NATIONAL BUREAU OF STANDARDS REPORT

6419

A Modification of the Type MB-1 Light
for Sealane Marker Service

By
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Photometry and Colorimetry Section
Optics and Metrology Division

U. S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

THE NATIONAL BUREAU OF STANDARDS

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For
Ship Installations Division
Bureau of Aeronautics
Department of the Navy

Bureau of Aeronautics Project TED NBS SI-5006

NBS

U. S. DEPARTMENT OF COMMERCE

NATIONAL BUREAU OF STANDARDS

A Modification of the Type MB-1 Light for Sealane Marker Service

This report describes a modification of the type MB-1 light to adapt it for use on a self-orienting channel-light support and to improve the efficiency of the light by reducing the leakage currents which would occur if the light were wet by salt water.

1. Introduction

The Naval Air Test Center, Patuxent River, Maryland, reported that severe leakage currents were developing across the lamp sockets of the MB-1 lights installed for test on a self-orienting channel-light support in Chesapeake Bay. Because these lights were sometimes submerged by wave action, electrically-conductive paths were developing in parallel with the terminals of the 20-ampere, 500-watt, medium-bipost lamps as a result of the accumulation of salt deposits on the "Transite" bases to which the lamp sockets were mounted. A modification was desirable since these lamps operate in a series circuit, and any leakage currents occurring between the lamp terminals reduce the lamp current, and, therefore, its intensity.

A further modification was desirable to adapt the unit for use on a self-orienting channel-light support. This requires that the lamp leads enter the lamp housing at some place other than through the base of the hollow pedestal. Therefore, task TED NBS SI-5006 covering the design modification of the type MB-1 light which would adapt the unit for use as a seadrome light was assigned to the National Bureau of Standards by the Visual Landing Aids Branch, Bureau of Aeronautics.

2. Modification of Socket Base

A series circuit was assembled for operating a sealane marker light with the lens and filter removed. Current was delivered to the lamp from a type C-1 regulator through a 500-watt, 6.6/20-ampere transformer. Provisions were made for measuring the current being delivered to the socket leads and to the lamp. The difference between the readings represented the leakage current across the insulating base and between the conductors in the socket leads.

Socket bases were machined from "Teflon", "Micarta", and "Micalex" to the same dimensions as the "Transite" base furnished with the unit. The unit was operated with each of the four bases under test conditions as listed in table I in the order shown. The lamp and socket currents were recorded and the current differences listed.

Table I

Leakage Currents in Sealane Marker Light

Test No.	Socket Material → Test Condition	Teflon ΔI (Amps)	Transite ΔI (Amps)	Micarta ΔI (Amps)	Micalex ΔI (Amps)	Silicone Treated Transite ΔI (Amps)
1	Dry.	0.00	0.00	0.00	0.00	
2	Soaked 16 hrs. in tap water, then blotted.	0.00	0.00	0.00	0.00	
3	Tested while submerged in tap water.	0.08	0.08	0.08	0.08	
4	Soaked 67 hrs. in 3% NaCl solution, then blotted.	0.00	0.00	0.00	0.00	
5	Tested while submerged in 3% NaCl solution.	8.92	9.24	9.04	9.24	
6	Soaked 16 hrs. in saturated NaCl solution, then blotted.	0.00	0.12	0.04	0.04	
7	Tested while submerged in saturated NaCl solution.	14.28	14.24	14.08	13.88	
8	Tested immediately after pulling from saturated NaCl solution.	0.08	0.32	0.16	0.40	
9	Same as Test 7.					12.00*
10	Same as Test 8.					0.96*

*Before testing the silicone-treated Transite, the leads to the lamp had been repeatedly submerged in saturated salt solution. As a result, the insulation became saturated and there was a leakage current between the conductors of the order of 1 ampere. These two ΔI's include that leakage current.

The results of the first 8 tests indicated that there was no justification for using one of the more expensive materials in preference to the "Transite" in current use. A second "Transite" base was made and then treated with a silicone-base grease. By this time the socket leads had been repeatedly soaked in a saturated salt solution, and, as a result, there developed a leakage current of the order of 1 ampere between the two leads. The current differences shown in the table for the silicone-treated base include this leakage current. Since the leakage varied over a moderate range, depending upon the relative position of the leads, no definite value can be assigned it, but it is of the order of 1 ampere. The results of the tests indicate that a silicone-treated "Transite" base would be preferred over any of the other materials tested.

3. Modification of Socket Leads

Locating a suitable hole in the housing for the entrance of the socket leads presented no problem. A 5/8"-diameter hole was drilled in the bottom of the housing between the pedestal and the flange which holds the filter and lens.* However, because of the heat generated within the enclosed unit, it has not been practical to use a waterproof insulation on the leads. The asbestos-insulated leads in use permit leakage currents to flow between the leads at points where the leads are in contact during and after submersion, especially at the point where they join the cable connector.

The problem was resolved into one of finding a waterproof insulating material for the leads and a suitable grommet for the lead-hole in the housing that will not be adversely affected by the elevated temperature within the lamp enclosure. The operating temperature of the leads is approximately 450°F near the junction of the lead and the contact at the lamp socket and 200°F just outside the housing of the light. A number of methods of solving the problem were tried. The most satisfactory of these was casting a connector, a section of cable, a grommet, and a pair of leads as an integral unit from types of silicone rubber recently available, Dow-Corning's Silastic RTV501 and General Electric's RTV20 and RTV60.

This type of insulating material, RTV silicone rubber, was chosen for two reasons:

1) Its high dielectric strength and other electrical and physical properties remain essentially unchanged during continuous exposure to weather, submersion in salt water, and temperatures ranging from -70°F to over 500°F.

2) It vulcanizes at room temperature within 24 hours after catalyzing, which facilitates the laboratory production of a few molded specimens.

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* This procedure is adapted to bases manufactured by A'G'A. Bases of the type used in the Westinghouse C-1 unit would require a different modification.

A brief comparison of the essential physical properties of the three types of RTV rubbers are shown in table II. The values listed are those specified by the manufacturers of the products.

Table II

	RTV501*	RTV20#	RTV60#
Durometer Hardness, Shore-A Scale	30	50	60
Tensile Strength, psi	230	450	650
Elongation, percent	250	140	110

* After vulcanizing for 24 hours at 77°F (Dow Corning Bulletin 9-384).
\# After curing for 144 hours at 80°F with 1% Silicure L-24 curing agent (GE Bulletin CDS-57).

A mold was made and several cable-connector-lead assemblies were cast from the three types of material. A nickel-plated phosphor-bronze clip was designed for clamping around the grommet section of the assembly inside the housing to hold the assembly in place. Figure 1 is a dimensional drawing of the cable-connector-lead assembly. Photographs of the modified part of the MB-1 unit are shown in figure 2. The silicone rubber materials appear to meet the temperature and insulation requirements very well but their tensile strengths are low. Because of these low tensile strengths, the rubbers are likely to tear at the junction of the leads and the reinforcing rib if a reasonable amount of care is not exercised in handling them before installation in the units.

Once the assembly is installed and restrained, with the clip provided, from slipping through the hole in the housing, tearing of the leads is not likely to occur. To reduce the strain on the restraining clip, the cable portion of the assembly outside of the housing should be secured with a strap or clamp to the pedestal flange on the bottom of the housing. One of the assemblies that was molded of the RTV60 rubber was fabricated so that the conductors in the lead portion of the assembly are bonded securely to the rubber. It is anticipated that this will increase the tear resistance of the lead.

This "bonded" assembly, an "unbonded" assembly of RTV60, two "unbonded" assemblies of RTV501, four restraining clips, and two modified MB-1 units were forwarded to the Naval Air Test Center, Patuxent River, Maryland, for field tests.

4. Discussion

These cable-connector-lead assemblies are also suitable for use as replacements for the connector-lead assemblies in the MB-1 units in service. If used as such, the leads will enter the housing through the pedestal as do the leads in present use. The restraining clip will not be needed.

In evaluating the results of the field tests, consideration should be given to the fact that the RTV silicone rubbers are particularly suited to the laboratory production of a few samples. Other silicone rubbers are available which have higher tensile strengths and which are better suited for production quantities.

May 1959
RTVaughan

USCOMM NBS DC

CONNECTOR, CABLE, GROMMET, AND LEAD ASSEMBLY

FOR MODIFIED MB-1 LIGHT

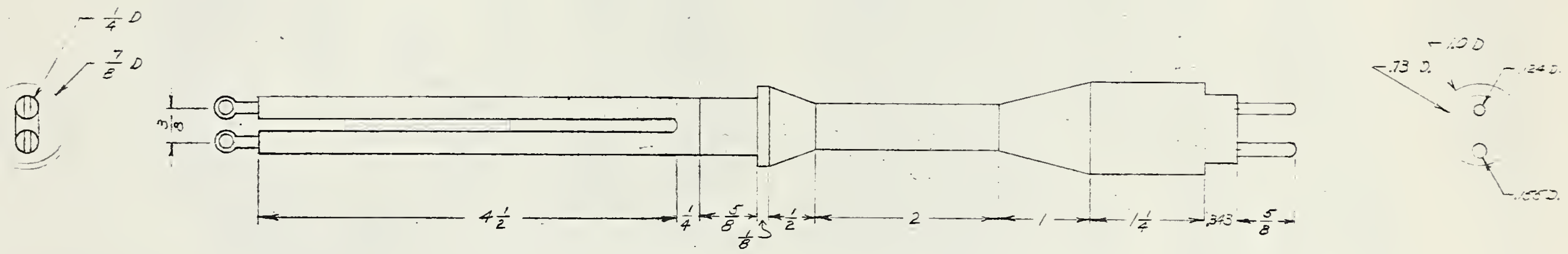

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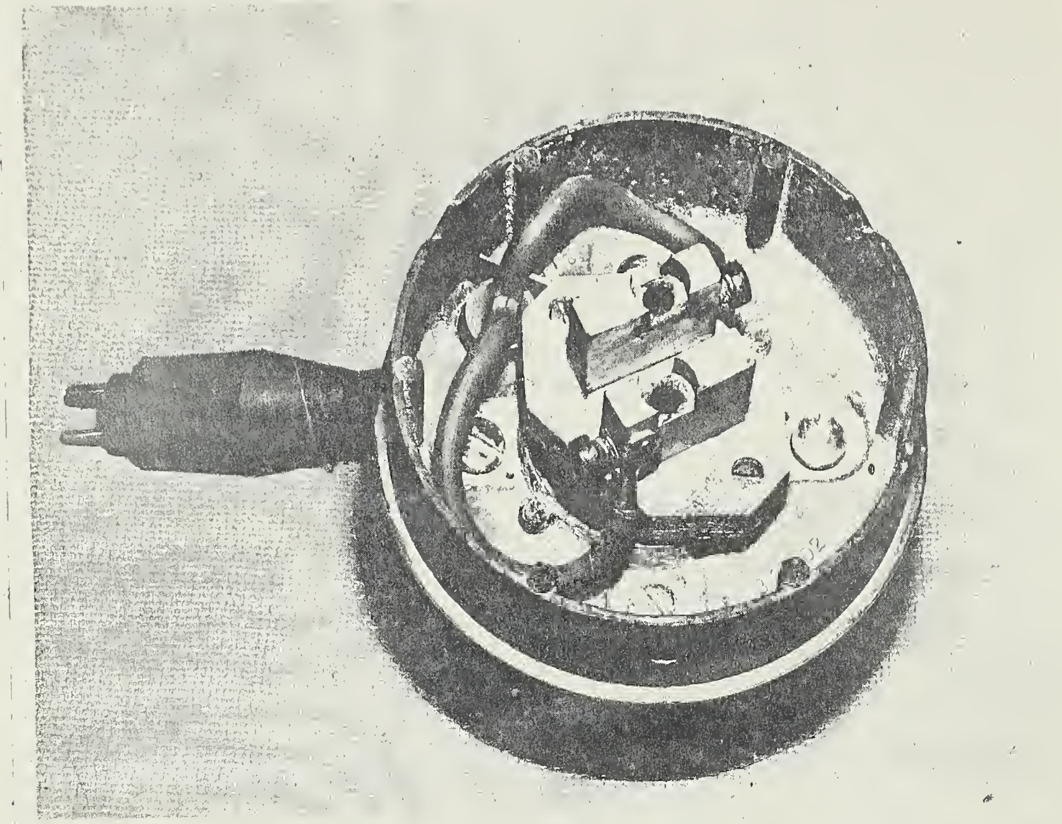
FIGURE 1

MODIFIED MB-1 BASE SHOWING CABLE-CONNECTOR-LEAD ASSEMBLY INSTALLED



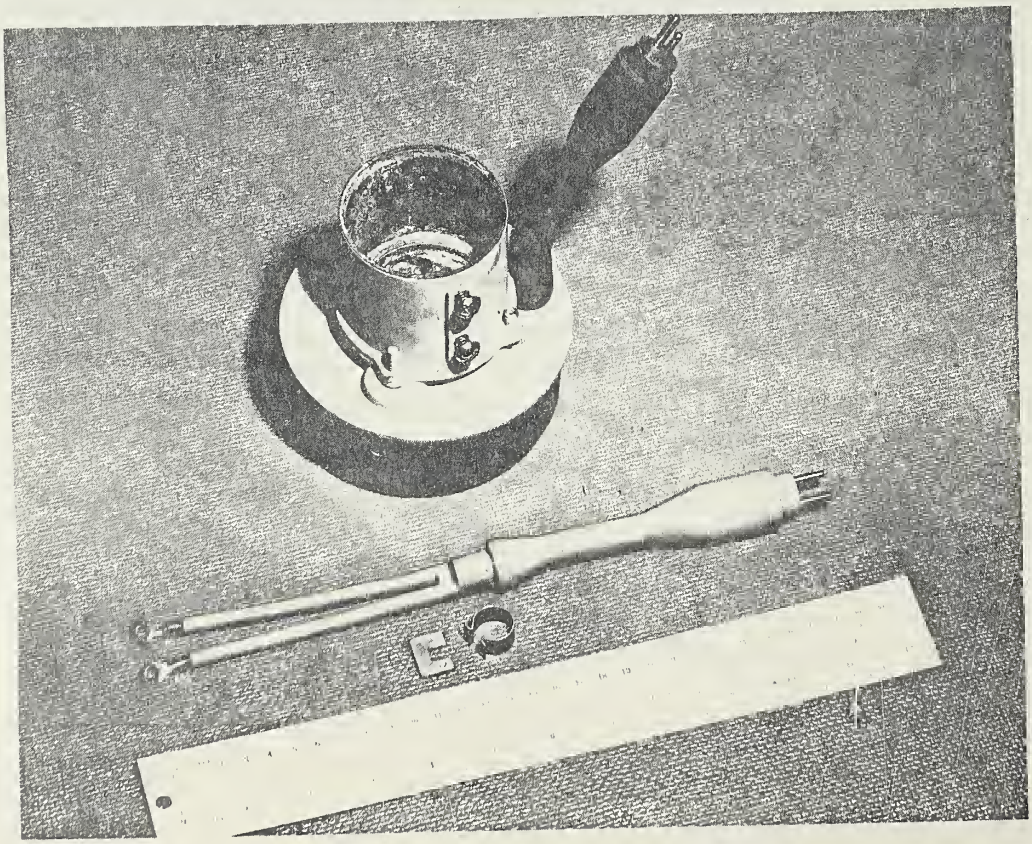


Figure 2

THE NATIONAL BUREAU OF STANDARDS

The scope of activities of the National Bureau of Standards at its headquarters in Washington, D. C., and its major laboratories in Boulder, Colo., is suggested in the following listing of the divisions and sections engaged in technical work. In general, each section carries out specialized research, development, and engineering in the field indicated by its title. A brief description of the activities, and of the resultant publications, appears on the inside front cover.

WASHINGTON, D. C.

Electricity and Electronics. Resistance and Reactance. Electron Devices. Electrical Instruments. Magnetic Measurements. Dielectrics. Engineering Electronics. Electronic Instrumentation. Electrochemistry.

Optics and Metrology. Photometry and Colorimetry. Optical Instruments. Photographic Technology. Length. Engineering Metrology.

Heat. Temperature Physics. Thermodynamics. Cryogenic Physics. Rheology. Engine Fuels. Free Radicals Research.

Atomic and Radiation Physics. Spectroscopy. Radiometry. Mass Spectrometry. Solid State Physics. Electron Physics. Atomic Physics. Neutron Physics. Radiation Theory. Radioactivity. X-rays. High Energy Radiation. Nucleonic Instrumentation. Radiological Equipment.

Chemistry. Organic Coatings. Surface Chemistry. Organic Chemistry. Analytical Chemistry. Inorganic Chemistry. Electrodeposition. Molecular Structure and Properties of Gases. Physical Chemistry. Thermochemistry. Spectrochemistry. Pure Substances.

Mechanics. Sound. Mechanical Instruments. Fluid Mechanics. Engineering Mechanics. Mass and Scale. Capacity, Density, and Fluid Meters. Combustion Controls.

Organic and Fibrous Materials. Rubber. Textiles. Paper. Leather. Testing and Specifications. Polymer Structure. Plastics. Dental Research.

Metallurgy. Thermal Metallurgy. Chemical Metallurgy. Mechanical Metallurgy. Corrosion. Metal Physics.

Mineral Products. Engineering Ceramics. Glass. Refractories. Enameled Metals. Concreting Materials. Constitution and Microstructure.

Building Technology. Structural Engineering. Fire Protection. Air Conditioning, Heating, and Refrigeration. Floor, Roof, and Wall Coverings. Codes and Safety Standards. Heat Transfer.

Applied Mathematics. Numerical Analysis. Computation. Statistical Engineering. Mathematical Physics.

Data Processing Systems. SEAC Engineering Group. Components and Techniques. Digital Circuitry. Digital Systems. Anolog Systems. Application Engineering.

- Office of Basic Instrumentation.
- Office of Weights and Measures.

BOULDER, COLORADO

Cryogenic Engineering. Cryogenic Equipment. Cryogenic Processes. Properties of Materials. Gas Liquefaction.

Radio Propagation Physics. Upper Atmosphere Research. Ionospheric Research. Regular Propagation Services. Sun-Earth Relationships. VHF Research. Ionospheric Communication Systems.

Radio Propagation Engineering. Data Reduction Instrumentation. Modulation Systems. Navigation Systems. Radio Noise. Tropospheric Measurements. Tropospheric Analysis. Radio Systems Application Engineering. Radio-Meteorology.

Radio Standards. High Frequency Electrical Standards. Radio Broadcast Service. High Frequency Impedance Standards. Electronic Calibration Center. Microwave Physics. Microwave Circuit Standards.

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