



# 6405/1640

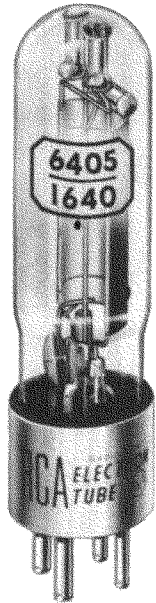
## GAS PHOTOTUBE

High Sensitivity  
Low Dark Current

S-I Response  
Low-Microphonic Type

4-7/16" Max. Length  
1-1/8" Max. Diameter

RCA-6405/1640 is a gas phototube designed for use in industrial applications critical as to microphonics and sensitivity gradient. Among such applications are electronic beverage-inspection equipment and ampul-inspection equipment.



Having high sensitivity to red and near infrared radiant energy, the 6405 is especially suitable for use with an incandescent light source.

The 6405 is provided with a non-hygroscopic base which insures a value of resistance between anode and cathode pins about 10 times higher than conventional bases under adverse operating conditions of high humidity. As a result, more output for a given light input is obtainable under high-humidity conditions.

### Characteristics at 90 Volts on Anode:

	Min.	Au.	Max.	
Sensitivity:				
Radiant at 8000 angstroms . . . . .	-	0.0135	-	$\mu\text{amp}/\mu\text{watt}$
Luminous: <sup>▲</sup>				
At 0 cps . . . . .	80	135	200	$\mu\text{amp}/\text{lumen}$
At 5000 cps . . . . .	-	116	-	$\mu\text{amp}/\text{lumen}$
At 10000 cps . . . . .	-	100	-	$\mu\text{amp}/\text{lumen}$
Sensitivity Difference Between Highest Value and Lowest Value Along Cathode Length <sup>⬇</sup> . . . . .	-	-	25	$\mu\text{amp}/\text{lumen}$
Gas Amplification Factor	-	-	9	
Anode Dark Current:				
At 25°C. . . . .	-	-	0.1	$\mu\text{amp}$

### Minimum Circuit Values:

With anode-supply voltage of	70 or less	90	volts
DC-Load Resistance:			
For dc currents above 5 $\mu\text{amp}$ . . . . .	0.1 min.	-	megohm
For dc currents below 5 $\mu\text{amp}$ . . . . .	0 min.	-	megohm
For dc currents above 3 $\mu\text{amp}$ . . . . .	-	2.5 min.	megohms
For dc currents below 3 $\mu\text{amp}$ . . . . .	-	0.1 min.	megohm

\* On plane perpendicular to indicated direction of incident light.

◊ Averaged over any interval of 30 seconds maximum.

▲ For conditions where the light source is a tungsten-filament lamp operated at a color temperature of 2870°K. A dc anode supply of 90 volts and a 1-megohm load resistor are used. For the 0-cycle measurements, a light input of 0.1 lumen is used. For the 5000 and 10000-cycle measurements, the light input is varied sinusoidally about a mean value of 0.015 lumen from zero to a maximum of twice the mean.

⬇ Measured under the same conditions as indicated under (▲) with light input of 0.1 lumen and a light spot 1/2 inch in diameter.

### DATA

#### General:

Spectral Response . . . . .	S-I
Wavelength of Maximum Response . . . . .	8000 ± 1000 angstroms
Cathode:	
Shape . . . . .	Semi-cylindrical
Minimum Projected Length* . . . . .	1-1/4"
Minimum Projected Width* . . . . .	5/8"
Direct Interelectrode Capacitance . . . . .	3 $\mu\text{f}$
Overall Length . . . . .	4-5/16" ± 1/8"
Seated Length . . . . .	3-11/16" ± 1/8"
Seated Length to Center of Cathode . . . . .	2-1/8" ± 3/32"
Maximum Diameter . . . . .	1-1/8"
Bulb . . . . .	T-8
Base . . . . .	Dwarf-Shell Small 4-Pin (JETEC No. A4-26), Non-hygroscopic
Mounting Position . . . . .	Any
Weight (Approx.) . . . . .	1.3 oz

#### Maximum Ratings, Absolute Values:

	Rating I	Rating II	
ANODE-SUPPLY VOLTAGE (DC or Peak AC) . . . . .	70 max.	90 max.	volts
AVERAGE CATHODE-CURRENT DENSITY . . . . .	50 max.	25 max.	$\mu\text{amp}/\text{sq. in.}$
AVERAGE CATHODE CURRENT <sup>◊</sup> . . . . .	10 max.	5 max.	$\mu\text{amp}$
AMBIENT TEMPERATURE . . . . .	100 max.	100 max.	°C

### DEFINITIONS

**Radiant Sensitivity.** The quotient of output current by incident radiant energy of a given wavelength, at constant electrode voltages.

**Luminous Sensitivity.** The quotient of output current by incident luminous flux, at constant electrode voltages.

**Electrode Dark Current.** The electrode current that flows when there is no radiant flux incident on the photocathode.

**Gas Amplification Factor.** The ratio of radiant sensitivities with and without ionization of the contained gas.

### INSTALLATION and APPLICATION

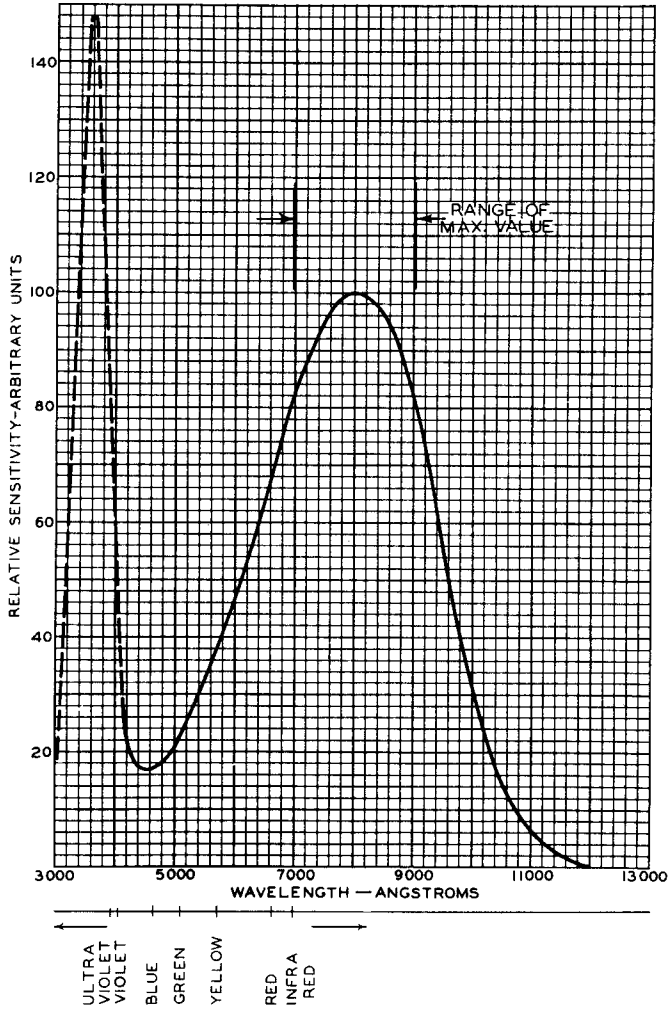
The maximum ratings shown in the tabulated data are limiting values above which the serviceability of the 6405 may be impaired from the viewpoint of life and satisfactory performance. Therefore, in order not to exceed these absolute ratings, the equipment designer has the responsi-



bility of determining an average design value for each rating below the absolute value of that rating by an amount such that the absolute values will never be exceeded under any usual condition of supply-voltage variation, load variation, or manufacturing variation in the equipment itself.

This rating should not be exceeded because too high a bulb temperature may cause the volatile cathode surface to evaporate with consequent decrease in the life and sensitivity of the tube.

The *minimum dc load resistance values* shown in the tabulated data are specified to prevent

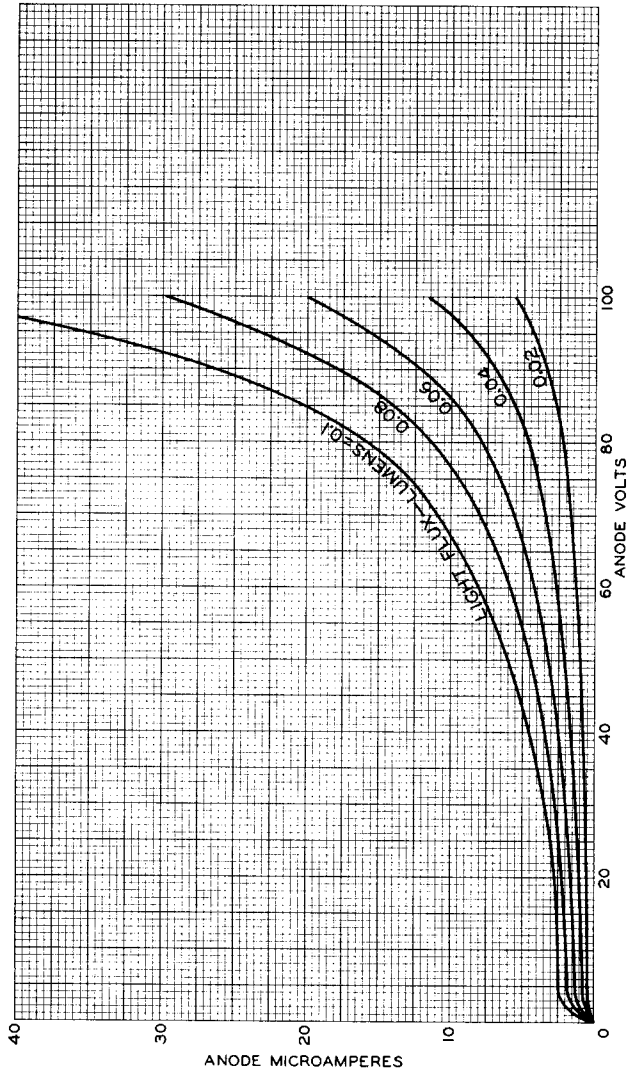


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*Spectral Sensitivity Characteristic of Phototube Having S-1 Response. Curve is Shown for Equal Values of Radiant Flux at All Wavelengths.*

If the voltage and current ratings of the 6405 are exceeded, a gas discharge may occur. This discharge is indicated by a faint blue glow within the tube. Once started, this discharge will continue independently of the illumination on the phototube. When a glow occurs, the anode-supply voltage should be disconnected immediately in order to prevent permanent damage to the tube.

The *maximum ambient temperature* as shown in the tabulated data is a tube rating which is to be observed in the same manner as other ratings.



92CM-8227

*Average Anode Characteristics of Type 6405.*

a blue glow discharge. With the indicated values of load resistance, supply voltage, and maximum cathode current, the dc voltage drop across the load is large enough to protect the 6405.

The *base pins* of the 6405 fit the small 4-contact socket which should be positioned so that the two large pin openings (pins No.1 and No.4) are toward the light source. This position places the cathode so that light is intercepted by its concave surface.



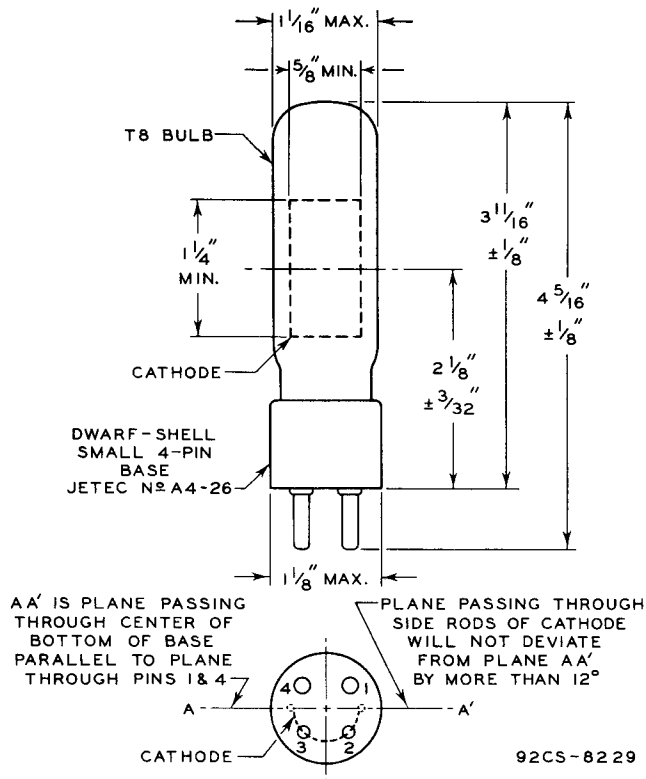
*Shielding* of the 6405 and its leads to the amplifier is recommended when amplifier gain is high or when the phototube load resistance is high. Whenever frequency response is important in a phototube circuit, the leads from the phototube to the amplifier should be made short so as to minimize capacitance shunting of the phototube load. Since a phototube is a high-resistance device, it is important that insulation of associated circuit parts and wiring be adequate.

The *operating stability* of the 6405 is dependent on the magnitude of the luminous-flux input and its duration. When the 6405 is operated continuously at high values of light input, a drop in sensitivity (sometimes called fatigue) may be expected. The extent of the drop below the tabulated sensitivity values depends on the severity of the operating conditions. After a period of idleness, the 6405 like other gas phototubes usually recovers a substantial percentage of such loss in sensitivity.

When maximum stability is required, the use of a light input not exceeding 0.02 lumen is recommended.

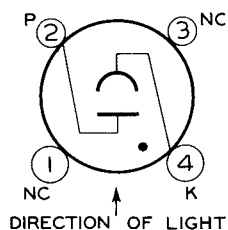
*Exposure to intense illumination*, such as direct sunlight, may decrease the sensitivity of the 6405 even though no voltage is applied to the tube. The magnitude and duration of the decrease depend on the length of the exposure. Permanent damage to the tube may result if it is exposed to light so intense as to cause excessive heating of the cathode.

## DIMENSIONAL OUTLINE



## SOCKET CONNECTIONS

### Bottom View



- PIN 1: NO CONNECTION
- PIN 2: ANODE
- PIN 3: NO CONNECTION
- PIN 4: CATHODE

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