

© Hitachi, Ltd.
NARASHINO WORKS

ENGINEERING SHEET

E.S. NO. ES0106

DATE 6. FEB. '88

TITLE

SERVICE MANUAL

PRODUCTS

HFC-VWS EUROPEAN

"HOW TO CHECK AND REPAIR HFC-VWS SERIES INVERTER"

1. MAIN CIRCUIT

() : For 1-phase

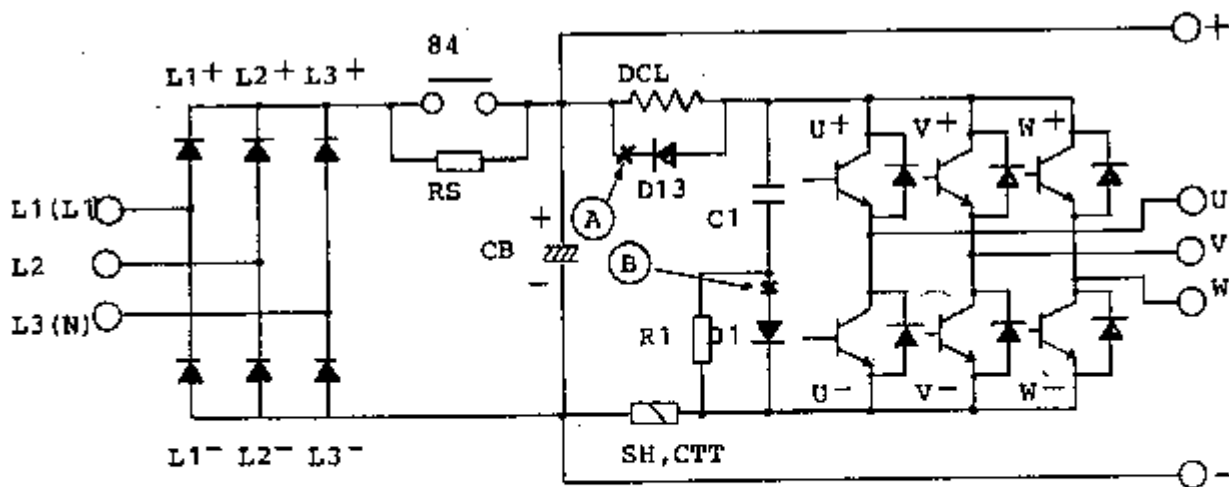


Fig.1

Before check, confirm the input power supply is removed, and the voltage between terminals + and - is 15V or less to prevent electric shock.

If the voltage between terminals + and - is higher, it is better to discharge the capacitor CB by connecting a resistor (30W, 500Ω) to between terminals + and - for 15 seconds or more.

LIMIT OF DISTRIBUTION

ISSUED BY *N. Suzuki*

HTC

DIST.
OEM

USER

DEPT.

*ELECTRIC
MACHINE
DESIGN*

- MEASUREMENT BY MEANS OF COIL-MOVING TESTER -

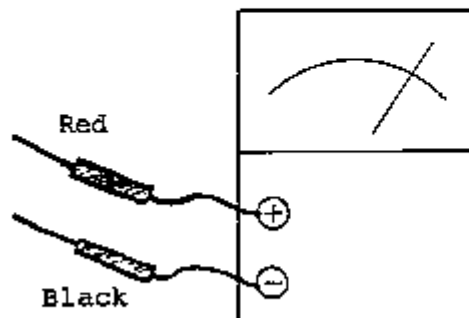
Tester set : 10 k Ω range

Table 1

Checked part	Measured terminals	Indication of tester		Remarks
		Forward direction	Reverse direction	
L1 ⁺ (L1 ⁺)	+ → L1 (L1)	⊕ → ⊖ Approx. 70 Ω or less	⊖ → ⊕ Full scale (∞)	If resistance value is nearly zero(0) or infinity(∞), replace the diode module.
L2 ⁺	+ → L2			
L3 ⁺ (N ⁺)	+ → L3 (N)			
L1 ⁻ (L1 ⁻)	- → L1 (L1)	Full scale (∞)	Approx. 70 Ω or less	If resistance value is nearly zero(0) or infinity(∞), replace the power module.
L2 ⁻ (L1 ⁻)	- → L2			
L3 ⁻ (N ⁻)	- → L3 (N)			
U ⁺	+ → U	Approx. 50 Ω or less	Full scale (\times)	If resistance value is nearly zero(0) or infinity(∞), replace the power module.
V ⁺	+ → V			
W ⁺	+ → W			
U ⁻	- → U	Full scale (\times)	Approx. 50 Ω or less	
V ⁻	- → V			
W ⁻	- → W			
CB	+ → -	150 Ω or less	Full scale (∞)	In case of no damage of modules.

The damage of DIODE and POWER MODULES make a short or open circuit, then, circuit tester indicates 0 or $\infty \Omega$.

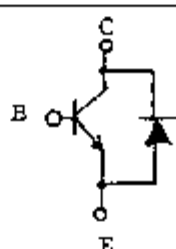
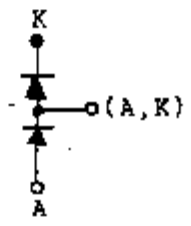
- DETAIL MEASUREMENT FOR EACH PART -

Open the cover of inverter.

In case of up to 15kVA, two printed circuit boards should be removed.

Table 2

Tester set: 10KΩ range

Part	Measured points	Indication of tester		Remarks
		Forward C → E	Reverse E → C	
Power module P 15B	C → E	50 Ω	full scale (∞)	 <p>Indicated values may be different for the kind of tester.</p>
	C → B	75 Ω	ditto	
	B → E	350 Ω	300 Ω	
" P 30X	C → E	50 Ω	full scale (∞)	
	C → B	70 Ω	ditto	
	B → E	250 Ω	220 Ω	
" Q 50 Z	C → E	50 Ω	full scale (∞)	
	C → B	70 Ω	"	
	B → E	360 Ω	360 Ω	
" Q 150 Z	C → E	40 Ω	∞	
	C → B	60 Ω	∞	
	B → E	180 Ω	220 Ω	
" Q 300 X	C → E	40 Ω	∞	
	C → B	55 Ω	∞	
	B → E	80 Ω	100 Ω	
Diode Module RM10TAH RM30DZ-2H	K → A	70 Ω	∞	
SKD30/16A	K → A	60 Ω	∞	
RM100Dz-2H	K → A	55 Ω	∞	

As to other kinds of module, compare with a good module.

Upon replacement, apply heat conductive silicone grease sparingly on the cooling surface of the module.

A damaged power module may sometimes be accompanied by a damaged base drive module on the printed circuit board.

Check visually for such consequential damages.

* Transformer T

Table 3

Applied model	Measured terminals	REsistance value
1.5 ~ 3.5SB	N - LL	100 Ω or less
5.5HB	L3 - LL *L2 - LL	* Before March production 1985
7.5 ~ 15HB 22, 33HC	L2 - LL	If value is zero or infinity, replace the transformer.
40 ~ 150HC	L1L - L2L L2L - L3L L3L - L1L	
Up to 33Hc	LH - LL	
40 ~ 150HC	L1L - L1 L2 - L2 L3 - L3	10 Ω or less

* Fly wheel diode D13 (5.5HB or bigger)

After having removed the point (A) as shown in Fig.1,
check by tester.

* Snubber parts C1, D1 (5.5HB or bigger)

After having removed the point (B) as shown in Fig.1,
check by tester.

* Smoothing condenser CB

When the polarity of tester
is changed once, the indicator
moves as shown Fig.2.

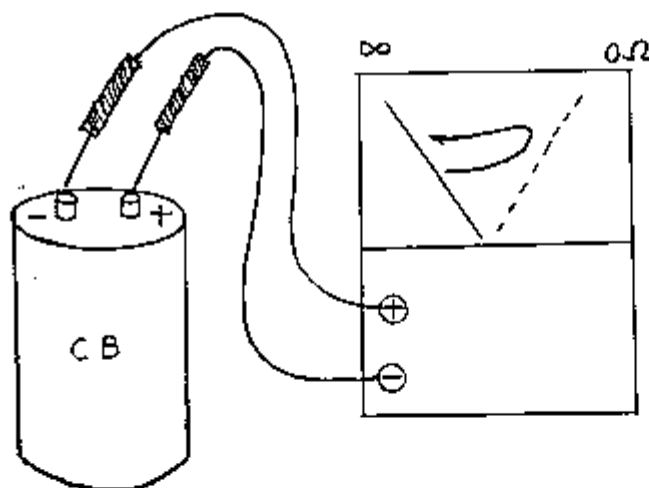


Fig. 2

2. LOGIC PCB

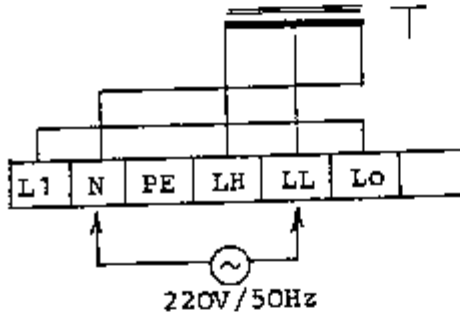
When both logic and base driving PCB are checked,

power supply should not be inputed to main circuit to prevent electric shock.

- HOW TO SUPPLY POWER TO LOGIC AND BASE DRIVING PCB -

At first, confirm the connection of transformer as follows.

(1.5 ~ 3.5SB)

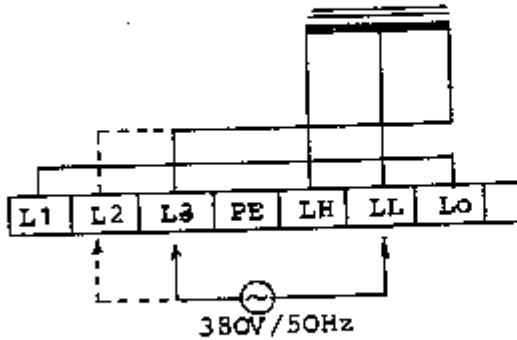


Resistance L1-Lo : 0 Ω

N -LL : 100 Ω or less

NOTE: Be careful not to connect between LH and LL to avoid the windings melting by big current.

(5.5HB)

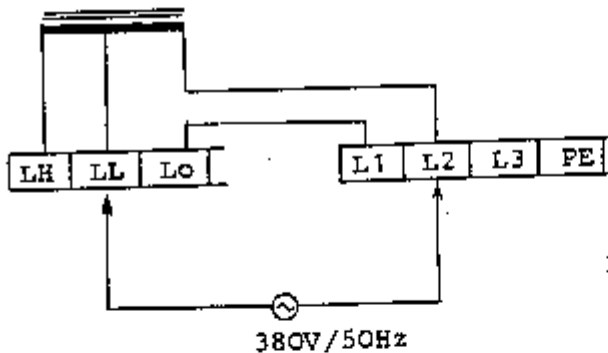


Resistance L1-Lo : 0 Ω

L3-LL : 100 Ω or less
(L2-LL)

-----: Before March production 1985

(7.5 ~ 15HB, 22, 33HC)

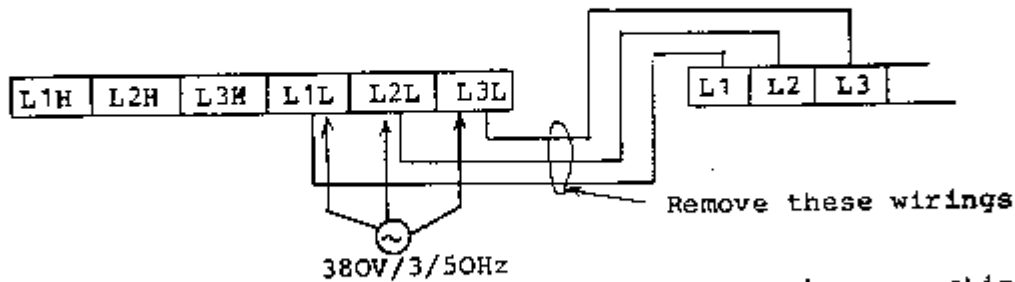


Resistance L1-Lo : 0 Ω

L2-LL : 100 Ω or less

Note: REMOVE THE CONNECTION OF TERMINAL RS (FORCED RESET).

(40 ~ 150HC)

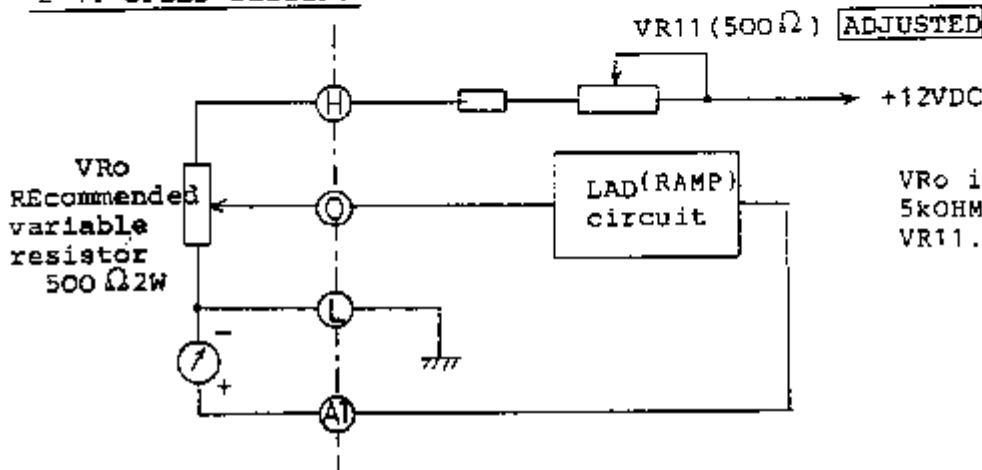


Note: Remove the connection of terminal RS (forced reset)

After having checked the above connection and removed the connector J2 as shown in Fig.3, connect power supply. At the moment, confirm the voltage between terminals + and - is 15V or less and power lamp on PCB is lighting before starting to check the PCBs.

If power lamp is not turned on, confirm the connection again.

2-1. SPEED SETTING



VR0 is available up to 5kOHM by adjusting VR11.

- H - O voltage \approx 10VDC
- O - L \approx 0 ~ 10VDC by changing VR0
- A1 - L \approx 0 ~ 10VDC reach to O - L voltage according to LAD time

If it is not possible to get the above voltages even if terminal PV12 supplies 12VDC, replace logic PCB.

The function and adjustment of VR11 will be explained later in **ADJUSTMENT**.

Be careful of the position of connector J1

Power Supply
from Transformer

Control Board

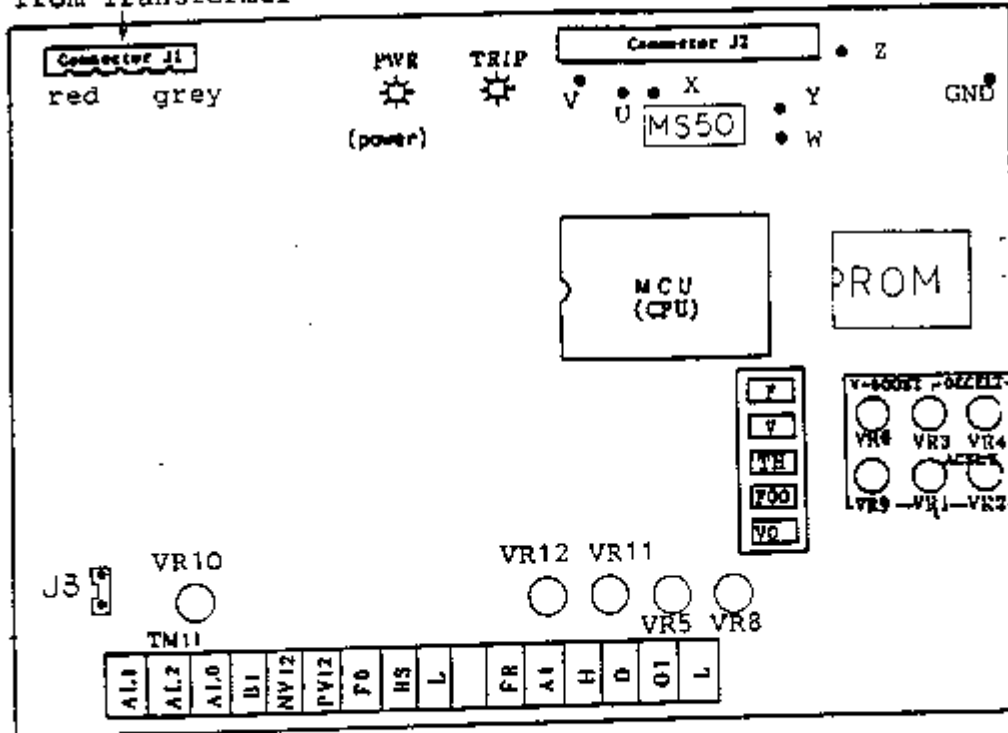
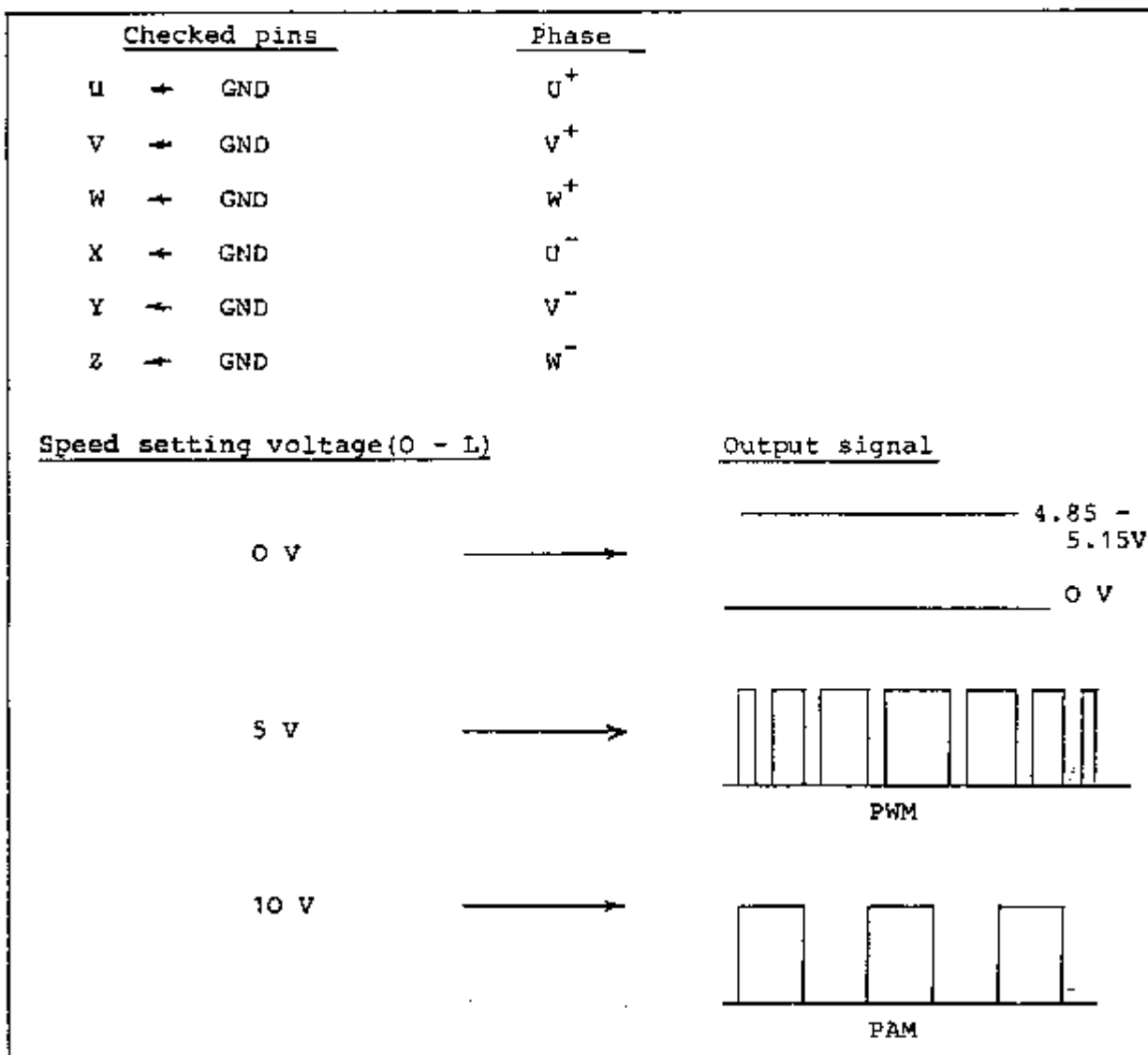


Fig. 3 PCB Parts Layout

● ----CHECK PINS

2-2. OUTPUT SIGNAL OF LOGIC CIRCUIT

Sin-coded waves(PWM) which logic circuit outputs can checked by check pins U,V,W,X,Y,Z and GND(ground) as shown in Fig.3 through oscilloscope. (Oscilloscope should be isolated.)



If any outputs are not correct, replace logic PCB.

3. OUTPUT SIGNAL OF BASE DRIVING PCB

Turn off power, then connect the cable J2 to logic PCB.

Layout of base PCB is shown as follows.

(1.5~3.5SB, 5.5HB)

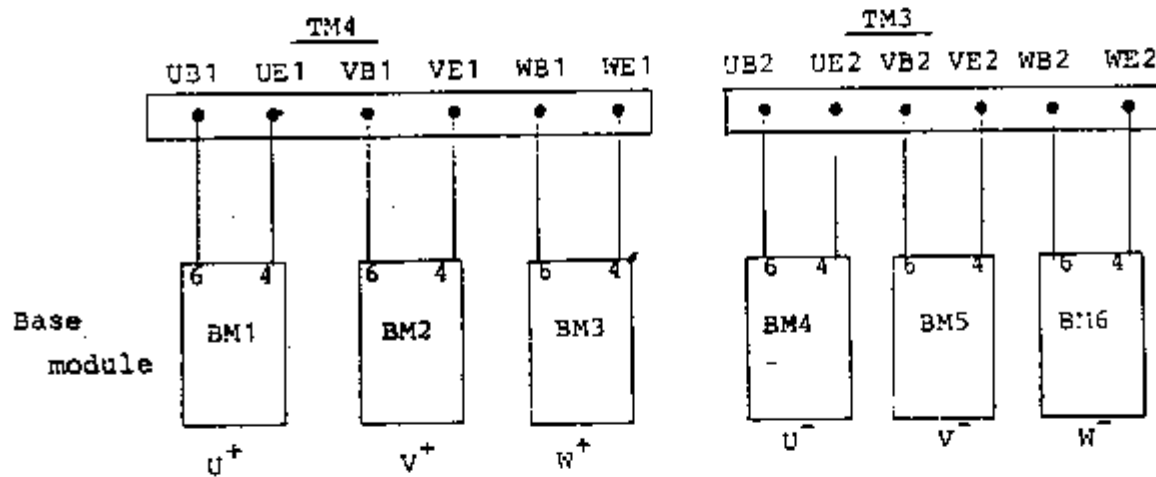
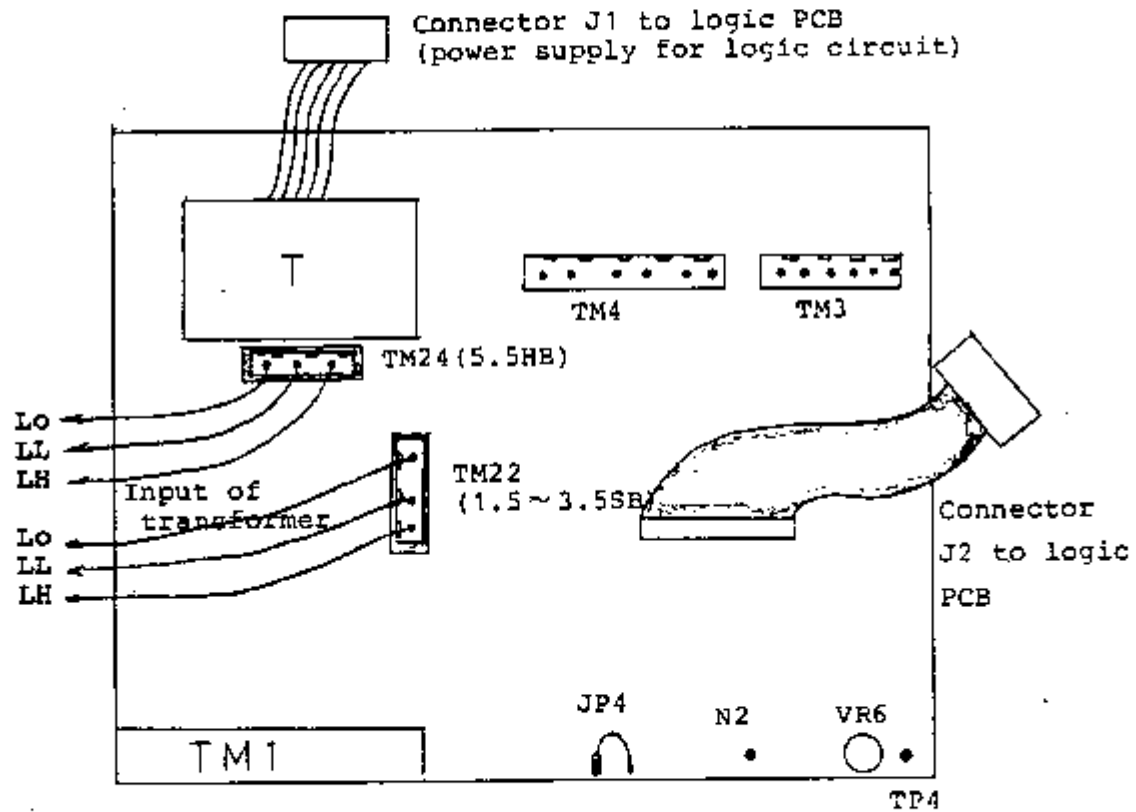


Fig. 4

(7.5~15HB, 22,33HC)

Connector J2 to logic PCB

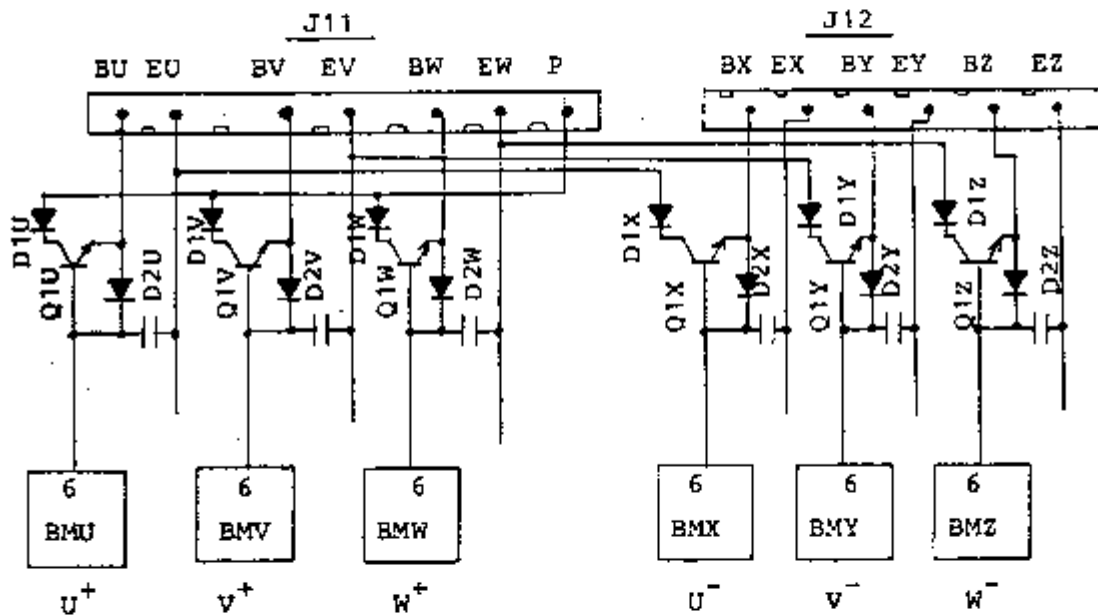
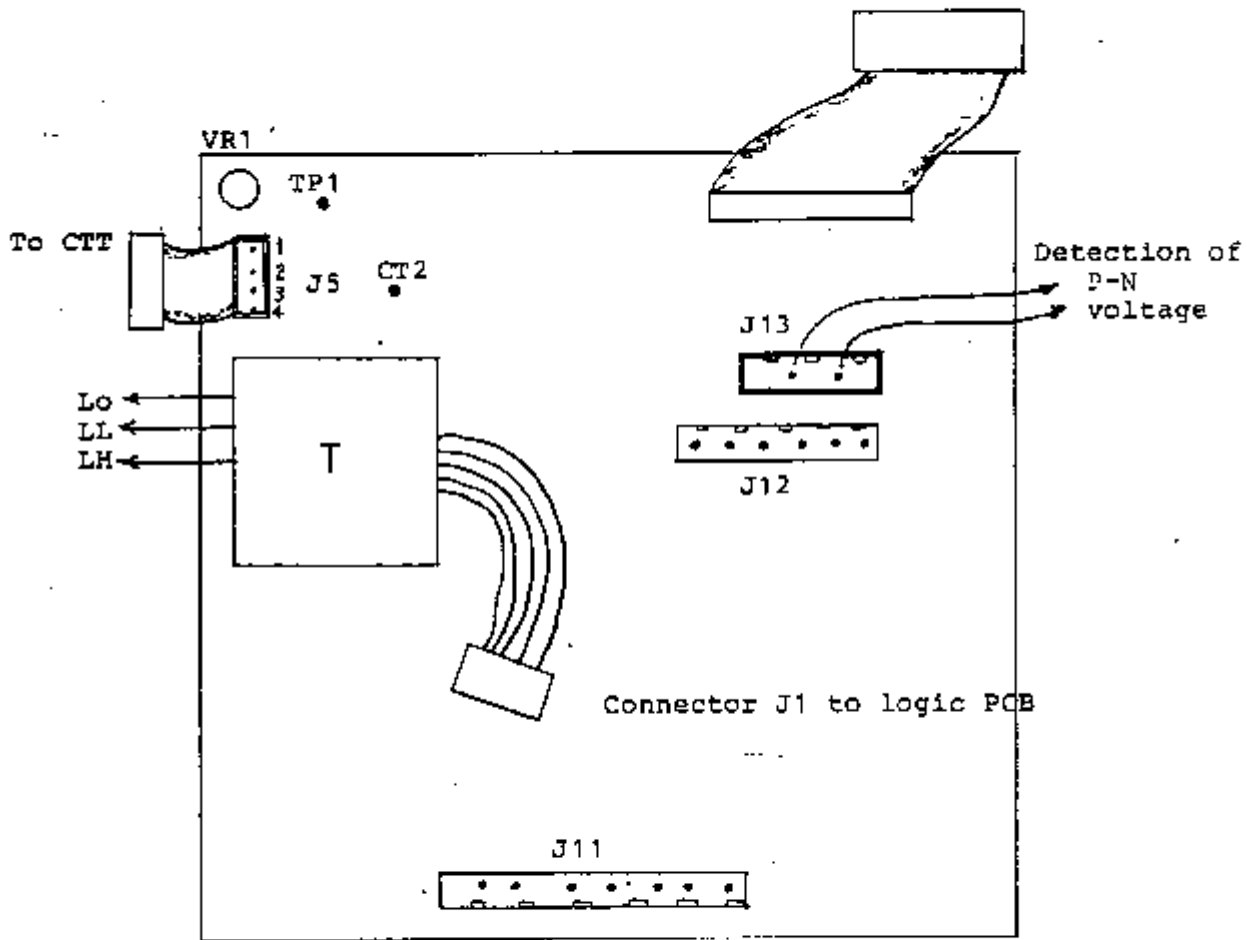


Fig.5

(40 ~ 150HC)

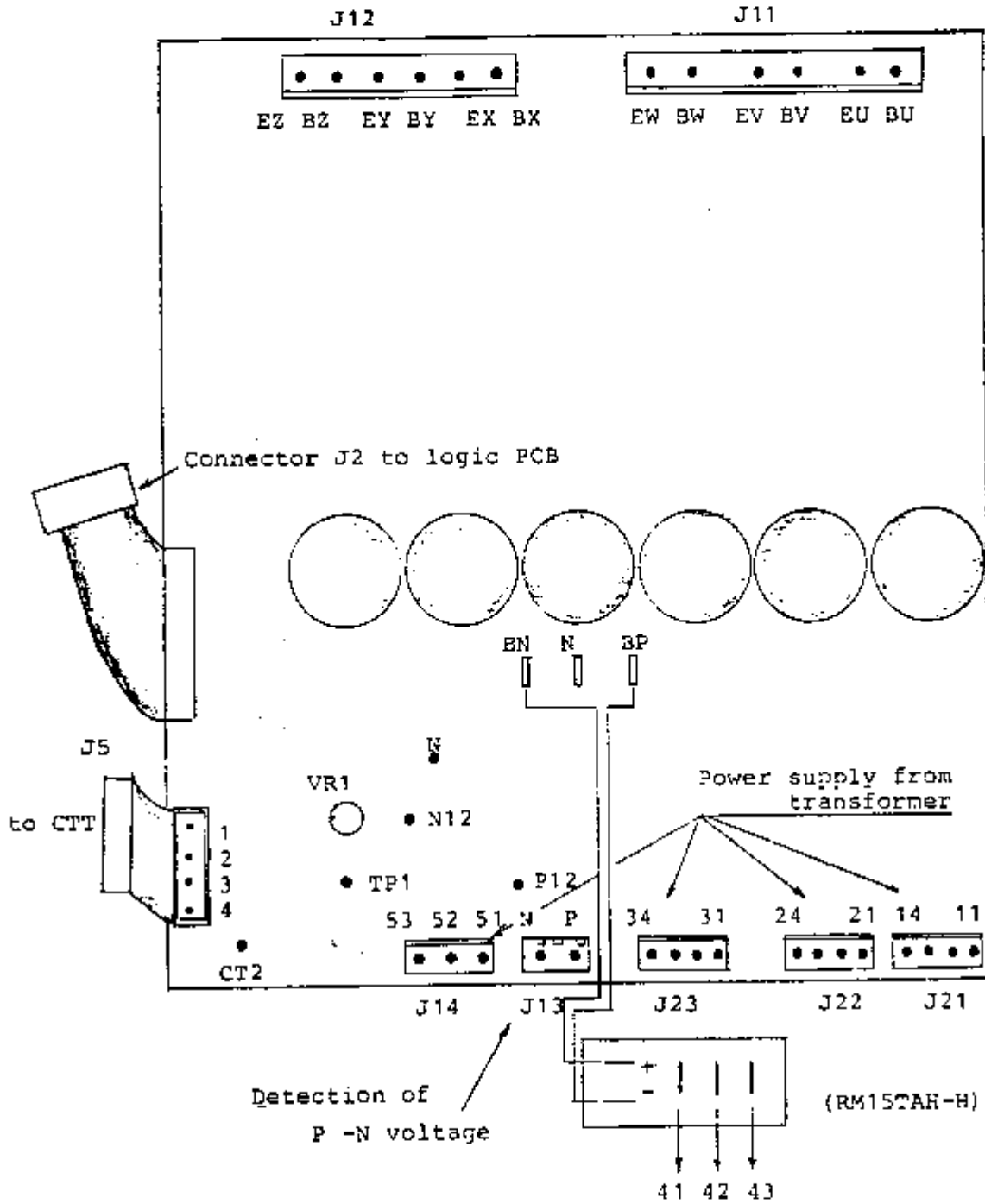


Fig.6

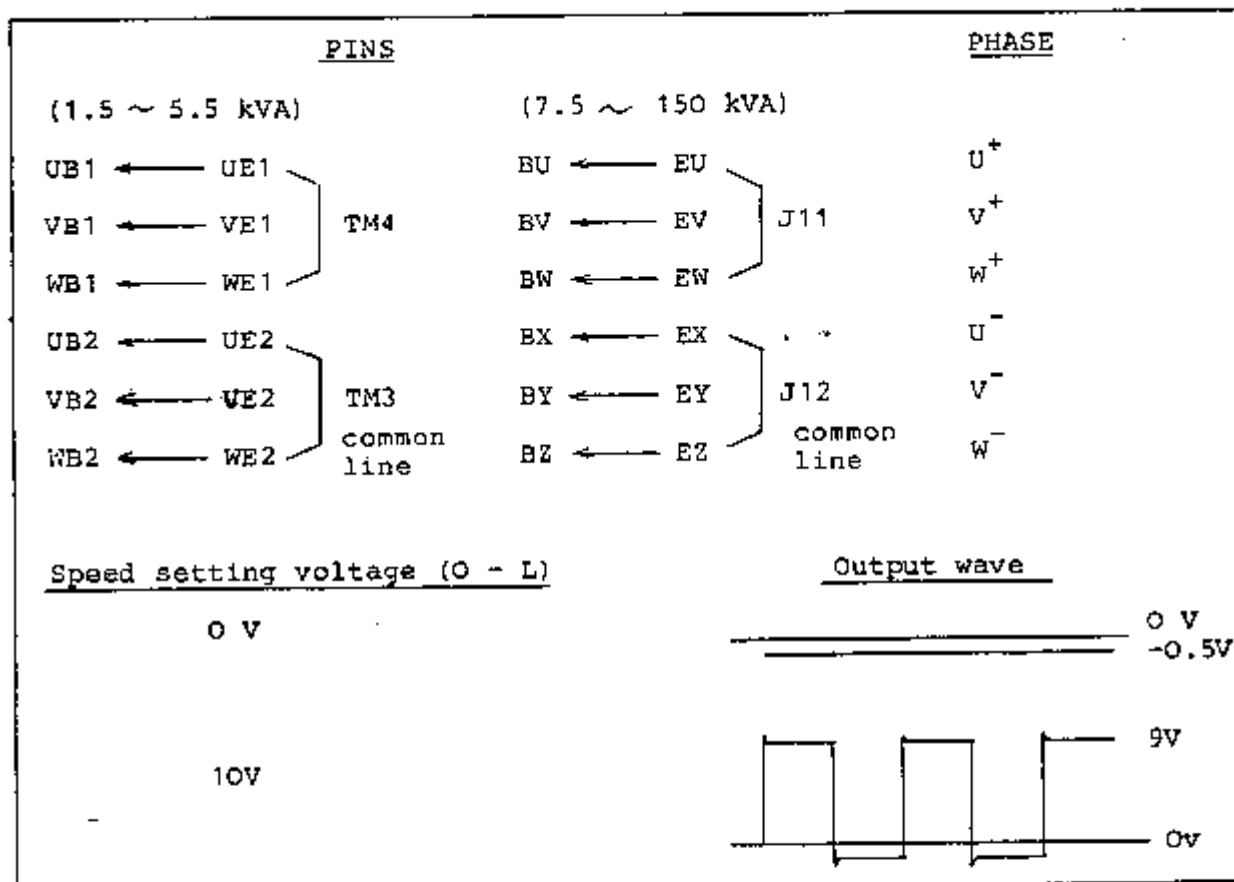
Disconnect the following connectors to check the output signal of base driving circuit.

1.5 ~ 3.5SB, 5.5HB	: TM3, TM4 (Fig.4)
7.5 ~ 15HB, 22 ~ 150HC	: J11, J12 (Fig.5, Fig.6)

Turn on power after disconnection.

Note: If TRIP lamp lights with disconnection of the above connectors, replace the base driving PCB because some ICs on PCB have failures.

Check the output signal of pins on connectors through oscilloscope.



If any outputs are not correct, replace a base module for wrong output or base PCB.

At replacement of base module for 7.5 33HC, check both diode (D1U, D1V, -----, D2U, D2V, ----) and transistor (Q1U, Q1V, -----), too.

4. MOTOR DRIVING

After having confirmed that every operation is okay, connect the connectors and wire correctly as shown in instruction manual. Then, try to drive amotor.

5. WARRANTY CLAIM

Hitachi suggests to fill out the attached check-sheet for warranty claim. (Refer to an example sheet.)

Let us report as detail as possible to solve your problem.

If possible, send us the connection diagram of customer application.

After checking your warranty report, Hitachi judges warranty or not and takes any action immediately.

HITACHI SUGGESTS FOR YOU TO HAVE SOME SPARE PARTS IN YOUR STOCK.

RECOMMENDED SPARE PARTS

1. POWER MODULE
2. CONVERTER MODULE
3. BASE MODULE
4. BASE DRIVING PCB
5. CONTROL PCB
6. TRANSFORMER

ENGINEERING SHEET

NARASHINO WORKS

DATE

MODEL NAME		MFG. NO.					
CLAIM NO.		ROM NO.					
PURCHASE DATE		INSTALLATION DATE		FAILURE DATE			
POWER MODULE (PM)	U+	U-	V+	V-	W+	W-	<input checked="" type="checkbox"/> : BROKEN PARTS <input type="checkbox"/> : MISSING PARTS <input type="checkbox"/> : OKAY
BASE MODULE (BM)	BM1 BMU	BM4 BMX	BM2 BMV	BM5 BMY	BM3 BMW	BM6 BMZ	
DIODE MODULE (DM)	FOR 3-PHASE		L1+	L2+	L3+	L1- L2- L3-	
	FOR 1-PHASE		L1+	N+	L1-	N-	
FLY-WHEEL DIODE	D13	SNUBBER PARTS		D1	C1	R1	
OTHER MAIN CIRCUIT PARTS							
OTHER BASE CIRCUIT PARTS							
LOGIC CIRCUIT PARTS							

SYMPTOM POWER LAMP : ON OFF
 TRIP INDICATION :
 PHENOMENON :








APPLICATIONS

INPUT POWER SUPPLY :
 APPLIED MOTOR :
 LOAD (MACHINE) :
 GD² OF LOAD :

POSITION OF POT. AND SHORT PINS :

F6	F	F5	VP	V	VC	OFF	TH	ON
F6Q	F0Q	F9C	V1	VQ	V2			

V. BOOST DECEL F. STOP ACCEL

 VR11  VR6  VR3  VR4  VR9  VR1  VR2

IF THE OTHER POT. METERS HAVE BEEN CHANGED, INDICATE THEIR POSITION.

YOUR COMMENTS FOR TROUBLE & CAUSES

Hitachi, Ltd.
NARASHINO WORKS

ENGINEERING SHEET

E.S NO. **0106**
DATE

WARRANTY CLAIM REPORT

EXAMPLE

MODEL NAME	HPC-VWS11HB		MFG. NO.	SE11HB152A			
CLAIM NO.	01		ROM NO.	B3E 0112			
PURCHASE DATE	05.04.85	INSTALLATION DATE	15.05.85	FAILURE DATE	20.07.85		
POWER MODULE (PM)	<input checked="" type="checkbox"/> U+	<input type="checkbox"/> U-	<input type="checkbox"/> V+	<input type="checkbox"/> V-	<input type="checkbox"/> W+	<input type="checkbox"/> W-	
BASE MODULE (BM)	<input checked="" type="checkbox"/> BM1 BMH	<input type="checkbox"/> BM4 BMK	<input type="checkbox"/> BM3 BMV	<input type="checkbox"/> BM5 BMY	<input type="checkbox"/> BM6 BMS	<input type="checkbox"/> BM2 BMZ	
DIODE MODULE (DM)	FOR 3-PHASE	<input type="checkbox"/> L1+	<input type="checkbox"/> L2+	<input type="checkbox"/> L3+	<input type="checkbox"/> L1-	<input type="checkbox"/> L2-	<input type="checkbox"/> L3-
	FOR 1-PHASE	<input type="checkbox"/> L1+	<input type="checkbox"/> N+	<input type="checkbox"/> L1-	<input type="checkbox"/> N-		
FLY-WHEEL DIODE	<input checked="" type="checkbox"/>	SNUBBER PARTS	<input type="checkbox"/> (D1)	<input type="checkbox"/> (C1)	<input type="checkbox"/> (R1)		
OTHER MAIN CIRCUIT PARTS	_____						
OTHER BASE CIRCUIT PARTS	Q1U (TRANSISTOR), D1U (DIODE)						
LOGIC CIRCUIT PARTS	_____						

: BROKEN PARTS
 : MISSING PARTS
 : OKAY

SYMPTOM
POWER LAMP : ON OFF
TRIP INDICATION : OVER CURRENT
PHENOMENON : AFTER TURNING ON POWER, O.C TRIP OCCURS AT FREQUENCY STARTING.

APPLICATIONS
INPUT POWER SUPPLY : 385V/3/50Hz
APPLIED MOTOR : 7.5kW 4POLES (RATED:16A)
LOAD (MACHINE) : CONVEYER
GD² OF LOAD : NOT AVAILABLE

POSITION OF POT. AND SHORT PINS : E6 VP OFF E60 V2

V. BOOST DECEL F. STOP ACCEL

IF THE OTHER POT. METERS HAVE BEEN CHANGED, INDICATE THEIR POSITION.

NO CHANGE (FACTORY SETTING)

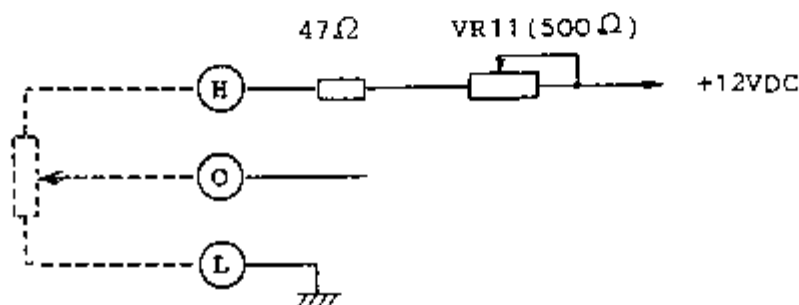
YOUR COMMENTS FOR TROUBLE & CAUSES
CUSTOMER MADE A SHORT CIRCUIT BETWEEN TERMINALS U & PE BY MISTAKE.

6. ADJUSTMENT

AS A PROMISE, DO NOT TOUCH ANY POT. METERS LOCKED BY PAINT.

But, if POT. meters locked by paint have already changed on purpose by customers, adjust them as follows.

VR11 : ADJUSTMENT OF THE H TERMINAL VOLTAGE (Refer to Fig.3)



If Hitachi standard operator is connected, frequency setting voltage can be adjusted exactly at 10VDC.

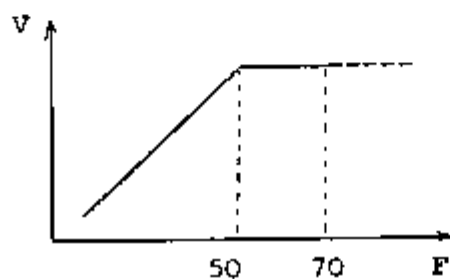
In this case, H terminal voltage changes from 5.7VDC to 11VDC by VR11.

In case of 2kΩ instead of 500Ω, the range is 9.4VDC to 11.7VDC.

SO, adjust for H terminal voltage to get 10VDC by VR11.

NOTE: VR11 is effective for the limitation of max. frequency, too.

For example, frequency is limited to max. 70Hz as follows.



Setting V/F pattern:

5-50-87Hz

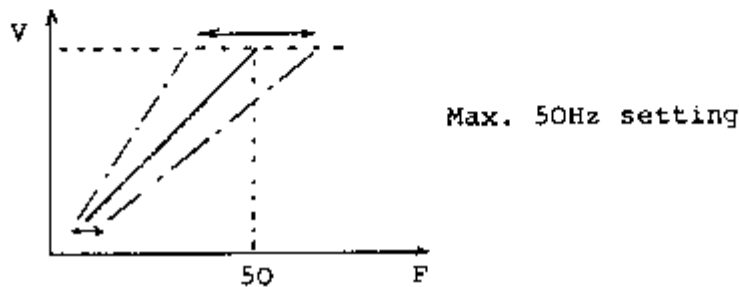
Adjust for H voltage as bellow:

$$V_H = 70\text{Hz} / 87\text{Hz} \times 10\text{V} = 8\text{V}$$

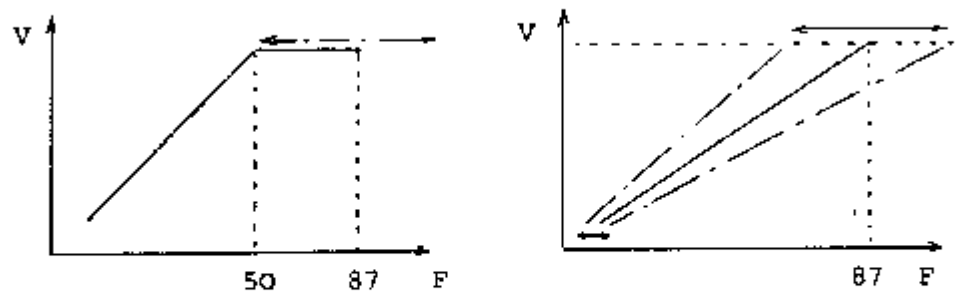
It is better to adjust with monitoring the digital frequency signal between terminals FO and L.

- HOW TO ADJUST THE OUTPUT FREQUENCY -VR8 : ADJUSTMENT OF MAX.FREQUENCY AT MAX.50Hz SETTINGVR5 : ADJUSTMENT OF MAX.FREQUENCY AT MAX.60Hz SETTING

(VR8 and VR5 can change the frequency, but not the voltage.)

VR12 : ADJUSTMENT OF MAX.FREQUENCY AT MAX.87Hz,104Hz SETTING

(VR12 can change the frequency and the voltage at the same time.)



Adjust the frequency with monitoring the digital frequency signal between terminals FO and L.

STEP1. Set the O-L voltage to max.10v by VR11 with external variable resistor maxmizing.

STEP2. Set pin connectors F60-F00, F6-F.
Adjust to get Fmax=60Hz by VR5.

STEP3. Change pin connectors F60-F00, F5-F.
Adjust to get Fmax=50Hz by VR8.

STEP4. Change pin connectors F90-F00, F5-F.
Adjust to get Fmax=87Hz by VR12.

After adjustment, lock pot.meters by paint.

IN CASE OF WRONG ADJUSTMENT, CPU ERROR OR INVERTER DAMAGE MAY BE CAUSED, IN CASE, HITACHI WILL NOT TAKE ANY WARRANTY.

VR10 : ADJUSTMENT OF THE DETECTION LEVEL FOR UNDER VOLTAGE

Adjust to get UNDER VOLTAGE TRIP at input power supply
177VAC(208 X 0.85 :200v class) or 323VAC(380 X 0.85:
400V class) by VR10.

A variable transformer is required to supply the above
voltage.

After adjustment, lock pot. meter by paint.

VR6, VR1 ON BASE PCB : ADJUSTMENT OF THE REFERENCE VOLTAGE TO
PROTECT INVERTER AGAINST OVER VOLTAGE
OVER CURRENT AND OVER LOAD

(1.5 - 3.5SB, 5.5HB: refer to Fig.4)

REmove the connection JP4 at check.

Adjust to get 4.4VDC (1.5 - 3.5SB), 4.2VDC (5.5HB)
for the voltage between check pins TP4 and N2 by VR6.

(7.5 - 15HB, 22 - 150HC : refer to Fig.5, Fig.6)

Disconnect J5 and put AVR the pins 3(+) and 4(-) of J5.

Adjust to get -7VDC between check pins TP1 and CT2
with AVR(8VDC) by VR1.

After adjustment, connect JP4 and lock pot. meters by paint.

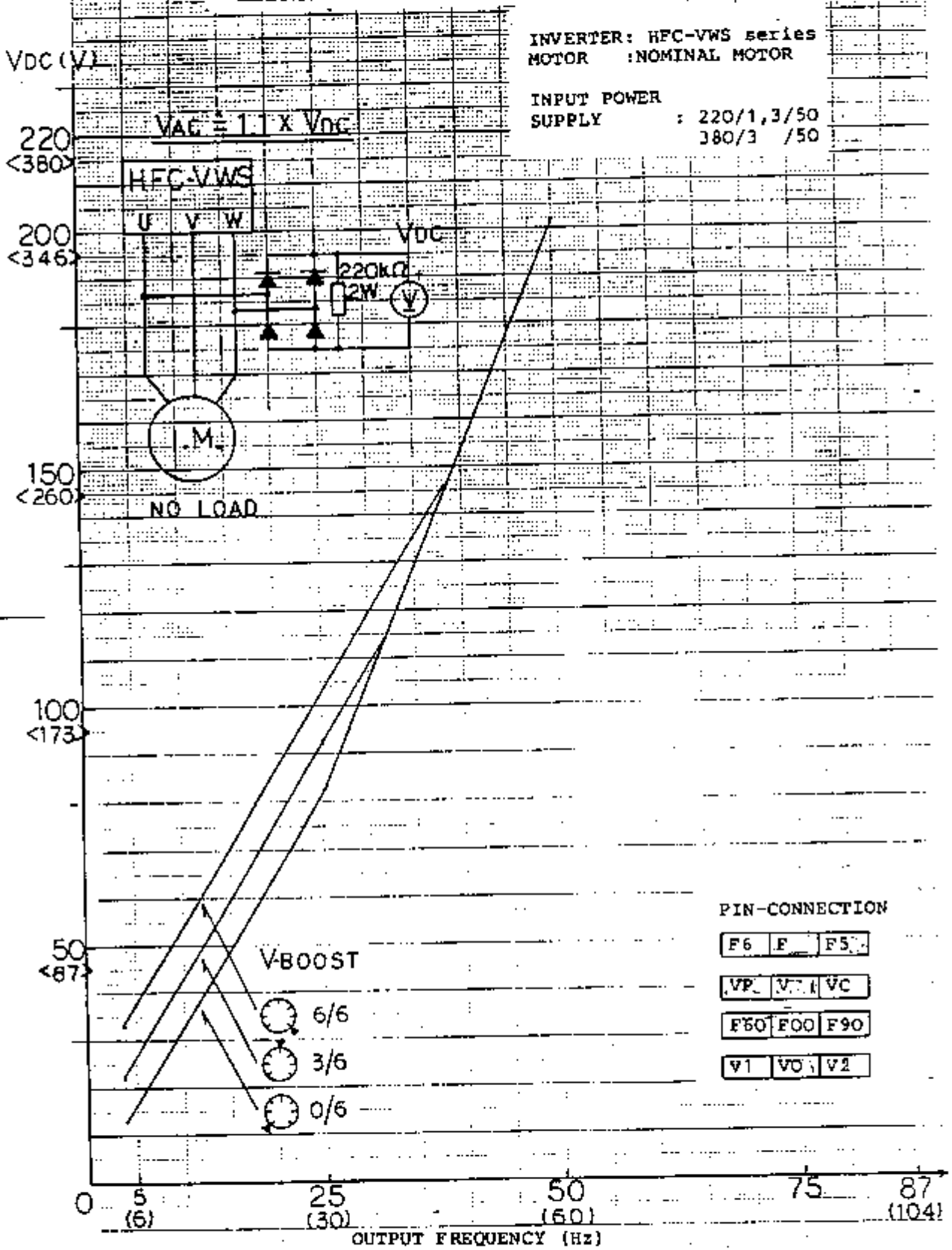
CHECK PINS P12, N12, N: CONTROL POWER SUPPLY FOR BASE PCB

P12 ← N: 8.5 - 10.5 VDC

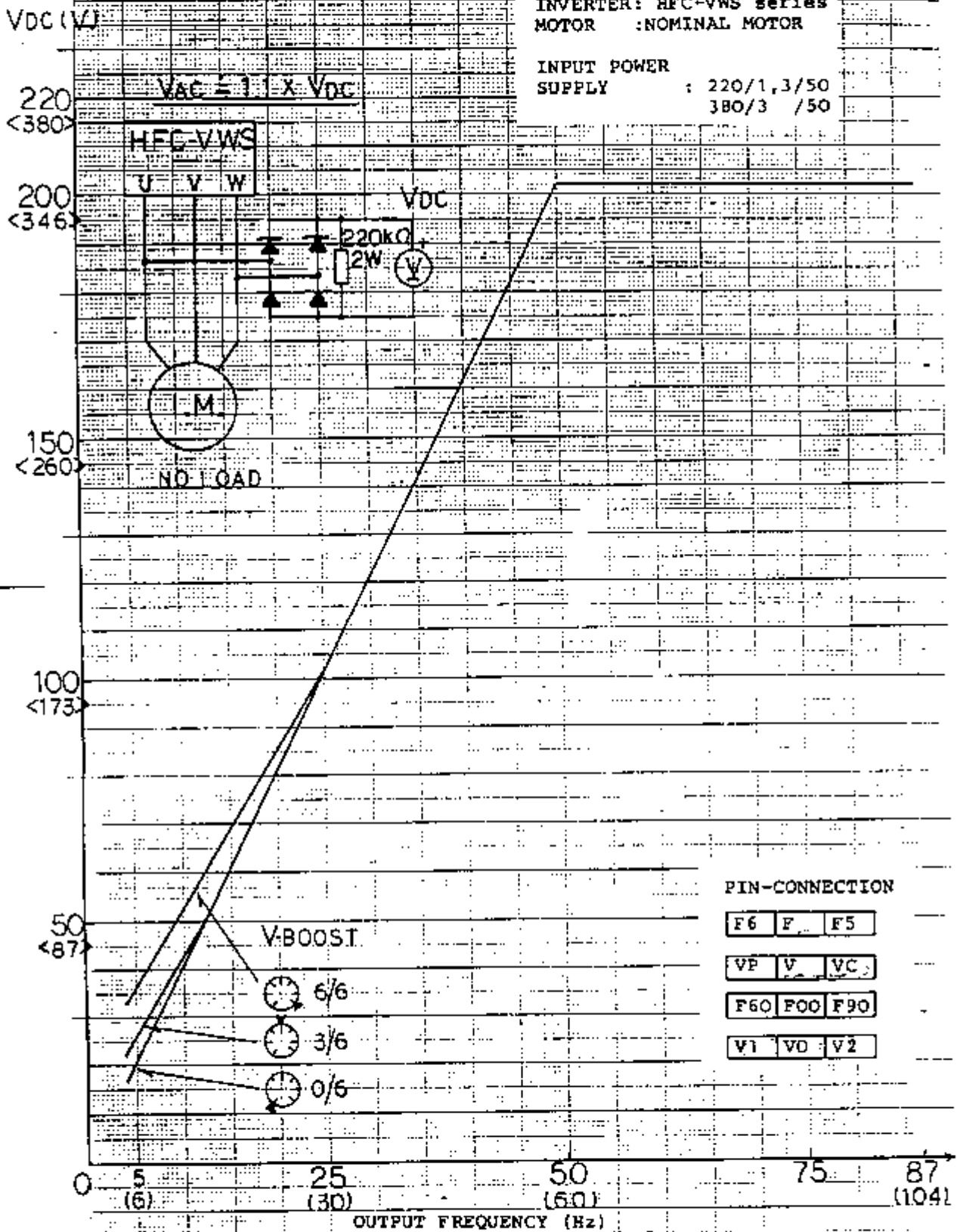
N12 ← N: -8.5 - -10.5 VDC

ATTENTION!!! HITACHI WILL NOT TAKE ANY WARRANTY FOR MISADJUSTMENT
AND THE CHANGE OF UNTOUCHABLE POT. METERS!

OUTPUT VOLTAGE/OUTPUT FREQUENCY CHARACTERISTICS



OUTPUT VOLTAGE/OUTPUT FREQUENCY CHARACTERISTICS



OUTPUT VOLTAGE/OUTPUT FREQUENCY CHARACTERISTICS

