RESPONSES TO THE NUCLEAR REGULATORY COMMISSION REQUESTS FOR ADDITIONAL INFORMATION DELAVAL DIESEL GENERATOR EVALUATION CATAWBA NUCLEAR STATION UNITS 1&2

PREPARED BY
DUKE POWER COMPANY
FEBRUARY 9, 1984

1. Provide a copy of the procurement specifications to which the standby diesel generators (DG) were ordered.

RESPONSE

Copies of the original bid specification (Specification CNS-1301.00-00-0002 Rev. 0) and the current specification (Specification CNS-1301.00-00-0002 Rev 3) are provided as Attachments 1-1 and 1-2 to this response.

ATTACHMENT 1-1

SPECIFICATION NO. CNS-1301.00-2

DATE October 3, 1974

OFFICE COPY

Not to be removed from File.

Nuclear Safety Related

DUKE POWER COMPANY

CATAWBA NUCLEAR STATION

UNITS 1 & 2

Title: Diesel Electric Generating Units

REVISION LOG

1_____

2_____

3_____

4_____

5_____

Form 301.1/Rev.1

STATE OF NORTH CAROLINA

COUNTY OF MECKLENBURG

A F F I D A V I T

Gail G. Davis, being duly sworn, says that:

1. She is Supervisor, Clerical Services Section, General Services Division, Design Engineering Department, Duke Power Company, Charlotte, North Carolina.

2. That Specification No. CNS-1301.00-2, Revision 0, attached herewith is a true copy of the original.

3. That the original of said Specification was inadvertently destroyed, and that verifying initials and dates replacing the original are on Form 301.2, also attached.

4. That this true copy of the original is now located in the correspondence files area of the Clerical Services Division.

Gail G. Davis
Affiant

Sworn to and subscribed before me this the
4th day of April, 1975.

Carolyn C. Smith
Notary Public
My Commission Expires: 4/24/78

VERIFICATION OF SPECIFICATION

Station and Unit Number: Catawba Nuclear Station Units #1 & #2

Title of Specification: Diesel Electric Generating Units

File Number: CN 1301.00-2

Revision:

This document specifies items related to nuclear safety. In accordance with established procedures, its quality has been assured. Signatures certify that the above specification was originated, checked, approved and inspected (or waived) as noted below:

Prepared By: John W Woodruff Date: 10/3/74 (JWW 3/27/75)

Checked By: J F Voglewede QPV 3/27/75 Date: 10/3/74 QPV 3/27/75

Approved By: M. J. Tuckey Jr Date: 10/3/74 MJT 3/27/75

Inspection Waived By: Date:

Inspection Waived For: ELECTRICAL MECHANICAL CIVIL

Inspected By: J.D.Wylie IDW Date: 10-3-74 3-28-75

Inspected By: S B Yager Date: 10-3-74 4-1-75

DIVISION QUALITY ASSURANCE Date: 10/4/74 3/27/75

****

(FOR ASME CODE ITEMS)

Division Date:

Design Engineering Department

This is to certify that the above specification has been reviewed by me, the undersigned, and is correct, complete, and in compliance with 1971 Edition of ASME Code, Section III, Paragraph NA-3250.

(SEAL) SIGNATURE:

NAME:

Registered Professional Engineer

State & No.

Form 301.2 Rev. 1

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DUKE POWER COMPANY
DIESEL ELECTRIC GENERATING UNITS

1. GENERAL

1.1 Scope: This specification covers the manufacture and delivery of: four (4) 6000 KW at 0.8 Power Factor, 4160 Volt, 3 phase, 60 hertz, single-engine Emergency Diesel Electric Generating Sets for Catawba Nuclear Station Units 1 & 2.

1.2 Installation Site: This equipment is to be installed at Catawba Nuclear Station.

1.3 Definitions:
Owner - Duke Power Company
Purchaser - Mill Power Supply Company
Contractor - Person or corporation to whom work is awarded
Bidder - Person or corporation who responds to purchaser's inquiry
Responsible Engineer - The Engineer designated as responsible for a particular piece of equipment.

1.4 Codes or Standards: The equipment specified is to be in accordance with the latest applicable standards of ANSI, IEEE and NEMA as listed below. In the event of conflict with any requirement of this specification, this specification will take precedence. In addition, the Bidder should notify the Owner per Section 14.

1.4.1 ANSI C50.10 - General Requirements for Synchronous Machines. 1965

1.4.2 ANSI C50.12 - Requirements of Salient Pole Synchronous Generators and Condensers. 1965

1.4.3 NEMA - Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines.

1.4.4 IEEE 43 - Recommended Practice for Testing Insulation Resistance of Rotating Machines. 1971 (Also ANSI C50.22-1972)

1.4.5 IEEE 51 - Guide Principles for Dielectric Tests. 1955

1.4.6 IEEE 115 - Test Procedures for Synchronous Machines. 1965

1.4.7 IEEE 275 - Test Procedure for Evaluation of Systems of Insulating Material for Electric Machinery Employing Form Wound Pre-Insulated Stator Coils. 1972

1.4.8 IEEE 308 - IEEE Criteria for Class IE Electrical Systems for Nuclear Power Generating Stations. 1971

1.4.9 IEEE 323 - General Guide for Qualifying Class 1 Electric Equipment for Nuclear Power Generating Stations. 1971

1.4.10 NEMA MG-1 - NEMA Standard for Motors and Generators 1972
Section 1 - Parts 1 and 2
Section 11 - Parts 10, 11 and 14
Section 111 - Parts 20 and 22

1.4.11 IEEE 112A - Test Procedure for Polyphase Induction Motors and Generators, 1964

1.4.12 A.E.C. Safety Guide #9 - Selection of Diesel Generator Set Capacity for Standby Power Supplies. 3-10-71.

1.4.13 IEEE STD 387 - 1972 - IEEE Trial - Use Standard: Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations. 1972.

1.4.14 IEEE 344 - Trial Use Guide for Seismic Qualification of Class 1 Electrical Equipment for Nuclear Power Generating Stations. 1972

1.4.15 AEC Safety Guide #6 - Independence Between Redundant Standby (On Site) Power Sources and Between Their Distribution System. 3-10-71.

1.4.16 Section III, Class 3 of ASME Boiler and Pressure Vessel Code Section III, Dated 1974.

1.4.17 NFPA No. 30 - Flammable and Combustible Liquids code.

1.4.18 NFPA No. 37 - Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

1.4.19 Title 10 Code of Federal Regulations, Section 50, Appendix,B, Quality Assurance Criteria for Nuclear Power Plant and Fuel Reprocessing Plants.

1.4.20 ANSI N45.2-1971, Quality Assurance Program Requirements for Nuclear Power Plants.

1.4.21 ANSI N45.2.2-1972.

1.5 (This section applicable to Owner only - see procedure EEQS 7.3.2.5.1)

Material and Equipment Status System Information:

Responsible Engineer J. P. Voglewede/J. W. Woodruff
Engineering Target Purchase Order Release Date 11-15-74
Date Specification sent to Mill Power _____

Line Item No.	Description	Qty. Unit of Measure	Quantity
1	Diesel Electric Generating Units	1 each	4

2. REFERENCE DRAWINGS AND DOCUMENTS

2.1 Codes and standards identified in paragraph 1.4.

3. OPERATING CONDITIONS AND REQUIREMENTS

3.1 The Diesel Electric Generating Sets are to be used as a source of on site Emergency Standby Power. Each set will furnish standby power to the Class IE distribution system loads for emergency shutdown of the two 1150 MW Catawba nuclear reactor- turbine-generator units. Each Diesel Engine-Generator set shall be housed in a separate room, a part of the Auxiliary Building, meeting all the requirements of a Class I structure for nuclear power plants. The diesel sets are to be operated at an elevation of 556 feet above sea level, indoors, 55°F to 125°F (Dry Bulb) environment ambient temperature range and 10% to 25% environment relative humidity range.

3.2 The maximum room ambient temperature of the Diesel Room will be 125°F and all equipment located in this room shall be capable of operating under these conditions for a continuous period. The air supply for the engine shall be taken from outside the diesel rooms and will be a maximum of 100°F during the summer months.

3.3 Each engine generator unit is to operate unattended at rated full load, voltage and frequency under the emergency condition for an indefinite period until manually shut down.

3.4 The diesel-generator units shall start automatically with no A.C. power available, accelerate to synchronous generator speed and acquire rated voltage upon receipt of Owner's "Start Diesel Signal"or Engineered Safeguard Signal.

3.5 All equipment is to have a minimum design life of forty (40) years with normal use and maintenance.

3.6 Vendor shall submit maximum inbalance on all rotating parts for approval by Owner.

4. EQUIPMENT TO BE FURNISHED

4.1 Engines

4.1.1 Four (4), 4 stroke cycle diesel engines rated at 6000 KW at 0.8 Power Factor each for continuous operation. The diesel engines shall be turbo-charged, multi-cylinder, Vee-type of manufacturer's current design for stationary service. The engine shall be direct connected to either an engine type or single bearing bracket type generator of electrical characteristic required to meet conditions of motor loads. The rated speed of the engine shall not exceed that of the manufacturer's engines of the same configuration already in operation for base load or emergency electrical power generation.

4.1.2 The Engine shall be suitable for continuous power generation duty, engineered, designed, manufactured and tested in accordance with the applicable DEMA (Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines) Standard.

4.1.3 The engine with its generator and exciter shall be engineered and designed as a complete unit, and shall be free of all deleterious critical speeds of torsional vibration within the range of 90 to 110% of normal operating speed. Any such critical speed of torsional vibration deemed objectionable by the purchaser shall be sufficient cause for rejection of the equipment.

4.1.4 The engine shall be capable of operating at 110% of rated speed without overstressing of any parts.

4.1.5 All parts and equipment incorporated into the units, their associated equipment and auxiliaries shall be new and the latest standard product of the manufacturer regularly engaged in the production of such equipment. All relays are to be of Cutler Hammer make and all pressure switches are to be of Custom Component make. Any substitution must be approved by the owner.

4.1.6 The engine is to be up to generator synchronous speed within 10 seconds from signal to start from a cold or hot condition and begin acceptance of load according to loading Table I attached.

4.1.7 The engine must be capable of positive start.

4.1.8 The engine's fuel is to be Diesel Fuel Oil #2.

4.1.9 The engine shall be able to operate at 6600KW continous for a period of two hours out of every twenty-four hours without affecting the life of the unit. The overload capacity shall be guaranteed and shall not unduly stress or overheat the units.

4.1.10 All major parts of the engine (piston, connecting rods, cylinder heads, crankshaft, flywheel, etc.) are to be Non Destructive Tested to insure the best quality of components are used in the equipment. Attachment II outlines the minimum Non Destructive Examination of critical components required by the Owner. However, any further NDT performed by the Contractor as a normal task in the manufacturing of any component shall be so stated by the Contractor and shall be included. All documentation shall be submitted to Owner.

4.1.11 The engine is to be capable of full load rejection at 10% overload without shutting down or damaging engine.

4.2 Basic Engine Accessory Equipment

4.2.1 Air inlet manifold.

4.2.2 Turbocharger air aftercooler.

4.2.3 Turbocharger and related auxiliary equipment.

4.2.4 Engine Flywheel.

4.2.5 Extension shaft and outboard bearing.

4.2.6 All engine accessory piping, including inlet and outlet connections for jacket water, lubricating oil, fuel, starting air, combustion air and exhaust, and any nonstandard companion flanges.

4.2.7 Exhaust manifold.

4.2.8 Lubricating oil sump (if required) including remote reading level indicator.

4.2.9 Attached pump for lubricating oil circulation.

4.2.10 Indicator pressure connection and shut-off cock for each cylinder.

4.2.11 Electric load and speed sensing and mechanical governors (Woodward EGB or equal), including control box, resistor box and potentiometer (droop and isochronous mode required).

4.2.12 Overspeed shutdown device.

4.2.13 Crankcase pressure relief valves.

4.2.14 Engine mounted and driven fuel oil booster pump.

4.2.15 DC motor driven fuel oil booster pump.

4.2.16 Flywheel barring device.

4.2.17 Temperature sensors for remote readout or indication on all critical sensing points (i.e. jacket water inlet and outlet, lubricating oil inlet and outlet etc.).

4.2.18 Temperature detectors on all engine bearings.

4.2.19 All oil strainers are to be of the double element type to allow changeout on one and not affect the engine while operating.

4.2.20 Speed switches are to be of the Airpax type with two separate pickups and control boxes furnished. At least three (3) separate different speed contacts are to be furnished on each control box.

4.2.21 Dual air starting system with the minimum capability of three (3) successive cold starts from each tank.

4.3 Generator, Exciter and Voltage Regulator

4.3.1 Each generator shall be salient pole, revolving field, synchronous, engine shaft driven with top air discharge The make is to be General Electric.

4.3.2 The generator shall have a minimum continuous capacity of 6000 KW at 0.8 lagging power factor, 4160 volts y/2400, 60 Hz, 3Ø with additional 10% overload capacity at 0.8 power factor for a period of two hours out of every twenty-four hours without affecting the life of the unit. The overload capacity shall be guaranteed and shall not unduly stress or overheat the units. The generator system is to be sized to enable starting and running loads as listed in table 1.

4.3.3 The duty shall be continuous.

4.3.4 The generator insulation shall be Class F with a temperature rise 95°C by embedded detecor over a 50°C ambient temperature at rated capacity.

4.3.5 The grounding transformer for each generator shall be specified later.

4.3.6 The speed of the generator shall be that of the engine.

4.3.7 The generator field exciter is to be of the static type with an operating frequency range from 58 to 62 Hertz.

4.3.8 The voltage regulator is to be the static type. The make is to be General Electric.

4.3.9 The generator stator is to have at least six temperature detectors (10 ohms at 25°C) located in accordance with ANSI C50.10. The RTD converters and power supplies are to be furnished by the contractor.

4.3.10 Maximum momentary generator voltage drop after application of each load is not to exceed 25% of rated generator voltage. Further, generator voltage shall recover to at least 90% of nominal and frequency shall be restored to at least 98% of nominal in less than 40% of each load sequence time interval.

4.3.11 Each diesel generator unit is to have the capability of automatically starting unattended at any time on a start signal and come up to rated frequency and voltage within ten (10) seconds. At the time the unit reaches rated speed it shall carry the emergency loads per the loading and time sequence as shown in table 1.

4.3.12 The generator shall be equipped with a means for heating which shall be adequate to maintain the internal temperature above the dew point when the equipment is idle. Heater leads are to be brought out to a terminal box suitable for Owner's connection.

4.3.13 Surge Protection is to be supplied for the Generator and will be furnished by the Contractor.

4.3.14 All relays are to be of Cutler Hammer make. Any substitutions are to be approved by the owner.

4.4 Air Intake System

4.4.1 The air intake system shall consist of silencer, dry type filter, flexible hose connection and piping.

4.4.2 The silencer and dry type filter are to be an in-line residential type, and are to be furnished by the contractor.

4.4.3 The Owner will connect his air intake piping to the silencer through a flexible hose. The flexible hose will be furnished by the contractor while the air intake piping will be furnished by the Owner.

4.5 Exhaust System

4.5.1 The exhaust system shall consist of flexible connections, mufflers and piping for each engine.

4.5.2 The flexible connection is to be a high grade of flexible metal, with flanged ends to assure expansion protection and vibration isolation.

4.5.3 The muffler is to be residential type, spark arresting, suitable for either horizontal or vertical service.

4.5.4 The exhaust piping shall be furnished by the Owner. The Contractor is to review the Owner's exhaust piping layout and advise the Owner how much the exhaust back pressure will effect the engine KW output.

4.6 Fuel Oil System

4.6.1 A complete fuel oil system (less yard storage tank which is to be furnished by the owner) is to be furnished for each diesel.

4.6.2 The engine fuel is to be commercial grade #2 and shall start the engine from cold condition by heat of compression without any auxiliary preheating of fuel.

4.6.3 Filters are to be duplex, replaceable cartridge type. Two filters are to be connected in parallel so as to enable the Owner to change one filter without affecting the operative ability of the unit.

4.6.4 Fuel lines are to be heavy seamless double rolled steel tubing of equal length to all cylinders between injection pumps and engine.

4.6.5 Each engine shall have an engine driven fuel oil booster pump and a DC motor driven fuel oil booster pump. The DC fuel oil booster pump is to supply fuel to the cylinders at the time of signal for engine start.

4.6.6 Each engine is to have a fuel oil day tank with two (2) separate float switches (each having low level and high level contacts), a liquid level indicator, automatic controls for maintaining tank fuel oil level for a minimum of 500 gallons.

4.6.7 Each engine is to have a fuel oil transfer pump for transferring fuel oil from the storage tank to the day tank.

4.7 Lubricating Oil System

4.7.1 A complete lube oil system shall be furnished by the Contractor to supply oil under pressure to the main and crank pin bearings, pistons, piston pins, timing gears, cam shaft bearings and rocker arm bearings. The maximum stabilzed oil temperature leaving the engine when the engine is carrying the short-time rating load in an ambient temperature of 125°F shall not exceed the manufacturer's maximum safe value.

4.7.2 The main lube oil pump shall be engine driven and shall supply lube oil at a constant pressure at all points requiring lubrication.

4.7.3 Strainers shall be of the full-flow duplex type. Each strainer arrangement is to have two units connected in parallel so one can be removed without effecting the operation of the diesel unit.

4.7.4 The lube oil filters are to be arranged such that changing oil filter cartridges out will not effect the operation of the diesel unit.

4.7.5 Pressure gauges shall be furnished on the inlets and outlets of all strainers and filters.

4.7.6 An electric motor driven oil pump shall be furnished to prelube the bearings on a programmed basis. Controls for this pump shall be so arranged that it will be able to continuously circulate warm oil through the engine when the engine is inoperative. Heaters are to be provided for heating the oil.

4.7.7 A pressure sensing device shall be furnished in the system to signal when the lube oil pressure drops to a predetermined low value. A low-low oil pressure alarm shall be furnished in the system to signal when the lube oil pressure drops to the lowest safe operating level. An engine shutdown safety device shall be provided for protection of the engine.

4.7.8 A lube oil cooler is to be supplied with each engine to maintain a safe temperature for the lube oil while operating normally and at its short time rating. The cooler is to be shell and tube type with removable tube bundles.

4.7.9 The crankcase shall be provided with suitable sump and drain to remove the lube oil.

4.8 Cooling Water System

4.8.1 Each engine cooling water system shall be furnished complete, including expansion tank, heat exchangers, temperature regulators, pressure gauges, thermometers, control instrumentation, piping, valves, fittings, engine driven jacket water pump, motor-driven jacket pump that may be used for circulating warm water through the engine when the engine is not operating, combustion air cooler, intercooler and/or aftercooler, any other cooling water pumps required by the engine's design, and miscellaneous piping for a completely satisfactory operating system.

4.8.2 Temperature control of the system shall be through valves located in the closed loop side of the main heat exchanger and not on the cooling pond side. The cooling pond side water flow through the heat exchanger will be 900 gpm, 150 psig max. at 95°F max.

4.9 Starting Air System

Two complete systems including tanks and compressors are to be provided so that the engine can be started from either one.

4.9.1 Each tank will have sufficient air capacity to provide a minimum of three (3) successive starts without recharging of the tank.

4.9.2 Each compressor shall be air cooled, motor driven and of the same model and capacity.

4.9.3 Each compressor is to have a start-stop pressure control switch. A low or too high air pressure condition on either tank is to alarm. Air relief valves are to be furnished by the Contractor.

4.9.4 Each compressor is to have sufficient capacity to recharge one (1) air receiver from minimum to maximum starting air pressure in not more than 30 minutes.

4.9.5 The air starting system is to have an air dryer system to insure dry starting and control air.

4.9.6 Air start valves shall be provided with one supplying each end of the air start ventifold. The half start valves should have indication of the valve open status which will be recorded.

4.10 Crank Case Breather System

Each engine is to have centrifugal air blown crank case breather system. The blower is to have an explosion proof motor.

4.11 Engine Control Cabinets

4.11.1 Each engine shall have two control cabinets. One is to be labeled "Engine Generator Control Panel" and the other "Engine Control Panel." Arrangement of all devices shall be subject to approval of Owner.

4.11.2 The Engine/Generator Control Panel is to have all devices necessary to manually close the generator breaker and manually load (parallel to system) the diesel locally. Contractor shall also arrange his connections so that the Owner can also have the capability to perform these functions in the control room.

4.11.3 The Engine Control Panel is to have all devices necessary to operate and monitor the diesel's engine operation locally.

4.11.4 Control Panels

4.11.4.1 Design

Contractor shall furnish one totally enclosed walk-in type control panel. A walk-in control panel is defined as one with a minimum depth of 5 ft. with doors in each end. Where control systems require less than 20 sq. ft. of front panel control space, a rear entry Hoffman type control panel may be supplied in lieu of a walk-in enclosure.

4.11.4.2 Arrangement

The interior of the control panel is to have convenience outlets and switches and lights for adequate interior lighting. The face of the control panel shall be illuminated using T12 rapid start fluorescent lights.

Purchaser shall have right to extra space and/or cutouts as specified later for Owner furnished equipment. Where blank space is specified for Owner mounted equipment, the interior of both walls (front and rear) in addition to the outside front panel shall be left unobstructed.

4.11.4.3 Construction

All panels and doors shall be gasketed so that the structure conforms to NEMA 12 requirements. Doors shall have keylock type handles with three point latches. The cubicle shall be designed for indoor installation on a concrete pad and constructed of not less than 11 gauge sheet steel. Panel surfaces shall be adequately braced and reinforced to provide suitable support to the components and to prevent warpage. Removable lifting eyes shall be provided in the top. Exposed mounting hardware on the exterior of the panel is not allowed. Cubicles shall be mounted on continous anti-vibration mounting pads which are to be furnished by the Owner. Holes and cutouts for equipment shall be drilled, punched or sawed. No burning of cutouts is permitted.

4.11.4.3.1 Painting

The cubicle is to be throughly cleaned to remove all rust, loose mill scale, welding slag or spatter, oil, grease, and other contaminants. The exterior of the cubicle is to be furnished painted with ASA #61 grey color over a rust resisting primer unless otherwise directed by the Owner. The interior of the panel is to be painted white. All shop painting is to be done in accordance with instructions of the coating manufacturer.

4.11.4.4 Wiring

Panels shall be completely wired with No. 14 AWG 19 strand tinned copper switchboard wire approved by the Owner. All terminations shall be made using full ring tongue preinsulated terminal lugs as approved by the Owner. Both ends of each wire shall be permanently identified with its circuit number. Where obtainable all control components are to have screw terminals. Flame retardant wire ducts are to be used to support wiring as necessary. These shall be free of sharp edges, corners or protruding screw threads. Wire ducts are to be sized to prevent overfilling, and all duct covers are to fit without binding the enclosed wiring. Wire bundles of less than 1" in diameter may be run exposed, but they must be supported at no greater than 18" intervals.

Circuits to which Owner installed wiring must connect shall be terminated on marked terminal blocks. These shall be States Manufacturing Co. type NT or Stanwick sliding link type. Ten percent spare terminal block points are to be supplied and one side of all terminal blocks is to be left clear for purchaser's wiring.

4.11.4.5 Specific Requirements

4.11.4.5.1 Nameplates

All panel mounted components are to have 2 1/2" x 1" engraved black plastic identification nameplates with white lettering. The nameplates are to be attached using two black self tapping sheet metal screws.

4.11.4.5.2 Adhesive Attachments

Adhesive attachments of any type are not acceptable anywhere in panel construction.

4.11.5 Control Components

4.11.5.1 All control components are to be of a high quality utility grade as approved by the Owner. All devices are to be identified.

4.11.5.2 Control Relays are to be Cutler Hammer Types D40, D23, D26.

4.11.5.3 Pushbutton/Indicator lights are to be Cutler Hammer Type 10250T.

4.11.5.4 Make of annunciator to be specified later by owner.

4.11.5.5 The types and manufacturers of proposed recorders will be specified later.

4.11.6 Pre-wiring by Contracter

All electrical circuits remote from the main control panel shall be terminated on States or Stanwick type terminal blocks enclosed in a NEMA 12 terminal cabinet mounted on each shipping section such that the Owner's electrical installation shall consists of no more than pulling and terminating cables (supplied by purchaser) between marked terminals.

4.11.7 Test and Inspection

After fabrication, all control panels and equipment shall be given a complete continuity test and a complete operational test. The Owner must be notified 10 days prior to the operational test so that he may witness these tests if he so elects.

4.11.8 Shipment

Equipment shall be handled and shipped with proper precautions being taken to protect shop painting and equipment from damage.

4.11.9 Information to be Furnished

Bidder shall state probable panel fabricator, manufacturer and catalog numbers of components to be furnished, proposed panel size and proposed panel layout.

4.11.10 Approvals Required By Owner

The Owner retains the right of prior approval or disapproval of any factors in control system or panel design. Factors of particular attention are; quality of steel work, control components to be furnished, panel size, panel arrangement, wiring methods, mounting methods and types of drawings to be furnished. Control panel construction shall not commence until all panel drawings are approved by the Owner.

4.11.11 Drawings to be Furnished

Electrical drawings to be furnished shall consist of complete elementary diagrams, point to point wiring diagrams, interconnection wiring diagrams, outlines, bills of materials, full descriptions of operations and recommended trouble shooting procedures. Drawings shall be submitted as stated elsewhere in this specification.

4.11.12 Copper Bus

A copper ground bus shall be provided the full width of each control panel along the bottom. The bus is to be insulated from the panel.

4.11.13 Engine/Generator Control Panel

4.11.13.1 Listed below is a minimum list of devices required on each Engine/Generator Control Panel for bid analysis only and is by no means final. It is the Contractor's responsibility to recommend additional devices that are required for safe and reliable operation. All devices are to be identified inside and outside the cabinet. Identification names are subject to Owner's approval. The Owner will furnish a layout and complete list of devices required on this panel at a later date.

4.11.13.1.1 Woodward Governor Control Box and associated wiring.

4.11.13.1.2 Airpax Speed Switch Control Boxes (2).

4.11.13.1.3 Any device needed to manually synchronize, load and monitor the engine and generator's operation which would include: Synchroscope and associated components, Governor Switch, Load Switch, Voltage Meters (2), Voltmeter Switch (2), Frequency Meter, Power Meter, Reactive Power Meter, Ammeter, Ammeter Switch, Watthour meter, Breaker Control Switch, Governor Droop Switch, and indicating lamps.

4.11.13.1.4 Engine hour meter

4.11.13.1.5 Engine Starting Time Clock with ability to accurately read 1/100 of a second.

4.11.14 Engine Control Panel

4.11.14.1 Listed below is a minimum list of devices required on each Control Panel and is by no means final. It is the Contractor's responsibility to recommend additional devices that are required for safe and reliable operation. All devices are to be identified inside and outside the cabinet.

4.11.14.1.1 Alarm Annunciator to be specified later by the Owner with a minimum of the following alarm windows:

4.11.14.1.1.1 High Lube Oil Temperature

4.11.14.1.1.2 Low Lube Oil Pressure

4.11.14.1.1.3 Low Starting Air Pressure

4.11.14.1.1.4 High/Low Fuel Oil Day Tank Level

4.11.14.1.1.5 High Jacket Water Temperature

4.11.14.1.1.6 Crankcase Pressure or Vacuum abnormal

4.11.14.1.1.7 Overspeed Condition

4.11.14.1.1.8 Stator High Temperature

4.11.14.1.1.9 Bearing High Temperature

4.11.14.1.1.10 Low/High D.C. Control Power Supply

4.11.14.1.1.11 Low Jacket Water Pressure

4.11.14.1.1.12 Control Air Low Pressure

4.11.14.1.1.13 Engine Failure to start

4.11.14.1.1.14 Annunciator shall have a common contract output to be used to alarm control room of "Diesel Trouble."

4.11.14.1.1.15 Contractor is to advise Owner if any additional alarms are necessary.

4.11.14.1.2 Instruments

4.11.14.1.2.1 Starting air pressure Tank #1 and Tank #2

4.11.14.1.2.2 Lube Oil Temperature

4.11.14.1.2.3 Lube Oil Pressure - Filter Inlet and Outlet

4.11.14.1.2.4 Fuel Oil Pressure - To Engine/To Filter

4.11.14.1.2.5 Jacket Water Temperature

4.11.14.1.2.6 Jacket Water Pressure

4.11.14.1.2.7 Crankcase Pressure or Vacuum

4.11.14.1.2.8 Generator Temperature Selector Switch

4.11.14.1.2.9 Generator Stator Temperature

4.11.14.1.2.10 Exhaust Temperature

4.11.14.1.2.11 Control Air/Manifold Air

4.11.14.1.2.12 Pyrometer Equipment

All instruments are to be flush mounted.

4.11.14.1.3 Off - On Switches with lights:

4.11.14.1.3.1 All DC and AC auxiliaries are to have on/automatic switches with red indicating lights on wh auxiliaries are available.

4.11.14.1.3.2 A. C. Power

4.11.14.1.3.3 D. C. Power

4.11.14.1.3.4 Jet Assist

4.11.14.1.4 Start button, Normal Stop Button, Emergency Stop Button.

4.11.14.1.5 A high speed recorder with chart speed of three inches per second for recording:

4.11.14.1.5.1 Engine Start signal.

4.11.14.1.5.2 Start Valves open (Each Valve).

4.11.14.1.5.3 Engine Speed.

4.11.14.1.5.4 Governor position.

4.11.14.1.5.5 Time Mark (one second interval)

4.11.14.1.5.6 Engine at one quarter, one half, three quarters and full speed.

This recorder will start when fast diesel start is initiated and full run for fifteen second

4.11.14.1.6 A recorder to record the following:

4.11.14.1.6.1 All cylinder exhause temperatures.

4.11.14.1.6.2 Supercharger inlet temperatures.

4.11.14.1.6.3 Supercharger outlet temperature

4.11.14.1.6.4 Jacket cooling water inlet temperature.

4.11.14.1.6.5 Jacket cooling water outlet temperature.

4.11.14.1.6.6 Lube oil inlet temperature.

4.11.14.1.6.7 Lube oil outlet temperature.

4.11.14.1.6.8 Others as recommended by contractor.

Note: All instruments, gauges and switches on the panel board are to be plainly marked for the service intended. Flow switches, temperature sensors and switches, and pressure switches containing mercury are not acceptable

4.12 Auxiliary Motor Drives

4.12.1 All motors with the exception of the DC fuel oil booster pump motor shall be 575 volt, 3 phase, 60 Hertz, 1.15 S.F. TEFC, squirrel cage induction motor with Class F insulated windings. Temperature rises for continuous operation at rated load shall be in accordance with the NEMA rises for Class B insulation systems.

The motor shall be as manufactured by Allis-Chalmers, Westinghouse, General Electric or Reliance Electric Company. Motor stands shall be carbon steel or manufacturer's standard. Shaft bearings shall have a minimum B-10 life of fifteen (15) years.

4.12.2 Contractor shall provide three (3) microfilmable copies of motor data information (Form M1) for approval within nine (9) weeks of receipt of order. The Contractor shall also furnish motor outline drawings for approval in accordance with the drawing requirements of this specification. He shall include adequate motor instructions in the instruction book.

4.13 Auxiliary Pumps

4.13.1 The following auxiliary pumps are required with each Diesel Generating System:

With engine - motor driven lubricating oil pump for "B and A" service

Lubricating System - engine driven lube oil service pump;

Fuel System - engine driven fuel oil booster pump; DC motor driven fuel oil booster pump; fuel oil transfer pump

Cooling Water System - Engine driven jacket water pump;

Preheat System - motor driven jacket water circ. pump; motor driven lube oil circ. pump

4.13.2 Motor drives, where required, for these pumps will be furnished in accordance with specification section 4.12. The above pumps are important to Nuclear Safety and the design and the materials of the casings, impellers, shafts and fittings shall be especially suitable for the operating conditions. These pumps shall be designed and built in accordance with Section III, Class 3 of the ASME Code dated 1974. Any pumps that is mounted on an integral part of the engine does not have to be manufactured to ASME Code.

4.13.3 These pumps are required to be seismically designed in accordance with the attached "Functional Design Requirements for ASME Section III Pumps within the Diesel Generator Building of Catawba 1-2". The seismic analysis required to establish equipment base details

where applicable shall be submitted for review no later than six weeks after issuance of motor frame size. Remaining seismic analyses will be submitted later. Calculations will be reviewed by Duke and approved as a correct before final drawing approval is made.

4.13.4 Vendor must submit maximum inbalance on all rotating parts for Owner's approval.

4.13.5 Each pump will be furnished with accessories necessary for operation and maintenance, including the following:

4.13.5.1 Fast type flexible coupling or approved equal, where applicable.

4.13.5.2 Air cocks, drain cocks and oil gauges.

4.13.5.3 Lifting eye bolts and special wrenches as required.

4.13.5.4 Motor support plates are to be cast iron or welded plate construction.

4.13.5.5 Bedplates are to have drip rims and drains.

4.13.5.6 A brass nameplate shall be attached to each major item of the pumping apparatus and shall show the following information:

4.13.5.6.1 Pump name

4.13.5.6.2 Manufacturer's name

4.13.5.6.3 Manufacturer's serial number

4.13.5.6.4 Rated pump capacity - gpm @_____ F

4.13.5.6.5 Rated total head _____ feet

4.13.5.6.6 Shut off head ____ Feet (design conditions)

4.13.5.6.7 Applicable codes

4.13.5.6.8 Official N-type symbol

4.13.5.6.9 Maximum casing-pressure (where applicable @ _____ F).

4.13.5.6.10 Class of pump

4.13.5.6.11 Design pressure and coincident temp.

4.13.5.6.12 Year built

A drawing of the nameplate meeting the above requirements is required.

4.13.5.7 Manufacturer must state the allowable forces and moments each pump will accept.

4.13.5.8 Each pump will be delivered with one extra set of flange gaskets.

4.13.6 Six copies of certified pump performance test curves for pumps covered by the specification are to be submitted to Mr. C. J. Wylie, for approval prior to shipment of any pumps.

Six copies of hydrotest results, where applicable, are required for approval prior to shipment of equipment.

4.13.7 In addition to nameplates, all pumps shall be tagged with metal tags showing the pump name and mark number. Tags shall be permanently secured with noncorroding wire.

4.13.8 All internal wetted surfaces shall be free of metal chips, weld spatter, slag, oil, grease, dirt, scale and other foreign material. Immediately after final cleaning, the end connections shall be sealed with plugs, caps or covers to prevent entry of contaminants and to prevent damage to facings or weld grooves. These caps are to be secured so as not to become detached during shipment or handling. Bidder shall also comply to ANSI N45.2.1-1973 clean Level B Requirements.

4.13.9 The pumps and accessories shall be packaged or crated to prevent deterioration, contamination, and physical damage during transit or storage; and to facilitate handling and unloading. Any article or material that might otherwise be lost shall be boxed or wired in bundles and marked for identification.

4.14 Piping and Miscellaneous In-Line Equipment

All auxiliary system piping including valves, furnished with the Diesel Electric Generating Unit but not on the Engine proper is to be designed, analyzed, tested and furnished of materials meeting the requirements of the ASME Boiler and Pressure Vessel Code, Section III - Nuclear Power Plant Components for Class 3 Components, 1974.

All such materials shall exhibit the appropriate "N" stamp in accordance with ASME Section III and the finished system must also bear the appropriate "N" stamp. Effective ASME Section III Code date is hereby established as of 1974.

The Contractor is to furnish allowable loading on all Owner piping connections for approval as applicable. Contractor is responsible for furnishing materials and anchorages that are heavy enough to accommodate Owner's piping loads (if Applicable) and therefore is cautioned about purchase of materials prior to obtaining Owner's approval of allowable loads.

4.15 Heat Exchangers

4.15.1 Main Diesel Generator Heat Exchangers

4.15.1.1 Four Diesel Generator Heat Exchangers (one heat exchanger per Diesel) are to be used to cool engine coolant in the Diesel Generator System. The Cooling medium is supplied from the Nuclear Service Water System (untreated lake water) and is circulated through the tube side of the heat exchanger. The tube side design fouling factor shall be 0.001. Pertinent NSW chemistry is shown in attached Table II.

4.15.1.2 The channel, tube sheet, and shell material shall be carbon steel. Tube material shall be inhibited admiralty. Three-fourth inch vent and three-fourth inch drain connections shall be provided on both shell and tube side.

4.15.1.3 Maximum fluid velocity through the tube side shall be limited to 8.0feet per second. Maximum pressure drop on the tube side shall be limited to 15 psi.

4.15.1.4 Design pressure of the tube side shall be 150 psig. Design temperature of the tube side shall be 95°F.

5.15.1.5 Each heat exchanger will be horizontal straight tube design. Removable channel covers shall be provided for easy access to the tubes.

4.14.1.6 Tube side design flow shall be Contractor's decision. However, each heat exchanger shall be capable of passing a maximum tube side flow of 900 gpm. without exceeding the maximum pressure loss.

4.15.1.7 Each heat exchanger shall be capable of withstanding the thermal stress resulting from 40 cycles of initiation of shell side flow, at Contractor's design temperature simultaneously with initiation of tube side flow at 40°F at design flow rates. Design life of each heat exchanger shall be 40 years.

4.15.1.8 Each heat exchanger shall accommodate the following design operating condition:

4.15.1.8.1 Tube side flow, gpm: Contractor's Decision, 900 Max.

4.15.1.8.2 Tube side inlet temp,°F: 95

4.15.1.8.3 Tube side outlet temp, F: Contractor's Decision

4.15.1.9 Contractor shall state total length allowed for each heat exchanger including tube pull length and the total width including nozzles.

4.15.2 Intercoolers and Oil Coolers

4.15.2.1 Intercoolers and oil coolers as required are to use engine jacket cooling water and may be sized by the Contractor. General requirements are similar to these of the diesel generator heat exchangers.

4.15.3 All Heat Exchangers

4.15.3.1 All auxiliary heat exchangers furnished as a part of the Diesel Electric Generating Unit are safety related and are to be designed, analyzed, tested and furnished of materials meeting the requirements of the ASME Boiler and Pressure Vessel Code, Section III Nuclear Power Plant Components for Class 3 components.

4.15.3.2 All such Heat Exchangers shall exhibit the appropriate "N" stamp in accordance with ASME code.

4.15.3.3 The effective ASME Section III Code date is hereby established as 1974.

4.15.3.4 The Contractor is to furnish allowable loadings on all Owner piping connections for approval as applicable. Contractor is responsible for furnishing Heat Exchangers that are heavy enough to accomodate Owner's piping loads (if applicable) and therefore is cautioned about purchase of heat exchangers prior to obtaining Owner's approval of allowable loads.

4.15.3.5 All materials shall be especially suitable for the service required. The heat exchangers shall be suitably degreased and capped and the finished exchangers shall be vacuum dried and nitrogen blanketed for shipment and storage at the plant before installation. Bidder shall submit pressure of nitrogen blanket prior to shipment for Owner's approval.

Note: AC for the Motor Control Center will not be available until diesel generator dead bus closure on a blackout condition. Therefore, the diesels are to have the capability of coming up to speed without AC power.

4.17 4160 Volt Switchgear

The 4160 Volt switchgear, diesel generator breaker and its protective relaying is to be furnished by the Owner. Contractor is to furnish the data required by him so that the Owner can size the generator breaker.

4.18 Foundation Equipment

A complete set of foundation bolts, nuts, plates, soleplates and washers for the engine-generator unit and related auxiliaries, where required, to anchor the equipment to their foundations is to be furnished by the contractor for each diesel. All material is to be furnished with Mill Test Reports.

4.19 Batteries and Battery Charger

Control and Power Batteries are to be furnished by the Contractor. The batteries are to be 125V DC and sized such that they will remain above 1.75 volts per cell for a period of three hours from a full "Floating" charge and loss of its charger. The charger is to be sized to carry the control and power loads and completely recharge the batteries from a 1.75 volt per cell state in eight hours. D. C. loads include all the diesel DC control power requirements, DC fuel oil booster pump motors and any other DC load the Contractor feels is necessary for safe diesel operation.

4.20 Miscellaneous Equipment

4.20.1 One complete set of standard and torque wrenches, special wrenches and special maintenance tools, which are required for the regular operations, maintenance and repair of the engine-generator unit is to be supplied for the station.

4.20.2 Spare parts - One set of manufacturer's standard spare parts to be furnished, properly processed, and placed in suitable labeled containers for long term storage. A list of these spare parts are to be indicated in the bid. The Contractor's recommended spare parts list should be made with consideration of the type of service for which the units will be used and to achieve minimum down time. This refers to considering such things as spare crank shaft and supercharger.

4.21 Thermocouples

All thermocouples are to be I.S.A. type J, 3 wire shielded iron-constantan with the ground wire being a copper wire.

5. GENERAL DESIGN

5.1 Description

As specified in Section 4.0 - Equipment to be Furnished.

5.2 Materials

5.2.1 The Bidder shall provide in his proposal a list and full description of all parts, materials, or equipment manufactured outside the United States, if any, that are intended to be furnished with this order. No parts, materials, or equipment shall be of manufacture outside the United States without prior approval of the Owner.

5.2.2 All materials used shall have inherent flame retardent characteristics.

5.2.3 No aluminum conductors are to be used without the Owner's written approval.

5.2.4 No aluminum or mercury is to be used without the Onwer's written approval.

5.3 Responsibilities

5.3.1 Owner:

In addition to the responsibilities designated in other portions of the sepcification, the Owner is responsible for:

5.3.1.1 All drawing and manual approvals.

5.3.1.2 Release for manufacture.

5.3.1.3 Release for shipment.

5.3.1.4 Approval of any alternates or deviations from the specification.

5.3.1.5 Approval of all test reports.

5.3.2 Contractor:

In addition to the responsibilities designated in other portions of the specification, the Contractor is responsible for:

5.3.2.1 Advising Purchaser and Sponser Engineer immediately of any potential schedule changes or equipment problems.

6. SPECIAL REQUIREMENTS

6.1 The attached General Conditions of Contract dated August 1, 1973 shall form a part of this specification.

6.2 Spare Contacts

All spare contacts on the proposed equipment should be wired to terminal blocks for future use as determined by Duke. All terminal blocks associated with these spares shall be located at one convenient location.

6.3 Painting and Coating

6.3.1 Prior to shipment all items of equipment are to be thoroughly cleared and painted.

Equipment shall be furnished with a Sherwin-Williams Polane T catalyzed polyurethane ANSI- 61 grey enamel finish, or Duke approved equal, in accordance with attached Duke Power Specification K-2. The Contractor may obtain all coating materials from the Sherwin-Williams Company, c/o Mr. R. E. Roberts, 307 Freeman Bldg., Greensboro, N. C. 27403, Phone - 919-299-9532.

6.4 Vendor Training Program - the Bidder shall indicate the availability of any training programs on the operation/maintenance of the equipment which is proposed. This information, which should be provided as a separate attachment to the technical proposal, should include specifics of the available programs, e.g. factory or site training, audio/visual training aids, etc.

6.5 Vendor Seminar

The Vendor shall indicate the availability of a one-day seminar program, for Duke engineers, to be held at his manufacturing facility. This information, which should be provided as a separate attachment to the technical program, should include specifics of the available program, i.e. equipment design, factory tour, visual aids, etc.

6.6 Equipment Photographs

The Contractor shall furnish the Owner with ___ sets of color photographs (Kodacolor or equivalent 8 X 10 inch size) taken at significant stages during manufacture. A set of photographs should consist of approximately 30 exposures. When applicable, an object of known size should be included in each photograph.

6.7 Equipment Transporting

Adequate means shall be provided for lifting and transporting equipment listed in this specification. These means shall be e.g. eye bolts, or through appropriate crating.

6.8 Impact Recorders

Impact Recorders are required on all major equipment shipments to record both vertical and horizontal shock forces.

7. QUALITY ASSURANCE REQUIREMENTS (SAFETY RELATED)

7.1 These specifications cover equipment, systems, structures and/or materials important to nuclear safety; and it is essential that they meet the quality standards of these specifications and referenced codes, standards and guides; and that this quality be proven by full documentation. With the proposal, each bidder shall submit a description of the quality assurance procedures he proposes to use; outline his quality assurance organization showing lines of authority; a description of the documentation that will be developed during manufacture and that will be shipped to the owner for retention for the life of the item. Evaluation of proposals will include analysis of information submitted and rendering a judgement with respect to each bidder's qualification to provide and document the quality required by these specifications. After award, the Contractor shall submit complete written quality assurance procedures for owner's review and approval.

7.2 The Contractor shall establish and maintain a quality assurance system which effectively maintains control over all phases of operation including design, procurement, receipt of material, storage, manufacturing, inspection testing and shipping. Accuracy of all physical and electrical measurements shall be ensured through an implemented calibration program. This system shall comply with the requirements of 10C FR50, Appendix B and ANSI N45.2-1971.

7.3 A Quality Assurance Manual shall be maintained current. This manual shall include organizational charts which show the relationship of the Quality Assurance function to other corporate/company functions (such as manufacturing, engineering, purchasing) as well as the structure and functional responsibilities of the Quality Assurance organization itself.

Written procedures shall be included to describe how each activity affecting quality is to be controlled. The manual shall reflect, through approval signatures, its authority as a control document.

7.4 Documentation attesting to product quality shall be generated and maintained. This documentation shall include, but not be limited to, manufacturing histories, inspection records, test records and calibration records as listed hereunder:

7.4.1 Certification

The Contractor shall provide two copies of Vendor Quality Assurance Certification (Form 930.1) for each delivery. Original is to be sent to Mr. H. L. Huggett, Quality Assurance Department, P. O. Box 2178, Charlotte, N. C. 28242. One copy is to be shipped with the equipment as part of the data package.

7.4.2 All standard factory and Owner specified tests certified including records of failures and their repair and retesting.

7.4.3 Certified seismic tests or analysis on the diesel generating units and all of its associated auxiliaries.

7.4.4 Certified Non Destructive Examination Test Reports.

7.4.5 Motor Data Sheets.

7.4.6 Certified pump performance test curves.

7.4.7 Pump hydrotest results.

7.4.8 Generator Data Sheets.

7.4.9 ME-102 Form.

7.4.10 ME-103 Form.

7.4.11 One copy for each heat exchanger of the following documents:

7.4.11.1 Copy of stress analysis

7.4.11.2 Certified copies of original mill test reports for all materials.

7.4.11.3 Certification that heat exchangers are built in accordance with attached "Seismic Requirements for Safety Related Heat Exchangers for Nuclear Power Stations".

7.4.11.4 Heat treatment charts.

7.4.11.5 Film of Radiographic Testing at 90% weld efficiency.

7.4.11.6 Results and records of an Ultrasonic Test on the tube sheets.

7.4.11.7 Results and records of eddy current tests on the tubes.

7.4.11.8 Results and records of hydrostatic tests.

7.4.11.9 Results and records of dye penetrant tests on tube to tube sheet welds.

7.5.11.10 Weld repair maps.

7.5.11.11 Certification that cleaning and degreasing was performed.

7.5.11.12 Data Report, Form N-1A.

7.4.11.13 Welder's qualifications.

7.4.11.14 Weld procedure qualifications.

7.4.11.15 NDT personnel qualifications.

7.4.11.16 Name Plate Rubbing.

7.4.11.17 Shipment release by Quality Control Manager.

7.4.11.18 As built drawings.

7.4.11.19 Result and records of tube leak test (tube to tube sheet).

7.4.11.20 Certification of type of weld material or mill test report.

7.4.11.21 Contract variations.

7.4.11.22 Certification that heat exchanger was fabricated in accordanc with Owner's specifications.

7.4.12 These records shall be traceable to the manufactured articles to which they apply.

7.5 The Bidder shall submit with and as a part of his proposal the following:

(1) A statement of intent that Duke Power Company will obtain from the Supplier full cooperation in the effort to obtain the highest degree of quality possible and to provide all documentation

(2) An agreement to furnish detailed production schedules monthly on each item to be furnished so that the Owner may decide whether to perform a quality survey on part or all of a particular manufacturing function.

(3) An agreement to effect that before final shipment of the equipment the Contractor must first obtain approval from the Owner. This approval will be based on the satisfactory completion of all requirements of the equipment specification including all documentation required by the Owner.

7.6 Anytime a specification is referenced to in a document or correspondence the specification number, latest revision/amendment designator and title/subject shall be included.

8. DELIVERY

8.1 Equipment shall be delivered to: Duke Power Company, c/o Project Manager, Catawba Nuclear Station, S. C. Highway 274, or Southern Railway, Newport, S. C.

8.2 Packaging and shipping instructions are as delineated in the attached Packaging and Shipping Requirements Form 301.4 and are to be filled out by the Bidder and approved by the Owner.

8.3 Equipment is to arrive at the site by

Unit #1 - Two (2) complete diesel generators and associated auxiliaries

Spare Parts -

Unit #2- Two (2) complete diesel generators and associated auxiliaries

8.4 All equipment is to be complete per this specification at the time of shipment. In the event the specified shipment date cannot be met because of equipment discrepancies, the Owner reserves the right to approve or disapprove shipment. If the Owner does approve shipment of the equipment with discrepancies, the Contractor is to furnish all necessary materials for field installation as soon as possible to resolve the equipment deficiencies.

8.5 Shipment must comply with ANSI N45.2.2-1972 for form 301.4.

8.5 The Contractor's Project Engineer assigned to this equipment is to review the Preparation and Method of Shipment before manufacture begins. The Project Engineer is to inspect all equipment covered in this specification in the "ready to load and ship" condition to insure all procedures have been followed.

8.6 The equipment being shipped should be accompanied by:

a. One copy of the Equipment Installation Procedure described in Section 10.

b. Form 930.1 -- A copy of this form must be included in each individual shipping package.

8.7 The Bidder shall delineate recommended equipment storage requirements in terms of temperature, humidity, necessary energization, etc.

9. VENDOR DRAWINGS

9.1 The Contractor shall prepare and submit five (5) prints each of all drawings, to Mr. C. J. Wylie, Duke Power Company, P. O. Box 2178, Charlotte, N. C. 28242. These prints are to be submitted within 30 days after receipt of order and are to be full-size and legible with uniform background density suitable for microfilming and subsequent reproduction from microfilming. These prints will be reviewed by the Owner and, if satisfactory, will be approved. If requested, one copy of each print, so marked, will be returned to the Contractor. If not satisfactory, the prints will be appropriately marked and one copy of each print returned to the Contractor for correction after which five (5) prints of the drawings as corrected shall again be submitted to the Owner for approval. The Contractor shall make any corrections required by the Owner and appropriately note any changes by dated revisions on the drawings.

If the drawings are not acceptable to the Owner for microfilming, the Contractor shall furnish 20 full-size copies of all drawings for the Owner's records within fifteen days of receipt of drawing approval.

9.2 The following drafting lettering standards should apply, as all drawings are to be microfilmed by the Owner.

Minimum character height (A, B, and C size drawings)-
0.125 in. (1/8)
Minimum character height (D and E size drawings) -
0.156 in. (5/32)
Minimum spacing between lines of characters -
height of characters.
Guide generated characters - 12 point size minimum
Uniform

9.3 On all drawings and correspondence concerning this order, the Contractor shall show:

9.3.1 Mill Power Supply Company Purchase Order Number

9.3.2 Duke Power Company Item Number

9.3.3 Name of Equipment, e.g. Diesels 1A & 1B

9.3.4 Station and Unit, e.g. Catawba Unit 2

9.4 Any drawings which are safety related must be stamped "Nuclear Safety Related" in a prominent position and in letters not less than 1/4 in. high.

9.4.1 Vendor assumes responsibility for this identification.

9.5 The minimum list of certified drawings to be submitted are listed below:

Schematic diagrams	Logic Diagrams
Front Views	Block Diagrams
Outlines	Connection Diagrams
Structural details	Mounting details

9.6 To eliminate any confusion or repetition of effort, the Contractor shall notify the Owner prior to submittal of Unit #2 or subsequent unit drawings. This does not apply to outline drawings.

10 INSTRUCTION MANUALS

10.1 Operation/Maintenance Instruction Manuals

10.1.1 Instruction manuals are to be provided per the following procedure. Initially five (5) copies shall be sent to Mr. C. J. Wylie, Duke Power Comany, P. O. Box 2178, Charlotte, N. C. 28242. These manuals will be submitted not later than 15 days after equipment delivery. They will be approved. If requested, one copy of the manual, so marked, will be returned to the Contractor. If the manuals are not satisfactory, they will be appropriately marked and one copy of each print returned to the Contractor for correction after which five (5) copies of the corrected pages shall again be submitted ot the Owner for approval. The Contractor shall make any corrections required by the Owner and appropriately note any changes by date revisions on the pages.

10.2 After approval of the manual, the Contractor shall furnish 20 copies for the Owner's records within twenty days of receipt of manual approval.

10.3 The instruction manuals, bound in suitable booklet form, shall be indexed and contain as a minimum the following:

10.3.1 General equipment description

10.3.2 Detailed operating description

10.3.2.1 Operating principles

10.3.2.2 Limitations and setpoints

10.3.2.3 Parts identification & cutaway drawing

10.3.3 Installation procesure

10.3.4 Maintenance instructions

10.3.4.2 Trouble shooting

10.3.4.3 Disassembly/Assembly Instructions

10.3.4.4 Renewal parts lists

10.4 Installation Procedure (To be included in the above manual also)

10 copies of the Equipment Installation Procedure section shall be sent to: Mr. C. J. Wylie, Atten: J. W. Woodruff, P. O. Box 2178, Charlotte, N. C. 28242 sixty days prior to initial equipment shipment. One copy of this Equipment Installation Procedure should accompany the equipment when it is shipped.

11. TESTS AND INSPECTIONS (Checked if applicable)

11.1 The Contractor shall perform the following tests on the proposed equipment:

11.1.1 Seismic Test (Must prove functional capability)

11.1.1.1 Equipment is to be seismically qualified by testing/analysis in accordance with the attached Electrical Seismic Criteria, Specification No. CNS 1393.00. All equipment is to be designed to remain structurally sound, operate functionally correct, and provide minimum seismic amplification during and after a safe shutdown earthquake.

11.1.2 Detailed Functional test

11.2 Manufacturer is to perform all his standard tests, any test called for in the standards listed in section 1 (Applicable Standards) and Owner's special tests as listed below:

11.2.1 Demonstrations shall be made of the starting reliability (Ability of diesel generator set to accept load within ten seconds starting from a stand by ambient condition) of a typical unit using the following procedure:

11.2.1.1 The number of starting reliability test starts is to be 300 and the diesel generating set is to have no more than one (1) failure per hundred starts.

11.2.1.2 For each test start the engine generator is to be at standby ambient temperature. Standby ambient temperature is defined as that temperature the diesel generating set would be subject to when in standby condition and having not been run for a long period of time. Test floor air ambient temperature conditions are acceptable, but temperatures on engine and generator components must return to normal ambient conditions.

11.2.1.3 The generator, exciter and voltage regulator to be used in this starting reliabity test shall be the actual equipment to be furnished with the diesel unit and as specified in section 4.3.

11.2.1.4 The other diesel appurtenances may be the manufacturer's standard test stand auxiliaries.

11.2.1.5 The test start is defined as fast starting the engine generator set within ten (10) seconds and loading the unit each time according to the following:

11.2.1.5.1 At 10 seconds or earlier, load the diesel generating set with two motors simutaneously. which are to be at least one loaded 1000 HP motc and one loaded 400 HP motor. Two motors are required for this application of load.

11.2.1.5.2 Immediately after two motors have reached full speed and full load, the diesel generating sets are to be fully loaded through the use of water rheostats to their nameplate rating (KW).

11.2.2 Largest Motor Trip Test

11.2.2.1 In addition to the reliability testing, the engine generator set is to be fully loaded with both motors and water rheostat and the 1000 H.P. motor is to be tripped off the total load and restarted. The trip and restart of the 1000 H.P. motor is to be demonstrated at least five times.

11.2.3 By analysis or tests demonstrate that the diesel is capable of starting all loads prescribed in Table I (LOCA or Blackout).

11.2.4 Certified full factory test reports are required on one set of motors or pumps of an exact type. If a motor or pump of exact type has been tested previously only certified test report submittal is required.

11.2.5 The Contractor shall provide detail testing procedures (including acceptance criteria) for Owner approval 30 days prior to testing.

11.2.6 The Owner reserves the right to witness any or all tests and inspections.

11.2.7 The Owner shall be notified in writing at least fourteen days prior to factory testing with a list of the tests/inspections to be performed and the date which they will be performed.

11.2.8 The Owner shall have the right to perform engineering or quality assurance inspection visits at the Contractor's manufacturing facility at any time.

11.2.9 Test and Inspection Reports

Safety-related Equipment - The original certified copy of all Contractor's test and inspection reports should be submitted to Mr. H. L. Huggett, Quality Assurance Department, P O Box 2178, Charlotte, North Carolina 28242, 19 certified copies of these reports should be sent to Mr. C. J. Wylie. All reports should be submitted at the same time the 930.1 Quality Assurance Certification Form is submitted.

12. SPARE PARTS

12.1 A listing of recommended spare parts shall be provided with the Bidder's proposal. The Bidder should provide the basis by which this list was acquired.

12.2 All spare parts shall equal or surpass the original part specifications. In the case of safety related components the appropriate certification must accompany the component.

13. INFORMATION TO BE FURNISHED BY BIDDER In addition to Basic Technical

The information requested by the following paragraphs shall be submitted as separate attachments to the proposal and be in the format of this section.

13.1 Available Vendor training programs/materials in accordance with Section 6.

13.2 Vendor seminar programs available in accordance with Section 6.

13.3 The General Information Section of the attached Equipment Coating Form # EC-1, Sheet 1, should be completed and the form submitted with the proposal. If desired, an alternate finish for the equipment may be proposed. Information describing this option should be provided on the attached Equipment Coating Form # EC-1, Sheet 2 and submitted with the proposal.

13.4 Quality Assurance Information Requested in Sect. 7 (Safety Related Only)

13.5 Storage Requirements per Section 8.

13.6 Completed Packaging and Shipping Requirements Form 301.4 per Section 8.

13.7 Technical Description of each individual proposed option.

13.8 General description of all Bidder's tests to be conducted as identified in Section 11.

13.9 On the attached Form GMW/100 please fill in dates for items 2, 3, and 5. If desired, you are welcome to comment on any other schedule items.

13.10 A list of recommended spare parts in accordance with Section 12.

13.11 A list of exceptions in accordance with Section 15.

13.12 Pricing information in accordance with Section 18.

13.13 Completed description of the equipment proposed, including:

13.13.1 Maximum ambient temperature the units and its auxiliaries will operate for a continuous period.

13.13.2 Complete description of engine including all its assembled parts and including:

13.13.2.1 Maximum continuous rating of the engine (KW) at 125 F ambie

13.13.2.2 Guaranteed time engine will be up to rated speed.

13.13.2.3 Curves showing load response for the diesel generator accepting load as described in table 1 attached.

13.13.2.4 What type fuel the diesel can use.

13.13.2.5 Maximum overload for a period of two hours without damagin any part of the engine.

13.13.2.6 A list and complete description of all engine accessory equipment including any equipment not listed in section 4.2. Descriptions are to include suppliers, locations, size and weight and are to include man power hours needed to change out major parts.

13.13.2.7 A list of expected engine temperatures (all temp. monitore at normal load and at overload.

13.13.2.8 Test data to indicate the fastest starting position of the engine (such as No. 2 right bank at two degrees past T.D.C. firing position). If the starting time of all positions are equal, the Bidder shall submit data to support this.

13.13.3 Complete description of Generator, Exciter and Voltage Regulator and including:

13.13.3.1 Maximum continuous rating of generator (KVA, Volt and P.F.) at 125 F ambient temperature.

13.13.3.2 Class of insulation on generator and temperature rise by thermometer/detector over a 40 C ambient temperature.

13.13.3.3 Speed of engine and generator

13.13.3.4 Type of generator voltage regulator, exciter and supplier

13.13.3.5 Number of temperature dectectors and their respective locations.

13.13.3.6 Graphs of voltage and frequency versus time for the loading sequence of table 1.

13.13.3.7 Description of generator heaters.

13.13.3.8 Typical Generator characteristics for generator supplied.

13.13.4 Complete description and suppliers of the following:

13.13.4.1 Air Intake System

13.13.4.2 Exhaust System

13.13.4.3 Fuel Oil System

13.13.4.4 Lubricating Oil System

13.13.4.5 Cooling Water System

13.13.4.6 Starting Air System

13.13.4.7 Crank Case Breather System

13.13.4.8 Engine Control Cabinets Including probable panel fabrication, manufacturer and catalog numbers of components to be furnished, proposed panel size and proposed panel layout.

13.13.4.9 Auxiliary Motor Drives including manufacturer, type HP, Voltage, S. F. etc.

13.13.4.10 Auxiliary Pumps including information listed below:

13.13.4.10.1 Predicted characteristic curve including head-capacity, efficiency, NPSH and BHP curves for each pump.

13.13.4.10.2 Material and construction of casing, impellers, shaft wearing rings, stuffing boxes, shaft and thrust bearings and foundation plates.

13.13.4.10.3 Type of lubrication (describe).

13.13.4.10.4 Identification of any proposed foreign manufacture.

13.13.4.10.5 Type of pump shaft seal.

13.13.4.10.6 List of all miscellaneous valves, plug etc. furnished by vendor and sketch or diagram of any special piping, valves, controls required and to be furnished by Owner. All connections must be identified to pump drawing connections

13.13.4.10.7 Complete Pump Detail Data Sheets Form ME-100

13.13.4.10.8 Allowable forces and moments on Duke piping connections.

13.13.4.10.9 Certification that the pump will be fabricated in accordance with Owner's specifications as outlined in specification section 4.13.

13.13.4.11 Each Heat Exchanger including the information listed below:

13.13.4.11.1 Outline drawing showing overall dimensions including cradle and heat exchanger mounting support details.

13.13.4.11.2 ASTM specifications of material and thickness of shell, channel tubesheet, baffles, and impingement plate.

13.13.4.11.3 Number, size, length, ASTM material, gage and pitch of tubes, and baffle spacing.

13.13.4.11.4 Effective surface area.

13.13.4.11.5 Corrosion allowance - shell, tubes.

13.13.4.11.6 Design pressure and temperature - shell side, tube side.

13.13.4.11.7 Weight of shell and tube bundle (empty and flooded).

13.13.4.11.8 Shell and channel connection sizes - inlet and outlet.

13.13.4.11.9 Extra Connections, number purpose and size.

13.13.4.11.10 Statement that the coolers will be degreased, vacuum dried, nitrogen blanketed and instrumented.

13.13.4.11.11 Completed copy of Heat Exhanger Data Sheet, Form ME-102.

13.13.4.11.12 Standard non-destructive test procedures.

13.13.4.11.13 Identification of any parts, materials, or equipment contemplated for manufacturer outside the United States.

13.13.4.11.14 Provisions taken to minimize tube vibration and erosion.

13.13.4.11.15 List of any and all exceptions to these specifications and statement of complete compliance otherwise.

13.13.4.11.16 Current installation list of similar heat exchangers.

13.13.4.11.17 Recommended spare parts list.

13.13.4.11.18 A separate exchanger specification sheet ME-103 showing velocity (tube size), pressure drop (shell side and tube side), log MTD corrected, transfer rate (for the fouled condition and 100% clean), cooling water quantity and outlet temperature for each mode of operation.

13.13.4.11.19 Completed copy of Heat Exchanger Specification Sheet, Form ME-103.

13.13.4.11.20 Seismic forces resisted by foundation.

13.13.4.11.21 Quality assurance information required by this specification.

13.13.4.11.22 List of all large components which are packaged in combustible material.

13.13.4.12 Piping

13.13.5 Maximum time diesel generating units can operate without cooling air and cooling water (1) from a dead start and (2) while operating at rated load without damaging the engine.

13.14 Complete list of tests to be performed including manufacturer's standard tests.

13.15 List of Foundation Equipment.

13.16 Complete description of batteries and battery charger including size and ratings.

13.17 Delivery Schedule.

13.18 Recommended manpower and manhours for unloading, installation, etc.

13.19 A preliminary layout of one complete diesel generator unit including its associated accessories and auxiliary equipment so that the Owner can determine a size required to house the prospective Contractor's diesels.

13.20 A complete list of all components to be Radiographic Tested, and/or Ultrasonic Tested and which test is applicable.

13.21 Proposed method of seismically qualifying all diesel equipment.

13.22 Maximum speed engine will reach on full 10% overload rejection.

13.23 A list of all standards manufacturer will adhere to in manufacturing the diesels sets and its auxiliary equipment.

13.24 Statements commenting on each paragraph following the same sequence as the specification and numbered accordingly stating compliance and/or exactly where technical information can be found. General statements will not be acceptable.

14. DESCREPANCIES AND INTERPRETATION

Should a Bidder find discrepancies in, or omission from these specifications or be in doubt as to their meaning, he shall notify the Owner who will issue a written interpretation.

15. CONFORMANCE WITH SPECIFICATIONS

15.1 Each Bidder shall state any and all exceptions to this specification. If no exceptions are taken, it shall be so stated in the technical proposal. No variations will be permitted without written approval of the Owner. It is particularly emphasized that any unapproved nonconformity with the specification must be changed to complete conformity at the manufacturer's expense, and this expense will include the cost of all labor and materials and all other related expenses by the Owner or the manufacturer.

15.2 Upon receipt of any specification amendment, the Contractor shall notify Mill Power Company that he will adhere to same amendment. Any and all exceptions should be noted.

16. CONSTRUCTION SERVICES

The Owner will unload, install, assemble and service the diesel/generator unit. The Owner will provide all tools, rigs, cranes and oil handling equipment. The Contractor shall provide all special materials such as gaskets, insulation materials, etc.

17. ERECTION ENGINEER

17.1 The manufacturer shall include the services of a factory trained erection supervisor to directly supervise the unloading, installation and initial start-up of the equipment.

17.2 The Contractor Shall provide all special installation and assembly instructions. These instructions shall be in the instruction books.

17.3 While performing work on the site the Contractor must comply with all provisions of the Federal Occupational Safety and Health Act of 1970.

18. SUBMISSION OF PROPOSALS AND PRICES

18.1 Technical proposals and price quotations shall be submitted by _____. Any late or incomplete proposal without prior approval by the Owner may not be considered in the award of the order. Extension of the above date will be granted only for valid and sufficient reasons of the Bidder and provided such requests do not delay or interfere with the work of the Owner. The Owner reserves the right to reject any and all bids. Proposals must be submitted in the same format as Section 13 of this specification. Additional information may be submitted as supplements.

18.2 Technical proposals and price quotations should be submitted separately. The quotation should include only pricing. Proposed shipping dates, exceptions, etc. should be included as a part of the technical proposal. -11- copies of the technical proposal and two copies of the price quotation shall be submitted to Mill Power Supply Company P. O. Box 1339, Charlotte, North Carolina 28232.

18.3 Base Proposal

18.3.1 Prices for two (2) 6000KW at 0.8 PF, 4160 volt, 3/ , 60 Hz single engine emergency diesel electric generating sets and all its associated auxiliaries as covered in this specification for Unit #1.

18.3.2 Prices for two (2) diesel generators the same as 12.1a except for Unit #2.

18.3.3 Price and list of one complete set of maintenance tools required per section 4.20.

18.3.4 Price of foundation equipment for each unit per second 4.18.

18.3.5 Price of supervision for erection for each unit.

18.3.6 Price differences, if any for the specified paint coating (Sec. 6.) vs. an option costing shall be provided in the price quotation.

18.3.7 Pricing for Vendor Training Program (Section 6).

18.3.8 Pricing for Vendor Seminar Program (Section 6).

18.3.9 Pricing for Equipment Photographs (Section 6).

18.3.10 Individual pricing shall be provided on all proposed options.

18.3.11 Pricing for recommended spare parts clearly stating all conditions, terms, and escalations.

19. ATTACHMENTS

Form 301.4	Packaging and Shipping Requirements
Form M1	Motor Data Sheet
Form 930.1	Vendor Quality Assurance Certification
Form ME-100	Pump Detail Data Sheet
Form ME-102	Heat Exchanger Data Sheet
Form ME-103	Heat Exchanger Specification Sheet
Form GMW/100	
Table I	List of Emergency Loads & Time Sequence and Sizing of Diesel Generators
Table II	Heat Exchanger NSW Chemistry
Attachment I	Non destructive examination
Attachment II	General Contract Specifications
Attachment III	Duke Power Coating Specifications K-2
Attachment IV	Electrical Seismic Criteria, Specification CNS 1393.00.-1, Amendment 3, July 17, 1974
Attachment V	Form EC-1

ATTACHMENT 1-2

Specification No. CNS1301.00-00-0002

Date October 3, 1974

30,035
10/18/83
Orig. Reid

DUKE POWER COMPANY

CATAWBA NUCLEAR STATION

UNITS 1&2

Title: DIESEL ELECTRIC GENERATOR UNITS

Revision Log

1	June 9, 1975	6	
2	December 4, 1978 (Incorporates all previous	7	
3	July 26, 1983 revisions)	8	
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5		10	

Form 301.1 Rev.2

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02548 (R2-83)
Form 301.2 Rev. 6

VERIFICATION OF SPECIFICATION

Station and Unit Number: CATAWBA NUCLEAR STATION UNITS 1 & 2

Title of Specification: DIESEL ELECTRIC GENERATING UNITS

Specification Number: CNS1301.00-00-0002

Revision: 3

This document specifies items related to QA CONDITION 1. In accordance with established procedures, its quality has been assured. Signatures certify that the above specification was originated, checked, approved and inspected (or waived) as noted below:

Prepared By: J. D. Heffner gmf 7/26/83 JPV 9/23/83 Date: 7/26/83

JPH 9/30/83

Checked By: J. F. Crenshaw Date: 09.26.83

Approved By: D. G. Owen Date: 9-29-83

Inspection Waived By: ______ Date: ______

Inspection Waived For: ☐ ELECTRICAL ☐ M/N ☐ C/E

Inspected By: J. G. Reeves Date: 10-3-83

Inspected By: T. High Date: 10-6-83

QUALITY ASSURANCE TC Roberts Date: 10/17/83

(FOR ASME CODE ITEMS)

Division ______ Date: ______
Design Engineering Department

This is to certify that the above specification has been reviewed by me, the undersigned, and is correct, complete, and in compliance with ______ Edition including the ______. Addendum of ASME Code, Section III, Paragraph ______.

(SEAL) Signature ______

Name: ______
Professional Engineer

No. & State ______

DUKE POWER COMPANY
SPECIFICATION AMENDMENT FORM

SPECIFICATION NO.: CNS1301.00-00-0002
SPECIFICATION DATE: October 3, 1974
AMENDMENT NO.: 3
AMENDMENT DATE: July 26, 1983

GENERATING STATION: CATAWBA NUCLEAR STATION UNITS 1 & 2

EQUIPMENT IDENTIFICATION: DIESEL ELECTRIC GENERATOR UNITS

These amended pages form an integral part of the above referenced Duke Power Company Specification, and invokes deletions from, substitutions in, and additions to the basic specification as listed.

The Contractor shall notify Mill Power Supply Company in writing that he will adhere to this amendment. Any and all exceptions should be noted.

List of pages/forms/attachments (with revision number) valid for this revision:

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*Retyped to include previous (2) amendments plus addition of new requirements as designated by sidelines.

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DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
UNITS 1 & 2

Diesel Electric Generating Units

1. GENERAL

1.1 Scope: This specification covers the manufacture and delivery of: four (4) 7000 KW at 0.8 Power Factor, 4160 Volt, 3 phase, 60 hertz, single-engine Emergency Diesel Electric Generating Sets for Catawba Nuclear Station Units 1 & 2.

1.1.1 This specification is not an ASME Design Specification. References to ASME requirements are contractural only and are offered as guidelines exclusive from the ASME Code requirements. The Contractor shall provide Design Specifications in compliance with the ASME Code. The Contractor shall act as Duke Power Company's "agent" or "designee" as defined by ASME. ASME Section III Specifications shall be submitted to the Owner for information only.

1.2 Installation Site: This equipment is to be installed at Catawba Nuclear Station.

1.3 Definitions:

Owner:	Duke Power Company
Purchaser:	Mill-Power Supply Company
Contractor:	Person or corporation to whom purchase order, is awarded
Bidder:	Person or corporation who responds to Purchaser's inquiry
Responsible Engineer:	The Engineer designated as responsible for a particular piece of equipment.

1.4 Codes or Standards: The equipment specified is to be in accordance with the applicable standards of ANSI, DEMA, IEEE, NEMA, AEC, NFPA, etc., as listed below. In the event of conflict with any requirement of this specification, this specification will take precedence. In addition, the Bidder should notify the Owner per Section 14. | 3

1.4.1 ANSI C50.10 - 1965: General Requirements for Synchronous Machines.

1.4.2 ANSI C50.12 - 1965: Requirements of Salient Pole Synchronous Generators and Condensers.

1.4.3 DEMA - Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines.

1.4.4 IEEE 43 - 1971: Recommended Practice for Testing Insulation Resistance of Rotating Machines. (Also ANSI C50.22-1972)

1.4.5 IEEE 51 - 1955: Guide Principles for Dielectric Tests.

1.4.6 IEEE 115 - 1965: Test Procedures for Synchronous Machines.

1.4.7 IEEE 275 - 1972: Test Procedure for Evaluation of Systems of Insulating Material for Electric Machinery Form Wound Pre-Insulated Stator Coils.

1.4.8 IEEE 308 - 1971: IEEE Criteria for Class IE Electrical Systems for Nuclear Power Generating Stations.

1.4.9 IEEE 323 - 1971: General Guide for Qualifying Class 1 Electric Equipment for Nuclear Power Generating Stations.

1.4.10 NEMA MG-1 - 1972: NEMA Standard for Motors and Generators
Section I - Parts 1 and 2
Section II - Parts 10, 11 and 14
Section III - Parts 20 and 22

1.4.11 IEEE 112A - 1964: Test Procedure for Polyphase Induction Motors and Generators. 3

1.4.12 AEC Safety Guide #9 - 3-10-71: Selection of Diesel Generator Set Capacity for Standby Power Supplies.

1.4.13 IEEE STD 387 - 1977: Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations.

1.4.14 IEEE 344 - 1972: Trial Use Guide for Seismic Qualification of Class 1 Electrical Equipment for Nuclear Power Generating Stations.

1.4.15 AEC Safety Guide #6 - 3-10-71: Independence Between Redundant Standby (On Site) Power Sources and Between Their Distribution System.

1.4.16 Section III, Class 3 of ASME Boiler and Pressure Vessel Code, and all applicable amendments, dated 1974.

1.4.17 NFPA No. 30 - 1974: Flammable and Combustible Liquids code.

1.4.18 NFPA No. 37 - 1974: Standard for the Installation and Use of Stationary Combustion Engines and Gas Turbines.

1.4.19 Title 10 Code of Federal Regulations, Section 50, Appendix B, Quality Assurance Criteria for Nuclear Power Plant and Fuel Reprocessing Plants.

1.4.20 ANSI N45.2-1971, Quality Assurance Program Requirements for Nuclear Power Plants.

1.4.21 ANSI N45.2.2-1972, Packaging, Shipping, Receiving, Storage and Handling of items for Nuclear Power Plants.

2. REFERENCE DRAWINGS AND DOCUMENTS

2.1 Codes and standards identified in Paragraph 1.4.

3. OPERATING CONDITIONS AND REQUIREMENTS

3.1 The Diesel Electric Generating Sets are to be used as a source of on-site Emergency Standby Power. Each set will furnish standby power to the Class 1E distribution system loads for emergency shutdown of the two 1150 MW Catawba Nuclear Reactor-turbine-generator units. Each Diesel Engine-Generator set shall be housed in a separate room, a part of Auxiliary Building, meeting all the requirements of a Class I structure for nuclear power plants. The diesel sets are to be operated at an elevation of 556 feet above sea level, indoors, 55°F to 125°F (Dry Bulb) environment ambient temperature range and at 10% to 25% environmental relative humidity range.

3.2 The maximum room ambient temperature of the Diesel Room will be 125°F and all equipment located in this room shall be capable of operating under these conditions for a continuous period. The air supply for the engine shall be taken from outside the diesel rooms and will be a maximum of 110°F during the summer months. 3

3.3 Each engine generator unit is to operate unattended at rated full load, voltage and frequency under the emergency condition for an indefinite period until manually shut down.

3.4 The diesel-generator unit shall start automatically with no AC power available, accelerate to synchronous generator speed and acquire rated voltage upon receipt of owner's "Start Diesel Signal" or Engineered Safeguard Signal.

3.5 All equipment is to have a minimum design life of forty (40) years with normal use and maintenance.

3.6 Vendor shall submit maximum imbalance on all rotating parts for approval by Owner.

4. EQUIPMENT TO BE FURNISHED

4.1 Engines:

4.1.1 Four (4) stroke cycle diesel engines rated at 7000 KW at 0.8 Power Factor each for continuous operation. The diesel engines shall be turbo-charged, multi-cylinder, Vee-type of manufacturer's current design for stationary service. The engine shall be directly connected to either an engine type or single bearing bracket type generator of electrical characteristic required to meet conditions of motor loads. The rated speed of the engine

shall not exceed that of the manufacturer's engines of the same configuration already in operation for base load or emergency electrical power generation.

4.1.2 The engine shall be suitable for continuous power generation duty, engineered, designed, manufactured and tested in accordance with the applicable DEMA (Standard Practices for Low and Medium Speed Stationary Diesel and Gas Engines) Standard.

4.1.3 The engine with its generator and exciter shall be engineered and designed as a complete unit, and shall be free of deleterious critical speeds of torsional vibration within the range of 90 to 110% of normal operating speed. Any such critical speed of torsional vibration deemed objectionable by the purchaser shall be sufficient cause for rejection of the equipment.

4.1.4 The engine shall be capable of operating at 115% of rated speed without overstressing of any parts.

4.1.5 All parts and equipment incorporated in the units, their associated equipment and auxiliaries shall be new and the latest standard product of the manufacturer regularly engaged in the production of such equipment. All relays are to be of Cutler Hammer make and all pressure switches are to be of Custom Component make. Any substitution must be approved by the Owner.

4.1.6 The engineer is to be up to generator synchronous speed within 10 seconds from signal to start from a cold or hot condition and begin acceptance of load according to loading Table I attached.

4.1.7 The engine must be capable of positive start.

4.1.8 The engine's fuel is to be Diesel Fuel Oil #2.

4.1.9 The engine shall be able to operate at 7700KW continous for a period of two hours out of every twenty-four hours without affecting the life of the unit. The overload capacity shall be guaranteed and shall not unduly stress or overheat the units.

4.1.10 All major parts of the engine (piston, connecting rods, cylinder heads, crankshaft, etc.) are to be Non-Destructive Tested to insure the best quality of components are used in the equipment. Attachment I outlines the minimum Non-Destructive Examination of critical components required by the Owner. However, any further NDT performed by the Contractor as a normal task in the manufacturing of any component shall be so stated by the Contractor and shall be included. All documentation shall be submitted to Owner.

4.1.11 The engine is to be capable of full load rejection at 10% overload without shutting down or damaging engine.

4.2 Basic Engine Accessory Equipment:

4.2.1 Air inlet manifold.

4.2.2 Turbocharger air aftercooler.

4.2.3 Turbocharger and related auxiliary equipment.

4.2.4 Engine Flywheel.

4.2.5 Extension shaft and outboard bearing.

4.2.6 All engine accessory piping, including inlet and outlet connections for jacket water, lubricating oil, fuel, starting air, combustion air and exhaust, and any nonstandard companion flanges.

4.2.7 Exhaust manifold.

4.2.8 Lubricating oil sump (if required) including remote reading level indicator

4.2.9 Attached pump for lubricating oil circulation.

4.2.10 Indicator pressure connection and shut-off cock for each cylinder.

4.2.11 Electric load and speed sensing and mechanical governors (Woodward EGB or equal), including control box, resistor box and potentiometer (droop and isochronous mode required).

4.2.12 Overspeed shutdown device.

4.2.13 Crankcase pressure relief valves.

4.2.14 Engine mounted and driven fuel oil booster pump.

4.2.15 DC motor driven fuel oil booster pump.

4.2.16 Flywheel barring device.

4.2.17 Temperature sensors for remote readout or indication on all critical sensing points (i.e., jacket water inlet and outlet, lubricating oil inlet and outlet, etc.).

4.2.18 Temperature detectors on all main engine bearings.

4.2.19 All oil strainers are to be of the double element type to allow changeout on one and not affect the engine while operating.

4.2.20 Speed switches are to be of the Airpax type with two separate pickups and control boxes furnished. At least three (3) separate different speed contacts are to be furnished on each control box.

4.2.21 Dual air starting system with the minimum capability of three (3) successive cold starts from each tank. The Owner will supply compressors, aftercoolers and tanks.

4.3 Generator, Exciter and Voltage Regulatory:

4.3.1 Each generator shall be salient pole, revolving field, synchronous, engine shaft driven with top air discharge. The optimized generator should be provided. The make is to be Electric Products.

4.3.2 The generator shall have a minimum continuous capacity of 7000KW at 0.8 lagging power factor, 4160 volts (wye)/2400 volts (Delta), 60 Hz, 3Ø with additional 10% overload capacity at 0.8 power factor for a period of two hours out of every twenty-four hours without affecting the life of the unit. The overload capacity shall be guaranteed and shall not unduly stress or overheat the units. The generator system is to be sized to enable starting and running loads as listed in Table I. | 3

4.3.3 The duty shall be continuous.

4.3.4 The generator insulation shall be Class F with a temperature rise 95°C by embedded detector over a 50°C ambient temperature at rated capacity.

4.3.5 The grounding transformer will be as approved on Contractor drawing CNM-1301.00-0245. | 3

4.3.6 The speed of the generator shall be that of the engine.

4.3.7 The generator field exciter is to be of the static type with an operating frequency range from 58 to 62 Hertz.

4.3.8 The voltage regulator is to be the static type.

4.3.9 The generator stator is to have at least six temperature detectors (10 ohms at 25°C) located in accordance with ANSI C50.10. The RTD converters and power supplies are to be furnished by the Contractor.

4.3.10 Maximum momentary generator voltage drop after application of each load is not to exceed 25% of rated generator voltage. Further, generator voltage shall recover to at least 90% of nominal and frequency shall be restored to at least 98% of nominal in less than 40% of each load sequence time interval.

4.3.11 Each diesel generator unit is to have the capability of automatically starting unattended at any time on a start signal and come up to rated frequency and voltage within ten (10) seconds. At the time the unit reaches rated speed it shall carry the emergency loads per the loading and time sequence as shown in Table I.

4.3.12 The generator shall be equipped with a means for heating which shall be adequate to maintain the internal temperature above the dew point when the equipment is idle. Heater leads are to be brought out to a terminal box suitable for Owner's connection.

4.3.13 Surge protection is to be supplied for the Generator and will be furnished by the Contractor.

4.3.14 All relays are to be of Cutler Hammer make. Any substitutions are to be approved by the Owner.

4.4 Air Intake System:

4.4.1 The air intake system shall consist of silencer, dry type filter, and flexible hose connection.

4.4.2 The silencer and dry type filter are to be an in-line residential type, and are to be furnished by the Contractor.

4.4.3 The Owner will connect his air intake piping to the silencer through a flexible hose. The flexible hose will be furnished by the Contractor while the air intake piping will be furnished by the Owner.

4.5 Exhaust System:

4.5.1 The exhaust system shall consist of flexible connections and mufflers for each engine.

4.5.2 The flexible connection is to be a high grade of flexible metal, with flanged ends to assure expansion protection and vibration isolation.

4.5.3 The muffler is to be residential type, suitable for vertical service.

4.5.4 The exhaust piping shall be furnished by Owner. The Contractor is to review the Owner's exhaust piping layout and advise the Owner how much the exhaust back pressure will affect the engine KW output.

4.6 Fuel Oil System:

4.6.1 A complete fuel oil system (less yard storage tank which is to be furnished by the Owner) is to be furnished for each diesel. All off-engine piping will be furnished by the Owner.

4.6.2 The engine fuel is to be commerical Grade #2 and shall start the engine from cold condition by heat of compression without any auxiliary preheating of fuel.

4.6.3 Filters are to be duplex, replaceable cartridge type. Two filters are to be connected in parallel so as to enable the Owner to change one filter without affecting the operative ability of the unit.

4.6.4 Fuel lines are to be heavy wall seamless tubing with special heat treating, double rolled steel tubing of each length to all cylinders between injection pumps and engine.

4.6.5 Each engineer shall have an engine driven fuel oil booster pump and a DC motor driven fuel oil booster pump. The DC fuel oil booster pump is to supply fuel to the cylinders at the time of signal for engine start.

4.6.6 Each engine is to have a fuel oil day tank with two (2) separate float switches (each having low level and high level contacts), a liquid level indicator, automatic controls for maintaining tank fuel oil level for a minimum of 500 gallons.

4.7 Lubricating Oil System:

4.7.1 A complete lube oil system shall be furnished by the Contractor to supply oil under pressure to the main and crank pin bearings, pistons, piston pins, timing gears, cam shaft bearings and rocker arm bearings. The maximum stabilized oil temperature leaving the engine when the engine is carrying the short-time rating load in an ambient temperature of 125°F shall not exceed the manufacturer's maximum safe value.

4.7.2 The main lube oil pump shall be engine driven and shall furnish lube oil at a constant pressure at all points requiring lubrication.

4.7.3 Strainers shall be of the full-flow duplex type. Each strainer arrangement is to have two units connected in parallel so one can be removed without affecting the operation of the diesel unit.

4.7.4 The lube oil filters are to be arranged such that changing oil filter cartridges out will not affect the operation of the diesel unit.

4.7.5 Pressure gauges shall be furnished on the inlets and outlets of all strainers and filters.

4.7.6 An electric motor driven oil pump shall be furnished to prelube the bearings. Controls for this pump shall be so arranged that it will be able to continuously circulate warm oil through the engine when the engine is inoperative. Heaters are to be provided for heating the oil.

4.7.7 A pressure sensing device shall be furnihsed in the system to signal when the lube oil pressure drops to a predetermined low value. A low-low oil pressure alarm shall be furnished in the system to signal when the lube oil pressure drops to the lowest

safe operating level. An engine shutdown safety device shall be provided for protection of the engine.

4.7.8 A lube oil cooler is to be supplied with each engine to maintain a safe temperature for the lube oil while operating normally and at its short time rating. The cooler is to be shell and tube type with removable tube bundles.

4.7.9 The crankcase shall be provided with suitable sump and drain to remove the lube oil.

4.8 Cooling Water System:

4.8.1 Each engine cooling water system shall be furnished complete, including expansion tank, heat exchangers, temperature regulators, pressure gauges, thermometers, control instrumentation, valves, fittings, engine driven jacket water pump, motor-driven jacket pump that may be used for circulating warm water through the engine when the engine is not operating, combustion air cooler, intercooler and/or aftercooler, any other cooling water pumps required by the engine's design, and miscellaneous piping for a completely satisfactory operating system.

4.8.2 Temperature control of the system shall be through valves located in the closed loop side of the main heat exchanger and not on the cooling pond side. The cooling pond side water flow through the heat exchanger will be 900 gpm, 150 psig max. at 95°F max.

4.9 Starting Air System: Two complete systems excluding tanks, aftercoolers, and compressors are to be provided so that the engine can be started from either one.

4.9.1 The air starting system is to have an air dryer system to insure dry starting and control air.

4.9.2 Air start valves shall be provided with one supplying each end of the air start ventifold. The air start valves should have indication of the valve open status which will be recorded.

4.10 Crank Case Breather System: Each engine is to have a crank case breather system. The blower is to have an explosion proof motor.

4.11 Engine Control Cabinets:

4.11.1 Each engine shall have two control cabinets. One is to be labeled "Engine Generator Control Panel" and other Engine Control Panel." Arrangement of all devices shall be subject to approval of Owner.

4.11.2 The Engine/Generator Control Panel is to have all devices necessary to manually close the generator breaker and manually load (parallel to system) the diesel locally. Contractor shall also arrange his

connections so that the Owner can also have the capability to perform these functions in the Control Room.

4.11.3 The Engine Control Panel is to have all devices necessary to operate and monitor the diesel's engine operation locally.

4.11.4 Control Panels:

4.11.4.1 Design

Contractor shall furnish one totally enclosed walk-in type control panel. A walk-in control panel is defined as one with a minimum depth of 5 ft. with doors in each end. Where control systems require less than 20 sq. ft. of front panel control space, a rear entry Hoffman type control panel may be supplied in lieu of walk-in enclosure.

4.11.4.2 Arrangement

The interior of the control panel is to have convenience outlets and switches and lights for adequate interior lighting. The face of the control panel shall be illuminated using T12 rapid start fluorescent lights.

Purchaser shall have right to extra space and/or cutouts as specified for Owner furnished equipment. Where blank space is specified for Owner mounted equipment, the interior of both walls (front and rear) in addition to the outside fron panel shall be left unobstructed.

4.11.4.3 Construction

All panels and doors shall be gasketed so that the structure conforms to NEMA 12 requirements. Doors shall have keylock type handles with three point latches. The cubicle shall be designed for indoor installation on a concrete pad and constructed of not less than 11 gauge sheet steel. Panel surfaces shall be adequately braced and reinforced to provide suitable support to the components and to prevent warpage. Removable lifting eyes shall be provided in the top. Exposed mounting hardware on the exterior of the panel is not allowed. Cubicles shall be mounted on continuous anti-vibration mounting pads which are to be furnished by the Owner. Holes and cutouts for equipment shall be drilled, punched or sawed. No burning of cutouts is permitted.

4.11.4.3.1 Painting

The cubicle is to be thoroughly cleaned to remove all rust, loose mill scale, welding slag or spatter, oil, grease, and other contaminants. The exterior of the cubicle is to be furnished painted with ASA #61 grey color over a rust resisting primer unless otherwise directed by the Owner. The interior of the panel is to be painted white. All shop painting is to be done in accordance with instructions of the coating manufacturer.

4.11.4.4 Wiring

Panels shall be completely wired with No. 14 AWG 19 strand tinned copper switchboard wire approved by the Owner. All terminations shall be made using full ring tongue preinsulated terminal lugs as approved by the Owner. Both ends of each wire shall be permanently identified with its circuit number. Where obtainable all control components are to have screw terminals. Flame retardant wire ducts are to be used to support wiring as necessary. These shall be free of sharp edges, corners or protruding screw threads. Wire ducts are to be sized to prevent overfilling, and all duct covers are to fit without binding the enclosed wiring. Wire bundles of less than 1" in diameter may be run exposed, but they must be supported at no greater than 18" intervals.

Circuits to which Owner installed wiring must connect shall be terminated on marked terminal blocks. These shall be States Manufacturing Co. Type NT or Stanwick sliding link type. Ten percent spare terminal block points are to be supplied and one side of all terminal blocks is to be left clear for purchaser's wiring.

4.11.4.5 Specific Requirements

4.11.4.5.1 Nameplates

All panel mounted components are to have 2½" x 1" engraved black plastic identification nameplates with white lettering. The nameplates are to be attached using two black self tapping sheet metal screws.

4.11.4.5.2 Adhesive Attachments

Adhesive attachments of any type are not acceptable anywhere in panel construction.

4.11.5 Control Components

4.11.5.1 All control components are to be of a high quality utility grade as approved by the Owner. All devices are to be identified.

4.11.5.2 Control Relays are to be Cutler Hammer Types D40, D23, D26.

4.11.5.3 Pushbutton/Indicator lights are to be Cutler Hammer Type 10250T or E30.

4.11.5.4 Make of annunciator is to be BETA.

4.11.5.5 The types and manufacturers of proposed recorders will be specified later.

4.11.6 Pre-wiring by Contractor

All electrical circuits remote from the main control panel shall be terminated on States or Stanwick type terminal blocks enclosed in a NEMA 12 terminal cabinet mounted on each shipping section such that the Owner's electrical installation shall consist of no more than pulling and terminating cables (supplied by purchaser) between marked terminals.

4.11.7 Test and Inspection

After fabrication, all control panels and equipment shall be given a complete continuity test and a complete operational test. The Owner must be notified 10 days prior to the operational test so that he may witness these tests if he so elects.

4.11.8 Shipment
Equipment shall be handled and shipped with proper precautions being taken to protect shop painting and equipment from damage.

4.11.9 Information to be Furnished

Bidder shall state probable panel fabricator, manufacturer and catalog numbers of components to be furnished, proposed panel size and proposed panel layout.

4.11.10 Approvals Required By Owner

The Owner retains the right of prior approval or disapproval of any factors in control system or panel design. Factors of

particular attention are quality of steel work, control components to be furnished, panel size, panel arrangement, wiring methods, mounting methods and types of drawing to be furnished. Control panel construction shall not commence until all panel drawings are approved by the Owner.

4.11.11 Drawings to be Furnished

Electrical drawings to be furnished shall consist of complete elementary diagrams, point to point wiring diagrams, interconnection wiring diagrams, outlines, bills of materials, full descriptions of operations and recommended trouble shooting procedures. Drawings shall be submitted as stated elsewhere in this specification.

4.11.12 Copper Bus

A copper ground bus shall be provided the full width of control panel along the bottom. The bus is to be insulated from the panel.

4.11.13 Engine/Generator Control Panel

4.11.13.1 Listed below is a minimum list of devices required on each Engine/Generator control panel for bid analysis only and is by no means final. It is the Contractor's responsibility to recommend additional devices that are required for safe and reliable operation. All devices are to be identified inside and outside the cabinet. Identification names are subject to Owner's approval. The Owner will furnish a layout and complete list of devices required on this panel at a later date.

4.11.13.1.1 Woodward Governor Control Box and associated wiring.

4.11.13.1.2 Airpax Speed Switch Control Boxes (2).

4.11.13.1.3 Instrumentation, switches and lights normally used in operating the generator will be placed on the generator side of the panel.

4.11.13.1.3.1 Frequency meter

4.11.13.1.3.2 Power-factor meter | 3

4.11.13.1.3.3 Watt meter

4.11.13.1.3.4 Voltmeter

4.11.13.1.3.5 AC ammeter

4.11.13.1.3.6 DC voltmeter

4.11.13.1.3.7 Synchroscope

4.11.13.1.3.8 AC voltmeter

4.11.13.1.3.9 Governor control switch

4.11.13.1.3.10 Voltage control switch

4.11.13.1.3.11 Generator breaker control switch

4.11.13.1.3.12 Normal switchgear bkr. control switch

4.11.13.1.3.13 Standby switchgear bkr. control switch

4.11.13.1.3.14 Watthour meter

4.11.13.1.3.15 One multipoint recorder

4.11.13.1.3.16 Pyrometer equipment | 3

4.11.13.1.3.17 Synchronizer control switch

4.11.13.1.3.18 One high speed recorder

4.11.13.1.4 Engine hour meter

4.11.13.1.5 Engine Starting Time Clock with ability to accurately read 1/100 of a second.

4.11.14 Engine Control Panel

4.11.14.1 Listed below is a minimum list of devices required on each Control Panel and is by no means final. It is the Contractor's responsibility to recommend additional devices that are required for safe and reliable operation. All devices are to be identified inside and outside the cabinet.

4.11.14.1.1 Alarm Annunciator with a minimum of the following alarm windows:

4.11.14.1.1.1 High ΔP lube filter | 3

4.11.14.1.1.2 High ΔP lube strainer

4.11.14.1.1.3	Low pressure turbo oil	
4.11.14.1.1.4	Low pressure lube oil	
4.11.14.1.1.5	Trip low pressure turbo oil	
4.11.14.1.1.6	Trip low pressure lube oil	
4.11.14.1.1.7	Low level lube tank	
4.11.14.1.1.8	Low temp lube oil inlet	
4.11.14.1.1.9	Low temp lube oil outlet	
4.11.14.1.1.10	High temp lube oil inlet	
4.11.14.1.1.11	High temp lube oil outlet	
4.11.14.1.1.12	Trip high press. crankcase	
4.11.14.1.1.13	Trip high temp bearings	3
4.11.14.1.1.14	Trip high temp lube oil outlet	
4.11.14.1.1.15	Trip low low lube oil pressure	
4.11.14.1.1.16	Low level main fuel tank	
4.11.14.1.1.17	High ΔP fuel TP strainer 1	
4.11.14.1.1.18	High ΔP fuel TP strainer 2	
4.11.14.1.1.19	Low level fuel day tank	
4.11.14.1.1.20	High level fuel day tank	
4.11.14.1.1.21	High ΔP fuel pump strainer	
4.11.14.1.1.22	High ΔP fuel filter	
4.11.14.1.1.23	Low press fuel oil	
4.11.14.1.1.24	High temp aftercooler water in	

4.11.14.1.1.25 Low level jacket water

4.11.14.1.1.26 Low temp jacket water in

4.11.14.1.1.27 Low tempjacket water out

4.11.14.1.1.28 High temp jacket water in

4.11.14.1.1.29 High temp jacket water out

4.11.14.1.1.30 Low press jacket water

4.11.14.1.1.31 Ground fault

4.11.14.1.1.32 Overcurrent

4.11.14.1.1.33 Trip generator fault

4.11.14.1.1.34 Low pressure control air

4.11.14.1.1.35 Panel intrusion

4.11.14.1.1.36 Barring device engaged

4.11.14.1.1.37 Low pressure starting air | 3

4.11.14.1.1.38 Unit failure to start

4.11.14.1.1.39 Trip vibration

4.11.14.1.1.40 Trip overspeed

4.11.14.1.1.41 Aux. equip not in auto

4.11.14.1.1.42 Exhaust temp high/low

4.11.14.1.2 Instruments to be located on engine side of panel:

4.11.14.1.2.1 Starting air pressure

4.11.14.1.2.2 Control air pressure

4.11.14.1.2.3 Turbo oil pressure

4.11.14.1.2.4 Lube oil pressure

4.11.14.1.2.5 Fuel oil pressure

4.11.14.1.2.6 Differential pressure fuel oil filter

4.11.14.1.2.7 Jacket water pressure

4.11.14.1.2.8 Crankcase pressure

4.11.14.1.2.9 Engine speed

4.11.14.1.2.10 Engine hours | 3

4.11.14.1.2.11 Auto/run switches and indicating lights for all auxiliaries

4.11.14.1.2.12 Manual pyrometer

4.11.14.1.2.13 Day-tank level

4.11.14.1.2.14 Lube-tank level

4.11.14.1.3 Off - On Switches with lights:

4.11.14.1.3.1 All DC and AC auxiliaries are to have RUN/AUTO switches with red indicating lights on when auxiliaries are running and green when off.

4.11.14.1.3.2 A C Power

4.11.14.1.3.3 D C Power

4.11.14.1.4 Start button, Normal Stop Button, Emergency Stop Button.

4.11.14.1.5 A high speed recorder with chart speed of three inches per second for recording:

4.11.14.1.5.1 Engine Start signal.

4.11.14.1.5.2 Start Valves open (Each Valve).

4.11.14.1.5.4 Governor position.

4.11.14.1.5.5 Time Mark (one second interval)

4.11.14.1.5.6 Engine at one quarter, one-half, three-quarters and full speed.

This recorder will start when fast diesel start is initiated and full run for fifteen seconds.

4.11.14.1.6 A recorder to record the following:

4.11.14.1.6.1 All cylinder exhaust temperatures.

4.11.14.1.6.2 Supercharger inlet temperatures.

4.11.14.1.6.3 Supercharger outlet temperature.

4.11.14.1.6.4 Jacket cooling water inlet temperature.

4.11.14.1.6.5 Jacket cooling water outlet temperature.

4.11.14.1.6.6 Lube oil inlet temperature.

4.11.14.1.6.7 Lube oil outlet temperature.

4.11.14.1.6.8 Others as recommended by Contractor.

Note: All instruments, gauges and switches on the panel board are to be plainly marked for the service intended. Flow switches, temperature sensors and switches, and pressure switches containing mercury are not acceptable.

4.11.14.1.7 Automatic Pyrometer to record the following:

4.11.14.1.7.1 All cylinder exhaust temperatures.

4.11.14.1.7.2 Supercharger inlet temperatures.

4.11.14.1.7.3 Supercharger outlet temperatures.

4.11.14.1.7.4 Jacket cooling-water inlet temperature.

4.11.14.1.7.5 Jacket cooling-water outlet temperature.

4.11.14.1.7.6 Lube-oil inlet temperature.

4.11.14.1.7.7 Lube-oil outlet temperature.

4.11.14.1.7.8 Others as recommended by Contractor.

4.12 Auxiliary Motor Drives:

4.12.1 All motors with the exception of the DC fuel oil booster pump motor shall be 575 volt, 3 phase, 60 Hertz, 1.15 S.F. TEFC, squirrel cage induction motor with Class F insulated windings. Temperature rises for continuous operation at rated load shall be in accordance with the NEMA rises for Class B insulation systems.

The motors shall be as manufactured by Seimens-Allis, Westinghouse, General Electric or Reliance Electric Company. Shaft bearings shall have a minimum B-10 life of fifteen (15) years. | 3

4.12.2 Contractor shall provide three (3) microfilmable copies of motor data information (Form M1) for approval within nine (9) weeks of receipt of order. The Contractor shall also furnish motor outline drawings for approval in accordance with the drawing requirements of this specification. He shall include adequate motor instructions in the instruction book.

4.13 Auxiliary Pumps

4.13.1 The following auxiliary pumps are required with each Diesel Generating System:

With engine - motor driven lubricating oil pump for "B and A" service

Lubricating System - engine driven lube oil service pump;

Fuel System - engine driven fuel oil booster pump; DC motor driven fuel oil booster pump.

Cooling Water System - engine driven jacket water pump;

Preheat System - motor driven jacket water circ. pump; motor driven lube oil circ. pump

4.13.2 Motor drives, where required, for these pumps will be furnished in accordance with specification Section 4.12. The above pumps are important to Nuclear Safety and the design and the materials of the casings, impellers, shafts and fittings shall be especially suitable for the operating conditions. These pumps shall be designed and built in accordance with Section III, Class 3 of the ASME Code dated 1974. Any pump that is mounted on an integral part of the engine does not have to be manufactured to ASME Code.

4.13.3 These pumps are required to be seismically designed in accordance with Attachment IV "Functional Design Requirements for ASME Section III Pumps within the Diesel Generator Building of Catawba 1-2." The seismic analysis required to establish equipment base details where applicable shall be submitted for review no later than six weeks after issuance of motor frame size. Remaining seismic analyses will be submitted later. Calculations will be reviewed by Duke and approved as correct before final drawing approval is made. | 3

4.13.4 Vendor must submit maximum imbalance on all rotating parts for Owner's approval.

4.13.5 Each pump will be furnished with accessories necessary for operation and maintenance, including the following:

4.13.5.1 Fast type flexible coupling or approval equal, where applicable.

4.13.5.2 Air cocks, drain cocks and oil gauges.

4.13.5.3 Lifting eye bolts and special wrenches as required.

4.13.5.4 Motor support plates are to be cast iron or welded plate construction.

4.13.5.5 Bedplates are to have drip rims and drains.

4.13.5.6 A brass nameplate shall be attached to each major item of the pumping apparatus and shall show the following information:

4.13.5.6.1 Pump name

4.13.5.6.2 Manufacturer's name

4.13.5.6.3 Manufacturer's serial number

4.13.5.6.4 Rated pump capacity - gpm @___F

4.13.5.6.5 Rated total head _____feet

4.13.5.6.6 Shut off head ___ feet (design conditions)

4.13.5.6.7 Applicable codes

4.13.5.6.8 Official N-type symbol

4.13.5.6.9 Maximum casing-pressure (where applicable @ ___F).

4.13.5.6.10 Class of pump

4.13.5.6.11 Design pressure and coincident temp.

4.13.5.6.12 Year built

A drawing of the nameplate meeting the above requirements is required.

4.13.5.7 Manufacturer must state the allowable forces and moments each pump will accept.

4.13.5.8 Each pump will be delivered with one extra set of flange gaskets.

4.13.6 Six copies of certified pump performance test curves for pumps covered by the specification are to be submitted to Mr. C. J. Wylie, Attn: J. M. Lines for approval prior to shipment of any pumps. Six copies of hydrotext results, where applicable, are required for approval prior to shipment of equipment. | 3

4.13.7 In addition to nameplates, all pumps shall be tagged with metal tags showing the pump name and mark number. Tags shall be permanently secured with noncorroding wire.

4.13.8 All internal wetted surfaces shall be free of metal chips, weld spatter, slag, oil, grease, dirt, scale and other foreign material. Immediately after final cleaning, the end connections shall be sealed with plugs, caps or covers to prevent entry of contaminants and to prevent damage to facings or weld grooves. These caps are to be secured so as not to become detached during shipment or handling. Bidder shall also comply to ASNI N45.2.1-1973 clean Level B requirements.

4.13.9 The pumps and accessories shall be packaged or crated to prevent deterioration, contamination, and physical damage during transit or storage; and to facilitate handling and unloading. Any articles or material that might otherwise be lost shall be boxed or wired in bundles and marked for identification.

4.14 Piping and Miscellaneous In-Line Equipment: All auxiliary system piping including valves, furnished with the Diesel Electric Generating Unit but not on the engine proper is to be designed, analyzed, tested and furnished of materials meeting the requirements of the ASME Boiler and Pressure

Vessel Code, Section III - Nuclear Power Plant Components for Class 3 Components, 1974.

All such materials shall exhibit the appropriate "N" stamp in accordance with ASME Section III and the finished system must also bear the appropriate "N" stamp. Effective ASME Section III Code date is hereby established as of 1974.

The Contractor is to furnish allowable loading on all Owner piping connections for approval as applicable. Contractor is responsible for furnishing materials and anchorages that are heavy enough to accomodate Owner's piping loads (if applicable) and therefore is cautioned about purchase of materials prior to obtaining Owner's approval of allowable loads.

4.15 Heat Exchangers:

4.15.1 Main Diesel Generator Heat Exchangers

4.15.1.1 Four Diesel Generator Heat Exchangers (one heat exchanger per Diesel) are to be used to cool engine coolant in the Diesel Generator System. The cooling medium is supplied from the Nuclear Service Water System (untreated lake water) and is circulated through the tube side of the heat exchanger. The tube side design fouling factor shall be 0.001. Pertinent NSW chemistry is shown in attached Table II.

4.15.1.2 The channel, tube sheet, and shell material shall be carbon steel. Tube material shall be inhibited admiralty. Three-fourth inch vent and three-fourth inch drain connections shall be provided on both shell and tube side.

4.15.1.3 Maximum fluid velocity through the tube side shall be limited to 8.0 feet per second. Maximum pressure drop on the tube side shall be limited to 14 psi.

4.15.1.4 Design pressure of the tube side shall be 250 psig. Design temperature of the tube side shall be 95°F.

4.15.1.5 Each heat exchanger will be horizontal straight tube design. Removable channel covers shall be provided for easy access to the tubes.

4.15.1.6 Tube side design flow shall be Contractor's decision. However, each heat exchanger shall be capable of passing a maximum tube side flow of 900 gpm without exceeding the maximum pressure loss.

4.15.1.7 Each heat exchanger shall be capable of withstanding the thermal stress resulting from 40 cycles of initiation of shell side flow, at Contractor's design temperature simultaneously with initiation of tube side flow at 40°F at design flow rates. Design life of each heat exchanger shall be 40 years.

4.15.1.8 Each heat exchanger shall accommodate the following design operating conditions:

4.15.1.8.1 Tube side flow, gpm: Contractor's decision, 900 Max.

4.15.1.8.2 Tube side inlet temp, °F: 95

4.15.1.8.3 Tube side outlet temp, °F: Contractor's decision.

4.15.1.9 Contractor shall state total length allowed for each heat exchanger including tube pull length and the total width including nozzles.

4.15.2 Deleted

4.15.3 All Heat Exchangers

4.15.3.1 All auxiliary heat exchangers furnished as a part of the Diesel Electric Generating Unit are safety related and are to be designed, analyzed, tested and furnished of materials meeting the requirements of the ASME Boiler and Pressure Vessel Code, Section III Nuclear Power Plant Components for Class 3 components.

4.15.3.2 All such heat exchangers shall exhibit the appropriate "N" stamp in accordance with ASME code.

4.15.3.3 The effective ASME Section III Code date is hereby established as 1974.

4.15.3.4 The Contractor is to furnish allowable loadings on all Owner piping connections for approval as applicable. Contractor is responsible for furnishing heat exchangers that are heavy enough to accommodate owner's piping loads (if applicable) and therefore is cautioned about purchase of heat exchangers prior to obtaining Owner's approval of allowable loads.

4.15.3.5 All materials shall be specially suitable for the service required The heat exchangers shall be suitably degreased and capped and the finished exchangers shall be vacuum dried and nitrogen blanketed for shipment and storage at the plant before installation. Bidder shall

submit pressure of nitrogen blanket to shipment for Owner's approval.

Each blanketed exchanger shall be shipped with a pressure gauge to monitor the blanketing pressure. Each heat exchanger shall be coated externally (except for any parts made of stainless steel or copper) with a primer which conforms to Attachment III, Duke Power Standard Coating Specification K2. The heat exchangers shall meet the seismic design conditions per "Seismic Requirements for Safety Related Heat Exchangers and Piping for Nuclear Power Stations." | 3

4.15.3.6 A brass nameplate shall be attached to each heat exchanger and shall show the following information:

4.15.3.6.1 Component name

4.15.3.6.2 Manufacturer's name

4.15.3.6.3 Manufacturer's serial number

4.15.3.6.4 Maximum working pressure psig ___ shell side tube side

4.15.3.6.5 Hydro test pressure psig ___ shell side ___ tube side

4.15.3.6.6 Maximum working temperature, F ___ shell side ___ tube side

4.15.3.6.7 Test temperature, F ___ shell side ___ tube side

4.15.3.6.8 ASME Code Stamp

4.15.3.6.9 Year built

4.15.3.7 All pipe connection nozzles shall have welding ends which conform to Duke Power Weld End Preparation Drawings CN-1676-1, Rev. 1, June 20, 1974 and CN-1676-1.1, Rev. 1, June 20, 1974, using piping Class C. These drawings will be sent to the Contractor after the bid is awarded.

4.15.3.8 All packaging materials, especially the wooden crating for large components, must be flame treated or non-combustible wherever possible.

4.16 Motor Control Center: Owner will furnish his own motor control center. Supply voltage will be 600V, 3Ø, 60 Hertz and will house all 575 volt auxiliary motor starters and load breakers. Contractor is to furnish necessary data for owner to design the motor control center.

Note: AC for the Motor Control Center will not be available until diesel generator dead bus closure on a blackout condition. Therefore, the diesels are to have the capability of coming up to speed without AC power.

4.17 4160 Volt Switchgear: The 4160 volt switchgear, diesel generator breaker and its protective relaying is to be furnished by the Owner. Contractor is to furnish the data required by him so that the Owner can size the generator breaker.

4.18 Foundation Equipment: A complete set of foundation bolts, nuts, plates, soleplates and washers for the engine-generator unit and related auxiliaries, where required, to anchor the equipment to their foundations is to be furnished by the Contractor for each diesel. All load bearing material, excluding washers, jacking plates, and shims, are to be furnished with Mill Test Reports.

4.19 Batteries and Battery Charger: Control and Power Batteries are to be initially furnished by the Contractor. The batteries are to be 125V DC and sized such that they will remain above 1.14 volts per cell for a period of three hours from a full "Floating" charge and loss of its charger. The charger is to be sized to carry the control and power loads and completely recharge the batteries from a 1.14 volt per cell state in eight hours. D C loads include all the diesel DC control power requirements, DC fuel oil booster pump motors and any other DC loads determined by the contractor necessary for safe diesel operation. 3

4.20 Miscellaneous Equipment:

4.20.1 One complete set of standard and torque wrenches, special wrenches and special maintenance tools, which are required for the required operations, maintenance and repair of the engine-generator unit is to be supplied for the station.

4.20.2 Spare parts - One set of manufacturer's standard spare parts to be furnished, properly processed, and placed in suitable labeled containers for long term storage. A list of these spare parts are to be indicated in the bid. The Contractor's recommended spare parts listed should be made with consideration of the type of service for which the units will be used and to achieve minimum downtime. This refers to considering such things as spare crank shaft and supercharger.

4.21 Thermocouples: All thermocouples are to be I.S.A. Type J, 3 wire shielded Iron-Constantan with the ground wire being a copper wire.

5. GENERAL DESIGN

5.1 Description: As specified in Section 4.0 - Equipment to be Furnished.

5.2 Materials:

5.2.1 The Bidder shall provide in his proposal a list and full description of all parts, materials, or equipment manufactured outside the United States, if any, that are intended to be furnished with this order. No parts, materials, or equipment shall be of manufacture outside the United States without prior approval of the Owner.

5.2.2 All materials used shall have inherent flame retardent characteristics.

5.2.3 No aluminum conductors are to be used without the Owner's written approval.

5.2.4 No aluminum or mercury is to be used without the Owner's written approval.

5.3 Responsibilities:

5.3.1 Owner:

In addition to the responsibilities designated in other portions of the specification, the Owner is responsible for:

5.3.1.1 All drawing and manual approvals.

5.3.1.2 Release for manufacture.

5.3.1.3 Release for shipment.

5.3.1.4 Approval of any alternates or deviations from the specification.

5.3.1.5 Approval of all test reports.

5.3.2 Contractor:

In addition to the responsibilities designated in other portions of the specification, the Contractor is responsible for:

5.3.2.1 Advising Purchaser and Sponsor Engineer immediately of any potential schedule changes or equipment problems.

6. SPECIAL REQUIREMENTS

6.1 The attached General Conditions of Contract dated August 1, 1973, shall form a part of this specification.

6.2 Spare Contacts: All spare contacts on the proposed equipment should be wired to terminal blocks for future use as determined by Duke. All terminal blocks associated with these spares shall be located at one convenient location.

6.3 Painting and Coating:

6.3.1 Prior to shipment all items of equipment are to be thoroughly cleaned and painted.

Equipment shall be furnished with a Sherwin-Williams Polane T catalyzed polyurethane ANSI - 61 grey enamel finish, or Duke approved equal, in accordance with attached Duke Power Specification K-2. The Contractor may obtain all coating materials from the Sherwin-Williams Company, c/o Mr. R. E. Roberts, 307 Freeman Bldg., Greensboro, N. C. 27403, Phone - 919-299-9532.

6.4 Vendor Training Program: The Bidder shall indicate the availability of any training programs on the operation/maintenance of the equipment which is proposed. This information, which should be provided as a separate attachment to the technical proposal, should include specifics of the available programs, e.g., factory or site training, audio/visual training aids, etc.

6.5 Vendor Seminar: The Vendor shall indicate the availability of a one-day seminar program, for Duke engineers, to be held at his manufacturing facility. This information, which should be provided as a separate attachment to the technical program, should include specifics of the available program, i.e., equipment design, factory tour, visual aids, etc.

6.6 Equipment Photographs: The Contractor shall furnish the Owner with 2 sets of color photographs (Kodacolor or equivalent 8 x 10 inch size) taken at significant stages during manufacture. A set of photographs should consist of approximately 30 exposures. When applicable, an object of known size should be included in each photograph. | 3

6.7 Equipment Transporting: Adequate means shall be provided for lifting and transporting equipment listed in this specification. These means shall be, e.g., eye bolts, or through appropriate crating.

6.8 Impact Recorders: Impact Recorders are required on all major equipment shipments to record both vertical and horizontal shock forces.

7. QUALITY ASSURANCE

7.1 This section covers Quality Assurance Requirements for equipment, systems, structures, and/or materials important to nuclear safety. As a minimum, the supplier shall comply with the codes, standards, and guides contained in this specification.

7.1.1 The supplier shall meet ANSI N45.2-1971 or 10CFR50, Appendix B by implementing this QA program which has been found satisfactory, at the time of audit, by Duke Power Company.

7.1.2 The supplier shall meet ANSI N45.2.2-1972 or Duke QA approved equivalent as delineated on the attached Packaging and Shipping Requirements Form 301.4.

7.1.3 When the specification is referenced in a document or correspondence, the specification number, latest revision designation and title shall be given.

7.1.4 The supplier shall provide two copies of the Supplier Quality Assurance Certification From 930.1 for each shipment as follows:

7.1.4.1 The original shall be sent to the QA Manager, Technical Division, Quality Assurance Department, P. O. Box 33189, Charlotte, NC 28242, no later than the shipment date. | 3

7.1.4.2 A copy shall accompany the equipment to the site. Absence of this copy shall be grounds for Owner to quarantine or return shipment to supplier.

7.1.5 The original certified copy of all required inspection records and test reports listed below, shall be submitted to the QA Manager, Technical Services Division. These records shall be traceable to the manufactured articles to which they apply. All this information, unless previously agreed upon, shall be submitted with the Certification Form 930.1. | 3

7.1.5.1 During manufacture, the components, assemblies, and systems involved shall be inspected and tested in accordance with the following:

7.1.5.1.1 All components and assemblies which form an integral part of or are attached to the engine shall be under the control of the supplier's Quality Assurance Program. This program shall be modified as necessary to encompass the requirements listed on Attachment 1.

7.1.5.1.2 All non-electrical engine related components and assemblies not included in 7.1.5.1.1 above and required to be manufactured and tested in accordance with Section III of the ASME Code, shall include the following as applicable:

a. Heat Treatment Certification or charts.

h. Welding Certification to ASME, Section IX.

c. Certification that each non-evidence producing form of NDE was completed in accordance with specified requirements. To include name and SNT-TC-1A Level of NDE personnel interpreting the examination.

d. Mill Test Reports for pressure boundary materials.

e. Performance Test Reports.

f. Final radiographic film, exposure diagram, technique sheet and reader sheets with results of examination. Reader sheets must give name and SNT-TC-1A Level of NDE personnel interpreting the examination.

g. Records of all major repairs including NDE performed.

h. Hydrostatic and/or Pneumatic Test Reports.

i. ASME Code Data Report.

j. Record of minimum wall thickness, comparing actual measurements with those required by ASME Section III (Valves only).

7.1.5.1.3 All electrical engine related components and assemblies not included in 7.1.5.1.1 above shall be manufactured and tested in accordance with the standards listed in Paragraph 1.4 of this specification. Documentation submitted shall include:

a. Continuity tests and insulation Hypot of all Control Panels and associated wiring.

b. Routine tests of all motors and complete tests for one motor of each type in accordance with IEEE 112A-1964.

7.1.5.1.4 The electrical generator shall be under the control of the Supplier's Quality Assurance Program. Manufacture and testing shall be

in accordance with the standards listed in Paragraph 1.4 of this specification. Reports on the following actual tests shall be submitted:

a. Dielectric Tests

b. No load saturation curve

c. Phase sequence

d. Voltage Balance

e. Check of mechanical balance

f. Resistance of armature and field windings

h. Bearing insulation resistance

7.1.5.2 Final Testing of the completed units shall include submittal of:

a. Test reports of the routine engine shop tests covering break-in and verification of operating characteristics.

b. Test reports generated as a result of the functional qualification testing program required in specification Paragraph 11.3 (Subparagraph 11.3.1 through 11.3.5).

c. The seismic qualification program generated to meet the requirements of specification Paragraph 11.1.1.2, including all subparagraphs and attachments.

7.2 The Bidder shall submit as part of the proposal, a statement of compliance addressing each of the following:

7.2.1 Duke Power Company shall receive full cooperation from the supplier in the effort to provide both the highest degree of quality possible and all the documentation listed in the specification.

7.2.2 Duke Power Company shall have the right to perform Quality Assurance surveillances at the supplier's manufacturing facility at any time. The presence of the Owner's agents shall in no way relieve the supplier of the responsibility to maintain and implement a Quality Assurance Program as required by the specification.

7.2.3 Duke Power Company's Quality Assurance Department, Vendors Division, shall be notified at least five (5) working days before final shipment. They shall have the right to put a "Hold" on any equipment based on the satisfactory completion of all requirements of the specification, including all Quality Assurance Documentation.

8. DELIVERY

8.1 Equipment shall be delivered to: Duke Power Company, c/o Project Manager, Catawba Nuclear Station, S. C. Highway 274, or Southern Railway, Newport, S. C.

8.2 Packaging and shipping instructions are as delineated in the attached Packaging and Shipping Requirements Form 301.4 and are to be filled out by the Bidder and approved by the Owner.

8.3 Equipment is to arrive at the site in accordance with the schedules advised by the Purchaser.

8.4 All equipment is to be complete per this specification at the time of shipment. In the event the specified shipment date cannot be met because of equipment discrepancies, the Owner reserves the right to approve or disaprove shipment. If the Owner does approve shipment of the equipment with discrepancies, the Contractor is to furnish all necessary materials for field installation as soon as possible to resolve the equipment deficiencies.

8.5 Shipment must comply with ANSI N45.2.2-1972 for Form 301.4.

The Contractor's Project Engineer assigned to this equipment is to review the Preparation and Method of Shipment before manufacture begins. The Project Engineer is to inspect all equipment covered in this specification in the "ready to load and ship" condition to insure all procedures have been followed.

8.6 The equipment being shipped should be accompanied by:

a. One copy of the Equipment Installation Procedure described in Section 10.

b. Form 930.1 -- A copy of this form must be included in each individual shipping package.

8.7 The Bidder shall delineate recommended equipment storage requirements in terms of temperature, humidity, necessary energization, etc.

9. VENDOR DRAWINGS

9.1 The Contractor shall prepare and submit five (5) prints each of all drawings, to Mr. C. J. Wylie, Attn: J. M. Lines, Duke Power Company, P. O. Box 33189, Charlotte, N. C. 28242. These prints are to be submitted within 30 days after receipt of order and are to be full-size and legible | 3

with uniform background density suitable for microfilming and subsequent reproduction from microfilming. These prints will be reviewed by the Owner and, if satisfactory, will be approved. If requested, one copy of each print, so marked will be returned to the Contractor. If not satisfactory, the prints will be appropriately marked and one copy of each print returned to the Contractor for correction after which five (5) prints of the drawings as corrected shall again be submitted to the Owner for approval. The Contractor shall make any corrections required by the Owner and appropriately note any changes by dated revisions on the drawings.

If the drawings are not acceptable to the owner for microfilming, the Contractor shall furnish 20 full-size copies of all drawings for the Owner's records within fifteen days of receipt of drawing approval.

9.2 The following drafting lettering standards should apply, as all drawings are to be microfilmed by the Owner:

Minimum character height (A, B, and C size drawings) - 0.125 in (1/8)
Minimum character height (D and E size drawings) - 0.156 in. (5/32)
Minimum spacing between lines of characters - height of characters
Guide generated characters - 12 point size minimum
Uniform

9.3 On all drawings and correspondence concerning this order, the Contractor shall show:

9.3.1 Mill-Power Supply Company Purchase Order Number

9.3.2 Duke Power Company Item Number

9.3.3 Name of Equipment, e.g., Diesels 1A & 1B

9.3.4 Station and Unit, e.g., Catawba Unit 2

9.4 Any drawings which are safety related must be stamped "Nuclear Safety Related" in a prominent position and in letters not less than 1/4 in. high.

9.4.1 Vendor assumes responsibility for this specification.

9.5 The minimum list of certified drawings to be submitted are listed below:

Schematic diagrams	Logic Diagrams
Front Views	Block Diagrams
Outlines	Connectio Diagrams
Structural details	Mounting deatils

9.6 To eliminate any confusion or repetion of effort, the Contractor shall notify the Owner prior to submittal of Unit #2 or subsequent unit drawings. This does not apply to outline drawings.

10. INSTRUCTION MANUALS

10.1 Operation/Maintenance Instruction Manuals

10.1.1 Instruction manuals are to be provided per the following procedure. Initially five (5) copies shall be sent to Mr. C. J. Wylie, Attn: J. M. Lines, Duke Power Company, P. O. Box 33189, Charlotte, N. C. 28242. These manuals will be submitted not later than 15 days after equipment delivery. They will be approved. If requested, one copy of the manual, so marked, will be returned to the Contractor. If the manuals are not satisfactory, they will be appropriately marked and one copy of each print returned to the Contractor for correction after which five (5) copies of the corrected pages shall again be submitted to the Owner for approval. The Contractor shall make any corrections required by the Owner and appropriately note any changes by date revisions on the pages. | 3

10.2 After approval of the manufal, the Contractor shall furnish 20 copies for the Owner's records within twenty days of receipt of manual approval.

10.3 The instruction manuals, bound in suitable booklet form, shall be indexed and contain as a minimum the following:

10.3.1 General equipment description

10.3.2 Detailed operating description

10.3.2.1 Operating principles

10.3.2.2 Limitations and setpoints

10.3.2.3 Parts identification and cutaway drawing

10.3.3 Installation procedure

10.3.4 Maintenance instructions

10.3.4.1 Trouble shooting

10.3.4.2 Disassembly/Assembly Instructions

10.3.4.3 Renewal parts lists

10.4 Installation Procedure: (To be included in the above manual also) copies of the Equipment Installation Procedure section shall be set to: Mr. C. J. Wylie, Attention: J. M. Lines, P. O. Box 33189, Charlotte, N. C. 28242 sixty days prior to initial equipment shipment. One copy of this Equipment Installation Procedure should accompany the equipment when it is shipped. | 3

11. TESTS AND INSPECTIONS

11.1 The Contractor shall perform the following seismic tests on the proposed equipment.

11.1.1 Equipment is to be seismically qualified by testing/analysis in accordance with the attached Electrical Seismic Criteria. All equipment is to be designed to remain structurally sound, operate functionally correct, and provide minimum seismic amplification during and after a safe shutdown earthquake.

11.1.1.1 If the equipment is to be qualified by seismic testing, the following information must be provided on the equipment drawings:

11.1.1.1.1 Magnitude and direction of all operating loads on the base.

11.1.1.1.2 Location of the center of gravity.

11.1.1.1.3 Dead load (weight).

11.1.1.2 If the equipment is to be qualified by seismic analysis, the bolt load (tension, shear) at each mounting location for all equipment must be included in the analysis report.

11.2 The Contractor is to perform the following minimum general tests:

11.2.1 Diesel Engine and auxiliaries.

11.2.1.1 All standard factory tests.

11.2.1.2 All applicable tests in accordance with the standards listed in Paragraph 1.4.

11.2.2 Generator

11.2.2.1 All applicable tests in accordance with the standards listed in Paragraph 1.4.

11.2.3 Excitation and Control System

11.2.3.1 All applicable tests in accordance with the standards listed in Paragraph 1.4.

11.3 In addition to the tests required in Section 11.2, the Contractor shall perform (at his facility) the qualification testing listed in 11.3.1 through 11.3.5. Use the Owner's auxiliary equipment except the exhaust muffler and the intake silencer and filter. If the Bidder proposes to "type quality" the equipment covered in this specification by tests performed on equipment other than the Owners, it should be completely

justified in his proposal. This justification should include: complete written test procedures, complete test results (when available), and justification for performing the tests with any engine or generator auxiliaries that are not duplicates of those to be supplied under this specification.

11.3.1 Load Capability Qualification is required as follows:

11.3.1.1 The engine should be loaded to continuous rating for the time required to reach engine temperature equilibrium plus 22 hours of operation. "Engine temperature equilibrium" is defined as jacket water and lube oil temperatures that are within ± 10°F of normal operating temperatures as established by the engine manufacturer.

11.3.1.2 The test of 11.3.1.1 should be immediately followed by running the engine at the "short time rating" for 2 hours (7700KW).

11.3.1.3 One successful completion of the tests of 11.3.1.1 through 11.3.1.2 will be acceptable.

11.3.2 The following block loading and full load rejection tests shall be performed:

11.3.2.1 A full load rejection test shall be performed. The test will be acceptable if the speed after load trip does not exceed 75% of the difference between nominal speed and the overspeed trip set point, or 1570 above nominal, whichever is lower. No mechanical damage or harmful stresses should occur.

11.3.2.2 A representive reactive block load 10% greater than the largest load of Table 1 will be applied. This load should occur after the generator has already been loaded to the accumulated load of Table 1 prior to this load. The effect of this load on generator output shall not exceed the limits specified in Section 4.3.10. | 3

11.3.2.3 One successful test of 11.3.2.1 and 11.3.2.2 will be acceptable.

11.3.3 The following tests shall be conducted to demonstrate the capability of the diesel generator set to start and accept load within ten seconds after receipt of start signal:

11.3.3.1 300 valid start and loading tests are to be made with no more than one failure per hundred starts.

11.3.3.2 Immediately following the starting and acceleration to rated speed, a single step load shall be applied equal to 3500 KW. This load may be totally resistive or a combination of resistive and reactive loads. The effect of this load on generator output shall not exceed the limits specified in 4.3.10. | 3

11.3.3.3 At least 270 of the 300 test starts shall be performed with the diesel generator temperature initially at or below "warm standby" (Section 4.3.12). After load is applied, the diesel-generator set shall continue to operate until jacket water and lube oil temperatures are within ±10°F of the normal engine operating temperature for the corresponding load.

11.3.3.4 At least 30 tests shall be performed with the engine initially at "engine operating temperature equilibrium" (defined in 11.3.1.1)

11.3.3.5 A failure to start (11.3.2.1 through 11.3.2.4) may be disregarded if it occurs for one or more of the following reasons:

1 - operator error
2 - a maintenance procedure defined prior to testing.
3 - failure of a temporary service system used just for testing.

11.3.4 Demonstrate by analysis that the diesel is capable of starting all loads in the time sequence prescribed in Table 1 (LOCA or Blackout).

11.3.5 Certified full factory test reports are required on one set of auxiliary pumps and motors of an exact type. If a motor or pump of the exact type has been previously tested, these certified test reports will be acceptable.

11.3.6 The Contractor shall provide detailed testing procedures (including acceptance criteria) for Owner's approval 30 days prior to testing.

11.3.7 The Owner reserves the right to witness any or all tests and inspections.

11.3.8 The Owner shall be notified in writing at least fourteen days to factory testing with a list of the tests/inspections to be performed and the date which they will be performed.

11.3.9 The Owner shall have the right to perform engineering or quality assurance inspection visits at the Contractor's manufacturing facility at any time.

11.3.10 Test and Inspection Reports:

Safety-related Equipment - The original certified copy of all Contractor's test and inspection reports should be submitted to QA Manager, Technical Services, Quality Assurance Department, P. O. Box 33189, Charlotte, North Carolina 28242. Nineteen certified copies of these reports should be sent to Mr. C. J. Wylie, Attention: J. M. Lines. All reports should be submitted at the time the 930.1 Quality Assurance Certification Form is submitted. | 3

12. SPARE PARTS

12.1 A listing of recommended spare parts shall be provided with the Bidder's proposal. The Bidder should provide the basis by which this list was acquired.

12.2 All spare parts shall equal or surpass the original part specifications. In the case of safety related components, the appropriate certification must accompany the component.

13. INFORMATION TO BE FURNISHED BY BIDDER IN ADDITION TO BASIC TECHNICAL

The information requested by the following paragraphs shall be submitted as separate attachments to the proposal and be in the format of this section.

13.1 Available Vendor training programs/materials in accordance with Section 6.

13.2 Vendor seminar programs available in accordance with Section 6.

13.3 The General Information Section of the attached Equipment Coating Form #EC-1, Sheet 1, should be completed and the form submitted with the proposal. If desired, an alternate finish for the equipment may be proposed. Information describing this option should be provided on the attached Equipment Coating Form #EC-1, Sheet 2 and submitted with the proposal.

13.4 Quality Assurance Information Requested in Section 7 (Safety Related Only).

13.5 Storage Requirements per Section 8.

13.6 Complete Packaging and Shipping Requirements Form 301.4 per Section 8.

13.7 Technical description of each individual proposed option.

13.8 General description of all Bidder's tests to be conducted as identified in Section 11.

13.9 On the attached Form GMW/100 please fill dates for Items 2, 3, and 5. If desired, you are welcome to comment on any other schedule items.

13.10 A list of recommended spare parts in accordance with Section 12.

13.11 A list of exceptions in accordance wtih Section 15.

13.12 Pricing information in accordance with Section 18.

13.13 Completed description of the equipment proposed, including:

13.13.1 Maximum ambient temperature this units and its auxiliaries will operate for a continuous period.

13.13.2 Complete description of engine including all its assembled parts and including:

13.13.2.1 Maximum continuous rating of the engine (KW) at 125° F ambient.

13.13.2.2 Guaranteed time engine will be up to rated speed.

13.13.2.3 Curves showing load response for the diesel generator accepting loads as described in Table I attached.

13.13.2.4 What type fuel the diesel can use.

13.13.2.5 Maximum overload for a period of two hours without damaging any part of the engine.

13.13.2.6 A list and complete description of all engine accessory equipment including any equipment not listed in Section 4.2. Descriptions are to include suppliers, locations, size and weight and are to include manpower hours needed to change out major parts.

13.13.2.7 A list of expected engine temperatures (all temp. monitored at normal load and at overload.)

13.13.2.8 Test data to indicate the fastest starting position of the engine (such as No. 2 right bank at two degrees past T.D.C. firing position). If the starting time of all positions are equal, the Bidder shall submit data to support this.

13.13.3 Complete description of Generator, Exciter and Voltage Regulator and including:

13.13.3.1 Maximum continuous rating of generator (KVA, Volt and P.F.) at 125°F ambient temperature.

13.13.3.2 Class of insulation on generator and temperature rise by thermometer/detector over a 40°C ambient temperature.

13.13.3.3 Speed of engine and generator.

13.13.3.4 Type of generator voltage regulator, exciter and supplier.

13.13.3.5 Number of temperature detectors and their respective locations.

13.13.3.6 Graphs of voltage and frequency versus time for the loading sequence of Table 1.

13.13.3.7 Description of generator heaters.

13.13.3.8 Typical Generator characteristics for generator supplied.

13.13.4 Complete description and suppliers of the following:

13.13.4.1 Air Intake System

13.13.4.2 Exhaust System

13.13.4.3 Fuel Oil System

13.13.4.4 Lubricating Oil System

13.13.4.5 Cooling Water System

13.13.4.6 Starting Air System

13.13.4.7 Crank Case Breather System

13.13.4.8 Engine Control Cabinets including probable panel fabrication, manufacturer and catalog numbers of components to be furnished, proposed panel size and proposed panel layout.

13.13.4.9 Auxiliary Motor Drives including manufacturer, type HP, Voltage, S.F. etc.

13.13.4.10 Auxiliary Pumps including information listed below:

13.13.4.10.1 Predicted characteristic curve including head-capacity, efficiency, NPSH and BHP curves for each pump.

13.13.4.10.2 Material and construction of casing, impellers, shaft wearing rings, stuffing boxes, shaft and thrust bearings and foundation plates.

13.13.4.10.3 Type of lubrication (describe).

13.13.4.10.4 Identification of any proposed foreign manufacture.

13.13.4.10.5 Type of pump shaft seal.

13.13.4.10.6 List of all miscellaneous valves, plugs, etc., furnished by vendor and sketch or diagram of any special piping, valves controls required and to be furnished by Owner. All connections must be identified to pump drawing connections.

13.13.4.10.7 Complete Pump Detail Data Sheets Form ME-100.

13.13.4.10.8 Allowable forces and moments on Duke piping connections.

13.13.4.10.9 Certification that the pump will be fabricated in accordance with Owner's specifications as outlined in specification Section 4.13.

13.13.4.11 Each heat exchanger including the information listed below:

13.13.4.11.1 Outline drawing showing overall dimensions including cradle and heat exchanger mounting support details.

13.13.4.11.2 ASTM specifications of material and thickness of shell, channel tubesheet, baffles, and impingement plate.

13.13.4.11.3 Number, size, length, ASTM material, gage and pitch of tubes, and baffle spacing.

13.13.4.11.4 Effective surface area.

13.13.4.11.5 Corrosion allowance - shell, tubes.

13.13.4.11.6 Design pressure and temperature - shell side, tube side.

13.13.4.11.7 Weight of shell and tube bundle (empty and flooded).

13.13.4.11.8 Shell and channel connection sizes - inlet and outlet.

13.13.4.11.9 Extra Connections, number purpose and size.

13.13.4.11.10 Statement that the coolers will be degreased, vacuum dried, nitrogen blanketed and instrumented

13.13.4.11.11 Completed copy of Heat Exchanger Data Sheet, Form ME-102.

13.13.4.11.12 Standard non-destructive test procedures.

13.13.4.11.13 Identification of any parts, materials, or equipment contemplated for manufacturer outside the United States.

13.13.4.11.14 Provisions taken to minimize tube vibration and erosion.

13.13.4.11.15 List of any and all exceptions to these specifications and statement of complete compliance otherwise.

13.13.4.11.16 Current installation list of similar heat exchangers.

13.13.4.11.17 Recommended spare parts list.

13.13.4.11.18 A separate exchanger specification sheet ME-103 showing velocity (tube size), pressure drop (shell side and tube side), log MTD corrected, transfer rate (for the fouled condition and 100% clean), cooling water quantity and outlet temperature for each mode of operation.

13.13.4.11.19 Complete copy of Heat Exchanger Specification Sheet, Form ME-103.

13.13.4.11.20 Seismic forces resisted by foundation.

13.13.4.11.21 Quality assurance information required by this specification.

13.13.4.11.22 List of all large components which are packaged in combustible material.

13.13.4.12 Piping

13.13.5 Maximum time diesel generating units can operate without cooling air and cooling water (1) from a dead start and (2) while operating at rated load without damaging the engine.

13.14 Complete list of test to be performed including manufacturer's standard tests.

13.15 List of Foundation Equipment.

13.16 Complete description of batteries and battery charger including size and ratings.

13.17 Delivery Schedule.

13.18 Recommended manpower and manhours for unloading, installation, etc.

13.19 A preliminary layout of one complete diesel generator unit including its associated accessories and auxiliary equipment so that the Owner can determine a size required to house the prospective Contractor's diesels.

13.20 A complete list of all components to be Radiographic Tested, and/or Ultrasonic Tested and which test is applicable.

13.21 Proposed method of seismically qualifying all diesel equipment.

13.22 Maximum speed engine will reach on full 10% overload rejection.

13.23 A list of all standards manufacturer will adhere to in manufacturing the diesel's sets and its auxiliary equipment.

13.24 Statements commenting on each paragraph following the same sequence as the specification and numbered accordingly stating compliance and/or exactly where technical information can be found. General statements will not be acceptable.

14. DISCREPANCIES AND INTERPRETATION

Should a Bidder find discrepancies in, or omission from these specifications or be in doubt as to their meaning, he shall notify the Owner who will issue a written interpretation.

15. CONFORMANCE WITH SPECIFICATION

15.1 Each Bidder shall state any and all exceptions to this specification. If no exceptions are taken, it shall be so stated in the technical proposal. No variations will be permitted without written approval of the Owner. It is particularly emphasized that any unapproved nonconformity with the specification must be changed to complete conformity at the manufacturer's expense, and this expense will include the cost of all labor and materials and all other related expenses by the Owner or the manufacturer.

15.2 Upon receipt of any specification amendment, the Contractor shall notify Mill-Power Company that he will adhere to same amendment. Any and all exceptions should be noted.

16. CONSTRUCTION SERVICES

The Owner will unload, install, assemble and service the diesel/generator unit. The Owner will provide all tools, rigs, cranes and oil handling equipment. The Contractor shall provide all special materials such as gaskets, insulation materials, etc.

17. ERECTION ENGINEER

17.1 The manufacturer shall include the services of a factory trained erection supervisor to directly supervise the unloading, installation and initial startup of the equipment.

17.2 The Contractor shall provide all special installation and assembly instructions. These instructions shall be in the instruction books.

17.3 While performing work on the site the Contractor must comply with all provisions of the Federal Occupational Safety and Health Act of 1970.

18. SUBMISSION OF PROPOSALS

18.1 Proposals shall be submitted in accordance with instructions of the Purchaser.

18.2 Bidder shall respond to each numbered paragraph of each section of this specification following the same sequence and numbering system as used in this specification. He shall respond with: "will comply", "agree to", or take exception/comment as appropriate. Any references used shall be specific. 3

18.3 Bidder shall submit a separate proposal for requested options.

19. ATTACHMENTS

Form 301.4	Packaging and Shipping Requirements
Form M1	Motor Data Sheet
Form 930.1	Vendor Quality Assurance Certification
Form ME-100	Pump Detail Data Sheet
Form ME-102	Heat Exchanger Data Sheet
Form ME-103	Heat Exchanger Specification Sheet
Form GMW/100	Schedule Information 3
Table I	List of Emergency Loads & Time Sequence and Sizing of Diesel Generators (Blackout condition)
Table II	List of Emergency Loads and Time sequence and sizing of Diesel Generators (LOCA Condition)

Table III	Heat Exchanger NSW Chemistry	
Attachment I	Non-destructive examination	
Attachment II	General Contract Specifications	
Attachment III	Duke Power Coating Specifications K-2	3
Attachment IV	Electrical Seismic Criteria, Specification CNS 1393.00-1, Amendment 4, September 30, 1975	
Attachment V	Form EC-1, Equipment Coating Information	

JDH/wpc
EL41102A

PACKAGING AND SHIPPING REQUIREMENTS

Specification No. Date

1. ITEM CLASSIFICATION (ANSI N45.2.2 - 1972)

   Level A B C D Special
   Special _____

2. PACKAGING (ANSI N45.2.2 - 1972, Section 3 and Appendix A3)

   Level A B C D Special
   Special Instructions _____

3. SHIPPING (ANSI N45.2.2 - 1972, Section 4.2)

   Carrier Open Closed Special
   Special Instructions _____

   Shipment via Train Truck Plane Barge Ship Other

   Description of other means _____

4. LOADING & TRANSIT (ANSI N45.2.2 - 1972, Section 4.3)

   Special Instructions for loading, rigging, handling, preservative coatings, seals; stacking and vandalism precautions _____

5. IDENTIFICATION AND MARKING (ANSI N45 2.2 - 1972, Appendix A3.9)

   Item Markings _____

   Container Markings _____

DUKE POWER COMPANY
ENGINEERING DEPARTMENT
SQUIRREL CAGE INDUCTION MOTOR DATA SHEET
FOR MOTORS RATED LESS THAN 100 HP

1. Motor Application _____
2. Quantity _____ Mill Power Order No. _____
3. Manufacturer _____ Order No. _____
4. Motor Type _____ Frame _____ Enclosure _____
5. Bearing Type _____ Lubrication _____
6. Rated HP _____ Speed-RPM: Syn _____ F.L. _____
7. Volts _____ Phases _____ Hertz _____ F.L. Current _____ Service Factor _____
8. Subtransient reactances in percent and based on kva of the motor
   X_d'' = _____
9. Locked Rotor Current and Power Factor at:
   A. 100% Voltage: LRC _____ P.F. _____
   B. 90% Voltage: LRC _____ P.F. _____
   C. 80% Voltage: LRC _____ P.F. _____
10. Heater Data: A. Watts _____ B. Volts _____ C. Phases _____
11. Insulation: Class _____ Rated Temp. Rise/Ambient _____ °C/ _____ °C
12. % Eff. - F.L. _____ 3/4 Load _____ 1/2 Load _____
13. % P.F. - F.L. _____ 3/4 Load _____ 1/2 Load _____
14. Torque at 100% voltage: F.L. _____ L.R. _____ Breakdown _____
15. Torque at 80% voltage: F.L. _____ L.R. _____ Breakdown _____
16. Time-current heating curves at 100%, 90% and 80% voltage. (Time for motor to reach thermal limits vs current)
17. Time motor will withstand locked rotor current without damage _____
18. Permissible successive attempts to start motor from ambient temperature and rated temperature without damaging motor insulation system: Ambient Temp. _____
    Rated Temp. _____
19. Time required for motor to return from maximum temperature limit of the insulation system to a temperature that will allow another safe start with: Mtr. Running _____
    Motor at standstill after attempted starts _____
20. Noise Level does not exceed _____ DBA/ _____ DBC between sound frequency levels of 20 HZ to 10,000 HZ at a distance of 3' from the motor.
21. Date curves and data sheet submitted _____

DUKE POWER COMPANY
QUALITY ASSURANCE DEPARTMENT
SUPPLIER QUALITY ASSURANCE CERTIFICATION

Name of Supplier _____ Date _____

Address of Supplier Plant _____ Mill Power Order No. _____

_____ Duke Item or Req. No. _____

_____ Spec. No. _____ Rev. ____

Supplier ID Nos. _____

Description of Component(s) or Material(s) _____

_____

_____

____ Attached Documentation covers all Components/Materials on Mill Power Order.
____ Attached Documentation covers partial shipment of Components/Materials on Mill Power Order.

The following listed tests, inspections and reports have been completed as required by the specification:

1) _____

2) _____

3) _____

4) _____

5) _____

6) _____

7) _____

This certifies that the listed Component(s) or Material(s) conform to the requirements of the above referenced Duke Power documents including all codes, standards, test requirements and Quality Assurance requirements invoked therein.

_____
Supplier Representative Authorized Signature

Title _____ Date _____

(See Instructions)

DUKE POWER COMPANY

PLANT _____

PUMP DETAIL DATA SHEET

1. PUMP - NAME: _____ MARK NO. _____

2. MANUFACTURER _____ VENDOR _____

3. DWG NO'S: MFGR _____ DUKE FILE _____ VENDOR _____

4. ALLOWABLE LOADINGS ON NOZZLES:

   FORCES _____ LB

   MOMENTS _____ FT-LB _____ IN-LB

   PUMP RESTRAINTS REQ'D: YES _____ NO _____

5. QUALITY ASSURANCE NDT:

   RT _____ UT _____ PT _____ MT _____ VISUAL _____

   OTHER _____

6. PUMP MEETS SEISMIC CONDITIONS:

   ANALYZED YES _____ NO _____

   TESTED YES _____ NO _____

7. TOTAL WEIGHT - PUMP AND BASE PLATE _____ LBS

8. WATER REQUIRED:

	SHAFT SEAL	GLAND COOLING	OIL COOLING	OTHER
TYPE WATER				
QTY, GPM				
MAX PRESS, PSIG				
MAX TEMP, °F				

9. MOTOR PUMP CPLG:

   MFGR _____ MODEL NO _____

10. CASING CONDITION:

    PAINTED YES _____ NO _____

    GENERIC TYPE _____ (PRIMER, ENAMEL, EPOXY, ETC)

    PRODUCT NAME _____ NUMBER _____

DUKE POWER COMPANY
PLANT _____
HEAT EXCHANGER DATA SHEET

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1. HEAT EXCHANGER NAME _____ MARK NO. _____
2. MANUFACTURER _____ VENDOR _____
3. DWG NO'S: MFGR _____ DUKE FILE _____ VENDOR _____
4. ALLOWABLE LOADINGS ON NOZZLES: (Attach Table Listing Nozzles)
   FORCES _____ LB
   MOMENTS _____ FT LB _____ IN-LB
5. QUALITY ASSURANCE NDT:
   RT _____ UT _____ PT _____ MT _____ VISUAL _____ OTHER _____
6. HEAT EXCHANGER MEETS SEISMIC CONDITIONS:
   ANALYZED: YES _____ NO _____
   TESTED: YES _____ NO _____
   DESIGN CONDITION: _____ g
   FORCES AND MOMENTS FOR SUPPORTS:
   FORCES _____ LB
   MOMENTS _____ FT-LB _____ IN-LB
7. CONDITIONS: SHELLSIDE

	OPERATING	DESIGN	HYDRO TEST
PRESSURE	_____ PSIG	_____ PSIG	_____ PSIG
VACUUM	_____ "HgAbs	_____ "HgAbs	_____ "HgAbs
TEMP	_____ °F	_____ °F	_____ °F

8. CONDITIONS: TUBESIDE

	OPERATING	DESIGN	HYDRO TEST
PRESSURE	_____ PSIG	_____ PSIG	_____ PSIG
TEMP	_____ °F	_____ °F	_____ °F

9. CODE: _____
   CODE STAMP: YES _____ NO _____
10. HEAT EXCHANGER CONDITION:

SHELL PAINTED:	PRIMER	FINISH
YES	_____	_____
NO	_____	_____
GENERIC TYPE	_____	_____
PRODUCT NAME	_____	_____
PRODUCT NUMBER	_____	_____
PAINT MFGR	_____	_____

   TUBE PROTECTION:
   PRESERVATIVE: PRODUCT NAME _____
   NITROGEN BLANKET: YES _____ NO _____

DUKE POWER COMPANY

HEAT EXCHANGER SPECIFICATION SHEET

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3

PLANT _____ SPEC NO. _____

MANUFACTURER _____

NO. OF UNITS _____ SHELLS/UNIT _____

SERVICE OF UNIT _____ ITEM NO. _____

SIZE _____ TYPE _____ (HORIZ.) CONNECTED IN _____

SQ. FT. SURF/UNIT (EFF.) _____ SHELLS/UNIT _____ SQ FT SURF/SHELL (EFF.) _____

PERFORMANCE OF ONE UNIT

	SHELL SIDE	TUBE SIDE
FLUID CIRCULATED		
TOTAL FLUID ENTERING		
VAPOR		
LIQUID		
STEAM		
NON-CONDENSABLES		
FLUID VAPORIZED OR (CONDENSED)		
STEAM CONDENSED		
GRAVITY		
VISCOSITY		
MOLECULAR WEIGHT		
SPECIFIC HEAT	BTU/LB°F	BTU/LB°F
THERMAL CONDUCTIVITY	BTU/HR-FT°F	BTU/HR-FT°F
LATENT HEAT	BTU/LB	BTU/LB
TEMPERATURE IN	°F	°F
TEMPERATURE OUT	°F	°F
OPERATING PRESSURE	PSIG	PSIG
NO. PASSES PER SHELL		
VELOCITY	FT/SEC	FT/SEC
PRESSURE DROP	PSI	PSI
FOULING RESISTANCE (MIN.)		

HEAT EXCHANGED-BTU/HR _____ MTD-CORRECTED-°F _____

TRANSFER RATE SERVICE _____ CLEAN _____

CONSTRUCTION OF ONE SHELL

DESIGN PRESSURE	PSI	PSI
TEST PRESSURE	PSI	PSI
DESIGN TEMPERATURE	°F	°F

TUBES NO. _____ O.D. _____ BWG _____ LENGTH _____ PITCH _____

SHELL _____ I.D. _____ O.D. _____ SHELL COVER _____ (INTEGL (REMOV)

CHANNEL OR BONNET _____ CHANNEL COVER _____

TUBE--STATIONARY _____ TUBESHEET-FLOATING _____

BAFFLES--CROSS _____ TYPE _____ FLOATING HEAD COVER _____

BAFFLES--LONG _____ TYPE _____ IMPINGEMENT PROTECTION _____

TUBE SUPPORT _____

TUBE TO TUBESHEET JOINT _____

GASKETS _____

CONNECTIONS-SHELL SIDE _____ IN _____ OUT _____ RATING _____

CHANNEL SIDE _____ IN _____ OUT _____ RATING _____

CORROSION ALLOWANCE--SHELL SIDE _____ TUBE SIDE _____

CODE REQUIREMENTS _____ TEMA CLASS _____

REMARKS _____

0 0 0 2 7 1 3 9 6 1

"SCHEDULE INFORMATION"

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3

1. Site Delivery Date _____
2. Manufacturer Ship Date _____
3. Start of Equipment Manufacture _____
4. Duke Equipment Release for Manufacture _____
5. Manufacturer cut-off date (No New Equipment Changes) _____
6. Duke Final Approval of Wiring Diagram (Allow two turn arounds or 12 weeks) _____
7. Duke Receipt of Wiring Diagram _____
8. Duke Design Information to Manufacturer for Wiring Diagram _____
9. Duke Final Approval of Outline and General Arrangement _____
10. Duke Receipt of Outline and General Arrangement _____
11. Duke Initial Information to Manufacturer for Outline Drawings _____
12. Duke Receipt of Foundation Drawings _____
13. Duke Information to Manufacturer for Foundation Drawings _____
14. Duke Order Placement _____

Comments:

In addition to the above, the successful Bidder shall provide a Manufacturing Milestone Schedule within 15 days after award of contract per Section 7 of the attached Conditions of Contract.

TABLE 1

3

BLACKOUT CONDITION

This table lists acutal HP required of the specified motor during this condition and time motor will be sequenced on the line.

SEQUENCE NO.	LOAD DESCRIPTION	BLACKOUT LOAD	VOLTAGE	P.F.	NO. OF MOTORS	INITIATION TIME AFTER DIESEL STARTS
1	IE 600V Load Centers (MCC's loads)	1200 HP	575	.9	*	10 Sec.
2	Centrifugal Charging PMIR.	480 HP	4000	.9	1	11 Sec.
3	Non IE 600V MCC's	700 HP	575	.9	*	15 Sec.
4	Component Cooling Water PMIR.	500 HP	4000	.9	2	30 Sec.
5	Nuclear Service Water PMIR.	1050 HP	4000	.9	1	35 Sec.
6	Auxiliary Feedwater PMIR.	600 HP	4000	.9	1	40 Sec.
7	Main Fire Protection PMIR.	300 HP	4000	.9	1	50 Sec.
8	Non IE 600V MCC's	400 HP	575	.9	*	60 Sec.
9	IE 600V Load Center (MCC's loads)	450 HP	575	.9	*	10 Min.
10	Computer Rm. Chiller Unit	175 HP	600	.9	1	10 Min.
11	Control Rm. Area Chiller Compressor	600 HP	4000	.9	1	11 Min.
12	Instrument Air Compressor	150 HP	600	.9	1	12 Min.
13	Fuel Pool Cooling PMIR.	300 HP	4000	.9	1	12 Min.
14	Pressurizer Heater Power Panel	416 KW	600	.9	1	12 Min.
15	Aux. Control Power System BTRY CHRGR	150 KVA	600	.9	1	12 Min.

7608 HP Total

$$\text{Blackout KVA} = \frac{7608 \times .746}{(.9)^2} = 7007$$

Blackout KW = 7007 X .9 = 6306

TABLE II

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3

LOCA CONDITION

This table lists actual HP required of the specified motor during this condition and time motor will be sequenced on the line.

SEQUENCE NO.	LOAD DESCRIPTION	LOCA LOAD	VOLTAGE	P.F.	NO. OF MOTORS	INITIATION TIME AFTER DIESEL STARTS
1	IE 600V Load Center (MCC's loads)	1100 HP	575	.9	*	10 Sec.
2	Centrifugal Charging PMIR.	690 HP	4000	.9	1	11 Sec.
3	Safety Injection PMIR.	450 HP	4000	.9	1	15 Sec.
4	Residual Heat Removal PMIR.	400 HP	4000	.9	1	20 Sec.
5	Containment Spray PMIR.	500 HP	4000	.9	1	25 Sec.
6	Component Cooling Water PMIR.	500 HP	4000	.9	2	30 Sec.
7	Nuclear Service Water PMIR.	1050 HP	4000	.9	1	35 Sec.
8	Aux. Feedwater PMIR.	600 HP	4000	.9	1	40 Sec.
9	IE 600V Load Center (MCC's loads)	350 HP	575	.9	*	10 Min.
10	Control Rm Area Chiller Compressor	600 HP	4000	.9	1	11 Min.
11	Fuel Pool Cooling PMIR.	300 HP	4000	.9	1	12 Min.
		6540 HP Total				

$$\text{LOCA KVA} = \frac{.746 \times 6540}{(.9)^2} = 6024$$

$$\text{LOCA KW} = .9 \times 6024 = 5421$$

NOTE: This table represents the equipment which are fed from D.G. 1A (worst case).
* A group of motors and heaters.

Heat Exchanger

NSW Chemistry

	Range	Average
Total dissolved soiids, ppm	40 - 66	53
Total Hardness, ppm as $CaCo_3$	10 - 18	14
Suspended solids, ppm	8 - 175	12
Conductivity, microhos	34 - 56	45
Silica, ppm as SiO_2	6 - 14	10
Total iron, ppm	0.1 - 6.0	0.5
Manganese, ppm	0.0 - 2.5	0.15
pH	6.0 - 7.6	6.8
Color (APHA)	1 - 6	3
Turbidity, JTU	5 - 140	10

ATTACHMENT 1

The following tests, inspections, and examinations shall be performed as indicated. Reports shall identify the inspector, the type of observation, the results, the acceptability and the action taken with any noted deficiencies. Personnel performing final evaluation of nondestructive examination shall be qualified to SNT-TC-1A-1975, Level II.

Cylinder Block - Hydrostatic Test
Mill Test Report
Inspection Reports (Visual & Dimensional)

Cylinder Heads - Magnetic Particle Examination *
Hydrostatic Test and Pneumatic Test
Mill Test Report

Cylinder Liners - Magnetic Particle Examination *
Hydrostatic Test
Mill Test Report

Crankshaft - Ultrasonic Examination
Magnetic Particle Examination *
RTNDT Guaranteed Level of 20°F (Tested to ASME Section III Acceptance Criteria)
Mill Test Report

Crankshaft Bearing Seats - Magnetic Particle *

Connecting Rods - Magnetic Particle Examination *
RTNDT Guaranteed Level of 20°F (Tested to ASME Section III Acceptance Criteria) One per heat
Mill Test Report

Pistons - Magnetic Particle Examinations * (Crown only)
Mill Test Report (Crown and skirt)

Cams - Inlet and Exhaust - Magnetic Particle Examination *
Surface Hardness Certification per Mill Standard 105D
Mill Test Report or Certification

Camshaft - Mill Test Report or Certification

Turbocharger - Shaft - Magnetic Particle Examination *
Mill Test Report or Certification

Gears - Magnetic Particle Examination *
Mill Test Report or Certification

Bolts, Studs, Nuts, Wrist Pins or Retaining Pins - Cylinder Heads, Connecting Rods, Main Bearing, Caps

Magnetic Particle Examination as per Mill Standard 105D
Mill Test Report or Certification

Pumps - Hydrostatic Test Certification
Performance Test (may be typical)

* NOTE - Liquid Penetrant Examination is an acceptable alternate for this requirement only if one of these methods are used:

a. Fluorescent - Solvent Removable

b. Fluorescent - Post Emulsifiable

1. GENERAL CONDITIONS

a) These General Conditions of Contract of the Owner shall prevail in the event conditions offered by the Contractor add to or are in conflict with these General Conditions.

) Where these General Conditions of Contract are in conflict with the Owner's specification, including revisions and addenda thereto, the specification shall prevail.

2. GUARANTEE

For a period of one calendar year after initial operation, the Contractor guarantees that the equipment covered by the specifications shall be free from defects in workmanship and materials, and shall operate satisfactorily under all conditions described by the specifications. Any equipment or components thereof which fail to meet the above guarantee shall be repaired, replaced, or upgraded by the Contractor to the full satisfaction of the Owner and at no cost to the Owner. The initial operation of this equipment is scheduled on or about _____.

3. FAILURE TO MEET GUARANTEE

a) Any defects in material or workmanship or other failure to meet requirements of the specifications, including errors or omissions, which are disclosed prior to final payment, or prior to acceptance by the Owner, whichever occurs at the later date, shall, if so directed by the Owner, be corrected entirely at the expense of the Contractor.

b) Any latent defects not disclosed before date of final payment or date of acceptance, whichever is the later date, but disclosed within one year after the equipment and/or systems are placed in use, shall be corrected promptly by and at the expense of the Contractor.

c) Any variation from the materials or design agreed upon with the Contractor at the time of the award of the contract shall be approved by the Owner before any such changes are incorporated in the equipment or system to be furnished by Contractor. Approved variations must be fully documented and records thereof furnished to the Owner.

4. RIGHT TO OPERATE UNSATISFACTORY EQUIPMENT

The Owner shall have the right to operate any and all equipment as soon and as long as it is in operating condition whether or not such equipment has yet been accepted as complete and satisfactory. This shall not be construed, however, to require continued operation of equipment which may be materially damaged by such operation before the required repair has been made.

8. MATERIALS AND WORKMANSHIP

a) All materials used in the construction of the equipment shall be new and of highest standard commercial quality normally used for this type of equipment, considering strength, ductility, durability, best engineering practice, and the purpose for which the equipment is to be used (unless otherwise required by the specifications). Substantial design margins shall be used throughout the design and especially in the design of all parts subject to alternating stresses or shock.

b) All work shall be performed and completed in a thorough workmanlike manner and shall follow the best modern practice in the manufacture of high quality equipment, notwithstanding any omissions from the specifications or drawings. All work shall be performed by workmen skilled in their various trades. All parts shall be made accurately to standard gauge, where possible, to facilitate replacement and repairs. Like parts shall be interchangeable insofar as practicable. Incidental fittings, fixtures, accessories and supplies shall be new, of approved manufacture and of standard first-grade quality. The Contractor shall provide and maintain in storage for at least ten years, free of cost to the Owner, sufficient templates, gauges, patterns, or other records to enable the Contractor to make repair and replacement parts. Prior to the Contractor's going out of business or otherwise ceasing to offer for sale the goods, equipment or systems purchased by Owner pursuant to these terms and conditions, Contractor shall either arrange for said storage or offer to sell such templates, gauges, patterns and other records to Owner upon terms and condtions which are mutually agreeable. All special gauges and templates, necessary for field erection and installation shall become the property of the Owner. The patterns shall remain the property of the Contractor.

9. INSPECTION AND TESTS

a) All materials furnished and all work performed will be subject to rigid inspection, and no materials shall be shipped until all required or specified tests, analyses, and inspections have been made, or certified copies of reports of tests and analyses or Contractor's guarantees shall have been accepted. The Contractor shall prepare specimens and perform tests and analyses in accordance with the specifications and as required to demonstrate conformance of the various materials with the applicable specifications. The Contractor shall furnish the Owner with copies of certified test reports for all tests and analyses and/or certifications required by the specifications.

b) The Contractor shall keep the Owner informed in advance, of the time of starting and of the progress of the work in its various stages so that arrangements can be made for inspection.

c) All items shipped to the Owner at any location will be subject to the Owner's receiving inspection upon arrival at the shipping destination and prior to unloading where possible.

d) Acceptance of the equipment or the waiving of the inspection thereof shall in no way relieve the Contractor of the responsibility for furnishing equipment meeting the requirements of the specifications.

14. SHIPMENT

a) The Contractor shall notify the Purchaser at least fifteen days in advance of expected shipping dates. When a shipment is made, the Contractor shall notify the Purchaser giving the type of carrier and name of transporting agent and also a description of the article or articles shipped, the packing list, and any other information necessary for the identification, storage or assembly of the article or articles shipped. The shipping weight of such item shall also be given.

b) Title to, risk of loss of, and damage to equipment, materials and articles shipped shall be and remain with the Contractor until delivered to and accepted at the destination designated by the Owner.

15. ERECTION

a) Erection of the equipment will be performed by the Owner with the technical advice of the Contractor's erection engineers as required.

b) The Contractor shall furnish, if and when and to the extent required by the Owner, one or more erection engineers who shall give technical direction for the erecting, inspecting, initial operation and testing until completed to the satisfaction of the Owner, and to instruct the Owner (and/or his agent) in the operational and maintenance features of the equipment. The work and operations of the erection engineer(s) shall be coordinated with the construction program at the erection site as directed by the Owner.

c) In addition to other warranty requirements specified herein, if any portion of the equipment is damaged as a direct result of faulty or inadequate technical direction of installation, inspecting or instruction by the Contractor's erection engineer(s) within one year from the date of initial operation, the Contractor shall correct such damage at his own expense.

16. INDEMNITY

The Contractor will indemnify and save harmless the Owner against all damages, claims for damages, suits, demands, attorney fees and costs, in whole or in part, growing out of or in any way connected with the performance of this contract by the Contractor and its employees or its subcontractors, if any, and their employees. In connection with the foregoing indemnity, the Contractor, on demand by the Owner, shall take over and defend any suit against the Owner covered by the indemnity. The Contractor shall not, however, be liable in any event for any loss or injury to persons or property (including the apparatus installed) caused solely by:

a) The negligence or fault of the Owner, its employees, agents, and other Contractors with Owner;

b) Failure to observe the erection engineer's instructions;

DUKE POWER COMPANY
DESIGN ENGINEERING DEPARTMENT

STANDARD COATING SPECIFICATION NO. K-1 Texture
K-2 Smooth

BY: Durwood Peach DATE 1-18-72 REVISED 1-3-74

POLANE FINISHING SYSTEM FOR CONTROL BOARDS AND CABINETS

1. SCOPE

1.1 This specification defines the method of surface preparation, material and application of shop applied Sherwin Williams Polane (textured polyurethane) Enamels to carbon steel surfaces exposed to interior service conditions and not subjected to immersion or temperatures exceeding 200°F.

1.2 Finished coating system possesses excellent abrasion chemical and moisture resistance in a 10° - 30° gloss range.

1.3 This system meets the Class A Fire Hazard Classification for non-combustionable substrates.

1.4 Uses: Electrical and mechanical control boards, cubicals, panels, desks, etc.

1.5 The vendor/fabricator shall provide all labor, equipment, and materials necessary for proper surface preparation and application of the coating system in accordance with the standards of this specification.

2. MATERIALS

2.1 Materials shall be those manufactured by the Sherwin Williams Paint Company, Chemical Coatings Division, Cleveland, Ohio.

2.1.1 Sealer - 10 parts E65A4 Polane Sealer with 1 part Y6627 Catalyst.

2.1.2 Finish - 6 parts F63 Series Polane Enamel with 1 part V66V27 Catalyst.

3. SURFACE PREPARATION

3.1 Clean cold rolled or hot rolled steel by degreasing with solvent wash.

3.2 Wipe surface with metal prep or a similar type phosporic acid metal etching solution - blow dry.

3.2 Sand E65 A4 Sealer with #400 sandpaper and wipe with tach rag prior to application of F63 Series Polane Enamel.

4. COATING SYSTEM

4.1 1 full coat #65A4 Polane Sealer @ 2.0 mils dft.

4.2 1 full coat F63 Polane Series Enamel @ 1.0-1.5 mils dft.

4.3 1 scatter or texture coat of F63 Polane Series Enamel

DUKE MILLER COMPANY

DESIGN ENGINEERING DEPARTMENT

STANDARD COATING SPECIFICATION NO. K-1 Texture
K-2 Smooth

BY: Durwood Peach DATE 1/18/72 REVISED 1-3-74

POLANE FINISHING SYSTEM FOR CONTROL BOARDS AND CABINETS - cont'd.

5. APPLICATION

5.1 Material shall be applied by conventional, (pressure feed or suction feed) electrostatic spray, roller coating, or curtain coating as recommended by Sherwin Williams.

5.2 Material shall not be applied by hot spray, dip or flo coating.

5.3 E 65A4 Polane Sealer shall air dry @ 70°F for 1 hour before sanding or for 30 minutes @ 180-200°F.

5.4 The first full smooth coat of F63 Polane Series Enamel shall be allowed to dry 2-3 minutes at 70°F prior to application of the texture or scatter coat.

6. SPRAY EQUIPMENT AND SPRAYING GUIDES

6.1 Full smooth coat of F63 Series Polane Enamel

6.1.1 Devilbiss (pressure feed) MBC gun with E tip and needle and No. 765 air cap sprayed at 5-8 PSI fluid pressure and 40-45 PSI atomizing pressure.

6.1.2 Devilbiss (suction feed) MBC gun with E tip and needle and No. 30 air cap sprayed at 45-50 PSI atomizing pressure.

6.1.3 For electrostatic, roller coating, curtain coating, and airless spray consult Sherwin Williams Company.

* 6.2 Texture coat of F63 Series Polane Enamel.

6.2.1 Devilbiss MCB gun with E tip and needle and No. 704 air cap sprayed at 15 PSI fluid pressure and 15-20 PSI atomizing pressure.

7. WORKMANSHIP

7.1 All phases of surface preparation, thinning, application and handling shall be as recommended by the Sherwin Williams Company.

7.2 All finished work shall be of uniform color and texture.

7.3 All finished work shall be free of runs, sags, drips, laps and holidays.

7.4 All finished work shall be packaged and handled so as to arrive at the job site with no scratches, dents, soil marks, fading or other surface blemishes.

* For Smooth Finish (K-2), apply a second coat as specified in section 6.1.

DUKE POWER COMPANY
DESIGN ENGINEERING DEPARTMENT

STANDARD COATING SPECIFICATION NO. K-1 Texture
K-2 Smooth

BY: Durwood Peach DATE 1/18/72 REVISED 1-3-74

POLANE FINISHING SYSTEM FOR CONTROL BOARDS AND CABINETS - cont'd.

8. INSPECTION

8.1 Both the owner and the coatings manufacturer and their responsible representative shall have access to the vendor/fabricator shop at all times during surface preparation and application of coatings or to inspect work previously finished.

8.2 The owner reserves the right to reject all work that does not meet these standards. This may be done either at the fabricator shop or at the company construction site.

8.3 Any change in the standards of this specification shall be agreed upon in writing by the Civil Design Section.

ATTACHMENT IV

August 17, 1973
CNS-1393.00-1
(EGS S - 14.2)
Amendment 1 - Dec. 7. 1973
Amendment 2 - March 11, 1974
Amendment 3 - July 17, 1974
Amendment 4 - Sept. 30, 1975

DUKE POWER COMPANY
DESIGN ENGINEERING DEPARTMENT
ELECTRICAL EQUIPMENT SEISMIC CRITERIA
FOR CATAWBA NUCLEAR STATION

This procedure outlines methods of seismically qualifying Class 1E electrical equipment for Catawba Nuclear Station that are acceptable to Duke Power Company. Included where applicable are the effects of the Catawba building torsional modes of vibration. Torsional considerations only apply to equipment that is located in the auxiliary building.

The procedure is divided into two types of equipment qualification:

Category A - Requirements for testing of electrical equipment

Category B - Requirements for analysis of electrical equipment

It is recognized that some types of Class 1E equipment cannot be practically qualified by analysis or testing alone. In this case some requirements for both Category A and B may apply. Included are the ground response spectra and floor translational and combined torsional-translational response spectra for Catawba.

General Requirements

The equipment shall be qualified seismically following the procedures outlined in IEEE Standard 344-1971, "IEEE Recommended Practices for Seismic Qualification of Class 1 Electrical Equipment for Nuclear Power Generating Stations", and the seismic requirements contained herein. Existing analyses, and/or test data meeting the above requirements for equipment that is similar to the type of equipment being specified will be considered. If available, this data should be submitted to Duke Power Company as part of the proposal package for review with the necessary justification included to show that it meets the above requirements.

Duke Power Company reserves the right to inspect, if requested, the proposed analytical models to be used for seismic analysis and/or the proposed test procedure for seismic testing.

Duke Power Company also reserves the right to review seismic analyses and/or test results prior to payment for seismic qualification.

Category A: Testing

1. Input data supplied:

   a. Equipment elevation 556 and building DIESEL GEN. BLDG

   b. Applicable response spectrum for horizontal acceleration, (OBE and SSE) Figure 1 ~~plots~~ without torsion.

   c. The spectrum used to represent the vertical acceleration (OBE and SSE)shall be taken as 2/3 of the horizontal ground spectrum (Fig. 1 Solid Line)

   d. Maximum horizontal floor (or ground) acceleration "G" level from high frequency asymptote, (ZPA) OBE 0.13, SSE 0.24.

   e. Equipment support information (mounting base pedestal, shock mounts, etc.) - RIGID ANCHOR BOLTS

   f. Percent damping - 1%.

   g. Seismic frequency qualification range - 0.5 to 40 hertz.

   h. Operational settings (or range of settings) for adjustable type devices (if any) - NA.

   i. Identification of non-Class 1 electrical devices in Class 1 assemblies (if any) - NA.

2. For the test procedure, the possible amplified design loads for equipment supports must be considered, either by testing the device on its supports, or by analyzing the supports to determine the level of amplification (if any).

   a. In analyzing supports to determine amplification, procedures as outlined on Category B should be followed.

   b. In testing supports, they must be tested with equipment installed. If the equipment is inoperative during the support test, the response at the equipment mounting location must be monitored and components must be tested separately with the actual input to the equipment more conservative (at least 10%) in amplitude and frequency than the monitored responses.

3. The test fixture design must simulate the actual service mounting and cause no dynamic coupling to the test item supports. The method of mounting shall be documented and shall include a description of interposing fixtures. The effect of such fixtures must be evaluated and justification of necessity must be included in the report if they are only used during qualification and not for in-service mounting.

4. Exploratory vibration tests may be run on equipment to aid in the determination of the test method that will best qualify the equip-

ment. If it can be shown that the equipment is not resonant at any frequency within the seismic frequency range, it may be considered a rigid body. If the configuration of the equipment is such that critical natural frequencies may not be ascertained due either to the complexity of the equipment or the inaccessibility of critical parts (sealed relays, etc.) the exploratory test should not be relied upon.

5. Siesmic excitation generally has a broad frequency content. A random type vibration input motion should be used. However, single frequency input, such as sine beats, may be applicable provided one of the following conditions is met and justified in the report:

   a. The anticipated response of the equipment is adequately represented by one mode.

   b. The input has sufficient intensity and duration to excite all modes to the required magnitude, such that the testing response spectra will envelope the corresponding response spectra of the individual modes.

   (The aim is to reproduce as faithfully as possible the actual earthquake environment. Where this is not practical, it is required to simulate the environment in a conservative manner.)

6. The actual input motion must be characterized in the same manner as the required input motion, and the conservatism in amplitude and frequency content must be demonstrated. A 10% margin should be added to the acceleration of the response spectrum at the mounting point of the equipment.

7. Equipment must be tested in an operating condition. Operability should be verified during and after the testing.

8. In order to simulate aging in equipment related to the life-time subjection of seismic disturbances, conduct two (2) OBE seismic tests plus one test at full SSE in each direction. Duration of each test should be at least 16.5 seconds.

9. The degree of coupling in the equipment will in general determine if single or multi-axis testing is required to conservatively produce the same response for the particular test method compared to a seismic event. In any case, all three axes (two horizontal and one vertical) shall be tested.

   a. If the degree of coupling can be determined and is non-existant or very light, single axis testing is allowable.

   b. If the degree of coupling can be determined, single axis testing is allowable provided it can be justified. The input should be sufficiently increased to include the effect of coupling on the response of the equipment.

c. If the degree of coupling cannot be determined, multi-axis testing is required. The input motion will be applied to one vertical and one principal horizontal axis simultaneously. The time phasing of the inputs in the vertical and horizontal directions must be such that a purely rectilinear resultant input is avoided. Or alternatively, have the vertical and horizontal inputs in phase, and then with inputs 180 degrees out of phase. The equipment shall then be rotated 90° in the horizontal plane and the tests repeated.

10. Documentation for the test results shall be as described in Section 4 of IEEE 344-1971, and shall be submitted to the Owner prior to shipment of the equipment. If prior tests have not been performed to serve as a basis for meeting the seismic qualification requirement of this procedure, the Owner reserves the right to witness the qualifying tests performed on this equipment.

Category B: Analysis

1. Input data supplied:

   a. Equipment elevation: 556 and building DIESEL GENERATOR BLDG.

   b. Applicable response spectrum for horizontal acceleration, (OBE and SSE)Figure 1, ~~with~~/without torsion.

   c. The spectrum used to represent the vertical accelerations (OBE and SSE) shall be taken as 2/3 of the horizontal ground spectrum (Figure 1, Solid Line).

   d. Equipment support information (mounting base, pedestal, shock mounts, etc.) - RIGID ANCHOR BOLTS.

   e. Percent damping: 1%

   f. Seismic frequency qualification range - 0.5 to 40 hertz.

   g. Identification of non-Class 1 electrical devices in Class 1 assemblies (if any) - NA.

   h. Maximum horizontal floor (or ground) acceleration "G" level from high frequency asymptote, (ZPA) OBE 0.13; SSE 0.24.

2. Possible amplied design loads for equipment supports must be considered, by analyzing the supports to determine their amplification (if any).

3. Static or Dynamic Analyses

   a. Assess the dynamic characteristics of the equipment to determine the adequacy of analytical techniques to properly predict the equipment's response under seismic conditions - If the equipment is too complex to model, testing procedures in Category A should be considered.

   b. Model the equipment (including the supports) to best represent its mass distribution and stiffness characteristics. The equipment may be modeled as a series of discrete mass points connected by mass-free members.

   c. Determine the natural frequencies (periods of vibration) and mode shapes of the equipment and its support system in both the major horizontal and vertical directions.

      If the model has no natural frequencies (equipment, including its supports) that are below the high frequency asymptote (ZPA, 20 HZ) it is considered rigid and may be analyzed statically.

d. Alternately, exploratory vibration tests may run on equipment to aid in the determination of the best method of analysis in qualifying equipment. If it can be shown that the equipment (including supports) is not resonant at any frequency below the high frequency asymptote (ZPA, 20 HZ), it may be considered a rigid body and analyzed statically (see Step 4). If the configuration of the equipment is such that critical natural frequencies may not be ascertained due to either the complexity of the equipment or the inaccessibility of critical parts (sealed relays, etc.) the exploratory test should not be relied upon.

e. An easier but more conservative method of analysis is the static coefficient method (see step 5).

f. If the equipment cannot be analyzed statically, a dynamic analysis must be performed (see step 6).

4. Static Analysis

In the static analysis, the seismic forces on each component of the equipment are obtained by concentrating its mass at its center of gravity and multiplying it by the maximum floor acceleration (ZPA).

a. In determining the adequacy (see Section 7) of the equipment, two cases of simultaneous loading in the horizontal and vertical directions must be considered. One case considers the horizontal accelerations acting along the longitudinal axis of the equipment in combination with the vertical accelerations. The other case considers the horizontal acceleration acting along the transverse axis in combination with the vertical acceleration.

b. If significant, the seismic stress should be added to the equipment's operating stresses, and a determination made of the adequacy (see Sect. 7) of the strength of the equipment.

5. Static Coefficient Analysis:

This is an alternate method that requires no determination of natural frequencies. The analysis may be performed by applying a static coefficient of 1.5 times the maximum peak of the applicable floor (horizontal & vertical) response spectrum. The seismic forces on each component of the equipment are obtained by concentrating its mass at its center of gravity and multiplying it by the static coefficient. A stress analysis shall then be performed.

a. In determining the adequacy (Section 7) of the equipment, two cases of simultaneous loading in the horizontal and vertical directions must be considered. One case considers the horizontal accelerations acting along the longitudinal axis of the equipment in combination with the vertical accelerations. The other case considers the horizontal acceleration acting along the transverse axis in combination with the vertical acceleration.

b. If significant, the seismic stress should be added to the equipment's operating stresses, and a determination made of the adequacy (see Sect. 7) of the strength of the equipment.

6. Dynamic Analysis

In the dynamic analysis, the equipment may be modeled as a series of discrete mass points connected by mass-free members and with sufficient mass points to ensure adequate representation (see Step 3b). The resulting system will be analyzed using the response spectra modal analysis technique. The corresponding spectral acceleration is obtained from curves referenced in 1b & c.

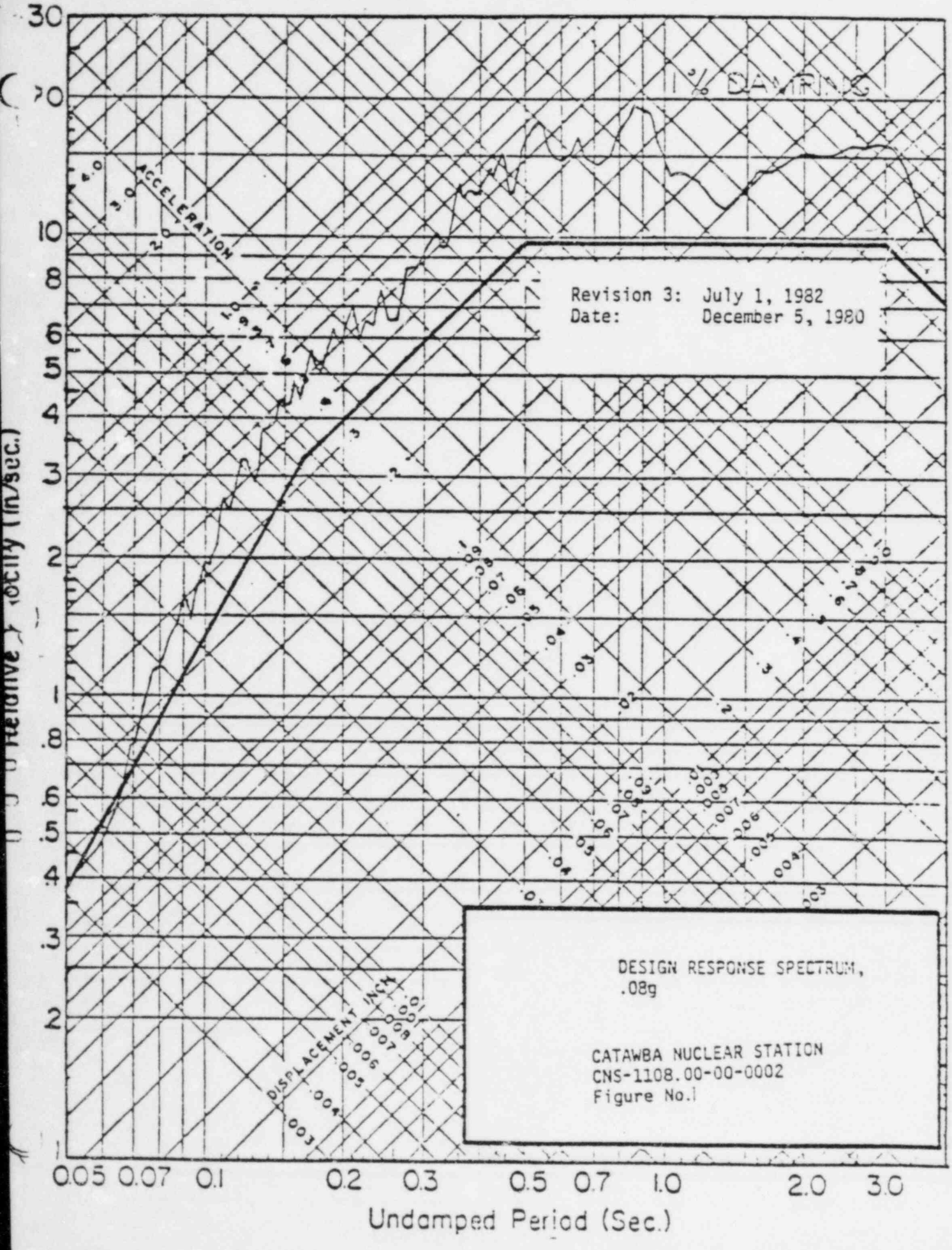
a. The forces, moments, and stresses of each mode (period greater than 0.025 seconds), must be evaluated independently according to the above procedure and combined according to the square root of the sum of the squares. The absolute sum of the responses should be considered for closely spaced in-phase modes.

b. In determining the adequacy (see Section 7) of the equipment, two cases of simultaneous loading in the horizontal and vertical directions must be considered. One case considers the horizontal accelerations acting along the longitudinal axis of the equipment in combination with the vertical accelerations. The other case considers the horizontal acceleration acting along the transverse axis in combination with the vertical acceleration.

c. If significant, the seismic stress should be added to the equipment's operating stresses, and a determination made of the adequacy (see Sect. 7) of the strength of the equipment.

7. Adequacy of the strenth of the equipment.

An evaluation of the effects of the calculated seismic stresses on mechanical strength, alignment (if critical to operation), electrical performance (contact bounce, etc.), and non-interruption of function as related to the functional requirements of the equipment during an SSE must be performed. Also, all interference effects caused by seismic displacements should be determined.


1% DAMPING
ACCELERATION
Revision 3: July 1, 1982
Date: December 5, 1980
DESIGN RESPONSE SPECTRUM,
.08g
CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No.1
DISPLACEMENT INCH
Relative Velocity (in/sec.)
Undamped Period (Sec.)
0.05 0.07 0.1 0.2 0.3 0.5 0.7 1.0 2.0 3.0

MCGUIRE & CATAWBA OBE 1% Composite Reponse Spectra for McGuire 733 and Catawba 560 Elevations in both N-S & E-W directions in Auxiliary Building.

These curves are for the operating basis earthquake (OBE). For the design basis earthquake (DBE) multiply these values by the ratio of (.015/.008)

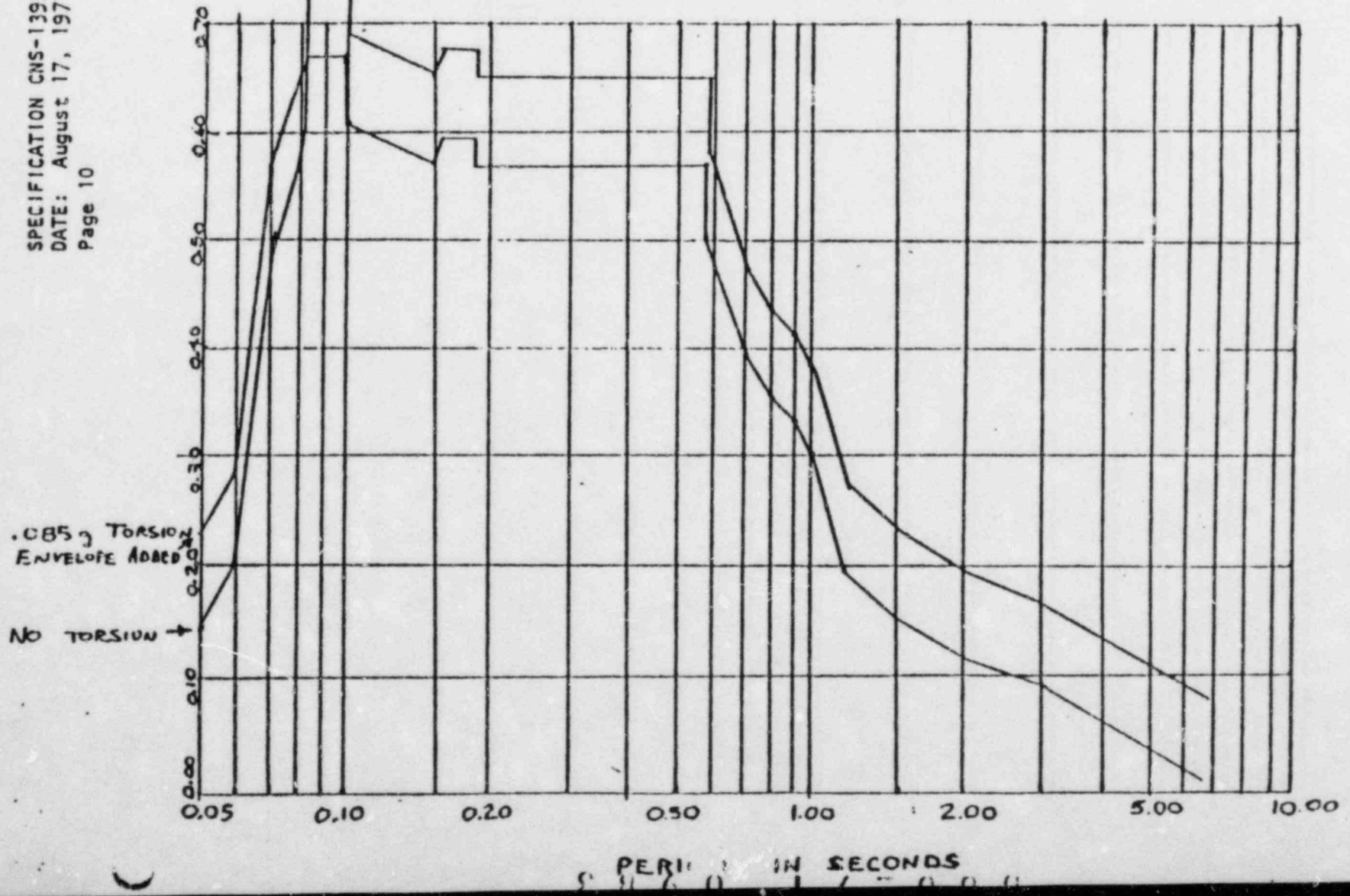
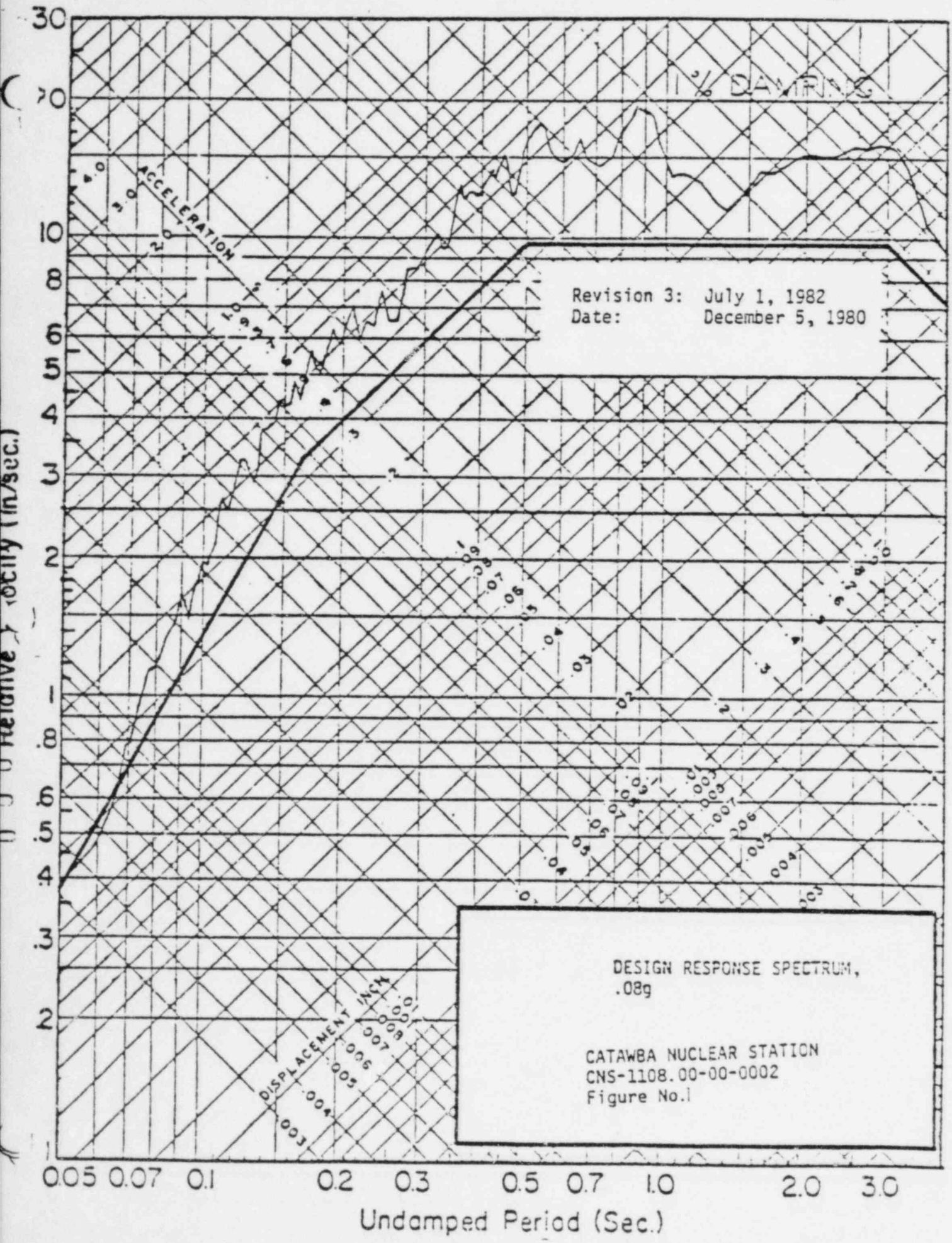
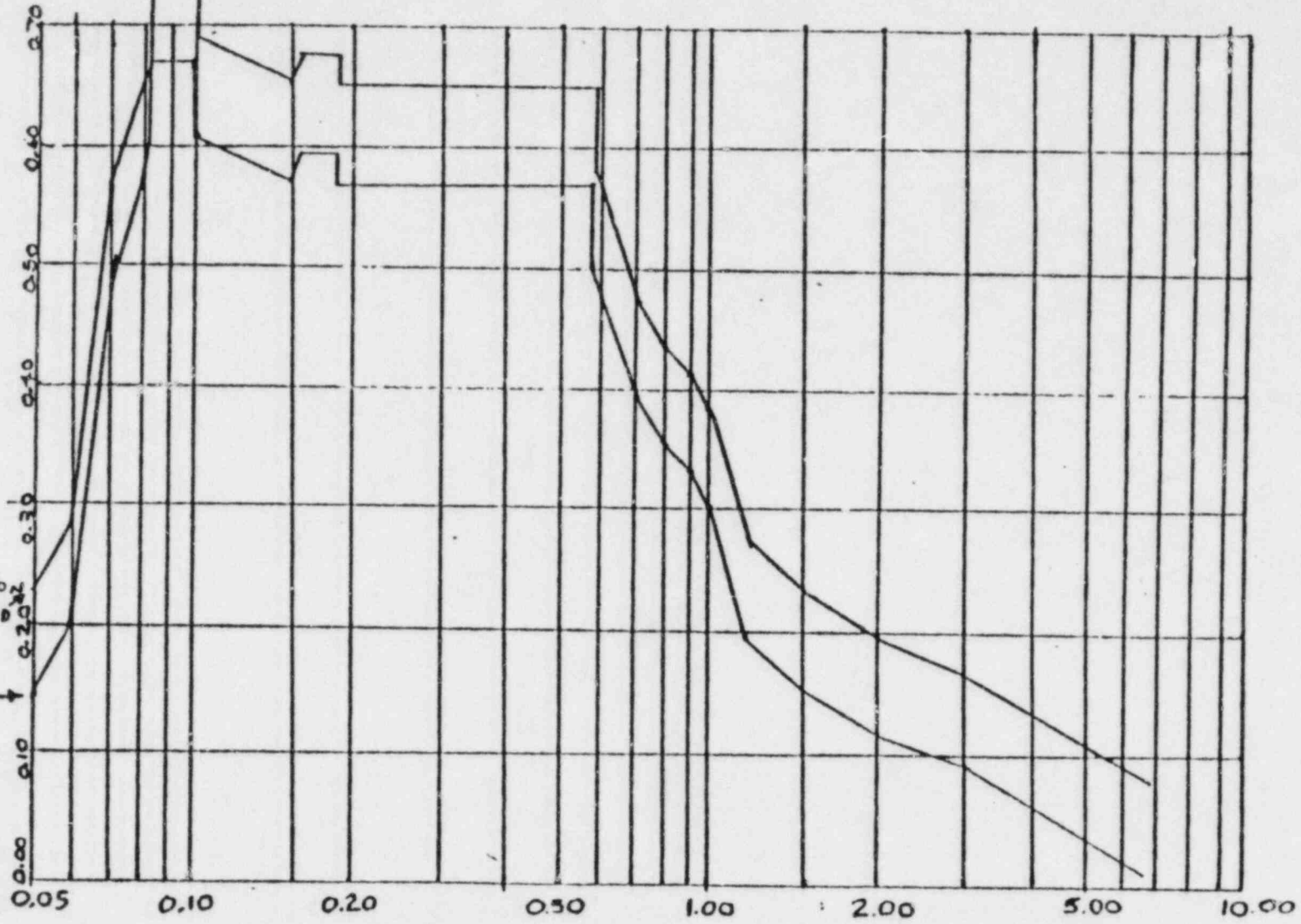


FIGURE 2


1% DAMPING
ACCELERATION
VELOCITY
DISPLACEMENT INCH
Revision 3: July 1, 1982
Date: December 5, 1980
DESIGN RESPONSE SPECTRUM,
.08g
CATAWBA NUCLEAR STATION
CNS-1108.00-00-0002
Figure No.1
Relative Velocity (in/sec.)
Undamped Period (Sec.)
0.05 0.07 0.1 0.2 0.3 0.5 0.7 1.0 2.0 3.0

MCGUIRE & CATAWBA OBE 1% Composite Reponse Spectra for McGuire 733 and Catawba 560 Elevations in both N-S & E-W directions in Auxiliary Building.

These curves are for the operating basis earthquake (OBE). For the design basis earthquake (DBE) multiply these values by the ratio of (.015/.008)



.085g TORSION ENVELOPE ADDED

NO TORSION

FIGURE 2

MCGUIRE & CATAWBA OBE 1% Composite Response Spectra for all McGuire 750' (& below) and Catawba 577 (& below) elevations in both N-S and E-W directions in Auxiliary Building,

These curves are for the operating basis earthquake (OBE). For the design basis earthquake (DBE) multiply these values by the ratio of (.015/.008)

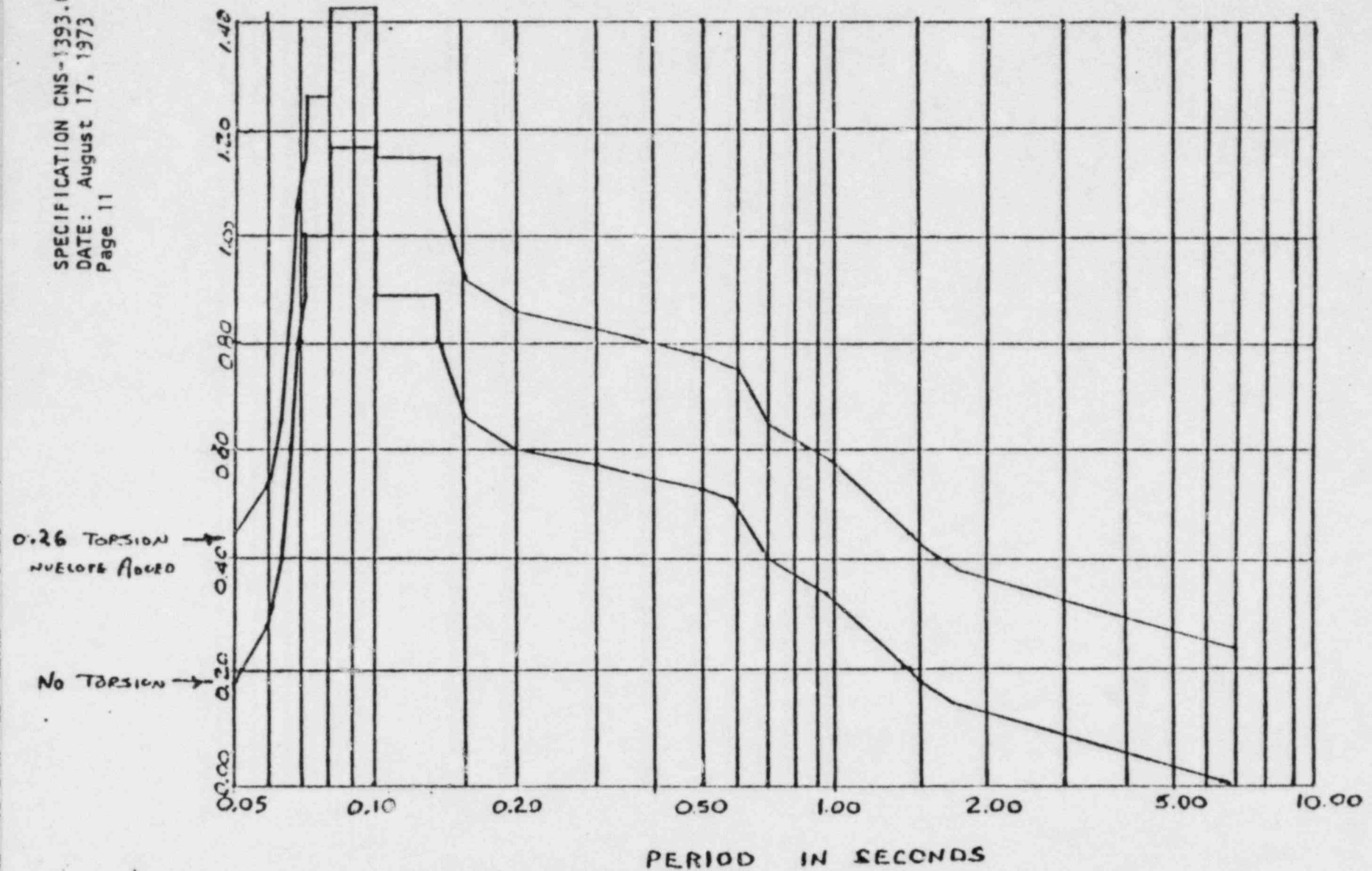


FIGURE 3

MCGUIRE & CATAWBA OBE 1% Composite Response Spectra for all McGuire 767 (and below) and Catawba 594' (and below) elevations in both N-S and E-W directions in Auxiliary Building.

These curves are for the operating basis earthquake (OBE). For the design basis earthquake (DBE) multiply these values by the ratio of (.015/.008)

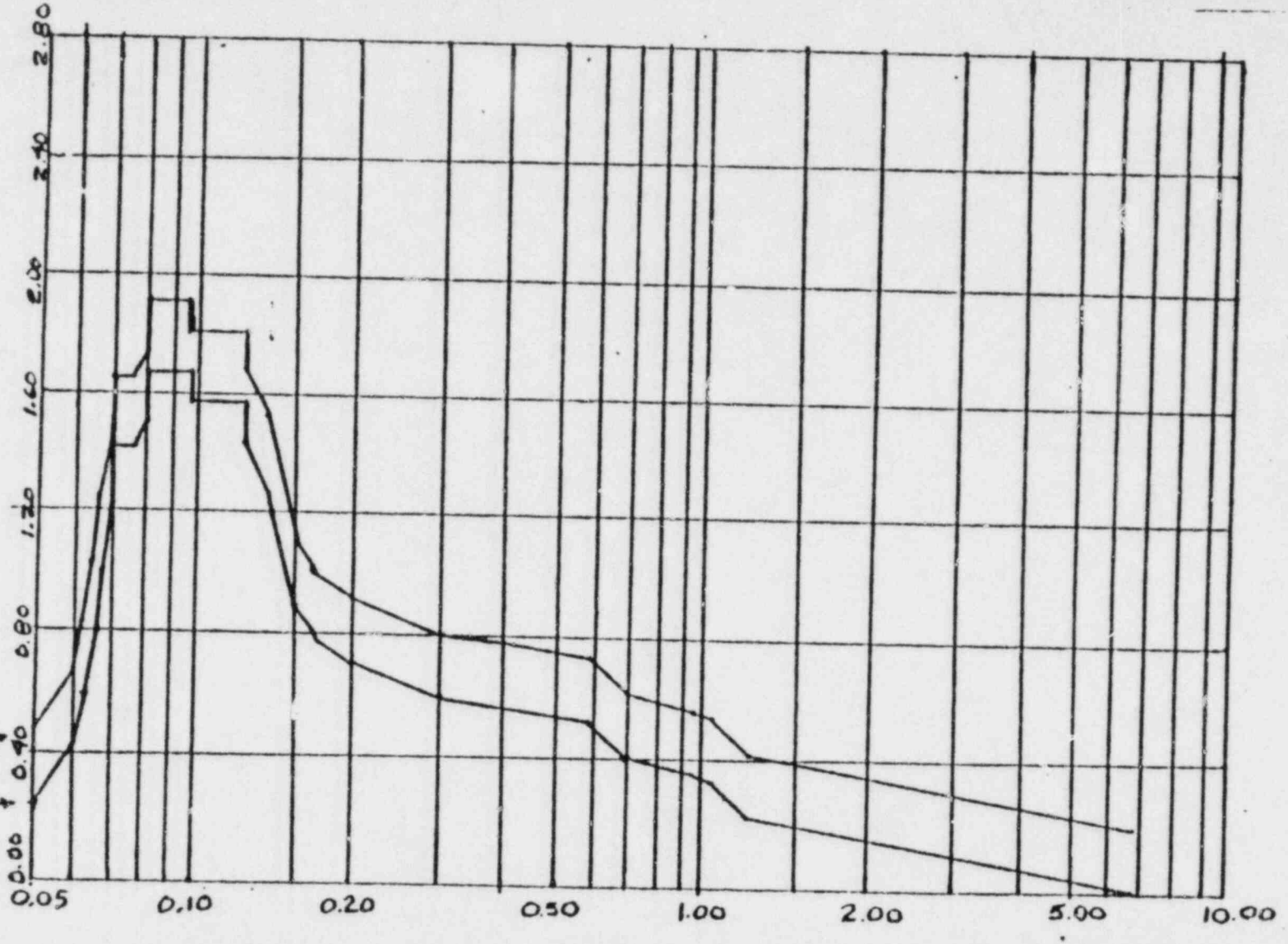


FIGURE 4

MCGUIRE & CATAWBA OBE 1% Composite Response Spectra for all McGuire 784' (and below) & Catawba 611' (and below) elevations in both N-S and E-W direction in Auxiliary Building

These curves are for the operating basis earthquake (OBE). For the design basis earthquake (DBE) multiply these values by the ratio of (.015/.008)

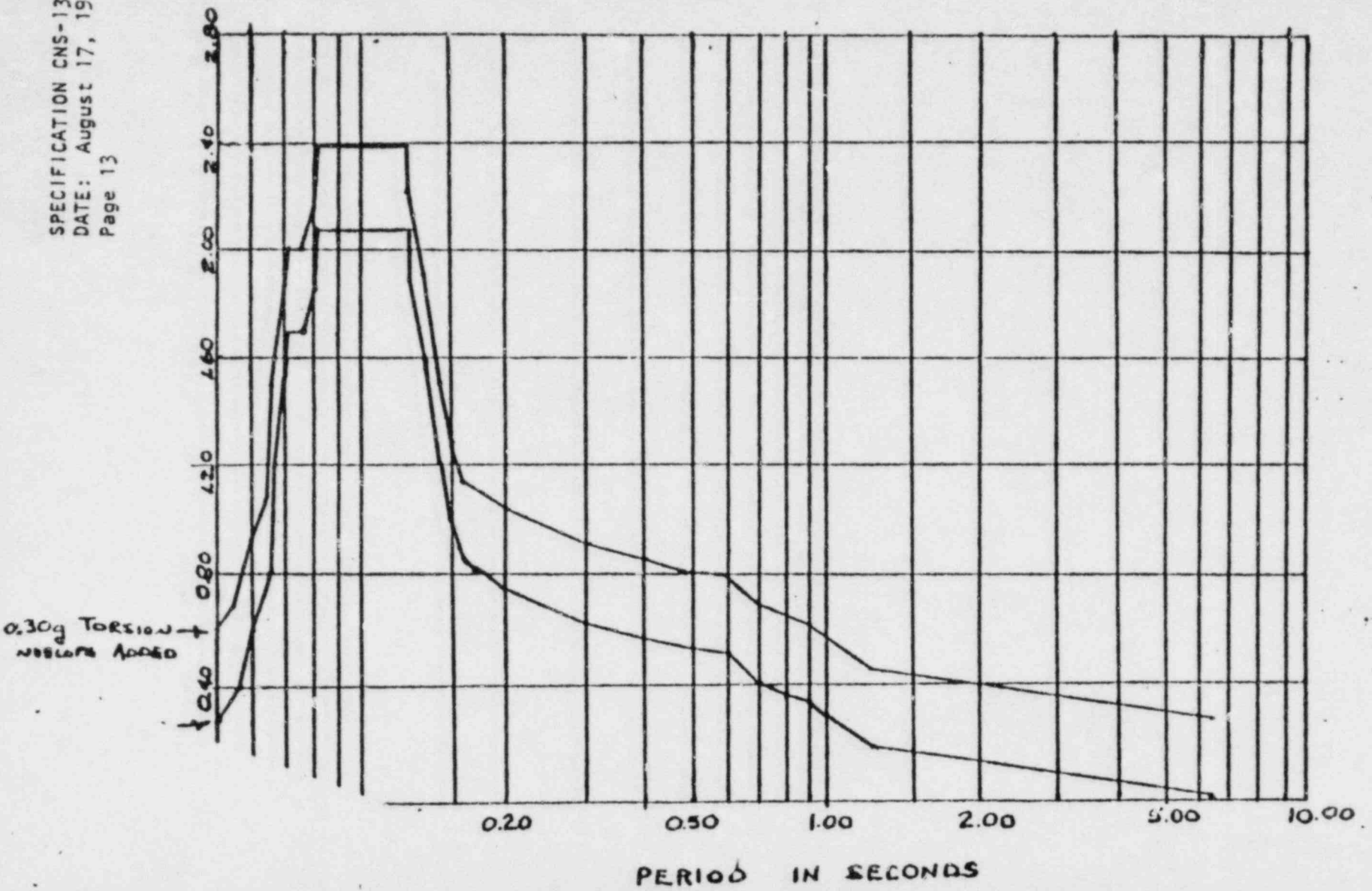


FIGURE 5

ATTACHMENT V

DUKE POWER COMPANY
DESIGN ENGINEERING DEPARTMENT
EQUIPMENT COATING INFORMATION
FORM EC-1

SHEET 1

PROJECT		DATE	
D.P. CO. SPEC. NO		PAINT CATEGORY	
EQUIP'T			
VENDOR			

FOR USE BY DUKE POWER ENGINEERING ONLY

	AEAN	INIT.	DATE	A	INIT.	DATE
DIVISION						
PAINT GROUP						
ARCH GROUP						

GENERAL INFORMATION (SECTION TO BE COMPLETED BY VENDOR)

SUBSTRATE MATERIALS			
EXPOSED SURFACE AREA (SQ FT)	PER ITEM	TOTAL	
ESTIMATED COATING MATERIAL QUANTITIES	PRIMER: GAL.	INTERMEDIATE: GAL.	FINISH: GAL.

SPECIFIED COATING (SECTION TO BE COMPLETED BY DUKE POWER DESIGN ENGINEERING)

DUKE POWER COATING SYSTEM		FINISH COLOR NO. AND NAME	
FINISH COAT PRODUCT NAME		FINISH COAT MANUFACTURER	

COMMENTS:

ATTACHMENT V

EQUIPMENT COATING INFORMATION FORM EC-1

SHEET 2

VENDOR'S STANDARD COATING

(SECTION TO BE COMPLETED BY VENDOR WITH COMPLETE SYSTEM OR PRIMER SYSTEM ONLY, AS APPLICABLE.)

SURFACE PREPARATION

STEEL STRUCTURES PAINTING COUNCIL - SSPC STANDARDS - 84

# SPEC	SP1	SP2	SP3	SP5	SP6	SP7	SP8	SP10	OTHER (DESCRIBE)

GENERIC COATING

	ALKYD	LACQUER	PHENOLIC	EPOXY	URETHANE	OTHER (DESCRIBE)	DRYING METHOD	
PRIMER							AIR	
INTERMEDIATE							BAKED	
FINISH							CATALYZED	

SPECIFIC COATING

	DFT	PRODUCT NO.	PRODUCT NAME	PRODUCT MANUFACTURER
PRIMER				
INTERMEDIATE				
FINISH				
FINISH COLOR NO.			COLOR NAME	COLOR SOURCE

FIELD APPLIED COATING

(SECTION TO BE COMPLETED BY DUKE POWER DESIGN ENGINEERING)

DUKE POWER COATING SYSTEM			
SURFACE PREPARATION			
PRIMER			
INTERMEDIATE			
FINISH			
FINISH COLOR NO		FINISH COLOR NAME	ATTACHMENT V PAGE 2 of 2 REVISION 0

2. Provide the performance specification and inspections performed upon receiving the DGs to show that the procurement specifications were met.

RESPONSE

The Performance Specification is the same as the procurement specification which is provided as Attachments 1-1 and 1-2 to the response to question 1.

Upon receipt, items are examined for identification, quantity, damage, packaging and the presence of appropriate documentation as required by the procurement specification and purchase requisition in accordance with Duke Power Company's Quality Assurance Program.

Receiving inspection of the Catawba diesel generators was performed in accordance with QA procedure P1 (Attachment 2-1) as follows:

1. Performed preliminary visual inspection prior to unloading. Inspected for environmental damage, tie down failure, or rough handling.

2. Checked component physical markings for conformance to specification CNS 1301.00-00-0002, i.e., fitted with permanent nameplates bearing its ratings.

3. Verified packaging and shipping met ANSI N45.2.2 Level C requirements.

4. Visually inspected diesel generator for completeness and physical damage:

   Checked external areas for detrimental gouges, dents, scratches and burns.

5. Reviewed documentation as per specification CNS 1301.00-00-0002.

Through the Duke Quality Assurance Representatives, who performed surveillance during the manufacturing of the diesel generator, TDI's compliance to the procurement documents was also verified. The Duke Power representatives activities consisted of witnessing various tests and examinations during fabrication. Among these tests were:

1. N.D.E.
2. Performance testing
3. Hydrostatic testing
4. Welding
5. Equipment Qualification Tests

FORM A-1D REVISION 0	PROCEDURE P-1	PAGE CS-1	REVISION 25

RECEIVING INSPECTION

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT

QUALITY ASSURANCE PROGRAM

COVER SHEET

CONSTRUCTION APPROVAL BY	DATE	QUALITY ASSURANCE APPROVAL BY	DATE
[signature]	1/5/84	[signature]	1/3/84

LIST OF PAGES, FORMS, & ATTACHMENTS VALID FOR THIS REVISION:

	REVISION
*Page CS-1	25
Page 1	16
*Page 2	16
*Page 3	16
*Page 4	5
*Page 5	1
Form P-1A	16.
Form P-1B	1
Form P-1E	5

*Indicates pages affected by this revision.

Note: Existing supply of Form P-1E may be used until supply is exhausted.

1. PURPOSE

This procedure establishes the method to assure that items received at a construction site meet the requirements of the procurement documents.

2. SCOPE

This procedure applies to all QA Condition items. It may also apply to other items when so designated by Construction Department Management.

3. RESPONSIBILITY

The Materials Manager is responsible for receipt, storage, and issue of items at each construction site. The Project Quality Assurance Manager is responsible for providing receiving inspection requirements if not provided on procurement documents and for documenting the acceptance of vendor records. The Project QA Manager is responsible for performing and documenting receiving inspections.

4. PROCEDURE

4.1 Receipt

As soon as practical after receipt of an item or prior to unloading if possible, the warehouseman shall determine whether the item is within the scope of this procedure. Normally the procurement document (i.e., item sheet or requisition) will specify the QA condition. If not specified on the procurement document, this determination shall be made from information provided by Design Engineering. The warehouseman shall notify a receiving inspector and afford him the opportunity to witness unloading of items when possible within the scope of this procedure. If the warehouseman cannot determine whether the item is within the scope of this procedure, he shall notify a receiving inspector who shall place the item in "QC-Hold" status.

4.2 Receiving Inspection Instruction Sheets

If Construction or Quality Assurance personnel identify a need for special receiving inspection instructions not included in the procurement document, they shall provide these on Form P-1B which shall be approved by the Engineering Manager and Project QA Manager. Form P-1B shall be provided for all Code items.

4.3 Receiving Inspection

⚠ Where sampling is used to perform the receipt inspection on ASME Code material it shall be based on a statistically valid sampling plan.

a. A visual inspection or examination shall be performed to determine if any damage occurred during shipping. Observations shall include, but not be limited to fire, excessive exposure, environmental damage, tie down failure, and rough handling.
b. Check that vendor documentation required by the procurement document to accompany the shipment is present.

c. Check that identification is as required by the procurement document and is consistent with the vendor documentation.
d. Perform other checks required by the procurement document.
e. Perform other checks required by Form P-1B.
f. Check that the item is stored at the level specified.

4.4 Status Determination

Upon completion of inspection and documentation review, the item's status shall be assigned as follows depending on the results:

a. QA Hold

This status shall be assigned to an item where required vendor documentation is not received with the shipment, when the inspection requirements cannot be determined, or at the option of the receiving inspector. An item assigned this status shall be identified with
⚠ "QA Hold" tape or tags. Catawba ASME Section III Code items assigned this status shall not be used or installed. Non Code items may be released if specifically approved by the Quality Assurance Department in writing. A receiving inspector shall be notified prior to moving an item in this status. "QA Hold" tape and tags may be removed only by a receiving inspector or by QA staff personnel only when the item has been assigned another status. Items assigned "QA Hold" for lack of documentation shall have all other inspection requirements satisfactorily completed.

b. Nonconforming

This status shall be assigned to an item that does not meet the requirements checked during the receiving inspection and is not placed in "QA Hold" status. The provisions of Procedure Q-1 shall be followed for an item in this status.

c. Inspection Acceptable

This status shall be assigned to an item that meets all the requirements checked during the receiving inspection. Items
⚠ assigned this status, except Catawba ASME Section III Code items that do not require a Code data report (e.g., NF-1, NPV-1, NPP-1) with the shipment and items to be used on an operating plant, may be issued.

d. QA Site Records Acceptable

For an item to be assigned this status, Form P-1A must be correct and acceptable, the 930.1 or certificate of compliance, if required with the shipment, and all other vendor documentation under the responsibility of Project QA must have been reviewed and approved by Project QA staff. For Catawba ASME Section III Code materials a
⚠ QA-301A shall be used to perform the review and approval of CMTRs.

The Project Quality Assurance staff is responsible for maintaining and documenting this status. An item assigned this status may be issued, except items to be used on an operating plant. Items to be used on an operating plant must have all required documentation approved prior to release of the item.

4.5 Documentation

a. The receiving inspection and status of items shall be documented using Form P-1A or equivalent. Warehouse inventory control forms may be used so long as all information required on Form P-1A is recorded on the warehouse form. If parts of a shipment are in different status, explanatory lists shall be attached to Form P-1A, or separate P-1A's shall be generated.

Form P-1A shall be completed according to the following instructions. Each instruction number relates to the corresponding space number on Form P-1A.

1. The construction project where the item is received shall be recorded by the receiving inspector. If a P-1A with the project name pre-entered is used, the receiving inspector shall verify its correctness.

2. The purchase requisition number or item number and Mill Power Supply Company purchase order number shall be recorded by the receiving inspector.

3. The vendor name and location, if known, and the manufacturer's order number shall be recorded by the receiving inspector.

4. The storage location shall be entered by the receiving inspector.

5. The receiving inspector shall enter a complete description of the item(s) received including any pertinent identification and marking on the item(s).

6. The receiving inspector shall enter the warehouse shipment number.

7. The receiving inspector shall enter the serial number and revision number of the P-1B used to perform the receiving inspection.

8. The receiving inspector shall check the appropriate block to indicate the appropriate QA condition and enter the Duke class.

9. The Senior QA Engineer or his designee shall enter the component number for mechanical equipment or other applicable number or N/A the block.

10. The receiving inspector shall enter any discrepancies noted during the receiving inspection or check the "Material Received in Satisfactory Visual Condition" block. If the item is placed in "QA-Hold" or is nonconforming, a description of the discrepancy shall be included. If an item is placed in "QA-Hold" because inspection requirements could not be determined or because of lack of documentation, the receiving inspector shall note this, enter the P-1E tag number, and forward the P-1A to the site QA Department. The documentation received with the shipment shall be listed on the appropriate line(s). If documentation is received after completion of the receiving inspection, the Senior QA Engineer or his designee shall enter it in the appropriate space and initial and date the entry.

11. The receiving inspector shall enter the storage requirements.

12. The receiving inspector shall date the sign sections a, b, or c.

    If the item is placed in QA-Hold, the P-1E tag number shall be entered. If the item is nonconforming, the Q-1A serial number shall be entered. The Senior QA Engineer or his designee shall date and sign section "d" after determining that documentation received meets the requirements for the item to be released for issue and after the item can be released from QA-Hold and/or the NonConforming Item Report is cleared.

13. The Senior QA Engineer or his designee shall enter the serial number and the name or number of the file in which the Form P-1A and associated documentation is to be filed.

b. When the purchase order requires notification of QA Vendors prior to shipment of the item, Form QA-605A, QA Vendors Release, is required for receipt inspection. This form is to show that QA Vendors Division has been notified and performed their review. In cases where time is a consideration, QA Vendors may verbally acknowledge the release, following with the hard copy. This form shall be filed with the P-1A form. If notification of QA Vendors was required and the QA-605A has not been received, place the item(s) in "hold" and contact QA Vendors Division for disposition.

4.6 Release of Items from QA-Hold or NCI Status

For items assigned "QA-Hold" status because of missing documentation, Form P-1A assigned as "QA Site Records Acceptable" by Quality Assurance shall serve as authority to remove the "QA-Hold" tape and tags. For

items assigned "QA-Hold" status, because inspection requirements could not be determined or because of a postponed inspection, the P-1A shall be retained by QA-Receiving. Nonconforming items shall be released for issue by QA Receiving signing Block C or QA signing Block D, depending on requirements of the Q-1A.

4.7 Release of Items

Copies of completed P-1A forms can be made available to the warehouse as necessary for providing status of items.

4.8 QA-Technical Services Review

QA Projects shall remove the construction copy of P-1A and forward original and QA Technical Services copy to QA Technical Services on items requiring QA Technical Services review. Upon completion of QA Technical Services review, a copy of P-1A will be retained and the original copy will be returned to the appropriate site. QA Projects shall maintain a log at each site of items for which copies have been sent and received from QA Technical Services.

5. FORMS

The following forms are required by this procedure:

Form P-1A Receiving Inspection Report
Form P-1B Receiving Inspection Instruction Sheet
Form P-1E QA-Hold Tag

6. FOOTNOTES

⚠ 1983 ASME Survey

25673 (R11-83)

FORM P-1A | REVISION 16

Q.A. RELEASE ☐YES ☐NO
Q.A. RELEASE # _____

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT McGuire 1.

13a. SERIAL NO. NA
b. FILE NO. ECB-533

RECEIVING INSPECTION REPORT

2. DUKE REQ./ITEM NO.	2. MILL POWER ORDER NO.	3. MFG. ORDER NO.	3. VENDOR & LOCATION
1354-02-00-0016	E-59347	NA	Brand Rex, Willimantic CT

5. DESCRIPTION & IDENTIFICATION

4 each: Electrical Cable Reels Mark # 3X1261

Reel #	Feet
29329	600
30999	5556
29481	1063
31897	894

EXAMPLE

6. SHIPMENT NUMBER	7. P-18 NUMBER, REV.	8. QA REC'D ☒YES ☐NO	9. COMPONENT NUMBER
46501	E-5 Rev 2	CONDITION 1	NA

10. RECEIVING INSPECTION VISUAL EXAMINATION REMARKS:
☐ MATERIAL RECEIVED IN SATISFACTORY VISUAL CONDITION
☐ OTHER (DESCRIBE) _____

4. STORAGE LOCATION: T-37

QUALITY ASSURANCE DOCUMENTATION RECEIVED: 9

11. STORAGE REQUIREMENTS:
LEVEL ☐A ☐B ☐C ☒D ☐SPECIAL Weatherproof covering

12. STATUS OF ITEM	DATE	SIGNATURE
a. Q.A. HOLD ☐Postponed ☐Documentation ☐Inspection Requirements S/N _____	NA	NA
b. NON-CONFORMING ITEM S/N _____	NA	NA
c. Q.A. INSPECTION ACCEPTABLE	5-1-80	Pam Honeycutt
d. Q.A. SITE RECORDS ACCEPTABLE (May be released from "Q.A. HOLD" if applicable)	5-8-80	Becky A. McCoy
e. Q.A. TECHNICAL SERVICES VENDOR RECORD REVIEW: COMPLETE AND ACCEPTED		

Original - Record Copy; Yellow - QA Technical Services; Pink - QA Projects

Example dated 8/14/79 | FORM P-1B | REVISION 1

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT
PROJECT Catawba SERIAL NUMBER M-18

RECEIVING INSPECTION INSTRUCTION SHEET

MATERIAL OR EQUIPMENT DESCRIPTION: Stainless Steel Piping Material Class B Fittings 1" O.D. and Less NUCLEAR SAFETY RELATED

ORDERED BY: Design Engineering

INSPECTION ASSISTANCE REQUIRED: As deemed necessary by the Receiving Inspector

DOCUMENTATION REQUIRED: Material Test Report with ASME Certification

INSPECTION INSTRUCTIONS: Assure that each container is marked with a code traceable to a Material Test Report. Inspect each piece for manufacturer's symbol, spec. 316, and traceable code. For a fitting not marked with a traceable code, the inspector shall require Warehouse Personnel to mark the fitting with the code shown on the container in which it was received. The QC Receiving Inspector shall inspect one item per-traceable code per shipment to verify correct wall thickness. The Receiving Inspector shall record the items received and their required markings on Form P-1A, "Receiving Inspection Sheet", including quantities of each item.

The Receiving Inspector shall require Warehouse Personnel to mark the Duke Class on the fittings. The inspector shall verify all markings and may require the remarking of any item, if within his judgement the existing markings are not permanent enough to remain legible.

The Receiving Inspector shall inspect the material to assure that it is free of rust.

When material is received with small nicks in the weld prep area, this type of defect shall not be considered a nonconformance if the defect will be corrected during normal cleaning and erection.

Contact QA-Mechanical on questionable items.

EXAMPLE

REVISION 2 ORIGINATED M.D. Johnson DATE 2-6-79

APPROVED: PROJ. ENGR. DL Frazier SR. QA ENGR. RM Mays

FORM 3-12 REVISION 5

Q.A.-HOLD

TAG NO. _____

THIS ITEM HAS BEEN ASSIGNED "Q.A.-HOLD" STATUS

DO NOT REMOVE THIS ITEM FROM THIS LOCATION UNTIL PROJECT Q.A. HAS BEEN NOTIFIED OF THE NEW LOCATION.

INSPECTOR _____

PROJECT Catawba SERIAL NUMBER E-8

RECEIVING INSPECTION INSTRUCTION SHEET

MATERIAL OR EQUIPMENT DESCRIPTION: Diesel Generator equipment: Item No. 1301.00-2, Mill Power order No. C-20660

ORDERED BY: Design Engineering (Electrical)

INSPECTION ASSISTANCE REQUIRED: As deemed necessary by the Receiving Inspector

DOCUMENTATION REQUIRED: 930.1

INSPECTION INSTRUCTIONS: These instructions pertain to the Receiving of the Diesel Electric Generating Units ordered by Design Specification CN 1301-00-00-0002. Code stamped items shall be received without an ASME Code Data Report due to the nature of para. 7.1.4.2 of specification CNS 1301-00-00-0002 ammendment No. 2. All Code stamped items shall be received in accordance with Section P-1 of the Duke Power Company Quality Assurance Manual for ASME Code Work. The documentation necessary for receiving shall be as required by the purchase order and the specification. All code stamp items shall have the following information recorded on the P-1A:

A. Equipment Serial Number

B. Year Built

REVISION 1 ORIGINATED Michael R. Rose DATE 12/27/79

APPROVED: PROJ. ENGR. [illegible] QA ENGR. D. Mauger

PROJECT Catawba SERIAL NUMBER M-17

RECEIVING INSPECTION INSTRUCTION SHEET

MATERIAL OR EQUIPMENT DESCRIPTION: Nuclear Safety Related Tanks except NSSS Vendor Equipment

ORDERED BY: Design Engineering

INSPECTION ASSISTANCE REQUIRED: As deemed necessary by the Receiving Inspector

DOCUMENTATION REQUIRED: Form 930.1, for ASME Code Tanks the appropriate Code Data Report

INSPECTION INSTRUCTIONS: Each tank shall have a metal tag attached displaying the manufacturer's name and serial number, Design Pressure and Temperature, Hydro Test Pressure, and for ASME Code Tanks the applicable Section VIII Code "U" stamp or Section III, Class 3 Code "N" stamp.

The QC Receiving Inspector shall record the items received and their required markings on Form P-1A.

Contact QA on questionable items.

NUCLEAR SAFETY RELATED

REVISION 1 ORIGINATED M D Shuman DATE 4-12-79

APPROVED: PROJ. ENGR. [signature] QA ENGR. [signature]

DUKE POWER COMPANY
CONSTRUCTION DEPARTMENT

PROJECT Catawba SERIAL NUMBER E-3

RECEIVING INSPECTION INSTRUCTION SHEET

MATERIAL OR EQUIPMENT DESCRIPTION: Foundation Equipment for Diesel Generators Item No. 1301.00-2, MPS C 20660.

ORDERED BY: Design Engineering

INSPECTION ASSISTANCE REQUIRED: As deemed necessary by the Receiving Inspector

DOCUMENTATION REQUIRED: Forms 930.1A, 930.1B, Mill Test Reports.

INSPECTION INSTRUCTIONS:

Q.C. Receiving inspector to verify and list each part number, identification number, and heat number found on all bolts, nuts, washers, anchors, plates and sole plates found in shipments 2761-2762 and 75017-20 of foundation equipment. If no heat or identification numbers are found list those items so that they may be identified in some manner (i.e. part number and quantity).

The Q.C. Receiving inspector shall record the above information on Form P-1A.

JUN 7 1979

NUCLEAR SAFETY RELATED

REVISION NUMBER 0 PREPARED BY David A. Jenkins

DATE 12/30/76 APPROVED BY R.A. Morgan

3. Identify the materials used in the design of the DGs at your plant (specifically limiting components such as crankshafts, camshafts, pistons, rocker arms, bearing materials, cylinder blocks, cylinder heads, pumps, turbochargers, etc.). Discuss how you assured yourself that design materials used in the manufacture of your DGs were as stated and in accordance with materials described in the TDI proposal, purchase specifications, and conformance to industry standards.

RESPONSE

Duke Power Company's purchase specification did not specify materials for the diesel generator. Diesel generator materials were specified by the manufacturer. Duke Power Company required that all major parts of the engine (piston, connecting rods, cylinder heads, crankshaft, etc.) be non-destructive tested to insure the best quality components are used. Duke Power Company also requires that personnel performing final evaluation of non-destructive examinations be qualified to SNT-TC-1A-1975, Level II. Attachment 3-1 outlines the minimum non-destructive examination of major components required by Duke Power Company.

Assurance was provided by means of requirements placed on Transamerica Delaval as specified under Section 7 of procurement specification CNS-1301.00-00-0002 dated October 3, 1974 and all revisions thereto. Verification that these requirements were implemented and maintained was accomplished by Duke Power Company Quality Assurance Department Audits of TDI's QA program prior to and during fabrication of the diesel generators.

Surveillance visits were performed periodically to verify that the diesels were being fabricated in accordance with the procurement specification.

The materials used in the design of the major diesel engine components (not including auxiliary components) are identified in Attachment 3-2.

ATTACHMENT 3-1

The following tests, inspections, and examinations shall be performed as indicated. Reports shall identify the inspector, the type of examination the results, the acceptability and the action taken with any noted deficiencies. Personnel performing final evaluation of nondestructive examination shall be qualified to SNT-TC-1A--1975, Level II.

Cylinder Block With Liners - Hydrostatic Test
Mill Test Reports
Inspection Reports (Visual & Dimensional)

Cylinder Heads - Magnetic Particle Examination*
Hydrostatic Test and Pneumatic Test
Mill Test Report

Crankshaft - Ultrasonic Examination
Magnetic Particle Examination*
Mill Test Report

Connecting Rods - Magnetic Particle Examination*
Mill Test Report

Pistons - Magnetic Particle Examinations* (Crown only)
Mill Test Report (Crown and skirt)

Cams - Inlet and Exhaust - Surface Hardness Certification per Mill Standard 105D
Mill Test Report or Certification (Typical)

Camshaft - Mill Test Report or Certification (Typical)

Turbocharger - Shaft - Mill Test Report, or Certification or Certificate of Conformance

Gears - Magnetic Particle Examination*
Mill Test Report or Certification

Bolts, Studs, Nuts, Wrist Pins or Retaining Pins - Cylinder Heads Connecting Rods, Main Bearing, Caps

Magnetic Particle Examination as per Mill Standard 105D Mill Test Report or Certification (Typical)

Pumps - Hydrostatic Test Certification or Engine Dyno Test
Performance Test (may be typical)

*NOTE - Liquid Penetrant Examination is an acceptable alternate for this requirement only if one of these methods are used:

a. Fluorescent - Solvent Removable

b. Fluorescent - Post Emulsifiable

ATTACHMENT 3-2

Diesel Generator Component Material

Crankshafts - One piece alloy steel forging 13 inch main journals and 13 inch crankpins. Crankwebs are 25 inches in diameter and 5-1/8 inch thick.

Camshafts - Cold Forged Ground Shafting

Cams - Steel Forging AISI B620

Pistons - Crown = Cast Steel ASTM A148
Skirt = Nodular Iron

Rocker Arms - Ductile Iron Castings
ASTM A536 GR. 65-45-12

Bearings - Aluminum, Alcoa B850-T5

Cylinder Blocks - Class 40 Gray Cast Iron ASTM, A48

Cylinder Heads - Cast Steel ASTM, A216

Connecting Rods - Alloy Steel AISI A-4142

4. Does TDI have a program where parts/components, etc., are modified (such that design margins are reduced) in order to improve operability and DG reliability? Does this apply to any DG parts at your plant? Provide a list of product improvements made by TDI on your model DG and identify and justify which of these were not incorporated on your diesels.

RESPONSE

Transamerica Delaval, Inc. has a program in the form of Service Information Memo's (S.I.M.). This program is used to distribute the latest information pertaining to TDI engines. These S.I.M's consist of product improvement information wherein experience gained either in the field or in the manufacturing facility is passed on to diesel owners as suggested or recommended modifications to correct or enhance product reliability.

This program was applied to the Catawba diesels and it is Duke Power Company's belief that in no instances were the design margins reduced.

Attachment 4-1 list the product improvements, made by Transamerica Delaval Inc. (TDI), to the Catawba diesels prior to, and after, delivery of the diesels.

ATTACHMENT 4-1

DIESEL IMPROVEMENTS MADE PRIOR TO DELIVERY OF THE DIESELS TO CATAWBA

1) Engine Cylinder Liner Seals

To improve the liners longevity, increase the diesel generator's reliability, and reduce maintenance expense, viton seals are now provided.

2) Jacket Water Outlet Manifold

A seismic shake test on another diesel indicated that additional stiffening of the manifold mounting bracket was required. This stiffening increases the reliability of these engines to perform during an "seismic event".

3) Engine Flywheel Guard

As an enhancement, the engine's flywheel guard was stiffened and braced to increase reliability during a "seismic event".

4) Engine Gear Case

To increase the longevity and reliability of the diesel, the jacket water and lube oil pumps were made on-engine. This change eliminated the need for electric driven pumps. To carry the additional horsepower and nozzle loads, the engine's gear case was stiffened by adding ribbing and bracing.

5) Piston

Reliability and longevity were improved with a new piston design. By making the piston material harder and changing the ring contour, lube oil consumption was significantly reduced. Reducing the lube oil consumption further reduces the need to add lube oil make-up.

6) Air Start Valve

A redesign of the air start valve was done to improve the starting reliability of the diesel. In addition, tolerances of machined parts were reduced which required more stringent inspections.

7) Engine Cylinder Head Seal

To increase starting reliability of nuclear diesel generators that are normally in a standby mode, a new seal was added to the intake valve guides. Without this seal the possibility existed that oil could drip down the intake guides and foul the valve parts and piston rings. The new design has considerably lessened this possibility.

8) Intake Air Manifold Bracket

The air manifold was originally supported by U-bolts from the engine platform. To increase longevity and reliability for nuclear standby service, the intake air manifold support was completely redesigned and relocated.

9) Exhaust Manifold Mounting Support

To increase reliability and longevity of the diesel engine in nuclear service, crossbracing was added to the exhaust manifold. This added rigidity and improved reliability during a "seismic event".

10) Exhaust Manifold Seal Ring

To increase reliability and longevity and decrease maintenance, a new ring material was provided. The new material has led to limitless trouble-free service.

11) Engine Governor

The addition of a governor hydraulic booster assembly significantly added to the quick start capability of the engine. This booster adds to the reliability of the generator.

12) Lube Oil Inlet Manifold

Field experience has shown that an engine with a continuously running keep-warm pump should not oil the rocker arms and part of the turbocharger. This reduces lube oil consumption and increases reliability of starting the engine. A new system of check valves and piping has been added to accomplish this.

13) Lube Oil Strainer Bracket

Shop testing indicated that the strainer bracket needed to be stiffened to eliminate resonance within the seismic response range. Consequently, the bracket was redesigned and additional stiffening added to improve reliability of the engine during a "seismic event".

14) Engine Platforms

To increase reliability of the engine and safety to personnel, the engine platforms were modified. Originally the platforms were supported by the air manifold. The platforms were changed to be supported by the floor.

15) Lube Oil Relief Valve

As a result of improving starting time, and to add reliability to quick starting, a second lube oil relief valve was added.

TDI PRODUCT IMPROVEMENTS MADE OR REVIEWED BY DUKE POWER COMPANY AFTER DIESEL DELIVERY TO CATAWBA AS A RESULT OF 10 CFR PART 21

1) Turbocharger Lube Oil Drip Modification
2) D/G Engine Valve Springs
3) D/G Piston Skirt - Belleville Springs
4) D/G Governor Lube Oil Cooler
5) D/G Starting Air Valve - Long Bolts
6) D/G Governor Drive Coupling
7) D/G Piston Skirt Stress Relieved
8) D/G Potential Transformer Sub Assembly Retainer Clips
9) D/G Fuel Line
10) Governor & Mag Pickup Cable

Item 2 was not applied to the Catawba diesels.
Justification: Letter from TDI stating modification is not applicable to the Catawba diesels.

Item 4 was not applied to the Catawba diesels.
Justificaton: Governor Lube Oil Coolers on the Catawba diesels were in their proper location - no modification was required.

5. If applicable, provide responses to all NRC open items on standby DGs at your plant.

RESPONSE

There are no open items in the Catawba Safety Evaluation Report (NUREG-0954) directly related to Delaval diesel generators.

However, the three following items are discussed in the referenced SER sections:

1. Diesel generator intake/exhaust (9.5)
2. Inadvertent operation of CO_2 in D/G building (9.5)
3. Internal corrosion protection for fuel oil storage tanks (9.5.4.2)

Duke has provided responses to each of these items.

6. Identify each of your DGs by model number and rating (continuous duty and short time overload) as purchased and discuss all tests (including torsional and other design proof tests) performed on the DGs that were observed (also those not observed) by you at the manufacturer's facilities.

RESPONSE

The diesel generator model number and ratings with engine specifications are listed in Attachment 6-1. Attachment 6-2, lists the qualification tests performed on one diesel generator by Transamerica Delaval, Inc. These tests conform to the guidance provided in Regulatory Guide 1.9, "Selection of Diesel Generator Set Capacity for Standby Power Supply's," and IEEE Standard 387-1977, "Criteria for Diesel Generator Units Applied as Standby Power Supplies for Nuclear Power Generating Stations." Additional tests were performed by TDI for design verification, such as the Crankshaft Torsiograph Test. Also, a seven day, no load, Idle Endurance Test was performed which demonstrates the diesel's ability to idle for long periods following a LOCA condition.

The remaining diesel units were subjected to the manufacturer's standard shop tests which verified component functional operation and system operability. Testing included diesel startup, running operation, and monitoring of engine operating parameters, to verify proper diesel performance.

The Catawba 1A diesel generator unit was the mechanism used to generically test and qualify the remaining three generators for Catawba.

In addition preoperational testing as outlined in Attachment 6-2 to this question, further assures the operability and reliability of each diesel and associated generator at Catawba.

ATTACHMENT 6-1

Diesel Engine Specifications

Model	DSRV-16-4
Engine Serial Numbers	2761-75017, 2762-75018 2763-75019 & 2764-75020
Service	Standby Generator for Nuclear Service
Fuel Mode	Diesel
Configuration	45° "V" type
No. of Cylingers	16
Bore (inches)	17
Stroke (inches)	21
Cycle Mode	4 stroke
Total Displacement (cubic inches)	76,266
Continuous Rating (KW)	7000
Overload Rating (KW)	7700
Quantity	4
Crankshaft Diameter (inches)	13
Crank Pin Diameter (inches)	13

ATTACHMENT 6-2

Qualification Testing [5]

	TEST[1]	SPECIFIED[2]	PERFORMED	WITNESSED[3]
1)	Functional (Components)	X	X	X
2)	Operational (System)	X	X	X
3)	Starting Air Compressor Capacity	TDI[4]	X	NO
4)	300 Start	X[6]	X	NO
5)	Sequential Load	X	X	X
6)	Load Rejection	X	X	X
7)	Margin	X	X	X
8)	Idle Endurance	X	X	NO
9)	Acoustical	TDI[4]	X	NO
10)	Crankshaft Torsion (Torsiograph)	TDI[4]	X	NO
11)	Starting Air Bottle Capacity	TDI[4]	X	NO
12)	Load Capability Qualification	X	X	X

Notes:
(1) Test Nomenclature taken from TDI Test Report.
(2) As required by Specification CNS-1301.00-00-0002.
(3) As witnessed by Duke Power.
(4) Additional tests performed by TDI to augment those required by Duke Power and/or DEMA.
(5) Complete qualification testing of the Catawba diesel generators was accomplished by performing tests on one diesel generator and generically qualifying the remaining diesel generators. The remaining diesels received standard shop testing to verify functional and operational performance.
(6) The 300 start test was performed on the Grand Gulf diesel which generically qualifies the Catawba diesels.

7. In addition to qualification tests performed in accordance with Regulatory Guides 1.9 and 1.108, and IEEE Std. 387, describe all other on-site tests performed on your DGs.

RESPONSE

Testing performed to date on Catawba's Unit 1 diesel generators was primarily related to startup testing and preoperational functional testing.

Those test conducted during the startup phase were documented in the vendors' initial run log sheet and time reports as well as in maintenance procedures.

They are chronologically (for each engine):

A. 15 minute unloaded run and bearing inspection.
B. 30 minute unloaded run and bearing inspection.
C. Step loading of D/G at approximately 25%, 50%, 75%, 100% and 110% for approximately one hour per load.
D. 24 hour loaded run.
E. The diesel generator was started and loaded to full load (7000 KW) within 60 seconds, and operated with this load for 60 minutes or more.
F. The diesel generator's fuel oil consumption rate at full load (7000 KW) will be determined to verify the fuel oil storage tanks' capacity for seven (7) days.

Those tests performed during the preoperational functional testing program which have been completed are starred (*) in the system verifications (Attachment 7-1). To date, all loaded megawatt hours are from this testing. The remaining accumulated engine hours are from unloaded runs during load sequencer and non-loaded testing.

Additional test and inspections of the Catawba Unit 1 diesels will be performed as part of the TDI Owners Group Program as well as Duke Power's Extended Operation Test of Diesel 1A.

ATTACHMENT 7-1

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

EQC - Diesel Generator Controls

APPROVED [illegible] 6/7/91
APPROVED [illegible]
APPROVED [illegible]
DATE
REVISION 1

SYSTEM CHECKOUT

1. All alarms, computer points, annunciating devices, and interlocks will be loop checked and put in service or verified. All instrumentation will be calibrated. The above will be done unless documented on turnover calibration work request. (I & E)
2. Initial preparation and run of Diesel Generator. (SU)
3. Put system into operation per appropriate OPS. (OPS)
4. All initial adjustments will be made to equipment. (Maint. & Vendors)

PREOPERATIONAL TESTS

TP/1/A/1100/02A - Diesel Generator 1A Preoperational Functional Test

* To demostrate that the Diesel Generator Auxiliary Systems Cooling water (KD), Lube Oil (LD), Fuel Oil (FD), Starting Air (VG), and Building Ventilation (VD) perform in accordance with Design.

* A) To demostrate the proper logic, proper operation of the following Trip Devices:

  Trip High Temp Lube Oil Outlet Alarm.
  Trip High Temp Bearings Alarm
  Trip High Temp Jacket Water Out Alarm
  Trip Low Press Turbo Oil Alarm
  Trip Low Press Lube Oil Alarm
  Trip Vibration Alarm
  Trip High Press Crankcase Alarm
  Trip Overspeed Alarm
  Trip Low Low Press Lube Oil Alarm
  Trip Generator Fault Alarm

  B) Proper operation of the following initiating devices and permissive and prohibit interlocks:

  Diesel Generator Govenor Control RAISE and LOWER (Local and Remote)
  Diesel Generator Voltage Adjustment RAISE and LOWER (Local and Remote)
  Diesel Generator STOP and EMERGENCY STOP (Local and Remote)
  Diesel Generator Breaker
  Diesel Generator Control Room Override
  Diesel Generator LOCAL and REMOTE

* To demonstrate that the Diesel Generator can be started and loaded to 7000KW in < 60 seconds, and operates with this load for ≥ 60 minutes.

PERFORMANCE MONITORING PROGRAM

No Performance Activities are identified because of extensive periodic testing requirements.

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

EQC - Diesel Generator Controls

APPROVED — 4/11/83
APPROVED
APPROVED
DATE
REVISION 1

SYSTEM CHECKOUT	PREOPERATIONAL TESTS	PERFORMANCE MONITORING PROGRAM
	4. To demonstrate that the Diesel Generator and its load group can function without any dependence upon any other load group or portion thereof. 5. To demonstrate that 1) The Diesel Generator is capable of starting and accelerating to rated speed, in the required sequence, all of the Engineered Safeguard Feature Loads, 2) At no time during the loading sequence that the frequency and voltage decreases to less than 95% of nominal and 75% of nominal, respectively, and 3) The frequency is restored to within 2% of normal, and the voltage is restored to within 10% of nominal within 60% of each load-sequence time interval. 6. To demonstrate, by simulating loss of all AC voltage, that the Diesel Generator can start automatically and attain the required voltage and frequency are maintained within required units. 7. To demonstrate the proper operation of the Diesel Generator during the Design-Accident-Loading Sequence and to verify that the voltage and frequency are maintained within required limits. 8. To demonstrate the full-load-carrying capability of the Diesel Generator for an interval of > 24 hours, of which at least 22 hours shall be at 100% load and at least 2 hours shall be at 110% load. 9. To demonstrate that the Fuel Oil Filter can be changed with the Diesel Generator operating, using the diverter valve, without a drop or loss of fuel oil pressure. 10. To demonstrate that the Fuel Oil Strainer can be changed with the Diesel Generator operating, using the diverter valve, without a drop or loss of fuel oil pressure.	

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

EQC - Diesel Generator Controls

APPROVED 6/11/85
APPROVED
APPROVED
DATE
REVISION 1

SYSTEM CHECKOUT	PREOPERATIONAL TESTS	PERFORMANCE MONITORING PROGRAM
	11. To verify the fuel oil storage capacity of seven days at full load by measuring the Diesel Generator's fuel consumption rate at full load.	
	12. To demonstrate the functional capability of the Diesel Generator, at full-load temperature, to operate properly. By actual loss of all AC voltage, verify that the Diesel Generator can start, in the required time and sequence loads automatically while maintaining voltage and frequency within required limits.	
	* To demonstrate the capability of the Diesel Generator, to start and accept ≥ 50% rated load ≥ 1 hour, 35 consecutive times.	
	14. To demonstrate that the transient following the complete loss of load should not cause the Diesel Generator to reach 500 RPM.	
	* To demonstrate that the capability of the Diesel Generator to supply emergency power within the required time is not impaired during testing.	
	16. To demonstrate that 1) the Diesel Generator is capable of starting and accelerating to rated speed, in the required sequence, all of the Black-Out loads, 2) at no time during the loading sequence that the frequency and voltage decreases to less than 95% of nominal and 75% of nominal, respectively, and 3) the frequency is restored to within 2% of nominal, and the voltage is restored to within 10% of nominal within 60% of each load-sequency time interval.	
	17. To demonstrate the capability of the Diesel Generator to reject a load of ~825 kW and maintain voltage at 4160 ± 416 volts and frequency at 60±1.2Hz	

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

FQC - Diesel Generator Controls

APPROVED [signature] 4/7/81
APPROVED [signature]
APPROVED [signature]
DATE
REVISION 1

SYSTEM CHECKOUT	PREOPERATIONAL TESTS	PERFORMANCE MONITORING PROGRAM
	18. To demonstrate the ability to 1) synchronize the Diesel Generator while connected to the emergency load, with offsite power, 2) transfer the emergency load to the offsite power, 3) isolate the Diesel Generator, and 4) restore the Diesel Generator to standby status.	
	✳ To demonstrate the capability to simultaneously start both Diesel Generators without a common failure	
	20. To verify that the auto-connected loads to the Diesel Generator do not exceed 7700 KW.	
	21. To demonstrate the Diesel Generator 1) starts from ambient conditions and accelerates to at least 427 RPM in ≤ 11 seconds, 2) the generator voltage and frequency shall be at least 4160 volts and 57 Hz within 11 seconds after the start signal on the following test signals: 1) Manual 2) Simulated loss of Offsite Power 3) Simulated loss of Offsite Power in Conjunction with an ESF actuation test signal 4) An ESF actuation test signal	
	22. To demonstrate on a simulated loss of offsite power 1) the de-energization of the emergency buses and 2) load shedding from the emergency buses.	

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

FD - Diesel Generator Fuel Oil System

APPROVED [signature] 6/11/88
APPROVED [signature]
APPROVED [signature]
DATE
REVISION 1

SYSTEM CHECKOUT

1. All alarms, computer points, annunciating devices, and interlocks will be looped checked and put in service or verified. All instruments will be calibrated. The above will be done unless documented on turnover calibration work requests. (I&E)

2. Verify the operability of the following: (OPS)

   A. Motor Driven Fuel Oil Booster Pump
   B. Fuel Oil Recirculation Pump

PREOPERATIONAL TESTS

1P/1/A/1550/01A & 01B - Diesel Generator 1A & 1B Fuel Oil System Cold Functional Test

1. To verify proper operation of the following alarms:

   A. High ΔP Fuel Filter
   B. High ΔP Fuel Pump Strainer
   C. High ΔP DC Pump Strainer
   D. Low Press Fuel Oil
   E. High Level Main Fuel Tank
   F. Low Level Main Fuel Tank
   G. Main FO Tank Tech Spec Warn
   H. High Level Fuel Day Tank
   I. Low Level Fuel Day Tank
   J. Fuel Pump O/S Drive Failure
   K. HI Level FO Retaining Wall

✱ To verify the interlock between the Diesel Generator 1A (1B) Fuel Oil Day Tank Retaining Wall Drain Valve and the Lube Oil Transfer Pump.

✱ To establish operating data on the Motor Driven Fuel Oil Booster Pump.

✱ To establish operating data on the Fuel Oil Recirculation Pump.

5. To verify the interlock between the Main FO Tank Tech Spec Warn Alarm and the Fuel Oil Recirculation Pump.

PERFORMANCE MONITORING PROGRAM

1. Motor Driven Fuel Oil Booster Pump

   Bearing Temperature
   Discharge Pressure
   Vibration
   Amps

2. Fuel Oil Recirculation Pump

   Bearing Temperature
   Discharge Pressure
   Vibration
   Amps

✱ Item Complete
/ Parts of item that is being tested
| Revision

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

KD - Diesel Generator Cooling Water System

APPROVED [signature] 6/11/84
APPROVED [signature]
APPROVED [signature]
DATE _____
REVISION 1

SYSTEM CHECKOUT

1. All alarms, computer points, annunciating devices, and interlocks will be looped checked and put in service or verified. All instruments will be calibrated. The above will be done unless documented on turnover calibration work requests. (I&I)

2. Verify the operability of the following: (OPS)

   A. Jacket Water Keep Warm Pump
   B. Jacket Water Heater

PREOPERATIONAL TESTS

IP/1/A/1400/07A & 07B - Diesel Generator 1A & 1B Cooling Water System Cold Functional Test

* To verify proper operation of the following alarms:

   A. Low Temp Jacket Water In
   B. Low Temp Jacket Water Out
   C. High Temp Jacket Water In
   D. High Temp Jacket Water Out
   E. Low Press Jacket Water
   F. Low Level Jacket Water

* To verify the interlock between the Jacket Water Keep Warm Pump and the Jacket Water Keep Warm Heater.

* To verify the capability of the KD System to maintain the Diesel in a warm condition during Standby operation.

PERFORMANCE MONITORING PROGRAM

1. Jacket Water Keep Warm Pump

   Bearing Temperature
   Discharge Pressure
   Standpipe Level
   Fluid Temperature
   Vibration
   Amps

2. KD Heat Exchanger

   Differential Temperature (Tube Side & Shell Side)
   Differential Pressure (Tube Side)
   Flow Rate (Tube Side)
   Fouling Factor

CATAWBA NUCLEAR STATION
UNIT
SYSTEM VERIFICATION

LD - Diesel Generator Lube Oil System

APPROVED [signature] 7-18-82
APPROVED [signature] 7-21-82
APPROVED [signature] 8-2-82
DATE 3-2-82
REVISION _____

SYSTEM CHECKOUT

1. All alarms, computer points, annunciating devices and interlocks will be looped checked and put in service or verified. All instruments will be calibrated. The above will be done unless documented on turnover calibration work requests. (I&E)

2. Verify the operability of the following: (OPS)

   a. Pre Lube Oil Pump
   b. Lube Oil Transfer Pump
   c. Clean Lube Oil Tank Transfer Pump
   d. Used Lube Oil Tank Transfer Pump
   e. Lube Oil Sump Tank Heater

PREOPERATIONAL TESTS

IP/1/A/1700/01A & 01B - Diesel Generator 1A & 1B Lube Oil System Cold Functional Test

✱ To verify proper operation of the following alarms:

   a. Low Temp Lube Oil Inlet
   b. Low Temp Lube Oil Outlet
   c. High Temp Lube Oil Inlet
   d. High Temp Lube Oil Outlet
   e. High ΔP Lube Filter
   f. High ΔP Lube Strainer
   g. Low Press Lube Oil
   h. Low Press Turbo Oil Right Front
   i. Low Press Turbo Oil Left Front
   j. Low Lube Tank Level

✱ To verify the interlock between the Pre-Lube Oil Pump and the Lube Oil Sump Tank Heater.

✱ To verify the capability of the Lube Oil Sump Tank Heater to maintain the lube oil in a warm condition during standby operation.

✱ To verify the capability of the Pre-Lube Oil Pump to maintain pressure and supply sufficient lube oil for lubrication and cooling during standby operation.

PERFORMANCE MONITORING PROGRAM

1. Pre-Lube Oil Pump

   Bearing Temperature
   Discharge Pressure
   Lube Oil Sump Tank Level
   Vibration
   Amps

2. Lube Oil Transfer Pump

   Bearing Temperature
   Vibration
   Amps

3. Clean Lube Oil Tank Transfer Pump

   Bearing Temperature
   Vibration
   Amps

4. Used Lube Oil Tank Transfer Pump

   Bearing Temperature
   Vibration
   Amps

5. Lube Oil Heat Exchanger

   Differential Temperature

CATAWBA NUCLEAR STATION
UNIT
SYSTEM VERIFICATION

KD - Diesel Generator Cooling Water System

APPROVED [signature] 6-21-82
APPROVED [signature] 6-22-82
APPROVED [signature] 6-29-82
DATE 6-29-82
REVISION

SYSTEM CHECKOUT

1. All alarms, computer points, annunciating devices, and interlocks will be looped checked and put in service or verified. All instruments will be calibrated. The above will be done unless documented on turnover calibration work requests. (I&E)

2. Verify the operability of the following: (OPS)

   A. Jacket Water Keep Warm Pump
   B. Jacket Water Heater

PREOPERATIONAL TESTS

TP/1/A/1400/07A & 07B - Diesel Generator 1A & 1B Cooling Water System Cold Functional Test

* To verify proper operation of the following alarms:

  A. Low Temp Jacket Water In
  B. Low Temp Jacket Water Out
  C. High Temp Jacket Water In
  D. High Temp Jacket Water Out
  E. Low Press Jacket Water
  F. Low Level Jacket Water
  G. Aux Equip Not In Auto

* To verify the interlock between the Jacket Water Keep Warm Pump and the Jacket Water Keep Warm Heater.

* To verify the capability of the KD System to maintain the Diesel in a warm condition during Standby operation.

PERFORMANCE MONITORING PROGRAM

1. Jacket Water Keep Warm Pump

   Bearing Temperature
   Discharge Pressure
   Standpipe Level
   Fluid Temperature
   Vibration
   Amps

2. KD Heat Exchanger

   Differential Temperature (Tube Side & Shell Side)
   Differential Pressure (Tube Side)
   Flow Rate (Tube Side)
   Fouling Factor

CATAWBA NUCLEAR STATION
UNIT 1
SYSTEM VERIFICATION

VG - Diesel Generator Starting Air System

APPROVED C.L. Jensen [illegible]
APPROVED [illegible]
APPROVED [illegible]
DATE 8/11/82
REVISION ____

SYSTEM CHECKOUT

1. All alarms, computer points, annuciating devices, and interlocks will be looped checked and put in service or verified. All instruments will be calibrated. The above will be done unless documented on turnover calibration work requests. (I&E)
2. Verify the operability of the Starting Air Compressors. (OPS)

PREOPERATIONAL TESTS

TP/1/A/1450/08A & 08B - Diesel Generator 1A & 1B Starting Air System Cold Functional Test

* To verify proper operation of the following alarms:

A. Low Press Starting Air
B. Low Press Control Air

* To verify that Starting Air Compressor 1A1 (1B1) operates automatically to maintain adequate Starting Air Tank 1A1 (1B1) pressure.

* To verify that Starting Air Compressor 1A2 (1B2) operates automatically to maintain adequate Starting Air Tank 1A2 (1B2) pressure.

PERFORMANCE MONITORING PROGRAM

1. Starting Air Compressors
   - Bearing Temperature
   - Discharge Pressure
   - Vibration
   - Amps
2. Starting Air Dryers
   - Inlet Dewpoint
   - Outlet Dewpoint
   - Tower Pressure
   - Differential Pressure

8. In addition to any deficiency reports already provided to the NRC, summarize and describe problems encountered and resolved during installation and preliminary operation of the DGs. During this period, were any unusual or abnormal operations observed such as excessive vibration, noise, etc., and how were these conditions corrected? Provide a detailed summary of the complete operating histories of your DGs.

RESPONSE

With few exceptions, the problems encountered during testing and installation could be classified as normal installation and testing problems; i.e., tightening leaks, correcting wiring discrepancies, and those associated with general engine preparation to run. There are, however, certain exceptions to the normal which have been documented under the NCI Program or repairs made via the work request format.

They are chronologically

A. The 1979 flood of the D/G rooms documented by NCI's: 6675, 6676, 6677, 6678, 6679, 6680, 6681, 6682, 6683, 6684, 6685, 8868, 6687, 6688, 6689, 6690

B. The engine rebuild for piston skirt heat treating, documented by NCI 16035 and supplemental work requests 784, 785, 786, & 787

C. The generator brush rigging repair, documented under NCI 16232

D. The tile in 1B generator documented under NCI CN40 and 50.55e report SD 413/414-83-14

E. Voltage regulator replacement work 1B request 1064 PRF

F. Governor Resistor Box Replacement 1B work request 1324 PRF

G. Right Bank Turbocharger Replacement 1B DG work request 1284 PRF

Also with regard to engine runs, vibration readings were taken both on the engines and supporting piping systems. Those readings which seemed high (excessive) were forwarded to Duke Power Company's Design Engineering Department for evaluation. At the present time, no excessive readings have been found on the engine. There are, however, readings on the fuel oil and lube oil piping systems requiring evaluation by mathematical modeling. From these evaluations, recommendations to resupport this piping will be made.

The following is a summary of D/G 1A's operating history:

6/83 - Initial start-up of the Diesel Generator with both Transamerica Delaval Inc. and Parsons Peebles/Electric Products representatives present. No major problems were experienced during this

period. Duke Power personnel and the vendor representatives were satisfied with the D/G performance.

7/83 - Initial testing of D/G Auxiliary Systems demonstrated all systems to be operating satisfactorily.

8/83 - Ventilation System testing was conducted and final intake and exhaust structure work was completed. D/G load sequencer testing began. Problems were experienced with air leaks and debris in the pneumatic control system of the D/G. During this time the Electrical Control System had to be revised to allow proper field flashing and emergency start logic.

9/83 - D/G Sequencer testing was completed after several electrical control problems corrected. These problems were associated with the D/G Sequencer Logic. D/G qualification testing began. Normal start, fast start, controls, trips, and reliability testing was completed with no discrepancies.

11/83- Simultaneous start testing of D/G 1A and D/G 1B was completed. All fuel pumps and injectors were removed, cleaned and reset. Engine exhaust temperatures were erratic. Several injectors were improperly set. After this work was completed, the engine temperatures returned to normal.

01/84- During a recent endurance run, the following incidents were encountered:

1) Fuel injection connector leak.
2) Turbocharger drip line leak.
3) Turbocharger excessive bearing wear.
4) Minor crack in one cylinder head.
5) Turbocharger lube oil drain line leak.
6) Cracked push rod(s).

The following is a summary of D/G 1B's operating history:

10/83- After replacing the generator stator which was damaged by a metal file, the initial start-up of the diesel generator was performed with both TDI and Parsons Peebles/Electric Products representatives present. Duke Power personnel and the vendor representatives were satisfied with D/G performance. Initial testing of D/G Auxiliary Systems demonstrated all systems to be operating satisfactorily. D/G Load Sequencer testing completed.

11/83- D/G Qualification Testing began. Normal start, fast start, controls and trips were completed with no discrepancies.

12/83- D/G Reliability Testing began. On start #31 the D/G tripped because of low pressure turbo oil. Further investigation revealed that the right front turbocharger bearing had failed. Replaced entire turbocharger. Reliability testing was completed with no discrepancies. Load control difficulties were experienced when paralled to the system. The problem was resolved by replacing the Governor Control Box. Engine has 132 hours of documented run time.

In summary, it is Duke Powers position that none of the incidents have a significant bearing on the actual reliability of the diesel.

9. Tabulate, compare and discuss differences in present actual DG loading to estimated loads included in the procurement specifications. Identify the magnitude of the increased load (if any) on the DGs and describe how the increased loading affects the DG capability with regard to reserve margin.

RESPONSE

A comparison of actual DG loading versus estimated loading included in the procurement specification is tabulated below.

		Loss of Off-Site Power		LOCA	
DG	Rating	Estimated Load (Proc. Spec.)	Actual* Loading	Estimated Load (Proc. Spec.)	Actual* Loading
A	7000KW	6306	5716	5421	5256
B	7000KW	6306	5284	5421	4706

*Connected load values are used with the exception of large motors in which case actual load values are used.

As can be seen from this comparison, the actual loading is less than the estimated loading included in the procurement specification and is substantially less than the diesel generator rating. This being the case, the reserve margin is more than estimated at time of procurement.

10. If DG loading has increased from that specified in the procurement specifications, has it been necessary to upgrade the standby DGs to meet the new load requirements? If DG upgrading has been performed, provide a detailed description of the upgrading accomplished on your DGs. What is the revised manufacturer's rating for each upgraded unit for normal continuous duty and short time overload conditions? Is the DG built-in design margin (after upgrading) still within the recommendations of IEEE Std. 387? What is the reserve load carrying capability (margin) of your upgraded DGs?

RESPONSE

Since the actual DG loading is less than the estimated loading included in the procurement specification, upgrading the DG's has not been necessary.

11. In light of the problems that have been identified to date with Delaval diesels, discuss your plans to perform an internal visual inspection of each standby DG with regard to potential crankshaft and/or web cracks as identified at the Shoreham Station and provide a detailed discussion of your plans to perform any non-destructive testing (NDT) such as dye penetrant testing, etc., as deemed appropriate to assure absence of cracks at these locations or at any other locations where cracks may have been observed. Discuss schedules for such testing.

RESPONSE

The Catawba DSRV-16-4 diesel engines are of the "V" type design utilizing a one piece alloy steel forged crankshaft having a main journal diameter of 13 inches and a crankpin diameter of 13 inches, joined by crankwebs 25 inches in diameter and 5-1/8 inches thick.

The crankshafts for Catawba were tested according to Attachment 3.1 under Question 3.

These are identical to the crankshafts used in MP&L's Grand Gulf Station diesels.

In light of the significantly longer operating hours on the Grand Gulf diesels (1097 hours) and the recent dye penetrant examinations performed on these diesels which revealed no problems, there is reasonable assurance the Catawba diesels will not experience crankshaft problems.

Transamerica Delaval Inc., (TDI) has concluded the Shoreham R-48 crankshaft failure was due to high cycle fatigue and that if the endurance limits of the material had been slightly higher, or the applied loads slightly lower (2-3%), the crankshaft failure would not have occurred.

Also, stress analysis performed by TDI demonstrates there is a substantial reduction in stresses associated with the RV-16-4 crankshafts compared to the stresses of the R-48 (11 inch) crankshaft.

Duke Power Company is performing a endurance run test on the Catawba diesel generator 1A which will expand the operating history to a minimum of 750 hours of documented running time. (Reference: Duke Power Company, Catawba Nuclear Station, Extended Operation Test of Diesel Generator 1A.) Additional test and inspections of the Catawba Unit 1 diesels will be performed as part of the TDI Owners Group Program.

12. Justify that the standby DGs at your plant are sufficiently reliable that there will be reasonable assurance that the facility can operate without undue risk to the health and safety of the public.

Your justification should include, but not be limited to, the following: (1) quality assurance program conducted by you during procurement, manufacturing and receipt of your DGs, (2) your assessment of the TDI manufacturing process, inspection, and quality assurance program conducted during manufacture of your DGs, (3) your assessment of TDI responsiveness to problems that have occurred with your engines during installation and preliminary operation including assessment of TDI performance, (4) comparison of your DGs with all other TDI emergency DG models now in use or to be used in other nuclear generating stations (and other non-nuclear facilities) to show that the conditions and/or failure modes present at Shoreham will not occur at your plant and at other nuclear plants; provide any supporting information that may be obtained from non-nuclear installations, (5) independent review or verification of any TDI design calculations for critical components of your DGs, and/or other means used to assure that your DGs are designed to DEMA standards and applicable industry codes and standards, and (6) your overall assessment of the DGs at your plant with regard to TDI system design, operating experience to date, and system dependability, availability and reliability to warrant operation of your plant.

12.(1) "Your justification should include, but not be limited to the following: (1) quality assurance program conducted by you during procurement, manufacturing and receipt of your DGs."

RESPONSE

The Duke Power Quality Assurance Program (Topical Report "Duke-1A") provided for the identification of the applicable regulatory, design, and quality requirements to be imposed on the supplier. The quality requirements imposed included the applicable portions of 10 CFR 50, Appendix B and the ANSI N45.2 standard, as well as the identification of documentation to be provided by the seller, submittal of a written description of the supplier's quality assurance program for approval, and provided access to the suppliers' facility records for inspection or audit.

Suppliers were evaluated prior to award to assure that their quality assurance program and facilities would comply with the procurement document requirements. These evaluations were based on surveys, audits and the review and approval of the suppliers documented quality programs.

The Duke Power Quality Assurance Program controls exercised during manufacturing were accomplished through surveillance, re-evaluation, review of suppliers' documents, and quality program audits.

Surveillance was performed at the supplier's facility to assure that materials, equipment, and verification documents conformed to the selected requirements of the procurement document. Surveillance consisted of reviewing and observing, (at random and at selected stages of manufacture), the supplier's personnel, material, equipment, processes, and tests performed. Reports were prepared documenting surveillances performed, tests witnessed, discrepancies observed, and corrective action taken.

Quality Assurance verification documents were reviewed for accuracy, completeness, and conformance to procurement documents.

Nonconformances to procurement documents dispositioned by the supplier as "repair" or "use-as-is" were submitted for Duke Power review and approval prior to shipment.

The Quality Assurance Program defined the responsibilities for the inspection of items and the associated quality verification documents received the jobsite. Items were examined upon receipt for identification, quantity, damage, and presence of appropriate documentation.

Items identified as nonconforming upon receiving were not released for installation until authorized dispositions had been completed.

Inspection for identification and quantity consisted of checking identification of the item, and records showing traceability to the items.

In the application of the Duke Power QA program with respect to the procurement of the diesel generators during the pre-award stage, TDI was evaluated based on their QA program meeting the 18 elements of 10CFR50, Appendix B; their past performances in manufacturing diesel generators; and their technical qualification in meeting the requirements of the procurement specification. After award, the

identified procedures, drawings and documents required by the procurement specification were reviewed and approved prior to TDI implementation. These are listed in Attachment 12-1.

During the manufacturing of the diesel generators, Duke Power's control through surveillance (as detailed in the response to Question 2) was exercised. In addition, audits and evaluation of TDI's Quality Assurance program and the implementing procedures were performed prior to the start of manufacturing, and then bi-annually through the manufacturing of the diesel generators.

As earlier stated, Duke Power's Quality Assurance program defined the receiving inspection. The characteristics checked at receiving inspection are detailed in our repsonse to Question 2.

ATTACHMENT 12-1

Documentation Required From TDI
(Summary)

- Engineering Drawings, Diagrams and Data Sheets
- Manufacturing/QA/QC Procedures and Reports
- Testing Procedures and Reports
- Installation Drawings and Instructions

12(2) "Your justification should include, but not be limited to the following: (2) your assessment of the TDI manufacturing process, inspection, and quality assurance program conducted during manufacture of your diesel generators."

RESPONSE

It is Duke Power Company's assessment, based on our audit/survey and surveillance program, that TDI's manufacturing process, inspection and Quality Assurance Program was satisfactory during manufacturing of the Duke diesel generators.

In verifying the implementation of TDI's documents during surveys, audits, and surveillance, as described above, various noncompliances were identified during surveillance and audit activities. These noncompliances were disclosed in quality program implementation, compliance to the Duke Power procurement specification, and compliance to TDI QC procedures. Some of these noncompliances were resolved through TDI's disposition to rework. Other noncompliances (those dispositioned repair, use-as-is or replace by TDI) were submitted to Duke Power for approval.

12(3) "Your assessment of TDI responsiveness to problems that have occurred with your engines during installation and preliminary operation including TDI performance."

RESPONSE

Throughout the installation and startup period of the diesel generators, a TDI representative participated in the installation and startup activities and coordinated the resolution to problems encountered during these activities. TDI provided engineering support services, as required, in an effective and timely manner to support the installation and startup activities. Our assessment of TDI's responsiveness to problems discovered during this period is that TDI was cooperative in providing accurate resolutions in a timely manner.

12(4) "Comparison of your diesel generators with all other TDI emergency diesel generator models now in use or to be used in other nuclear generating stations (and other non-nuclear facilities) to show that the conditions and/or failure modes present at Shoreham will not occur at your plant and at other nuclear plants; provide any supporting information that may be obtained from non-nuclear installations."

RESPONSE

TDI diesel generators at San Onofre Unit 1, Grand Gulf Unit 1, Catawba, Commanche Peak and Shoreham have operating time. Attachment 12(4)-1 lists operating times for plants with TDI Model DSRV-16-4 diesel generators.

While Grand Gulf has experienced various failures of TDI diesel generator equipment, it's operating history shows a relatively high valid test reliability (greater than 98%) for the TDI diesel generators (Reference: Reg. Guide 1.108).

During the preoperational testing of the Catawba diesel generators (Reference Question 7), valid test reliability has been high (100% for DG1A and DG1B).

In conversations with personnel at various nuclear facilities, we were informed the TDI diesel generators were reliable. However, problems in various areas similar to items reported in the responses to Questions 11, 14, and 15 were disclosed.

A summary of the evaluation of the Shoreham crankshaft failure on Grand Gulf was transmitted to the NRC on October 14, 1983. This evaluation concluded that, pending the results of the analysis underway at Shoreham to determine the root cause of the crankshaft failure, there is reasonable assurance, due to design differences, the Grand Gulf Division I and II diesel generator crankshafts will not fail in a mode similar to Shoreham. Since Catawba and Grand Gulf diesel crankshafts are identical, Duke Power feels the same conclusions apply.

A significant number of contacts have been made with TDI, and all effort is being made to cooperate in the exchange of information and resolution of problems with TDI and other utility owners of TDI diesel generators. In addition, a diesel generator Technical Information Exchange meeting was held in Atlanta, Georgia, on October 25, 1983. The purpose of the meeting was to provide a forum for the exchange of diesel generator operational experiences, reliability information and to find solutions to problems common to utility owners. Fifty-nine utility, INPO and EPRI representatives were in attendance. A diesel generator User's Group Steering Committee was organized with the intent of forming a Nuclear Task Action Committee to address utility diesel generator reliability issues. The committee consists of representatives from twelve utilities, of which ten are TDI owners.

Duke Power Company is in the process of evaluating the 16 significant known problems identified by the NRC and the owners group. This work is being performed in conjunction with the owners group.

ATTACHMENT 12(4) - 1

A List of Plants With DeLaval DSRV-16-4

DIESEL GENERATORS(1)

UTILITY	PLANT	RUN HOURS	FUEL LOAD DATE
Texas Utilities	Comanche Peak Unit 1 (2 D/Gs)	100/each	Early, 1984
Duke Power	Catawba Unit 1 (2 D/Gs)	232 (1A) (3) 132 (1B) (3)	May, 1984
CP&L	Shearon Harris	0	June, 1985
Cleveland	Perry	0	December, 1984
WPSS	Unit 1 and 4	0	1986 or later
Georgia Power	Vogtle	0	1987
TVA	Hartsville/ Phipps Bend	0	Indefinite
MP&L	Grand Gulf Unit 1(2) Division I Division II	1097 473	June 16, 1982

NOTES:
1. Data as of August, 1983, except Grand Gulf and Catawba
2. The data for Grand Gulf Unit 1 includes run hours for the test that were performed by DeLaval and Bechtel.
3. Hours actually documented - It is estimated that the Catawba diesel 1A has 450 hours and diesel 1B has 250 hours of operation.

12(5) "Independent review or verification of any Transamerica DeLaval Inc. (TDI) design calculations for critical components of your DG's, and/or other means used to assure that your DG's are designed to DEMA standards and applicable industry codes and standards."

RESPONSE

No independent review or verification has been made to date. However, Duke Power is a participant in an independent review of major TDI diesel generator components calculations, and operating experience in conjunction with other utilities (Diesel Generator Owner's Group). This independent review will ensure that the diesel components are designed to applicable codes, standards and qualified for their intended service.

12(6) "Your overall assessment of the DG's at your plant with regard to TDI system design, operating experience to date, and system dependability, availability and reliability to warrant operation of your plant."

RESPONSE

Duke Power's assessment is summarized as follows:

1) The design of the TDI diesels at Catawba is different from the Shoreham design [Reference the response to Questions 11 and 12(4)].

2) The Grand Gulf Division I and II engines run hours are higher than Shoreham engines, and there are no indications of crankshaft failure (Reference the response to Question 11). Catawba's diesels are basically the same as the Grand Gulf diesels.

3) As part of other preventive maintenance actions, the Catawba 1A, 1B, 2A & 2B diesel generator crankshafts were visually inspected during piston skirt removal/reinstallation. No deficiencies were noted which could be related to possible crankshaft or other torsional component failures.

4) Industry standards and codes have been properly applied in the design, manufacturing, and reliability testing of the diesel generators. Duke Power's QA program was effectively applied to verify the vendor's QA/QC program [Reference the response to Question 12(1)].

5) Shop testing met the qualification requirements of Regulatory Guide 1.9 and IEEE Std. 387 (Reference the response to Question 7).

6) The design ratings of the diesels provide adequate margin with respect to connected loads (Reference the response to Question 9).

7) The problems that have been indentified to date have been corrected. When a problem occurred on one diesel generator, the other diesel generators were evaluated for preventive/corrective actions for that problem. (Reference the response to Question 8.)

It is Duke Power's opinion, the Catawba emergency power supply system is dependable and provides reasonable assurance that the Catawba Nuclear Station can be operated, and will continue to operate, without undue risk to the health and safety of the public.

13. Provide a tabulation of the number of times (including each date of occurrence) voltage was lost at the emergency bus(es) requiring operation of the DG(s) including a brief description of each incident. In the above tabulation, also identify the loss of emergency bus voltage due to loss of off-site power.

RESPONSE

Since the Unit 1 D/G's have been placed in operation there has been only one occurrence of undervoltage requiring operation of the D/G's. During this period, D/G 1A was removed from service for construction and maintenance activities.

This undervoltage occurred on Wednesday, December 21, 1983 at 2135 hours. The Moser, pole type electrical tower adjacent to the switchyard fell causing a fault on the yellow bus.

All the breakers (PCB 25, 26, 27, 28, 29, 30) on the Moser incoming lines were closed allowing power to be supplied to both the Yellow and Red Buses. Unit 1 was in its second phase of Hot Functional Testing.

Icy conditions on the 21st day of December generated greater loads on the incoming Moser lines. In addition, there was an apparent large crack in the base of the pole that had gone undetected. With these conditions existing, the stresses applied to the pole compounded causing it to fall. During this failure, faults occurred on the Moser lines and the Yellow Bus.

The plant's 22KV Bus received 6 undervoltage alarms in a 6 second span. The longest undervoltage alarm lasted 0.191 seconds. During this time the sequencer initiated a diesel start. The sequencer never started load shedding, nor did it load the diesel.

This event posed no threat to the safety and health of the general public due to the following reasons:

1. Catawba was in Hot Functional Testing

2. The unstable supply of power to the 22KV Bus lasted only 6 seconds.

3. The Diesel Generator started and was in standby, if needed to supply power to the essential loads.

14. Shoreham has identified connecting rod bearing materials are not in accordance with design specifications on their engines. This condition may also exist on all other TDI diesels. Provide assurance that correct bearing design and materials have been used in your engines. Should you find that improper bearings have been used in your diesels, state how and when you propose to correct this problem.

RESPONSE

Connecting Rod bearings used in the Catawba diesels are of the correct design as specified by Transamerica DeLaval Inc. (TDI). Bearing material control is provided through TDI by means of material test reports from the bearing casting vendor. Material test reports were reviewed by the Duke Power Company Quality Assurance Department.

The bearing design used on the Shoreham diesels is different from the bearing design used for Catawba. The original connecting rods used in the Shoreham diesels have a 1/4 by 45 degree chamber at the bore ends. This allowed the bearing ends to overhang and be unsupported by the connecting rods. The Catawba diesels use connecting rods which have a 1/16 by 45 degree chamber at the bore ends. This eliminates the unsupported bearing ends and the bearing are fully supported.

There are no reported bearing problems on the DSRV-16-4 engines that are in operation. TDI states that this bearing design has provided excellent service for almost 30 years. (See Attachment 14-1 for TDI bearing history.)

Therefore, Duke Power feels the bearing design and materials used are adequate and satisfactory for the Catawba diesels.

TDI Bearing History

The history of the aluminum bearing dates back to 1961 when we set up to manufacture our own bearings. Actually, test work began back in the late 1950's, where a solid aluminum bearing was tested on an engine in the field with great success. This engine was equipped with unplated aluminum bearing shells throughout with excellent success. A solid aluminum bearing shell installed in a new engine in our factory failed quickly. It was found that an unplated aluminum shell could not be run against a new shaft journal. The journals had to have a glaze on them before the bare aluminum shell would operate satisfactorily. Therefore, it was necessary to electroplate an SAE 19 babbitt on the shell purely for break-in purposes. Once the journal has been broken in the babbitt could be worn away and we would still have an excellent bearing.

The aluminum used for the TDI bearings is an Alcoa B850-T5 material which is a 6% tin aluminum alloy. The aluminum surface is first "tinned" with several elements prior to the application of SAE 19 babbitt (90% lead and 10 to 12% tin). This bearing design has provided excellent service for almost 30 years. Recently 2.5 to 3% copper has been added to the babbitt to improve the fatigue and wear resistance of the plating.

15. Most of the piston skirts in the Shoreham diesels were cracked. Because of a common cylinder design for all TDI diesels, it is presumed that this condition potentially exists on all other TDI diesels. Discuss your plans, including internal inspection or other means to determine the potential or actual existence of such cracking. In your response, indicate whether the design and materials are identical to those in the Shoreham units; if not, identify differences. Identify any corrective actions you have taken to date or plan to take.

    The staff understands that TDI has a piston design modification to correct the above problem. Are you aware of this anc has TDI transmitted this service information to you?

RESPONSE

Based on information obtained from Transamerica DeLaval Inc., (TDI) the piston shirts used in the Shoreham diesel is a modified "AF" design while the skirts at Catawba are of the "AN" design. (Reference to Attachment 15-1 which is a response from TDI that covers history and modifications of their piston design.)

All piston skirts at Catawba have been removed, inspected and where applicable, returned to TDI for proper heat treating, stress relieving and machining. This work is complete for all the Catawba diesels.

Duke Power is aware of the new "AE" piston design and also that TDI considers both the "AE" and the "AN" pistons properly stress relieved to be suitable for use at the power ratings for which they were furnished.

Since all the "AN" piston skirts at Catawba have been properly stress relieved and since this type skirt has accumulated in excess of 2,760,000 hours (Reference Attachment 15-1) of service operation in other applications without significant problems, Duke Power Company feels that these skirts are suitable for application in the Catawba diesels.

4. PISTONS AND SKIRTS

A.C. Barich, Manager, Customer Service

All "Enterprise" R-4 series engines have been furnished with a two-piece piston (refer to figure 1). The two-piece piston design incorporates a cast steel piston crown attached to a cast nodular iron piston skirt by means of four studs. This piston design has evolved through design improvements since it's inception in 1967 to incorporate changes for higher reliability and less costly manufacture. The specific changes will be discussed later as they relate to nuclear installations. First it is worthwhile to discuss the concepts behind a two-piece design.

A review of the dynamic and thermal loads imposed on the piston reveals the following:

- Cyclic gas pressure loadings of 1650 psig maximum firing pressures. The gas pressure operates on a 17 inch diameter surface resulting in a force of 375,000 pounds.

- Cyclic inertia forces of 85,000 pounds.

- Cyclic thermal loads on the piston crown because it's upper surfaces are exposed to charge air (as low as 60 degrees F) and peak combustion gas temperatures (thousands of degrees F).

As horsepower ratings of engines increased in the mid 1960's Transamerica Delaval and other medium speed diesel engine manufacturers were forced to abandon the older style single piece piston design. The two piece piston is innerently better equipped to deal with higher thermal inputs of high BMEP engines, because it allows thermal growth of the crown without the crown growth causing bending stresses in the skirt. The two piece piston design is also better equipped to handle the higher pressure and inertia loadings of the increased horsepower engines.

A review of the cast steel crown used by TDI shows as thin a section thickness as possible consistent with required strength to provide good cooling. The piston crown cooling system consists oftwo partially filled oil chambers "A" and "B", shown in Figure 1, which are interconnected by lube oil transfer holes. The outer cooling cavity "A" extends up close to the crown combustion chamber surface to provide an effective heat dam to retard heat transfer to the ring belt area.

The nodular iron skirt we use passed through several design changes and will be the subject of part of our discussion. The following identifies and describes several design iterations of the piston skirts:

1. "AF" Pistons, refer to figure 2.

   a. This design was supplied in the LILCO/Shoreham, Southern California Edison/San Onofre and Mid South Energy/Grand Gulf engines.

The piston uses [redacted] spherical washers on the four studs which attach the crown to the skirt. These spherical washers are required to provide joint flexibility and worked extremely well when properly manufactured. TDI procured the spherical washer from a "commercial" source. Unfortunately, as supplied, these washers proved to have inconsistent quality and large and unacceptable variations in heat treatment and manufacturing tolerances. As a result, a small number of the washers failed in service, resulting in piston crown separation. One such separation occurred in a Grand Gulf unit during field testing. To solve the spherical washer problem, TDI elected to modify the design to incorporate the use of a "full stack" Belleville washer arrangement. TDI issued S.I.M. 324 to recommend the modification for existing "AF" skirts to the Belleville washer configuration. The modified "AF" skirt becomes an "AN" "old style" skirt and is shown in Figure 3. Two hundred fifty two "AF" style skirts have been modified. The 252 modified "AF" skirts have accumulated in excess of 1,772,000 hours of operation without a failure attributable to design.

During field testing several "AF" modified skirts at LILCO were found to have linear indications and one was found to have a crack near a stud bore. This crack finding is the reason for our 10CFR21 letter of November 16, 1983. At this writing, four (4) skirts have been examined at Grand Gulf where linear casting indications were found on two (2) skirts. The indications were easily removed by light grinding and polishing. There is absolutely no evidence of any cracks with depth.

Linear indications should not be taken lightly, however they should not be regarded as "failures" indiscriminately. Indications may be casting surface imperfections, scratches, or machining marks. They could contribute to fatigue cracks and should therefore be tested by grinding or polishing. Generally faint indications are not crack contributors and through experience may be left as found. Overly zealous inspection with very sensitive instruments often mislead one to assume there are cracks where none exist.

b. All "AF" style piston skirts were cast using the following heat treatment.

A. Heat to 1750 degrees F. (near the upper critical temperature) for 3 hours. Normalized (air cooled) in still air. Result: a pearlitic structure and 100,000 psi tensile strength.

B. Re-heat to 1050 degrees (slightly below the lower critical temperature) for 3 hours and cool in still air. This is a tempering process used to produce the desired ductility in the nodular iron.

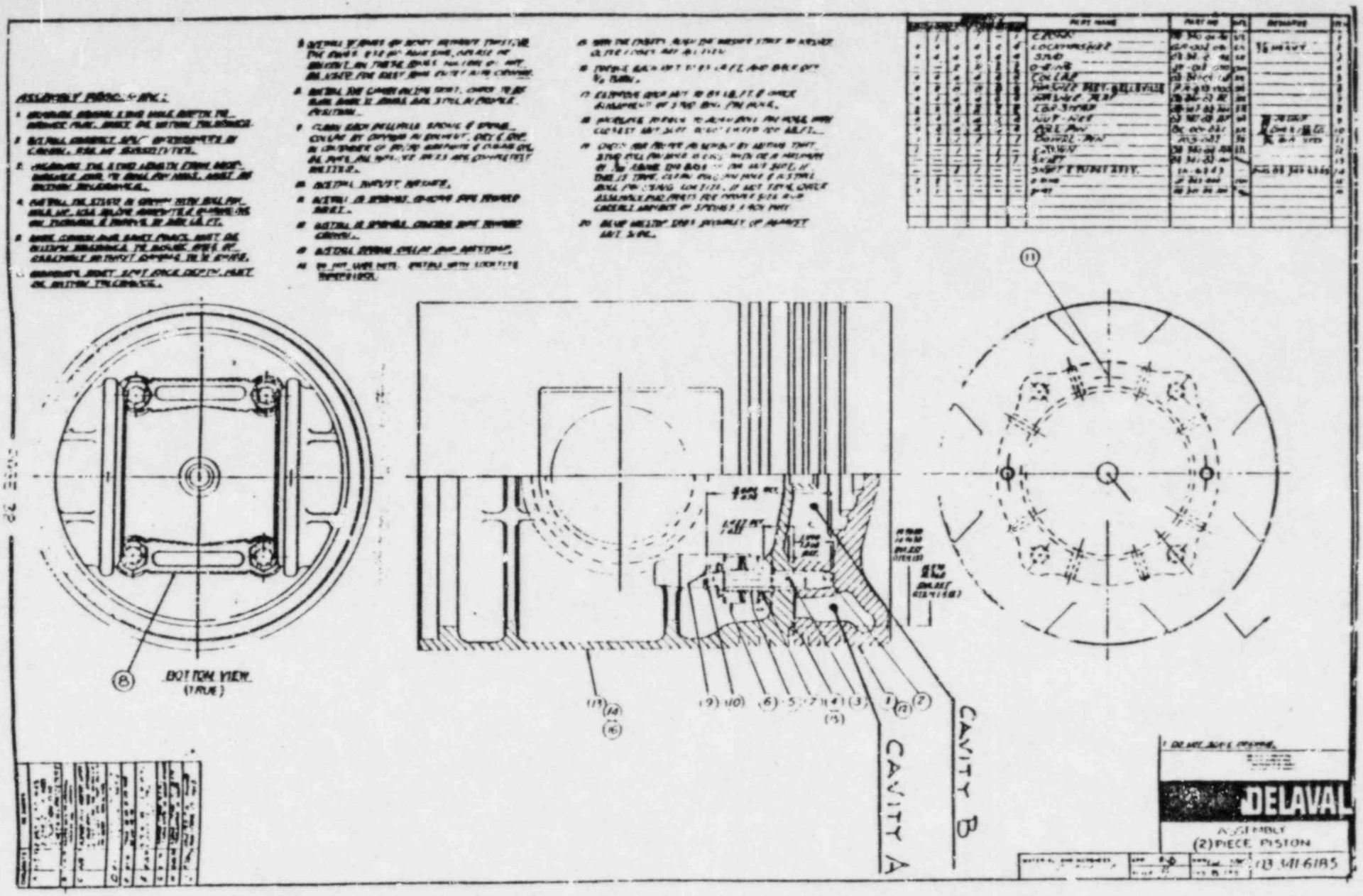
2. "AN" old style, refer to Figure 3.

This is the skirt design used in all other TDI nuclear standby diesel engines except the recent SMUD and CP&L engines which use the current AE skirts.

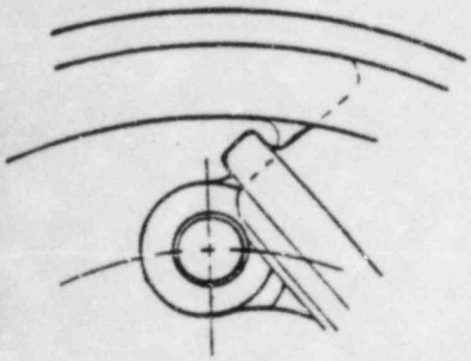
The "AN" skirt is almost identical to the modified "AF" skirt with the full stack Belleville washer configuration. The portions of the casting which were machined out of the "AF" to make a Belleville style joint have been removed from the casting by modifying the core.

operation on the R-5 test engine at 514 rpm, and 302 bmep.

The "AE" style skirt is interchangeable with existing R-4 piston crowns and requires only minor hardware changes.


BOTTOM VIEW
(TYPE)
CAVITY B
CAVITY A
DELAVAL
ASSEMBLY
(2) PIECE PISTON

PISTON COMPARISONS



SPHERICAL WASHER STYLE

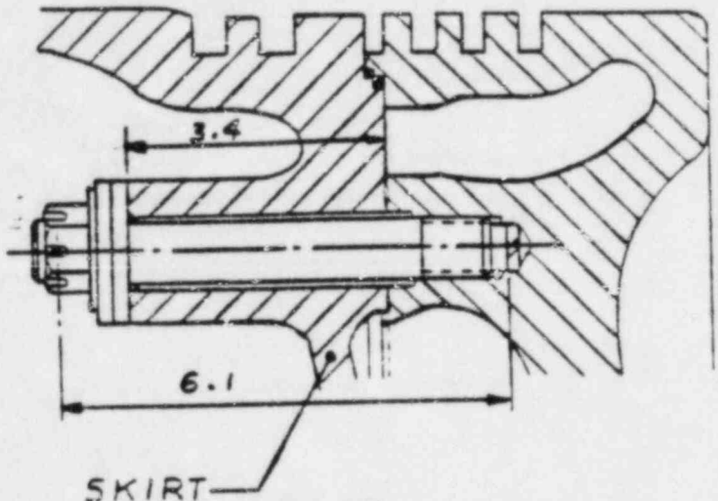
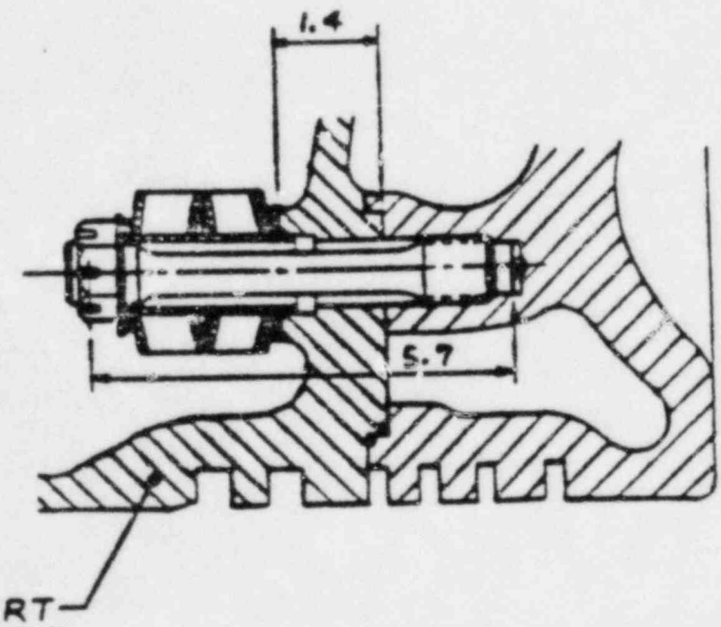


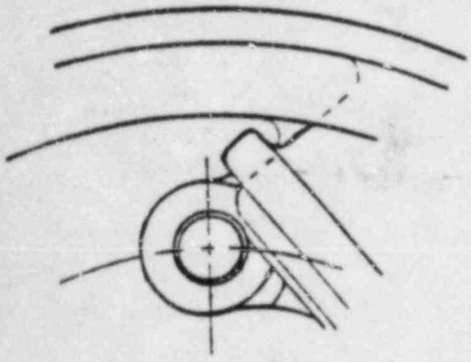
FIGURE 2

FULL STACK BELLVILLE STYLE



(OLD STYLE - MADE FROM 03-341-02-AN CASTING)

PISTON COMPARISONS



SPHERICAL WASHER STYLE

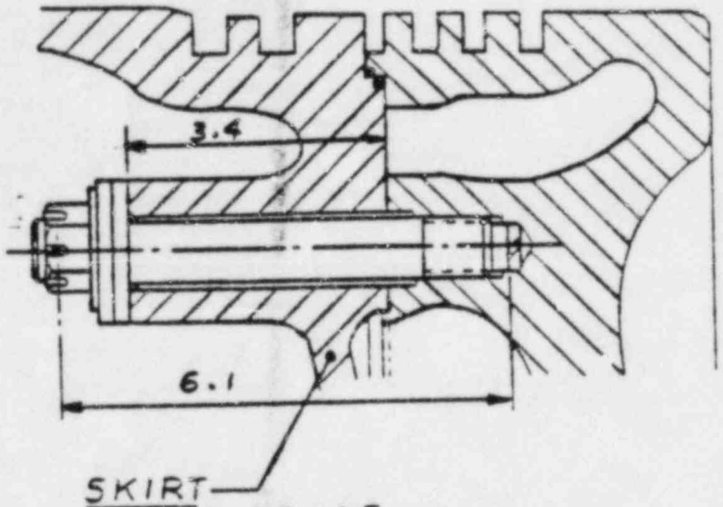
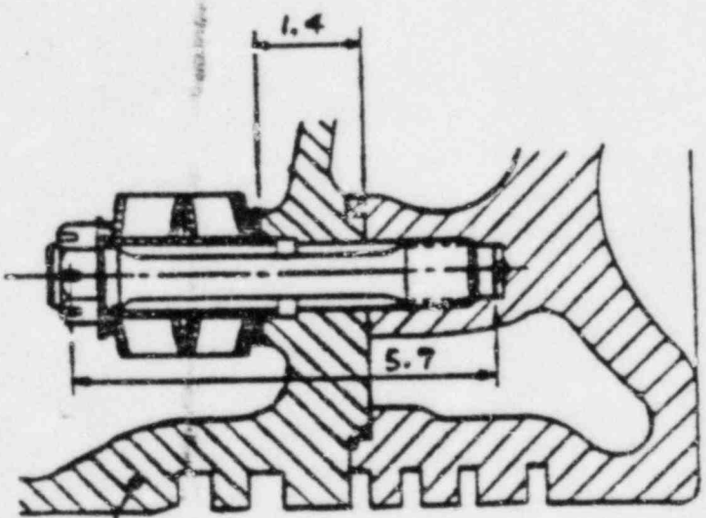


FIGURE 2

FULL STACK BELLVILLE STYLE



(OLD STYLE - MADE FROM 03-341-02-AN CASTING)

16. What maintenance and/or operating practices have you developed to assure optimum reliability of your diesel generators at your plant?

RESPONSE

The operations practices developed to assure reliability of the D/G's at Catawba can be broken into two sections; daily inspections activities of the D/G's and supporting equipment and a monthly periodic test.

During the daily inspection the operator will perform the following once per day or more frequently if necessary.

1. Drain starting air low point drains
2. Check engine and supporting systems for leaks
3. Check oil level in the governor, generator pedestal bearing, lube oil sump tank, and fuel oil day tank
4. Verify operation of the turbocharger lube oil drip system
5. Note D/G panel conditions

Status of the diesel availability due to valve and breaker alignment is maintained in the Diesel Generator Operation Procedure OP/1/A/G350/02 (Attachment 16-1)

Monthly test activities in the draft technical specifications are covered by periodic test PT/1/A/4350/06 4160 Essential Power System Test (Attachment 16-2)

Preventive maintenance activities for the diesel generators will be governed by PT/0/A/4350/13. While this periodic test is still under development, it will be based on the TDI suggested maintenance schedule as described in Volume I Section 5-B thru 5-B-7 of the Delaval Instruction Manual, and accumulated experience on diesel engines from military and nuclear applications. (Marked up version Attachment 16-3). Support System Preventative Maintenance Procedures are in development or review at the present time, and will follow manufacturers' recommendations.

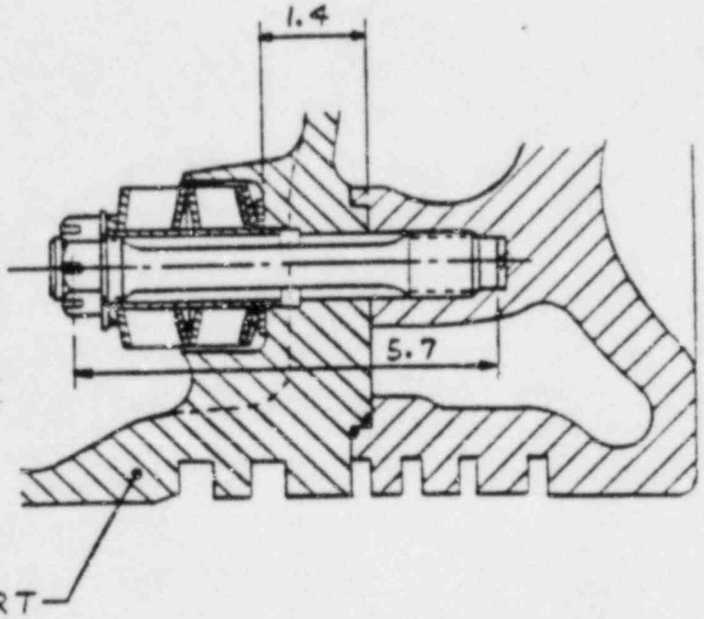
Preventative Maintenance Programs developed to date are:

PM1G 94: D/G Fuel Oil System
PM1G 98: D/G Starting Air Compressors
PM16 99: D/G Starting Air Dryers
PM16 100: D/G Fuel Oil Recirc. Pump

Under development or planned to be developed are PM Programs for:

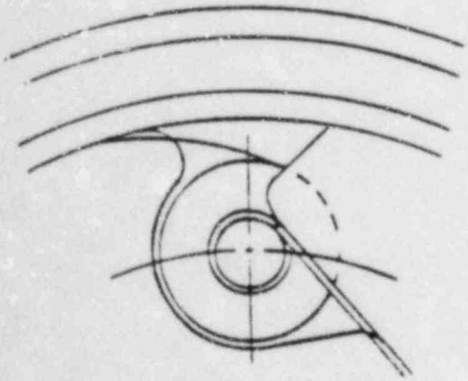
D/G Lube Oil System
D/G Combustion Air and Exhaust System
D/G Cooling Water System
D/G Engine
D/G Generator
D/G Control System

FULL STACK
BELLVILLE STYLE

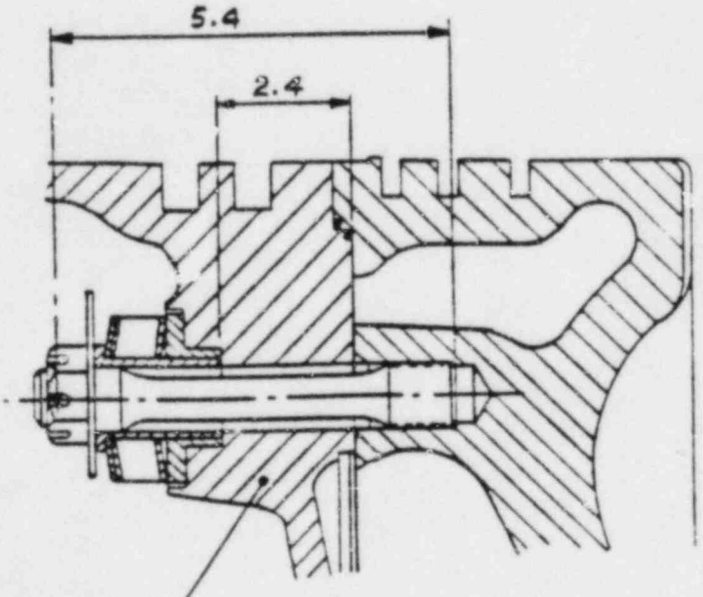


03-341-02-AN (NEW STYLE - MADE FROM 03-341-04-AE CASTING)

FIGURE 4



½ STACK
BELLVILLE STYLE



03-341-04-AE

FIGURE 5

FOR [illegible] ONLY

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
4160 ESSENTIAL POWER SYSTEM TEST

1.0 PURPOSE

The purpose of this test is to verify the capability of placing the 4160V Essential Switchgear onto their standby power sources.

2.0 REFERENCES

2.1 4160V Essential Auxiliary Power System Description CNSD-0115-01

2.2 OP/1/A/6350/02 (Diesel Generator Operation)

2.3 OP/0/A/6350/10 (Operation of Station Breakers and Disconnects)

2.4 Catawba FSAR Section 8.3

3.0 TIME REQUIRED

3.1 Manpower

3.1.1 Three Operators

3.2 Time

3.2.1 Four Hours

3.3 Frequency

3.3.1 Each Refueling Outage

4.0 PREREQUISITES

None

5.0 TEST EQUIPMENT

5.1 Rack-out wrench

6.0 LIMITS AND PRECAUTIONS

6.1 When transporting breakers from cubicle to cubicle, care must be taken to prevent damage of electrical contacts.

6.2 At least one offsite AC power source shall be operable at all times; otherwise, all operations involving core alterations or positive reactivity changes must be suspended.

7.0 UNIT STATUS (Complete and sign off in Enclosure 13.1)

7.1 The unit is in Mode 5 or 6.

7.2 Diesel Generator 1A and its auxiliaries are operable for Section 12.2.

7.3 Diesel Generator 1B and its auxiliaries are operable for Section 12.3.

8.0 PREREQUISITE SYSTEM CONDITIONS (Complete and sign off in Enclosure 13.1)

8.1 Auxiliary Transformer 1ATC is energized and is supplying 4160V Switchgear 1ETA.

8.2 Auxiliary Transformer 1ATD is energized and is supplying 4160V Switchgear 1ETB.

8.3 Auxiliary Transformers SATA and SATB are not being used to supply Unit #2 4160V Switchgear 2ETA or 2ETB.

9.0 TEST METHOD

9.1 Initially, the 4.16KV Switchgear is being supplied by its normal 6.9KV/4.16KV Transformer. The Diesel Generator is started and paralleled to the 4.16KV Switchgear. The normal supply is removed and the standby supply is paralleled with the Diesel Generator and closed onto the 4.16KV Switchgear. The 4.16KV Switchgear 1ETA (1ETB) normal breaker and the 4.16KV Switchgear 1ETA (1ETB) standby breaker cubicles utilize the same breaker. These breakers must be physically moved and placed in the correct cubicle to perform this test on Essential Power Train 1A (1B). The standby supply is then removed and the normal supply is paralleled with the Diesel Generator and closed onto the 4.16KV Switchgear. The Diesel Generator is then removed from service.

10.0 DATA REQUIRED

10.1 Enclosure 13.1 completed.

11.0 ACCEPTANCE CRITERIA

11.1 Verify the capability of placing the 4160V Essential Switchgear 1ETA and 1ETB on their respective standby power sources by completing Section 12.2 and 12.3 of PT/1/A/4350/06 as applicable.

11.2 Any discrepancy noted during the performance of this test which does not keep the test from meeting the acceptance criteria shall be given to the Shift Supervisor for evaluation.

11.3 Any discrepancy which keeps the test from meeting the acceptance criteria will be listed on a Procedure Discrepancy Process Record showing the corrective action taken.

11.4 If the acceptance criteria is not met, the Licensing and Projects Engineer shall be notified immediately for determination of reportability.

12.0 PROCEDURE

Date
Time/Initials

NOTE: Breaker positioning and Diesel Generator operations will be done at the Main Control Board.

_____ 12.1 Verify that Sections 4.0, 7.0 and 8.0 are signed off as complete on Enclosure 13.1.

NOTE: Sections 12.2 and 12.3 are independent of each other and can be run in any sequence.

12.2 4.16KV Essential Power Train 1A

_____ 12.2.1 Startup Diesel Generator 1A and load per OP/1/A/6350/02 (Diesel Generator Operation).

_____ 12.2.2 When the Diesel Generator has assumed bus 1ETA loads, open 1ETA-3 (ETA NORM FDR FRM ATC).

_____ 12.2.3 Open 1ETA-4 (4KV XFMR 1ATC FDR).

NOTE: The racking-in/out of all breakers shall be in accordance with OP/0/A/6350/10 (Operation of Station Breakers and Disconnects).

_____ 12.2.4 Rackout 1ETA-3 (ETA NORM FDR FRM ATC).

_____ 12.2.5 Transfer 1ETA-3 (4.16KV SWGR 1ETA Norm Incoming Bkr) to the 1ETA-4 (4.16KV SWGR 1ETA Stdby Bkr) cubicle.

_____ 12.2.6 Rack-in 1ETA-4 (ETA ALT FDR FRM SATA).

_____ 12.2.7 Verify SATA energized.

_____ 12.2.8 Parallel across and close 1ETA-4 (ETA ALT FDR FRM SATA).

_____ 12.2.9 Unload the Diesel Generator to minimum load per OP/1/A/6350/02 (Diesel Generator Operation) for 15 minutes to allow transformer heating to settle out.

_____ 12.2.10 Increase load on the Diesel Generator per OP/1/A/6350/02 (Diesel Generator Operation).

_____ 12.2.11 Open 1ETA-4 (ETA ALT FDR FRM SATA).

_____ 12.2.12 Rackout 1ETA-4 (ETA ALT FDR FRM SATA).

_____ 12.2.13 Transfer 1ETA-4 (ETA ALT FDR FRM SATA) to the 1ETA-3 (ETA NORM FDR FRM ATC) cubicle.

Date Time/Initials			
_____		12.2.14	Rack-in 1ETA-3 (ETA NORM FDR FRM ATC).
_____		12.2.15	Closed 1TA-4 (4KV Xfmr 1ATC Fdr).
_____		12.2.16	Parallel across and close 1ETA-3 (ETA NORM FDR FRM ATC).
_____		12.2.17	Shutdown Diesel Generator 1A per OP/1/A/6350/02 (Diesel Generator Operation).
	12.3	4.16KV Essential Power Train 1B	
_____		12.3.1	Startup Diesel Generator 1B and load per OP/1/A/6350/02 (Diesel Generator Operation).
_____		12.3.2	When the Diesel Generator has assumed bus 1ETB loads, open 1ETB-3 (ETB NORM FDR FRM ATD).
_____		12.3.3	Open 1TD-4 (4KV XFMR 1ATD FDR).
		NOTE:	The racking-in/out of all breakers shall be in accordance with OP/0/A/6350/10 (Operation of Station Breakers and Disconnects).
_____		12.3.4	Rackout 1ETB-3 (ETB NORM FDR FRM ATD).
_____		12.3.5	Transfer 1ETB-3 (ETB NORM FDR FRM ATD) to the 1ETB-4 (ETB ALT FDR FRM SATB) cubicle.
_____		12.3.6	Rack-in 1ETB-4 (ETB ALT FDR FRM SATB).
_____		12.3.7	Verify SATB energized.
_____		12.3.8	Parallel across and close 1ETB-4 (ETB ALT FDR FRM SATB).
_____		12.3.9	Unload the Diesel Generator to minimum load per OP/1/A/6350/02 (Diesel Generator Operation) for 15 minutes to allow transformer heating to settle out.
_____		12.3.10	Increase load on the Diesel Generator per OP/1/A/6350/02 (Diesel Generator Operation).
_____		12.3.11	Open 1ETB-4 (ETB ALT FDR FRM SATB).
_____		12.3.12	Rackout 1ETB-4 (ETB ALT FDR FRM SATB).
_____		12.3.13	Transfer 1ETB-4 (ETB ALT FDR FRM SATB) to the 1ETB-3 (ETB NORM FDR FRM ATC) cubicle.

Date
Time/Initials

_____	12.3.14	Rack-in 1ETB-3 (ETB NORM FDR FRM ATD).
_____	12.3.15	Close 1TD-4 (4KV XFMR 1ATD FDR).
_____	12.3.16	Parallel across and close 1ETB-3 (ETB NORM FDR FRM ATD).
_____	12.3.17	Shutdown Diesel Generator 1B per OP/1/A/6350/02 (Diesel Generator Operation).
_____	12.4	Complete Enclosure 13.1 and submit PT/1/A/4350/06 to the Shift Supervisor.

13.0 ENCLOSURES

13.1 Data Sheet

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
4160 ESSENTIAL POWER SYSTEM TEST
PT/1/A/4350/06
DATA SHEET
ENCLOSURE 13.1

_____/_____
Operator Performing Test
(Signature/Initials)

	Date	Time	Initial
Section 4.0 Complete	_____/	_____/	_____
Section 7.0 Complete	_____/	_____/	_____
Section 8.0 Complete	_____/	_____/	_____

Date/Time Completed _____/_____

TEST COMPLETED WITH:

No Discrepancies _____

Discrepancy Sheet Attached _____

Reviewed by _____
Unit Supervisor
(Signature)

JD/1/A/4350/06

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
4160 ESSENTIAL POWER SYSTEM TEST

JUSTIFICATION DOCUMENT

1.0 PURPOSE

Define the operations covered by this periodic test.

2.0 REFERENCES

2.1-2.5 Guidelines used to establish this periodic test procedure.

3.0 TIME REQUIRED

3.1 Manpower

3.1.1 Minimum number required to complete test.

3.2 Time

3.2.1 Estimate

3.3 Frequency

3.3.1 Ensures periodic testing during normal shutdown when the aux loads fed from the 4.16 KV essential switchgear are de-energized.

4.0 PREREQUISITE TESTS

None

5.0 TEST EQUIPMENT

5.1 Provides tool to accomplish task.

6.0 LIMITS AND PRECAUTIONS

6.1 Electrical contacts are easily damaged and can prevent racking in a breaker.

6.2 Ensures an available power source exists for emergency use.

7.0 UNIT STATUS

7.1 Provides a condition when aux loads fed from the 4.16 KV essential switchgear are de-energized.

7.2-7.3 Testing would stop if one diesel became inoperable due to possible emergency conditions.

8.0 PREREQUISITE SYSTEM CONDITIONS

8.1-8.2 Provides normal operating condition.

8.3 SATA or SATB provides availability to connect to the switchgear when the normal station aux transformer is out of service.

9.0 TEST METHOD

9.1 Provides method in which the test will be conducted.

10.0 DATA REQUIRED

10.1 Provide data needed for test accomplishment.

11.0 ACCEPTANCE CRITERIA

11.1 Provides minimum acceptable standards.

12.0 PROCEDURE

12.1 Standard statement per Operations Management Procedure 4-1.

12.2 States which train is to be tested.

12.2.1 Provide standby power for 1ETA.

12.2.2 Place 1ETA loads on D/G.

12.2.3 Provide for removal of 1ETA-3 Bkr.

12.2.4-12.2.6 1ETA-3 Bkr must be removed and placed in 1ETA-4 Bkr cubicle.

12.2.7 Provide for transfer of load from D/G 1A to SATA.

12.2.8 Place 1ETA load on SATA.

12.2.9 Place 1ETA load on D/G 1A to allow for removal of 1ETA-4 Bkr.

12.2.10-12.2.12 1ETA-4 Bkr must be removed and placed in 1ETA-3 Bkr cubicle.

12.2.13-12.2.15 Provide for normal power to 1ETA.

12.2.16 Provide for shutdown of D/G 1A.

12.3 States which train is to be tested.

12.3.1 Provide standby power to 1ETB.

12.3.2 Place 1ETB loads on D/G.

12.3.3 Provide for removal of 1ETB-3 Bkr.

12.3.4-12.3.6 1ETA-3 Bkr must be removed and placed in 1ETA-4 Bkr cubicle.

12.3.7 Provide for transfer of load from D/G 1B to SATB.

12.3.8 Place 1ETB loads on SATB.

12.3.9 Place 1ETB load on D/G 1B to allow for removal of 1ETB-4 Bkr.

12.3.10-12.3.12 1ETB-4 Bkr must be removed and placed in 1EGB-3 Bkr cubicle.

12.3.13-12.3.15 Provide for normal power to 1ETB.

12.3.16 Provide for shutdown of D/G 1B.

13.0 ENCLOSURES

13.1 Provide permanent record.

FC... ONLY

Form 34731 (10-81)
(Formerly SPD-1002-1)

ATTACHMENT 16-3

DUKE POWER COMPANY
PROCEDURE PREPARATION
PROCESS RECORD

(1) ID No: OP/1/A/6350/02
Change(s) 1 to
1 Incorporated

(2) STATION: CATAWBA NUCLEAR STATION

(3) PROCEDURE TITLE: DIESEL GENERATOR OPERATION

(4) PREPARED BY: R Kevin Sandy DATE: 12-20-83

(5) REVIEWED BY: [signature] DATE: 12-21-83

Cross-Disciplinary Review By: _____ N/R: N/A

(6) TEMPORARY APPROVAL (IF NECESSARY):

By: _____ (SRO) Date: _____

By: _____ Date: _____

(7) APPROVED BY: CW Graves / Date: 12/21/83

(8) MISCELLANEOUS:

Reviewed/Approved By: _____ Date: _____

Reviewed/Approved By: _____ Date: _____

...ONLY

DUKE POWER COMPANY
CATAWBA NUCLEAR STATION
DIESEL GENERATOR OPERATION

1.0 PURPOSE

The purpose of this procedure is to outline the operation of the Emergency Diesels in the following modes:

3.0 Diesel Alignment for ES Actuation

4.0 Local Diesel Startup and Shutdown

5.0 Remote Diesel Startup and Shutdown

6.0 Emergency Stop

7.0 Removing and Returning Diesel Generator From Service

8.0 Purging Diesel Buildings

9.0 Shutdown of the Diesel Generator After an Automatic Start

2.0 LIMITS AND PRECAUTIONS

2.1 The Diesel Generator should be operated at $\geq$ 3500 KW (50% of rated load) for a minimum of thirty (30) minutes after it has accumulated four (4) hours of no load/light load operation. The D/G log should be reviewed prior to operating the diesel to ensure that this guideline is followed.

2.2 Maximum exhaust temperature on Turbochargers is 1200 Deg. F.

2.3 Lube oil and cooling water at the engine outlets should be approximately 150 Deg. F while the engine is shutdown.

2.4 Starting the D/G will trip the fuel oil recirc pump if running and block it from starting until the D/G is shutdown.

3.0 DIESEL ALIGNMENT FOR ES ACTUATION

Date
Time/Initial

3.1 Initial Conditions

_____ 3.1.1 The Electrical Distribution Lineup has been completed per OP/1/A/6350/01 (Normal Power Checklist).

_____ 3.1.2 Nuclear Service Water System in operation per OP/0/A/6400/06C (Nuclear Service Water).

Date
Time/Initial

_____ 3.1.3 D/G Battery Charger is in operation per OP/1/A/6350/06 (125 VDC Diesel Auxiliary Power System).

_____ 3.1.4 Diesel Generator Fuel Oil System in normal alignment per OP/1/A/6550/01 (Diesel Generator Fuel Oil System Operation).

_____ 3.1.5 Diesel Generator Lube Oil System in normal alignment per OP/1/A/6550/02 (Diesel Generator Lube Oil System).

3.2 Procedure

3.2.1 For Diesel Generator 1A:

_____ 3.2.1.1 Complete or verify complete valve lineup and independent verification per Enclosures 10.1 and 10.2.

_____ 3.2.1.2 Complete ES Checklist and independent verification per Enclosures 10.5 and 10.6.

3.2.2 For Diesel Generator 1B:

_____ 3.2.2.1 Complete or verify complete valve lineup and independent verification per Enclosures 10.3 and 10.4.

_____ 3.2.2.2 Complete ES Checklist and independent verification per Enclosures 10.7 and 10.8.

4.0 LOCAL DIESEL STARTUP AND SHUTDOWN

Refer to Enclosure 10.11 for completion of this section.

5.0 REMOTE DIESEL STARTUP AND SHUTDOWN

Refer to Enclosure 10.12 for completion of this section.

6.0 EMERGENCY STOP

6.1 Initial Conditions

6.1.1 Diesel Generator is running and will not stop by normal means.

6.2 Procedure

6.2.1 Perform one of the following actions to stop the engine in an emergency situation.

6.2.1.1 Push the stop button which is located on the left hand side of the governor.

6.2.1.2 Manually trip both of the overspeed trips.

7.0 REMOVING AND RETURNING DIESEL GENERATOR FROM SERVICE

Refer to Enclosure 10.13 for completion of this section.

8.0 PURGING DIESEL BUILDINGS

Refer to Enclosure 10.14 for completion of this section.

9.0 SHUTDOWN OF THE DIESEL GENERATOR AFTER AN AUTOMATIC START

9.1 Initial Conditions

9.1.1 Diesel Generator is in operation and was started by an automatic signal.

9.2 Procedure

9.2.1 To shutdown the Diesel Generator locally, refer to Enclosure 10.11 (Local Diesel Startup and Shutdown) Step 4.2.15.

9.2.2 To shutdown the Diesel Generator remotely, refer to Enclosure 10.12 (Remote Diesel Startup and Shutdown) Step 5.2.16.

10.0 ENCLOSURES

10.1 D/G 1A Valve Checklist

10.2 D/G 1A Independent Verification Valve Checklist

10.3 D/G 1B Valve Checklist

10.4 D/G 1B Independent Verification Valve Checklist

10.5 D/G 1A Checklist For ES Actuation

10.6 D/G 1A Independent Verification Checklist For ES Actuation

10.7 D/G 1B Checklist For ES Actuation

10.8 D/G 1B Independent Verification Checklist For ES Actuation

10.9 D/G 1A Operating Parameters

10.10 D/G 1B Operating Parameters

10.11 Local Diesel Startup and Shutdown

10.12 Remote Diesel Startup and Shutdown

10.13 Removing and Returning Diesel Generator From Service

10.14 Purging Diesel Building

VALVE NO.	VALVE NAME		POSITION	INITIAL
	1A D/G STARTING AIR			
1VG-3	D/G Starting Air Aftercooler 1A1 Drain	DB	Closed	
1VG-137	D/G Starting Air Tnk X-Conn Drn	DB	Closed	
1VG-95	D/G Starting Air Tnk X-Conn Drn	DB	Closed	
1VG-138	D/G Starting Air Tnk X-Conn Drn	DB	Open	
1VG-97	D/G Starting Air Dryer 1A1 Purge Isol	DB	Throttled	
1VG-9	D/G Starting Air Tank 1A1 Inlet	DB	Open	
1VG-13	D/G Starting Air Tank 1A1 Drain	DB	Closed	
1VG-17	D/G Starting Air Tank 1A1 Outlet	DB	Open	
1VG-19	D/G Starting Air Lo Point Drain	DB	Closed	
1VG-4	D/G Starting Air Aftercooler 1A2 Drain	DB	Closed	
1VG-96	D/G Starting Air Dryer 1A2 Purge Isol	DB	Open	
1VG-98	D/G Starting Air Dryer 1A2 Purge Isol	DB	Throttled	
1VG-10	D/G Starting Air Tank 1A2 Inlet	DB	Open	
1VG-14	D/G Starting Air Tank 1A2 Drain	DB	Closed	
1VG-18	D/G Starting Air Tank 1A2 Outlet	DB	Open	
1VG-20	D/G Starting Air Lo Point Drain	DB	Closed	
1VG-36	D/G 1B Barring Device Inlet	DB	Open	
1VN-1	1A D/G Engine Exh Silencer Drain		Open	

The major difference between the "AE" and the early "AN" skirts is in the heat treating processes used. A number of "AN" skirts cast between 1976 and late 1979 were heat treated by heating to 1750 degrees F for 3 hours and then normalized in forced draft air to produce the desired nominal 100,000 psi tensile strength iron. These skirts were not tempered.

At that time, keel blocks of the normalized nodular iron were tested and found to have the desired physical properties including ductility. From our piston performance experience we had no reason to suspect there would be residual stresses of any significant magnitude present in the non tempered castings. 20/20 hindsight has proven this judgement to be correct for most, but not all pistons. This is supported by the fact that there are 1374 "AN" pistons in the field which have accumulated in excess of 2,760,000 hours of service without significant problems. Unfortunately, a small percentage of these non-tempered "AN" piston skirts have failed in operation. Failure analysis determined the presence of residual stresses of sufficient magnitude to contribute to premature failure. Further examination showed the previously abandoned temper process provided a necessary stress relief benefit to the piston skirt casting. Therefore, the temper or stress relieving process is applied to all nodular iron piston skirt castings. There have been no reported failures of "AN" piston skirts having proper stress relief and proper machining.

TDI considers both the "AE" and the old style "AN" piston skirts, as herein described, to be suitable for use at the power ratings for which they were furnished. This contention is supported by the historical data on the operating history of both piston skirt configurations.

3. "AN" New Style, Refer to Figure 4.

This skirt is machined from the new "AE" style skirt casting but still utilizes the full stack Belleville washer arrangement and was used on the SMUD Rancho Seco units, and the CP&L units.

These skirts are heat treated to produce stress relieved 100,000 psi tensile strength nodular iron.

The full stack Belleville arrangement was retained because at the time of building we had not acquired sufficient field experience on the "half stack" "AE" configuration.

4. "AE", Refer to Figure 5.

This is the latest R-4 piston skirt design. The design incorporates the knowledge we have gained through our field experience on the R-4 series engine as well as from our uprated R-5 series engine, just concluding research development testing.

All "AE" skirts are heat treated to produce stress relieved 100,000 psi tensile strength nodular iron. Successful operating experience with the "AE" skirts includes a 16 cylinder R-4 unit rated 7000 kw, 450 rpm, 225 bmep which has accumulated over 7000 hours of operation without a problem, and 687 hours

VALVE NO.	VALVE NAME		POSITION	INITIAL
1ZD-1	1A D/G Engine Crankcase Vent Drip Leg	DB	Throttled	
	1A D/G COOLING WATER			
1KD-5	D/G Eng Driven Jacket Water Circ Pump 1A Suct	DB	Open	
1KD-7	D/G Eng Driven Jacket Water Circ Pump 1A Disch	DB	Open	
1KD-13	D/G Eng Lube Oil Cooler 1A Outlet	DB	Open	
1KD-12	D/G Eng Lube Oil Cooler 1A Inlet	DB	Open	
1KD-15	D/G Eng Jacket Water Standpipe 1A Drain	DB	Closed	
1KD-2	D/G Eng Jacket Wawter Keep Warm Pump 1A Suct	DB	Open	
1KD-4	D/G Eng Jack Water Keep Warm Pump 1A Disch	DB	Open	
1KD-9	D/G Eng Jacket Water Cooler 1A Inlet	DB	Open	
1KD-10	D/G Eng Jacket Water Cooler 1A Outlet	DB	Open	
1KD-11	D/G Eng Jacket Water Cooler 1A Drain	DB	Closed	
1KD-33	D/G Eng Jacket Water Cooler 1A Vent	DB	Closed	
1KD-1	D/G Eng Jacket Water Standpipe 1A Fill	DB	Closed	
1KD-14	D/G Eng Lube Oil Cooler 1A Drain	DB	Closed	
1KD-31	D/G Eng Lube Oil Cooler 1A Drain	DB	Closed	
1KD-35	D/G 1A Eng Jacket Water Standpipe Drain	DB	Closed	
1KD-36	D/G 1A Eng Driven Jacket Water Circ Pump Suct Vent	DB	Closed	
1KD-37	D/G 1A Eng Driven Jacket Water Circ Pump Disch Drn	DB	Closed	

VALVE NO.	VALVE NAME		POSITION	INITIAL
1KD-38	D/G 1A Eng Driven Jacket Water Circ Pump Disch Vent	DB	Closed	
1KD-39	D/G 1A Eng Lube Oil Clr Vent	DB	Closed	
1KD-40	Supply To D/G 1A Engine Lube Oil Clr Vent	DB	Closed	
1KD-41	D/G 1A Clng Water Inlet Vent	DB	Closed	
1KD-42	Supply To D/G 1A Left Bank Inter Clr Vent	DB	Closed	
1KD-43	Ret To D/G 1A Eng Jacket Water Standpipe Vent	DB	Closed	
1KD-44	Ret To D/G 1A Eng Jacket Water Standpipe Drn	DB	Closed	
1KD-56	D/G 1A Eng Driven Jacket Wtr Circ Pmp Disch Drn	DB	Closed	
1KD-64	D/G Eng 1A Jacket Drain	DB	Closed	
1KD-65	D/G Eng 1A Jacket Drain	DB	Closed	
1KD-68	D/G Keep Warm Pmp 1A Outlet Vent	DB	Closed	
1KD-70	Jacket Wtr S/Pipe 1A Inlet Vent	DB	Closed	
1KD-73	Jacket Wtr Stor Tank Inlet To 1A S/Pipe	DB	Closed	
1KD-75	Jacket Wtr Stor Tank 1A Inlet	DB	Closed	
1KD-77	Jacket Wtr Stor Tank 1A Outlet	DB	Closed	
1KD-79	Jacket Wtr Stor Tanks Outlet Isol	DB	Closed	
1KD-80	Jacket Wtr Stor Tank Containment Dike Drn	DB	Open	
1KD-81	Jacket Wtr Stor Tank Inlet Isol	DB	Closed	
1KD-82	Jacket Wtr Stor Tank Inlet Isol	DB	Closed	

VALVE NO.	VALVE NAME		POSITION	INITIAL
1KD-83	Jacket Wtr Stor Tank Inlet Drn	DB	Closed	
1KD-84	Jacket Wtr Stor Tank Inlet Drn	DB	Closed	
1KD-88	KD Chem Pot Feeder A Inlet	DB	Closed	
1KD-89	KD Chem Pot Feeder A Outlet	DB	Closed	
1KD-93	KD Chem Pot Feeder A Drain	DB	Closed	
1KD-87	KD Chem Pot Feeder A Bypass	DB	Open	

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1A INDEPENDENT VERIFICATION VALVE CHECKLIST
ENCLOSURE 10.2

VALVE NO.	VALVE NAME		POSITION	INITIAL
	1A D/G STARTING AIR			
1VG-17	D/G Starting Air Tank 1A1 Outlet	DB	Open	
1VG-18	D/G Starting Air Tank 1A2 Outlet	DB	Open	
	1A D/G COOLING WATER			
1KD-5	D/G Eng Driven Jacket Water Circ Pump 1A Suct	DB	Open	
1KD-7	D/G Eng Driven Jacket Water Circ Pump 1A Disch	DB	Open	
1KD-13	D/G Eng Lube Oil Cooler 1A Outlet	DB	Open	
1KD-12	D/G Eng Lube Oil Cooler 1A Inlet	DB	Open	
1KD-15	D/G Eng Jacket Water Standpipe 1A Drain	DB	Closed	
1KD-9	D/G Eng Jacket Water Cooler 1A Inlet	DB	Open	
1KD-10	D/G Eng Jacket Water Cooler 1A Outlet	DB	Open	

DIESEL GENERAL OPERATION
OP/1/A/6350/02
D/G 1B VALVE CHECKLIST
ENCLOSURE 10.3

VALVE NO.	VALVE NAME		POSITION	INITIAL
	1B D/G COOLING WATER	DB		
1KD-16	D/G Eng Jacket Water Standpipe 1B Fill	DB	Closed	
1KD-17	D/G Eng Jacket Water Keep Warm Pump 1B Suct	DB	Open	
1KC-19	D/G Eng Jacket Water Keep Warm Pump 1B Disch	DB	Open	
1KD-20	D/G Eng Driven Jacket Water Circ Pump 1B Suct	DB	Open	
1KD-24	D/G Eng Jacket Water Cooler 1B Inlet	DB	Open	
1KD-25	D/G Eng Jacket Water Cooler 1B Outlet	DB	Open	
1KD-26	D/G Eng Jacket Water Cooler 1B Drain	DB	Closed	
1KD-34	D/G Eng Jacket Water Cooler 1B Vent	DB	Closed	
1KD-22	D/G Eng Driven Jacket Water Circ Pump 1B Disch	DB	Open	
1KD-27	D/G Eng Lube Oil Cooler 1B Inlet	DB	Open	
1KD-28	D/G Eng Lube Oil Cooler 1B Outlet	DB	Open	
1KD-30	D/G Eng Jacket Water Standpipe 1B Drain	DB	Closed	
1KD-29	D/G Eng Lube Oil Cooler 1B Drain	DB	Closed	
1KD-32	D/G Eng Lube Oil Cooler 1B Drain	DB	Closed	
1KD-45	D/G 1B Eng Jacket Water Standpipe Drain	DB	Closed	
1KD-46	D/G 1B Eng Driven Jacket Water Circ Pump Suct Vent	DB	Closed	
1KD-47	D/G 1B Eng Driven Jacket Water Circ Pump Disch Drain	DB	Closed	
1KD-48	D/G 1B Eng Driven Jacket Water Circ Pump Disch Vent	DB	Closed	

VALVE NO.	VALVE NAME		POSITION	INITIAL
1KD-49	D/G 1B Eng Lube Oil Clr Vent	DB	Closed	
1KD-50	Supply To D/G 1B Left Bank Inter Clr Vent	DB	Closed	
1KD-51	D/G 1B Supply Vent	DB	Closed	
1KD-52	Supply To D/G 1B Engine Lube Oil Clr Vent	DB	Closed	
1KD-53	Ret to D/G 1B Jacket Water Standpipe Vent	DB	Closed	
1KD-54	Ret to D/G 1B Jacket Water Standpipe Drain	DB	Closed	
1KD-59	D/G 1B Eng Driven Jacket Wtr Circ Pmp Disch Drn	DB	Closed	
1KD-66	D/G Eng 1B Jacket Drain	DB	Closed	
1KD-67	D/G Eng 1B Jacket Drain	DB	Closed	
1KD-69	D/G Keep Warm Pmp 1B Outlet Vent	DB	Closed	
1KD-74	Jacket Wtr Stor Tank Inlet to 1B S/Pipe	DB	Closed	
1KD-76	Jacket Wtr Stor Tank 1B Inlet	DB	Closed	
1KD-78	Jacket Wtr Stor Tank 1B Outlet	DB	Closed	
1KD-90	KD Chem Pot Feeder B Bypass	DB	Open	
1KD-91	KD Chem Pot Feeder B Inlet	DB	Closed	
1KD-92	KD Chem Pot Feeder B Outlet	DB	Closed	
1KD-94	KD Chem Pot Feeder B Drain	DB	Closed	
	1B D/G STARTING AIR			
1VG-47	D/G Starting Air Aftercooler 1B1 Drain	DB	Closed	

VALVE NO.	VALVE NAME		POSITION	INITIAL
1VG-139	D/G 1B Starting Air Tnk X-Conn Drn	DB	Closed	
1VG-117	D/G Starting Air Dryer 1B1 Purge Isol	DB	Open	
1VG-140	D/G 1B Starting Air Tank X-Conn Drn	DB	Closed	
1VG-119	D/G Starting Air Dryer 1B1 Purge Isol	DB	Throttled	
1VG-53	D/G Starting Air Tank 1B1 Inlet	DB	Open	
1VG-57	D/G Starting Air Tank 1B1 Drain	DB	Closed	
1VG-61	D/G Starting Air Tank 1B1 Outlet	DB	Open	
1VG-63	D/G Starting Air Lo Point	DB	Closed	
1VG-48	D/G Starting Air Aftercooler 1B2 Drain	DB	Closed	
1VG-120	D/G Starting Air Dryer 1B2 Purge Isol	DB	Throttled	
1VG-118	D/G Starting Air Dryer 1B2 Purge Isol	DB	Open	
1VG-54	D/G Starting Air Tank 1B2 Inlet	DB	Open	
1VG-58	D/G Starting Air Tank 1B2 Drain	DB	Closed	
1VG-62	D/G Starting Air Tank 1B2 Outlet	DB	Open	
1VG-64	D/G Starting Air Lo Point Drain	DB	Closed	
1VG-80	D/G 1B Barring Device Inlet	DB	Open	
1VN-2	1B D/G Engine Exh Silencer Drain	DB	Open	
1ZD-2	1B D/G Eng Crankcase Vent Drip Leg	DB	Throttled	

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DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1B INDEPENDENT VERIFICATION VALVE CHECKLIST
ENCLOSURE 10.4

VALVE NO.	VALVE NAME		POSITION	INITIAL
	1B D/G COOLING WATER			
1KD-20	D/G Eng Driven Jacket Water Circ Pump 1B Suct	DB	Open	
1KD-24	D/G Eng Jacket Water Cooler 1B Inlet	DB	Open	
1KD-25	D/G Eng Jacket Water Cooler 1B Outlet	DB	Open	
1KD-22	D/G Eng Driven Jacket Water Circ Pump 1B Disch	DB	Open	
1KD-27	D/G Eng Lube Oil Cooler 1B Inlet	DB	Open	
1KD-28	D/G Eng Lube Oil Cooler 1B Outlet	DB	Open	
1KD-30	D/G Eng Jacket Water Standpipe 1B Drain	DB	Closed	
	1B D/G STARTING AIR			
1VG-61	D/G Starting Air Tank 1B1 Outlet	DB	Open	
1VG-62	D/G Starting Air Tank 1B2 Outlet	DB	Open	

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1A CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.5

Date
Time/Initial

NOTE: The following checklist items may be verified in any desired sequence.

_____ 1. Check level in 1A D/G Fuel Oil Stor Tanks to be ≥ 82,068 gal (Tank 1A1 ≥ 90%, Tank 1A2 ≥ 90%).

_____ 2. Close or verify closed the following breaker:

1MXM - F02E (Diesel Building Normal Ventilation Heater 1A)

_____ 3. Close or verify closed 1ERPA BKR 21 power supply to 1FD-22 (D/G Eng Fuel Oil Day Tank 1A Fill).

_____ 4. 1A1, 1A2 Diesel Generator Bldg. vent fans in "AUTO" position (as indicated on Diesel Bldg 1A Vent Control Panel).

_____ 5. 1A Diesel Bldg. normal vent fan running (as indicated on Diesel Bldg 1A Vent Control Panel).

_____ 6. Check D/G Engine Jacket Water Standpipe Water level to be ≥ 1/2 on level indication (as indicated by gauge located on standpipe).

_____ 7. LD Transfer Pump 1A switch is in the Stop position (as indicated on Diesel Engine 1A LD Transfer Pump Loc Box).

_____ 8. Power switch on both 1A Starting Air Solenoid Panels is On.

_____ 9. Check governor oil level to be at or above the line on the sightglass.

_____ 10. Close or verify closed the following breakers on 1EMXE:

F01D - D/G Engine Jacket Keep Warm Pump Motor 1A
F02A - Diesel Generator Jacket Water Heater 1A
F02B - Diesel Gen Engine Prelube Oil Pump Motor 1A
F02C - Diesel Gen Engine Lube Oil Transfer Pump Motor 1A
F02D - Diesel Gen Engine Lube Oil Sump Tank Heater 1A
F03B - Diesel Starting Air Compressor Motor 1A1
F03C - Diesel Starting Air Compressor Motor 1A2
F03D - Diesel Generator Room Sump Pump Motor 1A2
F04A - Diesel Building Generator Vent Fan Motor 1A1
F05A - Diesel Building Generator Vent Fan Motor 1A2
F05E - Diesel Generator Room Sump Pump Motor 1A1
F05F - Diesel Generator Space Heater 1A

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1A CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.5

Date Time/Initial		
_____	11.	D/G 1A Room Sump Pumps 1A1 and 1A2 in operation per OP/1/A/6500/05 (Diesel Generator Rooms Sump System).
_____	12.	Check generator bearing oil level.
_____	13.	Check Starting Air Pressures (4 total) at approximately 250 psig (gauges on D/E Control Panel 1A).
_____	14.	Check control pressure at 60 psig (gauge on D/E Control Panel 1A).
_____	15.	A/C Control power on (as indicated on D/E Control Panel 1A).
_____	16.	D/C Control power on (as indicated on D/E Control Panel 1A).
_____	17.	Mode Select Switch in Reset position (lockout relay on D/E Control Panel 1A not tripped).
_____	18.	Jacket Water Pump and Heater in Auto (as indicated on D/E Control Panel 1A).
_____	19.	Lube Oil Pump and Heater in Auto (as indicated on D/E Control Panel 1A).
_____	20.	Check Fuel Oil Day Tank level at $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1A).
_____	21.	Check Diesel Lube Oil Sump Tank level to be $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1A).
_____	22.	D/G 1A Synchroscope selector switch is in the Off position (as indicated on D/G Control Panel 1A).
_____	23.	Jacket Water temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1A).
_____	24.	Lube Oil temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1A).

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1A INDEPENDENT VERIFICATION FOR ES ACTUATION
ENCLOSURE 10.6

Date
Time/Initial

NOTE: The following checklist items may be verified in any desired sequence.

_____ 1. Check level in 1A D/G Fuel Oil Stor Tanks to be ≥ 82,068 gal (Tank 1A1 ≥ 90%, Tank 1A2 ≥ 90%).

_____ 2. Close or verify closed the following breaker:

1MXM - F02E (Diesel Building Normal Ventilation Heater 1A)

_____ 3. Close or verify closed 1ERPA BKR 21 power supply to 1FD-22 (D/G Eng Fuel Oil Day Tank 1A Fill).

_____ 4. 1A1, 1A2 Diesel Generator Bldg. vent fans in "AUTO" position (as indicated on Diesel Bldg 1A Vent Control Panel).

_____ 5. 1A Diesel Bldg. normal vent fan running (as indicated on Diesel Bldg 1A Vent Control Panel).

_____ 6. Check D/G Engine Jacket Water Standpipe Water level to be ≥ 1/2 on level indication (as indicated by gauge located on standpipe).

_____ 7. LD Transfer Pump 1A switch is in the Stop position (as indicated on Diesel Engine 1A LD Transfer Pump Loc Box).

_____ 8. Power Switch on both 1A Starting Air Solenoid Panels is On.

_____ 9. Check governor oil level to be at or above the line on the sightglass.

_____ 10. Close or verify closed the following breakers on 1EMXE:

F01D - D/G Engine Jacket Keep Warm Pump Motor 1A
F02A - Diesel Generator Jacket Water Heater 1A
F02B - Diesel Gen Engine Prelube Oil Pump Motor 1A
F02C - Diesel Gen Engine Lube Oil Transfer Pump Motor 1A
F02D - Diesel Gen Engine Lube Oil Sump Tank Heater 1A
F03B - Diesel Starting Air Compressor Motor 1A1
F03C - Diesel Starting Air Compressor Motor 1A2
F03D - Diesel Generator Room Sump Pump Motor 1A2
F04A - Diesel Building Generator Vent Fan Motor 1A1
F05A - Diesel Building Generator Vent Fan Motor 1A2
F05E - Diesel Generator Room Sump Pump Motor 1A1
F05F - Diesel Generator Space Heater 1A

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1A INDEPENDENT VERIFICATION CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.6

Date Time/Initial		
_____	11.	D/G 1A Room Sump Pumps 1A1 and 1A2 in operation per OP/1/A/6500/05 (Diesel Generator Rooms Sump System).
_____	12.	Check generator bearing oil level.
_____	13.	Check Starting Air Pressures (4 total) at approximately 250 psig (gauges on D/E Control Panel 1A).
_____	14.	Check control pressure at 60 psig (gauge on D/E Control Panel 1A).
_____	15.	A/C Control power on (as indicated on D/E Control Panel 1A).
_____	16.	D/C Control power on (as indicated on D/E Control Panel 1A).
_____	17.	Mode Select Switch in Reset position (lockout relay on D/E Control Panel 1A not tripped).
_____	18.	Jacket Water Pump and Heater in Auto (as indicated on D/E Control Panel 1A).
_____	19.	Lube Oil Pump and Heater in Auto (as indicated on D/E Control Panel 1A).
_____	20.	Check Fuel Oil Day Tank level at $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1A).
_____	21.	Check Diesel Lube Oil Sump Tank level to be $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1A).
_____	22.	D/G 1A Synchroscope selector switch is in the Off position (as indicated on D/G Control Panel 1A).
_____	23.	Jacket Water temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1A).
_____	24.	Lube Oil temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1A).

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1B CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.7

Date
Time/Initial

NOTE: The following checklist items may be verified in any desired sequence.

_____ 1. Check level in 1B D/G Fuel Oil Stor Tanks to be ≥ 82,068 gal (Tank 1B1 ≥ 90%, Tank 1B2 ≥ 90%).

_____ 2. Close or verify closed 1ERPD BKR 21 power supply to 1FD-62 (D/G Eng Fuel Oil Day Tank 1B Fill).

_____ 3. Close or verify closed the following breaker:

1MXZ - F05B (Diesel Building Normal Ventilation Heater 1B)

_____ 4. 1B1, 1B2 Diesel Generator Bldg. vent fans in "AUTO" position (as indicated on Diesel Bldg 1B Vent Control Panel).

_____ 5. 1B Diesel Bldg. normal vent fan running (as indicated on Diesel Bldg 1B Vent Control Panel).

_____ 6. Check D/G Engine Jacket Water Standpipe Water level to be ≥ 1/2 on level indication (as indicated by gauge located on standpipe).

_____ 7. LD Transfer Pump 1B switch is in the Stop position (as indicated on Diesel Engine 1B LD Transfer Pump Loc Box).

_____ 8. Power Switch on both 1B Starting Air Solenoid Panels is On.

_____ 9. Check governor oil level to be at or above the line on the sightglass.

_____ 10. Close or verify closed the following breakers on 1EMXF:

F01D - D/G Engine Jacket Keep Warm Pump Motor 1B
F02A - Diesel Generator Jacket Water Heater 1B
F02B - Diesel Gen Engine Prelube Oil Pump Motor 1B
F02C - Diesel Gen Engine Lube Oil Transfer Pump Motor 1B
F02D - Diesel Gen Engine Lube Oil Sump Tank Heater 1B
F03B - Diesel Starting Air Compressor Motor 1B1
F03C - Diesel Starting Air Compressor Motor 1B2
F03D - Diesel Generator Room Sump Pump Motor 1B2
F04A - Diesel Building Generator Vent Fan Motor 1B1
F05A - Diesel Building Generator Vent Fan Motor 1B2
F05E - Diesel Generator Room Sump Pump Motor 1B1
F05F - Diesel Generator Space Heater 1B

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1B CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.7

Date Time/Initial		
_____	11.	D/G 1B Room Sump Pumps 1B1 and 1B2 in operation per OP/1/A/6500/05 (Diesel Generator Rooms Sump System).
_____	12.	Check generator bearing oil level.
_____	13.	Check Starting Air Pressures (4 total) at approximately 250 psig (gauges on D/E Control Panel 1B).
_____	14.	Check control pressure at 60 psig (gauge on D/E Control Panel 1B).
_____	15.	A/C Control power on (as indicated on D/E Control Panel 1B).
_____	16.	D/C Control power on (as indicated on D/E Control Panel 1B).
_____	17.	Mode Select Switch in Reset position (lockout relay on D/E Control Panel 1B not tripped).
_____	18.	Jacket Water Pump and Heater in Auto (as indicated on D/E Control Panel 1B).
_____	19.	Lube Oil Pump and Heater in Auto (as indicated on D/E Control Panel 1B).
_____	20.	Check Fuel Oil Day Tank level at $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1B).
_____	21.	Check Diesel Lube Oil Sump Tank level to be $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1B).
_____	22.	D/G 1B Synchroscope selector switch is in the Off position (as indicated on D/G Control Panel 1B).
_____	23.	Jacket Water temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1B).
_____	24.	Lube Oil temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1B).

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1B INDEPENDENT VERIFICATION CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.8

Date
Time/Initial

NOTE: The following checklist items may be verified in any desired sequence.

_____ 1. Check level in 1B D/G Fuel Oil Stor Tanks to be ≥ 82,068 gal (Tank 1B1 ≥ 90%, Tank 1B2 ≥ 90%).

_____ 2. Close or verify closed 1ERPD BKR 21 power supply to 1FD-62 (D/G Eng Fuel Oil Day Tank 1B Fill).

_____ 3. Close or verify closed the following breaker:

1MXZ - F05B (Diesel Building Normal Ventilation Heater 1B)

_____ 4. 1B1, 1B2 Diesel Generator Bldg. vent fans in "AUTO" position (as indicated on Diesel Bldg 1B Vent Control Panel).

_____ 5. 1B Diesel Bldg. normal vent fan running (as indicated on Diesel Bldg 1B Vent Control Panel).

_____ 6. Check D/G Engine Jacket Water Standpipe Water level to be ≥ 1/2 on level indication (as indicated by gauge located on standpipe).

_____ 7. LD Transfer Pump 1B switch is in the Stop position (as indicated on Diesel Engine 1B LD Transfer Pump Loc Box).

_____ 8. Power Switch on both 1B Starting Air Solenoid Panels is On.

_____ 9. Check governor oil level to be at or above the line on the sightglass.

_____ 10. Close or verify closed the following breakers on 1EMXF:

F01D - D/G Engine Jacket Keep Warm Pump Motor 1B
F02A - Diesel Generator Jacket Water Heater 1B
F02B - Diesel Gen Engine Prelube Oil Pump Motor 1B
F02C - Diesel Gen Engine Lube Oil Transfer Pump Motor 1B
F02D - Diesel Gen Engine Lube Oil Sump Tank Heater 1B
F03B - Diesel Starting Air Compressor Motor 1B1
F03C - Diesel Starting Air Compressor Motor 1B2
F03D - Diesel Generator Room Sump Pump Motor 1B2
F04A - Diesel Building Generator Vent Fan Motor 1B1
F05A - Diesel Building Generator Vent Fan Motor 1B2
F05E - Diesel Generator Room Sump Pump Motor 1B1
F05F - Diesel Generator Space Heater 1B

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1B INDEPENDENT VERIFICATION CHECKLIST FOR ES ACTUATION
ENCLOSURE 10.8

Date Time/Initial		
_____	11.	D/G 1B Room Sump Pumps 1B1 and 1B2 in operation per OP/1/A/6500/05 (Diesel Generator Rooms Sump System).
_____	12.	Check generator bearing oil level.
_____	13.	Check Starting Air Pressures (4 total) at approximately 250 psig (gauges on D/E Control Panel 1B).
_____	14.	Check control pressure at 60 psig (gauge on D/E Control Panel 1B).
_____	15.	A/C Control power on (as indicated on D/E Control Panel 1B).
_____	16.	D/C Control power on (as indicated on D/E Control Panel 1B).
_____	17.	Mode Select Switch in Reset position (lockout relay on D/E Control Panel 1B not tripped).
_____	18.	Jacket Water Pump and Heater in Auto (as indicated on D/E Control Panel 1B).
_____	19.	Lube Oil Pump and Heater in Auto (as indicated on D/E Control Panel 1B).
_____	20.	Check Fuel Oil Day Tank level at $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1B).
_____	21.	Check Diesel Lube Oil Sump Tank level to be $\geq$ 3/4 on level indication (gauge on D/E Control Panel 1B).
_____	22.	D/G 1B Synchroscope selector switch is in the Off position (as indicated on D/G Control Panel 1B).
_____	23.	Jacket Water temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1B).
_____	24.	Lube Oil temp. maintained at approximately 150°F (as indicated by Strip Chart Recorder or Temp Scanner on D/G Control Panel 1B).

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1A OPERATING PARAMETERS
ENCLOSURE 10.9

Cylinder Exhaust Temp	400°F at idle to 1000°F at 100%
Generator Stator Temp.	If Room Temp < 122°F (50°C), then Stator Temp < (95°C + Room Temp*) If Room Temp ≥ 122°F (50°C), then Stator Temp < 125°C
Engine Lube Oil Temp.	170°F - 180°F
Crankcase Vacuum	0 + 1.5 in. H2O at 100%
Lube Oil Filter ΔP	< 20 psid
Lube Oil Pressure	44-55 psi
Fuel Oil Filter ΔP	< 20 psid
Fuel Oil Pressure	20-30 psi
Jacket Cooling Water Temp.	170°F - 180°F
Jacket Cooling Water Press	10-30 psi
Control Air Pressure	60 psi
Lube Oil Press at Turbocharger Inlet	25-35 psi
Manifold Air Pressure	Increases with load
Color of Smoke from Stack	Clear, after initial start.

*Room temperature can be read on the thermometer located beind the Diesel Engine Control Panel. Note that this temperature is given in °F, and must be converted to °C.

DIESEL GENERATOR OPERATION
OP/1/A/6350/02
D/G 1B OPERATING PARAMETERS
ENCLOSURE 10.10

Cylinder Exhaust Temp.	400°F at idle to 1000°F at 100%
Generator Stator Temp.	If Room Temp < 122°F (50°C), then Stator Temp < (95°C + Room Temp*) If Room Temp ≥ 122°F (50°C), then Stator Temp < 125°C
Engine Lube Oil Temp.	170°F - 180°F
Crankcase Vacuum	0 + 1.5 in. H20 at 100%
Lube Oil Filter ΔP	< 20 psid
Lube Oil Pressure	44-55 psi
Fuel Oil Filter ΔP	< 20 psid
Fuel Oil Pressure	20-30 psi
Jacket Cooling Water Temp.	170°F - 180°F
Jacket Cooling Water Press.	10-30 psi
Control Air Pressure	60 psig
Lube Oil at Turbocharger Inlet	25-35 psi
Manifold Air Pressure	Increases with load.
Color of Smoke from Stack	Clear, after initial start.

*Room temperature can be read on the thermometer located beind the Diesel Engine Control Panel. Note that this temperature is given in °F and must be converted to °C.

4.0 LOCAL DIESEL STARTUP AND SHUTDOWN

Date
Time/Initials

4.1 Initial Conditions

_____ 4.1.1 Diesel Generator is aligned per Section 3.0 (Diesel Alignment for ES Actuation).

_____ 4.1.2 Lube oil temperature and jacket water temperature are ~ 150 Deg. F.

_____ 4.1.3 The Control Room has been informed that a Local Start of the Diesel is being performed.

_____ 4.1.4 The Diesel Generator being started locally is ____.

_____ 4.1.5 Obtain key for Manual Test Start Key Switch from Shift Supervisor.

4.2 Procedure

_____ 4.2.1 If permissible, roll the diesel with air prior to starting. If not, proceed to Step 4.2.2.

NOTE: This step should be performed during routine tests and starts where time permits. It will be eliminated during emergency situations due to the nature of the start. This step is primarily a pre-start check to help prolong engine life.

_____ 4.2.1.1 Depress "MAINTENANCE" pushbutton on Local D/E Control Panel and Control Room. Note annunciator F/3 'Return to Operational Mode) on D/G annunciator panel to verify the diesel is in the Maintenance Mode.

_____ 4.2.1.2 Open indicator cocks on all cylinder heads.

_____ 4.2.1.3 Depress "ENGINE ROLL" pushbutton on Local D/E Control Panel. Allow engine to crank for at least two revolutions, then release pushbutton.

Date
Time/Initials

_____	4.2.1.4	Inspect all indicator cocks. If liquid has been ejected from any of the cocks, the source must be found and corrected before proceeding.
_____	4.2.1.5	Close indicator cocks on all cylinders.
_____	4.2.1.6	Reset Mode Selector Switch (Lockout Relay) to place Diesel in "OPERATIONAL" mode.
	4.2.2	Transfer starting control to the local control panel:
_____	4.2.2.1	If possible, have the Control Room Operator place the "REMOTE/LOCAL" pushbutton in the Control Room in the LOCAL position.
_____	4.2.2.2	If there is an emergency or remote circuitry malfunction and the above step cannot be performed, actuate the Control Room Override at the Break Glass Station on the Local Control Panel.
_____	4.2.3	On Local Engine Control Panel, place key in the Manual Test Start Switch and turn to the "START" position (this switch will spring return to the "OFF" position).
_____	4.2.3.1	Ensure Diesel starts.
_____	4.2.3.2	Ensure that the associated D/G Hx Inlet opens: 1RN-232A (D/G 1A Hx Inlet) 1RN-292B (D/G 1B Hx Inlet)
_____	4.2.3.3	Ensure D/G Engine Driven Lube Oil Pump increases oil pressure and the Prelube Oil Pump stops.
_____	4.2.3.4	Ensure the Diesel Gen. Engine Driven Cooling Water Pump increases water pressure and the Jacket Keep Warm Pump stops.
_____	4.2.4	Ensure Shutdown System Active light is illuminated on Engine Control Panel.
_____	4.2.5	Adjust D/G voltage ("Voltage Control") to approximately 4160 volts.
_____	4.2.6	Turn on Synchroscope.
_____	4.2.7	Adjust Governor ("Speed Control") to allow Synchroscope to move slowly in the "Fast" direction.
_____	4.2.8	Adjust Voltage ("Voltage Control") to allow D/G voltage to be slightly higher than line voltage.

Date
Time/Initials

_____	4.2.9	Have the Control Room Operator notify Area Dispatcher of Unit coming on the line.
_____	4.2.10	With the Synchroscope rotating slowly in the "Fast" direction, and the pointer approaching vertical position, but within 5 min. before vertical position, close the Generator Breaker.
_____	4.2.11	Increase generator load ("Speed Control") to 1750 KW while adjusting voltage ("Voltage Control") to maintain ~ 0.98 lagging power factor.
_____	4.2.12	Turn off Synchroscope.
_____	4.2.13	During D/G operation, check the parameters on Enclosure 10.9 for D/G 1A and Enclosure 10.10 for D/G 1B against normal operating values.
_____	4.2.14	Increase generator load ("Speed Control") to desired amount while adjusting voltage ("Voltage Control") to maintain ~ 0.98 lagging power factor.
	NOTE:	The Diesel is now in operation. The following steps should be performed when it is desired to shutdown the diesel locally.
	NOTE:	If the Diesel Generator was started by an automatic signal and it is desired to shutdown the diesel locally, proceed with Step 4.2.15.
_____	4.2.15	Verify another power source is available to the 4160 volt bus.
_____	4.2.16	Have the Control Room Operator notify Area Dispatcher of pending shutdown of D/G unit.
_____	4.2.17	If the normal and alternate feeder breakers are open, proceed to step 4.2.18. If either the normal or alternate feeder breakers is closed, proceed to step 4.2.21.
_____	4.2.18	Turn on Synchroscope.
_____	4.2.19	Adjust D/G speed such that the Synchroscope is moving slowly in the fast direction. As the indicator reaches 5 min. before vertical position, close the normal or alternate breaker.
_____	4.2.20	Turn off the Synchroscope.
_____	4.2.21	Reduce D/G load to 200 KW and ~ 0 VARS, then trip the D/G breaker.
_____	4.2.22	Allow Diesel to idle unloaded until jacket water and lubricating oil temperatures are ~ 160 Deg. F.

Date
Time/Initials

_____ 4.2.23 Depress the "STOP" pushbutton on the Local D/E Control Panel and remove the key from the Manual Test Start Key Switch.

_____ 4.2.24 Ensure the following occurs when the diesel stops:

_____ 4.2.24.1 The associated D/G Hx Inlet closes:

1RN-232A (D/G 1A Hx Inlet)
1RN-292B (D/G 1B Hx Inlet)

_____ 4.2.24.2 Prelube oil pump starts.

_____ 4.2.24.3 Jacket Keep Warm pump starts.

_____ 4.2.25 Have the Control Room Operator place D/G control in REMOTE position on 1MC11.

_____ 4.2.26 Start the Diesel Building Normal Vent Fan 1A (1B).

_____ 4.2.27 If the D/G was in operation for $\geq$ 1 hour, drain any accumulated water from the Fuel Oil Day Tank by performing the following steps:

NOTE: Repeat Steps 4.2.27.1 through 4.2.27.5 until the drained fuel oil is free of water.

4.2.27.1 Place a container at the applicable D/G Fuel Oil Day Tank Drain Outlet.

4.2.27.2 Slowly open the appropriate drain valve to fill the container:

1FD-24 (D/G Eng Fuel Oil Day Tnk 1A Drain)
1FD-64 (D/G Eng Fuel Oil Day Tnk 1B Drain)

4.2.27.3 Close the appropriate drain valve:

1FD-24 (D/G Eng Fuel Oil Day Tnk 1A Drain)
1FD-64 (D/G Eng Fuel Oil Day Tnk 1B Drain)

4.2.27.4 Inspect the container for water.

4.2.27.5 Dump container contents in waste oil drum.

_____ 4.2.28 Complete ES Checklist and independent verification per Enclosures 10.5 and 10.6 for D/G 1A or Enclosure 10.7 and 10.8 for D/G 1B.

NOTE: Place the ES Checklist and the IV Checklist in the Control Copy Folder and route the outdated enclosures with this enclosure.

Date
Time/Initials

_____ 4.2.29 Return the key for the Manual Test Start Key Switch to the Shift Supervisor.

NOTE: The Diesel Generator is now aligned per Section 3.0 (Diesel Alignment for ES Actuation).

5.0 REMOTE DIESEL STARTUP AND SHUTDOWN

Date
Time/Initials

5.1 Initial Conditions

_____ 5.1.1 Diesel Generator is aligned per Section 3.0 (Diesel Alignment for ES Actuation).

_____ 5.1.2 Lube oil temperature and jacket water temperature are ~ 150 Deg. F.

_____ 5.1.3 The Diesel Generator being started remotely is _____.

5.2 Procedure

_____ 5.2.1 If permissible, roll the diesel with air prior to starting. If not, proceed to Step 5.2.2.

NOTE: This step should be performed during routine tests and starts where time permits. It will be eliminated during emergency situations due to the nature of the start. This step is primarily a pre-start check to help prolong engine life.

_____ 5.2.1.1 Depress "MAINTENANCE" pushbutton on Local D/E Control Panel and Control Room simultaneously. Note annunciator indicating system's mode.

_____ 5.2.1.2 Open indicator cocks on all cylinder heads.

_____ 5.2.1.3 Depress "ENGINE ROLL" pushbutton on Local D/E Control Panel. Allow engine to crank for at least two revolutions, then release pushbuttor.

_____ 5.2.1.4 Inspect all indicator cocks. If liquid has been ejected from any of the cocks, the source must be found and corrected before proceeding.

_____ 5.2.1.5 Close indicator cocks.

_____ 5.2.1.6 Reset Mode Selector Switch (Lockout Relay at D/E Control Panel) to place Diesel in OPERATIONAL Mode.

Date
Time/Initials

_____	5.2.2	Verify the "REMOTE/LOCAL" switch on 1MC11 in the REMOTE position.
_____	5.2.3	Depress "ON" pushbutton, insure the Engine starts by noting that the Diesel Running Status light is illuminated.
_____	5.2.4	Dispatch an operator to ensure that the associated D/G Hx Inlet opens: 1RN-232A (D/G Hx 1A Inlet) 1RN-292B (D/G Hx 1B Inlet)
_____	5.2.5	Ensure the Prelube Oil Pump and Jacket Keep Warm Pump stop.
_____	5.2.6	Adjust D/G voltage ("D/G 1A/1B Volt Adjust") to 4160V.
_____	5.2.7	Turn on D/G Synchroscope.
_____	5.2.8	Adjust Governor ("D/G 1A/1B Gov Cntl") to allow the Synchroscope to move slowly in the "FAST" direction.
_____	5.2.9	Adjust Voltage ("D/G 1A/1B Volt Adjust") to allow Generator Voltage to be slightly higher than Line Voltage.
_____	5.2.10	Notify Area Dispatcher of Unit coming on the line.
_____	5.2.11	With the synchroscope rotating slowly in the "FAST" direction, and the pointer approaching the vertical position, but within 5 minutes before the vertical position, close the D/G breaker.
_____	5.2.12	Increase generator load ("D/G 1A/1B Gov Cntl") to 1750 KW while adjusting voltage ("D/G 1A/1B Volt Adjust") to maintain ~ 0.98 lagging power factor.
_____	5.2.13	Turn off Synchroscope.
_____	5.2.14	During D/G operation, check the parameters on Enclosure 10.9 for D/G 1A and Enclosure 10.10 for D/G 1B against normal operating values.
_____	5.2.15	Increase Generator load ("D/G 1A/1B Gov Cntl") to desired amount while adjusting voltage ("D/G 1A/1B Volt Adjust") to maintain ~ 0.98 lagging power factor.
	NOTE:	The DIESEL is now in operation. The following steps should be performed when it is desired to shutdown the diesel remotely.
	NOTE:	If the Diesel Generator was started by an automatic signal and it is desired to shutdown the diesel remotely, proceed with Step 5.2.16.

Date
Time/Initials

_____ 5.2.16 Verify another power source is available to the 4160 V Bus.

_____ 5.2.17 Notify Area Dispatcher of pending shutdown of D/G Unit.

_____ 5.2.18 If the normal and alternate incoming feeder breakers are open, proceed to step 5.2.19. If either the normal or alternate Feeder breakers is closed, proceed to step 5.2.22.

_____ 5.2.19 Turn on Synchroscope.

_____ 5.2.20 Adjust D/G speed such that the Sychroscope is moving slowly in the "FAST" direction. As the indicator reaches 5 min. before vertical position, close the normal or alternate incoming breaker.

_____ 5.2.21 Turn off the Synchroscope.

_____ 5.2.22 Reduce D/G load to 200 KW and ~ 0 VARS, then trip the D/G breaker.

_____ 5.2.23 Allow Diesel to idle unloaded until jacket water temperatures and lubricating oil temperatures are ~ 160 Deg. F.

_____ 5.2.24 Depress D/G "OFF" pushbutton to stop the engine.

_____ 5.2.25 Ensure the following occurs when the engine stops. Dispatch Operators as necessary.

_____ 5.2.25.1 The associated D/G Hx Inlet closes:

1RN-232A (D/G 1A Hx Inlet)
1RN-292B (D/G 1B Hx Inlet)

_____ 5.2.25.2 Prelube Oil Pump starts.

_____ 5.2.25.3 Jacket Keep Warm Pump starts.

_____ 5.2.26 Have an operator start the Diesel Building Normal Vent Fan 1A (1B).

_____ 5.2.27 If the D/G was in operation for $\geq$ 1 hour, drain any accumulated water from the Fuel Oil Day Tank by performing the following steps:

NOTE: Repeat Steps 5.2.27.1 through 5.2.27.5 until the drained fuel oil is free of water.

5.2.27.1 Place a container at the applicable D/G Fuel Oil Day Tank Drain Outlet.

Date
Time/Initials

5.2.27.2 Slowly open the appropriate drain valve to fill the container:

1FD-24 (D/G Eng Fuel Oil Day Tnk 1A Drain)
1FD-64 (D/G Eng Fuel Oil Day Tnk 1B Drain)

5.2.27.3 Close the appropriate drain valve:

1FD-24 (D/G Eng Fuel Oil Day Tnk 1A Drain)
1FD-64 (D/G Eng Fuel Oil Day Tnk 1B Drain)

5.2.27.4 Inspect the container for water.

5.2.27.5 Dump container contents in waste oil drum.

_____ 5.2.28 Complete ES Checklist and independent verification per Enclosures 10.5 and 10.6 for D/G 1A or Enclosure 10.7 and 10.8 for D/G 1B.

NOTE: Place the ES Checklist and the IV Checklist in the Control Copy Folder and route the outdated enclosures with this enclosure.

NOTE: The Diesel Generator is now aligned per Section 3.0 (Diesel Alignment For ES Actuation).

7.0 REMOVING AND RETURNING DIESEL GENERATOR FROM SERVICE

Date
Time/Initials

7.1 Initial Conditions

_____ 7.1.1 Diesel Generator aligned per Section 3.0 (Diesel Alignment For ES Actuation).

_____ 7.1.2 Unit Supervisor's permission has been obtained to remove Diesel from service.

_____ 7.1.3 The Diesel Generator being removed from service is _____.

7.2 Procedure

_____ 7.2.1 Comply with action statements of Tech Spec 3.8.1.1 and 3.8.1.2.

_____ 7.2.2 If D/G 1A is to be removed from service, transfer the power supply for essential MCC 1EMXG from 1ELXA to 2ELXA per OP/1/A/6350/05 (Alternate A/C Power Sources) provided that D/G 2A is operable.

_____ 7.2.3 If D/G 1B is to be removed from service, verify that Essential MCC 2EMXH is receiving power from 2ELXB.

_____ 7.2.4 Depress "MAINTENANCE" pushbuttons on Local D/E Control Panel and in the Control Room on 1MC-11 simultaneously.

NOTE: The D/G is now out of service. The following step will return the D/G to service.

_____ 7.2.5 Manually reset the "MODE SELECTOR SWITCH" (Lockout Relay) located on the Local D/E Control Panel.

_____ 7.2.6 If D/G 1A is being returned to service, transfer the power supply for essential MCC 1EMXG from 2ELXA to 1ELXA per OP/1/A/6350/05 (Alternate A/C Power Sources).

_____ 7.2.7 If D/G 1B is being returned to service and D/G 2B is inoperable, transfer the power supply for Essential MCC 2EMXH from 2ELXB to 1ELXB per OP/2/A/6350/05 (Alternate A/C Power Sources).

Date
Time/Initials

_____ 7.2.8 Complete ES Checklist and independent verification per Enclosures 10.5 and 10.6 for D/G 1A or Enclosures 10.7 and 10.8 for D/G 1B.

NOTE: Place the ES Checklist and the IV Checklist in the Control Copy Folder and route the outdated enclosures with this enclosure.

NOTE: The Diesel Generator is now aligned per Section 3.0 (Diesel Alignment For ES Actuation).

8.0 PURGING DIESEL BUILDING

Date
Time/Initials

8.1 Initial Conditions

_____ 8.1.1 1A (1B) Diesel Building Ventilation System in operation per Enclosure 10.5 for 1A and/or Enclosure 10.7 for 1B.

_____ 8.1.2 The Diesel Generator Building being purged is _____.

8.2 Procedure

_____ 8.2.1 On Diesel Building 1A (1B) Ventilation Control Panel, place Diesel Engine Room 1A (1B) Purge Control in "START".

NOTE: This will stop the Normal Vent Fan start and start the Diesel Building Generator Vent Fans.

_____ 8.2.2 Place Diesel Building 1A (1B) Dampers "MIN POSITION CONTROL SWITCH" in "ON" and set RHEOSTAT to 20 milliamperes.

_____ 8.2.3 When purging is complete, place Diesel Building 1A (1B) purge controls in "STOP".

_____ 8.2.4 Start the Diesel Building Normal Vent Fan 1A (1B).

NOTE: This will return Diesel Building Ventilation System to normal operation.

17. What surveillance practices in addition to those required by plant technical specifications have you instituted to assure optimum reliability of your diesel generators at your plant?

Duke Power has (and will) develop surveillance practices in addition to those in the Technical Specifications. This additional surveillance will be implemented under the Prevenative Maintenance Program and the Chemistry Sampling Program.

1. Vibration readings of the D/G and Support Systems will be taken semi-annually under Prevenative Maintenance.

2. Lube oil spectrographic analysis will initially be done quarterly, under the Chemistry Sampling Program. (Reference Attachment 17-1). This is in addition to the monthly sampling of the lube oil for viscosity, Newt No. and percent water under Chemistry Procedure CP/0/A/8100/23, 24 and 25.

Fuel oil sampling will be done every two (2) months under chemistry procedure CP/0/A/8100/10, 24, and 26 for specific gravity, viscosity, and water/sediment.

Performance surveillance activities are more adequate than those committed to in the Technical Specifications.

OIL ANALYSIS OPERATING SPECIFICATIONS
CP/0/B/8800/05
ENCLOSURE 6.11

Table 1 - Analysis at Station

System	Sample	Viscosity Sus @ 100°F	Neut. # mg KOH/gm	Water v/v%	Water and Sediment v/v%	Specific Gravity	Particle Count					
							6-11 μ	12-20 μ	21-60 μ	61-105 μ	106-250 μ	>250 μ
LT	Main Turbine Lube Oil	140-170	<0.2		<0.2		210,000	6500	2370	117	18	0
LF	FWPT (A & B) Lube Oil	140-170	<0.2		<0.2		210,000	6500	2370	112	18	0
NC	NC Pump Motor Oil (A, B, C, D)	143-175	<0.4*		nil							
NC	NC Pump Motor Oil (Spare)		<0.4*		nil							
	Fuel Oil Tank Truck	(T) 32.6-40.1			(T) ≤0.05	(T) 0.83-0.89	See Table 2 also.					
FD	Fuel Oil Storage Tanks (A1, A2, B1, B2)						See Table 2.					
	Lube Oil Tank Truck	649-812	later	≤0.1								
LD	Clean Lube Oil Storage Tank	649-812	later	≤0.1								
LD	Lube Oil Sump Tank	649-812	later	≤0.1								
AD	Fuel Oil Storage Tank	30-45			≤0.1							
AD	Oil Pan	459-702			≤0.1							

Table 2 - Analysis by Consultant

System	Sample	Viscosity Sus @ 100°F		Distillation Temp °C(°F) 90% Point		Water and Sediment v/v%	Carbon Residue on 10% Residuum %	Copper Strip Corrosion	Flash Point °C(°F)	Cloud Point °F	Pour Point °F	Ash w/w%	Sulfur w/w%	Cetane Number	Insolubles mg/100ml	Specific Gravity	
		Min	Max	Min	Max											Min	Max
	Fuel Oil Tank Truck			(T) 283(540)	(T) 338(640)		(T) ≤0.35	(T) ≤3	(T) ≥52(125)	(T) ≤24	(T) ≤13	(T) ≤0.01	(T) ≤0.50	(T) ≥40	(T) <2		
FD	Fuel Oil Storage Tanks (A1, A2, B1, B2)	(T) 32.6	(T) 40.1	(T) 283(540)	(T) 338(640)	(T) ≤0.05	(T) ≤0.35	(T) ≤3	(T) ≥52(125)	(T) ≤24	(T) ≤13	(T) ≤0.01	(T) ≤0.50	(T) ≥40	(T) <2	(T) 0.83	(T) 0.89

T - Tech Spec

* - Difference from new oil

OIL SAMPLING AND ANALYSIS SCHEDULE
CP/C/B/8800/05
ENCLOSURE 6.2

Table 1 - Analysis at Station

System	Sample	Viscosity	Neut. #	% Water	Water and Sediment	Specific Gravity	Particle Count					
LT	Main Turbine Lube Oil	M	M		M		M	M	M	M	M	M
LF	FWPT (A&B) Lube Oil	M	M		M		M	M	M	M	M	M
NC	NC Pump Motor Oil (A,B,C,D)	SD	SD		SD							
NC	NC Pump Motor Oil (Spare)		2/y		2/y							
	Fuel Oil Tank Truck	PTA (T)			PTA (T)	PTA (T)	See Table 2 also; no analysis necessary if fuel is for AD diesel only					
FD	Fuel Oil Storage Tanks (A1,A2,B1,B2)						See Table 2					
	Lube Oil Tank Truck	PTA ***	Each Load ***	Each Load ***								
LD	Clean Lube Oil Storage Tank	M	M	M								
LD	Lube Oil Sump Tank	M	M	M								
AD	Fuel Oil Storage Tank	Q			Q							
AD	Oil Pan	Q	Q	Q								

Table 2 - Analysis by Consultant

System	Sample	Viscosity	Distillation Temp	Water and Sediment	Carbon Residue on 10% Residuum	Copper Strip Corrosion	Flash Point	Cloud Point	Pour Point	Ash	Sulfur	Cetane Number	Insoluble	Specific Gravity
	Fuel Oil Tank Truck		*(T)		*(T)	*(T)	*(T)	*(T)	*(T)	*(T)	*(T)	*(T)	**(T)	
FD	Fuel Oil Storage Tanks(A1,A2,B1,B2)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM *(T)	BM **(T)	BM *(T)

BM - Bi-monthly
M - Monthly
Q - Quarterly
Y - Yearly
SD - Shutdown
PTA - Prior to Addition
T - Tech Spec

* - Must be verified within 2 weeks of sampling
** - Must be verified within 1 week of sampling
*** - Viscosity must be within specification prior to addition to the tank; other analysis may be done later