



8D21

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PUSH-PULL POWER TETRODE

WATER AND FORCED-AIR COOLED

GENERAL DATA

Electrical:

Filament, Thoria-Coated:

Voltage (AC or DC) 3.2 av., 3.4 max. volts. See DATA 3 for operating instructions on conserving filament life.

Current, with 3.2 volts on filament. 125 amp

Starting Current Must never exceed 220 amperes, even momentarily

Cold Resistance. 0.0077 ohm

Minimum Heating Time 5 sec

Mu-Factor, Grid No.2 to Grid No.1 (Each Unit) 5

Direct Interelectrode Capacitances (Each Unit):*

Grid No.1 to Plate **

Input. 25.5 μ f

Output 6.5 μ f

Internal Grid-No.2 Bypass Capacitor (Approx.). 200 μ f

Mechanical:

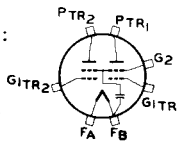
Terminal Connections:

FA - Filament

FB - Fil., Mounting Flange

G₁TR₁ - Grid No.1 of Tetrode #1

G₁TR₂ - Grid No.1 of Tetrode #2



G₂ - Grid No.2 of Tetrodes #1 & #2

P₁TR₁ - Plate of Tetrode #1

P₁TR₂ - Plate of Tetrode #2

Mounting Position. . . Plane of grid-No.1 leadshorizontal and below horizontal plane of plate leads

Maximum Overall Length 12-9/32"

Maximum Diameter 5-3/4"

Air Cooling:

Forced-air cooling of the glass envelope is required. The air flow must start with application of plate voltage, and should be directed from a 2"-diameter nozzle at the plate end of the tube so as to cool the area between the plate seals as well as the sides of the glass envelope. The air flow may be removed simultaneously with removal of plate voltage. Interlocking of the air flow with the power supplies is recommended to prevent the application of voltages to the tube without air cooling.

Air Flow 40 min. cfm

Bulb and Seal Temperature. 150 max. °C

Water Cooling:

Water cooling of the filament block, the No.1 grids, the No.2 grids, and the plates is required. The water flow must start before application of any voltages and preferably should continue for several seconds after removal of all voltages. Interlocking of the water flow through each of the electrodes with all power supplies is recommended to prevent tube damage in case of failure of adequate water flow.

* , ** : See next page.

← Indicates a change.

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→ Water Cooling (Continued):

Water Flow Required:

Filament Block, Cooling pipes in series.	0.1 min.	gpm
No.1 Grids, Cooling pipes in series. .	0.1 min.	gpm
No.2 Grids	0.1 min.	gpm

Plate of Each Unit:

With dissipation of 1.5 kw	0.3 min.	gpm
With dissipation of 2.25 kw	0.4 min.	gpm
With dissipation of 3 kw	0.5 min.	gpm

Water Flow Obtained with Pressure Drop of 60 psi:

	<u>Min.</u>	<u>Max.</u>	
Filament Block, Cooling pipes in series	0.18	0.37	gpm
No.1 Grids, Cooling pipes in series.	0.18	0.35	gpm
No.2 Grids	0.18	0.38	gpm
Plate of Each Unit	0.55	1.00	gpm
Water Pressure	100 max.		psi
Minimum Recommended Value.	60		psi
Outlet Water Temperature	70 max.		°C

GRID-MODULATED PUSH-PULL RF POWER AMPLIFIER--

Class C Television Service

*Synchronizing-Level Conditions unless otherwise noted;
Values are total for both units*

Maximum CCS* Ratings, Absolute Values:

DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE.	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE—White Level. . .	-1000 max.	volts
→ DC PLATE CURRENT (At Crest of Modulation)	2 max.	amp
PLATE INPUT.	10000 max.	watts
GRID-No.2 INPUT.	400 max.	watts
PLATE DISSIPATION.	6000 max.	watts
GRID-No.1 DISSIPATION.	50 max.	watts

Typical Operation in Television Service up to 216 Mc--

Bandwidth of 6 Mc:

DC Plate Voltage	5000 . .	volts
DC Grid-No.2 Voltage	800 . .	volts
DC Grid-No.1 Voltage:		
→ Synchronizing Level.	-220 . .	volts
→ Pedestal Level	-400 . .	volts
→ White Level.	-820 . .	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage .	1300 . .	volts
→ DC Plate Current:		
Synchronizing Level.	1.9 . .	amp
Pedestal Level	1.45 . .	amp
DC Grid-No.2 Current:		
Pedestal Level	-0.025 . .	amp

* , ** , • : See next page.

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DC Grid-No.1 Current:		
Synchronizing Level	0.050 . .	amp
Pedestal Level	0.010 . .	amp
Driving Power (Approx.) [*]	300 to 500	watts ←
Power Output:		
Synchronizing Level	5300 . .	watts ←
Pedestal Level	3100 . .	watts

PUSH-PULL RF POWER AMPLIFIER—

Class C Telegraphy or FM Telephony ←

*Key-down conditions without amplitude modulation;
Values are total for both units*

Maximum CCS[®] Ratings, Absolute Values:

DC PLATE VOLTAGE	6000 max.	volts
DC GRID-No.2 (SCREEN) VOLTAGE	1000 max.	volts
DC GRID-No.1 (CONTROL-GRID) VOLTAGE	-1000 max.	volts
DC PLATE CURRENT	2 max.	amp
PLATE INPUT	10000 max.	watts
GRID-No.2 INPUT	400 max.	watts
PLATE DISSIPATION	6000 max.	watts
GRID-No.1 DISSIPATION	50 max.	watts

Typical Operation in CW Service at 300 Mc:

DC Plate Voltage	6000 . .	volts
DC Grid-No.2 Voltage	800 . .	volts
DC Grid-No.1 Voltage [▲]	-275 . .	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	1350 . .	volts
DC Plate Current	1.6 . .	amp
DC Grid-No.2 Current	0.040 . .	amp
DC Grid-No.1 Current (Approx.)	0.085 . .	amp
Driving Power (Approx.)	500 . .	watts
Power Output (Approx.)	6500 . .	watts

Typical Operation in FM Service up to 216 Mc:

DC Plate Voltage	4500 . .	volts
DC Grid-No.2 Voltage	700 . .	volts
DC Grid-No.1 Voltage	-300 . .	volts
Peak RF Grid-No.1-to-Grid-No.1 Voltage	1150 . .	volts
DC Plate Current	1 . .	amp
DC Grid-No.2 Current	0.050 . .	amp
DC Grid-No.1 Current (Approx.)	0 . .	amp
Driving Power (Approx.)	400 . .	watts
Power Output (Approx.)	2500 . .	watts

Maximum Circuit Values (CW or FM Service):

Grid-No.1-Circuit Resistance	6000 max.	ohms
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* , ** , ● , ▲ : See next page.

← Indicates a change.

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CHARACTERISTICS RANGE VALUES FOR EQUIPMENT DESIGN

Values are for each unit, unless otherwise indicated

	<u>Note</u>	<u>Min.</u>	<u>Max.</u>	
Filament Current	1 . .	110	140	amp
Input Capacitance	- . .	22.5	28.5	μmf
Output Capacitance	- . .	5.3	7.7	μmf
Plate Current	1,2 . .	-	0.1	amp
Plate Current	1,3 . .	3.0	5.0	amp
Plate Current Average of Both Units	1,3 . .	3.25	-	amp
Grid-No.1 Current	1,3 . .	-0.15	+0.40	amp
Grid-No.1 Current Average of Both Units	1,3 . .	-	0.25	amp
Grid-No.2 Current	1,3 . .	-	1.5	amp
Grid-No.2 Current	1,4 . .	-	0.15	amp
Grid-No.2 Current Average of Both Units	1,4 . .	-	0.10	amp
Peak Cathode Current	1,5 . .	7	-	amp

Note 1: AC filament volts = 3.2.

Note 2: With dc plate voltage of 5000 volts; dc grid-No.2 voltage of 800 volts; and dc grid-No.1 voltage of -220 volts.

Note 3: With dc plate voltage of 1500 volts; dc grid-No.2 voltage of 800 volts; and dc grid-No.1 voltage of +500 volts.

Note 4: With dc plate voltage of 2500 volts; dc grid-No.2 voltage of 800 volts; and dc grid-No.1 voltage of +300 volts.

Note 5: Designers should limit the maximum usable cathode current to this value.

* With no external shielding.

** Grid-No.1-to-plate capacitance is internally neutralized by the tube structure to within 0.02 μmf .

• Continuous Commercial Service.

* Driving power is accounted for largely by circuit losses and is less at lower frequencies. In practical, grid-modulated circuit design with damping resistors, the indicated driving power, depending on frequency, is required to take care of losses in the damping resistors, the circuit losses, and the tube driving power.

▲ Obtained from combination of fixed bias and a grid-No.1 resistor of 2500 to 3000 ohms.

Data on operating frequencies for the 8D21 are given
on the sheet TRANS.TUBE RATINGS vs FREQUENCY.



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OPERATING INSTRUCTIONS FOR CONSERVING FILAMENT LIFE

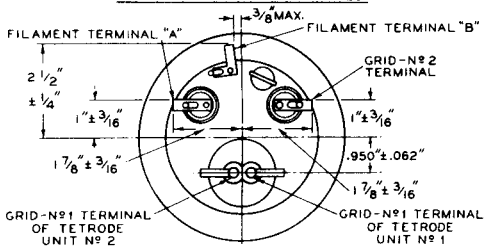
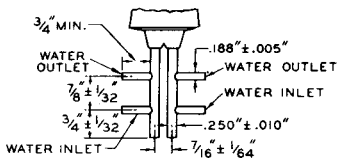
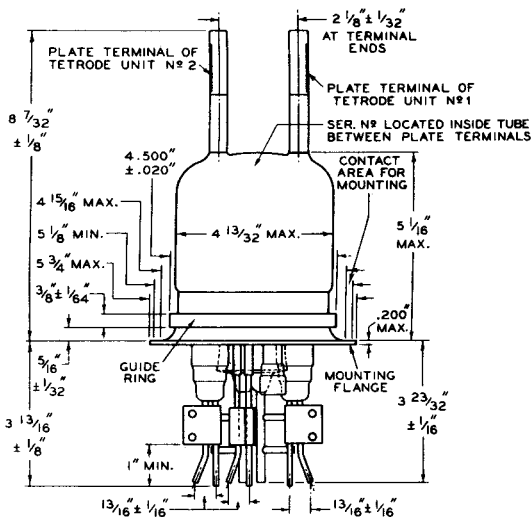
Filament life of the 8D21 can be conserved by operating its filament at the lowest voltage which will give the desired power output. Because the filament of this tube when operated at the tabulated value of 3.2 volts provides emission usually in excess of any requirements within ratings, it is recommended that the filament voltage be reduced below 3.2 volts to a value that will give adequate but not excessive emission for any particular application. The proper operating value may be found by reducing the filament voltage, with normal modulation applied to the transmitter, until a reduction in output is observed. The filament voltage must then be increased by an amount equivalent to the maximum percentage regulation of the filament-voltage supply, and then further increased by about 0.1 volt to allow for other variations. It is suggested that the adjustment procedure be carried out daily. However, if no significant changes in the operating voltage are found necessary, the adjustment procedure can be scheduled less frequently. Good regulation of the filament voltage is in general economically advantageous from the viewpoint of tube life.

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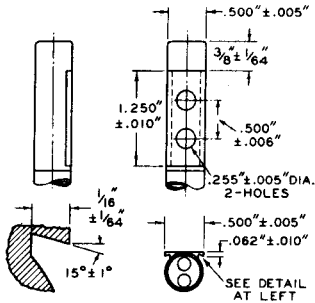
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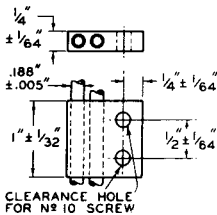
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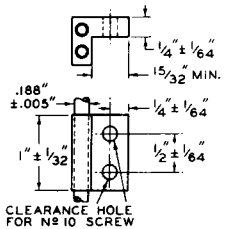
OUTLINE DETAILS



DETAIL OF PLATE TERMINALS



DETAIL OF FILAMENT
TERMINAL "A" AND
GRID-N^o 2 TERMINAL



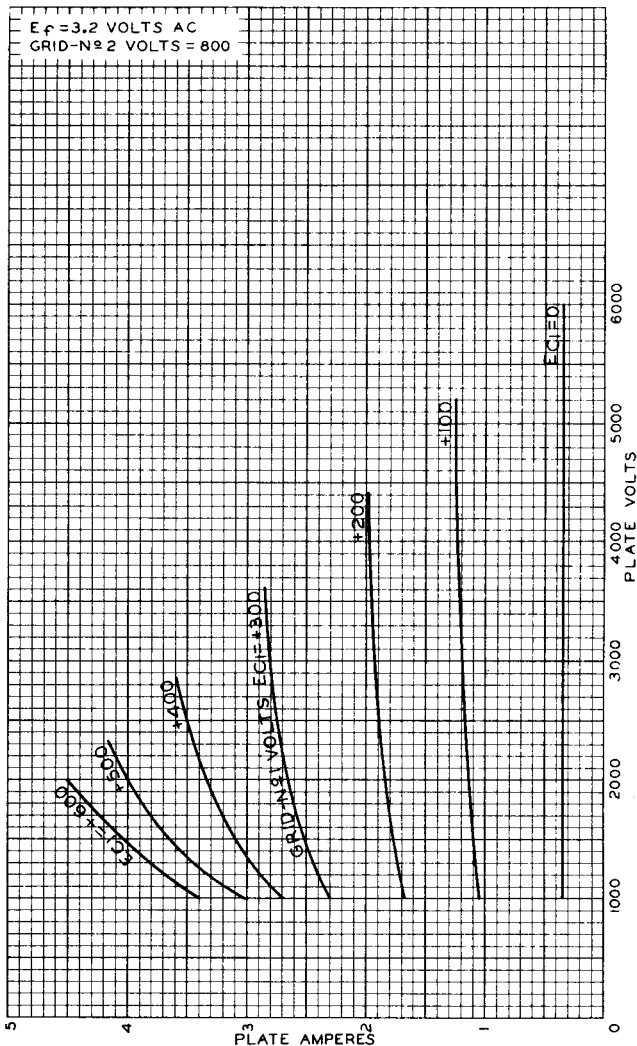
DETAIL OF FILAMENT
TERMINAL "B"

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AVERAGE PLATE CHARACTERISTICS FOR EACH UNIT



MAY 25, 1948

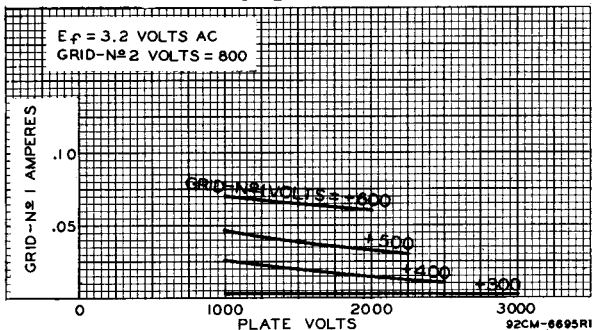
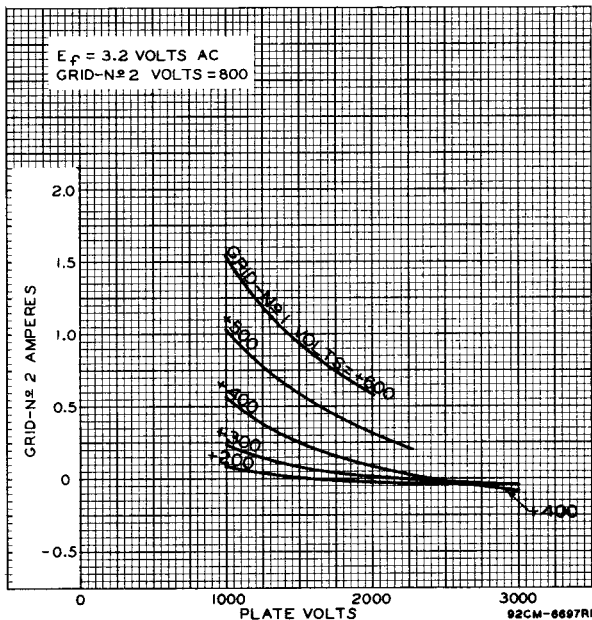
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TYPICAL CHARACTERISTICS
FOR EACH UNITTYPICAL CHARACTERISTICS
FOR EACH UNIT

MAY 26, 1948

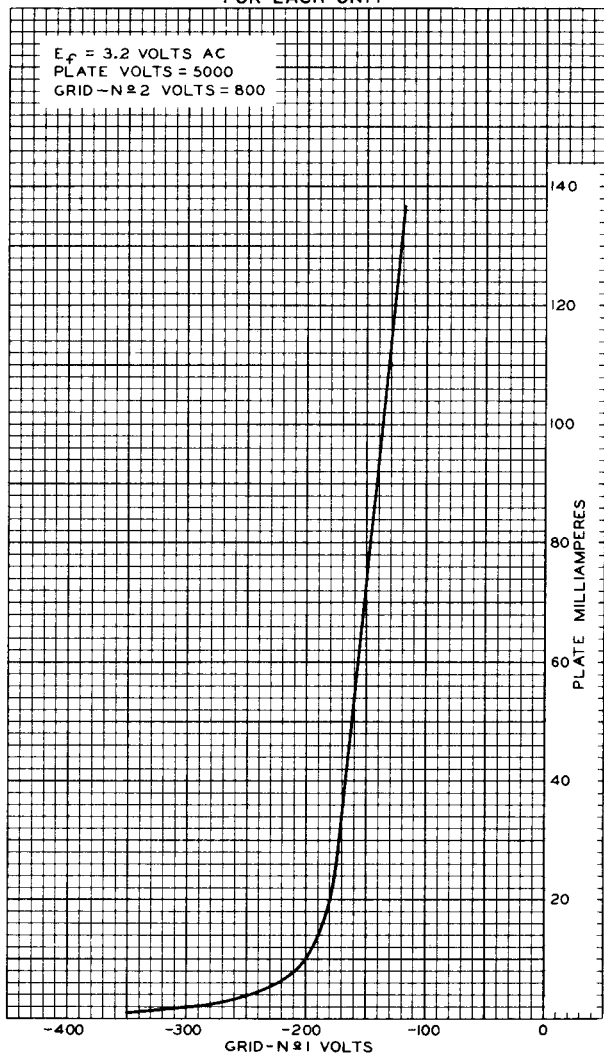
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AVERAGE CHARACTERISTIC
FOR EACH UNIT



MAY 27, 1948

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