Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

February 15, 1985

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Braidwood and Byron Stations
Supplemental Response to Generic Letter
No. 83-28, "Required Actions Based on
Generic Implications of Salem ATWS Events"
NRC Docket Nos. 50-454/455 and 456/457

References (a): Generic Letter No. 83-28 D. G. Eisenhut letter to All OLs and CPs dated July 8, 1983 (NL-83-0003)

(b): P. L. Barnes to H. R. Denton letter dated November 5, 1983 (NL-83-0520)

(c): P. L. Barnes to H. R. Denton letter dated February 29, 1984 (NL-84-0254)

(d): P. L. Barnes to H. R. Denton letter dated June 1, 1984

(e): G. L. Alexander to H. R. Denton letter dated October 10, 1984

Dear Denton:

Reference (e) contained a commitment to respond to thirteen generic questions regarding the shunt trip attachment modification for the reactor trip breaks at Byron Station. Since the same modification will be done at Braidwood, please find attached the responses for both Braidwood and Byron Stations.

A055
1/1

Please address any questions that you or your staff may have concerning our response to Generic Letter No. 83-28 to this office.

Respectfully,

G. L. Alexander

G. L. Alexander
Nuclear Licensing Administrator

Attachment

cc: US NRC, Docuement Control Desk
Washington, DC 20555

L. N. Olshan - LB1
J. G. Keppler - RIII
RIII Inspectors - BY/BW

9765N

ATTACHMENT PART I

BRAIDWOOD STATION

1. Request for Drawings

"Provide the electrical schematic/elementary diagrams for the reactor trip and bypass breakers showing the undervoltage and shunt coil actuation circuits as well as breaker control (e.g. closing) circuits, and circuits providing breaker status information/alarms to the control room".

CECo. Response to Question No. 1

Attached for your review are two prints of the requested electrical schematic diagrams. (Sargent & Lundy Drawings 6/20E-1-4030RD06 Rev. L, 6/20E-1-4030RD07 Rev. M, 6E-1-4030EF29 Rev. D and 6E-1-4030EF73 Rev. D).

2. Request for Class 1E Power with Indication and Overvoltage Capability

"Identify the power sources for the shunt trip coils. Verify that they are Class 1E and that all components providing power to the shunt trip circuitry are Class 1E and that any faults within non-Class 1E circuitry will not degrade the shunt trip function. Describe the annunciation/indication provided in the control room upon loss of power to the shunt trip circuits. Also, describe the overvoltage protection and/or alarms provided to prevent or alert the operator(s) to an overvoltage condition that could affect both the UV coil and the parallel shunt trip actuation relay".

CECo. Response to Question No. 2

The power sources for Reactor Trip Breaker A (RTA) and Reactor Trip Breaker B (RTB) shunt trip coils are 125 Vdc Buses 111 (211) and 112 (212), respectively. These redundant Class 1E power sources are electrically isolated and physically separated so that any failure involving one source will not jeopardize the other source. Each power supply to the shunt trip coil is made up of Class 1E components (distribution center, battery charger, battery, cabling, etc.). Non-1E circuits are isolated from Class 1E circuits as described in Appendix A (Reg. Guide 1.75) to the FSAR so that they will not degrade the shunt trip function.

Each Class 1E 125Vdc system has its own independent instrumentation and alarms as described in Section 8.3.2 of the FSAR (copy of pages 8.3.24 and 8.3.25 are attached). The listed instrumentation and alarms provide reliable supervision of the condition of each d-c system.

In addition, each Reactor Trip Breaker is provided with "Closed" and "Tripped" breaker position lights located at Main Control Panel 1PM05J. These lights are powered from the same 125Vdc source (branch circuit) as used for closing and tripping each Reactor Trip Breaker. The "Tripped" light indicates that the breaker is open and dc control power is available. The "Closed" light is connected so as to monitor/supervise the shunt trip coil and a breaker "a" auxiliary contact. The "Closed" light thus not only indicates that the breaker is closed, but also indicates that dc control power is available to the shunt trip coil and that there is circuit continuity via the shunt trip coil.

The UV Coil and the parallel shunt trip actuation relay for each Reactor Trip Breaker is powered from the 48Vdc system which is furnished by Westinghouse as part of the solid state protection system. These (Westinghouse specified) regulated 48Vdc power supplies are provided with voltage and current adjustments. The overvoltage protection point is factory adjusted for 115% of rated output voltage. A malfunction of the regulator circuit will cause the overvoltage circuitry to operate (open) the 48Vdc power supply output breaker and thus remove all loads including the UV coil and parallel shunt trip actuation relay. This in turn will trip the Reactor Trip breakers. In addition, opening the power supply output breaker will actuate the "Solid State Protection Cabinet General Warning" alarm in the main control room. Westinghouse has qualified the components of the added shunt trip circuitry to perform their intended function at 115% of nominal voltage.

3. Request for Information on Added Relays

"Verify that the relays added for the automatic shunt trip function are within the capacity of their associated power supplies and that the relay contacts are adequately sized to accomplish the shunt trip function. If the added relays are other than the Potter & Brumfield MDR series relays (P/N 2383A38 or P/N 955655) recommended by Westinghouse, provide a description of the relays and their design specifications."

CECo. Response to Question No. 3

It has been verified that the relay contacts are adequately sized for the shunt trip function and are within the capacity of their associated power supplies. The added relays specified in the generic design are the Potter and Brumfield MDR series relays (P/N 2383A38 (125 VDC) or P/N 955655 (48 VDC)). Engineering data for the selected Potter Brumfield MDR relays is attached (Figure 2).

4. Request for Test Procedure Proposed by WOG

State whether the test procedure/sequence used to independently verify operability of the undervoltage and shunt trip devices in response to an automatic reactor trip signal is identical to the test procedure proposed by the WOG. Identify any differences between the WOG test procedure and the test procedure to be used and the test procedure to be used and provide the rationale/justification for these differences."

CECo. Response to Question 4:

Braidwood commitment 20-85-015 has been issued to confirm that the procedure used to independently verify the operability of the under voltage and shunt trip devices in response to an automatic reactor trip signal will be essentially identical to the test procedure proposed by WOG. The WOG procedure will be used as a basis for the station procedure, and any deviations will be due to site-specific design and/or installation consideration.

5. Request for Class 1E Shunt Trip Function

Verify that the circuity used to implement the automatic shunt trip function is Class 1E (safety related), and that the procurement, installation, operation, testing, and maintenance of this circuitry will be in accordance with the quality assurance criteria set forth in Appendix B to 10 CFR Part 50".

CECo. Response to Question 5:

Circuitry used to implement the automatic shunt trip function is Class 1E. Since the modification is safety-related, procurement, installation, operation, testing and maintenance will be done in accordance with CECo. QA requirements which satisfy Appendix B to 10 CFR Part 50.

6. Request for Seismic Qualification

"Verify that the shunt trip attachments and associated circuitry are/will be seismically qualified (i.e., be demonstrated to be operable during and after a seismic event) in accordance with the provisions of Regulatory Guide 1.100, Revision 1 which endorses IEEE Standard 344, and that all non-safety related circuitry/components in physical proximity to or associated with the automatic shunt trip function will not degrade this function during or after a seismic event".

CECo. Response to Question No. 6

WOG is working with Westinghouse to obtain seismic qualification of the shunt trip attachment and the automatic shunt trip panel. CECo. will review whether non-safety related circuitry/components could degrade the automatic shunt trip function.

7. Request for Environmental Qualification

"Verify that the components used to accomplish the automatic shunt trip function are designed for the environment where they are located".

CECo. Response to Question 7

WOG is also working with Westinghouse to environmentally qualify the shunt trip attachment and the automatic shunt trip panel. The initial tests have been completed and a test report was recently issued. After we review the report, we will be able to respond to this question.

8. Request for Separation

"Describe the physical separation provided between the circuits used to manually initiate the shunt trip attachments of the redundant reactor trip breakers. If physical separation is not maintained between these circuits, demonstrate that faults within these circuits can not degrade both redundant trains."

CECo. Response to Question No. 8

The Reactor Trip switches used to manually initiate the shunt trip attachments of the redundant reactor trip breakers are dual section switches with metal barriers between redundant train switch desks. Where a six inch (6") air gap is not maintained between wiring for Train A and Train B, metal braid is used to enclose wiring. Field cabling from different sections of the panels are routed as ESF Div. 1 (Train A) and ESF Div. 2 (Train B) and are physically separated in accordance with IEEE Standards 279-1971, 317-1972 and 284-1974.

9. Request for Test Procedure of Control Board Manual Switches

"Verify that the operability of the control room manual reactor trip switch contacts and wiring will be adequately tested prior to startup after each refueling outage. Verify that the test procedure used will not involve installing jumpers, lifting leads, or pulling fuses and identify any deviations from the WOG procedure. Permanently installed test connections (i.e., to allow connection of a voltmeter) are acceptable."

CECo. Response to Question 9:

Based on the description of the testing features for the Solid State Protection System (SSPS), there are two types of testers the Semi-automatic Logic Tester and the Slave Relay Tester. The Logic Tester uses pulse techniques to avoid tripping the reactor trip breakers as it produces time-sequenced error output signals to check for correctly sequenced responses. Based on the preceding test, current continuity checks are performed through the output relay coils such that the reactor trip output to the undervoltage coils is checked without de-energizing the undervoltage coils (ergo, no reactor trip). Given the monthly surveillance by this test feature of the SSPS and preventative maintenance checks of the manual Reactor Trip Switch (control room) by the EM department every refueling outage, the concerns regarding verification of reactor trip circuitry should be adequately addressed. Braidwood commitment #20-85-013 is tracking the development of the applicable procedure to test the manual reactor trip switch each refueling outage.

10. Request for Bypass Breaker Testing

"Verify that each bypass breaker will be tested to demonstrate its operability prior to placing it into service for reactor trip breaker testing".

CECo. Response to Question 10:

Braidwood Station will test the reactor trip bypass breakers at each refueling outage. The station agrees with WOG that the failure of the reactor trip system during testing is unlikely and bypass breaker testing on an increased frequency is not required.

11. Request for Reactor Trip Breaker Operability Indication Test Procedure

"Verify that the test procedure used to determine reactor trip breaker operability will also demonstrate proper operation of the associate control room indication/annunciation".

CECo. Response to Question 11:

Braidwood commitment 20-85-015 will ensure that this item is addressed in the appropriate procedure.

12. Request for Response Time Testing

"Verify that the response time of the automatic shunt trip feature will be tested periodically and shown to be less than or equal to that assumed in the FSAR analyses or that specified in the technical specifications".

CECo. Response to Question 12:

Test points have been added to the reactor trip circuitry which will enable response time testing of the shunt trip attachment. This testing may be added in the future to enhance maintenance trending of the reactor trip breakers. However, proposed Tech. Spec. surveillance requirements will adequately demonstrate the response time of the reactor trip system.

13. Request for Technical Specification Changes

"Propose technical specification changes to require periodic testing of the undervoltage and shunt trip functions and the manual reactor trip switch contacts and wiring".

CECo. Response to Question 13:

Braidwood's Technical Specifications are currently in the developmental stage. They are being based on the approved version of Byron Unit 1 Technical Specifications. It is anticipated that these will be submitted for NRC review and approval in the second quarter of 1985.

ATTACHMENT PART II

BYRON STATION

1. Request for Drawings

"Provide the electrical schematic/elementary diagrams for the reactor trip and bypass breakers showing the undervoltage and shunt coil actuation circuits as well as breaker control (e.g. closing) circuits, and circuits providing breaker status information/alarms to the control room".

CECo. Response to Question No. 1

Attached for your review are two prints of the requested electrical schematic diagrams. (Sargent & Lundy Drawings 6/20E-1-4030RD06 Rev. L, 6/20E-1-4030RD07 Rev. M, 6E-1-4030EF29 Rev. D and 6E-1-4030EF73 Rev. D).

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The power sources for Reactor Trip Breaker A (RTA) and Reactor Trip Breaker B (RTB) shunt trip coils are 125 Vdc Buses 111 (211) and 112 (212), respectively. These redundant Class 1E power sources are electrically isolated and physically separated so that any failure involving one source will not jeopardize the other source. Each power supply to the shunt trip coil is made up of Class 1E components (distribution center, battery charger, battery, cabling, etc.). Non-1E circuits are isolated from Class 1E circuits as described in Appendix A (Reg. Guide 1.75) to the FSAR so that they will not degrade the shunt trip function.

Each Class 1E 125Vdc system has its own independent instrumentation and alarms as described in Section 8.3.2 of the FSAR (copy of pages 8.3.24 and 8.3.25 are attached). The listed instrumentation and alarms provide reliable supervision of the condition of each d-c system.

In addition, each Reactor Trip Breaker is provided with "Closed" and "Tripped" breaker position lights located at Main Control Panel 1PM05J. These lights are powered from the same 125Vdc source (branch circuit) as used for closing and tripping each Reactor Trip Breaker. The "Tripped" light indicates that the breaker is open and dc control power is available. The "Closed" light is connected so as to monitor/supervise the shunt trip coil and a breaker "a" auxiliary contact. The "Closed" light thus not only indicates that the breaker is closed, but also indicates that dc control power is available to the shunt trip coil and that there is circuit continuity via the shunt trip coil.

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3. Request for Information on Added Relays

"Verify that the relays added for the automatic shunt trip function are within the capacity of their associated power supplies and that the relay contacts are adequately sized to accomplish the shunt trip function. If the added relays are other than the Potter & Brumfield MDR series relays (P/N 2383A38 or P/N 955655) recommended by Westinghouse, provide a description of the relays and their design specifications."

CECo. Response to Question No. 3

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4. Request for Test Procedure Proposed by WOG

State whether the test procedure/sequence used to independently verify operability of the undervoltage and shunt trip devices in response to an automatic reactor trip signal is identical to the test procedure proposed by the WOG. Identify any differences between the WOG test procedure and the test procedure to be used and the test procedure to be used and provide the rationale/justification for these differences."

CECo. Response to Question 4:

Byron Station has reviewed the proposed WOG procedure and determined that the Station procedure will be the same in intent as the WOG procedure. The procedure will be implemented following the installation of the automatic shunt trip modification and will be verified on a frequency required by the Technical Specifications.

5. Request for Class 1E Shunt Trip Function

Verify that the circuity used to implement the automatic shunt trip function is Class 1E (safety related), and that the procurement, installation, operation, testing, and maintenance of this circuitry will be in accordance with the quality assurance criteria set forth in Appendix B to 10 CFR Part 50".

CECo. Response to Question 5:

Circuitry used to implement the automatic shunt trip function is Class 1E. Since the modification is safety-related, procurement, installation, operation, testing and maintenance will be done in accordance with CECo. QA requirements which satisfy Appendix B to 10 CFR Part 50.

6. Request for Seismic Qualification

"Verify that the shunt trip attachments and associated circuitry are/will be seismically qualified (i.e., be demonstrated to be operable during and after a seismic event) in accordance with the provisions of Regulatory Guide 1.100, Revision 1 which endorses IEEE Standard 344, and that all non-safety related circuitry/components in physical proximity to or associated with the automatic shunt trip function will not degrade this function during or after a seismic event".

CECo. Response to Question No. 6

WOG is working with Westinghouse to obtain seismic qualification of the shunt trip attachment and the automatic shunt trip panel. CECo. will review whether non-safety related circuitry/components could degrade the automatic shunt trip function.

7. Request for Environmental Qualification

"Verify that the components used to accomplish the automatic shunt trip function are designed for the environment where they are located".

CECo. Response to Question 7

WOG is also working with Westinghouse to environmentally qualify the shunt trip attachment and the automatic shunt trip panel. The initial tests have been completed and a test report was recently issued. After we review the report, we will be able to respond to this question.

8. Request for Separation

"Describe the physical separation provided between the circuits used to manually initiate the shunt trip attachments of the redundant reactor trip breakers. If physical separation is not maintained between these circuits, demonstrate that faults within these circuits can not degrade both redundant trains."

CECo. Response to Question No. 8

The Reactor Trip switches used to manually initiate the shunt trip attachments of the redundant reactor trip breakers are dual section switches with metal barriers between redundant train switch decks. Where a six inch (6") air gap is not maintained between wiring for Train A and Train B, metal braid is used to enclose wiring. Field cabling from different sections of the panels are routed as ESF Div. 1 (Train A) and ESF Div. 2 (Train B) and are physically separated in accordance with IEEE Standards 279-1971, 317-1972 and 284-1974.

9. Request for Test Procedure of Control Board Manual Switches

"Verify that the operability of the control room manual reactor trip switch contacts and wiring will be adequately tested prior to startup after each refueling outage. Verify that the test procedure used will not involve installing jumpers, lifting leads, or pulling fuses and identify any deviations from the WOG procedure. Permanently installed test connections (i.e., to allow connection of a voltmeter) are acceptable."

CECo. Response to Question 9:

Byron Station has found that the WOG procedure does not provide for testing the reactor trip breakers via the control room manual reactor trip switch contacts. A new procedure that will be used by the Station will provide for verification of control room annunciation for the manual trip. The new procedure will use the test jacks installed with the breaker modification and will not cycle the trip breakers. The procedure will be performed once every 18 months.

10. Request for Bypass Breaker Testing

"Verify that each bypass breaker will be tested to demonstrate its operability prior to placing it into service for reactor trip break testing".

CECo. Response to Question 10:

Byron Station tests the reactor trip bypass breakers at each refueling outage. The procedure to test the bypass breakers currently requires and will continue to require jumpers as the bypass breakers are not being modified. The Station agrees with WOG that the failure of the reactor trip system during testing is unlikely and bypass breaker testing on an increased frequency is not required.

11. Request for Reactor Trip Breaker Operability Indication Test Procedure

"Verify that the test procedure used to determine reactor trip breaker operability will also demonstrate proper operation of the associate control room indication/annunciation".

13

CECo. Response to Question 11:

Byron Station will include verification of associated control room indication/annunciation in the procedures that verify reactor trip breaker operability.

12. Request for Response Time Testing

"Verify that the response time of the automatic shunt trip feature will be tested periodically and shown to be less than or equal to that assumed in the FSAR analyses or that specified in the technical specifications".

CECo. Response to Question 12:

Byron Station currently tests the response time of the trip breakers to an undervoltage trip in accordance with Technical Specifications. The Station is in agreement with WOG that shunt trip response time testing should be deferred until completion of the life cycle testing of the reactor trip breakers.

13. Request for Technical Specification Changes

"Propose technical specification changes to require periodic testing of the undervoltage and shunt trip functions and the manual reactor trip switch contacts and wiring".

CECo. Response to Question 13:

Byron Station technical specifications already have a requirement to independently verify operation of the undervoltage and shunt trips of the reactor trip breakers once every 18 months. No changes to the technical specifications are currently required.

The primary sources of Class 1E d-c power system are the battery chargers. Every battery charger is rated to supply its associated d-c loads while fully recharging the battery. Each battery charger is fed from a 480-Vac ESF switchgear bus of the same division.

The 125-Vdc batteries are sized to carry the loads shown in Table 8.3-5 for the indicated time periods. During a loss-of-offsite power accident, the diesel-generators will provide a-c power to the associated battery chargers and thereby reduce the drain on the battery system.

The batteries are located in separate rooms. The rooms are described in the Byron/Braidwood Fire Protection Report, Subsection 2.3.5 (Reference 1). The ventilation requirements for these battery rooms are satisfied as follows:

a. To purge the room of hydrogen gas liberated from the battery, each room ventilation system limits the hydrogen concentration to less than 2% of the total volume of the room.

b. Filtered air is provided to maintain each battery area at an annual average temperature of approximately 77° F with a minimum temperature of 65° F. The battery is sized to provide adequate capacity at 77° F plus sufficient margin to allow for the expected temperature variations.

The 125-Vdc batteries, racks, chargers, distribution panels, and battery room ventilation equipment are classified as Safety Category I and meet Byron/Braidwood seismic requirements.

Each 125-Vdc system has its own independent instrumentation:

a. d-c voltmeter at the MCB to measure the voltage at the 125-Vdc distribution center bus;

b. d-c voltmeter with a selector switch to measure the d-c output voltage of the battery charger and the bus voltage;

c. d-c ammeter to measure the d-c output current of the battery charger;

d. d-c ammeter to measure the d-c current of the battery;

e. power failure alarm relay which indicates a loss of a-c power to the battery charger (alarms at the main control room);

f. charger d-c output failure alarm relay (alarms at the main control room);

g. charger low d-c voltage alarm relay (alarms at the main control room);

h. charger high d-c voltage shutdown relay;

i. recording ground-detector voltmeter and alarm (alarms at the main control room);

j. breaker trip alarms on the battery and battery charger breakers and an alarm indicating that the bus tie breaker is closed (alarms at the main control room); and

k. 125-Vdc bus undervoltage alarm relay (alarms at the main control room).

The instrumentation (and the related alarms) provides reliable supervision of the condition of the overall d-c system, but does not (by itself) provide adequate information on the condition of the battery (a component). The condition of the battery is tested initially as noted in Chapter 14.0 and periodically monitored and tested as noted in Subsection 16.3/4.8. The time schedule for performing inspections, measurements, and tests is established in accordance with the requirements of IEEE Standard 450-1975 (as modified by the proposed 1978 revision issued for comments on November 7, 1977) and 308-1971.

The following protection is provided against overcharging:

a. A high-voltage shutdown relay opens the main supply breaker to the charger when the d-c output voltage of the charger rises to approximately 15% over the battery float voltage.

b. A d-c voltmeter provides a visual check on battery voltage.

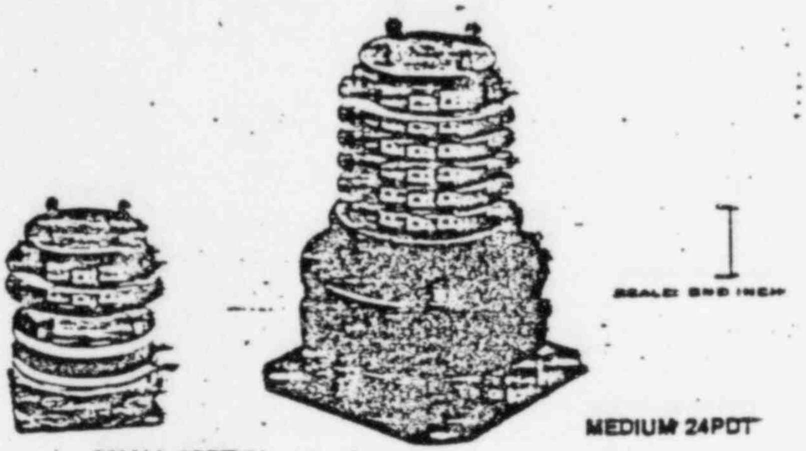
The tie between buses 111 and 211 and the tie between buses 112 and 212 (d-c buses for Unit 1 and Unit 2) are each provided with two normally open, manually operated circuit breakers. The ties are provided so that the nonredundant d-c buses of Unit 1 and Unit 2 can be interconnected during maintenance of the battery associated with either bus 111 or 211 and bus 112 or 212. No interlocks are provided since the interconnected buses are not redundant. However, administrative control will be provided during operation of the tie breakers. Tie breaker closed alarms are provided.

During normal operation, the batteries are kept fully charged by the battery chargers. Periodically, the voltage is raised for equalization of the charge on the individual battery cells.

P&B AMF | POTTER & BRUMFIELD

MDR SERIES

10 AMP ROTARY RELAYS



SMALL 8PDT

MEDIUM 24PDT

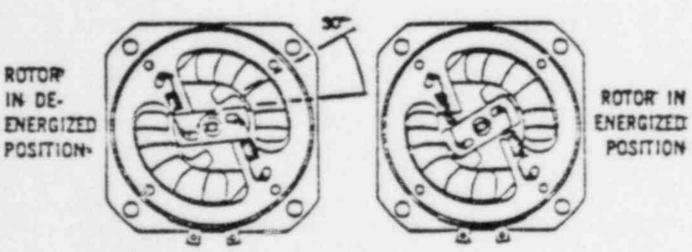
ENGINEERING DATA

Designed and constructed to meet or exceed the most rigorous requirements of military specifications, MDR series rotary relays are used in control circuits of nuclear reactors, missile systems, gun fire apparatus and computers.

MDR relays meet the most rigorous requirements of specifications MIL-R-19523 which includes the rugged requirements of MIL-STD-167 for vibration and MIL-S-901 for shock. The contacts will not chatter when relays are subjected to high-impact shock blows of 2000 ft-lbs. Endurance ratings are 100,000 operations for series 141, 170, and all latching series and 500,000 for all others. MDR relays are designed to operate over an ambient temperature range of 0°C to +65°C. MDR relays designed for operation over range of 0°C to +90°C are available on special order. Please consult factory.

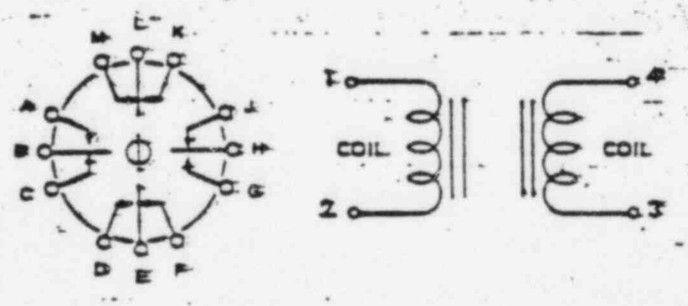
CONVENTIONAL NON-LATCHING SERIES

The basic construction of the conventional MDR relay consists of a rotary actuator mechanism with the contact sections mounted in insulating rings on top. The actuator mechanism embodies a stator assembly on which two relay coils are mounted. The two coils are connected in series inside the relay. When the coils are energized, a rotor turns through an arc of approximately 30 degrees, thereby operating the contact section through the extension of the rotor shaft. The travel of the rotor is confined to a 30 degree arc between the stator faces and the stop ring. Two springs return the rotor to the stop ring when the coils are de-energized. This also returns the contacts to their normal positions. Thus, the conventional non-latching series provide an "energized" and "de-energized" position.



LATCHING TWO-POSITION SERIES

Except for the latching feature, MDR latching two-position relays utilize the same general construction as conventional non-latching relays. They have two sets of coils and provide a latching two-position operation. They operate as follows:



When coil 1-2 is energized, contacts A-B, D-E, G-H and K-L close. The indicator line on the rotor shaft and the two dots on the top are not in alignment.

When coil 1-2 has been de-energized and coil 3-4 is energized, contacts B-C, E-F, H-J and L-M close. The indicator line and the two dots are aligned.

The armature is held by positive spring action in its last energized position when both coils are de-energized. Coils must be energized alternately, not simultaneously.

AVAILABLE IN SMALL AND MEDIUM SIZES

MDR rotary relays are offered in two basic sizes, small and medium. Each of these is available in conventional nonlatching and latching two-position versions. The small non-latching MDR is furnished with AC coils to 12PDT and with DC coils to 8PDT. The small latching relay with AC or DC coils is equipped with contacts to 8PDT. The medium non-latching series is provided with AC or DC coils to 24PDT, while latching version features AC or DC coils with contacts to 16PDT. All contact arrangements are Form C (break-before-make).

W P/N 955655 48VDC COIL FOR SSPS PLANTS (SPECIAL)

W P/N 2383A38 125VDC COIL FOR RELAY PROT. PLANTS

FIGURE 2

TYPICAL OPERATE AND RELEASE TIMES
AT NOMINAL COIL VOLTAGE AT +25°C

TYPE	OPERATE TIME IN MILLISECONDS	RELEASE TIME IN MILLISECONDS
SMALL AC NON-LATCHING	5 to 12	5 to 18
SMALL DC NON-LATCHING	15 to 30	5 to 15
SMALL AC LATCHING	6 to 12	N/A
SMALL DC LATCHING	10 to 16	N/A
MEDIUM AC NON-LATCHING	6 to 12	6 to 20
MEDIUM DC NON-LATCHING	65 to 90	10 to 30
MEDIUM AC LATCHING	8 to 14	N/A
MEDIUM DC LATCHING	30 to 60	N/A

COIL CHARACTERISTICS OF SMALL NON-LATCHING MDR ROTARY RELAYS

SMALL NON-LATCHING

SERIES	CONTACTS	COIL VOLTAGE 60 Hz for AC	COIL CURRENT AMPERES	DC COIL RESISTANCE OHMS	COIL POWER WATTS*	BREAKDOWN VOLTS RMS
MDR131-1	4PDT	115VAC	0.215	66	6.5	1230
MDR131-2	4PDT	440 VAC	0.045	1256	5.1	1880
MDR135-1	4PDT	28 VDC	0.362	76	10.0	1308
MDR137-8	4PDT	125VDC	0.082	1520	10.3	2375
MDR134-1	8PDT	115 VAC	0.215	66	6.5	1230
MDR134-2	8PDT	440 VAC	0.045	1256	5.1	1880
MDR136-1	8PDT	28 VDC	0.362	76	10.0	1308
MDR138-8	8PDT	125 VDC	0.082	1520	10.3	2375
MDR163-1	12PDT	115 VAC	0.230	62	6.9	1230
MDR163-2	12PDT	440 VAC	0.055	940	6.3	1880

*Actual Wattmeter readings

COIL CHARACTARISTICS OF MEDIUM NON-LATCHING MDR ROTARY RELAYS

MEDIUM NON-LATCHING

SERIES	CONTACTS	COIL VOLTAGE 60 Hz for AC	COIL CURRENT AMPERES	DC COIL RESISTANCE OHMS	COIL POWER WATTS*	BREAKDOWN VOLTS RMS
MDR170-1	16PDT	115 VAC	0.620	8.4	17.0	1230
MDR170-2	16PDT	440 VAC	0.160	107	17.0	1880
MDR172-1	16PDT	28 VDC	0.667	42	18.7	1308
MDR173-1	16PDT	125 VDC	0.125	1024	16.0	2375
MDR141-1	24PDT	115 VAC	0.620	8.4	17.0	1230
MDR141-2	24PDT	440 VAC	0.160	107	17.0	1880
MDR167-1	24PDT	28 VDC	0.667	42	18.7	1308
MDR142-1	24PDT	125 VDC	0.125	1024	16.0	2375

*Actual Wattmeter readings

COIL CHARACTERISTICS OF SMALL LATCHING MDR ROTARY RELAYS

SMALL LATCHING

SERIES	CONTACTS	COIL VOLTAGE 60 Hz for AC	COIL CURRENT AMPERES	DC COIL RESISTANCE OHMS	COIL POWER WATTS	BREAKDOWN VOLTS RMS
MDR67-2	4PDT	115 VAC	0.150	210	5.5	1230
MDR4091	4PDT	440 VAC	0.020	4500	3.0	1880
MDR67-3	4PDT	28 VDC	0.308	91	8.6	1308
MDR5060	4PDT	125 VDC	0.104	1200	13.0	2375
MDR4076	8PDT	115 VAC	0.150	210	4.725 5.5	1230
MDR4092	8PDT	440 VAC	0.020	4500	3.0	1880
MDR5035	8PDT	28 VDC	0.308	91	8.6	1308
MDR5061	8PDT	125 VDC	0.104	1200	13.0	2375

COIL CHARACTERISTICS OF MEDIUM LATCHING MDR ROTARY RELAYS

MEDIUM LATCHING

SERIES	CONTACTS	COIL VOLTAGE 60 Hz for AC	COIL CURRENT AMPERES	DC COIL RESISTANCE OHMS	COIL POWER WATTS	BREAKDOWN VOLTS RMS
MDR6064	12PDT	115 VAC	0.380	24	12.0	1230
MDR6065	12PDT	440 VAC	0.055	540	5.7	1880
MDR7020	12PDT	28 VDC	0.316	88.6	8.8	1308
MDR7035	12PDT	125 VDC	0.083	1500	10.4	2375
MDR66-4	16PDT	115 VAC	0.380	24	12.0	1230
MDR6066	16PDT	440 VAC	0.055	540	5.7	1880
MDR7025	16PDT	28 VDC	0.316	88.6	8.8	1308
MDR7036	16PDT	125 VDC	0.083	1500	10.4	2375

FIGURE 2

The primary sources of Class 1E d-c power system are the battery chargers. Every battery charger is rated to supply its associated d-c loads while fully recharging the battery. Each battery charger is fed from a 480-Vac ESF switchgear bus of the same division.

The 125-Vdc batteries are sized to carry the loads shown in Table 8.3-5 for the indicated time periods. During a loss-of-offsite power accident, the diesel-generators will provide a-c power to the associated battery chargers and thereby reduce the drain on the battery system.

The batteries are located in separate rooms. The rooms are described in the Byron/Braidwood Fire Protection Report, Subsection 2.3.5 (Reference 1). The ventilation requirements for these battery rooms are satisfied as follows:

a. To purge the room of hydrogen gas liberated from the battery, each room ventilation system limits the hydrogen concentration to less than 2% of the total volume of the room.

b. Filtered air is provided to maintain each battery area at an annual average temperature of approximately 77° F with a minimum temperature of 65° F. The battery is sized to provide adequate capacity at 77° F plus sufficient margin to allow for the expected temperature variations.

The 125-Vdc batteries, racks, chargers, distribution panels, and battery room ventilation equipment are classified as Safety Category I and meet Byron/Braidwood seismic requirements.

Each 125-Vdc system has its own independent instrumentation:

a. d-c voltmeter at the MCB to measure the voltage at the 125-Vdc distribution center bus;

b. d-c voltmeter with a selector switch to measure the d-c output voltage of the battery charger and the bus voltage;

c. d-c ammeter to measure the d-c output current of the battery charger;

d. d-c ammeter to measure the d-c current of the battery;

e. power failure alarm relay which indicates a loss of a-c power to the battery charger (alarms at the main control room);