NIAGARA MOHAWK

CENTRAL FILES

NIAGARA MOHAWK POWER CORPORATION/300 ERIE BOULEVARD WEST, SYRACUSE, N.Y. 13202/TELEPHONE (315) 474-1511

June 11, 1979

Mr. Boyce H. Grier
Director
U. S. Nuclear Regulatory Commission
Region 1
631 Park Avenue
King of Prussia, PA 19406

Dear Mr. Grier:

Re: Docket No. 50-220
I. E. Bulletin 79-01

Your February 8, 1979 I. E. Bulletin 79-01 addresses environmental qualification of electrical components.

The attached response discusses the environmental qualification of electrical equipment which is required to operate to mitigate loss of coolant accidents. The response concludes that required electrical equipment inside containment is qualified for loss of coolant accident environments.

Niagara Mohawk is further investigating qualifications of safety-related electrical equipment outside containment. The results of this investigation will be reported to the Nuclear Regulatory Commission by July 11, 1979. That response will include information to respond to I. E. Bulletin 79-01A dated June 6, 1979.

Very truly yours,
NIAGARA MOHAWK POWER CORPORATION

R. R. Schneider
Vice President
Electric Production

Attachment See Rpt Jacket

002
CCP

Xc: NRC Office of Inspection and Enforcement
Washington, D. C. 20555

~~7907300~~
7907300148

Ltr 6-11-79
50-220

7907300148

The following information is provided to respond to I.E. Bulletin 79-01. Each item below corresponds to the item identified in the Bulletin.

1. Complete the re-review program described in I.E. Circular 78-08 within 120 days of receipt of this Bulletin.

   78-08-1 - Niagara Mohawk responded on April 3, 1978 to I.E. Bulletin 77-05 which discusses electrical connector equipment qualification. Further information regarding the electrical connectors was provided on March 7, 1979 and April 18, 1979. A test was performed at Franklin Institute to ensure that the connectors would operate during a postulated loss of coolant accident. The connectors required to mitigate accidents satisfactorily passed the test. The test results and test plan were submitted to the Nuclear Regulatory Commission on April 3, 1978.

   On November 28, 1977, Niagara Mohawk responded to I.E. Bulletin 77-05A which discusses electrical connector qualification outside containment. Since the type of electrical connectors used outside containment are the same as those used inside, these connectors are acceptable. The environmental conditions expected outside containment are less severe.

   78-08-2 - I.E. Bulletin 77-06 addressed equipment qualification of General Electric Series 100 penetrations. Our November 30, 1977 letter to the Nuclear Regulatory Commission stated that Nine Mile Point Unit 1 does not utilize Series 100 penetrations. Additionally, our penetration nozzles are carbon steel and welded to the containment liner. A viton "O" ring is used to seal each penetration flange to the nozzle. The flange is secured with bolts to the nozzle. The penetration viton "O" rings will accept the post loss of coolant accident environment. Viton "O" rings were qualified in a simulated loss of coolant accident performed for the electrical connectors discussed in Item 78-08-1 above.

   78-08-3 - I.E. Bulletin 78-02 described unprotected terminal boards which were inadequate for post accident environmental conditions. Our Feb. 6, 1978 letter indicated that Unit 1 does not utilize unprotected terminal boards inside containment. Terminal boards are installed in NEMA Class 12 enclosures for the Main Steam Isolation Valves and the Electromatic Relief Valves.

   An unprotected CR 151 terminal successfully passed a loss of coolant accident environment which is comparable to the Unit 1 conditions. The results of the tests showed that the insulation resistance dropped, but remained at a sufficient level to assure continued function of electrical equipment without circuit overload. The construction of the EB-5 terminal boards in use at Nine Mile Point Unit 1 is equal to or better than the General Electric CR 151 terminal board. The Unit 1 terminal blocks are located in NEMA 12 enclosures which provide additional protection. Therefore, the EB-5 terminal boards are acceptable for the Unit 1 post loss of coolant accident environment.

RETURN TO REACTOR DOCKET FILES

78-08-4 - Nine Mile Point Unit 1 uses NAMCO limit switches (position switches SL3 C58 TW). Our July 29, 1975 letter to the Nuclear Regulatory Commission discusses the environmental qualification of similar limit switches. The report indicates that the installed limit switches are capable of withstanding post accident environmental steam conditions.

78-08-5 - Nine Mile Point Unit 1 does not use cable splices for electrical penetration assemblies.

78-08-6 - Other Components

a. Radiation and temperature effects on electrical cable - General Electric Vulkene Cable used for safety related systems which are required to mitigate accidents have been environmentally qualified for conditions inside containment. The electrical connector post accident environmental test discussed in item 1 above provides documentation. Since conditions inside containment are more severe than outside, Vulkene cabling is environmentally qualified for all applications at Nine Mile Point Unit 1.

b. Adequacy of separate versus sequential testing of environmental parameters - We have reviewed applicable information for Sandia Laboratory testing. The testing performed by these laboratories indicates that both cable and electrical connectors are not significantly affected by either separate or sequential testing. Also, IEEE 323-1974 indicates that either method is acceptable. Niagara Mohawk is not aware of information which may suggest that either type of test is inadequate.

   Niagara Mohawk used a combined sequential and separate type test for the electrical connectors. The electrical connectors were exposed to radiation separately. Then a sequential loss of coolant accident exposure was performed. This included a combined steam, and humidity environment, with the connectors being energized at various times during the accident. Further information was provided to the Nuclear Regulatory Commission in our test report which was submitted by letter dated April 3, 1978.

c. Temperature limitations on nylon components of solenoid valves - Nylon components are not used within containment. The equipment investigated included instrumentation cable, solenoids and electromagnetic relief valves.

d. Qualification of Electrical Transmitters - No transmitters are installed inside containment. During the 1979 refueling outage a new analog trip system was installed. The qualification of this equipment was discussed in our letter dated March 27, 1979 to the Nuclear Regulatory Commission. Also, the Containment Atmosphere Dilution system transmitters outside containment have been qualified to IEEE 323. These transmitters are required to mitigate accidents.

2. Determine if the types of stem mounted limit switches described above are being used or planned for use on safety-related valves which are located inside containment at your facility. If so, provide a written report to the NRC within the time frame specified and to the address specified in Item 4 below.

   Nine Mile Point Unit 1 uses qualified NAMCO limit switches as discussed in 79-01-1 above. NAMCO limit switch models SL-2-C-11, S3CML, SAI-31, SAI-32, D1200, EA-700 and ES-770 are not used in safety-related valves inside containment.

3. Provide written evidence of the qualification of electrical equipment required to function under accident conditions. For those items not having complete qualification data available for review, identify your plans for determining qualification, either by testing or engineering analysis, or combination of these, or by replacement with qualified equipment. Include your schedule for completing these actions and your justification for continued operation.

   The attached information is provided to document qualification of electrical equipment. The information shows that electrical equipment inside containment required to mitigate loss of coolant accidents is qualified for the service environment. Additional information will be provided as discussed in Response 4 below.

4. Report any items which are identified as not meeting qualification requirements for service intended to the Director, Division of Operating Reactors, Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, Washington, D.C. 20555 with a copy to the appropriate NRC Regional Office within 24 hours of identification. If plant operation is to continue <u>following identification</u>, provide justification for such operation. Provide a detailed written report within 14 days of identification to NRR, with a copy to the appropriate NRC Regional Office.

   At this stage in our review, we have not identified any components that do not meet the qualification requirements for the service intended. Niagara Mohawk is continuing to investigate qualifications of safety related electrical equipment outside containment. The results of this investigation will be reported to the Nuclear Regulatory Commission by July 11, 1979. However, due to the less severe environment outside containment, no inadequacies are expected. If some items do not meet environmental qualification requirements, we will identify these in accordance with Request 4 above.

QUALIFICATION OF EQUIPMENT REQUIRED TO MITIGATE
LOSS OF COOLANT ACCIDENTS INSIDE NINE MILE POINT UNIT 1 PRIMARY CONTAINMENT

Equipment	Component Description	Environmental Conditions	Environmental Qualifications
Electrical Connectors	D. G. O'Brien 19 pin #16 5 pin #16 4 pin # 8 28 pin #16	See letter dated 3/07/79 from D. P. Dise to T. Ippolito	See letters dated 4/03/79 and 4/18/79 to T. Ippolito from D. P. Dise
Terminal Blocks	General Electric EB-5	Same as above	See letter dated January 31, 1978 T. Collopy to W. P. Nowicki
Limit Switches	NAMCO SL3 C58TW	Same as above	See letter dated 7/29/75 from G. K. Rhode to B. C. Rusche
Cable Splices	Not applicable to Nine Mile Point Unit 1		
Cabling	General Electric Vulkene	Same as above	Qualified as part of the electrical connector test, see letters dated 4/03/78 and 4/18/79 from D. P. Dise to T. Ippolito
Valve Operators	Limitorque SMB-0 SMB-00 SMB-000 SMB-000-2 SMB-3 SMB-2 SB-4	Same as above	See attached Test Report "Test of Limitorque Valve Operator to meet general requirements of an Electric Valve Actuation in Nuclear Reactor Containment Environment"
Relief Valves	Dresser	Same as above	See attached letter dated 5/16/68 C. S. Darrow to W. A. Rumberger

REFILE 11-II.C.4.3

CR. M-610.

GENERAL ELECTRIC COMPANY

NUCLEAR ENERGY DIVISION

175 CURTNER AVE., SAN JOSE, CALIF. 95125 . . AREA CODE 408, TEL. 297-3000, TWX NO. 910-338-0116

Letter No. NM-1306

May 16, 1968

Mr. W. A. Rumberger
Niagara Mohawk Power Corp.
535 Washington Street
Buffalo, New York

Reference: Nine Mile Point Project

Subject: Electromatic Relief Valve Actuator Environmental Test

Dear Mr. Rumberger:

The subject test has been completed. The actuator was operated every five minutes for ten hours in sixty-two psig saturated steam. The condition of the actuator box showed very definite evidence of the environment. The lead wires to the valve were vulkene, similar to that used in the drywell, and no wire deterioration was noted.

A retype of the report follows:

Introduction

The actuator of the Dresser Electromatic Relief Valve must operate in saturated steam under accident conditions in the drywell. The actuator consists of a double coil solenoid (made by G.E.) mounted on a base plate and covered with a sheet metal box. The base plate has holes for the solenoid plunger and conduit connector. There are two micro-switches mounted on the solenoid frame to indicate that the solenoid has actuated.

Conclusions

(1) The actuator which was tested performed satisfactorily in 62 psi saturated steam for a ten hour duration.

(2) The actuator will produce the required force with the supply voltage at 105 V D.C.

GENERAL ELECTRIC

Recommendations

The soft rubber gasket between the solenoid and the base plate should be removed from those actuators shipped to the field. It serves no useful purpose and may prevent the plunger return, thereby holding the relief valve open. The actuator tested did not have a gasket.

Procedure

The actuator was placed on a stand with a hydraulic cylinder (extended) under the plunger, in an autoclave. The hydraulic cylinder was connected through the wall of the autoclave to another hydraulic cylinder (retracted) which had a 58 lb. weight to test the actuating force of the solenoid. The microswitches were connected through the wall of the autoclave, with a power source with separate indicator lights to test their reliability. One hundred and twenty five volt D.C. power was also connected through the autoclave wall with the necessary switchgear to actuate the solenoid.

After the autoclave was pressurized to 62 psig saturated steam the solenoid was energized for a one minute period in each five minutes, through a ten hour duration.

A test was also run to see what the lower voltage was which would actuate and successfully lift the required load. This was done by lowering the DC voltage to the coil until it could not lift the required weight.

Yours very truly,

C. S. Darrow

C. S. Darrow
Project Manager
Nine Mile Project

CSD:da

cc: R. S. Eggleston

RECEIVED
NUCLEAR ENGINEERING SECTION
MAY 27 1968
NIAGARA MOHAWK POWER CORP.

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY ..... 3532 JAMES STREET, P.O. BOX 4841
SYRACUSE, NEW YORK 13221, Phone (315) 456-7321

INSTALLATION AND
SERVICE
ENGINEERING
DIVISION

G-EA1-8-11

CC: NIAGARA MOHAWK POWER CORP.

T. J. Perkins, NMP 1
T. E. Lempges, NMP 1
C. V. Mangan, Syracuse

GENERAL ELECTRIC COMPANY

P. A. Ahearn, Syracuse
T. R. Augello, San Jose
J. W. Shaver, NMP 1

Subject: Electrical Terminal Block Testing

January 31, 1978

Mr. W. Nowicki
Niagara Mohawk Power Corporation
300 Erie Boulevard, West
Syracuse, New York 13093

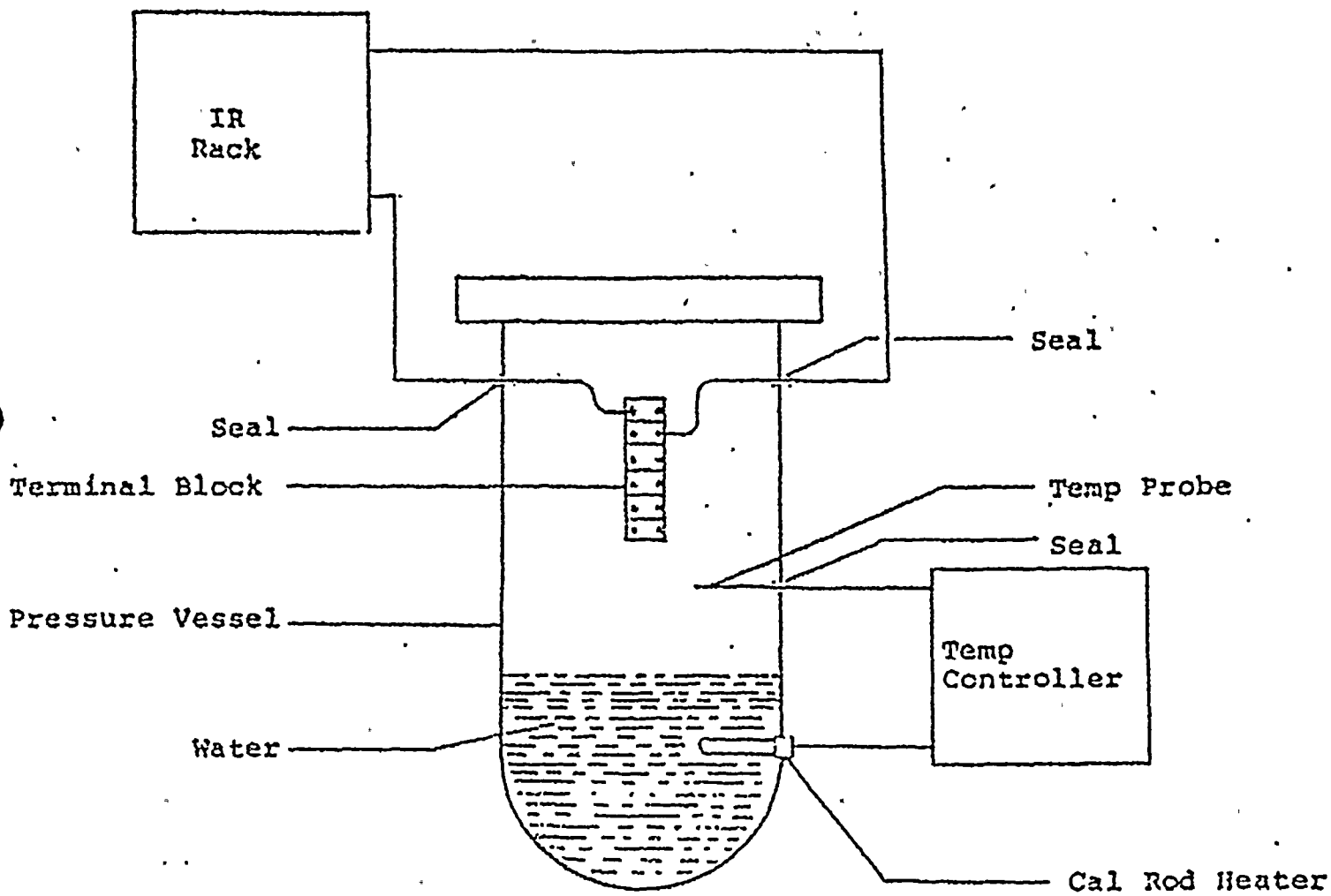
Dear Bill:

Several utilities have recently made inquiries on the qualification tests run by General Electric Company on electrical terminal blocks. The interest stems from laboratory tests conducted at Franklin Institute on two types of terminals. These are Marathon model number M6012 and Westinghouse model number 542247. The equipment was evaluated for performance when exposed to pressure, temperature and humidity conditions resulting from a Loss of Coolant Accident. The test was performed on unprotected terminal blocks defined as not installed in sealed or vented metal enclosures. The Marathon terminal block failed to survive the twenty-four hour test duration while the Westinghouse terminal block passed the test.

Part of the General Electric electrical penetration qualification testing program, recently reviewed by the NRC during a quality audit, was to evaluate the effect of the high temperature, pressure and humidity experienced during a LOCA on terminal blocks. The types of terminal blocks tested were GE type CR151 and States Company type NT. These were selected for testing since they are used in some power and control applications that could potentially be utilized in safety circuits which would be required to function in a LOCA environment. Terminal blocks for thermocouples were not included since these are not required to function during a LOCA.

The test was conducted with two adjacent terminals of each terminal block connected to an IR rack with #16AWG wire passing through two sealed ports in the pressure vessel. (See Test Circuit Diagram attached)

TEST CIRCUIT DIAGRAM



The insulation resistance was measured between the two terminals with 500 vdc power supply at ambient condition. The terminal blocks were then subjected to the LOCA condition, as shown in Table 1. The insulation resistance was recorded at least once a day and at each significant temperature condition during the test. After completion of the ten-day test, the cover was removed and the vessel was left open for 36 hours before final insulation resistance measurements were recorded.

Table 1

Temperature °F	260	320	340	320	260
Pressure PSIG	21	75	103	75	21
Relative Humidity	100	100	100	100	100
Duration	1.5 days	1.5 hrs	3 hrs	4.5 hrs	8 days

The results of this test showed that the insulation resistance dropped but remained at a sufficient level to assure the continued function of electrical equipment without circuit overload. Once the steam environment was removed, the terminal block insulation resistance recovered almost fully to pretest values. Each type showed no deterioration after testing except for some slight discoloration of the phenolic material.

It should be noted that while this test was evaluated for unprotected terminal blocks, the terminal blocks provided with General Electric penetrations are mounted in sealed boxes mounted on the penetration thus making the test more conservative than the actual field application of the equipment.

If any questions arise as a result of this information, please contact me.

Sincerely,

Tom Collopy

T. Collopy, Service Manager
Mechanical & Nuclear Service
Installation & Service Engineering
EMPIRE DISTRICT

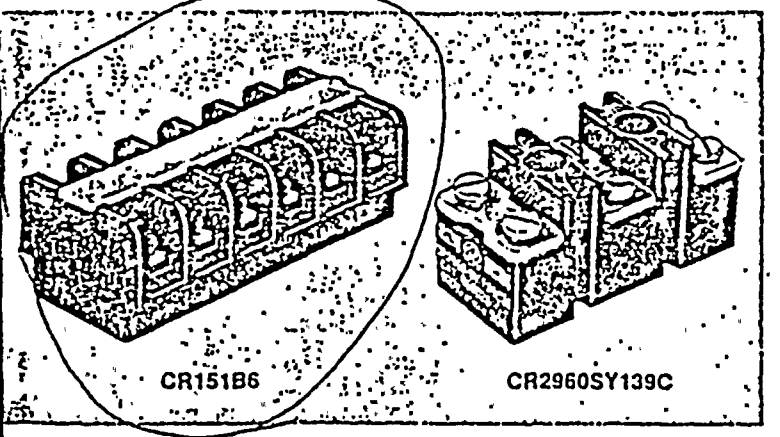
js

D-5, D-5G, D-5H, D-5K

ONE-PIECE TERMINAL BOARDS

600 Volts Max

CR151B
CR2960SY



APPLICATION

MOLDED TERMINAL BOARDS FOR CONTROL CIRCUITS

CR151 Type B 30-ampere

These molded terminal boards are for use in wiring of control panels. They are available with 4, 6, or 12 points and the terminals accommodate wire up to No. 10.

A new write-on marking strip markable with ink or pencil is included. Terminal boards may be mounted end-to-end without spacing.

MOLDED TERMINAL BOARDS FOR POWER CIRCUITS

CR2960 50-, 100-, 150-amperes

These heavy-duty terminal boards are for use in primary or power circuits up to the amp rating listed. Blocks have binding screws for both incoming and outgoing lines.

FEATURES

CR151 TYPE B TERMINAL BOARDS

- Rated 30-amperes, 600-volts for control circuits.
- Available with 4-, 6-, and 12-points.
- Screws, captive saddle-clamp, or washer head screw terminals on one side, clamp terminals on the other.
- Terminals accept wires through size #10.
- Write-on marking strips, 15-32-in. wide, provided with boards.

CR2960 TERMINAL BOARDS

- Power circuit boards rated 50-, 100-, and 150-amperes at 600-volts; available with 3 points per board.
- All types have screw terminals.

ORDERING DIRECTIONS

Order one piece terminal boards by complete catalog number. Example: six-point one-piece boards are required, rated 30 amps, 600 volts with screw-type terminals both sides: order 10 CR151B6 @ $24.00/pkg 10.

PRICING INFORMATION

Molded Terminal Boards For Control Circuits—30-Ampere

No. of Points (Circuits) Per Board①	Screw Type Both Sides② Catalog Number	List Price, GO-10G	Screw Type One Side, Saddle Clamp Other Side② Catalog Number	List Price, GO-10G	Saddle Clamp Both Sides② Catalog Number	List Price, GO-10G	Washer Head Screw, Both Sides② Catalog Number	List Price, GO-10G
4	CR151 B4	$16.00/Pkg.	CR151 B45	$21.00/Pkg.	CR151 B46	$24.00/Pkg.	CR151 B40	$14.00/Pkg.
6	B6	24.00/Pkg.	B65	27.00/Pkg.	B66	30.00/Pkg.	B60	21.60/Pkg.
12	B2	43.00/Pkg.	B25	50.00/Pkg.	B26	56.00/Pkg.	B20	39.00/Pkg.

Molded Terminal Boards For Power Circuits—50-, 100-, 150-Ampere

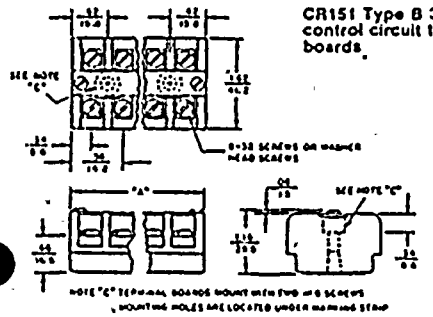
No. of Points (Circuits) Per Board①	Amp Rating	Catalog Number	List Price, GO-10G
3	50	CR2960 SY139C3B	$ 6.70
3	100	SY139C3C	8.50
3	150	SY139C3D	10.50

REFERENCE: Descriptive bulletin GEA-7317
Cross reference GEZ-6080

① Where number of circuits desired is not listed use combination of boards.
② Catalog number represents one piece. Sold only in packages of 10. Order in multiples of 10 pieces.

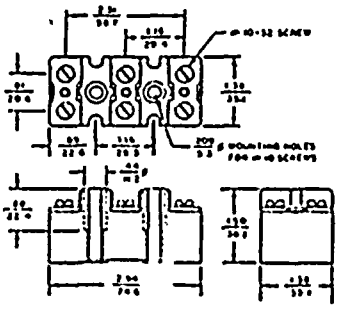
DUAL DIMENSIONS—INCHES/MILLIMETERS AND WEIGHTS (For Estimating Only)

CR151 Type B 30-ampere control circuit terminal boards

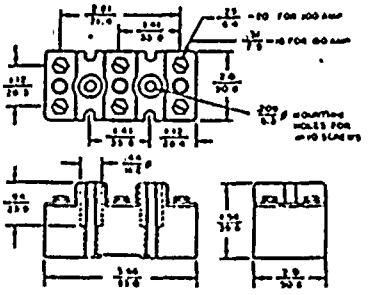


No. Points on Board	A (Length) In.	A (Length) Mm.	Between Centers of Mounting Holes In.	Between Centers of Mounting Holes Mm.	Shipping Wt. Lbs per pkg 10
4	2 38	60 4	1 12	28 5	2
6	3 50	88 9	2 25	57 2	3
12	6 88	174 8	5 62	142 8	6

CR2960 50-ampere power circuit terminal boards



CR2960 100-, 150-ampere power circuit terminal boards



Type EB-5 and EB-6 Fabricated Terminal Boards

Rating: 30 amperes continuous, 600 volts

APPLICATION

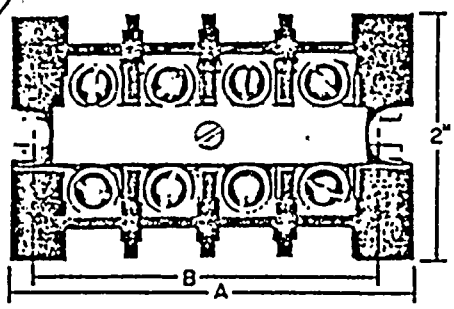
Where leads are brought to any part for permanent or temporary connection, especially if many wires are involved.

DESCRIPTION

The Type EB-5 are fabricated terminal boards. Each is equipped with the necessary washer head binding screws for circuit wire connections, and also a white marking strip for circuit identification (see notes a and b below). To mount, drill for No. 10 screw. Board will accommodate wires size No. 18 to No. 10 inclusive.

The Type EB-6 are fabricated terminal boards of the same construction and dimensions as the Type EB-5, except that clamp type connectors are furnished for circuit wire connections. Boards will accommodate wires No. 18 to No. 10 inclusive.

Boards with short-circuit strips are available with 2 to 12 points; without short-circuit strips from 2 to 18 points.



(Photo 8020488)

Fig. 1. 4-pole board Type EB-5 without short-circuit strips, Cat. 6422482G4

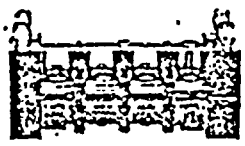
PRICING INFORMATION

No. of Circuits	Board Without Cover: Catalog No.	Marking Strip: W	Marking Strip: B	Marking Strip: B&W	Net Price Ea.	50 or More	Board With Cover: Catalog No.	Marking Strip: W	Marking Strip: B	Marking Strip: B&W	Net Price Ea.	50 or More	Approx Ship. Wt in Lb Each	Dimensions in Inches Fig. 1, 2 and 3: A	B
EB-5 WITH WASHER-HEAD SCREWS (FIG. 1)															
2	6422482	G2	G202	G402	Refer to nearest General Electric Sales Office		6422494	G2	G202	G402	Refer to nearest General Electric Sales Office		¾	2	1⅝
3	6422482	G3	G203	G403			6422494	G3	G203	G403			¾	2⅝	2¼
4	6422482	G4+	G204	G404			6422494	G4+	G204	G404			¾	3¼	2⅞
5	6422482	G5	G205	G405			6422494	G5	G205	G405			¾	3⅞	3½
6	6422482	G6+	G206	G406			6422494	G6+	G206	G406			1	4½	4⅛
7	6422482	G7	G207	G407			6422494	G7	G207	G407			1	5⅛	4¾
8	6422482	G8+	G208	G408			6422494	G8+	G208	G408			1	5¾	5⅜
9	6422482	G9	G209	G409			6422494	G9	G209	G409			1½	6⅜	6
10	6422482	G10	G210	G410			6422494	G10	G210	G410			1½	7	6⅝
11	6422482	G11	G211	G411			6422494	G11	G211	G411			1½	7⅝	7¼
12	6422482	G12+	G212	G412			6422494	G12+	G212	G412			2	8¼	7⅞
13	6422482	G13	G213	G413			6422494	G13	G213	G413			2	8⅞	8½
14	6422482	G14	G214	G414			6422494	G14	G214	G414			2½	9½	9⅛
15	6422482	G15	G215	G415			6422494	G15	G215	G415			2½	10⅛	9¾
16	6422482	G16	G216	G416			6422494	G16	G216	G416			2½	10¾	10⅜
17	6422482	G17	G217	G417			6422494	G17	G217	G417			3	11⅜	11
18	6422482	G18	G218	G418			6422494	G18	G218	G418			3	12	11⅝
EB-6 WITH PRESSURE TYPE CONNECTORS (FIG. 3)															
2	6422482	G102	G302	G502	Refer to nearest General Electric Sales Office		6422494	G102	G302	G502	Refer to nearest General Electric Sales Office		¾	2	1⅝
3	6422482	G103	G303	G503			6422494	G103	G303	G503			¾	2⅝	2¼
4	6422482	G104+	G304	G504			6422494	G104+	G304	G504			¾	3¼	2⅞
5	6422482	G105	G305	G505			6422494	G105	G305	G505			¾	3⅞	3½
6	6422482	G106+	G306	G506			6422494	G106+	G306	G506			1	4½	4⅛
7	6422482	G107	G307	G507			6422494	G107	G307	G507			1	5⅛	4¾
8	6422482	G108+	G308	G508			6422494	G108+	G308	G508			1	5¾	5⅜
9	6422482	G109	G309	G509			6422494	G109	G309	G509			1½	6⅜	6
10	6422482	G110	G310	G510			6422494	G110	G310	G510			1½	7	6⅝
11	6422482	G111	G311	G511			6422494	G111	G311	G511			1½	7⅝	7¼
12	6422482	G112+	G312	G512			6422494	G112+	G312	G512			2	8¼	7⅞
13	6422482	G113	G313	G513			6422494	G113	G313	G513			2	8⅞	8½
14	6422482	G114	G314	G514			6422494	G114	G314	G514			2½	9½	9⅛
15	6422482	G115	G315	G515			6422494	G115	G315	G515			2½	10⅛	9¾
16	6422482	G116	G316	G516			6422494	G116	G316	G516			2½	10¾	10⅜
17	6422482	G117	G317	G517			6422494	G117	G317	G517			3	11⅜	11
18	6422482	G118	G318	G518			6422494	G118	G318	G518			3	12	11⅝

EB-5 WITH SHORT-CIRCUIT STRIPS (FIG. 2)

	Board Without Cover		Board With Cover				
2	0165A6145G1	Refer to nearest General Electric Sales Office	0165A6145G6	Refer to nearest General Electric Sales Office	¾	2	1⅝
4	0165A6145G2+		0165A6145G7		¾	3¼	2⅞
6	0165A6145G3+		0165A6145G8		1	4½	4⅛
8	0165A6145G4+		0165A6145G9		1	5¾	5⅜
12	0165A6145G5+		0165A6145G10		1½	8¼	7⅞

+Stock in Philadelphia Works Warehouse and supplied with white marking strip only.



(Photo 8010542)

Fig. 2. 4-pole board Type EB-5 with 4 short-circuit strips, Cat. 0165A6145G2

(Photo 8010380)

Fig. 3. 4-pole terminal board, Type EB-6, with hinged cover in place, Cat. 6422494G104

For further information, contact your nearest General Electric Sales Office

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