



AEROSPACE INFORMATION REPORT

AIR 1093

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NUMERAL, LETTER AND SYMBOL DIMENSIONS FOR AIRCRAFT INSTRUMENT DISPLAYS

1. INTRODUCTION

Numerous variables influence the legibility of aircraft instrument dial characters. This situation makes it very difficult, if not impossible, to establish an exact act of rules for optimizing all installations.

Character size, one of the important considerations, can be optimized where adequate dial space exists. Usually this is not the case and the designer is faced with placing the information in a limited space while continuing to strive for error-free legibility. Appropriate minimum size requirements have been stated herein for guidance in air transport use.

2. PURPOSE

The purpose of this report is to provide recommendations for the minimum dimensions of characters and symbols used in aircraft instrument dials and panel displays as related to the conditions stated in para. 3.

3. GENERAL ENVIRONMENT

3.1 Viewing distance:

Nominal - 29 in.
Minimum - 10 in.
Maximum - 40 in.

3.2 Marking requirements:

- a. Light characters on dark background
- b. Minimum character brightness - 0.3 Foot Lamberts
- c. Brightness Contrast

| | |
|-----------------|--------------------|
| White on Black | - 12 (or greater) |
| Grey on Black | } - 5 (or greater) |
| Yellow on Black | |
| White on Grey | |
- d. Color of illumination - white

4. NUMERAL, LETTER AND DIAL REQUIREMENTS

4.1 Color of finish:

| | |
|---------------------|-------------------------------|
| Characters | |
| and symbols - White | FED. STD. 595 Color No. 37875 |
| Yellow | " " " " " 33538 |
| Background - Black | " " " " " 37038 |
| Grey | " " " " " 36373 |

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4.2 Dimensions:

| | MINIMUM CHARACTER HEIGHT | | WIDTH/HEIGHT RATIO | | STROKE WIDTH/HEIGHT RATIO | |
|-------------------|--------------------------|------|--------------------|---|---------------------------|---|
| | IN. | MM | | | | |
| <u>FLAT DIALS</u> | | | | | | |
| Fixed | 0.150 | 3.81 | 3/5 | 1 | 1/7 to 1/8 | 2 |
| Moving | 0.200 | 5.08 | 3/5 | 1 | 1/7 to 1/8 | 2 |
| <u>COUNTERS</u> | | | | | | |
| (Cylindrical) | | | | | | |
| Fixed (Settable) | 0.187 | 4.75 | 3/5 to 1/1 | 1 | 1/7 to 1/8 | 2 |
| Moving | 0.25 | 6.35 | | | | |

- 1 Except for the numerals "1" and "4" and the letters "I, M & W".
The "1" shall be one stroke width.
The "4" shall be one stroke width wider than the others.
The "I" shall be one stroke width.
The "M" & "W" shall be approximately 20% wider than the other letters.
- 2 Assuming direct illumination. When figures are trans-illuminated, a stroke-width/height range of 1/8 to 1/10 should be considered.

4.3 Grouping:

Character spacing - 1 stroke width, minimum.
Word spacing - 1 character width, minimum.
Graduation - Character spacing - 1 stroke width, minimum.

4.4 Suggested Styles (Not listed in order of preference):

MIL Standard MS33558 (ASG) Rev. 1-26-68
AMEL
Mackworth
Berger
Futura Medium

5. GLOSSARY

- a. ILLUMINATION - Illumination is the density of luminous flux on a surface; it is equal to the flux divided by the area when the latter is uniformly illuminated.
- b. LUMEN - The lumen is the unit of luminous flux. It is equal to the flux through a unit solid angle from a uniform point source of one candle, or the flux on a unit surface all points of which are at unit distance from a uniform point source of one candle.
- c. CANDLE - The candle is the unit of luminous intensity. It is defined as 1/60 of the intensity of one square centimeter of a black body radiator at the temperature of solidification of platinum (2,046K).
- d. FOOTCANDLE - The footcandle is the unit of illumination, equal to the illumination on a surface one square foot in area on which there is a uniformly distributed flux of one lumen, or illumination on a surface a distance of one foot from a uniform point source of one candle.

- e. BRIGHTNESS - Brightness is the luminous intensity of any surface in a given direction per unit of projected area of the surface as viewed from that direction.
- f. FOOTLAMBERT - The footlambert is a unit of brightness equal to the uniform brightness of a perfectly diffusing surface emitting or reflecting light at the rate of one lumen per square foot. The average brightness of any reflecting surface in footlamberts is the product of the illumination in footcandles by the reflection factor of the surface.
- g. BRIGHTNESS CONTRAST - Brightness contrast refers to the brightness difference between a viewed object (the dial marking) and its adjacent background. It is expressed as follows:

$$\text{Contrast "C"} = \frac{B_o - B_b}{B_b}$$

B_o is the brightness of the object in Foot Lamberts (F. L.) and B_b is the brightness of the background surface.

- h. LUMINOUS - Emitting or seeming to emit a steady diffused light that is reflected or produced from within.
- i. LUMINOSITY - The quality or state of being luminous.

6. REFERENCES

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