38	PENTODE	AMPLIFIER CLASS A	H	6.3	100.0 135.0	9.0 13.5	100.0 135.0			0.30	7.0 9.0	2.0 2.5		84,000 102,000	950 975	80.0 100.0	8,500 13,500	200 525	.3	4.1	8.5
39-44	PENTODE	SUPER-CONTROL R.F. AMPLIFIER MODULATOR	H	6.3	90.0 180.0 250.0 90.0 180.0 250.0	3.0 3.0 3.0 7.0(6) 7.0(8) 7.0(8)	90.0 90.0 90.0 90.0 90.0 90.0			0.30	5.6 5.8 5.8	1.6 1.4 1.4		375,000 750,000 1,000,000	960(7) 1000(7) 1050(7)	360.0 750.0 1050.0			.007	5.5	10.0
42	PENTODE	AMPLIFIER CLASS A	H	6.3	250.0	16.5	250.0			0.70	34.0	6.5		100,000	2200	222.0	7,000	3000			
43	PENTODE	AMPLIFIER CLASS A	H	25.0(11)	95.0 135.0	15.0 20.0	95.0 135.0			0.30	20.0 34.0	4.0 7.0		45,000 35,000	2000 2500	90.0 80.0	4,500 4,000	900(9) 2000(10)			
44	USE TYPE 39-44																				
45	TRIODE	AMPLIFIER CLASS A	F	2.5	180.0 250.0 275.0	31.5 50.0 56.0				1.50	31.0 34.0 36.0			1,900 1,750 1,670	1850 2000 2100	3.5 3.5 3.5	3,500 3,900 4,600	780 1600 2000	7.2	4.5	3.0
46	TETRODE	AMPLIFIER CLASS A AMPLIFIER CLASS B	F	2.5	250.0(15) 300.0 400.0	33.0 ± .0(12) ± .0(18)	250.0(12) ± .0(13) ± .0(13)			1.75	22.0 4.0(15) 6.0(16)			2,380	2350	5.6	6,400 1,300 1,450	1250 16000(16) 20000(16)			
47	USE TYPE PZ																				
50	TRIODE	AMPLIFIER CLASS A	F	7.5	350.0 400.0 450.0	63.0 70.0 84.0				1.25	45.0 55.0 55.0			1,900 1,800 1,800	2000 2100 2100	3.8 3.8 3.8	4,100 3,670 4,350	2400 3400 4600	9.0	5.0	3.0
51	TETRODE	VARIABLE-MU AMPLIFIER MODULATOR	H	2.5	180.0 250.0 250.0	3.0 3.0 7.0	90.0 90.0 90.0(11)			1.75	6.3 6.5	2.5 2.5		300,000 400,000	1160(17) 1110(17)	350.0 445.0			.007	5.0	10.0
55	DUPLEX DIODE TRIODE	AMPLIFIER (20) CLASS A	H	2.5	135.0 180.0 250.0	10.5 13.5 20.0				1.00	3.7 6.0 8.0			11,000 8,500 7,500	750 975 1100	8.3 8.3 8.3	25,000 20,000 20,000	75 150 350	1.5	1.5	3.0
56	TRIODE	DETECTOR BIASED(2) AMPLIFIER	H	2.5	250.0 250.0	20.0(4) 13.5				1.00	0.2 5.0			9,500	1450	13.8			3.2	3.2	2.2
57	PENTODE	DETECTOR BIASED(1) AMPLIFIER CLASS A	H	2.5	250.0 250.0	6.0(21) 3.0	100.0 100.0	(23)		1.00	0.1 2.0	1.0		1,500,000	1225(22)	1500.0	250,000		.007	5.2	6.8

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.
2. For use as a grid leak detector 90-volts plate; capacity .00025-mfd; resistance 1-5 megohms; grid return to cathode.
3. Screen g_2, -20 to -45-volts; adjust g_1 to give 0.1 ma. with no a.c. input signal.
4. Adjust g_1 bias for plate current of 0.2 ma. with no a.c. input signal.
5. 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.
6. Mutual conductance at g_1 -22.5 volts is approximately 15 u-mhos.
7. Mutual conductance at g_1 -42.5 volts is approximately 2 u-mhos.
8. This grid bias is minimum for oscillator peak potential of 6.0 volts.
9. Total harmonic distortion 11%.
10. Total harmonic distortion 9%.
11. Heater to cathode potential should not exceed 90 volts d.c. as measured between negative heater terminal and cathode.
12. Grid g_2 adjacent to plate is connected to plate.
13. g_1 and g_2 are connected together to serve as control grid.
14. Peak plate current (per tube) 150 ma. and maximum plate dissipation (per tube) 10 watts.
15. Peak plate current (per tube) 200 ma. and maximum plate dissipation (per tube) 10 watts.
16. Maximum continuous power output for two tubes 20-watts.
17. Maximum signal potential (rms per tube) 40 volts.
18. Maximum signal potential (rms per tube) 41 volts.
19. Mutual conductance at g_1 -40 volts is approximately 15.0 u-mhos, and at -50 is 0.
20. Diode units used for half-wave and full-wave detection, and avc arrangement.
21. Screen g_2, 20 to 60-volts, adjust g to give 0.2 ma. with no input signal.
22. Cut-off of cathode current occurs at -7 volts (g).
23. Suppressor (g) connected to cathode at socket.

TYPE	CLASS	OPERATION	EMITTER	ELECTRODE POTENTIALS (VOLTS)						ELECTRODE CURRENTS				AVERAGE COEFFICIENTS					INTERELECTRODE CAPACITANCE MMFD.		
				FILAMENT OR HEATER	PLATE	G_1 (NEGATIVE)	G_2	G_3	G_4	FILAMENT OR HEATER AMPS.	PLATE MA.	G_2 MA.	G_3 MA.	PLATE RESISTANCE OHMS	TRANSCONDUCTANCE MICROMHOS	AMPLIFICATION FACTOR	RATED PLATE LOAD OHMS	RATED POWER OUTPUT MILLIWATTS	GRID PLATE	INPUT	OUTPUT
58	PENTODE	VARIABLE-MU AMPLIFIER MODULATOR	H	2.5	250.0 250.0	3.0 10.0(25)	100.0 100.0	(23)		1.00	8.2	3.0		800,000	1600(42)	1280.0			.007	5.2	6.8
59	PENTODE	AMPL. CLASS A TRIODE AMPL. CLASS A PENTODE AMPL. CLASS B TRIODE PER TUBE TWO TUBES	H	2.5	250.0 250.0 400.0	28.0 18.0 ± .0(29)	250.0(26) 250.0(28) ± .0(29)	250(26) (27) 400(30)		2.00	26.0 35.0 13.0(31)	9.0		2,400 40,000	2600 2500	6.0 100.0	5,000 6,000 6,000(32)	1250 3000 20000			
71-A	TRIODE	AMPLIFIER CLASS A	F	5.0	90.0 135.0 180.0	16.5 27.0 40.5				0.25	10.0 17.3 20.0			2,170 1,820 1,750	1400 1650 1700	3.0 3.0 3.0	3,000 3,000 4,800	125 400 790	7.6	3.7	2.1
75	DUPLEX DIODE TRIODE	AMPLIFIER (33) CLASS A	H	6.3	250.0	2.0				0.30	0.8			91,000	1100	100.0			1.7	1.7	3.8
77	PENTODE	DETECTOR BIASED(1) AMPLIFIER CLASS A	H	6.3	250.0 250.0	7.0(21) 3.0	100.0 100.0	(34)		0.30	0.1 2.3	0.6		1,500,000	1250(35)	1500.0	250,000		.007	4.4	10.6
78	PENTODE	AMPLIFIER CLASS A	H	6.3	180.0 250.0 250.0	3.0 3.0 3.0	75.0 100.0 125.0	(34) (34) (34)		0.30	4.0 7.0 10.5	1.0 2.0 3.0		1,000,000 800,000 600,000	1100(37) 1450(38) 1650(39)	1100.0 1160.0 990.0			.007	4.4	10.6
79	DUPLEX TRIODE	AMPLIFIER CLASS B	H	6.3	180.0 (41)	±.0				0.60	7.5(42)						7,000(32)	5500(43)			
80	DUPLEX DIODE	RECTIFIER FULL-WAVE HALF-WAVE	F	5.0	350.0 (44) 400.0 (44) 550.0 (45) 350.0 (52) 400.0 (52) 550.0 (53)					2.00	125.0 110.0 135.0 250.0 220.0 270.0										
81	DIODE	RECTIFIER HALF-WAVE	F	7.5	700.0					1.25	85.0(46)										
82	DUPLEX DIODE (MERCURY VAPOR)	RECTIFIER FULL WAVE	F	2.5	500.0 (47)					3.00	125.0(48)						(49)				
83	DUPLEX DIODE (MERCURY VAPOR)	RECTIFIER FULL-WAVE	F	5.0	500.0 (47)					3.00	250.0(50)						(49)				
84	DUPLEX DIODE	RECTIFIER FULL-WAVE	H	6.3	225.0 (51)					0.60	50.0										
85	DUPLEX DIODE TRIODE	AMPLIFIER (20) CLASS A	H	6.3	135.0 180.0 250.0	10.5 13.5 20.0				0.30	3.7 6.0 8.0			11,000 8,500 7,500	750 975 1100	8.3 8.3 8.3	25,000 20,000 20,000	75 160 350	1.5	1.5	4.3
89	PENTODE	AMPLIFIER CLASS A TRIODE AMPLIFIER CLASS A PENTODE AMPLIFIER CLASS B TRIODE - PER TUBE TWO TUBES	H	6.3	160.0 180.0 163.0 180.0 180.0	20.0 22.5 17.0 18.0 ± .0(52)	160.0(26) 180.0(26) 163.0(28) 180.0(28) ± .0(52)	160(26) 180(26) (27) (27) 180(30)		0.40	17.0 20.0 17.0 20.0 3.0(53)	2.5 3.0		3,000 2,750 79,000 82,500	1570 1700 1575 1635	4.7 4.7 125.0 135.0	7,000 6,500 9,000 8,000 13,600(32)	300 400 1250 1500 2500(54)			
99 UV	TRIODE	DETECTOR OR AMPLIFIER	F	3.3	90.0	4.5				.06	2.5			15,500	425	6.6			3.3	2.5	2.5
99 UX	TRIODE	DETECTOR OR AMPLIFIER	F	3.3	90.0	4.5				.06	2.5			15,500	425	6.6			3.3	2.5	2.5
GA	PENTODE	AMPLIFIER CLASS A	F	5.0	180.0	10.0	180.0	(55)		.25	25.0	7.5		30,000	2000	60.0	7,000	800			
PZ	PENTODE	AMPLIFIER CLASS A	F	2.5	250.0	16.5	250.0	(55)		1.75	31.0	6.0		60,000	2500	150.0	7,000	2700	1.5	8.7	13.2
PZH	PENTODE	AMPLIFIER CLASS A	H	2.5	250.0	16.5	250.0	(56)		2.00	36.0	8.2		38,000	3160	98.0	6,600	3300			

WUNDERLICH A WUNDERLICH "A"-AUTO.	TETRODE	DETECTOR (SEE SPECIAL BULLETIN)	H H	2.5 6.3						1.00 0.40												
2A5	PENTODE	AMPLIFIER 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 MODULATOR	H	2.5	250.0	(56)	250.0	100(57)	-3.0 (58)	0.80	4.0	3.5	2.0	300,000	475(59)				(See Technical Bulletin)			
2B7	DUPLEX DIODE PENTODE	AMPLIFIER (20) R.F. OR I.F.	H	2.5	100.0 180.0 250.0 250.0 250.0	3.0 3.0 3.0 3.0 4.5	100.0 75.0 100.0 125.0 50.0	(34) (34) (34) (34) (34)		0.80	5.8 3.4 6.0 9.0 0.6	1.7 0.9 1.5 2.3		300,000 1,000,000 800,000 650,000	950(60) 840(61) 1000(60) 1125(62)	285.0 840.0 800.0 730.0	200,000					
		AMPLIFIER A.F.																				
5Z3	DUPLEX DIODE	RECTIFIER FULL-WAVE	F	5.0	500.0					3.00	250.0											
6A7	HEPTODE	IDENTICAL TO 2A7 EXCEPT HEATER	H	6.3						0.30												
6B7	DUPLEX DIODE PENTODE	IDENTICAL TO 2B7 EXCEPT HEATER	H	6.3						0.30												
12Z3	DIODE	RECTIFIER HALF-WAVE	H	12.5 (63)	225.0					0.30	60.0											
12Z5	DUPLEX DIODE	RECTIFIER FULL-WAVE VOLTAGE DOUBLER	H	12.6 6.3	225.0 225.0					0.30 0.60	60.0 60.0											
25Z5	DUPLEX DIODE	RECTIFIER FULL-WAVE 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 µ-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 hi-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.

TYPE	TYPE BULB	TYPE BASE	PHYSICAL CHARACTERISTICS — TERMINAL ARRANGEMENT PIN NO. 1	2	3	4	5	6	7	TOP CAP	OVERALL HEIGHT (MAX.) INCHES	DIAMETER (MAX.) INCHES
01-A	S-14	M-4	F	P	G_1	F					4.688	1.813
10	S-17	M-4	F	P	G_1	F					5.625	2.188
12 A	S-14	M-4	F	P	G_1	F					4.688	1.813
22	S-14C	M-4	F	P	G_2	F				G_1	5.031	1.813
24	S-14C	M-5	H	P	G_2	K	H			G_1	5.031	1.813
26	S-14	M-4	F	P	G_1	F					4.688	1.813
27	S-14	M-5	H	P	G_1	K	H				4.688	1.813
30	S-12	S-4	F	P	G_1	F					4.250	1.563
31	S-12	S-4	F	P	G_1	F					4.250	1.563
32	S-14C	M-4	F	P	G_2	F				G_1	5.031	1.813
33	S-14	M-5	F	P	G_1	G_2	F				4.688	1.813
34	S-14C	M-4	F	P	G_2					G_1	5.031	1.813
36	S-12C	S-5	H	P	G_2	K	H			G_1	4.531	1.563
37	S-12	S-5	H	P	G_1	K	H				4.250	1.563
38	S-12C	S-5	H	P	G_2	K	H			G_1	4.531	1.563
39-44	ST-12C	S-5	H	P	G_2	K	H			G_1	4.531	1.563
42	ST-14	M-6	H	P	G_2	G_1	K	H			4.688	1.813
43	ST-14	M-6	H	P	G_2	G_1	K	H			4.688	1.813
45	ST-14	M-4	F	P	G_1	F					4.688	1.813
46	S-17	M-5	F	P	G_1	G_2	F				5.625	2.188
50	S-21	M-4	F	P	G_1	F					6.250	2.563
51	S-14C	M-5	H	P	G_2	K	H			G_1	5.031	1.831
55	ST-12C	S-6	H	P	P_1	P_2	K	H		G_1	4.531	1.563
56	S-12	S-5	H	P	G_1	K	H				4.250	1.563
57	ST-12C	S-6	H	P	G_2	G_3	K	H		G_1	4.937	1.563
58	ST-12C	S-6	H	P	G_2	G_3	K	H		G_1	4.937	1.563
59	ST-16	M-7	H	P	G_2	G_1	G_3	K	H		5.375	2.063
71-A	S-14	M-4	F	P	G_1	F					4.688	1.813
75	ST-12C	S-6	H	P	P_1	P_2	K	H		G_1	4.531	1.563
77	ST-12C	S-6	H	P	G_2 (35)	G_3	K	H		G_1	4.531	1.563
78	ST-12C	S-6	H	P	G_2	G_3	K (40)	H		G_1	4.531	1.563
79	ST-12C	S-6	H	P_a	G_{1a}	K	P_b	H		G_{1b}	4.531	1.563
80	S-17	M-4	F	P_1	P_2	F					5.625	2.188
81	S-19	M-4	F	P	—	F					6.250	2.438
82	S-14	M-4	F	P_1	P_2	F					4.688	1.813
83	ST-16	M-4	F	P_1	P_2	F					5.375	2.063
84	S-12	S-5	H	P_1	P_2	K	H				4.250	1.563
85	ST-12C	S-6	H	P	P_1	P_2	K	H		G_1	4.531	1.563
89	ST-12C	S-6	H	P	G_2	G_3	K	H		G_1	4.531	1.563
99 UV	T-8	S-4M	F	P	F	G_1					3.500	1.063
99 UX	T-8	S-4	F	P	G_1	F					4.125	1.188
QA	S-14	M-5	F	P	G_1	G_2	F				4.688	1.813
PZ	S-17	M-5	F	P	G_1	G_2	F				5.625	2.188
PZH	S-17	M-7	H	P	G_2	G_1	G_3	K	H		5.625	2.188
WUNDERLICH 'A' WUNDERLICH 'A'-AUTO.	S-12C S-12	M-5 M-6	H H	G P	P G	G G	H K	H		K	4.438 4.125	1.563 1.563
2A5	ST-14	M-6	H	P	G_2	G_1	K	H			4.688	1.813
2A7	ST-12C	S-7	H	P	G_3 (57)	G_2	G_1	K	H	G_4	4.531	1.563
2B7	ST-12C	S-7	H	P	G_2	P_1	P_2	K	H	G_1	4.531	1.563
5Z3	ST-16	M-4	F	P_1	P_2	F					5.375	2.063
6A7	IDENTICAL TO 2A7 EXCEPT HEATER											
6B7	IDENTICAL TO 2B7 EXCEPT HEATER											
12Z3	ST-12	S-4	H	P	K	H					4.250	1.563
12Z5	ST-12	S-7	H	P_1	K_1	H (64)	K_2	P_2	H		4.250	1.563
25Z5	ST-12	S-6	H	P_1	K_1	K_2	P_2	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 ELEMENTS	CLASSIFICATION	NUMBER ELEMENTS	CLASSIFICATION
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_1 and P_2.

NOTE: P_1 and P_2 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_a and G_{1a}; the other unit P_b and G_{2b}.

GRID NOMENCLATURE

In tubes possessing more than one grid the notations G_1, G_2, etc. are used. G_1 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 eights 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.