ORGANIZATION: BERGEN PATERSON PIPESUPPORT CORPORATION
LACONIA, NEW HAMPSHIRE

REPORT NO.: 99900209/85-01	INSPECTION DATE(S): 8/19-23/85	INSPECTION ON-SITE HOURS: 26

CORRESPONDENCE ADDRESS: Bergen Paterson Pipesupport Corporation
ATTN: Mr. C. E. Faulkner
Vice President, Quality Assurance
34 Moulton Street
Laconia, NH 03246

ORGANIZATIONAL CONTACT: Mr. Robert Stephens, QA Manager
TELEPHONE NUMBER: (603) 524-1990

PRINCIPAL PRODUCT: Component Supports

NUCLEAR INDUSTRY ACTIVITY: Approximately 5-10 Percent

ASSIGNED INSPECTOR: _____ 10/31/85
FOR R. E. Oller, Reactive Inspection Section (RIS) Date

OTHER INSPECTOR(S):

APPROVED BY: _____ 10/31/85
E. W. Merschoff, Chief, RIS, Vendor Program Branch Date

INSPECTION BASES AND SCOPE:

A. BASES: Appendix B to 10 CFR Part 50 and 10 CFR Part 21.

B. SCOPE: The purpose of this reactive inspection was to review the technical aspects of manufacturing deficiencies in hydraulic shock and sway arrestors (snubbers) and various Bergen Paterson Pipesupport Corporation (BPPC) services offered to nuclear power plants (NPP). The status of previous inspection findings was also reviewed.

PLANT SITE APPLICABILITY: As indicated in the report text.

ORGANIZATION: BERGEN PATERSON PIPESUPPORT CORPORATION
LACONIA, NEW HAMPSHIRE

REPORT NO.: 99900209/85-01	INSPECTION RESULTS:	PAGE 2 of 10

A. SUBJECTS INSPECTED:

1. Snubber Deficiencies:

Snubber deficiencies reviewed: (a) fluid leakage at seals; (b) corrosion of accumulator springs; (c) valve block seal leaks; (d) mislocated accumulator overfill holes, and (e) disengagement of self aligning ball bearings.

2. Snubber Related BPPC Activities:

Snubber related activities reviewed: (a) qualification tests; (b) repair and test services; (c) maintenance and testing information; (d) spare parts; (e) snubbers for piping systems with continuous vibration loads, and (f) functional testing.

B. INSPECTION FINDINGS AND COMMENTS:

1. Hydraulic Shock and Sway Arrestor (Snubber) Deficiencies:

a. Background:

Early in 1985, Brookhaven National Laboratory (BNL) performed a study for the NRC in which snubber manufacturing deficiencies specific to each manufacturer of mechanical and hydraulic snubbers, were identified. BNL also provided other inspection recommendations that were common to all manufacturers of snubbers. As a result of this study, a Vendor Program Branch inspection was conducted on August 19-23, 1985 at the Bergen Paterson Pipesupport Corporation (BPPC) facility in Laconia, New Hampshire.

b. Findings:

(1) General Information

Discussions with the plant quality assurance and engineering personnel disclosed that BPPC manufactures a line of standard 2500 series hydraulic snubbers with load ratings of 3, 10, 20, 30, 50, 70, 130, and 200 KIPs (a deadweight load of 1000 pounds) for snubber sizes of 1½ inch through 10 inch bore. They also manufacture specially designed hydraulic snubbers up to a 12 inch bore and load rated up to two million pounds per square inch (psi). In the

standard 2500 series, the lockup and release (bleed) rates of 10 inches per minute (ipm), ±3 and 5 ipm, ±3 (respectively) are governed by the configuration of the poppet plug end-flats and bleed groove. Over the years there have been four design configuration changes of the standard hydraulic snubbers. All of these designs are in service at nuclear power plants (NPP). The current fourth generation standard 2500 series snubbers are constructed of corrosion resistant materials for those surfaces exposed to the atmosphere and the hydraulic fluid. For specialized service, such as for systems with continuous vibration loads, BPPC has case hardened all internal moving parts to improve wear resistance. All seals for standard snubbers are made of ethylene propylene (EP) material, which has been proven acceptable by test, and only GE SF-1154 hydraulic fluid is used.

(2) Snubber Deficiencies:

Discussions with the Product Designer (PD) and review of BPPC literature, indicated that most of the problems were found in the early 1970s after the snubbers had been in service for varying periods of time. These snubbers had been designed and manufactured before operational experience was available. The most frequently occurring problem was hydraulic fluid leakage of the polyurethane seals which had been in the snubbers several years. The first experience was at the Oyster Creek Nuclear Power Plant (NPP) in May, 1973, where several snubbers lost their fluid due to degradation of the millable gum polyurethane seals. In this case, temperature appeared to have been the cause. At other NPPs where seals were exposed to temperature and radiation, the formed polyurethane seal was found to have taken a permanent set resulting in leakage of the hydraulic fluid. By the Mid-1970s, leakage associated with polyurethane seals was a nationwide industry problem, and a change was made by snubber manufacturers to the ethylene propylene (EP) material. Tests demonstrated that EP was a more suitable material for seals and, to this date, has provided satisfactory service. The shelf life of EP is 5 to 7 years and BPPC recommends to their customers a seal replacement schedule of five years.

The PD indicated that the problem of corrosion in accumulator springs occurred with the use of neoprene-coated carbon steel springs. These were used in the "external pipe" snubber design. The corrosion occurred under the coating due to atmospheric moisture on the dry side of the accumulator. This problem was identified in the Mid-1970s and was resolved along with other potential problems by a general redesign of snubber parts using corrosion resistant materials. The spring material was changed to a stainless steel alloy. This material change, and other design changes, resulted in the current 2500 series standard snubber.

A problem involving leakage at the valve block seal to the main cylinder was due to the lack of adequate fasteners. This problem was corrected by the use of socket head cap screws properly torqued during assembly.

In 1974, certain 3 KIP snubbers were manufactured with mislocated overfill protection holes in the accumulator shell. This problem was corrected by torch welding the hole closed and drilling a new hole at the proper location.

The reported problem of disengagement of self aligning ball bearings on the snubber extension was discussed with the PD. He indicated that he was unaware of such a problem with the BPPC snubbers. Tests have shown that the BPPC design precluded the occurrence of this type of problem. Review of BPPC literature on various field problems also failed to show that this problem had occurred.

(3) Snubber Related Activities:

a. Qualification Tests

Discussions with the PD disclosed that each of the eight sizes (1½ inch through 10 inch bore) of the standard 2500 series hydraulic snubbers, was qualified by load rate testing to meet the ASME Code requirements. Review of test reports related to the 3, 50, 70, and 130 KIP rated snubbers verified that these snubbers met code requirements. The tests on the 3 and 50 KIP units were performed by Wyle Laboratories, and tests on the 70 and 130 KIP snubbers were performed by the BPPC affiliated New Hampshire Testing Laboratories.

b. Snubber Repair and Test Services:
Discussions with the Manager of Services (MS), disclosed that a variety of services, under the BPPC Service Group (SG), are offered to NPPs with regard to snubbers and other pipe support items. Review of technical bulletins issued by the Service Group identified the following services:

(1) Snubber maintenance programs.
(2) Snubber test stand sales.
(3) Mobile equipment test stand trailer services.
(4) New Hampshire Testing Laboratories mechanical testing service.
(5) Training courses in snubber rebuilding and functional testing.
(6) Engineering design staffing support.
(7) Engineering and staffing for other services, and data management.
(8) Nondestructive examination and metrology device calibration.

BPPC currently has a mobile trailer equipped with a series 2500 , Mark III vacuum purge functional test unit for use at NPPs. It is of major concern to BPPC that snubber rebuild areas be clean and have adequate work space to prevent contamination and mixup of snubber parts.

c. Snubber Maintenance and Testing Information

Discussions and review of BPPC literature disclosed that maintenance directions provided by BPPC to their customers in the past have changed with the development of each change in the standard hydraulic snubber configuration. There are now four generations of standard snubber design in service. The maintenance documentation furnished consists of the following:

(1) Revision 1 of the Technical Maintenance Manual (TMM) issued prior to October, 1973.
(2) Revision 2 of the TMM covering the period after October, 1973.
(3) Four BPPC shop procedures issued in 1979 and supplied to NPP customers.
(4) The BPPC Replacement Parts Book.

Currently, Revision 3 of the TMM is in draft form. When issued, this revision will include maintenance instructions for all standard hydraulic snubber configurations.

Review of the above noted shop procedure maintenance instructions (Nos. BP 5-9, BP 5-10, BP 5-12 and BP 5-14) disclosed that they provide information in the areas of: (a) subassembly and pre-calibration; (b) final assembly and calibration (functional testing); valve body replacement, and (d) retrofitting snubbers with fluid level indicators. Since there are four generations of hydraulic snubbers in service at NPPs, all of the above instructions apply.

In addition to the above, BPPC offers recommendations for special snubber installations. This was evidenced by BPPC procedure No. BP 8800-510, issued September 19, 1983, and titled "Hydraulic Suppressor Removal Technique Developed for TVA Browns Ferry Units 1, 2, and 3." This procedure deals with specially designed snubbers (Part No. 78000) installed on the containment suppression pool. Another special instruction that was reviewed was entitled, "Operation and Maintenance Manual for BP Series MK III Test Stand S/N 25000-024 for CP&L Brunswick Station."

In addition to the above instructions, BPPC issues Technical Information Bulletins on subjects pertinent to snubber usage. The following bulletins were reviewed:

(1) Ethylene Propylene Elastomers.
(2) General Electric GE-SF-1154 Silicone Fluid.
(3) Performance Criteria for Hydraulic Snubbers.
(4) Recommended Practice for Parts Inspection During Snubber Overhaul.

d. Furnishing of Spare Parts:
This activity is a part of sales at BPPC. Review of procurement record packages from four NPP customers for snubber master seal kits and various parts, disclosed that the purchase orders required; (a) that shelf life and cure dates for the EP seals be identified, (b) an approved QA program be followed, and (c) compliance with 10 CFR Part 21 be implemented. Review of the BPPs records in the procurement package indicated that the requirements were met.

e. Snubbers For Continuous Vibratory Load Systems:
In discussions with the PD, he indicated that BPPC had performed design and development work to improve the standard 2500 series snubber for this type of service. These changes included case hardening of moving parts to provide resistance to excessive wear. These snubbers, identified as Series 7800 snubbers, were given a two million cycle qualification test at 75° F. Disassembly and inspection of the parts disclosed no evidence of unusual wear. The acceptance criteria was left to be determined by the customer, who in this case was Tennessee Valley Authority/Browns Ferry Units 1, 2 and 3.

(f) Functional Testing (i.e., Calibration)

Review of BPPC literature disclosed that prior to October 1972, there were no requirements for individual testing for pre-shipment determination of actual lockup and release rates for hydraulic snubbers. Purchase documents required only testing by size. The test method was inaccurate and many snubbers later failed the functional testing when it became mandatory for each snubber.

Currently, BPPC manufactures its standard snubbers to operate at a lockup velocity of 10 inches per minute (ipm) and a release rate of 5 ipm with a tolerance for both of ± 3 ipm. These rates are determined by the design of the poppet plug as previously noted. The final manufacturing activities include assembly, filling and functional testing for drag, lockup and release. Data from the test are entered on a test report for each snubber. A green acceptance tag is attached to the snubber and then a Certificate of Conformance (C of C) containing the test data is made out and furnished to the customer.

The final activities of assembly, fill and test are controlled by approved BPPC procedures, specifically

procedure No. BP 5-9 for subassembly and pre-calibration (functional testing) and No. BP 5-10 for final assembly and calibration. These procedures are also provided to the customer NPP for site overhaul of the snubbers. All inspection and assembly activities must be performed under clean conditions to avoid contamination. Filling the snubbers with hydraulic fluid must be performed under a vacuum purge system to avoid entrainment of air in the fluid. (Entrainment of air would cause erroneous calibration results.) Review of copies of C of C's furnished with standard 2500 Series snubbers procured on five purchase orders, verified that the performance characteristics for each snubber was entered on the related C of C. No nonconformances were identified.

C. STATUS OF PREVIOUS INSPECTION FINDINGS:

1. (Closed) Nonconformance A (Report No. 83-03): The QC Examiner and Area Foreman failed to check the signoffs on certain check points on Production Cards (PC) for three separate lots of clamps identified as Lot Nos. 96735, 97109 and 39324.

   During this inspection, it was verified that the reason that the PC check points were not signed off was because they were accompanied by two Material Requisition and Control Form (MRCF) records which provided for final QC and production signoffs in lieu of signoffs of specific checkpoints on PCs. It was noted that the two MRCFs were properly signed and dated.

2. (Closed) Nonconformance B (Report No. 83-03): Liquid penetrant (LP) examination records identified as the NDE/Fabrication Report, were improperly filled out for the weld buildup on a laminated strap hanger No. 2MM-PRR-001, Job Order No. 4015. The 1C layer was incorrectly noted as being rejected.

   During this inspection, it was verified that inspection personnel issued Disposition Tag No. 13,031 to identify the problem and then corrected the records.

3. (Closed) Nonconformance C (Report No. 83-03): The Purchasing Agent failed to specify in purchase orders (P.O.) Nos. C-49706, C-50119 and C-52221 for Category B material, that 10 CFR Part 21 was applicable.

   During this inspection, it was verified that the QA Manager advised the responsible Purchasing Agent that 10 CFR Part 21 must be imposed on all P.O.s for Category B (nuclear service) material. Additionally, a training session was conducted for the responsible Purchasing Agent concerning requirements of 10 CFR Part 21 and customers specifications.

4. (Closed) Nonconformance D (Report No. 83-03): The shop failed to place the traveler packages with three pieces of hanger material in the work areas. Also, an incorrect record package was in the possession of the welder who was working on pipe clamp No. A7-236-2-PF-H-2313 at welder station No. 242.

   During this inspection, it was verified that the correct paperwork was placed with the material in the weld shop after it had been returned from the grit cleaning operation. Also, the correct paperwork was matched and placed with the work at welder station No. 242.

5. (Closed) Nonconformance E (Report No. 83-03): New material to replace nonconforming material for the Shearon Harris steam generator was obtained without the use of a required Material Requisition (MR), and supervisory personnel did not report this nonconformance to the QC department.

   During this inspection, it was verified that the material, which had been secured without an MR, was scrapped and new material was obtained from the original material purchased lot using an MR. The foreman who was responsible for the error was retrained in the requirements of the QA program Section 14-4.1 concerning reporting of nonconformances.

6. (Closed) Nonconformance F (Report No. 83-03): Hanger plates, for the Beaver Valley station were documented on NDT Report No. 0265 as having been magnetic particle (MP) examined. However, the surface condition of the plate had not been prepared for MP testing and the Level II technician indicated that the surface had not been MP inspected.

During this inspection, it was verified that a Dispostion Tag No. 7127 was completed and attached to the suspect material. The material was then properly prepared and MP inspection was completed. All NDT room examiners were given a documented retraining session on NDE record signoffs.

7. (Closed) Nonconformance G (Report No. 83-03): The BPPC purchase order No. C-47235 placed with PX Engineering Company for fabrication of main steam system restraint frame assemblies for Shearon Harris did not include requirments for the use of an appropriate quality assurance program by the subvendor.

   During this inspection, it was verified that the Estimator was instructed by the QA Manager to include all appropriate customer requirements in purchase orders. Additionally, the Estimator was given training in customer specification requirements.

8. (Closed) Nonconformance H (Report No. 83-03): Three sizes of austenitic stainless steel gas tungsten arc filler rods were observed in the welding material storage area without having a heat batch number identification; also, a welding material storage area holding oven was found to be not marked to indicate it contained 5/32-inch, E-308-16 electrodes.

   During this inspection, it was verified that all welding rods were properly tagged and the holding oven was properly identified as a stainless steel electrode holding oven. The weld material control technicians were then given retraining in the control of welding material.