Addendum No. 7

MAIN BUILDING GENERATOR CONNECTION

February 5, 2021

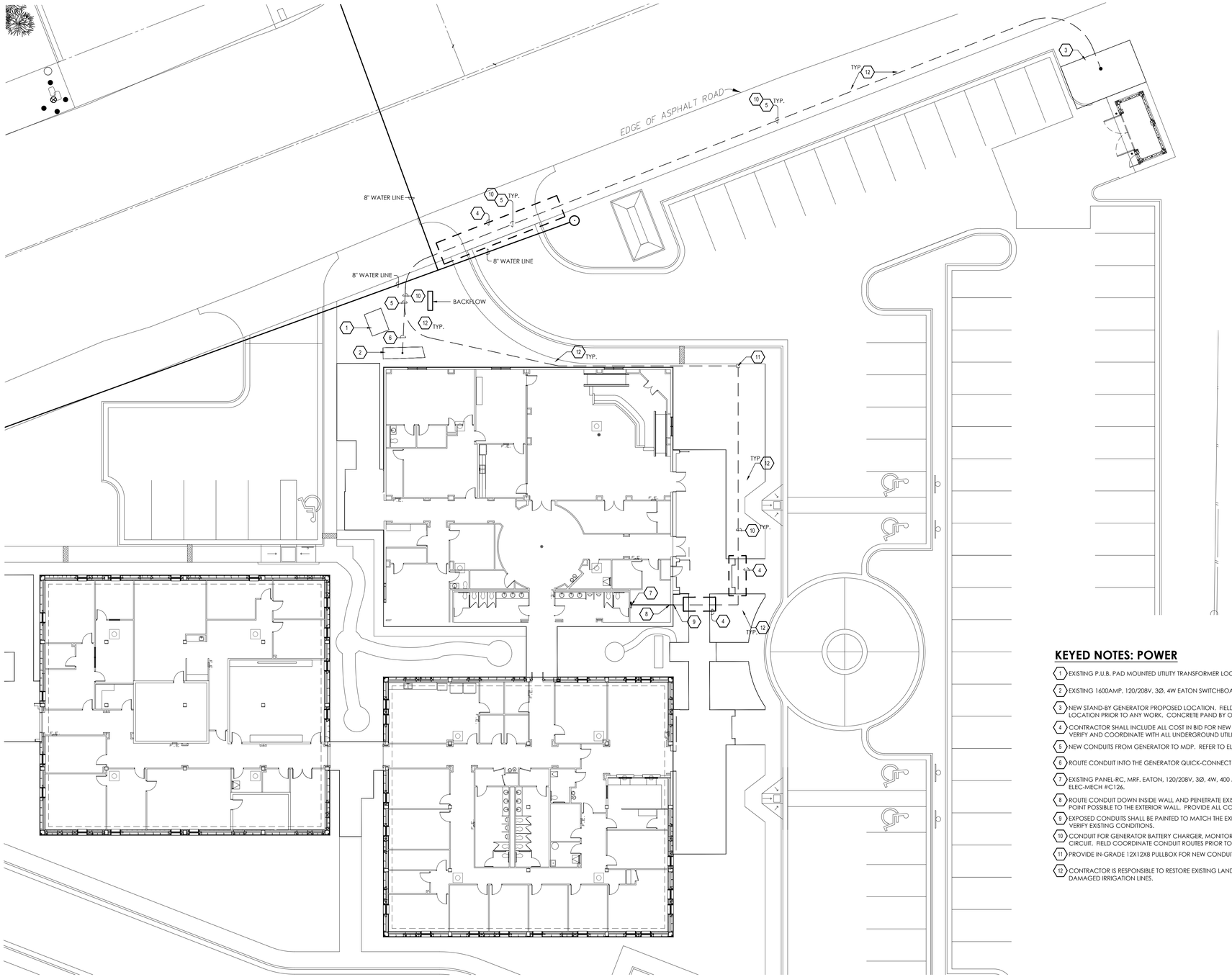
1. **CONSTRUCTION DRAWINGS AND SPECIFICATIONS: MEP**

a. The attached sets of drawings and specifications provide more details as to the desired alternatives for this project. Contractors must review and familiarize themselves with these documents and provide bid pricing for the designed options.

b. The **Mandatory Pre-Bid Meeting** is scheduled for **2:00 P.M. C.S.T.** on **Thursday, February 11**, as previously indicated. Bidders must attend said Mandatory Meeting in order for their bid to be considered.

c. If questions arise or if further clarifications are required, bidders must direct their questions or clarifications requests by email to achavez@portofbrownsville.com.

d. Another Addendum will be issued to revise the **Bid Form** and provide more detail as to the options being considered for this project.



1 SITE PLAN- ELECTRICAL

SCALE:1/16"=1'-0"

PROJECT # : 20.4.4
DATE: 1/27/2021
CHECKED BY: LM

REVISION:

PORT OF BROWNSVILLE
the port that works

GENERATOR PAD SITE OPTION

SOUTHEAST OF THE INTERSECTION
F.M. 511 AND CAPTAIN D.L. FOUST ROAD
BROWNSVILLE TEXAS

PORT OF BROWNSVILLE - STANDBY GENERATOR - SCOPE OF WORK SUMMARY

A. THE PROJECT CONSIST OF TAKING POSSESSION OF PORT OF BROWNSVILLE EXISTING TOWABLE 500KW GENERATOR SET FOR TRADE-IN VALUE/CREDIT FOR A NEW EMERGENCY UL LISTED STANDBY 500KW GENERATOR (DIESEL OR NATURAL GAS). COORDINATE WITH OWNER TO VISIT THE EXISTING GENERATOR LOCATION PRIOR TO BID DATE.

B. USE AND MODIFY THE EXISTING QUICK-CONNECT SWITCHBOARD AS AN AUTOMATIC TRANSFER SWITCH, REFER TO DRAWINGS FOR DIRECTIONS.

C. PROVIDE NEW ELECTRICAL UNDERGROUND FEEDERS FROM THE NEW GENERATOR LOCATION TO EXISTING SWITCHBOARD LOCATION.

D. PROVIDE POWER TO GENERATOR BATTERY CHARGER AND HEATER CIRCUITS FROM EXISTING BUILDING PANELBOARD, REFER TO DRAWINGS.

E. PROVIDE A WIRELESS REMOTE MONITORING SYSTEM FOR THE GENERATOR. SYSTEM WILL MONITOR GENERATOR STATUS.

F. THE PROJECT WILL CONSIST OF MULTIPLE ALTERNATES AS FOLLOWS.

a. ALTERNATE-1 - EXISTING TOWABLE GENERATOR INFORMATION AS FOLLOWS; MFR. KOHLER MODEL 500REOZT, 208-480V, DIESEL WITH 15 HOURS TO BE USE AS A TRADE-IN VALUE/CREDIT TOWARDS THE NEW GENERATOR. CONTRACTOR IS RESPONSIBLE TO VISIT GENERATOR TO GATHER EXISTING INFORMATION. CONTRACTOR CAN CONTACT JOE RIZZO @CAPITAL POWER SYSTEMS 512-897-4216 FOR CREDIT AMOUNT.

b. ALTERNATE-2 - NEW GENERATOR SHALL BE MFR. KOHLER 500KW, UL LISTED (DIESEL) STANDBY RATED, 120/208V, 3P, 4W, 1600AMP 100% RATED BREAKER, 24-HOUR UL LISTED TANK, WEATHERPROOF HOUSING RATED FOR 150MPH AND CORROSION RESISTANCE. INCLUDE MATERIAL, LABOR, AND START-UP FOR A COMPLETE INSTALLATION.

c. ALTERNATE- 3 - NEW GENERATOR SHALL BE MFR. KOHLER 500KW, UL LISTED (NATURAL GAS) STANDBY RATED, 120/208V, 3P, 4W, 1600AMP 100% RATED BREAKER, UL LISTED, WEATHERPROOF HOUSING RATED FOR 150MPH AND CORROSION RESISTANCE. INCLUDE MATERIAL, LABOR, AND START-UP FOR A COMPLETE INSTALLATION.

d. ALTERNATE-4 - EXISTING ELECTRICAL SWITCHBOARD MFR. EATON POW-R-LINE, TYPE-3R, 120/208Y 3-PHASE 4-WIRE, 1600AMP, 65KA, WITH QUICK CONNECTION TYPE TO CONVERTED TO PERFORM AS AUTOMATIC TRANSFER SWITCH. CONTRACTOR SHALL PROVIDE KRATOS INDUSTRIES ATS RETROFIT KIT PART #KATS-16-RF AND ALL LABOR TO PROVIDE A FULLY OPERABLE CODE COMPLIANT SYSTEM, REFER TO ELECTRICAL DOCUMENTS.

e. ALTERNATE-5 - ELECTRICAL FEEDERS FROM NEW GENERATOR LOCATION TO MAIN SWITCHBOARD, INCLUDE MATERIALS AND LABOR, REFER TO ELECTRICAL DOCUMENTS.

f. ALTERANTE-6 - PROVIDE THE WIRELESS MONITORING SYSTEM EQUAL TO AYANTRA TO GENERATOR TO MONITOR GENERATOR STATUS. INCLUDE ALL COST FOR MATERIAL AND LABOR.

KEYED NOTES: POWER

1. EXISTING P.U.B. PAD MOUNTED UTILITY TRANSFORMER LOCATION.
2. EXISTING 1600AMP, 120/208V, 3Ø, 4W EATON SWITCHBOARD-"MDP".
3. NEW STAND-BY GENERATOR PROPOSED LOCATION. FIELD COORDINATE EXACT LOCATION PRIOR TO ANY WORK. CONCRETE PAND BY OTHERS.
4. CONTRACTOR SHALL INCLUDE ALL COST IN BID FOR NEW CONDUIT BORES. FIELD VERIFY AND COORDINATE WITH ALL UNDERGROUND UTILITIES.
5. NEW CONDUITS FROM GENERATOR TO MDP. REFER TO ELECTRICAL RISER DIAGRAM.
6. ROUTE CONDUIT INTO THE GENERATOR QUICK-CONNECT COMPARTMENT.
7. EXISTING PANEL-RC, MRF. EATON, 120/208V, 3Ø, 4W, 400 AMP LOCATED IN ELEC-MECH #C126.
8. ROUTE CONDUIT DOWN INSIDE WALL AND PENETRATE EXISTING WALL AT THE LOWEST POINT POSSIBLE TO THE EXTERIOR WALL. PROVIDE ALL CONDUIT BODIES REQUIRED.
9. EXPOSED CONDUITS SHALL BE PAINTED TO MATCH THE EXISTING WALL FINISHES. FIELD VERIFY EXISTING CONDITIONS.
10. CONDUIT FOR GENERATOR BATTERY CHARGER, MONITORING SYSTEM AND HEATER CIRCUIT. FIELD COORDINATE CONDUIT ROUTES PRIOR TO ANY WORK.
11. PROVIDE IN-GRADE 12X12X8 PULLBOX FOR NEW CONDUITS.
12. CONTRACTOR IS RESPONSIBLE TO RESTORE EXISTING LANDSCAPE AND ANY DAMAGED IRRIGATION LINES.

GENERAL ELECTRICAL NOTES (TO ALL SHEETS)

A. ALL SLEEVES, PENETRATIONS, ETC. SHALL BE SEALED SOLID NON-SHRINKING MATERIAL IMMEDIATELY UPON FILLING OF THE OPENING WITH PIPE OR CONDUIT.

B. CONTRACTOR IS RESPONSIBLE FOR ALL EXCAVATION, TRENCHING AND BACKFILLING. COORDINATE WITH ALL UTILITIES PRIOR TO EXCAVATION.

C. CONTRACTOR IS RESPONSIBLE CALL DIG-TESS; 1-1800-DIG-TESS 2-BUSINESS DAYS IN ADVANCE.

D. ALL ELECTRICAL EQUIPMENT OUTDOORS SHALL BE RATED TYPE NEMA 3R UNLESS OTHERWISE NOTED.

E. CONTRACTOR SHALL HAVE A WORKING KNOWLEDGE OF LOCAL CODES AND ORDINANCES. ALL WORK SHALL CONFORM TO NATIONAL ELECTRICAL CODES AND ALL OTHER AUTHORITY HAVING JURISDICTION. OBTAIN PERMITS AND PAY ALL FEES. PERFORM MODIFICATIONS TO MEET CODE AND ORDINANCE REQUIREMENTS AT NO ADDITIONAL COST TO OWNER. ARCHITECT OR ENGINEER. VERIFY PRIOR TO BID DATE.

F. CONTRACTOR IS RESPONSIBLE TO VERIFY AND COORDINATE WITH EXISTING/NEW UNDERGROUND UTILITIES PRIOR TO ANY WORK.

G. IN COOPERATION WITH OTHER CONTRACTORS, DETERMINE THE EXACT LOCATION OF EQUIPMENT AND DEVICES AND CONNECTIONS THERETO BY REFERENCE TO THE SUBMITTALS AND ROUGH-IN DRAWINGS, AND BY MEASUREMENTS AT THE SITE. REFER TO ALL OTHER TRADES SUBMITTAL FOR ELECTRICAL INFORMATION.

H. GROUND ENTIRE ELECTRICAL SYSTEM IN STRICT ACCORDANCE WITH THE NATIONAL ELECTRICAL CODE.

I. VERIFY AT JOB SITE GENERAL WORK TO BE DONE AS SPECIFIED, AS NOTED, OR AS REQUIRED FOR INSTALLATION ELECTRICAL SYSTEMS PRIOR TO SUBMISSION OF BIDS.

J. CONTRACTOR SHALL FIELD VERIFY EXISTING CONDITIONS AND EQUIPMENT TO BE REMOVED AND REPLACED BEFORE SUBMITTING HIS BID.

K. ELECTRICAL DRAWINGS ARE DIAGRAMMATIC AND SMALL SCALE ONLY. THEY CONVEY THE INTENT OF THE WORK BUT DO NOT SHOW DETAIL SUCH AS JUNCTION AND PULL BOXES REQUIRED BY THE SPECIFICATIONS AND THE NATIONAL ELECTRICAL CODE(NEC). PROVIDE ALL MATERIALS AND METHODS CALLED FOR IN THE SPECIFICATIONS AND AS REQUIRED IN THE NEC TO PROVIDE A COMPLETE INSTALLATION OF ALL WORK.

L. ALL WIRING SHALL BE COPPER.

M. ARRANGE FOR SOURCES OF TEMPORARY CONSTRUCTION SERVICES. SUCH SERVICES SHALL BE NOMINALLY 120/240V, 1-PHASE, 3-WIRE FROM WHICH A COMPLETE SYSTEM OF TEMPORARY POWER AND LIGHTING SHALL BE PROVIDED FOR ALL CONSTRUCTION NEEDS.

"THESE DRAWINGS ARE INTENDED FOR INTERIM REVIEW ONLY UNDER THE AUTHORITY OF LEONARDO MUNOZ, P.E. NUMBER 97437, ON 01/16/2018. IT IS NOT TO BE USED FOR CONSTRUCTION PURPOSES."

01/27/21

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Project number:

STATE OF TEXAS
LEONARDO MUNOZ
97437
LICENSED PROFESSIONAL ENGINEER

ES1

GENERAL NOTES:

A. PROVIDE GROUND /BONDING AS INDICATED ON THE NATIONAL ELECTRICAL CODE.

B. NAME PLATES SHALL BE PROVIDED FOR ALL ELECTRICAL SWITCH GEAR, PANEL BOARDS, LIGHTING CONTACTORS, LIGHTING CONTROL PANELS, ETC.. BY ELECTRICAL CONTRACTOR.

C. NEW ELECTRICAL METERING AND SERVICE EQUIPMENT SHALL BE PROVIDED AND INSTALLED ACCORDING TO THE LOCAL POWER UTILITY CO. AND CITY REQUIREMENTS. VERIFY AND COORDINATE WITH POWER UTILITY CO. AND AHJ BEFORE BID AND INSTALLATION.

D. COMPLY WITH NFPA 70E SAFETY REQUIREMENTS.

E. ALL CONDUITS EMPTY OR USED SHALL BE SEALED WITH A RACEWAY SEALANT.

F. PANELBOARDS WITH MORE THAN 42 CIRCUITS SHALL BE IN ONE CABINET ENCLOSURE, UNLESS OTHERWISE NOTED.

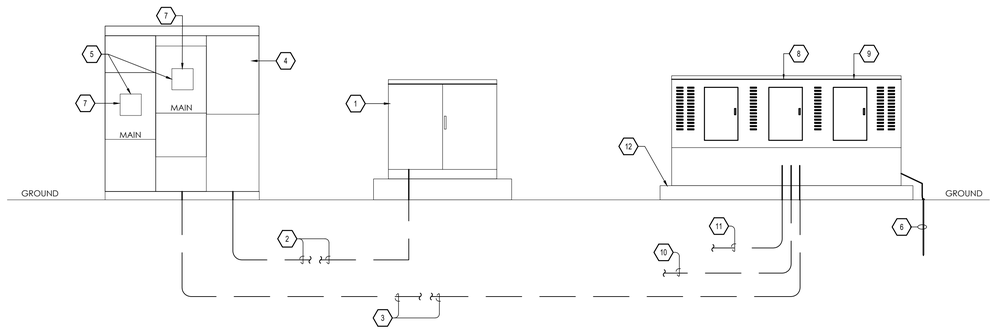
G. PROVIDE 4"CONCRETE PAD FOR ALL DRY-TYPE TRANSFORMERS.

H. ALL TWO SECTION PANELBOARDS SHALL BE FEED THRU LUGS.

I. CONTRACTOR SHALL BE RESPONSIBLE FOR DELIVERY OF ELECTRICAL SERVICE TO THE NEW BUILDING WITHIN PROJECT SCHEDULE. COORDINATE ALL COST FOR LABOR AND MATERIALS WITH LOCAL ELECTRICAL UTILITY COMPANY PRIOR TO BID. ALL COST ASSOCIATED WITH THE DELIVERY OF ELECTRICAL SERVICE INCLUDING ALL MATERIALS SHALL BE INCLUDED IN BID. TRANSITION OF NEW ELECTRICAL SERVICE SHALL PROCEED IN WEEKENDS OR HOLIDAYS, INCLUDE ALL COST IN BID FOR OVERTIME FROM ELECTRIC UTILITY COMPANY. NO ADDITIONAL PAYMENT WILL BE MADE FOR SERVICE DELIVERY COSTS AFTER CONTRACT HAS BEEN AWARDED.

KEYED NOTES:

1. EXISTING P.U.B. PAD MOUNT 120/208V, 3Ø, 4W TRANSFORMER
2. EXISTING UNDERGROUND FEEDERS, 4-RUNS EACH 4#600KCMIL, 4"C TO REMAIN.,
3. PROVIDE NEW 4-RUNS EACH 4#600KCMIL, 1#4/0G, 4"C.
4. EXISTING MFR. EATON SWITCHBOARD 120/208V, 3Ø, 4W, 1600AMP, 65 KA, 2-KEY INTERLOCK BREAKERS WITH GENERATOR QUICK CONNECT SECTION.
5. PROVIDE KRATES INDUSTRIES ATS RETROFIT KIT PART # KATS-16-RF
   -1 KRATES WALLMOUNT ATS CONTROL
   -3 RCT16-1600CT
   -2 EOP610BK
   -ONSITE INSTALLATION AND STARTUP.
   ATS RETROFIT KIT WILL CONVERT EXISTING KIRK KEY INTERLOCK BREAKER PAIR TO AN ATS BREAKER PAIR TRANSFER SWITCH.
6. 1#3/0G IN 1"C, 3/4"X10' COPPER CLAD RODS. PROVIDE GROUNDING AS PER NEC REQUIREMENTS.
7. CONTRACTOR SHALL INCLUDE COST FOR RETROFIT KIT PROVIDER TO SUPPLY BREAKER INJECTION TESTING AND RECERTIFICATION ON EXISTING EATON K FRAME BREAKERS.
8. NEW 500KW DIESEL KOHLER GENERATOR SET, 120/208V, 3Ø, 1600AMP LSI 100% RATED BREAKER. CORROSION RESISTANCE STANDARD WEATHER PROOF ENCLOSURE. 24-HOUR U.L. LISTED DOUBLE WALL TANK.
9. NEW 500KW NATURAL GAS KOHLER GENERATOR SET, 120/208V, 3Ø, 1600AMP LSI 100% RATED BREAKER. CORROSION RESISTANCE STANDARD WEATHER PROOF ENCLOSURE. 24-HOUR U.L. LISTED DOUBLE WALL TANK.
10. 2-1"C FOR GENERATOR BATTERY CHARGER CIRCUIT AND BLOCK HEATER CIRCUIT. HEATER CIRCUIT SHALL BE 40 AMP, 3-POLE, 3#6, 1#8G, 1"C. CHARGER CIRCUIT SHALL BE 20 AMP 1-POLE, 2#8, 1#10G, 1"C.
11. PROVIDE 2-14AWG, STRANDED SHIELDED TWISTED CABLE IN 1"C FOR GENERATOR START.
12. CONCRETE PAD SHALL BE SIZED FOR PROPOSED GENERATOR TOTAL WEIGHT. REFER TO CIVIL ENGINEERING PLANS FOR CONCRETE PAD INFORMATION.



1 ELECTRICAL SCHEMATIC DIAGRAM

SCALE: N.T.S.

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Project number:

STATE OF TEXAS
LEONARDO MUNOZ
97437
PROFESSIONAL ENGINEER

PROJECT # : 20.4.4
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REVISION:

PORT OF BROWNSVILLE
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GENERATOR PAD SITE OPTION
SOUTHEAST OF THE INTERSECTION
F.M. 511 AND CAPTAIN D.L. FOUST ROAD
BROWNSVILLE TEXAS

EG1

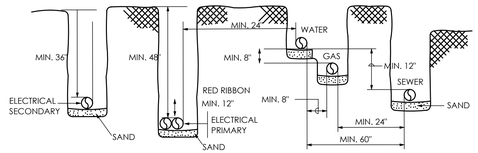
01

CLEAR TRENCH OF ALL ROCKS AND DEBRIS BEFORE ADDING SAND CUSHION.

COMPACT TRENCH FILL TO 95% PROCTOR DENSITY.

MAINTAIN A MINIMUM OF 60 INCHES UNDISTURBED EARTH BETWEEN PARALLEL WATER AND SEWER LINES OR SUPPORT WATER LINE ON SEPARATE SHELF A MINIMUM OF 12" ABOVE SEWER LINE.

MAINTAIN A MINIMUM OF 24" HORIZONTALLY BETWEEN ELECTRICAL (PRIMARY, SECONDARY, BRANCH CIRCUITS, COMMUNICATION) AND SEWER. MAINTAIN A MINIM OF 12" VERTICALLY OR 24" HORIZONTALLY BETWEEN ELECTRICAL (PRIMARY, SECONDARY, BRANCH CIRCUITS, COMMUNICATION) AND WATER LINES AND GAS LINES.

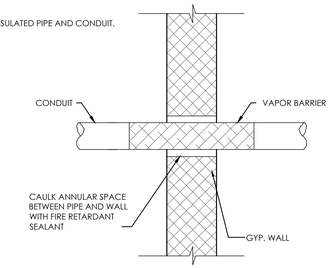


TRENCH DETAIL
NO SCALE

04

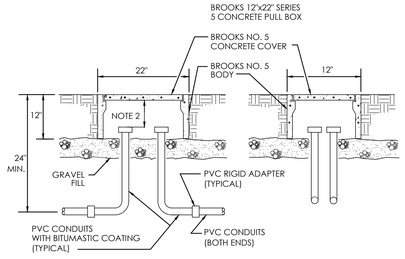
NOTE: WHERE PIPING IS EXPOSED AT FINISHED WALLS, PROVIDE FLUSH MOUNTED SLEEVE AND ESCUTCHEON PLATES. (CONTRACTOR MAY USE FIELD FABRICATED S.S. PLATE).

NOTE: SIMILAR FOR UNINSULATED PIPE AND CONDUIT.



CONDUIT THROUGH FIRE RATED WALL
NO SCALE

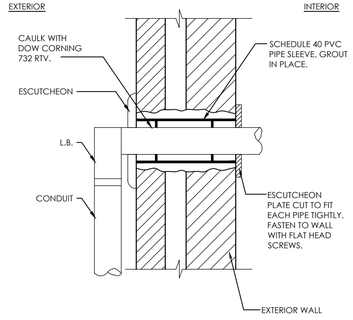
02



NOTES:
1. SEE PLAN FOR CONDUIT ORIENTATION
2. VARIES - MIN. 6", MAX-9"

TYPICAL PULLBOX DETAIL
NO SCALE

05



CONDUIT ENTRY THROUGH EXTERIOR
NO SCALE

03

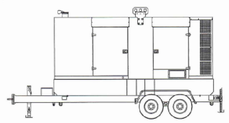
Model: 500REOZT

KOHLER POWER SYSTEMS 208-480 V Diesel

ISO 9001 KOHLER POWER SYSTEMS NATIONALLY REGISTERED

Industrial Towable Generator Sets

- Kohler Co. provides one-source responsibility for the generating system and accessories.
- The generator set and its components are prototype-tested, factory-built, and production-tested.
- A one-year limited warranty covers all systems and components.
- Generator sets are available with and without trailers.
- Generator set features:
  - Durable galvanized steel, sound-attenuating housing
  - Electrical power panel.
  - Unit-mounted radiator with 40°C (104°F) ambient air capability with prime rating.
  - Skid and vibration isolators.
  - Main line circuit breaker, 1600 amps.
  - Microprocessor controller with emergency stop switch.
  - Externally mounted, recessed emergency stop switch.
  - Generator set and trailer operation literature.
- Engine features:
  - Volvo engine with 24-volt battery charging alternator.
  - Heavy-duty air cleaner with air restrictor indicator.
  - Battery, battery rack, and cables.
  - Engine is compliant with the Environmental Protection Agency (EPA) requirements.
  - Water separator fuel filter.
  - Battery disconnect switch.
  - Block heater, 120 V/2250 W.
- Enclosure/fuel tank package features:
  - Quiet operation, 75 dB(A) @ 7 m (23 ft.) (full load).
  - Lockable housing doors.
  - Subbase fuel tank, 1770 L (468 gal.).
  - 110% environmental containment basin for fuel, oil, and coolant.
- Trailer features:
  - Lunette eye.
  - Lockable utility tool box.
  - Running lights with 7-wire harness and connector.
  - Dual-axle trailer with electric brake system including breakaway and battery backup. 4536 kg (10000 lb.) rating per axle.
  - Steel wheels, 8-bolt, and 215/75R17.5 LRH tires with 2180 kg (4805 lb.) load rating.
  - Rear stabilizer trailer jacks.



Ratings Range

		60 Hz
Standby:	kW	460–510
	kVA	575–636
Prime:	kW	440–460
	kVA	550–575

Generator Set Ratings

Alternator	Voltage	Ph	Hz	Standby Rating kW/kVA	Standby Rating Amps	Prime Rating kW/kVA	Prime Rating Amps
LSA472M7	120/208	3	60	460/575	1596	440/550	1527
	277/480	3	60	510/638	767	460/575	692

RATINGS: All three-phase units are rated at 0.8 power factor. All single-phase units are rated at 1.0 power factor. *Standby Ratings:* The standby rating is applicable to varying loads for the duration of a power outage. There is no overload capability for this rating. *Prime Power Ratings:* At varying load, the number of generators set operating hours is unlimited. A 10% overload capacity is available for one hour in twelve hours. Ratings are in accordance with ISO3046/1 and ISO8528/1. For information on other frequency ratings, consult the factory. Obtain technical information bulletin (TIB-101) for ratings guidelines, complete ratings definitions, and site condition derates. The generator set manufacturer reserves the right to change the design or specifications without notice and without any obligation or liability whatsoever. For dual fuel engines, use the natural gas ratings for both the primary and secondary fuels.

GS-572 (500REOZT) 6/12e

EXISTING GENERATOR DATA INFORMATION
NO SCALE

PROJECT # : 20.4.4
DATE: 1/27/2021
CHECKED BY: LM

REVISION:

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GENERATOR PAD SITE OPTION
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STATE OF TEXAS
LEONARDO MUNOZ
97437
PROFESSIONAL ENGINEER

EG2

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01/27/2021

DIVISION 26 – ELECTRICAL

26 01 00	ELECTRICAL
26 01 20	OPERATIONS AND MAINTENANCE OF LOW-VOLTAGE ELECTRICAL DISTRIBUTION
26 05 00	COMMON WORK RESULTS 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	RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS
26 05 53	IDENTIFICATION FOR ELECTRICAL SYSTEMS
26 32 13	STANDBY GENERATOR

SECTION 26 00 00

ELECTRICAL

PART 1 – GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions, Specification Sections and other Sections, apply to this Section.

1.2 WORK COVERED BY CONTRACT DOCUMENTS

A. The following Summary of Work is intended as an aid to achieve an understanding of the various elements of work included in the project, as is not intended to be all-inclusive. Detailed descriptions of work and requirements are given in drawings and specifications.
B. General Scope of Work:
   1. Providing new feeders, conduits, breakers, retrofit automatic transfer kit to existing switchboard, generator, and labor.

1.4 COORDINATION

A. All electrical work shall be done under sub-contract to a General Contractor. Electrical Contractor shall coordinate all work through General Contractor, even in areas where only electrical work is to take place.

B. Work shall take place with minimal disruption to Owner's operations in areas surrounding the existing building.

C. Cooperate fully with other contractors so that work under those contracts may be carried out smoothly, without interfering with or delaying work under this Contract.

D. Fully coordinate with mechanical contractor for providing power to mechanical equipment.

1.5 UTILITIES

1. Coordinate with existing power company underground lines. Coordinate with water, telephone, cable and gas utilities to locate all utilities prior to digging in any area.
2. Obtain any approvals required from utilities to relocate utilities.
3. Cost of relocating or bypassing utilities indicated on drawings shall be included in Base Bid.

1.6 CONTRACTOR USE OF PREMISES

A. Use of the Site: Limit use of the premises to work in areas indicated. Confine operations to areas within contract limits indicated. Do not disturb portions of the site beyond the areas in which the Work is indicated.

1. Driveways and Entrances: Keep driveways and entrances serving the premises, clear and

available to the Owner, the Owner's employees, and emergency vehicles at all time. Do not use these areas for parking or storage of materials. Schedule deliveries to minimize space and time requirements for storage of materials and equipment on-site.

B. Site Safety: Take every precaution to ensure the site does not present a threat to the safety of occupants and/or workers. Minimal safety requirements include, but are not limited to the following:

1. Temporary fencing around construction areas.
2. Yellow caution tape and construction barricades along open trenches during the day. Trenches shall be covered at night and warning lights provided on construction barricades.
3. Temporary fencing around equipment while site work is in progress.

1.7 SUBMITTALS

1. To extradite the submittal process more efficiently, do not piece-meal the submittals. Submit entire electrical in a bound enclosure in an electronic file. This will eliminate delays in the submittal process. Unbound submittals shall be returned without review.

1.8 CONTINGENCY FUND

1. The contractor shall provide a $10,000 contingency fund for electrical. Unuse funds will be return to contract for credit..

END OF SECTION

SECTION 26 01 20

OPERATION AND MAINTENANCE OF LOW-VOLTAGE ELECTRICAL DISTRIBUTION

PART1- GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions, Specification Sections and all relevant documents shall form a part of this Section of the Specifications, and shall be incorporated in this Section and each Section 260000 hereinafter as if repeated verbatim herein. All conditions imposed by these documents shall be applicable to all portions of the work under this Section. Certain specific paragraphs of said references may be referred to hereinafter in this Section. These references are intended to point out specific items to the Contractor, but in no way relieve him of the responsibility of reading and complying with all relevant parts of the entire Specification.

B. The Contractor shall examine and coordinate with all Contract Drawings and Specifications, and all Addenda issued. Failure to comply shall not relieve him of responsibility. The omission of details of other portions of the work from this Section shall not be used as a basis for a request for additional compensation.

C. The specific features and details for other portions of the work related to the construction in progress or to the adjacent building shall be determined by examination at the site.

1.2 SCOPE OF WORK

A. The requirements contained in this Section apply to all work performed under these Specifications.

B. The work covered by this Section of the Specifications comprises the furnishing of labor, material, equipment, transportation, tools and services, and performing operations required for, and reasonably incidental to, the installation of the work in accordance with the applicable Contract Documents, and subject to the terms and conditions of the Contract.

C. Refer to other Sections of the Specifications for related work.

1.3 DEFINITION OF "CONTRACTOR"

A. Where the word "Contractor" is used under any Section of this Section of the Specifications, it shall mean the Contractor engaged to execute the work included under that Section, even though this Contractor may be technically described as a Subcontractor, or an authorized representative.

B. If the Contractor, engaged to execute a portion of the work, employs a Subcontractor to perform some of that work, he shall be completely responsible for the proper execution of this Subcontractor’s work, in full conformity with the Contract Documents.

1.4 RESPONSIBILITY OF THE CONTRACTOR

A. The Contractor shall be responsible for all work of every description in connection with this Section of the Specifications. The Contractor shall specifically and distinctly assume, and does zeso assume, all risk for damage or injury from whatever cause to property or person used or

employed on or in connection with this work and of all damages or injury to any person or property wherever located, resulting from an action or operation under the Contract in connection with the work, and undertake the responsibility to defend the Owner against all claims on account of any such damage or injury.

B. The Contractor will be held responsible for the satisfactory execution and completion of the work in accordance with the true intent of the Contract Documents. The Contractor shall provide without extra charge all incidental items required as part of the work, even though it may not be specifically indicated. If the Contractor has reason for objecting to the use of any material, equipment, device or method of construction as indicated, the Contractor shall make report of such objections to the Owner's Representative, obtain proper approval and adjustment to the Contract, and shall proceed with the work.

1.5 TERMINOLOGY

A. Whenever the words "furnish", "provide", "furnish and install", "provide and install", and similar phrases occur, it is the intent that the materials, equipment and devices described be furnished, installed and connected under this Section, complete for operation, unless specifically noted to the contrary.

B. It is also the intent, unless specifically noted to the contrary, that all materials, equipment and devices described and specified under this Section of the Specifications be similarly furnished, installed and connected under this Section, whether or not a phrase as described in the preceding paragraph has been actually included.

C. Whenever the words “Owner’s Representative” occurs, it is intended to refer to the Architect, Engineer and/or specific Owner’s Representative responsible for or capable of providing the necessary direction pertaining to the referenced issue.

1.6 ORDINANCES, PERMITS AND CODES

A. It shall be the Contractor's duty to perform the work and provide the materials covered by these specifications in conformance with all ordinances and regulations of all authorities having jurisdiction.

B. All work herein shall conform to all applicable laws, ordinances and regulations of the local utility companies.

C. The Contractor shall obtain and pay for all permit and connection fees as required for the complete installation of the specified systems, equipment, devices and materials.

D. The Contractor shall obtain permits, plan checks, inspections and approvals applicable to the work as required by the regulatory authorities. Fees and costs of any nature whatsoever incidental to these permits, inspections and approvals shall be assumed and paid by the Contractor. The pro-rata costs, if any, for utilities serving this property will be paid for by the Owner and shall not be included as part of this Contract.

E. The work shall be in accordance with, but shall not be limited to, the requirements of:

1 National Fire Protection Association
2 National Electrical Code
3 National Safety Code
4 State of Texas Safety Code
5 Local City Building Codes

6 State of Texas Building Codes

F. Codes and standards referred to are minimum standards. Where the requirements of the Drawings or Specifications exceed those of the codes and regulations, the Drawings and Specifications govern.

1.7 MATERIALS, EQUIPMENT AND DEVICE DESCRIPTION

A. Materials, equipment and devices shall be of the best quality customarily applied in quality commercial practice, and shall be the products of reputable manufacturers. Each major component shall bear a nameplate giving the name and address of the manufacturer, and the catalog number or designation of the component.

B. Materials, equipment and devices furnished under this Section of the Specifications shall be essentially the standard product of the specified manufacturer, or where allowed, an alternate manufacturer. Where two or more units of the same kind or class of a specific item are required, these shall be the products of a single manufacturer; however, the component parts of the item need not be the products of one manufacturer.

C. In describing the various materials, equipment and devices, in general each item will be described singularly, even though there may be a multiplicity of identical items. Also, where the description is only general in nature, exact sizes, duties, space arrangements, horsepower requirements and other data shall be determined by reference to the Contract Documents.

D. Space allocations for materials, equipment and devices have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. The Contractor shall verify that all materials, equipment and devices proposed for use on this project are within the constraints of the allocated space.

1.8 QUALITY ASSURANCE

A. Materials, equipment and devices shall be new and of the quality specified, and shall be free from defects at the time of installation. Materials, equipment and devices damaged in shipment or otherwise damaged or found defective prior to acceptance by the Owner shall not be repaired at the job site, but shall be replaced with new materials, equipment or devices identical with those damaged, unless specifically approved otherwise by the Owner's Representative.

B. Wherever a UL standard has been established for a particular type of material, equipment or device, each item of such material, equipment or device provided on this project shall meet the requirements of the UL standard in every way, and shall be UL listed and labeled.

1.9 REFERENCE STANDARDS

A. Materials, equipment, devices and workmanship shall comply with applicable local, county, state and national codes, laws and ordinances, utility company regulations and industry standards.

B. In case of differences between building codes, state laws, local ordinances, industry standards, utility company regulations and the Contract Documents, the most stringent shall govern. The Contractor shall promptly notify the Owner's Representative in writing of any such difference. Should the Contractor perform any work that does not comply with local codes, laws and ordinances, industry standards or other governing regulations, the work shall be corrected of

noncompliance deficiencies with the Contractor bearing all costs.

C. In addition to the aforementioned ordinances, industry standards published by the following organizations shall apply:

AABM	-	American Association of Battery Manufacturers
ADA	-	American's with Disabilities Act
AIA	-	American Institute of Architects
ANSI	-	American National Standards Institute
ASTM	-	American Society for Testing and Materials
CBM	-	Certified Ballast Manufacturers Association
ETL	-	Electrical Testing Laboratories
FM	-	Factory Mutual
ICEA	-	Insulated Cable Engineers Associated
IEEE	-	Institute of Electrical and Electronic Engineers
IES	-	Illuminating Engineering Society
IRI	-	Industrial Risk Insurance
NBS	-	National Bureau of Standards
NEC	-	National Electrical Code
NECA	-	National Electrical Contractors Association
NEMA	-	National Electrical Manufacturers Association
NESC	-	National Electrical Safety Code
NETA	-	National Electrical Testing Association
NFPA	-	National Fire Protection Association
UL	-	Underwriters Laboratories

1.10 DRAWINGS AND SPECIFICATIONS

A. The interrelation of the Drawings (including the schedules) and the Specifications are as follows:
   1 The Drawings establish quantities, locations, dimensions and details of materials, equipment and devices. The schedules on the Drawings indicate the capacities, characteristics and components.
   2 The Specifications provide written requirements for the quality, standard and nature of the materials, equipment, devices and construction systems.

B. The Drawings and Specifications shall be considered as being compatible; therefore, the work called for by one and not by the other shall be furnished and installed as though called for by both. Resolution of conflicts between Drawings and Specifications shall be as follows:
   1 If the Drawings and Specifications disagree in themselves, or with each other, the Contractor's pricing shall be based on furnishing and installing the most expensive combination of quality and quantity of work indicated for a complete operable system.

Contractor is responsible to notifying the Architect and Engineer. In the event of this type of disagreement, the resolution shall be determined by the Owner's Representative. The contractor shall assume for an operable system at the most expensive combination as per the latest National Electrical Code. The contractor shall review all drawings and specifications prior to bid date.

2 The Contractor shall be responsible for bringing any conflicts in the Drawings and the Specifications to the attention of the Owner's Representative immediately, prior to bid date.

3 In general, if there is conflict between the Drawings and Specifications, the Drawings shall govern the Specifications.

4 Where the Specifications do not fully agree with schedules on the Drawings, the schedules shall govern. Actual numerical dimensions indicated on the Drawings govern scale measurements and large scale details govern small scale drawings.

5 Materials, equipment and devices called for on the Drawings and not indicated herein, shall be completely provided and installed as though it were fully described herein.

6 Materials, equipment and devices called for herein shall be completely provided and installed, whether or not it is fully detailed, scheduled or indicated on the Drawings.

C. The Contractor shall examine the Drawings and Specifications of the other portions of the work for fixtures and finishes in connection with this work. The Contractor shall carefully examine the Drawings to determine the general construction conditions, and shall familiarize himself with all limitations caused by such conditions.

D. When discrepancies exist between scale and dimension, or between the Drawings of the various portions of the work, they shall be called to the attention of the Owner's Representative for further instruction, whose instructions shall be final and binding and work promptly resumed without any additional cost to the Owner.

E. Review the construction details of the building(s) as illustrated on the Drawings of the other portions of the work, i.e., architectural, structural, civil, landscape, etc., and be guided thereby. Route conduits and set all boxes as required by the pace of the general construction.

F. The Drawings diagrammatically show the sizes and locations of the various equipment and devices, and the sizes of the major interconnecting wires, without showing exact details as to elevations, offsets, control wiring and other installation requirements. Carefully layout the work at the site to conform to the architectural and structural conditions, to avoid obstructions and to permit proper grading of pipe associated with other portions of the work. In cooperation with other Contractors, determine the exact location of equipment and devices and connections thereto by reference to the submittals and rough-in drawings, and by measurements at the site. Make minor relocations necessitated by the conditions at the site, or directed by the Owner's Representative, without additional cost to the Owner.

G. The Drawings and Specifications are intended to describe and illustrate systems which will not interfere with the structure of the building(s), fit into the available spaces, and insure complete and satisfactory operating installations. Prepare installation drawings as required for all critical areas illustrating the installation of the work in this Section as related to the work of all other Sections and correct all interferences with the other portions of the work or with the building structures before the work proceeds.

H. The Drawings do not indicate the existing electrical installations other than to identify modifications or extensions thereto. Visit the site and ascertain the conditions to be met and the work to be accomplished in removing and modifying the existing work, and in installing the new work. Failure to comply with this shall not constitute grounds for any additional payment in connection with removing or modifying any part of the existing installation or installing any new or temporary work under this Section.

1.11 SUBMITTALS

A. Submit product data and shop drawings in accordance with the Specifications.

B. Process product data and shop drawings to insure that the proposed materials, equipment and devices conform to the requirements of the Contract Documents, and that there are no omissions or duplications. Provide layouts, fabrication information and data for systems, materials, equipment and devices proposed for the project.

C. Submittals shall be provided for review and approval on all systems, equipment, devices and materials proposed for use on this project. Submittals shall include, but not be limited to, the following:

1 Lighting and Appliance Panelboards
2 Disconnect Switches
3 Circuit Breakers and Fuses
4 Materials: conduit, conductors, connectors, supports, etc.
5 Lighting Fixtures, Lamps and Control Systems/Devices
6 Wiring Devices
7 Transformers
8 Distribution Panelboards
9 Motor Control Center
10 As indicated on each submittal section

D. The product data shall not consist of manufacturer's catalogs or cut sheets that contain no indication of the exact item offered. The submission on individual items shall designate the exact item offered.

E. Do not submit detailed quantitative listings of materials, equipment and devices. It is the Contractor's responsibility to provide proper sizes and quantities to conform to Contract Documents.

F. Assemble submittals on related items procured from a single manufacturer in bound brochures or other suitable package form, rather than submitting a multiplicity of loose sheets.

G. Prepare shop drawings whenever equipment proposed varies in physical size and arrangement from that indicated thus causing rearrangement of equipment space, where tight spaces require extreme coordination between this work and other work, where called for elsewhere in these Specifications and where specifically requested by the Owner's Representative. Shop drawings shall be prepared at a scale of not less than 1/4 inch equals 1 foot.

H. The Contractor shall sign the submittal as an indication of compliance with the Contract Documents. If there are any deviations from the Contract Documents, he shall so indicate on the submittal. Any deviations not so indicated shall be cause for rejection and removal of the non-complying equipment at the Contractor’s expense.

1.12 SUBSTITUTIONS

A. Where a single manufacturer is mentioned by trade name or manufacturer's name, unless specifically noted otherwise, it is the only manufacturer that will be accepted.
B. Where multiple manufacturers are listed, none other than those manufacturers will be accepted.
C. Manufacturers not listed will be considered for substitution prior to bid only. The substitute manufacturer shall submit a complete copy of the appropriate technical specification section minimum seven (7) business days prior to bid with each sub-paragraph noted with the comment, "compliance", "deviation", "alternate" or “not applicable”. In the case of non-primary, vendor-supplied items, the name of the sub-vendor supplying said item, including model number, shall be indicated.
    1 By noting the term "compliance" or "C", it shall be understood that the manufacturer is in full compliance with the item specified and will provide exactly the same with no deviations.
    2 By noting the term "deviation" or "D", it shall be understood that the manufacturer prefers to provide a different component in lieu of that specified. Manufacturer shall indicate all deviations.
    3 By noting the term "alternate" or "A", it shall be understood that the manufacturer proposes to provide the same operating function but prefers to do it in a different manner. An alternate shall be fully described as to what the manufacturer proposes to provide.
    4 By noting the term “not applicable” or “N/A”, it shall be understood that the specified item is not applicable to the project.
D. It shall be understood that space allocations have been made on the basis of present and known future requirements and the dimensions of items of equipment or devices of a particular manufacturer whether indicated or not. If any item of equipment or device is offered in substitution which differs substantially in dimension or configuration from that indicated on the Drawings or specifications, provide as part of the submittal 1/4 inch equals 1 foot scaled drawings showing that the substitute can be installed in the space available without interfering with other portions of the work or with access for operations and maintenance in the completed project.
E. Where substitute equipment or devices requiring different arrangement or connections from that indicated is accepted by the Owner's Representative, install the equipment or devices to operate properly and in harmony with the intent of the Contract Documents, making all incidental changes in piping, ductwork or wiring resulting from the equipment or device selection without any additional cost to the Owner. The Contractor shall pay all additional costs incurred by other portions of the work in connection with the substituted equipment or device.
F. The Owner's Representative reserves the right to call for samples of any item of material, equipment or device offered in substitution, together with a sample of the specific item when, in their opinion, the quality of the item and/or the appearance is involved, and it is deemed that an evaluation of the item may be better made by visual inspection.
G. When any request for a substitution of material, equipment or device is submitted and rejected, the item named in the Contract Documents shall be furnished. Repetitive submittal

of substitutions for the same item will not be considered.

1.13 INSTALLATION DRAWINGS

A. Prepare installation drawings for coordinating the work of this Section with the work of other Sections, to illustrate its concealment in finished spaces, to avoid obstructions, and to demonstrate the adaptability of any item of material, equipment or device in the space upon which the Contract Documents are based.

B. Use these drawings in the field for the actual installation of this work. Provide three (3) copies, not for approval, to the Owner's Representative for his information, review and record.

1.14 WORKMANSHIP AND INSTALLATION

A. In no case shall the Contractor provide a class of material, equipment, device or workmanship less than that required by the Contract Documents or applicable codes, regulations, ordinances or standards. All modifications which may be required by a local authority having legal jurisdiction over all or any part of the work shall be made by the Contractor without any additional charge. In all cases where such authority requires deviations from the requirements of the Drawings or Specifications, the Contractor shall report same to the Owner's Representative and shall secure his approval before the work is started.

B. The work shall be performed by properly licensed technicians skilled in their respective trades. All materials, equipment and devices shall be installed in accordance with the recommendations of the manufacturer and in the best standard practice to bring about results of a first class condition.

C. The NECA "Standards of Installation" as published by the National Electrical Contractors Association shall be considered a part of these Specifications, except as specifically modified by other provisions contained in these Specifications.

1.15 INSPECTION OF SITE

A. The accompanying drawings do not indicate existing installations other than to identify modifications of and extensions thereto. The Contractor shall visit the site, inspect the installations and ascertain the conditions to be met and the work to be performed. Failure to comply with this shall not constitute ground for any additional payments in connection with removing or modifying any part of the existing installations and/or installing any new work under this Section.

B. Review construction details of the adjacent building presently under construction during the site inspection and include all work required to modify the existing installations and install new materials, comprising a part of the installation. Review all construction details of the new building as illustrated on the drawings and be guided thereby.

1.16 WARRANTY

A. All materials, equipment, devices and workmanship shall be warranted for a period of one year from the date of acceptance by the Owner's Representative for beneficial use by the Owner, except that where specific equipment is noted to have extended warranties. The warranty shall be in accordance with AIA Document A201. The Contractor shall be responsible for the proper registration of these warranties so that the Owner can make all proper claims should future need develop.

B. The Contractor shall furnish to the Owner's Representative for transmittal to the Owner, the

name, address and telephone number of those persons responsible for service on systems and equipment covered by the warranty.

1.17 OPERATION PRIOR TO ACCEPTANCE

A. When any equipment is operable, and it is to the advantage of the Contractor to operate the equipment, the Contractor may do so provided that he properly supervises the operation, and retains full responsibility for the equipment operated. Regardless of whether or not the equipment has or has not been operated, the Contractor shall clean the equipment properly, make required adjustments and complete punch list items before final acceptance by the Owner.

1.18 INSTRUCTION OF OWNER'S PERSONNEL

A. Provide the services of competent engineers and/or technicians acceptable to the Owner's Representative to instruct other representatives of the Owner in the complete and detailed operation of each item of equipment or device of all the various electrical systems. These instructions shall be provided for whatever periods may be necessary to accomplish the desired results. Upon completion of these instructions, the Contractor shall obtain a letter of release, acknowledged by the Owner or his authorized representative, stating the dates on which the various kinds of instruction were given, and the personnel to whom the instructions were given.

B. The Contractor shall be fully responsible for proper maintenance of equipment and systems until the instructions have been given to the Owner's personnel and the letter of release acknowledged.

C. In providing the instructions to the Owner's personnel, the written operating and maintenance manuals shall be followed in all instances, and the Owner's personnel shall be familiarized with such manuals. Operating and maintenance manuals used for instructions shall include wiring diagrams, manufacturer's operating and maintenance instructions, parts lists (with sources identified), and other data as appropriate for each system.

1.19 SCHEDULE AND SEQUENCE OF WORK

A. The Contractor shall meet and cooperate with the Owner and Owner's Representative to schedule and sequence this work so as to insure meeting scheduled completion dates and avoid delaying other portions of the work. Work requiring special sequencing shall be at no additional cost to the Owner and shall have no impact on the schedule.

1.20 INSTALLATION INSPECTIONS AND CERTIFICATIONS

A. Obtain timely inspections of the installation by the regulatory authorities. Remedy any deficiencies to the satisfaction of the inspecting official.

B. Upon final completion of the work, obtain certificates of acceptance from the regulatory authorities. Deliver the certificates to the Owner's Representative for transmission to the Owner.

1.21 EQUIPMENT INSTALLATION

A. Install equipment and devices in a manner to permit access to all surfaces or components, requiring such access, without the need to disassemble other unrelated parts of the work.

B. Equipment specified to be factory assembled and tested prior to shipment shall not be

disassembled at the job site and reassembled at its final location. Apparatus not so specified may be disassembled and reassembled in the proper location.

C. Furnish all scaffolding, rigging and hoisting required for the installation of all the work.

1.22 CONCRETE HOUSEKEEPING PADS

A. Concrete housekeeping pads shall be provided for all floor mounted equipment, unless noted or required otherwise.

B. All pads shall be not less than 3-1/2" high and extend a maximum 3" beyond the actual equipment size. Coordinate the proper size of the pad with the equipment furnished. Pads shall be poured in forms built of new dressed lumber with corners chamfered using sheet metal or triangular wood strips nailed to the form. Use 6 x 6 No. 3 mesh for reinforcing. Install heavy duty adjustable anchor bolts, set in the form and positioned using templates, prior to pouring concrete. After the equipment is set on the pad, the equipment shall be aligned, leveled and fully grouted to the pad and all void spaces shall be filled with a non-shrinking grout.

C. Perform all concrete work specified to be provided under this Section in strict accordance with the applicable provisions of Section, CONCRETE.

1.23 SLEEVES

A. Each conduit, regardless of material, which passes through a concrete slab, masonry wall, or roof or portion of the building structure shall be free from the structure and shall pass through a sleeve.

B. All sleeves shall be constructed from electrical-metallic tubing or equivalent weight galvanized steel tubing and shall be flush on both sides of the surface penetrated, unless noted otherwise. All sleeves penetrating the roof areas shall extend a minimum 10 inches above the roof with approved weatherproof counterflashing attached to the conduit above the roof. All sleeves penetrating floors shall extend a minimum of 6 inches above the finished floors. The sleeves shall be sized to allow free passage of the conduit to be inserted.

C. Sleeves passing through walls or floors on or below grade or in moist areas shall be constructed of galvanized rigid steel and shall be designed with a suitable flange in the center to form a waterproof passage. After the conduit has been installed in the sleeves, the void space around the conduit shall be caulked and filled with an asphalt-base compound to insure a waterproof penetration. Jute twine caulking shall not be used due to susceptibility to termite infestation.

1.24 ESCUTCHEONS

A. In each finished space, provided a chromium plated, sectional escutcheon on each conduit, or hanger rod penetrating a wall, floor or ceiling.

B. Size escutcheons and collars to fit snugly around conduit and rods.

C. Where required, provide escutcheons with set screws so that they fit snugly against the finished surface.

1.25 ACCESS PANELS

A. Provide wall and ceiling access panels for unrestricted access to all concealed electrical equipment items and devices installed behind furrings, chases or non-removable suspended ceilings.

B. Access panels shall be UL listed and labeled as required to suit the fire rating of the surface in which installed, with mounting straps, concealed hinges, screwdriver locks, 180 degree open

door design, 16 gauge steel construction and door and frame finished in prime coat finish. Panels shall be 12-inch by 12-inch minimum size, but shall be larger as the access requirement of the concealed electrical equipment item or device increases.

1.26 SEALING OF PENETRATIONS

A. All penetrations in horizontal or vertical fire-rated construction shall be sealed using approved fire-rated sealing materials equivalent to the following:
   1 Foam: Dow Corning 3-6548 RTV silicone foam, liquid component Part 4 (black) and liquid component Part B (off-white).
   2 Sealant: Dow Corning 96-081 RTV silicone adhesive sealant.
   3 Damming Materials: Mineral fiberboard, mineral fiber matting, mineral fiber putty, plywood or particle board, as selected by applicator.
B. Preparation: Remove combustible materials and loose impediments from penetration opening and involved surfaces. Remove free liquid and oil from penetration surfaces.
C. Installation: In accordance with manufacturer's instructions, install damming materials and sealant to cover and seal penetration openings; inject foam mixtures into openings.
D. In addition to the Dow Corning products, equal products by Spec Seal Firestop Products, 3M Fire Barrier or CS240 Firestop are acceptable.

1.27 PROTECTION OF APPARATUS

A. At all times take every precaution to properly protect apparatus from damage due to dust, dirt, water, etc. or from damage due to physical forces. Include the erection of temporary shelters as required, to adequately protect any apparatus stored at the site, the cribbing of any apparatus directly above the construction, and the covering of apparatus in the incomplete building with tarpaulins or other protective covering. Failure on the part of the Contractor to comply with the above to the entire satisfaction of the Owner's Representative will be sufficient cause for the rejection of the pieces of apparatus in question.
B. Responsibility for the protection of apparatus extend also to existing apparatus involved in this Section of the work, whether such apparatus is designated to be used temporarily and later removed, or is to be reused as a part of the permanent installation. Erect temporary sheltering structures, provide temporary bracing and supports, or cover equipment as required or directed to afford proper protection for that equipment.
C. The Contractor shall protect this work and the work of all other Contractors from damage by his work or workmen and shall make good any damage thus caused. He shall also be responsible for the proper protection of his equipment, machinery, materials and accessories delivered and installed on the job.

1.28 INSTALLATION OF CONTROL AND OPERATING DEVICES

A. The highest operable part of controls (light switches, dimmer switches, emergency power off devices, etc.), receptacles (electrical and communications) and other operable devices shall be 48" above finish floor. The lowest operable part shall be no less than 15" above finished floor. For purposes of uniformity, unless noted otherwise, the top of a device shall be maximum 48" AFF and the bottom of a device shall be minimum 15" AFF. Refer to the electrical symbols list on the Drawings for specific requirements.
B. Visual alarm appliances shall be placed 80" above finished floor (the highest floor level within a

space) or 6" below the ceiling, whichever is lower.

1.29 INSTALLATION AND CONNECTION OF OTHER SECTION'S EQUIPMENT

A. Verify the electrical requirements of all equipment furnished under other Sections, separate contracts, or by the Owner. Install conduit, power wiring, control wiring, devices, etc. as required for complete operation of all equipment.

1.30 OPTION TO RELOCATE OUTLETS AND RELATED DEVICES

A. The location of power, data and telephone outlets, wall switches and other related devices may be relocated at the Owner's option, at no additional cost to the Owner, to a point within10 feet of their present location provided the Contractor is notified prior to installation.

1.31 COOPERATION AND CLEAN-UP

A. It shall be the responsibility of the Contractor to cooperate fully to keep the job site in a clean and safe condition. Upon the Contractor shall immediately remove all of his tools, equipment, surplus materials and debris.

B. After he installation is complete and before the equipment is energized, clean the interior and exterior of all equipment thouroughly. Clean equipment, removing all debris, rubbish and foreign materials. Each component shall be cleaned and all dust and other foreign material. Components shall be cleaned of oxidation. The inside and outside of all switchgear shall also be wiped clean with lemon-oil rag after all other cleaning is complete. Any portion of the work requiring touch-up finishing shall be so finished to equal the specified finish on the product.

1.32 RECORD DRAWINGS AND DOCUMENTATION FOR OWNER

A. The Contractor shall obtain at his own expense a complete set of blueline prints on which to keep an accurate record of the installation of all materials, equipment and devices covered by the Contract. The Contractor shall record up to date information at least once a week and retain the set of prints on site for periodic review by the Architect/Engineer. The record drawings shall indicate the location of all equipment and devices, and the routing of all systems. If the Contractor prepared large scale installation drawings of electrical rooms, conduit routing, busduct, routing, etc., these drawings or reproducible sepias therefrom shall be revised as required to accurately illustrate the actual installation. All conduit buried in concrete slabs, walls and below grade shall be located by dimension; both horizontally and by vertical elevation, unless a surface mounted device in each space indicates the exact location.

B. Upon anticipated completion of the job, obtain one complete reproducible set of the original drawings on which to neatly, legibly and accurately transfer all project related notations and deliver these record drawings to the Architect/Engineer at job completion before final payment and delivery to the Owner. This information shall be delivered prior to final acceptance.

C. The Contractor shall accumulate in duplicate during the job progress, the following data prepared in indexed 3-ring looseleaf, hard-back binders sized for 8-1/2 inch by 11 inch sheets. No binder shall exceed 3-1/2 inches thick. This data shall be turned over to the Owner's Representative for review and subsequent delivery to the Owner prior to final acceptance.

1 Warranties, guarantees and manufacturer's directions on material, equipment and devices covered by the Contract.

2 Approved lighting fixture brochures, wiring diagrams and control diagrams.

3 Copies of approved submittals and shop drawings.
4 Operating instructions and recommended maintenance procedures for major apparatus.
5 Copies of all other data and/or drawings required during construction.
6 Repair parts list of major apparatus, including name, address and telephone number of local supplier or representative.
7 Tag charts and diagrams hereinbefore specified.

1.33 FINAL OBSERVATION

A. The purpose of the final observation is to determine whether the Contractor has completed the construction in accordance with the Contract Documents and that in the Owner Representative's opinion the installation is satisfactory for final acceptance by the Owner.
B. It shall be the responsibility of the Contractor to assure that the installation is ready for final acceptance prior to calling upon the Owner's Representative to make a final observation.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION (NOT USED)

END OF SECTION

SECTION 26 05 00

COMMON WORK RESULTS FOR ELECTRICAL

1.1 GENERAL

1.2 RELATED DOCUMENTS

Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.3 SUMMARY

This Section includes the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete equipment bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

1.4 DEFINITIONS

EMT: Electrical metallic tubing.

FMC: Flexible metal conduit.

IMC: Intermediate metal conduit.

LFMC: Liquidtight flexible metal conduit.

RNC: Rigid nonmetallic conduit.

1.5 SUBMITTALS

Product Data: For electricity-metering equipment.

Shop Drawings: Dimensioned plans and sections or elevation layouts of electricity-metering equipment.

Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.6 QUALITY ASSURANCE

Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

Comply with NFPA 70.

1.7 COORDINATION

Coordinate chases, slots, inserts, sleeves, and openings with general construction work and arrange in building structure during progress of construction to facilitate the electrical installations that follow.

1. Set inserts and sleeves in poured-in-place concrete, masonry work, and other structural components as they are constructed.

Sequence, coordinate, and integrate installing electrical materials and equipment for efficient flow of the Work. Coordinate installing large equipment requiring positioning before closing in the building.

Coordinate electrical service connections to components furnished by utility companies.

2. Coordinate installation and connection of exterior underground and overhead utilities and services, including provision for electricity-metering components.
3. Comply with requirements of authorities having jurisdiction and of utility company providing electrical power and other services.

Coordinate location of access panels and doors for electrical items that are concealed by finished surfaces. Access doors and panels are specified in Section "Access Doors."

Where electrical identification devices are applied to field-finished surfaces, coordinate installation of identification devices with completion of finished surface.

Where electrical identification markings and devices will be concealed by acoustical ceilings and similar finishes, coordinate installation of these items before ceiling installation.

1.8 PRODUCTS

1.9 EQUIPMENT FOR UTILITY COMPANY'S ELECTRICITY METERING

Current-Transformer Cabinets: Comply with requirements of electrical power utility company.

Meter Sockets: Comply with requirements of electrical power utility company.

Modular Meter Centers: Factory-coordinated assembly of a main meter center circuit-breaker unit with wireways, tenant meter socket modules, and tenant branch circuit breakers arranged in adjacent vertical sections, complete with interconnecting buses.

1. Housing: NEMA 250, Type 3R enclosure.
2. Tenant Branch Circuit Breakers: Series combination rated to protect circuit breakers in downstream panelboards that have 10,000-A interrupting capacity,
3. minimum.

1.10 CONCRETE BASES

Concrete Forms and Reinforcement Materials: As specified in Section "Cast-in-Place Concrete."

Concrete: 3000-psi, 28-day compressive strength as specified in Section "Cast-in-Place Concrete."

1.11 TOUCHUP PAINT

For Equipment: Equipment manufacturer's paint selected to match installed equipment finish.

Galvanized Surfaces: Zinc-rich paint recommended by item manufacturer.

PART 2 - PRODUCTS

PART 3 - EXECUTION

3.1 ELECTRICAL EQUIPMENT INSTALLATION

Headroom Maintenance: If mounting heights or other location criteria are not indicated, arrange and install components and equipment to provide the maximum possible headroom.

Materials and Components: Install level, plumb, and parallel and perpendicular to other building systems and components, unless otherwise indicated.

Equipment: Install to facilitate service, maintenance, and repair or replacement of components. Connect for ease of disconnecting, with minimum interference with other installations.

Right of Way: Give to raceways and piping systems installed at a required slope.

3.2 RACEWAY AND CABLE INSTALLATION

Conceal raceways and cables, unless otherwise indicated, within finished walls, ceilings, and floors.

Install raceways and cables at least 6 inches away from parallel runs of flues and steam or hot-water

pipes. Locate horizontal raceway runs above water and steam piping.

Use temporary raceway caps to prevent foreign matter from entering.

Make conduit bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

Use raceway and cable fittings compatible with raceways and cables and suitable for use and location.

Install raceways embedded in slabs in middle third of slab thickness where practical, and leave at least 1-inch concrete cover.

1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
2. Space raceways laterally to prevent voids in concrete.
3. Install conduit larger than 1-inch trade size parallel to or at right angles to main reinforcement. Where conduit is at right angles to reinforcement, place conduit close to slab support.
4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.
5. Make bends in exposed parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for exposed parallel raceways.

Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb tensile strength. Leave at least 12 inches of slack at each end of the pull wire.

Install telephone and signal system raceways, 2-inch trade size and smaller, in maximum lengths of 150 feet and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements, in addition to requirements above.

Connect motors and equipment subject to vibration, noise transmission, or movement with a maximum of 72-inch flexible conduit. Install LFMC in wet or damp locations. Install separate ground conductor across flexible connections.

Set floor boxes level and trim after installation to fit flush to finished floor surface.

3.3 ELECTRICAL SUPPORTING DEVICE APPLICATION

Damp Locations and Outdoors: Hot-dip galvanized materials or nonmetallic, U-channel system components.

Dry Locations: Steel materials.

Support Clamps for PVC Raceways: Click-type clamp system.

Selection of Supports: Comply with manufacturer's written instructions.

Strength of Supports: Adequate to carry present and future loads, times a safety factor of at least four; minimum of 200-lb design load.

3.4 SUPPORT INSTALLATION

Install support devices to securely and permanently fasten and support electrical components.

Install individual and multiple raceway hangers and riser clamps to support raceways. Provide U-bolts, clamps, attachments, and other hardware necessary for hanger assemblies and for securing hanger rods and conduits.

Support parallel runs of horizontal raceways together on trapeze- or bracket-type hangers.

Size supports for multiple raceway installations so capacity can be increased by a 25 percent minimum in the future.

Support individual horizontal raceways with separate, malleable-iron pipe hangers or clamps.

Install 1/4-inch-diameter or larger threaded steel hanger rods, unless otherwise indicated.

Spring-steel fasteners specifically designed for supporting single conduits or tubing may be used instead of malleable-iron hangers for 1-1/2-inch and smaller raceways serving lighting and receptacle branch circuits above suspended ceilings and for fastening raceways to slotted channel and angle supports.

Arrange supports in vertical runs so the weight of raceways and enclosed conductors is carried entirely by raceway supports, with no weight load on raceway terminals.

Simultaneously install vertical conductor supports with conductors.

Separately support cast boxes that are threaded to raceways and used for fixture support. Support sheet-metal boxes directly from the building structure or by bar hangers. If bar hangers are used, attach bar to raceways on opposite sides of the box and support the raceway with an approved fastener not more than 24 inches from the box.

Install metal channel racks for mounting cabinets, panelboards, disconnect switches, control enclosures, pull and junction boxes, transformers, and other devices unless components are mounted directly to structural elements of adequate strength.

Install sleeves for cable and raceway penetrations of concrete slabs and walls unless core-drilled holes are used. Install sleeves for cable and raceway penetrations of masonry and fire-rated gypsum walls and of all other fire-rated floor and wall assemblies. Install sleeves during erection of concrete and masonry walls.

Securely fasten electrical items and their supports to the building structure, unless otherwise indicated. Perform fastening according to the following unless other fastening methods are indicated:

1. Wood: Fasten with wood screws or screw-type nails.
2. Masonry: Toggle bolts on hollow masonry units and expansion bolts on solid masonry units.
3. New Concrete: Concrete inserts with machine screws and bolts.
4. Existing Concrete: Expansion bolts.
5. Instead of expansion bolts, threaded studs driven by a powder charge and provided with lock washers may be used in existing concrete.
6. Steel: Welded threaded studs or spring-tension clamps on steel.

    a. Field Welding: Comply with AWS D1.1.

7. Welding to steel structure may be used only for threaded studs, not for conduits, pipe straps, or other items.
8. Light Steel: Sheet-metal screws.
9. Fasteners: Select so the load applied to each fastener does not exceed 25 percent of its proof-test load.

3.5 IDENTIFICATION MATERIALS AND DEVICES

Install at locations for most convenient viewing without interference with operation and maintenance of equipment.

Coordinate names, abbreviations, colors, and other designations used for electrical identification with corresponding designations indicated in the Contract Documents or required by codes and standards. Use consistent designations throughout Project.

Self-Adhesive Identification Products: Clean surfaces before applying.

Identify raceways and cables with color banding as follows:

1. Bands: Pretensioned, snap-around, colored plastic sleeves or colored adhesive marking tape. Make each color band 2 inches wide, completely encircling conduit, and place adjacent bands of two-color markings in contact, side by side.
2. Band Locations: At changes in direction, at penetrations of walls and floors, at 50-foot maximum intervals in straight runs, and at 25-foot maximum intervals in congested areas.
3. Colors: As follows:

    a. Fire Alarm System: Red.
    b. Security System: Blue and yellow.
    c. Telecommunication System: Green and yellow.

Tag and label circuits designated to be extended in the future. Identify source and circuit numbers in each cabinet, pull and junction box, and outlet box. Color-coding may be used for voltage and phase identification.

Install continuous underground plastic markers during trench backfilling, for exterior underground power, control, signal, and communication lines located directly above power and communication lines. Locate 6 to 8 inches below finished grade. If width of multiple lines installed in a common trench or concrete envelope does not exceed 16 inches, overall, use a single line marker.

Color-code 208/120-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

4. Phase A: Black.
5. Phase B: Red.
6. Phase C: Blue.
7. Neutral: White.
8. Ground: Green.

Color-code 480/277-V system secondary service, feeder, and branch-circuit conductors throughout the secondary electrical system as follows:

9. Phase A: BROWN.
10. Phase B: ORANGE.
11. Phase C: YELLOW.
12. Neutral: White with a colored stripe or gray.
13. Ground: Green.

Install warning, caution, and instruction signs where required to comply with 29 CFR, Chapter XVII, Part 1910.145, and where needed to ensure safe operation and maintenance of electrical systems and of items to which they connect. Install engraved plastic-laminated instruction signs with approved legend where instructions are needed for system or equipment operation. Install metal-backed butyrate signs for outdoor items.

Install engraved-laminated emergency-operating signs with white letters on red background with minimum 3/8-inch-high lettering for emergency instructions on power transfer, load shedding, and other emergency operations.

3.6 UTILITY COMPANY ELECTRICITY-METERING EQUIPMENT

Install equipment according to utility company's written requirements. Provide grounding and empty conduits as required by utility company.

3.7 FIRESTOPPING

Apply firestopping to cable and raceway penetrations of fire-rated floor and wall assemblies to achieve fire-resistance rating of the assembly. Firestopping materials and installation requirements are specified in Section "Firestopping."

3.8 CONCRETE BASES

Construct concrete bases of dimensions indicated, but not less than 4 inches larger, in both directions, than supported unit. Follow supported equipment manufacturer's anchorage recommendations and setting templates for anchor-bolt and tie locations, unless otherwise indicated. Use 3000-psi, 28-day compressive-strength concrete and reinforcement as specified in Section "Cast-in-Place Concrete."

3.9 CUTTING AND PATCHING

Cut, channel, chase, and drill floors, walls, partitions, ceilings, and other surfaces required to permit electrical installations. Perform cutting by skilled mechanics of trades involved.

Repair and refinish disturbed finish materials and other surfaces to match adjacent undisturbed surfaces. Install new fireproofing where existing firestopping has been disturbed. Repair and refinish materials and other surfaces by skilled mechanics of trades involved.

3.10 FIELD QUALITY CONTROL

Inspect installed components for damage and faulty work, including the following:

1. Raceways.
2. Building wire and connectors.
3. Supporting devices for electrical components.
4. Electrical identification.
5. Electricity-metering components.
6. Concrete bases.
7. Electrical demolition.
8. Cutting and patching for electrical construction.
9. Touchup painting.

Test Owner's electricity-metering installation for proper operation, accuracy, and usability of output data.

10. Connect a load of known kW rating, 1.5 kW minimum, to a circuit supplied by the metered feeder.
11. Turn off circuits supplied by the metered feeder and secure them in the "off" condition.
12. Run the test load continuously for eight hours, minimum, or longer to obtain a measurable meter indication. Use a test load placement and setting that ensure continuous, safe operation.
13. Check and record meter reading at end of test period and compare with actual electricity used based on test load rating, duration of test, and sample measurements of supply voltage at the test load connection. Record test results.
14. Repair or replace malfunctioning metering equipment or correct test setup; then retest. Repeat for each meter in installation until proper operation of entire system is verified.

3.11 REFINISHING AND TOUCHUP PAINTING

Refinish and touch up paint. Paint materials and application requirements are specified in Section "Painting."

Clean damaged and disturbed areas and apply primer, intermediate, and finish coats to suit the degree of damage at each location.

1. Follow paint manufacturer's written instructions for surface preparation and for timing and application of successive coats.
2. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
3. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.12 CLEANING AND PROTECTION

1. On completion of installation, including outlets, fittings, and devices, inspect exposed finish. Remove burrs, dirt, paint spots, and construction debris.
2. Protect equipment and installations and maintain conditions to ensure that coatings, finishes, and cabinets are without damage or deterioration at time of Substantial Completion.

END OF SECTION

SECTION 26 05 19

LOW-VOLTAGE ELECTRICAL POWER CONDUCTOR AND CABLES

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes building wires and cables and associated connectors, splices, and terminations for wiring systems rated 600 V and less.

1.3 SUBMITTALS

A. Field Test Reports: Indicate and interpret test results for compliance with performance requirements.

1.4 QUALITY ASSURANCE

A. Listing and Labeling: Provide wires and cables specified in this Section that are listed and labeled.
   1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.

B. Comply with NFPA 70.

1.5 DELIVERY, STORAGE, AND HANDLING

A. Deliver wires and cables according to NEMA WC 26.

1.6 COORDINATION

A. Coordinate layout and installation of cables with other installations.

B. Revise locations and elevations from those indicated, as required to suit field conditions and as approved by Architect.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Manufacturers: Subject to compliance with requirements, provide products by one of the following:
   1. Wires and Cables:
      a. American Insulated Wire Corp.; Leviton Manufacturing Co.
      b. BICC Brand-Rex Company.
      c. Carol Cable Co., Inc.
      d. Senator Wire & Cable Company.
      e. Southwire Company.
   2. Connectors for Wires and Cables:
      a. AMP Incorporated.

b. General Signal; O-Z/Gedney Unit.
c. Monogram Co.; AFC.
d. Square D Co.; Anderson.
e. 3M Company; Electrical Products Division.

2.2 BUILDING WIRES AND CABLES

A. UL-listed building wires and cables with conductor material, insulation type, cable construction, and rating as specified in Part 3 "Wire and Insulation Applications" Article.
B. Rubber Insulation Material: Comply with NEMA WC 3.
C. Thermoplastic Insulation Material: Comply with NEMA WC 5.
D. Ethylene Propylene Rubber Insulation Material: Comply with NEMA WC 8.
E. Conductor Material: Copper.
F. Stranding: Solid conductor for No. 10 AWG and smaller; stranded conductor for larger than No. 10 AWG.
G. Plenum rated cable for all cables above the ceiling.

2.3 CONNECTORS AND SPLICES

A. UL-listed, factory-fabricated wiring connectors of size, ampacity rating, material, type, and class for application and service indicated. Comply with Project's installation requirements and as specified in Part 3 "Wire and Insulation Applications" Article.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine raceways and building finishes to receive wires and cables for compliance with requirements for installation tolerances and other conditions affecting performance of wires and cables. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRE AND INSULATION APPLICATIONS

A. Service Entrance: Type RHW or THWN, in raceway.
B. Feeders: Type 75C insulation THHN/THWN, in raceway.
C. Fire-Pump Feeder: Type MI, 3-conductor.
D. Branch Circuits: Type THHN/THWN, in raceway.
E. Fire Alarm Circuits: Type THHN/THWN, in raceway.
F. Class 1 Control Circuits: Type THHN/THWN, in raceway.
G. Class 2 Control Circuits: Type THHN/THWN, in raceway.
H. Equipment or any device rated 100 amperes or less, conductor shall be rated 60C as per National Electrical Code.
I. Equipment or any device rated over 100 amperes, conductor shall be rated 75C as per National Electrical Code.

3.3 INSTALLATION

A. Install wires and cables as indicated, according to manufacturer's written instructions and NECA's "Standard of Installation."
B. Remove existing wires from raceway before pulling in new wires and cables.
C. Pull Conductors: Use manufacturer-approved pulling compound or lubricant where necessary;

compound used must not deteriorate conductor or insulation. Do not exceed manufacturer's recommended maximum pulling tensions and sidewall pressure values.

D. Use pulling means, including fish tape, cable, rope, and basket-weave wire/cable grips, that will not damage cables or raceway.
E. Install exposed cables, parallel and perpendicular to surfaces of exposed structural members, and follow surface contours where possible.
F. Support cables according to Section "Basic Electrical Materials and Methods."
G. Seal around cables penetrating fire-rated elements according to Section "Firestopping."
H. Identify wires and cables according to Section "Basic Electrical Materials and Methods."
I. Identify wires and cables according to Section "Electrical Identification."

3.4 CONNECTIONS

A. Conductor Splices: Keep to minimum.
B. Install splices and tapes that possess equivalent or better mechanical strength and insulation ratings than conductors being spliced.
C. Use splice and tap connectors compatible with conductor material.
D. Use oxide inhibitor in each splice and tap connector for aluminum conductors.
E. Wiring at Outlets: Install conductor at each outlet, with at least 12 inches (300 mm) of slack.
F. Connect outlets and components to wiring and to ground as indicated and instructed by manufacturer.
G. Tighten electrical connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

3.5 FIELD QUALITY CONTROL

A. Testing: On installation of wires and cables and before electrical circuitry has been energized, demonstrate product capability and compliance with requirements.
   1. Procedures: Perform each visual and mechanical inspection and electrical test stated in NETA ATS, Section 7.3.1. Certify compliance with test parameters.
B. Correct malfunctioning conductors and cables at Project site, where possible, and retest to demonstrate compliance; otherwise, remove and replace with new units and retest.

END OF SECTION

SECTION 26 05 26

GROUNDING AND BONDING FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes grounding and bonding of electrical systems and equipment. Grounding requirements specified in this Section may be supplemented by special requirements of systems described in other Sections.

B. Related Sections include the following:

1. List below only products, construction, and equipment that the reader might expect to find in this Section but are specified elsewhere.
2. Section "Underground Ducts and Utility Structures" for ground test wells.

1.3 SUBMITTALS

A. Revise this Article to suit Project and office practice. Frequently, no product submittal is required for this Section.

B. Product Data: For each type of product indicated.

C. Retain paragraph above if Product Data are required for each product specified. Retain paragraph below if Product Data are required only for selected products.

D. Product Data: For the following:

1. Ground rods.
2. Chemical rods.
3. Qualification Data: For firms and persons specified in "Quality Assurance" Article.

E. Field Test Reports: Submit written test reports to include the following:

1. Test procedures used.
2. Test results that comply with requirements.
3. Results of failed tests and corrective action taken to achieve test results that comply with requirements.

1.4 QUALITY ASSURANCE

A. Retain paragraph and subparagraph below if Contractor or manufacturer selects testing agency. Delete if Contractor is allowed to perform ground-resistance testing.

B. Electrical Components, Devices, and Accessories: Listed and labeled as defined in NFPA 70, Article 100, by a testing agency acceptable to authorities having jurisdiction, and marked for intended use.

1. Comply with UL 467.

C. Comply with NFPA 70; for overhead-line construction and medium-voltage underground construction, comply with IEEE C2.

D. Comply with NFPA 780 and UL 96 when interconnecting with lightning protection system.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. See Editing Instruction No. 1 in the Evaluations for cautions about naming products and manufacturers.
2. Grounding Conductors, Cables, Connectors, and Rods:
   a. Apache Grounding/Erico Inc.
   b. Boggs, Inc.
   c. Chance/Hubbell.
   d. Copperweld Corp.
   e. Dossert Corp.
   f. Erico Inc.; Electrical Products Group.
   g. Framatome Connectors/Burndy Electrical.
   h. Galvan Industries, Inc.
   i. Hastings Fiber Glass Products, Inc.
   j. Ideal Industries, Inc.
   k. ILSCO.
   l. Kearney/Cooper Power Systems.
   m. Korns: C. C. Korns Co.; Division of Robroy Industries.
   n. Lightning Master Corp.
   o. Lyncole XIT Grounding.
   p. O-Z/Gedney Co.; a business of the EGS Electrical Group.
   q. Raco, Inc.; Division of Hubbell.
   r. Robbins Lightning, Inc.
   s. Salisbury: W. H. Salisbury & Co.
   t. Superior Grounding Systems, Inc.
   u. Thomas & Betts, Electrical.

2.2 GROUNDING CONDUCTORS

A. For insulated conductors, comply with Section "Conductors and Cables."

B. If only copper conductors are permitted in Division 16 Section "Conductors and Cables," delete paragraph below.

C. Material: copper.

D. Equipment Grounding Conductors: Insulated with green-colored insulation.

E. Grounding Electrode Conductors: Stranded cable.

F. Underground Conductors: stranded, unless otherwise indicated.
G. Sizes and types below are typical. Adjust to suit Project conditions and requirements.
H. Copper Bonding Conductors: As follows:
1. Bonding Cable: 28 kcmil, 14 strands of No. 17 AWG copper conductor, 1/4 inch (6.4 mm) in diameter.
2. Bonding Conductor: No. 4 or No. 6 AWG, stranded copper conductor.
3. Bonding Jumper: Bare copper tape, braided bare copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.
4. Tinned Bonding Jumper: Tinned-copper tape, braided copper conductors, terminated with copper ferrules; 1-5/8 inches (42 mm) wide and 1/16 inch (1.5 mm) thick.

2.3 CONNECTOR PRODUCTS
A. Comply with IEEE 837 and UL 467; listed for use for specific types, sizes, and combinations of conductors and connected items.
B. Bolted Connectors: Bolted-pressure-type connectors, or compression type.
C. Welded Connectors: Exothermic-welded type, in kit form, and selected per manufacturer's written instructions.

2.4 GROUNDING ELECTRODES
A. Copper-clad steel is most common. See Evaluations for discussion on where other materials might be more appropriate.
B. Ground Rods: Copper-clad steel.
1. Select paragraph above or paragraph and subparagraph below. Sectional types are used when rods longer than 10 feet (3 m) are installed.
2. Size: 3/4 by 120 inches (19 by 3000 mm) in diameter.

PART 3 - EXECUTION

3.1 APPLICATION
A. Use only copper conductors for both insulated and bare grounding conductors in direct contact with earth, concrete, masonry, crushed stone, and similar materials.
B. In raceways, use insulated equipment grounding conductors.
C. Exothermic-Welded Connections: Use for connections to structural steel and for underground connections, except those at test wells.
D. Equipment Grounding Conductor Terminations: Use bolted pressure clamps.

3.2 EQUIPMENT GROUNDING CONDUCTORS
A. Comply with NFPA 70, Article 250, for types, sizes, and quantities of equipment grounding conductors, unless specific types, larger sizes, or more conductors than required by NFPA 70 are indicated.
B. Install equipment grounding conductors in all feeders and circuits.
C. Install insulated equipment grounding conductor with circuit conductors for the following items, in addition to those required by NEC:
1. Feeders and branch circuits.
2. Lighting circuits.
3. Receptacle circuits.
4. Single-phase motor and appliance branch circuits.

5. Three-phase motor and appliance branch circuits.
6. Flexible raceway runs.
7. Armored and metal-clad cable runs.

D. Nonmetallic Raceways: Install an equipment grounding conductor in nonmetallic raceways unless they are designated for telephone or data cables.

3.3 INSTALLATION

A. Ground Rods: Install at least three rods spaced at least one-rod length from each other and located at least the same distance from other grounding electrodes.
1. Drive ground rods until tops are 2 inches (50 mm) below finished floor or final grade, unless otherwise indicated.
2. Interconnect ground rods with grounding electrode conductors. Use exothermic welds, except at test wells and as otherwise indicated. Make connections without exposing steel or damaging copper coating.

B. Grounding Conductors: Route along shortest and straightest paths possible, unless otherwise indicated. Avoid obstructing access or placing conductors where they may be subjected to strain, impact, or damage.

C. Bonding Straps and Jumpers: Install so vibration by equipment mounted on vibration isolation hangers and supports is not transmitted to rigidly mounted equipment. Use exothermic-welded connectors for outdoor locations, unless a disconnect-type connection is required; then, use a bolted clamp. Bond straps directly to the basic structure taking care not to penetrate any adjacent parts. Install straps only in locations accessible for maintenance.

D. Bond each aboveground portion of gas piping system upstream from equipment shutoff valve.

E. Install one test well for each service at the ground rod electrically closest to the service entrance. Set top of well flush with finished grade or floor.

3.4 CONNECTIONS

A. General: Make connections so galvanic action or electrolysis possibility is minimized. Select connectors, connection hardware, conductors, and connection methods so metals in direct contact will be galvanically compatible.
1. Use electroplated or hot-tin-coated materials to ensure high conductivity and to make contact points closer to order of galvanic series.
2. Make connections with clean, bare metal at points of contact.
3. Make aluminum-to-steel connections with stainless-steel separators and mechanical clamps.
4. Make aluminum-to-galvanized steel connections with tin-plated copper jumpers and mechanical clamps.
5. Coat and seal connections having dissimilar metals with inert material to prevent future penetration of moisture to contact surfaces.

B. Exothermic-Welded Connections: Comply with manufacturer's written instructions. Welds that are puffed up or that show convex surfaces indicating improper cleaning are not acceptable.

C. Equipment Grounding Conductor Terminations: For No. 8 AWG and larger, use pressure-type grounding lugs. No. 10 AWG and smaller grounding conductors may be terminated with winged pressure-type connectors.

D. Noncontact Metal Raceway Terminations: If metallic raceways terminate at metal housings without mechanical and electrical connection to housing, terminate each conduit with a grounding bushing. Connect grounding bushings with a bare grounding conductor to grounding bus or terminal in housing. Bond electrically noncontinuous conduits at entrances and exits with grounding bushings and bare grounding conductors, unless otherwise indicated.

E. Tighten screws and bolts for grounding and bonding connectors and terminals according to manufacturer's published torque-tightening values. If manufacturer's torque values are not indicated, use those specified in UL 486A and UL 486B.

F. Compression-Type Connections: Use hydraulic compression tools to provide correct circumferential pressure for compression connectors. Use tools and dies recommended by connector manufacturer. Provide embossing die code or other standard method to make a visible indication that a connector has been adequately compressed on grounding conductor.

G. Moisture Protection: If insulated grounding conductors are connected to ground rods or grounding buses, insulate entire area of connection and seal against moisture penetration of insulation and cable.

3.5 FIELD QUALITY CONTROL

A. Testing: Perform the following field quality-control testing:

1. After installing grounding system but before permanent electrical circuitry has been energized, test for compliance with requirements.

3.6 GRADING AND PLANTING

A. Restore surface features, including vegetation, at areas disturbed by Work of this Section. Reestablish original grades, unless otherwise indicated. If sod has been removed, replace it as soon as possible after backfilling is completed. Restore areas disturbed by trenching, storing of dirt, cable laying, and other activities to their original condition. Include application of topsoil, fertilizer, lime, seed, sod, sprig, and mulch. Comply with Section "Landscaping." Maintain restored surfaces. Restore disturbed paving as indicated.

END OF SECTION

SECTION 26 05 29

HANGERS AND SUPPORTS FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

B. Comply with this sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of supporting devices, including related systems and accessories.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Unistrut Corp.

B. B-Line Systems, Inc.

C. Midland Ross-Kindorf

2.2 MATERIALS

A. Suspension Hangers

1. Suspension hangers for individual conduit runs shall be zinc plated formed steel type.

B. Vertical Supports

1. Malleable iron one hole pipe straps shall be used for vertical runs

C. Clamps

1. Beam clamps shall be used for bar joists and beams.

D. Anti-Vibration Hangers

1. Anti-vibration hangers shall be combination type having a double deflection neoprene element in series with a steel coil spring; double deflection of 0.30"; steel coil spring shall be selected from a 1" static deflection series with a minimum additional travel to solid of ½"; spring diameters shall be large enough to permit 15 degree angular misalignment of the rod connecting the hanger to the ceiling support without rubbing the hanger box.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Hangers

1. Approved hangers and stiff leg supports shall be installed in quantity and size as required to carry the weight of raceway and contents and shall be arranged to prevent vibration transmission to the building and allow for raceway movement.
2. Hangers shall be supported by means of uncoated solid steel rods which are threaded to allow vertical adjustments. Lock nuts shall be provided in sufficient number and location to lock all rod adjustments permanently at the adjusted height. Two lock nuts shall be used unless the nut tightens against a threaded socket. Minimum rod diameters shall be as follows:

B. NOMINAL CONDUIT SIZE ROD DIAMETER

1/2" through 2 1/4"

2-1/2" through 3 3/8" 4" and 5 1/2"

1. Hanger spacing shall be as required for proper and adequate support raceway, but in no case shall be less than one hanger per 8'-0" of raceway length except that conduit less than 1" diameter shall be supported at least every 6'-0".
2. Where numerous conduits are run parallel to one another, they may be supported from a trapeze type hanger arrangement with strut bottom.
3. Anti-vibration type hangers shall be provided for equipment as required to minimize vibration and/or as directed by the Architect/Engineer.

Supports

4. Support of hangers shall be by means of sufficient quantities of individual after set steel expansion shields, or beam clamps attached to structural steel.
5. Stiff-legs shall be furnished and installed in cases where support from overhead structure is not possible.
6. Ceiling mounted lighting fixtures shall be supported from the building structure at two opposite corners. The Contractor shall provide fixture hangers to properly interface with the ceiling system.
7. Furnish and install complete any additional structural support steel, brackets, fasteners, etc., as required to adequately support all raceway and equipment.
8. Support of hangers from concrete slabs shall be by means of sufficient quantity of "U" brackets attached with after set expansion shields and bolts.
9. Support of hangers from concrete tees shall be by means of sufficient quantity of angle iron brackets attached with after set expansion shields and bolts.

END OF SECTION

SECTION 26 05 33

RACEWAYS AND BOXES FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED DOCUMENTS

A. Drawings and general provisions of the Contract, including General and Supplementary Conditions and Specification Sections, apply to this Section.

1.2 SUMMARY

A. This Section includes raceways, fittings, boxes, enclosures, and cabinets for electrical wiring.
   1. Edit lists below to suit Project.
   2. Raceways include the following:
      a. RMC.
      b. IMC.
      c. PVC externally coated, rigid steel conduits.
      d. PVC externally coated, IMC.
      e. EMT.
      f. FMC.
      g. LFMC.
      h. LFNC.
      i. RNC.
      j. ENT.
      k. Wireways.
      l. Surface raceways.
   3. Boxes, enclosures, and cabinets include the following:
      a. Device boxes.
      b. Floor boxes.
      c. Outlet boxes.
      d. Pull and junction boxes.
      e. Cabinets and hinged-cover enclosures.

B. Related Sections include the following:
   1. List below only products and equipment for this Project that the reader might expect to find in this Section but are specified elsewhere. Verify that Section titles listed below are correct for this Project's Specifications because Section titles may have changed since this Section was updated.
   2. Section "Basic Electrical Materials and Methods" for raceways and box supports.
   3. Section "Wiring Devices" for devices installed in boxes and for floor-box service fittings.

1.3 DEFINITIONS

A. EMT: Electrical metallic tubing.
B. ENT: Electrical nonmetallic tubing.
C. FMC: Flexible metal conduit.
D. IMC: Intermediate metal conduit.
E. LFMC: Liquidtight flexible metal conduit.
F. LFNC: Liquidtight flexible nonmetallic conduit.
G. RMC: Rigid metal conduit.

H. RNC: Rigid nonmetallic conduit.

1.4 SUBMITTALS

A. Product Data: For surface raceways, wireways and fittings, floor boxes, hinged-cover enclosures, and cabinets.

B. Delete below except for custom enclosures.

C. Shop Drawings: Include layout drawings showing components and wiring for nonstandard boxes, enclosures, and cabinets.

1.5 QUALITY ASSURANCE

A. Listing and Labeling: Provide raceways and boxes specified in this Section that are listed and labeled.

1. The Terms "Listed" and "Labeled": As defined in NFPA 70, Article 100.
2. Listing and Labeling Agency Qualifications: A "Nationally Recognized Testing Laboratory" as defined in OSHA Regulation 1910.7.

B. Comply with NECA's "Standard of Installation."

C. Comply with NFPA 70.

1.6 COORDINATION

A. Coordinate layout and installation of raceways and boxes with other construction elements to ensure adequate headroom, working clearance, and access.

PART 2 - PRODUCTS

2.1 MANUFACTURERS

A. Available Manufacturers: Subject to compliance with requirements, manufacturers offering products that may be incorporated into the Work include, but are not limited to, the following:

B. Retain above for nonproprietary or below for semiproprietary Specification. Refer to Division 1 Section "Materials and Equipment."

C. Manufacturers: Subject to compliance with requirements, provide products by one of the following:

1. Metal Conduit and Tubing:
    a. Alflex Corp.
    b. Anamet, Inc.; Anaconda Metal Hose.
    c. Anixter Brothers, Inc.
    d. Carol Cable Co., Inc.
    e. Cole-Flex Corp.
    f. Electri-Flex Co.
    g. Flexcon, Inc.; Coleman Cable Systems, Inc.
    h. Grinnell Co.; Allied Tube and Conduit Div.
    i. Monogram Co.; AFC.
    j. Spiraduct, Inc.
    k. Triangle PWC, Inc.
    l. Wheatland Tube Co.
2. Nonmetallic Conduit and Tubing:
    a. Anamet, Inc.; Anaconda Metal Hose.
    b. Arnco Corp.
    c. Breeze-Illinois, Inc.
    d. Cantex Industries; Harsco Corp.
    e. Certainteed Corp.; Pipe & Plastics Group.

f. Cole-Flex Corp.
g. Condux International; Electrical Products.
h. Electri-Flex Co.
i. George-Ingraham Corp.
j. Hubbell, Inc.; Raco, Inc.
k. Lamson & Sessions; Carlon Electrical Products.
l. R&G Sloan Manufacturing Co., Inc.
m. Spiraduct, Inc.
n. Thomas & Betts Corp.

3. Conduit Bodies and Fittings:
   a. American Electric; Construction Materials Group.
   b. Crouse-Hinds; Div. of Cooper Industries.
   c. Emerson Electric Co.; Appleton Electric Co.
   d. Hubbell, Inc.; Killark Electric Manufacturing Co.
   e. Lamson & Sessions; Carlon Electrical Products.
   f. O-Z/Gedney; Unit of General Signal.
   g. Scott Fetzer Co.; Adalet-PLM.
   h. Spring City Electrical Manufacturing Co.
4. Metal Wireways:
   a. Hoffman Engineering Co.
   b. Keystone/Rees, Inc.
   c. Square D Co.

2.2 METAL CONDUIT AND TUBING

A. Rigid Steel Conduit: ANSI C80.1.
B. Rigid Aluminum Conduit: ANSI C80.5.
C. IMC: ANSI C80.6.
D. EMT and Fittings: ANSI C80.3.
   1. Fittings: Set-screw type.
E. Fittings: NEMA FB 1; compatible with conduit/tubing materials.

2.3 NONMETALLIC CONDUIT AND TUBING

A. RNC: NEMA TC 2, Schedule 40 or 80 PVC.
B. RNC Fittings: NEMA TC 3; match to conduit or conduit/tubing type and material.
C. LFNC: UL 1660.

2.4 METAL WIREWAYS

A. Material: Sheet metal sized and shaped as indicated.
B. Fittings and Accessories: Include couplings, offsets, elbows, expansion joints, adapters, hold-down straps, end caps, and other fittings to match and mate with wireways as required for complete system.
C. Select features, unless otherwise indicated, as required to complete wiring system and to comply with NFPA 70.
D. Select 1 of 4 paragraphs below.
E. Wireway Covers: Screw – cover type flanged-and-gasketed type.
F. Finish: Manufacturer's standard enamel finish.

2.5 OUTLET AND DEVICE BOXES

A. Sheet Metal Boxes: NEMA OS 1.

B. Edit paragraph below. Aluminum is also available and suitable for use with steel raceways.

C. Cast-Metal Boxes: NEMA FB 1, Type FD, cast box with gasketed cover.

2.6 PULL AND JUNCTION BOXES

A. Small Sheet Metal Boxes: NEMA OS 1.

B. Cast-Metal Boxes: NEMA FB 1, cast aluminum with gasketed cover.

2.7 ENCLOSURES AND CABINETS

A. Hinged-Cover Enclosures: NEMA 250, Type 1, with continuous hinge cover and flush latch.
   1. Metal Enclosures: Steel, finished inside and out with manufacturer's standard enamel.
   2. Nonmetallic Enclosures: Plastic, finished inside with radio-frequency-resistant paint.

B. Cabinets: NEMA 250, Type 1, galvanized steel box with removable interior panel and removable front, finished inside and out with manufacturer's standard enamel. Hinged door in front cover with flush latch and concealed hinge. Key latch to match panelboards. Include metal barriers to separate wiring of different systems and voltage, and include accessory feet where required for freestanding equipment.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Examine surfaces to receive raceways, boxes, enclosures, and cabinets for compliance with installation tolerances and other conditions affecting performance of raceway installation. Do not proceed with installation until unsatisfactory conditions have been corrected.

3.2 WIRING METHODS

A. Use a comprehensive wiring method schedule on Drawings or use this Article to specify where various raceway types are to be installed. Edit examples below, adding or deleting materials and methods to suit Project. Coordinate with Division 16 Section "Wires and Cables." Do not duplicate information on Drawings, in NFPA 70, or in other Division 16 Sections. List exceptions to stated requirements. Check code to avoid specifying uses not permitted.

B. Outdoors: Use the following wiring methods:
   1. Exposed: Rigid steel.
   2. Concealed: Rigid steel.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC.
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): LFMC.
   6. Boxes and Enclosures: NEMA 250, Type 3R .

C. Indoors: Use the following wiring methods:
   1. Exposed: EMT.
   2. Concealed: EMT.
   3. Underground, Single Run: RNC.
   4. Underground, Grouped: RNC
   5. Connection to Vibrating Equipment (Including Transformers and Hydraulic, Pneumatic, Electric Solenoid, or Motor-Driven Equipment): FMC; except in wet or damp locations, use LFMC.
   6. Damp or Wet Locations: Rigid steel conduit.
   7. Boxes and Enclosures: NEMA 250, Type 1, except as follows:
      a. Select 1 of 2 subparagraphs below and add other specific box and enclosure requirements to suit Project.
      b. Damp or Wet Locations: NEMA 250, Type 4, stainless steel.

3.3 INSTALLATION

A. Install raceways, boxes, enclosures, and cabinets as indicated, according to manufacturer's written instructions.

B. Select paragraph above or below.

C. Minimum Raceway Size: 3/4-inch trade size (DN21).

D. Conceal conduit and EMT, unless otherwise indicated, within finished walls, ceilings, and floors.

E. Keep raceways at least 6 inches (150 mm) away from parallel runs of flues and steam or hot-water pipes. Install horizontal raceway runs above water and steam piping.

F. Install raceways level and square and at proper elevations. Provide adequate headroom.

G. Complete raceway installation before starting conductor installation.

H. Support raceways as specified in Section "Basic Electrical Materials and Methods."

I. Use temporary closures to prevent foreign matter from entering raceways.

J. Protect stub-ups from damage where conduits rise through floor slabs. Arrange so curved portion of bends is not visible above the finished slab.

K. Make bends and offsets so ID is not reduced. Keep legs of bends in the same plane and straight legs of offsets parallel, unless otherwise indicated.

L. Use raceway fittings compatible with raceways and suitable for use and location. For intermediate steel conduit, use threaded rigid steel conduit fittings, unless otherwise indicated.

M. Run concealed raceways, with a minimum of bends, in the shortest practical distance considering the type of building construction and obstructions, unless otherwise indicated.

N. Raceways Embedded in Slabs (Must be indicated on drawings to be embedded. Please notify Engineer if required but not shown): Install in middle third of slab thickness where practical, and leave at least 1-inch (25-mm) concrete cover.
   1. Secure raceways to reinforcing rods to prevent sagging or shifting during concrete placement.
   2. Space raceways laterally to prevent voids in concrete.
   3. Run conduit larger than 1-inch trade size (DN27) parallel to or at right angles to main reinforcement. Where at right angles to reinforcement, place conduit close to slab support.
   4. Transition from nonmetallic tubing to Schedule 80 nonmetallic conduit, rigid steel conduit, or IMC before rising above floor.

O. Install exposed raceways parallel to or at right angles to nearby surfaces or structural members, and follow the surface contours as much as practical.
   1. Run parallel or banked raceways together, on common supports where practical.
   2. Make bends in parallel or banked runs from same centerline to make bends parallel. Use factory elbows only where elbows can be installed parallel; otherwise, provide field bends for parallel raceways.

P. Join raceways with fittings designed and approved for the purpose and make joints tight.
   1. Make raceway terminations tight. Use bonding bushings or wedges at connections subject to vibration. Use bonding jumpers where joints cannot be made tight.
   2. Use insulating bushings to protect conductors.

Q. Tighten set screws of threadless fittings with suitable tools.

R. Terminations: Where raceways are terminated with locknuts and bushings, align raceways to enter squarely and install locknuts with dished part against the box. Where terminations are not secure with 1 locknut, use 2 locknuts: 1 inside and 1 outside the box.

S. Where raceways are terminated with threaded hubs, screw raceways or fittings tightly into the hub so the end bears against the wire protection shoulder. Where chase nipples are used, align raceways so the coupling is square to the box and tighten the chase nipple so no threads are exposed.

T. Install pull wires in empty raceways. Use No. 14 AWG zinc-coated steel or monofilament plastic line with not less than 200-lb (90-kg) tensile strength. Leave at least 12 inches (300 mm) of slack at each end of the pull wire.

U. Telephone and Signal System Raceways, 2-Inch Trade Size (DN53) and Smaller: In addition to the above requirements, install raceways in maximum lengths of 150 feet (45 m) and with a maximum of two 90-degree bends or equivalent. Separate lengths with pull or junction boxes where necessary to comply with these requirements.

V. Delete paragraph below if not applicable.

W. Install raceway sealing fittings according to manufacturer's written instructions. Locate fittings at suitable, approved, and accessible locations and fill them with UL-listed sealing compound. For concealed raceways, install each fitting in a flush steel box with a blank cover plate having a finish similar to that of adjacent plates or surfaces. Install raceway sealing fittings at the following points:

1. Where conduits pass from warm to cold locations, such as the boundaries of refrigerated spaces.
2. Where otherwise required by NFPA 70.

X. Stub-up Connections: Extend conduits through concrete floor for connection to freestanding equipment. Install with an adjustable top or coupling threaded inside for plugs set flush with the finished floor. Extend conductors to equipment with rigid steel conduit; FMC may be used 6 inches (150 mm) above the floor. Install screwdriver-operated, threaded flush plugs flush with floor for future equipment connections.

Y. Flexible Connections: Use maximum of 6 feet (1830 mm) of flexible conduit for recessed and semirecessed lighting fixtures; for equipment subject to vibration, noise transmission, or movement; and for all motors. Use liquidtight flexible conduit in wet or damp locations. Install separate ground conductor across flexible connections.

Z. Delete paragraph below if no high-frequency installation.

AA. Install nonferrous conduit or tubing for circuits operating above 60 Hz. Where aluminum raceways are installed for such circuits and pass through concrete, install in a nonmetallic sleeve.

BB. Do not install aluminum conduits embedded in or in contact with concrete.

CC. PVC Externally Coated, Rigid Steel Conduits: Use only fittings approved for use with that material. Patch all nicks and scrapes in PVC coating after installing conduits.

DD. Surface Raceways: Install a separate, green, ground conductor in raceways from junction box supplying the raceways to receptacle or fixture ground terminals.

1. Select each surface raceway outlet box, to which a lighting fixture is attached, of sufficient diameter to provide a seat for the fixture canopy.
2. Where a surface raceway is used to supply a fluorescent lighting fixture having central-stem suspension with a backplate and a canopy (with or without extension ring), no separate outlet box is required.
3. Provide surface metal raceway outlet box, and the backplate and canopy, at the feed-in location of each fluorescent lighting fixture having end-stem suspension.

4. Where a surface metal raceway extension is made from an existing outlet box on which a lighting fixture is installed, no additional surface-mounted outlet box is required. Provide a backplate slightly smaller than the fixture canopy.

EE. Set floor boxes level and adjust to finished floor surface.

FF. Select paragraph above for metal floor boxes and below for nonmetallic floor boxes.

GG. Set floor boxes level and trim after installation to fit flush to finished floor surface.

HH. Install hinged-cover enclosures and cabinets plumb. Support at each corner.

II. NO PVC CONDUIT ALLOWED ABOVE THE CEILING OR IN THE A/C RETURN PLENUM. PROVIDE RIGID CONDUIT. Verify all MEP documents.

3.4 PROTECTION

A. Provide final protection and maintain conditions, in a manner acceptable to manufacturer and Installer, that ensure coatings, finishes, and cabinets are without damage or deterioration at the time of Substantial Completion.
   1. Repair damage to galvanized finishes with zinc-rich paint recommended by manufacturer.
   2. Repair damage to PVC or paint finishes with matching touchup coating recommended by manufacturer.

3.5 CLEANING

A. On completion of installation, including outlet fittings and devices, inspect exposed finish. Remove burrs, dirt, and construction debris and repair damaged finish, including chips, scratches, and abrasions.

END OF SECTION

SECTION 26 05 53

IDENTIFICATION FOR ELECTRICAL SYSTEMS

PART 1 - GENERAL

1.1 RELATED REQUIREMENTS

A. The General Provisions, Supplemental General Provisions, Special Provisions and Specification sections, apply to work covered by this Section.

B. Comply with ELECTRICAL Sections, as applicable. Refer to other sections for coordination of work.

1.2 SCOPE OF WORK

A. Provide labor, material, equipment, tools and services, and perform operations required for, and reasonably incidental to, the providing of electrical identification, including related accessories.

B. Provide electrical identification for the following:

1. Panelboards, motor starters, contactors, disconnect switches, circuit breakers and other electrical equipment with nameplate identifying the item of equipment and the equipment serving the same.
2. Raceways, junction boxes and pull boxes.
3. Label each panelboard index indicating the room #s to the related circuit. Also add the index sheet in a laminated white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.
4. Wiring devices.
5. Wiring.
6. Three phase motor rotation.

1.3 SUBMITTALS

A.Submit product data in accordance with Section for products specified under PART 2 - PRODUCTS.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

A. Brady
B. Panduit
C. Thomas & Betts
D. Seton

2.2 IDENTIFICATION

E. A. Nameplates

1. Nameplates shall be black engraved surface on white core for normal power circuits and red engraved surface on white core for emergency power circuits.
2. Provide for each distribution panelboard, branch circuit panelboard, transformer and any other similar equipment furnished under this section identification as to its given name, voltage and origination of service. Examples are as follows:

'LR1' 120/240V FED FROM 'MDP'	'LR2' 120/240V FED FROM 'MDP'

3. Provide for each motor starter enclosure, circuit breaker enclosure, disconnect switch and any other similar equipment furnished under this section, identification as to the specific load that it serves and the origination of service. Examples are as follows:

'AHU-1' 'CU-1'
FED FROM 'MDP' FED FROM 'MDP'

4. Provide for each feeder protective device in each distribution panelboard and any other similar equipment furnished under this section, identification as to the specific load that it serves.
5. Nameplates shall be laminated, white core, plastic with beveled edges, minimum 1/16 inch thick. Lettering shall be machine-engraved, not less than 1/4" high, cut through the black or red surface to the white core.

F. B. Junction Boxes and Pull Boxes

1. 1. Identification shall be with a black permanent marking pen on the top of 4" x 4" junction box covers or on the back of an outlet box cover plate identifying the branch circuits and systems within the conduit. Pull boxes shall be provided with a nameplate stating voltage and system served.

G. C. Wiring Device Wall Plates

1. 1. On the back side of wiring device wall plates identify with a black permanent marking pen the panelboard and branch circuit number the device is served from.

H. D. Wire Markers

1. 1. Wire markers for identification of wiring shall be self-adhesive type having letters and numerals indicating serving equipment and feeder or branch circuit number.

I. Rotation Tags

1. Rotation tags shall be brass or aluminum securely attached to equipment.

PART 3 - EXECUTION

3.1 PREPARATION

A. Surfaces to receive labels or nameplates shall be carefully prepared in accordance with the manufacturer's instructions and recommendations.

3.2 NAMEPLATES

J. A.Nameplates shall be properly attached to identify panelboards, feeder circuit breakers, disconnect switches, pull boxes and other similar equipment furnished under this section.

3.3 WIRE MARKERS

K. A.Wire markers shall be applied to each conductor or cable within panelboards, motor starter enclosures, circuit breaker enclosures, disconnect switches, cabinets, junction boxes, pull boxes, and other similar equipment identifying the serving equipment and feeder or branch circuit from which the conductors originate.

END OF SECTION

SECTION 26 32 13

STANDBY GENERATOR

PART 1- GENERAL

1.1 References and Standards

The generator set covered by these specifications shall be designed, tested, rated, assembled and installed in strict accordance with all applicable standards below:

- CSA C22.2 No14
- CSA 282
- CSA 100
- EN61000-6
- EN55011
- FCC Part 15 Subpart B
- ISO8528
- IEC61000
- UL508
- UL2200
- UL142
- Designed to allow for installed compliance to NFPA 37, NFPA 70, NFPA 99 and NFPA 110

1.2 RELATED SECTIONS

1.3 WORK INCLUDED

A. Installation

The work includes supplying and installing a complete integrated generator system. The system consists of a (diesel generator OR natural gas generator) set with related component accessories and automatic transfer switches specified under a separate section.

B. Fuel System

1. Diesel - The CONTRACTOR shall provide a full tank of diesel fuel for the completion of all testing.
2. Natural Gas – The Contractor shall coordinate with gas company on the gas line to the generator location.

C. System Test

A complete system load test shall be performed after all equipment is installed. Guidelines in the Start-up Section.

D. Requirements, Codes and Regulations

The equipment supplied and installed shall meet the requirements of the NEC and all applicable local codes and regulations. All equipment shall be of new and current production by a MANUFACTURER who has 25 years of experience building this type of equipment. Manufacturer shall be ISO9001 certified.

1.4 SUBSTITUTION

Proposed deviations from the specifications shall be treated as follows:

A. Substitution Time Requirement

Requests for substitutions shall be made a minimum of ten (10) days prior to bid date. Manufacturers catalog data shall accompany each request and authorized acceptance shall be addenda only. **Keep in mind the manufacturer or company is required to provide credit for the existing generator as a trade-in value towards the new generator set.**

B. Substitution Responsibility

The power system has been designed to the specified manufacturer's electrical and physical characteristics. The equipment sizing, spacing, amounts, electrical wiring, ventilation equipment, fuel, and exhaust components have all been sized and designed around KOHLER gensets supplied equipment for Alternates bids. Should any substitutions be made, the CONTRACTOR shall bear responsibility for the installation, coordination and operation of the system as well as any engineering and redesign costs, which may result from such substitutions.

1.5 SUBMITTALS

Engine-generator submittals shall include the following information:

A. Factory published specification sheet.

B. Manufacturer's catalog cut sheets of all auxiliary components such as battery charger, control panel, enclosure, etc.

C. Dimensional elevation and layout drawings of the generator set, enclosure and transfer switchgear and related accessories.

D. Weights of all equipment.

E. Concrete pad recommendation, layout and stub-up locations of electrical and fuel systems.

F. Interconnect wiring diagram of complete emergency system, including generator, switchgear, day tank, remote pumps, battery charger, control panel, and remote alarm indications.

G. Engine mechanical data, including heat rejection, exhaust gas flows, combustion air and ventilation air flows, fuel consumption, etc.

H. Generator electrical data including temperature and insulation data, cooling requirements, excitation ratings, voltage regulation, voltage regulator, efficiencies, waveform distortion and telephone influence factor.

I. Generator resistances, reactances and time constants.

J. Generator locked rotor motor starting curves.

K. Manufacturer's documentation showing maximum expected transient voltage and frequency dips, and recovery time during operation of the generator set at the specified site conditions with the specified loads.

L. Manufacturer's and dealer's written warranty.

1.7 SYSTEM RESPONSIBILITY

A. Generator Set Distributor

The completed engine generator set shall be supplied by the Manufacturer's authorized distributor only.

B. Requirements, Codes and Regulations

The equipment supplied and installed shall meet the requirements of NEC and all-applicable local codes and regulations. All equipment shall be new, of current production. There shall be one source responsibility for warranty; parts and service through a local representative with factory trained service personnel.

C. Automatic Transfer Switch

The automatic transfer switch(es) specified in another section shall be supplied by the generator set manufacturer in order to establish and maintain a single source of system responsibility and coordination.

1.8 WARRANTY

A. Two Year Standby (ISO 8528-1: ESP) **Generator Set Warranty**

The manufacturer's standard warranty shall in no event be for a period of less than two (2) years from date of initial start-up of the system and shall include repair parts, labor, reasonable travel expense necessary for repairs at the job site, and expendables (lubricating oil, filters, antifreeze, and other service items made unusable by the defect) used during the course of repair. Running hours shall be limited to 500 hours annually for the system warranty by both the manufacturer and servicing distributor. Submittals received without written warranties as specified will be rejected in their entirety.

1.9 PARTS AND SERVICE QUALIFICATIONS

A. Service Facility

The engine-generator supplier shall maintain 24-hour parts and service capability within 100 miles of the project site. The distributor shall stock parts as needed to support the generator set package for this specific project. The supplier must carry sufficient inventory to cover no less than 80% parts service within 24hrs and 95% within 48 hours.

B. Service Personnel

The dealer shall maintain qualified factory trained service personnel.

PART 2- PRODUCT SPECIFICATIONS

2.1 GENERAL REQUIREMENTS

A. Generator set Requirements

The generator set shall be Standby Duty refer to drawings for KW rating,
N/A RPM, 0.8 power factor, 208 V, 3-Phase,
60 hertz, including radiator fan and all parasitic loads. Generator set shall be sized to operate at the specified load at a maximum ambient of 122F (50.0C) and altitude of
500.0 feet (152.4 m).
Standby Power Rating:
Power is available for the duration of an emergency outage
Average Power Output = 70% of standby power
Load = Varying

Typical Hours/Year = 200 Hours
Maximum Expected Usage = 500 hours/year
Typical Application = Standby

A. Material and Parts

a. All materials and parts comprising the unit shall be new and unused.

B. Engine

a. Diesel - The engine shall be diesel fueled, four (4) cycle, 6 inline, turbocharged, charge air cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 – D2 Emissions Cycle at specified ekW / bHP rating. Emissions requirements / certifications of this package:
    1. EPA T3

b. Natural gas - The engine shall be gas fueled, four (4) cycle, v-12, turbocharged, charge air cooled, while operating with nominal speed not exceeding 1800 RPM. The engine will utilize in-cylinder combustion technology, as required, to meet applicable EPA non-road mobile regulations and/or the EPA NSPS rule for stationary reciprocating compression ignition engines. Additionally, the engine shall comply with the State Emission regulations at the time of installation/commissioning. Actual engine emissions values must be in compliance with applicable EPA emissions standards per ISO 8178 – D2 Emissions Cycle at specified ekW / bHP rating. Emissions requirements / certifications of this package:
    2. EPA T3

C. Engine Governing

a. Diesel - The engine will be equipped with an isochronous electronic governor to maintain +/- 6 RPM steady state frequency variation from steady state no load to steady state full load.

b. Natural gas - The engine will be equipped with an JDEC electronic L15 governor to maintain +/- 6 RPM steady state frequency variation from steady state no load to steady state full load.

2.2 GENERATOR

A. Generator Specifications

The synchronous generator shall be a single bearing, self-ventilated, drip-proof design in accordance with NEMA MG 1 and directly connected to the engine flywheel housing with a flex coupling. The generator shall meet performance class G2 of ISO 8528. The excitation system shall be of brushless construction.

B. Voltage Regulator

C. Automatic Voltage Regulator

The automatic voltage regulator (AVR) shall maintain generator output voltage within +/- 0.5% for any constant load between no load and full load. The regulator shall be a totally solid state design, which includes electronic voltage buildup, volts per Hertz regulation, over-excitation protection, shall limit voltage overshoot on startup, and shall be environmentally sealed.

D. Integrated Voltage Regulator (IVR)

The IVR shall maintain generator output voltage within +/- 0.25% for any constant load between no load and full load. The regulator shall be capable of sensing true RMS in three phases of alternator output voltage, or operating in single phase sensing mode. The IVR shall be cable of configuring knee frequency and voltage regulation configurable up to +/-30% .The voltage regulator shall include a VAR/Pf control feature as standard. The regulator shall provide an adjustable dual slope regulation characteristic in order to optimize voltage and frequency response for site conditions. The IVR shall be capable of setpoint adjustment.

E. Motor Starting

Provide locked rotor motor starting capability of
450sKW at 20% instantaneous voltage dip as defined per NEMA MG 1. Sustained voltage dip data is not acceptable.

2.3 CIRCUIT BREAKER

A. Circuit Breaker Specifications

Provide a generator mounted 100%
circuit breaker, molded case, refer to drawings for size of breakers., 3 pole, NEMA 1/IP22. Breaker shall utilize a solid state trip unit. The breaker shall be UL/CSA Listed and connected to engine/generator safety shutdowns. Breaker shall be housed in an extension terminal box which is isolated from vibrations induced by the generator set. Mechanical type lugs, sized for the circuit breaker feeders shown on drawing, shall be supplied on the load side of breaker.

2.4 CONTROLS – GENERATOR SET MOUNTED (EMCP 4.2)

Provide a fully solid-state, microprocessor based, generator set control. The control panel shall be designed and built by the engine manufacturer. The control shall provide all operating, monitoring, and control functions for the generator set. The control panel shall provide real time digital communications to all engine and regulator controls via SAE J1939.

A. Environmental

The generator set control shall be tested and certified to the following environmental conditions:

A. –40°C to +70°C Operating Range
B. 100% condensing humidity, 30°C to 60°C
C. IP22 protection for rear of controller; IP55 when installed in control panel
D. 5% salt spray, 48 hours, +38°C, 36.8V system voltage
E. Sinusoidal vibration 4.3G's RMS, 24-1000Hz
F. Electromagnetic Capability (89/336/EEC, 91/368/EEC, 93/44/EEC, 93/68/EEC, BS EN 50081-2, 50082-2)
G. Shock: withstand 15G

B. Functional Requirements

The following functionality shall be integral to the control panel.

A. The control shall include a minimum 33 x 132 pixel, 24mm x 95mm, positive image, transflective LCD display with text based alarm/event descriptions.
B. The control shall include a minimum of 3-line data display
C. Audible horn for alarm and shutdown with horn silence switch
D. Standard ISO labeling
E. Multiple language capability
F. Remote start/stop control
G. Local run/off/auto control integral to system microprocessor
H. Cooldown timer
I. Speed adjust
J. Lamp test
K. Emergency stop push button
L. Voltage adjust
M. Voltage regulator V/Hz slope - adjustable
N. Password protected system programming

C. Digital Monitoring Capability

The controls shall provide the following digital readouts for the engine and generator. All readings shall be indicated in either metric or English units.

1. Engine

A. Engine oil pressure
B. Engine oil temperature
C. Engine coolant temperature
D. Engine RPM
E. Battery volts
F. Engine hours
G. Engine crank attempt counter
H. Engine successful start counter
I. Service maintenance interval
J. Real time clock
K. Engine exhaust stack temperature
L. Engine main bearing temperature

2. Generator

A. Generator AC volts (Line to Line, Line to Neutral and Average)
B. Generator AC current (Avg and Per Phase)
C. Generator AC Frequency
D. Generator kW (Total and Per Phase)
E. Generator kVA (Total and Per Phase)
F. Generator kVAR (Total and Per Phase)

G. Power Factor (Avg and Per Phase)
H. Total kW-hr
I. Total kVAR-hr
J. % kW
K. % kVA
L. % kVAR
M. Generator bearing temperature
N. Generator stator winding temperature

3. Voltage Regulation

A. Excitation voltage
B. Excitation current

D. Alarms and Shutdowns

The control shall monitor and provide alarm indication and subsequent shutdown for the following conditions. All alarms and shutdowns are accompanied by a time, date, and engine hour stamp that are stored by the control panel for first and last occurrence:

1. Engine Alarm/Shutdown

A. Low oil pressure alarm/shutdown
B. High coolant temperature alarm/shutdown
C. Loss of coolant shutdown
D. Overspeed shutdown
E. Overcrank shutdown
F. Emergency stop shutdown
G. Low coolant temperature alarm
H. Low battery voltage alarm
I. High battery voltage alarm
J. Control switch not in auto position alarm
K. Battery charger failure alarm

2. Generator Alarm/Shutdown

A. Generator phase sequence
B. Generator over voltage
C. Generator under voltage
D. Generator over frequency
E. Generator under frequency
F. Generator reverse power (real and reactive)
G. Generator overcurrent

3. Voltage Regulator Alarm/Shutdown

A. Loss of excitation alarm/shutdown
B. Instantaneous over excitation alarm/shutdown
C. Time over excitation alarm/shutdown
D. Rotating diode failure
E. Loss of sensing
F. Loss of PMG

E. Inputs and Outputs

1. Programmable Digital Inputs

The Controller shall include the ability to accept programmable digital input signals. The signals may be programmed for either high or low activation using programmable Normally Open or Normally Closed contacts.

2. Programmable Relay Outputs

The control shall include the ability to operate programmable relay output signals, integral to the controller. The output relays shall be rated for 2A @ 30VDC and consist of six (6) Form A (Normally Open) contacts and two (2) Form C (Normally Open & Normally Closed) contacts.

3. Programmable Discrete Outputs

The control shall include the ability to operate two (2) discrete outputs, integral to the controller, which are capable of sinking up to 300mA.

F. Maintenance

All engine, voltage regulator, control panel and accessory units shall be accessible through a single electronic service tool. The following maintenance functionality shall be integral to the generator set control

A. Engine running hours display
B. Service maintenance interval (running hours or calendar days)
C. Engine crank attempt counter
D. Engine successful starts counter
E. 40 events are stored in control panel memory
F. Programmable cycle timer that starts and runs the generator for a predetermined time. The timer shall use 7 user-programmable sequences that are repeated in a 7-day cycle. Each sequence shall have the following programmable set points:

1. Day of week

2. Time of day to start
3. Duration of cycle

G. Remote Communications

1. Remote Communications

The control shall include Modbus RTU communications as standard via RS-485 half duplex with configurable baud rates from 2.4k to 57.6k.

2. Remote Monitoring Software

The control shall provide Monitoring Software with the following functionality

A. Monitor up to eight (8) generator sets, plus ATS and UPS.
B. Provide access to all date and events on generator set communications network
C. Provide remote control capability for the generator set(s)
D. Ability to communicate via Modbus RTU or remote modem
E. Ability to communicate email/text alerts.

2.5 COOLING SYSTEM

The generator set shall be equipped with a rail-mounted, engine-driven radiator with blower fan and all accessories. The cooling system shall be sized to operate at full load conditions and 110 F* ambient air entering the room or enclosure (If an enclosure is specified). The generator set supplier is responsible for providing a properly sized cooling system based on the enclosure static pressure restriction.

2.6 FUEL SYSTEM

A. Fuel System

The fuel system shall be integral with the engine. In addition to the standard fuel filters provided by the engine manufacturer, there shall also be installed a primary fuel filter/water separator in the fuel inlet line to the engine. All fuel piping shall be black iron or flexible fuel hose rated for this service. No galvanized piping will be permitted. Flexible fuel lines shall be minimally rated for 300 degrees F and 100 psi. Include fuel 3/4 full.

B. Fuel Sub Base Tank

Provide a double wall sub-base tank constructed to meet all local codes and requirements. A fuel tank base of 24 hour capacity shall be provided as an integral part of the enclosure. It shall be contained in a rupture basin with 110% capacity. The tank shall meet UL142 standards. A locking fill cap, a mechanical reading fuel level gauge, low fuel level alarm contact, and fuel tank rupture alarm contact shall be provided.

2.8 STARTING SYSTEM

A. Starting Motor

A DC electric starting system with positive engagement shall be furnished. The motor voltage shall be as recommended by the engine manufacturer.

B. Jacket Water Heater

Jacket water heater shall be provided and shall be sized to insure that genset will start within the specified time period and ambient conditions.

C. Batteries

Batteries - A lead-acid storage battery set of the heavy-duty diesel starting type shall be provided. Battery voltage shall be compatible with the starting system.

D. Battery Charger

A UL listed/CSA certified 10 amp voltage regulated battery charger shall be provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float and equalize charge settings, with provisions to automatically switch between the two modes. It shall maintain its rated output voltage within ±0.2% with AC input variation of ±10%. Operational monitors shall provide with individual form C contacts rated at 4 amps, 120 VAC, 30VDC for remote indication of battery charger malfunction, low battery voltage, and high battery voltage. Charger shall include an Analog DC voltmeter and ammeter and fused AC input and DC output, and shall be wall mount type in a NEMA 1 enclosure.

2.9 ENCLOSURE

A. Attenuated Enclosure (Standard Sound optional)

The complete (diesel or natural gas) engine generator set, including generator control panel, engine starting batteries and fuel oil tank, shall be enclosed in a factory assembled, sound attenuated enclosure mounted on the fuel tank base.

A. A weather resistant, sound attenuated enclosure of steel with electrostatically applied powder coated baked polyester paint. The enclosure shall have a resulting sound level of ___dba @____ft with the genset running under full load. It shall consist of a roof, side walls, and end walls. Fasteners shall be either zinc plated or stainless steel. Enclosure shall be rated for 150MPH.

PART 3- EXECUTION

3.1 INSTALLATION

Install equipment in accordance with manufacturer's recommendations, the project drawings and specifications, and all applicable codes.

3.2 START-UP AND TESTING

Coordinate all start-up and testing activities with the Engineer and Owner. After installation is complete and normal power is available, the manufacturer's local dealer shall perform the following:
Perform a 4 hour load bank test at a 1.0 PF at full nameplate rating. Loadbank, cables and other equipment required for this test to be supplied by the genset supplier.

3.3 OPERATION AND MAINTENANCE MANUALS

Provide two (2) sets of operation and maintenance manuals covering the generator, switchgear, and auxiliary components. Include final as-built wiring interconnect diagrams and recommended preventative maintenance schedules.

3.4 TRAINING

A. On-Site Training

Provide on-site training to instruct the owner's personnel in the proper operation and maintenance of the equipment. Review operation and maintenance manuals, parts manuals, and emergency service procedures.

END OF SECTION