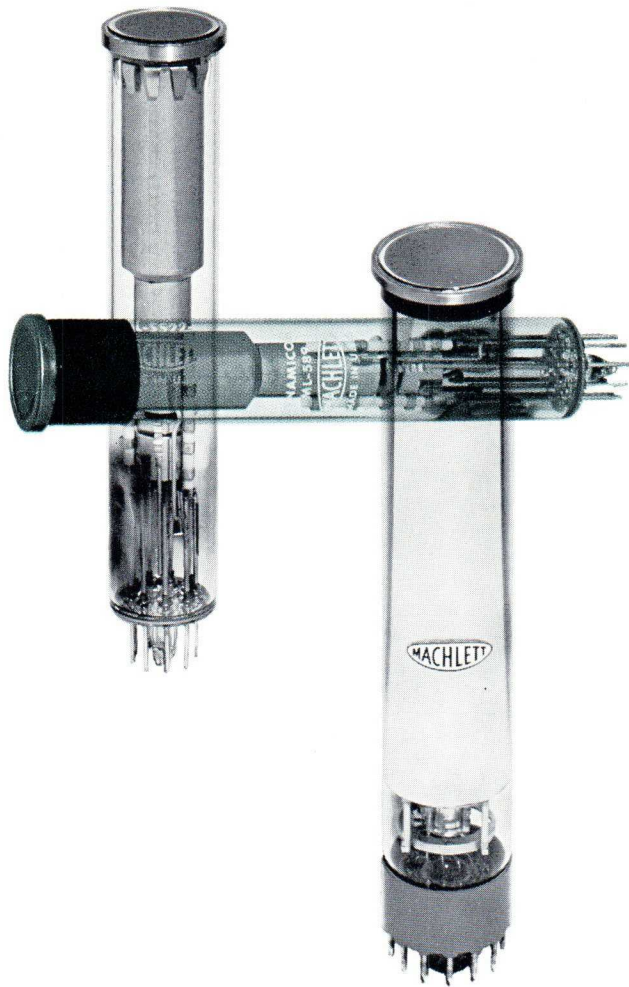


**Machlett**  
Special-  
Purpose  
**Vidicons**



# Machlett

## Special-Purpose

# Vidicons

The design, development and production of specialized, high-quality TV vidicon camera tubes is a unique capability of The Machlett Laboratories. Since entering the vidicon field with a broadcast vidicon that provided "live" quality to film transmission in mid-1958, Machlett has continued to advance the state of the art with a succession of new and difficult-to-produce vidicons. The current Machlett line, described on succeeding pages, consists of exclusive, special purpose, high quality tubes. Each of these tubes represents a technological breakthrough which was the culmination of extensive research and custom engineering.

In addition to exclusively Machlett development programs, the Company is continually engaged in sponsored development on special or custom vidicons for the military, private research institutions and others. Machlett, with its staff of specialists, continues to solicit sponsored development programs.

Among the special Machlett vidicons, currently used in slow-scan systems in satellite applications, is the ML-7351A. It is highly sensitive in the red region, and has lag characteristics that make this tube particularly adaptable to CCTV systems viewing radar scopes, and the like.

Two tubes in the line — the ML-S522B and the ML-2128G — have spectral response which peaks near the ultraviolet region. Applications of these tubes include TV display of

ultraviolet microscope images of specimens which could not be viewed, or would be changed by exposure to visible light.

The incorporation of fiber-optics faceplates as an integral part of the ML-2128G and the ML-2128U vidicons has significantly advanced the capability of TV systems. With fiber optics, images can be transferred over short or long distances (in this case, short) with high sensitivity, efficiency, and resolution, while a lens system is restricted by its focal length.

The development of two x-ray sensitive camera tubes — termed DYNAMICONS\* — combines instantaneous, enlarged x-ray image reproduction with protection for observing personnel. Performance of both static and in-motion medical and non-destructive radiographic examinations are notable advantages of these tubes.

The two-inch vidicon — represented by the ML-2058G and ML-2135G — was developed for applications which required a wider input field than was possible with the conventional  $\frac{1}{2}$ " x  $\frac{3}{8}$ " scanned area of the 1" vidicon. The 2" tubes provide for a full 1" x 1" raster.

On the following pages are the essential details and characteristics of the current Machlett vidicon line. Further inquiry on these tubes as to applications and capabilities, as well as special developmental requirements, is invited.

\*Trade name registered by The Machlett Laboratories, Inc.

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**ML-7351/  
ML-7351A**  
1" High sensitivity  
at low light levels

The ML-7351 and 7351A are 1" TV vidicon camera tubes designed for low light level applications with limited subject motion. The slow-scan and target storage characteristics of these tubes are particularly advantageous in CCTV systems, viewing radar display scopes. Resolution is normally about 500 TV lines (over 800 lines with elevated focusing potential). Sensitivity is extremely high; scenes with as little as 0.05 fc illumination on the faceplate can be registered. For average scenes, this corresponds to 2.5 fc illumination on a scene when using an f/2 lens. Spectral response peaks at 6000 Å (in red region), and is somewhat dependent on dark current. Signal decay rate is approximately half that of standard light-sensitive vidicons. The ML-7351 has a side tip protrusion; ML-7351A does not have side tip, which permits use of longer deflection yoke.

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**ML-2128G**  
1" High contrast;  
fiber-optics input

The ML-2128G is a 1" TV vidicon camera tube with a fiber-optics faceplate. This faceplate permits the tube to be directly coupled to cathode ray, storage or image intensifier tubes provided with fiber-optics output. Fiber-optics combinations for such purposes greatly increase light transmission capabilities, are lighter in weight and utilize less space than comparable optically coupled devices. Spectral response is S-18. Resolution is 600 TV lines. High contrast is enhanced by means of extra-mural absorption in the fiber optics.

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**ML-S522B**  
1" Fast, near UV  
spectral response

The ML-S522B is a 1" TV vidicon camera tube which is sensitive to near ultraviolet illumination. It is ideally suited for TV systems coupled to devices such as the ultraviolet microscope, which provides increased resolving power with the advantages of fluorescence. The S-522B spectral response peaks at 4000 Å. When used with monochromatic radiation at this wavelength, the tube has a sensitivity of about  $4.5 \mu\text{a}/\mu\text{w}$ . Resolution is normally 500 TV lines, but may be higher with elevated focusing potentials. Signal decay rate is approximately double that of standard light-sensitive vidicons.

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**ML-2128U**  
1" Near UV; fiber  
optics input

The ML-2128U is a 1" TV vidicon camera tube that has a fiber-optics faceplate. It is sensitive to near ultraviolet illumination, and is especially suited for TV coupling to cathode ray, storage or image intensifier tubes which are provided with fiber-optics output. Such fiber-optics combinations are usually smaller, lighter in weight and have greater light-transmission qualities than comparable lens coupled devices. Spectral response peaks at 4000 Å, which permits increased over-all sensitivity when used with devices having ultraviolet-emitting output screens. Resolution is approximately 500 TV lines; high contrast is obtained by means of extra-mural absorption in fiber optics.

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**ML-2058G**  
2" High resolution;  
1.4" diagonal image

The ML-2058G is a 2" TV vidicon camera tube which provides high-detail resolution. It may be used with conventional image orthicon magnetic deflection coils. Length is 12". Features include: a 1" x 1" raster (1.4" diagonal working area); a limiting resolution exceeding 2000 TV lines, 1100 TV lines at 50% amplitude modulation; S-18 spectral response. Transfer Characteristics and Aperture Response Curves follow "Typical Operating Conditions." Development of a 2" tube with a near UV response is both practical and feasible.

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**ML-589**  
1" X-ray sensitive;  
High contrast image

The ML-589 DYNAMICON is a 1" TV camera tube which is sensitive to x-radiation incident on its faceplate. It provides high-contrast images with detail resolution down to .0005", and penetrator sensitivities to 2% when used with an adequate CCTV system and x-ray source. This tube makes possible static and in-motion non-destructive examinations of metal weldments, encapsulated components, and biological specimens. Magnifications to 50X easily obtainable. Resolution of 300 ASA phosphor bronze mesh and .0005" dia. single tungsten wires (at faceplate) can be obtained without additional absorber in x-ray beam. Tube has a low-absorption beryllium faceplate.

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**ML-2135G**  
2" X-ray sensitive;  
1.4" diagonal image

The ML-2135G DYNAMICON is a 2" TV camera tube which is sensitive to x-radiation incident on its faceplate. This tube permits high-contrast images, brightness intensification, remote viewing and improved x-ray protection. It has a 1" x 1" raster (1.4" diagonal working area). Resolution of 300 ASA phosphor bronze mesh and .0005" dia. single tungsten wires (at faceplate) can be obtained without an additional absorber in the x-ray beam. This tube is ideally suited for static and in-motion non-destructive examinations of metal weldments, encapsulated components, and biological specimens, especially for applications that cannot be adequately scanned by 1" ML-589.

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Units

ML-7351/  
ML-7351A  
1" High-  
Sensitivity

### GENERAL CHARACTERISTICS

Heater, for Unipotential Cathode:		
Voltage (AC or DC) . . . . .	V	6.3 ± 10%
Current . . . . .	A	.6
Direct Interelectrode Capacitance,		
Signal Electrode to All Other Electrodes (Note 1) . . . . .	pf	4.5
Spectral Response . . . . .	—	See Curve
Photoconductive Layer:		
Aspect ratio of rectangular image . . . . .	—	4 x 3
Maximum useful diagonal image . . . . .	in.	.62
Orientation of quality rectangle . . . . .	—	Note 2
Focusing Method . . . . .	—	Magnetic
Deflection Method . . . . .	—	Magnetic
Operating Position . . . . .	—	Any
Overall Length . . . . .	in.	6.25 ± .25
Greatest Diameter . . . . .	in.	1.125 ± .010 (Note 4)
Bulb . . . . .	—	T-8
Base, JEDEC No. . . . .	—	E8-11
Socket, equivalent to Cinch No. . . . .	—	54A18088
Weight, approximate . . . . .	oz	2

### FIBER-OPTICS CHARACTERISTICS

Fiber Diameter . . . . .	microns
Faceplate Thickness . . . . .	in.
Numerical Aperture, nominal . . . . .	—

**Note 1** — This capacitance, which effectively is the output impedance of the vidicon, is increased when the tube is mounted in the deflecting-yoke and focusing-coil assembly. The resistive component of the output impedance is in the order of 100 megohms.

**Note 2** — Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and short index pin.



**ML-2128G**  
1" Fiber-Optics Input

**ML-S522B**  
1" Near-UV

**ML-2128U**  
1" Near-UV/  
Fiber-Optics

**ML-2058G**  
2" High-Resolution

**ML-589**  
1" X-Ray Sensitive

**ML-2135G**  
2" X-Ray Sensitive

$6.3 \pm 10\%$ .6	$6.3 \pm 10\%$ .6	$6.3 \pm 10\%$ .6	$6.3 \pm 10\%$ .6	$6.3 \pm 10\%$ .6	$6.3 \pm 10\%$ .6
4.5	4.5	4.5	6.5	4.5	6.5
S-18	See Curve	See Curve	S-18	X-ray	X-ray
4 x 3 .62 Note 2	4 x 3 .62 Note 2	4 x 3 .62 Note 2	1 x 1 1.4 Note 3	4 x 3 .62 Note 2	1 x 1 1.4 Note 3
Magnetic Magnetic Any	Magnetic Magnetic Any	Magnetic Magnetic Any	Magnetic Magnetic Any	Magnetic Magnetic Face up to horizontal	Magnetic Magnetic Any
$6.25 \pm .25$ $1.125 \pm .010$	$6.25 \pm .25$ $1.125 \pm .010$	$6.25 \pm .25$ $1.125 \pm .010$	$12.0 \pm .25$ $2.25 \pm .010$	$6.25 \pm .25$ $1.125 \pm .015$	$12.0 \pm .25$ $2.25 \pm .010$
T-8 E8-11 54A18088 2	T-8 E8-11 54A18088 2	T-8 E8-11 54A18088 2	— B14-45 — 10	— E8-11 54A18088 2	— B14-45 — 10
7 .09 .84		7 .09 .84			

**Note 3** — Proper orientation is obtained when the horizontal scan is essentially parallel to the plane passing through the tube axis and base key.

**Note 4** — ML-7351 has a side tip projecting beyond maximum diameter.

## MAXIMUM RATINGS

	Units	ML-7351/ ML-7351A 1" High- Sensitivity
Absolute Values for a scanned area as noted . . . . .	in.	1/2 x 3/8
Signal-Electrode Voltage . . . . .	Vdc	75
Grid No. 4 and Grid No. 3 Voltage . . . . .	Vdc	1000
Grid No. 2 Voltage . . . . .	Vdc	500
Grid No. 1 Voltage:		
Negative bias value . . . . .	Vdc	125
Positive bias value . . . . .	V	0
Peak Heater-Cathode Voltage:		
Heater negative with respect to cathode . . . . .	v	125
Heater positive with respect to cathode . . . . .	v	10
Dark Current . . . . .	uA dc	.1
Peak Target Current . . . . .	ua	.55
Faceplate Temperature . . . . .	°C	71
Faceplate Illumination . . . . .	fc	100

## TYPICAL OPERATING CONDITIONS

Signal-Electrode Voltage . . . . .	Vdc	10 to 25
Grid No. 4 (Decelerator) and Grid No. 3 (Beam-Focus Electrode) Voltage (Note 7) . . . . .	Vdc	250 to 300
Grid No. 2 (Accelerator) Voltage . . . . .	Vdc	300
Grid No. 1 Voltage for Picture Cutoff (Note 8) . . . . .	Vdc	-45 to -100
Minimum Peak-to-Peak Blanking Voltage:		
When applied to Grid No. 1 . . . . .	v	40
When applied to Cathode . . . . .	v	10
Faceplate Illumination, highlight . . . . .	fc	.3 to .7
Faceplate Temperature . . . . .	°C	30 to 35
Dark Current . . . . .	uA dc	.02
Target Current, highlight (Note 9) . . . . .	uA	.32 to .42
Average Gamma for Transfer Characteristics . . . . .	—	.65
For signal output current as given . . . . .	uA	.02 to .2
Visual equivalent Signal-to-Noise Ratio, approx. (Note 10) . . . . .		300:1
Field Strength at Center of Focusing Coil, approx. . . . .	gauss	40
Field Strength of Adjustable Alignment Coil . . . . .	gauss	0 to 4

**Note 5**— The maximum signal-electrode voltage is determined by the secondary emission first cross-over potential of the photoconductive layer. With a conventional deflection field rate of 60 cps, the cross-over potential will be reached, under no-radiation conditions, at a signal electrode voltage of between 35 and 50 volts. If the tube is operated above the first cross-over potential, the photoconductive surface will be stabilized by the G4 electrode. The potential across the photoconductive layer will then be the difference between the potentials applied to G4 and the signal-electrode.

If operated above the first cross-over potential during early life, this tube is very susceptible to picture and raster burns

due to the high potential gradient across the layer. Although this effect becomes less apparent with increased operating hours, the manufacturer deems it advisable to limit the signal-electrode potential to a few volts below the cross-over point in order to prevent picture deterioration. The maximum signal-electrode potential is therefore given for each tube delivered.

With the beam off, the cross-over will be reached with a somewhat lower signal-electrode potential, as a result of the extended photoconductive storage time. It is important, therefore, to turn the beam on before increasing the signal-electrode potential above zero.

ML-2128G 1" Fiber- Optics Input	ML-S522B 1" Near-UV	ML-2128U 1" Near-UV/ Fiber-Optics	ML-2058G 2" High- Resolution	ML-589 1" X-Ray Sensitive	ML-2135G 2" X-Ray Sensitive
1/2 x 3/8	1/2 x 3/8	1/2 x 3/8	1 x 1	1/2 x 3/8	1 x 1
75	40	40	75	Note 5	Note 5
1000	1000	1000	3500	1000	3500
500	500	500	350	500	350
125	125	125	125	125	125
0	0	0	0	0	0
125	125	125	125	125	125
10	10	10	10	10	10
.25	.02	.02	1.0	Note 6	Note 6
.55	.55	.55	2.0	.40	1.4
71	45	45	60	45	45
1000	—	—	1000	—	—
15 to 35	10 to 25	10 to 25	25 to 60	10 to 30	10 to 30
250 to 300	250 to 300	250 to 300	2900 to 3100	250 to 300	2900 to 3100
300	300	300	300	300	300
-45 to -100	-45 to -100	-45 to -100	-45 to -100	-45 to -100	-45 to -100
75	40	40	75	75	75
20	10	10	20	20	20
15	—	—	15	—	—
30 to 35	30 to 35	30 to 35	30 to 35	20 to 30	20 to 30
.02	.005	.005	.08	(Note 6)	(Note 6)
.32 to .42	.2 to .4	.2 to .4	1.2 to 1.6	—	—
.65	—	—	.65	—	—
.02 to .2	—	—	.08 to .8	—	—
300:1	300:1	300:1	300:1	300:1	300:1
40	40	40	60	40	60
0 to 4	0 to 4	0 to 4	0 to 3	0 to 4	0 to 3

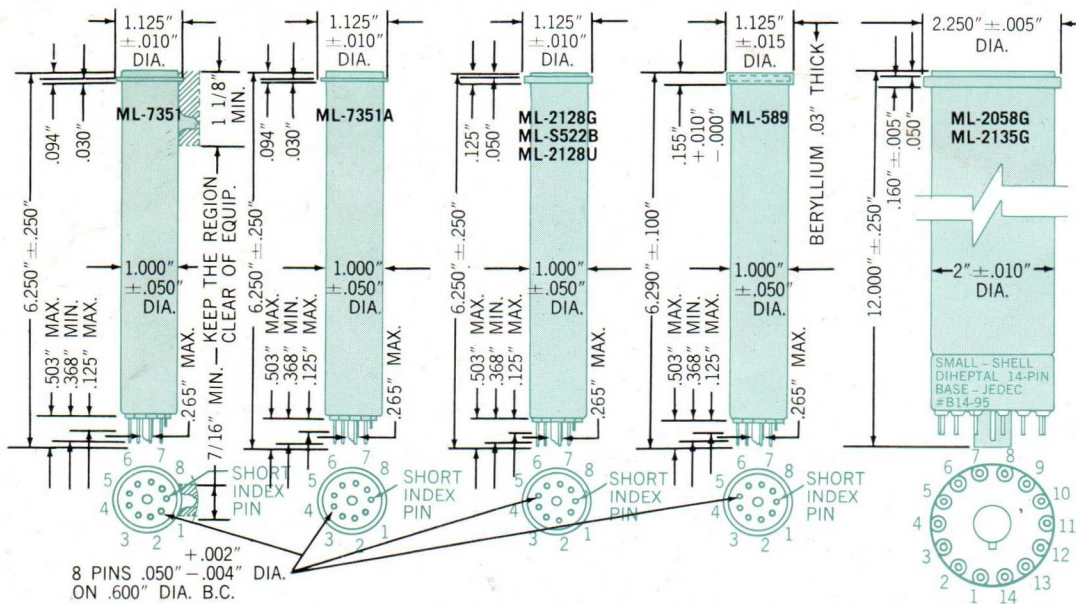
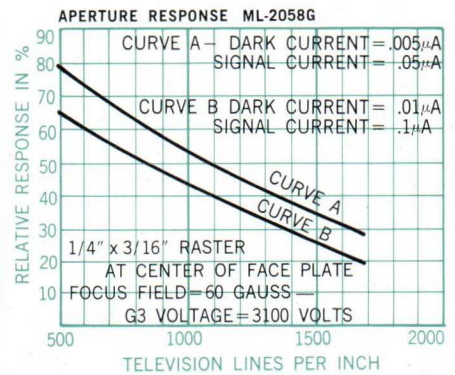
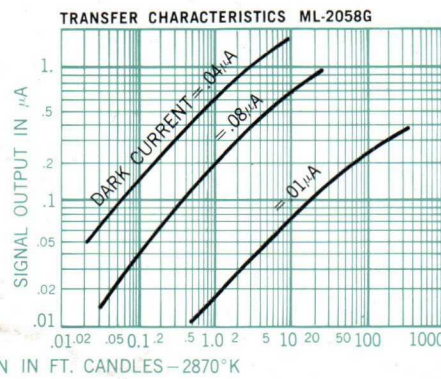
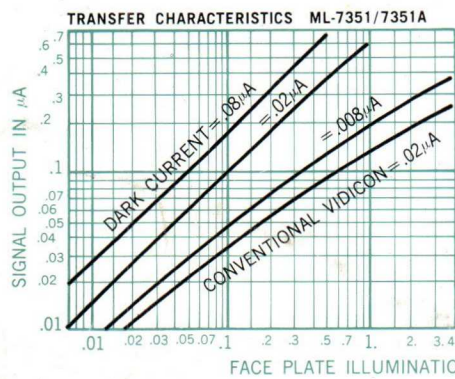
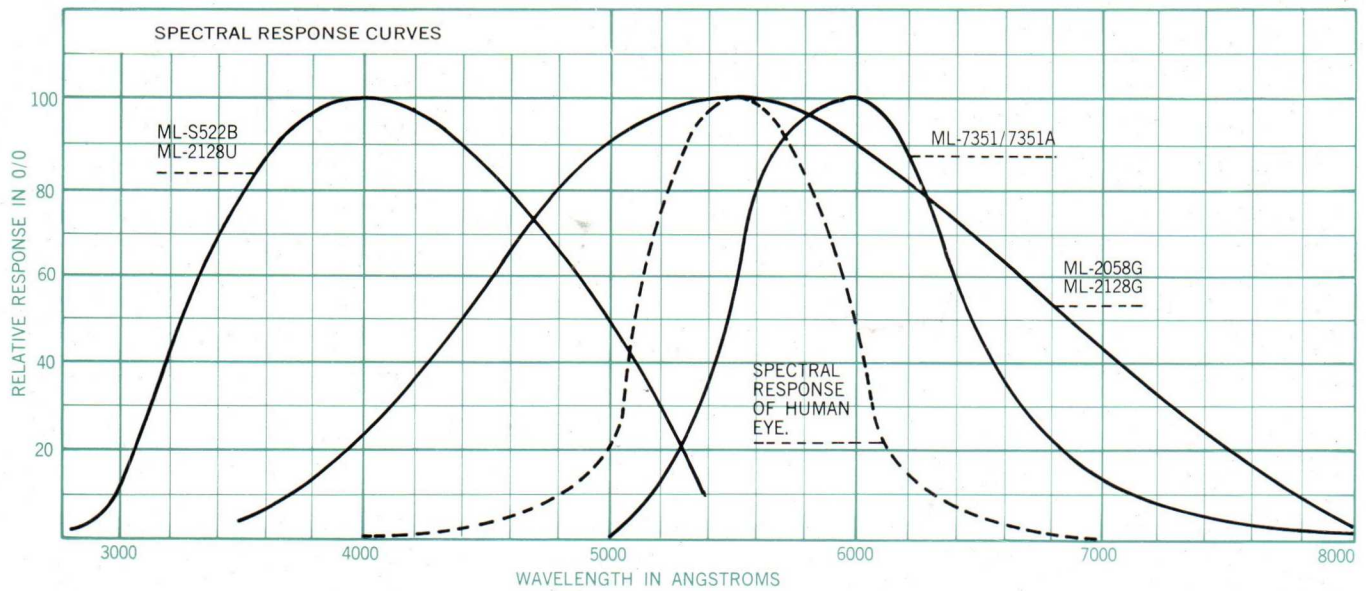
**Note 6** — The characteristics of the photoconductive surface are such that the operating dark current is extremely small compared to that obtained with conventional light-sensing vidicons. It is somewhat difficult to measure due to the presence of leakage currents, and it is not therefore considered a useful operating parameter.

**Note 7** — Definition, focus uniformity and picture quality decrease with decreasing Grid No. 3 and Grid No. 4 voltage. In general, Grid No. 3 and Grid No. 4 should not be operated below the lower value shown.

**Note 8** — With no blanking voltage on Grid No. 1.

**Note 9** — Video amplifiers must be designed properly to handle target currents of this magnitude to avoid amplifier overload or picture distortion.

**Note 10** — Measured with high-gain, low noise, cascode-input-type amplifier having bandwidth of 5 megacycles.



PIN CONNECTIONS FOR 1" TUBE	
PIN NO.	ELEMENT
1 & 8	HEATER
2	GRID NO. 1
3 & 4	INTERNAL CONNECTIONS-DO NOT USE
5	GRID NO. 2
6	GRID NO. 3 & GRID NO. 4
7	CATHODE
FLANGE	SIGNAL ELECTRODE
INDEX PIN	INTERNAL CONNECTION-DO NOT USE
2" TUBE	
2	GRID NO. 4
3	GRID NO. 3
4	INTERNAL CONNECTION-DO NOT USE
10	GRID NO. 2
13	CATHODE
1 & 14	HEATER
5 thru 12	GRID NO. 1

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