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DATE: 20 Apr 71



ADVISORY CIRCULAR

DEPARTMENT OF TRANSPORTATION FEDERAL AVIATION ADMINISTRATION

SUBJECT: MAINTENANCE GUIDE FOR DETERMINING DEGRADATION AND CLEANING OF
CENTERLINE AND TOUCHDOWN ZONE LIGHTS

1. PURPOSE. This advisory circular contains maintenance recommendations for determining degradation and cleaning of centerline and touchdown zone lights installed in airport pavement.
 2. REFERENCES.
 - a. Obtain the following publications and additional copies of this circular from the Department of Transportation, Distribution Unit, TAD-484.3, Washington, D.C. 20590:
 - (1) Advisory Circular (AC) 150/5340-4B, Installation Details for Runway Centerline and Touchdown Zone Lighting Systems.
 - (2) Order 8400.3A, Minimum Operating Standards for Touchdown Zone and Centerline Lighting Systems.
 - b. Obtain copies of Military Specification MIL-L-27160, Light Instrument, Integral, White General Specification For, from the Commanding Officer, Navy Supply Depot, 5901 Tabor Avenue, Philadelphia, Pennsylvania 19120, Attention: Code CDS.
 3. BACKGROUND.
 - a. Pilots operating aircraft in low visibility conditions need to see in-pavement runway centerline and touchdown zone lights that project a certain level of light output. The light output of these fixtures are subject to degradation from component failures, deposits of rubber and fuel, and sandblasting of the glassware by flying debris. Major degradation of in-pavement lights and lamp outages are normally detected by daily ground or air visual observations. Uniform degradation of the systems maximum light output is not obvious with these visual observations.
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- b. Centerline and touchdown zone lighting systems have been installed and are in operation at a number of Category II airports. These systems are designed to facilitate landing or takeoff under adverse visibility conditions during day and night operations. Unless the lights are installed and maintained in the designed configuration, they do not serve the intended purpose and could even compromise safety by providing inadequate visual guidance. This advisory circular is intended to provide guidance for detecting when the light fixtures are providing intensities below an acceptable level. In addition, guidance is provided for removal of contaminants from the exterior surface of the fixture's glassware.

4. DEGRADATION LIMITS. The maximum degradation levels should not be considered acceptable maintenance levels. Maintenance and inspection requirements are contained in AC 150/5340-4B, Installation Details for Runway Centerline and Touchdown Zone Lighting Systems. The maximum degradation limit is the maximum acceptable reduction in the systems configuration or the light output of the individual fixtures.

- a. Systems. The maximum number of inoperable lights and the number of consecutive lights permitted in the centerline and touchdown zone lighting systems are as specified in the latest issuance of Order 8400.3A, Minimum Operating Standards for Touchdown Zone and Centerline Lighting Systems. The criteria in Order 8400.3A is applicable whenever the centerline and touchdown zone lighting systems are installed (domestically) and landing or takeoff minima are predicated on their use. Criteria are as follows:
- (1) Not more than 10 percent of the lights of the centerline lighting system shall be inoperative.
 - (2) Not more than 10 percent of the lights in either side of the touchdown zone lighting system shall be inoperative.
 - (3) Not more than four consecutive lights of the centerline lighting system shall be inoperative.
 - (4) More than one barrette of the touchdown zone system may be inoperative; however, two adjacent barrettes on the same side of the system shall not be inoperative. A barrette is considered to be inoperative when all of its lights are out.
- b. Lighting Fixtures. Clean or replace the optical assembly of the centerline or touchdown zone light fixtures when the intensity of the light unit is less than 70 percent of the initial brightness of the

fixture operated at maximum intensity. A fixture degraded below 70 percent of full brightness is considered extinguished for high background brightness, low visibility day conditions.

5. LIGHT MEASUREMENTS. Procedures and equipment are available for measuring the degradation of lighting fixtures under workshop or field conditions. In either situation relative readings are obtained. The readings relate to the optical performance of the fixture under test to the optical performance of a new fixture in accordance with design specification requirements.
- a. Workshop Measurements. Make provisions for obtaining these measurements by drawing the light fixtures' photometric curve on a flat surface as shown in figures 1 and 2. Strategically locate photocells at key points on the curve. Connect the photocells to a microammeter to complete the detection and measurement system. The photocells are calibrated with a new lighting fixture that meets specification requirements. This calibration is obtained by placing the test fixture 10 feet from the test board, operating the light at maximum brightness, and noting the deflection on the microammeter scale. Test fixtures are substituted for the calibrated units and comparative readings are obtained. Keep the original calibrated light fixtures (one centerline and one touchdown zone) and a record of the initial readings. Use these initial readings to monitor the degradation of the installed fixtures. See figure 3 for a correlation between meter readings and degradation values.
- b. Field Measurements. Random measurements of the intensity of installed fixtures may be made with the instruments shown in figure 4 or an equivalent device. It is not practical to measure the light output of all fixtures under a field condition unless these measurements are made in conjunction with cleaning the glassware. The operator of the field test instrument must stop at each fixture to obtain an accurate reading of degradation. The average time for taking this field measurement is two minutes and one minute, for centerline and touchdown zone lights, respectively.
- c. Miscellaneous Equipment. There are several commercially available measuring devices that could be adapted to airport applications. One of these devices is specified in MIL-L-27160. The time required to set the MIL-L-27160 instrument up under field conditions is excessive for airport application, however, this instrument can be used under workshop conditions. After the MIL-L-27160 instrument is installed on a stable tripod and measurements are made from the light source to instrument, photometric readings can be obtained within a minute.

- c. New Development. New devices are being developed to clean centerline and touchdown zone lights and measure light degradation under day and night field conditions. After these devices have been developed and tested, this advisory circular will be revised accordingly.

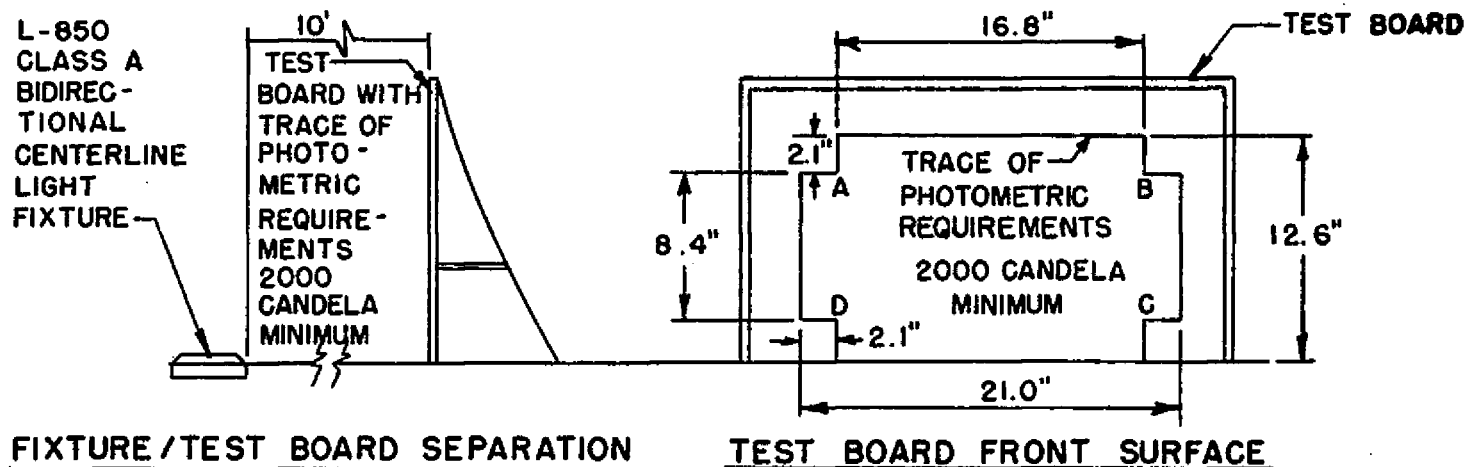
6. MAINTENANCE.

- a. Daily Checks. Make a daily visual and operational check of the centerline and touchdown zone lighting systems. Accomplish this by energizing the lights and observing the overall appearance of the systems without the use of an instrument. If any lamps are out or fixtures are obscured with foreign material, record the locations of the fixtures and correct the deficiencies at a time when the electrical circuit is deenergized. Schedule maintenance activities to obtain minimum runway downtime.
- b. Unscheduled Inspections. Periodic inspections should be made of sample fixtures in various portions of the centerline and touchdown zone lighting systems to detect uniform degradation of the lighting systems. These inspections can be completed by exchanging installed light fixture assemblies for spare assemblies and measuring the fixture's degradation under workshop conditions. See paragraph 5a for guidance on workshop measurements. An alternate procedure is to use the instrument specified in paragraph 5b or an equivalent device to measure degradation under field conditions. The frequency of inspections for uniform degradation should be determined at each location. Use the activity on the runway and daily visual checks as a guide for the need for taking measurements with an instrument. Unless otherwise specified, biweekly checks should be made for uniform degradation of sample sections of the systems. The sample sections should include fixtures near both ends of the runway, the center portion, and the touchdown zone area of the pavement.
- c. Cleaning. Commercially available cleaning detergents and pads can be used for removal of deposits from light fixture's lens unless otherwise prohibited by the light fixture manufacturer. The time required to clean light fixtures, however, can be reduced by using one of the methods listed below. The need for cleaning runway centerline and touchdown zone fixtures' glassware is determined by the location of the runway, weather conditions, and traffic activity. Normally fixtures require cleaning on a biweekly basis at active locations. Regular cleaning of all lighting fixtures will eliminate the need of checking for uniform degradation.

- (1) Ground Shells. Clean fixture's lens in accordance with fixture manufacturer's instructions. Unless prohibited by the fixture manufacturer, use 20/30 grade, clean ground walnut or pecan shells and clean dry compressed air or nitrogen (nozzle pressure 85 p.s.i.) to clean fixtures. This method reduces cleaning time. Use a shield with the compressed air source to restrict the direction of flow of the ground shells. See figure 5 for a typical example of how to clean with these shells. The average cleaning time is 10 seconds followed by a dry cloth wipe of the lens. The average use of walnuts is 0.6 pound per fixture. This method of cleaning has been used successfully on fixtures installed on existing Category II runways. There is no apparent damage of lens sealing material by ground nut shells.
 - (2) Abrasive Brush. Abrasive brushes have been used, in conjunction with a holding tool driven by air pressure, to clean foreign material from centerline and touchdown zone glassware under working conditions. The average cleaning time is 30 seconds per lens. If a portable air source is available, this method could be used under field conditions. Care must be taken to prevent removal of lens sealing material in the cleaning process. Removal of lens sealing material can be prevented with the use of a shield.
- d. Water Removal. Exercise care to properly place optical system and gasket to prevent the entrance of water. Securely tighten all fixtures to the manufacturer's specified torque. Water in the centerline and touchdown zone optical housing will cause a rapid deterioration of electrical components and deposits on the lamp and inside surface of the lens. Excessive water will cause the fixtures to glow at a low intensity when the input current is at its maximum value.
 - e. Spare. Keep an adequate number of spare optical assemblies for unscheduled inspections referenced in paragraph 6b. Spare units are advantageous for replacing units that need workshop maintenance. Replacing defective fixtures with spares can reduce runway downtime by permitting lamp changes and regular fixture maintenance to be performed under workshop conditions.

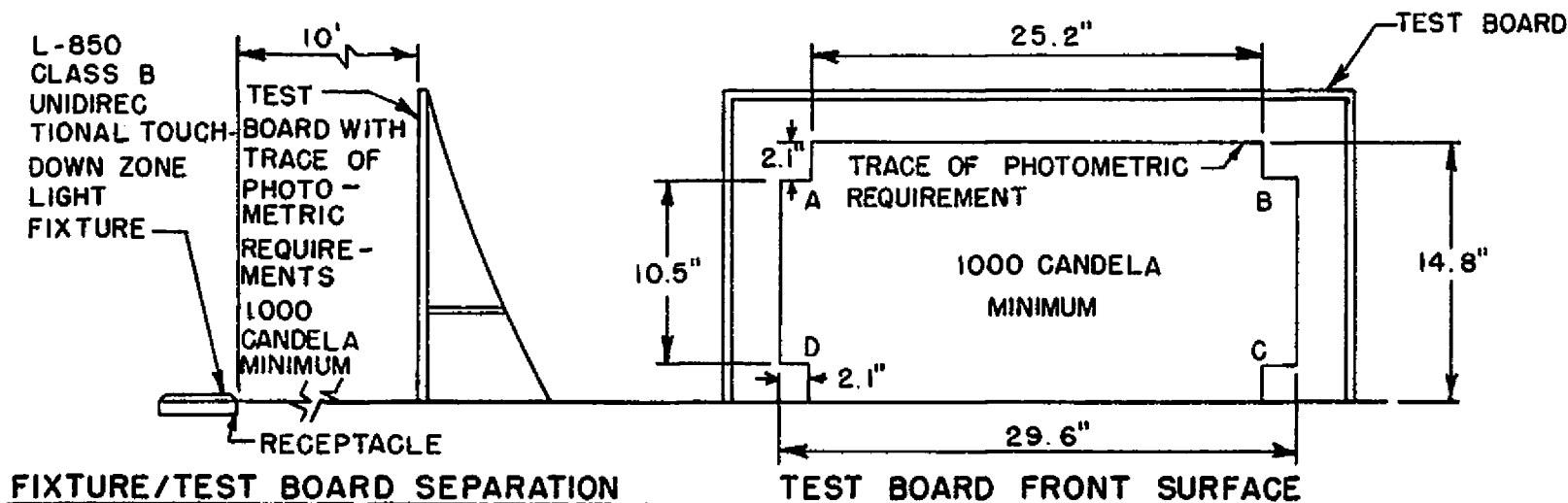


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**NOTES:**

1. LOCATE THE CALIBRATED OR TEST LIGHT FIXTURE 10 FEET FROM THE TEST BOARD. TAKE LOCATION MEASUREMENTS FROM THE OUTSIDE SURFACE OF THE LIGHT FIXTURE TO FRONT SURFACE OF THE TEST BOARD.
2. USE THE TRACE OF THE PHOTOMETRIC CURVE AS A GUIDE FOR LOCATIONS TO POSITION PHOTO-METRIC DETECTOR (PHOTOCELL LOCATIONS). THE PHOTOCELLS MAY BE PERMANENTLY ATTACHED TO THE TEST BOARD OR TEMPORARILY HELD TO BOARD WHEN READINGS ARE TAKEN.
3. OPERATE THE LIGHT FIXTURE AT 6.6 AMPERES AND TAKE READINGS AT POINTS "A","B","C" AND "D" AS A MINIMUM.
4. SEE FIGURE 1c FOR TEST EQUIPMENT AVAILABLE FOR TAKING MEASUREMENTS AND METHODS OF CONVERTING READING IN MICROAMMETERS TO CANDELA VALUES.
5. IF THE LIGHT FIXTURE IS PLACED ON THE SAME LEVEL AS THE TEST BOARD, RAISE THE PHOTOMETRIC CURVE TO COMPENSATE FOR FIXTURE'S THICKNESS.
6. TAKE PHOTOMETRIC READING UNDER LOW AMBIENT LIGHTING CONDITIONS.
7. MEASURE LIGHT OUTPUT IN BOTH DIRECTIONS.

FIGURE 1. WORKSHOP MEASUREMENT OF CENTERLINE LIGHT DEGRADATION



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FIGURE 2. WORKSHOP MEASUREMENT OF TOUCHDOWN ZONE LIGHT DEGRADATION

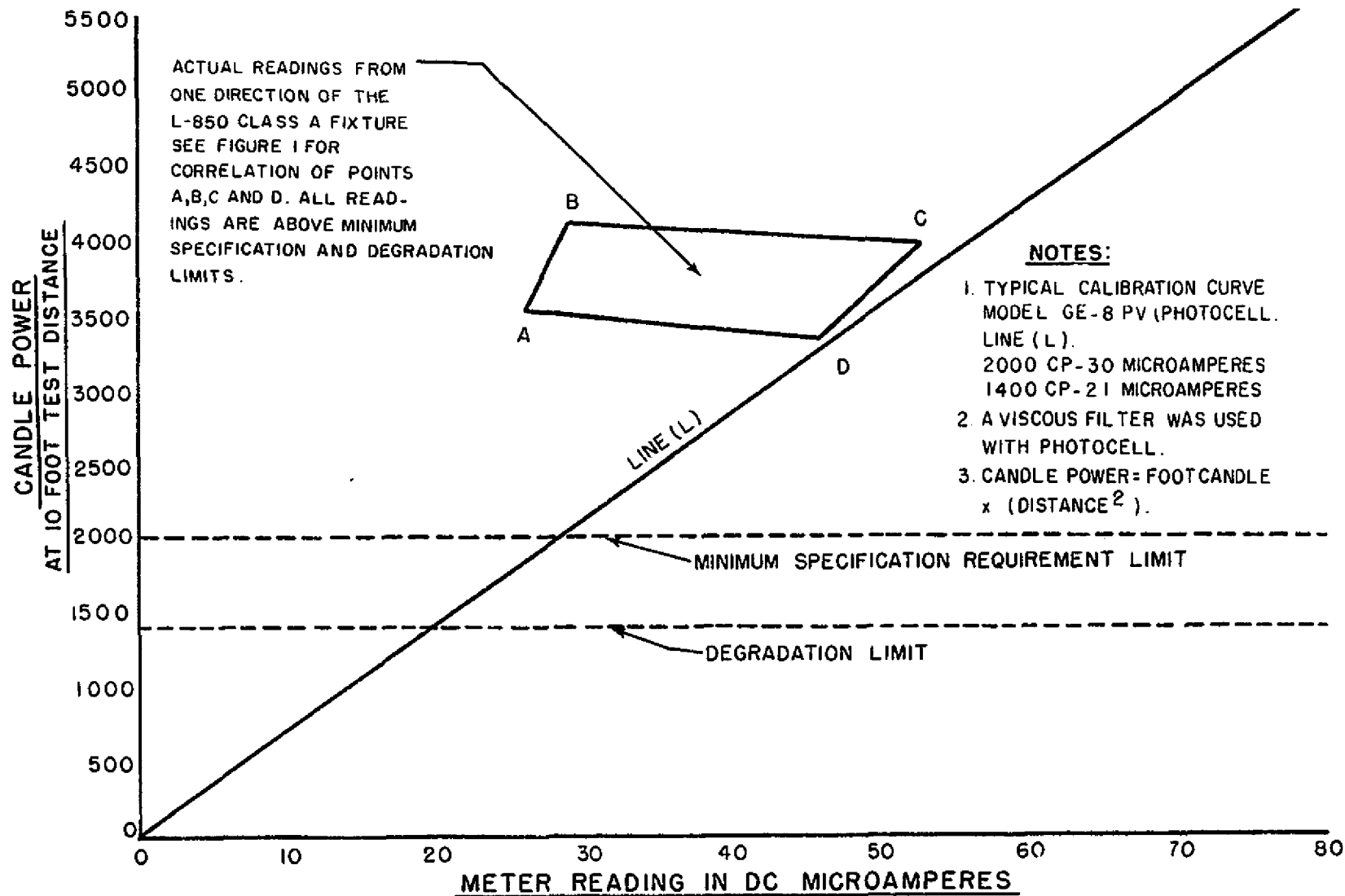


FIGURE 3. CORRELATION OF MEASUREMENTS

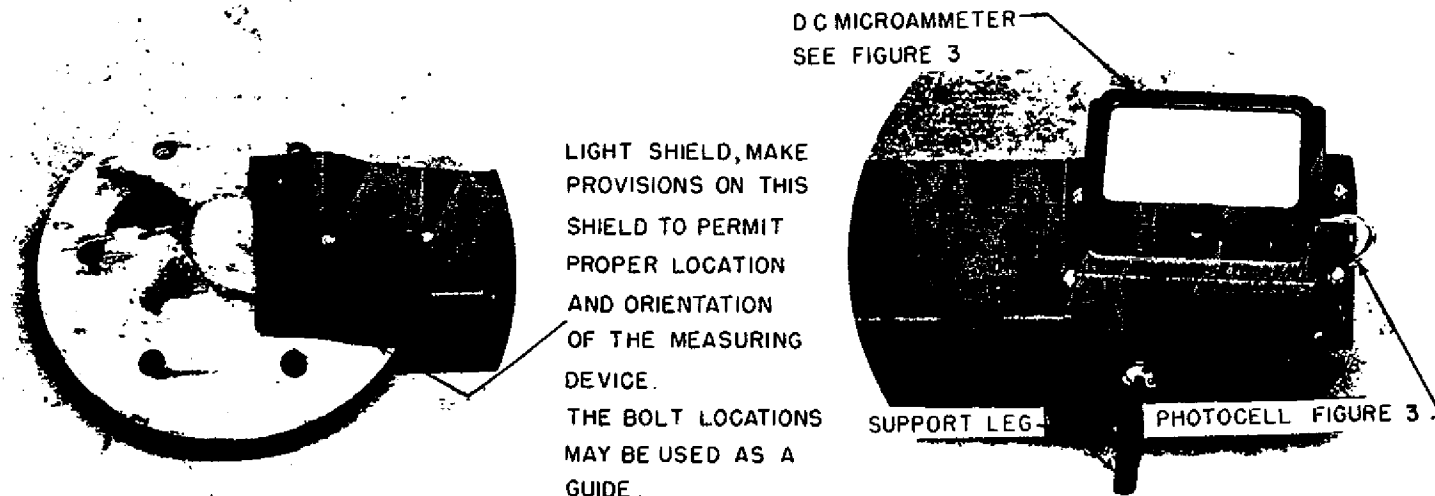
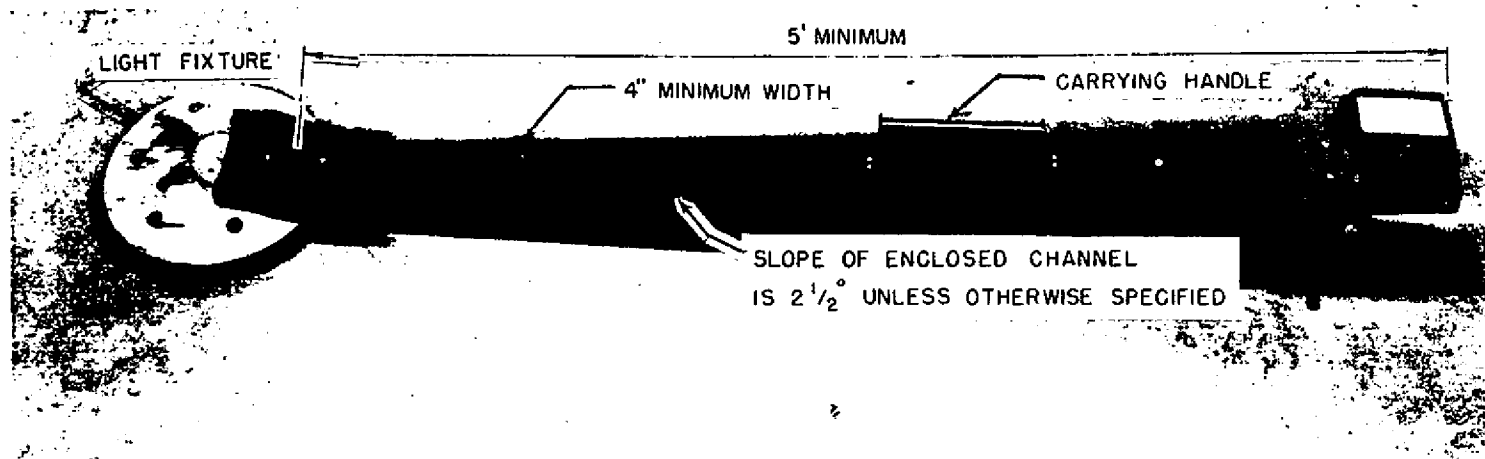


FIGURE 4. MEASUREMENT DEVICE

NOTES:

1. AN AVERAGE TIME OF 10 SECONDS IS REQUIRED FOR CLEANING THE EXTERNAL SURFACE OF A FIXTURE'S LENS.
2. THE AVERAGE USAGE OF GROUND WALNUT SHELLS IS 0.6 POUND PER FIXTURE.
3. THE CLEANING SYSTEM SHOWN IS NOT AVAILABLE AS AN ASSEMBLED UNIT; HOWEVER, A COMMERCIALY AVAILABLE AIR COMPRESSOR WITH CONTROLS AND GAUGES, A SAND BLASTER UNIT, AND ABRASIVE RESISTANCE HOSES ARE ACCEPTABLE.
4. A NOZZLE PRESSURE OF 85 P.S.I. IS ACCEPTABLE FOR REMOVING DEPOSITS SUCH AS TIRE MARKS AND TAR.
5. AFTER REMOVAL OF DEPOSIT FROM LENS, THE FIXTURE'S LIGHT CHANNEL MAY BE CLEANED OF SHELLS WITH A BLAST OF AIR, AND THE REMAING DUST WIPED OFF WITH A CLEAN CLOTH.
6. CLEANING WITH WALNUT SHELLS HAS BEEN SUCESSFULLY USED AT EXISTING AIRPORTS WITH CENTER-LINE AND TOUCHDOWN ZONE LIGHTS.

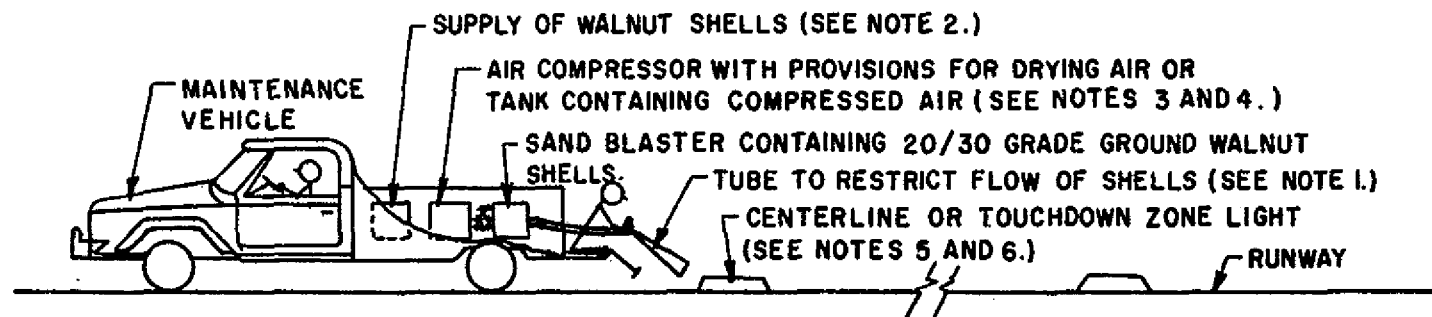


FIGURE 5. CLEANING CENTERLINE AND TOUCHDOWN ZONE LIGHTS

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