NATIONAL BUREAU OF STANDARDS REPORT

8551

Bibliography of National Bureau of Standards Reports and Papers on Aviation Ground Lighting, 1961 - 1964

By
E. B. Way

NBS

U.S. DEPARTMENT OF COMMERCE
NATIONAL BUREAU OF STANDARDS

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Bibliography of National Bureau of Standards Reports and Papers on Aviation Ground Lighting
1961 - 1964

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INTRODUCTION

This report is a supplement to NBS Report 7322, Bibliography of National Bureau of Standards Reports and Papers on Aviation Ground Lighting, 1945 - 1961. Reports and papers issued since that time by the Aviation Ground Lighting Group of the Photometry and Colorimetry Section, Metrology Division, are summarized and indexed. Sections are numbered and titled to correspond to those in NBS Report 7322, with some additions. Reports of tests of equipment and reports of transitory interest have not been included.

1. AVIATION GROUND LIGHTING AND MARKING

1.1 GENERAL

The Requirements of a Minimum Lighting System for Secondary Airports

by C. A. Douglas

Memorandum Report, June 1961, 12 pages
NBS Project 0201-30-02302

The report recommends that the design of a lighting system for secondary airports should be based on a study of the fundamental requirements for guidance, the characteristics of the aircraft using secondary airports, and the flight pattern of these aircraft during an approach and landing. Based on the analysis, priorities are suggested for the installation of lighted visual landing aids as a general practice at secondary airports. An analysis was made of the intensity distribution requirements of lights for small airports and a comparison was made of the merits of edge and centerline lights for these airports.

1.2 APPROACH AND RUNWAY LIGHTING

An Investigation of Beam-Spreading Techniques for Semiflush-Prismatic Type Airport-Marker Lights

by A. C. Wall, A. S. Brown, C. A. Douglas

NBS Report 8169, January 1964, 13 pages, 10 figures, 4 tables
NBS Report 8169 Supplementary, February 1964, 3 pages, 2 figures
NBS Project 0201-20-02411

These reports give the results of tests of the feasibility of incorporating a cylindrical plano-convex lens into the optical system of B- and BB-type semiflush-prismatic type airport-marker lights. With the lens in the type BB light, the vertical beam spread was increased from 4.6° to 16.2° (using a 500-watt lamp) without lowering the peak intensity; with the lens in the type B light, the vertical beam spread was increased from about 8° to values ranging from 10° to 19°, depending on the position of the lens. The peak intensities were, however, lower with the type B unit when the lens was in place. The work did not determine optimum lens placement or focal length, but was done only to evaluate the basic principle.

Temperature Measurements of a 500-Watt, Flush Runway-Light Installation

by James E. Davis

NBS Report 7182, August 1961, 12 pages, 8 figures
NBS Report 7182 Supplementary, October 1961, 10 pages, 8 figures
NBS Project 0201-20-02414

Tests were made of the temperature rise of a 500-watt prismatic-head light mounted on a base containing a 500-watt isolating transformer. Tests were made at several ambient temperatures; with wet and dry soil conditions; with the transformer in the upright position and on its side; and with two thicknesses of aluminum foil placed between the lamp and transformer. Results indicate that the foil shielding between the lamp assembly and transformer is a satisfactory method of utilizing the MS-24526, 16-inch-deep base assembly for housing a class B15 flush runway light with a 500-watt lamp and a 500-watt isolating transformer.

1.5 SEADROME LIGHTING

Electrical Characteristics of Static Inverters for Battery-Operated Fluorescent Seadrome Lights

by L. Chernoff, R. T. Vaughan

NBS Report 7040, June 1961, 16 pages, 6 figures
NBS Project 0201-20-02411

The use of a static inverter and 12-volt battery as the power pack for the type FMF-6B buoy-mounted 6-watt fluorescent channel marker light was studied. The static inverter appears satisfactory for this use and produces higher intensity, greater efficiency and longer battery life than the present 90-volt power pack, at a reduced cost. A photoelectric switch could easily be employed in lights using these inverters since the battery voltage would be suitable.

1.7 VISUAL GLIDE SLOPE INDICATORS

Performance Criteria for a Two-Color Visual Glide Slope Indicator

by Andrew C. Wall

NBS Report No. 7419, January 1962, 22 pages, 6 figures, 9 tables
NBS Project 0201-30-02303

Comparison tests were made of the effects of lamp characteristics on the photometric performance of a simulated R.A.E.-type Visual Glide Slope Indicator. Data from three previously issued NBS test reports are used to provide a basis of suggested specification requirements. A simple device was developed for aligning the lamps in the VGSI for optimum utilization.

The study brought out (1) the advantages of the use of the 300-watt lamps over the 200-watt lamps in the R.A.E.-type Visual Glide Slope Indicator, (2) the effect of the transition bar on intensity distribution, and (3) the only slight difference between the British-made and American-made spread lenses used in the test.

The Transition Zone of the Visual Approach Slope Indicator as a Function of Beam Chromaticities

by Andrew C. Wall

NBS Report 7591, August 1962, 14 pages, 4 figures, 4 tables
NBS Project 0201-30-02303

A group of observers was used to determine how changes in the chromaticities of the projected beams of a Visual Approach Slope Indicator resulting from the use of "highway-red" and "color-correcting white" (4000°K) filters affect the location of the transition zone. A statistical analysis of the data accumulated indicated a large, but normally distributed, variation in the responses of the observers. The study showed specifically that changes in both the color temperature of the lamps and in the chromaticity of the light affected the elevation angle of the pink zone systematically and the width of the pink zone randomly. All of the changes, however, were small.

Photometric Characteristics of a Lens Cell of the Fresnel-Lens Optical Landing System

by A. C. Wall

NBS Report 8167, January 1964, 10 pages, 5 figures, 2 tables
NBS Project 0201-20-02411

The results of a study of one lens cell of a source-light indicator assembly of the Mark 6 Fresnel-Lens Optical Landing System are given. The areas investigated were: the intensity distribution of the unit; the effect of test distance on intensity distribution measurements; and the brightness of a cell when it is viewed by an observer not on the glide path indicated by the cell.

The report concludes that (1) the intensity measurement based on the inverse square law, as well as beam angles, must include a correction based on the distance of the virtual image from the lens, and (2) there are no "hot spots" on the face of the lenses that would show up as ghosts to a pilot not on the glide slope.

2. AIRFIELD LIGHTING EQUIPMENT

2.1 GENERAL

Field Tests of Airfield Lighting Cable Connections

by James E. Davis and J. W. Simeroth

NBS Report 8106, November 1963, 8 pages, 1 table
NBS Project 0201-20-02414

This report presents the results of field tests of cable connectors and splices which were buried for 42 to 50 months. One type of connector and two types of splices designed for use on airfield lighting cable are included in the tests. Field tests were undertaken to determine the performance of the connectors and splices, the change of the insulation resistance of these connections with time, and methods of installation to reduce the number of connection failures. Tests included periodic measurement of insulation resistance and a visual inspection of the connections.

All three types of connections, properly prepared according to the manufacturer's instructions, and buried for several years, exceeded the 3000 megohms minimum insulation resistance required by Military Specification MIL-C-7192 and FAA Specification L-823. The insulation resistances of the test connections and sections of cable had decreased to approximately one-half of the initial values after four years, but still ranged from 8,000 to 50,000 megohms. Tests are continuing.

2.3 REGULATORS AND TRANSFORMERS

Study of Waveforms of 200-Watt and 45-Watt Series-Series, 6.6/6.6-Ampere, Isolation Transformers

by F. Gavreau

Memorandum Report, February 1962, 10 pages, 8 figures
NBS Project 0201-30-02302

The results are given of a study of the output and input current and voltage waveforms, with and without load, of a typical 200-watt series-series, 6.6/6.6-ampere, isolation transformer and a typical 45-watt, series-series, 6.6/6.6-ampere, isolation transformer. Each transformer was studied with its secondary winding open-circuited, and with its secondary winding loaded with a lamp of the proper value to obtain information about peak values of voltage and current, for use in the design of film cutouts. When the transformers were connected into a circuit supplied by a 4-kilowatt regulator, the open-circuit voltage of the 45-watt transformer was 288 volts peak-to-peak and that of the 200-watt transformer was 775 volts peak-to-peak.

Overcurrent Protector for Monocyclic-Square Type Series-Circuit Regulators

by C. A. Douglas and James E. Davis

NBS Report 7712 September 1962, 7 pages, 3 figures, 2 tables
NBS Project 0201-20-02411

The development and testing of an overcurrent control for use with series-circuit regulators are described. The protector can automatically reduce the brightness setting of the series-circuit regulator when the output current reaches a predetermined value. The protector will operate whether the increase in current is produced by open secondaries of isolating transformers in the circuit or by an increase in input voltage. The protector also indicates that a reduction in brightness step from increased output current has occurred although the regulator has been de-energized.

4. LAMPS

Output Maintenance of Sealed-Reflector Approach and Runway Light Lamps

by Robert T. Vaughan

NBS Report 7702 September 1962, 24 pages, 17 figures, 4 tables
NBS Project 0201-20-02411

The report presents an analysis of the periodic measurements of the relative output of 6.6-ampere and 20-ampere approach light lamps. Curves are included showing the decrease in output with burning time for the complete lamps and for selected zones of the lamps for both vertical and horizontal positions of the seating planes. With the exception of the 6.6-ampere lamps with stippled covers, all of the lamp types showed higher maintenance of both peak intensity and lumen output when the lamps were burned in their design position. Usually the relative lumen output of the lamps decreased more slowly than the relative peak intensity. Measurement of total lumen output, therefore, is not a good measure of the performance of the lamps.

Current-Intensity, Voltage-Intensity, and Current-Voltage Characteristics of Airfield Lighting Lamps

NBS Report 6190 Supplementary   September 1962, 44 pages, 41 figures
NBS Project 0201-20-02411

This report is a supplement to National Bureau of Standards Report 6190 and contains a compilation of measurements of the intensity-current-voltage characteristics of lamps of the types used in approach, runway, and taxiway light systems. The characteristics of lamps which have been developed since Report 6190 was issued in October 1958 are given. Figures representative of current lamp production are included for lamps 4588 and 4586 to replace those appearing in Report 6190.

5. VISIBILITY

5.1 GENERAL

Horizon-Sky Brightnesses Produced by Airfield Lighting

by J. W. Simeroth

NBS Report 8019   June 1963,   15 pages, 5 figures, 2 tables
NBS Project 0201-20-02414

This report presents the results of measurements of the photometric brightness (luminance) of the sky near the horizon from environmental lights and from high intensity runway and approach lights. Values of horizon-sky brightness from environmental lights of 0.0005 to 0.2 foot-lamberts were measured. The high intensity lights increased the brightness of the sky near the horizon by as much as 0.5, 5, and 50 foot-lamberts respectively for type M-2 runway lights, slopeline approach lights, and centerrow approach lights. The effect of the brightnesses on the threshold illuminance is discussed.

The Effective Intensity of Flashing 399PAR Lamps

by Robert T. Vaughan

NBS Report 8358   June 1964,   16 pages, 9 figures, 1 table
NBS Project 0201-20-02411

The results of a study of the intensity-time characteristics and of the effective intensity of flashing 399PAR lamps are presented. The lamps are of the type used as wave-off lights in the optical landing system. A study of the characteristics of the white light is included as well as a study of the beam transmitted through aviation-red and aviation-green filters at the voltages applied to the datum

lights on the seven steps of the optical landing system: 21, 27, 35, 44, 60, 80, and 115 volts.The method of computing the effective intensity of flashing 399PAR lamps outlined may be used for any flash rate for these lamps at any voltage for which the instantaneous intensity-time curve is known. The method may be used for other lamps with approximately the same current rating with sufficient accuracy for engineering estimates.

Approximations of the Effective Intensity of PAR-Type Lamps Mounted on a Rotating Turntable

by G. P. Gillum

NBS Report 8392, July 1964, 28 pages, 17 figures, 2 tables
NBS Project 2120411

Data for approximating the effective intensity of several PAR-type lamps mounted on rotating turntables are given for turntable speeds of 1 to 200 rpm and for any angle of elevation within the beam. The data for each lamp type are given in a plot of effective intensity factor as a function of turntable speed, and in a vertical intensity distribution. A simple method of using the curves to obtain effective intensity is explained. This method is considered adequate for engineering design purposes where PAR-type lamps are to be used as revolving lights. Use of the method makes possible the easy and compact grouping of data for many lamp types and many turntable speeds for reference use.

5.2 TRANSMISSOMETER

Development of a Transmissometer Calibrator

by C. A. Douglas and J. W. Simeroth

NBS Report 7706 September 1962, 25 pages, 9 figures, 2 tables
NBS Project 0201-20-02411

This report describes the design and theory of operation of a portable calibrator developed for use in adjusting the transmissometer. The results of field tests of the instrument are included. Appendices provide operating instructions, graduation data for TRANSMISSION scale of the instrument, and a discussion of alternative calibration methods. With the calibrator, used carefully, the expected error in the setting of the transmissometer is approximately 0.015 when the transmittance over the transmissometer baseline is 0.90 or greater.

Methods of Modifying the Transmissometer System to Permit Its Use During Periods of Very Low Runway Visual Range

by C. A. Douglas

NBS Report 8188 February 1964, 11 pages, 3 figures, 2 tables
NBS Project 0201-20-02411

When operation of the transmissometer is required in fogs in which the runway visual range is lower than 1000 feet, modification of the instrument is required. The choice of type of modification is dependent upon the maximum fog density (minimum RVR) at which operation is required. For operation in RVR's lower than about 800 feet, a reduction in length of baseline is the preferred modification. Compensation can be made for the decreased length of sample incurred with this reduction in baseline length by the use of two short-baseline transmissometers in an essentially "end-to-end" position. If the minimum RVR for which the transmissometer operation is required is about 800 feet, increasing both the sensitivity of the receiver and the intensity of the projector should provide satisfactory operation.

Investigation of the Effect of Line Voltage on the Sensitivity of the Transmissometer Receiver

by C. A. Douglas

Memorandum Report February 1964, 2 pages
NBS Project 0201-20-02411

The cause of the sensitivity change noted in transmissometers with change of line voltage was traced to oscillations in the discharge through the trigger tube. Only the trigger tubes manufactured in recent years showed this effect. The addition of a damping resistor in the plate circuit of this tube eliminated the sensitivity change.

6. MISCELLANEOUS

Bibliography of National Bureau of Standards Reports and Papers on Aviation Ground Lighting, 1945 - 1961

by Andrew C. Wall, E. B. Way

NBS Report 7322 August 1961, 29 pages
NBS Project 0201-20-02411

This is a bibliography of the reports and papers issued in the field of aviation ground lighting from 1945 to 1961 by the Aviation Ground Lighting Group of the Photometry and Colorimetry Section, Metrology Division. A summary of each report is given in the bibliography. Reports are indexed by subject and by number. Reports of tests of equipment and reports of transitory interest are not included.

A Survey of the Equipment and Procedures for the Photometry of Projectors at the National Bureau of Standards

by L. Chernoff

NBS Report 7410 March 1962, 26 pages, 13 figures, 1 table
NBS Project 0201-20-02411

also issued as

Photometry of Projectors at the National Bureau of Standards

by L. Chernoff

NBS Technical Note 198 December 1963, 28 pages, 13 figures, 1 table

Detailed descriptions are given of the variety of techniques used at the National Bureau of Standards in the photometry of several types of projectors. Photometric testing is carried out on two photometric ranges at NBS: a short range on which the test distance may be varied up to a maximum of 30 meters, and a longer range with a fixed test distance of 279 meters. Photometric measurements are made by comparing the test lamp with a standard lamp of known luminous intensity in a specified direction. These comparisons are made with photosensors which are color-corrected by filters so that the spectral response is similar to the CIE luminous efficiency function. Considerable care is required to keep the experimental errors within desired limits. Calibration procedure is explained for an external shunt circuit, zero-resistance circuit, and for a phototube with electrometer amplifier circuit. Equipment is described in detail, with photographs and diagrams.

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