GL-7629

IMAGE ORTHICON

FOCUS-MAGNETIC **DEFLECTION-MAGNETIC**

The GL-7629 is a low-light-level image orthicon designed to meet a variety of applications in the industrial, military, and scientific fields. It provides an effective low-light-level sensitivity of 3 x 10^{-6} foot-candles photocathode illumination for resolution of 100 television lines per target inch, or higher where extended integration is not a requirement.

The tube features a high-gain, thin-film magnesium-oxide target with a sensitivity ten to twenty times that of glass targets. The extreme thinness and the anisotropic property of this semiconductor target virtually eliminates lateral leakage and increases the resolution 25 to 50 percent over that of standard glass targets. Since operation of the target depends on electron conduction, which is not a depletion process, rather than on ion conduction, permanent stickiness and burn-in are virtually eliminated. Low gamma provides a very wide operating range.

These and other features of the 7629 assure long life and reliable operation in such applications as low-light-level color and monochrome telecasting and closed-circuit service. The tube is also well adapted to x-ray intensifier use since it permits better detectability of lower contrasts and detail than is possible with image orthicons employing glass targets.

Electrical

Cathode—Unipotential

Heater
- Voltage, AC or DC . . . . . 6.3 ± 10% Volts
- Current . . . . . 0.6 Amperes

Photocathode—Semi-Transparent

Spectral Response—S-10

Rectangular Image, 4 by 3 aspect ratio
- Useful Size, maximum diagonal . . . . . 1.8 Inches
- Orientation—Proper orientation is obtained when the vertical scan is essentially parallel to the plane passing through the center of the faceplate and pin No. 7 of the shoulder base.

Focusing Method—Magnetic

Deflection Method—Magnetic

Direct Interelectrode Capacitance
- Anode to all other Electrodes . . . . . 12 $\mu\mu$f

Mechanical

Over-all Length	15.20 ± 0.25	Inches
Greatest Bulb Diameter	3.00 ± 0.06	Inches
Deflecting Coil		
Length	5	Inches
Minimum Inside Diameter	2⅜	Inches
Focusing-Coil Length	10	Inches
Alignment-Coil Length	$\frac{15}{16}$	Inches
Photocathode Distance Inside End of Focusing Coil	½	Inches
Weight, approximate	14	Ounces

Operating Position—Any, except with diheptal base up and tube axis at an angle of less than 20 degrees from vertical.

Thermal

Operating Temperature at any Part of Bulb, maximum	70	C
Operating Temperature of Bulb at Large End of Tube, Target Section, minimum	0	C
Temperature Difference Between Target Section and any Part of Bulb Hotter than Target Section	7.5	C

MAXIMUM RATINGS—ABSOLUTE VALUES

Photocathode		
Voltage	−600	Volts
Illumination	50	Foot-candles
Anode Supply Voltage*	1850	Volts
Grid-No. 1 Voltage		
Negative Bias Value	135	Volts
Positive Bias Value	0	Volts
Grid-No. 2 and Dynode-No. 1 Voltage	380	Volts
Grid-No. 3 Voltage	400	Volts
Grid-No. 4 Voltage	300	Volts
Grid-No. 5 Voltage	150	Volts
Grid-No. 6 Voltage	−600	Volts
Dynode-No. 2 to Dynode-No. 1 Voltage	350	Volts
Dynode-No. 3 to Dynode-No. 2 Voltage	350	Volts
Dynode-No. 4 to Dynode-No. 3 Voltage	680	Volts
Dynode-No. 5 to Dynode-No. 4 Voltage	350	Volts
Anode to Dynode-No. 5 Voltage	100	Volts
Voltage per Multiplier Stage	400	Volts
Target Voltage		
Above Target Cutoff, positive direction	10	Volts
Negative	10	Volts
Peak Heater-Cathode Voltage		
Heater Negative with Respect to Cathode	125	Volts
Heater Positive with Respect to Cathode	10	Volts

* Ratio of dynode voltages appears under Typical Operation.

TYPICAL OPERATION—AVERAGE VALUES

	Normal Performance†	Maximum Sensitivity Performance‡	
Photocathode Voltage, image focus	−400 to −540	−400 to −550	Volts
Grid-No. 1 Voltage for Picture Cutoff, Beam	−45 to −115	−45 to −115	Volts
Photocathode Illumination—See Page 5			
Scene Illumination—See Page 5			
Grid-No. 2 and Dynode-No. 1 Voltage	300	370	Volts
Grid-No. 3 Voltage, multiplier focus§	225–330	225–380	Volts
Grid-No. 4 Voltage, beam focus	140–180	140–250	Volts
Grid-No. 5 Voltage, decelerator	0–125	0–125	Volts
Grid-No. 6 Voltage, accelerator—75 percent of photocathode voltage, approximate	−300 to −405	−300 to −465‖	Volts
Dynode-No. 2 Voltage	600	770	Volts
Dynode-No. 3 Voltage	910	1080	Volts
Dynode-No. 4 Voltage	1200	1360	Volts
Dynode-No. 5 Voltage	1490	1610	Volts
Anode Voltage	1550	1700	Volts
DC Anode Current, maximum	30	30	Microamperes
Signal Output Current, peak-to-peak—See Light-Transfer Characteristic			
Target Cutoff Voltage¶	−3 to +1	−3 to +1	Volts
Target Temperature Range	15–55	15–55	C
Peak-to-Peak Blanking Voltage	5–20	5–20	Volts
Field Strength at Center of Focusing Coil**	75	75	Gausses
Field Strength of Alignment Coil, approximate#	0–3	0–3	Gausses

† Although these tubes will operate in standard equipment, modification to permit operation at these values will improve effective sensitivity for most applications.

‡ These values will permit the best low-light-level-sensitivity capability of the tube to be realized and will assure the maximum useful multiplier gain required in extreme low-light-level applications. The resolution sensitivity information in this data sheet was derived with these higher multiplier voltages.

§ Adjust to give the most uniformly shaded picture near maximum signal.

‖ 75 to 85 percent of photocathode voltage.

¶ The target supply voltage should be adjustable from −3 to +5 volts with blanking voltage off. Maximum target voltage is +10 volts above target cutoff. Recommended target voltage is +2 volts above cutoff. Slight readjustment, usually only a small fraction of a volt, may be necessary to minimize microphonics.

**Direction of current should be such that a north-seeking pole is attracted to the image end of the focusing coil, with the indicator located outside of and at the image end of the focusing coil.

Adjust to produce flattest field with maximum response. Alignment is correct when the center of the picture merely goes through focus and does not rotate when beam focus (Grid No. 4) is varied. For most commercial focus coils a 75-gauss field results from a focus-coil current of 75 milliamperes.

OPERATING NOTES

Some magnesium-oxide targets may be damaged permanently if directly and intermittently exposed, while in operation, to extremely bright sources which cause high photoelectron densities to occur at the target. Such sources include the sun, photoflash lamps, and exploding wire flashes. Damage, if it does occur, takes the form of black image spots burned in the target by the intense light.

In most cases an 80-megohm, ¼-watt resistor in series with the photocathode in the camera will protect the tube. This resistor will not interfere with normal operation of these or other image orthicons which may be used in the modified camera.

If these or similar bright sources are to be observed continuously, appropriate exposure control of photocathode illumination can be supplied by neutral-density filters.

SPECIFIC PARAMETERS ON RECORDED DATA

All curves except spectral-sensitivity characteristics were recorded under the following conditions:

Camera Chain: General Electric TE-5 (modified)
Amplifier bandwidth—total 20 mc, flat to 6 mc

Resolution Chart: National Bureau of Standards Lens Test Chart, 100% contrast transparency.

Window Chart: 100% contrast, 1% area window for signal-noise and transfer characteristic data.

Light Source: 2870^0 Kelvin—tungsten

Light Level: Aperture and neutral density controlled (within specially constructed low-light-level box) to provide range from 10^{-8} to 10^{-2} foot-candles illumination on photocathode. For corresponding scene brightness in foot-lamberts when using Leitz f/1.5 lens (85 mm), multiply photocathode illumination in foot-candles by 12.

Operating Temperature for Image End: 25 to 30 C.

Target Raster: Target diameter is 1.40 inches. For corners of scanning raster just touching target edge raster dimensions are:

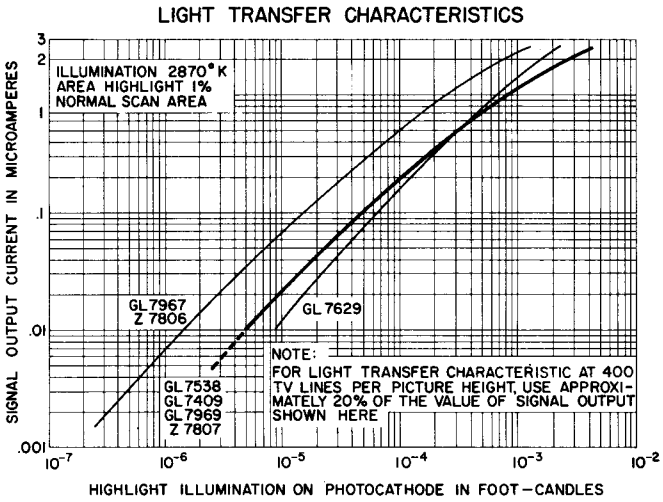
Aspect Ratio	Horizontal	Vertical
1 x 1 (square)	0.99″	0.99″
4 x 3 (standard)	1.12″	0.84″

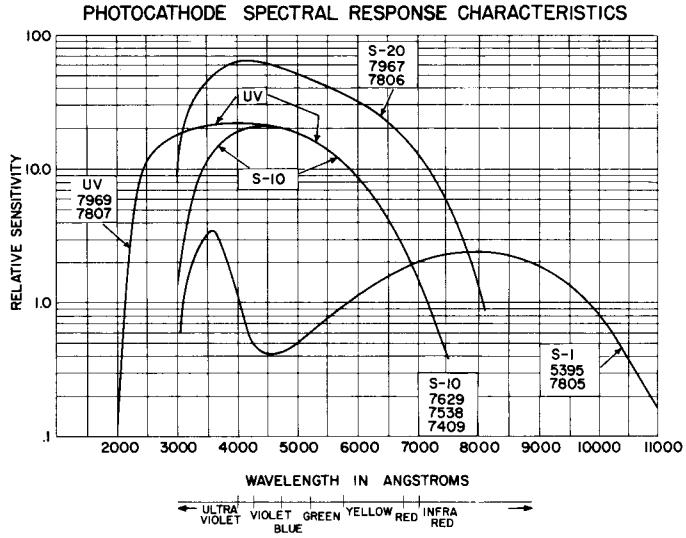
Horizontal TV lines = 1.12 x TV lines per target inch

Vertical TV lines (EIA) = 0.84 x TV lines per target inch

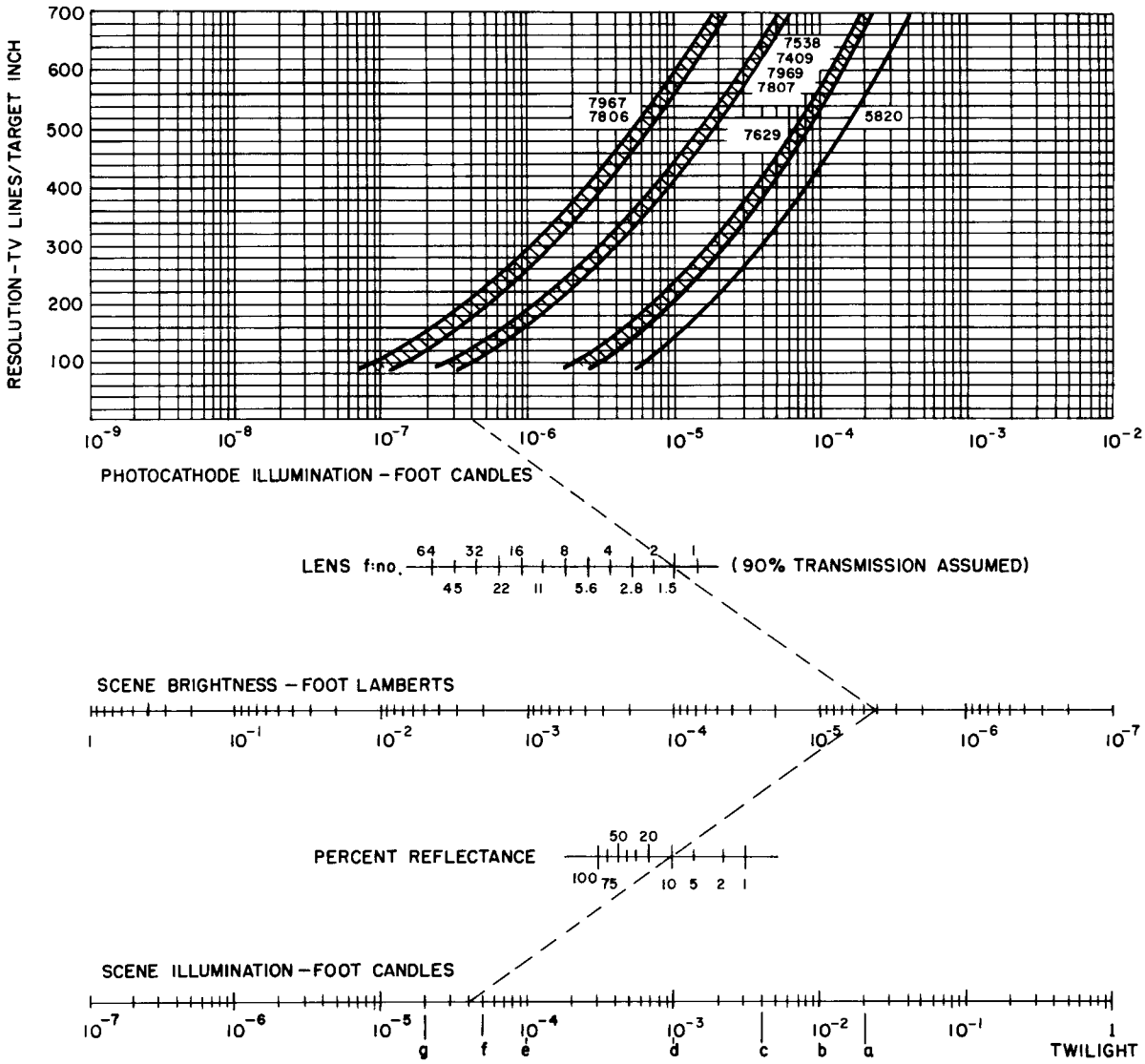
Resolution sensitivity data is recorded in TV lines per target inch

Therefore, 700 TV lines per target inch = 784 horizontal lines
= 588 vertical lines (EIA)


LIGHT TRANSFER CHARACTERISTICS
ILLUMINATION 2870°K
AREA HIGHLIGHT 1%
NORMAL SCAN AREA
GL 7967
Z 7806
GL 7629
GL 7538
GL 7409
GL 7969
Z 7807
NOTE:
FOR LIGHT TRANSFER CHARACTERISTIC AT 400 TV LINES PER PICTURE HEIGHT, USE APPROXIMATELY 20% OF THE VALUE OF SIGNAL OUTPUT SHOWN HERE
SIGNAL OUTPUT CURRENT IN MICROAMPERES
3
2
1
.1
.01
.001
10^{-7}
10^{-6}
10^{-5}
10^{-4}
10^{-3}
10^{-2}
HIGHLIGHT ILLUMINATION ON PHOTOCATHODE IN FOOT-CANDLES


PHOTOCATHODE SPECTRAL RESPONSE CHARACTERISTICS
S-20
7967
7806
UV
S-10
UV
7969
7807
S-1
5395
7805
S-10
7629
7538
7409
RELATIVE SENSITIVITY
100
10.0
1.0
.1
2000
3000
4000
5000
6000
7000
8000
9000
10000
11000
WAVELENGTH IN ANGSTROMS
ULTRA VIOLET
VIOLET
BLUE
GREEN
YELLOW
RED
INFRA RED

SCENE ILLUMINATION VS TYPICAL RESOLUTION SENSITIVITY BY TYPE*

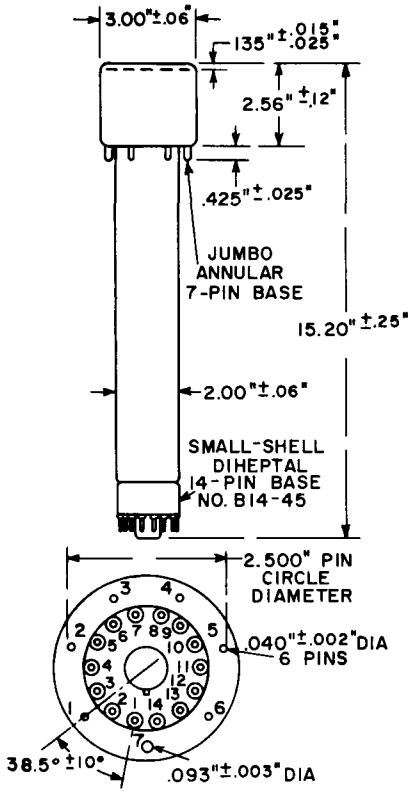


Code	Ambient Condition	Scene Illumination
a	Full moon–clear	2×10^{-2} ft-c
b	Half moon	1×10^{-2} ft-c
c	Full moon–moderately cloudy	4×10^{-3} ft-c
d	Quarter moon–clear	1×10^{-3} ft-c
e	No moon–clear	1×10^{-4} ft-c
f	No moon–moderately cloudy	5×10^{-5} ft-c
g	No moon–heavy cloud	2×10^{-5} ft-c

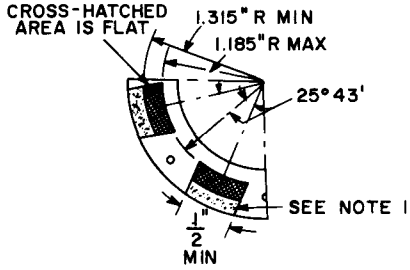
NEUTRAL DENSITY FILTERS FOR EXPOSURE CONTROL

TYPE AND DENSITY	PERCENT TRANSMITTANCE	NUMBER OF STOPS
ND .30	50.0	1
ND .60	25.0	2
ND .90	13.0	3
ND 1.00	10.0	3.3
ND 2.00	1.0	6.6
ND 3.00	0.10	10.0
ND 4.00	0.010	13.2

*This chart reprinted by permission of B. A. Bang.



ENLARGED BOTTOM VIEW



DETAIL OF BOTTOM VIEW OF JUMBO ANNULAR BASE

NOTE 1: DOTTED AREA IS FLAT OR EXTENDS TOWARD DIHEPTAL-BASE END OF TUBE BY 0.060" MAX.

ANNULAR BASE GAGE

ANGULAR VARIATIONS BETWEEN PINS AS WELL AS ECCENTRICITY OF NECK CYLINDER WITH RESPECT TO PHOTOCATHODE CYLINDER ARE HELD TO TOLERANCES SUCH THAT PINS AND NECK CYLINDER WILL FIT FLAT-PLATE GAGE WITH:

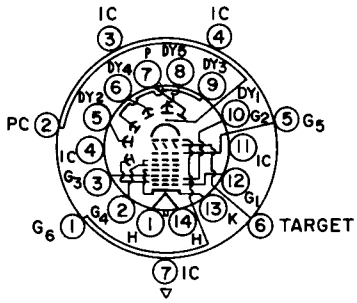
a. SIX HOLES HAVING DIAMETER OF 0.065"±.0.001" AND ONE HOLE HAVING DIA OF 0.150"±0.001". ALL HOLES HAVE DEPTH OF 0.265"±0.001". THE SIX 0.065" HOLES ARE ENLARGED BY 45° TAPER TO DEPTH OF 0.047". ALL HOLES ARE SPACED AT ANGLES OF 51° 26'±5' ON CIRCLE DIAMETER OF 2.500"±0.001".

b. SEVEN STOPS HAVING HEIGHT OF 0.187"±0.001", CENTERED BETWEEN PIN HOLES, TO BEAR AGAINST FLAT AREAS OF BASE.

c. RIM EXTENDING OUT OF A MINIMUM OF 0.125" FROM 2.812" DIAMETER AND HAVING HEIGHT OF 0.126"±0.001".

d. NECK-CYLINDER CLEARANCE HOLE HAVING DIAMETER OF 2.200"±0.001".

DIRECTION OF LIGHT: PERPENDICULAR TO LARGE END OF TUBE



WHITE INDEX LINE ON FACE

BOTTOM VIEW

BASING DIAGRAM

SMALL-SHELL DIHEPTAL 14-PIN BASE

PIN 1: HEATER
PIN 2: GRID NO. 4 & FIELD MESH
PIN 3: GRID NO. 3
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: DYNODE NO. 2
PIN 6: DYNODE NO. 4
PIN 7: ANODE
PIN 8: DYNODE NO. 5
PIN 9: DYNODE NO. 3
PIN 10: DYNODE NO. 1, GRID NO. 2
PIN 11: INTERNAL CONNECTION-DO NOT USE
PIN 12: GRID NO. 1
PIN 13: CATHODE AND SUPPRESSOR GRID
PIN 14: HEATER

KEYED JUMBO ANNULAR 7-PIN BASE

PIN 1: GRID NO. 6
PIN 2: PHOTOCATHODE
PIN 3: INTERNAL CONNECTION-DO NOT USE
PIN 4: INTERNAL CONNECTION-DO NOT USE
PIN 5: GRID NO. 5
PIN 6: TARGET
PIN 7: INTERNAL CONNECTION-DO NOT USE