CITY OF TORRINGTON
INVITATION TO BID

BID # STG-031-113004 STAND-BY GENERATOR FOR STREET DEPARTMENT

Date of bid opening: Nov 30, 2004 Time: 10:00AM Location: Room 109A, City Hall

Bid Bond or Certified Check required with bid: 5%
Performance Bond required if awarded bid: 100 %

Submit an original bid and a duplicate.

The City of Torrington reserves the right to accept or reject any or all bids or any portion thereof, to waive technicalities, and to award the contract as will best serve the public interest.

Omit State and Federal Taxes.

All prices must be F.O.B.: Destination (Torrington) unless otherwise requested.

Dated in Torrington: 11/3/2004 Purchasing Agent _____
Charlene R. Antonelli, CPPB

ITEM	PRICE
GENERATOR PER SPECIFICATIONS **Mfg. & Model No.** _____	$ _____

Bid Submitted By:_____

Name of Company_____
Address_____
_____
Phone_____ Fax_____
Delivery Date_____
E-mail address _____
Comments:

_____
Signature

_____
Title

Date_____

Web Page _____

INSTRUCTIONS TO BIDDERS

Sealed bids will be received by the Purchasing Agent, Room 109A, 140 Main St., Torrington, CT until the time and date specified on the cover sheet and opened thereafter in the Purchasing Department, Room 110. Bids received later than the time specified will not be accepted. Amendments to or withdrawal of any section of the submitted bid received later than the time & date set for the bid opening will not be considered. Bid proposals must remain in effect for a minimum of 30 days unless otherwise noted elsewhere in the bid specifications.

BID DOCUMENTS: are available over the Internet on the City's web page, under "open bids", www.torrington-CT.org
Businesses Without Internet Access may contact the Purchasing Department at 860-489-2224 for the bid documents.

BID BONDS: shall be in the amount of 5% of the total bid made out in favor of the City of Torrington and issued by a Surety company acceptable to the City of Torrington must accompany each bid**.** A certified check, cashier's check, Treasurer's check, or money order in the same amount may be submitted in lieu of the bid bond. Bids submitted without Certified Check or Bid Bond will not be accepted. The City of Torrington will not be held liable for the accrual of interest on any check held by the city in conjunction with this bid. All checks or bid bonds will be refunded to the unsuccessful bidders after award of the bid by the City Council. The deposit check or Bid Bond of the successful bidder will be held in escrow until such time as the city determines that the bidder has or will meet their obligations as stated by the bid. If the bidder fails or refuses within a reasonable time after due notice that the contract has been awarded to him, to execute the same, an amount representing a loss to the city by reason of such failure shall be retained and paid into the city treasury.

REPLIES: whether bid or no bid, must have the bid number clearly identified on the outside of the envelope. Bidders not marking the envelopes with the Bid number and date/time of opening on the envelope will have no recourse against the City of Torrington or its employees. Such bidders run the risk of the bid being opened prior to the scheduled Bid Opening time. Once opened such bids are public record.
Any alleged oral agreement made by a bidder or contractor with any agency or employee of the City of Torrington will be disregarded.

FREIGHT: Prices quoted shall be net delivery **F.O.B. Torrington, CT.** All bid prices must include prepaid delivery, assembly, and/or installation (ready for operation and/or use) of all equipment and/ or materials to the individual locations(s) as designated by the Purchasing Agent. All bid prices are to be submitted on the sheets provided on this bid. Quantities and pricing are to be listed in accordance with these sheets.

QUESTIONS: Request for interpretation of any portion of the bid may be made by telephone to the Purchasing Agent at (860)489-2225. All replies will be given verbally and a copy of any such inquiry and advice (if deemed vital to the bid by the Purchasing Agent) will be made available to each prospective bidder. Bidders should check the web site for addendums/updates 48 hours prior to the bid opening.

In the event of receipt of identical bids as to offerings, delivery, service, content, price, etc., the bid will be awarded in accordance with the information contained in the bid document, based on first received as to date and time of receipt of the bid.

NON-COLLUSION STATEMENTS: In order for bids to be considered, a non-collusive statement must be submitted with the bid. A sample non-collusive bid statement is attached. Bidders may elect to submit their own notarized non-collusion statement.

CONDITIONAL, QUALIFIED OR NON-RESPONSIVE BIDS/PROPOSALS: All bids/proposals shall be submitted in the form and manner as indicated by the bid documents and bid forms. Any proposal which is not submitted in the form and manner indicated by the bid documents or which contains information, statements, conditions, or qualifications which place conditions or qualifications on the proposal submittal for purposes of making an award, or which alter any proposal terms, conditions, specifications, or forms, which has not been previously approved by written addendum from the Purchasing Agent, or which does not meet legal requirements, shall be declared as a qualified, conditional, or non-responsive proposal and shall be rejected without further consideration. Any proposal response that does not fully respond to and comply with all detailed specifications or requests for information including execution of proposal forms, may be declared "non-responsive" and recommended for rejection. The City of Torrington shall not be responsible for any errors or omissions of the Offeror.

TAXES: Omit all State and Federal taxes from the bid. The City of Torrington is exempt from the payment of taxes imposed by Federal government and/or the State of Connecticut.

OWNERSHIP OF DOCUMENTS: All documents, including drawings, plans, specifications, videotapes, or other documents or maps prepared by a contractor pursuant to any agreement arising from this bid shall become the property of the City of Torrington upon completion of the project or any termination of the project prior to the completion of the project.

LEGALITY: All bid offers for commodities, work, materials, or equipment hereunder shall comply in every respect with the laws, specifications and requirements of the State of Connecticut and the Federal government. Contractor will comply with the provisions of the Connecticut Fair Employment Practices Law.

LANGUAGE DISPUTES: Any disputes over the interpretation and/or meaning of any individual terms, conditions, and/or language within this Request for Bid/Proposal document shall be resolved by and at the sole discretion of the City Purchasing Agent in a manner that is in the best interest of, and best advantage to, the City of Torrington, provided any such interpretation shall be reasonable. In the event that an individual term, condition, and/or language/wording is determined at any time, including after award, by the City Purchasing Agent to be "not applicable at all" tot his contract, then the term, condition, and or language/wording may be disregarded, even though an addendum is not issued. However, if the Purchasing Agent determines that the term, condition, and/or language/wording "is applicable in part", then the term, condition, and/or language/wording will apply to the degree applicable, even though an addendum is not issued.

RESPONSIBILITY: The Contractor shall save the City of Torrington, its agents or employees, harmless from liability of any kind for all claims of labor payments and materials furnished for this work, and for use of any copyrighted or uncopyrighted composition, secret process patented or unpatented invention, article or application furnished or used in the performance of the contract of which the Contractor is not the patentee, assignee, or licensee. The successful bidder agrees to indemnify and hold harmless the City of Torrington, its agents and employees from any and all liability arising out of the successful bidders' operations, functions and/or supplied items.

The successful bidder, vendor, and/or contractor must protect all property of the City of Torrington (i.e. all floors, furniture, grass, land, etc.) from injury or other damage. Any damage so caused must be repaired by contractor/vendor at his/her own expense. At the completion of work, the vendor and/or contractor must remove from the premises all surplus materials and all debris created by same. The premises must be left in a broom-clean and finished condition acceptable to the owner or its agents. Successful bidder will furnish adequate protection from damage for all work and to repair damage of any kind; for which he or his workers are responsible, to the premises or equipment to his own work or to the work of other contractors.

DEFAULT: It shall be understood that a bidder supplying equipment and/or supplies will be considered to be in default if/when they have not delivered the item(s) within the time constraints listed in this document or subsequent purchase orders and/or contract. Bidders providing a service and/or construction will be considered to be in default if/when they have failed to meet the completion date set forth in this document or its subsequent contract and/ or purchase orders and/ or they have ceased work on the project for a period of fifteen (15) working days, cumulative or consecutive.

TRADE NAME REFERENCES: Any and all references to trade names, types, styles, model numbers, stock numbers or catalogs are intended to be descriptive only and not restrictive. The intention is to indicate to bidders the type and quality of the articles and or materials that will be satisfactory. When reviewing the information, it is the responsibility of the prospective bidder to inform the City of Torrington of any discrepancy that is found (i.e. number listed does not fit item description) Bids received on other makes or models with reference to other catalogs will be considered. The bidder is to clearly state in his bid exactly what he intends to furnish and to furnish with his bid a cut or illustration or other descriptive matter that will clearly indicate and give specification as to the product he/she proposes to furnish. Where a bid is offered on an item other than the trade standard used in the specification the item should be identified on the bid form by entering the MAKE, TRADE NAME AND MODEL NUMBER. It is understood that any substitutes and/or alternates that might be offered are guaranteed by the bidder to be of equal or better quality than is reference in the bid. The item(s) must be equivalent as to function, basic design, type and quality of material, method of construction and any required dimensions. It shall be further understood that during original as well as subsequent shipments spot checks will be performed to insure that the items received are in fact the items offered in the bid. When received, should items/materials prove to be different from what was bid in any way, the bidder agrees to the return of the items and agrees to supply correct items (per bid specifications) at the bidders expense. In the event this return action is required, it is understood the bidder may be subject to removal from the city's approved bidder's list. Bidders are cautioned that surplus, seconds, factory rejects, floor samples, close outs or distressed items are not acceptable and shipments of substitutions, defective or shop-worn equipment will be returned for a full refund at the vendor's expense.

QUANTITY: The quantities and/or materials listed in the specifications/bid sheets may be increased or decreased by the City of Torrington or its designated representative based on actual need at the time the purchase orders are placed.

QUALITY: The City of Torrington reserves the right to reject any proposal in whole or in part offering equipment and/or materials and/or services that in its or its agents opinion does not meet the quality standards desired. Such decision is final and not subject to further recourse by the bidder.

SAMPLES: forwarded by the bidder will be returned to the bidder at his request and expense. Requests for return of samples must be submitted in writing at the time the sample is given to the City of Torrington or its representative. Samples not returned to the bidder will be disposed of at the discretion of the City of Torrington or its designated representative. Large pieces of equipment submitted for evaluation and inspection are to be picked up by the bidder within 30 days of the bid opening date. Items not picked up within 30 days will be disposed of by the City of Torrington or its designated agent.

AWARD: It is the intent to award this bid in its entirety to one bidder, however, the City reserves the right to award the bid line item by line item if it is deemed in its best interest to do so. In addition, bidders are advised that should budgetary constraints dictate, part, and/or all the items in this bid may be rejected. This decision shall be considered final and not subject to recourse by the bidder.

In determining the lowest or highest responsible bidder, the City reserves the right to consider, in addition to price, the compatibility, quality, cost of maintenance and availability of parts, experience and/or past performance of the bidder, sufficiency of the financial resources of the bidder as relates to the offerings as well as the ability of the bidder to provide future maintenance and service.

Documents previously submitted to the city of Torrington will not be considered as satisfying submission requirements for this bid.

No bidder can claim any contract rights by virtue of bidding alone. Awarding of the contract means actual written notice by letter and a properly executed purchase order to the bidder or bidders to whom the bid has been awarded.

OPTION TO RENEW: This contract may be extended for three (3) additional one (1) year periods, provided all terms and conditions remain in full force and effect except for the contract period being extended. This option, if exercised, is to executed in the form of a letter of agreement, to be issued no later than 30 days prior to the expiration of the then current contract period. This option to renew requires the mutual agreement of both parties. Refusal by either party to exercise this option to extend, will cause this contract to expire on the original or mutually agreed upon date. The total period of this contract, including all extensions as a result of exercising this option, will not exceed a maximum combined period of five (5) years.

BONDS:Performance Bond: The Contractor, when awarded the Bid, must submit within 10 days of the bid award, and before beginning the work or signing a contract, a Performance Bond amounting to one hundred percent (100%) of the total amount of the bid. Said performance bond must be in favor of the City of Torrington and executed by a surety company authorized to do business in the State of Connecticut. The City of Torrington reserves the right to retain the Bid Bond or Certified Check on bids below $25,000.00 as a Performance Bond. On bids of $25,000.00 or more the Performance Bond may be furnished in the following manner: Performance Bond, Surety Bond, Certified Check, Bank Check, Savings Account in both the City & Vendor's name or Letter of Credit

Maintenance Bond: The contractor, upon signing a contract and before beginning the work , must submit to the Purchasing Agent a Maintenance Bond to guarantee that if defects in either labor or materials becomes evident within one year after completion and acceptance of work will be fixed at no cost to the City of Torrington. The maintenance bond may be included as a portion of the Performance bond or as a separate bond. If it is issued as a separate bond said maintenance bond must be in favor of the City of Torrington and issued by a surety company licensed and authorized to do business in the State of Connecticut.

Labor and Material Bonds: Per Section 49-41 of the Conn General Statutes, on Public Works project where the estimate is in excess of $25,000.00, a labor (payment) and material bond must be furnished to the City. Said bonds must be filed with the Purchasing Agent prior to the commencement of work.

Consent for Release of Final Payment: AIA Document G707 & G706, or equivalent, must be signed and returned by the Surety Company before final payment will be released to the contractor.

INSURANCE: Certificate of Insurance: All insurers must have an AM Best rating of A-V11 or better and admitted to do business in the State of Connecticut. All insurance policies must include a Waiver of Subrogation whereby the insured waives its right to subrogated against the City, its subsidiaries, employees, volunteers, directors and officers. Proof of proper insurance coverage, Workers Compensation Insurance, Liability and Property damage, and Vehicle Insurance shall be filed with the City of Torrington Purchasing Agent within 10 days after the award of the bid. The Certificate of Insurance must name the City of Torrington, 140 Main St., Torrington, CT, its subsidiaries, employees, volunteers, directors & officers as the additional insured and filed with the Purchasing Agent prior to commencement of work. Renewal Certificates of Insurance must be mailed to the Purchasing Agent 10 days prior to the expiration of the required coverage.

Workman's Compensation Insurance: The Contractor shall take out and maintain during the life of the contract adequate Workman's compensation Insurance for all the employees employed on said work. In case any class of employees or subcontractors is engaged in hazardous work under the contract at the site of the work is not protected under the Workman's Compensation statute, the contractor shall provide Workman's Compensation Insurance for the protection of employees not otherwise protected.

Liability Insurance: The Contractor shall take out and maintain for the life of the contract, adequate public liability insurance insuring against liability to persons not employed by him in an amount of not less than $1,000,000.00 for injuries, wrongful death to any one person and subject to the limit for each person in an amount of not less than $2,000,000.00 on account of one accident and property damage insurance in an amount of not less than $1,000,000.00.

Vehicle Insurance: The Contractor shall take out and maintain for the life of the contract, adequate automotive/truck or other vehicle insurance with minimum coverage of $1,000,000.00 each for both liability and under

insured and uninsured motorist as well as any other coverage required by the State of Connecticut or requested by an official of the City of Torrington as relates to the contract.

Additional Security: The City of Torrington reserves the right to require successful bidders to enter into and such security arrangements as are deemed necessary to protect the City of Torrington, its property and goods.

PERMITS: The successful bidder agrees to obtain all work/building permits as might be required. The cost of obtaining such permits is the responsibility of the bidder. The City of Torrington reserves the right to waive local permit fees. In addition, it shall be understood that where property lines are to be considered, bidders are to verify said lines and measurements with proper City Officials prior to commencement of work.

It is to be understood that any/all specifications and/or plans or drawings contained in or developed as a result of the bid process are and shall be presented subject to the approval of the City of Torrington planning, zoning and building officials and that awards made prior to said approval are subject to cancellation.

PREVAILING WAGE: When the State of Connecticut Prevailing Wage Rate is applicable to the bid, the successful bidder must submit a Certified Payroll Record prior to any request and/or invoice for payment..

S**AFETY:**

Machine and/or Equipment Hazard Assessment and Safety Training: Upon delivery of machines and/or equipment, suppliers are required to provide to the end-user employees, at no additional charge, a training session which will emphasize hazard awareness and assessment and the safe use of such machinery/equipment.

Occupational Safety and Health Act of 1970: Seller shall warrant that the machinery, equipment or other materials covered hereby shall upon delivery to the City of Torrington, be in compliance with the standards required by said Act and any updates as pertain to or reference said Act as well as the standards required by comparable State and local laws, if any, for such machinery, equipment or other materials in effect at the time of delivery.

Machines and/or Equipment Lockout/Tagout: In an effort to comply with OSHA's final rule on the control of hazardous energy sources, vendors must warrant that any and all machines and/or equipment as is covered under this bid will be supplied and/or installed equipped with lockout/tagout devices as prescribed by OSHA.

Toxic Substance Control Act (PL94-469): Seller warrants that each and every chemical substance constituting or contained in the products sold or otherwise transferred to the City of Torrington under this bid and subsequent purchase orders is not on the list of prohibited chemical substances compiled and published by the Administrator of the Environmental Protection Agency pursuant to Act PL94-469 and are otherwise in compliance with said Act.

Hazardous Materials: Any materials required by this bid and subsequent purchase orders that are hazardous under federal, state, or local statute, ordinance, regulation, or agency order will be packaged, labeled, marked and shipped by the seller to comply with all federal, state and local regulations then in effect including but limited to the provisions of the Hazardous Materials Transportation Act and Regulations promulgated thereunder and will further comply with any special requirements and any policies and procedures of the City of Torrington relating to the purchase of hazardous materials as might be noted on subsequent purchase orders or otherwise communicated to seller in writing.

Material Safety Data Sheets: Shall be provided by the Seller upon delivery to the City of Torrington of any goods having constituents listed in the following references - OSHA 1910, ACHIG Current Threshold Values, DOT HazMat Table 49, IARC Carcinogen List, National Toxicology Program Carcinogen List, and/or Radioactive Materials. These Material Safety Data Sheets must be consistent with and include information required by the OSHA Hazard Communication Standard published as 29 CFR 1910.1200, as the same may be amended or supplemented from time to time.

Asbestos: Bidders are advised that asbestos-containing material may be located in the boiler rooms, pipe tunnels, storage areas and various portions of City buildings. Before proceeding on any contractual work on City buildings or their interiors, it is mandatory that bidders familiarize themselves with the asbestos-containing material and that said material be considered as a health hazard and all precautionary measurers according to the Ahera Rules & Regulations be observed. It is the bidder's responsibility to notify all employees and/or subcontractors of this notification.

SUBCONTRACTORS: The successful bidder shall not employ any subcontractor to fulfill any of the duties herein specified without express, prior written approval of the City of Torrington or its designated agent.

EEO: The successful bidder shall provide any/all additionally required, affirmative action statements, fair employment plans and non-discrimination programs and statement as might be required by the City of Torrington. In connection with the execution of this bid, subsequent purchase orders and/or contracts, the seller shall not discriminate against any employee or applicant for employment because of age, race, religion, color, sex or national origin. Bidders must comply with all rules & regulations of the Department of Labor with regard to Equal Employment Opportunities as pertains to municipalities.

TERMINATION OF CONTRACT: Any contract entered into by the City and the successful bidder shall provide that the City may terminate the contract upon thirty (30) days notice to the bidder.

The City of Torrington reserves the right to award or reject any or all bids, or any portion thereof, to waive technicalities, and to award the bid and/or contracts to one or more bidders submitting essentially identical proposals and, that in the city's judgment, will best serve the public interest.
The terms and conditions of these "Instructions To Bidders" are made a part this bid.

SAMPLE FORM

Bid #_____

NON-COLLUSION AFFIDAVIT

STATE OF _____ COUNTY OF _____

I,_____, being first duly sworn, deposes and says that:

1. I am _____ of_____, the bidder that has submitted the attached request for proposal for _____;

2. I am fully informed respecting the preparation and contents of the attached RFP and of all pertinent circumstances respecting such bid;

3. Such Bid is genuine and is not a collusive or sham Bid;

4. Neither the Bidder nor any of its officers, partners, owners, agents, representatives, employees or parties of interest, including this affiant, has in any way colluded, conspired, connived or agreed directly or indirectly with any other Bidder, firm or person to submit a collusive or sham Bid in connection with the work for which the attached Bid has been submitted nor has it in any manner, directly or indirectly, sought by agreement or collusion or communication or conference with any other Bidder, firm or person to fix the price or prices in the attached Bid or of any other Bidder, or to fix any overhead, profit or cost element of the Bid price or the price of any Bidder, or to secure through any collusion, conspiracy, connivance or unlawful agreement any advantage against the City of Torrington or any person interested in the proposed Bid; and

5. The price or prices quoted in the attached Bid are fair and proper and are not tainted by any collusion, conspiracy, connivance or unlawful agreement on the part of the Bidder or any of it agents, representatives, owners, employees, or parties in interest, including this affiant.

Signed _____

Title _____

Subscribed and sworn to before this _____ day of _____, 20___.

_____

_____
Notary Public

My commission expires _____

SAMPLE FORM

BID # _____

CONSENT OF SURETY COMPANY TO RELEASE FINAL PAYMENT

City ☐
Architect ☐
Contractor ☐
Surety ☐
Other ☐

PROJECT/BID NUMBER :

TO: City of Torrington
Attn: Purchasing Agent
140 Main Street
Torrington, CT 06790

CONTRACTOR: _____
_____
_____
_____

In accordance with the provisions of the Contract between the City of Torrington and the Contractor as indicated above, the (insert name & address of Surety Co.)

_____
_____
_, SURETY COMPANY on bond of (insert name & address of Contractor)_____
_____,
CONTRACTOR, hereby approves of the final payment to the Contractor, and agrees that final payment to the Contractor shall not relieve the Surety Company of any of its obligations to the CITY OF TORRINGTON as set forth in the Surety Company's bond.

Subscribed and sworn to before this
_____ day of _____, 20__.

_____
Surety Company

_____

_____
Authorized Representative's Signature

_____
Notary Public

_____
Title

My commission expires _____

BID # STG-031-113004

STAND-BY GENERATOR WITH TRANSFER CONTROLS AND

WEATHER PROTECTED HOUSING FOR STREET DEPARTMENT

1. GENERAL

1.1 DESCRIPTION

A. Provide a complete, 150KW, stand-by, emergency electric power generating system. The system must be new and delivered to the site completely wired, tested, and ready for installation. The system shall include the following:
   1. A diesel engine driven system
   2. Complete engine start-stop control & monitoring system
   3. Starting batteries with battery charger
   4. Automatic load transfer controls to provide automatic starting and stopping of the electric plant and switching of the load
   5. All accessories, control devices, components wiring & connections to provide proper system operation
   6. Test reports, documentation & services as needed to meet the performance requirements of this specification

B. The equipment, including engine-generator sets shall be manufactured by a single manufacturer who has been regularly engaged in the production of engine-generator sets for a minimum of five years.
   1. All components shall be sourced from one manufacturer who shall also be the source of supply and responsibility for all warranty, parts, and service. The manufacturer shall have a local representative who can provide a trained service person on a 24-hour per day basis, shall have stock of replacement parts and can provide technical assistance.
   2. Different manufacturers for the engine-generator set and the automatic load transfer controls will be acceptable providing the engine-generator set manufacturer is the source of parts supply and responsibility for warranty, parts, and service.
   3. The responsibility for performance to this specification in its entirety cannot be split up among individual suppliers of components but must be assumed solely by the supplier of the system.
   4. The manufacturer shall furnish schematic and wiring diagrams for the engine-generator set.
   5. All controls shall be the standard of the manufacturer. Control parts shall be identified by part numbers of the manufacturer and have at least two sources of open market supply. Control systems that are supplied by a subcontractor and not incorporated within the documentation drawings of the generator manufacturer are not acceptable.

1.2 QUALITY ASSURANCE

A. The system must meet all of NFPA 110 (level 2) or most current NFPA standards including design specifications, prototype tests, one-step full –load pickup and installation acceptance.

B. The performance of the electric plant shall be certified by an independent testing laboratory verifying the electric plant's full power rating, stability and voltage and frequency regulation.

C. The complete standby power system installation, start-up and operating instructions shall be performed under the supervision of a factory-trained engineer/representative of the system manufacturer.

D. Acceptable Manufacturers:
   1. Electric Plant:
      a. Cummins Power Generation
      b. Kohler
      c. Caterpillar
   2. Automatic Load Transfer Control
      a. Cummins Power Generation
      b. Kohler
      c. Caterpillar
      d. Automatic Switch Company

3. Equipment as described herein is that as manufactured by Cummins Power Generation at Minneapolis, Minnesota, and all equipment furnished shall be equal or better to that specified herein, including quality, operation, and function. It is the bidder's responsibility to provide sufficient documentation for the evaluation committee to easily determine equivalency.

4. The equipment spacing, mounts, electrical wiring, ventilation equipment, fuel and exhaust components have all been sized and designed around the manufacturers listed. If alternate equipment is substituted, the contractor shall be responsible for changes in the facilities work, made necessary from installation of equipment other than Cummins Power Generation, without additional cost to the Owner, and shall verify all work with the equipment manufacturer.
   a. Any bidder wishing to use substitute equipment shall submit detailed data to the Owner with the bid proposal. Complete shop drawings, diagrams, and details shall be prepared specifically for this project. Standard and typical drawings will <u>not be acceptable</u>. Data for substitute equipment shall include complete information for the following:
      1) Plan drawing to verify that substitute equipment will fit into space allocated and allow for removal and service.
      2) Allowance for proper cooling and combustion air.
      3) To verify that all interconnecting wiring and piping is accounted for, provide complete interconnecting wiring diagrams and piping diagrams.
      4) Provide the results of engineering to show compliance with the requirements for "prototype testing".
      5) Complete load study and load profile to show that engine-generator set(s) will not be overloaded during any phase of operation, including motor starting and steady-state load conditions.
      6) Specification information, factory literature, catalog sheets, etc., to show compliance with specifications.
      7) Deductions or additions to contract price for use of proposed substitute equipment.
      8) Complete list of deviations from these specifications on a so labeled attachment to the bid proposal.
      9) Short circuit study of the load circuits to verify that selective coordination and thermal and magnetic stresses on components will be equal to that specified.
      10) List of projects using similar equipment for the last 5 years.

E. Service:
   1. Replacement parts and competent service shall be available within the New England states.

1.3 <u>SUBMITTALS</u>

A. Provide complete shop drawings for the system and equipment specified, including all auxiliary devices. Shop drawing submittals shall consist of a single soft cover binder with index tabs, 3 copies and shall include:

1. Complete typewritten description of system operation(s), and ratings, including a listing of all auxiliary devices.
2. Manufacturer's data sheets and detailed dimensioned drawings for all pieces of equipment and auxiliary devices.
3. Complete interconnecting wiring diagrams, cross referenced with equipment designations indicated in the bid documents, indicating all required wiring between the electric plant control panel, the automatic load transfer controls and all auxiliary devices.
4. Independent testing laboratory reports indicating the performance test results of the electric plants including power rating, stability and voltage and frequency regulation.
5. Unless specified otherwise herein, all performance data and other information shall be as on the manufacturer's printed literature. Performance data shall be the result of test procedures in accordance with nationally recognized standards, plus such other procedures that are judged necessary by the manufacturer to insure maximum service reliability for emergency systems, and shall be available for inspection by the Engineer upon request.

1.4 TESTING

A. The intent of this specification is to provide equipment of proven reliability and compatibility. Three separate series of tests shall be performed: Factory Prototype Model Tests, Factory Production Model Tests, and Field Tests.
   1. Factory Prototype Model Tests: The electric generating system consisting of prime mover, generator, governor, coupling and all controls must have been tested as complete unit on representative engineering prototype model as required by NFPA 110. The tests, being potentially damaging to the equipment tested, must not be performed on equipment to be sold, but on separate prototype models as specified by NFPA 110, paragraph 3-2.1 thru 3-2.1.2 and their accomplishment certified by means of documentation of the tests accompanying submittal data. These tests shall have included:
      a. Maximum power level (maximum kW).
      b. Maximum motor starting capacity (maximum KVA) and voltage dip recovery within seven (7) cycles of applied load.
      c. Structural soundness (Short-Circuit and Endurance Tests).
      d. Torsiograph Analysis: The manufacturer of the engine-generator set shall verify that the engine-generator combination, as configured, is free from harmful torsional stresses. The analysis shall include correlation of empirical data from tests on a representative prototype unit. The empirical data must include spectrum analysis of the torsional transducer output within the critical speed range of the engine-generator set. Results of this analysis shall be made available to the specifier on request. Calculations based on engine and generator separately are not acceptable.
      e. Engine-generator cooling and combustion air requirements.
      f. Transient response and steady-state speed control and voltage regulation.
      g. Generator temperature rise per NEMA MG1-22.40.
      h. Harmonic analysis and voltage waveform deviation per MIL-STD-705B, method 601.4.
      i. Three-phase short-circuit test for mechanical and electrical strength. With system operating at rated volts, amps, power factor, and speed, the generator terminals must be short circuited ten times on all three phases for a duration of thirty seconds. Engine-generator set must build up and perform normally without manual interventions of any kind such as resetting of circuit breakers or other tripping devices when the short circuit is removed.
      j. Failure mode test for voltage regulator. With engine-generator set operating at no load, rated speed and voltage, the AC sensing circuit to the regulator

must be disconnected for a period of at least one hour. The engine-generator set must be fully operative after the test, and without evidence of damage.

k. Endurance testing is required to detect and correct potential electrical and mechanical problems associated with typical operation.

2. Field Tests after Installation: After installation the engine generator set and automatic load transfer controls shall be fully tested as specified herein.

1.5 WARRANTY

A. The complete standby electric power system, including 1800 r/min engine-generator set and transfer switch equipped with set exerciser, and running time meter, shall be warranted for a period of five (5) years or fifteen hundred (1,500) operating hours, whichever occurs first, from the date of Substantial Completion. Multiple warranties for individual components (engine, generator, controls, etc.) will not be acceptable. Satisfactory warranty documents must be provided. This warranty shall be detailed in available written documents submitted with the bid proposal. In the judgment of the specifying authority, the manufacturer supplying the warranty for the complete system must have necessary financial strength and technical expertise with all components supplied to provide adequate warranty support.

PART 2 - PRODUCTS

2.1 MATERIALS

A. General:

1. This system shall include Cummins Power Generation Model 150 DGFA engine-generator set as represented in the published specifications for that model. The set shall be rated for 150 kW, 187 KVA, at 0.8 PF, 60 Hz, 3 phase, 120 / 208 volts on a continuous standby basis or equal manufactured by Kohler or Caterpillar.(weather protected housing)

2. Engine-generator set shall be mounted on a heavy duty steel base to maintain proper alignment between components, and each set shall incorporate spring type vibration isolators, size and number as recommended by manufacturer, whether mounted internally or externally to the set.

B. Engine:

1. Engine shall be liquid-cooled, diesel for use with number 2 diesel fuel. Design shall be turbocharged and intercooled where required by engine manufacturer.

2. Engine shall be certified by the engine manufacturer as capable of driving a generator yielding a kW rating as specified herein. Engine shall be capable of driving the generator of this rating on a continuous standby basis for the duration of normal utility source interruptions per SAE J1349 conditions.

3. Fuel injection and valves shall not require adjustment while in service.

4. Maximum ambient air temperature 122°F.

5. Engine equipment shall include the following:

a. An electric starter(s) as required by the manufacturer.

b. Positive displacement, mechanical full pressure lubrication oil pump, full flow lubrication oil filters with replaceable elements and dipstick oil level indicator.

c. Fuel filter with replaceable element, and an engine driven, mechanical positive displacement fuel pump, all mounted on the engine.

d. Replaceable dry element air cleaner.

e. Engine speed isochronous electronic governing system to control generator frequency within ±0.25% of rated frequency under steady state load conditions, and capable of parallel operation with load sharing controls.

f. Engine protection devices shall have sensing elements located on the engine to initiate the following preliminary alarms and engine shutdowns:

1) Low coolant temperature alarm

2) Low lubrication oil pressure alarm

3) High coolant temperature alarm
4) Low lubrication oil pressure shutdown
5) High coolant temperature shutdown
6) Overspeed shutdown
7) Overcrank lockout
8) Low coolant level shutdown

g. Engine starter battery charging alternator with solid-state voltage regulator.
h. Engine mounted thermostatically controlled water jacket heater(s) for each engine to aid in quick starting. Heater(s) shall be rated 1000 watts, 208 volts, single phase, 60 Hz.

6. Cooling System:
   a. Engine shall be radiator cooled by engine mounted radiator system including belt-driven pusher fan, coolant pump, and thermostat temperature control. Performance of components shall be as required by set manufacturer.
7. Engine Exhaust System:
   a. Exhaust muffler shall be provided for each engine of a size as recommended by the set manufacturer.
   b. Stainless steel flexible exhaust connection shall be provided as required for connection between engine exhaust manifold and exhaust line, in compliance with applicable codes and regulations.
   c. All components shall be properly sized to assure proper operation without excessive back pressure when installed as shown on drawings.
8. Fuel System:
   a. Provide sub-base fuel tank with level gauge. The 24-hour tank shall be new, unused, and shall not be galvanized. Tank shall be UL listed for secondary containment, dual wall, with rupture basin switch.
   b. A low fuel supply sensing device shall be installed on the fuel tank. The sensing device shall be adjusted to signal low fuel level when the tank contains less than a three (3) hour supply. The three hour supply level shall be as recommended by the manufacturer of the engine-generator set.
   c. The fuel tank shall be provided with a drain plug, a 2 inch exterior fill line with lockable cap, and a 2 inch exterior vent line with whistle signal and approved vent cap. The locking cap shall be a minimum of 2 feet above the top of the tank. The vent shall terminate at 8 feet above finished grade.

C. Alternator:
1. Generator shall be single-bearing, 2/3rd Pitch, self-aligning, four-pole, synchronous type, revolving field, with amortisseur windings, with direct drive centrifugal blower for proper cooling and minimum noise, with temperature compensated solid-state voltage regulator, with brushless PMG exciter system. No brushes will be allowed. Telephone influence factor less than 50 per NEMA MG1-22.43.
2. Generator shall be directly connected to engine flywheel housing and driven through a flexible coupling to insure permanent alignment; gear driven generators are not acceptable under this specification.
3. Insulation shall meet NEMA standards for Class H and additionally shall meet the Quality Assurance requirements of paragraph 4 of the Cummins Power Generation "PTS" certificate.
4. The maximum alternator temperature rise shall not exceed 105°C above ambient. Generator design shall prevent potentially damaging shaft currents.
5. The three-phase, broad range, reconnectible generator shall have 12 leads brought out to allow connection by user to obtain any of the available voltages for the unit.
6. Voltage regulator shall be solid-state design and shall function by controlling the exciter magnetic field between stator and rotor to provide no load to full load regulation of rated voltage within ± 1% during steady-state conditions.

a. The engine-generator set and regulator must sustain at least 90% of no load voltage for ten (10) seconds with 250% of rated load at near zero power factor connected to its terminals.
b. The voltage regulator shall be insensitive to severe load induced waveshape distortion from SCR or thyrister circuits such as those used in battery charging (UPS) and motor speed control equipment.
c. A rheostat shall provide a minimum of ±5% voltage adjustment from rated value.

7. The generator, exciter, and voltage regulator shall be designed and manufactured by the engine-generator set manufacturer so that the characteristics shall be matched to the torque curve of the prime mover. This design allows the prime mover to use its fullest power producing capacity (without exceeding it or over compensating) at speeds lower than rated, to provide the fastest possible system recovery from transient speed dips. A system that routinely selects a linear-type (straight line) constant volts/hertz characteristic, without regard for the engine power and torque characteristics, will not meet this specification. These characteristics shall be demonstrable as follows:
   a. Calculations must demonstrate that the exciter and voltage regulator will permit utilization of at least 80% of maximum available prime mover torque at all engine speeds between 50% and rated speed, and with rated unity power factor load connected to its terminals.
8. PMG Exciter shall be three-phase, full-wave, rectified, with heavy-duty silicon diodes mounted on the common rotor shaft and sized for maximum motor starting loads.
9. Generator design shall be of the self-protecting type, as demonstrated by the prototype short-circuit test as described under "Testing" herein. All other generator performance criteria shall be equal to that of the specified equipment.

D. Engine-generator Set Control:
1. Provide a lighted, unit mounted control console that is factory built, wired, tested, and shock-mounted by the generator manufacturer. Control console shall be a rigid metal enclosure, mounted on the generator end of the set, containing all devices as specified herein, shown on the drawings, and as required for described functions.
   a. Control console shall include a control section, control panel, and cable termination box. Hinged, front-opening doors shall provide required access to all components; removable top and side panels shall provide required access to load cable entry and terminations.
   b. Control wire shall have termination identification on each wire for ease of tracing. Terminal blocks for control wires which run between generator set controls shall have identical terminations on both ends.
   c. Identification shall be provided for each device or function and shall be engraved nameplates.
   d. Metal enclosures shall be chemically treated and painted manufacturer's standard color with black control panels.
2. Engine-generator set control shall include the following.
3. Gauges and meters: oil pressure gauge, coolant temperature gauge, charge rate ammeter and running time meter.
   b. Manual selector switch: RUN-STOP-REMOTE
   c. Remote, two-wire 12 volt DC controls start-stop terminals.
   d. Manual reset circuit breaker.
   e. Automatic engine shut down for the following fault conditions:
      1) Overcrank
      2) Overspeed
      3) Low lube oil pressure
      4) High engine temperature
      5) Low coolant level

f. Remote emergency stop
g. Indicator lamps shall be provided to signal the following functions and fault conditions:
    1) RUN - indicates start disconnect
    2) FAULT - indicates Overcrank, Overspeed, High Coolant Temperature, Low Oil Pressure, Low Coolant Level, Low Fuel System. Only first five faults shall be shut down faults.
    3) OVERCRANK - indicates the starter has been locked out because cranking time was excessive.
    4) OVERSPEED - indicates engine has shut down because of excessive r/min
    5) HIGH ENGINE TEMPERATURE - indicates engine has shut down because of critically high temperature.
    6) LOW OIL PRESSURE - indicates engine has shutdown because of critically low oil pressure.
    7) PRE HIGH ENGINE TEMPERATURE - indicates engine temperature is marginally high.
    8) PRE LOW OIL PRESSURE - indicates oil pressure is marginally low.
    9) LOW ENGINE TEMPERATURE - indicates engine temperature is marginally low for starting.
    10) SWITCH OFF (flashing) - indicates control switch is in the "STOP" position.
    11) LOW FUEL - indicates fuel supply is marginally low in either the day tank or main tank.
    12) LOW COOLANT LEVEL - indicates that coolant level in radiator is too low.
h. Any fault condition shall sound an audible alarm on the control enclosure and close a contact for remote annunciation. The shutdown faults shall shut off the engine-generator set as well. A fault reset switch shall be provided to clear fault indications and silence the audible alarm, if condition has been rectified, and allow restarting of the engine after shut down faults. Provide separate silence switch to allow silencing alarm until condition is rectified. The control design shall be such that the fault indication shall remain until reset. The fault indicator memory shall not be dependent on the presence of either A-C or D-C voltage and shall retain the fault status memory even through complete removal and replacement of the starting batteries. The fault reset function shall operate only when the RUN-STOP-REMOTE switch is in the STOP position.
i. Output circuit breakers sized as shown on the Drawings. The output circuit breaker shall <u>not</u> be housed in the automatic load transfer controls enclosure.
j. A locking screw driver type potentiometer shall be provided to adjust the voltage ±2% from rated value.
k. The generator set shall be provided with an AC metering set with the following features and functions:
    1) 2.5 inch, 90 degree scale analog voltmeter, ammeter, frequency meter and kilowatt (kW) meter. Meters shall be provided with phase select switch and an indicating lamp for upper and lower scale on the meters.
    2) Digital metering set, 0.5% accuracy, RMS type, to indicate generator voltage, frequency, output current, output KW, kilowatt hours, and power factor. Generator voltage shall be available in line-to-line and line-to-neutral voltages, and shall display all three phase voltages (line-to-line or line-to-neutral) or output current simultaneously.
l. Running time meter, 9,999.9 maximum reading in hours.

E. Auxiliary Equipment:

1. Starting Battery: Two (2) batteries shall be supplied and shall be mounted in a battery rack within the engine-generator set skidbase. Batteries shall be 12 volt, heavy duty, diesel starting lead-acid type.
2. Battery Charger(s): A voltage regulated battery charger shall be provided for each engine-generator set. Chargers shall be equipped with float, taper, and equalize charge settings. Provide charger with 20 foot, 14 gauge, 3 conductor cord with molded plug.
3. A 120 VAC heater with thermostat shall be provided within the engine-generator set control panel to eliminate condensation.
4. Weather protective housing (exterior location installation)
5. Remote emergency stop station.

F. Automatic Load Transfer Switch:
1. General: The transfer switch shall be designed, built, tested, furnished and warranted by the manufacturer of the engine-generator set to ensure one source of responsibility and equipment compatibility. A transfer switch manufactured by a different manufacturer may be equivalent providing the engine-generator and transfer switch is tested, furnished and warranted by the manufacturer of the engine-generator set.
2. An approved transfer switch manufacturer shall have been regularly engaged in the production of U.L. (Underwriters Laboratory) Standard 1008 Listed transfer switch. The transfer switch shall be documented, and have been offered for sale on the open market for a minimum of five (5) years. The manufacturer shall provide factory trained parts and service support through a factory authorized distributor that is regularly doing business in the area of the installation.
3. The manufacturer shall supply literature containing diagrams, parts lists and descriptions sufficient for the owners personnel, or subcontract supplier to install, operate and perform normal maintenance on the equipment.
4. Testing: To provide proven reliability of the system, transfer switch shall be completely tested as follows:
   a. Representative production samples of the transfer switch supplied, shall be demonstrable, through tests, the ability to withstand at least 10,000 mechanical operating cycles. An operating cycle shall consist of one (1) electrically operated transfer from normal to emergency and back to normal.
   b. During the development of the original transfer switching mechanism for this family of transfer switch, a prototype of the transfer switching mechanism shall have passed the environmental tests listed in Military Standard, Mil-Std-202E. These tests shall include Method 101D-Condition B, Salt Spray-Corrosion; Method 103B-Condition B, Humidity; Method 107D-Condition A, Thermal Shock; Method 110A Sand and Dust.
   c. Transfer switch shall be U.L. Listed per Standard 1008. The minimum WCR (Withstand and Closing Current Ratings) shall meet the requirements of U.L. Standard 1008 and shall be obtained without contact welding. Where the line side overcurrent protection is provided by circuit breakers at 208 volts AC or less, the short circuit WCR shall be as follows:

TRANSFER SWITCH CONTINUOUS CURRENT RATINGS	K & J/L* FUSES	WITHSTAND AND CLOSING RATINGS
40A, 70A, 100A	125A/200A*	14,000A RMS
150A, 260A	400A/600A*	30,000A RMS
400A, 600A	1200A/1200A*	65,000A RMS
800A, 1000A	2000A/2000A*	65,000A RMS

* Class J and L Fuses WCR = 200,000A RMS

1) The RMS (root Mean Square) symmetrical fault current ratings shall be verified by U.L. witnessed tests on representative test samples. All WCR tests shall be performed with the overcurrent protective devices located external to the transfer switch. Tests conducted with overcurrent protective devices internal to the transfer switch, in such a manner that the transfer switch interrupts the current rather than withstanding the current, are not acceptable under this definition of withstand.
2) Where the line side overcurrent protection is provided by current-limiting fuses, the fuses shall be U.L. Class RK1, RK5, J, or L (with the fuse sizes being no larger than the U.L. listed maximum ratings or component recognition procedures for the transfer switches supplied). The transfer switch closing rating shall be suitable for 200,000A available fault current, as verified by U.L. witnessed tests on representative test samples.

d. Provide testing as specified herein.

5. Ratings: All transfer switches shall be U.L. Listed per Standard 1008. All transfer switch shall be suitable for use on emergency and legally required standby systems in accordance with ANSI-C1 and NFPA-99, rated for total system load. These loads shall include motors, electric discharge lamps, resistive loads, and tungsten lamps as described in Section 1 of U.L. 1008 Standard.
6. Transfer switch shall be 60 Hz. Refer to drawings for the number and locations of transfer switch, number of phases, number of poles, voltage, and ampere ratings.
7. Transfer switch shall be rated to carry 100 percent of their rated current continuously when in an enclosure. Transfer switch which must be derated when installed in an enclosure (due to integral overcurrent devices or any other reasons) do not meet this specification. Transfer switch shall be rated for continuous operation in ambient temperatures of -40° C (-40°F) to 67°C (142°F).
8. Construction: Transfer switch shall be over center operation, double-throw construction, positively electrically and mechanically interlocked by a simple mechanical beam to prevent simultaneous closing (for break before make operation), and mechanically held in both normal and emergency positions.
   a. Transfer switch shall be quick-break, quick-make operation so that the speed of opening and closing is not controlled by an operator during manual operation. Transfer switches shall provide a center "Programmed Transition" position for manual switching.
   b. Transfer switch shall be approved for manual operation under full load by integral mounted, permanently attached, high dielectric, manual operating handles. Manual operating handles, which are normally stored and must be installed for manual operation, do not meet this specification.
   c. The electrical operating means shall be a direct-acting, constant force in both directions, bi-directional linear induction motor to provide minimum friction, straight-line switch action. Motor shall be attached directly to the switching mechanism without the use of gears, cams, or other complex mechanical linkage methods.
   d. Transfer switch shall not contain any integral overcurrent devices in the main power circuit, including molded case circuit breakers or fuses.
   e. The transfer switch electrical actuator shall have an independent disconnect means to disable the electrical operation during manual switching.
   f. Manual operating handles and controls (other than key- operated switches) shall be accessible to authorized personnel only by opening the keylocking cabinet door. Transfer switches located on the outside of the cabinet do not meet this specification.
   g. Unless noted or specified otherwise, transfer switch shall be mounted in separate NEMA 1 cabinet enclosures with key-locking front doors.

h. Maximum transfer time in either direction shall be six (6) cycles, except where the "Programmed Transition" feature is furnished.
i. Transfer switch shall have transparent protective covers to protect operating personnel during manual operation, and to allow an operator to visually determine that the main contacts are "Open" or "Closed".
j. The main switch contacts shall be of the no maintenance type and high pressure silver cadmium oxide to resist burning and pitting for long life operation. All switches shall have arc chutes of heat absorbing material and metal leaves for positive extinguishing of arcs quickly and effectively; arc chutes shall have insulating covers to prevent interphase flashover.
k. Transfer switch shall have one (1) S.P.D.T. (Single Pole Double Throw), 208 volts auxiliary switch on both the normal and emergency-sides, operated by the transfer switch. These auxiliary switches shall be factory wired to an easy access terminal block and may be used to monitor transfer switch position for controlling indicator lamps or other peripheral equipment.
l. Complete AL-CU (Aluminum-Copper) lugs, U.L. listed and CSA certified, shall be provided for both normal and emergency load positions. For 150A and larger transfer switches, top or bottom feed for load connections shall be provided for slimmer design, requiring less wall space. Load connections shall be field changeable either from top-to-bottom or bottom-to-top. Wiring space at normal, emergency, and load lugs inside the transfer switch cabinet shall comply with 1996 NEC Table 373-6(b). Full rated neutral bar with lugs for normal, emergency, and load neutral conductors shall be provided inside the cabinet.
m. Relay, with 2 N.O. and 2 N.C. contacts that is energized whenever the normal source is available regardless of switch position.
n. Relay with 2 N.O. and 2 N.C. contacts that is energized whenever the emergency source is available regardless of switch position.

9. Controls: Control accessories, either electronic or relay, shall be mounted in a separate smaller cabinet mounted on the inside of the main cabinet door. This is to allow for ease of service when the main cabinet lockable door is opened, but to prevent access by unauthorized personnel.
   a. Control circuit disconnect plugs shall be provided to reenergize control circuits to avoid the hazards of electrical shock to personnel while making adjustments.
   b. The Power Sentry electronic control, undervoltage and time delay modules, shall be a printed circuit board for ease of service. The solid-state undervoltage sensors shall simultaneously monitor all phases of the normal and emergency power sources to provide field adjustable range sensors for specific applications.
      1) Voltage pickup settings shall be adjustable from a minimum of 85% to a maximum of 100% of nominal voltage. Voltage dropout settings shall be adjustable from a minimum of 74% to a maximum of 98% of the pickup setting with a fixed dropout time delay of 0.5 second.
      2) Voltage sensors shall be of the temperature compensated type, for maximum deviation over the temperature range of -32°C (-25°F) to 79°C (175°F). Voltage sensors shall allow for adjustment to sense partial loss of voltage on any phase of the normal or emergency power source, even where motor feedback voltages exist.
   c. The Overvoltage and Frequency Sensing control, overvoltage and frequency sensing module, shall be a printed circuit board for ease of service. The solid-state overvoltage sensor(s) shall simultaneously monitor all phases of the source(s) to provide field adjustable ranges of voltage pickup and dropout and time delays. Frequency sensor(s) shall simultaneously monitor all phases of

the source(s) to provide field adjustable ranges of frequency pickup and dropout and time delays.
   1) Overvoltage for both the emergency and normal sources.
   2) Under/over frequency sensing for the emergency source.

d. Controls shall signal the emergency power system to start upon signal from normal source voltage sensors. Solid-state adjustable time delay (0-90 sec) start shall avoid nuisance engine-generator set start-ups on momentary voltage dips or interruptions.

e. The transfer switch shall transfer the load to the emergency power system after the engine-generator set reaches proper voltage and frequency and has stabilized.

f. The transfer switch shall control the engine-generator set to allow the set to start and transfer the load within 10 seconds (adjustable from 2 to 120 sec) after a normal source power failure. It shall be the responsibility of the transfer switch supplier to meet this requirement.

g. The transfer switch shall retransfer the load to the normal source after normal source power is restored, allowing normal source to stabilize before retransfer and shall allow staggered retransfer of loads in multiple transfer switch systems. Retransfer time delay shall be adjustable from 0-30 min.

h. The controls shall signal the engine-generator set(s) to stop after load retransfer to the normal source, but shall maintain the availability of the emergency source in the event that the normal source fails shortly after retransfer, The controls shall allow the engine-generator set(s) to run unloaded for a cooldown period prior to shut down (adjustable from 0 to 10 min).

i. The controls shall provide an automatic retransfer of the load from the emergency source to the normal source if the emergency source fails when the normal source is available.

j. The transfer switch operating power for transfer and retransfer shall be obtained from the source to which the load is being transferred.

k. Controls shall provide built-in "Control Mode Status" indicators, mounted on the interior of the enclosure, consisting of L.E.D.s (Light Emitting Diodes) to indicate a sequence of functions such as the following:
   1) Source 1 OK
   2) 2-Wire Run
   3) Source 2 Ok
   4) Timing for Transfer
   5) Transfer Command
   6) Timing for Retransfer
   7) Retransfer Command
   8) Timing for Stop

l. The indicators shall allow the operator to determine that the controls are properly sequencing and shall assist in determining the sequence of any malfunctions that might occur.

m. Main cabinet front door mounted controls and indicator lamps shall consist of oil-tight, neon position indicator lamps (NORMAL - White and EMERGENCY - Amber) and key-operated Test and Selector switches to provide the following functions:
   1) TEST - Simulated normal source power loss to control unit for testing engine-generator set capability. Provide selector switch inside cabinet to allow for choice of load transfer or test without transfer.
   2) NORMAL - Normal operating position and also restores the system to stand by operation; and if load was transferred, retransfers load from emergency to normal source after test and time delays.

3) RETRANSFER - Spring-loaded momentary position of switch, that overrides retransfer time delay to cause the immediate return to the normal source after a test or actual power outage.

n. Transfer switch shall have the "Programmed Transition" feature factory installed. This feature shall consist of a Program Timer plugged into a timing receptacle. This provides the capability of either factory or field installation or modifications of this feature. This feature shall incorporate a field adjustable time delay (0.5 to 5 seconds). The time delay shall occur during switching in both directions, during which time the load is isolated from both normal and emergency sources. This will allow residual voltage components of motors or other inductive loads (such as transformers) to decay before completing the switching cycle.

o. The Program Timer shall be connected in a manner that will not cause the time delay in switching, where the time delay has already been established by the loss of voltage to the load during normal source power interruptions.

10. Switch shall be equipped with the following items:

a. Provide Exerciser clock to set day-of-week (one week dial minimum), time-of-day, and duration-of-time of engine-generator set(s) exercise. A period with/without load selector switch.

b. Battery Charger: A voltage regulated battery charger shall be provided for engine-generator set. Charger shall be equipped with float and taper charge settings.

c. Provide Manual-Automatic retransfer selector switch. After normal source is restored, this switch provides either manual or automatic retransfer after the retransfer time delay has expired in the automatic position, or manual retransfer at a time selected by an operator.

PART 3 - EXECUTION

3.1 INSTALLATION

A. Installation shall be made in complete accordance with manufacturer's recommendations.

B. Install unit on concrete base located outside of building and provide for servicing access and oil pan removal.

D. Flexible connections shall be used on all connections to unit.

E. Fill the engine cooling system with a solution of 50 percent ethylene glycol and water.

F. Bond steel base, generator and engine frames and all equipment enclosures to main ground electrodes.

3.2 FIELD TESTS AFTER INSTALLATION

A. The complete installation shall be initially started and checked out for operational compliance by factory-trained representative(s) of the engine-generator set(s) manufacturer. The engine lubrication oil as recommended by the manufacturer for operation under environmental conditions specified, shall be provided by the engine-generator set(s) supplier.

B. Upon completion of initial start-up and system checkout, the supplier of the system shall perform a field test in the presence of the Contractor, Engineer and Owner's operating personnel to demonstrate load carrying capability and voltage and frequency stability.

C. The Contractor shall supply fuel for generator, water for pumps, and complete electrical system operating and functional in order to verify that generator will start the connected loads in the order specified.

D. A power failure shall be initiated by opening all switches or breakers supplying the normal power to the building or facility. Load shall consist of building load plus load bank if required. Unity power factor is suitable for on-site testing, provided that rated load tests at power factor have been performed by the manufacturer prior to shipment.

1. Records shall be maintained throughout the tests consisting of:
    a. Time-of-day
    b. Coolant temperature
    c. Cranking time until prime mover starts and runs
    d. Time required to come up to operating speed, voltage and frequency overshoot
    e. Time required to achieve steady-state condition with all switches transferred to the emergency position
    f. Voltage
    g. Frequency
    h. Current
    i. Oil pressure
    j. Ambient air temperature
    k. Kilowatts
    l. Power factor
    m. Battery charger rate at 5 minute intervals for the first 15 minutes
2. Data shall be recorded at 15 minute intervals throughout the test.
3. Continue this load test for 2 hours observing and recording load changes and the resultant effect on voltage and frequency.
4. Return normal power, record the time delay on retransfer for each switch (set for 15 minutes minimum) and the time delay on prime mover cooldown period and shutdown.
5. Upon completion of the above test, allow the prime mover to cool for 5 minutes. Then apply full rated load (nameplate kW) consisting of building load supplemented by a load bank if required. This full-load pickup shall be in one step immediately upon reaching rated r/min.
6. During or after the tests, the Owner's operating personnel shall be fully instructed by the factory-trained representative in the operation and maintenance of this equipment.