

Omaha Public Power District
1623 Harney Omaha, Nebraska 68102
402/536-4000

November 16, 1984
LIC-84-393

Mr. James R. Miller, Chief
U. S. Nuclear Regulatory Commission
Office of Nuclear Reactor Regulation
Division of Licensing
Washington, DC 20555

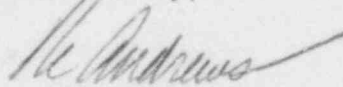
- References: (1) Letter from W. C. Jones to Mr. James R. Miller
dated November 4, 1983
- (2) Letter from James R. Miller to R. L. Andrews
dated October 4, 1984
- (3) Locket No. 50-285

Dear Mr. Miller:

Required Actions Based on Generic Implications
of Salem ATWS Events at the Fort Calhoun
Station Unit No. 1, Items 4.2.1 and 4.2.2

The Omaha Public Power District received your request for additional information dated October 4, 1984 (Reference 2). Forty copies of the District's response is the attached to this letter. This information is intended to supplement that provided in Reference 1, and is not intended to replace or supercede that information.

Sincerely,



R. L. Andrews
Division Manager
Nuclear Production

RLA/dao

cc: LeBoeuf, Lamt, Leiby & MacRae
1333 New Hampshire Avenue, N.W.
Washington, DC 20036

Mr. E. G. Tourigny
Mr. L. A. Vandell

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P PDR

A055
1/40

Attachment A

This attachment provides information requested by letter from Mr. Miller to Mr. Andrews dated October 4, 1984. The maintenance program for the Allen-Bradley Model 702 contactors consists of Maintenance Procedure MP-RPS-M-Contactor which is attached. The manufacturer's service bulletin is included in the maintenance procedure. Additionally, the contactors are tested monthly by using Surveillance Test ST-RPS-11. The circuit breakers (CB-AB and CB-CD), Westinghouse molded case JA breakers are included in the maintenance program and have a separate maintenance procedure, MP-RPS-Breaker which is attached. Again, the manufacturer's service bulletin is included in the maintenance procedure. Specific responses to the requests are presented below:

Request 1.1 Provide the contactor and breaker manufacturers' specific recommendations, including frequency, regarding periodic maintenance and surveillance.

District
Response:

For the Allen-Bradley contactor, the manufacturer recommendations for periodic maintenance are:

- a. Check for contamination
- b. Check operating mechanisms
- c. Check contacts for excessive wear or dirt
- d. Check terminals
- e. Check arc hoods and arc chutes
- f. Check coil for overheating

Frequency specified is three to four months after initial installation and periodically thereafter as determined by operating conditions and experience. No surveillance is recommended by the manufacturer, however, surveillance is performed on the contactor each month by utilizing ST-RPS-11.

For the Westinghouse JA circuit breakers, the manufacturer's recommendations for periodic maintenance are:

- a. Check terminal lugs for tightness
- b. Check trip unit for tightness
- c. Although the service bulletin states that contact cleaning is accomplished by the inherent wiping action of the contacts, conversations with the manufacturer representative indicates that by opening and closing the breaker "several times" under load will keep the contacts clean.

No specific guidance is available from the manufacturer on frequency of preventive maintenance. Therefore, the District has elected to perform this preventive maintenance at refueling frequency.

Request 1.2 Provide a point-by-point comparison of the manufacturers' recommendations with the Fort Calhoun periodic maintenance program and, where the Fort Calhoun program is less stringent than the manufacturers', provide justification for those differences.

District
Response:

For both the Allen-Bradley contactor and the Westinghouse JA circuit breaker, the District has a program that is equal to or more stringent than the manufacturers' recommendations; therefore, no justification for differences is required.

A point-by-point comparison of the manufacturers' recommendations and the current Fort Calhoun periodic maintenance program is provided below:

Manufacturers' Requirement

District Compliance

Allen-Bradley Contactor

- a. Check for contamination
- b. Check operating mechanism
- c. Check contacts for excessive wear or dirt
- d. Check terminals
- e. Check arc hoods and arc chutes
- f. Check coil for overheating

MP-RPS-M-Contactor Step 5.1
MP-RPM-M-Contactor Step 5.2
MP-RPS-M-Contactor Step 5.3
MP-RPS-M-Contactor Step 5.4
MP-RPS-M-Contactor Step 5.5
MP-RPS-M-Contactor Step 5.6

Westinghouse JA Circuit Breaker

- a. Check terminal lugs for tightness
- b. Check trip unit for tightness
- c. Check wiping under load

MP-RPS-Breaker Step 5.4
MP-RPS-Breaker Step 5.5
ST-RPS-10 Step F.1.b.1

Request 2.1 Verify that maintenance records are kept and periodically reviewed to identify any trends toward degradation and identify which specific parameters are to be used for trending. The licensee should also identify the organization which will perform trend analyses, how often the analyses will be performed and how the information derived from the analyses will be used to affect periodic maintenance.

District
Response:

A review of maintenance records indicates there has never been a failure of either the Allen-Bradley contactors or the Westinghouse circuit breakers. The only maintenance ever performed on the contactors or breakers has taken the form of preventive maintenance. Due to the location (control room) of the contactors and breakers, the environment is conducive to a long service life of these components. Records are kept on maintenance activities at Fort Calhoun Station. During January, 1984, records were computerized with the CHAMPS system and prior to January, 1984, records have been kept, but are manual and only cataloged in a computer program. In either case, maintenance records from initial startup are available.

Maintenance records are reviewed prior to final entry into the computer system by the supervisor in charge of the work and others.

Since there has never been a failure of the contactor or circuit breaker and since there has never been any indication of degradation of either component at Fort Calhoun Station, trend analysis is not necessary or possible.

Programs are in place at Fort Calhoun Station that would initiate trend analysis if failure or degradation of these components ever occurs. These programs include the Operations Incident program, LER program, maintenance order review program and NPPDS program. If analysis is ever necessary, initial analysis will be performed by the Plant Review Committee. Additional analysis, if required, will be performed by the Technical Services department.

The District believes that this amplifying information, coupled with the information in our November 4, 1983, letter should enable the Commission to complete its review.

Fort Calhoun Station Unit No. 1
MAINTENANCE PROCEDURE
MP-RPS-Breaker

Maintenance of Clutch Power Supply Breakers

1.0 PURPOSE:

1.1 To provide direction to perform preventive maintenance for Westinghouse Type JA Circuit Breakers.

1.2 Reference:

1.2.1 Attached application data sheets

2.0 PRECAUTIONS AND LIMITATIONS

2.1 Reactor is shutdown and tripped.

3.0 INITIAL CONDITIONS

SIGN OFF/DATE

3.1 This work covered by M. O. No. _____

_____ / _____

3.2 Shift Supervisor informed this M.P. to be accomplished.

_____ / _____
Shift Supv.

4.0 EQUIPMENT CHECKLIST

4.1 Normal electricians hand tools.

5.0 PROCEDURE

5.1 Remove power from the circuit by opening the following breakers:

CB-9 AI-40A

_____ / _____

CB-7 AI-40C

_____ / _____

CB-9 AI-40B

_____ / _____

CB-7 AI-40D

_____ / _____

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SIGN OFF/DATE

5.2 Remove metal cover plate from front of circuit breakers.

 /
CB-AB

 /
CB-CD

5.3 Remove cover from circuit breaker.

 /
CB-AB

 /
CB-CD

5.4 Check terminal lugs to ensure they are tight.

 /
CB-AB

 /
CB-CD

5.5 Check trip unit to ensure it is tight.

 /
CB-AB

 /
CB-CD

5.6 Check general condition of circuit breaker. If any abnormal conditions are present, note in Remarks.

 /
CB-AB

 /
CB-CD

5.7 Replace cover on circuit breaker.

 /
CB-AB

 /
CB-CD

5.8 Replace metal cover on AI-57

 /
CB-AB

 /
CB-CD

5.9 Return power to system by closing breakers CB-9 (AI-40A), CB-7(AI-40C), CB-9 (AI-40B), CB-7(AI-40D).

 /

5.10 Perform ST-RPS-10 or ensure it is scheduled to be performed prior to start up of the reactor.

 /
I&C Supv.

5.11 Inform Shift Supervisor maintenance is completed.

 /
Shift Supv.

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6.0 REMARKS: _____

Work Completed By: _____ Date/Time _____ / _____



Westinghouse Electric Corporation
Low Voltage Breaker Division
Beaver, Pennsylvania 15009

29-160 A WE A
Application Data

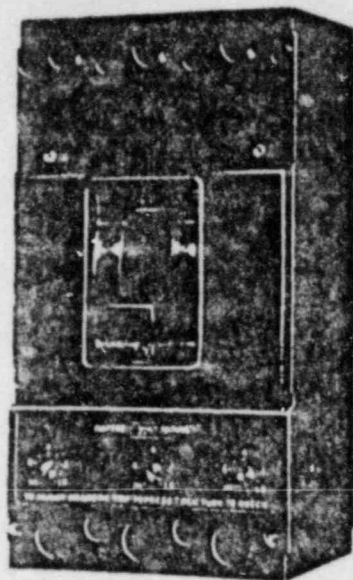
Page 39

MP-RPS-Breaker-4

September, 1976
Supersedes Application Data
29-160 all previous issues.
Mailed to: E, D, C/1901, 1928/DB

Standard Types JA, KA, and MARK 75®
Type HKA
70-225 Amperes, 600 Volts Ac, 250 Volts Dc,
2 and 3 Poles

AB DE-ION® Circuit Breakers



Continuous Ampere Ratings
Underwriters' Laboratories, Inc. Listed
70, 90, 100, 125, 150, 175, 200, 225

Interrupting Ratings, Amperes
Underwriters' Laboratories, Inc. Listed

Types JA and KA
240 Volts Ac: 30,000 Asym., 25,000 Sym.
480 Volts Ac: 25,000 Asym., 22,000 Sym.
600 Volts Ac: 25,000 Asym., 22,000 Sym.
250 Volts Dc: 10,000

Mark 75 Type HKA
240 Volts Ac: 75,000 Asym., 65,000 Sym.
480 Volts Ac: 40,000 Asym., 35,000 Sym.
600 Volts Ac: 30,000 Asym., 25,000 Sym.
250 Volts Dc: 20,000^②

Application
These breakers are designed for the protection of branch and feeder circuits. Being of compact size, they are ideally suited for use in control panels, panelboards, switchboards or separate enclosures where a 225 ampere frame size breaker is required.

MARK 75 Type HKA Breakers, because of their higher interrupting capacity, are ideally suited for use in network systems where unusually high fault currents are available.

Listed with Underwriters' Laboratories, Inc.

On all three phase Delta, grounded B phase applications, refer to Westinghouse.

Construction

These breakers have all the standard AB breaker features. Two and three pole breakers are supplied in one frame size; the current carrying parts being omitted from the center pole for two pole breakers. In addition, the MARK 75 Type HKA molded case is a higher strength glass polyester material with greater resistance to tracking. Type JA breakers have non-interchangeable trip units. Types KA and HKA have interchangeable trips.

Federal Specification W-C-375b
See tabulation on page 20-1

Terminals

Two terminals required per pole. Terminals are Underwriters' Laboratories, Inc. listed for wire type and range listed below. When used with aluminum conductors, use joint compound.

Terminal arrangement permits ready use of other circuit connecting means, such as rear-connecting studs, panelboard connectors and plug-in adaptor kits.

Max. Breaker Amps	Catalog Number	Wire Range, Type No. of Cables
Standard Pressure Terminals (Copper Only)		
225	T225LA	1 - #6-350 MCM
Optional Al/Cu Pressure Terminals		
225	TA225LAT	1 - #6-350 MCM Cu, 1 - #4-350 MCM Al

Operation

When the breaker contacts are open the handle is in either the mid or OFF position. If in the mid position the breaker has been tripped automatically. The latch must be reset by moving the operating handle to the extreme OFF position before attempting to restore service. Contacts may be closed, after resetting the latch, by moving the handle to the ON position. JA breakers may be mounted in an inverted position and are approved for reverse feed. Types KA and HKA may be mounted in an inverted position, but are not approved for reverse feed. The toggle handle operates with the following forces in pounds from the end of the handle: ON - 24 lbs; OFF - 10 lbs; reset - 15 lbs.

Thermal Magnetic Breakers

These breakers are equipped with thermal, front-adjustable magnetic trip elements. Thermal trip elements are of an indirectly heated bimetallic type having a long time delay well suited for starting motors having high inrush currents of long duration. Instantaneous

magnetic trip settings may be adjusted between established limits to take care of circuit surge conditions. Trip units are non-interchangeable on JA breakers, and interchangeable on Type KA and HKA.

Magnetic Trip Setting and Range^③

Ampere Rating	70	90	100	125	150	175	200	225
High	200	900	1000	1250	1500	1750	2000	2250
Low	350	450	500	625	750	875	1000	1125

Magnetic Only Circuit Interrupters^④

These are breakers with adjustable magnetic trip elements only, for applications where short circuit protection only is required. Magnetic trip ranges are the same as those listed for thermal-magnetic breakers, but the continuous current ratings in all cases are 225 amperes.

Ambient Compensating Breakers^⑤

Have thermal and magnetic trip elements. They are thermal compensating to carry full load at 50°C while also meeting U/L trip requirements at 25°C. Can be applied where a wide range of ambients is experienced.

Saf-T-Vue Breakers (JA, KA Only)^⑥

Saf-T-Vue breakers are similar to standard breakers except that they have a transparent window located over the breaker contacts. Saf-T-Vue breakers are commonly used in steel mill applications where sight of contacts is required. Can be supplied in all standard ratings.

Molded Case Switches (JA, KA Only) (Non-Auto Interrupters)

Breakers with non-automatic details (latch bracket and bridging strap) can be installed where a heavy-duty, high-capacity disconnect switch without overcurrent protection is required. Accessories, such as shunt trip, undervoltage release, etc., cannot be field mounted in molded case switches as a dummy trip is required for mounting. Accessories can be mounted if specified when breaker is ordered.

Mining Service Breakers^⑦

A special version of KA and HKA breakers is available to meet Bureau of Mines requirements for trailing cable applications. Refer to Technical Data 29-128 TWE A.

- ① All adjustable magnetic trips when in high position at factory, may be adjusted down to required limit in the field.
- ② Not Underwriters' Laboratories, Inc. listed.
- ③ Except when used with an auxiliary switch having 2A-210 contacts.
- ④ Ratings above 10,000 amps are not UL listed.

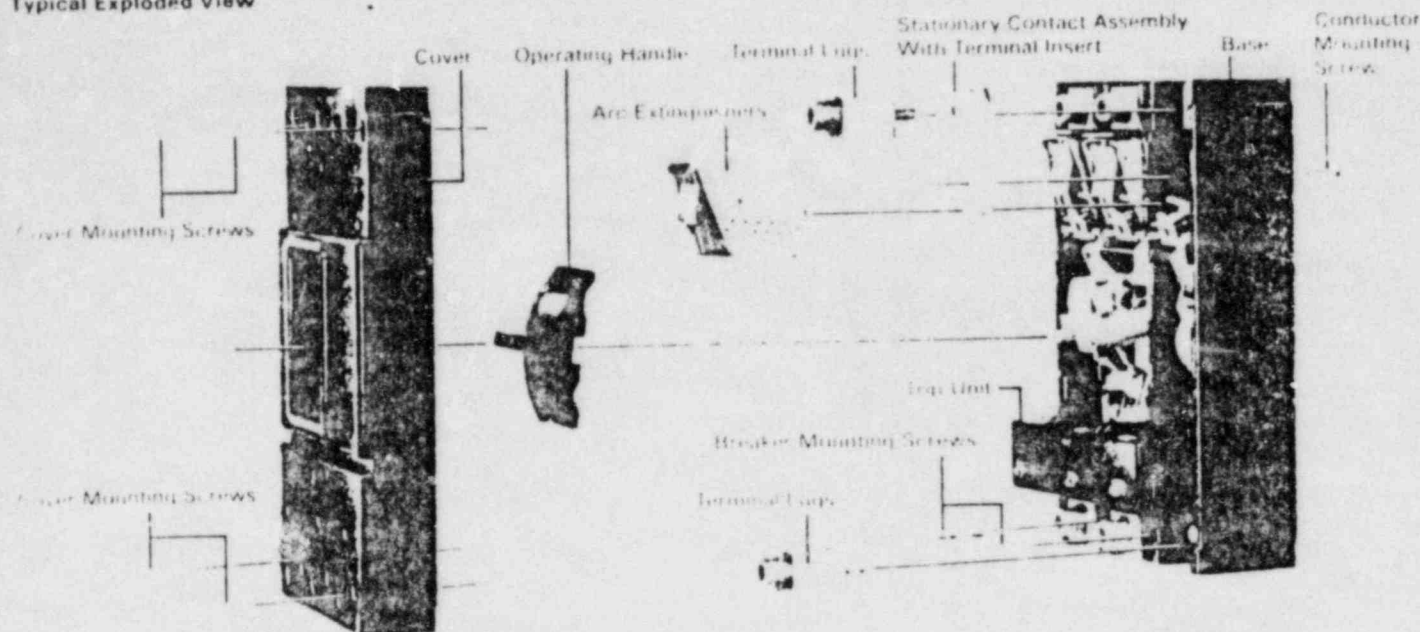
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Typical Exploded View



Circuit Breaker Removal

Before inspecting, installing, or removing from a circuit, the circuit breaker should be in the OFF position, and if practicable the circuit should be de-energized. If the circuit cannot be de-energized insulated tools, rubber gloves and a rubber floor mat should be used.

To remove a rear-connected circuit breaker from its mounting, remove terminal stud lock-nuts and pull circuit breaker forward.

To remove a front-connected circuit breaker from its mounting, loosen screws in terminal lugs and remove cables from terminals. Remove circuit breaker mounting screws and pull circuit breaker forward.

To remove a circuit breaker equipped with plug-in mounting blocks from its mounting, remove breaker mounting screws and pull circuit breaker forward.

Inspection and Maintenance

Good maintenance procedure calls for periodic inspection of all electrical apparatus including molded case circuit breakers. Terminal lugs and trip units must be tight to prevent overheating. Due to the inherent wiping action built into the moving contacts of all Westinghouse circuit breakers, operating the breaker several times under load will remove any high resistance film that may have formed. Under normal conditions, additional cleaning of contacts is not required. However, should operating and/or atmospheric conditions make it desirable to clean the contacts further, the following procedure is recommended:

2. Wipe contact surfaces with a clean cloth dipped in a chlorinated solvent. If surfaces are excessively oxidized or corroded, scrape lightly with a fine file before wiping.

It should be noted that removing the sealed cover of the type JA breaker voids the Underwriters Laboratories, Inc., label.

Replacing Interchangeable Trip Unit, Types KA and HKA

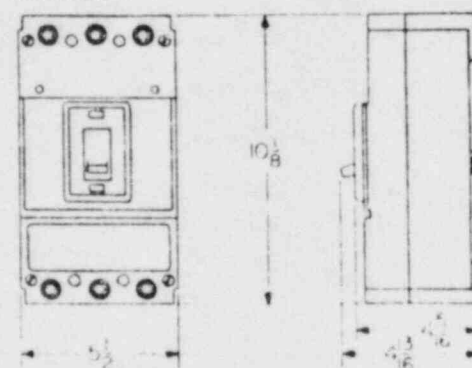
1. Remove circuit breaker from its mounting per instructions under "circuit breaker removal".
2. Remove cover by removing four screws.
3. Remove screws from the outer poles of the line side of the trip unit and loosen the screw in the center pole of the same side of the trip unit.
4. Lift trip unit from frame after removing the operating handle from its mounting.
5. Install new trip unit by reversing above procedure.
6. Before replacing frame cover and mounting circuit breaker, check for proper latching and closing. Perform latching and closing operations per instructions under "operation". Open and close breaker several times to make certain proper latching has been achieved.
7. Replace frame cover and mount circuit breaker.

Accessories and Modifications

Accessories and modifications available include: alarm switch, auxiliary switch, shunt trip, undervoltage release, line terminal shields, plug-in adaptor kits, rear-connecting studs, center studs, mechanical interlocks, panel-board connectors, paralleling straps, motor operators, handle locking devices, moisture and fungus treatment.

Dimensions, Inches $\frac{1}{16}$

Not to be used for construction purposes. See Dimension Sheet 29-170 for detailed dimensions.



As 2 1/2 inch breaker supplied on 3 pole frame, with 1 inch trip per pole, listed.

Further Information

Prices: Price List 29-020 P WE A
Ordering Data: Tech. Data 29-120 T WE A
Dimensions: Dimension Sheet 29-170
Trip Curves: App. Data 29-161 A WE A

1. Remove cover, arc extinguishers and stationary contact assemblies.

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Fort Calhoun Station Unit No. 1
 MAINTENANCE PROCEDURE
 MP-RPS-M-Contactor

Maintenance of M-Contactors for Clutch Power Supplies

1.0 Purpose:

SIGN OFF/DATE

1.1 To provide direction to perform preventive maintenance for Allen-Bradley Bulletin 702 Contactors.

1.2 Reference:

1.2.1 CE Drawing D-23866-411-027

1.2.2 Attached service information

2.0 Precautions and Limitations

2.1 Reactor must be shut down and tripped.

2.2 Power should be removed by opening M-Contactor power supply breakers located in AI-31B and C (CB-1, CB-2, CB-3, CB-4).

3.0 Initial Conditions

3.1 This work covered by M.O. No. _____

3.2 Shift Supervisor informed this M.P. to be accomplished.

4.0 Equipment Checklist:

4.1 Normal Electrician Handtools.

5.0 Procedure:

CAUTION: Under no conditions are any parts of the contactor to be lubricated.

5.1 Examine enclosure and contactor for foreign material (dust, dirt, ect.) Clean as required.

M1 _____ M2 _____ M3 _____ M4 _____

5.2 Check for any loose parts or broken parts. Replace or tighten if required.

M1 _____ M2 _____ M3 _____ M4 _____

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5.0 Procedure (Continued)

SIGN OFF/DATE

5.3 Check contacts for wear and dirt. Clean as required.

CAUTION: Do not use spray contact cleaner. If contact replacement is necessary, replace complete set of contacts.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.4 Check terminals for tightness. Replace or tighten as required.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.5 Check ARC hoods and ARC chutes for cracks, brakes, or deep erosion. Replace if required.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.6 Check coil for evidence of overheating. If necessary, replace coil.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.7 Check operation of contactor. This may be accomplished in the following manner.

5.7.1 Reset clutch power circuit breakers.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.7.2 Reset reactor. Contactors should pick up.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.7.3 Push manual trip button on CR-4. Contactors should drop out.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.8 Close Contactors enclosures.

M1	M2	M3	M4
_____ / _____	_____ / _____	_____ / _____	_____ / _____

5.9 Inform Shift Supervisor Maintenance is complete.

SS
_____ / _____

6.0 REMARKS:

Work Completed By: _____ Date/Time _____ / _____

MAILED

APR 23 1983

FC/MP/03

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INSTRUCTIONS

MP-RPS-M-Contactor-4

GENERAL INFORMATION

MAINTENANCE OF INDUSTRIAL CONTROL EQUIPMENT

WARNING: Servicing energized Industrial Control Equipment can be hazardous. Severe injury or death can result from electrical shock, burn, or unintended actuation of controlled equipment. Recommended practice is to disconnect and lockout control equipment from power sources, and release stored energy, if present. Refer to National Fire Protection Association Standard No. NFPA70E, Part II for safety related work practices, including procedural requirements for lockout-tagout, and appropriate work practices, personnel qualifications and training requirements where it is not feasible to de-energize and lockout or tagout electric circuits and equipment before working on or near exposed circuit parts.

PERIODIC INSPECTION - Industrial control equipment should be inspected periodically. Inspection intervals should be based on environmental and operating conditions, and adjusted as indicated by experience. An initial inspection within 3 to 4 months after installation is suggested. Applicable parts of the following guidelines should be used.

CONTAMINATION - If inspection reveals that dust, dirt, moisture or other contamination has reached the control equipment, the cause must be eliminated. This could indicate an incorrectly selected or ineffective enclosure, unsealed enclosure openings (conduit or other) or incorrect operating procedures. Replace any improperly selected enclosure with one that is suitable for the environmental conditions - refer to National Electrical Manufacturers Association (NEMA) Standards Publication No. 250-1979 for enclosure type descriptions and test criteria. Replace any damaged or embrittled elastomer seals - and repair or replace any other damaged or malfunctioning parts (e.g., hinges, fasteners, etc.). Dirty, wet or contaminated control devices must be replaced unless they can be cleaned effectively by vacuuming or wiping.

OPERATING MECHANISMS - Check for proper functioning and freedom from sticking or binding. Replace any broken, deformed or badly worn parts or assemblies according to individual product renewal parts lists. Check for and retighten securely any loose fasteners. Lubricate if specified in individual product instructions.

NOTE: Allen-Bradley magnetic starters, contactors and relays are designed to operate without lubrication - do not lubricate these devices since oil or grease on the pole faces (mating surfaces) of the operating magnet may cause the device to stick in the "ON" mode. Some parts of other devices are factory lubricated - if lubrication during use or maintenance of these devices is needed, it will be specified in their individual instructions. If in doubt, consult the nearest Allen-Bradley sales office for information.

CONTACTS - Check contacts for excessive wear and dirt accumulations. Vacuum or wipe contacts with a soft cloth if necessary to remove dirt. Contacts are not harmed by discoloration and slight pitting. Contacts should never be filed, as dressing only shortens contact life. Contact spray cleaners should not be used as their residues on magnet pole faces or in operating mechanisms may cause sticking, and on contacts can interfere with electrical continuity. Contacts should only be replaced after silver has become badly worn. Always replace contacts in complete sets to avoid misalignment and uneven contact pressure.

TERMINALS - Loose connections in power circuits can cause overheating that can lead to equipment malfunction or failure. Loose connections in control circuits can cause control malfunctions. Loose bonding or grounding connections can increase hazards of electrical shock. Check the tightness of all terminals and bus bar connections and tighten securely any loose connections. Replace any parts or wiring damaged by overheating, and any broken wires or bonding straps.

ARC HOODS - Check for cracks, breaks or deep erosion. Arc hoods and arc chutes should be repaired or replaced if damaged or deeply eroded.

COILS - If a coil exhibits evidence of overheating (cracked, melted or burned insulation), it must be replaced. In that event, check for and correct overvoltage or undervoltage conditions, which can cause coil failure. Be sure to clean any residues of melted coil insulation from other parts of the device or replace such parts.

PILOT LIGHTS - Replace any burned out lamps or damaged lenses.

SOLID STATE DEVICES - Solid state devices require little more than a periodic visual inspection. Printed circuit boards should be inspected to determine whether they are properly seated in the edge board connectors. Board locking tabs should also be in place.

Necessary replacements should be made only at the P.C. board or plug-in component level. Solvents should not be used on printed circuit boards. Where blowers are used, air filters should be cleaned or changed periodically depending on the specific environmental conditions encountered.

CAUTION: Use of other than factory recommended test equipment for solid state controls may result in damage to the control or test equipment or unintended actuation of the controlled equipment.

LOCKING AND INTERLOCKING DEVICES - Check these devices for proper working condition and capability of performing their intended functions. If necessary, readjust, repair or replace in accordance with individual product instructions, if applicable, or consult nearest Allen-Bradley sales office.

MAINTENANCE AFTER A FAULT CONDITION - Opening of the short circuit protective device (such as fuses or circuit breakers) in a properly coordinated motor branch circuit is an indication of a fault condition in excess of operating overload. Such conditions can cause damage to control equipment. Before restoring power, the fault condition must be corrected and any necessary repairs or replacements must be made to restore the control equipment to good working order. Refer to NEMA Standards Publication No. ICS-2, Part ICS2-302 for procedures.

FINAL CHECK OUT - After maintenance or repair of industrial controls, always test the control system for proper functioning under controlled conditions that avoid hazards in the event of a control malfunction.

For additional information, refer to NFPA70B, RECOMMENDED PRACTICE FOR ELECTRICAL EQUIPMENT MAINTENANCE, published by the National Fire Protection Association.



ALLEN-BRADLEY

Milwaukee, Wisconsin 53204

ISSUED

MAR 23 1985

RO 3-23-83

Publication GI-5.0 - September, 1982

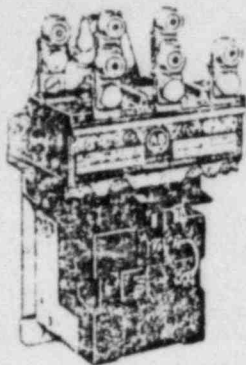
Supersedes Publication GI-5.0 Dated June, 1979



MP-RPS-M-Contactor-5

AC CONTACTORS • SERIES K CONSTRUCTION

BULLETINS 702-702PM SIZE 3 • BULLETINS 702L-702LP SIZE 100 AMPERES



Bulletin 702, 3 Pole



Bulletin 702L, 3 Pole



Bulletin 702PM, 3 Pole
(Bulletin 702LP Similar)

DESCRIPTION —

The Bulletin 702 contactors are motor load rated AC contactors. They are used to control motors that require no overload protection, or motors where protection is provided separately.

The Bulletin 702PM contactors are permanent magnet latch type designed for switching motor loads on those applications where the contactor must remain closed without the coil circuit being energized.

The Bulletin 702L lighting contactors are electrically held contactors especially designed to switch the current to incandescent filament, fluorescent, mercury arc lamps and other non-motor loads.

The Bulletin 702LP contactors are the permanent magnet latch type of lighting contactor used on applications similar to the Bulletin 702L applications.

NOTE — Refer to Page 4 for Engineering Data.

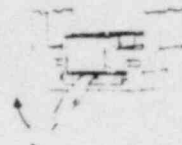
PREVENTIVE MAINTENANCE — For recommended preventive maintenance instructions refer to Publication GI-5.0 or the Handy Catalog.

REPAIRS — Contactors can be disassembled as depicted in the illustrations on Page 2 of this Parts List. Additional consideration should be given to the techniques below.

IMPORTANT — **Never** apply AC voltage to the coil terminals of a permanent magnet type contactor. To do so will partially de-magnetize the permanent magnet.

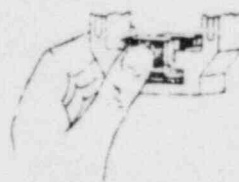
REMOVING MAGNET ARMATURE

Bulletins 702-702L — To remove the magnet armature from the movable contact support, insert screwdriver into slot as illustrated and lift screwdriver in the direction shown. At the same time push the magnet armature out. It may be necessary to wiggle the armature before it can be removed because of the pressure applied by the retainer spring.



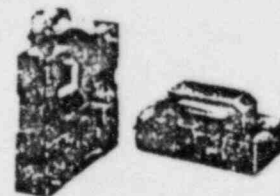
REMOVING MAGNET ARMATURE—Bulletins 702LP-702PM

To remove the magnet armature from the movable contact support, take out the two Allen head screws located beneath the movable contact support. Then place thumb as illustrated and push the magnet armature towards the back.



REPLACING OPERATING COIL

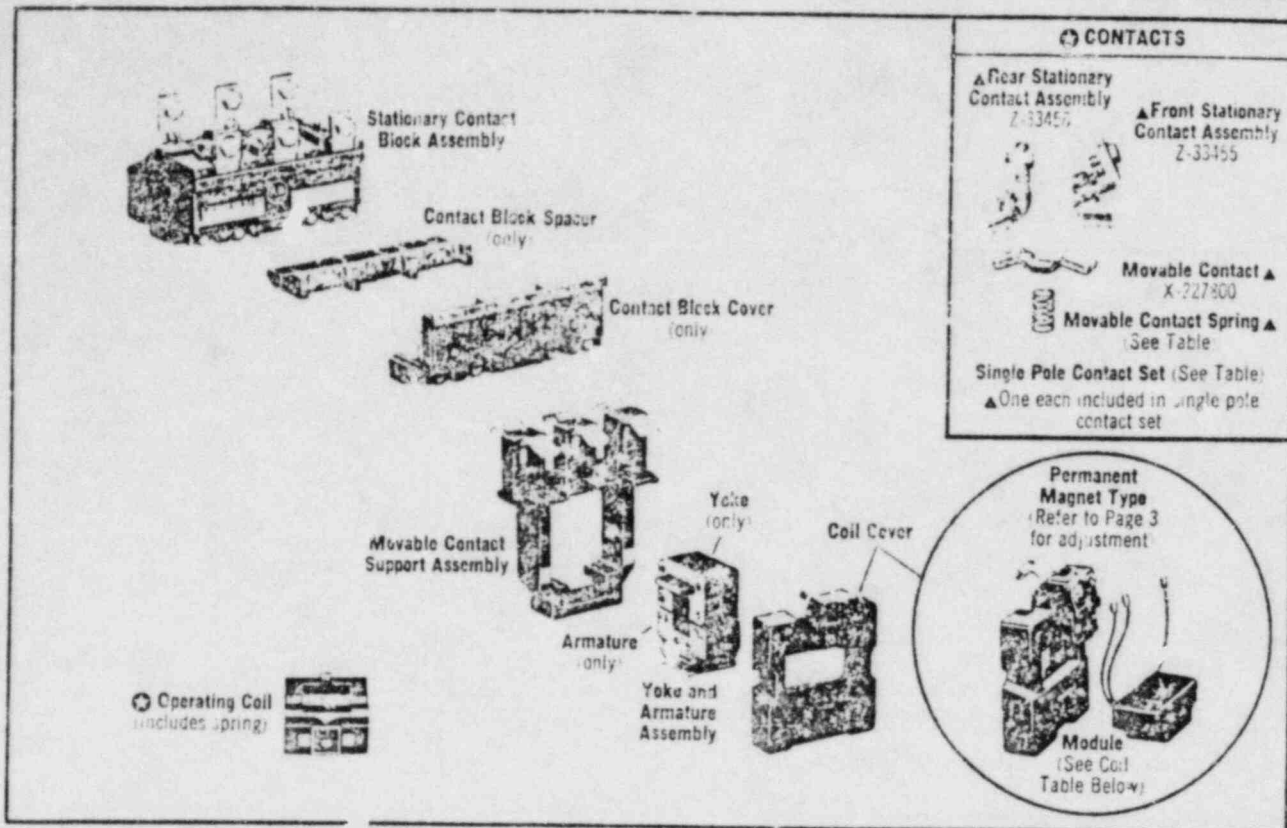
To replace the operating coil, first insert the magnet yoke into the operating coil as shown. After this has been done, insert both the operating coil and the magnet yoke as a unit into the coil cover. When replacing the coil cover into the switch unit, be sure the operating lever of the interlock contact rests on top of the movable contact support. **Note:** The Bulletin 702L contactor does not have an interlock contact on the coil cover.



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RO 3-23-83
Publication 702-6.13 — November, 1977
Supersedes Publication 702-6.13 Dated October, 1969



Parts indicated with ⊕ are recommended spare parts.

⊕ ELECTRICALLY HELD CONTACTORS — OPERATING COILS

Volts	Hz	Coil Number	2-3 POLES				Coil Number	4-5 POLES			
			Coil Current		Volt-Amperes			Coil Current		Volt-Amperes	
			Inrush	Sealed	Inrush	Sealed		Inrush	Sealed	Inrush	Sealed
120	60	73A86	4.82	356	580	43	73A803	5.34	392	640	47
110	50		5.10	400	550	44		5.80	428	640	47
110	60	73A01	5.26	389	580	43	73A754	5.82	428	640	47
95	50		5.12	404	490	39		5.72	430	490	41
110	25	73A05	2.92	410	320	45	73A05	2.92	410	320	45
208	60	73A113	2.78	205	580	43	73A875	3.08	226	640	47
240	60	73A83	2.41	178	580	43	73A804	2.67	196	640	47
220	50		2.55	200	550	44		2.90	214	640	47
220	60	73A06	2.63	194	580	43	73A755	2.91	214	640	47
220	25	73A10	1.46	205	320	45	73A10	1.46	205	320	45
440	60	73A288	1.20	089	580	43	73A805	1.33	098	640	47
440	50		1.27	100	550	44		1.45	107	640	47
440	60	73A11	1.32	097	580	43	73A756	1.45	107	640	47
380	50		1.43	108	490	39		1.43	108	490	41
440	25	73A15	.74	120	320	45	73A15	.74	120	320	45
600	60	73A81	.965	071	580	43	73A987	1.07	078	640	47
550	50		1.02	080	550	44		1.16	086	640	47
550	60	73A16	1.05	078	580	43	73A757	1.16	086	640	47
550	25	73A20	.58	320	320	45	73A20	.58	082	320	45

Parts indicated with ⊕ are recommended spare parts.

⊕ PERMANENT MAGNET TYPE CONTACTORS — MODULES AND OPERATING COILS

Volts	Hz	Module Number	Coil Number	RMS Coil Current		Volt-Amperes		Volts	Hz	Module Number	Coil Number	RMS Coil Current		Volt-Amperes	
				Latch	Unlatch	Latch	Unlatch					Latch	Unlatch	Latch	Unlatch
120	60	X-296277	113A86	4.55	640	546	76.8	480	60	X-296275	113A288	1.21	150	581	76.8
110	50			4.45	612	490	67.3	440	50			1.19	153	524	67.3
110	60	X-296269	113A01	4.17	659	459	72.5	440	60	X-296280	113A11	1.11	166	488	73.0
208	60	X-296278	113A113	2.09	321	435	66.8	600	60	X-296276	113A81	1.18	153	705	91.8
240	60	X-296274	113A83	2.41	335	578	80.4	550	50			1.14	145	627	80.0
220	50			2.36	319	519	70.2	550	60	X-296281	113A16	.873	129	480	71.0
220	60	X-296279	113A06	2.21	339	486	74.6								

Parts indicated with ⊕ are recommended spare parts.

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ELECTRICALLY PLED CONTACTORS — RENEWAL PARTS

Description of Part	Bulletin 702				Bulletin 702L		
	2 Pole	3 Pole	4 Pole	5 Pole	2 Pole	3 Pole	4 Pole
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
Stationary Contact Block Assembly (includes contacts, spacer and cover)	X-35654	X-35655	X-35656	X-35657	X-35654	X-35655	X-35656
Stationary Contact Block Assembly (less contacts)	X-35653	X-35659	X-35660	X-35661	X-35658	X-35659	X-35660
Contact Block Spacer (only)	F-20194	F-20124	F-20776	F-20780	F-20494	F-20424	F-20776
Contact Block Cover (only)	X-232806	X-232807	X-232808	X-232809	X-232806	X-232807	X-232808
Movable Contact Support Assembly (includes contacts and springs)	X-232704	X-232705	X-232706	X-232707	X-242260	X-266222	X-266234
Movable Contact Support Assembly (less contacts and springs)	F-20497	F-20527	F-20777	F-20781	F-20497	F-20527	F-20777
Movable Contact Spring	B-29071	B-29071	B-29071	B-29071	B-33706	B-33706	B-36089
Yoke and Armature Assembly 60-50 Hz (includes retainers and springs)	Z-31850	Z-31850	Z-31850	Z-31850	Z-31850	Z-31850	Z-31850
Yoke and Armature Assembly 25 Hz (includes retainers and springs)	Z-31854	Z-31854	Z-31854	Z-31854	Z-31854	Z-31854	Z-31854
Yoke (only) 60-50 Hz	X-227198	X-227198	X-227198	X-227198	X-227198	X-227198	X-227198
Yoke (only) 25 Hz	X-264859	X-264859	X-264859	X-264859	X-264859	X-264859	X-264859
Armature (only) 60-50-25 Hz	X-227197	X-227197	X-227197	X-227197	X-227197	X-227197	X-227197
Coil Cover — Without Interlock Contact	Z-21139	Z-21139	Z-21139	Z-21139	Z-21139	Z-21139	Z-21139
Coil Cover — With Normally Closed Interlock Contact	Z-21136	Z-21136	Z-21136	Z-21136	—	—	—
Coil Cover — With Normally Open Interlock Contact	Z-21137	Z-21137	Z-21137	Z-21137	—	—	—
Coil Cover — With Normally Open-Normally Closed Interlock Contact	Z-21138	Z-21138	Z-21138	Z-21138	—	—	—
Set of Front and Rear Stationary Contacts	Z-23374	Z-23375	Z-23376	Z-23377	Z-23374	Z-23375	Z-23376
Set of Movable Contacts and Springs	Z-21116	Z-21117	Z-21118	Z-21119	Z-21116	Z-21117	Z-21118
Set of Front and Rear Stationary Contacts, Movable Contacts and Springs	X-247289	X-247290	X-247291	X-247292	Z-31110	X-326803	Z-31111
Single Pole Contact Set (▲)	Z-34040	Z-34040	Z-34040	Z-34040	Z-34115	Z-34115	Z-34115

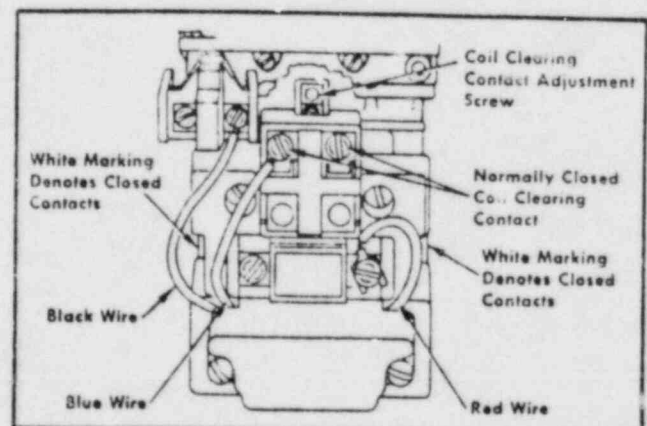
Parts indicated with Ⓢ are recommended spare parts.

PERMANENT MAGNET TYPE CONTACTORS — RENEWAL PARTS

Description of Part	Bulletin 702LP			Bulletin 702PM		
	2 Pole	3 Pole	4 Pole	2 Pole	3 Pole	4 Pole
	Part No.	Part No.	Part No.	Part No.	Part No.	Part No.
Stationary Contact Block Assembly (includes contacts, spacer and cover)	X-356424	X-356425	X-356426	X-356424	X-356425	X-356426
Stationary Contact Block Assembly (less contacts)	X-356427	X-356428	X-356429	X-356427	X-356428	X-356429
Contact Block Spacer (only)	F-20494	F-20424	F-20776	F-20494	F-20424	F-20776
Contact Block Cover (only)	X-288364	X-288365	X-288366	X-288364	X-288365	X-288366
Movable Contact Support Assembly (includes contacts and springs)	X-290823	X-290824	X-290825	X-290823	X-290824	X-290825
Movable Contact Support Assembly (less contacts and springs)	F-22313	F-22314	F-22315	F-22313	F-22314	F-22315
Movable Contact Spring	B-33706	B-29071	B-29071	B-33706	B-29071	B-29071
Yoke and Armature Assembly 60-50 Hz (includes retainers and springs)	Z-31916	Z-31916	Z-31916	Z-31916	Z-31916	Z-31916
Yoke (only) 60-50 Hz	X-295154	X-295154	X-295154	X-295154	X-295154	X-295154
Armature (only) 60-50 Hz	X-288611	X-288611	X-288611	X-288611	X-288611	X-288611
Coil Cover — Adjustable Coil Clearing Contact	X-322216	X-322216	X-322216	X-322216	X-322216	X-322216
Set of Front and Rear Stationary Contacts	Z-23374	Z-23375	Z-23376	Z-23374	Z-23375	Z-23376
Set of Movable Contacts and Springs	Z-21117	Z-21117	Z-21118	Z-21117	Z-21117	Z-21118
Set of Front and Rear Stationary Contacts, Movable Contacts and Springs	Z-31140	X-247290	X-247291	Z-31140	X-247290	X-247291
Single Pole Contact Set (▲)	Z-34115	Z-34040	Z-34040	Z-34115	Z-34040	Z-34040

Parts indicated with Ⓢ are recommended spare parts.

ADJUSTING THE NORMALLY CLOSED COIL CLEARING CONTACT — Bulletins 702LP-702PM — Disconnect power. Remove **black wire** at auxiliary contact, loosen contact block cover screws and lift out contact block cover. Close contactor by hand. **White markings** will appear in side slots of coil cover indicating contacts are closed. Adjust **coil clearing contact** to the break point as determined by using an ohmmeter or continuity indicator. Turn the **adjustment screw** 1/2 to 3/4 turn clockwise. The screw is self-locking and does not require sealing. Do not push up on movable contact support while making this adjustment.

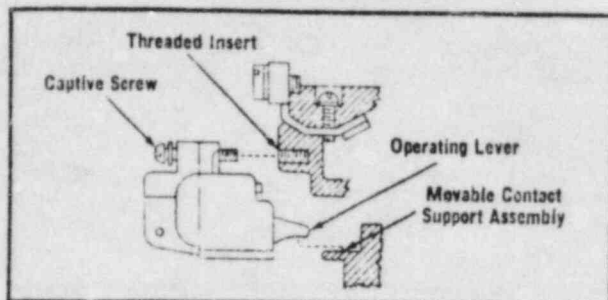


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BULLETIN 1495 AUXILIARY CONTACTS — These auxiliary contacts are designed to operate on the upward motion of the movable contact support assembly. The auxiliary contacts are furnished with a captive screw. The captive screw is used to engage either of the four inserts imbedded in the contact block front cover. Refer to illustration below.

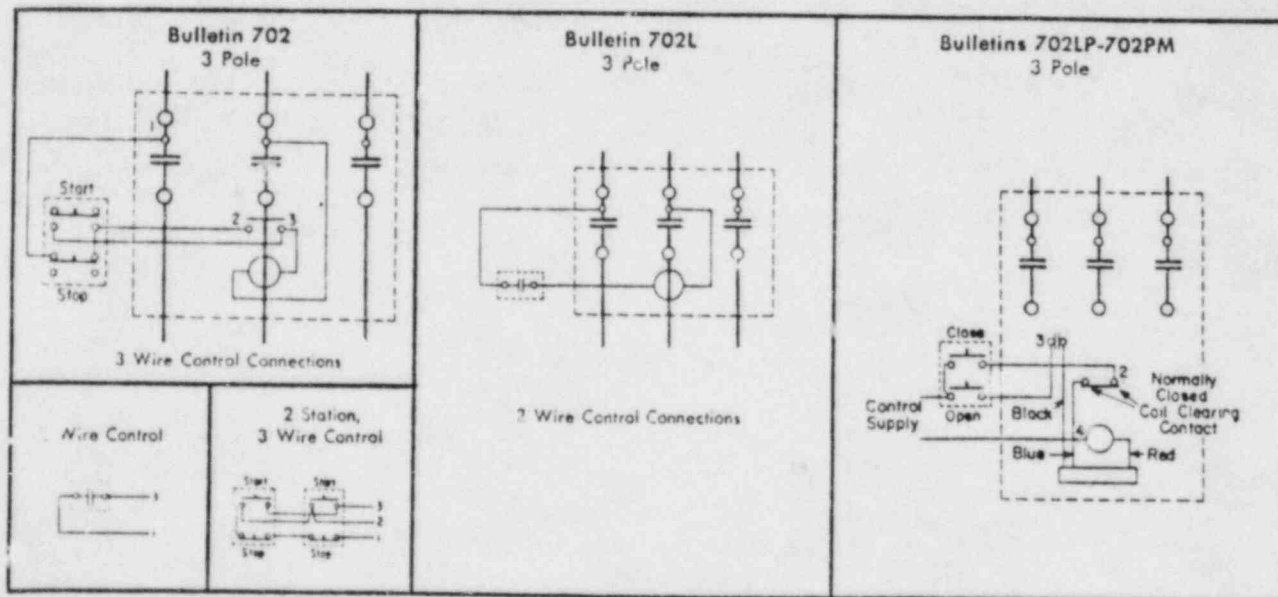
IMPORTANT — The auxiliary contact operating lever **must** rest on top of the movable contact support assembly.

Refer to listings in Handy Catalog for replacement catalog numbers.



ORDERING INFORMATION — Your order cannot be entered unless the following information is given. Part number, description of part, catalog number and series letter of contactor. This renewal parts list also applies to these contactors when used on control apparatus listed under other bulletin numbers.

TYPICAL WIRING DIAGRAMS —



ENGINEERING DATA —

1.P-RPS-M-Contactor-8

Bulletins 702-702PM

600 VOLTS MAXIMUM • 60 Hz			
Continuous Ampere Rating	Maximum Horsepower Rating		
	Coil Volts	3 or 2 Phase	Single Phase
90	120	15	7½
	208	25	—
	240	30	15
	480	50	—
	600	50	—

Full load current must not exceed "Continuous Ampere Rating."

Bulletins 702L-702LP

600 VOLTS MAXIMUM • 60 Hz						
Tungsten Lamp Loads	Non- Motor Loads General Use	Volts	Transformer Primary Switching KVA		Capacitor Switching 3 Phase KVAR	
	Ballast Loads Fluorescent					
	Mercury Vapor Lamps					
	Resistive Heating Loads					
	Line 480 Volts Maximum Load 277 Volts Maximum					
Maximum Continuous Ampere Rating			Single Phase	3 Phase		
100	100	120	4.1	—	—	
		208	—	12	—	
		240	8.1	14	27	
		480	16	28	53	
		600	20	35	67	

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MAR 23 1985

Fort Calhoun Station Unit No. 1
SURVEILLANCE TEST
ST-RPS-10

Manual Trip Channels

A. PURPOSE

1. To verify the operation of the Reactor Protective System manual trip circuits.

B. REFERENCES

1. C-E RPS Technical Manual.
2. Technical Specifications, Paragraph 3.1, Table 3-1, Item 10.

C. SPECIAL INSTRUMENTATION/EQUIPMENT

None

D. PREREQUISITES

1. Reactor is shut down.
2. Reactor Protective System is operable and is energized.

E. PRECAUTIONS

1. The reactor must be shutdown to perform this procedure, as the Reactor Protective System will be tripped. Secondary actions will take place. Exercise sound operator judgement during the performance of this test; otherwise, equipment damage may result.
2. High Voltage exists in the cables and cabinets when the RPS is energized.
3. Do not jumper any connections in any part of the RPS unless specifically called for in this procedure.

F. TEST PROCEDURE (Continued)

1. Manual Trip Check

Frequency: Prior to each startup, unless done the previous week. Step b.(1) need only be done if starting up after a refueling shutdown.

Responsibility: Operations

a. Initial Conditions

SIGN OFF/DATE

(1) See Section E.1.

CAUTION: EQUIPMENT DAMAGE MAY RESULT IF THE PRECAUTIONS OF SECTION E.1 ARE NOT ADHERED TO.

(2) Shift Supervisor notified prior to start of this test.

SS /

(3) On the Control Room ERF CRT, display the computer point Y3466, Reactor Trip.

/

b. Test Procedure

(1) Ensure Reactor is reset, then cycle CB-AB and then CB-BC (AI-57) three times. This Step is to comply with I E Bulletin 83-04.

/

(2) Push manual REACTOR TRIP pushbutton on RPS cabinet assembly.

/

(3) Verify that:

(a) RPS circuit breakers CB-AB and CB-CD open.

/

(b) The trip lights on clutch power supplies PS-1, PS-2, PS-3 and PS-4 are illuminated.

/

(c) Turbine trip circuit actuated.

/

NOTE: K3 and K4 Relay indicating lights will extinguish behind AI-31B and AI-31C indicating turbine trip circuit actuated.

(d) The diesel generator start circuit actuated.

/

(e) The reactor trip annunciator on the main control board operated.

/

F.1 TEST PROCEDURE (Continued)SIGN OFF/DATE

- (f) The station computer circuitry reacts properly to RPS trip input signal. _____/_____
- (g) The Control Room ERF CRT indicates Y3466 as tripped and Post Trip Review Log is printed on the Control Room Line Printer. _____/_____
- (4) Manually reset RPS circuit breakers CB-AB and CB-DC located in AI-57. _____/_____
- (5) Push manual REACTOR TRIP RESET pushbutton on Main Control Board. _____/_____
- (6) Verify that clutch power supplies PS-1, PS-2, PS-3 and PS-4 are re-energized. _____/_____
- (7) Push manual REACTOR TRIP pushbutton on Main Control Board. _____/_____
- (8) Verify the same results occur as in Section F.1.b.(3) with the exception that RPS circuit breakers CB-AB and CB-CD do not open, but contactors M1, M2, M3 and M4 are de-energized. _____/_____
- (9) Push manual REACTOR TRIP RESET pushbutton on Main Control Board and verify that the system cannot be reset within approximately 30 seconds. _____/_____
- (10) System resets after approximately 30 seconds. _____/_____
- (11) Shut down Diesels. _____/_____
- (12) Shift Supervisor notified equipment is returned to normal. _____/_____
- SS

c. Remarks: _____

Test Completed By _____ Date/Time _____/_____

Fort Calhoun Station Unit No. 1
SURVEILLANCE TEST
ST-RPS-11

RPS Logic Units

A. PURPOSE

1. Verification of operation of the logic networks and clutch power contactors.

B. REFERENCES

1. C-E RPS Technical Manual.
2. Technical Specification, Table 3.1, Table 3-1, Item 12.

C. SPECIAL INSTRUMENTATION/EQUIPMENT

None

D. PREREQUISITES

1. Reactor Protective System is operable and is energized.

E. PRECAUTIONS

1. During the following tests, the Reactor Protective System Logic is tested for proper operation. Utilizing the Built-in testing system test inputs will be used to check all possible two-out-of-four protective system logic combinations. This test will, at various times, place the RPS in a half-tripped condition.
2. High Voltage is present in the drawers and coaxial cables when the RPS is energized.
3. Do not jumper any connections in any part of the Reactor Protective System unless specifically called for in this procedure. Record all jumpers in the Fort Calhoun Station Jumper Log.

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FC/ST/03

R8 6-7-84

F. TEST PROCEDURE

1. RPS Logic Units Test

Frequency: Monthly

Responsibility: I and C

a. Initial Conditions

SIGN OFF/DATE

- (1) RPS is operable and is energized.
- (2) Reactor is operating and all trip units are clear, or;
- (3) If plant conditions are such that you have low steam generator level, proceed as follows:
(Record data in the Test Record).
 - (a) To clear trip units 4 and 5 remove field wiring from "trip unit interconnection Model Ass'y AW-9, BW-9, CW-9, and DW-9".

For Trip Unit 4, Terminals 41 and 42.

For Trip Unit 5, Terminals 37 and 38.
 - (b) Jumper Terminals 41 in A, B, C and D cabinets together.
 - (c) Jumper Terminals 42 in A, B, C and D cabinets together.
 - (d) Jumper Terminals 37 in A, B, C and D cabinets together.
 - (e) Jumper Terminals 38 in A, B, C and D cabinets together.
 - (f) Use a power supply and connect it to terminal 41 to plus and terminal 42 to minus.
 - (g) Use a power supply and connect it to terminal 37 to plus and terminal 38 to minus.
- (4) Shift Supervisor notified prior to start of this test.

SS /

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R8 6-7-84

F.1 TEST PROCEDURE (Continued)SIGN OFF/DATE

b. Test Procedure

CAUTION: This test will at various times, place the RPS in a half-tripped condition as a normal procedural step.

- (1) Reset all trip and pretrip lights on each trip unit. Some pretrip lights will remain on. /
- (2) Put all MATRIX RELAY TRIP SELECT switches of the EPS Testing System in the OFF position. /
- (3) Put all CHANNEL TRIP SELECT switches in the OFF position. /
- (4) Check closed circuit breakers CW20-CB1, BW20-CB2, CW19-CB3 and BW19-CB4. /
- (5) Check closed RPS trip circuit breakers CB-AB and CB-CD located in RPS Distribution Cabinet AI-57. /
- (6) Verify the following:
 - (a) All trip lights on trip units not illuminated. /
 - (b) The twelve D.C. power supplies that supply power to the logic matrices are on. /
 - (c) All matrix relay lights AB-1, AB-2, AB-3, AB-4 through CD-4 are on. /
 - (d) On the clutch power supplies in the RPS Auxiliary Cabinet, AI-3, the lights that are on are the AC ON, DC ON and the AC TROUBLE lights. The GROUND lights are slightly and evenly illuminated. The TRIP light is off. If unit is down, reset trip reset on CB-4. /
 - (e) Contact protection voltmeters on the RPS Auxiliary Cabinet AI-3 read approximately 20 volts. /

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F.1 TEST PROCEDURE (Continued)SIGN OFF/DATE

(6) (Continued)

- (f) RPS D.C. Power Supply ammeters, located on AI-3 each read 13 AMP. (nominal). If unit is down, no indication on ammeters.

- (7) Switch the TEST POWER SUPPLY of the RPS Testing System ON by momentarily depressing the TEST POWER ON pushbutton.
- (8) Push and hold MATRIX RELAY HOLD pushbutton on the AB Matrix Test module and verify that four HOLD lights are on.
- (9) Rotate the MATRIX RELAY TRIP SELECT switch on the AB Matrix Test module through its four positions. Verify in each numbered position appropriate HOLD light is OFF and the other three HOLD lights are ON. Return MATRIX RELAY TRIP SELECT switch to the OFF position.
- (10) Rotate the CHANNEL TRIP SELECT switch on the AB MATRIX TEST module through its twelve positions, verifying that the four AB matrix lights are off and the following trip unit lights are on in each switch position:

<u>Switch Position</u>	<u>Lights "ON"</u>	
1	ATU-1 Light 1, BTU-1 Light 1	/
2	ATU-2 Light 1, BTU-2 Light 1	/
3	ATU-3 Light 1, BTU-3 Light 1	/
4	ATU-4 Light 1, BTU-4 Light 1	/
5	ATU-5 Light 1, BTU-5 Light 1	/
6	ATU-6 Light 1, BTU-6 Light 1	/
7	ATU-7 Light 1, BTU-7 Light 1	/
8	ATU-8 Light 1, BTU-8 Light 1	/
9	ATU-9 Light 1, BTU-9 Light 1	/
10	ATU-10 Light 1, BTU-10 Light 1	/

F.1 TEST PROCEDURE (Continued)SIGN OFF/DATE

(10) (Continued)

Switch PositionLights "ON"

11 ATU-11 Light 1, BTU-11 Light 1

12 ATU-12 Light 1, BTU-12 Light 1

(11) Return CHANNEL TRIP SELECT switch to the OFF position.

(12) Repeat Steps 8, 9 and 10 for the AC Matrix Test module verifying:

Switch PositionLights "ON"1 ATU-1 Light 2, CTU-1 Light 1
through

12 ATU-12 Light 2, CTU-12 Light 1

(13) Repeat Steps 8, 9 and 10 for the AD Matrix Test module verifying:

Switch PositionLights "ON"1 ATU-1 Light 3, DTU-1 Light 1
through

12 ATU-12 Light 3, DTU-12 Light 1

(14) Repeat Steps 8, 9 and 10 for the BC Matrix Test module verifying:

Switch PositionLights "ON"1 BTU-1 Light 2, CTU-1 Light 2
through

12 BTU-12 Light 2, CTU-12 Light 2

(15) Repeat Steps 8, 9 and 10 for the BD Matrix Test module verifying:

Switch PositionLights "ON"1 BTU-1 Light 3, DTU-1 Light 2
through

12 BTU-12 Light 3, DTU-12 Light 2

F.1 TEST PROCEDURE (Continued)SIGN OFF/DATE

- (16) Repeat Steps 8, 9 and 10 for the CD Matrix Test module verifying:

<u>Switch Position</u>	<u>Lights "ON"</u>	
1 through 12	CTU-1 Light 3, DTU-1 Light 3 through CTU-12 Light 3, DTU-12 Light 3	/

- (17) Push and hold in MATRIX RELAY HOLD push-button on the AB Matrix Test module and verify that four HOLD lights are on.

AB AC AD BC BD CD

— — — — —

- (18) Put CHANNEL TRIP SELECT switch in Position 1 on the AB Matrix Test module. Verify that the four AB Matrix Relay lights are off.

— — — — —

- (19) Rotate the MATRIX RELAY TRIP SELECT switch on the AB Matrix Test module through its positions verifying the following in each of the four active positions:

— — — — —

<u>Switch Position</u>	<u>Action</u>	
1	(1) AB-1 thru AB-4 Matrix Relay lights off.	— — — — —
	(2) AB-1 Matrix Relay DROP-OUT light on.	— — — — —
	(3) AB-1 Matrix Relay HOLD light off.	— — — — —
	(4) Contactor M1 de-energized.	— — — — —
	(5) TRIP light on CLUTCH POWER SUPPLY PS-1 is on. DC ON light on PS-1 and PS-3, and GROUND lights on PS-3 are slightly illuminated. All other lights on PS-1 and PS-3 are off.	— — — — —
	(6) M1 Contact Protection voltmeter will read zero volts.	— — — — —
	(7) PS-1 and PS-3 Power Ammeters will read approximately zero AMPS.	— — — — —

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F.1 TEST PROCEDURE (Continued)

AB AC AD BC BD CD

<u>Switch Position</u>	<u>Action</u>					
Intermediate Between 1 and 2	(1) AB-1 Matrix Relay DROP- OUT light off.	---	---	---	---	---
	(2) AB-1 Matrix Relay HOLD light on.	---	---	---	---	---
	(3) Contactor M1 energized.	---	---	---	---	---
	(4) All RPS Power Supplies have identical indications as shown in Step F.1.b.(6)(d)	---	---	---	---	---
2	(1) AB-1 thru AB-4 Matrix Relay lights off.	---	---	---	---	---
	(2) AB-2 Matrix Relay DROP- OUT light on.	---	---	---	---	---
	(3) AB-2 Matrix Relay HOLD light off.	---	---	---	---	---
	(4) Contactor M2 de-energized.	---	---	---	---	---
	(5) TRIP light on CLUTCH POWER SUPPLY PS-3 is on. DC ON light on PS-1 and PS-3, and GROUND lights on PS-1 are slightly illuminated. All other lights on PS-1 and PS-3 are off.	---	---	---	---	---
	(6) M2 Contact Protection volt- meter will read zero volts.	---	---	---	---	---
	(7) PS-1 and PS-3 Power Ammeters will read approximately zero AMPS.	---	---	---	---	---
Intermediate Between 2 and 3	(1) AB-2 Matrix Relay DROP- OUT light off.	---	---	---	---	---
	(2) AB-2 Matrix Relay HOLD light on.	---	---	---	---	---
	(3) Contactor M2 energized.	---	---	---	---	---
	(4) All RPS Power Supplies have identical indications as shown in Step F.1.b.(6)(d)	---	---	---	---	---

F.1 TEST PROCEDURE (Continued)

AB AC AD BC BD CD

<u>Switch Position</u>	<u>Action</u>					
3	(1) AB-1 thru AB-4 Matrix Relay lights are off.	—	—	—	—	—
	(2) AB-3 Matrix Relay DROP-OUT light on.	—	—	—	—	—
	(3) AB-3 Matrix Relay HOLD light off.	—	—	—	—	—
	(4) Contactor M3 de-energized.	—	—	—	—	—
	(5) TRIP light on CLUTCH POWER SUPPLY PS-2 is on. DC ON light on PS-2 and PS-4, and GROUND lights on PS-4 are slightly illuminated. All other lights on PS-2 and PS-4 are off.	—	—	—	—	—
	(6) M3 Contact Protection voltmeter will read zero.	—	—	—	—	—
	(7) PS-2 and PS-4 Power Ammeters will read approximately zero AMPS.	—	—	—	—	—
Intermediate Between 3 and 4	(1) AB-3 Matrix Relay DROP-OUT light off.	—	—	—	—	—
	(2) AB-3 Matrix Relay HOLD light on.	—	—	—	—	—
	(3) Contactor M3 energized.	—	—	—	—	—
	(4) All RPS Power Supplies have identical indications as shown in Step F.1.b.(6)(d)	—	—	—	—	—
4	(1) AB-1 thru AB-4 Matrix Relay lights are off.	—	—	—	—	—
	(2) AB-4 Matrix Relay DROP-OUT light on.	—	—	—	—	—
	(3) AB-4 Matrix Relay HOLD light off.	—	—	—	—	—
	(4) Contactor M4 de-energized.	—	—	—	—	—

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F.1 TEST PROCEDURE (Continued)

AB AC AD BC BD CD

Switch PositionAction

- | | | | |
|-----|------|--|-------|
| | (5) | TRIP light on CLUTCH POWER SUPPLY PS-4 is on. DC CN light on PS-2 and PS-4, and GROUND lights on PS-2 are slightly illuminated. All other lights on PS-2 and PS-4 are off. | _____ |
| | (6) | M4 Contact Protection voltmeter will read zero. | _____ |
| | (7) | PS-2 and PS-4 Power Ammeters will read approximately zero AMPS. | _____ |
| OFF | (1) | AB-4 Matrix Relay DROP-OUT light off. | _____ |
| | (2) | AB-4 Matrix Relay HOLD light on. | _____ |
| | (3) | Contactor M4 energized. | _____ |
| | (4) | All RPS Power Supplies have identical indications as shown in Step F.1.b.(4), (5) and (6). | _____ |
| | (20) | Return CHANNEL TRIP SELECT switch to the OFF position on AB Matrix Test Module. | _____ |

SIGN OFF/DATE

- | | | |
|------|---|---------------|
| (21) | Repeat Steps 17, 18, 19 and 20 for matrices AC, AD, BC, BD, and CD. On completion of this test, return CHANNEL TRIP SELECT and MATRIX RELAY TRIP SELECT switches to the OFF position. | _____ / _____ |
| (22) | Remove power supplies and return wiring removed to return trip units 4 and 5 to their original conditions. Record data in the Test Record. | _____ / _____ |
| (23) | Shift Supervisor notified equipment is returned to normal. | _____ / _____ |

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c. Remarks:

Test Completed By _____ Date/Time _____ / _____

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TEST RECORD

Section F.1

<u>Channel</u>	<u>Jumper Installed Terminal 41</u>	<u>Jumper Removed Terminal 41</u>	<u>Jumper Installed Terminal 42</u>	<u>Jumper Removed Terminal 42</u>	<u>Jumper Installed Terminal 37</u>	<u>Jumper Removed Terminal 37</u>	<u>Jumper Installed Terminal 38</u>	<u>Jumper Removed Terminal 38</u>
CHANNEL "A"								
CHANNEL "B"								
CHANNEL "C"								
CHANNEL "D"								

Remarks: _____

Test Completed By: _____ Date/Time: _____ / _____