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STATE OF CALIFORNIA—TRANSPORTATION AGENCY

RONALD REAGAN, Governor

DEPARTMENT OF PUBLIC WORKS
DIVISION OF HIGHWAYS
MATERIALS AND RESEARCH DEPARTMENT
5900 FOLSOM BLVD., SACRAMENTO 95819

September 1968

M&R No. 36439

Mr. J. A. Legarra
State Highway Engineer
California Division of Highways
Sacramento, California

Dear Sir:

Submitted for your consideration is a report on:

EVALUATION TESTS OF

"POP UP TRAFFIC SENTINEL"

MANUFACTURED BY TERRA ENGINEERING CO.

ERIC F. NORDLIN
Principal Investigator

ROBERT N. FIELD
Co-Principal Investigator

ROGER A. PELKEY
Co-Investigator

Very truly yours,

JOHN L. BEATON
Materials and Research Engineer

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TRAFFIC SENTINEL POP-UP TUBE

I. BACKGROUND

An expenditure authorization dated May 31, 1968 was issued by Headquarters Design Department for the development and evaluation of innovative "pop-up" tube barrier devices for the intermittent closure of the Santa Barbara on-ramp to the southbound Harbor Freeway, 07-LA-11.

A letter dated July 10, 1968, Schaefer to Legarra, requested the Materials and Research Department to test and evaluate the Pop-Up Traffic Sentinel manufactured by the Terra Engineering Co., Monterey, California.

A Materials and Research Department project work order, 19602-762550-36439, for $2,500 was issued on July 23, 1968, and a pop-up tube unit was purchased for testing and evaluation.

II. DESCRIPTION

The device tested was a pop-up "Traffic Sentinel" lane control device manufactured by the Terra Engineering Co., Inc., 271 Figueroa Street, Monterey, California. The cost of this unit is approximately $350 (Exhibit 1).

Basically, this device consists of a 5 inch diameter steel tube outer casing, a steel tube inner casing, and an actuator piston, attached to the pop-up tube, which operates vertically between the inner and outer casings. The pop-up tube itself is molded neoprene 4 inches in diameter by 20 inches long and reinforced with both longitudinal and radial cord. The unit is activated pneumatically, operating on from 15 to 50 psi air pressure (see attached Exhibit 2 for details). To extend the tube, air is injected between the casings from the bottom, exerting pressure on the bottom of the actuation piston thereby pushing it (and the tube) upward. To retract

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the tube, air is injected into the inner casing, passes through an air passage at the top into the space between the casings above the piston, exerting pressure on the top of the actuation piston, pushing it (and the tube) downward.

III. CONCLUSIONS AND RECOMMENDATIONS

The Pop-up Traffic Sentinel device tested appears to be well constructed and its operation is satisfactory. Traffic damage from being struck or run over at the relatively low speeds anticipated on a ramp entrance can be expected to be minimal and should not affect operation. Contaminants such as sand, water, etc. do not appear to adversely affect operation of the unit. However, some moisture can enter the casing through the "O" ring seals and cause corrosion problems of the metal parts. It is suggested that oil be injected into the air supply thus providing a constant lubrication to all parts and minimize the corrosion problem. The manufacturer assured us that all rubber parts are oil resistant.

The primary question yet to be resolved is one of target value. The exposed 4" x 18" tube is a small target and should be furnished in bright colors, such as yellow or signal red, and reflectorized for maximum night-time target value. The tube tested was coated with a dull, red, reflective paint which provided questionable day-time target value. During the physical tests, the reflective paint cracked and crazed as the tube was deflected during impact and would have a short service life under these conditions. We have not conducted a reflectance test on the tube tested, as too much of the beaded surface was removed by the skid tests. We feel that the wiping feature on the outer surface of the tube as it is raised and lowered may abrade any surface coating. We will work with the manufacturer in selecting the most effective and efficient coating for the tubes and will make the final reflectance tests before delivery of the units to the district.

The construction procedures as employed in the test installation appear to be satisfactory and are recommended for the trial field installations.

The size of air supply lines should be determined dependent upon air volume, pressure supplied, and the number of units in an installation. For the test, air was supplied at 125 cfm, 35 to 50 psi, through 1/2-inch diameter rubber tubing.

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IV. INSTALLATION

The unit tested was installed at our Lincoln Airport test site on August 15, 1968.

Installation details are as shown on attached Exhibit 3, and consisted of boring an 8-inch diameter by 24-inch deep hole with an 18-inch diameter by 6-inch deep area excavated at the top. The hole was filled with sand as required to position the top of the device approximately flush with the roadway surface. With the device centered vertically in the hole, the hole was backfilled with sand up to the excavated area. The approximately 6-inch deep excavated area was then filled with concrete up to the roadway surface forming a stabilizing collar.

The device is so constructed that the air supply outlets are located below the concrete collar, thus the air supply lines can be run below the roadway surface to the main supply line.

This installation operated satisfactorily throughout the physical tests and is recommended for experimental in-service installation.

V. PHYSICAL TESTS

The physical tests were conducted on the Pop-up Traffic Sentinel installation on August 28, 1968. In attendance were the following personnel:

Representing the manufacturer: Messrs. Fox and Bowersocks.

Representing the M & R Department: Messrs. Field, Eagan, and Pelkey.

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The test vehicle was a 1967 Oldsmobile sedan. Except as noted, the pop-up unit was operated at an air pressure of 50 psi.

1. Test No. 1

With the tube in the extended position, the vehicle straddled the tube and impacted head-on at 35 mph. The tube deflected on impact and returned to the upright position immediately with no visible damage other than surface scuffing. Operation of the device was unaffected by the impact.

2. Test No. 2

With the tube in the extended position, the vehicle impacted at 35 mph with both the left front and left rear tires passing over the tube. The tube deflected and was flattened under the impacting tires and returned to the upright position immediately with no visible damage. Operation of the device was unaffected by the impact.

3. Test No. 3

A repeat of Test 2 with the same results.

4. Test No. 4

A repeat of Test 2 with the same results.

5. Test No. 5

Before the impact test and with the tube in the down position, the installation was covered with sand and gravel and water was poured onto it. It was satisfactorily operated several times, up and down at an air pressure of 35 psi. The unit is designed so that a wiping action on the outer and inner surfaces of the tube takes place as it is extended and lowered, thus minimizing the passage of foreign material into the unit where it could cause jamming. On the particular model tested, the outer seal had excessive clearance and did not wipe satisfactorily. Although no operating problems were experienced, the manufacturer plans to correct the clearance on the future model.

For the impact portion of this test we proposed locking the vehicle brakes at 10 mph and skidding a

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tire over the extended tube. On the first attempt it appeared that the brakes were inadvertently released just as the wheel passed over the tube. On the repeat test at 10 mph the left front tire skidded directly across the tube, deflecting and flattening it against the pavement. Other than black skid marks on the tube surface, no other damage was apparent to either the tube or the formed rubber inner and outer caps of the recessed casing. The tube returned immediately to the upright position and operation of the unit was unaffected by this impact.

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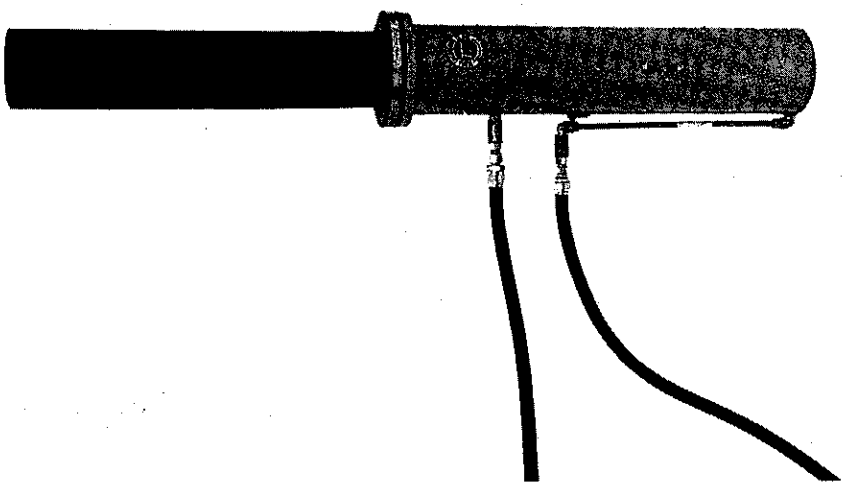
Exhibit 1



TUBE EXTENDED

TUBE RETRACTED

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Exhibit 2

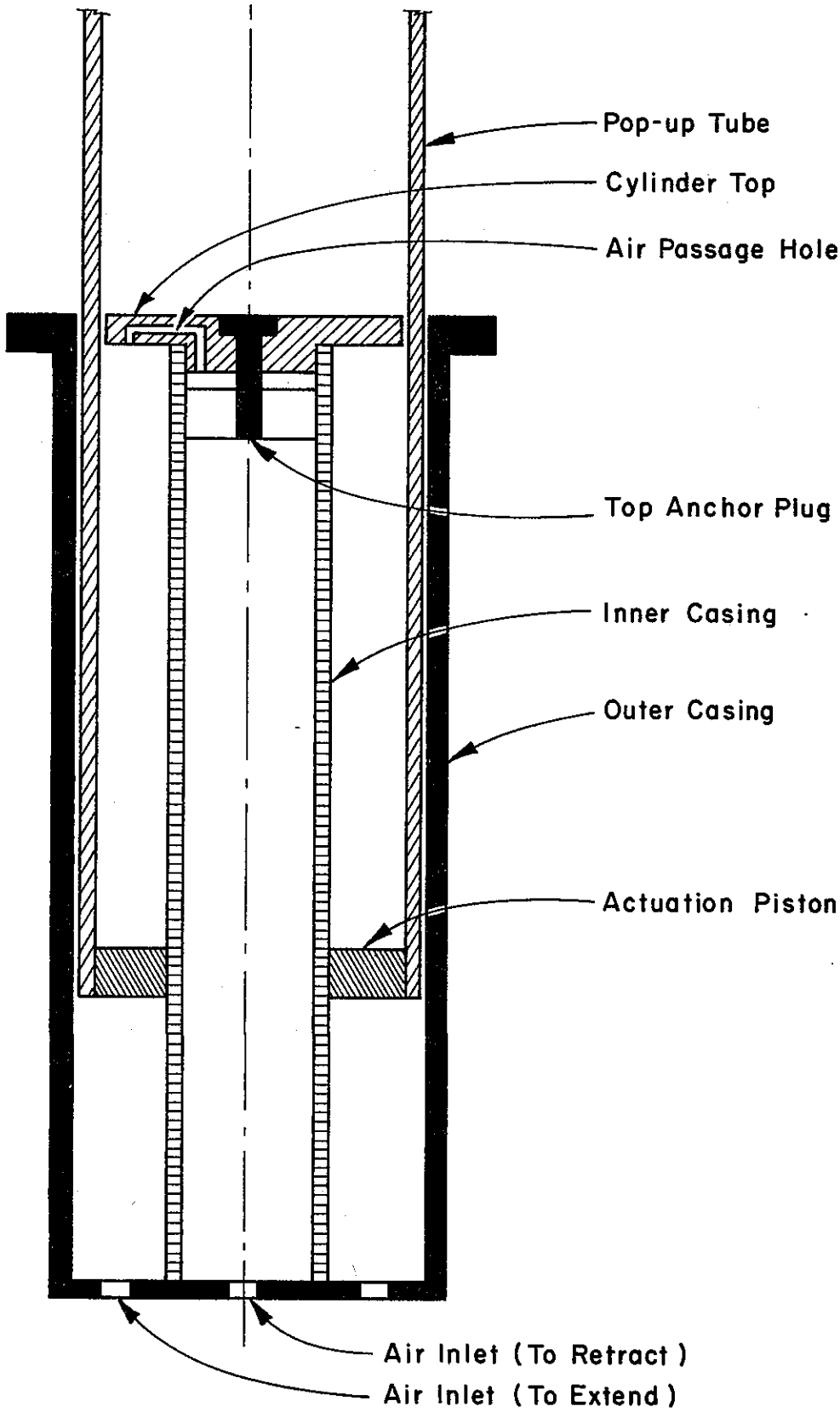

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Exhibit 3

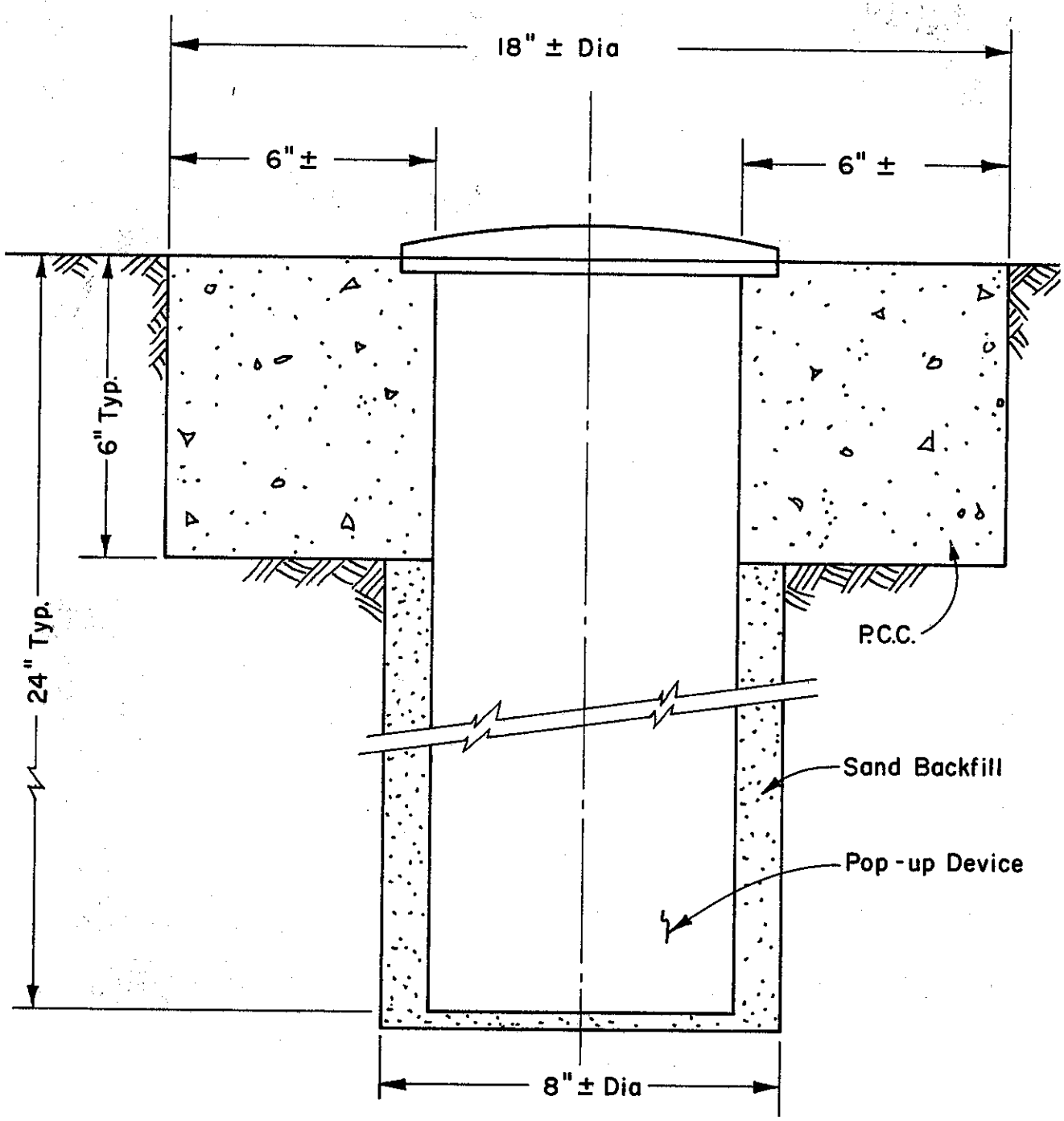

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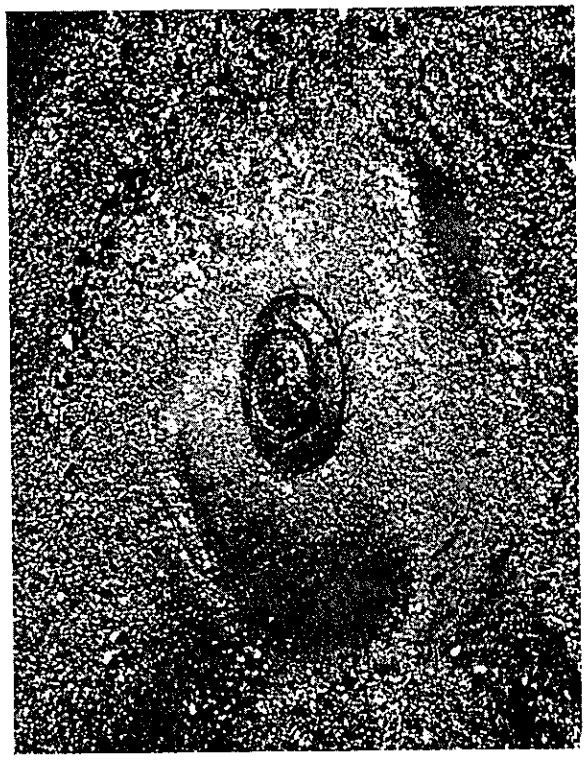
EXHIBIT 4

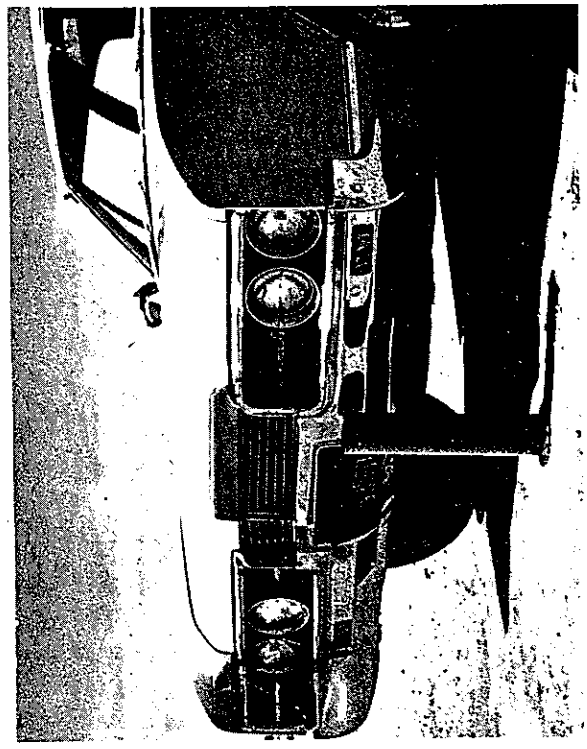
Traffic Sentinel at Test Location



Moisture and Grit Test - Tube Retracted

Moisture and Grit Test - Tube Extended

Installation and Equipment



Bumper Height Comparison

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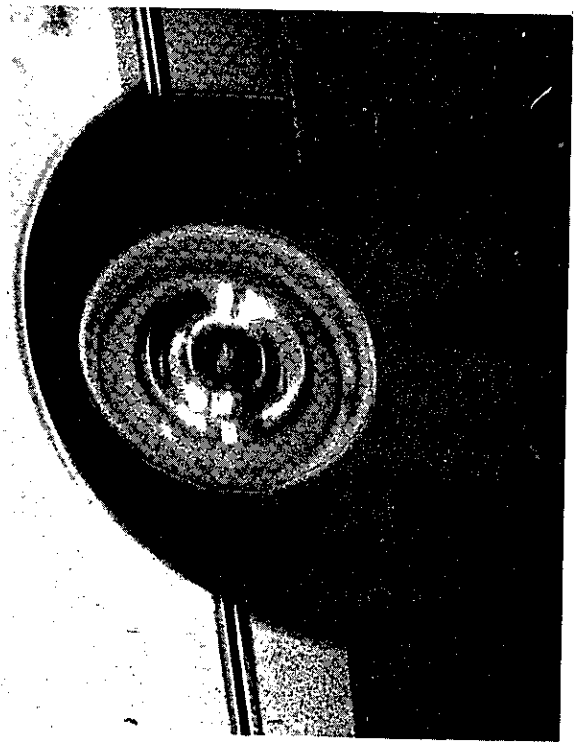
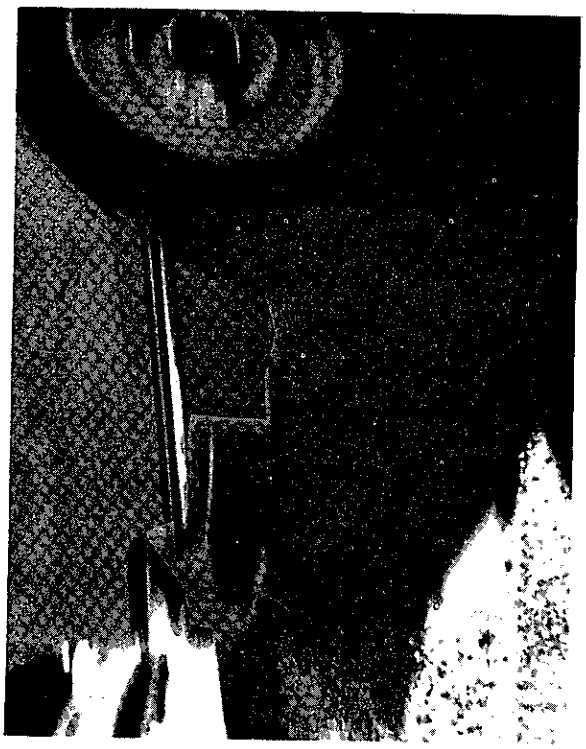
EXHIBIT 5

Data Shots - Test Nos. 1 and 5

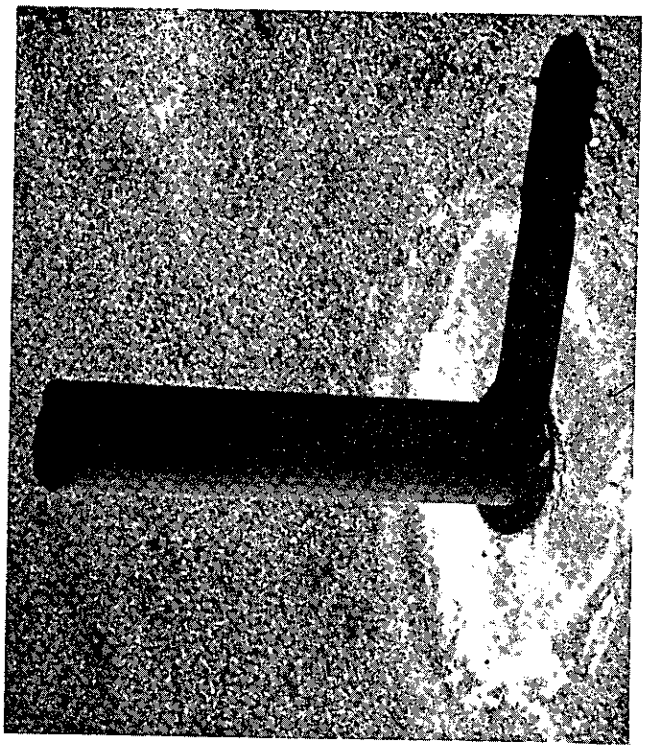


Test No. 5

Tube Damage - Test No. 5



Test No. 1



Tube Damage - Test No. 1

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