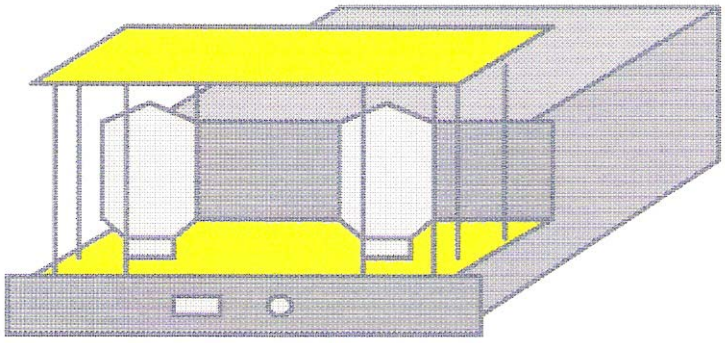


Owner's Manual
The David Berning Company

SIEGFRIED

Power Amplifier

The David Berning Company
12430 McCrossin Lane
Potomac, Maryland 20854
301-962-3371

WARNING: For safety, the cover of this amplifier should be secured at all times. DC voltages as high as 1700 V and peak ac voltages as high as 3000 V are present inside. The service information in this manual is intended for trained service personnel. Furthermore, this amplifier generates radio-frequency energy that can interfere with communications equipment if the cover screws are not tightly secured.

Siegfried--Configuration Options

Siegfried is available configured to use the Svetlana SV 811-10 power triode, or alternatively, to use the Western Electric 300B power triode. These triodes are not interchangeable, and circuit changes are required to change the type of output triode used.

Assembly and Shipping Instructions

Siegfried is shipped with the tubes removed from their sockets and the tube cover plate and support rods disassembled. Whenever Siegfried is shipped, these parts must be removed and wrapped separately; the tubes should be individually wrapped and laid horizontally in the space that they normally occupy when installed in their sockets. The tube cover plate should be wrapped in a soft padding papers and sandwiched between two pieces of cardboard and taped. The support rods should be individually wrapped so they do not touch, and then taped in a bundle. The ends of the bundle should be taped so that the rods do not slide out of the ends of the bundle.

The audio tube panel, the solid-brass tube cover plate, and the solid-brass support rods are gold plated. These surfaces will lose some of their luster from oils in the skin when touched. It is recommended that they be handled after washing ones hands with soap, or by using thin cloth gloves. If they are accidentally touched, they can be wiped promptly with a soft cloth, preferably made damp with alcohol.

The tubes can be installed either before or after the plate is mounted. Use great care in handling the Svetlana SV 811-10 power tubes. They use a thoriated-tungsten filament, which is very fragile. The two larger pins of these tubes are positioned so as to straddle the dot on their sockets.

To assemble Siegfried, gently screw the rods into the threaded studs on the tube panel. Do not overtighten. Position the plate on top of the rods so that the ten holes line up with the rods. Secure the plate to the rods with the screws provided. Do not overtighten. To disassemble, hold the rods while removing the screws. Never use pliers directly on the rods. Should the rods become attached too firmly to the screws to hold by hand, some pieces of wood or thick plastic can be used in the jaws of pliers to obtain additional holding force.

Initial Power-Up and Check-Out

The Svetlana 811-10 tubes light up brighter than most tubes, and show the light spectral color of a low-power light-bulb. Upon applying power to Siegfried, the 811-10 tubes should both glow brightly within one second. These tubes should be inspected to make sure that both filament sections are glowing. 300B tubes use an oxide-coated filament that has a dim orange glow.

After initial power-up, there is about a one-minute delay before plate power is applied. This delay allows all tubes in the amplifier to warm up and stabilize before the amplifier

becomes operational. Should any tube be defective, or if any tube is missing or in the wrong socket, Siegfried will shut down within a few seconds after the delay period expires. If shutdown occurs, the power switch must be turned off before the turn-on sequence can be initiated again. An error-induced shutdown like the above leaves the power supply capacitors in a charged-up state, and a five-minute wait is required before the capacitors discharge sufficiently through bleeder resistors so that another start-up sequence can be initiated. It is normal to hear a "thump" through the speakers when the delay period expires. Siegfried incorporates a dc-servo system that encircles the entire amplifier, and the entire amplifier is dc-coupled. This servo loop is broken until the delay period expires, and the low-frequency transient is simply the readjustment of all voltages in the amplifier so that there is no dc voltage fed to the speaker during normal operation. This servo will activate an error-induced shutdown of the power supply if the dc can not be nulled.

Tube Selection Considerations

Since Siegfried is a zero-feedback design, the gain matching for the two channels is subject to slight variations governed by the amplification factors of the individual tubes. The matching is most dependent on the 6SN7 tubes in Siegfried. If both 6SN7 tubes on one particular channel have a higher amplification factor than those on the other channel, the one channel may be 1dB or so louder than the other. This is not an obvious difference, but it can cause the image the shift slightly to one side. If this occurs, one 6SN7 from one channel should be interchanged with the corresponding one on the other channel.

The Svetlana SV 572-10 tube can be used in place of the SV 811-10.

Westrex Corp. is making the 300B following the original materials specifications of the Western Electric tube, and it is this tube that is supplied with Siegfried. There are currently a number of different manufacturers making copies of the 300B tube. Some of these versions of the 300B may not work properly in Siegfried due to excessive inductance in their heaters. There are various similar tubes that might work in the 300B version of Siegfried, and some that do not work properly. If the heater glows an orange color in the tube in question, it will probably work. If an orange glow cannot be seen, Siegfried may enter an error-induced shutdown-down necessitating a five-minute wait before it can be restarted. If Siegfried is turned off before the delay period for plate power expires, this five-minute wait can be avoided.

Operation

The operation of the Siegfried is straightforward. There are two basic ways to use the amplifier. One way to use Siegfried is as a basic amplifier, with all system control functions being performed with a pre-amplifier. To use Siegfried this way, one would turn the level control on Siegfried to the maximum clockwise position.

Siegfried can be used without a pre-amplifier if the audio system incorporates only one high-level signal source, such as a CD player. The level control on Siegfried can then serve as the system volume control. Using Siegfried in this way provides the highest-quality reproduction because the pre-amplifier and one set of interconnect cables are removed from the signal path.

The Zero-Feedback Single-Ended Amplifier --A Primer

The zero-feedback single-ended triode amplifier has gained a following from music lovers who feel that high-quality sound reproduction at natural levels is more important than reproduction at loud levels. To these listeners, midrange quality is more important than room-shaking bass.

The single-ended amplifier uses a single output tube, or several in parallel that act as one, to amplify both the positive and negative polarity portions of the music signal. In contrast, most amplifiers are configured so that the positive polarity of the signal is amplified by one output device and the negative polarity is amplified by another device. This second type of amplifier is termed push-pull, and the music signal is handed from one device to the other, and back again with each cycle of the frequency being amplified.

Triodes are usually used in single-ended circuits because they are relatively linear voltage amplifying devices and they have low output impedance for good speaker damping. Although triodes are more linear than other devices, they do exhibit compression at the high-voltage, low-current portion of their transfer characteristics. This compression results in low-order harmonic distortion on the order of 5% for large voltage swings. This distortion could be largely eliminated by using negative feedback, but most listeners find that feedback introduces more problems than it solves.

Features and Specifications

In 1996 Berning introduced a radically new technology (US patent no. 5,612,646) for tube amplifiers that eliminated the problematic audio-output transformer. This amplifier was designated the ZH270, and it is a push-pull design. The ZH270 was the first amplifier using all-tube amplification that properly matches the high-voltage, low-current operating parameters of vacuum tubes to the low-voltage, high-current drive requirements of dynamic loudspeakers without using audio-output transformers.

Both the ZH270 and Siegfried use radio frequency to change the voltage-current transfer characteristics of the output tube from its normal impedance-plane to one suitable for driving a dynamic loudspeaker. The radio-frequency remapping is implemented using special high-frequency power conversion techniques. The high-voltage, low-current tube impedance plane is remapped to the high-current speaker impedance plane through a special transformer at a constant RF carrier frequency of 250 kHz. Because the audio signal is riding on a carrier, it is not subject to parasitic elements of the transformer that would otherwise distort the audio signal. There is no lower-frequency limit for this

impedance conversion, and Siegfried is dc-coupled, although dc-offset-null servo circuits prevent dc from being fed to the speakers.

The effective turns ratio of the audio-output transformer determines the impedance matching between the output tube and speaker in the conventional amplifier. In Siegfried, this matching is precisely determined by the effective turns ratio of the RF conversion transformer. Audio-output transformers have a limited impedance conversion range imposed by the parasitic elements, and this is especially true of gapped transformers for single-ended circuits. Audio-output transformers also have limits imposed by voltage breakdown between primary and secondary windings, and the required insulation also affects the parasitics elements adversely. It is difficult to make a high-fidelity transformer with much more than a 25:1 overall primary-to-secondary turns ratio for the above reasons. These restrictions are eliminated in Siegfried, and an effective overall turns ratio of 80:1 is used. The effective plate loading on the SV 811-10 output tube in Siegfried is 38 kΩ (with a 6 Ω speaker connected). A high turns ratio is desirable because the output tube operates in a more linear region, and with more efficiency, than it does with lower ratios. This ratio also determines the output impedance of the triode amplifier when negative feedback is not used, and the higher the ratio, the lower the output impedance. The 300B version of Siegfried uses an effective turns ratio of 30:1, as this tube is designed for much lower voltage operation than the SV 811-10. The plate loading is 7 kΩ when an 8 Ω speaker is used.

Audio-output transformer-coupled amplifiers should not be operated without a load connected because the inductance of the transformer's primary winding can cause the plate voltage reach a sufficiently high voltage to break down insulating materials, resulting in amplifier failure and even fire. Siegfried can, however, be operated safely without a load, as the voltage cannot exceed its normal designed-in operating voltage.

Siegfried uses a regulated resonant switching power supply to achieve extremely low hum levels. This supply operates at 250 kHz. An important side benefit is that the heaters of the output tubes are heated with this RF through properly configured center-tapped transformers. No hum is generated, and the tubes have the proper equipotential cathodes with their true transfer function.

Siegfried follows other Berning designs in that the tubes are operated at lower temperatures for long life. The SV 811-10 output tubes are operated at a plate dissipation of 31.5 watts, where as they are rated for 65 watts.

The audio portion of Siegfried is constructed using point-to-point hand wiring. This extra step is necessary because it was found the high-impedance audio signals are sonically degraded by the dielectric properties of a circuit board.

Siegfried uses unusual constant-current source loads for each output tube. These are resonant power converters that are operated at resonance. When tuned to resonance they behave like high-impedance current sources. Unlike conventional current sources that

would dissipate large amounts of power as heat, these current sources actually return this power to the power supply.

Other features and specifications include:

- On-board level control -- can be used without a preamp.
- Tube complement per channel: 6SN7 differential input; 6SN7 balanced amplifier; 6J5 follower-driver; Svetlana SV 811-10 output triode or Western Electric 300B output triode.
- Single ended inputs only.
- RF ac heating of output tubes.
- No negative feedback of audio. Entire amplifier dc-feedback stabilized.
- Constant output impedance over entire audio spectrum.
- Unique brown-out protection circuitry.
- Built-in four-stage power-line filter and surge suppressor.
- Non-magnetic chassis prevents skin-effect induced distortion.
- Power consumption: 170 W
- Power required: 100-130V ac or 200-260 V ac, 50-440 Hz.
- Signal to noise: (typical) 92 dB, 20 kHz bandwidth. RF carrier: -50dB (0.5 MHz). Unweighted.
- Line-frequency hum components: 60 Hz: -94dB; 120 Hz: -100dB; 180 Hz: -104 dB.
- Distortion products (typical, into 6 Ω load): 4% 2nd harmonic, 1.5% 3rd harmonic, 0.23% 4th harmonic; 0.26% 5th harmonic; 0.16% 6th harmonic, at 10 watts output (THD=4.3%). These products are reduced at lower output power.
- SV 811-10 Typical output power (per channel) at onset of clipping: 6 Ω - 12 W; 8 Ω - 10W; 4 Ω - 8 W
- 300B Typical output power (per channel) at onset of clipping: 8 ohms - 7 W; 16 Ω - 5W; 4 Ω - 4 W.
- Full power bandwidth (-3dB), 6 Ω: 0.2 Hz to 34 kHz, (-1.5dB 20 kHz)
- Typical cross talk, At 1 kHz: -60dB; 10 Hz: -42 dB; 100 Hz: -57 dB; 10 kHz: -43 dB.
- Typical output impedance (measured at 1 A, 60 Hz): 1.5 Ω.
- Sensitivity: 0.6V RMS for 10 W out.
- Input impedance: 50 kΩ.
- Size: 33 cm wide, 43 cm deep, 23 cm high (13 X 17 X 9 inches), not including connectors.
- Net weight: 8.2 kg (18 lb.).
- Finish: black anodized aluminum with gold-plated brass tube cage.

240 Volt / 120 Volt Operation

Siegfried is normally supplied for 120 V operation. Conversion to 240 V operation is done by removing the jumper on the circuit board labeled "120 V JUMPER". This

jumper is located near the rear of the circuit board, and slightly left of the center. Conversion back to 120 V is done by replacing the jumper.

Amplifier Channel Strapping and Bridged Configuration

The two channels of Siegfried can be wired in parallel to make a mono-block unit if more power is desired. To strap the channels together, the plus speaker terminals are connected together and the left and right inputs are connected together. The minus speaker terminals are internally connected together. Both the input impedance and the output impedance are cut in half by the strapping operation. The strapping procedure results in an amplifier that delivers typically 20 W into 3 ohms or 12 W into 8 ohms with lower distortion.

Siegfried can be used in a bridge configuration by applying a positively phased signal to one channel and a negatively phased signal to the other channel (these signals are available from a signal source that has true balanced output), and then connecting the speaker between the plus terminals of the two channels. The SV 811-10 version of Siegfried so configured can deliver 20 watts to a 16 ohm speaker, where as normally it can delivery only 5 watts into 16 ohms. This bridging doubles the output impedance to 3 ohms, and largely cancels 2nd harmonic distortion due to the balanced operation of the output stage.

Calibration Procedure

Siegfried does not have any bias adjustments as biasing is automatic. There are, however, two variable inductors (one in each channel) that tune the resonant constant-current sources for the output tubes. There are tuned at the factory and normally do not ever need to be calibrated. As long as Siegfried is operated from a nominal line voltage of 120 V (jumper installed) or 240 V (jumper removed), these inductors should not need to be adjusted. If the amplifier is operated from a substantially different voltage, such as 100 V, the current sources should be retuned to obtain maximum output power.

Each inductor is tuned by sliding the band that holds the inductor winding up or down to change the flux field near an air gap. These inductors are located towards the front and left side of the power converter circuit board, and are labeled L103 for the left channel L203 for the right channel.

To tune each channel, an oscilloscope, sine-wave generator, and a 6-Ω, 15 watt load resistor are required. Connect the generator to the left-channel input and set its frequency to about 1 kHz. Connect the load resistor and oscilloscope to the left-channel output. Adjust the level so that the amplifier just begins to clip. Slide the band with the coil on L103 for maximum negative voltage excursion on the sine wave. Readjust the level if necessary. When properly adjusted, amplifier clipping should be symmetric with the 6-Ω load. Repeated this procedure for L203 with the connections changed to the right channel. Repeat the left-channel, and then the right-channel adjustments once again.

For the 300B version of Siegfried, an 8-ohm resistor should be used.

Limited Two-Year Warranty *

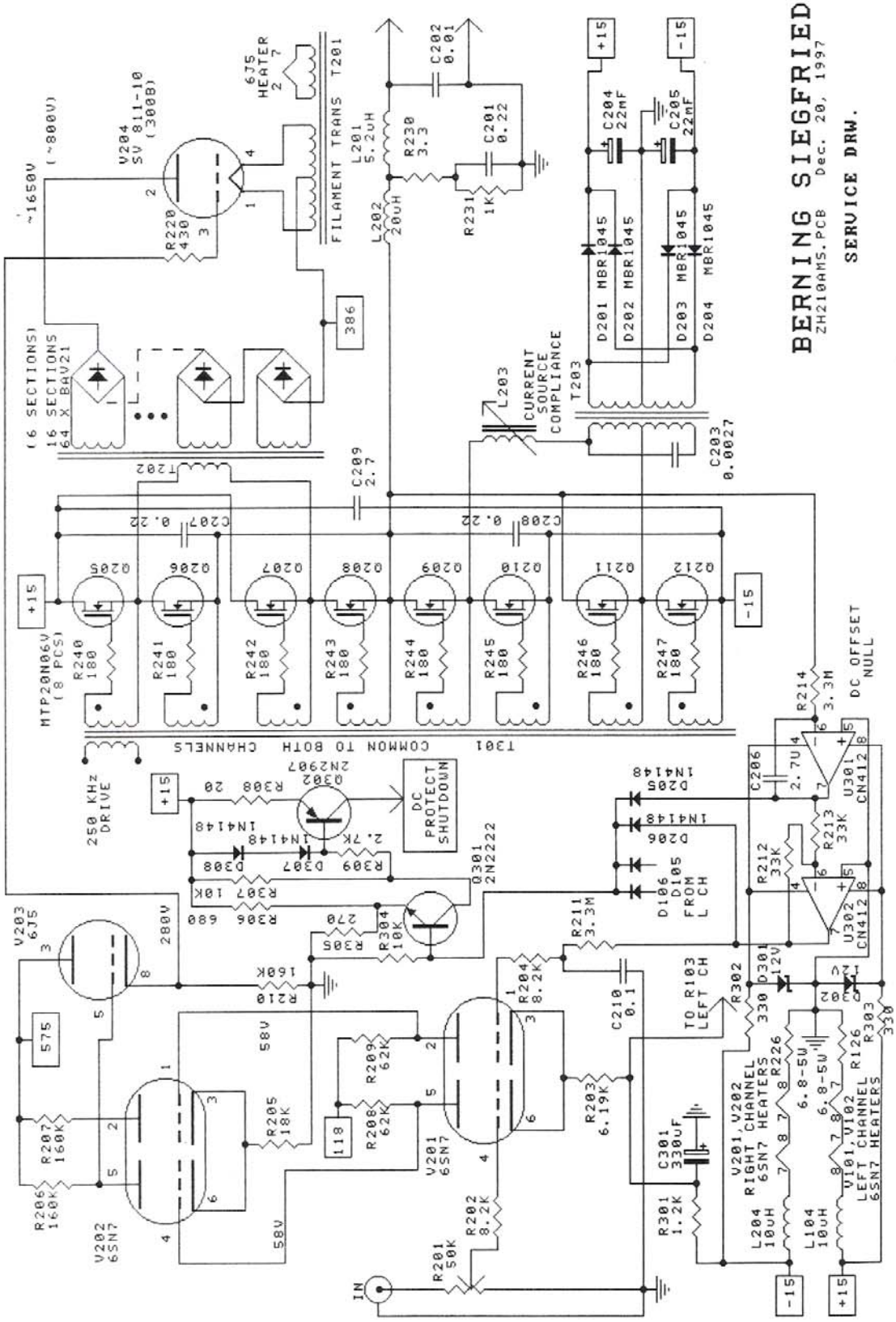
1. Your new Berning product is covered by a limited two-year warranty against defects in material and workmanship. Any repairs required will be made at no charge within the first two years after purchase as a new unit.

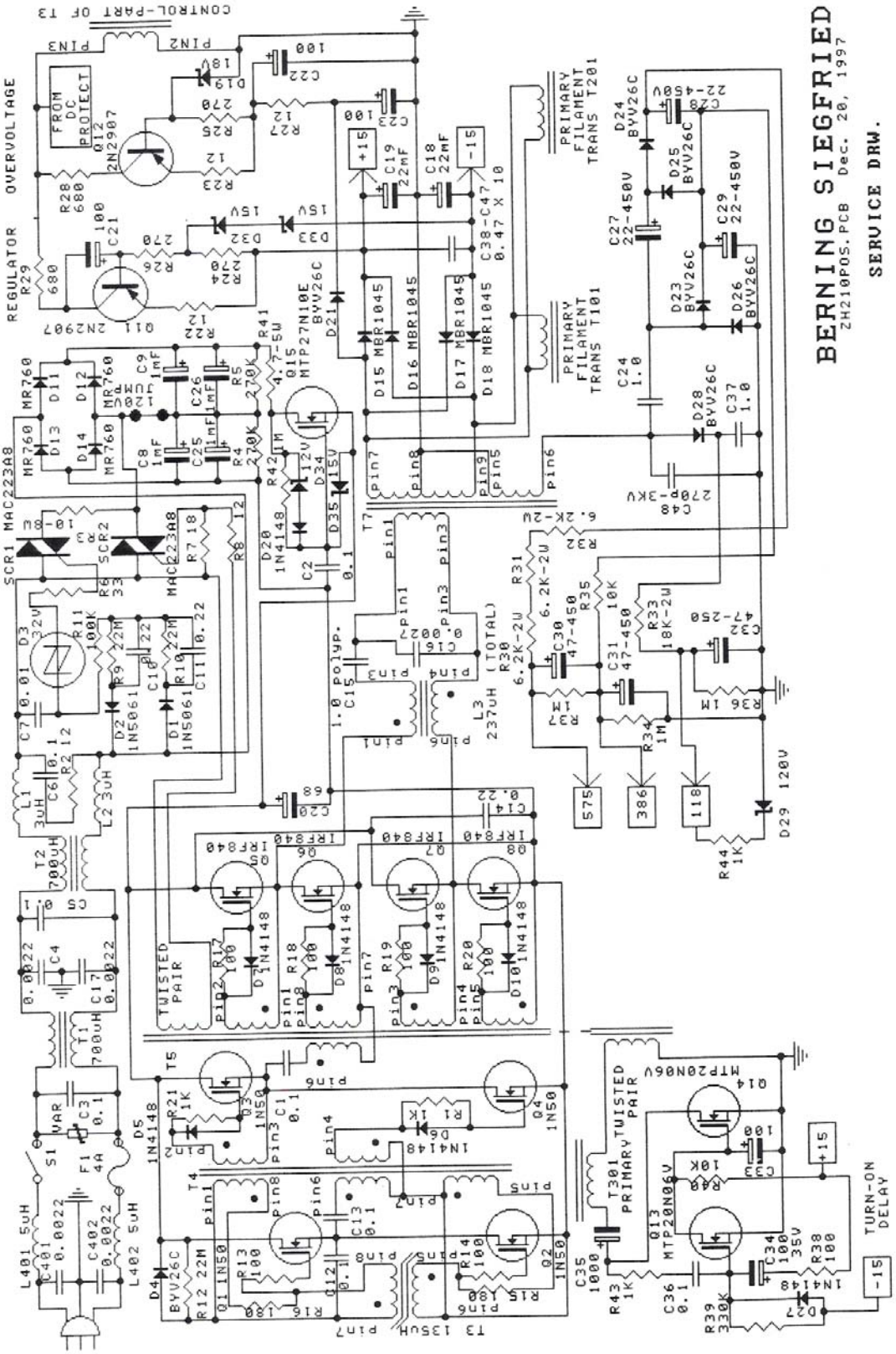
2. Any units returned for warranty repair must be shipped prepaid after receiving return authorization from the David Berning Company. For safe handling, and if at all possible, the unit should be shipped in its original carton. If such is not possible, the unit should be well packed with particular attention paid to protection of all corners and avoidance of any looseness in the carton. If desired, a new shipping carton can be purchased from the David Berning Co. Return transportation will be paid by the David Berning Co.

3. This warranty does not apply to damage resulting from physical abuse or unauthorized alterations or repairs; or damage to exterior finish resulting from careless use. The warranty is void if the serial number has been removed, altered, or defaced.

4. The David Berning Co. reserves the right to improve or change its products without obligation to modify previously manufactured units.

* Applicable for domestic sales only. Handling and shipping costs preclude extension of this warranty to overseas sales.


BERNING SIEGFRIED
ZH210AMS.PCB Dec. 20, 1997
SERVICE DRW.
~1650V
V204 SV 811-10 (3008)
6J5 HEATER
FILAMENT TRANS T201
L201 5.2uH
L202 20uH
R230 3.3
R231 1K
C201 0.22
C202 0.01
R220 430
386
16 SECTIONS 64 X BAV21
16 SECTIONS
T202
C209 2.7
C207 0.2
C208 0.2
L203
CURRENT SOURCE COMPLIANCE
T203
C203 0.0027
D201 MBR1045
D202 MBR1045
D203 MBR1045
D204 MBR1045
C204 22nF
C205 22nF
+15
-15
MTP20N06V (8 PCS)
Q205
Q206
Q207
Q208
Q209
Q210
Q211
Q212
R240 180
R241 180
R242 180
R243 180
R244 180
R245 180
R246 180
R247 180
T301 COMMON TO BOTH CHANNELS
250 KHz DRIVE
Q302 2N2907
R308 20
R309 2.7K
D307 IN4148
D308 IN4148
DC PROTECT SHUTDOWN
Q301 2N2222
R307 10K
R306 680
R305 270
R304 10K
D205 IN4148
D206 IN4148
D106 D105 FROM L CH
R211 3.3M
R214 3.3M
DC OFFSET NULL
C206 2.7U
U301 CN412
R213 33K
R212 33K
U302 CN412
V203 6J5
280V
R210 160K
575
R207 160K
R206 160K
V202 6SN7
58V
R205 18K
118
R209 62K
R208 62K
V201 6SN7
R204 8.2K
R203 6.19K
C210 0.1
TO R103 LEFT CH
R302 330
D301 12V
R303 330
R202 8.2K
R201 50K
IN
R301 1.2K
C301 330UF
V201,V202 RIGHT CHANNEL 6SN7 HEATERS
R226 6.8-5W
L204 10uH
V101,V102 LEFT CHANNEL 6SN7 HEATERS
R126 6.8-5W
L104 10uH


BERNING SIEGFRIED
ZH210POS.PCB Dec. 20, 1997
SERVICE DRW.