

## 289A AND 289B AMPLIFIERS

### DESCRIPTION

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#### 1. GENERAL

**1.01** The 289A and 289B amplifiers (Fig. 1) are plug-in units designed for use in test access circuits.

**1.02** The 289A amplifier was designed primarily for Switched Maintenance Access Systems but can be used in other applications where low loss circuits or isolation is desired. The amplifier consists of two balanced audio-frequency amplifier circuits mounted on a single circuit board. The amplifiers are designed to operate in 600 ohm circuits.

**1.03** The 289B amplifier is similar to the 289A amplifier; but was designed primarily for use in the 23A Testboard. The amplifying units of the 289B are designed to operate in 900 ohm circuits.

**1.04** When buildout resistors are used with the 289A or 289B amplifier, as shown in Fig. 2, the nominal gain of each amplifying unit is 0 dB. Provision is made for a  $\pm 0.2$  dB adjustment to allow for amplifier variations. The gain-frequency characteristic is flat to 0.1 dB from 250 Hz to 5000 Hz.

**1.05** The maximum output power level is +10 dBm. These amplifiers are designed to operate from a supply voltage of -48 volts dc  $\pm 10$  percent. The ambient temperature for satisfactory operation may range from +50° to +120°F.

**1.06** The amplifier inputs are capacitor-coupled. This allows dc potentials up to  $\pm 150$  volts on the input terminals. The output terminals can be biased with dc voltage but must have a net dc current equal to zero to avoid saturating the output transformer.

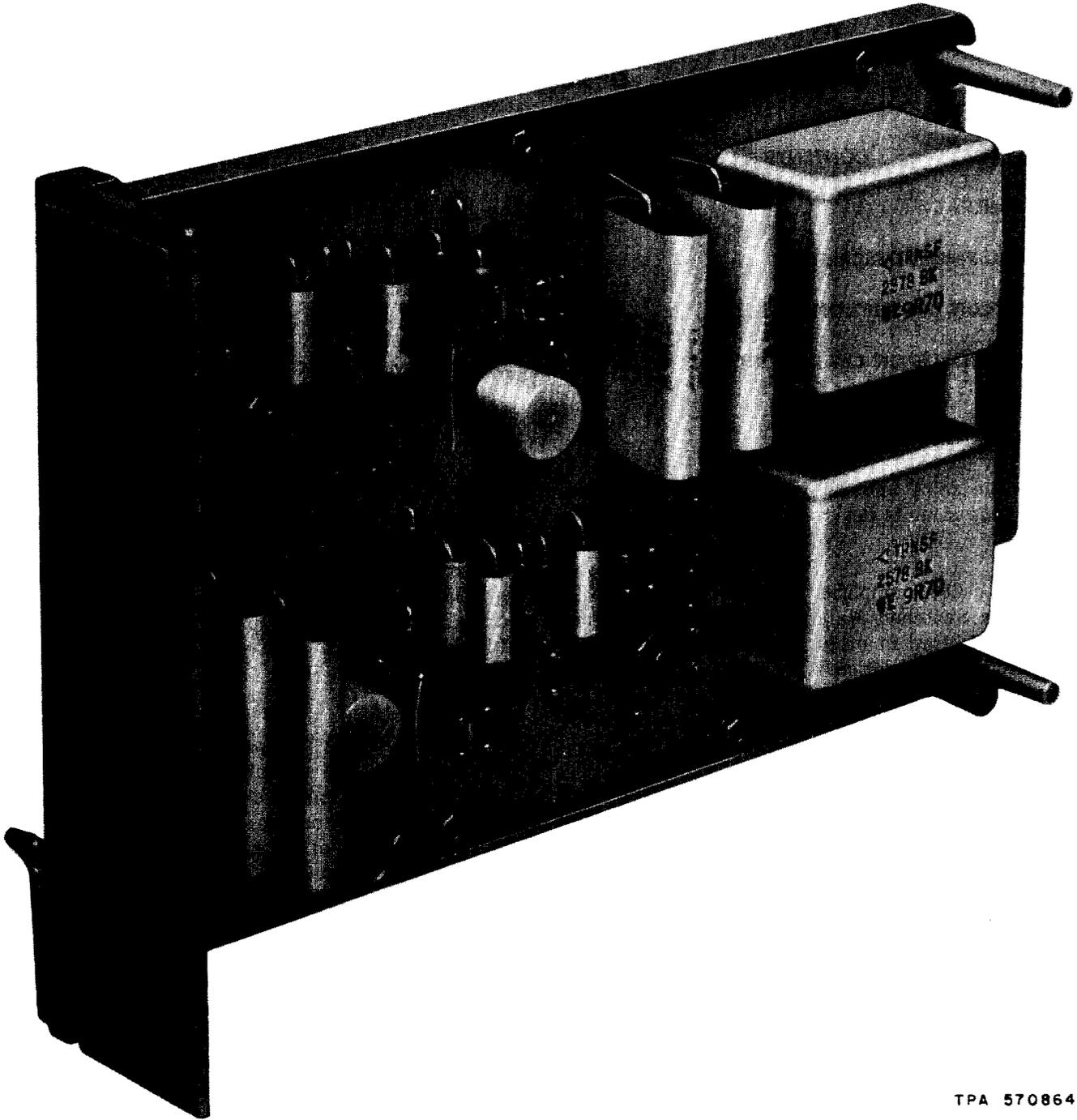
#### 2. EQUIPMENT DESCRIPTION

**2.01** The 289A amplifier (Fig. 1) is a plug-in unit terminated in 20 printed wiring path terminals that mate with the 911A connector. The amplifier is designed to be mounted on a shelf (P30H561), on 1-3/4 inch centers. Overall dimensions are approximately 1.7 inches wide by 5.9 inches high by 7.95 inches long. The 289B amplifier is identical to the 289A amplifier except for electrical component value differences.

**2.02** The 289A or 289B amplifier consists of circuit components mounted on a printed wiring board assembled on card holder P45J994. Latch P45R733 provided on the front of the card holder facilitates removal of the amplifier from its mounting shelf socket.

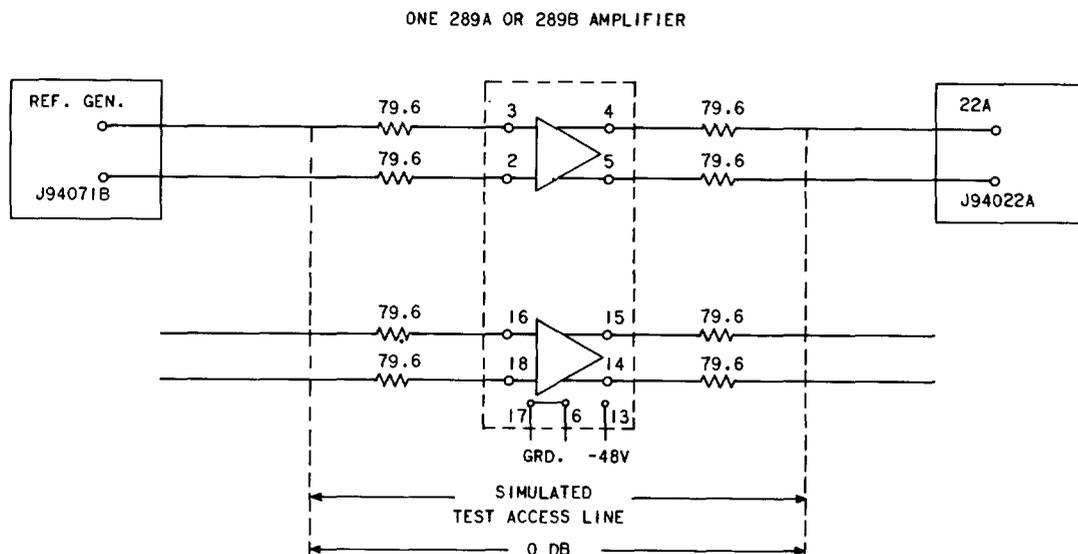
**2.03** Two dc balance potentiometers are mounted on the printed wiring board, one for each amplifying circuit. They are labeled R5.0 and R5.1 and provide manufacturing adjustments to balance the dc current in the primary of the output transformers.

**2.04** Two gain control potentiometers are mounted on the printed wiring board, one for each amplifying circuit. They are labeled R11.0 and R11.1.



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Fig. 1—289A Amplifier



**Fig. 2—Test Circuit for Measuring 289A or 289B Amplifier**

### 3. CIRCUIT DESCRIPTION

**3.01** A schematic of the 289A or 289B amplifier is shown in Fig. 3. The circuit consists of two independent amplifying circuits. Each amplifying unit is a balanced, two-stage amplifier with shunt feedback.

**3.02** The input and output impedances are each 441 ohms for the amplifier units of the 289A amplifier and 741 ohms for the amplifier units of the 289B amplifier. These impedances become 600 ohms and 900 ohms, respectively, when cable and build-out resistors are added.

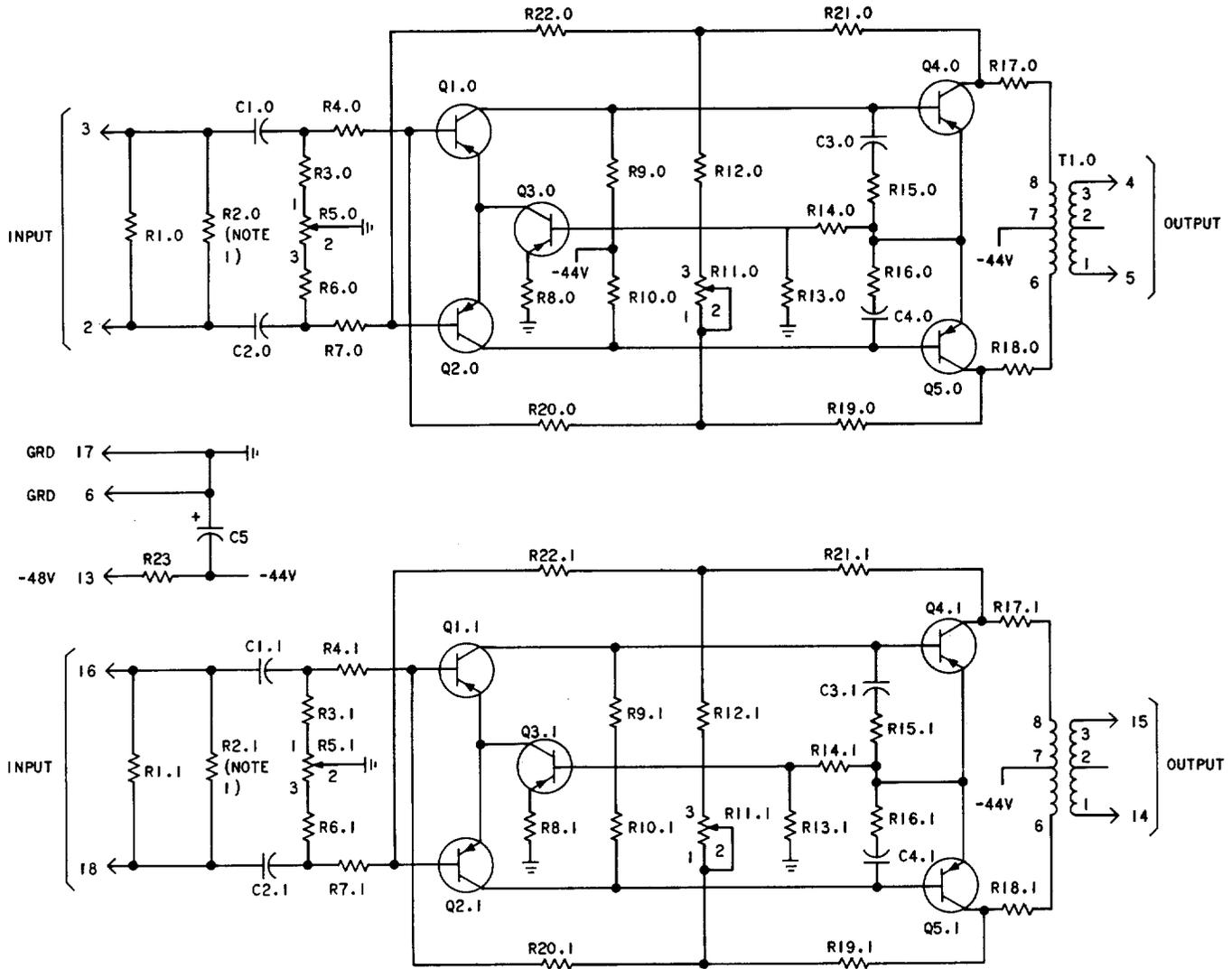
**3.03** The input of each amplifier unit is capacitor-coupled to block dc voltages. In order to use reasonable capacitor values a high-impedance pad is used in the input bias circuit. The ac impedance of the amplifier is controlled by resistors R1 and R2.

**3.04** The output of each amplifier unit contains a transformer which steps the impedance down by a factor of 3:1. In order to maintain low-delay distortion and good output return loss no net dc current is permitted in the transformer. This is accomplished by means of a balance adjustment with potentiometer R5 in the input bias circuit.

**3.05** A potentiometer, R11, in the feedback circuit of each amplifier unit provides a gain adjustment of  $\pm 0.2$  dB to correct for variations in amplifier components.

**3.06** Transistor Q3 in each amplifier unit provides high common mode rejection.

**3.07** The power supply circuit consists of R23 and C5 which serve to decouple the amplifiers from the -48-volt power supply. The amplifier requires an input of -43.2 to -52.8 volts with respect to positive ground and draws a nominal current of 32 milliamperes.



NOTES:

1. R2.0 AND R2.1 ARE USED ONLY IN 289A AMPLIFIER.
2. THE INPUT AND OUTPUT IMPEDANCE OF THE 289A AMPLIFIER IS 441 OHMS.
3. THE INPUT AND OUTPUT IMPEDANCE OF THE 289B AMPLIFIER IS 741 OHMS.

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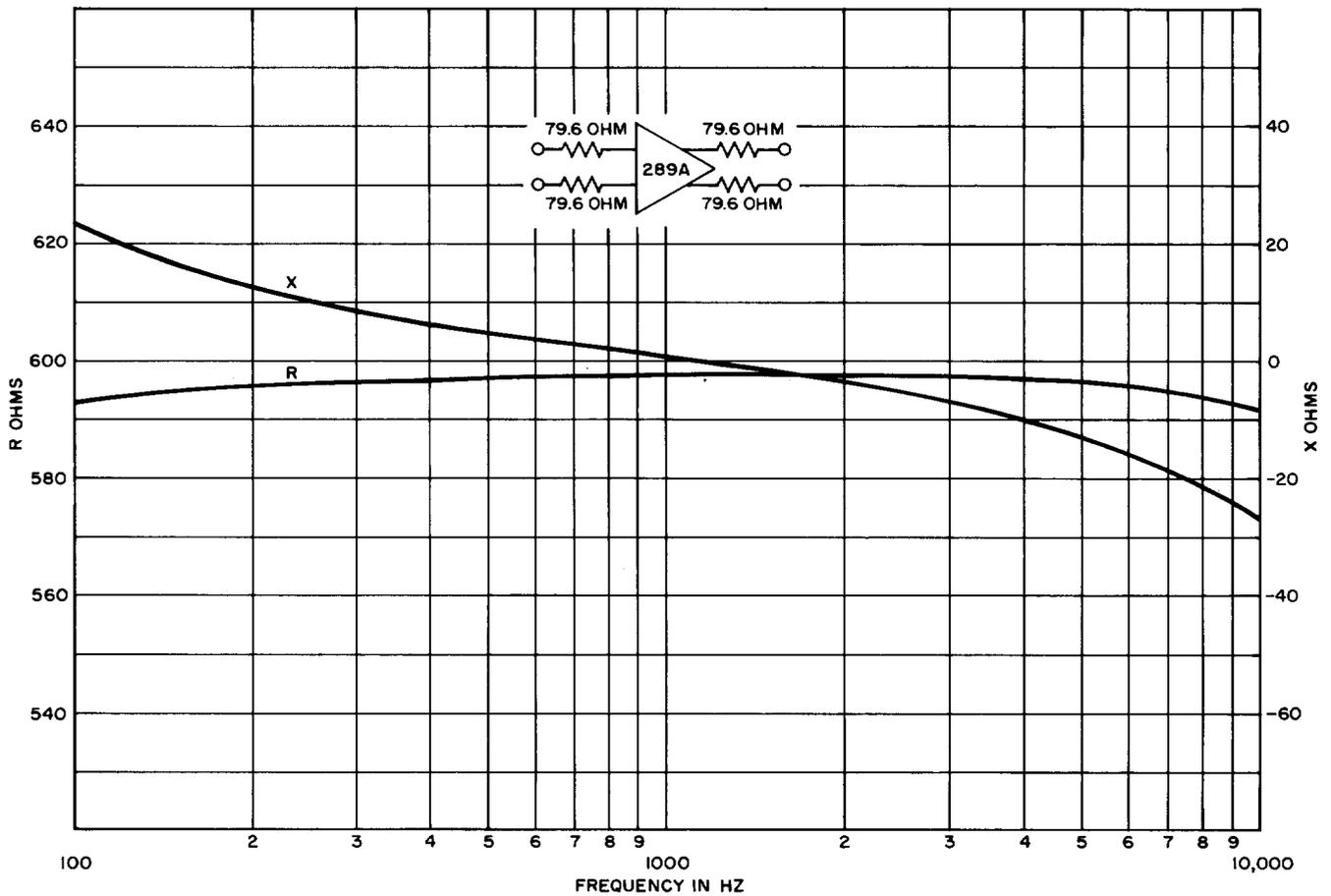
Fig. 3—Schematic Diagram of 289A and 289B Amplifier

**4. TRANSMISSION CHARACTERISTICS**

**4.01** The transmission characteristics given in the following paragraphs are representative of the 289A and 289B amplifiers.

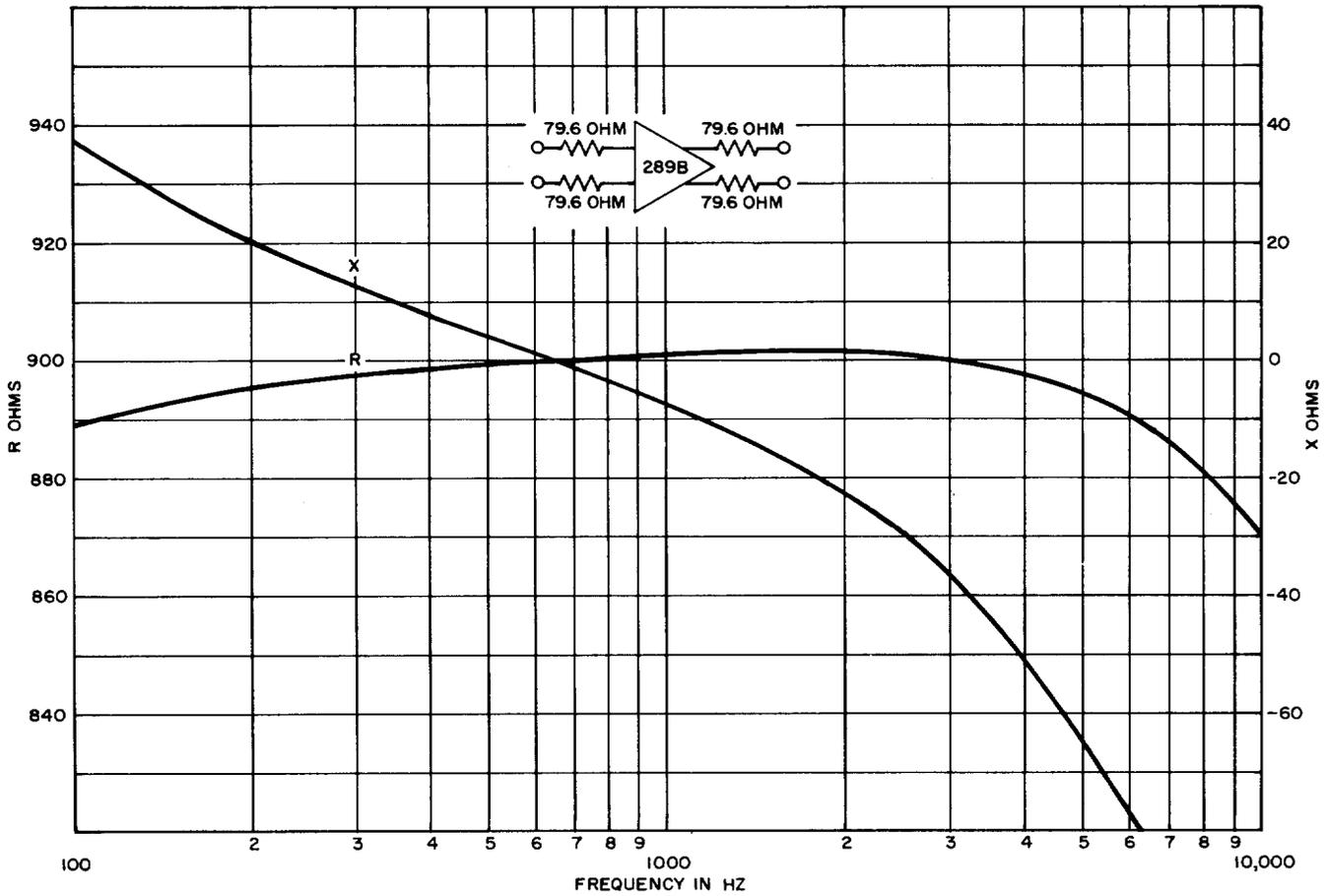
**4.02** The impedances in the amplifying units of the 289A or 289B amplifiers are built-out to 600 or 900 ohms, respectively, by build-out

resistors and cable resistances. Fig. 4 shows the measured 289A amplifier output impedance and Fig. 5 shows the measured 289B amplifier output impedance. The input resistors consist of the pad made up of R1 through R7 and R1.1 through R7.1. R1 and R1.1 are the controlling input resistors of the amplifiers. Their resistance tolerance is  $\pm 0.5$  percent and have a temperature coefficient of  $\pm 25$  ppm/c.



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**Fig. 4—289A Amplifier Output Impedance**

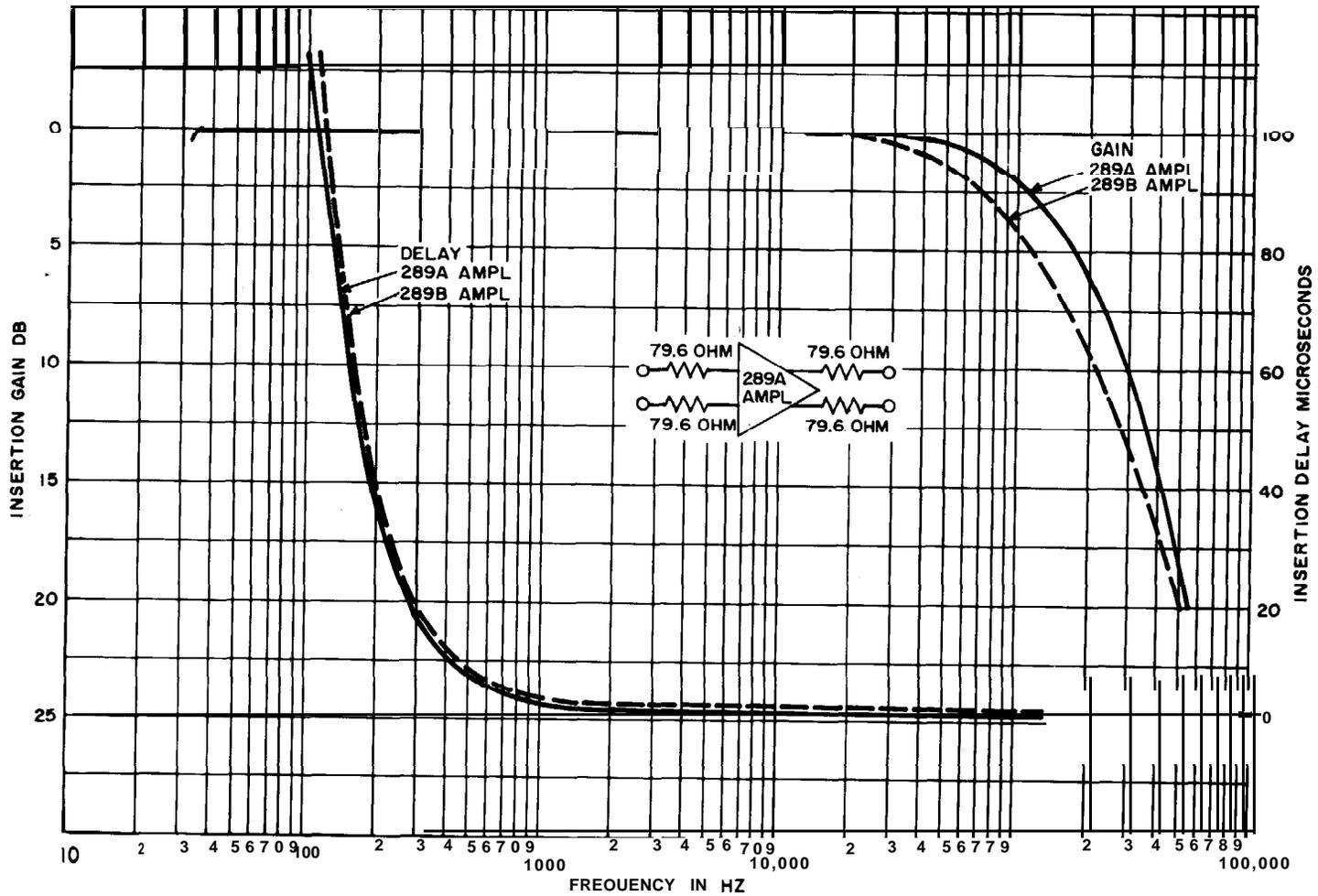


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**Fig. 5—289B Amplifier Output Impedance**

**4.03** The envelope delay characteristics of the 289A or 289B amplifiers are not sensitive to potentiometer settings. The delay characteristics of typical 289A or 289B amplifiers are shown in Fig. 6.

**4.04** The gain-frequency characteristic of the typical 289A or 289B amplifier is shown in Fig. 6.



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Fig. 6—289A and 289B Amplifier—Envelope Delay and Gain-Frequency Characteristics