



CITY OF HOUSTON

INVITATION TO BID

Issued: January 15, 2010

Bid Opening:

Sealed bids, in duplicate, will be received by the City Secretary of the City of Houston, in the City Hall Annex, Public Level, 900 Bagby, Houston, Texas 77002 until **10:30 A.M. Thursday, February 4, 2010**, and all bids will be opened and publicly read in the City Council Chamber, City Hall Annex, Public Level, 900 Bagby at 11:00 A.M. on that date for the purchase of:

FURNISH AND INSTALL A NEW 800KW GENERATOR AT HOUSTON TRANSTAR FOR THE PUBLIC WORKS AND ENGINEERING DEPARTMENT

Bid No. S50-C23530

NIGP Code: 760-27 / 285-37

Buyer:

Questions regarding this solicitation should be addressed to Arturo Lopez, Senior Procurement Specialist, at **832-393-8731** or e-mail to arturo.lopez@cityofhouston.net

Electronic Bidding:

In order to submit a bid for the items associated with this procurement, you must fill in the pricing information on the "PLACE BID" page.

Prebid Conference:

A Pre-Bid Conference will be held for all Prospective Bidders in the Strategic Purchasing Division, Concourse Level (Basement), Conference Room, #1 City Hall, 901 Bagby, at **10:00 a.m. on Monday, January 25, 2010**. **The site visit will be scheduled at the pre-bid conference.**

All Prospective Bidders are urged to be present. It is the bidder's responsibility to ensure that they have secured and thoroughly reviewed all aspects of the solicitation documents prior to the Pre-Bid Conference. Any revisions to be incorporated into this solicitation document arising from discussions before, during and subsequent to the Pre-Bid Conference will be confirmed in writing by Letter(s) of Clarification prior to the bid due date. Verbal responses will not otherwise alter the specifications, terms and conditions as stated herein.

Bidding forms, specifications, and all necessary information should be downloaded from the Internet at www.houstontx.gov/purchasing/index.html. By registering and downloading this solicitation document, all updates to this solicitation document will be automatically forwarded via e-mail to any registered bidders. This information may also be obtained from the Supplier Assistance Desk, Strategic Purchasing Division, 901 Bagby, Concourse Level, Houston, Texas 77002.

The place of the bid opening may be transferred in accordance with Paragraph (b), (5) of Section 15-3 of The Code of Ordinances, Houston, Texas. The bid-opening meeting may be rescheduled in accordance with Paragraph (b), (6) of said Section 15-3.

The City reserves the right to reject any or all bids, or to accept any bid or combination of bids deemed advantageous to it.

City employees are prohibited from bidding on this solicitation in accordance with the Code of Ordinances Section 15-1.

***CONTENTS:**

- A. OFFER
- B. SCOPE OF WORK/SPECIFICATIONS
- C. GENERAL, SUPPLEMENTARY CONDITIONS AND BOND FORMS

*NOTE 1: Actual page numbers for each section may change when the solicitation document is downloaded from the Internet or because of letters of clarification. Therefore, bidders must read the solicitation document in its entirety and comply with all the requirements set forth therein.

*NOTE 2: **To be considered for award please submit the electronic bid form and the forms listed in section A, including the signature page, which must be signed by a company official authorized to bind the company and a 10% Bid Bond.**

SECTION A



**FORMAL ONE-TIME BID
FURNISH AND INSTALL A NEW 800KW GENERATOR AT HOUSTON TRANSTAR
FOR THE PUBLIC WORKS AND ENGINEERING DEPARTMENT
Bid No. S50-C23530
NIGP Code: 760-27 / 285-37**

To The Honorable Mayor
and City Council Members
of the City of Houston, Texas (the "City"):

The undersigned hereby offers to provide services necessary to **Furnish and Install a New 800KW Generator at Houston Transtar, located at 6922 Old Katy Road**, F.O.B. destination point Houston, Texas, in accordance with the City's Specifications and General Terms & Conditions and/or samples/drawings provided herein. When issued by the City of Houston, Letters of Clarification shall automatically become part of this bid document and shall supersede any previous specifications or provisions in conflict with Letters of Clarification. It is the responsibility of the bidder to ensure that it has obtained all such letters. By submitting a bid on this project, bidder shall be deemed to have received all Letters of Clarification and to have incorporated them into the bid.

The City may accept this bid offer by issuance of a Notice of Award Letter and/or a Purchase Order at any time on or before the 120th day following the day this Official Bid Form is opened by the City. This offer shall be irrevocable for 120 days after bid opening or for 90 days after City Council awards the bid, whichever comes last, but this period may be extended by written agreement of the parties.

The City reserves the right to INCREASE quantities during the twelve-month period following the issuance of the first purchase order subject to agreement in writing by the Prime Contractor/Supplier to honor the same bid price.

The City reserves the option, after bids are opened, to adjust the quantities listed on the electronic bid form upward or downward, subject to the availability of funds, and/or make award (s) on a line item basis.

SECTION A

Documents/forms must be downloaded from the City's Website
<http://www.houstontx.gov/purchasing/index.html>

Additional Required Forms to be Included with this bid:

In addition to the electronic Bid Form and the Official Signature Page, the Forms listed in Table 1 **must be completed and submitted to the Office of the City Secretary on or before the date and time the bid is due:**

Table 1
Affidavit of Ownership
Fair Campaign Ordinance
Statement of Residence
Conflict of Interest Questionnaire
Contractors References
Pay or Play Contract Compliance Acknowledgement Form
10% Bid Bond

Table 2 lists other documents and forms that should be viewed/downloaded from the City's website, but are not required to be submitted with the bid. The City will request these forms, as applicable, to be completed and submitted to the City by the recommended/successful bidder:

Table 2
Formal Instructions for Bid Terms
Drug Forms
Insurance Certificates Over \$50,000.00
OCP Insurance Certificate Over \$100,000.00
Performance, Maintenance and Statutory Payment Bonds
2009 Davis-Bacon Building Wage Decision
Pay or Play Certification of Agreement to Comply with Program
Pay or Play Form 3 / List of Participating Contractors

Questions concerning the Bid should be submitted in writing to: City of Houston, Strategic Purchasing Division, 901 Bagby, Room B506, Houston, TX 77002, Attn: Arturo Lopez or via fax: 832-393-8759 or via email (preferred method) to arturo.lopez@cityofhouston.net no later than **4:00 PM, Wednesday, January 27, 2010.**

PERMITS:

Successful Contractor shall be responsible for securing any and all permits for proposed work. Any fee charged for these permits should be the responsibility of the Contractor and not the City of Houston.

CITY BUILDING CODES:

All work performed or equipment installed shall be in strict accordance with the City of Houston Building Codes. The Contractor will immediately correct any deficiencies discovered during work or after completion. Failure to correct deficiencies will result in the City having corrections made at the Contractor's expense.

BID BOND:

The Contractor shall be required to provide and submit with the bid a Bid Bond in the amount of 10% of the total amount bid by the Contractor. The Bid Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this Bidder (as "Principal") and by a corporate surety company licensed to do business in the State of Texas, and if the amount of the bond is greater than \$100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury, or a Cashier's or a Certified check in a like amount. Company or personal checks are not acceptable.

PERFORMANCE BOND and PAYMENT BOND:

The successful Contractor(s) shall be required to provide a Performance and Payment Bond in the total amount (100%) of the Contract if the award is in excess of \$25,000.00.

The Performance and/or Payment Bond shall be in the same form as that distributed by the City, and attached hereto, all duly executed by this bidder (as "Principal") and by an incorporated surety company licensed to do business in the State of Texas. If the amount of the bond is greater than \$100,000.00 the surety must hold a certificate of authority from the United States Secretary of the Treasury.

The Contractor(s) shall be required to provide a Performance and/or Payment Bond as outlined above, which will be delivered to the City Purchasing Agent of the City, on or before the tenth (10th) day following the day the bidder receives notice from the City.

MAINTENANCE BOND:

The Contractor shall furnish a maintenance bond in the total (100%) bid amount in the form required by the City (samples attached). One bond, also referred to as the One Year Maintenance Bond, will be conditioned upon Contractor's repair, replacement or restoration of any work or any portion of the work which is found to be defective or fails in any way to comply strictly with this contract or the plans and specifications for such work within a period of one (1) year from the date of acceptance of such work by the City Council or after the date that the "CO", or his designee in writing, determines, in a written notice to the Contractor, to be the date upon which the project is both substantially complete and available for the full and beneficial occupancy or use of the City.

QUALITY AND WORKMANSHIP:

The bidder must be able to demonstrate upon request that it has performed satisfactorily, services similar to the services specified herein. The bidder will provide records of warranty and repair services performed for others upon request. The City of Houston shall be the sole judge whether the services performed are similar to the scope of services specified herein.

CONTRACTOR'S QUESTIONNAIRE

In order to receive bid award consideration, the bidder must be able to demonstrate that they are currently providing or have had at least one contract, to **Furnish and Install a New 800 KW Generator** that is similar in size and scope to this contract. **Bidder must have references documenting that it has performed Installation of a new 800 KW Generator.** The reference(s) should be included in the space provided below. Please attach another piece of paper if necessary. If references are not included with the bid, the bidder shall be required to provide such references to the City of Houston within five working days from receipt of a written request from the City of Houston to do so. **Bidder's capability and experience shall be a factor in determining the Contractor's responsibility.**

1. Business Name: _____

Business Address: _____

City, State, Zip: _____

Name of Owner/Contact Person: _____

Phone: _____ Fax: _____ Email: _____

No. of Years providing Service to this business: _____

2. Business Name: _____

Business Address: _____

City, State, Zip: _____

Name of Owner/Contact Person: _____

Phone: _____ Fax: _____ Email: _____

No. of Years providing Service to this business: _____

3. Business Name: _____

Business Address: _____

City, State, Zip: _____

Name of Owner/Contact Person: _____

Phone: _____ Fax: _____ Email: _____

No. of Years providing Service to this business: _____

SITE INSPECTION

The City of Houston reserves the right to inspect the bidder's current place of business to evaluate equipment condition and capabilities, staff experience, training and capabilities, and storage capabilities as they relate to the performance of this contract.

SECTION B
SCOPE OF WORK

1.0 Summary of Scope of Work:

1.1 GENERAL

1.1.1 The work for this project shall require the Contractor to provide all labor, equipment, materials, and incidentals necessary to furnish and install a new 800 KW Generator and associated equipment. To furnish, install, test, program, and place the following systems in normal working conditions:

1.1.1.1 The Contractor shall provide and install a new 800 k.w 277/480 volt, 3 phase, 4 wire, diesel fuel, new emergency generator.

1.1.1.2 The Contractor shall provide and install a new 1,600 amp, 277/480 volt, 4 pole, 60 hz; automatic transfer switch (ATS) to receive emergency power from two emergency generators and feed emergency power to the existing emergency switchboard.

1.1.1.3 The Contractor shall provide and install a temporary emergency generator with portable cables.

1.1.1.4 The Contractor shall provide and install new emergency feeders.

1.1.1.5 The Contractor shall provide modifications to the existing emergency feeders and control wiring.

1.1.1.6 The Contractor shall provide and install new branch circuits to serve the new generator, ventilation fan, fuel pumps, etc.

1.1.1.7 The Contractor shall provide modifications to existing diesel fuel lines and new diesel fuel day tank with transfer fuel pumps.

1.1.1.8 The Contractor shall provide and install new wall louvers, overhead door, ventilation fan, exhaust pipes, concrete, pads, etc.

1.2 The scope of work described above is a brief description of the work, entire scope of work shall be as per requirements of engineer's documents.

END OF SCOPE OF WORK

TECHNICAL SPECIFICATIONS

HOUSTON TRANSTAR

6922 OLD KATY ROAD
HOUSTON, TEXAS

NEW EMERGENCY GENERATOR

Dabhi Engineering Assoc., Inc.

21210 PARK YORK DRIVE
KATY, TEXAS 77450
TEL 713/492-6885

September 24, 2009



Makash Dabhi
9/24/09

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SECTION
15050/16050

GENERAL CONDITIONS FOR MECHANICAL, ELECTRICAL, AND PLUMBING
(MEP) SYSTEMS

PART 1 - GENERAL

1.1 GENERAL

- A. Structural plans and specifications, including general conditions, special conditions, supplements or addenda thereto, information to bidders, and other pertinent documents issued by City of Houston are a part of these specifications and accompanying MEP drawings. The above is included herewith, and shall be examined by all bidders. Failure to comply shall NOT relieve Contractor of responsibility or be used as basis for additional compensation due to omission of related work shown and or mentioned in bid documents.

1.2 SCOPE

- A. Scope of work under the MEP Sections of specifications shall include complete systems as specified in bid drawings and as specified herein. Contractors shall provide supervision, labor, materials, equipment, machinery, plant, and items necessary to complete MEP systems. Items of equipment may be specified in singular; however, contractors shall provide a number of items of equipment as indicated on drawings, specified in specifications, and as required for complete systems. Work shall include all attendant accessories, etc. necessary to deliver complete and satisfactory operating new Emergency power and diesel fuel systems acceptable to the Owner and Engineer.
- B. These specifications and drawings outline the scope of work of the MEP Subcontractor. The complete new Emergency Generator, automatic transfer switch with accessories, battery, battery charger, new electrical feeders, branch circuits, fire alarm system devices, etc are considered as parts of Electrical systems. New diesel fuel day tank, fuel transfer pumps, piping, accessories, etc. are considered a part of the plumbing system. New exhaust fans, duct work, intake and exhaust louvers, flue gas vent pipe from new generator, modifications to the building temperature control systems, etc. are considered parts of the Mechanical system. It shall be contractor's responsibility to provide a specified item of the MEP systems, at no additional cost when specified in the bid documents.
- C. If additional details or special conditions are required, it is the responsibility of The Contractor to furnish the same, as well as provide material and equipment usually furnished with such systems or required to complete installation, whether mentioned or not.
- D. Indication on the drawings or mention in the Construction bid Documents of articles, materials, tests, operations or methods require that the Contractor or his/her Subcontractors provide each item indicated or mentioned of the quality or subject to the qualifications noted; perform according to conditions stated for each operation, and provide, therefore, all necessary labor, equipment, services and designate the quality and type of materials or equipment to be furnished.

1.3 DEFINITIONS

- A. "As Directed": Wherever phrase "as directed" is used, it means "as directed by Owner, Engineer or his authorized representative.
- B. "Bidder": The bidder shall mean the same as Contractor.
- C. "Not in Contract": Items indicated on Drawings as "NIC" or noted "Not in Contract", are shown for convenience only and are not part of the Contractor's work unless specifically indicated.
- D. "Owner": The term "Owner" herein refers to the City of Houston entering into a written contract for construction of the project and execution of the work defined by the plans and specifications.
- E. "Provide": Wherever the word "provide" is used, it means "furnish, install, test, complete, and place in normal working conditions as intended.
- F. "G.C.": Wherever word "General Contractor" or "G.C." is used, it means the Prime Contractor for the project. Any special feature or knowledge should be coordinated with him.
- G. "Contractor": Wherever word "Contractor" is used, it means respective Plumbing, Heating, Ventilating and Air Conditioning, Electrical, Fire Alarm System contractor.
- H. "Subcontractor": See "Contractor".
- I. "Prime Contractor": See "General Contractor"

1.4 CONTRACTORS QUALIFICATIONS

- A. The MEP contractors shall be experienced and qualified contractors, in the field of MEP, fire alarm, and diesel fuel systems.
- B. City of Houston specifically reserves the right to reject any Contractor who has previously failed to perform properly, or complete in a reasonable time, a contract of similar nature, or who has not paid his/her bills, or otherwise disregarded his/her obligations to other subcontractors, material supplier, and/or employees.
- C. General contractor and each sub-contractor shall have had for a minimum of 5 consecutive years just prior to bid date, the following:
 - 1. A minimum of 5 years of experience in his/her field and shall present a list of a minimum 5 similar projects completed by his/her company.
 - 2. A permanent place of business.
 - 3. Adequate personnel and equipment to do the work properly and expeditiously.

4. A suitable financial status to meet the obligations incident to the work.
5. Competent technical experience in MEP, fire alarm, and diesel fuel systems' installation and services.

1.5 COMPLIANCE

- A. The Contractor shall fully comply with requirements of bid documents.
- B. The owner reserves the right to reject any or all bids or to accept any bid considered advantageous. The owner also reserves the right to waive any or all bid formalities.

1.6 QUALITY ASSURANCE

- A. Product Conformance Certificate and Quality Assurance Release. Submit an overall conformance certificate for MEP systems components signed by the person responsible for product quality. Specifically identify the purchased material or equipment by project name and location, purchase order number, supplements, and item number where applicable, including materials and services provided by others. Indicate that all requirements have been met.
- B. Field Inspection
 1. MEP and diesel fuel system work shall be inspected and approved by the local code inspector and the Owner's (City of Houston) representative.
 2. Contractor shall give an advance notice to owner's and local code inspectors, number days as required by local code inspectors.
 3. Concealed work such as installation of under ground conduits, conductors, etc shall be inspected before it is covered up.
 4. All MEP and diesel fuel systems' equipment and materials shall be inspected upon arrival by the Owner's representative for compliance with the bid documents.

1.7 SITE VISIT AND FAMILIARIZATION

- A. The Contractor shall be familiar with the bid documents and shall have examined the existing building, existing structure, Mechanical/Electrical rooms, emergency generator room, mechanical yard, overhead door, diesel fuel storage tank, associated fuel piping, all wiring sections including control wiring of the generator, normal and emergency switchboards, other electrical panel boards, building's direct digital controls, fire pump's controller, etc. and understand the conditions

under which he/she will be obligated to operate in performing the contract.

- B. The Contractor shall also acquaint himself/herself with the existing electrical system, automatic transfer switches (ATS) verify locations of the existing equipment, feeder locations and include all anticipated costs in the bid to properly install new emergency (generator), ATS, feeders, control wires, and connect new equipment to the existing electrical system. They shall also include all costs associated with installations of new diesel fuel day tank, piping etc.

1.8 GUARANTEE AND PREVENTATIVE MAINTENANCE

- A. Guarantee: New emergency generator and ATS shall be warranted as per requirements of Specification Sections 16210
- B. The Contractor shall guarantee all work installed by him/her for a period of one (1) year after a substantial completion date; said guarantee to require the Contractor to furnish all necessary materials and labor to replace any defective materials or workmanship without cost to the owner. The date of substantial completion will be made a matter of written record by the Engineer. When the manufacturer offers an extended warranty for an item or system, this warranty shall be transferred to or written in the name of the owner.

1.9 WORKMANSHIP AND CODES

- A. All work shall be executed by none but skilled mechanics, and be first class and complete in both effectiveness and appearance whether finally concealed or exposed.
- B. Work shall conform to requirements, rules, regulations and ordinances of the local City of Houston, City of Houston, and other authorities having jurisdiction, and with the standards promulgated pursuant to the Federal occupational, Safety and Health Act latest edition, whether shown on drawings or not and shall be completed to the entire satisfaction of the Engineer. In cases where alterations to and/or deviations from specifications and accompanying drawings are required by said authority, the Contractor shall report the same to the Engineer, and secure approval in writing before work is started. In cases where requirements of bid documents are in excess of Codes and other similar requirements, the specifications and drawings shall govern.
- C. The work shall also fully comply with all requirements of the latest adopted standards of City of Houston, the National Board of Fire Underwriters, the latest edition of National Electrical Code, National Fire Protection Association, American with Disability Act (ADA), Texas Accessibility Standards and other applicable industry standards. The work shall also fully comply with all requirements of governmental departments having jurisdiction.

- D. Codes: All work shall be executed in accordance with the local, national, and state codes, ordinances and regulations governing the particular class of work involved. Should these specifications and the accompanying drawings conflict with codes or ordinances requirements, the Contractor shall follow codes or ordinances requirements only if such codes require a higher class of work than is outlined in bid documents. On completion of the various portions of the work, the installation shall be tested by the constituted authorities and approved, and on final completion of the work, certificates of acceptance from the regulatory body under whose jurisdiction the work has been inspected shall be given to the Owner.
- E. Contractor shall include, without extra cost to the Owner, any labor, materials, services, apparatus, or drawings, in order to comply with applicable codes, laws, ordinances, rules, and regulations whether or not shown on drawings and or specified in the bid documents.
- F. Materials and equipment for electrical work shall bear appropriate approval label, and shall be listed by Underwriter's Laboratories.

1.10 DISCREPANCIES

- A. Clarification shall be obtained from the Engineer before submitting a bid for the work under Divisions 15, 16, architectural, and structural disciplines as to discrepancies or omissions from the Contract Documents, or questions as to the intent thereof.
- B. Consideration will not be granted for misunderstanding of the amount of work to be performed. Tender of a proposal conveys full agreement of the items and conditions specified, shown, scheduled or required by the nature of the project.

1.11 DRAWINGS AND SPECIFICATIONS

- A. The drawings are schematic in nature and indicate approximate locations and elevations of the various items of the systems. These items are shown approximately to scale and attempt to show how these items should be integrated with the existing building conditions. Locate all the items by on-the-job measurements, conformance with Contract Documents, and cooperation with other trades.
- B. When bid drawings do not give exact details as to elevation of conduits, pipes, duct work, etc physically arrange them to fit into spaces available at elevations intended with proper grades for functioning of systems involved. Piping, exposed conduit, and duct systems are generally intended to be installed as high as possible against structure in a neat and workmanlike manner. All junction and pull boxes, electrical equipment, diesel fuel equipment, valves, etc shall be fully accessible for service and maintenance. Minor modifications to routings of the new feeders, branch circuits, piping, etc shall be made to avoid conflicts at no extra cost.

- C. Should drawings disagree in themselves or with specifications, better quality or greater quantity of work or materials shall be estimated upon, unless otherwise instructed by Engineer, in writing. Figures given on drawings govern small scale drawings.
- D. Exact locations of electrical conduits, piping, and equipment items shall be determined by references to general plans and to detail drawings, equipment drawings, rough-in drawings, certified construction drawings, etc. Minor relocations necessitated by conditions at the site or directed by the Engineer shall be made without additional cost.
- E. Piping interferences shall be handled by giving precedence to pipe lines which require a stated grade for proper operation.
- F. Titles to Divisions, Sections and Sub-Sections in these specification Contract Documents are introduced merely for convenience and shall not be taken as a correct, complete segregation of the several units of materials and labor. No responsibility, direct or implied, is assumed by the Engineer for omissions or duplications by the Contractor or his/her sub-contractor due to real alleged error in arrangement of matter in these Documents.

1.12 PREFERENCE IN AUTHORITY OF DOCUMENTS

- A. In case the Specifications should not fully agree with drawings contact Engineer for clarifications. If the clarifications are not issued, by Engineer, before the bid date, include costs for greater quantities and or better in quality (for items in question) in the bid. Figures given on Drawings govern scale measurements, and large scale details govern small scale drawings.
- B. Where figures are lacking, scale measurements may be followed, but in all cases, the measurements are to be checked from the work in place. Should any variations be found, such must be referred to the Engineer for instructions. Details or notes shown on the Drawings are typical for all similar conditions throughout the project.
- C. Certified Construction Drawings of approved equipment and materials shall take precedence over catalog dimensions or sizes and shapes. Certified construction drawings shall be used in determining final installed conditions.

1.13 LAYING OUT WORK, MEASUREMENTS, LEVELS AND SURVEYS

- A. The General Contractor shall establish and maintain all lines and levels and shall be responsible for the accuracy thereof.
- B. Contractor shall base measurements, both horizontal and vertical, from established bench marks. Work shall agree with these established lines and levels. Verify measurements at site and check corrections of the same as related to work, prior to fabrication of shop made items or

ordering of factory-made items.

- C. Before ordering any materials, or doing any work contractor shall verify all measurements at the building and shall be responsible for the correctness of the same. No extra charge or compensation will be allowed on account of differences between actual dimensions and the measurements indicated on the Drawings. Any differences that may be found shall be submitted to the Engineer for consideration before proceeding with the work.
- D. Should Contractor discover a discrepancy between actual measurements and those indicated, which prevents following good practice or intent of drawings and specifications, he/she shall notify Engineer and shall not proceed with work until he/she has received instructions from the Engineer.

1.14 PERMITS, LICENSES, FEES, & REFERENCES

- A. **Permits & Fees:** Contractor shall give notices, obtain permits, licenses and pay fees, government sales taxes, and other costs. He/she shall file necessary plans, prepare documents and obtain necessary approvals of governmental departments having jurisdiction; obtain required certificates of inspection for his/her work, and deliver same to Engineer before request for acceptance and final payment.
- B. **REFERENCE CODES AND STANDARDS:** In addition to state and local ordinances, following industry standards apply, where applicable, except where requirements of plans and specification are more stringent, than the following standards. Unless noted otherwise, references are the latest standards or codes current at the time of bidding.
 - 1. American National Standards Institute (ANSI).
 - 2. American Institute of Electrical Engineers (AIEE)
 - 3. American Society of Testing Materials (ASTM)
 - 4. Institute of Electrical and Electronics Engineers (IEEE).
 - 5. Insulated Cable Engineers Association (ICEA).
 - 6. National Electrical Code (NEC).
 - 7. National Electrical Manufacturers Association (NEMA).
 - 8. National Electrical Safety Code (NESC).
 - 9. National Fire Protection Association (NFPA).
 - 10. Underwriters' Laboratories (UL).

1.15 REGULATIONS AND PERMITS

- A. Regulations. Work, materials and equipment shall comply with the latest rules and regulations of the following:
 - 1. National Electrical Code (NEC).
 - 2. National Electrical Safety Code (NESC).
 - 3. Occupational Safety and Health Act (OSHA).
 - 4. Americans with Disabilities Act (ADA).
 - 5. Local - Building Codes.
 - 6. County, and State federal codes, ordinances and regulations.
- B. Discrepancies. The drawings and specifications are intended to comply with listed codes, ordinances, regulations and standards. Where discrepancies occur, immediately notify the Engineer in writing and ask for an interpretation. Should installed materials or workmanship fail to comply with requirements of plans, specifications and codes, the Contractor is responsible for correcting the improper installation. Additionally, where sizes, capacities, or other such features are required in excess of a minimum code or standards requirements, provide those specified or shown at no additional cost.
- C. Where these standards have conflicting requirements, the more stringent requirements shall apply.
- D. Permits. Obtain certificates of inspection and other permits required as a part of the work.
- E. Equipment of foreign manufacture must meet U.S. codes and standards.
- F. Equipment and materials shall conform to requirements of plans, specification and bid documents for the project.

1.16 SUBSTITUTIONS AND DEVIATIONS

- A. Intent of these specifications is to establish quality standards of material and equipment installed.
- B. Substitutions: All materials, equipment, apparatus or products shall be new unless noted otherwise and of the quality indicated in the bid documents. Where manufacturer's names are mentioned in the body of the specifications and/or included in a list of approved equipment, the products so mentioned have proved to be satisfactory under similar conditions of service are the products acceptable for this installation except as outlined below.

- C. New Automatic Transfers Switch (ATS): The new ATS shall be as specified in bid drawings with accessories. It shall be manufactured by Russelectric. Substitute manufacturer's ATS shall not be used and will not be accepted for this project. All bidding contractors shall include cost of the specified ATS in their bids.
- D. It is not the Engineer's intention to discriminate against any manufacturer or product, and any manufacturer desiring to submit his/her product for approval as an equal to that specified may do so by delivering a sample, or in the case of large equipment, a sample specification to the Engineer's office at least fifteen (15) days prior to the bid opening, preferably sooner.
- E. Naming of a manufacturer, brand or model number as a part of all of the description of manufactured items shall be deemed to include any description or specifications of such item in that manufacturer's catalogs, advertisements or other representations. Should there be contradictions or variations in the manufacturer's literature currently available, the better quality or greater quantity of material or workmanship described shall be furnished under this contract.
- F. Where two or more units of the same type or class or equipment are required, provide units of a single manufacturer. Manufacturers' names and catalog numbers specified under sections of Division 15 and 16 are used to establish the minimum standard of design, performance, quality and serviceability.
- G. The Engineer will examine the data submitted and a written response will be issued. The written response will include only the names of the acceptable manufacturers. This does not mean that all their products fully comply with requirements of plans and specifications. During the submittal phase of the project Engineer will review the submittals. If in engineer's opinion the substitute products do not comply with requirements of the bid documents, the contractor shall provide the specified equipment at no additional cost. Only those products mentioned by name may be furnished for this project.
- H. Where a substitute item alters the design or space requirements indicated on drawings, Contractor shall include items of cost for revised design and construction, including cost of allied trades involved. The substitute manufacturer's products, equipment, and or materials shall not be acceptable when they do not properly fit into the allocated spaces allowing code clearances and spaces for the maintenance.
- I. An acceptance or rejection of a proposed substitution is subject to Engineer's approval. If engineer so requests, the Contractor shall submit samples of specified and substitute items for evaluation.
- J. Where a minor deviation requires a different quantity and arrangement of wiring & conduit, from that specified or indicated on drawings, Contractor shall provide such electrical wiring and conduits, and other additional

equipment required by system, at no additional cost.

1.17 MATERIALS AND EQUIPMENT

- A. Materials, equipment and apparatus, shall be new, unless noted otherwise, of first class quality, and shall be furnished, delivered, erected, connected, and finished in every detail, and shall be selected and arranged to fit properly into assigned building spaces. Where no specific kind or quality is given, furnish a first-class standard article approved by Engineer.
- B. Materials: Building materials, contractor's equipment, etc., may be stored on the premises but the placing of the same shall be within the construction areas allowed by Owner. When any room in the building is used as a shop, office, store room, etc., the one making use of such room will be held responsible for any repairs, patching, or cleaning arising from such use. Contractor shall protect and be responsible for any damage to his work or material from the date of the agreement until the final payment is made, and will make good without cost to the Owner, any damage or loss that may occur during this period. The Contractor will handle all materials as directed so that it may be inspected by the Engineer's representative. All materials affected by the weather shall be covered and protected to keep them free from damage while they are being transported to the site as well as when they are stored on the site.
- C. During the execution of the work, open ends of all conduits, pipes, and all openings in equipment shall be closed before leaving the work at anytime as to prevent the entrance of all foreign matter.
- D. All existing light fixtures, panel boards, motor control centers, ATS, distribution panel board, switchboards, variable frequency drives, safety switches, fire and Jockey pumps, emergency generator, building temperature controls, fuel storage tank, mechanical/electrical room doors, steps, mechanical yard, fuel piping, generator exhaust pipe, louvers, transformers, and other MEP Systems equipment shall be protected from damages.
- E. Contractor in performing his/her work shall take particular care not to damage the existing structure and or building components. All existing finished floors, step treads and the Owner's equipment shall be covered to prevent any damage by workmen or their tools and equipment during the installation of the specified system. In addition contractor shall protect any materials on the job site, whether a part of his/her contract or the property of another Contractor or the Owner.
- F. Contractor shall be responsible for any damage done to the Owner's property or any adjacent property caused by activity in connection with his/her portion of the work. All damages done to the building, driveways, side walks, building systems, and or adjacent properties shall be repaired, to owner's satisfaction, at no additional cost.

- G. Equipment: Equipment installed on the project shall have local representation, local factory-authorized service, and local stock or repair parts.
- H. Physical dimensions of electrical equipment specified in bid documents are based on dimensions of a particular manufacturer. While other manufacturers may be acceptable, it is the responsibility of the Contractor to determine if equipment he/she proposes to furnish will fit into the assigned space allowing all code clearances and maintenance spaces. Shop drawings shall be prepared as required indicating suitable arrangement.
- I. All MEP and diesel fuel system equipment shall be installed to comply with all requirements of local and national codes. Permit access to equipment and accessory items installed in place for regular maintenance and to allow removal for service without disassembly of another part of the system.
- J. All apparatus shall be cribbed up from the floor by the Contractor and covered with tarpaulins or other protective covering where necessary or directed.
- K. The printed directions supplied by the manufacturer of each item of equipment shall be followed in the preparation, installation, erection, and cleaning of all manufactured equipment and/or materials, unless otherwise specified.
- L. Contractor shall not deliver, or receive, equipment at the job-site until ready for installation, or unless suitable protected space shall have been provided to prevent weather, or other damages.

1.18 SUPPORTS

- A. Securely attach equipment to the building structure and floor in approved manner. Attachments shall be strong and sturdy and if not considered so by the Engineer, installations shall be replaced as directed.
- B. When equipment supports are not detailed in these documents, Contractor shall provide equipment supports as recommended by the equipment manufacturer at no additional cost.

1.19 GENERAL

- A. Contractor shall keep a competent superintendent or a foreman on the job at all times, and shall be fully responsible for the conduct and supervision of all work performed under his/her contract.
- B. A periodic observation of the work by the Engineer, commonly referred to as supervision, is only for the express purpose of verifying compliance with the contract documents. Such site visits by the Engineer shall not be construed as construction supervision.

- C. Contractor shall be solely responsible for providing a safe place for the performance of the work by his/her personnel and for taking safety precautions and/or providing safety appliances for his employees and for his/her subcontractor.
- D. Read and comply with all General and Special conditions, addenda, information to Bidders, Proposal Forms and all other pertinent documents issued by the Engineer.
- E. Install conduits concealed (in ceiling spaces) in finished areas as shown or noted on drawings. In unfurnished spaces where pipe and conduits must be exposed, install in a neat manner; install conduits square to the building.
- F. Be responsible for fitting his/her equipment into the space assigned, or report to the Engineer in writing prior to ordering of equipment for instructions, should his/her equipment require greater space than that assigned. Failure to comply shall render Contractor liable for all expenses necessary to provide adequate space.
- G. Provide minor details necessary for proper installation and operation as if herein specified or shown.
- H. Locate new ATS, emergency generator, diesel fuel day tank, and other specified systems' equipment which must be serviced, operated or maintained, in fully accessible positions. Minor deviations from drawings may be made to allow for better accessibility; however, changes must be approved by Engineer prior to installation.
- I. Contractor shall furnish, as required, necessary templates, patterns, setting plans, and shop details for proper installation of work and for purpose of coordinating adjacent work.

1.20 FOUNDATIONS, SUPPORTS AND PIERS

- A. Provide necessary foundations, concrete pads, and support bases for proper installations of all mechanical, electrical, plumbing, and diesel fuel systems equipment as required. Submit submittals to Engineer for review and approval before purchase, fabrication, or construction.
- B. For equipment where foundations are indicated, provide concrete pads as shown. Extend pads 4 inches beyond machine base in all directions unless noted otherwise; chamfer top edge. Insert steel dowel rods into floors to anchor pads. Submit drawings of foundation and pads to Engineer for his record.
- C. Where foundations, supports, pads, bases, and piers are mounted on floor, construction shall be of same material and quality of finish as adjacent flooring material.
- D. Securely attach equipment to building in approved manner. Attachments

shall be strong and durable and if not considered so by the Engineer, shall be replaced as directed at no cost.

- E. When foundations or equipment supports are not detailed in these documents, Contractor shall provide equipment supports or foundation as recommended by the equipment manufacturer at no additional cost.

1.21 OUTLET OPERATING AND VIBRATIONS

- A. Systems shall operate under all load conditions without excessive sound or vibration. Sound levels of the new emergency generator shall not be higher than listed in manufacturer's submittal documents. When sound and or vibration levels are determined to be higher than specified, they shall be corrected by contractor and equipment manufacturer by use of approved vibration eliminator as recommended by equipment manufacturers at contractor's expense.

1.22 SHOP DRAWINGS AND PRODUCT DATA

- A. Prior to commencement of installation of any equipment, conduits, pipe, duct, etc; the contractor shall submit shop drawings.
- B. The Contractor shall be responsible for and bear any expense of alterations to the existing building or its appurtenances resulting from the substitution of equipment to that specified in the bid Documents.
- C. Within allowed working days (in other section of specification), the Contractor shall submit copies of shop drawings and published engineering data. The copies shall be assembled in individual sets with the item being submitted indicated by the item number shown on drawings and/or specifications. Included shall be drawings and descriptive literature providing required dimensional, ratings and operational data on items tabulated below and all corrections in submission and resubmit if requested.
- D. Obtain, check, certify, and submit complete shop drawings and brochures from Contractors, Manufacturers, Suppliers, Vendors, etc., for all materials and equipment specified herein.
- E. All shop drawings shall be checked by contractors for full compliance of bid documents. They shall be properly sealed, signed and dated by contractors before submitted to Engineer.
- F. Shop drawings shall be submitted for the following

items: New Emergency Generator
Exhaust pipe for new generator with rain cap and wall thimble
New Automatic transfer switch
Diesel fuel day tank with transfer pumps and accessories
Diesel fuel piping, valves, fittings
New panel board with over current protection
devices New conduits, conductors, junction boxes

and pull boxes Feeder and branch circuit breakers
New wall louvers, intake and
exhaust New overhead door
with all hardware New fire
alarm system devices Exhaust
pipe insulation
Aluminum jacket
Wall thimble detail
Exhaust fan and room thermostat

- G. Any one group of similar equipment as described in the listings above shall be the product of one manufacturer.
- H. Approval of shop drawings does not release the Contractor and equipment manufacturer from fully complying with the requirements of bid documents and providing satisfactorily operating MEP and diesel fuel systems. Material and equipment shall be approved for final acceptance when construction is completed and all units and systems have been operated, tested, programmed, and electrical loads balanced to the satisfaction of the Engineer. Should proposed approved alternate equipment involve rearrangement of designed equipment, a complete layout of the area involved shall be submitted by the Contractor, and shall be approved in writing before installation of any such items of equipment. Any additional expenses involved shall be a Contractor borne expense.

1.23 AS-BUILT DRAWINGS

- A. The Contractor shall maintain a record set of blue line prints at the project site which is dedicated to marking in "red" any variation in the work as compared to the general design drawings. This record set is to be carefully maintained and kept neat and clean and used for no other purpose.
- B. The Contractor shall deliver the corrected blue line set of drawings to the Engineer upon completion of work. Final approval will not be given by the Engineer until the record a set of prints have been received by the Engineer with all corrections marked.

1.24 CUTTING AND PATCHING

- A. Core drill existing walls for installations of conduits, emergency generator vent pipe, fuel vent pipes, etc. All new pipes and conduits shall be installed in rigid galvanized steel sleeves when penetrating existing electrical, Mechanical, and generator rooms. All wall openings around sleeves shall be sealed off water- tight using similar materials and final finishes shall match the adjacent existing surface. All sleeve opening around conduits and pipes shall be sealed off using UL listed fire stopping sealants. During core drilling no existing structural member shall be damaged.
- B. Cutting and patching of the floor slab in the existing generator room:

Refer to MEP drawings for specified modifications to the existing underground emergency feeders. Contractor shall field trace and determine exact locations of the existing under ground electrical conduits. The existing floor slab shall be carefully saw cut, modifications to the existing conduits shall be made, and new conduits shall be installed and connected to existing conduits. The saw cut floor slab shall be repaired to match the adjacent floor slab. Required steel rebars, size to match the existing rebars, shall be installed in new repaired slab.

- C. Underground conduits not in duct banks: Install new conduits in a 6" thick layer of clean bank sand. Fill the trench (saw cut floor slab) with a 6" thick clean bank sand layer. Compact sand layers above and below conduits. Fill the remaining trench up to grade or paving with clean back fill soil and compact.

1.25 IDENTIFICATION OF EQUIPMENT

- A. Provide equipment nameplates on all items of MEP systems such as new emergency generator, ATS, diesel fuel day tank, fuel transfer pumps, and electrical equipment. Nameplates shall include:
 - 1. Manufacturer's name, serial and model number.
 - 2. General engineering information.
 - 3. Electrical requirements.
- B. The nameplates shall be of stainless steel and shall be attached to the equipment in conspicuous places with self-tapping stainless steel screws or contact adhesive where screws cannot be used.

1.26 OWNER'S MANUAL, SERVICE TOOLS

- A. Prepare, in bound form and identified with lettering imprinted on the face of binder, Owner's Manual which shall consist of the following:
 - 1. Complete description of each item of equipment and apparatus furnished and installed under Division 15 and 16 (MEP Divisions), including ratings, capacities and characteristics.
 - 2. Fully detailed, applicable parts lists, including all numbered parts, of each item of equipment and apparatus furnished and installed under Divisions 15 and 16.
 - 3. Manufacturers printed instructions describing operation, servicing and maintenance, and repair of each item of equipment and apparatus.
 - 4. Typewritten record of all tests made of materials, equipment and systems included under Divisions 15 and 16. Such records shall

state the dates the tests were conducted, names of person(s) making and witnessing the tests, and citing unusual conditions relevant to the tests.

- B. Owner's Manual is approved for content and format prior to final preparation. Submit (5) copies of Owner's Manual.
- C. All tests shall have been made and approved and Owner's Manuals shall be complete, approved and delivered to the Owner's authorized representative prior to requesting acceptance of the installation.
- D. Provide and deliver to the owner any special tools required for maintenance of equipment and apparatus installed under Divisions 15 and 16.

1.27 FINAL REVIEW

- A. Upon completion of the work, there shall be a final review of new emergency generator, ATS, diesel fuel day tank, fuel transfer pumps, new overhead door, and mechanical and electrical systems.
- B. New and existing emergency generators with the existing and new ATSs shall be tested to for proper operations and must transfer emergency power to the existing emergency switchboard as specified.
- B. All systems shall be operating properly.
- C. Certificates and Documents required herein shall be in order and presented at least two weeks prior to the review.
- D. After the review, any changes or corrections noted as necessary for the work to comply with these specifications and the drawings shall be accomplished without delay in order to secure final acceptance of the work.
- E. The date for the final review shall be sufficiently in advance of the Contract completion date to permit the execution before the expiration of the contract of any adjustments and/or alterations which the final acceptance tests indicate as necessary for the proper functioning of all equipment. Any such modification shall be completed within the number of days allotted for completion of the contract. Retests shall be conducted as directed and shall be of such time duration as necessary to assure proper functioning of adjusted and altered items. Retests shall not relieve the Contractor of completion date responsibility.
- F. Qualified persons of the new emergency generator, ATS, and contractor's must be present at the final inspection to demonstrate proper functioning of the MEP systems and to prove the performance of the equipment as per requirements of bid documents.
- G. Upon completion of work, and at time designated by the Engineer

provide services of Mechanical and Electrical contractor for a period of at least 8 hours, to instruct the owner's representatives in the operations and maintenance of the new emergency generator, ATS, and diesel fuel day tank and fuel transfer pumps.

1.28 CLEANING

- A. At the end of the construction phase, the existing emergency generator room, mechanical yard, electrical rooms, fire pump room, existing and new fuel tank areas, and all other areas of the building, used by contractor, shall be cleaned. All dirt and debris shall be removed. All wall scratches shall be repaired and paint touched up to adjacent matching surfaces

END OF SECTION

SECTION 15606

DIESEL FUEL STORAGE TANK, PIPING, AND VALVES

PART 1 - GENERAL

- 1.1 Furnish and install diesel fuel system complete with day tank, fuel transfer pumps, pipes, fittings, valves, sleeves and accessories as indicated and specified in bid documents for complete satisfactory operation of existing and new emergency generators. All materials shall be new and manufactured in U.S.A.
- 1.2 Shop drawings for the day tank, pumps, pipe materials, fittings, and valves shall be submitted for approval. All pipe materials and fittings shall have manufacturers name clearly cast or stamped thereon.

PART 2 - PRODUCTS

- 2.1 Diesel fuel piping above grade inside the building:
 - A. 2 inch and smaller- shall be ASTM A53, Grade A or B, schedule 40 (standard weight), seamless carbon steel pipe with 150 pound, screwed, malleable iron, threaded fittings confirming with requirements of ANSI B16.3. All piping and fittings shall be manufactured in U.S.A.
 - B. Vent pipe and fittings shall be the same as specified in sub-section 2.1A.
 - C. Flex connectors - Resistoflex corp. R-29236-24-L/32-L.
- 2.2 Diesel fuel piping above grade outdoor (outside of the building):

- A. 2 inch and smaller - type "K" hard drawn copper ASTM B-88 with wrought copper fittings ANSI B16.22.

2.3 DIESEL FUEL VALVES

- A. Ball Valve: It shall be bronze ball valve with bronze trim. The valve shall be third party UL listed for flammable liquids. The valve shall be three piece body with full port. It shall be NIBCO Model- T-595-Y-UL or approved equal Crane or Conbraco Industries.

Body: Bronze, complying with
ASTM B584. Ball: Chrome plated
bronze.

Stem: Bronze, blowout proof.

Seats: Reinforced TFE, blowout proof.

Packing: Threaded body, packnut design with adjustable-
stem packing. Ends: Threaded

Cold water pressure rating: 600 psig.

Service mark: Initials "WOG" shall be permanently marked on valve
body.

- B. Union 2" and smaller: Malleable iron with brass to iron seat, ground joint, threaded ends, class 150 ASME B16.39.
- C. Weatherproof vent cap: Cast iron or malleable iron increaser fitting with corrosion resistant screen, with free area at least equal to cross-sectional area of connecting pipe and threaded end connection.

2.4 DIESEL FUEL DAY TANK WITH FUEL TRASFER PUMPS ASSEMBLY

- A. General: The diesel fuel day tank of specified capacity with duplex supply pumps, return fuel pump, pump motors, associated fuel piping, valves, fitting, controls, and accessories as specified in bid documents shall be furnished and installed. The day tank shall be of double wall construction fully complying with all requirements of UL Standard-142, Harris County, and City of Houston adopted local codes.
- B. Manufacturer: Day tank manufacturer shall have a minimum of ten years experience in the design, fabrication, and manufacturing of similar and larger sized diesel fuel day tanks.
- C. Acceptable Manufacturers: Day tank shall be as manufactured by Engine & Compressor Accessories SCDT Series or approved equal Tramont, or Simplex Inc provided they fully comply with all requirements of bid documents.
- D. Construction
 - 1. Day tank shall be constructed in accordance with Underwriters Laboratories Standard UL-142. The day

tank shall also be constructed in accordance with Flammable and Combustible Liquids Code, NFPA 30, Standard for Installation and use of Stationary Combustible Engine and Gas Turbines, and NFPA 37. Day tank shall be fabricated of 12 gauge (heavy gauge) steel using a lap joint construction. The tank shall include removable, nonconductive, welded steel top cover for indoor applications. Fuel pumps and piping shall be installed on black carbon steel required channels on the top of the tank. The tank shall be ready to receive fuel supply, return, and vent piping at the jobsite. The specified hand pump with suction and discharge piping, fittings, valves, etc shall be factory furnished and installed and shall be ready to receive flexible fuel line at the jobsite. The hand pump shall be UL listed as specified in bid drawing. The tank interior shall be coated with a permanent, rust inhibiting, two solvent-based or petroleum based film for rust prevent shall be unacceptable. All exterior surfaces of the tank shall be factory cleaned, primed and finish painted using minimum 2 coats of industrial enamel paint. The paint color shall be "Gray". The tank shall be factory installed with the following fittings. Furnish and factory install all fittings at top of the tank as specified in bid drawings. Additional tank fittings at top tanks shall be provided as required by codes.

- E. The tank shall be provided with atmospheric (normal) vent cap with screen and appropriately sized, zinc plated, UL Listed emergency vent cap. UL Listed emergency vent cap shall be spring pressure operated. Opening pressure shall be 0.5 psig; full opening pressure shall be 2.5 psig. Limits shall be marked on top of each vent.
- F. Fuel Containment Basin: The day tank shall be factory fabricated with secondary containment. The secondary containment shall consist of a welded heavy gauge steel structure. The secondary containment shall prevent fuel spilling into the environment in the event of a primary tank leakage. The secondary containment shall be provided with atmospheric (normal) vent cap with screen and appropriately sized UL Listed emergency vent cap.
- G. Leak Detection System: A [secondary containment] leak detector float switch shall be factory furnished, installed, and wired into the control circuitry of the day tank assembly. Upon sensing fuel leakage into the secondary containment basin, the leak detection system shall de-energize power to fuel pump motors and de-energize pumps and solenoid valves.
- H. Fuel Level Gauge: The tank shall be factory furnished and installed with fuel a level gauge. The fuel gauge shall provide a direct-reading of the fuel level in the tank.
- J. Automatic Day Tank Level Controller

1. The control circuitry shall be designed and supplied as an engineered system by Engine & Compressor Accessories. The controller shall have replaceable relays or approved equal: non replaceable relays shall be unacceptable. The controller shall have independent float switches to provide multiple signals to the control circuitry. The control panel shall have the following Control and indication functions as a minimum. All control and indication functions shall be factory wired to the Control panel:

2. CONTROL FUNCTIONS

- a. "Press-to-Test" fill control momentary switch
- b. Critical high fuel level (Pump/motor shutdown)
- c. High fuel level in the tank
- d. Low fuel level in the tank
- e. Critical low level [12V DC] [24V DC] signal
- f. Rupture basin alarm (Pump/motor shall shutdown)
- g. Pump/motor and solenoid control

3. INDICATION FUNCTIONS

- a. Pump Running
- b. Critical high fuel level
- c. High fuel level
- d. Low fuel level
- e. Critical low level

4. OUTPUTS: Provide one set of normally open and one set of normally closed 10 amp, 120 VAC rated relay contacts for remote monitoring (annunciation). The remote monitoring feature shall provide the following monitoring points as a minimum at remote monitoring unit.

- a. Critical high fuel level (Pump/motor shutdown)
- b. High fuel level
- c. Low fuel level
- d. Critical low level
- e. Rupture basin alarm (Pump/motor shutdown)

K. Duplex Fuel Pumps

1. The tank shall be factory furnished and installed with 2 fuel supply pumps with two motors, 2 sets of associated fuel piping, solenoid valves, check valves, and shut off valves. Each pump shall be of a positive displacement, bronze, rotary gear fuel oil pump to draw fuel oil from the existing outdoor main fuel storage tank to the day tank. Pump capacity shall be sized as specified in bid drawings. Each pump shall be rated to lift 20 feet (20 feet to vertical lift) of water above mean sea level. Each pump shall be manufactured by Oberdorfer or approved equal. Each pump motor shall be of sufficient

horsepower, but not less than of specified horse power in bid drawings. Each pump shall operate at full load condition (pump specified amount of fuel at required head) without overloading the motor and or operating in motor's safety factor.

L. ALTERNATING SYSTEM

1. The pump/motors shall be factory furnished, installed, and properly wired to automatically alternate lead/lag operations of the pumps. The lead/lag operations of the pumps shall be alternated at every ON/OFF cycle when pumping fuel. The lead pump shall activate when the fuel level declines to 86% of tank capacity; the second pump (lag pump) shall be automatically activated and operate in tandem with the lead pump if the fuel level in the tank declines to 82% of the tank capacity. Appropriately sized solenoid valves with strainers shall be factory installed on the pump fuel inlets.
2. Check valve shall be furnished and factory installed in discharge line of the pump.
3. "Hand-Off-Auto" switches shall be furnished, installed, and properly wired for each pump.

M. Reverse Pumping System

1. A reverse pumping system shall be provided in applications where the primary tank's maximum fuel level is at a higher level than the day tank. The reverse pump/motor will return fuel to the primary tank in the event the day tank level exceeds its normal capacity. The reverse pump shall be automatically activated by a separate critical high level float switch. The reverse pump capacity will be equal to or greater than the capacity of supply pump. If the tank is factory installed with a duplex supply pumping system, the reverse pump shall be equal to or greater than the combined capacity of the two supply pumps.

N. Electrical: All electrical components shall fully comply with requirements of UL and NEC. Pump motors, safety switches, control devices, HOAs, and monitoring devices shall be factory wired and entire unit shall be factory ready to receive single point electrical connection at the building. It shall be suitable to operate with 120 volt, 1 phase, 60 hz; power. Fused step down control transformer, if required, shall be furnished, installed, and wired by tank manufacturer.

P. Testing: The entire day tank with piping, valve, accessories shall be factory pressure tested for a minimum pressure of 3 psig for a period of 8 hours. Any and all leaks found shall be corrected and the test shall be repeated until proven to be leak-proof.

PART 3 - EXECUTION

3.1 INSTALLATION

- A. New day tank and fuel piping shall be installed as indicated in bid drawings. Minor modifications to fuel piping arrangement shall be made to suit building conditions, avoid interferences with other trades, and maintain access to all parts of the day tank and piping systems at no extra cost.
- B. Provide additional offsets, fittings, valves, drains, etc., where required by construction to avoid conflicts with other trades at no extra cost.
- C. Run fuel piping parallel with or at right angles to walls and other piping, unless noted otherwise, neatly spaced and with plumb risers.
- D. Provide diesel fuel piping of proper size as specified in bid documents. Each line shall be installed with ball shut off valve .
- E. Joints shall be made in accordance with manufacturer's instructions.
 - 1. Screwed joints: Threads shall be clean cut of exact length. Ream pipe after cutting and threading and apply approved compound compatible to diesel fuel on male threads only. Make screwed joints using machine cut USASI taper pipe threads. Apply a suitable joint compound to the male threads only. The joint compound must be compatible to diesel fuel and must not adversely affect diesel fuel in lines. Ream the pipe to full inside diameter after cutting. All-thread nipples are not permitted.
 - 2. Make fuel piping layout and installation in the most advantageous manner possible with respect to the generators and day tank equipment clearances. Give particular attention to piping and conduits in the vicinity of equipment. Preserve the maximum access to various equipment parts for maintenance.
 - 3. Because of the small scale of drawings, the indication of all offsets and fittings is not possible. Carefully investigate the field conditions affecting the work and take such steps as may be required to meet such conditions. Furnish and install all required pipe fittings and supports at no extra cost.
 - 4. Do not cut or weaken any existing structural member.
 - 5. Cut all pipes accurately to measurement determined at the site. After cutting pipe, ream it to remove burrs.
 - 6. Install piping neatly free of traps and pockets. Work pipes into place without springing or forcing. Use fittings to make all changes in direction. Field bending and mitering are prohibited. All 90 degree and 45 degree elbows shall be long sweep type.
 - 7. Fuel piping shall not be installed over electrical equipment
- F. Copper pipe shall be cut square and burrs removed. Mechanically

clean and flux ends of pipe and fittings before assembling. Fuel piping joints shall be made with non corrosive paste flux and solid string of lead free solder as recommended by solder manufacturer. The selected solder shall not have any adverse affects on diesel fuel. The finished solder joints in copper piping system must withstand test pressure of 150 psig.

- G. Entire new and sections of the existing diesel fuel piping shall be isolated from existing fuel storage tank, from new day tank, and from the existing and new emergency generators. Entire new fuel piping system shall be pressure tested to a pressure of 150 psig for a period of 24 hours. The system shall be proven to be leak-proof. Any and all leaks found during the testing shall be repaired to Engineer's satisfaction and retested until the system is proven to be leak-proof. Furnish and install new valves required for isolation.
- H. All new fuel lines, vent pipes, fittings, valves, pipe supports, and field installed surfaces of accessories associated with new day tank shall be cleaned. All rust spots and paint shall be removed. Pipes, fitting, accessories, shall be prepared for painting. All new fuel lines, fittings, valves, pipe supports, etc shall be painted using 1 coat of galvanized metal primer not less than 1.5 mils thick and 2 coats of finish exterior acrylic latex paint not less than 3 mils thick. The paint color shall be "Gray". All concrete pads, wall surfaces, surfaces of the day tank, etc shall be protected from paint. Any and all other surfaces receiving pint shall be cleaned by contractor and no additional cost.
- I. New diesel fuel day tank: New diesel fuel day tank with transfer pumps shall be installed on concrete pad at location in the drawing as per day tank manufacturer's instructions.

END OF SECTION

SECTION 15608

FLUE GASES VENT PIPE (ENGINE EXHAUST PIPE) AND INSULATION FOR
EMERGENCY GENERATOR SYSTEM

PART 1 - GENERAL

1.1 GENERAL

- A. The emergency generator flue gases vent pipe, also referred as engine exhaust pipe, vent pipe insulation, and aluminum jacket shall be furnished and installed as per requirements of this specification and other bid documents.
- B. The flue gases vent pipe, fittings, and other materials shall be new and manufactured in USA. All pipe materials and fitting shall have manufacturer's name clearly stamped or cast thereon.

- C. Welder: Employ welders qualified to perform welding operations required either by certifications or by submitting to required tests.

PART 2 - PRODUCTS

2.1 The flue gases vent pipes: The size of the flue gas vent pipe shall be as per requirements of bid drawings. Furnish and install pipe meeting requirements of ASTM A 53, Grade A or B, standard weight seamless, or electric resistance, welded, hot dipped galvanized (carbon) steel pipe with standard weight, seamless galvanized steel welding fittings, satisfying all requirements of ASTM A 234, Grade WPA or WPB, ANSI B16.9 The flue gas vent pipe shall be hot dipped galvanized after fabrication.

2.2 Insulation and jacket for flue gases vent pipe:

A. The type of insulation and its installation shall be in strict accordance with this Section of the specification and the application technique shall be as recommended by the manufacturer. Insulation together with insulation accessories, vapor barrier, adhesives (if any), and finishes shall be submitted and approved by the Engineer before any insulation is installed. The insulation products specified are by Johns-Manville; however, approved equal products of other manufacturers listed here shall be acceptable.

B. All insulation shall have composite (insulation, jacket or facing and adhesive and used to adhere the facing or jacket to the insulation) fire and smoke hazard as tested by Procedure ASTM E-84, NFPA 255 and UL 723 not exceeding:

Flame Spread 0

Smoke Developed 0

All accessories required with this specified insulation and jacket shall have the same component ratings as listed above.

C. Labels: All products or their shipping cartons shall have a label affixed indicating that flame spread and developed ratings do not exceed above requirements.

D. Insulation Thickness: Insulation thickness shall not be less than the following:

<u>Surface</u>	<u>Thickness in inches</u>
Emergency Generator	2" flue gases vent pipe

E. The flue gases vent pipe (with fittings) shall be externally insulated using calcium silicate insulation blocks. The manufacturer's product

(calcium silicate) which has been listed with the local authorities having jurisdiction shall be used. The calcium silicate insulation shall be 100 percent asbestos free. It shall be available in both sectional pipe insulation and block form. The insulation shall not burn and or spread flame. The insulation shall be factory tested in accordance with the latest requirements of ASTM. The insulation shall be insoluble in water and can be soaked in water without permanent damage. The insulation shall have a maximum service temperature of 1200 degree F. Thermal conductivity shall not be higher than 0.58 BTU\HR.\SQ. FT\DEG F at mean temperature of 900 degree F. The surface burning characteristics of insulation shall fully comply with all requirements of ASTM-E84, NFPA 255, and UL 723 for 25/50 flame and smoke standards. The calcium silicate insulation as manufactured by Johns Manville Company or approved equal shall be used.

F. Aluminum Jacket:

1. Flue gases vent pipe: Furnish for finishing insulated pipe, a metal jacket of Type 3003-H14 aluminum alloy, 0.016 inch thick. The aluminum jacket shall contain a permanent plastic weatherproof sealant which shall be concentrated over the circumferential joint made where the fitting butts against the straight section of pipe.
2. Fittings: For fittings provide formed aluminum covers, 0.024 inch thick, type 3003-H14 aluminum alloy.
3. Straps and Seals: Provide aluminum strapping and seals for jackets and covers according to manufacturer's recommendation.
4. Acceptable Manufacturers: Jacketing as manufactured by Preformed Metal Products Company, Childers, or Johns- Manville will be acceptable.

PART 3 - EXECUTION

3.1 WELDING

- A. Weld and fabricate flue gases vent pipe in accordance with ANSI Standard B31.1 latest edition, Code for Pressure Piping. Machine beveling in shop is preferred. Field beveling may be done by flame cutting to recognized standards.
- B. Align vent pipe and equipment so that no part is offset more than 1/16 inch. Set all fittings and joints square and true, and preserve alignment during welding operation. Use of alignment rods inside pipe is prohibited.
- C. Do not permit any weld to project within the flue gases pipe so as to restrict it. Tack welds, if used, shall be of the same material and made by the same procedure as the completed weld. Otherwise, remove tack

welds during welding operation.

- D. Do not split, bend, flatten, or otherwise damage flue gas pipe before, during or after installation.
- E. Remove dirt, scale and other foreign matter from inside flue gases pipe before tying in sections, fittings, or equipment.
- F. Hot dipped galvanized entire flue gas vent pipe.

3.2 INSULATION FOR GENERATOR FLUE GASES VENT PIPE

- A. The emergency generator flue gases vent pipe with all fittings shall be externally insulated and jacketed with aluminum jacket. The calcium silicate insulation shall be applied as per manufacturer's instructions. The insulation shall be applied over clean dry vent pipe and fittings with all insulation joints butted firmly together. A moisture barrier shall be applied between the calcium silicate insulation and aluminum jacket. All fittings shall be insulated using prefabricated calcium silicate insulation sections.

3.3 ALUMINUM JACKETING

- A. Provide aluminum jacket on the entire length of the externally insulated flue gases vent pipe. The aluminum jacket shall be applied according to manufacturer's recommendations, using aluminum strapping and seals, to provide completely weather tight covering. The insulation and aluminum jacket shall be secured in place by a continuous friction type joint to provide a positive weatherproof seal along the entire length of the aluminum jacket.
- B. Aluminum jacketing is not considered as contributing to the vapor barrier or the insulation jacket. The vapor barrier must be completely sufficient in itself for this function.

END OF SECTION

SECTION 15840

DUCT WORK

PART 1 - GENERAL

1.1 DRAWING NOTES

- A. The Drawings are schematic in nature and show a radiator discharge duct and connections of the duct to the emergency generator and to the wall louver through exhaust air plenum. Field verifies size of the discharge duct connection to the radiator flange and to the louver before fabrication of the duct.

- B. Where requirements of the specifications (in this section or in other related sections) are more stringent, and or of better quality, than required by SMACNA Standards, the specifications shall be followed.

1.2 CODES AND STANDARDS

- A. The following codes and standards of the issue in effect on the date of release of this specification shall govern.
 - 1. HVAC Duct Construction Standards, Metal and Flexible, Sheet Metal and Air Conditioning Contractors National Association, Inc. (SMACNA) Manuals: Second Edition 1995.

PART 2 - PRODUCTS

2.1 GENERAL

- A. All low and medium velocity sheet metal duct work shall be fabricated and installed by the contractor, in accordance with details and instructions shown in HVAC DUCT CONSTRUCTION STANDARDS (Metal Flexible), Second Edition-1995 unless noted otherwise in bid documents.

2.2 MATERIAL

- A. Galvanized Steel: The radiator discharge duct and plenum shall be fabricated of galvanized steel sheets. All sheet metal ducts shall be prime low carbon, galvanized steel of lock forming galvanizing of 0.90 ounces per sq. ft. on each side of the sheet, ASTM A525 Coating Designation G90 and with name of manufacturer and trade name stamped on each sheet.

2.3 FLEXIBLE CONNECTION

- A. Flexible connections shall be made of "Ventglas" fire resistant glass fabric, asbestos free material, as manufactured by Ventfabrics, Inc., 640 North Kedzie Avenue, Chicago 12, Illinois, or approved equal, with suitable frame at each end. Material shall weigh approximately 30 ounces per square yard.

2.4 PLENUM

- A. Discharge air plenum shall be constructed (fabricated) with galvanized steel framing members and galvanized sheet steel, cross broken and rigidly braced with galvanized steel angles. The plenum shall not breathe or drum during normal operations or at starting and stopping of the emergency generator. Gages, bracing, and reinforcing shall conform to SMACNA recommendations for duct work and plenum of like size unless otherwise specified in bid drawings. Openings for connections of radiator discharge duct and access doors, etc. shall be

framed and reinforced with proper size galvanized steel angles.

PART 3 - FABRICATION

3.1 GENERAL

- A. A radiator discharge duct and plenum behind discharge (exhaust) louver shall be installed at location shown in bid drawings. Required minor modifications shall be made to suit building conditions at no extra cost.
- B. Discharge air duct shall be properly connected to the discharge air plenum and to the emergency generator (discharge side of the radiator). The discharge air plenum shall be connected to discharge air louver. All connections shall be made using proper gaskets and shall be air-tight.

3.2 SHEET METAL DUCT WORK

- A. The duct work shall be fabricated and erected by the sheet metal contractor in a thorough and lye airtight as modern sheet metal practice will permit. The discharge duct and plenum shall not breathe or rattle when the emergency generator is in operation. Any rattling and or breathing occurs during starting, running, and shut down of the emergency generator shall be corrected by the contractor at no additional cost.
- B. The interior surfaces of discharge air duct and plenum shall be smooth. No sheet metal parts, tabs, angles, or anything else may project into the air ducts for any reason unless specified to do so. All seams and joints shall be external.
- C. Prior to system operation, the interior of all duct work shall be thoroughly cleaned by the contractor.

3.3 SHEET METAL GAUGES

- A. Sheet metal gauge of the emergency generator's radiator discharge duct shall be as per requirements of SMACNA tables except exhaust plenum and the discharge duct shall be fabricated of heavier gauge if specified in bid drawings. Fabrication, reinforcing, cross breaking, duct and plenum supports, etc shall fully comply with all requirements of SMACNA.

3.4 SEALING OF JOINTS

- A. Hard Cast Joints: All the transverse and longitudinal joints, of the discharge air duct and plenum shall be sealed using Hard Cast adhesive. The adhesive shall be FTA-20 manufactured by Hard Cast Company or approved equal. The adhesive shall be non-toxic, non-flammable, UL approved and shall have flame spread rating less than

25 and smoke developed rating less than 50. The adhesive shall be used in conjunction with Hard Cast DT type duct tape. The adhesive and DT tape shall provide airtight joints for the discharge duct and plenum. The adhesive shall be of the quality that does not require pre-cleaning of ducts and can adhere to oil and damp duct surfaces.

3.5 HANGERS AND SUPPORTS

- A. Hangers and supports shall be in accordance with the requirements of SMACNA, with the following exceptions:
 - 1. Trapeze hangers shall be used for ducts 4' and over in width, with length of each support angle not more than 6" greater than the duct width. Hanger rods shall be not less than 3/8" in diameter. Wire hangers shall not be used.
 - 2. Ducts shall not be hung from a metal panel roof deck.
- B. All hangers shall be hung from the floor and roof structure above as applicable. All galvanized steel channels, angles, Unistrut members and other required support members shall be furnished, and properly installed by this sheet metal contractor for support of duct work and plenum.
- C. No conduit, pipe, and or cable shall be installed through the discharge duct work.

3.6 SCREENS

- A. Provide screens on duct openings unless noted otherwise, which lead to, or are outdoors and are not provided with screened louvers. Screens shall be No. 16 gauge galvanized steel mesh attached to a removable galvanized steel frame.

3.7 CONNECTIONS TO LOUVERS

- A. All louvers shall be furnished and installed by this contractor. The duct connection to the louvers shall be watertight. Bottom of the exhaust plenum behind louver shall have watertight soldered joints and be sloped to weep holes in bottom of louver. Lap the duct over a bottom louver blade where possible.

END OF SECTION

SECTION 15879

INTAKE AND EXHAUST AIR LOUVERS

PART 1 - GENERAL

1.1 GENERAL

- A. Furnish and install new ventilation louvers where shown on the drawing. The louver shall be as specified on louver schedule.

PART 2 - PRODUCTS

2.1 LOUVER

- A. Louvers shall be stationary drainable type with a frame depth as schedule in bid documents. Frames and blades shall be 0.081 inch thick 6063-T5 extruded aluminum alloy. Blades shall be located on an approximate 35 degrees blade angle. Louvers shall be assembled entirely by welding. Louvers shall be factory finished after assembly with a Kynar 500 coating; substitute finish will not be acceptable, in a color selected from the manufacturer's color chart. The louver color will be selected by the building owner during the submittal phase of the project. Louver shall bear AMCA certified ratings seals for air performance, water penetration and air leakage ratings. Manufacturer shall submit AMCA licensed test data on a 4' x 4' louver when requested. Minimum free area for 6" deep louver shall be 54 percent.
- B. Maximum free area velocity through the louver shall be 1050 FPM with a maximum pressure drop of 0.15 inches of W.C and shall carry less than 0.02 ounce of water per square foot of free area during a 15 minute period when tested in accordance with AMCA standard 500.

PART 3 - EXECUTION

- 3.1 6" deep intake and exhaust louvers shall be installed in the existing concrete block wall openings at locations shown in bid documents. The louvers shall be installed as per manufacturer's recommendations and details shown in bid documents. All required hardware shall be hot dipped galvanized steel. All steel components of the louvers shall be isolated from aluminum surfaces using neoprene gaskets to eliminate direct steel to aluminum contacts. The louver installations shall be water-tight. All scratches shall be paint touched up by matching paint after installation.

END OF SECTION

SECTION 16110

ELECTRICAL RACEWAYS

PART 1 - GENERAL

1.1 GENERAL

- A. All wiring shall be in conduits and concealed wherever possible. All conduits of a given type shall be the product of one manufacturer.

1.2 REFERENCES

- A. American National Standards Institute (ANSI).
 - 1. ANSI C80.1: Electrical Rigid Steel Conduit (ERSC)- Zinc Coated.
 - 2. ANSI C80.4: Fittings for Rigid Metal Conduit.
 - 3. ANSI C80.3: Standards for steel Electric Metallic Tubing (EMT conduits).
 - 4. ANSI/UL-1 Standards for Flexible Conduits.
 - 5. RN2-1987 Master Bundles conform to NEMA Standard.
- B. Federal Specifications.
 - 1. W-C-58C: Conduit Outlet Boxes, Bodies Aluminum and Malleable Iron.
 - 2. W-C-1094: Conduit and Conduit Fittings Plastic, Rigid.
 - 3. WW-C-566C: Flexible Metal Conduit.
 - 4. WW-C-581D: Coatings on Steel Conduit.
 - 5. WW-C-563: For EMT conduits.
- C. National Electrical Manufacturers Association (NEMA).
 - 1. NEMA RN1: Polyvinyl Chloride Externally Coated Galvanized Rigid Steel Conduit and Electrical Metallic Tubing.
 - 2. NEC Article 348: Flexible Metal Conduits.
- D. National Fire Protection Association (NFPA), ANSI/NFPA 70-All applicable articles of National Electrical Code (NEC).
- E. Underwriters' Laboratories (UL).
 - UL 1: Flexible Metal Electrical Conduit. UL 797: EMT Conduits.
 - UL 6: Rigid Metal Electrical Conduit.
 - UL 514B: Fittings for Conduit and Outlet Boxes.

1.4 APPLICABLE PROVISIONS

- A. Refer to Section 15050/16050 General conditions for Mechanical, Electrical, and Plumbing Systems.

1.5 SUBMITTALS

- A. Submit the following under the provisions of Submittals:
 - 1. Manufacturer's cut sheets, catalog data, with selected products clearly marked.
 - 2. Installation, terminating and splicing procedure.
 - 3. Instruction for handling and storage.
 - 4. Dimensions and weight.

1.6 QUALITY ASSURANCE

- A. Tests.
 - 1. Rigid steel conduit shall pass the bending, ductility, and thickness of zinc coating tests described by ANSI C80.1.
 - 2. Flexible conduit shall pass the tension, flexibility, impact, and zinc coating test described by UL1.

1.7 DELIVERY STORAGE AND HANDLING

- A. Package conduit in 10 foot bundles maximum with conduits and coupling thread protectors suitable for indoor and outdoor storage. Package fittings in manufacturer's standard quantities and packaging suitable for indoor storage. Package plastic-coated rigid steel conduit, fittings, and bodies in such a manner as to protect the coating from damage during shipment and storage.
- B. Store conduit above ground on racks to prevent corrosion and entrance of debris.

PART 2 - PRODUCTS

2.1 ACCEPTABLE MANUFACTURERS

- A. Rigid Steel and EMT Conduits.
 - 1. Allied Tube and Conduit
 - 2. Triangle Wire and Cable, Inc.

3. Wheatland Tube Company
 4. Youngstown
 5. Republic
- B. PVC Coated Steel Conduit.
1. Occidental Coating Company (O-Cal Blue)
 2. Plasti-Bond by Robroy Industries, Inc.
 3. Perma Coate
- C. Conduit Fittings and Bodies.
1. Appleton Electric
 2. Crouse-Hinds
 3. Killark Electric Manufacturing Company
 4. O-Z/Gedney
 5. Steel City
 6. Raco
- D. Liquid tight and Flexible Conduits.
1. Anamet, Inc.
 2. Electriflex Company
 3. Triangle Wire and Cable, Inc.

2.2 MATERIALS

- A. Design Conditions. Use electrical conduits, fittings, pull boxes, and conduit bodies designed for electrical service in areas as specified in sections of Division 16, in the sections of General Conditions for Mechanical Electrical Requirements, and in this section to form a continuous raceway system for power, and control, conductors and cables.
- B. Conduits exposed to the Weather, in Concrete slabs, in Concrete Block, in above and underground conduits in the existing Emergency Generator room: Rigid Galvanized Steel (RGS) conduits with threaded malleable iron cadmium plated or hot dipped galvanized fittings. All conduits shall be suitable for their intended use, clean, and with a smooth bore that can not injure conductors. Mild steel tubing shall be

used for conduits, nipples, and couplings and shall be free of defects on both the inner and outer surfaces. Rigid steel conduits, covers, RGS conduit bends, nipples, and all other fittings shall fully comply with the latest requirements of ANSI C80.1, UL 6, Federal Specification WW-C-581D, and NEC Article 346. Conduit bodies for rigid steel conduit shall be steel or cast-iron and shall comply with ANSI C80.4, UL 514B, and Federal Specification W-C-58C.

- C. Conduits, Indoor, above ground in existing Electrical Room: Use Electrical Metallic Tubing (EMT) conduits for branch circuit electrical raceway systems where conduits are exposed in Electrical rooms and concealed in furred ceilings or in sheet rock wall spaces. Use galvanized steel compression fittings. Installations of cast fittings and or set screw type couplings are not acceptable. Use water tight fittings where required. Conduits and fittings shall be galvanized and comply with ANSI C80.3 and C80.4. Installation of EMT conduits in the existing Emergency Room will not be acceptable.
- D. PVC-Coated Rigid Steel Conduit, Fittings, and conduit bodies (Conduitlets):
1. The conduit shall be same as rigid galvanized steel conduit as specified above plus a factory applied coatings inside and out as specified herein. PVC-coated conduit, fittings, bodies, and covers shall conform to NEMA RN1 (Type A). Rigid steel galvanized conduit and fittings before coating shall conform to Federal Specification WW-C-581D, ANSI C80.1, and UL 6. Electrical continuity shall be maintained across assembled joints in the conduit system. Conduit bodies shall conform to UL 514B, CSA Standard C22.2 No.18, and Federal Specification W-C-58C. Provide sufficient coating for touch up after installation.
 2. PVC-coated conduits and fittings shall carry "ETL" verified PVC-001 label.
 3. The conduits shall be hot dipped galvanized inside and out with hot dipped galvanized threads.
 4. The PVC coating shall be uniformly and consistently applied to the exterior of all conduits and shall be a nominal 40 mil thick. Conduits having coating thickness less than 40 mil will not be acceptable.
 5. The PVC coating on the outside of conduit couplings shall have a series of longitudinal ribs 40 mils in thickness.
 6. Form 8 conduitlets, ½" through 2" diameters, shall have a tongue-in-groove gasket to effectively seal against the elements.
 7. Form 8 style conduit body fittings, ½" through 2" diameters, shall have an integral V-Seal gasket for superior corrosion protection. Conduit bodies without V-seal gaskets will not be

accepted.

8. A red urethane coating shall be uniformly and consistently applied to the interior of all conduit and fittings and shall be a nominal 2 mil thick.
 9. The pvc exterior and urethane interior coatings applied to the conduit shall afford sufficient flexibility to permit field bending without cracking or flaking of the coating at ambient temperature above 30 degree F.
 10. Conduit covers shall have plastic encapsulated stainless steel thumbscrews.
 11. PVC coated conduit bodies shall be Plasti-Bond RED H2OT or approved equal.
 12. Training: The manufacturer shall provide "hand on" training for the contractor on proper methods of preparation, installations and touch up.
- E. All Galvanized Steel Rigid (RGS) and PVC coated RGS Conduits: All conduit sections shall be joined by malleable iron cadmium plated or hot dipped galvanized steel threaded couplings and other threaded fittings as required. "No Thread" fittings shall not be used unless noted otherwise.
- F. Under slab and Under Ground Conduits: Rigid galvanized steel (RGS) with RGS fittings as specified in Section 2.1 A above.
- G. Liquid tight Flexible Metal Conduit:
1. Use liquid tight flexible metal conduit and fittings for all motor connections and for other electrical equipment connections where subject to movements and vibration and when subject to 1 or more of the following conditions: Exterior location, moist or humid atmosphere where condensate can be expected to accumulate; corrosive atmosphere; subject to water spray; subject to dripping oil, grease or water, a conduit smaller than 1/2" in diameter shall not be permitted.
 2. Liquid tight Flexible conduits shall be fabricated in full compliance with the UL Standards, and NEC Article 356, UL 1 and Federal Specification WW-C-566C. It shall be manufactured of a narrow galvanized steel strip with a gray polyvinyl chloride jacket pressure-extruded over the core which shall seal out liquids, dirt, corrosive fumes, dust and salt sprays. The flexible liquid metal conduit shall be crush and abrasion resistant. All flexible metal conduits shall have green ground copper conductors. The maximum lengths of the liquid tight flexible conduits shall not be greater than 6 feet. The liquid tight flexible conduits shall not be installed in areas not permitted by the latest NEC.

2.3 MINIMUM CONDUIT SIZE

- A. If the size is not shown, conduits shall be 1/2" diameter as a minimum and shall not contain more than three # 12 THWN/THHN conductors.

PART 3 - EXECUTION

3.1 GENERAL

- A. Routing: The conduit routings shall be adapted to field conditions, unless shown otherwise, but final connections of feeder to equipment and branch circuits to new fixtures and outlets shall be made as specified in bid documents.
- B. Conduit runs shall be installed parallel or perpendicular to walls, ceilings, or main structural members unless specified otherwise. Group multiple conduits together where possible. All conduits shall be mechanically secured to the surfaces and or structural members and protected from physical harms and damages. They shall be electrically continuous and neat in appearance. The interiors of conduits shall provide clean, smooth raceways through which conductors may be drawn without damage to the insulation. For RGS conduit system make threaded connections wrench tight.
- C. Conduits shall be cut square with a power saw or a rotary type conduit cutter designed to leave a flat face. Do not use plumbing pipe cutters for cutting conduit. Ream the cut ends of conduit with a reamer, designed for the purpose to eliminate rough edges and burrs.
- D. RGS Conduits: cut threads with standard conduit dies providing required taper per foot, allowing the proper length so that joints and terminals may be made up tight and the ends of the conduit not deformed. Keep dies sharp and use a good quality threading oil continuously during the threading operation. Remove metal cuttings and oil from the conduit ends after the threads are cut and paint threads before connections are made. Use zinc rich, brush-on compound on the threads of steel conduit before connections are made.
- E. Make up changes in direction of conduit using elbows or fittings. Do not use pull boxes to make direction changes unless specified and specifically designated otherwise.
- F. Field fabricated bends shall be free of indentations or elliptical sections. The radius of the bend shall not be less than 6 times the smallest diameter of the raceway.

- 3.2 Routing: The conduit routings shall be adapted to field conditions, unless shown otherwise, but light fixtures, receptacles, and equipment shall be connected to the circuits as shown on drawings. Verify the actual physical conduit route and prepare the conduit support system. Verify the equipment locations to which the conduit will be connected and determine detail requirements for connections. Exact locations and elevations of all conduit

racks and individual conduit runs shall be field coordinated, before installations, with roof structure, light fixtures, duct work, mechanical (HVAC), plumbing, fire protection piping, and communication and fire alarm systems cables and conduits to avoid conflicts and delays.

- 3.3 Conduit installations: Conduits shall be installed so that conductors may be drawn in without injury or excessive strain. Installation of all conduit runs shall be continuous between enclosures such as outlets, junction and pull boxes, panel boards, ATS, emergency generator, switchboards, control cabinets etc; with a maximum of 100 feet between pull points for branch circuits and 300 feet for feeders. The number of equivalent 90 degree bends between pull points shall not exceed the following: for 1/2" through 2 1/2" conduit - 3, for conduits larger than 2 1/2" - 2. Furnish and install pull boxes and or junction boxes as required to comply with 90 degree bend requirements at no additional cost. Copper green ground wire shall be provided in all non metallic conduits (PVC), flexible metal conduits, liquid tight conduits, in armored cables and in other conduits as specified on drawings and shall be connected to the ground terminal of device or the equipment.
- 3.4 All metallic conduit work shall be screwed tight so as to constitute a continuous, conductive metal raceway. All conduits shall be suitably capped or plugged during construction to prevent entrance of water or foreign matter. Trapped conduits shall be swabbed to remove moisture or foreign matter before wires are pulled in. All conduits, where entering panel boards, switchboard, control cabinet, pull boxes, ATS, emergency generators, junction boxes, wire ways, outlet (receptacles) boxes, etc; where no threaded hubs are provided, shall be secured in place by galvanized double lock nuts with approved non metallic bushings. In general, all conduits, pull boxes, etc; shall be complete and clean before installation of conductors is begun. At conduit terminations, provide insulated bushings for conductor protection. Where conduits terminate in equipment having a ground bus, such as in panel boards, switchboard, ATS, Emergency Generator etc; provide conduit with an insulated grounding bushing and extend and connect grounding wire to the ground bus with copper grounding attachment device.
- 3.5 Exposed conduits shall be neatly and securely clamped to the surface (or suspended from the structure with clevis hangers or trapeze supports), parallel with at right angles to the building surfaces and main structural members unless shown otherwise. Group multiple conduits together where possible. Do not install conduit where it interferes with the use of passageways, doorways, equipment removal areas or working areas. In no case shall conduit routing present a safety hazard.
- 3.6 Conduits and or boxes may be exposed only in those areas specifically noted on drawings or in the areas having no ceilings. Provide steel chrome plated floor and ceiling plates around conduits exposed to view and passing through walls, floors, partitions, or ceilings in finished areas. Select properly sized plates to fit the conduit when securely locked in places.
- 3.7 Bends and offsets in conduits shall be made with standard factory elbows made for the purpose, or with field bending devices that will produce uniform bends without damaging the finish or reducing the section of the conduit. Do not install bends or offsets in which conduit is crushed, deformed or otherwise

injured.

- 3.8 Conduit bodies shall be used in lieu of conduit elbows where ease of installation and appearance warrants their use. Specifically in finished areas where conduits are exposed and owner's representative requires installations of conduit bodies, they shall be installed at no additional cost.
- 3.9 Make conduit bends offsets neatly, in keeping with the high standards of workmanship that will be required. Cut conduits squarely, ream and draw threaded couplings up tightly. All threads shall be painted with an approved rust inhibiting and sealing compound before make-up. Sweep bends are preferred for concealed conduits.
- 3.10 Provide No. 30 nylon pulling line in conduits in which wiring is not installed under this work. Suitably cap conduits during construction to avoid water, dirt and trash entrance.
- 3.11 Connect all electrical equipment such as pump motors, emergency generators, and rotating equipment, subject to localize sound, vibration or movement with liquid-tight, minimum 24 inches length flexible metal conduits, unless noted otherwise. Where the equipment, other than motors, is located in an air-conditioned space, flexible metal conduit may be used.
- 3.12 Use expansion-deflection fittings on conduit crossing structural expansion joints and on exposed conduit runs where necessary. Provide bonding jumpers across fittings in metal raceway systems.
- 3.13 With a coupling, terminate concealed conduit for future use at structural surfaces. Install a pipe plug flush with the surface.
- 3.14 Openings around electrical penetrations of fire-resistance rated walls, partitions, floors or ceilings shall be fire stopped to maintain the fire resistance rating using approved methods. If local authority having jurisdictions require installations of conduits in rigid galvanized steel sleeves at fire rated walls and or floors, contractor shall install required sleeves, UL listed fire stopping sealant and other required materials to comply with requirements of local authorities at no extra cost.
- 3.15 CONDUITS SUPPORTS
 - A. Construct conduit racks to permit access for wire or cable pulling at all pull points, even when future conduits are added to fill the racks.
 - B. Where conduit racks are supported on rods from beam clamps or by some other non-rigid suspension system, install rigid supports at no more than 50-foot intervals to give lateral stability to the rack.
 - C. Support conduit sizes 2 inches and larger at spacing not exceeding 10 feet and conduit sizes 1-1/2 inches and smaller at spacing not exceeding 8 feet. All EMT conduits shall be supported at spacing no more than allowed by the latest NEC.

- D. Support conduit runs with conduit clamps, hangers, straps and metal framing channel attached to existing structural steel members. Conduits of 1-1/2 inch size or less may be supported by one-hole conduit straps on concrete or steel work, but for larger size conduit, use 2-hole straps. Use clamps of galvanized malleable iron for rigid galvanized.
- E. Install conduits supported from building walls with at least 1/4-inch clearance from the wall to prevent the accumulation of dirt and moisture behind conduit.
- F. Installation and support of conduit shall be from steel or concrete structures. Furnish necessary conduit straps, clamps, fittings and supports. Straps, screws and bolts shall be plated, of substantial construction and suitable for the application. Caddy clips and beam clamps are acceptable. Perforated strapping is not allowed. Galvanized tie wire (neatly installed) may be used to secure conduits running through existing bar joists.
- G. Rods to support conduits, fixtures and trapezes shall be a minimum of 1/4" plated all threaded.
- H. All conduits and other electrical equipment must be securely mounted. Generally, use 1/4-20 plated machine screws or toggle bolts for supporting surface work. Plastic plugs are not acceptable.

3.16 PVC COATED CONDUITS

- A. Use only tools specifically made for bending and installing PVC-coated conduits when installing PVC coated materials. Use strap wrenches only to tighten joints in plastic coated rigid steel conduit. Replace all damaged plastic coated conduits and fittings with new plastic coated conduits at no extra cost. Damages to the plastic coating, such as cuts, nicks, and threader chuck jaw marks will be considered as damaged conduits and fittings.

3.17 UNDER GROUND CONDUITS:

- A. All under ground conduits shall be installed as per manufacturer's instructions using factory made long sweep elbows. All conduit joints shall be water proof and made as per manufacturer's instructions using manufacturer recommended solvent cement.
- B. All under ground conduit systems shall be watertight. Elbows used with RGS conduit shall be long sweep as required for ease of pulling conductors. All stub-ups above finished grade shall be rigid steel conduit.
- C. The underground conduit shall be installed a minimum of 24" below grade, unless noted otherwise, to top of conduit. The Contractor shall perform excavation and back filling as required for installation of underground conduits and other work. He/She shall perform shoring, bailing, and pumping, as required to maintain trenches in a dry

condition.

- D. If electrical conduits with underground water or sanitary lines, conduits shall be placed a minimum of six (6") inches above water and sanitary line, with compacted sand between bottom of conduit (bottom of concrete encasement for electrical conduit in duct bank) and top of water pipe.
- E. Conduits shall be thoroughly cleaned before using or laying. During construction and after the duct line is completed, the ends of the conduits shall be plugged to prevent entrance of debris, dirt, water, etc into the conduits. Particular care shall be taken to keep the conduits clean of concrete, dirt and any other substance during the course of construction. After the duct line has been completed, a standard flexible mandrel not less than twelve (12") long, having a diameter approximately one-quarter inch less than the inside diameter of the conduit shall be pulled through each conduit after which a brush with stiff bristles shall be pulled through each conduit to make certain that no particles of earth, sand or gravel have been left in the line. After cleaning, place in each duct a # 30 nylon line with a plastic tag on each end reading "Pulling Line".
- G. Provide 6" wide red warning tape, installed 6" below grade, running the entire length of the underground conduit and duct bank runs.

3.18 EMPTY SPARE CONDUITS

- A. All empty conduits shall be capped off at both ends using threaded caps. All empty conduits shall be installed with sequential nylon pull strings.

END OF SECTION

SECTION 16120

INSULATED CONDUCTORS

PART 1 - GENERAL

1.1 GENERAL

- A. Scope: This section specifies the furnishing and installation of insulated conductors.
- B. Furnish and install Type THWN/THHN and type XHHW-2 conductors as specified in bid drawings.

1.2 REFERENCE STANDARDS

- A. ANSI/IEEE 386 - Separable Insulated Connectors for Power Distribution Systems above 600 Volts.

- B. ANSI/UL 83 and 44 - Thermoplastic-Insulated Wires and Cables for THHN- THWN and XHHW-2.
- C. UL-1063, and UL-758 – Polyvinyl Chloride (PVC), heat and moisture resistant, flame retardant compound.
- D. ANSI/UL 1072 - Medium-Voltage Power Cables.
- E. ICEA S-61-402 (NEMA WC 5) - Thermoplastic-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- F. ICEA S-68-516 (NEMA WC 8) - Ethylene-Propylene-Rubber-Insulated Wire and Cable for the Transmission and Distribution of Electrical Energy.
- G. UL -1063 for Stranded conductors.
- H. ASTM – B3, B8, and B787 (for solid and stranded copper conductors)
- I. FEDERAL SPECIFICATION-J-C-30B and A-A-5954A.
- J. NEMA WC70/ICEA, S-95-658.

1.3 APPLICABLE PROVISIONS

- A. Refer to Section 1505/16050 - General Conditions for Mechanical, Electrical, and Plumbing systems.

1.4 SUBMITTALS

- A. Provide product data on the following:
 1. 600 Volt conductor, splicing, and terminating materials.

1.5 ACCEPTABLE MANUFACTURERS

- A. The following wire or cable manufacturers are acceptable as long as all requirements of the specifications are met.
 1. American Insulated Wire Corporation
 2. Carol Cable Company, Inc.
 3. Cablec
 4. General Cable Company
 5. Okonite Company
 6. Rome Cable Company
 7. Southwire
 8. Triangle Wire and Cable, Inc.

1.6 QUALIFICATIONS

- A. Manufacturers: Company specializing in manufacturing products

specified in this section with minimum three years documented experience.

1.7 FIELD SAMPLES

- A. Submit one 18 inch length of each wire and cable assembly used.
- B. Select each length to include complete set of manufacturer markings.
- C. Attach tag indicating cable size and application information.

PART 2 - PRODUCTS

2.1 600 VOLT INSULATED CONDUCTORS TYPE

THWN/THHN

- A. Size: As specified in bid drawings.
- B. Design: Provide cable designated as THWN/THHN single conductor type and UL 83 and UL 1063 listed, rated 600 volts and certified for continuous operation at a maximum conductor temperature of 90 degrees C in dry locations and 75 degrees C in wet locations while installed in underground duct, in above ground conduit, or in control panels (MTW) in accordance with NEC Articles 210 and 310.
- C. Conductors. Provide conductors, which are Class B, concentric, stranded (solid conductor will not be acceptable), soft-drawn annealed, un-coated, copper 98 percent conductivity with physical and electrical properties complying with ASTM B3 and B8 and Part 2 of ICEA S-61-402. Each wire shall be continuous without a weld, splice and or joint throughout the length and it shall be uniform in cross section, new unused and free from flaws, scales and other imperfections. All wiring shall comply with UL standards and shall bear its stamp of approval, size, type and voltage rating.
- D. Insulation. Each conductor shall be PVC insulated and nylon jacketed to meet the requirements of Part 3 of ICEA S-61-402. The insulation thickness shall match the dimensions listed in Table 310-13 of NEC 2005 for type THHN and THWN wire.

2.2 600 VOLT INSULATED CONDUCTORS TYPE XHHW-2

- A. Size: As specified in bid drawings.
- B. Design: Provide cable designated as XHHW-2 single conductor UL Standard 44, rated for 600 volts or lower operation and certified for continuous operations at a maximum conductor temperature of 90 degrees C in dry or in wet locations while installed in underground and above ground conduit, or in control panels (MTW) in accordance with

NEC Articles 210 and 310. Conductor shall meet or exceed requirements of UL Standard 44, Federal Specification A-A-59544, and the latest requirements of National Electrical Code (NEC). It shall also meet or exceed construction requirements of ICEA S-95-658 (NEMA WC70)-Nonshield 0-2 KV Cables, with testing frequencies based on UL requirements. Each conductor shall be available in sizes from AWG 14 through 1000 kcmil and in black, white, red, blue, yellow, green, orange, brown, purple, and gray colors.

- C. Conductors. Provide conductors, which are Class B, concentric, stranded (solid conductor will not be acceptable), soft-drawn annealed, un-coated, copper 98 percent conductivity with physical and electrical properties complying with ASTM B3 and B8 and Part 2. Each wire shall be continuous without a weld, splice and or joint throughout the length and it shall be uniform in cross section, new unused and free from flaws, scales and other imperfections. All wiring shall comply with UL standards and shall bear its stamp of approval, size, type and voltage rating.
- D. Insulation. Each conductor shall be insulated with abrasion, high-heat and moisture resistant Cross-Linked Polyethylene (XLP) insulation. The insulation thickness shall match the dimensions listed in Table 310-13 of NEC 2005 for type XHHW-2 wire.

2.3 WIRE MARKING

- A. Wire marking shall be in accordance with NEC Article 310-11 and shall be printed on the wire insulation at 2-foot intervals.
- B. The printing method used shall be permanent and the color shall sharply contrast with the jacket color.

2.4 MINIMUM WIRE SIZE

- A. Use: All branch circuit wiring shall be a minimum No. 12 AWG in size unless specified otherwise. For field-installed control wiring, a minimum size shall be No. 14 AWG. Type armored cable (AC) with copper phase, neutral and ground conductors may be used as noted on the bid documents.

PART 3 - EXECUTION

3.1 EXAMINATION

- A. Verify that conditions are correct for wire and cable installation.
- B. Mechanical work which would likely damage wire and cable should be completed prior to installation of wire and cable.

3.2 PREPARATION

- A. Complete the cable raceway systems and underground conduits and duct banks before installing cables.
- B. Verify sizing of raceways and pull boxes to ensure proper accommodation for the cables.
- C. Check the length of the cable raceway system against the length of cable on the selected reel.
- D. Clean conduits of foreign matter before cables are pulled.

3.3 INSTALLATION

A. Installation:

1. Protection: Unless otherwise indicated, mechanically protect conductors for systems by installing in raceways. Do not install the conductors until raceway system is complete and properly cleaned. Pull cables into conduits using adequate lubrication to reduce friction. Lubricants must not be harmful to the conductor insulation. Do not bend any conductor either permanently or temporarily during installation to radii less than four times the outer diameter of 600 volt insulated conductors. Do not exceed manufacturer's recommended values for maximum pulling tension. When requested by Engineer, provide suitable method of measuring pulling tension during installation. Install type AC cable as per requirements of latest NEC Article 320.
2. Install conductors in accordance with the manufacturer's instructions and NEC Chapter 3 - Wiring Methods and Materials. Do not exceed a maximum wire tension, maximum insulation pressure and minimum bending radius.
3. Splices and Terminations: Use solder less connector for NO.8 wire and smaller, such as Buchanan B caps (wire nuts). Splice larger wires with compression sleeves or bronze split-bolt connectors. Tape shall be vinyl plastic, equal to Scotch #33. Use ring-tongue type terminations on all control wiring. Make splices in accessible junction boxes. Use wire nuts with insulated caps for lighting wiring splices. Splice control circuit with insulated crimp connectors.
4. Appearance: Neatly and securely bundle all conductors in an enclosure using nylon straps with a locking hub or head on one end and a taper on the other. All circuits shall be identified by wire markers in panel board gutters, pull boxes, control panels, etc; markers shall be pre-marked, self- adhesive wrap around cloth type similar to E-2 Code, Brady "Perma" Code or approved equal.
5. Service and all feeder conductors shall be run their entire

length in a continuous fashion without joints or splices unless specified otherwise.

3.4 INSULATED CONDUCTORS

- A. No wiring shall be electrically loaded beyond the permitted ampacity allowed by the latest edition of NEC. A maximum voltage drop to the farthest point on the circuit shall not exceed 3 % after applying appropriate de-rating factor.
- B. Color Code: Use factory-colored insulated conductors for No. 10 and smaller conductors and color code larger insulated conductors with an approved field-applied tape. Use different colors for control wiring. Follow the color scheme below or as required by local Codes.

<u>Line</u>	<u>277/480</u>	<u>120/208</u>
A or L1	Brown	Black
B or L2 or L3	Orange	Red C
Neutral	Yellow	Blue
Ground	Gray	White
	Green	Green

3.5 FIELD TESTING

- A. In general, test insulation integrity of the wiring system before terminating. Make sure to disconnect sensitive electronic equipment before testing insulation. Insulation resistance of all conductors shall be tested. Each conductor shall have its insulation resistance tested after the installation is completed and all splices, taps and connections are made except connection to or into its source and point (or points) or termination. Insulation resistance of conductors which are to operate at 600 volt or less shall be tested by using a Biddle Megger of not less than 1000 volts d-c. Insulation resistance of conductors rated at 600 volts shall be free of shorts and ground and have a minimum resistance phase-to-phase and phase-to-ground of at least 10 mega-ohms. Conductors that do not exceed insulation resistance values listed above shall be removed at contractor's expense and replaced and test repeated. The contractor shall furnish all instruments and personnel required for tests, shall tabulate readings observed, and shall forward copies of the test readings to the owner. These reports shall identify each conductor tested, date and time of test and weather conditions. Each test shall be signed by the party making the test.

END OF SECTION

SECTION 16130

OUTLET, JUNCTION, AND PULL BOXES

PART 1 - GENERAL

1.1 GENERAL

- A. Scope: This section specifies the furnishing and installation of outlet boxes, junction boxes and pull boxes. The boxes shall be of Code gauge galvanized steel with screw covers and ample size to accommodate all conductors. Install all boxes at locations so that covers are readily accessible and easily removable after completion of the installation.
- B. The fittings, lock nuts and hardware used with the outlet boxes and conduit shall be compatible with the type of conduit and boxes used.
- C. Construct interior junction or pull boxes not over 150 cubic inches in size as standard outlet boxes, and those over 150 cubic inches the same as "Cabinets" with screw covers of the same gauge metal. Removable covers must be accessible at all times.

1.2 REFERENCE STANDARDS

- A. ANSI/NEMA Publication No. OS 1 - Sheet-steel Outlet Boxes, Device Boxes, Covers and Box Supports.
- B. ANSI/UL 514A - Metallic Outlet Boxes.
- C. ANSI/UL 514B - Fittings for Conduit and Outlet Boxes.
- D. PULL AND JUNCTION BOXES: UL 50 and NFPA 70 and shall be UL listed and labeled.

1.3 SUBMITTALS

- A. Provide product data on outlet, junction, and pull boxes.

1.4 APPLICABLE PROVISIONS

- A. Refer to Section 15050/16050 General conditions of Mechanical, Electrical, and plumbing systems.

PART 2 - PRODUCTS

2.1 OUTLET BOXES

- A. Boxes for Lighting Fixtures: Provide galvanized steel octagonal boxes with fixture stud supports and attachments as required to properly support ceiling and bracket-type lighting fixtures. Unless otherwise noted, provide 1-1/2 inch deep by 4-inch box.
- B. Exposed (inside building) Devices Boxes: Provide galvanized steel boxes with industrial galvanized steel covers for surface mounting in areas having exposed EMT and rigid steel conduits. Exposed device

boxes shall be factory pre-painted as manufactured by the surface metal raceway manufacturer when used with the exposed surface metal raceways where specified.

- C. Listing: UL 514.
- D. Conduit outlet Bodies:
 - 1. Fittings, bodies, and covers for rigid steel conduit shall comply with requirements of ANSI C80.4, UL 514B, Federal Specification W-C-586D, NEC Article 314, and CSA Standard 514B.
 - 2. They shall be manufactured of ferrous iron (cast iron) alloy with conduit hubs for rigid threaded conduit connections. Large pulling elbow may be manufactured of die-cast copper-free aluminum. The hubs shall have tapered threads and integral bushing for protection of wire insulation. They shall be available in many styles and sizes. The final finish shall be electro-galvanized with aluminum acrylic paint.
- E. Grounding Bushing: UL listed and labeled, zinc-plated malleable iron or steel, phenolic insulation with 150 C UL rating molded on over metallic conduit stop, tin-plated grounding saddle.
- F. Accessories: Outlet boxes shall be provided with mounting brackets, wallboard hangers, extension rings, plaster rings, fixture studs, cable clamps, metal straps and other appurtenances as necessary for box installations.
- G. Acceptable Manufacturers: Appleton, Bowers, Crouse-Hinds, Midwest, OZ/Gedney, RACO, Steel City, T & B.

2.2 ABOVE GROUND PULL BOX

- A. All above ground pull boxes shall be fabricated of a minimum 14 gauge galvanized steel sheets. All edges shall be deburred and smooth. All pull boxes located outside and exposed to weather shall have NEMA 3R enclosures. All boxes located inside buildings and not exposed to weather shall have NEMA 1 enclosures.

PART 3 - EXECUTION

3.1 EXECUTION

- A. Fixture Boxes: boxes for suspended lighting fixtures shall be attached to the existing roof structural members.
- B. Mounting Height: Mounting height of a wall-mounted outlet box means the height from finished floor to horizontal center line of the cover plate. Where outlets are indicated adjacent to each other, mount these outlets in a symmetrical pattern with all tops at the same

elevation.

- C. Box Openings: Provide only the conduit openings necessary to accommodate the conduits at the individual location.
- D. Wall mounted outlet boxes shall be installed with center of box 18" from the finished floor level unless otherwise noted. The Engineer reserves the right to make any reasonable changes in locations and mounting heights without change in contract sum before installation.
- E. All boxes shall be rigidly secured to the structure upon which they are being installed mounted and shall have removable cover plates.

3.2 JUNCTION AND PULL BOXES

- A. Installation. Install boxes as required to facilitate cable installation in raceway systems. Generally provide boxes in conduit runs of more than 100 feet or as required in Section 16110.
- B. Covers. Provide boxes so that covers are readily accessible and easily removable after completion of the installation. Include suitable access doors for boxes above inaccessible ceilings. Select a practical size for each box and cover.

END OF SECTION

SECTION 16133

CONTROL CABINETS AND WIRE WAY

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnish all control cabinets and gutters as required and or shown on the drawings and as herein specified.

PART 2 - PRODUCTS

2.1 Control Cabinets

- A. All control cabinets shall meet National Electrical Code requirements, be of standard make, U.L. labeled, of sheet steel with corrosion resistant finish, and with ample space for all wires, connections and equipment. Provide each cabinet with door and flush catch and lock. All locks shall be keyed alike. Furnish five (5) keys to the owner.
- B. Control cabinet fronts shall consist of 14 gauge sheet steel panels

with a hinged door. Fronts for flush cabinets shall be larger than cabinet on all sides, and set so that the front will rest firmly against the finished wall surface.

- C. Finish: ANSI 61 Gray polyester powder coating inside and out over phosphatized surfaces.
- D. Provide suitable devices for securing, supporting and adjusting cabinet interiors and fronts. Cabinets shall be arranged to provide a wiring gutter not less than 3 inches or larger as specified in the National Electrical code.
- E. Control cabinets shall be manufactured by Hoffman or approved equal.

2.2 Gutters (Wire ways):

- A. Wire way shall be designed and manufactured for routing and mechanical protection of power, lighting, and control system conductors and cables. It shall be factory shipped completely assembled and shall not require installation of end caps at job site.
- B. Each wire way shall fully comply with all requirements of the following Industrial Standards:
 - UL 870 and UL 870 Type-3R
 - NEMA/EEMAC Type I.
 - CSA Type
- C. Gutters shall be UL approved, constructed of rust inhibiting enameled steel with Knockouts on bottom side, spaced at 3 inches on center, a maximum deflection at mid-span of 1/4 inch (simple beam) with supports at 8 inches on centers. All gutters shall be constructed from a minimum of 14 gauge steel sheets and shall be hot dipped galvanized after fabrication. The wire way sizes shall be as per drawings but not less than 4" x 4". Field applies a 90 percent zinc paint coating over cuts or scratches before any other finish is applied.
- D. Gutters for exterior and interior installation shall be unpainted galvanized steel with all hot dipped galvanized steel hardware.
- E. Wire ways shall be available in sizes from 4"x4" to 12"x12".
- F. Each wire way shall have mounting holes on the back of the enclosure.
- G. Interior gutters shall have screw on covers.
- H. Exterior gutters shall be rain-tight with removable covers.
- I. Manufacturers shall be Square D, Hoffman, Wiegman, B-Line or approved substitution.

PART 3 - EXECUTION

3.1 Installation

- A. All control cabinets shall be set rigidly in place, with fronts straight and plumb. Cabinet interiors shall be centered in the door opening. The control cabinets shall be installed such that mounting heights of control devices comply with requirements of ADA.
- B. All gutters shall be rigidly secured in place, not supported by conduit.
- C. All gutters shall bear the UL label or stamp that is factory applied. Gutters with UL labels applied other than by the manufacturer are unacceptable.

END OF SECTION

SECTION 16140

WIRING DEVICES

PART 1 - GENERAL

1.1 GENERAL

- A. This section specifies the furnishing and installation of wiring devices and device plates.

1.2 REFERENCE STANDARDS

Americans with Disabilities Act

(ADA). ANSI/UL 20 - General-

Use Snap Switches.

ANSI/UL 498 - Electrical Attachment Plugs and

Receptacles. ANSI/UL 943 - Ground Fault Circuit

Interrupters.

NEMA WD 1 - General Requirements for Wiring

Devices. Federal Specification W-S-896.

1.3 SUBMITTALS

- A. Provide product data on wiring devices and plates.

1.4 APPLICABLE PROVISIONS

- A. Refer to Section 15050/16050 General conditions for mechanical, electrical, and plumbing systems.

1.5 ACCEPTABLE

MANUFACTURER

Arrow Hart
Hubbell
Leviton
Pass and Seymour
Bryant Electric

PART 2 - PRODUCTS

2.1 NEW RECEPTACLES

- A. All general purpose receptacles shall be 20 amperes, 125 volts AC, 60 Hz; back and side wired, industrial specification grade, and shall meet requirements of UL and Federal Specification W C596, NEMA Std. WD-2, WD-6, ANSI, UL and CSA Certified.

DEVICE

LEVITON NO.

Receptacle, Duplex, Nema 5-20R

5362-W Receptacle Duplex, GFI with 6898-W and 4970

weather proof, die-cast zinc,
1-gang, two independent
self closing lids

2.2 DEVICE PLATES:

- A. 304 Stainless steel cover plates for wiring devices in mechanical, electrical rooms, and on concrete block walls, and for devices exposed to the weather.
- B. Die-cast zinc cover plates with weatherproof gaskets over devices located outdoor and for all devices exposed to the weather.

2.3 DEVICE COLOR

Supply regular service items: White.

2.4 STAINLESS STEEL COVER PLATES

- A. Stainless steel cover plates shall be provided by devices manufacturer. They shall comply with all requirements of UL and Federal Specification WP-455A. They shall be manufactured from 304 stainless steel sheet and shall have excellent resistance to corrosion.

PART 3 - EXECUTION

3.1 EXECUTION

- A. Device Coordination: Where items of equipment are provided under other sections of this specification or by the owner, provide a compatible receptacle for the cap or plug and cord of the equipment.

3.2 RECEPTACLES

- A. Mount receptacles vertically in a suitable steel outlet boxes with center of receptacles 18 inches above finished floor levels unless shown or noted other wise. The Engineer reserves the right to make any reasonable changes in receptacle locations without change in the contract sum before installation.

3.3 WIRING DEVICES

- A. Install wiring devices in accordance with applicable requirements of the NEC, NEMA, ADA, ANSI, and the product manufacturer recommendations.

END OF SECTION

SECTION 16210

DIESEL FUEL EMERGENCY GENERATOR

PART 1 - GENERAL

1.1 SECTION INCLUDES

- A. Furnishing and installation of a diesel fueled emergency generator. This specification and other bid documents may refer "emergency generator" as "generator".

1.2 GENERAL REQUIREMENTS

- A. It is the intent of this specification to secure an emergency generator system that has been factory built, factory tested, site tested, of the latest proven commercial design, together with all accessories necessary for a complete installation as shown on the drawings and specified herein. The equipments supplied and installed shall meet the latest requirements of the National Electrical Code, along with all applicable local codes and regulations. All equipment shall be new, of current production of a national firm which manufactures the generator and controls, and assembles the standby 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 emergency generator shall be manufactured in U.S.A.

1.3 TEMPORARY PORTABLE GENERATOR

A. The building shall be served by a temporary portable generator. Refer to Section 4.4 below.

1.4 SUBMITTAL

A. Submittal shall include a factory test certification and specification sheets showing all standard and optional accessories to be supplied, schematic wiring diagrams, dimensional drawings, and interconnection diagrams identifying by terminal number, each required interconnection between the generator set, automatic transfer switch and the remote annunciator panel if it is included elsewhere in this specification and or in bid documents.

1.5 CODES AND STANDARDS

- A. The generator set shall conform to the requirements of the following codes and standards:
1. CSA C22.2, No.14-M91 Industrial Control Equipment
 2. EN50082-2, Electromagnetic Compatibility - Generic Immunity Requirements, Part2: Industrial.
 3. EN55011, Limits and Methods of Measurement of Radio Interference Characteristics of Industrial, Scientific and Medical Equipment.
 4. IEC8528 part 4. Control Systems for Generator Sets
 5. IEC Standard 801.2, 801.3, and 801.5 for susceptibility, conducted, and radiated electromagnetic emissions.
 6. IEEE446 – Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
 7. Mil Std 461D – 1993. Military Standard, Electromagnetic Interference Characteristics.
 8. Mil Standard 462D – 1993. Military Standard, Measurement Electromagnetic Interference Characteristics.
 9. NFPA70 – National Electrical Code. Equipment shall be suitable for use in systems in compliance to Article 700, 701, and 702.
 10. NFPA99 – Essential Electrical Systems for Health Care Facilities

11. NFPA110 – Emergency and Standby Power Systems. The generator set shall meet all requirements for Level 1 systems. Level 1 prototype tests required by this standard shall have been performed on a complete and functional unit, component level type tests will not substitute for this requirement.
12. UL2200. The generator set shall be listed to UL2200 or submit to an independent third party certification process to verify compliance as installed

1.6 ACCEPTABLE

MANUFACTURERS Kohler
Stewart and Stevenson
Caterpillar

GENERAC and other manufacturers' emergency generators are not acceptable.

1.7 FIELD VERIFICATIONS

- A. The building is presently served by one 750 KW, diesel fueled, Spectrum emergency generator. The new specified emergency generator will be installed as a standby (back-up) generator to the existing generator. Regular operations of both generators (the existing and new) will be automatically alternated through new specified automatic transfer switch. Both generators will be fueled from a new diesel fuel day tank.
- B. The new generator manufacturer shall provide installation verifications, field testing, and start up services for both the existing and new generators. During the installation phase of the new generator, the generator manufacturer's qualified, experienced technician and or field engineer shall make a minimum of one visit to customer's building to inspect the following as a minimum. For field testing and start up services refer to sub-section 4.2.
 1. Reconnections of fuel supply lines from the new day tank to the existing generator.
 2. Modifications of the existing emergency feeder wiring to the existing generator and new Automatic Transfer Switch (ATS).
 3. Modifications of the remote starting wiring, from the existing ATSS and Fire Pump ATS to the existing generator through new specified ATS.
 4. Installation of the new generator on concrete pad and adjustment of spring type vibration isolators.
 5. Installation and connections of diesel fuel lines to the new generator.

6. Installation and connection of the radiator discharge to new wall louver.
 7. Installation of muffler, exhaust pipe, wall thimble, outside exhaust stack, rain cap, insulations, support etc; associated with new generator.
 8. Installation and connection of new electrical feeder to the new generator and to new ATS.
 9. Installations of new remote starting wiring, from the existing ATSES and Fire Pump ATS to the existing generator through new specified ATS.
- C. Field verification visit shall be scheduled and coordinated by contractor with the generator manufacturer and with the building inspector and/or manager a minimum one week in advance. The generator manufacturer's technician (or engineer) must make second visit if all installation verifications can not be achieved in one visit at no extra cost. All findings of the generator manufacturer's technician shall be documented in writing and a written report shall be sent to the engineer. All costs associated with the field verification services such as technician (and or field engineer's) time, travel time to the building, cost of air fare, rent a car, travel expenses, hotel, meals, and lodging expenses shall be included in manufacturer's base bid. All requirements of the bid documents and manufacturer's instructions shall be met. All installation deficiencies, improper installations deficiencies, wirings, fuel line connections, etc; shall be corrected by contractors as per generator technician's recommendations at no extra cost before load testing and start-up of the emergency power systems begin.

1.8 WARRANTY

- A. The entire emergency generator (generator) system shall be warranted by the generator manufacturer for 2 year from the date of substantial completion. The date of substantial completion shall be made a matter of record by the Engineer. All parts, labor, software, and engineering services required for the emergency generator to operate satisfactorily with the specified building loads through the existing and new automatic switches shall be warranted. The warranty shall include replacement of all defective parts, materials, labor as required at customer's emergency generator location. The manufacturer's technician shall visit the customer's generator and take corrective measures within 4 hours after the manufacturer or his local representative is notified by a telephone call, e-mail message, and or in writing by the customer. All costs associated with the warranty such as costs of visits to customer's building, parts, materials, software, labor, air fares, hotel expenses, lodging, meals, rent a car, costs for an over night stay, and taxes shall be paid by the generator manufacturer.
- B. The generator set manufacturer and its distributor shall maintain a 24-

hour parts and service organization. This organization shall be regularly engaged in a maintenance contract program to perform preventive maintenance and service on equipment similar to that specified. A service agreement shall be available and shall include system operation under simulated operating conditions, adjustment to the generator set and controls as required, and certification in the owner's maintenance log of repairs made and proper functioning systems

PART 2 – PRODUCTS

2.1 GENERAL

- A. The emergency generator set shall be rated for KW, voltages, and hertz as scheduled in bid documents for a continuous standby duty for 500 feet altitude and 104 degree F DB ambient temperature. The emergency generator rated and or producing lower than specified KW of emergency power for the specified conditions will not be acceptable.
- B. The generator set shall be capable of starting motor loads of 3050 starting KVA inrush, with a maximum voltage dip of 35 %.
- C. The emergency generator shall be skid mounted with 500 watt, 120 volt, 1 phase, generator strip heater with thermostat, critical exhaust silencer, an oil drain kit, flexible fuel line, and a gas filter.
- D. The generator shall be factory furnished, installed, and wired with 16 LED lights controller, KOHLER Model-DECISION MAKER 3 PLUS fully complying with requirements of NFPA 110.
- E. Vibration isolators: Proper size number of neoprene type isolators shall be factory installed between the engine-generator and welded steel base.

2.2 ENGINE

- A. Each engine shall deliver a minimum scheduled HP at a governed speed of 1800 rpm. The engine shall be equipped with the following:
 - 1. An engine-driven fuel transfer pump capable of pulling required fuel (at part and full loads) from the day tank, lifting fuel to the required elevation, returning excessive fuel to the day tank, fuel filters, electric solenoid fuel shut-off valve, and fuel distribution system.
 - 2. Provide an electronic isochronous governor capable of regulating the no load to full load frequency of plus/minus 0.25 percent steady-state frequency regulation, when serving loads.
 - 3. 24 Volt positive engagement solenoid shift-starting motor.

4. 70 - Ampere minimum automatic battery charging alternator with solid-state voltage regulation.
5. Positive displacement, full pressure lubrication oil pump, cartridge oil filters, dipstick, and oil drain.
6. Dry-type replaceable air cleaner elements. Engines requiring glow plugs shall not be acceptable.
7. The natural aspirated or turbocharged engine shall be fueled with No.2 diesel fuel and be supplied with a unit mounted electric solenoid fuel shut off valve.
8. The engine shall have a minimum of 12 cylinders and be liquid cooled by unit-mounted radiator, blower fan, water pump, thermostat, and radiator duct flange shall properly cool the engine with up to 0.5 inches of water column static pressure of the fan in an ambient temperature of 122 degree F dry bulb. The fan shall be installed in the weather proof enclosure.
9. The Engine shall be manufactured by one of the following engine manufacturer:

John Deer Cummins Detroit Diesel Caterpillar

2.3 ALTERNATOR

- A. The alternator shall be a Fast Response TM II permanent magnet brushless design. The alternator excitation shall be of a permanent magnet exciter design. The Alternator shall be Kohler Model-5M4038.
- B. The alternator shall be salient-pole, brushless, 10-lead, re-connectable, self-ventilated of drip-proof construction with amortisseur rotor windings and skewed stator for smooth voltage wave form. The insulation shall meet the NEMA standard (MG1-33.40 and 16.40) for Class H and be vacuum impregnated with epoxy varnish to be fungus resistant per MIL 1-24092. Temperature rise of the rotor and stator shall be limited to 130deg C. The excitation system shall be of brushless construction controlled by a solid-state voltage regulator capable of maintaining voltage within +, - 2 % at any constant load from 0 to 100% of rating. The regulator must be isolated to prevent tracking when connected to SCR loads, and provide individual adjustments for voltage range stability and volts-per-hertz operations. The regulator shall be protected from the environment by a vacuum impregnated, fungus resistive epoxy varnish coating.
- C. Upon one-step application of any load up to 90% of the rated load at 0.8 power factor, the voltage dip shall not exceed 20 % and shall recover to 2 % of rated voltage within one second.
- D. The generator set shall meet the transient performance requirements of ISO 8528-5, level G-2. The generator shall be capable of sustaining at least 250 % of rated current for at least 10 seconds under a three -

phase symmetrical short circuit by inherent design without the addition of separate current support devices.

- E. A re-settable line current sensing circuit breaker with inverse time versus current response shall be furnished which protects the generator from damage due to its own high current capability. This breaker shall not trip within the 10 seconds specified above to allow selective tripping of down-stream fuses or circuit breakers under a fault condition. This breaker shall not automatically reset preventing restoration of voltage if maintenance is being performed. A field current sensor will not be acceptable.
- F. The alternator, having a single maintenance-free bearing, shall be directly connected to the fly wheel housing with a semi flexible coupling between the rotor and the flywheel.

2.4 CONTROLLER

- A. The emergency generator controller shall be solid state type and shall be vibration isolated on the generator enclosure. The controller shall be capable of being remote- mounted. The microprocessor control board shall be moisture proof and capable of satisfactory operations from -40 degree C to 85 degree C. Relays will only be acceptable in high-current circuits. The microprocessor control board shall have fungus resistive epoxy varnish coating. The controller shall be easily accessible and located on the generator at location indicated on the Drawing.
- B. Circuitry shall be of plug-in design for quick replacement. 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 as a minimum:
 - 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 starter engagement with a moving flywheel. Battery charging alternator voltage shall 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 re- engage the starter.
 - 5. A cranking cycler with ten-second ON and OFF cranking periods.
 - 6. Over crank protection shall be designed to open the cranking circuit after 60 seconds if the engine fails to start.
 - 7. Circuitry shall shut down the engine when signal for high coolant

temperature, low oil pressure, or over speed is received.

8. Engine cool down timer shall be factory set at five minutes to permit unloaded running of the standby set after transfer of the load to normal.
9. Three-position (Automatic - 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 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 shut down in case of an emergency. Reset of any fault shall also be accomplished by putting the switch to the OFF position.
10. Standard indicating lights to signal the following as a minimum shall be included:
 - Switch "OFF" (flashing red)
 - Over crank (red)
 - Emergency stop (red)
 - High water temperature (red)
 - Over speed (red)
 - Low oil pressure (red)
 - High battery voltage (red)
 - Low battery voltage (red)
 - Low fuel pressure (red)
 - System ready (green)
 - Anti-high water temperature (yellow)
 - Anti-low oil pressure (yellow)
 - Low coolant temp (red)
 - Auxiliary Pre-alarm (yellow)
 - Auxiliary Fault (red)
 - Battery Charger malfunction (red)
11. Test button for indicating lights.
12. Alarm horn with silencer switch per NFPA 110.
13. Terminals shall be provided for each indicating light above, plus additional terminals for common fault and common pre-alarm.

2.5 INSTRUMENT PANEL

- A. An instrument panel shall include the following as a minimum:
1. Dual range voltmeter 3 1/2 inch in diameter and 2% accuracy.
 2. Dual range ammeter 3 1/2 inch in diameter and 2 % accuracy.
 3. Voltmeter-ammeter phase selector switch.
 4. Lights to indicate high or low meter scale.
 5. Direct reading pointer-type frequency meter 3 1/2 inch in diameter, 5% accuracy, with 45 to 65 hertz scale.
 6. Panel illuminating lights.
 7. Battery charging Voltmeter.
 8. Coolant temperature gauge.
 9. Oil pressure gauge.
 10. Running time meter.
 11. Voltage adjust rheostat.

2.6 FACTORY INSTALLED ACCESSORIES

- A. The following accessories shall be furnished and factory installed as standard items and cost of these accessories shall be included in bid.
1. Engine Block heater 9,000 Watt, 480 Volt 3 Phase AC. Thermostatically controlled to maintain engine coolant at proper temperature to meet the start-up requirement of NFPA-99 and 110, Level -1 Regulation.
 2. Generator strip heater 120 volt, 1 phase for high humidity applications.
 3. Over voltage protection device shall shut down the unit one (1) second after the over voltage condition of 15% or higher is sensed (detected).
 4. Main Circuit Breaker: 1,600 amp frame, 1600 amp trip, molded case main circuit breaker shall be furnished, factory installed, and wired at the generator. It shall be sized for full KVA capacity of the generator. It shall be selected for proper short circuit rating of the generator to protect down stream equipment and feeder from the generator short circuit current. Load side lugs of the breaker shall be suitable to accept specified conductors. The main breaker shall have a ground fault sensor

and ground fault alarm. The breaker shall indicate the ground fault condition, without tripping of the breaker, if a ground fault is sensed. The main breaker shall be manufactured by Square-D, G.E, Eaton, or Siemens.

5. The emergency generator shall be factory installed with required instruments to report the status of the Generator (in "Standby" or "Emergency" mode), single phasing, and unbalanced load conditions at the ATS.
6. Two flexible fuel lines rated at a minimum of 257 degree F temperature and 100 psi pressure ending in pipe thread.
7. The radiator discharge air shall be ducted to the fixed wall louver. The generator radiator shall be factory furnished and installed with a radiator duct flange adaptor. Refer bid document drawings for the sized of the specified duct.

2.7 ACCESSORIES

- A. The following accessories may be shipped loose and field installed, tested, and placed in normal conditions by the contractor as per manufacturer's instructions at no additional cost.
 1. 12-volt lead-antimony battery(ies) capable of holding the manufacturer's recommended minimum cold-cranking Amps required at 0degree F, per SAE Standard J-537, shall be supplied.
 2. 10-Ampere automatic float and equalize battery charger with +/- 1% constant voltage regulation from no load to full load over +/- 10% AC input line variation, current limited during engine cranking and short circuit conditions, temperature compensated for ambient temperatures from -40 degree C to 60 degree C, 5% accurate voltmeter and ammeter, fused, reverse polarity and transient protected.
 3. Battery rack, battery cables, 12 Volt battery capable of delivering the manufacturer's recommended minimum cold-cranking Amps required at 0 degree F shall be supplied dry, along with separate electrolyte which will be added just prior to start-up.
 4. Gas proof, seamless, stainless steel, flexible exhaust connection and engine exhaust silencer rated for critical grade application. The engine exhaust silencer shall be coated to be temperature and rust resistance rated for critical application. Exhaust noise shall be limited to 85 dba maximum as measured at 10 feet distance from the generator in a free- field environment.
 5. Spring type vibration isolators:
 - a. Spring type vibration isolator shall be furnished by the generator manufacturer and installed at job site by

contractor. Spring type vibration isolators shall be field adjustable, multi spring type, housed in aluminum or corrosion protected steel housing. Design and treat components of vibration isolators for resistance to corrosion. Furnish phosphatized steel components with industrial grade, corrosion resistant enamel. Furnish zinc electroplated nuts, bolts and washers to prevent corrosion. Clean steel bases thoroughly of welding slag and prime with zinc chromate or metal etching primer. An elastomeric pad with minimum thickness of 1/4 inch shall be bonded to the base plate. Vibration isolator spring mounting housing shall have telescoping top and bottom sections separated by resilient inserts of neoprene to limit horizontal motion.

- b. The isolator manufacturer must calculate the amount of spring deflection required for the emergency generator to achieve optimum performance and to prevent the transmission of objectionable vibration and noise. The minimum spring deflection shall be 1 inch. Select and furnish vibration isolators of more than 1 inch deflection, if required, at no additional cost. All spring isolators must be completely stable in operation and must be designed for not less than 30 percent reserve deflection beyond actual operating condition.
- c. Submit product data showing type, size, load, deflection and other information required. Include clearly outlined procedures for installing and adjusting isolators.

2.8 SOUND LEVEL

- A. At full load conditions the sound level produced by the emergency generator shall not exceed the following values when measured on "A" scale.

<u>Distance from Generator</u>	<u>Sound level in dBA</u>
3 Ft.	97
6 Ft.	91
10 Ft.	85
23 Ft.	75

PART 3 – FACTORY TESTING

3.1 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 separate tests: design

prototype tests, final production tests, and site tests.

- B. Design Prototype Tests: 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 preproduction models, which will not be sold, shall have been used for the following tests.
1. Maximum power (KW).
 2. Maximum motor starting (KVA) at 35% instantaneous voltage dip.
 3. Alternator temperature rise by embedded thermocouple and by resistance method as per NEMA MG1-32.40 and 16.40 standards.
 4. Governor speed regulation under steady-state and transient conditions.
 5. Voltage regulation and generator transient response.
 6. Fuel consumption at 1/4, 1/2, 3/4, and full loads.
 7. Harmonic analysis, voltage wave form deviation, and telephone influence factor.
 8. Three-phase short circuit tests.
 9. Alternator cooling air flow.
 10. Torsional analysis testing to verify that the generator set is free of harmful torsional stresses.
 11. Endurance testing.

3.2 FINAL PRODUCTION TESTS

- A. Each generator set shall be tested under varying loads with guards and exhaust system in place. Tests shall include:
1. Single-step load pickup.
 2. Transient and steady-state governing.
 3. Safety shut down service testing.
 4. Voltage regulation.
 5. Rated power at 0.80 power factor.
 6. Maximum power.
- B. A certified factory test record shall be sent to Owner representative prior to shipment of the emergency generator.

PART 4 – EXECUTION

4.1 GENERAL

- A. Construction phases shall be scheduled with the building manager in such a way that the existing emergency generator does not have to be de-energized for more than 30 days. Refer for furnishing and installations of temporary portable generator.

4.2 PROTECTION OF EXISTING EQUIPMENT

- A. During the construction phase building, the existing generator, conduits, cables, fuel lines, concrete pad, generator exhaust system, louver, etc

shall be protected from damages. All temporary, required size, protection shields shall be furnished and installed by the contractor. Any and all damages done to the existing building generator, conduits, cables, concrete pads, exhaust system, and emergency power system equipment accessories shall be repaired to their original condition or replaced at no extra cost. The regular generator exercise schedule shall be obtained from the building manager. All temporary shields shall be removed when the generator is running.

4.3 INSTALLATION OF NEW EQUIPMENT

- A. The new emergency generator shall be installed at location shown in the drawing. It shall be installed on factory furnished spring type vibration isolators on the concrete pad as per Generator manufacturer's instructions. All spring type vibration isolators shall be precisely adjusted as per generator manufacturer's instructions to eliminate transmission of excessive vibrations and noise. The spring isolators shall be anchored to the concrete pad and the generator shall be bolted to the isolators as per generator manufacturer's instructions. The generator shall operate under all load conditions without transmission of objectionable vibrations and noise. The noise levels, under all load conditions, shall be within the scheduled values. Transmission of excessive vibrations (above and beyond acceptable industry standards) and or sound levels exceeding the specified values either inside the emergency generator room or outside (the room) shall be corrected to specified values, in approved manners, by the contractor and the generator manufacturer at no additional cost.
- B. The radiator discharge duct shall be properly connected to the radiator flange using high temperature, asbestos free gasket. The discharge duct shall be properly supported from the roof structure above and from the floor. The duct support members shall not be attached to the roof metal deck. The duct connections to the radiator flange and to the discharge plenum shall be air-tight. The plenum connection to the louver shall be air-tight.
- C. New overhead door: New roll up overhead door shall be properly secured to building wall and installed as per door manufacturer's instructions. New overhead door shall be installed as per requirements of bid documents. All installation hardware shall be hot dipped galvanized steel. All specified door hardware shall be installed as per hardware manufacturer's instructions. The over head door and all installed hardware shall function properly. All alignment and adjustments to the door shall be made as per door manufacturer's instructions.

4.4 TEMPORARY PORTABLE EMERGENCY GENERATOR

- A. The building must be served by an emergency power at all times. The contractor shall provide a minimum 500 kW, 277/480 volt, 3 phase, 4 wires, 60 hz; temporary portable, diesel fuel emergency generator with required size portable cables, connectors, and operating fuels for

required number of days. The generator shall have sub-base diesel fuel tank with required connections. The portable cables shall be sized to provide 500 k.w of emergency power to the existing emergency switchboard "EPS" in the building. The portable generator shall be temporarily connected to the service side lugs of the existing emergency switchboard "EPS". All required additional lugs shall be furnished and temporarily installed by contractor if required to connect portable cables to the existing switchboard. The temporary generator shall provide emergency power to the building while required modifications to the existing emergency generators are made and new existing generators and new ATS is ready to serve the emergency power to the building. It is contractor's responsibility to refuel and maintain the portable generator in normal working conditions. The length of the time to serve the existing emergency switchboard by portable generator shall be determined by contractor and must be approved by the building manager. New emergency power system shall be programmed, tested, and placed in normal working conditions before the temporary portable generator is removed from the site.

- B. The temporary emergency generator shall be parked in the existing, outside mechanical yard at location instructed by the building owner. All portable cables shall be protected from damages. All cost associated with the portable generator cables, labor, materials, etc shall be included in contractor's bid. The contractor shall be reimbursed for costs of diesel and other operating fuels plus 10 percent of the actual cost for the length of the time the portable generator is serving the TRANSTAR building. The contractor shall provide all receipts of the fuels and other required fluids being used during operating periods of the portable generator.

4.5 TROUBLE SHOOTING, FIELD TESTING, AND START UP SERVICES

- A. The generator manufacturer's experienced technician and or engineer shall be present at the Transtar building to provide trouble shooting, field testing, and start up services. These services shall be scheduled a minimum of two weeks in advance with building inspector/manager/engineer, generator manufacturer, and ATS manufacturer's technician by the contractor. These services shall be provided by contractor and the generator manufacturer and shall be coordinated with ATS manufacturer's technician. This phase of the work shall be completed in one day. This phase of the work shall continue the following day at no extra cost, if trouble shooting, field testing, and start up services can not be completed in one day. All costs associated with this phase such as technician (and or field engineer's) time, travel time to the building, cost of air fare, rent a car, travel expenses, hotel, meals, and lodging expenses shall be included in contractor and manufacturer's base bid.
- B. During this phase both the existing and new emergency generators with the existing and new ATS's shall be tested using external load bank. They shall be placed in normal working conditions after tests are successfully completed and accepted by owner and engineer. Both

generators shall be tested for automatic alternating conditions through new ATS.

- C. During the testing phase of the project, the building shall be served by a temporary portable generator as specified in bid documents and in this specification. The portable generator, cables, and temporary proper hook-up to the existing emergency switchboard (inside building) shall be provided by the contractor. Refer bid drawings.
- D. The emergency generator shall be tested to transfer emergency power to the existing building loads under full and part load conditions. If the existing building loads do not accept, retain, and operate successfully on the emergency power, the Generator manufacturer shall fully cooperate with the ATS manufacturer, electrical contractor, owner, and engineer (team) to fully analyze problem(s) and assist the team so that the emergency power can be successfully transferred and building loads can be successfully operated on the emergency power.

4.6 SITE TESTS

- A. An installation check, start-up, and building load test shall be performed by the manufacturer's representative. The engineer and the Owners representative shall be notified, two weeks in advance, of the time and date of the site test.
Temporary external load bank, required size portable cables, required diesel fuel, lubricating oil, engine coolant, and other required materials shall be provided by this contractor. All costs shall be included in contractor's bid. The tests shall include:
 - 1. Fuel, lubricating oil, and antifreeze shall be checked for conformity to the manufacturer's recommendations, under the environmental conditions present and expected.
 - 2. Accessories that normally function while the emergency generator is standing by shall be checked prior to cranking the engine. These shall include: block heaters, battery charger, generator strip heaters, remote annunciator (if specified), etc; as a minimum.
 - 3. Start-up under test mode to check for exhaust leaks path of exhaust gases, cooling air flow, movement engine generator and other components of the unit during starting and stopping, vibration during running, normal and emergency line-to-line voltage and phase rotation.
 - 4. Automatic start-up by means of simulated power outage to test remote-automatic starting, transfer of the load and automatic shutdown. Prior to this test, all transfer switch timers shall be adjusted for proper system coordination. Engine coolant temperature, oil pressure, and battery charge level along with generator voltage, Amperes, and frequency shall be monitored throughout the test.

5. An external load bank and cables rated at 150 percent capacity of the full load rating of the generator shall be brought to the site and connected to the system, at no additional cost. The emergency generator shall be tested to transfer emergency power to the building loads under full and part load conditions. If the existing building loads do not accept and operate successfully on the emergency power, the generator and ATS manufacturers shall fully analyze the problem in cooperation with the engineer and make necessary recommendations. If additional job site visits are required to the building to produce and place the emergency power system in satisfactorily working conditions, they shall be made by the generator manufacturer at no additional cost.

6. The emergency generator with the automatic transfer switches shall be tested for the part and full loads as follows:

Load Minimum time period

25 percent of full load capacity	1 Hour
50 percent of full load capacity	1 Hour
100 percent of full load capacity	2 Hour

During load testing the frequency shall not deviate more than 5 percent and voltage variation shall not be greater than 10 percent. The voltage dip shall recover to full voltage in no more than 4 minutes.

7. The load bank shall be set at 100 percent rating of the generator and the generator shall be energized and run for 15 minutes. The generator shall be de-energized and allowed to be cooled off for a period of 15 minutes then energized again with the load bank connected for 15 minutes.

8. During above testing the generator shall run without excessive noise, vibration, surging, and or other abnormal conditions. All abnormal conditions shall be corrected by the generator manufacturer at no additional cost.

END OF SECTION

SECTION 16250

NEW AUTOMATIC TRANSFER SWITCH (N) ATS-5

PART 1 - GENERAL

1.1 GENERAL REQUIREMENTS

- A. Furnish, install, properly wired, and program new specified automatic transfer switch (ATS) to automatically energize two emergency generators alternatively and feed emergency power source to the existing emergency switchboard as specified in bid documents. Number of poles, amperage, voltage, withstand and close-on ratings of ATS shall be as specified in the bid documents. ATS shall be factory installed with specified microprocessor controllers and accessories to provide automatic operation. ATS switch and controllers shall be the products of the same manufacturer

1.2 SUBMITTAL

- A. Manufacturer shall submit shop drawings before manufacturing of the ATS for review and acceptance. The shop drawings shall include the following, as a minimum:
 - 1. Descriptive literature
 - 2. Plan, elevation, side, and front view arrangement drawings, including overall dimension, weights and clearances, as well as mounting or anchoring requirements and conduit entrance locations.
 - 3. Schematic diagrams.
 - 4. Wiring diagrams.
 - 5. List of all accessories to be provided.
 - 6. ATS shall be provided with an operator's manual providing installation and operating instructions.

1.3 CODES AND STANDARDS

- A. The automatic transfer switch covered by this specification and bid documents shall be designed, tested, and assembled in strict accordance with all applicable standards of ANSI, U.L., IEEE and NEMA. The ATS and controls shall conform to the requirements of the following as minimum:
- B. UL 1008 - Standard for Transfer Switch Equipment and shall be UL listed for Rated in Amperes for a total system transfer including control of motors, UPS loads, electric-discharge lamps, electric- heating and tungsten-filament load.
- C. IEC 947-6-1 Low-voltage Switchgear and Control gear; Multifunction equipment; Automatic Transfer Switching Equipment
- D. NFPA 70 - National Electrical Code
- E. NFPA 99 - Essential Electrical Systems for Health Care Facilities
- F. NFPA 110 - Emergency and Standby Power Systems

- G. IEEE Standard 446 - IEEE Recommended Practice for Emergency and Standby Power Systems for Commercial and Industrial Applications
- H. NEMA Standard ICS10-1993 (formerly ICS2-447) - AC Automatic Transfer Switches
- I. UL 508 Industrial Control Equipment.

1.4 CERTIFICATION

- A. The manufacturer shall provide a letter certifying compliance with all requirements of the bid documents for ATS. The certification shall identify equipment by serial number and shall include no exceptions to the bid documents.

1.5 DELIVERY

- A. ATS in shipping crate shall be delivered in brand new conditions to the job site. Damaged, dented, scratched equipment, parts or components will not be acceptable. All shipping, delivery, insurance, and other related costs shall be included in ATS manufacturer's bid.

1.6 FIELD VERIFICATIONS

- A. The building is presently served by one 750 KW, diesel fueled, Spectrum emergency generator and 4 Russelectric automatic transfer switches (ATS). The generator feeds the existing emergency switch board which feeds 4 existing ATS and fire pump ATS. The new specified emergency generator will be installed as a standby (back-up) generator to the existing generator. Normal operations of both generators (the existing and new) will be automatically alternated through new specified automatic transfer switch.
- B. The new ATS manufacturer shall provide installation verifications, field testing, and start up services for new ATS. During the installation phase ATS manufacturer's qualified, experienced technician and or field engineer shall make one visit to customer's building to inspect the following as a minimum. For field testing and start up services refer to sub-section 3.3.
 - 1. Installation of new ATS.
 - 2. Installation of remote start control wiring from the existing ATSEs and fire pump ATS to new ATS, refer bid documents for re-routing of the existing control wires to new ATS.
 - 3. Installation and connections of emergency feeders from both the existing and new emergency generators to new ATS.
 - 4. Installation of new emergency feeder from new ATS to the existing emergency switchboard.
 - 5. Installations of all control and monitoring wiring between new ATS and emergency generators.

- C. Field verification visit shall be scheduled and coordinated by contractor with the ATS manufacturer and owner's inspector a minimum one week in advance. All findings of the technician shall be documented in writing and a written report shall be sent to the engineer. All costs associated with the field verification services such as technician (and or field engineer's) time, travel time to the building, cost of air fare, rent a car, travel expenses, hotel, meals, and lodging expenses shall be included in manufacturer's base bid. All installation deficiencies shall be corrected by the contractor as per ATS technician's recommendations at no extra cost before load testing and start-up of the emergency generators and ATS begin.

1.7 ACCEPTABLE MANUFACTURER

- A. Russelectric

PART 2 PRODUCTS

2.1 CONSTRUCTION

- A. General

1. The ATS shall be furnished and installed as specified in bid documents. Refer bid drawings for voltage, continuous current rating, number of poles, modifications, and accessories to achieve sequences of operations as specified.
2. On 3 phase, 4 wire systems, utilizing ground fault protection, a true 4 pole switch shall be supplied with all four poles mounted on a common shaft. The continuous current rating and the closing and withstand rating of the fourth pole shall be identical to the rating of the main poles.
3. ATS shall be factory mounted in a NEMA 1 enclosure, unless otherwise indicated. Enclosures shall be fabricated from a minimum 12 gauge steel. All surfaces of the enclosure shall be factory finished and painted. The owner shall select the color of the enclosure from ATS manufacturer's standard colors at no extra cost. The enclosure shall be sized to exceed a minimum wire bending space required by UL 1008.
4. The transfer switch shall be equipped with an internal welded steel pocket, housing an operations and maintenance manual.
5. The transfer switch shall be top and bottom accessible.
6. The main contacts shall be capable of being replaced without removing the main power cables.
7. The main contacts shall be visible for inspection without any major disassembly of the transfer switch.

8. All bolted bus connections shall have Belleville compression type washers.
9. When a solid neutral is required, a fully rated bus bar with required AL-CU neutral lugs shall be provided.
10. Control components and wiring shall be front accessible. All control wires shall be multi-conductors minimum 18 gauge 600 volt SIS switchboard type point to point harness. All control wire terminations shall be identified with tubular sleeve-type markers.
11. The switch shall be equipped with 90 degrees C rated copper/aluminum Solder-less mechanical type lugs. All lugs shall be suitable to receive number of conductors and sizes as specified in bid documents.
12. The complete transfer switch assembly shall be factory tested to ensure proper operations and compliance with the specification requirements. A copy of the factory test report shall be available upon request.

B. AUTOMATIC TRANSFER SWITCH (ATS)

1. The transfer switch shall be double throw, actuated by two electric operators momentarily energized, and connected to the transfer mechanism by a simple over center type linkage. Minimum transfer time shall be 400 milliseconds.
2. The emergency generator number-1 and 2 contacts shall be positively interlocked mechanically and electrically to prevent simultaneous closing. Main contacts shall be mechanically locked in both the normal and emergency positions without the use of hooks, latches, magnets, or springs, and shall be silver-tungsten alloy. Separate arcing contacts with magnetic blowouts shall be provided on all transfer switches. Interlocked, molded case circuit breakers or contactors are not acceptable.

C. The ATS rating shall use a stored energy, "quick-break", "quick-make" design. ATS which rely on electrical operator speed to move contacts is not acceptable.

D. The ATS shall be equipped with a safe external manual operator, (EMO) arranged so that the transfer switch quick break - quick make mechanism can be operated manually under load without opening the enclosure door, designed to prevent injury to operating personnel. The manual operator shall provide the same contact to contact transfer speed as the electrical operator to prevent a flashover from switching the main contacts slowly. The external manual operator shall be safely operated from outside of the transfer switch enclosure while the enclosure door is closed.

E. ATS CONTROLS

1. The ATS shall be equipped with a microprocessor based control system, to provide all the operational functions of the ATS. The controller shall have two asynchronous serial ports. The controller shall have a real time clock with Ni-cad battery back-up.
2. The CPU shall be equipped with self diagnostics which perform periodic checks of the memory I/O and communication circuits, with a watchdog/power fail circuit.
3. The controller shall also be capable of monitoring, logging, and trending of power data.
4. The controller shall be accurate to 1% measured. Voltage and current for all phases shall be sampled simultaneously to assure high accuracy in conditions of low power factor or large waveform distortions (harmonics).
5. The controller shall be capable of operating at nominal frequencies of 45 to 66 Hz.
6. The controller shall accept inputs from industry standard current transformers (5A secondary). Direct phase voltage connections, 600 VAC and under, shall be possible without the use of PT's.
7. The controller shall be capable of being applied in single or 3-phase, three and four wire circuits.
8. All setup parameters required by the controller for power monitoring shall be stored in non-volatile memory and retained in the event of a control power interruption.
9. The following metered readings shall be communicated by the Controller, via local display and serial communication.

Current, per phase RMS and neutral
Current Unbalance %
Voltage, phase-to-phase and phase-to-neutral
Voltage Unbalance %
Real power (KW), per phase and 3-phase total Apparent power (KVA), per phase and 3-phase total Reactive power (KVAR), per phase and 3-phase total Power factor, 3-phase total & per phase
Frequency
Accumulated Energy, (KWH, KVAH, and KVARH)
10. Displaying each of the metered quantities shall be accomplished through the use of menu scroll buttons.
11. Setup for systems requirements shall be allowed through the local access display. Setup provisions shall include:

CT rating (xxxxx: 5)
System type (three phase, 4 wire)

12. Reset of the following electrical parameters shall also be allowed from the local access display:
Real Energy (KWH) Apparent Energy (KVAH) Reactive Energy (KVARH)
13. All reset and setup functions shall have a means for protection against unauthorized/accidental changes.
14. The Controller shall be capable of storing records in memory for access either locally or remotely for up to 100 events. The reports shall include date, time and a description of the event and shall be maintained in a non volatile memory.
15. The controller shall use industry standard open architecture communication protocol for high speed serial communications via multi-drop connection to other controllers and to a master terminal with up to 4000 ft of cable, or further, with the addition of a communication repeater. The serial communication port shall be RS422/485 compatible.
16. The serial communication port shall allow interface to either the manufacturers or the owner's furnished remote supervisory control.
17. The controller shall have password protection required to limit access to qualified and authorized personnel.
18. The controller shall include 20 characters, LCD display, with a keypad, which allows access to the system.
19. The controller shall be capable of storing the following records in memory for access either locally or remotely:
 - a. Number of hours ATS is in the emergency position, EMG-1, (total since record reset).
 - b. Number of hours emergency power, EMG-1, is available (total since record reset).
 - c. Total transfer in either direction (total since record reset).
 - d. Date, time, and description of the last four source failures.
 - e. Date of the last exercise period.
 - f. Date of record reset.

F. SEQUENCE OF OPERATIONS

1. Upon a loss of Normal Power at any of the five (5) existing Automatic Transfer Switches (4 Russelectric and 1 fire pump ATS) shall initiate and start emergency generator. The selected emergency generator (EMG-1 or EMG-2) shall start and provide emergency power to the existing building loads through the existing emergency switchboard "EPS".
2. If the selected emergency generator fails to start, the alternate emergency generator shall be automatically signaled to start by new ATS-5 and after a preset (field adjustable) time delay of 10 seconds the alternate generator must start and provide emergency power to the existing load through emergency switchboard "EPS".
3. If the selected emergency generator should fail or produces emergency power at 90 percent or lower values of voltage and or frequency, while carrying the load, the alternate emergency generator must be signaled to start automatically by ATS- 5 and ATS-5 shall transfer to the alternate emergency generator position to supply emergency power to the load. The lead emergency generator shall be de- energized after the alternate generator is energized and running.
4. ATS-5 manufacturer shall be factory furnish, install, and wire a field programmable electric alternator to automatically alternate lead/alternate sequence of two emergency generators on a weekly basis. The ATS manufacturer shall also furnish, install, and factory wire a two, position manual emergency generator selector switch which allow the operator to select the preferred and alternate emergency generator selection on a manual basis to balance the engine hours between the two emergency generators.
5. The logic shall perform the exact same operations regardless of which emergency generator is selected as the preferred emergency generator.

G. ATS ACCESSORIES

1. Cost of the following accessories, programming, and re-programming shall be included in contractor and ATS manufacturer's bid. The functions of this accessories as specified below and in this bid documents may have to be re- programmed as per owner's requirements during testing and start-up at the building (job site). It may have to be reprogrammed within the warranty period of two years, if requested by the building manager. All costs associated with the re-programming shall be included in contractor and ATS manufacturer's bid.
2. The specified ATS-5 shall energize and de-energize two emergency generators, EMG-1, and EMG-2 in lead and alternate sequence as has been specified. The lead and alternate sequence shall be alternated automatically or manually as has been specified. The EMG-1 and EMG-2 have also been referred as "lead" and alternate source. The existing emergency power switchboard is "EPS".

3. Programmable three phase sensing of the preferred source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage. Programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases, set at 20%, and phase sequence monitoring.
4. Programmable three phase sensing of the Alternate source set to pickup at 90% and dropout at 80% of rated voltage and overvoltage to pickup at 120% and dropout out at 110% of rated voltage programmable frequency pickup at 95% and dropout at 90% and over frequency to pickup at 110% and dropout at 105% of rated frequency. Programmable voltage differential between phases set at 20%, and phase sequence monitoring.
5. Time delay for override of momentary preferred source power outages (delays engine start signal and transfer switch operation) programmable 0-9999 seconds. Factory set at 3 seconds, if not otherwise specified.
6. Time delay to control contact transition time on transfer to either source, programmable 0-9999 seconds, factory set at 3 seconds.
7. Time delay on retransfer to EMG-1, programmable 0-9999 seconds, factory set at 300 seconds if not otherwise specified, with overrun to provide programmable 0-9999 second time delay, factory set at 300 seconds, unoperation after retransfer to normal.
8. Time delay on transfer to EMG-2, programmable 0-9999 seconds, factory set at 3 seconds.
9. A maintained type load test switch shall be included to simulate an EMG-1 power failure, keypad initiated.
10. A remote type load test switch shall be included to simulate a EMG-1 power failure, remote switch initiated.
11. A time delay bypass on retransfer to EMG-1 shall be included. Keypad initiated.
12. Contact, rated 10 Amps 30 volts DC, to close on failure of normal source to initiate engine starting.
13. Contact, rated 10 Amps 30 volts DC, to open on failure of EMG-1source for customer functions.
14. Light emitting diodes shall be mounted on the microprocessor panel to indicate: switch is in EMG-1 position, switch is in EMG-2 position, and controller is running.

15. A plant exerciser shall be provided with (10) 7 day events, programmable for any day of the week and (24) calendar events, programmable for any month/day, to automatically exercise her "no load" (switch will not transfer) or "load" (switch will transfer) exercise period. Keypad initiated.
16. Provision to select either "no commit" or "commit" to transfer operation in the event of EMG-1 power failure shall be included. In the "no commit position," the load will transfer to EMG-2 position unless EMG-1 power returns before the EMG-2 source has reach 90% of it's rated values (switch will remain in normal). In the "commit position" the load will transfer to the EMG-2 position after any EMG-1 power failure. Keypad initiated.
17. Two auxiliary contacts rated 10 Amp, 120 volts AC (for switches 100 to 800 amps) 15 amp, 120 volts AC (for switches 1000 to 4000 amps), shall be mounted on the main shaft, one closed on EMG-1, the other closed on EMG-2. Both contacts will be wired to a terminal strip for ease of customer connections.
18. A three phase digital LCD voltage readout, with 1% accuracy shall display all three separate phase to phase voltages simultaneously, for both the normal and emergency source.
19. A digital LCD frequency readout with 1% accuracy shall display frequency for both normal and emergency source.
20. An LCD readout shall display normal source and emergency source availability.
21. The following accessories shall be available by simple activation, via the key pad, if required.
 - a. Include (2) time delay contacts that open simultaneously just (milliseconds) prior to transfer in either direction. These contacts close after a time delay upon transfer. Programmable 0-9999 seconds after transfer.
 - b. A block transfer function shall be included, energized from a 24VDC signal from the emergency power switchboard "EPS", to allow transfer to emergency.
 - c. A load shed function shall be included, energized from a 24VDC signal from the "EPS", to disconnect the load from the emergency source when an overload condition occurs.
 - d. A peak shave function shall be included, energized from a 24VDC signal from the "EPS". This function will start the emergency generator and ATS-5 shall feed emergency power to "EPS" reducing the utility supply to the building. After the peak shave signal is removed, the transfer switch will retransfer to the normal

supply, bypassing the retransfer time delay.

H. APPROVAL

1. As a condition of approval, the manufacturer of the automatic transfer switches shall verify that their switches are listed by Underwriters Laboratories, Inc., Standard UL- 1008 with 3 cycle short circuit closing and withstand as follows: RMS Symmetrical Amperes 480 VAC

<u>3 Cycle Amperes</u>	<u>Current Limiting Closing and Withstand</u>	<u>Fuse Rating</u>
1600-4000	100,000	200,000

2. During the 3 cycle closing and withstand tests, there shall be no contact welding or damage. The 3 cycle tests shall be performed without the use of current limiting fuses. The test shall verify that contacts separation has not occurred, and there is contact continuity across all phases. Test procedures shall be in accordance with UL-1008, and testing shall be certified by Underwriters' Laboratories, Inc.
3. When conducting temperature rise tests to UL-1008, the manufacture shall include post-endurance temperature rise tests to verify the ability of the transfer switch to carry full rated current after completing the overload and endurance tests.
4. The microprocessor controller shall meet the following requirements:
 - Storage conditions - 25 degrees C to 85 degrees C
 - Operation conditions - 20 degrees C to 70 degrees C ambient
 - Humidity 0 to 99% relative humidity, non-condensing
 - Capable of withstanding infinite power interruptions
 - Surge withstand per ANSI/IEEE C-37.90A-1978
5. Manufacturer shall provide copies of test reports upon request.

I. MANUFACTURER

1. The ATS manufacturer shall employ a nationwide factory-direct, field service organization, available on a 24-hour a day, 365 days a year, call basis.
2. The manufacturer shall include an 800 telephone number, for field service contact, affixed to each enclosure.
3. The manufacturer shall maintain records of each transfer switch, by serial number, for a minimum 20 years.

PART 3 EXECUTION

3.1 INSTALLATION

- A. Automatic Transfer Switches shall be provided with adequate lifting means for ease of installation of wall or floor mounted enclosures.
- B. Provide access and working space as indicated in bid documents.
- C. New automatic transfer switch (ATS) shall be installed on concrete pad at location shown in the drawing. It shall be anchored to the concrete pad and installed as per ATS manufacturer's instructions. All control, monitor, and emergency feeder wiring shall be installed as per ATS manufacturer's instructions and shall be field verified by a representative of the ATS manufacturer.

3.2 ADJUSTMENTS

- A. Tighten assembled bolted connections with appropriate tools to manufacturer's torque recommendations prior to first energization of ATS.

3.3 FIELD TESTING, AND START UP SERVICES

- A. The ATS manufacturer's experienced technician and or engineer shall be present at the Transtar building to provide trouble shooting, field testing, and start up services. These services shall be scheduled a minimum of two weeks in advance by the contractor. This phase of the work shall be completed in one day. This phase of the work shall continue the following day at no extra cost, if trouble shooting, field testing, and start up services can not be completed in one day. All costs associated with this phase such as technician (and or field engineer's) time, travel time to the building, cost of air fare, rent a car, travel expenses, hotel, meals, and lodging expenses shall be included in contractor and manufacturer's base bid.
- B. During this phase both the existing and new emergency generators with the existing and new ATSES shall be tested using external load bank. They shall be placed in normal working conditions after tests are successfully completed and accepted by owner and engineer. Both generators shall be tested for automatic alternating conditions through new ATS.
- C. The emergency generator shall be tested to transfer emergency power to the existing building loads under full and part load conditions. If the existing building loads do not accept, retain, and operate successfully on the emergency power, the ATS manufacturer shall fully cooperate with the generator manufacturer, electrical contractor, owner, and engineer (team) to fully analyze problem(s) and assist the team so that the emergency power can be successfully transferred and building loads can be successfully operated on the emergency power.

3.4 WARRANTY

- A. Provide a manufacturer's standard 5 year warranty. First two years coverage shall include parts and labor, on site. The final three years shall be for parts only. Provide documentation of availability of local factory

support for this warranty. First line of response shall be factory direct personnel.

PART 4 PERFORMANCE TIME

- 4.1 The Contractor shall have **140 calendar days** to complete all work specified in the contract scope of work after receipt of the Notice-To-Proceed from the City.

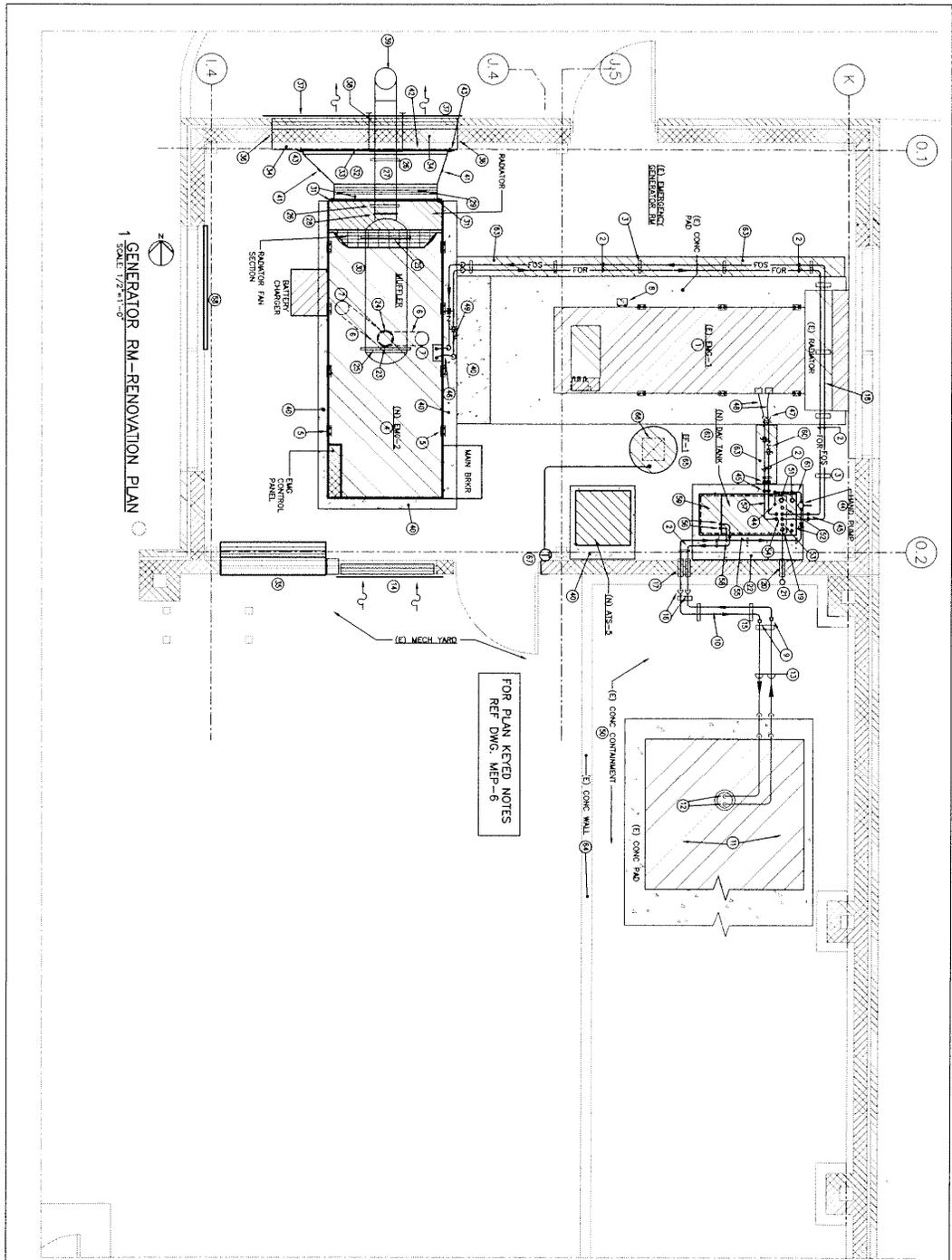
PART 5 MECHANICAL DRAWINGS

- 5.1 ***Mechanical Drawings: (See the next following pages)***

A PDF version of the Mechanical Drawings
can also be viewed on the following web Link

<https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23530>

END OF TECHNICAL SPECIFICATIONS



1 GENERATOR RM-RENOVATION PLAN
SCALE: 1/2"=1'-0"

FOR PLAN KEYED NOTES
REF DWG. MEP-6

NO.	DATE	C.O.	BY
1			

ISSUED FOR PERMITS AND CONSTRUCTION

PROJECT TITLE:
INSTALLATION OF NEW
EMERGENCY GENERATOR
TRANSSTAR CENTER

PROJECT LOCATION:
MECH. P/BIG ROOM
TRANSSTAR CENTER
1400 S. 10TH ST.
DALLAS, TX 75204

CLIENT:
DART ENGINEERING, INC.
2810 DART ROAD, SUITE 100
DALLAS, TX 75228
TEL: 972-242-2828
WWW.DARTENGINEERING.COM

SHEET TITLE:
ENGINE ROOM
MECH/P/BIG FLS PLAN

SHEET NUMBER:
MEP-5

DATE:
3/24/2008

DRAWN BY:
SB

CHECKED BY:
M.C.D.

SCALE:
JOB NO.:

- PLAN KEYED NOTES FOR DWG. MEP-5.**
- 1 GENERATOR SHALL REMAIN IN NORMAL WORKING CONDITIONS TO DRIVE FEEDER AND INSTALL (N) SCH 40 BLACK CARBON ST. 1" DIA. RIGID SUPPLY AND RETURN LINES ON UNSTRUT CHANNEL ON CONC PAD TO UNSTRUT TOP
 - 2 SECURE DUCT ST. UNSTRUT TO CONC PAD AND FILL LINES TO UNSTRUT TOP
 - 3 GENERATOR SHALL BE INSTALLED ON CONC PAD WITH MIN OF 8" SPRING TYPE VIBRATION ISOLATORS.
 - 4 TOP OF 8" DOUBLE SPRING TYPE VIBRATION ISOLATORS AND INSTALLED BY CONTRACTOR.
 - 5 GENERATOR W/RT FURNISHED W/RE FLEXIBLE EXH CONNECTOR AS INSTALLED BY CONTRACTOR.
 - 6 THIS END OF W/RT CONNECTOR SHALL BE CONNECTED TO APPROX. 1" DIA. ENGINE EXH CONNECTOR BY CONTRACTOR. REF TO DETAIL-2/MEP-10.
 - 7 BATTERY CHARGER SHALL REMAIN
 - 8 CONNECT (N) 1" LINES TO (E) LINES WITH PROPER COUPLINGS.
 - 9 (N) 1" DIA. TYPE-K CU. TOST. AND TOST. LINES.
 - 10 (E) 5/8" O.D. ALUM. DIESEL FUEL STORAGE TANK SHALL REMAIN.
 - 11 (E) TOST. AND TOST. LINES CONNECTED TO TOP OF TANK SHALL REMAIN.
 - 12 1" DIA. CU TOST. AND TOST. LINES INSTALLED ON CONC CONTAINMENT FLR SHALL REMAIN.
 - 13 (N) 5'-0"x10'-0" TALL GA. LOWER. REF ARCH DWG FOR INSTALLATION DETAILS.
 - 14 (N) DUCT ST. UNSTRUT SECURE TO CONTAINMENT FLR. SECURE (N) UNSTRUT TO UNSTRUT ISOLATE (N) LINE FROM CONTAINMENT FLR.
 - 15 (N) 1" DIA. TYPE-K CU. TOST. AND TOST. LINES DN ON WALL TO CONTAINMENT FLR.
 - 16 INSTALL LINES IN (N) SCH. 40 PVC WALL SLEEVES NEAR FN FLR.
 - 17 INSTALL (N) TOST. AND TOST. LINES BELOW (E) RADVATOR. PROPERLY SUPPORT THEM FROM FLR.
 - 18 CONNECT 2" VENT LINE TO TANK FITTING WITH OIL-TIGHT THREADED CONN.
 - 19 INSTALL 2" VENT LINE IN SCH. 40 PVC WALL SLEEVE.
 - 20 INSTALL 2" VENT LINE UP ALONG WALL SUPPORT IT FROM WALL WITH DUCT CLAMP. TERMINATE VENT LINE AT PENETRATION ON CEILING WITH 2" FIBRE FN TUBE.
 - 21 (E) 8" HOSE KEEPING CONC PAD. REF STRUC DWG FOR DETAIL.
 - 22 12" DIA. APPROX. 2 FT LONG, SCH. 40 BLACK CARBON ST. END. SHALL BE FURNISHED AND INSTALLED BY CONTRACTOR. BOLT HOLES OF FITTINGS SHALL MATCH BOLT HOLES OF FITTINGS. CONTRACTOR SHALL VERIFY BOLT HOLES MATCH BOLT HOLES AS PER DWG. USER'S INSTRUCTIONS.
 - 23 COIN 12" DIA. CONTRACTOR SUPPLIED EXH PIPE BETWEEN W/RTERS. INLET AND OUTLET OF W/RT CONNECTORS BOLT HOLES OF W/RTERS INLET. REF TO DETAIL-2/MEP-10.
 - 24 ST. RADVATOR SUPPORT ON ST. ANGLE IRON. SUPPORTED FROM ROOF STRUC ABOVE.
 - 25 TOP DUCT ST. UNSTRUT SUPPORT. SECURE UNSTRUT TO ROOF STRUC ABOVE.
 - 26 SCH 40 DUCT ST. 12" DIA. ENGINE EXH PIPE IT SHALL BE INSULATED AND ALUMINUM JACKETED.
 - 27 CONNECT 12" DIA. EXH PIPE TO 12" DIA. OUTLET OF THE W/RTER WITH HIGH TEMP. DUCT AND DUCT ST. HANGWARE APPROX. 4" LONG, WITH ANGLE BRACKET. CONTRACTOR SHALL BE BOLTED TO DUCT ST. RADVATOR DISCHARGE DUCT CONNECTION WITH STRUTS SHALL NOT BE ACCEPTABLE.
 - 28 ENGINE W/RTER (GENERATOR) FURNISHED BY DOW. W/RT DETAIL-2/MEP-10 & CONNECTED BY CONTRACTOR. REF TO DETAIL-2/MEP-10.
 - 29 APPROX. 6" X 65" H. DUCT STEEL RADVATOR EXH DUCT. CONNECT TO DUCT DISCHARGE AIR-TIGHT WITH HIGH TEMP. CONCRETE DUCT. REF TO DETAIL-2/MEP-10.
 - 30 (N) 4x12 TRANSITION FROM APPROX. 60/60 TO 64/72.
 - 31 84/72 DUCT ST. DISCHARGE CONN TO FLEXIBLE AIR-TIGHT.
 - 32 APPROX. 12" DEEP X 8" WIDE X 10'-6" HIGH W/RT AND W/RTER SHALL BE EXH LOADED. DUCT ST. FLEXIBLE CONN. FROM WALL AND FN FLR. FLEXIBLE SUPPORT FLEXIBLE DETAIL-1/MEP-9 FOR WALL THIRBLE DETAIL.
 - 33 12" DIA. ENGINE EXH PIPE SHALL BE TERMINATED APPROX. 2" ABOVE BIAS PROTECTOR WITH A RAINCAP. REF DETAIL-1/MEP-9.
 - 34 (N) CONC PAD. REF STRUC DWG.
 - 35 SUPPORT TRANSITION DUCT FROM STRUC ABOVE AND FN FLR USING HEAVY DWT. GALV. ST. STRIPS AND ANGLES ON BOTH SIDES OF DUCT.
 - 36 SECURE DISCHARGE AIR DUCT TO PENUM ON ALL 4 SIDES WITH GASKET AND SHEET METAL SCREWS.
 - 37 DUCT PLUMB SUPPLY CONNECTION BY TANK W/RT. REF DETAIL-1/MEP-10.
 - 38 (N) 1" DIA. SCH. 40 BLACK CARBON ST. TOST. AND TOST. LINES DN FROM FN FLR.
 - 39 FLEX. FUEL LINES BY END W/RT.
 - 40 (E) VERTICAL TOST. AND TOST. LINES SHALL BE CONNECTED TO (E) FLEXIBLE FUEL LINES WITH PROPER FITTINGS.
 - 41 (E) FLEXIBLE TOST. AND TOST. LINES SHALL REMAIN. EXCEPT THE VERTICAL TOST. AND TOST. LINES SHALL BE CONNECTED TO (N) FLEXIBLE FUEL LINES WITH PROPER FITTINGS AS PER GENERATOR W/RT'S INSTRUCTIONS.
 - 42 BOTTOM OF (E) CONC CONTAINMENT IS APPROX. 24" BELOW FN FINISH IN W/RT YARD.
 - 43 4" FACTORY INST. (WITH AL. SPRING LOADED CAPS) END VENT SHALL REMAIN.
 - 44 1. 1"-1" DIA. NET SPARE TANK FITTINGS. INSTALL THREADED OVER OTHER OVERLAYS.
 - 45 IF DIA. DOWN PER TUBE CONN.
 - 46 2. 1" DIA. TOST. AND 2. 1" DIA. TOST. CONNECTIONS. CONNECT TOST. AND TOST. LINES TO TANK CONNECTIONS USING (E) FLEXIBLE FUEL LINES.
 - 47 1. 1" DIA. TOST. LINES TO BE INSTALLED NEAR FLR TO SERVE DUCT PLUMB.
 - 48 CONNECT FLEXIBLE TOST. AND TOST. LINES TO FUEL SHAP CONN. AS PER W/RT'S INSTRUCTION. CONNECTIONS SHALL BE COMPATIBLE TO PUMP SECTION LINES.
 - 49 INSTALL 1" DIA. SCH. 40 BLACK CARBON ST. TOST. AND TOST. LINES ON TOP OF TANK.
 - 50 1" DIA. CU FUEL LINES DN TO TOP OF CONC PAD.
 - 51 CONTROL SECTION OF DUCT TANK PLUMB.
 - 52 THESE VALVE SHALL BE INSTALLED IN (N) VERTICAL LINES FOR A REASON OF DWG. CLARITY THEY ARE SHOWN IN HORIZONTAL LINES.
 - 53 TOST. WITH FITTINGS BY TANK W/RT.
 - 54 INSTALL APPROX. 12" WIDE RAUP OVER FUEL LINES THE SHAP SHALL BE FIELD BUILT USING 2"x4" WOOD BLOCKS AND 1" DIA. SCH. 40 BLACK CARBON ST. TOST. AND TOST. LINES. ELEV. AT TOP OF CONC PAD. IT SHALL BE SECURED TO END
 - 55 APPROX. 12" TALL (AFTER EACH YARD PAVED) CONC WALL. INSTALL (N) DSI PAN ON ROOF CURB ON ROOF. FIELD COORDINATE WITH ROOF STRUC. INSTALLATION SHALL BE WATER-TIGHT.
 - 56 (E) CUI. REQUIRED SIZE ROOF OPENING. INSTALL ROOF CURB WITH FIELD ADJUSTABLE. 100 DUCT 1" DIA. HORIZONTAL PAN. THERMOSTAT TEMP. SHALD BE 60-90 DEG. F. TO CONTROL EXH PAN. TOP OF PAN THERMOSTAT SHALL BE 48" AFT.
 - 57 THIS SECTION OF (E) LOUVER SHALL BE CLOSED OFF FROM INSIDE. REF DWG. MEP-3.

NO.	DATE	C.O.	BY
1	9/24/2008	M.D.	M.C.D.

REVISIONS AND CORRECTIONS

PROJECT TITLE: TRANSSTAR CENTER

PROJECT LOCATION: HENDERSON, TEXAS 77024

DESIGNER: DAVIS ENGINEERING & ARCHITECTS, L.P.
 2815 W. PARKWAY, SUITE 200
 HOUSTON, TEXAS 77024
 TEL: 281-447-4444
 FAX: 281-447-4444
 WWW.DAVIS-ARCHITECTS.COM

PREPARED BY: M.C.D.

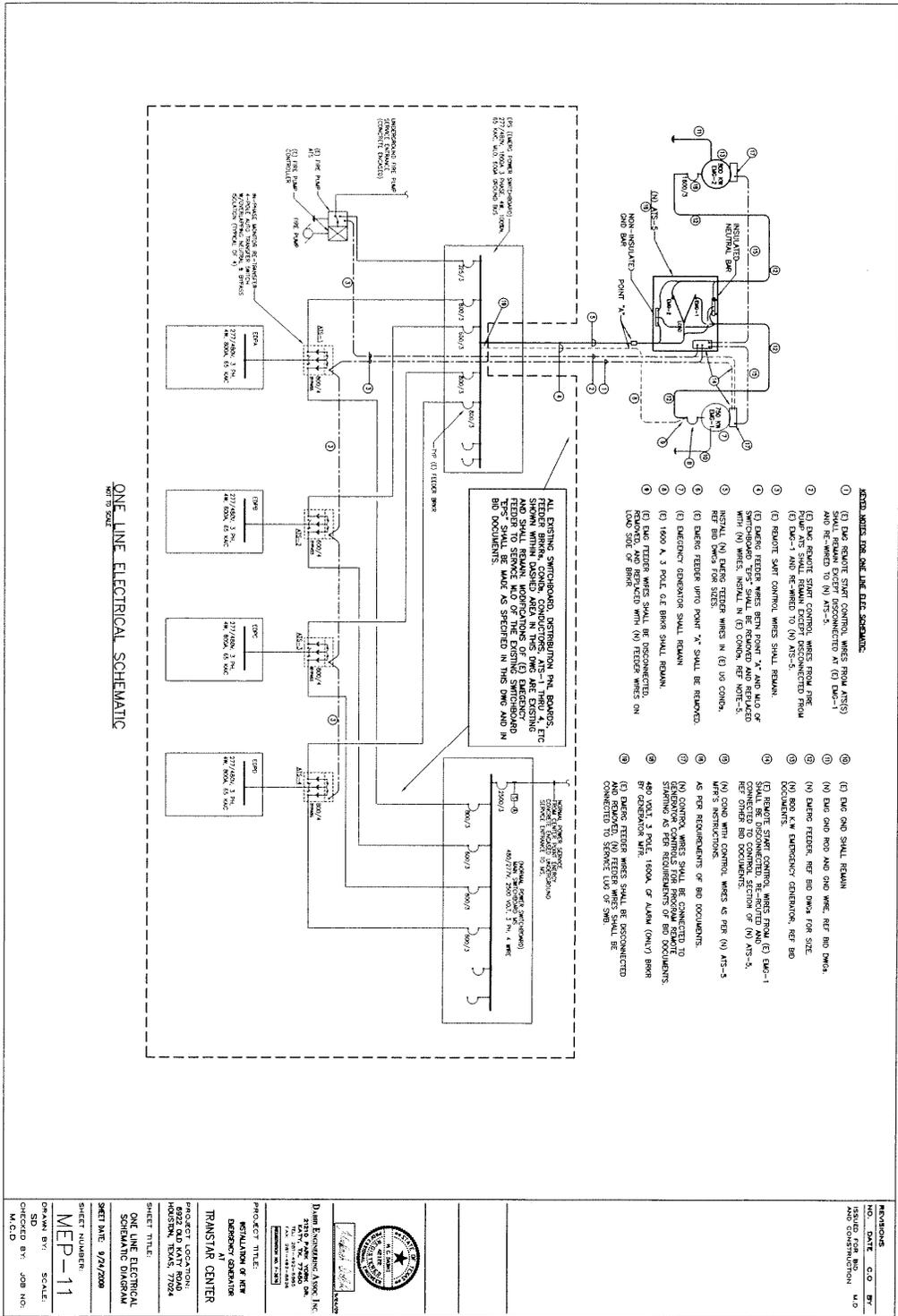
PROJECT TITLE: REPLACEMENT OF NEW TRANSSTAR CENTER

SHEET NUMBER: MEP-6

SHEET DATE: 9/24/2008

SCALE: AS SHOWN

CHECKED BY: M.C.D.



A PDF version of the Mechanical Drawings can also be viewed on the following web Link <https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23530>

SECTION C

DAVIS-BACON BUILDING WAGE DECISION

A PDF version of the Davis/Bacon Building Wage Decision
can be viewed on the following web Link

<https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23530>

GENERAL CONDITIONS

A PDF version of the General Conditions can be viewed on the following web link:

<https://purchasing.houstontx.gov/buyer/BidDocumentManager.aspx?id=C23530>

Document 00800

SUPPLEMENTARY CONDITIONS

The following Paragraphs amend and supplement the 2005 edition of General Conditions. Unaltered portions of General Conditions remain in effect.

ARTICLE 3 - THE CONTRACTOR

3.5 *LABOR: Insert the following Paragraph 3.5.3.1.1.*

3.5.3.1.1 Contractor shall make good faith efforts to comply with the City ordinances regarding Minority and Women Business Enterprises (MWBE) and Persons with Disabilities Business Enterprises (PDBE) participation goals which are as follows:

- .1 the MWBE goal is 0 percent, and
- .2 the PDBE goal is 0 percent.

3.28 **CONTRACTOR DEBT**

3.28.1 **IF CONTRACTOR, AT ANY TIME DURING THE TERM OF THIS AGREEMENT, INCURS A DEBT, AS THE WORD IS DEFINED IN SECTION 15-122 OF THE HOUSTON CITY CODE OF ORDINANCES, IT SHALL IMMEDIATELY NOTIFY CITY CONTROLLER IN WRITING. IF CITY CONTROLLER BECOMES AWARE THAT CONTRACTOR HAS INCURRED A DEBT, IT SHALL IMMEDIATELY NOTIFY CONTRACTOR IN WRITING. IF CONTRACTOR DOES NOT PAY THE DEBT WITHIN 30 DAYS OF EITHER SUCH NOTIFICATION, CITY CONTROLLER MAY DEDUCT FUNDS IN AN AMOUNT EQUAL TO THE DEBT FROM ANY PAYMENTS OWED TO CONTRACTOR UNDER THIS AGREEMENT, AND CONTRACTOR WAIVES ANY RECOURSE THEREFORE.**

ARTICLE 8 - TIME

- 8.1 *PROGRESS AND COMPLETION: Delete Paragraph 8.1.6. and replace with the following 8.1.6.*
- 8.1.6.1 Contractor shall credit the City by Change Order for inspection services for overtime work or work performed on Sundays or Legal Holidays. The amount Contractor credits the City will be **\$50.00 per hour** per inspector for inspection services.

ARTICLE 9 - PAYMENTS AND COMPLETION

- 9.1 *UNIT PRICE WORK: Delete Section 9.1 in its entirety and insert the following Section 9.1.*
- 9.1 References to Unit Prices in individual Specification sections are not applicable to the Contract. Include payment for portions of the Work required by these sections in the Stipulated Price for the Contract.
- 9.12 LIQUIDATED DAMAGES: Insert the following Paragraph 9.12.1.1.**
- 9.12.1.1 The amount of liquidated damages provided in General Conditions Paragraph 9.12.1 payable by Contractor or Surety for each and every day of delay beyond Contract Time, are \$800.00 per day.**

ARTICLE 11 - INSURANCE AND BONDS

- 11.2 *INSURANCE TO BE PROVIDED BY CONTRACTOR: Delete Paragraph 11.2.8. and replace with the following 11.2.8.*
- 11.2.1.4 Contractor shall provide Owners and Contractor's Protective Liability Insurance only if the contractor's bid price is equal to or greater than \$100,000.00.
- 11.2.8 *Endorsement of Primary Insurance:* Each policy except Workers' Compensation Insurance must contain an endorsement that the policy is primary insurance to any other insurance available to additional insured with respect to claims arising under the Contract.

CITY OF HOUSTON -- BIDDER'S BOND

(Must be in an amount at least 10% of the bid. If the bid is upon alternates this bond must be for at least 10% of the highest amount for which the bidder offers to do any or all the work bid upon.)

THE STATE OF TEXAS

§
§

KNOW ALL MEN BY

THESE PRESENTS:

COUNTY OF HARRIS

§

THAT WE, _____ as principal and the other subscriber hereto as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation in the sum of \$_____ Dollars (\$_____).

The condition of this obligation is that: ---

WHEREAS, the said principal is submitting to the City of Houston his or its bid for the doing for the City of Houston of certain work and construction of which the following is a brief description, to-wit: ---

Bid No. S50-C23530

INSTALLATION OF A NEW 800 KW GENERATOR AT HOUSTON TRANSTAR

in accordance with the plans and specifications for such work upon which such bid is made, to which plans and specifications reference is made for a more full description of the work and construction referred to.

NOW, THEREFORE, if the said bidder is awarded the contract for such work, the said bidder will, within the time provided in the specifications, enter into a contract with the City therefore upon the form and to the purpose and intent provided in the specifications, will furnish insurance as required in the specifications and will furnish a good and sufficient construction surety bond executed by said bidder and one corporate surety organized under the laws of the State of Texas or authorized to do business in the State of Texas and having a fully paid up capital stock of not less than \$100,000.00 and duly licensed and qualified by the Board of Insurance Commissioners of the State of Texas, which bond shall be for an amount equal to 100 percent of the contract price and shall be conditioned in accordance with the requirements stated in the specifications upon which such bid is being submitted.

In the event said bidder is unable or fails to execute said contract for the work proposed to be done, is unable or fails to furnish insurance as specified or is unable or fails to furnish said construction bond in the amount and condition as aforesaid, the undersigned principal and surety shall be liable to said City of Houston for the full amount of this obligation which is here and now agreed upon and admitted as the amount of the damages which will be suffered by the City of Houston on account of the failure of such bidder to so comply with the terms of this bid.

Executed this _____ day of _____, A.D. 2008.

PRINCIPAL

By _____

By _____

Surety

ONE-YEAR MAINTENANCE BOND

THAT WE, _____, as Principal, hereinafter called Contractor, and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston, a municipal corporation, in the sum of \$_____, for the payment of which sum well and truly to be made to the City of Houston and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City of Houston for _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall comply with the provisions of Paragraph 11.5.1 of the General Conditions, and correct work not in accordance with the Contract documents discovered within the established one-year period, then this obligation shall become null and void, and shall be of no further force and effect; otherwise, the same is to remain in full force and effect.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

WITNESS: (if not a corporation)

Name of Contractor _____

By: _____

Name:

Title:

By: _____

Name:

Title:

Date:

ATTEST/SURETY WITNESS:

(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____

Name:

Title:

Date:

By: _____

Name:

Title: Attorney-in-Fact

Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date

PERFORMANCE BOND

THAT WE, _____, as Principal, (the "Contractor"), and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound to the City of Houston (the "City"), a municipal corporation, in the penal sum of \$_____ for the payment of which sum, well and truly to be made to the City, its successors and assigns, Contractor and Surety do bind themselves, their heirs, executors, administrators, successors and assigns, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a Contract in writing with the City for _____, _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein.

NOW THEREFORE, if the said Contractor shall faithfully and strictly perform the Contract in all its terms, provisions, and stipulations in accordance with its true meaning and effect, and in accordance with the Contract documents referred to therein and shall comply strictly with each and every provision of the Contract and with this Bond, then this obligation shall become null and void and shall have no further force and effect; otherwise the same is to remain in full force and effect. Should the Contractor fail to faithfully and strictly perform the Contract in all its terms, including but not limited to the indemnifications thereunder, the Surety shall be liable for all damages, losses, expenses and liabilities that the City may suffer in consequence thereof, as more fully set forth herein.

It is further understood and agreed that the Surety does hereby relieve the City or its representatives from the exercise of any diligence whatever in securing compliance on the part of the Contractor with the terms of the Contract, and the Surety agrees that it shall be bound to take notice of and shall be held to have knowledge of all acts or omissions of the Contractor in all matters pertaining to the Contract. The Surety understands and agrees that the provision in the Contract that the City will retain certain amounts due the Contractor until the expiration of 30 days from the acceptance of the Work is intended for the City's benefit, and the City will have the right to pay or withhold such retained amounts or any other amount owing under the Contract without changing or affecting the liability of the Surety hereon in any degree.

It is further expressly agreed by Surety that the City or its representatives are at liberty at any time, without notice to the Surety, to make any change in the Contract documents and in the Work to be done hereunder, as provided in the Contract, and in the terms and conditions thereof, or to make any change in, addition to, or deduction from the Work to be done hereunder; and that such changes, if made, shall not in any way vitiate the obligation in this Bond and undertaking or release the Surety there from.

It is further expressly agreed and understood that the Contractor and Surety will fully indemnify and save harmless the City from any liability, loss, cost, expense, or damage arising

out of Contractor's performance of the Contract.

If the City gives Surety notice of Contractor's default, Surety shall, within 45 days, take one of the following actions:

1. Arrange for Contractor, with consent of the City, to perform and complete the Contract; or
2. Take over and assume completion of the Contract itself, through its agents or through independent contractors, and become entitled to the payment of the balance of the Contract Price.

If the Surety fails to take either of the actions set out above, it shall be deemed to have waived its right to perform and complete the Contract and receive payment of the balance of the Contract Price and the City shall be entitled to enforce any remedies available at law, including but not limited to completing the Contract itself and recovering any cost in excess of the Original Contract Price from the Surety.

This Bond and all obligations created hereunder shall be performable in Harris County, Texas. This Bond is given in compliance with the provisions of Chapter 2253, Texas Government Code, as amended, which is incorporated herein by this reference.

Notices required or permitted hereunder shall be in writing and shall be deemed delivered when actually received or, if earlier, on the third day following deposit in a United States Postal Service post office or receptacle, with proper postage affixed (certified mail, return receipt requested), addressed to the respective other Party at the address prescribed in the Contract documents, or at such other address as the receiving party may hereafter prescribe by written notice to the sending party.

EXECUTED in multiple originals this _____ day of _____, 20_____.

ATTEST/SEAL: (if a corporation)

WITNESS: (if not corporation)

(Name of Principal)

(Address of Principal)

By: _____

Name:

Title:

Date:

By: _____

Name:

Title:

Date:

ATTEST/SEAL

SURETY WITNESS:

(Name of Surety)

(Address of Surety)

By: _____

Name:

Title:

Date:

By: _____

Name:

Title:

Date:

REVIEWED:

This Bond has been reviewed as to form by the undersigned Paralegal and has been found to meet established Legal Department criteria.

Date

Paralegal

STATUTORY PAYMENT BOND

THAT WE, _____, as Principal, hereinafter called Contractor and the other subscriber hereto, _____, as Surety, do hereby acknowledge ourselves to be held and firmly bound unto the City of Houston, a municipal corporation, in the sum of \$_____ for the payment of which sum, well and truly to be made to the City of Houston, and its successors, the said Contractor and Surety do bind themselves, their heirs, executors, administrators, successors, jointly and severally.

THE CONDITIONS OF THIS OBLIGATION ARE SUCH THAT:

WHEREAS, the Contractor has on or about this day executed a contract in writing with the City of Houston for _____, all of such work to be done as set out in full in said Contract documents therein referred to and adopted by the City Council, all of which are made a part of this instrument as fully and completely as if set out in full herein;

NOW, THEREFORE, if the said Contractor shall pay all claimants supplying labor and materials to him or a Subcontractor in the prosecution of the Work provided for in the Contract, then, this obligation shall be void; otherwise the same is to remain in full force and effect;

PROVIDED HOWEVER, that this Bond is executed pursuant to the provisions of Chapter 2253, Texas Government Code, as amended, and all liabilities on this Bond shall be determined in accordance with the provisions of said Article to the same extent as if it were copied at length herein.

IN WITNESS THEREOF, the said Contractor and Surety have signed and sealed this instrument on the respective dates written below their signatures and have attached current Power of Attorney.

ATTEST, SEAL: (if a corporation)
WITNESS: (if not a corporation)

Name of Contractor

By: _____
Name:
Title:

By: _____
Name:
Title:
Date:

ATTEST/SURETY WITNESS:

(SEAL)

Full Name of Surety

Address of Surety for Notice

Telephone Number of Surety

By: _____
Name:
Title:
Date:

By: _____
Name:
Title: Attorney-in-Fact
Date:

This Ordinance or Contract has been reviewed as to form by the undersigned legal assistant and have been found to meet established Legal Department criteria. The Legal Department has not reviewed the content of these documents.

Legal Assistant

Date