

ALTEC[®]

1590B POWER AMPLIFIER

OPERATING INSTRUCTIONS



SPECIFICATIONS

Type:	Power amplifier
Gain:	67 dB
Input Sensitivity:	0.8 volt for rated output
Power Output:	200 watts at less than 1.0% THD, 50 - 12,000 Hz
Frequency Response:	±1 dB, 20 - 20,000 Hz
Input Impedance:	15,000 ohms
Source Impedance:	150 and 600 ohms (with ALTEC 15095 Line Transformer)
Load Impedance:	6.25/8 and 25/32 ohms
Load Voltage:	35 and 70 volts
Output Impedance:	Less than 25% of nominal load imped- ance
Noise Level:	Output noise 85 dB below rated out- put
Operating Temperature:	Up to 55° centigrade (131° Fahren- heit)
Controls:	Volume Control, continuously vari- able composition Power Switch High-Pass Filter Switch
Power Supply:	120/240V ac, 50/60 Hz 25 watts at zero signal level 260 watts at 70 watts output level 420 watts at 200 watts output level OR 24/28V dc (Battery (-) Ground) 0.2 amps at zero signal level 8 amps at 70 watts output level 14 amps at 200 watts output level
Dimensions:	10-1/2" H x 19" W x 8-1/4" D
Weight:	41 pounds
Accessories:	ALTEC 15095 Line Transformer ALTEC 15335 Bridging and Matching Transformer

- Special Features:
1. Automatic transfer from ac to dc source in event of ac power failure. Trickle charge to maintain battery provided when ac operation is used.
 2. An active dissipation-sensing circuit providing protection to the output transistors. Should a malfunction occur, or the load represent a severe downward mismatch in the presence of high level program material, the sensing circuit prevents the output transistors from operating in a mode which would cause damage or degradation. As the action of the circuit is immediate and effective, only that portion of the program material which would damage the transistors is limited. The amplifier recovers its normal function as soon as the output fault is removed.
 3. High-pass filter for use in speech systems. Approximate cutoff frequency, 500 Hz. Chassis mounted continuously variable composition gain control.
 4. Safety - Underwriters' Laboratories Listed

DESCRIPTION

The ALTEC 1590B Power Amplifier is an improved version of ALTEC's 1590A Power Amplifier, designed for applications where uninterrupted operation is required. Solid-state, 100% silicon, the amplifier provides 200 watts of power at less than 1.0% total harmonic distortion from 50 to 12,000 Hz.

Specifications and components subject to change without notice. Overall performance will be maintained or improved.

ALTEC[®]

SOUND PRODUCTS DIVISION

1515 S. Manchester Ave., Anaheim, Calif. 92803

42-02-041977-07

Litho in USA CP-875-2.5K

Capable of operation from a 120 or 240 volt ac source or a negative grounded 28 volt dc source, the ALTEC 1590B is immune to power failure. Incorporated in the amplifier is a 'Fail Safe', silent, automatic transfer to dc operation in the event of power failure. When ac power is restored, the amplifier will automatically transfer back to the ac source and provide a float charge to the dc battery, returning the battery to a fully charged state.

Figures 1, 2 and 3 show performance characteristics of the 1590B.

Frequency response of the ALTEC 1590B Power Amplifier is ± 1.0 dB 20 to 20,000 Hz. The ALTEC 1590B Power Amplifier also contains a highpass filter for use in speech systems, a high input impedance of 15,000 ohms, with an octal socket provided for plug-in transformer to input line isolation.

Featured with the ALTEC 1590B Power Amplifier is the exclusive dissipation-sensing circuit, providing protection to the out-

put transistors. If a malfunction occurs, or if the load represents a severe downward mismatch in the presence of high-level program material, the sensing circuit prevents the output transistors from operating in a mode which would cause damage or degradation. Because the action to the circuit is immediate and effective at all frequencies within the passband of the amplifier, only that portion of the program material which would cause damage to the transistors is limited. The amplifier recovers its normal function as soon as the output fault is removed.

The ALTEC 1590B Power Amplifier, designed for rack mounted use, occupies only 6 units of rack space, and allows easy access to components via the hinged front panel. All circuitry is accessible for servicing when the front panel is open without removing the amplifier from the rack. A printed circuit board (PCB), plugged into a receptacle contains all active input and driver circuitry. Output transistors and associated drivers are mounted on a massive heat sink assembly which unplugs from the rear of the chassis when the protective shroud is removed.

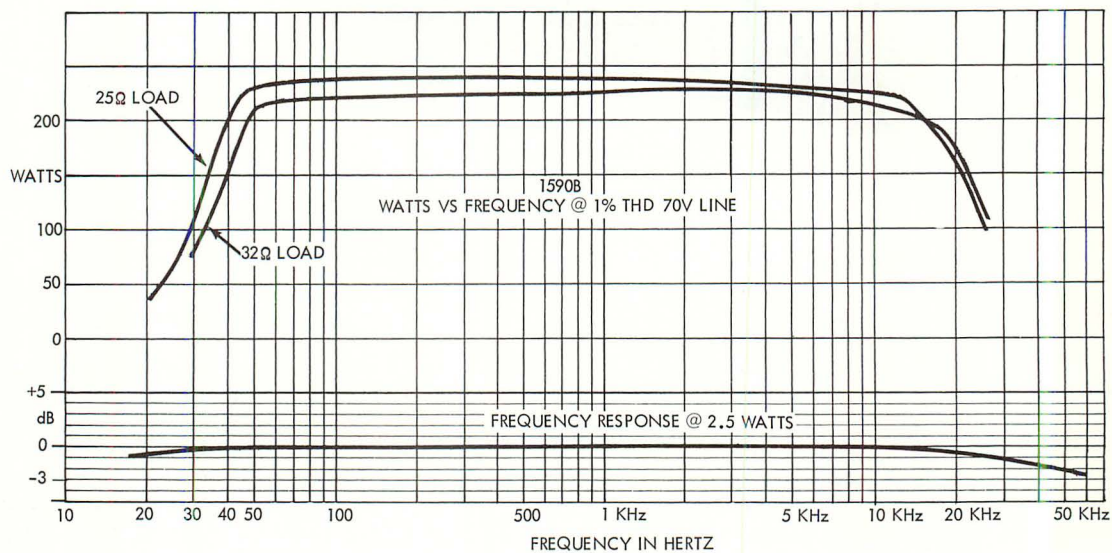


Figure 1. Power and Frequency Response Characteristics

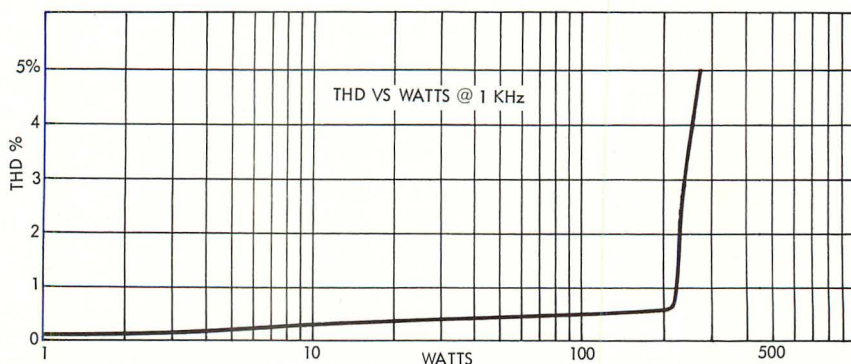


Figure 2. Distortion/Power Characteristics

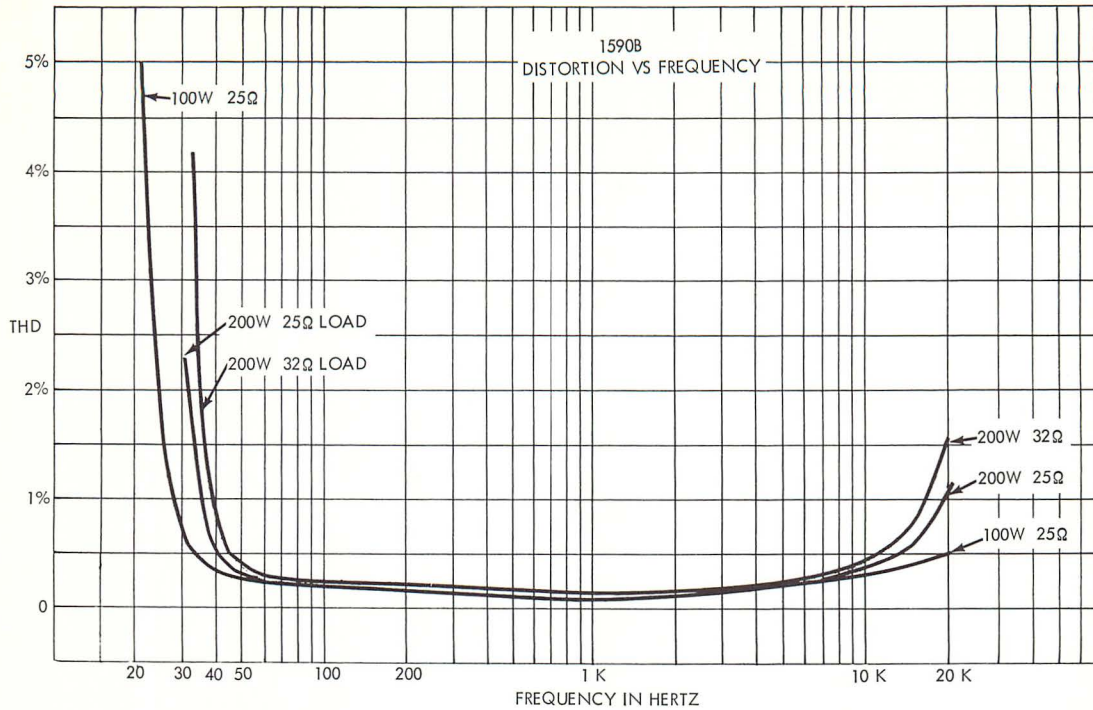


Figure 3. Distortion/Frequency Characteristics

POWER CONNECTIONS

120 volt, 50/60 Hz: Equipment supplied for domestic use will have the power transformer primary strapped for 120 volts, (terminals 1 to 2 and 3 to 4 on TB3). The power input nameplate on the chassis adjacent to the power cord will be mounted to show the appropriate side specifying the connections.

240 volt, 50/60 Hz: Export equipment, so specified, will have the power transformer primary strapped for 240 volts operation (terminals 2 to 3 on TB3). The power input nameplate on the chassis adjacent to the power cord will be mounted to show the appropriate side specifying the connections.

Battery Operation: If desired, the 1590B may be connected to an external 24/28 volt dc (-) ground (battery) power source. Terminals for the dc power connections are located on the rear panel.

When the amplifier is connected to an ac source, the battery will receive a 'float' charge of approximately 100 mA keeping it charged. Should an ac power failure occur or the ac switch be turned off, immediate and silent transfer to the dc source is accomplished. When the amplifier is operating from the dc source, the pilot lamp will be off. With the restoration of ac power, the pilot lamp will again be on, and battery charging will resume.

INPUT CONNECTIONS

There are two pairs of input terminals on the amplifier. Terminals 1 and 2 which connect directly to the input potentiometer, are used for unbalanced high impedance sources or for bridging unbalanced low impedance lines which have a signal voltage of 1 volt or more. Terminals 3 and 4, which connect to a standard octal socket, are used for low impedance (150 or 600 ohm) sources when transformer isolation is required. Terminal 2 is used to connect the shield of the incoming line. The ALTEC 15095 Line Transformer must be used in the octal socket

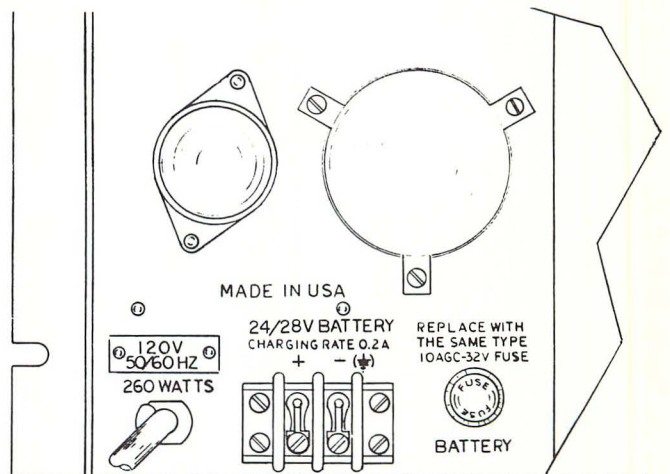


Figure 4. Power Connections

for this connection. The octal socket is strapped for 600 ohm operation. The 150 ohm input is obtained by strapping the socket terminals as shown on the schematic. Both inputs may be used simultaneously if isolation resistors are installed in either or both input lines as required to prevent one source from short-circuiting the other. Figure 5 illustrates the input connections.

OUTPUT CONNECTIONS

Output connections are illustrated in Figure 7 and on the transistor protective shroud on the rear of the amplifier. Use the output tap which matches the total speaker impedance. If the total speaker impedance falls between two output terminal values, use the lower impedance terminals. If a severe mismatch is unavoidable, or if a lower impedance is not available, use an ALTEC 15067 Autotransformer to achieve a proper match.

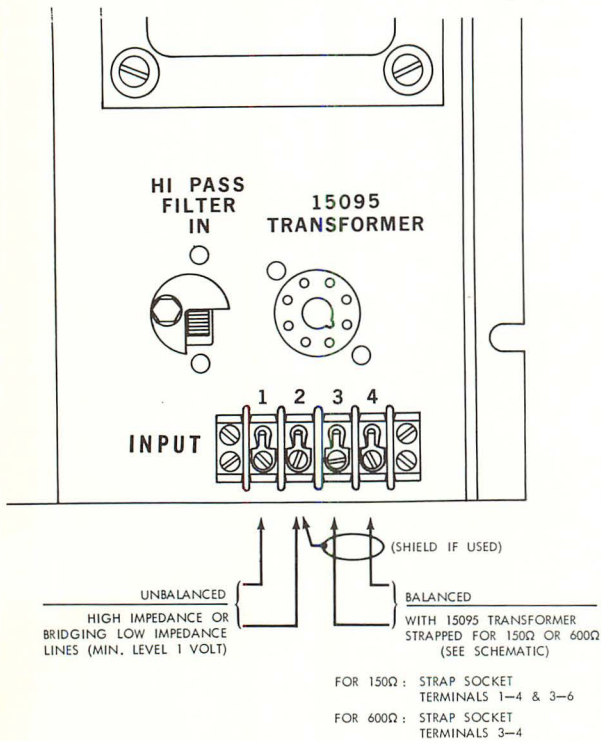


Figure 5. Input Connections

The 70-volt distribution system permits connections to a large number of speakers, each to operate at its individual power level without the necessity of computing impedances. In this system each speaker is equipped with a transformer containing a number of taps rated in terms of power. Select the tap which gives the power desired for that particular speaker. The total power settings for all speakers should be equal to, or less than, the amplifier power rating. The 1590B Power Amplifier is equipped with output to drive both a 70-volt (25/32 ohm) line and a 35-volt (6.25/8 ohm) line.

HIGHPASS FILTER

A highpass filter is incorporated for use in voice frequency systems where low frequency reproduction (below 500 Hz) is not required. The integral highpass filter is controlled by an ON-OFF slide switch located above the input terminals and next to the 15095 Transformer socket. A moveable safety plate, furnished with the filter switch, may be used to lock the switch in either position.

VENTILATION

The 1590B, an all-transistor amplifier, generates a minimum of heat during normal usage. Although the amount of heat is relatively low, the amplifier must be ventilated to prevent a temperature rise. Because transistors are heat sensitive, the amplifier should not be placed adjacent to heat-generating equipment, or in areas where the ambient temperature exceeds 55° centigrade (131° Fahrenheit). The protective shroud, mounted over the transistor heat sink, acts as a heat-extracting ventilator. The output transistor cases, which are protected by the protective shroud, have ac and dc voltages on them. Therefore, the protective shroud should not be removed from the amplifier when the amplifier is in operation.

IMPORTANT

The 1590B must be mounted so that both top and bottom of the heat sink are unobstructed for air passage.

The temperature rise from bottom to top of the shroud is 40° C when the amplifier is being driven. If one is mounted above the other in a rack, space must be provided between units or the upper amplifier will become too hot.

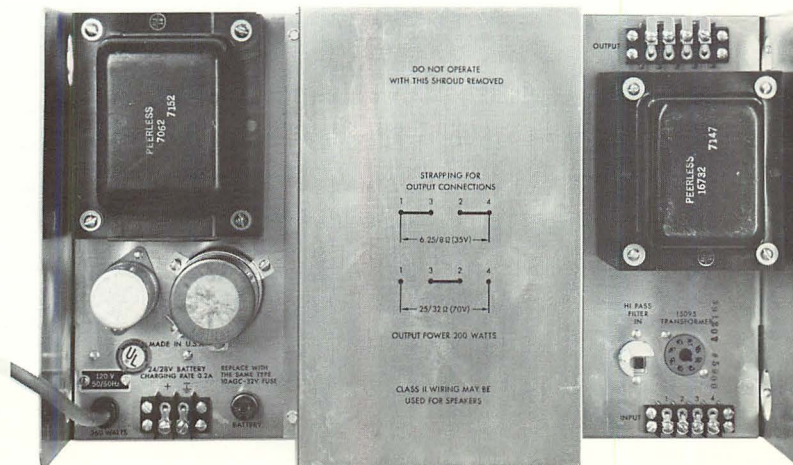


Figure 6. Rear View of 1590B Power Amplifier

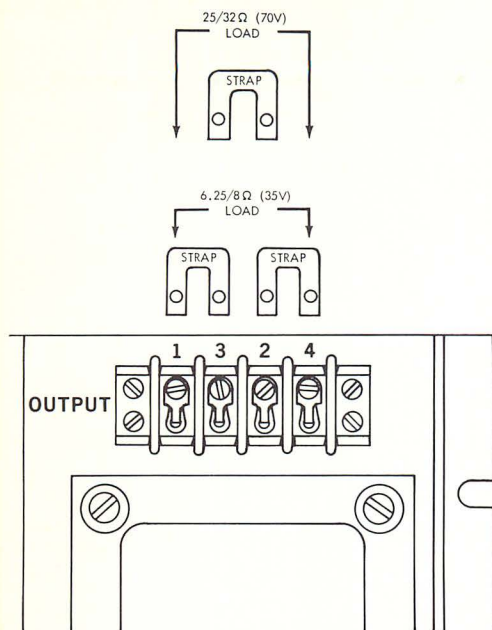


Figure 7. Output Connections

If the 1-3/4" perforated panel (10399) is used between two amplifiers, the inlet air temperature for the upper amplifier will be 27° C above the cabinet ambient. If the cabinet ambient is 25° C the inlet air temperature will be 52° C and within the amplifiers temperature rating of 55° C. If more than two units are to be stacked, greater spacing will be required between units or the 1-3/4" panels can be used with a single blower pressurizing the entire cabinet.

If there is any doubt as to inlet air temperature when several amplifiers are mounted in a single cabinet, operate the system until temperatures have stabilized and measure inlet air. This can be done with a bulb type thermometer held at the bottom of the heat sink shroud where the air enters. Care should be taken to keep the thermometer bulb from touching metal which will probably be hotter than air.

SERVICING

Should the amplifier become inoperative, a check of dc voltages will aid in localizing the trouble. The schematic diagram, Figure 9, indicates pertinent voltages and conditions for their measurement.

If a malfunction occurs, service should be performed by an ALTEC Qualified Service Representative. For factory service, ship the 1590B prepaid to Customer Service, ALTEC, 1515 South Manchester Avenue, Anaheim, California 92803. For additional information or technical assistance, call (714) 774-2900, or TWX 910-591-1142.

ACCESS

Remove the four screws securing the front panel, then open and lower the hinged front panel to gain access to the chassis interior.

OUTPUT TRANSISTOR MODULE

The output transistor module is a plug-in unit which is mounted at the rear of the amplifier. Before checking the transistors in this module, turn off the amplifier. Remove the protective shroud (four screws) and the two screws which hold the heat sink assembly to the two standoffs. Remove the assembly from the standoffs. The transistors now are accessible for removal and checking with an ohmmeter or transistor tester.

CAUTION

DO NOT operate the amplifier without the shroud in place. It is a vital part of the air passage in the heat sink.

RECOMMENDED SERVICE TECHNIQUES

If it becomes apparent through systematic troubleshooting that a replacement of a component is necessary, a few precautions must be observed.

Output Adjustment

Potentiometer R116 on the PCB is factory adjusted for minimum distortion at 200 watts output at 1000 Hz. Should it become necessary to replace one or more of the transistors Q3 to Q16 inclusive, readjustment of R116 may be required. If a distortion analyzer is available, adjust R116 for minimum distortion of 200 watts output at 1000 Hz. If not, use an oscilloscope and adjust R116 for equal top and bottom clipping of the waveform with the amplifier being driven just to clipping at 1000 Hz.

Adjustment of Output "Q" Balance Controls

Output "Q" balance controls R135 and R136 on the PCB assembly balance the bias current of output transistors Q1 through Q8. Inadequate adjustment of these controls may result in distortion or excessive current drain from one or more output transistors. If adjustment is indicated (such as replacement of one or more output transistors), use the following recommended procedure:

- Step 1. Turn VOLUME control fully counterclockwise to (0).
- Step 2. Remove four screws securing front panel, then lower panel for access to interior.

CAUTION

High voltage may be encountered when chassis is opened for service. This procedure should be referred to a qualified service technician.

- Step 3. Turn output "Q" balance controls R135 and R136 fully clockwise.
- Step 4. Turn on power and allow a 5-minute warmup period.
- Step 5. Adjust R135 and R136 by one of the following methods [method (a) is preferred].

- (a) Locate wire attached to terminal 1 of output transformer T2 (see Figure 9). Connect a clamp-on milliammeter to this wire and adjust R135 counterclockwise for a "Q" current of 65 mA. Change connection of milliammeter to wire attached to terminal 3 of output transformer T2 and adjust R136 for a "Q" current of 65 mA. Remove clamp-on milliammeter.
- (b) Connect a millivoltmeter across resistor R9 (see Figure 9), starting with the highest scale to protect meter. Adjust R135 for meter reading of 10 mV. Change connection of millivoltmeter to read across resistor R10 and adjust R136 for meter reading of 10 mV. Remove millivoltmeter.

Step 6. Close front panel and secure with four screws removed in Step 2.

Transistor Orientation

Solid-state components are packaged in various case sizes and types with various lead configurations. Typical solid-state component orientations are shown in Figure 8. Before removing a solid-state component from a PCB or tie points, sketch the lead orientation with respect to the PCB or tie points. Form the leads of the new component to conform with the leads on the part being replaced to aid in making proper connections.

Before removing small "plug-in" transistors, note the position of the index tab with respect to the socket. Cut the leads of the new transistor to the required length and insert them into the socket properly indexed.

Replacing Power Transistors

Be sure the following conditions exist when replacing power transistors.

1. The mica insulator is not damaged.
2. No grit or metal particles are lodged between transistor and heat sink.
3. Both sides of mica insulator are covered with silicone grease or fluid.
4. Mounting screws are tight.

Testing Transistors

Transistors should be checked with a transistor tester. If a tester is not available, an ohmmeter may be used because most transistor failures result in a collector-to-emitter short or open circuit. Use the following procedure when testing transistors with an ohmmeter.

Step 1. Remove suspected transistor from circuit (see "Replacing PCB Components").

- Step 2. Connect ohmmeter leads to collector and emitter and read on lowest ohms scale. Reverse leads and read again.
- Step 3. If resistance reading is low and virtually unchanged when ohmmeter connections are reversed, transistor is short circuited.
- Step 4. If ohmmeter indicates infinity on highest ohms scale for both readings, transistor is open circuited.

Replacing PCB Components

Before removing and replacing components on a PCB, observe the following instructions.

- Step 1. Solid-state components and PCB's may be damaged by excessive heat. Use a small soldering iron with a 1/8-inch diameter chisel tip and use small-diameter 60/40 rosin-cored solder.
- Step 2. Remove components by placing soldering iron on component lead on conductor side of PCB and pull out lead. Avoid overheating conductor.

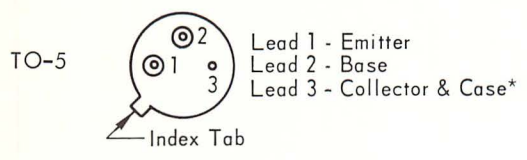
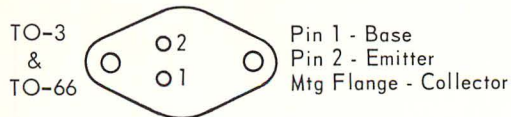
CAUTION

The conductor on the PCB is a metal surface plated with solder and laminated to the board. Too much pressure or overheating may lift the conductor from the board.

- Step 3. If component is faulty or damaged, clip leads close to component and then unsolder leads from board. Withdraw leads from component side.
- Step 4. Clear solder from circuit board holes before inserting leads of new component. Heat solder remaining in hole, remove iron and quickly insert a pointed non-metallic object, such as a toothpick, from conductor side.
- Step 5. Shape new component leads and clip to proper length. Lead shape should provide stress relief for component. Insert leads in holes, observing same polarity or orientation of removed component. Apply heat and solder on conductor side.

Repairing Fractured or Damaged PCB Conductor

If a conductor is fractured, damaged or lifted from the circuit board, a recommended method of repair is to solder a section of good conducting wire along the damaged area and then seal with epoxy.



*Not all types. Some have base-to-case internally; others have no connection to case.



Figure 8. Typical Transistor Package Configurations

PARTS LIST

Reference Designator	Ordering Number	Name and Description
None	27-01-042080-01	PCB assembly
None	27-04-044777-01	Heat sink assembly
C1	15-02-100087-01	Cap., 0.02 μ F \pm 20%, 100V
C2, 110, 111	15-02-100307-01	Cap., 0.01 μ F \pm 20%, 100V
C3	15-06-100157-01	Cap., 1 μ F \pm 10%, 100V
C4	15-01-100284-01	Cap., 1000 μ F, 35V
C5	15-01-100299-01	Cap., 13500 μ F, 35V
C101	15-01-100156-01	Cap., 1 μ F, 25V
C102	15-02-107470-01	Cap., 220pF \pm 10%, 100V
C103	15-02-107532-01	Cap., 330pF \pm 10%, 100V
C104, 105	15-01-108543-01	Cap., 5 μ F, 25V
C106, 107	15-06-102605-01	Cap., 0.47 μ F \pm 10%, 100V
C108, 109	15-02-100305-01	Cap., 0.005 μ F \pm 20%, 100V
CR1	48-01-107429-01	Diode, STB 568
CR2, 3	48-01-042787-01	Diode, 1N1004 (selected)
CR4	48-01-107271-01	Diode, Zener, 20V \pm 5%
CR5	48-01-108576-01	Diode, Zener, 15V \pm 5%
CR6, 7, 8, 9, 10	48-02-108690-01	Diode, rectifier, 1N3492, 18A, 100 PIV
CR101, 102, 103, 104, 105, 106	48-01-107017-01	Diode, 1N456A, 25V, 100 mA
F1	51-04-100469-01	Fuse, 4A, 125V, Slo-Blo
F2	51-04-105890-01	Fuse, 10A, 3AG
PL1	39-01-100539-01	Pilot lamp, neon
Q1, 2, 3, 4, 5, 6, 7, 8	48-03-040934-04	Transistor, 2N6254 (selected)
Q101, 103, 108, 109	48-03-101098-03	Transistor, 2N2712 (selected)
Q102	48-03-041440-02	Transistor, 2N3906 (selected)
Q104, 105	48-03-119140-02	Transistor, 2N5308 (selected)
Q106, 107	48-03-107447-03	Transistor, 2N5320, 10W, 75V (selected)
R1	47-06-042509-01	Pot., 15K Ω \pm 20%
R2, 3	47-01-100635-01	Res., 22 Ω \pm 10%, 1W
R4, 5, 7, 8, 9, 10	47-02-108691-01	Res., 0.3 Ω \pm 10%, 5W
R6	47-01-100652-01	Res., 1.8K Ω \pm 10%, 1W

Reference Designator	Ordering Number	Name and Description
R11, 12	47-02-108692-01	Res., 1 Ω \pm 10%, 5W, noninductive
R13	47-01-102551-01	Res., 470 Ω \pm 10%, 1W
R14	47-02-100715-01	Res., 200 Ω \pm 10%, 5W
R15	47-02-100713-01	Res., 47 Ω \pm 10%, 5W
R16	47-01-102376-01	Res., 56K Ω \pm 10%, 1/2W
R101	47-01-100479-01	Res., 680K Ω \pm 10%, 1/4W
R102	47-01-102190-01	Res., 180K Ω \pm 10%, 1/4W
R103, 106, 110	47-01-102171-01	Res., 4.7K Ω \pm 10%, 1/4W
R104	47-01-102168-01	Res., 2.7K Ω \pm 10%, 1/4W
R105	47-01-102167-01	Res., 2.2K Ω \pm 10%, 1/4W
R107	47-01-100477-01	Res., 470K Ω \pm 10%, 1/4W
R108, 109	47-01-102102-01	Res., 10K Ω \pm 5%, 1/4W
R111, 112	47-01-102187-01	Res., 100K Ω \pm 10%, 1/4W
R113, 131, 134	47-01-102177-01	Res., 15K Ω \pm 10%, 1/4W
R114	47-01-102165-01	Res., 1.5K Ω \pm 10%, 1/4W
R115, 117	47-01-102140-01	Res., 10 Ω \pm 10%, 1/4W
R116, 135, 136	47-05-014697-01	Pot., 50 Ω \pm 20%, 2W
R118, 119	47-01-102161-01	Res., 680 Ω \pm 10%, 1/4W
R120, 123	47-01-100642-01	Res., 330 Ω \pm 10%, 1W
R121, 122	47-01-102338-01	Res., 47 Ω \pm 10%, 1/2W
R124	47-01-102147-01	Res., 47 Ω \pm 10%, 1/4W
R125	47-01-102062-01	Res., 220 Ω \pm 5%, 1/4W
R126, 127, 137, 138	47-01-102253-01	Res., 360 Ω \pm 10%, 1/2W
R128	47-01-102148-01	Res., 56 Ω \pm 10%, 1/4W
R129, 132	47-01-102081-01	Res., 1.3K Ω \pm 5%, 1/4W
R130, 133	47-01-102174-01	Res., 8.2K Ω \pm 10%, 1/4W
S1	51-02-100992-01	Switch, DPDT, slide
S2A, 2B	51-01-100988-01	Switch, 2-gang, rotary, 125V, 3A and 20V, 5A
T1	56-08-007062-11	Transformer, power
T2	56-07-016732-04	Transformer, output
T101	56-07-015315-07	Transformer, driver
TB1	21-04-101038-01	Terminal board, 4-terminal
TB2	21-04-101040-01	Terminal board, 4-terminal
TB3	21-04-105882-01	Terminal board, 5-terminal
TB4	21-04-101036-01	Terminal board, 2-terminal

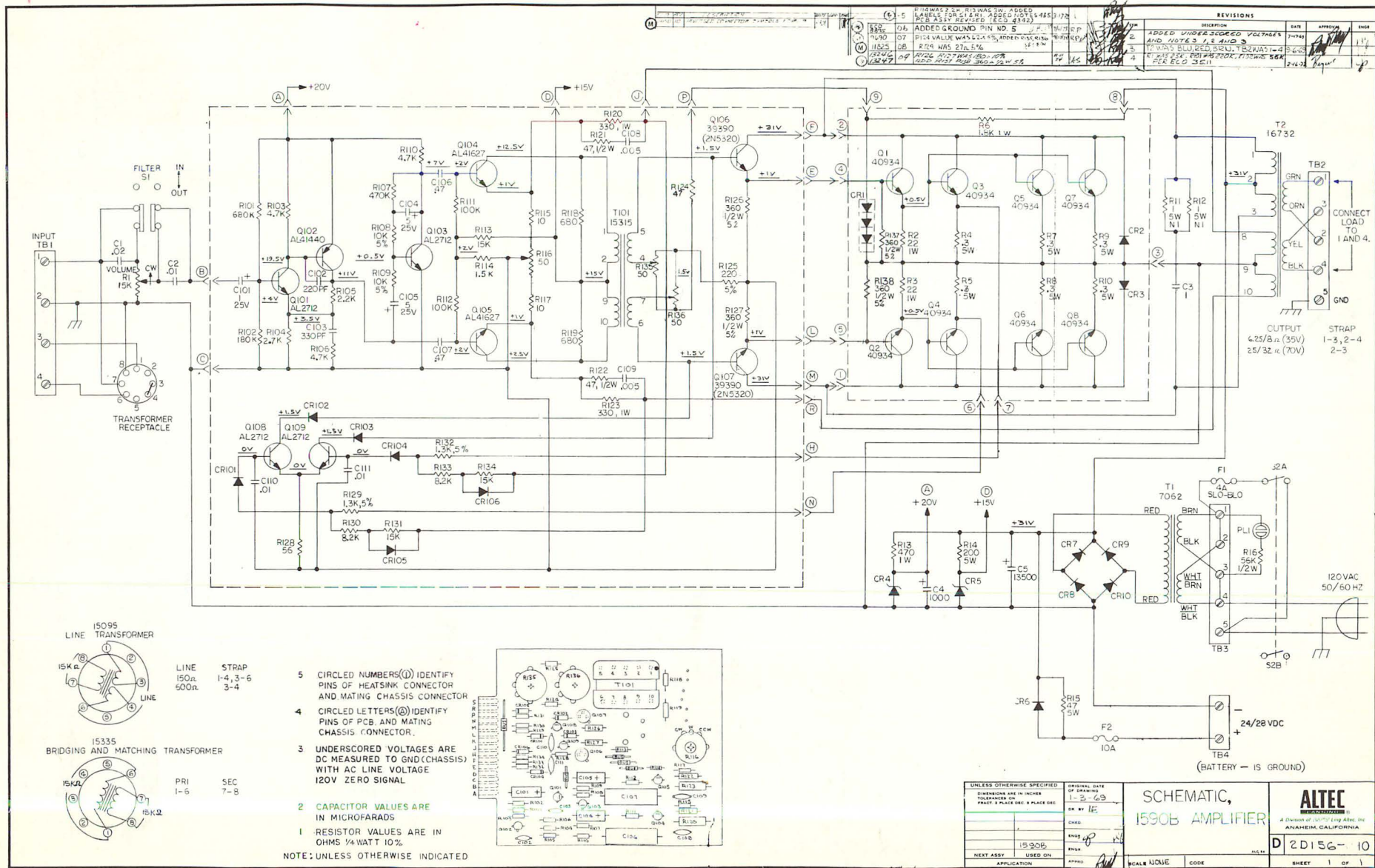


Figure 9. Schematic (2D156-10), 1590B Power Amplifier