359A EQUALIZER

DESCRIPTION

1. GENERAL

1.01 This section describes the 359A equalizer, which is a plug-in apparatus unit designed for use in V4 telephone repeater applications.

1.02 This section is reissued to include information on 25-gauge metropolitan area trunk (MAT) cable. Arrows normally used to indicate changes are not used due to the extensive revision.

1.03 The 359A equalizer is typically used in conjunction with a 227-type amplifier to provide equalization of H88-loaded cable facilities when gain is required. Independently adjustable low- and high-frequency equalization sections provide the necessary equalization to obtain a substantially flat frequency response over the range of 250 to 3000 Hz. The high-frequency section is designed specifically for equalization of H88-loaded high-capacitance cable. The low-frequency section is not limited to equalization of H88-loaded high-capacitance cable but may be used to provide low-frequency equalization in other loading systems, and in an H88-loaded low-capacitance system, such as 25-gauge MAT cable. The 1 kHz insertion loss varies between 6.2 and 20 dB as the equalizer sections are adjusted.

1.04 Strapping charts for the 359A equalizer when used with 227A, B, C, D, E, or F amplifiers may be found in Section 332-116-201.

2. EQUIPMENT DESCRIPTION

2.01 The 359A equalizer (Fig. 1) is a plug-in unit equipped with a 20-pin connector plug and is designed to be plugged directly into the equalizer connector socket of the repeater mounting shelf.

2.02 The 359A equalizer consists of thirteen resistors, five capacitors, and one inductor mounted on a printed wiring board and housed in a metal can approximately 1-3/4 inches high by 1-3/4 inches wide by 7 inches long. Tabs are provided on the front of the can to facilitate removal of the equalizer from the repeater mounting shelf with the use of a 602D tool.

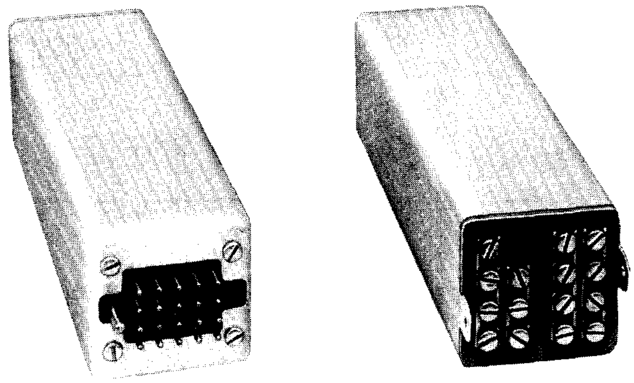

Fig. 1—359A Equalizer

2.03 Fifteen screw-type switches are mounted on the equalizer faceplate. These switches permit the indicated component values to be added to or removed from the circuit, as required, when adjusting equalization.

3. CIRCUIT DESCRIPTION

A. General

3.01 The general circuit configuration of the 359A equalizer is illustrated in Fig. 2. Resistor R_{LF} and capacitor C_{LF} make up the series arm low-frequency equalizing section; inductor L1, capacitor C1, and resistor R_{HF} make up the shunt arm high-frequency section; and resistors R1, R2, and R3 make up a 6.2-dB pad which reduces interaction between the high- and low-frequency sections.

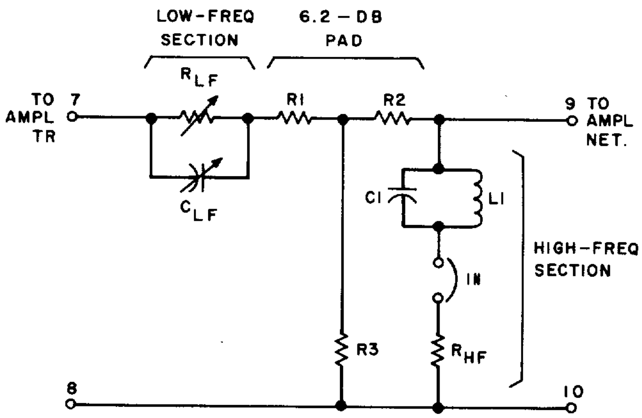

Fig. 2—359A Equalizer—General Circuit Configuration

3.02 Figure 3 is a schematic of the 359A equalizer illustrating typical circuit connections when plugged into the equalizer socket of a 24V4 or 44V4 repeater. The transmitting side of the 359A equalizer provides no equalization but does provide connections to the AMPL OUT and MON jacks and thus connects the 1200-ohm transmitting amplifier output to the H88-loaded 4-wire line.

3.03 The receiving side of the equalizer contains the actual equalizing elements and selects the proper secondary tap of the receiving amplifier input transformer to make the primary side look like approximately 1200 ohms. Received transmission signals from the 4-wire line at terminals 2 and 4 are connected through to the 1200-ohm receiving amplifier input circuit at terminals 1 and 3. Terminals 7, 8, and 9 connect the high- and low-frequency equalizing sections into the receiving amplifier circuit.

3.04 The high- and low-frequency sections are adjusted by means of the faceplate screw-type switches. In the low-frequency section, the capacitors are added to the circuit when the associated screw-type switches are closed (turned in) and are removed when the switches are opened (turned out). The resistors in both the low- and high-frequency sections are bypassed when the associated screw-type switches are closed (turned in) and are placed in the circuit when the switches are opened (turned out). The screw-type switch designated IN puts the high-frequency section in the circuit when turned ***in*** and removes the high-frequency section when opened (turned out).

B. High Capacitance (.083 μF per mile) H88 Loaded Cable

3.05 The series arm low-frequency components R_{LF} and C_{LF} provide compensation for amplitude distortion in the 4-wire line facilities at frequencies up to approximately 1000 Hz. Figures 4 and 5 illustrate typical equalization losses which may be obtained by various combinations of C_{LF} and R_{LF}. Fig. 4 shows the results of keeping C_{LF} constant at 0.25 μF and varying R_{LF} with the HF section out of the circuit; Fig. 5 shows the results of keeping R_{LF} constant at 1500 ohms and varying C_{LF} with the HF section out of the circuit.

3.06 The shunt arm high-frequency components provide amplitude equalization for H88-loaded high-capacitance cable where the nominal cutoff is 3500 Hz. C1 and L1 form a parallel resonant circuit tuned to 3000 Hz and in series with the adjustable resistor R_{HF}. Varying resistor R_{HF} adjusts the amount of high-frequency equalization for various lengths and gauges of facilities. Fig. 6 illustrates the typical corrective losses which may be obtained by various settings of R_{HF}.

3.07 While the series arm low-frequency components R_{LF} and C_{LF} provide compensation for amplitude distortion, they introduce delay distortion at the same time. Fig. 7 and 8 illustrate typical delay-frequency characteristics obtained by various combinations of C_{LF} and R_{LF}. Fig. 7 shows the results of keeping C_{LF} constant at 0.25 μF and varying R_{LF} with the HF section out of the circuit; Fig. 8 shows the results of keeping R_{LF} constant at 1500 ohms and varying C_{LF} with the HF section out of the circuit.

3.08 While the shunt arm high-frequency components provide compensation for amplitude distortion, they introduce delay distortion at the same time. Fig. 9 illustrates typical delay-frequency characteristics obtained by varying R_{HF}.

C. Low Capacitance (.064 μF per mile) H88 Loaded Cable

3.09 The 359A equalizer in combination with a 227-type amplifier may be used to effectively equalize the low-capacitance MAT cable. Since the new MAT cable has a relatively flat frequency response between 1 and 3 kHz, only the low-frequency section of the equalizer is required (the HF section of the equalizer must be removed from the circuit by opening the IN screw).

3.10 For typical applications of H88 loaded MAT cable with nominal 3 kft and sections, the insertion loss of the 359A will be between 6.2 and 6.9 dB.

3.11 The loss-frequency and delay characteristics of the equalizer are identical to those shown for the low-frequency section used with high-capacitance cable.

3.12 The 359A is capable of equalizing up to 60 kft of H88 loaded MAT cable when used with 227A, B, E, or F type amplifiers. Only 42 kft of loaded MAT cable may be equalized when used with 227C or D amplifiers due to the increased low-frequency loss required.

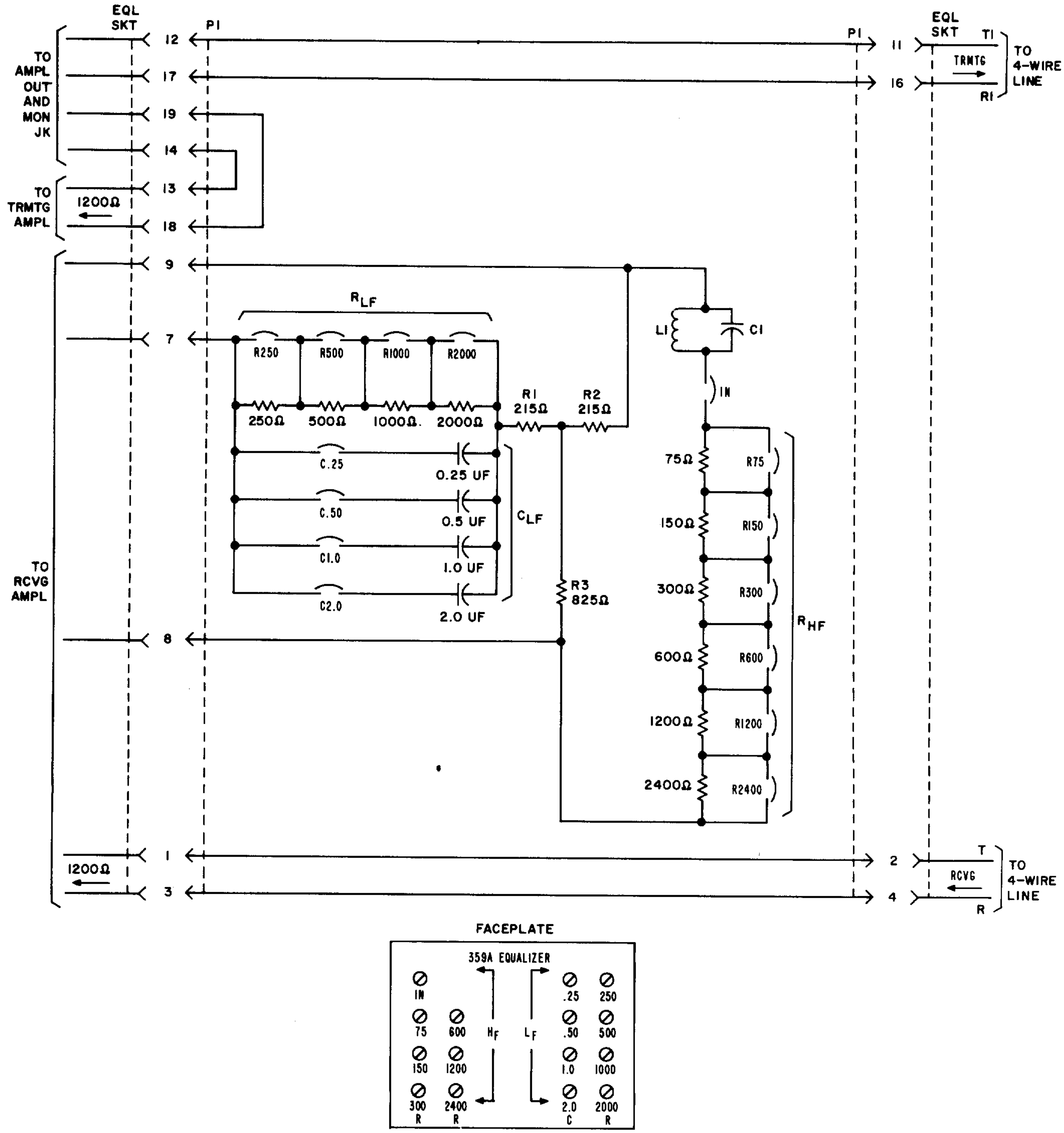

Fig. 3—359A Equalizer—Schematic and Typical Circuit Connection

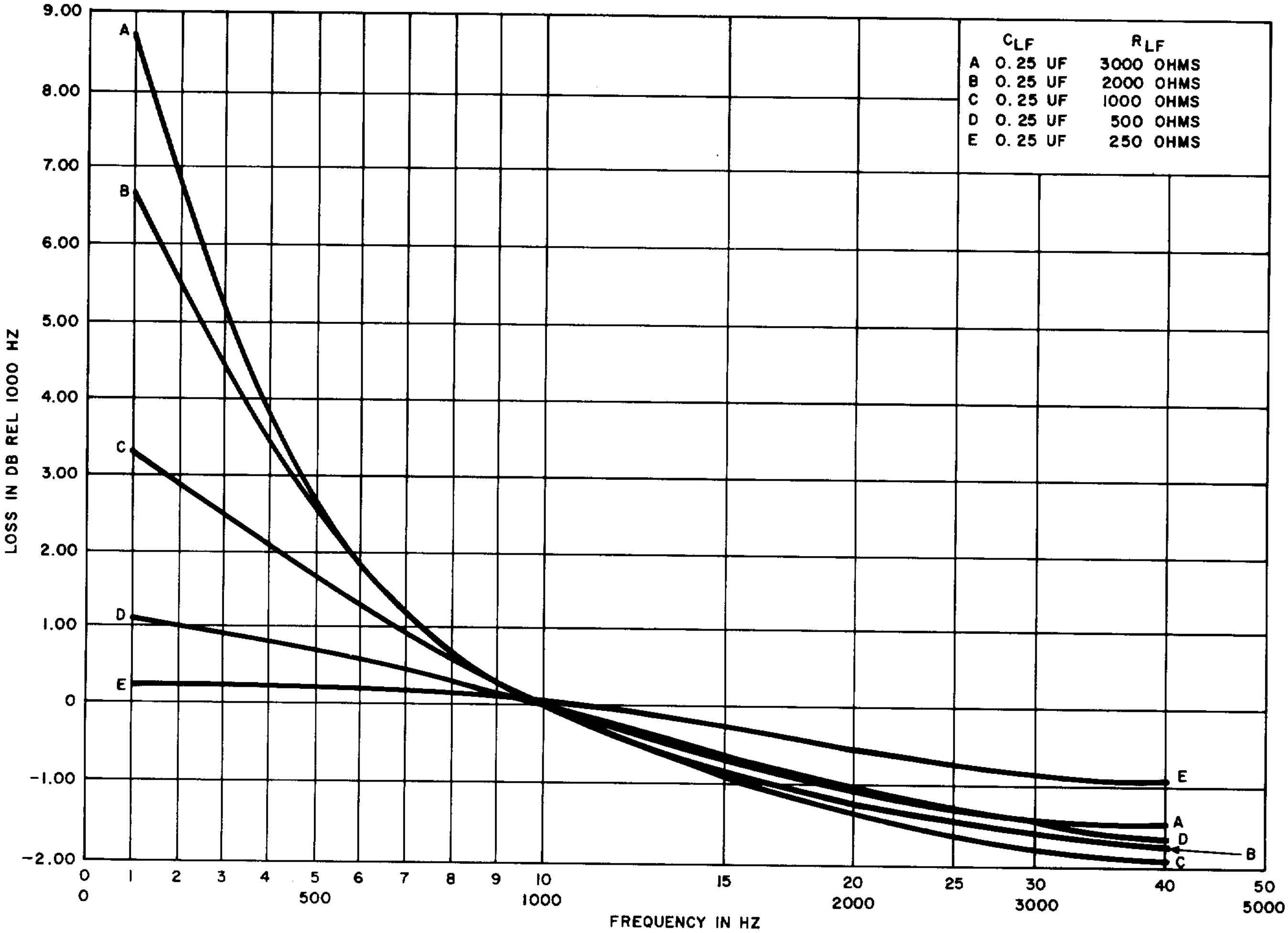

Fig. 4—359A Equalizer—Low-Frequency Section Loss-Frequency Characteristics Between 600 Ohms—Varying R_{LF} for C_{LF} Constant at 0.25 μF

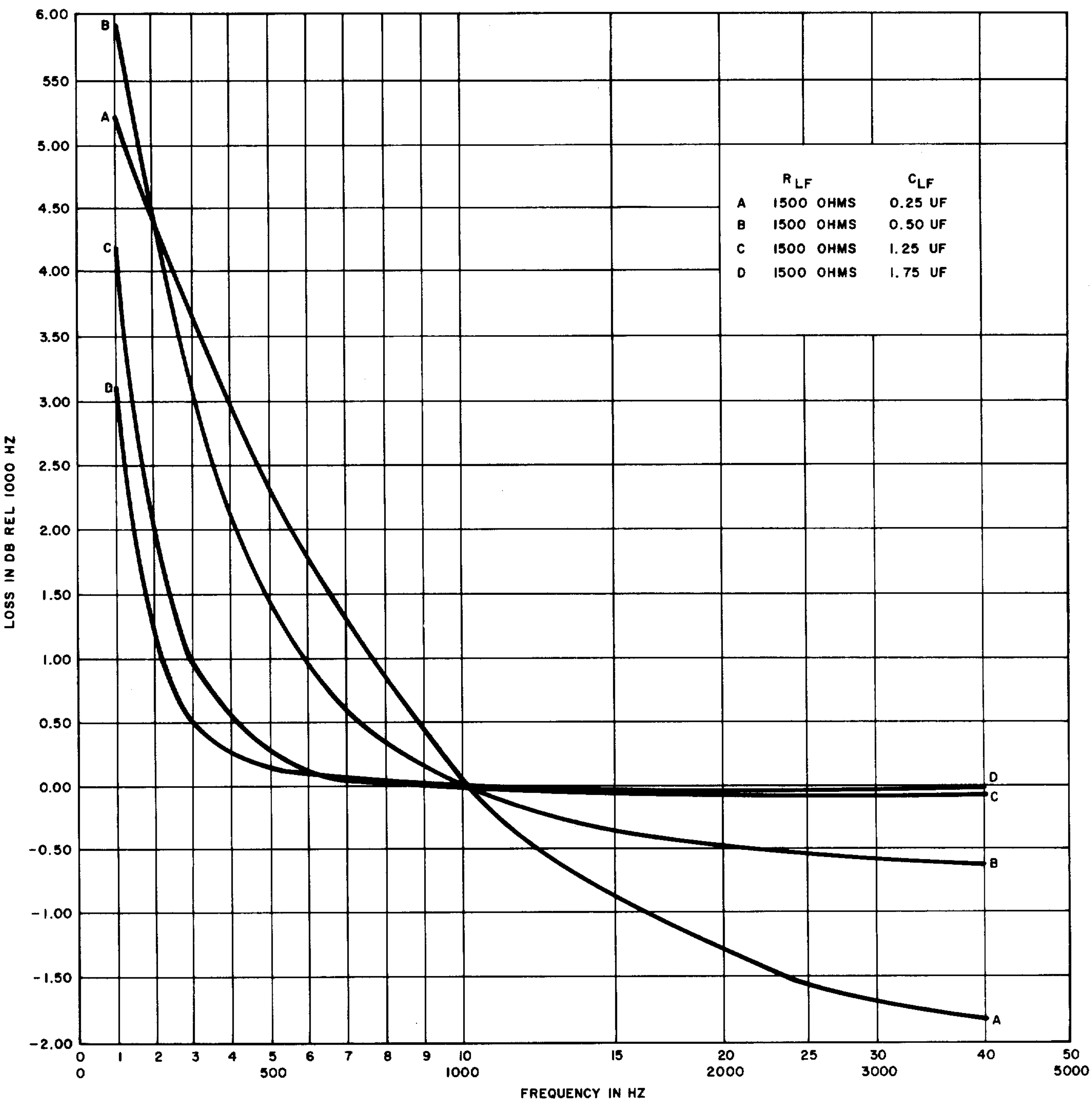

Fig. 5—359A Equalizer—Low-Frequency Section Loss-Frequency Characteristics Between 600 Ohms—Varying C_{LF} for R_{LF} Constant at 1500 Ohms

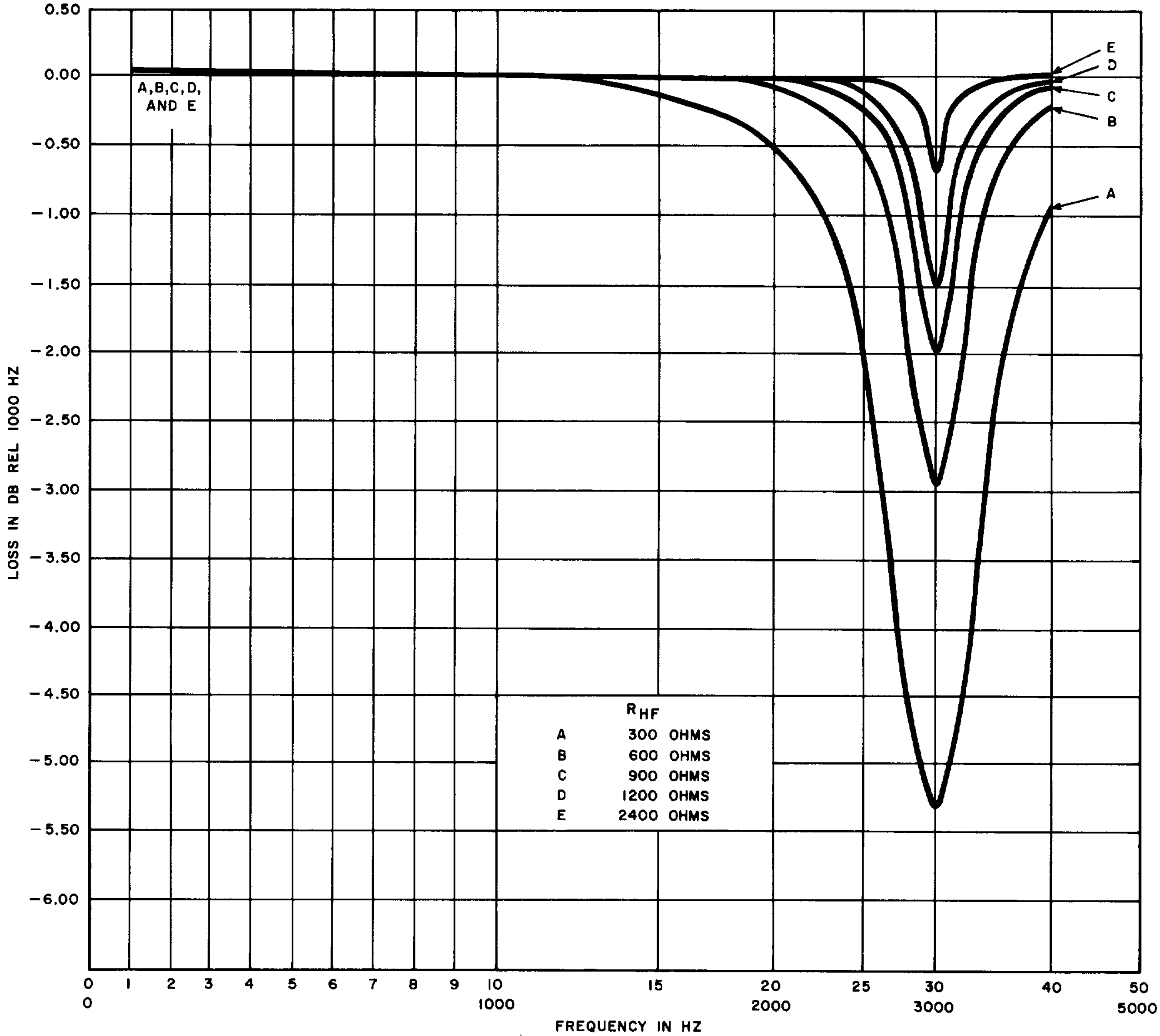

Fig. 6—359A Equalizer—High-Frequency Section Loss-Frequency Characteristics Between 600 Ohms—At Various Settings of R_{HF}

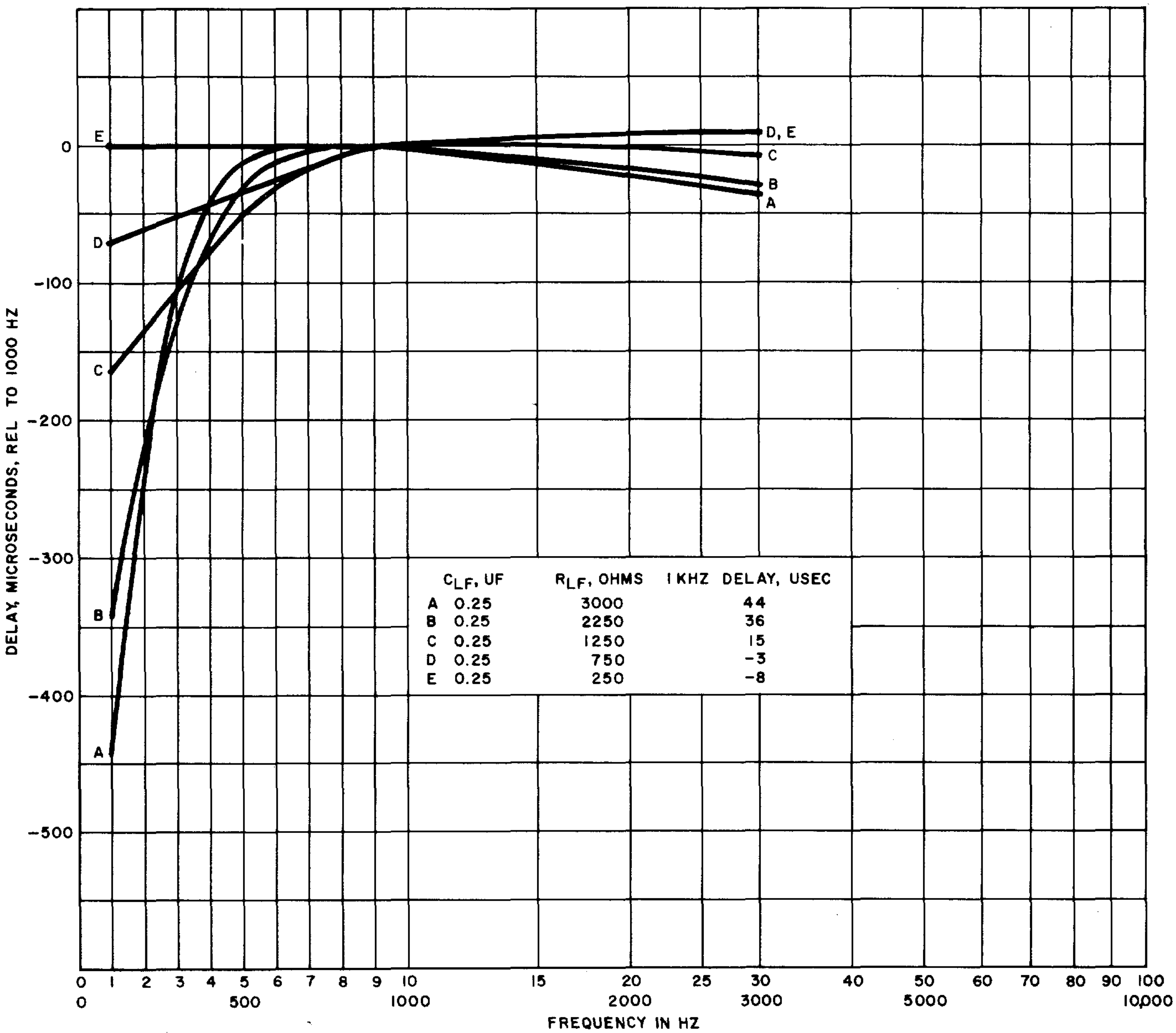

Fig. 7—359A Equalizer—Low-Frequency Section Delay-Frequency Characteristics Between 600 Ohms—Varying R_{LF} for C_{LF} = 0.25 μF

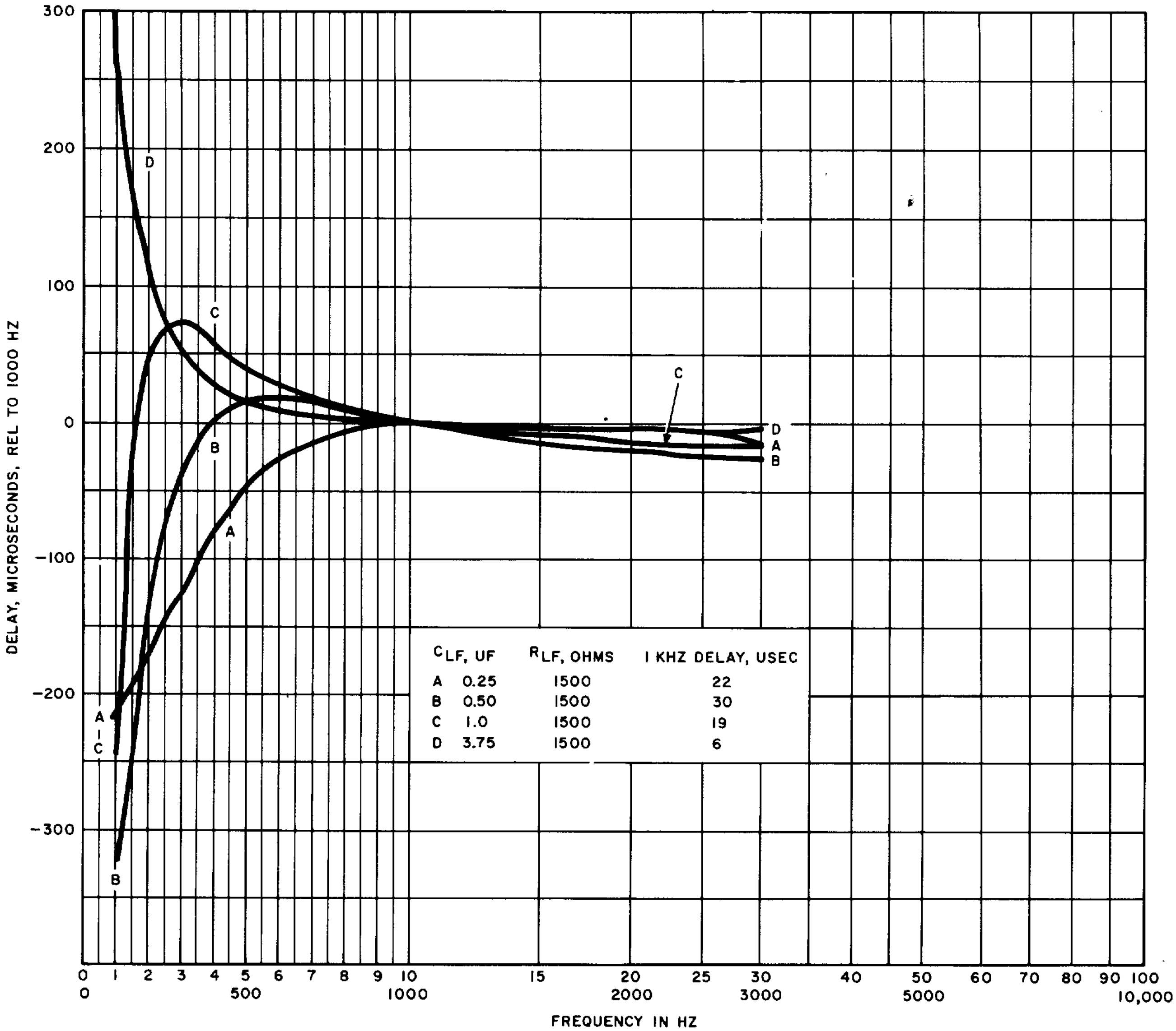

Fig. 8—359A Equalizer—Low-Frequency Section Delay-Frequency Characteristics Between 600 Ohms—Varying C_{LF} for R_{LF} = 1500 Ohms

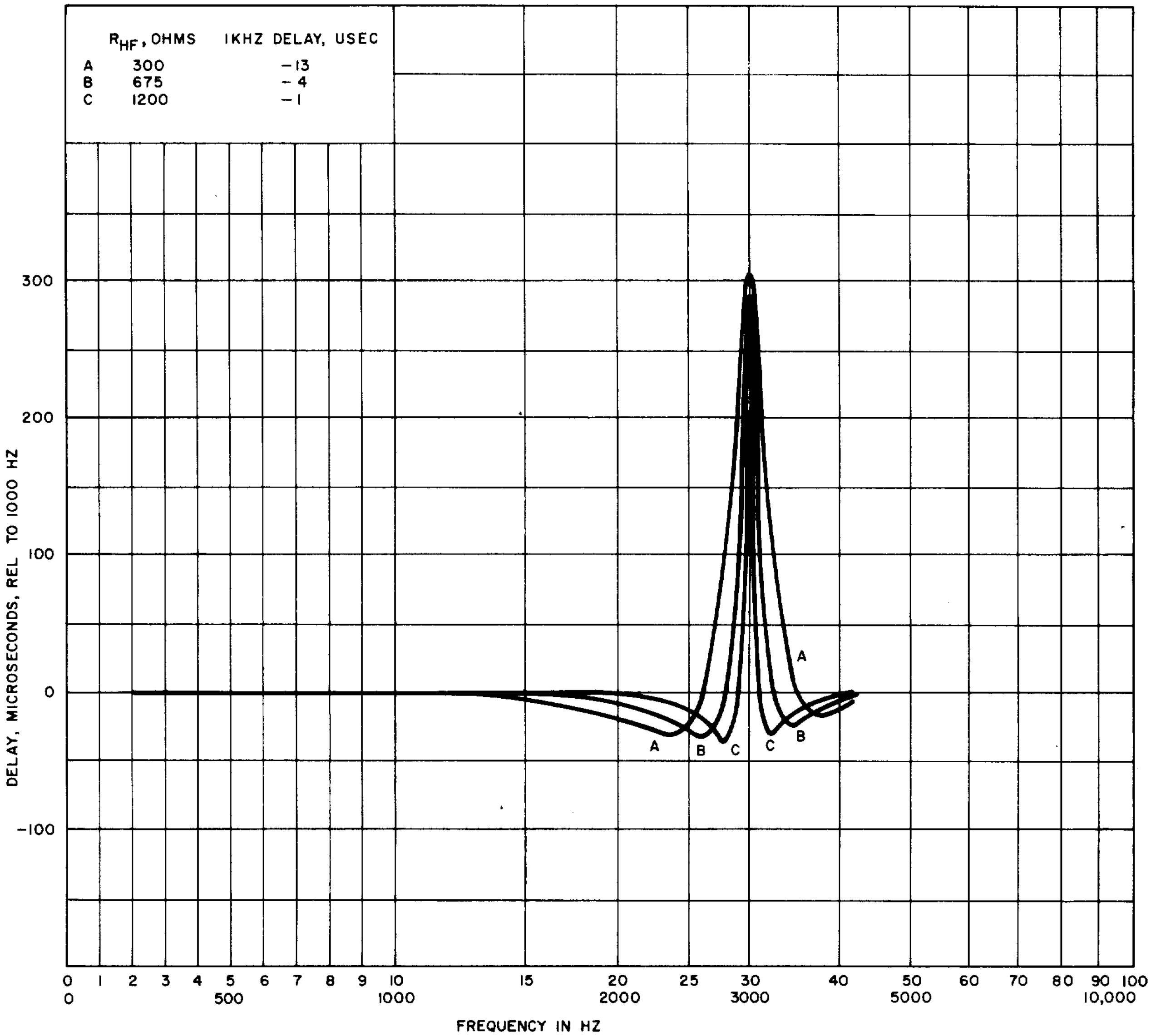

Fig. 9—359A Equalizer—High-Frequency Section Delay-Frequency Characteristics Between 600 Ohms—at Various Settings of R_{HF}