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# Evaluation of Metal Containers for Shipping Hazardous Materials

(U.S.) Naval Air Development Center, Warminster, PA

Prepared for

Department of Transportation, Washington, DC Office of Hazardous Materials

Sept 72

8000688

The contents of this report reflect the views of the Naval Air Development Center which is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policy of the Department of Transportation. This report does not constitute a standard, specification or regulation.

## A B S T R A C T

An investigation was conducted to evaluate various types of new metal drums and pails being used for the packaging and shipping of hazardous materials, to determine if these containers will spill their contents when subjected to high internal pressure and to specified rough handling tests. Various quantities of 17H and 17C open head drums as well as samples of 37A and 37C drums and pails spilled liquid contents after rough handling. In addition, some 37A, 37B drums and 37A and 37C pails spilled their dry (powder) contents after rough handling.

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## I N T R O D   C T I O N

The Office of Hazardous Materials, Department of Transportation (DOT) initiated a project for the purpose of testing and evaluating the various types of new drums and pails being used for packaging hazardous materials. It is expected the data gathered will form a basis for potential, future regulatory amendment as well as to confirm generally the quality of drums and pails being furnished by and stated by the industry to conform with the requirements of Title 49 CFR Parts 170-189.

For this project, the Naval Air Development Center was supplied drums and pails submitted by members of the Steel Shipping Container Institute. In keeping with the DOT invitation to industry to witness the testing of the containers, various representatives witnessed these tests as listed in the Appendix.

## S A M P L E S   A N D   P R E P A R A T I O N

The Naval Air Development Center received 289 containers, designed to conform to the DOT specifications, for testing. Of these, 165 were 55 gallon drums and 124 were 5 gallon pails which varied in the style of closure and gauge of the metal. Also included were the special mono-stress 55 gallon metal drums and some 55 gallon plastic drums. The number of containers received under each specification, the type of closures and gauge of metal used in each container are listed in Table 1. Containers designated for pressure tests were fitted with bulkhead nipples for pressurizing the containers. The nipple was placed in the center of

required for all open head 55 gallon drums as illustrated in Figure 1. The nipple was placed in the center of the bottom of all 5 gallon pails. On the closed head, 55 gallon drums, the 3/4 inch bung was adapted to pressurize the drums. No special preparations were required on those containers designated to be subjected to the drop tests.

## PROCEDURE

Visual Examination. Each container was examined for dents, creases, type of seam and chimes, and repair if any. Gaskets were examined for material, conditions, type, mold marks and fit. Number of lugs and spacing on lug-head covers, number and distance between hoops were noted. The height of the drum, distance between the 2 inch and the 3/4 inch bung openings, diameter of containers and convexity in heads of drums were also noted. The markings were examined for size, whether they were embossed, and if they were complete with name, gauge, rated capacity, year of manufacture and DOT specification (see Table 2). Ten percent of the containers under each specification were measured for thickness (see Table 3). The gauge thickness of the containers was measured with an automatic ultrasonic Digital Thickness Gage, Model G2-B, illustrated in Figure 2. The measurements were made by placing a transducer, which had been calibrated, firmly in contact with the container, Figure 3. The ultrasonic signal emitted by the transducer passes through the material and is picked up and amplified by the unit. The thickness in thousandth of an inch was noted on the readout digital scale.

The gauges of the containers were found to be slightly thicker than

marked on the container. The general overall appearance and condition of the containers were good. A few minor dents and small areas where paint had been scuffed off in shipment were observed. Twelve 5 gallon closed head pails were received without flex spouts. Only three containers, one 55 gallon drum and two 5 gallon pails, all open head, were damaged in shipment to the extent they could not be tested. The open ends of these containers were bent out of round at the upper chime; therefore, the covers would not fit properly.

Hydrostatic Pressure Test. The containers were filled to 100 percent capacity with water, wiped dry, closed and sealed. The torque applied to the closed head containers depended on the type of gasket and type of fitting used. The torque in pound-feet for the 2 inch opening with the Rieke Corporation fitting was 40 with asbestos, 30 with Hycar (Buna), 40 with polyethylene, 30 with ethylene-propylene terpolymer, and 40 with Dapon. For the American Flange and Manufacturing Company 2 inch fitting, the torque in pound-feet was 15 with Buna rubber, 25 with polyethylene, and 40 with fiber. The 3/4 inch openings were not torqued because they were used to attach an air line for pressurizing the containers. The open head 55 gallon drums were torqued to 50 pound-feet. The 5 gallon pails fitted with a Rieke Flex Spout were closed and sealed using a Rieke Flex Spout Crimper. Five gallon open head pails were closed and sealed with a 16 lug pail crimper.

The equipment used to conduct this test consisted of (1) two high pressure and two low pressure gauges, (2) one pressure regulator, (3) one bleed-off and one cut-off valve, (4) four roll over drum stands, and (5)

Imperial Hand Model, 120 psig air supply. All gauges were calibrated on 3 May 1972 using an Ashcroft Dead Weight Gauge Calibrator, Model 1390, Serial No. 11617/1742B.

The containers were placed on the roll over drum stand on their side with the locking ring joint, the 2 inch closure and the side seams down. Each container was pressurized to the test pressures listed below.

| <u>Drum</u>           | <u>Pressure (psig)</u> |
|-----------------------|------------------------|
| DOT-5 (closed head)   | 40                     |
| DOT-5A                | 80                     |
| DOT-5B (closed head)  | 40                     |
| DOT-6J (closed head)  | 15 (10 gauge)          |
| DOT-17C (closed head) | 40                     |
| DOT-17C (open head)   | 20                     |
| DOT-17E               | 15                     |
| DOT-17H               | 15                     |
| DOT-37A (5 gallon)    | 7                      |
| DOT-37B (5 gallon)    | 7                      |
| DOT-37C               | 5                      |
| DOT-37D               | 15                     |
| Monostress II         | 40                     |

The test pressures were maintained for 5 minutes or until spillage was noted, indicating a leak. The results reported in Table 4 reveal that eight drums and seven pails failed the test. The drum failures were noted as leaks at the locking ring joint for Exhibits 14, 38, 53, 57, 58, 92, 112, 113, and a leak at the 2 inch bung adaptor for Exhibit 125.

The pail failures were noted as a leak at the flex spout for Exhibit 29, a leak at the upper chime for Exhibit 36, and a leak at the cover for Exhibits 7, 48, and 73. The failures are illustrated in Figure 4 through Figure 11.

Pneumatic Leak Test. Containers subjected to this test were prepared, torqued, and tested using the same equipment as in the hydrostatic pressure test except empty containers were tested. The empty containers were pressurized to the internal air pressures listed below.

| <u>Drum</u>         | <u>Pressure (psig)</u> |
|---------------------|------------------------|
| DOT-5               | 15                     |
| DOT-5A              | 15                     |
| DOT-5B              | 15                     |
| * DOT-6C            | 15                     |
| * DOT-6J            | 15 (16 gage)           |
| DOT-6J              | 7 (18 gage)            |
| * DOT-6K            | 7                      |
| DOT-17C             | 15                     |
| DOT-17E (55 gallon) | 7                      |
| DOT-17E (5 gallon)  | 5                      |
| * DOT-17F           | 15                     |
| DOT-17H (55 gallon) | 7                      |
| DOT-37A (55 gallon) | 7                      |
| DOT-37A (5 gallon)  | 5                      |
| DOT-37B (55 gallon) | 7                      |
| DOT-37B (5 gallon)  | 5                      |

\* Not received

|               |    |
|---------------|----|
| DOT-37C       | 5  |
| DOT-57D       | 7  |
| Monostress II | 15 |

The pressures were maintained for 5 minutes or unless a leak was noted by a drop in the pressure gauge. After reaching the required pressure, a bubble supporting solution was applied to the seams, upper and lower chimes, and fittings. The containers were examined for evidence of leakage. The results reported in Table 4 reveal that no drums failed the test; however, five pails failed the test. The failures are noted as leaks at the lids for Exhibits 9, 10, 49, and 76. Exhibit 58 leaked at the intersection of the side seam and top chime. The type of failures are illustrated in Figures 12 and 13.

Diagonal Drop Test. Containers were filled with water to 98 percent capacity. The drums were filled to within 1-3/4 inches of the top and the pails within 1-1/2 inches of the top. Each container was closed and torqued as stated in the hydrostatic pressure test. The equipment consisted of a (1) crane for raising containers to drop height, (2) "Any Angle" drum lifter for positioning the drum for drop, (3) adjustable drum sling, and (4) a helicopter personnel automatic/manual quick release mechanism. A reinforced concrete pad 10 x 10 x 2 feet was used as the impact surface.

The containers were lifted using the drum lifter and positioned so that the head of the container faced downward and formed a diagonal with the impact surface as illustrated in Figure 14.

For the closed head containers, the 2 inch bung was placed in the center of the impact area. For the open head 55 gallon drum, the locking ring joint was positioned so it would impact the test pad. The containers were raised to the heights listed below and dropped diagonally on to the concrete pad.

| <u>Specification</u> | <u>Height of Drop (feet)</u> |
|----------------------|------------------------------|
| DOT-5                | 4                            |
| DOT-5A               | 6                            |
| DOT-5B               | 4                            |
| DOT-6J               | 4                            |
| DOT-17C              | 4                            |
| DOT-17E              | 4                            |
| DOT-17H              | 4                            |
| DOT-37A              | 4                            |
| DOT-37B              | 4                            |
| DOT-37C              | 32 inches                    |
| DOT-37D              | 4                            |
| Monostress II        | 6                            |

After drop, the containers remained in the first position for 2 minutes during which time the container and concrete pad were examined for spillage. The containers were turned two revolutions, brought to rest at a different position for one minute and re-examined for spillage. They were removed from the impact area and placed head down and examined again for spillage. Spillage in the first two minutes was listed as a failure.

The results reported in Table 4 indicated that 11 drums and 11 pails failed. The drum failures were noted as leaks in the impact area for Exhibits 20, 16, 50, 54, 68, 141, and leaks at the locking ring joint for Exhibits 132 and 140. The latter drums (132 and 140) were not tested, the leaks having occurred when they were lifted for testing. The failures are illustrated in Figures 15 through 19. Pail failures were noted as a leak at the flex spout of Exhibit 37, severe leaks in the impact area for Exhibits 5, 6, 8, and 57 when dropped from 32 inches, and a slight leak for Exhibit 67 when dropped from 28 inches. Exhibits 41 and 44 leaked after a 4-foot drop, Exhibit 43 leaked after a 42-inch drop, and Exhibits 46 and 47 leaked after a 36-inch drop. Typical failures are illustrated in Figures 20 through 26.

Horizontal Drop Test. The containers were prepared and tested in the same manner using the same height and test equipment as for the diagonal drop test, with the exception that the containers were raised as illustrated in Figure 27 and dropped so that the side seam impacted the base pad. After drop, the container and pad were examined for spillage. The results reported in Table 4 reveal that seven drums and six pails failed the test. Failures for the drums were noted as leaks at the locking ring joint of Exhibits 12, 15, and 73, and Exhibit 39 leaked at the end of the crush pattern. Exhibit 110 leaked at bottom chime, and Exhibits 142 and 143 leaked at the locking ring joint when lifted by the crane to be changed. The latter two drums (142 and 143) were not dropped. Failures of the pails were noted as leaks at the covers of Exhibits 11, 45, 50, 60, 61, and 66. Typical failures are illustrated in Figures 28 through 35.

Powder (Dry Test. Containers were filled to within 2 inches of the normal loading depth and to the gross weight marked on the container with dry sand. Where necessary, materials such as lead shot and empty cans and foamed cushioning materials were used to attain the required weight and still maintain the loading depth. The sand was topped with 2 inches of sodium bicarbonate which is the test material. Each container was closed for test. Containers fitted with the standard closing ring and the lap type of closure ring were torqued to 200 inch-pounds. Beyond this torque the closure ring bent. Containers with 9 inch opening were closed with a special crimping tool. The pails were closed using a 16 lug crimper and a Rieke spout crimper. The containers were tested in the same manner using the same equipment as for the diagonal and horizontal drop tests previously discussed, with the exception that the drop was 4 feet for all containers. After each drop the container was examined for spillage.

The results reported in Table 4 indicate that seven drums and five pails failed. Drum failures were noted as a split chime at the bottom of the container for Exhibit 71, a leak at the end of the crush pattern for Exhibit 158, and a leak at the ring closure for Exhibits 69, 160, and 163. Metal tore 3 inches at the bottom chime for Exhibit 157 and a leak at the ring closure for Exhibit 69. Failures for the 5 gallon pails were noted as leaks at the end of the crush patterns for Exhibits 90, 91, 103, 105, and 116. The failures are illustrated in Figures 36 through 46.

## DISCUSSION OF RESULTS

The measured gauge of the containers submitted indicate that the metal used was thicker than that marked on the container. The thickness varied from one to two gauges thicker than that indicated.

The initial failure of the open head 55 gallon drums under the 17H and 17C categories led to changes in the torque requirement for these containers. The torque specified was 50 pound-feet for open head drums; however, industry questioned this torque since it did not use a specific torque when it tested containers as specified in Title 49. The locking ring was tightened until the distance between the bottom of the locking ring and the side of the container was approximately 1/16 inches. The method could hardly be used as a standard. After some discussion between DOT and industry representatives, 800 pound-inches (66.7 pound-feet) was set as the torque for open head drums. Failures still occurred after retorquing to 800 pound-inches. Because of the controversy concerning the torque requirement, industry requested that another group of fourteen 17H 55 gallon drums be dropped. This time the containers would be closed until the distance between the ends of the locking ring was 1/4 inch. They would then be subjected to the diagonal and horizontal tests only. The locking ring was closed to 1/4 inch or less on 11 drums, 17/32 inch on one drum, and two drums were torqued to 800 pound-inches. Six of the 14 drums received for test failed. Four drums which were closed until the distance between the ends of the locking ring was 1/4 inch and one drum torqued to 800 pound-inches leaked at the locking ring joint when lifted to be dropped. The other drum leaked in the crush pattern after being dropped.

Failures noted in the case of the 37A and 37C 5-gallon pails were due to the severity of the tests. Containers under these two categories were to be tested using powder as the contents. The 37A containers were to be dropped from 48 inches and the 37C containers from 32 inches. An attempt was made to determine if these containers could be used to ship liquids. The water-filled pails failed when dropped from the specified height. The drop height was lowered until the containers would pass. The 37A containers failed at the 36 inches height. However, there were not enough containers to determine the height at which they would pass. For the 37C containers, the drop height at which they passed was 28 inches for the diagonal drop and 24 inches for the horizontal drop. A brief resume of the complete air and liquid tests is noted in Table 6.

For the powder test, the open head drums under the 37A category failed because of the closure ring. An attempt to increase the torque resulted in bending of the ring. Therefore, no further attempt was made to tighten the ring. The failure of the 37B drums was attributed to the high pressure used to form the chime, thereby thinning the material in this area. Failure of the 5-gallon pails in the 37A and 37C categories may be due to the excessive weight specified for the containers. No failures were noted for the horizontal drop test. There were not sufficient containers available to determine the height at which the containers would pass the diagonal drop test. A brief resume of the powder test is noted in Table 5.

## C O N C L U S I O N S

It is concluded that the massive failure of the open head drums under categories 17H and 17C drums is attributed to the inadequacy of the locking ring and not the severity of the test. The failures noted for the 37A and 37C 5-gallon pails are believed due to the severity of the test requirements. These pails failed when dropped at the specified height of 48 inches but passed when dropped at heights of 28 and 24 inches for the diagonal and horizontal drop tests, respectively. Such heights are too low to consider their use for shipment of hazardous liquids since the average trailer-bed height is 48 inches. These containers may spill their contents if accidentally knocked from a loading platform or a tail gate.

It is further concluded that the failure of the open head drums under category 37A and evaluated in the powder test is also attributed to the inadequacy of the locking ring. The failure of the pails is due to weight specified for the containers.

## R E C O M M E N D A T I O N S

It is recommended that the manufacturers be requested to redesign the locking ring to enable the 17H, the open head 17C, and 37A drums to meet the pressure and drop test requirements. It is further recommended that the 37A and 37C pails not be used to ship hazardous liquid or powder materials.

KEY SHEET OF EXHIBITORS

Company

|   |                                      |
|---|--------------------------------------|
| A | Southline Metal Products Company     |
| B | Southeastern Steel Container Company |
| C | Inland Steel Container               |
| D | Central Can Company, Inc.            |
| E | U.S. Steel Products                  |
| F | Trilla Steel Drum Corporation        |
| G | Eastern Steel Barrel Corporation     |
| H | Greif Brothers Corporation           |
| I | Manion Steel Barrel                  |
| J | Rheem Manufacturing Company          |
| K | Reliable Steel Drum Company          |
| L | GPF                                  |

TABLE 1. DESCRIPTION OF TEST CONTAINERS

| Company | DOT Specification | Gauge | Type Closure | Hydrostatic Test | Diagonal Drop | Pneumatic Test | Horizontal Drop |      | Powder | Total |
|---------|-------------------|-------|--------------|------------------|---------------|----------------|-----------------|------|--------|-------|
|         |                   |       |              |                  |               |                | Drop            | Drop |        |       |
| A       | 17E               | 18    | Closed       | X                | X             | X              |                 |      |        | 3     |
| A       | 17E               | 20/18 | Closed       | X                | X             | X              |                 |      |        | 3     |
| A       | 17E               | 24    | 5 Gallons    | X                | X             | X              | X               |      |        | 5     |
| D       | 17E               | 24    | 5 Gallons    | 3X               | 3X            | 3X             | 3X              |      |        | 12    |
| E       | 17E               | 24    | 5 Gallons    | X                | X             | X              | X               |      |        | 4     |
| E       | 17E               | 18    | Closed       | X                | X             | X              | X               |      |        | 4     |
| E       | 17E               | 20/18 | Closed       | X                | X             | X              | X               |      |        | 4     |
| C       | 17E               | 18    | Closed       | X                | X             | X              | X               |      |        | 4     |
| C       | 17E               | 20/18 | Closed       | X                | X             | X              | X               |      |        | 4     |
| F       | 17E               | 18    | Closed       | 2X               | X             | X              | X               |      |        | 5     |
| C       | 17E               | 24    | 5 Gallons    | X                | X             | X              | X               |      |        | 4     |
| I       | 17E               | 18    | Closed       | X                | X             | X              | X               |      |        | 4     |
| I       | 17E               | 20/18 | Closed       | X                | X             | X              | X               |      |        | 4     |
| J       | 17E               | 20/18 | Closed       | X                | X             | X              | X               |      |        | 4     |
| J       | 17E               | 18    | Closed       | X                | X             | X              | X               |      |        | 4     |
| J       | 17E               | 24    | 5 Gallons    | X                | X             | X              | X               |      |        | 3     |
| L       | 17E               | 24    | 5 Gallons    | 2X               | X             | X              | X               |      |        | 5     |

TABLE 1. DESCRIPTION OF TEST CONTAINERS (Con't)

| <u>Company</u> | <u>DOT Specification</u> | <u>Gauge</u> | <u>Type Closure</u> | <u>Hydrostatic Test</u> | <u>Diagonal Drop</u> | <u>Pneumatic Test</u> | <u>Horizontal Drop</u> | <u>D Powder</u> | <u>H Total</u> |
|----------------|--------------------------|--------------|---------------------|-------------------------|----------------------|-----------------------|------------------------|-----------------|----------------|
| C              | 17H                      | 18/16        | Opened              | X                       | X                    | X                     | X                      | -               | 4              |
| E              | 17H                      | 18/16        | Opened              | X                       | X                    | X                     | X                      | -               | 4              |
| F              | 17H                      | 18/16        | Opened              | 2X                      | X                    | X                     | X                      | -               | 5              |
| I              | 17H                      | 18/16        | Opened              | X                       | X                    | X                     | X                      | -               | 4              |
| J              | 17H                      | 18/16        | Opened              | X                       | X                    | X                     | -                      | -               | 3              |
| K              | 17H                      | 16/18        | Opened              | 2X                      | X                    | X                     | X                      | -               | 5              |
| C              | 17H                      | 18/16        | Opened              | -                       | 2X                   | -                     | 2X                     | -               | 4              |
| E              | 17H                      | 18/16        | Opened              | -                       | 3X                   | -                     | 3X                     | -               | 6              |
| J              | 17H                      | 18/16        | Opened              | -                       | 2X                   | -                     | 2X                     | -               | 4              |
| H              | 37A                      | 22           | Open Head           | -                       | X                    | -                     | -                      | 2X 2X           | 5              |
| G              | 37A                      | 24           | Opened              | -                       | -                    | -                     | -                      | 3X 2X           | 5              |
| G              | 37A                      | 26           | Opened              | -                       | -                    | -                     | -                      | 3X 2X           | 5              |
| J              | 37A                      | 24           | Opened<br>5 Gallons | -                       | -                    | -                     | -                      | -               | 11             |
| J              | 37A                      | 26           | Opened<br>5 Gallons | -                       | -                    | -                     | -                      | -               | 10             |

TABLE 1. DESCRIPTION OF TEST CONTAINERS (Con't)

| Company | DOT Specification | Gauge | Type Closure        | Hydrostatic Test | Diagonal Drop | Pneumatic Test | Horizontal Drop |      | Dropper | Hopper | Total |
|---------|-------------------|-------|---------------------|------------------|---------------|----------------|-----------------|------|---------|--------|-------|
|         |                   |       |                     |                  |               |                | Drop            | Drop |         |        |       |
| B       | 37C               | 28/26 | 5 Gallons           | 3X               | X             | 3X             | X               | X    | 2X      | 1X     | 10    |
| J       | 37C               | 28/26 | 5 Gallons           | -                | 4X            | -              | 3X              | X    | X       | X      | 6     |
| C       | 37C               | 28/26 | 5 Gallons           | -                | 2X            | -              | 2X              | X    | X       | X      | 6     |
| E       | 37C               | 28/26 | 5 Gallons           | -                | 3X            | -              | 3X              | X    | X       | X      | 14    |
| L       | 37C               | 28/26 | 5 Gallons           | X                | 2X            | X              | 2X              | 2X   | 2X      | 2X     | 10    |
| A       | 17C               | 16    | Closed              | X                | X             | X              | -               | -    | -       | -      | 3     |
| C       | 17C               | 16    | Opened              | X                | X             | X              | X               | X    | -       | -      | 4     |
| C       | 17C               | 16    | Closed              | X                | X             | X              | X               | X    | -       | -      | 4     |
| I       | 17C               | 16    | Closed              | X                | X             | X              | X               | X    | -       | -      | 4     |
| J       | 17C               | 16    | Closed              | X                | X             | X              | -               | -    | -       | -      | 3     |
| E       | 17C               | 16    | Closed              | X                | X             | X              | X               | X    | -       | -      | 4     |
| C       | 37D               | 23    | Closed              | X                | X             | X              | X               | X    | -       | -      | 4     |
| C       | 37D               | 21/20 | Closed              | X                | X             | X              | X               | X    | -       | -      | 6     |
| D       | 37B               | 28    | Closed<br>5 Gallons | 3X               | 1X            | 3X             | X               | X    | 2X      | 2X     | 10    |
| H       | 37B               | 25    | Small<br>Open Head  | X                | X             | X              | -               | -    | X       | X      | 5     |
| G       | 37B               | 24    | 42 Gallons          | -                | -             | -              | -               | -    | 3X      | 2X     | 5     |
| L       | 37B               | 28    | Closed<br>5 Gallons | 2X               | 2X            | X              | X               | X    | 2X      | 2X     | 10    |

TABLE 1. DESCRIPTION OF TEST CONTAINERS (Con't)

| <u>Company</u> | <u>DOT Speci-<br/>fication</u> | <u>Gauge</u> | <u>Type<br/>Closure</u> | <u>Hydrostatic<br/>Test</u> | <u>Diagonal<br/>Drop</u> | <u>Pneumatic<br/>Test</u> | <u>Horizontal<br/>Drop</u> | <u>D H<br/>Powder</u> | <u>Total</u> |
|----------------|--------------------------------|--------------|-------------------------|-----------------------------|--------------------------|---------------------------|----------------------------|-----------------------|--------------|
| J              | 5B                             | 16           | Closed                  | 3X                          | 3X                       | 2X                        | 2X                         | -                     | 10           |
| E              | 5B                             | 16           | Closed                  | 2X                          | 1X                       | 1X                        | 1X                         | -                     | 5            |
| J              | 6J                             | 18           | Closed                  | X                           | X                        | X                         | X                          | X                     | 5            |
| E              | 5A                             | 14           | Closed                  | 2X                          | X                        | X                         | X                          | -                     | 5            |
| E              | 5                              | 14           | Closed                  | 2X                          | 1X                       | 1X                        | 1X                         | -                     | 5            |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS

| Features               | Exhibit Number       |                                    |  |
|------------------------|----------------------|------------------------------------|--|
|                        | <u>1 - 3</u>         | <u>4 - 6</u>                       | <u>7 - 9</u> <u>10 - 13</u>                                |
| Dents                  | No                   | #4 - Flat at chime<br>#6 - 4" dent | #7 - 5" dent<br>#8 - Flat on chime<br>#13 - 3" dent        |
| Paint                  | Slight Scuff         | OK                                 | OK   |
| Inside Surface Treated | No                   | No                                 | Head Coated  |
| Seam and Chimes        | OK                   | OK                                 | OK   |
| Type Seam              | Beam Weld            | Beam Weld                          | Beam Weld  |
| Weld Quality           | OK                   | OK                                 | OK   |
| Condition of Gaskets   | OK                   | OK                                 | OK   |
| Type                   | Molded Poly-ethylene | Molded Poly-ethylene               | Molded Poly-ethylene<br>Head- Molded Rubber<br>Side - Buna |
| Number of Lugs         | N/A                  | N/A                                | N/A  |
| Spacing                | N/A                  | N/A                                | N/A  |
| Depth Convexity        | 5/8"                 | 5/8"                               | 5/8"   |
| Bolt Size              | N/A                  | N/A                                | 9/16"  |
| Cover Bib              | N/A                  | N/A                                | Satisfactory   |
| Number of Hoops        | Two                  | Two                                | Three  |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features                      | <u>Exhibit Number</u>        |                            |                                  |
|-------------------------------|------------------------------|----------------------------|----------------------------------|
|                               | <u>1 - 3</u>                 | <u>4 - 6</u>               | <u>7 - 9</u>                     |
| Location of Hoops             | Bottom to Top<br>12" - 12"   | Bottom to Top<br>12" - 12" | Bottom to Top<br>12" - 12" - 8"  |
| Condition of Hoops            | OK                           | OK                         | OK                               |
| Configuration of Hoops        | Rolled                       | Rolled                     | Rolled                           |
| Size of Markings              | 5/8" and 1"                  | 5/8" and 1"                | 3/4"                             |
| Manufacturer's Identification | S-L<br>16 55 4 72<br>DOT 17C | S-L<br>18 55 72<br>DOT 17E | Inland<br>18/16 55 72<br>DOT 17H |
| Overall Diameter              | 23"                          | 22-3/4"                    | 24"                              |
| Inside Diameter               | 22-3/8"                      | 22-3/8"                    | 22-3/8"                          |
| Height                        | 35"                          | 35"                        | 34-3/4"                          |
| Openings C/C                  | 18"                          | 18"                        | N/A                              |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features               | Exhibit Number                      |                          |           |
|------------------------|-------------------------------------|--------------------------|-----------|
|                        | 14 - 21                             | 22 - 25                  | 26 - 29   |
| Dents                  | #19 - 4" dent                       | No                       | No        |
| Paint                  | OK                                  | OK                       | OK        |
| Inside Surface Treated | Head Coated                         | No                       | No        |
| Seam and Chimes        | OK                                  | OK                       | OK        |
| Type Seam              | Beam Weld                           | Beam Weld                | Beam Weld |
| Weld Quality           | OK                                  | OK                       | OK        |
| Condition of Gaskets   | OK                                  | OK                       | OK        |
| Type                   | Head - Molded Rubber<br>Side - Buna | 2" - Buna<br>3/4" - EPT* | Buna      |
| Number of Lugs         | N/A                                 | N/A                      | N/A       |
| Spacing                | N/A                                 | N/A                      | N/A       |
| Depth Convexity        | 5/8"                                | 5/8"                     | None      |
| Bolt Size              | 9/16"                               | N/A                      | N/A       |
| Cover Rib              | Satisfactory                        | N/A                      | N/A       |
| Number of Hoops        | Three                               | Two                      | Two       |

\*Ethylene-Terpolymer

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con')

| Features                      | <u>Exhibit Number</u>           |                                  |                                  |
|-------------------------------|---------------------------------|----------------------------------|----------------------------------|
|                               | 14 - 21                         | 22 - 25                          | 26 - 29                          |
| Location of Hoops             | Bottom to Top<br>12" - 12" - 8" | Bottom to Top<br>12" - 12"       | 1-1/2" Apart                     |
| Condition of Hoops            | OK                              | OK                               | OK                               |
| Configuration of Hoops        | Rolled                          | Rolled                           | Rolled                           |
| Size of Markings              | 3/4"                            | 3/4"                             | 3/4"                             |
| Manufacturer's Identification | Inland<br>16 55 72<br>DOT 17C   | Inland<br>20/18 55 72<br>DOT 17E | Inland<br>21/20 55 72<br>DOT 37D |
| Overall Diameter              | 24"                             | 22-3/4"                          | 22-7/8"                          |
| Inside Diameter               | 22-3/8"                         | 22-3/8"                          | 22-3/8"                          |
| Height                        | 34-3/4"                         | 35"                              | 33-3/4"                          |
| Openings C/C                  | N/A                             | 17-1/2"                          | 17"                              |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features               | Exhibit Number |                                   |           |
|------------------------|----------------|-----------------------------------|-----------|
|                        | 34 - 37        | 38 - 40                           | 41 - 44   |
| Dents                  | No             | No                                | No        |
| Paint                  | OK             | OK                                | OK        |
| Inside Surface Treated | No             | No                                | No        |
| Seams and Chimes       | OK             | OK                                | OK        |
| Type Seam              | Beam Weld      | Beam Weld                         | Beam Weld |
| Weld Quality           | OK             | OK                                | OK        |
| Condition of Gaskets   | OK             | OK                                | OK        |
| Type                   | Buna           | Head - Molded Rubber<br>2" - Buna | Buna      |
| Number of Lugs         | N/A            | N/A                               | N/A       |
| Spacing                | N/A            | N/A                               | N/A       |
| Depth Convexity        | 5/8"           | 3/4"                              | 1/4"      |
| Bolt Size              | N/A            | 9/16"                             | N/A       |
| Cover Rib              | N/A            | Satisfactory                      | N/A       |
| Number of Hoops        | Two            | Three                             | Two       |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features                      | <u>Exhibit Number</u>         |                                 |                              |                               |
|-------------------------------|-------------------------------|---------------------------------|------------------------------|-------------------------------|
|                               | <u>34 - 37</u>                | <u>38 - 40</u>                  | <u>41 - 44</u>               | <u>45 - 48</u>                |
| Location of Hoops             | Bottom to Top<br>12" - 11"    | Bottom to Top<br>11" - 13" - 8" | Bottom to Top<br>12" - 12"   | Bottom to Top<br>12" - 12"    |
| Condition of Hoops            | OK                            | OK                              | OK                           | OK                            |
| Configuration of Hoops        | Rolled                        | Rolled                          | Rolled                       | Rolled                        |
| Size of Markings              | 7/8"                          | 7/8"                            | 1"                           | 1"                            |
| Manufacturer's Identification | Inland<br>18 55 72<br>DOT 17E | MSB<br>18/16 55 72 5<br>DOT 17H | USS<br>16 55 9 72<br>DOT 17C | USS<br>20/18 55 72<br>DOT 17E |
| Overall Diameter              | 22-7/8"                       | 22-3/4"                         | 22-7/8"                      | 22-3/4"                       |
| Inside Diameter               | 22-3/8"                       | 22-3/8"                         | 22-3/8"                      | 22-3/8"                       |
| Height                        | 34-3/4"                       | 35-1/4"                         | 34-7/8"                      | 35"                           |
| Openings C/C                  | 17-1/2"                       | N/A                             | 18"                          | 18"                           |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features               | Exhibit Number                 |               |   |
|------------------------|--------------------------------|---------------|---|
|                        | 49 - 52                        | 53 - 56       | 57 - 61                                 |
| Dents                  | #51 - 2" dent<br>#52 - 3" dent | #56 - 4" dent | #62 - 2" dent                           |
| Paint                  | Slight Scuff                   | OK            | Slight Scuff                            |
| Inside Surface Treated | No                             | No            | No                                      |
| Seams and Chimes       | OK                             | OK            | OK                                      |
| Type Seam              | Beam Weld                      | Beam Weld     | Beam Weld                               |
| Weld Quality           | OK                             | OK            | OK                                      |
| Condition of Gaskets   | OK                             | OK            | Gasket seized to chime, leaving deposit |
| Type                   | Buna                           | Molded Rubber | Sponge                                  |
| Number of Lugs         | N/A                            | N/A           | N/A                                     |
| Spacing                | N/A                            | N/A           | N/A                                     |
| Depth Convexity        | 1/4"                           | 1/4"          | 1/4"                                    |
| Bolt Size              | N/A                            | 9/16"         | N/A                                     |
| Cover Rib              | N/A                            | Satisfactory  | Satisfactory                            |
| Number of Hoops        | Two                            | Three         | Two                                     |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features                      | <u>Exhibit Number</u>      |                                   |                               |
|-------------------------------|----------------------------|-----------------------------------|-------------------------------|
|                               | <u>49 - 52</u>             | <u>53 - 56</u>                    | <u>57 - 61</u> <u>62 - 66</u> |
| Location of Hoops             | Bottom to Top<br>12" - 12" | Bottom to Top<br>12" - 12" - 8"   | Bottom to Top<br>12" - 11"    |
| Condition of Hoops            | OK                         | OK                                | OK                            |
| Configuration of Hoops        | Rolled                     | Rolled                            | Rolled                        |
| Size of Markings              | 1"                         | 1"                                | 3/4"                          |
| Manufacturer's Identification | USS<br>18 55 72<br>DOT 17E | USS<br>1-4 DOT 17H<br>18-16 55 72 | Trilla<br>18 55 72<br>DOT 17E |
| Overall Diameter              | 22-7/8"                    | 24"                               | 22-3/4"                       |
| Inside Diameter               | 22-3/8"                    | 22-3/8"                           | 22-3/8"                       |
| Height                        | 35"                        | 34-3/4"                           | 34-1/4"                       |
| Openings C/C                  | 18"                        | N/A                               | 17-1/2"                       |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features               | Exhibit Number                   |                |   |
|------------------------|----------------------------------|----------------|---|
|                        | <u>73</u>                        | <u>74 - 77</u> | <u>78 - 81</u>  |
| Dents                  | (1) 2" long                      | No             | #78 - 3" dent   |
| Paint                  | Slight Scuff                     | OK             | OK  |
| Inside Surface Treated | No                               | No             | No  |
| Seam and Chimes        | OK                               | OK             | OK  |
| Type Seam              | Beam Weld                        | Beam Weld      | Beam Weld   |
| Weld Quality           | OK                               | OK             | OK  |
| Condition of Gaskets   | OK                               | OK             | OK  |
| Type                   | Head- Molded Rubber<br>2" - Buna | Buna           | Buna  |
| Number of Lugs         | N/A                              | N/A            | N/A   |
| Spacing                | N/A                              | N/A            | N/A   |
| Depth Convexity        | 3/4"                             | 5/8"           | 5/8"  |
| Bolt Size              | 9/16"                            | N/A            | N/A   |
| Cover Bib              | Satisfactory                     | N/A            | N/A   |
| Number of Hoops        | Three                            | Two            | Two<br>15 small hoops<br>in top and bottom<br>sections<br>Two large |

82 - 85

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features                      | Exhibit Number                  |                            |                                 |
|-------------------------------|---------------------------------|----------------------------|---------------------------------|
|                               | 73                              | 74 - 77                    | 78 - 81                         |
| Location of Hoops             | Bottom to Top<br>11" - 13" - 8" | Bottom to Top<br>12" - 12" | Bottom to Top<br>12" - 11-1/2"  |
| Condition of Hoops            | OK                              | OK                         | OK                              |
| Configuration of Hoops        | Rolled                          | Rolled                     | Rolled                          |
| Size of Markings              | 7/8"                            | 7/8"                       | 7/8"                            |
| Manufacturer's Identification | MSB<br>18/16 55 72 5<br>DOT 17H | MSB<br>18 55 72<br>DOT 17E | MSB<br>20/18 55 72 5<br>DOT 17E |
| Overall Diameter              | 22-3/4"                         | 22-7/8"                    | 22-7/8"                         |
| Inside Diameter               | 22-3/8"                         | 22-7/16"                   | 22-3/8"                         |
| Height                        | 35-1/4"                         | 34-7/8"                    | 34-3/4"                         |
| Openings C/C                  | N/A                             | 17-1/2"                    | 17-1/2"                         |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| <u>Features</u>        | <u>Exhibit Number</u> |                |                |
|------------------------|-----------------------|----------------|----------------|
|                        | <u>86 - 88</u>        | <u>89 - 91</u> | <u>92 - 94</u> |
| Dents                  | No                    | No             | #97 - 3" dent  |
| Paint                  | #86 - Scuff           | OK             | Slight Scuff   |
| Inside Surface Treated | No                    | No             | No             |
| Seam and Chimes        | OK                    | OK             | OK             |
| Type Seam              | Beam Weld             | Beam Weld      | Beam Weld      |
| Weld Quality           | OK                    | OK             | OK             |
| Condition of Gaskets   | OK                    | OK             | OK             |
| Type                   | Buna                  | Asbestos       | Molded Rubber  |
| Number of Lugs         | N/A                   | N/A            | N/A            |
| Spacing                | N/A                   | N/A            | N/A            |
| Depth Convexity        | 5/8"                  | 1/4"           | 5/8"           |
| Bolt Size              | N/A                   | N/A            | 9/16"          |
| Cover Bib              | N/A                   | N/A            | Satisfactory   |
| Number of Hoops        | Two                   | Two            | Two            |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| <u>Features</u>               | <u>Exhibit Number</u>            |                                     |  |
|-------------------------------|----------------------------------|-------------------------------------|--|
|                               | <u>86 - 88</u>                   | <u>89 - 91</u>                      | <u>92 - 94</u>                             |
| Location of Hoops             | Bottom to Top<br>12" - 11"       | Bottom to Top<br>12" - 11"          | Bottom to Top<br>11-1/2" - 11-1/2" -<br>9" |
| Condition of Hoops            | OK                               | OK                                  | OK   |
| Configuration of Hoops        | Rolled                           | Rolled                              | Rolled                                     |
| Size of Markings              | 1"                               | 1"                                  | 1"   |
| Manufacturer's Identification | Rheem L<br>18 55 2 72<br>DOT 17E | Rheem L<br>20/18 55 2 72<br>DOT 17E | Rheem<br>18/16 55 5 72<br>DOT 17H          |
| Overall Diameter              | 22-7/8"                          | 22-7/8"                             | 23"  |
| Inside Diameter               | 22-3/8"                          | 22-3/8"                             | 22-3/8"                                    |
| Height                        | 34-7/8"                          | 34-7/8"                             | 34-7/8"                                    |
| Openings C/C                  | 17-1/2"                          | 17-1/2"                             | 17-1/2"                                    |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features               | <u>Exhibit Number</u> |                          |                                   |
|------------------------|-----------------------|--------------------------|-----------------------------------|
|                        | <u>98 - 101</u>       | <u>102 - 111</u>         | <u>112 - 116</u> <u>117 - 121</u> |
| Dents                  | No                    | No                       | #114 - 4" dent      No            |
| Paint                  | OK                    | OK                       | #114 - Slight Scuff      Scuffed  |
| Inside Surface Treated | No                    | No                       | No                                |
| Seam and Chimes        | OK                    | Reinforced chimes<br>OK  | OK                                |
| Type Seam              | Beam Weld             | Beam Weld                | Beam Weld                         |
| Weld Quality           | OK                    | OK                       | OK                                |
| Condition of Gaskets   | OK                    | OK                       | OK                                |
| Type                   | Buna                  | Molded Poly-<br>ethylene | Buna      Asbestos                |
| Number of Lugs         | N/A                   | N/A                      | N/A                               |
| Spacing                | N/A                   | N/A                      | N/A                               |
| Depth Convexity        | 1/4"                  | 1/4"                     | 1/4"                              |
| Bolt Size              | N/A                   | N/A                      | N/A                               |
| Cover Bib              | N/A                   | N/A                      | #114 - Flat Spot      N/A         |
| Number of Hoops        | Two                   | Two                      | Three                             |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features                      | Exhibit Number                 |                               |                                |
|-------------------------------|--------------------------------|-------------------------------|--------------------------------|
|                               | 98 - 101                       | 102 - 111                     | 112 - 116                      |
| Location of Hoops             | Bottom to Top<br>12" - 11-1/2" | Bottom to Top<br>12" - 11"    | Bottom to Top<br>11-1/2" - 12" |
| Condition of Hoops            | OK                             | OK                            | OK                             |
| Configuration of Hoops        | Rolled                         | Rolled                        | Rolled                         |
| Size of Markings              | 1"                             | 1"                            | 7/8"                           |
| Manufacturer's Identification | Rheem<br>18 55 5 72<br>DOT 6J  | Rheem<br>16 55 5 72<br>DOT 5B | USS<br>16 55 4 72<br>DOT 5B    |
| Overall Diameter              | 22-7/8"                        | 23-3/8"                       | 23-1/4"                        |
| Inside Diameter               | 22-3/8"                        | 22-1/8"                       | 22-1/8"                        |
| Height                        | 34-3/4"                        | 35"                           | 35"                            |
| Openings C/C                  | 17-1/2"                        | 17-1/2"                       | 17"                            |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| <u>Features</u>        | <u>122 - 126</u> | <u>127 - 131</u> | <u>Exhibit Number</u><br><u>132 - 135</u> | <u>136 - 139</u> |
|------------------------|------------------|------------------|---|------------------|
| Dents                  | No               | No               | No  | No               |
| Paint                  | Scuffed          | Scuffed          | OK  | OK               |
| Inside Surface Treated | No               | No               | Head - Coated                             | No               |
| Seam and Chimes        | OK               | OK               | OK  | OK               |
| Type Seam              | Flash Weld       | Flash Weld       | Beam Weld                                 | Beam Weld        |
| Weld Quality           | OK               | OK               | OK  | OK               |
| Condition of Gaskets   | OK               | OK               | OK  | OK               |
| Type                   | Asbestos         | Asbestos         | Head - Molded Rubber<br>Side - Buna       | Molded Rubber    |
| Number of Lugs         | N/A              | N/A              | N/A                                       | N/A              |
| Spacing                | N/A              | N/A              | N/A                                       | N/A              |
| Depth Convexity        | 5/8"             | 5/8"             | 5/8"                                      | 5/8"             |
| Bolt Size              | N/A              | N/A              | 9/16"                                     | 9/16"            |
| Cover Rib              | N/A              | N/A              | Satisfactory                              | Satisfactory     |
| Number of Hoops        | Two              | Two              | Three                                     | Three            |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| Features                      | <u>Exhibit Number</u>              |                                |                                    |
|-------------------------------|------------------------------------|--------------------------------|------------------------------------|
|                               | <u>122 - 126</u>                   | <u>127 - 131</u>               | <u>132 - 135</u>                   |
| Location of Hoops             | Bottom to Top<br>11-1/2" - 12-1/2" | Bottom to Top<br>12" - 12-1/2" | Bottom to Top<br>11-1/2" - 11-1/2" |
| Condition of Hoops            | OK                                 | OK                             | OK                                 |
| Configuration of Hoops        | T-Bar                              | T-Bar                          | Rolled                             |
| Size of Markings              | 1"                                 | 1"                             | 1"                                 |
| Manufacturer's Identification | USS<br>14 55 72<br>DOT 5A          | USS<br>14 55 72<br>DOT 5       | Rheem<br>18/16 55 5 72<br>DOT 17H  |
| Overall Diameter              | 23-1/8"                            | 23-1/8"                        | 22-3/4"                            |
| Inside Diameter               | 22"                                | 22"                            | 22-3/8"                            |
| Height                        | 35-7/8"                            | 35-5/8"                        | 35-1/4"                            |
| Openings C/C                  | 17"                                | 17"                            | N/A                                |

TABLE 2. VISUAL EXAMINATION OF 55-GALLON DRUMS (Con't)

| <u>Features</u>        | <u>Exhibit Number</u><br>140 - 145 | <u>Features</u>               | <u>Exhibit Number</u><br>140 - 145 |
|------------------------|------------------------------------|-------------------------------|------------------------------------|
| Dents                  | No                                 | Cover Bib                     | Satisfactory                       |
| Paint                  | OK                                 | Number of Hoops               | Three                              |
| Inside Surface Treated | No                                 | Location of Hoops             | Bottom to Top<br>12" - 12" - 8"    |
| Seam and Chimes        | OK                                 | Condition of Hoops            | OK                                 |
| Type                   | Beam Weld                          | Configuration of Hoops        | Rolled                             |
| Weld Quality           | OK                                 | Size of Markings              | 1"                                 |
| Condition of Gaskets   | OK                                 | Manufacturer's Identification | USS<br>18/16 55 72<br>DOT 17H      |
| Type                   | Molded Rubber                      | Overall Diameter              | 24"                                |
| Number of Lugs         | N/A                                | Inside Diameter               | 22 3/8"                            |
| Spacing                | N/A                                | Height                        | 34-3/4"                            |
| Depth Convexity        | 1/4"                               | Openings C/C                  | N/A                                |
| Bolt Size              | 9/16"                              |                               |                                    |

TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS

| Features               | <u>Exhibit Number</u>      |                  |                                    |
|------------------------|----------------------------|------------------|------------------------------------|
|                        | <u>1 - 4</u>               | <u>5 - 11</u>    | <u>12 - 23</u> <u>24 - 27</u>      |
| Dents                  | #2, 3, 4, - Two dents each | No               | #17 - 4" dent      No              |
| Paint                  | OK                         | OK               | OK      OK                         |
| Inside Surface Treated | No                         | No               | No      No                         |
| Seam and Chimes        | OK                         | OK               | OK      OK                         |
| Type Seam              | Beam Weld                  | Beam Weld        | Beam Weld      Beam Weld           |
| Weld Quality           | OK                         | OK               | OK      OK                         |
| Condition of Gaskets   | OK                         | OK               | OK      CK                         |
| Type                   | Fibre                      | Flowed-In Sponge | Flexible Spout      Flexible Spout |
| Number of Lugs         | N/A                        | 16               | N/A      N/A                       |
| Spacing                | N/A                        | 2-1/4" C/C       | N/A      N/A                       |
| Depth Convexity        | None                       | None             | None      None                     |
| Bolt Size              | N/A                        | N/A              | N/A      N/A                       |
| Cover Bib              | N/A                        | N/A              | N/A      N/A                       |
| Number of Hoops        | None                       | Two              | None      None                     |

TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS (Con't)

| Features                      | <u>Exhibit Number</u>           |                                   |   |
|-------------------------------|---------------------------------|-----------------------------------|---|
|                               | <u>1 - 4</u>                    | <u>5 - 11</u>                     | <u>12 - 23</u>                            |
| Location of Hoops             | N/A                             | Bottom to Top<br>9-1/2" - 3"      | N/A                                       |
| Condition of Hoops            | N/A                             | OK                                | N/A                                       |
| Configuration of Hoops        | N/A                             | Rolled                            | N/A                                       |
| Size of Markings              | 1-3/4" and 3/4"                 | 5/8" and 1/2"                     | 7/16" and 1/2"                            |
| Manufacturer's Identification | Southline<br>24 5 72<br>DOT 17E | Sesco<br>28/26 5 72<br>DOT 37C 80 | Central Can Company<br>24 5 72<br>DOT 17E |
| Overall Diameter              | 11-3/8"                         | 11-3/4"                           | 11-3/8"                                   |
| Inside Diameter               | 11-1/8"                         | 11-1/4"                           | 11-3/16"                                  |
| Height                        | 14"                             | 13-1/2"                           | 13-3/4"                                   |
| Openings C/C                  | N/A                             | N/A                               | N/A                                       |
|                               |                                 |                                   | 1/2" and 3/4"                             |
|                               |                                 |                                   | USS<br>24 5 72<br>DOT 17E                 |
|                               |                                 |                                   | 11-3/8"                                   |
|                               |                                 |                                   | 11-1/8"                                   |
|                               |                                 |                                   | 14"                                       |
|                               |                                 |                                   | N/A                                       |
|                               |                                 |                                   | N/A                                       |

TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS (Con't)

| Features               | <u>Exhibit Number</u> |                |                  |
|------------------------|-----------------------|----------------|------------------|
|                        | <u>28 - 35</u>        | <u>36 - 39</u> | <u>40 - 42</u>   |
| Dents                  | No                    | No             | No               |
| Paint                  | OK                    | OK             | OK               |
| Inside Surface Treated | No                    | No             | No               |
| Seam and Chimes        | OK                    | OK             | OK               |
| Type Seam              | Beam Weld             | Beam Weld      | Beam Weld        |
| Weld Quality           | OK                    | OK             | OK               |
| Condition of Gaskets   | OK                    | OK             | OK               |
| Type                   | Flexible Spout        | Flexible Spout | Flowed In Sponge |
| Number of Lugs         | N/A                   | N/A            | 16               |
| Spacing                | N/A                   | N/A            | 2-1/4" C/C       |
| Depth Convexity        | None                  | None           | None             |
| Bolt Size              | N/A                   | N/A            | N/A              |
| Cover Bib              | N/A                   | N/A            | N/A              |
| Number of Hoops        | None                  | None           | Two              |

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TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS (Con't)

| <u>Features</u>               | <u>Exhibit Number</u>                    |                              |                              |
|-------------------------------|--|------------------------------|------------------------------|
|                               | <u>28 - 35</u>                           | <u>36 - 39</u>               | <u>40 - 42</u>               |
| Location of Hoops             | N/A                                      | N/A                          | Bottom to Top<br>9-1/2" - 3" |
| Condition of Hoops            | N/A                                      | N/A                          | OK                           |
| Configuration of Hoops        | N/A                                      | N/A                          | Rolled                       |
| Size of Markings              | 1/2" and 5/8"                            | 1/2"                         | 1/2"                         |
| Manufacturer's Identification | Central Can Co.<br>28 5 72<br>DOT 37B 60 | Inland<br>24 5 72<br>DOT 17E | Rheem<br>26 5 72<br>DOT 37A  |
| Overall Diameter              | 11-3/8"                                  | 11-3/8"                      | 11-3/8"                      |
| Inside Diameter               | 11-3/16"                                 | 11-1/8"                      | 11-1/8"                      |
| Height                        | 13-3/4"                                  | 14"                          | 13-3/4"                      |
| Openings C/C                  | N/A                                      | N/A                          | N/A                          |

TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS (Con't)

| <u>Features</u>        | <u>Exhibit Number</u> |                |                |                  |
|------------------------|-----------------------|----------------|----------------|------------------|
|                        | <u>50 - 52</u>        | <u>53 - 55</u> | <u>56 - 62</u> | <u>63 - 67</u>   |
| Dents                  | No                    | No             | No             | No               |
| Paint                  | OK                    | OK             | OK             | OK               |
| Inside Surface Treated | No                    | No             | No             | No               |
| Seam and Chimes        | OK                    | OK             | OK             | OK               |
| Type Seam              | Beam Weld             | Beam Weld      | Beam Weld      | Beam Weld        |
| Weld Quality           | OK                    | OK             | OK             | OK               |
| Condition of Gaskets   | OK                    | OK             | OK             | OK               |
| Type                   | Flowed-In Sponge      | Flexible Spout | Flow-In Sponge | Flowed-In Sponge |
| Number of Lugs         | 16                    | N/A            | 16             | 16               |
| Spacing                | 2-1/4" C/C            | N/A            | 2-1/4" C/C     | 2-1/4" C/C       |
| Depth Convexity        | None                  | None           | None           | None             |
| Bolt Size              | N/A                   | N/A            | N/A            | N/A              |
| Cover Bib              | N/A                   | N/A            | N/A            | N/A              |
| Number of Hoops        | Two                   | None           | Two            | Two              |

TABLE 2. VISUAL EXAMINATION 5-GALLON DRUMS (Con't)

| <u>Features</u>               | <u>50 - 52</u>               | <u>53 - 55</u>              | <u>Exhibit Number</u><br><u>56 - 62</u> | <u>63 - 67</u>                  |
|-------------------------------|------------------------------|-----------------------------|---|---------------------------------|
| Location of Hoops             | Bottom to Top<br>9-1/2" - 3" | N/A                         | Bottom to Top<br>9-1/2" - 3"            | Bottom to Top<br>9-1/2" - 3"    |
| Condition of Hoops            | OK                           | N/A                         | OK                                      | OK                              |
| Configuration of Hoops        | Rolled                       | N/A                         | Rolled                                  | Rolled                          |
| Size of Markings              | 1/2"                         | 1/2"                        | 1/2"                                    | 1/2"                            |
| Manufacturer's Identification | Rheem<br>24 5 72<br>DOT 37A  | Rheem<br>24 5 72<br>DOT 17E | Rheem<br>28/26 5 72<br>DOT 37C          | Inland<br>28/26 5 72<br>DOT 37C |
| Overall Diameter              | 11-1/4"                      | 11-3/8"                     | 11-3/8"                                 | 11-3/4"                         |
| Inside Diameter               | 11'1/8"                      | 11'1/8"                     | 11'1/8"                                 | 11'1/4"                         |
| Height                        | 13-3/4"                      | 13-3/4"                     | 15"                                     | 13-3/4"                         |
| Openings C/C                  | N/A                          | N/A                         | N/A                                     | N/A                             |

TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS (Con't)

| Features               | Exhibit Number   |                  |                |
|------------------------|------------------|------------------|----------------|
|                        | 68 - 72          | 73 - 78          | 79 - 84        |
| Dents                  | No               | No               | No             |
| Paint                  | OK               | OK               | OK             |
| Inside Surface Treated | No               | No               | No             |
| Seam and Chimes        | OK               | OK               | OK             |
| Type Seam              | Beam Weld        | Beam Weld        | Beam Weld      |
| Weld Quality           | OK               | OK               | OK             |
| Condition of Gaskets   | OK               | OK               | OK             |
| Type                   | Flowed-In Sponge | Flowed-In Sponge | Flexible Spout |
| Number of Lugs         | 16               | 16               | N/A            |
| Spacing                | 2-1/4" C/C       | 2-1/4" C/C       | N/A            |
| Depth Convexity        | None             | None             | None           |
| Bolt Size              | N/A              | N/A              | N/A            |
| Cover Bib              | N/A              | N/A              | N/A            |
| Number of Hoops        | Two              | Two              | None           |

TABLE 2. VISUAL EXAMINATION OF 5-GALLON DRUMS (Con't)

| <u>Features</u>               | <u>68 - 72</u>               | <u>73 - 78</u>               | <u>Exhibit Number</u><br><u>79 - 84</u> | <u>85 - 89</u>            |
|-------------------------------|------------------------------|------------------------------|---|---------------------------|
| Location of Hoops             | Bottom to Top<br>9-1/2" - 3  | Bottom to Top<br>9-1/2" - 3  | N/A                                     | N/A                       |
| Condition of Hoops            | OK                           | OK                           | N/A                                     | N/A                       |
| Configuration of Hoops        | Rolled                       | Rolled                       | N/A                                     | N/A                       |
| Size of Markings              | 1/2" and 3/4"                | 1/2"                         | 1/2"                                    | 1/2"                      |
| Manufacturer's Identification | USS<br>28/26 5 72<br>DOT 37C | GPF<br>28/26 5 72<br>DOT 37C | GPF<br>28 5 72<br>DOT 37B               | GPF<br>24 5 72<br>DOT 17E |
| Overall Diameter              | 11-3/4"                      | 11-3/4"                      | 11-3/8"                                 | 11-3/8"                   |
| Inside Diameter               | 11-1/4"                      | 11-1/4"                      | 11-3/16"                                | 11-1/8"                   |
| Height                        | 13-3/4"                      | 13-3/4"                      | 13-3/4"                                 | 14"                       |
| Openings C/C                  | N/A                          | N/A                          | N/A                                     | N/A                       |

TABLE 3. Measured Gauges of 55-Gallon Drums and 5-Gallon Pails

| <u>Exhibit</u> | <u>Measured Thickness</u> |            |               |            | <u>Manufacturer's Gauge</u> |
|----------------|---------------------------|------------|---------------|------------|-----------------------------|
|                | <u>Body</u>               |            | <u>Head</u>   |            |                             |
|                | <u>Inches</u>             | <u>AWG</u> | <u>Inches</u> | <u>AWG</u> |                             |
| <b>Drums</b>   |                           |            |               |            |                             |
| 6              | .0464                     | 17         | .0497         | 16         | 18                          |
| 13             | .0474                     | 17         | .0548         | 15         | 18/16                       |
| 18             | .0575                     | 15         | .0468         | 16         | 16                          |
| 27             | .0483                     | 16         | .0337         | 19         | 21/20                       |
| 36             | .0537                     | 16         | .0425         | 18         | 18                          |
| 45             | .0326                     | 20         | .0451         | 17         | 20/18                       |
| 60             | .0468                     | 17         | .0536         | 16         | 18/16                       |
| 84             | .0545                     | 15         | .0497         | 16         | 16                          |
| 89             | .0330                     | 20         | .0507         | 16         | 20/18                       |
| 98             | .0483                     | 16         | .0465         | 17         | 18                          |
| 115            | .0451                     | 17         | .0555         | 15         | 16/18                       |
| 118            | .0537                     | 16         | .0500         | 16         | 16                          |
| 125            | .0712                     | 13         | .0704         | 13         | 14                          |
| 127            | .0725                     | 13         | .0702         | 13         | 14                          |
| <b>Pails</b>   |                           |            |               |            |                             |
| 19             | .0213                     | 23         | .0228         | 23         | 24                          |
| 24             | .0228                     | 23         | .0229         | 23         | 24                          |
| 33             | .0154                     | 26         | .0158         | 26         | 28                          |
| 48             | .0164                     | 26         | .0166         | 26         | 26                          |
| 70             | .0139                     | 27         | .0163         | 26         | 28/26                       |
| 76             | .0132                     | 28         | .0183         | 25         | 28/26                       |
| 88             | .0245                     | 22         | .0225         | 23         | 24                          |

TABLE 4. TABLE OF RESULTS

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u>  | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>  | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|--------------|-------------------------|---------------|---|---------------|
| 1              | A              | 17C                      | 178.115                     | 16           | 55          | Closed              | Hydro-static | 40 PSIG                 | Pass          | Crowning of both heads - radial stress lines, top and bottom chimes uncurled 4 inches from 2-inch bung. |               |
| 2              | A              | 17C                      | 178.115                     | 16           | 55          | Closed              | Diagonal     | 4 FT                    | Pass          | No leaks - distortion at 2-inch bung area.  |               |
| 3              | A              | 17C                      | 178.115                     | 16           | 55          | Closed              | Pneumatic    | 15 PSIG                 | Pass          | No distortion.  |               |
| 4              | A              | 17E                      | 178.116                     | 18           | 55          | Closed              | Hydro-static | 15 PSIG                 | Pass          | Slight radial stress lines top and bottom.  |               |
| 5              | A              | 17E                      | 178.116                     | 18           | 55          | Closed              | Diagonal     | 4 FT                    | Pass          |   |               |
| 6              | A              | 17E                      | 178.116                     | 18           | 55          | Closed              | Pneumatic    | 7 PSIG                  | Pass          |   |               |
| 7              | A              | 17E                      | 178.116                     | 20/18        | 55          | Closed              | Hydro-static | 15 PSIG                 | Pass          | Excessive radial stress on top and bottom.  |               |
| 8              | A              | 17E                      | 178.116                     | 20/18        | 55          | Closed              | Diagonal     | 4 FT                    | Pass          |   |               |
| 9              | A              | 17E                      | 178.116                     | 20/18        | 55          | Closed              | Pneumatic    | 7 PSIG                  | Pass          |   |               |
| 10             | C              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Diagonal     | 4 FT                    | Fail          | Severe leak at impact area.   |               |

TABLE 4. TABLE OF CONTENTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|--|---------------|
| 11             | C              | 17H                      | 178.118                     | 18/16        | 55          | Open                | Hydrostatic | 15 PSIG                 | Pass          | Retorque to 800 in.lb. Slight crowning and excessive radial lines top.   |               |
| 12             | C              | 17H                      | 178.118                     | 18/16        | 55          | Open                | Horizontal  | 4 FT.                   | Fail          | Leak at locking ring joint.  | 28            |
| 13             | C              | 17H                      | 178.118                     | 18/16        | 55          | Open                | Pneumatic   | 7 PSIG                  | Pass          | Very slight crowning top and bottom.                                     |               |
| 14             | C              | 17C                      | 178.115                     | 16           | 55          | Open                | Hydrostatic | 20 PSIG                 | Fail          | Retorque to 800 in.lb. Leak at 18 lb. at locking ring joint.             | 4             |
| 15             | C              | 17C                      | 178.115                     | 16           | 55          | Open                | Horizontal  | 4 FT                    | Fail          | Retorqued to 800 in.lb. Locking ring near bottom.                        | 29            |
| 16             | C              | 17C                      | 178.115                     | 16           | 55          | Open                | Diagonal    | 4 FT.                   | Fail          | Retorqued to 800 in.lbs. Leak at end of crush pattern.                   | 16            |
| 17             | C              | 17C                      | 178.115                     | 16           | 55          | Open                | Pneumatic   | 15 PSIG                 | Pass          | Retorqued to 800 in.lb. Slight crowning and radial lines top and bottom. |               |
| 18             | C              | 17C                      | 178.115                     | 16           | 55          | Closed              | Pneumatic   | 15 PSIG                 | Pass          | Slight radial stress lines top and bottom heads.                         |               |
| 19             | C              | 17C                      | 178.115                     | 16           | 55          | Closed              | Diagonal    | 4 FT                    | Pass          | Leak at distorted chime after two minutes.                               |               |
| 20             | C              | 17C                      | 178.115                     | 16           | 55          | Closed              | Hydrostatic | 40 PSIG                 | Pass          | Excess crowning and radial lines top and bottom.                         |               |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Spec-<br/>ification</u> | <u>CFR Section<br/>Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type<br/>Closure</u> | <u>Test</u>      | <u>Test Re-<br/>quirement</u> | <u>Re-<br/>sult</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------------|---------------------------------|--------------|-------------|-------------------------|------------------|-------------------------------|---------------------|--|---------------|
| 21             | C              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                |  |               |
| 22             | C              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                | No leaks. Distortion at 2-<br>inch bung.   |               |
| 23             | C              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                | Drum humped on top at rest<br>position.  |               |
| 24             | C              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Hydro-<br>static | 15 PSIG                       | Pass                | Excessive crowning top and<br>bottom with radial lines.  |               |
| 25             | C              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Pneumatic        | 7 PSIG                        | Pass                | Very slight crowning. Slight<br>radial stress lines top and<br>bottom.                               |               |
| 26             | C              | 37D                            | 178.137                         | 21/20        | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                | Dropped from crane about 8<br>feet on corner of cement.<br>No leak. Retest at 6 feet<br>on diagonal. |               |
| 27             | C              | 37D                            | 178.137                         | 21/20        | 55          | Closed                  | Hydro-<br>static | 15 PSIG                       | Pass                | Slight crowning and radial lines<br>top only.  |               |
| 28             | C              | 37D                            | 178.137                         | 21/20        | 55          | Closed                  | Pneumatic        | 7 PSIG                        | Pass                | Slight crowning and very slight<br>radial lines top and bottom.                                      |               |
| 29             | C              | 37D                            | 178.137                         | 21/20        | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                | Top sagged. Reinforced chime<br>separated slightly.  |               |
| 30             | C              | 37D                            | 178.137                         | 23           | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                | Top sagged. Reinforced chime<br>separated slightly.  |               |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test         | Test Requirement | Result | Remarks  | Figure |
|---------|---------|-------------------|----------------------|-------|------|--------------|--------------|------------------|--------|--|--------|
| 31      | C       | 37D               | 178.137              | 23    | 55   | Closed       | Diagonal     | 4 FT.            | Pass   |  |        |
| 32      | C       | 37D               | 178.137              | 23    | 55   | Closed       | Hydro-static | 15 PSIG          | Pass   | Radial lines at bottom.                              |        |
| 33      | C       | 37D               | 178.137              | 23    | 55   | Closed       | Pneumatic    | 7 PSIG           | Pass   |  |        |
| 34      | C       | 17E               | 178.116              | 18    | 55   | Closed       | Diagonal     | 4 FT             | Pass   | Leak at third attitude.                              |        |
| 35      | C       | 17E               | 178.116              | 18    | 55   | Closed       | Horizontal   | 4 FT             | Pass   |  |        |
| 36      | C       | 17E               | 178.116              | 18    | 55   | Closed       | Hydro-static | 15 PSIG          | Pass   | Excessive crowning radial lines top and bottom.      |        |
| 37      | C       | 17E               | 178.116              | 18    | 55   | Closed       | Pneumatic    | 7 PSIG           | Pass   |  |        |
| 38      | I       | 17H               | 178.118              | 18/16 | 55   | Opened       | Hydro-static | 15 PSIG          | Fail   | Massive leak at closure joint 11 lb.                 | 5      |
| 39      | I       | 17H               | 178.118              | 18/16 | 55   | Opened       | Horizontal   | 4 FT             | Fail   | Torque 800 in-lb. leak at end of crush pattern.      | 30     |
| 40      | I       | 17H               | 178.118              | 18/16 | 55   | Opened       | Pneumatic    | 7 PSIG           | Pass   | Very slight crowning.                                |        |
| 41      | E       | 17C               | 178.115              | 16    | 55   | Closed       | Hydro-static | 40 PSIG          | Pass   | Excessive radial lines crowning top and bottom.      |        |
| 42      | E       | 17C               | 178.115              | 16    | 55   | Closed       | Diagonal     | 4 FT             | Pass   | No leak initially - leak at second attitude at side. |        |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test        | Test Requirement | Result    | Remarks  | Figure |
|---------|---------|-------------------|----------------------|-------|------|--------------|-------------|------------------|-----------|--|--------|
| 43      | E       | 17C               | 178.115              | 16    | 55   | Closed       | Pneumatic   | 15 PSIG          | Pass      | Slight crowning top and bottom. Slight radial lines top and bottom.                                |        |
| 44      | E       | 17C               | 178.115              | 16    | 55   | Closed       | Horizontal  | 4 FT             | Pass      | Slight puff at 2-inch bung on impact.  |        |
| 45      | E       | 17E               | 178.116              | 20/18 | 55   | Closed       | Hydrostatic | 15 PSIG          | Pass      | Moderate radial lines, crowning top and bottom.  |        |
| 46      | E       | 17E               | 178.116              | 20/18 | 55   | Closed       | Diagonal    | 4 FT             | Pass      | Leak at chime in impact area after two minutes and first roll.                                     |        |
| 47      | E       | 17E               | 178.116              | 20/18 | 55   | Closed       | Pneumatic   | 7 PSIG           | Pass      | Very slight radial stress bottom head.   |        |
| 48      | E       | 17E               | 178.116              | 20/18 | 55   | Closed       | Horizontal  | 4 FT             | Pass      | Drum humped on top.  |        |
| 49      | E       | 17E               | 178.116              | 18    | 55   | Closed       | Hydrostatic | 15 PSIG          | Drum Pass | Radial lines top and bottom. Leak at 2-inch bung due to gasket gathering. Retest for gasket. Pass. |        |
| 50      | E       | 17E               | 178.116              | 18    | 55   | Closed       | Diagonal    | 4 FT.            | Fail      | Leak in impact area at chime.  | 17     |
| 51      | E       | 17E               | 178.116              | 18    | 55   | Closed       | Pneumatic   | 7 PSIG           | Pass      |  |        |
| 52      | E       | 17E               | 178.116              | 18    | 55   | Closed       | Horizontal  | 4 FT             | Pass      | Slight puff at both 3/4-inch and 2-inch bung.  |        |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>  | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|---|---------------|
| 53             | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Hydrostatic | 15 PSIG                 | Fail          | Crowning top and bottom head. Leak at locking ring joint area. Radial stress lines. Leak stopped after 2 minutes. | 6             |
| 54             | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Diagonal    | 4 FT                    | Fail          | Leak at initial contact area - leak at 90 degrees from contact after 2 minutes.                                   | 18            |
| 55             | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Pneumatic   | 7 PSIG                  | Pass          |   |               |
| 56             | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Horizontal  | 4 FT                    | Pass          | Retorque 800 in.lb. Slight puff on impact.  |               |
| 57             | F              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Hydrostatic | 15 PSIG                 | Fail          | Slight crowning bottom and top head. Leak at closure joint in 2.5 minutes.  |               |
| 58             | F              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Hydrostatic | 15 PSIG                 | Fail          | Slight crowning bottom head. Very slight radial stress at top. Slow leak at locking ring joint.                   |               |
| 59             | F              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Diagonal    | 4 FT                    | Pass          | Very slight puff of H <sub>2</sub> O at impact. No leak thereafter.   |               |
| 60             | F              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Pneumatic   | 7 PSIG                  | Pass          |   |               |
| 61             | F              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Horizontal  | 4 FT                    | Pass          | Torque 800 in-lbs.  |               |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test        | Test Requirement | Result | Remarks  | Figure |
|---------|---------|-------------------|----------------------|-------|------|--------------|-------------|------------------|--------|--|--------|
| 62      | F       | 17E               | 178.116              | 18    | 55   | Closed       | Hydrostatic | 15 PSIG          | Pass   | Top head slight radial lines - bottom head slight crowning.                        |        |
| 63      | F       | 17E               | 178.116              | 18    | 55   | Closed       | Hydrostatic | 15 PSIG          | Pass   | Slight radial lines top and bottom.  |        |
| 64      | F       | 17E               | 178.116              | 18    | 55   | Closed       | Diagonal    | 4 FT             | Pass   |  |        |
| 65      | F       | 17E               | 178.116              | 18    | 55   | Closed       | Pneumatic   | 7 PSIG           | Pass   |  |        |
| 66      | F       | 17E               | 178.116              | 18    | 55   | Closed       | Horizontal  | 4 FT             | Pass   | Very slight puff of H <sub>2</sub> O at impact. Drum humped at top side.           |        |
| *67     | H       | 37A               | 178.131              | 22    | 55   | Opened       | Diagonal    | 4 FT             | Fail   | Leaked at end of crush pattern.  |        |
| 68      | H       | 37A               | 178.131              | 22    | 55   | Opened       | Diagonal    | 4 FT             | Fail   | Very severe leak. Drum emptied in seconds.   |        |
| *69     | H       | 37A               | 178.131              | 22    | 55   | Opened       | Diagonal    | 4 FT             | Fail   | Leaked at ring closure before dropping. Bolt ring tried, 100 in-lb. torque. Failed |        |
| *70     | H       | 37B               | 178.132              | 26    | 55   | 9" Open      | Diagonal    | 4 FT             | Pass   | Slight dusting in second attitude.   | 36     |
| *71     | H       | 37B               | 178.132              | 26    | 55   | 9" Open      | Diagonal    | 4 FT             | Fail   | Bottom and top seam split.   |        |
| *72     | H       | 37B               | 178.132              | 26    | 55   | 9" Open      | Diagonal    | 4 FT             | Fail   |  |        |
| 73      | I       | 17H               | 178.118              | 18/16 | 55   | Opened       | Horizontal  | 4 FT             | Fail   | Re-torqued to 200 in-lb. torque on impact at closure joint.                        |        |

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TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Spec-<br/>ification</u> | <u>CFR Section<br/>Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type<br/>Closure</u> | <u>Test</u>      | <u>Test Re-<br/>quirement</u> | <u>Re-<br/>sult</u> | <u>Remarks</u>  | <u>Figure</u> |
|----------------|----------------|--------------------------------|---------------------------------|--------------|-------------|-------------------------|------------------|-------------------------------|---------------------|---|---------------|
| 74             | I              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Hydro-<br>static | 15 PSIG                       | Pass                | Crowning and radial lines top<br>and bottom.            |               |
| 75             | I              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                |   |               |
| 76             | I              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Pneumatic        | 7 PSIG                        | Pass                |   |               |
| 77             | I              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                |   |               |
| 78             | I              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Hydro-<br>static | 15 PSIG                       | Pass                | Crowning top and bottom. Also<br>radial lines.          |               |
| 79             | I              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                | Sharp creases in middle before<br>drop. No leak.        |               |
| 80             | I              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Pneumatic        | 7 PSIG                        | Pass                |   |               |
| 81             | I              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                |   |               |
| 82             | I              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Hydro-<br>static | 40 PSIG                       | Pass                | Excess crowning bottom and top.<br>Radial stress lines. |               |
| 83             | I              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                | Leak at third attitude.                                 |               |
| 84             | I              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Pneumatic        | 15 PSIG                       | Pass                | Slight radial lines top and<br>bottom.                  |               |
| 85             | I              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Horizontal       | 4 FT                          | Pass                |   |               |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specif-<br/>ication</u> | <u>CFR Section<br/>Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type<br/>Closure</u> | <u>Test</u>      | <u>Test Re-<br/>quirement</u> | <u>Re-<br/>sult</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------------|---------------------------------|--------------|-------------|-------------------------|------------------|-------------------------------|---------------------|--|---------------|
| 86             | J              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Hydro-<br>static | 15 PSIG                       | Pass                | Slight crowning, radial lines<br>top and bottom.                   |               |
| 87             | J              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                | Leak at second attitude.   |               |
| 88             | J              | 17E                            | 178.116                         | 18           | 55          | Closed                  | Pneumatic        | 7 PSIG                        | Pass                |  |               |
| 89             | J              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Hydro-<br>static | 15 PSIG                       | Pass                | Slight crowning, radial lines<br>top and bottom.                   |               |
| 90             | J              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                |  |               |
| 91             | J              | 17E                            | 178.116                         | 20/18        | 55          | Closed                  | Pneumatic        | 7 PSIG                        | Pass                |  |               |
| 92             | J              | 17H                            | 178.118                         | 18/16        | 55          | Opened                  | Hydro-<br>static | 15 PSIG                       | Fail                | Very slight leak at ring<br>closure joint - 800 in.lbs.<br>torque. |               |
| 93             | J              | 17H                            | 178.118                         | 18/16        | 55          | Opened                  | Diagonal         | 4 FT                          | Pass                | Torque 800 in-lbs.   |               |
| 94             | J              | 17H                            | 178.118                         | 18/16        | 55          | Opened                  | Pneumatic        | 7 PSIG                        | Pass                | Very slight crowning and<br>radial lines.                          |               |
| 95             | J              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Hydro-<br>static | 40 PSIG                       | Pass                | Excessive crowning. Radial<br>lines top and bottom.                |               |
| 96             | J              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Diagonal         | 4 FT                          | Pass                |  |               |
| 97             | J              | 17C                            | 178.115                         | 16           | 55          | Closed                  | Pneumatic        | 15 PSIG                       | Pass                | Very slight radial lines,<br>crowning top and bottom.              |               |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u>  | <u>Test Requirement</u> | <u>Results</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|--------------|-------------------------|----------------|--|---------------|
| 98             | J              | 6J                       | 178.100                     | 18           | 55          | Closed              | Hydro-static | 15 PSIG                 | Pass           | Crowning top and bottom head. Radial stress lines.   |               |
| 99             | J              | 6J                       | 178.100                     | 18           | 55          | Closed              | Diagonal     | 4 FT                    | Fail           | Leak at the end of crush pattern.  |               |
| 100            | J              | 6J                       | 178.100                     | 18           | 55          | Closed              | Pneumatic    | 7 PSIG                  | Pass           |  |               |
| 101            | J              | 6J                       | 178.100                     | 18           | 55          | Closed              | Horizontal   | 4 FT                    | Pass           |  |               |
| 102            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Hydro-static | 40 PSIG                 | Pass           | Crowning top and bottom. Radial stress lines.  |               |
| 103            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Hydro-static | 40 PSIG                 | Pass           | Very slight crowning. Slight radial lines top and bottom.  |               |
| 104            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Hydro-static | 40 PSIG                 | Pass           |  |               |
| 105            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Diagonal     | 4 FT                    | Pass           | Slight distortion.   |               |
| 106            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Diagonal     | 4 FT                    | Pass           | Very little distortion.  |               |
| 107            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Diagonal     | 4 FT                    | Pass           | Very little distortion. Retest at 6 feet on bottom. Retest at 8 feet on bottom. Reinforced ring broke loose one side. No leak. |               |
| 108            | J              | 5B                       | 178.82                      | 16           | 55          | Closed              | Pneumatic    | 7 PSIG                  | Pass           |  |               |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test         | Test Requirement | Result | Remarks  | Figure |
|---------|---------|-------------------|----------------------|-------|------|--------------|--------------|------------------|--------|--|--------|
| 109     | J       | 5B                | 178.82               | 16    | 55   | Closed       | Pneumatic    | 7 PSIG           | Pass   |  |        |
| 110     | J       | 5B                | 178.82               | 16    | 55   | Closed       | Horizontal   | 4 FT             | Fail   | Puff at bottom head. Very slow leak at bottom head.              |        |
| 111     | J       | 5B                | 178.82               | 16    | 55   | Closed       | Horizontal   | 4 FT             | Pass   | Very little distortion.  |        |
| 112     | K       | 17H               | 178.118              | 16/18 | 55   | Opened       | Hydro-static | 15 PSIG          | Fail   | Massive leak at ring closure joint, 11 psi - 800 in.lbs. torque. | 7      |
| 113     | K       | 17H               | 178.118              | 16/18 | 55   | Opened       | Hydro-static | 15 PSIG          | Fail   | Leak at closure joint at 13-1/2 PSIG - torqued to 800 in.lbs.    |        |
| 114     | K       | 17H               | 178.118              | 16/18 | 55   | Opened       | Diagonal     | 4 FT             | Void   | Cover had flat spot from being dropped. No seal. Did not test.   |        |
| 115     | K       | 17H               | 178.118              | 16/18 | 55   | Opened       | Pneumatic    | 7 PSIG           | Pass   | 800 in.lbs. torque.  |        |
| 116     | K       | 17H               | 178.118              | 16/18 | 55   | Opened       | Horizontal   | 4 FT             | Pass   | Slight puff at impact.   |        |
| 117     | E       | 5B                | 178.82               | 16    | 55   | Closed       | Hydro-static | 40 PSIG          | Pass   | Slight crowning.   |        |
| 118     | E       | 5B                | 178.82               | 16    | 55   | Closed       | Hydro-static | 40 PSIG          | Pass   | Very slight crowning and radial lines.                           |        |
| 119     | E       | 5B                | 178.82               | 16    | 55   | Closed       | Diagonal     | 4 FT             | Pass   | Very little distortion.  |        |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|--|---------------|
| 120            | E              | 5B                       | 178.82                      | 16           | 55          | Closed              | Pneumatic   | 15 PSIG                 | Pass          | Very little affect.  |               |
| 121            | E              | 5B                       | 178.82                      | 16           | 55          | Closed              | Horizontal  | 4 FT                    | Pass          | Very little distortion.  |               |
| 122            | E              | 5A                       | 178.81                      | 14           | 55          | Closed              | Hydrostatic | 80 PSIG                 | Drum Pass     | Leak at 76 PSIG at closure torque 410 in.lb. Radial lines medium crowning. |               |
| 123            | E              | 5A                       | 178.81                      | 14           | 55          | Closed              | Hydrostatic | 80 PSIG                 | Pass          | Slight crowning and radial lines.  |               |
| 124            | E              | 5A                       | 178.81                      | 14           | 55          | Closed              | Diagonal    | 6 FT                    | Pass          |  |               |
| 125            | E              | 5A                       | 178.81                      | 14           | 55          | Closed              | Pneumatic   | 15 PSIG                 | Pass          | Very little effect.  |               |
| 126            | E              | 5A                       | 178.81                      | 14           | 55          | Closed              | Horizontal  | 6 FT                    | Pass          |  |               |
| 127            | E              | 5                        | 178.80                      | 14           | 55          | Closed              | Hydrostatic | 40 PSIG                 | Pass          | Slight crowning, radial lines top only.                                    |               |
| 128            | E              | 5                        | 178.80                      | 14           | 55          | Closed              | Hydrostatic | 40 PSIG                 | Fail          | Leak from 2-inch bung threaded adapter at 0 pressure.                      | 8             |
| 129            | E              | 5                        | 178.80                      | 14           | 55          | Closed              | Diagonal    | 4 FT                    | Pass          |  |               |
| 130            | E              | 5                        | 178.80                      | 14           | 55          | Closed              | Pneumatic   | 15 PSIG                 | Pass          | Slight crowning and radial lines.  |               |
| 131            | E              | 5                        | 178.80                      | 14           | 55          | Closed              | Horizontal  | 4 FT                    | Pass          |  |               |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test       | Test Requirement | Result | Remarks  | Figure |
|---------|---------|-------------------|----------------------|-------|------|--------------|------------|------------------|--------|--|--------|
| 132     | C       | 17H               | 178.118              | 18/16 | 55   | Opened       | Diagonal   | 4 FT             | Fail   | No torque value. Ring tightened to 3/16 inch at closure joint. Leak at closure upon lifting drum. No drop    |        |
| 133     | C       | 17H               | 178.118              | 18/16 | 55   | Opened       | Horizontal | 4 FT             | Pass   | No torque value. Ring tightened to 3/16 inch at closure joint.   |        |
| 134     | C       | 17H               | 178.118              | 18/16 | 55   | Opened       | Diagonal   | 4 FT             | Pass   | No torque value. Ring tightened to 11/16 inch at closure joint. Puff at impact area. Leak at third attitude. |        |
| 135     | C       | 17H               | 178.118              | 18/16 | 55   | Opened       | Horizontal | 4 FT             | Pass   | No torque value. Ring tightened to 3/16 inch at closure joint.   |        |
| 136     | J       | 17H               | 178.118              | 18/16 | 55   | Opened       | Diagonal   | 4 FT             | Pass   | No torque value. Ring tightened to 1/4 inch at closure joint.  |        |
| 137     | J       | 17H               | 178.118              | 18/16 | 55   | Opened       | Diagonal   | 4 FT             | Pass   | No torque value. Ring tightened to 1/4 inch at closure joint. No leak.                                       |        |
| 138     | J       | 17H               | 178.118              | 18/16 | 55   | Opened       | Horizontal | 4 FT             | Pass   | No torque value. Ring tightened to 1/4 inch at closure joint.  |        |
| 139     | J       | 17H               | 178.118              | 18/16 | 55   | Opened       | Horizontal | 4 FT             | Pass   | No torque value. Ring tightened to 7/32 inch at closure joint.   |        |
| 140     | E       | 17H               | 178.118              | 18/16 | 55   | Opened       | Diagonal   | 4 FT             | Fail   | No torque value. Ring tightened to 3/16 inch at closure joint. Leak at closure upon lifting drum. No drop.   |        |

TABLE 4. TABLE OF RESULTS (Cont'd)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|--|---------------|
| 141            | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Diagonal    | 4 FT                    | Fail          | No torque value. Ring tightened to 3/16 inch at closure joint. Very slow leak at crush pattern.                        | 19            |
| 142            | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Horizontal  | 4 FT                    | Fail          | No torque value. Ring tightened to 1/4 inch at closure joint. Leak at closure when drum inverted. No drop.             |               |
| 143            | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Horizontal  | 4 FT                    | Fail          | Torque 800 in. lbs. Very slight leak at ring closure upon lifting drum. No drop.                                       |               |
| 144            | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Diagonal    | 4 FT                    | Pass          | Torque 800 in. lbs. Puff at impact.  |               |
| 145            | E              | 17H                      | 178.118                     | 18/16        | 55          | Opened              | Horizontal  | 4 FT                    | Fail          | No torque value. Ring tightened to 17/32 inch. This is an old ring from drum number 55. Leaks when lifted from ground. |               |
| *146           | G              | 37B                      | 178.132                     | 24           | 42          | Opened              | Diagonal    | 4 FT                    | Pass          | 300 lbs. 9-in. opening. No leaks.  |               |
| *147           | G              | 37B                      | 178.132                     | 24           | 42          | "                   | Diagonal    | 4 FT                    | Pass          | 300 lbs. 9-in. opening. No leaks.  |               |
| *148           | G              | 37B                      | 178.132                     | 24           | 42          | "                   | Diagonal    | 4 FT                    | Pass          | 300 lbs. 9-in. opening. No leaks.  |               |
| *149           | G              | 37B                      | 178.132                     | 24           | 42          | "                   | Horizontal  | 4 FT                    | Pass          | 300 lbs. 9-in. opening. No leaks.  |               |

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TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|--|---------------|
| *150           | G              | 37B                      | 178.132                     | 24           | 42          | Opened              | Horizontal  | 4 FT                    | Pass          | 300 lbs. 9-in. opening. No leaks.  |               |
| *151           | G              | 37A                      | 178.131                     | 24           | 55          | Opened              | Diagonal    | 4 FT                    | Pass          | 350 lbs. torque 200 in.lbs. No leaks.  |               |
| *152           | G              | 37A                      | 178.131                     | 24           | 55          | Opened              | Diagonal    | 4 FT                    | Pass          | 350 lbs. torque 200 in.lbs. Leak at second attitude at both ends of crush.                     |               |
| *153           | G              | 37A                      | 178.131                     | 24           | 55          | Opened              | Diagonal    | 4 FT                    | Pass          | 350 lbs. torque 200 in.lbs. Puff at impact. Slight sift upon rolling.                          |               |
| *154           | G              | 37A                      | 178.131                     | 24           | 55          | Opened              | Horizontal  | 4 FT                    | Pass          | 350 lbs. torque 200 in.lbs. No leaks.  |               |
| *155           | G              | 37A                      | 178.131                     | 24           | 55          | Opened              | Horizontal  | 4 FT                    | Pass          | 350 lbs. torque 200 in.lbs. Ring closure placed at end of crush before drop. No leaks.         |               |
| *156           | H              | 37B                      | 178.132                     | 26           | 55          | Opened              | Horizontal  | 4 FT                    | Not Tested    | 275 lbs., 9-in. opening.   |               |
| *157           | H              | 37B                      | 178.132                     | 26           | 55          | Opened              | Horizontal  | 4 FT                    | Fail          | 275 lbs., 9-in. opening. Metal core at end of crush pattern. 3-in. split - bottom.             |               |
| *158           | H              | 37A                      | 178.131                     | 22           | 55          | Open                | Diagonal    | 4 FT                    | Fail          | 480 lbs. Lever lock. New cover brought by manufacturer. Leak at end of crush, leak at closure. | 38            |

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TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Speci-<br/>fication</u> | <u>CFR Section<br/>Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type<br/>Closure</u> | <u>Test</u> | <u>Test Re-<br/>quirement</u> | <u>Re-<br/>sult</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------------|---------------------------------|--------------|-------------|-------------------------|-------------|-------------------------------|---------------------|--|---------------|
| *159           | H              | 37A                            | 178.131                         | 22           | 55          | Opened                  | Horizontal  | 4 FT                          | Pass                | 480 lbs. Lever lock. No leaks.   |               |
| *160           | G              | 37A                            | 178.131                         | 26           | 55          | Opened                  | Diagonal    | 4 FT                          | Fail                | 150 lbs. torque 200 in. lbs. Leak at ring closure. Bib folded causing leak.  | 39            |
| *161           | G              | 37A                            | 178.131                         | 26           | 55          | Opened                  | Diagonal    | 4 FT                          | Pass                | 150 lbs. torque 200 in. lbs.   |               |
| *162           | G              | 37A                            | 178.131                         | 26           | 55          | Opened                  | Diagonal    | 4 FT                          | Pass                | 150 lbs. torque 200 in. lbs. Slow leak at second attitude upon rolling.  |               |
| *163           | G              | 37A                            | 178.131                         | 26           | 55          | Opened                  | Horizontal  | 4 FT                          | Fail                | 150 lbs. torque 200 in. lbs. Closure placed at end of crush. Leak at impact at closure. Leak continued upon rolling. | 40            |
| *164           | G              | 37A                            | 178.131                         | 26           | 55          | Opened                  | Horizontal  | 4 FT                          | Pass                | 150 lbs. torque 200 in. lbs. Slow leak at second attitude upon rolling.  |               |
| *165           | H              | 37A                            | 178.131                         | 22           | 55          | Opened                  | Horizontal  | 4 FT                          | Pass                | 480 lbs. Lever lock. No leaks.   |               |
| *166           | H              | 37A                            | 178.131                         | 22           | 55          | Opened                  | Horizontal  | 4 FT                          | Pass                | 480 lbs. Lever lock. Slight puff upon rolling.   |               |
| *167           | H              | 37B                            | 178.132                         | 22           | 55          | Opened                  | Diagonal    | 4 FT                          | Pass                | 650 lbs. 9-in. opening. No leaks.  |               |

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TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Spec-<br/>ification</u> | <u>CFR Section<br/>Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type<br/>Closure</u> | <u>Test</u>      | <u>Test Re-<br/>quirement</u> | <u>Re-<br/>sult</u> | <u>Remarks</u>  | <u>Figure</u> |
|----------------|----------------|--------------------------------|---------------------------------|--------------|-------------|-------------------------|------------------|-------------------------------|---------------------|---|---------------|
| 1              | A              | 17E                            | 178.116                         | 24           | 5           | Closed                  | Pneumatic        | 5 PSIG                        | Pass                | Leak at flexible spout - flex-<br>ible spout recrimped, retested.<br>No leaks.    |               |
| 2              | A              | 17E                            | 178.116                         | 24           | 5           | Closed                  | Hydro-<br>static | 15 PSIG                       | Void                | Unable to torque cap.   |               |
| 3              | A              | 17E                            | 178.116                         | 24           | 5           | Closed                  | Diagonal         | 4 FT                          | Pass                | Torque - 75 in.lb.  |               |
| 4              | A              | 17E                            | 178.116                         | 24           | 5           | Closed                  | Horizontal       | 4 FT                          | Pass                | Torque - 35 in.lb.  |               |
| 5              | B              | 37C                            | 178.135                         | 28/26        | 5           | Opened                  | Diagonal         | 32"                           | Fail                | Diagonal drop 32 inches.<br>Leak at impact area.                                  | 21            |
| 6              | B              | 37C                            | 178.135                         | 28/26        | 5           | Opened                  | Diagonal         | 32"                           | Fail                | Diagonal drop 32 inches.<br>Leak at impact area.                                  |               |
| 7              | B              | 37C                            | 178.135                         | 28/26        | 5           | Opened                  | Hydro-<br>static | 15 PSIG                       | Fail                | Leak at 4 psi. Crowning<br>at head excessive.                                     | 10            |
| 8              | B              | 37C                            | 178.135                         | 28/26        | 5           | Opened                  | Diagonal         | 32"                           | Fail                | Leak at lugs where pail -<br>creased - midway up pail -<br>leak at all positions. | 22            |
| 9              | B              | 37C                            | 178.135                         | 28/26        | 5           | Opened                  | Pneumatic        | 5 PSIG                        | Fail                | Leak at 4 psi. Excessive<br>crowning at top.                                      |               |
| 10             | B              | 37C                            | 178.135                         | 28/26        | 5           | Opened                  | Pneumatic        | 5 PSIG                        | Fail                | Leak at 3-1/2 psi. Crowning<br>top and bottom.                                    |               |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u>  | <u>Test Requirement</u> | <u>Results</u> | <u>Remarks</u>   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|--------------|-------------------------|----------------|--|---------------|
| 11             | B              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal   | 32"                     | Fail           | Leak at impact area at lugs. Continued to leak at all positions. |               |
| 12             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Hydro-static | 15 PSIG                 | Pass           | Slight crowning top and bottom.                                  |               |
| 13             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Hydro-static | 15 PSIG                 | Pass           | Moderate crowning, radial lines top and bottom.                  |               |
| 14             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Hydro-static | 15 PSIG                 | Pass           | Slight crowning, top and bottom.                                 |               |
| 15             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Diagonal     | 4 FT                    | Pass           |  |               |
| 16             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Diagonal     | 4 FT                    | Pass           |  |               |
| 17             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Diagonal     | 4 FT                    | Pass           |  |               |
| 18             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Pneumatic    | 5 PSIG                  | Pass           |  |               |
| 19             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Pneumatic    | 5 PSIG                  | Pass           |  |               |
| 20             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Pneumatic    | 5 PSIG                  | Pass           |  |               |
| 21             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Horizontal   | 4 FT                    | Pass           | No leak.   |               |
| 22             | D              | 17E                      | 178.116                     | 24           | 5           | Closed              | Horizontal   | 4 FT                    | Pass           |  |               |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test         | Test Re-quirement | Re-sult | Remarks  |
|---------|---------|-------------------|----------------------|-------|------|--------------|--------------|-------------------|---------|--|
| 23      | D       | 17E               | 178.116              | 24    | 5    | Closed       | Horizontal   | 4 FT              | Pass    |  |
| 24      | E       | 17E               | 178.116              | 24    | 5    | Closed       | Hydro-static | 15 PSIG           | Pass    |  |
| 25      | E       | 17E               | 178.116              | 24    | 5    | Closed       | Diagonal     | 4 FT              | Void    | Flexible spout completely left pail causing immediate emptying of pail. Improper crimp |
| 26      | E       | 17E               | 178.116              | 24    | 5    | Closed       | Pneumatic    | 5 PSIG            | Pass    |  |
| 27      | E       | 17E               | 178.116              | 24    | 5    | Closed       | Horizontal   | 4 FT              | Pass    | Slight puff at impact.   |
| 28      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Hydro-static | 7 PSIG            | Pass    | Moderate crowning top and bottom.  |
| 29      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Hydro-static | 7 PSIG            | Fail    | Leak at 1.5 PSIG at flexible spout.  |
| 30      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Hydro-static | 7 PSIG            | Pass    | Moderate crowning top and bottom.  |
| 31      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Diagonal     | 4 FT              | Pass    |  |
| 32      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Diagonal     | 4 FT              | Pass    |  |
| 33      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Pneumatic    | 5 PSIG            | Pass    | Very slight crowning radial lines toward bottom.                                       |
| 34      | D       | 37B               | 178.132              | 28    | 5    | Closed       | Pneumatic    | 5 PSIG            | Pass    | Very slight crowning radial lines toward bottom.                                       |

Figure 10-10-10

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>                                     | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|--|---------------|
| 35             | D              | 37B                      | 178.132                     | 28           | 5           | Closed              | Horizontal  | 4 FT                    | Pass          |  |               |
| 36             | C              | 17E                      | 178.116                     | 24           | 5           | Closed              | Hydrostatic | 15 PSIG                 | Fail          | Leak at chime. Excessive crowning at top - 15 PSI  |               |
| 37             | C              | 17E                      | 178.116                     | 24           | 5           | Closed              | Diagonal    | 4 FT                    | Fail          | Leak from under crimp of spout.                    | 20            |
| 38             | C              | 17E                      | 178.116                     | 24           | 5           | Closed              | Pneumatic   | 5 PSIG                  | Pass          |  |               |
| 39             | C              | 17E                      | 178.116                     | 24           | 5           | Closed              | Horizontal  | 4 FT                    | Pass          |  |               |
| 40             | J              | 37A                      | 178.131                     | 24           | 5           | Opened              | Diagonal    | 4 FT                    | Pass          | Leak at second attitude.                           |               |
| 41             | J              | 37A                      | 178.131                     | 24           | 5           | Opened              | Diagonal    | 4 FT                    | Fail          | Leak at end of crush pattern.                      |               |
| 42             | J              | 37A                      | 178.131                     | 24           | 5           | Opened              | Diagonal    | 42 IN                   | Pass          | Diagonal drop at 42 inches. No leak.               |               |
| 43             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Diagonal    | 42 IN                   | Fail          | Puff at impact. Slow leak in impact. 42-inch drop. | 24            |
| 44             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Diagonal    | 4 FT                    | Fail          | Massive leak at end of crush pattern.              | 23            |
| 45             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Horizontal  | 42 IN                   | Fail          | Severe leak.                                       |               |
| 46             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Diagonal    | 36 IN                   | Fail          | Slow leak.   | 25            |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u>  | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>   | <u>Figures</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|--------------|-------------------------|---------------|--|----------------|
| 47             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Diagonal     | 36 IN                   | Fail          | Leak at end of crush.                                      | 26             |
| 48             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Hydro-static | 7 PSIG                  | Fail          | Massive leak between 5 and 6 PSIG at crimp joint seal.     | 11             |
| 49             | J              | 37A                      | 178.131                     | 26           | 5           | Opened              | Pneumatic    | 5 PSIG                  | Fail          | Leak at 3 PSIG at crimp in lid.                            | 12             |
| 50             | J              | 37A                      | 178.131                     | 24           | 5           | Opened              | Horizontal   | 42 IN                   | Fail          | Leak at impact area.                                       | 35             |
| 51             | J              | 37A                      | 178.131                     | 24           | 5           | Opened              | Hydro-static | 7 PSIG                  | Pass          | Very slight crowning top and bottom.                       |                |
| 52             | J              | 37A                      | 178.131                     | 24           | 5           | Opened              | Pneumatic    | 5 PSIG                  | Pass          |  |                |
| 53             | J              | 17E                      | 178.116                     | 24           | 5           | Closed              | Hydro-static | 15 PSIG                 | Pass          | Crowning top and bottom.                                   |                |
| 54             | J              | 17E                      | 178.116                     | 24           | 5           | Closed              | Diagonal     | 4 FT                    | Pass          |  |                |
| 55             | J              | 17E                      | 178.116                     | 24           | 5           | Closed              | Pneumatic    | 5 PSIG                  | Fail          | Leak at 4 PSIG at intersection of top chime and seam weld. | 13             |
| 56             | J              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal     | 28 IN                   | Pass          | Puff at impact.  |                |
| 57             | J              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal     | 32 IN                   | Fail          | Leak at impact.  |                |
| 58             | J              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal     | 28 IN                   | Pass          |  |                |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specif-ication</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Re-quirement</u> | <u>Re-sult</u> | <u>Remarks</u>                           | <u>Figure</u> |
|----------------|----------------|---------------------------|-----------------------------|--------------|-------------|---------------------|-------------|--------------------------|----------------|--|---------------|
| 59             | J              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 28 IN                    | Pass           |  |               |
| 60             | J              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 28 IN                    | Fail           | Leak in impact area.                     | 34            |
| 61             | J              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 28 IN                    | Fail           | Leak in impact area.                     | 33            |
| 62             | J              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 28 IN                    | Void           | Leak at handle anchor upon filling.      |               |
| 63             | C              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 28 IN                    | Pass           | Puff at impact.                          |               |
| 64             | C              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 28 IN                    | Pass           | Puff at impact.                          |               |
| 65             | C              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 24 IN                    | Pass           | Puff at impact.                          |               |
| 66             | C              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 24 IN                    | Fail           | Leak in impact area.                     | 32            |
| 67             | C              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 28 IN                    | Fail           | Leak at impact.                          |               |
| 68             | E              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 28 IN                    | Pass           | Puff at impact.                          |               |
| 69             | E              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 28 IN                    | Pass           | Puff at impact. Leak at second attitude. |               |
| 70             | E              | 37C                       | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 24 IN                    | Pass           | Puff at impact.                          |               |

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u>  | <u>Test Requirement</u> | <u>Re-sult</u> | <u>Remarks</u>                   | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|--------------|-------------------------|----------------|----------------------------------|---------------|
| 71             | E              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal   | 24 IN                   | Pass           | Puff at impact.                  |               |
| 72             | E              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal   | 24 IN                   | Pass           | Puff at impact.                  |               |
| 73             | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Hydro-static | 5 PSIG                  | Fail           | Leak from under crimp at 5 PSIG. |               |
| 74             | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal     | 28 IN                   | Pass           | Slight puff.                     |               |
| 75             | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal     | 28 IN                   | Pass           |                                  |               |
| 76             | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Pneumatic    | 5 PSIG                  | Fail           | Leak from under crimp at 5 PSIG  |               |
| 77             | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal   | 24 IN                   | Pass           |                                  |               |
| 78             | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal   | 24 IN                   | Pass           |                                  |               |
| 79             | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Hydro-static | 7 PSIG                  | Pass           | Slight crowning top and bottom.  |               |
| 80             | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Hydro-static | 7 PSIG                  | Pass           | Slight crowning top and bottom.  |               |
| 81             | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Diagonal     | 4 FT                    | Pass           | Slight crowning top and bottom.  |               |
| 82             | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Diagonal     | 4 FT                    | Pass           |                                  |               |
| 83             | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Pneumatic    | 5 PSIG                  | Pass           | Slight crowning top and bottom.  |               |

TABLE 4. TABLE OF RESULTS (Con't)

| Exhibit | Company | DOT Specification | CFR Section Title 49 | Gauge | Size | Type Closure | Test         | Test Requirement | Result | Remarks                                   | Figure |
|---------|---------|-------------------|----------------------|-------|------|--------------|--------------|------------------|--------|---|--------|
| 84      | L       | 37B               | 178.132              | 28    | 5    | Closed       | Horizontal   | 4 FT             | Pass   |   |        |
| 85      | L       | 17E               | 178.116              | 24    | 5    | Closed       | Hydro-static | 15 PSIG          | Pass   | Crowning and radial lines top and bottom. |        |
| 86      | L       | 17E               | 178.116              | 24    | 5    | Closed       | Hydro-static | 15 PSIG          | Pass   | Crowning and radial lines top and bottom. |        |
| 87      | L       | 17E               | 178.116              | 24    | 5    | Closed       | Diagonal     | 4 FT             | Pass   |   |        |
| 88      | L       | 17E               | 178.116              | 24    | 5    | Closed       | Pneumatic    | 5 PSIG           | Pass   |   |        |
| 89      | L       | 17E               | 178.116              | 24    | 5    | Closed       | Horizontal   | 4 FT             | Pass   |   |        |
| *90     | J       | 37A               | 178.131              | 26    | 5    | Opened       | Diagonal     | 4 FT             | Fail   | Leak at end of crush pattern.             | 42     |
| *91     | J       | 37A               | 178.131              | 26    | 5    | Opened       | Diagonal     | 4 FT             | Fail   | Leak at both ends of crush pattern.       | 43     |
| *92     | J       | 37A               | 178.131              | 26    | 5    | Opened       | Horizontal   | 4 FT             | Pass   |   |        |
| *93     | J       | 37A               | 178.131              | 24    | 5    | Opened       | Diagonal     | 4 FT             | Pass   |   |        |
| *94     | J       | 37A               | 178.131              | 24    | 5    | Opened       | Diagonal     | 4 FT             | Pass   |   |        |
| *95     | J       | 37A               | 178.131              | 24    | 5    | Opened       | Horizontal   | 4 FT             | Pass   | 80 lbs.                                   |        |
| *96     | C       | 37C               | 178.135              | 28/26 | 5    | Opened       | Diagonal     | 4 FT             | Pass   | 80 lbs.                                   |        |

\*Powder

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Re-sult</u> | <u>Remarks</u>  | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|----------------|---|---------------|
| *97            | C              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Pass           | 80 lbs. Slight leak end of crush - second attitude.         |               |
| *98            | C              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass           | 80 lbs.   |               |
| *99            | C              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass           | 80 lbs.   |               |
| *100           | B              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Pass           | Puff at impact. Leak end of crush. Second attitude. 80 lbs. |               |
| *101           | B              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Pass           | Puff at impact. Leak end of crush. Second attitude. 80 lbs. |               |
| *102           | B              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass           | 80 lbs.   |               |
| *103           | J              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Fail           | Puff at impact. Leak ends of crush. 80 lbs.                 | 44            |
| *104           | J              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass           | 80 lbs.   |               |
| *105           | E              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Fail           | Puff at impact. Leak ends of crush. 80 lbs.                 | 45            |
| *106           | E              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass           | 80 lbs.   |               |
| *107           | D              | 37B                      | 178.132                     | 28           | 5           | Closed              | Diagonal    | 4 FT                    | Pass           | 60 lbs.   |               |
| *108           | D              | 37B                      | 178.132                     | 28           | 5           | Closed              | Diagonal    | 4 FT                    | Pass           | No flake flexible spout.                                    |               |
| *109           | D              | 37B                      | 178.132                     | 28           | 5           | Closed              | Horizontal  | 4 FT                    | Pass           | 60 lbs.   |               |

\*Powder

TABLE 4. TABLE OF RESULTS (Con't)

| <u>Exhibit</u> | <u>Company</u> | <u>DOT Specification</u> | <u>CFR Section Title 49</u> | <u>Gauge</u> | <u>Size</u> | <u>Type Closure</u> | <u>Test</u> | <u>Test Requirement</u> | <u>Result</u> | <u>Remarks</u>  | <u>Figure</u> |
|----------------|----------------|--------------------------|-----------------------------|--------------|-------------|---------------------|-------------|-------------------------|---------------|---|---------------|
| *110           | D              | 37B                      | 178.132                     | 28           | 5           | Closed              | Horizontal  | 4 FT                    | Pass          | 60 lbs.   |               |
| *111           | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Diagonal    | 4 FT                    | Pass          | 60 lbs.   |               |
| *112           | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Diagonal    | 4 FT                    | Pass          | 60 lbs.   |               |
| *113           | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Horizontal  | 4 FT                    | Pass          | 60 lbs.   |               |
| *114           | L              | 37B                      | 178.132                     | 28           | 5           | Closed              | Horizontal  | 4 FT                    | Pass          | No Rieke flexible spout.<br>60 lbs.                       |               |
| *115           | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Pass          | Puff both ends of crush. Leak at second attitude. 80 lbs. |               |
| *116           | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Diagonal    | 4 FT                    | Fail          | Puff both ends of crush. Leak both ends of crush. 80 lbs. | 46            |
| *117           | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass          | 80 lbs.   |               |
| *118           | L              | 37C                      | 178.135                     | 28/26        | 5           | Opened              | Horizontal  | 4 FT                    | Pass          | 80 lbs.   |               |

\*Powder

TABLE 5. RESUME OF RESULTS FOR POWDER (DRY) CONTENTS

| DOT<br>Specification | Capacity<br>Gallons | Content<br>Weight | Number<br>Tested | Closure              | Results |       |      | Failures |          |            |
|----------------------|---------------------|-------------------|------------------|----------------------|---------|-------|------|----------|----------|------------|
|                      |                     |                   |                  |                      | Pass    | Fail  | Void | Gauge    | Diagonal | Horizontal |
| 37A                  | 55                  | 480               | 6                | Lever Lock           | 3       | 3     | 0    | 22       | 3        | 0          |
| 37A                  | 55                  | 350               | 5                | Lap Lock             | 5       | -     | 0    | 24       | 0        | 0          |
| 37A                  | 55                  | 150               | 5                | Standard<br>Ring     | 3       | 2     | 0    | 26       | 1        | 1          |
| 37B                  | 55                  | 650               | 1                | 9" Open              | 1       | 0     | 1    | 22       | 0        | 0          |
| 37B                  | 42                  | 450               | 5                | 9" Open              | 5       | -     | 0    | 24       | 0        | 0          |
| 37B                  | 55                  | 275               | 4                | 9" Open              | 2       | 2     | 0    | 26       | 1        | 1          |
| TOTAL                |                     |                   | 26               |                      | 19      | 7     | 1    |          | 5        | 2          |
| PERCENTAGE           |                     |                   |                  |                      | 73.07   | 26.92 |      |          | 71.42    | 28.57      |
| 37A                  | 5                   | 80                | 3                | Open Head            | 3       | 0     | 0    | 24       | 0        | 0          |
| 37A                  | 5                   | 60                | 3                | Open Head            | 1       | 2     | 0    | 26       | 2        | 0          |
| 37B                  | 5                   | 60                | 6                | Closed Head          | 6       | 0     | 2    | 28       | 0        | 0          |
| 37C                  | 5                   | 80                | 4                | Open Head<br>w/Rieke | 3       | 1     | 0    | 28/26    | 1        | 0          |
| 37C                  | 5                   | 80                | 11               | Open Head            | 9       | 2     | 0    | 28/26    | 2        | 0          |
| TOTAL                |                     |                   | 27               |                      | 22      | 5     | 2    |          | 5        | 0          |
| PERCENTAGE           |                     |                   |                  |                      | 81.48   | 18.51 |      |          | 18.51    | 0          |
| GRAND TOTAL          |                     |                   | 53               |                      | 41      | 12    | 2    |          | 10       | 2          |
| PERCENTAGE           |                     |                   |                  |                      | 77.35   | 22.64 |      |          | 83.33    | 16.66      |

TABLE 6. RESUME OF RESULTS FOR AIR AND LIQUID CONTENTS

| DOT<br>Specification   | Received |        |       | Results |      |       |          | Failures   |           |             |  |
|------------------------|----------|--------|-------|---------|------|-------|----------|------------|-----------|-------------|--|
|                        | Quantity | Tested | Pass  | Fail    | Void | Gauge | Diagonal | Horizontal | Pneumatic | Hydrostatic |  |
| <u>55-Gallon Drums</u> |          |        |       |         |      |       |          |            |           |             |  |
| 17E                    | 41       | 41     | 40    | 1       | 0    | 18    | 1        | 0          | 0         | 0           |  |
| 17C                    | 22       | 22     | 19    | 3       | 0    | 16    | 1        | 1          | -         | 1           |  |
| 17H                    | 39       | 39     | 20    | 18      | 1    | 18/16 | 5        | 6          | 0         | 7           |  |
| 37D                    | 8        | 8      | 8     | 0       | 0    | -     | -        | -          | -         | -           |  |
| 37A                    | 15       | 1      | -     | 1       | -    | -     | 1        | 0          | 0         | 0           |  |
| 5B                     | 15       | 15     | 14    | 1       | 0    | 16    | 0        | 1          | 0         | 0           |  |
| 6J                     | 5        | 4      | 3     | 1       | 0    | 18    | 1        | 0          | 0         | 0           |  |
| 5A                     | 5        | 5      | 5     | 0       | 0    | -     | -        | -          | -         | -           |  |
| 5                      | 5        | 5      | 4     | 1       | 0    | 14    | 0        | 0          | 0         | 1           |  |
| TOTAL                  | 165      | 139    | 113   | 26      | 1    | -     | 9        | 8          | 0         | 9           |  |
| PERCENTAGE             | 57.09    | 84.24  | 81.29 | 17.98   | .71  | -     | 34.61    | 30.76      | 0         | 34.61       |  |

TABLE 6. RESUME OF RESULTS FOR AIR AND LIQUID CONTENTS (Con't)

| DOT<br>Specification  | Received |        | Results |       |      |       | Failures |            |           |             |
|-----------------------|----------|--------|---------|-------|------|-------|----------|------------|-----------|-------------|
|                       | Quantity | Tested | Pass    | Fail  | Void | Gauge | Diagonal | Horizontal | Pneumatic | Hydrostatic |
| <u>5-Gallon Pails</u> |          |        |         |       |      |       |          |            |           |             |
| 17E                   | 32       | 32     | 27      | 3     | 2    | 24    | 1        | 0          | 1         | 1           |
| 37C                   | 49       | 30     | 15      | 14    | 1    | 28/26 | 5        | 4          | 3         | 2           |
| 37B                   | 22       | 14     | 13      | 1     | 0    | 28    | 0        | 0          | 0         | 1           |
| 37A                   | 21       | 13     | 4       | 9     | 0    | 24/26 | 5        | 2          | 1         | 1           |
| TOTAL                 | 124      | 89     | 59      | 27    | 3    | -     | 11       | 6          | 5         | 5           |
| PERCENTAGE            | 42.90    | 71.77  | 66.29   | 30.33 | 3.37 | -     | 33.33    | 22.22      | 18.51     | 25.92       |
| GRAND TOTAL           | 289      | 228    | 172     | 52    | 4    | -     | 20       | 14         | 5         | 14          |
| PERCENTAGE            | 94.75    | 78.89  | 75.43   | 22.80 | 1.75 | -     | 36.53    | 25.00      | 9.61      | 28.84       |

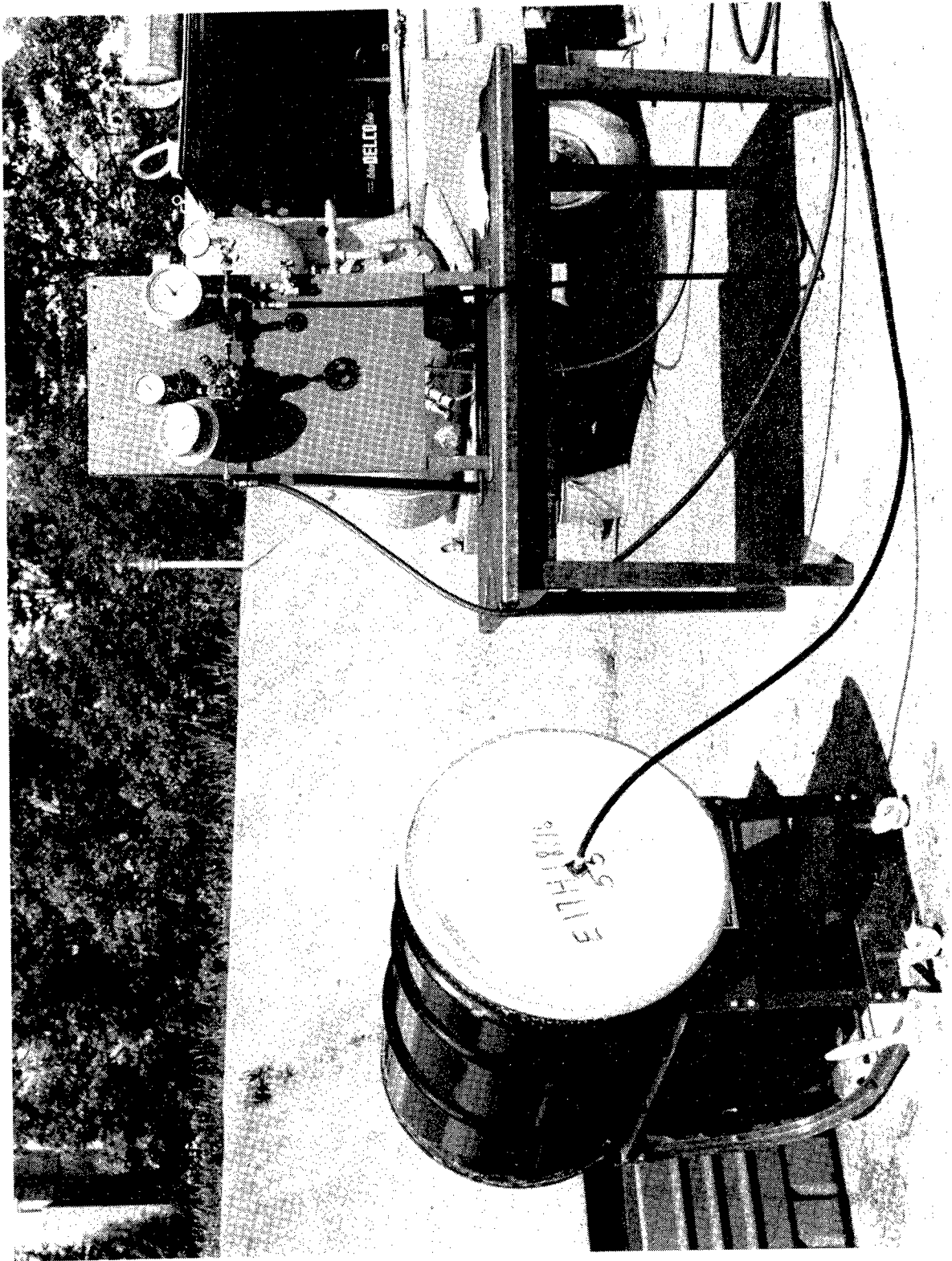


FIGURE 1 PRESSURE TEST

FIGURE 1

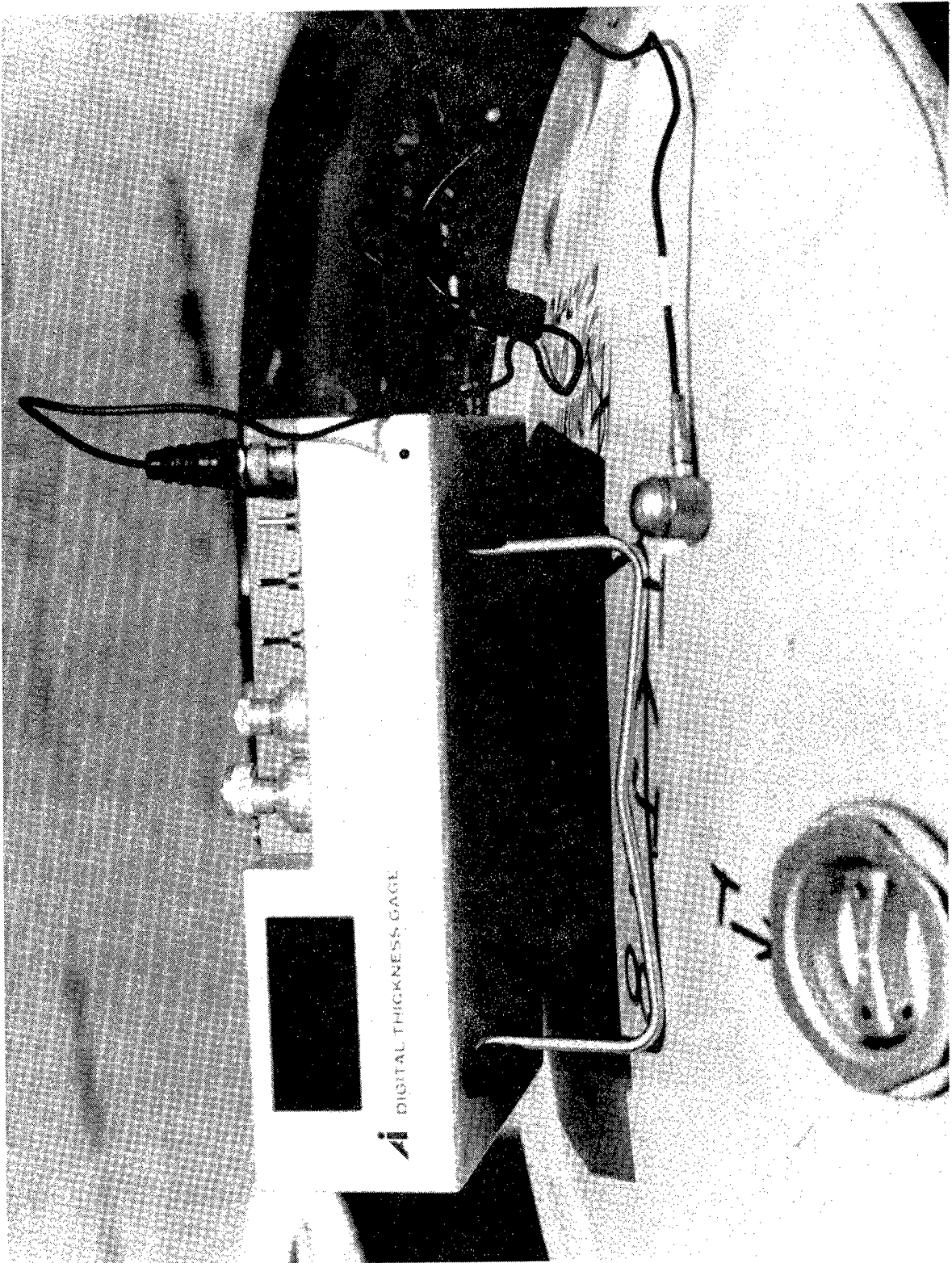


FIGURE 2 AUTOMATIC DIGITAL THICKNESS GAUGE

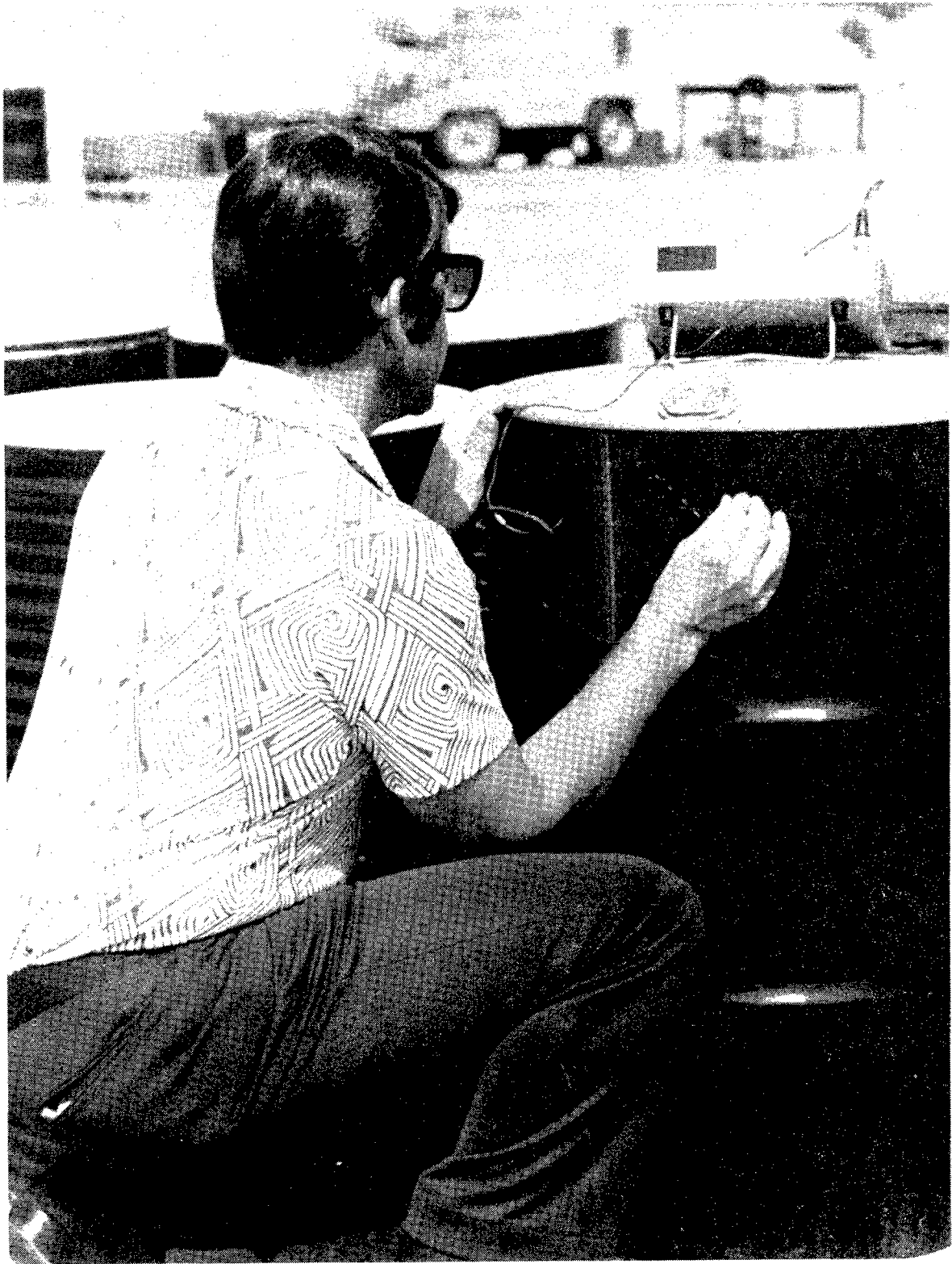


FIGURE 3

MEASURING GAUGE THICKNESS

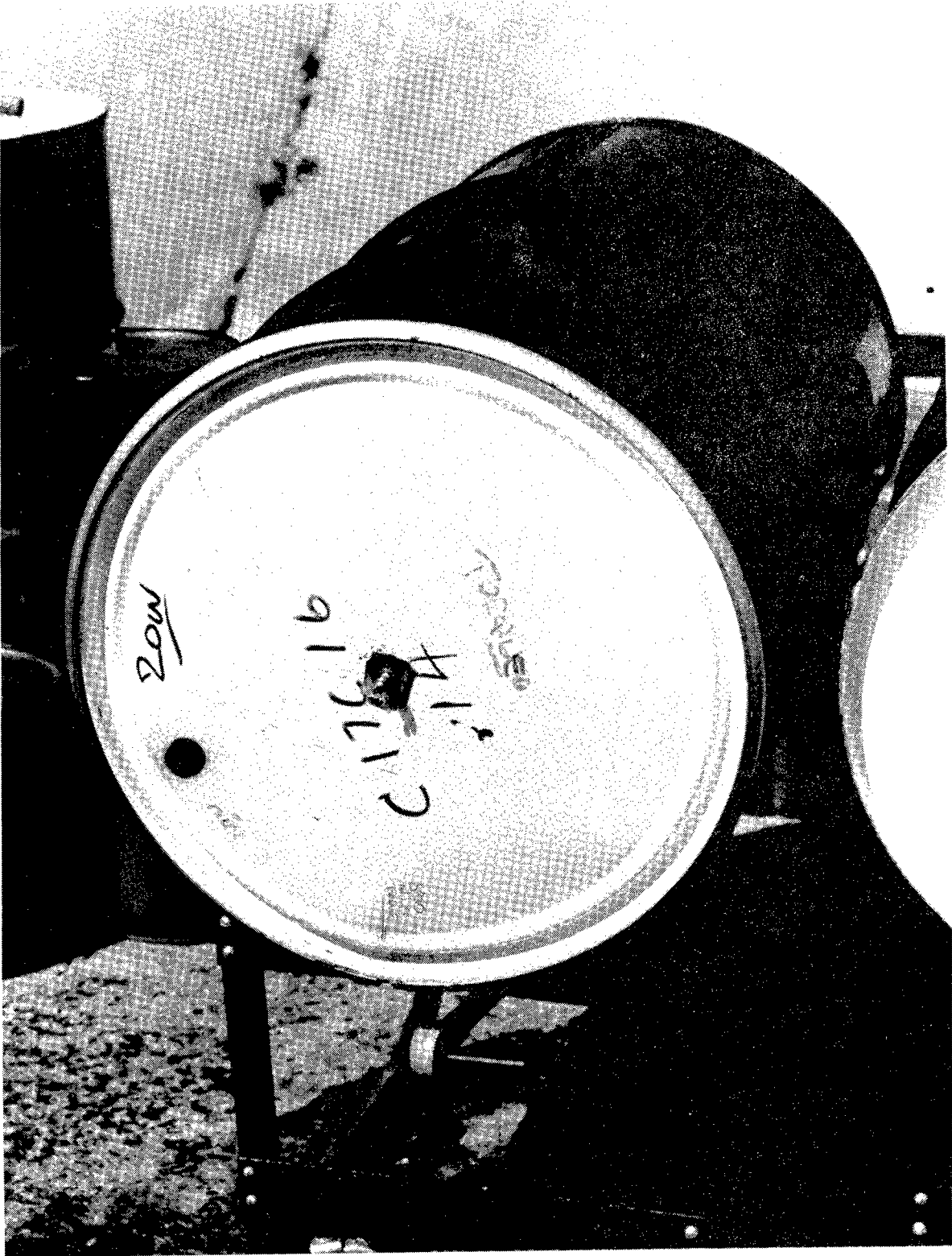


FIGURE 4

HYDROSTATIC PRESSURE TEST



FIGURE 5

HYDROSTATIC PRESSURE TEST

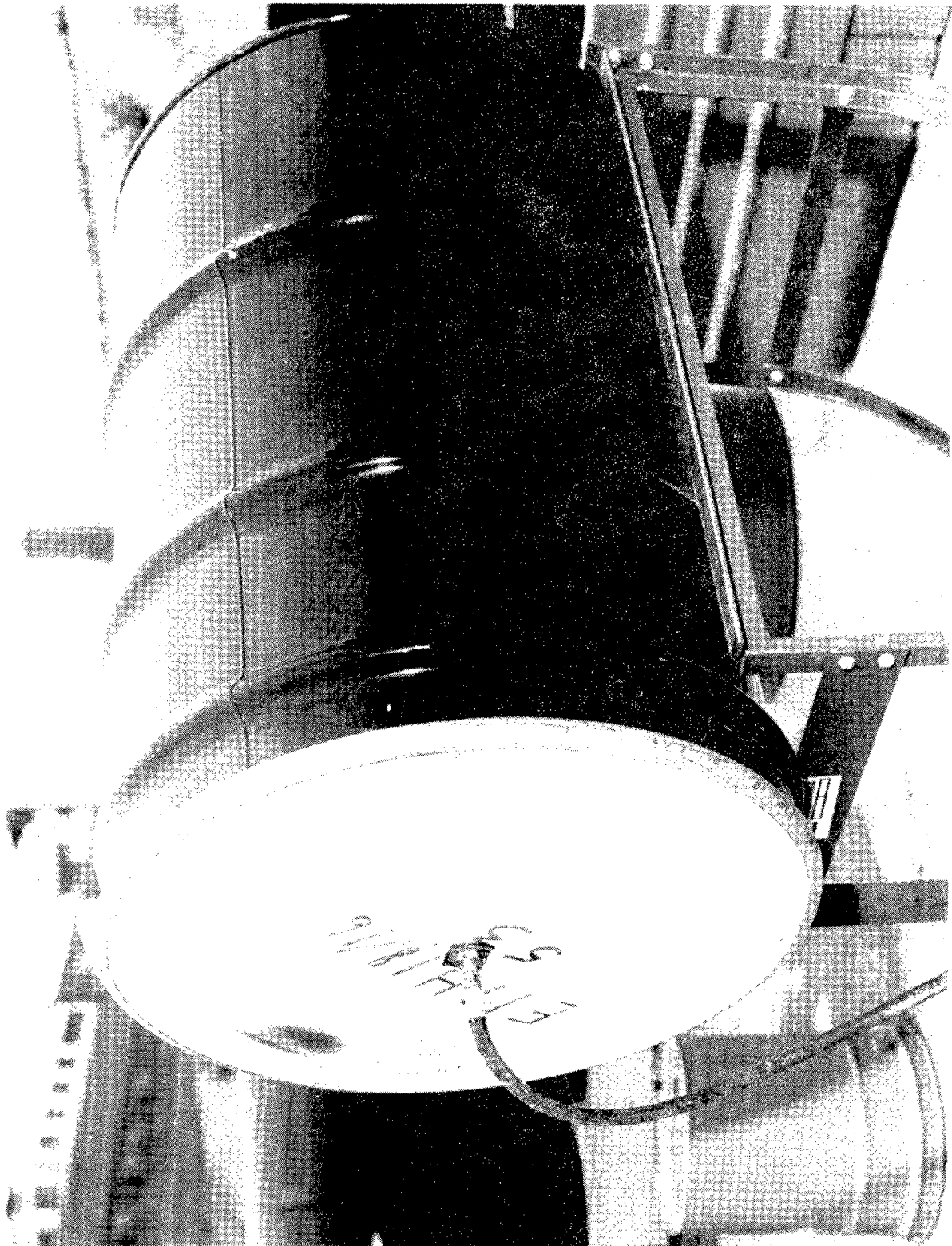


FIGURE 6 HYDROSTATIC PRESSURE TEST

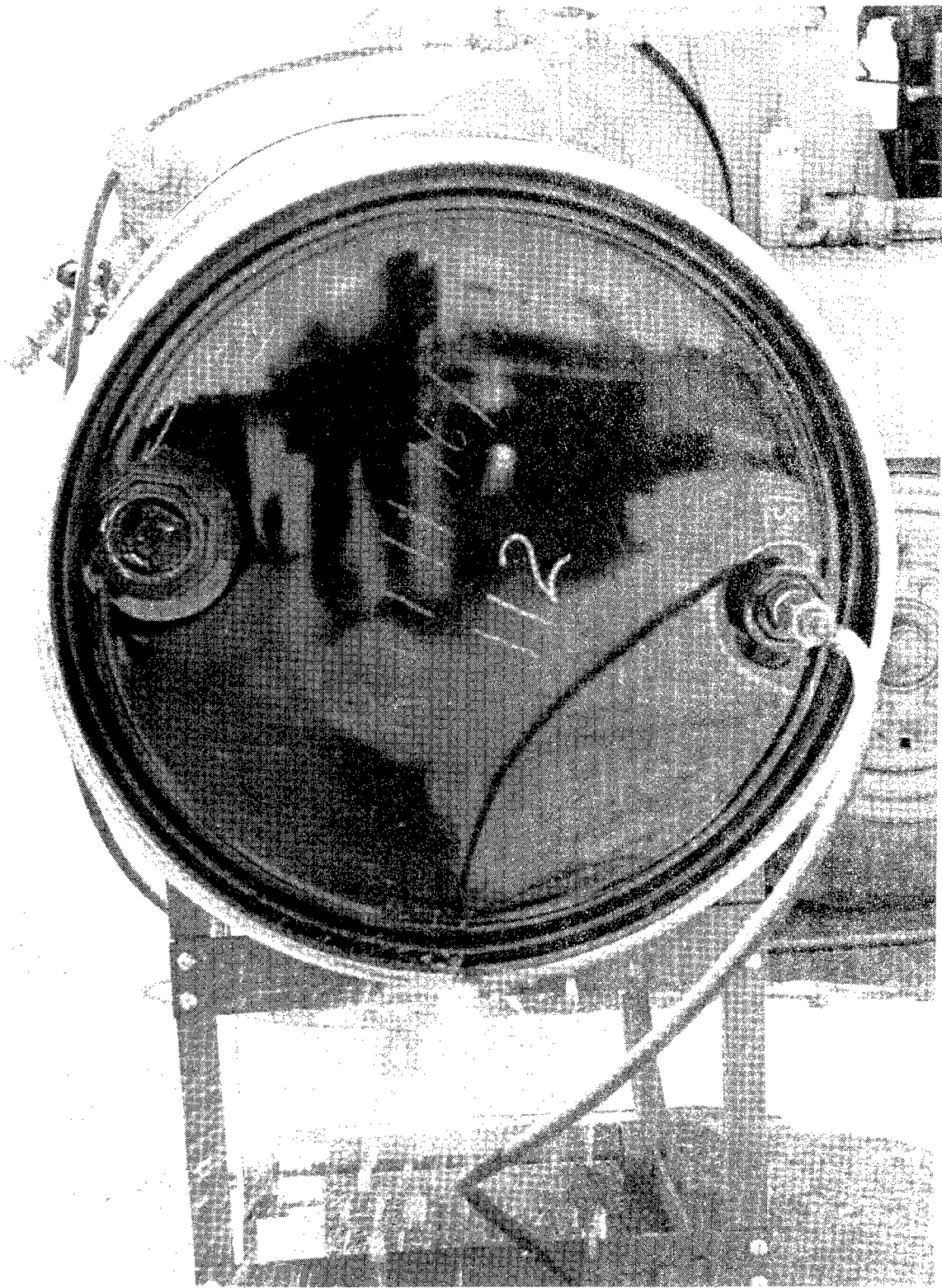


FIGURE 7

HYDROSTATIC PRESSURE TEST

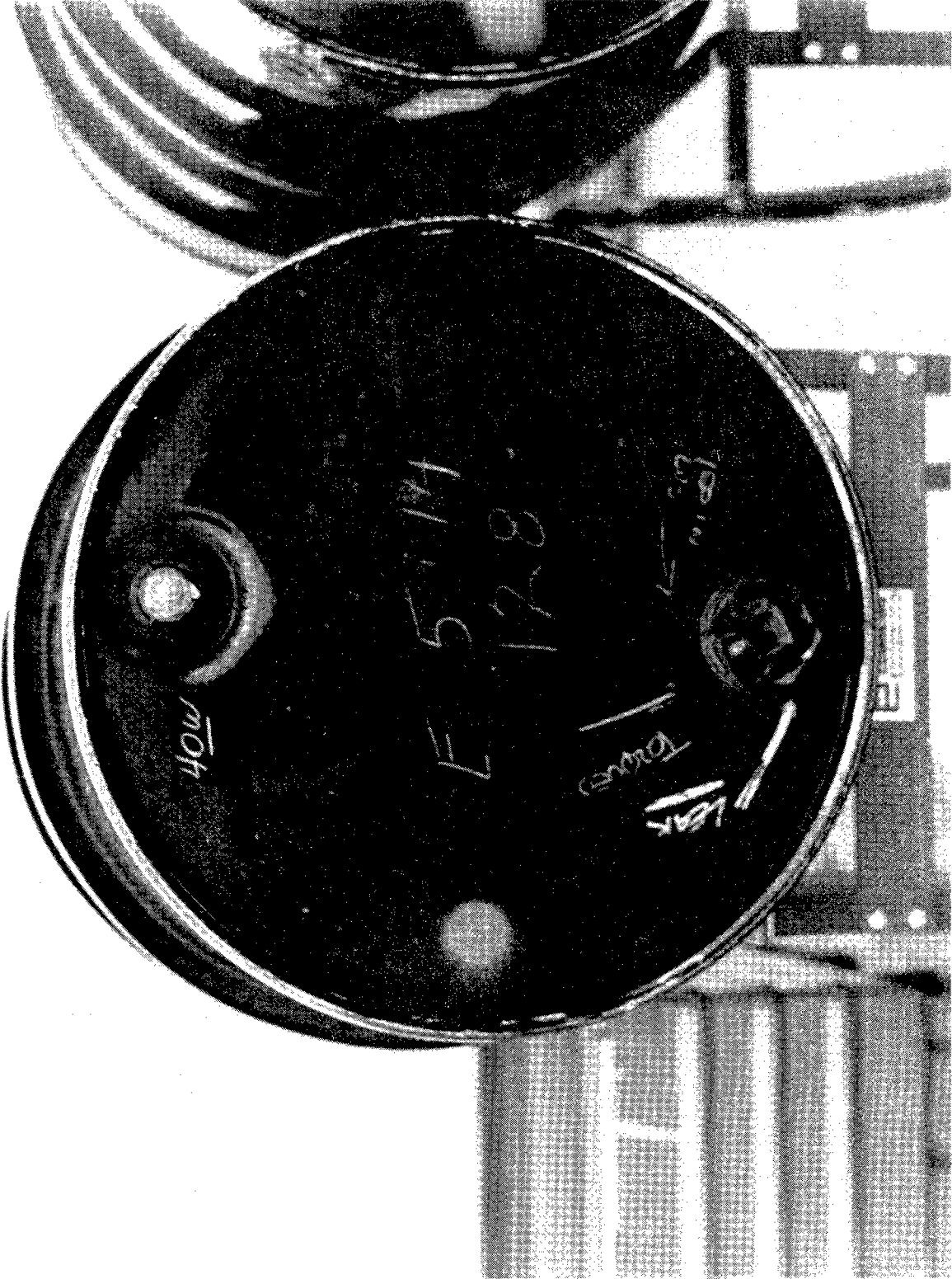


FIGURE 8 HYDROSTATIC PRESSURE TEST

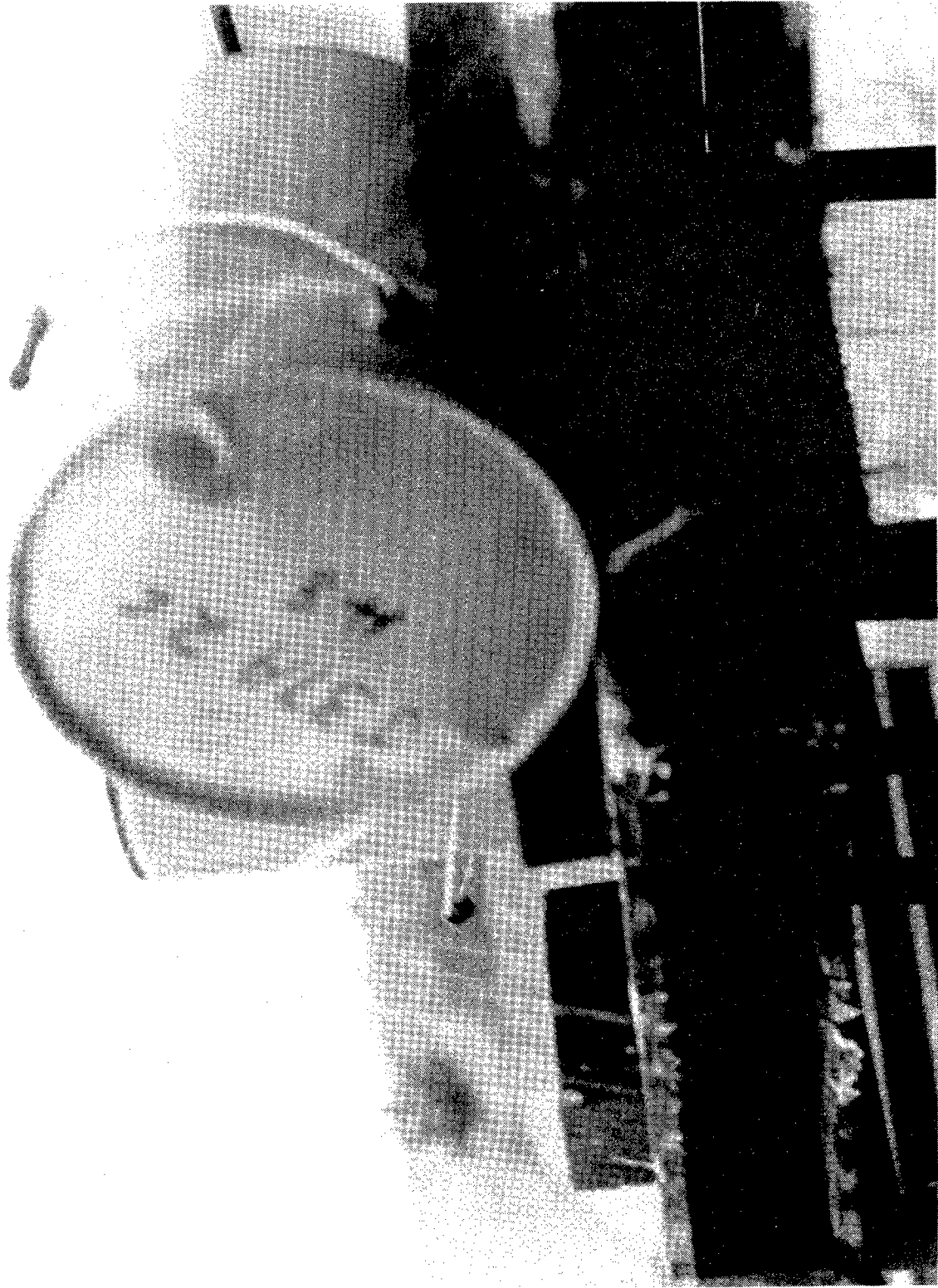


FIGURE 9 HYDROSTATIC PRESSURE TEST



HYDROSTATIC PRESSURE TEST

FIGURE 10



HYDROSTATIC PRESSURE TEST

FIGURE 11

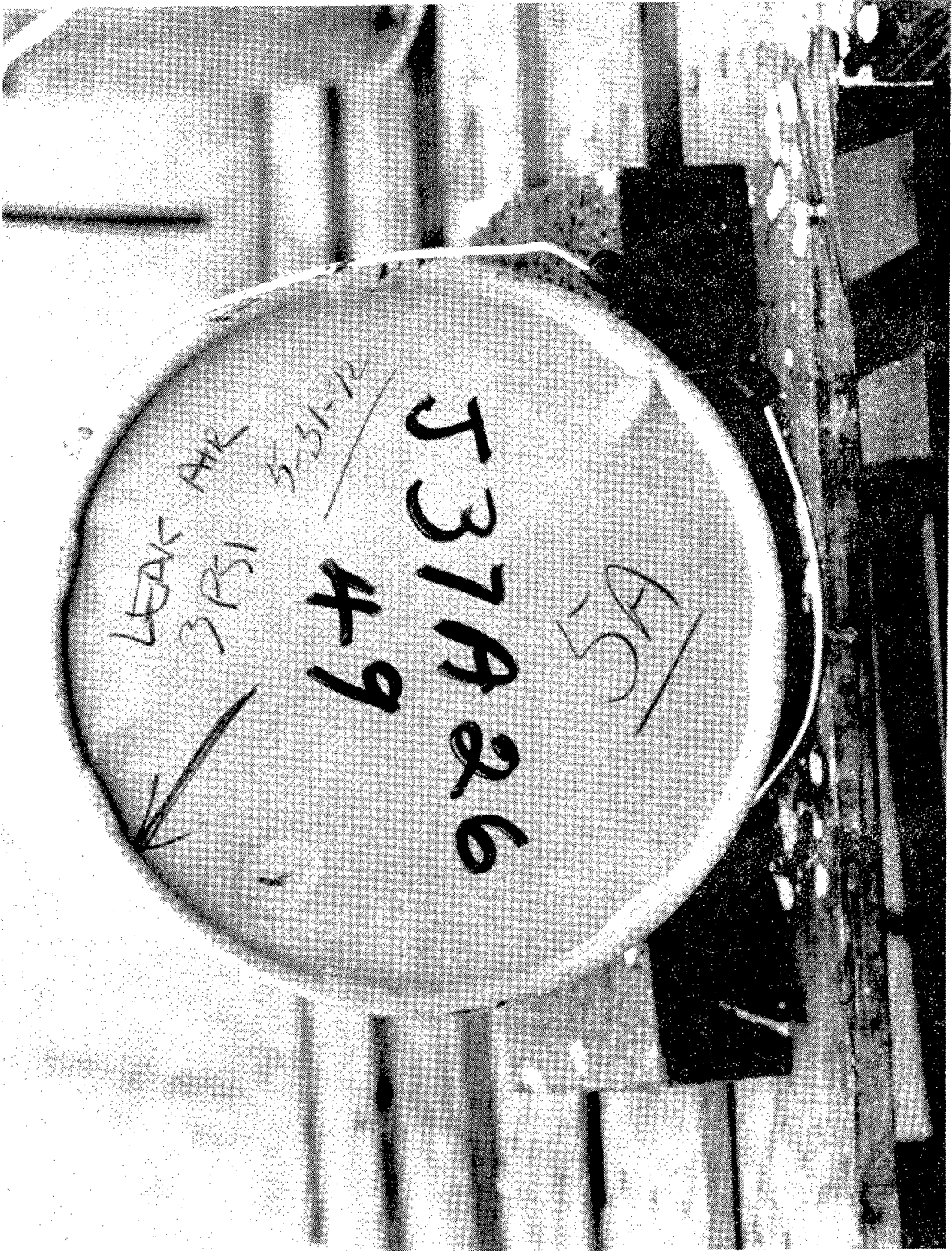
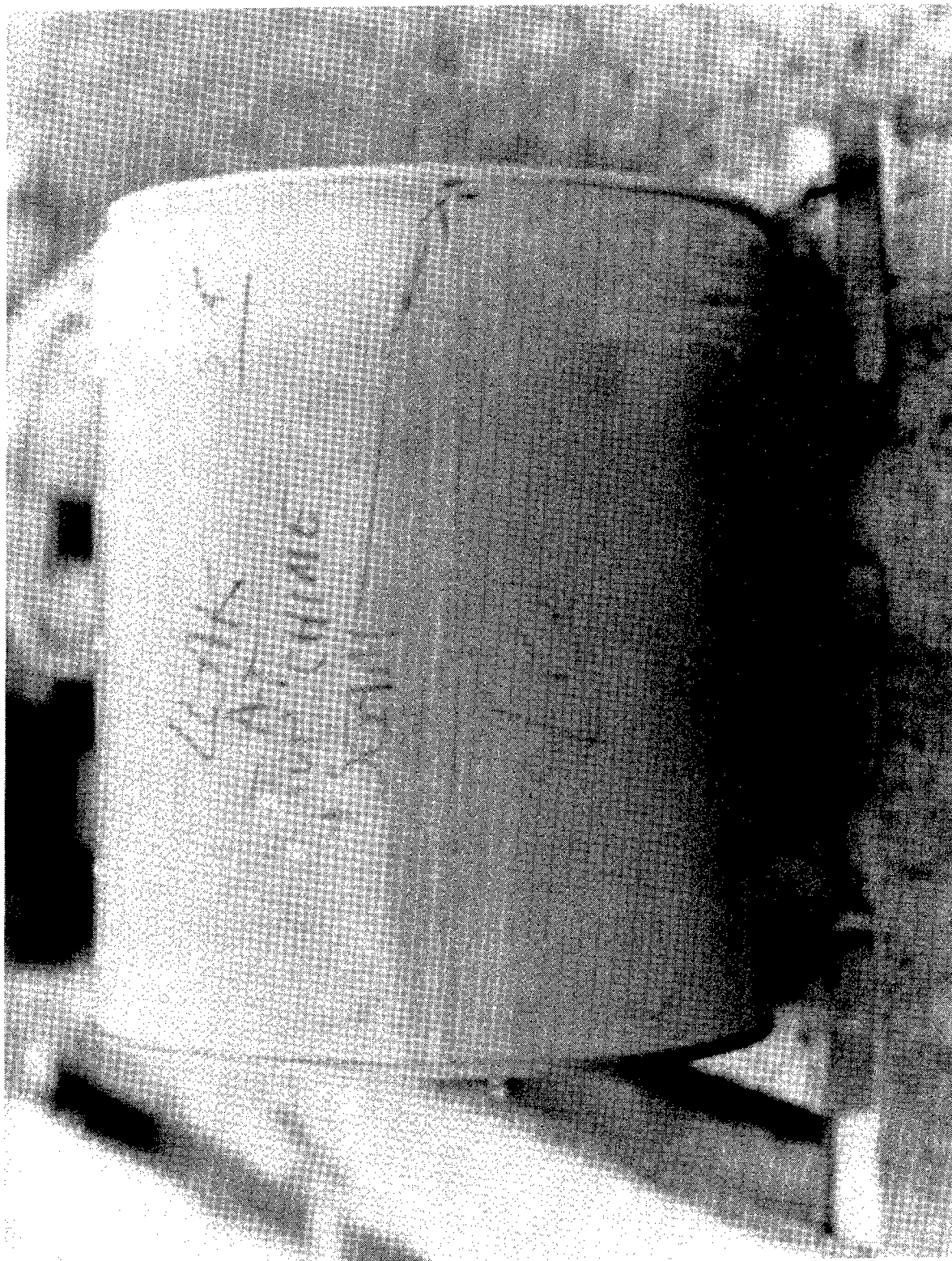


FIGURE 12 PNEUMATIC LEAK TEST

FIGURE 12



PNEUMATIC LEAK TEST

FIGURE 13



FIGURE 14

POSITION FOR DIAGONAL DROP



DIAGONAL DROP TEST

FIGURE 15

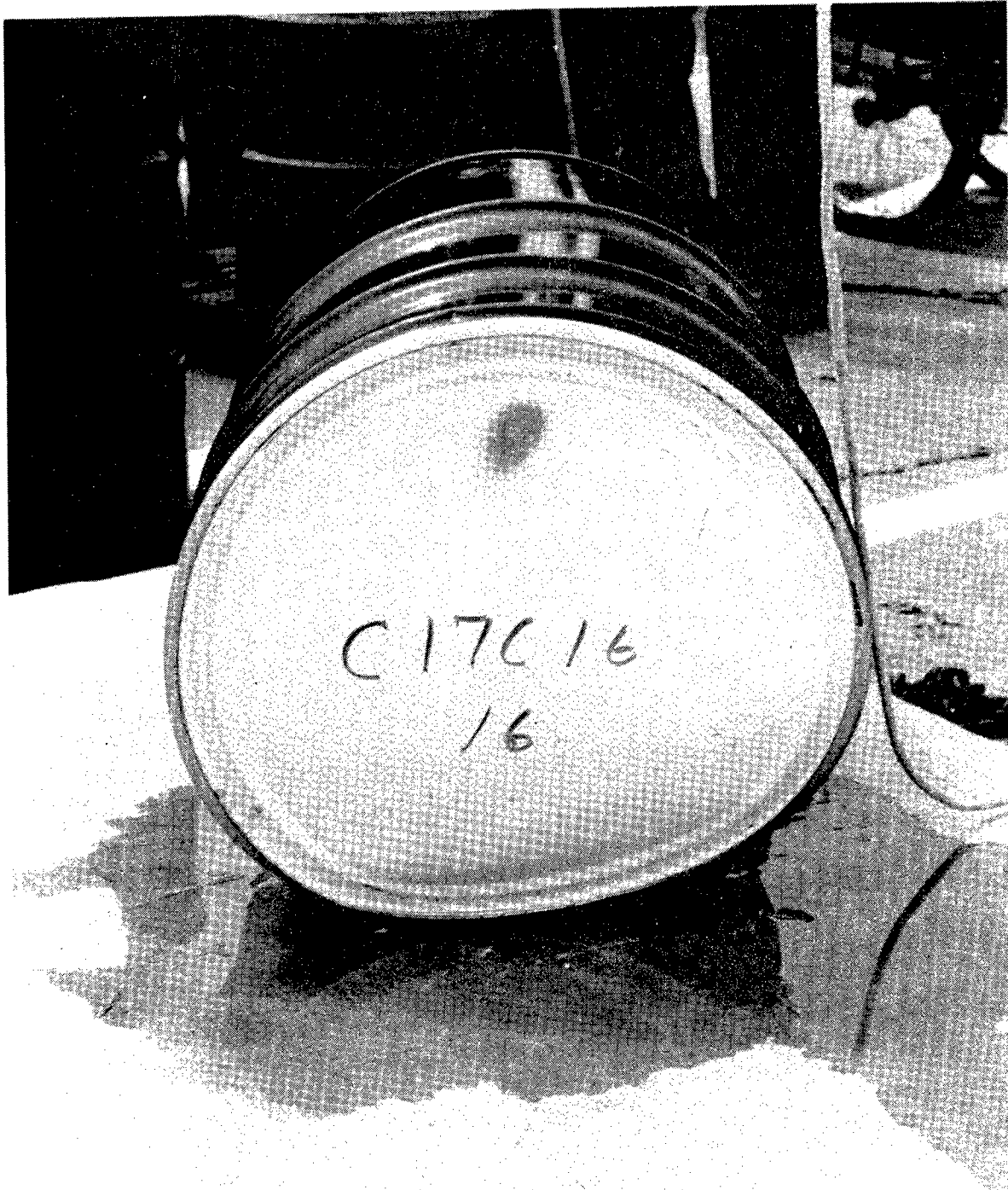


FIGURE 16

DIAGONAL DROP TEST

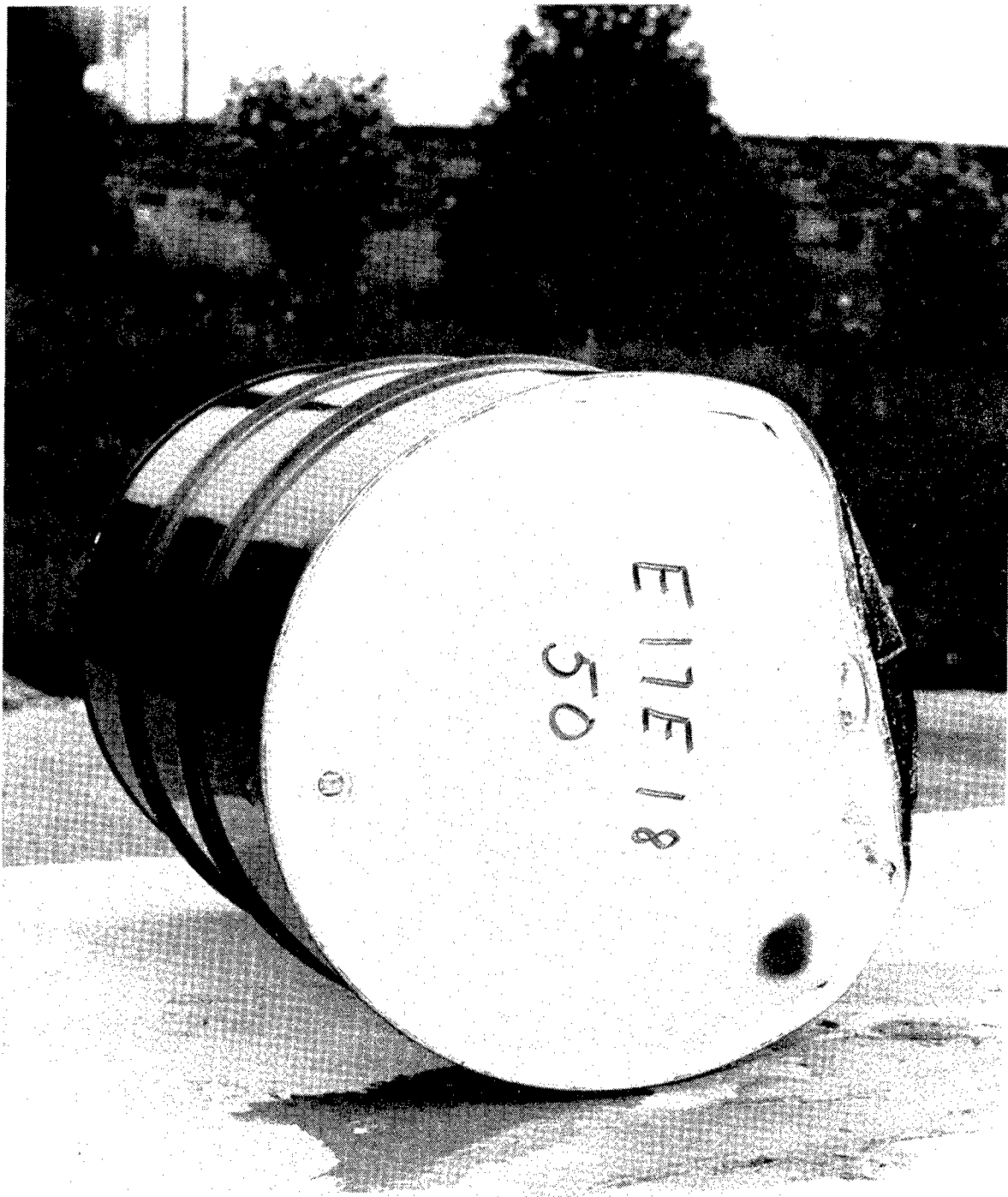


FIGURE 17

DIAGONAL DROP TEST



DIAGONAL DROP TEST

FIGURE 18



DIAGONAL DROP TEST

FIGURE 19

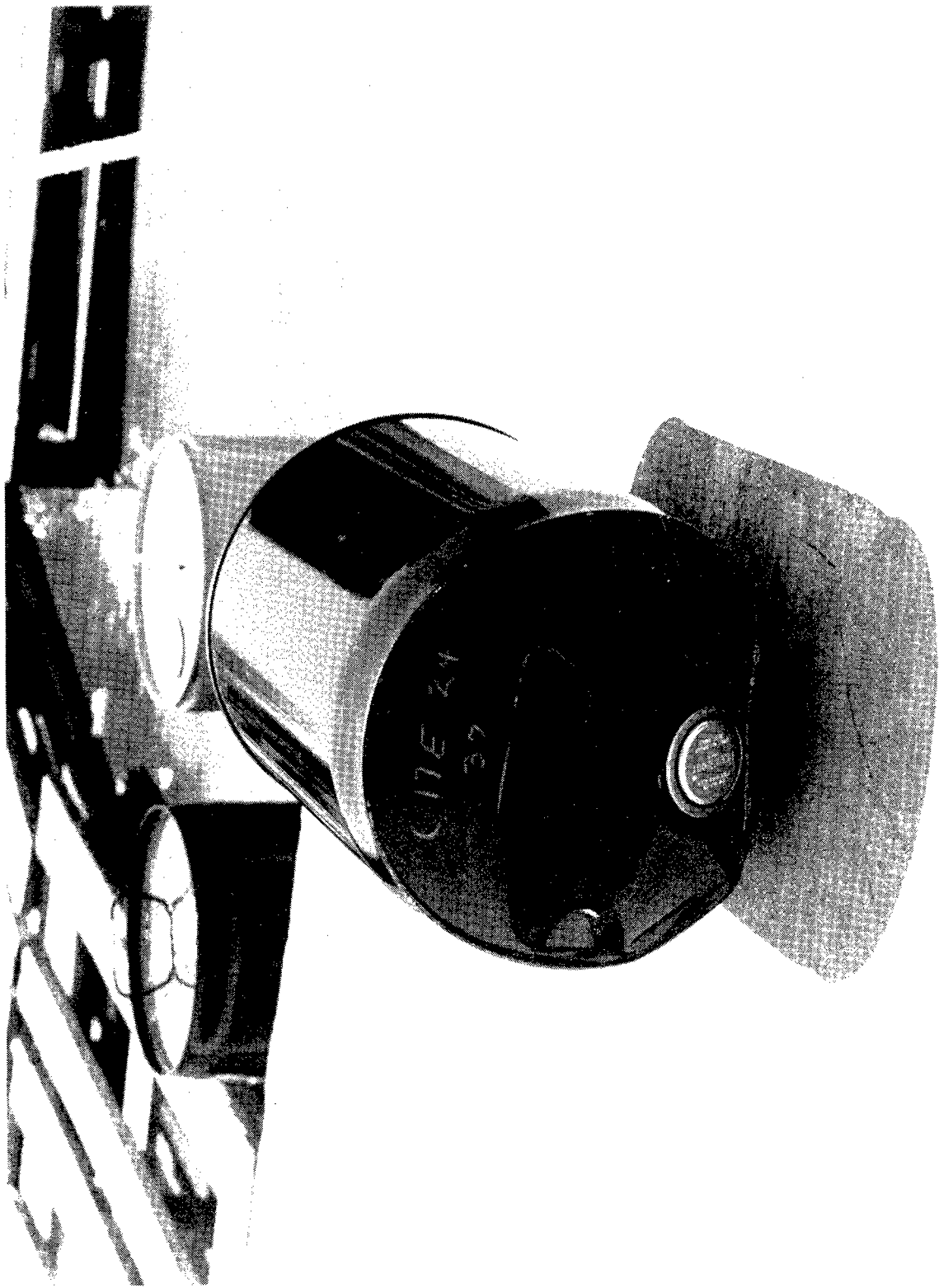


FIGURE 20 DIAGONAL DROP TEST



DIAGONAL DROP TEST

FIGURE 21



DIAGONAL DROP TEST

FIGURE 22

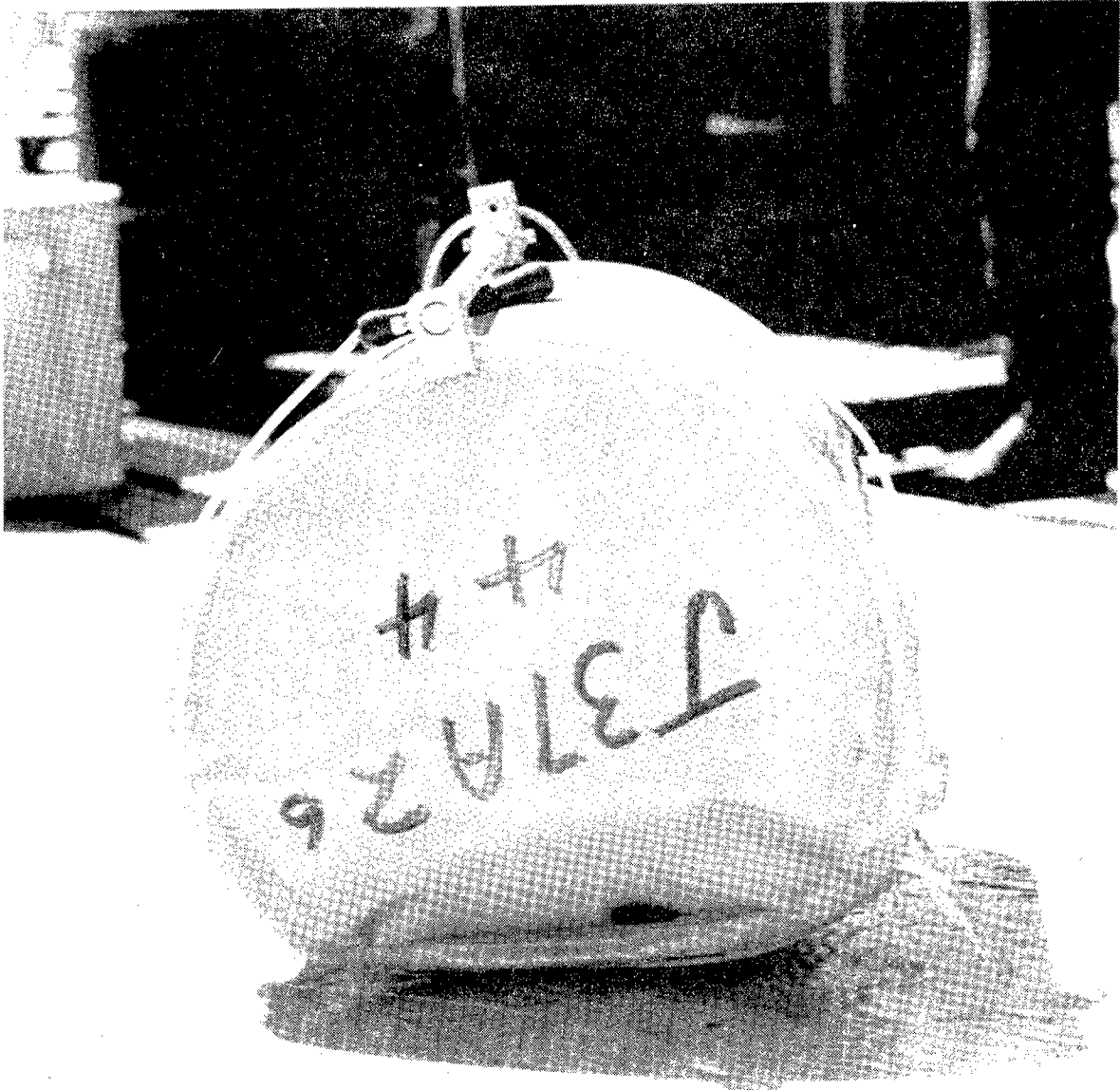


FIGURE 23

DIAGONAL DROP TEST

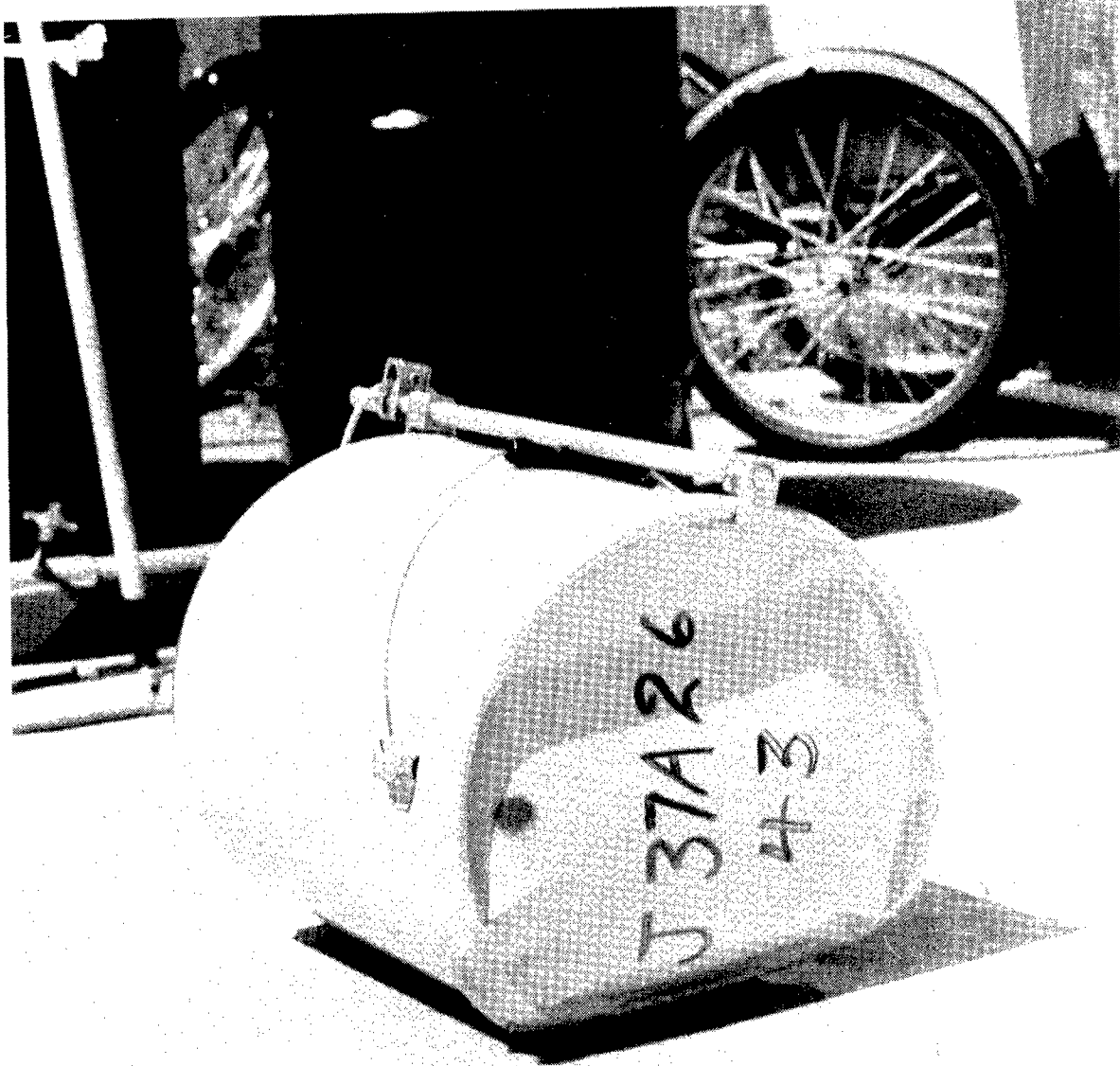


FIGURE 24

DIAGONAL DROP TEST



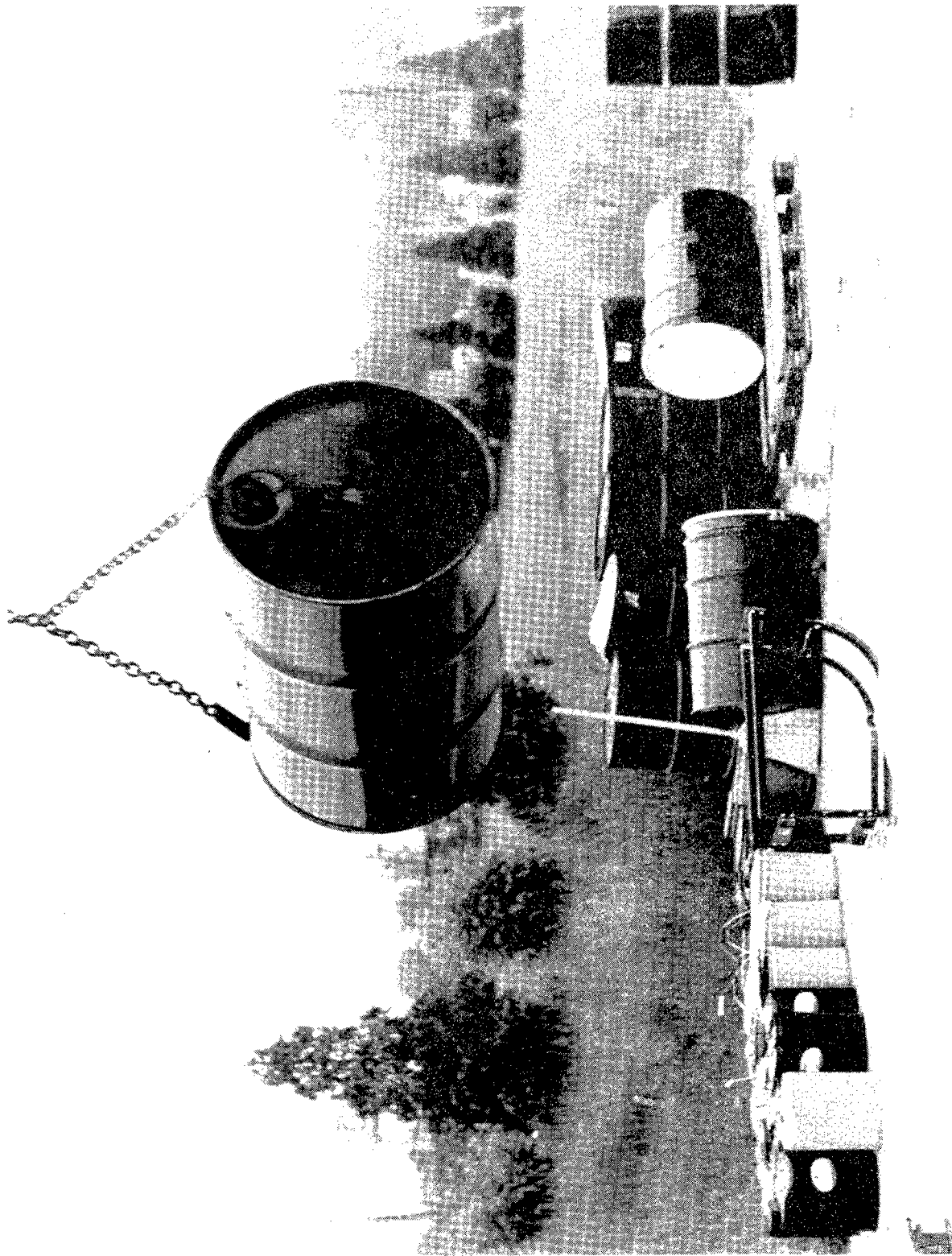
DIAGONAL DROP TEST

FIGURE 25



DIAGONAL DROP TEST

FIGURE 26



POSITION FOR HORIZONTAL DROP

FIGURE 27



FIGURE 28

HORIZONTAL DROP TEST



HORIZONTAL DROP TEST

FIGURE 29

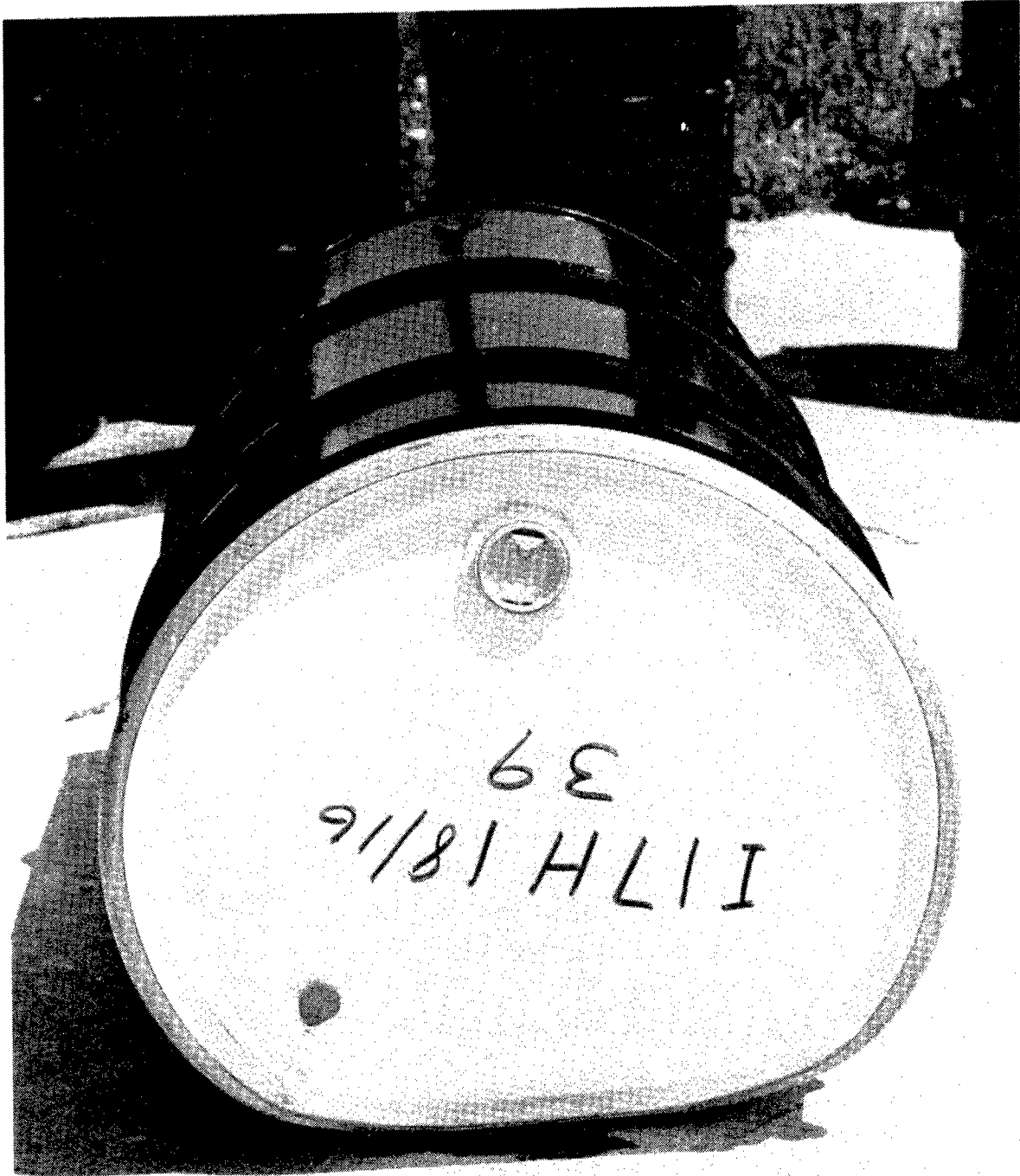


FIGURE 30

HORIZONTAL DROP TEST

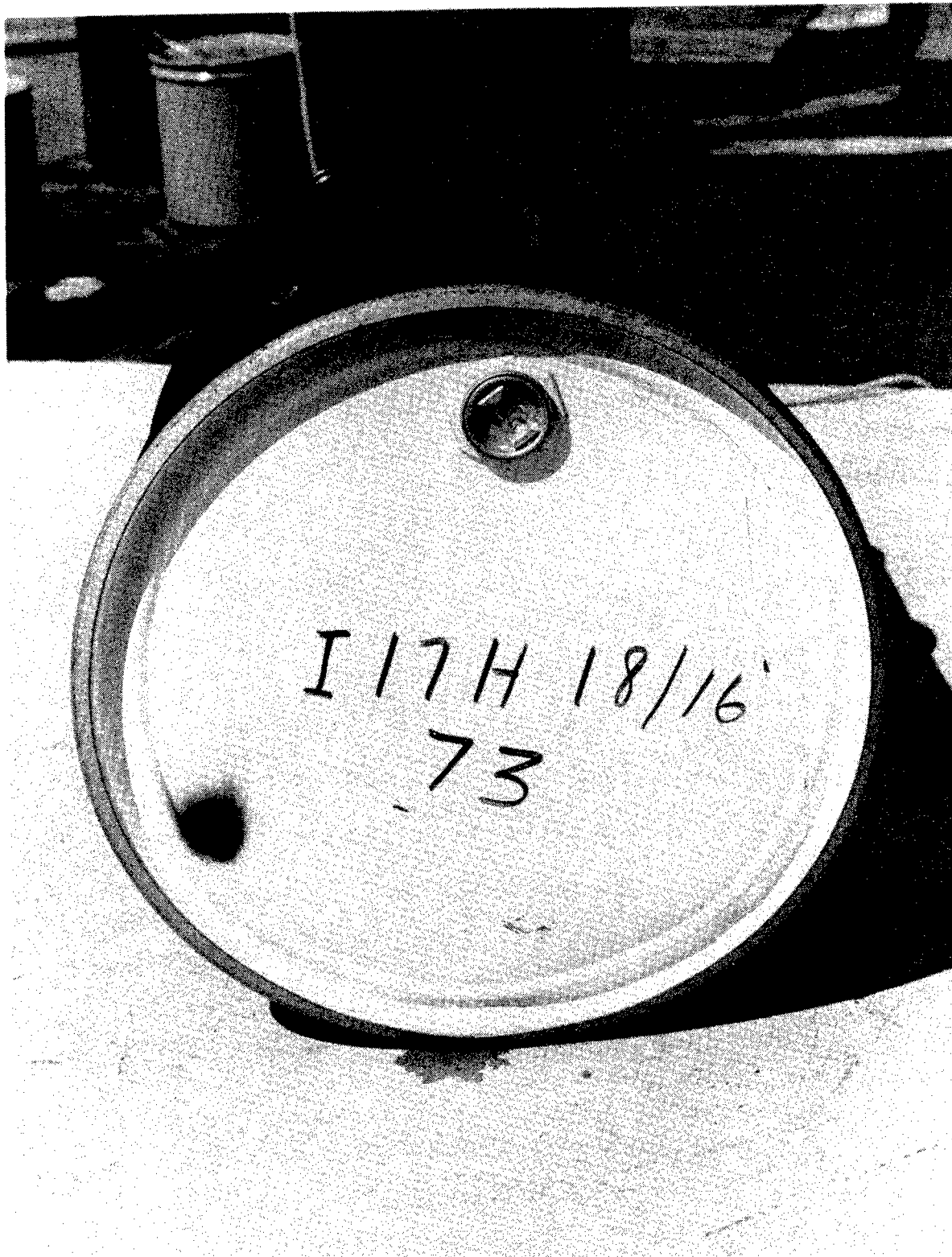


FIGURE 31

HORIZONTAL DROP TEST



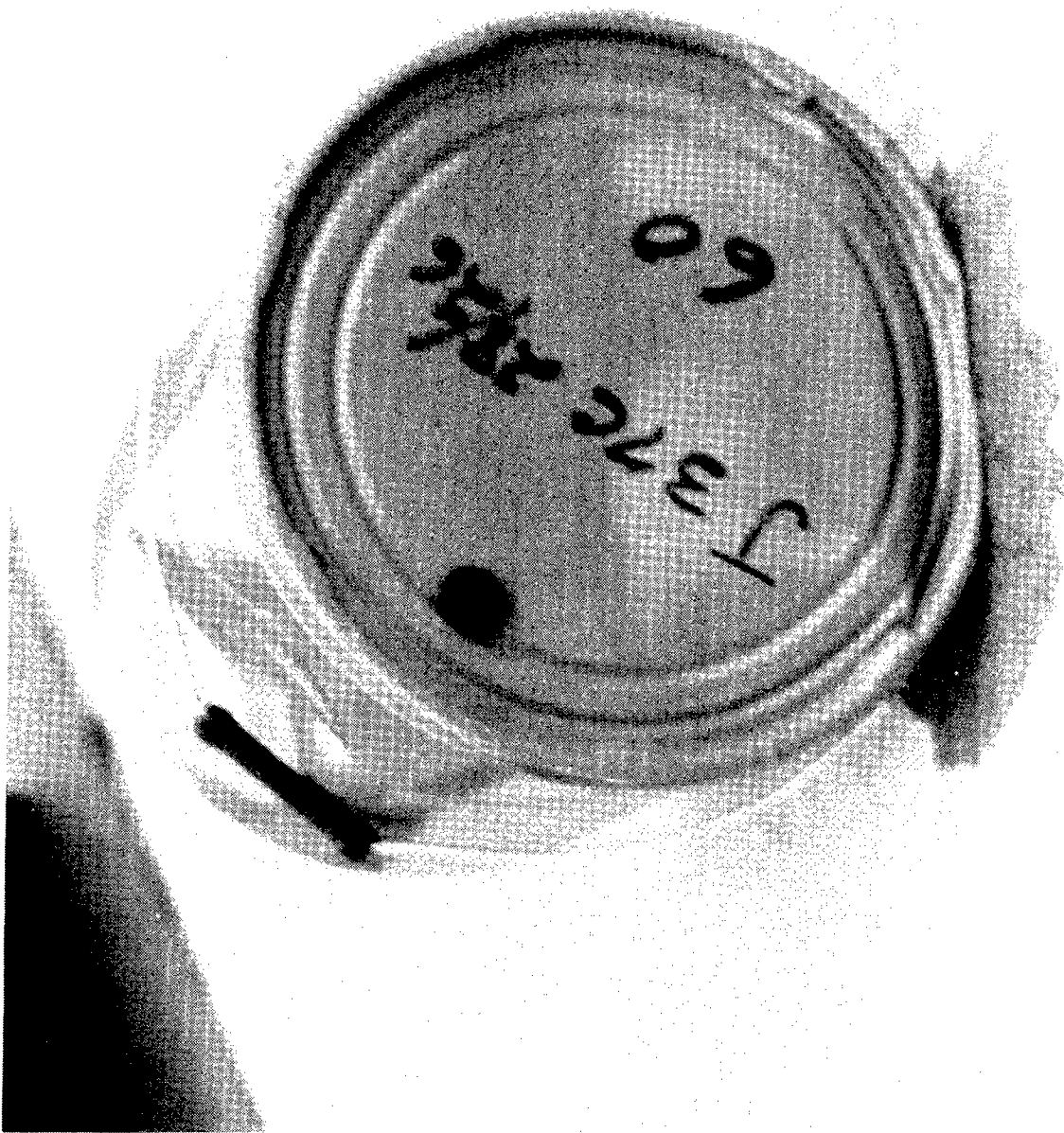
HORIZONTAL DROP TEST

FIGURE 32



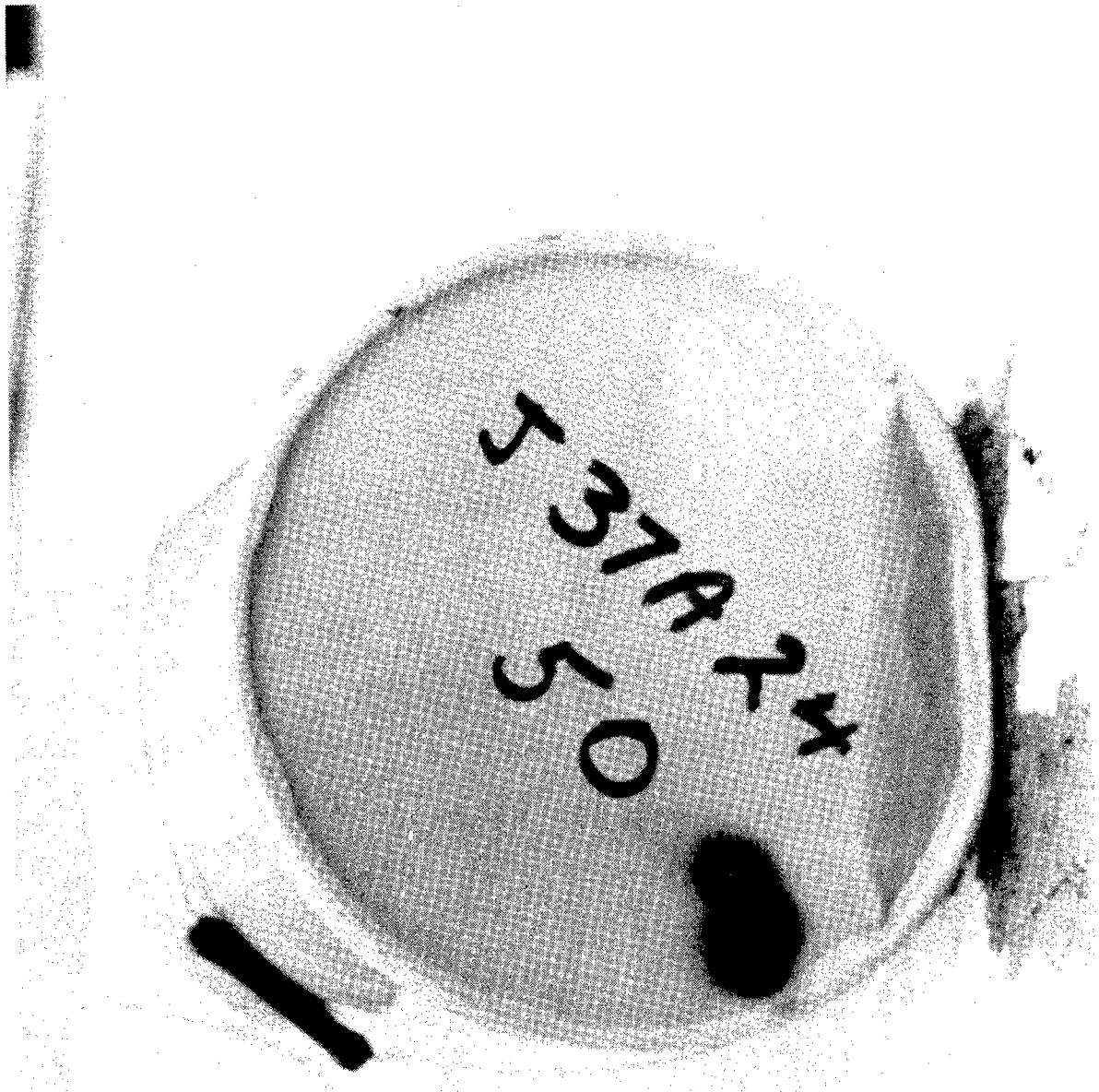
HORIZONTAL DROP TEST

FIGURE 33



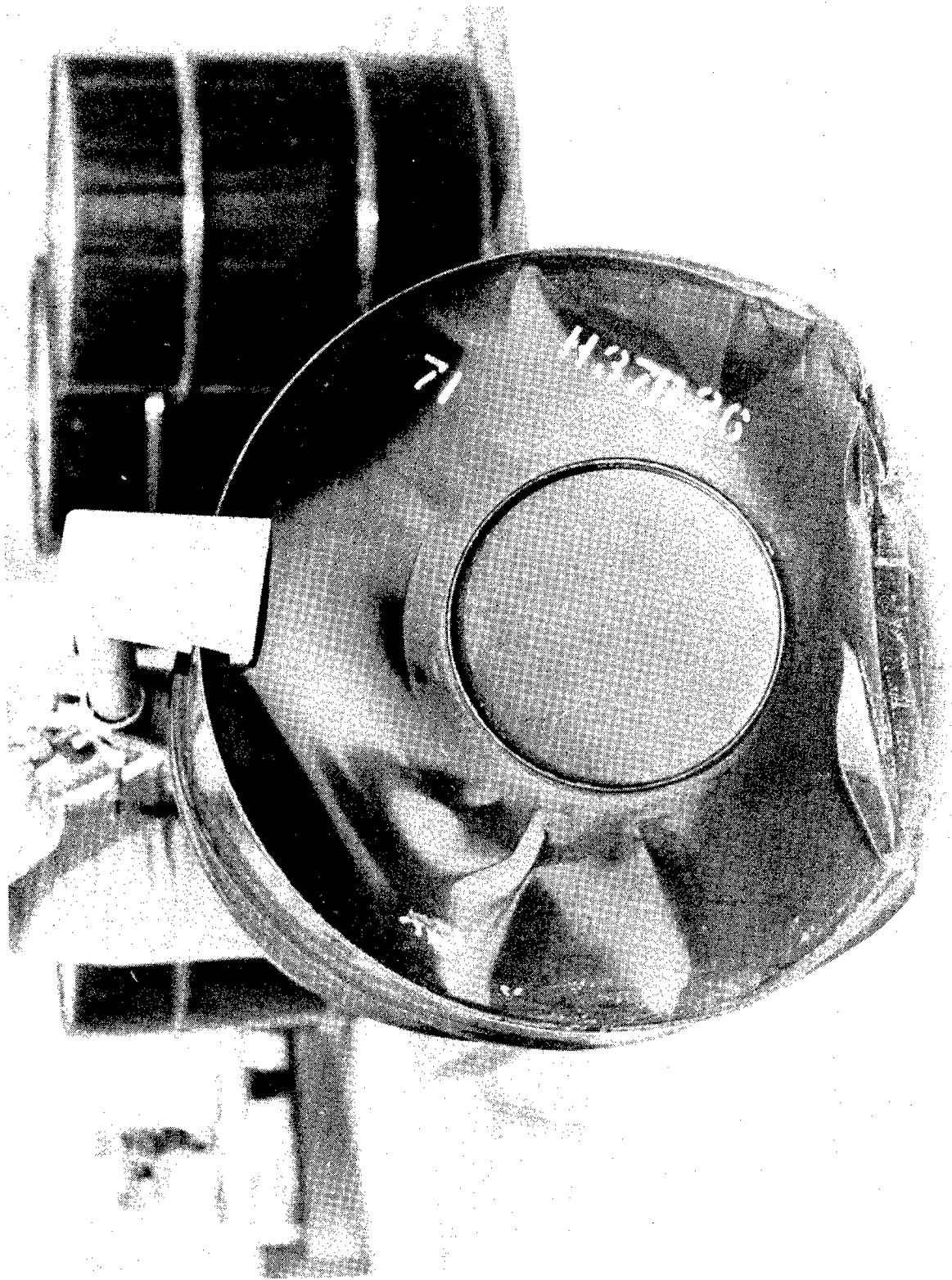
HORIZONTAL DROP TEST

FIGURE 34



HORIZONTAL DROP TEST

FIGURE 35



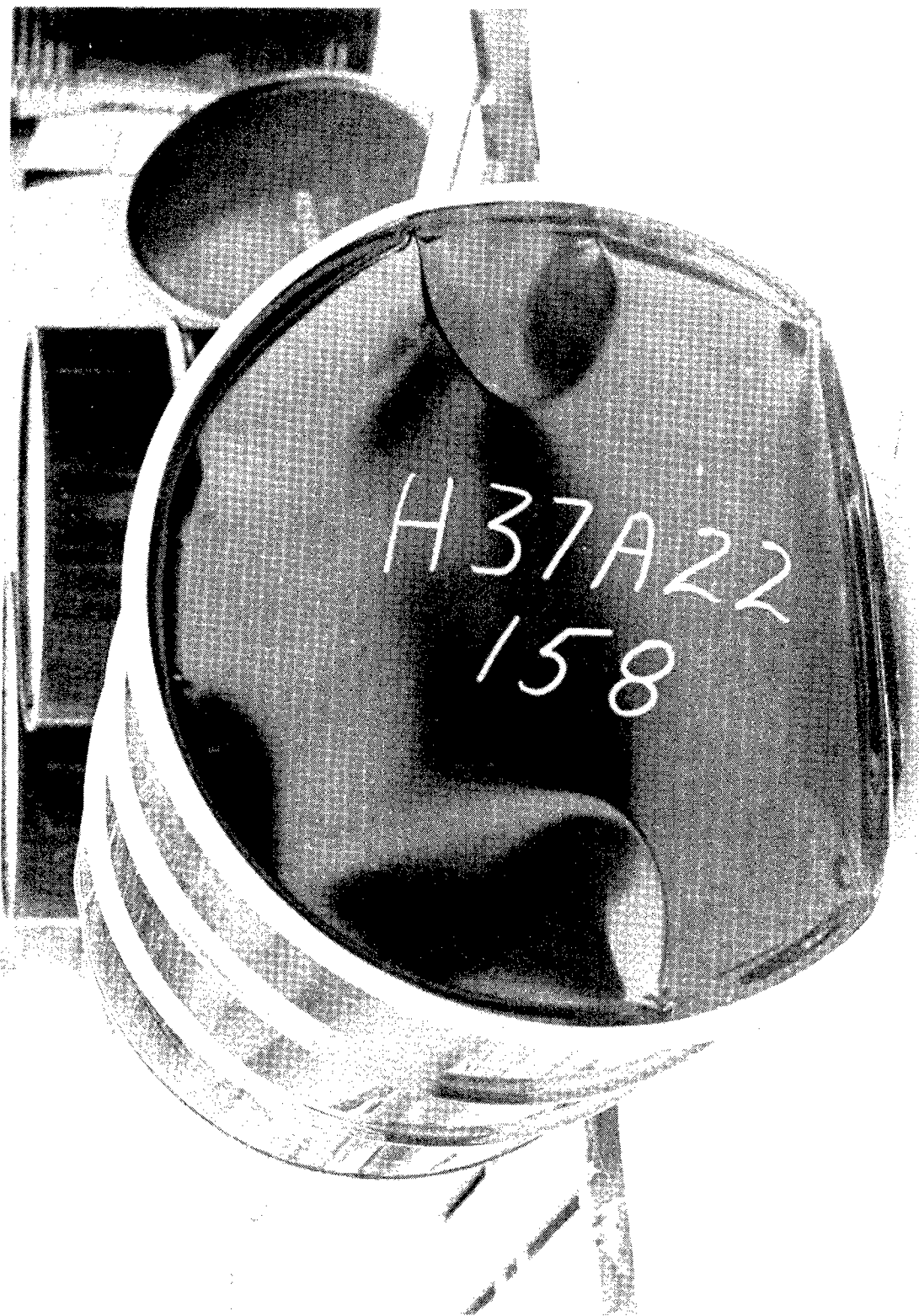
DIAGONAL DROP TEST, POWDER

FIGURE 36



DIAGONAL DROP TEST, POWDER

FIGURE 37



H37A22  
158

DIAGONAL DROP TEST, POWDER

FIGURE 38

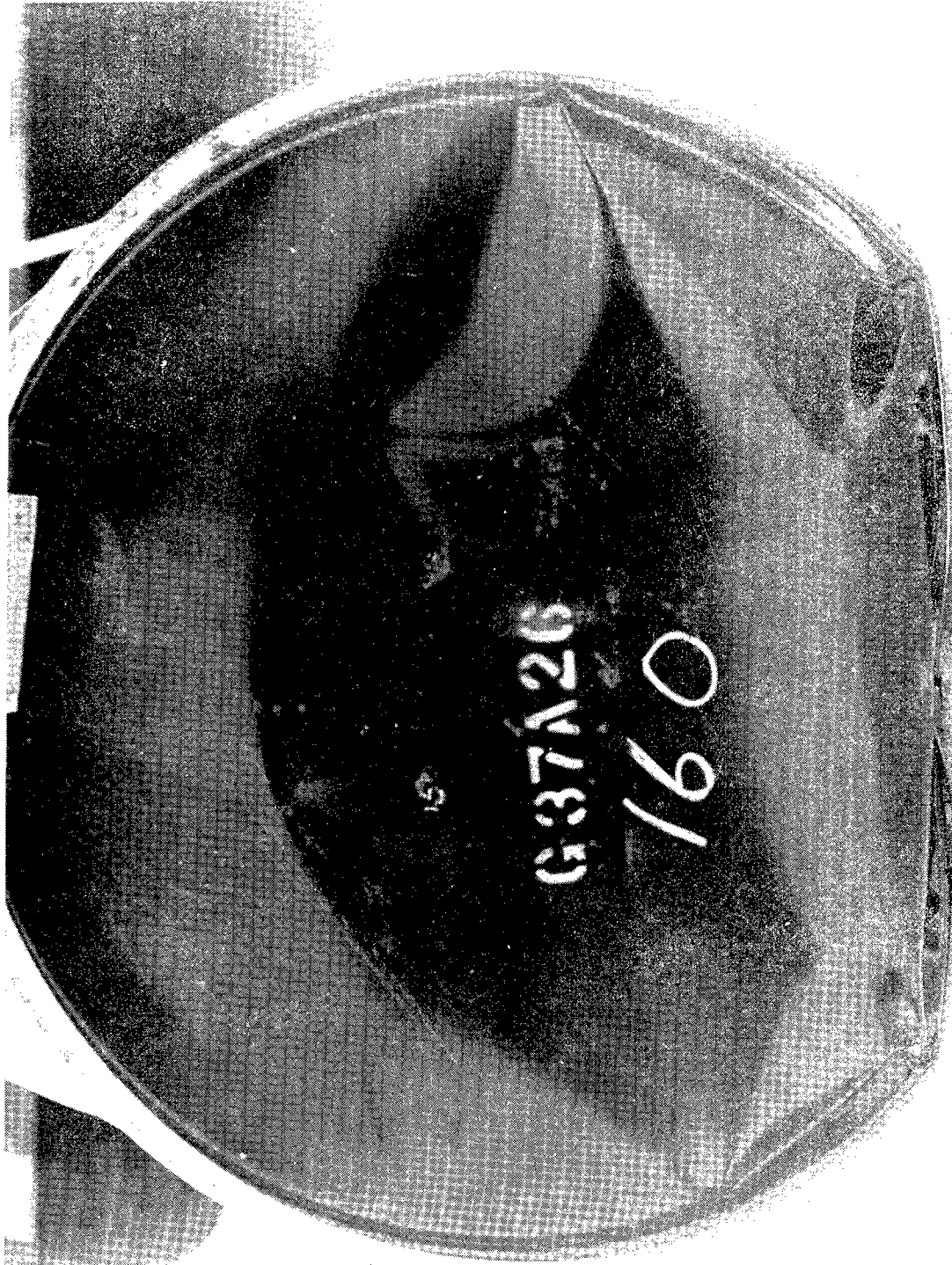
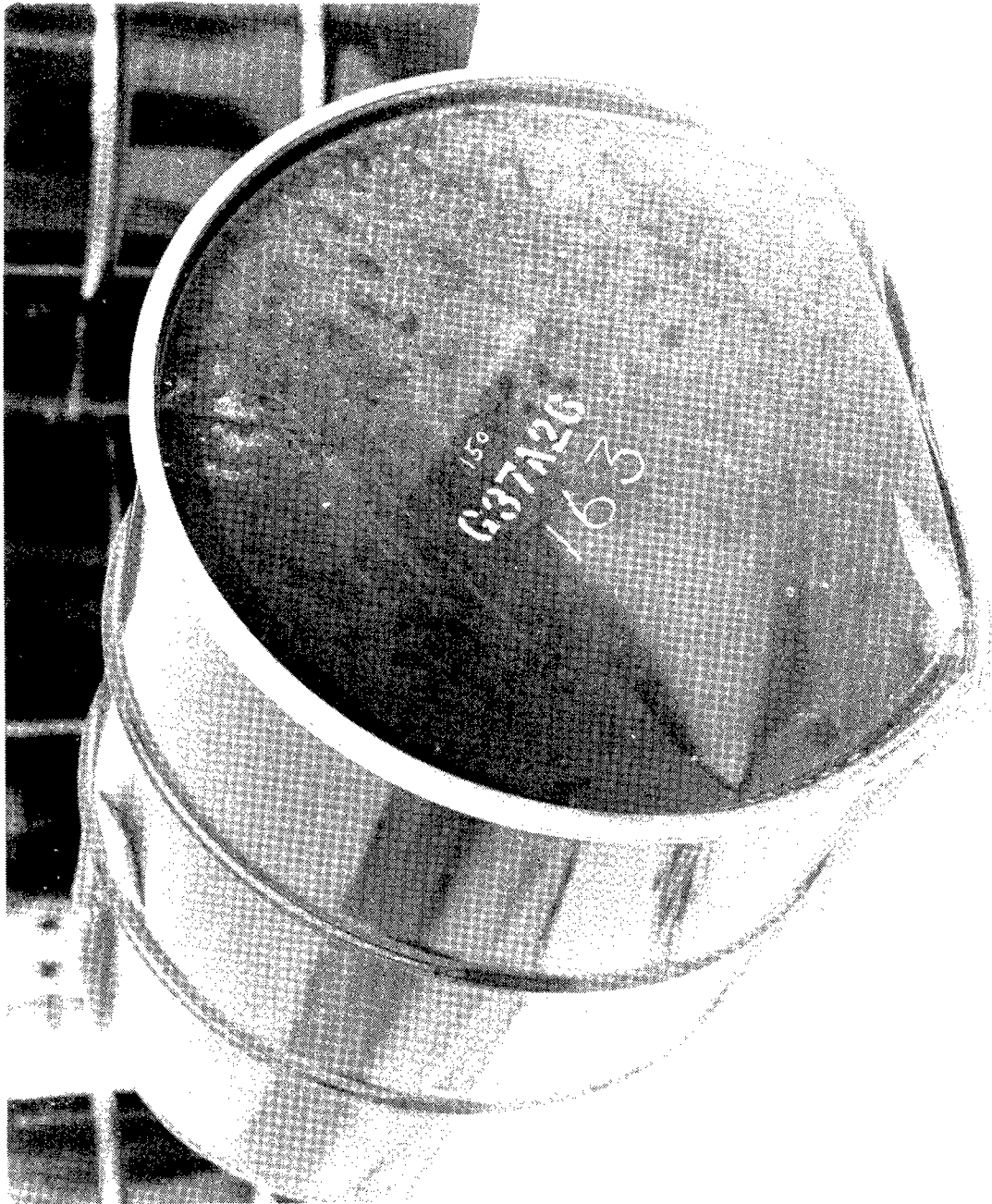


FIGURE 39 DIAGONAL DROP TEST, POWDER



HORIZONTAL DROP TEST, POWDER

FIGURE 40

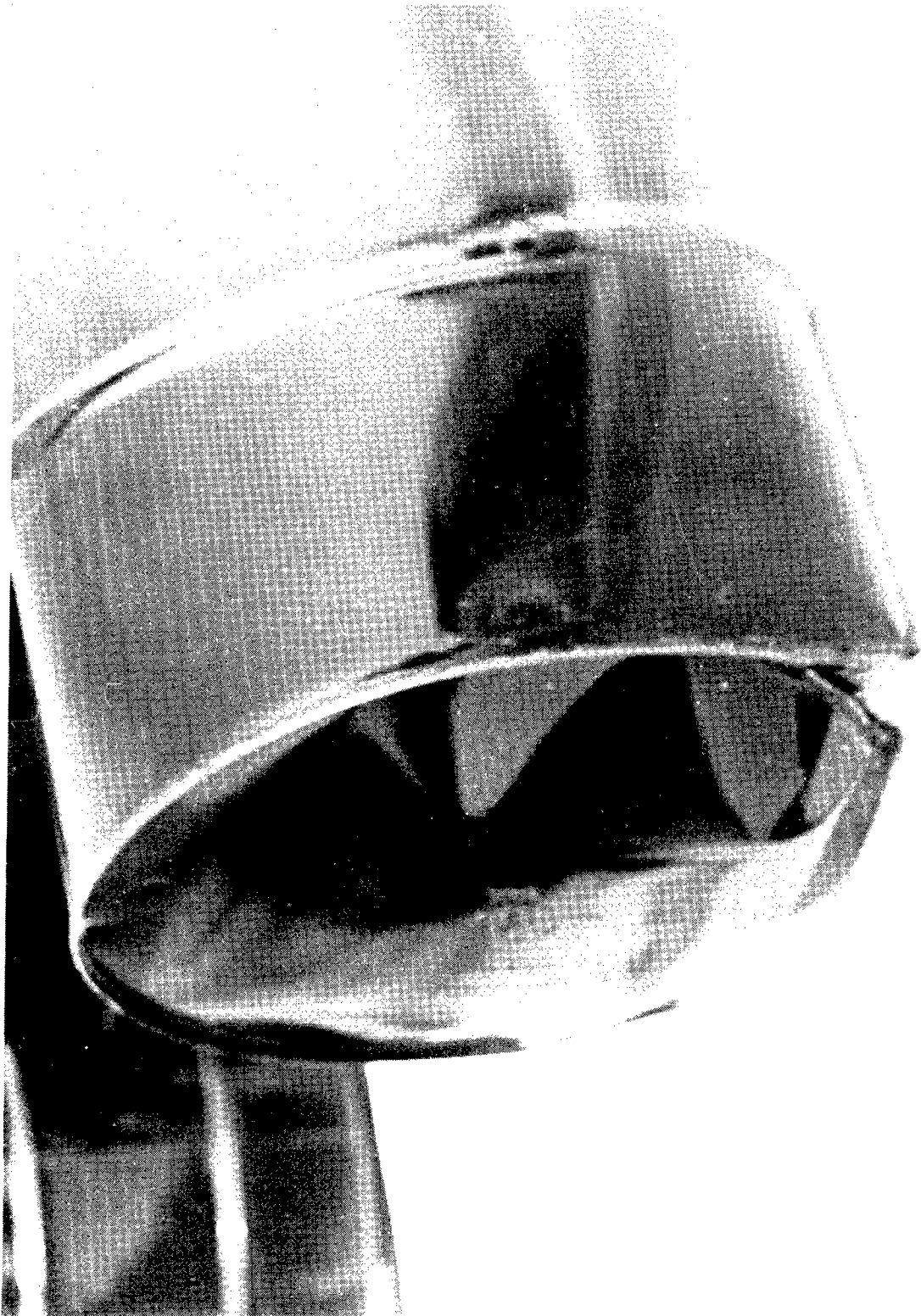
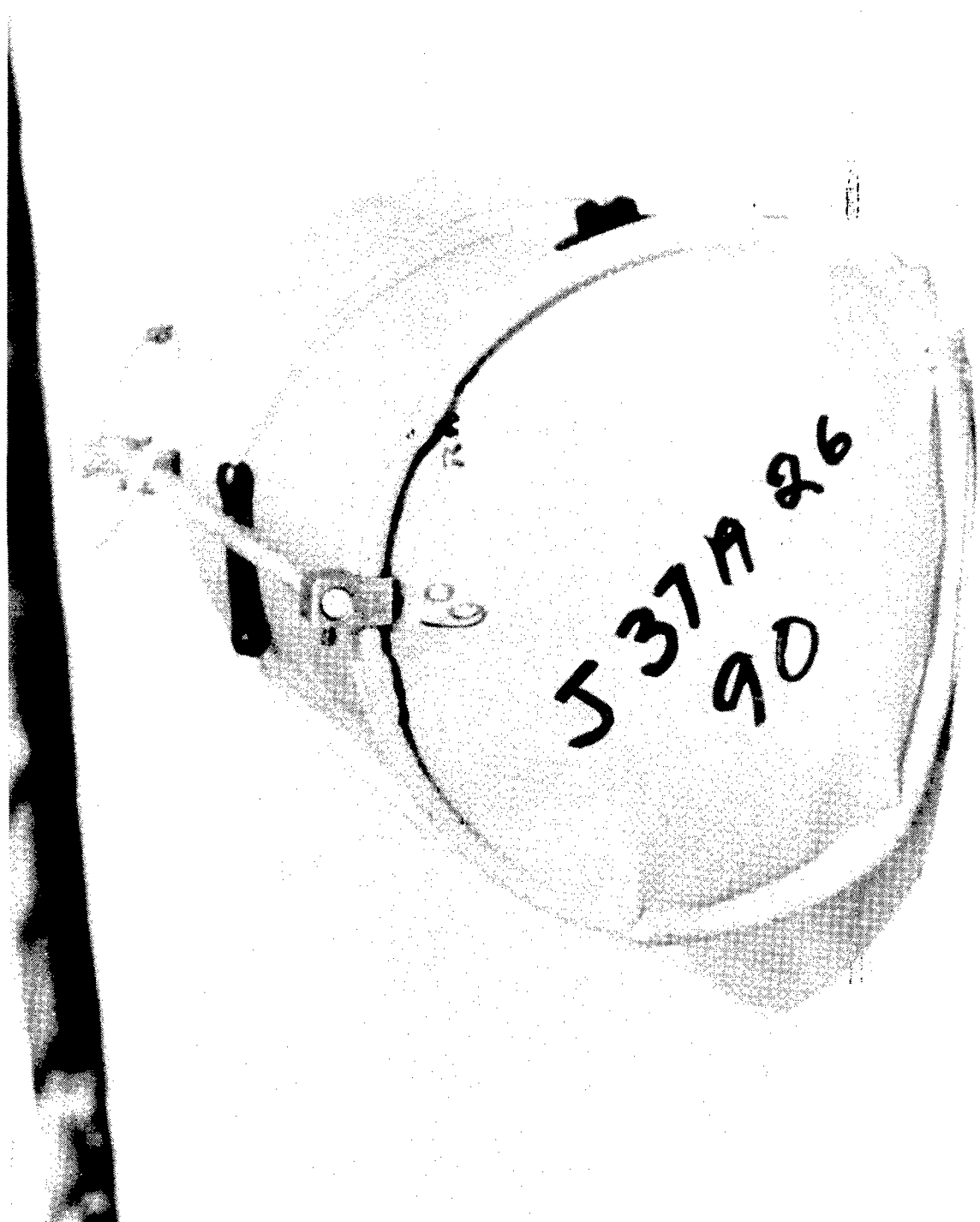


FIGURE 41 HORIZONTAL DROP TEST, POWDER



DIAGONAL DROP TEST, POWDER

FIGURE 42

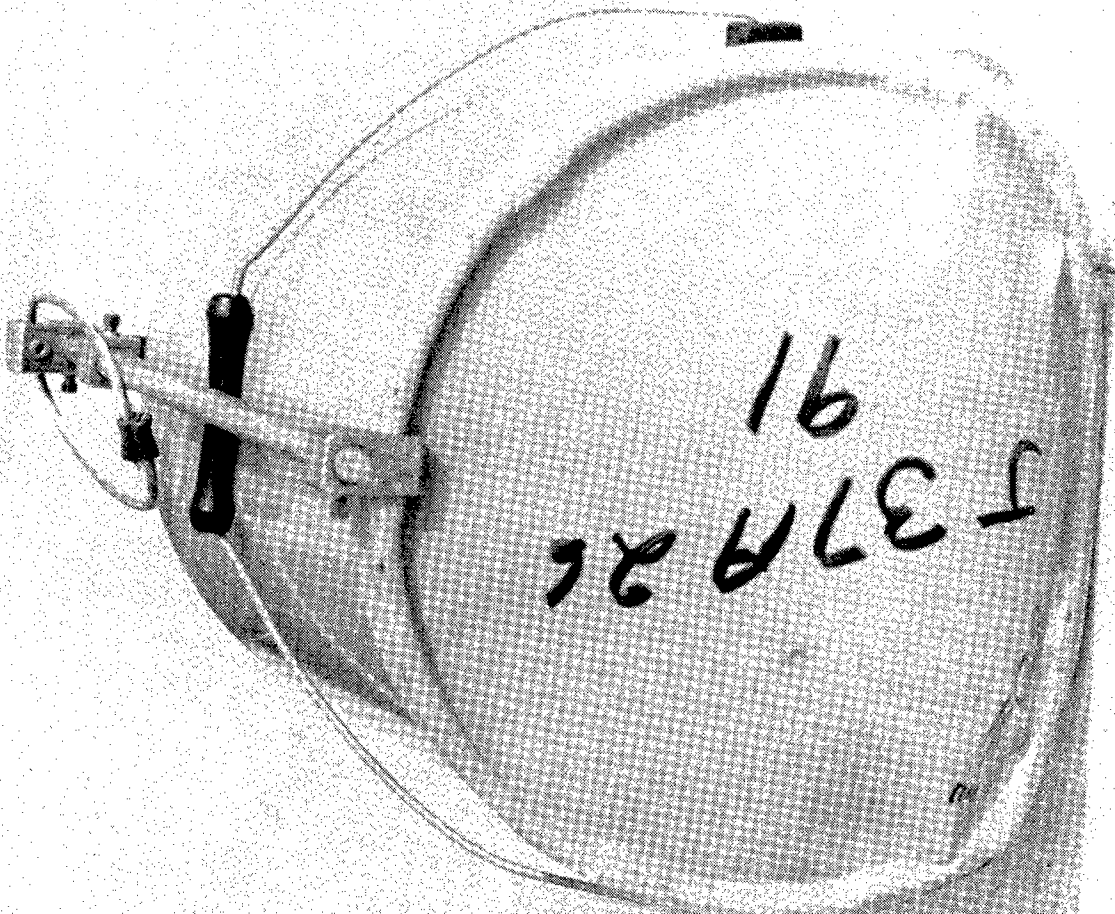


FIGURE 43 DIAGONAL DROP TEST, POWDER



FIGURE 44  
DIAGONAL DROP TEST, POWDER



DIAGONAL DROP TEST, POWDER

FIGURE 45



FIGURE 46 DIAGONAL DROP TEST, POWDER

FIGURE 46

A P P E N D I X

VISITORS THAT WITNESSED THE TESTS

APPENDIX  
VISITORS THAT WITNESSED THE TESTS

| <u>Date</u> | <u>Name</u>   | <u>Activity</u>      |
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| 5/18/72     | J. Higgins    | U.S. Steel           |
|             | A. Calipristi | DOT                  |
|             | E. Berryman   | SSCI *               |
| 5/19/72     | J. Higgins    | U.S. Steel           |
|             | A. Calipristi | DOT                  |
| 5/22/72     | A. Nides      | SSCI *               |
|             | P. Urasky     |                      |
|             | E. Berryman   | SSCI *               |
|             | J. Higgins    | U.S. Steel           |
| 5/23/72     | W. J. Burns   | DOT                  |
|             | A. Nides      | SSCI *               |
|             | A. Calipristi | DOT                  |
|             | P. Urasky     |                      |
|             | R. Deeds      | DOT                  |
| 5/24/72     | J. Higgins    | U.S. Steel           |
|             | E. Stark      | Rheem Manufacturing  |
|             | A. Murphy     | Manion Steel         |
|             | J. Gotts      | NOL                  |
|             | Mr. Raw       | NOL                  |
|             | Mr. Fridinger | NOL                  |
| 5/26/72     | E. Stark      | Rheem Manufacturing  |
|             | E. R. Byrne   | Eastern Steel Barrel |
|             | J. Higgins    | U.S. Steel           |
|             | L. Trilla     | Trilla Steel Drum    |
|             | L. Baruch Jr. | Trilla Steel Drum    |
| 7/11/72     | E. Berryman   | SSCI *               |
|             | P. Beal       | Greif Brothers       |
|             | W. Berry      |                      |

\*Steel Shipping Container Institute

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| 4. DESCRIPTIVE NOTES (Type of report and inclusive dates)<br><b>FINAL</b>  |   |   |  |
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| 13. ABSTRACT<br><br><b>An investigation was conducted to evaluate various types of new metal drums and pails being used for the packaging and shipping of hazardous materials, to determine if these containers will spill their contents when subjected to high internal pressure and to specified rough handling tests. Various quantities of 17H and 17C open head drums as well as samples of 37A and 37C drums and pails spilled liquid contents after rough handling. In addition, some 37A, 37B drums and 37A and 37C pails spilled their dry (powder) contents after rough handling.</b> |   |   |  |