DRESSER INDUSTRIES

INDUSTRIAL VALVE OPERATIONS ☐ BOX 1430 ☐ ALEXANDRIA, LOUISIANA 71301
TEL. 318/640-2250 ☐ TWX: 510-976-5733 TELEX: 58-6423 CABLE: DIVID

Revision 1

59-323

Docket No. 99900054/85-01
Reported Violation (85-01-01):

PRODUCT ENGINEERING REPORT SV-221
3707RA DISC COLLAR FAILURE
PACIFIC GAS & ELECTRIC COMPANY
DIABLO CANYON UNIT 2

Prepared By: _____ 1/29/86
R. S. Huffman — Date
Sr. Product Engineer

Reviewed By: _____ 1-29-86
F. P. Bolger — Date
Chief Product Engineer

Approved By: _____ 1-29-86
Y. A. Lai — Date
Director, Product Engineering

Docket No. 99900054/85-01
Reported Violation (85-01-01):

Revision	Description
0	File SV-221 was set up containing letter dated 7-01-84 and sketches 1 thru 4.
1	To clarify cause of failure, a formal report was set up adding (1) cover page, summary and sketch 5.

1. SUMMARY

1.1 The failure of the disc collar/spindle threaded joint was due to defective (split) threads on the spindle (see Figure 5). This event is considered an isolated quality problem because all other valves shipped in the same time frame have been in service for many years without reported failure. The subject valve was manufactured in 1973 and placed in storage at site prior to testing at Wyle Laboratories.

1.2 This event is not equivalent to the disc collar failure at Toledo Edison, Davis-Besse which was due to system vibrations causing physical damage to the threaded joint.

1.3 The subject safety valve (serial number BN 1741) was manufactured in 1971-73 along with forty-two (42) other valves for PG&E/Diablo Canyon, Units 1 and 2. The safety valves were shipped to the site and placed in storage because of construction and licensing delays. In May, 1984, twenty-two (22) safety's were shipped to Wyle Laboratories, Huntsville, Alabama, for blowdown testing.

1.4 On 5-15-84, safety valve serial number BN 1741, on the first actuation at approximately 1065 psig, lifted with simultaneous shearing of the disc collar/spindle threads and cotter pin. On closing, the disc holder stayed in the full open position as the disc moved downward with the spindle out of the pocket in the disc holder. The disc and spindle deflected sidewise with the disc becoming wedged between the nozzle seat area and the bottom of the disc holder. Thus, the valve became mechanically jammed where it could not open again (see Figures 1 thru 4).

1.5 Subsequent inspection following disassembly indicated that the threads on the spindle were defective (split threads) as manufactured by Dresser, so that proper thread engagement between the disc collar and spindle did not exist. The threads in the disc collar were acceptable. The split threads on the spindle were easily detectable by visual inspection. No other defects were noted during the inspection (see Figure 5).

1.6 The remaining twenty-one (21) safety valves were disassembled and inspected. No other spindles were found with defective threads. All valves were then blowdown tested and returned to site. Both Bechtel Energy Corporation and Pacific Gas and Electric Company witnessed all inspections and tests. Twenty (20) of these safety valves are now in service for the first time on Unit 2.

It is Dresser's understanding that the remaining twenty-one (21) safety's in storage at the site for Unit 1 were either to be sent to Wyle Laboratories for refurbishment and blowdown testing or were to be disassembled and inspected on site.

1.7 All other nuclear power stations, excluding Davis-Besse, having safety valves of the same type and design have been operational for several years without reported failure of these safety valves during overpressure conditions.

1.8 Considerable changes have occurred in Dresser's quality inspection since 1973 and we conclude that additional action is not warranted.

1.9 Therefore, we conclude that the failure of the safety valve BN 1741 belonging to Pacific Gas and Electric Company for Diablo Canyon was due to a defective spindle thread and is an isolated event.

Docket No. 99900054/85-01
Reported Violation (85-01-01):

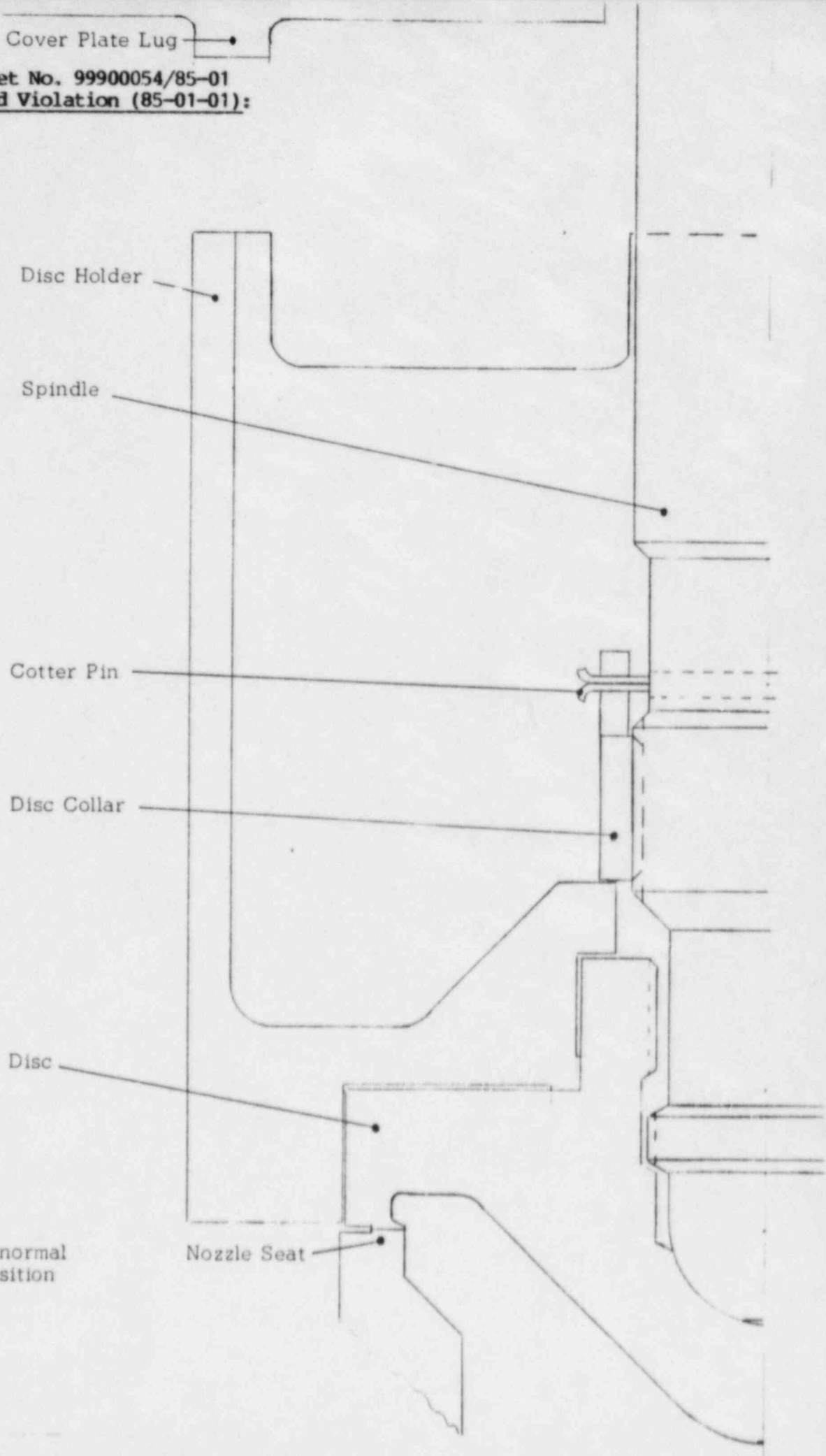


Figure 1 - Valve in normal closed position

Docket No. 99900054/85-01
Reported Violation (85-01-01):

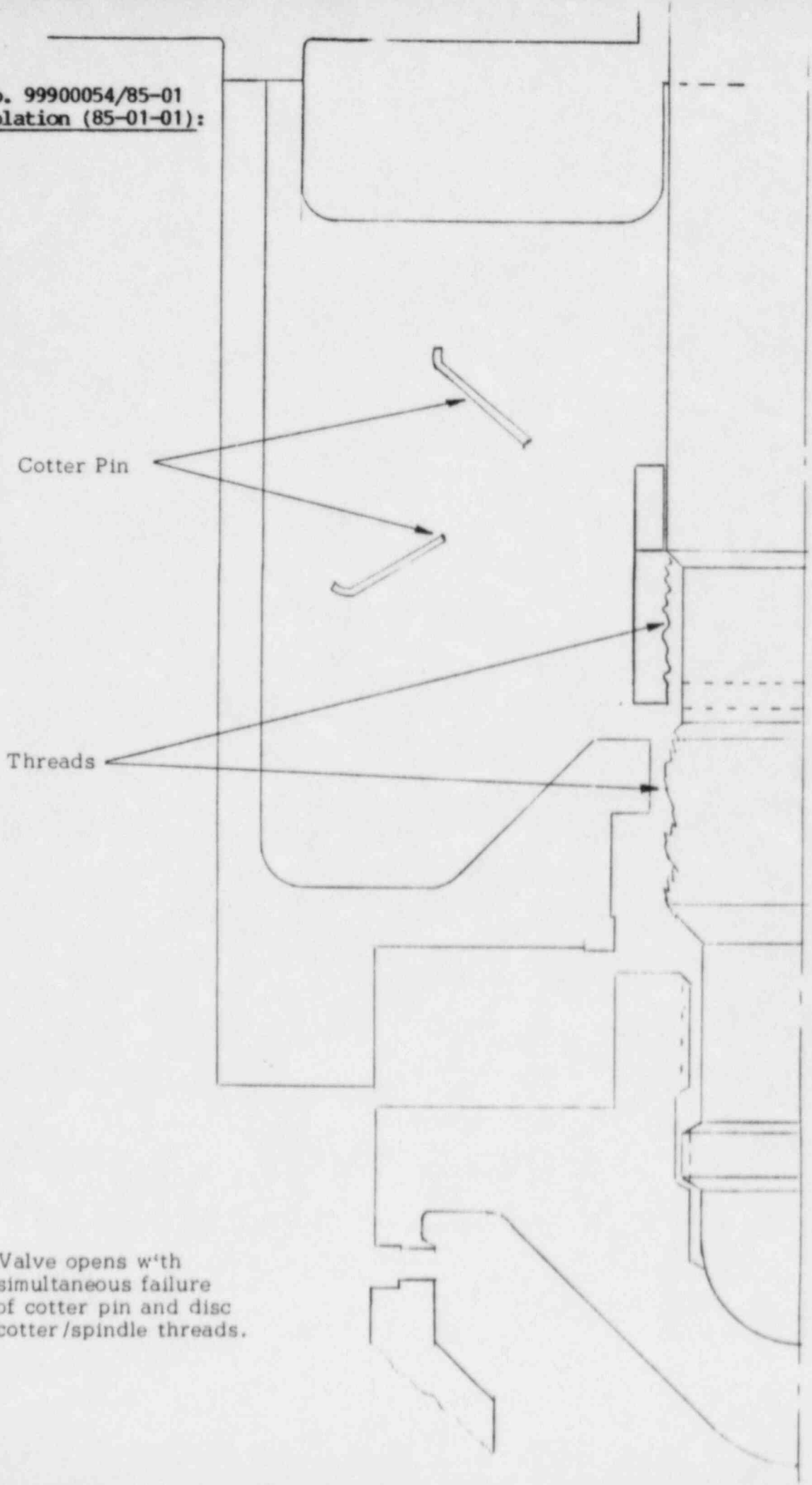


Figure 2 - Valve opens w'th simultaneous failure of cotter pin and disc cotter/spindle threads.

Docket No. 99900054/85-01
Reported Violation (85-01-01):

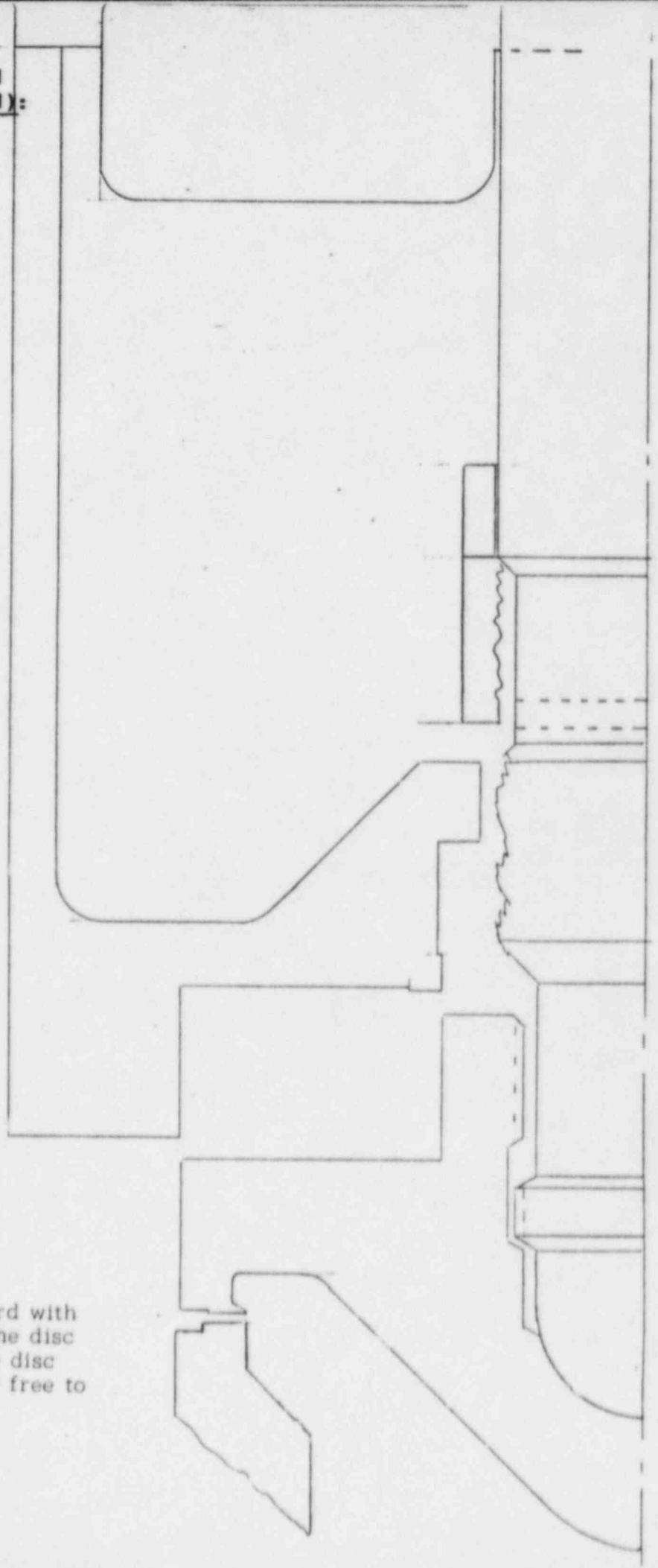


Figure 3 - Disc moves downward with the spindle out of the disc holder pocket. The disc and spindle are now free to deflect sidewise.

Docket No. 99900054/85-01
Reported Violation (85-01-01):

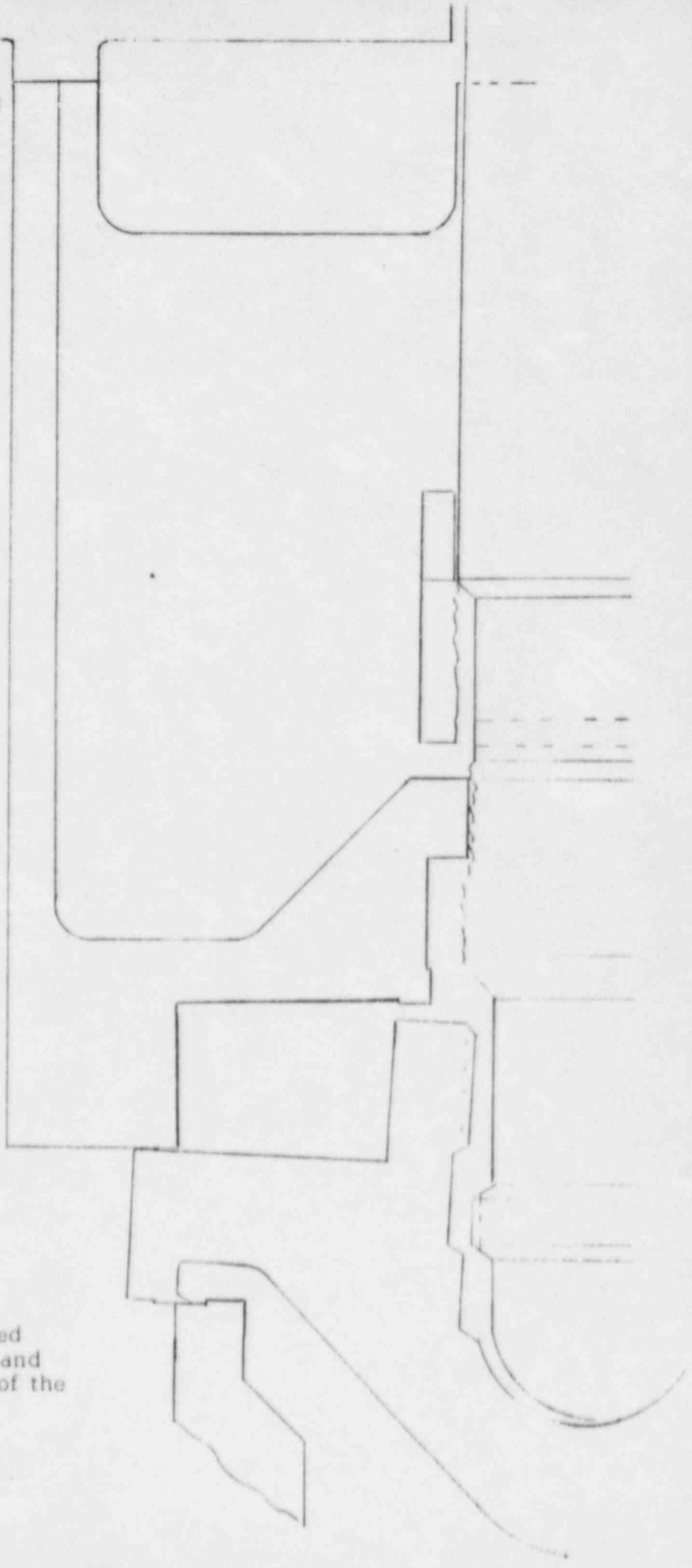
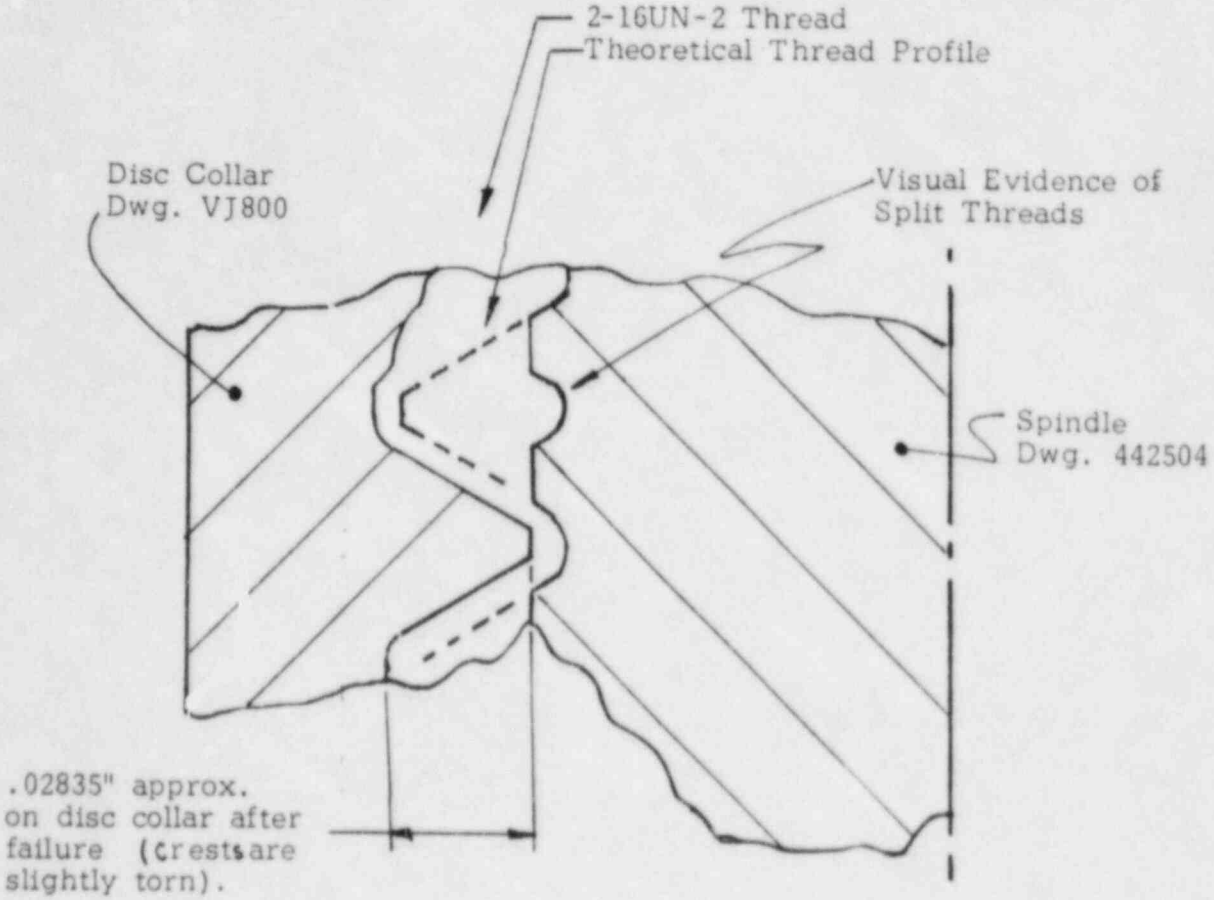


Figure 4 - Disc and spindle deflects sidewise. Disc becomes trapped between the nozzle and the bottom surface of the disc holder.



Note 1: Height for the external thread per ANSI B1.1 is 0.027 to 0.032. Therefore, disc collar thread was correct as manufactured.

Figure 5 Disc Collar/Spindle Threads After Failure

Docket No. 99900054/85-01
Reported Violation (85-01-01):

TO: R. A. Cedel DATE: July 2, 1984 FROM: R. S. Huffman SUBJECT: DISC COLLAR FAILURE 3707RA SAFETY VALVE	DRESSER INDUSTRIES, INC. Industrial Valve Division

COPY TO: F. P. Bolger
B. G. Brunson
J. P. Watz

Possible 10 CFR Part 21:

In May, 1984, the main steam safety valves from Pacific Gas & Electric/Diablo Canyon 2 were sent to Wyle Laboratories, Huntsville, Alabama, for blowdown testing. These valves were Dresser type 3707RA.

On 5/15/84, valve serial number BN1741, on the first actuation at approximately 1065 psig, the valve lifted with simultaneous shearing of the disc collar/spindle threads and cotter pin (see Figures 1 & 2). On closing, the disc holder stayed in the full open position as the disc moved downward with the spindle out of the pocket in the disc holder (see Figure 3). The disc and spindle deflected sidewise with the disc becoming wedged between the nozzle seat area and the bottom of the disc holder (see Figure 4). Thus, the valve became mechanically jammed where it could not open again, although it was leaking severely because the disc was not seated properly.

Following the completion of the test program, the failure was verbally reported to Mr. R. Cedel and Mr. B. Brunson on May 23, 1984. This letter follows up that verbal report.

This is the second reported failure in this mode. The failure occurred in August, 1981, at Toledo Edison/Davis-Besse. Report is attached.

R. S. Huffman
Sr. Product Engineer

RSH/sc

Docket No. 99900054/85-01
Reported Violation (85-01-01):

Industrial Valve Operations | DRESSER | inter-office correspondence

TO: R.S. Huffman

DATE: October 22, 1981

FROM: R.D. Walsh, Jr.

COPY TO: F.P. Bolger

SUBJECT: Maxiflow Spindle Collar - Nuclear Service

A lift stop collar, Figure 1, and a cotter pin, Figure 2, were submitted for metallurgical evaluation by Rolland Huffman. It was reported that when the valve was disassembled, the cotter pin pieces were found on top of the guide and that the collar had to be cut off of the spindle.

The visible evidence strongly suggests that the collar was repeatedly impacted upon with extreme force. This then caused the collar's threads to be stripped and subsequently, the cotter pin was sheared. The basis for this conclusion is described below.

Figure 3 is a profile view of the lift stop collar. It was noted that the top portion of the collar has been flared outwards. This is indicative of numerous impacts of moderate to extreme magnitude.

The eventual result of the impacting is documented in Figure 4. Here the threads are shown to have sheared and been flattened from the impacting. Once again, many cycles are indicated by the smooth nature and regional variation of the damage.

There is also evidence that the cotter pin was sheared off in the process of thread failure. The indications of this behavior are; a straight pin length equivalent to the stop collar I.D. and a marked "ironing" of one pin end. See Figures 2 & 5. The pieces of the pin were probably then "blown" onto the guide shelf by discharging media.

As in any failure analysis, the material properties were examined. It was found that the cotter pin was cold formed 304 stainless steel, and the collar itself was cast 430 (CB-30) stainless steel. Both the chemistries and hardnesses of the components were correct and the substantiating test results are displayed in Figures 6 & 7.

In conclusion, installation irregularities are considered responsible for this failure. These parts are designed to be able to accommodate impacts. However, the degree of deformational damage is not normal for this assembly, and gives witness to the magnitude of the pounding they received. An examination of the customer's operating and setting practices, with appropriate corrective action, should eliminate similar occurrences.

R. D. Walsh, Jr.

eds

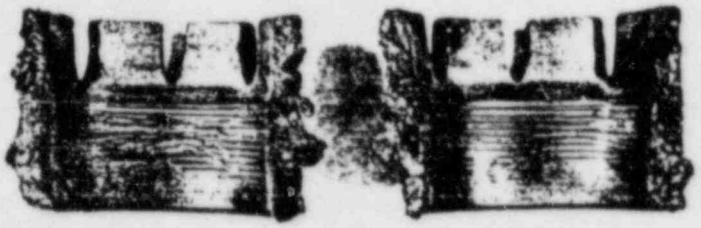


FIGURE 1
Lift Stop Collar
Exhibiting Thread Damage
(Component Was Cut Off Spindle For Examination)

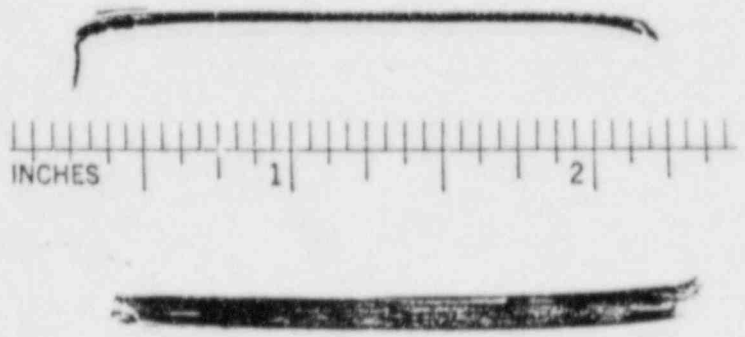


FIGURE 2
Cotter Pin Pieces
Pieces Were Found In Upper Recess Of Valve

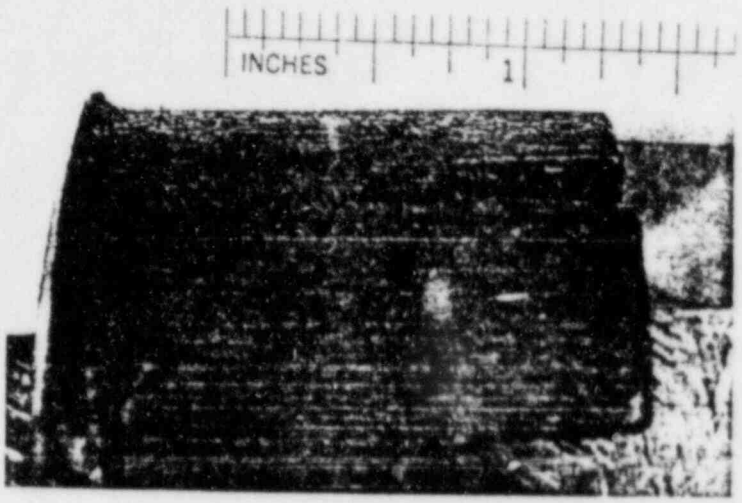


FIGURE 3
Lift Stop Collar Profile View
Note "Flaring" On Left End
Due To High, Repeated Loading

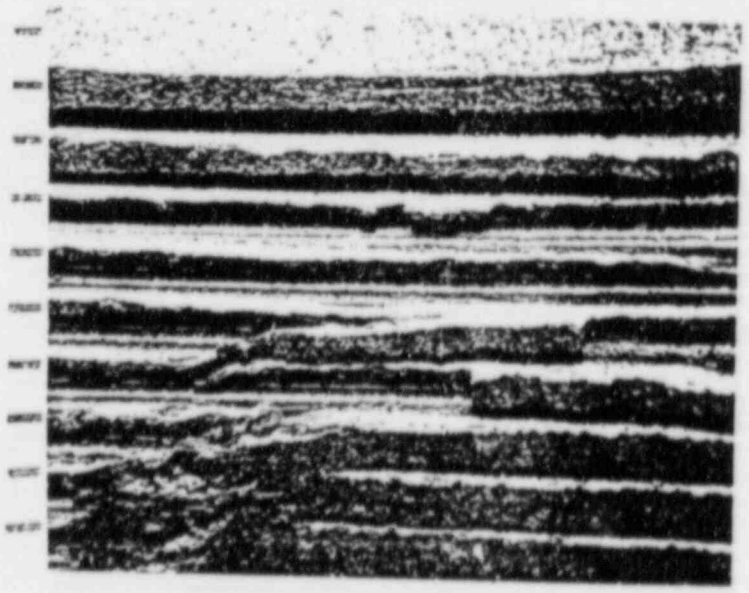


FIGURE 4
Spindle Collar Threads
Stripped Due To High Loading
Exhibited in Figure 3

FIGURE 5
Cotter Pin Segment
Shows "Ironing" Effect Of
Stripped Lift Stop Collar

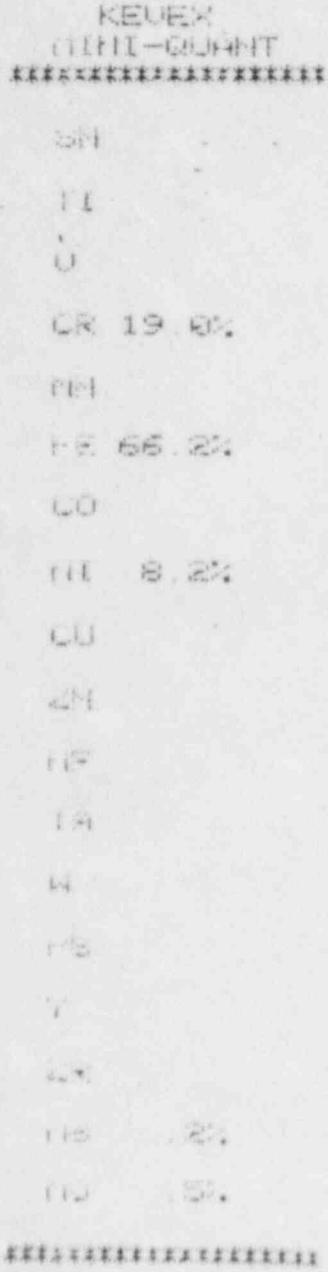


FIGURE 6
Cotter Pin Analysis
304 Stainless Steel
Hardness = 27Rc

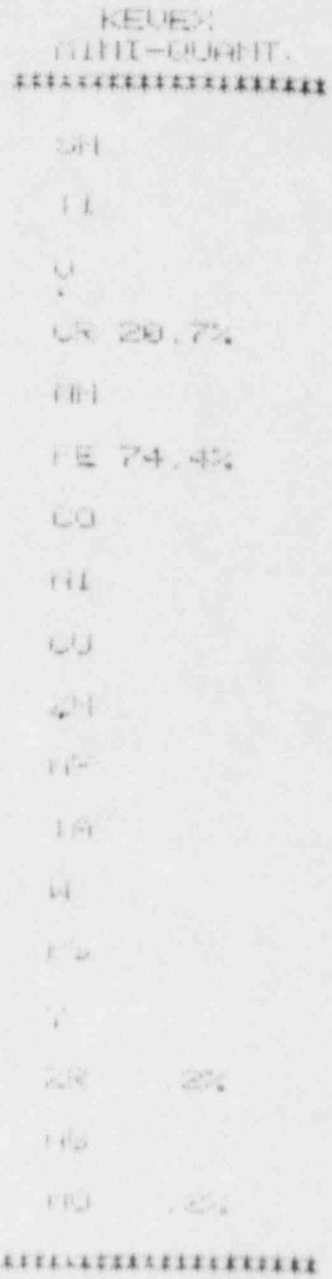


FIGURE 7
Collar Analysis
CB-30 (430) Stainless Steel
Hardness = $87R_B$

Docket No. 99900054/85-01
Reported Violation (85-01-01):

INSPECTION REPORT
Valve: 3707RA
Serial No.: BM8635

The valve was disassembled in the Clean Room on Wednesday, September 30, 1981. The disassembly was witnessed by the writer. The disassembly was documented on video tape. No customer witness.

Valve Data: Serial No.: BM8635
Nameplate Set Pressure: 1070 psig
Base Heat No.: HT8129
Valve Type: 3707RA-RT21-XLP
Utility: Toledo Edison Company
Site: Davis-Besse

Sequence of Disassembly and Comments:

1. Visually examined valve. The following was noted:
   a. The seal wire for the ring pins was broken.
   b. The cap assembly and release nut were not with the valve.
   c. On the yoke, opposite the valve outlet, were hammer marks.
   d. Body was a casting.
   e. Cotter pin hole for the release nut was near the end of the spindle. (Through the second thread.)
   f. Threads on spindle on one side above the compression screw were flatten.
   g. Adjusting rings were not frozen but rattled easily. Ring pins were engaged.

h. The disc holder was in full open position and against the cover plate.

i. The disc was on its seat in closed position.

j. The spring was extended in closed position.

k. The vertical lengths from the top of the yoke (the surface immediately below the head of the compression screw) to the top of the compression screw and to the end of the spindle were 1-29/64" and 4-1/16", respectively. Measured with scales.

2. Loosen the compression screw locknut. Installed the jacking device on the valve to remove spring load from the upper yoke rod nuts. Removed upper yoke rod nuts and yoke assembly. The following was noted:

a. Spindle threads at the spindle/compression screw interface were severely flatted (primarily on two sides).

b. The lower inside diameter (spindle/compression screw interface) was severely galled.

3. Removed the top spring washer and spring. The following was noted:

a. Metal chips were scattered on the top surface of the lower spring washer (this would be within the spring inside cavity) and the top surface of the cover plate. Most chips were singular and crescent in shape. However, one chip was a fine wire, spiral shaped piece. This piece was saved for analysis.

b. When the spring was removed the disc holder dropped to closed position.

4. Removed the bottom spring washer. The radius of the spindle (the spindle/bottom washer bearing surface) was slightly galled.

5. Removed cover plate bolting and cover plate. The following was noted:

   a. The head of the spindle (cover plate/spindle interface) was severely galled (all around).

   b. The spindle was a two-piece spindle. There were two drive pin holes in the spindle head. The drive pin was in the lower hole. The threads on the spindle stem above the head was excessively long. The assembly was tight.

   c. Two fragments of a cotter pin (approximately 1-7/8" long) were found in the crevice between the cover plate inside diameter and the upper outside diameter of the guide. Both fragments were laying in the crevice side by side.

6. Removed the spindle/disc/disc holder assembly. Attempted to unscrew the disc from the spindle, but could not. Noted the following:

   a. No scoring of the disc holder O.D. nor the guide I.D. was noted. But oblong rust color water spots existed on these surfaces.

   b. The nozzle seat was scored (large circular marks across the seat). These appeared to be impressions left by the disc seat but were off center. Estimated four separate impressions. The seat gave no evidence of valve chatter.

   c. No visual damage to disc seat.

Docket No. 99900054/85-01
Reported Violation (85-01-01):

c. Disc holder. The bottom surface of the disc holder had a circular imprint where the disc holder contacted the backside of the disc. The disc holder/disc collar interface in the disc holder was brinelled.

d. Disc. The disc pocket bearing surface indicated that the disc was off center. Threads could not be inspected because they were removed during the cut-off operation.

R S Huffman 10/5/81

R. S. HUFFMAN
Sr. Product Engineer

RSH:rsl

d. The disc collar was flopping on the spindle. This allowed the disc holder to move upward away from the disc.

e. The lower adjusting ring was 8 notches below the nozzle seat.

f. The vertical dimension from the underside of the guide flange (guide/body interface) to the bottom of the upper adjusting is 6.860". Measured with dial calipers. The vertical dimension from the guide/body interface in the body to the nozzle seat was 7-1/32". Measured with scales. The delta value is 7.031-6.860 = .171".

7. Cut the spindle/disc/disc holder assembly apart. Cut the disc collar with a oxygen-acetylene torch. Crack in disc holder resulted from this operation. Removed the disc by machining. The following was noted:

a. Disc collar. The inside diameter was severely upset. All threads were hammered to a flat surface (no thread profile). The upper portion of the inside diameter showed some evidence of the original threads, but the lower portion was a smooth surface. The bottom surface was upset and flared to the outside.

b. Spindle. The relief diameter immediately passed the first thread on the spindle tip was imprinted with the disc threads at one point. The first threads on the spindle were damaged. The second threads on the spindle tip (disc collar/spindle interface) were severely flattened.

NONCONFORMANCE: (85-01-02)

Dresser obtained calibration services and certifications of furnace thermocouples from unapproved vendors.

CAUSE:

Purchase orders for thermocouple wire was placed with approved sources, Honeywell, Baton Rouge, LA who in turn, purchased from other Honeywell facilities.

ACTION TO CORRECT DEFICIENCIES:

Honeywell, Corp. Drive, Houston, TX, was audited, approved and added to Dresser's Approved Vendor List. Orders since that date and future orders will be placed directly from this approved supplier.

ACTION TO PREVENT RECURRENCE:

Calibration certifications are being reviewed on receipt to assure the calibration facility address agrees with the Approved Vendor List.

NONCONFORMANCE: (85-01-03)

Four containers of type 7018 nuclear weld rods, lot 3C504YOZ, heat 76175, were not stamped (or verified) by the Receiving Inspection personnel.

CAUSE:

The four cans of weld rod were purchased for non-Section III use and was inadvertently placed in the storage area assigned for Section III weld rod. The area assigned for non-Section III weld rod is located adjacent to the Section III weld rod storage area and as the rod was moved from Receiving Inspection to storage, it was placed in the Section III area.

ACTION TO CORRECT DEFICIENCIES:

The rod was moved to the correct cage.

ACTION TO PREVENT RECURRENCE:

The Section III weld rod storage area will be moved to a different location to prevent recurrence.

NOTE: The shop traveler for Section III orders requires the inspector to record rod heat and lot numbers on the traveler and obtain Quality Assurance approval prior to use; therefore, the rod would not have been used on Section III orders.

NONCONFORMANCE: (85-01-04)

As of October 4, 1985, there was no objective evidence that calibration of the Charpy V-Notch Impact Testing Machine has been performed once in each six-month interval, during the last five years.

CAUSE:

The impact machine has not been in use.

ACTION TO CORRECT DEFICIENCIES:

The impact machine has been tagged indicating calibration required prior to use. QTI-33 has been revised to require calibration prior to use.

ACTION TO PREVENT RECURRENCE:

This machine has been added to Dresser's QAR-5 "Monthly Report of Equipment Calibration" to assist in highlighting calibration requirements.

NONCONFORMANCE: (85-01-05)

As of October 4, 1985, calibration certifications #1343 and 6141 had no documentation of a calibration standard serial number. Certification #1343 indicated calibration to 50% tolerance of full scale reading instead of the specified 5%.

CAUSE:

These were errors on the part of the technicians completing the report.

ACTION TO CORRECT DEFICIENCIES:

Wrench S/N 1343 was recalibrated 11/26/85 with acceptable certification. Wrench S/N 6141 is no longer in use.

ACTION TO PREVENT RECURRENCE:

(1) The technician and supervisor were made aware of the errors.
(2) The QA Engineer will review each report in detail and indicate acceptance by stamp and date.

NONCONFORMANCE: (85-01-06)

As of October 4, 1985, there was no objective evidence that calibration for WR-12 Carbon Determinator (models 761-100 and 761-200 (BCD) is traceable to National Standards on equipment manufacturer's recommended standards. The WR-12 Carbon Determinator is used to determine carbon and sulfur content.

CAUSE:

Proper standards were acquired with the equipment; however, we failed to follow up assuring certification to National Standards.

ACTION TO CORRECT DEFICIENCIES:

Certifications were obtained from Leco and are on file.

ACTION TO PREVENT RECURRENCE:

Future standards will be purchased with proper certifications.

This equipment has been added to Dresser's QAR-5 "Monthly Report of Equipment Calibration", to assist in highlighting calibration requirements.

NONCONFORMANCE: (85-01-07)

As of October 4, 1985, there was no objective evidence that calibration of nuclear welding rod oven bi-metal thermometers (TG-2, TG-4, TG-6, TG-8, TG-11, TG-20 & TG-21) was carried out in accordance with QAOP 3-1.

OBSERVATION:

This appears to be an error in documenting audit notes. Only four of these thermometers are used in the Section III rod ovens and according to our records, were within the required calibration schedule.

NOTE: This subject was discussed with Mr. Zech and he advised us to respond and explain our position as above.

Nonconformance: (85-01-08)

Dresser's Part 21 file no. 85-01 did not identify/list the required pertinent data (85-01-08).

Cause:

Error on the part of Dresser's evaluation team to identify/list pertinent data for Dresser's 10CFR21 investigation file number 85-01.

Action to Correct Deficiencies:

Records are being generated to identify/list pertinent data for this investigation of 3050 diaphragm valves.

Action to Prevent Recurrence:

Evaluation team members have received latest copy of Dresser's Part 21 procedure which contains above requirements to identify/list pertinent data in paragraph 3.2.8.