RCA MANUFACTURING COMPANY, INC.
A RADIO CORPORATION OF AMERICA SUBSIDIARY
Harrison, New Jersey

RCA RADIOTRON
DIVISION

APPLICATION NOTE No.105

APPLICATION NOTE ON A CHANGE IN MAXIMUM RATINGS OF RECEIVER TUBES

This Note presents information on receiving-tube ratings according to the new system adopted by the Radio Manufacturers Association.

The system of ratings which has been in use up to the present was originated in the early days of radio when B-supply voltages were obtained from batteries. In those days, the output of a 90-volt supply fell below 90 volts during receiver operation, but it never rose appreciably above 90 volts. Maximum plate-voltage ratings for tubes, therefore, were set up as absolute maximums. A maximum plate-voltage rating of 90 volts meant that the d-c plate voltage should not exceed the rating at any time.

This practice of setting ratings as absolute maximums has continued up to the present even though other sources of supply have been in common use. Today, tube voltages are usually obtained from sources, such as power lines, where the voltage varies, not only below, but also above its nominal value. In many receivers, this upward variation causes tube voltages to exceed the maximum ratings. The reason is that these receivers have been designed so that plate and screen voltages are at the maximum rated values when line voltage is at its average value. In other words, many receiver designers have interpreted tube maximum ratings as design maximum values, although the ratings were intended to be absolute maximums. While this misinterpretation has caused no trouble with many tube types because of the factor of safety in the ratings of these types, it has caused trouble with some rectifier and power amplifier types. To avoid this misinterpretation, it has become desirable to modify the system of tube ratings.

It is also desirable that tube ratings be established so as to make allowance for the difference in variation of supply voltage which exists between automobile receivers and receivers operated from power lines. Surveys have shown that most of the power lines in this country deliver a voltage within ±10% of 117 volts. The voltage of automobile storage batteries, however, may vary 40% or more.

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In the new system of ratings, the meaning of a maximum rating is changed from "absolute maximum" to "design maximum." A complete interpretation of ratings according to the new RMA system is included in this Note. From the tube types on which RMA has recommended new ratings, we have selected types of particular interest to the set designer and included them in the accompanying Chart.

It can be seen from this Chart that the values of the new design maximum ratings for many rectifier and power-amplifier types have been made lower than the former absolute maximum values. In certain other types, the new values of design maximum ratings are the same as the former absolute maximum values. For these types, the change in interpretation of ratings is, in effect, an increase in ratings. In some of the voltage-amplifier types, the design maximum plate-voltage rating has been made 300 volts instead of the former 250-volt absolute maximum.

RCA publications are being changed as rapidly as possible to show ratings in accordance with the new system. Meanwhile this Note supplies new ratings for the more important types on which ratings are now available.

RECEIVING TUBE RATINGS
According to RMA System

It shall be standard to interpret the ratings on receiving types of tubes according to the following conditions:

CATHODE: The heater or filament voltage is given as a normal value unless otherwise stated. This means that transformers or resistances in the heater or filament circuit should be designed to operate the heater or filament at rated value for full-load operating conditions under average supply-voltage conditions. A reasonable amount of leeway is incorporated in the cathode design so that moderate fluctuations of heater or filament voltage downward will not cause marked falling off in response; also, moderate voltage fluctuations upward will not reduce the life of the cathode to an unsatisfactory degree.

PLATE AND SCREEN: In the case of plate voltage and screen voltage, however, recommended maximum values are given. The interpretation of this maximum value depends on the power source, as follows:

A-C or D-C Power Line: The maximum ratings of plate and screen voltages and dissipations given on the tube type data sheets are Design Maximums. For equipment designed for use in the United States on nominal power-line services of 105 - 125 volts, satisfactory performance and serviceability may be anticipated provided the equipment is designed so as not to exceed these Design Maximums at a line voltage of 117 volts.

Automobile Storage Batteries: When a tube is used in automobile receivers and other equipment operated from automobile storage batteries, consideration should be given to the larger percentage range over which the battery voltage varies as compared with the power-line voltage. The average voltage value of automobile batteries has been established as 6.6 volts. Automobile-battery-operated equipment should be designed so that when the battery voltage is 6.6 volts, the plate voltage, the plate dissipation, the screen voltage, the screen dissipation, and the rectifier load current will not exceed 90% of the respective recommended design maximum values given in the data for each tube type.

"B" Batteries: Equipment operated from "B" batteries should be designed so that under no condition of battery voltage will the plate voltage, the plate dissipation, the screen voltage, and the screen dissipation ever exceed the recommended respective maximum values shown in the data for each type by more than 10%.

OTHER ELECTRODES: When a tube is of the multigrid type, the voltage applied to the additional positive electrodes will be governed by the considerations stated under Plate and Screen.

TYPICAL OPERATION: For many receiving tubes, the data show typical operating conditions in particular services. These typical operating values are given to show concisely some guiding information for the use of each type. They are not to be considered as ratings, because the tube can be used under any suitable conditions within its rating limitations.

NEW MAXIMUM RECEIVING-TUBE RATINGS

ACCORDING TO RMA SYSTEM

VOLTAGE AMPLIFIERS

TYPE	NAME	MAXIMUM					MINIMUM
		PLATE VOLTAGE Volts	SCREEN SUPPLY Volts	SCREEN VOLTAGE Volts	DISSIPATION PLATE Watts	DISSIPATION SCREEN Watts	EXTERNAL GRID BIAS Volts
6B6-G	DUPLEX-DIODE HIGH-MU TRIODE	250	-	-	-	-	-
6B8 6B8-G	DUPLEX-DIODE PENTODE	300	300	125	2.25	0.3	0
6C5 6C5-G	DETECTOR AMP-LIFIER TRIODE	300	-	-	2.5	-	0
6C8-G	TWIN TRIODE AMPLIFIER	250	-	-	*1.0	-	0
6F8-G	TWIN TRIODE AMPLIFIER	300	-	-	*2.5	-	0
6J5 6J5-G	DETECTOR AMP-LIFIER TRIODE	300	-	-	2.5	-	0
6J7 6J7-G	AS PENTODE	300	300	125	0.75	0.1	0
	AS TRIODE	250	-	-	1.75	-	0
6K7 6K7-G	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	300	300	125	2.75	0.35	0
6L7 6L7-G	AS CLASS A_1 AMPLIFIER	300	-	100	1.5	1.0	-
6S7 6S7-G	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	300	300	100	2.25	0.25	0
6SQ7	DUPLEX-DIODE HIGH-MU TRIODE	250	-	-	-	-	-
6U7-G	TRIPLE-GRID SUPER-CONTROL AMPLIFIER	300	300	100	2.25	0.25	0
6W7-G	TRIPLE-GRID DETECTOR AMPLIFIER	300	300	100	0.5	0.1	0
12SQ7	DUPLEX-DIODE HIGH-MU TRIODE	250	-	-	-	-	-

* For each plate.

POWER AMPLIFIERS

TYPE	NAME	MAXIMUM			
		PLATE VOLTAGE Volts	SCREEN VOLTAGE Volts	PLATE DISSIPATION Watts	SCREEN DISSIPATION Watts
6F6 6F6-G	AS PENTODE	375	285	11.0	3.75
	AS TRIODE	350	-	10.0	-
6G6-G	PENTODE	180	180	2.75	0.75
6K6-G	PENTODE	315	285	8.5	2.8
6L6 6L6-G	AS BEAM TUBE	360	270	19.0	2.5
	AS TRIODE	250	-	10.0	-
6V6 6V6-G	BEAM POWER AMPLIFIER	315	250	12.0	2.0
6Y6-G	BEAM POWER AMPLIFIER	200	135	12.5	1.75
25A6 25A6-G	PENTODE	160	135	5.3	1.9
25B6-G	PENTODE	200	135	12.5	2.0
25L6-G	BEAM POWER AMPLIFIER	117	117	4.0	1.25

TUNING INDICATORS

TYPE	NAME	MAXIMUM		MINIMUM
		PLATE SUPPLY Volts	TARGET VOLTAGE Volts	TARGET VOLTAGE Volts
6E5	ELECTRON-RAY TUBE	250	250	100
6N5	ELECTRON-RAY TUBE	180	180	100
6U5/6G5	ELECTRON-RAY TUBE	250	250	100

CONVERTERS AND MIXERS

TYPE	NAME	MAXIMUM									MINIMUM
		PLATE VOLTAGE Volts	SCREEN SUPPLY Volts	SCREEN VOLTAGE Volts	ANODE-GRID SUPPLY Volts	ANODE-GRID VOLTAGE Volts	DISSIPATION			TOTAL CATHODE CURRENT Milliamperes	EXTERNAL SIGNAL-GRID BIAS Volts
							PLATE Watts	SCREEN Watts	ANODE-GRID Watts		
6A8 6A8-G	PENTAGRID CONVERTER	300	300	100	300	200	1.0	0.3	0.75	14	0
6D8-G	PENTAGRID CONVERTER	300	300	100	300	200	1.0	0.3	0.75	13	0
6K8 6K8-G	TRIODE-HEXODE CONVERTER	300*	300	150	-	125#	0.75**	0.7	0.75##	16	0
6L7 6L7-G	AS MIXER	300	-	150	-	-	1.0	1.5	-	-	-

* Hexode plate voltage. # Triode plate voltage. ** Hexode plate dissipation. ## Triode plate dissipation.

RECTIFIERS

TYPE	NAME	MAXIMUM			CONDENSER INPUT TO FILTER			CHOKE INPUT TO FILTER		
					MAXIMUM		MINIMUM	MAXIMUM		MINIMUM
		PEAK INVERSE VOLTAGE Volts	STEADY-STATE PEAK PLATE CURRENT PER PLATE# Milliamperes	D-C HEATER-CATHODE POTENTIAL Volts	A-C PLATE VOLTAGE* Volts (RMS)	D-C OUTPUT CURRENT Milliamp.	TOTAL EFFECTIVE PLATE-SUPPLY IMPEDANCE* Ohms	A-C PLATE VOLTAGE* Volts (RMS)	D-C OUTPUT CURRENT Milliamperes	VALUE OF INPUT CHOKE Henries
5T4	FULL-WAVE	1550	675	-	450	225	150	550	225	3
5U4-G	FULL-WAVE	1550	675	-	450	225	75	550	225	3
5V4-G	FULL-WAVE	1400	525	-	375	175	65	500	175	4
5W4 5W4-G	FULL-WAVE	1400	300	-	350	100	25	500	100	6
5X4-G	FULL-WAVE	1550	675	-	450	225	75	550	225	3
5Y3-G	FULL-WAVE	1400	375	-	350	125	10	500	125	5
5Y4-G	FULL-WAVE	1400	375	-	350	125	10	500	125	5
5Z4	FULL-WAVE	1400	375	-	350	125	30	500	125	5
6X5 6X5-G	FULL-WAVE	1250	210	450	325	70	150	450	70	8
6ZY5-G	FULL-WAVE	1250	240	450	325	40	225	450	40	13.5
25Z4	HALF-WAVE	700	750	350	235	125	100	-	-	-
25Z6	VOLTAGE-DOUBLER	700	450	350	117	75	□	-	-	-
25Z6-G	HALF-WAVE	700	450	350	235	75	100	-	-	-

\# When a filter input condenser larger than 40 μf is used, it may be necessary to use more plate-supply impedance than the MINIMUM value shown.

* Per plate.

□ Zero ohms for full-wave voltage-doubler circuit; 30 ohms for half-wave voltage-doubler circuit (in which one d-c terminal is connected to one side of a-c line).