October 1, 1960

DIRECT VIEW STORAGE TUBE TYPE 7356

Two Identical Write-Erase Guns
Flood Gun
Integral Tube and Shield Assembly
High Speed Selective Erasure

5-1/4" Overall Diameter Including Shield
15-3/4" Overall Length
25 Pin Two-Tier Base
4" Display Diameter

The 7356 is a direct-view storage tube incorporating two identical Write-Erase guns and a Viewing gun system capable of producing a bright, non-flickering, uniform display over a full four inch diameter viewing area. The two electrostatically focused and deflected Write-Erase guns permit independent and simultaneous writing of two signals, or writing with one gun and high speed selective erasure with the other.

Performance characteristics of the tube include a brightness of 2500 foot-lamberts with 10,000 volts applied to the phosphor, good resolution of half-tone displays, and excellent display uniformity. The writing speed of 36,000 inches per second is sufficient to "freeze" high frequency transients, and storage time is long enough to allow adequate examination and recording of the display.

The 7356 is particularly useful for such applications as airborne fire control radar, weather radar, navigational radar, transient studies, data transmission including half-tone storage, telemetering, facsimile, and visual displays requiring steady, narrow-bandwidth transmission over telephone lines.

The 7356 is designed to operate under military environmental conditions. It may be operated unpressurized at high altitudes. The pin connections have been grouped according to operating potentials within a Westinghouse designed Two-Tier 25 Pin Base (JEDEC B25-216) which features unusually long external leakage paths between pin circles. In addition, the base is potted to eliminate internal leakage.

The entire tube is potted within its magnetic shield with a synthetic silicone-rubber material providing protection against mechanical shock, vibration, humidity, and leakage between bulb terminals. The magnetic shield is resistant to salt spray.

The integral tube-and-shield assembly together with the improved base design greatly simplify tube installation procedure.

from JEDEC release #3248, April 24, 1961

ELECTRICAL:

Storage:

Type	Half-Tone or Line
Mode	Control of Transmission
Types of Erasure	High Speed Selective or Overall

Write-Erase Guns: (Each Gun)

Cathode				Coated Unipotential
Heater:	Min.	Bogey	Max.	
Voltage (ac or dc)	5.67	6.3	6.93	Volts
Current at Bogey Voltage	0.50	0.60	0.70	Amperes
Focusing Method				Electrostatic
Deflection Method				Electrostatic
Number of Write-Erase Guns				Two

Flood Gun:

Cathode				Coated Unipotential
Heater:	Min.	Bogey	Max.	
Voltage	5.67	6.3	6.93	Volts
Current at Bogey Voltage	0.50	0.60	0.70	Ampere
Warm-up Time before Applying High Voltages	30	--	--	Seconds

Focus and Deflection. . . Undeflected, Collimated "Flood" Gun

Direct Interelectrode Capacitances:

External Integral Shield Grounded

Write-Erase Gun Cathode to All	7	max.	μμf
Flood Gun Cathode to All	10	max.	μμf
Write-Erase Gun Grid 1 to All	10	max.	μμf
Flood Gun Grid 1 to All	18	max.	μμf
Deflecting Electrode 1 to Deflecting Electrode 2	3	max.	μμf
Deflecting Electrode 3 to Deflecting Electrode 4	2	max.	μμf
Deflecting Electrode 1 to All	8	max.	μμf
Deflecting Electrode 2 to All	8	max.	μμf
Deflecting Electrode 3 to All	8	max.	μμf
Deflecting Electrode 4 to All	8	max.	μμf
Backing Electrode to All	110	max.	μμf

OPTICAL:

Phosphor:

Type	High Visual Efficiency, Aluminized P20
Fluorescence	Yellow-Green
Phosphorescence	Yellow-Green
Persistence	Short
Faceplate	Optical Glass, Ground and Polished Flat

MECHANICAL:

Minimum Useful Viewing Diameter	4.0"
Maximum Overall Length	16"
Maximum Seated Length	14-1/4"
Greatest Shield Diameter	5-1/4" ± 1/16"
Viewing Screen Terminal	Flexible Cable
Caps on Large End of Bulb	
Backing Electrode	Recessed Small Ball (JEDEC J1-22)
Collecting Electrode	Recessed Small Ball (JEDEC J1-22)
Collimating Electrode	Recessed Small Ball (JEDEC J1-22)
Base	25 pin Two-Tier Deci-Quindecimal (JEDEC B25-216)
Mounting Position	Any

MAXIMUM RATINGS:

Absolute Maximum Values

WRITE-ERASE GUNS:

(Reference Voltage is Write-Erase Gun Cathode)

Grid 2 & 4 Voltage♦	3700	max.	Volts
With Respect to Flood Gun Cathode	200	max.	Volts
Grid 3 Voltage (Focus)	3000	max.	Volts
Negative with Respect to Flood Gun Cathode	2600	max.	Volts
Grid 1 Voltage:			
Negative Bias Value	150	max.	Volts
Positive Bias Value	0	max.	Volts
Positive Peak Value	2	max.	Volts
Cathode Voltage Negative with Respect to Flood Gun Cathode	3500	max.	Volts
Voltage Between any Deflection Electrode and Grids 2 & 4:♦			
Positive or Negative Peak Value	500	max.	Volts
Peak Heater-Cathode Voltage:			
Heater Positive or Negative with Respect to Cathode	125	max.	Volts

FLOOD GUN:

(Reference Voltage is View Gun Cathode)

Viewing Screen Voltage	11000	max.	Volts
Grid 5 Voltage (Backing Electrode)	35	max.	Volts
Grid 4 Voltage (Collecting Electrode)	300	max.	Volts
Grid 3 Voltage (Collimating Electrode)	300	max.	Volts
Grid 2 Voltage (Accelerating Electrode)♦	200	max.	Volts
Grid 1 Voltage:			
Negative Bias Value	150	max.	Volts
Positive Bias Value	0	max.	Volts
Peak Heater-Cathode Voltage Heater Positive or Negative with Respect to Cathode	125	max.	Volts

LIMITING CIRCUIT VALUES

Viewing Screen Series Current-Limiting Resistance	1.0	min.	Megohm
Backing Electrode Circuit Resistance	5000	max.	Ohms
Collecting Electrode Unbypassed Series Current-Limiting Resistance	22000	min.	Ohms
Grid 1 Circuit Resistance	1.0	max.	Megohm
Resistance in Any Deflecting Electrode Circuit⊕	0.2	max.	Megohm

ENVIRONMENTAL LIMITS

Atmospheric Pressure	60	max.	P.S.I.
Altitude (Non-pressurized)	60,000	max.	Feet
Temperature:			
Operating	0 to 50 °C		
Non-Operating	-55 to 100 °C		
Relative Humidity (Non-Operating)	95 Percent		

Vibration . . . . Sinusoidal Vibration from 10 to 50 cycles per second with a total excursion of 0.015 inches and from 50 to 500 cycles per second with 2 g acceleration will not damage the tube.

TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS

Note: Damage to the 7356 may occur if the Write-Erase-Gun beam is turned on before the Flood-Gun-beam current has reached normal operating value or if the Flood-Gun beam is turned off before the Write-Erase-Gun-beam.

Reference Point for DC Voltages is Ground

WRITE-ERASE-GUNS:

Grids 2 & 4 Voltage♠	50 to 125	Volts
Grid 3 Voltage (Focus):★		
During Writing Operation	-1435 to -1375	Volts
During Selective Erasure	-3150 to -3050	Volts
Grid 1 Voltage to Write-Erase Gun Cathode	0 to -100	Volts
Cathode Voltage:★		
During Writing Operation	-1600	Volts
During Selective Erasure	-3500	Volts
Grids 2 & 4 Current♠	100	µampere
Grid 3 Current (per gun)	-10 to 5	µampere
Cathode Current	See Gun Transfer Characteristic	
Deflection Sensitivity:♦		
Deflecting Electrodes 1 and 2	32 to 40 V dc/In./KV	
Deflecting Electrodes 3 and 4	32 to 40 V dc/In./KV	
Focused Beam Position †	0.5 Inch	

FLOOD GUN:	Range	Typical	
Viewing Screen Voltage	8000 to 11000	10000	Volts
Grid 5 Voltage (Backing Electrode)	-35 to +35	10	Volts
Grid 4 Voltage (Collecting Electrode)	175 to 300	200	Volts
Grid 3 Voltage (Collimating Electrode)	5 to 150	75	Volts
Grid 2 Voltage♠	50 to 125	100	Volts
Grid 1 Voltage	0 to -50	0	Volts
Cathode			Grounded
Viewing Screen Current		250	µamperes
Grid 5 Current (Backing Electrode)		2	µamperes
Grid 4 Current (Collecting Electrode)		1.5	Ma.
Grid 3 Current (Collimating Electrode)		200	µamperes
Cathode Current		2	Ma.

♠ Grids 2 & 4 of both Write-Erase Guns are internally connected together and to Grid 2 of the View Gun.

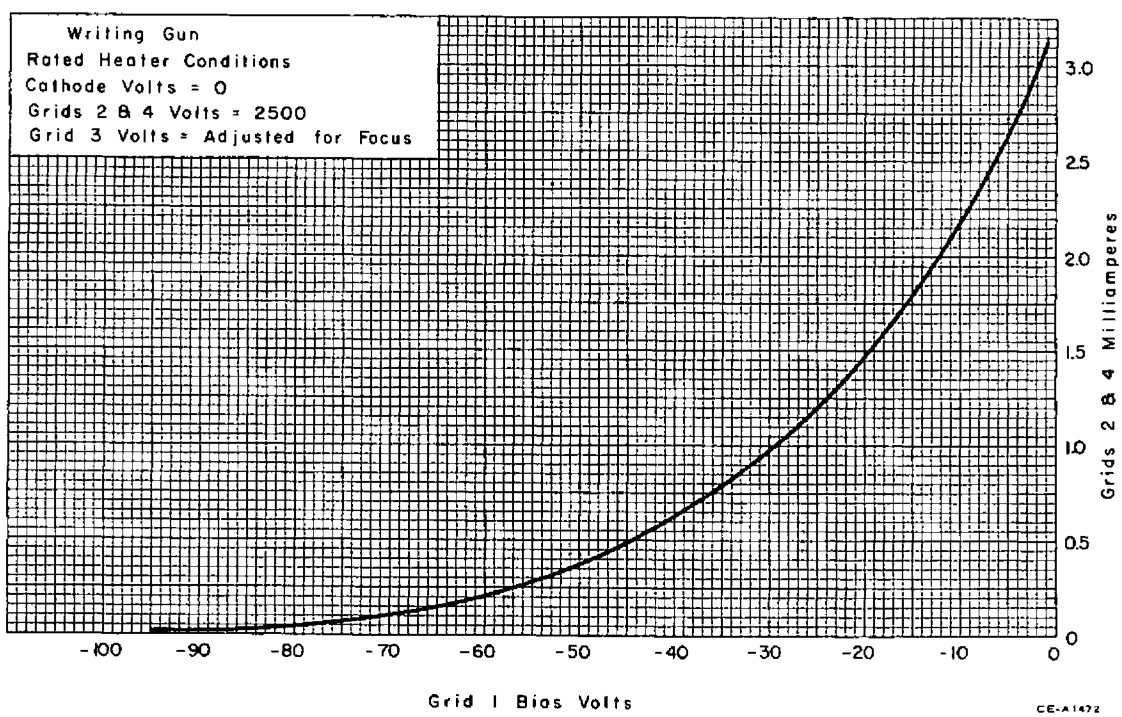
♦ Deflection Sensitivity is in Volts dc/In./KV of Accelerating Potential.

† With all deflecting electrodes tied to Grids 2 & 4, and erasure at a convenient value the undeflected, focused spots will fall within a circle of 0.5 inch radius, centered on the tube faceplate.

⊕ Approximately equal resistances should be used in each deflecting electrode circuit.

★ The accelerating voltage of the Write-Erase Guns determines their mode of operation. The second crossover potential of a typical tube is in the range from 2000 to 3000 volts. Accelerating voltages exceeding this point result in selective erasure. Writing occurs with voltages lower than second crossover. Optimum-focus voltage will change with changes in the accelerating voltage.

AVERAGE WRITING GUN ANODE TRANSFER CHARACTERISTIC



PERFORMANCE DATA

Viewing Time	5	Seconds
Erasing Time (View Gun Erasure)	50	Milliseconds
Erasing Speed (Selective Erasure)	20,000	Inches/Second
Display Uniformity (Δe_p min.)	1	Volt
Writing Speed	36,000	Inches/Second
Half Tones	3	
Brightness (Screen Voltage = 10 KV)	2500	Ft-Lamberts
Contrast Ratio	5	
Resolution	50	Lines/Inch
Grid Drive	30	Volts

Methods of Measuring Tube Performance

Viewing Time: Viewing duration is the time during which the visual output of a storage tube increases from exactly visual extinction to 10% of saturated brightness without the application of a writing signal or erase pulses. The tube shall be primed and then erased to exactly visual extinction. The erase pulses are removed and the screen allowed to increase in brightness. The time interval required for the brightness level at the center of the screen to increase to 10% of saturated brightness is the viewing duration.

Erasing Time: The storage surface is primed. Erasure is produced by a positive rectangular pulse applied to the backing electrode. The amplitude of this pulse is set to one volt above backing electrode cutoff and the pulse width necessary to erase from saturated brightness to 10% of saturation brightness is the erasing time.

Display Uniformity (Δe_p min.): The difference between the amplitude of an erase pulse required to brighten any area of an unwritten screen, and the amplitude of an erase pulse required to evenly illuminate the screen is described as the display uniformity, (Δe_p min.). The erase pulses used for this measurement are positive rectangular pulses adjusted from 2 to 10 volts peak to peak to produce complete erasure in 50 milliseconds.

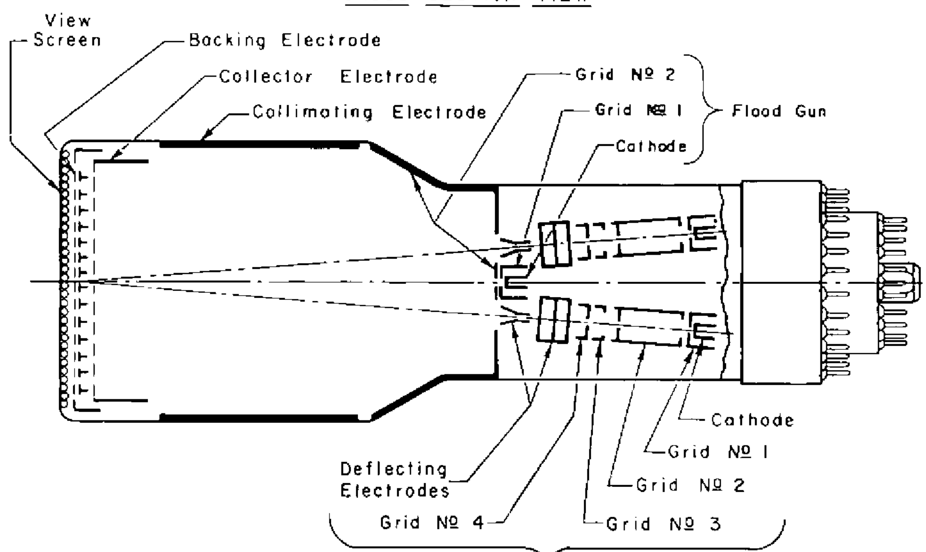
Writing Speed (Cathode Current): A raster is applied having frequencies and trace length necessary to produce a scanning speed of 36,000 inches per second. The focus electrode is adjusted for best focus at the center of the raster. The tube is erased to cutoff and a single raster is written by applying a rectangular pulse of adjustable amplitude to Grid 1 of the writing gun. The last step is repeated moving the lines of the raster progressively closer together until the individual lines in the written raster cannot be discerned visually. As the lines approach the merging condition, the control grid pulse amplitude is adjusted to give a written raster of 2000 ft-L. When this brightness is achieved and the lines cannot be discerned visually, the condition of the visually limited contrast ratio exists and it is under this condition that the cathode current is measured.

Contrast Ratio: A trace is written to saturation brightness while continuously writing and erasing. Using positive rectangular erase pulses variable from 2 to 10 volts peak-to-peak, the persistence (time required for a written area to be reduced to 10% of saturated brightness) is adjusted to 2 seconds. The ratio of brightnesses in the written and unwritten areas is defined as the contrast ratio. This measurement is made with a maximum ambient brightness of 10 foot-lamberts.

Resolution: A 60 cps sawtooth voltage is applied between deflecting electrodes D_3D_4 and a 2100 to 6300 cps sawtooth voltage is applied between deflecting electrodes D_1 and D_2 giving a raster of approximately 40 lines. Blanking is used to eliminate trace return lines. Trace length shall be adjusted to 3.5 inches. Raster is expanded and number of lines determined. Focus electrode is adjusted for best focus at the center of the raster. Backing electrode is erased to cutoff and G_1, writing gun, is pulsed to write as single raster. Last step is repeated moving the lines progressively closer together until the individual lines in the written raster cannot be discerned visually. As the lines approach the merging condition, the grid pulse amplitude shall be adjusted to give brightness of 1000 ft-L. When the specified brightness is achieved and the lines cannot be discerned visually, the condition for visually limited contrast ratio exists, and the resolution measured at this condition is the limiting resolution. The resolution in lines per inch is the number of horizontal lines counted when the raster was expanded divided by the height of the compressed raster.

Grid Drive: This is the drive required for writing to 90% of saturated brightness with a writing speed of 36,000 inches per second in 1 scan. Note the writing gun drive characteristic. In the useful region, writing speed is proportional to writing current.

CROSS SECTION VIEW



Principles of Operation

The WL-7356 contains, in addition to a phosphor screen and Write-Erase Guns similar to those of conventional cathode-ray tubes, a storage surface, a secondary-electron collector and a Flood Gun with an electron collimating system, all of which can be seen in Cross Section View.

The storage surface is a dielectric material deposited on a fine metallic mesh called the backing electrode. Initially this surface is charged to a uniform potential near the viewing gun cathode voltage. Either or both of the writing guns scan the storage surface and create a charge pattern by secondary emission from the dielectric material. Because this dielectric material is an excellent insulator, the charge pattern does not leak away, but remains for a period of time, as long as a week under non-operating conditions. The secondary electrons liberated from the storage surface are attracted to a collecting mesh.

The reading or flood gun does not scan the screen, but produces a wide-angle beam of electrons which "floods" the entire storage mesh and penetrates through its holes to bombard the phosphor screen. The charge pattern written upon the storage surface controls the viewing gun beam in a manner similar to the control of plate current by the signal applied to the control grid of a triode. In this way the signals applied to the Write-Erase Guns are converted to patterns on the storage surface, and these produce corresponding patterns on the phosphor screen. The penetration of electrons through the storage mesh is proportional to the charge written upon it, hence, intermediate shades of gray or half-tones may be reproduced. Because of the high current density of the flood beam, the high accelerating potential on the screen, and simultaneous bombardment of all portions of the viewing screen, the display is extremely bright.

The Flood Section

The flood section consists of the following elements: a cathode, control grid, accelerating grid, collimating electrode, collecting electrode, backing electrode, and viewing screen.

The cathode is oxide coated and indirectly heated. Grids 1 & 2 are conventional aperture grids and the collimating electrode (Grid 3) is a conductive coating applied to the bulb wall. The collecting electrode (Grid 4) is a fine metallic mesh mounted slightly toward the cathode from the backing electrode.

The backing electrode (Grid 5) is an extremely fine metallic mesh upon which the dielectric or storage material is deposited. This material is on the cathode side of the mesh as shown in Cross Section View.

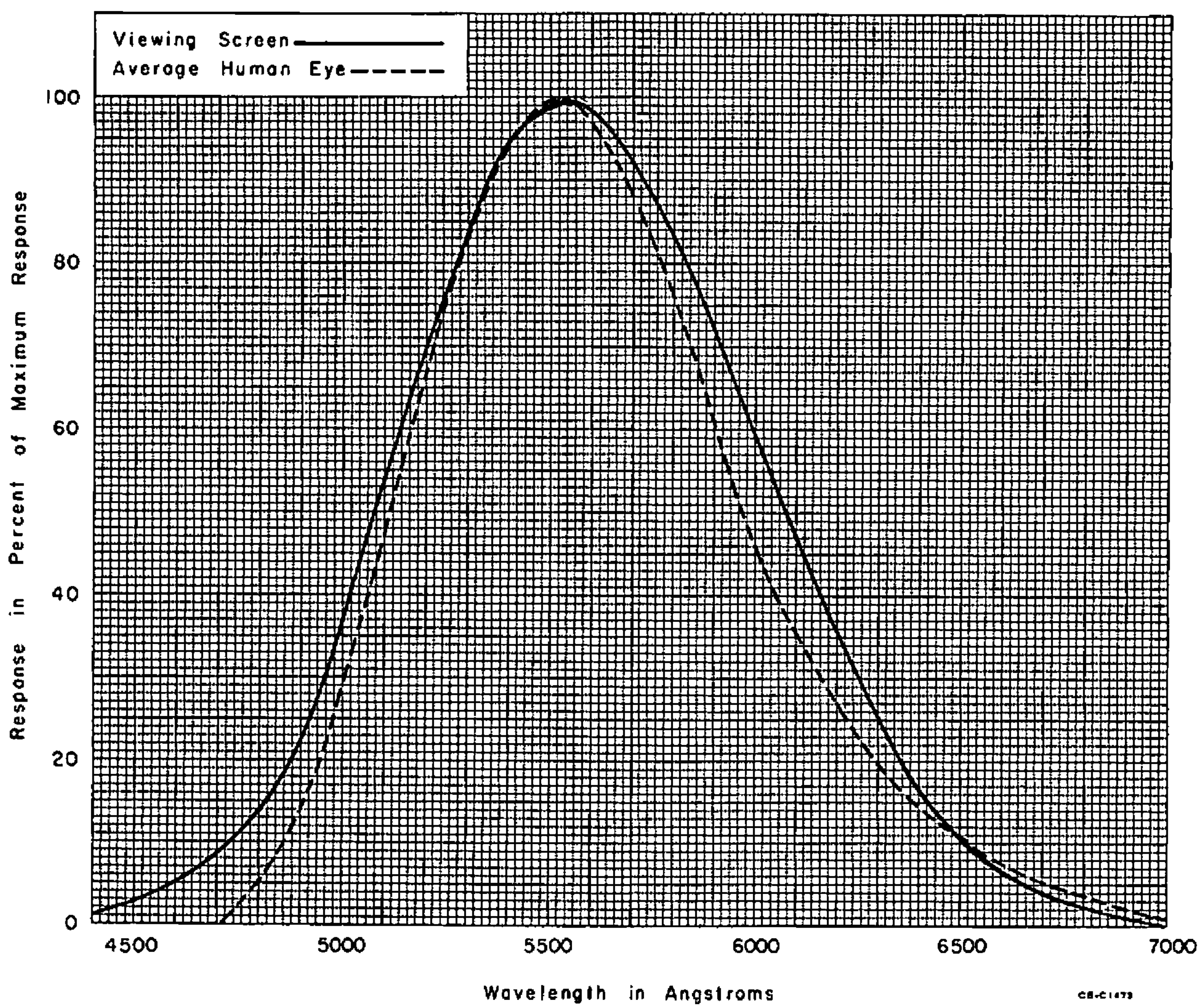
The viewing screen is an aluminized P20 phosphor having short persistence and high visual efficiency. The Spectral Response Curves show that the peak radiation from this phosphor coincides with the peak sensitivity of the human eye.

The Viewing Operation

The Flood Gun produces a wide angle, low energy, high density electron stream which continuously floods the storage surface. The electrons are highly divergent as they emerge from the aperture of the accelerating electrode (Grid 2), but by proper adjustment of Grids 2, 3, and 4, the electron stream is collimated to provide uniform, normal flooding of the backing electrode. It is necessary that all of the electrons of the viewing beam approach the storage surface in paths normal to the backing electrode in order that they will have equal energy components in this direction. Only under this operating condition will equal charges at various points on the storage surface have equal control of the flood beam. Thus, collimation is necessary for uniformity of display.

The functions of the collecting electrode are several. In addition to its effect upon collimation, it serves to accelerate electrons in the beam; it repels positive ions produced by collisions of electrons with gas

SPECTRAL RESPONSE CHARACTERISTICS



molecules in the region between cathode and collector, thus preventing destruction of the stored pattern by ions; it collects secondary electrons produced when the writing beams impinge upon the storage surface; and it collects viewing beam electrons turned back near the storage surface when its potential is negative.

When the viewing section voltages are applied, some of the flood beam electrons are intercepted by the collector mesh, and others are decelerated to near zero velocity at the storage grid. Their velocity is so low at this point that fewer secondary electrons are emitted than strike the storage surface. Thus electrons accumulate until the potential is approximately the same as the Flood Gun cathode, or zero potential.

At this time when the collimated viewing beam approaches the storage mesh, electrons cannot land upon the storage mesh, but will either return to the more positive collecting electrode or penetrate through the holes of the backing electrode to be accelerated to the phosphor viewing screen producing a bright display. The brightness of the screen under this condition is designated as "saturated brightness". A condition of equilibrium exists, and the storage surface remains charged to approximately zero potential. If the storage surface is made positive by a writing gun or other means, the surface will be immediately restored to zero potential by the viewing gun beam. If, now the backing electrode is suddenly made more positive by several volts, the storage surface will also become positive momentarily because of the very close capacitive coupling between the backing electrode and storage surface, but again the viewing beam will restore the storage surface to zero potential. If next the backing electrode is returned to its original value, the storage surface potential will drop by an equal amount to a negative potential and will retain this charge since viewing beam electrons cannot land. If this negative voltage is great enough, it will cut the viewing beam electrons preventing them from reaching the phosphor and resulting in a dark screen.

The Write-Erase Guns are used to produce a charge pattern upon the storage surface varying in potential from the storage surface cutoff value to zero potential. Since these potentials are at or below viewing gun cathode potential, no viewing beam electrons may land upon the storage surface to destroy the written pattern and it will remain until erased or degraded by positive ions produced by collision of electrons in the viewing beam with residual traces of gas between the viewing screen and collecting electrode.

Without altering its own form the stored charge pattern in thus able to control the electrons impinging upon the screen, producing a bright stored image with full tone range from visual extinction to saturated brightness.

The Write-Erase Guns

The two Write-Erase Guns are of identical design and are similar to those found in electrostatically focused and deflected oscilloscope tubes. They are capable of forming a well defined beam having high current-density resulting in excellent resolution and high writing speed.

Both guns are shown in Cross Section View and each consists of an oxide coated, indirectly heated cathode, a control electrode (Grid 1), two accelerating electrodes (Grids 2 & 4) which are internally connected, a focusing electrode (Grid 3); and horizontal and vertical deflection plates.

The Writing Operation

The Write-Erase Guns are generally operated with the cathode at -2400 volts with respect to the Flood Gun cathode. At this potential the electrons from the writing beam have sufficient energy to cause the secondary-emission ratio at the storage surface to be greater than unity. Thus, since more electrons are leaving the storage surface than are arriving, the surface assumes a less-negative potential whenever the beam strikes. Since the secondaries are attracted to the positive collecting electrode it would appear that the writing beam could charge the storage surface to collecting-electrode potential, but in practice the viewing beam lands upon the surface whenever it tends to become positive and returns it to approximately viewing-gun cathode potential.

The writing-beam electrons striking the storage surface can then result in potentials varying from storage-grid-cutoff voltage to approximately zero potential. The storage-surface potential is controlled over this range by the amplitude and duration of the writing-beam current which is determined by the signal applied to the control grid.

As was described previously, the potential at any point on the storage surface determines the number of viewing-beam electrons passing through the storage-mesh holes in that immediate vicinity. When any point is sufficiently positive to allow passage of electrons, they will be accelerated by the high viewing- screen potential and strike the phosphor directly opposite that point. The result is a bright spot on the viewing screen having a size only slightly larger than that of the corresponding point where the writing beam struck the storage surface. The brightness of this spot is directly proportional to the density and velocity of the electrons landing on the element, the density being determined by the elemental changes of the storage surface, and the velocity by the potential of the viewing screen.

The image brightness may be varied by adjusting the screen potential, but because the screen is aluminized, the light output decreases rapidly below 5000 volts. Operation below this value is not recommended.

The Erasing Operations

Flood Gun Erasure (Overall)

A method of preparing the storage surface for the writing operation has already been described under The Viewing Operation. This technique, which involves charging the storage surface to a negative value by the momentary application of a positive potential to the backing electrode, is actually an erasing method known as static erasure.

Static Erasure

During the application of the positive potential to the backing electrode, viewing-beam electrons land on the storage surface and drive it uniformly to cathode potential thus erasing any stored information.

A disadvantage of this method is that during erasure and subsequent re-writing no information or only incomplete information is displayed. Also the entire screen is illuminated to the saturation-brightness level or higher during erasure.

Dynamic Erasure

In most applications it is desirable to present a display which gradually decays after a given interval of time. This type of operation may be obtained by applying a continuous series of positive pulses to the backing electrode at a rate sufficiently fast to prevent visible phosphor flicker. The technique of applying a series of pulses to the backing electrode is known as dynamic erasure.

The amount of charge erased during each erase pulse depends upon pulse duration, shape and amplitude. These factors together with erasing-pulse repetition frequency determine the rate at which the observed display decays.

If the erasing pulses are smaller in amplitude than the viewing-beam cutoff voltage, erasure will not be complete, whereas if the pulses are greater than cutoff they will eventually drive the storage surface below cutoff or "blacker than black". Therefore it is not advisable to use erase pulse amplitude as a means of adjusting erasing time.

When a rectangular erasing pulse is used, all portions of the storage surface will simultaneously become positive with respect to the viewing-gun cathode and viewing-beam electrons will be deposited at nearly the same rate over the entire surface regardless of initial charge. Thus charges representing the brighter elements will remain after other elements have been erased and the brighter areas will be visible for a longer period than the darker areas.

If a positive-going sawtooth erasing pulse is used, the least-negative storage elements will reach cathode potential before the remaining elements, thus allowing viewing-beam electrons to land on elements representing brighter areas for a longer period than on those representing darker areas. With this type of proportional erasure, half-tones will persist as long as bright areas.

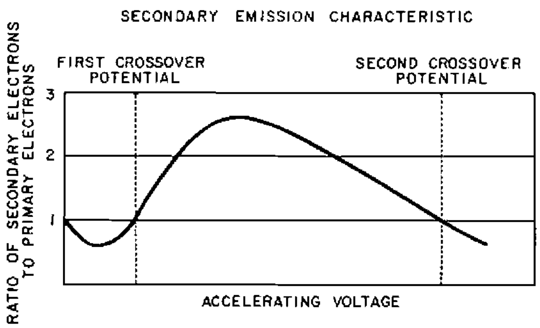
For applications involving half-tone display, the rectangular erase pulses should be adjusted in amplitude so that the storage surface is charged to exactly cutoff potential by the erasing operation.

For applications such as radar, where noise must be suppressed, a more positive erase pulse may be used to drive the storage surface several volts below cutoff. The writing beam must then scan the surface several times to bring the written elements above cutoff.

If possible the erase-pulse amplitude should be adjusted so that the noise component of the writing gun signal is just sufficient to bring the storage surface to cutoff. The signal above this level will than allow viewing-beam electrons to produce a display representing that signal without any noise background.

Write-Erase Gun-Erasure (High Speed Selective)

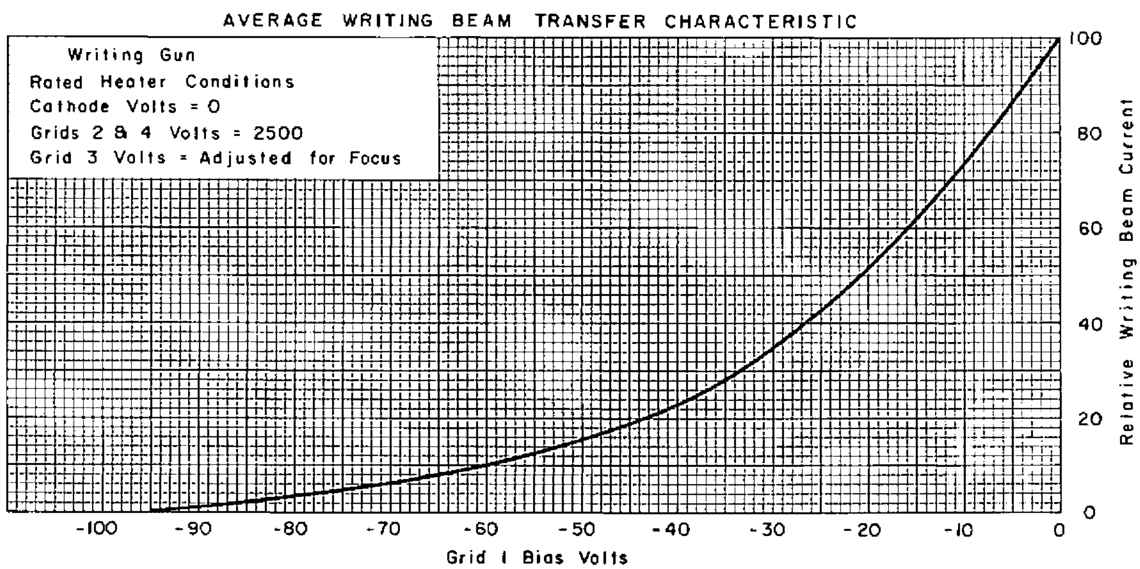
It is often advantageous to erase a specific part of the stored signal without erasing other parts. As the total electron-volt energy of the beam increases from zero volts, the secondary-emission ratio first decreases then increases to a maximum value, substantially greater than unity. This maximum usually



occurs at 1200 volts for the 7356. In the interest of better resolution, operation of the writing gun at 1600 volts is recommended. As the voltage of the electron beam increases further, the secondary emission ratio goes below unity, and it becomes possible to use the beam for selective erasure. With the 7356 selective erasure of reasonable speed usually occurs at a voltage of the order of 2400 volts. This high velocity erase mode has many advantages. The erase beam has high resolution resulting in much greater selectivity. The erase beam is also capable of much greater density. The greater beam density results in a faster erasing speed, and also results in substantially less interaction between guns used simultaneously in the write or erase modes.

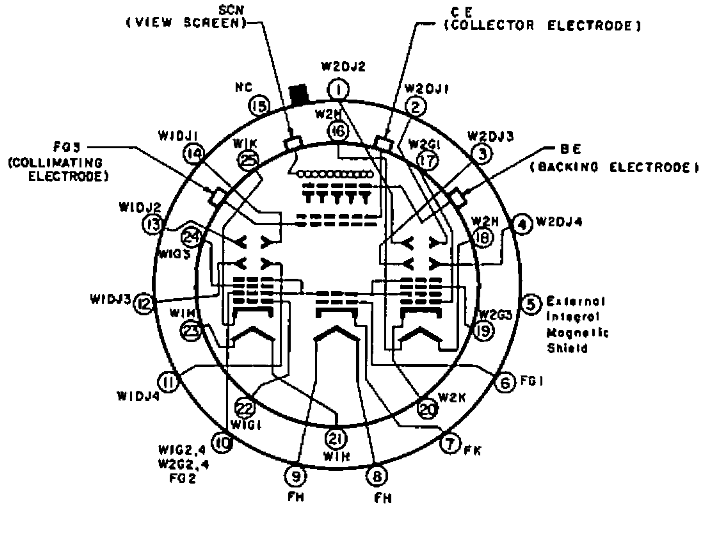
A serious drawback of a low-velocity-erase system is the effect of the collimating optics of the flood gun on the erase beam. Since the erase beam is of the same order of velocity as the flood beam in this system, the collimating optics of the flood gun converge not only the flood beam, but also the erase beam. The erase beam tends to be deflected toward the center of the tube by the collimating lenses. Consequently, a low velocity erase beam is very difficult to control and has serious non-uniformities in deflection linearity.

Since the 7356 utilizes a selective erase system with a high-velocity beam, it is essentially free from distortions of the type described above. The 7356 may be employed as a direct view storage tube with two separately focused and deflected writing guns. Simply by rasing the potential of one of the writing guns, the tube becomes a direct view storage tube with high selectivity and speed of erasure.



INDEX of TERMINALS

Pin No.	Gun	Element
1	Write-Erase (2)	Deflection Electrode 2
2	Write-Erase (2)	Deflection Electrode 1
3	Write-Erase (2)	Deflection Electrode 3
4	Write-Erase (2)	Deflection Electrode 4
5	External Integral Magnetic Shield	
6	Flood	Grid 1
7	Flood	Cathode
8	Flood	Heater
9	Flood	Heater
10	Write-Erase (1 & 2)	Grids 2 & 4
	Flood	Grid 2
11	Write-Erase (1)	Deflection Electrode 4
12	Write-Erase (1)	Deflection Electrode 3
13	Write-Erase (1)	Deflection Electrode 2
14	Write-Erase (1)	Deflection Electrode 1
15	No Connection (Do NOT Use)	
16	Write-Erase (2)	Heater
17	Write-Erase (2)	Grid 1
18	Write-Erase (2)	Heater
19	Write-Erase (2)	Grid 3
20	Write-Erase (2)	Cathode
21	Write-Erase (1)	Heater
22	Write-Erase (1)	Grid 1
23	Write-Erase (1)	Heater
24	Write-Erase (1)	Grid 3
25	Write-Erase (1)	Cathode



BOTTOM VIEW

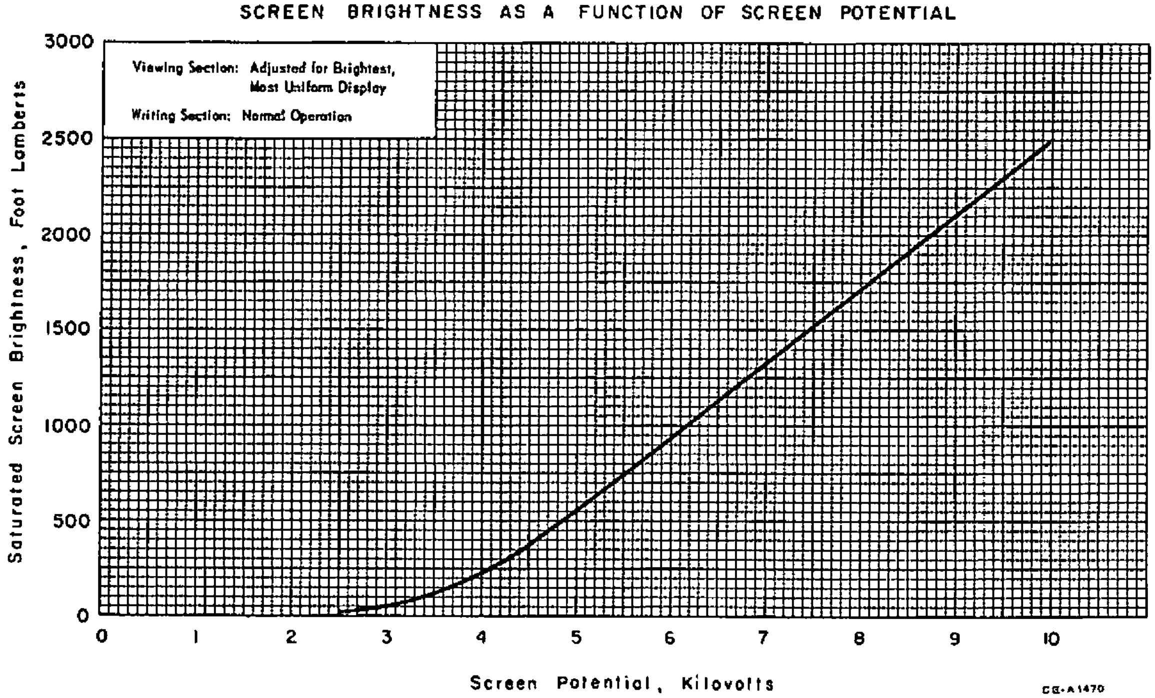
CE-41389,R2

BULB CAPS

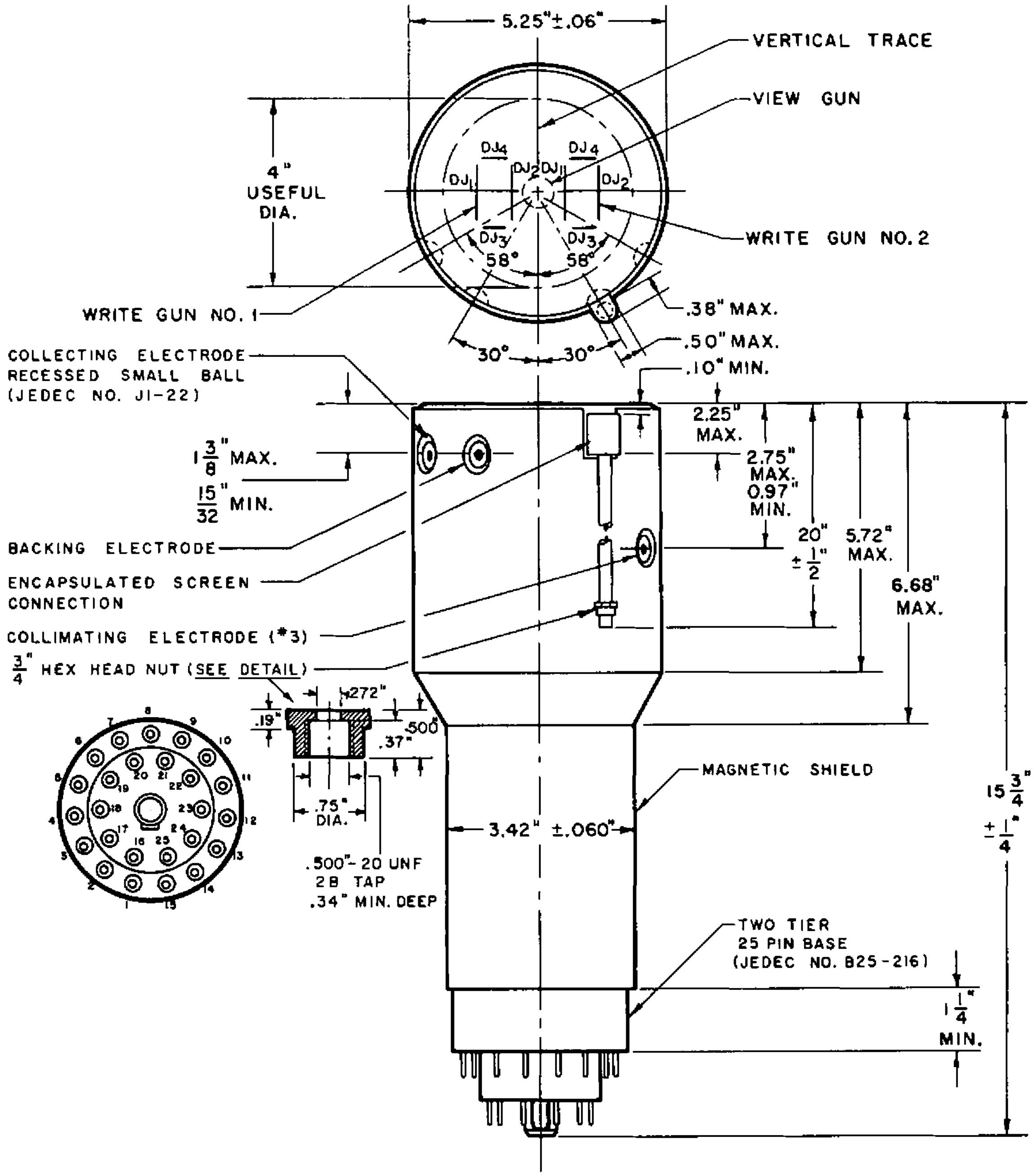
Flood Grid 3 (Collimating Electrode)
Collection Electrode
Backing Electrode
View Screen

Note: Write-Erase guns 1 & 2 are identical. Either may be used for writing or selective erasure.

SCREEN BRIGHTNESS AS A FUNCTION OF SCREEN POTENTIAL



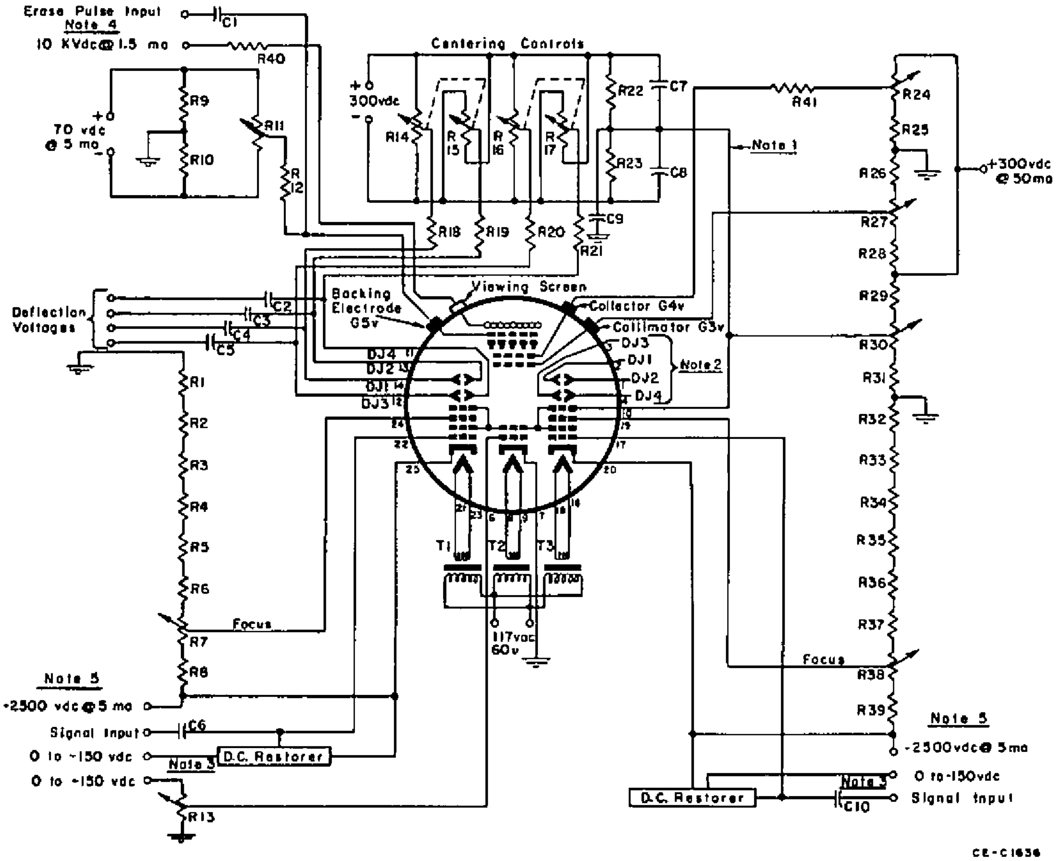
OUTLINE DRAWING



NOTES:

1. CENTERLINE OF BULB AXIS TO BE NOT MORE THAN 3° FROM A PERPENDICULAR ERECTED AT CENTER OF FACEPLATE.
2. FACEPLATE TO BE EVEN WITH SHIELD EDGE OR EXTEND BEYOND SHIELD BY LESS THAN 1/16".

CE-C1483



Note 1: The mean deflection potential is referred to the writing gun final anode potential to prevent astigmatism.
Note 2: Centering and deflection circuitry for Writing Gun 2 is similar to that shown for Writing Gun 1.
Note 3: Voltages are with respect to each writing gun cathode. Entire supply must be insulated from ground for 4000 volts.
Note 4: Erase Pulse Characteristics, Amplitude: 0 to 10 volts peak-to-peak, Width: 2 to 10 microseconds, Frequency: 0 to 1000 pulses per second
Note 5: Power supply requirement for gun to be used for selective erasure is –3000 volts.

C_1: 0.1 μf, 200 volts
C_2, C_3, C_4, C_5: Value depends on deflection-voltage frequency and waveform
C_6, C_{10}: Value depends on signal-voltage frequency and waveform, 4000 volts
C_7, C_8: 0.05 μf, 600 volts
C_9: 0.5 μf, 600 volts
R_1, R_{32}: 91,000 ohms, 1 watt
R_2, R_{25}, R_{29}, R_{33}: 100,000 ohms, 1 watt
R_3, R_4, R_5, R_6, R_{34}, R_{35}, R_{36}, R_{37}: 470,000 ohms, 2 watts
R_7: Write Gun 1 Focus Control, 250,000-ohm potentiometer, 2 watts
R_8, R_{39}: 180,000 ohm, 1 watt
R_9, R_{10}, R_{22}, R_{23}: 1 megohm, 0.5 watt
R_{11}: Backing Electrode Control 100,000-ohm potentiometer, 2 watts
R_{12}: 5,000 ohm, 1 watt
R_{13}: View Gun Grid 1 Control, 250,000-ohm potentiometer 2 watts
R_{14}, R_{15}: Write Gun 1 DJ_1 & DJ_2 Centering Controls Dual 1 megohm potentiometers, 2 watts
R_{16}, R_{17}: Write Gun 1 DJ_3 & DJ_4 Centering Controls Dual 1 megohm potentiometers, 2 watts
R_{18}, R_{19}, R_{20}, R_{21}: 100,000 ohm, 0.5 watt
R_{24}: Collector Control, 200,000-ohm potentiometer, 2 watts
R_{26}, R_{28}, R_{31}: 51,000 ohm, 1 watt
R_{27}: Collimator Control, 200,000-ohm potentiometer, 2 watts
R_{30}: Accelerating Anode Control, 150,000 ohm potenti- 2 watts
R_{38}: Write Gun 2 Focus Control, 250,000-ohm potentiometer, 2 watts
R_{40}: 1 megohm, 5 watts
R_{41}: 22,000 ohm, 1 watt
T_1, T_3: Filament Transformer Primary 117 volts, Secondary 6.3 volts @ 1 ampere Insulated for 4000 volts
T_2: Filament Transformer Primary 117 volts, Secondary 6.3 volts @ 1 ampere.