

Supplement to the
EMERGENCY DIESEL GENERATOR
"AUXILIARY MODULE CONTROL
WIRING AND TERMINATION"
QUALIFICATION REVIEW

Prepared for
TDI EMERGENCY DIESEL GENERATOR
OWNERS GROUP

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Prepared

by

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SECTION 1

APPLICABILITY

This report is applicable to the TDI diesel generators utilized at the Grand Gulf Nuclear Power Station Unit No. 1 and its engine auxiliary module control wiring and terminations as part of the TDI Owners Group Design Review/Quality Revalidation effort. Diesel generators utilized at other plants will be evaluated separately. This review included identification of the specific wire/cable and termination types used for connecting auxiliary module class 1E skid-mounted devices.

This report covers Division I and Division II diesel generators. Since the wiring and terminations are identical in both divisions, all comments and recommendations made are applicable to both diesel generators.

SECTION 2

EXECUTIVE SUMMARY

An overall evaluation of all electrical cable and wire supplied with the emergency diesel generators at the Grand Gulf station was undertaken as a result of Transamerica Delaval, Inc.'s Service Information Memo (SIM) 361, Rev. 1. This memo was transmitted to MP&L reporting three improperly selected engine-mounted cables associated with the Woodward governor/actuator and the Air-Pax magnetic pickup.

A field survey was conducted of all class 1E auxiliary module wiring and terminations presently installed on the engines. Each circuit's service characteristics were identified and compared to the service ratings of the cable and termination types used. The evaluation of wiring also addressed flame retardancy of the insulation, qualification to industry standards, routing in conduit, and the need for special requirements, such as shielding.

In addition, it was verified that the specification for the Grand Gulf station's emergency diesel generator (Ref. 1) stated that control wiring shall be qualified to IEEE 383-1974.

The investigation also confirmed that qualified replacement cable was installed by MP&L in accordance with SIM 361, Rev. 1.

SECTION 3

OBJECTIVES

The objectives of this review were to evaluate the functional attributes of the electrical wiring and terminations supplied with the emergency diesel generators as detailed in the Component Design Review Task Description. Task Description details include:

1. Review of wiring insulation for compatability with circuit requirements.
2. Determine whether insulating material is known to have generic fire-retardant characteristics and is qualified to IEEE 383 or some other industry standard.
3. Review the wiring installation method for routing in order to determine the actual physical environment for each cable.
4. Evaluate any special circuit requirements to determine if special cable construction is required (i.e., shielded cable).
5. Compare the termination type, material, size, and insulation ratings with characteristics required for application.

SECTION 4

SUMMARY OF SERVICE CONDITIONS

The electrical metallic tubing (EMT) installed on the skid and supported away from the engine was considered to be at the same temperature as the maximum room ambient of 120°F (Ref. 1). The junction box, EMT, and cable which are directly attached to the engine block may be exposed to temperatures greater than 120°F. The engine block surface temperature, during full load operation, was conservatively assumed to be equal to the jacket water and lube oil maximum normal operating temperature of 180°F (82.2°C) (Ref. 2).

Electrical requirements for cables and terminations are provided in the attached Table B.

SECTION 5

METHODS OF ANALYSIS

5.1 Determination of Circuit Electrical Requirements

Each component listed in the attached Table was inspected for pertinent nameplate data. Manufacturers' catalog information was also reviewed. This review established the circuit requirements for each component and is listed in the attached Table.

5.2 Determination of Wire Insulation Rating

Each wire and cable was inspected for manufacturer's information on the insulation or jacket. An investigation was then performed for each cable to determine its insulation properties, flame retardancy, and electrical rating.

5.3 Determination of Termination Type

All terminations and terminal blocks were inspected to identify manufacturer, type, or model number. Additional design and vendor documents were utilized as required to determine the model or rating of each component.

5.4 Determination of Wiring and Termination Acceptability

The evaluation for the acceptability of cable and wire included reviews for the following:

- a. Voltage rating of the insulation system was equal to or greater than the application service voltage.
- b. The maximum allowable operating temperature of the wire was greater than the sum of the expected ambient and the expected conductor temperature rise.
- c. A review was made for qualification to IEEE 383-1974 in addition to other industry standard to determine if the insulated wire and cable installed having acceptable flame retardancy characteristics.
- d. Routing.

SECTION 6

DISCUSSION OF RESULTS

I. Termination

All existing termination components and terminal blocks are acceptable.

II. Wiring and Cables

A. Cable Ampacity and Temperature Rating

1. The starting air supply solenoid valves (1P75-SV-F507A, B and SV-F508A, B) are required to operate during engine starting only. These solenoid valves, one for each of two separate independent air supply systems, are connected to the ends of the starting air header on each diesel generator. To start the engine, starting air is admitted to the air header via the solenoid valves and, in turn, to the starting air valves for the cylinders as well as two starting air distributors. During normal operation, these solenoid valves are closed (de-energized). These solenoid valves are energized by Raychem Flamtrol wires, which are IEEE-383 qualified and of the proper service rating and size.
2. Replacement cables documented by TDI in accordance with SIM 361, Rev. 1, are acceptable for expected ampacities and temperatures. This includes the wires to the governor, Airpax tachometer relay, and the magnetic pickups.

B. Cable/Wire Routing

All cable was routed in EMT or flexible conduit, except as noted for the cable going from the engine-mounted junction box to the governor.

C. Special Considerations

Shielded cable, when required, was provided by TDI or by MP&L

D. Cable Insulation System

All wire and cable types used are of an acceptable flame-retardant construction for their application.

SECTION 7

CONCLUSIONS/RECOMMENDATIONS

A field survey was conducted to Grand Gulf Nuclear Station Unit No. 1. The results of that survey are satisfactory. All cables meet their intended function and are acceptable for the required operation.

TABLE A

Wire and Termination Material

<u>Item</u>	<u>Description</u>	<u>TDI Part No.</u>	<u>Mfr.</u>	<u>Technical Data</u>
1.	Wire 14 AWG	NIA	Raychem	Flametrol, 600 V, 90°C XLPE insulation
2.	Shielded Cable	F-509-494	BIW	Part No. 13292-H-002, 21C, 16 AWG, Shielded, 600 V, 90°C, XLPE Insulation, CSPE Jacket
3.	Cable	F-509-495	BIW	Part No. 13258-H-002, 21C, 14 AWG, 600 V, 90°C, XLPE insulation, CSPE jacket
4.	Terminal Block	F-591-114	GE	EB-25, 30 amp, 600 V
5.	Terminal Block	F-591-005	TRW	Cinch Jones series 14/1,100 V, 20 amps
6.	Terminal Lug	NIA	Amp	Nuclear PIDC pre-insulated ring tongue lug
7.	Connector Plug	Part of 74033-120	Amphanol	MS3108A-18-/S 10 pin circular connector 1,750 V dc, 22 amps connector 1,750 V dc, 22 amps

TABLE B

EMERGENCY DIESEL GENERATOR AUXILIARY MODULE COMPONENT LIST

<u>Description</u>	<u>TDI Part No.</u>	<u>Circuit Requirements</u>	<u>Wire/Cable Type</u> (see Table A)	<u>Terminal Type</u>	<u>Comments</u>	<u>References</u>
Starting Air Solenoid Circle Seal Controls Part No. SV13532P4PE (1P75-SV-F507A,B, 508A, B)	Part of KR-001-000	115 V dc, .6 amps max. Class H coil	1	4, 5, 6	Item 1 is IEEE-383 qualified	4, 8
Woodward Governor Actuator model EGB35	74033-120	Transducer coil 0-.75 V	3	4, 6, 7	Item 3 is IEEE-383 qualified	7, 9
Air Pax Magnetic Pickup	EA-002-000	Output Signal Average 50 V P-P	2	4, 5, 6	Item 2 is IEEE-383 qualified	7, 9

REFERENCES

1. Bechtel Specification No. 9645-M-018.0 Rev. 22, dated 4-23-82, titled "Design Specification for Standby Diesel Generators for Mississippi Power & Light Co."
2. Transamerica Delaval Instruction Manual Volume I, Document Identification No. 9645-M-018.0-Q1P75E001A-4.0-4-I.
3. Transamerica Delaval Parts Manual Volume II, Document Identification No. 9645-M-180.0-QS-2.0-2-D.
4. Transamerica Delaval Associated Publication Manual Volume III, Books 1 and 2, Document Identification No. 9645-M-018.0-Q1P75E001A-4.04-I.
5. TDI Drawing No. 09-688-74033 Rev. L, titled "Engine and Auxiliary Skid Wiring Schematic."
6. TDI Drawing No. 09-500-74033 Rev. M, titled "Control Panel Schematic" (8 sheets).
7. TDI SIM 361 Rev. 1, date Nov. 4, 1982
8. Raychem Flametrol IEEE383 Test Report No. FIRJ (F-C4033-1).
9. Boston Insulated Wire and Cable Co., Report No. B916, dated April 1980.

APPENDIX TASK DESCRIPTION

COMPONENT DESIGN REVIEW: DR-03-688B-1

DR-03-688B

Wiring and Termination
Part No. 03-688B

Classification A
Completion 3/9/84

PRIMARY FUNCTION:

The wiring and terminations interconnect instrument, control, and power circuits on diesel generator itself and within the control panels.

FUNCTIONAL ATTRIBUTES:

1. Conductors, insulation, and termination must be suitable for specified amp rating.
2. Conductors and insulation must be flame retardant.
3. Material and insulation rating should be appropriate for engine and generator applications.

SPECIFIED STANDARDS: IEEE 383

EVALUATION:

1. Review wiring insulation for compatibility with circuit requirements:
2. Flame-retardant insulation:
 - a. Determine whether insulation is qualified to IEEE 383, UL, or some other industry standard
 - b. Determine whether insulation is a material known to have generic fire-retardant characteristics
 - c. Determine whether wiring need be installed in individual conduit to minimize insulation damage
3. Evaluate any special circuit requirements, such as shielded cable:
4. Compare termination type, material, size, and insulation ratings with characteristics required for application:

REVIEW TDI ANALYSES: Review, if available.

INFORMATION REQUIRED:

1. Cable type test reports or other approved qualification method for each cable type supplied with the engine: