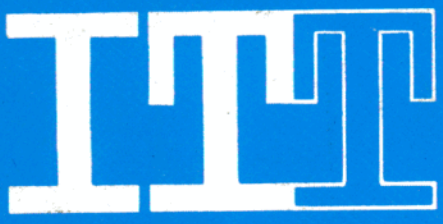

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

IATRON TUBES - CONDENSED LISTING

Type	Nominal Diameter In.	Write Gun Data			Phosphor Voltage	Light Output Ft. Lamberts
		Location	Deflection	Voltage		
7172	2.5	Coaxial	ES	-450	6.0 KV	5000
7173	4	Off Set	EM	-450	7.0 KV	2800
7174	4	Off Set	EM	-450	15.0 KV	15000
7423	5	Off Set	ES	-750	8.5 KV	4000
D-3001 FW202	5	Off Set	ES	-750	8.5 KV	2000
FW-204	5	Coaxial	EM	-2500	10.0 KV	2500
FW-208	7.5	Off Set	EM	-2500	10.0 KV	1250
FW-211	2.5	Coaxial	ES	-900	8.5 KV	4000
FW-212	5	Coaxial	ES	-1500	10.0 KV	2500
FW-223	5	Coaxial	EM	-1000	10.0 KV	2500
FW-227 * FW231 FW232	4	Off Set	ES	-1000	4.0 KV	200
FW-235	4	Off Set	ES	-600	8.5 KV	2000

EM - Electromagnetic

ES - Electrostatic

* - Two Write Guns; P11 Phosphor

OPERATING PRINCIPLES OF IATRON* STORAGE TUBES

The Iatron Storage Tube is a cathode ray device which produces a bright visual display for direct viewing of electrically stored information. The tube consists of a CRT type writing gun for the electrical signal input, an insulator mesh for storage of the writing beam charge, a flooding gun to illuminate the storage mesh, and an aluminized phosphor viewing screen for visual output. The large undeflected flood beam continuously excites the phosphor after passing through the insulator mesh. The insulator mesh acts as a grid and modulates in cross section, the flooding beam. This modulation is in accordance with the charge placed on the insulator mesh by the writing beam. To erase stored information the metallic backing mesh which supports the insulator is pulsed, and by capacitive action the charged areas are erased. The rate of erasing, or persistance, can be controlled by adjusting the frequency, width, and amplitude of the erase pulses.

Viewing time in the range of milliseconds to several minutes may be obtained.

Electrode Functions

There are three basic sections in an Iatron tube; these are the writing, flooding, and imaging sections. The functions of the backing electrode and viewing screen have been previously discussed and henceforth will be considered as part of the flooding section.

The writing section contains only the writing gun, which is of a type commonly used in cathode ray tubes and is operated in the same fashion. Complete operating data is given under the Operating Values and Typical Characteristics Sections for the particular tube type.

In the flooding section, a special diode gun produces a high current divergent beam. Conductive coatings on the inside of the glass bulb serve as anodes, whose purpose is to collimate the flooding beam. The flood gun anodes and the collector mesh all affect collimation but only the voltages on two or three anodes need be adjustable to achieve optimum collimation, when the other electrodes are operated at the specified operating voltages.

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Flooding Beam Collimation

The tube must be operated in a magnetic shield to prevent deflection of the flood beam by magnetic field. Failure to provide adequate shielding will cause non-uniform light output across the tube face.

To collimate the flood beam, apply typical operating voltages as specified under Operating Values and Typical Performance Characteristics. Bias the writing gun to cutoff and turn off the erase pulses. Allow the tube to ion write to full brightness, (this may take several minutes), then adjust the collimating anode voltages so that the flood beam produces uniform light output over the entire screen.

Do not permit the tube to operate in this maximum brightness condition any longer than necessary to make the collimation adjustments. Operating at full brightness for periods up to 5 minutes is permissible for making the collimation adjustments but operation for prolonged periods at this high brightness will result in damage to the tube. Apply the erase pulses to the tube to reduce light output.

Flooding

As its name implies, the flood gun simultaneously floods the entire storage surface with a low velocity high current electron beam. The beam is not deflected and is of uniform current density in cross section. As the beam passes through the meshes of the storage surface, the individual rays of the beam defined by the meshes are modulated by the potentials stored on the surface surrounding each mesh opening.

The value of the most positive potential stored on the storage surface is negative with respect to the flooding gun cathode. Consequently, flooding current cannot strike the surface but can penetrate the openings in the meshes if the potential level there is as high or higher than the cathode voltage. The cathode is normally operated at zero voltage and the backing electrode at +10 volts. The combined effect of the backing electrode and the storage surface voltages is to establish a potential level greater than zero in the mesh openings when the storage surface voltage is more positive than approximately -4 volts. Within the control range of -4 to 0 volts, flood current penetrates the mesh openings in proportion to the storage surface potential, continues on to strike the phosphor, and produces visible light output. As noted above, flooding beam cutoff occurs at a storage surface potential of approximately -4 volts and, as will be explained, zero voltage corresponds to maximum light output.

Writing

The writing gun produces a low current high density electron beam, which is either electrostatically or magnetically focused and deflected. The writing spot is modulated and deflected in the usual manner for cathode ray tubes. Before striking the phosphor the writing beam passes in sequence through two fine mesh metal screens, the collector and the backing electrode, which are mounted close behind the phosphor. The two mesh assemblies intercept about one-half of the electrons passing through them.

The backing electrode, located immediately behing the phosphor, derives its name from its primary purpose in the tube, which is to support the storage (insulator) surface. This storage surface consists of a thin layer of insulator material coated on one side of the mesh, the side facing the electron guns.

The portion of the writing beam, which is intercepted by the storage surface causes secondary electron emission, and the collector mesh, by virtue of its proximity to the storage surface, assures uniform collection of the secondary electrons. Since the secondary emission ratio is greater than unity for primary electrons with the velocity of the writing beam electrons the net result is that a net positive charge is stored on the insulator mesh wherever the writing beam impinges upon it.

Wherever charges are stored during writing, the potential of the storage surface is shifted in the positive direction according to the relationship $dv=dq/C$. The voltage shift, dv, or the capacity, C, of the elemented area encompassed on the storage surface by the writing spot is proportioned to the stored writing charge, dq. In this way a potential distribution, corresponding to the beam modulating voltage and position with respect to the unwritten areas is established on the areas of the storage surface, which are written upon. The storage surface, therefore, acts as a grid for the flood gun and modulates the flood beam.

The storage surface potential can increase in the positive directions during writing until a peak value, positive with respect to the flooding gun cathode, may be reached after prolonged writing. However, it cannot be stored at that level but is automatically and continuously erased by the flooding beam to cathode potential after writing has ceased.

Erasing

Positive ions resulting from collision of the flood electrons with residual gas molecules land uniformly on the storage surface causing it to charge slowly in the positive direction. This is frequently termed ion writing. In less than one minute it can write the tube from cutoff to full light output, if no erase pulses are applied to the tube.

Erasing (Cont'd)

The ion writing can never cause the storage surface to go more positive than flood gun cathode potential because further increase in potential is checked by the landing of flood beam electrons on the storage surface should it become positive. Unlike the high energy writing beam, the flooding beam has insufficient energy to cause appreciable secondary emission; therefore, its effect in landing is to charge the storage surface in the negative direction to cathode potential, zero voltage.

The process of using the flood beam to charge the storage surface in the negative direction is termed erasing. In order to erase, the storage surface potential must first exceed zero volts and this condition is met by momentarily increasing the voltage of the backing electrode. A change in the backing electrode voltage induces a like change on the storage surface. The electrical circuit is completed by the beam in the tube, when the storage surface potential increases above zero volts and erasing begins.

The normal operating voltage of the backing electrode is +10 volts and the storage surface potentials are assumed distributed in the control range of 0 to -4 volts. If the backing electrode is suddenly raised to +14 volts, the storage surface potentials are likewise raised 4 volts to the range 0 to +4 volts. Flooding electrons will land on the storage surface charging it to zero volts. Next, restoring the backing electrode voltage to +10 volts reduces the storage surface to -4 volts and flood beam cutoff.

Viewing Time

Iatron tubes write bright traces on a dark background. The dark bachground is established and maintained by erasing with a continuous train of positive going voltage pulses applied to the backing electrode. To maintain a dark background, it is necessary to prevent ion writing, which, as already stated, can cause the viewing screen brightness to increase to maximum in a period of less than one minute. Assuming an ion writing time of 40 seconds, this rate referred to the storage surface is about 4/40 volts per second = .1 volt per second. If the rate of erasing, which causes brightness to decrease, is greater than the rate of ion writing, then the net change will be in the direction of decreasing brightness. Thus the effect of ion writing is overcome and an increase in background brightness is prevented. Since the maximum rate of erasing is about 4/.02 or 1000 volts per second (about 10,000 times greater than that required to counteract ion writing) this objective can be readily obtained.

The average rate of erasing is adjustable by pulse width, frequency, or both and provides a means of adjusting viewing time. Viewing time is the time required to erase from maximum brightness to cutoff. When the rate of erase is set so that it is just sufficient to overcome ion writing, the time to erase to cutoff is maximum and viewing time is maximum.

Black Level

It will be obvious from the discussion of erasing that the potential level to which the storage surface is erased depends to some extent on the amplitude of the erase pulses. The correct combination of erase duty cycle and amplitude should erase the tube to cutoff but not beyond cutoff. If there is insufficient erase the background will not be dark and if there is too much erase, writing must commence from a point beyond cutoff and writing speed capabilities will be reduced. Therefore, the erase pulse conditions must be correctly adjusted for optimum tube performance.

The correct amount of erase may be determined experimentally. With the tube collimated and writing gun biased off, slowly increase the amount of erase to some level which causes the light output of the tube to just dim uniformly. Next, turn off the erase pulses and observe the tube face. If the tube is still illuminated the tube is above cutoff. Go back and increase the erase slightly and repeat the procedure. Continue in this manner until the minimum amount of erase, which will just cause the face of the tube to go completely dark is found. These increments of erase increase must be very small as cutoff is approached because if cutoff is exceeded the tube will require considerable time operating with no erase to ion write back-up to above cutoff. As discussed previously, erase in excess of that required for cutoff will result in viewing times less than the full capabilities of the tube.

Power Supply Requirements

The writing gun voltages are all negative with respect to the flood gun cathode, which is normally operated at ground potential. The writing gun voltages may be obtained from a voltage divider circuit across the writing gun power supply in the usual manner for cathode ray tube guns.

Any voltage variations of the backing electrode are capacitively coupled to the storage surface which acts as a control grid for the flood beam. Therefore, the same precautions as regards ripple and shielding should be taken in operating the backing electrode as would be taken in operating any vacuum tube control grid. Although the backing electrode does not intercept current directly it does conduct all storage surface charging currents and therefore the impedance of the associated DC and pulse circuitry should not exceed 10,000 ohms.

The regulation of the viewing screen high voltage is not critical. Changes in phosphor voltages less than 10% do not cause a significant change in any of the electrode currents or tube characteristics. A series current limiting resistor of at least 1 megohm should be used and the power supply designed so that with no current through the current limiting resistor the voltage at the tube does not exceed the maximum ratings.

Special Precautions

Observe maximum ratings to avoid possible damage to the tube. In particular, the viewing screen voltage should be limited so as to never exceed the maximum rated value.

The full voltage should never be applied to the viewing screen instantaneously. An ordinary RC filter at the output of the power supply will provide adequate assurance that the voltage build up will not be too abrupt.

Repeated bombardment with the high current focused writing beam on a small area of the storage surface can burn and damage the storage surface. This will result in the burned area having different persistance characteristics causing the burned area to be visible when the writing beam is scanned across the area. The burned area may remain for several hours or even permanently. Therefore, deflection voltages should be applied before operating the writing beam. It should be noted that the burning is on the storage surface and not the phosphor, so that the tube may be damaged while there is no phosphor voltage applied to the tube and consequently no visual light output.

Attention is again called to the fact that the storage surface can be erased to far below cutoff by a high amplitude pulse applied to the backing electrode. A large transient voltage on this electrode can prevent normal writing for several minutes.

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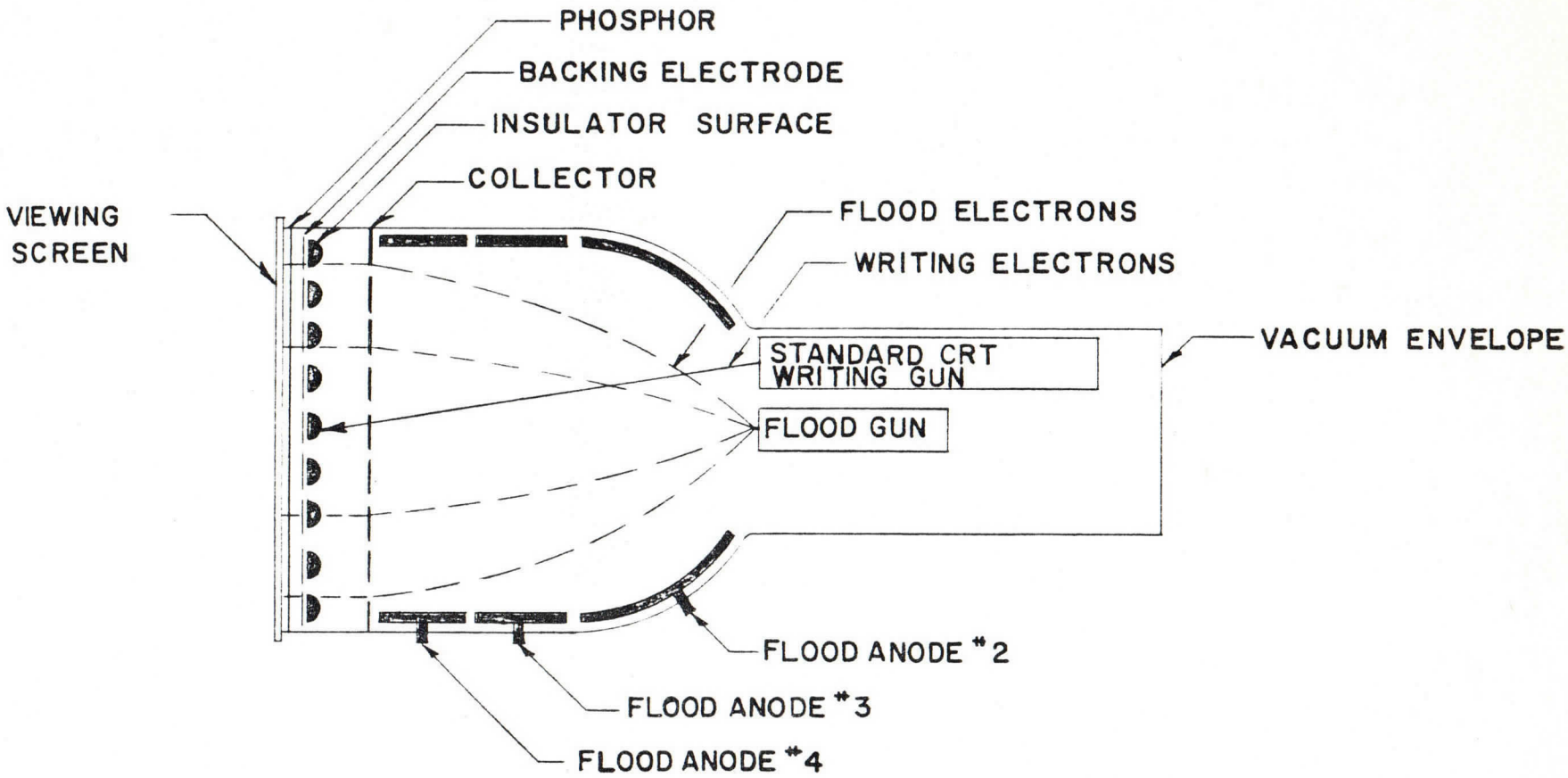

PICTORIAL VIEW
IATRON TUBE

DESCRIPTION:

THE F-7172 IS A 2-1/2 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROSTATICALLY FOCUSED AND DEFLECTED. IT INCORPORATES A CATHODE-RAY GUN FOR ELECTRICAL SIGNAL INPUT, AN INSULATOR MESH FOR BEAM CHARGE STORAGE, A FLOODING GUN FOR VIEWING AND ERASING, AND AN ALUMINIZED PHOSPHOR VIEWING SCREEN FOR VISUAL OUTPUT. THE LARGE UNDEFLECTED FLOODING BEAM CONTINUOUSLY EXCITES THE 1-7/8 INCH VIEWING SCREEN THROUGH THE INSULATOR MESH AND IS MODULATED IN CROSS-SECTION BY THE STORED SIGNAL CHARGE PATTERN.

SPECIAL FEATURES OF THIS TUBE ARE BRIGHT DAYLIGHT VIEWING OF ELECTRICAL SIGNALS BY IMAGE AMPLIFICATION AND THE ABILITY TO WRITE, STORE, AND ERASE SUCH INFORMATION AT WILL.

USED AS A PANEL-MOUNTED INDICATOR IN AIRCRAFT, ITS FAST WRITING AND HIGH DEFLECTION SPEED PERMITS ACCURATE AND INSTANTANEOUS PRESENTATION OF ELECTRICAL INFORMATION. SINCE COAXIAL ELECTRON GUNS ARE USED IN THE TUBE, THERE IS NO TRAPEZOIDAL DISTORTION OF THE SCANNING PATTERN, AND THE SYMMETRICAL ENVELOPE OCCUPIES MINIMUM SPACE.

DEFLECTION CIRCUITS WITH ADEQUATE POWER TO DEFLECT THE TUBE CAN BE INCLUDED IN THE SPACE BETWEEN THE TUBE NECK AND INDICATOR CASE, AND CONNECTIONS TO THE DEFLECTING ELECTRODES ARE CONVENIENTLY LOCATED IN THE SHOULDER STEM.

ALTHOUGH THE OVER-ALL OPERATING VOLTAGE IS ONLY 4500 VOLTS, SIGNALS ARE DISPLAYED AT A BRIGHTNESS OF 1500 FOOT-LAMBERTS, AND A DISPLAY OF RANDOM DOTS NOT PERCEPTIBLE WITH A CONVENTIONAL CATHODE-RAY TUBE, OR OCCURING WHILE THE OPERATOR'S ATTENTION IS DIVERTED, CAN BE STORED AND VIEWED FOR PERIODS UP TO 30 SECONDS.

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GENERAL:

	Writing Section	Flooding Section	
Heater			
Voltage (ac or dc)	6.3	6.3	Volts
Current	0.6	1.2	Amperes
Direct Interelectrode Capacitances (approx. without external shield)			
Grid #1 to all other Electrodes	4.2		uuf
Cathode to all other Electrodes	0.5		uuf
Deflecting Electrode D1 to D2 Front	3.7		uuf
Deflecting Electrode D3 and D4 Rear	3.3		uuf
D1 to all other Electrodes	4.75		uuf
D2 to all other Electrodes	4.0		uuf
D3 to all other Electrodes	5.0		uuf
D4 to all other Electrodes	4.5		uuf
Focusing Method	Electrostatic	Electrostatic	
Deflection Method	Electrostatic	None	
Deflection Sensitivity			
D1 D2	36		Volts/inch
D3 D4	34		Volts/inch
Phosphor	High-Visual-Efficiency Type (aluminized)		
Fluorescence	Yellow-Green		
Minimum Useful Screen Diameter	1-7/8		Inches
Maximum over-all Length	9-11/16		Inches
Maximum Bulb Diameter	2-3/4		Inches
Maximum Neck Diameter	1-7/16		Inches
Base (neck)	Special 9-Pin		
Shoulder Terminals	Special 8-Pin		
Bulb Terminals	1 Flexible Lead (High Voltage)		
	1 - 7-Pin E7-1 Miniature Base		

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MAXIMUM RATINGS:

	Writing Section	Flooding Section	
Screen Voltage		5000	Volts
Backing Electrode Voltage (Peak)		25	Volts
Collector Voltage		200	Volts
Anode #4 Voltage		100	Volts
Anode #3 (Collimating Electrode) Voltage		50	Volts
Anode #2 (Collimating Electrode) Voltage		50	Volts
Anode #1 Voltage		20	Volts
Grid #3 (Focusing Electrode) Voltage	300**		Volts
Grid #2 Voltage	1100**		Volts
Grid #1 Voltage	**0 to 100		Volts
Cathode Voltage	-1000	0 Reference	Volts
Peak Voltage Between Grid #2 and Any Deflecting Electrode	200		Volts
Peak Heater-Cathode Voltage			Volts
Heater Negative with Respect to Cathode	125	125	Volts
Heater Positive with Respect to Cathode	10	10	Volts

OPERATING VALUES AND TYPICAL PERFORMANCE CHARACTERISTICS:

	Writing Section	Flooding Section	
Screen Voltage		4000	Volts
Screen Current (maximum)		0.75	ma
Backing Electrode			
Voltage (dc)		10	Volts
Voltage (pulse)		10	Volts
Collector Voltage		150	Volts
Anode #4 Voltage		75	Volts
Anode #3 Voltage (Adjust for Collimation)		12	Volts
Anode #2 Voltage (Adjust for Collimation)		15	Volts
Anode #1 Voltage		15	Volts
Grid #3 (Adjust for Focus) Voltage	-300 to -325		Volts
Grid #2 Voltage	0		Volts
Grid #1 Voltage	-495		Volts

(Continued)

** All voltages are with reference to the flooding gun cathode except those marked by an asterisk indicating reference to the writing gun cathode potential.

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	Writing Section	Flooding Section	
Deflecting Electrodes			
Voltage (peak to peak)	45		Volts
Voltage (average)	0		Volts
Current (Note 1)	0.5 (max.)		Volts
Cathode Voltage	-450	0 Reference	Volts
Cathode Current		16	ma

RANGE OF OPERATING ADJUSTMENTS:

	Writing Section	Flooding Section	
Backing-Electrode Erasing Voltage Pulses (Note 2)			
Voltages		3 - 10	Volts
Frequency		5000 - 50	pps
Anode #3 Voltage (Note 3)		10 - 20	Volts
Anode #2 Voltage (Note 3)		10 - 20	Volts
Grid #3 Voltage	±75 percent ± 5 percent of cathode voltage		
Grid #1 Bias Voltage	3 percent ± 2 percent of cathode voltage		

PERFORMANCE CHARACTERISTICS:

Writing Time (Note 4)	2×10^{-6}	Second
Erasing Time (Note 5)	0.003	Second
Viewing Time (Note 6)	30	Seconds
Stored Spot Size (Note 7)	0.040	Inches
Brightness (Note 8)	1500	Foot-Lamberts

NOTES:

1. Deflecting electrodes intercept flooding beam current reflected at the storage surface. The deflection circuits should therefore have low output resistance.

2. The specified range of pulse frequencies adjusts the viewing time from about 1 to 40 seconds using 0.5 microsecond pulses. The pulse amplitude adjusts the potential level to which the storage surface is erased.

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3. ANODE VOLTAGE ADJUSTMENTS ARE NECESSARY TO ADJUST COLLIMATION AND SPOT SIZE OF THE FLOODING BEAM.

4. THE TIME REQUIRED USING MAXIMUM WRITING BEAM CURRENT AND A FOCUSED STATIONARY BEAM TO WRITE A SPOT TO 90 PERCENT OF MAXIMUM BRIGHTNESS.

5. THE SHORTEST TIME TO REDUCE THE OUTPUT BRIGHTNESS FROM MAXIMUM BRIGHTNESS TO CUTOFF BY ERASING.

6. THE LONGEST TIME DURING WHICH INFORMATION WRITTEN JUST TO THE MAXIMUM BRIGHTNESS LEVEL IN THE USEFUL VIEWING AREA IS STILL VISIBLE UNDER THE CONDITION THAT ERASING PULSES ARE APPLIED CONTINUOUSLY TO THE TUBE.

7. THE DIAMETER MEASURED WITH A MICROSCOPE OF THE DISPLAY OF A STORED SPOT WRITTEN WITH A FOCUSED STATIONARY BEAM TO A BRIGHTNESS OF 90 PERCENT OF MAXIMUM BRIGHTNESS.

8. THE AVERAGE BRIGHTNESS OF THE USEFUL SCREEN AREA WRITTEN TO MAXIMUM BRIGHTNESS USING SPECIFIED TYPICAL OPERATING VOLTAGES.

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR, THE VIEWING-SCREEN VOLTAGE SHOULD BE LIMITED SO AS NEVER TO EXCEED 6 KILOVOLTS.

THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY R-C FILTER AT THE OUTPUT OF THE POWER SUPPLY PROVIDES ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD-UP WILL NOT BE TOO ABRUPT. THE MINIMUM RESISTANCE OF THE HIGH-VOLTAGE LEAD SHOULD BE 1 MEGOHM.

REPEATED BOMBARDMENT WITH A HIGH-CURRENT FOCUSED WRITING BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

ATTENTION IS AGAIN CALLED TO THE FACT THAT THE STORAGE SURFACE CAN BE ERASED TO FAR BELOW CUTOFF BY A HIGH-AMPLITUDE VOLTAGE PULSE APPLIED TO THE BACKING ELECTRODE. A LARGE TRANSIENT VOLTAGE ON THAT ELECTRODE CAN PREVENT NORMAL WRITING FOR SEVERAL MINUTES THEREAFTER.

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DEFLECTING ELECTRODES D1 AND D2 CAN ACT AS MIRROR ELECTRODES TO REFLECT FLOODING CURRENT. FLOODING CURRENT REFLECTED AT THE STORAGE SURFACE, RETURNING DOWN THE TUBE, CAN BE REFLECTED BY THE DEFLECTION ELECTRODES AT THE INSTANT WHEN THEIR POTENTIAL PASSES THROUGH ZERO VOLTAGE. THIS RE-REFLECTED AND CONCENTRATED CURRENT CAN THEN TRAVERSE THE LENGTH OF THE TUBE FOR THE THIRD TIME CAUSING A BRIGHT REGION TO APPEAR IN THE DISPLAY AND MAY EVEN ERASE THAT AREA IF ITS ARRIVAL COINCIDES IN TIME WITH AN ERASING PULSE. REFLECTION OF CURRENT BY THE DEFLECTING ELECTRODES IS IN SYNCHRONISM WITH THE DEFLECTING VOLTAGE APPLIED TO THEM SO THAT BRIGHTENING OF THE AFFECTED AREA OF THE DISPLAY OCCURS AT THE SAME FREQUENCY. TO AVOID THIS DISTURBANCE THE HIGHER-FREQUENCY DEFLECTION VOLTAGE SHOULD BE APPLIED TO THE OFFENDING DEFLECTING ELECTRODES D1 AND D2. THIS REDUCES THE DURATION OF THE TRANSIENT CURRENT PULSE TO THE EXTENT THAT ITS EFFECTS ARE NEGLIBIBLE.

WARNING:

THE METAL RING WHICH ENCIRCLES THE FACEPLATE OF THE 7172 IS AT VIEWING-SCREEN POTENTIAL. ALTHOUGH NORMALLY ENCAPSULATED IN PLASTIC AND ADEQUATELY INSULATED FROM METAL GROUND, TO AVOID POSSIBLE SHOCK BE CERTAIN THE HIGH VOLTAGE IS TURNED OFF BEFORE TOUCHING THE TUBE.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY

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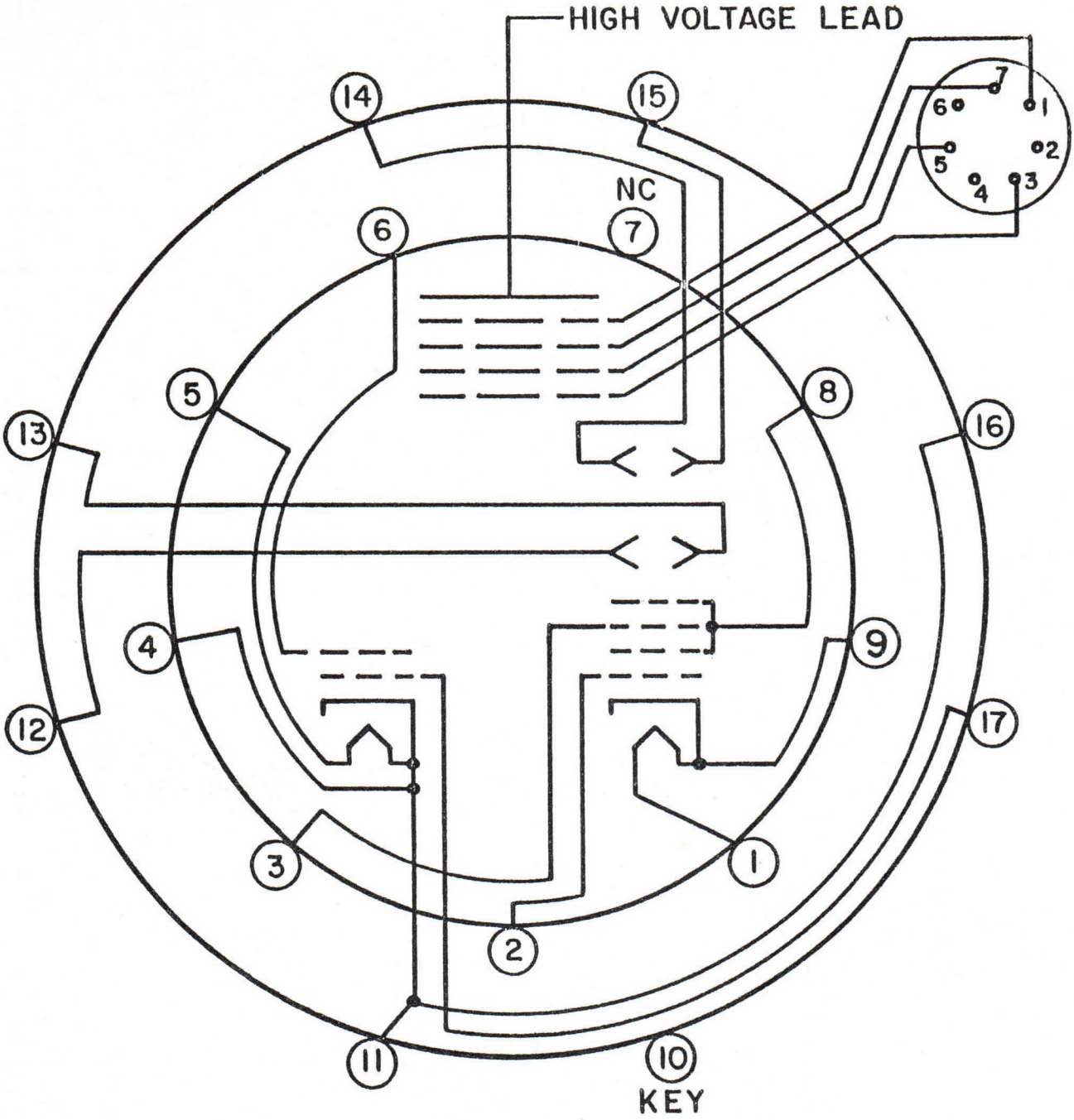
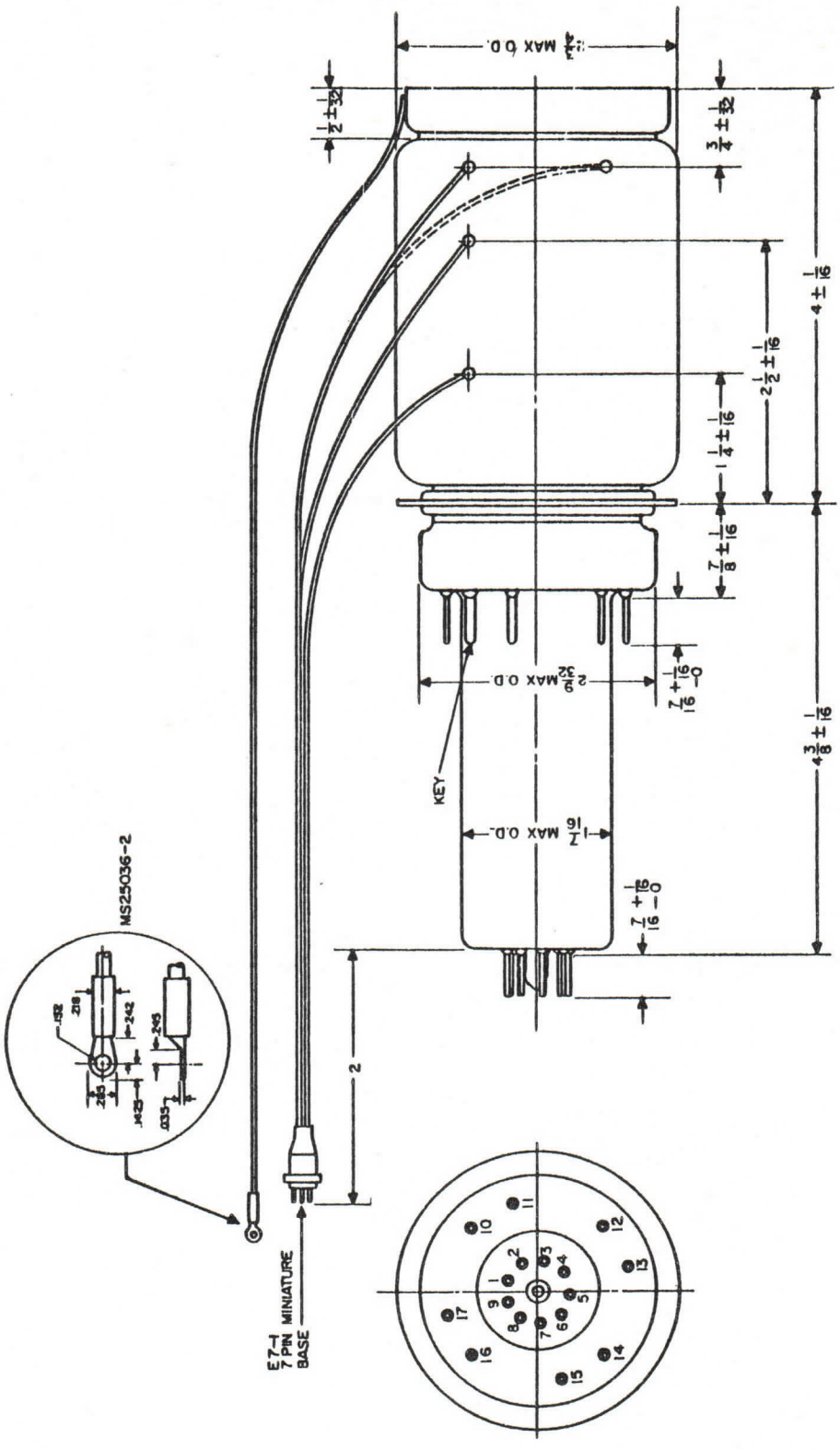


F-7172

BASING DIAGRAM



F-7172 OUTLINE

TENTATIVE

DESCRIPTION:

THE F-7173 IS A 4 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROMAGNETICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES ON A DARK BACKGROUND, CAN BE VIEWED IN DIRECT SUNLIGHT, AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE INFORMATION AT WILL. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL.

GENERAL:

DIMENSIONS	SEE OUTLINE AND FUNCTIONAL SCHEMATIC	
NOMINAL TUBE DIAMETER	4	INCHES
MINIMUM USEFUL DISPLAY DIAMETER	3	INCHES
PHOSPHOR	P-20	ALUMINIZED
OPERATING POSITION		ANY
CATHODE PRE-HEATING TIME	60	SECONDS
FOCUS		MAGNETIC
DEFLECTION		MAGNETIC

DIRECT INTERELECTRODE CAPACITANCES WITHOUT EXTERNAL SHIELD (APPROX.)

GRID #1 TO ALL OTHER ELECTRODES	2.5	UUF
WRITE CATHODE TO ALL OTHER ELECTRODES	8.0	UUF
FLOOD CATHODE TO ALL OTHER ELECTRODES	3.0	UUF

MAXIMUM RATINGS:

VIEWING SCREEN	10	KV DC	
BACKING ELECTRODE	25	VDC	
COLLECTOR	200	VDC	
ANODE #2	75	VDC	
GRID #3	INTERNALLY CONNECTED TO ANODE #2		
GRID #2	250	VDC	RESPECT WRITE CATHODE
GRID #1	0	VDC	RESPECT WRITE CATHODE
WRITE CATHODE	-1000	VDC	
HEATER-CATHODE	125	VDC	
FLOOD CATHODE	200	VDC	

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TYPICAL OPERATING VALUES:

FLOOD SECTION

VIEWING SCREEN	+7	KV DC 700 UA MAXIMUM
BACKING ELECTRODE	+10	VDC AND ERASE PULSES
COLLECTOR	+125	VDC
ANODE #2	+44	VDC
ANODE #1	+60	VDC
CATHODE	0	VDC
HEATER	6.3	V AC OR DC 1.4 A

WRITE SECTION

HEATER	6.3	V AC OR DC .6A
CATHODE	-450	VDC 3 MA
GRID #1 (NOTE 1)	-40	VDC RESPECT WRITE CATHODE
GRID #2	+150	VDC RESPECT WRITE CATHODE
GRID #3	INTERNALLY CONNECTED TO ANODE #2	

RANGE OF OPERATING ADJUSTMENTS:

ANODE #2	+35 TO +50	VDC ADJUST FOR BEST COLLIMATION
GRID #1 (CUTOFF - NOTE 1)	-32 TO -45	VDC RESPECT WRITE CATHODE
ERASE PULSES	4-10 VOLTS	100-5000 PRF .5 U/SEC. WIDE

TYPICAL PERFORMANCE:

RESOLUTION (NOTE 2)		
MINIMUM BRIGHTNESS	120	LINES/INCH
MAXIMUM BRIGHTNESS	50	LINES/INCH
LIGHT OUTPUT	2800	FT. LAMBERTS
WRITING SPEED TO 90% BRIGHTNESS	40000	IN/SEC.
ERASE TIME (NOTE 3)	3	MILLISECONDS
VIEWING TIME (NOTE 4)	30	SECONDS

NOTES:

1. VISUAL CUTOFF OF THE STORED, FOCUSED, UNDEFLECTED SPOT.

2. RESOLUTION IS MEASURED BY THE SHRINKING RASTER METHOD AT THE CENTER OF THE VIEWING SCREEN.

3. ERASE TIME IS THE SHORTEST TIME IN WHICH INFORMATION CAN BE REMOVED FROM THE TUBE AFTER BEING STORED AT FULL BRIGHTNESS.

4. VIEWING TIME IS THE TIME THAT A SIGNAL STORED AT FULL BRIGHTNESS ANYWHERE IN THE DISPLAY AREA CAN BE VIEWED WITH ERASE PULSES APPLIED TO COUNTERACT ION WRITING.

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED SO AS TO NEVER EXCEED 10 KV.

THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY WILL PROVIDE ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD UP WILL NOT BE TOO ABRUPT. THE VIEWING SCREEN POWER SUPPLY SHOULD HAVE A SERIES RESISTANCE OF AT LEAST 1 MEG OHM.

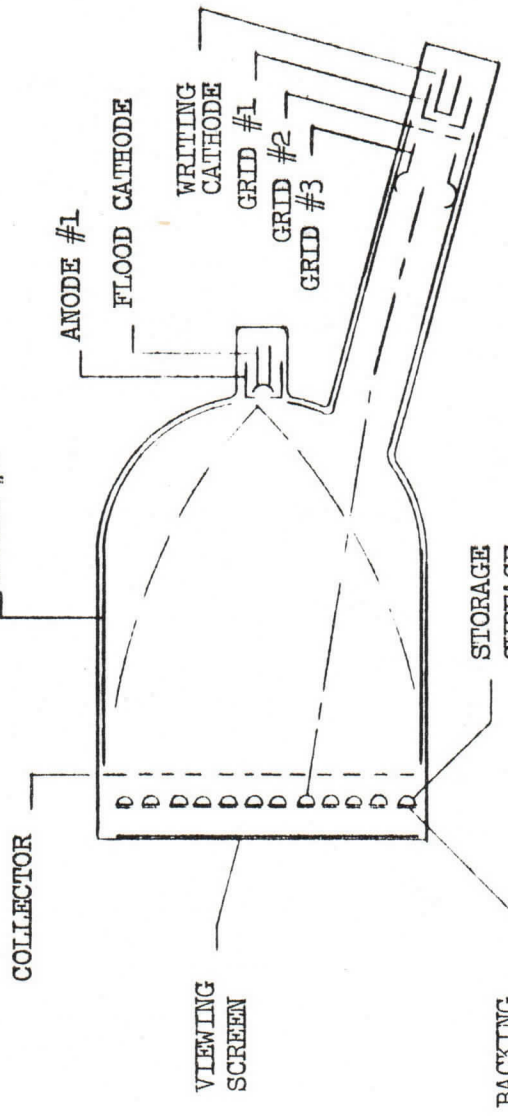
REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, THE DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY

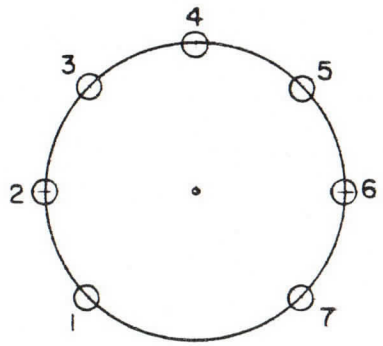
* TRADEMARK OF ITT

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

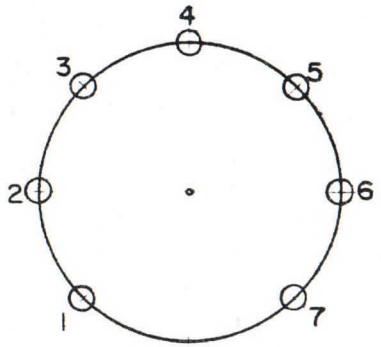


FUNCTIONAL SCHEMATIC

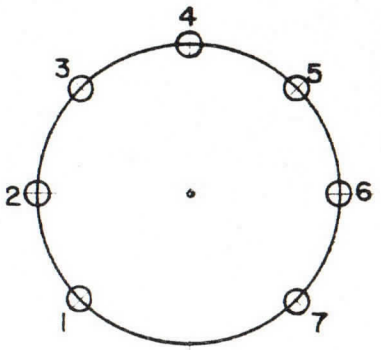
F-7173



BOTTOM VIEW



BOTTOM VIEW



BOTTOM VIEW

FLOOD GUN

Pin	Element
1	Anode #1
2	N/C
3	Heater
4	Heater
5	Anode #1
6	N/C
7	Cathode

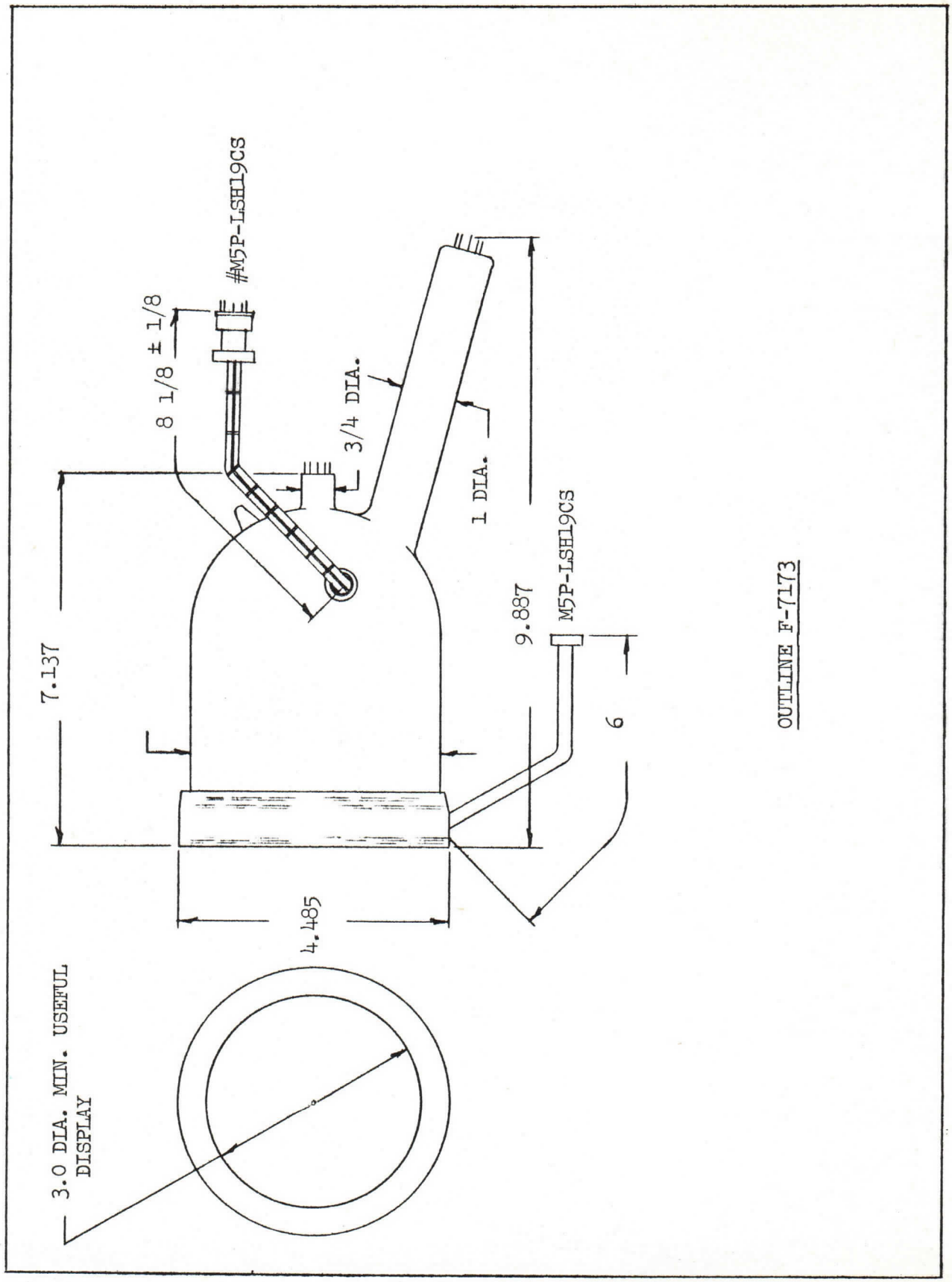
WRITE GUN

Pin	Element
1	Grid #1
2	N/C
3	Heater
4	Heater
5	Grid #3
6	Grid #2
7	Cathode

7 PIN PLUG FOR BULB CONNECTIONS

Pin	Electrode
1	Backing Electrode
2	N/C
3	N/C
4	Anode #2
5	N/C
6	N/C
7	Collector

7173 PIN CONNECTIONS



OUTLINE F-7173

ITT EXPORT CORPORATION
67 BROAD STREET · NEW YORK 4, N. Y.

TENTATIVE

DESCRIPTION:

THE F-7174 IS A 4 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROMAGNETICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES THAT CAN BE VIEWED IN DIRECT SUNLIGHT AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE INFORMATION AT WILL. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN, WHICH ILLUMINATES THE VIEWING SCREEN IN ACCORDANCE WITH THE STORED SIGNAL.

GENERAL:

DIMENSIONS	SEE OUTLINE AND FUNCTIONAL SCHEMATIC	
NOMINAL TUBE DIAMETER	4	INCHES
MINIMUM USEFUL DISPLAY DIAMETER	3	INCHES
PHOSPHOR	P-20	ALUMINIZED
OPERATING POSITION		ANY
WEIGHT	0.89	POUNDS
CATHODE PRE-HEATING TIME	30	SECONDS
FOCUS METHOD		MAGNETIC
DEFLECTION METHOD		MAGNETIC

DIRECT INTER-ELECTRODE CAPACITANCES WITHOUT EXTERNAL SHIELD (APPROX.)

GRID #1 TO ALL OTHER ELECTRODES	2.5	UUF
WRITE CATHODE TO ALL OTHER ELECTRODES	8.0	UUF
FLOOD CATHODE	3.0	UUF
ANODE #1	3.7	UUF

MAXIMUM RATINGS

	FLOOD SECTION	
VIEWING SCREEN	18	KVDC
BACKING ELECTRODE	25	VDC
COLLECTOR	250	VDC
ANODE #4	150	VDC
ANODE #3	150	VDC
ANODE #2	150	VDC
ANODE #1	80	VDC
CATHODE	200	VDC
HEATER-CATHODE	125	VDC

MAXIMUM RATINGS (CONTINUED)

	Write Section	
Heater Cathode	125	VDC
Cathode	-1000	VDC
Grid #1	-150	VDC Respect Write Cathode
Grid #2	+500	VDC Respect Write Cathode
Grid #3		Internally Connected to Anode #2
Peak Voltage between Grid #2 and Grid #1 or Grid #3	500	VDC

TYPICAL OPERATING VALUES:

	Flood Section	
Viewing Screen	15	KVDC (1.7 Ma Max.)
Backing Electrode	+10	VDC and erase pulses
Collector	+180	VDC .5 to 1.7 Ma
Anode #4	+90	VDC 35 to 300 ua
Anode #3	+20	VDC 200 to 500 ua
Anode #2	+30	VDC 1 to 1.5 Ma
Anode #1	+60	VDC .5 to 2.0 Ma
Cathode	0	VDC 4.7 Ma Max.
Heater	6.3	V AC or DC 1.4 A

	Write Section	
Heater	6.3	V AC or DC .6 A
Cathode	-450	VDC .5 to 1.5 Ma
Grid #1 (Cut-off Note 1)	-35	VDC Respect write cathode
Grid #2	+150	VDC Respect write cathode
Grid #3		Internally connected to anode #2

RANGE OF TYPICAL OPERATING ADJUSTMENTS:

Anode #2	25 to 40 Volts Adjust for best collimation
Anode #3	10 to 25 Volts Adjust for best collimation
Grid #1 (Cut-off Note 1)	-28 to -46 Volts
Erase Pulses	3-12 Volts, 1.5 usec. wide, 100-5000 PRF Adjust for desired viewing time

TYPICAL PERFORMANCE:

Resolution (Note 2) at 50% of full brightness	35	Lines per Inch
Brightness	15,000	Ft. Lamberts
Writing Speed 20 Volts Drive to 90%	25,000	Inches per Second
Erase Time (Note 3)	3	Milliseconds
Viewing Time (Note 4)	2	Seconds
Number of Half-tone Steps	4	

* Trademark of ITT

NOTES:

1. VISUAL CUT-OFF OF THE STORED, FOCUSED, STATIONARY SPOT.

2. RESOLUTION IS MEASURED BY THE SHRINKING RASTOR METHOD AT THE CENTER OF THE VIEWING SCREEN.

3. ERASE TIME IS THE SHORTEST TIME IN WHICH INFORMATION CAN BE REMOVED FROM THE TUBE AFTER BEING STORED AT FULL BRIGHTNESS.

4. VIEWING TIME IS THE TIME THAT A SIGNAL STORED AT FULL BRIGHTNESS ANYWHERE IN THE DISPLAY AREA CAN BE VIEWED WITH ERASE PULSES APPLIED TO COUNTERACT ION WRITING.

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR, THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED SO AS TO NEVER EXCEED 18 KV.

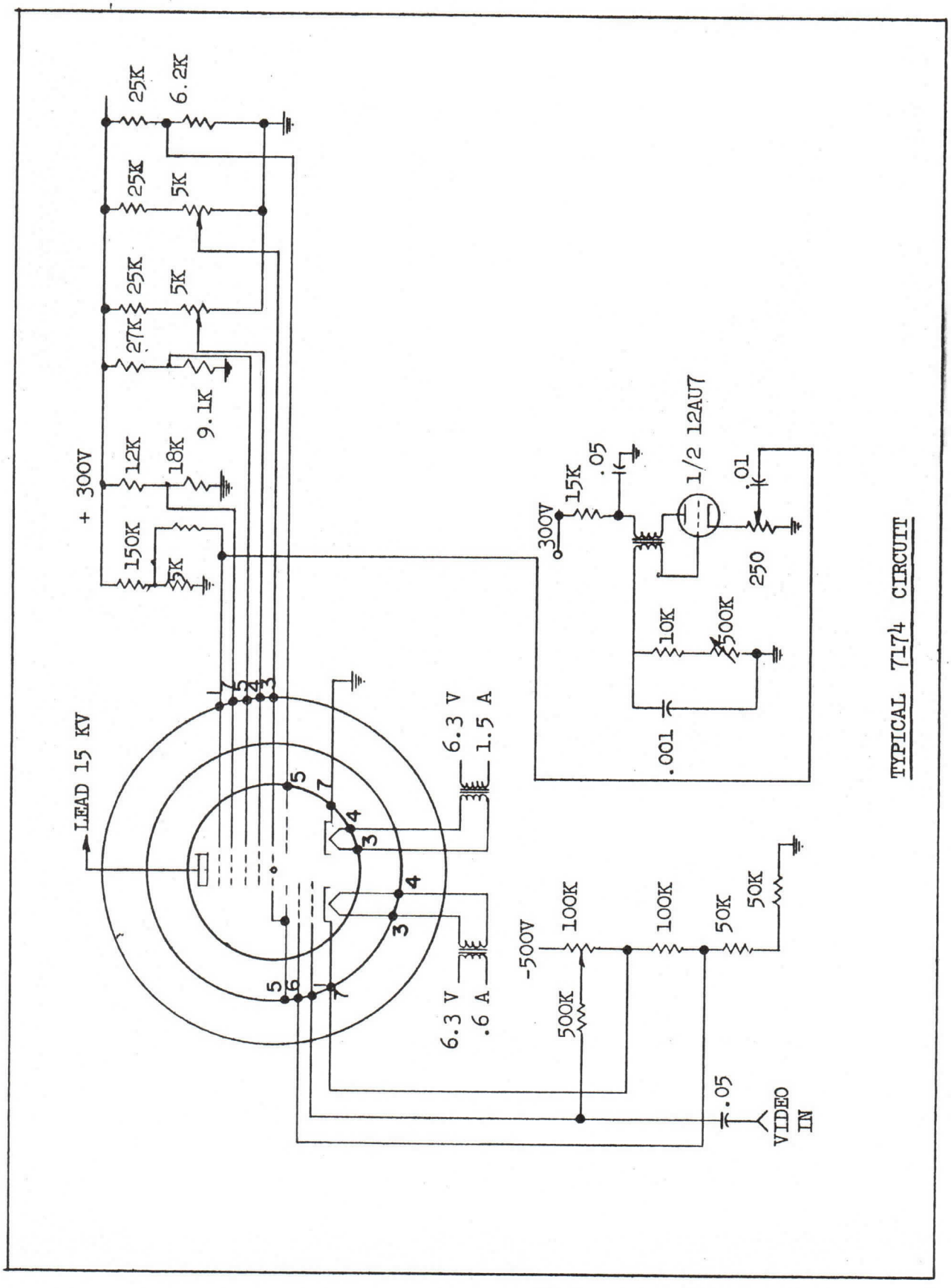
THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY PROVIDES ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD UP WILL NOT BE TOO ABRUPT. THE MINIMUM RESISTANCE OF THE HIGH VOLTAGE LEAD SHOULD BE 1 MEGOHM.

REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED WRITING BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY, WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

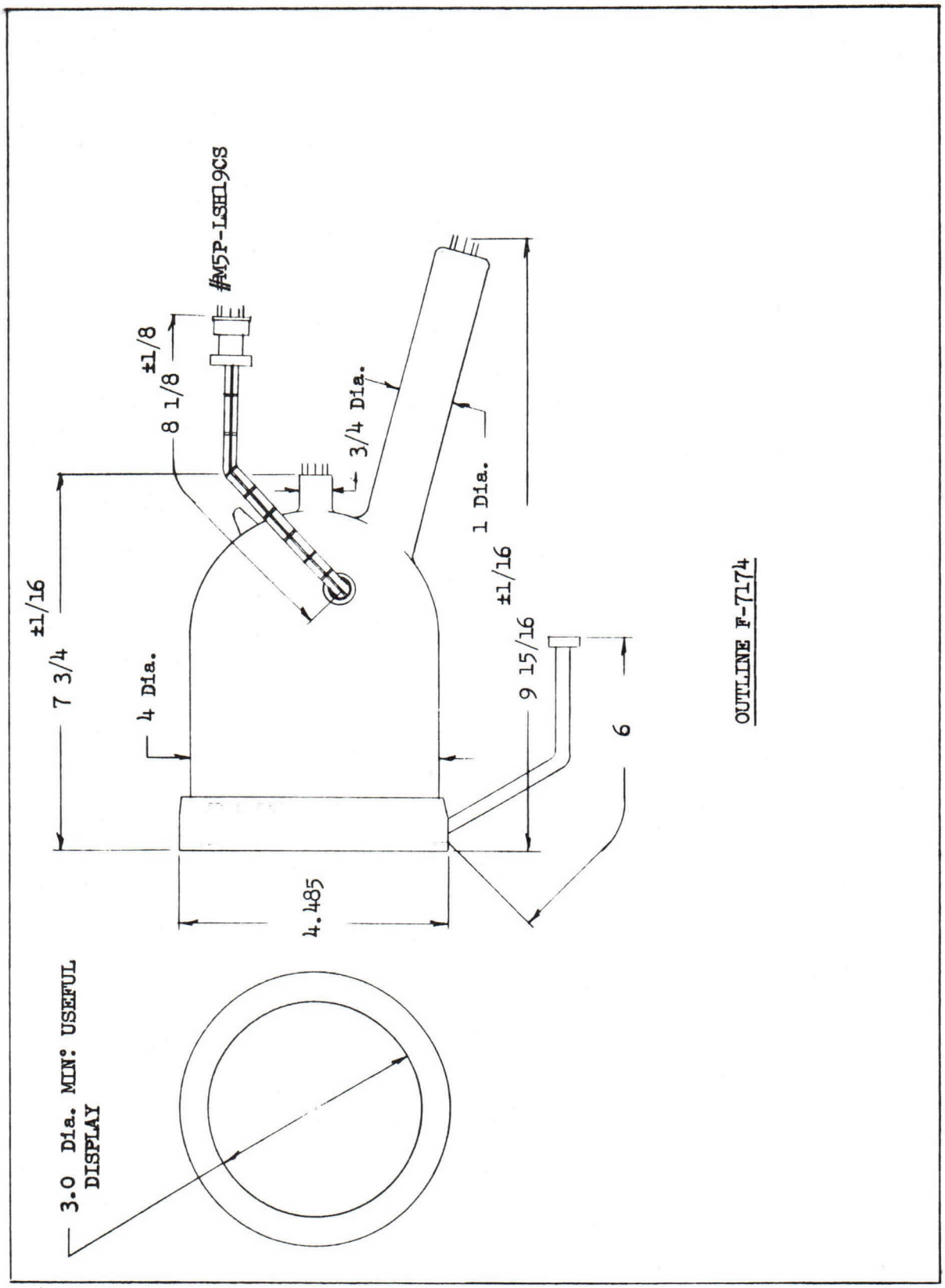
ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 7065
ROANOKE, VIRGINIA

* TRADEMARK OF ITT

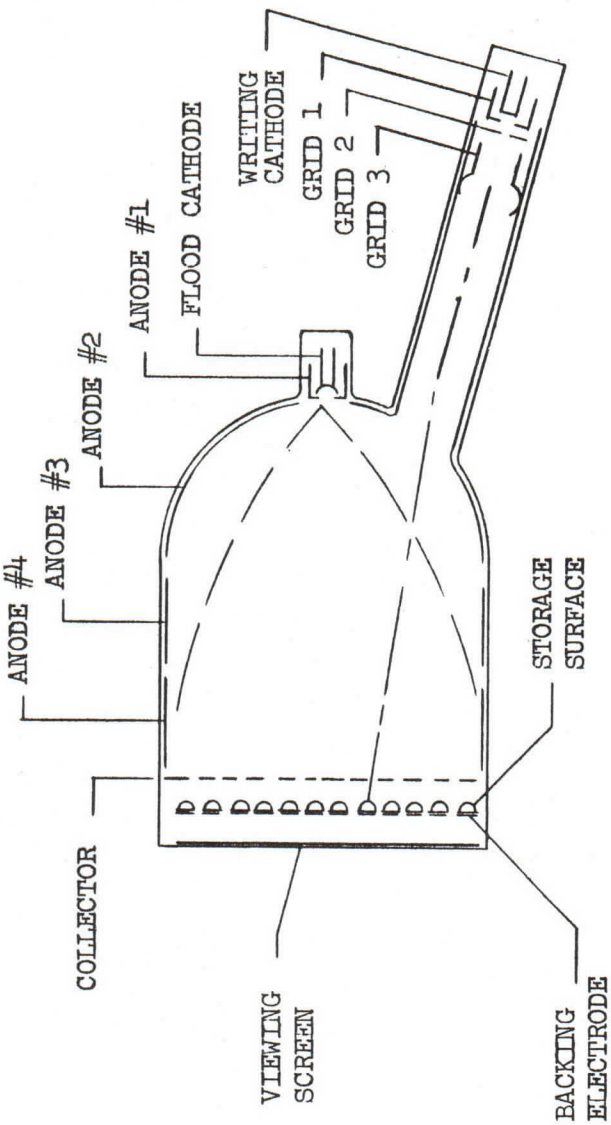


TYPICAL 7174 CIRCUIT



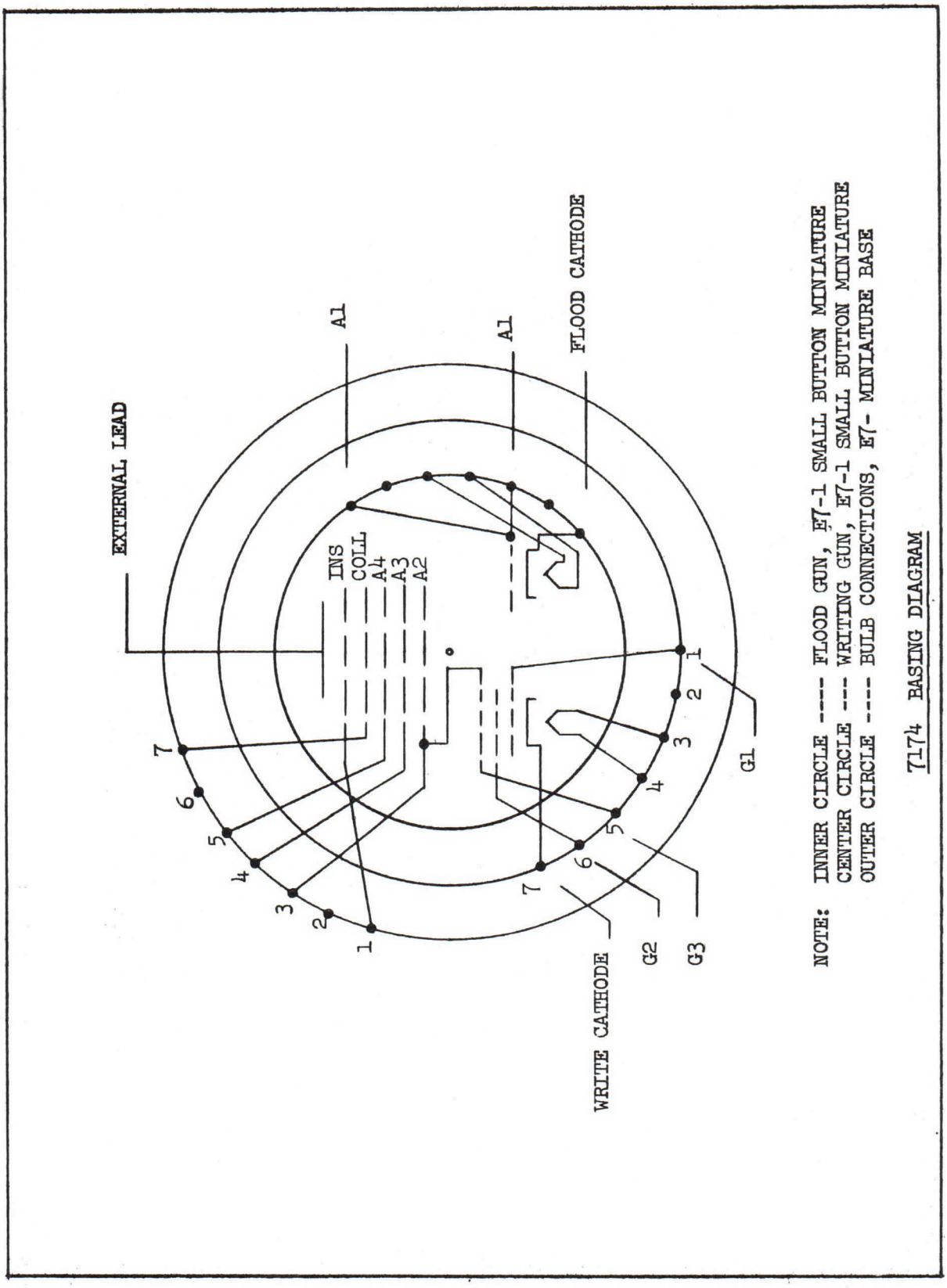
OUTLINE F-7174

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



FUNCTIONAL SCHEMATIC

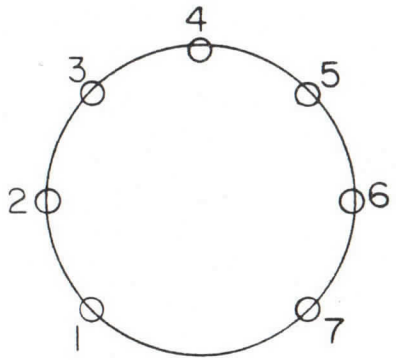
F-7174



NOTE: INNER CIRCLE ---- FLOOD GUN, E7-1 SMALL BUTTON MINIATURE
CENTER CIRCLE --- WRITING GUN, E7-1 SMALL BUTTON MINIATURE
OUTER CIRCLE ---- BULB CONNECTIONS, E7- MINIATURE BASE

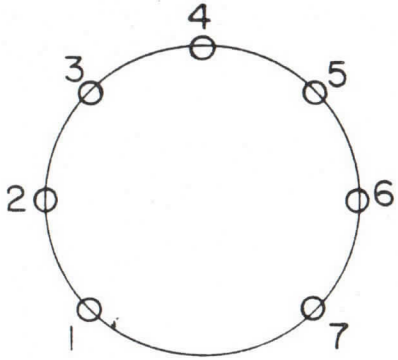
7174 BASING DIAGRAM

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY



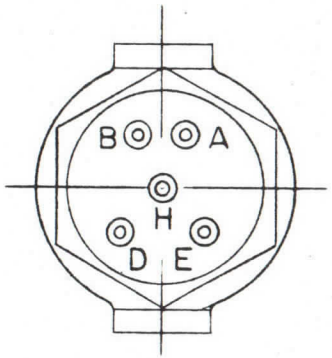
BOTTOM VIEW
FLOOD GUN

Pin	Element
1.	Anode #1
2.	N/C
3.	Heater
4.	Heater
5.	Anode #1
6.	N/C
7.	Cathode



BOTTOM VIEW
WRITE GUN

Pin	Element
1.	Grid #1
2.	N/C
3.	Heater
4.	Heater
5.	Grid #3, Anode #2
6.	Grid #2
7.	Cathode



WINCHESTER PLUG
M5P-LSH19CS

Pin	Element
A.	Rear Wall
B.	Center Wall
D.	Collector
E.	Front Wall
H.	Insulator

7174 PIN CONNECTIONS

SUPERSEDES OUTLINE DATED 7/61

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

F-7423
IATRON*

TENTATIVE

DESCRIPTION:

THE F-7423 IS A 5 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROSTATICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND THE TUBE FEATURES THE ABILITY TO WRITE, STORE AND ERASE SIGNAL INFORMATION AT THE WILL OF THE OPERATOR. GRAY SHADES ARE PRODUCED IN ACCORDANCE WITH THE AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO ELECTRON GUNS, A WRITING GUN WHICH WRITES THE INPUT SIGNAL ON AN INSULATOR STORAGE SCREEN, AND A FLOOD GUN WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL.

GENERAL:

DIMENSIONS	SEE OUTLINE ATTACHED
NOMINAL TUBE DIAMETER	5 INCHES
MINIMUM USEFUL DISPLAY DIAMETER	4 INCHES
PHOSPHOR	P-20 ALUMINIZED
OPERATING POSITION	ANY
WEIGHT (APPROXIMATE)	2 LB. 8 OZ.
CATHODE PRE-HEATING TIME	30 SECONDS
FOCUS METHOD	ELECTROSTATIC
DEFLECTION METHOD	ELECTROSTATIC

MAXIMUM RATINGS:

	FLOOD SECTION
VIEWING SCREEN	±10 KV
BACKING ELECTRODE	±25 V
COLLECTOR	±250 V
ANODE #4	±150 V
ANODE #3	±150 V
ANODE #2	±150 V
ANODE #1	±80 V
HEATER-CATHODE VOLTAGE	±125 V

* TRADEMARK OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

WRITE SECTION

WRITE CATHODE	-1000 V	
GRID #1	NEGATIVE VOLTAGE RESPECT WRITE CATHODE	150 V
	POSITIVE VOLTAGE RESPECT WRITE CATHODE	0 V
GRID #2	±150 V	
GRID #3	±500 V	RESPECT WRITE CATHODE
HEATER-CATHODE VOLTAGE	±125 V	
GRID #2 TO ANY DEFLECTING ELECTRODE	±500 V	

TYPICAL OPERATING VALUES:

FLOOD SECTION

VIEWING SCREEN	±8.5	KV DC	2 MA (MAX.)
BACKING ELECTRODE	±10	VDC	
COLLECTOR	±180	VDC	2 MA (MAX.)
ANODE #4	±90	VDC	1.5 MA (MAX.)
ANODE #3	±20	VDC	1.5 MA (MAX.)
ANODE #2	±30	VDC	1.8 MA (MAX.)
ANODE #1	±60	VDC	5.0 MA (MAX.)
FLOOD CATHODE	0	VDC	10.0 MA (MAX.)
HEATER	6.3	V AC OR DC	1.4 A

WRITE SECTION

WRITE CATHODE	-750	VDC	3.0 MA (MAX.)
GRID #1 CUTOFF (NOTE 1)	-60	VDC	RESPECT WRITE CATHODE
GRID #2	0	VDC	
GRID #3	±165	VDC	RESPECT WRITE CATHODE
HEATER	6.3	V AC OR DC	.6 A
MEAN DEFLECTION PLATE VOLTAGE	0	V	

RANGE OF TYPICAL OPERATING ADJUSTMENTS:

ANODE #2	25 TO 35	VDC	ADJUST FOR BEST COLLIMATION
ANODE #3	15 TO 30	VDC	ADJUST FOR BEST COLLIMATION
GRID #1 CUTOFF (NOTE 1)	-40 TO -85	VDC	
GRID #3 FOCUS	105 TO 210	VDC	ADJUST FOR BEST FOCUS
ERASE PULSES	0 TO 10		VOLT AMPLITUDE, 1 USECOND WIDE, 100-5000 PRF - ADJUST FOR DESIRED VIEWING TIME.

* TRADEMARK OF ITT

TYPICAL PERFORMANCE.

Resolution (Note 2)		
50% of Full Brightness	40	Lines/Inch
Brightness	4,000	ft. Lamberts
Writing Speed		
20 Volt Drive to 50% Brightness	20,000	Inches/Second
40 Volt Drive to 50% Brightness	40,000	Inches/Second
Erase Time (Note 3)	12	Milliseconds
Viewing Time (Note 4)	10	Seconds
Storage Time (Note 5)	20	Seconds
Deflection Factor		
D1-D2	40-49	Volts/Inch
D3-D4	38-47	Volts/Inch
Half-tone Steps	4	(Minimum)

ENVIRONMENTAL DATA:

Ambient Temperature Range		
Operating	-55° to +71°	C
Non-operating	-65° to +100°	C
Altitude	70,000	Feet
Vibration (Continuous)	3G, 5	Cps to 500 Cps
Shock (3 axes)		
Operating	15G for 40	MS, 18 impacts
Operating	25G for 5	MS, 6000 impacts
Non-operating (Crash Safety)	30G for 11	MS, 2 impacts

NOTES:

1. Visual cutoff of the stored, focused, undeflected spot.

2. Resolution is measured by the shrinking raster method at the center of the tube

3. Erase time is the shortest time in which a signal can be removed from the tube after being stored at full brightness.

4. Viewing time is the minimum time that a signal stored at full brightness anywhere in the display areas can be viewed with erase pulses continuously applied to counteract ion writing.

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ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

5. Storage time is the time required for the brightness to increase from cutoff to 50 per cent of full value in the absence of erase pulses.

SPECIAL PRECAUTIONS:

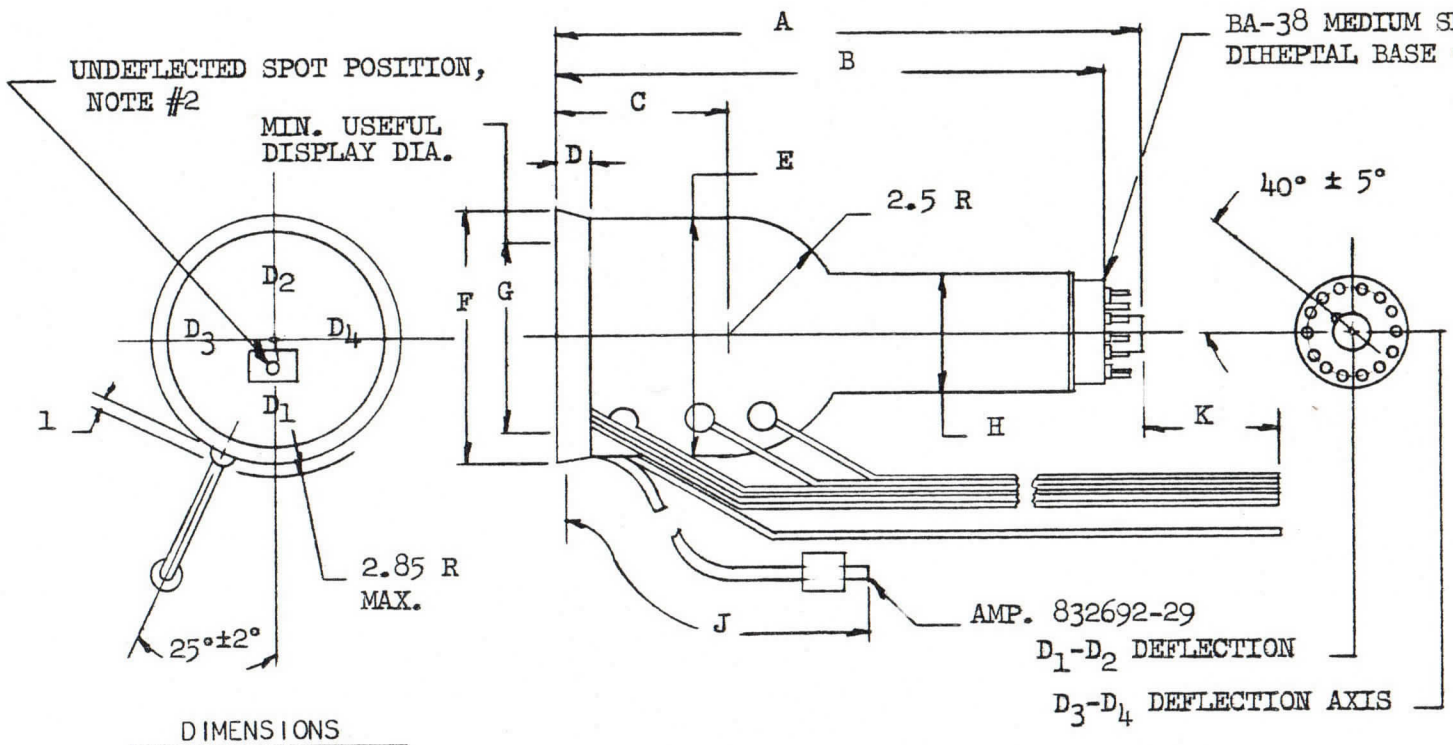
Observe maximum ratings to avoid possible damage to the tube. In particular the viewing screen voltage should be limited so as to never exceed 10 KV. The full voltage should not be applied to the viewing screen instantaneously. An ordinary RC filter at the output of the power supply will provide adequate assurance that the voltage build up will not be too abrupt. The minimum resistance of the high voltage circuit should be 1 meg ohm.

Repeated bombardment with a high current focused writing beam on a small area of the storage surface can burn a dark image into the display area, which may remain for several hours or even permanently. Therefore, deflection voltages should be applied before operating the writing beam.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Post Office Box 412
Clifton, New Jersey

* Trademark of the International Telephone & Telegraph Corporation

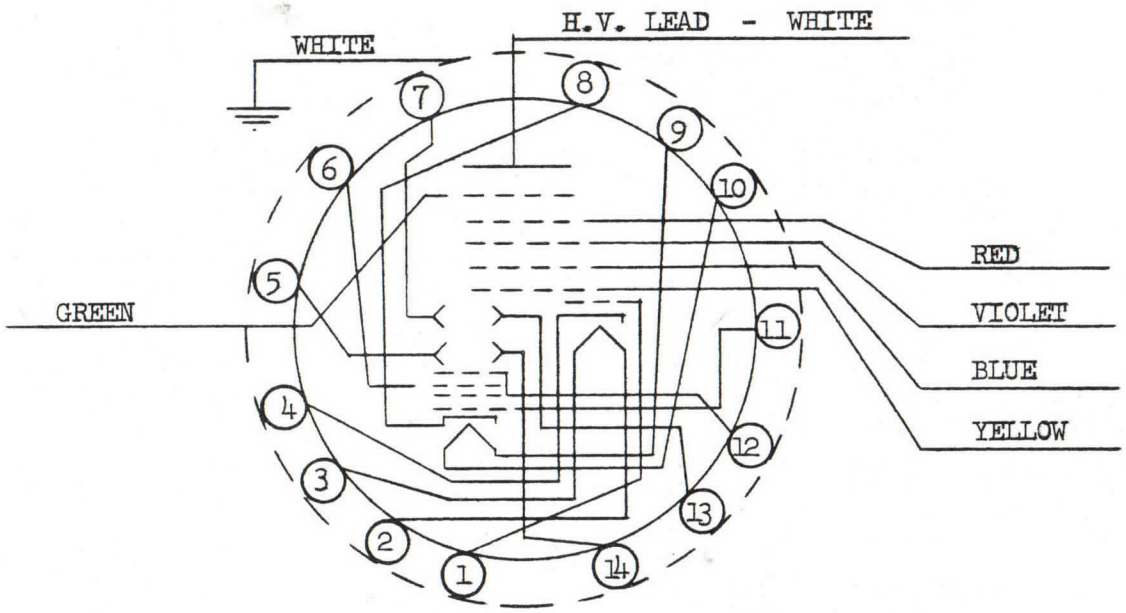


REF.	DIMENSIONS MIN.	MAX.
A		12 1/16
B	11 1/8	11 1/4
C	3.73	3.83
D	.69	.81
E		5.12
F		5.37
G	4.0	
H	2.44	2.56
I	.24	.26
J		8.25
K	4.5	

NOTE 1: DEFLECTING ELECTRODES D_1, D_2 ARE NEARER THE SCREEN; DEFLECTING ELECTRODES D_3, D_4 ARE NEARER THE BASE WITH D_1 POSITIVE WITH RESPECT TO D_2. THE SPOT WILL BE DEFLECTED TOWARD PINS No. 9 AND 10; LIKEWISE WITH D_3 POSITIVE WITH RESPECT TO D_4. THE SPOT WILL BE DEFLECTED TOWARD PIN No. 6.

NOTE 2: THE SPOT SHALL FALL WITHIN A CIRCLE OF 0.2 INCH RADIUS CENTERED 0.6 INCHES ABOVE THE CENTER OF THE TUBE FACE.

F-7423 IATRON OUTLINE



14 PIN BASE

1	ANODE #1
2	FLOOD HEATER
3	FLOOD HEATER
4	FLOOD CATHODE
5	D-3
6	GRID #3 (FOCUS)
7	D-1
8	WRITE CATHODE
9	WRITE HEATER
10	WRITE HEATER
11	GRID #1
12	GRID #2
13	D-2
14	D-4

FLYING LEADS

WHITE SMALL DIAMETER	ELECTROSTATIC SHIELD
WHITE LARGE DIAMETER	VIEWING SCREEN
YELLOW	ANODE #2
BLUE	ANODE #3
VIOLET	ANODE #4
RED	COLLECTOR
GREEN	BACKING ELECTRODE

F-7423 IATRON

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

TENTATIVE

DESCRIPTION:

THE D-3001 IS A 5 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROSTATICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND THE TUBE FEATURES THE ABILITY TO WRITE, STORE AND ERASE SIGNAL INFORMATION AT THE WILL OF THE OPERATOR. GRAY SHADES ARE PRODUCED IN ACCORDANCE WITH THE AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO ELECTRON GUNS, A WRITING GUN WHICH WRITES THE INPUT SIGNAL ON AN INSULATOR STORAGE SCREEN, AND A FLOOD GUN WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL.

GENERAL:

DIMENSIONS	SEE OUTLINE ATTACHED
NOMINAL TUBE DIAMETER	5 INCHES
MINIMUM USEFUL DISPLAY DIAMETER	4 INCHES
PHOSPHOR	P-20 ALUMINIZED
OPERATING POSITION	ANY
WEIGHT (APPROXIMATE)	2 LB. 8 OZ.
CATHODE PRE-HEATING TIME	30 SECONDS
FOCUS METHOD	ELECTROSTATIC
DEFLECTION METHOD	ELECTROSTATIC

MAXIMUM RATINGS:

	FLOOD SECTION
VIEWING SCREEN	±10 KV
BACKING ELECTRODE	±25 V
COLLECTOR	+250 V
ANODE #4	+150 V
ANODE #3	+150 V
ANODE #2	+150 V
ANODE #1	+80 V
HEATER-CATHODE VOLTAGE	±125 V

* TRADEMARK OF INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION

WRITE SECTION

WRITE CATHODE	-1000 V	
GRID #1	NEGATIVE VOLTAGE	RESPECT WRITE CATHODE 150 V
	POSITIVE VOLTAGE	RESPECT WRITE CATHODE 0 V
GRID #2	±150 V	
GRID #3	±500 V	RESPECT WRITE CATHODE
HEATER-CATHODE VOLTAGE	±125 V	
GRID #2 TO ANY DEFLECTING ELECTRODE	±500 V	

TYPICAL OPERATING VALUES:

FLOOD SECTION

VIEWING SCREEN	±8.5 KV DC	1.0 MA (MAX.)	
BACKING ELECTRODE	±10 VDC		
COLLECTOR	±180 VDC	2.0 MA (MAX.)	
ANODE #4	±90 VDC	1.5 MA (MAX.)	
ANODE #3	±20 VDC	1.5 MA (MAX.)	
ANODE #2	±30 VDC	1.8 MA (MAX.)	
ANODE #1	±60 VDC	5.0 MA (MAX.)	
FLOOD CATHODE	0 VDC	10.0 MA (MAX.)	
HEATER	6.3 V AC OR DC	1.4 A	

WRITE SECTION

WRITE CATHODE	-750 VDC	3.0 MA (MAX.)
GRID #1 CUTOFF (NOTE 1)	-60 VDC	RESPECT WRITE CATHODE
GRID #2	0 VDC	
GRID #3	±165 VDC	RESPECT WRITE CATHODE
HEATER	6.3 V	AC OR DC .6 A
MEAN DEFLECTION PLATE VOLTAGE	0 V	

RANGE OF TYPICAL OPERATING ADJUSTMENTS:

ANODE #2	25 TO 35	VDC	ADJUST FOR BEST COLLIMATION
ANODE #3	15 TO 30	VDC	ADJUST FOR BEST COLLIMATION
GRID #1 CUTOFF (NOTE 1)	-60 TO -120	VDC	
GRID #3 FOCUS	±105 TO 210	VDC	ADJUST FOR BEST FOCUS
ERASE PULSES	0 TO 10	VOLT AMPLITUDE, 1 USECOND WIDE, 100-5000 PRF - ADJUST FOR DESIRED VIEWING TIME.	

* TRADEMARK OF ITT

TYPICAL PERFORMANCE:

Resolution (Note 2)		
50% of Full Brightness	60	Lines/Inch
Brightness	2,000	ft. Lamberts
Writing Speed		
20 Volt Drive to 50% Brightness	20,000	Inches/Second
40 Volt Drive to 50% Brightness	40,000	Inches/Second
Erase Time (Note 3)	12	Milliseconds
Viewing Time (Note 4)	20	Seconds
Storage Time (Note 5)	20	Seconds
Deflection Factor		
D1-D2	40 to 49	Volts/Inch
D3-D4	38 to 47	Volts/Inch
Half-tone Steps	4	(Minimum)

ENVIRONMENTAL DATA:

Ambient Temperature Range		
Operating	-55° to +71°	C
Non-Operating	-65° to +100°	C
Altitude	70,000	Feet
Vibration (Continuous)	3G, 5 Cps to 500	Cps
Shock (3 axes)		
Operating	15G for 40	MS, 18 Impacts
Operating	25G for 5	MS, 6000 Impacts
Non-Operating (Crash Safety)	30G for 11	MS, 2 Impacts

NOTES:

1. Visual cutoff of the stored, focused, undeflected spot.

2. Resolution is measured by the shrinking raster method at the center of the tube.

3. Erase time is the shortest time in which a signal can be removed from the tube after being stored at full brightness.

4. Viewing time is the minimum time that a signal stored at full brightness anywhere in the display areas can be viewed with erase pulses continuously applied to counteract ion writing.

* Trademark of ITT

5. Storage time is the time required for the brightness to increase from cutoff to 50 per cent of full value in the absence of erase pulses.

SPECIAL PRECAUTIONS:

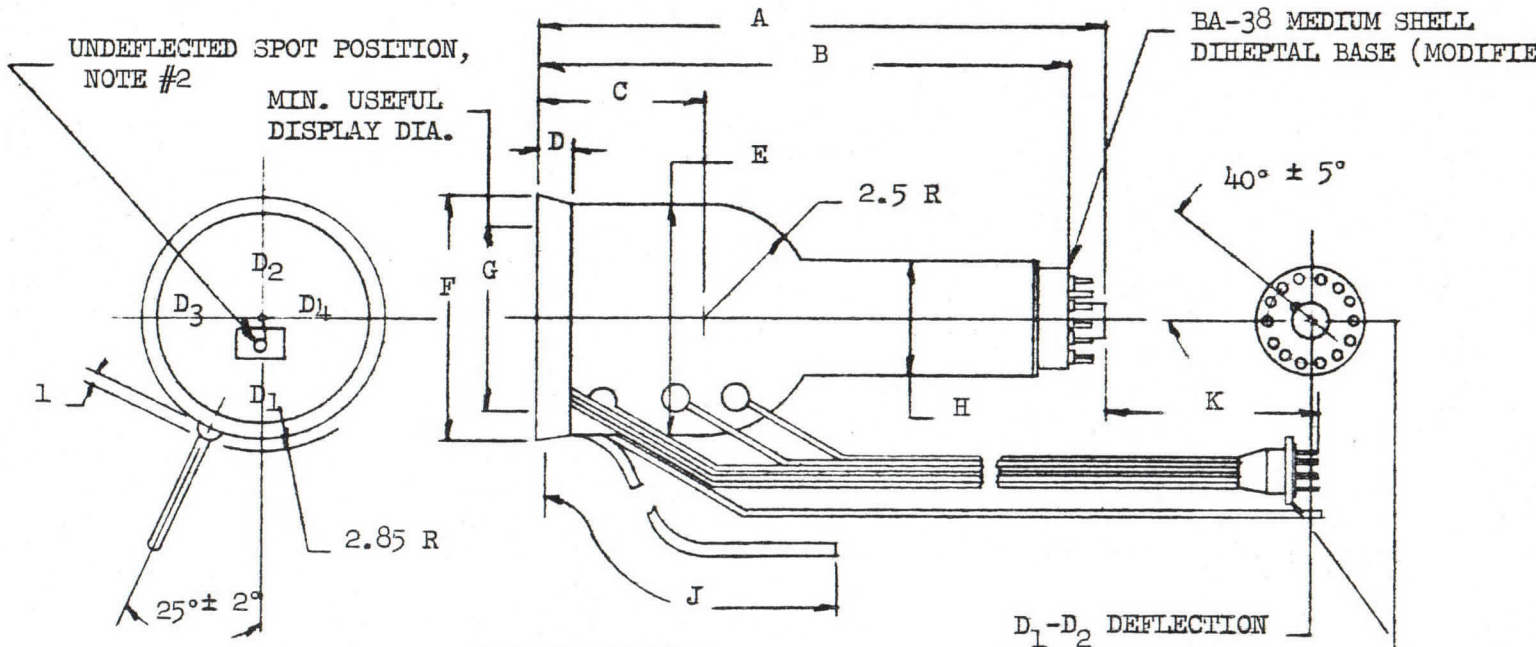
Observe maximum ratings to avoid possible damage to the tubes. In particular the viewing screen voltage should be limited so as to never exceed 10 KV. The full voltage should not be applied to the viewing screen instantaneously. An ordinary RC filter at the output of the power supply will provide adequate assurance that the voltage build up will not be too abrupt. The minimum resistance of the high voltage circuit should be 1 meg ohm.

Repeated bombardment with a high current focused writing beam on a small area of the storage surface can burn a dark image into the display area, which may remain for several hours or even permanently. Therefore, deflection voltages should be applied before operating the writing beam.

Additional information for specific applications can be obtained from the

Electron Tube Applications Section
ITT Components Division
Post Office Box 412
Clifton, New Jersey

* Trademark of the International Telephone & Telegraph Corporation



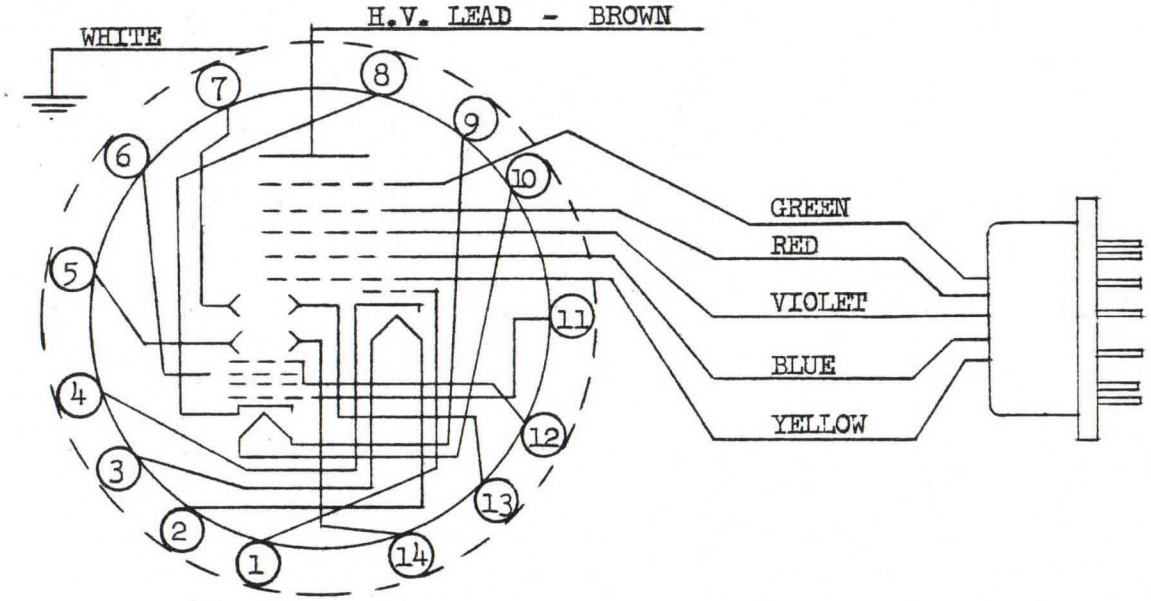
D-3001 OUTLINE

REF.	MIN.	MAX.
A		12 1/16
B	11 1/8	11 1/4
C	3.73	3.83
D	.69	.81
E		5.12
F		5.37
G	4.0	
H	2.44	2.56
I	.24	.26
J		24.0
K	4.5	

NOTES:

1. DEFLECTING ELECTRODES D_1, D_2 ARE NEARER THE SCREEN; DEFLECTING ELECTRODES D_3 , D_4 ARE NEARER THE BASE WITH D_1 POSITIVE WITH RESPECT TO D_2. THE SPOT WILL BE DEFLECTED TOWARD PINS No. 9 AND 10; LIKEWISE WITH D_3 POSITIVE WITH RESPECT TO D_4. THE SPOT WILL BE DEFLECTED TOWARD PIN No. 6.

2. THE SPOT SHALL FALL WITHIN A CIRCLE OF 0.2 INCH RADIUS CENTERED 0.6 INCHES ABOVE THE CENTER OF THE TUBE FACE.



14 PIN BASE

1	ANODE #1
2	FLOOD HEATER
3	FLOOD HEATER
4	FLOOD CATHODE
5	D-3
6	GRID #3 (FOCUS)
7	D-1
8	WRITE CATHODE
9	WRITE HEATER
10	WRITE HEATER
11	GRID #1
12	GRID #2
13	D-2
14	D-4

FLYING LEADS

WHITE SMALL DIAMETER ELECTROSTATIC SHIELD
BROWN LARGE DIAMETER VIEWING SCREEN

E7-1 PIN CONNECTIONS

1	BACKING ELECTRODE
2	N/C
3	ANODE #2
4	ANODE #3
5	ANODE #4
6	N/C
7	COLLECTOR

D-3001

TENTATIVE

APPLICATION:

THE DARK TRACE TUBE IS A CATHODE-RAY TUBE THAT RETAINS AN IMAGE FOR AN EXTENDED PERIOD OF TIME. IMAGE TIME IS ADJUSTABLE BETWEEN A FEW SECONDS AND SEVERAL HOURS.

THE IMAGE APPEARS DARK ON A LIGHT BACKGROUND AND CAN BE VIEWED IN NORMAL LIGHT. THE TUBE CAN BE USED WHEREVER UNIQUE OR SLOWLY DEVELOPING PHENOMENA WITH SPEEDS TO ABOUT 300 M/SEC (975 FT/SEC) ARE TO BE RECORDED, FOR EXAMPLE IN SWITCHING OR METERING, WHICH USED TO REQUIRE A LOOP OSCILLOGRAPH, OR IT CAN BE USED AS A STORAGE DEVICE IN RECORDING EQUIPMENT. OTHER EXAMPLES OF APPLICATION ARE IMAGE TRANSMISSION SYSTEMS WITH SLOW IMAGE SEQUENCE, MEANS FOR DIRECT TRANSMISSION OF DRAWINGS, AND RADAR DISPLAY UNITS. SINCE THE IMAGE CAN BE VIEWED UNDER NORMAL LIGHTING CONDITIONS, THAT IS, WITH THE EYE ADAPTED TO BRIGHT LIGHT, IT FINDS MANY APPLICATIONS IN THE LABORATORY AND INDUSTRY.

THE IMAGE CAN BE ERASED AT ANY TIME WITHIN ABOUT 10 SECONDS BY APPLYING A QUENCHING VOLTAGE.

DESIGN:

THE GLASS ENVELOPE HAS A RECTANGULAR IMAGE SCREEN MEASURING 4 X 5-1/4 INCHES. THE SCREEN DIAGONAL IS 6-3/4 INCHES, AND THE EFFECTIVE SCREEN AREA IS 3-1/8 X 4-7/8 INCHES.

THE TUBE'S BEAM SYSTEM IS FOCUSSED ELECTROSTATICALLY. DEFLECTION IS ACCOMPLISHED MAGNETICALLY AND THE DEFLECTION ANGLE IS 70°. A THIN MICA SHEET IS ARRANGED IMMEDIATELY BEHIND THE FRONT PANE AS AN IMAGE SCREEN. ON THE SIDE OF THE SHEET FACING THE CATHODE, A POTASSIUM CHLORIDE LAYER HAS BEEN DEPOSITED BY VAPORIZATION. WHEN THE CATHODE RAY STRIKES AN AREA, IT CHANGES THE GRID STRUCTURE OF THE CRYSTALS AND THIS LEADS TO A PURPLISH COLORING.

ON THE SIDE OF THE MICA SHEET FACING THE VIEWER, THERE IS A TRANSPARENT SEMICONDUCTIVE LAYER CONNECTED TO TWO TERMINALS THAT PASS THROUGH THE ENVELOPE. WHEN A QUENCHING VOLTAGE IS APPLIED, THE IMAGE IS QUENCHED BY JOULEAN HEAT. AT THE SAME TIME, THE PLATE VOLTAGE IS APPLIED OVER ONE OF THE TERMINALS.

THE FRONT PANE OF THE TUBE IS MADE OF FLAT GLASS, SO THAT ANY IMAGE CAN BE ACCURATELY TRACED ON TRANSPARENT PAPER APPLIED TO THE GLASS.

THE TUBE'S OPERATING CONDITIONS HAVE BEEN SO CHOSEN THAT THE REQUIRED VOLTAGES CAN BE PRODUCED WITH STANDARD TELEVISION COMPONENTS. SINCE WITH THE PHENOMENA TO BE REPRESENTED IT IS IN MANY CASES NOT POSSIBLE TO USE THE DEFLECTION FREQUENCIES COMMONLY USED IN THE TELEVISION INDUSTRY, SPECIAL CIRCUIT ARRANGEMENTS HAVE BEEN WORKED OUT FOR THE AS 17-21 TUBE THAT ALLOWS USING MASS-PRODUCED TELEVISION PARTS TO PRODUCE THE OPERATING VOLTAGES AND PROPER DEFLECTION.

TECHNICAL CHARACTERISTICS:

BEAM SYSTEM	TETRODE WITH UNIT LENS
ENVELOPE	ALL-GLASS DESIGN
BASE	TWELVE-SIDED (DUODEKAL) WITH 7 PRONGS
FOCUSSING	ELECTROSTATIC
DEFLECTION	MAGNETIC
DEFLECTION ANGLE	70° DIAGONAL
FRONT AREA	FLAT CLEAR GLASS
SCREEN	DARK TRACE SCREEN
IMAGE TIME	EXTREMELY LONG, UP TO SEVERAL HOURS
SCREEN AREA	3-1/8 X 4-7/8 INCHES
OVERALL LENGTH, INCLUDING BASE	APPROX. 10-1/2 INCHES
WEIGHT	APPROX. 1-1/2 POUNDS
WRITING RATE	12,000 INCHES PER SECOND

HEATING VALUES FOR PARALLEL OR SERIES SUPPLY

FILAMENT VOLTAGE	V_H 6.3 V
FILAMENT	I_H 0.3 A
OXIDE CATHODE	INDIRECTLY HEATED

RATINGS:

PLATE VOLTAGE	7 - 14	KV
SCREEN GRID VOLTAGE	300	VOLTS, APPROX.
CONTROL GRID VOLTAGE (PEAK)	∱2	VOLTS
FOCUSSING VOLTAGE	0 - 400	VOLTS
BIASING POTENTIAL	-40 - -86	VOLTS
QUENCHING POWER	10 - 15	WATTS
RESISTANCE OF QUENCHING LAYER	80 - 120	OHMS
MAXIMUM CATHODE CURRENT	0.5	MILLIAMPERE
NEGATIVE GRID BIAS	0 - 150	VOLTS
GRID LEAK RESISTANCE	0.5	MEGOHMS
CATHODE CURRENT WITH STATIONARY SPOT	0.5	UA
CHARGE DENSITY DURING BEAM DEFLECTION	1.5	UC/CM^2

AVERAGE OPERATING CONDITIONS:

ANODE VOLTAGE	10	KV
GRID NO. 2 VOLTAGE	300	VOLTS
GRID NO. 3 VOLTAGE	0 - 400	VOLTS
CUT-OFF VOLTAGE (NOTE 1)	-40 - 86	VOLTS
ERASING WATTAGE (NOTE 2)	75	WATTS

NOTE 1: THE CUT-OFF VOLTAGE CORRESPONDS TO THAT VOLTAGE WHICH DOES NOT RESULT IN A DISCOLORATION OF THE SCREEN BY THE SHARPLY FOCUSED BEAM.

NOTE 2: TO ERASE THE PICTURE, AN ERASING VOLTAGE MUST BE APPLIED TO THE TWO CONTACTS AT THE NARROW BULB SIDES. IT IS RECOMMENDED THAT THE VOLTAGE WHICH WILL RESULT IN AN ERASING POWER OF 75 WATTS BE FOUND BY EXPERIMENT. THE RESISTANCE OF THE ERASING COAT IS 80 TO 120 OHMS.

HEATER-CATHODE VOLTAGE:

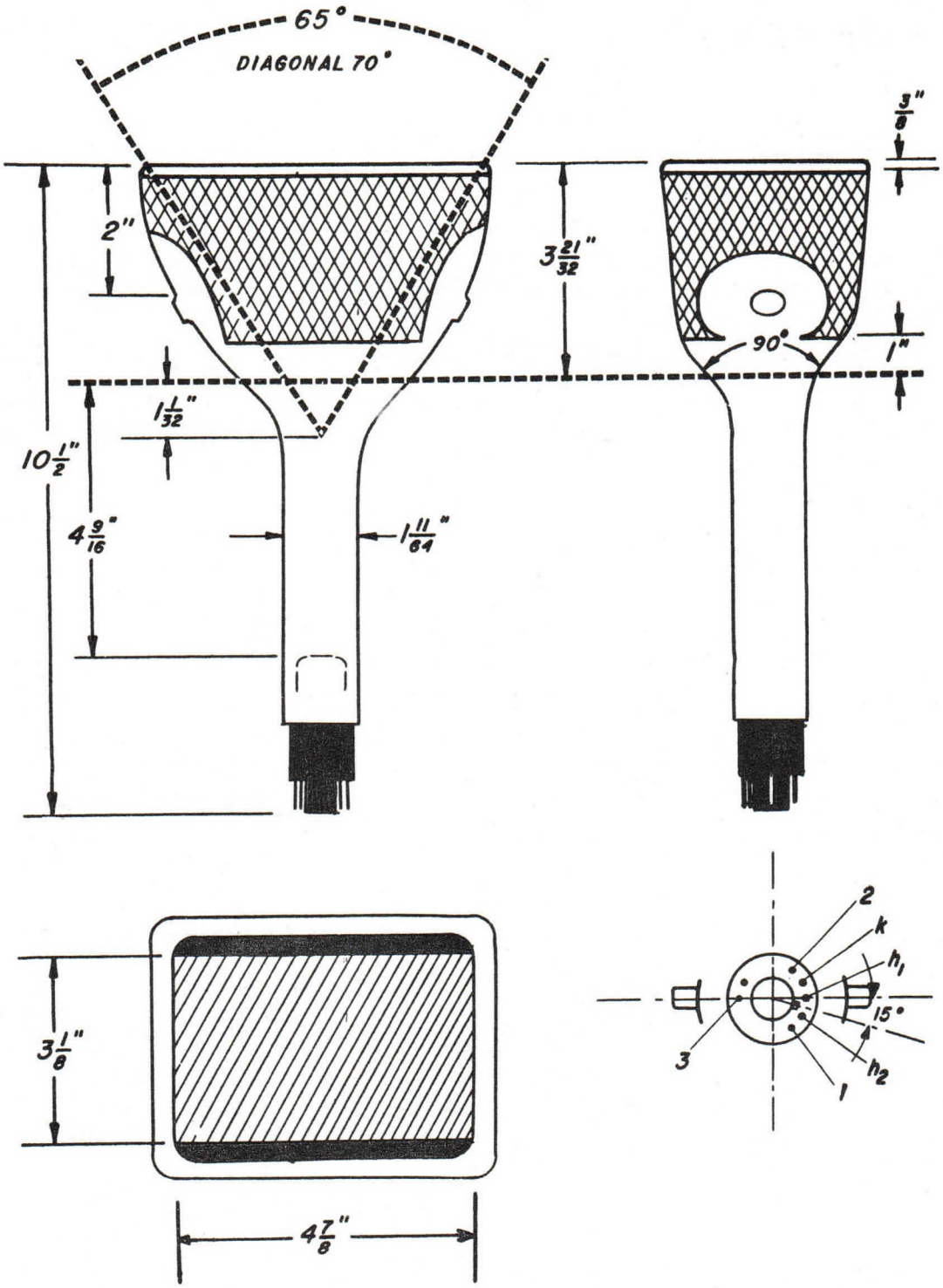
HEATER NEGATIVE		
DURING THE FIRST 15 SECONDS OF THE HEATING-UP PERIOD	410	VOLTS
AFTER THE HEATING-UP PERIOD	200	VOLTS
HEATER POSITIVE	125	VOLTS

CAPACITANCES

CONTROL GRID TO ALL OTHER ELECTRODES	7	UUF
CATHODE TO ALL OTHER ELECTRODES	5	UUF
ANODE TO EXTERNAL COATING	400 - 800	UUF

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY



OUTLINE

D-3003/AS 17-21 STORAGE TUBE

TENTATIVE

DESCRIPTION:

THE FW-204 IS A 5 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROMAGNETICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES ON A DARK BACKGROUND THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE INFORMATION AT WILL. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH THE AMPLITUDE VARIATION OF THE INPUT SIGNAL. THE TUBE HAS TWO CONCENTRIC ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN, WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL. THE CONCENTRIC ARRANGEMENT OF THE GUNS REDUCES DISTORTION OF THE WRITING BEAM TO A MINIMUM.

GENERAL:

DIMENSIONS	SEE OUTLINE AND FUNCTIONAL SCHEMATIC	
NOMINAL TUBE DIAMETER	5	INCHES
MINIMUM USEFUL DISPLAY DIAMETER	4	INCHES
PHOSPHOR	P-20	ALUMINIZED
OPERATING POSITION		ANY
CATHODE PRE-HEATING TIME	60	SECONDS
FOCUS		MAGNETIC
DEFLECTION		MAGNETIC

TYPICAL OPERATING VOLTAGES:

			FLOOD SECTION
VIEWING SCREEN	+10	KV DC	600 UA MAXIMUM
BACKING ELECTRODE	+10	VDC	AND ERASE PULSES
COLLECTOR	+150	VDC	1.0 MA
ANODE #5	+100	VDC	25 UA
ANODE #4	+20	VDC	200 UA
ANODE #3	+16	VDC	300 UA
ANODE #2	+45	VDC	3000 UA
ANODE #1	+12	VDC	25 MA
CATHODE	0	VDC	30 MA
HEATER	6.3	V AC OR DC	2.1 A

* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

WRITE SECTION

CATHODE	-2500	VDC	2 MA
GRID #1 (CUTOFF - NOTE 1)	-50	VDC	RESPECT WRITE CATHODE
GRID #2	0	VDC	2 MA
HEATER	6.3	V AC OR DC	.6 A

RANGE OF OPERATING ADJUSTMENTS:

ANODE #1	0 TO 20	VDC	ADJUST FOR BEST COLLIMATION
ANODE #2, 3, 4	0 TO 50	VDC	ADJUST FOR BEST COLLIMATION
ERASE PULSES	3 - 10	V	AMPLITUDE 1/2 U/SEC. WIDE 75 TO 4000 PRF

TYPICAL PERFORMANCE:

RESOLUTION (NOTE 2)		
200 FT. LAMBERTS	125	LINES PER INCH
2000 FT. LAMBERTS	35	LINES PER INCH
BRIGHTNESS	2500	FT. LAMBERTS
WRITING SPEED		
ZERO BIAS WRITING TO 80% BRIGHTNESS	150,000	IN/SEC.
ERASE TIME (NOTE 3)	5	MILLISECONDS
VIEWING TIME (NOTE 4)	30	SECONDS MAXIMUM

NOTES:

1. VISUAL CUTOFF OF STORED, FOCUSED, UNDEFLECTED SPOT.

2. MEASURED BY THE SHRINKING RASTER METHOD AT THE CENTER OF THE TUBE.

3. ERASE TIME IS THE SHORTEST TIME THAT INFORMATION CAN BE REMOVED FROM THE TUBE AFTER BEING STORED AT FULL BRIGHTNESS.

4. VIEWING TIME IS THE TIME THAT A SIGNAL STORED AT FULL BRIGHTNESS ANYWHERE IN THE DISPLAY CAN BE VIEWED WITH ERASE PULSES APPLIED TO COUNTERACTION WRITING.

*TRADEMARK OF ITT

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED SO AS TO NEVER EXCEED 12 KV.

THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY WILL PROVIDE ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD UP WILL NOT BE TOO ABRUPT. THE VIEWING SCREEN POWER SUPPLY SHOULD HAVE A SERIES RESISTANCE OF AT LEAST 1 MEG OHM.

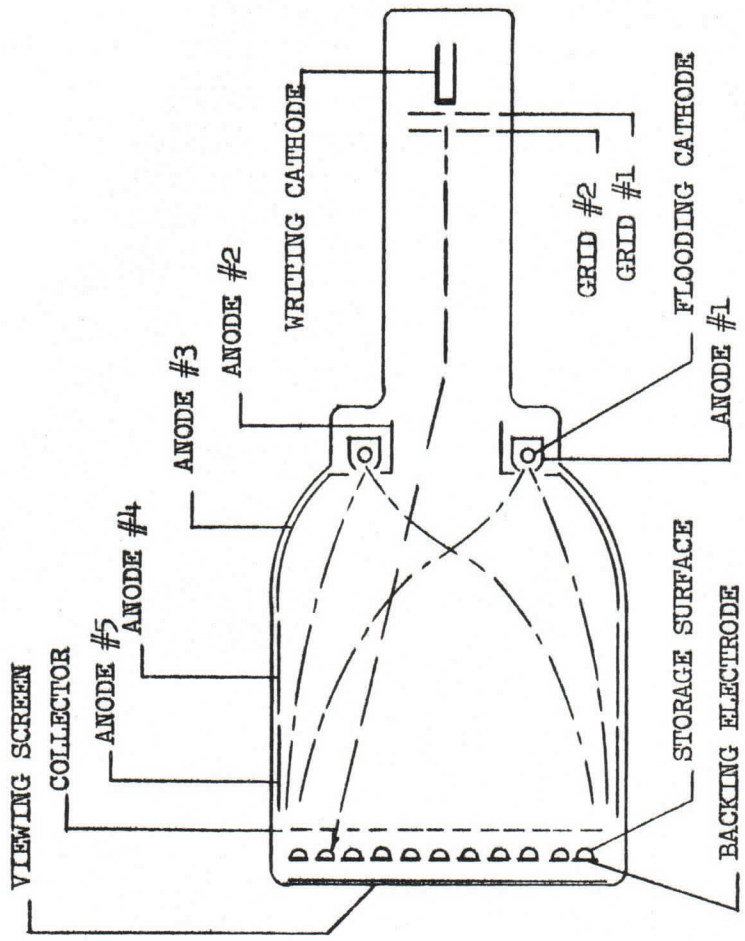
REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY, WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, THE DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

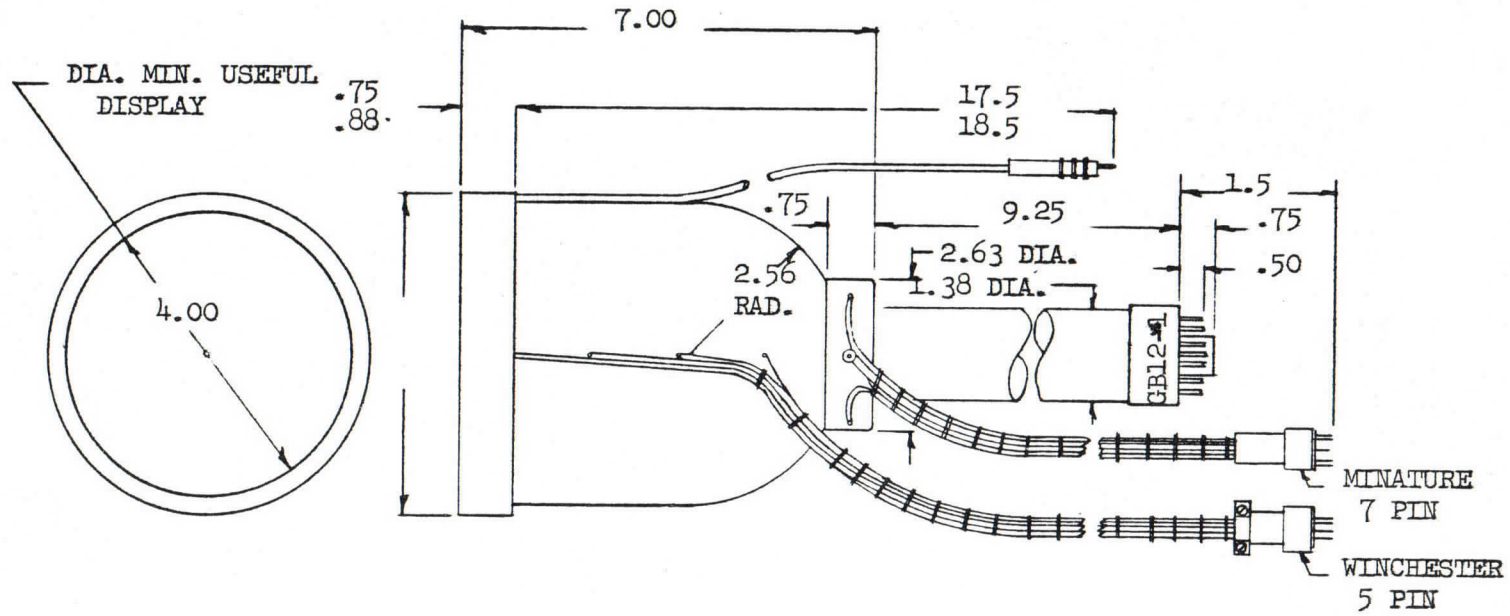
ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY

* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY


VIEWING SCREEN
COLLECTOR
ANODE #5
ANODE #4
ANODE #3
ANODE #2
WRITING CATHODE
GRID #2
GRID #1
FLOODING CATHODE
ANODE #1
STORAGE SURFACE
BACKING ELECTRODE

FW-204



1. GRID #1
2. WRITING GUN CATHODE
3. WRITING GUN HEATER
4. WRITING GUN HEATER
5. NO CONNECTION
6.
7.
8.
9.
10. NO CONNECTION
11. GRID #2
12. NO CONNECTION

1. ANODE #1
2. NO CONNECTION
3. FLOODING GUN HEATER
4. FLOODING GUN HEATER
5. ANODE #2
6. NO CONNECTION
7. FLOODING GUN CATHODE

A. ANODE #3
B. ANODE #4
D. BACKING ELECTRODE
E. COLLECTOR
H. ANODE #5

FW-204

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

TENTATIVE

DESCRIPTION:

THE FW-208 IS A 7.5 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROMAGNETICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE SIGNAL INFORMATION AT THE WILL OF THE OPERATOR. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH THE AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL.

GENERAL:

DIMENSIONS	SEE OUTLINE AND FUNCTIONAL SCHEMATIC	
MINIMUM USEFUL DISPLAY DIAMETER	6.0	INCHES
NOMINAL TUBE DIAMETER	7.5	INCHES
PHOSPHOR	P-20	ALUMINIZED
OPERATING POSITION		ANY
CATHODE PRE-HEATING TIME - NOTE 1	30	SECONDS
FOCUS		MAGNETIC
DEFLECTION		MAGNETIC

OPERATING VALUES AND TYPICAL PERFORMANCE CHARACTERISTICS:

	FLOOD SECTION		
VIEWING SCREEN	+10	KV	
BACKING ELECTRODE	+10	VDC	
COLLECTOR	+150	VDC	
ANODE #4	+75	VDC	
ANODE #3	+10 TO +30	VDC	ADJUSTABLE SEE NOTE 2
ANODE #2	0 TO +80	VDC	ADJUSTABLE INTERNALLY CONNECTED TO GRID #2 SEE NOTE 2
ANODE #1	+60	VDC	
CATHODE	0		
HEATER	6.3	V	1.4 AMPERES NOMINAL AC OR DC

* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

WRITING SECTION

CATHODE	-2500	VDC
GRID #1 CUTOFF	-30	VDC RESPECT CATHODE SEE NOTE 3
GRID #2	0 TO +80	INTERNAL CONNECTION TO ANODE #2
HEATER - SEE NOTE 4	6.3	VOLTS .6 AMPERES NOMINAL AC OR DC
RESULUTION - SEE NOTE 5		
125 FT. LAMBERTS	80	LINES PER INCH
625 FT. LAMBERTS	55	LINES PER INCH
1000 FT. LAMBERTS	40	LINES PER INCH
BRIGHTNESS	1250	FT. LAMBERTS
WRITING SPEED		
WRITING TO 50% BRIGHTNESS	40000	INCHES PER SECOND - SEE NOTE 6
VIEWING TIME - SEE NOTE 7	60	SECONDS MINIMUM
ERASE TIME - SEE NOTE 8	30	MILLISECONDS

NOTES:

1. MINIMUM TIME RECOMMENDED FOR CATHODE WARM-UP BEFORE OPERATING VOLTAGES ARE APPLIED.

2. ADJUST FOR BEST COLLIMATION OF FLOOD BEAM.

3. VISUAL CUTOFF OF FOCUSED, UNDEFLECTED, STORED SPOT.

4. HEATER TRANSFORMER CENTER TAP SHOULD BE CONNECTED TO CATHODE VOLTAGE.

5. RESOLUTION MEASURED BY THE SHRINKING RASTER METHOD AT THE CENTER OF TUBE.

6. MEASURED WITH 25 VOLTS VIDEO DRIVE ABOVE 1/2 UA BEAM CURRENT BIAS LEVEL.

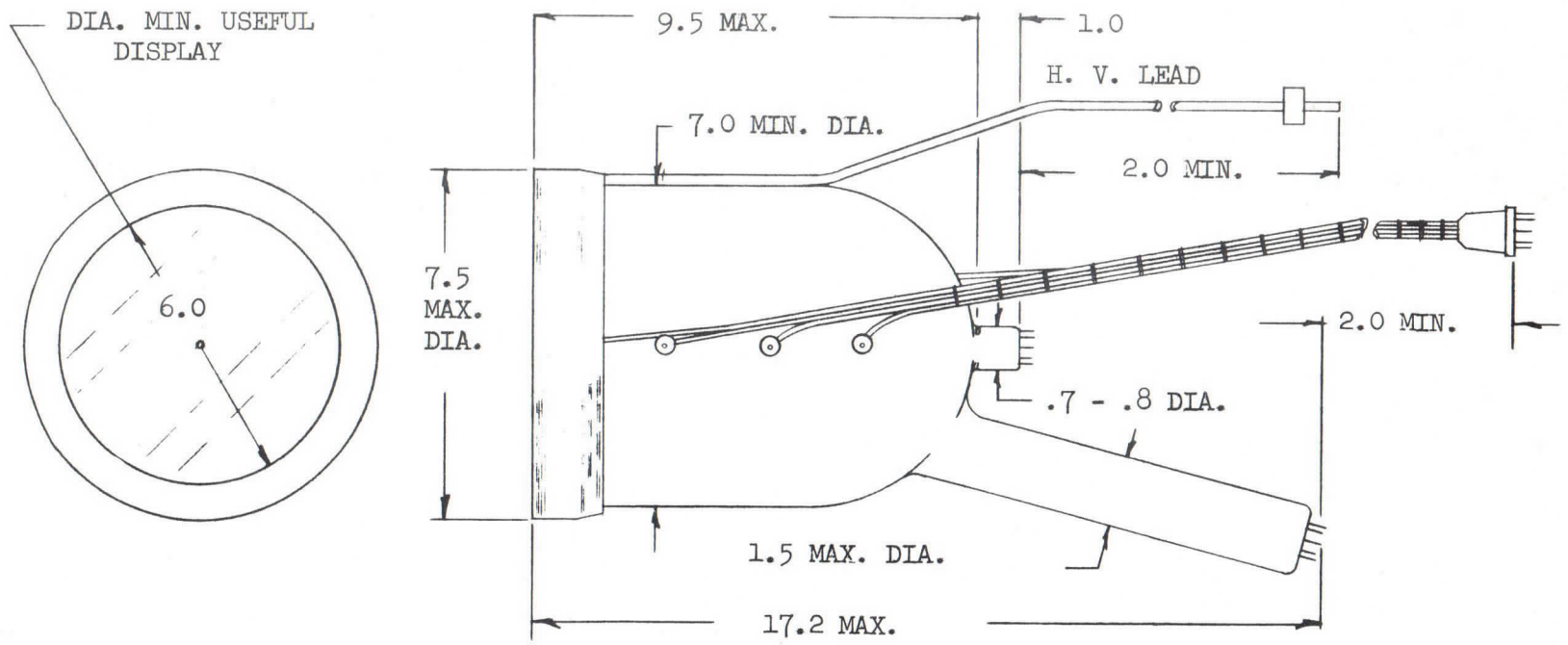
7. VIEWING TIME IS THE TIME THAT A SIGNAL STORED AT MAXIMUM BRIGHTNESS ANYWHERE IN THE DISPLAY CAN BE VIEWED WITH ERASE PULSES BEING CONTINUOUSLY APPLIED TO COUNTERACT POSITIVE ION CHARGING OF THE STORAGE SURFACE.

8. ERASE TIME IS THE SHORTEST TIME THAT INFORMATION CAN BE REMOVED AFTER BEING STORED AT FULL BRIGHTNESS.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY

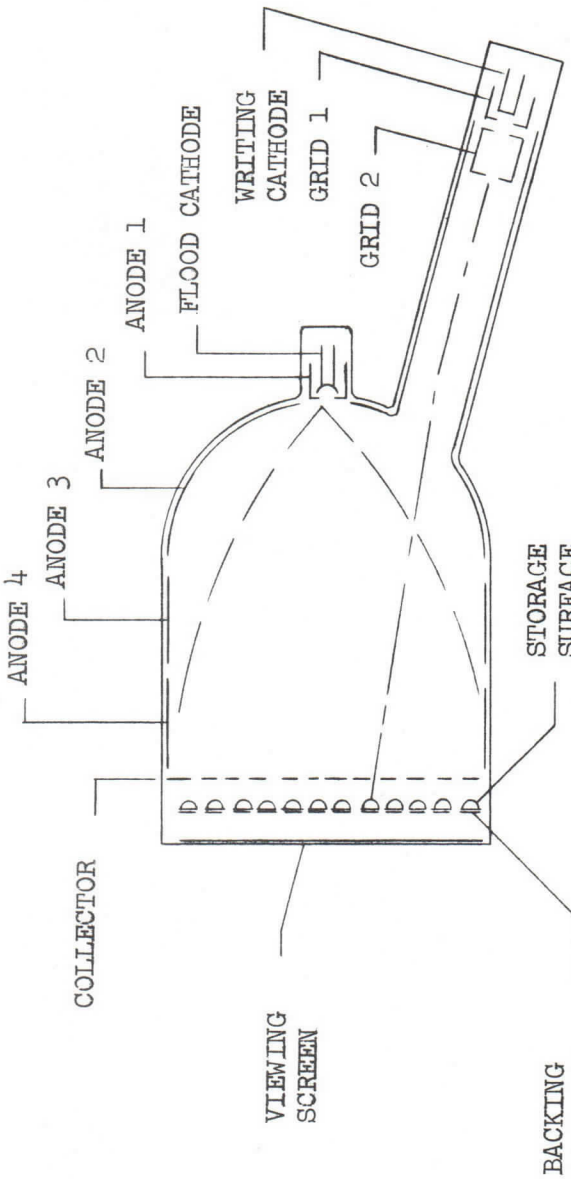
* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION



	FLOODING GUN BASE		WRITING GUN BASE		7 PIN MINIATURE
PIN	1. ANODE 1	PIN	1. GRID 1	PIN	1. BACKING ELECTRODE (GREEN)
	2. NO CONNECTION		2. NO CONNECTION		2. NO CONNECTION
	3. HEATER		3. HEATER		3. ANODE 2 (YELLOW)
	4. HEATER		4. HEATER		4. ANODE 3 (BLUE)
	5. ANODE 1		5. NO CONNECTION		5. ANODE 4 (PURPLE)
	6. NO CONNECTION		6. GRID 2		6. NO CONNECTION
	7. CATHODE		7. CATHODE		7. COLLECTOR (RED)

DIMENSIONAL DRAWING & ELECTRICAL CONNECTIONS

FW - 208



FUNCTIONAL SCHEMATIC

FW - 208

ELECTRON TUBE DEPARTMENT ■ COMPONENTS DIVISION
INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

TENTATIVE

DESCRIPTION:

THE FW-211 IS A 2-1/2 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROSTATICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES ON A DARK BACKGROUND THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE INFORMATION AT WILL. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO CONCENTRIC ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN, WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL. THE CONCENTRIC ARRANGEMENT OF THE GUNS REDUCES DISTORTION OF THE WRITING BEAM TO A MINIMUM.

GENERAL:

DIMENSIONS	SEE OUTLINE AND OPERATIONAL SCHEMATIC ATTACHED	
NOMINAL TUBE DIAMETER	2-1/2	INCHES
MINIMUM USEFUL DISPLAY DIAMETER	1.8	INCHES
PHOSPHOR	P-20	ALUMINIZED
OPERATING POSITION		ANY
CATHODE PRE-HEAT TIME	60	SECONDS
FOCUS		ELECTROSTATIC
DEFLECTION		ELECTROSTATIC

TYPICAL OPERATING VALUES:

	FLOOD SECTION		
VIEWING SCREEN	8.5	VDC	600 UA MAXIMUM
BACKING ELECTRODE	∱10	VDC	AND ERASE PULSES
COLLECTOR	∱135	VDC	
ANODE #4	∱65	VDC	
ANODE #3	∱5 TO 25	VDC	ADJUST FOR BEST COLLIMATION
ANODE #2	∱5 TO 25	VDC	ADJUST FOR BEST COLLIMATION
ANODE #1	∱12	VDC	
FLOOD CATHODE	0	VDC	
HEATER	6.3	V AC OR DC	1.4 A

* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

		WRITING SECTION	
HEATER	6.3	V	AC OR DC .6 A
CATHODE	-900	VDC	
GRID #1 CUTOFF (NOTE 1)	-50	VDC	RESPECT WRITE CATHODE
GRID #2	0	VDC	
GRID #3 (FOCUS)	+200		RESPECT WRITE CATHODE
MEAN DEFLECTION PLATE VOLTAGE	0	VDC	

TYPICAL PERFORMANCE CHARACTERISTICS:

RESOLUTION (NOTE 2)		
200 FT. LAMBERTS	120	LINES/INCH
2000 FT. LAMBERTS	80	LINES/INCH
4000 FT. LAMBERTS	40	LINES/INCH
LIGHT OUTPUT	4000	FT. LAMBERTS
WRITING SPEED		
20 VOLTS DRIVE TO 1000 FT. LAMBERTS	20000	IN/SECOND
ZERO BIAS TO 2000 FT. LAMBERTS	50000	IN/SECOND
ERASE TIME (NOTE 3)	5	MILLISECONDS
VIEWING TIME (NOTE 4)	5	SECONDS

NOTES:

1. VISUAL CUTOFF OF STORED, FOCUSED, UNDEFLECTED SPOT.

2. RESOLUTION MEASURED AT TUBE CENTER BY THE SHRINKING RASTER METHOD.

3. ERASE TIME IS THE SHORTEST TIME THAT INFORMATION CAN BE REMOVED FROM THE TUBE AFTER BEING STORED AT FULL BRIGHTNESS.

4. VIEWING TIME IS THE TIME THAT A SIGNAL STORED AT FULL BRIGHTNESS ANYWHERE IN THE DISPLAY AREA CAN BE VIEWED WITH ERASE PULSES APPLIED TO COUNTERACT ION WRITING.

* TRADEMARK OF ITT

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED SO AS TO NEVER EXCEED 10 KV.

THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY WILL PROVIDE ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD UP WILL NOT BE TOO ABRUPT. THE VIEWING SCREEN POWER SUPPLY SHOULD HAVE A SERIES RESISTANCE OF AT LEAST 1 MEG OHM.

REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, THE DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
POST OFFICE BOX 412
CLIFTON, NEW JERSEY

* TRADEMARK OF ITT

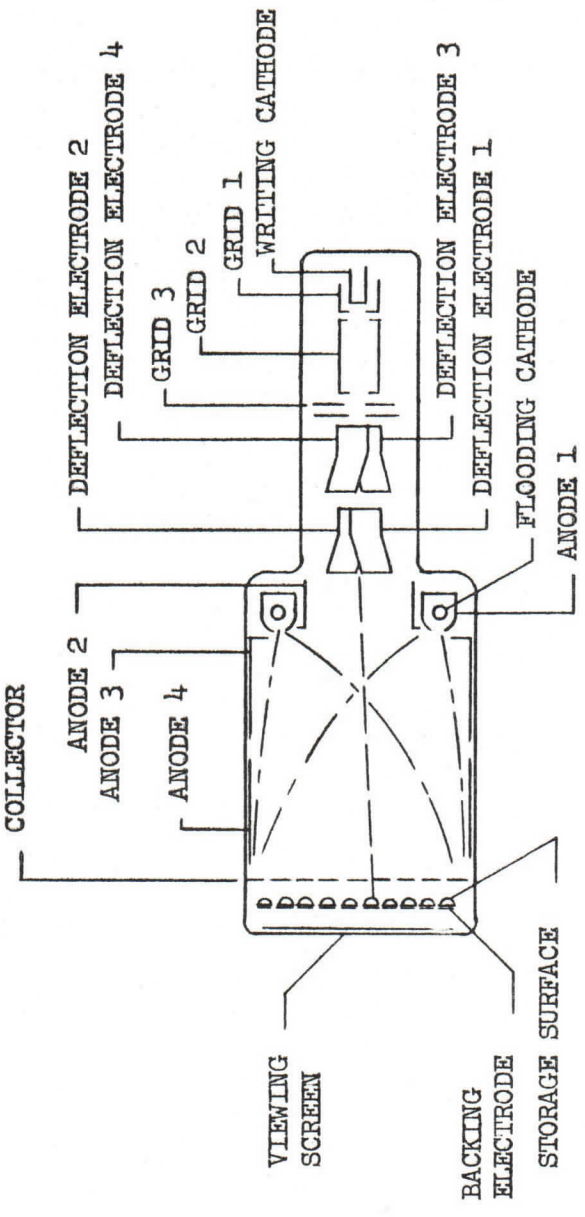
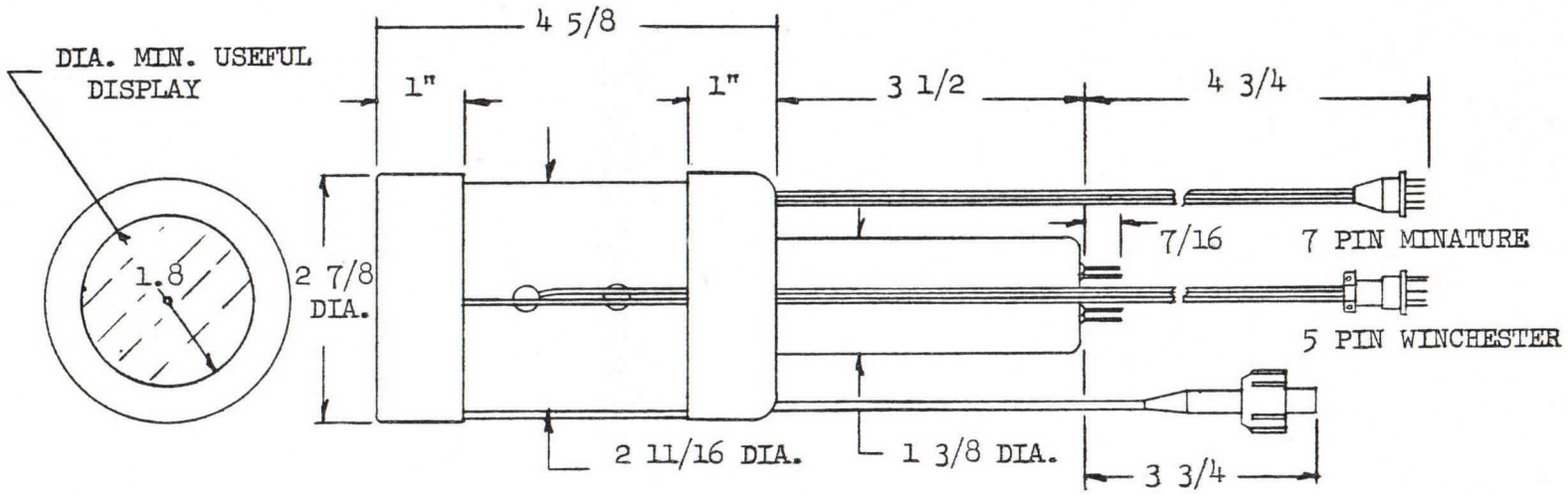


FIGURE 1 OPERATIONAL SCHEMATIC - FW-211



PIN	9 PIN BASE
1.	FLOOD GUN HEATER & ANODE 1
2.	FLOOD GUN HEATER
3.	GRID 2
4.	NO CONNECTION
5.	WRITING GUN HEATER & CATHODE
6.	WRITING GUN HEATER
7.	GRID 1
8.	GRID 3 (FOCUS)
9.	KEY PIN (CLIPPED)

PIN	7 PIN MINATURE
1.	FLOOD GUN CATHODE
2.	ANODE 2
3.	NO CONNECTION
4.	DEFLECTION ELECTRODE 1
5.	DEFLECTION ELECTRODE 2
6.	DEFLECTION ELECTRODE 3
7.	DEFLECTION ELECTRODE 4

PIN	5 PIN WINCHESTER
A.	NO CONNECTION
B.	ANODE 3
D.	COLLECTOR
E.	ANODE 4
H.	BACKING ELECTRODE

HIGH VOLTAGE MATES WITH AMPHENOL H.A. & H.V. TERMINAL ASSEMBLY NO. 832,608 or 834,333

FIGURE 2 DIMENSIONAL OUTLINE - FW-211

TENTATIVE

DESCRIPTION:

THE FW-212 IS A 5-INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION. IT IS ELECTROSTATICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES ON A DARK BACKGROUND THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE INFORMATION AT WILL. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO CONCENTRIC ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN, WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL. THE CONCENTRIC ARRANGEMENT OF THE GUNS REDUCES DISTORTION OF THE WRITING BEAM TO A MINIMUM.

GENERAL:

DIMENSIONS	SEE OUTLINE AND FUNCTIONAL SCHEMATIC	
NOMINAL TUBE DIAMETER	5	INCHES
MINIMUM USEFUL DISPLAY DIAMETER	4	INCHES
PHOSPHOR	P-20	ALUMINIZED
OPERATING POSITION		ANY
CATHODE PRE-HEATING TIME	60	SECONDS
FOCUS		ELECTROSTATIC
DEFLECTION		ELECTROSTATIC

OPERATING VALUES:

			FLOOD SECTION	
VIEWING SCREEN	10	KV DC	600	MA MAX.
BACKING ELECTRODE	∱10	VDC	AND ERASE PULSES	
COLLECTOR	∱150	VDC	1000	UA
ANODE #5	∱100	VDC	25	UA
ANODE #4	∱20	VDC	(0 TO 50 VOLTS ADJUSTABLE)	200 UA
ANODE #3	∱16	VDC	(0 TO 50 VOLTS ADJUSTABLE)	300 UA
ANODE #2	∱45	VDC	(0 TO 50 VOLTS ADJUSTABLE)	3000 UA
ANODE #1	∱12	VDC	(0 TO 20 VOLTS ADJUSTABLE)	25 MA
CATHODE	0	VDC		30 MA
HEATER	6.3	V	AC OR DC	2.1 A

* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

Writing Section

Cathode	-1500	VDC	2 Ma
Grid #1 (Cutoff - Note 1)	-35	VDC	Respect write cathode
Grid #2	0	VDC	2 Ma
Grid #3 (Focus)	∔300	VDC	Respect write cathode
Grid #4	0	VDC	
Heater	6.3	V	AC or DC .6 A
Deflection Sensitivity		Approximately 85 volts / inch	
Mean Deflection Plate Voltage	0 to ∔60	VDC	Adjust for least astigmatism

Typical Performance

Resolution (Note 2)		
200 ft. Lamberts	90	Lines/inch
1000 ft. Lamberts	60	Lines/inch
2500 ft. Lamberts	35	Lines/inch
Brightness	2500	Ft. Lamberts
Writing Speed		
20 Volts Drive, writing to 1,000 ft. Lamberts	35,000	Inches per Second
Zero bias, writing to 1,000 ft. Lamberts	70,000	Inches per Second
Erase Time (Note 3)	5	Milliseconds
Viewing Time (Note 4)	30	Seconds Maximum

NOTES:

1. Visual cutoff of stored, focused, undeflected spot.
2. Resolution measured at tube center by the shrinking raster method.
3. Erase time is the shortest time that information can be removed after being stored at 100% brightness.
4. Minimum time that a signal stored at full brightness anywhere in the display area can be viewed with erase pulses continuously applied to counteract ion writing.

* Trademark of ITT

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED SO AS TO NEVER EXCEED 12 KV.

THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY WILL PROVIDE ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD-UP WILL NOT BE TOO ABRUPT. THE VIEWING SCREEN POWER SUPPLY SHOULD HAVE A SERIES RESISTANCE OF AT LEAST 1 MEG OHM.

REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, THE DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

ELECTRON TUBE APPLICATIONS SECTION
ITT COMPONENTS DIVISION
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CLIFTON, NEW JERSEY

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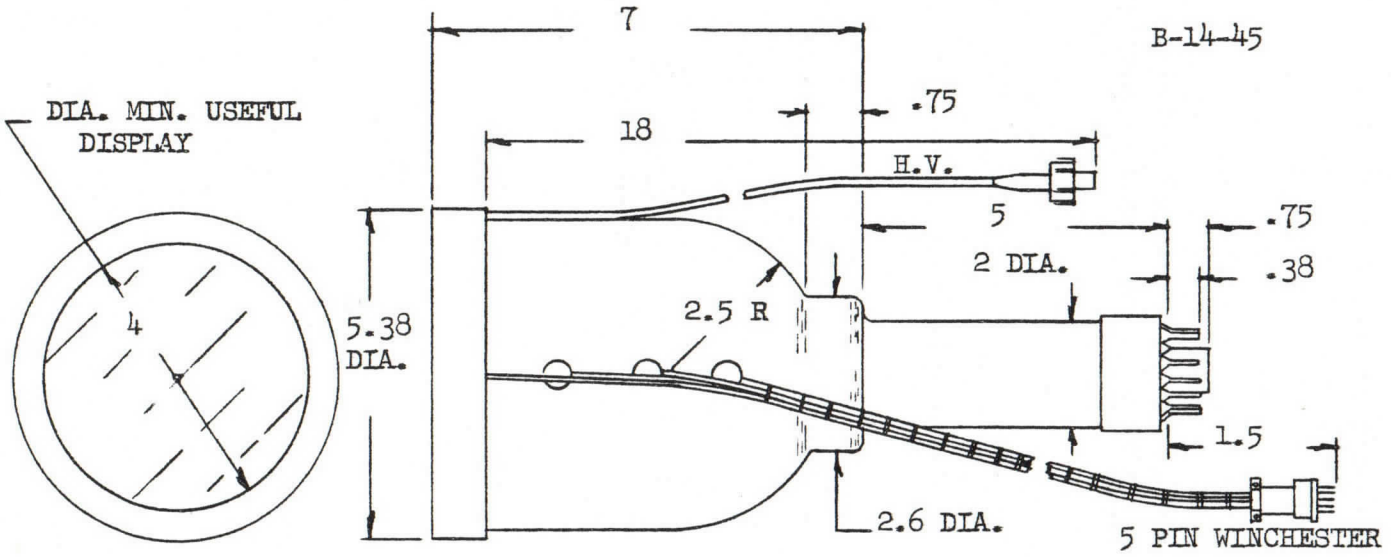

PIN

1	WRITING GUN HEATER
2	GRID 3
3	DEFLECTION ELECTRODE 2
4	GRID 5
5	GRIDS 2, 4, & 6
6	ANODE 2
7	DEFLECTION ELECTRODE 3
8	FLOOD GUN CATHODE
9	FLOOD GUN HEATER
10	FLOOD GUN HEATER & ANODE 1
11	GRID 1
12	DEFLECTION ELECTRODE 4
13	DEFLECTION ELECTRODE 1
14	WRITING GUN HEATER & CATHODE

PIN

A	ANODE 3
B	ANODE 4
D	COLLECTOR
E	ANODE 5
H	BACKING ELECTRODE

H.V. MATES WITH AMP.
H.A. & H.V. TERMINAL ASSEMBLY

FIGURE 2 DIMENSIONAL OUTLINE FW-212

TENTATIVE

DESCRIPTION:

THE FW-223 IS A 5 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION.

IT IS MAGNETICALLY DEFLECTED AND ELECTROSTATICALLY FOCUSED. THE TUBE DISPLAYS BRIGHT IMAGES ON A DARK BACKGROUND THAT CAN BE VIEWED IN DIRECT DAYLIGHT, AND FEATURES THE ABILITY TO WRITE, STORE, AND ERASE AT WILL. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH AMPLITUDE VARIATIONS OF THE INPUT SIGNAL. THE TUBE HAS TWO CONCENTRIC ELECTRON GUNS, A WRITING GUN, WHICH WRITES THE INPUT SIGNAL ON A STORAGE MESH, AND A FLOOD GUN, WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL. THE CONCENTRIC ARRANGEMENT OF THE GUNS REDUCES DISTORTION OF THE WRITING GUN TO A MINIMUM.

GENERAL:

DIMENSIONS	SEE OUTLINE AND OPERATIONAL SCHMATIC ATTACHED
NOMINAL TUBE DIAMETER	5 INCHES
MINIMUM USEFUL DISPLAY DIAMETER	4 INCHES
PHOSPHOR	P-20 ALUMINIZED
OPERATING POSITION	ANY
CATHODE PRE-HEAT TIME	60 SECONDS
FOCUS	ELECTROSTATIC
DEFLECTION	MAGNETIC

TYPICAL OPERATING VOLTAGES:

	FLOOD SECTION	
VIEWING SCREEN	∱10 KV	
BACKING ELECTRODE	∱10 VDC	AND ERASE PULSES
COLLECTOR	∱200 VDC	
ANODE #5	∱145 VDC	
ANODE #4	∱32 VDC	ADJUST FOR BEST COLLIMATION
ANODE #3	∱12 VDC	ADJUST FOR BEST COLLIMATION
ANODE #2	∱19 VDC	ADJUST FOR BEST COLLIMATION
ANODE #1	∱16 VDC	ADJUST FOR BEST COLLIMATION
CATHODE	0 VOLTS	
HEATER	6.3 AC OR DC	2.1 A

* TRADEMARK OF INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

WRITE SECTION

HEATER	6.3	V AC OR DC .6 A	
CATHODE	-1000	VDC	
GRID #1 (CUTOFF - NOTE 1)	-50	VDC	RESPECT WRITE CATHODE
GRID #2, #4 (INTERNAL CONNECTION)	0	VDC	
GRID #3 (FOCUS)	+200 TO +500		RESPECT WRITE CATHODE

TYPICAL PERFORMANCE:

RESOLUTION (NOTE 2)		
200 FT. LAMBERTS	120	LINES PER INCH
1500 FT. LAMBERTS	50	LINES PER INCH
LIGHT OUTPUT	2500	FT. LAMBERTS
WRITING SPEED TO 1500 FT. LAMBERTS	70000	INCHES PER SECOND
ERASE TIME (NOTE 3)	10	MILLISECONDS
VIEWING TIME (NOTE 4)	30	SECONDS MAXIMUM

NOTES:

1. VISUAL CUTOFF OF THE STORED, FOCUSED, UNDEFLECTED SPOT.

2. MEASURED BY THE SHRINKING RASTER METHOD AT THE CENTER OF THE TUBE.

3. ERASE TIME IS THE SHORTEST TIME THAT INFORMATION CAN BE REMOVED FROM THE TUBE AFTER BEING STORED AT FULL BRIGHTNESS.

4. VIEWING TIME IS THE TIME THAT A SIGNAL STORED AT FULL BRIGHTNESS ANYWHERE IN THE DISPLAY AREA CAN BE VIEWED WITH ERASE PULSES APPLIED TO COUNTERACT ION WRITING.

SPECIAL PRECAUTIONS

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED, SO AS TO NEVER EXCEED 12 KV.

THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY WILL PROVIDE ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD UP WILL NOT BE TOO ABRUPT. THE VIEWING SCREEN POWER SUPPLY SHOULD HAVE A SERIES RESISTANCE OF AT LEAST 1 MEG OHM.

REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK IMAGE INTO THE DISPLAY WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, THE DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

ADDITIONAL INFORMATION FOR SPECIFIC APPLICATIONS CAN BE OBTAINED FROM THE

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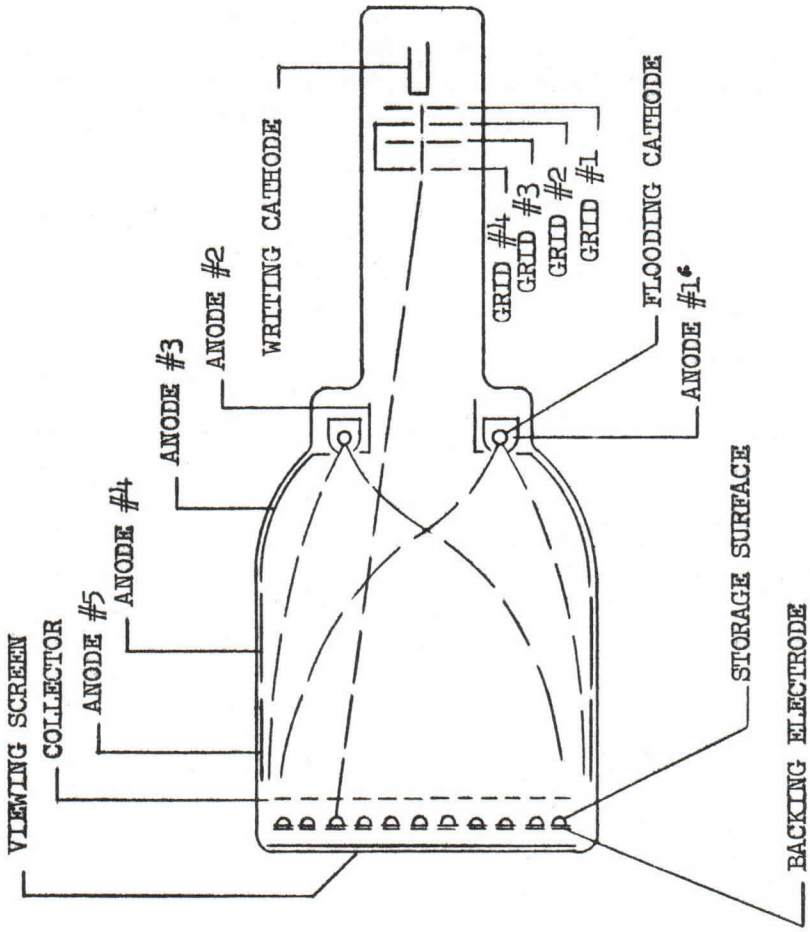
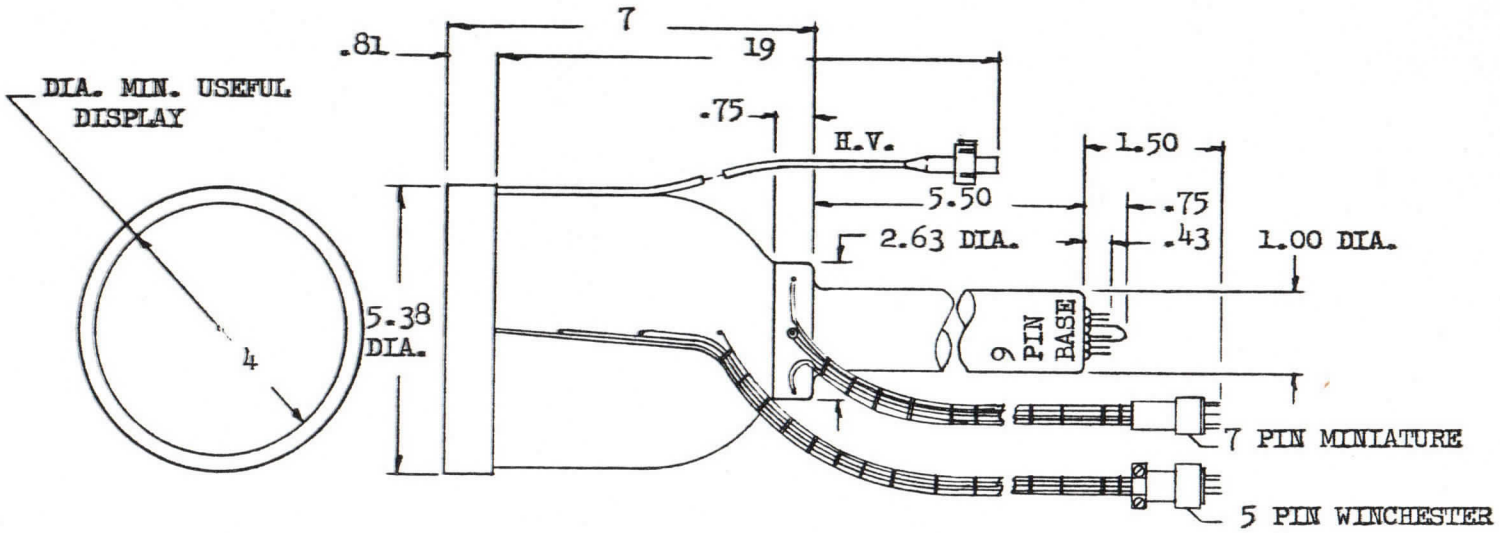


FIGURE 1 OPERATIONAL SCHEMATIC - FW-223



PIN	7 PIN MINIATURE
1.	NO CONNECTION
2.	NO CONNECTION
3.	FLOOD GUN HEATER & ANODE #1 (GREEN)
4.	FLOOD GUN HEATER (WHITE)
5.	ANODE #2 (BLUE)
6.	NO CONNECTION
7.	FLOOD GUN CATHODE (YELLOW)

PIN	5 PIN WINCHESTER
A.	ANODE #3 (YELLOW)
B.	ANODE #4 (BLUE)
D.	COLLECTOR (RED)
E.	ANODE #5 (PURPLE)
H.	BACKING ELECTRODE (GREEN)

PIN	9 PIN BASE
1.	GRID #1
2.	HEATER
3.	HEATER
4.	NO CONNECTION
5.	CATHODE
6.	GRID #2 & #4
7.	NO CONNECTION
8.	GRID #3 (FOCUS)
9.	NO CONNECTION

HIGH VOLTAGE MATES WITH AMPHENOL
H.A. and H.V. TERMINAL ASSEMBLY NO. 832,608 or 834,333

FIGURE 2 DIMENSIONAL OUTLINE - FW-223

TENTATIVE

DESCRIPTION:

THE FW-227 IS A 4 INCH IATRON (DIRECT VIEW STORAGE CATHODE-RAY TUBE) THAT PRODUCES A BRIGHT VISUAL DISPLAY OF ELECTRICALLY STORED INFORMATION.

THE TUBE INCORPORATES TWO WRITING GUNS, WHICH ARE ELECTROSTATICALLY FOCUSED AND DEFLECTED. THE TUBE DISPLAYS BRIGHT IMAGES ESPECIALLY SUITABLE FOR PHOTOGRAPHIC PURPOSES BECAUSE OF THE BLUE P-11 PHOSPHOR. THE ABILITY TO WRITE, STORE, AND ERASE INFORMATION AT WILL ARE FEATURES OF THE TUBE. GREY SHADES ARE PRODUCED IN ACCORDANCE WITH AMPLITUDE VARIATIONS OF THE INPUT SIGNALS. THE TUBE HAS THREE ELECTRON GUNS, TWO IDENTICAL WRITING GUNS, WHICH WRITE INPUT SIGNALS ON AN INSULATOR STORAGE MESH, AND A FLOOD GUN WHICH ILLUMINATES THE PHOSPHOR IN ACCORDANCE WITH THE STORED SIGNAL.

GENERAL:

DIMENSIONS	SEE OUTLINE ATTACHED
NOMINAL TUBE DIAMETER	4 INCHES
MINIMUM USEFUL DISPLAY DIAMETER	3 INCHES
PHOSPHOR	P-11 ALUMINIZED
OPERATION POSITION	ANY
WEIGHT	2.8 POUNDS
CATHODE PRE-HEATING TIME	30 SECONDS
FOCUS METHOD	ELECTROSTATIC
DEFLECTION METHOD	ELECTROSTATIC

MAXIMUM RATINGS:

	FLOOD SECTION
VIEWING SCREEN	10 KV
BACKING ELECTRODE	25 V
COLLECTOR	250 V
ANODE #4	150 V
ANODE #3	150 V
ANODE #2	150 V
ANODE #1	80 V

* TRADEMARK OF THE INTERNATIONAL TELEPHONE & TELEGRAPH CORPORATION

WRITE SECTION - EACH GUN

GRID #3	500	V	RESPECT WRITE CATHODE
GRID #2	150	V	RESPECT WRITE CATHODE
GRID #1	-150	V	RESPECT WRITE CATHODE
CATHODE	-1100	V	
PEAK VOLTAGE BETWEEN GRID #2 AND ANY DEFLECTING ELECTRODE OF CORRESPONDING GUN	±500	V	
HEATER-CATHODE VOLTAGE	±125	V	

TYPICAL OPERATING VALUES:

FLOOD SECTION

VIEWING SCREEN	4	KV DC	1.2 MA MAXIMUM
BACKING ELECTRODE	+10	VDC	
COLLECTOR	+180	VDC	2.0 MA MAXIMUM
ANODE #4	+90	VDC	300 UA MAXIMUM
ANODE #3	+20	VDC	500 UA MAXIMUM
ANODE #2	+30	VDC	1.5 MA MAXIMUM
ANODE #1	+60	VDC	2.0 MA MAXIMUM
CATHODE	0	V	4.5 MA MAXIMUM
HEATERS	6.3	V AC OR DC	1.4 A

WRITE SECTION - EACH GUN

HEATER	6.3	V AC OR DC	.6 A
CATHODE	-1000	VDC	1 MA
GRID #1 (CUTOFF - NOTE 1)	-70	VDC	RESPECT WRITE CATHODE
GRID #2			INTERNALLY CONNECTED TO ANODE #2
GRID #3 (FOCUS)	+150		RESPECT WRITE CATHODE
DEFLECTION SENSITIVITY	60	VOLTS PER INCH, APPROXIMATELY	

RANGE OF OPERATING ADJUSTMENTS:

ANODE #2	+25 TO +50	VDC	ADJUST FOR BEST COLLIMATION
ANODE #3	+15 TO +40	VDC	ADJUST FOR BEST COLLIMATION
GRID #1 CUTOFF	-55 TO -110	VDC	RESPECT WRITE CATHODE, EACH GUN
GRID #3 FOCUS	+130 TO +330	VDC	RESPECT WRITE CATHODE, EACH GUN

* TRADEMARK OF ITT

TYPICAL PERFORMANCE:

RESOLUTION (NOTE 2)	
10% OF FULL BRIGHTNESS	100 LINES PER INCH
50% OF FULL BRIGHTNESS	50 LINES PER INCH
BRIGHTNESS	200 FT. LAMBERTS
WRITING SPEED (EACH GUN)	
28 VOLTS DRIVE WRITING TO 180 FT. LAMBERTS	11000 INCHES PER SECOND
ERASE TIME	5 MILLISECONDS
VIEWING TIME	NO VISIBLE DEGRADATION OF A SIGNAL STORED AT 90% BRIGHTNESS FOR AT LEAST 1 SECOND WITH NO ERASE APPLIED.

ENVIRONMENTAL DATA:

HIGH TEMPERATURE	MIL-E-5272A PROCEDURE I
LOW TEMPERATURE	MIL-E-5272A PROCEDURE II
TEMPERATURE-SHOCK	MIL-E-5272A PROCEDURE I, EXCEPT HIGH TEMPERATURE TO BE 160°F AND LOW TEMPERATURE TO BE -65°F
ALTITUDE	70000 FT.
VIBRATION	6G 10-150 CPS 2G 150-500 CPS
SHOCK (3 AXES)	
OPERATING	15G FOR 32 MS, 18 IMPACTS
NON-OPERATING (CRASH SAFETY)	30G FOR 11 MS, 18 IMPACTS

NOTES:

1. VISUAL CUTOFF OF THE STATIONARY WRITING BEAM IS TO BE DETERMINED IN A DARKENED ROOM. THE WRITING BEAM SHOULD BE FOCUSED AND THE BACKING ELECTRODE VOLTAGE REDUCED TO -20 VOLTS.

2. RESOLUTION MEASURED BY THE SHRINKING RASTER METHOD AT THE CENTER OF THE VIEWING SCREEN.

3. ERASE TIME IS THE SHORTEST TIME THAT INFORMATION CAN BE REMOVED AFTER BEING STORED AT 100% BRIGHTNESS.

* TRADEMARK OF ITT

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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY

SPECIAL PRECAUTIONS:

OBSERVE MAXIMUM RATINGS TO AVOID POSSIBLE DAMAGE TO THE TUBE. IN PARTICULAR THE VIEWING SCREEN VOLTAGE SHOULD BE LIMITED SO AS TO NEVER EXCEED 10 KV. THE FULL VOLTAGE SHOULD NOT BE APPLIED TO THE VIEWING SCREEN INSTANTANEOUSLY. AN ORDINARY RC FILTER AT THE OUTPUT OF THE POWER SUPPLY WILL PROVIDE ADEQUATE ASSURANCE THAT THE VOLTAGE BUILD UP WILL NOT BE TOO ABRUPT. THE VIEWING SCREEN POWER SUPPLY SHOULD HAVE A SERIES RESISTOR OF AT LEAST 1 MEG OHM.

REPEATED BOMBARDMENT WITH A HIGH CURRENT FOCUSED BEAM ON A SMALL AREA OF THE STORAGE SURFACE CAN BURN A DARK AREA INTO THE DISPLAY, WHICH MAY REMAIN FOR SEVERAL HOURS OR EVEN PERMANENTLY. THEREFORE, THE DEFLECTION VOLTAGES SHOULD BE APPLIED BEFORE OPERATING THE WRITING BEAM.

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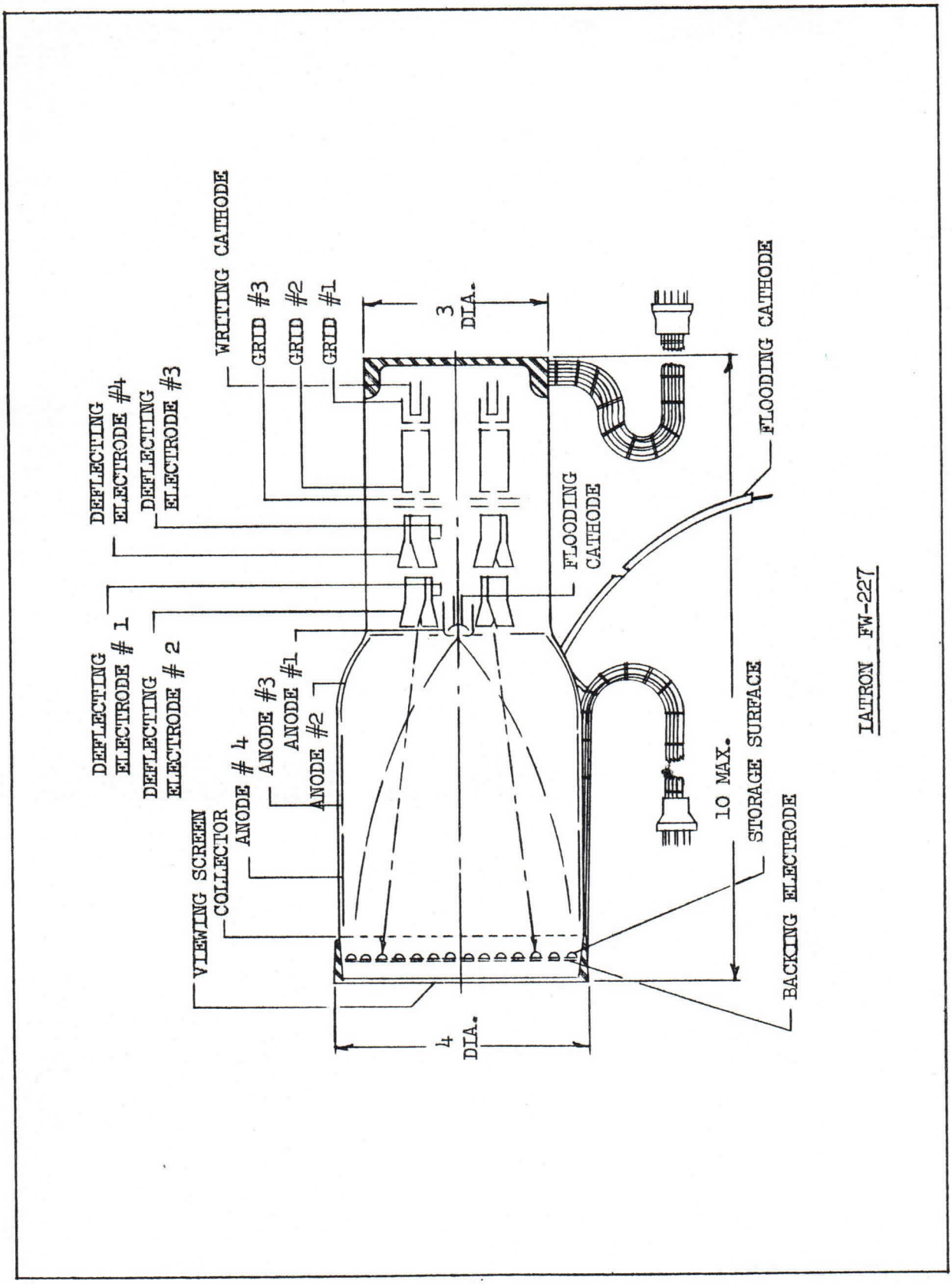

IATRON FW-227

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INTERNATIONAL TELEPHONE AND TELEGRAPH CORPORATION, CLIFTON, NEW JERSEY