UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D.C. 20555

January 14, 1994

NRC INFORMATION NOTICE 94-04: DIGITAL INTEGRATED CIRCUIT SOCKETS WITH INTERMITTENT CONTACT

Addressees

All NRC licensees except licensed operators.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to a potential problem involving socket connectors used for digital integrated circuits manufactured by Augat, Inc. It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate, to avoid similar problems. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific action or written response is required.

Description of Circumstances

During April 1993, at the D. C. Cook Nuclear Plant, the licensee observed intermittent failures of various process control units during testing. The internal monitoring system for a control unit would detect a problem and shut the instrument down (i.e., cause its outputs to reduce to zero and remain in an audible alarm state). The NRC learned about this recurrent problem during an analog-to-digital process instrumentation inspection at this site (NRC Inspection Report 50-315/93-18; 50-316/93-18). Subsequent to a July 1, 1993, meeting between the licensee and the control unit manufacturer, Asea Brown Boveri-Kent-Taylor (ABB-Kent-Taylor), the problem was isolated to the sockets for the integrated circuits. Deficiencies in the sockets resulted in intermittent contacts between the integrated circuits and the sockets, thus interrupting signal processing. These sockets, which are manufactured by Augat, Inc., are made in various grades and one of the lower grade sockets was being used. Augat, Inc. is an international supplier of interconnection systems for the computer, automotive, and telecommunications industries. These sockets were produced in large numbers and some may be in use in nuclear as well as non-nuclear applications where their failure could either initiate a transient or interfere with response to a transient.

The process control units (Taylor MOD 30) were built as commercial-grade equipment in 1989 but were not delivered to the licensee until 1992, and were not shipped to the site until the Spring of 1993. The original purchase order included both safety-related units and nonsafety-related units. Asea Brown Boveri-Combustion Engineering (ABB-CE) was supposed to qualify the equipment

designated for safety-related use before the safety-related equipment was released and shipped to the D.C. Cook plant. For reasons unrelated to the socket deficiencies, the contract was amended to exclude safety-related equipment. However, the nonsafety-related equipment will be used in the AMSAC [ATWS (anticipated transients without scram) Mitigation System Actuation Circuitry].

The licensee informed ABB-CE of this potential generic product deficiency in an August 20, 1993, letter. Followup in September 1993 revealed that the manufacturer believes it has not sold any Taylor MOD 30 instruments to nuclear power plants for use in safety-related applications.

Discussion

In the D. C. Cook application, the sockets are located on an internal component identified as a "digital board." There are 7 sockets per digital board; 5 of the sockets are 28-pin sockets and are being used for programmed PROMs (Programmable Read Only Memories), one 20-pin socket is being used for a programmed logic array integrated circuit, and one 40-pin socket is being used for a single-chip microprocessor unit. The 520 instruments contain a total of more than 3500 sockets.

Subsequent discussions with the licensee concerning the generic nature of the deficiency produced additional information. The 20-, 28-, and 40-pin sockets had the following respective Augat part numbers: 520-AG12D-ES, 528-AG12D-ES, 540-AG12D-ES. The "ES" suffix indicates that a socket is an Economy Series socket. Augat, Inc. introduced this series in 1985 to provide a less expensive version of its traditional machined contact. The contact portion of the ES socket is produced by a stamping process rather than by a machining process. The stamped ES sockets were first used in Taylor MOD 30 equipment in 1988. In February 1991, the control unit manufacturer, ABB-Kent-Taylor, changed back to the machined version after producing approximately 7,000-10,000 instruments with the ES sockets. Tests performed in July 1993 confirmed that the withdrawal force for the ES stamped contact sockets was considerably less than for the machined contact sockets. Both of these sockets had a tin-lead inner contact. The ES sockets are being replaced with machined contact 520-AG12D, 528-AG12D, and 540-AG12D sockets.

Some Augat, Inc. ES sockets have exhibited a relatively high incidence of intermittent failure. The failure rate among the 256 Taylor MOD 30 instruments tested was determined to be approximately 15 percent through July 1993. It appears that the use of a tin-lead inner contact, the stamping method of manufacture, and the length of time an instrument sits de-energized may serve in combination to permit or create oxidation on the contacts. However, the root cause of the intermittent contact between the integrated circuit and its socket has not been determined. ABB-Kent-Taylor believes that the delay between shipment and construction, while the units sat de-energized, may have been a contributing factor in the failure. If this is the case, instruments stored as spare parts (which would also be de-energized) could be similarly affected.

A recent design review of an analog-to-digital upgrade for the reactor protection system at a foreign plant revealed that the integrated circuit socket specified was the type discussed above; i.e., it was manufactured by Augat, Inc. and was the ES type. The contact design is being reevaluated.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation project manager.

Brian K. Grimes, Director
Division of Operating Reactor Support
Office of Nuclear Reactor Regulation

Technical contacts: Edward R. Schweibinz, RIII
(708) 829-9712

Vern Hodge, NRR
(301) 504-1861

Attachment:
List of Recently Issued NRC Information Notices

LIST OF RECENTLY ISSUED NRC INFORMATION NOTICES

Information Notice No.	Subject	Date of Issuance	Issued to
94-03	Deficiencies Identified during Service Water System Operational Performance Inspections	01/11/94	All holders of OLs or CPs for nuclear power reactors.
94-02	Inoperability of General Electric Magne-Blast Breaker Because of Mis-Alignment of Close-Latch Spring	01/07/94	All holders of OLs or CPs for nuclear power reactors.
94-01	Turbine Blade Failures Caused by Torsional Excitation from Electrical System Disturbance	01/07/94	All holders of OLs or CPs for nuclear power reactors.
93-101	Jet Pump Hold-Down Beam Failure	12/17/93	All holders of OLs or CPs for boiling-water reactors.
93-100	Reporting Requirements for Bankruptcy	12/22/93	All U.S. Nuclear Regulatory Commission licensees.
91-29, Supp. 2	Potential Deficiencies Found During Electrical Distribution System Functional Inspections	12/22/93	All holders of OLs or CPs for nuclear power reactors.
93-99	Undervoltage Relay and Thermal Overload Setpoint Problems	12/21/93	All holders of OLs and CPs for nuclear power reactors.
93-98	Motor Brakes on Valve Actuator Motors	12/20/93	All holders of OLs and CPs for nuclear power reactors.
93-97	Failures of Yokes Installed on Walworth Gate and Globe Valves	12/17/93	All holders of OLs or CPs for nuclear power reactors.
93-96	Improper Reset Causes Emergency Diesel Generator Failures	12/14/93	All holders of OLs or CPs for nuclear power reactors.

OL = Operating License
CP = Construction Permit

A recent design review of an analog-to-digital upgrade for the reactor protection system at a foreign plant revealed that the integrated circuit socket specified was the type discussed above; i.e., it was manufactured by Augat, Inc. and was the ES type. The contact design is being reevaluated.

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Original signed by
Brian K. Grimes

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This information notice was coordinated with MBCongdon, OIP/PDD, on about 11/22/93.

This information notice was coordinated with EWBrach, NMSS/LLWM, on 12/22/93.

*SEE PREVIOUS CONCURRENCE

OFFICE	*OGCB	*TECH ED.	*C:HICB/DSSA	*REGION III
NAME	CVHodge	RSanders	JSWermiel	ERSchweibinz
DATE	11/18/93	11/16/93	11/18/93	12/01/93

*D:DRP/REGION III	*C:OGCB/NRR	D:DORS/NRR
EGGreenman	GHMarcus	BKGrimes
12/01/93	12/02/93	01/10/94

DOCUMENT NAME: 94-04.IN

During a September 13-14, 1993, Digital System Reliability and Nuclear Safety Workshop sponsored by the NRC in cooperation with the National Institute of Standards and Technology, this subject was discussed with a foreign participant. The following week that participant contacted the NRC for more details, because a design review of an analog-to-digital upgrade for the reactor protection system at the foreign plant revealed that the IC socket specified was the type discussed above; i.e., it was manufactured by Augat, Inc. and was the ES type. Subsequently, the design has been reevaluated to consider specification of a machined contact.

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OFFICE	*OGCB	*TECH ED.	*REGION III	*Region III	*C:HICB/DSSA
NAME	CVHodge	RSanders	ERSchweibinz	EGGreenman	JSWermiel
DATE	11/18/93	11/16/93	12/01/93	12/01/93	11/18/93

C:OGCB/NRR	D:DORS/NRR
GHMarcus GHM	BKGrimes
12/2 /93	11/ /93

DOCUMENT NAME: ICSOCKET.INF