



Buchanan Nuclear Qualified Terminal Blocks



SEISMIC AND RADIATION TESTED

There has been increasing interest among nuclear power plant designers and builders in electrical components complying with IEEE Standards 323, 344, 383. To meet these requirements, Buchanan has introduced a series of one-piece terminal blocks which have demonstrated compliance with these standards, among others.

In addition to satisfying the guidelines included in those IEEE Standards, these blocks were successfully tested to applicable LOCA (Loss-of-Coolant Accident) parameters, and can be supplied with documentation in accordance with

Nuclear Regulatory Commission Regulations 10CFR21 and 10CFR50.

Both strap screw and tubular screw contact styles are included, with nickel-plated non-ferrous (brass or copper) contact material used throughout.

The following pages present a summary of the test program, which was conducted by the Franklin Research Center of Philadelphia, Pennsylvania. The complete report is available for purchase under Part Number CTP-NQ-51171 from Thomas & Betts, Memphis, TN.

TEST PROCEDURE

A total of three samples each of 6- and 12-circuit one-piece blocks molded of Durez Grade 152 phenolic compound. The blocks were mounted in a Hoffman NEMA-4 sheet metal enclosure and connected with 12 AWG EPR insulated wire.

Before aging, an insulation resistance test was performed to establish reference values.

Thermal Aging

The test specimens were thermally aged to simulate a 40 year life @ 50°C. This was 39.6 days at 165°C (329°F) for the Durez 152. These parameters were calculated from an Arrhenius regression line, using the activation energy of the material.

Radiation Aging

The specimens were then subjected to irradiation, using a 200 Mrad gamma level at .56 Mrad/hr. from a flat array of Cobalt 60 pencils.

Following these two tests, another set of contact resistance and insulation resistance tests were performed. There was no significant change from the original test results.

Vibration Aging

One sample of each block was first tested to simulate normal environmental aging. They were subjected to accelerations of 0.05 to 1.18g over a span from 3 to 60Hz for a total duration

of 450 minutes. Following this, they were again checked for contact and insulation resistance, with no appreciable change from the initial values.

Seismic Tests

Another set of the specimen blocks (one each) was submitted to a seismic fragility test to determine whether the proposed seismic test levels would be too severe. The samples survived the maximum amplitude levels satisfactorily, and no further fragility tests were conducted.

The blocks which had been vibration aged were then subjected to two series of seismic vibration tests, five Operating Base Earthquake (OBE) levels and one Safe Shutdown Earthquake (SSE) level. The OBE tests were conducted at 6g maximum for 30 seconds dwell each, while the SSE tests were performed at 8g maximum at 30 seconds dwell. Both test series were conducted at frequency levels from 1 to 40 Hz.

The samples were then rotated 90° and the tests repeated, including the OBE and SSE dwells. Two more 90° rotations and tests followed, so that each sample was exposed to five OBE dwells and one SSE dwell in each of four orientations. The seismic response level is shown in Figure 1.

Following the seismic test series, the specimen blocks were subjected to contact resistance and high potential withstand tests, with no significant changes from the initial results being recorded.

LOCA Tests

All test blocks finally underwent a seven day steam/chemical-spray exposure test, to simulate a Loss of Cooling Accident (LOCA). This included two rapid rises to 346°F (174°C) and 113 lbf/in² (779 kPa). The temperature/pressure profile is shown in Figure 2.

Conclusion

Final insulation resistance, high potential, and wire retention tests were again conducted at the conclusion of the test program. These final tests, along with the checks during seismic and LOCA testing confirm that insulation integrity and electrical conductivity were maintained, as well as satisfactory pull-out forces required to remove the conductor from the terminal block.

Based on these results, we believe that the products tested comply fully with all applicable portions of IEEE Standards 323, 344, and 383.

ONE-PIECE BLOCKS

Contact: Nickel-plated brass (strap screw)

Nickel-plated copper (tubular clamp)

Screw: Nickel-plated brass

Insulator: Durez Grade 152, brown, rated UL94V-0

Cover and Marking Strip: NEMA Grade G7 silicone laminate, grey-white.

Marking: Traceability code is stamped on the base of each block.

Catalog No.	No. of Circuits	Contact Type	Wire Range	Voltage Rating
NQB102	2	Strap Screw	#18 - #8 AWG	600V
NQB102S	2	Tubular Clamp	#14 - #6 AWG	600V
NQB104	4	Strap Screw	#18 - #8 AWG	600V
NQB104S	4	Tubular Clamp	#14 - #6 AWG	600V
NQB106	6	Strap Screw	#18 - #8 AWG	600V
NQB106S	6	Tubular Clamp	#14 - #6 AWG	600V
NQB108	8	Strap Screw	#18 - #8 AWG	600V
NQB108S	8	Tubular Clamp	#14 - #6 AWG	600V
NQB112	12	Strap Screw	#18 - #8 AWG	600V
NQB112S	12	Tubular Clamp	#14 - #6 AWG	600V

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