Power Pentode

NOVAR TYPE
For High-Fidelity Audio-Amplifier Applications

GENERAL DATA

Electrical:
Heater, for Unipotential Cathode:
Voltage (AC or DC) .................. 6.3 ± 10% volts
Current at 6.3 volts .................. 0.8 amp
Direct Interelectrode Capacitances
(Approx.): a
Grid No.1 to plate .................. 0.15 μμf
Grid No.1 to cathode & grid No.3,
grid No.2, and heater ................ 11 μμf
Plate to cathode & grid No.3,
grid No.2, and heater ............... 4.4 μμf

Mechanical:
Operating Position .................. Any
Maximum Overall Length ............. 3.24"
Maximum Seated Length .............. 2.86"
Length, Base Seat to Bulb Top (Excluding tip) ........ 2.30" ± 0.09"
Diameter ................................ 1.062" to 1.188"
Bulb .................................. T9
Socket ................................ Cinch Mfg. Corp. No.149 19 00 24, or equivalent
Base ................................ Small-Button Novar 9-Pin (JEDEC No.E9-75)
Basing Designation for BOTTOM VIEW ................................ 9NZ

Pin 1—Grid No.2
Pin 2—Grid No.1
Pin 3—Cathode,
Grid No.3
Pin 4—Heater
Pin 5—Heater

Pin 6—Grid No.1
Pin 7—Grid No.2
Pin 8—Internal Connect—
Do Not Use
Pin 9—Plate

AF POWER AMPLIFIER — Class A1

Maximum Ratings, Design—Maximum Values:

PLATE VOLTAGE .................. 550 max. volts
GRID-No.2 (SCREEN-GRID) VOLTAGE .... 440 max. volts
CATHODE CURRENT ................. 90 max. ma
GRID-No.2 INPUT ................. 3.3 b max. watts
PLATE DISSIPATION ................. 19 max. watts
PEAK HEATER—CATHODE VOLTAGE:
Heater negative with respect to cathode .. 200 max. volts
Heater positive with respect to cathode .. 200 c max. volts
BULB TEMPERATURE (At hottest point
on bulb surface) .................. 240 max. 0°C

Typical Operation and Characteristics:
Plate Voltage .................. 300 volts
Grid-No.2 Voltage ............... 300 volts
Power Pentode

NOVAR TYPE

For Output Stages of High Fidelity Audio-Amplifiers and Radio Receivers

ELECTRICAL

Heater Characteristics and Ratings:
- Voltage (AC or DC) .................. \( 6.3 \pm 0.6 \) volts
- Current at heater volts = 6.3 .................. \( 0.800 \) amp
- Maximum Heater-Cathode Voltage:
  - Heater negative with respect to cathode .................. \( 200 \) volts
  - Heater positive with respect to cathode .................. \( 200 \) volts
  - DC component .................. \( 100 \) volts
- Direct Interelectrode Capacitances (Approx.):
  - Grid No.1 to plate .................. \( 0.15 \) pf
  - Input: G1 to \( (K + G3, G2, H) \) .................. \( 11.0 \) pf
  - Output: P to \( (K + G3, G2, H) \) .................. \( 4.4 \) pf

MECHANICAL

- Operating Position .................. Any
- Type of Cathode .................. Coated Unipotential
- Maximum Overall Length .................. \( 3.110 \) in
- Maximum Seated Length .................. \( 2.730 \) in
- Diameter .................. \( 1.062 \) to \( 1.188 \) in
- Bulb .................. T9
- Dimensional Outline .................. See General Section
- Bases (Alternates):
  - Small-Button Novar 9-Pin .................. (JEDEC No.E9-75)
  - Small-Button Novar 9-Pin with Exhaust Tip .................. (JEDEC No.E9-89)

BASING DESIGNATION (Bottom View)

Pin 1 - Grid No.2
Pin 2 - Grid No.1
Pin 3 - Cathode, Grid No.3
Pin 4 - Heater
Pin 5 - Heater
Pin 6 - Grid No.1
Pin 7 - Grid No.2
Pin 8 - LC - See Note
Pin 9 - Plate

Note: May be used as tie point for components operating at or near the DC voltage of either the grid No.2 or plate, or between these voltages. Otherwise, do not use.

AF POWER AMPLIFIER — Class A1

Maximum Ratings, Design-Maximum Values:
- Plate Voltage .................. \( 550 \) volts
- Grid-No.2 (Screen-Grid) Voltage .................. \( 440 \) volts
- Cathode Current .................. \( 90 \) ma
- Grid-No.2 Input .................. \( 3.3 \) \( b \) watts
- Plate Dissipation .................. \( 19 \) watts
- Bulb Temperature (At hottest point on bulb surface) .................. \( 240 \) \( ^\circ \)C

\( b \) Indicates a change.
Grid-No.1 (Control-Grid) Voltage: -10 volts
Peak AF Grid-No.1 Voltage: 10 volts
Zero-Signal Plate Current: 60 ma
Max.-Signal Plate Current: 75 ma
Zero-Signal Grid-No.2 Current: 8 ma
Max.-Signal Grid-No.2 Current: 15 ma
Plate Resistance (Approx.): 29000 ohms
Transconductance: 10200 μhos
Effective Load Resistance: 3000 ohms
Total Harmonic Distortion: 13 %
Max.-Signal Power Output: 11 watts

Maximum-Circuit Values:
Grid-No.1-Circuit Resistance:
For fixed-bias operation: 0.3 max. megohm
For cathode-bias operation: 1 max. megohm

**PUSH-PULL AF POWER AMPLIFIER — Class AB₁**

**Maximum Ratings, Design-Maximum Values:**

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>PLATE VOLTAGE</td>
<td>550 max. volts</td>
</tr>
<tr>
<td>GRID-No.2 (SCREEN-GRID) VOLTAGE</td>
<td>440 max. volts</td>
</tr>
<tr>
<td>CATHODE CURRENT</td>
<td>90 max. ma</td>
</tr>
<tr>
<td>GRID-No.2 INPUT</td>
<td>3.3b max. watts</td>
</tr>
<tr>
<td>PLATE DISSIPATION</td>
<td>19 max. watts</td>
</tr>
<tr>
<td>PEAK HEATER-CATHODE VOLTAGE:</td>
<td></td>
</tr>
<tr>
<td>Heater negative with respect to cathode</td>
<td>200 max. volts</td>
</tr>
<tr>
<td>Heater positive with respect to cathode</td>
<td>200c max. volts</td>
</tr>
<tr>
<td>BULB TEMPERATURE (At hottest point on bulb surface)</td>
<td>240 max. 0°C</td>
</tr>
</tbody>
</table>

**Typical Operation:**

Values are for 2 tubes

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Fixed Bias</th>
<th>Cathode Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Supply Voltage</td>
<td>300 350 400 450 450 450</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.2 Supply Voltage</td>
<td>300 350 350 350 400 400</td>
<td>volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-12.5 -15.5 -16 -16.5 -21</td>
<td>volts</td>
</tr>
<tr>
<td>Cathode Resistor (Common to both cathodes)</td>
<td>- - - - - 170</td>
<td>ohms</td>
</tr>
<tr>
<td>Peak AF Grid-No.1- to- Grid-No.1 Voltage</td>
<td>25 31 32 33 42 31</td>
<td>volts</td>
</tr>
<tr>
<td>Zero-Signal Plate Current</td>
<td>74 72 64 60 40 86</td>
<td>ma</td>
</tr>
<tr>
<td>Max.-Signal Plate Current</td>
<td>116 130 135 142 145 94</td>
<td>ma</td>
</tr>
<tr>
<td>Zero-Signal Grid-No.2 Current</td>
<td>10 9.5 8 7.2 5 10</td>
<td>ma</td>
</tr>
<tr>
<td>Max.-Signal Grid-No.2 Current</td>
<td>28 32 28 26 30 20</td>
<td>ma</td>
</tr>
</tbody>
</table>
Effective Load
Resistance (Plate
to plate) .......... 6600 6600 6600 6600 6600 6600 10000 ohms
Total Harmonic
Distortion .......... 5 2.5 2 2.5 5 2 %
Max.-Signal
Power Output ....... 24 30 34 38 44 28 watts

Maximum Circuit Values:
Grid-No.1-Circuit Resistance:
For fixed-bias operation .......... 0.3 max. megohm
For cathode-bias operation .......... 1 max. megohm

PUSH-PULL AF POWER AMPLIFIER — Class $AB_1$

Grid No. 2 of each tube connected to tap
on plate winding of output transformer

Maximum Ratings, Design-Maximum Values:
PLATE AND GRID-No.2 (SCREEN-GRID)
SUPPLY VOLTAGE .......... 440 max. volts
DC CATHODE CURRENT ........ 90 max. ma
GRID-No.2 INPUT .......... 3.3 max. watts
PLATE DISSIPATION ......... 19 max. watts
PEAK HEATER-CATHODE VOLTAGE:
Heater negative with respect to cathode . 200 max. volts
Heater positive with respect to cathode . 200 max. volts
BULB TEMPERATURE (At hottest point
on bulb surface) .......... 240 max. °C

Typical Operation:
Values are for 2 tubes

<table>
<thead>
<tr>
<th></th>
<th>Fixed Bias</th>
<th>Cathode Bias</th>
</tr>
</thead>
<tbody>
<tr>
<td>Plate Supply Voltage</td>
<td>400</td>
<td>425 volts</td>
</tr>
<tr>
<td>Grid-No.2 Supply Voltage</td>
<td>d</td>
<td>d volts</td>
</tr>
<tr>
<td>Grid-No.1 Voltage</td>
<td>-20.5</td>
<td>- volts</td>
</tr>
<tr>
<td>Cathode Resistor</td>
<td></td>
<td>185 ohms</td>
</tr>
</tbody>
</table>

(Coherent to both cathodes)

Peak AF Grid-No.1-to-
Grid-No.1 Voltage ....... 41 42 volts

Zero-Signal Plate Current ...... 60 88 ma
Max.-Signal Plate Current ..... 115 100 ma
Zero-Signal Grid-No.2 Current ... 8 12 ma
Max.-Signal Grid-No.2 Current ... 18 16 ma
Effective Load Resistance
(Plate to plate) .......... 6600 6600 ohms
Total Harmonic Distortion .... 2.5 3.5 %
Max.-Signal Power Output ....... 23 21 watts

Maximum Circuit Values:
Grid-No.1-Circuit Resistance:
For fixed-bias operation .......... 0.3 max. megohm
For cathode-bias operation .......... 1 max. megohm
a) Without external shield.

b) Grid-No. 2 input may reach 6 watts during peak levels of speech and music signals.

c) The dc component must not exceed 100 volts.

d) Obtained from taps on the primary winding of the output transformer. The taps are located on each side of the center-tap (B+) so as to supply 50 per cent of the plate signal voltage to the grid No. 2 of each output tube.

**OPERATING CONSIDERATIONS**

The bulb becomes hot during operation. To insure adequate cooling, it is essential that free circulation of air be provided.

* APPLIES IN ZONE STARTING 0.375" FROM BASE SEAT.

** MEASURED FROM BASE SEAT TO BULB-TOP LINE AS DETERMINED BY A RING GAUGE OF 0.600" INSIDE DIAMETER.
AVERAGE CHARACTERISTICS

$E_f = 6.3$ VOLTS
GRID-No.2 VOLTS = 300

PLATE (I_p) OR GRID-No.2 (I_{C2}) MILLIAMPERES

PLATE VOLTS

RADIO CORPORATION OF AMERICA
Electron Tube Division
Harrison, N. J.
OPERATION CHARACTERISTICS
Push-Pull Class AB₁

$E_t = 6.3 \text{ VOLTS}$  
GRID–No.1 VOLTS = –16

PLATE VOLTS = 400  
AF GRID–No.1–TO–GRID–No.1

GRID–No.2 VOLTS = 350  
VOLTS (RMS) = 22.4

POWER OUTPUT — WATTS

DISTORTION

TOTAL HARMONIC DISTORTION — PER CENT

EFFECTIVE LOAD RESISTANCE (PLATE TO PLATE) — OHMS

92CS–11077