



**Consumers  
Power  
Company**

*JMB*

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July 27, 1984

83-11 #4

Mr. J G Keppler, Regional Administrator  
US Nuclear Regulatory Commission  
Region III  
799 Roosevelt Road  
Glen Ellyn, IL 60137

MIDLAND ENERGY CENTER PROJECT  
DOCKET NOS 50-329 AND 50-330  
POTENTIAL DEFECTS IN MECHANICAL SHOCK ARRESTORS  
FILE: 0.4.9.83 SERIAL: 30356

Reference: J W Cook letters to J G Keppler, same subject:

- 1) Serial 26651, dated January 6, 1984
- 2) Serial 28041, dated March 16, 1984
- 3) Serial 30268, dated May 4, 1984

The referenced letters were interim 10CFR50.55(e) reports concerning defective capstan springs in Pacific Scientific mechanical shock arrestors. This is a final report.

Because further investigation could not eliminate the possibility of eventual capstan spring failure in Midland equipment and because those failures could have prevented some mechanical shock arrestors from performing their intended safety functions, this condition is considered reportable under the requirements of 10CFR50.55(e). Attachment 1 describes the investigation of the concern and the correction actions that have been completed or planned.

*James W. Cook*

JWC/AHB/cd

Attachment: 1) MCAR 75, Final Report, dated July 2, 1984

CC: Document Control Desk, NRC  
Washington, DC

Midland NRC Resident Office  
Midland Nuclear Plant

DSHood, USNRC Office of NRR

INPO Records Center

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PDR ADOCK 05000329  
S PDR

OC0784-0018A-MP01

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3/14/84

# Bechtel Power Corporation

777 East Eisenhower Parkway  
Ann Arbor, Michigan

Mail Address: P.O. Box 1000, Ann Arbor, Michigan 48106



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July 2, 1984

BLC-20070

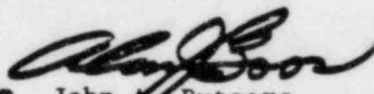
Consumers Power Company  
1945 Parnall Road  
Jackson, Michigan 49201

Attention: Mr. J.W. Cook  
Vice President  
Projects, Engineering and Construction

Subject: Midland Plant Units 1 and 2  
Consumers Power Company  
Bechtel Job 7220  
MCAR 75 - FINAL REPORT

The Final Report for MCAR 75, concerning defective capstan springs in Pacific Scientific Company shock arrestors supplied to the Midland plant, is attached for your information and use.

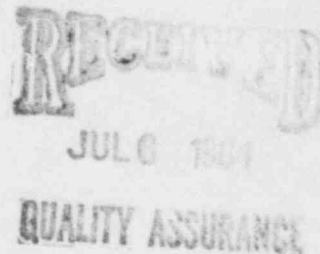
Very truly yours,

  
for John Rutgers  
Project Manager

JAR/RCH/dkj

Attachment: MCAR 75 - Final Report

CC: ~~W.R.~~ Bird  
J.T. Christy  
J.W. Cook  
G.R. Eagle  
R.J. Erhardt  
L. Gibson  
J.P. Knight  
D.T. Perry  
D.L. Quamme  
B.W. Marguglio  
R.A. Wells  
(all w/a)



Written Response Requested: No

154980

Bechtel Associates Professional Corporation

SUBJECT: MCAR 75

154982

Potential Defects in Mechanical Shock Arrestor Models PSA-1 and PSA-3

FINAL REPORT

DATE: July 2, 1984

PROJECT: Consumers Power Company  
Midland Plant Units 1 and 2  
Bechtel Job 7220

Introduction

This report addresses potentially defective capstan springs in Pacific Scientific Company (PSA) shock arrestors supplied to the Midland project. This has been identified as a 10 CFR 21 condition by Pacific Scientific.

Description of Concern

Attachment 1 identifies certain Pacific Scientific Company mechanical shock arrestor Models PSA-1 and PSA-3 furnished to the Midland project by ITT Grinnell Corporation that may have cracked capstan springs. The suspect capstan springs were supplied to Pacific Scientific by one of two spring manufacturers. ITT Grinnell previously identified 283 shock arrestors furnished to Midland that contain suspect springs. Subsequently, this number was reduced to 222 because of further investigation (reference: Attachment 2).

Summary of Investigation and Historical Background

Pacific Scientific Company has investigated the subject deficiency and concluded that springs with possible cracks are limited to those supplied by one spring manufacturer. ITT Grinnell has identified those snubbers furnished to the Midland project that contain the suspect springs. Subsequently, PSA and ITT Grinnell have recommended that additional inspection/testing of suspect snubbers be performed. This is further addressed under the Corrective Action section of this report.

Analysis of Safety Implication

The possibility exists that cracks in the capstan springs could result in spring failure during dynamic loading, thereby potentially affecting the ability of the component to perform its intended safety function.

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Final Report

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Root Cause

As discussed in Attachment 3, the root cause of this problem has been traced to one of Pacific's sub-suppliers and the manufacturing process the sub-supplier used. The suspect process was as follows:

- a. Cold draw round bar into rectangular form
- b. Age harden the rectangular wire
- c. Coil wire into a spring shape
- d. Stress relieve
- e. Nondestructive examination
- f. Silver plate

A metallurgical evaluation concluded that the microcracks were caused by formation of spring tang after age hardening at 900F followed by silver plating.

Corrective Action

1. Field engineering has identified suspect piping shock arrestors on Nonconformance Report (NCR) C-00949 issued December 13, 1983. ITT Grinnell was the sole supplier for Midland of snubbers (for piping) containing suspect capstan springs. A review was performed to determine that no other disciplines/areas on the Midland project have similar concerns. It was determined from this review that no other similar concerns exist.
2. All suspect shock arrestor capstan springs will be inspected for cracks; all defective capstan springs will be replaced. This activity will be completed before fuel load, and will be tracked via NCR C-00949.
3. Corrective actions taken by Pacific to preclude recurrence were to revise the manufacturing process and add further inspection requirements. The process now followed is:
  - a. Cold draw round bar into rectangular form
  - b. Normalize the material

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- c. Coil wire into a spring shape
- d. Age harden
- e. Stress relieve
- f. Nondestructive examination
- g. Silver plate
- h. Nondestructive examination

Reportability

Based on the safety implications, this deficiency was reported to the NRC as potentially reportable in accordance with Title 10 of the Code of Federal Regulations, Part 50.55(e) on December 7, 1983.

Submitted by: *E.B. Poser*  
*for* E.B. Poser  
Project Engineering Manager

Approved by: *B.R. Klein*  
B.R. Klein  
Plant Design Chief Engineer

Approved by: *E.H. Smith*  
E.H. Smith  
Engineering Manager

Concurrence by: *H.A. Dietrich*  
*for* H.A. Dietrich  
Project Quality Assurance  
Engineer

RFT/MS/rar\*(PD)

- Attachments:
- 1. ITT Grinnell letter to Bechtel, 10/5/83 (Com 131017)
  - 2. ITT Grinnell letter to Bechtel, 4/10/84 (Com 147609)
  - 3. ITT Grinnell letter to Bechtel, 3/6/84 (Com 144941)

Kin-Tech Division 154982



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21 September 1983

cc: D. CHARTRAU  
D. SEWELL  
B. KELLY

ITT Grinnell  
621 Dana Street N.E.  
Warren, Ohio 44481

Attention: Mr. T. Lauka

Subject: Pacific Scientific Mechanical Shock Arrestors  
Model PSA-1 and PSA-3

Reference: Service Report No. SR83-01

Gentlemen:

The attached report discusses potential problems with certain serial number PSA-1 and PSA-3 snubbers. Our records indicate that the units shown on Attachment A are in the affected group and were delivered to you.

At your convenience, please return these snubbers to us for inspection and repair as necessary. If the snubbers are still in warranty (one year warranty if shipped prior to 1 April 1983 and five year warranty if shipped on or after 1 April 1983), this will be done at no charge to you--excluding freight. Should the units be beyond the warranty period, there will be a \$100.00 per unit charge, also excluding freight.

All affected snubbers will be returned to you within 30 days after we receive them.

The foregoing will apply to snubbers returned to us through 31 December 1984.

We apologize for any inconvenience this may cause you.

Very truly yours,

P. A. Hadnagy  
Director Technical Operations

PAH:sf

Enclosure

ATTACHMENT I

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SR 83-01

SHOCK ARRESTOR CAPSTAN SPRING SERVICE REPORT

During testing of Pacific Scientific Company's PSA-1 Shock Arrestors, part number 1801102-05, at Union Electric Callaway Station by Daniel International personnel, 4 of 7 snubbers tested revealed a broken capstan spring tang.

Pacific Scientific Company requested failed springs for independent metallurgical examination. Failed components were returned to Pacific Scientific Company who forwarded broken springs to "Mettek", 1805 E. Carnegie, Santa Ana, CA 92705, (714) 549-1083, for metallurgical and fracture analysis.

One spring exhibiting a visual crack in one tang (removed from snubber S/N 21524 which was returned by Union Electric) was installed by Pacific Scientific Co. into a snubber and subjected to a full load (1500 lbs.) acceleration test. This test was repeated 5 times (10 full load cycles) with no failures. The cracked spring was then subjected to a dynamic load cycling test. This test cycles the snubber at 3 Hertz intervals from 3 to 33 Hertz for 10 seconds at each interval at 100%, 75% and 50% rated loads, a total of 5940 cycles. The cracked spring satisfactorily passed this test.

Springs from the identical lot as those that failed were traced to snubbers located at Kansas Gas & Electric Co. Wolf Creek Station. These were returned to Pacific Scientific for testing and evaluation.

Eleven (11) each 1801102-05 PSA-1 Shock Arrestors returned to Pacific Scientific Co. by Kansas Gas & Electric Co. Wolf Creek Station were visually and functionally tested by Pacific Scientific Co. personnel in the presence of KG&E and Union Electric Co. personnel.

All eleven PSA-1 Shock Arrestors (S/Ns 21511 thru 21521) were disassembled to a level permitting verification that the capstan spring was properly installed and whole. The Shock Arrestors were reassembled and subjected to a successful acceleration test at full rated load (1500 lbs.).

Following successful acceleration test, all eleven Shock Arrestors were disassembled to facilitate visual and non-destructive examination of the capstan springs:

S/N 21511 - No apparent visual defects. Magnetic particle non-destructive examination revealed indications in both spring tangs with one tang exhibiting three separate indications. Indications were suspected to be micro cracks.

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## SHOCK ARRESTOR CAPSTAN SPRING SERVICE REPORT - (Cont'd.)

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- S/N 21512 - No apparent visual defects. Magnetic particle examination exhibited an indication of one micro crack on one tang.
- S/N 21513 - No apparent visual defects. No magnetic particle examination indications.
- S/N 21514 - No apparent visual defects. No magnetic particle examination indications.
- S/N 21515 - No apparent visual defects. Both tangs exhibited a magnetic particle micro crack indication.
- S/N 21516 - No apparent visual defects. No magnetic particle examination indications.
- S/N 21517 - No apparent visual defects. No magnetic particle examination indications.
- S/N 21518 - No apparent visual defects. Both tangs exhibited a magnetic particle micro crack indication.
- S/N 21519 - No apparent visual defects. Both tangs exhibited a magnetic particle micro crack indication.
- S/N 21520 - No apparent visual defects. One tang exhibited a magnetic particle micro crack indication.
- S/N 21521 - No apparent visual defects. One tang exhibited a magnetic particle micro crack indication.

Five (5) capstan springs exhibiting non-destructive magnetic particle examination indications were assembled into a test snubber and subjected to a dynamic load of 1500 lbs. at frequencies of 3 to 33 Hertz intervals for 10 seconds each at 100%, 75% and 50% of rated load.

The springs tested represented the "worst case" as determined by the non-destructive magnetic particle inspection. They were S/Ns 21511, 21515, 21518, 21519 and 21520.

Springs, S/Ns 21515 and 21518, survived the entire test (5940 cycles). Spring, S/N 21511, survived 533 full load cycles before both tangs failed. S/N 21518 survived 1800 full load cycles before one tang failed, and S/N 21520 survived 1850 full load cycles before one tang failed.

Metallurgical report by Mettek Material Engineering Technology Laboratories indicates spring cracking occurred because of stresses induced during spring forming which caused hydrogen cracking during subsequent silver plating.

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SHOCK ARRESTOR CAPSTAN SPRING SERVICE REPORT - (Cont'd.)

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Metallurgical report also explains that, although the spring fracture face exhibited brittleness at the crack onset, the core of the spring was ductile and spring fracture was simple dimple (ductile) rupture. This accounts for the ability of the springs to withstand the full load functional and dynamic load testing conducted and suggests that the useful life of springs which contain cracks remains to be substantial.

The capstan springs are manufactured for Pacific Scientific Co. by a spring manufacturer. These springs are supplied formed, stress relieved and 100% magnetic particle inspected to Pacific Scientific Co., who then subcontracts the springs for silver plating. Pacific Scientific Co. part numbers for the capstan springs are as follows:

PSA-1 (1801613)

PSA-3 (1801614)

Pacific Scientific is effecting corrective action with the spring manufacturer, the nature of which is not yet fully established.

Recommendations

At your earliest convenience, return the affected snubbers to Pacific Scientific for inspection.

Inspection will include removal of spring to facilitate examination for tang cracks by use of magnetic particle or liquid penetrant non-destructive examination.

Urgency of inspection is to be assessed by individual owners based on snubber system application and analysis of results of tests conducted on failed snubbers and reported herein.

Affected Serial Numbers

PSA-1 Pacific Scientific Part No. 1801102-05

S/Ns 15672 thru 16921

16526 " 16662  
18211 thru 21160

21411 thru 22060

22311 thru 22710

22711 " 22860

PSA-3 Pacific Scientific Part No. 1801106-05

S/Ns 21311 thru 21610

24311 thru 25310

25361 thru 25960

27194 thru 28543

20302 " 20395

20551 " 20636

20398 " 20400

20637

20700

20851 THRU 20869

20870 " 20955

LONG STROKES - 07

506 THRU 510

486 " 487

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- 1) Model Number PSA-1  
Part Number 1801102-05 and -07

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Serial Numbers

16526 thru 16662  
 16667 thru 16733  
 16754 thru 16920  
 18346 thru 18445  
 18709 thru 18724  
 18725 thru 18735  
 18736 thru 18765  
 18766 thru 18908  
 19482 thru 19551  
 19552 thru 19576  
 19982 thru 20081  
 20418 thru 20547  
 20691 thru 20736  
 20961 thru 21060  
 21061 thru 21084  
 22443 thru 22542  
 22711 thru 22860

- 2) Model Number PSA-3  
Part Number 1801106-05 and -07

Serial Numbers

28144 thru 28232  
 27623 thru 27693  
 27906 thru 27937  
 27696 thru 27738  
 27739 thru 27905  
 25826 thru 25916  
 25444 thru 25498  
 25532 thru 25642  
 25646 thru 25759  
 25036  
 25393 thru 25443  
 24711 thru 24910  
 21565 thru 21610  
 506 thru 510 (-07)  
 486 thru 487 (-07)  
 24311 thru 24410  
 21461 thru 21495  
 20302 thru 20395  
 20551 thru 20636  
 20398 thru 20400  
 20637  
 20700  
 20851 thru 20869  
 20870 thru 20955

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CONTRACT: MD

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18720	MD-A89	MIDLND	1-638-14-503
18712	MD-A89	MIDLND	1-603-1-500
18732	MD-A89	MIDLND	2-639-14-500
8731	MD-A89	MIDLND	1-603-2-38
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8715	MD-A89	MIDLND	2-652-1-505
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A. Hutchinson II  
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22825	MD-D01	.	.
22827	MD-D01	.	.
22828	MD-D01	.	.
22829	MD-D01	.	.
22831	MD-D01	.	.
22833	MD-D01	.	.
22834	MD-D01	.	.
22835	MD-D02	.	.
22838	MD-D01	.	.
22839	MD-D01	.	.
22850	MD-D01	.	.
22851	MD-D01	.	.
22856	MD-D01	.	.

NUMBER OF RECORDS FOUND: 189

0  
0  
0

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PSA105-R01  
10/03/83  
06:09:08

I T T GRINNELL CORPORATION  
PIPE HANGER DIVISION - WARREN  
PSA LOG BY CONTRACT

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CONTRACT NO - MIDLAND

SERIAL NO ORDER NO MARK/SKETCH NUMBER SIZE

24318	E-MD-A21-00	2-632-2-23	
24322	E-MD-A21-00	1-610-1-504	
24329	E-MD-A21-00	1-616-2-505	
24353	E-MD-A21-00	1-610-1-507	
24354	E-MD-A21-00	1-610-1-503	
24357	E-MD-A21-00	1-610-2-503	
24358	E-MD-A21-00	2-617-5-121	
25400	E-MD-A55-00	1-638-13-503	
25408	E-MD-A55-00	2-611-2-501	
25428	E-MD-A55-00	1-601-1-503	
25437	E-MD-A55-00	1-601-2-503	
25438	E-MD-A55-00	1-601-1-503	
25182	E-MD-A56-00	2-632-2-34	
25209	E-MD-A56-00	1-638-13-501	
25214	E-MD-A56-00	1-631-2-133	
25215	E-MD-A56-00	2-631-2-33	
24806	E-MD-A84-00	2-602-1-21	
24814	E-MD-A84-00	1-610-1-517	
25143	E-MD-A89-00	2-602-1-21	
25148	E-MD-A89-00	2-639-13-504	
25216	E-MD-A89-00	2-602-1-21	
25228	E-MD-A89-00	2-602-1-21	
25233	E-MD-A89-00	2-639-13-501	
25238	E-MD-A89-00	1-638-13-504	
25240	E-MD-A89-00	2-639-13-505	
25244	E-MD-A89-00	2-602-1-2	
25247	E-MD-A89-00	2-602-1-2	
25613	E-MD-A89-01	2-639-13-505	
25149	E-MD-A90-00	1-601-1-501	
25155	E-MD-A90-00	1-638-13-505	
25549	E-MD-A98-00		3
25451	E-MD-A98-00		3
25602	E-MD-A98-00	2-618-3-512	
25609	E-MD-A98-00		
25612	E-MD-A98-00		
25618	E-MD-A98-00	1-618-3-520	
25619	E-MD-A98-00		
25620	E-MD-A98-00	1-618-3-512	
25714	E-MD-B10-00		
25834	E-MD-B10-00		3
25839	E-MD-B10-00		3
25653	E-MD-B10-00		
25733	E-MD-B18-00		
25741	E-MD-B18-00		
25565	E-MD-B42-00	2-639-3-512	
25566	E-MD-C01-00		3
25569	E-MD-C01-00		
25570	E-MD-C01-00		
25572	E-MD-C01-00		

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ITT Grinnell Corporation

April 10, 1984

Bachtel Power Corporation  
P O Box 1000  
Ann Arbor, MI 48106

621 East Avenue, N. E.  
Warren, Ohio 44081  
(216) 373-1500

Attention: E.B. Poser

Subject: Midland Units 01 & 2  
Bachtel Job 7220  
P.O. No. 7220-N-106-AC  
PSA Capstan Spring Problem

Gentlemen:

There are no additions to previous listings of PSA Mechanical Sausbers with potential capstan spring problems which were supplied for the Midland Project by ITT Grinnell Corp., Warren, Ohio. However, per Pacific Scientific Report 83-01, Rev. 2, the following sausbers supplied by ITT Grinnell, Warren, Ohio have been deleted from the list of PSA Sausbers with potential capstan spring problems:

PSA-1

S/N: 22717	22742	22763	22789	22795	22805
22720	22745	22771	22790	22796	22806
22722	22747	22776	22791	22900	22807
22723	22749	22781	22792	22801	22808
22790	22752	22783	22793	22802	22810
22741	22753	22786	22794	22803	22811
22813	22818	22822	22827	22833	22839
22813	22819	22823	22828	22834	22850
22816	22820	22824	22829	22835	22851
22817	22821	22825	22831	22838	22856

PSA-3

S/N: 20630

(Total - 60 PSA-1, 1 PSA-3)

If you have further questions, don't hesitate to contact me at (216) - 373-1500 ext. 254.

Yours Truly,

Endolph Favlík  
QA Manager

cc: D. Sewell  
E. Taylor

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*ITT Grinnell Corporation*

*Pipe Hanger Division*

*260 West Exchange Street  
Providence, Rhode Island 02901  
Telephone (401) 831-7000*

March 6, '84

Bechtel Power Corporation  
P.O. Box 1000  
Ann Arbor, MI 48106

Attn: Mr. E. Roser

Subject: MIDLAND - UNITS 1 & 2  
P.O. No. 7220-M-106-AC

Gentlemen:

In response to your Telex BGH 1813 dated February 21, '84, we would like to provide the following clarifications:

Reference A concerns potential interference problems with clamps/rear brackets for ITT Grinnell Fig. 306/307 mechanical snubbers. The root cause of this problem is a tolerance stack-up problem that was not anticipated in the initial design of the attachments for these products. If the tolerances are fully evaluated in a worst case condition, a potential exists that the pivot mount or end cap of the snubber may interfere with its mating attachment. If this were to happen, there would be a reduction in the included cone of action that is provided to accommodate anticipated thermal movements. Also, this interference would result in a slightly higher drag force on the piping system - but would not cause the snubber to malfunction.

The corrective actions taken were to -

- 1) reduce the edge distances (the distance from the centerline of the load stud to the edge of the clamp stock) to slightly over the code minimums,
- 2) we redesigned the rear brackets to configurations that would be less sensitive to the large tolerances we had encountered in the past, and
- 3) we drew all combinations to scale with all tolerances considered and allowed for plus or minus 7 degrees of swing even though we only recommend that plus or minus 5 degrees be used.

Reference B addresses the capstan springs in Pacific Scientific mechanicals with potential microcracks which could affect service life. The root cause of this problem has been traced to one of Pacific's subsuppliers and the manufacturing process they used. The suspect process was to cold draw round bar into a rectangular shape, age harden the rectangular wire, coil into a spring

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To: Bechtel Pwr. Corp.  
Attn: Mr. E. Poser

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March 6, '84

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shape, stress relieve, inspect, and then silver plate. A metallurgical evaluation concluded that the microcracks were caused in the plating process. The corrective actions taken by Pacific to preclude recurrence were to revise the manufacturing process and add further inspection requirements. The process now followed is - cold draw round bar into rectangular form, normalize the material, coil into spring, age harden, stress relieve, inspect, silver plate, inspect again. This process should eliminate the problem, however, if it does not, the additional inspection will identify if a problem exists.

Should you have any further comments or questions, please feel free to contact us.

Very truly yours,

ITT GRINNELL CORPORATION



N. A. DeCRISTOFARO  
Project Manager

NAD/m (0329h)

cc: P. Straube-Bechtel  
T. Smith-Prov.  
D. Powers-Prov.  
P. Stanish-Prov.