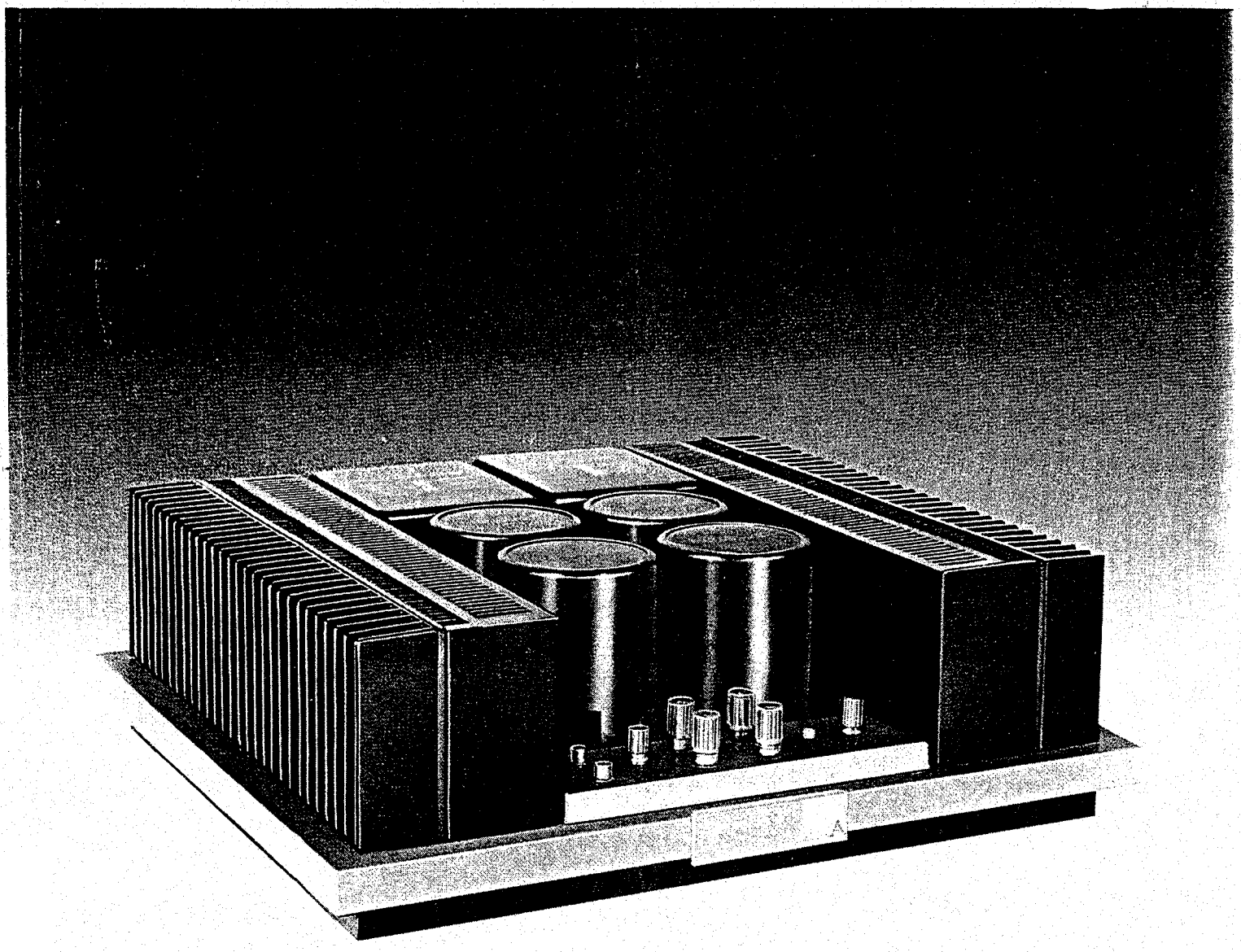
STEREO POWER AMPLIFIER

M-22

SERVICE MANUAL



PIONEER

1. SPECIFICATIONS

Semiconductors

Transistors 44
Diodes . . . . . 66(KL-type), 65(N-type)

Amplifier Section

Circuitry . . . . . 2-stage Differential push-pull, 2-stage Darlington connection, parallel push-pull, direct-coupled OCL (Class-A operation)

Continuous Power Output from 10 Hertz to 30,000 Hertz (Both channels driven) . . . . 30 watts per channel (8 ohms)
Total Harmonic Distortion at 10Hz to 30,000Hz
Continous rated power output 0.01%
15 watts per channel power output, 8 ohms . . . 0.005%
1 watt per channel power output, 8 ohms 0.005%
Intermodulation Distortion (50Hz: 7kHz = 4:1)
Continuous rated power output 0.01%
15 watts per channel power output, 8 ohms 0.01%
1 watt per channel power output, 8 ohms 0.01%
Frequency Response . . . . . 2Hertz to 150,000Hertz $^{+1}_{-3}$dB
Input (Sensitivity/Impedance)
INPUT 1V/50kilohms
Output
SPEAKER . . . . . 8 ohms
Damping Factor (20Hertz to 20,000Hertz, 8 ohms) . . . 60
Hum and Noise (IHF, short-circuited, A network) . . 106dB

Miscellaneous

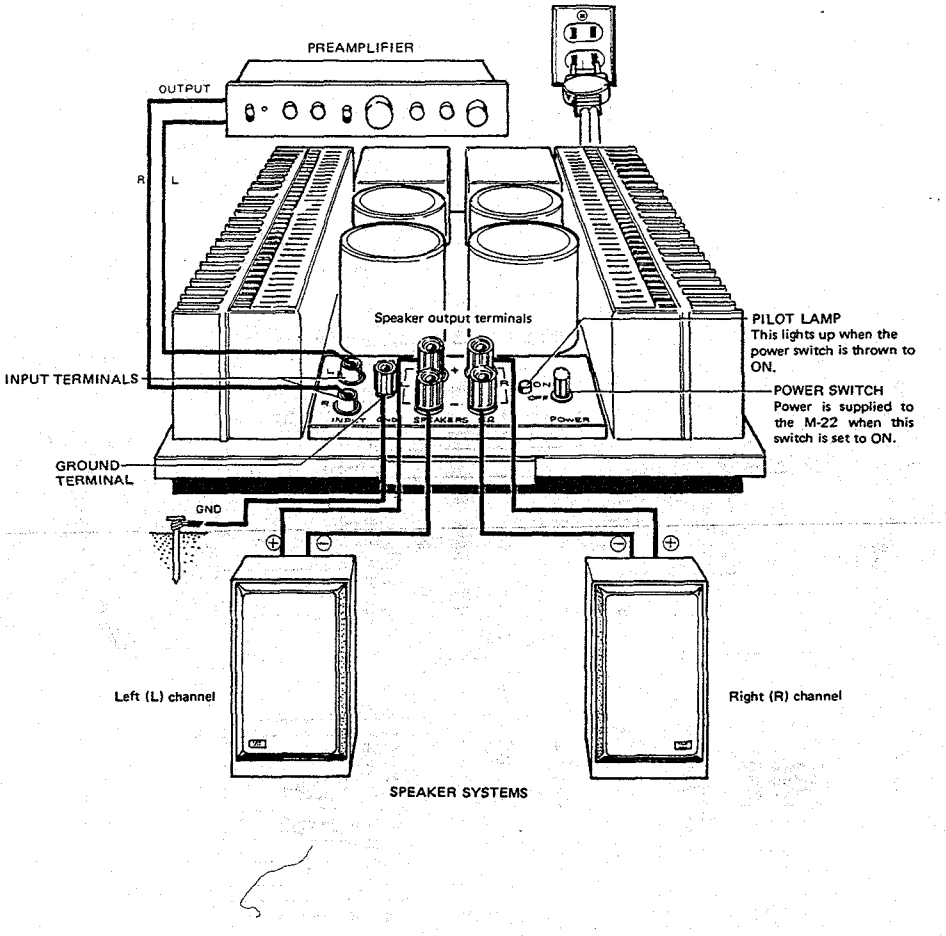
Power Requirements . . . . . 120V 60Hz (KL-type)
220V 50/60Hz (N-type)
Power Consumption. . . . . 280 watts (UL)
Dimensions . . . . . 420(W)x153(H)x370(D) mm
16-9/16 - 6-1/32 - 14-9/16 in.
Weight Without Package: 22kg (48 lb 7 oz)
With Package: 24.7 kg (54 lb 6 oz)

Furnished Parts

Connection Cord with Pin plugs 1
Operating Instructions 1

NOTE:
Specifications and the design subject to possible modification without notice due to improvements.

2. CONNECTION DIAGRAM



MODEL M-22 COMES IN TWO VERSIONS DISTINGUISHED AS FOLLOWS:

Type	Voltage	Remarks
KL	120V only	U. S. A. model
N	220V only	General export model

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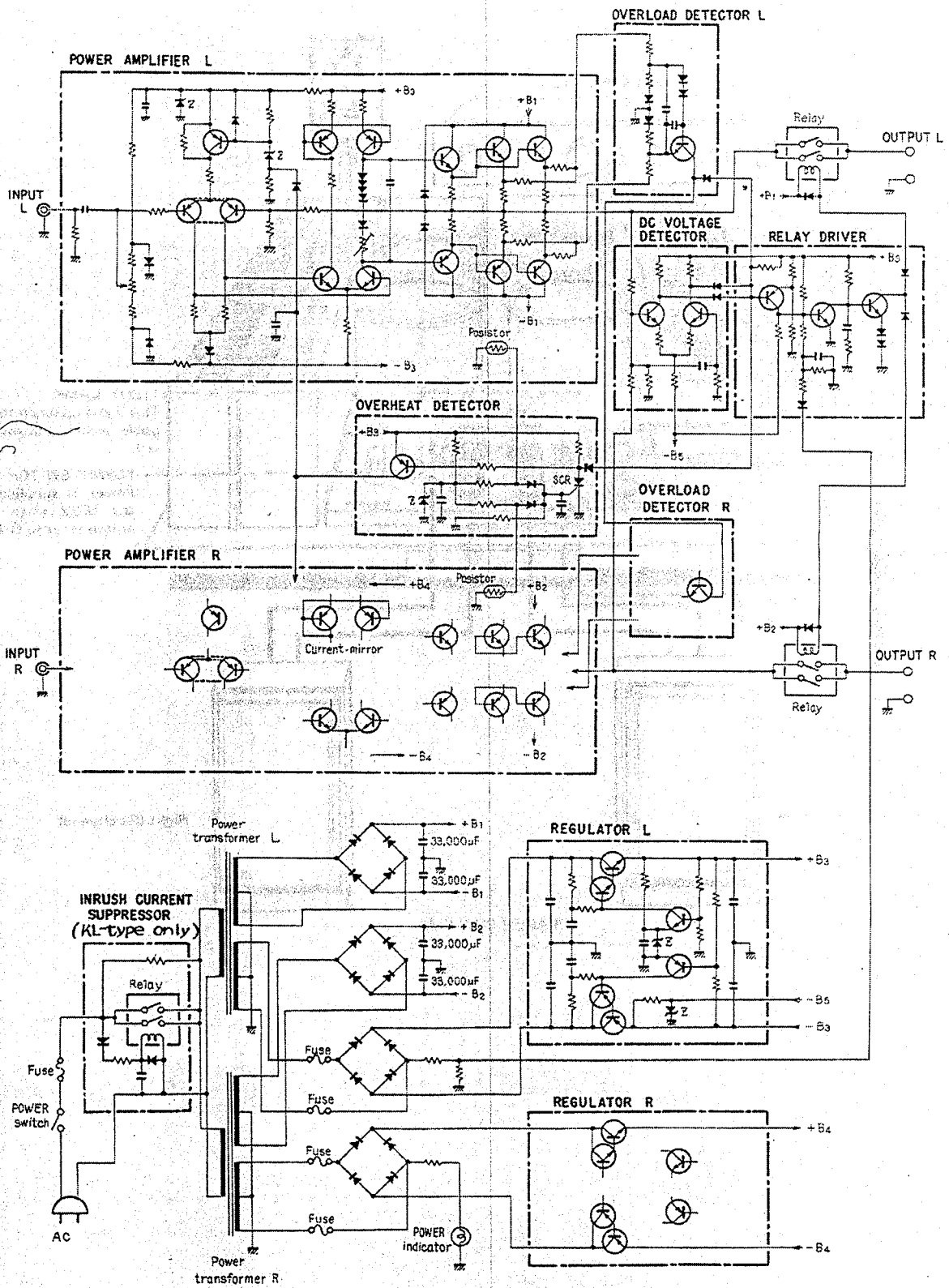
3. BLOCK DIAGRAM



4. CIRCUIT DESCRIPTIONS

4.1 AMPLIFIER SECTION

The first stage is a low noise twin transistor (Q_1) differential amplifier. The twin transistor consists of two transistors having the same characteristics mounted in a single unit. Consequently, the two transistors are subjected to the same thermal conditions and are ideal as a differential amplifier. Neutral potential drift is also suppressed by using the forward voltage of silicon diodes D_1 and D_2 which have matched temperature coefficients in the offset voltage adjustment circuit so that temperature changes are mutually cancelled.

The predriver stage is a differential amplifier (Q_2, Q_3) with current mirror (Q_4, Q_5) and is operated as a push-pull amplifier. The base of Q_4 is connected to the collector and is equivalent to a diode.

The base-to-emitter voltage generated at Q_4 by the collector current of Q_2 forward biases Q_5. Q_4 and Q_5 are the same type, and if R_{14} and R_{15} are equivalent, the emitter current of Q_4 and Q_5 also becomes equivalent. If the common emitter current transfer ratio of Q_4 and Q_5 is made sufficiently large, the collector current of Q_5 equals the collector current of Q_2. Therefore, Q_3 and Q_5 are operated in a push-pull arrangement.

The power stage is a 2-stage Darlington connection SEPP.

The final stage power transistors are connected in parallel.

The idle current is 0.85A/transistor. Operation is Class A.

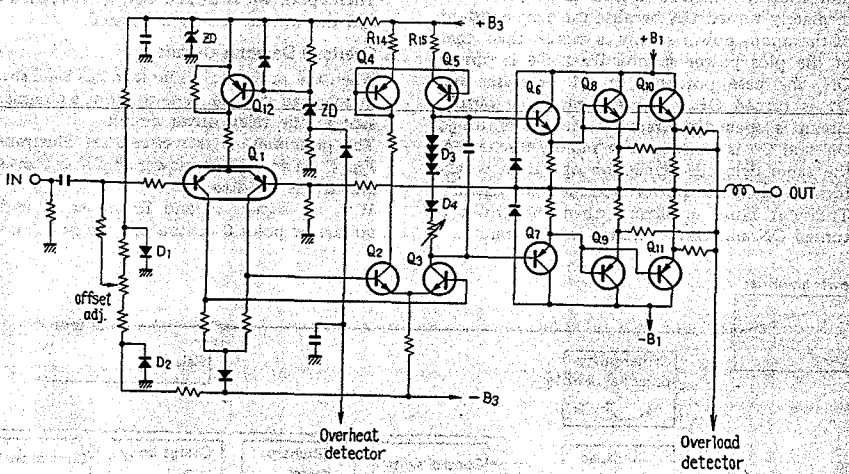


Fig. 1 Basic circuitry of power amplifier

4.2 PROTECTION CIRCUIT

The amplifier and speakers are safeguaded by a protection circuit which employs a relay to automatically open and close the output circuit. This circuit consists of four parts (Fig. 2).

1. Relay Driver Circuit (Fig. 3)

This circuit controls the operation of the relay. Delay connection at power ON and muting at power OFF and disconnection (see items 2 ~ 4) based on commands from the detection circuits are performed by this circuit.

Muting Operation

When the power is turned ON, the base of Q6 is reverse biased and Q6 remains OFF. Q5 also normally remains OFF. When C4 is charged thru R22 and R23, the base potential of Q7 rises and Q7 is turned ON. Current then flows in the relay coils (RL2, RL3), the relay contacts are closed and the output circuit is connected. When the power is turned OFF, the base of Q6 is momentarily forward biased and Q6 is immediately turned ON because the time constant of the minus power supply is shorter than that of the plus power supply. When Q6 is turned ON, the base potential of Q7 decreases and Q7 is turned OFF. Consequently, the output circuit is opened. Moreover, since Q6 is turned ON and C4 is subsequently rapidly discharged, the same delayed connection operation is performed when the power is turned ON again. Transient noise occurring when the power is turned ON and OFF is muted in this manner.

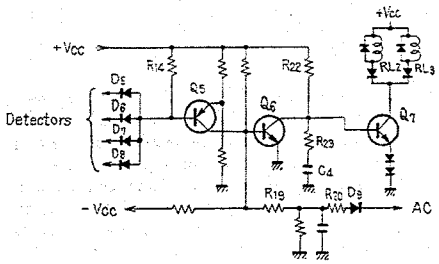


Fig. 3 Relay driver circuit

Operation by Detector Circuit Command

Detector circuit commands are actually current flowing in D5, D6, D7 or D8. Normally, Q5 is in the OFF state. When current flows in D5, D6, D7 or D8, a voltage is generated across R14. This voltage forward biases Q5 turning it ON. Thereupon, Q6 is turned ON, Q7 is turned OFF and the output circuit is opened.

2. Overload Detector Circuit

When the power amplifier load has been shorted or the load impedance is too low, a command is sent to the relay driver circuit.

The principles of this circuit are illustrated in Fig. 4. Qa and Qb are power amplifier transistors and R_L is the load.

With no signal, Ia and Ib are equal and the voltage at point C (output neutral point) is zero.

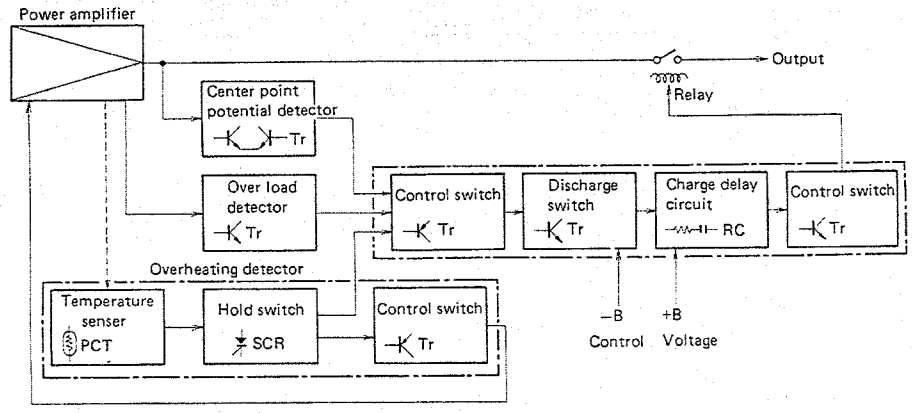


Fig. 2 Block diagram of protection circuit

The voltage at point D is the voltage at point A divided by R1 and R3. The voltage at point E is the voltage at point B divided by R2 and R4. The potential difference between point D and point E is applied between the base and emitter of Q1 thru D3 and D4. However, since this potential difference is lower than the sum of V_F (forward voltage) of D3 and D4 and V_{BE} (base-to-emitter voltage) of Q1, base current doesn't flow at Q1 so Q1 is turned OFF.

At the positive half cycle of the signal, Ia increases, Ib decreases, their difference flows through R_L and a positive voltage is generated at point C.

Since Qa and Qb are operated in a Class A push-pull configuration, the amount of increase of Ia and the amount of decrease of Ib are equal, and the potential difference between point A and point B remains the same as with no signal. Since D2 is turned OFF by a rise in the voltage at point B, the voltage at point E becomes almost equal to that at point B. Therefore, the difference in potential between point D and point B is applied to the base of Q1 thru D3 and D4. Since the difference between Ia and Ib becomes greater as R_L is made smaller, the potential difference between point A and point C becomes larger. Consequently, if R_L is too small, the level shift by V_F of D3 and D4 is exceeded, current flows in Q1 turning it ON. This causes current to flow in D5. This current becomes a command to the relay driver circuit. If R_L is sufficiently large, the voltage of point E becomes higher than that of point D, Q1 is reverse biased and is turned OFF.

At the negative half cycle of the signal, Ib increases, Ia decreases, their resultant current flows through R_L and a negative voltage is generated at point C.

Since D1 is turned OFF by the voltage drop at point A, the voltage of point D becomes almost equal to that at point A. Therefore, the difference of potential difference between point A and point E is applied to the base of Q1 thru D3 and D4. Since the difference between Ia and Ib becomes greater as R_L is made smaller, the potential difference between point B and point C becomes larger. Consequently, if R_L is too small, the level shift by V_F of D3 and D4 is exceeded, current flows in Q1 turning it ON. This causes current to flow in D5. This current becomes a command to the relay driver circuit. If R_L is sufficiently large, the voltage at point D becomes lower than that at point E, Q1 is reverse biased and is turned OFF.

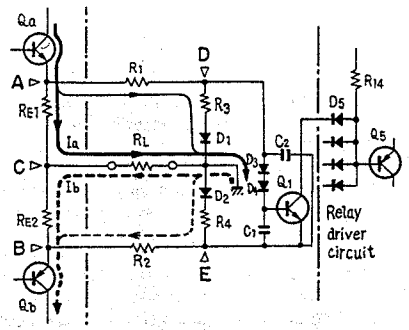


Fig. 4 Overload detector circuit

3. Center Point Potential Detector Circuit

When a DC potential is generated at the output center point of the power amplifier, a command is sent to the relay driver circuit. The principles of this circuit are illustrated in Fig. 5. Q3 and Q4 form a differential amplifier. Therefore, there is no output even if the same input is applied to the base of both transistors. The output center point is normally only an AC signal. Since the reactance of C2 is sufficiently low, the same signal is applied to Q3 and Q4 and no output appears at their collectors.

When a DC potential is produced at the output center point, input is only applied to Q3. If this DC potential is positive, the collector current of Q3 increases and the collector current of Q4 decreases. Therefore, the collector voltage of Q3 drops and current flows in D7. If the DC voltage produced at the output center point is negative, the collector current of Q4 increases. Therefore, the collector voltage of Q4 drops and current flows in D6.

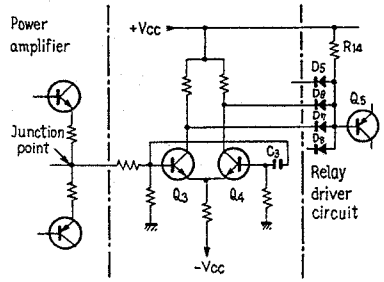


Fig. 5 Center point potential detector

4. Overheating Detector Circuit

This circuit detects overheating of the heat sink for the power transistors.

A PCT (Positive Coefficient Thermistor) is used as the sensor. When the temperature of the PCT exceeds the rated temperature, its resistance increases abruptly.

Q9 and Q10 in Fig. 6 are the first stage of the power amplifier. Q8 is normally in the OFF state and Q9 provides constant-current drive for the differential amplifier (Q10).

The PCT is mounted at the heat sink and its resistance increases abruptly when the temperature of the heat sink exceeds the specified value. Thereupon, the gate voltage of the SCR (Silicon Controlled Rectifier) exceeds the trigger voltage and the SCR is turned ON. This causes current to flow in D8. This current is sent to the relay driver circuit as a command. Moreover, at this time Q8 is also turned ON and the base voltage of Q9 increases and Q9 is turned OFF. This causes the power amplifier to be placed in the cutoff state, almost no current flows in the power transistors and the excessive calorific value is reduced.

Once turned ON, the SCR remains ON as long as the current does not fall below the holding current. Therefore, once this detector circuit has been operated, the output circuit remains open and the power amplifier remains in the cutoff state even if the temperature of the heat sink falls below the specified temperature. The power must be turned OFF to reset the detector circuit.

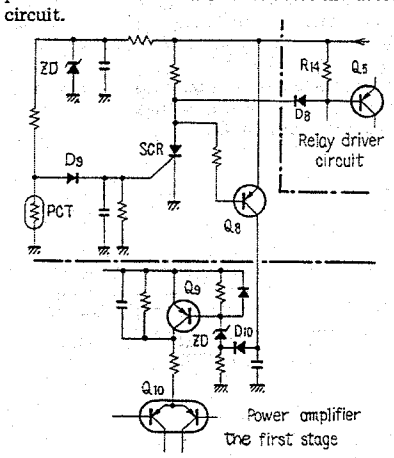


Fig. 6 Overheating detector circuit

4.3 POWER SUPPLY CIRCUIT

Two power transformers are used and the power amplifier power supplies are independent for the left and right channels.

Positive and negative voltages are supplied to the power stage by a bridge rectifier and 33000μF (×2) capacitors. Positive and negative voltages are supplied to the drive stage from separate windings (other than those used for the power stage) by a bridge rectifier and plus and minus voltage regulators.

Inrush Current Suppressor Circuit

NOTE:
This circuit is only applicable to model (KL-type) having 120V primary voltage.

An extremely large inrush current flows in equipment having two high capacity power supplies, such as this unit, when the power is turned ON. This circuit suppresses this inrush current.

Resistor R1 is inserted in series with the primary windings of the power transformers. Since the inrush current flows thru R1 when the power is turned ON, it is suppressed substantially. When C1 is charged thru D1 and R2, the contacts of the relay are closed and R1 is shorted. The time required for this is made sufficiently shorter than the muting time of the output circuit at power ON so that normal operation is not effected.

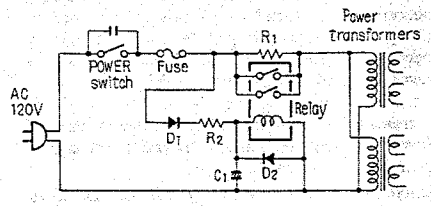
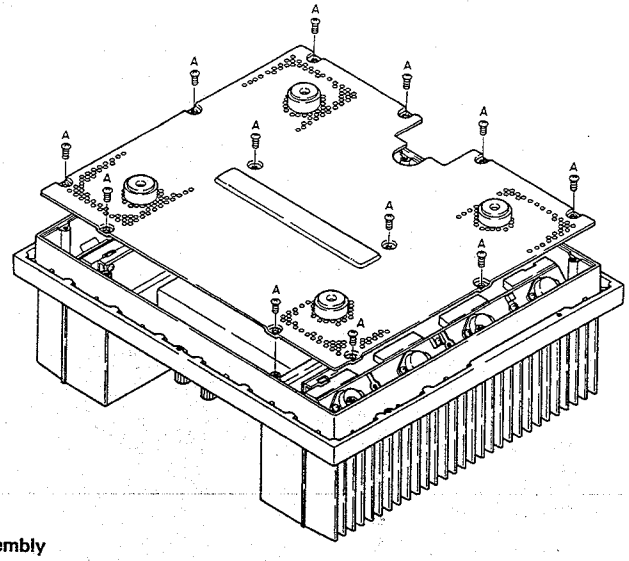


Fig. 7 Inrush current suppressor circuit

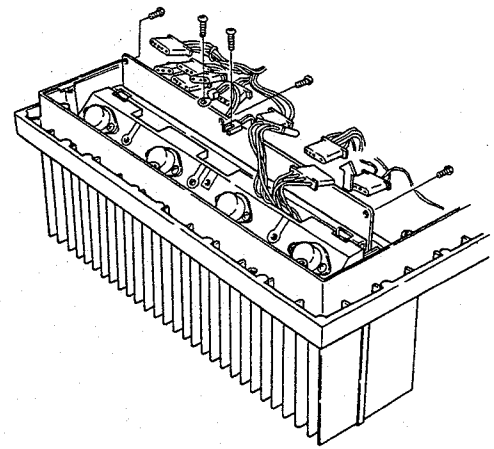
5. DISASSEMBLY

Remove the 12 mounting screws(A) at the bottom plate and lift off the bottom plate.

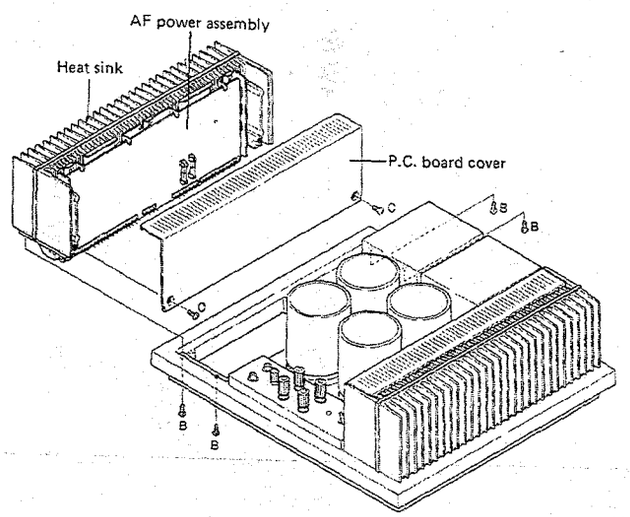


AF Power Assembly

Disconnect the connectors and remove the 5 screws. Pull off the P.C. board.

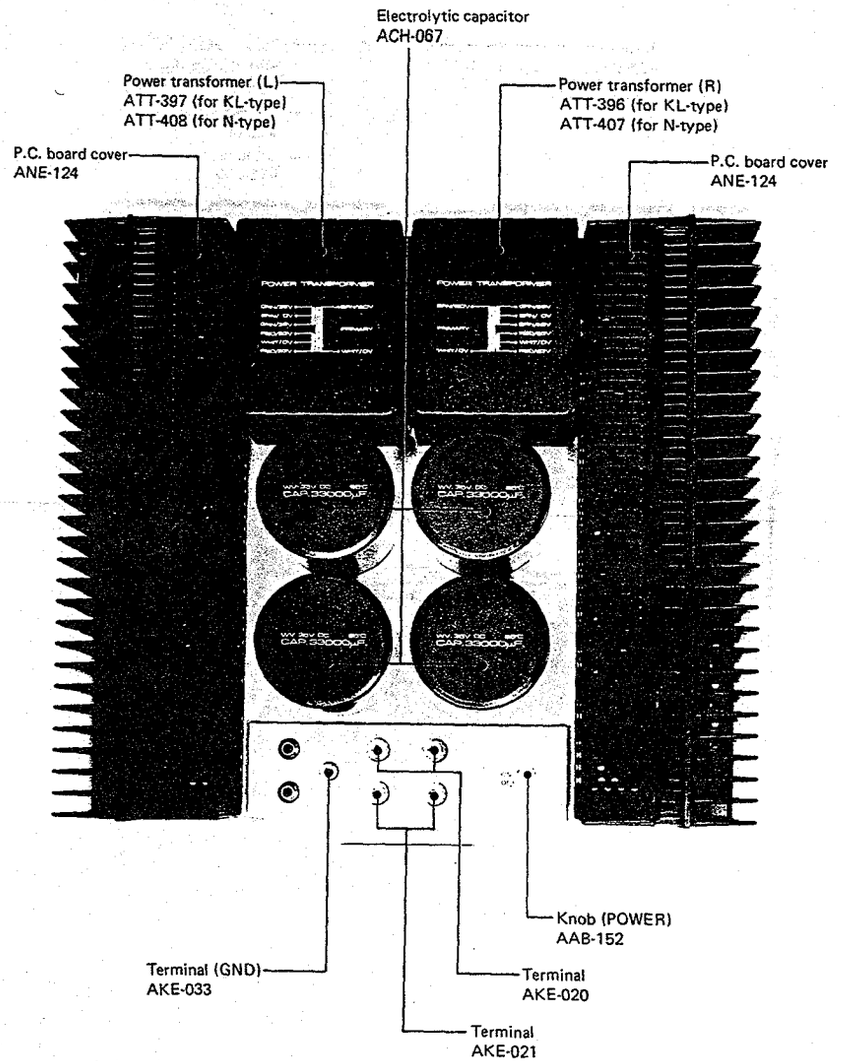


Heat Sink
Remove the 4 screws(B)

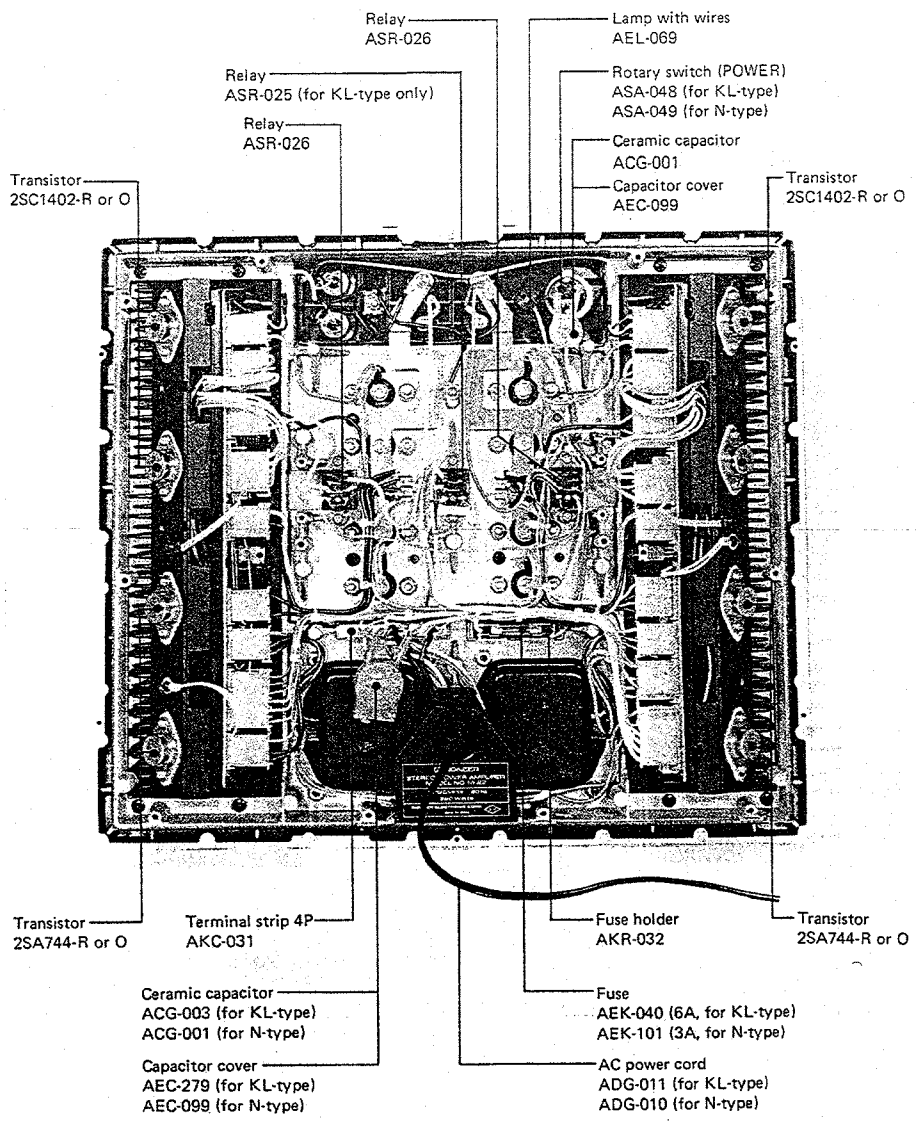


6. PARTS LOCATION

6.1 TOP VIEW



6.2 BOTTOM VIEW



7. ADJUSTMENT

- Open both the input and output terminals.
- Perform the measurement with a DC voltmeter.
- AWK-057 is the left channel printed circuit board and AWK-058 is the right channel printed circuit board.

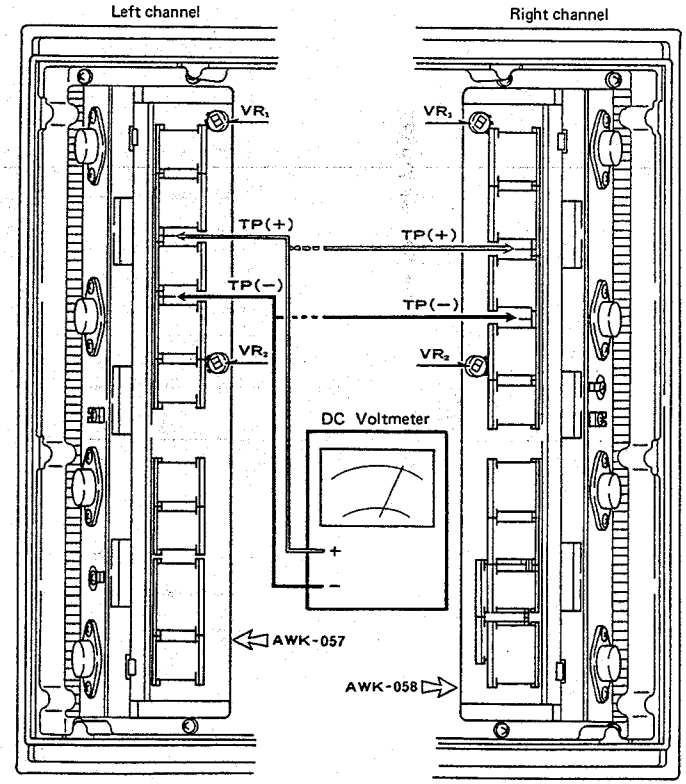
DC Balance Adjustment

Adjust VR1 for +80mV between the (+) and (—) output terminals.

Idle Current Adjustment

Adjust VR2 for 850mV between the TP terminals. Readjust after 10 minutes.

NOTE:
Idle current is 1.7A (0.85A/transistor).



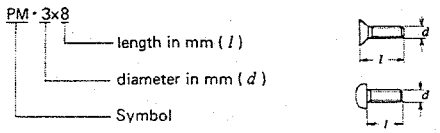
8. EXPLODED VIEW

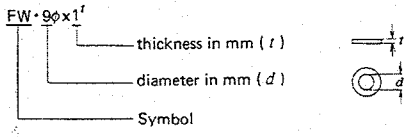
The following symbols stand for screws, washers and nuts as shown in exploded view.

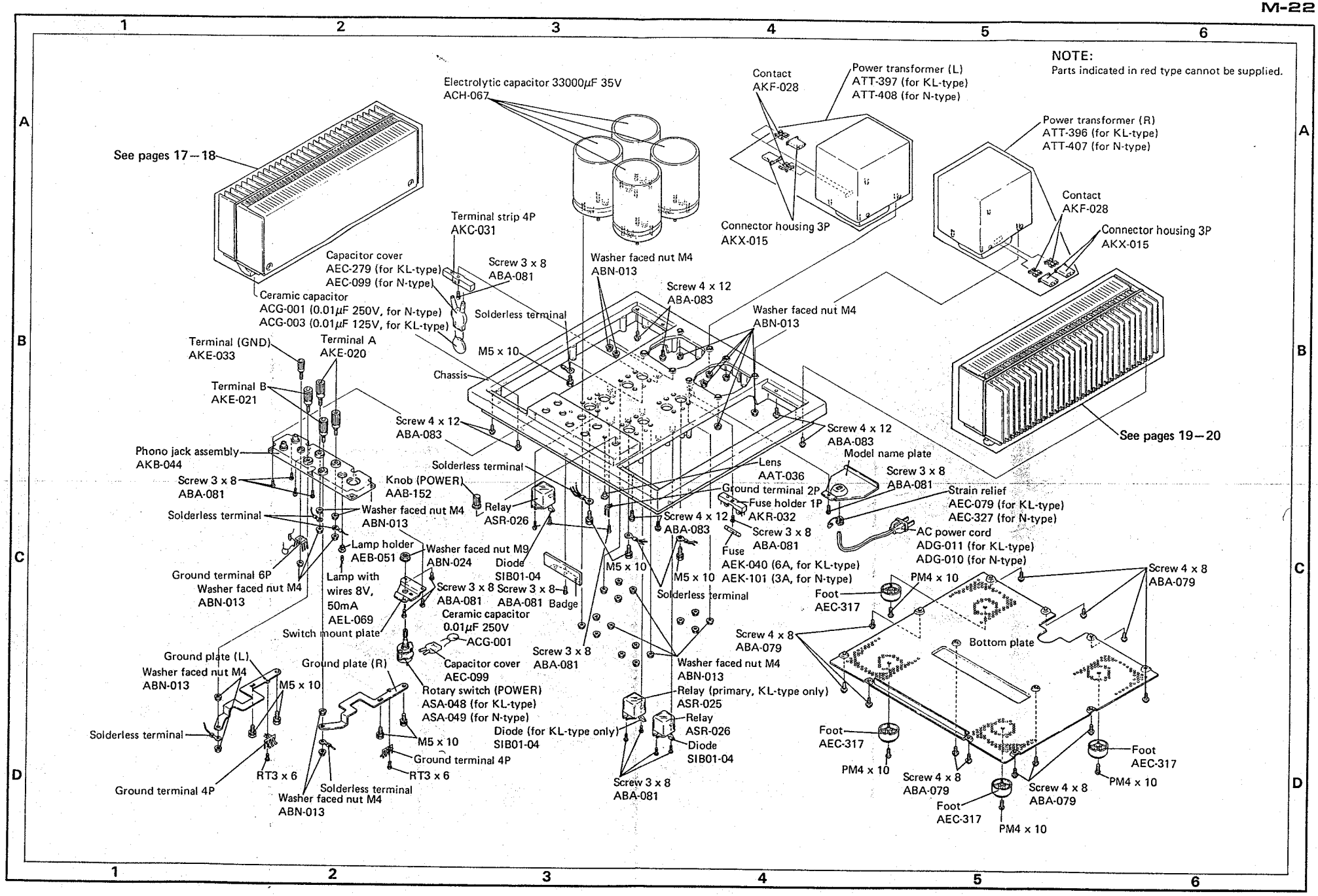
Symbol	Description	Shape
RT	Brazier head tapping screw	
PT	Pan head tapping screw	
BT	Binding head tapping screw	
CT	Countersunk head tapping screw	
TT	Truss head tapping screw	
OCT	Oval countersunk head tapping screw	
PM	Pan head machine screw	
CM	Countersunk head machine screw	
OCM	Oval countersunk head machine screw	
TM	Truss head machine screw	
BM	Binding head machine screw	
PSA	Pan head screw with spring lock washer	
PSB	Pan head screw with spring lock washer and flat washer	
PSF	Pan head screw with flat washer	

Symbol	Description	Shape
EW	E type washer	
FW	Flat washer	
SW	Spring lock washer	
N	Nut	
WN	Washer faced nut	
ITW	Internal toothed lock washer	
OTW	Outernal toothed lock washer	
SC	Slotted set screw (Cone point)	
SF	Slotted set screw (Flat point)	
HS	Hexagon socket headless set screw	
OCW	Oval countersunk head wood screw	
CW	Countersunk head wood screw	
RW	Round head wood screw	

EXAMPLE

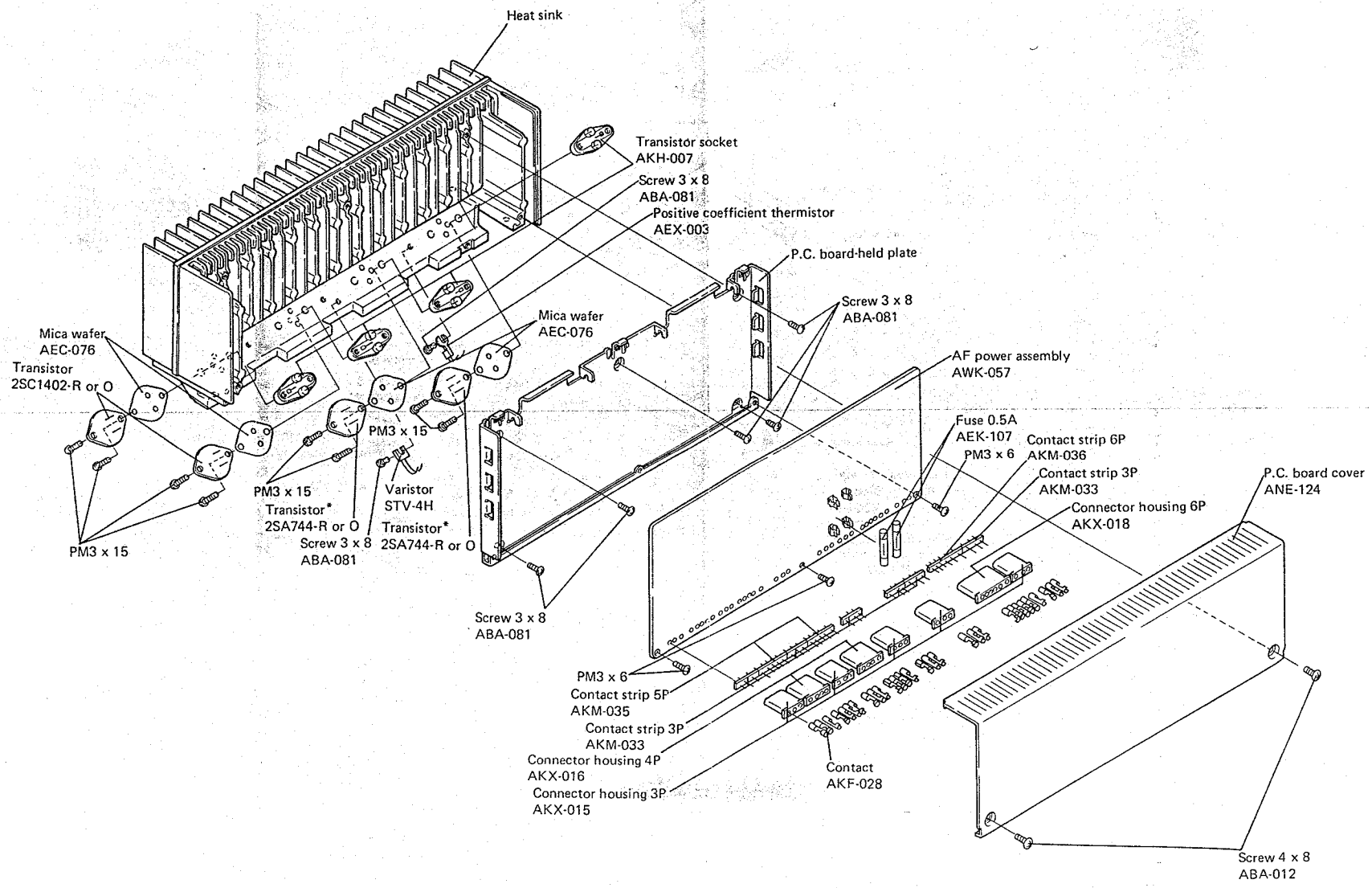





NOTE:
Parts indicated in red type cannot be supplied.
See pages 17—18
Electrolytic capacitor 33000μF 35V
ACH-067
Contact
AKF-028
Power transformer (L)
ATT-397 (for KL-type)
ATT-408 (for N-type)
Power transformer (R)
ATT-396 (for KL-type)
ATT-407 (for N-type)
Contact
AKF-028
Connector housing 3P
AKX-015
Connector housing 3P
AKX-015
Terminal strip 4P
AKC-031
Capacitor cover
AEC-279 (for KL-type)
AEC-099 (for N-type)
Screw 3 x 8
ABA-081
Washer faced nut M4
ABN-013
Screw 4 x 12
ABA-083
Ceramic capacitor
ACG-001 (0.01μF 250V, for N-type)
ACG-003 (0.01μF 125V, for KL-type)
Solderless terminal
Washer faced nut M4
ABN-013
Terminal (GND)
AKE-033
Terminal A
AKE-020
M5 x 10
Chassis
Terminal B
AKE-021
Screw 4 x 12
ABA-083
Screw 4 x 12
ABA-083
See pages 19—20
Model name plate
Phono jack assembly
AKB-044
Solderless terminal
Lens
AAT-036
Screw 3 x 8
ABA-081
Screw 3 x 8
ABA-081
Knob (POWER)
AAB-152
Ground terminal 2P
Fuse holder 1P
AKR-032
Strain relief
AEC-079 (for KL-type)
AEC-327 (for N-type)
Relay
ASR-026
Washer faced nut M4
ABN-013
Solderless terminal
Screw 4 x 12
ABA-083
Screw 3 x 8
ABA-081
AC power cord
ADG-011 (for KL-type)
ADG-010 (for N-type)
Lamp holder
AEB-051
Washer faced nut M9
ABN-024
Diode
SIB01-04
Fuse
AEK-040 (6A, for KL-type)
AEK-101 (3A, for N-type)
M5 x 10
M5 x 10
Ground terminal 6P
Washer faced nut M4
ABN-013
Lamp with
wires 8V,
50mA
AEL-069
Screw 3 x 8
ABA-081
Screw 3 x 8
ABA-081
Badge
Solderless terminal
PM4 x 10
Foot
AEC-317
Screw 4 x 8
ABA-079
Switch mount plate
Ceramic capacitor
0.01μF 250V
ACG-001
Screw 4 x 8
ABA-079
Bottom plate
Ground plate (L)
Washer faced nut M4
ABN-013
M5 x 10
Ground plate (R)
Capacitor cover
AEC-099
Screw 3 x 8
ABA-081
Rotary switch (POWER)
ASA-048 (for KL-type)
ASA-049 (for N-type)
Washer faced nut M4
ABN-013
Relay (primary, KL-type only)
ASR-025
Relay
ASR-026
Diode
SIB01-04
Diode (for KL-type only)
SIB01-04
Solderless terminal
M5 x 10
Ground terminal 4P
RT3 x 6
RT3 x 6
Ground terminal 4P
Solderless terminal
Washer faced nut M4
ABN-013
Screw 3 x 8
ABA-081
Foot
AEC-317
PM4 x 10
Screw 4 x 8
ABA-079
Foot
AEC-317
Screw 4 x 8
ABA-079
Foot
AEC-317
PM4 x 10
PM4 x 10

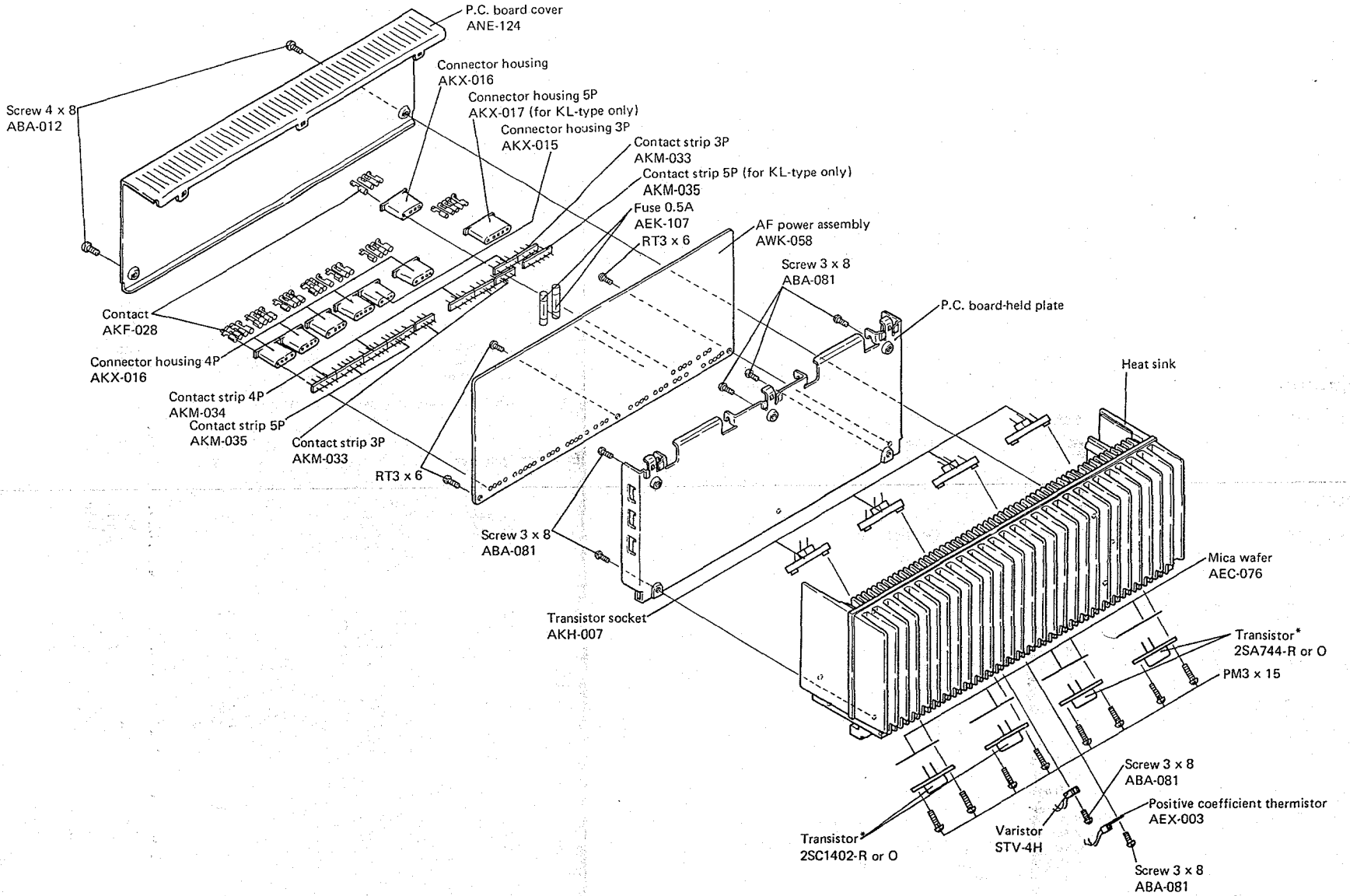
Power Amplifier Block (L)

NOTE:
Parts indicated in red type cannot be supplied.



Power Amplifier Block (R)

NOTE:
Parts indicated in red type cannot be supplied.



9. SCHEMATIC DIAGRAMS, P. C. BOARD PATTERNS AND PARTS LIST

9.1 MISCELLANEA

Miscellaneous Parts

NOTE:
- *Capacitors: in μF unless otherwise noted p:pF*
- *Resistors: in Ω, ¼W unless otherwise noted k:kΩ, M:MΩ*

FUSE

Symbol	Description	Part No. (KL-type)	Part No. (N-type)	Remarks
FU1	Fuse 6A	AEK-040	.....	
	Fuse 3A	.....	AEK-101	
FU2	Fuse 0.5A	AEK-107	AEK-107	
FU3	Fuse 0.5A	AEK-107	AEK-107	
FU4	Fuse 0.5A	AEK-107	AEK-107	
FU5	Fuse 0.5A	AEK-107	AEK-107	

TRANSFORMERS

Symbol	Description	Part No. (KL-type)	Part No. (N-type)	Remarks
T1	Power transformer	ATT-396	ATT-407	Rch.
T2	Power transformer	ATT-397	ATT-408	Lch.

CAPACITORS

Symbol	Description			Part No. (KL-type)	Part No. (N-type)	Remarks
C1	Ceramic	0.01	250V	ACG-001	ACG-001	
C2	Ceramic	0.01	250V	ACG-001	ACG-001	
C3	Ceramic	0.01	250V	ACG-001	ACG-001	
C4	Ceramic	0.01	250V	ACG-001	ACG-001	
C5	Ceramic	0.01	250V	ACG-001	ACG-001	
C6	Ceramic	0.01	125V	ACG-003	.....	
	Ceramic	0.01	250V	.....	ACG-001	

SEMICONDUCTORS

Symbol	Description	Part No.	Remarks
Q1	Transistor	2SC1402-R or O	
Q2	Transistor	2SA744-R or O	
Q3	Transistor	2SC1402-R or O	
Q4	Transistor	2SA744-R or O	
Q5	Transistor	2SC1402-R or O	
Q6	Transistor	2SA744-R or O	
Q7	Transistor	2SC1402-R or O	
Q8	Transistor	2SA744-R or O	

* hfe of these transistors (Q1 – Q8) should have the same value (mached pair).

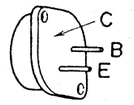
D1	Diode	SIB01-04	KL-type only
D2	Diode	SIB01-04	
D3	Diode	SIB01-04	

OTHERS

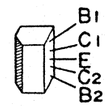
Symbol	Description	Part No. (KL-type)	Part No. (N-type)	Remarks
PL1	Lamp with wires 8V, 50mA	AEL-069	AEL-069	
S1	Rotary switch (POWER)	ASA-048	ASA-049	
RL1	Relay (primary)	ASR-025	.....	
RL2	Relay	ASR-026	ASR-026	
RL3	Relay	ASR-026	ASR-026	
	Terminal strip 4P	AKC-031	AKC-031	
	Fuse holder 1P	AKR-032	AKR-032	
	AC power cord	ADG-011	ADG-010	
R1	Carbon film resistor 2.2k ½W	RD½PS 222J	.....	

External Appearances of Transistors

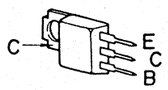
2SA744
2SC1402



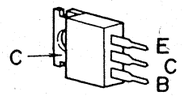
2SA798



2SB526
2SD536

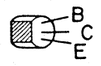


2SB507
2SD313



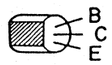
2SA898
2SC1903

2SA733
2SC945A



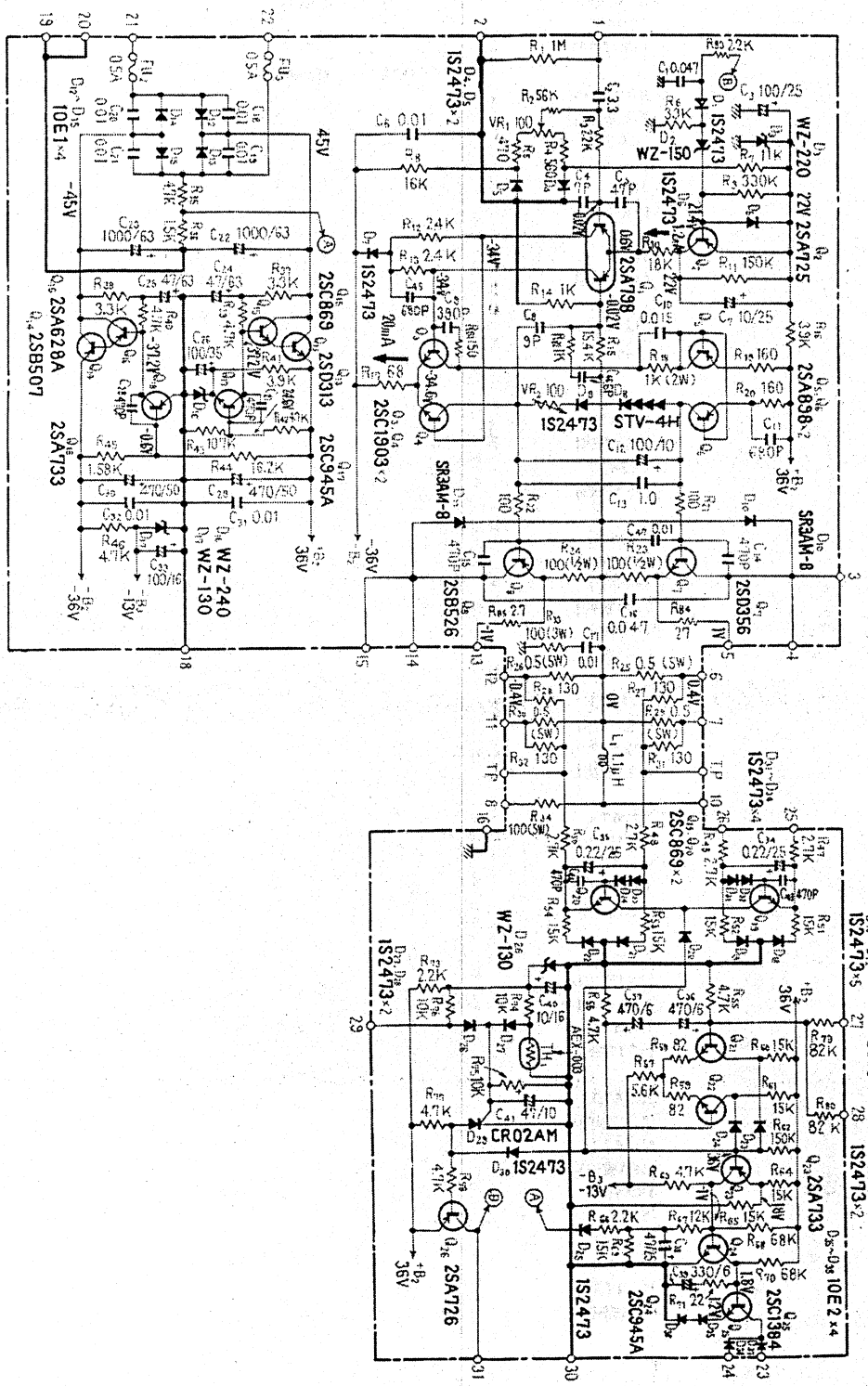
2SA725
2SA726
2SA628A
2SC869

2SC1384



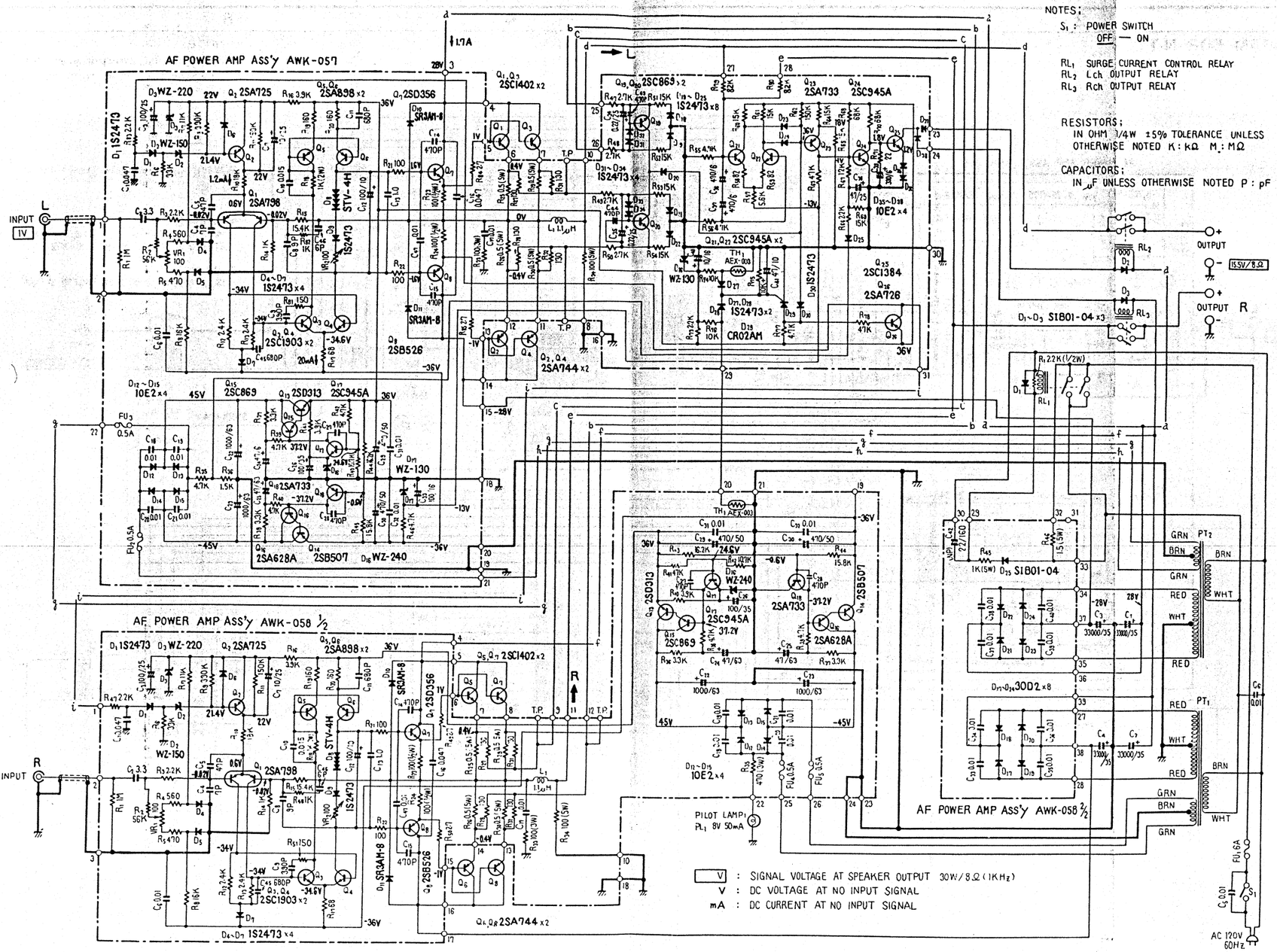
Symbol	Description	Part No.
D7	Diode	1S2473 (1S1555)
D8	Varistor	STV-4H
D9	Diode	1S2473 (1S1555)
D10	Diode	SR3AM-8
D11	Diode	SR3AM-8
D12	Diode	10E2 (1S1885)
D13	Diode	10E2 (1S1885)
D14	Diode	10E2 (1S1885)
D15	Diode	10E2 (1S1885)
D16	Zener diode	WZ-240
D17	Zener diode	WZ-130
D18	Diode	1S2473 (1S1555)
D19	Diode	1S2473 (1S1555)
D20	Diode	1S2473 (1S1555)
D21	Diode	1S2473 (1S1555)
D21	Diode	1S2473 (1S1555)
D23	Diode	1S2473 (1S1555)
D24	Diode	1S2473 (1S1555)
D25	Diode	1S2473 (1S1555)
D26	Zener diode	WZ-130
D27	Diode	1S2473 (1S1555)
D28	Diode	1S2473 (1S1555)
D29	SCR	CR02AM-2
D30	Diode	1S2473 (1S1555)
D31	Diode	1S2473 (1S1555)
D32	Diode	1S2473 (1S1555)
D33	Diode	1S2473 (1S1555)
D34	Diode	1S2473 (1S1555)
D35	Diode	1S2473 (1S1555)
D36	Diode	1S2473 (1S1555)
D37	Diode	1S2473 (1S1555)
D38	Diode	1S2473 (1S1555)

AF Power Assembly (AWK-057)



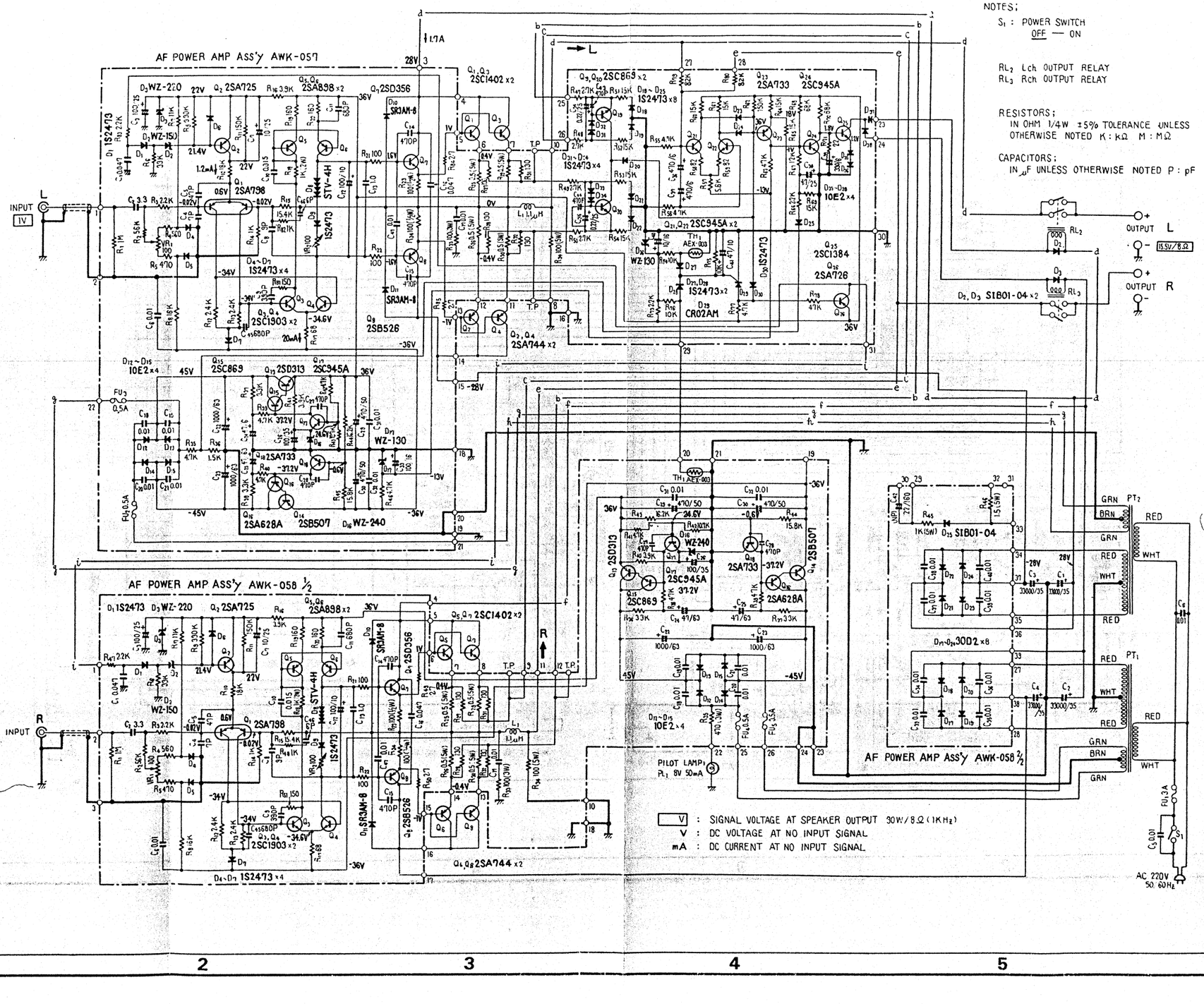
9.2 SCHEMATIC DIAGRAM FOR KL-TYPE

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.



9.3 SCHEMATIC DIAGRAM FOR N-TYPE

NOTE:
The indicated semiconductors are representative ones only. Other alternative semiconductors may be used and are listed in the parts list.



9.4 AF POWER ASSEMBLY (AWK-057)

OTHERS

Symbol	Description	Part No.
L1	AF choke coil 1.1μH	ATH-012
	Fuse clip	AKR-013
	Contact strip 3P	AKM-033
	Contact strip 5P	AKM-035
	Contact strip 6P	AKM-036
	Heat sink (small)	ANH-317
	Sponge	AEC-387

CAPACITORS

Symbol	Description			Part No.
C1	Mylar	0.047	50V	CQMA 473J 50
C2	Metallized mylar	3.3	100V	ACE-013
C3	Electrolytic	100	25V	CEA 101P 25
C4	Ceramic	7p	50V	CCDSL 070F 50
C5	Ceramic	47p	50V	CCDSL 470K 50
C6	Ceramic	0.01	50V	CKDYF 103Z 50
C7	Electrolytic	10	25V	CEA 100P 25
C8	Ceramic	9p	50V	CCDSL 090F 50
C9	Ceramic	390p	50V	CCDSL 391J 50
C10	Mylar	0.015	50V	CQMA 153J 50
C11	Ceramic	680p	50V	CKDYB 681K 50
C12	Electrolytic	100	10V	CEA 101P 10
C13	Metallized mylar	1	100V	ACE-008
C14	Ceramic	470p	50V	CKDYB 471K 50
C15	Ceramic	470p	50V	CKDYB 471K 50
C16	Mylar	0.047	100V	CQMA 473J 100
C17	Mylar	0.01	50V	CQMA 103J 50
C18	Ceramic	0.01	150V	ACG-004
C19	Ceramic	0.01	150V	ACG-004
C20	Ceramic	0.01	150V	ACG-004
C21	Ceramic	0.01	150V	ACG-004
C22	Electrolytic	1000	63V	ACH-319
C23	Electrolytic	1000	63V	ACH-319
C24	Electrolytic	47	63V	CEA 470P 63
C25	Electrolytic	47	63V	CEA 470P 63
C26	Electrolytic	100	35V	CEA 101P 35
C27	Ceramic	470p	50V	CKDYB 471K 50
C28	Ceramic	470p	50V	CKDYB 471K 50
C29	Electrolytic	470	50V	CEB 471P 50
C30	Electrolytic	470	50V	CEB 471P 50
C31	Ceramic	0.01	50V	CKDYF 103Z 50
C32	Ceramic	0.01	50V	CKDYF 103Z 50
C33	Electrolytic	100	16V	CEA 101P 16
C34	Electrolytic	0.22	25V	CSSA R22M 25
C35	Electrolytic	0.22	25V	CSSA R22M 25
C36	Electrolytic	470	6V	CEA 471P 6
C37	Electrolytic	470	6V	CEA 471P 6
C38	Electrolytic	4.7	25V	CEA 4R7P 25
C39	Electrolytic	330	6V	CEA 331P 6
C40	Electrolytic	10	16V	CEA 100P 16

Symbol	Description			Part No.
C41	Electrolytic	47	10V	CEA 470P 16
C42	Vacancy			.....
C43	Ceramic	470p	50V	CKDYB 471K 50
C44	Ceramic	470p	50V	CKDYB 471K 50
C45	Ceramic	680p	50V	CKDYB 681K 50
C46	Ceramic	6p	50V	CKDYB 060F 50
C47	Mylar	0.01	50V	CQMA 103J 50

RESISTORS

Symbol	Description			Part No.
VR1	Semi-fixed	100-B		ACP-032
VR2	Semi-fixed	100-B		ACP-032
R1	Metal film	1M	½W	RN½PT 1004G
R2	Metal film	56k	1/5W	RN1/5SQ 5602F
R3	Metal film	2.2k	1/5W	RN1/5SQ 2201F
R4	Carbon film	560		RD¼PS 561J
R5	Carbon film	470		RD¼PS 471J
R6	Carbon film	33k		RD¼PS 333J
R7	Carbon film	11k		RD¼PS 113J
R8	Carbon film	16k		RD¼PS 163J
R9	Carbon film	330k		RD¼PS 334J
R10	Carbon film	18k		RD¼PS 183J
R11	Carbon film	150k		RD¼PS 154J
R12	Carbon film	2.4k		RD¼PS 242J
R13	Carbon film	2.4k		RD¼PS 242J
R14	Metal film	1k	1/5W	RN1/5SQ 1001F
R15	Metal film	15.4k	1/5W	RN1/5SQ 1542F
R16	Carbon film	3.9k		RD¼PS 392J
R17	Carbon film	68		RD¼PS 680J
R18	Metal oxide	1k	2W	RS2P 102J
R19	Carbon film	160		RD¼PS 161J
R20	Carbon film	160		RD¼PS 161J
R21	Carbon film	100		RD¼PS 101J
R22	Carbon film	100		RD¼PS 101J
R23	Carbon film	100	½W	RD½PSF 101J
R24	Carbon film	100	½W	RD½PSF 101J
R25	Wire wound	0.5	5W	RT5B 0R5K
R26	Wire wound	0.5	5W	RT5B 0R5K
R27	Carbon film	130		RD¼PS 131J
R28	Carbon film	130		RD¼PS 131J
R29	Wire wound	0.5	5W	RT5B 0R5K
R30	Wire wound	0.5	5W	RT5B 0R5K

Symbol	Description			Part No.
R31	Carbon film	130		RD¼PS 131J
R32	Carbon film	130		RD¼PS 131J
R33	Metal oxide	100	3W	RS3P 101J
R34	Wire wound	100	5W	RT5B 101K
R35	Carbon film	4.7k		RD¼PS 472J
R36	Carbon film	1.5k		RD¼PS 152J
R37	Carbon film	33k		RD¼PS 333J
R38	Carbon film	33k		RD¼PS 333J
R39	Carbon film	47k		RD¼PS 473J
R40	Carbon film	47k		RD¼PS 473J
R41	Carbon film	3.9k		RD¼PS 392J
R42	Metal film	4.7k	1/5W	RN1/5SQ 4701F
R43	Metal film	10.7k	1/5W	RN1/5SQ 1072F
R44	Metal film	16.2k	1/5W	RN1/5SQ 1622F
R45	Metal film	15.8k	1/5W	RN1/5SQ 1582F
R46	Carbon film	4.7k		RD¼PS 472J
R47	Carbon film	2.7k		RD¼PS 272J
R48	Carbon film	2.7k		RD¼PS 272J
R49	Carbon film	2.7k		RD¼PS 272J
R50	Carbon film	2.7k		RD¼PS 272J
R51	Carbon film	15k		RD¼PS 153J
R52	Carbon film	15k		RD¼PS 153J
R53	Carbon film	15k		RD¼PS 153J
R54	Carbon film	15k		RD¼PS 153J
R55	Carbon film	4.7k		RD¼PS 472J
R56	Carbon film	4.7k		RD¼PS 472J
R57	Carbon film	5.6k		RD¼PS 562J
R58	Carbon film	82		RD¼PS 820J
R59	Carbon film	82		RD¼PS 820J
R60	Carbon film	15k		RD¼PS 153J
R61	Carbon film	15k		RD¼PS 153J
R62	Carbon film	150k		RD¼PS 154J
R63	Carbon film	4.7k		RD¼PS 472J
R64	Carbon film	15k		RD¼PS 153J
R65	Carbon film	15k		RD¼PS 153J
R66	Carbon film	2.2k		RD¼PS 222J
R67	Carbon film	12k		RD¼PS 123J
R68	Carbon film	68k		RD¼PS 683J
R69	Carbon film	15k		RD¼PS 153J
R70	Carbon film	68k		RD¼PS 683J
R71	Carbon film	22		RD¼PS 220J
R72	Vacancy			.....
R73	Carbon film	2.2k		RD¼PS 222J
R74	Carbon film	10k		RD¼PS 103J
R75	Carbon film	10k		RD¼PS 103J
R76	Carbon film	10k		RD¼PS 103J
R77	Carbon film	4.7k		RD¼PS 472J
R78	Carbon film	4.7k		RD¼PS 472J
R79	Carbon film	82k		RD¼PS 823J
R80	Carbon film	82k		RD¼PS 823J

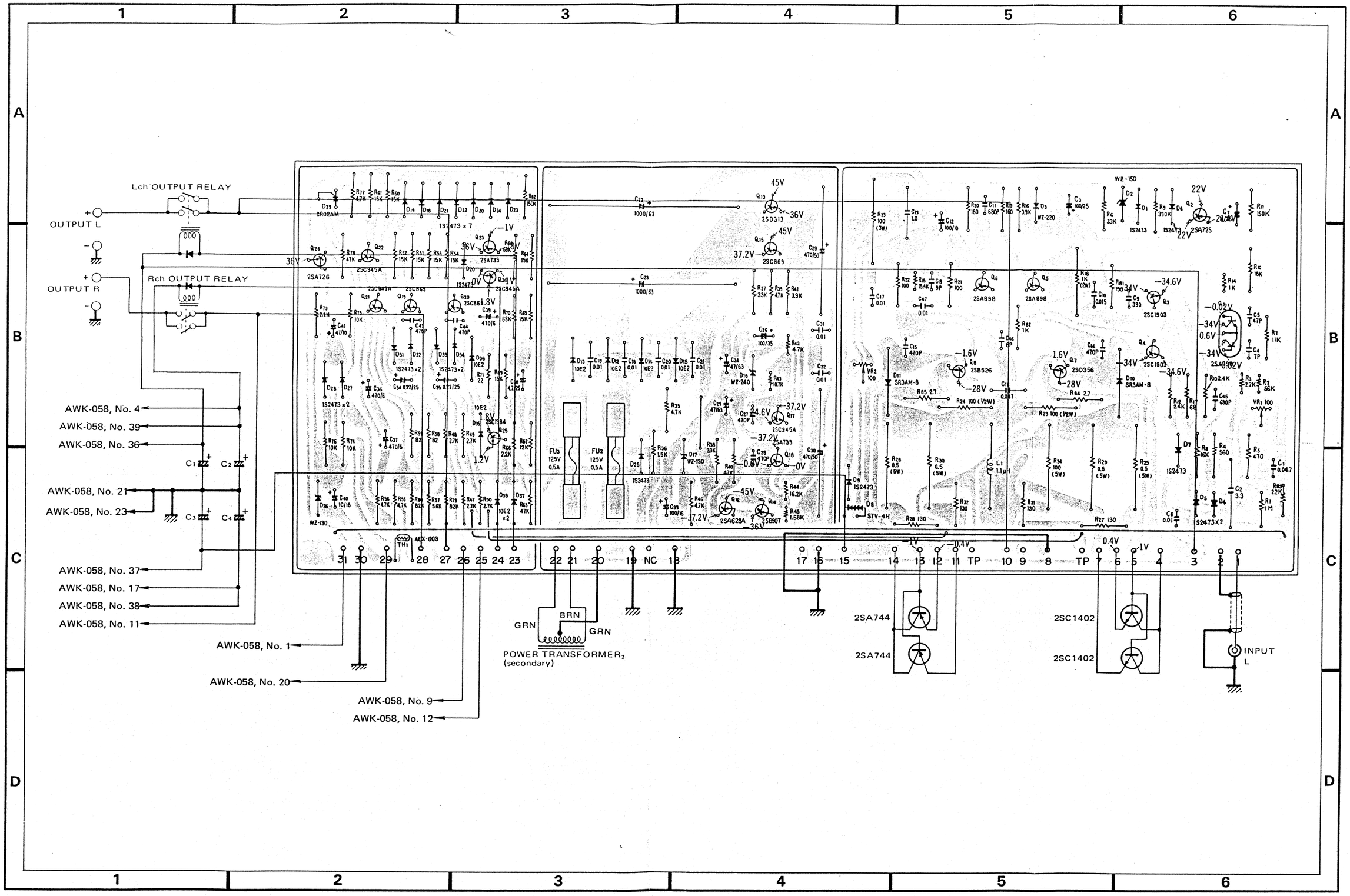
Symbol	Description		Part No.
R81	Carbon film	150	RD¼PS 151J
R82	Carbon film	1k	RD¼PS 102J
R83	Carbon film	2.2k	RD¼PS 222J
R84	Carbon film	2.7	RD¼PS 2R7J
R85	Carbon film	2.7	RD¼PS 2R7J

SEMICONDUCTORS

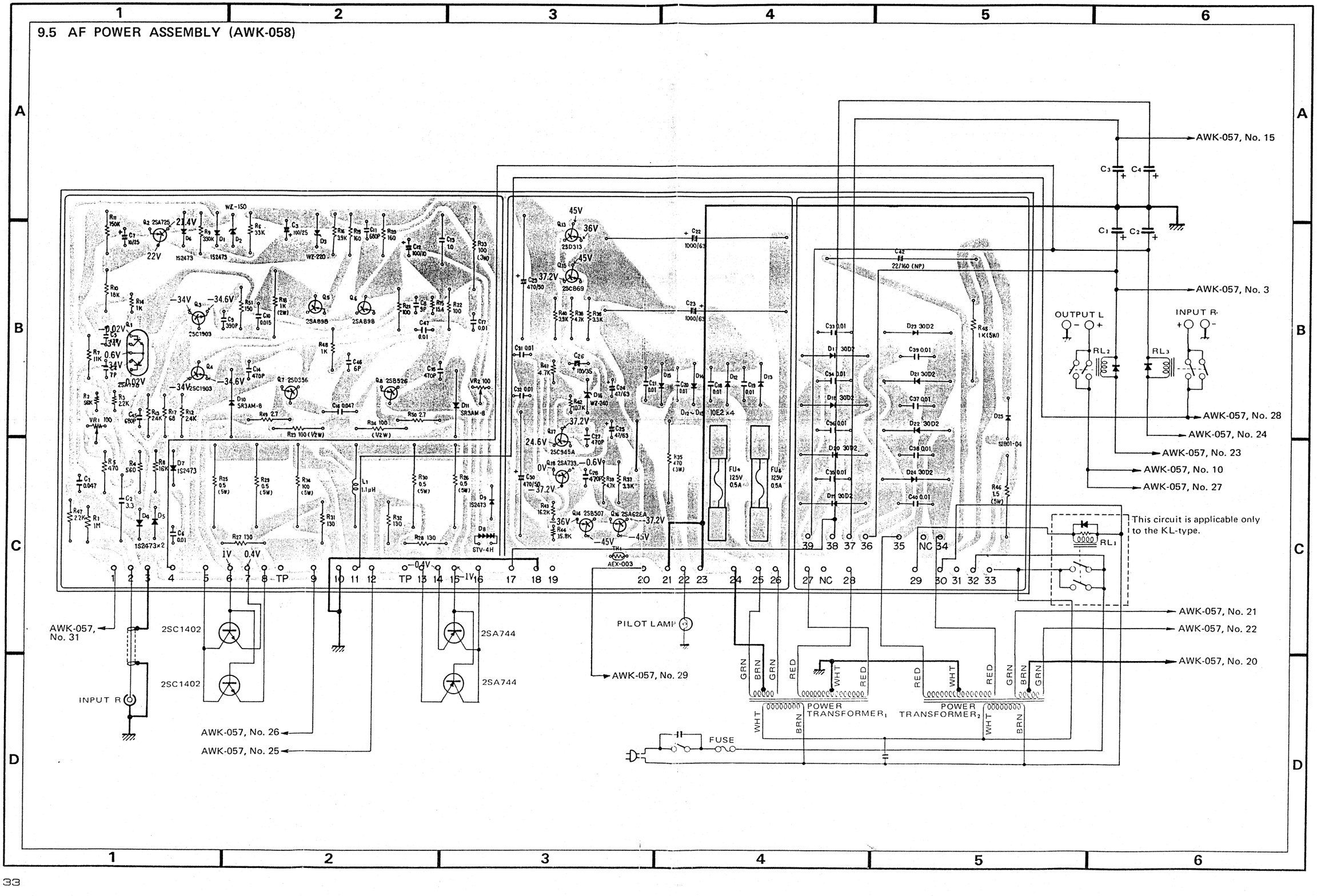
Symbol	Description	Part No.
Q1	Transistor	2SA798-F or G
Q2	Transistor	2SA725-F or G
Q3	Transistor	2SC1903-B or V
Q4	Transistor	2SC1903-B or V
Q5	Transistor	2SA898-B or V
Q6	Transistor	2SA898-B or V
Q7*	Transistor	2SD356-D or C
Q8*	Transistor	2SB526-D or C

* hfe of Q7 and Q8 should have the same value (matched pair).

Q13	Transistor	2SD313-D or E
Q14	Transistor	2SB507-D or E
Q15	Transistor	2SC869-D or C
Q16	Transistor	2SA628A-D or C
Q17	Transistor	2SC945A-P or Q
Q18	Transistor	2SA733-R or Q (2SA823-P or Q)
Q19	Transistor	2SC869-D or C
Q20	Transistor	2SC869-D or C
Q21	Transistor	2SC945A-P or Q (2SC1647-P or Q)
Q22	Transistor	2SC945A-P or Q (2SC1647-P or Q)
Q23	Transistor	2SA733-R or Q (2SA823-P or Q)
Q24	Transistor	2SC945A-P or Q (2SC1647-P or Q)
Q25	Transistor	2SC1384-R or S (2SC1166-O or Y)
Q26	Transistor	2SA726-F or G
TH1	Positive coefficient thermistor	AEX-003
D1	Diode	1S2473 (1S1555)
D2	Zener diode	WZ-150
D3	Zener diode	WZ-130
D4	Diode	1S2473 (1S1555)
D5	Diode	1S2473 (1S1555)
D6	Diode	1S2473 (1S1555)

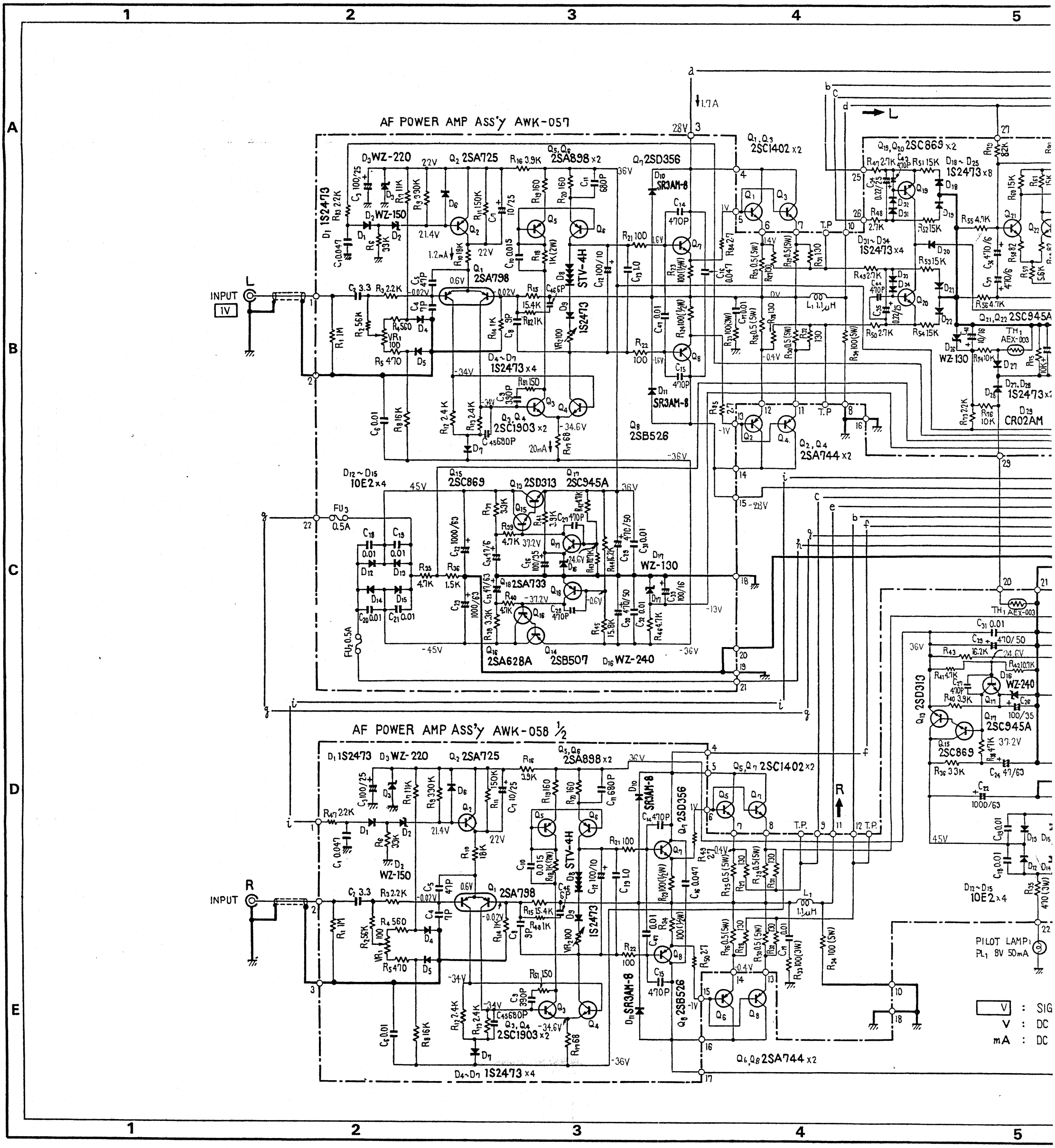

Lch OUTPUT RELAY
Rch OUTPUT RELAY
OUTPUT L
OUTPUT R
AWK-058, No. 4
AWK-058, No. 39
AWK-058, No. 36
AWK-058, No. 21
AWK-058, No. 23
AWK-058, No. 37
AWK-058, No. 17
AWK-058, No. 38
AWK-058, No. 11
AWK-058, No. 1
AWK-058, No. 20
AWK-058, No. 9
AWK-058, No. 12
POWER TRANSFORMER2
(secondary)
GRN
BRN
GRN
2SA744
2SA744
2SC1402
2SC1402
INPUT L
WZ-150
1S2473 x 7
1S2473 x 2
1S2473 x 2
1S2473
1S2473
1S2473

9.5 AF POWER ASSEMBLY (AWK-058)



STEREO POWER AMPLIFIER

M-22 N



PIONEER

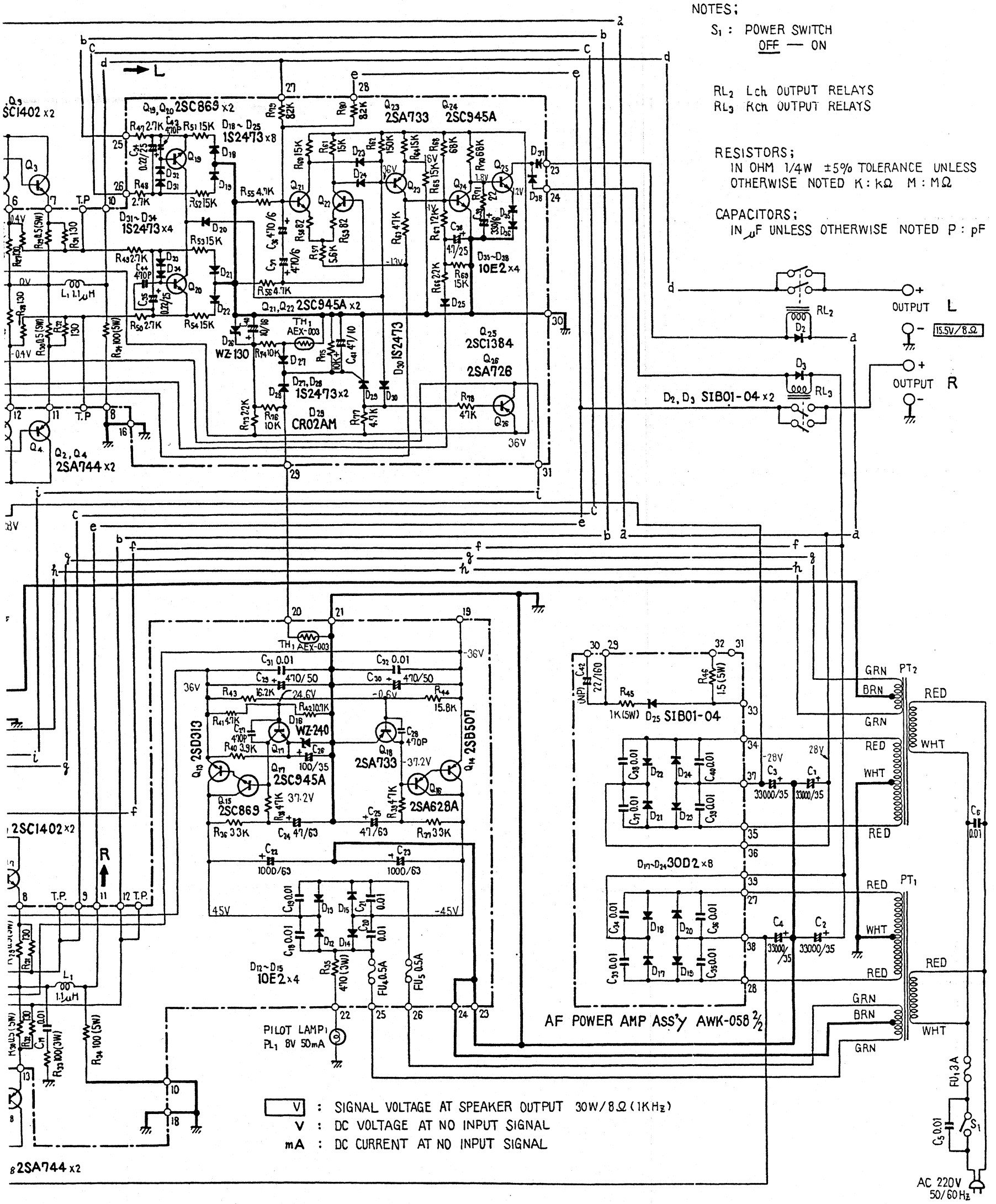
NOTES;

S_1 : POWER SWITCH
OFF — ON

RL_2 Lch OUTPUT RELAYS
RL_3 Rch OUTPUT RELAYS

RESISTORS;
IN OHM 1/4W ±5% TOLERANCE UNLESS OTHERWISE NOTED K : kΩ M : MΩ

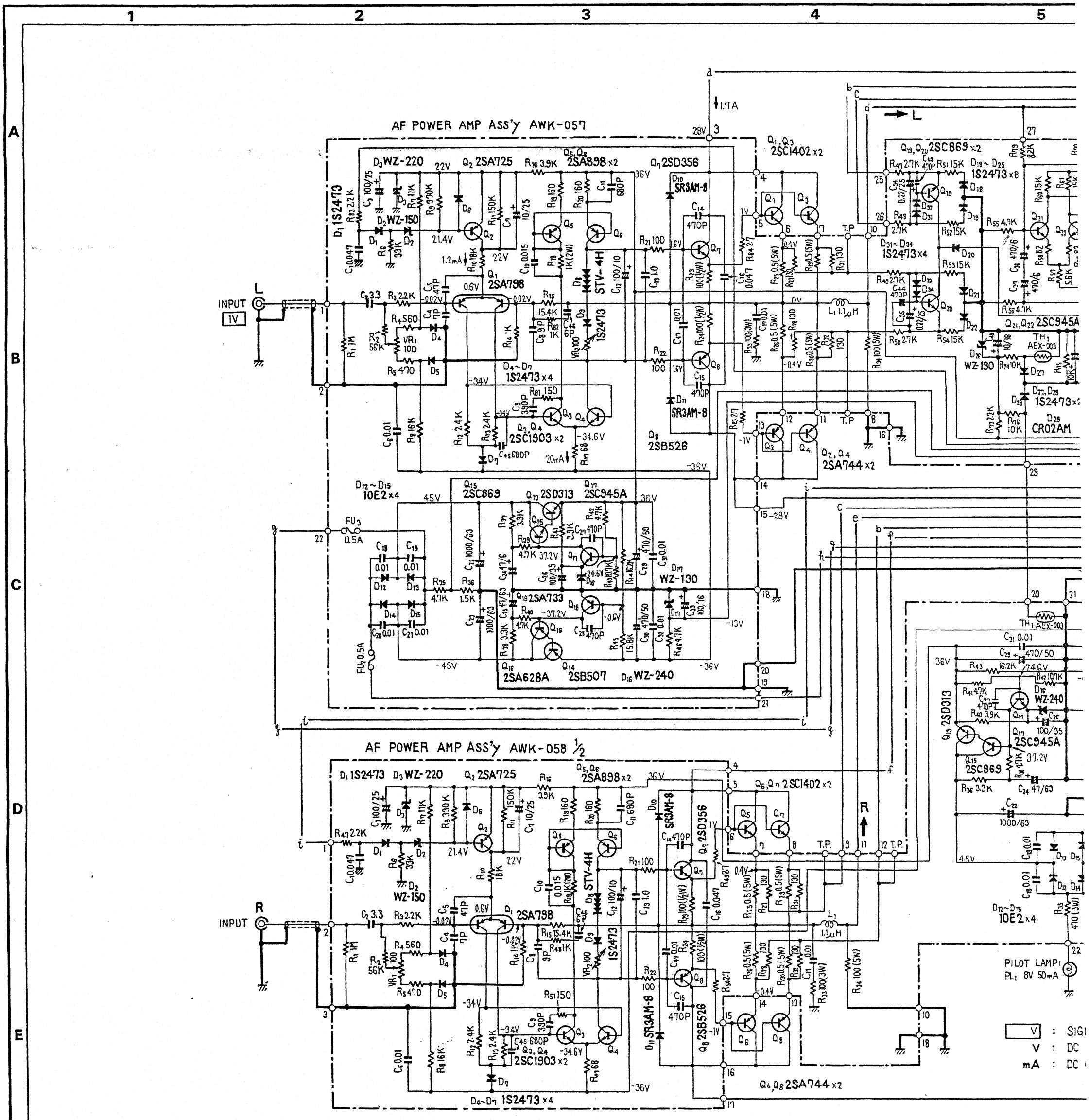
CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P : pF



V : SIGNAL VOLTAGE AT SPEAKER OUTPUT 30W/8Ω (1KHz)
V : DC VOLTAGE AT NO INPUT SIGNAL
mA : DC CURRENT AT NO INPUT SIGNAL

STEREO POWER AMPLIFIER

M-22 KL



PIONEER

NOTES;

S_1 : POWER SWITCH
OFF — ON

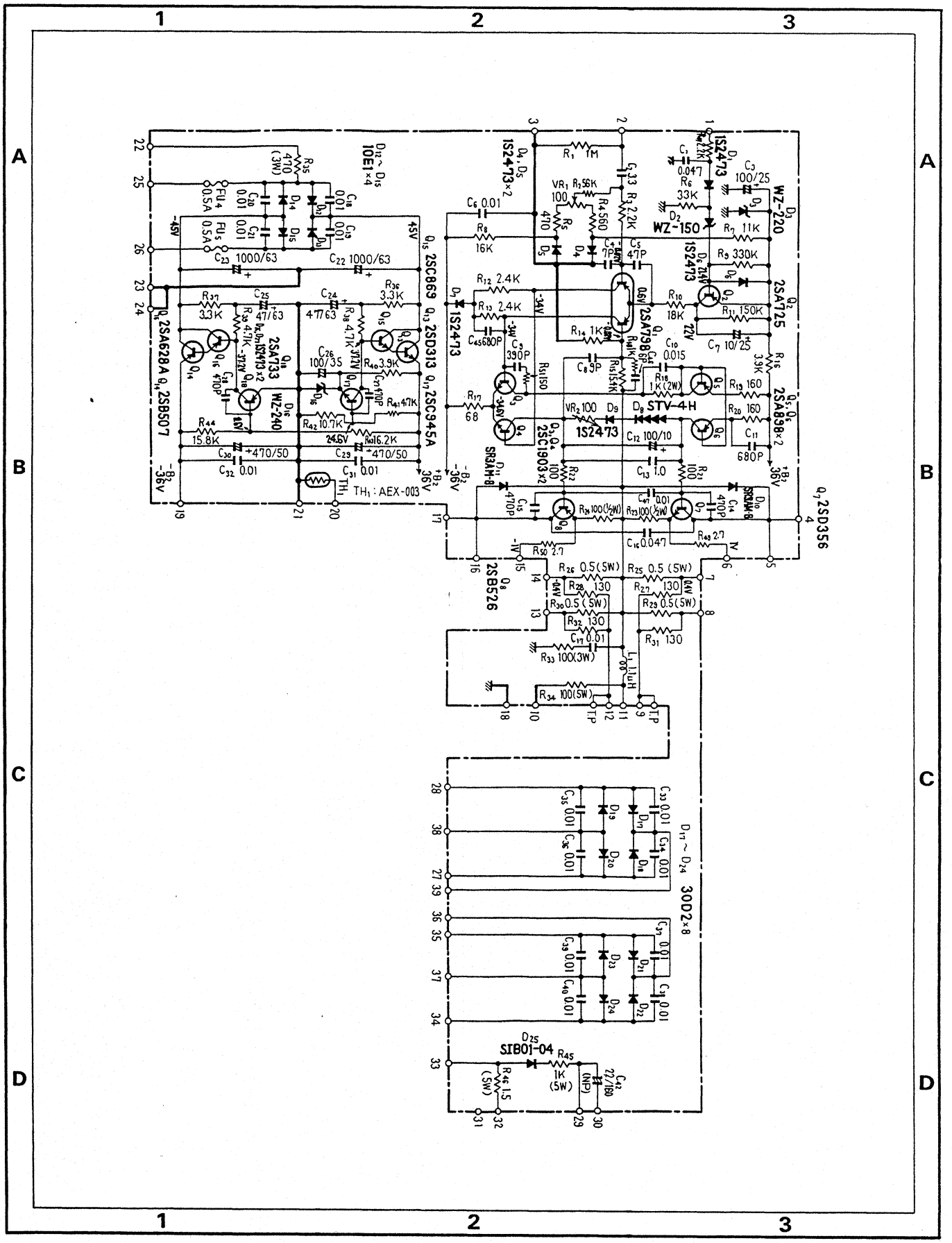
RL_1 SURGE CURRENT CONTROL RELAYS
RL_2 Lch OUTPUT RELAYS
RL_3 Rch OUTPUT RELAYS

RESISTORS;
IN OHM 1/4W ±5% TOLERANCE UNLESS OTHERWISE NOTED K : kΩ M : MΩ

CAPACITORS;
IN μF UNLESS OTHERWISE NOTED P : pF

V : SIGNAL VOLTAGE AT SPEAKER OUTPUT 30W/8Ω (1KHz)
V : DC VOLTAGE AT NO INPUT SIGNAL
mA : DC CURRENT AT NO INPUT SIGNAL

AF POWER AMP ASS'Y AWK-058 2/2


1
2
3
A
B
C
D
TH1 : AEX-003
WZ-220
WZ-150
WZ-240
STV-4H
2SA798
2SA725
2SA733
2SA628A
2SB507
2SC869
2SD313
2SC945A
2SC1903×2
2SB526
2SD356
30D2×8
SIB01-04
10E1×4
1S2473×2
SR3AM-8

Parts List of AF Power Assembly (AWK-058)

OTHERS

Symbol	Description	Part No.
L1	AF choke coil 1.1μH	ATH-012
	Fuse clip	AKR-013
	Contact strip 3P	AKM-033
	Contact strip 4P	AKM-034
	Contact strip 5P	AKM-035
	Heat sink (small)	ANH-317
	Sponge	AEC-387

CAPACITORS

Symbol	Description			Part No.
C1	Mylar	0.047	50V	CQMA 473J 50
C2	Metallized mylar	3.3	100V	ACE-013
C3	Electrolytic	100	25V	CEA 101P 25
C4	Ceramic	7p	50V	CCDSL 070F 50
C5	Ceramic	47p	50V	CCDSL 470K 50
C6	Ceramic	0.01	50V	CKDYF 103Z 50
C7	Electrolytic	10	25V	CEA 100P 25
C8	Ceramic	9p	50V	CCDSL 090F 50
C9	Ceramic	390p	50V	CCDSL 391J 50
C10	Mylar	0.015	50V	CQMA 153J 50
C11	Ceramic	680p	50V	CKDYB 681K 50
C12	Electrolytic	100	10V	CEA 101P 10
C13	Metallized mylar	1	100V	ACE-008
C14	Ceramic	470p	50V	CKDYB 471K 50
C15	Ceramic	470p	50V	CKDYB 471K 50
C16	Mylar	0.047	100V	CQMA 473J 100
C17	Mylar	0.01	50V	CQMA 103J 50
C18	Ceramic	0.01	150V	ACG-004
C19	Ceramic	0.01	150V	ACG-004
C20	Ceramic	0.01	150V	ACG-004
C21	Ceramic	0.01	150V	ACG-004
C22	Electrolytic	1000	63V	ACH-319
C23	Electrolytic	1000	63V	ACH-319
C24	Electrolytic	47	63V	CEA 470P 63
C25	Electrolytic	47	63V	CEA 470P 63
C26	Electrolytic	100	35V	CEA 101P 35
C27	Ceramic	470p	50V	CKDYB 471K 50
C28	Ceramic	470p	50V	CKDYB 471K 50
C29	Electrolytic	470	50V	CEB 471P 50
C30	Electrolytic	470	50V	CEB 471P 50
C31	Ceramic	0.01	50V	CKDYF 103Z 50
C32	Ceramic	0.01	50V	CKDYF 103Z 50
C33	Ceramic	0.01	150V	ACG-004
C34	Ceramic	0.01	150V	ACG-004
C35	Ceramic	0.01	150V	ACG-004
C36	Ceramic	0.01	150V	ACG-004
C37	Ceramic	0.01	150V	ACG-004
C38	Ceramic	0.01	150V	ACG-004
C39	Ceramic	0.01	150V	ACG-004
C40	Ceramic	0.01	150V	ACG-004

Symbol	Description			Part No.
C41	Vacancy			.....
C42	Electrolytic (NP)	22	160V	ACH-322
C43	Vacancy			.....
C44	Vacancy			.....
C45	Ceramic	680p	50V	CKDYB 681K 50
C46	Ceramic	6p	50V	CCDSL 060F 50
C47	Mylar	0.01	50V	CQMA 103J 50

RESISTORS

Symbol	Description			Part No.
VR1	Semi-fixed	100-B		ACP-032
VR2	Semi-fixed	100-B		ACP-032
R1	Metal film	1M	½W	RN½PT 1004G
R2	Metal film	56k	1/5W	RN1/5SQ 5602F
R3	Metal film	2.2k	1/5W	RN1/5SQ 2201F
R4	Carbon film	560		RD¼PS 561J
R5	Carbon film	470		RD¼PS 471J
R6	Carbon film	33k		RD¼PS 333J
R7	Carbon film	11k		RD¼PS 113J
R8	Carbon film	16k		RD¼PS 163J
R9	Carbon film	330k		RD¼PS 334J
R10	Carbon film	18k		RD¼PS 183J
R11	Carbon film	150k		RD¼PS 154J
R12	Carbon film	2.4k		RD¼PS 242J
R13	Carbon film	2.4k		RD¼PS 242J
R14	Metal film	1k	1/5W	RN1/5SQ 1001F
R15	Metal film	15.4k	1/5W	RN1/5SQ 1542F
R16	Carbon film	3.9k		RD¼PS 392J
R17	Carbon film	68		RD¼PS 680J
R18	Metal oxide	1k	2W	RS2P 102J
R19	Carbon film	160		RD¼PS 161J
R20	Carbon film	160		RD¼PS 161J
R21	Carbon film	100		RD¼PS 101J
R22	Carbon film	100		RD¼PS 101J
R23	Carbon film	100	½W	RD½PSF 101J
R24	Carbon film	100	½W	RD½PSF 101J
R25	Wire wound	0.5	5W	RT5B 0R5K
R26	Wire wound	0.5	5W	RT5B 0R5K
R27	Carbon film	130		RD¼PS 131J
R28	Carbon film	130		RD¼PS 131J
R29	Wire wound	0.5	5W	RT5B 0R5K
R30	Wire wound	0.5	5W	RT5B 0R5K
R31	Carbon film	130		RD¼PS 131J
R32	Carbon film	130		RD¼PS 131J
R33	Metal oxide	100	3W	RS3P 101J
R34	Wire wound	100	5W	RT5B 101K
R35	Metal oxide	470	3W	RS3P 471J

Symbol	Description			Part No.
R36	Carbon film	33k		RD¼PS 333J
R37	Carbon film	33k		RD¼PS 333J
R38	Carbon film	47k		RD¼PS 473J
R39	Carbon film	47k		RD¼PS 473J
R40	Carbon film	3.9k		RD¼PS 392J
R41	Metal film	4.7k	1/5W	RN1/5SQ 4701F
R42	Metal film	10.7k	1/5W	RN1/5SQ 1072F
R43	Metal film	16.2k	1/5W	RN1/5SQ 1622F
R44	Metal film	15.8k	1/5W	RN1/5SQ 1582F
R45	Wire wound	1k	5W	RT5B 102K
R46	Wire wound	1.5	5W	RT5B 1R5K
R47	Carbon film	2.2k		RD¼PS 222J
R48	Carbon film	1k		RD¼PS 102J
R49	Carbon film	2.7		RD¼PS 2R7J
R50	Carbon film	2.7		RD¼PS 2R7J
R51	Carbon film	150		RD¼PS 151J

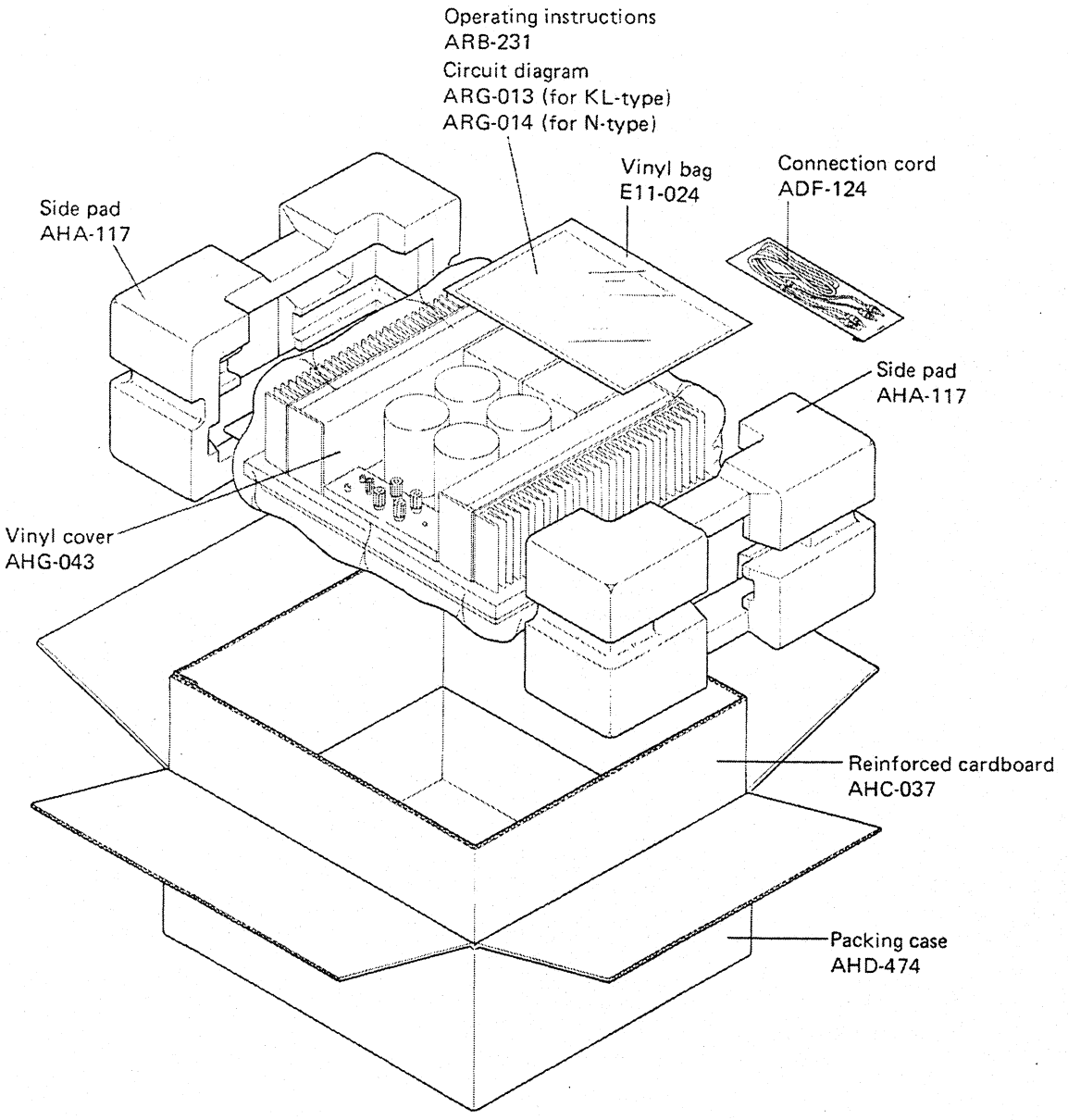
SEMICONDUCTORS

Symbol	Description	Part No.
Q1	Transistor	2SA798-F or G
Q2	Transistor	2SA725-F or G
Q3	Transistor	2SC1903-B or V
Q4	Transistor	2SC1903-B or V
Q5	Transistor	2SA898-B or V
Q6	Transistor	2SA898-B or V
Q7*	Transistor	2SD356-D or C
Q8*	Transistor	2SB526-D or C

* hfe of Q7 and Q8 should have the same value (matched pair).

Q13	Transistor	2SD313-D or E
Q14	Transistor	2SB507-D or E
Q15	Transistor	2SC869-D or C
Q16	Transistor	2SA628A-D or C
Q17	Transistor	2SC945A-P or Q (2SC1647-P or Q)
Q18	Transistor	2SA733-R or Q (2SA823-P or Q)
TH1	Positive coefficient thermistor	AEX-003
D1	Diode	1S2473 (1S1555)
D2	Zener diode	WZ-150
D3	Zener diode	WZ-220
D4	Diode	1S2473 (1S1555)
D5	Diode	1S2473 (1S1555)
D6	Diode	1S2473 (1S1555)
D7	Diode	1S2473 (1S1555)
D8	Varistor	STV-4H
D9	Diode	1S2473 (1S1555)
D10	Diode	SR3AM-8
D11	Diode	SR3AM-8
D12	Diode	10E2 (1S1885)
D13	Diode	10E2 (1S1885)
D14	Diode	10E2 (1S1885)
D15	Diode	10E2 (1S1885)
D16	Zener diode	WZ-240
D17	Diode	30D2 (SR3AM-4)
D18	Diode	30D2 (SR3AM-4)
D19	Diode	30D2 (SR3AM-4)
D20	Diode	30D2 (SR3AM-4)
D21	Diode	30D2 (SR3AM-4)
D22	Diode	30D2 (SR3AM-4)
D23	Diode	30D2 (SR3AM-4)
D24	Diode	30D2 (SR3AM-4)
D25	Diode	SIB01-04

10. PACKING


Operating instructions
ARB-231
Circuit diagram
ARG-013 (for KL-type)
ARG-014 (for N-type)
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Connection cord
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Side pad
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Side pad
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Vinyl cover
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Reinforced cardboard
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