joints may be used when pipe sizes exceed 24 inches or specified movements exceed Type 23 capabilities.
- R. Where piping passes through walls, floors or ceilings the vibration isolation manufacturer shall provide Type 27 wall seals.
- S. Locate isolation hangers as near to the overhead support structure as possible.
- T. All mechanical equipment shall be vibration isolated and seismically restrained unless otherwise indicated.

3.02 VIBRATION ISOLATION OF PIPING

- A. Horizontal Pipe Isolation: The first four pipe hangers in the main lines near the mechanical equipment shall be as described in Type 11. Brace hanger rods with SRC clamps Type 14.

Horizontal runs in all other locations throughout the building shall be isolated by hangers as described in Type 10 & Type 10A. Floor supported piping shall rest on isolators as described in Type 6. Heat exchangers and expansion tanks are considered part of the piping run. The first three isolators from the isolated equipment will have the same static deflection as specified for the mountings under the connected equipment. If piping is connected to equipment located in basements and hangs from ceilings under occupied spaces the first three hangers shall have 0.75 inch (19 mm) deflection for pipe sizes up to and including 3 inch (75 mm), 1-1/2 inch (38 mm) deflection for pipe sizes up to and including 6 inch (150 mm), and 2-1/2 inch (64 mm) deflection for pipes larger than 6 inch (150 mm) Hangers shall be located as close to the overhead structure as practical. Hanger locations that also have seismic restraints attached shall have type RW Rebound Washers to limit uplift. Where piping connects to mechanical equipment install Type 23 expansion joints or Type 24 stainless hoses as required for the service.

- B. Riser Isolation: Risers shall be suspended from Type 10A hangers or supported by Type 5 mountings, anchored with Type 25 anchors, and guided with Type 26 sliding guides. Steel springs shall be a minimum of 0.75 inch (19 mm) except in those expansion locations where additional deflection is required to limit load changes to plus or minus 25 percent of the initial load. Submittals shall include riser diagrams and calculations showing anticipated expansion and contraction at each support point, initial and final loads on the building structure, spring deflection changes and seismic loads. Submittal data shall include certification that the riser system has been examined for excessive stresses and that none will exist in the proposed design.
- C. Seismic Restraint of Piping:
 - 1. Seismically restrain all piping listed as a, b or c below. Use Type 12 cables if isolated. Type 12 or Type 13 restraints may be used on unisolated piping.
 - a. Fuel oil piping, gas piping, medical gas piping, and compressed air piping that is 1 inch (25 mm) I.D. or larger.
 - b. Piping located in boiler rooms, mechanical equipment rooms, and refrigeration equipment rooms that is 1-1/4 inch (32 mm) I.D. and larger.
 - c. All other piping 2-1/2-inch (64 mm) diameter and larger.
 - 2. Transverse piping restraints shall be at 40 feet (12 m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
 - 3. Longitudinal restraints shall be at 80 feet (24 m) maximum spacing for all pipe sizes, except where lesser spacing is required to limit anchorage loads.
 - 4. Where thermal expansion is a consideration, guides and anchors may be used as transverse and longitudinal restraints provided they have a capacity equal to or greater than the restraint loads in addition to the loads induced by expansion or contraction.
 - 5. For fuel oil and all gas piping transverse restraints shall be at 20 feet (6 m) maximum and longitudinal restraints at 40 feet (12 m) maximum spacing.
 - 6. Transverse restraint for one pipe section may also act as a longitudinal restraint for a pipe section of the same size connected perpendicular to it if the restraint is installed within 24 inches (600 mm) of the elbow or TEE or combined stresses are within allowable limits at longer distances.
 - 7. Hold down clamps shall be used to attach pipe to all trapeze members before applying restraints in a manner similar to clevis supports.
 - 8. Branch lines may not be used to restrain main lines.
 - 9. Cast iron pipe of all types, glass pipe and any other pipes joined with a four band shield and clamp assembly in areas with S_s of 0.35 or greater shall be braced as in Sections 3.02.C.2 and 3.02.C.3. For areas with S_s less than 0.35, 2 band clamps may be used with a reduced spacing of 1/2 of those listed in sections 3.02.C.2 and 3.02.C.3.
 - 10. Connection to the structure shall be made with a non-friction connection (i.e. no C-clamps).
 - 11. Hanger locations that also have seismic restraints attached shall have Type 10A RW Rebound Washers.

D. Pipe Exclusions:

1. Gas piping less than 1 inch (25 mm) inside diameter.
2. Piping in boiler and mechanical rooms less than 1-1/4 inch (32 mm) inside diameter.
3. All other piping less than 2-1/2 inch (64 mm) inside diameter.
4. Certain suspended piping:
 - a. All piping suspended by clevis hangers where the distance from the top of the pipe to the suspension point is 12 inches or less.
 - b. All trapeze supported piping where the distance from the suspension point to the trapeze member is 12-inch or less.
 - c. If any suspension location in the run fails to qualify under (a) or (b) above, the entire run shall be braced.

3.03 ELECTRICAL SERVICES

A. Seismic Restraint:

1. All electrical conduit 2-1/2-inch (64 mm) in diameter and larger shall be restrained with Type 12 seismic cable restraints or Type 13 for seismic solid brace restraints.
2. All electrical bus ducts, cable trays and ladder trays shall be restrained with Type 12, seismic cable restraints or Type 13 seismic solid brace restraints.
3. Transverse restraints shall occur at 30 feet (9 m) intervals or both ends if the electrical run is less than the specified interval. Transverse restraints shall be installed at each electrical services turn and at each end of the electric run.
4. Longitudinal restraints shall occur at 60 feet (18 m) intervals with at least one restraint per electric run. Transverse restraints for one electric section may also act as a longitudinal restraint for a duct for an electric section connected perpendicular to it if the restraints are installed within 4 feet (1.2 m) of the intersection of the electric run and if the restraints are sized for the larger electric run.
5. All floor mounted transformers, motor starters, switchgears and substations shall have a resilient media between the equipment mounting hole and the anchor bolt. Anchor bolts shall be designed in accordance with seismic forces shown on Structural Drawings. Neoprene bushings shall be Type 4 and anchor bolts shall be Type 18 or Type 19.
6. Wall mounted panels, transformers and motor starters shall be mounted with Type 3 bushings. Floor mounted panels shall be mounted on Type 4 bushings. Anchor bolts shall be Type 18 or Type 19.
7. All generators shall be mounted on a Type 21 concrete inertia base, with Type 5 spring isolators and Type 17 seismic snubbers.
8. Connection to the structure shall be made with a non-friction connection (i.e. no C-clamps)

B. Exclusions:

1. All conduit less than 2-1/2 inches (64 mm) diameter suspended by individual hanger rods.
2. Certain Suspended Conduit:
 - a. All conduits suspended by clevis hangers where the distance from the top of the conduit to the suspension point is 12 inches (300 mm) or less.
 - b. All trapeze supported conduits, bus ducts and cable trays where the distance from the suspension point to the trapeze member is 12 inches (300 mm) or less.
 - c. If any suspension location in the run fails to qualify under (a) or (b) above, the entire run shall be braced.

END OF SECTION

SECTION 23 05 53

IDENTIFICATION FOR HVAC PIPING AND EQUIPMENT

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Nameplates.
- B. Tags.
- C. Pipe markers.

1.03 REFERENCE STANDARDS

- A. ASME A13.1 - Scheme for the Identification of Piping Systems; 2020.
- B. ASTM D709 - Standard Specification for Laminated Thermosetting Materials; 2017.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. List: Submit list of wording, symbols, letter size, and color coding for mechanical identification.
- C. Chart and Schedule: Submit valve chart and schedule, including valve tag number, location, function, and valve manufacturer's name and model number.
- D. Product Data: Provide manufacturers catalog literature for each product required.
- E. Manufacturer's Installation Instructions: Indicate special procedures, and installation.
- F. Project Record Documents: Record actual locations of tagged valves.

PART 2 PRODUCTS

2.01 IDENTIFICATION APPLICATIONS

- A. Automatic Controls: Tags. Key to control schematic.
- B. Control Panels: Nameplates.
- C. Boiler: Nameplates.
- D. Instrumentation: Tags.
- E. Major Control Components: Nameplates.
- F. Piping: Pipe markers.
- G. Tanks: Nameplates.
- H. Valves: Tags.

2.02 NAMEPLATES

- A. Manufacturers:
- B. Letter Color: White.
- C. Letter Height: 1/4 inch.
- D. Background Color: Black.
- E. Plastic: Comply with ASTM D709.

2.03 TAGS

- A. Manufacturers:
- B. Plastic Tags: Laminated three-layer plastic with engraved black letters on light contrasting background color. Tag size minimum 1-1/2 inch diameter.

- C. Metal Tags: Brass with stamped letters; tag size minimum 1-1/2 inch diameter with smooth edges.
- D. Valve Tag Chart: Typewritten letter size list in anodized aluminum frame.

2.04 PIPE MARKERS

- A. Color: Comply with ASME A13.1.
- B. Plastic Pipe Markers: Factory fabricated, flexible, semi- rigid plastic, preformed to fit around pipe or pipe covering; minimum information indicating flow direction arrow and identification of fluid being conveyed.
- C. Plastic Tape Pipe Markers: Flexible, vinyl film tape with pressure sensitive adhesive backing and printed markings.

PART 3 EXECUTION

3.01 PREPARATION

- A. Degrease and clean surfaces to receive adhesive for identification materials.

3.02 INSTALLATION

- A. Install nameplates with corrosive-resistant mechanical fasteners, or adhesive. Apply with sufficient adhesive to ensure permanent adhesion and seal with clear lacquer.
- B. Install tags with corrosion resistant chain.
- C. Install plastic pipe markers in accordance with manufacturer's instructions.
- D. Install plastic tape pipe markers complete around pipe in accordance with manufacturer's instructions.
- E. Use tags on piping 3/4 inch diameter and smaller.

END OF SECTION

SECTION 23 05 93
TESTING, ADJUSTING, AND BALANCING FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Testing, adjustment, and balancing of hydronic and steam systems.k
- B. Measurement of final operating condition of HVAC systems.
- C. Commissioning activities.

1.03 RELATED REQUIREMENTS

- A. Section 01 40 00 - Quality Requirements: Employment of testing agency and payment for services.
- B. Section 01 91 13 - General Commissioning Requirements: Commissioning requirements that apply to all types of work.
- C. Section 23 08 00 - Commissioning of HVAC.

1.04 REFERENCE STANDARDS

- A. AABC (NSTSB) - AABC National Standards for Total System Balance, 7th Edition; 2016.
- B. ASHRAE Std 111 - Measurement, Testing, Adjusting, and Balancing of Building HVAC Systems; 2008, with Errata (2019).
- C. NEBB (TAB) - Procedural Standards for Testing Adjusting and Balancing of Environmental Systems; 2015, with Errata (2017).
- D. SMACNA (TAB) - HVAC Systems Testing, Adjusting and Balancing; 2002.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Installer Qualifications: Submit name of adjusting and balancing agency and TAB supervisor for approval within 30 days after award of Contract.
- C. TAB Plan: Submit a written plan indicating the testing, adjusting, and balancing standard to be followed and the specific approach for each system and component.
 - 1. Submit to Architect Engineer.
 - 2. Submit to the Commissioning Authority.
 - 3. Submit six weeks prior to starting the testing, adjusting, and balancing work.
 - 4. Include certification that the plan developer has reviewed the contract documents, the equipment and systems, and the control system with the Architect Engineer and other installers to sufficiently understand the design intent for each system.
 - 5. Include at least the following in the plan:
 - a. List of all water flow, steam, sound level, system capacity and efficiency measurements to be performed and a description of specific test procedures, parameters, formulas to be used.
 - b. Copy of field checkout sheets and logs to be used, listing each piece of equipment to be tested, adjusted and balanced with the data cells to be gathered for each.
 - c. Discussion of what notations and markings will be made on the duct and piping drawings during the process.
 - d. Final test report forms to be used.
 - e. Expected problems and solutions, etc.
 - f. Procedures for formal deficiency reports, including scope, frequency and distribution.

- D. Final Report: Indicate deficiencies in systems that would prevent proper testing, adjusting, and balancing of systems and equipment to achieve specified performance.
 - 1. Submit to the the Commissioning Authority within two weeks after completion of testing, adjusting, and balancing.
 - 2. Revise TAB plan to reflect actual procedures and submit as part of final report.
 - 3. Submit draft copies of report for review prior to final acceptance of Project. Provide final copies for Architect Engineer and for inclusion in operating and maintenance manuals.
 - 4. Include actual instrument list, with manufacturer name, serial number, and date of calibration.
 - 5. Form of Test Reports: Where the TAB standard being followed recommends a report format use that; otherwise, follow ASHRAE Std 111.
 - 6. Units of Measure: Report data in I-P (inch-pound) units only.
 - 7. Include the following on the title page of each report:
 - a. Name of Testing, Adjusting, and Balancing Agency.
 - b. Address of Testing, Adjusting, and Balancing Agency.
 - c. Telephone number of Testing, Adjusting, and Balancing Agency.
 - d. Project name.
 - e. Project location.
 - f. Project Contractor.
 - g. Report date.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 GENERAL REQUIREMENTS

- A. Perform total system balance in accordance with one of the following:
 - 1. AABC (NSTSB), AABC National Standards for Total System Balance.
 - 2. ASHRAE Std 111, Practices for Measurement, Testing, Adjusting and Balancing of Building Heating, Ventilation, Air-Conditioning, and Refrigeration Systems.
 - 3. SMACNA (TAB).
 - 4. Maintain at least one copy of the standard to be used at project site at all times.
- B. Begin work after completion of systems to be tested, adjusted, or balanced and complete work prior to Substantial Completion of the project.
- C. Where HVAC systems and/or components interface with life safety systems, including fire and smoke detection, alarm, and control, coordinate scheduling and testing and inspection procedures with the authorities having jurisdiction.
- D. TAB Agency Qualifications:
 - 1. Company specializing in the testing, adjusting, and balancing of systems specified in this section.
 - 2. Having minimum of three years documented experience.
 - 3. Certified by one of the following:
 - a. AABC, Associated Air Balance Council: www.aabc.com; upon completion submit AABC National Performance Guaranty.
 - b. TABB, The Testing, Adjusting, and Balancing Bureau of National Energy Management Institute: www.tabbcertified.org
- E. TAB Supervisor and Technician Qualifications: Certified by same organization as TAB agency.

3.02 EXAMINATION

- A. Verify that systems are complete and operable before commencing work. Ensure the following conditions:
 - 1. Systems are started and operating in a safe and normal condition.
 - 2. Temperature control systems are installed complete and operable.
 - 3. Proper thermal overload protection is in place for electrical equipment.

4. Hydronic systems are flushed, filled, and vented.
 5. Proper strainer baskets are clean and in place.
 6. Service and balance valves are open.
- B. Submit field reports. Report defects and deficiencies that will or could prevent proper system balance.
- C. Beginning of work means acceptance of existing conditions.

3.03 PREPARATION

3.04 ADJUSTMENT TOLERANCES

- A. Hydronic Systems: Adjust to within plus or minus 10 percent of design.

3.05 RECORDING AND ADJUSTING

- A. Field Logs: Maintain written logs including:
1. Running log of events and issues.
 2. Discrepancies, deficient or uncompleted work by others.
 3. Contract interpretation requests.
 4. Lists of completed tests.
- B. Ensure recorded data represents actual measured or observed conditions.
- C. Permanently mark settings of valves, and other adjustment devices allowing settings to be restored. Set and lock memory stops.
- D. After adjustment, take measurements to verify balance has not been disrupted or that such disruption has been rectified.
- E. Leave systems in proper working order.
- F. At final inspection, recheck random selections of data recorded in report. Recheck points or areas as selected and witnessed by the Owner.

3.06 WATER SYSTEM PROCEDURE

- A. Adjust water systems to provide required or design quantities.
- B. Use calibrated Venturi tubes, orifices, or other metered fittings and pressure gages to determine flow rates for system balance. Where flow metering devices are not installed, base flow balance on temperature difference across various heat transfer elements in the system.
- C. Adjust systems to provide specified pressure drops and flows through heat transfer elements prior to thermal testing. Perform balancing by measurement of temperature differential in conjunction with air balancing.
- D. Effect system balance with automatic control valves fully open to heat transfer elements.
- E. Effect adjustment of water distribution systems by means of balancing cocks, valves, and fittings. Do not use service or shut-off valves for balancing unless indexed for balance point.

3.07 COMMISSIONING

- A. See Sections 01 91 13 - General Commissioning Requirements and 23 08 00 for additional requirements.
- B. Perform prerequisites prior to starting commissioning activities.
- C. Fill out Prefunctional Checklists for:
1. Water side systems.
- D. Furnish to the Commissioning Authority, upon request, any data gathered but not shown in the final TAB report.
- E. In the presence of the Commissioning Authority, verify that:
1. Final settings of all valves and other adjustment devices have been permanently marked.

2. The water system is being controlled to the lowest possible pressure while still meeting design loads, less diversity; this shall include a review of TAB methods, established control setpoints.

3.08 SCOPE

- A. Test, adjust, and balance the following:
 1. Boiler Feedwater Pumps.

3.09 MINIMUM DATA TO BE REPORTED

- A. Electric Steam Boilers:
 1. Boiler manufacturer
 2. Model number
 3. Serial number
 4. Design kW
 5. Number of steps
 6. Phase, voltage, amperage
 7. Test voltage (each phase)
 8. Test amperage (each phase)
 9. Steam capacity, design and actual
 10. Steam pressure, design and actual
 11. Feedwater temperature, design and actual

END OF SECTION

SECTION 23 07 16

HVAC EQUIPMENT INSULATION

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Flexible removable and reusable blanket insulation.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- B. Section 23 22 13 - Steam and Condensate Heating Piping: Placement of hangers and hanger inserts.
- C. Section 23 22 14 - Steam and Condensate Heating Specialties

1.03 REFERENCE STANDARDS

- A. ASTM C177 - Standard Test Method for Steady-State Heat Flux Measurements and Thermal Transmission Properties by Means of the Guarded-Hot-Plate Apparatus; 2019.
- B. ASTM C518 - Standard Test Method for Steady-State Thermal Transmission Properties by Means of the Heat Flow Meter Apparatus; 2021.
- C. ASTM C553 - Standard Specification for Mineral Fiber Blanket Thermal Insulation for Commercial and Industrial Applications; 2013 (Reapproved 2019).
- D. ASTM C1695 - Standard Specification for Fabrication of Flexible Removable and Reusable Blanket Insulation for Hot Service; 2020.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- F. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for equipment scheduled.
- C. Manufacturer's Instructions: Indicate installation procedures that ensure acceptable workmanship and installation standards will be achieved.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with not less than three years of documented experience.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site in original factory packaging, labeled with manufacturer's identification, including product density and thickness.
- B. Protect insulation from weather and construction traffic, dirt, water, chemical, and mechanical damage, by storing in original wrapping.

1.07 FIELD CONDITIONS

- A. Maintain ambient temperatures and conditions required by manufacturers of adhesives, mastics, and insulation cements.
- B. Maintain temperature during and after installation for minimum period of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 FLEXIBLE REMOVABLE AND REUSABLE BLANKET INSULATION

- A. Insulation: ASTM C553 Type V; flexible, noncombustible.
 - 1. Comply with ASTM C1695.
 - 2. K Value: 0.37 at 100 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 3. Maximum Service Temperature: 500 degrees F.
 - 4. Maximum Water Vapor Absorption: Less than 5.0 percent by weight.
 - 5. Color: Gray.
 - 6. Weight: 7.65 oz per sq ft.
 - 7. Effective Thickness: 1.25 plus/minus 0.25 inch.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that equipment has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Factory Insulated Equipment: Do not insulate.
- C. Exposed Equipment: Locate insulation and cover seams in least visible locations.
- D. Apply insulation close to equipment by grooving, scoring, and beveling insulation. Fasten insulation to equipment with studs, pins, clips, adhesive, wires, or bands.
- E. Fill joints, cracks, seams, and depressions with bedding compound to form smooth surface. On cold equipment, use vapor barrier cement.
- F. Insulated equipment containing fluids below ambient temperature; insulate entire system.
- G. Fiber glass insulated equipment containing fluids below ambient temperature; provide vapor barrier jackets, factory-applied or field-applied. Finish with glass cloth and vapor barrier adhesive.
- H. For hot equipment containing fluids over 140 degrees F, insulate flanges and unions with removable sections and jackets.
- I. Nameplates and ASME Stamps: Bevel and seal insulation around; do not insulate over.
- J. Equipment Requiring Access for Maintenance, Repair, or Cleaning: Install insulation so it can be easily removed and replaced without damage.

3.03 SCHEDULE

- A. Heating Systems:
 - 1. Steam gate valve bodies: Flexible Removable and Reusable blanket insulation

END OF SECTION

SECTION 23 07 19
HVAC PIPING INSULATION

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Piping insulation.
- B. Jackets and accessories.

1.03 RELATED REQUIREMENTS

- A. Section 01 61 16 - Volatile Organic Compound (VOC) Content Restrictions.
- B. Section 07 84 00 - Firestopping.
- C. Section 09 91 23 - Interior Painting: Painting insulation jacket.
- D. Section 23 21 13 - Hydronic Piping: Placement of hangers and hanger inserts.
- E. Section 23 22 13 - Steam and Condensate Heating Piping: Placement of hangers and hanger inserts.

1.04 REFERENCE STANDARDS

- A. ASTM C195 - Standard Specification for Mineral Fiber Thermal Insulating Cement; 2007 (Reapproved 2013).
- B. ASTM C534/C534M - Standard Specification for Preformed Flexible Elastomeric Cellular Thermal Insulation in Sheet and Tubular Form; 2020a.
- C. ASTM C547 - Standard Specification for Mineral Fiber Pipe Insulation; 2019.
- D. ASTM D2842 - Standard Test Method for Water Absorption of Rigid Cellular Plastics; 2019.
- E. ASTM E84 - Standard Test Method for Surface Burning Characteristics of Building Materials; 2021a.
- F. ASTM E96/E96M - Standard Test Methods for Water Vapor Transmission of Materials; 2016.
- G. UL 723 - Standard for Test for Surface Burning Characteristics of Building Materials; Current Edition, Including All Revisions.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product description, thermal characteristics, list of materials and thickness for each service, and locations.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with not less than three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept materials on site, labeled with manufacturer's identification, product density, and thickness.

1.08 FIELD CONDITIONS

- A. Maintain ambient conditions required by manufacturers of each product.
- B. Maintain temperature before, during, and after installation for minimum of 24 hours.

PART 2 PRODUCTS

2.01 REGULATORY REQUIREMENTS

- A. Surface Burning Characteristics: Flame spread index/Smoke developed index of 25/50, maximum, when tested in accordance with ASTM E84 or UL 723.

2.02 GLASS FIBER, RIGID

- A. Insulation: ASTM C547 and ASTM C795; rigid molded, noncombustible.
 - 1. K Value: ASTM C177, 0.24 at 75 degrees F.
 - 2. Maximum Service Temperature: 850 degrees F.
 - 3. Maximum Moisture Absorption: 0.2 percent by volume.
- B. Insulation: ASTM C547 and ASTM C795; semi-rigid, noncombustible, end grain adhered to jacket.
 - 1. Maximum Service Temperature: 650 degrees F.
 - 2. Maximum Moisture Absorption: 0.2 percent by volume.
- C. Vapor Barrier Jacket: White kraft paper with glass fiber yarn, bonded to aluminized film; moisture vapor transmission when tested in accordance with ASTM E96/E96M of 0.02 perm-inches.
- D. Vapor Barrier Lap Adhesive: Compatible with insulation.
- E. Insulating Cement/Mastic: ASTM C195; hydraulic setting on mineral wool.
- F. Indoor Vapor Barrier Finish:
 - 1. Cloth: Untreated; 9 oz/sq yd weight.
 - 2. Vinyl emulsion type acrylic, compatible with insulation, black color.

2.03 HYDROUS CALCIUM SILICATE

- A. Insulation: ASTM C533 and ASTM C795; rigid molded, asbestos free, gold color.
 - 1. K Value: 0.40 at 300 degrees F, when tested in accordance with ASTM C177 or ASTM C518.
 - 2. Maximum Service Temperature: 1200 degrees F.
 - 3. Density: 15 pcf.
- B. Tie Wire: 0.048 inch stainless steel with twisted ends on maximum 12 inch centers.
- C. Insulating Cement: ASTM C449.

2.04 JACKETS

- A. PVC Plastic.
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: 0 degrees F.
 - b. Maximum Service Temperature: 150 degrees F.
 - c. Moisture Vapor Permeability: 0.002 perm inch, maximum, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 10 mil.
 - e. Connections: Brush on welding adhesive.
 - 2. Covering Adhesive Mastic: Compatible with insulation.
- B. ABS Plastic:
 - 1. Jacket: One piece molded type fitting covers and sheet material, off-white color.
 - a. Minimum Service Temperature: Minus 40 degrees F.
 - b. Maximum Service Temperature: 180 degrees F.
 - c. Moisture Vapor Permeability: 0.012 perm inch, when tested in accordance with ASTM E96/E96M.
 - d. Thickness: 30 mil.
 - e. Connections: Brush on welding adhesive.
- C. Aluminum Jacket: ASTM B209 (ASTM B209M) formed aluminum sheet.

1. Thickness: 0.016 inch sheet.
2. Finish: Embossed.
3. Joining: Longitudinal slip joints and 2 inch laps.
4. Fittings: 0.016 inch thick die shaped fitting covers with factory attached protective liner.
5. Metal Jacket Bands: 3/8 inch wide; 0.015 inch thick aluminum.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that piping has been tested before applying insulation materials.
- B. Verify that surfaces are clean and dry, with foreign material removed.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Exposed Piping: Locate insulation and cover seams in least visible locations.
- C. Insulated pipes conveying fluids below ambient temperature; insulate entire system including fittings, valves, unions, flanges, strainers, flexible connections, and expansion joints.
- D. For hot piping conveying fluids 140 degrees F or less, do not insulate flanges and unions at equipment, but bevel and seal ends of insulation.
- E. For hot piping conveying fluids over 140 degrees F, insulate flanges and unions at equipment.
- F. Glass fiber insulated pipes conveying fluids above ambient temperature.
 1. Provide standard jackets, with or without vapor barrier, factory-applied or field-applied. Secure with self-sealing longitudinal laps and butt strips with pressure sensitive adhesive. Secure with outward clinch expanding staples.
 2. Insulate fittings, joints, and valves with molded or mitered insulation of like material and thickness as adjoining pipe. Finish with glass cloth and adhesive or PVC fitting covers.
- G. Inserts and Shields:
 1. Shields: Galvanized steel between pipe hangers or pipe hanger rolls and inserts.
 2. Insert location: Between support shield and piping and under the finish jacket.
 3. Insert Configuration: Minimum 6 inches long, of same thickness and contour as adjoining insulation; may be factory fabricated.
 4. Insert Material: Hydrous calcium silicate insulation or other heavy density insulating material suitable for the planned temperature range.
- H. Continue insulation through walls, sleeves, pipe hangers, and other pipe penetrations. Finish at supports, protrusions, and interruptions. At fire separations, refer to Section 07 84 00.
- I. Pipe Exposed in Mechanical Equipment Rooms or Finished Spaces (less than 10 feet above finished floor): Finish with aluminum jacket.

3.03 SCHEDULE

- A. Heating Systems:
 1. Steam: 2" hydrous calcium silicate insulation
 2. Steam Condensate and Boiler Feedwater: 2" rigid fiberglass insulation
 3. Blowdown and drains: Un-insulated

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 08 00
COMMISSIONING OF HVAC SYSTEMS

PART 1 GENERAL

1.01 SUMMARY:

- A. The requirements of this Section apply to all sections of Division 23.
- B. This project will have selected building systems commissioned. The commissioning process is defined in Section 01 91 13 General Commissioning Requirements. The Commissioning Authority (CxA) appointed by the Owner will oversee and manage the commissioning process.
- C. This section covers additional Contractor responsibilities for commissioning; each subcontractor or installer responsible for the installation of a particular system or equipment to be commissioned is responsible for the commissioning activities relating to that system or equipment.
- D. The Commissioning Authority (CxA) directs and coordinates all commissioning activities and provides pre-functional checklists and functional performance test procedures for Contractor's uses.

1.02 RELATED REQUIREMENTS

- A. Section 01 91 13 - General Commissioning Requirements

1.03 DEFINITIONS:

- A. Refer to Section 01 91 13 General Commissioning Requirements for definitions.

1.04 DESCRIPTION

- A. Refer to Section 01 91 13 General Commissioning Requirements for the description of the Commissioning process.

1.05 SUBMITTALS

- A. Refer to 01 30 00 Administrative Requirements for specific submittal requirements. In addition, provide the Commissioning Authority the following:
 - 1. Manufacturers Installation Instructions for all equipment and components included in the commissioning process related to Division 23.
 - 2. Equipment product data
 - 3. Equipment installation, operation, and maintenance manuals
 - 4. Performance data cut sheets, Pump and fan curves
 - 5. Completed equipment start up reports from manufacturers start up representative
 - 6. Sequences of Operation Submittals: The Controls Contractor's submittals of control drawings shall include complete detailed sequences of operation for each piece of equipment, regardless of the completeness and clarity of the sequences in the specifications. They shall include:
 - a. An overview narrative of the system (1 or 2 paragraphs) generally describing its purpose, components, and function.
 - b. All interactions and interlocks with other systems.
 - c. Detailed delineation of control between any packaged controls and the building automation system, listing what points the BAS monitors only and what BAS points are control points and are adjustable.
 - d. Written sequences of control for packaged controlled equipment. (Equipment manufacturers' stock sequences may be included, but will generally require additional narrative).
 - e. Start-up sequences.
 - f. Warm-up mode sequences.
 - g. Normal operating mode sequences.
 - h. Unoccupied mode sequences.
 - i. Shutdown sequences.

- j. Capacity control sequences and equipment staging.
- k. Temperature and pressure control: setbacks, setups, resets, etc.
- l. Detailed sequences for all control strategies, e.g., economizer control, optimum start/stop, staging, optimization, demand limiting, etc.
- m. Effects of power or equipment failure with all standby component functions.
- n. Sequences for all alarms and emergency shut downs.
- o. Seasonal operational differences and recommendations.
- p. Initial and recommended values for all adjustable settings, setpoints, and parameters that are typically set or adjusted by operating staff; and any other control settings or fixed values, delays, etc. that will be useful during testing and operating the equipment.
- q. Schedules, if known.
- 7. Control Drawings Submittal
 - a. The control drawings shall have a key to all abbreviations.
 - b. The control drawings shall contain graphic schematic depictions of the systems and each component.
 - c. The schematics shall include the system and component layout of any equipment that the control system monitors, enables or controls, even if the equipment is primarily controlled by packaged or integral controls.
- 8. Owners training plan

1.06 RESPONSIBILITIES

- A. Mechanical, Controls, and TAB Contractors: The commissioning responsibilities applicable to each of the Mechanical, Controls, and TAB contractors of Division 23 (all references apply to commissioned equipment only):
- B. Construction and Acceptance Phases
 - 1. In each purchase order or subcontract written, include requirements for submittal data and completion of commissioning documentation.
 - 2. Incorporate commissioning activities into the master project schedule.
 - 3. Update schedule as required throughout the construction period.
 - 4. Attend and actively participate in commissioning meetings and other meetings necessary to facilitate the Commissioning process.
 - 5. Provide requested documentation to the CxA for development of the commissioning documentation.
 - 6. Complete a start-up and initial checkout plan using manufacturer's start-up procedures and the CxA furnished Pre-functional checklists for all commissioned equipment. Submit to GC for review prior to startup. CxA will verify for compliance. Refer to Section 01 91 13 for further details related to start-up.
 - 7. Coordinate with the CxA to provide (36) hour advance notice so that the witnessing of equipment and system start-up and testing can begin.
 - 8. During the startup and initial checkout process, execute the related portions of the pre-functional checklists for all commissioned equipment.
 - 9. Assist the CxA in all verification and functional performance tests.
 - 10. Correct system deficiencies before functional testing. Air and water TAB shall be completed with discrepancies and problems remedied before functional testing of the respective air-or water-related systems.
 - 11. Provide skilled technicians to execute starting of equipment and to execute the functional performance tests. Ensure that they are available and present during the agreed upon schedules and for sufficient duration to complete the necessary tests, adjustments, and problem-solving.
 - 12. Complete CxA furnished functional performance tests and procedures. Subs shall review test procedures to ensure feasibility, safety and equipment protection, and provide necessary written alarm limits to be used during the tests.

13. Perform functional performance testing under the direction of the CxA for specified equipment. Assist the CxA in interpreting the monitored data, as necessary
 14. Correct deficiencies (differences between specified and observed performance) as interpreted by the CxA and A/E, and retest the equipment.
 15. Prepare O&M manuals according to the Contract Documents.
 16. During construction, maintain as-built red-line mark-ups for all drawings. Update as needed following functional testing. Furnish final copy to CxA for inclusion in final report.
- C. Controls Contractor: The commissioning responsibilities of the controls contractor, during construction and acceptance phases:
1. An updated as-built version of the control drawings and sequences of operation shall be included in the final controls O&M Manual submittal.
 2. Assist and cooperate with TAB contractor in the following manner:
 - a. Meet with the TAB contractor prior to beginning TAB and review the TAB plan to determine the capabilities of the control system toward completing TAB. Provide the TAB contractor any unique instruments needed for setting terminal unit boxes and instruct TAB in their use (handheld control system interface for use around the building during TAB, etc.).
 - b. For a given area, have all required pre-functional checklists, calibration, startup, and selected functional tests of the system completed prior to TAB.
 3. Assist and cooperate with the CxA in the following manner.
 - a. Complete appropriate portions of the commissioning pre-functional checklists as the work progresses. Checklists shall be current with the actual job progress. Return completed pre-functional checklists to the CxA through the proper contractual protocols.
 - b. Using a skilled technician who is familiar with the installed systems in this building, execute the functional testing of the controls system. Assist in the functional testing of all equipment and systems.
 - c. Execute and provide all control system trend logs as requested by CxA.
 - d. Execute and provide system reports as requested by the CxA.
 4. Provide a signed and dated certification to the GC upon completion of the checkout of each controlled device, equipment and system prior to functional testing for each piece of equipment or system, that all system programming is complete as to all respects of the Contract Documents, except functional testing requirements.
 5. List and clearly identify on the as-built duct and piping drawings the locations of all monitoring and control sensors.
- D. TAB Contractor: The commissioning responsibilities of the TAB contractor, during construction and acceptance phases:
1. The TAB field technicians shall keep a running log of events and issues. Submit hand-written reports of discrepancies, deficient or uncompleted work by others, contract interpretation requests and lists of completed tests to the CxA and GC at least twice a week.
 2. Communicate in writing to the controls contractor all setpoint and parameter changes made or problems and discrepancies identified during TAB.
 3. Assist the CxA in the TAB verification process. The TAB contractors will take readings with the CxA present, using the calibrated instruments used during the TAB process. Verification readings will be compared to reported TAB readings and evaluated for consistency and repeatability.
 4. Assist as needed during the functional performance testing conducted by the commissioning team.
 5. Provide a draft copy of the TAB report to the CxA within 2 weeks of completion. The report shall contain a full explanation of the methodology, assumptions, and the results in a clear format with designations of all uncommon abbreviations and column headings. Provide the CxA with any updates as a result of A/E review.

PART 2 PRODUCTS - NOT USED

PART 3 EXECUTION

3.01 SCHEDULE

- A. Prepare a preliminary schedule for Division 23 activities. Include key milestone activities included in the commissioning process.
- B. The following activities shall be shown on the schedule and linked by progression of work. Start and finish dates shall be shown for each activity. The following are the minimum required:
 - 1. Equipment rough in
 - 2. Equipment trim out
 - 3. Equipment start up
 - 4. ATC rough in
 - 5. ATC trim out
 - 6. Programming completion
 - 7. Graphic completion
 - 8. System quality control testing - Piping and HVAC duct cleaning, flush out, and pressure testing.
 - 9. Pre-functional checklist execution
 - 10. Pre-functional checklist completion
 - 11. TAB
 - 12. Functional testing
 - 13. O&M turnover
 - 14. Owner training sessions
- C. The preliminary schedule will be distributed to the commissioning team members. The schedule will be updated throughout the construction period on a regular basis.

3.02 MEETINGS

- A. Commissioning during the Construction phase begins with a coordination/kickoff meeting led by the Commissioning Authority wherein the commissioning process, activities, and each team member responsibilities are reviewed with the commissioning team members. Commissioning meetings will be conducted throughout construction to plan, coordinate, and schedule activities and address commissioning related issues.

3.03 SUBMITTAL REVIEW

- A. The CxA will review submittals related to the equipment included in the commissioning process. The submittals will be reviewed for quality and compliance with the project requirements. The CxA will indicate on the submittal schedule which submittals are considered to be Cx related. The Contractor will provide the requested submittals. Typical submittal data needed for commissioning includes: manufacturer installation instructions, startup, operating, and troubleshooting procedures, fan and pump curves, and performance data. This submittal data is used for the development of the pre-functional checklists.

3.04 PRE-FUNCTIONAL CHECKLISTS

- A. Pre-Functional checklists ensure that the equipment and systems are properly installed and operational before functional testing begins. Pre-functional checklists are static type inspections and procedures to prepare the equipment for initial operation.
 - 1. Pre-Functional Checklist: The Commissioning Authority will develop specific pre-functional checklists for each piece of equipment included in the commissioning process. The CxA will issue the pre-functional checklist to the installing contractors.
 - 2. Execution of Pre-Functional Checklists: The installing contractors will fill out the pre-functional checklists. Checklists should be completed as the equipment installation progresses. The GC will manage the process and ensure all PFC forms have been completed & signed by the installing contractors. The CxA will verify 10 percent of the pre-function checklists as the checklists are being completed. Inaccurate or incomplete

prefunctional checklist shall be returned to the Contractor for corrections and resubmission. The GC will provide all completed pre-functional checklist to the CXA for inclusion in the final commissioning report.

3. Only individuals that have direct knowledge and witnessed that a line item task on the pre-functional checklist was actually performed shall initial or check that item off.
- B. B. Deficiencies: The installing contractor shall list any outstanding items of the initial start-up and pre-functional procedures that were not completed successfully, at the bottom of the procedures form or on an attached sheet. The procedures form and any outstanding deficiencies shall be provided to the GC and the CxA within 2 days of test completion. The GC and CxA will review and monitor outstanding deficiencies. The installing contractors shall correct deficiencies and re-inspect or re-test, as applicable.

3.05 ISSUES LOG

- A. The Commissioning Authority will prepare and maintain a Commissioning Issues Log that describes Commissioning Issues and Commissioning Observations that are identified during the Commissioning process. These observations and issues include, but are not limited to, those that are at variance with the Contract Documents. The Commissioning Issues Log will identify and track issues as they are encountered, the party responsible for resolution, progress toward resolution, and document how the issue was resolved. The Master Commissioning Issues Log will also track the status of unresolved issues. The CXA will verify the corrected issue and provide the commissioning team with updated issues log on a routine basis.
 1. Creating a Commissioning Issues Log Entry:
 - a. Identify the issue with unique numeric or alphanumeric identifier by which the issue may be tracked.
 - b. Assign a descriptive title for the issue.
 - c. Identify date of the issue.
 - d. Identify test number of test being performed at the time of the observation, if applicable, for cross reference.
 - e. Identify system, subsystem, and equipment to which the issue applies.
 - f. Identify location of system, subsystem, and equipment.
 - g. Include information that may be helpful in diagnosing or evaluating the issue.
 - h. Note recommended corrective action.
 - i. Identify commissioning team member responsible for corrective action.
 - j. Identify expected date of correction.
 - k. Identify person that identified the issue.
 2. Documenting Issue Resolution:
 - a. Log date correction is completed or the issue is resolved.
 - b. Describe corrective action or resolution taken. Include description of diagnostic steps taken to determine root cause of the issue, if any.
 - c. Identify changes to the Contract Documents that may require action.
 - d. State that correction was completed and system, subsystem, and equipment are ready for retest, if applicable.
 - e. Identify person(s) who corrected or resolved the issue.
 - f. Identify person(s) verifying the issue resolution.

3.06 TAB VERIFICATION

- A. The TAB contractor will provide the CXA with a preliminary TAB report for review. The CXA will review the TAB report to verify or assure the following:
 1. TAB results for all equipment and systems covered in the specifications are included in the TAB report
 2. Actual flow rates were adjusted to the design values plus or minus specified tolerances.
 3. The report discusses any TAB activities that failed to produce the required results.
 4. The report and process followed adheres to the TAB firms national organizations standard and project specifications.

- B. Verification of Report Accuracy: The CxA and TAB contractor will verify the accuracy of the TAB report readings by randomly sampling the readings noted in the report in the field using the TAB contractors calibrated instruments.
1. The CxA will note any deviations greater than the tolerance specified in the TAB specifications (+/- 10%, for example)
 2. Deviations noted should be corrected and documented by the TAB contractor.
 3. If the total number of sampled readings that deviate beyond specified tolerances exceeds 10 percent, Additional sampling will be required.

3.07 FUNCTIONAL TESTING:

- A. Objectives and Scope
1. The CxA directs comprehensive equipment and system testing and documents all testing performance. This testing is conducted using functional performance test procedures developed by the CxA.
 2. The objective of functional testing is to demonstrate that each system is operating according to the Contract Documents. Functional testing facilitates bringing the systems to full dynamic operation. During the testing process, areas of deficient performance are identified and corrected, improving the operation and functioning of the systems.
 3. In general, each system should be operated through all modes of operation (seasonal, occupied, unoccupied, warm-up, cool-down, part- and full-load) where there is a specified system response. Verifying each sequence in the sequences of operation is required. Proper responses to such modes and alarm conditions as power failure, freeze conditions, low oil pressure, no flow, equipment failure, etc. shall also be tested.
 4. Functional Performance testing will not be scheduled until all pre-functional checklists are completed and return to the CxA, the Certificate of Readiness has been provided to the CxA, TAB is complete and all control programming and check out is complete.
- B. Documentation and Non-Conformance
1. Documentation: The CxA will execute the functional testing with support from the appropriate installing contractors and document the results of all functional performance tests using the specific procedural forms developed for that purpose.
 2. Non-Conformance
 - a. Systems or equipment for which 100 percent sample size are tested fail if one or more of the test procedures results in discovery of a deficiency and the deficiency cannot be resolved within 15 minutes during the test. Re-test to the extent necessary to confirm that the deficiencies have been corrected without negatively impacting the performance of the rest of the system.
 - b. The CxA will record the results of the functional test on the procedure or test form. All deficiencies or non-conformance issues shall be noted on the commissioning issues log and functional test form.
 - c. All deficiencies or non-conformance issues identified during the functional testing shall be corrected and retested at no additional cost to the Owner.
 3. Aborted Tests and Re-Testing
 - a. Abort functional performance test if any deficiency prevents successful completion of the test or if any required commissioning team member is not present for the test. Functional performance test may be aborted if the CxA determines the system is not sufficiently complete or ready for testing. The Contractor will reimburse the Owner for all cost associated with the effort lost due to re-testing due to test failures and aborted tests. These costs must include salary, travel costs, and per diem for Owner commissioning team members. Re-test only after all deficiencies identified during the original test have been corrected.

3.08 EQUIPMENT/SYSTEMS TO BE COMMISSIONED

- A. The work included in the commissioning process involves a complete and thorough evaluation of the operation and performance of all components, systems and sub-systems. The CxA with assistance from the installing Contractors will evaluate the equipment and systems during the

commissioning process. The specific systems and subsystems to be commissioned for Division 23 are listed below:

1. HVAC & R Systems
2. Building Automation System
 - a. DDC Controllers
 - b. User graphics
 - c. Control valves
 - d. Motorized dampers
 - e. Airflow measuring station
 - f. Flow meters
 - g. Sensors
 - h. Relays
 - i. Switches

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 09 13
INSTRUMENTATION AND CONTROL DEVICES FOR HVAC

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Control panels.
- B. Input/Output Sensors:
 - 1. Temperature sensors.

1.03 RELATED REQUIREMENTS

- A. Section 22 05 48 - Vibration and Seismic Controls for Plumbing Piping and Equipment.
- B. Section 23 05 19 - Meters and Gauges for HVAC Piping: Thermometer sockets and gauge taps.
- C. Section 23 05 48 - Vibration And Seismic Controls For HVAC Piping And Equipment.
- D. Section 23 09 23 - Direct-Digital Control System for HVAC.
- E. Section 23 21 13 - Hydronic Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.
- F. Section 23 22 13 - Steam and Condensate Heating Piping: Installation of control valves, flow switches, temperature sensor sockets, and gauge taps.
- G. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.
- H. Section 26 27 26 - Wiring Devices: Elevation of exposed components.

1.04 REFERENCE STANDARDS

- A. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata and Amendments (2021).

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week before starting work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide description and engineering data for each control system component. Include sizing as requested. Provide data for each system component and software module.
- C. Shop Drawings: Indicate complete operating data, system drawings, wiring diagrams, and written detailed operational description of sequences. Submit schedule of valves indicating size, flow, and pressure drop for each valve. For automatic dampers indicate arrangement, velocities, and static pressure drops for each system.
- D. Samples: Submit two of each type of room thermostat and cover.
- E. Manufacturer's Instructions: Provide for all manufactured components.
- F. Project Record Documents: Record actual locations of control components, including panels, thermostats, and sensors. Accurately record actual location of control components, including panels, thermostats, and sensors.
 - 1. Revise shop drawings to reflect actual installation and operating sequences.
- G. Operation and Maintenance Data: Include inspection period, cleaning methods, recommended cleaning materials, and calibration tolerances.

- H. Warranty: Submit manufacturer's warranty and ensure forms have been filled out in Owner's name and registered with manufacturer.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.07 QUALITY ASSURANCE

- A. Designer Qualifications: Design system under direct supervision of a Professional Engineer experienced in design of this work and licensed in the State in which the Project is located.
- B. Manufacturer Qualifications: Company specializing in manufacturing the Products specified in this section with minimum three years documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

1.08 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals, for additional warranty requirements.

PART 2 PRODUCTS

2.01 EQUIPMENT - GENERAL

- A. Products Requiring Electrical Connection: Listed and classified by Underwriters Laboratories Inc., as suitable for the purpose specified and indicated.

2.02 CONTROL PANELS

- A. Unitized cabinet type for each system under automatic control with relays and controls mounted in cabinet and temperature indicators, pressure gauges, pilot lights, push buttons and switches flush on cabinet panel face.
- B. NEMA 250, general purpose utility enclosures with enameled finished face panel.
- C. Provide common keying for all panels.

2.03 INPUT/OUTPUT SENSORS

- A. Temperature Sensors:
 - 1. Use thermistor or RTD type temperature sensing elements with characteristics resistant to moisture, vibration, and other conditions consistent with the application without affecting accuracy and life expectancy.
 - 2. Construct RTD of nickel or platinum with base resistance of 1000 ohms at 70 degrees F.
 - 3. 100 ohm platinum RTD is acceptable if used with project DDC controllers.
 - 4. Temperature Sensing Device: Compatible with project DDC controllers.
 - 5. Performance Characteristics:
 - a. RTD:
 - 1) All Other Accuracy: Plus/minus 0.75 degrees F minimum.
 - 2) Range: Minus 40 degrees F through 220 degrees F minimum.
 - b. Thermistor:
 - 1) Accuracy (All): Plus/minus 0.36 degrees F minimum.
 - 2) Range: Minus 25 degrees F through 122 degrees F minimum.
 - 3) Heat Dissipation Constant: 2.7 mW per degree C.
 - c. Temperature Transmitter:
 - 1) Accuracy: 0.10 degree F minimum or plus/minus 0.20 percent of span.
 - 2) Output: 4 to 20 mA.
 - d. Sensing Range:
 - 1) Provide limited range sensors if required to sense the range expected for a respective point.
 - 2) Use RTD type sensors for extended ranges beyond minus 30 degrees F to 230 degrees F.

- 3) Use temperature transmitters in conjunction with RTD's when RTD's are incompatible with DDC controller direct temperature input.
- e. Wire Resistance:
 - 1) Use appropriate wire size to limit temperature offset due to wire resistance to 1.0 degree F or use temperature transmitter when offset is greater than 1.0 degree F due to wire resistance.
 - 2) Compensate for wire resistance in software input definition when feature is available in the DDC controller.

2.04 THERMOSTATS

- A. Immersion Thermostats:
 1. Remote bulb or bimetallic rod and tube type, proportional action with adjustable setpoint and adjustable throttling range.

2.05 TRANSMITTERS

- A. Pressure Transmitters:
 1. One pipe direct acting indicating type for gas, liquid, or steam service, range suitable for system, proportional electronic output.
 2. Service Monitoring Range: 0 to 100 psig.
 3. Wetted Material: Brass for general service or stainless steel for steam and corrosive.
 4. Hardwired Output: Two-wire, 4 to 20 mA, loop powered.
 5. Accessories: Provide gauge-port plug, isolation ball valve, and pigtail steam siphon.
- B. Thermal Mass Flow Meters:
 1. Manufacturers:
 - a. Fox Thermal Instruments, Inc: www.foxthermal.com.
 - b. Onicon, Inc: www.onicon.com.
 - c. Sierra Instruments, Inc; Innovamass Series: www.sierrainstruments.com.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Inline Type: Class 150 flanged.
 3. Insertion Type: Include interfacing ball valve and threadolet.
 4. Flow Capacity Range: As indicated on drawings.
 5. Construction: Stainless steel or aluminum sensor with integral NEMA 250 Type 4 or 4X stainless steel or aluminum enclosure to hold thermal mass sensor and circuits with numeric display for consumption reading.
 6. Accuracy: Two percent over measured flow range, adjustable.
 7. Output: Two-wire, 0 to 10 VDC non-loop powered.
 8. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135, BACnet IP.
 9. Service Pressure and Temperature: Up to 300 psi and minus 40 to 250 degrees F gas side, 150 degrees F ambient.
- C. Temperature Transmitters:
 1. One pipe, directly proportional output signal to measured variable, linearity within plus or minus 1/2 percent of range for 200 degrees F span and plus or minus 1 percent for 50 degrees F span, with 200 degrees F. temperature range, compensated bulb, averaging capillary, or rod and tube operation on 20 psig input pressure and 3 to 15 psig output.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify existing conditions before starting work.
- B. Verify that systems are ready to receive work.
- C. Beginning of installation means installer accepts existing conditions.
- D. Sequence work to ensure installation of components is complementary to installation of similar components in other systems.

- E. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.
- F. Ensure installation of components is complementary to installation of similar components.
- G. Coordinate installation of system components with installation of mechanical systems equipment such as air handling units and air terminal units.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Provide separable sockets for liquids and flanges for air bulb elements.
- C. Provide valves with position indicators and with pilot positioners where sequenced with other controls.
- D. Mount control panels adjacent to associated equipment on vibration free walls or free standing angle iron supports. One cabinet may accommodate more than one system in same equipment room. Provide engraved plastic nameplates for instruments and controls inside cabinet and engraved plastic nameplates on cabinet face.
- E. Install "hand/off/auto" selector switches to override automatic interlock controls when switch is in "hand" position.
- F. Provide conduit and electrical wiring in accordance with Section 26 05 83. Electrical material and installation shall be in accordance with appropriate requirements of .

3.03 MAINTENANCE

- A. Provide service and maintenance of control system for one year from Date of Substantial Completion.
- B. Provide complete service of controls systems, including call backs, and submit written report of each service call.
- C. In addition to normal service calls, make minimum of 4 complete normal inspections of approximately 12 hours duration to inspect, calibrate, and adjust controls.

END OF SECTION

SECTION 23 21 13

HYDRONIC PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Hydronic system requirements.
- B. Equipment drains and overflows.
- C. Pipe hangers and supports.
- D. Unions, flanges, mechanical couplings, and dielectric connections.
- E. Valves:
 - 1. Ball valves.
 - 2. Butterfly valves.
 - 3. Check valves.
- F. Flow controls.

1.03 RELATED REQUIREMENTS

- A. Section 23 05 48 - Vibration And Seismic Controls For HVAC Piping And Equipment.
- B. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- C. Section 23 07 19 - HVAC Piping Insulation.
- D. Section 23 21 14 - Hydronic Specialties.
- E. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.04 REFERENCE STANDARDS

- A. ASME BPVC-IX - Boiler and Pressure Vessel Code, Section IX - Qualification Standard for Welding, Brazing, and Fusing Procedures; Welders; Brazers; and Welding, Brazing, and Fusing Operators; 2021.
- B. ASME B16.3 - Malleable Iron Threaded Fittings: Classes 150 and 300; 2016.
- C. ASME B31.9 - Building Services Piping; 2020.
- D. ASTM A53/A53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc-Coated, Welded and Seamless; 2020.
- E. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- F. ASTM A183 - Standard Specification for Carbon Steel Track Bolts and Nuts; 2014 (Reapproved 2020).
- G. ASTM A234/A234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2019.
- H. ASTM A536 - Standard Specification for Ductile Iron Castings; 1984 (Reapproved 2019)e1.
- I. ASTM F708 - Standard Practice for Design and Installation of Rigid Pipe Hangers; 1992, with Editorial Revision (2018).
- J. AWS D1.1/D1.1M - Structural Welding Code - Steel; 2020.
- K. MSS SP-58 - Pipe Hangers and Supports - Materials, Design, Manufacture, Selection, Application, and Installation; 2018.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.
- B. Sequencing: Ensure that utility connections are achieved in an orderly and expeditious manner.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Welders Certificate: Include welders certification of compliance with ASME BPVC-IX.
- C. Product Data:
 - 1. Include data on pipe materials, pipe fittings, valves, and accessories.
 - 2. Provide manufacturers catalogue information.
 - 3. Indicate valve data and ratings.
 - 4. Show fittings, valves, and specialties on drawings and product submittals, specifically identified with the manufacturer's style or series designation.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- E. Project Record Documents: Record actual locations of valves.
- F. Maintenance Data: Include installation instructions, spare parts lists, exploded assembly views.

1.07 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing products of the type specified in this section, with minimum three years of documented experience.
- B. Installer Qualifications: Company specializing in performing work of the type specified in this section, with minimum 3 years of experience.
- C. Provide all fittings, valves, and specialties from a single manufacturer.
- D. Date stamp all castings used for fittings, valve bodies, etc. for quality assurance and traceability.
- E. Welder Qualifications: Certify in accordance with ASME BPVC-IX.
 - 1. Provide certificate of compliance from authority having jurisdiction, indicating approval of welders.
 - 2. Provide a test weld for inspection by the owner and architect/engineer's representative.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 HYDRONIC SYSTEM REQUIREMENTS

- A. Comply with ASME B31.9 and applicable federal, state, and local regulations.
- B. Piping: Provide piping, fittings, hangers and supports as required, as indicated, and as follows:
 - 1. Where more than one piping system material is specified, provide joining fittings that are compatible with piping materials and ensure that the integrity of the system is not jeopardized.
 - 2. Use non-conducting dielectric connections whenever jointing dissimilar metals.
 - 3. Provide pipe hangers and supports in accordance with ASME B31.9 or MSS SP-58 unless indicated otherwise.

- C. Pipe-to-Valve and Pipe-to-Equipment Connections: Use flanges or unions to allow disconnection of components for servicing; do not use direct welded, soldered, or threaded connections.
- D. Valves: Provide valves where indicated:
 - 1. Provide drain valves where indicated, and if not indicated provide at least at main shut-off, low points of piping, bases of vertical risers, and at equipment. Use 3/4 inch gate valves with cap; pipe to nearest floor drain.
 - 2. Isolate equipment using butterfly valves with lug end flanges.
 - 3. For throttling, bypass, or manual flow control services, use globe or ball valves.
 - 4. For shut-off and to isolate parts of systems, use gate or ball valves.
 - 5. For throttling service, use plug cocks. Use non-lubricated plug cocks only when shut-off or isolating valves are also provided.
- E. Welding Materials and Procedures: Conform to ASME BPVC-IX.

2.02 EQUIPMENT DRAINS AND OVERFLOWS

- A. Steel Pipe: ASTM A53/A53M, Schedule 40 galvanized; using one of the following joint types:
 - 1. Threaded Joints: Galvanized cast iron, or ASME B16.3 malleable iron fittings.

2.03 PIPE HANGERS AND SUPPORTS

- A. Provide hangers and supports that comply with MSS SP-58.
 - 1. If type of hanger or support for a particular situation is not indicated, select appropriate type using MSS SP-58 recommendations.

2.04 UNIONS, FLANGES, AND DIELECTRIC CONNECTIONS

- A. Unions for Pipe 2 Inches and Less:
- B. Flanges for Pipe 2 Inches and Greater:
- C. Dielectric Connections:
 - 1. Waterways:
 - a. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - b. Dry insulation barrier able to withstand 600 volt breakdown test.
 - c. Construct of galvanized steel with threaded end connections to match connecting piping.
 - d. Suitable for the required operating pressures and temperatures.
 - 2. Flanges:
 - a. Dielectric flanges with same pressure ratings as standard flanges.
 - b. Water impervious insulation barrier capable of limiting galvanic current to 1 percent of short circuit current in a corresponding bimetallic joint.
 - c. Dry insulation barrier able to withstand 600 volt breakdown test.
 - d. Construct of galvanized steel with threaded end connections to match connecting piping.
 - e. Suitable for the required operating pressures and temperatures.

2.05 BALL VALVES

- A. Up To and Including 2 Inches:
 - 1. Bronze one piece body, chrome plated brass ball, teflon seats and stuffing box ring, lever handle with balancing stops, solder ends with union.
- B. Over 2 Inches:
 - 1. Ductile iron body, chrome plated stainless steel ball, teflon or Virgin TFE seat and stuffing box seals, lever handle or gear operated, flanged ends, rated to 800 psi.

2.06 BUTTERFLY VALVES

- A. Body: Cast or ductile iron with resilient replaceable EPDM seat, wafer, lug, or grooved ends, extended neck.

- B. Disc: Construct of aluminum bronze, chrome plated ductile iron, stainless steel, ductile iron with EPDM encapsulation, or Buna-N encapsulation.
- C. Operator: 10 position lever handle.

2.07 SWING CHECK VALVES

- A. Up To and Including 2 Inches:
 - 1. Bronze body, bronze trim, bronze rotating swing disc, with composition disc, solder ends.

2.08 SPRING LOADED CHECK VALVES

- A. Iron body, bronze trim, split plate, hinged with stainless steel spring, resilient seal bonded to body, wafer or threaded lug ends.

2.09 FLOW CONTROLS

- A. Construction: Class 125, Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet, blowdown/backflush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Prepare pipe for grooved mechanical joints as required by coupling manufacturer.
- C. Remove scale and dirt on inside and outside before assembly.
- D. Prepare piping connections to equipment using jointing system specified.
- E. Keep open ends of pipe free from scale and dirt. Protect open ends with temporary plugs or caps.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Route piping in orderly manner, parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and to avoid interfere with use of space.
- D. Group piping whenever practical at common elevations.
- E. Sleeve pipe passing through partitions, walls and floors.
- F. Slope piping and arrange to drain at low points.
- G. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- H. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9, ASTM F708, or MSS SP-58.
 - 2. Install hangers to provide minimum 1/2 inch space between finished covering and adjacent work.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.

5. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
6. Prime coat exposed steel hangers and supports. Refer to Section 09 91 23. Hangers and supports located in crawl spaces, pipe shafts, and suspended ceiling spaces are not considered exposed.
- I. Provide clearance in hangers and from structure and other equipment for installation of insulation and access to valves and fittings. Refer to Section 23 07 19.
- J. Use eccentric reducers to maintain top of pipe level.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- L. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

- A. Hanger Spacing for Steel Piping.
 1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
 2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
 3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
 4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
 5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
 8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
 9. 8 inches: Maximum span, 19 feet; minimum rod size, 5/8 inch.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 21 14
HYDRONIC SPECIALTIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Air vents.
- B. Strainers.
- C. Pressure-temperature test plugs.
- D. Balancing valves.
- E. Combination flow controls.

1.03 RELATED REQUIREMENTS

- A. Section 23 21 13 - Hydronic Piping.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Preinstallation Meeting: Conduct a preinstallation meeting one week prior to the start of the work of this section; require attendance by all affected installers.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide product data for manufactured products and assemblies required for this project. Include component sizes, rough-in requirements, service sizes, and finishes. Include product description and model.
- C. Certificates: Inspection certificates for pressure vessels from authority having jurisdiction.
- D. Manufacturer's Installation Instructions: Indicate hanging and support methods, joining procedures.
- E. Maintenance Data: Include installation instructions, assembly views, lubrication instructions, and replacement parts list.
- F. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.

1.06 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- C. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 AIR VENTS

- A. Manual Type: Short vertical sections of 2 inch diameter pipe to form air chamber, with 1/8 inch brass needle valve at top of chamber.
- B. Float Type:

1. Brass or semi-steel body, copper, polypropylene, or solid non-metallic float, stainless steel valve and valve seat; suitable for system operating temperature and pressure; with isolating valve.
 2. Cast iron body and cover, float, bronze pilot valve mechanism suitable for system operating temperature and pressure; with isolating valve.
- C. Washer Type:
1. Brass with hygroscopic fiber discs, vent ports, adjustable cap for manual shut-off, and integral spring loaded ball check valve.
- D. Maximum Fluid Pressure: 150 psi.
- E. Maximum Fluid Temperature: 250 degrees F.

2.02 STRAINERS

- A. Size 2 inch and Under:
1. Screwed brass or iron body for 175 psi working pressure, Y pattern with 1/32 inch stainless steel perforated screen.
- B. Size 2-1/2 inch to 4 inch:
1. Provide flanged or grooved iron body for 175 psi working pressure, Y pattern with 1/16 inch, or 3/64 inch stainless steel perforated screen.

2.03 PRESSURE-TEMPERATURE TEST PLUGS

- A. Construction: Brass body designed to receive temperature or pressure probe with removable protective cap, and Neoprene rated for service employed.
- B. Application: Use extended length plugs to clear insulated piping.

2.04 BALANCING VALVES

- A. Size 2 inch and Smaller:
1. Provide ball style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and NPT threaded or soldered connections.
 2. Metal construction materials consist of bronze or brass.
 3. Non-metal construction materials consist of Teflon, EPDM, or engineered resin.
- B. Size 2.5 inch and Larger:
1. Provide ball style with flow balancing, flow measurement, and shut-off capabilities, memory stops, minimum of two metering ports and flanged, grooved, or weld end connections.
 2. Valve body construction materials consist of cast iron, carbon steel, or ductile iron.
 3. Internal components construction materials consist of brass, aluminum bronze, bronze, Teflon, EPDM, or NORYL.

2.05 COMBINATION FLOW CONTROLS

- A. Construction: Brass or bronze body with union on inlet and outlet, temperature and pressure test plug on inlet and outlet with blowdown/backflush drain.
- B. Calibration: Control flow within 5 percent of selected rating, over operating pressure range of 10 times minimum pressure required for control, maximum minimum pressure 3.5 psi.
- C. Control Mechanism: Stainless steel or nickel plated brass piston or regulator cup, operating against stainless steel helical or wave formed spring.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install specialties in accordance with manufacturer's instructions.
- B. Where large air quantities can accumulate, provide enlarged air collection standpipes.
- C. Provide manual air vents at system high points and as indicated.
- D. For automatic air vents in ceiling spaces or other concealed locations, provide vent tubing to nearest drain.

- E. Provide valved drain and hose connection on strainer blow down connection.
- F. Provide radiator balancing valves on water outlet from terminal heating units such as radiation, unit heaters, and fan coil units.
- G. Select system relief valve capacity so that it is greater than make-up pressure reducing valve capacity. Select equipment relief valve capacity to exceed rating of connected equipment.

3.02 MAINTENANCE

- A. See Section 01 70 00 - Execution Requirements, for additional requirements relating to maintenance service.
- B. Explain corrective actions to Owner's maintenance personnel in person.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 22 13
STEAM AND CONDENSATE HEATING PIPING

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Pipe and pipe fittings.
- B. Valves.
- C. Steam piping system.
- D. Steam condensate piping system.

1.03 RELATED REQUIREMENTS

- A. Section 23 05 48 - Vibration and Seismic Controls for Heating, Ventilation, Air-Conditioning, and Cooling (HVAC)
- B. Section 23 07 19 - HVAC Piping Insulation.
- C. Section 23 05 53 - Identification for HVAC Piping and Equipment.
- D. Section 23 22 14 - Steam and Condensate Heating Specialties.
- E. Section 23 52 13 - Electric Boilers

1.04 REFERENCE STANDARDS

- A. ASME (BPV IX) - Boiler and Pressure Vessel Code, Section IX - Welding and Brazing Qualifications; The American Society of Mechanical Engineers; 2007.
- B. ASME B16.3 - Malleable Iron Threaded Fittings; The American Society of Mechanical Engineers; 1998 (R2006).
- C. ASME B31.1 - Power Piping; The American Society of Mechanical Engineers; 2007 (ANSI/ASME B31.1).
- D. ASME B31.9 - Building Services Piping; The American Society of Mechanical Engineers; 2008 (ANSI/ASME B31.9).
- E. ASTM A 53/A 53M - Standard Specification for Pipe, Steel, Black and Hot-Dipped, Zinc Coated, Welded and Seamless; 2007.
- F. ASTM A 234/A 234M - Standard Specification for Piping Fittings of Wrought Carbon Steel and Alloy Steel for Moderate and High Temperature Service; 2007.
- G. AWS D1.1/D1.1M - Structural Welding Code - Steel; American Welding Society; 2010.
- H. MSS SP-58 - Pipe Hangers and Supports - Materials, Design and Manufacture; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2009.
- I. MSS SP-69 - Pipe Hangers and Supports - Selection and Application; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.
- J. MSS SP-89 - Pipe Hangers and Supports - Fabrication and Installation Practices; Manufacturers Standardization Society of the Valve and Fittings Industry, Inc.; 2003.

1.05 SYSTEM DESCRIPTION

- A. When more than one piping system material is selected, ensure systems components are compatible and joined to ensure the integrity of the system is not jeopardized. Provide necessary joining fittings. Ensure flanges, unions, and couplings for servicing are consistently provided.

- B. Use unions and flanges downstream of valves and at equipment or apparatus connections. Use dielectric unions where joining dissimilar materials. Do not use direct welded or threaded connections.
- C. Provide pipe hangers and supports in accordance with ASME B31.9 unless indicated otherwise.
- D. Use rising stem gate valves for shut-off and to isolate equipment, part of systems, or vertical risers.

1.06 SUBMITTALS

- A. See Section 01 35 23 - Owner Safety Requirements.
- B. Product Data: Provide data on pipe materials, pipe fittings, valves and accessories. Provide manufacturers catalogue information. Indicate valve data and ratings.
- C. Welders Certificate: Include welders certification of compliance with ASME (BPV IX).
- D. Project Record Documents: Record actual locations of valves.

1.07 QUALITY ASSURANCE

- A. Manufacturer: Company specializing in manufacturing the type of products specified in this section, with minimum three years of documented experience.
- B. Welders: Certify in accordance with ASME (BPV IX).

1.08 REGULATORY REQUIREMENTS

- A. Conform to ASME B31.9 and ASME B31.1 code for installation of piping system.
- B. Provide certificate of compliance from authority having jurisdiction indicating approval of welders.
- C. Welding Materials and Procedures: Conform to ASME (BPV IX) and applicable state labor regulations.

1.09 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labelling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

1.10 EXTRA MATERIALS

- A. See Section 01 60 00 - Product Requirements, for additional provisions.
- B. Provide two repacking kits for each size and valve type.

PART 2 PRODUCTS

2.01 MEDIUM AND PRESSURE STEAM PIPING (150 PSIG MAXIMUM)

- A. Steel Pipe: ASTM A 53/A 53M, Schedule 40, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 150, or ASTM A 234/A 234M wrought steel welding type.
 - 2. Joints: ASME B31.1 welded.

2.02 MEDIUM PRESSURE STEAM CONDENSATE PIPING

- A. Steel Pipe: ASTM A53/A53M, Schedule 80, black.
 - 1. Fittings: ASME B16.3 malleable iron Class 300, or ASTM A 234/A 234M wrought steel.
 - 2. Joints: Threaded, or ASME B31.1 welded.

2.03 PIPE HANGERS AND SUPPORTS

- A. Conform to ASME B31.9.

- B. Hangers for Pipe Sizes 2 to 4 Inches: Carbon steel, adjustable, clevis.
- C. Hangers for Pipe Sizes 6 Inches and Over: Adjustable steel yoke, cast iron roll, double hanger.
- D. Multiple or Trapeze Hangers for Pipe Sizes 6 Inches and Over: Steel channels with welded spacers and hanger rods; cast iron roll and stand.

2.04 UNIONS, FLANGES, AND COUPLINGS

- A. Unions for Pipe 2 Inches and Under:
 - 1. Ferrous Piping: 150 psig galvanized malleable iron, threaded.
- B. Flanges for Pipe Over 2 Inches:
 - 1. Ferrous Piping: 150 psig forged steel, slip-on.
 - 2. Gaskets: Spiral wound metallic
- C. Dielectric Connections: Union with galvanized or plated steel threaded end, copper solder end, water impervious isolation barrier.

2.05 GATE VALVES, GLOBE VALVES, CHECK VALVES

- A. Manufacturers:
 - 1. Bonney Forge; www.bonneyforge.com
 - 2. Velan; www.velan.com
 - 3. McMaster Carr; www.mcmaster.com
- B. Construction
 - 1. Up To and Including 2 Inches:
 - a. ASME Class 150
 - b. Forged Steel Valves
 - c. Female threaded connection
 - 2. Over 2 Inches:
 - a. ASME Class 150
 - b. Cast Steel Valves
 - c. Raised flange connection
 - 3. Rising Stem OS&Y
 - 4. Bolted bonnet
 - 5. Spiral wound stainless steel & graphite gasket material
 - 6. Full port on all gate valves

2.06 SWING CHECK VALVES

- A. Up To and Including 2 Inches:
 - 1. Steel body, bronze trim, bronze rotating swing disc with composition seat, solder ends.
- B. Over 2 Inches:
 - 1. Steel body, bronze trim, bronze or bronze faced rotating swing disc, renewable disc and seat, flanged ends.

PART 3 EXECUTION

3.01 PREPARATION

- A. Ream pipe and tube ends. Remove burrs. Bevel plain end ferrous pipe.
- B. Remove scale and dirt on inside and outside before assembly.
- C. Prepare piping connections to equipment with flanges or unions.
- D. Keep open ends of pipe free from scale and dirt. Whenever work is suspended during construction protect open ends with temporary plugs or caps.
- E. After completion, fill, clean, and treat systems.

3.02 INSTALLATION

- A. Install in accordance with manufacturer's instructions.

- B. Route piping in orderly manner, plumb and parallel to building structure, and maintain gradient.
- C. Install piping to conserve building space and avoid interference with use of space.
- D. Install piping to allow for expansion and contraction without stressing pipe, joints, or connected equipment.
- E. Inserts:
 - 1. Provide inserts for placement in concrete formwork.
 - 2. Provide inserts for suspending hangers from reinforced concrete slabs and sides of reinforced concrete beams.
 - 3. Provide hooked rod to concrete reinforcement section for inserts carrying pipe over 4 inches.
 - 4. Where concrete slabs form finished ceiling, locate inserts flush with slab surface.
 - 5. Where inserts are omitted, drill through concrete slab from below and provide through-bolt with recessed square steel plate and nut above slab.
- F. Pipe Hangers and Supports:
 - 1. Install in accordance with ASME B31.9.
 - 2. Support horizontal piping as scheduled.
 - 3. Place hangers within 12 inches of each horizontal elbow.
 - 4. Use hangers with 1-1/2 inch minimum vertical adjustment. Design hangers for pipe movement without disengagement of supported pipe.
 - 5. Support vertical piping at every other floor. Support riser piping independently of connected horizontal piping.
 - 6. Where several pipes can be installed in parallel and at same elevation, provide multiple or trapeze hangers.
 - 7. Provide copper plated hangers and supports for copper piping.
- G. Provide clearance for installation of insulation and access to valves and fittings.
- H. Provide access where valves and fittings are not exposed.
- I. Slope steam piping one inch in 40 feet in direction of flow. Use eccentric reducers to maintain bottom of pipe level.
- J. Slope steam condensate piping one inch in 40 feet. Provide drip trap assembly at low points and before control valves. Run condensate lines from trap to nearest condensate receiver. Provide loop vents over trapped sections.
- K. Where pipe support members are welded to structural building framing, scrape, brush clean, and apply one coat of zinc rich primer to welds.
- L. Prepare unfinished pipe, fittings, supports, and accessories ready for finish painting. Refer to Section 09 90 00.
- M. Install valves with stems upright or horizontal, not inverted.

3.03 SCHEDULES

- A. Hanger Spacing for Steel Steam Piping.
 - 1. 1/2 inch: Maximum span, 8 feet; minimum rod size, 1/4 inch.
 - 2. 3/4 inch and 1 inch: Maximum span, 9 feet; minimum rod size, 1/4 inch.
 - 3. 1-1/4 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
 - 4. 1-1/2 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
 - 5. 2 inches: Maximum span, 13 feet; minimum rod size, 3/8 inch.
 - 6. 2-1/2 inches: Maximum span, 14 feet; minimum rod size, 3/8 inch.
 - 7. 3 inches: Maximum span, 15 feet; minimum rod size, 3/8 inch.
 - 8. 4 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.
 - 9. 6 inches: Maximum span, 21 feet; minimum rod size, 1/2 inch.
 - 10. 8 inches: Maximum span, 24 feet; minimum rod size, 5/8 inch.
- B. Hanger Spacing for Steel Steam Condensate Piping.

1. 1/2 inch, 3/4 inch, and 1 inch: Maximum span, 7 feet; minimum rod size, 1/4 inch.
2. 1-1/4 inches: Maximum span, 8 feet; minimum rod size, 3/8 inch.
3. 1-1/2 inches: Maximum span, 9 feet; minimum rod size, 3/8 inch.
4. 2 inches: Maximum span, 10 feet; minimum rod size, 3/8 inch.
5. 2-1/2 inches: Maximum span, 11 feet; minimum rod size, 3/8 inch.
6. 3 inches: Maximum span, 12 feet; minimum rod size, 3/8 inch.
7. 4 inches: Maximum span, 14 feet; minimum rod size, 1/2 inch.
8. 6 inches: Maximum span, 17 feet; minimum rod size, 1/2 inch.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 22 14
STEAM AND CONDENSATE HEATING SPECIALTIES

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Steam traps.
- B. Steam air vents.
- C. Steam safety valves.
- D. Control valves.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 13 - Common Motor Requirements for HVAC Equipment: Pump motors.
- B. Section 23 07 16 - HVAC Equipment Insulation.
- C. Section 23 07 19 - HVAC Piping Insulation.
- D. Section 23 22 13 - Steam and Condensate Heating Piping.
- E. Section 23 52 13 - Electric Boilers

1.03 REFERENCE STANDARDS

- A. ASME B31.9 - Building Services Piping; 2020.
- B. ASTM A126 - Standard Specification for Gray Iron Castings for Valves, Flanges, and Pipe Fittings; 2004 (Reapproved 2019).
- C. ASTM A743/A743M - Standard Specification for Castings, Iron-Chromium, Iron-Chromium-Nickel, Corrosion Resistant, for General Application; 2017.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data:
 - 1. Provide for manufactured products and assemblies required for this project.
 - 2. Include product description, model, dimensions, component sizes, rough-in requirements, service sizes, and finishes.
 - 3. Submit schedule indicating manufacturer, model number, size, location, rated capacity, load served, and features for each specialty.
 - 4. Include electrical characteristics and connection requirements.
- C. Manufacturer's Installation Instructions: Indicate application, selection, and hookup configuration. Include pipe and accessory elevations.
- D. Operation and Maintenance Data: Include installation instructions, servicing requirements, and recommended spare parts lists.
- E. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 - 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 - 2. Steam Trap Service Kits: One for each type and size.

1.05 QUALITY ASSURANCE

- A. Perform Work in accordance with State of Arkansas standard for installation of boilers and pressure vessels.
 - 1. Maintain one copy of each document on site.
- B. Manufacturer Qualifications: Company specializing in manufacturing the types of products specified in this section, with minimum 10 years of documented experience.
- C. Products Requiring Electrical Connection: Listed and classified by UL as suitable for the purpose indicated.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Accept valves on site in shipping containers with labeling in place. Inspect for damage.
- B. Provide temporary protective coating on cast iron and steel valves.
- C. Provide temporary end caps and closures on piping and fittings. Maintain in place until installation.
- D. Protect piping systems from entry of foreign materials by temporary covers, completing sections of the work, and isolating parts of completed system.

PART 2 PRODUCTS

2.01 STEAM TRAPS

- A. Manufacturers:
 - 1. Armstrong International, Inc: www.armstronginternational.com.
 - 2. Marshall Engineered Products Company: www.mepcollc.com.
 - 3. Spirax-Sarco: www.spiraxsarco.com/us.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 STEAM TRAPS

- A. Steam Trap Applications:
 - 1. Use Float and Thermostatic Traps for:
 - a. Boilers
 - 2. Use Inverted Bucket Steam Traps for:
 - a. Main headers.
 - b. Branch lines.
- B. Steam Trap Performance:
 - 1. Select to handle minimum of two times maximum condensate load of apparatus served.
 - 2. Pressure Differentials:
 - a. Low Pressure Systems (5 psi and less): 1/2 psi.
 - b. Medium Pressure Steam (25 psi maximum): 5 psi.
 - c. High Pressure Steam (100 psi maximum): 30 psi.
- C. Inverted Bucket Traps: ASTM A126, cast iron or semi-steel body with bolted cover, brass bucket, stainless steel seats and plungers, and stainless steel lever mechanism with knife edge operating surfaces.
 - 1. Rating: 60 psi WSP.
 - 2. Features: Access to internal parts without disturbing piping, top test plug, bottom drain plugs.
 - 3. Accessories:
 - a. Integral inlet strainer of brass.
 - b. Integral inlet check valve.
 - c. Integral bimetal air vent.
- D. Float and Thermostatic Traps: ASTM A126 cast iron or semi-steel body and bolted cover, stainless steel or bronze bellows type air vent, stainless steel or copper float, stainless steel lever and valve assembly.
 - 1. Rating: 15 psi WSP.
 - 2. Features: Access to internal parts without disturbing piping, bottom drain plug.
 - 3. Accessories: Gauge glass with shut-off cocks.

2.03 STEAM AIR VENTS

- A. 125 psi WSP: Balanced pressure type; cast brass body and cover; access to internal parts without disturbing piping; stainless steel bellows, stainless steel valve and seat.

2.04 SAFETY RELIEF VALVES

- A. Valve: Bronze body, stainless steel valve spring, stem, and trim, direct pressure actuated, capacities ASME certified and labelled.
- B. Accessories: Drip pan elbow.

2.05 CONTROL VALVES

- A. Materials:
 - 1. Valve Body: Carbon steel A216 Grade WCB.
 - 2. Bonnet: Carbon steel A216 Grade WCB.
 - 3. Valve/Valve Seat: 17-4 PH h900.
 - 4. Valve Spindle: Stainless steel, comply with ASTM A276/A276M, Type 431.
 - 5. Gland Packing:
 - a. Carbon filled V-Teflon, 450 degrees F.
 - b. Grafoil, 800 degrees F.
 - 6. Yoke: Ductile iron.
 - 7. Actuator Spring: Silicon chromium spring steel.
 - 8. Actuator Diaphragm: Nitrite reinforced with nylon fiber.
 - 9. Cage Material: Stainless steel CB30, comply with ASTM A743/A743M.
 - 10. Sealing Ring Material: Carbon filled V-Teflon.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install steam and steam condensate piping and specialties in accordance with ASME B31.9.
- B. Install specialties in accordance with manufacturer's instructions.
- C. Steam Traps:
 - 1. Provide minimum 3/4 inch size on steam mains and branches.
 - 2. Install with union or flanged connections at both ends.
 - 3. Provide gate valve and strainer at inlet, and gate valve and check valve at discharge.
 - 4. Provide minimum 10 inch long, line size dirt pocket between apparatus and trap.
- D. Remove thermostatic elements from steam traps during temporary and trial usage, and until system has been operated and dirt pockets cleaned of sediment and scale.
- E. In high pressure and medium pressure mains, provide 3/4 inch nipple in bottom of main, extending 3/4 inch into and above bottom of pipe. Provide dirt pocket with 1/2 inch high pressure thermostatic trap.
- F. Provide pressure reducing stations with pressure reducing valve, valved bypass, strainer and pressure gauge on upstream side, relief valve and pressure gauge on downstream side of pressure reducing valve.
 - 1. Pressure reducing station shall be one or two stages as indicated, to produce flat reduced pressure curve over range of capacity.
 - 2. Locate pilot operator control minimum 6 feet downstream of valve.
- G. Rate relief valves for pressure upstream of pressure reducing station, for full operating capacity. Set relief at maximum 20 percent above reduced pressure.
- H. Terminate relief valves to outdoors 2 feet minimum above roof. Provide drip pan elbow with drain connection to nearest floor drain.
- I. When several relief valve vents are connected to a common header, header cross section area shall equal sum of individual vent outlet areas.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 23 52 13 ELECTRIC BOILERS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Boiler.
- B. Boiler controls.
- C. Water connections.
- D. Electrical hook-up.

1.02 RELATED REQUIREMENTS

- A. Section 23 05 48 - Vibration and Seismic Controls for HVAC Piping and Equipment.
- B. Section 23 09 13 - Instrumentation and Control Devices for HVAC: Installation and wiring of indoor-outdoor controller.
- C. Section 23 22 14 - Steam and Condensate Heating Specialties.
- D. Section 26 05 83 - Wiring Connections: Electrical characteristics and wiring connections.

1.03 REFERENCE STANDARDS

- A. AHRI 1500 - Performance Rating of Commercial Space Heating Boilers; 2015.
- B. ASME B16.5 - Pipe Flanges and Flanged Fittings: NPS 1/2 through NPS 24 Metric/Inch Standard; 2020.
- C. ASHRAE Std 135 - A Data Communication Protocol for Building Automation and Control Networks; 2020, with Errata and Amendments (2021).
- D. ASME BPVC-IV - Boiler and Pressure Vessel Code, Section IV - Rules for Construction of Heating Boilers; 2021.
- E. ASME BPVC-VIII-1 - Boiler and Pressure Vessel Code, Section VIII, Division 1: Rules for Construction of Pressure Vessels; 2021.
- F. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.

1.04 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide literature indicating general assembly components, controls, safety controls, wiring diagrams with electrical characteristics and connection requirements, and service connections.
- C. Shop Drawings: Indicate assembly, weights, heater configuration, and electrical characteristics and connection requirements.
- D. Manufacturer's Instructions: Indicate rigging, installation, and start-up procedures.
- E. Manufacturer's Field Reports: Indicate conditions observed after start-up, including control settings.
- F. Start-Up Reports: Factory Hydrostatic test results. Field tests to be performed during start-up.
- G. Operation and Maintenance Data: Include manufacturer's descriptive literature, operating instructions, cleaning procedures, replacement parts list, and maintenance and repair data.
- H. Warranty: Submit manufacturer warranty and ensure forms have been completed in Owner's name and registered with manufacturer.

1.05 QUALITY ASSURANCE

- A. Manufacturer Qualifications: Company specializing in manufacturing the type of products specified in this section, with minimum 10 years of documented experience.
- B. Hydrostatic Test: Factory to perform a functional controls test for all safety devices; perform hydrostatic test; and continuity test for contactors and relays.
- C. Test and inspect factory-assembled boilers, before shipping, according to most current ASME Boiler and Pressure Vessel Code.
- D. All wiring shall be in compliance with the National Electric Code.

1.06 DELIVERY, STORAGE, AND HANDLING

- A. Protect units before, during, and after installation from damage to casing by leaving factory shipping packaging in place until immediately prior to final acceptance.

1.07 WARRANTY

- A. See Section 01 78 00 - Closeout Submittals for additional warranty requirements.
- B. Manufacturer agrees to repair or provide replacement components of boilers that fail in materials or workmanship within specified warranty period.
- C. Warranty period
 - 1. The pressure vessel shall be warranted against defective workmanship and materials for a period of ten (10) years from shipment. This warranty does not include issues caused by improper water treatment or incorrect use and/or abuse of the boiler.
 - 2. Heating elements shall be warranted against defective workmanship and materials for a period of five (5) years from shipment. This warranty does not include issues caused by improper water treatment or incorrect use and/or abuse of the boiler.
 - 3. All parts not covered by the above shall carry a two (2) year warranty from shipment.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Cleaver Brooks: www.cleaverbrooks.com; Model S.
- B. Chromalox: www.chromalox.com; Model CHSI
- C. Lattner Boiler Company: www.lattner.com; Cabinet Series
- D. Substitutions: See Section 01 60 00 - Product Requirements.

2.02 REGULATORY REQUIREMENTS

- A. Comply with applicable codes for internal wiring of factory wired equipment.
- B. ASME Compliance: Fabricate and label boilers to comply with the current version of the ASME Boiler and Pressure Vessel Code.
 - 1. ASME stamp on boiler vessel.
- C. UL Compliance: Test boilers for compliance with UL 834. Boilers shall be listed and labeled by a testing agency acceptable to authorities having jurisdiction.
 - 1. cULus packaged boiler label affixed to the control panel.
- D. Boiler and controls shall be compliant with ASME CSD-1 Code requirements.
- E. National Board registered with stamp on boiler vessel.
- F. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, by a qualified testing agency, and marked for intended location and application.
 - 1. "National Electrical Code," Article 424, Part VII.

2.03 PERFORMANCE REQUIREMENTS

- A. Performance rating in accordance with AHRI 1500.
- B. Rating: As indicated on equipment schedule.

- C. Electrical Characteristics: As indicated on equipment schedule.
 - 1. See Section 26 05 83.

2.04 MANUFACTURED UNITS

- A. Description: Electric steam boiler with automatic controls. The boiler, with all piping and wiring, shall be a factory package. Each boiler shall be neatly finished, thoroughly tested, and properly packaged for shipping. Boiler design and construction shall be in accordance with Section I of the ASME Code for steam boilers with a maximum working pressure of 150 PSIG.

2.05 FABRICATION

- A. Assembly: Welded steel shell; heater support nipples or flanges; inspection handhole; necessary fittings to accept gauges, safety and operating controls; threaded or flanged inlet and outlet connections; inlet diffuser; and lifting lugs, complying with ASME BPVC-IV and ASME BPVC-VIII-1 requirements, and tested for maximum working pressure of 160 psig.
- B. Heating Elements: Threaded or flanged, incoloy 800 sheathed (copper is not acceptable), with maximum density of 75 W/sq in, suitable for operation at 160 psig. Attach each element to tube sheet by mechanical assembly permitting single elements to be replaced with standard tools without replacing the entire tube bundle.
 - 1. The heating elements length shall not exceed 36 inches.
- C. Insulate heat exchanger with a minimum of 2 inch thick mineral-fiber insulation with a minimum 1.5 pcf density. Radiation and convection losses shall not exceed 0.5% of total boiler output. Enclose insulation in a minimum 18-gauge steel jacket with factory applied baked enamel finish in manufacturer's standard color.

2.06 TRIM

- A. ASME Section I approved side outlet type pressure relief valve set at 150 psi.
- B. Assemble with pressure gauge, thermometer in brass separable well, automatic air vent, and drain valve.
- C. Low water cut-off float type control with automatic reset and test switch to automatically prevent operation when water falls below safe level. Auxiliary low water cut-off probe with manual reset.
- D. Status lights for power on, high pressure cutoff, low water cutoff, auxiliary low water cutoff, and step status for each step.
- E. Alarm horn (electronic sounder)
- F. Steam isolation valve and piping for flanged connection
- G. Electronic operating temperature controller with full cover for wall mounting, ambient temperature range minus 30 to 150 degrees F, adjustable reset ration of outside air temperature change to discharge control point change 1:2 to 100:1, integral setpoint adjustment 80 to 230 degrees F, electronic primary and outdoor sensors, for on-off switching of pilot duty relays.
- H. High limit temperature controller with automatic reset to prevent boiler water temperature from exceeding safe system temperature.

2.07 CONTROLS

- A. Provide pre-wired, factory assembled electric controls enclosed in NEMA 250, Type 1A cabinet, factory mounted integral with unit.
- B. Controls:
 - 1. All controls to be panel mounted and located on the boiler as to provide ease of servicing the boiler without disturbing the controls and also located to prevent possible damage by water according to UL and CSA requirements.
 - 2. System integration controller shall be provided to stage boiler with future boiler using a separate boiler lead-lag panel.

- a. The control shall include automatic selection of needed boilers based on load demand. The control shall monitor supply water heater temperature, return water temperature to each boiler, and shall communicate to boilers using a 4-20mA analog signal.
 3. Boilers controls shall communicate with existing BACnet I/P building management system utilizing a protocol translator if boiler native protocol is anything other than BACnet.
 - a. Protocol translator shall be factory mounted in a NEMA 1 enclosure with power supply and terminals.
 4. The boiler controls shall include provisions for remote pressure setpoint.
 5. Remote monitoring capabilities to allow end user 24/7 viewing access into the electric boiler panel and be provided with push alerts.
 6. Proportioning step control capabilities:
 - a. 1-Step: (1) On/Off temperature switch.
 - b. 2-Steps: (2) On/Off temperature switch.
 - c. 3-Steps+: (1) solid state electronic proportional temperature control with progressive step control, adjustable span, and interstage time delay.
 - 1) Boiler pressure and pressure setpoint shall be displayed. A pressure transmitter shall be provided and wired to the PID process controller.
 - 2) Control shall be equipped with a touchscreen display for set up, trouble shooting, and operational display, and shall include BACnet communication capability.
 - 3) Set-points and configurations shall be factory pre-configured. Parameter settings are to be established to suit jobsite conditions and to be configured at the time of initial jobsite operation.
 - d. Silicon controlled rectifier (SCR) control
- C. Peak load control system.
 1. Pump motor starter auxiliary contact and modulating pump control.
 2. Flow switch.
- D. BAS, SCADA, or other Integrated Automation Link: ASHRAE Std 135, BACnet IP.
 1. External Point Mapping: Provide mapping table for each parameter included in the local visual interface with software-toggle flag to allow reduced mapping of available points.
 2. Remotely coordinated by boiler plant demand optimization controller; see Section 25 14 00.

2.08 ELECTRICAL POWER

- A. Electrical power: As indicated on equipment schedule.
- B. Main lugs for supply circuits.
 1. Mechanical lugs bolted to copper bus bars or distributions blocks with pressure connectors.
 2. Panel electrical short circuit current rating (SCCR) shall be 10,000 amps interrupting current. Higher SCCR ratings available upon request.
- C. Fused 120V control circuit transformer.
- D. Supplemental internal branch circuit fuses, current limiting, non-renewable, rated at 200,000 amps interrupting capacity.
- E. Magnetic contactors rated at 500,000 cycles, 50A resistive up to 600V.
- F. Housed in NEMA 250, Type 1A enclosure with louvers.
- G. Wiring shall be numbered and color coded to match a wiring diagram.
 1. Install factory wiring outside of an enclosure in a metal raceway or conduit.
 2. Minimum heating element wire size shall be #8 AWG.
 3. Minimum control circuit wire size shall be #16 AWG.
- H. Field power interface shall be to fused disconnect switch or molded case magnetic circuit breaker.

1. Disconnect shall be through the door type and mounted directly to boiler main electrical cabinet.
2. Ground fault current interrupting (GFCI) circuit breaker
3. Panel mounted power meter to measure and display input voltage, amperage, and/or power.
 - a. Data Logging:
 - 1) Totalized power consumption (kWh)
 - 2) Real-time clock
 - 3) Limit alarms
 - b. Communications over Ethernet

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install in accordance with manufacturer's instructions.
- B. Secure boiler to existing concrete housekeeping base. Verify pad level and provide leveling where necessary. Attach packaged boiler base skid at anchoring pockets to concrete base with seismically rated anchor bolts. see Section 23 05 48.
- C. Provide piping connections and accessories as indicated; see Section 23 22 13.
- D. Pipe relief valves to nearest floor drain.
- E. Provide for connection to electrical service; see Section 26 05 83.
- F. Coordinate BAS, BMS, or Integrated Automation linking between unit controller(s) and remote monitoring location as indicated on plans..

3.02 FIELD QUALITY CONTROL

- A. General: The boiler supplier's factory authorized service organization shall be responsible for performance of inspections, start up and testing of the package boiler, and accessory equipment and materials furnished under this Section. All labor, equipment, and test apparatus shall be furnished by the authorized service organization. All equipment defects discovered by the tests shall be rectified either by the service organization or boiler manufacturer.
- B. Equipment inspection: Boiler representative shall inspect boilers and other equipment upon arrival, verifying completeness of equipment supplied and potential damages. All shipped loose components, to be mounted and installed on boiler by contractor.
- C. Equipment shall be flushed prior to start-up per the water treatment company guidelines and product installation manual requirements.
- D. Pre start-up walk through: Boiler representative shall review the installation with the mechanical contractor prior to start-up and note any required changes prior to start-up.
- E. Start-up shall be conducted by experienced and factory authorized technician in the regular employment of the authorized service organization, and shall include:
 1. Demonstrate that boiler, controls, and accessories comply with requirements of this Section as proposed by the boiler and accessories supplier. Pre-test all items prior to scheduling the final testing that will be witnessed by the test engineer.
 2. Demonstrate that boiler performs at different rates of load to ensure progressive step controller function.
- F. Auxiliary Equipment and Accessories: Observe and check all valves, electric motors and other accessories and appurtenant equipment during the operational and capacity tests for leakage, malfunctioning, defects, and non-compliance with referenced standards or overloading as applicable.
- G. Commissioning Requirements: Refer to Commissioning Specification Section - 23 0800 for additional requirements.
 1. Set up operating set points
 2. Set up modulating process controller

3. Check all safeties, including low water cutoff and high limits.
4. Check heating elements for moisture accumulation.

3.03 DEMONSTRATION AND TRAINING

- A. Training to include all safety procedures, maintenance procedures, control operations, and diagnostic procedures. Training to be provided in a single 4 hour continuous session to accommodate operator's availability on site.

3.04 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training for additional requirements.

3.05 MAINTENANCE

- A. See Section 01 70 00 - Execution and Closeout Requirements for additional requirements.
- B. Provide service and maintenance of boilers for one year from Date of Substantial Completion.

END OF SECTION

SECTION 26 05 05
SELECTIVE DEMOLITION FOR ELECTRICAL

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Electrical demolition.

1.02 RELATED REQUIREMENTS

- A. Section 01 70 00 - Execution and Closeout Requirements: Additional requirements for alterations work.

PART 2 PRODUCTS

2.01 MATERIALS AND EQUIPMENT

- A. Materials and equipment for patching and extending work: As specified in individual sections.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify field measurements and circuiting arrangements are as indicated.
- B. Verify that abandoned wiring and equipment serve only abandoned facilities.
- C. Demolition drawings are based on casual field observation and existing record documents.
- D. Report discrepancies to Architect Engineer before disturbing existing installation.
- E. Beginning of demolition means installer accepts existing conditions.

3.02 PREPARATION

- A. Disconnect electrical systems in walls, floors, and ceilings to be removed.
- B. Coordinate utility service outages with utility company and Owner.
- C. Provide temporary wiring and connections to maintain existing systems in service during construction. When work must be performed on energized equipment or circuits, use personnel experienced in such operations.
- D. Existing Electrical Service: Maintain existing system in service until new system is complete and ready for service. Disable system only to make switchovers and connections. Minimize outage duration.
 - 1. Obtain permission from Owner at least 24 hours before partially or completely disabling system.
 - 2. Make temporary connections to maintain service in areas adjacent to work area.

3.03 DEMOLITION AND EXTENSION OF EXISTING ELECTRICAL WORK

- A. Perform work for removal and disposal of equipment and materials containing toxic substances regulated under the Federal Toxic Substances Control Act (TSCA) in accordance with applicable federal, state, and local regulations. Applicable equipment and materials include, but are not limited to:
 - 1. PCB-containing electrical equipment, including transformers, capacitors, and switches.
 - 2. PCB- and DEHP-containing lighting ballasts.
 - 3. Mercury-containing lamps and tubes, including fluorescent lamps, high intensity discharge (HID), arc lamps, ultra-violet, high pressure sodium, mercury vapor, ignitron tubes, neon, and incandescent.
- B. Remove, relocate, and extend existing installations to accommodate new construction.
- C. Remove abandoned wiring to source of supply.
- D. Remove exposed abandoned conduit, including abandoned conduit above accessible ceiling finishes. Cut conduit flush with walls and floors, and patch surfaces.

- E. Disconnect abandoned outlets and remove devices. Remove abandoned outlets if conduit servicing them is abandoned and removed. Provide blank cover for abandoned outlets that are not removed.
- F. Disconnect and remove electrical devices and equipment serving utilization equipment that has been removed.
- G. Repair adjacent construction and finishes damaged during demolition and extension work.
- H. Maintain access to existing electrical installations that remain active. Modify installation or provide access panel as appropriate.
- I. Extend existing installations using materials and methods compatible with existing electrical installations, or as specified.

3.04 CLEANING AND REPAIR

- A. See Section 01 74 19 - Construction Waste Management and Disposal for additional requirements.
- B. Clean and repair existing materials and equipment that remain or that are to be reused.
- C. Panelboards: Clean exposed surfaces and check tightness of electrical connections. Replace damaged circuit breakers and provide closure plates for vacant positions. Provide typed circuit directory showing revised circuiting arrangement.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTORS AND CABLES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Single conductor building wire.
- B. Manufactured wiring systems.
- C. Wiring connectors.
- D. Electrical tape.
- E. Heat shrink tubing.
- F. Wire pulling lubricant.
- G. Cable ties.

1.03 RELATED REQUIREMENTS

- A. Section 07 84 00 - Firestopping.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems: Additional requirements for grounding conductors and grounding connectors.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.

1.04 REFERENCE STANDARDS

- A. ASTM B3 - Standard Specification for Soft or Annealed Copper Wire; 2013 (Reapproved 2018).
- B. ASTM B8 - Standard Specification for Concentric-Lay-Stranded Copper Conductors, Hard, Medium-Hard, or Soft; 2011 (Reapproved 2017).
- C. ASTM B33 - Standard Specification for Tin-Coated Soft or Annealed Copper Wire for Electrical Purposes; 2010, with Editorial Revision (2020).
- D. ASTM B787/B787M - Standard Specification for 19 Wire Combination Unilay-Stranded Copper Conductors for Subsequent Insulation; 2004 (Reapproved 2020).
- E. ASTM D3005 - Standard Specification for Low-Temperature Resistant Vinyl Chloride Plastic Pressure-Sensitive Electrical Insulating Tape; 2017.
- F. ASTM D4388 - Standard Specification for Nonmetallic Semi-Conducting and Electrically Insulating Rubber Tapes; 2013.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- H. NEMA WC 70 - Power Cables Rated 2000 Volts or Less for the Distribution of Electrical Energy; 2021.
- I. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- J. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- K. UL 44 - Thermoset-Insulated Wires and Cables; Current Edition, Including All Revisions.
- L. UL 83 - Thermoplastic-Insulated Wires and Cables; Current Edition, Including All Revisions.
- M. UL 183 - Manufactured Wiring Systems; Current Edition, Including All Revisions.
- N. UL 267 - Outline of Investigation for Wire-Pulling Compounds; Most Recent Edition, Including All Revisions.

- O. UL 486A-486B - Wire Connectors; Current Edition, Including All Revisions.
- P. UL 486C - Splicing Wire Connectors; Current Edition, Including All Revisions.
- Q. UL 486D - Sealed Wire Connector Systems; Current Edition, Including All Revisions.
- R. UL 510 - Polyvinyl Chloride, Polyethylene, and Rubber Insulating Tape; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes of raceways, boxes, and equipment enclosures installed under other sections with the actual conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate with electrical equipment installed under other sections to provide terminations suitable for use with the conductors to be installed.
 - 3. Notify Architect Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conductors and cables, including detailed information on materials, construction, ratings, listings, and available sizes, configurations, and stranding.
- C. Field Quality Control Test Reports.
- D. Project Record Documents: Record actual installed circuiting arrangements. Record actual routing for underground circuits.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conductors and cables in accordance with manufacturer's instructions.

1.09 FIELD CONDITIONS

- A. Do not install or otherwise handle thermoplastic-insulated conductors at temperatures lower than 14 degrees F, unless otherwise permitted by manufacturer's instructions. When installation below this temperature is unavoidable, notify Architect Engineer and obtain direction before proceeding with work.

PART 2 PRODUCTS

2.01 CONDUCTOR AND CABLE APPLICATIONS

- A. Do not use conductors and cables for applications other than as permitted by NFPA 70 and product listing.
- B. Provide single conductor building wire installed in suitable raceway unless otherwise indicated, permitted, or required.
- C. Nonmetallic-sheathed cable is not permitted.
- D. Manufactured wiring systems are permitted only as follows:

2.02 CONDUCTOR AND CABLE GENERAL REQUIREMENTS

- A. Provide products that comply with requirements of NFPA 70.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Provide new conductors and cables manufactured not more than one year prior to installation.

- D. Unless specifically indicated to be excluded, provide all required conduit, boxes, wiring, connectors, etc. as required for a complete operating system.
- E. Comply with NEMA WC 70.
- F. Thermoplastic-Insulated Conductors and Cables: Listed and labeled as complying with UL 83.
- G. Thermoset-Insulated Conductors and Cables: Listed and labeled as complying with UL 44.
- H. Conductors for Grounding and Bonding: Also comply with Section 26 05 26.
- I. Conductor Material:
 - 1. Provide copper conductors only. Aluminum conductors are not acceptable for this project. Conductor sizes indicated are based on copper.
 - 2. Copper Conductors: Soft drawn annealed, 98 percent conductivity, uncoated copper conductors complying with ASTM B3, ASTM B8, or ASTM B787/B787M unless otherwise indicated.
 - 3. Tinned Copper Conductors: Comply with ASTM B33.
- J. Minimum Conductor Size:
 - 1. Branch Circuits: 12 AWG.
 - a. Exceptions:
 - 1) 20 A, 120 V circuits longer than 75 feet: 10 AWG, for voltage drop.
 - 2) 20 A, 120 V circuits longer than 150 feet: 8 AWG, for voltage drop.
 - 3) 20 A, 277 V circuits longer than 150 feet: 10 AWG, for voltage drop.
 - 2. Control Circuits: 14 AWG.
- K. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- L. Conductor Color Coding:
 - 1. Color code conductors as indicated unless otherwise required by the authority having jurisdiction. Maintain consistent color coding throughout project.
 - 2. Color Coding Method: Integrally colored insulation.
 - a. Conductors size 4 AWG and larger may have black insulation color coded using vinyl color coding electrical tape.
 - 3. Color Code:
 - a. 480Y/277 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Brown.
 - 2) Phase B: Orange.
 - 3) Phase C: Yellow.
 - 4) Neutral/Grounded: Gray.
 - b. 208Y/120 V, 3 Phase, 4 Wire System:
 - 1) Phase A: Black.
 - 2) Phase B: Red.
 - 3) Phase C: Blue.
 - 4) Neutral/Grounded: White.
 - c. Equipment Ground, All Systems: Green.
 - d. Travelers for 3-Way and 4-Way Switching: Pink.
 - e. For modifications or additions to existing wiring systems, comply with existing color code when existing code complies with NFPA 70 and is approved by the authority having jurisdiction.
 - f. For control circuits, comply with manufacturer's recommended color code.

2.03 SINGLE CONDUCTOR BUILDING WIRE

- A. Manufacturers:
 - 1. Copper Building Wire:
 - a. Cerro Wire LLC: www.cerrowire.com/#sle.
 - b. Encore Wire Corporation: www.encorewire.com/#sle.

- c. General Cable Technologies Corporation: www.generalcable.com/#sle.
 - d. Service Wire Co: www.servicewire.com/#sle.
 - e. Southwire Company: www.southwire.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Single conductor insulated wire.
- C. Conductor Stranding:
 - 1. Feeders and Branch Circuits:
 - a. Size 10 AWG and Smaller: Solid.
 - b. Size 8 AWG and Larger: Stranded.
 - 2. Control Circuits: Stranded.
- D. Insulation Voltage Rating: 600 V.
- E. Insulation:
 - 1. Copper Building Wire: Type THHN/THWN or THHN/THWN-2, except as indicated below.
 - a. Size 4 AWG and Larger: Type XHHW-2.
 - b. Fixture Wiring Within Luminaires: Type TFFN/TFN for luminaires with labeled maximum temperature of 90 degrees C; Approved suitable type for luminaires with labeled maximum temperature greater than 90 degrees C.

2.04 MANUFACTURED WIRING SYSTEMS

- A. Description: Manufactured wiring assemblies complying with NFPA 70 Article 604, and listed and labeled as complying with UL 183.
- B. Provide components necessary to transition between manufactured wiring system and other wiring methods.
- C. Branch Circuit Cables:
 - 1. Conductor Stranding (Size 10 AWG and Smaller): Solid.
 - 2. Insulation Voltage Rating: 600 V.
 - 3. Insulation: Type THHN.
 - 4. Grounding: Full-size integral equipment grounding conductor.
 - 5. Armor: Steel, interlocked tape.
- D. Connectors: Keyed and color-coded to prevent interconnection of different voltages.
- E. Fixture Leads: Type TFN insulation.

2.05 WIRING CONNECTORS

- A. Description: Wiring connectors appropriate for the application, suitable for use with the conductors to be connected, and listed as complying with UL 486A-486B or UL 486C as applicable.
- B. Connectors for Grounding and Bonding: Comply with Section 26 05 26.
- C. Wiring Connectors for Splices and Taps:
 - 1. Copper Conductors Size 8 AWG and Smaller: Use twist-on insulated spring connectors.
 - 2. Copper Conductors Size 6 AWG and Larger: Use mechanical connectors or compression connectors.
- D. Wiring Connectors for Terminations:
 - 1. Provide terminal lugs for connecting conductors to equipment furnished with terminations designed for terminal lugs.
 - 2. Provide compression adapters for connecting conductors to equipment furnished with mechanical lugs when only compression connectors are specified.
 - 3. Where over-sized conductors are larger than the equipment terminations can accommodate, provide connectors suitable for reducing to appropriate size, but not less than required for the rating of the overcurrent protective device.
 - 4. Provide motor pigtail connectors for connecting motor leads in order to facilitate disconnection.

5. Copper Conductors Size 8 AWG and Larger: Use mechanical connectors or compression connectors where connectors are required.
6. Stranded Conductors Size 10 AWG and Smaller: Use crimped terminals for connections to terminal screws.
7. Conductors for Control Circuits: Use crimped terminals for all connections.
- E. Do not use insulation-piercing or insulation-displacement connectors designed for use with conductors without stripping insulation.
- F. Do not use push-in wire connectors as a substitute for twist-on insulated spring connectors.
- G. Twist-on Insulated Spring Connectors: Rated 600 V, 221 degrees F for standard applications and 302 degrees F for high temperature applications; pre-filled with sealant and listed as complying with UL 486D for damp and wet locations.
- H. Mechanical Connectors: Provide bolted type or set-screw type.
- I. Compression Connectors: Provide circumferential type or hex type crimp configuration.
- J. Crimped Terminals: Nylon-insulated, with insulation grip and terminal configuration suitable for connection to be made.

2.06 ACCESSORIES

- A. Electrical Tape:
 1. Vinyl Color Coding Electrical Tape: Integrally colored to match color code indicated; listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; suitable for continuous temperature environment up to 221 degrees F.
 2. Vinyl Insulating Electrical Tape: Complying with ASTM D3005 and listed as complying with UL 510; minimum thickness of 7 mil; resistant to abrasion, corrosion, and sunlight; conformable for application down to 0 degrees F and suitable for continuous temperature environment up to 221 degrees F.
 3. Rubber Splicing Electrical Tape: Ethylene Propylene Rubber (EPR) tape, complying with ASTM D4388; minimum thickness of 30 mil; suitable for continuous temperature environment up to 194 degrees F and short-term 266 degrees F overload service.
 4. Electrical Filler Tape: Rubber-based insulating moldable putty, minimum thickness of 125 mil; suitable for continuous temperature environment up to 176 degrees F.
 5. Varnished Cambric Electrical Tape: Cotton cambric fabric tape, with or without adhesive, oil-primed and coated with high-grade insulating varnish; minimum thickness of 7 mil; suitable for continuous temperature environment up to 221 degrees F.
 6. Moisture Sealing Electrical Tape: Insulating mastic compound laminated to flexible, all-weather vinyl backing; minimum thickness of 90 mil.
- B. Heat Shrink Tubing: Heavy-wall, split-resistant, with factory-applied adhesive; rated 600 V; suitable for direct burial applications; listed as complying with UL 486D.
- C. Wire Pulling Lubricant:
 1. Manufacturers:
 - a. 3M: www.3m.com/#sle.
 - b. American Polywater Corporation: www.polywater.com/#sle.
 - c. Ideal Industries, Inc: www.idealindustries.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Listed and labeled as complying with UL 267.
 3. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 4. Suitable for use at installation temperature.
- D. Cable Ties: Material and tensile strength rating suitable for application.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that interior of building has been protected from weather.

- B. Verify that work likely to damage wire and cable has been completed.
- C. Verify that raceways, boxes, and equipment enclosures are installed and are properly sized to accommodate conductors and cables in accordance with NFPA 70.
- D. Verify that field measurements are as indicated.
- E. Verify that conditions are satisfactory for installation prior to starting work.

3.02 PREPARATION

- A. Clean raceways thoroughly to remove foreign materials before installing conductors and cables.

3.03 INSTALLATION

- A. Circuiting Requirements:
 - 1. Unless dimensioned, circuit routing indicated is diagrammatic.
 - 2. When circuit destination is indicated without specific routing, determine exact routing required.
 - 3. Arrange circuiting to minimize splices.
 - 4. Include circuit lengths required to install connected devices within 10 ft of location indicated.
 - 5. Maintain separation of Class 1, Class 2, and Class 3 remote-control, signaling, and power-limited circuits in accordance with NFPA 70.
 - 6. Maintain separation of wiring for emergency systems in accordance with NFPA 70.
 - 7. Circuiting Adjustments: Unless otherwise indicated, when branch circuits are indicated as separate, combining them together in a single raceway is not permitted.
 - 8. Common Neutrals: Unless otherwise indicated, sharing of neutral/grounded conductors among single phase branch circuits of different phases installed in the same raceway is not permitted. Provide dedicated neutral/grounded conductor for each individual branch circuit.
- B. Install products in accordance with manufacturer's instructions.
- C. Perform work in accordance with NECA 1 (general workmanship).
- D. Installation in Raceway:
 - 1. Tape ends of conductors and cables to prevent infiltration of moisture and other contaminants.
 - 2. Pull all conductors and cables together into raceway at same time.
 - 3. Do not damage conductors and cables or exceed manufacturer's recommended maximum pulling tension and sidewall pressure.
 - 4. Use suitable wire pulling lubricant where necessary, except when lubricant is not recommended by the manufacturer.
- E. Exposed Cable Installation (only where specifically permitted):
 - 1. Route cables parallel or perpendicular to building structural members and surfaces.
 - 2. Protect cables from physical damage.
- F. Paralleled Conductors: Install conductors of the same length and terminate in the same manner.
- G. Secure and support conductors and cables in accordance with NFPA 70 using suitable supports and methods approved by the authority having jurisdiction. Provide independent support from building structure. Do not provide support from raceways, piping, ductwork, or other systems.
 - 1. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conductors and cables to lay on ceiling tiles.
 - 2. Installation in Vertical Raceways: Provide supports where vertical rise exceeds permissible limits.
- H. Install conductors with a minimum of 12 inches of slack at each outlet.

- I. Where conductors are installed in enclosures for future termination by others, provide a minimum of 5 feet of slack.
- J. Neatly train and bundle conductors inside boxes, wireways, panelboards and other equipment enclosures.
- K. Group or otherwise identify neutral/grounded conductors with associated ungrounded conductors inside enclosures in accordance with NFPA 70.
- L. Make wiring connections using specified wiring connectors.
 - 1. Make splices and taps only in accessible boxes. Do not pull splices into raceways or make splices in conduit bodies or wiring gutters.
 - 2. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors.
 - 3. Do not remove conductor strands to facilitate insertion into connector.
 - 4. Clean contact surfaces on conductors and connectors to suitably remove corrosion, oxides, and other contaminants. Do not use wire brush on plated connector surfaces.
 - 5. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 6. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- M. Insulate splices and taps that are made with uninsulated connectors using methods suitable for the application, with insulation and mechanical strength at least equivalent to unspliced conductors.
 - 1. Dry Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For taped connections, first apply adequate amount of rubber splicing electrical tape or electrical filler tape, followed by outer covering of vinyl insulating electrical tape.
 - b. For taped connections likely to require re-entering, including motor leads, first apply varnished cambric electrical tape, followed by adequate amount of rubber splicing electrical tape, followed by outer covering of vinyl insulating electrical tape.
 - 2. Damp Locations: Use insulating covers specifically designed for the connectors, electrical tape, or heat shrink tubing.
 - a. For connections with insulating covers, apply outer covering of moisture sealing electrical tape.
 - b. For taped connections, follow same procedure as for dry locations but apply outer covering of moisture sealing electrical tape.
 - 3. Wet Locations: Use heat shrink tubing.
- N. Insulate ends of spare conductors using vinyl insulating electrical tape.
- O. Field-Applied Color Coding: Where vinyl color coding electrical tape is used in lieu of integrally colored insulation as permitted in Part 2 under "Color Coding", apply half overlapping turns of tape at each termination and at each location conductors are accessible.
- P. Identify conductors and cables in accordance with Section 26 05 53.
- Q. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- R. Unless specifically indicated to be excluded, provide final connections to all equipment and devices, including those furnished by others, as required for a complete operating system.

3.04 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS, except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.3.2. The insulation resistance test is required for all conductors. The resistance test for parallel conductors listed as optional is not required.

1. Disconnect surge protective devices (SPDs) prior to performing any high potential testing.
Replace SPDs damaged by performing high potential testing with SPDs connected.
- D. Correct deficiencies and replace damaged or defective conductors and cables.

END OF SECTION

SECTION 26 05 26
GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Grounding and bonding requirements.
- B. Conductors for grounding and bonding.
- C. Connectors for grounding and bonding.
- D. Ground bars.
- E. Ground plate electrodes.

1.03 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Additional requirements for conductors for grounding and bonding, including conductor color coding.
 - 1. Includes oxide inhibiting compound.
- B. Section 26 05 36 - Cable Trays for Electrical Systems: Additional grounding and bonding requirements for cable tray systems.
- C. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- D. Section 26 56 00 - Exterior Lighting: Additional grounding and bonding requirements for pole-mounted luminaires.

1.04 REFERENCE STANDARDS

- A. IEEE 81 - IEEE Guide for Measuring Earth Resistivity, Ground Impedance, and Earth Surface Potentials of a Grounding System; 2012.
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- D. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- E. NFPA 99 - Health Care Facilities Code; 2018.
- F. NFPA 780 - Standard for the Installation of Lightning Protection Systems; 2020.
- G. UL 467 - Grounding and Bonding Equipment; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify exact locations of underground metal water service pipe entrances to building.
 - 2. Coordinate the work with other trades to provide steel reinforcement complying with specified requirements for concrete-encased electrode.
 - 3. Notify Architect Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for grounding and bonding system components.

- C. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- D. Field quality control test reports.
- E. Project Record Documents: Record actual locations of grounding electrode system components and connections.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 GROUNDING AND BONDING REQUIREMENTS

- A. Existing Work: Where existing grounding and bonding system components are indicated to be reused, they may be reused only where they are free from corrosion, integrity and continuity are verified, and where acceptable to the authority having jurisdiction.
- B. Do not use products for applications other than as permitted by NFPA 70 and product listing.
- C. Unless specifically indicated to be excluded, provide all required components, conductors, connectors, conduit, boxes, fittings, supports, accessories, etc. as necessary for a complete grounding and bonding system.
- D. Where conductor size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
- E. Grounding System Resistance:
 - 1. Achieve specified grounding system resistance under normally dry conditions unless otherwise approved by Architect Engineer. Precipitation within the previous 48 hours does not constitute normally dry conditions.
 - 2. Grounding Electrode System: Not greater than 5 ohms to ground, when tested according to IEEE 81 using "fall-of-potential" method.
 - 3. Between Grounding Electrode System and Major Electrical Equipment Frames, System Neutral, and Derived Neutral Points: Not greater than 0.5 ohms, when tested using "point-to-point" methods.
- F. Grounding Electrode System:
 - 1. Provide connection to required and supplemental grounding electrodes indicated to form grounding electrode system.
 - a. Provide continuous grounding electrode conductors without splice or joint.
 - b. Install grounding electrode conductors in raceway where exposed to physical damage. Bond grounding electrode conductor to metallic raceways at each end with bonding jumper.
 - 2. Metal Underground Water Pipe(s):
 - a. Provide connection to underground metal domestic and fire protection (where present) water service pipe(s) that are in direct contact with earth for at least 10 feet at an accessible location not more than 5 feet from the point of entrance to the building.
 - b. Provide bonding jumper(s) around insulating joints/pipes as required to make pipe electrically continuous.

- c. Provide bonding jumper around water meter of sufficient length to permit removal of meter without disconnecting jumper.
- 3. Metal In-Ground Support Structure:
 - a. Provide connection to metal in-ground support structure that is in direct contact with earth in accordance with NFPA 70.
- 4. Concrete-Encased Electrode:
 - a. Provide connection to concrete-encased electrode consisting of not less than 20 feet of either steel reinforcing bars or bare copper conductor not smaller than 4 AWG embedded within concrete foundation or footing that is in direct contact with earth in accordance with NFPA 70.
- 5. Ground Ring:
 - a. Provide a ground ring encircling the building or structure consisting of bare copper conductor not less than 2 AWG in direct contact with earth, installed at a depth of not less than 30 inches.
 - b. Where location is not indicated, locate ground ring conductor at least 24 inches outside building perimeter foundation.
 - c. Provide connection from ground ring conductor to:
 - 1) Perimeter columns of metal building frame.
 - 2) Ground rod electrodes located as indicated.
- 6. Provide additional ground electrode(s) as required to achieve specified grounding electrode system resistance.
- 7. Ground Bar: Provide ground bar, separate from service equipment enclosure, for common connection point of grounding electrode system bonding jumpers as permitted in NFPA 70. Connect grounding electrode conductor provided for service-supplied system grounding to this ground bar.
 - a. Ground Bar Size: 1/4 by 2 by 12 inches unless otherwise indicated or required.
 - b. Where ground bar location is not indicated, locate in accessible location as near as possible to service disconnect enclosure.
 - c. Ground Bar Mounting Height: 18 inches above finished floor unless otherwise indicated.
- 8. Ground Riser: Provide common grounding electrode conductor not less than 3/0 AWG for tap connections to multiple separately derived systems as permitted in NFPA 70.
- G. Service-Supplied System Grounding:
 - 1. For each service disconnect, provide grounding electrode conductor to connect neutral (grounded) service conductor to grounding electrode system. Unless otherwise indicated, make connection at neutral (grounded) bus in service disconnect enclosure.
 - 2. For each service disconnect, provide main bonding jumper to connect neutral (grounded) bus to equipment ground bus where not factory-installed. Do not make any other connections between neutral (grounded) conductors and ground on load side of service disconnect.
- H. Grounding for Separate Building or Structure Supplied by Feeder(s) or Branch Circuits:
 - 1. Provide grounding electrode system for each separate building or structure.
 - 2. Provide equipment grounding conductor routed with supply conductors.
 - 3. For each disconnecting means, provide grounding electrode conductor to connect equipment ground bus to grounding electrode system.
 - 4. Do not make any connections and remove any factory-installed jumpers between neutral (grounded) conductors and ground.
- I. Separately Derived System Grounding:
 - 1. Separately derived systems include, but are not limited to:
 - a. Transformers (except autotransformers such as buck-boost transformers).
 - b. Uninterruptible power supplies (UPS), when configured as separately derived systems.
 - c. Generators, when neutral is switched in the transfer switch.

2. Provide grounding electrode conductor to connect derived system grounded conductor to nearest effectively grounded metal building frame. Unless otherwise indicated, make connection at neutral (grounded) bus in source enclosure.
 3. Provide bonding jumper to connect derived system grounded conductor to nearest metal building frame and nearest metal water piping in the area served by the derived system, where not already used as a grounding electrode for the derived system. Make connection at same location as grounding electrode conductor connection.
 4. Where common grounding electrode conductor ground riser is used for tap connections to multiple separately derived systems, provide bonding jumper to connect the metal building frame and metal water piping in the area served by the derived system to the common grounding electrode conductor.
 5. Outdoor Source: Where the source of the separately derived system is located outside the building or structure supplied, provide connection to grounding electrode at source in accordance with NFPA 70.
 6. Provide system bonding jumper to connect system grounded conductor to equipment ground bus. Make connection at same location as grounding electrode conductor connection. Do not make any other connections between neutral (grounded) conductors and ground on load side of separately derived system disconnect.
 7. Where the source and first disconnecting means are in separate enclosures, provide supply-side bonding jumper between source and first disconnecting means.
- J. Bonding and Equipment Grounding:
1. Provide bonding for equipment grounding conductors, equipment ground busses, metallic equipment enclosures, metallic raceways and boxes, device grounding terminals, and other normally non-current-carrying conductive materials enclosing electrical conductors/equipment or likely to become energized as indicated and in accordance with NFPA 70.
 2. Provide insulated equipment grounding conductor in each feeder and branch circuit raceway. Do not use raceways as sole equipment grounding conductor.
 3. Where circuit conductor sizes are increased for voltage drop, increase size of equipment grounding conductor proportionally in accordance with NFPA 70.
 4. Unless otherwise indicated, connect wiring device grounding terminal to branch circuit equipment grounding conductor and to outlet box with bonding jumper.
 5. Terminate branch circuit equipment grounding conductors on solidly bonded equipment ground bus only. Do not terminate on neutral (grounded) or isolated/insulated ground bus.
 6. Provide bonding jumper across expansion or expansion/deflection fittings provided to accommodate conduit movement.
 7. Provide bonding for interior metal piping systems in accordance with NFPA 70. This includes, but is not limited to:
 - a. Metal water piping where not already effectively bonded to metal underground water pipe used as grounding electrode.
 - b. Metal gas piping.
 8. Provide bonding for interior metal air ducts.
 9. Provide bonding for metal building frame.
 10. Provide bonding for metal siding not effectively bonded through attachment to metal building frame.
 11. Provide bonding and equipment grounding for pools and fountains and associated equipment in accordance with NFPA 70.
 12. Provide redundant grounding and bonding for patient care areas of health care facilities in accordance with NFPA 70 and NFPA 99.
- K. Lightning Protection Systems:
1. Do not use grounding electrode dedicated for lightning protection system for component of building grounding electrode system provided under this section.

2. Provide bonding of building grounding electrode system provided under this section and lightning protection grounding electrode system in accordance with NFPA 70 and NFPA 780.

L. Cable Tray Systems: Also comply with Section 26 05 36.

M. Pole-Mounted Luminaires: Also comply with Section 26 56 00.

2.02 GROUNDING AND BONDING COMPONENTS

A. General Requirements:

1. Provide products listed, classified, and labeled as suitable for the purpose intended.
2. Provide products listed and labeled as complying with UL 467 where applicable.

B. Conductors for Grounding and Bonding, in Addition to Requirements of Section 26 05 26:

1. Use insulated copper conductors unless otherwise indicated.
 - a. Exceptions:
 - 1) Use bare copper conductors where installed underground in direct contact with earth.
 - 2) Use bare copper conductors where directly encased in concrete (not in raceway).
2. Factory Pre-fabricated Bonding Jumpers: Furnished with factory-installed ferrules; size braided cables to provide equivalent gauge of specified conductors.

C. Connectors for Grounding and Bonding:

1. Description: Connectors appropriate for the application and suitable for the conductors and items to be connected; listed and labeled as complying with UL 467.
2. Unless otherwise indicated, use exothermic welded connections for underground, concealed and other inaccessible connections.
 - a. Exceptions:
 - 1) Use mechanical connectors for connections to electrodes at ground access wells.
3. Unless otherwise indicated, use mechanical connectors, compression connectors, or exothermic welded connections for accessible connections.
 - a. Exceptions:
 - 1) Use exothermic welded connections for connections to metal building frame.
4. Manufacturers - Mechanical and Compression Connectors:
 - a. allG Fabrication: www.allgfab.com/#sle.
 - b. Burndy LLC: www.burndy.com/#sle.
 - c. Harger Lightning & Grounding: www.harger.com/#sle.
 - d. Thomas & Betts Corporation: www.tnb.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
5. Manufacturers - Exothermic Welded Connections:
 - a. Burndy LLC: www.burndy.com/#sle.
 - b. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.

D. Ground Bars:

1. Description: Copper rectangular ground bars with mounting brackets and insulators.
2. Size: As indicated.
3. Holes for Connections: As indicated or as required for connections to be made.
4. Manufacturers:
 - a. allG Fabrication: www.allgfab.com/#sle.
 - b. Harger Lightning & Grounding: www.harger.com/#sle.
 - c. thermOweld, subsidiary of Continental Industries; division of Burndy LLC: www.thermoweld.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

- E. Ground Plate Electrodes:
 - 1. Material: Copper.
 - 2. Size: 24 by 24 by 1/4 inches, unless otherwise indicated.
 - 3. Manufacturers:
 - a. allG Fabrication: www.allgfab.com/#sle.
 - b. Harger Lightning & Grounding: www.harger.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Oxide Inhibiting Compound: Comply with Section 26 05 19.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that work likely to damage grounding and bonding system components has been completed.
- B. Verify that field measurements are as indicated.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Perform work in accordance with NECA 1 (general workmanship).
- C. Ground Rod Electrodes: Unless otherwise indicated, install ground rod electrodes vertically. Where encountered rock prohibits vertical installation, install at 45 degree angle or bury horizontally in trench at least 30 inches (750 mm) deep in accordance with NFPA 70 or provide ground plates.
 - 1. Outdoor Installations: Unless otherwise indicated, install with top of rod 6 inches below finished grade.
- D. Ground Plate Electrodes: Unless otherwise indicated, install ground plate electrodes at a depth of not less than 30 inches.
- E. Make grounding and bonding connections using specified connectors.
 - 1. Remove appropriate amount of conductor insulation for making connections without cutting, nicking or damaging conductors. Do not remove conductor strands to facilitate insertion into connector.
 - 2. Remove nonconductive paint, enamel, or similar coating at threads, contact points, and contact surfaces.
 - 3. Exothermic Welds: Make connections using molds and weld material suitable for the items to be connected in accordance with manufacturer's recommendations.
 - 4. Mechanical Connectors: Secure connections according to manufacturer's recommended torque settings.
 - 5. Compression Connectors: Secure connections using manufacturer's recommended tools and dies.
- F. Identify grounding and bonding system components in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Inspect and test in accordance with NETA ATS except Section 4.
- C. Perform inspections and tests listed in NETA ATS, Section 7.13.
- D. Perform ground electrode resistance tests under normally dry conditions. Precipitation within the previous 48 hours does not constitute normally dry conditions.
- E. Investigate and correct deficiencies where measured ground resistances do not comply with specified requirements.

- F. Submit detailed reports indicating inspection and testing results and corrective actions taken.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other electrical work.

1.03 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.
- C. Section 26 05 33.13 - Conduit for Electrical Systems: Additional support and attachment requirements for conduits.
- D. Section 26 05 36 - Cable Trays for Electrical Systems: Additional support and attachment requirements for cable tray.
- E. Section 26 05 33.16 - Boxes for Electrical Systems: Additional support and attachment requirements for boxes.
- F. Section 26 05 48 - Vibration and Seismic Controls for Electrical Systems.
- G. Section 26 51 00 - Interior Lighting: Additional support and attachment requirements for interior luminaires.
- H. Section 26 56 00 - Exterior Lighting: Additional support and attachment requirements for exterior luminaires.

1.04 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- D. MFMA-4 - Metal Framing Standards Publication; 2004.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- G. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.
- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- E. Installer's qualification statement.
- F. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.07 QUALITY ASSURANCE

- A. Installer Qualifications for Field Welding: See Section 05 50 00.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. NFPA 70.
 - b. Applicable building code.
 - c. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of electrical work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 4. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.

- d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Components for Vibration Isolation and/or Seismic Controls: See Section 26 05 48.
- C. Materials for Metal Fabricated Supports: See Section 05 50 00.
- D. Conduit and Cable Supports: Straps and clamps suitable for conduit or cable to be supported.
 - 1. Manufacturers:
 - a. ABB: www.electrification.us.abb.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 3. Conduit Clamps: Bolted type unless otherwise indicated.
 - 4. Products:
 - a. Gripple, Inc; Universal Bracket: www.gripple.com/#sle.
 - b. Gripple, Inc; Fast Trak: www.gripple.com/#sle.
 - c. Gripple, Inc; Universal Clamp (Threaded): www.gripple.com/#sle.
 - d. Gripple, Inc; Low Profile Bracket Kits: www.gripple.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- E. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
 - 1. Manufacturers:
 - a. ABB: www.electrification.us.abb.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. HoldRite, a brand of Reliance Worldwide Corporation: www.holdrite.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Metal Channel/Strut Framing Systems:
 - 1. Manufacturers:
 - a. ABB: www.electrification.us.abb.com/#sle.
 - b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
 - c. Eaton Corporation: www.eaton.com/#sle.
 - d. Elgen Manufacturing Company, Inc: www.elgenmfg.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - f. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
 - 2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 - 3. Comply with MFMA-4.
 - 4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
 - 5. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 - 6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 - 7. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.
- G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2-inch diameter.
 - b. Busway Supports: 1/2-inch diameter.
 - c. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
 - d. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.

- e. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
 - f. Outlet Boxes: 1/4-inch diameter.
 - g. Luminaires: 1/4-inch diameter.
- H. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
- 1. Manufacturers:
 - a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Green Link, Inc: www.greenlinkengineering.com/#sle.
 - d. PHP Systems/Design: www.phpsd.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
 - 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 - 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 - 5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- I. Anchors and Fasteners:
- 1. Manufacturers - Mechanical Anchors:
 - a. Dewalt: anchors.dewalt.com/#sle.
 - b. Hilti, Inc: www.hilti.com/#sle.
 - c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Manufacturers - Powder-Actuated Fastening Systems:
 - a. Dewalt: anchors.dewalt.com/#sle.
 - b. Hilti, Inc: www.hilti.com/#sle.
 - c. ITW Ramset, a division of Illinois Tool Works, Inc: www.ramset.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 3. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
 - 4. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 - 5. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 - 6. Hollow Masonry: Use toggle bolts.
 - 7. Hollow Stud Walls: Use toggle bolts.
 - 8. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 - 9. Sheet Metal: Use sheet metal screws.
 - 10. Wood: Use wood screws.
 - 11. Plastic and lead anchors are not permitted.
 - 12. Powder-actuated fasteners are not permitted.
 - 13. Hammer-driven anchors and fasteners are not permitted.
 - 14. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
 - b. Comply with MFMA-4.
 - c. Channel Material: Use galvanized steel.
 - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 - 15. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect Engineer, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Provide required vibration isolation and/or seismic controls; see Section 26 05 48.
- I. Field Welding, Where Approved by Architect Engineer: See Section 05 50 00.
- J. Equipment Support and Attachment:
 - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Unless otherwise indicated, mount floor-mounted equipment on properly sized concrete pad 3 inches in height; see Section 03 30 00.
 - 5. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- K. Conduit Support and Attachment: See Section 26 05 33.13 for additional requirements.
- L. Cable Tray Support and Attachment: See Section 26 05 36 for additional requirements.
- M. Box Support and Attachment: See Section 26 05 33.16 for additional requirements.
- N. Interior Luminaire Support and Attachment: See Section 26 51 00 for additional requirements.
- O. Exterior Luminaire Support and Attachment: See Section 26 56 00 for additional requirements.
- P. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- Q. Secure fasteners in accordance with manufacturer's recommended torque settings.
- R. Remove temporary supports.
- S. Identify independent electrical component support wires above accessible ceilings, where permitted, with color distinguishable from ceiling support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.

- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

SECTION 26 05 33.13
CONDUIT FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Stainless steel rigid metal conduit (RMC).
- C. Aluminum rigid metal conduit (RMC).
- D. Galvanized steel intermediate metal conduit (IMC).
- E. Stainless steel intermediate metal conduit (IMC).
- F. Flexible metal conduit (FMC).
- G. Galvanized steel electrical metallic tubing (EMT).
- H. Stainless steel electrical metallic tubing (EMT).

1.03 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 84 00 - Firestopping.
- C. Section 220548 - Vibration Isolation and Seismic Control (For Seismic Bracing of Conduit, Equipment and Boxes)
- D. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
 - 1. Includes additional requirements for fittings for grounding and bonding.
- E. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- F. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- G. Section 26 21 00 - Low-Voltage Electrical Service Entrance: Additional requirements for electrical service conduits.

1.04 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- E. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- F. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- G. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- H. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- I. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- J. NEMA RN 1 - Polyvinyl-Chloride (PVC) Externally Coated Galvanized Rigid Steel Conduit and Intermediate Metal Conduit; 2018.
- K. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.

- L. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- M. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- N. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- O. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- P. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- Q. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- R. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- S. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- T. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- U. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.
- V. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- W. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- X. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of conductors to be installed, including adjustments for conductor sizes increased for voltage drop.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment, and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of conductors and cables until installation of conduit between termination points is complete.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for conduits and fittings.
- C. Shop Drawings:
 - 1. Indicate proposed arrangement for conduits to be installed within structural concrete slabs, where permitted.
 - 2. Include proposed locations of roof penetrations and proposed methods for sealing.
- D. Project Record Documents: Record actual routing for conduits installed underground, conduits embedded within concrete slabs, and conduits 2-inch (53 mm) trade size and larger.

1.07 QUALITY ASSURANCE

- A. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

- B. Multi-trade Coordination: In lieu of detailed shop drawings, the Contractor may conduct a pre-installation and coordination meeting, with follow-up meetings to coordinate routing of mechanical, fire protection and electrical elements. Locations and conflict resolutions shall be made during these meetings. Notify Architect-Engineer of meeting times and dates. Do not install any conduit until this meeting has taken place.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, manufacturer's instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.
- C. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- D. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- E. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- F. Exposed, Interior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).
 - 1. Locations subject to severe physical damage include, but are not limited to:
 - a. High traffic industrial and warehouse areas where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in industrial manufacturing areas.
- G. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- H. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).
 - 1. Exterior locations subject to severe physical damage include, but are not limited to:
 - a. Where exposed to vehicular traffic below 20 feet.

- I. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).
- J. Flexible Connections to Luminaires Above Accessible Ceilings: Use flexible metal conduit (FMC).
- K. Flexible Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit (FMC).
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit (LFMC).
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Transformers.
 - b. Motors.
- L. Panelboard feeders: Use galvanized steel rigid metal conduit.
- M. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
 - 1. Where permitted, existing conduits to be reused may be used as sole equipment grounding conductor only when continuity of conduit pathway, including associated boxes and fittings, is verified; see Section 26 05 26.
- C. Electrical Service Conduits: See Section 26 21 00 for additional requirements.
- D. Fittings for Grounding and Bonding: See Section 26 05 26 for additional requirements.
- E. Provide conduit, fittings, supports, and accessories required for complete raceway system.
- F. Provide products listed, classified, and labeled as suitable for purpose intended.
- G. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Branch Circuits: 3/4-inch trade size.
 - 2. Branch Circuit Homeruns: 3/4-inch trade size.
 - 3. Control Circuits: 1/2-inch trade size.
 - 4. Flexible Connections to Luminaires: 1/2-inch trade size.
 - 5. Underground, Interior: 1-inch trade size.
 - 6. Underground, Exterior: 1-inch trade size.
- H. Where conduit size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a Division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.

- b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings Inc: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
- 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
- 4. Material: Use steel or malleable iron.
 - a. Where not subject to severe corrosive influence, stainless steel fittings may be used.
 - b. Do not use die cast zinc fittings.
- 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - 2. Gibson Stainless & Specialty Inc: www.gibsonstainless.com/#sle.
 - 3. Patriot Industries, a division of Patriot Aluminum Products LLC: www.patriotsas.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.
 - 1. Material: Type 304 or 316 stainless steel.
- C. Fittings:
 - 1. Manufacturers:
 - a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - b. Eaton: www.eaton.com/#sle.
 - c. Gibson Stainless & Specialty Inc: www.gibsonstainless.com/#sle.
 - d. Patriot Industries, a division of Patriot Aluminum Products LLC: www.patriotsas.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
 - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 - 4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 - 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.05 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. American Conduit. www.americanconduit.com.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.

- c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
- d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
- e. Substitutions: See Section 01 60 00 - Product Requirements.
2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
4. Material: Use aluminum.
5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.06 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 4. Material: Use steel or malleable iron.
 - a. Where not subject to severe corrosive influence, stainless steel fittings may be used.
 - b. Do not use die cast zinc fittings.
 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 6. More than Five Feet from Foundation Wall:
 - a. In Dirt: Use rigid steel conduit.
 - b. Under Road: Use rigid steel conduit.
 7. In or Under Slab on Grade: Use Schedule 40 PVC.
- D. Slab Penetrations:
 1. Vertical penetrations: Use rigid steel conduit.
 2. Elbows: Use rigid steel conduit.
- E. Motor and other moving equipment connections:
 1. Dry locations: Flexible steel conduit.
 2. Damp locations: Liquid-tight flexible steel conduit.

2.07 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.

1. Material: Type 304 or 316 stainless steel.
- C. Fittings:
 1. Manufacturers:
 - a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - b. Eaton: www.eaton.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 5. Connectors and Couplings: Use threaded type fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.

2.08 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com.
 2. Flex Tubes: www.flex-tubes.com
 3. Electri-Flex Company: www.electriflex.com.
 4. International Metal Hose: www.metalhose.com.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.09 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 1. AFC Cable Systems, Inc: www.afcweb.com.
 2. Electri-Flex Company: www.electriflex.com.
 3. International Metal Hose: www.metalhose.com.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.

2.10 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit: www.alliedeg.com.
 - 2. Nucor Tubular Products: www.nucortubular/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube Company: www.wheatland.com.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 4. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - 5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.

2.11 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.
 - 1. Material: Type 304 or 316 stainless steel.
- C. Fittings:
 - 1. Manufacturers:
 - a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 - 4. Connectors and Couplings: Use compression/gland or set-screw type.

2.12 NONMETALLIC CONDUIT

- A. Manufacturers:
 - 1. ABB; Carlon: www.carlon.com/#sle.
 - 2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.com/#sle.
 - 3. Cantex Inc: www.cantexinc.com/#sle.
 - 4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
 - 5. JM Eagle: www.jmeagle.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage; rated for use with conductors rated 90 degrees C.

- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.

2.13 ACCESSORIES

- A. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- B. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- C. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- D. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.
- E. Sealing Systems for Concrete Penetrations:
 - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
 - 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- F. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
 - 1. Products:
 - a. Menzies Metal Products; Electrical Roof Stack and Cap: www.menzies-metal.com/#sle.
 - b. Menzies Metal Products; Electrical Retro Box: www.menzies-metal.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
- G. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
 - 1. Products:
 - a. Quickflash Weatherproofing Products, Inc: www.quickflashproducts.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
- H. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
 - 1. Products:
 - a. HoldRite, a brand of Reliance Worldwide Corporation; HydroFlame Pro Series/HydroFlame Custom Built: www.holdrite.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Aluminum Rigid Metal Conduit (RMC): Install in accordance with NECA 102.

- E. Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.
- F. PVC-Coated Galvanized Steel Rigid Metal Conduit (RMC): Install using only tools approved by manufacturer.
- G. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- H. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Mechanical equipment rooms.
 - 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than equivalent of four 90-degree bends between pull points.
 - 9. Arrange conduit to provide no more than 150 feet between pull points.
 - 10. Route conduits above water and drain piping where possible.
 - 11. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 12. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 13. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 - 14. Group parallel conduits in same area on common rack.
- I. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction; see Section 26 05 29.
 - 2. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 - 4. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 - 5. Use metal channel/strut with accessory conduit clamps to support multiple parallel surface-mounted conduits.
 - 6. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 - 7. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple parallel suspended conduits.
 - 8. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
 - 9. Use of spring steel conduit clips for support of conduits is not permitted.

10. Use of wire for support of conduits is not permitted.
 11. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- J. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
 7. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect conductors.
 8. Secure joints and connections to provide mechanical strength and electrical continuity.
- K. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves for penetrations as indicated or as required to facilitate installation. Set sleeves flush with exposed surfaces unless otherwise indicated or required.
 4. Conceal bends for conduit risers emerging above ground.
 5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Provide metal escutcheon plates for conduit penetrations exposed to public view.
 9. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.
- L. Underground Installation:
1. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 18 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 2. Provide underground warning tape along entire conduit length for service entrance where not concrete-encased; see Section 26 05 53.
- M. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
 2. Secure conduits to prevent floating or movement during pouring of concrete.
- N. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete-encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.
- O. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed conductors or connected equipment. This includes, but is not limited to:
1. Where conduits cross structural joints intended for expansion, contraction, or deflection.

2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 3. Where conduits are subject to earth movement by settlement or frost.
- P. Conduit Sealing:
1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 - c. Where conduits penetrate coolers or freezers.
 3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings or conduit mechanical seals as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.
- Q. Provide pull string in each empty conduit and in conduits where conductors and cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- R. Provide grounding and bonding; see Section 26 05 26.
- S. Identify conduits; see Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Where coating of PVC-coated galvanized steel rigid metal conduit (RMC) contains cuts or abrasions, repair in accordance with manufacturer's instructions.
- D. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of conductors.

END OF SECTION

SECTION 26 05 33.16
BOXES FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Outlet and device boxes up to 100 cubic inches, including those used as junction and pull boxes.
- B. Cabinets and enclosures, including junction and pull boxes larger than 100 cubic inches.

1.03 RELATED REQUIREMENTS

- A. Section 08 31 00 - Access Doors and Panels: Panels for maintaining access to concealed boxes.
- B. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- C. Section 26 05 33.13 - Conduit for Electrical Systems:
 - 1. Conduit bodies and other fittings.
 - 2. Additional requirements for locating boxes to limit conduit length and/or number of bends between pulling points.
- D. Section 26 27 26 - Wiring Devices:
 - 1. Wall plates.
 - 2. Additional requirements for locating boxes for wiring devices.
- E. Section 230548 - Heating, Ventilation and Air-Conditioning (HVAC) Vibration Isolation And Seismic Restraint.

1.04 REFERENCE STANDARDS

- A. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- B. NECA 130 - Standard for Installing and Maintaining Wiring Devices; 2010.
- C. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- D. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- E. NEMA OS 1 - Sheet-Steel Outlet Boxes, Device Boxes, Covers, and Box Supports; 2013.
- F. NEMA OS 2 - Nonmetallic Outlet Boxes, Device Boxes, Covers and Box Supports; 2013 (R2020).
- G. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- H. UL 50 - Enclosures for Electrical Equipment, Non-Environmental Considerations; Current Edition, Including All Revisions.
- I. UL 50E - Enclosures for Electrical Equipment, Environmental Considerations; Current Edition, Including All Revisions.
- J. UL 508A - Industrial Control Panels; Current Edition, Including All Revisions.
- K. UL 514A - Metallic Outlet Boxes; Current Edition, Including All Revisions.
- L. UL 514C - Nonmetallic Outlet Boxes, Flush-Device Boxes, and Covers; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:

1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances for electrical equipment required by NFPA 70.
2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
3. Coordinate minimum sizes of boxes with the actual installed arrangement of conductors, clamps, support fittings, and devices, calculated according to NFPA 70.
4. Coordinate minimum sizes of pull boxes with the actual installed arrangement of connected conduits, calculated according to NFPA 70.
5. Coordinate the placement of boxes with millwork, furniture, devices, equipment, etc. installed under other sections or by others.
6. Coordinate the work with other trades to preserve insulation integrity.
7. Coordinate the work with other trades to provide walls suitable for installation of flush-mounted boxes where indicated.
8. Notify Architect Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cabinets and enclosures, boxes for hazardous (classified) locations, floor boxes, and underground boxes/enclosures.
- C. Project Record Documents: Record actual locations for pull boxes, cabinets and enclosures, floor boxes, and underground boxes/enclosures.

1.07 QUALITY ASSURANCE

- A. Conform to requirements of NFPA 70 (NEC).

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 BOXES

- A. General Requirements:
 1. Do not use boxes and associated accessories for applications other than as permitted by NFPA 70 and product listing.
 2. Provide all boxes, fittings, supports, and accessories required for a complete raceway system and to accommodate devices and equipment to be installed.
 3. Provide products listed, classified, and labeled as suitable for the purpose intended.
 4. Where box size is not indicated, size to comply with NFPA 70 but not less than applicable minimum size requirements specified.
 5. Provide grounding terminals within boxes where equipment grounding conductors terminate.
- B. Outlet and Device Boxes Up to 100 cubic inches, Including Those Used as Junction and Pull Boxes:
 1. Use sheet-steel boxes for dry locations unless otherwise indicated or required.
 2. Use cast iron boxes or cast aluminum boxes for damp or wet locations unless otherwise indicated or required; furnish with compatible weatherproof gasketed covers.
 3. Use cast iron boxes or cast aluminum boxes where exposed galvanized steel rigid metal conduit or exposed intermediate metal conduit (IMC) is used.
 4. Use nonmetallic boxes where exposed rigid PVC conduit is used.
 5. Use suitable concrete type boxes where flush-mounted in concrete.
 6. Use suitable masonry type boxes where flush-mounted in masonry walls.

7. Use raised covers suitable for the type of wall construction and device configuration where required.
8. Use shallow boxes where required by the type of wall construction.
9. Do not use "through-wall" boxes designed for access from both sides of wall.
10. Sheet-Steel Boxes: Comply with NEMA OS 1, and list and label as complying with UL 514A.
11. Cast Metal Boxes: Comply with NEMA FB 1, and list and label as complying with UL 514A; furnish with threaded hubs.
12. Nonmetallic Boxes: Comply with NEMA OS 2, and list and label as complying with UL 514C.
13. Boxes for Supporting Luminaires and Ceiling Fans: Listed as suitable for the type and weight of load to be supported; furnished with fixture stud to accommodate mounting of luminaire where required.
14. Boxes for Ganged Devices: Use multigang boxes of single-piece construction. Do not use field-connected gangable boxes unless specifically indicated or permitted.
15. Minimum Box Size, Unless Otherwise Indicated:
 - a. Wiring Devices (Other Than Communications Systems Outlets): 4 inch square by 1-1/2 inch deep (100 by 38 mm) trade size.
 - b. Ceiling Outlets: 4 inch octagonal or square by 1-1/2 inch deep (100 by 38 mm) trade size.
16. Wall Plates: Comply with Section 26 27 26.
17. Manufacturers:
 - a. Cooper Crouse-Hinds, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hubbell Incorporated; Bell Products: www.hubbell-rtb.com.
 - c. Hubbell Incorporated; RACO Products: www.hubbell-rtb.com.
 - d. O-Z/Gedney, a brand of Emerson Electric Co: www.emerson.com/#sle.
 - e. Thomas & Betts Corporation: www.tnb.com/#sle.
 - f. Substitutions: See Section 01 60 00 - Product Requirements.
- C. Cabinets and Enclosures, Including Junction and Pull Boxes Larger Than 100 cubic inches:
 1. Comply with NEMA 250, and list and label as complying with UL 50 and UL 50E, or UL 508A.
 2. NEMA 250 Environment Type, Unless Otherwise Indicated:
 - a. Indoor Clean, Dry Locations: Type 1, painted steel.
 - b. Outdoor Locations: Type 3R, painted steel.
 3. Junction and Pull Boxes Larger Than 100 cubic inches:
 - a. Provide screw-cover or hinged-cover enclosures unless otherwise indicated.
 4. Finish for Painted Steel Enclosures: Manufacturer's standard grey unless otherwise indicated.
 5. Manufacturers:
 - a. Cooper B-Line, a division of Eaton Corporation: www.cooperindustries.com/#sle.
 - b. Hoffman, a brand of Pentair Technical Products: www.hoffmanonline.com/#sle.
 - c. Hubbell Incorporated; Wiegmann Products: www.hubbell-wiegmann.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that mounting surfaces are ready to receive boxes.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install boxes in accordance with NECA 1 (general workmanship) and, where applicable, NECA 130, including mounting heights specified in those standards where mounting heights are not indicated.
- C. Arrange equipment to provide minimum clearances in accordance with manufacturer's instructions and NFPA 70.
- D. Unless otherwise indicated, provide separate boxes for line voltage and low voltage systems.
- E. Flush-mount boxes in finished areas unless specifically indicated to be surface-mounted.
- F. Unless otherwise indicated, boxes may be surface-mounted where exposed conduits are indicated or permitted.
- G. Box Locations:
 - 1. Locate boxes to be accessible. Provide access panels in accordance with Section 08 31 00 as required where approved by the Architect.
 - 2. Unless dimensioned, box locations indicated are approximate.
 - 3. Locate boxes as required for devices installed under other sections or by others.
 - a. Switches, Receptacles, and Other Wiring Devices: Comply with Section 26 27 26.
 - 4. Locate boxes so that wall plates do not span different building finishes.
 - 5. Locate boxes so that wall plates do not cross masonry joints.
 - 6. Unless otherwise indicated, where multiple outlet boxes are installed at the same location at different mounting heights, install along a common vertical center line.
 - 7. Do not install flush-mounted boxes on opposite sides of walls back-to-back. Provide minimum 6 inches horizontal separation unless otherwise indicated.
 - 8. Acoustic-Rated Walls: Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches horizontal separation.
 - 9. Fire Resistance Rated Walls: Install flush-mounted boxes such that the required fire resistance will not be reduced.
 - a. Do not install flush-mounted boxes on opposite sides of walls back-to-back; provide minimum 24 inches separation where wall is constructed with individual noncommunicating stud cavities or protect both boxes with listed putty pads.
 - b. Do not install flush-mounted boxes with area larger than 16 square inches or such that the total aggregate area of openings exceeds 100 square inches for any 100 square feet of wall area.
 - 10. Locate junction and pull boxes as indicated, as required to facilitate installation of conductors, and to limit conduit length and/or number of bends between pulling points in accordance with Section 26 05 33.13.
 - 11. Locate junction and pull boxes in the following areas, unless otherwise indicated or approved by the Architect:
 - a. Concealed above accessible suspended ceilings.
 - b. Within joists in areas with no ceiling.
 - c. Electrical rooms.
 - d. Mechanical equipment rooms.
- H. Box Supports:
 - 1. Secure and support boxes in accordance with NFPA 70 and Section 26 05 29 using suitable supports and methods approved by the authority having jurisdiction.
 - 2. Provide independent support from building structure except for cast metal boxes (other than boxes used for fixture support) supported by threaded conduit connections in accordance with NFPA 70. Do not provide support from piping, ductwork, or other systems.
 - 3. Installation Above Suspended Ceilings: Do not provide support from ceiling grid or ceiling support system.
 - 4. Use far-side support to secure flush-mounted boxes supported from single stud in hollow stud walls. Repair or replace supports for boxes that permit excessive movement.
- I. Install boxes plumb and level.

- J. Flush-Mounted Boxes:
 - 1. Install boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that front edge of box or associated raised cover is not set back from finished surface more than 1/4 inch or does not project beyond finished surface.
 - 2. Install boxes in combustible materials such as wood so that front edge of box or associated raised cover is flush with finished surface.
 - 3. Repair rough openings around boxes in noncombustible materials such as concrete, tile, gypsum, plaster, etc. so that there are no gaps or open spaces greater than 1/8 inch at the edge of the box.
- K. Install boxes as required to preserve insulation integrity.
- L. Install permanent barrier between ganged wiring devices when voltage between adjacent devices exceeds 300 V.
- M. Install firestopping to preserve fire resistance rating of partitions and other elements, using materials and methods specified in Section 07 84 00.
- N. Close unused box openings.
- O. Install blank wall plates on junction boxes and on outlet boxes with no devices or equipment installed or designated for future use.
- P. Provide grounding and bonding in accordance with Section 26 05 26.
- Q. Do not mount boxes back-to-back.

3.03 CLEANING

- A. Clean interior of boxes to remove dirt, debris, plaster and other foreign material.

3.04 PROTECTION

- A. Immediately after installation, protect boxes from entry of moisture and foreign material until ready for installation of conductors.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 26 05 53
IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Electrical identification requirements.
- B. Identification nameplates and labels.
- C. Wire and cable markers.
- D. Conduit and raceway markers.
- E. Underground warning tape.
- F. Floor marking tape.
- G. Warning signs and labels.
- H. Instruction signs.

1.03 RELATED REQUIREMENTS

- A. Section 26 05 19 - Low-Voltage Electrical Power Conductors and Cables: Color coding for power conductors and cables 600 V and less; vinyl color coding electrical tape.
- B. Section 26 05 73 - Power System Studies: Arc flash hazard warning labels.

1.04 REFERENCE STANDARDS

- A. ANSI Z535.2 - American National Standard for Environmental and Facility Safety Signs; 2011 (Reaffirmed 2017).
- B. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
- C. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- D. UL 969 - Marking and Labeling Systems; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Verify final designations for equipment, systems, and components to be identified prior to fabrication of identification products.
- B. Sequencing:
 - 1. Do not conceal items to be identified, in locations such as above suspended ceilings, until identification products have been installed.
 - 2. Do not install identification products until final surface finishes and painting are complete.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.
- B. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation and installation of product.
- C. Samples: For each type of label and sign to illustrate size, colors, lettering style, mounting provisions and graphic features of identification products.
- D. Identification Schedule: An index of nomenclature of electrical equipment and system components used in identification signs and labels.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of the National Electrical Code - NFPA 70 (NEC).

1.08 FIELD CONDITIONS

- A. Do not install adhesive products when ambient temperature is lower than recommended by manufacturer.

PART 2 PRODUCTS

2.01 IDENTIFICATION REQUIREMENTS

- A. Identification for Equipment:
 - 1. Use identification nameplate to identify each piece of electrical distribution and control equipment and associated sections, compartments, and components.
 - a. Switchboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Use identification nameplate to identify main overcurrent protective device.
 - 5) Use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - b. Panelboards:
 - 1) Identify ampere rating.
 - 2) Identify voltage and phase.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify main overcurrent protective device. Use identification label for panelboards with a door. For power distribution panelboards without a door, use identification nameplate.
 - 5) Use typewritten circuit directory to identify load(s) served for panelboards with a door. Identify spares and spaces using pencil.
 - 6) For power panelboards without a door, use identification nameplate to identify load(s) served for each branch device. Do not identify spares and spaces.
 - c. Transformers:
 - 1) Identify kVA rating.
 - 2) Identify voltage and phase for primary and secondary.
 - 3) Identify power source and circuit number. Include location when not within sight of equipment.
 - 4) Identify load(s) served. Include location when not within sight of equipment.
 - d. Enclosed switches, circuit breakers, and motor controllers:
 - 1) Identify voltage and phase.
 - 2) Identify power source and circuit number. Include location when not within sight of equipment.
 - 3) Identify load(s) served. Include location when not within sight of equipment.
 - 2. Service Equipment:
 - a. Use identification nameplate to identify each service disconnecting means.
 - b. For buildings or structures supplied by more than one service, or any combination of branch circuits, feeders, and services, use identification nameplate or means of identification acceptable to authority having jurisdiction at each service disconnecting means to identify all other services, feeders, and branch circuits supplying that building or structure. Verify format and descriptions with authority having jurisdiction.
 - 3. Emergency System Equipment:
 - a. Use identification nameplate or voltage marker to identify emergency system equipment in accordance with NFPA 70.

- b. Use identification nameplate at each piece of service equipment to identify type and location of on-site emergency power sources.
 - c. Use identification nameplate to identify emergency operating instructions for emergency system equipment.
 4. Use voltage marker to identify highest voltage present for each piece of electrical equipment.
 5. Use identification nameplate to identify equipment utilizing series ratings, where permitted, in accordance with NFPA 70.
 6. Use identification nameplate to identify switchboards and panelboards utilizing a high leg delta system in accordance with NFPA 70.
 7. Use identification nameplate to identify disconnect location for equipment with remote disconnecting means.
 8. Use identification label or handwritten text using indelible marker on inside of door at each fused switch to identify required NEMA fuse class and size.
 9. Use identification label or handwritten text using indelible marker on inside of door at each motor controller to identify nameplate horsepower, full load amperes, code letter, service factor, voltage, and phase of motor(s) controlled.
 10. Use identification label to identify overcurrent protective devices for branch circuits serving fire alarm circuits. Identify with text "FIRE ALARM CIRCUIT".
 11. Use field-painted floor markings, floor marking tape, or warning labels to identify required equipment working clearances where indicated or where required by the authority having jurisdiction.
 12. Available Fault Current Documentation: Use identification label to identify the available fault current and date calculations were performed at locations requiring documentation by NFPA 70, including but not limited to the following.
 - a. Service equipment.
 - b. Industrial control panels.
 - c. Motor control centers.
 - d. Elevator control panels.
 - e. Industrial machinery.
 13. Arc Flash Hazard Warning Labels: Comply with Section 26 05 73.
 14. Use warning signs to identify electrical hazards for entrances to all rooms and other guarded locations that contain exposed live parts operating at 600 V nominal or less with the word message "DANGER; Electrical hazard; Authorized personnel only" or approved equivalent.
 15. Use warning signs to identify electrical hazards for entrances to all buildings, vaults, rooms, or enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
 16. Use warning labels to identify electrical hazards for equipment, compartments, and enclosures containing exposed live parts or exposed conductors operating at over 600 V nominal with the word message "DANGER; HIGH VOLTAGE; KEEP OUT".
 17. Use warning labels, identification nameplates, or identification labels to identify electrical hazards for equipment where multiple power sources are present with the word message "DANGER; Hazardous voltage; Multiple power sources may be present; Disconnect all electric power including remote disconnects before servicing" or approved equivalent.
- B. Identification for Conductors and Cables:
 1. Color Coding for Power Conductors 600 V and Less: Comply with Section 26 05 19.
 2. Use identification nameplate or identification label to identify color code for ungrounded and grounded power conductors inside door or enclosure at each piece of feeder or branch-circuit distribution equipment when premises has feeders or branch circuits served by more than one nominal voltage system.
 3. Use wire and cable markers to identify circuit number or other designation indicated for power, control, and instrumentation conductors and cables at the following locations:
 4. Use underground warning tape to identify direct buried cables.

2.02 IDENTIFICATION NAMEPLATES AND LABELS

- A. Identification Nameplates:
 - 1. Materials:
 - a. Indoor Clean, Dry Locations: Use plastic nameplates.
 - b. Outdoor Locations: Use plastic, stainless steel, or aluminum nameplates suitable for exterior use.
 - 2. Plastic Nameplates: Two-layer or three-layer laminated acrylic or electrically non-conductive phenolic with beveled edges; minimum thickness of 1/16 inch; engraved text.
 - a. Exception: Provide minimum thickness of 1/8 inch when any dimension is greater than 4 inches.
 - 3. Stainless Steel Nameplates: Minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 4. Aluminum Nameplates: Anodized; minimum thickness of 1/32 inch; engraved or laser-etched text.
 - 5. Mounting Holes for Mechanical Fasteners: Two, centered on sides for sizes up to 1 inch high; Four, located at corners for larger sizes.
- B. Identification Labels:
 - 1. Manufacturers:
 - a. Brady Corporation: www.bradyid.com/#sle.
 - b. Brother International Corporation: www.brother-usa.com/#sle.
 - c. Panduit Corp: www.panduit.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Materials: Use self-adhesive laminated plastic labels; UV, chemical, water, heat, and abrasion resistant.
 - a. Use only for indoor locations.
 - 3. Text: Use factory pre-printed or machine-printed text. Do not use handwritten text unless otherwise indicated.
- C. Format for Equipment Identification:
 - 1. Minimum Size: 1 inch by 2.5 inches.
 - 2. Legend:
 - a. System designation where applicable:
 - 1) Emergency Power System: Identify with text "EMERGENCY".
 - b. Equipment designation or other approved description.
 - c. Other information as indicated.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height:
 - a. System Designation: 1 inch.
 - b. Equipment Designation: 1/2 inch.
 - c. Other Information: 1/4 inch.
 - 5. Color:
 - a. Normal Power System: White text on black background.
 - b. Emergency Power System: White text on red background.
 - c. Fire Alarm System: White text on red background.
- D. Format for General Information and Operating Instructions:
 - 1. Minimum Size: 1 inch by 2.5 inches.
 - 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 - 3. Text: All capitalized unless otherwise indicated.
 - 4. Minimum Text Height: 1/4 inch.
 - 5. Color: Black text on white background unless otherwise indicated.
 - a. Exceptions:

- 1) Provide white text on red background for general information or operational instructions for emergency systems.
 - 2) Provide white text on red background for general information or operational instructions for fire alarm systems.
- E. Format for Caution and Warning Messages:
1. Minimum Size: 2 inches by 4 inches.
 2. Legend: Include information or instructions indicated or as required for proper and safe operation and maintenance.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 1/2 inch.
 5. Color: Black text on yellow background unless otherwise indicated.
- F. Format for Fire Alarm Device Identification:
1. Minimum Size: 3/8 inch by 1.5 inches.
 2. Legend: Designation indicated and device zone or address.
 3. Text: All capitalized unless otherwise indicated.
 4. Minimum Text Height: 3/16 inch.
 5. Color: Red text on white background.
- G. Nameplate Inscription:
1. Nameplates must adequately describe the function or use of the particular equipment to which it is attached. Where nameplates are detailed on the drawings, inscription and size of letters shall be as shown. Nameplates for panelboards and switchboards shall include the panel designation, voltage and phase of the supply. Example: "Panel A, 277/480 v, 3-phase, 4-wire".
 2. The name of the machine on the motor nameplates for a particular machine shall be the same as the one used on all motor starters, disconnect and PB station nameplates for that machine.
 3. Use 1-7/8 inch letters for identifying signs on enclosures containing high voltage equipment. Signs shall read "DANGER - HIGH VOLTAGE".
 4. Warning signs (items 3 & 4 above) to be of standard manufacture, fabricated of 18 ga. steel, or heavier, with a porcelain enamel finish. Letters shall be red on white background.

2.03 WIRE AND CABLE MARKERS

- A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
 2. HellermannTyton: www.hellermanntyton.com/#sle.
 3. Panduit Corp: www.panduit.com/#sle.
 4. Seton Identification Products: www.seton.com/aec.
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Markers for Conductors and Cables: Use wrap-around self-adhesive vinyl cloth, wrap-around self-adhesive vinyl self-laminating, heat-shrink sleeve, plastic sleeve, plastic clip-on, or vinyl split sleeve type markers suitable for the conductor or cable to be identified.
- C. Markers for Conductor and Cable Bundles: Use plastic marker tags secured by nylon cable ties.
- D. Legend: Power source and circuit number or other designation indicated.
- E. Text: Use factory pre-printed or machine-printed text, all capitalized unless otherwise indicated.
- F. Minimum Text Height: 1/8 inch.
- G. Color: Black text on white background unless otherwise indicated.

2.04 VOLTAGE MARKERS

- A. Manufacturers:
1. Brady Corporation: www.bradyid.com/#sle.
 2. Brimar Industries, Inc: www.brimar.com/#sle.

3. Seton Identification Products: www.seton.com/#sle.
4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Markers for Conduits: Use factory pre-printed self-adhesive vinyl, self-adhesive vinyl cloth, or vinyl snap-around type markers.
- C. Markers for Boxes and Equipment Enclosures: Use factory pre-printed self-adhesive vinyl or self-adhesive vinyl cloth type markers.
- D. Minimum Size:
 1. Markers for Equipment: 1 1/8 by 4 1/2 inches.
- E. Legend:
 1. Markers for Voltage Identification: Highest voltage present.
- F. Color: Black text on orange background unless otherwise indicated.

2.05 UNDERGROUND WARNING TAPE

- A. Manufacturers:
 1. Brady Corporation: www.bradyid.com/#sle.
 2. Brimar Industries, Inc: www.brimar.com/#sle.
 3. Seton Identification Products: www.seton.com/#sle.
 4. The C. H. Hanson Co.: www.chhanson.com
 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Materials: Use non-detectable type polyethylene tape suitable for direct burial, unless otherwise indicated.
 1. Exception: Use foil-backed detectable type tape where required by serving utility or where directed by Owner.
- C. Non-detectable Type Tape: 6 inches wide, with minimum thickness of 4 mil.
- D. Foil-backed Detectable Type Tape: 3 inches wide, with minimum thickness of 5 mil, unless otherwise required for proper detection.
- E. Legend: Type of service, continuously repeated over full length of tape.
- F. Color:
 1. Tape for Buried Power Lines: Black text on red background.
 2. Tape for Buried Communication, Alarm, and Signal Lines: Black text on orange background.

2.06 FLOOR MARKING TAPE

- A. Floor Marking Tape for Equipment Working Clearance Identification: Self-adhesive vinyl or polyester tape with overlamine, 3 inches wide, with alternating black and white stripes.

2.07 WARNING SIGNS AND LABELS

- A. Manufacturers:
 1. Brimar Industries, Inc: www.brimar.com/#sle.
 2. Clarion Safety Systems, LLC: www.clarionsafety.com/#sle.
 3. Seton Identification Products: www.seton.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Comply with ANSI Z535.2 or ANSI Z535.4 as applicable.
- C. Warning Signs:
 1. Materials:
 - a. Indoor Dry, Clean Locations: Use factory pre-printed rigid plastic or self-adhesive vinyl signs.
 - b. Outdoor Locations: Use factory pre-printed rigid aluminum signs.
 2. Rigid Signs: Provide four mounting holes at corners for mechanical fasteners.
 3. Minimum Size: 7 by 10 inches unless otherwise indicated.
- D. Warning Labels:

1. Materials: Use factory pre-printed or machine-printed self-adhesive polyester or self-adhesive vinyl labels; UV, chemical, water, heat, and abrasion resistant; produced using materials recognized to UL 969.
 - a. Do not use labels designed to be completed using handwritten text.
2. Machine-Printed Labels: Use thermal transfer process printing machines and accessories recommended by label manufacturer.
3. Minimum Size: 2 by 4 inches unless otherwise indicated.

PART 3 EXECUTION

3.01 PREPARATION

- A. Clean surfaces to receive adhesive products according to manufacturer's instructions.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install identification products to be plainly visible for examination, adjustment, servicing, and maintenance. Unless otherwise indicated, locate products as follows:
 1. Surface-Mounted Equipment: Enclosure front.
 2. Flush-Mounted Equipment: Inside of equipment door.
 3. Free-Standing Equipment: Enclosure front; also enclosure rear for equipment with rear access.
 4. Elevated Equipment: Legible from the floor or working platform.
 5. Branch Devices: Adjacent to device.
 6. Interior Components: Legible from the point of access.
 7. Boxes: Outside face of cover.
 8. Conductors and Cables: Legible from the point of access.
 9. Devices: Outside face of cover.
- C. Install identification products centered, level, and parallel with lines of item being identified.
- D. Secure nameplates to exterior surfaces of enclosures using stainless steel screws and to interior surfaces using self-adhesive backing or epoxy cement.
- E. Install self-adhesive labels and markers to achieve maximum adhesion, with no bubbles or wrinkles and edges properly sealed.
- F. Install underground warning tape above buried lines with one tape per trench at 3 inches below finished grade.
- G. Secure rigid signs using stainless steel screws.
- H. Mark all handwritten text, where permitted, to be neat and legible.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Replace self-adhesive labels and markers that exhibit bubbles, wrinkles, curling or other signs of improper adhesion.
- C. Install wire, cable and underground markers per manufacturers' instructions.
- D. Install conduit, raceway and instructions signs parallel to lines and surrounding surfaces. Install instruction signs in a clearly visible location, straight and square to surroundings.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 26 05 73
POWER SYSTEM STUDIES

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Short-circuit study.
- B. Protective device coordination study.
- C. Arc flash and shock risk assessment.
 - 1. Includes arc flash hazard warning labels.
- D. Criteria for the selection and adjustment of equipment and associated protective devices not specified in this section, as determined by studies to be performed.

1.03 RELATED REQUIREMENTS

- A. Section 26 05 53 - Identification for Electrical Systems: Additional requirements for arc flash hazard warning labels.
- B. Section 26 24 13 - Switchboards.
- C. Section 26 24 16 - Panelboards.
- D. Section 26 28 13 - Fuses.

1.04 REFERENCE STANDARDS

- A. ANSI Z535.4 - American National Standard for Product Safety Signs and Labels; 2011 (Reaffirmed 2017).
- B. IEEE 141 - IEEE Recommended Practice for Electrical Power Distribution for Industrial Plants; 1993 (Reaffirmed 1999).
- C. IEEE 242 - IEEE Recommended Practice for Protection and Coordination of Industrial and Commercial Power Systems; 2001, with Errata (2003).
- D. IEEE 399 - IEEE Recommended Practice for Industrial and Commercial Power Systems Analysis; 1997.
- E. IEEE 551 - IEEE Recommended Practice for Calculating Short-Circuit Currents in Industrial and Commercial Power Systems; 2006.
- F. IEEE 1584 - IEEE Guide for Performing Arc-Flash Hazard Calculations; 2018, with Errata (2019).
- G. NEMA MG 1 - Motors and Generators; 2018.
- H. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- I. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- J. NFPA 70E - Standard for Electrical Safety in the Workplace; 2021.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Existing Installations: Coordinate with equipment manufacturer(s) to obtain data necessary for completion of studies.
 - 2. Coordinate the work to provide equipment and associated protective devices complying with criteria for selection and adjustment, as determined by studies to be performed.

3. Notify Architect Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Pre-Study Meeting: Conduct meeting with Owner to discuss system operating modes and conditions to be considered in studies.
- C. Sequencing:
 1. Submit study reports prior to or concurrent with product submittals.
 2. Do not order equipment until matching study reports and product submittals have both been evaluated by Architect Engineer.
 3. Verify naming convention for equipment identification prior to creation of final drawings, reports, and arc flash hazard warning labels (where applicable).
- D. Scheduling:
 1. Arrange access to existing facility for data collection with Owner.
 2. Where work of this section involves interruption of existing electrical service, arrange service interruption with Owner.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Study preparer's qualifications.
- C. Study reports, stamped or sealed and signed by study preparer.
- D. Product Data: In addition to submittal requirements specified in other sections, include manufacturer's standard catalog pages and data sheets for equipment and protective devices indicating information relevant to studies.
 1. Include characteristic time-current trip curves for protective devices.
 2. Include impedance data for busway.
 3. Include impedance data for engine generators.
 4. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 5. Include documentation of listed series ratings upon request.
 6. Identify modifications made in accordance with studies that:
 - a. Can be made at no additional cost to Owner.
 - b. As submitted will involve a change to the contract sum.
- E. Arc Flash Hazard Warning Label Samples: One of each type and legend specified.
- F. Site-specific arc flash hazard warning labels.
- G. Field quality control reports.
- H. Certification that field adjustable protective devices have been set in accordance with requirements of studies.
- I. Project Record Documents: Revise studies as required to reflect as-built conditions.
 1. Include hard copies with operation and maintenance data submittals.
 2. Include computer software files used to prepare studies with file name(s) cross-referenced to specific pieces of equipment and systems.

1.07 POWER SYSTEM STUDIES

- A. Scope of Studies:
 1. Perform analysis of new electrical distribution system as indicated on drawings.
 2. Except where study descriptions below indicate exclusions, analyze system at each bus from primary protective devices of utility source down to each piece of equipment involved, including parts of system affecting calculations being performed (e.g. fault current contribution from motors).
 3. Include in analysis alternate sources and operating modes (including known future configurations) to determine worst case conditions.
 - a. Known Operating Modes:

- 1) Utility as source.
- B. General Study Requirements:
 1. Comply with NFPA 70.
 2. Perform studies utilizing computer software complying with specified requirements; manual calculations are not permitted.
- C. Data Collection:
 1. Compile information on project-specific characteristics of actual installed equipment, protective devices, feeders, etc. as necessary to develop single-line diagram of electrical distribution system and associated input data for use in system modeling.
 - a. Utility Source Data: Include primary voltage, maximum and minimum three-phase and line-to-ground fault currents, impedance, X/R ratio, and primary protective device information.
 - 1) Obtain up-to-date information from Utility Company.
 - b. Generators: Include manufacturer/model, kW and voltage ratings, and impedance.
 - c. Motors: Include manufacturer/model, type (e.g. induction, synchronous), horsepower rating, voltage rating, full load amps, and locked rotor current or NEMA MG 1 code letter designation.
 - d. Transformers: Include primary and secondary voltage ratings, kVA rating, winding configuration, percent impedance, and X/R ratio.
 - e. Protective Devices:
 - 1) Circuit Breakers: Include manufacturer/model, type (e.g. thermal magnetic, electronic trip), frame size, trip rating, voltage rating, interrupting rating, available field-adjustable trip response settings, and features (e.g. zone selective interlocking).
 - 2) Fuses: Include manufacturer/model, type/class (e.g. Class J), size/rating, and speed (e.g. time delay, fast acting).
 - f. Protective Relays: Include manufacturer/model, type, settings, current/potential transformer ratio, and associated protective device.
 - g. Conductors: Include feeder size, material (e.g. copper, aluminum), insulation type, voltage rating, number per phase, raceway type, and actual length.
- D. Short-Circuit Study:
 1. Comply with IEEE 551 and applicable portions of IEEE 141, IEEE 242, and IEEE 399.
 2. For purposes of determining equipment short circuit current ratings, consider conditions that may result in maximum available fault current, including but not limited to:
 - a. Maximum utility fault currents.
 - b. Maximum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. For each bus location, calculate the maximum available three-phase bolted symmetrical and asymmetrical fault currents. For grounded systems, also calculate the maximum available line-to-ground bolted fault currents.
- E. Protective Device Coordination Study:
 1. Comply with applicable portions of IEEE 242 and IEEE 399.
 2. Analyze alternate scenarios considering known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
 3. Analyze protective devices and associated settings for suitable margins between time-current curves to provide adequate protection for equipment and conductors while achieving full selective coordination.
- F. Arc Flash and Shock Risk Assessment:
 1. Comply with NFPA 70E.
 2. Perform incident energy and arc flash boundary calculations in accordance with IEEE 1584 (as referenced in NFPA 70E Annex D), where applicable.

- a. For single-phase systems, study preparer to perform calculations assuming three-phase system in accordance with IEEE 1584 using single phase bolted fault current, yielding conservative results.
 3. For equipment with main devices mounted in separate compartmentalized sections, perform calculations on both the line and load side of the main device.
 4. Analyze alternate scenarios considering conditions that may result in maximum incident energy, including but not limited to:
 - a. Maximum and minimum utility fault currents.
 - b. Maximum and minimum motor contribution.
 - c. Known operating modes (e.g. utility as source, generator as source, utility/generator in parallel, bus tie breaker open/close positions).
- G. Study Reports:
 1. General Requirements:
 - a. Identify date of study and study preparer.
 - b. Identify study methodology and software product(s) used.
 - c. Identify scope of studies, assumptions made, implications of possible alternate scenarios, and any exclusions from studies.
 - d. Identify base used for per unit values.
 - e. Include single-line diagram and associated input data used for studies; identify buses on single-line diagram as referenced in reports, and indicate bus voltage.
 - f. Include conclusions and recommendations.
 2. Short-Circuit Study:
 - a. For each scenario, identify at each bus location:
 - 1) Calculated maximum available symmetrical and asymmetrical fault currents (both three-phase and line-to-ground where applicable).
 - 2) Fault point X/R ratio.
 - 3) Associated equipment short circuit current ratings.
 - b. Identify locations where the available fault current exceeds the equipment short circuit current rating, along with recommendations.
 3. Protective Device Coordination Study:
 - a. For each scenario, include time-current coordination curves plotted on log-log scale graphs.
 - b. For each graph include (where applicable):
 - 1) Partial single-line diagram identifying the portion of the system illustrated.
 - 2) Protective Devices: Time-current curves with applicable tolerance bands for each protective device in series back to the source, plotted up to the maximum available fault current at the associated bus.
 - 3) Conductors: Damage curves.
 - 4) Transformers: Inrush points and damage curves.
 - 5) Generators: Full load current, overload curves, decrement curves, and short circuit withstand points.
 - 6) Motors: Full load current, starting curves, and damage curves.
 - 7) Capacitors: Full load current and damage curves.
 - c. For each protective device, identify fixed and adjustable characteristics with available ranges and recommended settings.
 - 1) Circuit Breakers: Include long time pickup and delay, short time pickup and delay, and instantaneous pickup.
 - 2) Include ground fault pickup and delay.
 - 3) Include fuse ratings.
 - 4) Protective Relays: Include current/potential transformer ratios, tap, time dial, and instantaneous pickup.
 - d. Identify cases where either full selective coordination or adequate protection is not achieved, along with recommendations.

4. Arc Flash and Shock Risk Assessment:
 - a. For the worst case for each scenario, identify at each bus location:
 - 1) Calculated incident energy and associated working distance.
 - 2) Calculated arc flash boundary.
 - 3) Bolted fault current.
 - 4) Arcing fault current.
 - 5) Clearing time.
 - 6) Arc gap distance.
 - b. For purposes of producing arc flash hazard warning labels, summarize the maximum incident energy and associated data reflecting the worst case condition of all scenarios at each bus location.
 - c. Include recommendations for reducing the incident energy at locations where the calculated maximum incident energy exceeds 8 calories per sq cm.

1.08 QUALITY ASSURANCE

- A. Study Preparer Qualifications: Professional electrical engineer licensed in the State in which the Project is located and with minimum five years experience in preparation of studies of similar type and complexity using specified computer software.
 1. Study preparer may be employed by manufacturer of electrical distribution equipment.
- B. Field Testing Agency Qualifications: Independent testing organization specializing in testing, analysis, and maintenance of electrical systems with minimum five years experience; NETA Accredited Company.
- C. Computer Software for Study Preparation: Use the latest edition of commercially available software utilizing specified methodologies.
 1. Products:
 - a. EasyPower LLC: www.easypower.com/#sle.
 - b. Power Analytics Corporation: www.poweranalytics.com/#sle.
 - c. SKM Systems Analysis, Inc: www.skm.com/#sle.

PART 2 PRODUCTS

2.01 ARC FLASH HAZARD WARNING LABELS

- A. Provide warning labels complying with ANSI Z535.4 to identify arc flash hazards for each work location analyzed by the arc flash and shock risk assessment.
 1. Materials: Comply with Section 26 05 53.
 2. Minimum Size: 4 by 6 inches.
 3. Legend: Provide custom legend in accordance with NFPA 70E based on equipment-specific data as determined by arc flash and shock risk assessment.
 - a. Include orange header that reads "WARNING" unless otherwise indicated.
 - b. Include the text "Arc Flash and Shock Hazard; Appropriate PPE Required" or approved equivalent.
 - c. Include the following information:
 - 1) Arc flash boundary.
 - 2) Available incident energy and corresponding working distance.
 - 3) Site-specific PPE (personnel protective equipment) requirements.
 - 4) Nominal system voltage.
 - 5) Limited approach boundary.
 - 6) Restricted approach boundary.
 - 7) Equipment identification.
 - 8) Study preparer, report reference, and date calculations were performed.

PART 3 EXECUTION

3.01 INSTALLATION

- A. Install arc flash warning labels in accordance with Section 26 05 53.

3.02 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Provide the services of field testing agency or equipment manufacturer's representative to perform inspection, testing, and adjusting.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Adjust equipment and protective devices for compliance with studies and recommended settings.
- E. Notify Architect Engineer of any conflicts with or deviations from studies. Obtain direction before proceeding.
- F. Submit detailed reports indicating inspection and testing results, and final adjusted settings.

3.03 CLOSEOUT ACTIVITIES

- A. Training: Include as part of the base bid training for Owner's personnel on electrical safety pertaining to arc flash and shock hazards.
 - 1. Use site-specific arc flash and shock risk assessment report as training reference, supplemented with additional training materials as required.

END OF SECTION

SECTION 26 24 13

SWITCHBOARDS

PART 1 GENERAL

1.01 RELATED DOCUMENTS

- A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Division 01 Specification Sections, apply to this Section.

1.02 SECTION INCLUDES

- A. Low-voltage (600 V and less) switchboards and associated accessories for service and distribution applications.
- B. Overcurrent protective devices for switchboards.

1.03 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete equipment pads.
- B. Section 26 05 26 - Grounding and Bonding for Electrical Systems.
- C. Section 26 05 29 - Hangers and Supports for Electrical Systems.
- D. Section 26 05 53 - Identification for Electrical Systems: Identification products and requirements.
- E. Section 26 05 73 - Power System Studies: Additional criteria for the selection and adjustment of equipment and associated protective devices specified in this section.

1.04 REFERENCE STANDARDS

- A. FS W-C-375 - Circuit Breakers, Molded Case; Branch Circuit and Service; 2013e (Amended 2017).
- B. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- C. NECA 400 - Standard for Installing and Maintaining Switchboards; 2007.
- D. NEMA 250 - Enclosures for Electrical Equipment (1000 Volts Maximum); 2020.
- E. NEMA PB 2 - Deadfront Distribution Switchboards; 2011.
- F. NEMA PB 2.1 - General Instructions for Proper Handling, Installation, Operation, and Maintenance of Deadfront Distribution Switchboards Rated 600 Volts or Less; 2013.
- G. NETA ATS - Acceptance Testing Specifications for Electrical Power Equipment and Systems; 2017.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. UL 489 - Molded-Case Circuit Breakers, Molded-Case Switches and Circuit Breaker Enclosures; Current Edition, Including All Revisions.
- J. UL 891 - Switchboards; Current Edition, Including All Revisions.

1.05 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate the work with other trades to avoid placement of ductwork, piping, equipment, or other potential obstructions within the dedicated equipment spaces and working clearances required by NFPA 70.
 - 2. Coordinate arrangement of electrical equipment with the dimensions and clearance requirements of the actual equipment to be installed.
 - 3. Verify with manufacturer that conductor terminations are suitable for use with the conductors to be installed.
 - 4. Coordinate with manufacturer to provide shipping splits suitable for the dimensional constraints of the installation.

5. Notify Architect Engineer of any conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.

1.06 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements, for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for switchboards, enclosures, overcurrent protective devices, and other installed components and accessories.
 1. Include characteristic trip curves for each type and rating of overcurrent protective device upon request.
- C. Shop Drawings: Indicate dimensions, voltage, bus ampacities, overcurrent protective device arrangement and sizes, short circuit current ratings, conduit entry locations, conductor terminal information, and installed features and accessories.
 1. Include dimensioned plan and elevation views of switchboards and adjacent equipment with all required clearances indicated.
 2. Include wiring diagrams showing all factory and field connections.
 3. Clearly indicate whether proposed short circuit current ratings are fully rated or, where acceptable, series rated systems.
 4. Include documentation of listed series ratings upon request.
 5. Include documentation demonstrating selective coordination upon request.
- D. Source Quality Control Test Reports: Include reports for tests designated in NEMA PB 2 as production (routine) tests.
- E. Manufacturer's Installation Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.
- F. Field Quality Control Test Reports.
- G. Project Record Documents: Record actual installed locations of switchboards and final equipment settings.
- H. Maintenance Data: Include information on replacement parts and recommended maintenance procedures and intervals.
- I. Maintenance Materials: Furnish the following for Owner's use in maintenance of project.
 1. See Section 01 60 00 - Product Requirements, for additional provisions.
 2. Enclosure Keys: Two of each different key.
 3. Drawout Devices:
 - a. Handles Necessary for Racking of Devices: One for each electrical room containing switchgear with drawout devices.
 - b. Lifting Yokes: One of each different yoke required, for each electrical room containing drawout devices.
 - c. Removable Covers: One for blocking each different opening size when device is temporarily removed from its compartment.

1.07 QUALITY ASSURANCE

- A. Comply with requirements of NFPA 70.
- B. Manufacturer Qualifications: Company specializing in manufacturing the products specified in this section with minimum three years documented experience.
- C. Product Listing Organization Qualifications: An organization recognized by OSHA as a Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.08 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store switchboards in accordance with manufacturer's instructions, NECA 400, and NEMA PB 2.1.

- B. Store in a clean, dry space having a uniform temperature to prevent condensation (including outdoor switchboards, which are not weatherproof until completely and properly installed). Where necessary, provide temporary enclosure space heaters or temporary power for permanent factory-installed space heaters.
- C. Maintain factory wrapping or provide an additional heavy canvas or heavy plastic cover to protect units from dirt, water, construction debris, and traffic.
- D. Handle carefully to avoid damage to switchboard internal components, enclosure, and finish.

1.09 FIELD CONDITIONS

- A. Maintain field conditions within required service conditions during and after installation.

PART 2 PRODUCTS

2.01 MANUFACTURERS

- A. Switchboards:
 - 1. Eaton Corporation: www.eaton.com/#sle.
 - 2. Schneider Electric: www.se.com/#sle.
 - 3. Siemens Industry, Inc: www.new.siemens.com/#sle.

2.02 SWITCHBOARDS

- A. Provide switchboards consisting of all required components, control power transformers, instrumentation and control wiring, accessories, etc. as necessary for a complete operating system.
- B. Provide products listed, classified, and labeled as suitable for the purpose intended.
- C. Description: Dead-front switchboard assemblies complying with NEMA PB 2, and listed and labeled as complying with UL 891; ratings, configurations and features as indicated on the drawings.
- D. Front-Connected Switchboards:
 - 1. Main Device(s): Individually-mounted.
 - 2. Feeder Devices: Panel/group-mounted.
 - 3. Arrangement: Front accessible only (not rear accessible), rear aligned.
 - 4. Gutter Access: Bolted covers.
- E. Short Circuit Current Rating:
 - 1. Provide switchboards with listed short circuit current rating not less than the available fault current at the installed location as determined by short circuit study performed in accordance with Section 26 05 73.
 - 2. Minimum Rating: 65,000 rms symmetrical amperes.
- F. Selectivity: Where the requirement for selectivity is indicated, furnish products as required to achieve selective coordination.
- G. Bussing: Sized in accordance with UL 891 temperature rise requirements.
 - 1. Through bus (horizontal cross bus) to be fully rated through full length of switchboard (non-tapered). Tapered bus is not permitted.
 - 2. Provide solidly bonded equipment ground bus through full length of switchboard, with a suitable lug for each feeder and branch circuit equipment grounding conductor.
 - 3. Phase and Neutral Bus Material: Copper.
 - 4. Ground Bus Material: Copper.
- H. Conductor Terminations: Suitable for use with the conductors to be installed.
 - 1. Line Conductor Terminations:
 - a. Main and Neutral Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Main and Neutral Lug Type: Mechanical.
 - 2. Load Conductor Terminations:

- a. Lug Material: Aluminum, suitable for terminating aluminum or copper conductors.
 - b. Lug Type:
- I. Enclosures:
 - 1. Environment Type per NEMA 250: Unless otherwise indicated, as specified for the following installation locations:
 - 2. Finish: Manufacturer's standard unless otherwise indicated.
 - 3. Enclosure Space Heaters:
 - a. Provide in each switchboard section installed outdoors and in unconditioned indoor spaces.
 - b. Size according to manufacturer's recommendations for worst case ambient temperature to prevent condensation.
 - c. Heater Control: Thermostat.
 - d. Heater Power Source: Provide connection to transformer factory-installed in switchboard or suitable external branch circuit as indicated or as required.

2.03 OVERCURRENT PROTECTIVE DEVICES

- A. Circuit Breakers:
 - 1. Interrupting Capacity:
 - a. Provide circuit breakers with interrupting capacity as required to provide the short circuit current rating indicated, but not less than specified minimum requirements.
 - b. Fully Rated Systems: Provide circuit breakers with interrupting capacity not less than the short circuit current rating indicated.
 - 2. Molded Case Circuit Breakers:
 - a. Description: Quick-make, quick-break, over center toggle, trip-free, trip-indicating circuit breakers; listed and labeled as complying with UL 489, and complying with FS W-C-375 where applicable; ratings, configurations, and features as indicated on the drawings.
 - 1) Provide thermal magnetic circuit breakers unless otherwise indicated.
 - 2) Provide electronic trip circuit breakers where indicated.
 - b. Thermal Magnetic Circuit Breakers: For each pole, furnish thermal inverse time tripping element for overload protection and magnetic instantaneous tripping element for short circuit protection.
 - 1) Provide field-adjustable magnetic instantaneous trip setting for circuit breaker frame sizes 225 amperes and larger.
 - 2) Provide interchangeable trip units where indicated.
 - c. Electronic Trip Circuit Breakers: Furnish solid state, microprocessor-based, true rms sensing trip units.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - 2) Provide communication capability where indicated: Compatible with system indicated.
 - d. Provide the following circuit breaker types where indicated:
 - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.
 - 3. Insulated Case Circuit Breakers:

- a. Description: Quick-make, quick-break, trip-free circuit breakers with two-step stored energy closing mechanism; standard 80 percent rated unless otherwise indicated; listed and labeled as complying with UL 489; ratings, configurations, and features as indicated on the drawings.
- b. Operation:
 - 1) Provide manually operated circuit breakers unless otherwise indicated.
 - 2) Provide electrically operated circuit breakers where indicated.
 - 3) Pad-Lock Provision: For preventing circuit breaker closing operation.
- c. Construction:
 - 1) Provide fixed-mount circuit breakers unless otherwise indicated.
 - 2) Provide drawout circuit breakers where indicated.
- d. Drawout Circuit Breakers:
 - 1) Allows withdrawal of circuit breaker into test and disconnected positions, with racking position indication (connected, test, disconnected, withdrawn).
 - 2) Provide safety interlock to prevent racking of circuit breaker while in the ON position.
 - 3) Pad-Lock Provision: For preventing circuit breaker drawout operation.
- e. Minimum Interrupting Capacity:
 - 1) 65,000 rms symmetrical amperes at 480 VAC.
- f. Trip Units: Solid state, microprocessor-based, true rms sensing.
 - 1) Provide the following field-adjustable trip response settings:
 - (a) Long time pickup, adjustable by replacing interchangeable trip unit or by setting dial.
 - (b) Long time delay.
 - (c) Short time pickup and delay.
 - (d) Instantaneous pickup.
 - (e) Ground fault pickup and delay where ground fault protection is indicated.
 - 2) Provide zone selective interlocking capability where indicated, capable of communicating with other electronic trip circuit breakers and external ground fault sensing systems to control short time delay and ground fault delay functions for system coordination purposes.
- g. Provide the following circuit breaker types where indicated:
 - 1) 100 Percent Rated Circuit Breakers: Listed for application within the switchboard where installed at 100 percent of the continuous current rating.
 - 2) Current Limiting Circuit Breakers: Without using fusible elements, designed to limit the let-through energy to a value less than the energy of a one-half cycle wave of the symmetrical prospective current when operating within its current limiting range.

2.04 SOURCE QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.
- B. Verify that the ratings and configurations of the switchboards and associated components are consistent with the indicated requirements.
- C. Verify that mounting surfaces are ready to receive switchboards.
- D. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.

- B. Install switchboards in accordance with NECA 1 (general workmanship), NECA 400, and NEMA PB 2.1.
- C. Arrange equipment to provide required clearances and maintenance access, including accommodations for any drawout devices.
- D. Where switchboard is indicated to be mounted with inaccessible side against wall, provide minimum clearance of 1/2 inch between switchboard and wall.
- E. Provide required support and attachment in accordance with Section 26 05 29.
- F. Install switchboards plumb and level.
- G. Unless otherwise indicated, mount switchboards on properly sized 4 inch high concrete pad constructed in accordance with Section 03 30 00.
- H. Provide grounding and bonding in accordance with Section 26 05 26.
- I. Install all field-installed devices, components, and accessories.
- J. Where accessories are not self-powered, provide control power source as indicated or as required to complete installation.
- K. Set field-adjustable circuit breaker tripping function settings as indicated.
- L. Provide filler plates to cover unused spaces in switchboards.
- M. Identify switchboards in accordance with Section 26 05 53.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements, for additional requirements.
- B. Before energizing switchboard, perform insulation resistance testing in accordance with NECA 400 and NEMA PB 2.1.
- C. Inspect and test in accordance with NETA ATS, except Section 4.
- D. Perform inspections and tests listed in NETA ATS, Section 7.1.
- E. Molded Case and Insulated Case Circuit Breakers: Perform inspections and tests listed in NETA ATS, Section 7.6.1.1 for all main circuit breakers. Tests listed as optional are not required.
- F. Correct deficiencies and replace damaged or defective switchboards or associated components.

3.04 ADJUSTING

- A. Adjust tightness of mechanical and electrical connections to manufacturer's recommended torque settings.
- B. Adjust alignment of switchboard covers and doors.

3.05 CLEANING

- A. Clean dirt and debris from switchboard enclosures and components according to manufacturer's instructions.
- B. Repair scratched or marred surfaces to match original factory finish.

3.06 CLOSEOUT ACTIVITIES

- A. See Section 01 78 00 - Closeout Submittals, for closeout submittals.
- B. See Section 01 79 00 - Demonstration and Training, for additional requirements.
- C. Training: Train Owner's personnel on operation, adjustment, and maintenance of switchboard and associated devices.
 - 1. Use operation and maintenance manual as training reference, supplemented with additional training materials as required.
 - 2. Provide minimum of two hours of training.
 - 3. Instructor: Manufacturer's authorized representative.

4. Location: At project site.

3.07 PROTECTION

- A. Protect installed switchboards from subsequent construction operations.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 27 05 29

HANGERS AND SUPPORTS FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Support and attachment requirements and components for equipment, conduit, cable, boxes, and other communications work.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete.
- B. Section 05 50 00 - Metal Fabrications: Materials and requirements for fabricated metal supports.

1.03 REFERENCE STANDARDS

- A. ASTM A123/A123M - Standard Specification for Zinc (Hot-Dip Galvanized) Coatings on Iron and Steel Products; 2017.
- B. ASTM A153/A153M - Standard Specification for Zinc Coating (Hot-Dip) on Iron and Steel Hardware; 2016a.
- C. ASTM B633 - Standard Specification for Electrodeposited Coatings of Zinc on Iron and Steel; 2019.
- D. BICSI ITSIMM - Information Technology Systems Installation Methods Manual, 7th Edition; 2017.
- E. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- F. MFMA-4 - Metal Framing Standards Publication; 2004.
- G. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- H. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- I. TIA-569 - Telecommunications Pathways and Spaces; 2019e.
- J. UL 5B - Strut-Type Channel Raceways and Fittings; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate sizes and arrangement of supports and bases with actual equipment and components to be installed.
 - 2. Coordinate work to provide additional framing and materials required for installation.
 - 3. Coordinate compatibility of support and attachment components with mounting surfaces at installed locations.
 - 4. Coordinate arrangement of supports with ductwork, piping, equipment and other potential conflicts.
 - 5. Notify Architect Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not install products on or provide attachment to concrete surfaces until concrete has cured; see Section 03 30 00.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittal procedures.
- B. Product Data: Provide manufacturer's standard catalog pages and data sheets for cable supports, channel/strut framing systems, nonpenetrating rooftop supports, and post-installed concrete/masonry anchors.

- C. Shop Drawings: Include details for fabricated hangers and supports where materials or methods other than those indicated are proposed for substitution.
- D. Derating Calculations for Fiberglass Channel/Strut Framing Systems: Indicate load ratings adjusted for applicable service conditions.
- E. Evaluation Reports: For products specified as requiring evaluation and recognition by ICC Evaluation Service, LLC (ICC-ES), provide current ICC-ES evaluation reports upon request.
- F. Installer's qualification statement.
- G. Manufacturer's Instructions: Indicate application conditions and limitations of use stipulated by product testing agency. Include instructions for storage, handling, protection, examination, preparation, and installation of product.

1.06 QUALITY ASSURANCE

- A. Installer Qualifications for Field Welding: See Section 05 50 00.
- B. Product Listing Organization Qualifications: Organization recognized by OSHA as Nationally Recognized Testing Laboratory (NRTL) and acceptable to authorities having jurisdiction.

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store products in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 SUPPORT AND ATTACHMENT COMPONENTS

- A. General Requirements:
 - 1. Comply with the following. Where requirements differ, comply with most stringent.
 - a. TIA-569.
 - b. NFPA 70.
 - c. Applicable building code.
 - d. Requirements of authorities having jurisdiction.
 - 2. Provide required hangers, supports, anchors, fasteners, fittings, accessories, and hardware as necessary for complete installation of communications work.
 - 3. Provide products listed, classified, and labeled as suitable for purpose intended, where applicable.
 - 4. Where support and attachment component types and sizes are not indicated, select in accordance with manufacturer's application criteria as required for load to be supported with minimum safety factor of 5 times applies force. Include consideration for vibration, equipment operation, and shock loads where applicable.
 - 5. Do not use products for applications other than as permitted by NFPA 70 and product listing.
 - 6. Do not use wire, chain, perforated pipe strap, or wood for permanent supports unless specifically indicated or permitted.
 - 7. Steel Components: Use corrosion-resistant materials suitable for environment where installed.
 - a. Indoor Dry Locations: Use zinc-plated steel or approved equivalent unless otherwise indicated.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel, stainless steel, or approved equivalent unless otherwise indicated.
 - c. Zinc-Plated Steel: Electroplated in accordance with ASTM B633.
 - d. Galvanized Steel: Hot-dip galvanized after fabrication in accordance with ASTM A123/A123M or ASTM A153/A153M.
- B. Materials for Metal Fabricated Supports: See Section 05 50 00.
- C. Conduit Supports: Straps and clamps suitable for conduit to be supported.
 - 1. Manufacturers:
 - a. ABB: www.electrification.us.abb.com/#sle.

- b. Eaton Corporation: www.eaton.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Conduit Straps: One-hole or two-hole type; steel or malleable iron.
 - 3. Conduit Clamps: Bolted type unless otherwise indicated.
- D. Noncontinuous Cable Supports: Suitable for cables to be supported, including but not limited to J-hooks, bridle rings, drive rings, and flexible harnesses/slings.
 - 1. Applications:
 - a. Do not exceed 5 feet between cable supports.
 - b. Maximum Number of Cables per Cable Support:
 - 1) J-Hooks: 50, regardless of capacity.
 - c. Allowable Cable Types:
 - 1) J-Hooks: Category 3, Category 5e, and Category 6.
 - 2. J-Hooks: Noncontinuous cabling support with removable top retainer clip.
 - a. Material: Use galvanized steel, factory-painted steel, or stainless steel.
 - b. Provide support surfaces with smooth, beveled edges and radius not less than minimum allowable bend radius of cables supported.
 - c. Provide multitiered J-hooks where required to support multiple cabling systems.
 - d. Color coding to be visible from below after installation.
- E. Outlet Box Supports: Hangers and brackets suitable for boxes to be supported.
 - 1. Manufacturers:
 - a. ABB: www.electrification.us.abb.com/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
- F. Metal Channel/Strut Framing Systems:
 - 1. Manufacturers:
 - a. ABB: www.electrification.us.abb.com/#sle.
 - b. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
 - c. Eaton Corporation: www.eaton.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - e. Source Limitations: Furnish channel/strut and associated fittings, accessories, and hardware produced by single manufacturer.
 - 2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware required for field assembly of supports.
 - 3. Comply with MFMA-4.
 - 4. Channel/Strut Used as Raceway, Where Indicated: Listed and labeled as complying with UL 5B.
 - 5. Channel Material:
 - a. Indoor Dry Locations: Use painted steel, zinc-plated steel, or galvanized steel.
 - b. Outdoor and Damp or Wet Indoor Locations: Use galvanized steel.
 - 6. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch.
 - 7. Minimum Channel Dimensions: 1-5/8 inch wide by 13/16 inch high.
- G. Hanger Rods: Threaded, zinc-plated steel unless otherwise indicated.
 - 1. Minimum Size, Unless Otherwise Indicated or Required:
 - a. Equipment Supports: 1/2-inch diameter.
 - b. Single Conduit up to 1-inch (27 mm) Trade Size: 1/4-inch diameter.
 - c. Single Conduit Larger than 1-inch (27 mm) Trade Size: 3/8-inch diameter.
 - d. Trapeze Support for Multiple Conduits: 3/8-inch diameter.
 - e. Outlet Boxes: 1/4-inch diameter.
- H. Nonpenetrating Rooftop Supports for Low-Slope Roofs:
 - 1. Manufacturers:

- a. Atkore International Inc; Unistrut: www.unistrut.us/#sle.
 - b. Eaton Corporation: www.eaton.com/#sle.
 - c. PHP Systems/Design: www.phpsd.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Description: Steel pedestals with thermoplastic or rubber bases that rest on top of roofing membrane, not requiring attachment to roof structure and not penetrating roofing assembly, with support fixtures as specified.
 3. Base Sizes: As required to distribute load sufficiently to prevent indentation of roofing assembly.
 4. Attachment/Support Fixtures: As recommended by manufacturer, same type as indicated for equivalent indoor hangers and supports.
 5. Mounting Height: Provide minimum clearance of 6 inches under supported component to top of roofing.
- I. Rooftop Support Systems for Metal Roofs:
1. Manufacturers:
 - a. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Description: Factory-fabricated, continuous-slot, metal channel/strut and associated fittings, accessories, and hardware for field assembly of supports.
 3. Standing-Seam Metal Roofs: Use nonpenetrating fasteners that utilize mechanical clamping action for attachment.
 4. Exposed-Fastener Metal Roofs: Use piercing fasteners with rubber gaskets.
- J. Anchors and Fasteners:
1. Manufacturers - Mechanical Anchors:
 - a. Dewalt: anchors.dewalt.com/#sle.
 - b. Hilti, Inc: www.hilti.com/#sle.
 - c. ITW Red Head, a division of Illinois Tool Works, Inc: www.itwredhead.com/#sle.
 - d. Simpson Strong-Tie Company Inc: www.strongtie.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Unless otherwise indicated and where not otherwise restricted, use anchor and fastener types indicated for specified applications.
 3. Concrete: Use preset concrete inserts, expansion anchors, or screw anchors.
 4. Solid or Grout-Filled Masonry: Use expansion anchors or screw anchors.
 5. Hollow Masonry: Use toggle bolts.
 6. Hollow Stud Walls: Use toggle bolts.
 7. Steel: Use beam clamps, machine bolts, or welded threaded studs.
 8. Sheet Metal: Use sheet metal screws.
 9. Wood: Use wood screws.
 10. Plastic and lead anchors are not permitted.
 11. Powder-actuated fasteners are not permitted.
 12. Hammer-driven anchors and fasteners are not permitted.
 13. Preset Concrete Inserts: Continuous metal channel/strut and spot inserts specifically designed to be cast in concrete ceilings, walls, and floors.
 - a. Manufacturer: Same as manufacturer of metal channel/strut framing system.
 - b. Comply with MFMA-4.
 - c. Channel Material: Use galvanized steel.
 - d. Minimum Channel Thickness: Steel sheet, 12 gauge, 0.1046 inch minimum base metal thickness.
 14. Post-Installed Concrete and Masonry Anchors: Evaluated and recognized by ICC Evaluation Service, LLC (ICC-ES) for compliance with applicable building code.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

- B. Verify that mounting surfaces are ready to receive support and attachment components.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install hangers and supports in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Install anchors and fasteners in accordance with ICC Evaluation Services, LLC (ICC-ES) evaluation report conditions of use where applicable.
- D. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
- E. Unless specifically indicated or approved by Architect Engineer, do not provide support from suspended ceiling support system or ceiling grid.
- F. Unless specifically indicated or approved by Architect Engineer, do not provide support from roof deck.
- G. Do not penetrate or otherwise notch or cut structural members without approval of Structural Engineer.
- H. Provide required seismic controls.
- I. Field Welding, Where Approved by Architect Engineer: See Section 05 50 00.
- J. Equipment Support and Attachment:
 - 1. Use metal, fabricated supports or supports assembled from metal channel/strut to support equipment as required.
 - 2. Use metal channel/strut secured to studs to support equipment surface mounted on hollow stud walls when wall strength is not sufficient to resist pull-out.
 - 3. Use metal channel/strut to support surface-mounted equipment in wet or damp locations to provide space between equipment and mounting surface.
 - 4. Securely fasten floor-mounted equipment. Do not install equipment such that it relies on its own weight for support.
- K. Preset Concrete Inserts: Use manufacturer provided closure strips to inhibit concrete seepage during concrete pour.
- L. Secure fasteners in accordance with manufacturer's recommended torque settings.
- M. Remove temporary supports.
- N. Identify independent communications component support wires above accessible ceilings, where permitted, with color distinguishable from other support wires in accordance with NFPA 70.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Inspect support and attachment components for damage and defects.
- C. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- D. Correct deficiencies and replace damaged or defective support and attachment components.

END OF SECTION

This page was intentionally left blank for duplex printing.

SECTION 27 05 33.13
CONDUIT FOR COMMUNICATIONS SYSTEMS

PART 1 GENERAL

1.01 SECTION INCLUDES

- A. Galvanized steel rigid metal conduit (RMC).
- B. Stainless steel rigid metal conduit (RMC).
- C. Aluminum rigid metal conduit (RMC).
- D. Galvanized steel intermediate metal conduit (IMC).
- E. Stainless steel intermediate metal conduit (IMC).
- F. Flexible metal conduit (FMC).
- G. Liquidtight flexible metal conduit (LFMC).
- H. Galvanized steel electrical metallic tubing (EMT).
- I. Stainless steel electrical metallic tubing (EMT).
- J. Rigid polyvinyl chloride (PVC) conduit.
- K. Electrical nonmetallic tubing (ENT).
- L. Inside-plant flexible nonmetallic communications raceway/innerduct.

1.02 RELATED REQUIREMENTS

- A. Section 03 30 00 - Cast-in-Place Concrete: Concrete encasement of conduits.
- B. Section 07 84 00 - Firestopping.

1.03 REFERENCE STANDARDS

- A. ANSI C80.1 - American National Standard for Electrical Rigid Steel Conduit (ERSC); 2020.
- B. ANSI C80.3 - American National Standard for Electrical Metallic Tubing -- Steel (EMT-S); 2020.
- C. ANSI C80.5 - American National Standard for Electrical Rigid Metal Conduit -- Aluminum (ERMC-A); 2020.
- D. ANSI C80.6 - American National Standard for Electrical Intermediate Metal Conduit; 2018.
- E. BICSI ITSIMM - Information Technology Systems Installation Methods Manual, 7th Edition; 2017.
- F. BICSI N1 - Installation Practices for Telecommunications and ICT Cabling and Related Cabling Infrastructure, 1st Edition; 2019.
- G. BICSI TDMM - Telecommunications Distribution Methods Manual, 13th Edition; 2014.
- H. NECA 1 - Standard for Good Workmanship in Electrical Construction; 2015.
- I. NECA 101 - Standard for Installing Steel Conduits (Rigid, IMC, EMT); 2013.
- J. NECA 102 - Standard for Installing Aluminum Rigid Metal Conduit; 2004.
- K. NECA 111 - Standard for Installing Nonmetallic Raceways (RNC, ENT, LFNC); 2017.
- L. NEMA FB 1 - Fittings, Cast Metal Boxes, and Conduit Bodies for Conduit, Electrical Metallic Tubing, and Cable; 2014.
- M. NEMA TC 2 - Electrical Polyvinyl Chloride (PVC) Conduit; 2020.
- N. NEMA TC 3 - Polyvinyl Chloride (PVC) Fittings for Use with Rigid PVC Conduit and Tubing; 2021.
- O. NEMA TC 13 - Electrical Nonmetallic Tubing (ENT); 2014 (Reaffirmed 2019).
- P. NFPA 70 - National Electrical Code; Most Recent Edition Adopted by Authority Having Jurisdiction, Including All Applicable Amendments and Supplements.
- Q. TIA-568.0 - Generic Telecommunications Cabling for Customer Premises; 2020e.

- R. TIA-569 - Telecommunications Pathways and Spaces; 2019e.
- S. UL 1 - Flexible Metal Conduit; Current Edition, Including All Revisions.
- T. UL 6 - Electrical Rigid Metal Conduit-Steel; Current Edition, Including All Revisions.
- U. UL 6A - Electrical Rigid Metal Conduit-Aluminum, Red Brass, and Stainless Steel; Current Edition, Including All Revisions.
- V. UL 360 - Liquid-Tight Flexible Steel Conduit; Current Edition, Including All Revisions.
- W. UL 514B - Conduit, Tubing, and Cable Fittings; Current Edition, Including All Revisions.
- X. UL 651 - Schedule 40, 80, Type EB and A Rigid PVC Conduit and Fittings; Current Edition, Including All Revisions.
- Y. UL 797 - Electrical Metallic Tubing-Steel; Current Edition, Including All Revisions.
- Z. UL 797A - Electrical Metallic Tubing - Aluminum and Stainless Steel; Current Edition, Including All Revisions.
- AA. UL 1203 - Explosion-Proof and Dust-Ignition-Proof Electrical Equipment for Use in Hazardous (Classified) Locations; Current Edition, Including All Revisions.
- AB. UL 1242 - Electrical Intermediate Metal Conduit-Steel; Current Edition, Including All Revisions.
- AC. UL 1653 - Electrical Nonmetallic Tubing; Current Edition, Including All Revisions.
- AD. UL 2024 - Standard for Cable Routing Assemblies and Communications Raceways; Current Edition, Including All Revisions.
- AE. UL 2419 - Outline of Investigation for Electrically Conductive Corrosion Resistant Compounds; Current Edition, Including All Revisions.

1.04 ADMINISTRATIVE REQUIREMENTS

- A. Coordination:
 - 1. Coordinate minimum sizes of conduits with actual type and quantity of cables to be installed.
 - 2. Coordinate arrangement of conduits with structural members, ductwork, piping, equipment and other potential conflicts.
 - 3. Verify exact conduit termination locations required for boxes, enclosures, and equipment.
 - 4. Coordinate work to provide roof penetrations that preserve integrity of roofing system and do not void roof warranty.
 - 5. Notify Architect Engineer of conflicts with or deviations from Contract Documents. Obtain direction before proceeding with work.
- B. Sequencing:
 - 1. Do not begin installation of communications cables until installation of conduit between termination points is complete.

1.05 SUBMITTALS

- A. See Section 01 30 00 - Administrative Requirements for submittals procedures.

1.06 QUALITY ASSURANCE

1.07 DELIVERY, STORAGE, AND HANDLING

- A. Receive, inspect, handle, and store conduit and fittings in accordance with manufacturer's instructions.

PART 2 PRODUCTS

2.01 CONDUIT APPLICATIONS

- A. Do not use conduit and associated fittings for applications other than as permitted by NFPA 70, TIA-569, BICSI ITSIMM, BICSI TDMM, manufacturers' instructions, and product listing.
- B. Unless otherwise indicated and where not otherwise restricted, use conduit types indicated for specified applications. Where more than one listed application applies, comply with most

restrictive requirements. Where conduit type for particular application is not specified, use galvanized steel rigid metal conduit.

C. Underground:

1. Under Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or rigid PVC conduit.
2. Exterior, Direct-Buried: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or rigid PVC conduit.
3. Exterior, Embedded Within Concrete: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or rigid PVC conduit.
4. Where rigid polyvinyl chloride (PVC) conduit is provided, transition to galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC) where emerging from underground.
5. Where rigid polyvinyl chloride (PVC) conduit is provided, use galvanized steel rigid metal conduit (RMC) elbows, stainless steel rigid metal conduit (RMC) elbows, or PVC-coated galvanized steel rigid metal conduit (RMC) elbows for bends.
6. Where galvanized steel rigid metal conduit (RMC) or galvanized steel intermediate metal conduit (IMC) is installed in direct contact with earth where soil has resistivity of less than 2000 ohm-centimeters or is characterized as severely corrosive based on soils report or local experience, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection.
7. Where galvanized rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or galvanized steel electrical metallic tubing (EMT) emerges from concrete into soil, use corrosion protection tape, factory-applied corrosion protection coating, or field-applied corrosion protection compound acceptable to authorities having jurisdiction to provide supplementary corrosion protection for minimum of 4 inches on either side of where conduit emerges.

D. Embedded Within Concrete:

1. Within Slab on Grade: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), PVC-coated galvanized steel rigid metal conduit (RMC), galvanized steel electrical metallic tubing (EMT), or rigid PVC conduit. Embed within structural slabs only where approved by Structural Engineer.
2. Within Slab Above Ground: Not permitted.

E. Concealed Within Masonry Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

F. Concealed Within Hollow Stud Walls: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

- G. Concealed Above Accessible Ceilings: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or inside-plant flexible nonmetallic communications raceway/innerduct.
- H. Interior, Damp or Wet Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- I. Exposed, Interior, Not Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- J. Exposed, Interior, Subject to Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), stainless steel electrical metallic tubing (EMT), or schedule 80 rigid PVC conduit.
 - 1. Locations subject to physical damage include, but are not limited to:
 - a. Where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in warehouse areas.
- K. Exposed, Interior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).
 - 1. Locations subject to severe physical damage include, but are not limited to:
 - a. High traffic industrial and warehouse areas where exposed below 8 feet, except within electrical and communication rooms or closets.
 - b. Where exposed below 20 feet in industrial manufacturing areas.
- L. Exposed, Exterior, Not Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- M. Exposed, Exterior, Subject to Severe Physical Damage: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), or stainless steel intermediate metal conduit (IMC).
 - 1. Exterior locations subject to severe physical damage include, but are not limited to:
 - a. Where exposed to vehicular traffic below 20 feet.
- N. Concealed, Exterior, Not Embedded in Concrete or in Contact With Earth: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).
- O. Hazardous/Classified Locations: Use galvanized steel rigid metal conduit (RMC), stainless steel rigid metal conduit (RMC), galvanized steel intermediate metal conduit (IMC), stainless steel intermediate metal conduit (IMC), or PVC-coated galvanized steel rigid metal conduit (RMC).
- P. Flexible Connections to Vibrating Equipment:
 - 1. Dry Locations: Use flexible metal conduit.
 - 2. Damp, Wet, or Corrosive Locations: Use liquidtight flexible metal conduit.
 - 3. Maximum Length: 6 feet unless otherwise indicated.
 - 4. Vibrating equipment includes, but is not limited to:
 - a. Motorized equipment.

- Q. Fished in Existing Walls, Where Necessary: Use flexible metal conduit (FMC), galvanized steel electrical metallic tubing (EMT), or stainless steel electrical metallic tubing (EMT).

2.02 CONDUIT - GENERAL REQUIREMENTS

- A. Comply with NFPA 70 and TIA-569.
- B. Existing Work: Where existing conduits are indicated to be reused, they may be reused only where they comply with specified requirements, are free from corrosion, and integrity is verified by pulling mandrel through them.
- C. Provide conduit, fittings, supports, and accessories required for complete communications pathway.
- D. Provide products listed, classified, and labeled as suitable for purpose intended.
- E. Maximum Number of Communications Outlet Boxes per Continuous Conduit Homerun: Two.
- F. Minimum Conduit Size, Unless Otherwise Indicated:
 - 1. Communications Outlet Box: 1-inch trade size.
 - 2. Continuous Conduit Homerun Serving One Communications Outlet Box: 1-inch trade size.
 - 3. Continuous Conduit Homerun Serving Two Communications Outlet Boxes: 1-inch trade size.
- G. Where conduit size is not indicated, size to comply with NFPA 70, TIA-569, and BICSI TDMM, but not less than applicable minimum size requirements specified. Where specified standards differ, comply with most stringent.

2.03 GALVANIZED STEEL RIGID METAL CONDUIT (RMC)

- A. Description: NFPA 70, Type RMC galvanized steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6.
- B. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6.
 - 2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 - 3. Material: Use steel or malleable iron.
 - a. Where not subject to severe corrosive influence, stainless steel or aluminum fittings may be used.
 - b. Do not use die cast zinc fittings.
 - 4. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 - 5. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.04 STAINLESS STEEL RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - 2. Gibson Stainless & Specialty, Inc: www.gibsonstainless.com/#sle.
 - 3. Patriot Industries, a division of Patriot Aluminum Products, LLC: www.patriotsas.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC stainless steel rigid metal conduit complying with ANSI C80.1 and listed and labeled as complying with UL 6A.
 - 1. Material: Type 304 or 316 stainless steel.
- C. Fittings:
 - 1. Manufacturers:
 - a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - b. Eaton: www.eaton.com/#sle.

- c. Gibson Stainless & Specialty, Inc: www.gibsonstainless.com/#sle.
- d. Patriot Industries, a division of Patriot Aluminum Products, LLC: www.patriotsas.com/#sle.
- e. Substitutions: See Section 01 60 00 - Product Requirements.
- 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A.
- 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
- 4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
- 5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
- 6. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.05 ALUMINUM RIGID METAL CONDUIT (RMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type RMC aluminum rigid metal conduit complying with ANSI C80.5 and listed and labeled as complying with UL 6A.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 6A
 - 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 - 4. Material: Use aluminum.
 - 5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 - 6. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.06 GALVANIZED STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 - 1. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.

2. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
3. Material: Use steel or malleable iron.
 - a. Where not subject to severe corrosive influence, stainless steel or aluminum fittings may be used.
 - b. Do not use die cast zinc fittings.
4. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
5. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.07 STAINLESS STEEL INTERMEDIATE METAL CONDUIT (IMC)

- A. Manufacturers:
 1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 2. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type IMC galvanized steel intermediate metal conduit complying with ANSI C80.6 and listed and labeled as complying with UL 1242.
- C. Fittings:
 1. Manufacturers:
 - a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - b. Eaton: www.eaton.com/#sle.
 - c. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Nonhazardous Locations: Use fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B or UL 1242.
 3. Hazardous/Classified Locations: Use fittings listed and labeled as complying with UL 1203 for classification of installed location.
 4. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 5. Connectors and Couplings: Use threaded fittings only. Threadless fittings, including set screw and compression/gland types, are not permitted.
 6. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.08 FLEXIBLE METAL CONDUIT (FMC)

- A. Manufacturers:
 1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
 2. Electri-Flex Company: www.electriflex.com/#sle.
 3. International Metal Hose: www.metalhose.com/#sle.
 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type FMC standard-wall steel flexible metal conduit listed and labeled as complying with UL 1, and listed for use in classified firestop systems.
- C. Fittings:
 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 4. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.09 LIQUIDTIGHT FLEXIBLE METAL CONDUIT (LFMC)

- A. Manufacturers:
 - 1. AFC Cable Systems, a division of Atkore International: www.afcweb.com/#sle.
 - 2. Electri-Flex Company: www.electriflex.com/#sle.
 - 3. International Metal Hose: www.metalhose.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type LFMC polyvinyl chloride (PVC) jacketed steel flexible metal conduit listed and labeled as complying with UL 360.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - c. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - d. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 4. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.10 GALVANIZED STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - 2. Nucor Tubular Products: www.nucortubular.com/#sle.
 - 3. Western Tube, a division of Zekelman Industries: www.westerntube.com/#sle.
 - 4. Wheatland Tube, a division of Zekelman Industries: www.wheatland.com/#sle.
 - 5. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type EMT galvanized steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797.
- C. Fittings:
 - 1. Manufacturers:
 - a. ABB; T&B: www.electrification.us.abb.com/#sle.
 - b. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - c. Bridgeport Fittings, LLC: www.bptfittings.com/#sle.
 - d. Emerson Electric Co; O-Z/Gedney: www.emerson.com/#sle.
 - e. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use steel or malleable iron.
 - a. Do not use die cast zinc fittings.
 - 4. Connectors and Couplings: Use compression/gland or set-screw type.
 - a. Do not use indenter type connectors and couplings.
 - 5. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.11 STAINLESS STEEL ELECTRICAL METALLIC TUBING (EMT)

- A. Manufacturers:
 - 1. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - 2. Substitutions: See Section 01 60 00 - Product Requirements.

- B. Description: NFPA 70, Type EMT stainless steel electrical metallic tubing complying with ANSI C80.3 and listed and labeled as complying with UL 797A.
 - 1. Material: Type 304 or 316 stainless steel.
- C. Fittings:
 - 1. Manufacturers:
 - a. Calbrite, a division of Atkore International: www.calbrite.com/#sle.
 - b. Substitutions: See Section 01 60 00 - Product Requirements.
 - 2. Description: Fittings complying with NEMA FB 1 and listed and labeled as complying with UL 514B.
 - 3. Material: Use stainless steel with corrosion resistance equivalent to conduit.
 - 4. Connectors and Couplings: Use compression/gland or set-screw type.
 - 5. Damp or Wet Locations, Where Permitted: Use fittings listed for use in wet locations.
 - 6. Conduit Bodies: Standard conduit bodies designed for electrical raceways are not permitted.

2.12 RIGID POLYVINYL CHLORIDE (PVC) CONDUIT

- A. Manufacturers:
 - 1. ABB; Carlon: www.electrification.us.abb.com/#sle.
 - 2. Allied Tube & Conduit, a division of Atkore International: www.alliedeg.us/#sle.
 - 3. Cantex Inc: www.cantexinc.com/#sle.
 - 4. Heritage Plastics, a division of Atkore International: www.heritageplastics.com/#sle.
 - 5. JM Eagle: www.jmeagle.com/#sle.
 - 6. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type PVC rigid polyvinyl chloride conduit complying with NEMA TC 2 and listed and labeled as complying with UL 651; Schedule 40 unless otherwise indicated, Schedule 80 where subject to physical damage.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of conduit to be connected.
 - 2. Description: Fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; material to match conduit.
 - 3. Conduit Bodies: Use only conduit bodies specifically designed for communications cabling. Standard conduit bodies designed for electrical raceways are not permitted.
 - a. Comply with TIA-568.0 minimum bend radius requirements for fiber optic cables.

2.13 ELECTRICAL NONMETALLIC TUBING (ENT)

- A. Manufacturers:
 - 1. ABB; Carlon: www.electrification.us.abb.com/#sle.
 - 2. Cantex Inc: www.cantexinc.com/#sle.
 - 3. IPEX, a division of Aliaxis: www.ipexna.com/#sle.
 - 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: NFPA 70, Type ENT electrical nonmetallic tubing complying with NEMA TC 13 and listed and labeled as complying with UL 1653.
- C. Fittings:
 - 1. Manufacturer: Same as manufacturer of ENT to be connected.
 - 2. Use solvent-welded type fittings.
 - 3. Solvent-Welded Fittings: Rigid PVC fittings complying with NEMA TC 3 and listed and labeled as complying with UL 651; suitable for use with ENT.

2.14 INSIDE-PLANT FLEXIBLE NONMETALLIC COMMUNICATIONS RACEWAY/INNERDUCT

- A. Manufacturers:
 - 1. Eastern Wire + Conduit, a division of Atkore International: www.easternwire.com/#sle.
 - 2. Endot Industries: www.endot.com/#sle.
 - 3. Premier Conduit: www.premierconduit.com/#sle.

- 4. Substitutions: See Section 01 60 00 - Product Requirements.
- B. Description: Flexible, corrugated, nonmetallic communications raceway and associated fittings listed and labeled as complying with UL 2024; also suitable for installation as innerduct.
- C. Raceway Applications: Use listed plenum raceway unless otherwise indicated.
- D. Use only with approved cables in accordance with listing.
- E. Color: Orange, unless otherwise indicated.

2.15 ACCESSORIES

- A. Inside-Plant Fabric Innerduct:
 - 1. Listed as complying with UL 2024; plenum rated.
- B. Outside-Plant Fabric Innerduct:
 - 1. Designed for installation in underground raceways.
- C. Outside-Plant HDPE Innerduct: Smooth interior wall; orange unless otherwise indicated.
- D. Corrosion Protection Tape: PVC-based, minimum thickness of 20 mil, 0.020 inch.
- E. Conduit Joint Compound: Corrosion-resistant, electrically conductive compound listed as complying with UL 2419; suitable for use with conduit to be installed.
- F. Solvent Cement for PVC Conduit and Fittings: As recommended by manufacturer of conduit and fittings to be installed.
- G. Pull Strings: Use nylon or polyester tape with average breaking strength of not less than 1,250 lbf.
- H. Foam Conduit Sealant:
 - 1. Removable, two-part, closed-cell foam, specifically designed for sealing conduit openings against water, moisture, gases, and dust.
 - 2. Suitable for use with conductors/cables and associated insulation/jackets to be installed.
 - 3. Rated to hold minimum of 10 ft water head pressure.
- I. Sealing Compound for Hazardous/Classified Location Sealing Fittings: Listed for use with particular fittings to be installed.
- J. Sealing Systems for Concrete Penetrations:
 - 1. Sleeves: Provide water stop ring or cement coating that bonds to concrete to prevent water infiltration.
 - 2. Rate for minimum of 40 psig; suitable for sealing around conduits to be installed.
- K. Sealing Systems for Roof Penetrations: Premanufactured components and accessories as required to preserve integrity of roofing system and maintain roof warranty; suitable for conduits and roofing system to be installed; designed to accommodate existing penetrations where applicable.
- L. Flashing Panels for Exterior Wall Penetrations: Premanufactured components and accessories as required to preserve integrity of building envelope; suitable for conduits and facade materials to be installed.
- M. Firestop Sleeves: Listed; provide as required to preserve fire resistance rating of building elements.
- N. Duct Bank Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for concrete encasement in open trench installation; suitable for conduit/duct arrangement to be installed.
- O. Bore Spacers: Nonmetallic; designed for maintaining conduit/duct spacing for installation within casing; furnished with roller wheels to facilitate installation, openings to facilitate grout flow, and holes for stabilization cable; suitable for casing and conduit/duct arrangement to be installed.

PART 3 EXECUTION

3.01 EXAMINATION

- A. Verify that field measurements are as indicated.

- B. Verify that mounting surfaces are ready to receive conduits.
- C. Verify that conditions are satisfactory for installation prior to starting work.

3.02 INSTALLATION

- A. Install products in accordance with manufacturer's instructions.
- B. Install conduit in accordance with NECA 1, BICSI ITSIMM, and BICSI N1.
- C. Galvanized Steel Rigid Metal Conduit (RMC): Install in accordance with NECA 101.
- D. Aluminum Rigid Metal Conduit (RMC): Install in accordance with NECA 102.
- E. Galvanized Steel Intermediate Metal Conduit (IMC): Install in accordance with NECA 101.
- F. Galvanized Steel Electrical Metallic Tubing (EMT): Install in accordance with NECA 101.
- G. Rigid Polyvinyl Chloride (PVC) Conduit: Install in accordance with NECA 111.
- H. Electrical Nonmetallic Tubing (ENT): Install in accordance with NECA 111.
- I. Conduit Routing:
 - 1. Unless dimensioned, conduit routing indicated is diagrammatic.
 - 2. When conduit destination is indicated without specific routing, determine exact routing required.
 - 3. Conceal conduits unless specifically indicated to be exposed.
 - 4. Conduits in the following areas may be exposed, unless otherwise indicated:
 - a. Electrical rooms.
 - b. Communications rooms.
 - c. Mechanical equipment rooms.
 - 5. Unless otherwise approved, do not route exposed conduits:
 - a. Across floors.
 - b. Across roofs.
 - c. Across top of parapet walls.
 - d. Across building exterior surfaces.
 - 6. Conduits installed underground or embedded in concrete may be routed in shortest possible manner unless otherwise indicated. Route other conduits parallel or perpendicular to building structure and surfaces, following surface contours where practical.
 - 7. Arrange conduit to maintain adequate headroom, clearances, and access.
 - 8. Arrange conduit to provide no more than equivalent of two 90-degree bend(s) between pull points.
 - a. The equivalent of three 90-degree bends between pull points is permitted only under conditions described in BICSI TDMM.
 - 9. Arrange conduit to provide no more than 100 feet between pull points.
 - 10. Arrange conduit to provide minimum bend radii in accordance with BICSI TDMM.
 - 11. Route conduits above water and drain piping where possible.
 - 12. Arrange conduit to prevent moisture traps. Provide drain fittings at low points and at sealing fittings where moisture may collect.
 - 13. Maintain recommended separation from sources of EMI greater than 5 kVA in accordance with BICSI ITSIMM and BICSI TDMM.
 - 14. Maintain minimum clearance of 6 inches between conduits and piping for other systems.
 - 15. Maintain minimum clearance of 12 inches between conduits and hot surfaces. This includes, but is not limited to:
 - a. Heaters.
 - b. Hot water piping.
 - c. Flues.
 - 16. Group parallel conduits in same area on common rack.
- J. Conduit Support:
 - 1. Secure and support conduits in accordance with NFPA 70 using suitable supports and methods approved by authorities having jurisdiction.

2. Provide required seismic controls.
 3. Provide independent support from building structure. Do not provide support from piping, ductwork, or other systems.
 4. Installation Above Suspended Ceilings: Do not provide support from ceiling support system. Do not provide support from ceiling grid or allow conduits to lay on ceiling tiles.
 5. Use conduit strap to support single surface-mounted conduit.
 - a. Use clamp back spacer with conduit strap for damp and wet locations to provide space between conduit and mounting surface.
 6. Use metal channel/strut with accessory conduit clamps to support multiple, parallel, surface-mounted conduits.
 7. Use conduit clamp to support single conduit from beam clamp or threaded rod.
 8. Use trapeze hangers assembled from threaded rods and metal channel/strut with accessory conduit clamps to support multiple, parallel, suspended conduits.
 9. Use nonpenetrating rooftop supports to support conduits routed across rooftops, where approved.
 10. Use of spring steel conduit clips for support of conduits is not permitted.
 11. Use of wire for support of conduits is not permitted.
 12. Where conduit support intervals specified in NFPA 70 and NECA standards differ, comply with most stringent requirements.
- K. Connections and Terminations:
1. Use approved zinc-rich paint or conduit joint compound on field-cut threads of galvanized steel conduits prior to making connections.
 2. Where two threaded conduits must be joined and neither can be rotated, use three-piece couplings or split couplings. Do not use running threads.
 3. Use suitable adapters where required to transition from one type of conduit to another.
 4. Provide drip loops for liquidtight flexible conduit connections to prevent drainage of liquid into connectors.
 5. Terminate threaded conduits in boxes and enclosures using threaded hubs or double lock nuts for dry locations and raintight hubs for wet locations.
 6. Terminate outside-plant entrance conduits at 4 inches above finished floor unless otherwise indicated.
 7. Where spare conduits stub up through concrete floors and are not terminated in box or enclosure, provide threaded couplings equipped with threaded plugs set flush with finished floor.
 8. Provide insulating bushings, insulated throats, or listed metal fittings with smooth, rounded edges at conduit terminations to protect cables.
 9. Secure joints and connections to provide mechanical strength and electrical continuity.
- L. Penetrations:
1. Do not penetrate or otherwise notch or cut structural members, including footings and grade beams, without approval of Structural Engineer.
 2. Make penetrations perpendicular to surfaces unless otherwise indicated.
 3. Provide sleeves and/or slots for penetrations as indicated or as required to facilitate installation.
 4. Conceal bends for conduit risers emerging above ground.
 5. Provide suitable sealing system where conduits penetrate exterior wall below grade.
 6. Where conduits penetrate waterproof membrane, seal as required to maintain integrity of membrane.
 7. Make penetrations for roof-mounted equipment within associated equipment openings and curbs where possible to minimize roofing system penetrations. Where penetrations are necessary, seal as indicated or as required to preserve integrity of roofing system and maintain roof warranty.
 8. Install firestopping to preserve fire resistance rating of partitions and other elements; see Section 07 84 00.

- M. Underground Installation:
 - 1. Minimum Cover, Unless Otherwise Indicated or Required:
 - a. Underground, Exterior: 18 inches.
 - b. Under Slab on Grade: 12 inches to bottom of slab.
 - 2. Provide underground warning tape along entire conduit length.
 - 3. Provide copper conductor for use with toning location in conduit systems where only nonmetallic fiber optic cables are installed.
- N. Embedment Within Structural Concrete Slabs (only where approved by Structural Engineer):
 - 1. Maximum Conduit Size: 1-inch trade size unless otherwise approved.
 - 2. Install conduits within middle one third of slab thickness.
 - 3. Secure conduits to prevent floating or movement during pouring of concrete.
- O. Concrete Encasement: Where conduits not otherwise embedded within concrete are indicated to be concrete encased, provide minimum concrete cover of 3 inches on all sides unless otherwise indicated; see Section 03 30 00.
- P. Conduit Movement Provisions: Where conduits are subject to movement, provide expansion and expansion/deflection fittings to prevent damage to enclosed cables or connected equipment. This includes, but is not limited to:
 - 1. Where conduits cross structural joints intended for expansion, contraction, or deflection.
 - 2. Where calculated in accordance with NFPA 70 for rigid polyvinyl chloride (PVC) conduit installed above ground to compensate for thermal expansion and contraction.
 - 3. Where conduits are subject to earth movement by settlement or frost.
- Q. Conduit Sealing:
 - 1. Use foam conduit sealant to prevent entry of moisture and gases. This includes, but is not limited to:
 - a. Where conduits enter building from outside.
 - b. Where service conduits enter building from underground distribution system.
 - c. Where conduits enter building from underground.
 - d. Where conduits may transport moisture to contact live parts.
 - 2. Where conduits cross barriers between areas of potential substantial temperature differential, use foam conduit sealant at accessible point near penetration to prevent condensation. This includes, but is not limited to:
 - a. Where conduits pass from outdoors into conditioned interior spaces.
 - b. Where conduits pass from unconditioned interior spaces into conditioned interior spaces.
 - 3. Where conduits cross boundaries of hazardous/classified locations, provide identified/listed sealing fittings as approved by authorities having jurisdiction; locate as indicated or in accordance with NFPA 70.
- R. Provide pull string in each empty conduit and innerduct/cell, and in each conduit where cables are to be installed by others. Leave minimum slack of 12 inches at each end.
- S. Provide grounding and bonding.

3.03 FIELD QUALITY CONTROL

- A. See Section 01 40 00 - Quality Requirements for additional requirements.
- B. Repair cuts and abrasions in galvanized finishes using zinc-rich paint recommended by manufacturer. Replace components that exhibit signs of corrosion.
- C. Correct deficiencies and replace damaged or defective conduits.

3.04 CLEANING

- A. Clean interior of conduits to remove moisture and foreign matter.

3.05 PROTECTION

- A. Immediately after installation of conduit, use suitable manufactured plugs to provide protection from entry of moisture and foreign material and do not remove until ready for installation of cables.

END OF SECTION