RMA Release # 326 Feb. 26, 1943

8025

U-H-F TRANSMITTING TRIODE

The 8025 is a three-electrode transmitting tube designed especially for use at the ultra-high frequencies. It has high perveance and low transit time. The tube may be operated at maximum ratings at frequencies as high as 500 megacycles and at reduced ratings at higher frequencies. The maximum plate dissipation rating with forced-air cooling is 40 watts for class C telegraph service.

The thoriated-tungsten filament of the 8025 is of the double-helical type, and is center-tapped within the tube to minimize the effects of filament-lead inductance. Heavy double leads reduce lead inductance and eliminate within the tube common impedances between the tank and neutralizing circuits. The tube is provided with a small four-pin base for the filament terminals.

TENTATIVE CHARACTERISTICS and RATINGS

FILAMENT VOLTAGE (A.C. or D.C.)	6.3	Volts
FILAMENT CURRENT	1.92	Amperes
AMPLIFICATION FACTOR	18	
DIRECT INTERELECTRODE CAPACITANCES:		
Grid-Plate	2.8	μμf
Grid-Filament	2.7	μμf
Plate-Filament	0.35	μμf
DIMENSIONS	See *OUTLINE DRAWING* T-8	
BULB		
CAPS (four)	Saddle Skirted Miniature, with Nub	
BASE	Small 4-Pin Micanol	

Maximum Ratings Are Absolute Values

MAXIMUM RATINGS and TYPICAL OPERATING CONDITIONS

CCS = Continuous Commercial Service
ICAS = Intermittent Commercial and Amateur Service

As Grid-Modulated R-F Power Amplifier - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	Forced-Air Cooling - CCS	*Natural Cooling ICAS*	
D-C PLATE VOLTAGE	1000 max.	1000 max.	Volts
D-C GRID VOLTAGE	-200 max.	-200 max.	Volts
D-C PLATE CURRENT	65 max.	65 max.	Ma.
PLATE INPUT	60 max.	50 max.	Watts
PLATE DISSIPATION	40 max.	30 max.	Watts
TYPICAL OPERATION:			
D-C Plate Voltage	1000		Volts
D-C Grid Voltage			
From a fixed supply of	-135		Volts
From a cathode resistor of	2500		Ohms
Peak R-F Grid Voltage	155		Volts
Peak A-F Grid Voltage	65		Volts
D-C Plate Current	50		Ma.
D-C Grid Current (Approx.)*	4		Ma.
Driving Power (Approx.)* o	3.5		Watts
Power Output (Approx.)	20		Watts

As Plate-Modulated R-F Power Amplifier - Class C Telephony

Carrier conditions per tube for use with a max. modulation factor of 1.0

	Forced-Air Cooling - CCS.	*Natural Cooling ICAS*	
D-C PLATE VOLTAGE	800 max.	800 max.	Volts
D-C GRID VOLTAGE	-200 max.	-200 max.	Volts
D-C PLATE CURRENT	65 max.	65 max.	Ma.
D-C GRID CURRENT	20 max.	20 max.	Ma.
PLATE INPUT	50 max.	33 max.	Watts
PLATE DISSIPATION	27 max.	20 max.	Watts
TYPICAL OPERATION:			
D-C Plate Voltage	800		Volts
D-C Grid Voltage			
From a fixed supply of	-105		Volts
From a grid resistor of	10000		Ohms
Peak R-F Grid Voltage	145		Volts
D-C Plate Current	40		Ma.
D-C Grid Current (Approx.)*	10.5		Ma.
Driving Power (Approx.)*	1.4		Watts
Power Output (Approx.)	22		Watts

As R-F Power Amplifier and Oscillator - Class C Telegraphy

Key-down conditions per tube without modulation #

	Forced-Air Cooling - CCS	*Natural Cooling ICAS*	
D-C PLATE VOLTAGE	1000 max.	1000 max.	Volts
D-C GRID VOLTAGE	-200 max.	-200 max.	Volts
D-C PLATE CURRENT	80 max.	80 max.	Ma.
D-C GRID CURRENT	20 max.	20 max.	Ma.
PLATE INPUT	75 max.	50 max.	Watts
PLATE DISSIPATION	40 max.	30 max.	Watts
TYPICAL OPERATION:			
D-C Plate Voltage	1000		Volts
D-C Grid Voltage			
From a fixed supply of	-90		Volts
From a grid resistor of	6400		Ohms
From a cathode resistor of	1400		Ohms
Peak R-F Grid Voltage	130		Volts
D-C Plate Current	50		Ma.
D-C Grid Current (Approx.)*	14		Ma.
Driving Power (Approx.)*	1.6		Watts
Power Output (Approx.)	35		Watts

* Subject to wide variations depending on the impedance of the load circuit. High-impedance load circuits require more grid current and driving power to obtain the desired output. Low-impedance circuits need less grid current and driving power, but plate-circuit efficiency is sacrificed. The driving stage should be capable of supplying considerably more than the required driving power.

\# Modulation essentially negative may be used if the positive peak of the audio-frequency envelope does not exceed 115% of the carrier conditions.

o At crest of audio-frequency cycle with modulation factor of 1.0.

INSTALLATION

The *base* of the 8025 fits the standard four-contact socket, such as RCA stock No.9919, which should be installed to hold the tube in a vertical position. Connections to the grid and plate caps should have large contact surfaces but they should be of small size in order to minimize circuit capacitances. These connections must be flexible enough so that normal expansion will not place a strain on the caps and the seals, yet heavy enough to carry the high circulating r-f currents. The cap connectors should be fastened to the caps before the tube is mounted in position. The connectors should be sprung slightly so that they can be slipped easily over their respective caps. Connections should never be soldered directly to the caps because the heat of soldering may result in cracking of the lead

seals. The caps should not be used to support circuit parts.

The *bulb* becomes very hot during continuous operation of the tube so that either forced ventilation or the free circulation of air (depending on operating conditions) should be provided. In the case of forced ventilation, a fan directed at the bulb is recommended. The installation of all wires and connections should be made so that they will not be close to or touch the bulb in order to avoid puncture of the glass bulb due to peak voltage effects.

The *thoriated-tungsten filament* of the 8025 is center-tapped within the tube. The center lead is brought out to a separate base pin. With this arrangement, it is possible to minimize the effect of filament-lead inductance by connecting all three leads in parallel through by-pass condensers. The center lead of this parallel connection should not be returned directly to the center tap of the filament-transformer winding or to ground, although it may be by-passed to either of these points if desired. Under normal full-load conditions, the filament should be maintained at the rated voltage within ± 5%; with light loads, reduction of the filament voltage by as much as 5% is permissible. In the latter case, care must be taken that the reduction of filament voltage and, therefore, of emission, is not so great the peak current requirements cannot be supplied. It is recommended that, in intermittent service where the standby periods are no longer than 15 minutes, the filament voltage be reduced to 80% of normal during standbys; for longer periods, the filament voltage should be shut off. The filament should be operated at constant voltage rather than constant current and must be allowed to reach operating temperature before other voltages are applied.

Overheating of the 8025 by severe overload may decrease the filament emission. The filament activity can sometimes be restored by operating the filament at rated voltage for ten minutes or longer with no voltage on plate and grid. This process may be accelerated by raising the filament voltage to 7.5 volts (not higher) for a few minutes. The positive high-voltage supply lead should be provided with a protective device such as a relay. This device should remove the plate voltage instantly when the d-c plate current reaches a value 50% greater than normal.

The *plate* of the 8025 shows a dull red color at its maximum plate-dissipation rating for each class of service.

R-f by-passing of the grid and plate return circuits should be made to the center lead of the filament. It is important that the returns be made to this common connection in order to avoid r-f interaction through common return circuits. In some applications, it may also be advisable to supplement the action of the by-pass condensers by r-f chokes placed close to the condensers in the voltage-supply leads.

In order that the maximum ratings given under CHARACTERISTICS and RATINGS will not be exceeded changes in plate and filament voltages due to line-voltage fluctuation, load variation, and manufacturing variation of the associated apparatus must be determined. An average value of plate and filament voltage should then be chosen so that under the usual voltage variations the maximum rated voltages will not be exceeded.

When a new circuit is tried or when adjustments are made, the plate voltage should be reduced in order to prevent damage to the tube or associated apparatus in case circuit adjustments are incorrect. It is advisable to use a protective resistance of about 6000 ohms in series with the plate lead during such adjustments.

The rated plate voltage of the 8025 is high enough to be dangerous to the user. Care should be taken during the adjustment of circuits, especially when the exposed circuit parts are at high d-c potential.

APPLICATION

In *grid-modulated class C telephone service*, the 8025 may be supplied with d-c grid bias from a cathode resistor, unbypassed for audio frequencies, or from a fixed supply. The audio power required in this service is very small. It need be only sufficient to meet the peak power requirement of the grid of the class C amplifier on the crest of the input signal. The actual peak value is generally never more than 3 watts.

In *plate-modulated class C r-f service*, the 8025 may be supplied with grid bias from a grid resistor, or from a combination of grid resistor with either fixed supply or cathode resistor. The cathode resistor should be suitably by-passed for both a.f. and r.f. The combination method has the advantage of not only protecting the tube from damage through loss of excitation but also of minimizing distortion by bias-supply compensation.

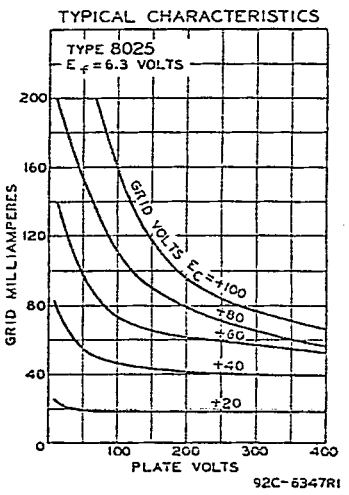
In *class C r-f telegraph service*, the 8025 may be supplied with bias by any convenient method. When the tube is used in the final amplifier or a preceding stage of a transmitter designed for break-in operation and oscillator keying, a small amount of fixed bias must be used to maintain the plate current at a safe value. If the 8025 is operated at the maximum rated plate voltage of 1000 volts, a fixed bias of at least -40 volts should be used.

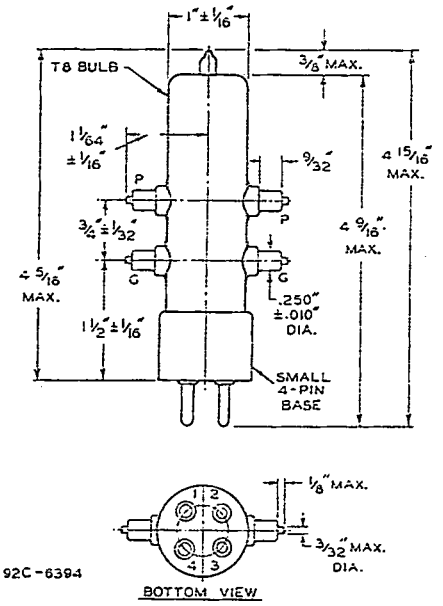
The 8025 may be operated with maximum ratings at frequencies as high as 500 Mc but as the frequency is raised, the efficiency and power output fall off. The 8025 may be operated at higher frequencies provided the maximum values of plate voltage and power input are reduced (rated maxi-

mum plate input may be used up to 600 Mc); other maximum ratings are the same as shown under CHARACTERISTICS and RATINGS. The table below shows the highest percentage of maximum plate voltage that can be used up to 600 Mc. Special attention should be given to adequate cooling at these frequencies.

When the 8025 is operated at the ultra-high frequencies, push-pull operation is recommended. This connection has the advantage of simplifying the balancing of high-frequency circuits by providing symmetry of layout. In oscillator service, it is desirable to connect the two grid terminals and the two plate terminals of each tube in parallel in order to reduce their respective lead inductances.

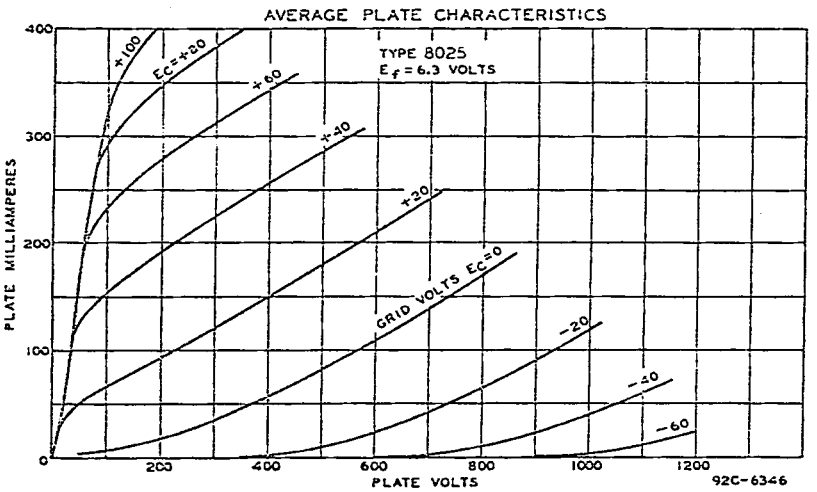
FREQUENCY	500	600	Mc
MAX. PERMISSIBLE PERCENTAGE of MAX. RATED PLATE VOLTAGE:			
class C telephony, grid-mod.	100	77	Per cent
class C telephony, plate-mod.	100	63	Per cent
class C telegraphy	100	63	Per cent



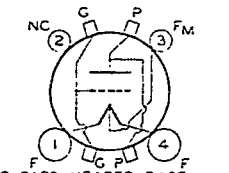


℄ OF EACH CAP SHALL NOT DEVIATE MORE THAN 3° FROM PLANE NORMAL TO THE PLANE OF PINS NO.1 & NO.4 AND PASSING THROUGH CENTER OF BOTTOM OF BASE.

℄ OF BULB SHALL NOT DEVIATE MORE THAN 5° IN ANY DIRECTION FROM THE PERPENDICULAR ERECTED AT CENTER OF BOTTOM OF BASE.



Bottom View of Socket Connections



G-CAPS NEARER BASE
P-CAPS NEARER BASE TIP
4AQ

P = PLATE
G = GRID
F = FILAMENT
F_M = FILAMENT MID-TAP