TNE48 – 40 – Westinghouse

Checked: 24/03/22 Packed: 24/03/22

WESTINGHOUSE RECTIFIER

Type	TNE48/40
Input	230 volts (nom.), single phase, 50 Hertz, 15 amps.
Output	(i) Float 44.0 - 56.0 volts D.C. at up to 40 amps (ii) Boost 20 - 40 amps D.C. up to max. voltage of 62.4V.
Specification	WR584/26
Serial No.	A6058/1 - 12
Customer Order No.	A002769

Manufactured for

NEW ZEALAND ELECTRICITY DEPARTMENT

by

WESTINGHOUSE - McKENZIE - HOLLAND (N.Z.) LTD.
Rata Street,
NAENAE

April 1975

I N D E X

WESTINGHOUSE RECTIFIER

TYPE TNE48/40

1. GENERAL

The Westinghouse TNE48/40 Rectifier Set is designed to float charge a battery in the voltage range 44 to 56 volts.

The battery manufacturer's recommendations in regard to charging voltage should be followed, but generally the following conditions apply to float charge systems:-

(a) At less than 2.1 volts/cell, with a standing load, the battery will discharge very slowly.

(b) At 2.1 volts/cell the battery will neither charge nor discharge.

(c) At 2.15 volts/cell the battery would recharge very slowly.

(d) At 2.28 volts/cell the battery would recharge after a discharge on mains failure.

(e) At 2.32 volts/cell the battery would recover more quickly, but would reach the gassing level, with consequent increase of maintenance and topping up of the battery.

(f) N.Z.E.D. practice is to set the charger, initially, at 2.20 volts per cell.

(g) For gas charging, to equalise cell voltages and provide rapid recovery of capacity, the battery can be charged up to 2.60 volts per cell.

Prolonged charging in this condition will result in rapid loss of electrolyte, overheating of the battery, due to the high charge rate, and possible damage to cells. It must, therefore, be well supervised.

The charger is capable of an output of 40 amps and will supply this current while floating the battery.

If the load exceeds 40 amps the charger voltage will fall, so that additional current required is supplied by the battery.

2. SITE

The charger is suitable for floor standing or wall mounting.

A clear space should be left around the charger to allow air to enter the bottom of the equipment and leave through the side ventilation openings.

The charger should not be mounted above the battery or above equipment which produces heat.

3. INSTALLATION

The charger may be either floor standing or wall mounted.

Should wall mounting be required a frame should be constructed, with sufficient strength to support the weight (Approx. 350 lbs).

Keyhole cut-outs are provided to allow mounting on ½" W bolts, correctly positioned in a mounting frame.

Input and output terminals are clearly marked and connections are shown on Circuit Diagram BW804/113.

NOTE: Ensure that the positive battery terminal is connected to the positive output terminal of the charger.

When all connections are made turn the charger on and adjust the voltage by means of the control potentiometer.

No further attention should be necessary and the charger will charge the battery at up to its rated current, according to battery condition and floating load.

If it is required to give the battery a gassing charge it is only necessary to raise the output voltage to 2.60 volts/cell, by means of the float boost switch.

The current limit circuit will keep the charging rate within safe limits and, as the voltage rises, the charging current will gradually fall. The boost current can be adjusted in the range 20 - 40 amps.

When gassing charge is complete reset the voltage to the float level.

4. Description of Charger Circuit - Refer Drg. BW804/113

230 volts, 50 Hertz, single phase is supplied to the charger input terminal block, then via the mains fuse and switch to the main transformer T1.

The secondary voltage of T1 is applied to the controlled bridge rectifier.

The D.C. output from the bridge rectifier is controlled by the controller - driver, which varies the point on the voltage sine wave at which the thyristors are fired.

A feedback signal from the charger output is compared with a reference in the controller and the firing point is advanced or retarded to compensate for any variations of the output voltage from the set level.

The secondary current of the transformer is sensed by the current transformer on the P.C. board. When the output signal of the current transformer exceeds the voltage feedback signal the set enters a current limited mode, where the charger voltage is depressed.

The charger output current is detected by monitoring the volt drop across D1. When the current drops below the preset level the charge fail relay is operated.

5. OPERATION OF THE CONTROLLER-DRIVER - Refer Drg. BW845/51

The controller-driver is a plug-in printed circuit assembly, designed to regulate the output voltage and current by providing correctly timed firing pulses to the thyristor gates.

The circuit consists of the following main sections:-

1. Power Supply
2. Regulating Circuit
3. Phase Controller and Pulse Amp

1. Power Supply

A small transformer is mounted on the printed circuit and is supplied at 230 volts, 50 Hertz via edge connections 23, 24 via FS1.

The transformer secondary voltage is rectified by D1 to D4, to supply an unsmoothed D.C. voltage of 110 volts.

The zener ZR1 is fed from the dropping resistor R1, and this serves two functions:-

(a) To supply an isolated, smoothed D.C. voltage across C1 via D5;

(b) To supply the reset waveform for the unijunction transistor TR1.

2. Regulating Circuit

The regulating circuit is based upon a high performance, operational amplifier, which is used as a differential amplifier with controlled gain and time constant.

A reference voltage is generated by ZR2 and fed directly to the non-inverting input of the amplifier.

The charger output voltage is sensed by the divider chain, RV2, R16, RV1 and any one of the resistors R14 to R15, depending on the set output voltage.

The feedback signal to the amplifier is obtained by sensing the volt drop across RV1 (external) and R16 and comparing this to the reference voltage.

The difference signal is amplified by IC1 and a time constant is added on test by selection of C2.

The current limit signal from T3 is rectified by D9 to D12 and feeds a burden, RV3 plus RV4.

When the volt drop across RV3 plus RV4 exceeds that of the feedback signal, diode D13 conducts and the amplifier output voltage is reduced.

3. Phase Controller and Pulse Amp

A timing ramp is generated on C3 from two sources:-

(a) A modified cosine ramp is produced by the charging circuit of R6, C3, derived from the rectified sine wave;

(b) A pedestal, which is derived from ZR1 via R5 and D7. This pedestal varies in height to control the position of the firing pulse.

At the end of each half-cycle the voltage across TR1 will drop to zero and the timing capacitor C3 will be discharged.

During the half-cycle capacitor C3 charges at a rate determined by the ramp and pedestal until it reaches the peak point voltage of TR1, whereupon it is discharged into Transformer T2.

Transformer T2 provides two output windings to drive the gates of thyristors via R8, R9.

In operation, consider the case where the D.C. output voltage is low. The voltage which appears at the amplifier inverting input via R17 will be low and the amplifier output will tend to move more positive.

This will cause the volt drop across R5 to be less, resulting in a higher pedestal on capacitor C3.

Under the effect of the charge current via R6, C3 will charge to the peak point voltage of TR3 earlier in the half-cycle and the first pulse will be advanced.

The thyristor will fire earlier in the half-cycle and the output voltage will rise until equilibrium is established at the amp input.

6. CHARGE FAIL DETECTOR

The volt drop across the external diode is sensed by RV5 and D15. The base voltage of TR2, a germanium transistor, is derived from the wiper of RV5 and biasses TR2 on under normal conditions.

RV5 is adjusted so that TR2 switches off when the current drops below a specified level, nominally 50 mA.

6. MAINTENANCE

The charger is completely static in operation, so that no maintenance, other than periodic inspection, should be necessary for long periods.

A cover should be removed at, say, annual intervals and any dust which may have accumulated should be blown clear, using dry, low pressure air.

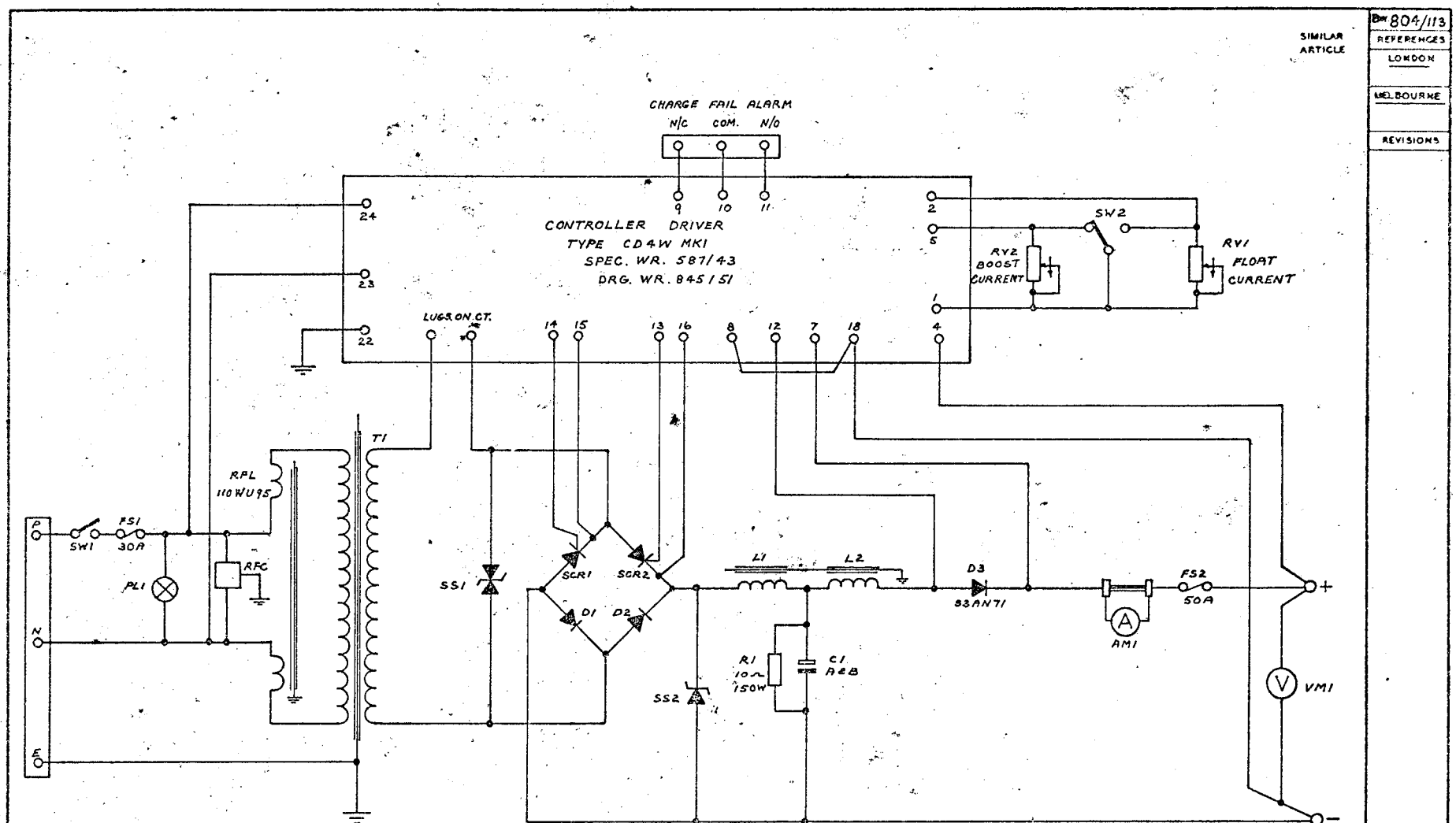
Check that all terminals are clean and tight.

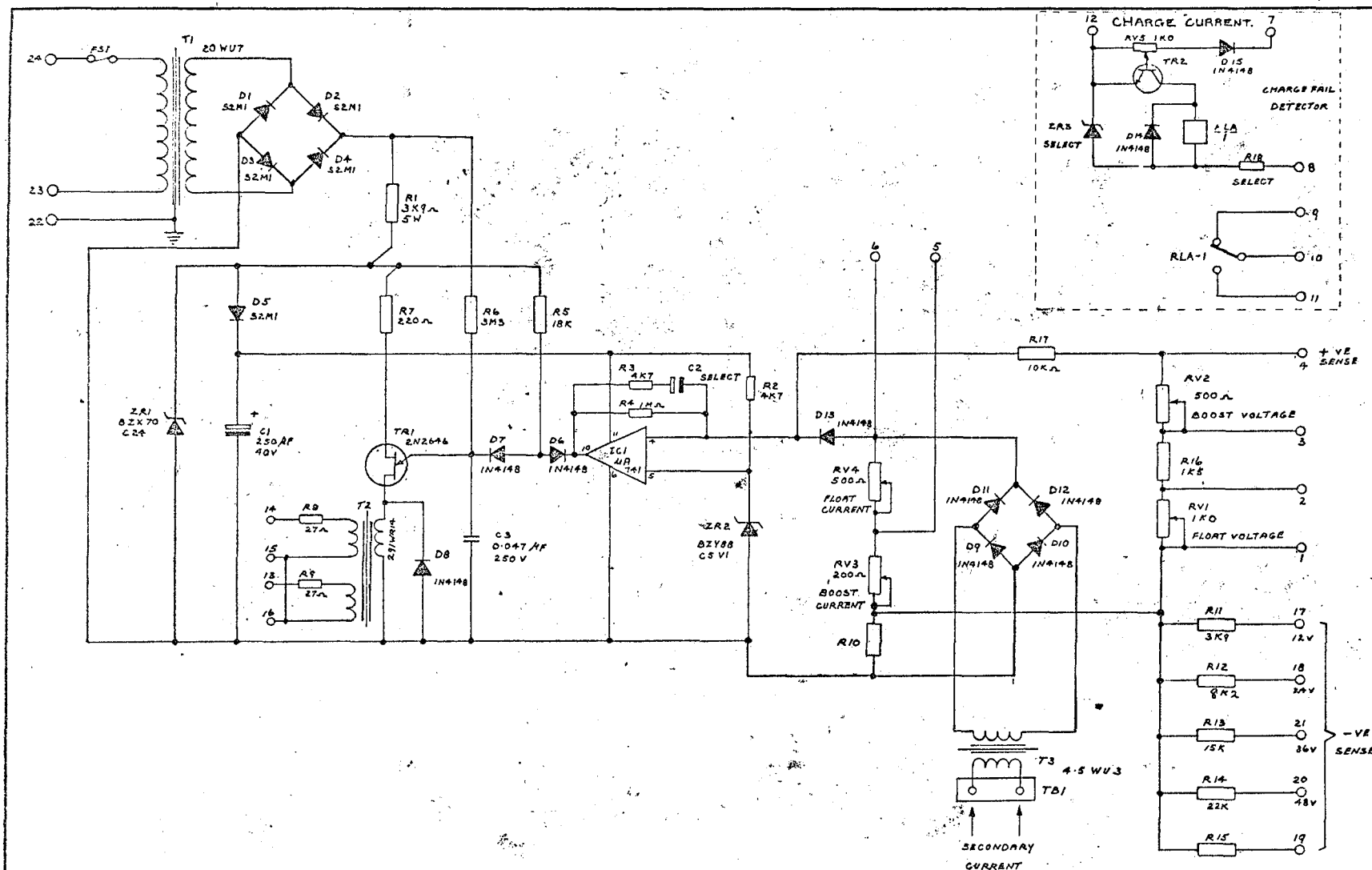
8. COMPONENT LIST - MAIN CHARGER CIRCUIT (Ref. BW804/113)

Ref.	DESCRIPTION	QTY.	SPEC.	SUPPLIER
SW1	Switch	1	C41-A210	N.Z. Solenoid Co.Ltd.
PL1	Lamp	1	SC.360	Westinghouse-McK-H
T1	Transformer	1	4150WU31	"
L1	Choke	2	700WU175	"
SS1	Surge Suppressor	1	C121L06C	"
SS2	" "	1	C121L06A	"
D1-2	Diodes	2	S5AR55	"
D3	Diode	1	S5AR71	"
SCR1-2	Thyristor	2	29TB4	"
FS1	Fuse Holder	1	SM30P	Giles & Elliott Ltd.
	Link	1	T1A30	"
AM1	Ammeter	1	0 - 50A	Westinghouse-McK-H
VM1	Voltmeter	1	0 - 75V	"
RV1	Potentiometer	1	1 k.ohm 3 watt	E.D.A.C.
RV2	"	1	220 ohm 3 watt	"
RFL	R.F. Filter Choke	1	110WU95	Westinghouse-McK-H
RFC	Suppressor Capacitor	1	ERO FN350E	Tee Vee Radio
C1A-B	Capacitor	4	8000 mfd, 75V	Westinghouse-McK-H.
SW2	Switch	1	2 amp Toggle	"
FS2	Fuse Holder	1	SM60P	Giles & Elliott Ltd.
	Link	1	TIS50	"

9. COMPONENT LIST - CONTROLLER-DRIVER, WR587/43 (Ref. Drg. BW845/51)

Ref.	Description	Type	Supplier
R1	Resistor	3K9 .5 watt	Welwyn
R2,R3	"	4K7 ½ "	"
R4	"	1M ohm ½ "	"
R5	"	18K " ½ "	"
R6	"	3M3 " ½ "	"
R7	"	220 " ½ "	"
R8,R9	"	27 " ½ "	"
R11	"	3K9 " ½ "	"
R12	"	8K2 " ½ "	"
R17	"	10K " ½ "	"
R13	"	15K " ½ "	"
R14	"	22K " ½ "	"
R16	"	1K8 " ½ "	"
R18	"	390 " 5 "	"
D1-4	Diode	S10M1	Westinghouse-McK-H.
D5	"	S2M1	"
D6-15	"	1N4148	E.D.A.C.
ZR1	Zener Diode	1N4749A	N.E.E.C.O.
ZR2	" "	BZY88C5V1	E.D.A.C.
ZR3	" "	BZX70 C24	"
TR1	Unijunction Transistor	2N2646	N.E.E.C.O.
TR2	Transistor	AC128-01	E.D.A.C.
IC1	Integrated Cct.	µA741	T.V. Radio
C1	Capacitor, Electrolytic	250mfd, 40V	E.D.A.C.
C2	" "	10mfd. 63V	"
C3	" Mylar	.047mfd 50V	"
RV4	Potentiometer	500 ohm	E.D.A.C.
RV5	"	1K ohm	"
RLA	Relay	Pye, TMC 302/2CHD/30A	Pye
T1	Transformer	20WU7	Westinghouse-McK-H.
T2	"	291WR14	"
T3	"	4.5WU3	"
FS1	Fuse Holder	PC '00'	"
	Link	500 mA	"


Bw 804/113
REFERENCES
LONDON
MELBOURNE
REVISIONS
SIMILAR ARTICLE
CHARGE FAIL ALARM
N/C COM. N/O
9 10 11
CONTROLLER DRIVER
TYPE CD4W MKI
SPEC. WR. 587/43
DRG. WR. 845/51
24
23
22
LUGS ON CT.
14 15 13 16 8 12 7 18 4
2 5 1
SW2
RV2 BOOST CURRENT
RV1 FLOAT CURRENT
T1
RPL 110WU95
SW1
FS1 30A
PL1
RFC
SS1
SCR1 SCR2
D1 D2
L1 L2
D3 S3AN71
FS2 50A
AM1
R1 10Ω 150W
C1 A&B
SS2
VM1
N
E
+
−
CONTINUED FROM TO
WESTINGHOUSE-McKENZIE-HOLLAND (N.Z.) LTD.
N.Z.E.D. TNE. 48/40
DRAWN. ETB 13·2·75
SCALE
CHKD
APPD
DRAWING No. Bw804
SHEET 113



Dw. 845/51

REFERENCES

LONDON

ME BOURNE

REVISIONS

ISSUE 2 8-10-73 ADDED

ISSUE 3 24/11/73 CCT CORRECTED

ISSUE 4 LAYOUT CHANGED 12/8/74

ISSUE 5 R12 WAS 10K. 24/5/74 RAK

CONTINUED FROM | TO

McKENZIE & HOLLAND (N.Z.) LTD.	CONTROLLER DRIVER CD4W MKI	DRAWN ETB. 8-10-73	DRAWING No. Bw845
		SCALE	SHEET 51
		CHKD	
		APPD.	

FORM A27

McKENZIE & HOLLAND (N.Z.) LTD.

SPECIFICATION No. AW5047/91

SHEET No. ..... TOTAL No. OF SHEETS .....

FOR MODIFICATION TO CHARGE FAIL ON CONTROLLER DRIVER CARDS IN TNE 48/50

COMPLETE PART No. .....

Drawn up by J.L.G. Checked by ..... Approved by ..... Date 29-8-75