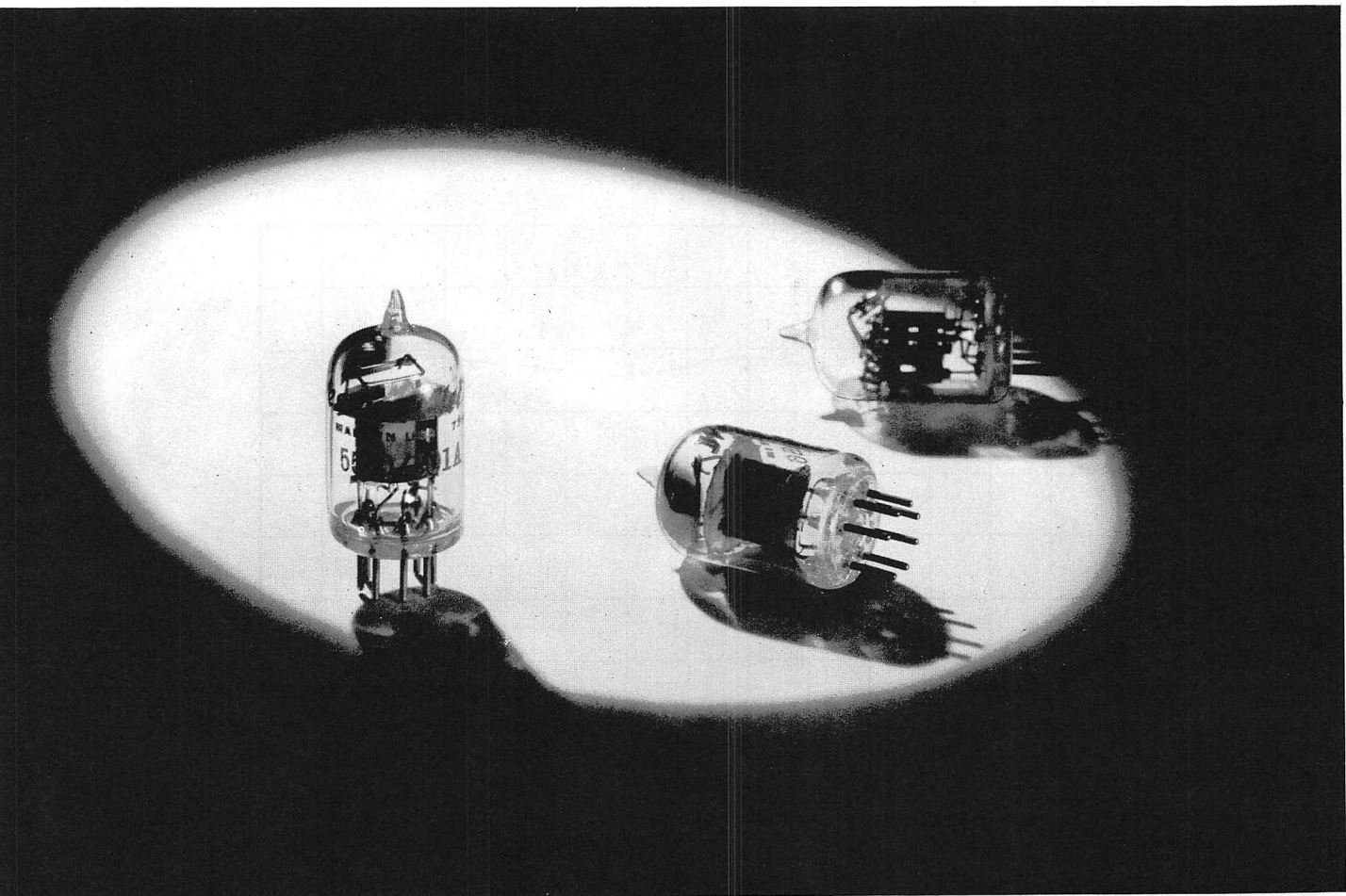




PENTODE  
MINIATURE

*Western Electric*

DESCRIPTION

The 5590/401A\* is a 7-pin miniature pentode having an indirectly heated cathode. It is designed for use in amplifier circuits at high and ultra high frequencies.

CHARACTERISTICS

|                                                                                   |                  |
|-----------------------------------------------------------------------------------|------------------|
| Heater Voltage . . . . .                                                          | 6.3 volts        |
| Plate Current<br>( $E_b = E_{c2} = 90$ volts, $E_{c1} = -5.0$ volts) . . . . .    | 3.9 milliamperes |
| Transconductance<br>( $E_b = E_{c2} = 90$ volts, $E_{c1} = -5.0$ volts) . . . . . | 2000 micromhos   |

ELECTRON TUBE DATA SHEET  
FILE: MINIATURE SECTION  
11-47

**401A\***  
PENTODE

GENERAL CHARACTERISTICS

ELECTRICAL DATA

|                                    |                         |                          |
|------------------------------------|-------------------------|--------------------------|
| Heater Voltage                     |                         | 6.3 volts                |
| Heater Current                     |                         | 150 milliamperes         |
| Direct Interelectrode Capacitances | without external shield | with external shield     |
| Grid to Plate (max.)               | 0.017                   | (RMA #316)<br>*0.010 uuf |
| Input                              | 3.2                     | * 3.4 uuf                |
| Output                             | 2.0                     | * 2.9 uuf                |

MECHANICAL DATA

|                                                                   |                        |
|-------------------------------------------------------------------|------------------------|
| Cathode                                                           | Coated Unipotential    |
| Bulb                                                              | T 5½                   |
| Base                                                              | Miniature Button 7-pin |
| Mounting Position                                                 | Any                    |
| Dimensions and pin connections shown in outline drawing on Page 4 |                        |

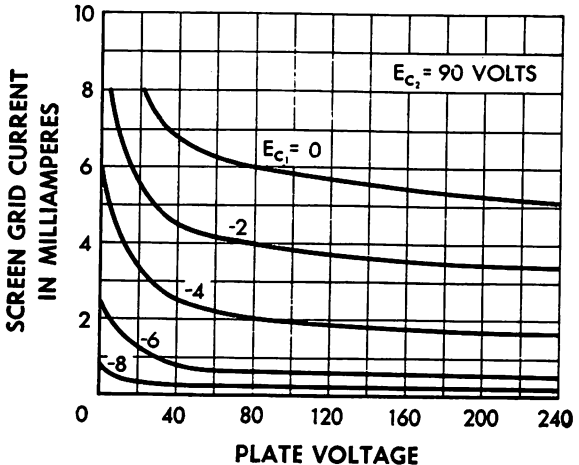
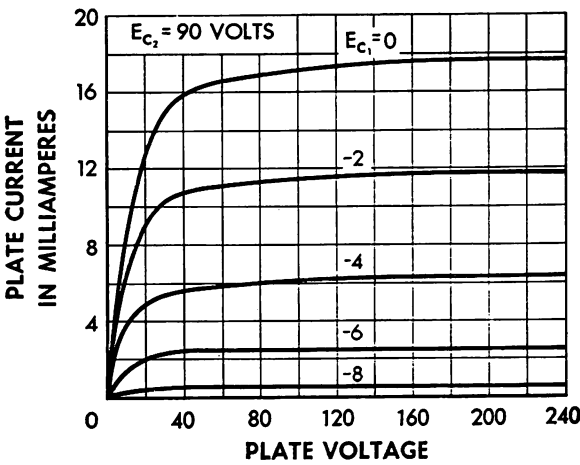
MAXIMUM RATINGS, Design-Center Values

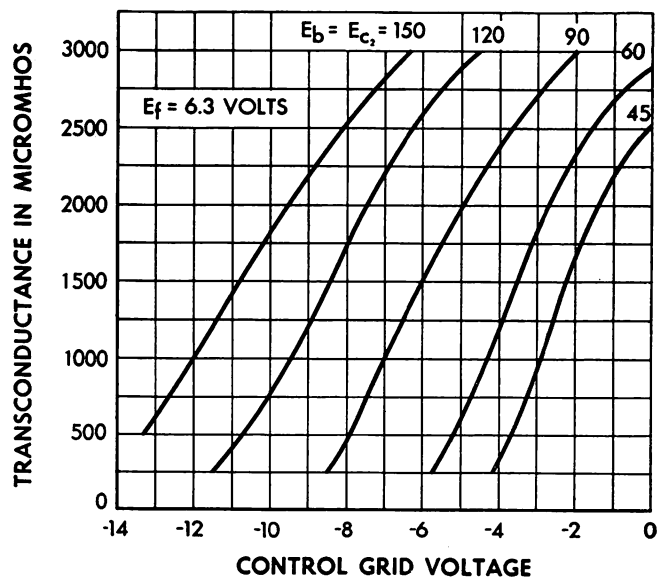
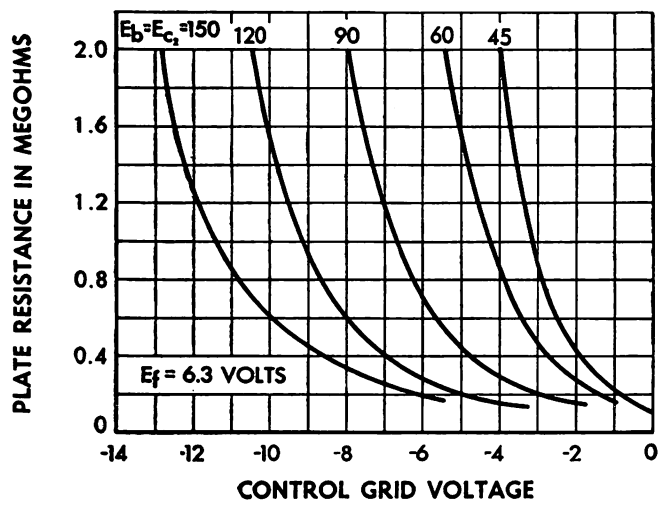
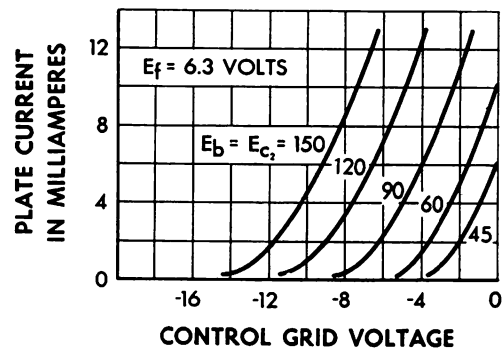
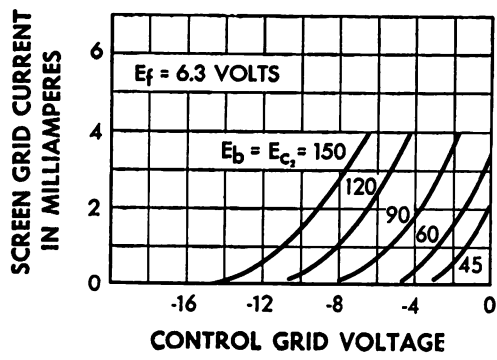
|                        |                 |
|------------------------|-----------------|
| Plate Voltage          | 180 volts       |
| Screen Voltage         | 140 volts       |
| Plate Dissipation      | 1.7 watts       |
| Screen Dissipation     | 0.5 watts       |
| Cathode Current        | 18 milliamperes |
| Heater-Cathode Voltage | 90 volts        |
| Bulb Temperature       | 120 centigrade  |

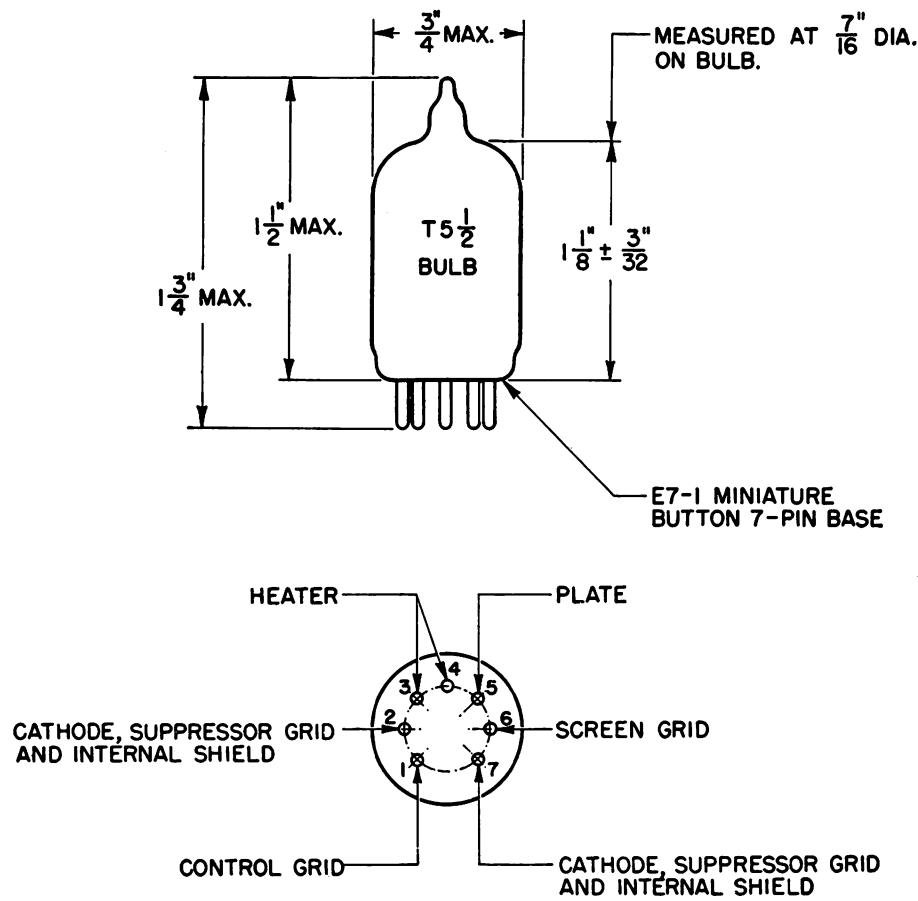
TYPICAL OPERATING CONDITIONS AND CHARACTERISTICS, CLASS A<sub>1</sub> AMPLIFIER

|                                  |       |       |       |                  |
|----------------------------------|-------|-------|-------|------------------|
| Plate Voltage                    | 45    | 90    | 90    | 120 volts        |
| Screen Grid Voltage              | 45    | 90    | 90    | 120 volts        |
| Control Grid Voltage             | −1.5  | −5.0  | ..... | −7.0 volts       |
| Cathode Bias Resistor            | ..... | ..... | 820   | ..... ohms       |
| Plate Current                    | 3.0   | 3.9   | 4.3   | 5.1 milliamperes |
| Screen Grid Current              | 1.1   | 1.3   | 1.4   | 1.8 milliamperes |
| Plate Resistance                 | 0.29  | 0.45  | 0.41  | 0.41 megohm      |
| Transconductance                 | 2000  | 2000  | 2100  | 2200 micromhos   |
| Grid Voltage (approximate) for   |       |       |       |                  |
| Plate Current of 10 microamperes | −5.3  | −10.6 | ..... | −14.3 volts      |

\*External shield connected to cathode pins 2 and 7







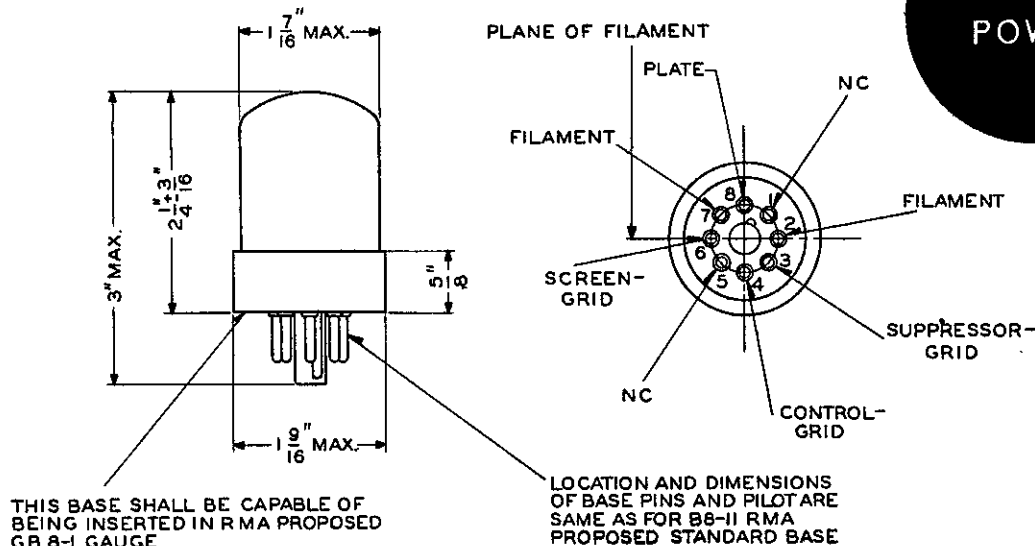
*Western Electric*

A development of Bell Telephone Laboratories, the research laboratories of the American Telephone and Telegraph Company and the Western Electric Company

## ADVANCE ELECTRON TUBE DATA SHEET

### WESTERN ELECTRIC 5603/398A ELECTRON TUBE

**5603/398A**  
**POWER PENTOD**  
**AMPLIFIER**



#### CLASSIFICATION

Filamentary Power Pentode Amplifier

#### MOUNTING

The tube should be mounted preferably in a vertical position. If mounted in a horizontal position, the plane through contact pins 2 and 6 must be vertical.

#### MAXIMUM RATINGS (DESIGN-CENTER VALUES)

|                    |                 |
|--------------------|-----------------|
| Plate Voltage      | 150 volts       |
| Plate Dissipation  | 8.0 watts       |
| Screen Voltage     | 150 volts       |
| Screen Dissipation | 2.5 watts       |
| Cathode Current    | 75 milliamperes |

#### OPERATING CONDITIONS AND CHARACTERISTICS

|                         |                 |
|-------------------------|-----------------|
| Filament Voltage        | 6.3 volts       |
| Filament Current        | 0.5 amp.        |
| Plate Voltage           | 135 volts       |
| Plate Current           | 50 milliamperes |
| Screen Voltage          | 135 volts       |
| Screen Current          | 4 milliamperes  |
| Suppressor-Grid Voltage | 0 volts         |
| Cathode Bias Resistor   | 230 ohms        |
| Amplification Factor    | 92              |
| Plate Resistance        | 17000 ohms      |
| Transconductance        | 5400 micromhos  |
| Signal Grid Voltage     | 8.5 volts a-c   |
| Load Resistance         | 2500 ohms       |
| Power Output            | 2.2 watts       |

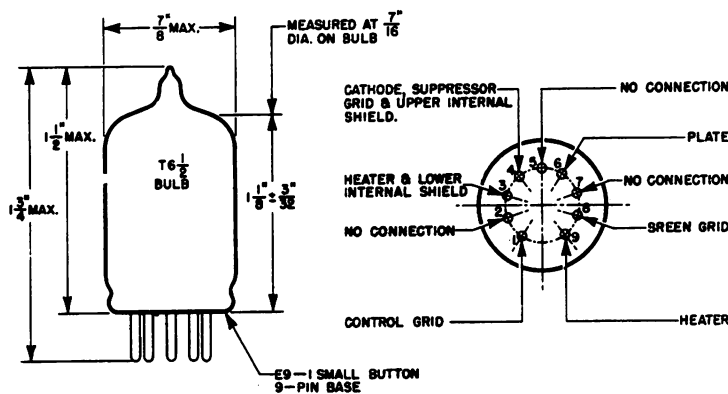
#### INTERELECTRODE CAPACITANCES (NO SHIELD)

|                                                           |             |
|-----------------------------------------------------------|-------------|
| Control-grid to filament, screen-grid and suppressor-grid | 9.5 $\mu$ f |
| Plate to control-grid                                     | 0.3 $\mu$ f |
| Plate to filament, screen-grid and suppressor-grid        | 7.5 $\mu$ f |

ADVANCE ELECTRON TUBE DATA SHEET

WESTERN ELECTRIC 5847/404A ELECTRON TUBE

5847/404A  
MINIATURE  
PENTODE



DESCRIPTION

This tube is a miniature pentode of the unipotential cathode type. It is designed for use in high-gain amplifiers at high and ultra-high frequencies.

MAXIMUM RATINGS (Design Center Values)

|                         |      |              |
|-------------------------|------|--------------|
| Plate Voltage           | 180  | volts        |
| Screen-Grid Voltage     | 150  | volts        |
| Plate Dissipation       | 3    | watts        |
| Screen-Grid Dissipation | 0.75 | watt         |
| Cathode Current         | 35   | milliamperes |
| Heater-Cathode Voltage  | 50   | volts        |
| Grid Resistance         | 0.1  | megohm       |
| Bulb Temperature        | 120° | Centigrade   |

GENERAL CHARACTERISTICS

ELECTRICAL DATA

|                                          |                               |                                          |    |
|------------------------------------------|-------------------------------|------------------------------------------|----|
| Heater Voltage, A-C or D-C .....         | 6.3                           | volts                                    |    |
| Heater Current .....                     | 300                           | milliamperes                             |    |
| Direct Interelectrode Capacitances ..... |                               |                                          |    |
|                                          | Without<br>External<br>Shield | With<br>External<br>Shield<br>(RMA #315) |    |
| Grid to Plate, Maximum .....             | .0 5                          | .0 4                                     | μf |
| Input .....                              | 7.0                           | 7.1                                      | μf |
| Output .....                             | 2.5                           | 2.9                                      | μf |

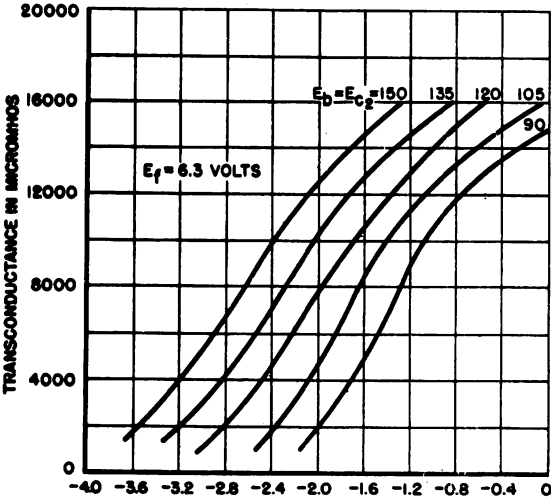
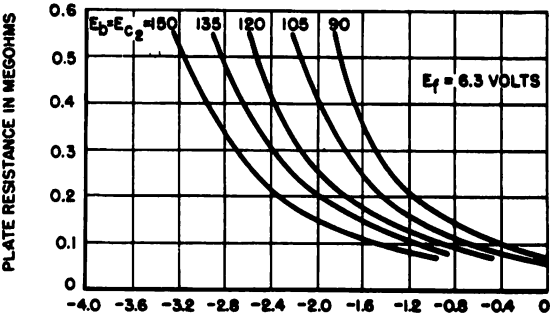
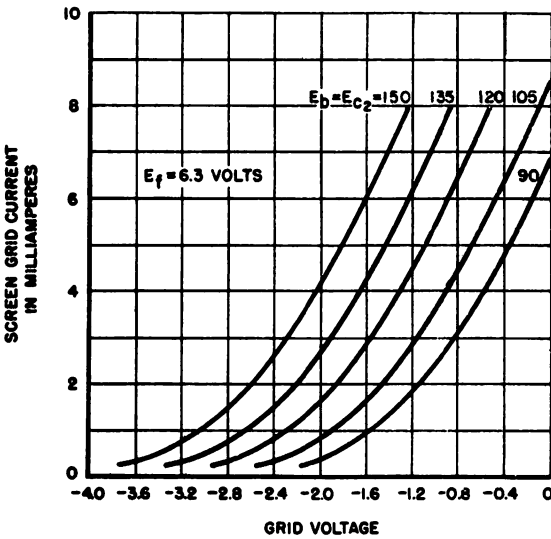
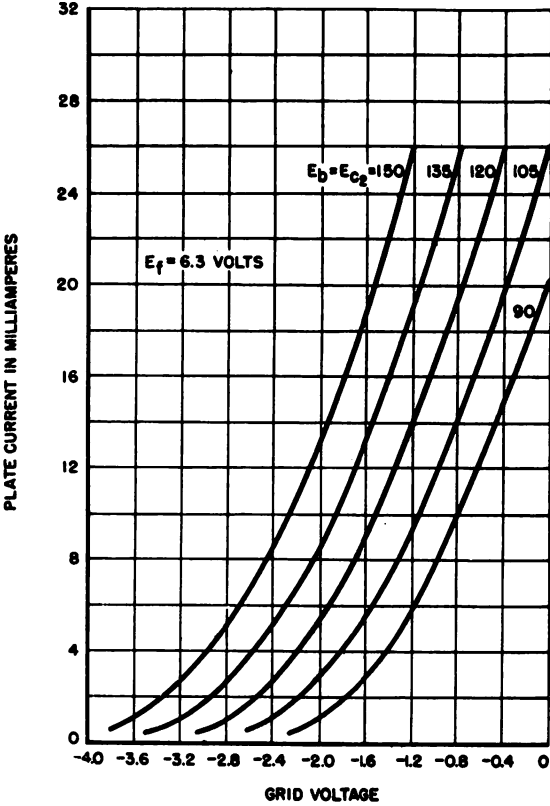
MECHANICAL DATA

|                   |                     |
|-------------------|---------------------|
| Cathode           | Coated Unipotential |
| Bulb              | T 6-1/2             |
| Base              | Small Button, 9-pin |
| Mounting Position | Any                 |

OPERATING CONDITIONS AND CHARACTERISTICS

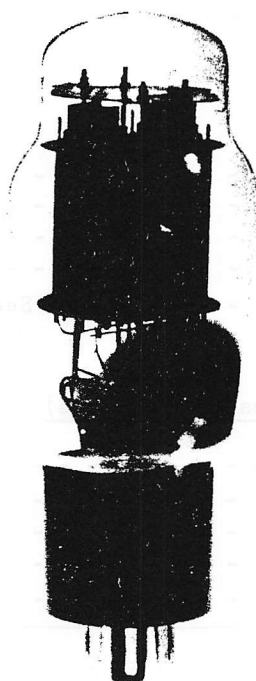
|                            |       |       |              |
|----------------------------|-------|-------|--------------|
| Plate Supply Voltage       | 150   | 160   | volts        |
| Screen-Grid Supply Voltage | 150   | 160   | volts        |
| Control Grid Voltage       | 0     | +8.5  | volts        |
| Plate Current              | 13    | 13    | milliamperes |
| Screen-Grid Current        | 4.5   | 4.5   | milliamperes |
| Cathode Resistor           | 110   | 600   | ohms         |
| Transconductance           | 12500 | 12500 | micromhos    |

\*Operating conditions to minimize gain variations due to supply voltage fluctuations.



ELECTRON TUBE DATA SHEET

WESTERN ELECTRIC 5998\* ELECTRON TUBE



DESCRIPTION

The 5998/421A\* is a double triode having separate indirectly heated cathodes. It is intended for use as a series tube in regulated rectifier circuits.

CHARACTERISTICS

|                              |                            |                  |
|------------------------------|----------------------------|------------------|
| Heater Voltage               | - - - - -                  | 6.3 volts        |
| Plate Current per Section    | { Ebb = 110 volts; } - - - | 125 milliamperes |
| Transconductance per Section | { Rk = 65 ohms } - - -     | 20000 micromhos  |

5998/421A - PAGE 2

GENERAL CHARACTERISTICS

ELECTRICAL DATA

|                          |             |
|--------------------------|-------------|
| Heater Voltage - - - - - | 6.3 volts   |
| Heater Current - - - - - | 2.4 amperes |

MECHANICAL DATA

|                                          |                            |
|------------------------------------------|----------------------------|
| Cathode - - - - -                        | Coated Unipotential        |
| Bulb - - - - -                           | ST 16                      |
| Base - - - - -                           | Medium 8-pin cctal         |
| Mounting Position - - - - -              | Any                        |
| Dimensions and Pin Connections - - - - - | See Outline drawing page 4 |

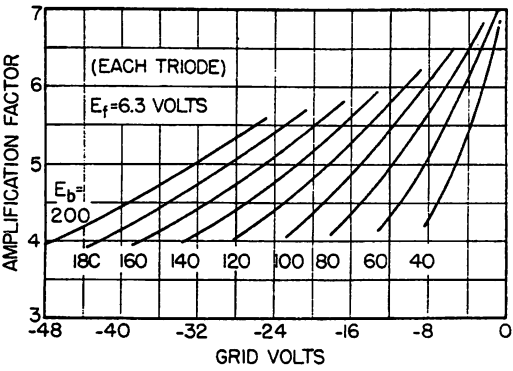
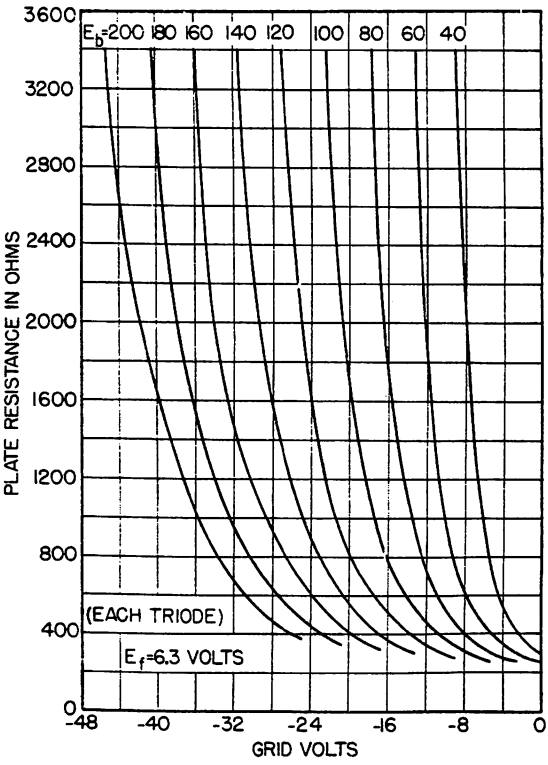
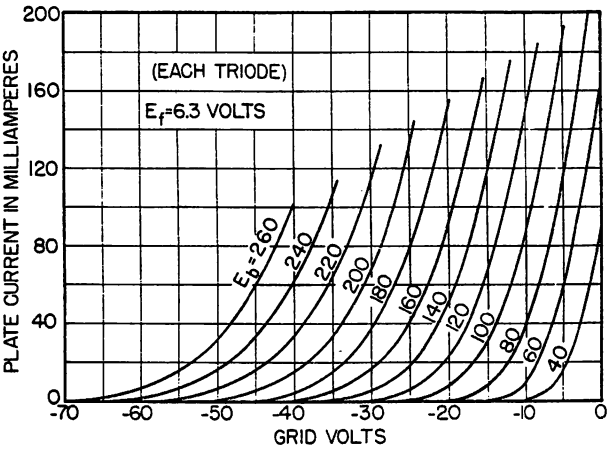
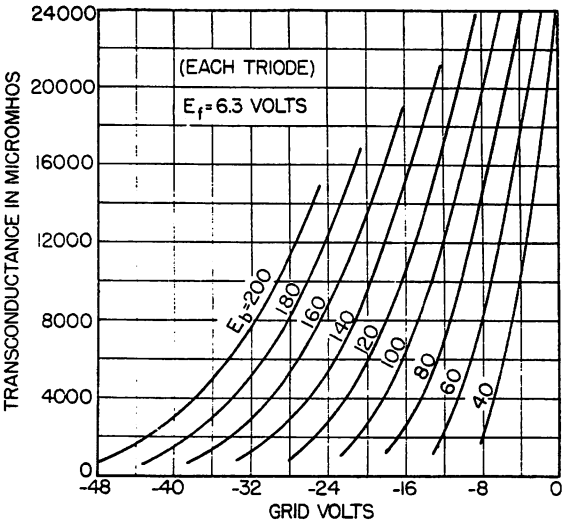
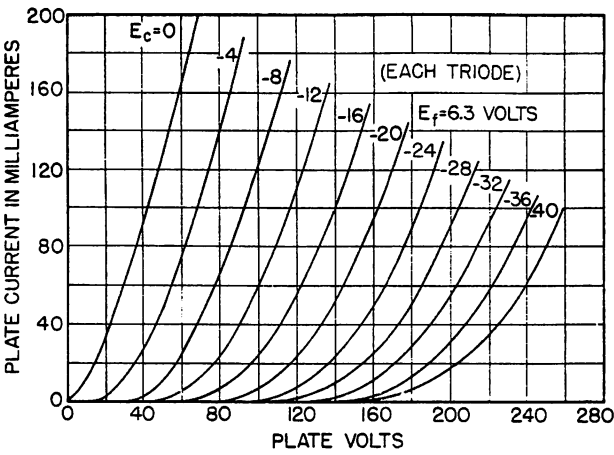
MAXIMUM RATINGS, Design-Center Values (Each Triode)

|                                                      |                  |
|------------------------------------------------------|------------------|
| Plate Voltage - - - - -                              | 250 volts        |
| Plate Dissipation - - - - -                          | 13 watts         |
| Cathode Current - - - - -                            | 125 milliamperes |
| Heater-Cathode Voltage <sup>1</sup> - - - - -        | 150 volts        |
| Bulb Temperature <sup>1</sup> - - - - -              | 200°Centigrade   |
| <hr/>                                                |                  |
| Maximum Grid Circuit Resistance for Cathode Bias - - | 0.1 megohm       |

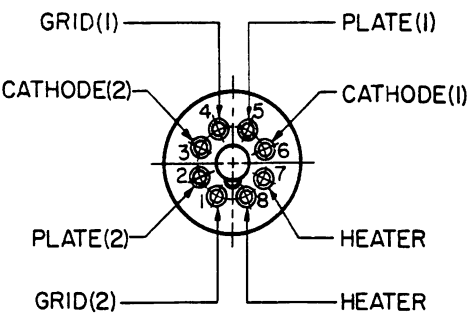
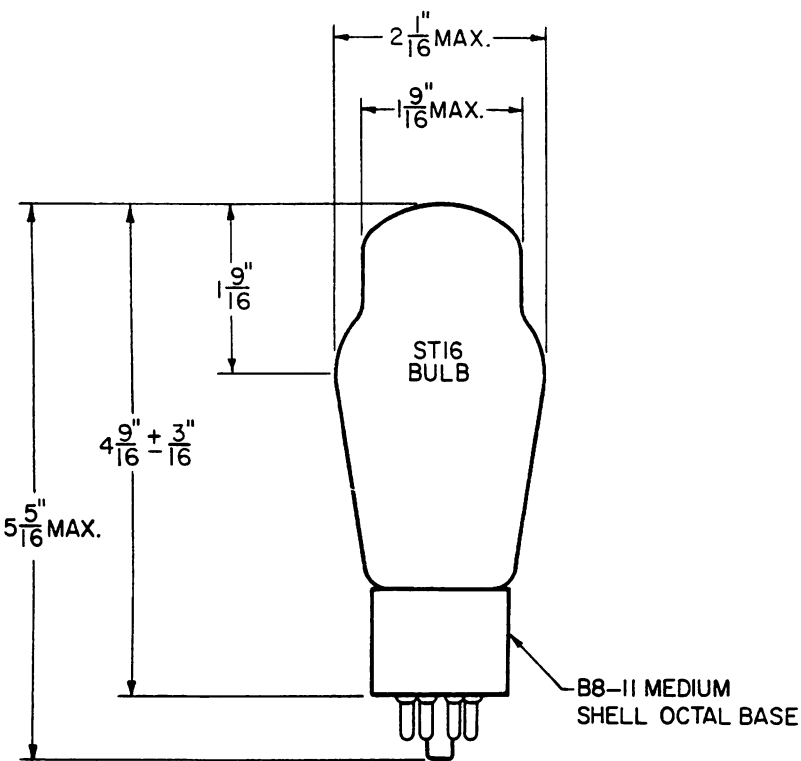
OPERATING CONDITIONS AND CHARACTERISTICS (Each Triode)

|                                   |       |                  |
|-----------------------------------|-------|------------------|
| Plate Supply Voltage - - - - -    | 110   | 110 volts        |
| Cathode Bias Resistance - - - - - | 90    | 65 ohms          |
| Plate Current - - - - -           | 100   | 125 milliamperes |
| Amplification Factor - - - - -    | 5.9   | 6.1              |
| Plate Resistance - - - - -        | 330   | 305 ohms         |
| Transconductance - - - - -        | 18000 | 20000 micromhos  |

Note 1: For optimum life expectancy the heater-cathode voltage should not exceed 90 volts and forced-air cooling should be provided. The air flow should be sufficient to keep the bulb temperature below 150°C.



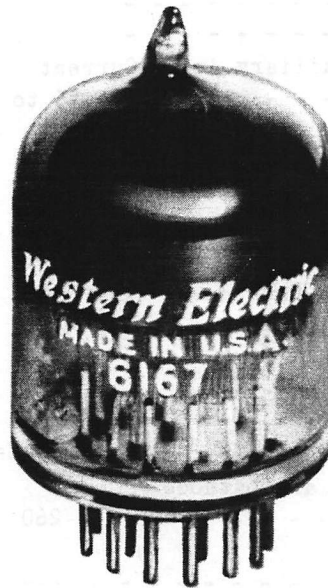
5998/421A - PAGE 4



A development of Bell Telephone Laboratories, the research laboratories of the American Telephone and Telegraph Company and the Western Electric Company

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ELECTRON TUBE DATA SHEET  
WESTERN ELECTRIC 6167 ELECTRON TUBE



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**DESCRIPTION**

The 6167 is a ten-stage cold-cathode gas-discharge stepping tube designed for continuous counting or registration of pulses at rates up to 1000 pulses per second. Each stage consists of a stepping cathode (Bn) followed by an output cathode (Kn). Connections to each output cathode permit obtaining an output signal from each or any stage. A normal (zero) cathode is provided outside the counting ring and operates into the first stepping cathode (B1). The auxiliary anode can be operated to supply an additional output signal when current is carried from K10 cathode. The direction of forward transfer of discharge is in a clockwise direction and the position of the cathode glow may be observed through the top of the envelope.

FILE: COLD CATHODE SECTION  
ISSUE 1, 6-52

6167

RATINGS, Absolute Values

## Cathode Current

|                                                  |                       |
|--------------------------------------------------|-----------------------|
| Maximum Peak - - - - -                           | 10 milliamperes       |
| Maximum Average - - - - -                        | 3 milliamperes        |
| Minimum Average - - - - -                        | .1 milliampere        |
| Maximum Averaging Time - - - - -                 | 0.5 second            |
| Maximum Inverse Anode or Auxiliary Anode Current | 0.0 milliampere       |
| Ambient Temperature Limits - - - - -             | -55 to +60 centigrade |

ELECTRICAL DATA<sup>1</sup>

|                                                                                       | <u>Min.</u> | <u>Bogey</u> | <u>Max.</u> |       |
|---------------------------------------------------------------------------------------|-------------|--------------|-------------|-------|
| Anode Voltage Drop - - - - -                                                          | ---         | 110          | ---         | volts |
| Anode Breakdown Voltage                                                               |             |              |             |       |
| Output Cathodes and Normal Cathode - - - -                                            | 180         | 225          | 300         | volts |
| Stepping Cathodes (B1-B10) - - - - -                                                  | 150         | 190          | 250         | volts |
| Auxiliary Anode                                                                       |             |              |             |       |
| Voltage Drop to Cathode K10 - - - - -                                                 | ---         | 112          | ---         | volts |
| Breakdown Voltage - - - - -                                                           | 260         | 300          | ---         | volts |
| Transfer Voltage <sup>2</sup> to Cathode K10 - - - -                                  | See Curve   |              |             |       |
| Transfer Voltage <sup>2, 3</sup> to any Cathode<br>except K10 - - - - -               | 260         | 290          | ---         | volts |
| Cathode                                                                               |             |              |             |       |
| Forward Transfer Voltage <sup>4</sup> - - - - -                                       | ---         | -10          | -20         | volts |
| Transfer Voltage Between Adjacent Output<br>Cathodes <sup>5, 6</sup> - - - - -        | -45         | ---          | ---         | volts |
| Transfer Voltage Between Normal Cathode and<br>Output Cathodes <sup>6</sup> - - - - - | -30         | ---          | ---         | volts |

MECHANICAL DATA

Mounting Position - - - - - Any  
 Bulb - - - - - T9  
 Dimensions and pin connections shown in outline on Page 4

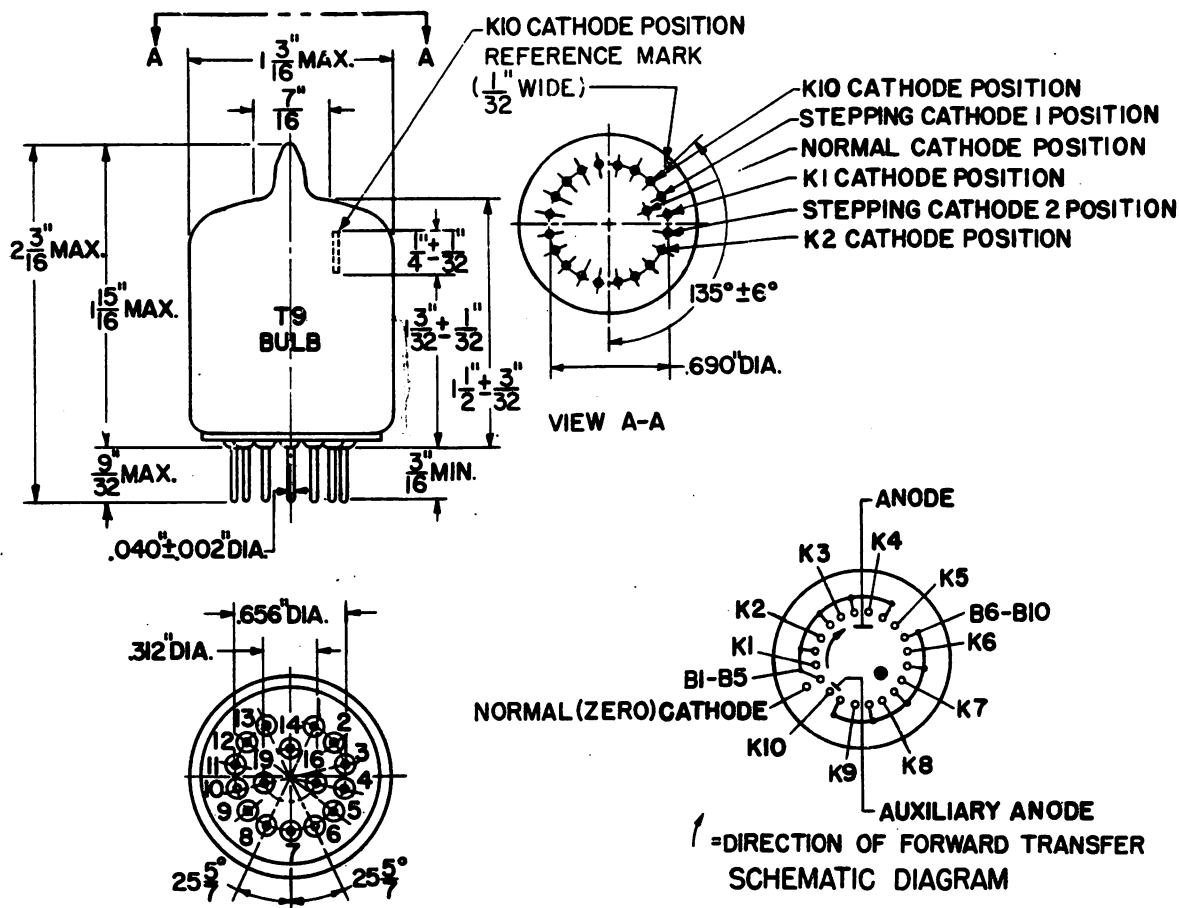
Note 1 All data are based on operation of the tube within average current ratings at the time of stepping or transfer of the discharge.

Note 2 Voltage, with respect to an operating cathode, at which conduction occurs from the auxiliary anode to cathode indicated.

Note 3 Measured with maximum K10 voltage of +50 volts with respect to the operating cathode.

Note 4 Voltage, with respect to an operating cathode, applied to the adjacent forward cathode to transfer the discharge to that cathode.

Note 5 Measured under static conditions. This is an absolute limit on output voltage but as frequency of operation is increased, the available output voltage is decreased because of residual ionization in the preceding cathodes.



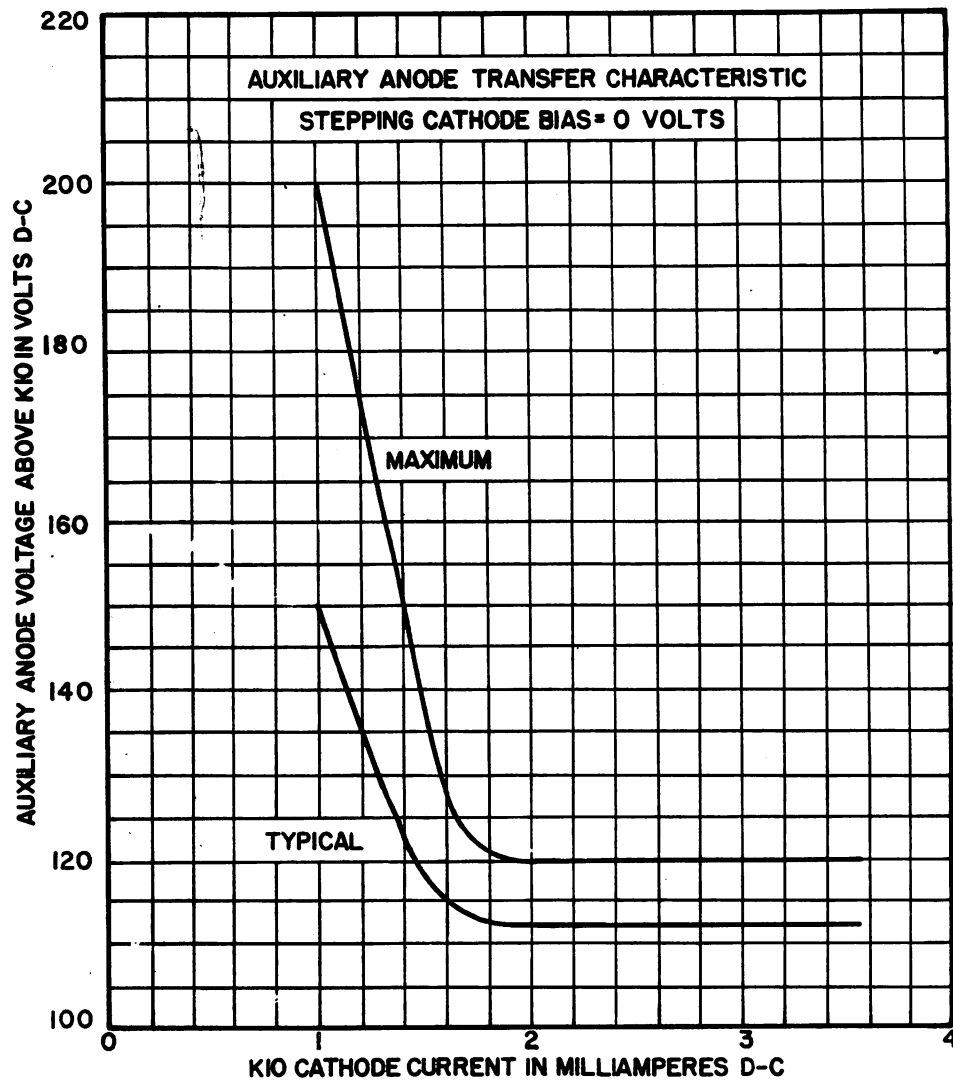
PIN 1. OUTPUT CATHODE (K3)  
 PIN 2. OUTPUT CATHODE (K2)  
 PIN 3. OUTPUT CATHODE (K1)  
 PIN 4. OUTPUT CATHODE (K10)  
 PIN 5. AUXILIARY ANODE  
 PIN 6. INTERNAL CONNECTION  
 PIN 7. OUTPUT CATHODE (K9)  
 PIN 8. OUTPUT CATHODE (K8)

PIN 9. OUTPUT CATHODE (K7)  
 PIN 10. OUTPUT CATHODE (K6)  
 PIN 11. STEPPING CATHODES B6-B10  
 PIN 12. OUTPUT CATHODE (K5)  
 PIN 13. OUTPUT CATHODE (K4)  
 PIN 14. STEPPING CATHODES B1-B5  
 PIN 16. NORMAL CATHODE  
 PIN 19. ANODE

NOTE - BASE PIN NO 6 MARKED "INTERNAL CONNECTION" SHOULD NOT BE CONNECTED TO ANY PORTION OF AN EXTERNAL CIRCUIT. FAILURE TO OBSERVE THIS PRECAUTION MAY RESULT IN IMPROPER OPERATION OF THE TUBE.

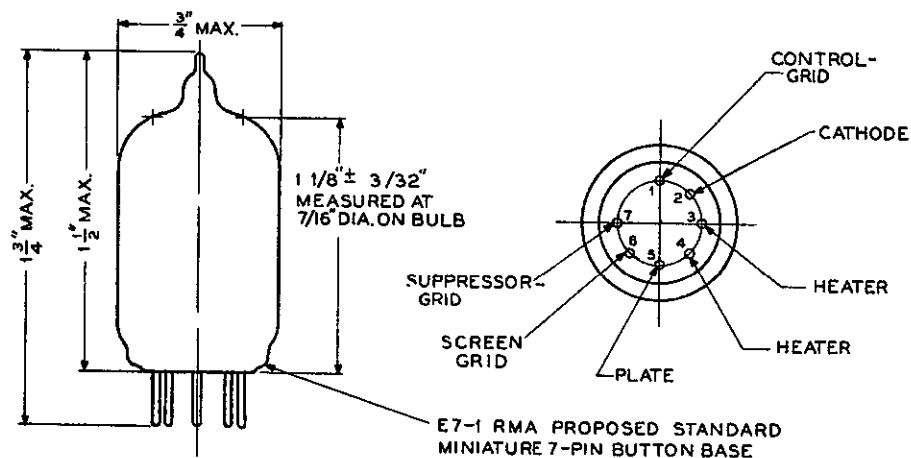
A development of Bell Telephone Laboratories, the research laboratories of the American Telephone and Telegraph Company and the Western Electric Company.

Note 6 Measured with maximum B1-B10 voltage of +20 volts with respect to the operating cathode.



ADVANCE ELECTRON TUBE DATA SHEET

WESTERN ELECTRIC 6AS6/409A ELECTRON TUBE



**6AS6/409A**  
**MINIATURE**  
**PENTODE**  
**U. H. F.**

CLASSIFICATION

The 6AS6/409A electron tube is a 7-pin miniature, triple-grid pentode with an indirectly heated cathode. It is intended for low power applications at high and ultra-high frequencies. The usual control-grid and the suppressor-grid can be used as independent control elements. The tube is suitable for use in gated amplifiers, gain controlled amplifiers, delay circuits, and mixers.

MOUNTING

The dimensions and arrangement of terminal connections are as shown above. The tube may be mounted in any position.

HEATER RATING

|                            |              |
|----------------------------|--------------|
| Heater voltage, a-c or d-c | 6.3 volts    |
| Nominal heater current     | 0.175 ampere |

MAXIMUM RATINGS (Design-center values)

|                             |                 |
|-----------------------------|-----------------|
| Plate voltage               | 180 volts       |
| Screen voltage              | 140 volts       |
| Positive suppressor voltage | 27 volts        |
| Plate dissipation           | 1.7 watts       |
| Screen dissipation          | 0.75 watt       |
| Cathode current             | 18 milliamperes |
| Heater-cathode voltage      | 90 volts        |
| Bulb temperature            | 120°Centigrade  |

OPERATING CONDITIONS AND CHARACTERISTICS

|                                   |      |                  |
|-----------------------------------|------|------------------|
| Plate voltage                     | 120  | 120 volts        |
| Screen voltage                    | 120  | 120 volts        |
| Suppressor voltage                | - 3  | 0 volts          |
| Grid voltage                      | - 2  | - 2 volts        |
| Plate current                     | 3.6  | 5.2 milliamperes |
| Screen current                    | 4.8  | 3.5 milliamperes |
| Transconductance, control-grid    | 1850 | 3200 umhos       |
| Transconductance, suppressor-grid | 810  | 470 umhos        |

CONTROL-GRID PLATE CURRENT CUT-OFF CHARACTERISTICS

|                                  |     |       |
|----------------------------------|-----|-------|
| Plate voltage                    | 120 | volts |
| Screen voltage                   | 120 | volts |
| Suppressor voltage               | 0   | volts |
| Nominal cut-off, control-grid    | - 6 | volts |
| Guaranteed cut-off, control-grid | -10 | volts |

SUPPRESSOR-GRID PLATE CURRENT CUT-OFF CHARACTERISTICS

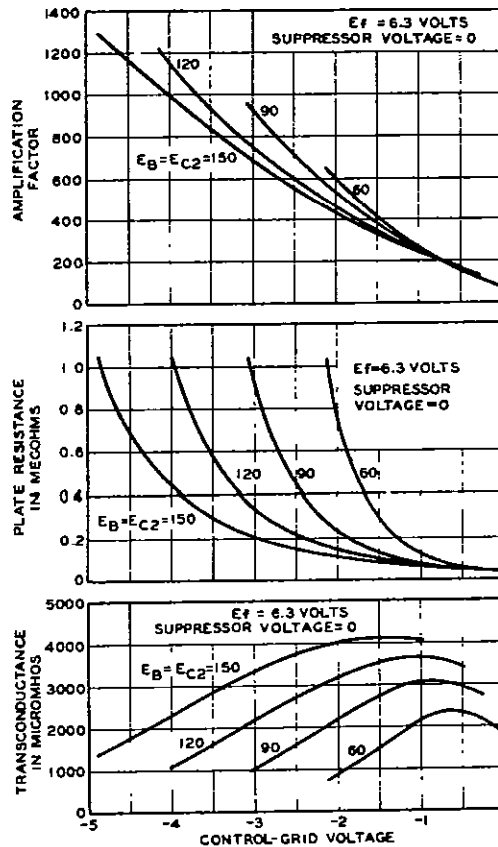
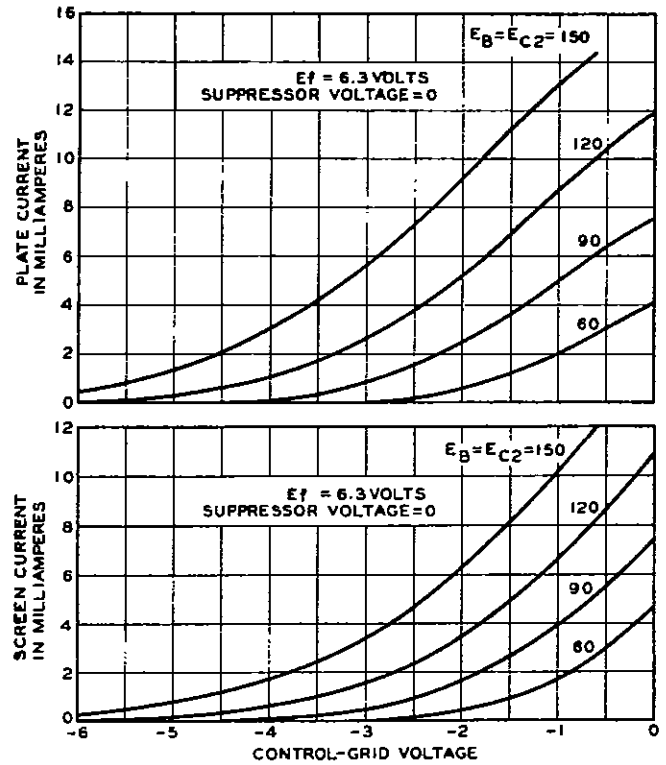
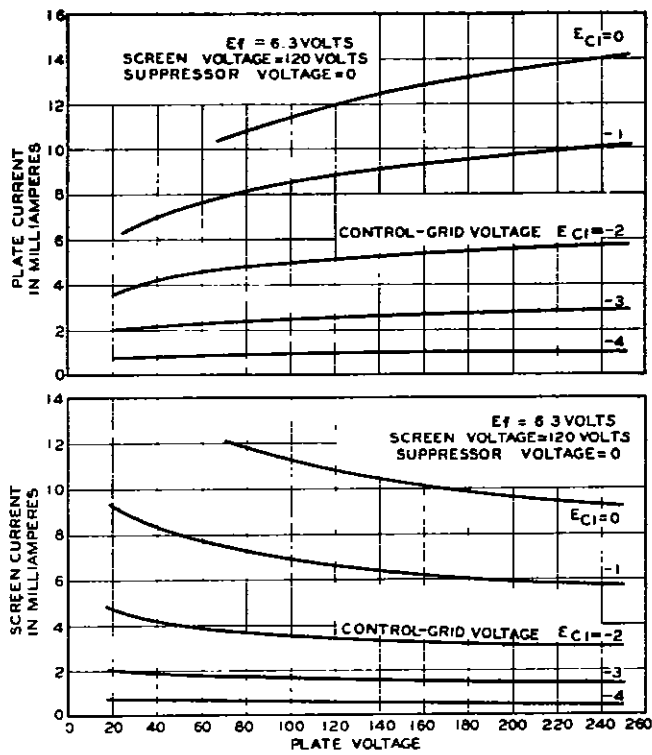
|                                     |     |           |
|-------------------------------------|-----|-----------|
| Plate voltage                       | 120 | 120 volts |
| Screen voltage                      | 120 | 60 volts  |
| Grid voltage                        | - 2 | 0 volts   |
| Nominal cut-off, suppressor-grid    | -10 | - 8 volts |
| Guaranteed cut-off, suppressor-grid | -15 | -10 volts |

INTERELECTRODE CAPACITANCES (With JAN 1A No. 314 shield connected to cathode)

|                                                             |          |
|-------------------------------------------------------------|----------|
| Control-grid to heater, cathode, screen and suppressor-grid | 3.9 uuf  |
| Plate to control-grid                                       | 0.01 uuf |
| Plate to heater, cathode, screen and suppressor-grid        | 3.0 uuf  |
| Control-grid to suppressor-grid                             | 0.1 uuf  |

*Western Electric*

# NORMAL PENTODE CHARACTERISTICS



# SUPPRESSOR - GRID CHARACTERISTICS

