

**12FK6**

Refer to chart at end of section.

**12FM6**

Refer to chart at end of section.

**12FQ7**

Refer to type 6FQ7/6CG7.

**12FQ8**

Refer to chart at end of section.

**12FR8**

Refer to chart at end of section.

**12FV7**

Refer to chart at end of section.

**12FX5****POWER PENTODE****19FX5, 60FX5**

Miniature type used in output stages of audio amplifiers. Outlines section, 5D; requires miniature 7-contact socket. Types 19FX5 and 60FX5 are identical with type 12FX5 except for heater ratings.

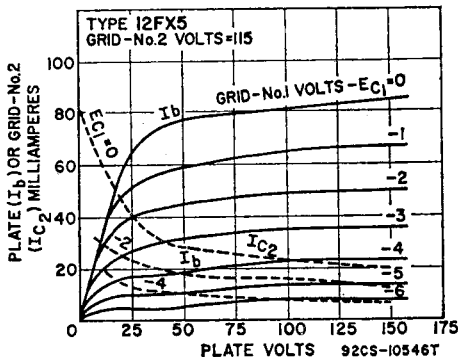
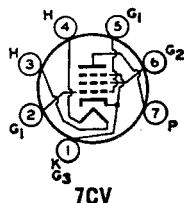
|  | 12FX5    | 19FX5    | 60FX5    |         |
|--|----------|----------|----------|---------|
| Heater Voltage (ac/dc) .....                                 | 12.6     | 18.9     | 60       | volts   |
| Heater Current .....   | 0.45     | 0.3      | 0.1      | ampere  |
| Heater Warm-up Time (Average) .....                          | 11       | 11       | —        | seconds |
| Heater-Cathode Voltage:                                      |          |          |          |         |
| Peak value .....   | ±200 max | ±200 max | ±200 max | volts   |
| Average value .....  | 100 max  | 100 max  | 100 max  | volts   |
| Direct Interelectrode Capacitances (Approx.):                |          |          |          |         |
| Grid No.1 to Plate .....                                     |          |          | 0.65     | pF      |
| Grid No.1 to Cathode, Heater, Grid No.2, and Grid No.3 ..... |          |          | 17       | pF      |
| Plate to Cathode, Heater, Grid No.2, and Grid No.3 .....     |          |          | 9        | pF      |

**Class A<sub>1</sub> Amplifier****MAXIMUM RATINGS (Design-Maximum Values)**

|   |     |       |
|---|-----|-------|
| Plate Voltage .....                       | 150 | volts |
| Grid-No.2 (Screen-Grid) Voltage .....     | 130 | volts |
| Plate Dissipation .....                   | 5.5 | watts |
| Grid-No.2 Input .....                     | 2   | watts |
| Bulb Temperature (At hottest point) ..... | 225 | °C    |

**TYPICAL OPERATION**

|  |       |       |
|--|-------|-------|
| Plate Supply Voltage .....             | 110   | volts |
| Grid-No.2 Supply Voltage .....         | 115   | volts |
| Cathode-Bias Resistor .....            | 62    | ohms  |
| Peak AF Grid-No.1 Voltage .....        | 3     | volts |
| Zero-Signal Plate Current .....        | 36    | mA    |
| Maximum-Signal Plate Current .....     | 35    | mA    |
| Zero-Signal Grid No.2 Current .....    | 10    | mA    |
| Maximum-Signal Grid No.2 Current ..... | 12    | mA    |
| Plate Resistance .....                 | 17500 | ohms  |
| Transconductance .....                 | 13500 | μmhos |
| Load Resistance .....                  | 3000  | ohms  |

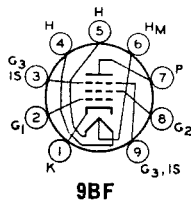


|                                   |     |          |
|-----------------------------------|-----|----------|
| Total Harmonic Distortion .....   | 8   | per cent |
| Maximum-Signal Power Output ..... | 1.3 | watts    |

**MAXIMUM CIRCUIT VALUES**

|                                  |     |        |
|----------------------------------|-----|--------|
| Grid-No.1-Circuit Resistance:    |     |        |
| For fixed-bias operation .....   | 0.1 | megohm |
| For cathode-bias operation ..... | 0.5 | megohm |

|  |                               |
|--|-------------------------------|
| Refer to chart at end of section.        | <b>12FX8</b><br><b>12FX8A</b> |
| Refer to chart at end of section.        | <b>12GA6</b>                  |
| For replacement use type 12BQ6GTB/12CU6. | <b>12GB3</b>                  |
| For replacement use type 12GW6/12DQ6B.   | <b>12GB6</b><br><b>12GB7</b>  |
| Refer to chart at end of section.        | <b>12GC6</b>                  |
| Refer to type 6GE5.                      | <b>12GE5</b>                  |
| Refer to chart at end of section.        | <b>12GJ5</b>                  |
| Refer to type 6GJ5A.                     | <b>12GJ5A</b>                 |
| Refer to chart at end of section.        | <b>12GN7</b>                  |
| Refer to chart at end of section.        | <b>12GN7A</b>                 |
| For replacement use type 12HG7/12GN7A.   |                               |
| Refer to chart at end of section.        | <b>12GT5</b><br><b>12GT5A</b> |
| Refer to type 6GW6/6DQ6B.                | <b>12GW6/12DQ6B</b>           |
| Refer to chart at end of section.        | <b>12H6</b>                   |
| Refer to type 38HE7.                     | <b>12HE7</b>                  |
| For replacement use type 12HG7/12GN7A.   | <b>12HG7</b>                  |



**9BF**

**SHARP-CUTOFF PENTODE**

**12HG7/  
12GN7A**

Miniature types with frame grid used as video amplifier in color and black-and-white television receivers. Outlines section, 6E; require 9-contact miniature socket.

|                              |        |          |        |
|------------------------------|--------|----------|--------|
| Heater Arrangement:          | Series | Parallel |        |
| Heater Voltage (ac/dc) ..... | 12.6   | 6.3      | volts  |
| Heater Current .....         | 0.26   | 0.52     | ampere |

## Heater-Cathode Voltage:

|  |          |       |
|--|----------|-------|
| Peak value .....   | ±200 max | volts |
| Average value .....  | 100 max  | volts |
| Direct Interelectrode Capacitances:  |          |       |
| Grid No.1 to Plate .....   | 0.15 max | pF    |
| Grid No.1 to Cathode, Heater, Grid No.2, Grid No.3, and<br>Internal Shield ..... | 14 max   | pF    |
| Plate to Cathode, Heater, Grid No.2, Grid No.3, and<br>Internal Shield .....     | 4.4 max  | pF    |

Class A<sub>1</sub> Amplifier

## MAXIMUM RATINGS (Design-Maximum Values)

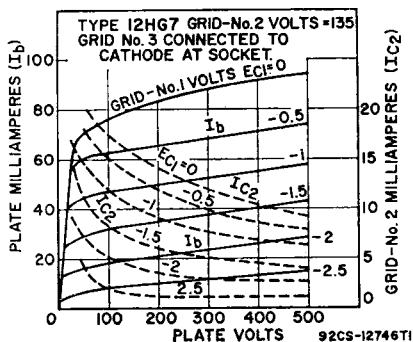
|   |                    |       |
|---|--------------------|-------|
| Plate Voltage .....   | 400                | volts |
| Grid-No.2 (Screen-Grid) Supply Voltage .....                | 330                | volts |
| Grid-No.2 Voltage .....                                     | See curve page 300 |       |
| Grid-No.1 (Control-Grid) Voltage, Positive-bias value ..... | 0                  | volts |
| Plate Dissipation .....                                     | 10                 | watts |
| Grid-No.2 Input:  |                    |       |
| For Grid-No.2 voltages up to 165 volts .....                | 1                  | watt  |
| For Grid-No.2 voltages between 165 and 330 volts .....      | See curve page 300 |       |

## CHARACTERISTICS

|   |   |       |
|---|---|-------|
| Plate Supply Voltage .....                                    | 300   | volts |
| Grid No.3 (Suppressor Grid) .....                             | Connected to cathode at socket                |       |
| Grid-No.2 Supply Voltage .....                                | 135   | volts |
| Grid No.1 .....   | Connected to negative end of cathode resistor |       |
| Cathode Resistor .....  | 47  | ohms  |
| Plate Resistance (Approx.) .....                              | 60000   | ohms  |
| Transconductance .....  | 32000   | μmhos |
| Plate Current .....   | 31  | mA    |
| Grid-No.2 Current .....                                       | 4.8   | mA    |
| Grid-No.1 Voltage (Approx.) for plate current of 100 μA ..... | -4.5  | volts |

## MAXIMUM CIRCUIT VALUES

|                                  |      |        |
|----------------------------------|------|--------|
| Grid-No.1-Circuit Resistance:    |      |        |
| For fixed-bias operation .....   | 0.1  | megohm |
| For cathode-bias operation ..... | 0.25 | megohm |

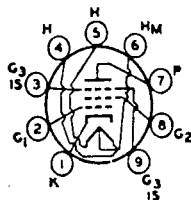


## 12HL7

## SHARP-CUTOFF PENTODE

Miniature type with frame grid used as a video output amplifier in color television receivers. Outlines section, 6E; requires miniature 9-contact socket.

|                          |        |          |        |
|--------------------------|--------|----------|--------|
| Heater Arrangement ..... | Series | Parallel |        |
| Heater Voltage .....     | 12.6   | 6.3      | volts  |
| Heater Current .....     | 0.3    | 0.6      | ampere |



|   |          |          |       |
|---|----------|----------|-------|
| Heater-Cathode Voltage:   |          |          |       |
| Peak value  | ±200 max | ±200 max | volts |
| Average value   | 100 max  | 100 max  | volts |
| Direct Interelectrode Capacitances:                                     |          |          |       |
| Grid No.1 to Plate  |          | 0.15     | pF    |
| Grid No.1 to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield |          | 15       | pF    |
| Plate to Cathode, Heater, Grid No.2, Grid No.3, and Internal Shield     |          | 6        | pF    |

**Class A<sub>1</sub> Amplifier**

**MAXIMUM RATINGS (Design-Maximum Values)**

|  |  |                    |       |
|--|--|--------------------|-------|
| Plate Voltage  |  | 400                | volts |
| Grid-No.3 (Suppressor-Grid) Voltage, Positive-bias value |  | 0                  | volts |
| Grid-No.2 (Screen-Grid) Supply Voltage                   |  | 330                | volts |
| Grid-No.2 Voltage  |  | See curve page 300 |       |
| Grid-No.1 (Control-Grid) Voltage, Positive-bias value    |  | 0                  | volt  |
| Plate Dissipation  |  | 10                 | watts |
| Grid-No.2 Input  |  | 1                  | watt  |

**CHARACTERISTICS**

|   |     |       |       |
|---|-----|-------|-------|
| Plate Supply Voltage                                    | 50  | 250   | volts |
| Grid-No.3 Voltage, Referred to negative end of cathode  | —   | 0     | volts |
| Grid-No.2 Voltage                                       | 125 | 150   | volts |
| Grid-No.1 Voltage                                       | 0   | 0     | volts |
| Cathode Resistor (Bypassed)                             | —   | 122   | ohms  |
| Plate Current   | 76  | 25    | mA    |
| Grid-No.2 Current                                       | 32  | 6     | mA    |
| Transconductance, Grid No.1 to Plate                    | —   | 21000 | μmhos |
| Plate Resistance (Approx.)                              | —   | 55000 | ohms  |
| Grid-No.1 Voltage (Approx.) for plate current of 100 μA | —   | -7.2  | volts |

**MAXIMUM CIRCUIT VALUES**

|                               |  |      |        |
|-------------------------------|--|------|--------|
| Grid-No.1-Circuit Resistance: |  |      |        |
| For fixed-bias operation      |  | 0.1  | megohm |
| For cathode-bias operation    |  | 0.25 | megohm |

|                                   |               |
|-----------------------------------|---------------|
| Refer to chart at end of section. | <b>12J5GT</b> |
| Refer to chart at end of section. | <b>12J7GT</b> |
| Refer to chart at end of section. | <b>12J8</b>   |
| Refer to chart at end of section. | <b>12JB6</b>  |
| Refer to type 6JB6A.              | <b>12JB6A</b> |
| Refer to chart at end of section. | <b>12JF5</b>  |
| Refer to type 6JN6.               | <b>12JN6</b>  |
| Refer to chart at end of section. | <b>12JN8</b>  |
| Refer to type 6JQ6.               | <b>12JQ6</b>  |
| Refer to chart at end of section. | <b>12JT6</b>  |
| Refer to type 6JT6A.              | <b>12JT6A</b> |
| Refer to chart at end of section. | <b>12K5</b>   |
| Refer to chart at end of section. | <b>12K7GT</b> |
| Refer to chart at end of section. | <b>12K8</b>   |
| Refer to chart at end of section. | <b>12KL8</b>  |
| Refer to chart at end of section. | <b>12L6GT</b> |
| Refer to type 6MD8.               | <b>12MD8</b>  |
| Refer to chart at end of section. | <b>12Q7GT</b> |
| Refer to chart at end of section. | <b>12R5</b>   |

|                    |  |
|--------------------|--|
|                    | Refer to chart at end of section.            |
| <b>12RK19</b>      | For replacement use type 12AF3/12BR3/12RK19. |
| <b>12S8GT</b>      | Refer to chart at end of section.            |
| <b>12SA7</b>       |  |
| <b>12SA7GT</b>     | Refer to chart at end of section.            |
| <b>12SC7</b>       | Refer to chart at end of section.            |
| <b>12SF5</b>       |  |
| <b>12SF5GT</b>     | Refer to chart at end of section.            |
| <b>12SF7</b>       | Refer to chart at end of section.            |
| <b>12SG7</b>       | Refer to chart at end of section.            |
| <b>12SH7</b>       | Refer to chart at end of section.            |
| <b>12SJ7</b>       |  |
| <b>12SJ7GT</b>     | Refer to chart at end of section.            |
| <b>12SK7</b>       |  |
| <b>12SK7GT</b>     | Refer to chart at end of section.            |
| <b>12SL7GT</b>     | Refer to type 6SL7GT.                        |
| <b>12SN7GT</b>     | Refer to chart at end of section.            |
| <b>12SN7GTA</b>    | Refer to type 6SN7GTB.                       |
| <b>12SQ7</b>       |  |
| <b>12SQ7GT</b>     | Refer to chart at end of section.            |
| <b>12SR7</b>       |  |
| <b>12SR7GT</b>     | Refer to chart at end of section.            |
| <b>12SW7</b>       | Refer to chart at end of section.            |
| <b>12SY7</b>       | Refer to chart at end of section.            |
| <b>12T10</b>       | Refer to type 6T10.                          |
| <b>12U7</b>        | Refer to chart at end of section.            |
| <b>12V6GT</b>      | Refer to type 6V6.                           |
| <b>12W6GT</b>      | Refer to type 6W6GT.                         |
| <b>12X4</b>        | Refer to type 6X4.                           |
| <b>12Z3</b>        | Refer to chart at end of section.            |
| <b>13CW4</b>       | Refer to type 6CW4.                          |
| <b>13DE7</b>       | Refer to type 6DE7.                          |
| <b>13DR7</b>       | Refer to type 6DR7.                          |
| <b>13EM7</b>       | Refer to chart at end of section.            |
| <b>13EM7/15EA7</b> | For replacement use type 13EM7/15EA7.        |
| <b>13FD7</b>       | Refer to type 6EM7/6EA7.                     |
| <b>13FM7</b>       | Refer to type 6FD7.                          |
| <b>13FM7/15FM7</b> | Refer to type 6FM7.                          |
| <b>13GB5</b>       | Refer to chart at end of section.            |
| <b>13GB5/XL500</b> | Refer to type 6GB5/EL500.                    |
| <b>13GF7A</b>      | Refer to type 6GF7A.                         |