21CYP22

COLOR PICTURE TUBE

THREE-GUN, GRADED-HOLE, SHADOW-MASK TYPE
ALUMINIZED TRICOLOR PHOSPHOR-DOT SCREEN
ALL-GLASS ENVELOPE — ELECTROSTATIC FOCUS
MAGNETIC CONVERGENCE — 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:	
Voltage	6.3 ac or dc volts
Current	1.8 ± 10% amp
Direct Interelectrode Capacitances (Approx.):	
Grid No.1 of any gun to all other electrodes except the No.1 grids of the other two guns	7 μμf
Cathode of blue gun + cathode of green gun + cathode of red gun to all other electrodes	16 μμf
Grid No.3 (Of each gun tied within tube to No.3 grids of other two guns) to all other electrodes	9 μμf
External conductive coating to grid No.6	2500 max. μμf 2000 min. μμf
Faceplate, Spherical	Filterglass
Light transmission (Approx.)	72%
Screen, on Inner Surface of Faceplate:	
Type	Aluminized, Tricolor, Phosphor-Dot
Phosphor (Three separate phosphors, collectively)	P22
Fluorescence and phosphorescence of separate phosphors, respectively	Blue, Green, Red
Persistence of group phosphorescence	Medium
Dot arrangement	Triangular group consisting of blue dot, green dot, and red dot
Spacing between centers of adjacent dot trios (Approx.)	0.029"
Size (Minimum):	
Greatest width	19-1/4"
Height	15-1/2"
Projected area	261 sq. in.
Focusing Method	Electrostatic
Convergence Method	Magnetic
Deflection Method	Magnetic
Deflection Angles (Approx.):	
Horizontal	70°
Vertical	55°
Tube Dimensions:	
Overall length	25-1/32" ± 3/8"
Diameter	20-13/16" ± 1/8"
Weight (Approx.)	36-1/2 lbs
Operating Position	Tube Axis Horizontal (Base pin 12 and V-grooved panel pad on top)

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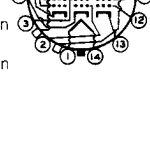
Caps (Two). . . . . .Recessed Small Cavity (JETEC No.J1-21)
Socket. . . . . Alden Nos.214NMINSC (Radial leads), 214NMINC (Axial leads), or equivalent
Base. . . . Small-Shell Neodiheptal 12-Pin (JETEC No.B12-131)
Basing Designation for BOTTOM VIEW. 14AL

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 Over Pin 1-Ultor (Grid No.4, Grid No.5)
Cap♦ Over Pin 2-Grid No.6, Collector, High-Voltage-Supply Terminal
C-External Conductive Coating

Maximum Ratings, *Design-Center Values:*

ULTOR-TO-CATHODE (Of each gun) VOLTAGE. . . 25000 max. volts
Between the Ultor Terminal and the High-Voltage-Supply Terminal *(See Dimensional Outline)*, it is necessary to connect a resistor of 50,000 ohms as described under *Limiting Circuit Values*. The high voltage must be connected to the High-Voltage-Supply Terminal--never directly to the Ultor Terminal.

GRID-No.3-TO-CATHODE (Of each gun) VOLTAGE. 6000 max. volts
GRID-No.2-TO-CATHODE VOLTAGE (Each gun) . . 600 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
PEAK HEATER-CATHODE VOLTAGE (Each gun):
Heater negative with respect to cathode:
During equipment warm-up period not exceeding 15 seconds. . . . . 410 max. volts
After equipment warm-up period. . . . . 180 max. volts
Heater positive with respect to cathode . 180 max. volts

Equipment Design Ranges:

With ultor voltage (E_{c_4} $k_{each\ gun}$) between 20000♦ and 25000 volts

Grid-No.3 (Focusing Electrode)-to-Cathode (Of each gun) Voltage . 16.8% to 20% of E_{c_4} $k_{each\ gun}$ volts

♦,♦: See next page.

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Grid-No.2-to-Cathode Voltage (Each gun) when circuit design utilizes grid-No.1-to-cathode voltage (E_{c_1k}) 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_{c_2k}) at fixed value.	*See Cutoff Design Chart*		
Variation in Raster Cutoff Between Guns in Any Tube.	± 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: *To Produce White of 8500° K + 27 M.P.C.D. (I.C.I. Coordinates x = 0.287, y = 0.316):*			
Red gun.	50		%
Blue gun	19		%
Green gun.	31		%
Ratios of Cathode Currents: *To Produce White of 8500° K + 27 M.P.C.D. (I.C.I. Coordinates x = 0.287, y = 0.316):*	*Min.*	*Typical*	*Max.*
Red cathode to green cathode .	1	1.6	2
Red cathode to blue cathode. .	1.5	2.7	4
Maximum Raster Shift in Any Direction from Screen Center□ . .		7/8	inch
Maximum Required Displacements of Beam Trios with Respect to Associated Phosphor-Dot Trios: Uniform in any direction over entire screen area			0.005"*

♦ Connect high-voltage supply to this cap and also connect 50,000-ohm resistor between this cap and cap over pin 1 (Ultor cap).

Brilliance and definition decrease with decreasing ultor voltage. In general, the ultor voltage should not be less than 20,000 volts.

* If this displacement is accomplished by means of a purifying magnet located on the neck of the tube, the equivalent raster movement is about 3/4".

□: See next page.

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Localized around edge of screen—	
Tangential	0.002"
Radial	0.003"
Adjustment to be Provided by the Following Components:	
Lateral-Converging Magnet:⊕♦	
Maximum lateral shift of blue beam	±1/4"
Maximum lateral shift of red beam and green beam	±1/8" to ±3/8"
Average of maximum lateral shift of red beam and green beam	±7/32" to ±9/32"
Radial-Converging Magnet Assembly:⊕	
For static convergence including compensation for dc component of dynamic convergence (Each beam)	Shift of ±5/8"
For dynamic convergence†—	
Effected by magnetomotive force of parabolic and/or sawtooth waveshape synchronized with scanning.	
Horizontal:	
Blue pattern—	
Parabola amplitude to provide▲	Shift of 3/16" to 1/2"
Sawtooth amplitude to provide⁰⁰	Shift of ±50% of the shift caused by parabola amplitude
Red pattern & green pattern—	
Parabola:	
Amplitude to provide▲	Shift of 1/16" to 5/16"
Ratio of red-pattern shift to green-pattern shift	2/3 to 3/2
Sawtooth:	
Amplitude to provide⁰⁰	Shift of −60% to +60% of the shift caused by parabola amplitude
Difference between red-pattern shift and green-pattern shift ($Shift_R - Shift_G$)	−75% to +75%

□ Centering of the raster on the screen may be accomplished by passing direct current of the required value through each pair of deflecting coils to compensate for raster shift resulting from adjustments for optimum convergence and color purity.

⊕ Shift is the movement of the regions of dot/crosshatch-generator pattern indicated in notes (▲) and (⁰⁰).

♦ The direction of movement of the red and green beam is opposite to that of the blue beam.

† Indicated values apply when RCA test yoke is used with the 21CYP22.

▲,⁰⁰: See next page.

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Vertical:
- Blue pattern—
  - Parabola amplitude to provide▲ . . . . . Shift of -1/8" to +1/16"
  - Sawtooth amplitude to provide∞ . . . . . Shift of -1/16" to +3/16"
- Red pattern & green pattern—
  - Parabola:
    - Amplitude to provide▲ . . . . Shift of 1/8" to 5/16"
    - Ratio of red-pattern shift to green-pattern shift . . . . . 2/3 to 3/2
  - Sawtooth:
    - Amplitude to provide∞ . . Shift of -1/8" to +3/16"
    - Difference between red-pattern shift and green-pattern shift ($Shift_R - Shift_G$) . . . . . -100% to +100%

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	4200 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 with inherent regulation to limit the continuous short-circuit current to 50

▲ The parabola amplitude is determined by the average value of the shifts at the extremities of the respective horizontal and vertical axes of the screen with convergence of the three beams maintained at the center of the screen. An increase in amplitude should move the blue beam toward the top of the screen; the red beam toward the lower left of the screen; and the green beam toward the lower right of the screen.

∞ The sawtooth amplitude is determined by the difference between the shifts at the extremities of the respective horizontal and vertical axes of the screen. Positive amplitude indicates that the shift at the right or bottom of the screen is greater than the shift at the left or top of the screen.

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milliamperes. In addition, to prevent cathode damage with resultant decrease in tube life, an external resistor having a value of 50,000 ohms must be connected between the two bulb terminals and the effective resistance between the grid-No.3 power-supply output capacitor and the grid-No.3 electrode should not be less than 50,000 ohms. These resistances should be capable of withstanding the maximum instantaneous currents and voltages in their respective circuits. It is to be noted that the high voltage must be connected only to the High-Voltage-Supply Terminal--*never directly to the Ultor Terminal*. A resistor of 50,000 ohms must be connected between the Ultor Terminal and the High-Voltage-Supply Terminal.

In equipment utilizing a well-regulated ultor power supply, the *grid-No.3-circuit resistance* should be limited to 7.5 megohms.

Low-Voltage Circuits:

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

When the cathode of each gun is not connected directly to the heater, 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 an instantaneous or 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.

When the cathode is connected directly to the heater, the grid-No.2-to-heater circuit, and the grid-No.1-to-heater circuit should each have an impedance such that their respective power sources in combination will not supply an instantaneous or 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.

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 center 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 the 21CYP22 is designed to be operated at ultor voltages as high as 25 kilovolts (design-center maximum value), shielding of the 21CYP22 for X-ray radiation may be needed to protect against possible injury from prolonged exposure at close range.

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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 the 21CYP22 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 enclosing 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.

REFERENCE-LINE AND NECK-FUNNEL-CONTOUR GAUGE for Type 21CYP22 is the same as that shown for Type 21AXP22-A

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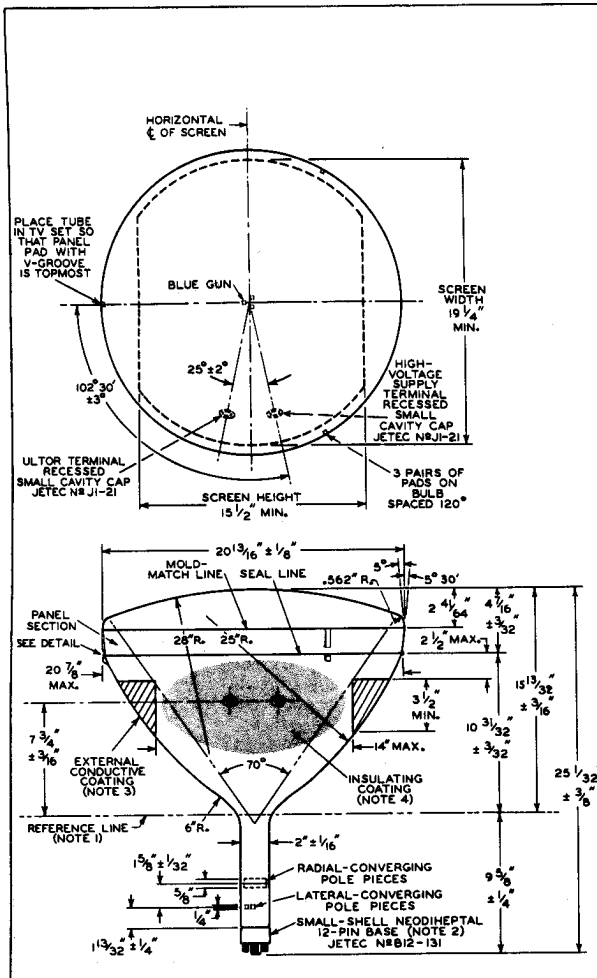

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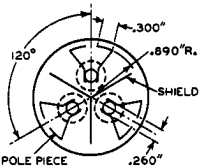
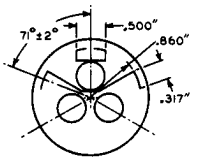
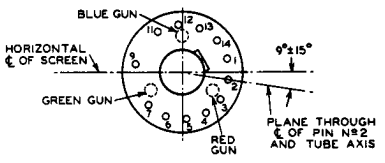


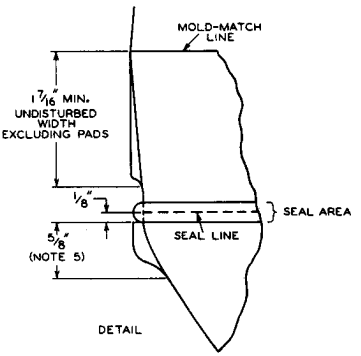
LOCATION OF RADIAL-CONVERGING POLE PIECES VIEWED FROM SCREEN END OF GUNS



LOCATION OF LATERAL-CONVERGING POLE PIECES WITH RESPECT TO GUNS



BASE
BOTTOM VIEW



DETAIL

92CL-9340R1

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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".

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RCA

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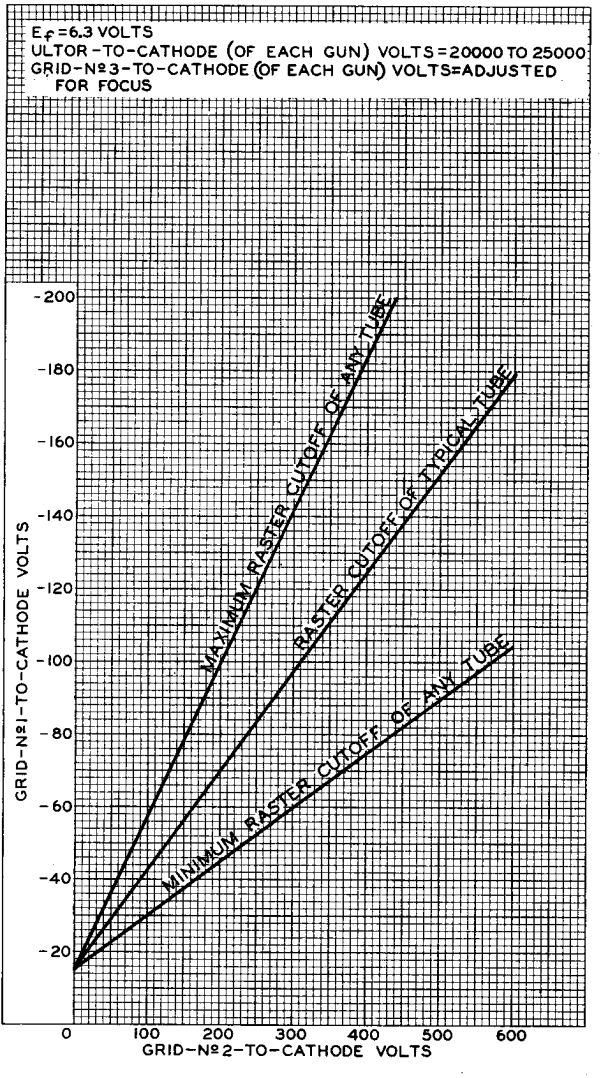
CUTOFF DESIGN CHART



RCA

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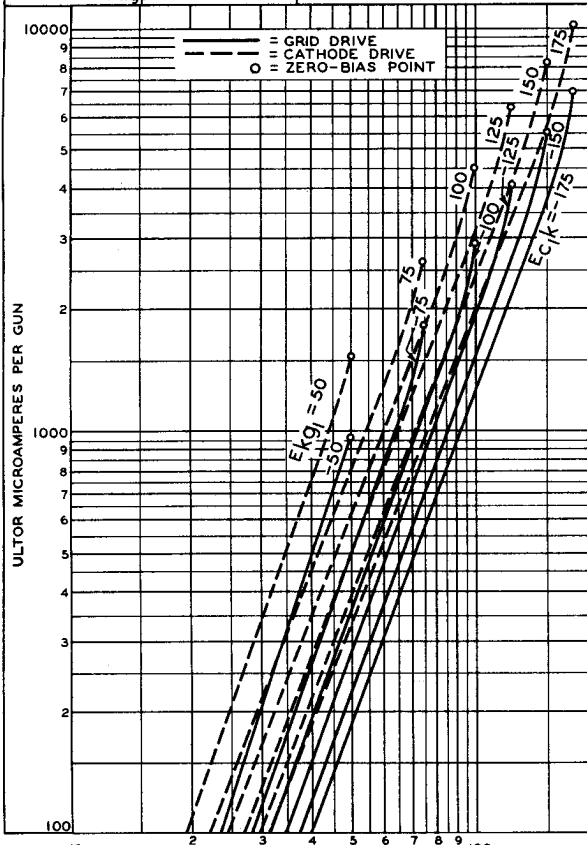
TYPICAL DRIVE CHARACTERISTICS

CATHODE-DRIVE SERVICE	GRID-DRIVE SERVICE
E_f = 6.3 VOLTS	E_f = 6.3 VOLTS
ULTOR-TO-GRID-№1 (OF EACH GUN) VOLTS = 20000 TO 25000	ULTOR-TO-CATHODE (OF EACH GUN) VOLTS = 20000 TO 25000
GRID-№3-TO-GRID-№1 (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS	GRID-№3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
GRID-№2-TO-GRID-№1 VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED CATHODE-TO-GRID-№1 (EACH GUN) VOLTAGE (E_{kg_1})	GRID-№2-TO-CATHODE VOLTS (EACH GUN) = ADJUSTED TO PROVIDE ULTOR-CURRENT CUTOFF FOR DESIRED FIXED GRID-№1-TO-CATHODE (EACH GUN) VOLTAGE (E_{c_1k}).



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TYPICAL LIGHT-OUTPUT CHARACTERISTICS

E_f = 6.3 VOLTS
GRID-№3-TO-CATHODE (OF EACH GUN) VOLTS = ADJUSTED FOR FOCUS
DRIVE OF EACH GUN IS ADJUSTED TO GIVE COMPOSITE ULTOR CURRENT TO PRODUCE 8500° K+27 M.P.C.D. WHITE LIGHT OUTPUT.
PERCENTAGE OF TOTAL ULTOR CURRENT SUPPLIED BY EACH GUN TO PRODUCE 8500° K+27 M.P.C.D. WHITE:

RED GUN:	50 %
BLUE GUN:	19 %
GREEN GUN:	31 %

RASTER SIZE: 19¼" x 14½" CENTERED ON TUBE FACE.
*MEASURED WITHIN 5"-DIAMETER AREA CENTERED ON TUBE FACE.