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AUTH.NAME AUTHOR AFFILIATION
HINTZ,D.C. Wisconsin Public Service Corp.
RECIP.NAME RECIPIENT AFFILIATION
EISENHUT,D.G. Division of Licensing

SUBJECT: Forwards response to Generic Ltr 83-28,Section 4.3 re design package for DB-50 reactor trip switchgear automatic reactor protection sys trip via switchgear shunt coil trip attachment.

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NRC-84-138

WISCONSIN PUBLIC SERVICE CORPORATION

P.O. Box 1200, Green Bay, Wisconsin 54305

August 31, 1984

Director, Office of Nuclear Reactor Regulation
Attention: Mr. D. G. Eisenhut, Director
Division of Licensing
Office of Nuclear Reactor Regulation
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Eisenhut:

Docket 50-305
Operating License DPR-43
Kewaunee Nuclear Power Plant
Generic Implication of Salem ATWS Event (Generic Letter 83-28)

References: 1) Generic Letter 83-28 dated July 8, 1983
2) Letter from C. W. Giesler to D. G. Eisenhut dated December 2, 1983

This letter provides the information requested by members of your staff concerning the preliminary design report describing the conceptual design of the Kewaunee Nuclear Power Plant's (KNPP) implementation of the shunt trip modification.

Reference 2 provided you with our initial response to Generic Letter 83-28 in which we committed to install an automatic actuation of the shunt trip attachment during the scheduled 1986 refueling outage. It also provided justification for the proposed implementation schedule.

WPSC is continuing to participate in the Westinghouse Owners Group activities in response to Generic Letter 83-28. These activities include the life cycle testing of shunt and undervoltage devices, which is still in progress. The addition of the shunt trip automatic actuation is therefore only a part of the ongoing program to respond to Generic Letter 83-28.

Enclosed please find 25 copies of our response to Generic Letter 83-28 section 4.3.

A055
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Update Instructions

Please follow the instructions below when making the revision to this response. If you have any questions concerning this revision please call.

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Very truly yours,

D. C. Hintz
Manager - Nuclear Power

DJM/js

Enc.

cc - Mr. S. A. Varga, US NRC
Mr. Robert Nelson, US NRC

DESIGN PACKAGE

FOR

DB-50 REACTOR TRIP SWITCHGEAR AUTOMATIC REACTOR PROTECTION SYSTEM TRIP VIA THE SWITCHGEAR SHUNT COIL TRIP ATTACHMENT

WISCONSIN PUBLIC SERVICE CORPORATION
KEWAUNEE NUCLEAR POWER PLANT

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Introduction

This package has been developed to describe the conceptual design for the addition of an automatic reactor protection system actuation of the reactor trip switchgear via the switchgear shunt coil trip attachment. This design is based on the generic Westinghouse design submitted to the NRC on June 14, 1983. However, due to the availability of spare contacts on reactor protection system relays, the interposing relay used in the Westinghouse generic design is not necessary. This proposed design minimizes equipment and additional steps or complication in the test procedure, while providing the extra trip reliability via the shunt trip coil.

Included in this package is a discussion of the design bases, conceptual hardware, functional requirements, test procedure and licensing issues.

Design Bases

This design modification utilizes the reactor trip breaker shunt trip mechanism as a backup to the undervoltage (UV) trip mechanism for automatically initiated trip signals. By utilizing the shunt trip mechanisms as a backup to the UV trip mechanisms for automatically initiated trip signals, a higher level of reliability will be achieved by the reactor protection system.

The shunt trip mechanisms have not been tested to show that they are capable of operating during and after a seismic event. Tests, however, have been performed to show that during a seismic event the shunt trip mechanisms will not degrade the operation of the breakers or the automatic UV trip mechanisms.

The shunt trip mechanism for Reactor Trip Breaker A shall receive automatic trip signals from the Train A protection system logic. The shunt trip mechanism for

Reactor Trip Breaker B shall receive automatic trip signals from the Train B protection system logic. The addition of the automatic shunt trip to the bypass breakers is not necessary since there is little benefit and a high expense for adding the automatic shunt trip to the bypass breakers.

Test hardware and procedures shall be provided to demonstrate that the shunt and UV trip mechanisms are independently operable on line at power and capable of providing sufficient force to open the reactor trip breakers on automatic demand by the reactor protection system.

The incorporation of the shunt trip attachment into the reactor protection system (RPS) will provide diverse backup to the undervoltage trip attachments for automatically tripping the reactor trip breakers. The shunt trip mechanism shall be Class 1E equipment. The quality assurance program shall ensure that the function of the shunt trip mechanism is met. The general requirements of IEEE Standard 279-1971 and other applicable standards and criteria shall be met by the shunt trip mechanisms to provide this assurance.[1] The undervoltage mechanism continues to ensure Updated Safety Analysis Report (USAR) assumptions.

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[1] The KNPP was designed to comply with the requirements of GDC 23 and IEEE 279-1968 (which was under development at the time of construction). The automatic trips associated with the RPS fulfill these requirements. The modifications to the shunt trip will conform to the requirements of IEEE 279-1971 to the extent practical; however, the automatic trip system utilizing the UV coil continues to be the method of compliance with KNPP design bases. System reliability and plant availability shall be maximized through the use of reliable components and conservative design practices.

The shunt trip mechanisms shall meet all the requirements normally associated with protection systems except for the failure mode criteria specified in GDC 23, since electrical power is required to initiate a reactor trip via the shunt trip coil mechanism. The requirements of GDC 23, however, are still met by the UV trip mechanisms.

Functional Requirements

The modification of the reactor protection system will be made in accordance with the design criteria applied to the Kewaunee Nuclear Plant, as expressed in the Kewaunee Nuclear Plant's USAR. The installation will be done such that no unreviewed safety question is created, with no degradation of existing protection systems, and without increased risk to public health and safety.

The following environmental qualification conditions apply to the shunt trip mechanisms. It must be demonstrated that the shunt trip mechanisms can function during and after each of the following conditions and yet not cause a spurious trip to occur.

Plant Design Normal and Abnormal Operating Conditions

The reactor trip switchgear including the shunt trip coil is located in the control rod drive room. The design conditions for this room is 60°F - 104°F, and 10% - 80% relative humidity.

Plant Operating Conditions for Design Basis Events

The postulated seismic event is the only design basis event affecting the shunt trip mechanism. Seismic testing of the shunt trip attachment

for qualification is an ongoing Westinghouse Owners Group project which WPSC is supporting. The proposed modification will not change the seismic response of the existing shunt trip mechanism or reactor trip breaker switchgear.

Requirements of Test and Calibration

Test hardware and procedures shall be provided to independently demonstrate that the shunt and UV trip mechanisms are operable at power on automatic demand by the RPS. Consideration to human factors principles shall be given to the development of test features, indications, and procedures such that testing avoids the generation of spurious trips or undue unavailability of the trip breakers.

Power Supply

The power supply for the shunt trip mechanisms shall be from a Class 1E electrical power source and shall be of such a reliability that it is not interrupted during plant transients. The power supply for Reactor Trip Breaker A shunt trip mechanism shall be from a Train A power supply and the power supply for Reactor Trip Breaker B shunt trip mechanism shall be from a Train B power supply.

Mr. D. G. Eisenhut
August 31, 1984

Conceptual Design for Automatic Shunt Trip of Reactor Trip Breakers

Introduction

This design concerns the addition of automatic trip signals to the shunt trip devices of the main circuit breakers in the Reactor Trip Switchgear (RTS). In the present Reactor Protection System (RPS) designs, automatic reactor trip signals actuate the undervoltage trip devices of all the circuit breakers in the RTS.

Background Information

The configuration of the reactor trip system is two main reactor trip breakers and two reactor trip bypass breakers. The bypass breakers allow testing of the main reactor trip breakers at power. The four breaker reactor trip system is equipped with type DB-50 circuit breakers.

Electrically-operated type DB-50 circuit breakers are equipped with an electrical closing circuit and a shunt trip circuit for control from a remote location. The breaker is closed by momentarily energizing the closing circuit. The breaker mechanism is mechanically latched in the closed position. The breaker is unlatched to the tripped (open) position when the shunt trip coil is momentarily energized. For the reactor trip application, the undervoltage trip option is added to the basic circuit breaker. The undervoltage (UV) trip coil must be continuously energized in order to close the breaker and keep it closed. Tripping on loss of voltage is required in order to meet General Design Criterion 23.

A reactor trip signal removes voltage from the normally energized UV trip coil. This releases the UV trip lever, which actuates the trip bar, causing the

breaker to unlatch from the closed position. The trip bar is also actuated by a shunt trip lever when the normally deenergized shunt trip coil is energized. In the present RPS design, the shunt trip coils are energized only during a manual reactor trip operation since no credit is taken for their operation in a reactor trip in the present safety analysis. A manual reactor trip simultaneously deenergizes all the UV trip coils and energizes all the shunt trip coils. An automatic reactor trip signal from the Train A RPS deenergizes the UV trip coils of Reactor Trip Breaker A (RTA) and Reactor Trip Bypass Breaker B (BYB). The Train B RPS deenergizes the UV trip coils of Reactor Trip Breaker B (RTB) and Reactor Trip Bypass Breaker A (BYA). The cross-train tripping of the bypass breakers is required to ensure a reactor trip when the RTS is in test and there is a single failure.

Description of Modification

The proposed design to add automatic reactor trip signals to the shunt trip devices covers the main reactor trip breakers only. Adding automatic trip signals to the bypass breakers introduces physical separation problems in the train related wiring of the RTS, because of the cross-train tripping for the bypass breakers. The bypass breakers are normally tripped and withdrawn from the power circuit except for approximately three hours per month during the testing of the reactor trip breakers. The complexity and cost of adding an automatic shunt trip to the bypass breakers outweighs the benefits, and they are not included in the proposed change.

The attached figures show the modification for breaker RTA. The same modification is required for RTB. A logic matrix, which is the energize-to-trip equiva-

lent to the ladder matrix used on the undervoltage trip, is developed using spare contacts on the reactor protection relays. No additional relays are installed for this design. Two test pushbuttons along with a monitor light and switch are installed on the reactor protection test panel. When an anticipated transient occurs, contacts open in the ladder matrix to deenergize the undervoltage coil. Simultaneously contacts close in the new logic matrix to energize the shunt trip coil. Thus the trip bar of RTA will be actuated by both the UV and shunt trip devices. The two test pushbuttons, monitor light and switch are used during testing to individually confirm the operability of the UV trip and the shunt trip.

The "Shunt Trip Test" pushbutton switch is used to energize the shunt trip coil while the undervoltage trip coil remains energized. The "Shunt Trip Block" pushbutton switch is used to prevent the shunt trip coil from energizing when the undervoltage trip coil is being tested. The test light is used to confirm proper operation of the shunt trip coils' reactor trip matrix relays. The "Enable Shunt Trip Test Light" switch is used to remove the test light from the circuit when not in use.

The 125 VDC train-related source for the shunt trip coil is provided in the reactor protection system racks.

Mr. D. G. Eisenhut
August 31, 1984

Procedure for On-Line Testing the Automatic Shunt Trip and Undervoltage Trip of the Reactor Trip Switchgear

Purpose

The purpose of this procedure is to provide a method for independently verifying the ability of the shunt trip and undervoltage trip mechanisms to trip the reactor trip breakers. This test, which is to be performed on-line, also confirms the operation of the circuitry for the automatic trip through the shunt trip device.

Introduction

The reactor protection system at the Kewaunee Nuclear Plant is based on trip logic formed on electromechanical relay contacts. Since spare contacts are available on these relays, the automatic breaker trip using the shunt trip coil can be achieved without the addition of a new relay. The testing of this system will be achieved such that changes and additions to the existing test procedure can be minimized.

The on-line test procedure in the generic Westinghouse Owners Group response will be used as general guidance.

Criteria

In order to satisfy the requirements of GDC 23, the operability of the undervoltage and shunt trip functions of the reactor trip breakers shall be independently verified by surveillance testing.

Assumptions

1. Automatic reactor trips actuate both the UV and shunt trip mechanisms.
2. The breakers will be tested using strict plant procedural controls.
3. This test is to be performed on the reactor trip main breakers only.
4. This test is to be performed periodically on-line.

Precautions

1. This test is to be performed on one trip breaker at a time, since only one bypass breaker may be closed at a time.

Procedure

The following is a general description of the procedure sequence used to test both reactor trip main breakers.

Action:	Purpose:
1. Rack in and close bypass breaker which is in parallel with trip breaker to be tested.	Permits on-line testing of trip breaker.
NOTE: Only one bypass breaker is to be closed at one time.	
2. Depress "Shunt Trip Block" pushbutton and hold.	Prevents automatic trip through shunt trip device.
3. Depress "Shunt Trip Test" pushbutton and verify that the breaker does not trip.	Indicates that automatic shunt trip is blocked to permit independent testing of UV coil trip.
4. Release "Shunt Trip Test" pushbutton only. Maintain "Shunt Trip Block" pushbutton in depressed position.	

5.	From the Reactor Protection System cabinet which corresponds to the trip breaker which is in test, initiate a trip of the breaker by momentarily making up a reactor trip matrix with the test cabinet pushbuttons.	Initiates breaker trip from protection system through UV coil only.
6.	Verify that the trip breaker opens by observing the breaker position lamps on the Relay Protection System test cabinet, or on the Main Control Board (MCB) or a flag locally at the breaker.	Confirms operation of the breaker through the UV coil.
7.	Release the "Shunt Trip Block" pushbutton.	Removes block of breaker trip through the shunt trip device.
8.	Reclose the trip breaker.	Permits breaker test.
9.	Depress "Shunt Trip Test" push-button momentarily.	Initiates breaker trip through shunt trip device only.
10.	Verify that the trip breaker opens by observing the breaker position lamps on the Relay Protection System test cabinets, or on the MCB or a flag locally at the breaker.	Confirms operation of the breaker through the shunt trip device.
11.	Proceed with testing the RPS logic per procedure verifying that both UV and shunt receive trip signals by monitoring the event recorder and shunt trip monitor light. (The "Enable Shunt Trip Test Light" switch must be closed when verifying the shunt trip coil receives a trip signal.)	
12.	Open "Enable Shunt Trip Test Light" switch, depress "Shunt Trip Test" pushbutton and verify shunt trip monitor light remains off.	Verifies "Shunt Trip Monitor Light" is removed from the circuit.
13.	Reclose the trip breaker.	Permits opening of bypass breaker.

14.	Open and rack out the bypass breaker which was closed during trip breaker testing.	Restores Reactor Protection System to normal conditions.

NOTE: This completes the test of one reactor trip breaker for operation through both the UV coil and shunt trip device. This procedure should be repeated for the opposite train trip breaker.

Mr. D. G. Eisenhut
August 31, 1984

DISCUSSION OF LICENSING ISSUES

Introduction

The method used to consider licensing issues for the automatic shunt trip proposed design modification has been to review the design description and figures of the conceptual design, and compare them to the Westinghouse generic design and generic licensing discussion.

Criterion: Conformance to General Functional Requirements (Paragraph 4.1 of IEEE 279-1971)

Response: The shunt trip attachment on the Reactor Trip (RT) circuit breaker initiates a reactor trip from the same automatic protection system signals that cause the undervoltage trip attachment of the RT circuit breaker to initiate a reactor trip. Although the undervoltage trip attachment continues to furnish the primary protective function, the shunt trip is being incorporated into the protection system in order to provide an automatic backup protective function. It meets all of the same criteria that the undervoltage trip attachment meets except for the deviation from the preferred failure mode identified by GDC 23 (protection system failure modes), which is implementation of a deenergize to trip principle. The shunt trip attachment trips on an energize to trip principle, that is, energization of the shunt coil from a nominal 125 VDC bus will result in a reactor trip. This is acceptable because the primary protective function from the undervoltage trip attachment operates on a deenergize to trip principle and will generate a reactor trip should its energy source fail.

Criterion: Conformance to the Single Failure Criterion (Paragraph 4.2 of IEEE 279-1971)

Response: The Kewaunee Nuclear Plant's reactor trip protection system meets the single failure criterion requirements of IEEE 279-1971. Analyses and evaluations in accordance with IEEE 279-1971 that attest to this compliance have been documented in the KNPP Updated Safety Analysis Report (USAR). This documentation shows that any single random failure within a channel or train will not prevent protective action at the system level when required. Conformance to the single failure criterion is not sensitive to the addition of the automatic shunt trip modification.

Criterion: Conformance to the Requirements for Quality Components and Modules (Paragraph 4.3 of IEEE 279-1971, GDC 1).

Response: Components and wiring will be of a quality that is consistent with those already in use in the KNPP Reactor Protection System and will confirm with the KNPP Operational Quality Assurance Program.

Criterion: Conformance to the Requirements for Equipment Qualification

Response: The reactor trip switchgear is not mounted in a harsh environment.

No new devices are being mounted in the switchgear, so that its seismic response is unchanged.

The TEST and BLOCK pushbuttons in the proposed design are identical to those already installed in the reactor protection

system racks performing similar functions. The Enable switch and light are removed from the circuit when not in use. Therefore no new or additional environmental and seismic qualification program will be necessary for this modification.

WPSC is continuing to support and participate in the WOG testing and study of the UV and shunt trip devices.

Criterion: Conformance to the Requirements to Maintain Channel Integrity (Paragraph 4.5 of IEEE 279-1971, GDC 2, GDC 3, GDC 4)

Response: The automatic shunt trip function implementation will be designed to maintain its capability to initiate a reactor trip during and following natural phenomena credible to the plant site, such as earthquakes, tornadoes, floods, winds, etc. Functional capability will be maintained despite degraded conditions that may exist in the plant due to credible events such as fires, flooding, vehicular crashes, explosions, missiles, electrical faults, toxic or corrosive gaseous releases, pipe whip, etc. Redundancy of equipment will ensure the reactor trip on demand despite loss of one of the redundant RT circuit breaker trip means.

Criterion: Conformance to the Requirements to Maintain Channel Independence (Paragraph 4.6 of IEEE 279-1971, GDC 22, IEEE 384-1974)

Response: Wiring and component location for the redundant sets of automatic shunt trip additions will employ physical separation or barriers to ensure independence of the circuits to the extent that is equivalent to the existing independent measures

employed by the RPS and RT switchgear. The separation provisions of the presently existing RPS cabinets and RT switchgear can be maintained.

Criterion: Conformance to the Requirements concerning Control and Protection System Interaction (Paragraph 4.7 of IEEE 279-1971, GDC 24)

Response: The shunt trip attachment of the RT circuit breaker initiates a reactor trip from the same automatic protection system signals that cause the undervoltage trip attachment of the RT circuit breaker to initiate a reactor trip. The reactor trip occurs when the circuit breaker interrupts the rod control motor generator power source to the Control Rod Drive Mechanism (CRDM) magnetic jack coils, thus decoupling the control rod assemblies drive lines from the magnetic jacks. The rods will then insert into the core by gravity fall. The only interface between the RT protection system and the rod control system is the power supply bus bar arrangement whose circuit is interrupted by the RT circuit breaker. The automatic shunt trip modifications do not compromise this interface and therefore control protection interaction considerations are not sensitive to this modification. For the evaluation of control rod system sensitivity to potential interactive failures refer to section 7 of the KNPP USAR.

Criterion: Conformance to the Requirements concerning the Deviation of System Inputs (Paragraph 4.8 of IEEE 279-1971)

Response: To the extent feasible and practical, protection system inputs will be derived from signals that are direct measures of the

desired variables. Compliance with this objective is not sensitive to the automatic shunt trip modification.

Criterion: Conformance to the Requirements to Provide Capability for Sensor Checks (Paragraph 4.9 of IEEE 279-1971)

Response: Compliance with this objective is not sensitive to the automatic shunt trip modification.

Criterion: Conformance to the Requirements to Provide Capability for Test and Calibration (Paragraph 4.10 of IEEE 279-1971, GDC 17, GDC 21)

Response: The automatic shunt trip modification makes use of and shares on-line testing provisions which are already available as part of in-place installations. It also adds features necessary to assure independent verification of the ability of the shunt trip and the undervoltage trip attachments to trip the RT breakers. These features provide testability during full power operation without interferring with the normally provided in-place capability for testing and calibrating channels and devices used to derive the final system reactor trip initiation signal from the various channel signals. Capability is provided to overlap the tests to be made for the automatic shunt trip with existing tests of the reactor trip function and shared equipment, signals, circuitry, and electrical power sources.

The method whereby independent verification of the reactor trip capabilities of both the shunt trip and the undervoltage (UV) trip is achieved can be described by referring to the attached

figures. The interfacing circuitry is typical of the Westinghouse RPS. The manual reactor trip switches are tested under a separate procedure while shutdown. When the RT breaker in a given train is tested on-line, only the parallel connected bypass breaker is racked in and closed.

In order to verify that the RT breaker will not trip when the shunt trip is blocked, the "Shunt Trip Block" switch is held in the depressed state followed by a depression of the "Shunt Trip Test" switch, which would energize the shunt trip coil if it were not blocked. With the "Shunt Trip Test" pushbutton now released while maintaining the depressed position of the "Shunt Trip Block" switch, the trip of the main RT breaker is initiated from the RPS. This involves a manual operation at an existing test panel which simulates a "making up" of the required-for-trip coincidence logic of a protection system process monitoring parameter. Since the shunt coil trip is blocked, a reactor trip from the UV trip is verified. After reclosing the breaker the verification of reactor trip from the shunt coil is verified by release of the "Shunt Trip Block" switch, and depression of the "Shunt Trip Test" switch. Whenever the main RT breaker is tripped, this condition is verified by observing the breaker position indicators such as the flag locally at the breaker or lights at Main Control Board or RPS test cabinet.

Criterion: Conformance to the Requirements on Channel Bypass or Removal from Operation (Paragraph 4.11 of IEEE 279-1971)

Response: Provisions are made at the Kewaunee Nuclear Plant to apply a bypass of one of the redundant trains, i.e., a block of the reactor trip function which causes deenergization of CRDM coils from that train so that at full power, on-line operation of the final actuated equipment (in this case the breakers) can be tested. The reactor trip initiation is a "one-out-of-two" system, that is, it has two-way redundancy in order to meet the single failure criterion. During a short period of time (approximately three hours per month) the bypass breaker, that is in parallel to the RT breaker being tested, is racked in and closed. The violation of the single failure criterion for testing during this period of time is allowed by the exception statement in section 4.11. Since exemption is based on the brevity the RT breaker is bypassed, there is some sensitivity of conformance to this requirement when it is considered that additional tests are now performed to verify independent reactor trip from two diverse trip attachments. This sensitivity is held to a minimum by strict administrative procedures that assure that personnel participating in the test are stationed at the RPS test cabinet and at the Main Control Board and that they are in communication with each other. During this short test time duration, should a demand for a reactor trip be initiated, the demand signal trips the redundant RT breaker and also trips the bypass breaker that is in parallel with the main RT breaker being tested.

Criterion: Conformance to Requirements Governing Access to Setpoint Adjustments, Calibration, and Test Points (Paragraph 4.18 of IEEE 279-1971)

Response: Redundant sets of two test switches will be added at the RPS racks as a result of the Automatic Shunt Trip modification. These two switches are:

a. "Shunt Trip Block" pushbutton switch

b. "Shunt Trip Test" pushbutton switch

A third switch will be added, but will be in use only during testing of the shunt trip matrix.

Compliance to the requirement that access to and use of these switches assumes that strict administrative control will govern their use.

Criterion: Conformance to the remaining requirements of IEEE 279-1971 listed as follows is not sensitive to the automatic shunt trip modification:

Response:

a. Operating Bypasses (Paragraph 4.12)

b. Indication of Bypasses (Paragraph 4.13)

c. Access to Means for Bypassing (Paragraph 4.14)

d. Multiple Set Points (Paragraph 4.15)

e. Completion of Protection Action Once It Is Initiated (Paragraph 4.16)

f. Manual Initiation (Paragraph 4.17)

g. Identification of Protective Actions (Paragraph 4.19)

h. Information Readout (Paragraph 4.20)

i. System Repair (Paragraph 4.21)

j. Identification (Paragraph 4.22)

Concerning conformance to 10 CFR 50 GDC's 20, (Protection System Functions), GDC 25 (Protection System Requirements for Reactivity Control Malfunctions), and GDC 29 (Protection Against Anticipated Operational Occurrences as well as conformance to the two ANS documents (ANS 18.2 and 18.8) cited in the functional requirements, compliance with these criteria is not sensitive to the automatic shunt trip modification.

Mr. D. G. Eisenhut
August 31, 1984

COMPONENTS FOR USE IN AUTOMATIC

SHUNT TRIP MODIFICATION

The following components are proposed for implementing the Automatic Shunt Trip feature for the Reactor Trip Breakers. The pushbuttons are identical to push-buttons already used on the reactor protection system test panels for the RPS logic test.

For Westinghouse Plants with Relay Protection Systems:

Component	Description
Block and Shunt Trip Test Pushbuttons	Westinghouse Type OT2 snap action pushbutton switch
Enable Shunt Trip Test Light Switch	Unknown at this time
Test Light	Westinghouse Mini-light (with resistor)

Question #1

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

WPSC Response

The attached three figures show the proposed modification.

Question #2

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

WPSC Response

Power Sources

The Kewaunee Nuclear Plant reactor trip breakers, including the shunt trip coils, are supplied from class 1E safeguards power supplies. The Train A breaker is fed from the A Train 125 VDC safeguards battery through a DC distribution panel. The Train B breaker is fed from the B Train 125 VDC safeguards battery through a DC distribution panel. Presently, non-class 1E circuitry share a common power source with the manual reactor trip breaker trip coils. (This does not affect the automatic RPS trips.) A design change has been initiated to split up the power sources such that the manual reactor trip breaker trip coils are supplied power from dedicated feeders. This design change will be completed prior to startup from the 1986 refueling outage.

Control Room Annunciation/Indication

Indication is provided in the control room upon loss of power to the shunt trip circuits. This indication consists of red and green position lights. These lights are powered from the same fused 125 VDC supply used for closing the breaker and tripping the breaker via the shunt trip attachment. Illumination of the green light indicates that the breaker is open and control power is available to the breaker. The red light indicates the breaker is closed and control power is available to the breaker. Since the red light is in series with the shunt trip coil and an "a" auxiliary contact, the red light also indicates that power is available to the shunt trip device and that there is circuit continuity in the shunt trip coil, including through the "Shunt Trip Block" pushbutton. This provides an indication that the shunt trip coil is ready to perform its function when required.

Overvoltage Condition

No new components are being added which are sensitive to overvoltage. The shunt trip coils in the reactor trip breakers are powered from 125 VDC via the station batteries. Normally the shunt trip coils are in a deenergized condition. When the trip breakers are closed, the red lamp current flows through the trip coil to monitor the circuit continuity. This current is not large enough to actuate the trip coil armature. The reactor trip signal applies a nominal voltage of 125 VDC to each shunt trip coil in the redundant trains. As the breaker trips, its auxiliary switch opens to deenergize the shunt trip coil. Since the 125 VDC voltage is supplied from the battery system, it may temporarily rise to the battery equalizing voltage (not exceeding 115% of nominal voltage). The shunt

trip coil will cause the breaker to open, despite an overvoltage condition, since it is energized to operate.

Question #3

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

WPSC Response

The logic matrix being added for the automatic shunt trip function is being formed using existing Westinghouse BFD relay contacts rated at 10A. Therefore no new relays are being added.

Question #4

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

WPSC Response

The on-line test procedure/sequence provided in the Westinghouse Owners Group generic response, to independently verify operability of the undervoltage and shunt trip devices in response to an automatic reactor trip, will be used as a guide to incorporating this test into the existing KNPP monthly reactor protection system test. The KNPP procedure will include the use of a monitor light to verify that power is reaching the shunt trip coil terminals after the initial tripping of the breaker. An additional switch is being added to remove the monitor light from the circuit when it is not in use.

Question #5

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

WPSC Response

The additional circuitry used to implement the automatic shunt trip function is Class 1E, safety related. The procurement, installation, operation, testing and maintenance of this circuitry will be in accordance with the KNPP's Operational Quality Assurance Program for Class 1E safety related systems and components. This quality assurance program fulfills the requirements of 10 CFR 50, Appendix B. The existing reactor trip breaker circuitry which interfaces with the new automatic shunt trip circuitry is Class 1E safety related.

Question #6

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

WPSC Response

The KNPP proposed design does not add new components which would create a new seismic qualification question. KNPP is supporting the Westinghouse Owners Group seismic testing of shunt trip attachments. The results of this testing will be reviewed and if applicable it will be factored into maintenance, replacement and qualification programs.

Question #7

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

WPSC Response

No new components are being added at the reactor trip breaker switchgear cabinets. Components added at the reactor protection system cabinets are identical to components already there which perform similar functions. WPSC is continuing to monitor the ongoing WOG testing of the shunt trip attachment.

Question #8

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

WPSC Response

The components, cabling, and panel wiring for the UV and shunt trip circuitry are redundant ("A" and "B" Trains). The circuitry of each redundant safety-related Class 1E train is train aligned and physically separated. Each of the reactor trip switches actuates both UV and shunt trip coils for both trains of protection. Full train separation is maintained throughout the circuit.

Question #9

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

WPSC Response

Presently, functional testing of the reactor trip system shunt trip feature is a required procedural step to be performed prior to each reactor startup. (This includes the reactor startup after each refueling outage.) The procedural step requires the reactor trip breakers be tripped using each of the manual reactor trip pushbuttons located on the control boards. The performance of this procedural step verifies the operability of the control room manual reactor trip pushbuttons and wiring. Upon the completion of the automatic shunt trip modification, the requirement to trip the reactor using both reactor trip pushbuttons prior to each reactor startup will be changed. The new requirement will verify the operability of the control room manual reactor trip pushbuttons and wiring prior to startup after each refueling outage. Neither the procedure presently in use nor the future procedure will require the use of jumpers, lifted leads, or pulled fuses.

Question #10

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

WPSC Response

The bypass breakers undergo a functional test during the RPS logic test which demonstrates its operability prior to placing it into service. The RPS logic test procedure is the procedure which will be modified to include automatic shunt trip testing.

Question #11

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

WPSC Response

The KNPP reactor protection system logic test procedure used to determine reactor trip breaker operability also demonstrates proper operation of the associated control room indication and annunciation.

Question #12

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

WPSC Response

The KNPP was designed to comply with the requirements of GDC 23 and IEEE 279-1968 (which was under development at the time of construction). The automatic trips associated with the RPS fulfill these requirements. The modifications to the shunt trip will conform to the requirements of IEEE 279-1971 to the extent practical; however, the automatic trip system utilizing the UV coil continues to be the method of compliance with KNPP design bases. System reliability and plant availability shall be maximized through the use of reliable components and conservative design practices. The undervoltage mechanism continues to ensure Updated Safety Analysis Report (USAR) assumptions.

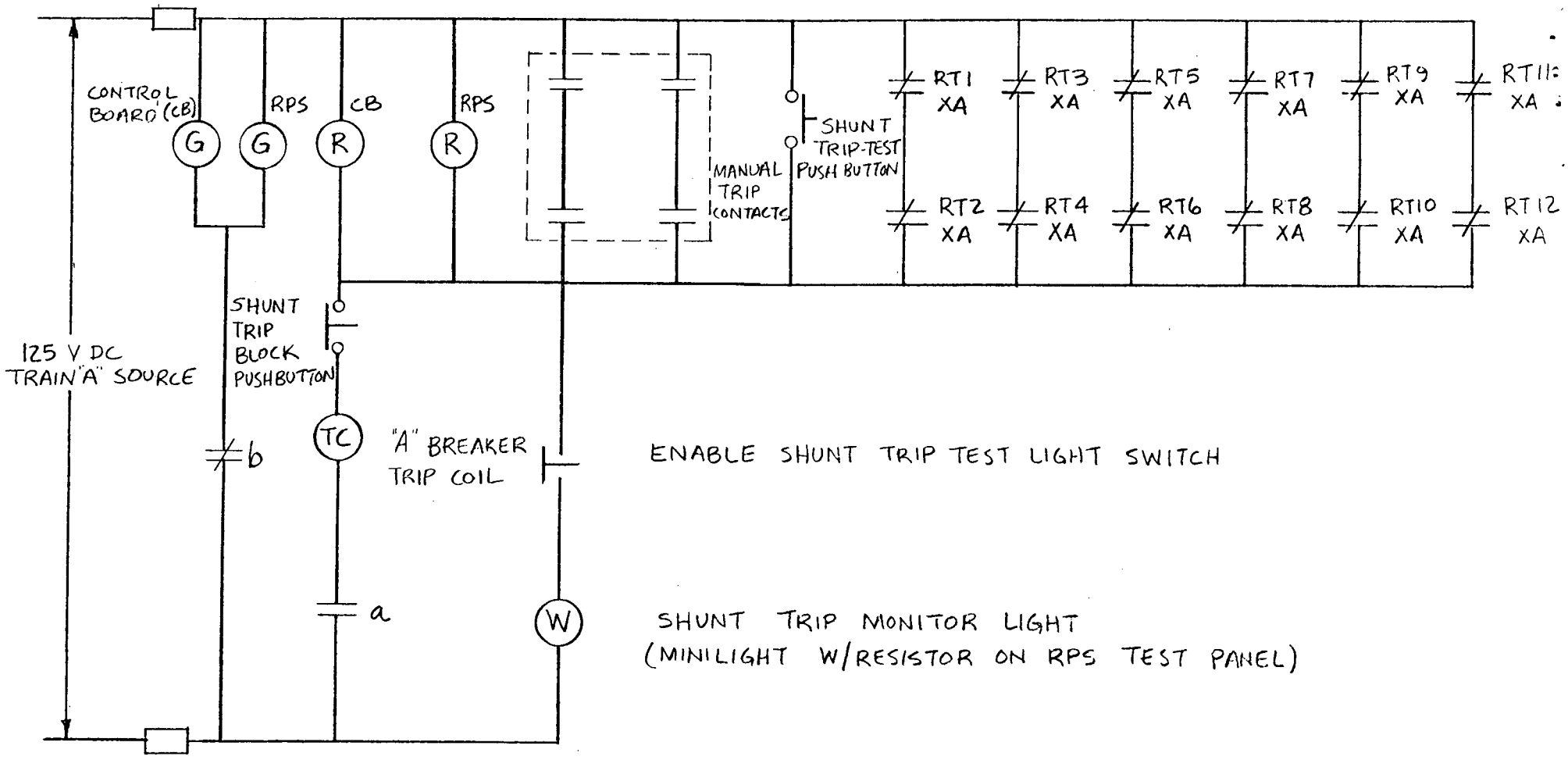
WPSC is participating in and supporting the Westinghouse Owners Group testing of the shunt trip attachment, including life cycle testing. Periodic on-line testing of reactor trip breaker response time would be considered by WPSC if life cycle testing shows that breaker trip response time degrades with operation.

Question #13

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

WPSC Response

A review of existing Kewaunee Nuclear Plant Technical Specifications requirements associated with the reactor trip system has been conducted and results indicate that there is no need for changes.



SHUNT TRIP CIRCUIT INCLUDING SHUNT TRIP MATRIX

FIGURE 1 of 3

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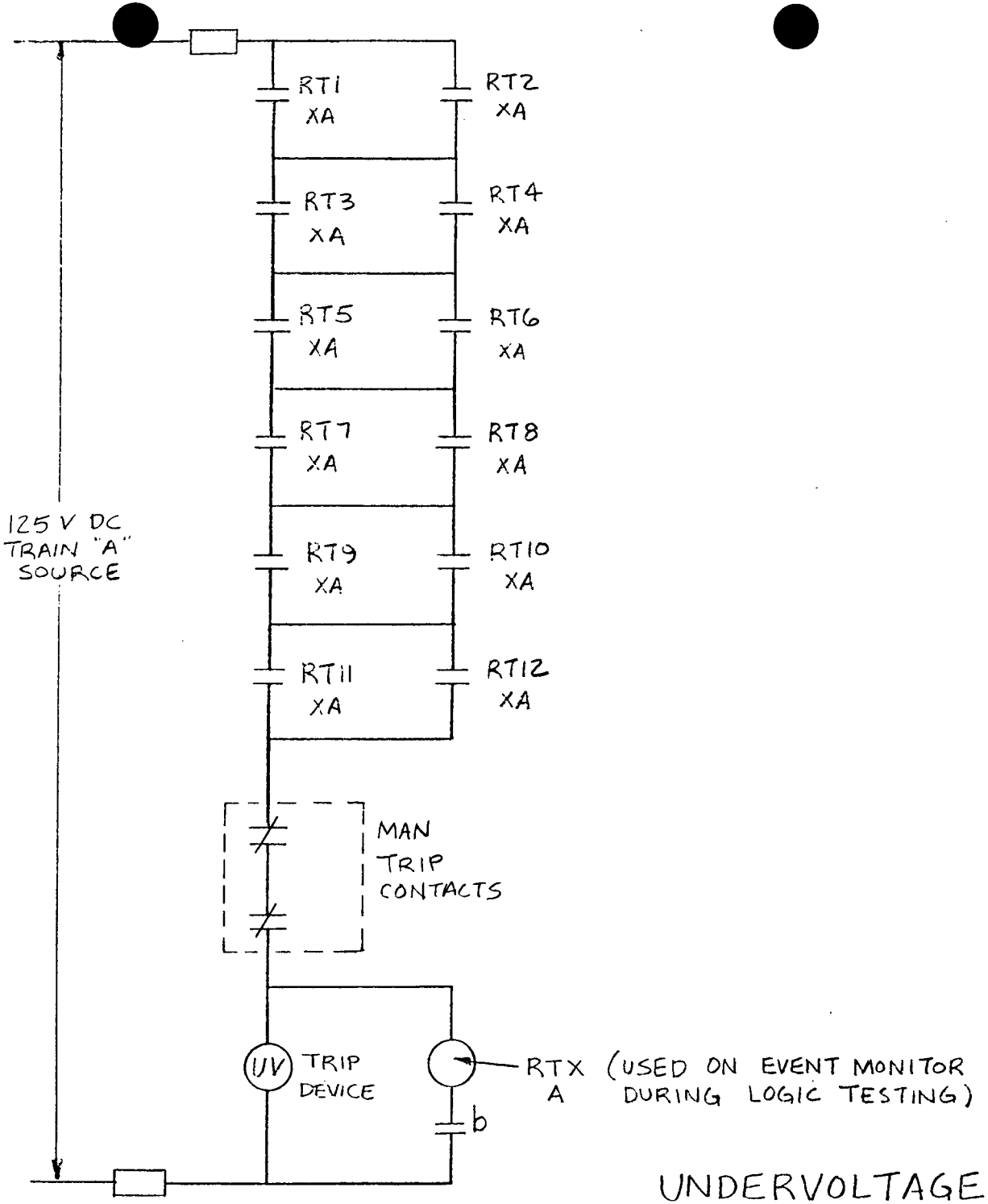

UNDERVOLTAGE TRIP CIRCUIT

FIGURE 2 of 3

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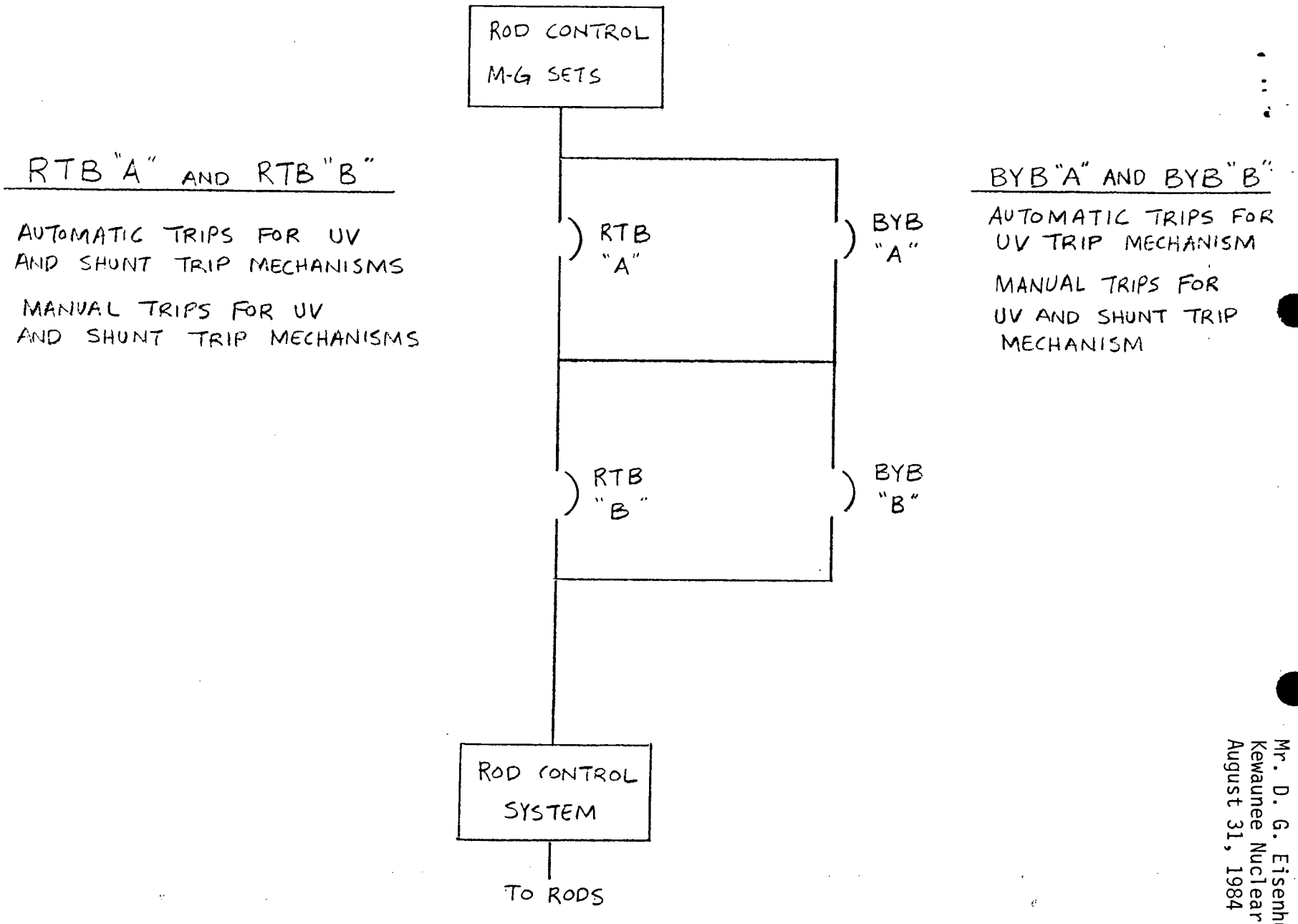
August 31, 1984



MODIFIED TRIP AND BYPASS BREAKER CONFIGUATION

FIGURE 3 of 3.

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