8857/V1,V2, 8858

Image Intensifier Tubes

18-mm Types Having Fiber-Optic Input and Output Faceplates

GENERAL

All Types

Spectral Response	S-20 with extended red response
Wavelength of Maximum Response	4700 + 1000 Å -500 Å
Photocathode:	
Material	Na-K-Cs-Sb (Multialkali)
Minimum useful area	2.5 cm^2 (0.4 in^2)
Minimum useful diameter	18 mm (0.71 in)
Image surface:	
Shape	Flat, Circular
Material	Fiber-Optics
Fluorescent Screen:	
Minimum useful area	2.5 cm^2 (0.4 in^2)
Minimum useful diameter	18 mm (0.71 in)
Phosphor	P20, Aluminized
Fluorescence and phosphorescence	Yellow-Green
Persistence	Medium to Medium Short
Image surface:	
Shape	Flat, Circular
Material	Fiber-Optics
Focusing Method	Electrostatic
Tube Dimensions:	
Maximum overall length	
Type 8858	5.93 in
Types 8857/V1, 8857/V2	1.926 in
Maximum diameter	
Type 8858	2.08 in
Types 8857/V1, V2	1.480 in[a]
Operating Position	Any
Weight (Approx.)	
Type 8858	1 lb
Types 8857/V1, V2	3 oz

TYPICAL PERFORMANCE CHARACTERISTICS

	Type 8858			Type 8857/V1			Type 8857/V2			
	Under conditions with 2.65 V dc applied, and an ambient temperature of 22° C, unless otherwise noted.			Under conditions with a dc anode voltage of 12 kV, and an ambient temperature of 22°C, unless otherwise noted.						
	Min.	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Min.**	**Typ.**	**Max.**	**Units**
Resolution:										
Center[d]	32	36	–	64	73	–	64	73	–	Line-Pairs/mm
Edge[e] (Peripheral)	30	36	–	64	73	–	64	73	–	Line-Pairs/mm
Screen Luminance (Brightness)[f]	–	1	125	–	–	–	–	–	–	fL
Luminance Gain:[g]										
At 22° C	3×10^{4}	5×10^{4}	–	65[h]	–	–	–	–	–	fL/fc
With green light source	–	–	–	–	–	–	22[j]	–	–	fL/fc
Equivalent Screen Background Input:										
Luminous[k]	–	5×10^{-12}	2×10^{-11}	–	–	2×10^{-11}	–	–	2×10^{-10}	lm/cm^2

TYPICAL PERFORMANCE CHARACTERISTICS (Cont'd)

	Type 8858			Type 8857/V1			Type 8857/V2			
Photocathode Sensitivity:	Min.	Typ.	Max.	Min.	Typ.	Max.	Min.	Typ.	Max.	Units
Radiant:										
At 4700 Å[m]	–	4.6×10^{-2}	–	–	4.6×10^{-2}	–	–	4.6×10^{-2}	–	A/W
At 8000 Å	1×10^{-2}	1.3×10^{-2}	–	1×10^{-2}	1.3×10^{-2}	–	–	–	–	A/W
At 8500 Å	3×10^{-3}	7×10^{-3}	–	3×10^{-3}	7×10^{-3}	–	–	–	–	A/W
Luminous[n]	1.75×10^{-4}	2.1×10^{-4}	–	1.75×10^{-4}	2.1×10^{-4}	–	–	1.6×10^{-4}	–	A/lm
Luminance Uniformity	–	3:1[p]	4:1[p]	–	1.4:1[q]	2:1[q]	–	1.4:1[r]	2:1[r]	
Modulation Transfer Function (MTF):[s] (See **Figures 3** and **7**)										
For 2.5 Line-Pairs/mm	93	95	–	–	–	–	–	–	–	%
For 7.5 Line-Pairs/mm	65	73	–	–	–	–	–	–	–	%
For 16 Line-Pairs/mm	25	31	–	–	–	–	–	–	–	%
Paraxial Image Magnification (Cmx)[t]	0.82	0.84	1.0	0.94	–	1.0	0.94	–	1.0	
Image Alignment[u]	–	–	0.06	–	–	0.02	–	–	0.02	in
Image Stability in 30 Seconds[v]	–	–	0.005	–	–	0.005	–	–	0.005	in
Distortion[w]	–	12	20	–	–	6	–	–	6	%

MAXIMUM RATINGS, Absolute-Maximum Values

DC Input Voltage
Type 8858 . . . . . 3.0 V

DC Voltage:
Anode with respect to photocathode
Types 8857/V1,V2 . . . . . 13 max. kV

Average Photocathode Current[c] (Continuous operation)
Types 8857/V1,V2 . . . . . 0.25 max. μA

Ambient-Temperature Range:
Non-operating . . . . . -54 to +68° C
Operating . . . . . -54 to +52° C

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[a] Excluding exhaust tip.

[c] The specified value is the maximum permitted average anode current with the photocathode uniformly illuminated. This value is averaged over any interval of 10 seconds maximum.

[d] The resolution, both horizontal and vertical, is determined with a test pattern consisting of alternate black and white lines of equal width. Any two adjacent lines are designated a "line pair."

[e] This minimum value applies at a distance of 7 mm from the major (optical) axis of the tube.

[f] Maximum screen luminance (brightness) is limited automatically by the oscillator power supply and occurs when the input illumination is equal to or greater than 10^{-3} footcandle. Typical values are measured at 2×10^{-5} footcandle using a 2854° K tungsten lamp.

[g] Luminance Gain is defined as the quotient of screen brightness in footlamberts by the photocathode illumination in footcandles provided by a tungsten-filament lamp having a lime-glass envelope. The lamp is operated at a color temperature of 2854° K. The value of light input radiation on the photocathode image surface is in the range of 1×10^{-5} to 3×10^{-5} footcandle and illuminates uniformly a 0.5"-diameter spot on the photocathode. The output is measured with a photometer centered on a 10-mm diameter spot on the screen.

[h] Under same conditions of footnote (g) except input radiation on photocathode is 5×10^{-2} footcandle. Anode voltage is 15 kV.

[j] Under the same conditions of footnote (g) except that a light input of 5×10^{-2} footcandle is incident on Corning C.S. No.3-71 and C.S. No.4-67 interposed between the light source and the tube. Anode voltage is 12 kV. Use of these filters in conjunction with the 2854° K source closely approximates the P20 spectral distribution.

k Defined as the equivalent value of luminous flux from a tungsten-filament lamp operating at 2854° K that would be required to cause an increase in screen brightness equal to screen background brightness.

m For incident radiation at the wavelength of maximum response of the spectral sensitivity characteristic.

n Under the following conditions: The light source is a tungsten-filament lamp having a lime-glass envelope. The lamp is operated at a color temperature of 2854° K. The value of light flux is 0.03 lumen. The light spot has a nominal diameter of 0.5", and 300 volts are applied between anode and photocathode.

p The light source is a tungsten-filament lamp having a lime-glass envelope. The lamp is operated at a color temperature of 2854° K. Luminance uniformity will not vary more than the ratio stated over a circular area 17 mm in diameter centered on the image screen when the photocathode is illuminated uniformly with 1×10^{-5} to 3×10^{-5} footcandle and the output is scanned with a 1 millimeter aperture in a spiral pattern.

q The light source is a tungsten-filament lamp having a lime-glass envelope. The lamp is operated at a color temperature of 2854° K. Luminance uniformity will not vary more than the ratio stated over a circular area 17 mm in diameter centered on the image screen.

r Under the same conditions as shown in footnote (q) except that Corning C.S. No.3-71 and C.S. No.4-67 filters are interposed between the light source and the tube.

s A two-dimensional resolution pattern, providing constant illumination in the Y direction, and sinusoidal variation of intensity in the X direction is projected on the photocathode. Per cent image modulation M may then be defined as:

$$M = \frac{W - B}{W + B} \times 100$$

where W = maximum illumination in white line
B = minimum illumination in black line

Output image brightness is also a sinusoidal function of the distance across one direction of the pattern, and the output modulation is equal to or less than the input modulation. The modulation transfer function (MTF) is defined as the ratio of the output modulation to input modulation expressed as a function of the spatial frequency of the incident illumination pattern. MTF for the tubes is measured using Modulation Transfer Function Anaylzer Model No.K1-b, a product of Optics Technology, Inc., Belmont, CA, using the specified procedure for that instrument.

Modulation is recorded with a square-wave resolution pattern for types 8857/V1 and 8857/V2.

In this case, modulation is expressed as a function of line frequency and is called "contrast transfer characteristic". MTF is calculated from the contrast transfer data using the following relationship.

$$M(N) = \frac{\pi}{4}\left[C(N) + \frac{C(3N)}{3} - \frac{C(5N)}{5} + \frac{C(7N)}{7}\right]$$

where M(N) is the MTF value at line frequency N
and C(N) is the contrast transfer value at line frequency N

t Paraxial Image Magnification (Cmx) is defined as the ratio of the separation of two diametrically opposite image points on the screen to the separation of the two corresponding image points on the photocathode. The image points on the photocathode are separated by a distance of 1 mm and are located equal distances from the major axis of the tube.

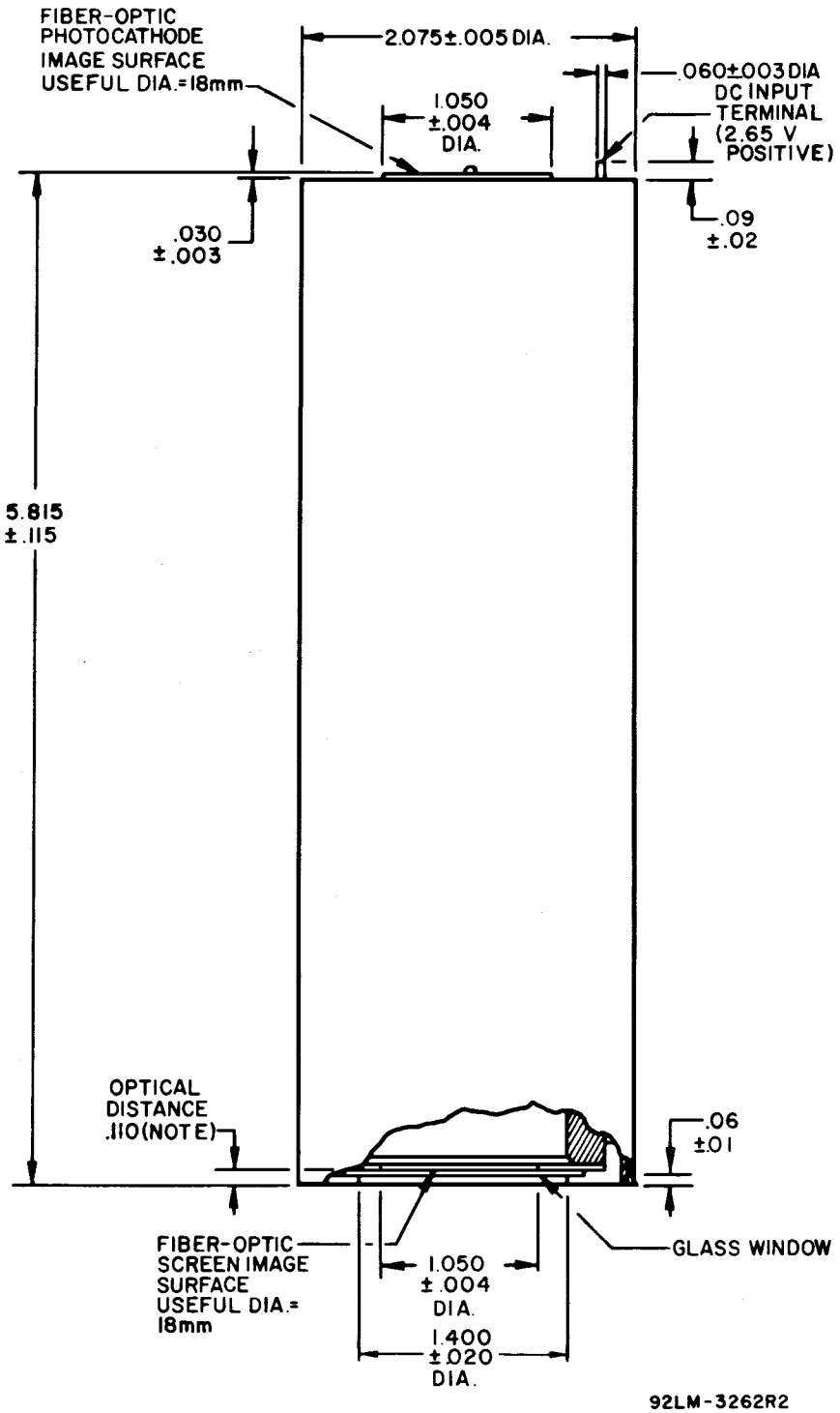
u The center of an image produced on the screen by focusing a test pattern on the optical axis of the photocathode will fall with in a circle concentric with the optical axis of the screen having the specified diameter.

v The center of an image produced on the screen by focusing a test pattern on the optical axis of the photocathode will not shift more than the specified value during 30 seconds of operation.

w A second magnification value (Emx) is obtained as stated in footnote (m) except the image points on the photocathode are separated by a distance of 14 mm. Per-cent distortion is defined by the equation.

$$\text{Per-Cent Distortion} = \frac{Emx - Cmx}{Cmx} \times 100$$

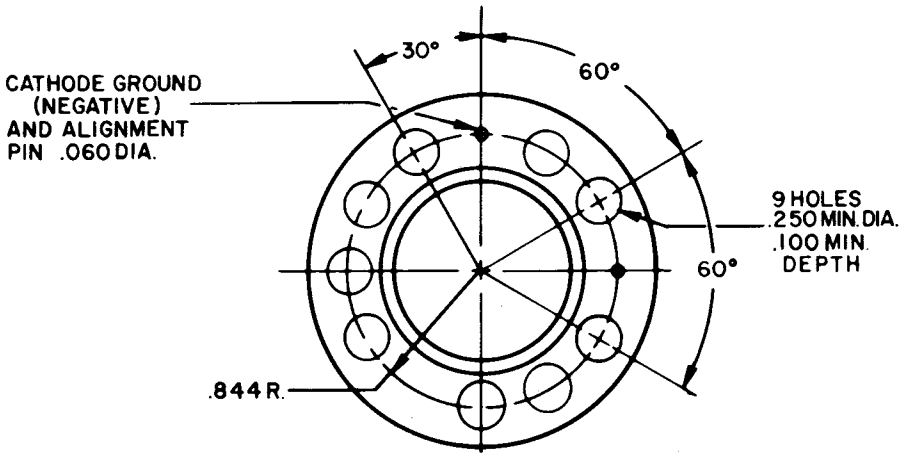
DIMENSIONAL OUTLINE FOR TYPE 8858



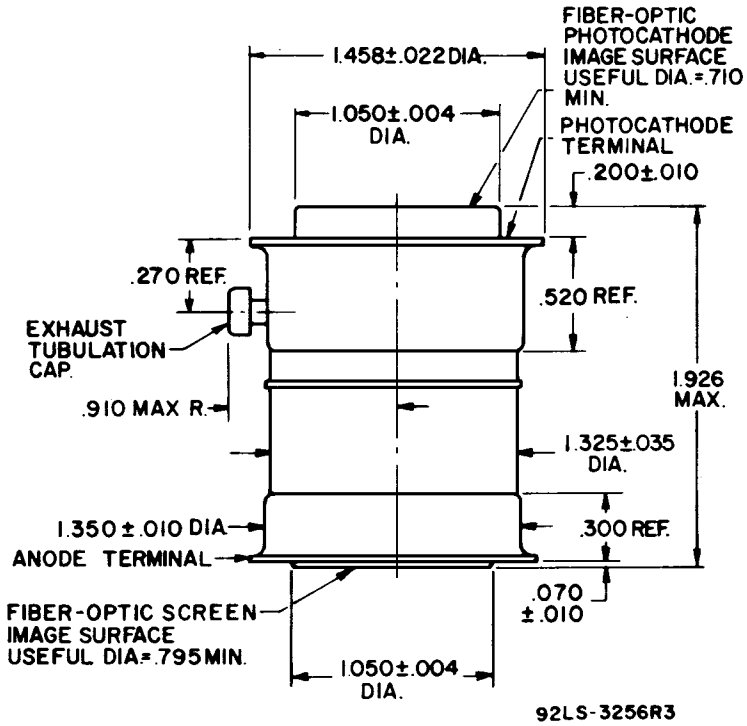
Note: This distance is measured with a depth microscope.

Dimensions in Inches

DIMENSIONAL OUTLINE FOR TYPE 8858

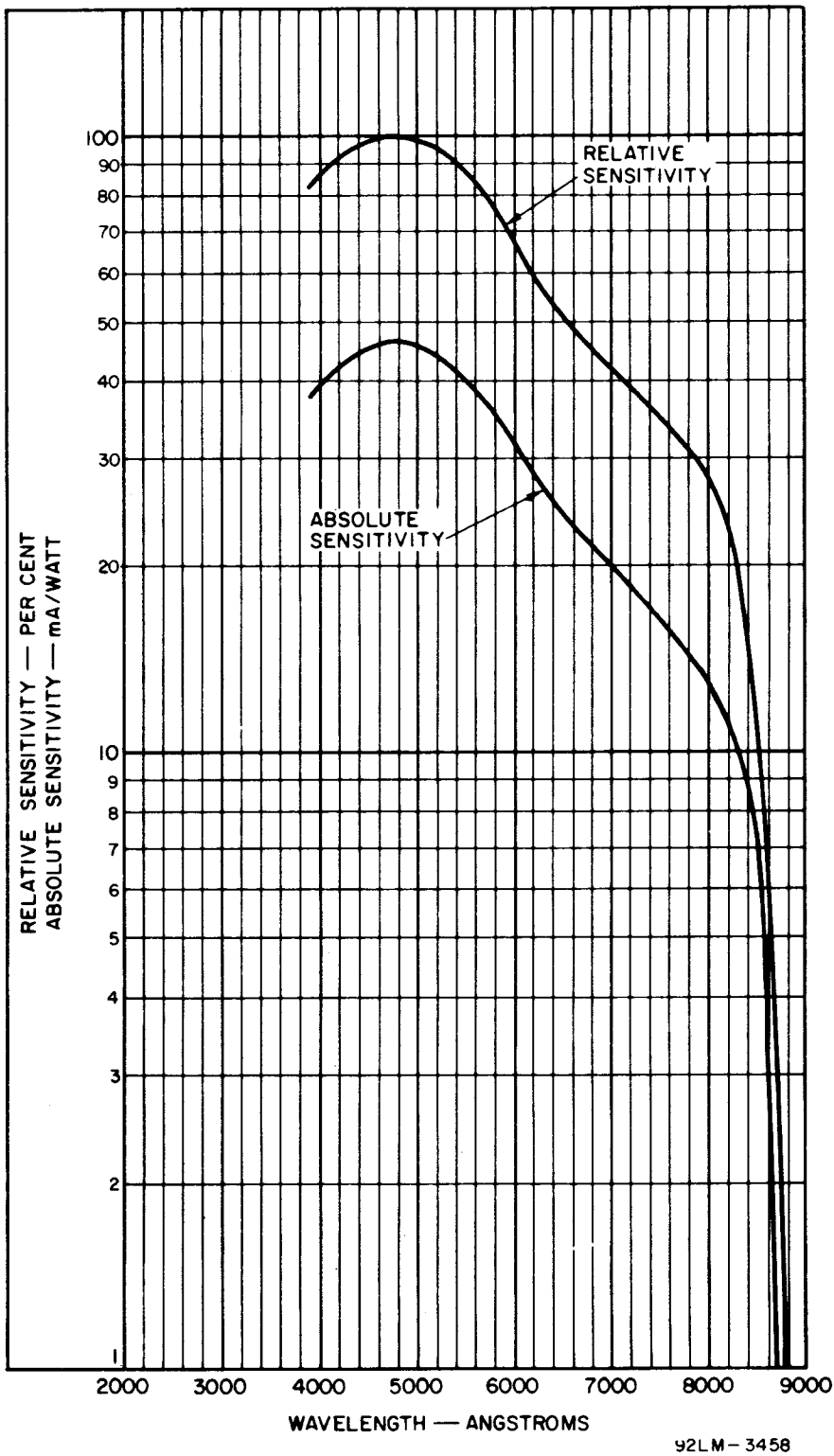


DIMENSIONAL OUTLINE FOR TYPES 8857/V1, 8857/V2

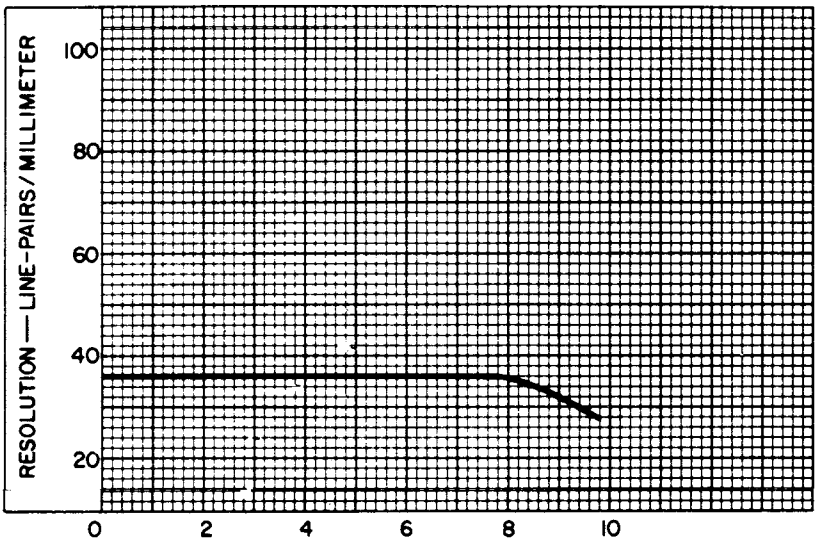


Dimensions in Inches

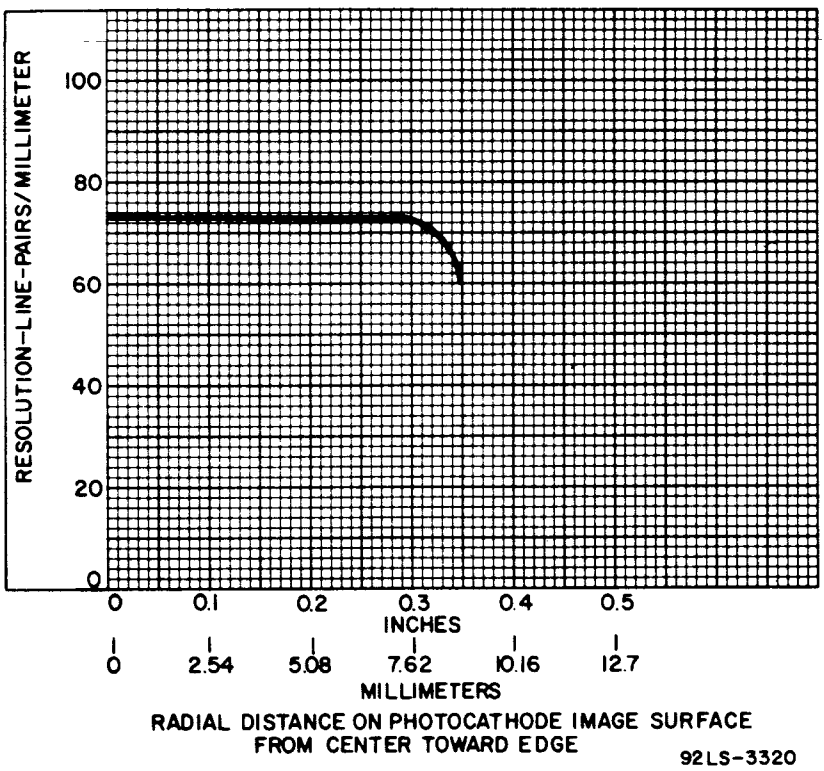
TYPICAL SPECTRAL RESPONSE CHARACTERISTICS FOR ALL TYPES



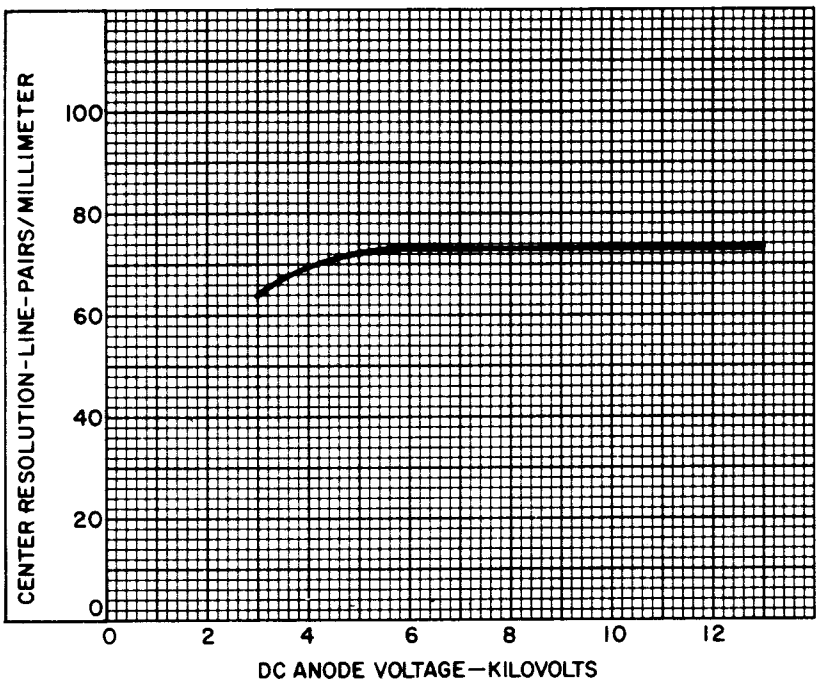
TYPICAL RESOLUTION AS A FUNCTION OF RADIAL DISTANCE ON PHOTOCATHODE FOR TYPE 8858



TYPICAL RESOLUTION AS A FUNCTION OF RADIAL DISTANCE ON PHOTOCATHODE FOR TYPES 8857/V1, 8857/V2

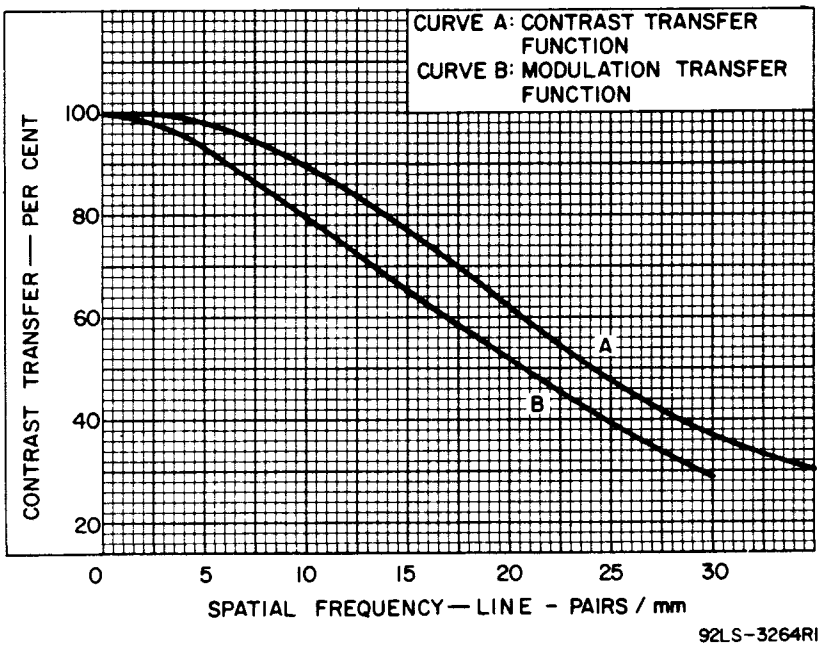


TYPICAL RESOLUTION AS A FUNCTION OF ANODE VOLTAGE FOR TYPES 8857/V1, 8857/V2



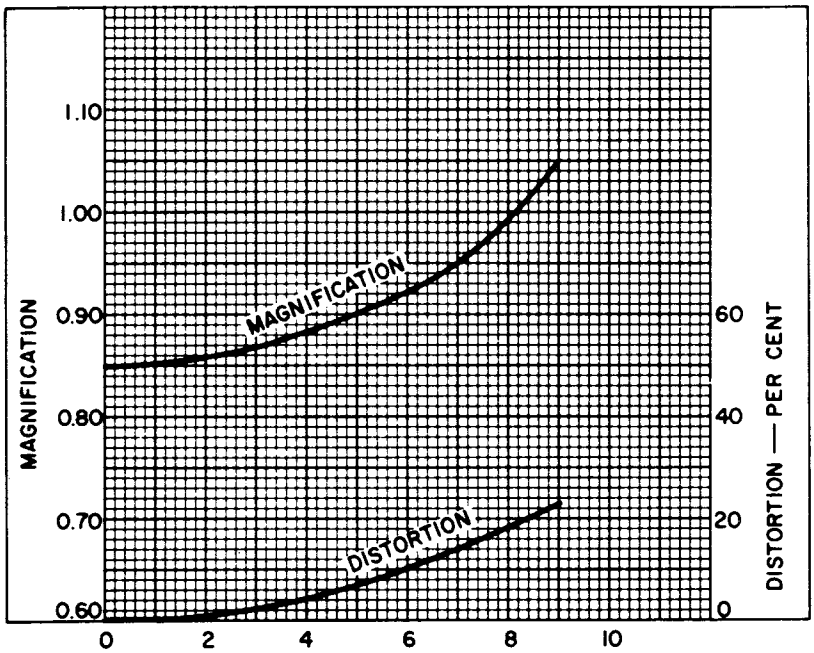
92LS-3319

TYPICAL MODULATION TRANSFER FUNCTION AND CONTRAST TRANSFER CHARACTERISTICS FOR TYPES 8857/V1, 8857/V2

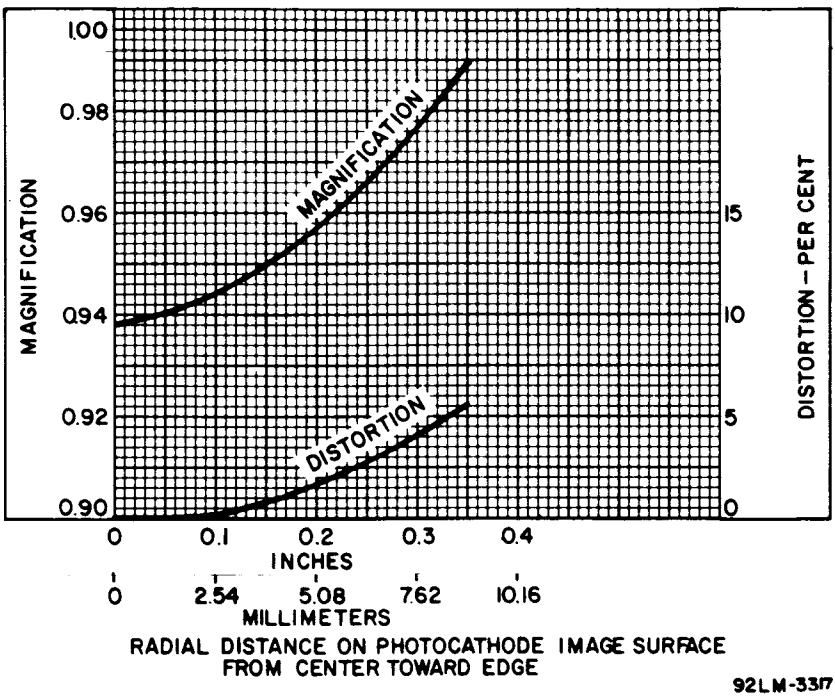


92LS-3264RI

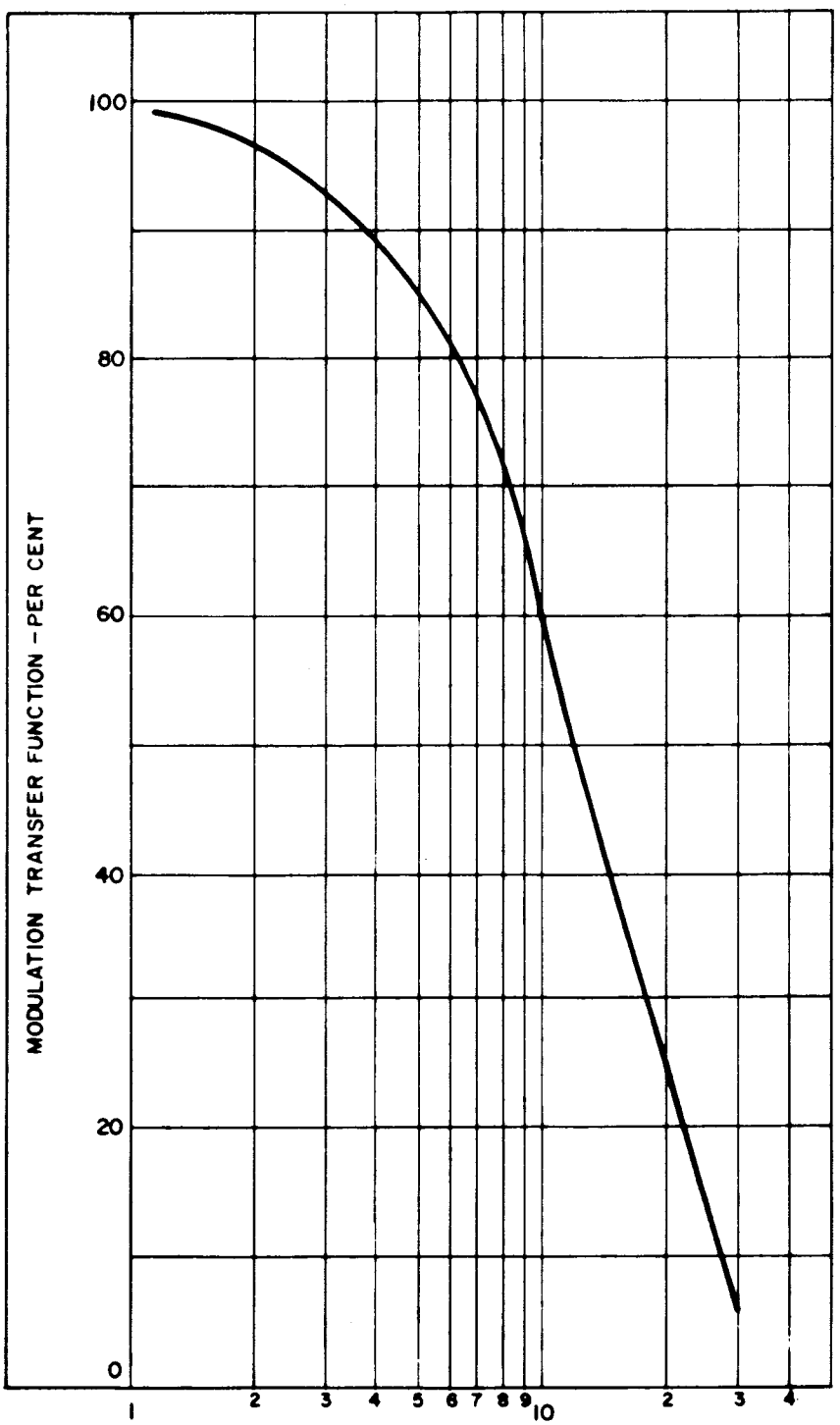
TYPICAL MAGNIFICATION AND DISTORTION CHARACTERISTICS FOR TYPE 8858



TYPICAL MAGNIFICATION AND DISTORTION CHARACTERISTICS FOR TYPES 8857/V1, 8857/V2

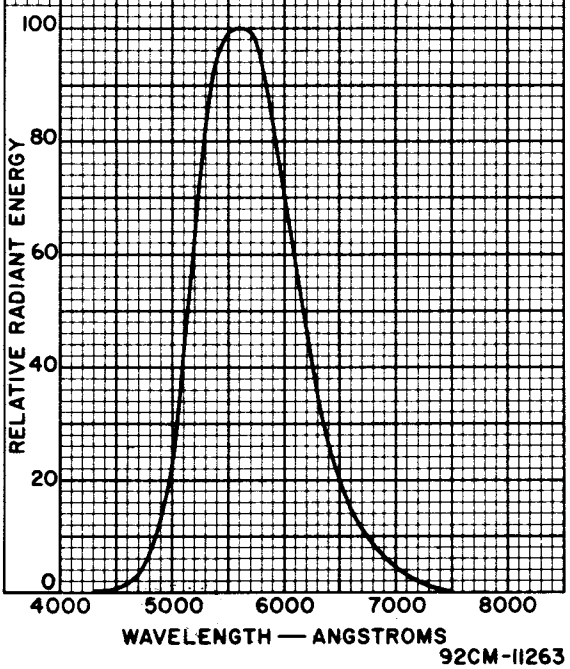


TYPICAL MODULATION TRANSFER FUNCTION FOR TYPE 8858



JEDEC PHOSPHOR P20 FOR ALL TYPES

COLOR	C.I.E. COORDINATES	
	X	Y
YELLOW–GREEN	0.426	0.546



RELATIVE LIGHT OUTPUT CHARACTERISTIC FOR TYPES 8857/V1, 8857/V2