



November 20, 1995

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Document Control Desk  
US Nuclear Regulatory Commission  
Washington, D.C. 20555

SUBJECT: ABB Relays Power Shield Units Type SS-13  
Illinois Power, Docket Number 50-461  
10CFR Part 21 Report

NOTIFICATION BY: ABB Power T&D Company  
Protective Relay Division  
7036 Snowdrift Road  
Allentown, PA 18106  
Harry A. Hinch  
Quality Assurance

On October 11, 1995 ABB Power T&D Co. Inc., Allentown, PA. received a copy of a letter from Illinois Power, Clinton Station, that was sent to the NRC Document Control Desk, Docket Number 50-461 dated October 6, 1995. This letter was in regard to the two (2) Power Shield Trip Units, Type SS-13 Part Number 609901-T012, serial numbers 45779 and 45778 that Illinois Power reported had false tripped their VC and VX system circuit breakers.

Serial number 45779 was returned to ABB on October 13, 1995 for failure analysis. The manufacturing date of this relay was 1980. The suspect relay was electrically tested and inspected by the QA and Repair Department with the following results:

1. Upon initial electrical testing, the reported problem of serial number 45779 was verified. The unit was found with an intermittent output signal that would cause the circuit breaker to false trip.
2. The above unit was disassembled and inspected and the following problem was identified:

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- 2a. A broken solder connection, 360 degree break, was found on pin #1 of the printed circuit board edge connector located on the control board. Pin #1 connects the anode of diode D-205 to terminal # 3 which is connected to R-11 power supply external load resistor. Opening this circuit will cause the unit to trip. The edge connector is a Molex right angle type 2145 with gold plated brass terminals.

Serial number 45778 was returned to ABB on October 20, 1995 for test and failure analysis. The manufacturing date of this unit was also 1980. This unit was also electrically tested and inspected by the QA and Repair Department with the following results:

1. Upon initial electrical testing, serial number 45778 operated normally on all functions. No malfunctions were identified.
2. The unit was disassembled and inspected. The following items were identified:

- 2a. A broken solder connection, 360 degree break, was found on pin #1 of the edge connector of the control board. ( Same location identified in S/N 45779 ).
- 2b. Pin #2 on the same edge connector showed some partial signs of cracking, less than 360 degrees.

Harry Hinch ,the Allentown ABB Quality Supervisor, visited Illinois Power Clifton Station on October 21, 1995 to train Illinois Power personnel in disassembly, inspection, assembly and testing of the Power Shield Units Type SS-13. During the inspection several more questionable solder connections were found. These connections were desoldered, cleaned and resoldered per ABB procedures by Illinois Power personnel.

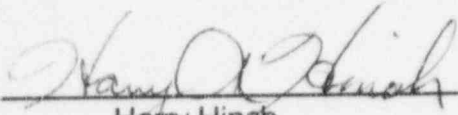
ABB has sent several printed circuit boards with defective solder connections to SAIC (Science Applications International Corp.) test lab for failure analysis. The findings are that the solder fillets have become embrittled through copper diffusion (time and temperature related phenomena). This in itself is not enough to cause a failure, as evidenced by the lack of failures from other solder joints on the board. However, embrittled solder is prone to fatigue cracks brought on by mechanical and thermal stress. Thermal stress was probably a minor problem, as none of the other solder joints from this assembly showed any signs of cracking. Normal mechanical stress associated with the connector mating operation and copper diffusion probably caused the majority of the cracks.

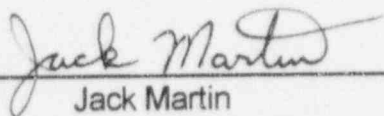
ABB recommends that all Power Shield SS Trip Units prior to serial number 80,000 in service be inspected. This potentially defective solder connection could be present on the female edge connector on any of the printed circuit boards and/or the male connector on the base board. Instructions for inspection of acceptable and non-acceptable solder connections, and procedures for removing solder, cleaning and resoldering of defective solder connections are provided in Attachment A to this letter.

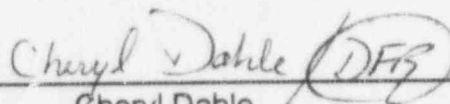
Relays manufactured after serial number 80,000 contain a technical improvement, namely double sided pads and plated through printed circuit board holes which greatly reduce the likelihood of solder connection failures. ABB has not seen any failures of this type since changing the design.

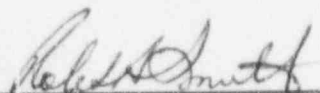
These Power Shield SS Trip Units were manufactured during a period when corporate name changes occurred. The nameplate may show one of these Company names: ITE, Gould, BBC Brown Boveri Electric Co., BBC Brown Boveri, or ASEA BROWN BOVERI.

ABB will notify all end users who purchased this product.

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All Power Shield Trip Units type SS prior to serial number 80,000 should be inspected for broken or cracked solder connections. Units above serial number 80,000 contain a technical improvement namely double sided pads and plated through printed circuit board holes which greatly reduce the likelihood of solder connection failure. ABB has not seen any failures of this type since changing the design. Inspection of units above serial number 80,000 is not required.

**Before disassembly, the unit must be de-energized and removed from the circuit breaker.**

**Disassembly:**

1. Remove the four (4) screws on the Plexiglas cover. Remove cover.
2. Record the tap pin settings for each function so the unit can be reset after rework is complete. Remove tap pins after recording settings.
3. Remove terminal screws number 3 and 16. Detach external resistor wires.
4. Remove the two (2) shoulder screws at the top of the front panel and the two (2) screws at the bottom of the panel. Remove the front panel. Carefully remove the two (2) round spacers located on the face of the mounting blocks on each side of the terminal block. Note: at times, spacers stick to the underside of the front panel.
5. Remove two (2) screws, one from the face of each mounting block. Remove the circuit card assembly from the gray case.
6. Remove the four mounting screws from the top printed circuit board. ( Short Time and Ground card PCB, if the unit is equipped with these functions). Remove board.
7. Remove the four (4) shoulder screws from the next printed circuit board ( Long Time and Inst. PCB). Remove board.
8. Remove the four (4) shoulder screws from the next printed circuit board ( Control Board PCB). Remove board.
9. Remove mother board from Transformer printed circuit board.

ABB Power T & D Company Inc.

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**Inspection:**

1. Inspect the solder connections on the female edge connector of each printed circuit board and all the solder connections on the four (4) male connectors mounted on the mother board. The Martin Marietta soldering standards or photographs provided by ABB should be used when inspecting these solder connections. Photographs identifying the defective joints can be provided upon request. If any broken or defective solder connections are found, they should be repaired by qualified personnel familiar with electronic repair. ABB recommends the following method be used:
  - 1a. The defective solder connection must be completely desoldered by using a good quality desoldering tool or solder wick. Care must be used when desoldering the joint. Excessive heat will cause the printed circuit pad to lift off the board.
  - 1b. All flux residue and poly spray must be removed from the connection area. ABB recommends that Micro Care MCC Pro Clean be used.
  - 1c. ABB recommends when resoldering the connection, a 60/40 rosin core solder be used. The soldering iron temperature should be 700 to 800 degrees. Upon completion, the soldered connection should be cleaned of all flux residue. Personnel resoldering questionable connections should have electronic repair and soldering skills and follow established ESD practices. When resoldering the connection on the female edge connector, ABB recommends that the rear mother board with male connectors is inserted into the female connector during soldering.

**Reassembly:**

1. Upon completion of the inspection, repair, and cleaning of the solder connections, proceed with the assembly in reverse order of steps 1 to 9.
2. Hardware should be torqued 9 to 10 inch pounds. All required lockwashers should be fully compressed.

Upon completion of the reassembly, the unit must be tested per Instruction bulletin IB number 6.1.2.7-4 before being returned to service.