

Color Picture Tube

THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN

ALL-GLASS ENVELOPE
MAGNETIC CONVERGENCE

ELECTROSTATIC FOCUS
MAGNETIC DEFLECTION

DATA

General:

Electron Guns, Three with Axes Tilted
Toward Tube Axis. Blue, Green, Red
Heater, for Unipotential Cathode of
Each Gun, Paralleled with Each of
the Other Two Heaters within Tube:
Current at 6.3 volts. 1.8 amp
Focusing Method Electrostatic
Convergence Method. Magnetic
Deflection Method Magnetic
Deflection Angles (Approx.):
Horizontal. 70°
Vertical. 55°
Direct Interelectrode Capacitances (Approx.):
Grid No.1 of any gun to all other
electrodes. 10 μf
Cathode of blue gun + cathode of green
gun + cathode of red gun to all
other electrodes. 16 μf
Grid No.3 to all other electrodes 9 μf
External Conductive Coating to ultor. $\begin{cases} 2500 \text{ max.} \\ 2000 \text{ min.} \end{cases}$ μf

Optical:

Faceplate, Spherical. Filterglass
Light transmission (Approx.). 72%
Screen, on Inner Surface of Faceplate:
Type. Aluminized, Tricolor, Phosphor-Dot
Phosphor (Three separate phosphors,
collectively)^a. P22—All-Sulfide Type
Fluorescence and phosphorescence of
separate phosphors, respectively. . . . Blue, Green, Red
Persistence of group phosphorescence. . . . Medium Short
Dot arrangement Triangular group consisting of
blue dot, green dot, and red dot
Spacing between centers of adjacent dot trios (Approx.). 0.029"

Mechanical:

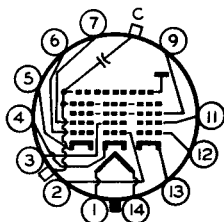
Tube Dimensions:
Overall length. 25-1/32" $\pm$ 3/8"
Diameter. 20-13/16" $\pm$ 1/8"
Screen Dimensions (Minimum):
Greatest width. 19-1/4"
Height. 15-1/2"
Projected area. 261 sq. in.
Weight (Approx.). 36-1/2 lbs



21FBP22

Operating Position. Tube Axis Horizontal
 (Base pin 12 and V-grooved panel pad on top)
 Cap Recessed Small Cavity (JEDEC No.J1-21)
 Socket. Alden Nos.214NMINS (Radial leads),
 214NMINC (Axial leads), or equivalent
 Base. . . . Small-Shell Neodiheptal 12-Pin (JEDEC No.B12-131)
 Basing Designation for BOTTOM VIEW. 14AU

Pin 1-Heater
 Pin 2-Grid No.1 of Red Gun
 Pin 3-Grid No.2 of Red Gun
 Pin 4-Cathode of Red Gun
 Pin 5-Cathode of Green Gun
 Pin 6-Grid No.1
 of Green Gun
 Pin 7-Grid No.2
 of Green Gun
 Pin 9-Grid No.3
 Pin 11-Grid No.2
 of Blue Gun
 Pin 12-Grid No.1
 of Blue Gun
 Pin 13-Cathode of Blue Gun
 Pin 14-Heater



Cap-Ultor (Grid No.4,
 Grid No.5, Collector)
 C-External Conductive
 Coating

Maximum and Minimum Ratings, Design-Maximum Values:

ULTOR-TO-CATHODE (Of each gun) VOLTAGE. . . 27500 max. volts
 GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE. 6000 max. volts
 PEAK GRID-No.2-TO-CATHODE VOLTAGE, INCLUDING
 VIDEO SIGNAL VOLTAGE (Each gun). 650 max. volts
 GRID-No.1-TO-CATHODE VOLTAGE (Each gun):
 Negative-bias value 400 max. volts
 Positive-bias value 0 max. volts
 Positive-peak value 2 max. volts
 HEATER VOLTAGE (AC or DC)^b. { 6.9 max. volts
 { 5.7 min. volts
 PEAK HEATER-CATHODE VOLTAGE (Each gun):
 Heater negative with respect to cathode:
 During equipment warm-up period
 not exceeding 15 seconds. 450 max. volts
 After equipment warm-up period. 200 max. volts
 Heater positive with respect to cathode . 200 max. volts

Equipment Design Ranges:

With ultor voltage (E_{c4} each gun) between 20000^c and 27500 volts
 Grid-No.3 (Focusing
 Electrode)-to-Cathode
 (Of each gun) Voltage. 16.8% to 20% of E_{c4} each gun volts
 Grid-No.2-to-Cathode
 Voltage (Each gun)
 when circuit design
 utilizes grid-No.1-
 to-cathode voltage
 (E_{c1k}) at fixed value
 for raster cutoff. See Cutoff Design Chart

Grid-No.1-to-Cathode
Voltage (Each gun)
for Visual Extinction
of Focused Raster
when circuit design
utilizes grid-No.2-
to-cathode voltage
(E_{c2k}) at fixed
value. See *Cutoff Design Chart*

Variation in Raster
Cutoff Between Guns
in Any Tube. $\pm 21\%$ of average of highest
and lowest cutoff values

Grid-No.3 Current. -45 to +45 μa
Grid-No.2 Current (Each gun). -5 to +5 μa
Percentage of Total Ultor
Current Supplied by
Each Gun (Average):

Red Gun Blue Gun Green Gun

To Produce White of
8500° K + 27 M.P.C.D.
(CIE Coordinates
 $x = 0.287, y = 0.316$). 44 26 30 %

To Produce White of
9300° K + 27 M.P.C.D.
(CIE Coordinates
 $x = 0.281, y = 0.311$). 42 28 30 %

Ratios of Cathode Currents:

Red to Green Red to Blue
Min. Av. Max. Min. Av. Max.

To Produce White
of 8500° K + 27
M.P.C.D. 0.9 1.45 2 1 1.7 2.4

To Produce White
of 9300° K + 27
M.P.C.D. 0.85 1.4 1.95 0.8 1.5 2.2

Maximum Raster Centering Correction
in Any Direction^d. 7/8 inch

Adjustment to be Provided by
the Following Components:

Purifying Magnet:

Maximum Required Displacements
of Beam Trios in Any direction
with Respect to Associated
Phosphor-Dot Trios 0.005" ^e

Lateral-Converging Magnet:^f

Maximum lateral shift of blue beam $\pm 1/4"$

Radial-Converging Magnet Assembly:

For static convergence
including compensation
for dc component of
dynamic convergence
(Each beam). Shift of $\pm 5/8"$



Examples of Use of Design Ranges:

For ultor voltage of	20000	25000	volts
Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage. . .	3360 to 4000	1200 to 5000	volts
Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage of -70 volts for raster cutoff. . .	130 to 370	130 to 370	volts
Grid-No.1-to-Cathode Voltage (Each gun) for Visual Extinction of Focused Raster when circuit design utilizes grid-No.2-to-cathode voltage of 200 volts. . .	-45 to -100	-45 to -100	volts

Limiting Circuit Values:

High-Voltage Circuits:

In order to minimize the possibility of damage to the tube caused by a momentary internal arc, it is recommended that the *high-voltage power supply* and the *grid-No.3 power supply* be of the limited-energy type.

Grid-No.3 Circuit Resistance (Each gun) 7.5 max. megohms

Low-Voltage Circuits:

Effective Grid-No.1-to-Cathode-Circuit Resistance (Each gun). 0.75 max. megohm

The grid-No.2-to-heater circuit, the grid-No.1-to-heater circuit, and the cathode-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply a continuous short-circuit current of more than 300 milliamperes total. Such current limitation will prevent heater burnout in case of a momentary internal arc within the tube.

- ^a For Curves, see front of this Section.
- ^b For maximum cathode life, it is recommended that the heater supply be regulated at 6.3 volts.
- ^c Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.
- ^d Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils. With all components properly adjusted, the raster centering correction is the distance from the undeflected focused beams to the center of the screen.
- ^e The equivalent raster movement is about $3/4"$.
- ^f Lateral converging magnet must shift the red beam and the green beam in opposite direction to the shift of the blue beam. Under conditions where the blue beam has been shifted $1/4"$, the shift of the red beam and green beam should be in the range of $1/8"$ to $3/8"$.

DEFINITIONS

Beam trio. The red beam, green beam, and blue beam passing through a common hole in the shadow mask.

Register. Exact correspondence in position of the centers of beam trios with respect to the centers of the associated phosphor-dot trios.

Misregister. Lack of correspondence in position of the centers of the beam trios with respect to the centers of the associated phosphor-dot trios.

Displacement. Shift of the position of the beams with respect to the phosphor dots.

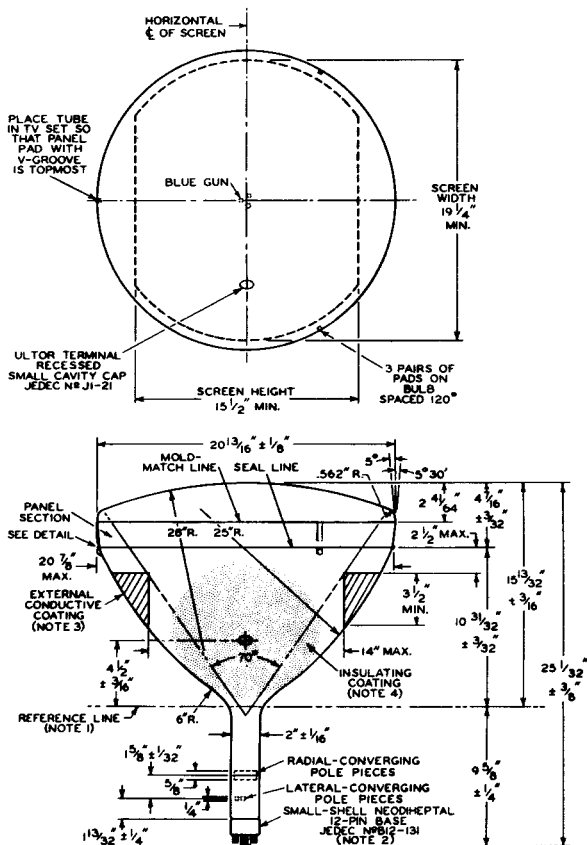
GENERAL CONSIDERATIONS

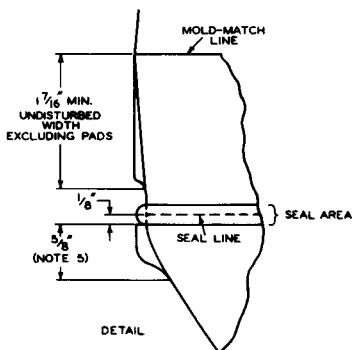
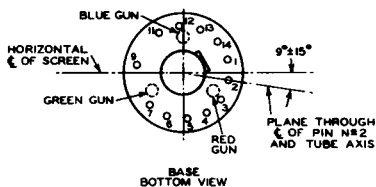
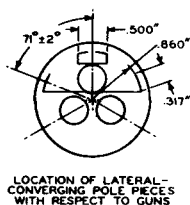
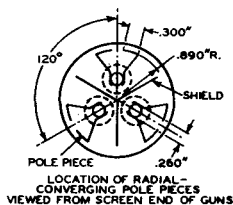
X-Ray-Warning. Because this color picture tube is designed to be operated at ultor voltages as high as 27.5 kilovolts (Design-maximum value), shielding of this color picture tube for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.

Shatter-Proof Cover Over the Tube Face. Following conventional picture-tube practice, it is recommended that the cabinet be provided with a shatter-proof, glass cover over the face of this color picture tube to protect it from being struck accidentally and to protect against possible damage resulting from tube implosion under some abnormal condition. This safety cover can also provide X-ray protection when required.

High Voltages. The high voltages at which cathode-ray tubes are operated may be very dangerous. Great care should be taken in the design of apparatus to prevent the operator from coming in contact with the high voltages. Precautions include the inclosing of high-potential terminals and the use of interlocking switches to break the primary circuit of the power supply when access to the equipment is required.







92CL-10849



NOTE 1: WITH TUBE NECK INSERTED THROUGH FLARED END OF REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE AND WITH TUBE SEATED IN GAUGE, THE REFERENCE LINE IS DETERMINED BY THE INTERSECTION OF THE PLANE CC' OF THE GAUGE WITH THE GLASS FUNNEL.

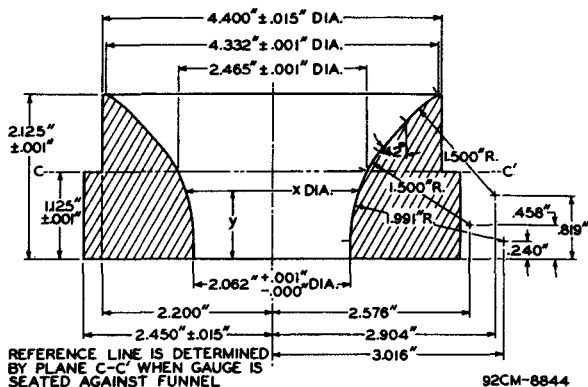
NOTE 2: SOCKET FOR THIS BASE SHOULD NOT BE RIGIDLY MOUNTED; IT SHOULD HAVE FLEXIBLE LEADS AND BE ALLOWED TO MOVE FREELY. BOTTOM CIRCUMFERENCE OF BASE SHELL WILL FALL WITHIN A CIRCLE CONCENTRIC WITH BULB AXIS AND HAVING A DIAMETER OF 3".

NOTE 3: THE DRAWING SHOWS THE MINIMUM SIZE AND LOCATION OF THE CONTACT BAND OF THE EXTERNAL CONDUCTIVE COATING. THE ACTUAL AREA OF THIS COATING WILL BE GREATER THAN THAT OF THE CONTACT BAND SO AS TO PROVIDE THE REQUIRED CAPACITANCE. EXTERNAL CONDUCTIVE COATING MUST BE GROUNDED.

NOTE 4: TO CLEAN THIS AREA, WIPE ONLY WITH SOFT DRY LINT-LESS CLOTH.

NOTE 5: THE MAXIMUM EFFECTIVE WIDTH OF A FUNNEL PAD IS 5/8".

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE



y	x
0.000"	2.062" + 0.001" - 0.000"
0.125"	2.062" + 0.001" - 0.000"
0.250"	2.062" + 0.001" - 0.000"

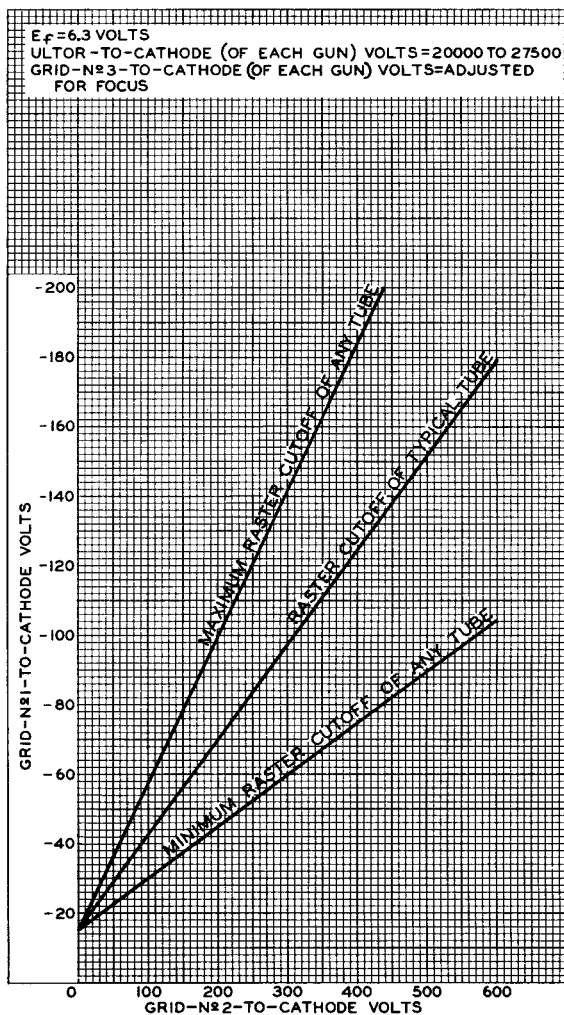
y	x
0.375"	2.062" + 0.001" - 0.000"
0.385"	2.062" + 0.001" - 0.000"
0.500"	2.084" ± 0.001"
0.625"	2.122" ± 0.001"

y	x
0.750"	2.182" $\pm$ 0.001"
0.875"	2.258" $\pm$ 0.001"
1.000"	2.352" $\pm$ 0.001"
1.125"	2.465" $\pm$ 0.001"
1.250"	2.604" $\pm$ 0.001"

y	x
1.375"	2.778" $\pm$ 0.001"
1.500"	2.990" $\pm$ 0.001"
1.625"	3.216" $\pm$ 0.001"
1.750"	3.440" $\pm$ 0.001"
1.875"	3.678" $\pm$ 0.001"
2.000"	3.958" $\pm$ 0.001"
2.125"	4.332" $\pm$ 0.001"



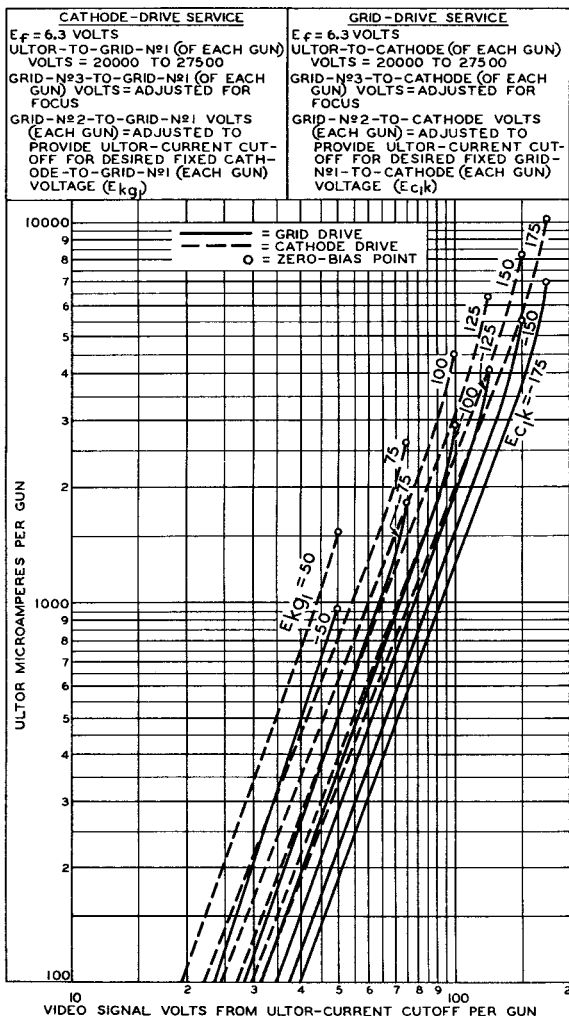
CUTOFF DESIGN CHART



92CM-10846



TYPICAL DRIVE CHARACTERISTICS



92CL-10845



TYPICAL LIGHT-OUTPUT CHARACTERISTICS

$E_f = 6.3$ VOLTS

GRID-N^o3--TO--CATHODE (OF EACH GUN) VOLTS=ADJUSTED FOR FOCUS

DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 9300°K+27 M.P.C.D. WHITE LIGHT OUTPUT. PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 9300°K+27 M.P.C.D. WHITE:

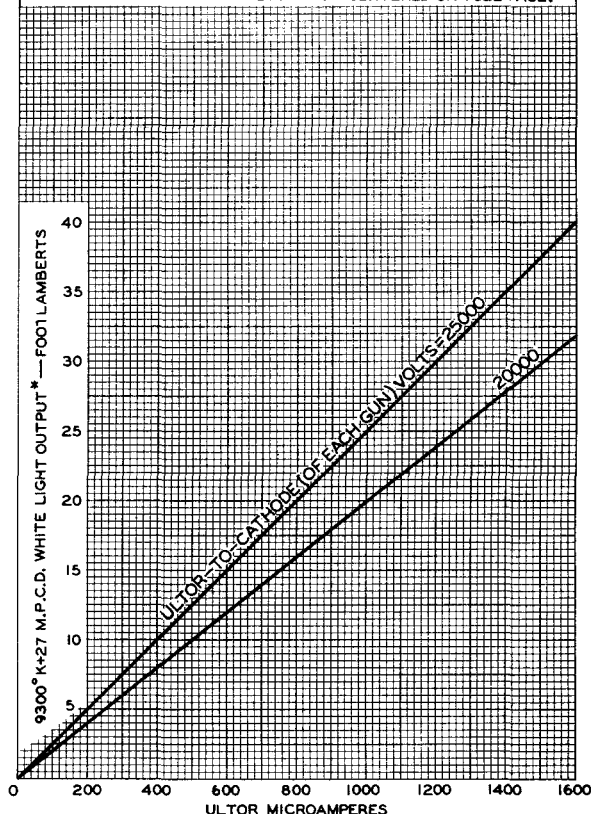
RED GUN: 42%

BLUE GUN: 28%

GREEN GUN: 30%

RASTER SIZE: $19\frac{1}{4} \times 14\frac{1}{2}$ " CENTERED ON TUBE FACE.

* MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.



92CM-10853