

SUPPLEMENT TO THE
EMERGENCY DIESEL GENERATOR
AUXILIARY MODULE CONTROL
WIRING AND TERMINATION
QUALIFICATION REVIEW

Prepared for
TDI EMERGENCY DIESEL GENERATOR
OWNERS GROUP

Prepared
by
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SECTION 1
APPLICABILITY

This report is applicable to the TDI diesel generators (and the engine auxiliary module control wiring and terminations) utilized at the Commanche Peak Nuclear Power Station Unit 1. 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.

SECTION 2

EXECUTIVE SUMMARY

An overall evaluation of all electrical cable and wire supplied with the emergency diesel generators at Commanche Peak Nuclear Power Station site was undertaken as a result of Transamerica Delaval, Inc.'s Service Information Memo (SIM) 361, Rev. 1. This memo notified Texas Utilities Service Incorporated of two potentially defective 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.

Additionally, surveyed wire and cable was reviewed for qualification to IEEE Standard 383-1974. The result of this investigation is that all functional attributes of wiring and termination are acceptable.

SECTION 3

OBJECTIVES

The objective of this review was 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. The wiring and terminations considered were those shown on Reference and 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 rigid galvanized steel installed on the skid and supported away from the engine was considered to be at the same temperature as the maximum room ambient of 122°F (see Reference No. 1). The junction box, conduit, and cable which are directly attached to the engine block may be exposed to temperatures greater than 122°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) (see Reference No. 9).

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

SECTION 5
METHODS OF ANALYSIS

5.1 Determination of Circuit Electrical Requirements

Each component listed in Table B was inspected for pertinent nameplate data. Manufacturers' catalog information contained in Reference No. 10 was also reviewed. This review established the circuit requirements for each component and is listed in Table B.

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. These results are listed in Table A.

5.3 Determination of Termination Type

All terminations and terminal blocks were inspected to identify manufacturers, type, or model number. Additional design and vendor documents were utilized as required to determine the model or rating of each component. This information is listed in Table A. A comparison was made to the circuit requirements in Table B.

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 standards, to determine if the insulated wire and cable installed have acceptable flame retardancy characteristics.
- d. Routing.

SECTION 6

DISCUSSION OF RESULTS

I. Termination

All termination components and terminal blocks are acceptable, as demonstrated in Tables A and B.

II. Wiring and Cables

A. Cable Ampacity and Temperature Rating

1. TU's diesel generator specification (see Ref.No. 1) requires that all control cable be qualified to IEEE-383. The equipment qualification group provided the qualification documents to demonstrate that the installed wire is acceptable.
2. Implementation of TDI Service Information Memo No. 361 was reviewed. TDI concurred to use Rockbestos Firewall III Cable (Ref. 6 and 7) vs the TDI replacement cable described in the SIM. The field-supplied replacement cables have been installed satisfactorily to both the magnetic pick-ups and the governor/actuators.
3. All other wiring in Table B has a rating of 90°C, and associated components operate either intermittently or draw currents which do not appreciably affect conductor temperature rise.

B. Cable/Wire Routing

All cable was routed in rigid galvanized steel or flexible conduit.

C. Special Considerations

Shielded cable, when required, was provided by TDI or the field, Reference Table A, item 2.

D. Cable Insulation System

All wire and cable types used are of an acceptable flame-retardant construction for their application. All wire and cable used is qualified to IEEE 383-1974 (see Table B).

SECTION 7

CONCLUSIONS/RECOMMENDATIONS

As a result of the field survey and evaluation of the Class IE electrical components of the Commanche Peak Nuclear Power Station emergency diesel generators, all functional attributes of this component design review are satisfied and, therefore, the electrical wires and terminations are satisfactory for their intended use.

TABLE A

Emergency Diesel Generator Auxiliary Module Control Wiring
and Termination Material List

<u>Item</u>	<u>Description</u>	<u>TDI Part No.</u>	<u>Manufacturer</u>	<u>Technical Data</u>
1	14 AWG SIS Wire	F-509-337	Raychem	600V, 90°C XL PE insulation Flame-trol
2	Cable	N/A	Rockbestos	TU's Mark No. W-()65 () = 1 or 2 where 1 = orange colored jacket, 2 = green colored jacket 16 AWG, 600V, 1 twisted shielded pair, 90°C, XLPE insulation, CSPE jacket.
3	Cable	N/A	Rockbestos	TU's Mark No. W-1 () 66, 1 twist pair 16 AWG, 600V, 90°C, XLPE insulation CSPE jacket.
4	Terminal Block	F-591-114	GE	Cat No. EB-25, 30 amps, 600V.
5	Terminal Block	F-591-005	TRW	Clinch Joens Series 141 1100V, 20 amps.
6	Terminal Lug	N/A	AMP	Nuclear PIDG terminal, preinsulated ring tongue lug, 150°C.
7	Connector Plug	Part of	Amphano1	MS3108A-18-1S 97 Series standard circular 76001-104 connector 1750VDC, 1250 VAC, 22 amps.

APPENDIX A - TASK DESCRIPTION

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

Wiring and Termination
Part No. 03-688B

Classification A
Completion

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 of 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:

APPENDIX B - REFERENCES

1. Gibbs & Hill, Inc., Diesel Generator Sets Specification 2323-MS-34, Revision 1, April 8, 1976.
2. Gibbs & Hill, Inc., "600V Instrument Cable and Thermocouple Extension Wire," Specification 2323-ES-13C.
3. TDI Drawing No. 09-688-76001 Sh. 1-3, Rev. H, Engine & Auxiliary Skid Electrical Diagram & Schematic.
4. TDI Report No. 76001-709, "Nuclear Environmental Qualification Report of Engine Control Panel and Accessories" (or Wyle Lab Report No. 58401, Rev. 1, April 1982).
5. TDI Service Information Memo (SIM) 361, Subject: IE Nuclear Qualified Cable, dated October 21, 1982.
6. TWX #14.009, from: M. R. McRay (TU) to: Steve Schumacker (TDI) dated November 29, 1982, Subject TUSI S/N 76001/04.
7. TWX #9108908660 from: S.C. Schumacker to: M.R. McRay dated November 30, 1982, Subject: TUSI S/N 76001/04.
8. TDI Parts Manual 7220-M18-376-2.
9. TDI Instruction Manual 7220-M18-373-5.
10. TDI Associated Publication Manual 7220-M18-375-5.
11. Texas Utilities Construction Operation Traveler No's EE83-0097-2904 and EE83-0098-2094.
12. TDI Drawing No. 09-500-76001, sh. 3 of 8, Rev. T.
13. Rockbestos Report No. QR-1806, Rev. 1 dated 10/8/81, "Qualification of Firewall III Class IE Electrical Cable".

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>Termination Type</u>	<u>Comments</u>	<u>References</u>
Starting Air Solenoid Circle Seal Controls Part No. SV13532P4PE	88339-107	115 VDC, .6 amps max.	1	4, 5, 6	Item 1 is IEEE-383 qualified	4
Woodward Governor Actuator model EGB35C	76001-104	Transducer coil 0-.75 volts	3	4, 6, 7	Item 3 is IEEE-383 qualified	13
Air Pax Magnetic Pick-Up	EA-002-000	Output Signal Average 50 volts P-P	2	4, 5, 6	Item 2 is IEEE-383 qualified	13