

| TYPE | CLASS       | OPERATION                       | EMITTER | ELECTRODE POTENTIALS (VOLTS)  |                                          |                                       |                      |                |                | ELECTRODE CURRENTS                     |                                 |                       |                       | AVERAGE COEFFICIENTS             |                                              |                              |                                |                                             | INTERELECTRODE CAPACITANCE MMFD. |       |        |
|------|-------------|---------------------------------|---------|-------------------------------|------------------------------------------|---------------------------------------|----------------------|----------------|----------------|----------------------------------------|---------------------------------|-----------------------|-----------------------|----------------------------------|----------------------------------------------|------------------------------|--------------------------------|---------------------------------------------|----------------------------------|-------|--------|
|      |             |                                 |         | FILA-<br>MENT<br>OR<br>HEATER | PLATE                                    | G <sub>1</sub><br>(NEGATIVE)          | G <sub>2</sub>       | G <sub>3</sub> | G <sub>4</sub> | FILA-<br>MENT<br>OR<br>HEATER<br>AMPS. | PLATE<br>MA.                    | G <sub>2</sub><br>MA. | G <sub>3</sub><br>MA. | PLATE<br>RESIS-<br>TANCE<br>OHMS | TRANS-<br>CONDUCT-<br>ANCE<br>MICRO-<br>MHOS | AMPLIFI-<br>CATION<br>FACTOR | RATED<br>PLATE<br>LOAD<br>OHMS | RATED<br>POWER<br>OUTPUT<br>MILLI-<br>WATTS | GRID<br>PLATE                    | INPUT | OUTPUT |
|      |             |                                 |         |                               |                                          |                                       |                      |                |                |                                        |                                 |                       |                       |                                  |                                              |                              |                                |                                             |                                  |       |        |
| 01-A | TRIODE      | DETECTOR                        | F       | 5.0                           | 22.5                                     | 4.5                                   |                      |                |                | 0.25                                   | 2.5                             |                       |                       | 11,000                           | 725                                          | 8.0                          |                                |                                             | 8.1                              | 3.1   | 2.2    |
|      |             | AMPLIFIER                       |         |                               | 45.0<br>90.0<br>125.0                    |                                       |                      |                |                |                                        |                                 |                       |                       |                                  |                                              |                              |                                |                                             |                                  |       |        |
| 10   | TRIODE      | AMPLIFIER<br>CLASS A            | F       | 7.5                           | 250.0<br>350.0<br>425.0                  | 22.0<br>31.0<br>39.0                  |                      |                |                | 1.25                                   | 10.0<br>16.0<br>18.0            |                       |                       | 6,000<br>5,150<br>5,000          | 1230<br>1550<br>1600                         | 8.0<br>8.0<br>8.0            | 13,000<br>11,000<br>10,200     | 400<br>900<br>1600                          | 7.0                              | 4.0   | 3.0    |
| 12-A | TRIODE      | DETECTOR OR AMPLIFIER           | F       | 5.0                           | 90.0                                     | 4.5                                   |                      |                |                | 0.25                                   | 5.2                             |                       |                       | 5,400                            | 1575                                         | 8.5                          | 5,500                          | 35                                          | 8.1                              | 4.0   | 2.0    |
|      |             | AMPLIFIER                       |         |                               | 125.0<br>180.0                           | 9.0<br>13.5                           |                      |                |                |                                        | 6.2<br>7.6                      |                       |                       | 5,100<br>4,700                   | 1550<br>1800                                 | 8.5<br>8.5                   | 9,000<br>10,650                | 130<br>285                                  |                                  |       |        |
| 22   | TETRODE     | AMPLIFIER                       | F       | 5.3                           | 125.0<br>135.0                           | 1.5<br>1.5                            | 45.0<br>67.5         |                |                | 0.13                                   | 1.7<br>3.7                      | 0.6<br>1.3            |                       | 725,000<br>325,000               | 575<br>500                                   | 270.0<br>160.0               |                                |                                             | .01                              | 3.0   | 10.0   |
| 24   | TETRODE     | DETECTOR BIASED (1)             | H       | 2.5                           | 250.0                                    | 5.0(4)                                | 20.0(4)              |                |                | 1.75                                   | 0.1                             | 1.0                   |                       | 400,000                          | 1050                                         | 420.0                        |                                |                                             | .007                             | 5.3   | 10.5   |
|      |             | AMPLIFIER                       |         |                               | 180.0<br>180.0<br>250.0                  | 1.5<br>3.0<br>3.0                     | 75.0<br>90.0<br>90.0 |                |                |                                        | 4.0<br>4.0<br>4.0               |                       |                       | 400,000<br>400,000<br>600,000    | 1000<br>1000<br>1050                         | 420.0<br>400.0<br>630.0      |                                |                                             |                                  |       |        |
| 26   | TRIODE      | AMPLIFIER                       | F       | 1.5                           | 90.0                                     | 7.0                                   |                      |                |                | 1.05                                   | 2.9                             |                       |                       | 8,900                            | 935                                          | 8.5                          |                                |                                             | 8.1                              | 3.5   | 2.2    |
|      |             | AMPLIFIER                       |         |                               | 125.0<br>180.0                           | 10.0<br>14.5                          |                      |                |                |                                        | 5.5<br>6.2                      |                       |                       | 7,600<br>7,300                   | 1100<br>1150                                 | 8.5<br>8.5                   |                                |                                             |                                  |       |        |
| 27   | TRIODE      | DETECTOR BIASED (2)             | H       | 2.5                           | 250.0                                    | 30.0(4)                               |                      |                |                | 1.75                                   | 0.2                             |                       |                       | 11,000                           | 820                                          | 9.0                          | 14,000                         | 50                                          | 3.3                              | 3.5   | 3.0    |
|      |             | AMPLIFIER                       |         |                               | 275.0<br>90.0<br>125.0<br>180.0<br>250.0 | 35.0(4)<br>6.0<br>9.0<br>13.5<br>21.0 |                      |                |                |                                        | 0.2<br>2.7<br>4.5<br>5.0<br>6.2 |                       |                       | 9,000<br>9,000<br>9,250          | 1000<br>1000<br>975                          | 9.0<br>9.0<br>9.0            | 13,000<br>18,700<br>24,000     | 80<br>165<br>300                            |                                  |       |        |
| 30   | TRIODE      | DETECTOR OR AMPL.               | F       | 2.0                           | 90.0                                     | 4.5                                   |                      |                |                | 0.06                                   | 2.5                             |                       |                       | 11,000                           | 850                                          | 9.5                          | 15,000                         | 16                                          | 6.0                              | 3.7   | 2.1    |
|      |             | AMPLIFIER                       |         |                               | 125.0<br>180.0                           | 9.0<br>13.5                           |                      |                |                |                                        | 3.0<br>3.1                      |                       |                       | 10,300<br>10,300                 | 900<br>900                                   | 9.5<br>9.5                   |                                |                                             |                                  |       |        |
| 31   | TRIODE      | POWER<br>AMPLIFIER              | F       | 2.0                           | 125.0<br>180.0                           | 22.5<br>30.0                          |                      |                |                | 0.13                                   | 8.0<br>12.3                     |                       |                       | 4,100<br>3,600                   | 925<br>1050                                  | 3.8<br>3.8                   | 7,000<br>5,700                 | 185<br>375                                  | 5.7                              | 3.5   | 2.2    |
| 32   | TETRODE     | DETECTOR BIASED (3)             | F       | 2.0                           | 125.0                                    | 4.5(4)                                | 45.0                 |                |                | 0.06                                   | 0.2                             | 0.4                   |                       | 950,000                          | 640                                          | 610.0                        | 100,000                        |                                             | .015                             | 6.0   | 11.7   |
|      |             | AMPLIFIER                       |         |                               | 180.0<br>125.0<br>180.0                  | 5.0(4)<br>3.0<br>3.0                  | 67.5<br>87.5<br>67.5 |                |                |                                        | 0.2<br>1.7<br>1.7               |                       |                       | 1,200,000                        | 650                                          | 780.0                        | 100,000                        |                                             |                                  |       |        |
| 33   | PENTODE     | AMPLIFIER<br>CLASS A            | F       | 2.0                           | 125.0                                    | 13.5                                  | 125.0                |                |                | 0.26                                   | 14.5                            | 3.0                   |                       | 50,000                           | 1450                                         | 70.0                         | 7,000                          | 700                                         | .9                               | 8.9   | 11.1   |
| 34   | PENTODE     | SUPER-CONTROL<br>R.F. AMPLIFIER | F       | 2.0                           | 67.5                                     | 3.0                                   | 67.5                 |                |                | 0.06                                   | 2.7                             | 1.1                   |                       | 400,000                          | 550(4)                                       | 224.0                        |                                |                                             | .02                              | 5.8   | 11.6   |
|      |             | AMPLIFIER                       |         |                               | 125.0<br>180.0                           | 3.0<br>3.0                            | 67.5<br>67.5         |                |                |                                        | 2.8<br>2.8                      | 1.0<br>1.0            |                       | 600,000<br>1,000,000             | 560(4)<br>620(4)                             | 260.0<br>620.0               |                                |                                             |                                  |       |        |
| 35   | USE TYPE 51 |                                 |         |                               |                                          |                                       |                      |                |                |                                        |                                 |                       |                       |                                  |                                              |                              |                                |                                             |                                  |       |        |
| 36   | TETRODE     | AMPLIFIER                       | H       | 6.5                           | 90.0                                     | 1.5                                   | 55.0                 |                |                | 0.30                                   | 1.8                             | 0.6                   |                       | 250,000                          | 850                                          | 215.0                        |                                |                                             | .01                              | 3.7   | 9.2    |
|      |             | AMPLIFIER                       |         |                               | 125.0<br>180.0                           | 1.5<br>3.0                            | 67.5<br>90.0         |                |                |                                        | 3.0<br>3.1                      | 1.0<br>1.1            |                       | 300,000<br>350,000               | 1050<br>1050                                 | 315.0<br>370.0               |                                |                                             |                                  |       |        |
| 37   | TRIODE      | DETECTOR BIASED (2)             | H       | 6.5                           | 90.0                                     | 10.0(4)                               |                      |                |                | 0.30                                   | 0.2                             |                       |                       | 11,500                           | 780                                          | 9.0                          |                                |                                             | 2.0                              | 3.3   | 2.2    |
|      |             | AMPLIFIER                       |         |                               | 180.0<br>90.0<br>125.0<br>180.0          | 20.0(4)<br>6.0<br>9.0<br>13.5         |                      |                |                |                                        | 0.2<br>2.5<br>4.1<br>4.3        |                       |                       | 10,000<br>10,000                 | 900<br>900                                   | 9.0<br>9.0                   |                                |                                             |                                  |       |        |

|       |                     |                                         |   |          |                              |                              |                                |  |  |      |                          |                   |  |                                 |                              |                          |                            |                                |      |     |      |
|-------|---------------------|-----------------------------------------|---|----------|------------------------------|------------------------------|--------------------------------|--|--|------|--------------------------|-------------------|--|---------------------------------|------------------------------|--------------------------|----------------------------|--------------------------------|------|-----|------|
| 38    | PENTODE             | AMPLIFIER CLASS A                       | H | 6.3      | 100.0<br>135.0               | 9.0<br>12.5                  | 100.0<br>135.0                 |  |  | 0.30 | 7.0<br>9.0               | 2.0<br>2.5        |  | 84,000<br>102,000               | 950<br>975                   | 80.0<br>100.0            | 8,500<br>12,500            | 200<br>525                     | .3   | 4.1 | 8.5  |
| 39-44 | PENTODE             | SUPER-CONTROL R.F. AMPLIFIER            | H | 6.3      | 90.0<br>180.0<br>250.0       | 3.0<br>3.0<br>3.0            | 90.0<br>90.0<br>90.0           |  |  | 0.30 | 5.6<br>5.8<br>5.8        | 1.6<br>1.4<br>1.4 |  | 375,000<br>750,000<br>1,000,000 | 960(?)<br>1000(?)<br>1050(?) | 360.0<br>750.0<br>1050.0 |                            |                                | .007 | 5.5 | 10.0 |
|       |                     | MODULATOR                               |   |          | 90.0<br>180.0<br>250.0       | 7.0(?)<br>7.0(?)<br>7.0(?)   | 90.0<br>90.0<br>90.0           |  |  |      |                          |                   |  |                                 |                              |                          |                            |                                |      |     |      |
|       |                     |                                         |   |          |                              |                              |                                |  |  |      |                          |                   |  |                                 |                              |                          |                            |                                |      |     |      |
| 42    | PENTODE             | AMPLIFIER CLASS A                       | H | 6.3      | 250.0                        | 16.5                         | 250.0                          |  |  | 0.70 | 34.0                     | 6.5               |  | 100,000                         | 2300                         | 222.0                    | 7,000                      | 3000                           |      |     |      |
| 43    | PENTODE             | AMPLIFIER CLASS A                       | H | 25.0 (1) | 95.0<br>135.0                | 15.0<br>20.0                 | 95.0<br>135.0                  |  |  | 0.30 | 20.0<br>34.0             | 4.0<br>7.0        |  | 45,000<br>35,000                | 2000<br>2300                 | 90.0<br>80.0             | 4,500<br>4,000             | 900(?)<br>2000(?)              |      |     |      |
| 44    | USE TYPE 39-44      |                                         |   |          |                              |                              |                                |  |  |      |                          |                   |  |                                 |                              |                          |                            |                                |      |     |      |
| 45    | TRIODE              | AMPLIFIER CLASS A                       | F | 2.5      | 180.0<br>250.0<br>275.0      | 31.5<br>50.0<br>56.0         |                                |  |  | 1.50 | 31.0<br>34.0<br>36.0     |                   |  | 1,900<br>1,750<br>1,670         | 1850<br>2000<br>2100         | 3.5<br>3.5<br>3.5        | 3,500<br>3,900<br>4,600    | 780<br>1600<br>2000            | 7.2  | 4.5 | 3.0  |
| 46    | TETRODE             | AMPLIFIER CLASS A<br>AMPLIFIER CLASS B  | F | 2.5      | 250.0 (15)<br>300.0<br>400.0 | 33.0<br>± .0(12)<br>± .0(10) | 250.0(2)<br>± .0(3)<br>± .0(3) |  |  | 1.75 | 22.0<br>4.0(?)<br>6.0(?) |                   |  | 2,380                           | 2350                         | 5.6                      | 6,400<br>1,300<br>1,450    | 1250<br>16000(16)<br>20000(16) |      |     |      |
| 47    | USE TYPE PZ         |                                         |   |          |                              |                              |                                |  |  |      |                          |                   |  |                                 |                              |                          |                            |                                |      |     |      |
| 50    | TRIODE              | AMPLIFIER CLASS A                       | F | 7.5      | 350.0<br>400.0<br>450.0      | 63.0<br>70.0<br>84.0         |                                |  |  | 1.25 | 45.0<br>55.0<br>55.0     |                   |  | 1,900<br>1,800<br>1,800         | 2000<br>2100<br>2100         | 3.8<br>3.8<br>3.8        | 4,100<br>3,670<br>4,350    | 2400<br>3400<br>4600           | 9.0  | 5.0 | 3.0  |
| 51    | TETRODE             | VARIABLE-MU AMPLIFIER                   | H | 2.5      | 180.0<br>250.0               | 3.0<br>3.0                   | 90.0<br>90.0                   |  |  | 1.75 | 6.3<br>6.5               | 2.5<br>2.5        |  | 300,000<br>400,000              | 1160(?)<br>1110(?)           | 350.0<br>445.0           |                            |                                | .007 | 5.0 | 10.0 |
|       |                     | MODULATOR                               |   |          | 250.0                        | 7.0                          | 90.0(1)                        |  |  |      |                          |                   |  |                                 |                              |                          |                            |                                |      |     |      |
| 55    | DUPLEX DIODE TRIODE | AMPLIFIER CLASS A (20)                  | H | 2.5      | 135.0<br>180.0<br>250.0      | 10.5<br>12.5<br>20.0         |                                |  |  | 1.00 | 3.7<br>6.0<br>8.0        |                   |  | 11,000<br>8,500<br>7,500        | 750<br>975<br>1100           | 8.3<br>8.3<br>8.3        | 25,000<br>20,000<br>20,000 | 75<br>160<br>350               | 1.5  | 1.5 | 3.0  |
| 56    | TRIODE              | DETECTOR BIASED(2)<br>AMPLIFIER         | H | 2.5      | 250.0<br>250.0               | 20.0(4)<br>12.5              |                                |  |  | 1.00 | 0.2<br>5.0               |                   |  | 9,500                           | 1450                         | 13.8                     |                            |                                | 3.2  | 3.2 | 2.2  |
| 57    | PENTODE             | DETECTOR BIASED(1)<br>AMPLIFIER CLASS A | H | 2.5      | 250.0<br>250.0               | 6.0(21)<br>3.0               | 100.0<br>100.0 (23)            |  |  | 1.00 | 0.1<br>2.0               | 1.0               |  | 1,500,000                       | 1225(22)                     | 1500.0                   | 250,000                    |                                | .007 | 5.2 | 6.8  |

- For use as a grid leak detector 250-volts plate; screen up to 70-volts; capacity .00025-mfd; resistance 1-5 megohms; grid return to cathode.
- For use as a grid leak detector 90-volts plate; capacity .00025-mfd; resistance 1-5 megohms; grid return to cathode.
- Screen  $g_2$ , -20 to -45-volts; adjust  $g_1$  to give 0.1 ma. with no a.c. input signal.
- Adjust  $g_1$  bias for plate current of 0.2 ma. with no a.c. input signal.
- For use as a grid leak detector 135-volts plate; .00025-mfd; resistance 1-5 megohms; screen up to 45 volts; plate load 100,000 ohms; grid return to cathode.
- Mutual conductance at  $g_1$  -22.5 volts is approximately 15 u-mhos.
- Mutual conductance at  $g_1$  -42.5 volts is approximately 2 u-mhos.
- This grid bias is minimum for oscillator peak potential of 6.0 volts.
- Total harmonic distortion 11%.
- Total harmonic distortion 9%.
- Heater to cathode potential should not exceed 90 volts d.c. as measured between negative heater terminal and cathode.

- Grid  $g_2$  adjacent to plate is connected to plate.
- $g_1$  and  $g_2$  are connected together to serve as control grid.
- Peak plate current (per tube) 150 ma. and maximum plate dissipation (per tube) 10 watts.
- Peak plate current (per tube) 200 ma. and maximum plate dissipation (per tube) 10 watts.
- Maximum continuous power output for two tubes 20-watts.
- Maximum signal potential (rms per tube) 40 volts.
- Maximum signal potential (rms per tube) 41 volts.
- Mutual conductance at  $g_1$  -40 volts is approximately 15.0 u-mhos, and at -50 is 0.
- Diode units used for half-wave and full-wave detection, and avc arrangement.
- Screen  $g_2$ , 20 to 60-volts, adjust  $g$  to give 0.2 ma. with no input signal.
- Cut-off of cathode current occurs at -7 volts ( $g$ ).
- Suppressor ( $g$ ) connected to cathode at socket.

|                                       |                                              |                                        |            |           |       |      |       |                     |           |              |       |     |     |           |                      |       |         |      |  |                             |
|---------------------------------------|----------------------------------------------|----------------------------------------|------------|-----------|-------|------|-------|---------------------|-----------|--------------|-------|-----|-----|-----------|----------------------|-------|---------|------|--|-----------------------------|
| WUNDERLICH<br>WUNDERLICH<br>"X"-AUTO. | TETRODE   DETECTOR<br>(SEE SPECIAL BULLETIN) | H<br>H                                 | 2.5<br>6.3 |           |       |      |       |                     |           | 1.00<br>0.40 |       |     |     |           |                      |       |         |      |  |                             |
| 2A5                                   | PENTODE                                      | AMPLIFIER<br>CLASS A                   | H          | 2.5       | 250.0 | 16.5 | 250.0 | (34)                |           | 1.75         | 34.0  | 6.5 |     | 100,000   | 2200                 | 220.0 | 7,000   | 3000 |  |                             |
| 2A7                                   | HEPTODE                                      | OSCILLATOR<br>MODULATOR                | H          | 2.5       | 250.0 | (56) | 250.0 | 100 <sup>(37)</sup> | -3.0 (38) | 0.80         | 4.0   | 3.5 | 2.0 | 300,000   | 475 <sup>(39)</sup>  |       |         |      |  | (See Technical<br>Bulletin) |
| 2B7                                   | DUPLEX<br>DIODE<br>PENTODE                   | AMPLIFIER<br>R.F. OR I.F.              | H          | 2.5       | 100.0 | 3.0  | 100.0 | (34)                |           | 0.80         | 5.8   | 1.7 |     | 300,000   | 950 <sup>(40)</sup>  | 285.0 |         |      |  |                             |
|                                       |                                              |                                        |            |           | 180.0 | 3.0  | 75.0  | (34)                |           |              | 3.4   | 0.9 |     | 1,000,000 | 840 <sup>(41)</sup>  | 840.0 |         |      |  |                             |
|                                       |                                              |                                        |            |           | 250.0 | 3.0  | 100.0 | (34)                |           |              | 6.0   | 1.5 |     | 800,000   | 1000 <sup>(42)</sup> | 800.0 |         |      |  |                             |
|                                       |                                              |                                        |            |           | 250.0 | 3.0  | 125.0 | (34)                |           |              | 9.0   | 2.3 |     | 650,000   | 1125 <sup>(43)</sup> | 730.0 |         |      |  |                             |
|                                       |                                              | AMPLIFIER A.F.                         |            |           | 250.0 | 4.5  | 50.0  | (34)                |           |              | 0.6   |     |     |           |                      |       | 200,000 |      |  |                             |
| 5Z3                                   | DUPLEX<br>DIODE                              | RECTIFIER<br>FULL-WAVE                 | F          | 5.0       | 500.0 |      |       |                     |           | 3.00         | 250.0 |     |     |           |                      |       |         |      |  |                             |
| 6A7                                   | HEPTODE                                      | IDENTICAL TO 2A7<br>EXCEPT HEATER      | H          | 6.3       |       |      |       |                     |           | 0.30         |       |     |     |           |                      |       |         |      |  |                             |
| 6B7                                   | DUPLEX<br>DIODE PENTODE                      | IDENTICAL TO 2B7<br>EXCEPT HEATER      | H          | 6.3       |       |      |       |                     |           | 0.30         |       |     |     |           |                      |       |         |      |  |                             |
| 12Z3                                  | DIODE                                        | RECTIFIER<br>HALF-WAVE                 | H          | 12.5 (43) | 225.0 |      |       |                     |           | 0.30         | 60.0  |     |     |           |                      |       |         |      |  |                             |
| 12Z5                                  | DUPLEX<br>DIODE                              | RECTIFIER                              | H          | 12.6      | 225.0 |      |       |                     |           | 0.30         | 60.0  |     |     |           |                      |       |         |      |  |                             |
|                                       |                                              | FULL-WAVE<br>VOLTAGE DOUBLER           |            |           | 225.0 |      |       |                     |           | 0.60         | 60.0  |     |     |           |                      |       |         |      |  |                             |
| 25Z5                                  | DUPLEX DIODE                                 | RECTIFIER FULL-WAVE<br>VOLTAGE DOUBLER | H          | 25.0      | 125.0 |      |       |                     |           | 0.30         | 100.0 |     |     |           |                      |       |         |      |  |                             |

1. For use as a grid leak detector 250-volts plate; screen up to 70-volts; capacity .00025-mfd; resistance 1-5 megohms; grid return to cathode.
20. Diode units used for half-wave and full-wave detection, and avc arrangement.
21. Screen  $g_2$ , 20 to 60-volts, adjust  $g_1$  to give 0.2 ma. with no input signal.
24. Mutual conductance at  $g_1$  -40 volts is approximately 10  $\mu$ -mhos and at -50 is 2.
25. This grid bias is minimum for oscillator peak voltage of 9.0-volts.
26. Grids ( $g_2$ ) and ( $g_3$ ) are connected to plate when operated as class "A" amplifier.
27. Grid ( $g_3$ ) tied to cathode.
28. Grid ( $g_2$ ) is screen only.
29. Grids ( $g_1$ ) and ( $g_2$ ) tied together and average dissipation is 1.5-watts (max.).
30. Grid ( $g_3$ ) tied to plate.
31. Dynamic peak plate current 200 ma. and average plate dissipation 10-watts (max.).
32. Plate to plate.
33. The triode unit is  $h_i$ -mu and the diode units are used in various detector arrangements.
34. Grid ( $g_3$ ) connected to cathode at socket as suppressor.
35. Both the internal shield surrounding plate and grid ( $g_2$ ) tied internally to pin 3.
36. Mutual conductance approximately 0 (cathode current cut-off) at  $g_1$ , -7.5 volts.
37. Mutual conductance at  $g_1$  -25 volts is approximately 10, and at -32.5 is 2.
38. Mutual conductance at  $g_1$  -35 volts is approximately 10, and at -42.5 is 2.
39. Mutual conductance at  $g_1$  -45 volts is approximately 10, and at -52.5 is 2.
40. Both internal shield surrounding plate and cathode connected internally to pin 5.
41. Average plate dissipation 7-watts (max.).
42. Static plate current 7.5 ma. and dynamic peak plate current (per plate) 90 ma. (max.).

43. With average power in-put of 380 milli-watts applied between grids  $g_{1a}$  and  $g_{1b}$ .
44. Operating with condenser in-put filter.
45. Operating with choke in-put filter of 20-henry (min.).
46. Two tubes operated as full-wave rectifier delivers 170 ma. (max.) at 700 plate volts rms. (max.).
47. Maximum peak inverse potential 1400-volts.
48. Maximum peak plate current 400 ma.
49. Approximate internal drop 15 volts.
50. Maximum peak plate current should not exceed 800 ma.
51. Operating with either condenser or choke in-put to filter.
52. Grids ( $g_1$ ) and ( $g_2$ ) tied together and average dissipation 0.35 watts (max.).
53. Dynamic peak plate current 75 ma. (max.).
54. With a plate load of 9400-ohms nominal power output is 3500 milli-watts.
55. Grid ( $g_2$ ) tied to center of filament.
56. Grid ( $g_1$ ) operating in oscillator circuit feeding 50,000 ohms.
57. Grids ( $g_3$ ) and ( $g_5$ ) connected together.
58. Grid ( $g_4$ ) operating as control grid for modulator.
59. Conversion conductance 475 at -3 volts grid ( $g_4$ ), and 2 at -50 volts.
60. Cathode current cut-off at -17 volts  $g_1$ .
61. Cathode current cut-off at -13 volts  $g_1$ .
62. Cathode current cut-off at -21 volts  $g_1$ .
63. Heater-cathode potential should not exceed 100-volts.
64. Center tap on heater to permit dual operation.

| — PHYSICAL CHARACTERISTICS — |                                   |           |                      |                |                                |                   |                   |                |   |                 |                              |                        |
|------------------------------|-----------------------------------|-----------|----------------------|----------------|--------------------------------|-------------------|-------------------|----------------|---|-----------------|------------------------------|------------------------|
| TYPE                         | TYPE BULB                         | TYPE BASE | TERMINAL ARRANGEMENT |                |                                |                   |                   |                |   |                 | OVERALL HEIGHT (MAX.) INCHES | DIAMETER (MAX.) INCHES |
|                              |                                   |           | 1                    | 2              | 3                              | 4                 | 5                 | 6              | 7 | TOP CAP         |                              |                        |
| 01-A                         | S-14                              | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.688                        | 1.813                  |
| 10                           | S-17                              | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 5.625                        | 2.188                  |
| 12 A                         | S-14                              | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.688                        | 1.813                  |
| 22                           | S-140                             | M-4       | F                    | F              | G <sub>2</sub>                 | F                 |                   |                |   | G <sub>1</sub>  | 5.051                        | 1.813                  |
| 24                           | S-140                             | M-5       | H                    | F              | G <sub>2</sub>                 | K                 | H                 |                |   | G <sub>1</sub>  | 5.051                        | 1.813                  |
| 26                           | S-14                              | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.688                        | 1.813                  |
| 27                           | S-14                              | M-5       | H                    | F              | G <sub>1</sub>                 | K                 | H                 |                |   |                 | 4.688                        | 1.813                  |
| 30                           | S-12                              | S-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.250                        | 1.563                  |
| 31                           | S-12                              | S-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.250                        | 1.563                  |
| 32                           | S-140                             | M-4       | F                    | F              | G <sub>2</sub>                 | F                 |                   |                |   | G <sub>1</sub>  | 5.051                        | 1.813                  |
| 33                           | S-14                              | M-5       | F                    | F              | G <sub>1</sub>                 | G <sub>2</sub>    | F                 |                |   |                 | 4.688                        | 1.813                  |
| 34                           | S-140                             | M-4       | F                    | F              | G <sub>2</sub>                 |                   |                   |                |   | G <sub>1</sub>  | 5.051                        | 1.813                  |
| 36                           | S-120                             | S-5       | H                    | F              | G <sub>2</sub>                 | K                 | H                 |                |   | G <sub>1</sub>  | 4.551                        | 1.563                  |
| 37                           | S-12                              | S-5       | H                    | F              | G <sub>1</sub>                 | K                 | H                 |                |   |                 | 4.250                        | 1.563                  |
| 38                           | S-120                             | S-5       | H                    | F              | G <sub>2</sub>                 | K                 | H                 |                |   | G <sub>1</sub>  | 4.551                        | 1.563                  |
| 39-44                        | ST-120                            | S-5       | H                    | F              | G <sub>2</sub>                 | K                 | H                 |                |   | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 42                           | ST-14                             | M-6       | H                    | F              | G <sub>2</sub>                 | G <sub>1</sub>    | K                 | H              |   |                 | 4.688                        | 1.813                  |
| 43                           | ST-14                             | M-6       | H                    | F              | G <sub>2</sub>                 | G <sub>1</sub>    | K                 | H              |   |                 | 4.688                        | 1.813                  |
| 45                           | ST-14                             | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.688                        | 1.813                  |
| 46                           | S-17                              | M-5       | F                    | F              | G <sub>1</sub>                 | G <sub>2</sub>    | F                 |                |   |                 | 5.625                        | 2.188                  |
| 50                           | S-21                              | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 6.250                        | 2.563                  |
| 51                           | S-140                             | M-5       | H                    | F              | G <sub>2</sub>                 | K                 | H                 |                |   | G <sub>1</sub>  | 5.051                        | 1.831                  |
| 55                           | ST-120                            | S-6       | H                    | F              | P <sub>1</sub>                 | P <sub>2</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.551                        | 1.563                  |
| 56                           | S-12                              | S-5       | H                    | F              | G <sub>1</sub>                 | K                 | H                 |                |   |                 | 4.250                        | 1.563                  |
| 57                           | ST-120                            | S-6       | H                    | F              | G <sub>2</sub>                 | G <sub>3</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.957                        | 1.563                  |
| 58                           | ST-120                            | S-6       | H                    | F              | G <sub>2</sub>                 | G <sub>3</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.957                        | 1.563                  |
| 59                           | ST-16                             | M-7       | H                    | F              | G <sub>2</sub>                 | G <sub>1</sub>    | G <sub>3</sub>    | K              | H |                 | 5.375                        | 2.063                  |
| 71-A                         | S-14                              | M-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.688                        | 1.813                  |
| 75                           | ST-120                            | S-6       | H                    | F              | P <sub>1</sub>                 | P <sub>2</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 77                           | ST-120                            | S-6       | H                    | F              | G <sub>2</sub> <sup>(35)</sup> | G <sub>3</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 78                           | ST-120                            | S-6       | H                    | F              | G <sub>2</sub>                 | G <sub>3</sub>    | K <sup>(40)</sup> | H              |   | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 79                           | ST-120                            | S-6       | H                    | F <sub>a</sub> | G <sub>1a</sub>                | K                 | F <sub>b</sub>    | H              |   | G <sub>1b</sub> | 4.531                        | 1.563                  |
| 80                           | S-17                              | M-4       | F                    | F <sub>1</sub> | F <sub>2</sub>                 | F                 |                   |                |   |                 | 5.625                        | 2.188                  |
| 81                           | S-19                              | M-4       | F                    | F              | —                              | F                 |                   |                |   |                 | 6.250                        | 2.438                  |
| 82                           | S-14                              | M-4       | F                    | F <sub>1</sub> | F <sub>2</sub>                 | F                 |                   |                |   |                 | 4.688                        | 1.813                  |
| 83                           | ST-16                             | M-4       | F                    | F <sub>1</sub> | F <sub>2</sub>                 | F                 |                   |                |   |                 | 5.375                        | 2.063                  |
| 84                           | S-12                              | S-5       | H                    | F <sub>1</sub> | F <sub>2</sub>                 | K                 | H                 |                |   |                 | 4.250                        | 1.563                  |
| 85                           | ST-120                            | S-6       | H                    | F              | P <sub>1</sub>                 | P <sub>2</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 89                           | ST-120                            | S-6       | H                    | F              | G <sub>2</sub>                 | G <sub>3</sub>    | K                 | H              |   | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 99 UV                        | T-8                               | S-4H      | F                    | F              | F                              | G <sub>1</sub>    |                   |                |   |                 | 3.500                        | 1.063                  |
| 99 UX                        | T-8                               | S-4       | F                    | F              | G <sub>1</sub>                 | F                 |                   |                |   |                 | 4.125                        | 1.188                  |
| 9A                           | S-14                              | M-5       | F                    | F              | G <sub>1</sub>                 | G <sub>2</sub>    | F                 |                |   |                 | 4.688                        | 1.813                  |
| P2                           | S-17                              | M-5       | F                    | F              | G <sub>1</sub>                 | G <sub>2</sub>    | F                 |                |   |                 | 5.625                        | 2.188                  |
| P2H                          | S-17                              | M-7       | H                    | F              | G <sub>2</sub>                 | G <sub>1</sub>    | G <sub>3</sub>    | K              | H |                 | 5.625                        | 2.188                  |
| WUNDERLICH<br>"A"            | S-120                             | M-5       | H                    | G              | P                              | G                 | H                 | H              |   | K               | 4.438                        | 1.563                  |
| WUNDERLICH<br>"A-AUTO."      | S-12                              | M-6       | H                    | F              | G                              | G                 | K                 | H              |   |                 | 4.125                        | 1.563                  |
| 2A5                          | ST-14                             | M-6       | H                    | F              | G <sub>2</sub>                 | G <sub>1</sub>    | K                 | H              |   |                 | 4.688                        | 1.813                  |
| 2A7                          | ST-120                            | S-7       | H                    | F              | G <sub>3</sub> <sup>(57)</sup> | G <sub>2</sub>    | G <sub>1</sub>    | K              | H | G <sub>4</sub>  | 4.531                        | 1.563                  |
| 2B7                          | ST-120                            | S-7       | H                    | F              | G <sub>2</sub>                 | P <sub>1</sub>    | P <sub>2</sub>    | K              | H | G <sub>1</sub>  | 4.531                        | 1.563                  |
| 523                          | ST-16                             | M-4       | F                    | F <sub>1</sub> | F <sub>2</sub>                 | F                 |                   |                |   |                 | 5.375                        | 2.063                  |
| 6A7                          | IDENTICAL TO 2A7<br>EXCEPT HEATER |           |                      |                |                                |                   |                   |                |   |                 |                              |                        |
| 6B7                          | IDENTICAL TO 2B7<br>EXCEPT HEATER |           |                      |                |                                |                   |                   |                |   |                 |                              |                        |
| 1223                         | ST-12                             | S-4       | H                    | F              | K                              | H                 |                   |                |   |                 | 4.250                        | 1.563                  |
| 1225                         | ST-12                             | S-7       | H                    | F <sub>1</sub> | K <sub>1</sub>                 | H <sup>(64)</sup> | K <sub>2</sub>    | P <sub>2</sub> | H |                 | 4.250                        | 1.563                  |
| 2525                         | ST-12                             | S-6       | H                    | F <sub>1</sub> | K <sub>1</sub>                 | K <sub>2</sub>    | P <sub>2</sub>    | H              |   |                 | 4.250                        | 1.563                  |

## EXPLANATION OF SYMBOLS

### CLASS OF TUBE

Tubes are assigned names according to the number of active elements, progressing outward from the cathode; a tube with a cathode, a control grid and a plate is classified as a triode.

| NUMBER<br>ELEMENTS | CLASSIFI-<br>CATION | NUMBER<br>ELEMENTS | CLASSIFI-<br>CATION |
|--------------------|---------------------|--------------------|---------------------|
| 2                  | Diode               | 6                  | Hexode              |
| 3                  | Triode              | 7                  | Heptode             |
| 4                  | Tetrode             | 8                  | Octode              |
| 5                  | Pentode             |                    |                     |

Where two separate units are contained in a single bulb, a compound name is assigned -- i.e., double diode, diode triode, etc.

### TUBE TYPE NUMBERS (New Tubes)

The first digit or digits indicates the filament voltage in steps of one volt. The figure 1 is used for voltages below 2.0; the figure 2, for voltages between 2.0 and 2.9; 3, voltages between 3.0 and 3.9; etc.

Next is a letter for serial designation. Rectifiers start at "Z" and work backwards; all other types start at "A".

The next number indicates the number of useful elements brought out to terminals.

### ELECTRODE SYMBOLS

In a tube embodying a single set of elements, the electrodes are designated:

|             |           |
|-------------|-----------|
| H - Heater  | G - Grid  |
| K - Cathode | P - Plate |

### PLATE NOMENCLATURE

In tubes with one plate the letter "P" is employed; tubes possessing two sets of elements, as the type 75 (duplex diode triode), the plate of the triode unit is identified by the letter "P"; the two diode plates as P<sub>1</sub> and P<sub>2</sub>.

NOTE: P<sub>1</sub> and P<sub>2</sub> always designate the plates of a diode or rectifier.

Where duplex elements are contained in a bulb each set are uniformly correlated and designated by small letters, a, b, etc. For instance, the type 79 class "B" twin amplifier; the plate and grid of one unit should be designated as P<sub>a</sub> and G<sub>1a</sub>; the other unit P<sub>b</sub> and G<sub>2b</sub>.

### GRID NOMENCLATURE

In tubes possessing more than one grid the notations G<sub>1</sub>, G<sub>2</sub>, etc. are used. G<sub>1</sub> is the grid nearest the cathode and the numbering runs consecutively toward the plate.

Where grids are not coaxially arranged but interlaced as in the co-planar or twin-grid construction, the grids are designated as No. A-1 grid and No. A-2 grid, etc.

### PIN IDENTIFICATION

To identify the contact pins of a vacuum tube base, point the pins toward the observer so that the two heater pins (the heater terminals or pins are larger than the others) are at the top. Separate these two pins by a vertical line and the heater pin to the right is No. 1.

The numbers assigned to the remaining pins progress consecutively in a clock-wise direction.

### TUBE DIMENSIONS

When capital letters designate the various dimensions of a radio tube, generally the letter "A" represents the over-all height of the tube as measured from the extreme bottom of the pins to the extreme top of the tube. When a top cap is employed "A" represents the over-all height of the tube including the top cap.

- B, the largest diameter of the tube,
- C, the diameter of the dome,
- D, the height of the top-cap,
- E, the height from the bottom of the base to the top of the dome,
- F, the height of the base,
- G, the length of the pins,
- H, the diameter of the base.

When a single dimension is listed it represents the average dimension; when two are entered they are maximum and minimum.

### BULB SHAPE AND DIMENSIONS

A letter indicates the shape of the bulb and a figure represents the number of eighths of inches as the maximum diameter of the bulb.

When the bulb is referred to as a S-16, it describes a "straight-sloped sided" bulb similar to that of the 01-A, the maximum diameter being 16/8" or 2".

An ST-12 bulb has a tee section at the top, commonly called a dome bulb, similar to the glass of the 25-Z-5 rectifier. "C" appended to the bulb designation indicates a top cap.