DMB

SNUPPS
Standardized Nuclear Unit
Power Plant System

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July 21, 1983

SLNRC 83-0039 FILE: 0491.10.2
SUBJ: Interim Report: Westinghouse 7300 Process Protection System (SDR 83-08)

Mr. James G. Keppler
Administrator, Region III
U.S. Nuclear Regulatory Commission
799 Roosevelt Road
Glen Ellyn, Illinois 60137

Mr. John T. Collins
Administrator, Region IV
U.S. Nuclear Regulatory Commission
Suite 1000, Parkway Central Plaza
Arlington, Texas 76012

Docket Nos. STN 50-482 and STN 50-483

Ref: IE Information Notice 83-38, Defective Heat Sink Adhesive and Seismically Induced Chatter in Relays Within Printed Circuit Cards

Gentlemen:

On June 2, 1983, NRC Region III and Region IV representatives were informed by SNUPPS Staff (R. White) of deficiencies in Callaway and Wolf Creek 7300 Process Protection Systems manufactured by the Industry Electronics Division (IED) of Westinghouse. In the June 2 notifications, it was explained that there were two significant deficiencies within the 7300 Process Protection System. The two deficiencies involve a) the potential failure of the adhesive bond used to bond heat sinks on the Loop Power Supply (NLP) printed circuit cards and b) seismically induced chatter in mercury relays used in Temperature Channel Test (NTC) printed circuit cards. These items were reported by Westinghouse to the NRC pursuant to 10CFR21 and 10CFR50.55(e) requirements, and were subsequently the subject of the referenced IE Information Notice.

On June 28, 1983, SNUPPS (R. White) contacted NRC Region III and IV (P. Pelke and B. Seidle) and obtained an extension from July 2 to July 22, 1983 for providing this report to the NRC. At that time it was anticipated that this would be the final report. However, it has been decided to hold this SDR open until after successful completion of Westinghouse seismic testing of replacement NTC circuit cards.

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Item a), Heat Sinks on NLP Card

Description of Problem

Heat sink adhesive failures have been identified at several plants other than Callaway or Wolf Creek and were reported to Westinghouse as field deficiencies. All reported field failures have occurred only on the loop power supply (NLP) cards. Westinghouse has determined that NLP printed circuit cards shipped from Westinghouse Industry Electronics Division (WIED) between August 1, 1980 and September 1, 1982, were equipped with a thermal heat sink assembly on the inverter transistors. The heat sink assemblies are subject to potential failures in the adhesive bond between an insulating washer and the thermal link (see Attachment 1). The affected printed circuit boards are:

5NLP Sub-level 18 and above
6NLP Sub-level 18 and above
Note: Previous Sub-levels did not contain heat sinks. The assembly sub-level identification sticker is attached to the solder side of the card near the front edge, and is not the revision identified on the front edge.

The adhesive failure mechanism or expected number of hours of system operation before failure is not defined. All reported problems have occurred under normal system usage or storage.

Consequences of Heat Sink Adhesive Failure

If the adhesive bond defect had remained undetected, failure of the bond could cause the heat sink plate to separate from the thermal links and fall off the printed circuit board. The plate is conductive metal and under certain circumstances could cause shorting of low level signals if it were to become wedged between cards in the card frame. These low level signals are associated with various protective functions within a given Protection Set of the 7300 Process Protection System Cabinets. For example, one such protective function is the Pressurizer Pressure (2 of 4 Logic) Reactor Trip. Under the unlikely condition of three concurrent adhesive failures in three different cabinets, each resulting in the shorting of one of the four logic signals generating the trip function, it is possible that reactor trip would be delayed, and that fuel temperatures would exceed those presented in certain FSAR analyses.

To date, Westinghouse reports that adhesive failures have not resulted in any damage to the affected 7300 Process Protection Systems nor have these failures resulted in any loss of system safety function.

Corrective Action, NSSS Equipment

Heat sinks that are subject to this potential adhesive failure mechanism will be identified by Westinghouse and replaced. These heat sinks will be identified by inspection of the printed circuit card for hex nuts visible on the top side of the assembly. See attached, superseded drawing 404A605 (Attachment 1). The replacement heat sinks have screw heads visible from the top side of the assembly (see Drawing 403A947, Attachment 2). The new style replacement heat sink cards feature screws that penetrate the heat sink material and hold the material securely in place.

Replacement heat sinks for NSSS equipment will be installed at Callaway and Wolf Creek prior to fuel load. The installation will be in accordance with standard practices and procedures governing site rework and repair.

Corrective Action, BOP Equipment

Westinghouse reports that WIED supplies this type of equipment directly to Architect/Engineers for utility balance of plant (BOP) use and also to other NSSS vendors. Preliminary indications are that it is unlikely that NLP cards with heat sinks have been used at Callaway, but that one or more NLP cards may have been used at Wolf Creek (other than in the Westinghouse 7300 Process Protection System). An investigation is being made to verify that no other NLP cards have been used at Callaway and to confirm the preliminary indications of defective NLP card(s) at Wolf Creek. Should the investigation confirm receipt or installation of these NLP cards at either Callaway or Wolf Creek, the defective cards will be replaced prior to fuel load. The results of this investigation will be available on site for NRC review.

Item b), NTC Card Relay

Description of Problem

During 3-axis seismic testing of the Temperature Channel Test (NTC) card, contact bounce was experienced in the mercury relay utilized on this card. These cards had previously undergone single-axis seismic testing, and had been released based on successful completion of that testing. The intermittent contact bounce exhibited in the 3-axis testing could result in signal saturation of the downstream RTD Amplifier (NRA) card in the T_{cold} and T_{hot} circuits of the Westinghouse 7300 Process Protection System. In these systems, filters are adjusted to maintain a total time constant of approximately two seconds for the RTD/filter combination. Since the filter is downstream of the relay, the characteristics of the channel response depends on the time constant of the filter. For RTD's specified by Westinghouse, the filter has been set at either zero or two seconds, depending on the type of RTD (fast or slow response) utilized. Callaway and Wolf Creek applications utilize unfiltered signals.

Consequences of Seismic Relay Chatter

For unfiltered signals, saturation of the NRA card could delay initiation of the Overtemperature - Delta T and Overpower - Delta T trips. Had this problem gone undetected, and had the problem occurred during plant operation, the delay in reactor trip could have resulted in fuel temperatures in excess of those presented in certain FSAR analyses. This problem would only occur as a result of contact bounce induced by a seismic event.

Corrective Action

Two candidate replacement relays have been identified, and are being tested by the Westinghouse Advanced Energy Systems Division. The current testing is scheduled for completion in October, 1983. Each of the two replacement relay candidates are solenoid activated electromechanical relays, and should eliminate the chatter exhibited by the mercury relay being replaced. The SNUPPS project will review and confirm that the results of the Westinghouse test program are satisfactory prior to release of the replacement cards for installation. Replacement relays for NSSS equipment will be installed prior to fuel load for Callaway and Wolf Creek.

This report should be considered an interim report concerning the NLP and NTC circuit card deficiencies. It is anticipated that the final report will be issued by the end of the year, after the completion of seismic testing of the replacement NTC cards. The NRC will be informed should there be any significant developments concerning this issue in the interim.

Very truly yours,

S. J. Seiken
Manager, Quality Assurance

RPW/dck10a12&10b1-3

Attachments: 1. Superseded Drawing 404A605
2. Drawing 403A947

cc: D. T. McPhee KCPL
G. L. Koester KGE
D. F. Schnell UE
Record
H. W. Roberds USNRC/CAL
J. H. Neisler USNRC/WC
H. M. Wescott USNRC Region III
Richard DeYoung Director I&E

ATTACHMENT 1

DFTM.	6-24-81
CHKD.	
SUPV.	
APPD.	
APPD.	
APPD.	
S.O. DEO-	1
2	DEO-41704-4 IT. 3 NOTE WAS "DO NOT OVER-TORQUE" GBK 9-11-81
3	DEO-42685-4 SUPERSEDURE NOTE WAS NOT ON GBK 10-4-82

INDUSTRY SYSTEMS DIVISION
PITTSBURGH, PA. U.S.A.

Westinghouse Electric Corporation

TITLE HEAT SINK ASSEMBLY

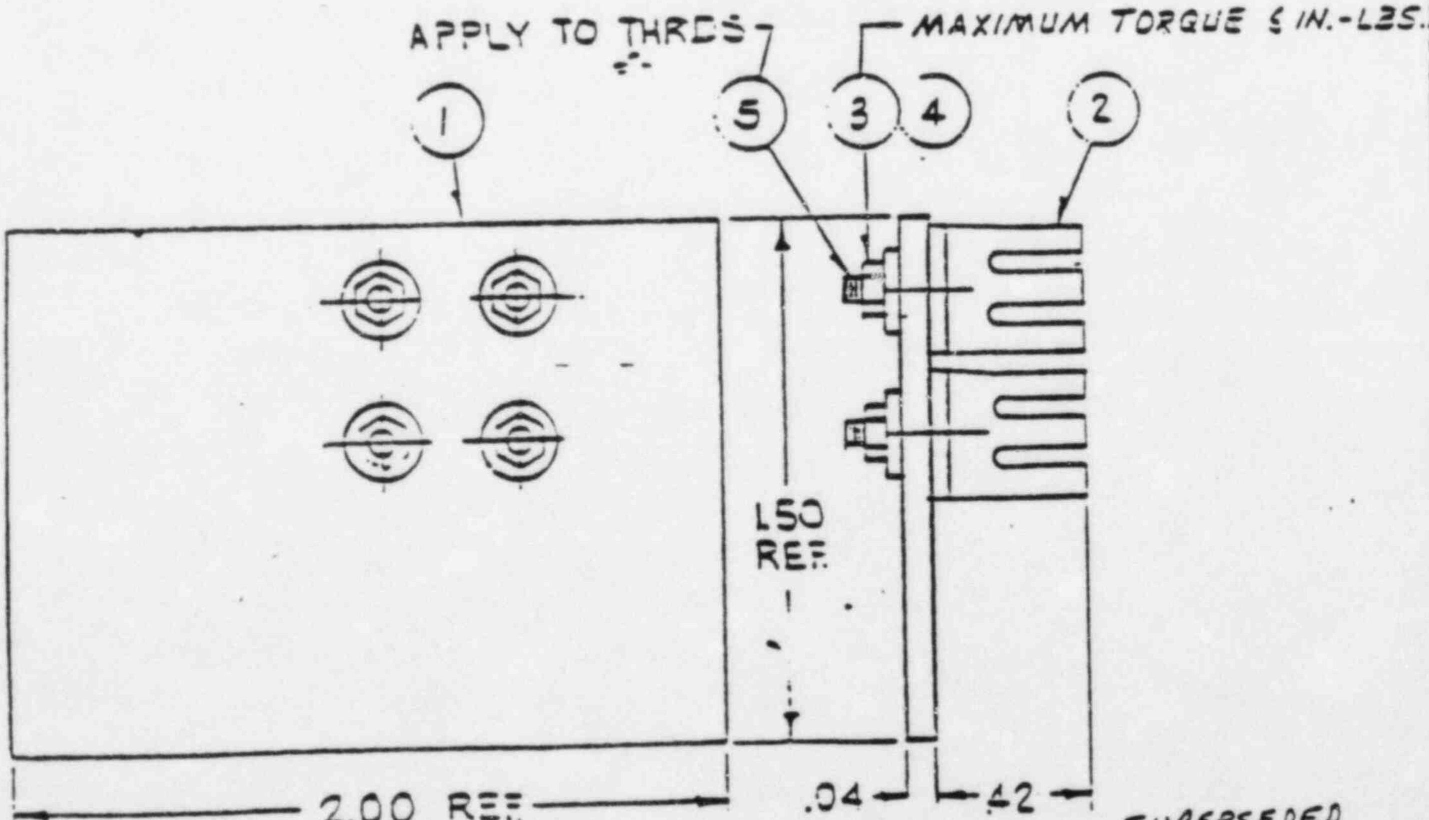
DWG 404A605 SUB 2 FINISH CHART

SYM.	ITEM	DESCRIPTION—MATERIAL DIMENSIONS IN INCHES	PATT. NO. OR REF. DWG.	STYLE NO.	SYM. GR. 1	2	3	4	5
	1	HEAT SINK PLATE		2836A35H01	1				
	2	THERMAL LINK		404A606H01	4				
	3	.138-32 NYLON HEX NUT	09080		4				
	4	.138 EXT. TOOTH WASHER	11009		4				
	5	LOCTITE #271	26182		A.R.				

SUPERSEDED BY DWG. 403A947G01 FOR OLD OR NEW DESIGN.

NOTE:

1-TO RETROFIT TO EXISTING P.C. BD ASSEMBLIES, MOUNT THERMAL LINK IT. 2 TO TRANSISTORS BEFORE ASSEMBLING TO HEAT SINK PLATE IT. 1.



SUPERSEDED

STANDARD DRAWING ANY CHANGE MUST BE AUTHORIZED BY DEVELOPMENT ENGINEERING DEPT.	~~404A605~~

ATTACHMENT 2

DRN.	CHKD.	SUPV.	APPD.	APPD.	APPD.	S.O. DEO-12683-6

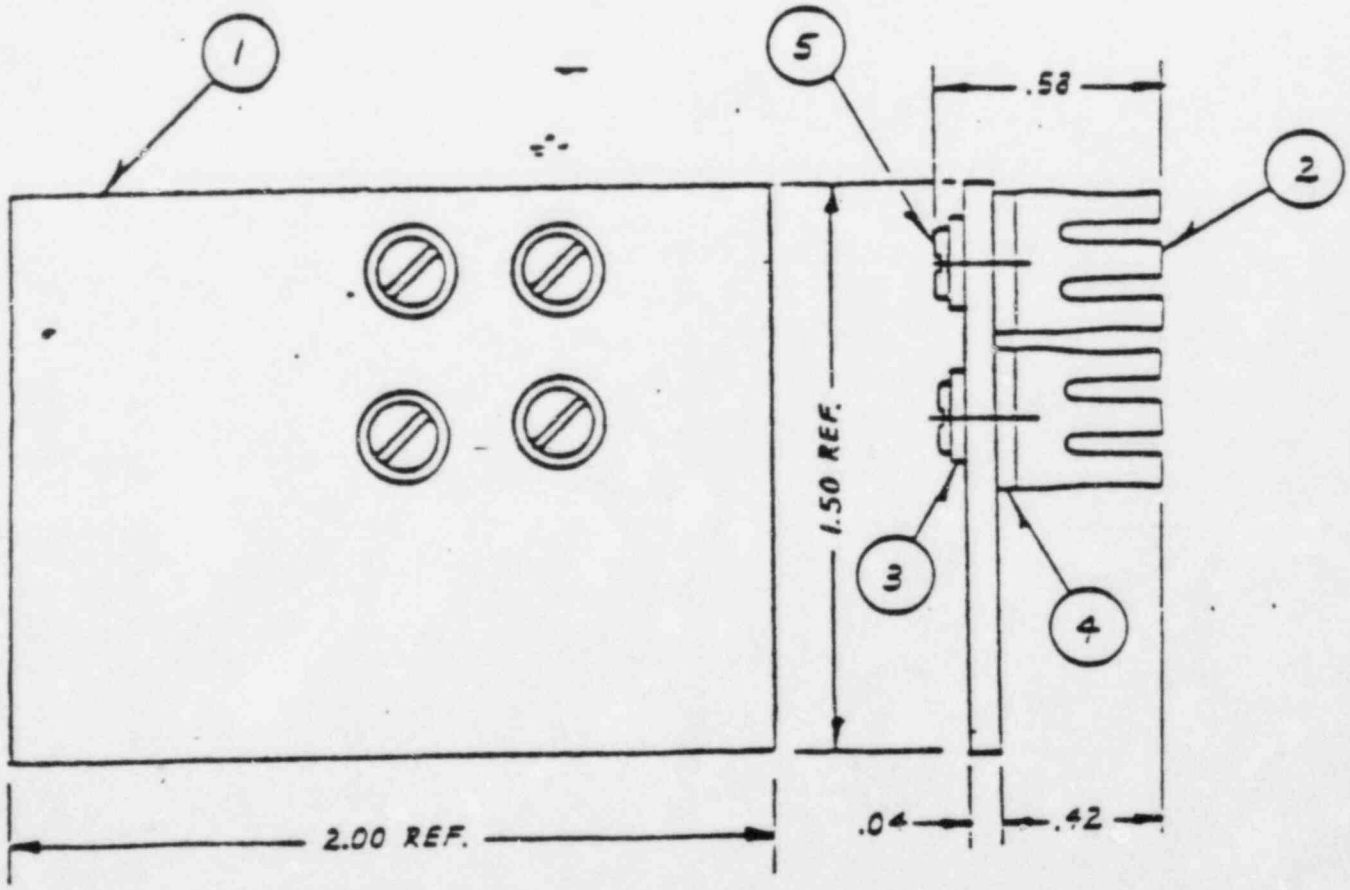
Westinghouse Electric Corporation

INDUSTRY SYSTEMS DIVISION

TITLE HEAT SINK ASSEMBLY, TO-5

DWG 403A947 SUB. 1 FINISH CHART

ITEM	STYLE NO.	DESCRIPTION	GROUP 1	2	3	4	5
1	29ESA3EH01	HEAT SINK PLATE	1				
2	404A947H01	THERMAL LINK	4				
3	H02	SHOULDER WASHER	4				
4	H03	3E 0 WASHER	4				
5	10101	4-40 x .25 SCREW, BIND. HD.	4				



STANDARD DRAWING
ANY CHANGE MUST BE AUTHORIZED BY DEVELOPMENT ENGINEERING DEPT

403A947