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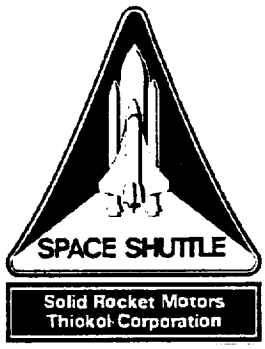

FLEX BEARING UUEC FINAL REPORT VOLUME II

14-sep-1993

Prepared for:

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
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FLEX BEARING UUEC
FINAL REPORT

1 September 1993

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TABLE OF CONTENTS

FIGURES

TABLES

1.0 INTRODUCTION

This volume, Volume II, of this Flex Bearing UUEC Final Report documents findings and data pertaining to Team B's tasks. Team B was organized as one of two sub-teams of the Unplanned/Unintended Event or Condition (UUEC) board established per InterOffice Memorandum (IOM) A100-FY93-072. Team A determined the cause of the unacceptable unbonds (referred to as "heat-affect" unbonds), including the initial, light rust film, in the FSM #3 flex bearing was overheating of the Forward End Ring (FER) during cure, specifically in zone 8 of the mold. Team A's findings are documented in Volume I of this report. Team B developed flight rationale for existing bearings, based on absence or presence of an unpropitious unbond condition like that in FSM #3's flex bearing.

2.0 SUMMARY AND CONCLUSIONS

Team B, and Management via the Flight Readiness Review (FRR) process, concludes that there are no flex bearings in the inventory with unbonds like the discrepant unbonds in the FSM #3 flex bearing. Flight rationale is based on absence of that condition, and, therefore, similarity to the qualified flex bearing configuration. To determine flight rationale:

1. Process similarities, or changes (including tooling, equipment, raw material fabrication, and T-17 procedures), were used to define populations of bearings of markedly similar pedigree.

2. Dissected hardware and/or documentation were evaluated to determine goodness or badness of hardware fabricated using known processes, raw materials, tooling, and so on.

3. Bearings built between December 1980 and October 1985 were assessed in greatest detail, since bearings in that population were exposed to the highest zone-8 temperatures. Other populations were promptly cleared based on cooler zone-8 temperatures and no special-cause variation in other parameters.

4. Inference criteria (thresholds) were established for zone-8 cure temperatures, based on the "goodness" or "badness" of associated, dissected hardware. Only two bearings (those assigned to flight motors 360X031B and 34A) are above the threshold defined by fully-bonded dissected hardware. Those two bearings are, however, below the temperature threshold defined by the bonded areas of the FSM #3 bearing.

The UUEC team concludes that all bearings remaining in the fleet are acceptable for flight. That assessment is based on:

1. non-similarity to the FSM #3 bearing, and non-similarity to the bearing fabricated just after the FSM #3 bearing. "FSM #3 plus 1" was cured hot like FSM #3 and exhibited corrosion/pitting on the FER. Cure temperatures for existing flight bearings were less severe than those for the FSM #3 and "FSM #3 plus 1" bearings.

2. compliance with baseline T-17 acceptance-test and edge-separation criteria.

3. adequate understanding of the cause and condition of heat-affect unbonds and performance of the FSM #3 flex bearing. Specifically:

   a. peel samples from dissected hardware reveal that bonds in hot bearings are strong in areas that are indeed bonded. Propagation of unbonds is not a concern.

   b. the bearing in FSM #3 was successfully flown or static tested several (six) times.

3.0 RECOMMENDATIONS

It was increasingly apparent throughout the UUEC investigation that flex bearing cures are sensitive and narrowly bounded operations. Rubber-pad cure temperatures less than approximately 300 degrees F are believed to yield weaker bonds (refer to 1979/1980 task force findings); cure temperatures greater than roughly 340 degrees F may yield rust and unbonds. Heating a massive component like the (R)SRM flex bearing within a narrow temperature band is difficult. An improved, uniformly-heated mold tool and/or a more forgiving adhesive system would improve producibility of flex bearing assemblies immensely. An increased number of heat-zones were recently incorporated, allowing more individual control of heat

application and improving heat-uniformity. Alternate adhesives can be practically evaluated and incorporated as part of the OLDs program.

The databases created to support the investigation are valuable resources that should be maintained and used by flex bearing team members. The information will lend itself especially well to Statistical Process Control (SPC) efforts. The team will also consider using non-baseline test procedures, such as Gas Chromatography/Mass Spectroscopy (GC/MS), to define SPC parameters for raw materials. Parameters not defined or recently defined in engineering, such as adhesive failure rates realized during material acceptance-testing, may also be assessed using SPC techniques.

To address the aforementioned issues, the UUEC recommends the following actions be taken:

1. M&P Engineering complete a trade study of alternate adhesive systems.
2. M&P/Core Design Engineering conduct preliminary testing of promising alternate adhesives, if any.
3. M&P/Core Design Engineering define a development/qualification plan for an alternate adhesive system, if promising candidates are identified.
4. Manufacturing/M&P Engineering define the thermal environment (identify areas of non-uniform heating, identify areas where heat is lost) in the mold tool during flex bearing cures.
5. Manufacturing/M&P Engineering complete a trade study of alternate mold-tool systems.

6. Manufacturing/M&P Engineering define a development/qualification plan for an alternate or modified mold-tool.

7. ICWC (Design, Manufacturing, and Quality) Engineering implement SPC evaluation of process parameters.

8. Quality Engineering provide visibility of/involvement in raw materials' SPC efforts being pursued by Procurement Quality Engineering (PQE).

4.0 DISCUSSION

4.1 APPROACH

The premise of Team B's effort is the unacceptable heat-affect unbonds and initial, light rust film in the FSM #3 flex bearing were caused by overheating of the Forward End Ring (FER) during cure, specifically in the 0-90 degree (approximately) quadrant (actually, 345-110 degrees). Heavily rusted areas developed as the unbonds were exposed to the post-fabrication environment. Overheating caused the Chemlok 220 adhesive to degrade and initiated a subsequent chemical reaction between the Chemlok 220 by-products, the Chemlok 205 primer, and the D6AC steel FER and shim. That reaction yielded large, internal unbonds on the FER and shim #10, and rusting of the metal. Figures 1 and 2 are sketches of the discrepant unbonds, which are unique to pad #11 (nearest the FER) interfaces and roughly coincide with butterfly-heater locations, every 40 degrees beginning at 20 degrees, circumferentially. The cause and characteristics of the condition, including a fault tree analysis, are addressed in detail in Volume I and, only as applicable, in this report.

Because the discrepant areas of the FSM #3 flex bearing were isolated to shim #10, pad #11, and the FER, the UUEC team considered only those areas during evaluation of existing assemblies. For example, as a minimum, only cure-zones near the FER (i.e. zone 8) were ultimately considered, although other zones were examined prior to determining that overheating in zone 8 was the mechanism that caused the discrepant unbonds in the FSM #3 flex bearing. The following general approach, subsequently discussed in detail, was used to determine the probable condition of flex bearings in the fleet.

A lot of information was collected and evaluated for relevance to the cause and characteristics of the FSM #3 flex bearing's unbonds and the condition of the existing inventory. Information that is essential to understanding the problem and substantiating the conclusions of the UUEC team is presented. Notes or data that are not strictly relevant may not be referenced, but are included in the appendices of this report or are available in permanent records (i.e. manufacturing logs, DRs).

Approach:

1. Define flex bearing populations based on similar pedigree with respect to, for example, process requirements, cure histories, tooling configuration, or lot-to-lot raw material variation.

2. Classify (dissected or discrepant) flex bearings "good" or "bad" based on the known condition of shim #10, pad #11, and/or the FER. The condition of hardware was determined by inspecting dissected flex bearings (including FSM

#3's), examining dissection photographs, and reviewing Discrepancy Reports (DRs), Process Departures (PDs), reports, and IOMs.

3. Deem zone-8 cure data "good" or "bad", whichever applies to the condition of the applicable bearing per (1) above, to develop a relationship (inference criteria) between good or bad bearings and their respective histories, especially cure temperatures.

4. Compare zone-8 cure data for bearings whose conditions are known (see 2, above) to zone-8 data for flex bearings still in the inventory. Clear bearings or populations of bearings that were cured cooler, since overheating in zone-8 is the cause determined by the UUEC.

5. Verify the inferred conditions of bearings in the inventory by reviewing documentation such as DRs or acceptance-test results, to assure no conflicts exist between inferred and documented conditions.

6. Identify and compare all other cure-related variables (i.e. raw material changes, process changes) to establish similarity between flex bearings, and, more importantly, establish that cure-temperature variation is the variable that would predominantly cause unbonds like those in the FSM #3 flex bearing, and believed to have been in the "FSM #3 plus 1" bearing.

4.2 FLEX BEARING IDENTIFICATION/POPULATIONS

Flex bearing data obtained during the course of the UUEC investigation were compiled, to a large extent, on Line Of Position (LOP) charts. SRM and RSRM Process Summary LOP charts, Figures 3 and 4, are examples. Line of Position charts provide information for corresponding flex bearings identified by as-fabricated dash number and serial number, and build date. Data were also complied in a table (Table I) where flex bearings are identified by part number, serial number, refurbishment identifier, and bearing number - an arbitrary tracking number assigned, in roughly chronological order, to each assembly. Populations of flex bearings have been identified to segregate bearings of similar pedigree. Populations were defined based on the historical information provided in the 5 February 1993 charts that were presented to Management and are included in the appendix of this report.

4.3 "GOOD" AND "BAD" BEARINGS

Flex bearings described in sections 4.3.1 through 4.3.11 are presented in hierarchial order from hottest to coolest average, third-cycle cure temperatures. They were judged to be "good" or "bad" based on likeness, considering only shims #10, pads #11, and FERs, to the FSM #3 flex bearing. Judgement was primarily based on the size of unbond areas, visual likeness to FSM #3, and presence of rust or corrosion. Shore A measurements were not used to distinguish between "good" and "bad" bearings since poor (too high or too low) values were not characteristic of the FSM #3 flex bearing's condition (refer to Volume I).

Available dissected hardware was first evaluated by creating and testing thirty-degree peel specimens extending from the Inner Diameter (ID) edge to the Outer Diameter (OD) edge on FERs. If appropriate FERs were not available, the OD surfaces of shims #10 were evaluated first. Peel specimens were pulled at optimum 30-degree angles (approximately, since the angle was difficult to maintain) as shown in Figure 5. If an unbond was found, circumferential strips of rubber were removed from the location of the unbond to evaluate the extent of the defect. Also, if an unbond was found, an ID edge-to-OD edge peel specimen was tested on the next bond surface (the OD surface of shim #10 if the FER was evaluated, the ID surface of shim #10 if the OD surface of Shim #10 was evaluated, and so on) at the same circumferential location. This procedure was repeated until no unbonds or adhesive failures of peel specimens were realized. Peel specimens were also fabricated and pulled along the boundaries of heat-affect unbonds. Photographs were taken and rubber samples (peels) were retained for evaluation in the lab. The rubber acreage and peeled areas were visually examined and photo-documented.

Dissected bearings not physically evaluated during the UUEC investigation were assessed based on recorded data. DR reviews revealed no FERs other than that in the "FSM #3 plus 1" bearing that were corroded or pitted. DR reviews also revealed no unbonds of the magnitude found in the FSM #3 flex bearing.

4.3.1 BEARING NUMBER 24

Fabrication Date: 02/12/83

Fabrication P/N, S/N: 1U51060-12, S/N 0000007

Dissection P/N, S/N: 1U76916-04, S/N 0000013 R6

Classification: Bad (0-90 degree quadrant), Good (90-360 degrees)

Comments:

This is the bearing that was used in FSM #3. It was scrapped because a deep edge-unbond was found in pad #11. Dissection revealed large internal unbonds addressed in Volume I of this report. Team A, as documented in Volume I, characterized the unbonds in this bearing and identified the cause of the condition. Well-bonded areas of rubber are also seen in the FSM #3 bearing and corresponding cure data defines a relationship between good hardware and acceptable cure temperatures. This observation was fundamental to clearing the bearings in motors 31B and 34A, since zone-8 temperatures in good areas were lower than those in bad areas and higher than the highest temperatures in other bearings. Specific dissection observations are discussed in Volume I, but, in summary, peel specimens failed cohesively and no heat-affect unbonds were identified between approximately 140 and 300 degrees, circumferentially. Figure 6 shows the condition of the FER.

Conclusions:

Areas (0-90 degree quadrant, approximately) of the FSM #3 flex bearing are bad. All other areas of pad #11 are considered good.

4.3.2 BEARING NUMBER 25

Fabrication Date: 03/23/83

Fabrication P/N, S/N: 1U51060-12, S/N 0000008

Dissection P/N, S/N: 1U51060-12, S/N 0000008 R2

Classification: Bad (0-90 degree quadrant), Good (90-360 degrees)

Comments:

This bearing is referred to as "FSM #3 plus 1". It was dissected because an unbond in pad #2 exceeded maximum depth criteria, and the assembly and individual pads #4, #6, and #11 violated separation-area limits. This bearing was the next bearing fabricated after FSM #3's and is believed to have had a pad #11-condition similar to that in the FSM #3 flex bearing, deeming this bearing bad in the same quadrant as FSM #3. Separation-inspection data indicates the condition of pad #11 was significantly poorer than pads #4 and #6. Although the unbonds in pad #11 were located at the OD edge (refer to DR 143606), they were in the 0-90 degree quadrant and ID unbonds may have been masked by the characteristic heat-affect rind. The FER from the assembly was discrepant - it was heavily pitted at the pad #11 interface at approximately 0-90 degree circumferential locations (refer to DR 143649). An Action Order (AO 4C2-1124) was issued to expedite refurbishment of the FER used in the FSM #3 flex bearing to validate the belief that the pitting is also due to, and indicative of, overheating of the FER during cure.

Conclusion:

This bearing is believed to have been very similar to the bearing used in FSM #3. Accordingly, it is deemed bad in the 0-90 degree quadrant of the FER, and good at other circumferential locations.

4.3.3 BEARING NUMBER 29

Fabrication Date: 10/02/83

Fabrication P/N, S/N: 1U51060-12, S/N 0000012

Dissection P/N, S/N: 1U76916-06, S/N 0000002 R2

Classification: Good

Comments:

This flex bearing was dissected because pads #1- #8 and the assembly as a whole exceeded subsequently-revised edge-separation criteria. Slightly more than nine years have passed since this assembly was fabricated, ample time for heat-affect unbonds to develop if an overheated cure-condition existed.

The FER was not available. Peel specimens on the OD surface of shim #10 revealed uniform Chemlok, no heat-affect unbonds, and no rubber that had pulled away from the FER, which would have suggested there was an unbond on the convex surface of pad #11. Peel specimens failed cohesively. Shallow (less than 0.1 inch in depth), intermittent rust was found on the

ID and OD edges and at a single, isolated location, approximately 60 degrees circumferentially. The condition of the shim is shown in Figure 7; the photograph is mis-labeled.

Conclusion:

This bearing was good, based on positive dissection-evaluation findings and lack of anomalies in pad #11. Upon dissection of the bearing assembly and refurbishment of the FER, no corrosion of the FER was documented on DRs.

4.3.4 BEARING NUMBER 22

Fabrication Date: 10/18/82

Fabrication P/N, S/N: 1U51060-12, S/N 0000005

Dissection P/N, S/N: 1U52840-03, S/N 0000010 R4

Classification: Good

Comments:

This flex bearing was scrapped because pads 2,4,5,8, and 10 exceeded the maximum allowed per-pad separation-area limit (9 square inches)(which is no longer an engineering requirement); the assembly as a whole exceeded engineering requirements (that were subsequently changed) with a total separation area of 567.794 square inches. Slightly more than ten years have

elapsed since fabrication, ample time for heat-affect unbonds to develop if an overheated cure-condition existed.

The FER of the dissected assembly was not available, so shim #10 was evaluated. No heat-affect unbonds were found, and no evidence of rust or unbonded rubber that pulled away from the FER during dissection was found. Intact Chemlok was visible in areas where peel specimens were tested. All peels failed cohesively, indicating a good bond. The dissected condition of this bearing is shown in Figure 8. Small, typical amounts of rust were present at 220 and 260 degrees, circumferentially.

Conclusion:

This bearing was good, based on positive dissection-evaluation findings and a lack of anomalies in pad #11. Upon dissection of the bearing assembly and refurbishment of the FER, no corrosion of the FER was documented on DRs.

4.3.5 BEARING NUMBER 20

Fabrication Date: 04/02/82

Fabrication P/N, S/N: 1U51060-12, S/N 0000003

Dissection P/N, S/N: 1U52840-03, S/N 0000016 R5

Classification: Good

Comments:

This bearing, referred to as "the snubbed bearing", was dissected at the direction of the UUEC team because it was snubbed during splashdown and remained in a stretched position from 10/06/90 to 10/29/90 (see DR 405760), rendering it unsuitable for flight, based on available rationale. More importantly, this bearing is in the same population as the FSM #3 bearing and is representative, with respect to hot zone-8 cure temperatures, of flex bearings assigned to flight motors 360X031B (31B) and 360X034A (34A). The condition of this bearing, assuming little variation in parameters other than temperature, is indicative of the condition of the 31B and 34A bearings.

Dissected hardware from the snubbed bearing was evaluated and is shown in Figure 9. Only one heat-affect unbond was found. It was located between 57 and 72 degrees, circumferentially, on the OD edge of the FER and was 1.5 inches deep, maximum. Rubber was bonded intermittently along the OD edge of the adjacent area of shim #10; a bonded "rind" is characteristic of heat-affect unbonds. The unbond was moderately rusted. The ID edges of the shims were rusted intermittently - the area was greased for storage, so rust samples were not obtained. A rust-coated rubber sample was removed from the ID edge of the FER; the results of Energy Dispersive Analysis of X-rays (EDAX) testing are documented in IOM 2466-FY93-M100, included in the appendix.

All peel specimens, including those at the perimeter of the unbond, failed cohesively. Shore A measurements were taken at butterfly-heater locations on the FER, at the ID edges and in

the middle of the elastomer pad. Those shore A values were 14-18, the average of 18 readings was 15.78. The rubber on the FER was too thin to provide reliable measurements at the OD edges. Shore A measurements on the OD surface of shim #10 at 60 degrees, circumferentially, were 16 (ID), 16 (middle), and 18 (OD). Shore A readings for rust coated rubber were averaged 23 on the FER and 19 on the OD surface of shim #10. The shore A values do not meet the 18-22 elastomer-acceptance requirement and the values are somewhat lower than those measured in the only other full-scale assembly (refer to TWR-63806, RSRM Flex Bearing Aging Study, Phase I) that was evaluated for shore A hardness. The measurements are, at best, indicators of the elastomer's condition, and not a discriminator of Chemlok degradation, the subject of the UUEC investigation. Therefore, shore A values are not of fundamental importance to the UUEC, but may be a valuable SPC variables, or of use when evaluating the integrity of snubbed bearings.

Conclusion:

This bearing, based on the condition of the FER, was good. The edge-separation area is within engineering limits; isolated, minimal amounts of rust are commonly revealed in dissected bearings, especially at ID edges; peel specimens do not indicate poor bonds.

4.3.6 BEARING NUMBER 27

Fabrication Date: 06/03/83

Fabrication P/N, S/N: 1U51060-12, S/N 0000010

Dissection P/N, S/N: 1U76916-04, S/N 0000009 R4

Classification: Good

Comments:

This flex bearing was dissected because an unbond in pad #4 violated maximum depth criteria. Unbond depths shall not exceed 3.20 inches for refurbished assemblies; the actual unbond depth was 3.9 inches. Nearly ten years have passed since fabrication, ample time for heat-affect unbonds to develop if an overheated cure-condition existed.

Dissected hardware was available. Small, typical amounts of rust existed on the ID and OD edges of the shims. Peel specimens revealed no unbonds, visible Chemlok, and no additional rust. No unbonds were found on the FER, even when all rubber between 340 and 100 degrees, circumferentially, was removed. Figure 10 is a photograph of this dissected bearing.

Conclusion:

This bearing was good, based on positive dissection-evaluation findings and a lack of anomalies in pad #11.

4.3.7 BEARING NUMBER 35

Fabrication Date: 11/04/85

Fabrication P/N, S/N: 1U51060-12, S/N 0000018

Dissection P/N, S/N: 1U52840-03, S/N 0000011 R2

Classification: Good

Comments:

This flex bearing was dissected because pad #1 exceeded the maximum allowed unbond depth of 2.0 inches in 18 places. The assembly's separation-area (138.863 square inches) exceeded engineering limits, also. Seven years have elapsed since fabrication, a time period sufficient for heat-affect unbonds to develop if an overheated cure-condition existed.

Dissected hardware was evaluated and the FER was acceptable. All peel specimens failed cohesively, Chemlok was visible beneath the rubber, and no unbonds were revealed. Figure 11 documents the condition of the FER of this assembly.

Conclusion:

This bearing was good, based on positive dissection-evaluation findings and a lack of anomalies in pad #11.

4.5.8 BEARING NUMBER 39

Fabrication Date: 07/31/86

Fabrication P/N, S/N: 1U51060-12, S/N 0000022

Dissection P/N, S/N: 1U52840-03, S/N 0000007 R3

Classification: Good

Comments:

This flex bearing was dissected because pads #3- #7 exceeded per-pad edge-separation criteria and the assembly, with 293.64 square inches of unbond area, violated requirements. Five and a half years have elapsed since fabrication, a time period sufficient for heat-affect unbonds to develop if an overheated cure-condition existed.

The condition of the FER was acceptable. All peel specimens failed cohesively, Chemlok was visible beneath the rubber, and no unbonds were revealed (see Figure 12).

Conclusion:

This bearing was good since dissection-evaluation findings were positive and no anomalies were identified in pad #11.

4.3.9 BEARING NUMBER 53

Fabrication Date: 11/03/89

Fabrication P/N, S/N: 1U52840-01, S/N 0000013

Dissection P/N, S/N: 1U76916-01, S/N 0000002 R1

Classification: Good

Comments:

This flex bearing was dissected because the flex bearing assembly exceeded separation-area limits at depths between 1.4 and 3.2 inches, primarily in pad #1. Approximately three years have passed since fabrication, a time period sufficient for heat-affect unbonds to develop had an overheated cure-condition existed.

The condition of the FER was acceptable, per dissection-evaluation. All peel specimens failed cohesively, Chemlok was visible beneath the rubber, and no unbonds were revealed (see Figure 13).

Conclusion:

This bearing was good, based on positive dissection-evaluation findings and a lack of anomalies in pad #11.

4.3.10 BEARING NUMBER 70

Fabrication Date: 08/19/92

Fabrication P/N, S/N: 1U76916-06, S/N 0000016

Dissection P/N, S/N: 1U76916-06, S/N 0000016

Classification: Not Applicable

Comments:

This assembly is referred to as "the zone-4 out" bearing because the cal-rod in zone 4 of the mold tool (see Figure 14) failed during cure. Zone 6, located at the ID edge of the FER, was hotter than usual to compensate for the lost heater. The assembly was subsequently scrapped because max ID depth-plus-max OD depth criteria was violated on pad #1. The limit is 3.3 inches, which was exceeded in two places with values of 4.0 inches and 3.7 inches. Five months (0.4 years) have elapsed since fabrication, a time period obviously (since heat-affect unbonds did form) sufficient for heat-affect unbonds to develop.

A heat-affect unbond was found at 340 degrees at the ID edge of the FER. That unbond was 0.8 inch deep and 10.7 inches long (circumferentially), and was lightly rusted with a film similar to that found in the isolated unbond in the FSM #3 flex bearing. A second, smaller, heat-affect unbond was found at 20 degrees. That unbond was 0.4 inch deep and 6.8 inches long. Both heat-affect unbonds had the characteristic rind of rubber along the ID edge. Peel tests at the perimeter of the unbonds failed cohesively, indicating a good bond. Uniform Chemlok and no unbonds were found on the OD surface of shim #10 and the ID edge of the

FER at 20 and 340 degrees. Peel specimens at butterfly-heater locations (not including the 20- or 340-degree locations) on the FER failed cohesively and intact Chemlok was visible. The condition of this bearing is shown in Figure 15.

Conclusion:

Because of the cure deviation (zone-4 failure), this bearing is not representative of bearings produced using the baseline process and was not used as a basis for comparison.

4.3.11 BEARING NUMBER 68

Fabrication Date: 06/15/92

Fabrication P/N, S/N: 1U76916-06, S/N 0000015

Dissection P/N, S/N: 1U76916-06, S/N 0000015

Classification: Not Applicable

Comments:

This bearing is referred to as "the double-cure bearing". It was initially cured per baseline process requirements. During mold disassembly, a defect was identified in pad #1 and disassembly did not proceed. The defect was presumed to have been caused by pressure loss/material extrusion through obsolete thermocouple holes in the monarch ring adjacent to pad #1. Two T/C holes were plugged and two were unplugged, pad #1 and the substrate adhesives were removed and re-applied, the tooling was re-assembled, and the bearing was

cured - the second cure for pads #2-#11. The second cure, accomplished to evaluate the effects of T/C through-holes, was completed using the Yokogawa automatic control system and baseline temperature limits.

Figure 16 shows the heat-affect unbonds resulting from exposure to two cure cycles. The photograph is mis-labeled. Temperature limits were not violated during either cure, indicating that heat-affect is a function of time-at-temperature, rather than high temperature only.

Peel specimens at butterfly-heater locations revealed heat-affect unbonds on the FER. Again, the unbonds were concealed by characteristic "rinds" along the edges of the pads and appeared to be well bonded along the perimeter. The unbonds were coated with light films of rust. Chemlok was visible beneath rubber where unbonds did not exist.

Heat-affect unbonds were located on the FER and ID and OD surfaces of shims #4-#10. Depth and location data are included in the appendix of this report.

Conclusion:

The double cure bearing is not representative of flex bearings in the inventory, so it was not used as a basis for comparison. Double cure data are provided and valuable, however, when affirming characteristics of heat-affect unbonds.

4.4 ZONE-8 CURE TEMPERATURE

Zone-8 cure temperatures were primarily considered to determine goodness or badness of existing bearings. Consideration of, primarily, zone 8 is acceptable, within the scope of the UUEC, since overheating in that zone is the recognized cause of the discrepant unbonds in the FSM #3 flex bearing, and the presumed cause of the inferred condition of the "FSM #3 plus 1" flex bearing. Temperatures in zones adjacent to zone 8, specifically zones 6 and 4, were and are cure-acceptance criteria, and Process Departures (PDs) would have been written had temperatures in those regions been excessive. Had zones 6 and 4 been overly hot, the DR/PD search conducted by the UUEC would have revealed it. Therefore, only cure records for zone 8, which did not constitute cure-acceptance criteria prior to 1988, were evaluated. Zone-8, third-cycle (cure) temperatures are shown on the SRM and RSRM LOP charts (Figures 3 and 4).

Several issues associated with zone-8 data were addressed and resolved by the UUEC team. Specifically, the team addressed: (1) the validity of thermocouple (T/C) #4 data, (2) pegged temperatures (temperatures greater than 400 degrees F), and (3) the use of average (versus maximum) zone-8 temperatures to when evaluating cures.

In some cases T/C #4 measurements are lower than expected. That T/C data is erroneous for certain flex bearing builds. T/C #4's measurements were comparable in magnitude to T/Cs #1, #2, and #11 for cures completed prior to 1981; that same T/C registered significantly lower temperatures after 1981. No tooling modifications or installations of replacement

thermocouples were identified, so the most plausible explanation for the lower measurements after 1981 is T/C #4 was pinched and shorted, providing erroneous readings. A thermal analysis of the bearing mold supports this conclusion, and is addressed in Volume I.

Also, in some cases maximum temperatures exceeded the 400-degree F limit the strip-chart equipment was capable of recording, so some strip-charts pegged. In those cases maximum temperatures were determined by extrapolating the data. For individual flex bearing cures, temperature at a thermocouple location where the strip-chart did not peg was plotted against temperature at a T/C location where temperatures did peg, for several times during the third cycle of the cure (see Figures 17, 18 and 19, examples). The points were curve-fit (linearly, fortunately), then extrapolated beyond the 400-degree F limit. The relationship was used to estimate actual temperatures above 400 degrees F, knowing the corresponding unpegged temperature.

The FSM #3 flex bearing was subjected to the maximum average zone-8 temperature. However, comparison of maximum temperatures is not strictly accurate since temperatures often peaked briefly at temperatures higher than what was typical during third-cycles. This is apparent when cure data, included in the appendix of this report, are reviewed. Therefore, average third-cycle temperatures were calculated and used as a basis for comparison. When zone-8 third-cycle data for all bearings are compared, populations other than that including the FSM #3 flex bearing are cleared based on relatively cooler temperatures. Clearance assumes there are no special-cause variations in other parameters, which would introduce cure-

affecting variables other than zone-8 temperature. The "FSM #3" population was addressed in great detail since bearings in that population were chiefly subjected to the most extreme maximum and average third-cycle, zone-8 temperatures. All other populations are considered acceptable because they clearly were not subjected to the mechanism, excessive heat from the butterfly heaters, that caused the unacceptable unbonds in FSM #3's flex bearing.

Cure data for hotter-than-average bearings are presented in Table II, in addition to other compiled information. That table was used to compare and infer the conditions of existing hardware, as discussed in Section 4.5.

Temperature was primarily considered, however cure time is implicated by the double-cure bearing. During the double-cure, acceptable zone-8 temperatures were realized for twice the normal exposure time and heat affect unbonds resulted. Therefore, development of unbonds like those in the FSM #3 flex bearing is a function of both time and temperature. Laboratory studies (refer to IOM 2433-80-M223 and TWR-12947) suggest that the function is not linear and tests are in-work in the laboratory, intended to support definition of a time-temperature relationship. That work is addressed in detail in Volume I.

4.5 DATA COMPARISON

The information presented in Table II is used to identify bearings, if any, that are similar to that in FSM #3. In using this approach, the team did not define the threshold beyond which higher temperature results in heat-affect unbonds. Instead, data for bearings being evaluated were compared with data associated with knowingly good hardware. Although definition of the threshold is not required to establish flight rationale, testing in the laboratory is being conducted to characterize heat-affect unbonds. That testing is addressed in Volume I.

Information in Table II is color-coded. Red indicates conditions deemed bad (refer to section 4.3); green is good, and blue indicates an uncertain condition. Per Table II it is apparent that the flex bearing in FSM #3 was worst-case. "FSM #3 plus 1" was also bad in the 0-90 degree quadrant. All others were subjected to zone-8 maximum average temperatures that were cooler than good (green) bearings or bonded areas of the FSM #3 and "FSM #3 plus 1" bearings. Existing bearings are, therefore, acceptable. Even relatively hot bearings, particularly 31B and 34A, are certainly no worse than the bonded areas of the FSM #3 flex bearing, which successfully and repeatedly demonstrated a 1.0 factor of safety during each of its flight and static-test uses. Temperature data pertaining to 31B and 34A are presented in greater detail in Table III, which is color-coded like Table II.

4.6 CHANGES TO PROCESSES AND MATERIALS

Changes to processes and materials were reviewed to identify differences, if any, that might have affected the cure of flex bearings. The purpose of that review was to establish similarity

(within normal lot-to-lot or assembly-to-assembly variation) among (R)SRM bearings - to establish, for example, that all lots of each raw material will degrade at roughly the same cure temperature. By establishing similarity with respect to materials properties and process parameters, temperature remains the primary discriminator used to identify bearings with "FSM #3" unbonds.

Vendor-supplied change-summaries for Chemlok adhesives are available only for changes incorporated after 1985. Additional testing of the specific lots used in existing bearings cannot be accomplished since the lots were wholly used to fabricate flex bearings, so samples no longer exist. Goodness is inferred from existing material acceptance-test results, dissection observations, and test results for lots of material that are available.

Stock and lot numbers of Chemlok 205, Chemlok 220, TR3005A elastomer, and Tycement used in each flex bearing are listed in Table IV. Change summaries are included in the appendix. No significant changes were made to Tycement or Chemlok 220 adhesive. Elastomer changes were insignificant or justified and documented well prior to incorporation. Also, elastomer behavior was not identified as a cause of unbonds in FSM #3's flex bearing, so detailed evaluation is outside the scope of the UUEC. More than other raw materials, the Chemlok 205 formulation and processes have changed since 1985 (see Appendix D). Again, goodness is inferred from acceptance-test results, dissection observations, and test results for lots of material that are available. All raw materials are tested prior to acceptance. Baseline acceptance data provides no evidence that properties have changed. Reject rates have not

increased (other than in 1978, when the Chemlok 220 formulation changed) and acceptance-test results are within three-sigma limits (data is included in the appendix), indicating that consistently similar material has been accepted.

Available lots of flex bearing materials are being tested in the lab, repeating the "heat-affect unbond" study accomplished in 1980. The results of testing completed to date are addressed in detail in Volume I and summarized here. Gas chromatography evaluation of available Chemlok 220 and 205 samples yield constituents similar to those previously identified. Results of tests conducted in 1980 indicate that hydrochloric acid (HCL) and water are by-products of Chemlok degradation; recent tests confirm those results when dried, rather than wet, Chemloks are evaluated.

Test results and acceptance data indicate acceptable materials are received; there is no reason to believe that changes to raw materials have adversely affected the cure of flex bearings or increased the potential for creating heat-affect unbonds.

Also, fortunately, some lots of raw materials were used in several flex bearing assemblies, eliminating a variable (raw material variation) when establishing similarity between bearings. The flex bearing assigned to flight motor 360X031B used the same lot (stock number 7408, LOT0021) of Chemlok 220 that was used in good bearing #22 (10/18/82), establishing exceptional similarity between those two assemblies. Bearing #22 also incorporated Chemlok 220 LOT0022, which was used in FSM #3 with poor results, further indicting temperature

rather than Chemlok variation as the discriminating parameter considered in the UUEC investigation. Confidence in temperature as the primary discriminator is further increased since bearings #25 (bad - hot cure), #26 (34A - inferred condition - good), and #27 (good - cooler cure) all used the same lots of Chemloks 205 and 220 (7407/LOT0022 and 7408/LOT0023, respectively) with different results. Since raw material properties are essentially constant, this observations supports the theory that hot cures caused the discrepant unbonds in the FSM #3 (and "FSM #3 plus 1") bearing.

Process changes incorporated throughout the (R)SRM program are shown on LOP charts (Figures 3 and 4). They were assessed as part of the UUEC investigation to determine if they would affect the product's response during cure. Application of adhesives and cure temperatures are considered the most pertinent variables. Adhesive application is critical because the amount of material is a fundamental factor in any chemical-reaction, vulcanization in this case, process, and because vendor information confirms that sufficient Chemlok 205 must be present to protect steel from Chemlok 220. Although no changes to the adhesive application process were identified, laboratory tests are in-progress to determine the effects of variation in adhesive-thickness. Cure-temperature limits were scrutinized in most detail, since excessive zone-8 temperatures predominately caused the FSM #3 flex bearing's unbonds. Process changes incorporated in late 1988 were in the direction of goodness with respect to zone-8 temperatures. Notably, shields were placed over the butterfly heaters to better distribute the applied heat, thermocouples were placed on the FER rather than the tooling, and zone-8 temperatures became cure-acceptance criteria. Bearings fabricated after the

aforementioned changes were incorporated were not exposed to excessive heat and, therefore, are cleared of having "FSM #3" unbonds. Prior to 1988, temperature limits varied but no other changes were identified that would uniquely affect zone-8, establishing similarity between bearings and supporting strict comparison of cure temperatures to determine if "FSM #3" unbonds may exist in other bearings.

Further supporting comparison of cure-temperatures, bearing #14 (05/30/80) was the only bearing fabricated after third-cycle temperature limits were increased from 315 to 335 degrees, maximum, for T/Cs on monarch rings. That bearing exhibited unbonds like those in FSM #3 (refer to TWR-12947) and monarch-ring temperature limits were subsequently reduced. Zone-8 temperatures, however, were not cure-acceptance criteria and were not evaluated or redefined at that time.

Acceptance-test procedures and results were also evaluated. With only two exceptions, no bearings have violated performance limits for tests conducted in T-17. Those two exceptions are bearings that violated leak-test requirements: one leaked, one violated the maximum deflection limit that was subsequently deleted from engineering. The data, included in the appendix, show shifts over time; the trends are interesting and should be evaluated, but are considered beyond the scope of the UUEC, since successful versus unsuccessful T-17 performance cannot be used to discriminate an unbond-condition similar to that in the FSM #3 bearing.

Separation-area, typically used to judge goodness or badness of bearings, was assessed. Since it is not a valuable discriminator - the edge-separation inspection did not reveal the condition of "FSM #3" prior to previous uses - assessment of separation-areas was not valuable to nor accomplished by the UUEC team.

Discrepancy Reports (DRs) and Process Departures (PDs) written against raw materials were reviewed. No departures were identified that would make the FSM #3 flex bearing, or any other bearing, unique with respect to integrity of raw materials or process parameters.

DRs and IOMs pertaining to bearings #38 and #41 and the process checkout bearings fabricated in December 1987 and March 1988 indicate that butterfly heaters may have been unusually close to or touching the FERs of those bearings during cure. A butterfly-heater shaped impression was noted on the OD surface of the FERs. The condition was not noted for any other bearings. Had a "cal-rod touch" condition existed for other bearings and was not documented, there is evidence that the hardware was not adversely affected. Bearings #38 and #41 and the process checkout bearings have all been dissected; records review and physical evaluation of dissected bearing #41 (the "Beckstrand" bearing) reveal no unusual effects of resulted from possible contact between butterfly heaters and FERs. Furthermore, changes, namely incorporation of heat shields and T/Cs on the FERs rather than the tooling, implemented during the 1988 task force preclude(ed) cal-rod/FER contact and overheating of FERs.

4.7 ACRONYMS

AO	Action Order
DR	Discrepancy Report
EDAX	Energy Dispersive Analysis of X-rays
FER	Forward End Ring
FRR	Flight Readiness Review
FSM	Flight Simulation Motor
GC/MS	Gas Chromatography/Mass Spectroscopy
HCL	Hydrochloric Acid
ID	Inner Diameter
IOM	InterOffice Memorandum
LOP	Line Of Position
OD	Outer Diameter
PD	Process Departure
P/N	Part Number
PQE	Procurement Quality Engineering
RSRM	Redesigned Solid Rocket Motor
S/N	Serial Number
SPC	Statistical Process Control
SRM	Solid Rocket Motor
T/C	Thermocouple
UUEC	Unplanned/Unintended Event or Condition

FIGURES

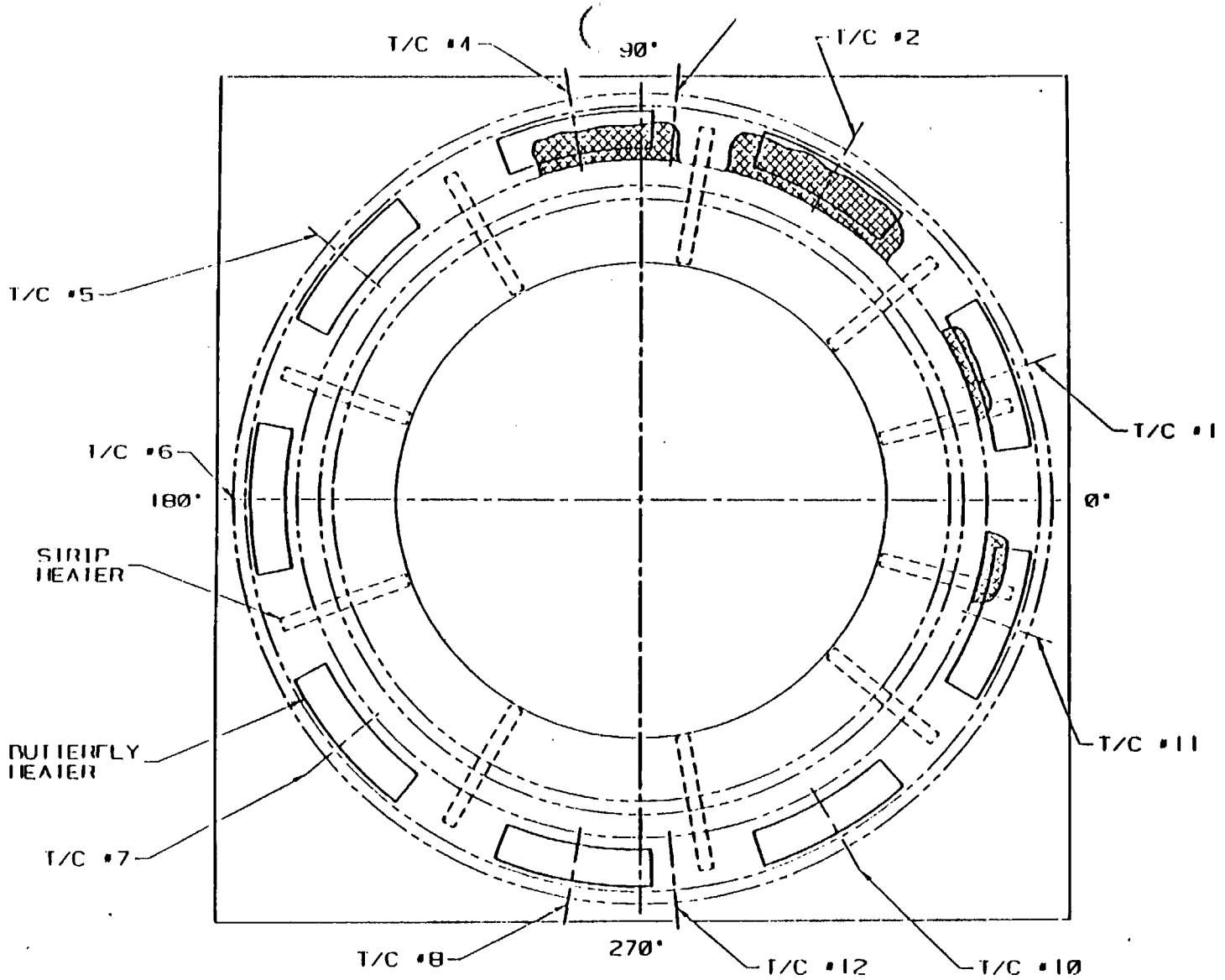

Figure 1. FSM #3 FER Sketch

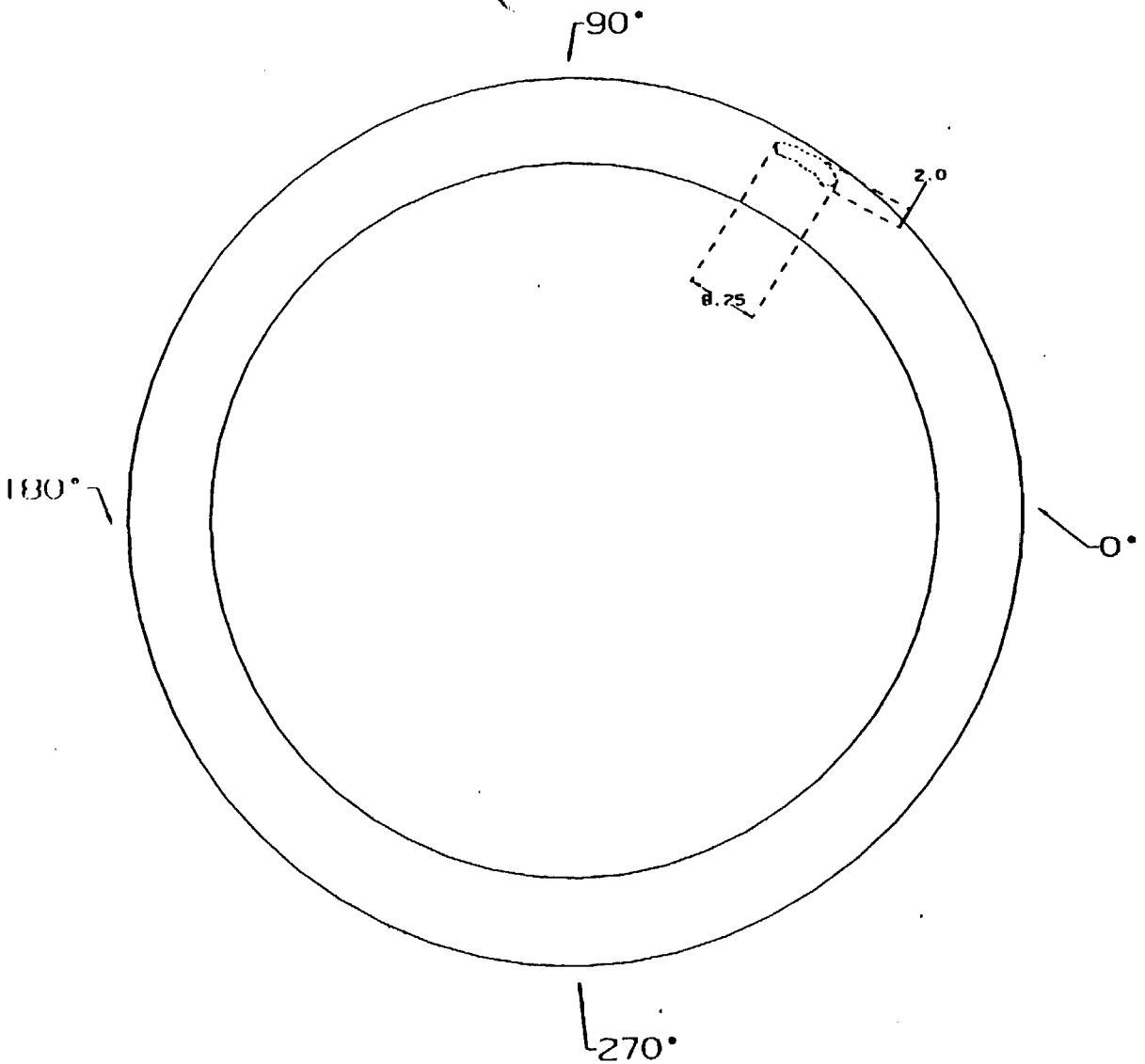

Figure 2. FSM #3 Shim #10 Sketch

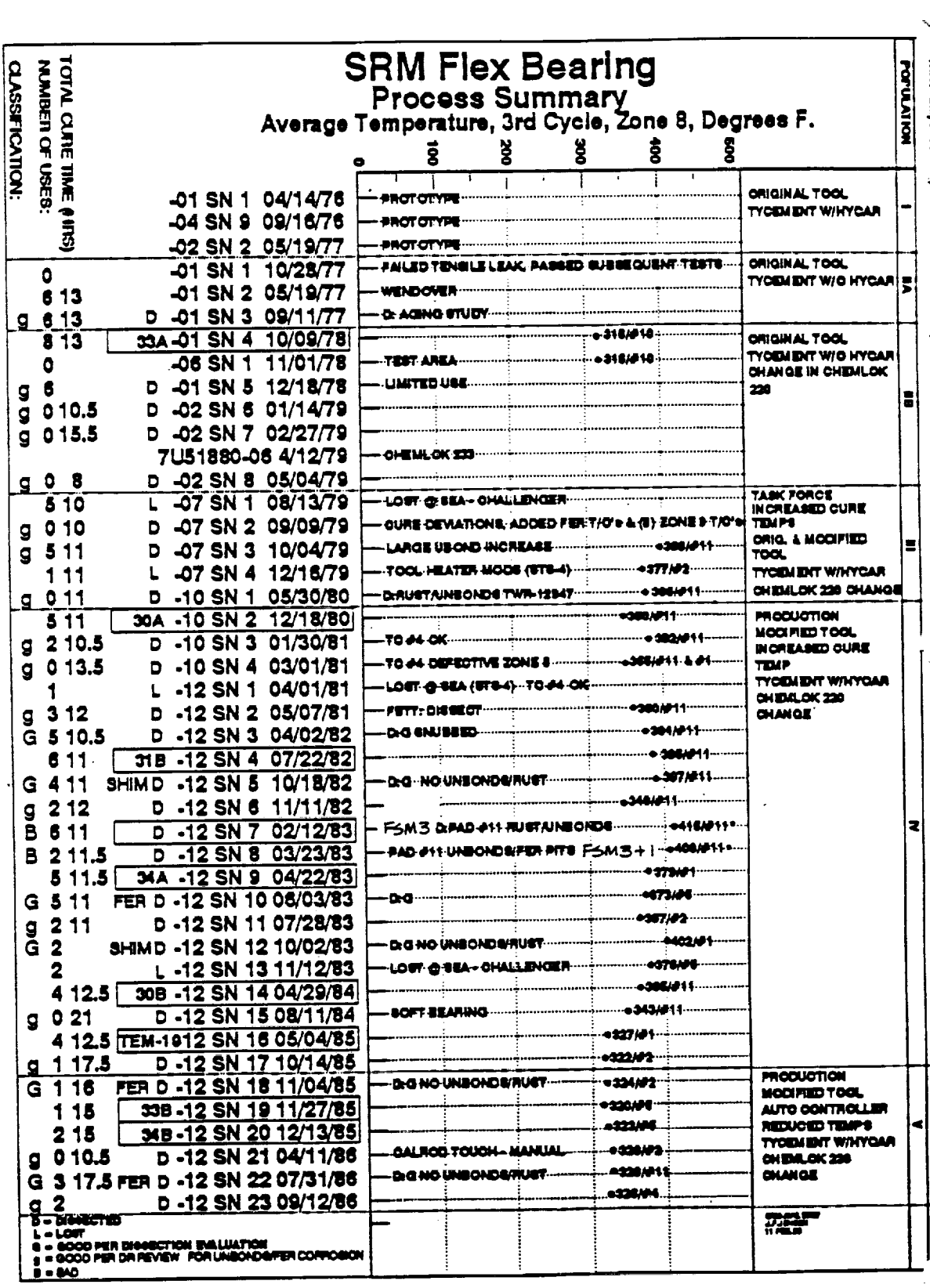

Figure 3. SRM Line Of Position Chart

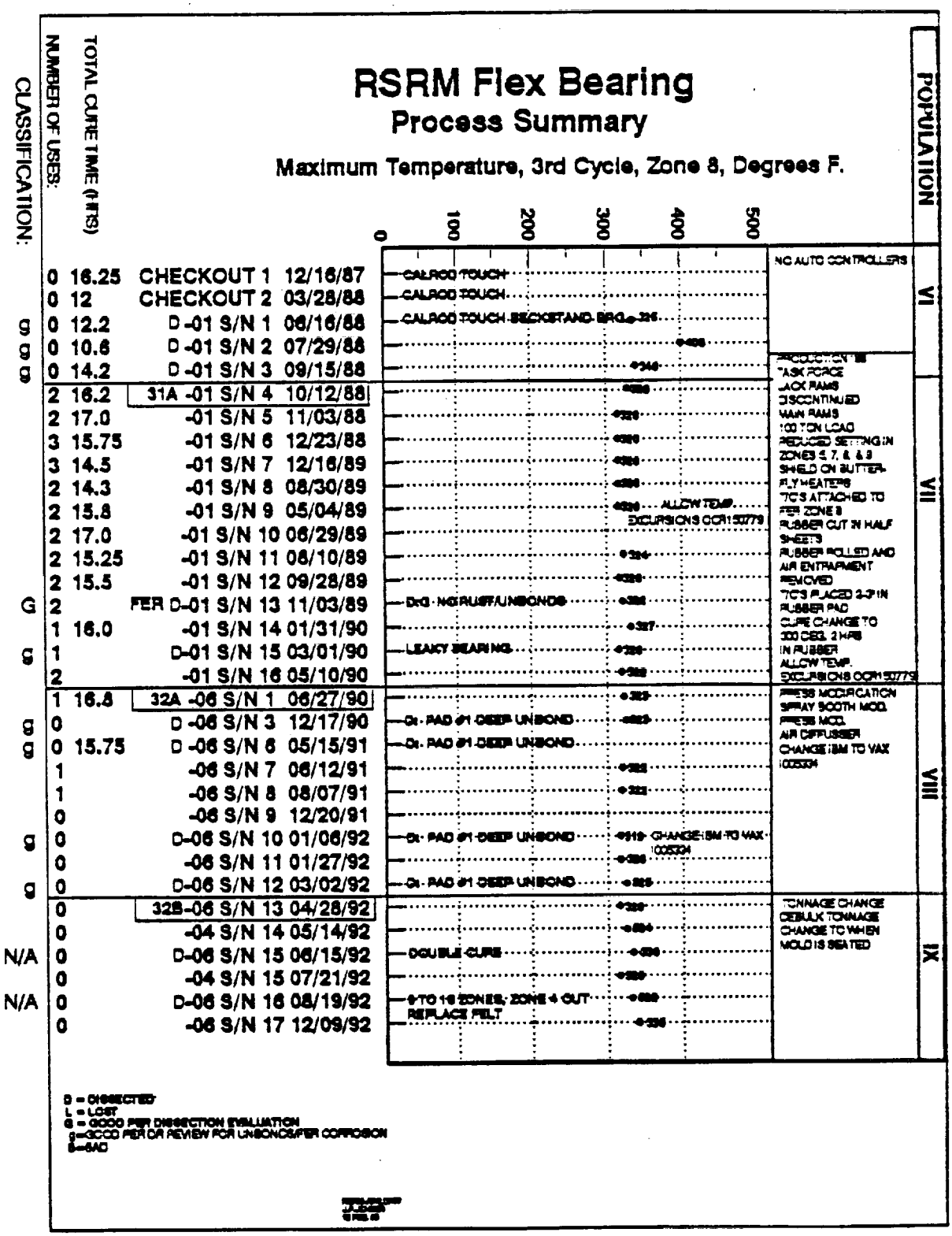

Figure 4. RSRM Line Of Position Chart

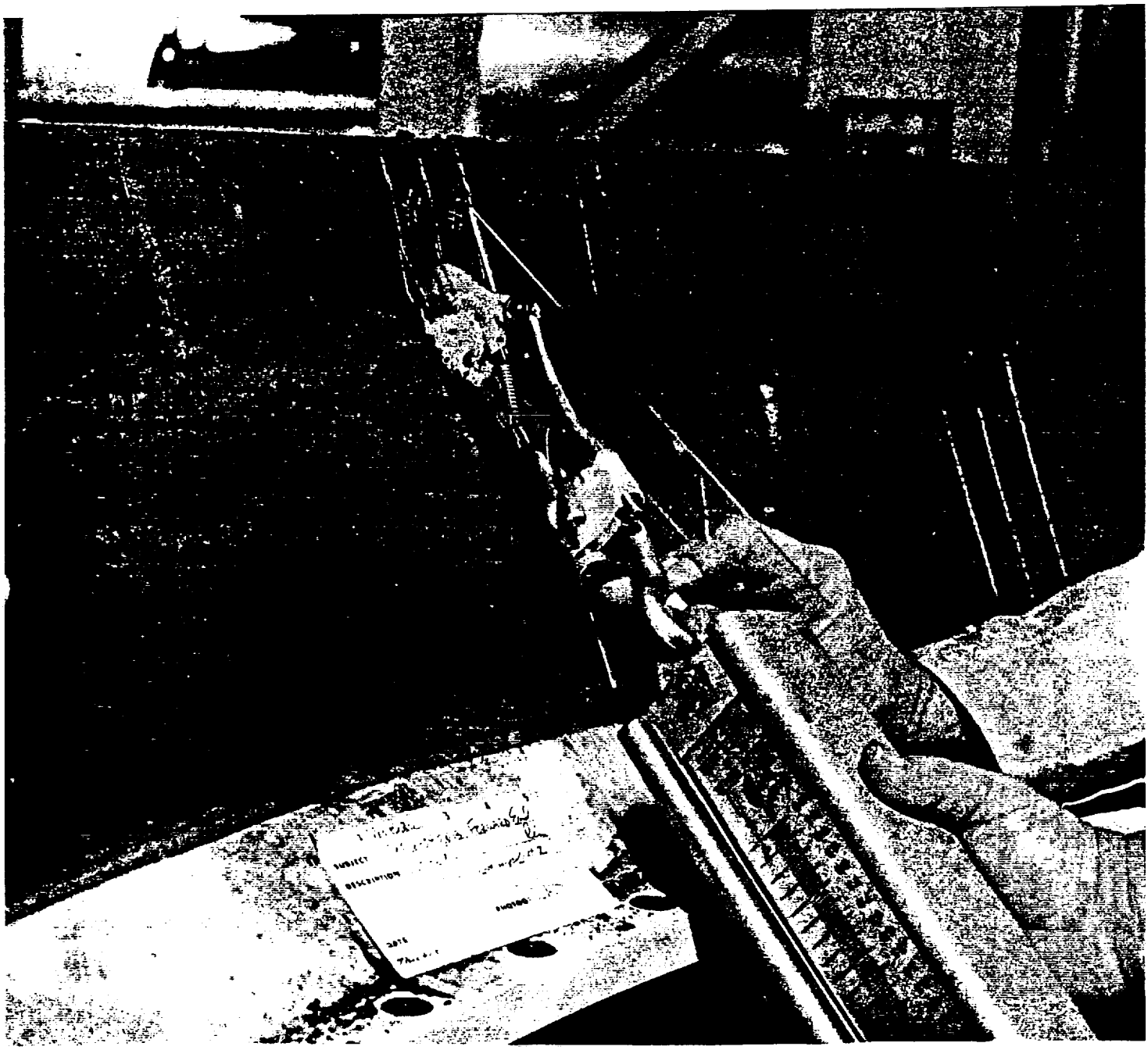

Figure 5. 30-degree Peel Specimens

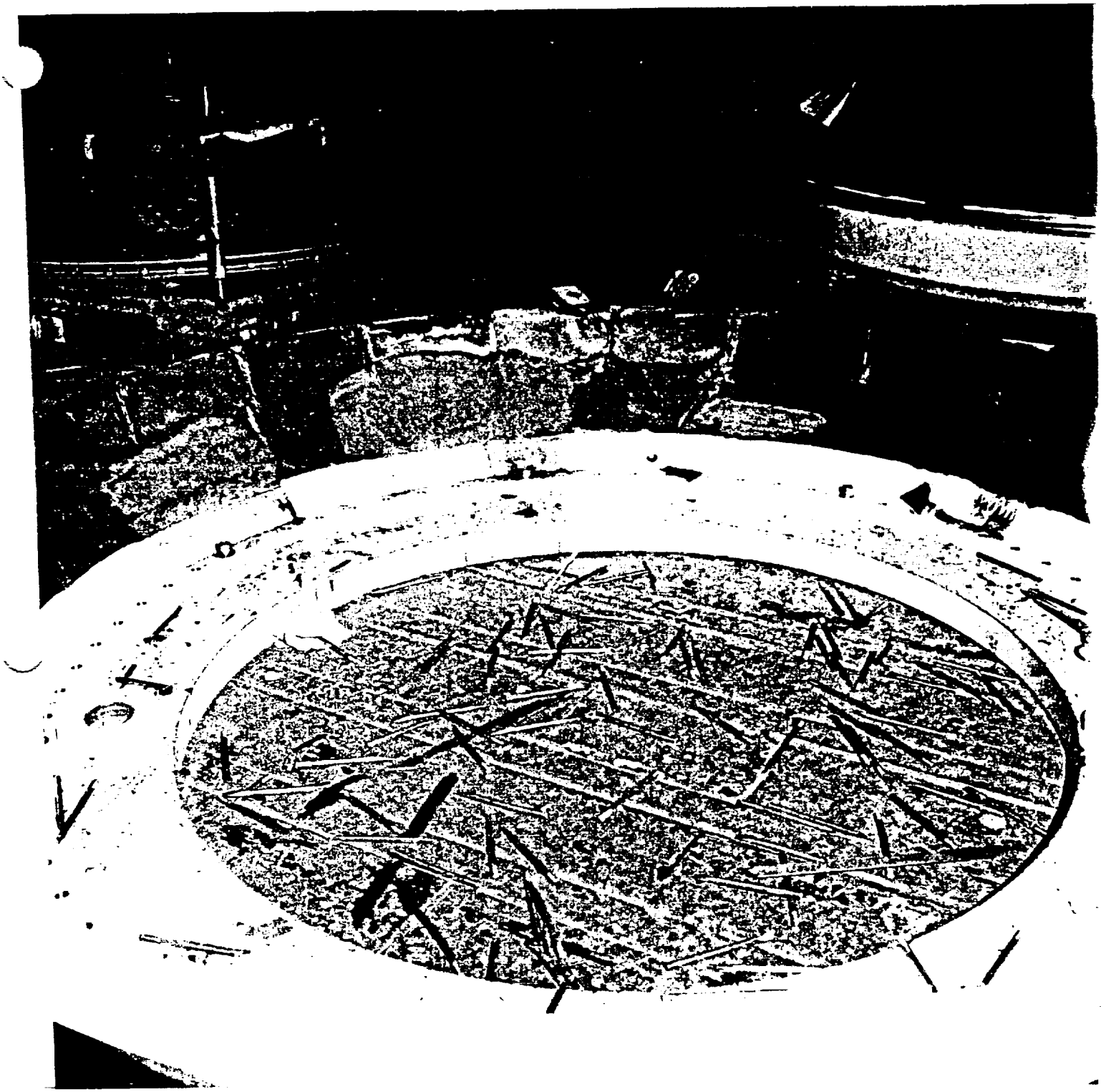

Figure 6. Bearing #24 - FSM #3

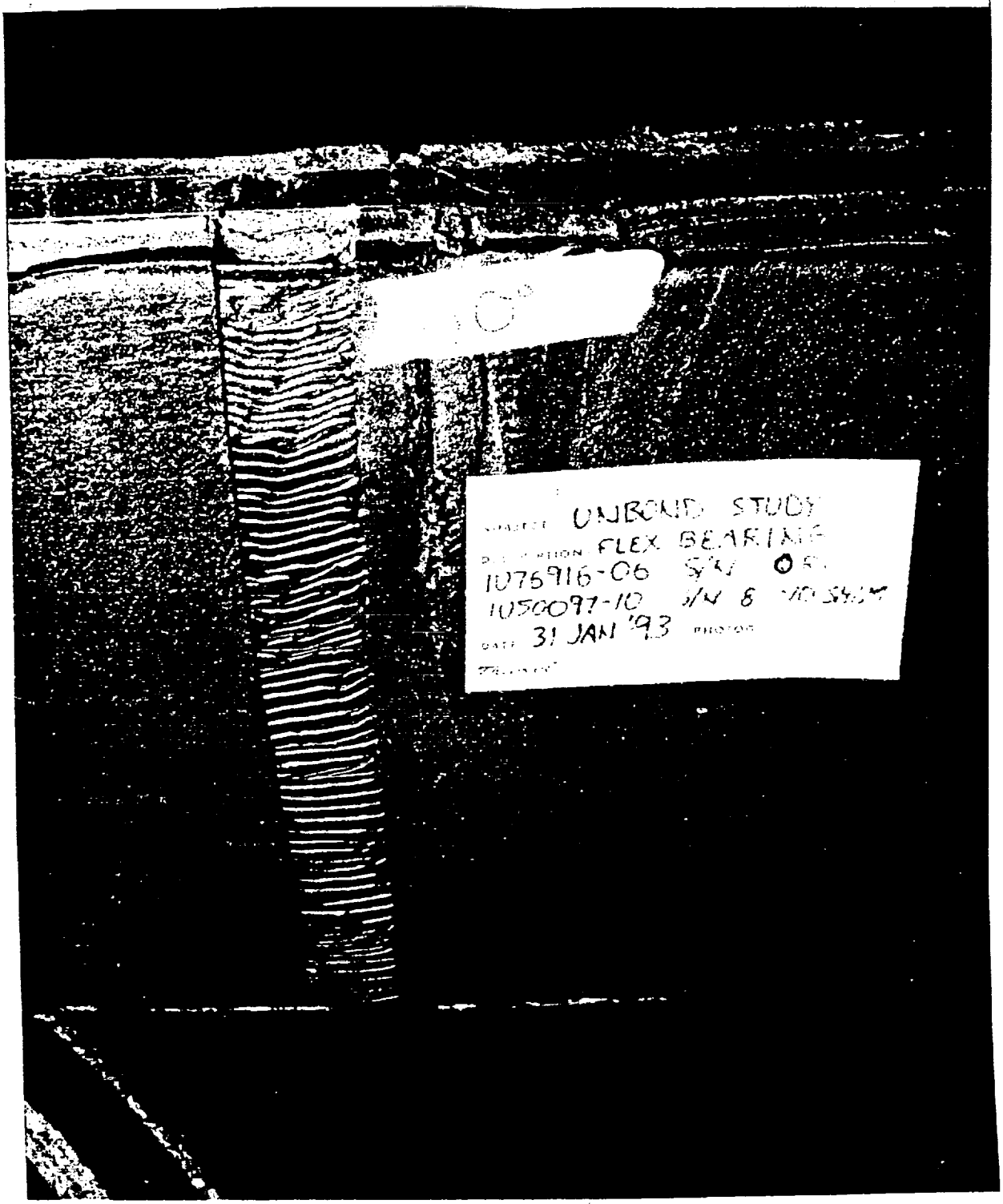

Figure 7. Bearing #29

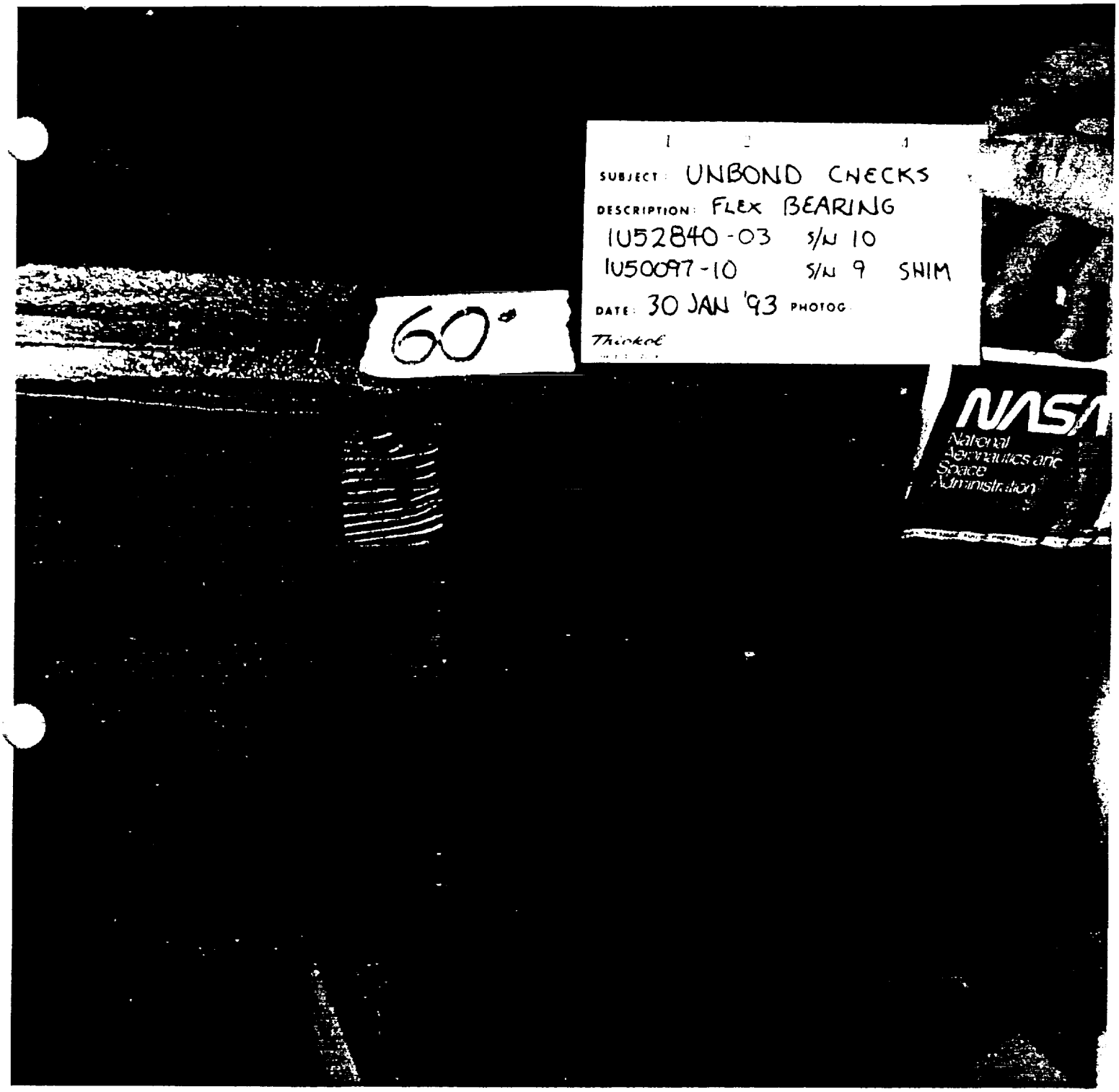

Figure 8. Bearing #22

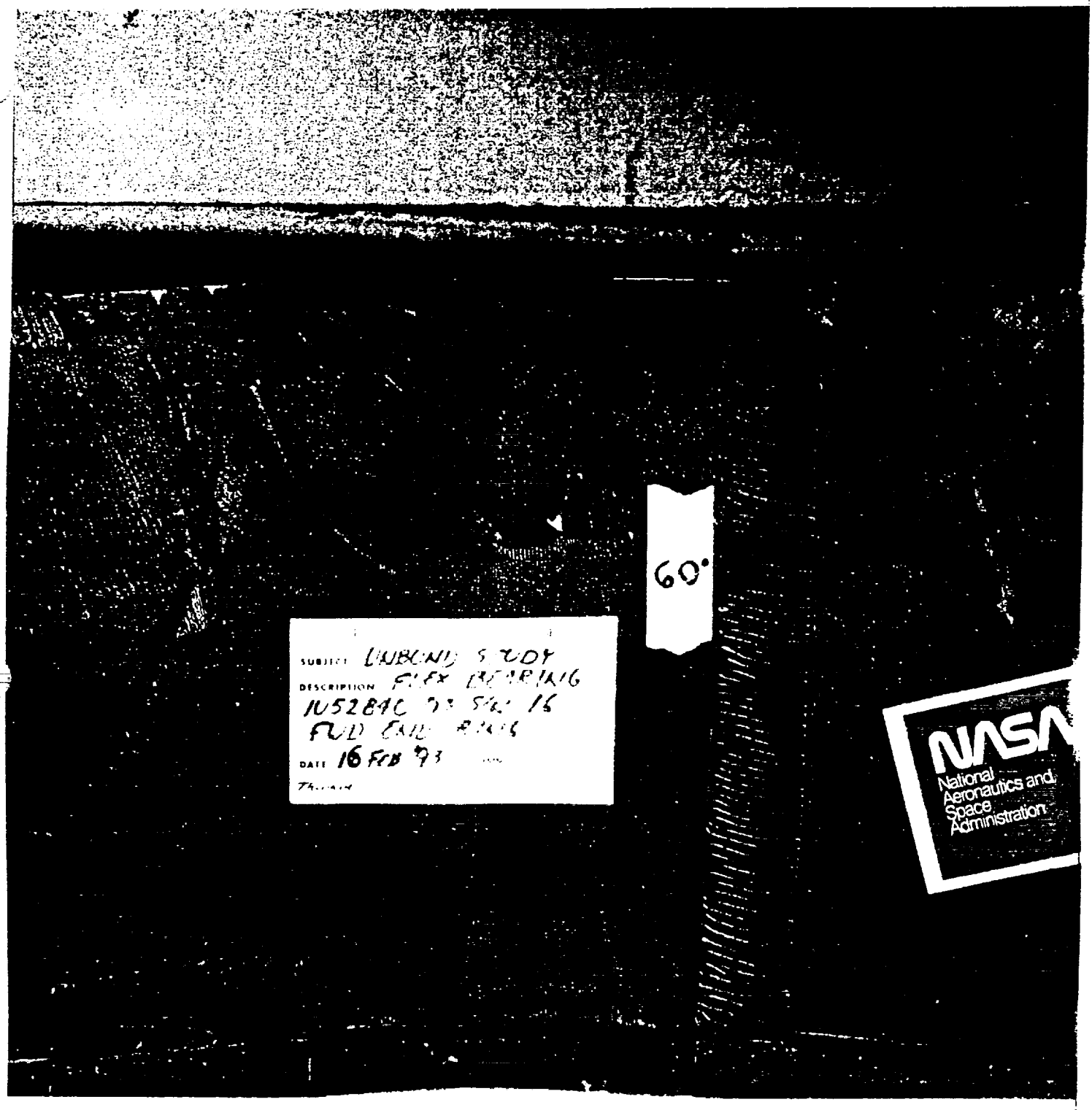

Figure 9. Bearing #20 - Snubbed

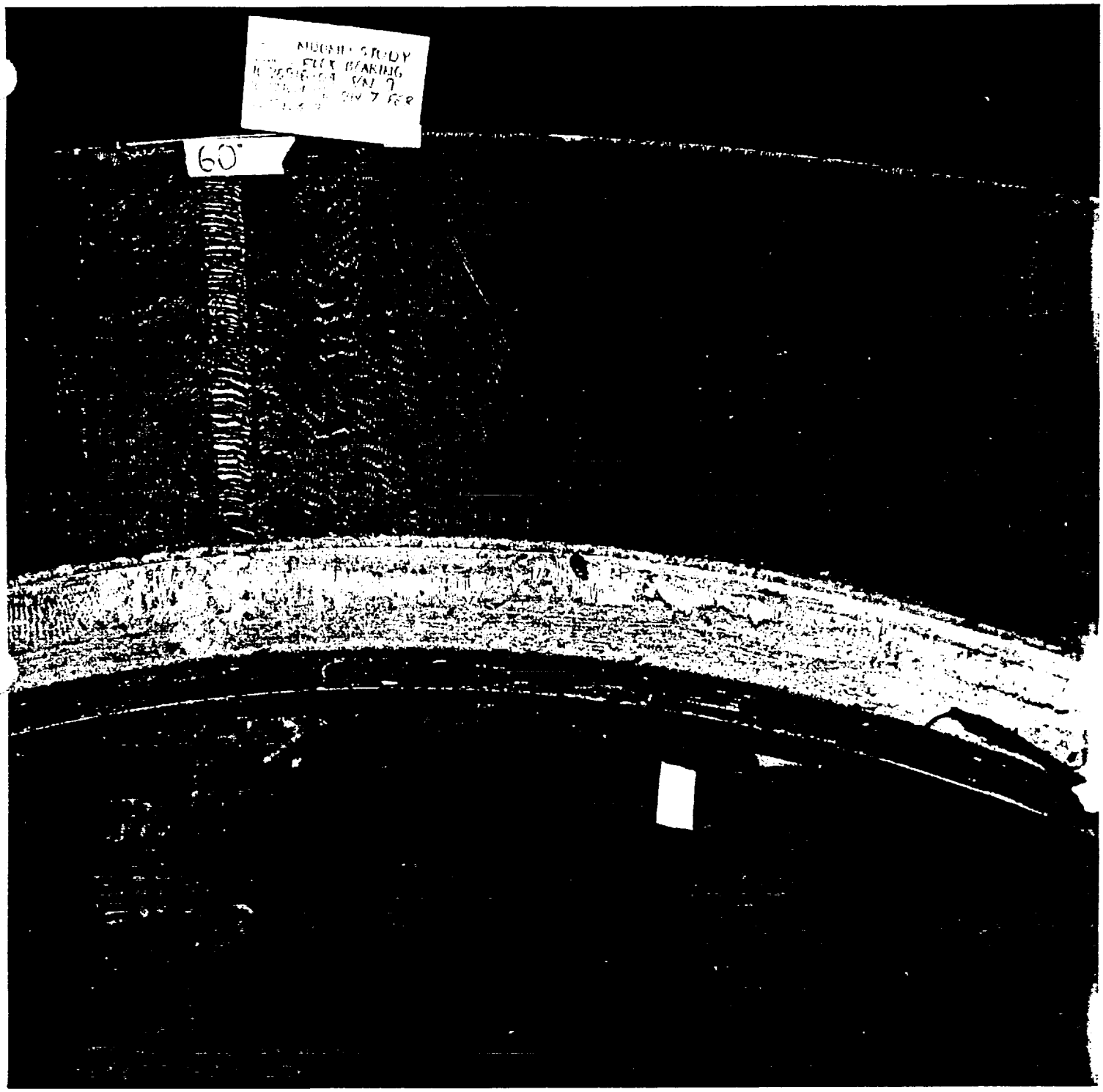

Figure 10. Bearing #27

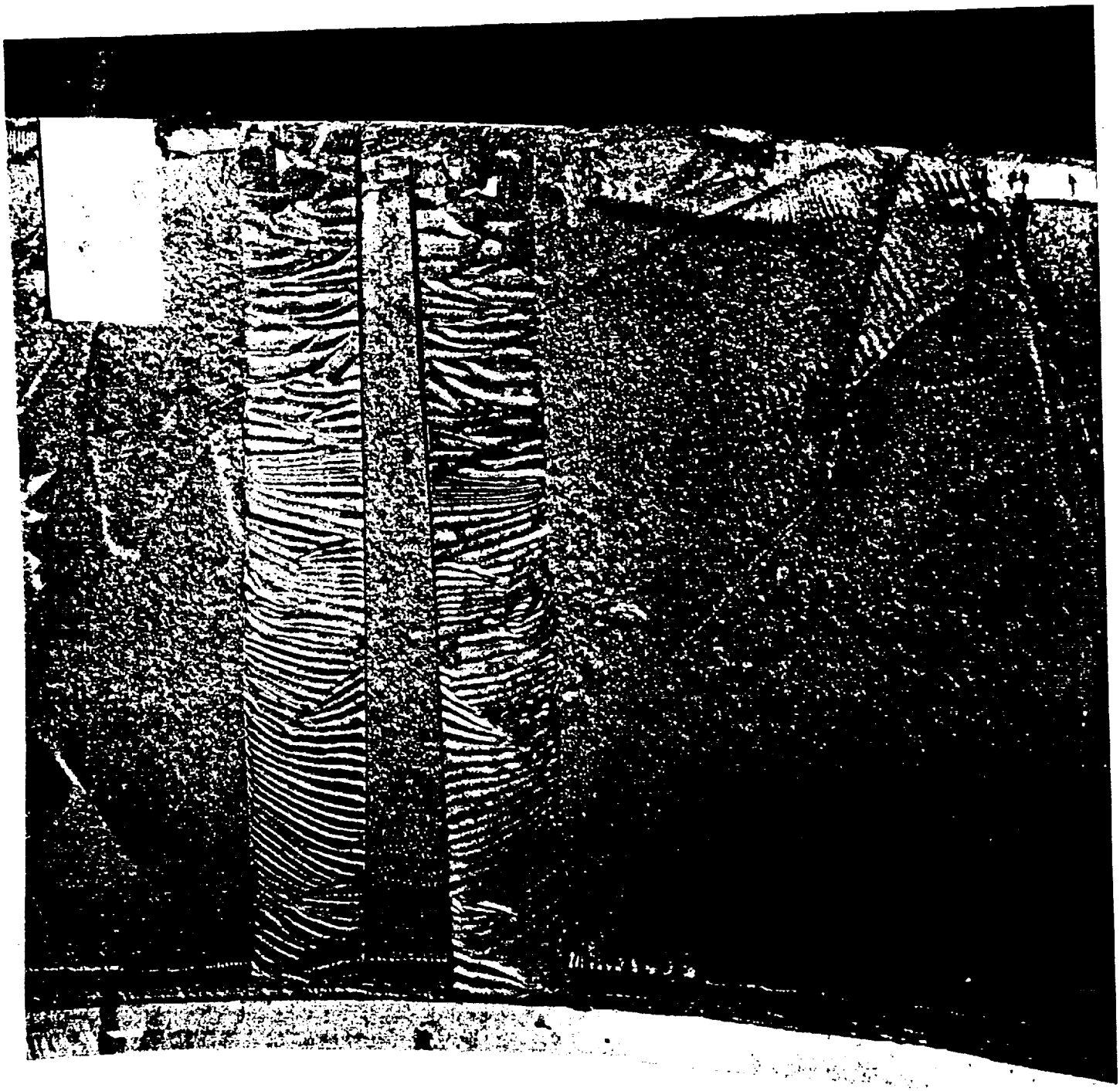

Figure 11. Bearing #35

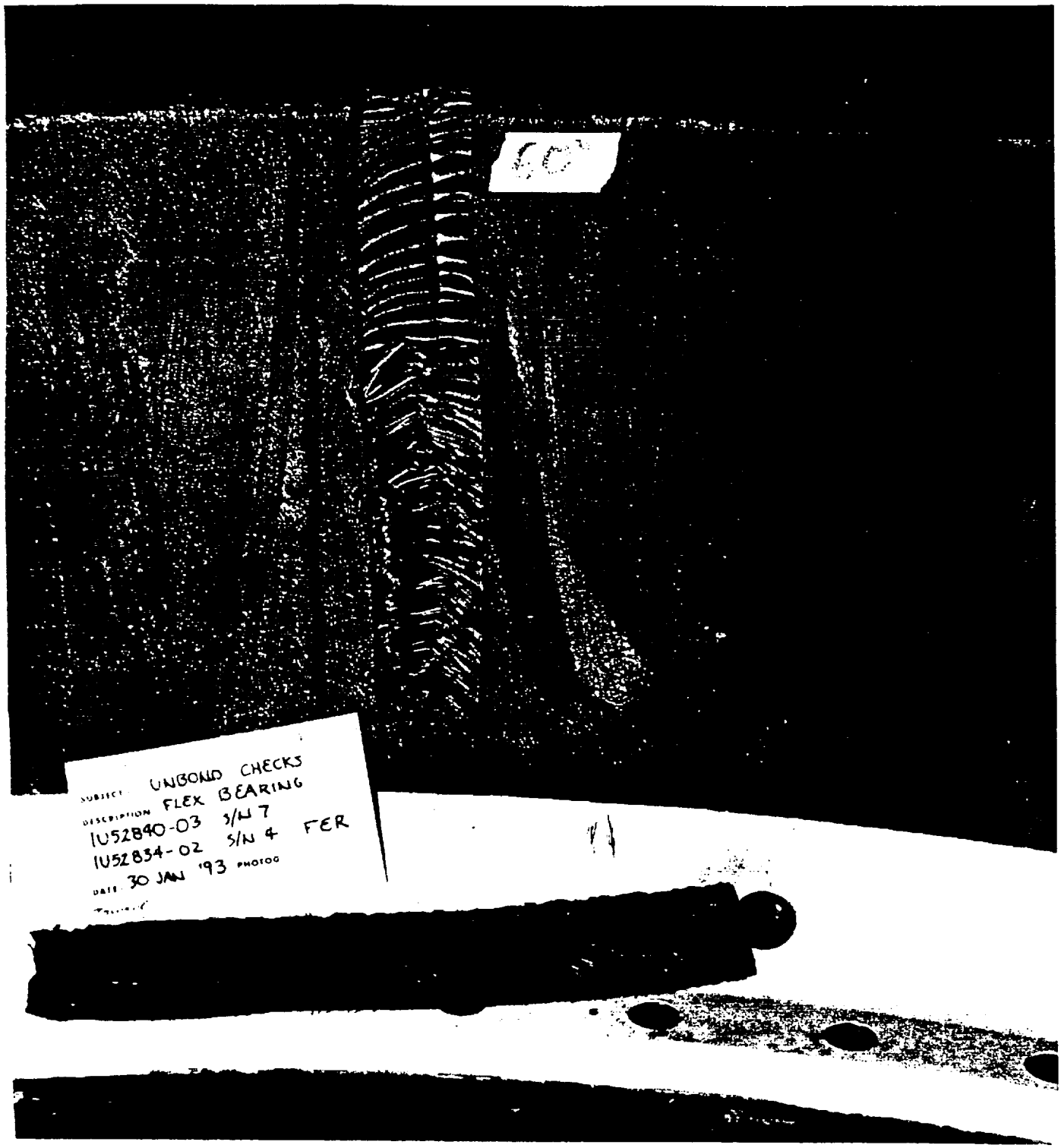

Figure 12. Bearing #39

Figure 13. Bearing #53

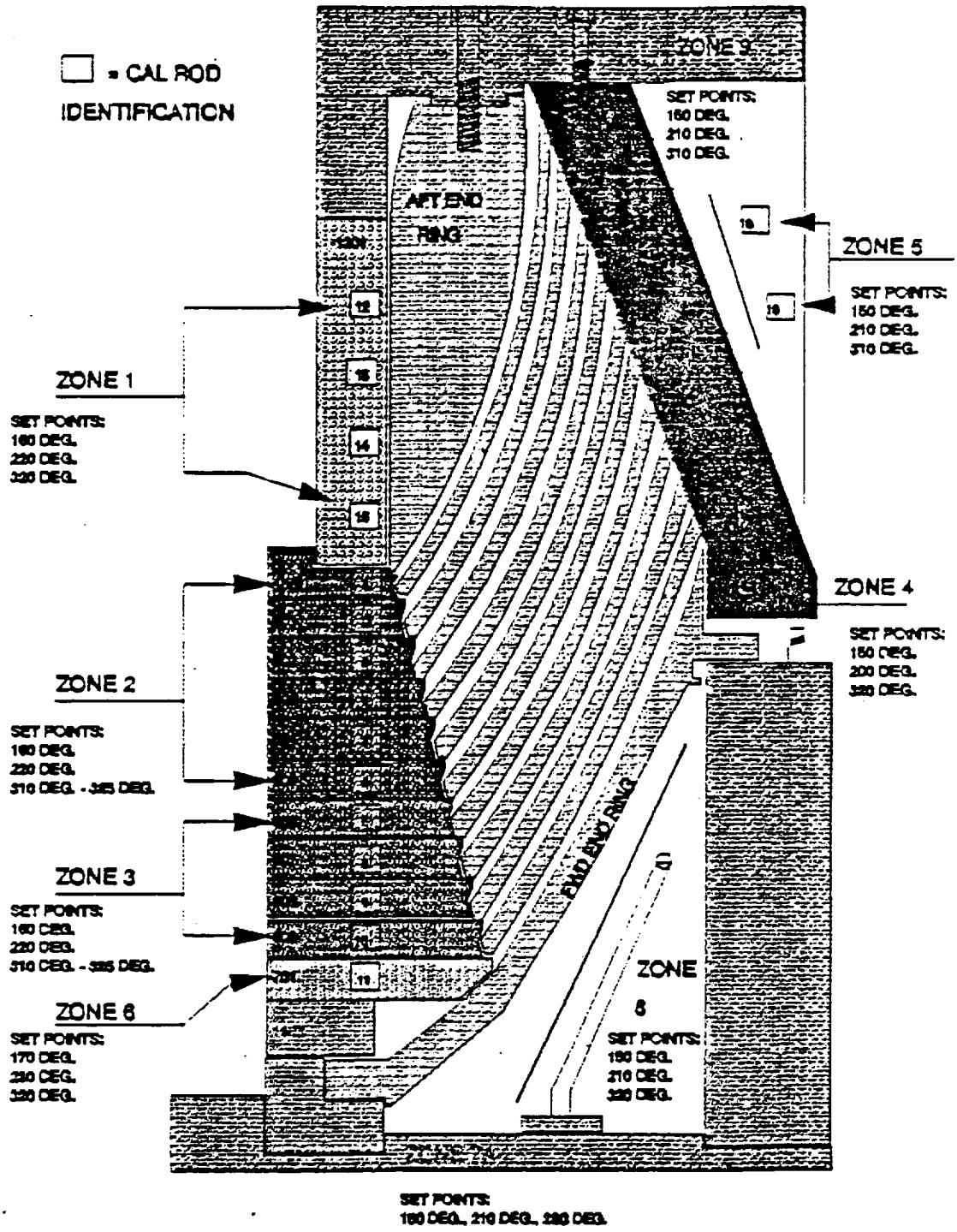

Figure 14. Mold Tool

Figure 15. Bearing #70 - Zone #4 Out

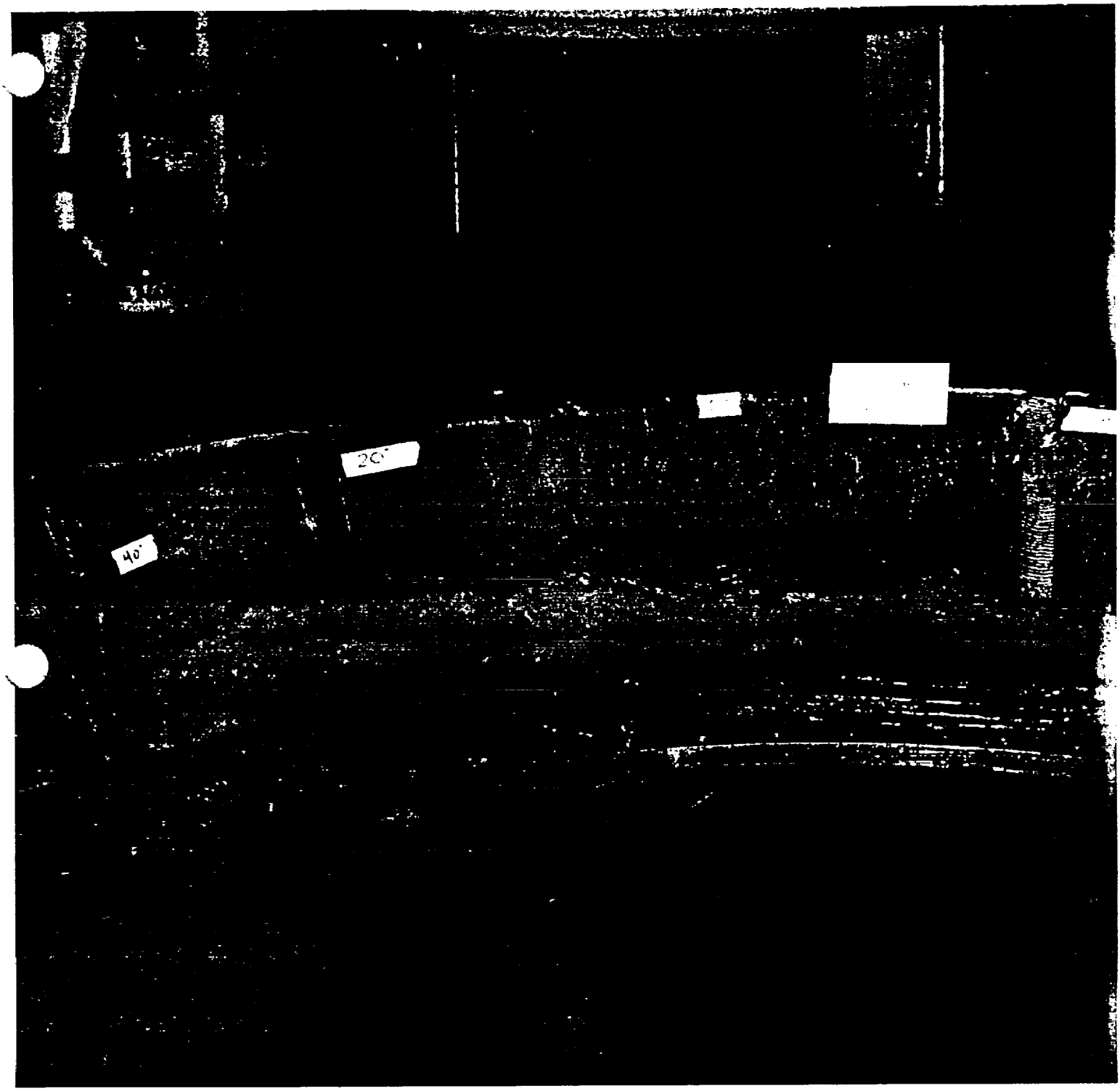

Figure 16. Bearing #68 - Double Cure

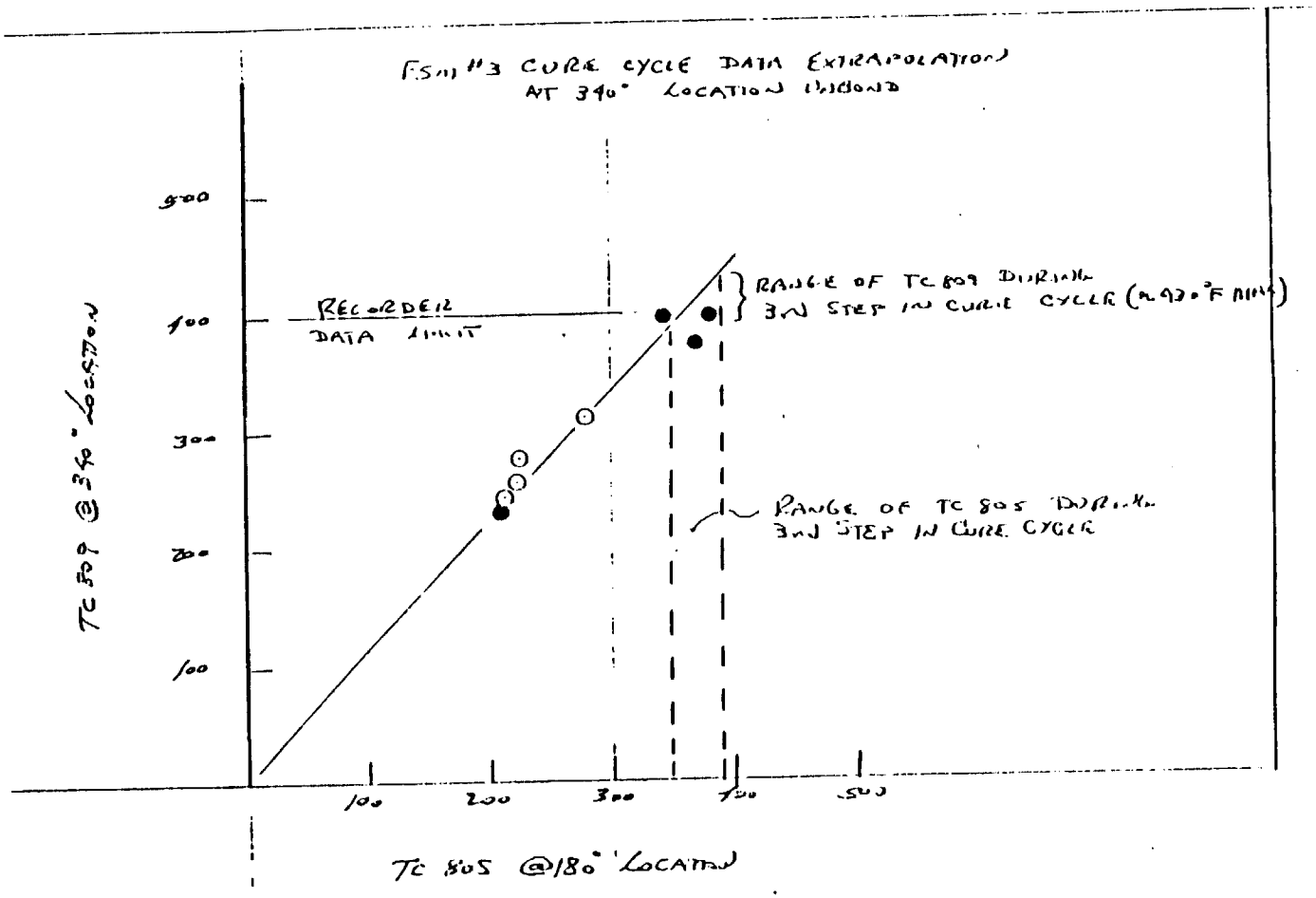

Figure 17. Temperature Extrapolation

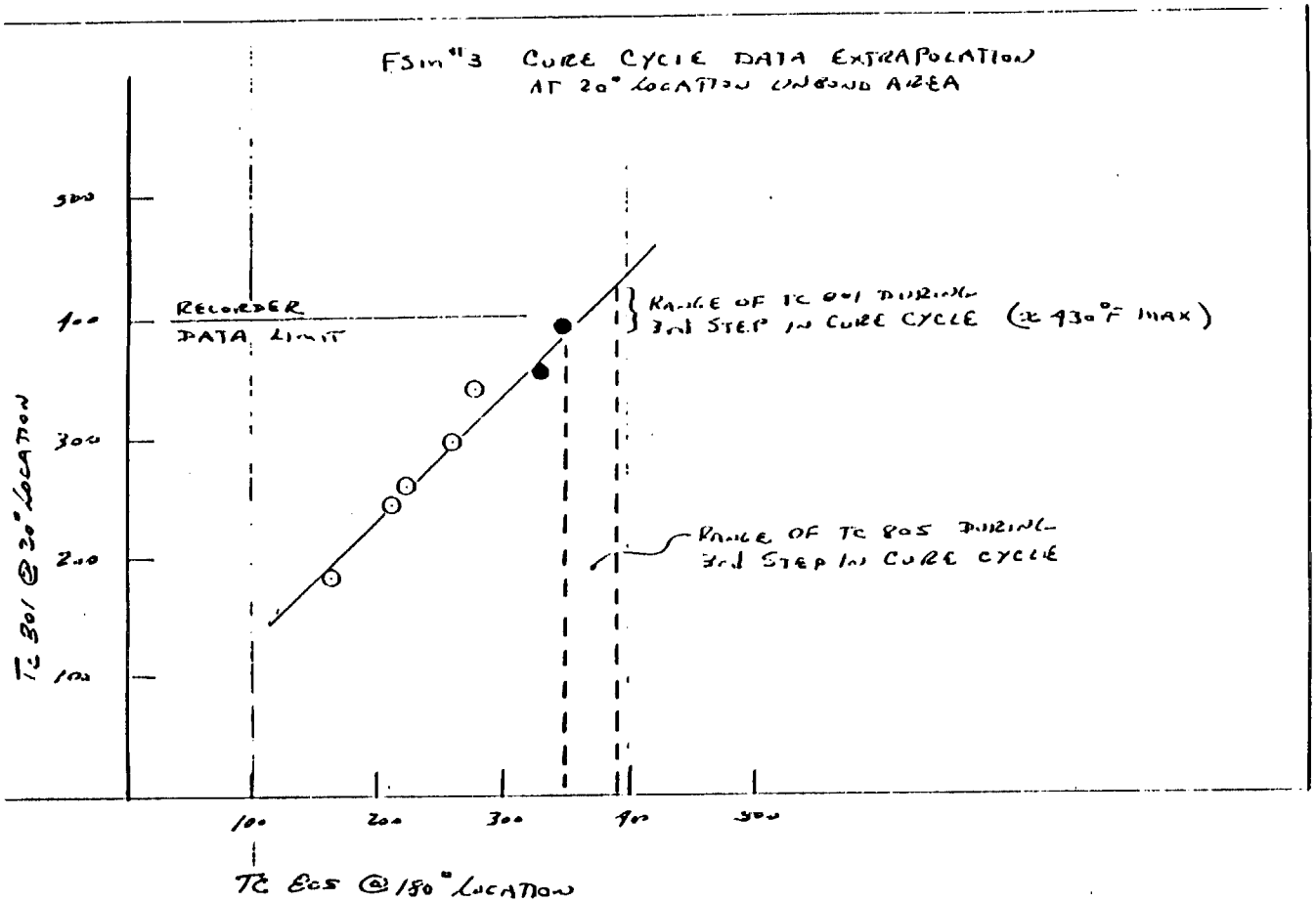

Figure 18. Temperature Extrapolation

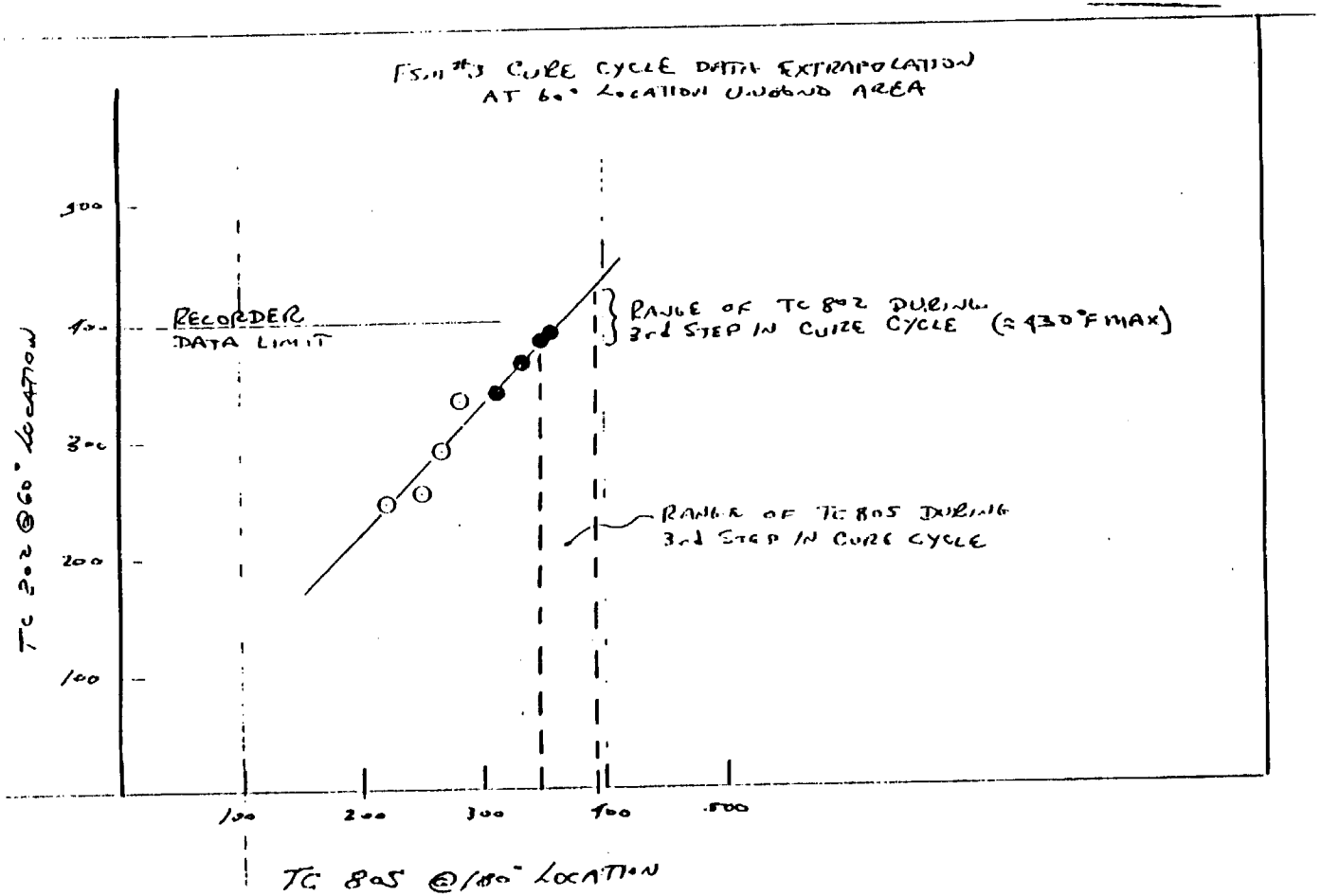

Figure 19. Temperature Extrapolation

TABLES

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Refurb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
1	1U51060-01	1	0	2/28/77		0	0	0	0	0			0	0	0	0	0		YES	PRTO-TYPE
2	1U51060-01	2	0	5/19/77		0	0	0	0	0		6/3/77	0.62	3	0	0	0	IRR35271		DM-1
2	1U51060-01	2	R1		9/26/77	0	0	0	0	0			0	0	0	0	0			DM-3
2	1U51060-01	2	R2		11/28/78	0	0	0	0	0		1/4/79	0	0	0	0	0			QM-1
2	1U51060-01	2	R3		8/8/79	0	0	0	0	0		8/30/79	0.4	9	7.84	9	7.84			2A
2	1U51060-01	2	R4		2/3/82							3/16/82	0.35	3	0.25	3	0.25			7A
2	1U51060-01	2	R5		8/18/83	6	1	11.73	1	16.98										13B
2	1U51060-01	2	R6																	WENDOVER
3	1U51060-01	3	0	9/8/77		0	0	0	0	0		10/15/77	0	0	0	0	0			DM-2
3	1U51060-01	3	R1		4/3/79	1.75	1	8.5	1	8.5	IRR50406	4/27/79	1	1	5.83	1	5.83	IRR50406		DM-4
3	1U51060-01	3	R2		6/19/81	2.55	1	15.24	1	15.24	GFP6018	7/20/81	1.75	1	8.34	1	9.92			1B
3	1U51060-01	3	R3		2/6/82	2.75	1	19.76	1	43		1/13/83	0.15	1	0.96	1	1.06			DM-5
3	1U51060-01	3	R4			2.6	1	19.37	1	19.35	DR120401	3/6/85	2.5	1	25.93	1	26.01			12B
3	1U51060-01	3	R5			2.4	1	65.39	1	299.69			2.4	1	68.68	1	302.9			TEM-4
3	1U76916-06	5	R6		10/1/91	2.7	1	65.4	1	299.69		10/23/91	2.7	1	68.68	1	303.5			DISSECTED
4	1U51060-01	4	0	10/9/78	11/3/78	0	0	0	0	0		12/14/78	0	0	0	0	0			QM-2
4	1U51060-01	4	R1		12/11/79	0.36	6	0.27	6	0.27		1/24/80	0							3A
4	1U51060-01	4	R2		5/13/82							7/7/82	0.3	6	0.11	4	0.2			8A
4	1U51060-01	4	R3			0	0	0	0	0		5/16/84	0.45	6	6.82	5	6.96			17A
4	1U51060-01	4	R4		6/15/85	0.4	3	8.8	3	14.75		7/9/85	0.4	6	0.14	6	0.28			24B
4	1U52840-03	9	R5			0.8	1	36.34	3	112.16		2/24/88	0.5	3	10.25	3	31.35	DR169478		R3A
4	1U52840-03	9	R6																	10A
4	1U76916-04	8	R7		8/14/90	1.5	4	62.7	2	273.96	DR404001	9/18/90	1.5	4	62.7	2	277.05	DR404044		R21A
4	1U76916-04	8	R8														283.93			R33A
5	1U51060-01	5	0	11/1/78	12/22/78							2/20/79	0.5	10	0.23	10	0.23			1A
5	1U51060-01	5	R1		6/10/81	0.25	5	0.5	5	0.88		8/14/81	0.45	6	1.71	6	2.67			6B
5	1U51060-01	5	R2		6/3/83	0.4	7	1.25	7	1.8		7/14/83	0.63	1	2.5	1	4.4			13A
5	1U51060-01	5	R3									11/2/84	1.3	4	1.41	6	4.13			21B
5	1U51060-01	5	R4		2/27/86	0.7	4	8.5	6	14.29		4/3/86	1.3	2	3.25	1	7.98			DM-9
5	1U52840-03	1	R5		4/15/88	4.8	2	78.65	2	86.04	DR150152	5/11/88	4.8	2	79.04	2	137.56			TEM-7
5	1U52840-03	1	R6																	DISSECTED
6	1U51060-02	6	0	1/14/79	2/6/79	12	1	200	1	0	IRR49664		0	0	0	0	0			DISSECTED
7	1U51060-02	7	0	2/27/79	3/1/79	0.9	1	17.75	1	25.48	IRR50261		0	0	0	0	0			DISSECTED

Table I. Flex Bearing Identifiers/Uses

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Refurb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
8	1U51060-02	8	0	5/4/79	5/7/79	T2	1	0	0	0	IRR51650		0	0	0	0	0			DISSECTED
9	1U51060-06	1	0		11/3/78	9.5	1	615.13	1	677.13			0	0	0	0	0			TEST AREA
10	1U51060-07	1	0	8/5/79	8/13/79	0.2	8	0.24	8	0.24		9/17/79	0.2	8	1.62	8	6.12			QM-3
10	1U51060-07	1	R1		5/2/80	0.8	1	1.8	1	2.4			0	0	0	0	0			3B
10	1U51060-07	1	R2		5/13/82	0.75	1	1.26	1	3.09		8/2/82	0.76	1	6.62	1	4.15			8B
10	1U51060-07	1	R3		1/25/84	0.8	1	4.56	1	7.32		2/27/84	1.1	1	8.13	1	10.35			16A
10	1U51060-07	1	R4		7/11/85	1	1	11.96	1	13.34	DR126489	8/6/85	1.08	1	11.95	1	12.56			25A - LOST
11	1U51060-07	2	0	9/9/79	10/10/79	4.25	1	194.5	1	210.16	IRR54938	10/29/79	4.6	1	263.89	1	283.12			DISSECTED
12	1U51060-07	3	0	10/4/79	10/10/79	0.31	3	0.28	3	0.28		11/13/79	1.17	1	2.11	1	2.26			2B
12	1U51060-07	3	R1		2/25/82	2.6	1	42.7	2	83	GFPR6823	6/25/82	2.6	1	116.4	1	450.5		YES	QM-4
12	1U51060-07	3	R2		5/9/83	3	3	0	0	0		8/13/83	2.55	3	0	0	0	GFPR6823		DM-6
12	1U51060-07	3	R3		12/4/84						DR122007									ETM-1A
12	1U52840-03	12	R4		7/3/88	2.8	1	116.7	1	499.91		8/1/88	3.4	2	103.79	2	524.94			QM-8
12	1U52840-03	12	R5																	DISSECTED
13	1U51060-07	4	0	12/16/79	12/21/79	1.1	2	1.2	10	1.64		1/30/80	1	2	1.2	1	4.25			4A - LOST
14	1U51060-10	1	0	5/30/80	6/9/80	0	0	0	0	0		8/28/80	0.88	1	9.85	1	9.96	IRR70744		DISSECTED
15	1U51060-10	2	0	12/18/80	1/9/81	0	0	0	0	0		2/27/81	0	0	0	0	0			5A
15	1U51060-10	2	R1		3/16/83	0	0	0	0	0		4/11/83	0.36	11	6.58	10	9.46			11B
15	1U51060-10	2	R2		8/1/84	0.8	10	1.92	10	2.13		10/2/84	0.2	11	0.12	11	0.12			21A
15	1U51060-10	2	R3		11/7/85	1	1	1.58	1	1.58		12/3/85	0.35	2	3.8	2	3.8			R6A
15	1U76916-																			
15	1U76916-04	6	R4		1/3/90	0.5	1	50.17	2	151.64		2/2/90	0.5	1	50.17	2	153.14			R19B
15	1U76916-04	6	R5							189.72	DR411852						190.87			R30A
16	1U51060-10	3	0	1/30/81	2/5/81	0.25	7	1.27	7	1.65		3/10/81	0.18	7	0.08	7	0.08			5B
16	1U51060-10	3	R1									9/15/83	3.15	1	31.17	1	61.27			12A
16	1U51060-10	3	R2		12/6/84	4.2	1	54.6	1	82.56	DR121930	1/11/85	4.26	1	76.68	1	106.41	DR121930		DISSECTED
17	1U51060-10	4	0	3/1/81																DISSECTED
18	1U51060-12	1	0	4/1/81																4B - LOST
19	1U51060-12	2	0	5/7/81	5/14/81	1.6	1	6	7	15.9		6/25/81	1	1	8.1	1	8.62			6A

Table II. Data Comparison

Hierarcy Based upon Max. Average Temp. for any Zone #8 Heater

Bearing Status	Part # Serial #	Fab. Date	Max. Avg. Temp. F.	Max. Temp. F.	FER Condition	Shim #10 Condition	Pad # - Unbonds	Comments
FSM#3	-12 S/N 7	02/12/83	415/#11	424	Rust/Unbonds (I.D. & O.D.)	Rust/Unbonds	YES - I.D. O.D.	Visual Exam. (340 - 110 deg.)
Dissect	-12 S/N 8	03/23/83	401/#2(***)	438	Rust/Unbonds (I.D. & O.D.)	"	YES - O.D.	DR (46 -107 deg.)
Dissect - good areas	-12 S/N 8	03/23/83	408/#11	438	"	"		
Dissect	-12 S/N 12	10/08/83	402/#1	442	"	No Rust/Unbonds	NO	Visual Exam. (No FER)
Dissect	-12 S/N 5	10/18/82	397/#11	415	"	No Rust/Unbonds	NO	Visual Exam. (No FER)
R31B	-12 S/N 4	07/20/82				OK	NO	
Dissect	-10 S/N 3	01/30/81	392/#11	420	"		NO	
FSM #3 - good areas	-12 S/N 7	02/12/83	392/#5	400	No Rust/Unbonds	No Rust/Unbonds	NO	Visual Exam.
Dissect	-10 S/N 1	05/30/80	386/#11	414	"		NO	Discoloration/corrosion on I.D. of shim and FER ***
Dissect	-12 S/N 3	04/02/82	384/#11	400		No Rust/Unbonds	NO	Visual Exam., Edge unbond; O.D. FER 57 to 72 deg 1.5 in. deep max. (62 deg)
R34A	-12 S/N 9	04/22/85	379/#1	400	OK	OK	YES - O.D.	59.4 sq. in, all on O.D.; 1.7 max depth at 120 deg.
Lost	-07 S/N 4	12/16/79	377/#2	416	N/A	N/A	NO	
Lost	-12 S/N 13	11/12/83	376/#5	400	N/A	N/A	YES - O.D.	53 to 96 deg.; 55 sq. in.; max depth at 2.25" (ALL OD.)
Dissect	-12 S/N 10	06/06/83	375/#5	399	No Rust/Unbonds	No Rust/Unbonds	NO	Visual Exam.
Dissect	-12 S/N 11	07/28/83	367/#2	398	"		NO	
R30B	-12 S/N 14	04/29/84	365/#11	400	OK	OK	YES - O.D.	1.8 SQ in. (O.D.); 314 deg = 1 in. deep
Dissect	-12 S/N 2	05/07/81	360/#11	404	"	"	NO	
Dissect	-10 S/N 4	03/01/81	355/#11	420	"		NO	
R30A	-10 S/N 2	12/18/80	350/#11	395	OK	OK	NO	
Test Area	-12 S/N 6	11/11/82	348/#11	364	N/A	N/A	NO	
Dissect	-12 S/N 15	08/11/84	343/#11	363	"		NO	
Dissect	-12 S/N 21	04/11/86	328/#2	339	"		NO	Cal Rod Touched
TEM#10	-12 S/N16	05/04/85	327/#1	346	OK	OK	YES - O.D.	14.3 in. (all O.D.) intermintently 238; 352 deg.
Dissect	-12 S/N 18	11/12/85	324/#2	330	No Rust/Unbonds	No Rust/Unbonds	NO	Visual Exam
R34B	-12 S/N 20	12/13/85	323/#5	337	OK	OK	YES - O.D.	.7 sq. in. (O.D.) max depth .5
Dissect	-12 S/N 17	10/14/85	322/#1	329	"		YES - O.D.	5.8 total (all O.D.) max. depth .5 @ 335 to 347 deg
R33B	-12 S/N 19	11/27/85	320/#1	326	OK	OK	NO	

* No Record of Pitting/Rust/Corrosion or Unbonds

** Minimum

*** Typical of the majority of bearings

	TC #1 20 DEG	TC #2 60 DEG	TC #3 85 DEG	TC #4 100 DEG	TC #5 140 DEG	TC #6 180 DEG	TC #7 220 DEG	TC #8 260 DEG	TC #10 300 DEG	TC #11 340 DEG	275 DEG
FSM #3	414	413	352	306	392	376	384	386	379	415	325
DISSECT 3/23/83	407	401	352	308	N/A	374	382	382	378	408	325
DISSECT 10/08/83	402	401	356	312	379	360	354	386	382	401	329
DISSECT 10/18/82	387	390	344	305	378	372	379	382	380	397	323
R 31 B 7/20/82	N/A	391	347	302	377	365	371	371	367	395	318
DISSECT 1/30/81	391	385	336	290	365	358	370	374	368	392	324
DISSECT 5/30/80	380	376	339	376	362	351	371	379	366	386	338
DISSECT 4/02/82	374	374	335	292	355	354	365	366	355	384	313
R 34 A 4/22/83	379	378	335	290	353	343	355	358	352	375	310

Table III. Temperature Comparison

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Refurb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
19	1U51060-12	2	R1			0	0	0	0	0		8/12/83	0.01	1	4.3	1	5.93			10B
19	1U51060-12	2	R2		4/13/84	1.5	2	82.5	2	141.12	DR133791									DM-7
19	1U51060-12	2	R3		8/22/85	2.1	2	70.74	2	95.18	DR113791		3.3	5	173.68	5	702.92			FBTT-DISST
20	1U51060-12	3	0	4/2/82	4/9/82	0.3	1	4.85	9	6		5/7/82	0	0	0	0	0			7B
20	1U51060-12	3	R1		8/12/83	0.45	9	3.61	3	5.86		11/23/83	1.9	1	10.21	3	11.54	DR107667		18A
20	1U51060-12	3	R2		8/15/85	1.4	0	11.31	3	14.66	DR127804	9/26/85	1.92	1	12.24	3	17.18			TEM-3
20	1U52840-03	16	R3		12/16/89	2.6	1	38.97	1	100.81	DR400421	1/19/90	2.6	1	47.4	1	130.24			R13B
20	1U52840-03	16	R4									3/25/91	2.5	1	75.6	1	223.8			FSM-2
20	1U52840-03	16	R5		12/19/91	2.5	1	78.4	1	230.8										DISSECTED
21	1U51060-12	4	0	7/22/82	8/3/82	0	0	0	0	0		10/7/82	0.53	1	5.96	1	6.83			9A
21	1U51060-12	4	R1		2/16/84	0.65	1	1.3	1	2.67			0	0	0	0	0			17B
21	1U51060-12	4	R2		5/30/85	0.8	2	7.37	4	25.7		7/1/85	0.9	3	9.29	3	12.43			24A
21	1U51060-12	4	R3		6/26/86	0.9	3	5.76	4	16.94		8/13/86	0.97	3	8.36	3	16.49			R1B
21	1U52840-03	3	R4			0.95	3	9.98	3	23.53		2/15/89	1	4	5.55	4	21.39			R9B
21	1U76916-04	7	R5			1.2	4	38.08	6	107.07		8/1/90	1.8	4	59.23	6	153.27			R20A
21	1U76916-04	7	R6							252.56	DR412347						357.75	DR412347		R31B
22	1U51060-12	5	0	10/18/82	10/26/82			0.9	2	1.15										10A
22	1U51060-12	5	R1		4/10/84			26.8	2	65.6	DR113775									19A
22	1U52840-03	10	R2		10/9/85	2.45	2	20.22	2	25.59	DR127756	11/11/85	2.2	2	11.29	2	17.29			R2B
22	1U52840-03	10	R3		2/7/89	2.2	2	59	2	321.61	DR165123	9/24/89	2.24	2	58.25	2	332.05	DR165124		FSM-1
22	1U52840-03	10	R4							306.05							337.14			DISSECTED
23	1U51060-12	6	0	11/11/82	11/23/82			1.96	10	2.96										14B
23	1U51060-12	6	R1		2/8/85	0	0	45.08	2	77.21	DR120443	3/18/85	1.9	2	33.82	2	81.28			22A
23	7U76754-01	1	R2		4/15/86	0	0	0	0	0	DR146751	6/24/86	2.3	8	77.08	2	151.18	DR146751		TEST AREA
24	1U51060-12	7	0	2/12/83	2/18/83	0.15	5	0.16	4	0.34			0.4	2	1.32	1	2.62			9B
24	1U51060-12	7	R1		2/10/84	1.3	4	7.27	5	14.17			0	0	5.52	1	14.6			20A
24	1U51060-12	7	R2		1/7/86	2	1	2.08	1	10.1		2/19/86	2.22	1	33.67	1	117.27	DR143454		DM-8
24	1U52840-03	6	R3			2.11	1	14.7	5	29.51		12/7/87	2.1	1	32.43	1	82.79			R2A
24	1U52840-03	6	R4			0	0	0	0	0		3/25/89	2.18	1	74.9	1	141.95			R16B
24	1U76916-04	13	R5		8/19/91	2.6	1	87.51	1	204.69	DR409428	10/3/91	2.6	1	88.49	1	252.78	DR409428		FSM-3
24	1U76916-04	13	R6															DR414550		DISSECTED
25	1U51060-12	8	0	3/23/83								5/18/83	1.32	4	4.08	11	10.19			14A
25	1U51060-12	8	R1		1/11/85	1.5	3	3.61	4	10.25		3/22/85	2.26	1	1.71	3	4.98	DR123224		22B
25	1U51060-12	8	R2		1/15/86	2.26	1	48.63	11	65.46			2.5	2	121.88	11	194.65			DISSECTED

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Refurb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
26	1U51060-12	9	0	4/22/83		0	0	0	0	0			0	0	0	0	0			15A
26	1U51060-12	9	R1		3/17/85	0.63	10	2.17	10	2.67		4/30/85	0	0	23.16	11	25.56	DR123439		23A
26	1U52840-03	2	R2			0	0	0	0	0			0.8	11	61.16	1	130.61			R1A
26	1U52840-03	2	R3			0	0	0	0	0		2/27/89	2	3	19.92	11	26.79			R8A
26	1U76916-04	2	R4		4/18/90	0.75	3	54.7	1	122.89		5/15/90	0.9	3	61.16	1	130.61			R17B
26	1U76916-04	2	R5		10/25/91	2.1	11	85.45	1	340.13		10/25/91	2.1	11	85.45	10	340.13			R34A
27	1U51060-12	10	0	6/3/83	6/6/83	0.5	1	0.79	1	1.17		6/11/83	1.35	3	1.5	1	3.02			11A
27	1U51060-12	10	R1		6/13/84	1.5	3	2.08	3	6.55			0	0	0	0	0			19B
27	1U51060-12	10	R2		10/1/85	1.95	4	3.65	1	10.41		11/6/85	1.7	4	3.83	2	13.6			R4B
27	1U52840-03	14	R3			1.9	4	7.5	6	18.51		8/3/89	1.9	4	7.6	6	22.05			R10B
27	1U76916-04	9	R4		8/27/90	3.2	4	26.71	4	56.99		10/11/90	3.9	4	26.71	4	62.34			R20B
27	1U76916-04	9	R5																	DISSECTED
28	1U51060-12	11	0	7/28/83		0	0	0	0	0		9/24/83	2.1	2	29.87	2	41.11	DR105934		16B
28	1U51060-12	11	R1		7/13/85	3.68	2	52.03	2	85.3	DR126494		0	0	0	0	0	DR126494		TEM-2
28	1U51060-12	11	R2																	DISSECTED
29	1U51060-12	12	0	10/2/83	1/8/84	0.9	1	5.5	1	5.97		1/24/84	1.13	1	16.59	1	23.74	DR110157		18B
29	1U51060-12	12	R1		9/11/85	1.5	2	9.64	1	14.1		10/15/85	1.45	2	35.08	1	58.5	DR127760		TEM-5
29	1U76916-06	2	R2		12/5/90	1.7	3	193.59	1	791.06	DR405392									DISSECTED
30	1U51060-12	13	0	11/12/83	11/18/83	1.8	1	32.18	1	72.11		1/12/84	2.63	1	72.1	1	103.72	DR107477		15B
30	1U51060-12	13	R1		3/15/85	2.6	1	49.79	1	64.53		5/14/85	2.8	1	55.45	11	149.25	DR128579		25B - LOST
31	1U51060-12	14	0	4/29/84	5/24/84	1.9	2	7.75	2	11.62										20B
31	1U51060-12	14	R1		1/27/86	2.2	2	20.92	2	37.51	DR143883	3/18/86	2.45	3	23.17	3	64.67	DR143649		QM-6
31	1U52840-03	4	R2		5/16/88	2.1	2	75.84	2	125.66		6/20/88	2.3	3	27.85	3	98.47	DR169668		R3B
31	1U67916-04	4	R3		6/1/89	2.1	2	75.91	2	128.69		7/1/89	2.37	2	81.08	2	152.75			R18B
31	1U67916-04	4	R4		12/2/91	2.7	2	97.98	2	185.68		1/16/92	2.7	3	98.68	2	203.83			R30B
32	1U51060-12	15	0	8/11/84																DISSECTED
33	1U51060-12	16	0	5/4/85		0	0	0	0	0		6/5/85	0.8	1	1.78	1	2.08			23B
33	1U51060-12	16	R1		4/29/86	0.6	11	2.05	11	3.41		6/11/86	0.62	3	38.41	1	76.59			BLT
33	1U52840-03	8	R2							131.43	DR169577	5/28/88					196.68	DR169653		TEM-8
33	1U52840-03	8	R3																	TEM-10
34	1U51060-12	17	0	9/22/85	10/14/85	2.7	1	5.5	1	11.18										NONE

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Refurb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
																				R4A
34	1U52840-03	13	R1																	
34	1U52840-03	13	R2									6/25/91	6.3	1	293.04	1	390.15	DR402229		DISSECTED
35	1U51060-12	18	0	11/4/85	11/12/85	1.3	10	38.07	10	50.94		1/26/86	0.8	2	1.95	2	3.85			BOOT BRST
35	1U52840-03	11	R1								DR169678									TEM-6
35	1U52840-03	11	R2																	DISSECTED
36	1U51060-12	19	0	11/27/85	12/10/85	0.38	2	0.81	10	1.32		12/30/85	0.35	2	5.76	3	8.51			TEM 9
36	1U76916-06	14	R1																	R33B
37	1U51060-12	20	0	12/21/85	12/31/85	0.18	3	0.6	4	1.33		1/22/86	1	3	69.1	10	116.93	DR143874		TEM-1
37	1U76916-06	4	R1		2/21/91	0.4	10	56.21	10	56.21			1	3	57.5	10	99.65			R24B
37	1U76916-06	4	R2										1.5	3	49.82	10	96.85			R34B
38	1U51060-12	21	0	4/11/86	6/2/86	6.2	1	63.75	1	77.8	DR146867									DISSECTED
39	1U51060-12	22	0	7/31/86	8/7/86	1.6	10	6.97	10	13.37	DR146922	1/31/87	0	0	0	0	0	DR147158		PVM-1A
39	1U52840-03	7	R1			2.1	4	102.57	10	202.91		10/17/88	1.97	4	91.36	10	175.43	DR150165		R5A
39	1U52840-03	7	R2		10/7/89	1.9	4	93.88	10	188		11/15/89	1.9	6	96.32	10	199.95			R14A
39	1U52840-03	7	R3		4/26/91	0.83	10	111.13	10	254.26		6/21/91	1	10	124.8	10	293.64			DISSECTED
40	1U51060-12	23	0	9/12/86	11/16/86	0	0	0	0	0	DR147005	8/20/87	3.55	2	66.39	3	123.75	DR147005		QM-7
40	1U52840-03	5	R1		8/10/89	3.4	3	89.45	3	171.47		9/16/89	3.5	3	95.85	3	184.57	DR169782		R5B
40	1U52840-03	5	R2																	DISSECTED
41	1U52840-01	1	0	6/16/88	6/24/88	0.6	1	2.1	3	3.73		3/16/90	0.5	1	4.7	1	7.14			BECKSTRAND
42	1U52840-01	2	0	7/29/88	8/5/88	12.5	2	178.35	2	254.46										DISSECTED
43	1U52840-01	3	0	9/15/88	9/20/88	8.9	2	40.43	2	53.72										DISSECTED
44	1U52840-01	4	0	10/13/88		0.5	11	0.7	11	0.88			0.5	11	0.9	11	2.43			R6B
44	1U52840-01	4	R1		1/5/90	1	10	1.28	1	3.54		2/13/90	0.6	1	2.11	1	4.68			R14B
44	1U76916-01	5	R2		5/24/91	0.7	1	4.21	1	13.64	DR408332	6/7/91	0.6	5	17.27	5	53.71	DR408322		R31A
45	1U52840-01	5	0	11/3/88	11/29/89	0.35	10	0.6	10	0.82										R9A
45	1U76916-01	1	R1		5/30/90	0.4	1	2.2	4	6.83			0.9	5	2.24	6	10.52			R25A
46	1U52840-01	6	0	12/13/88	12/23/88	0.5	2	1.1	2	2.21		3/15/89	1.5	2	2.87	1	5.12			R7B
46	1U52840-01	6	R1		2/25/90	1.2	1	6.52	1	9.48		3/26/90	1.15	1	8.79	1	12.46			R15A

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Returb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
46	1U76916-01	6	R2			0.5	1	7.57	1	11.65		6/20/91	1.15	1	9.34	1	20.7			R25B
47	1U52840-01	7	0	12/16/89	2/23/89	0.5	1	6.9	1	15.5		4/16/89	0.5	1	4.21	1	9.92			R7A
47	1U52840-01	7	R1		4/6/90	0.5	1	4.94	1	15.14										R16A
47	1U76916-04	12	R2		7/23/91	0.4	2	4.85	2	7.92		9/24/91	0.4	2	5.96	2	12.87			R26B
48	1U52840-01	8	0	8/30/89																R8B
48	1U76916-04	3	R1									4/6/90	0.4	1	1.6	11	4.22			R18A
48	1U76916-04	3	R2		11/12/91	0.5	1	3.2	1	17.77		12/5/91	0.5	1	7.83	7	21.03			R28A
49	1U52840-01	9	0	5/4/89								7/14/89	1.44	5	17.11	11	27.94			R11A
49	1U76916-04	10	R1		1/25/91	0.7	11	31.7	11	54.06		3/13/91	0.7	11	34.35	11	50.25			R24A
50	1U52840-01	10	0	6/29/89								8/30/89	0.9	1	1.16	1	1.61			R11B
50	1U76916-04	11	R1			0.6	1	7.63	1	10.6		3/1/91	0.6	1	7.5	1	15.55			R23B
51	1U52840-01	11	0	8/10/89								10/5/89	0.6	1	4.5	1	9.93			R12A
51	1U76916-01	4	R1		1/7/91	0.9	1	6.23	1	11.11		2/5/91	0.9	1	6.61	1	12.07			R22B
52	1U52840-01	12	0	9/28/89	10/10/89	0.38	11	2.35	11	3.24										R12B
52	1U76916-01	3	R1		1/8/91	1	5	7.95	1	8.8		1/23/91	1	5	11.24	1	12.18			R23A
53	1U52840-01	13	0	11/3/89								12/11/89	0.47	1	9.21	1	10.58	DR400413		R13A
53	1U76916-01	3	R1		11/20/90	1.5	2	24.1	1	41.9										R22A
53	1U76916-01	3	R2																	DISSECTED
54	1U52840-01	14	0	1/31/90																R15B
54	1U76916-01	7	R1		5/30/91	1.4	1	3.7	1	4.49		7/8/91	0.5	1	5.57	1	8.37			R26A
55	1U52840-01	15	0	3/1/90		0.3	10	7.5	10	15.93			0.3	10	8.36	10	19.67			R17A
55	1U76916-04	1	R1									11/13/91	5.2	1	14.5	1	35.2			DISSECTED
56	1U52840-01	16	0	5/10/90								6/14/90	1.9	1	9.2	1	16.5			R19A
56	1U76916-04	5	R1		1/13/92	1.9	1	12.7	1	27.4										R29B
57	1U76916-06	1	0	6/27/90		0.5	10	5.93	10	8.25		9/28/90	2.5	1	9.4	1	21.38			R21B
57	1U76916-06	1	R1																	R32A
58	1U76916-06	3	0	12/17/90	1/3/91	3.5	1	36.9	1		DR406420									DISSECTED

Flex Bearing History and Disposition

Bearing Number	Part Number	Serial Number	Returb Number	Build Date	First Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Second Stretch	Max Depth	Max Depth Pad #	Pad Total	Pad Number	Total Area	DR Number	Limited	Assignment
59	1U76916-06	6	0	5/15/91	5/23/91	0.4	10	52.35	10	68.4										DISSECTED
60	1U76916-06	7	0	6/12/91								8/22/91	0.4	10	60.65	10	77.31			R27A
61	1U76916-06	8	0	8/7/91	8/20/91	1.7	1	19.23	2	39.32		10/14/91	0.5	1	24.95	1	72.87			R28B
62	1U76916-06	9	0	12/9/91	12/20/91	1	1	4.9	1	7.7			1	1	8.4	1	17.53			R29B
63	1U76916-06	10	0	1/6/92							DR411846									DISSECTED
64	1U76916-06	11	0	1/27/92														DR411890		R29A
65	1U76916-06	12	0	3/2/92						166.97	DR412339									DISSECTED
66	1U76916-06	13	R0		5/29/92															R32B
67	1U76916-04	14	R0																	
68	1U76916-06	15	R0		6/15/92	92														DOUBLE CURE
69	1U76916-04	15	R0																	
70	1U76916-06	16	R0		8/19/92															ZONE 4 OUT
71	1U76916-06	17	R0																	
	1U76916-06	18	R0		3/3/93															
72																				

	A	B	C	D	E	F	G	H	I
1			1	2	3	4		5	21
2	1	PART NUMBER	1U51060-02	1U51061-02	1U51060-02	1U51060-02	1U51060-02	1U51060-11	1U51060-13
3	2	SERIAL NUMBER	0000001	0000003	0000004	0000005	000006	0000002	000002
4	3	FABRICATION DATE	8-Feb-77	30-Aug-77	6-Oct-78	19-Dec-78	15-Jan-79	16-Dec-80	07-May-81
5	4	OCR/DR	IRR32980	DR - CONTAMINATION.		OCR 67699	IRR	IRR, PD, PD	IRR75171
6	5	DESCRIPTION						30A	
7	6	CHEMLOK STOCK LOT							
8	7	CHEMLOK 205	0002	0003	0005	7407/0009	0009	7407/0016	0017
9	8	CHEMLOK 220	0002	0003	0005	7408/0009	0005/0009	7408/0016	0016, 17, 18
10	9	TYCEMENT	7502/0032-0036	7880/0006-7	0008	7880/0011	0015/0016	7469/0024	0002
11	10	1ST MIX - 205 LOT NUM.					0009		0017
12	11	1ST MIX - 205 VISCOSITY UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA	38	27	23
13	12	1ST MIX - 205 VISCOSITY DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		42	40
14	13	1ST MIX - 205 PRIMER WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		14.78	17.2
15	14	1ST MIX - 205 DILUTENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		3.04	1.4
16	15	2ND MIX - 205 LOT NUM.	NO DATA	NO DATA	NO DATA	NO DATA			0017
17	16	2ND MIX - 205 VISCOSITY UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		29	24
18	17	2ND MIX - 205 VISCOSITY DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		41	40
19	18	2ND MIX - 205 PRIMER WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		19.79	22.56
20	19	2ND MIX - 205 DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		3.32	3.9
21	20	3RD MIX - 205 LOT NUM.	NO DATA	NO DATA	NO DATA	NO DATA			0017
22	21	3RD MIX - 205 VISCOSITY UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		27	24
23	22	3RD MIX - 205 VISCOSITY DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		41	42
24	23	3RD MIX - 205 PRIMER WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		14.8	14.1
25	24	3RD MIX - 205 DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		3.21	2.2
26	25	1ST MIX - 220 LOT NUM.	NO DATA	NO DATA	NO DATA	NO DATA			0017
27	26	1ST MIX - 220 VISCOSITY UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		22	19
28	27	1ST MIX - 220 VISCOSITY DILUTED	NO DATA	NO DATA	NO DATA	NO DATA	20	20	20
29	28	1ST MIX - 220 ADHESIVE WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		16	18.2
30	29	1ST MIX - 220 DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		7.34	4.6
31	30	2ND MIX - 220 LOT NUM.	NO DATA	NO DATA	NO DATA	NO DATA			0018
32	31	2ND MIX - 220 VISCOSITY UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		23	18
33	32	2ND MIX - 220 VISCOSITY DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		21	20
34	33	2ND MIX - 220 ADHESIVE WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		24.22	23.7
35	34	2ND MIX - 220 DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		9.58	8.6
36	35	3RD MIX - 220 LOT NUM.	NO DATA	NO DATA	NO DATA	NO DATA			0016
37	36	3RD MIX - 220 VISCOSITY UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		23	22
38	37	3RD MIX - 220 VISCOSITY DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		21	20
39	38	3RD MIX - 220 ADHESIVE WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		19.14	15.6
40	39	3RD MIX - 220 DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		6.36	6.7
41	40	1ST MIX - TYCEMENT LOT NUMBER	NO DATA	NO DATA	NO DATA	NO DATA			0002
42	41	1ST MIX - TYCEMENT VISC. UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		31	20
43	42	1ST MIX - TYCEMENT VISC. DILUTED	NO DATA	NO DATA	NO DATA	NO DATA	22	22	22
44	43	1ST MIX - TYCEMENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		13.18	16.3
45	44	1ST MIX - TYCEMENT DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		8.51	4.1
46	45	2ND MIX - TYCEMENT LOT NUMBER	NO DATA	NO DATA	NO DATA	NO DATA			0002

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OF POOR QUALITY

	A	B	C	D	E	F	G	H	I
47	46	ND MIX - TYCEMENT VISC. UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		35	17
48	47	2ND MIX - TYCEMENT VISC. DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		21	22
49	48	2ND MIX - TYCEMENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		23.17	20.4
50	49	ND MIX - TYCEMENT DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		11.73	9
51	50	3RD MIX - TYCEMENT LOT NUMBER	NO DATA	NO DATA	NO DATA	NO DATA			0002
52	51	RD MIX - TYCEMENT VISC. UNDILUTED	NO DATA	NO DATA	NO DATA	NO DATA		33	16
53	52	3RD MIX - TYCEMENT VISC. DILUTED	NO DATA	NO DATA	NO DATA	NO DATA		22	22
54	53	3RD MIX - TYCEMENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		13.16	13.5
55	54	RD MIX - TYCEMENT DILUENT WEIGHT	NO DATA	NO DATA	NO DATA	NO DATA		10.97	4.4
56	55	RUBBER PAD - LOT NUMBER							
57	56	FWD END RING	0032	0044	0046	0049	0051	0082	0016
58	57	SHIM -10	0032	0044	0046	0049	0051	0082	0016
59	58	SHIM -09	0035	0044	0046	0049	0051	0082	0016
60	59	SHIM -8	0035	0044	0046	0049	0051	0083	0016
61	60	SHIM -7	0033	0044	0046	0049	0051	0082	0016
62	61	SHIM -6	0033	0045	0046	0049	0051	0082	0016/0017
63	62	SHIM -5	0033	0045	0047	0048	0050	0082	0017
64	63	SHIM -4	0033	0045	0047	0048	0050	0083	0017
65	64	SHIM -3	0032	0045	0047	0048	0050	0083	0017
66	65	SHIM -2	0036	0045	0047	0048	0050	0083	0017
67	66	SHIM -1	0034	0045	0047	0048	0049/0050	0083	0017
68	67	AFT END RING							
69	68	SPRAY INFORMATION - FER ONLY				VIS. 38			
70	69	CHEMLOK 205 LOT#	NO DATA	NO DATA				0016	0017
71	70	BOOTH TEMP	NO DATA	NO DATA				82	76
72	71	BOOTH HUMIDITY	NO DATA	NO DATA				40	38
73	72	MATERIAL TEMP	NO DATA	NO DATA				73	79
74	73	SPRAY INFORMATION - FER ONLY	NO DATA	NO DATA		VIS. 20			
75	74	CHEMLOK 220 LOT#	NO DATA	NO DATA				0016	0017
76	75	BOOTH TEMP	NO DATA	NO DATA				80	76
77	76	BOOTH HUMIDITY	NO DATA	NO DATA				30	42
78	77	MATERIAL TEMP	NO DATA	NO DATA				78	79
79	78	SPRAY INFORMATION - FER ONLY	NO DATA	NO DATA		VIS. 21			
80	79	TYCEMENT LOT#	NO DATA	NO DATA				0024	0002
81	80	BOOTH TEMP	NO DATA	NO DATA				80	76
82	81	BOOTH HUMIDITY	NO DATA	NO DATA				30	38
83	82	MATERIAL TEMP	NO DATA	NO DATA				75	70
84	83	CURE PARAMETERS							
85	84	MANUAL OR AUTO CURE	MANUAL	MANUAL	MANUAL	MANUAL		NOT LISTED	MAN
86	85	UPPER MOLD HALF ASSEMBLE TIME	28181	NO DATA		N/A		17/12/80 16:10	05/06/81 3:00
87	86	MOLD HEIGHT PRIOR TO CURE		NO DATA		28.094	28.145	28.25	28.5
88	87	START OF CURE	NO DATA	NO DATA	NO DATA	NO DATA	1/14/79 12:55	12/18/80 7:08	06/05/81 4:12
89	87A	MOLD HEIGHT AT 100 TONS							
90	88	MOLD HEIGHT WITH 55 TON LOAD	27.481	27.7	27.87	25 +/- 5 TONS	OCR	27.785	28.25
91	89	MOLD HEIGHT PRIOR TO DEBULK		NO DATA		N/A	27.25	27.118	27.283
92	90	MOLD HEIGHT AT DEBULK	27.104	27.06	27.09	27.054	27	27.074	27.131

	A	B	C	D	E	F	G	H	I
93	91	MOLD LOAD AT DEBULK - TONS	375	375	375	375 +/-50 TONS		376	200
94	92	DATE AND TIME	NO DATA	NO DATA	NO DATA	NO DATA		NO DATA	07/05/81 10:44
95	93	290 TEMP HOLD TIME						NA	07/05/81 10:44
96	94	END OF CURE - DATE AND TIME	02/28/77 18:52	NO DATA	10/09/78 18:46	12/18/78 11:17	01/15/79 0:40	12/18/80 18:16	07/05/81 16:22
97	95	LOWER MOLD - DATE AND TIME		NO DATA	10/09/78 19:47		01/15/79 1:50		08/05/81 7:10
98	96	TOTAL CURE TIME (IN HOURS)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	11.75	11.13	30.51
99	97	TIME IN +300 DEG. CURE (IN HOURS)	#VALUE!	#VALUE!	#VALUE!	#VALUE!	692880.67	#VALUE!	5.63
100	98								
101	99	CYCLE #1 SET POINTS							
102	100	ZONE 1	150	150	150	150	150	160	160
103	101	ZONE 2	160	160	160	160	160	160	170
104	102	ZONE 3	160	160	160	160	160	160	160
105	103	ZONE 4	160	160	160	160	160	160	160
106	104	ZONE 5	220	220	220	220	220	220	220
107	105	ZONE 6						160	160
108	106	ZONE 7	160	160	160	160	160	140	140
109	107	ZONE 8	160	150	160	160	160	160	160
110	108	ZONE 9	150		150	150	150	160	160
111	109	CYCLE #2 SET POINTS							
112	110	ZONE 1	200	200	200	200	200	220	220
113	111	ZONE 2	220	220	220	220	220	220	220
114	112	ZONE 3	220	220	220	220	220	220	220
115	113	ZONE 4	220	220	220	220	220	220	220
116	114	ZONE 5	220	220	220	270	270	220	
117	115	ZONE 6						220	220
118	116	ZONE 7	220	220	220	220	220	220	200
119	117	ZONE 8	220	220	220	220	220	200	220
120	118	ZONE 9	220	220	220	220	220	220	220
121	119	CYCLE #3 SET POINTS							
122	120	ZONE 1	285	285	285	285	285	320	320
123	121	ZONE 2	315	315	315	315	315	320	310
124	122	ZONE 3	315	315	315	315	315	320	310
125	123	ZONE 4	315	315	315	315	315	320	320
126	124	ZONE 5	315	315	315	315	315	320	320
127	125	ZONE 6						320	320
128	126	ZONE 7	315	315	315	315	315	250	250
129	127	ZONE 8	315	315	315	315	315	320	320
130	128	ZONE 9	285	220	285	285	285	320	320
131	129	OVERALL HEIGHT	N/A	NO DATA	VARIED		24.95	24.822	24.858
132	130	COMMENTS			BUMP DURING CURE				
133	131	ABNORMAL CURE DESCRIPTION					OCR		

Table IV. Flex Bearing Database

	J	K	L	M	N	O	P	Q	R
1	6	24	7	8	9	22	10	11	12
2	1U51060-11	1U51060-13	1U51060-13	1U51060-01	1U51060-13	1U51060-13	1U51060-13	1U51060-13	1U51060-13
3	0000004	000003	0000004	0000007	0000008	000008	0000009	0000010	0000012
4	11-Feb-82	01-Apr-82	21-Jul-82	27-Feb-83	11-Mar-83	23-Mar-83	18-Apr-83	23-May-83	28-Sep-83
5	IRR 83660	IRR #35077		OCR 82487	OCR, SQUAWK	OCR #82681	LOTS OF DR'S	OCR 84228	DR 105671
6				STS-11A					
7									
8	7407/0018	0018	7407/0019	7407/0023	7407/0022	0022	0022	0022	0024
9	7408/0019	0021	7408/0021	7408/0022	7804/0023	0023	0023	0023	0024
10	7469/0026	0003	6376/0003	6376/0004	6376/0004	0004/0005	0005	0004	0008
11		0018	0019			0022		0022	
12	25	23	23	24	25	25	25	24	26
13	40	41	40	40	40	40	40	42	41
14	15	12.2	15.3	15.54	15.47	15.47	22.5	18	21
15	2.1	1.3	2.1	4.66	2.98	2.98	2.9	1.7	4.1
16		0018	0020			0022		0022	
17	25	22	22.5	25	27	27	25	23	25
18	41	41	39	40	42	42	42	41	40
19	14.5	14.5	15.25	16.6	13.8	13.8	18.2	18	14.1
20	1.7	1.5	2.2	4.78	1.7	1.7	2.6	2.2	5
21		0018	0020			0022		0022	
22	22.5	22	22.5	25	27	27	25	22	26
23	41	40	40	40	41	41	42	42	40
24	14.3	7.06	16.2	23.7	21	21	25.7	22.4	13.3
25	1.3	1	2	6.2	3.2	3.2	3.9	3	4.7
26		0021	0021			0023		0023	
27	NOT LISTED	25	23.5	27	23	23	25	25	26
28	NOT LISTED	20	19.5	19	19	19	20	20	19
29	NOT LISTED	15.94	15.9	16.1	23.6	23.6	19	17	24
30	NOT LISTED	6.3		9.92	12.8	12.8	6.4	6.2	10.6
31		0021	0021			0023		0023	
32	26	25	25	32	25	25	25	23	25
33	19.8	20	20	19	20	20	20	20	19
34	15.6	15.94	16.1	15.6	15.9	15.9	25.1	23	15.7
35	8.1	6.3	6.6	7.4	7.1	7.1	11.1	10	7.5
36		0021	0021			0023		0023	
37	26	24	25	28	26	26		25	24
38	20	20	20	19	20	20		19	19
39	17.9	15.9	15.7	15.8	16	16		13.7	15.7
40	8.4	8.4	7.73	9.2	7.1	7.1		6.8	7.3
41		0003	0003			0004	0005	0004	
42	21.4	19	18	17	20	20	22	19	20
43	21.4	21	20	21	21	21	22	22	21
44	14.8	12.55	12.6	13.5	20.45	20.45	14.4	15.9	14.1
45	7.4	5.5	5.8	6.04	10.05	10.05	5.3	4.6	6.9
46		0003	0003			0004	0005	0004	

	J	K	L	M	N	O	P	Q	R
47	21.2	18	19	21	22	20	23	21	20
48	21.38	22	22	22	21	21	22	20	21
49	14.55	13.6	13.3	13.3	13.25	13.25	12.2	6.8	21.3
50	6.3	8.8	6	7.2	6.41	6.41	4.5	2.9	11.5
51		0003	0003			0004	0005	0005	
52	19.89	20	18	21.5	22	22	23	25	22
53	21.8	22	21	21	22	21	22	21	21
54	14	13	13.1	13.6	12.6	12.6	12	18.4	21.2
55	6.4	5.4	5.9	8.6	6.8	6.8	5.7	8.8	11.7
56					6591/0033				
57	0087	0018	0020	0026	0031	031	0034	0032	0058
58	0087	0018	0020	0026	0031	031	0034	0032	0058
59	0088	0018	0020	0026	0031	031	0034	0035	0058
60	0088	0018	0020	0026	0031	031	0034	0035	0058
61	0088	0018	0020	0026	0031	031	0034	0032	0057
62	0088	0018	0020	0026	0031	031	0034	0032	0057
63	0088	0018	0020	0026	0033	031	0034	0032	0057
64	0089	0019	0021	0030	0033	031/033	0035	0032	0057
65	0089	0019	0021	0030	0033	031/033	0035	0037	0058
66	0088	0019	0021	0030	0033	033	0035	0037	0058
67	0089	0019	0021	0030	0033	033	0035	0037	0057
68			0021		0033				
69									
70	0018	0018	0019	0021	0022	0022	0022	0022	0024
71	84	78	80	80	75	75	82	80	75
72	7	22	38	32	32	32	35	32	48
73	71.2	70	75	70	74	74	70	77	73
74									
75	0019		0021	21	0022	23	0023	0023	0023	0024
76	80	78	85	74	80	80	80	79	82
77	10	31	35	35	38	38	42	40	40
78	71.4	75	76	64	77	77	70	79	74
79									
80		0003	0003	0004	0004	0004	0005	0004	0008
81	0026	77	85	80	75	75	78	80	80
82	84	14	35	29	56	56	50	40	40
83	8	72	75	70	78	78	70	75	75
84	70.4								
85	MANUAL	MAN	MANUAL	MANUAL	MANUAL	MAN	MANUAL	MANUAL	MANUAL
86	2/10/82 18:00	03/30/82 6:30	22/7/82 01:30	30357.11806	3/21/83 20:45	03/23/83 7:45	30427.29861	30462.02083	30/9/85 12:00
87	29.408	28.815	29.003	28.69	28.625	28.625	28.642	28.56	28.48
88	02/11/82 7:45	04/01/82 6:05	07/22/82 7:25	02/11/83 1:56	03/23/83 7:45		NO DATA	05/26/83 19:10	NO DATA
89									
90	27.701	28.568	28.353	28.151	28.525	28.525	28.281	28.115	28.1
91	27.349	27.178	27.072	27.12	27.225	27.225	27.15	27.142	27.25
92	37.086	27.108	27.142	27.06	27.116	27.116	27.065	27.041	27.15

	J	K	L	M	N	O	P	Q	R
93	369	200	375	375	375	375	374	378	350
94	NO DATA	4/1/82 11:15	07/22/82 22:54	02/11/83 7:20	03/23/83 13:16	03/23/83 13:16	04/22/83 10:10	05/27/83 0:26	09/01/83 22:40
95	NOT LISTED		12-Feb-82		NOT LISTED			NOT LISTED	NOT LISTED
96	02/11/82 19:20	4/1/82 16:32	07/23/82 4:30	02/11/83 12:36	03/23/83 19:30	03/23/83 19:30	04/22/83 16:00	05/27/83 6:05	09/02/83 4:50
97	02/12/82 9:40	4/2/82 0700	07/23/82 19:23	02/12/83 2:20	03/24/83 9:50	03/24/83 9:50	04/23/83 7:00	05/27/83 19:30	09/02/83 18:25
98	11.58	10.45	21.08	10.67	11.75	729571.50	#VALUE!	10.92	#VALUE!
99	#VALUE!	5.28	5.60	5.27	6.23	6.23	5.83	5.65	6.17
100									
101									
102	160	160	160	160	160	160	160	160	160
103	170	170	170	170	170	170	170	170	170
104	160	160	160	160	160	160	160	160	160
105	160	160	160	160	160	160	160	160	160
106	220	220	220	220	220	220	220	220	220
107	160	160	160	160	160	160	160	160	160
108	140	140	140	140	140	140	140	140	140
109	160	160	160	160	160	160	160	160	160
110	160	160	160	160	160	160	160	160	160
111									
112	220	220	220	220	220	220	220	220	220
113	220	220	220	220	220	220	220	220	220
114	220	220	220	220	220	220	220	220	220
115	220	220	220	220	220	220	220	220	220
116	220	220		NOT LISTED	220			NOT LISTED	NOT FOUND
117	220	220	220	220	220	220	220	220	220
118	200	200	200	200	200	200	200	200	200
119	220	220	220	220	220	220	220	220	220
120	220	220	220	220	220	220	220	220	220
121									
122	320	320	320	320	320	320	320	320	320
123	310	310	310	310	310	310	310	310	310
124	310	310	310	310	310	310	310	310	310
125	320	320	320	320	320	320	320	320	320
126	320	320	320	320	320	320	320	320	320
127	320	320	320	320	320	320	320	320	320
128	250	250	250	250	250	250	250	250	250
129	320	320	320	320	320	320	320	320	320
130	320	320	320	320	320	320	320	320	320
131	24.825	24.893	24.845	24.858	NOT LISTED	24.877	24.882		24.852
132								OCR 84228, 84228	MOI
133									SHIM #8 AT 180 DEG

Table IV. Flex Bearing Database

	S	T	U	V	W	X	Y	Z	AA
1	13	14	15	16	17	18	19	20	23
2	1U51060-13	1U51060-13	1U51060-13	1U51060-13	1U51060-13	1U51060-13	1U51060-13	1U51060-13	1U52843-02
3	0000014	0000015	0000016	0000019	0000020	0000021	0000022	0000023	000004
4	28-Apr-84	6-Aug-84	30-Apr-85	26-Nov-85	17-Dec-85	8-Apr-86	30-Jul-86	30-Sep-86	10-Oct-88
5	P.D., OCR	OCR 91197	OCR 97162		D.R. -REGRTBLST	DR - 143623	OCR106108	LOTS OF DR'S	PD #169476
6		SCRAP-BAD CURE							
7									
8	7407/0025	0026	0028	0030	0030	0031	0030	0032	0037
9	7408/0026	0026	0027	0030	0030	0030	0030	0031	0037
10	6376/0007	0009	0011	0014	0014	0015	0156	0015	0024
11			0028	0030	0030	0031		0032	0037
12	24.8	28	25	23	30	24	0036	23	29
13	42	40	41	41	40	40	26	39	39
14	21.8	21.1	25.2	27.5	32	28.5	42	28.3	22.1
15	3.3	5.3	4.5	9.4	9.7	4.2	24.7	3.8	6.5
16			28	0030	0030	0031	0030	0032	0037
17	27	28	25	23	27	24	27	23	29
18	39	41	41	41	39	40	42	39	40
19	14.5	14.5	25	28.3	21.7	28.2	29.1	28.5	15.4
20	2.2	2.7	4.7	6.9	7.7	3.9	4.4	4.1	3.3
21			28		0030	N/A		N/A	0037
22	26	25	25	N/A	26	N/A		N/A	30
23	40	38	41	N/A	39	N/A		N/A	40
24	14.3	14.5	10.1	N/A	21.5	N/A		N/A	17.7
25	2.3	3.5	1.3	N/A	7.3	N/A		N/A	3.6
26			27	0030	0030	0030	0030	0031	0037
27	26	22	32	25	20	25	28	28	26
28	19	20	20	20	19	20	20	20	20
29	23.2	23.9	23.5	23.5	16.5	29.9	24	28	25.5
30	13.5	10.3	11.5	11.5	8.5	13.8	13.5	15.2	13.2
31			27	0030	0030	0030	0030	0031	0037
32	25	21	31	24	22	25	27	27	26
33	20	19	20	20	19	20	20	20	21
34	24.1	15.3	16.5	23.5	24.2	31	16	14.9	8.6
35	14	6.6	8	10.5	13	12.9	8.7	9.9	4.4
36			27	0030	0030	N/A	0030	0031	0037
37	24	24	32	26	21	N/A	25	27	25
38	20	20	20	20	20	N/A	19	20	19
39	8	15.3	17	7.4	16.4	N/A	18.5	16.4	19.6
40	4	6	8.5	4.5	8.8	N/A	7.9	10.4	10.7
41			11	0014	0014	0015	0015		0024
42	25	26	24	44	40	20	18	19	30
43	21	21.5	22	21	21	21	20.5	22	22
44	19.4	20.3	26	17.5	15.5	19.2	24.4	23.4	16.7
45	11.3	10.9	10.6	12.5	12.1	9.8	9.5	11.8	11.7
46			11	0014	0014	0015	0015		0024

	S	T	U	V	W	X	Y	Z	AA
47	27	30	21	34	39	20	18	20	29
48	21	21.5	22	22	21	21	21	21	22
49	19.2	19.3	25.6	18	14.9	17.5	23.3	23	16.4
50	12	12.4	10.4	12.5	12.7	8.5	8.5	16.8	13.4
51			11	0014	0014	0015	0015		0024
52	27	28	25	41	41	19	19	20	30
53	21	21	21	21	20	21	21	22	21
54	19	13.1	20.9	10	14	18.8	13.5	18.5	17.8
55	11	8.7	9.6	8.6	12.1	10.1	4.6	8.5	13.8
56							0080/0081		
57	0046	0048	0059	0065	0068	0077	0080	0084	0110
58	0046	0048	0059	0065	0068	0077	0080	0084	0107
59	0046	0048	0059	0065	0068	0077	0080	0085	0107
60	0046	0048	0059	0065	0068	0077	0081		0107/0110
61	0046	0048	0059	0065	0068	0076	0081	0083	0110
62	0046	0048	0059	0065	0068	0076	0081	0083	0107/0108
63	0046	0049	0071	0065	0066	0076	0081	0084	0107/0108
64	0046	0049	0071	0065	0068	0076	0081	0084	0108
65	0047	0049	0071	0067	0066	0076	0081	0084	0108
66	0047	0049	0071	0067	0066	0076	0081	0085	0108
67	0047	0049	0071	0067	0066	0076	0081	0085	0108
68									
69									
70	0025	0026	0028	0030		0031	0030		0037
71	78	85	82	80	0030	80	80		82
72	16	46	25	15	78	29	43		30
73	73	79	73	67	20	72	83		72
74					72				
75	0026	0026	0027	0030		0030	0030		0037
76	77	84	82	80	0030	80	83		79
77	20	56	25	15	78	30	52		45
78	73	82	78	68	35	72	84		70.5
79					72				
80	0007	0009	0011	0014	0014	0015	0015		0024
81	78	82	83	82	80	80	81		82
82	22	52	26	10	15	29	46		34
83	72	82	77	75	74	72	80	75	70.3
84									OCR #141970
85	MANUAL	MANUAL	MANUAL	AUTO	AUTO	MANUAL	AUTO	AUTO	MAN
86	30799.29167	30903.04167	02/05/85 12:00	31376.94444	31391.60417	9 APR 86 1055	31624.35417	11/06/86 13:20	13-Oct-88
87	28.9	28.437	29.45	28.75	28.5	28.25	28.25	28.5	28.25
88	04/28/84 3:14	08/10/84 9:30	NO DATA	11/26/85 17:34	NO DATA	NO DATA	NO DATA	NO DATA	
89									27.6
90	28.5	28.125	28.0265	26 NOV 85 28:50	28.125	27.465	27.375	28.125	
91	27.15	27.235	27.185	N/A		27.125			27
92	27.03	27.1	27.036	27.25	27.125	27	27.125	27.062	26.94

	S	T	U	V	W	X	Y	Z	AA
93	373	225	200	N/A		376	31625.31944		375
94	04/28/84 9:40	08/10/84 18:00	05/03/85 21:55	11/27/85 1:15	NO DATA	04/10/86 9:30	NO DATA	11/07/86 21:50	10/13/88 11:32
95				27-Nov-85				NO DATA	
96	04/28/84 15:40	08/11/84 6:30	05/04/85 3:45	11/27/85 7:40	NO DATA	4/10/86 15:00	NO DATA	11/08/86 6:00	10/13/88 20:00
97	04/28/84 9:40	08/11/84 20:45	05/04/85 17:35	11/27/85 21:00		04/11/86 5:00			10/14/88 10:35
98	12.43	21.00	#VALUE!	14.10	#VALUE!	#VALUE!	#VALUE!	#VALUE!	778316.00
99	6.00	12.50	5.83	6.42	#VALUE!	5.50	#VALUE!	8.17	8.47
100									
101									
102	160	160	160			160	160	160	160
103	170	170	170			170	170	170	160
104	160	160	160			160	160	160	160
105	160	160	160			160	160	160	150
106	220	220	220			220	220	220	150
107	160	160	160			160	160	160	170
108	140	140	140			140	140	140	150
109	160	160	160			160	160	160	150
110	160	160	160			160	160	160	150
111									
112	220	220	220			220	220	220	220
113	220	220	220			220	220	220	220
114	220	220	220			220	220	220	220
115	220	220	220			220	220	220	200
116	220	NOT LISTED	NOT LISTED						210
117	220	220	220			220	220	220	230
118	200	220	200			200	200	200	210
119	220	220	220			220	220	220	210
120	220	220	220			220	220	220	210
121									
122	320	320	320			320	320	320	320
123	310	310	310			310	310	310	310
124	310	310	310			310	310	310	310
125	320	320	320			320	320	320	320
126	320	320	320			320	320	320	310
127	320	320	320			320	320	320	320
128	250	250	250			250	250	250	280
129	320	320	320			320	320	320	310
130	320	320	320			320	320	320	310
131	24.884	NO DATA	24.882	25.015					24.89
132	D HALF REMVD	SCRAP	OCR 97162						
133		DR 117148				REFER TO NOTES			PAD