

Newton County
Request for Proposals
RFP 2019-06

Newton County is seeking proposals from qualified firms for purchase and installation of two generators under FEMA's Hazard Mitigation Grant Program resulting from Federal Disaster Declaration 4266 (TX-Storms and Flooding).

Please submit your proposals for these proposed services to the address below:

Sandra Duckworth
County Clerk
Newton County
115 Court Street
P.O. Box 484
Newton, Texas 75956

Proposals must be received by the County no later than 4:30 p.m. on Friday, May 17, 2019 to be considered. The County reserves the right to negotiate with any and all individuals or firms that submit proposals, as per the Texas Professional Services Procurement Act and the Uniform Grant and Contract Management Standards.

Newton County is an Affirmative Action/Equal Opportunity Employer.

Newton County, Texas

Request for Proposals

RFP 2019-06

Newton County is seeking Requests for Proposal from qualified firms to purchase and install generators at the Newton County Courthouse and the Newton County Deweyville Senior Center, under FEMA's Hazard Mitigation Grant Program DR-4266. The submittal shall include separate proposals for each location.

Please submit your proposals for the following to: Sandra Duckworth, County Clerk, 115 Court Street, P.O. Box 484, Newton, Tx 75966. The deadline for submittal is Friday, May 17, 2019, 4:30 p.m. The County will not accept any emailed proposals or proposals in digital format. The County will not accept any proposals received after the stated deadline and will not accept responsibility for late delivery of proposals. One bound copy and five unbound copies of the proposal shall be submitted.

Newton County reserves the right to award this contract on the basis of Best Offer in accordance with the laws of Texas, to waive any formality or irregularity, to make award to more than one proposer, and/or to reject any or all proposals.

The successful proposer will be required to comply with the Americans With Disabilities Act and with all provisions of Federal, State, County, and local laws and regulations to ensure that no employee or applicant for employment is discriminated against because of race, color, religion, sex, age, handicap or national origin.

No verbal interpretation or clarification will be made as to the meaning of the RFP. Requests for interpretation or clarification shall be made in writing and emailed to Elizabeth Holloway, County Auditor, Elizabeth.holloway@co.newton.tx.us. The deadline for questions or requests for interpretation or clarification is Friday, May 10, 2019 by 4:30 p.m. A response will be issued in the form of an addendum to the RFP by the County.

All Proposals must contain a transmittal letter that specifically states that all terms and conditions contained in this RFP are accepted by the proposing firm. At a minimum, the proposing firm's RFP must contain the following:

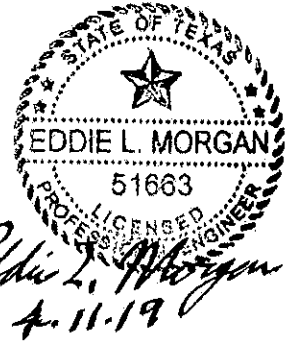
1. Agency/company description
2. A printout of the firm's System for Award Management (SAM) registration and current status.
3. Experience of company in this type of project.
4. Project delivery timeline.
5. Description of readiness to begin work following contract signing.

Evaluation of proposals will be made according to the following criteria:

Applicable related experience	30 points
Capacity, performance schedule	30 points
Company qualifications	20 points
Cost of services	20 points

SECTION 16050

ELECTRICAL BASIC MATERIALS AND METHODS



PART 1—GENERAL

1.1 SCOPE

A. Supplementary Conditions

1. The General Conditions and Requirements, Special Provisions are hereby made a part of this section.
2. The Electrical Drawings and Specifications under this division shall be made a part of the contract documents. The drawings and specifications of other divisions of this contract, as well as supplements issued thereto, information to bidders, and other pertinent documents issued by the Owner's Representatives are a part of these drawings and specifications and shall be complied with in every respect. All the above documents will be on file at the office of the Owner's Representative and shall be examined by all bidders. Failure to examine all documents shall not relieve the bidder of any responsibility nor shall it be used as a basis for additional compensation due to omission of details of other divisions from the electrical documents.
3. Furnish all work, labor, tools, superintendence, material, equipment, and operations necessary to provide for a complete and workable electrical system as defined by the contract documents.
4. Contractor shall be responsible for visiting the site and checking the existing conditions. He shall also ascertain the conditions to be met for installing the work and adjust bid accordingly.
5. It is the intent of the contract documents that upon completion of the electrical work, the entire system shall be in a finished workable condition.
6. All work that may be called for in the specifications but not shown on the drawings, or, all work that may be shown on the drawings but not called for in the specifications, shall be performed by the Contractor as if described in both. Should work be required which is not set forth in either document, but which work is nevertheless required for the fulfilling of the intent thereof; then, the Contractor shall perform all such work as fully as if it were specifically set forth in the contract documents.
7. The use the word "furnish" or "install" or "provide" shall be taken to mean that the item or facility is to be both furnished and installed under this section unless specifically stated to the contrary; that the item or facility is to be furnished under another section and installed under this section; furnished under this section and installed under another section; or furnished and installed under another section.
8. The use of the term "as (or where) indicated"; "as (or where) shown"; "as (or where) specified"; or "as (or where) scheduled" shall be taken to mean that the reference is made to the contract documents, either under the drawings or the specifications, or both documents.

B. Standards

1. All materials and equipment shall conform to the requirements of the contract documents. They shall be new, free from defects, and they shall conform to the following standards where these organizations have set standards:
 - a. U/L – Underwriters Laboratories, Inc.
 - b. NEMA – National Electrical Manufacturer's Association
 - c. ANSI – American National Standards Institute
 - d. IPCEA – Insulated Power Cable Engineers Association
 - e. IMSA – International Municipal Signal Association
 - f. AISC – American Institute of Steel Construction
 - g. ASTM – American Society for Testing and Materials
 - h. IEEE – Institute of Electrical and Electronics Engineers
2. The definition of terms used throughout the contract documents shall be as specified by the following agencies:
 - a. Underwriters Laboratories
 - b. National Electrical Manufacturer's Association
 - c. American National Standards Institute
 - d. Insulated Power Cable Engineers Association
 - e. National Electrical Code
 - f. National Fire Protection Association
 - g. American Society for Testing and Materials
 - h. Institute of Electrical and Electronics Engineers
3. Submit copies of applicable standards with each submittal.
4. All material and equipment, of the same class, shall be supplied by the same manufacturer unless specified to the contrary.
5. All materials shall bear UL labels where standards have been set for listing.

C. Permits, Codes, and Utilities

1. Secure all permits, licenses, and inspections as required by all authorities having jurisdiction. Give all notices and comply with all laws, ordinances, rules, regulations, and contract requirements bearing on the work.
2. The minimum requirements of the Electrical system installation shall conform to the latest edition of the National Fire Protection Association as well as local and state codes.
3. Work shall comply with the regulations of the State of Texas having lawful jurisdiction and the codes, statutes, and reference standards identified within these Specifications. These Specifications shall not be construed as negating the regulations or requirements of lawful jurisdictions.
4. Codes and ordinances having jurisdiction over the work shall serve as minimum requirements, but, if the contract documents indicate requirements which are in excess of those minimum requirements, then the requirements of the contract documents shall be followed. Should there be any conflicts between the contract documents and codes, or any ordinances having jurisdiction, report these with the bid.
5. Determine the exact requirements for the utility services as set by the utilities that will serve

the facility, and pay for and perform all work as required by those utilities for temporary electrical construction power. Provisions for permanent electrical power to the site shall be the responsibility of the Owner.

6. All electrical work shall be performed by journeymen electricians and apprentice electricians under the direct supervision of a master electrician, all of which shall be licensed by the State of Texas.

1.2 SUBMITTAL AND REVIEW OF MATERIALS

A. Submittal Time

1. Submit six (6) copies for review of all shop drawings and submittals as hereinafter called for within thirty (30) days after award of contract. If shop drawings and submittals are not received in thirty (30) days, the Owner's representative reserves the right to go directly to the manufacturer for the information and any expense incurred shall be borne by the Contractor.

B. Manner of Submittal

1. Submit product data and shop drawings at one time in three ring, bard back binders. Partial submittals will not be accepted unless approved by the Engineer. Submittal format shall follow the specification format, with each specification section having a section divider and with equipment and materials referenced to the particular paragraph(s) of the Specifications.

C. Submittals

1. Submittals shall be taken to mean catalog cuts, general descriptive information, catalog numbers, and manufacturer's name. Indicate on the front cover or the cover sheet of each binder the following: the title of the submittal; the name and location of the project; the names of the Engineer; Contractor's name; and the date of the submittal. Arrangement of the above information shall be such that the cover or title sheet can accept the Contractor's stamp or certification.
2. Arrangement of items
 - a. Subdivide items according to specifications sections, with each section having a divider with tab clearly denoting the section and referencing the appropriate paragraphs of the specifications. Index as follows:
 - i. General Index: Located behind the title sheet indexing the entire submittal by section (divider)
 - ii. Section Index: Located at each section divider, listing each item included as follows:

THE MANUFACTURER'S NAME AND THE MODEL NUMBER SPECIFIED

AND

THE MANUFACTURER'S NAME AND MODEL NUMBER SUBMITTED IF
OTHER THAN THAT SPECIFIED

- b. Manufacturer's Data

- i. Manufacturer's descriptive literature, equipment drawings, diagrams, performance and characteristic curves, and catalog cuts. Each shall include the manufacturer's name, trade name, catalog or model, nameplate, physical dimensions, specification references, applicable industry, and other information necessary to establish Contract compliance.

c. Shop Drawings

- i. Shop drawings shall illustrate types, dimensions, schedules, weights, capacities, accessories, elevations, floor plans, sectional views, installation details, elementary diagrams as necessary to demonstrate compliance. Wiring diagrams shall identify circuit terminals and shall indicate the internal wiring for each item of equipment and the interconnection between the items. Drawings shall also indicate adequate clearance for operation, maintenance and replacement of operating equipment devices.

3. Compliance Statement

- a. Include with each submittal, a signed compliance statement certifying that each item submitted complies with the Specifications, and is physically compatible with and appropriate to the installed location. Unless so certified, documents will be returned without review. Certification shall be in the following format:

I hereby certify that the attached submittal has been checked prior to submission and that it complies in all respects (except as noted*) with the requirements of the Contract Documents.

(Name of Contractor)

Signed _____

Date _____

*Refer to exception requirements herein.

4. Submittal Review

- a. Review and comment is performed for general compliance with the intent of the Contract Documents. Review and comments do not relieve the Contractor of the responsibility of compliance with the requirements of the Contract Documents, nor will such review remove the responsibility for error in the shop drawings or submittals.
- b. The omission of any specified or reasonably implied characteristic, function, capacity, or component, on any item submitted is inferred to indicate, by virtue of the Contractor's compliance statement, that the item complies with the intent of the Contract Documents.
- c. The Engineer reserves the right to require submittal information, including samples, as considered necessary to accomplish review. When requested, furnish samples of materials for acceptance review. If a sample has been reviewed and accepted, that item of material or equipment when installed on the job shall be equivalent in quality to the sample. If it is found that the installed item is not equivalent, then all such items shall be replaced with an item that is deemed to be equivalent to the accepted sample.
- d. The Engineer reserves the right to reject any item or material, because of deceptive submittal material, and to require that any time found by field observation to be

deficient in represented characteristics, capacity and function, be removed from the site and that specified items be provided.

- e. Shop drawings and submittals will be returned and unchecked if the specific items proposed are not clearly marked, or if the general contractor's approval stamp is omitted.

5. Owner's Records

- a. Submit for the Owner's records six (6) complete "Final Review" submittals prior to final project acceptance.

6. Spare Parts Data

- a. Prior to final acceptance, furnish spare parts data for installed equipment. Include a complete list of parts and supplies, including the manufacturer's recommended items to be purchased as spare parts, with current unit prices and sources of supply; a list of parts and supplies that are either normally furnished at no extra cost with the purchase of the equipment, or specified hereinafter to be furnished as part of the Contract.

B. Operations and Maintenance Manuals

1. Furnish six (6) complete copies of bound, indexed operating and maintenance manuals with complete technical data for each electrical system for review. Deliver to the Engineer six (6) weeks prior to the time that system and equipment acceptance tests are preformed. The manual shall include the following information:
 - a. Manufacturer's installation instructions
 - b. Manufacturer's local representative and/or distributor's name and address
 - c. Manufacturer's operating and maintenance instructions
 - d. Manufacturer's internal wiring diagrams
 - e. Contractor's installation wiring diagrams
 - f. Control system installation Drawings
 - g. Replacement part number listings and descriptions
 - h. Framed operating instructions when required in individual specification sections
 - i. A framed final electrical distribution one-line diagram
 - j. Warranties and guarantees
 - k. Systems Certifications required by individual specification sections

C. Record Drawings

1. During the progression of the job, mark up with red pencil on blue-line prints all deviations from the Contract Documents of all raceway, wiring, and equipment installations.

2. After completion of job, transcribe the deviation information onto reproducible prints and label "Record Drawings."
3. Drawings shall clearly indicate the following installed conditions:
 - a. Raceways system; size and location of service entrance and feeder conductors, exterior and interior.
 - b. Identify and indicate the installed locations of distribution and control equipment
 - c. Identify the branch circuit serving each outlet and each unit of utilization equipment and appliance
 - d. One-line diagrams, illustrating the installed configuration of the power distribution system and each supervisory and control system provided under this Division
 - e. Locations and invert elevations of the underground installations
 - f. Identify modifications of the original construction documents implemented by value engineering, change order, supplemental instruction or other authorized directive.
4. Details of control instrumentation and signal wiring that are not shown in the Contract Drawings shall be included with the Record Drawings.
5. Raceway and wiring details of each pullbox and junction box larger than 100 cubic inches shall be included with the Record Drawings. These details shall show size of each conduit penetration, wire size, wiring function and terminus information of each raceway and wire.

1.3 QUALITY CONTROL

A. Acceptance and Substitution

1. All manufacturers named are a basis as standard of quality and substitutions of any equivalent product will be considered for acceptance. The judgment of equivalence of product substitution shall be made by the Engineer.
2. Substitutions after award of contract shall be made only within sixty days after the award of contract. Furnish all required supporting data. The submittal of substitutions for review shall not be cause for time extensions.
3. Where substitutions are offered, the substituted product shall meet the product performance as set forth in the specified manufacturer's current catalog literature, as well as meeting the details of the contract documents.
4. The details on the drawings and the requirements of the specifications are based on the first listed item of materials or equipment. If any other than the first listed materials or equipment is furnished, then the Contractor shall assume responsibility for the correct function, operation, and accommodation of the substituted item. In the event of misfits or changes (due to the Contractor's substitution) in the work required, either in this Section or other Sections of the contract, or in both; the Contractor shall bear all costs in connection with all changes arising out of the use of other than the first listed item specified.
5. Energy efficiency of each item of power consuming equipment shall be considered one of

the standards for evaluation.

B. Excavation and Backfilling

1. Do all excavating and backfilling necessary for the installation of the work. This shall include shoring and pumping in ditches to keep them dry until the work in question has been installed. All shoring required to protect the excavation and safeguard employees shall be properly performed. See Contract Specification Section TRENCHING as applicable.
2. All excavations shall be made to the proper depth, with allowances made for floor slabs, forms, beams, finished grades, etc. Ground under conduits shall be well compacted before conduits are installed.
3. All backfill shall be made with selected soil, free of rocks and debris and shall be pneumatically tamped in six inch layers to secure a field density ration of 90% unless otherwise specified.
4. All excavated material not suitable and not used in the backfill shall be removed to the on-site disposal area. Area shall be as directed by the Engineer.
5. Field check and verify the locations of all underground utilities prior to any excavating. Avoid disturbing these as far as possible. In the event existing utilities are broken into or damaged, they shall be repaired so as to make their operation equivalent to that before the trenching was started.
6. Where the excavation requires the opening of existing walks, drives, or other existing pavement, these facilities shall be cut as required to install new lines and to make connections to existing lines. The sizes of the cut shall be held to a minimum, consistent with the work to be installed. After installation of new work is completed and the excavation has been backfilled in accordance with above, repair existing walks, drives, or other existing pavement to match existing installation.

C. Cutting and Patching

1. Cutting and patching required under this section shall be done in a neat workmanlike manner. Cutting lines shall be uniform and smooth.
2. Use concrete saws for large cuts in concrete and use core drills for small round cuts in concrete.
3. Where openings are cut through masonry walls, provide lintel or other structural supports to protect the remaining masonry. Adequate support shall be provided during the cutting operation to prevent damage to the masonry.
4. Where large openings are cut through metal surfaces, attach metal angles around the opening.
5. Patch and fill concrete openings with nonmetallic, non-shrinking grout. Finished concrete patching shall be troweled smooth and shall be uniform with surrounding surfaces.
6. No cutting of structural elements shall be done without permission of the Engineer.

D. Flashing

1. Provide waterproof flashing for each penetration of exterior walls and roofs.
2. Flashing for conduit penetrations through built-up roofs shall be made with pitch panel filled full with pitch.

E. Construction Requirements

1. Except where specifically detailed or shown, the locations and elevations of equipment are approximate and are subject to small revisions as may prove necessary, or desirable, at the time the work is installed. Final locations shall be confirmed with the Engineer in advance of construction. Confirmed locations shall be made for the following:
 - a. Poles
 - b. Receptacles
 - c. Rough-ins and connections for equipment furnished under other sections
 - d. Lighting Fixtures
 - e. Outlets
 - f. Motor Controllers, Panelboards, etc.
2. Where equipment is being furnished under another section, request from the Engineer an accepted drawing that will show exact dimensions of required locations of connections. Install the required facilities to the exact requirements of the approved drawings.
3. All work shall be done in the best and most workmanlike manner by qualified, careful electricians who are skilled in their trade. The standards of work required throughout shall be of the first class only and electricians whose work is unsatisfactory to the Engineer shall be instantly dismissed from the work upon written notice from the Engineer. All work must meet the approval of the Engineer.
4. Unless shown in detail, the drawings are diagrammatic and do not give exact details as to elevations and routing of conduits, nor do they show all offsets and fittings; nevertheless, install the conduit system to conform to the structural and mechanical conditions of the construction. Unless locations and routing of exposed conduits are shown, confirm locations and routing prior to installation with the Engineer.
5. Holes for raceway penetration into sheet metal cabinets and boxes shall be accurately made using a hole punch. Cutting openings with a torch or other device that produces a jagged, rough cut will not be acceptable.
6. Raceway entry into equipment shall be carefully planned. Cutting of enclosure framework to accommodate poorly planned raceway placement will not be acceptable.
7. Cabling inside equipment shall be carefully routed, trained, and laced. Cables so placed that they obstruct equipment devices shall not be acceptable.
8. Equipment shall be set level and plumb. Supporting devices installed shall be set and so braced that equipment is held in a rigid, tight fitting manner.

F. Equipment Protection

1. Provide suitable protection for all equipment, work, and property against damage during construction.
2. Assume full responsibility for material and equipment stored at the site and incorporated

within the project.

3. Conduit openings shall be closed with caps or plugs during installation. All outlet boxes and cabinets shall be kept free of concrete, plaster, dirt, and debris.
4. Equipment shall be covered and tightly sealed against entrance of dust, dirt, and moisture.
5. Protect ferrous metallic materials against corrosion. Ferrous metallic equipment and component parts shall be provided with a factory applied rust inhibiting treatment and enamel or epoxy paint finish, hot dip galvanized, electro-galvanized or equivalent rust inhibiting finish. Reference individual Division 16000 sections for specific requirements pertaining to equipment and materials specified therein.
6. All dry transformers prior to being energized shall be protected against moisture and dirt absorption by a suitable covering. Also, maintain heat inside the covering by means of 200 watt minimum lamps.
7. Interiors of switchgear and motor control centers shall be kept clean and dry prior to being energized. Maintain heat inside each unit with one 200 watt lamp located at bottom of each vertical section. Energizing integral condensation heaters shall be acceptable in place of lamps.

G. Cooperation with Work Under Other Sections

1. Cooperate with all other trades so as to facilitate the general progress of the work. Allow other trades every reasonable opportunity for the installation of their work and the storage of their materials.
2. The work under this section shall follow the general building construction closely. Set all pipe sleeves, inserts, etc., and see that openings for cases, pipes, etc., are provided before concrete is placed or masonry installed.
3. Work with other trades in determining exact locations of outlets, conduits, fixtures, and pieces of equipment to avoid interference with lines as required to maintain proper installation of other work.
4. Make such progress in work that will not delay the work of other trades. Schedule the work so that completion dates as established by the Engineer are met. Furnish sufficient labor or work overtime to accomplish these requirements if directed to do so.

H. Installation and Connection of Work under Another Section

1. Except as otherwise indicated, details of control wiring required for plant instrumentation are not shown; however, ascertain the requirements and install all wiring as required under those sections.
2. Verify the electrical capacities of all motors and electrical equipment furnished under other sections, or furnished by the Owner, and request wiring information from the Engineer if wiring requirements are different from that specified under this section. Do not make rough-ins until equipment verifications has been received.
3. Install all motors, controllers, terminal boxes, pilot devices, and miscellaneous items of electrical equipment that are not integrally mounted with the equipment furnished under other sections. All such equipment shall be securely mounted and adequately supported in

a neat workmanlike manner.

I. Cleanup and Test

1. Remove all temporary labels, dirt, paint, grease, and stains from all exposed equipment. Upon completion of work, clean equipment and the entire installation so as to present a first class job suitable for occupancy. No loose parts or scraps of equipment shall be left on the premises.
2. Equipment paint scars shall be repaired with paint kits supplied by the equipment manufacturer, or with an approved paint.
3. Clean interiors of each item of electrical equipment. At completion of work, all equipped interiors shall be free from dust, dirt, and debris.
4. Test insulation value of each service entrance cable, each feeder cable, and each branch circuit wire. Test shall be made by means of crank-type ohmmeter that impresses 1500 volts DC across the insulation. Each ungrounded conductor shall have its insulation integrity tested after installation within its raceways from termination-to-termination. However, testing shall be made prior to connection to line and load. All such testing shall be done in the presence of the Owner's Representative and the test results shall be submitted for review. Insulation value of each installed cable and wire shall be equivalent to, or greater than 500,000 ohms. Should the test indicate an insulation value of less than 500,000 ohms, the conductor in question shall be replaced and re-tested. This procedure shall be repeated until the conductor is in compliance.
5. Perform system testing, verification, and demonstration, and provide Owner instruction in the maintenance and operation manuals as specified within each individual specification section.

J. Guarantee

1. Contractor shall guarantee materials and workmanship for a period of not less than twelve (12) months or as otherwise required by Division 1 or individual specification sections after the final acceptance of work.
2. Materials shall be new and unused. Material and equipment damaged in transit, during delivery to premises, while in storage, while being erected and installed, or while being tested, prior to final acceptance, shall be removed and acceptable material installed in place thereof.
3. Contractor shall comply with the National Electrical Code (NEC), ANSI Code C2-1978, National Electrical Safety Code, and all applicable State and Federal Codes. The Contractor is responsible for helping to accomplish this end.

PART 2—PRODUCTS

2.1 RACEWAYS

- A. Rigid ferrous metallic conduit shall be hot-dipped galvanized steel, inside and out. Conduit couplings shall be threaded steel with hot-dipped galvanized finish. Such conduit shall be Republic, Triangle, Wheatland, or equivalent.
- B. Rigid non-metallic conduit shall be Schedule 40 PVC plastic. Couplings shall be PVC solvent-

weld type. Such conduit shall be Carlon, or equivalent.

- C. Plastic jacketed rigid metallic conduit shall be heavy wall galvanized rigid steel and shall have a 40 mil minimum thickness PVC coating on exterior metallic surfaces. Couplings shall be sleeved. Such conduit shall be OCAL, Rob-Roy, or Perma-cote.
- D. Flexible liquid tight ferrous metallic conduit shall have extruded thermoplastic cover with interlocked galvanized steel core. The conduit shall be U. L. listed. Such conduit shall be Anaconda, Republic, Electriflex, or equivalent.
- E. Flexible liquid tight non-metallic conduit shall consist of a PVC spiral encased in a flexible PVC jacket. Such conduit installations shall include non-metallic liquid tight fittings. The conduit shall be Carlon Carflex or equivalent.
- F. Rigid metallic conduit locknuts shall be galvanized steel in sizes under 2" and galvanized malleable iron on sizes 2-1/2" and larger. Sealing locknuts shall have in addition to that specified above, an integrally fused thermoplastic gasket so that the locknut is rated NEMA-4.
- G. Rigid metallic conduit insulating bushings shall be molded canvas bakelite type suitable for operation in 100 degrees C rise over 40 degrees C ambient. Polypropylene bushings shall not be acceptable.
- H. Grounding type bushings shall have threaded steel body, insulated throat, and ground lug. Insulated throat shall meet specifications under Article G above.
- I. Rigid metallic conduit expansion/deflection fittings shall be water-tight with flexible plastic sleeve that allows 3/4" movements in all directions. Hubs shall be threaded, hot dipped galvanized (HDG) malleable iron. Clamping bands shall be stainless steel. There shall be an equipment ground bonding jumper. Expansion deflection fittings shall be Crouse-Hinds, OZ, or equivalent.
- J. Rigid metallic conduit hubs shall be liquid-tight type with threaded HDG malleable iron female body, with sealing ring on conduit side and threaded male tapered steel body with hardened steel locknut on box side. Plastic jacketed hubs shall have a 40 mil PVC coating. Such fittings shall be T&B, Crouse-Hinds, or equivalent.
- K. Chase nipples, reducers, enlargers, "Ericksons", capped els, short els, long els, split couplings and fitting shall be HDG malleable iron threaded type for use with rigid metallic conduit.
- L. Rigid metallic conduit bodies shall be HDG malleable iron type with threaded hubs, gasketed cast metal covers with stainless steel screws. All such conduit bodies shall be Crouse-Hinds, or equivalent.
- M. Liquid-tight flexible conduit fittings shall consist of HDG steel body with captive grounding ferrule and sealing ring, and compression nut. Connector body shall have nylon insulated throat. Pull-out resistance of each completed connector shall be at least 1-1/2 times U. L. minimum. Such fittings shall be T&B, Crouse-Hinds, Appleton, or equivalent.
- N. Rigid metallic conduit boxes shall be HDG cast iron, with threaded integrally-cast hubs, cast metal cover, and stainless steel cover screws. Such boxes shall be Crouse-Hinds, Appleton, or equivalent. Plastic jacketed type shall have a 40 mil minimum coating of PVC.
- O. Cadmium and electro-galvanized plated devices and hardware shall not be acceptable.
- P. Aluminum conduit and fittings shall be made of 6063 alloy, T-1 temper (former designation T-42)

and meet Federal Specification WW-C-540c, Underwriters Laboratories UL-6, latest revision, and American Standard Association (ASA) C80.5. Aluminum conduit and fittings shall be Alumax Extrusions, Inc., American Conduit by Sapa, or equivalent.

- Q. Service entrance caps shall be aluminum, rated for indoor and outdoor, clamp-on type, and able to mount to metal, rigid, or IMC conduit. Such caps shall be Hallex or equivalent.
- R. Conduit seals for use in classified hazardous locations or where shown on the contract drawings shall be Crouse-Hinds sealing fittings. Sealant shall be Crouse-Hinds Chico SpeedSeal Compound.

2.2 WIRE & WIRING DEVICES

A. Wire

1. All conductors for power and control wiring shall be stranded, soft drawn copper.
2. Insulation for Power and Control Circuitry shall be 75°C rated THHN/THWN-2 for all installations in conduits, except as specifically noted otherwise.
3. Factory pigmented insulation color for sizes #6 and smaller for power wiring shall be as follows:

- a. 150V-to-ground, or less:

<u>Phase</u>	<u>Color</u>
A	Red
B	Black
C	Blue
Grounding Conductor	Green
Grounded Conductor	White

- b. Greater than 150V-to-ground:

<u>Phase</u>	<u>Color</u>
A	Brown
B	Purple
C	Yellow
Grounding Conductor	Green
Grounded Conductor	Gray

(Orange is reserved for the high leg of 240V, 3 phase systems)

4. Bare conductors for grounding purposes shall be hard-drawn stranded copper.
5. Instrumentation hook-up wire (TPS)—shall be 600V U. L. rated #16 AWG tinned stranded (19x29) copper with 32 mil polyethylene insulated, twisted pair or triad with aluminum-polyester shield and #18 AWG stranded tinned copper drain wire and a 32 mil chrome vinyl jacket. The wire shall be Belden 8719 for 2/C and Belden 8618 for 3/C or equivalent by Dekeron. Other types shall be as noted on the contract drawings.

B. Connectors

1. Mechanical connectors shall be bolted pressure type with tin-plated bronze body and tin-plated silicon-bronze hardware.
2. Insulated spring wire connectors shall be plated spring steel with thermoplastic jacket. Connectors shall be rated at 105°C continuous. Such connectors shall be Ideal, T&B, or equivalent.
3. Insulated set-screw connectors shall consist of copper body with flame-retardant, 600V. Class insulated shell. Such connectors shall be Ideal, T&B, or equivalent.
4. Terminal connectors for flat-head terminal screws shall be locking spade type with vinyl insulated, compression indent shaft, T&B, Ideal, Amp, or equivalent.
5. Terminal strips shall be channel-mounted type with tin-plated solderless box lugs contained with barriered nylon-insulated separable barriers. Such devices shall be Square D, Cutler-Hammer, Allen Bradley, or equivalent.

C. Insulating Products

1. General purpose electrical tape shall be 7 mil thick stretchable vinyl plastic, pressure-adhesive type 3M "Scotch #33", or equivalent.
2. Insulation putty shall be rubber-based, non-vulcanizing, elastic-type putty in tape 3M "Scotchfill", or equivalent.
3. High temperature, insulating void filling, moisture-proof tape shall be stretchable ethylene propylene rubber with high-tack, self fusing surfaces. Tape shall be rated for 90 degree Centigrade continuous, 130 degree Centigrade overload. Such tape shall be 3M "Scotch 23", or equivalent.
4. Underground moisture proof electrical connections shall be made using 3M "UF Splice Kit", or equivalent only after notification and approval from Engineer.

D. Labels, Nameplates, and Signs

1. Marking labels for wire numbering shall be type-on heat shrink plastic. Such labels shall be Raychem "Shrinkmark", or equivalent.
2. Write-on labels for conduit identification shall be weather resistant polyester with flat surface for making pen application of usage.
3. Colored bonding tape shall be 5 mil stretchable vinyl, self-adhesive, and with permanent solid colors corresponding to here in before specified wire colors 3M "Scotch 35", or equivalent.
4. Three layer laminated nameplates shall be 3/32" inch thick, lengths as required to accommodate lettering, and in 3/4" and 1-1/4" widths. Each plate shall have adhesive backing with pull-apart resistance of at least 100 psi. Plates shall be laminated type with white surfaces, black core, and Condensed Gothic lettering at least 1/4" high. Nomenclature shall identify the equipment served.
5. Factory assembled equipment shall have nameplates securely attached to the equipment. Nameplates shall include identification of product catalog number, serial number, style

number, manufacturer's name and address. Other markings that indicate voltage, current, wattage, or other ratings, as specified in the National Electrical Code, shall be provided.

6. Remote light switches, equipment control switches, special purpose outlets, and pilot lights shall be identified by engraving the device cover plates. Engraving shall be 3/16" condensed Gothic and shall be filled with black enamel. Nomenclature shall identify the equipment served, the service of the outlet, or the indication of the pilot.
7. Signs shall be similar to nameplates in 4. above, with the size, type, and wording as indicated on the contract drawings.

E. Supporting Devices

1. Slotted channel supports and framing members shall be cold rolled steel. Finish for all locations shall be hot dipped galvanized after fabrication. Size of slotted channel unless otherwise indicated, shall be 1-5/8"W x 1-5/8"D in cross section. Furnish Unistrut P-1000 or equivalent.
2. All cut ends of supporting devices shall be coated with cold galvanized spray prior to completion.
3. Beam clamps, side-beam connectors, and one-hole clamps shall be hot dipped galvanized malleable iron, and shall be Steel City, T&B, or Gedney. Plastic coated types shall have 40 mils, minimum PVC covering.
4. Pressed steel, two-piece single bolt, slotted channel conduit straps shall be hot dipped galvanized steel and shall be of the same manufacturer as the slotted channel. Plastic coated types shall have 40 mils, minimum PVC covering and hardware shall be stainless steel.
5. Slotted channel hardware (nuts, bolts, washers, etc.) shall have hot dipped galvanized finish.
6. Concrete and masonry anchors shall be stainless steel type equivalent to Hilti brand.

F. Wiring Devices

1. All wiring devices shall be specification grade, ArrowHart, Hubbell, or equivalent.
2. Two-pole, 3-wire grounding 20A/125V, NEMA 5-20R duplex receptacle shall be AH #5362, Hubbell #5362, or equivalent.
3. GFCI device shall be a duplex 5-20R, 20 amp, 125 VAC, 3-wire outlet with reset and test pushbuttons P&S #2091, or equivalent. Dry location enclosure shall consist of nylon coverplate. Wet location enclosure shall consist of stainless steel coverplate P&S #4516 on an FD box.
4. Single-pole, single throw, 20A toggle switch shall be AH #1991, Hubbell #1223, or equivalent.
5. Single-pole, double throw (three way) 20A toggle switch shall be AH #1993, Hubbell #1223, or equivalent.
6. Double-pole, double throw 20A toggle switch shall be AH #1994, Hubbell #1224, or

equivalent.

7. Manual motor controllers shall be Allen Bradley Bulletin 600, Square D Class 2510, or equivalent. Select overloads to be 1.15 times motor FLA.
8. Covers for wiring devices located out-of-doors, and in damp or wet locations shall have stainless steel weather proof cover, gaskets, and stainless steel cover screws.

2.3 DISTRIBUTION EQUIPMENT

A. Safety Switches

1. Safety switches shall be size and type as indicated. Each disconnect means shall be heavy-duty, quick-mate, quick-break mechanisms.
2. Unless otherwise indicated, safety switches shall be in a NEMA 4X stainless steel enclosure.

B. Fuses

1. Fuses shall be furnished for each fused over-current device and, in addition, three spare fuses for each rating required shall be furnished.
2. Fuses above 600 amperes shall be constructed using silver links with a fusing alloy soldered to the link for low temperature overload protection. The design shall provide time-delay of not less than 45 seconds at 300% of ampere rating. The interrupting rating shall be at least 200,000 amperes RMS symmetrical.
3. Fuses rated 600 amperes or less shall be dual element Class R, time-delay type. Such fuses shall incorporate separate thermal overload and short circuit elements. The design shall provide time delay of not less than 10 seconds at 500% of ampere rating. The interrupting rating shall be 200,000 amperes RMS symmetrical.
4. Fuses shall be Bussman, or equivalent.

C. Panelboards

1. Panelboards shall be dead-front type and shall be manufactured in accordance with Underwriters' Laboratories, Inc., standard for Panelboards (UL67). Residential load centers shall not be acceptable in lieu of panelboards.
2. The panelboards shall include automatic short circuit and over-current protective devices of the molded case circuit breaker type. All multi-pole breakers shall be so designed that an overload on one pole automatically causes all poles of the circuit breaker to open. The circuit breakers shall have the short circuit interrupting ratings indicated on the drawings.
3. Interiors shall be assembled on reinforced mounting pans or rails which provide protection against damage during handling or installation. Circuit breakers shall be assembled in accordance with the panel schedules included on the drawings. Design shall permit replacement of individual breakers without disturbing adjacent units or without disturbing main bus or branch circuit connectors. Interior design shall permit changing of branch circuits or the addition of circuit breakers to future spaces without additional machining, drilling, or tapping. Main bus bars and branch circuit connectors shall be made of copper. In-and-out adjustments of the panel interior shall be provided.

4. Panel bussing shall be arranged to maintain sequence phasing throughout, that is, adjacent poles shall be of unlike polarity and rotated in sequence. Circuit members shall be provided for each pole space or breaker space as shown on the panel schedule.
5. Cabinets shall be manufactured in accordance with Underwriters' laboratories, Inc., standard for Cabinets and Boxes (UL50) and shall provide a minimum of four inches wiring gutter on all sides. Cabinet fronts shall include doors with semi-concealed hinges, combination lock and catch on doors and a directory frame with circuit directory behind clear plastic, mounted on back of door. The front shall be attached to the box with suitable provision to provide proper alignment of trims.

2.4 MISCELLANEOUS

A. Quality Assurance

1. Manufacturers regularly engaged in the manufacture of grounding equipment and components of the types specified for a period of not less than five years.

B. Grounding Devices

1. Ground rods shall be copper clad steel in lengths and diameters as indicated.
2. Ground rod connectors shall be copper alloy with silicon bronze bolts and in sizes to fit ground rod diameters. Furnish Blackburn, Copperweld, Teledyne Metal Forming, or equivalent.
3. Grounding electrode conductor and bonding jumpers shall be soft drawn, bare copper.
4. Equipment grounding conductors shall be stranded copper conductors having a green insulating jacket for sizes #10 and smaller and color code tape or wire markers sizes #8 and larger. Conductor sizes #8 and larger shall be identified using 3M "Scotch #35", or equivalent vinyl tape at every point where the conductor is accessible.
5. Pipe ground connectors shall be copper alloy with silicon bronze bolts and in sizes to fit pipe diameter. Furnish Burndy, OZ, Buchanan, Blackburn, Cadweld, or equivalent.
6. Thermal welding devices shall consist of correct size molds to fit application and correct amount of weld metal. Furnish Enrico "Cadweld", Burndy "Thermoweld", or equivalent.

C. Execution

1. Clean contact surfaces thoroughly before connections are made to ensure clean metal to metal contact.
2. Splice grounding conductors only at equipment enclosures or manholes.
3. Ground the non-current-carrying metallic parts of electrical distribution systems and equipment and utilizations equipment fixed in place or connected by permanent wiring by means of the metal raceway system and by a supplemental equipment grounding conductor as specified in 2.4(B)(4).
4. Provide a bare ground conductor, encased in each concrete ductbank, and as detailed in the drawings.

5. Perform ground resistances test of system grounds using the fall of potential method as recommended by IEEE 81. Perform tests in normally dry weather and not sooner than 24 hours after rainfall. Record test results and submit to the Engineer with the project record documents. If any measurement exceeds 25 ohms, verify system connections and repeat last test. If resistance remains greater than 25 ohms, notify the Engineer immediately.

PART 3—EXECUTION

3.1 INSTALLATION

A. Basic Materials and Methods

1. Install the conduit system to provide the facility with the utmost degree of reliability and maintenance free operation. Kinked conduit, conduit inadequately supported or carelessly installed shall not be accepted.
2. Raceways shall be installed for all wiring runs except as otherwise indicated.
3. Conduit sizes, where not indicated, shall be code-sized to accommodate the number and diameter of wires to be pulled into the conduit. Use NEC tables for sizing.
4. Exposed runs of conduit shall be installed parallel to the lines of the structure.
5. All above grade conduit and fittings (except as specifically noted otherwise) shall consist of hot dipped galvanized rigid steel or aluminum. All underground conduit and fittings shall be direct buried schedule 40 PVC. All below grade conduit runs for low voltage signal wiring shall consist of schedule 40 PVC unless otherwise noted on the contract drawings.
6. PVC runs shall be joined with manufacturer's approved cement.
7. Finished installation of conduit runs from each terminus to each terminus shall be watertight.
8. Generally, raceways shall be installed exposed in the buildings and structures, except as otherwise specified. Horizontal runs shall be supported on 24" centers and vertical runs on 48" centers.
9. Yard runs of conduit shall consist of direct buried schedule 40 PVC. The transition from underground horizontal to above grade shall consist of schedule 80 PVC conduit and fittings to 6" above grade, at all up-turns to structures and equipment. The last three feet and up-turn shall be made with schedule 80 PVC 90 degree elbow and conduit unless otherwise noted on the contract drawings. Depth of lateral runs shall be 24" minimum and 36" maximum, unless otherwise indicated. Coordinate installation with site work finished grades.
10. Place an approved (OZ, Crouse-Hinds, Appleton) expansion fitting where crossing building expansion joints.
11. Conduit Hubs shall be installed for all exposed wire runs for #4 and larger sizes.
12. All conduits entering enclosures shall be terminated with aluminum or stainless steel conduit hub. Conduit hubs shall be Crouse-Hinds Myers Hubs or equivalent.
13. Conduit bodies such as "LB", "T", Condulets, Unilets, or equivalent shall be installed in

exposed runs of conduit wherever required to overcome obstructions, and to provide pulling access to wiring. Covers for such fittings shall be accessible and unobstructed by the adjacent construction. The use of wireways and junction boxes shall be held to a minimum. The use of wireways and junction boxes shall be coordinated with the engineer before installation.

14. Conduit shall enter all wireways, boxes, motor control centers, panelboards and other enclosures straight and true. Conduits installed cocked and not parallel to the lines of the enclosure shall not be acceptable.
15. Plastic jacketed flexible metallic (2" and larger) or non-metallic conduit (below 2") shall be used for connections to motor, electric valve operators, HVAC equipment, motorized louvers, lay-in lighting fixtures, and other devices that may need to be removed for servicing.
16. Flexible conduit runs shall consist of liquid tight conduit only. Flexible conduit runs shall be joined with specified connectors and the connectors shall be made up tightly onto the lengths of flex and onto its connected devices. All plastic jacketed flexible conduit connections shall be watertight.
17. Cap each end of conduits as soon as placed to prevent mud, dirt, debris, and water from entering raceways. Each run shall be swabbed clean prior to wire pulling.
18. All junction and pull boxes shall be equipped with blank covers.
19. All boxes shall be installed with their axes parallel to the lines of the building structure.
20. All conductors shall be the size as indicated and where no size is given, the conductor size shall be #12 AWG, unless otherwise specified.
21. Generally, control wiring shall be #14 AWG.
22. All wiring shall be installed in raceways unless otherwise indicated.
23. All power and control wiring shall be made with insulated, stranded copper wire.
24. No wire or cable shall be drawn into a conduit, until all work of a nature which may cause injury to the wire, is completed. A cable pulling compound shall be used as a lubricant and its composition shall not affect the conductor or its insulation.
25. Do not exceed cable manufacturer's recommended pulling tensions.
26. Service and feeder wiring runs shall be made from terminus to terminus without splice except for yard runs which may be spliced in junction boxes or manholes.
27. Branch circuits shall run from supply to load without splice except where taps and splices are required for receptacle, light fixture, and small appliance loads.
28. Taps, splices, and connections in #8 AWG and larger shall be made with tinned copper alloy bolted pressure connectors. Make up connection tightly to produce as low a resistance as if the conductor were continuous. Such connectors shall be insulated with a smooth cover of void-filling insulation putty and then covered with at least four (4) half lapped layers of electrical tape. Insulated connector shall have at least 1-1/2 KV insulation value.

29. Except as otherwise specified; taps, splices, and connections with #10 AWG and smaller shall be made with insulated spring wire connectors. Such connectors in damp or wet locations shall be further insulated with an envelope of half-lapped EPR over the wire nut and down 1/2" over the incoming wires; prior to applying the envelope, use a stretched piece around each wire to fill the interstices between the wires; finished splices shall be waterproof.
30. Specified sizes of wire shall be installed with factory-pigmented colors. Phase label black pigmented wires with colored banding tape as specified. Install labels at each terminus.
31. Numbered marking labels shall be installed to identify circuit numbers from panelboards and to identify control wires. Install labels on each wire in each panelboard, junction and pullbox, and device and control connection.
32. Label each wiring run with write-on waterproof labels inside each motor controller panelboard, pullbox, and handhole. Wrap label ties around wire group at conduit entrance and write on label the wire size, conduit size, and service.
33. Control wiring that terminates onto flat head type terminals shall be equipped with crimp-type spade lugs. Label each wire with number to correspond with terminal strip number.
34. All wiring inside enclosures shall be neatly trained and laced with tie-wraps.
35. All raceway systems, outlets, boxes, wireways, cabinets, enclosures, lighting fixtures, transformers, and related equipment shall be adequately and safely supported with at least 3-1 safety factor.
36. Slotted channels shall be used to support equipment that is mounted free of structure. Use factor fabricated back-to-back hot dipped galvanized members with dimension of 1-5/8" X 3-1/4" deep that have hot dipped galvanized factory fabricated welded feet.
37. Runs of exposed conduits shall be installed as follows:
 - a. Single surface runs shall be attached to the structure by means of conduit clamps, except as otherwise specified. Single runs along structural members shall be supported by means of side beam clamps, or similar supporting devices.
 - b. Multiple surface runs shall be attached to the structure by means of slotted channels. Each conduit shall be attached to the slotted channel by means of two-piece conduit clamps.
38. Slotted channels that are field cut shall have raw edges painted with cold galvanized coating spray paint.
39. All conduits shall include an NEC-250 sized insulated equipment grounding/bonding conductor.
40. Install 9" wide yellow "Electrical Warning" tape 6" above outdoor buried conduit.

B. Equipment

1. Panelboards, motor controllers, and electrical enclosures shall be installed as follows:
 - a. Install equipment and components in a manner to permit access to parts requiring

- service, and to permit removal for service without disassembly of adjacent equipment.
- b. Equipment too large to permit access through stairways, doorways, or shafts shall be installed prior to enclosing the structure.
 - c. Completed installation shall provide minimum working clearances as required by NEC.
 - d. Follow manufacturer's installation instructions. Install enclosures plumb and level. Bolt enclosures to concrete with 1/4" (minimum) diameter stainless steel bolts in Hilti type concrete anchors.
 - e. Conduit entries into enclosures shall be carefully arranged and equipped with insulating bushing. The use of reducing washers shall not be allowed.
 - f. All cables inside enclosures shall be neatly arranged and bundled and bound with plastic tie-wraps.
 - g. Tighten all wire and busbar connectors to factory recommended torque settings using a torque wrench. Coat all wiring terminations with an ample amount of anti-corrosion compound, T&B Kopr-shield or equivalent.

3.2 DRAWINGS AND SUBMITTALS

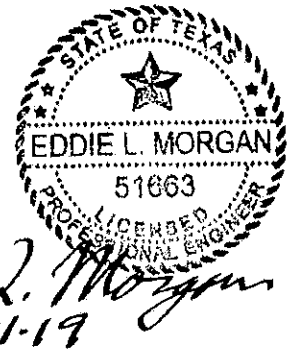
A. Submit shop drawings for the following:

- 1. Wire
- 2. Conduit-all types
- 3. Safety Switches
- 4. Pilot Devices
- 5. Enclosures
- 6. Terminal Blocks
- 7. Panelboards
- 8. Grounding Devices

B. Submit catalog literature of each item of material listed in Article A above.

END SECTION

SECTION 16620
EMERGENCY GENERATOR



PART 1—GENERAL

1.1 General Requirements

- A. It is the intent of this specification to secure a generator system that has been prototype tested, factory built, production tested, site tested, of the latest commercial design, together with all accessories necessary for a complete installation as shown on the contract drawings and specified herein. The equipment supplied and installed shall meet the requirements of the latest edition National Electrical Code, NFPA, and all applicable local codes and regulations. All equipment shall be new, of current production of a national form which assembles the generator sets as a matched unit so that there is one-source responsibility for warranty, parts, and service through a local representative with factory-trained servicemen.
- B. The generator set(s) must conform to applicable NFPA standards.
- C. The generator set(s) must be available with the Underwriters Laboratories listing (UL2200) for a stationary engine generator assembly.
- D. The generator set(s) must meet current EPA Tier Level of federal emission guidelines for stationary standby power generation.
- E. The supplier shall be the manufacturer's authorized distributor, who shall provide initial start-up services, conduct field acceptance testing, and warranty service. The supplier shall have 24-hour service availability and factory trained service technicians authorized to do warranty service on all warrantable products.
- F. The generator set supplier shall have permanent service facilities in this trade area. These facilities shall maintain a proper supply of spare parts for the supplied equipment, a shop with overhaul capabilities, and be able to provide 24 hours per day, 7 days per week, and 365 day per year field service capability.
- G. The manufacturer shall maintain model and serial number records of each generator set provided for at least 20 years.
- H. Each generator shall be provided with a factory installed nameplate giving the manufacturer's name, the rated frequency, the number of phases if ac, the rating in kilowatts or kilovolt-amperes, the normal volts and amperes corresponding to the rating, the rated revolutions per minute, and the rated ambient temperature or rated temperature rise.
- I. All stationary generators and portable generators rated more than 15 kW shall have a factory installed nameplate with the power factor, the subtransient and transient impedances, the insulation system class, and the time rating.
- J. Marking shall be provided by the manufacturer to indicate whether or not the generator neutral is bonded to the generator frame. Where the bonding of a generator is modified in the field, additional marking shall be required to indicate whether the generator neutral is bonded to the generator frame.

1.2 Submittal

A. Submittals shall include the following:

1. Manufacturer's product literature and performance data, sufficient to verify compliance to specification requirements. Estimated minimum of air flow requirements for cooling and combustion, plus an estimate of heat rejection of the engine and generator when operating at 100% load, shall be included.
2. Manufacturer's certification of prototype testing.
3. Manufacturer's published warranty documents.
4. Shop drawings showing plan and elevation views with certified overall and interconnection point dimensions.
5. Interconnection wiring diagrams showing all external connections required; with field wiring terminals marked in a consistent point-to-point manner.
6. Manufacturer's installation instructions.

B. Six (6) sets of Owner's manuals specific to the product supplied must accompany delivery of the equipment. General operating instructions, preventative maintenance, wiring diagrams, schematics and parts exploded views specific to this model must be included.

1.3 Testing

A. To assure that the equipment has been designed and built to the highest reliability and quality standards, the manufacturer and local representative shall be responsible for three (3) separate tests: design prototype tests, final production tests, and site tests.

1. Design Prototype Tests

- a. Components of the emergency system such as the engine/generator set, transfer switch, and accessories shall not be subjected to prototype tests since the tests are potentially damaging. Rather, similar design prototypes and reliability preproduction models, which will not be sold, shall be used for these tests. Upon request, the following certified test records shall be made available:
 - i. Maximum power (KW)
 - ii. Maximum motor starting (KVA) at 20% instantaneous voltage dip
 - iii. Alternator temperature rise by embedded thermocouple and by resistance method per NEMA MG1-22.40 and 16.40
 - iv. Governor speed regulation under steady-state and transient conditions
 - v. Voltage regulation and generator transient response
 - vi. Fuel consumption at no load, 1/4, 1/2, 3/4, and full load
 - vii. Harmonic analysis, voltage wave form deviation, and telephone influence factor

- viii. Three phase short circuit tests
- ix. Alternator cooling air flow
- x. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses
- xi. Endurance testing

2. Final Production Testing

- a. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
 - i. Single-step load pickup per NFPA 110
 - ii. Transient and steady-state governing
 - iii. Safety shutdown device testing
 - iv. Voltage regulation
 - v. Rated power
 - vi. Maximum power
- b. Verify all timing sequences operate properly and are set to factory settings.
- c. Verify the transfer mechanism operates properly.
- d. Verify all manual operations and indications are functioning properly.
- e. Upon request, arrangements to witness this test shall be made or a certified test record shall be sent prior to shipment.

3. Site Tests

- a. An installation check, start-up, and resistive load bank test, from an external source, shall be performed by the manufacturer's local representative. The existing building load shall not be used. The engineer, regular operators, and the maintenance staff shall be notified of the time and date of the site test. The tests shall include:
 - i. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations under the environmental conditions present and expected.
 - ii. Accessories that normally function while the set is standing by shall be checked prior to cranking the engine. This shall include block heaters, battery charger, generator strip heaters, etc.
 - iii. Start-up under test mode to check for exhaust leaks, path of exhaust gases, cooling air flow, movement during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.

- iv. Manual start-up, manual transfer of the load, and manual shutdown. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, amperes, and frequency shall be monitored throughout the test. An external load bank shall be connected to the system for testing.

1.4 Warranty

- A. The standby generator system shall be warranted by the manufacturer for two (2) years. The warranty shall include all parts, labor, travel, mileage, freight, and expenses for the full warranty period.
- B. The warranty period shall commence when the standby power system is first placed into service. Multiple warranties for individual components (engine, alternator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided.

PART 2—PRODUCT

2.1 Equipment

- A. The generator set shall be rated continuous standby, defined as continuous for the duration of any power outage, (1 phase, 3 wire, 1.0 power factor at 500 feet altitude, and 110°F, or 3 phase, 4 wire, 0.8 power factor at 500 feet altitude, and 110°F) as a minimum.
 - 1. The unit shall be rated as shown on the "One-Line Diagram".
 - 2. The generator set shall be capable of delivering the required starting KVA as outlined on the "One-Line Diagram" with a maximum instantaneous voltage dip of 35%.
 - 3. Each engine-generator set shall be mounted on a heavy duty steel base to maintain alignment between components. Base shall include vibration isolators provided by manufacturer.
 - 4. It is preferred that the electric plant (engine and alternator) be mounted with internal vibration isolation onto a welded steel base. If internal vibration isolation is not available as a manufacturer option, external vibration isolation, as designed and tested by the manufacturer, shall be provided.
- B. The engine must be EPA certified by the manufacturer or field certified upon construction completion.

2.2 Engine

- A. The prime mover shall be a liquid cooled, internal combustion, 4-cycle design maximum 3,600 RPM, equipped to operate on fuel indicated on the "One-Line Diagram".
- B. The engine shall be cooled with a unit mounted radiator, fan, water pump, and closed coolant recovery system providing visual diagnostic means to determine if the system is operating with a normal engine coolant level. The radiator shall be designed for operation in 122°F, 50°C ambient temperature. The equipment supplier shall provide 50% ethylene glycol antifreeze solution to fill engine cooling system.
- C. The dry type replacement air cleaner elements must be mounted on the unit. Full pressure lubrication shall be supplied by a positive displacement lube oil pump. The engine shall have a replaceable oil filter(s) with internal bypass and replaceable element(s). Engine coolant and oil

drain extensions, equipped with pipe plugs, and must be provided to outside of the mounting base for cleaner and more convenient engine servicing. A fan guard must be installed for personnel safety.

- D. The engine shall have a 65 ampere minimum automatic battery charging alternator with a transistorized voltage regulator. Remote 2-wire starting shall be by a 24 volt positive engagement solenoid shift, electric starter.
- E. The engine fuel system shall be designed for primary operation on one of the following fuels, as specified on the "One-Line Diagram":
 - 1. Natural gas having a BTU content of 1,000 BTU per cubic foot delivered to the engine in a vapor state. A carburetor, secondary regulator, fuel lock-off solenoid, and all piping must be installed at the point of manufacturing, terminating at a single pipe opening external to the mounting base.
 - 2. LP gas having a BTU content of 2,500 BTU (nominal) per cubic foot delivered to the engine in a vapor state. A carburetor, secondary regulator, fuel lock-off solenoid, and all piping must be installed at the point of manufacturing, terminating at a single pipe opening external to the mounting base.

If indicated on the contract drawings a hot water vaporizer shall be installed by the manufacturer at the point of manufacturing with a pipe connection provided for LP gas delivered to the engine in a liquid state.

If the genset is powered by LP gas, the fuel system shall include a (see "One-Line Diagram") gallon (useable) concrete pad mounted fuel tank. It shall be provided by the contracted LP gas provider and installed on the pre-poured concrete pad (by the Contractor). The location of the tank shall conform to the NFPA 58 Appendix 1 minimum required distances from structures and equipment.

The tank shall be filled with LP gas after start-up, check-out, and final acceptance of the unit. Contractor shall be responsible for all LP gas needed.

- 3. Diesel No. 2. A primary fuel filter, water separator, manual fuel priming pump, engine-driven or electric fuel transfer pump capable of lifting fuel six feet, fuel shutoff solenoid, fuel distribution system with a isochronous governor, and all fuel lines must be installed at the point of manufacture. The primary diesel fuel filter shall be capable of removing contaminants of 10 microns. Element shall be replaceable paper type.

If the genset is powered by diesel fuel, the fuel system shall include a (see "One-Line Diagram") gallon (useable) double-walled base-mounted fuel tank. It shall have a stub-up area convenient for electrical conduit entry. It shall have the structural integrity to support the engine-generator set and carry the UL 142 mark. Minimum features shall include all welded construction, a fuel filter cap, double wall leakage detection monitor, electric fuel level sensor, sight glass or level gauge, fuel line check valve, vent and fittings for fuel supply, return, fill, and emergency vent. This tank must be supplied by the engine-generator set manufacturer and be installed before shipment. Supply the base tank with emergency venting per NFPA 37. The base tank fuel fill pipe must be extended 8" to facilitate filling the base tank.

Tank provided shall be installed in accordance with EPA 40 CFR 112. Any fuel tank installed exceeding 1320 gallons shall have spill containment installed as per EPA requirements and approved by engineer at no additional cost to Owner.

The fuel tank shall be filled with #2 diesel fuel after start-up, check-out, and final acceptance of the unit. Contractor shall be responsible for all diesel fuel needed.

4. A system shall be supplied to deliver an adequate amount of fuel to the engine from a storage tank. Pipe sizes shall be no smaller than the minimum recommended by the engine manufacturer to avoid fuel flow restrictions. The engine supply and return line shall be equipped with a length of flexible fuel lines, unions, and gate valves. No copper lines are acceptable.
- F. Sensing elements to be located on the engine for low oil pressure shutdown, high coolant temperature shutdown, low coolant level shutdown, over-speed shutdown and over-crank shutdown. These sensors are to be connected to the control panel using a wiring harness with the following features: wire number labeling on each end of the wire run for easy identification, each sensor connection shall be sealed to prevent corrosion and all wiring to be run in flexible conduit for protection from the environment and any moving objects.
- G. Engine speed shall be controlled by isochronous governor with no change in alternator frequency from no load to full load. Steady state regulation is to be 0.25%.
- H. The generator system shall support generator start-up and load transfer within 10 seconds.

2.3 Alternator

- A. The alternator shall be a revolving field type, rated at KW rating and wired for voltage and phase as indicated on the "One-Line Diagram". Each alternator shall be salient-pole, brushless, 12-lead re-connectable, self-ventilated of drip-proof construction with Amortisseur rotor windings and skewed stator for smooth voltage waveform. Photosensitive components will not be permitted in the rotating exciter. The stator shall be direct connected to the engine to ensure permanent alignment. The insulation shall meet the NEMA standard (MGI-22.40 and 16.40) for Class F and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL E-4970A. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within $\pm 2\%$ at any constant load from 0 to 100% of rating. The regulator shall be protected from the environment by conformal coating.
- B. The generator shall meet temperature rise standards for Class "H" insulation; operate within Class "F" standards for extended life. All leads must be extended into an AC connection panel. The alternator shall be protected by internal thermal overload protection and an automatic reset field circuit breaker.
- C. An additional "tropical" coating shall be applied to the alternator windings to exclude the entrance of moisture and inhibit the growth of fungus and moss.

2.4 Generator

- A. Voltage regulation shall be $\pm 2\%$ of rated voltage for any constant load between no load and rated load.
- B. Frequency regulation shall be capable of single step load pickup of 100% nameplate KW and power factor, less applicable derating factors, with the engine-generator set at operating temperature.
- C. The engine-generator set shall be capable of single step load pickup of 100% nameplate KW and power factor, less applicable derating factors, with the engine-generator set at operating

temperature in accordance with NFPA 110.

- D. Available SKVA to be as indicated on the "One-Line Diagram". The generator set shall be capable of sustaining a minimum of 90% of rated no load voltage with the specified KVA load at near zero power factor applied to the generator set.
- E. Upon one-step application of any load up to 90% of the rated load at rated power factor voltage dip shall not exceed 35% and shall recover to $\pm 2\%$ of rated voltage within one second.
- F. The generator shall be capable of sustaining at least 250% of rated current for at least 10 seconds under a three phase symmetrical short by inherent design or by the addition of an optional current boost system.

2.5 Controller

- A. The generator control system shall be a fully integrated microprocessor based control system for standby emergency engine generators meeting all requirements of NFPA 110 level, as indicated on the "One-Line Diagram".
- B. The generator control system shall be a fully integrated control system enabling remote diagnostics and easy building management integration of all generator functions. The generator controller shall provide integrated and digital control over all generator functions including: engine protection, alternator protection, speed governing, voltage regulation, and all related generator operations. The generator controller must also provide seamless digital integration with the engine's electronic management system if so equipped.
- C. Controls shall be capable of communications with building automation via the Modbus protocol without network cards or protocol exchangers. Internet and intranet connectivity shall be available as an option at additional cost.
- D. The control system shall provide an environmentally sealed design including encapsulated circuit boards and sealed automotive style plugs for all sensors and circuit board connections. The use of non-encapsulated boards, edge cards, and PC ribbon cable connections are considered unacceptable.
- E. A set-mounted controller capable of facing right, left, or rear shall be mounted with vibration isolators on the generator unit. The controller shall include a microprocessor control board that shall be conformal coated. Relays shall only be acceptable in high current circuits. Circuit boards that utilize large capacitors or heat sinks must utilize encapsulation methods to securely support these components.
- F. A predictive maintenance algorithm that alarms when maintenance is required. The controller shall have the capability to call out the local servicing dealer when maintenance is required.
- G. Diagnostic capabilities should include time-stamped event and alarm logs, ability to capture operational parameters during events, simultaneous monitoring of all input or output parameters, callout capabilities, support for multi-channel digital strip chart functionality and 0.1 ms data logging capabilities.
- H. The control system shall provide pre-wired customer use I/O: 4 contact inputs, 2 analog inputs, 4 relay outputs, and communications support via RS232, RS485, and an optional modem. Customer I/O shall be software configurable providing full access to all alarm event, data logging, and shutdown functionality. In addition, custom ladder logic functionality shall be supported to provide application support flexibility. The ladder logic function shall have access to all the

controller inputs and customer assignable outputs.

- I. Control panel will display all user pertinent unit parameters including:
 1. Engine and alternator operating conditions
 2. Oil pressure and optional oil temperature
 3. Coolant temperature and level alarm
 4. Engine speed
 5. DC battery voltage
 6. Run time hours
 7. Generator voltages, amps, frequency, kilowatts, and power factor
 8. Alarm Status
 9. Current alarm(s) condition per NFPA 110 level, as indicated on the "One-Line Diagram"
 10. Alarm log of last twenty alarm events (date and time stamped)
- J. For system reliability and security concerns, access to and manipulation of the internal operating parameters and alarm limits shall be password protected software by trained personnel. System configuration support shall be provided locally or remotely by the manufacturer's servicing representatives.
- K. The following equipment is to be installed at the engine-generator set manufacturer's facility:
 1. A double-pole double-throw relay shall be factor installed, socket mounted in the generator control panel and operate on engine start and run for customer connection.
- L. The following equipment is to be provided by the engine-generator set manufacturer and shipped loose with the unit.
 1. **If indicated on the contract drawings**, provide a NFPA 110 level, as indicated in the contract documents, compliant alarm annunciator panel for remote indication per local and national code requirements. The annunciator shall be controlled using RS485 communications from the generator controller. Annunciators requiring individual contacts and wires per indication point are unacceptable. The panel shall have an ALARM switch that when moved to the OFF position silences the audible alarm. A TEST/RESET switch must be included to verify the lights are functional and reset any condition after it has cleared. The remote annunciator shall have provision for installing a switch with the capability of starting, and stopping the standby generator set from the annunciator panel.
- M. Circuitry shall be of plug-in design for quick replacement. The controller shall be equipped to accept a plug-in device capable of allowing maintenance personnel to test controller performance without operating the engine. The controller shall include:
 1. Fused DC circuits
 2. Complete two-wire start/stop control which shall operate on closure of a remote contact

3. Speed sensing and a second independent starter motor disengagement systems shall protect against the starter engaging with a moving flywheel. Battery charging alternator voltage will not be acceptable for this purpose.
4. The starting system shall be designed for restarting in the event of a false engine start, by permitting the engine to completely stop and then reengage the starter.
5. Cranking cycle with ten-second ON and OFF cranking periods
6. Over-crank protection designed to open the cranking circuit after 60 seconds if the engine fails to start
7. Circuitry to shut down the engine when a signal for high coolant temperature, low oil pressure, or over-speed is received
8. Engine cool down timer factory set at five (5) minutes to permit unloaded running of the standby set after transfer of the load to normal.
9. Three-position (AUTO – OFF – TEST) selector switch. In the test position the engine shall start and run regardless of the position of the remote starting contacts. In the automatic position the engine shall start when contacts in the remote control circuit close and stop five (5) minutes after those contacts open. In the off position the engine shall not start even though the remote start contacts close. This position shall also provide for immediate shutdown in case of an emergency. Reset of any fault lamp shall also be accomplished by putting the switch to the off position.
10. Indicating lights to signal:
 - a. Switch "OFF" (flashing red)
 - b. Over-crank (red)
 - c. Emergency stop (red)
 - d. High Water temperature (red)
 - e. Over-speed (red)
 - f. Low oil pressure (red)
11. Test button for indicating lights
12. Alarm horn with silencer switch

2.6 Instrument Panel

A. A set-mounted solid-state instrument panel shall include the following functions:

1. Voltmeter
2. Ammeter
3. Frequency
4. Battery Charging Voltmeter
5. Coolant Temperature

6. Oil Pressure
7. Running Time Meter
8. Voltage Adjust Rheostat
9. Dry Contact Closure for Remote "RUN" Indication
10. Dry Contact Closure for Remote Common "FAIL" Alarm Indication
11. Engine Cool Down Timer

2.7 Accessories

A. The following accessories shall be installed

1. Block heater, 1500 watt, 120/208/240 volt thermostatically controlled to maintain engine coolant at proper temperature to meet the start-up requirement of NFPA-99 Regulation.
2. Thermostatically controlled 120 volt, 100 watt heater in the control panel; and 120 volt, 150 watt heater in the alternator frame.
3. Weatherproof housing – Factory-assembled to generator set and constructed of Galvaneel sheet material. Housing shall provide ample airflow for generator set operation. Housing and tank shall be painted with an offshore painting system consisting of an initial coating of primer, and a top coat of polyurethane paint. Manufacturer's stand powder coated painting system shall also be acceptable. Side panels shall be lockable and easily removed for servicing.

If indicated on the contract drawings, provide a weatherproof, sound enclosure with the features of the weatherproof housing listed and with outlet hoods designed to redirect air and noise vertically and acoustical insulation (HL 94 HF1 flammability classification).

4. Battery charger shall be a 10 amp (minimum) voltage regulated floating type battery charger provided for each engine-generator set. Input AC voltage and DC output voltage shall be as required. Chargers shall be equipped with float, taper, and equalize charge settings. Operational monitors shall provide visual output along with individual form C contacts rated at 4 amps, 120 VAC, 30 VDC for remote indication of:
 - a. Loss of AC power – **red** light
 - b. Low battery voltage – **red** light
 - c. High battery voltage – **red** light
 - d. Power ON – **green** light
5. Low coolant level shutdown
6. Battery rack, battery cables, heavy duty, lead type 12-volt or 24-volt battery capable of delivering the manufacturer's recommended minimum cold-cranking amps required at 0°F shall be supplied dry, along with separate electrolyte which will be added just prior to start-up. The batteries shall be installed in plastic boxes to prevent spillage of electrolyte onto the generator/fuel tank structure.
7. Engine exhaust silencer (rated for critical application) shall be provided for each engine, size and type as recommended by the generator set manufacturer. The silencer shall be

connected to the engine with a flexible, gasproof, seamless, stainless steel exhaust connection. A rain shield flapper valve(s) will terminate the exhaust pipe. All components must be properly sized to assure operation without excessive backpressure when installed.

8. A NEMA 1 panel that is an integral part of the generator set must be provided to allow the installer a convenient location in which to make electrical output connections. A fully rated, isolated neutral must be included by the generator set manufacturer to insure proper sizing.
9. A main line circuit breaker rated at the amperage rating shown on the "One-Line Diagram" and carrying the UL mark shall be factory installed. The breaker shall be rated per the manufacturer's recommendations and N.E.C. recommendations and shall be mounted in the genset connection box. The breaker shall be set-mounted, molded case thermal-magnetic type, with 12 volt DC shunt trip, and auxiliary contacts for breaker position. The line side connections are to be made at the factory. Output lugs shall be provided for load side connections. A system utilizing manual reset circuit breakers with current transformers is unacceptable.
10. **If indicated on the contract drawing**, provide and install a remote annunciator located inside the building. The remote annunciator shall provide all the indications and audible alarms called for by NFPA Standard 110 as provided on the engine-generator set control panel; and in addition shall provide indications for high battery voltage, low battery voltage, normal battery voltage, battery charger malfunction. Alarm silence and lamp test switches shall be provided.
11. For natural gas generator a non-resettable hour meter shall be installed on the engine.

2.8 Acceptable Manufacturers

- A. This system shall be supplied by a manufacturer who has been regularly engaged in the production of engine-alternator sets, automatic transfer switches, and associated controls for a minimum of ten (10) years, thereby identifying one source of supply and responsibility.
- B. The manufacturer shall have printed literature and brochures describing the standard series specified, not a one-of-a-kind fabrication.
- C. The generator unit shall be as manufactured by Caterpillar Power Systems, Cummins Power Generation, Generac Power Systems, Kohler Power Systems, Baldor Electric Co., Taylor Power Systems, or engineer accepted equivalent.

PART 3—AUTOMATIC TRANSFER SWITCH

3.1 GENERAL REQUIREMENTS

- A. Furnish and install an automatic transfer switch having the ratings, options, etc., indicated on the drawings or noted herein. The automatic transfer switch shall be fully rated to protect all types of loads, inductive and resistive, from loss of continuity of power.
- B. The transfer switch shall automatically transfer its load circuit to an emergency or alternate power supply upon failure of its normal or preferred source.
- C. The transfer switch shall be either MANUAL or AUTOMATIC as indicated on the "One-Line Diagram". The transfer switch shall be furnished by the manufacturer of the engine-generator set so as to maintain system compatibility and local service responsibility for the complete

emergency power system. It shall be listed by Underwriter's Laboratory, Standard 1008 with fuse or circuit breaker protection. Representative production samples of the transfer switch supplied shall have demonstrated through tests the ability to withstand at least 10,000 mechanical operation cycles. One operation cycle is the electrically operated transfer from normal to emergency and back to normal. Wiring must comply with the NEC.

- D. The manufacturer shall furnish schematic and wiring diagrams for the particular automatic transfer switch and a typical wiring diagram for the entire system.

3.2 RATINGS & PERFORMANCE

- A. The transfer switch shall be a 3-pole or 4-pole design, as shown on the "One-Line Diagram". Rated for the amp rating as shown on the "One-Line Diagram" and designed for continuous operation in ambient temperatures of -20°F (-30°C) to 140°F (60°C). Main power switch contacts shall be rated for 600 VAC minimum. The transfer switch supplied shall have a minimum withstand and closing rating when fuse protected of 200,000 amperes. Where the line side over-current protection is provided by circuit breakers, the short circuit withstand and closing ratings shall be 85,000 amperes RMS. These RMS symmetrical fault current ratings shall be the rating listed in the UL listing or component recognition procedures for the transfer switch. All withstand tests shall be performed with the over-current protective devices located external to the transfer switch.

3.3 CONSTRUCTION

- A. The transfer switch shall be double throw construction, positively electrically and mechanically interlocked to prevent simultaneous closing and mechanically held in both normal and emergency positions. Independent break before make action before make action shall be used to positively prevent dangerous source-to-source connections. When switching the neutral, this action prevents the objectionable ground currents and nuisance ground fault tripping that can result from overlapping designs. The transfer switch shall be approved for manual operation. The electrical operating means shall be by electric solenoid. Every portion of the contractor is to be positively mechanically connected. No clutch or friction drive mechanism is allowed, and parts are to be kept to a minimum. The transfer switch shall not contain integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
- B. The transfer switch shall provide complete protection with field adjustable solid-state voltage sensing logic to monitor each phase of the normal power supply. The close differential adjustment shall be factory set to drop out when the monitored voltage drops below 70% of normal and initiate load transfer when the alternate stand-by source becomes available. Upon restoration of the normal source to a pickup level of 90%, the logic shall initiate automatic re-transfer of the load circuits to the normal source.
- C. The transfer switch shall consist of completely enclosed contact assemblies and a separate control logic panel. The contact assemblies shall be operated by a non-fused unidirectional motor operator or stored energy mechanisms, and be energized only momentarily during transfer providing inherently double throw switching action. Control power for all transfer operations shall be derived from the line side of the source to which the load is being transferred.
- D. Transfer switches shall be capable of being operated manually under full load conditions. Manual operation shall be accomplished via a permanently affixed manual operator or

integrally mounted pushbutton operators located on the face of the contact assemblies. Removable manual operating handles and handles which move in the event electrical operators should suddenly become energized while performing a manual transfer operation are not acceptable. The manual operator shall provide the same contact-to-contact transfer time as provided under normal automatic operation to prevent possible flashovers from switching the main contacts slowly. In addition, provisions shall be provided to allow disengagement of the electrical operator during manual operation.

- E. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching. Maximum electrical transfer time in either direction shall be 160 milliseconds, exclusive of time delays. Main switch contacts shall be high pressure silver alloy with arc chutes to resist burning and pitting for long life operation.
- F. Each transfer switch shall be positively interlocked both mechanically and electrically to prevent simultaneous closing of both sources under either automatic or manual operation. A neutral position shall not be possible under normal electrical operation unless a delayed transition accessory is required for switching highly inductive loads. Each transfer switch shall have a manual neutral position for load circuit maintenance. A transfer switch position indicator shall be visible from the front of the switch to show to which source the transfer switch is connected.
- G. Transfer switches applied as service entrance switches shall be provided with over-current trip units and a service entrance label. An external key-operated selector switch shall be provided to disconnect the power supplies. External pilot lights shall indicate the availability of each source as well as breakers in a tripped or disconnected position. Provide a neutral disconnect link for three pole solid neutral switches, and a neutral to ground main bonding jumper for all switches to meet UL service entrance requirements. Ground fault protection shall be provided for all switches rated 1000 amperes or more applied on 480Y/277 volt systems in accordance with NEC Article 230-95.
- H. All three phase four wire transfer switches used on systems with ground fault equipment shall be true four pole switched neutral type with all four poles for each source being fully rated and connected to a common shaft. The fourth (neutral) pole contact shall be of identical construction as, and operated simultaneously with, the main power contacts. Add-on or overlapping neutral contacts shall be acceptable for rating below 600 amperes.
- I. Inspection and replacement of all separate arcing contacts (moving and stationary) shall be possible from the front of the transfer switch.
- J. A solid state sensing and control logic panel shall be separately mounted from the power switching portion of the transfer switch. The two sections shall be connected together by control cables with plug-in connectors. The control section shall be capable of being disconnected from the power section for maintenance purposes.
- K. The logic circuit shall utilize solid-state components mounted on printed circuit boards to accomplish functions such as timing, time delays, and voltage and frequency monitoring. LED's shall be furnished to indicate the operation of each solid-state function furnished. Construction shall be such that functions are individually replaceable without requiring replacement of the complete solid-state package. Plug-in modifications shall be available for field installation without voiding the UL label.
- L. The transfer switch shall be suitable for operation on any voltage from 208 through 600 volts

AC, 50 or 60 Hertz.

- M. All pilot devices and relays shall be industrial type rated 10 amperes with self-cleaning contacts.

3.4 CONTROLS

- A. All control equipment shall be mounted on the inside of the cabinet door in a metal lockable enclosure with transparent safety shield to protect all solid state circuit boards. This will allow for ease of service access when main cabinet lockable door is open, but to prevent access by unauthorized personnel. Control boards shall have installed cover plates to avoid shock hazard while making control adjustments. The solid-state voltage sensors and time delay modules shall be plug-in circuit boards with silver or gold contacts for ease of service.
- B. A solid-state under voltage sensor shall monitor all phases of the normal source and provide adjustable ranges for field adjustments for specific application needs. Pick-up and drop-out settings shall be adjustable from a minimum of 70% to a maximum of 95% of nominal voltage. A utility sensing interface shall be used, stepping down system voltage to 24 VAC, helping to protect the printed circuit board from voltage spikes and increasing personnel safety when troubleshooting.
- C. Controls shall signal the engine-generator set to start in the event of a power interruption. A set of contacts shall close to start the engine and open for engine shutdown. A solid-state time delay start, adjustable, 1 to 60 seconds, shall delay this signal to avoid nuisance start-ups on momentary voltage dips or power outages.
- D. The transfer switch shall transfer the load to the engine-generator set after it has reached proper voltage, adjustable from 70-90% of system voltage, and frequency, adjustable from 80-90% of system frequency. A solid-state time delay, adjustable from 5 seconds to 3 minutes, unless noted otherwise on the "One-Line Diagram", shall delay this transfer to allow the engine-generator to warm-up before application of load. There shall be a switch to bypass this warm-up timer when immediate transfer is required.
- E. The transfer switch shall retransfer the load to the line after normal power restoration. A return to utility timer, adjustable from 1-30 minutes, shall delay this transfer to avoid short-term normal power restoration.
- F. The operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred. Controls shall provide an automatic retransfer of the load from emergency to normal if the emergency source fails with the normal source available.
- G. The transfer switch shall signal the engine-generator to stop after the load retransfers to normal. A solid-state engine cool-down timer, adjustable from 1-30 minutes, shall permit the engine to run unloaded to cool-down before shutdown. Should the utility power fail during this time, the switch will immediately transfer back to the generator.
- H. Provide an engine minimum run timer, adjustable from 5-30 minutes, to ensure an adequate engine run period.
- I. Provide a solid-state plant exercise clock. It must allow selection of any combination of days of the week and the time of day for the generator set exercise period. Clock shall have a one week cycle and be powered by the load side of the transfer switch. A battery must be

supplied to maintain the circuit board clock operation when the load side of the transfer switch is de-energized. Include a switch to select if the load will transfer to the engine-generator set during the exercise period.

- J. The transfer switch shall have a time delay neutral feature to provide a time delay, adjustable from 0.1 to 10 seconds, during the transfer in either direction, during which time the load is isolated from both power sources. This allows residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle. A switch will be provided to bypass all transition features when immediate transfer is required.
- K. The transfer switch shall have an in-phase monitor which allows the switch to transfer between live sources if their voltage waveforms become synchronous within 20 electrical degrees within 10 seconds of transfer initiation signal. A switch must be provided to bypass this feature if not required.
- L. If the in-phase monitor will not allow such a transfer, the control must default to time delay neutral operation. Switches with in-phase monitors which do not default to time delay neutral operation are not acceptable.
- M. Front mounted controls shall include a selector switch to provide for a NORMAL TEST mode with full use of time delays, FAST TEST mode which bypasses all time delays to allow for testing the entire system in less than one minute, or AUTOMATIC mode to set the system for normal operation.
- N. Provide bright lamps to indicate the transfer switch position in either UTILITY (white) or EMERGENCY (red). A third lamp is needed to indicate STANDBY OPERATING (amber). These lights must be energized from utility or the engine-generator set.
- O. Provide manual operating handle to allow for manual transfer. This handle must be mounted inside the lockable enclosure so accessible only by authorized personnel.
- P. Provide maintenance disconnect switch to prevent load transfer and automatic engine start while performing maintenance. This switch will also be used for manual transfer switch operation.
- Q. Provide LED status lights to give a visual readout of the operating sequence. This shall include utility on, engine warm-up, standby ready, transfer to standby, in-phase monitor, time delay neutral, return to utility, engine cool-down, and engine minimum run. A "signal before transfer" lamp shall be supplied to operate from optional circuitry.

3.5 ACCESSORIES

- A. The transfer switch mechanism and controls are to be mounted in a NEMA enclosure, type and location as indicated on the "One-Line Diagram".
- B. The following options are to be provided by the transfer switch manufacturer:
 - 1. Four additional SPDT (form C), 10 ampere, 24 volt auxiliary contacts, (2 NO and 2 NC) to indicate transfer switch position and the availability of each source.
 - 2. Engine start contact

3. Delayed transition time delay, adjustable 0 to 120 seconds, when the load is transferred in either direction to prevent excessive inrush currents due to out-of-phase switching of large inductive loads.
4. Four position selector switch to provide "TEST", "AUTO", "OFF", "ENGINE START".
Furnish white pilot light for "OFF" indication.

PART 4—EXECUTION

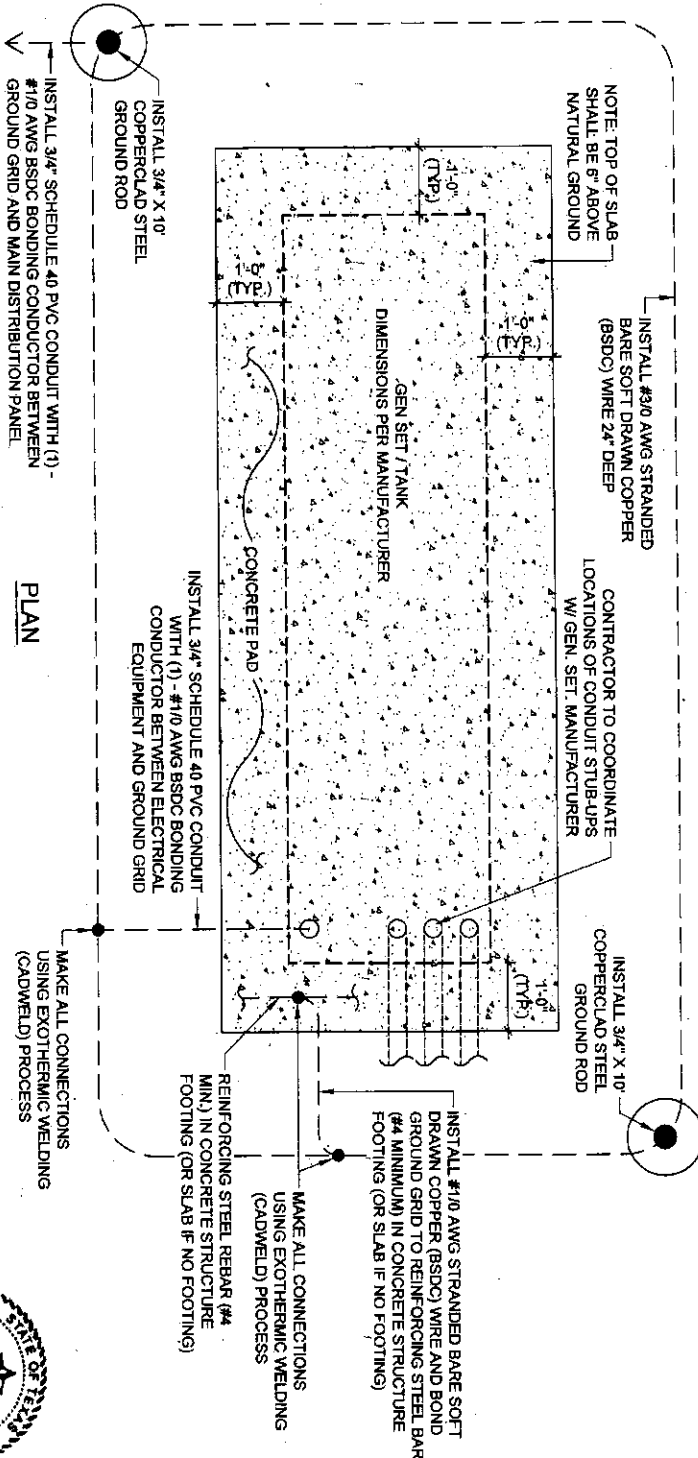
4.1 INSTALLATION

- A. Installation shall comply with applicable state and local codes as required by the authority having jurisdiction. Install equipment in accordance with manufacturer's instructions and instructions included in the listing or labeling of UL listed products. The installer shall provide the electrical power wiring circuits to all heaters on the generator set.
- B. Generator set factory tests on the equipment to be shipped shall be performed at rated load and rated power factor. Generator sets that have not been factory tested at rated power factor will not be acceptable. Tests shall include: run at full load, maximum power, voltage regulation, transient and steady-state governing, single step load pickup, and safety shutdowns.
- C. The supplier of the electric generating plant and associated items covered herein shall provide factory-trained technicians to checkout the completed installation and to perform an initial start-up inspection to include:
 1. Ensuring the engine starts (both hot and cold) within the specified time
 2. Verification of engine parameters within specification
 3. Verify no load frequency and voltage, adjusting if required
 4. Test all automatic shutdowns of the engine-generator
 5. Perform a load test of the electric plant; ensuring full load frequency and voltage are within specification by using building load
- D. The complete installation shall be tested for compliance with the specification following completion of all site work. Testing shall be conducted by representatives of the manufacturer, with required fuel supplied by Contractor. The Engineer shall be notified two (2) days in advance and shall have the option to witness the test.
- E. Installation acceptance tests to be conducted on-site shall include a "cold start" test, building load test for 1.5 hours, and a full load test with a resistive load bank for 30% @ 30 minutes, 50% @ 30 minutes, and 100% @ 60 minutes in accordance with NFPA 110. Provide a resistive load bank and make temporary connections for full load test. Start-up time and operating parameters shall be recorded and included with report.

END SECTION

NOTE: ALL CONDUITS SHALL BE
INSTALLED THROUGH CONCRETE PAD.
CONDUIT RUNS ON TOP OF CONCRETE
PAD SHALL BE UNACCEPTABLE.

COORDINATE CONDUIT ROUTING WITH
NATURAL GAS SUPPLY PIPING. RE: NATURAL
GAS NOTE #13 FOR GAS SUPPLY DETAILS.

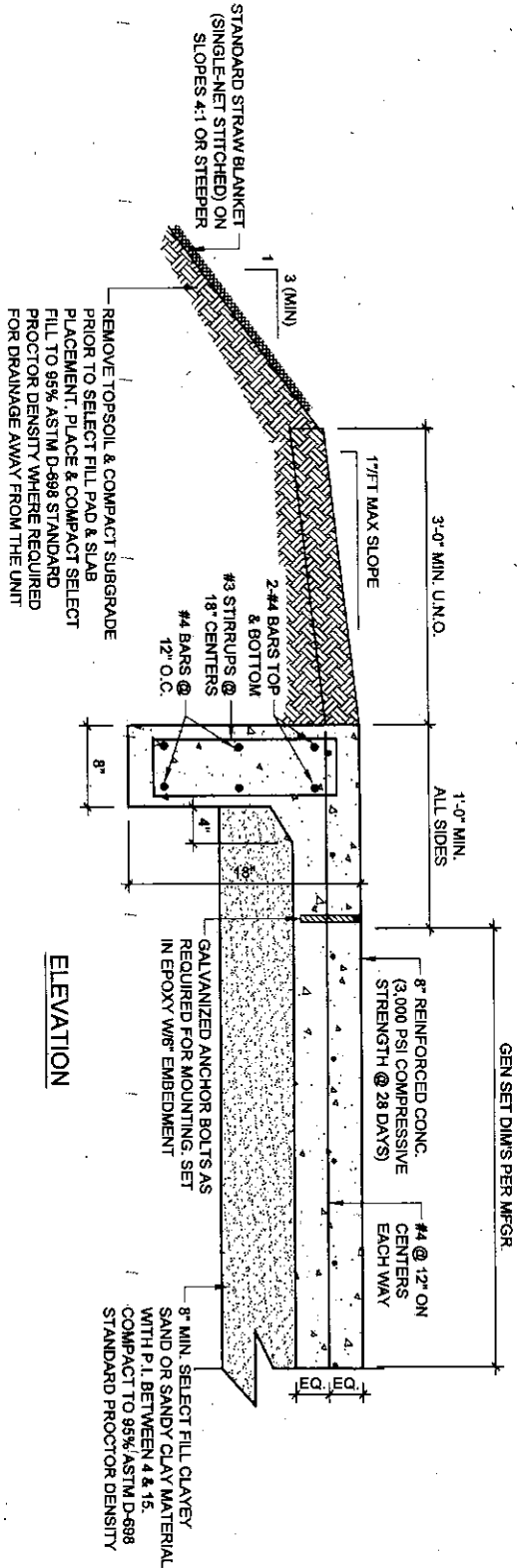


PLAN

		DATE		DRAWN BY		APPROVED BY		SCALE		SHEET NO.	
		4-11-19		JRT		ELM		N.T.S.		148063	
GOODWIN-LASTER-STRONG, INC. ENGINEERING & ARCHITECTURE 1000 W. MAIN ST., SUITE 100 NEWTON COUNTY, TEXAS 77858 (936) 265-1111 FAX (936) 265-1112											
NEWTON COUNTY Generators Newton County, Texas Generator Slab Layout 2019 ALL RIGHTS RESERVED BY GOODWIN-LASTER, INC. UNAUTHORIZED USE OR REPRODUCTION IS PROHIBITED WITHOUT WRITTEN CONSENT FROM GOODWIN-LASTER, INC. TITLE BLOCK PRESENTATION 4-11-19 10-19 PM PRESENTATION 11/10/2020											

Edie L. Morgan
4-11-19





ELEVATION

NOTE:
1. CONTRACTOR TO COORDINATE WITH GENERATOR MANUFACTURER FOR LOCATIONS OF CONDUIT, ANCHORING, AND SUPPORT SLAB DIMENSIONS.
2. ALL CONCRETE WORK SHALL BE IN CONFORMANCE WITH THE MOST RECENT EDITION OF ACI 318 BUILDING CODE REQUIREMENTS FOR REINFORCED CONCRETE.

- NOTE: IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO INVESTIGATE SUBSURFACE SITE CONDITIONS AND BECOME FAMILIAR WITH THE REQUIREMENTS OF INSTALLING 3/4" X 10' COPPER/LAD STEEL GROUND RODS. THE CONTRACTOR SHALL PROVIDE EQUIPMENT AS NECESSARY TO ACCOMPLISH THE FOLLOWING STEPS:
- 1) DRIVE THE GROUND RODS TO THE FULL 10' DEPTH. IF THE GROUND RODS CANNOT BE DRIVEN THEN THEY SHALL BE INSTALLED PER STEP 2.
 - 2) BORE A 6" DIAMETER X 10' DEEP GROUND WELL BY WHATEVER MEANS NECESSARY. INSTALL 10' GROUND ROD (ONE 10' SECTION INTO CENTER OF WELL, BACKFILL AND TAMP AROUND ROD WITH ENCO 195M COMPOUND TO WITHIN 24" OF GRADE. FINISH BACKFILL WITH SELECT TOPSOIL AFTER CONNECTION OF GROUNDING ELECTRODE CONDUCTORS(S).

		DATE	DRAWN BY	APPROVED BY	SCALE	25% REDUCED
		4-11-19	JR	ELM	N.T.S.	1/8"=1'-0"
Newton County Generators Newton County, TX Generator Slab Detail		SHEET NO. E2				
2019 ALL RIGHTS RESERVED BY GOODWIN-LASTER-STRONG, INC. UNAUTHORIZED USE OR REPRODUCTION IS PROHIBITED WITHOUT WRITTEN CONSENT FROM GOODWIN-LASTER-STRONG, INC. THE PUMP REGISTRATION #413 THE PUMP REGISTRATION #1010000						

Eddie L. Morgan
4-11-19

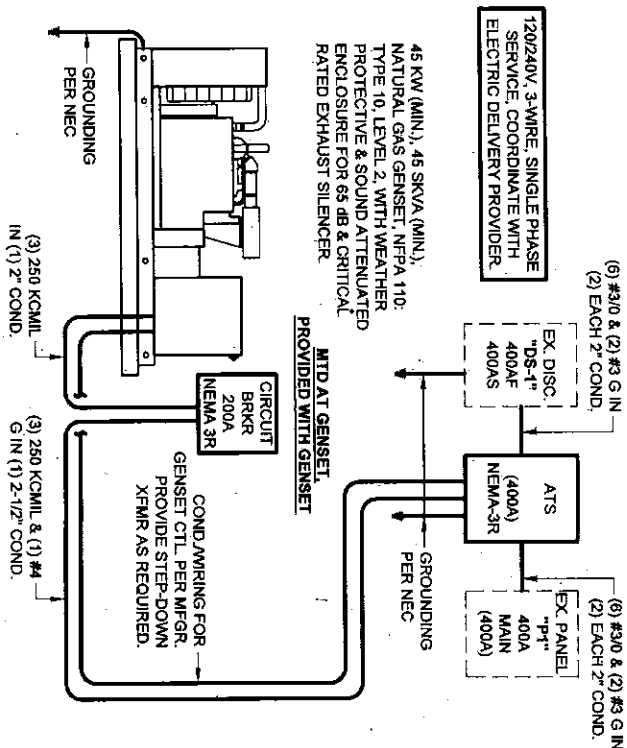
STATE OF TEXAS
EDDIE L. MORGAN
51063
REGISTERED PROFESSIONAL ENGINEER
EXPIRATION DATE 04/30/2024

NOTE: ALL CONDUCTORS BY CONTRACTOR SHALL BE COPPER.

NOTE: NEUTRAL CONDUCTOR SHALL BE BONDED AT THE GENERATOR.

NOTE: PROVIDE PERMANENT PLAQUE ON FUSED DISC. DIS-1" INDICATING TYPE & LOCATION OF ON-SITE EMERGENCY POWER SOURCES AS PER N.E.C. 700.7. PERMANENT PLAQUE SHALL BE THREE LAYER LAMINATED NAMEPLATE 3/32" INCH THICK, LENGTHS AS REQUIRED TO ACCOMMODATE LETTERING, & IN 3/4" AND 1-1/4" WIDTHS. PLATE SHALL HAVE ADHESIVE BACKING WITH PULL-APART RESISTANCE OF AT LEAST 100 PSI. PLATE SHALL BE LAMINATED TYPE WITH WHITE SURFACES, BLACK CORE, & CONDENSED GOTHIC LETTERING AT LEAST 1/4" HIGH.

GENERAL NOTES:
1. VERIFY THE RATING OF THE CIRCUIT BREAKER PROVIDED BY THE GENSET MANUFACTURER BEFORE DOING ANY WORK. IF THE MFG-PROVIDED BREAKER RATING DIFFERS FROM THE RATING SHOWN IN THIS ONE-LINE, PROVIDE AND INSTALL APPROPRIATE CONDUIT/CONDUCTOR SIZES, TRANSFER SWITCH RATING, ETC. PER N.E.C. TO MATCH BREAKER PROVIDED.
2. COORDINATE WITH ELECTRICAL DELIVERY PROVIDER TO MINIMIZE SYSTEM DOWNTIME.



GOODWIN-LASTER-STRONG

ENGINEERING & DESIGN, INC.

10077 CHURCH ROAD, SUITE 100, NEWTON, TEXAS 77858-1000

TEL: 409-776-8700 FAX: 409-776-8700

DATE	DRAWN BY	CHECKED BY	SCALE	SHEET NO.
4-11-19	JMR	ELM	N.T.S.	148063

Newton County Generators

Newton County, Texas

Senior Center One-Line Diagram

E3

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Eddie L. Morgan

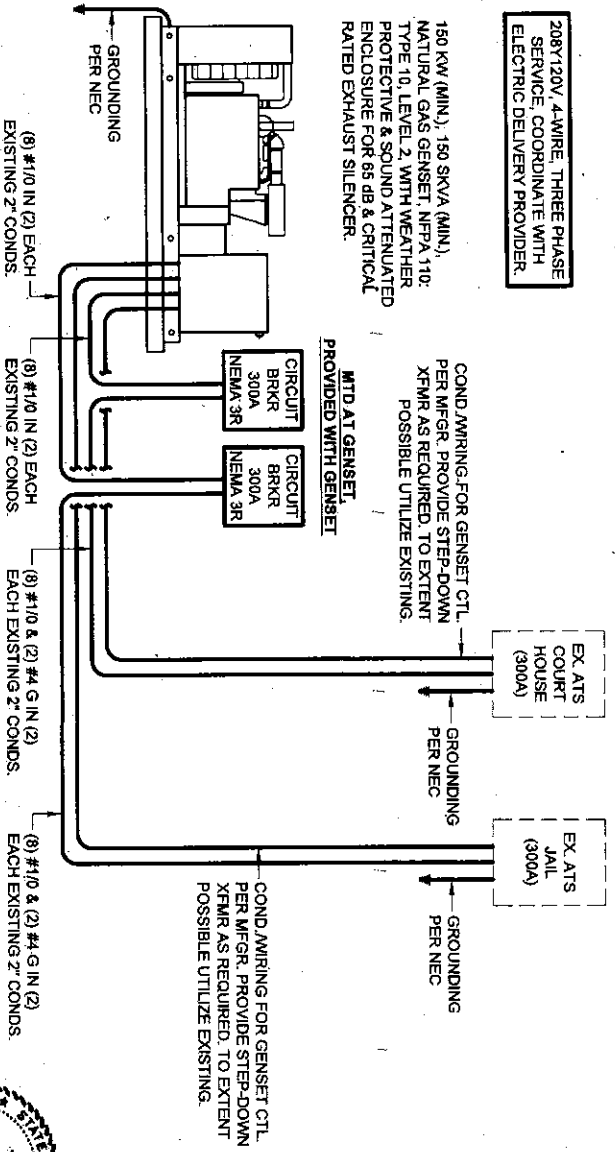
 4-11-19

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 2. COORDINATE WITH ELECTRICAL DELIVERY PROVIDER TO MINIMIZE SYSTEM DOWNTIME.
 3. REMOVE & REPLACE EXISTING QUAD RECEPTACLE ON EXTERIOR OF JAIL ADJACENT TO EXISTING GENERATORS. NEW RECEPTACLE SHALL BE WP/GFCI, PROVIDE NEW BRANCH CIRCUIT.
 4. REMOVE (2) EXISTING GENERATORS & DELIVER TO OWNER. COORDINATE WITH NATURAL GAS PROVIDER FOR REMOVAL OF EXISTING NATURAL GAS SERVICE TO EXISTING GENERATORS & FOR NEW NATURAL GAS SERVICE TO NEW GENERATOR.
 5. GENERATOR SHALL BE INSTALLED ON EXISTING CONCRETE SLAB. CUT EXISTING BOLTS FLUSH WITH CONCRETE.

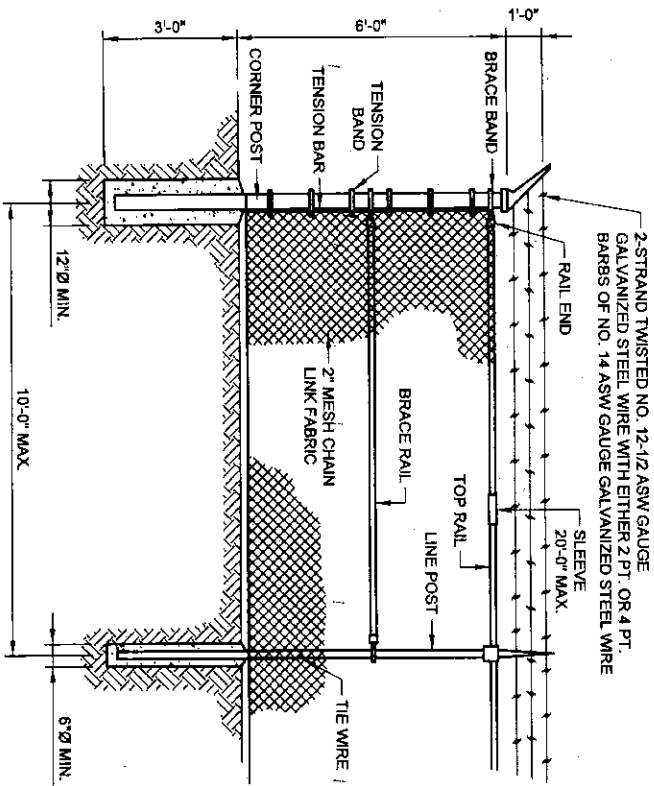


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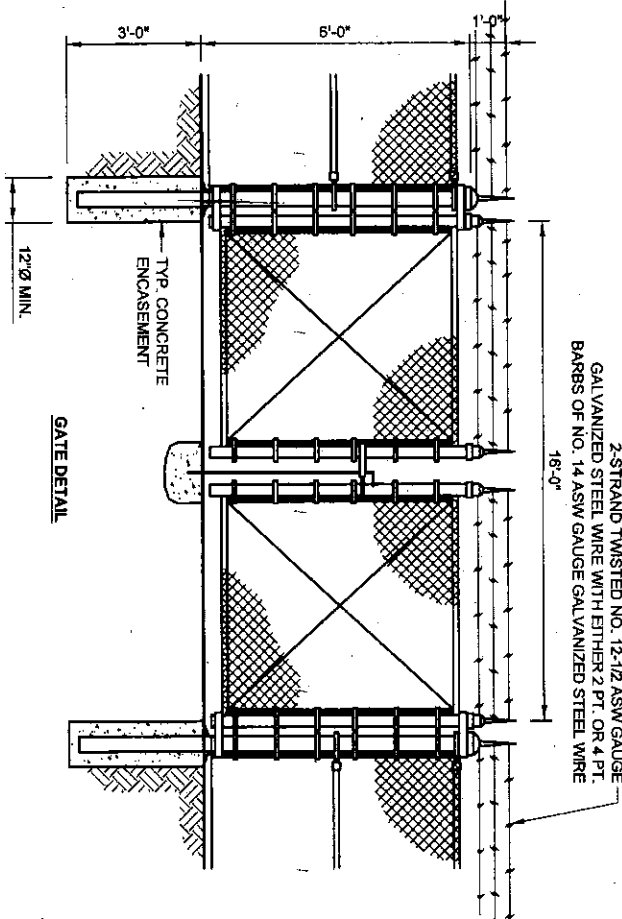
DATE	4-11-19	DRAWN BY	ARS	CHECKED BY	ELM	SCALE	N.T.S.	SHEET NO.	148083
Newton County Generators									
Newton County, Texas									
Courthouse One-Line Diagram									
E4									

Eddie L. Morgan
4-11-19

EDDIE L. MORGAN
51063
Professional Engineer
State of Texas



2-STRAND TWISTED NO. 12-1/2 ASW GAUGE GALVANIZED STEEL WIRE WITH EITHER 2 PT. OR 4 PT. BARBS OF NO. 14 ASW GAUGE GALVANIZED STEEL WIRE



2-STRAND TWISTED NO. 12-1/2 ASW GAUGE GALVANIZED STEEL WIRE WITH EITHER 2 PT. OR 4 PT. BARBS OF NO. 14 ASW GAUGE GALVANIZED STEEL WIRE

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GOODWIN-LASTER-STRONG

REGISTERED PROFESSIONAL ENGINEER - CIVIL

14772 EXHIBIT ROAD, SUITE 100, BAYVIEW, TEXAS 77528-1072

14772 EXHIBIT ROAD, SUITE 100, BAYVIEW, TEXAS 77528-1072

DATE	SCALE	BY	CHKD	DATE	BY	CHKD	DATE	BY	CHKD
4-11-19	AS SHOWN	ELM	N.T.S.						
Newton County Generators									
Newton County, Texas									
Fence Details									
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Eddie L. Morgan

4-11-19

STATE OF TEXAS

ENGINEER

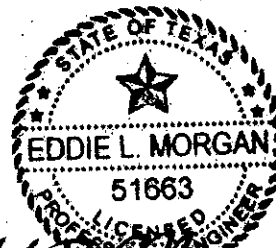
EDDIE L. MORGAN

51603

NATURAL GAS NOTES

1. ALL MATERIALS AND INSTALLATION SHALL CONFORM TO STANDARD GAS CODE AND LOCAL ORDINANCES.
2. GAS PIPING SHALL BE ASTM A53 SCHEDULE 40 BLACK IRON PIPE WITH ASME B16 FITTINGS. THE INSTALLED SYSTEM SHALL BE TESTED PER STANDARD GAS CODE. REPAIR LEAKS AND DEFECTS AND RETEST AS NECESSARY.
3. INSTALL ALL "HORIZONTAL" GAS PIPING AT A UNIFORM GRADE OF 0.1 PERCENT SLOPE UPWARD TOWARDS RISERS.
4. BURIED GAS PIPE OUTSIDE BUILDING MAY BE POLYETHYLENE (SDR 11, P.E. 2406/ ASTM D-2513, 1248, D3350) WITH HEAT-FUSION JOINTS, OR COATED AND MILL WRAPPED BLACK IRON.
5. SERVICE LINE RISERS SHALL BE BLACK IRON PIPE OR PE PIPE WITH A STEEL PIPE CASING. EXPOSED METAL SHALL BE COATED WITH AN OIL-BASED RUST INHIBITING PRIMER AND GRAY ALKYD-ENAMEL EXTERIOR USE TOP-COAT.
6. ALL GAS SERVICE REGULATORS AND GAS STOPS SHALL BE AGA/ISA LISTED AND STAMPED. ATMOSPHERIC VENTS SHALL HAVE CORROSION RESISTANT SCREEN.
7. EQUIPMENT CONNECTIONS - UNIONS OR FLEXIBLE COUPLINGS SHALL BE USED AT POINTS OF CONNECTION TO EQUIPMENT.
8. ABOVE GROUND EXPOSED PIPING - GAS PIPING LOCATED OUTSIDE AND ABOVE GROUND SHALL BE CLEANED AND PAINTED WITH ONE COAT OF ZINC RUST PRIMER AND ONE COAT OF FINISH COAT OF ALUMINUM BASE PAINT.
9. BELOW GROUND STEEL PIPING - WRAP WITH APPROVED MATERIAL DESIGNED FOR SUCH PURPOSE.
10. TESTING - AIR TEST COMPLETED LINE TO REQUIREMENTS OF GAS UTILITY AND STATE AND LOCAL CODES.
11. CARE SHOULD BE TAKEN TO KEEP THE INSIDE OF PIPING DRY AND FREE OF DIRT, CUTTING BURRS, AND FOREIGN SUBSTANCES. ALL THREADED PIPING SHALL BE REAMED SMOOTH AFTER CUTTING AND SHALL BE THREADED WITH TRUE, SHARP DIES TO INSURE A PROPER JOINT MAKE-UP.
12. INSTALL PER GENSET MANUFACTURER'S INSTRUCTIONS.
13. INSTALL 3/4" UNDERGROUND GAS POLY LINE (5 PSIG) FROM SENIOR CITIZEN CENTER GAS METER TO 5 PSIG-TO-0.5 PSIG PRESSURE REGULATOR AT THE GENSET (BASED ON NOT MORE THAN 400' PIPE RUN). AT THE SENIOR CITIZEN CENTER, INSTALL 1-1/4" PS FROM THE ABOVE PRESSURE REGULATOR TO THE GENSET (BASED ON NOT MORE THAN 20' TOTAL STRAIGHT PIPE LENGTH). AT THE COURTHOUSE, INSTALL 2" PS TO GENSET (BASED ON NOT MORE THAN 12' TOTAL STRAIGHT PIPE LENGTH). NOTE: VERIFY PRESSURE REQUIRED AT GENSET WITH MANUFACTURER OF THE GENSET PROVIDED AND PROVIDE PRESSURE REGULATOR TO MATCH REQUIREMENT.

DO NOT USE AN OPEN FLAME OF ANY KIND TO TEST FOR LEAKS



Eddie L. Morgan
4-11-19

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4-11-19	ANM	ELM	N.T.S.	148063
Newton County Generators				SHEET NO.
Newton County				P1
Newton County, Texas				
Natural Gas Notes				
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