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April 18, 1983

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

Attention: Ms. E. G. Adensam, Chief
Licensing Branch No. 4

Re: McGuire Nuclear Station
Docket Nos. 50-369, 50-370

Dear Mr. Denton:

As requested by the April 1, 1983 letter from Elinor G. Adensam to H. B. Tucker, attached is a report on the reactor trip breakers for McGuire Nuclear Station. Please note that information concerning recent failures at Farley Nuclear Plant was not received in time to incorporate into this report. Appropriate actions will be taken if the problems at Farley are determined to be applicable to McGuire.

Very truly yours,

Hal B. Tucker

Hal B. Tucker

REH:jfw
Attachment

B021

cc: Mr. James P. O'Reilly, Regional Administrator
U. S. Nuclear Regulatory Commission
Region II
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Mr. W. T. Orders
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Reactor Trip Protection System

Design Bases and Criteria

The Reactor Trip System acts to limit the consequences of Condition II events (faults of moderate frequency), such as loss of feedwater flow, by, at most, a shutdown of the reactor and turbine, with the plant capable of returning to operation after corrective action. The Reactor Trip System features impose a limiting boundary region to plant operation which ensures that the reactor safety limits are not exceeded during Condition II events and that these events can be accommodated without developing into more severe conditions. Reactor trip setpoints and response times are given in the Technical Specifications.

The design requirements for the Reactor Trip System are derived by analyses of plant operating and fault conditions where automatic rapid control rod insertion is necessary in order to prevent or limit core or reactor coolant boundary damage.

The Reactor Trip Protection System functional design bases ensure the following:

* Minimum DNBR meets core acceptance criteria for condition II transients.

* Maximum rated linear power density meets core acceptance criteria for condition II transients.

* Maximum reactor coolant system (RCS) stress limits specified in FSAR Chapter 5 are not exceeded.

* For any condition III or IV faults, core damage is limited to preclude undue risk to public health and safety due to potential radioactivity releases.

The design requirements which the Reactor Trip Protection System meets include all the requirements listed in IEEE Standard 279-1971.

DESIGN DESCRIPTION OF REACTOR PROTECTION SYSTEM

The basic Reactor Protection System (RPS) consists of analog channels, combinational logic units and trip breakers. A typical analog channel is made up of a sensor, signal conditioning circuits and a comparator, of which the comparator is the output device, providing input to the combinational logic. Any particular protective feature will have either 2, 3, or 4 separate analog channels each providing input to two separate combinational logic trains. Each train of combinational logic will upon detection of 1 of 2, 2 of 3, or 2 of 4 (whichever is appropriate) inputs indicating that the monitored parameter is beyond the setpoint, trip the respective reactor trip breaker. The reactor trip breakers are in series and provide power to the shutdown and control rod drive power cabinets. Opening of either breaker will remove power from the rods, allowing the rods to fall into the core. Parallel bypass breakers are provided as part of this system to allow for testing of the reactor trip breakers while at power.

ANALOG CHANNELS

The analog channels comprise the input portion of the RPS. A typical analog channel consists of: a sensor, loop power supplies, signal conditioning circuits and signal comparators. Separation of the redundant analog channels originates at the process (or NIS) sensors and continues through the field wiring and containment penetrations to the protection racks. At the protection racks, the components of the four channels are located in separate panels with the four arrangements being

designated Protection Sets I, II, III, and IV. Furthermore, power for each channel is supplied from separate buses. The major components are briefly described below.

1. The sensor measures physical parameters such as temperature, pressure, level or flow. The measurement is converted to an electrical signal and transmitted to the protection racks. The normal signal is a 4 to 20 milliampere current proportional to the parameter being measured.

2. The loop power supply performs three functions:

   a. It provides a constant 24 VDC to the sensor/transmitter.

   b. It samples the loop current from the transmitter (4-20 ma) and converts it to a proportional 0 to 10 VDC non-isolated output signal for the protective functions.

   c. It samples the loop current from the transmitter and converts it to a proportional 0 to 10 VDC isolated output to control and indication functions.

3. The signal conditioning modules perform a number of functions such as amplification, square root derivation, lead/lag compensation, integration, summation, and isolation.

Outputs of the universal boards are connected to the undervoltage (UV) output board. Connections to safeguards are discussed below. The UV board in each SSPS train maintains two undervoltage coils in an energized condition, one for the reactor trip breaker and one for the bypass breaker. When a universal board in a train generates a trip signal, the 48 volt output of the UV board will be removed, deenergizing the UV coils of the trip breaker in that train and in the bypass breaker of the opposite train. This will open the reactor trip and opposite train bypass (if closed) breaker removing power from the rods, allowing rods to fall into the core. The equivalent action will be performed by the redundant train.

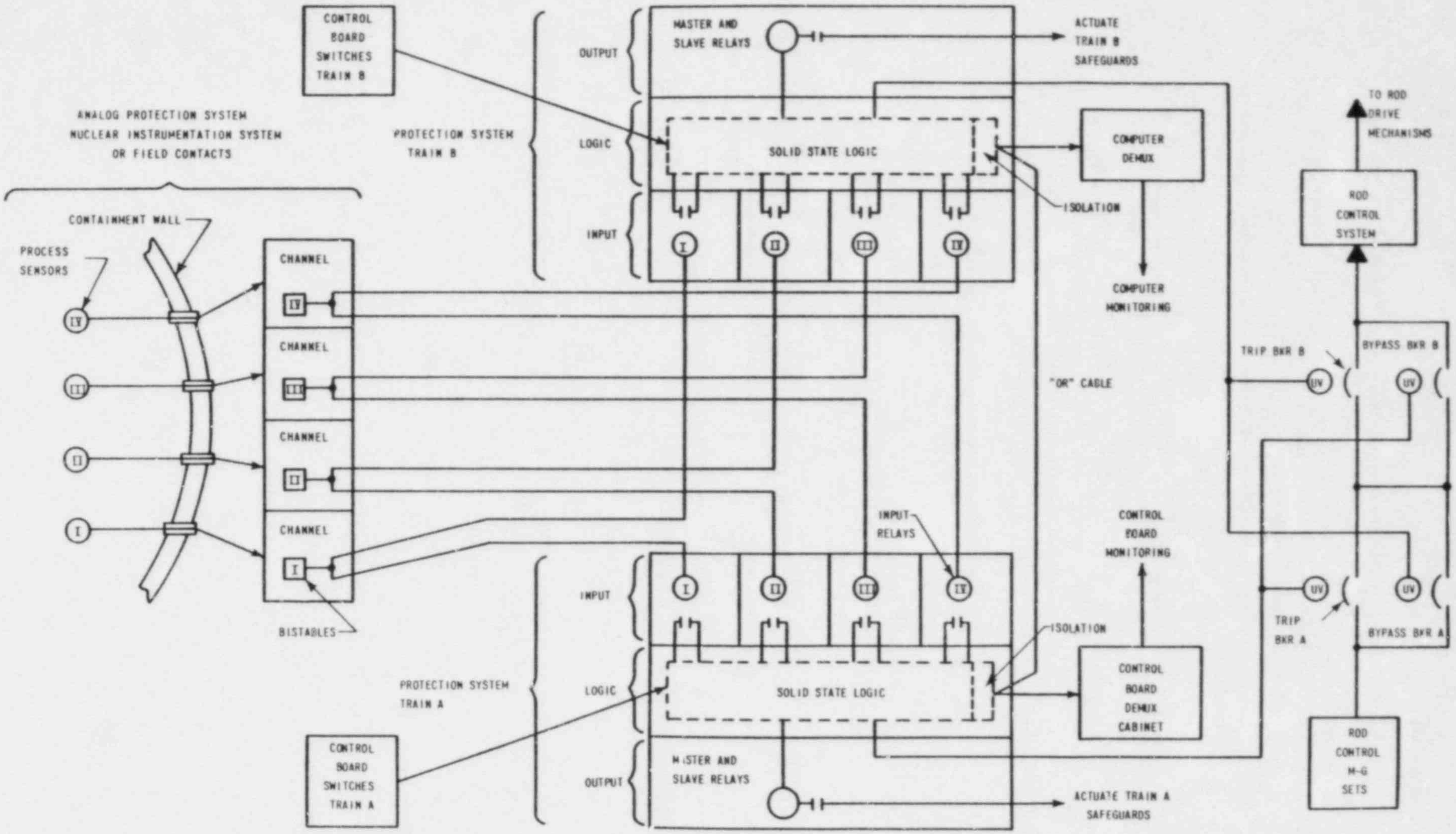
ENGINEERED SAFETY FEATURES INSTRUMENTATION

Portions of the Engineered Safety Features (ESF) instrumentation system are identical to the RPS. Analog channels provide input to universal boards in the SSPS which in turn send signals to safeguard output boards which through master and slave relays cause the actuation of ESF equipment. Circuitry and components from the sensor to the universal boards are the same as or identical to that in the RPS. For example, pressurizer pressure channels send signals to the RPS and the ESF system. Components common to the two systems are the sensor, loop power supply and some signal conditioning modules. Components that are identical are comparators, input relays and universal boards.

4. A signal comparator is usually a bistable device. The bistable compares the incoming signal to a predetermined setpoint and turns its output off or on if the input voltage exceeds the setpoint. Note that the setpoint can be exceeded in either direction to provide high and low alarms and trips. For most trip functions, the signal comparator supplies a 24 VDC output for parameters within the normal range and 0 VDC for a trip signal. Each bistable will control two separate relays, one associated with reactor trip logic train A and one associated with reactor trip logic train B.

LOGIC CABINET AND REACTOR TRIP BREAKERS

The Logic Cabinet, or Solid State Protection System (SSPS) is a dual train, redundant protection system receiving inputs from the analog channels. The interface between the analog channels and the SSPS is accomplished using relays in either an energized or deenergized state, as determined by the output of the comparators. The normally energized relays operate grounding contacts in the SSPS circuitry. When a comparator senses a trip condition the corresponding input relay will deenergize, applying a ground to a specific logic input. The logic inputs are applied to universal boards which are the basic circuits of the protection system. They contain 1 of 2, 2 of 3, 2 of 4, etc., logic circuits. Grounding of the appropriate number of universal board inputs will cause a trip signal to be generated.



Protection System Block Diagram

Figure 1

B. Reactor Trip Breakers

The reactor trip breakers are series connected and are provided with two bypass breakers connected so that each bypass breaker is parallel with its associated reactor trip breaker. This equipment comprises the Reactor Trip Switchgear. The bypass breakers are provided to allow for testing of the trip breakers with the reactor in operation.

1.1 The design criteria applicable to the Reactor Trip Switchgear are:

1.1.1 General Design Criteria Section III, Protection and Reactivity Control Systems. (GDC-23; Fail in a safe direction)

1.1.2 Westinghouse Functional Requirements

1.1.2.1 IEEE-279

1.1.2.2 Maximum Interrupting Time

1.2.2.3 IEEE-344

1.2.2.4 Industry Standards (i.e., NEMA, ANSI, NEC)

1.2 Safety Classification - IE

2.0 Design Description

The Reactor Trip Breakers are Westinghouse Model DS-416 1600 amp 480 volt power circuit breakers. These breakers operate on the magnetic de-ion principle of interruption. In these breakers the arc rises from the main contacts into a series of insulated plates. These plates break the arc into a series of smaller arcs to cool and extinguish them and funnel the heat to ambient air.

The breakers are designed for use in metal enclosed switchgear and are equipped with spring-stored energy closing mechanisms.

These breakers are supplied with a shunt trip attachment (energize to actuate) and an undervoltage trip attachment (deenergize to actuate) for purposes of opening the breaker remotely. There is also a mechanical trip mechanism for opening the breaker locally.

I. C. Description of McGuire RTB Failures

Feb. 4 - McGuire Unit 2 Train B reactor trip breaker failed to trip during RPS logic testing five consecutive times via the undervoltage trip device. The breaker was successfully tripped with the shunt trip. All subsequent UV trips were successful. A work request was written to inspect the breaker.

Feb. 16 - The Unit 2 Train B breaker failed to trip via UV trip device on several attempts during RPS response time test.

Feb. 18 - As a result of the February 4 work request, the Unit 2 Train B breaker was inspected and tripped via the UV trip device 7 or 8 times without any problems detected.

Mar. 16 - Unit 2 breakers were tested in response to IE83-04. Breakers tripped as required.

Mar. 18 - In addition to the required IE83-04 tests, further testing was performed on the Unit 2 Train B RTB because of the Feb. 4-18 failures. The Unit 2 Train B RTB again failed to trip on undervoltage during the testing. Continued testing resulted in a total of three failures out of 125 cycles on this breaker.

Mar. 19 - Unit 1 Train A RTB twice failed to trip on undervoltage during RPS response time testing.

II. Identification of Cause of Breaker Failure to Trip

Introduction and Overview

Mar. 21 - Westinghouse representatives inspected the two McGuire breakers that had failed to trip on undervoltage. Their preliminary assessment was that the Unit 2 breaker failed due to binding in the undervoltage device, and the Unit 1 breaker failed due to improper clearance between the UV device and the trip shaft pin.

Mar. 23 - The Unit 2 UV device was disassembled at Westinghouse factory. Westinghouse concluded that binding of UV device was due to improper clearances between the device components.

Mar. 28 - During preventative maintenance of the Unit 2 breakers, the bearing surfaces of the breaker trip shafts were found to be improperly machined. Westinghouse was asked to evaluate the trip shaft problems.

Mar. 30 - McGuire received preliminary telecopy of the dimension checks to be performed on the UV devices.

Mar. 31 - Westinghouse provided final dimension check requirements. No McGuire breakers passed all of the checks. Catawba breakers were checked and two of the 8 Catawba breakers passed.

Apr. 1 - The two Catawba breakers that passed the test were transferred to McGuire, inspected, serviced, and cycled 10 times, and installed as the Unit 2 Train A & B Reactor Trip Breakers.

Apr. 2 - The Unit 2 Train B breaker failed to trip via the UV trip device during a functional check prior to rod drop tests.

Apr. 4 - Westinghouse personnel inspected the Unit 2 Train B breaker at McGuire and determined the failure to be due to dislocation of the UV device roller arm shaft. The dislocation was attributed to a snap retaining ring missing from the shaft.

Apr. 6 - A new UV trip device supplied by Westinghouse was installed on the Unit 2 Train B breaker and cycled 25 times without any problems. Response time tests were conducted with no problems. Rod drop test was initiated. No subsequent breaker problems were discovered.

II. Identification of Cause of Breaker Failure to Trip

A. Description of Investigative Tests

1.0 McGuire Unit #2

During preoperational testing Reactor Trip breaker "B" exhibited an intermittent failure to trip upon demand utilizing the undervoltage trip attachment. A work request was written and the breaker was removed from service. Investigation by maintenance personnel could not readily identify any problems and the breaker was returned to service.

On March 18, 1983, Westinghouse was notified that the intermittent failure had again occurred. On March 20, Westinghouse was advised of a failure of a Unit #1 breaker to trip. Westinghouse personnel arrived on site to conduct preliminary investigation in order to isolate the probable cause of the failures.

Unit #2 reactor trip breaker B had been removed from the cabinet and taken to a maintenance area where the undervoltage device was energized and the breaker closed on March 18 and allowed to remain over the weekend. After several cycles of the breaker the failure was repeated. The undervoltage trip device was then removed from the breaker and a series of "drop-out" tests (lowering of the coil slowly to 60%-30% of rating) were performed. In addition, manual manipulation of the moving parts was performed. This activity identified a sluggish operation of the moving core and roller bracket caused by a binding between the parts where they are connected.

2.0 McGuire Unit #1

Investigation and cycling of the 'A' reactor trip breaker could not reproduce the intermittent operation. However, it was noticed that there was no gap between the undervoltage trip lever and the breaker trip shaft pin. The design of the trip mechanism requires that a gap exist for optimal tripping efficiency.

3.0 Examination of the Unit #2 UV Trip Attachment in Pittsburgh

Because the Unit #1 failure could not be separated and the observed anomaly most probably cuased the intermittent failure, the undervoltage trip attachment was not removed. In addition, this UV attachment did have observable end-play between the plunger and roller bracket allowing freedom of movement.

The McGuire Unit #2 UV trip attachment was returned to Pittsburgh for further evaluation. This attachment was disassembled and a complete detailed dimensional check was made of all the parts against drawing requirements. Detailed layout drawings were also made to check dimensional tolerances.

B. Results of Tests/Evaluation

The detailed evaluation of the parts identified that the operating rod in the moving core was not within specification and verified the "binding" effect initially identified as causing the sticking.

C. Conclusions

Unit #2

The manufacturing drawings did not clearly specify tolerances causing variations in the manufactured parts. These manufacturing variations caused interference between the moving core and roller bracket which resulted in intermittent operation. A further, though of lesser degree, contributing effect was lack of side to side clearance of the roller bracket. Action: Clarify dimensional tolerance information on drawings for critical parts.

In addition, the missing retaining ring was attributed to insufficient width of the groove where the retaining ring snaps into place. Therefore, all new devices will have wider grooves to accomodate the retaining rings.

Unit #1

Failure of the undervoltage device to trip the breaker is attributed to the absence of the gap between the undervoltage trip reset lever and the breaker trip shaft pin. No additional evidence was identified on which to base other conclusions. Action: Replace UV Trip Attachment

Evaluation of the effect of the grinding to the end of the trip shaft indicated that no significant adverse problems would occur from this condition. Although no previous problems have been attributed to this grinding condition, prudent engineering judgement recommends change out of the trip shafts.

Reactor Trip Breaker Issue for McGuire

It is the goal of Duke Power maintenance programs to identify adverse equipment performance trends and resolve them promptly; involving the manufacturer when appropriate. This is evidenced by the response in 1979 to Oconee control rod drive circuit breaker undervoltage trip response deficiencies. General Electric was involved in a timely on-site review of the failures, resulting in permanent procedure revision to check dimensions and torque, along with an undervoltage device setpoint revision. The preventive maintenance frequency was also increased. The actions resulted in a significant performance improvement demonstrated by surveillance testing at Oconee during the last four years. Manufacturer's technical advisories were later issued to appropriate owners in 1979.

III. Maintenance & Testing Procedures (RTBs)

A. All vendor information letters (vil) are received by the manager of Nuclear Operations and distributed to the responsible groups dependent on subject matter. Each responsible group (or person) receiving the vil reviews it for action to be taken (if necessary) and then initiates the appropriate response.

Technical manuals are issued from the Vendor to Duke's Design Engineering Department which in turn assigns the appropriate identification number. Design then issues the manuals to their central files, Nuclear Production general office central files and to the Nuclear Station (s). It is the responsibility of each station to properly file the technical manuals and to notify appropriate station personnel of receipt of the manuals.

B. Control of RTB Configuration

The breaker maintenance program is consistent with maintenance on all safety-related equipment and is handled as such using the station work request. In the case of the RTB whenever maintenance is performed a copy of the completed procedure and data sheet is attached to the work request for each RTB and filed in the station master file. The breaker data sheet will identify the breaker by type and serial number so that a history of each breaker is available for traceability.

C. RTB Maintenance Programs

1. Procedures & QA/QC Requirements

The review and approval process for safety-related procedures includes a review by the Quality Assurance Department. Prior to use, a safety evaluation of each procedure is performed in order to determine the impact the procedure would have on the station FSAR and Technical Specifications. Also,

prior to use each new procedure is reviewed by a qualified reviewer in order to determine if additional or cross disciplinary review is necessary.

Attached to the approved maintenance procedure is a work request which among other items denotes actions required by Quality Control to assure quality assurance actions related to the physical characteristics of materials, structures, systems or components which provide a means to control the quality of the materials, structures, systems or components or predetermined requirements.

The breaker maintenance procedure currently in use was reviewed and approved by the station QA department along with a technical review by station engineers.

The data sheet of the breaker maintenance procedure is reviewed and signed off by the station QC department.

2. Maintenance History

As described in B a maintenance history for each breaker is kept in the station master file. Also a computer PM/PT Program is also used at the station to store equipment maintenance history. The reactor trip breaker is assigned a computer identification number which then may be used to call up the maintenance history for that breaker type.

3/10 - 3/13/78

Preventive maintenance performed on Unit 1 Reactor Trip and Bypass Breakers A and B.

7/26/79

Preventive maintenance performed on Unit 2 Reactor Trip and Bypass Breakers A and B.

4/25/80

Preventive maintenance performed on Unit 1 Reactor Trip and Bypass Breakers A and B.

2/4/83

Unit 2 B Train Reactor Trip Breaker failed to trip on approximately five consecutive undervoltage (UV) trip signal attempts during the Reactor Protection System Functional Test, TP/2/A/1600/03 (preoperational). A recorder connected to the UV trip coil voltage indicated zero volts during the failure. The breaker was then successfully tripped using the Control Board switch (shunt and UV trips). The breaker tripped properly on UV after that. Work Request No. 64081 IAE was written to troubleshoot breaker.

3. Vendor Maintenance Activities

Any unusual problems or failures of vendor supplied equipment is brought to the attention of the vendor. If it appears that the failures are vendor design or manufacturing in nature then the vendor is requested to investigate and provide a suitable solution. Westinghouse on-site engineers have been involved in the RTB failure to trip problem at McGuire since the Unit 2 B Train RTB failed to trip on February 4, 1983.

4. Reporting of Failures

All failures of the RTB are potentially reportable depending on the cause of failure. However, any failure of a breaker which indicates it might not have performed its safety function while in service is considered reportable (whether the failure occurred while installed or on the test bench).

III D - Compliance with NRC Bulletins and Circulars

IEC 81-12 issued on July 22, 1981 involved the failure of a reactor trip breaker to trip on an UV trip signal at the St. Lucie Nuclear Power Plant. Upon review of the circular, it was verified that the periodic testing identified for the reactor trip breakers would check the UV trip coil separate from the shunt trip coil. IP/0/A/3010/05 included a section to verify an UV signal would trip the breakers. The Maintenance procedure for breaker PM, MP/0/A/2001/04, included a section to check for a broken or misaligned trip mechanism.

IEB 83-01 issued on February 25, 1983, involved the failure of a Westinghouse type DB-50 breaker to trip on UV signal at the Salem Nuclear Power Plant. Response for McGuire indicated this breaker type, DB-50, was not used in any application at the McGuire facility. Further review verified the UV trip device used on the McGuire breakers was of a different design than the DB-50. The manual for the McGuire breakers, type DS-416, stated the UV trip device required no lubrication. Previous preventative maintenance performed on the McGuire breakers had indicated no problems with the UV trip coil.

IEB 83-04 issued on March 11, 1983, required testing of UV and shunt trip functions, review of the maintenance program, notification of all licensed operators of the recent trip breaker failures and a review of applicable emergency procedures. The tests on the breakers was completed on March 16, 1983 for Unit 2 and on March 17, 1983 for Unit 1. During these tests the breakers functioned as required, however, subsequent testing revealed the breaker failures that have been previously discussed. Previous review had indicated the maintenance performed on the breakers had been in accordance with Westinghouse instructions. Operations personnel reviewed the recent breaker failures and applicable emergency procedures with each on-coming shift. This was completed on April 11, 1983 for all McGuire operating shifts.

E. Proposed Revisions

Prior to the RTB being considered operable each breaker will be checked for proper manufacturing tolerances (dimensional checks) as provided by Westinghouse. All components not passing the dimensional checks will be replaced with qualified components provided by the vendor. Each breaker will be checked and lubricated per the latest technical manual and recommendations from Westinghouse and then cycled on the test bench.

The procedure used to perform maintenance on the RTBs, titled "Air Circuit Breaker Inspection and Maintenance", MP/0/A/2001/04, is being amended to include the specific requirements to maintain the DS-416 Westinghouse air circuit breaker.

IV. Periodic Surveillance Testing of Reactor Trip Breakers

There are currently four separate surveillance procedures that cover various requirements for reactor trip breaker testing. These procedures cover manual trip verification, automatic trip from reactor protection system, separate verification of UV and shunt trips, and breaker response times. Table 1 shows the procedure number and frequency of tests. The maintenance procedure used for preventative maintenance is also listed which includes provisions for inspection, cleaning and lubrication of the breakers.

Tests have been completed on McGuire Unit 1, as required, since issuance of the operating license on January 23, 1981. As a result of these tests no failures of the reactor trip breakers to open has been noted, with the exception of the recent failure on Unit 1 during Reactor Protective System Time Response Testing.

As shown on Table 1, the response times of the reactor trip breakers is included in the Reactor Protective System Time Response Test. This time is measured from the time the voltage signal on the UV circuit reaches 30% of the nominal value to the opening of the breaker contacts by using a high speed recorder. The acceptance criteria specified is for the time to be less than .15 seconds. However, in subsequent sections of the test this time is assumed to be .15 seconds in determining the total channel response times. Table 2 lists the response times measured for the McGuire breakers during past tests.

The current McGuire Technical Specifications requires the testing shown on Table 1 in the areas listed. This testing is completely adequate to demonstrate proper functioning of the reactor trip breakers and therefore no changes in the Technical Specifications are proposed.

Table 1

PERIODIC SURVEILLANCE TESTING ON MCGUIRE REACTOR TRIP BREAKERS

PROCEDURE	FREQUENCY	TRIP BREAKER ACCEPTANCE
PT/1/A/4600/56 Manual Reactor Trip Functional Test	Each Startup if not done in previous 7 days	Manual Trip of all reactor trip and bypass breakers
IP/0/A/3010/05 Solid State Protection System Periodic Test	Every 62 days on a staggered basis	Reactor trip breakers and bypass breaker trip on UV.
PT/0/A/4600/12 Reactor Trip Breaker Actuating Device Operational Testing	18 months and following maintenance or adjustment	Verify trip on UV and shunt separately
IP/0/A/3010/06 Reactor Protection System Time Response	One train every 18 months	Verify response time on reactor trip breakers less than .15 seconds
MP/0/A/2001/04 Air Circuit Breaker Inspection & Maintenance	Refueling	Perform preventative maintenance

Table 2

RESPONSE TIME TESTING FOR MCGUIRE BREAKERS

	BREAKER	DATE	RESPONSE TIME
UNIT 1			
	RTB A	12/1/80	.06 Sec.
	RTB B	12/1/80	.07 Sec.
UNIT 2			
	RTB A	2/24/83	.09 Sec.
	RTB B	2/24/83	.08 Sec.

V. RTB Modification

A. Repairs

1. UV devices will be replaced on all McGuire and Catawba RTB's with new devices provided by Westinghouse. All new UV devices have been manufactured and inspected per Westinghouse dimension/tolerance critieria.

2. All McGuire RTB trip shafts will be replaced as a precaution.

3. All Catawba RTB trip shafts are being inspected. Will be replaced if necessary.

4. All RTB's will be cycle tested after repairs.

B. Modifications

1. PURPOSE

To further enhance RTB trip reliability, a modification has been made such that the protection system simultaneously activates the RTB shunt trip device with the standard actuation of the UV trip device. Capability has also been provided for independent testing of the UV and shunt trip devices.

No modifications were made to the bypass breaker trip functions.

2. DESCRIPTION

The automatic shunt trip modification consists of a 48 VDC relay wired in parellel with the existing RTB undervoltage device. A contact of this relay is wired in parallel with the existing manual trip switch. In normal operation with the breaker closed, the relay is energized and the contact is open. Upon receipt of trip signals, the reactor protection system logic de-energizes the relay (and the UV device). The relay contact closes and energizes the breaker shunt trip coil. Figure 2 shows a sketch of the modification.

For testing, one pushbutton switch is wired in series with the relay coil, and another pushbutton switch is wired in series with the relay contact. Both switches are normally closed. The test sequence and logic are detailed on Figures 3 - 9.

The relay and pushbutton switches are physically mounted on a "C" channel which has been added between the structural braces in the rear of the switchgear cabinet. See Figure 10.

3. IMPACT ON DESIGN BASIS OF RPS/RTB

There is no impact on the design basis of either the RPS or RTB. The simultaneous activation of both the UV and shunt trip is a standard feature of manual trip. Thus, the only difference in function of the RTB is that a simultaneous UV and shunt trip occurs for both manual and protection system initiated trips, rather than only UV trip with protection system initiation.

The addition of the relay in parallel to the UV device is within the current ratings of the protection system power supply and switching device (verified by Westinghouse). There has been no compromise of channel or train independence nor separation/isolation criteria.

4. POST-MODIFICATION TEST

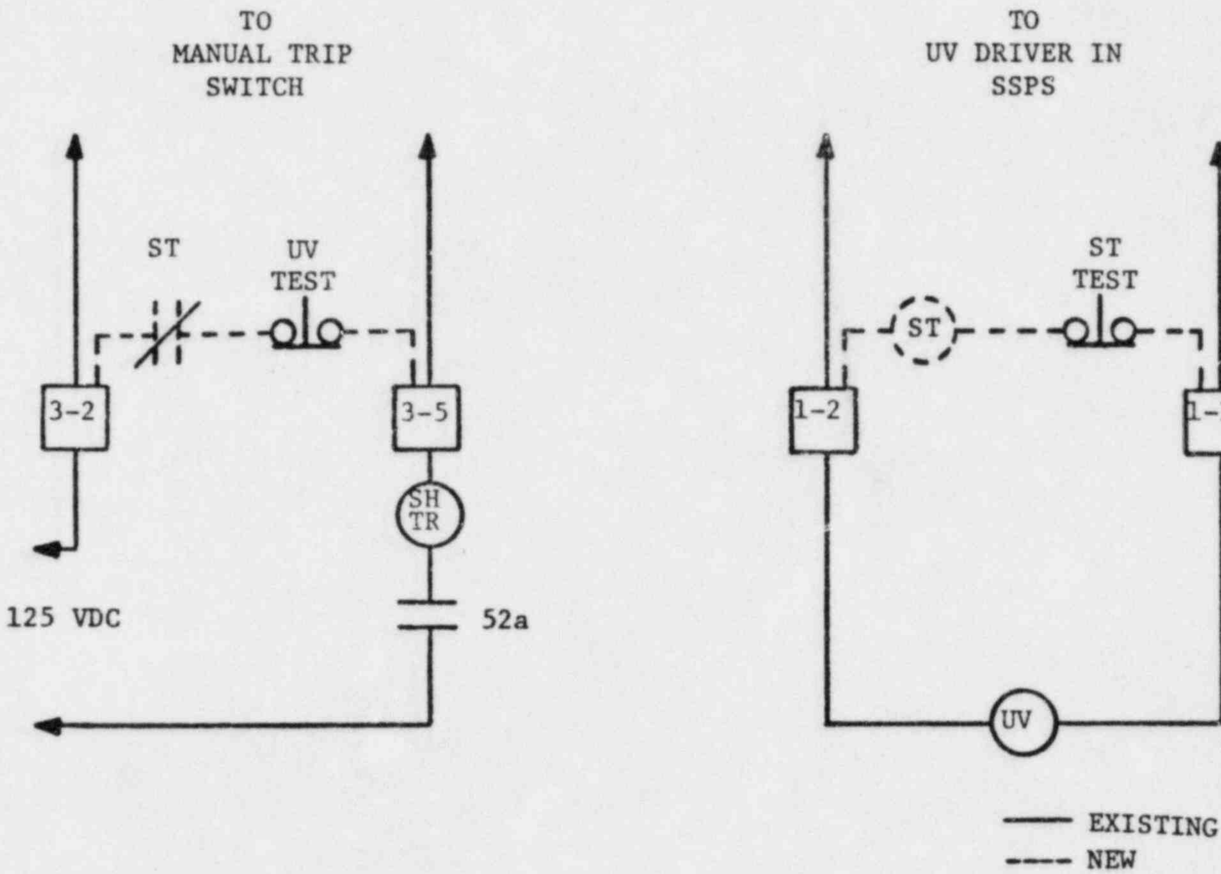
The testing procedure detailed in Figures 3-9 fully verifies proper independent operation of both trip devices, and verifies proper circuit restoration after testing. The Tech. Spec. tests verify proper breaker response times.

5. SCHEDULE

The modifications were installed on April 4 - 8, 1983.

FIGURE 2

AUTOMATIC SHUNT TRIP MODIFICATION



SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

STEP 1. DEPRESS AND HOLD UV TEST SWITCH.

STEP 2. DEPRESS SHUNT TRIP TEST SWITCH.

STEP 3. VERIFY NO BREAKER TRIP OCCURS.

STEP 4. RELEASE SHUNT TRIP TEST SWITCH ONLY.

STEP 5. DE-ENERGIZE THE UV COIL BY INJECTING A TRIP SIGNAL INTO THE SSPS.

STEP 6. VERIFY BREAKER TRIPS OPEN.

STEP 7. RELEASE UV TEST SWITCH.

STEP 8. RE-ENERGIZE UV COIL BY CLEARING THE SSPS TRIP.

STEP 9. RECLOSE TRIP BREAKER.

STEP 10. DEPRESS SHUNT TRIP TEST SWITCH.

STEP 11. VERIFY BREAKER TRIPS OPEN.

STEP 12. RELEASE SHUNT TRIP TEST SWITCH.

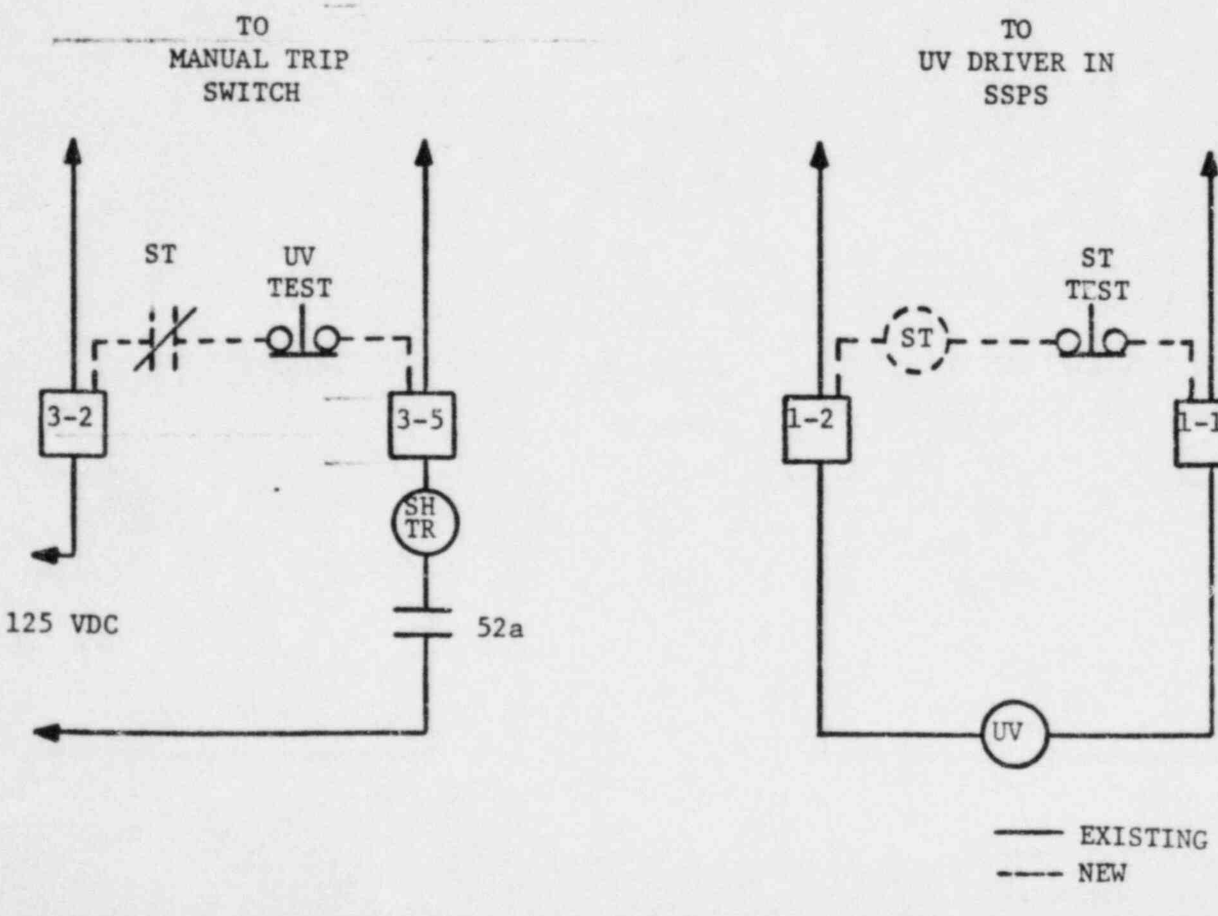


FIGURE 4

SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

REQUIRED CONDITIONS - UV COIL ENERGIZED FROM SSPS

- TRIP BREAKER CLOSED

STEP 1. DEPRESS AND HOLD UV TEST SWITCH.

PURPOSE - BLOCK AUTOMATIC TRIP TO SHUNT COIL SO UV COIL CAN BE TESTED INDIVIDUALLY.

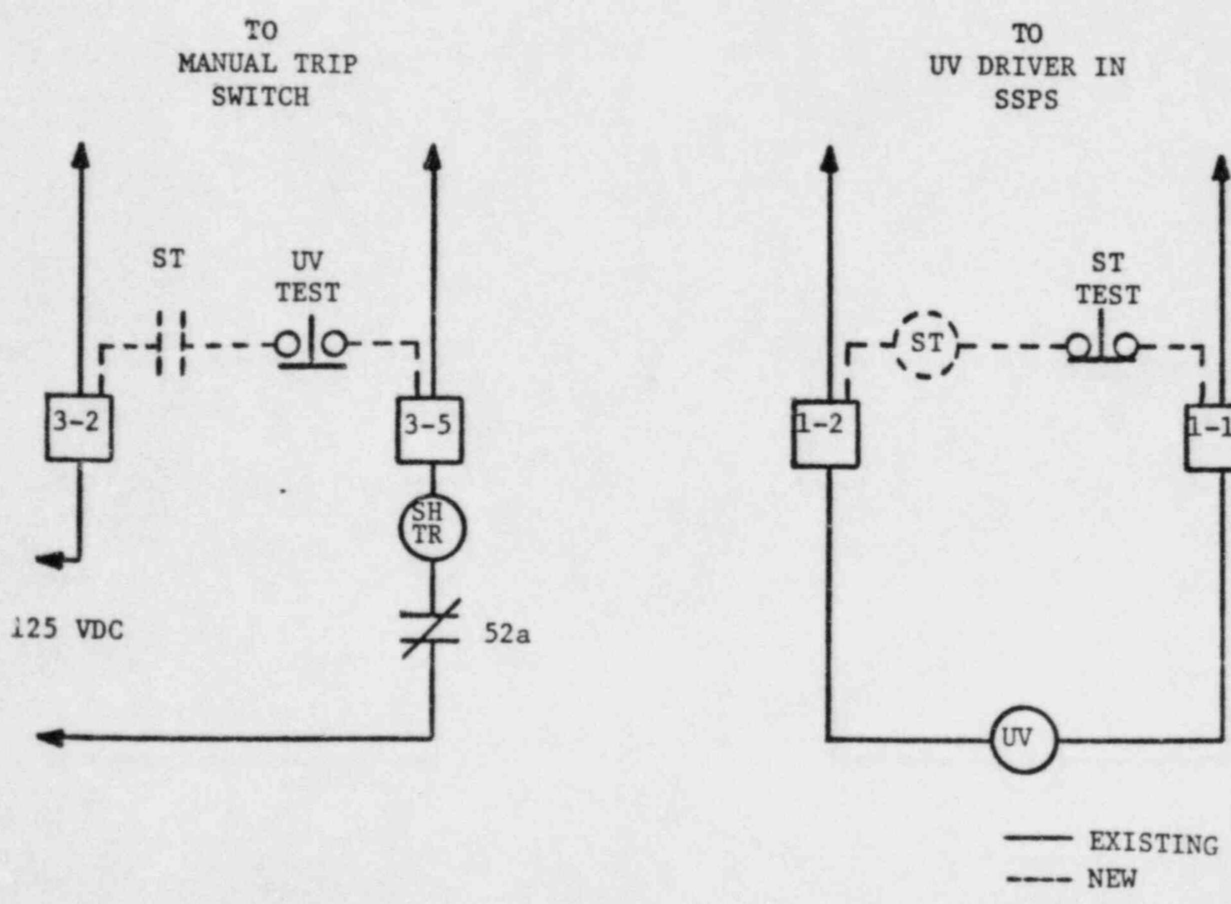


FIGURE 5

SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

STEP 2. DEPRESS SHUNT TRIP TEST SWITCH.

STEP 3. VERIFY THAT NO BREAKER TRIP OCCURS.

PURPOSE - VERIFY THAT UV TEST SWITCH CONTACT IS OPEN.

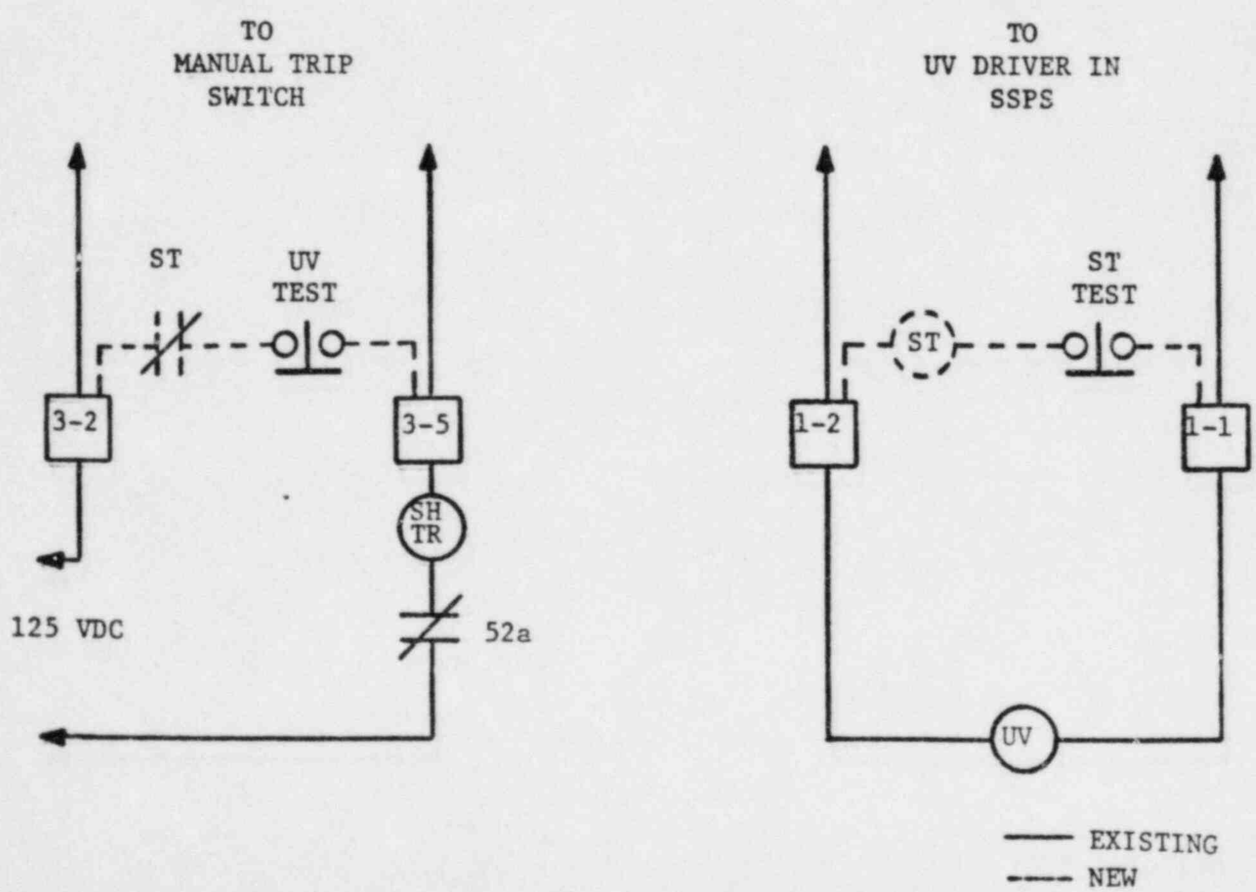


FIGURE 6

SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

STEP 4. RELEASE SHUNT TRIP TEST SWITCH ONLY.

STEP 5. DE-ENERGIZE THE UV COIL BY INJECTING A TRIP SIGNAL INTO THE SSPS.

STEP 6. VERIFY BREAKER TRIPS OPEN.

PURPOSE - VERIFY AUTOMATIC REACTOR TRIP VIA UV COIL.

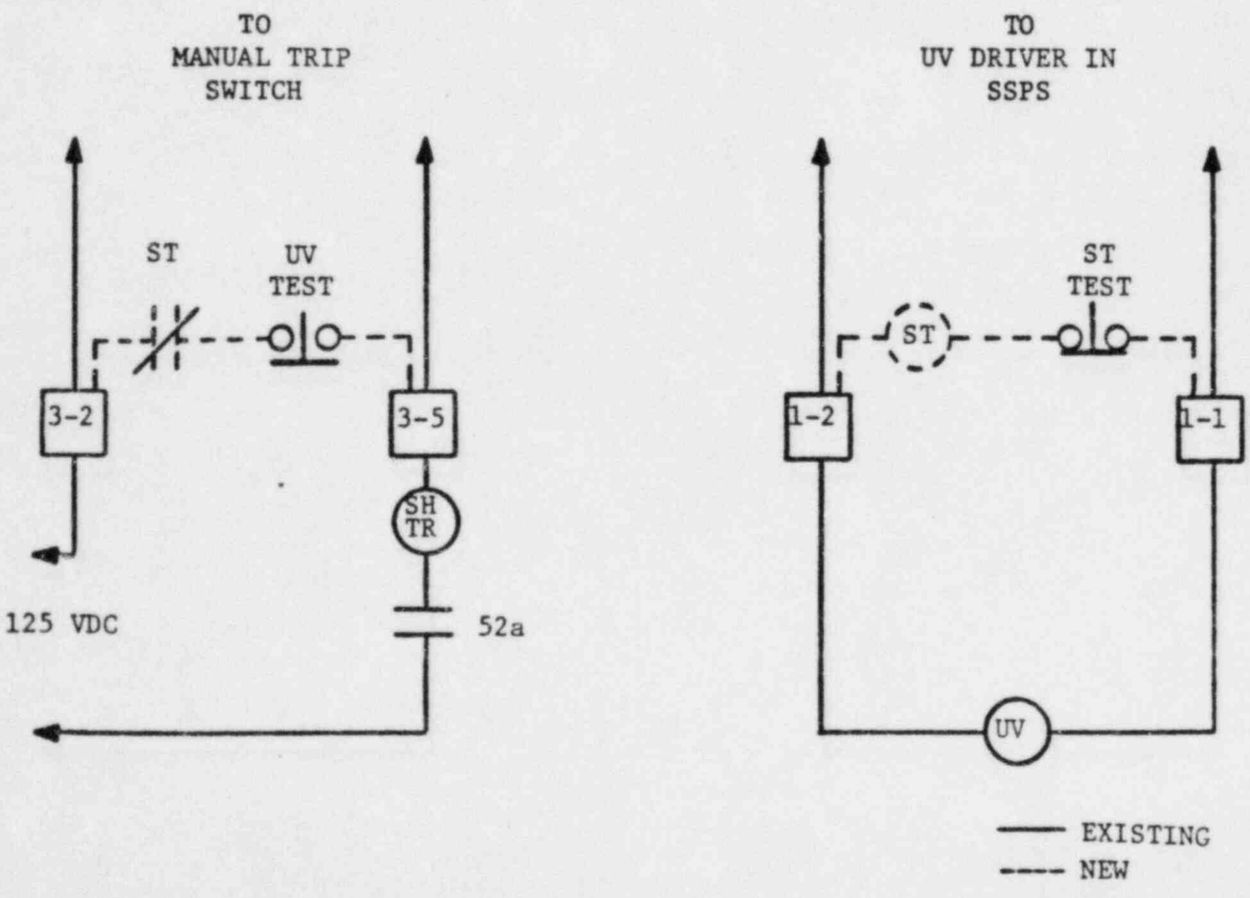


FIGURE 7

SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

STEP 7. RELEASE UV TEST SWITCH.

STEP 8. RE-ENERGIZE UV COIL BY CLEARING THE SSPS TRIP.

STEP 9. RECLOSE TRIP BREAKER.

PURPOSE - RE-ENABLE AUTOMATIC TRIP CIRCUIT TO SHUNT TRIP COIL.

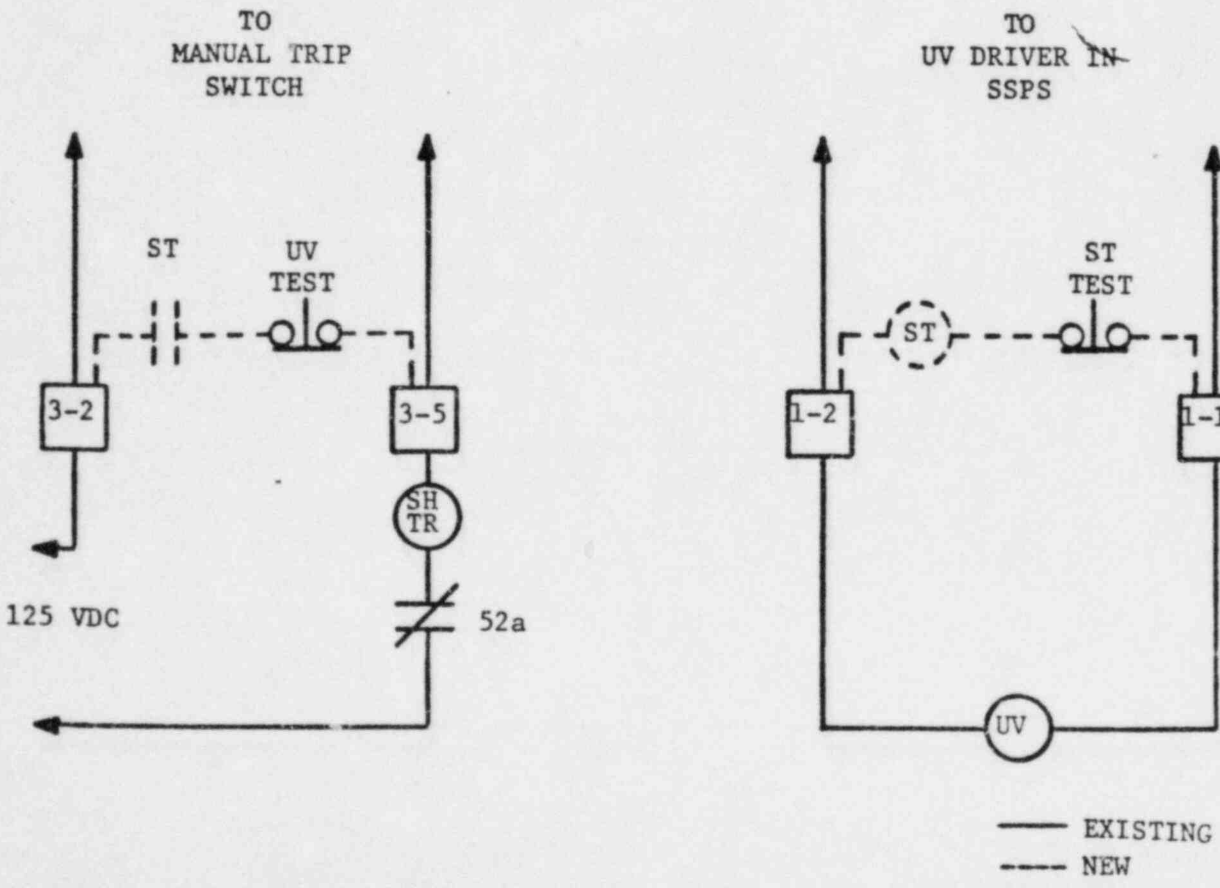


FIGURE 8

SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

STEP 10. PRESS SHUNT TRIP TEST BUTTON.

STEP 11. VERIFY BREAKER TRIPS OPEN.

PURPOSE - VERIFY AUTOMATIC TRIP RELAY (ST) TRIPS BREAKER VIA SHUNT TRIP COIL.

- VERIFY UV TEST SWITCH CONTACT HAS RECLOSED.

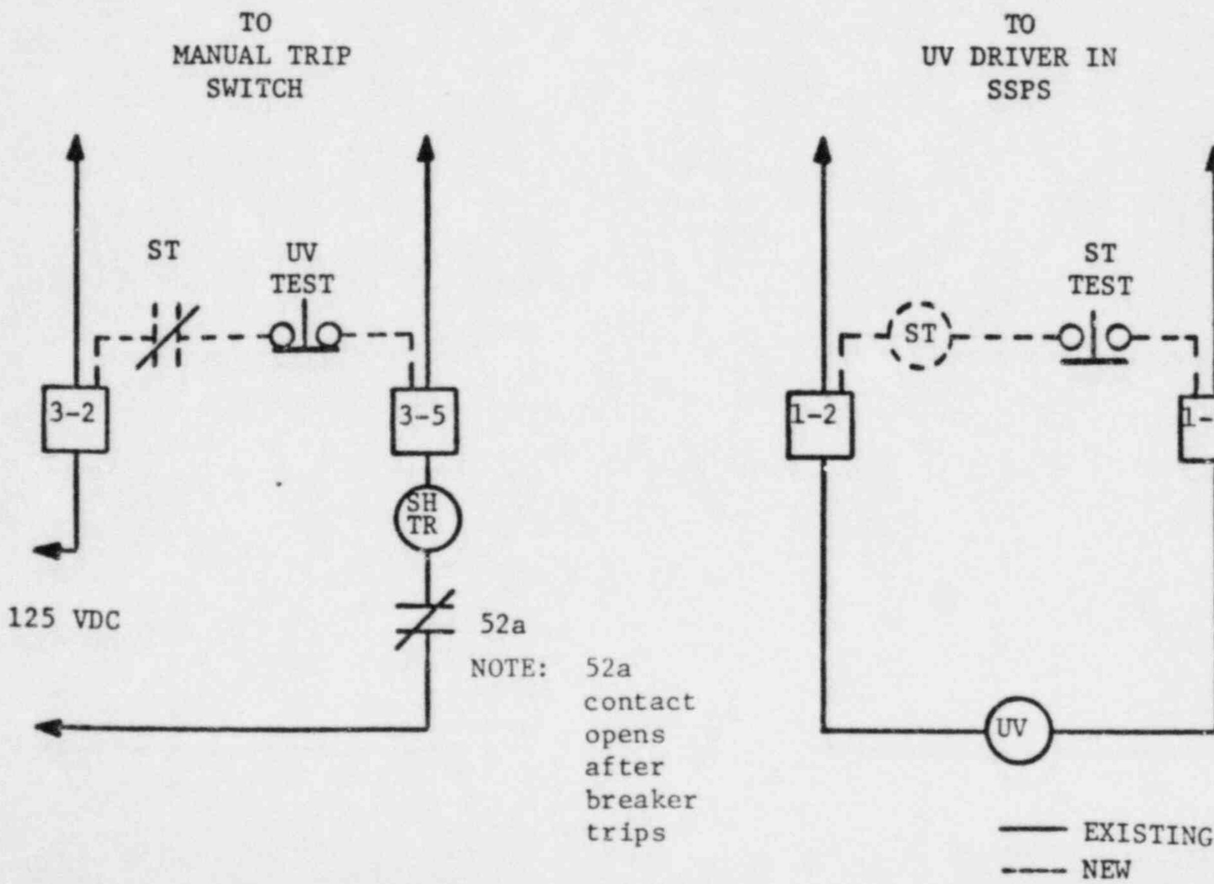


FIGURE 9

SHUNT AND UNDER-VOLTAGE (UV) TRIP TEST

STEP 12. RELEASE SHUNT TRIP TEST SWITCH.

PURPOSE - ALLOW CIRCUITS TO RETURN TO NORMAL OPERATION.

- THE NEXT RECLOSURE OF THE BREAKER WILL VERIFY THE ST TEST SWITCH CONTACT HAS RECLOSED.

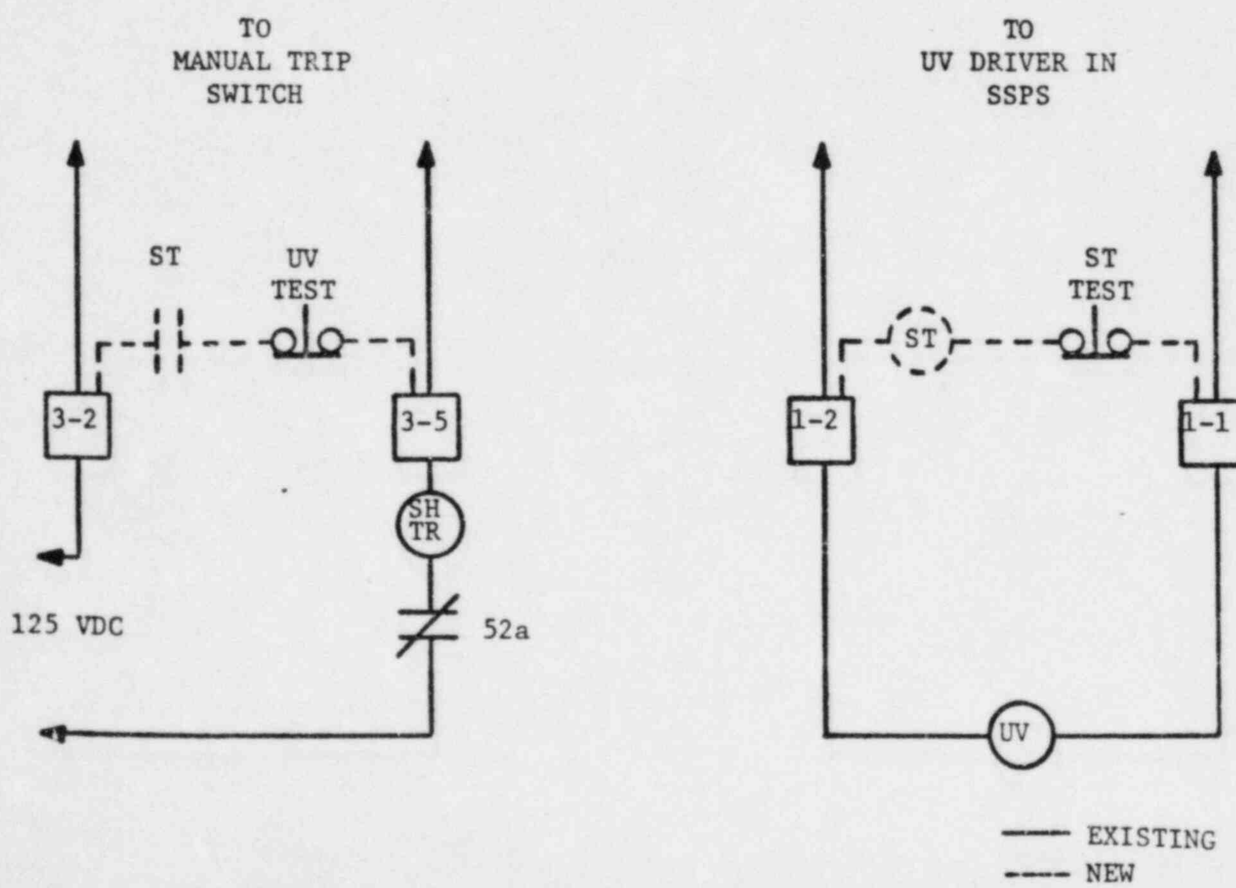
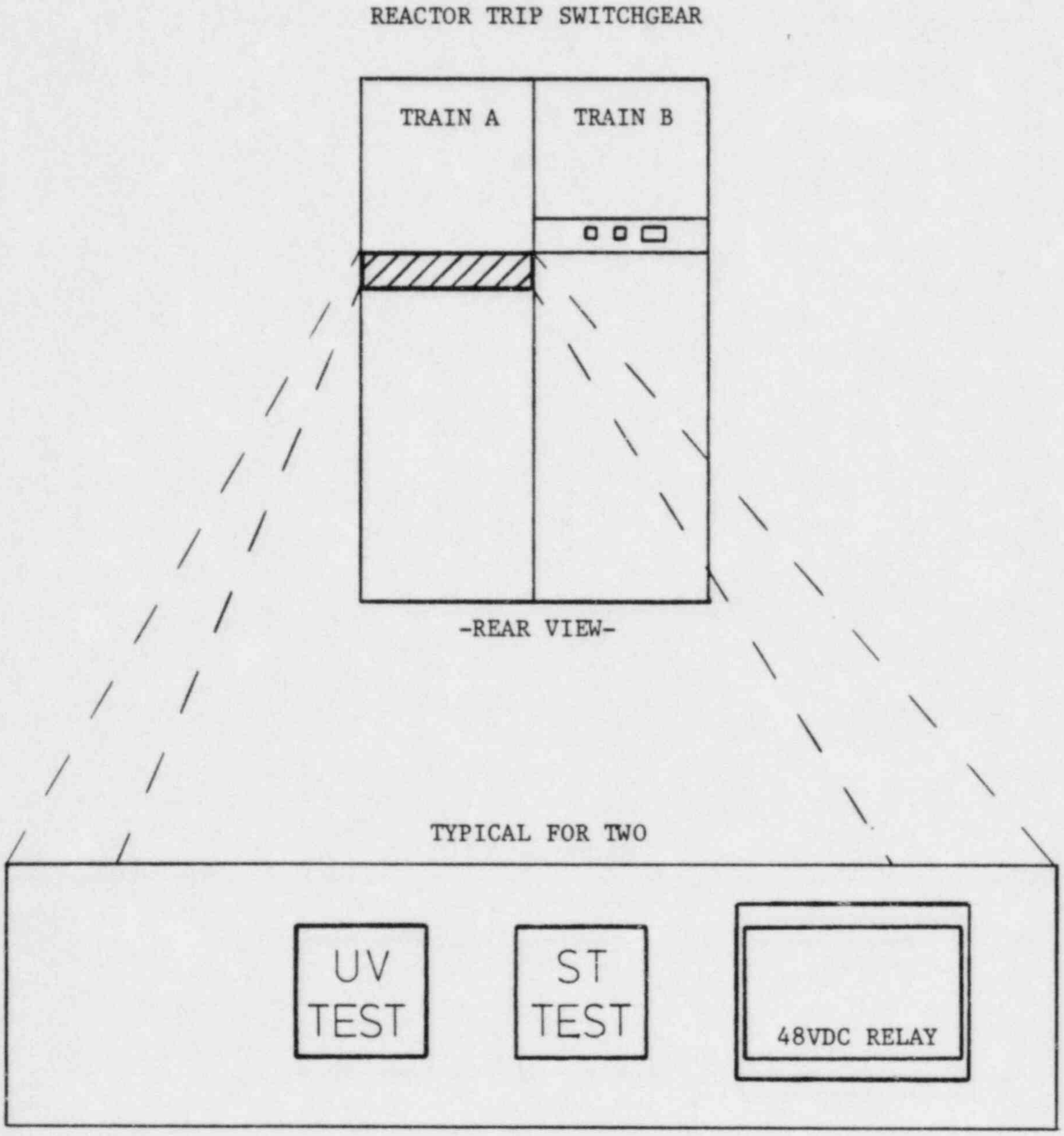


FIGURE 10

REACTOR TRIP SWITCHGEAR MODIFICATION FOR AUTOMATIC SHUNT TRIP



UV TEST --	CUTLER HAMMER	E30AA	SWITCH
ST TEST --	CUTLER HAMMER	E30AA	SWITCH
RELAY --	STRUTHERS DUNN	219BBXP	RELAY

VI. Human Factors Considerations

As a result of the modifications to the reactor trip breakers previously detailed, no operating or emergency procedures required revision. The modification activates the UV and shunt trip and therefore an immediate action to actuate manual trip will not provide additional protection. The procedure used for checking the UV and shunt trips separately, PT/0/A/4600/12, and the monthly test IP/0/A/3010/05 have been revised to incorporate changes due to the modification to the reactor trip breakers.

Since the modifications involved only changes in the breaker cabinet, no control room design changes were considered. The manual reactor trip on the McGuire control boards was not revised and consists of a manually operated trip handle for each train that is physically attached.

As noted earlier, all licensed operators were notified of the reported reactor trip breaker failures. The modification on the reactor trip breakers has been reviewed by operations personnel and determined not to effect operation's procedures. The physical modification will be reviewed with operation's personnel as required by the station modification procedure.

VII. Conclusions

A. Identification of Causes of Failures

The McGuire RTB failures to trip were determined to be caused by improper manufacturing tolerances for several different dimensions in the UV devices.

B. Proposed Corrective Actions

The following actions will be taken before startup of each McGuire unit:

1. All RTB UV devices will be replaced with devices having proper manufacturing tolerances and clearances. Proper operation will be verified by testing at least 25 cycles with no failures.
2. All RTB trip shafts will be replaced.
3. To enhance RTB reliability, a modification will be made so that the shunt trip device will receive an automatic signal to actuate from the RPS.

C. Basis for Plant Restart

Relative to the recent RTB failures, startup for McGuire Units 1 and 2 is acceptable for the following reasons:

1. The breaker UV devices which were not in conformance with manufacturing specifications will be replaced and the manufacturing specifications will be verified. Additional experience which may be gained from investigation of RTB failures at Farley Nuclear Plant will be incorporated into the McGuire design and/or procedures.

2. The modification to the shunt trip device actuation logic improves the overall reliability of the RTB to ensure that prompt reactor trip will occur when needed. Experience has shown the shunt trip devices to be reliable.

3. Maintenance procedures for the RTB's are in accordance with the manufacturer's recommendations.

4. Periodic surveillance testing is adequate to demonstrate continued proper functioning of the RTB's including the UV devices.