

AIR FORCE MEDICAL OPERATIONS AGENCY-HEALTH FACILITIES DIVISION

QUALITY STANDARDS FOR AFMS INFRASTRUCTURE SYSTEMS-REVISION 4.2

4. ELECTRICAL INFRASTRUCTURE SYSTEMS:
- 4.1. GENERAL REQUIREMENTS.
- 4.1.1. PURSUANT THE HQ AIR FORCE CIVIL ENGINEER ETL 10-2: LIGHT-EMITTING DIODE (LED) FIXTURE DESIGN AND INSTALLATION CRITERIA FOR INTERIOR AND EXTERIOR LIGHTING APPLICATIONS, DATED 18 MARCH 2010, LED'S ARE NOT PERMITTED FOR USE AS LUMINAIRES INSIDE OR OUTSIDE AIR FORCE FACILITIES (WHICH INCLUDE AFMS FACILITIES). THE ONLY EXCEPTION IS FOR LIGHTING IN DISPLAY CASES AND BULLETIN BOARDS.
- 4.1.2. INTERIOR ELECTRICAL DISTRIBUTION (600V OR LESS) INTERIOR LIGHTING AND POWER LOADS SHALL BE SERVED AT THE HIGHEST VOLTAGE PRACTICABLE.
- 4.1.3. LIGHT FIXTURE TYPE-FLUORESCENT LIGHTING SHALL BE T-5 OR T-8, ELECTRONIC BALLAST AND SUPPLIED WITH 277/480V SYSTEM. EXEMPTION: ELECTRONIC BALLAST WITH RFI FILTERS SHALL BE USED IN OPERATING ROOMS, DELIVERY ROOMS, LABORATORIES, SPECIAL PROCEDURE ROOMS, MRI AREAS, MEDICAL EQUIPMENT REPAIR AND TEST AREAS. T-5 FLUORESCENT LIGHTING WILL BE USED IN HIGH CEILING AREAS IN LIEU OF HID.
- 4.1.4. DRY-TYPE TRANSFORMERS SHALL BE UTILIZED TO PROVIDE 120/208V POWER FOR 120V LIGHTING, RECEPTACLE AND SMALL EQUIPMENT LOADS. ALL DRY-TYPE TRANSFORMERS SHALL BE ISOLATION TYPE TP-1, K RATED, COPPER WOUND TRANSFORMERS AND WIRED AS A SEPARATELY DERIVED SYSTEM.
- 4.1.5. SWITCHGEAR AND SWITCHBOARDS SHALL BE UL LISTED & HOSPITAL SWITCHGEAR SHALL BE CONFIGURED UTILIZING A MAIN/TIE/MAIN CONFIGURATION CONTAINING ELECTRONICALLY OPERATED CIRCUIT BREAKERS AND BE OF THE DRAW-OUT, SOLID STATE, ADJUSTABLE TRIP CIRCUIT BREAKER.
- 4.1.6. ALL BRANCH CIRCUIT DISTRIBUTION PANELBOARDS SHALL BE OF THE BOLT-ON CIRCUIT BREAKER TYPE AND EQUIPPED WITH A MAIN BREAKER. OUTDOOR HUMID AREAS SHALL REQUIRE FUNGICIDAL TREATMENT.
- 4.1.7. TRANSIENT VOLTAGE SURGE SUPPRESSION (TVSS) AND GROUND FAULT PROTECTION SHALL BE PROVIDED WHERE REQUIRED. ALL PROTECTIVE DEVICES SHALL BE COORDINATED FOR SELECTIVE OVERLOAD, SHORT CIRCUIT AND GROUND FAULT PROTECTION.
- 4.1.8. BUSSES IN SWITCHBOARD, PANELBOARD AND TRANSFORMER WINDINGS SHALL BE COPPER. ALUMINUM BUSSES OR ALUMINUM TRANSFORMER WINDINGS ARE NOT ALLOWED.
- 4.1.9. NEW ELECTRICAL METERS SHALL HAVE "MODBUS RTU" CAPABILITY FOR FUTURE ENERGY CONSUMPTION MONITORING APPLICATION.

- 4.2. LOCATION AND SPACE REQUIREMENTS-ELECTRICAL EQUIPMENT ROOMS SHALL BE LOCATED AT OR NEAR THE BUILDING EXTERIOR TO FACILITATE INITIAL INSTALLATION, MAINTENANCE AND WHEN NECESSARY, THE REPLACEMENT OF LARGE OR DEFECTIVE EQUIPMENT. EQUIPMENT'S PHYSICAL DIMENSIONS, AISLE WAYS AND DOORWAYS WITHIN THE ELECTRICAL AND MECHANICAL EQUIPMENT ROOMS SHALL BE SIZED, SPACED AND ARRANGED TO PERMIT THE MOVEMENT OF PHYSICAL PLANT MAJOR EQUIPMENT ASSEMBLIES WITHOUT HAVING TO COMPLETELY DISASSEMBLE SAID APPARATUS. PIPES AND OTHER EQUIPMENT, FOREIGN TO THE ELECTRICAL EQUIPMENT, SHALL NOT BE LOCATED IN, ENTER OR PASS THROUGH SUCH SPACES OR ROOMS. AT ALL TIMES, THE PROVISIONS FOR CLEAR WORKING SPACE IN ARTICLE 110.26 (A) (1), NFPA 70 MUST BE MET.

- 4.3. CONDUIT, CABLE TRAY AND WIRE-ALL WIRING SHALL BE INSULATED COPPER IN CONDUITS AND INSTALLED PER NFPA 70 AND UFC 4-510-01. METAL ENCLOSED FEEDERS, PLUG-IN BUSWAYS OR SURFACE METAL RACEWAY MAY BE USED.
- 4.3.1. CONDUIT FITTINGS FOR EMT SHALL BE COMPRESSION STEEL TYPE.
- 4.3.2. CONDUITS 1-1/4" TRADE SIZE AND LARGER, SHALL HAVE GROUNDING BUSHINGS. ALL OTHERS SHALL HAVE PLASTIC OR FIBER BUSHINGS.

- 4.4. GROUNDING CONDUCTORS-A GREEN INSULATED COPPER GROUND CONDUCTOR SHALL BE RUN WITH ALL BRANCH CIRCUITS. A CLEARLY MARKED AND IDENTIFIED GROUNDING CONDUCTOR SHALL BE INSTALLED WITH EACH FEEDER.

- 4.5. CRITICAL CARE PANELBOARDS-BRANCH CIRCUIT PANELS SERVING CRITICAL CARE AREAS SHALL BE LOCATED IN THE VICINITY OF THEIR LOADS. UNDER NO CIRCUMSTANCES, SHALL A PANELBOARD BE PLACED IN A HALLWAY.

- 4.6. CRITICAL CARE WIRING-WIRING IN ALL PATIENT CARE AREAS, THE LIFE SAFETY AND CRITICAL CARE BRANCH CIRCUITS OF THE ESSENTIAL ELECTRICAL SYSTEM SHALL CONSIST OF INSULATED CONDUCTORS INSTALLED IN A SEPARATE METALLIC RACEWAY. OPEN CABLE TRAYS ARE NOT TO BE USED IN THE MAIN SWITCHGEAR ROOM OR GENERATOR ROOM. CONDUCTORS INSTALLED TO FURNISH EMERGENCY POWER SHALL NOT BE INSTALLED IN THE SAME RACEWAY WITH NORMAL POWER CONDUCTORS. ALL NORMAL AND EMERGENCY POWER JUNCTION BOXES, PULL BOXES AND SIMILAR PARTS SHALL BE READILY ACCESSIBLE WITH CLEARLY IDENTIFIED ACCESS PANELS FOR PROPER MAINTENANCE AND OPERATION OF THE ELECTRICAL DISTRIBUTION SYSTEM.

- 4.7. HOSPITAL GRADE RECEPTACLES-HOSPITAL GRADE RECEPTACLES SHALL BE PROVIDED IN THE FOLLOWING AREAS AND ANNOTATED AS "hg" RECEPTACLES ON THE FINAL AS-BUILT DRAWINGS:

- 4.7.1. GENERAL CARE PATIENT BED LOCATIONS
- 4.7.2. CRITICAL CARE PATIENT BED LOCATIONS
- 4.7.3. ANY LOCATION WHERE A PATIENT BED OR PATIENT CARE SERVICE CONSOLE IS LOCATED
- 4.7.4. ANESTHETIZING LOCATIONS, OPERATING ROOMS, DELIVERY ROOMS, ORAL SURGERY, CYSTOSCOPY, CARDIAC CATHETERIZATION LAB, ANGIOGRAPHY, CT SCANNING ROOMS, MRI SCANNING ROOMS, MEDICAL MAINTENANCE, INTENSIVE CARE, EMERGENCY TRAUMA ROOMS, FLUOROSCOPY ROOMS, ENDOSCOPY ROOMS, PULMONARY/RESPIRATORY THERAPY AND NUCLEAR MEDICINE.

- 4.8. GROUND FAULT CIRCUIT INTERRUPTERS (GFCI)-HOSPITAL GRADE CLASS "A" GFCI RECEPTACLE PROTECTION SHALL BE PROVIDED AT LOCATIONS REQUIRED BY NFPA 70 AND "WET" LOCATIONS. GFCI "WILL NOT BE PROVIDED" ON CIRCUITS SERVING CRITICAL LIFE SUPPORT EQUIPMENT.

- 4.9. WET LOCATIONS. GFCI RECEPTACLES SHALL BE USED IN THE FOLLOWING LOCATIONS: HYDROTHERAPY, THERAPEUTIC POOL AREAS, TOILET AREAS WITH SHOWERS, STAFF LOCKERS WITH TOILET AREAS, PATIENT TOILET BATHROOMS, SHOWERS, STAFF LOUNGE WITH KITCHEN FACILITIES, OUTDOOR RECEPTACLES, RECEPTACLES ACCESSIBLE FROM A BUILDING ROOF AND CRAWL SPACES. SUB-STERILE AND SCRUB AREAS TO SURGERY AND DELIVERY ARE CLASSIFIED AS "DAMP" AREAS AND GFCI RECEPTACLES ARE NOT REQUIRED.

- 4.10. OPERATING ROOM & DELIVERY ROOM RECEPTACLE & POWER REQUIREMENTS

- 4.10.1. EACH SURGERY, OPERATING & DELIVERY ROOM SHALL BE PROVIDED WITH AT LEAST THIRTY SIX (36) SIMPLEX OR DUPLEX RECEPTACLES. TWELVE (12) SHALL BE LOCATED IN EACH SERVICE COLUMN AND SIX (6) ON EACH WALL MOUNTED 3 FEET ABOVE THE FLOOR. THESE RECEPTACLES SHALL BE 20 AMPERE, 125 VOLT, 2-POLE, 3 WIRE, STRAIGHT BLADE, GROUNDED TYPE.

- 4.10.2. EACH SURGERY, OPERATING & DELIVERY ROOM SHALL ALSO BE PROVIDED WITH AT LEAST ONE (1) 60 AMPERE, 250 VOLT, 2-POLE, 3 WIRE, TWIST-LOCK, GROUND-TYPE, FLUSH MOUNTED RECEPTACLE FOR MOBILE FLUOROSCOPY UNIT OR LASER PHOTO COAGULATOR.

- 4.10.3. EACH SURGERY, OPERATING & DELIVERY ROOM SHALL ALSO BE PROVIDED WITH TWO (2) THREE PHASE PANELBOARDS LOCATED WITHIN THE RESPECTIVE ROOM. THESE PANELS SHALL BE FED FROM A SEPARATE CRITICAL BRANCH SUB-PANEL AND WHENEVER PRACTICABLE FROM SEPARATE CRITICAL BRANCH AUTOMATIC TRANSFER SWITCHES. PANEL PHASES SHALL BE CONNECTED IN THE SAME PHASE ARRANGEMENT.

- 4.11. PATIENT CARE AREA GROUNDING-GENERAL CARE AND CRITICAL CARE AREAS, INCLUDING ALL ANESTHETIZING LOCATIONS SHALL BE PROVIDED WITH A GROUNDING SYSTEM AS REQUIRED BY ART 517, NFPA 70 AND NFPA 99. GROUNDING SYSTEM DESIGN AND INITIAL TESTING SHALL BE INCLUDED IN THE CONTRACT DOCUMENTS.

- 4.12. MEDIUM VOLTAGE APPARATUS (ABOVE 600 VOLTS)

- 4.12.1. ALL EXTERIOR MEDIUM VOLTAGE SWITCHGEAR, TRANSFORMERS, CABLE JUNCTION PEDESTALS AND VACUUM SWITCHES SHALL MEET THE PUBLISHED REQUIREMENTS, INCLUDING COLOR, MANUFACTURER AND CONSTRUCTION TYPE OF THE LOCAL BASE.

- 4.12.2. ALL MEDIUM VOLTAGE SWITCHGEAR ENCLOSURES SHALL HAVE SITE GLASSES INSTALLED THAT PROVIDE VISIBILITY SWITCH CONTACT POSITIONS AND OPERABLE CONNECTIONS. ENCLOSURES SHALL ALSO BE EQUIPPED WITH REMOVABLE PANELS AND INSPECTION PORTS THAT PROVIDE AN EASY AND SAFE VIEW AND INFRARED THERMAL INSPECTION OF CRITICAL CONNECTION POINTS.

- 4.12.3. SWITCHGEAR, TRANSFORMERS AND OTHER SIMILAR APPARATUS THAT ARE TO BE POSITIONED OUTSIDE ON GRADE, SHALL BE PROVIDED A PERMANENT FOUNDATION WITH SUBSTANTIAL FOOTING ON COMPACTED SOIL TO SUPPORT THE APPARATUS. PRE-FORMED CONCRETE PADS ARE NOT ACCEPTABLE.

- 4.12.4. TRANSFORMERS SHALL BE:

- 4.12.4.1. FUSED PROTECTED ON THE PRIMARY (H) SIDE OF COILS

- 4.12.4.2. EQUIPPED WITH A LOAD BREAK ON/OFF SWITCH

- 4.12.4.3. NON-PCB, MINERAL OIL OR SILICONE OIL FILLED

- 4.12.4.4. LOOP FEED-THROUGH LOAD BREAK ELBOW CONNECTED WITH PARKING STANDS & ARRESTORS.

- 4.12.5. NEWLY INSTALLED CABLE JUNCTION PEDESTALS AND/OR SECTIONALIZERS SHALL MATCH ANY PUBLISHED STANDARDS FOR THE EXISTING BASE. THE CABLE PEDESTALS SHALL CONTAIN SECTIONS FOR BOTH 600 AMP AND 200 AMP CONNECTIONS. CABLE JUNCTION PEDESTALS SHALL NOT BE PLACED ON A PRE-FORMED CONCRETE PAD.

- 4.12.6. MEDIUM VOLTAGE ELECTRICAL CABLE SHALL BE 133% EPR INSULATION, RIBBON-SHIELDED, UNLESS OTHERWISE DIRECTED BY BASE REQUIREMENTS.

- 4.12.7. MEDIUM VOLTAGE UNDERGROUND CONDUIT SHALL BE SCHEDULE 80 PVC, EXCEPT FOR 90 DEGREE ELBOWS, WHICH SHALL BE LONG RADIUS RIGID CONDUIT.

- 4.12.8. ALL UNDERGROUND CONDUITS SHALL BE INSTALLED AT A MINIMUM DEPTH OF 3 FEET, ENCASED IN A MINIMUM OF 2" CONCRETE AND SHALL HAVE A TRACEABLE 12" WIDE MARKING TAPE PLACED NOT LESS THAN 12" ABOVE THE CONCRETE ENCASEMENT WHICH MARKS THE HAZARD. PROVIDE RED CONCRETE.

- 4.12.8.1. ALL CONDUITS EMERGING FROM GRADE SHALL BE RIGID METAL CONDUIT (RMC).

- 4.12.9. ALL CONDUIT TERMINATED AT THE CONCRETE PAD SHALL HAVE A GROUNDED BUSHING INSTALLED.

- 4.12.10. GROUNDING ELECTRODES (RODS) SHALL BE COPPER CLAD AND BE A MINIMUM OF 5/8" DIAMETER WITH A MINIMUM OF 8 FEET IN LENGTH OR LONGER, AS NECESSARY TO ACHIEVE AN ADEQUATE GROUND PATH. GROUND WIRE SHALL BE A MINIMUM OF 2/0 AWG STRANDED BARE COPPER WIRE. ALL CONNECTIONS MUST BE EITHER EXOTHERMIC WELD OR COMPRESSION FITTINGS.

- 4.13. HOSPITAL ELECTRICAL UTILITY MAIN SERVICE ENTRANCE

- 4.13.1. HOSPITALS SHALL TYPICALLY REQUIRE MORE THAN ONE SUB-STATION WITH SWITCHGEAR.

- 4.13.2. HOSPITAL LOW VOLTAGE MAIN SERVICE ENTRANCE SWITCHGEAR SHALL BE UL LISTED AS AN ASSEMBLY AND CONTAIN TWO (2) MAIN BREAKERS AND A BUSS TIE BREAKER. THE "A" BUSS & "B" BUSS BREAKERS AND BUSS SHALL SHARE EQUAL LOADS DURING NORMAL OPERATION, WHICH IS WITH THE "TIE" BREAKER IN THE OPEN POSITION. THESE BREAKERS SHALL BE ELECTRICALLY CONTROLLED, MECHANICALLY INTERLOCKED AND WITH CLOSING COILS OR OPERATORS POWERED FROM A DC CONTROL POWER BATTERY BANK OR STORED ENERGY AS NECESSARY FOR AN "AUTOMATIC THROW-OVER" IN THE EVENT POWER IS LOST AT EITHER THE "A" MAIN BREAKER OR THE "B" MAIN BREAKER.

- 4.13.3. "BEST SOURCE SELECT" CONTROLS-IF POWER IS LOST AT THE "A" MAIN BREAKER, THE "TIE" BREAKER SHALL CLOSE ELECTRONICALLY. THE "B" MAIN BREAKER REMAINS CLOSED, WHILE THE "A" MAIN BREAKER REMAINS OPEN. ONCE POWER IS RESTORED TO THE "A" MAIN BREAKER, THE SWITCHGEAR SHALL SWITCH BACK TO THE NORMAL CONFIGURATION WITH BOTH THE "A" AND "B" BREAKERS CLOSED AND THE "TIE" BREAKER OPEN. THIS SHALL BE ACCOMPLISHED ELECTRONICALLY, BUT MUST PROVIDE THE ABILITY TO MANUALLY SWITCH BACK, IN THE EVENT OF CONTROL CIRCUITRY FAILURE. THE SWITCHGEAR SHALL ALSO PROVIDE A DIGITAL DISPLAY FOR BOTH "A" AND "B" BUSS, WHICH CONSISTS OF VOLTAGE PHASE TO NEUTRAL, PHASE TO PHASE, AMPERAGE FOR ALL THREE PHASES, NEUTRAL CURRENT, KVA, KWH AND COMPLETE HISTORY.

- 4.13.4. STATUS DISPLAY-A GRAPHIC DISPLAY SHALL BE PROVIDED ON THE MAIN PANEL DOOR(S) WHICH ILLUSTRATE THE CURRENT CONFIGURATION AND DISPLAY THE VOLTAGE PHASE TO NEUTRAL, PHASE TO PHASE, AMPERAGE FOR ALL THREE PHASES, NEUTRAL CURRENT, KVA, KWH AND COMPLETE HISTORY OF ALL PRIMARY INPUT FEEDERS AND BREAKERS. THE SWITCHGEAR SHALL BE CONTROLLED ELECTRICALLY BY A NON-PROPRIETARY PROGRAMMABLE LOGIC CONTROLLER (PLC).

- 4.13.5. ALL CIRCUIT BREAKERS SHALL BE ELECTRICALLY OPERATED, DRAW-OUT TYPE WITH DIGITAL OR ELECTRONIC TRIP MODULES.

- 4.13.6. LOADBANK CONNECTION-THE SWITCHGEAR SHALL BE EQUIPPED WITH A BREAKER PROTECTED CUBICLE WITH A SUITABLE QUICK CONNECT STABS FOR THE CONNECTION OF A EXTERNAL LOAD BANK. THE TERMINATIONS SHALL BE CAM-LOCK TERMINATIONS TO PROVIDE FOR QUICK CONNECT TO A TEMPORARY GENERATOR.

- 4.13.7. SERVICE ENTRANCE GROUNDING-EACH HOSPITAL MAIN ELECTRICAL ROOM SHALL HAVE A GROUND COUNTERPOISE SYSTEM INSTALLED AND CONNECTED TO EITHER BUILDING STEEL OR THE MAIN WATER SUPPLY WITH A MINIMUM #4/0 AWG STRANDED COPPER CONDUCTOR AND SHALL PROVIDE A READING OF LESS THAN 25 OHMS. GROUND READINGS LOCATIONS SHALL BE MARKED AND VISBLE TO THE MAINTENANCE PROVIDER. ALL ELECTRICAL EQUIPMENT IN THE ELECTRICAL ROOM SHALL BE CONNECTED TO THE COUNTERPOISE SYSTEM BY UTILIZING EITHER EXOTHERMIC WELD CONNECTION OR COMPRESSION CONNECTIONS.

- 4.14. MAIN UTILITY ROOM, GENERATOR AND EES ROOM LIGHTING-LIGHTING IN THE MAIN ELECTRICAL SWITCHGEAR ROOMS SHALL BE PULSE START T-5 FLUORESCENT LIGHTS WITH BATTERY BALLASTS, TO FACILITATE EASE OF SWITCHING AND REPAIRS.

- 4.15. ESSENTIAL ELECTRICAL SYSTEMS FOR HEALTHCARE OCCUPANCIES-THE ESSENTIAL ELECTRICAL SYSTEM SHALL CONSIST OF AT LEAST TWO (2) (N+1) DIESEL ENGINE GENERATOR SETS, AUTOMATIC TRANSFER SWITCHES WITH MAINTENANCE BYPASS CAPABILITY (FOR ESSENTIAL LOADS), USER SELECTABLE PRIORITY LOAD MANAGEMENT CONTROL SYSTEMS AND PARALLELING SWITCHGEAR.

- 4.15.1. THE ESSENTIAL ELECTRICAL SYSTEM SHALL NOT BE PROVIDED WITH GROUND FAULT PROTECTION DEVICES. THE GENERATOR CIRCUIT BREAKER AND ESSENTIAL ELECTRICAL MAIN DISTRIBUTION BOARD CIRCUIT BREAKER WILL BE PROVIDED WITH GROUND FAULT DETECTION FEATURES TO INDICATE A GROUND FAULT AND SOUND AN AUDIBLE ALARM BUT NOT TRIP THE BREAKER.

- 4.15.2. DIESEL ENGINE GENERATOR SETS-GENERATOR SETS AND AUXILIARIES SHALL BE LOCATED, AS CLOSE AS POSSIBLE, TO THE HOSPITAL TO MINIMIZE LINE LOSSES AND PREVENT EXCESSIVE CABLE RUNS. SERVICE ENTRANCE TRANSFORMERS AND OTHER EQUIPMENT, NOT SUPPORTING THE ESSENTIAL EMERGENCY SYSTEM, SHALL NOT BE INSTALLED IN THE SAME ROOM AS THE ENGINE GENERATOR SETS. WHEN CONFIGURED AS A PAIR (2 GENERATORS), EACH GENERATOR SET SHALL BE INDIVIDUALLY SIZED N+1 AND CAPABLE FOR CARRYING 120% OF THE LIFE SAFETY, CRITICAL CARE AND ESSENTIAL EQUIPMENT LOADS CONTINUOUSLY FOR AT LEAST 72 HOURS. WHEN CONFIGURED IN A THREE (3) GENERATOR PLANT, EACH GENERATOR SHALL BE SIZED SUCH THAT ANY ONE GENERATOR CAN CARRY THE LIFE SAFETY AND CRITICAL CARE LOAD; AND TWO GENERATORS CAN CARRY 120% OF LIFE SAFETY, CRITICAL CARE AND ESSENTIAL EQUIPMENT LOADS CONTINUOUSLY FOR 72 HOURS. THE ALTERNATORS SHALL BE BRUSHLESS, 60 HERTZ, 277/480V, EXCEPT IN OVERSEAS AREAS, WHERE LOCAL CONDITIONS WILL DICTATE DIFFERENT SYSTEM VOLTAGES AND FREQUENCIES.

- 4.15.2.1. PRIME MOVER EMISSIONS SHALL MEET THE MINIMUM REQUIREMENTS OF TIER II REQUIREMENTS, UNLESS LOCAL PUBLISHED STANDARDS ARE MORE STRINGENT.

- 4.15.2.2. GENERATOR DIESEL MUFFLER/SILENCERS SHALL BE RATED FOR "RESIDENTIAL" ATTENUATION. RECOMMEND CRITICAL GRADE SILENCERS AND TOTAL SYSTEM NOISE ATTENUATION PERFORMANCE TO BE MEASURED AT 70dB WEIGHTED "A" SCALE AT 50'-0" FROM OPENINGS AT GRADE.

- 4.15.2.3. FUEL SUPPLY IN DAY TANK SHALL PROVIDE FOR 3 HOURS RUN TIME. THE MAIN TANK SHALL BE SIZED TO PROVIDE A MINIMUM OF 48 HOURS RUN TIME FOR THE PLANT AT FULL RATED LOAD.

- 4.15.2.4. ALL RACEWAYS/CONDUITS WITHIN THE GENERATOR ROOM SHALL BE INTERMEDIATE METALLIC CONDUIT (IMC). WHERE A TRANSITION TO FLEXIBLE WATER-TIGHT CONDUIT IS REQUIRED FOR TERMINATION, THE FLEXIBLE WATER-TIGHT CONDUIT SHALL NOT EXCEED 24". ALL CONDUITS AND OTHER WALL PENETRATIONS SHALL BE SLEEVE AND FIRE STOPPED.

- 4.15.2.5. THE GENERATORS SHALL BE ELECTRIC START, CONTAIN JACKET WATER HEATERS AND PRE-LUBE PUMPS, AS NECESSARY TO PROVIDE FAST AND RELIABLE START RESPONSE.

- 4.15.2.6. THE RADIATORS CAN BE EITHER SKID OR REMOTE MOUNTED, HOWEVER IF THE RADIATORS ARE SKID MOUNTED, A METAL SHROUD SHALL BE INSTALLED TO DIRECT THE AIR INTAKE.

- 4.15.2.7. THE GENERATOR ROOM SHALL BE EQUIPPED WITH VENTILATION EXHAUST FANS THAT RUN UPON GENERATOR START-UP AND MAINTAIN THE INTERIOR ENVIRONMENT WHILE OPERATING AT RATED LOAD ON AN ASHRAE DESIGN DAY.

- 4.15.3. GENERATOR PARALLELING SWITCHGEAR

- 4.15.3.1. GENERATOR PARALLELING SWITCHGEAR SHALL BE UL LISTED AS A COMPLETE ASSEMBLY AND CONTROLLED BY A NON-PROPRIETARY PROGRAMMABLE LOGIC CONTROLLER (PLC).

- 4.15.3.2. THE CONTROL BOARD SHALL PROVIDE INDIVIDUAL FLAT SCREEN ILLUMINATED COLOR GRAPHICAL DISPLAYS FOR EACH GENERATOR PANEL DOOR AND SIMILAR FLAT SCREEN COLOR GRAPHICAL DISPLAY ON MASTER CONTROL CABINET DOOR THAT ILLUSTRATES THE ENTIRE EES SYSTEM. THE GRAPHICAL DISPLAYS SHALL INCORPORATE ANIMATION GRAPHICS, WHICH SIMULATE OPERATIONS, MOVEMENTS, POSITION CHANGES AND FLOWS CONSISTENT WITH ACTUAL FUNCTIONS.

- 4.15.3.3. PLC ALARM AND EVENT HISTORY/LOG-THE PLC WILL HAVE A NON-VOLITILE MEMORY AND USER-FRIENDLY REPORT GENERATOR THAT CAN DISPLAY AND GENERATE AN ALARM, SYSTEMS OPERATIONS, FAULT/FAILURES, TEST AND EVENT CHRONOLOGICAL LOG/RECORD/REPORT. THE PLC MEMORY SHALL BE CAPABLE OF STORING AT LEAST 20,000 CRITICAL EVENTS THAT CANNOT BE PURGED OR ERASED FROM MEMORY AND 100 GIGABYTES WORTH OF MEMORY FOR NON-CRITICAL DATA WHERE THE OLDEST NON-CRITICAL EVENTS CAN BE DOWNLOADED AND/OR ERASED WHEN NO LONGER REQUIRED.

- 4.15.3.4. PRIORITY LOAD MANAGEMENT-HEALTHCARE ESSENTIAL ELECTRICAL LOADS ARE DIVIDED INTO THREE CATEGORIES: LIFE SAFETY, CRITICAL CARE AND ESSENTIAL EQUIPMENT LOADS. IN SOME LOCATIONS, A FOURTH PRIORITY IS ESTABLISHED FOR CRITICAL "MISSION" LOADS, SUCH AT THE MEDICAL COMMAND CENTER AND COMMUNICATIONS. ALL OTHER LOADS, CONSIDERED "NON-ESSENTIAL", MUST BE SACRIFICED (SHED) TO SALVAGE THE HIGHER PRIORITY LOADS, SHOULD THE SYSTEM BECOME OVERLOADED. SENSING SHALL BE ACCOMPLISHED THROUGH THE USE OF A WATT-TRANSDUCER AND AS THE SYSTEM APPROACHES CAPACITY (80% OF AVAILABLE GENERATOR RATING), LOAD MANAGEMENT WILL BE INITIATED AND SHEDDING OF LESSER PRIORITY LOADS SHALL COMMENCE, UNTIL AT OR BELOW 70% OF AVAILABLE GENERATOR CAPACITY OR ADDED GENERATORS ARE BROUGHT ON-LINE TO ACCEPT AND/OR REDUCE BUS LOAD. THE ORDER FOR SHEDDING LOADS IS IN REVERSE ORDER OF IMPORTANCE. THE FIRST LOAD TO BE SHED IS ALL NON-ESSENTIAL LOADS, FOLLOWED BY THE ESSENTIAL EQUIPMENT LOAD (WITH THE EXCEPTION OF THE FIRE PUMP AND FIRE PUMP CONTROLS), THEN THE CRITICAL CARE LOAD. THE LIFE SAFETY LOAD IS NEVER SHED. THE EES WILL RUN ITSELF TO FAILURE TO PROTECT THIS VITAL LOAD.

SHEET PLOTTED FULL SIZE = 24"x36"	
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ADDITIONS AND REVISIONS	
ISSUED FOR 65% DESIGN	1/10/14
ISSUED FOR 65% DESIGN-REV. 1	1/13/14
ISSUED FOR 100% DESIGN	2/21/14

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<b>19TH MEDICAL SUPPORT GROUP</b> LITTLE ROCK AFB, ARKANSAS REPAIR OF MECHANICAL BUILDING INFRASTRUCTURE SYSTEMS			
DRAWN BY	RPK	QUALITY STANDARDS	Sheet No.
CHECKED BY	MM	FOR AFMS	E-2
APPROVED BY	MM	INFRASTRUCTURE SYSTEMS	
SCALE	NONE		
DATE	JANUARY 2014	JOB No.	14554