KS-20472 BELLCELL* BATTERY

VISUAL INSPECTION PROCEDURE

CONTENTS PAGE

*Trademark

1. GENERAL

1.01 This section describes the approved procedure for visually inspecting positive post seals of KS-20472 BELLCELL batteries in the field. Visual inspection of KS-20472, L1, L2, L3, or L4 cells involves utilization of a special J-hook tool to lift the rubber boot around the positive post high enough to see the epoxy seal and expose any signs of possible corrosion.

1.02 Whenever this section is reissued, the reasons for reissue will be listed in this paragraph. The Equipment Test List is affected.

1.03 Visual inspection is to be performed on all KS-20472, L1, L2, L3, and L4 BELLCELL batteries regardless of supplier. ***No inspection is required on KS-20472, L1S, L2S, L3S, and L4S cells with short positive post seals and on cells with one long and one short post seal.***

1.04 Refer to Sections 157-601-101 and 157-629-701 for precautions to be observed while performing work operations on lead-acid storage cells. For personal protection and protection of clothing, use splash proof safety goggles, acid resistant gloves, and an acid proof apron. Remove all jewerly, watches, wire rim glasses and large belt buckles.

1.05 Part 8 contains figures and detailed descriptions useful in determining the extent of post corrosion.

2. APPARATUS

2.01 A visual inspection set consists of the tools and supplies listed in paragraph 2.02. The boot lifting tool is shown in Fig. 1.

2.02 ***List of Tools:*** The following list of tools is required for the inspecting procedures in this section.

TOOLS	DESCRIPTION
R-3034	Acid Resistant Gloves
R-3043	Acid Proof Apron
R-3053, R-4501	Splash Proof Safety Goggles
R-4940	Boot Lifting Hook*, PVC construction, canvas phenolic handle. Hook should be obtained from: Astro Craft, Inc., U.S. Route 12, Spring Grove, Ill. 60081
—	Defective Cell Label*, prepared locally (Fig. 3)
—	Flashlight, regular or angular having plastic or rubber housing
—	Visual Inspection Report Form* (Fig. 5)
—	Wiper Paper, Scott, No. 58 or 59

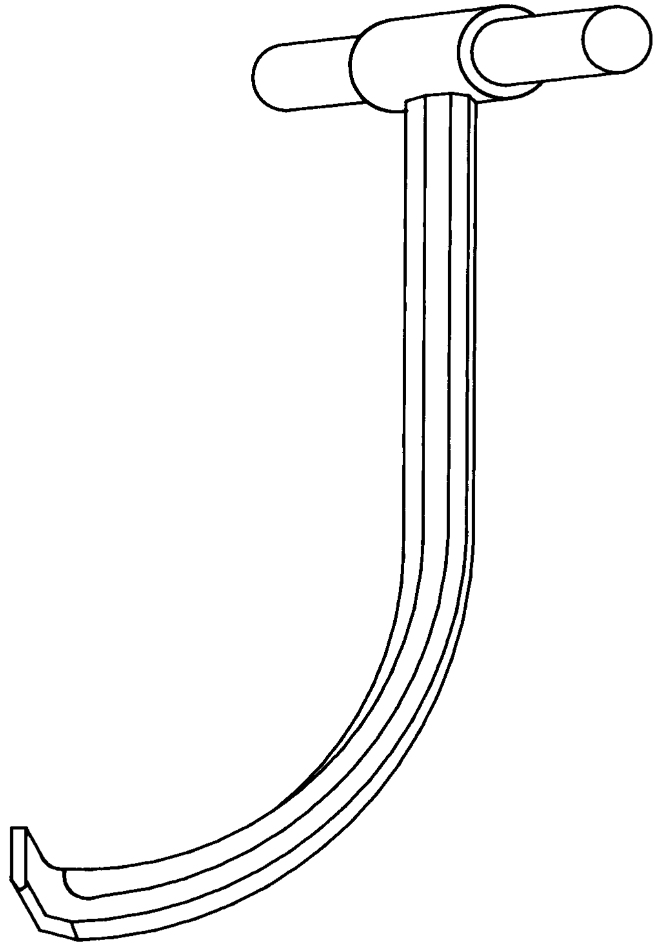


Fig. 1—Boot Lifting Hook

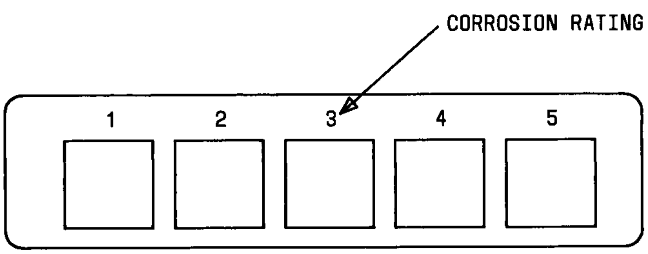
*Tool or supply which must be obtained specifically for this procedure.

3. INSPECTION PROCEDURE

Danger: For high voltage UPS service, special precautions apply.

3.01 The cells can remain in the battery stand and connected on line during visual inspection. It is not required to remove a string from service while performing the type of visual inspection described in this practice. All tools and equipment used are nonconductive, thereby eliminating the chance of accidental short circuiting. The chance of cell damage due to the inspection process as outlined in this section, even in cases of severe corrosion, is extremely remote. For multiple string setups, only one string will be inspected at a time.

3.02 A Corrosion Rating Label (see Fig. 2) should appear on all cells which should be inspected. Any L1, L2, L3, and L4 cells which have not been inspected and labeled by Western Electric Co. should be brought to the attention of Western Electric Quality Service Management (QSM).



NOTE: PLACE DATE OF TEST IN APPROPRIATE BOX

Fig. 2—Corrosion Rating Label

Danger: ***Do not perform the visual inspection procedure on cells that have been boost charged within 24 hours. Entering "live" cells with a boot lifting tool is hazardous due to excessive gassing. Tests on BELLCELL batteries have demonstrated that on float at 2.17 v/cell, the hydrogen concentration within a properly vented cell drops below the explosive limit (10% hydrogen) in less than 15 hours after termination of boost charge at 2.50 v/cell. In 24 hours on float, the hydrogen concentration has dropped to approximately 1% (well below the explosive limit). Nevertheless, in the unlikely event that cells have been subjected to an unreported boost charge, workers who are about to use the boot lifting tool should momentarily ground themselves before starting.***

3.03 In the visual inspection process, the R-4940 boot lifting hook is inserted into the cell through the safety vent opening (see Fig. 3). The hook is used to lift up a section of the rubber boot around the positive post. The level of corrosion is then determined and recorded. Following are the detailed instructions for the procedure in which the hook is used.

(1) Start the visual inspection at one end of the stand and work down the string. For convenience, work on one level at a time.

Warning: ***To minimize the possibility of damaging a vent during removal, grip as much of the vent as possible to prevent the plastic sections from shearing off from the stone. The vent should then be carefully rotated counterclockwise one-fourth turn or less for removal. Care should be taken when replacing the vent as overtightening could break the bayonet threads.***

(2) Remove the safety vent cap (funnel shaped) and let the acid drip off the spout before completely lifting it out. Any excess acid may be wiped off with a paper towel. Place the safety vent caps from an entire row upside down and away from the immediate area.

Note: It may be convenient to place the vents on the cells directly above or below the cells being hooked.

Danger: ***In order to prevent a static electricity charge from building up in the hook, do not rub excessively when cleaning.***

(3) Insert the boot lifting hook in through the vent hole and position the tip of the hook under the lower lip of the boot. (See Fig. 3.)

(4) Pull up on the boot, exposing the epoxy-lead interface. An initial pull may not be sufficient. A second attempt will further loosen the boot, making it easier to lift. (See Fig. 4.)

(5) Use the flashlight to examine the epoxy-lead interface through the jar wall. The inspection should be carried out over the widest possible circumference; thus, it may be necessary to move the hook to a new location.

Note: During the inspection, the boot must be held up with the hook. Because of its elastic

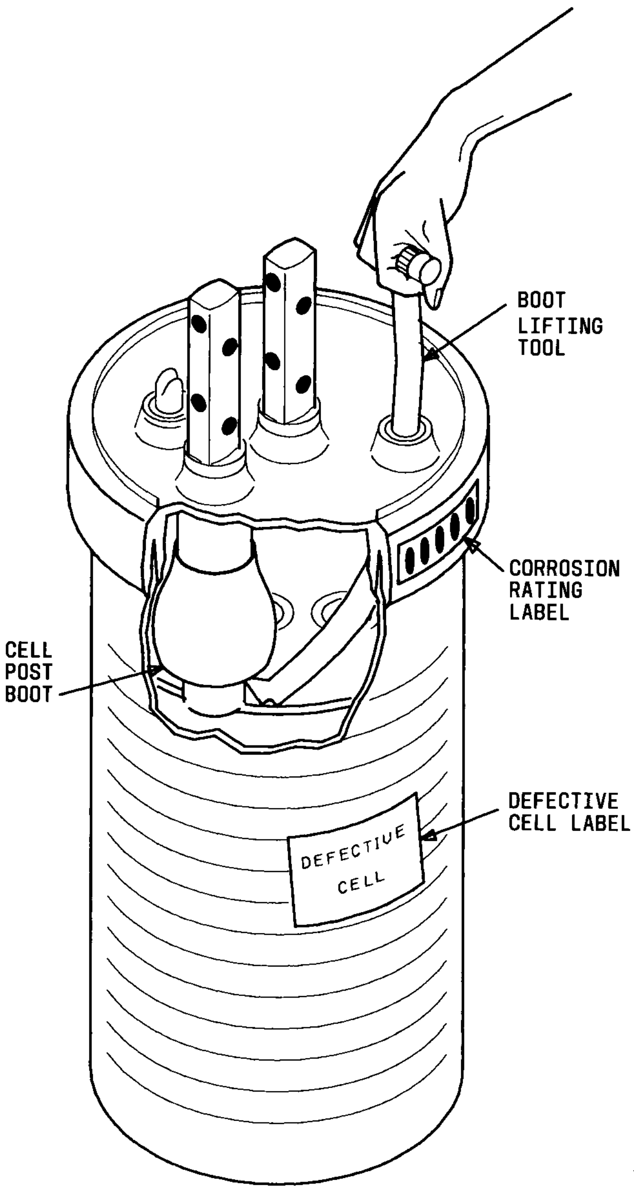


Fig. 3—KS-20472 BELLCELL Battery Showing Hook Inserted and Placement of Labels

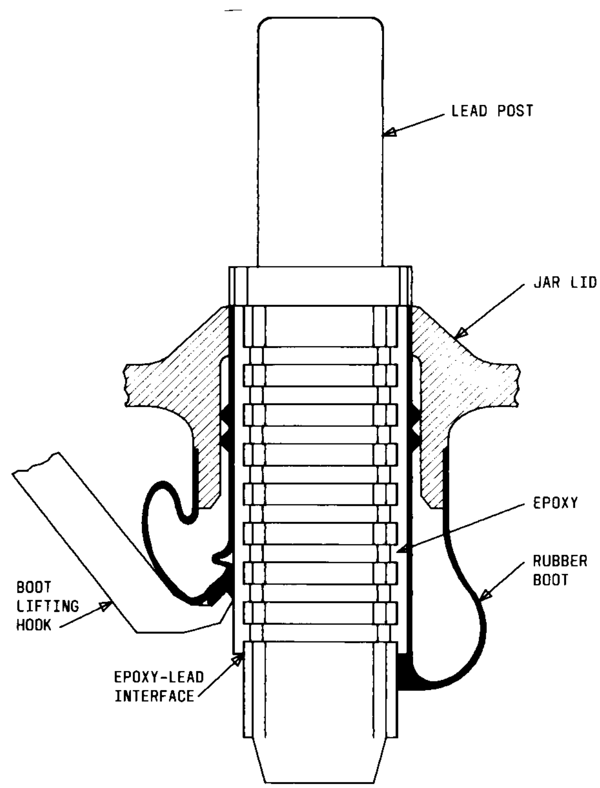


Fig. 4—Cell Post Showing Placement of Boot Lifting Hook

properties, the boot will usually fall back into its original position if it is released. If the boot is torn in the process, the operation of the cell will not be affected. Note this on the Visual Inspection Report Form (Fig. 5) and in the office records.

(6) Determine the corrosion category of the post (see Part 4), and record this on the Corrosion Rating Label by writing the date the cell was inspected in the appropriate box (1, 2, 3, 4 or 5). Write small enough to insure that subsequent dates can be inserted in the box.

(7) Carefully extract the hook from the cell. If the boot does not return to its original position, it may be left in the raised position. If the hook is coated with black butyl adhesive, wipe it clean with a paper towel.

***Danger:* In order to prevent a static electricity charge from building up in the hook, do not rub it excessively with the towel. Wipe it only enough to clean it or keep it from dripping.**

(8) Proceed to the next cell and continue the boot lifting process until the last cell is reached.

Note: Cells which are aligned 90° in reference to the aisle need not be turned for visual inspection.

BELLCELL
VISUAL INSPECTION REPORT

PAGE ___ OF ___

CENTRAL OFFICE: ______________________________ TYPE: __________________________
(NAME OR CODE) (ESS, XBAR, ETC.)

ADDRESS: ____

CITY: ____

STATE: ______________________________ ZIP CODE: __________________

INSPECTED BY: ____

BOC REP SIGNATURE ____

INSPECTION

START DATE__________ COMPLETE DATE__________

STRING ID AND CELL NO.	C&D (√)	GOULD (√)	MO & YR MFG	LIST NO.	(√) CORROSION CATEGORY					C&D POS POST SER# OR GOULD LABEL (FOR CORROSION CATEGORY 4 OR 5)	REMARKS (SUCH AS "BOOT TORN", "CAN'T LIFT BOOT", ETC.)
					1	2	3	4	5		

RETAIN WITH OFFICE RECORDS

Fig. 5—Visual Inspection Report Form

(9) When a row is completed, replace all the safety vent caps, taking care not to over tighten and thus damage the bayonet thread. Check to be sure that the rubber extension funnel stem is below the electrolyte level. Check for acid drops and wipe up as necessary.

(10) After inspection of each row of cells is completed, corrosion information should be recorded on the Visual Inspection Report Form. In order to identify cells with a corrosion rating of 4 or 5 on the Visual Inspection Report Form, the serial number must be recorded. These numbers can most conveniently be checked cell by cell as they are being inspected.

4. DETERMINING LEVEL OF CORROSION

4.01 The corrosion at the epoxy-lead interface will be rated and put into the categories indicated in Table A.

4.02 Corrosion normally begins at the epoxy-lead interface and spreads from there. If corrosion builds up under the epoxy, it will swell and bulge the epoxy outward. Severe cases will cause epoxy to crack open.

4.03 As the corrosion increases, broken particles and powder can start to fill up the boot. Techniques for assembling the post seals in manufacture are such that the boot section of the rubber sleeve will usually have depressions in it. These depressions are shown in Fig. 6. On positive posts, with severely defective seals, the accumulation of corrosion product expands the rubber boot such that the depressions disappear. This is shown in Fig. 7 where no depressions exist in the boot of the positive post seal. Depressions still exist in the negative post boot since corrosion does not occur on the negative post. Sometimes the boot section is inflated because of air pressure inside the boot. Accordingly, it is necessary to probe the boot with the tip of the hook in order to differentiate between corrosion and air. If air fills the boot, it will be flexible. If corrosion fills the boot, it will be hard and should not be lifted.

> ***Note:*** Part 8 contains detailed descriptions and color photographs of the corrosion conditions and the rating system.

4.04 If the boot cannot be raised, the corrosion level shall be considered as Class 3, unless one has reason to believe that a higher rating exists. Swollen boot or heavy debris under the post would justify a 4 or 5 rating.

4.05 The determined level of corrosion on the Corrosion Rating Label shall be indicated in the appropriate space on the Visual Inspection Report Form (see Fig. 5).

4.06 For all cells whose boots cannot be lifted, an appropriate comment shall be entered in the REMARKS column of the Visual Inspection Report Form.

5. REPORTING DATA

5.01 Completed Visual Inspection Report Forms are to be retained with battery office records.

6. REPLACEMENT OF DEFECTIVE CELLS

6.01 Place a defective cell label on all defective Class 4 and 5 cells (see Fig. 3). An Engineering Complaint should be filed to obtain replacement of all Class 4 and 5 cells. Copies of the replacement Visual Inspection Report Form should be attached to the Engineering Complaint.

7. FREQUENCY

7.01 During 1981 and early 1982, all KS-20472, L1, L2, L3, and L4 BELLCELL batteries installed in Operating Telephone Company (OTC) facilities will be inspected for corrosion conditions by Western Electric, the acid level lowered to reduce the rate of further corrosion, and any condition 4 or 5 cells replaced. ***The first follow-up inspection by the OTCs on these cells should occur approximately 6 months after the Western Electric inspection***. Subsequent inspections should be in accordance with the schedule in Table B.

8. SUPPLEMENTAL CORROSION RATING INFORMATION

8.01 Examples of various types of corrosion are shown in Fig. 8 through 20. Table A describes the corrosion shown in these figures and the corresponding corrosion rating.

8.02 Unless otherwise stated, all references to the lead or lead post refer to the epoxy/lead interface on the positive post. See Fig. 9, Point E.

8.03 When hooking the boot, the hook will rub against the lower portion of the post. A brown

TABLE A

CORROSION RATINGS

RATING	DESCRIPTION (SEE NOTE)	EXAMPLES
1	No visible corrosion	Fig. 8 Fig. 9, Point E
2	(a) Slight blisters or swelling visible on lead (less than 1/8-inch diameter)	Fig. 14, Point A
	(b) Slight pullaway of epoxy from lead surface	—
3	(a) Blisters or swelling visible on lead (greater than 1/8-inch diameter)	Fig. 15, Point B
	(b) Small to medium size eruptions on lead	Fig. 15, Point A Fig. 18, Points A and C
	(c) Worst case of Class 3 type eruption	Fig. 17, Point A
	(d) Medium degree of flaring or pullaway of epoxy at the bottom edge of the epoxy column	Fig. 16, Points A and B
	(e) No corrosion visible on lead, but brown debris (powder) visible on white plastic cap directly below positive post. This brown powder should not be confused with the brown pieces of lead found on the plastic cap of a cell which has flaked	—
	(f) Swelling centered at edge of epoxy (approximately 1/8-inch high, 1/2-inch diameter)	Fig. 13, Point A
4	(a) Epoxy cracked, caused by corrosion at Point B on Fig. 18 and 20	Fig. 18, Point D Fig. 20, Point A
	(b) Epoxy deteriorated (Note how epoxy has both vertical and horizontal cracks and appears to be falling off post)	Fig. 19
	(c) Large size eruptions on lead, greater than that shown in Fig. 17	—
	(d) Lower portion of epoxy appears severely swollen (flared), due to corrosion under epoxy	Fig. 19
5	(a) Crack in battery cover	—
	(b) Bellows portion of post sleeve is hard to the touch (filled with corrosion product)	—
	(c) Large portion of lead post is corroded	Fig. 20, Point B
	(d) Corrosion has progressed into post to a depth of 3/8-inch or greater	—

Note: If more than one of the listed problems exist on a given battery, the corrosion rating is determined by the worst case.

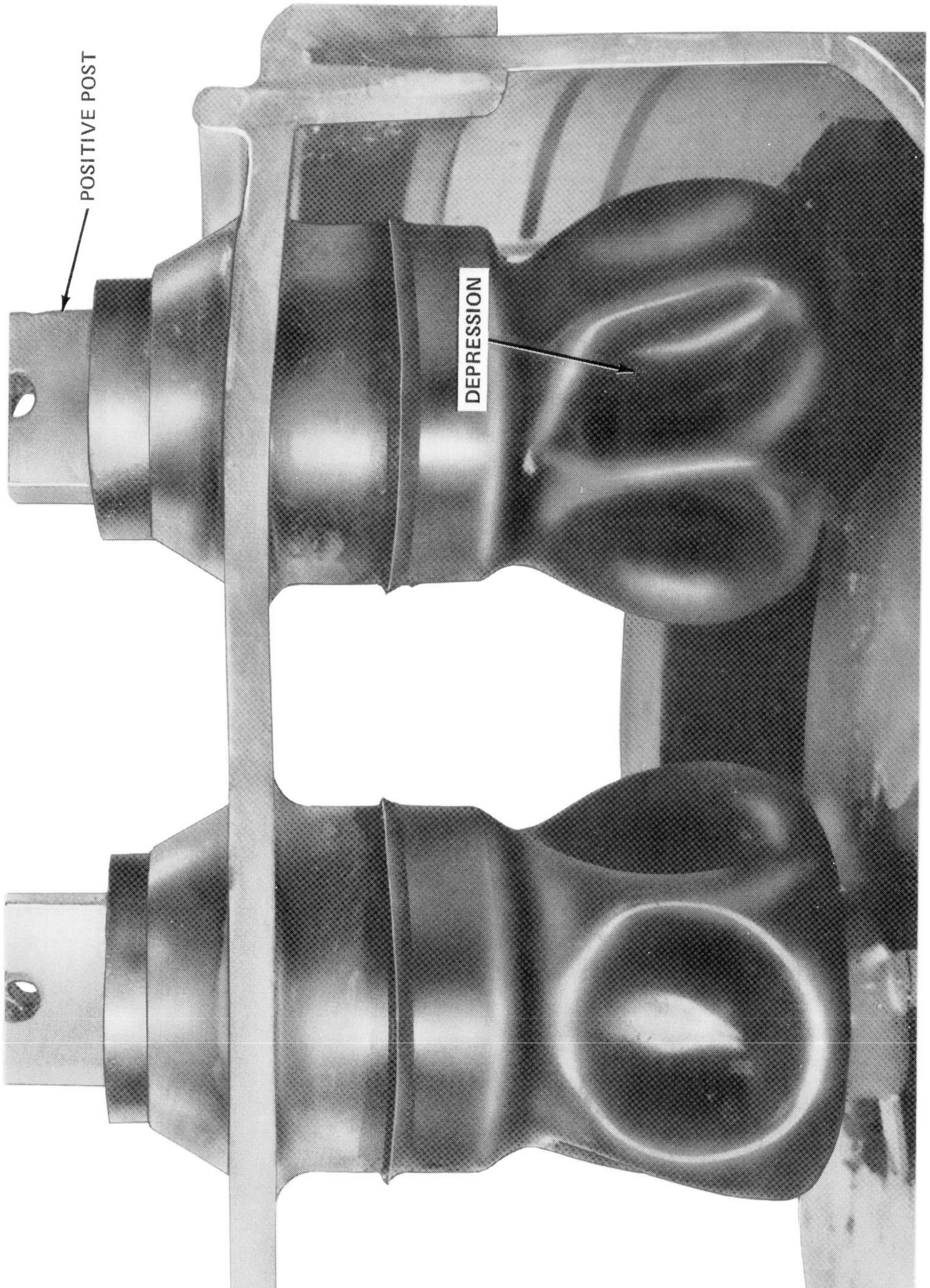


Fig. 6—Cell Post Boots Showing Normal Depression

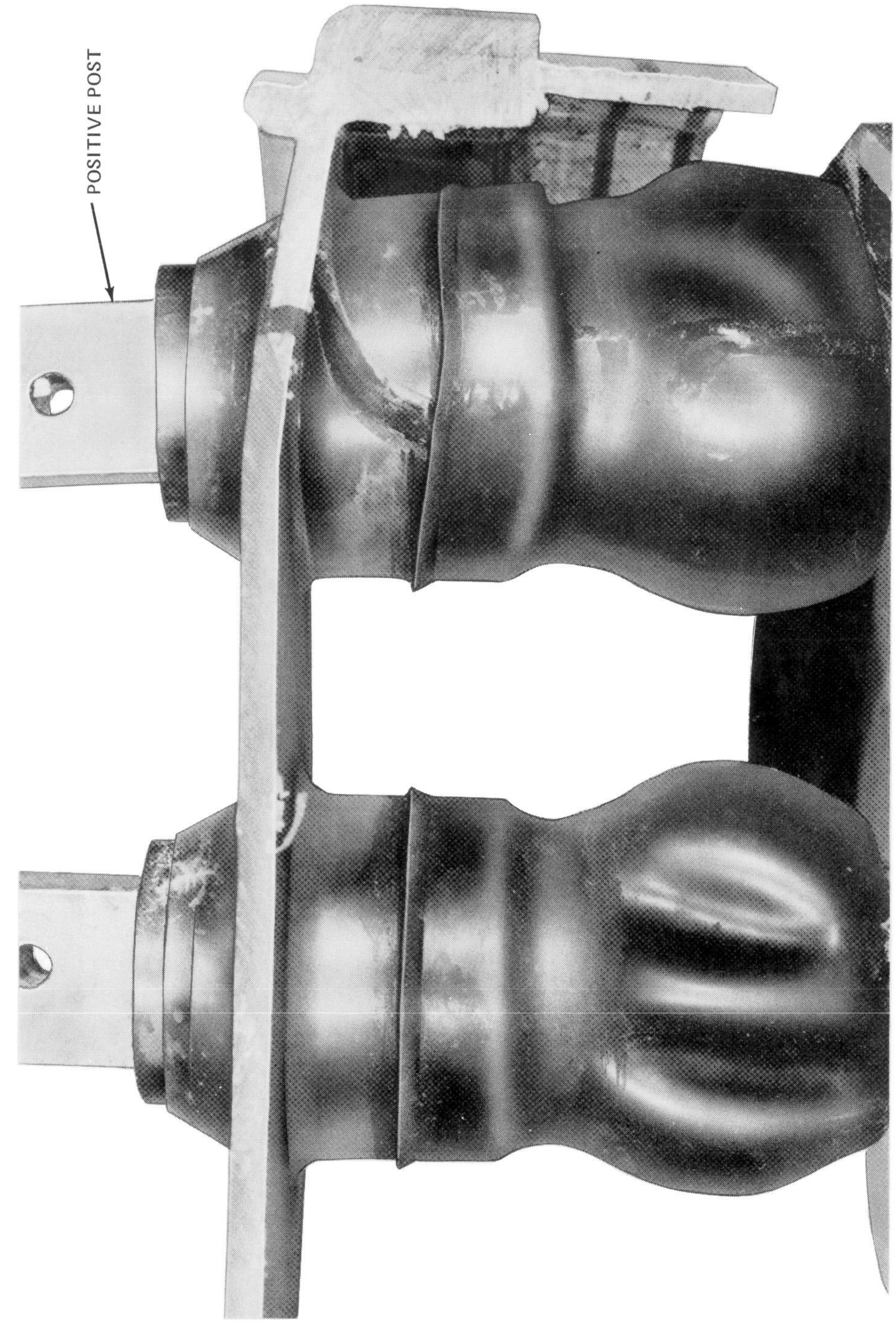


Fig. 7—Cell Posts Showing Swollen Boot Due to Post Corrosion

TABLE B

INSPECTION INTERVALS

CORROSION CONDITION	INTERVAL (SEE NOTE) BEFORE NEXT INSPECTION
1	12M
2	12M
3	6M
4	Replace
5	Replace

Note: A series of field and laboratory studies currently underway will indicate the degree to which these intervals may safely be extended since all cells no longer have the epoxy immersed in the electrolyte.

scratch may become visible on the post. This is normal.

8.04 On some cells, the lead post will have craters or an irregular surface (Fig. 9, Points A, B, and C) which is the result of the post flaking. These surface conditions should not be mistaken for corrosion. Cells which have these surface conditions will have brown debris (not powder) on top of the white cap under the post. Do not confuse this debris with the powder debris described under corrosion rating 3.

8.05 Some cells examined will have a black butyl adhesive material on the lead post, and on or under the epoxy (Fig. 9, Point D; Fig. 10, Point A; and Fig. 11, Point B). This butyl material should not be confused with post corrosion.

8.06 The amber color of the epoxy shown in Fig. 8, Point A, and Fig. 9, above Point D is normal for this type of epoxy.

8.07 The white and black areas under the epoxy shown in Fig. 8, Point B; and Fig. 10; Fig. 12, Point B; and Fig. 15, below Point C are the result of acid creepage up the epoxy/lead interface and are not indications of post corrosion.

8.08 The irregularity on the lead post (Fig. 11, Point A) and on the lower edge of the epoxy (Fig. 12, Point A) should not be confused with post corrosion.

Fig. 8—Rating 1—Normal Post (No Corrosion)

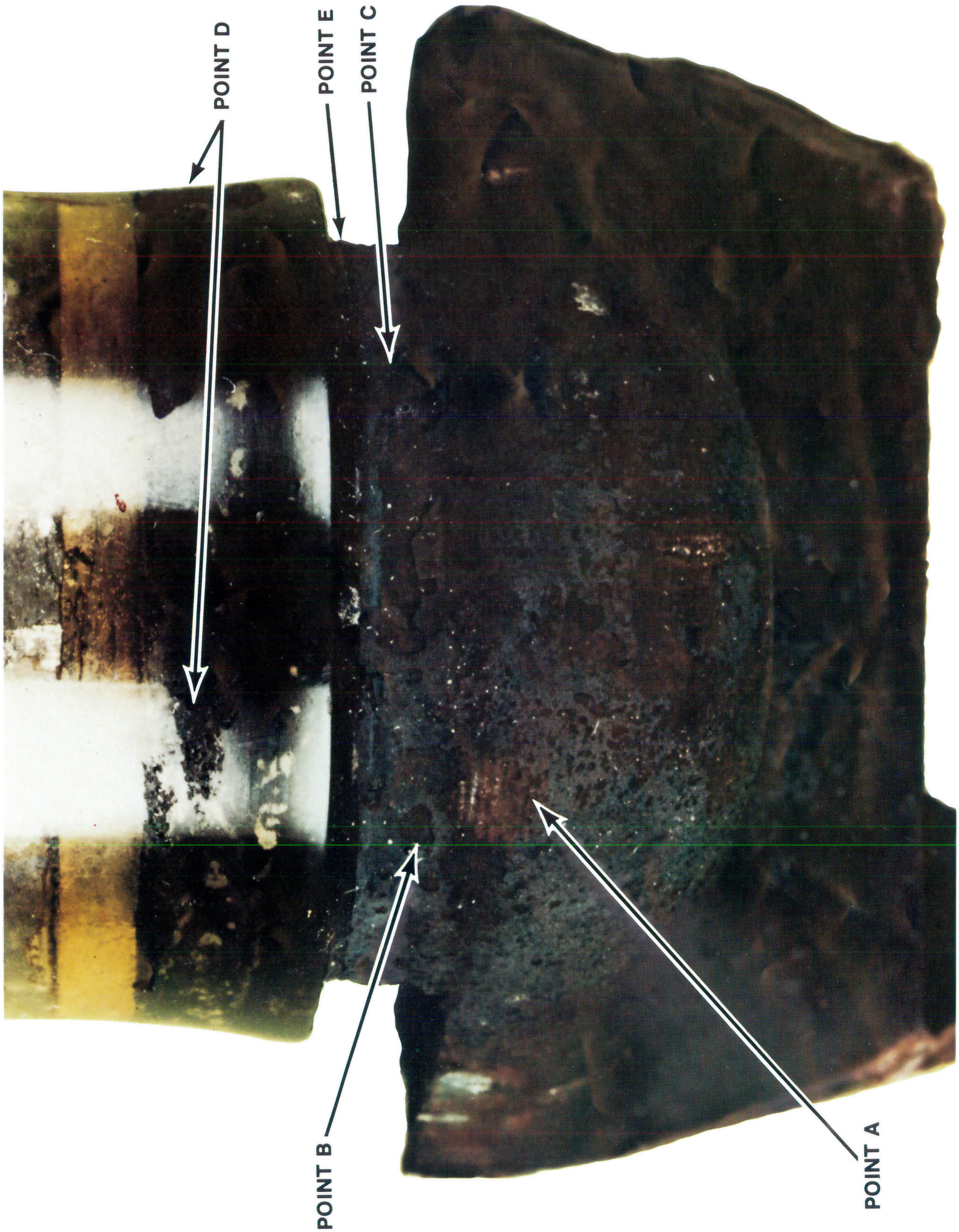


Fig. 9—Rating 1—Typical Close-Up

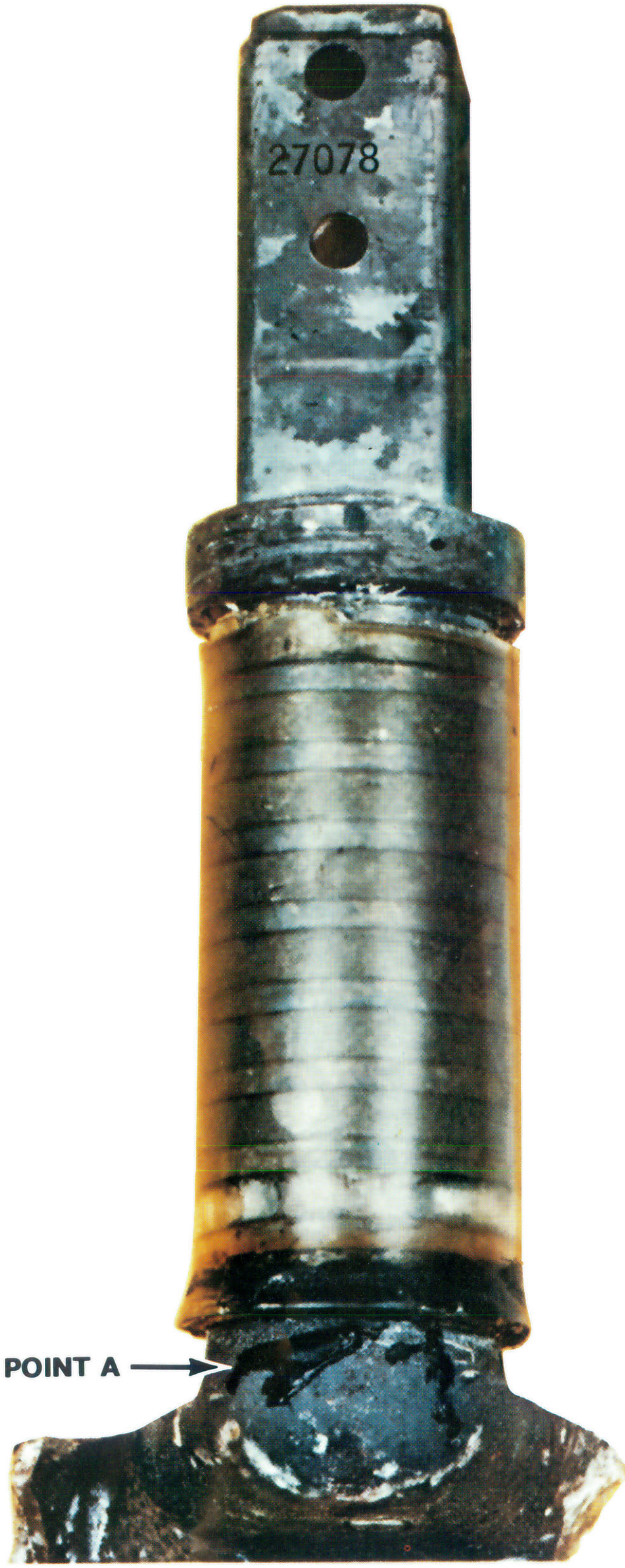


Fig. 10—Rating 1—With Butyl Adhesive

Fig. 11—Rating 1—With Butyl Adhesive Under Epoxy

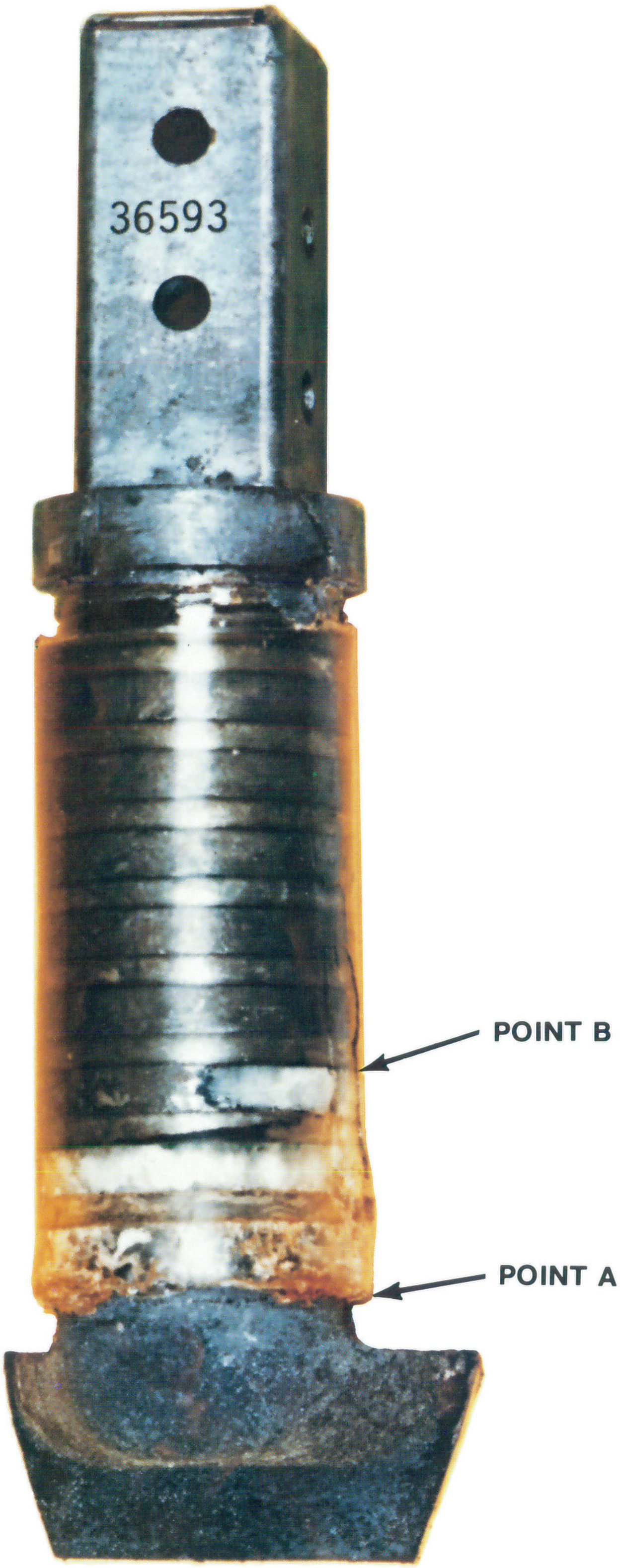


Fig. 12—Rating 1—With Distorted Epoxy

Fig. 13—Rating 3—Swelling at Edge of Epoxy

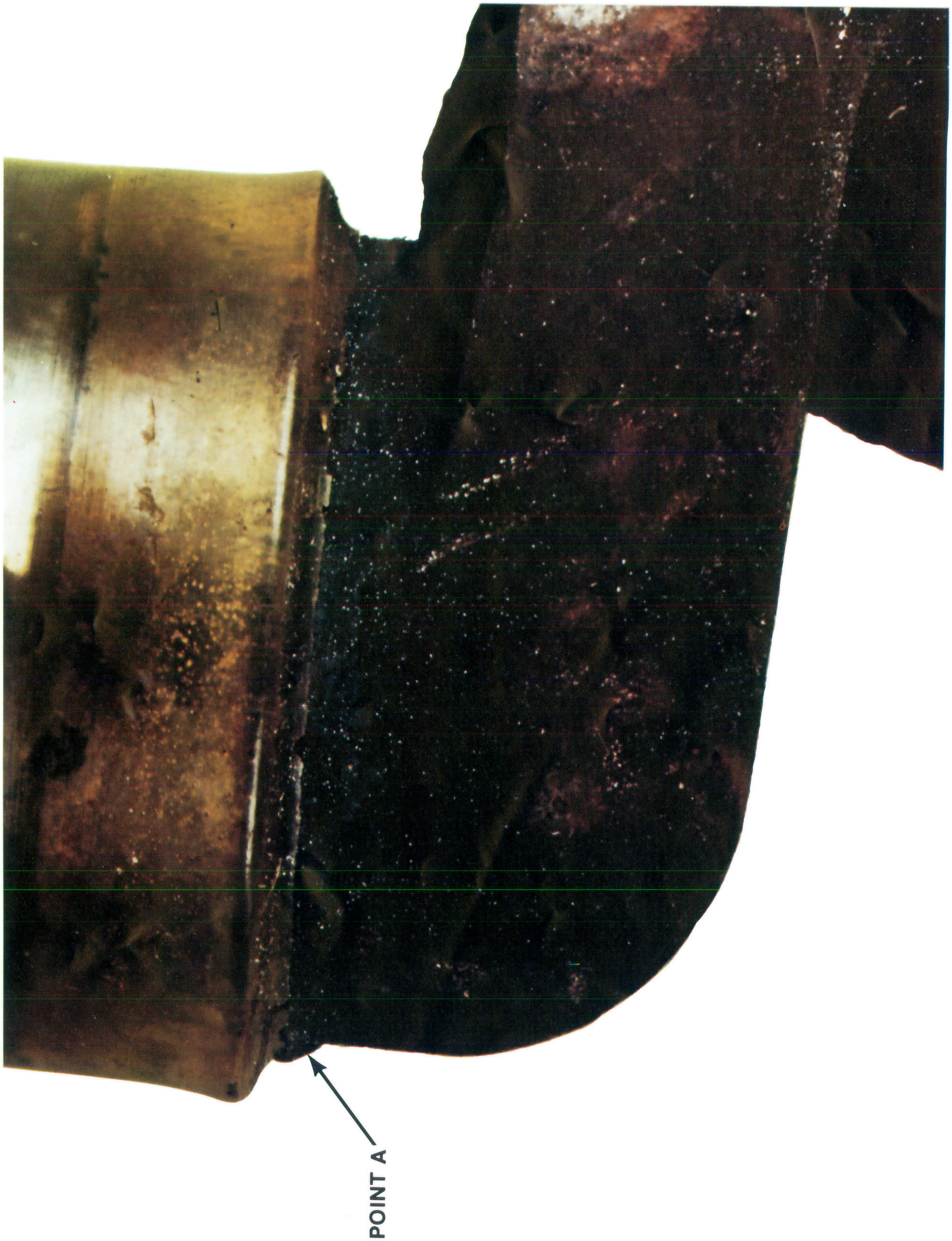


Fig. 14—Rating 2—Close-Up

Fig. 15—Rating 3—With Two Corrosion Sites

Fig. 16—Rating 3—With Epoxy Flare

Fig. 17—Rating 3—Worst Case

Fig. 18—Rating 4—Typical

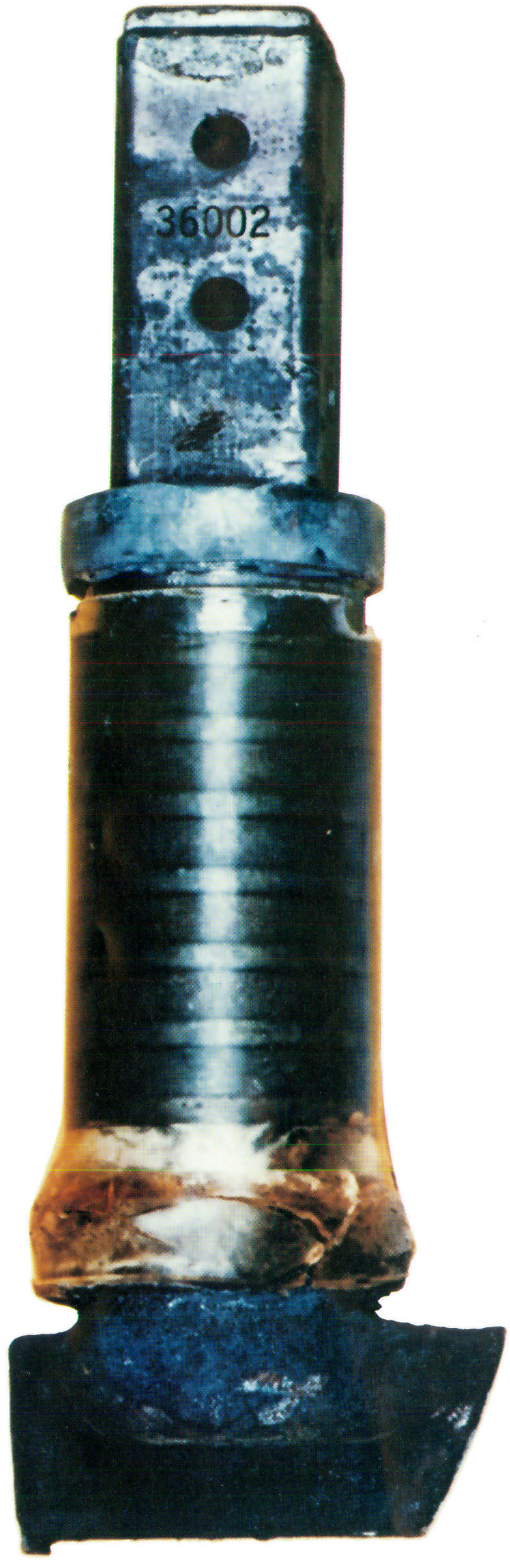


Fig. 19—Rating 4—Deteriorated Epoxy

Fig. 20—Rating 5—Typical