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April 13, 1989
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(TAC No. 59151)

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Dear Sir:

Three Mile Island Nuclear Station, Unit 1 (TMI-1)
Operating License No. DPR-50
Docket No. 50-289
ATWS Implementation (10 CFR 50.62)
RAI Meeting - Post Meeting Questions

GPU Nuclear Corporation (GPUN) representatives met with NRC staff members on February 15, 1989, to discuss ATWS implementation issues. As a result of these discussions, the NRC staff requested additional clarification as related to the issue of the number of control rod groups required to be inserted by the ATWS Diverse Scram System (DSS). Enclosure 2 of the Staff's February 27, 1989 letter presents Post-Meeting Questions on TMI-1 ATWS. These questions are repeated in GPUN's attached response for convenience.

Also, during the February 15, 1989 meeting, GPUN representatives agreed to provide a response to the January 3, 1989 - NRC Review of ATWS Implementation letter and its enclosed Request for Additional Information (RAI) in May, 1989. The GPUN response, albeit not containing all the typical final design details, will address the RAI questions with what GPUN expects to be the Final Design Plan in generic terms and with specific information where available. Additional final design details will be available subsequent to the May 1989 transmittal.

Sincerely,

H. D. Hukill
Vice President and Director, TMI-1

GMG/lml

cc: W. Russell, NRC
R. Hernan, NRC
F. Young, NRC

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ATTACHMENT

Response to Enclosure 2 to the NRC letter dated February 27, 1989.

"Post-Meeting Questions on TMI-1 ATWS Systems"

Introduction:

Following ATWS implementation during TMI-1 refueling outage 9R, fuel enrichment for Cycle 9 and future cycles will be such that to achieve "hot zero power" upon actuation of Diverse Scram System (DSS), more than control rods Groups 5, 6 and 7 must be inserted. It is GPUN's position that a DSS should indeed scram the reactor and achieve zero reactor power. GPUN will design the TMI-1 DSS to drop all control rod groups (1-7). To accomplish this, electrical power must be removed from the control rod drive mechanisms (CRDMs), a function redundant to that provided by the Reactor Trip System (RTS). Figure 1 provides a simplified description of the devices used to interrupt power to the CRDMs for both ATWS-DSS and RTS implementation.

Question 1:

Provide information regarding the physical and operating characteristics of the Westinghouse circuit breakers being considered for use in the revised ATWS/DSS design and the existing General Electric circuit breakers that are currently used to interrupt power to the CRDMs at TMI-1. Include in this discussion information regarding the differences of the devices used to trip the circuit breakers and the type and voltage level that is used to operate these tripping devices.

Response:

GPUN proposes to use the Westinghouse circuit breakers depicted on the one-line diagram of Figure 1 which are upstream of the Reactor Trip System. This design is a 2 out of 2 trip logic, which requires the addition of a new shunt trip device to the upstream Westinghouse breakers. The new shunt trip is energized-to-trip from the new independent 115 VAC UPS source for ATWS-DSS.

Diversity is the major design criteria to be met by the ATWS DSS. The diversity of interest is between the Westinghouse breaker and the SCR de-gate and also between the Westinghouse breaker and the General Electric (GE) breaker, as the RTS utilizes the SCR de-gate and the GE breakers to remove power from the CRDMs. The Westinghouse breakers (DSS) and SCR de-gate (RTS) are quite diverse in both hardware design and function. There is a general diversity between the Westinghouse and GE breakers from a manufacturing viewpoint and a specific diversity in the manner in which each accomplishes its trip function. The RTS-GE breakers interrupt 125 VDC to the CRDMs while the DSS Westinghouse breakers interrupt 480 VAC. See Table 1.

Response:
(cont'd)

The GE breaker utilizes an undervoltage trip coil (120 VAC) and a 125 VDC shunt trip coil controlled from a control relay which is actuated by the loss of the same 120 VAC. The Westinghouse breaker will utilize a 120 VAC shunt trip coil powered by the new independent power source for the DSS/AMSAC logic. The GE breaker (model: AK-2-15) and the Westinghouse breaker (model: DB-25) are depicted on Figures 2 and 3, also attached. The specific differences of interest are the methods of releasing the springs which open the moving arc contacts. The GE breakers utilize rotation of a trip shaft to release the opening spring. The Westinghouse breaker actuates a trip bar in a straight line to release the opening spring.

Question 2

Provide information on the history that TMI-1 has experienced while operating the Westinghouse and General Electric circuit breakers in question. Include in this discussion information related to the preventive maintenance program that is being used to maintain these circuit breakers.

Response:

The GE breakers associated with the Reactor Trip System (RTS) have only one other application at TMI-1. The Westinghouse breakers, both DB-25s and other sizes, are utilized throughout the electric distribution system.

The maintenance history of GE AK Breakers and Westinghouse DB breakers at TMI-1 have been reviewed. When examining the maintenance history it is important to consider the experiance base. The few GE AK breakers at TMI-1 associated with the RTS receive extensive surveillance testing directed at the trip function. The much larger number of Westinghouse DB breakers are routinely tripped during normal plant operations and system testing. Both manufacturer's breakers have tripped reliably using the shunt trip. For comparison with the GE breakers, the machinery history for ten DB-25 breakers was reviewed. These breakers were selected because they are known to be operated quarterly for ES logic testing. The breaker is tripped using the shunt trip after the auto start. No failures to trip were found. Inadvertent tripping of DB breakers has occurred on some occasions due to problems with the electromechanical overcurrent trip devices. This problem was eliminated by replacement of the electromechanical trip device with a solid state trip device,which will not affect the desired trip function.

GE breakers at TMI have had several instances of failure to trip using the undervoltage trip. These problems were related to mechanical problems with the undervoltage trip device and trip shaft. These problems have been resolved with improved lubrication and improved maintenance and testing procedures. One case of failure of the shunt trip coil on an AK breaker occurred at TMI.

Response:
(cont'd)

NUREG 1000 "Generic Implications of ATWS Events at the Salem Nuclear Power Plant" documents a number of failures of both DB and AK breakers. These failures relate to the undervoltage trip. We believe the undervoltage trip is more prone to failure because it relies on spring force (de-energize to trip) and therefore has less motive force to operate the trip mechanism than the shunt trip.

Relative to industry experience with Westinghouse DB breakers, review of the NPRD information indicates that there were three incidences of a failure to trip (using shunt trip) of DB breakers at other facilities. Two of the failures were because of blown fuses and one was due to a loose connection.

Table 1 indicates which plant procedures are used at TMI-1 in the preventative maintenance program for the subject breakers. These procedures are written to reflect the suggested preventative maintenance methods used by the breaker manufacturers, GE and Westinghouse. The Westinghouse DB breaker inspections performed by PM E-5 include but are not limited to examination of the breaker cubicle rails and extension arms, inspection of the breaker arc quenchers, stationary, moving and arcing contacts and main and auxiliary breaker stabs. Wiring is checked for fraying or deterioration. Terminations are checked for tightness and breakage. The breaker internals and insulating surfaces are cleaned and lubrication of the bearing points, sliding surfaces, primary and secondary disconnects is performed. Electrical checks include measurement of the main contact resistance and breaker insulation resistance. A functional test is also performed. PM procedure E-5 is currently performed on an 18 month interval.

Inspections of the GE model AK breakers performed by PM procedure E-36 include breaker trip timing checks, undervoltage device pickup and dropout voltage testing and trip latch roller and latch surface inspections in addition to the E-5 inspection. Numerous checks and inspections of the uv device are also performed and include centering of the uv trip paddle and armature disc pad, uv armature clearance, air gap and overtravel measurements and uv trip paddle adjustment. This PM is performed on a yearly interval for the GE AK breakers. These procedures are available onsite for further review.

In summary, the shunt trip of both the DB and AK breaker has been reliable at TMI and the rest of the industry. Use of the shunt trip is a reliable means of tripping the breaker and diversity is achieved in design, procedures, power source, and location of the breakers.

Question 3

Provide general information on the cost and manpower requirements if another method of interrupting power to control rods is considered. Use the Davis Besse (All SCRs) reactor trip design or consider the use of a heavy duty line contactors as possible other design concepts to interrupt power.

Response:
(cont'd)

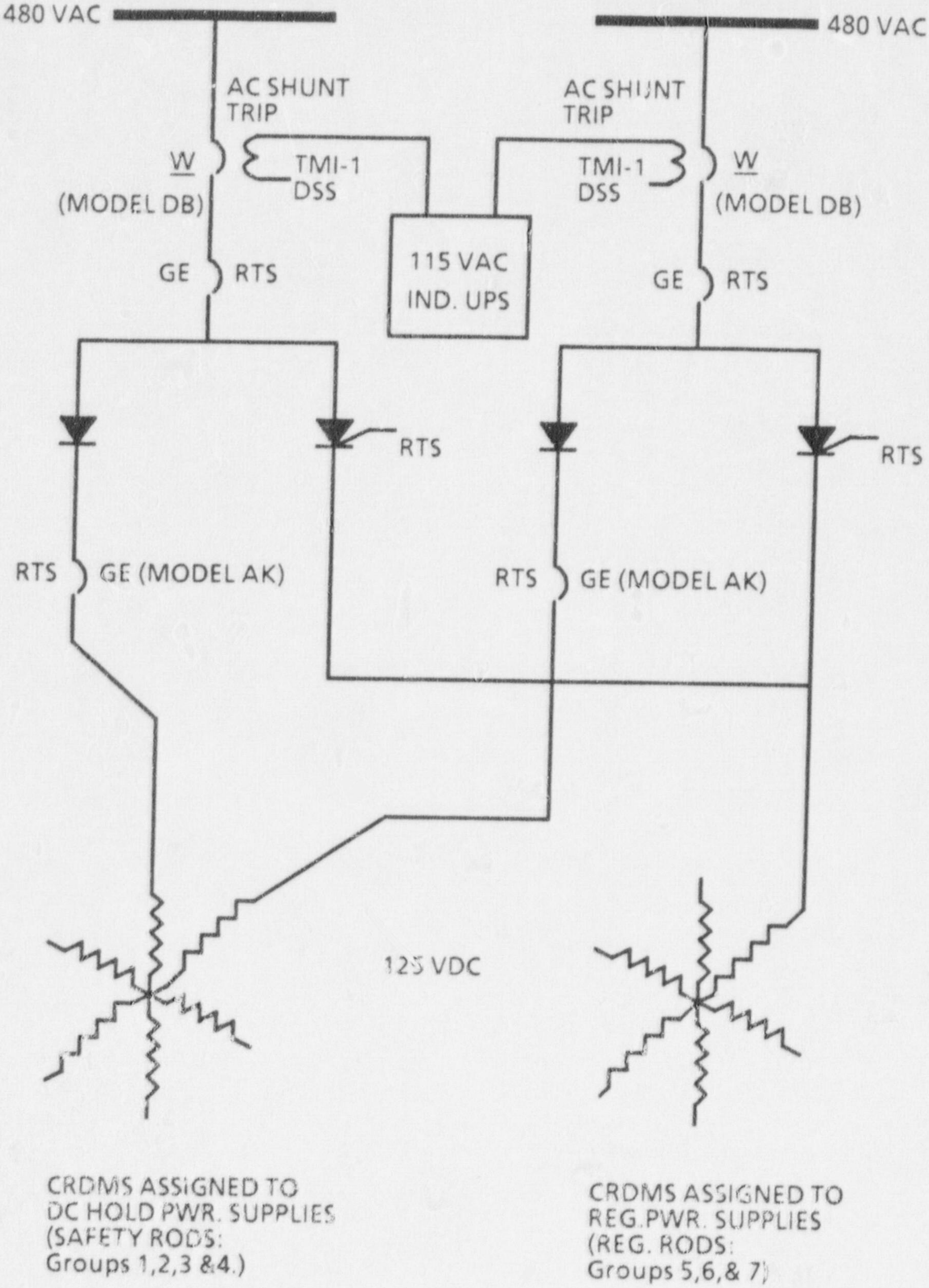
Alternatives have been considered. The Davis Besse (DB) approach (which provides similar diversity to the B&WOG DSS scheme in dropping control rod groups 5, 6, and 7) is the use of SCR (regulating) power supplies for removing power to the safety rods, part of the original DB design. The manufacturer of the regulating power supplies is no longer in this business. Clearly, the costs of building 4 new regulating power supplies, (requiring start-up of a new manufacturing line) to interface with the existing control rod drive system, and the subsequent installation of such supplies would be prohibitive.

The possibility of using heavy duty line contactors as an alternative design concept to interrupt power to the CRDMs has been evaluated in light of the ATWS rule and found to not meet the requirements because these devices are energized to close, not energized to trip.

TABLE 1

COMPARISONS BETWEEN WESTINGHOUSE DB-25 AND GE AK-25 (AK-15) CIRCUIT BREAKERS

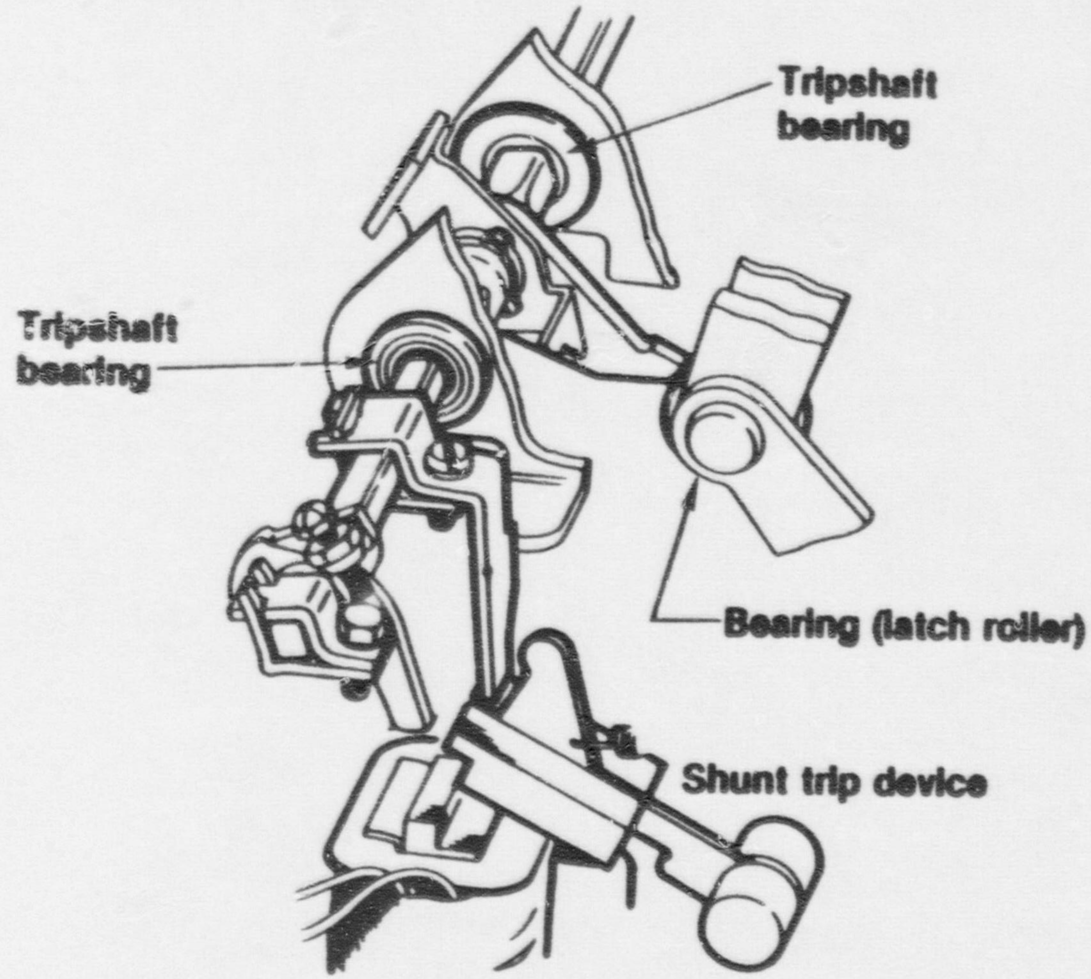
MANUFACTURER MODEL	WESTINGHOUSE DB-25	GENERAL ELECTRIC AK-25 (AK-15)
Location	1G Bus Unit 2A; 1L Bus Unit 2A Control Building 322' Elev.	CB1; CB2; CB3; CB4 Control Building 338' Elev.
PM Procedure	E-5	E-36
Vendor Manual	VM-TM-0283	VM-TM-0035
System Voltage	480V AC	120V DC
Control Voltage	125V DC	125V DC/120V AC
Voltage Rating	600V AC/250V DC	600V AC (250V DC)
Current Rating	600 Amps	600 Amps (250 Amps DC)
Overcurrent Tripping Device	Solid State (Amptector)	None
Operating Mechanism	Manual	Solenoid
Auxiliary Switches	None	2 Aux. Contact Blocks 1-Mech. and 1-Elect.
Shunt Trip	120V AC	125V DC
Undervoltage Trip	None	Undervoltage Trip 120V AC



(*) EACH DIODE ABOVE REPRESENTS 24 ACTUAL. EACH SCR REPRESENTS 144 ACTUAL.

FIGURE 1

FIGURE 2



GE - MODEL AK

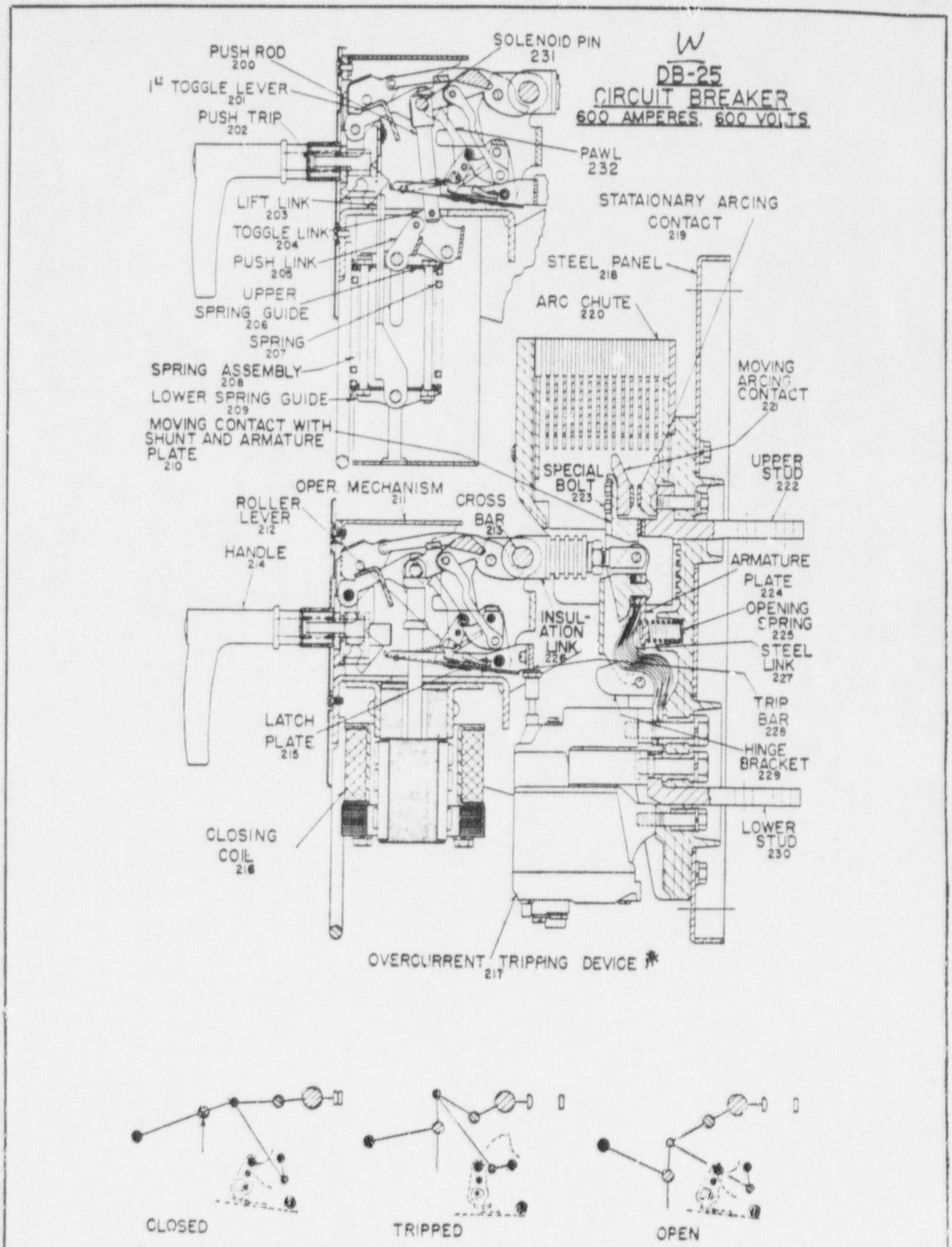


FIG. 5. Cross-Sectional View of Type DB-25 Circuit Breaker

* RETROFIT REPLACED THE ELECTRO-MECHANICAL OVERCURRENT DEVICE WITH A SOLID STATE OVERCURRENT TRIP DEVICE

FIGURE 3