ONLY FOR EDD SERVICE
NOT FOR EDD DISTRIBUTORS

HITACHI INVERTER

HFC-VWS3U(H) SERIES

SERVICE MANUAL FOR USA-VERSION

HITACHI

ES-0132

C O N T E N T S

1 INVESTIGATION

When trouble happens!

- Investigate the customer's application and phenomenon and fill in them on the trouble report sheet.
- Fill in the setting data of customer on the data setting list.
- Investigate the customer's setting data whether they are proper for the application system.
- Check the inverter
  Which parts have been damaged: See page

* The reason for the trouble is not always inverter's failure. We must check the system and inverter both of them.

TROUBLE REPORT

Customer	
Model Type	
Serial No.(MFG.No.)	
Date of Purchase	
Date of Installation	
Date of Failure	

APPLICATION

DETAILS OF FAILURE

BROKEN COMPONENTS

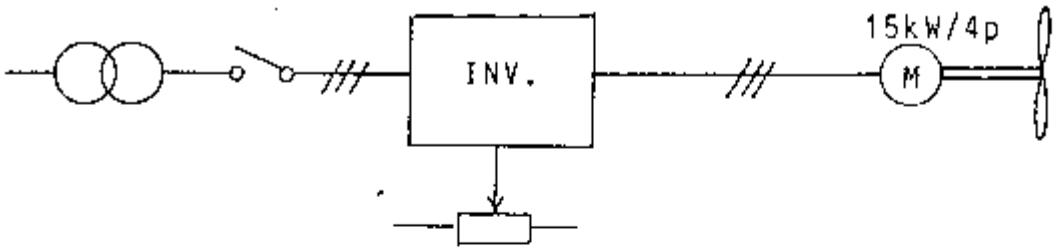
REMARKS

TROUBLE REPORT (Example)

Customer	
Model Type	HFC-VWS 22 HF3UH
Serial No.(MFG.No.)	SU22HF 3H89A
Date of Purchase	SEPT. 88
Date of Installation	OCT. 88
Date of Failure	NOV. 88

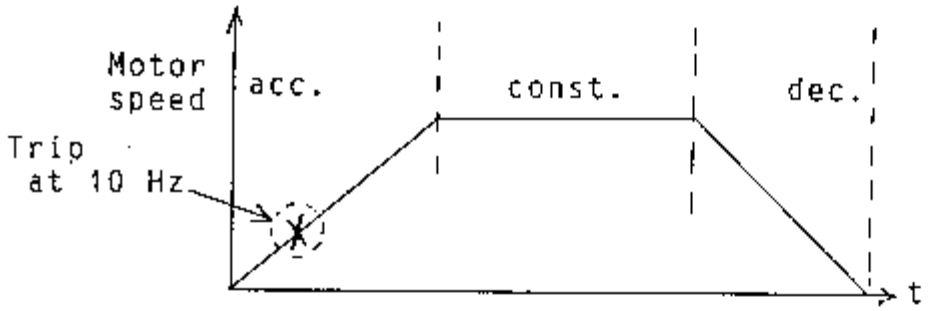
APPLICATION

Fan drive



DETAILS OF FAILURE

When the reference signal (0-10V) is applied to the inverter, over current trip comes.



BROKEN COMPONENTS

Power module

REMARKS

(APPENDIX)

HFC-VWS$_3$ Series DATA SETTING LIST

HFC-VWS$_3$ inverter has many function so that the setting data can be changed by customers.

It is recommended to fill the setting data out the following data sheet for service, maintenance and investigation of trouble.

TYPE : HFC-VWS ☐

MFG. No. : ☐

Described on spec. label on top cover

* Monitor Mode

Display Sequence	Monitor Name	Initial Display	Standard Setting	Setting Data
1	Output frequency display	FM 000.0Hz	—	
2	Frequency setting command	FS 000.0Hz	—	
3	Frequency command method	F-SET-M Ope.-key	Ope.-key	
4	Operation command method	F/R-SW Ope.-key	Ope.-key	
5	Motor speed display	RPM 4P 0000RPM	4	
6	Output current display	[ ]---- A 1=000.0%	—	
7	Manual torque boost adjustment	V-Boost Code(31)	31	
8	Output voltage gain adjustment	V-Gain 100%	100	
9	Jogging frequency setting	Jogging 01.0Hz	1.0	
10	Fault display	*	—	—

Table 1

* Function Mode

Display Sequence	Function Name	Function Mode	Display Contents	Standard Setting	Setting Data
1	V/F pattern setting	F-00	VFT-VC	VTE-VC 060-060	
2	Acceleration time setting	F-01	ACCEL-1	30	
3	Deceleration time setting	F-02	DECEL-1	30	
4	Maximum frequency fine adjustment	F-03	*FMAX.	0	
5	Starting frequency adjustment	F-04	*FMIN.	0.5	
6	Maximum frequency limiter setting	F-05	H-LIM-F	0	
7	Minimum frequency limiter setting	F-06	L-LIM-F	0	
8	Jump frequency 1 setting	F-07	JUMP-F1	0	
9	Jump frequency 2 setting	F-08	JUMP-F2	0	
10	Jump frequency 3 setting	F-09	JUMP-F3	0	
11	Motor noise adjustment	F-10	CF-code	6	
12	Adjustment of frequency step time at start	F-11	Fstep-T	1.0	
13	Multistage speed 1 setting	F-12	Speed-1	0	
14	Multistage speed 2 setting	F-13	Speed-2	0	
15	Multistage speed 3 setting	F-14	Speed-3	0	
16	2-stage acceleration time setting	F-14	ACCEL-2	30	
17	2-stage deceleration time setting	F-19	DECEL-2	30	
18	DC braking frequency adjustment	F-20	F-DCB	1	
19	DC braking power adjustment	F-21	V-DCB	00	
20	DC braking time adjustment	F-22	T-DCB	00	
21	Electric thermal level adjustment	F-23	Ethern	100	
22	Linear/S-character curved acceleration selection	F-24	ACCline	Linear	
23	Linear/S-character curved deceleration selection	F-25	DECline	Linear	
24	Start point frequency of external frequency setting	F-26	F-START	0	
25	End point frequency of external frequency setting	F-27	F-END	0	
26	Switch selection	F-28	SWITCH1	00000111	
27	Overload limit time constant setting	F-30	LM.CONS	1.0	
28	Overload warning level adjustment	F-31	OLalarm	100	
29	Automatic torque boost adjustment	F-32	V-auto	00	
30	Allowable instantaneous power failure time setting	F-33	IPS-T	1	
31	Stand-by time setting for restart after instantaneous power failure	F-34	IPS-1-T	1	

Description of MFG. No.

◎ Note our arrangement of MFG. No.

In case of AF-150502-0480 (Rev. No. =A and MFGD in 1988, Sep.),

MFG. No. SU5HF3H89A

① ②③④⑤⑥⑦⑧⑨

① : Inverter series name
SU→USA MODEL

② : Inverter capacity
1.5KVA→ 1.5
2.5KVA→ 2
:
5.5KVA→ 5
8 KVA→ 8
11 KVA→11
:

③ : Input power
H : 400V and three phase class
L : 200V and three phase class

④ : Inverter construction
D : Enclosed type with disital operator station
F : With disital operator station

⑤ : Series number
3 →Same as VWS3 series

⑥ : Ground foult protection
H : With G.F.P
Blank : Without G.F.P

⑦ : MFG. Year
8 →1988
9 →1989
0 →1990
1 →1991
:
:

⑧ : MFG. Month
Jan. →1
Feb. →2
: :
: :
Oct. →0
Nov. →J
Dec. →K

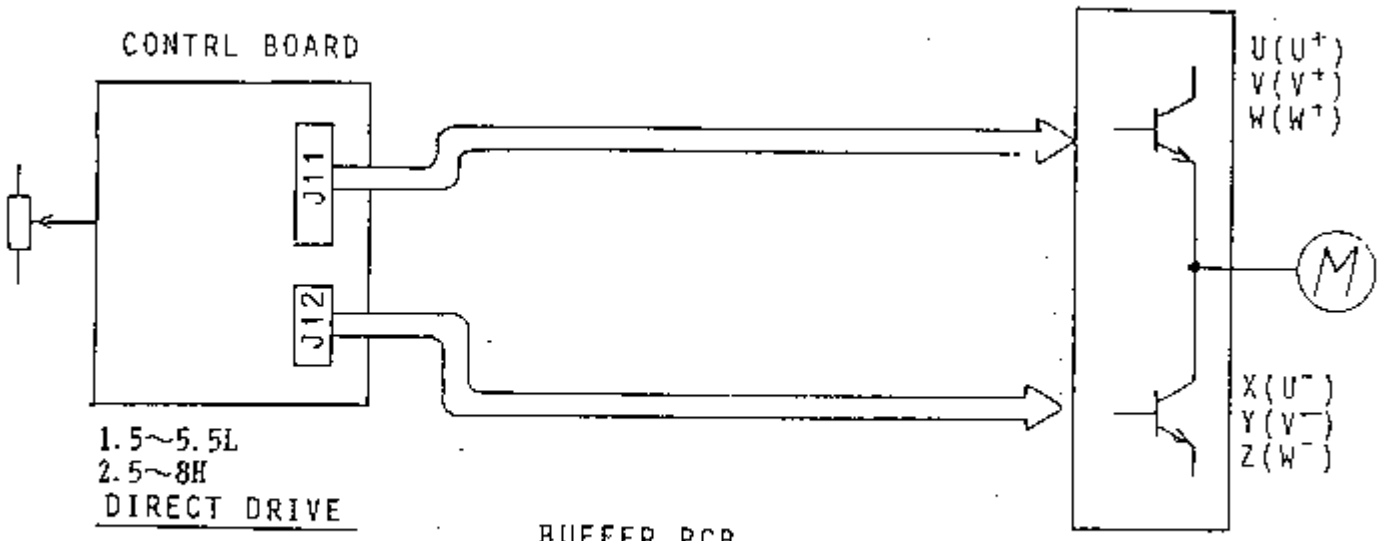
⑨ : Revision No.
A, B, C……

2 KIND OF PRINTED CIRCUIT BOARD

Series	VWS3U (H)	
Use	Control	Base drive Buffer
1. 5L	SU3L1. 5LO	
2. 5L	SU3L2LO	
3. 5L	SU3L3-5LO	
5. 5L	↓	
8L	SU3L8-11LO	SU3B8-22LO
11L	↓	↓
16L	SU3L16-22LO	↓
22L	↓	↓
33L	SU3L33LO	SU3B33LO
40L	SU3L40LO	SU3B40LO
50L	SU3L50-75LO	SU3B50LO
60L	↓	SU3B60LO
75L	↓	SU3B75LO
2. 5H	SU3L1-3HO	
3. 5H	↓	
5. 5H	SU3L5HO	
8H	SU3L8HO	
11H	SU3L11-16HO	SU3B11-22HO
16H	↓	↓
22H	SU3L22HO	↓
33H	SU3L33-40HO	SU3B33HO
40H	↓	SU3B40-50HO
50H	SU3L50-75HO	↓
60H	↓	SU3B60-75HO
75H	↓	↓

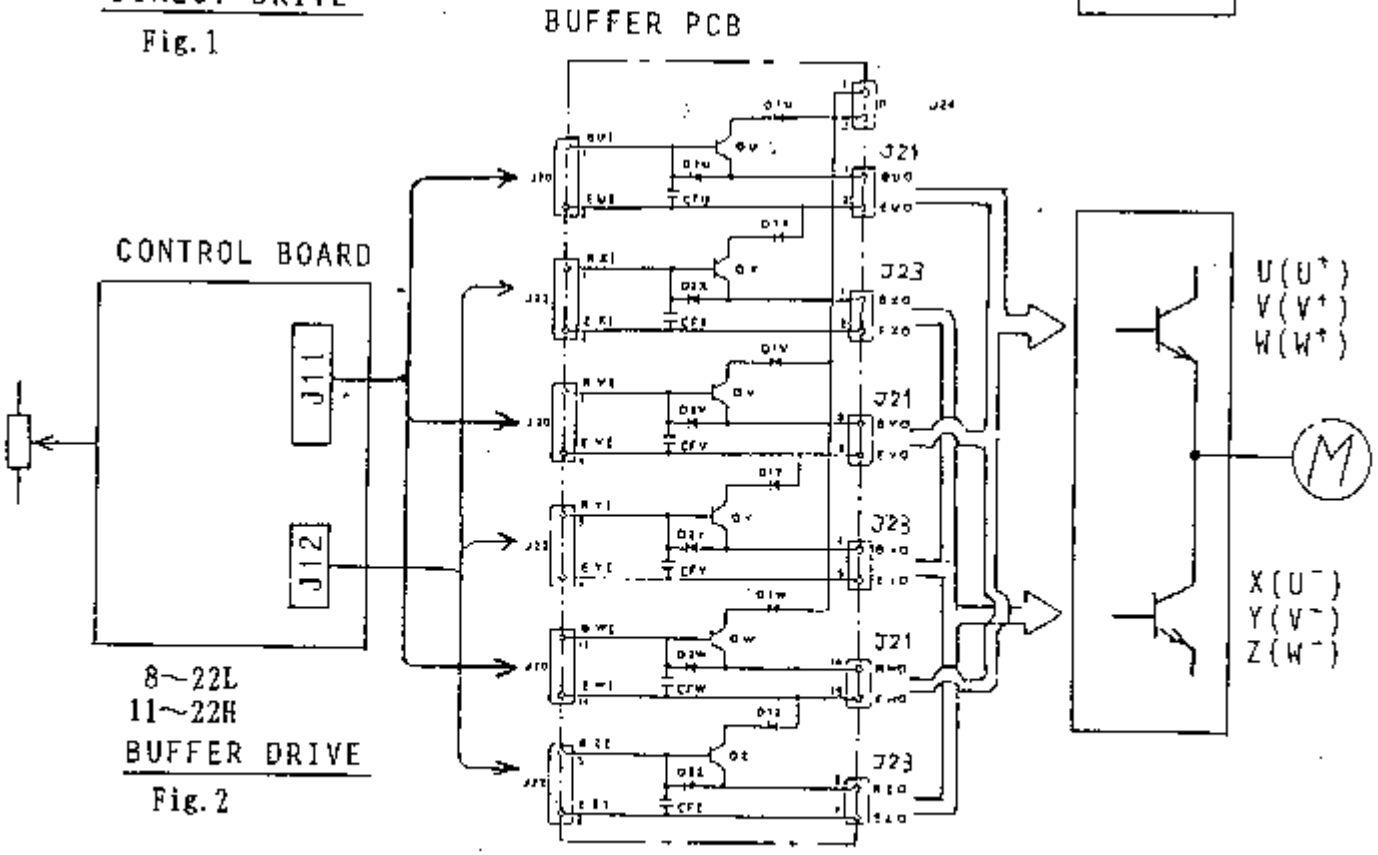
Table 2

O: Rev. No.



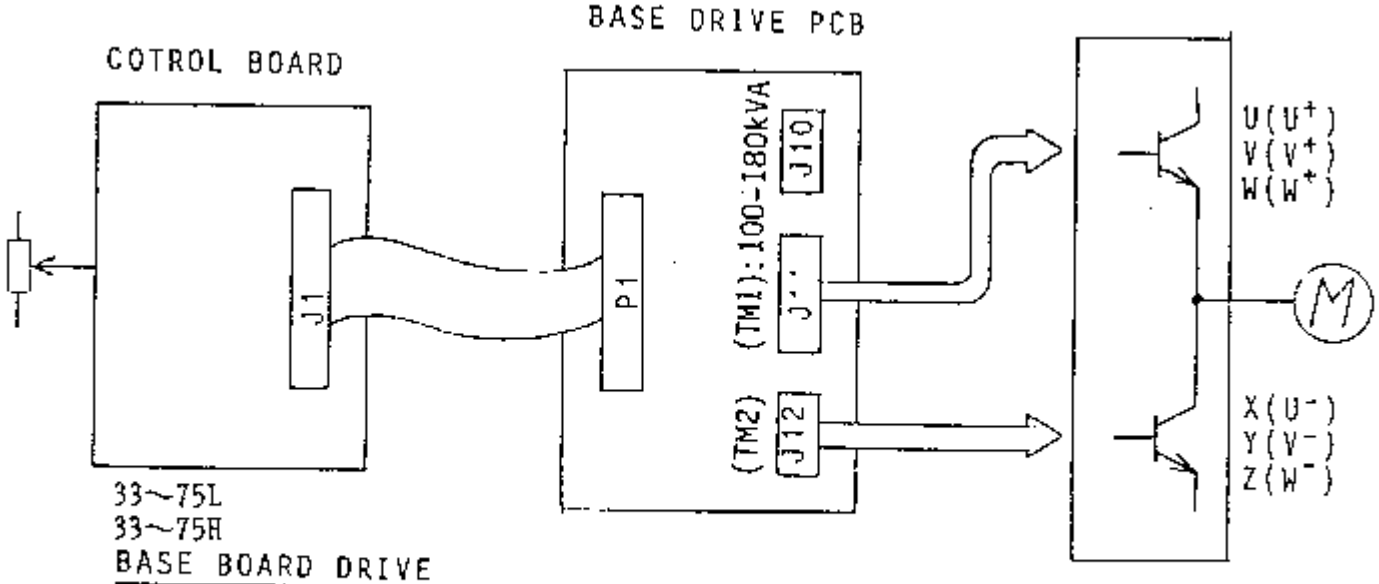
1.5~5.5L
2.5~8H
DIRECT DRIVE

Fig. 1



8~22L
11~22H
BUFFER DRIVE

Fig. 2



33~75L
33~75H
BASE BOARD DRIVE

Fig. 3

METHOD OF TRANSISTOR DRIVE

3 USE AND LEVEL OF CHECKPINS

After disconnecting Sub. PCB.

Check pin	Use and level	Address(Location)	
		~22kVA	33~75kVA
PV5	Power source for dig.circuit PV5-L:4.9~5.1 VDC (HC245-20pin-L)←Upto22kVA	5A	3E(L)←Logic 7G(B)←Base
PV12	Power source for analogue circuit PV12-L:11.76~12.24 VDC	9E	5B(L) 7G(B)
NV12	Power source for analogue circuit NV12-L:-11.76~12.24 VDC	3A	5B(L) 7G(B)
L	Ground for analogue circuit	1A,10A	8A,2E(L) 7G(B)
AP5	Power source for protection circuit AP5-AL:4.9~5.1 VDC	8E	5F(B)
AL	Ground for AP5	8E	—
VDC	Over voltage VDC-AL :3.25 V (Trip level)	8E	6F(B)
P	DC voltage of the-intermidiate circuit P-N:max. 400VDC	6H	6F(B)
N2	DC current of main circuit N2-N:1.3VDC (Trip level) (up to 5.5kVA)	7H	—
N	Ground for P and N2	8H	6F(B)
UL	Ground for base circuit of U+ DP 7Ⓚ-UL: 6.5~9.5V *1) (1.5~75 kVA) DP31Ⓐ-UL:-6.5~9.5V (33 ~75 kVA)	2F	1F(B)
VL	Ground for base circuit of V+ DP 8Ⓚ-VL: 6.5~9.5V *1) (1.5~75 kVA) DP34Ⓐ-VL:-6.5~9.5V (33 ~75 kVA)	3E	2E(B)
WL	Ground for base circuit of W+ DP 9Ⓚ-WL: 6.5~9.5V *1) (1.5~75 kVA) DP37Ⓐ-WL:-6.5~9.5V (33 ~75 kVA)	4E	3E(B)
XL	Ground for base circuit of X (U-,V-,W-) DP10Ⓚ-XL: 6.5~9.5V *1) (1.5~75 kVA) DP41Ⓐ-XL:-6.5~9.5V (33 ~75 kVA)	3H	6A(B)

MAIN (DANGER FOR HIGH VOLTAGE) →←LOGIC

Table 3

After connecting Sub. PCB.

PV12	Power source for Sub. PCB PV12-L :11.76~12.24	1B	1B
NV12	Power source for Sub. PCB NV12-L : 11.76~12.24	1A	1A

Table 4

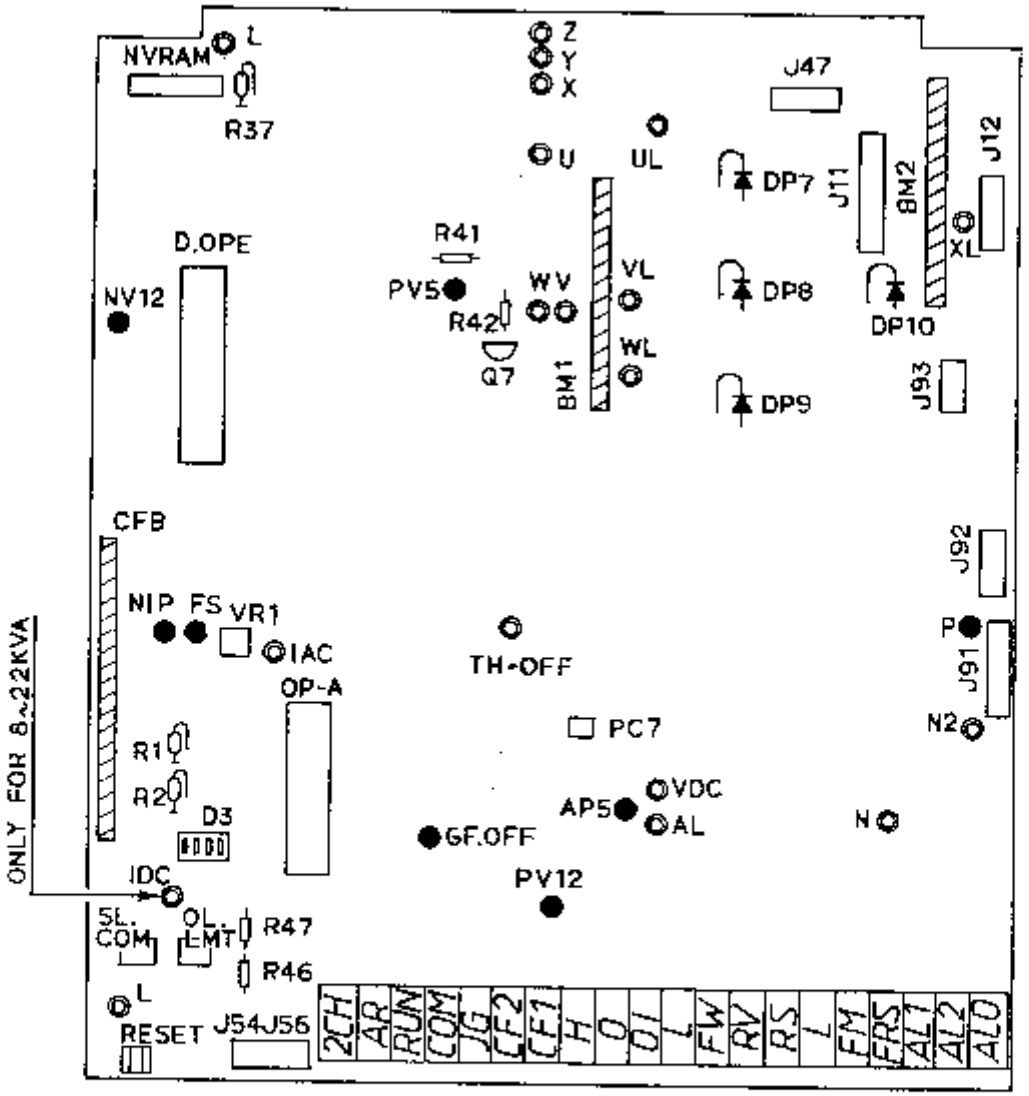
*1) Power source of base circuit for 22kVA or less is positive voltage.
Power source of base circuit for 33kVA or more is both positive and negative voltage.

*2) L:PCB for control
B:PCB for base drive

heck in	Use and level	Address(Location) ~5.5KVA	8 ~22kVA	33~75kVA	See pag
U V W X Y Z	PWM signal from control board U+ - L , X(U-) - L V+ - L , Y(V-) - L W+ - L , Z(W-) - L Transistor:OFF Transistor:ON  	2D 2D 3D 1D 1D 1D	2D 3D 3D 1D 1D 1D	3E(L) 3E(L) 2E(L) 2E(L) 3E(L) 2E(L)	
FS	V/F converter output signal FS — L O-L = 10V (Dip. switch 10V) 5V (Dip. switch 5V) OI-L = 20mA FS-L  In case of the above FS-L : approx.390kHz	6A	6A	4A (L)	
IAC	Motor current detecting signal  IAC — L	7B	7B	5C(L)	24
IDC	DC-current signal IDC — L		9A	7E(L)	
NIP	Motor speed detecting signal It is used for automatic restart NIP — L  	6A	6A	5E(L)	
T.OFF	When it is shorted with Ⓛ ,electric thermal and over load limiter function would be stopped	6C	6C	4E(L)	

Table 5

1.5~22KVA



○ CHECK PIN

● CHECK LAND

Fig.4

33~75KVA

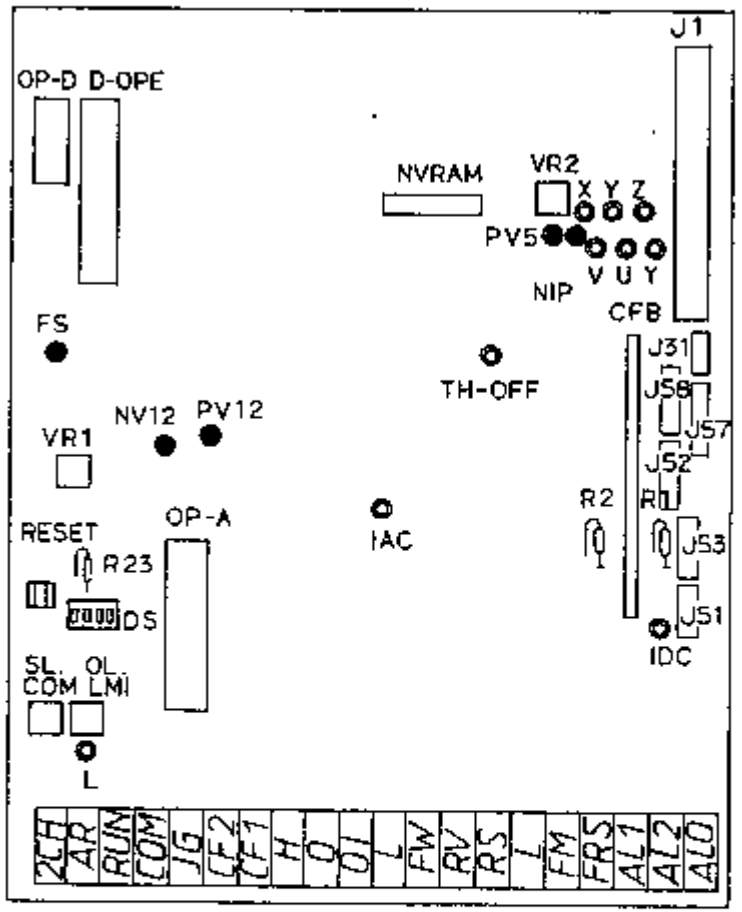


Fig.5

PARTS LAYOUT OF CONTROL BOARD

33~75KVA

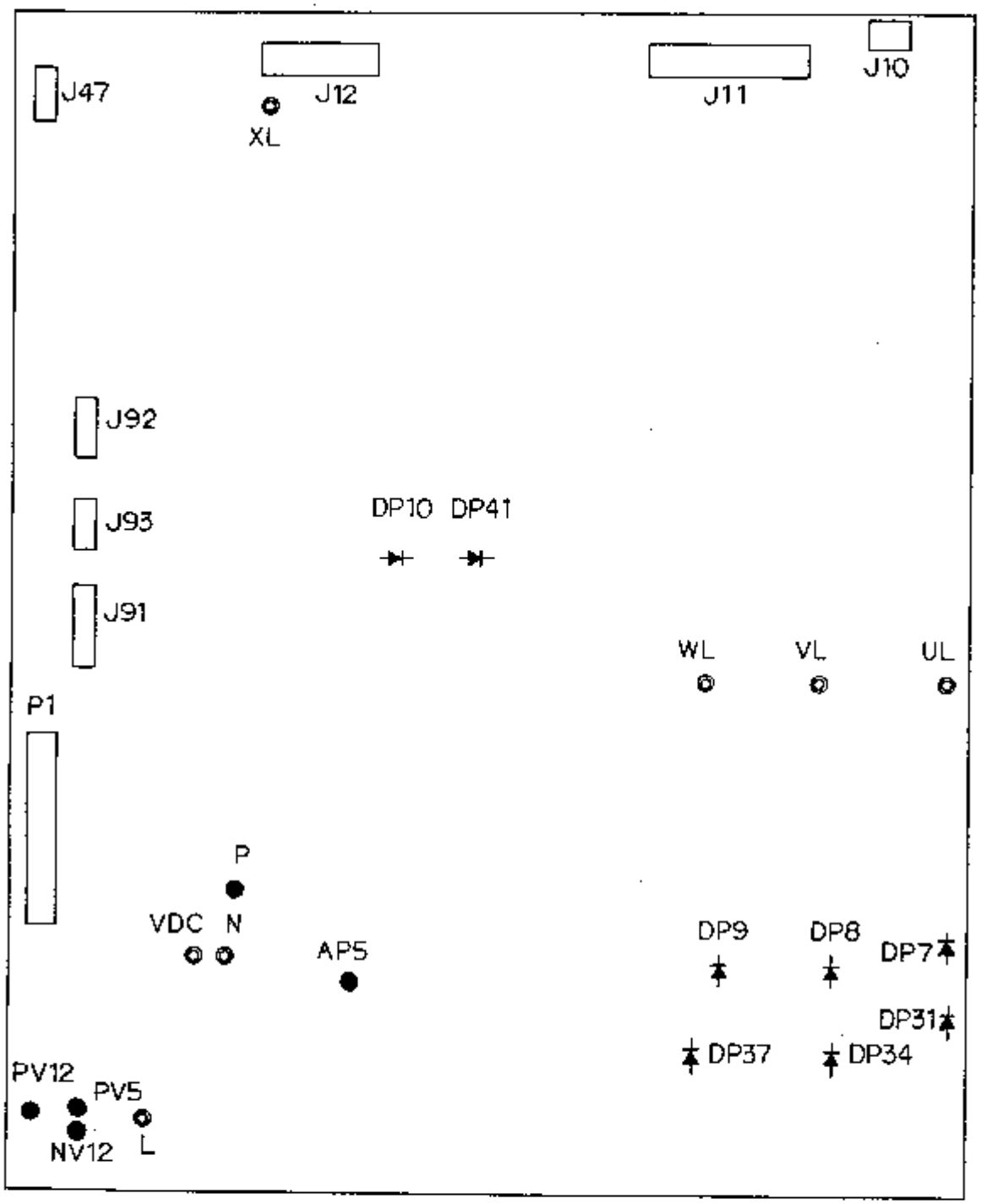


Fig.6

PARTS LAYOUT OF BASE DRIVE BOARD

4 TROUBLE SHOOTING

4-1 TROUBLE SHOOTING AND MESSAGE CONTENTS

The inverter will operate as shown in Table 6 below if abnormal. Locate the cause and take corrective measures promptly before re-starting operation.

Table 6 Fault Message and Diagnosis

Symptom of malfunction					Cause for fault (Message contents)	Reset	Check points	Suggested remedy
Circuit breaker MCB	Electromagnetic contactor Mg	Thermal relay THRY	Display on digital operation panel (?ERROR ▨)	Fault alarm relay				
			Over.V	○	DC smoothing circuit - Overvoltage	A	Check for sudden deceleration.	Increase the deceleration time.
							Check that the motor is not rotated from the load side.	The motor cannot be applied to continuous regenerative load.
			OC.Accel	○	Overcurrent during motor acceleration (overcutrent at acceleration)	A	Check for sudden acceleration.	Increase the acceleration time.
							Check for output shortcircuit or ground fault.	Check for the output line (motor) and motor shortcircuit.
							Check that torque boost is not too high.	Reduce the torque boost.
							Check that the motor is not locked.	Check the motor or load.
							Check that jogging frequency is too high.	Reduce the jogging frequency.
			OC.Decel	○	Overcurrent during motor deceleration (Overcurrent at deceleration)	A	Check for sudden deceleration.	Increase the deceleration time.
							Check for output shortcircuit or ground fault.	Check the output line motor shortcircuited.
			OC.Drive	○	Overcurrent during constant operation of motor (Overcurrent during operation)	A	Check for sudden change in load.	Eliminate sudden changes in load.
							Check for output shortcircuit and ground fault.	Check the output line motor shortcircuit.
			Over.L	○	Inverter overload (Overloaded operation)	A	Check that the load is not too heavy.	Reduce the load factor.
							Check that the electronic thermal level is correct (not changed).	Adjust to a proper level.

Symptom of malfunction					Cause for fault (Message contents)	Reset	Check points	Suggested remedy
Circuit Breaker MCB	Electromagnetic contactor Mg	Thermal relay THRY	Display on digital operation panel (?ERROR ▨)	Fault alarm relay				
			OH Fin	O	Temperature significantly increasing (Fin overheat)	A	Check that the cooling fan is rotating.	Replace the cooling fan.
							Check that the ambient temperature is not too high.	
			OVER C.	O	Overcurrent detection just after power ON	A	Check that the detector current circuit is normal.	Check abnormal conditions of current detector and PC board detector circuit.
			Under V.	O	Power supply abnormal (Undervoltage)	A	Check that no voltage drops.	Review the power supply system.
							Check that no poor contact of MCB and Mg is found.	Replace MCB and Mg.
							Check that power has been turned OFF or instantaneous power failure has occurred during jogging.	Do not turn power OFF during jogging operation.
							Check that 100 msec or less instantaneous power failure has occurred more than 10 times repeatedly for 10 minutes.	Re-check the power supply system.
			Inst.P-F	O	Power supply abnormal (Instantaneous power failure)	A	Check that no voltage drop is found.	Review the power supply system.
							Check that no poor contact of MCB and Mg is found.	Replace MCB and Mg.
			NC-FRS	O	Free-run stop command abnormal	A	Check that the operation command is given during motor free-run, and that no FRS is entered.	Do not enter operation command, FRS during free run.
							With Free-run Stop applied, undervoltage or instantaneous power failure has occurred.	Re-start operation after reset.
							With Free-run Stop applied, power has been cut off.	Re-start operation after reset. With Free-run Stop applied, do not turn power OFF.
							With Free-run Stop applied, power has been turned ON or reset operation has been performed.	

Symptom of malfunction					Cause for fault (Message contents)	Reset	Check points	Suggested remedy
Circuit breaker MCB	Electromagnetic contactor Mg	Thermal relay THRY	Display on digital operation panel (↑ERROR ▨)	Fault alarm relay				
			CPU	o	(CPU error)	A	Check that no large noise source is found nearby.	Keep the noise source away from the unit.
							Inverter abnormal	Repair
			DB OT	o	(DC braking setting time over.)	A	Check that the DC braking external command input time does not exceed the time preset by F-22 T-DCB.	Re-set the T-DCB time or adjust DC braking external command input time to less than T-DCB.
			NG·JOG	o	(The jogging mode is used inadvertently)	A	Check that power has been turned ON with the jogging mode ON, commercial power supply voltage has been switched or reset operation has been performed.	With the jogging mode ON, do not turn power ON, switch commercial power supply voltage or reset.
o			-	-	-	B	Power supply side shortcircuit and ground fault.	Repair the short-circuit and ground fault.
			-				Insufficient MCB capacity	Increase MCB capacity.
							Inverter module or converter module damaged.	Repair
	o		-	-	Power failure	B	Check for the power failure.	Review the power supply system.
							Check that no poor contact of MCB and Mg is found.	Replace MCB and Mg.
		o	-	-	-	C	Overload	Reduce the load factor.
							Thermal relay preset value faulty	Set the preset value to a proper one.
			NG.DB	o	DB terminal was used inadvertently.	A	With DB ON, power has been turned ON or reset operation has been performed.	With DB ON, do not turn power ON or reset.
			UV WAIT		Supply voltage abnormal (Undervoltage)	A	When restart function was selected, supply voltage dropped to 100V or less.	Review the power supply system.

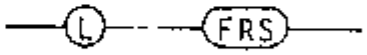
Symptom of malfunction					Cause for fault (Message contents)	Reset	Check points	Suggested remedy
Circuit breaker MCB	Electromagnetic contactor Mg	Thermal relay THRY	Display on digital operation panel (?ERROR ▨)	Fault alarm relay				
			ADJUST 0.5S		Supply voltage abnormal	A	Re-start function was selected without connecting Ro and To, and instantaneous power failure and undervoltage UC, UV tripped (200V class).	Connect Ro and To.
			BOO Numeral		Refer to para. 12.2 on the following page.	D	Refer to para. 12.2 on the following page.	Refer to para. 12.2. on the following page.

O: shows the equipment which seems to operate in general.

* 2 contents of check points when trouble happens.

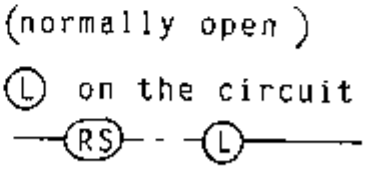
No motor rotates

- Check the wiring between inverter and motor.
- Check the input voltage whether it is rated voltage or not.
- Check the wiring between (FRS) and (L) on the circuit board
  *They should be open.



(normally open)

- Check the wiring between (RS) and (L) on the circuit board
  *They should be open.



- Check the operation mode in the monitor mode whether it is set according to application system.

  F-SET-M: OPE-key/Terminal
  F/R-SW : OPE-key/Terminal

- Check the reference (freq.setting) signal
  - When F-SET-M "OPE-key" is selected,check the FS□□□.□Hz in the monitor mode.
  - When F-SET-M "Terminal" is selected,check the voltage or current signal on the terminal of printed board.

    V_{O-L} :0~10VDC or 0 5VDC
    I_{OI-L}:4~20mA

    Also check the FS□□□. □□Hz in the monitor mode.

- Check whether setting frequency is less than minimum frequency
  *Set the frequency more than minimum frequency.
- Check whether LCD indication is in "Monitor" mode.
  *Select "Monitor" mode.
  In the function mode,the inverter cannot start.
- Check whether [STOP] key of Dig.Ope is pushed when F/R-SW in "Monitor" mode is selected with "terminal".
  *Once,run command(FW/RV) must be turned off,and then turned on again from the terminal.
- Check the output voltage of U-V,V-W and W-V whether they are balanced or not.
- Check whether setting frequency of "SPEED1"~"SPEED3" is proper value when you use multi stage speed terminal(CF1,CF2).
  * "SPEED1~3" must be set or multi stage speed command (CF1,CF2) must be removed.

Ter. / SP.	Forward	Reverse	STOP	Stop
SP1	ON	OFF	OFF	ON
SP2	OFF	ON	OFF	ON

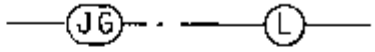
- Check whether [FWD RUN] key and [REV RUN] key of D-OPE are pushed togethe in "Ope-key" mode.
- Check whether forward operation command and reverse operation command are input together in "Terminal" mode.
  * Only one signal should be input.

No motor accelerates

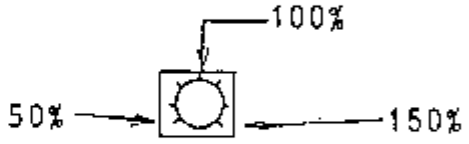
- Check the reference((freq.setting) signal
  - When F-SET-M "OPE-key" is selected,check the FS□□□.□Hz in the monitor mode.
  - When F-SET-M "Terminal" is selected,check the voltage or current signal on the terminal of printed board.

    V_{O-L} :0~10VDC or 0 5VDC

    I_{OI-L}:4~20mA
- Check the F-05(frequency upper limiter).
- Check whether the preset value of "F-END" in the function mode is more than maximum frequency.
- Check wherther the wiring between (JG) and (L) on the circuit board is open.



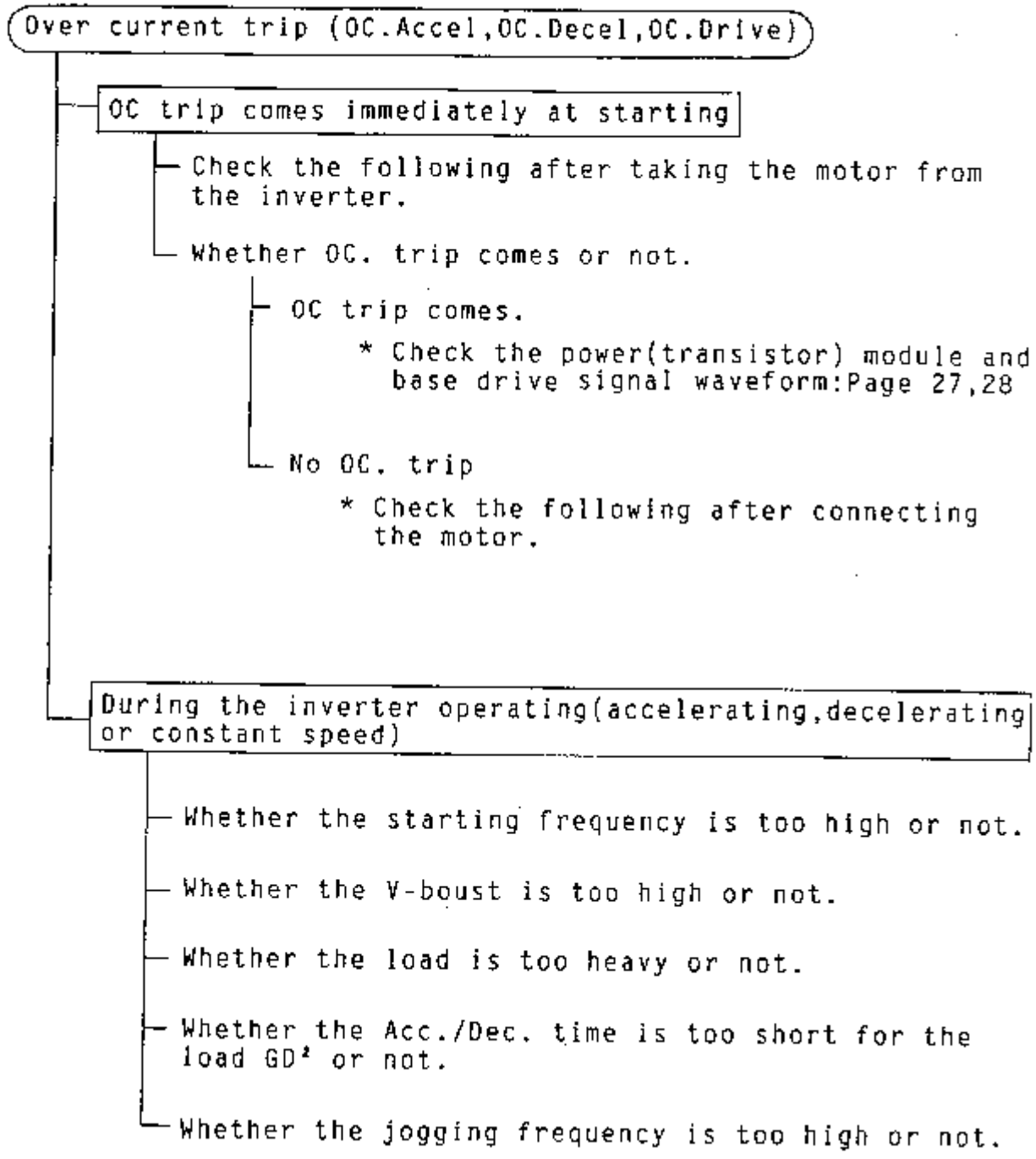
- Check the load whether it is too heavy or not.
  *Reduce the load or adjust the overload limit level by "OL.LMT" (VR) clockwise.



OL.LMT

- Check whether setting frequency of "SPEED1"~"SPEED3" is prope value when you use multi stage speed terminal(CF1,CF2).

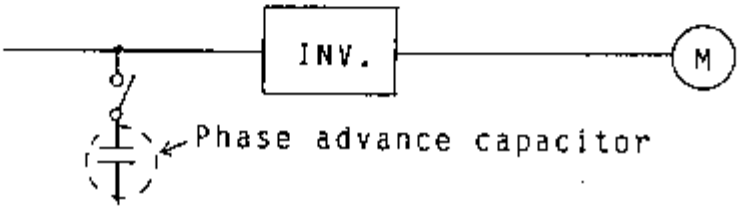
  * "SPEED1~3" must be set or multi stage speed command (CF1,CF2) must be removed.


Over current trip (OC.Accel,OC.Decel,OC.Drive)
OC trip comes immediately at starting
Check the following after taking the motor from the inverter.
Whether OC. trip comes or not.
OC trip comes.
* Check the power(transistor) module and base drive signal waveform:Page 27,28
No OC. trip
* Check the following after connecting the motor.
During the inverter operating(accelerating,decelerating or constant speed)
Whether the starting frequency is too high or not.
Whether the V-boust is too high or not.
Whether the load is too heavy or not.
Whether the Acc./Dec. time is too short for the load GD² or not.
Whether the jogging frequency is too high or not.

Over voltage trip

- Check the deceleration time whether it is too short for the GD^2 of load or not.
  * Prolong the deceleration time.
  * Use the regenerative braking unit.

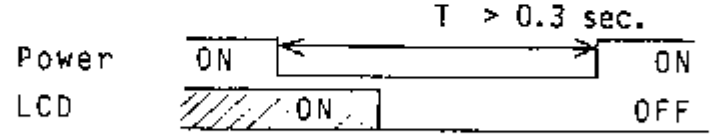
- Check the power source network line whether there are phase advance capacitors on it and they are turned on/off during inverter operation or not.



  * Change the wiring system with the phase advance capacitor.
  * Put the braking unit in order to suppress the over voltage.

Instantaneous power failure trip

- Check whether power source is turned on again before LCD display is turned off.
  * Power source should be turned on again after LCD display is turned off.



- Check the magnetic contactor on the inverter primary side whether it has chattering or not.

- Did the power failure occur?
  * If the automatic restart function after instantaneous power failure is allowed for the application system,use the automatic restart function in the function mode F-28.

F-28 switch 00[00]0101

00: Not available restart
10: Available restart

Under voltage trip

- Check the power source voltage whether they are less than protection level or not.

200Vclass 1.5~75 kVA : 150~160 VAC
400Vclass 2.5~75kVA : 280~320 VAC

- Check the transient voltage drop by rush current into the smoothing condenser or starting current of the motor.
  * Increase the power source capacity.
  * Use the restart function on the F-28

F-28 switch 00[00]0101

00: Not available restart
10: Available restart

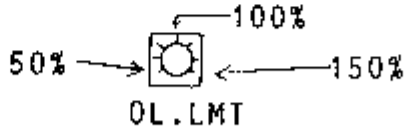
- Check the magnetic contactor whether it has chattering or not.

Overheat trip

- Whether cooling fan in the inverter is rotating or not.
- Whether air inlet and exhaust ports on the panel box is blocked or not.
- Whether the cooling air path is blocked or not.
- Whether the temperature in the panel box is less than specified value or not.
  * If it is too high, improve the cooling.
    :See page 59~62, selection of ventilation

Overload trip

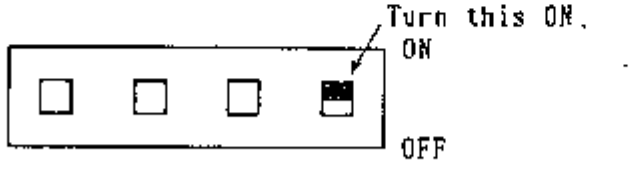
- Check the electronic thermal level in the function made F-23 whether it is proper for the load condition or not.
- Check the overload limiter level whether it is proper for the load condition or not.
  * This level can change with "OL.LMT".



4-3 HOW TO RETURN THE SETTING TO THE INITIAL SETTING

When retuning the setting to the initial setting for some reason, flolow the steps below.

① Turn power on.
② Set the right side of DIP SW on PCB to "ON".



③ With the [MON] [FUN] [STR] keys on the digital operation panel pressed at the same time, turn the forced reset button ON.

④ After resetting , release these 3 keys pressed in 1 or 2 sec.

At this time, [B O O ....] (ROM NO.) is displayed and operation steps.

If [F M 0 0 0 . 0 H z] is displayed, it means that these 3 keys has been released too early. Repeat steps ② - ④ above again.

NOTE: But NVRAM failure makes [B O O ....] remain displayed even for the above steps.

Good NVRAM : Displays [F M 0 0 0 . 0 H z] by forced reset

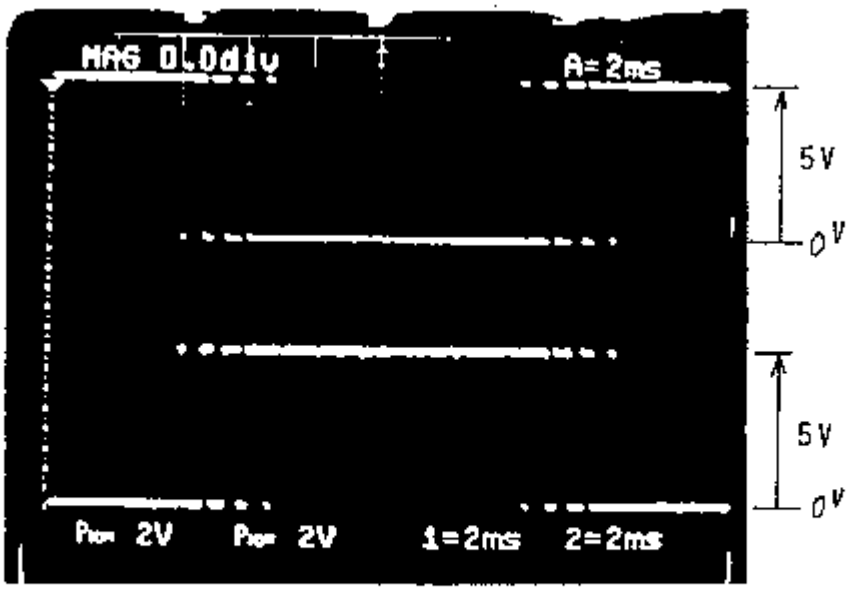
Failed NVRAM : Displays still [B O O ....] by forced reset

⑤ Turn power OFF or turn the forced reset buttom or switch ON.
⑥ Turn DIP SW OFF.
⑦ Turn power ON again, and check that the data corresponds to the standard perset value(factory setting).

5.1 PWM OUTPUT SIGNAL WAVEFORM FROM THE CONTROL BOARD

- The PWM control signal can be checked with the check pins,U~Z, on the control board.
- Check pins and waveform

Pin			Phase
U	←	L	U+
V	←	L	V+
W	←	L	W+
X	←	L	U-
Y	←	L	V-
Z	←	L	W-

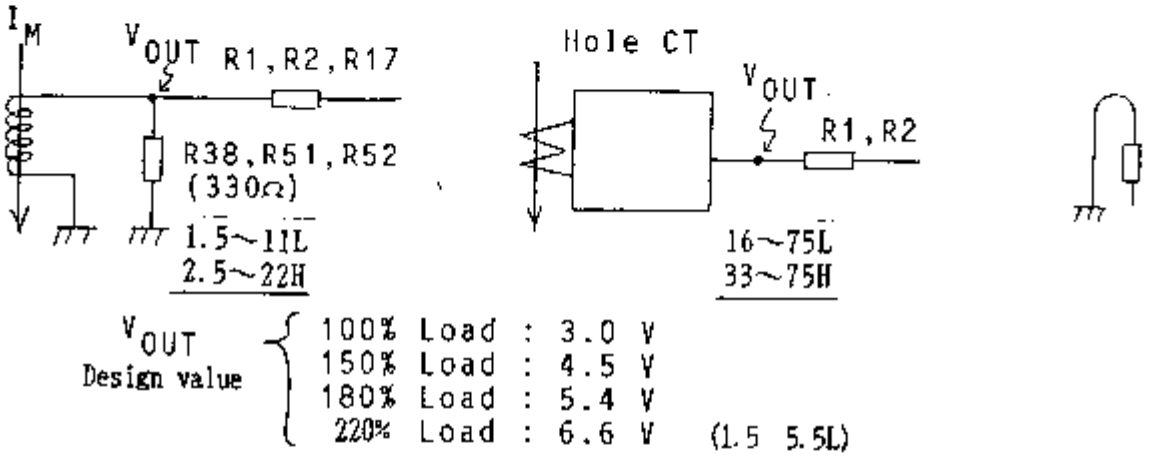


* The pulse number would be changed according to output frequency.
* When the PWM signal is not proper,the control board should be changed.

5.2 MOTOR CURRENT WAVEFORM

- The motor current waveform can be checked with resistors on the control board. The signals come from AC/CT of the output.

- AC/CT output

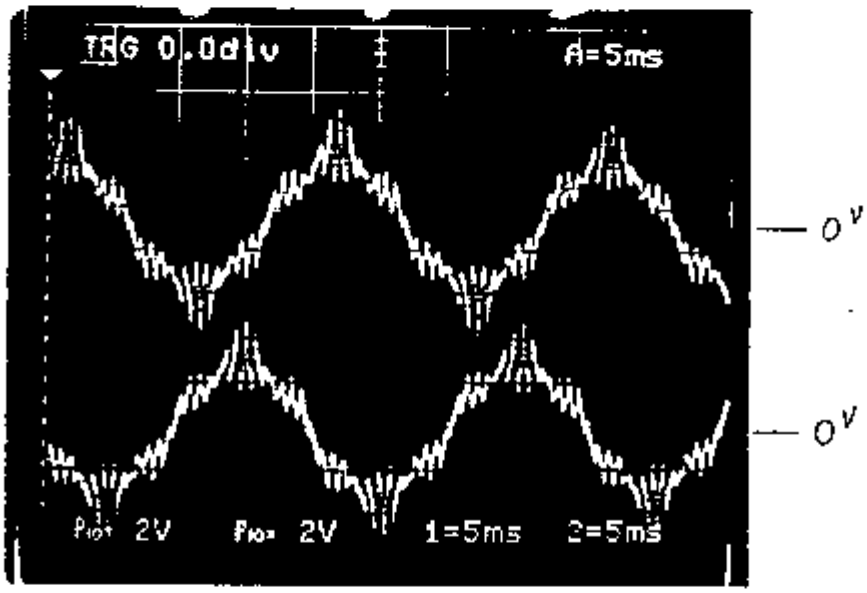


V_{OUT} Design value

100% Load	:	3.0 V
150% Load	:	4.5 V
180% Load	:	5.4 V
220% Load	:	6.6 V (1.5 5.5L)

- Resistors for check and waveform

Resistor	Phase
R1 ←— L	U
R2 <·— L	W

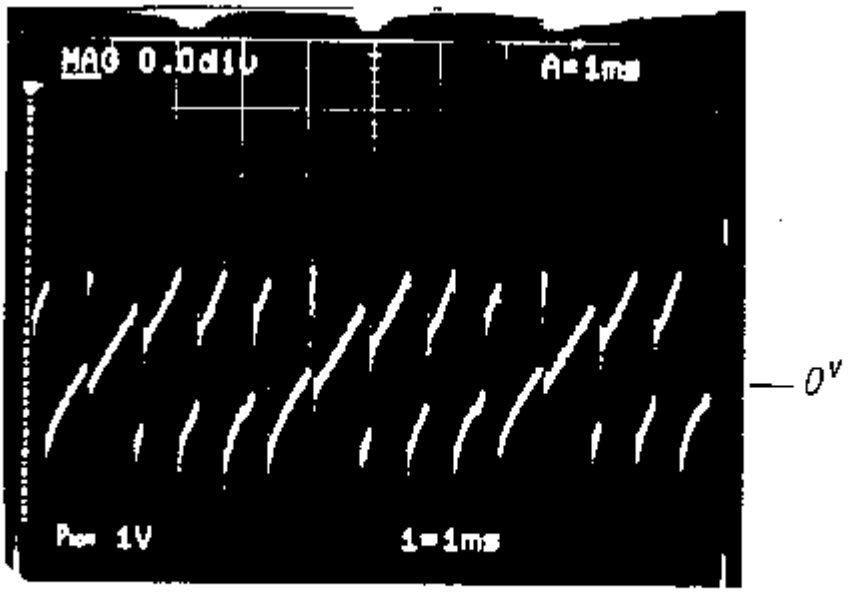


* The waveform would be changed according to output frequency.

5.3 DC-CURRENT SIGNAL

- The DC-current of the intermidiate circuit can be checked with the checkpin on the control board or base drive board.
- The signal is used for O.C trip.
- Checkpin and waveform

  N2 — N (on the control board) : 1.5~5.5kVA
  IDC — L (on the control board) : 8 ~ 75 kVA

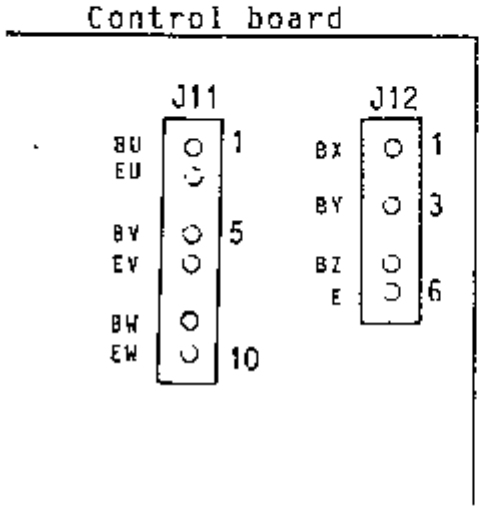


- Trip level

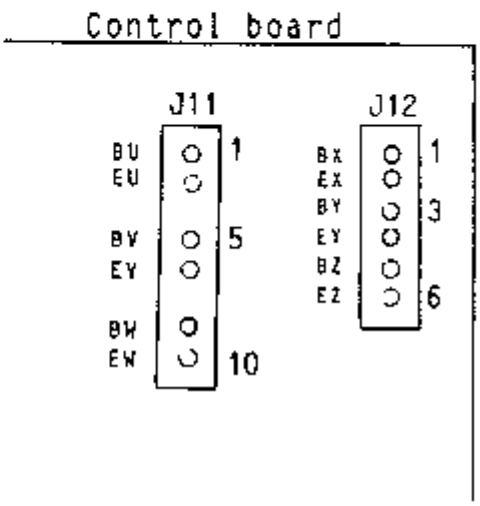
Inv. Model	1.5~5.5L 2.5~5.5H	8~33L 8~40H	40L	50~75L	50~75H
Trip level (Design value)	1.3V	6.6V	7.9V	7.6V	7.1V
Checkpin	N2 — N	IDC — L			

5.4 Output signal of base drive

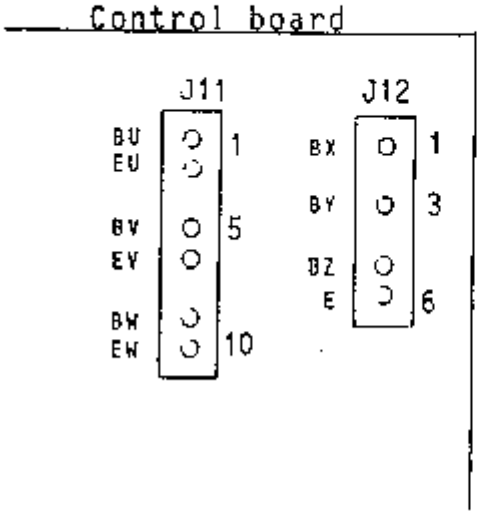
①1.5, 2.5L

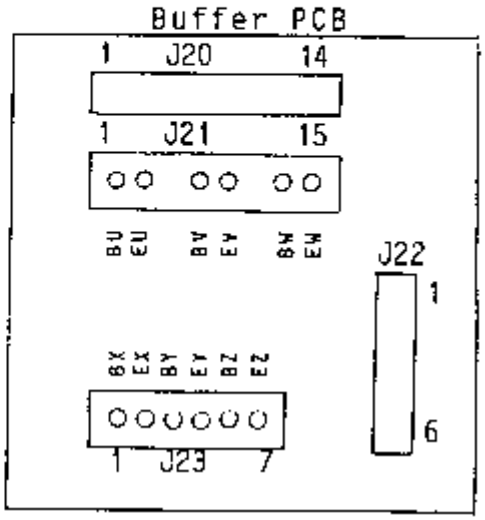


②3.5, 5.5L , 2.5~8H

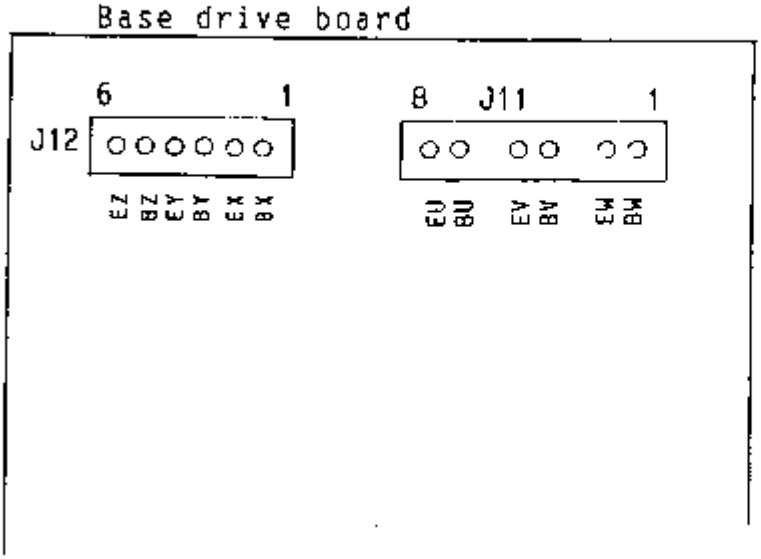


③8~22L, 11~22H



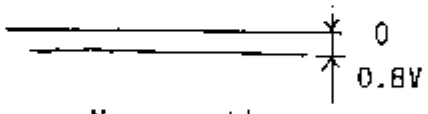


④33~75KVA

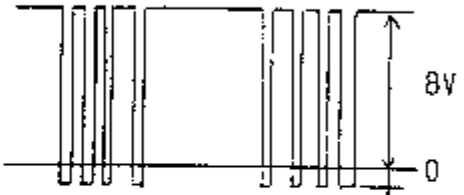


①1.5, 2.5L

BU — EU (G) (R)	(U+)	J11
BV — EV (V) (R)	(V+)	J11
BW — EW (BL) (R)	(W+)	J11
BX — E (BR) (W)	(U-)	J12
BY — E (Y) (W)	(V-)	J12
BZ — E (O) (W)	(W-)	J12



No operating



Operating

②3.5, 5.5L , 2.5～8H

BU — EU (G) (R)	(U+)	J11
BV — EV (V) (R)	(V+)	J11
BW — EW (BL) (R)	(W+)	J11
BX — EX (BR) (W)	(U-)	J12
BY — EY (Y) (W)	(V-)	J12
BZ — EZ (O) (W)	(W-)	J12

Wiring color
B - Black
BL- Blue
BR- Brown
G - Green
O - Orange
V - Violet
R - Red
W - White
Y - Yellow

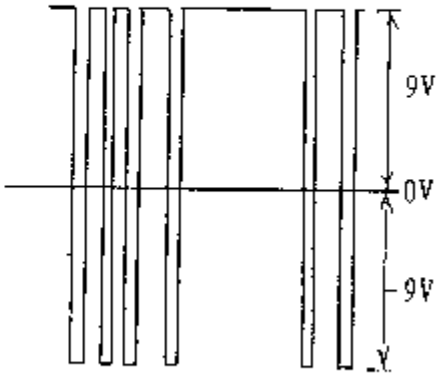
③8～22L, 11～22H

BU — EU (G) (R)	(U+)	J 21
BV — EV (V) (R)	(V+)	J 21
BW — EW (BL) (R)	(W+)	J 21
BX — EX (BR) (W)	(U-)	J 23
BY — EY (Y) (W)	(V-)	J 23
BZ — EZ (O) (W)	(W-)	J 23

④33～75KVA

BU — EU (G) (R)	(U+)	J11
BV — EV (V) (R)	(V+)	J11
BW — EW (BL) (R)	(W+)	J11
BX — EX (BR) (W)	(U-)	J12
BY — EY (Y) (W)	(V-)	J12
BZ — EZ (O) (W)	(W-)	J12

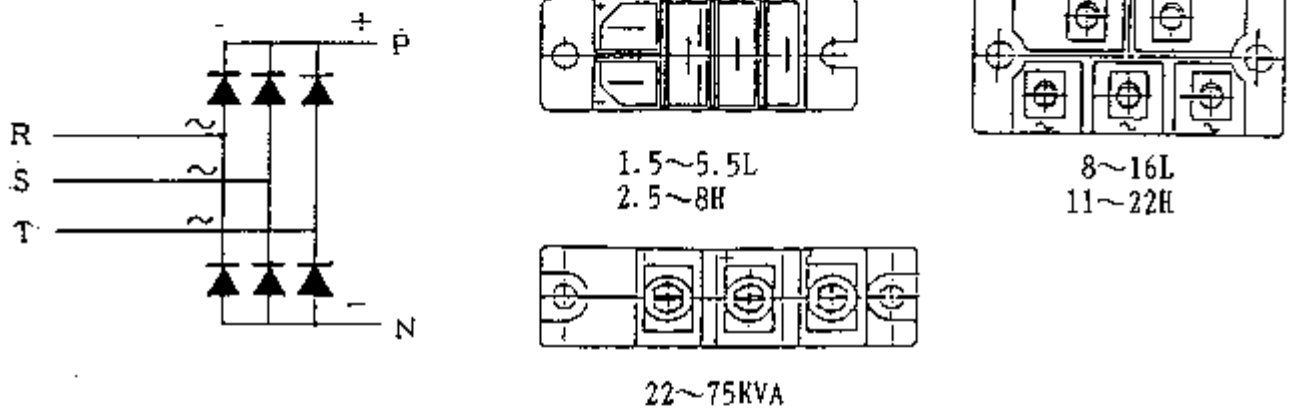
No operating



Operating

5.5 How to check converter modules

The converter module can be checked to a certain extent at terminals.



Converter module circuit diagram and top views

Turning off power source, make sure that voltage between P and N is below 15V before operation.

Remove the wirings connected to the converter module and check it alone.

Measure with the tester set to 1Ω range.

Colors of tester terminals Black--------Red	Resistance value
R(~) ⟶ S(~)	50kΩ or more
S(~) ⟶ T(~)	
R(~) ⟶ T(~)	
P(+) ⟶ R(~)	50kΩ or more
P(+) ⟶ S(~)	
P(+) ⟶ T(~)	
R(~) ⟶ P(+)	50Ω or less
S(~) ⟶ P(+)	
T(~) ⟶ P(+)	
N(-) ⟶ R(~)	50Ω or less
N(-) ⟶ S(~)	
N(-) ⟶ T(~)	
R(~) ⟶ N(-)	50kΩ or more
S(~) ⟶ N(-)	
T(~) ⟶ N(-)	

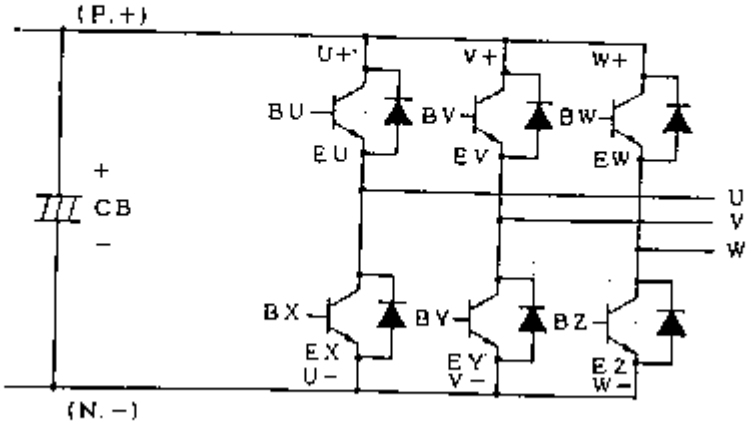
~:alternation terminal

If the resistance value is not proper, replace the diode module.

* Failure symptom : MCB trip (shortcircuit of Power module)

5.6 How to check inverter modules

The inverter module can be checked to a certain extent at terminals



Inverter module circuit diagram

Turning off power source, make sure that voltage between P and N is below 15V before operation.
Measure with the tester set to 1Ω range.

(Easy method to check inverter module without disassembly)

Color of tester terminals Black----------Red			Resistance value	Check spot
P	→	U	50kΩ or more	U+
P	→	V		V+
P	→	W		W+
N	→	U	50Ω or less	U−
N	→	V		V−
N	→	W		W−
U	→	P	50Ω or less	U+
V	→	P		V+
W	→	P		W+
U	→	N	50kΩ or more	U−
V	→	N		V−
W	→	N		W−

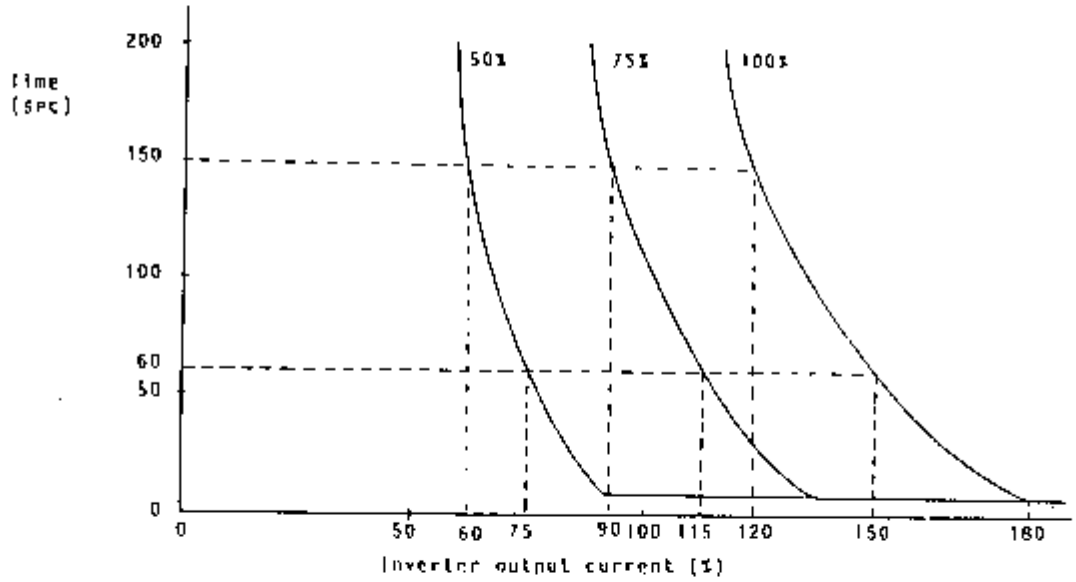
(Check after disassembly)

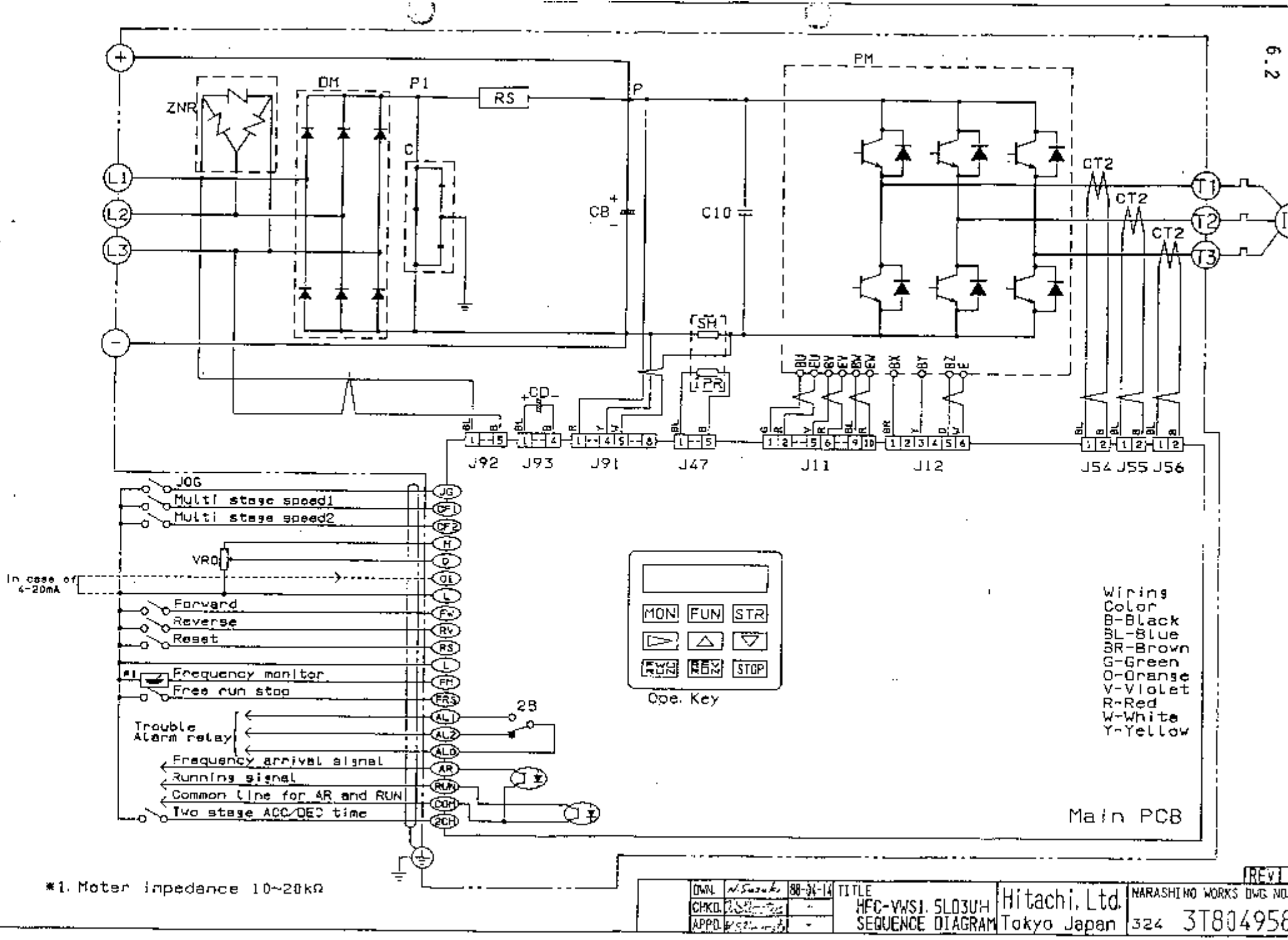
Color of tester terminals Black----------Red			Resistance value	Check spot
BU	→	U	100Ω or less	U+
BV	→	V		V+
BW	→	W		W+
BX	→	U	100Ω or less	U−
BY	→	V		V−
BZ	→	W		W−
U	→	BU	50～200Ω or more	U+
V	→	BV		V+
W	→	BW		W+
U	→	BX	50～200Ω or more	U−
V	→	BV		V−
W	→	BZ		W−

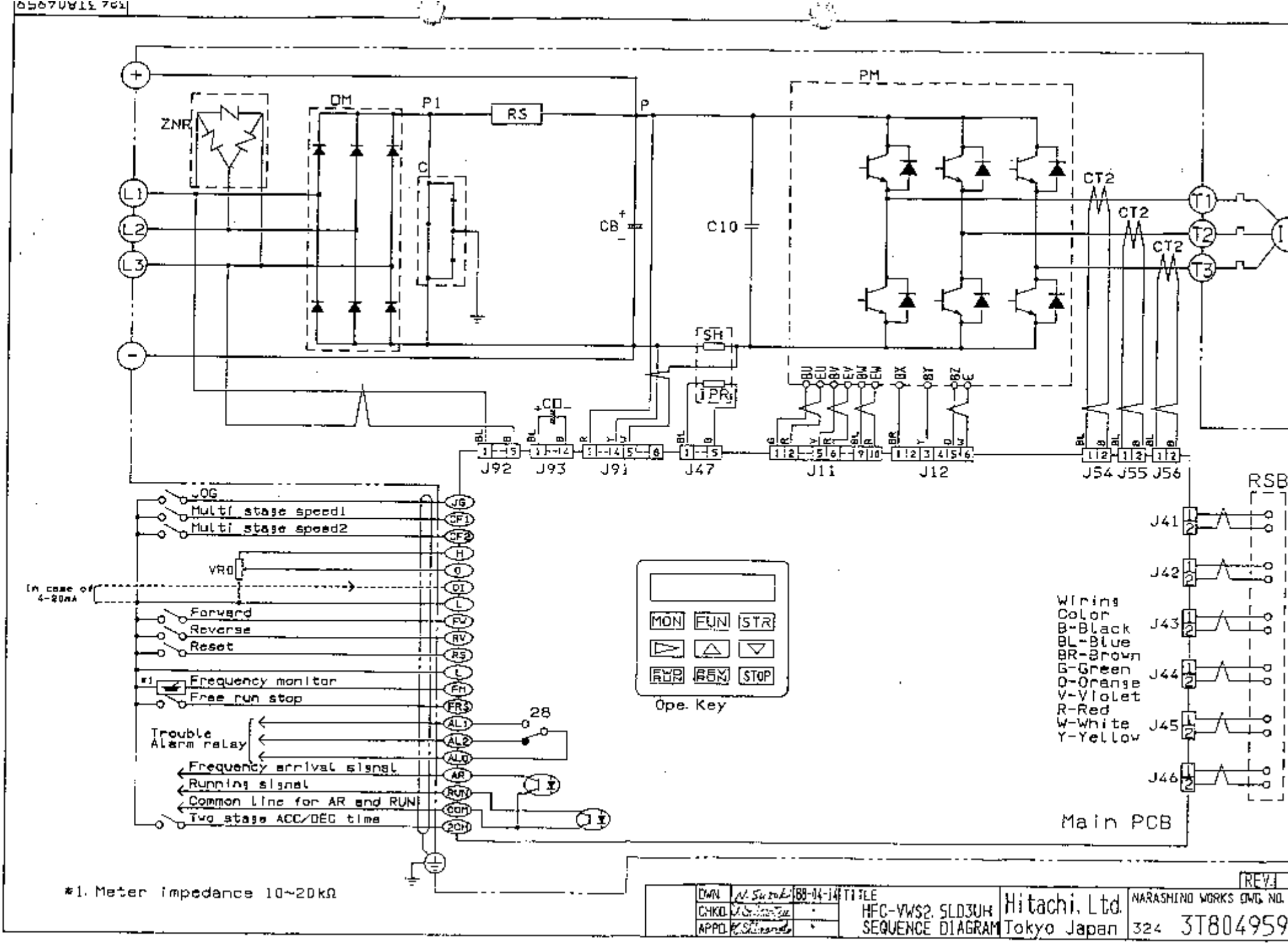
* Failure symptom : Over current trip causes without connected to a motor.

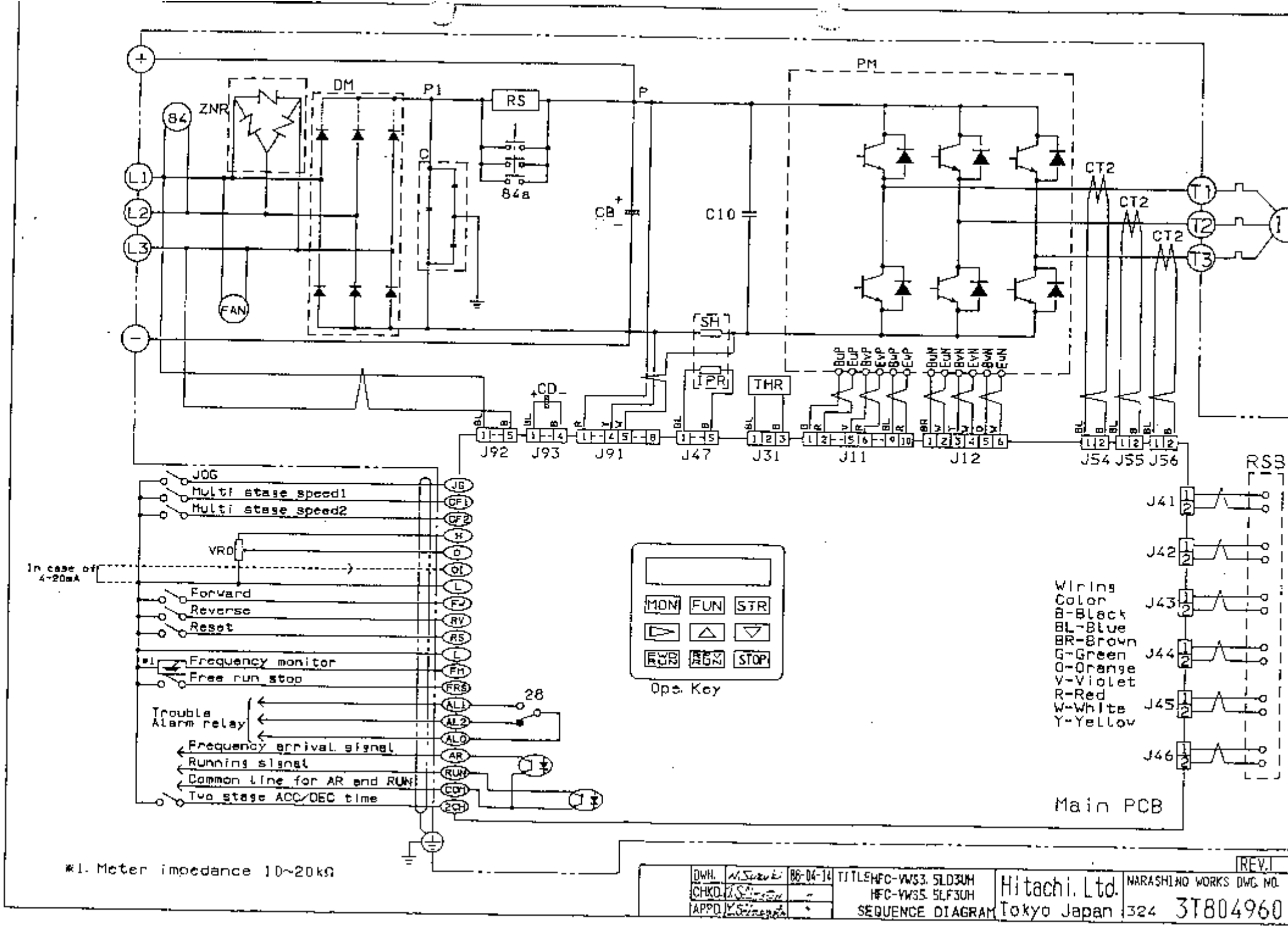
6-1 E-THERM FUNCTION (F-23)

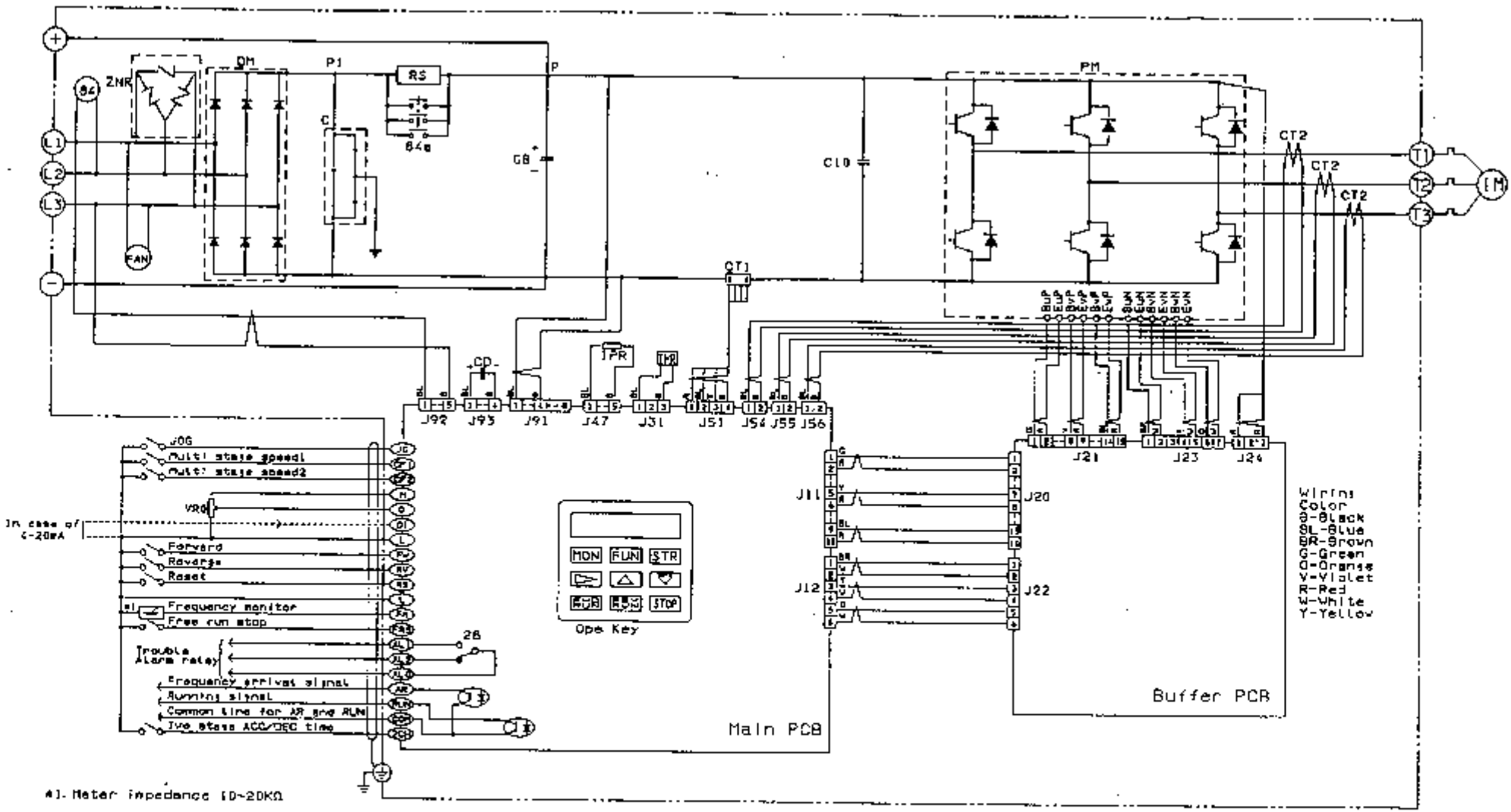
The protection characteristics of the electronic thermal can be changed by OPE-key.
The characteristics is approximately as follows:



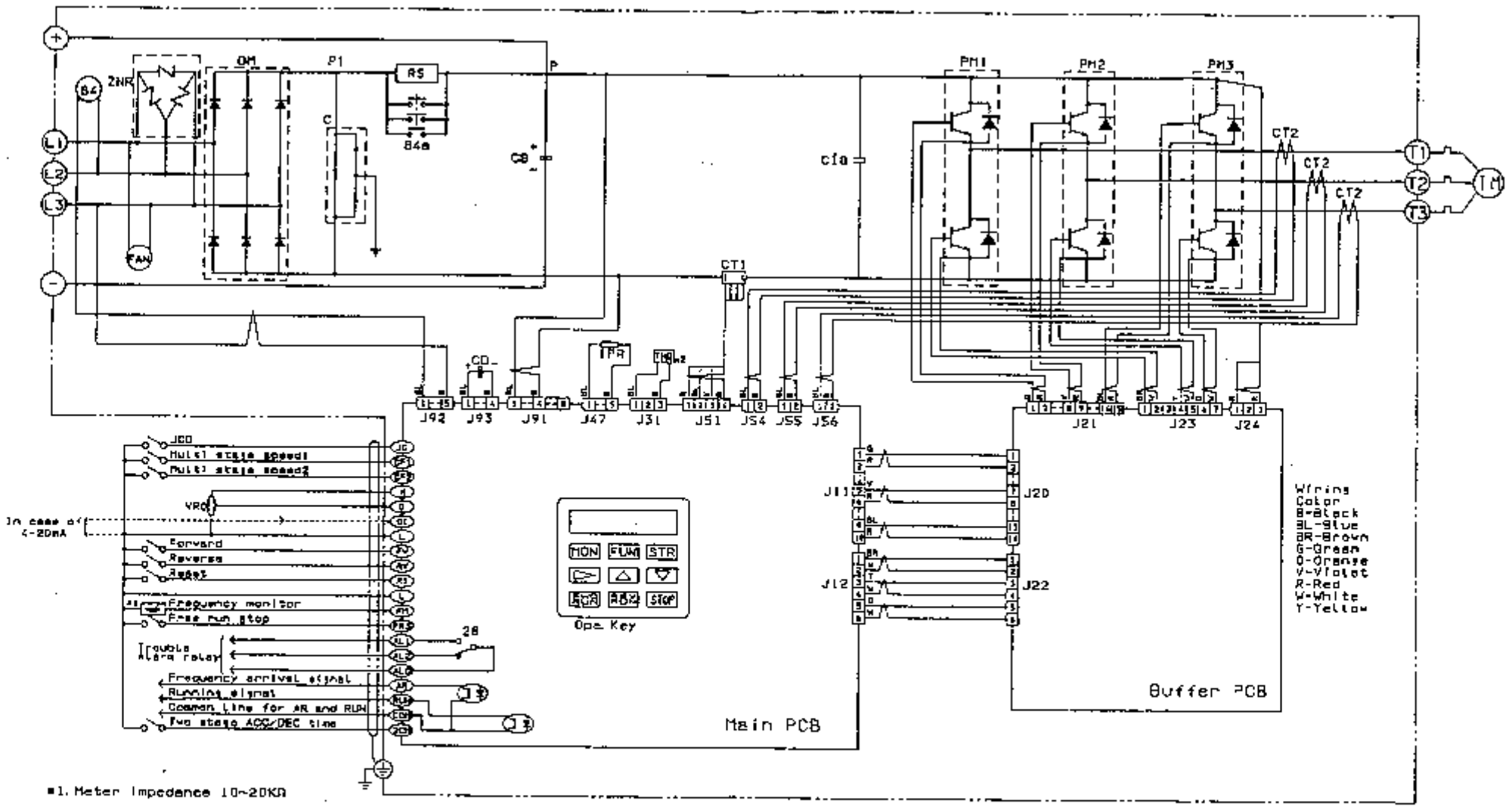

ZNR
DM
P1
RS
P
PM
C
CB
C10
CT2
CT2
CT2
L1
L2
L3
T1
T2
T3
SH
PR
CD
J92
J93
J91
J47
J11
J12
J54 J55 J56
JOG
Multi stage speed1
Multi stage speed2
VRO
In case of 4-20mA
Forward
Reverse
Reset
Frequency monitor
Free run stop
Trouble Alarm relay
Frequency arrival signal
Running signal
Common line for AR and RUN
Two stage ACC/DEC time
2B
*1
MON
FUN
STR
STOP
Ope. Key
Wiring Color
B-Black
BL-Blue
BR-Brown
G-Green
O-Orange
V-Violet
R-Red
W-White
Y-Yellow
Main PCB
*1. Moter impedance 10~20kΩ
DWN
CHKD
APPD
88-04-14
TITLE
HFC-VWS1. 5L03UH
SEQUENCE DIAGRAM
Hitachi, Ltd.
Tokyo Japan
HARASHINO WORKS DWG NO.
324 3T804958
REV.


ZNR
DM
P1
RS
P
C
CB
C10
PM
CT2
CT2
CT2
T1
T2
T3
SR
PR
CD
J92
J93
J91
J47
J11
J12
J54 J55 J56
OG
Multi stage speed1
Multi stage speed2
VRO
In case of 4-20mA
Forward
Reverse
Reset
Frequency monitor
Free run stop
Trouble Alarm relay
28
Frequency arrival signal
Running signal
Common line for AR and RUN
Two stage ACC/DEC time
JG
CF1
CF2
H
O
OI
L
FW
RV
RS
C
FM
FR
AL1
AL2
ALO
AR
RUN
COM
2CH
MON
FUN
STR
RUN
RSM
STOP
Ope. Key
RSB
J41
J42
J43
J44
J45
J46
Wiring Color
B-Black
BL-Blue
BR-Brown
G-Green
O-Orange
V-Violet
R-Red
W-White
Y-Yellow
Main PCB
*1. Meter impedance 10~20kΩ
DWN
CHKD
APPD
88-04-14
TITLE
HFC-VWS2, SLD3UH
SEQUENCE DIAGRAM
Hitachi, Ltd.
Tokyo Japan
NARASHINO WORKS DWG NO.
3T804959
REV.

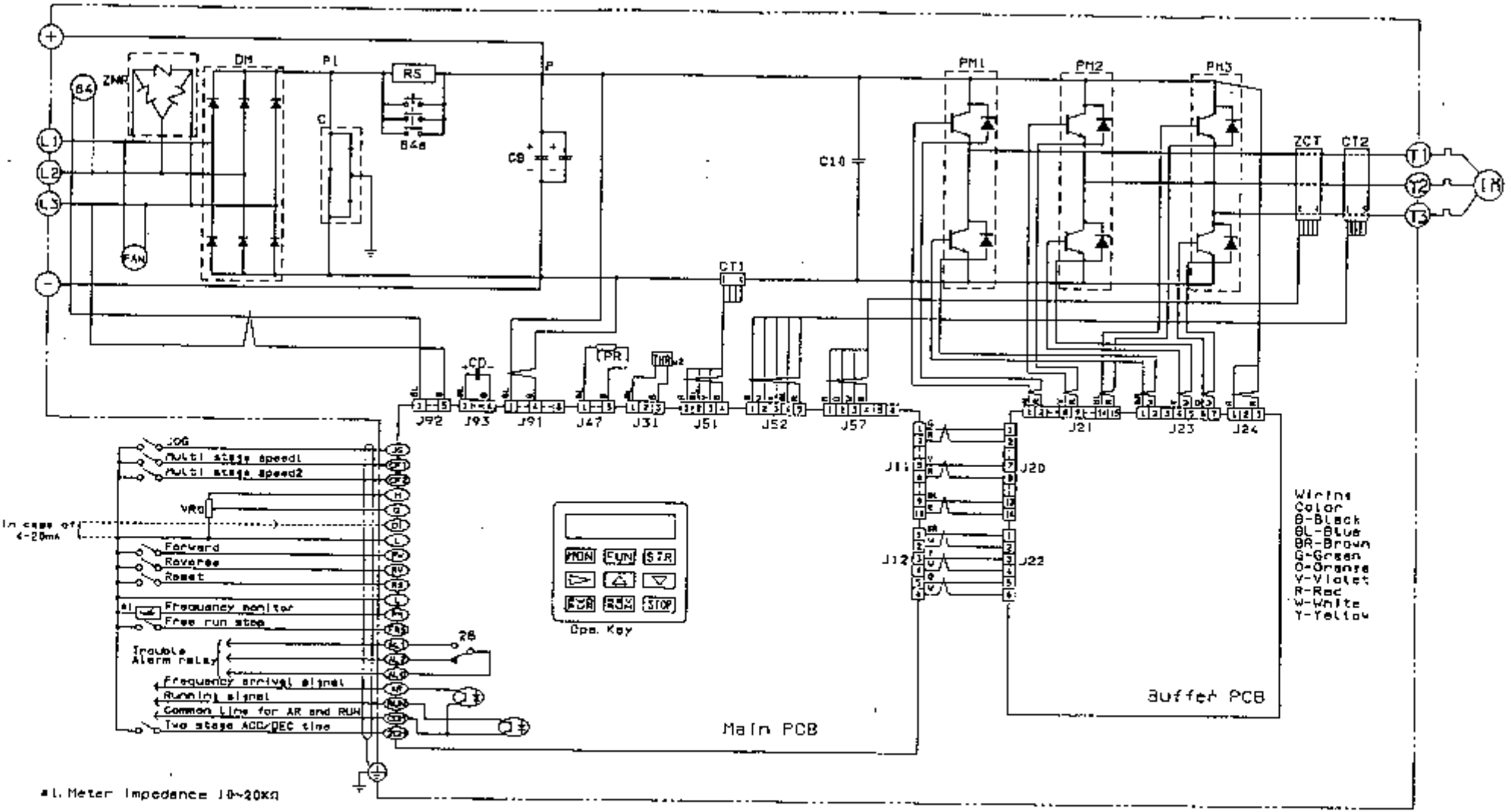

+
L1
L2
L3
−
84
ZNR
FAN
DM
P1
C
RS
84a
P
CB
C10
PM
CT2
CT2
CT2
T1
T2
T3
SH
IPR
THR
+CD−
J92
J93
J91
J47
J31
J11
J12
J54
J55
J56
RSB
J41
J42
J43
J44
J45
J46
JOG
Multi stage speed1
Multi stage speed2
VR
In case of 4-20mA
Forward
Reverse
Reset
*1
Frequency monitor
Free run stop
Trouble Alarm relay
28
Frequency arrival signal
Running signal
Common line for AR and RUN
Two stage ACC/DEC time
JG
CF1
CF2
H
O
OI
L
FW
RV
RS
L
FM
FRS
AL1
AL2
AL0
AR
RUN
COM
2CH
MON
FUN
STR
RUN
STOP
Ope. Key
Wiring Color
B-Black
BL-Blue
BR-Brown
G-Green
O-Orange
V-Violet
R-Red
W-White
Y-Yellow
Main PCB
*1. Meter impedance 10~20kΩ
DWN.
CHKD.
APPD.
86-04-14
TITLE HFC-VW53, 5LD3UH
HFC-VW35, 5LF3UH
SEQUENCE DIAGRAM
Hitachi, Ltd.
Tokyo Japan
HARASHINO WORKS DWG. NO.
3T804960
REV.



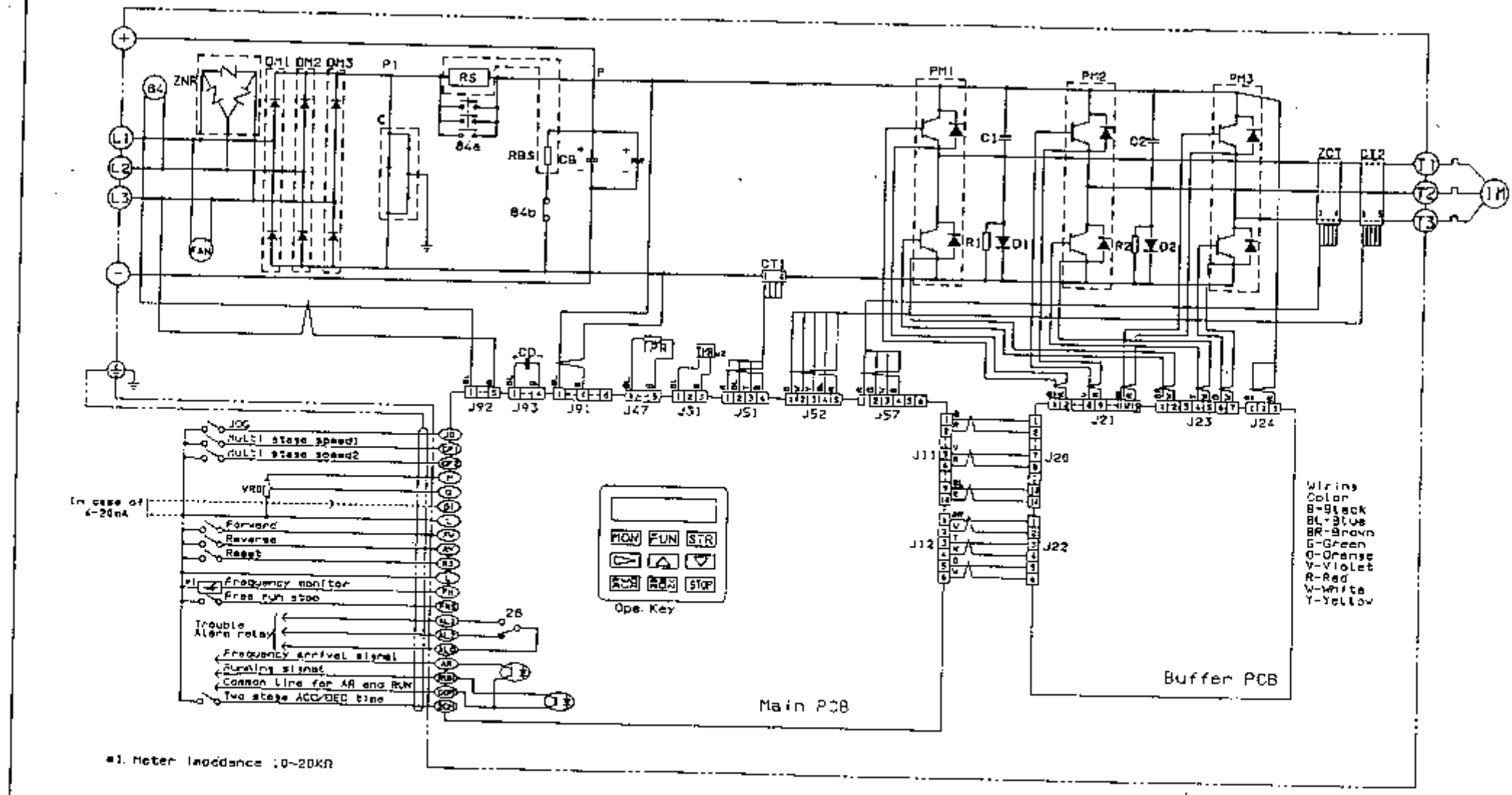
DWN			TITLE	Hitachi, Ltd.	NAMASHINO WORKS DWG.
CHKD			HFC-VWS8LF3UH SEQUENCE DIAGRAM	Tokyo Japan	SIZE 2T80042
APPD					



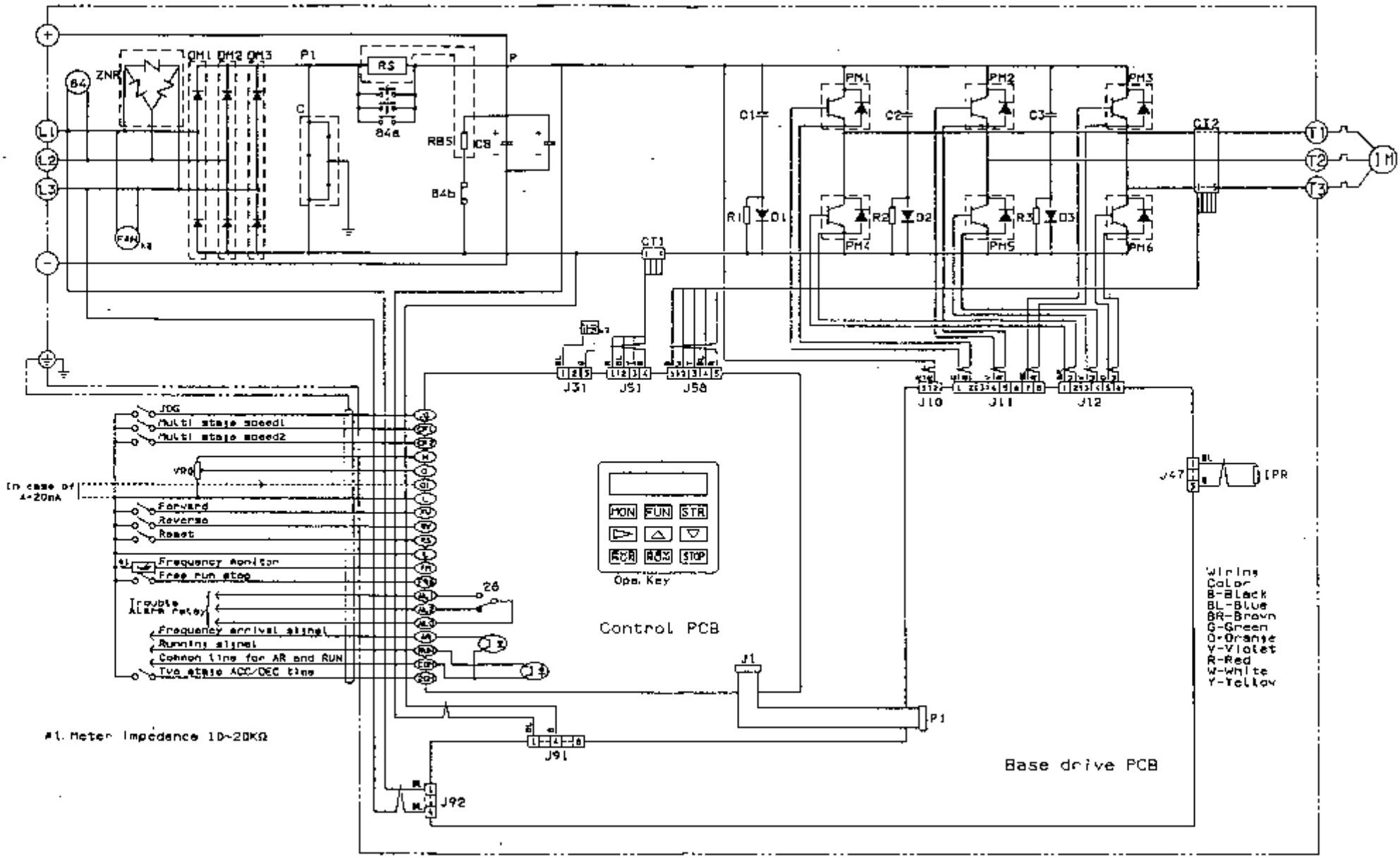
DWN			TITLE	Hitachi. Ltd.	HARASHINO WORKS DWG
CHKD			PFC-VWSLLF3UN SEQUENCE DIAGRAM	Tokyo Japan	324 2T8004
APPD					



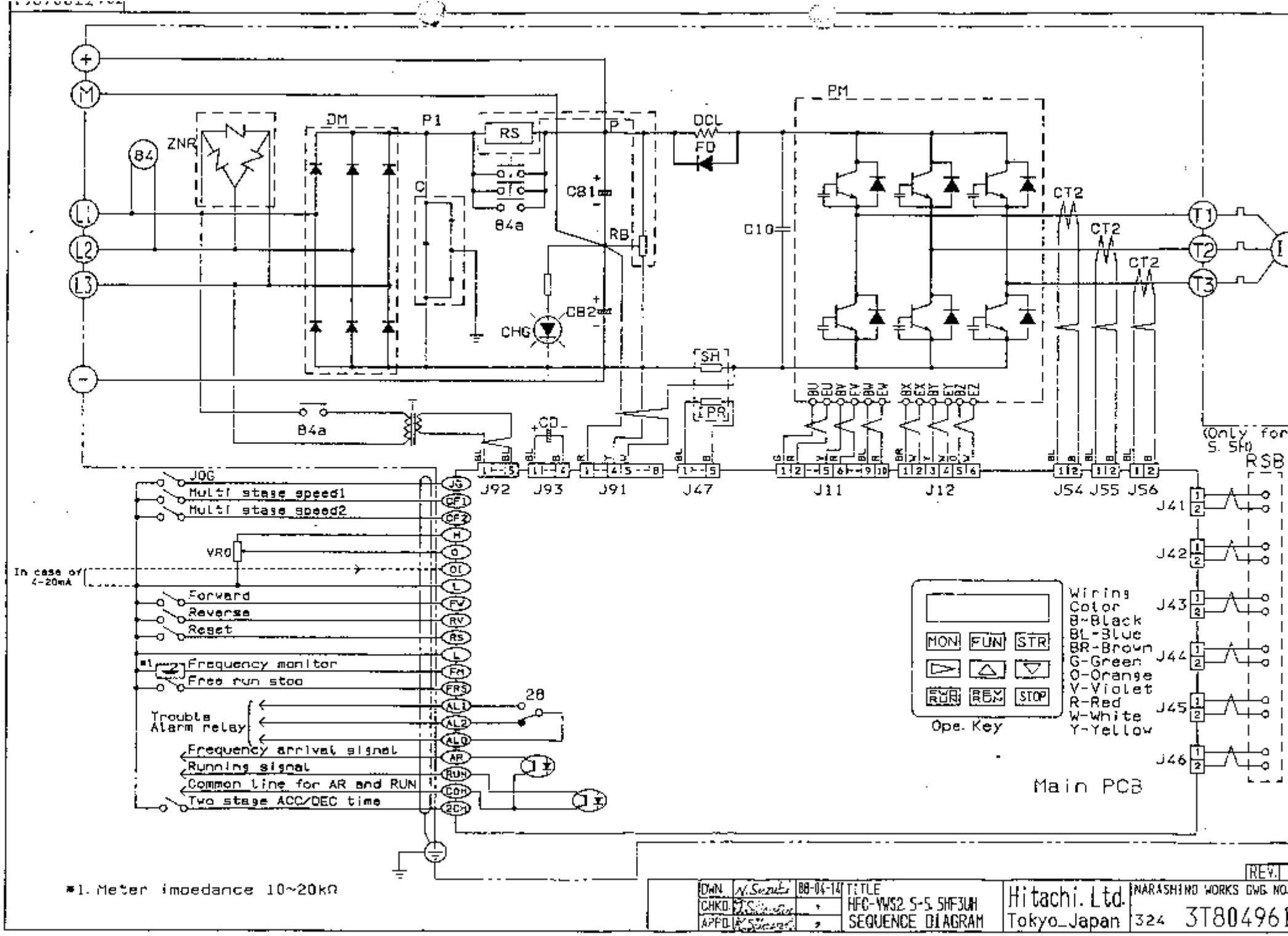
DWN. M.Suzuki 00-05-29	TITLE	Hitachi. Ltd.	REV.		
CHKD.	HFC-VW5164LFXUH	Tokyo Japan	HARASHINO WORKS DWG NO.		
APPD.	SEQUENCE 01AGRAH		324	2T800441	

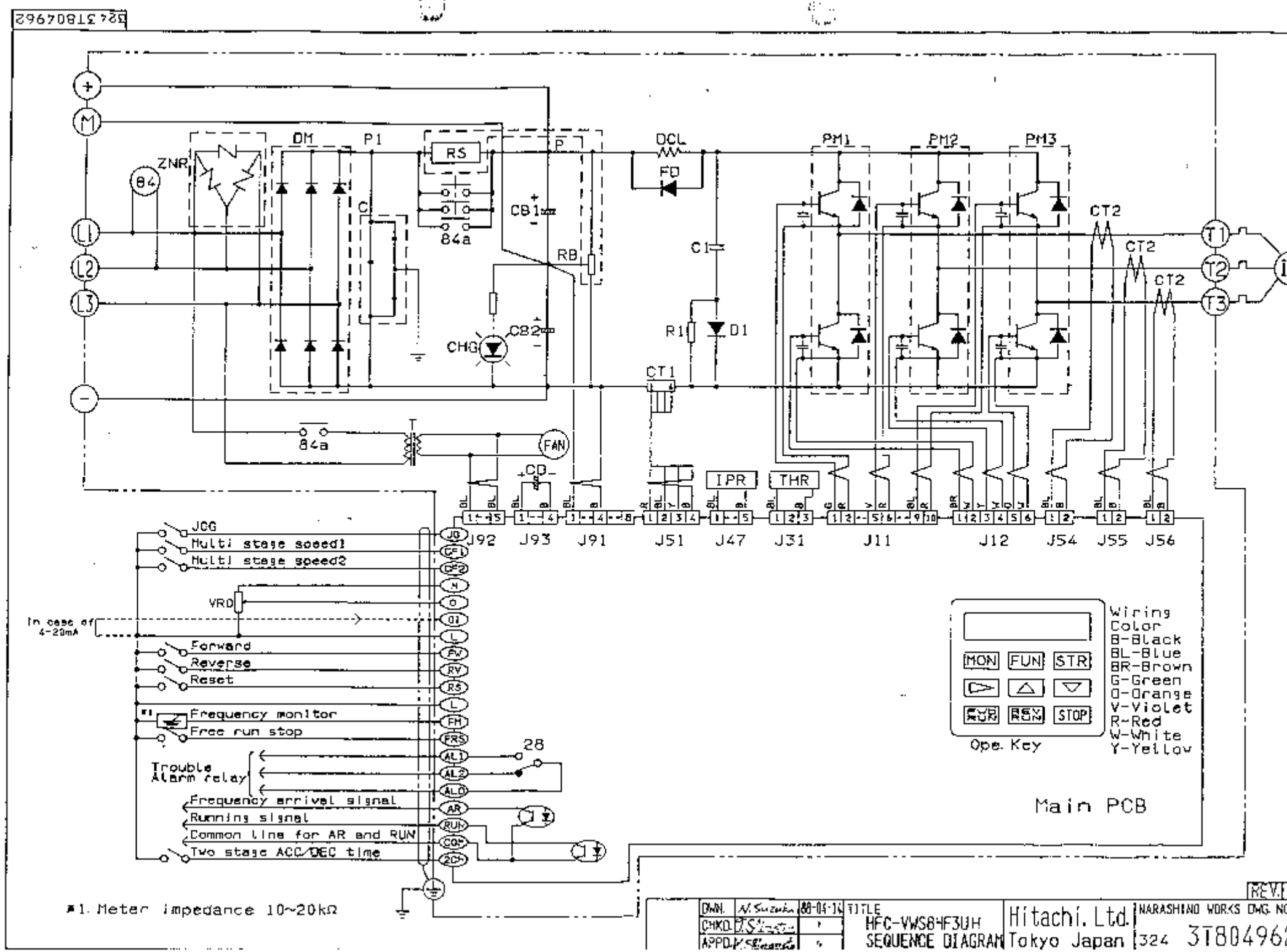


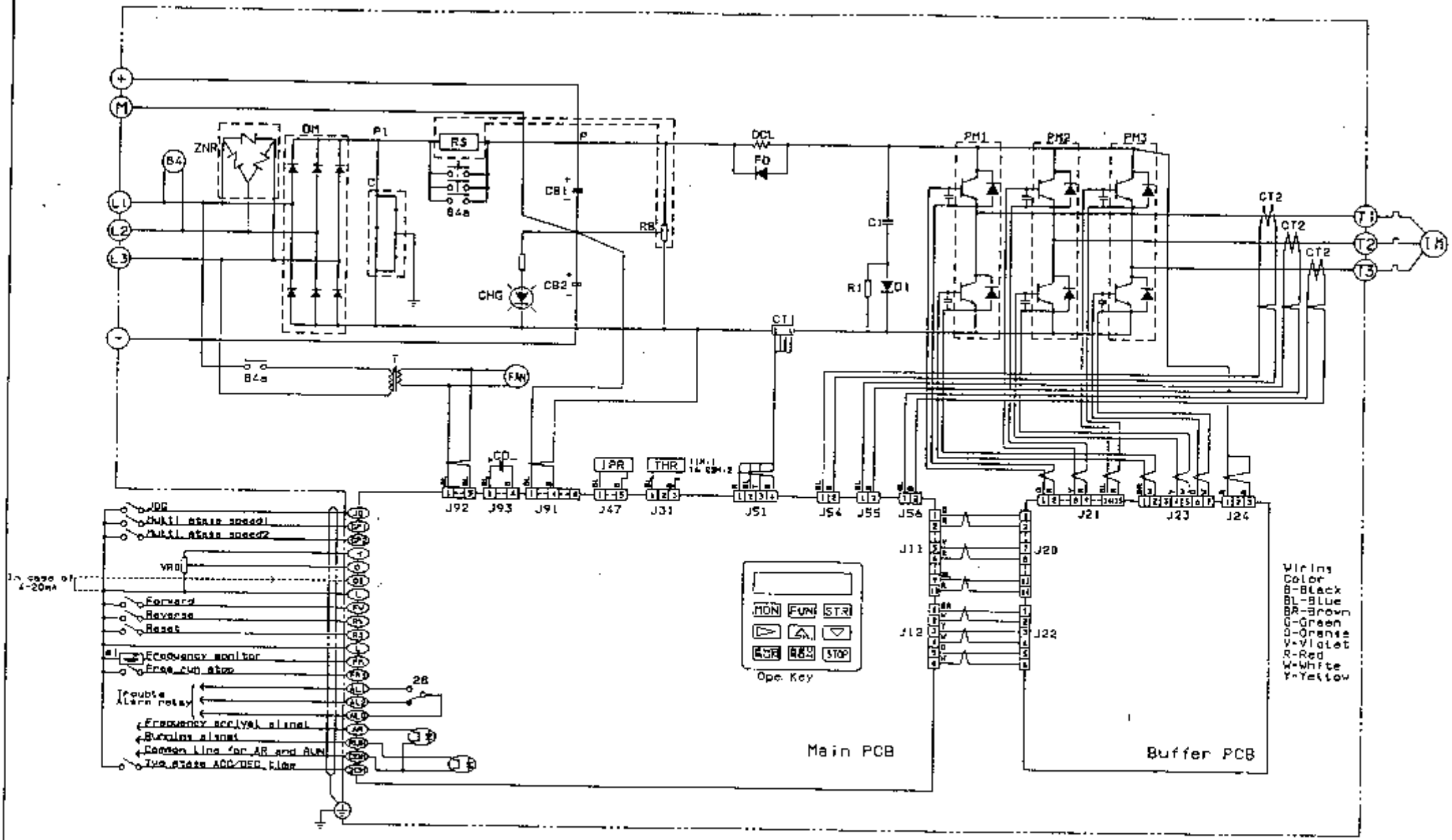
DRN.	M. Suzuki	91-05-27	TITLE	Hitachi. Ltd	HARASHINO WORKS DWG NO.	REV.
CHKD	T. Nakamura	"	HFC-VWS22LF3UH SEQUENCE DIAGRAM	Tokyo Japan	324 2T800442	
APPD	K. Shimada	"				



DWN.		TITLE	Hitachi. Ltd.	HIRAKATA WORKS DWG.
CHK'D		NFC-VWS33LF3U SEQUENCE DIAGRAM	Tokyo Japan	324 2T8004
APPD.				

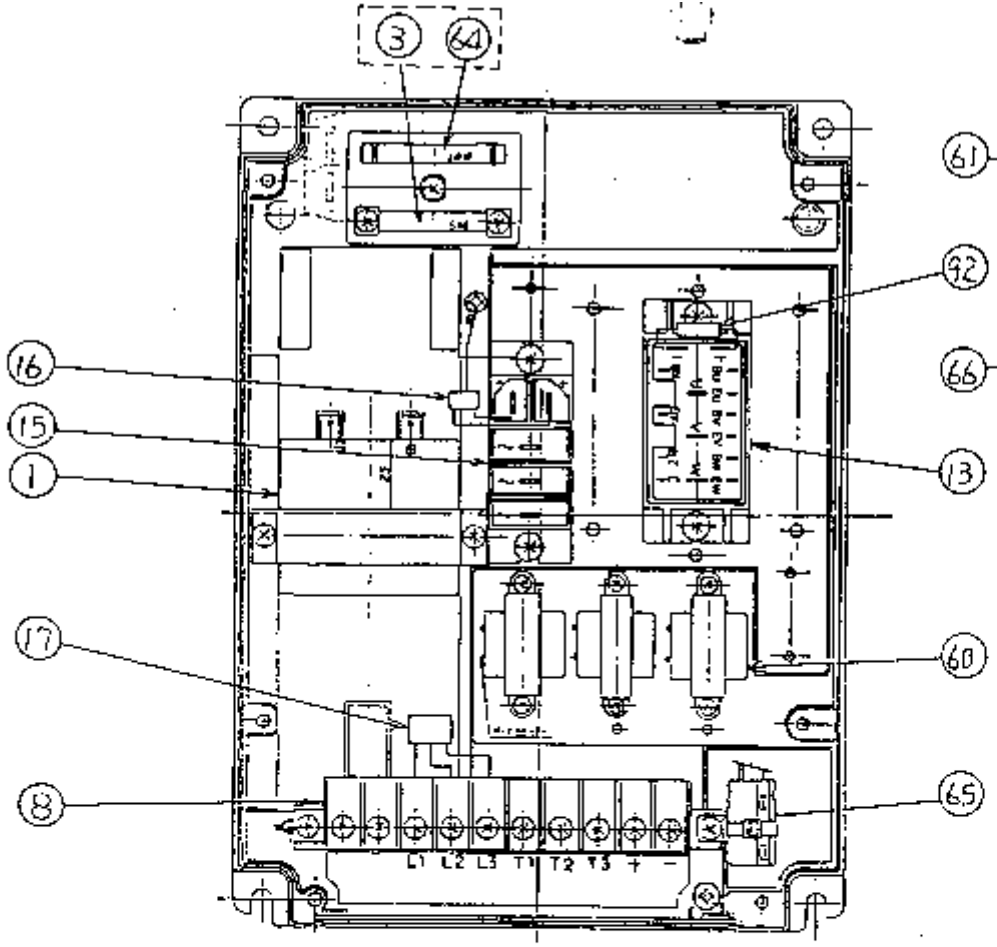

+
M
L1
L2
L3
-
B4
ZNR
DM
P1
RS
P
DCL
FD
C
C81
84a
RB
C10
PM
CT2
CT2
CT2
T1
T2
T3
CHG
CB2
SH
PR
B4a
+CD-
BU EU BV EV BW EW
BX EX BY EY BZ EZ
J92
J93
J91
J47
J11
J12
J54 J55 J56
(Only for S. SH)
RSB
J41
J42
J43
J44
J45
J46
JOG
Multi stage speed1
Multi stage speed2
VR0
In case of 4-20mA
Forward
Reverse
Reset
*1
Frequency monitor
Free run stop
Trouble Alarm relay
28
Frequency arrival signal
Running signal
Common line for AR and RUN
Two stage ACC/DEC time
JG
CF1
CF2
H
O
OI
L
FW
RV
RS
AL
FM
FRS
AL1
AL2
ALO
AR
RUN
COM
2CH
MON
FUN
STR
RUN
REM
STOP
Ope. Key
Wiring Color
B-Black
BL-Blue
BR-Brown
G-Green
O-Orange
V-Violet
R-Red
W-White
Y-Yellow
Main PCB
*1. Meter impedance 10~20kΩ
DWN.
CHKD.
APPD.
88-04-14
TITLE
HFC-VWS2 S-5 5HF3UH
SEQUENCE DIAGRAM
Hitachi. Ltd.
Tokyo_Japan
HITACHI WORKS DWG NO.
324 3T804961
REV.

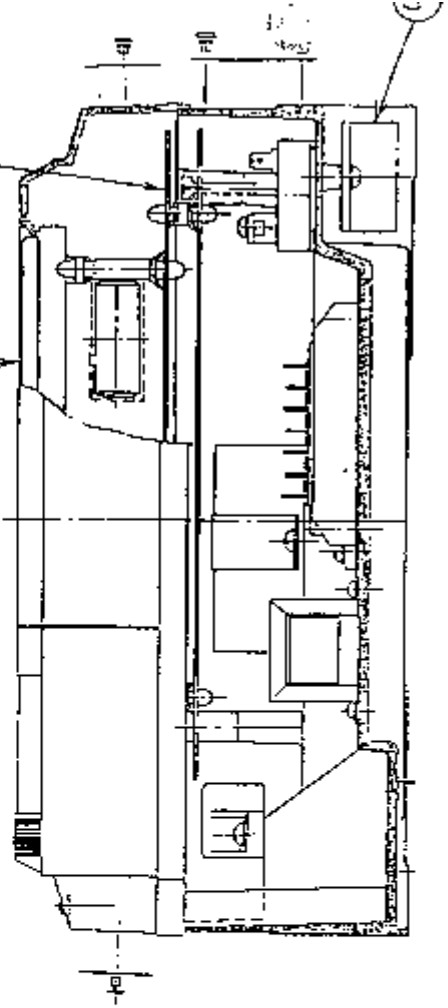

DM
P1
RS
P
DCL
FD
PM1
PM2
PM3
CT2
CT2
CT2
ZNR
84
84a
CB1
RB
C1
R1
D1
CHG
CB2
CT1
84a
T
FAN
+CD-
IPR
THR
J92
J93
J91
J51
J47
J31
J11
J12
J54
J55
J56
JOG
Multi stage speed1
Multi stage speed2
VRD
In case of 4-20mA
Forward
Reverse
Reset
Frequency monitor
Free run stop
Trouble Alarm relay
28
Frequency arrival signal
Running signal
Common line for AR and RUN
Two stage ACC/DEC time
*1
MON
FUN
STR
RUN
STOP
Ope. Key
Wiring Color
B-Black
BL-Blue
BR-Brown
G-Green
O-Orange
V-Violet
R-Red
W-White
Y-Yellow
Main PCB
*1. Meter impedance 10~20kΩ
DWN.
CHKD.
APPD.
88-04-14
TITLE
HFC-VWS8HF3UH
SEQUENCE DIAGRAM
Hitachi. Ltd.
Tokyo Japan
HARASHINO WORKS DWG NO
324 3T804962
REV.

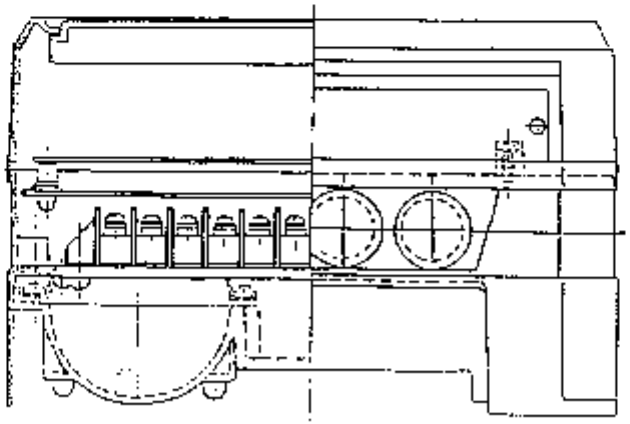


DWN.			TITLE	Hitachi. Ltd.
CHKD			HFC-VWS1]-22HF3UH SEQUENCE DIAGRAM	Tokyo Japan
APPD				

HARASHEAD WORKS DWG. NO. 2T80043

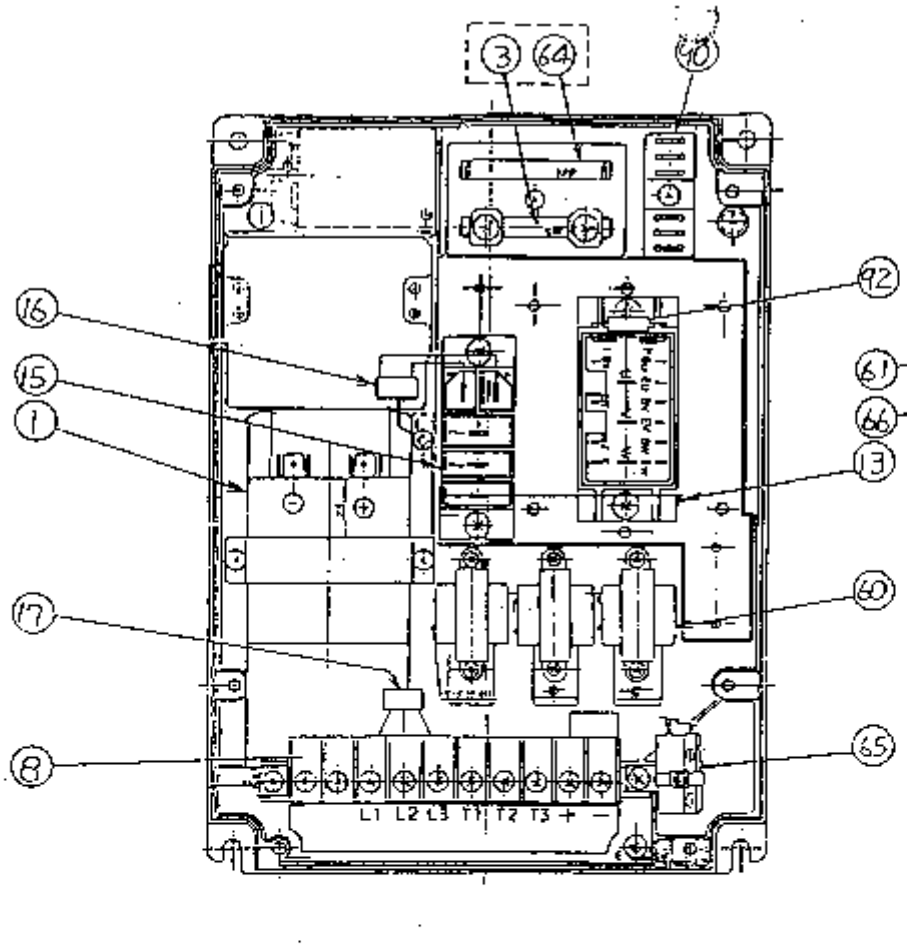


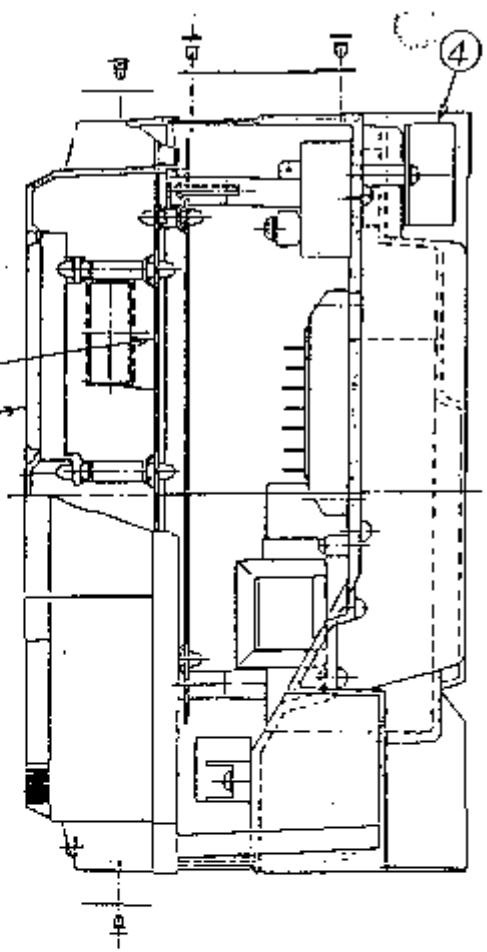


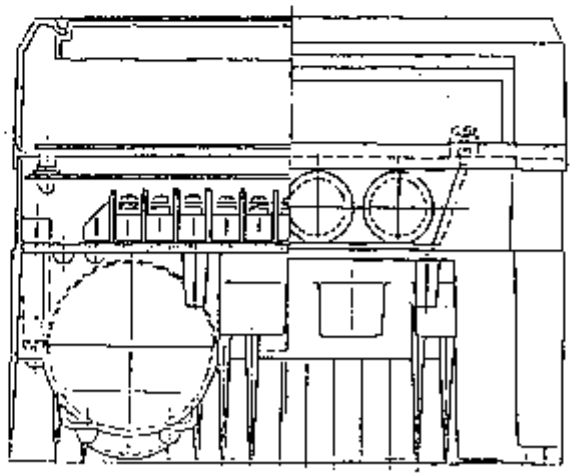


NO.	SYMBOL	PARTS NAME	Q'TY/UNIT	AVAILABILITY
1	CB	SMOOTHING CAPACITOR	1	○
3	SH	SHUNT RESISTOR	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
64	IPR	RESISTOR	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
92	C10	CAPACITOR	1	—

CUSTOMER		QUANTITY	ORDER NO	WORK NO
DWN	N. Suzuki 95-10-06	TITLE	Hitachi, Ltd. Tokyo, Japan	HITACHI WORKS DWG NO
CHKD	H. Yamada	HFC-VWS1.5LD3UH ASSEMBLY		324 3T805292
APPD	S. Shimada			SH 01

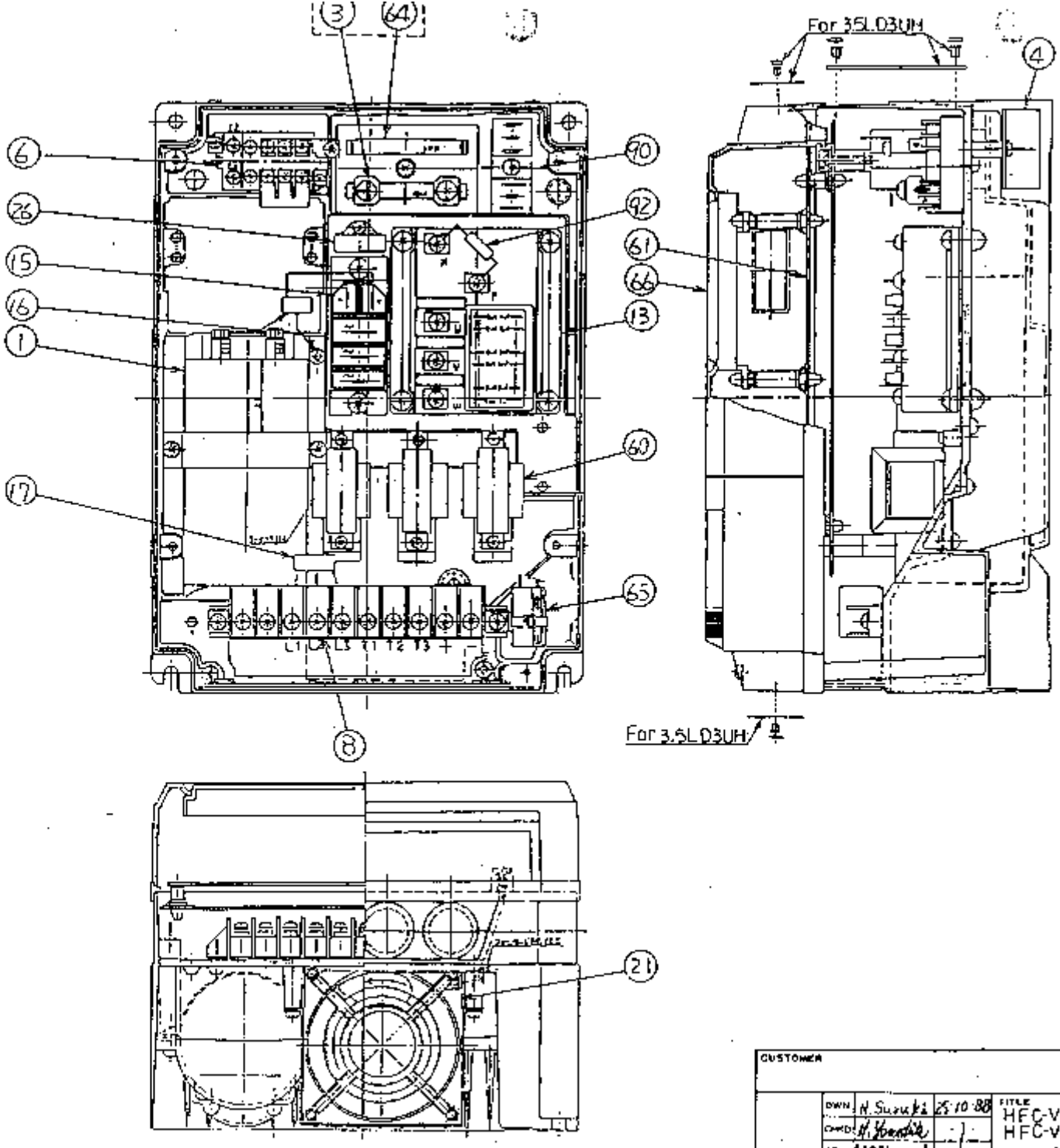






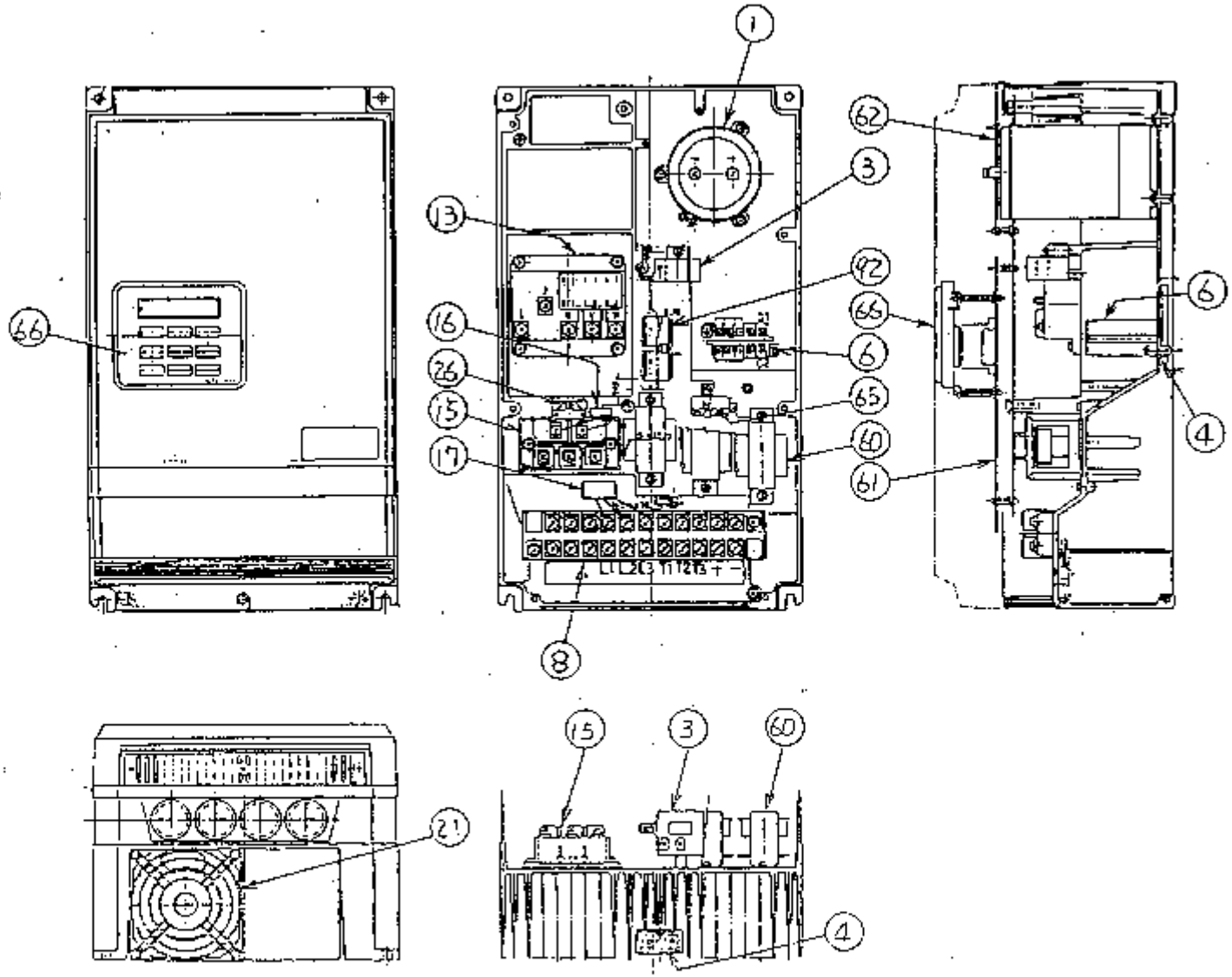
NO.	SYMBOL	PARTS NAME	Q'TY/ UNIT	AVAILA-BILITY
1	CB	SMOOTHING CAPACITOR	1	○
3	SH	SHUNT RESISTOR	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
64	IPR	RESISTOR	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
90	RSB	BASE DRIVE RESISTOR	1	○
92	C10	CAPACITOR	1	—

CUSTOMER		QUANTITY	ORDER NO.	WORK NO
DWN	N. Suzuki	85-10-08	TITLE	NARASHINO WORKS DWG. NO
CHD	H. Yamada	-/-	HFC-VWS25LD3UH ASSEMBLY	Hitachi, Ltd. Tokyo Japan
APPD	Y. Shimada	-/-		324 3T805293 SH OF



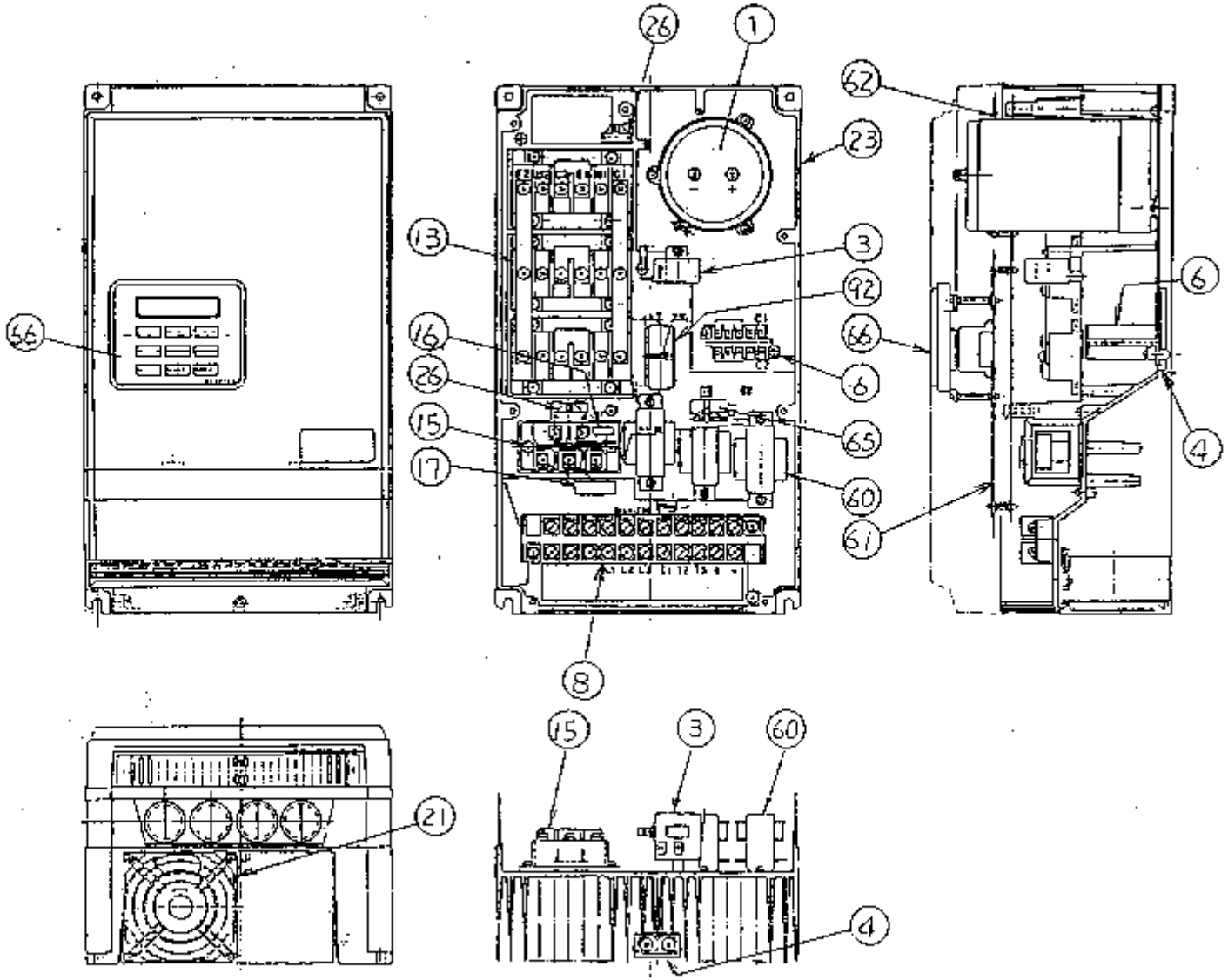
NO.	SYMBOL	PARTS NAME	Q'TY/ UNIT	AVAILA-BILITY
1	CB	SMOOTHING CAPACITOR	1	○
3	SH	SHUNT RESISTOR	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	1	—
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
64	IPR	RESISTOR	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
90	RSB	BASE DRIVE RESISTOR	1	○
92	C10	CAPACITOR	1	—

CUSTOMER		QUANTITY	ORDER NO.	WORK NO
DWN	N. Suzuki 25.10.88	TITLE	Hitachi, Ltd. Tokyo Japan	NARASHINO WORKS DWG. NO.
CHKD	H. Yoneda	HFC-VWS3.5LD3UH HFC-VWS55LF3UH ASSEMBLY		324 3T805294
APPD	K. Shimada			SH OF



NO.	SYMBOL	PARTS NAME	Q'TY/ UNIT	AVAILA-BILITY
1	CB	SMOOTHING CAPACITOR	1	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	1	—
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
92	C10	CAPACITOR	1	—

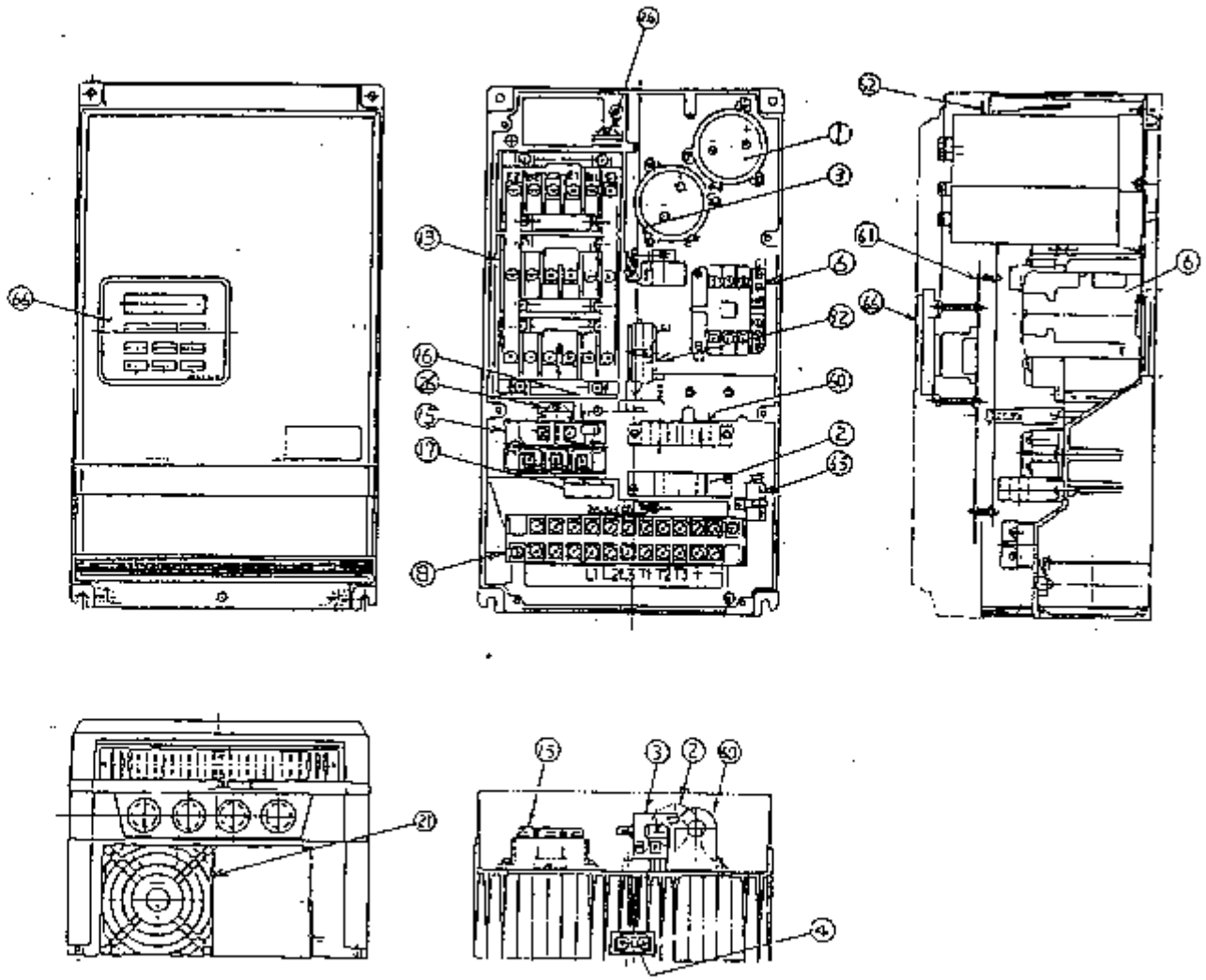
CUSTOMER		QUANTITY	ORDER NO.	WORK NO
DWN	N. Suzuki 25-10-88	TITLE		
CHKD	H. Yamada	HFC-VWS&LF3UH ASSEMBLY	Hitachi, Ltd. Tokyo Japan	324 3T805295
APPD	K. Shimada			



NO.	SYMBOL	PARTS NAME	Q'TY/ UNIT	AVAILA-BILITY
1	CB	SMOOTHING CAPACITOR	1	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	2	—
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
92	C10	CAPACITOR	1	—

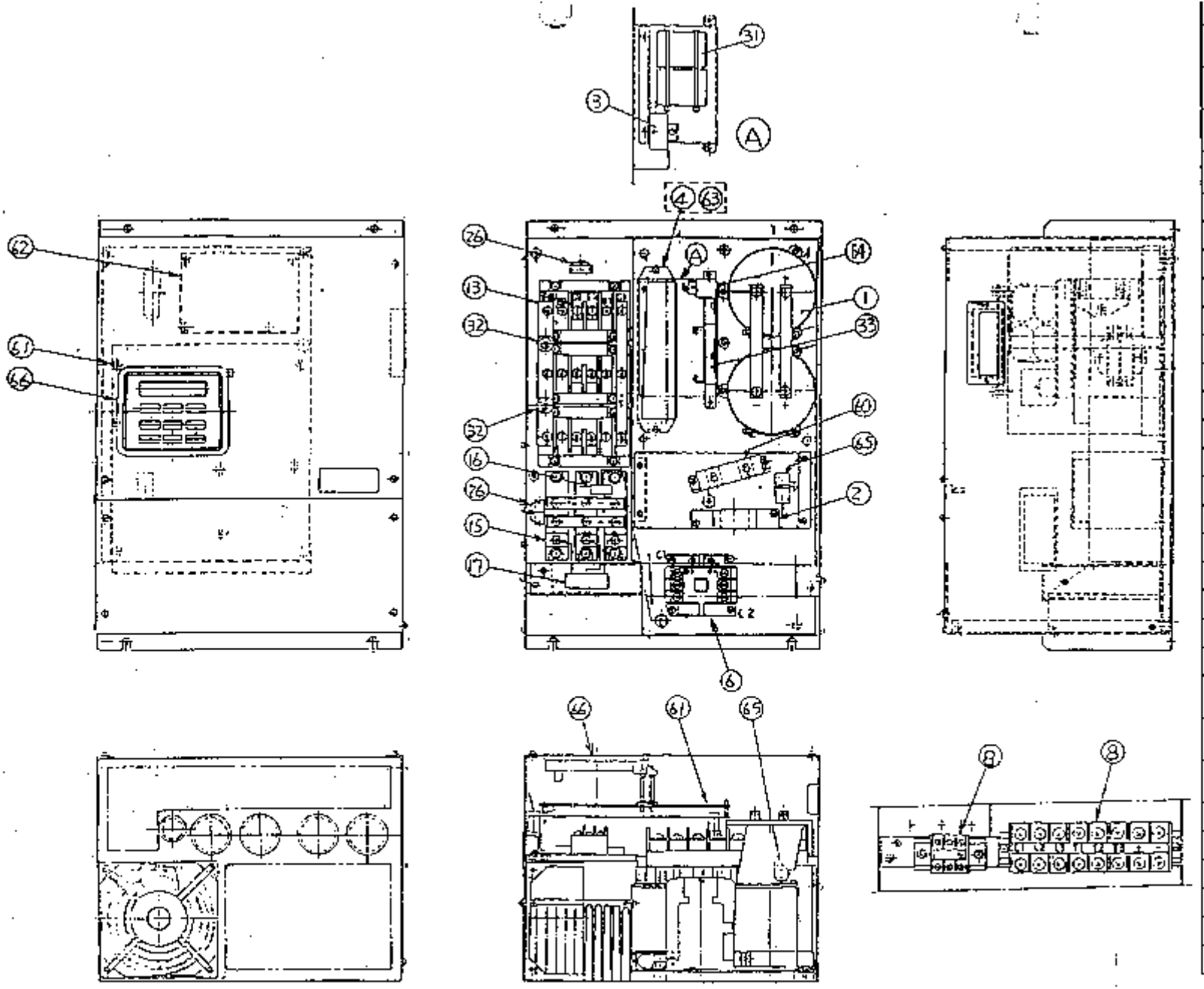
CUSTOMER		QUANTITY	ORDER NO	WORK NO

			TITLE		NARASHINO WORKS DWG NO.
DWN	N. Suzuki	95 10 88	HFC-VWS11LF3UH ASSEMBLY	Hitachi, Ltd. Tokyo Japan	324 3T805296
CHKD	K. Yamada	〃			SH DF
APPD	K. Shimada	〃			



NO.	SYMBOL	PARTS NAME	Q'TY/ UNIT	AVAILA-BILITY
1	CB	SMOOTHING CAPACITOR	2	○
2	ZCT	CURRENT TRANSFORMER	1	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	2	—
60	CT2	AC CURRENT TRANSFORMER	1	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
92	C10	CAPACITOR	1	—

CUSTOMER		QUANTITY	ORDER NO	WORK NO
DWN N.Suzuki 95.10.26	TITLE HFC-VWS16LF3UH ASSEMBLY	Hitachi, Ltd. Tokyo, Japan	HITACHI WORKS DWG NO 324 3T805297	
CHKD H.Yamashita 1				
APPD H.Shimazaki 1			SH OF	



			UNIT	BILITY
1	CB	SMOOTHING CAPACITOR	2	○
2	ZCT	CURRENT TRANSFORMER	1	—
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	3	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	2	—
31	C1	SNUBBER CAPACITOR	2×2	—
32	D1	SNUBBER DIODE	2	○
33	R1	SNUBBER RESISTOR	2	○
60	CT2	AC CURRENT TRANSFORMER	1	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
63	RBS	RESISTOR	1	○
64	IPR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○

CUSTOMER	QUANTITY	ORDER NO.	WORK NO

DWN N. Suzuki 25 10 88
DES H. Yamada 1
APPD K. Shimada 1

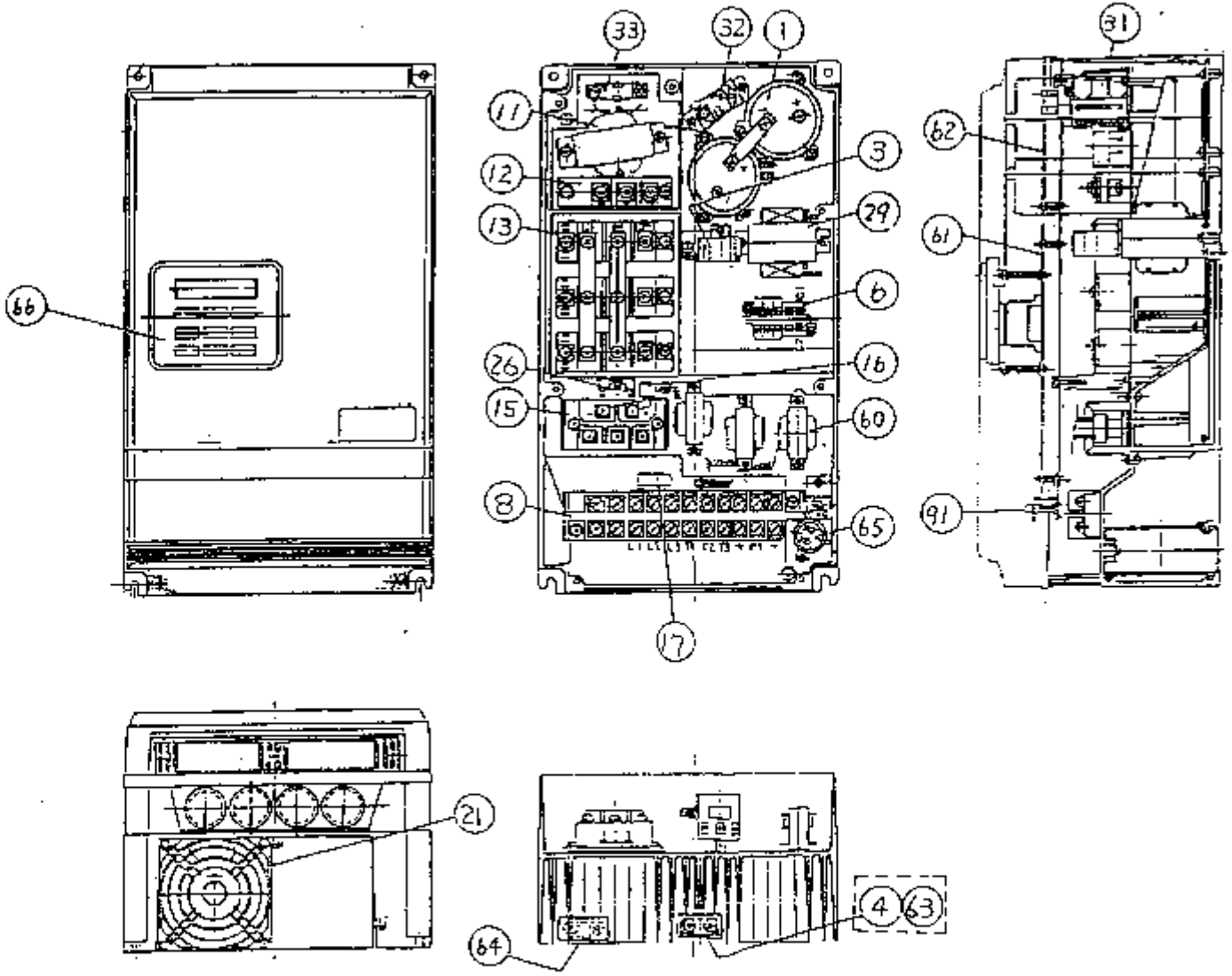
TITLE HFC-VWS22LF3UH ASSEMBLY

Hitachi, Ltd. Tokyo, Japan

HARASHINO WORKS DWG. NO. 324 3T805298

SH OF

5—1



			UNIT	SIBILITY
1	CD	SMOOTHING CAPACITOR	2	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	B4	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	—
12	FD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	1	—
29	T	TRANSFORMER	1	○
31	C1	SNUBBER CAPACITOR	3	—
32	D1	SNUBBER DIODE	1	○
33	R1	SNUBBER RESISTOR	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
63	RB	BALANCE RESISTOR	1	○
64	IPR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
91	CHG	CHARGE LAMP	1	—

CUSTOMER	QUANTITY	ORDER NO	WORK NO

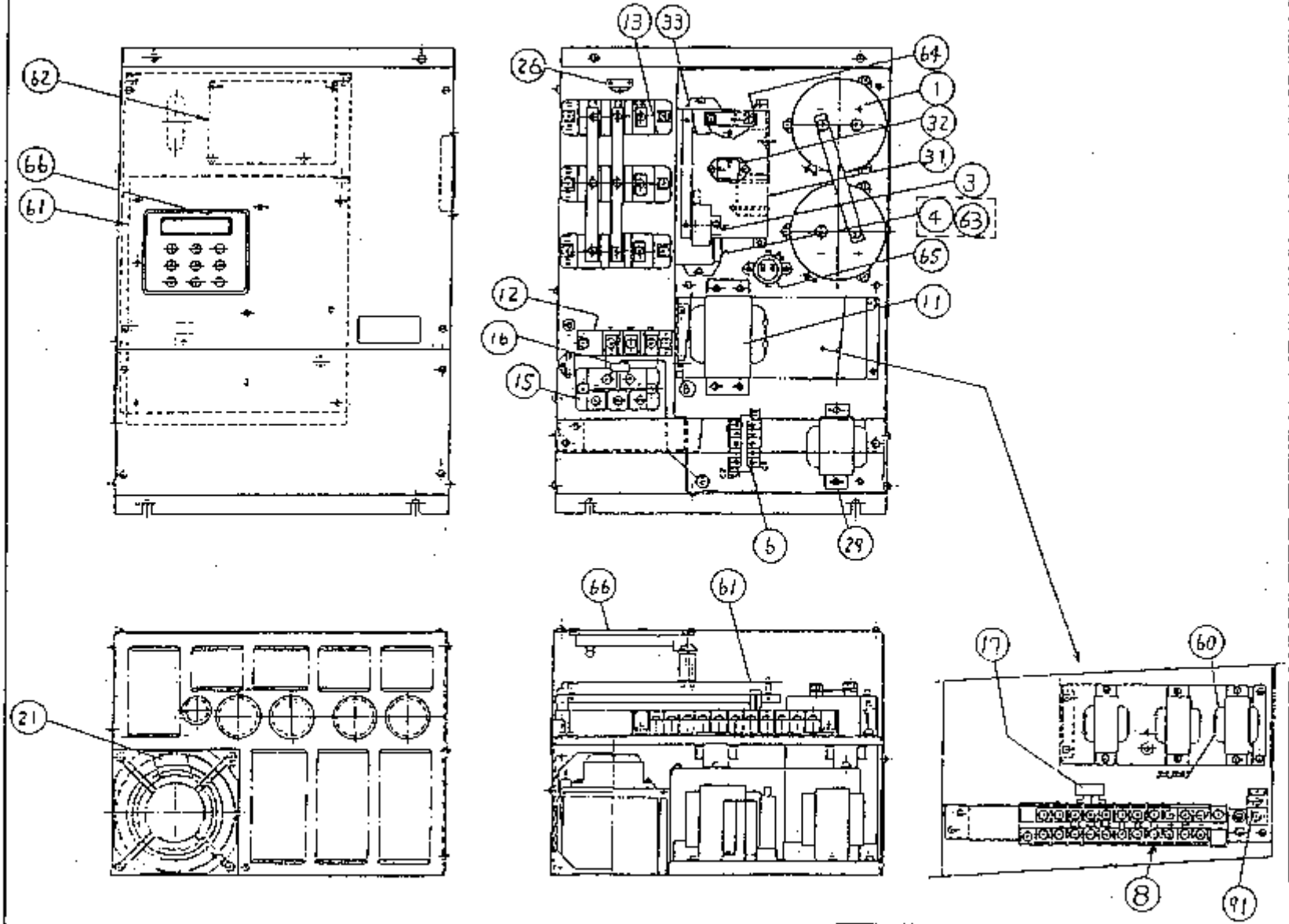
DWN. N. Suzuki 85 10 88
CHKD H. Yamashita
APPD K. Shimazaki

TITLE: HFC-VWS11HF3UH ASSEMBLY

Hitachi, Ltd. Tokyo Japan

HARASHINO WORKS DWG NO: 324 3T805304

SH OF



NO.	SYMBOL	PARTS NAME	Q'TY/UNIT	AVAILABILITY
1	CB	SMOOTHING CAPACITOR	2	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	—
12	FD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	1	—
29	T	TRANSFORMER	1	○
31	C1	SNUBBER CAPACITOR	3	—
32	D1	SNUBBER DIODE	1	○
33	R1	SNUBBER RESISTOR	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
63	RB	BALANCE RESISTOR	1	○
64	1PR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
91	CHG	CHARGE LAMP	1	

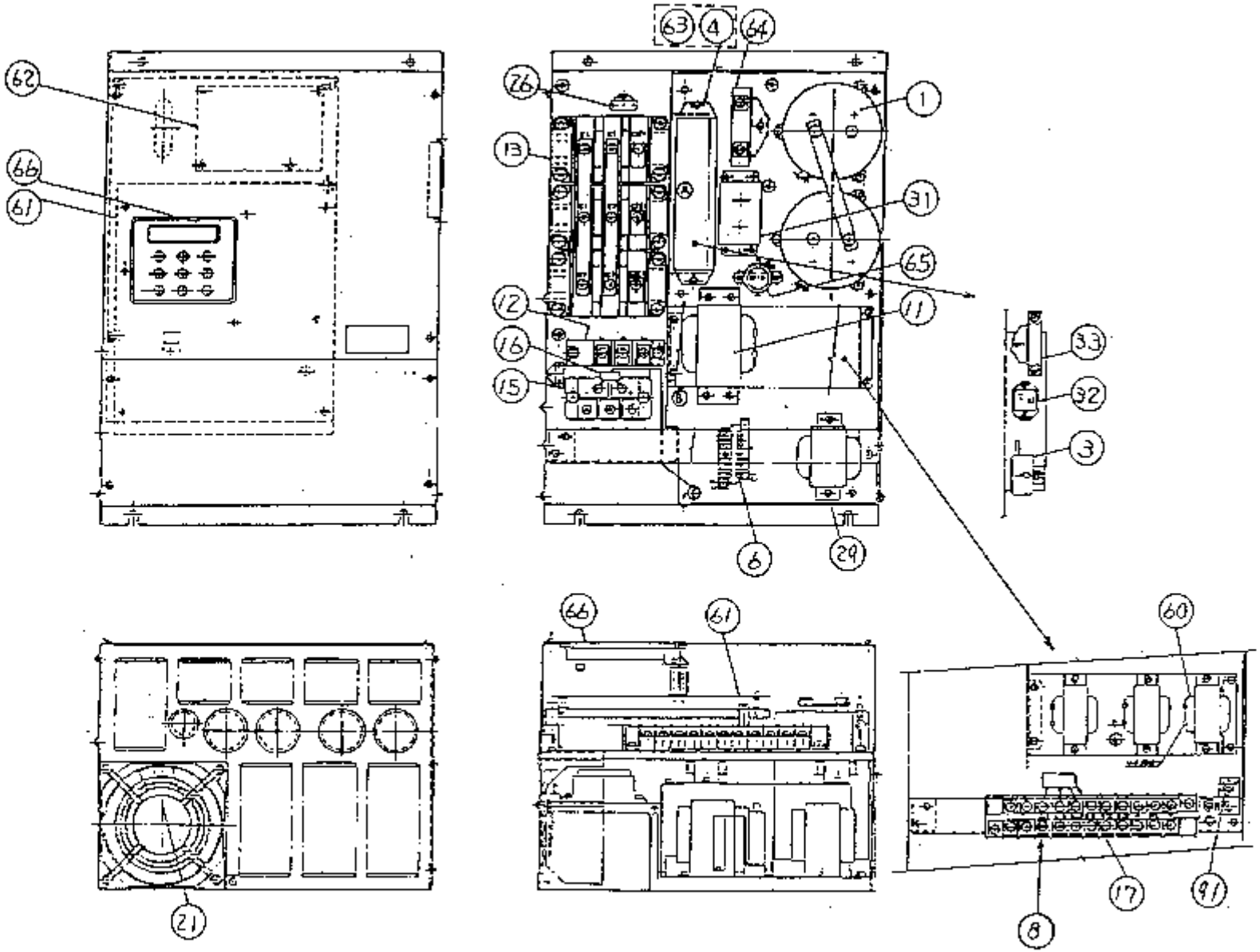
CUSTOMER		QUANTITY	ORDER NO	WORK NO

DWN	N. Suzuki	5/10 88	TITLE	HFC-VWS16HF3UH ASSEMBLY
CHKD	H. Yamashita	1		
APPD	K. Shimada	1		

Hitachi, Ltd. Tokyo Japan

HARASHINO WORKS DWG NO 324 3T805305

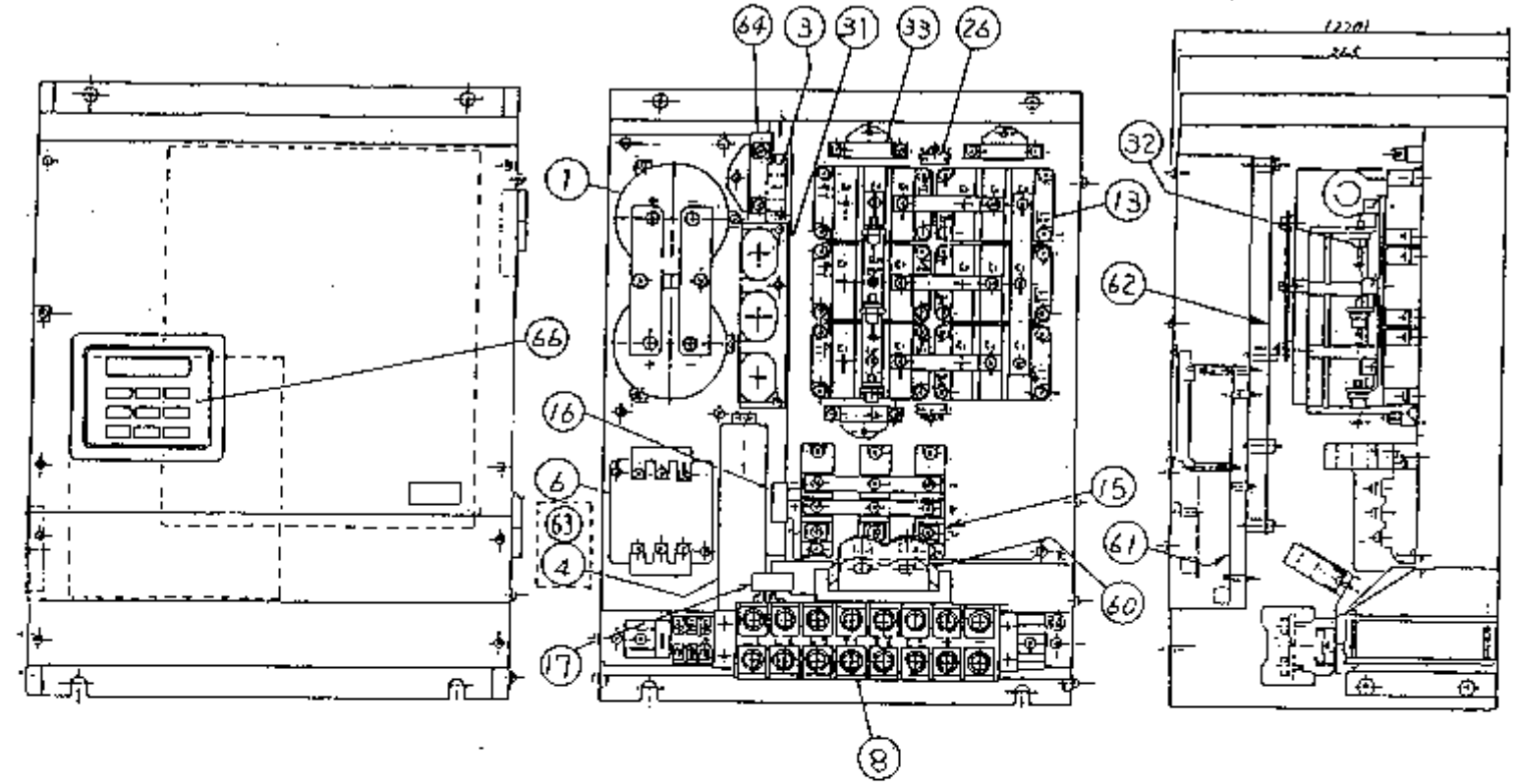
SH OF

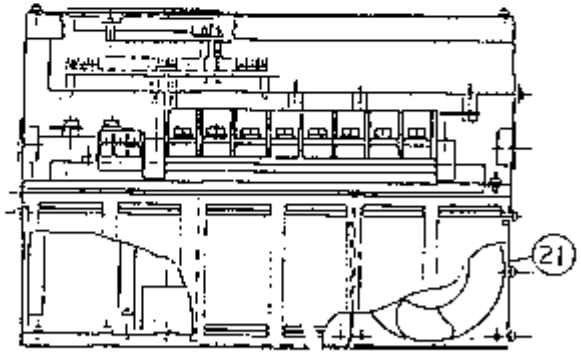


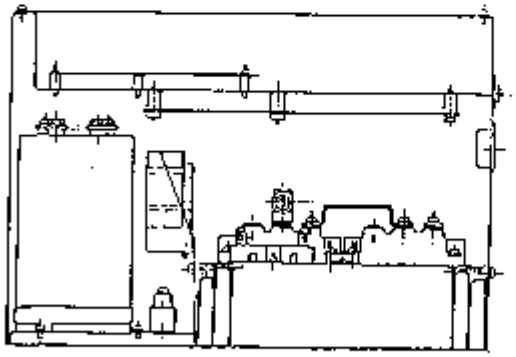
NO.	SYMBOL	PARTS NAME	QTY/UNIT	AVAILABILITY
1	CB	SMOOTHING CAPACITOR	2	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	S4	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	—
12	FD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	1	—
29	T	TRANSFORMER	1	○
31	CI	SNUBBER CAPACITOR	1	—
32	DI	SNUBBER DIODE	1	○
33	RI	SNUBBER RESISTOR	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BUFFER)	1	○
63	RD	BALANCE RESISTOR	1	○
64	TPR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
91	CHG	CHARGE LAMP	1	—

CUSTOMER	QUANTITY	ORDER NO	WORK NO

DWN	N.Suzuki	5-10-88	TITLE	Hitachi, Ltd. Tokyo, Japan	HARASHINO WORKS DWG. NO.
CHKD	H. Yamada		HFC-VWS22HF3UH ASSEMBLY		324 3T805306
APPD	K.Shimada				SH OF



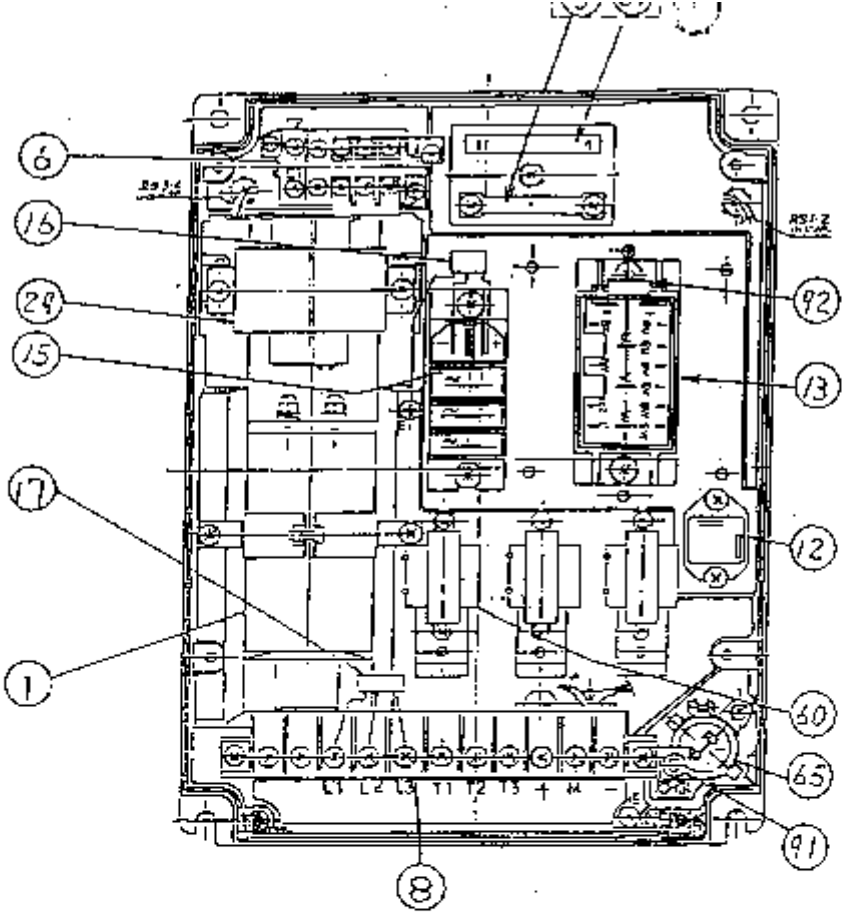


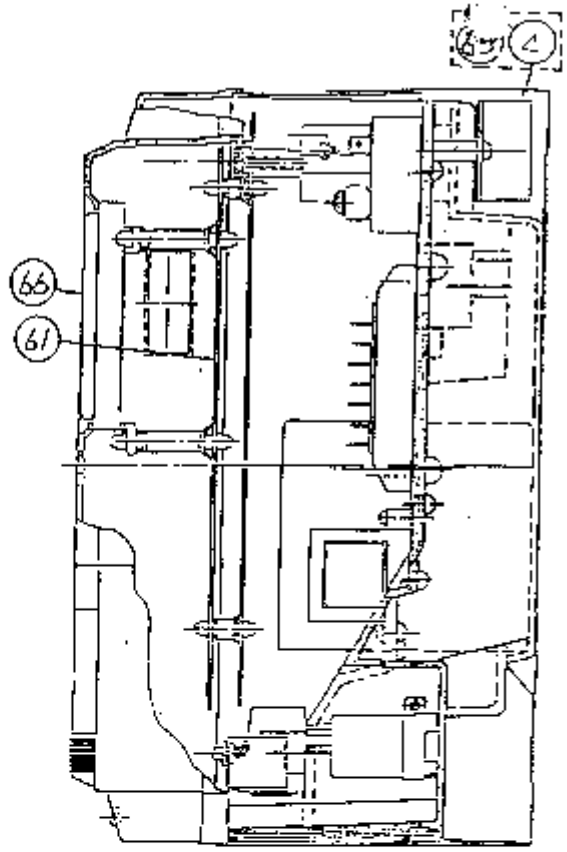


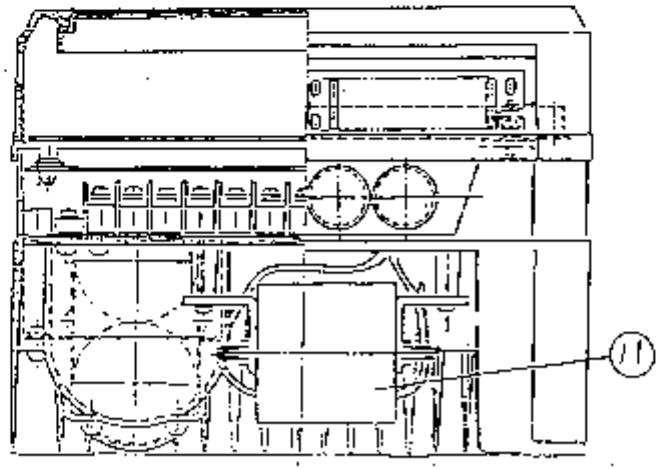
NO.	SYMBOL	PARTS NAME	Q'TY/ UNIT	AVAILA-BILITY
1	CD	SMOOTHING CAPACITOR	2	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
13	PM	TRANSISTOR MODULE	6	○
15	DM	DIODE MODULE	3	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	2	○
26	THR	THERMAL RELAY	2	—
31	C1	SNUBBER CAPACITOR	3	○
32	D1	SNUBBER DIODE	3	○
33	R1	SNUBBER RESISTOR	3	○
60	CT2	AC CURRENT TRANSFORMER	1	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
62	PCB	PRINTED CIRCUIT BOARD (BASE)	1	○
63	RBS	RESISTOR	1	○
64	IPR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○

CUSTOMER		QUANTITY	ORDER NO	WORK NO.

DWN.	N. Suzuki	25.10.88	TITLE	Hitachi, Ltd. Tokyo, Japan	HITACHINO WORKS DWG. NO.
CHKD	H. Yamada		HFC-VWS33LF3U ASSEMBLY		324 3T805299
APPD	K. Shimada				SH OF



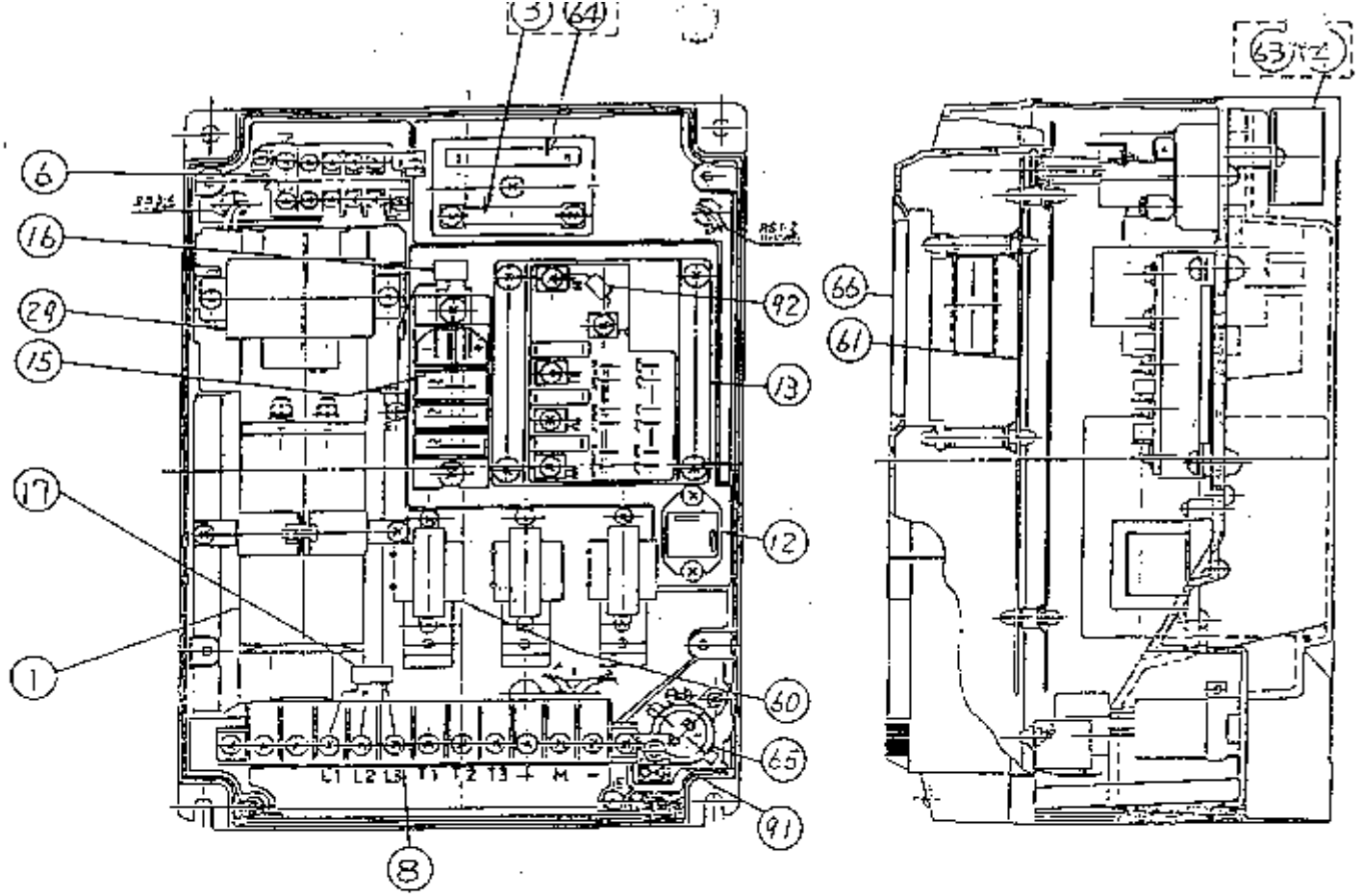


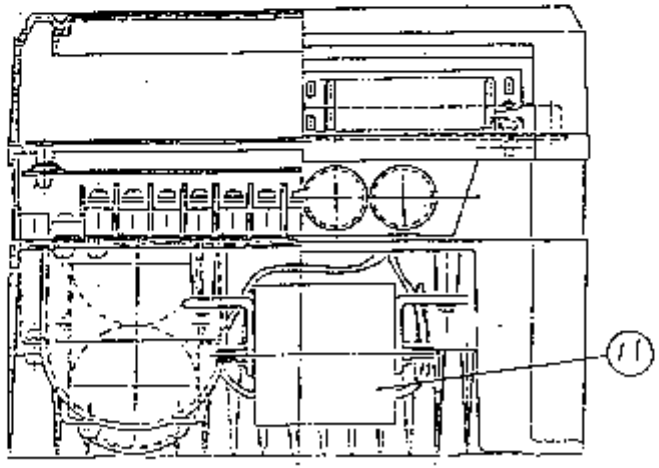


			UNIT	UTILITY
1	CB	SMOOTHING CAPACITOR	2	○
3	SH	SHUNT RESISTOR	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	
12	PD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
29	T	TRANSFORMER	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
63	RB	BALANCE RESISTOR	1	○
64	IPR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
91	CHG	CHARGE LAMP	1	—
92	C10	CAPACITOR	1	—

CUSTOMER		QUANTITY	ORDER NO	WORK NO

			TITLE		HARASHINO WORKS DWG NO
DWN.	N. Suzuki	25.10.88	HFC-VWS25HF3UH ASSEMBLY	Hitachi, Ltd. Tokyo Japan	324 3T805300
CHKD					SH OF
APPD					





			UNIT	SELECTIVITY
1	CB	SMOOTHING CAPACITOR	2	○
3	SH	SHUNT RESISTOR	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	
12	FD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
29	T	TRANSFORMER	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
63	RB	BALANCE RESISTOR	1	○
64	TPR	RESISTOR	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
91	CHG	CHARGE LAMP	1	—
92	C10	CAPACITOR	1	—

CUSTOMER	QUANTITY	ORDER NO	WORK NO

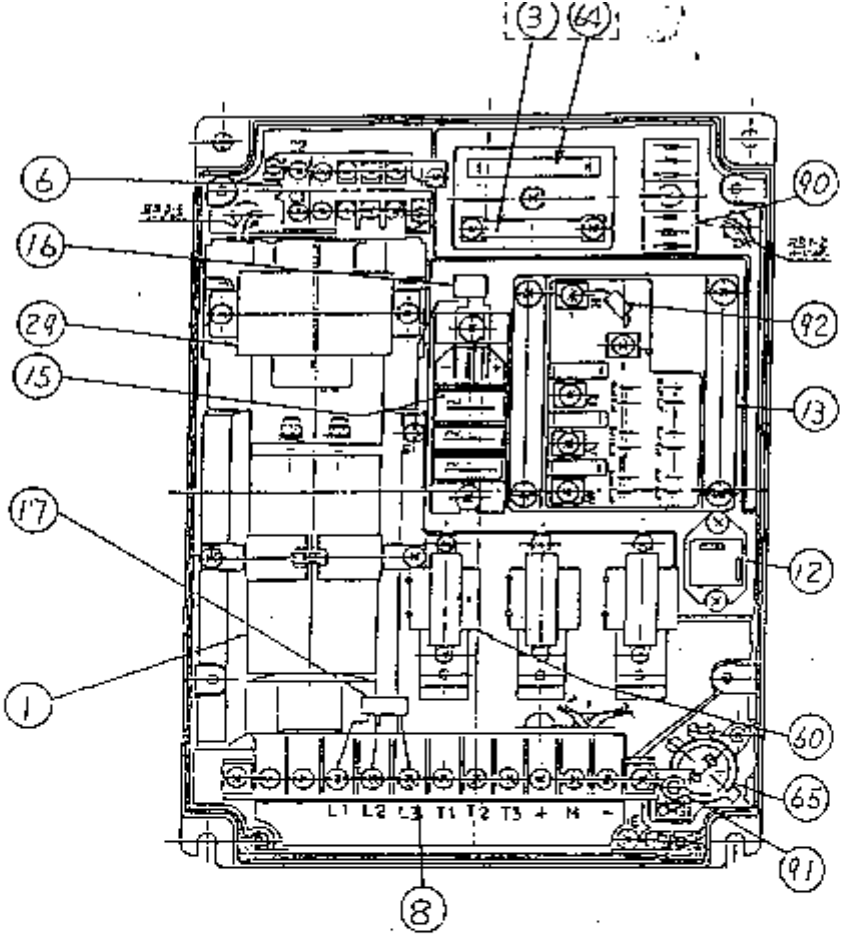
DWN N.Suzuki 25.10.88
CHKD
APPD

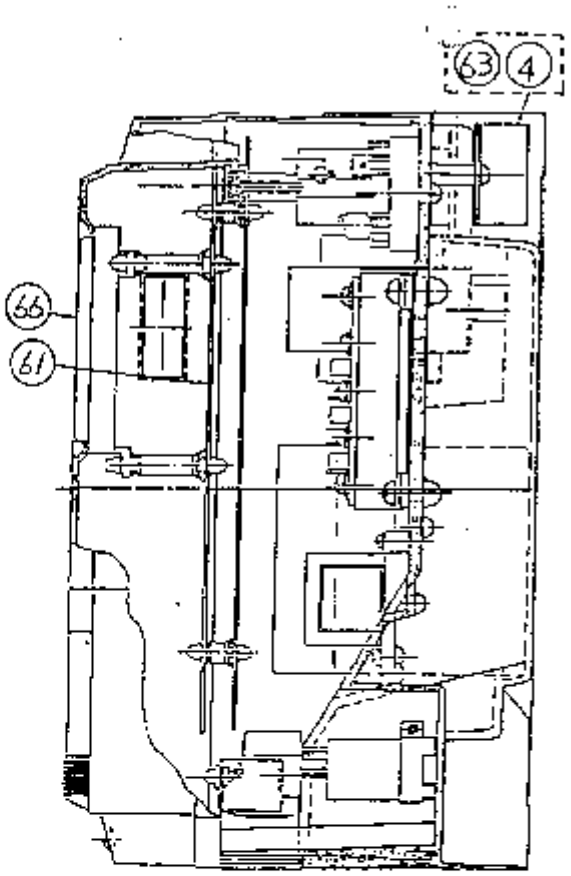
TITLE: HFC-VWS3.5HF3UH ASSEMBLY

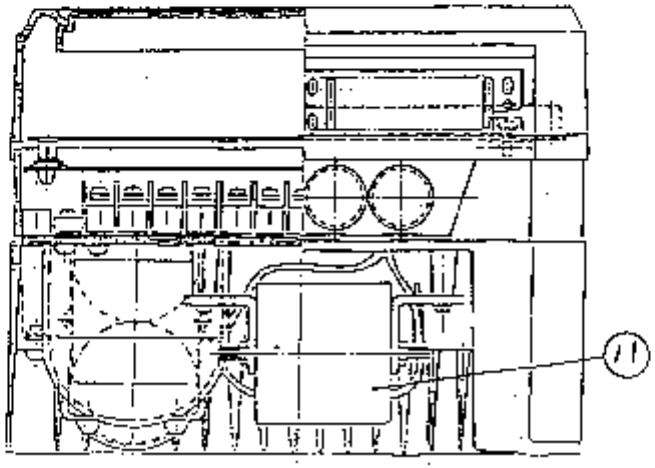
Hitachi, Ltd. Tokyo, Japan

HARASHINO WORKS DWG. NO. 324 3T805301

SH 01





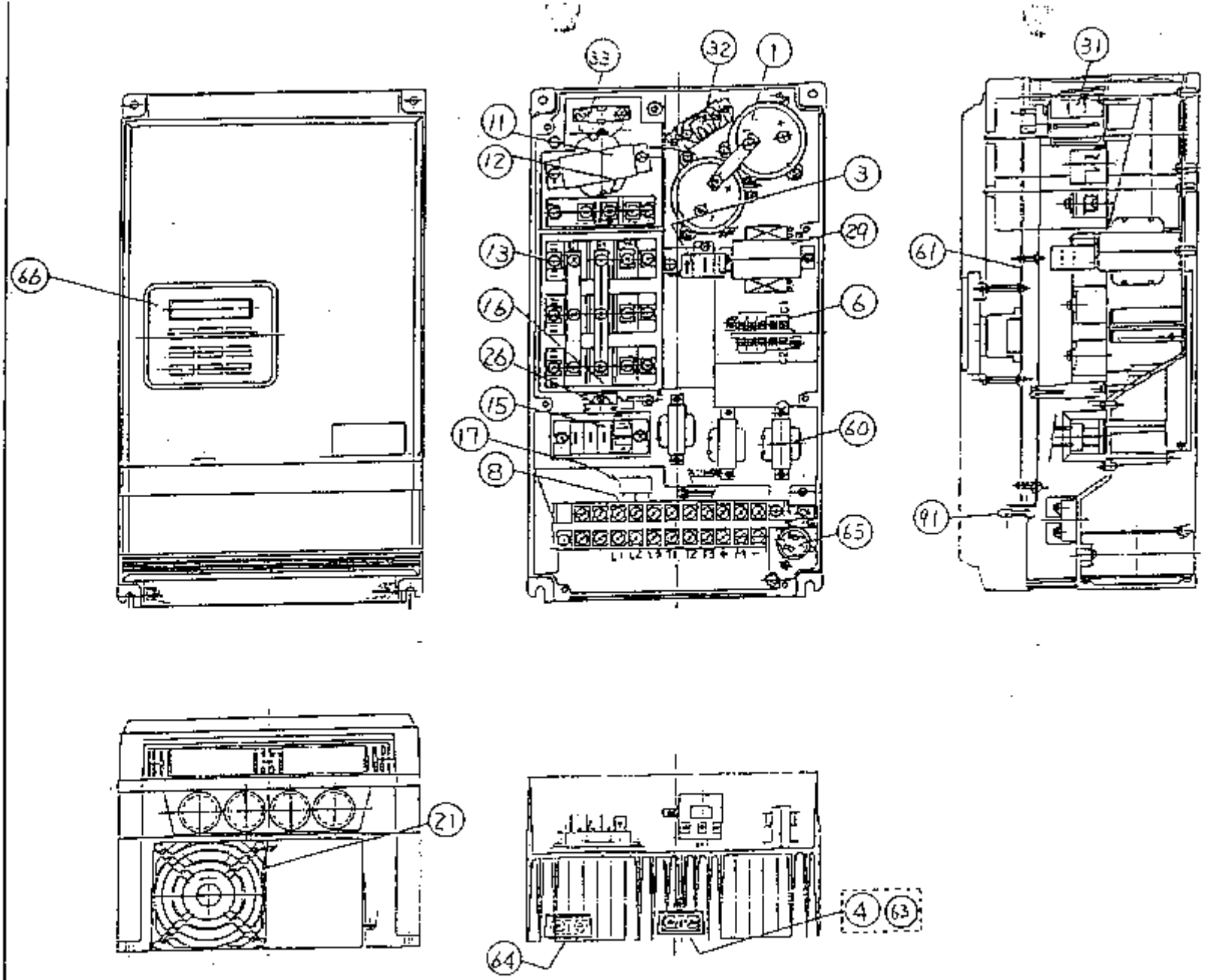


			UNIT	QUALITY
1	CB	SMOOTHING CAPACITOR	2	○
3	SH	SHUNT RESISTOR	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	—
12	FD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	1	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
29	T	TRANSFORMER	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
63	RB	BALANCE RESISTOR	1	○
64	IPR	RESISTOR	1	○
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
90	RSB	BASE DRIVE RESISTOR	1	○
91	CHG	CHARGE LAMP	1	—
92	C10	CAPACITOR	1	—

CUSTOMER		QUANTITY	ORDER NO.	WORK NO.

DWN	N. Suzuki	25.10.88	TITLE: HFC-VWS55HF3UH ASSEMBLY	Hitachi, Ltd. Tokyo Japan
CHKD				
APPD				

HARASHINO WORKS DWG. NO.
324 3T805302
SH 01



			UNIT	BILITY
1	CD	SMOOTHING CAPACITOR	2	○
3	CT1	DC CURRENT TRANSFORMER	1	○
4	RS	CURRENT LIMITING RESISTOR	1	○
6	-84	MAGNETIC CONTACTOR	1	○
8	TM	TERMINAL BLOCK	1	○
11	DCL	DC REACTOR	1	—
12	FD	FLYWHEEL DIODE	1	○
13	PM	TRANSISTOR MODULE	3	○
15	DM	DIODE MODULE	1	○
16	C	NOISE FILTER	1	—
17	ZNR	SURGE ABSORBER	1	○
21	FAN	COOLING FAN	1	○
26	THR	THERMAL RELAY	1	—
29	T	TRANSFORMER	1	○
31	C1	SNUBBER CAPACITOR	2	—
32	D1	SNUBBER DIODE	1	○
33	R1	SNUBBER RESISTOR	1	○
60	CT2	AC CURRENT TRANSFORMER	3	○
61	PCB	PRINTED CIRCUIT BOARD (LOGIC)	1	○
63	RB	BALANCE RESISTOR	1	○
64	TPR	RESISTOR	1	—
65	CD	CAPACITOR	1	—
66	PANEL	DIGITAL PANEL	1	○
91	CHG	CHARGE LAMP	1	—
92	C10	CAPACITOR	1	—

CUSTOMER	QUANTITY	ORDER NO	WORK NO

DWN	N. Suzuki	25-10-88	TITLE: HFC-VWS8HF3UH ASSEMBLY	Hitachi, Ltd. Tokyo Japan
DSD	H. Yamashita	1		
APPD	K. Shimazaki	1		

HITACHI WORKS DWG NO: 324 3T805303

SH DF

(FOR YOUR REFERENCE)

(IP23)

6.4 SELECTION OF VENTILATING FAN OF INVERTER BOX

When the inverter unit shall be received in the box, it is necessary to keep the ambient temperature as follows:

Enclosed wall mount type(A,& B type)	Not exceed 40°C
Open wall mount type(C type)	Not exceed 50°C

Then please install ventilating fan to ventilate well.

(1) Inverter capacity, necessary ventilation and ventilating hole area

1. The calculation examples are given in the list below. [Q is in case of 10°C at temperature (ΔT=10°C)]

Inverter capacity (kVA)	Inverter generation loss(approx. value)(KW)	H Inverter calorific value (Kcal/hr)	Q Necessary ventilation T=10 C (m3/min)	S Ventilating hole area (minimum) (m2)
1.5	0.075	64.5	0.37	0.004
2.5	0.13	108	0.62	0.005
3.5	0.18	151	0.87	0.010
5.5	0.28	237	1.37	0.015
7.5	0.38	322	1.87	0.02
11	0.55	473	2.74	0.03
15	0.75	645	3.73	0.04
22	1.1	946	5.47	0.06
33	1.7	1419	8.21	0.09
40	2.0	1720	9.95	0.11
50	2.5	2150	12.4	0.14
60	3.0	2580	14.9	0.16
70	3.5	3010	17.4	0.20
100	5.0	4300	24.9	0.28
120	6.0	5160	29.9	0.33
150	7.5	6450	37.3	0.42

(2) Calculation formula

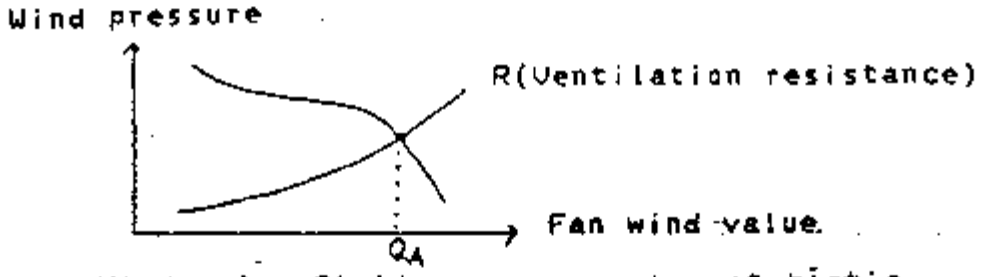
$$Q = \frac{H}{K \times \Delta T \times 60} \quad (m^3/min)$$

Q: Necessary ventilation (m^3/min)
H: Inverter calorific value (Kcal/hr)
Total value if having other heating power
K: Constant
$\gamma \cdot Cp = 0.29$(Kcal/m^3C)
[γ: Specific gravity of air=1.2(kg/m^3)
Cp: Specific heat of air=0.24(Kcal/kg°C)]
ΔT: Allowable temperature rise(°C)
Remarks: 1KW=860Kcal/hr

2 Consideration of fan selection

Necessary ventilation Q shall be calculated in the way above mentioned. Fan shall be chosen considering the following matters.

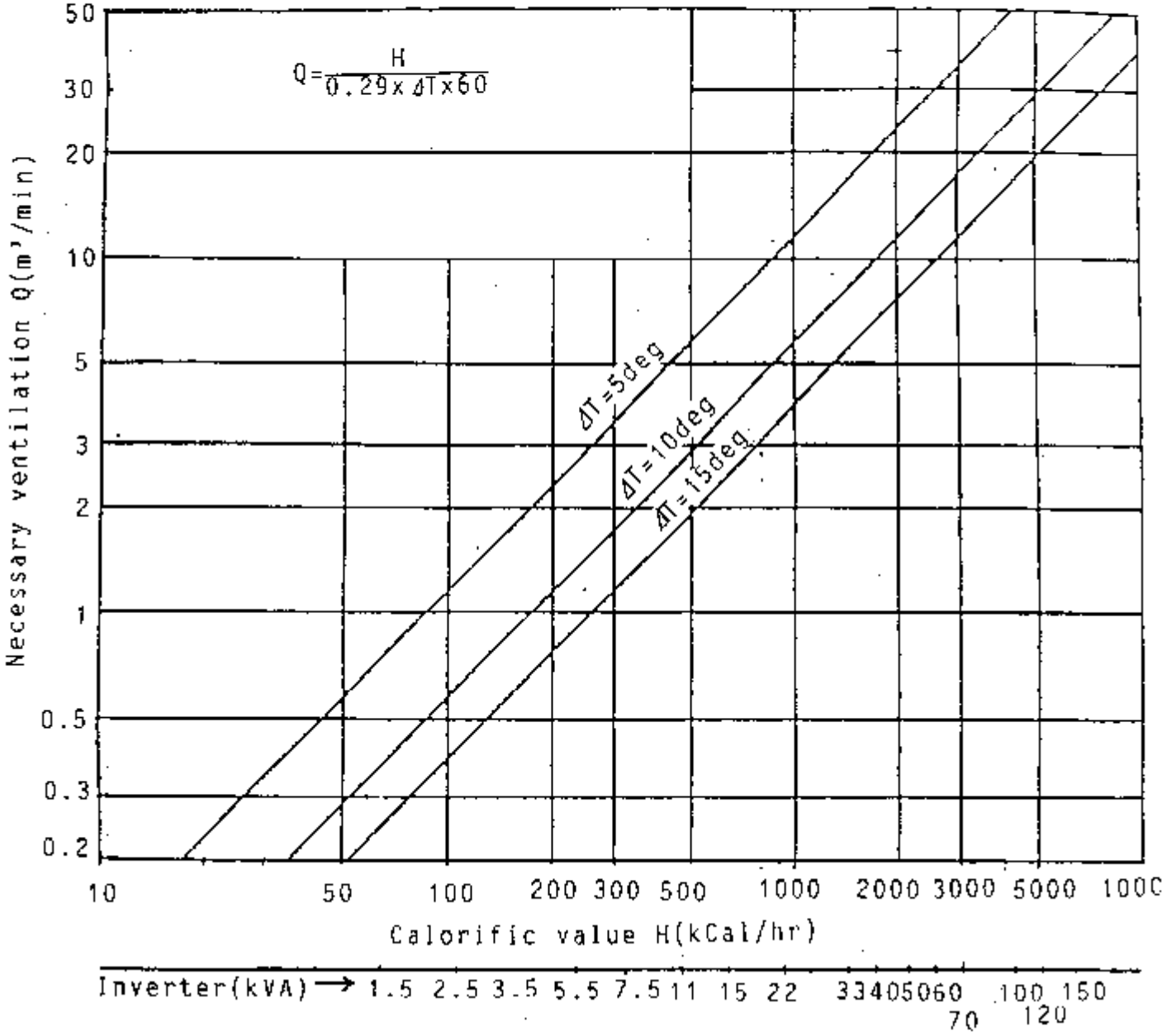
(1.) In case of mounting the filter at the ventilating entrance, operating point QA shall be calculated according to Q-H curve of the fan.



Wind value-Static pressure characteristic

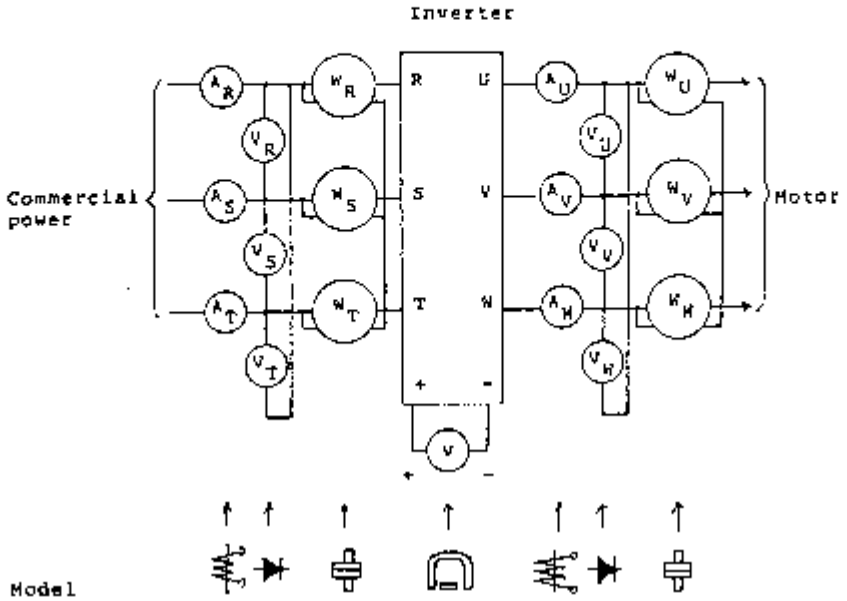
(2.) In case of bad ventilation because of fully mounting in the box, it is also the same as the mentioned above.

The relation between calorific value and necessary ventilation



6.5 HOW TO MEASURE THE VOLTAGE, CURRENT AND POWER

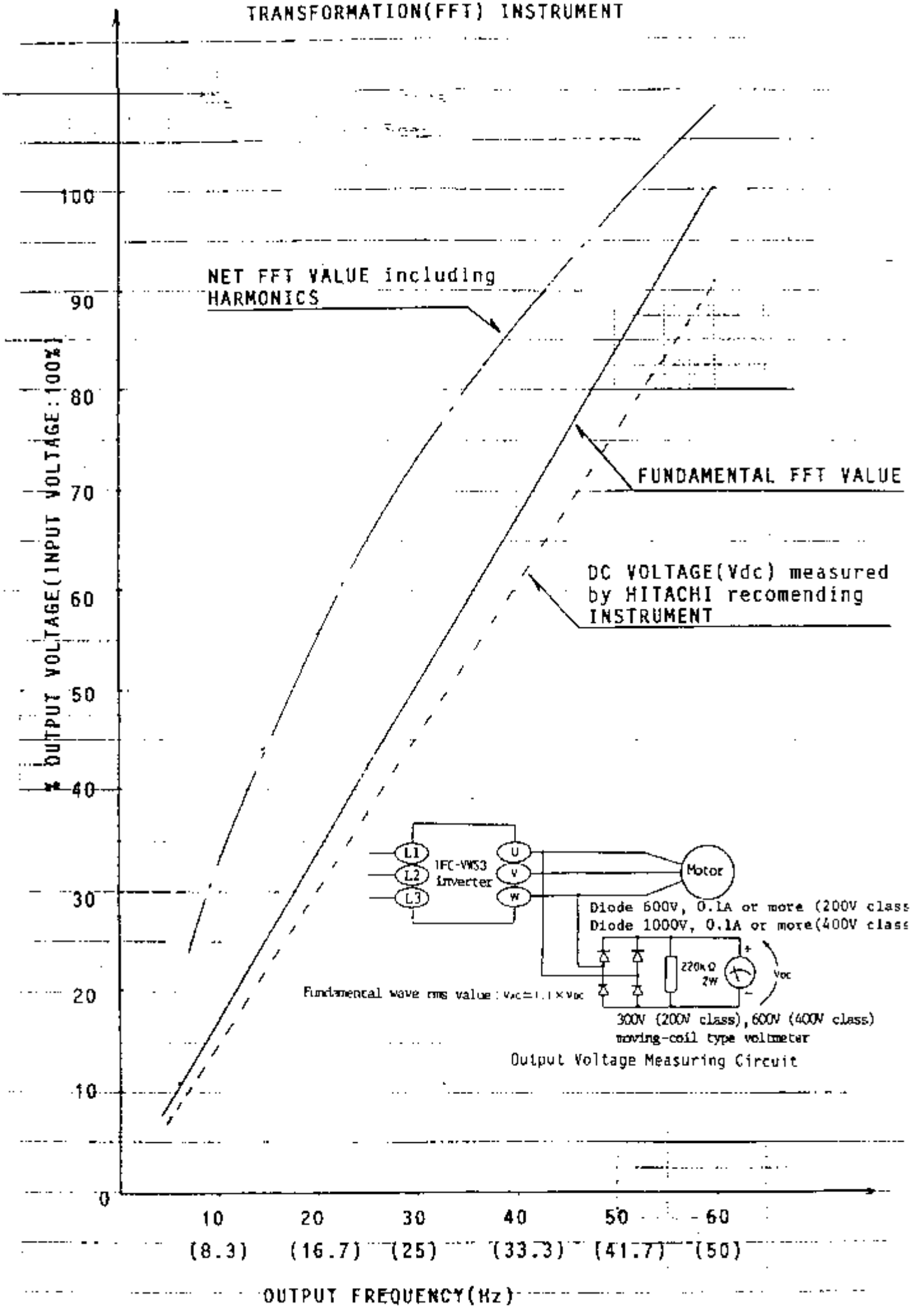
MEASURING INSTRUMENTS AND MEASURING POINTS



Model

Measuring items	Measuring points	Measuring instruments	Remarks (Measuring value)
Input voltage V1	Between R-S, S-T, T-R	Moving iron-type or Rectifier-type	Commercial power 50Hz 180-230V 60Hz 180-230V
Input current I1	R, S, T (Line current)	Moving iron-type	
Input power P1	R, S, T or R-S, S-T, T-R	Electro-dynamic-type	$P1=W_R+W_V+W_T$ (Use 3 same type units)
Input power factor P_{f1}	Calculate according to the following formula. $P_{f1}=\frac{P1}{\sqrt{3}\,V1\cdot I1}\times 100\ (\%)$		
Output voltage V2	Between U-V, V-W W-U	Rectifier-type (Not moving iron-iron-type)	
Output current I2	U, V, W	Moving iron-type	
Output power P2	U, V, W U-V, V-W; W-U	Electro-dynamic-type	$P1=W_U+W_V+W_W$ (Use 3 same type units)
Output power factor P_{f2}	Calculate as well as input power factor. $P_{f2}=\frac{P2}{\sqrt{3}V1\cdot I1}\times 100\ (\%)$		
Converter output V_{CB}	Between ⊕ and ⊖	Moving iron-type (Tester is O.K.)	

OUTPUT_VOLTAGE CALUCULATED BY FAST FOURIER TRANSFORMATION(FFT) INSTRUMENT



(1) Output voltage

When you measure the fundamental harmonic effective value of output voltage,you can use a rectifier type voltmeter. There are many type voltmeters such as moving-iron type and thermoelectric type. The rectifier type voltmeter indicates the nearest value of the fundamental harmonic effective value.

Fig. shows the measurement characteristics of output voltage of PWM inverter by using each instrument and Fig. shows those of PAM inverter. The indication of the rectifier type shows a good lineality against the operating frequency and an approximate value of the fundamental harmonic effective value (FFT).

You can get more approximate value of it by using a rectifier type voltmeter with connecting a filter to output terminals like Fig. when you measure the output voltage of PWM inverter which generates reverse voltage between output terminals eachtime PWM switches.

Fig, Measurement characteristics of output voltage of PWM inverter by using each instrument

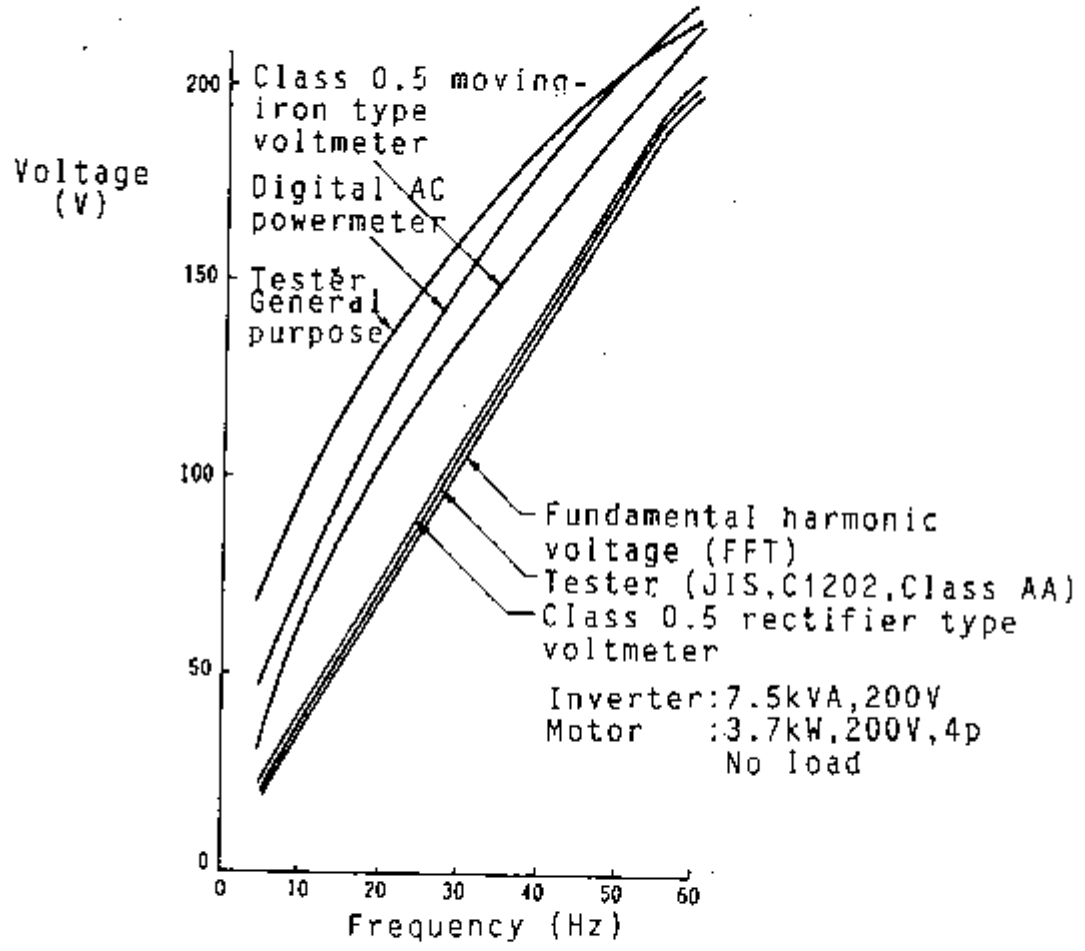


Fig. Measurement characteristics of output voltage of PAM inverter by using each instrument

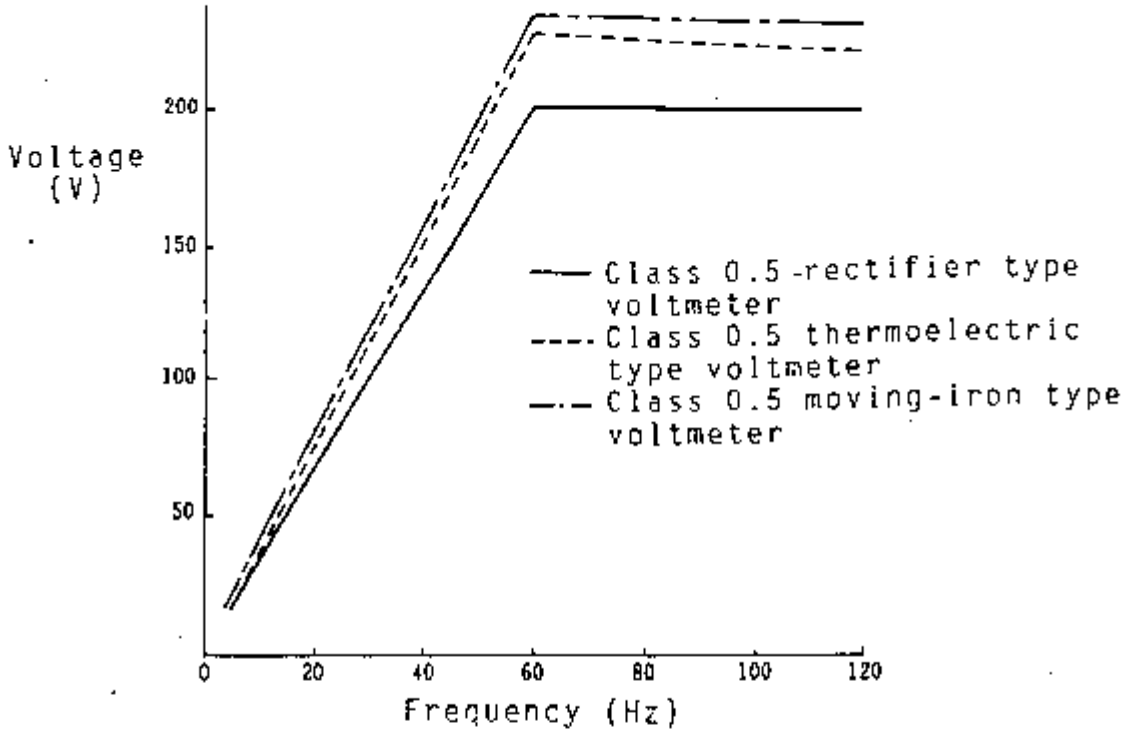
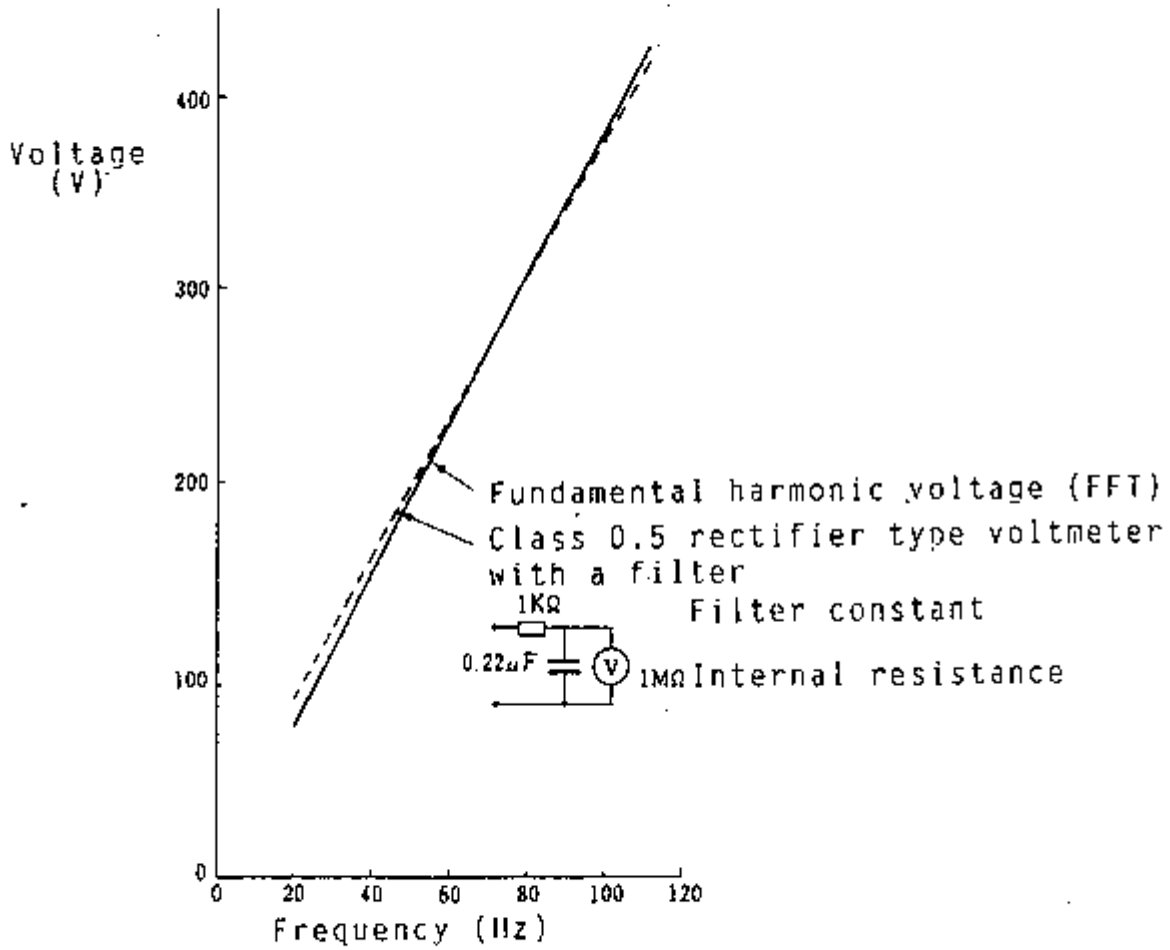


Fig. Measurement characteristics by using a rectifier type voltmeter with a filter



(2) Output current

When you measure the output current,you can use a moving-iron amperemeter because of necessity for the measurement of total effective current.

In case of the measurement of the effective current a thermoelectric type amperemeter is also available,but in many cases a moving-iron amperemeter is used due to ease to treat. Fig. shows the comparison betwen measurement characteristics of the thermoelectric type amperemeter with resistance load and that of the moving-iron type amperemeter (There is a little difference between the fundamental harmonic current and total effective current in case of an actual motor load.)

It is necessary to check the capacity of the current transformer when you use it because some current transformer saturate themselves in low frequency.

Fig. shows the saturation curves of current transformers in low frequency.

Fig. Measurement characteristics of output current by using each instrument

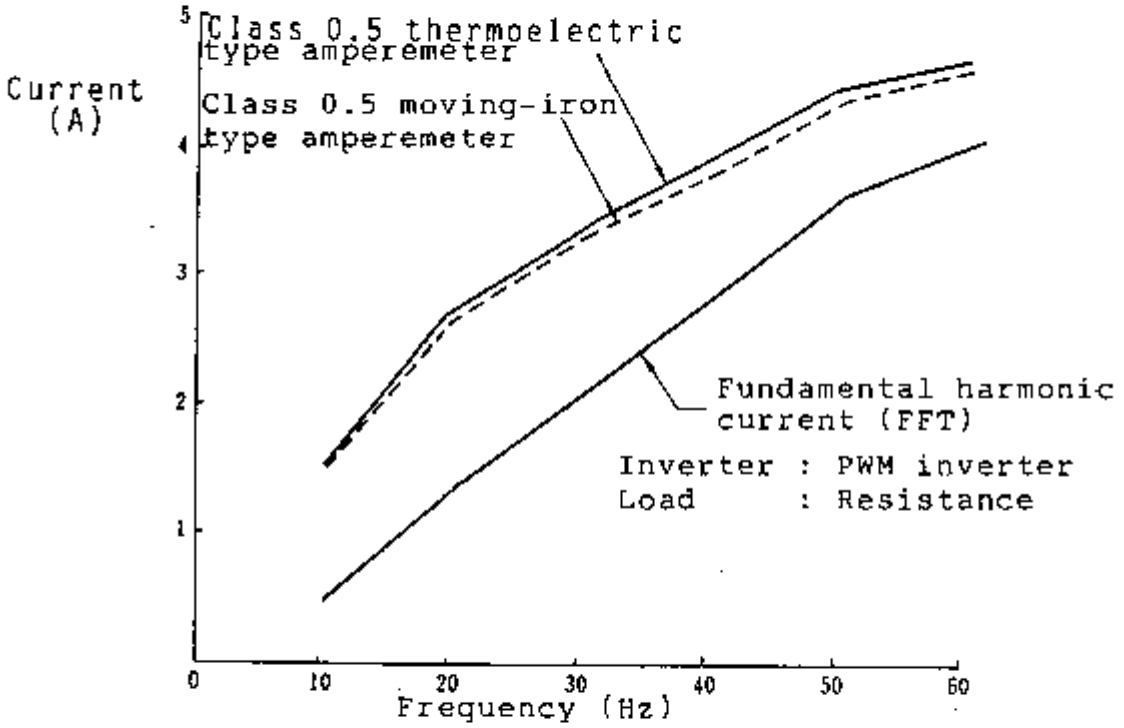
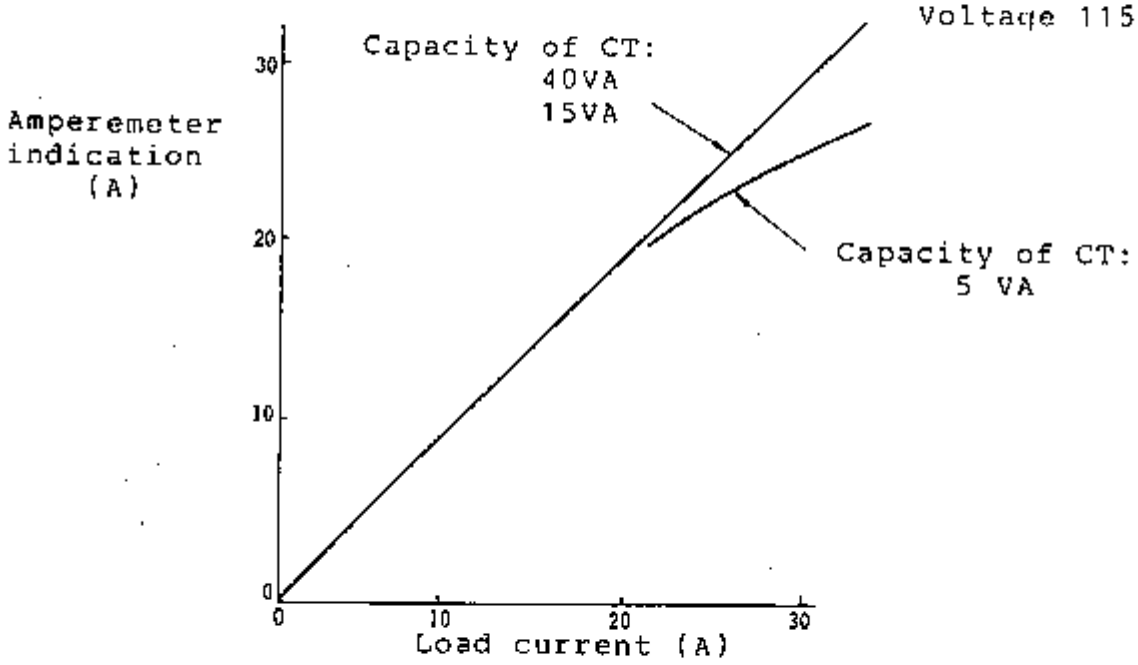


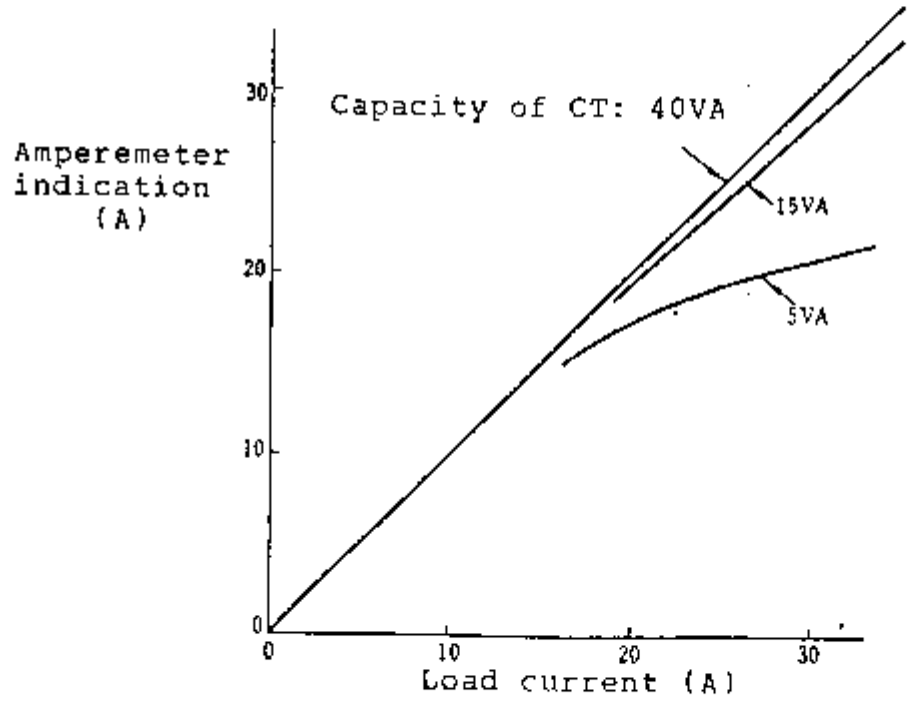
Fig Saturation curves of current transformers

Inverter
Current transformer : 50/5A Through type
Error class 1.0
Over current rating
more than 3
Voltage 1150V

(a) Inverter frequency
at 7.5Hz



(b) Inverter frequency
at 5Hz



(3) Output power

The double wattmeters method and the triple wattmeters method are available for the measurement of the output power, and the double wattmeters method is often used because of ease to treat.

It is desirable to use the triple wattmeters method when the imbalance of the phase current is remarkable like the measurement of the input power.

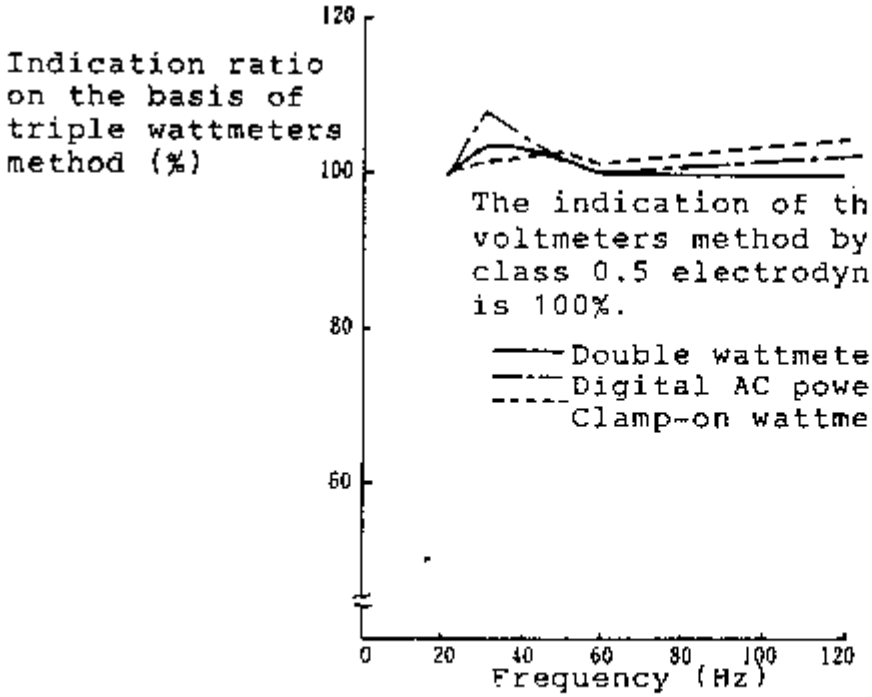
There are two types of wattmeters such as the thermoelectric type and electrodynamometer type is useful because of the accuracy and the ease to obtain it.

Fig. shows the comparison of the indication ratio between the double wattmeters method and other wattmeters on the basis of the triple wattmeters method.

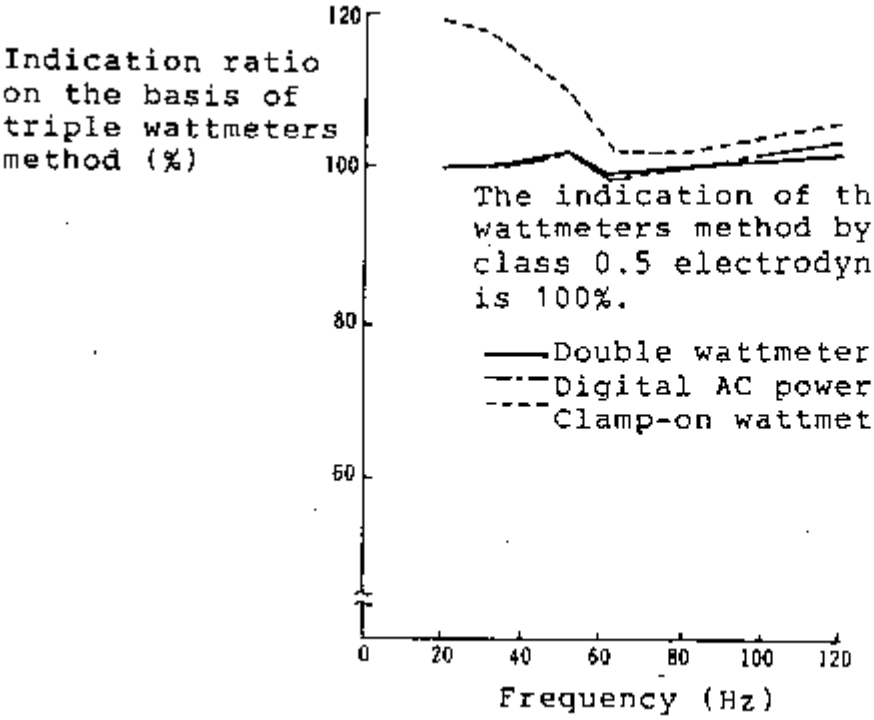
Fig Measurement characteristics by using each wattmeter

(a) PAM inverter

Inveter: PAM, PWM 5kVA 200V
Motor : 3.7kW 200V 4poles



(b) PWM inverter



NOTE : Both (a) and (b) show the indication ratio as the indication of the triple wattmeters method is 100% while the torque is constant from 0Hz to 60Hz and the power is constant for more than 60Hz.

(4) Power factor of inverter

It is impossible to measure the power factor of the inverter by a powe factor meter because the output frequency changes.

NOTE: It is possible to calculate the power factor through the output voltage,the output current and the output power. But there is difference between the power factor as is usually expressed and that which is obtained by calculation because of the difference of the measurement of higher harmonics. So the power factor of the inverter isn't ordinarily measured.

(5) Measured efficiency of inverter

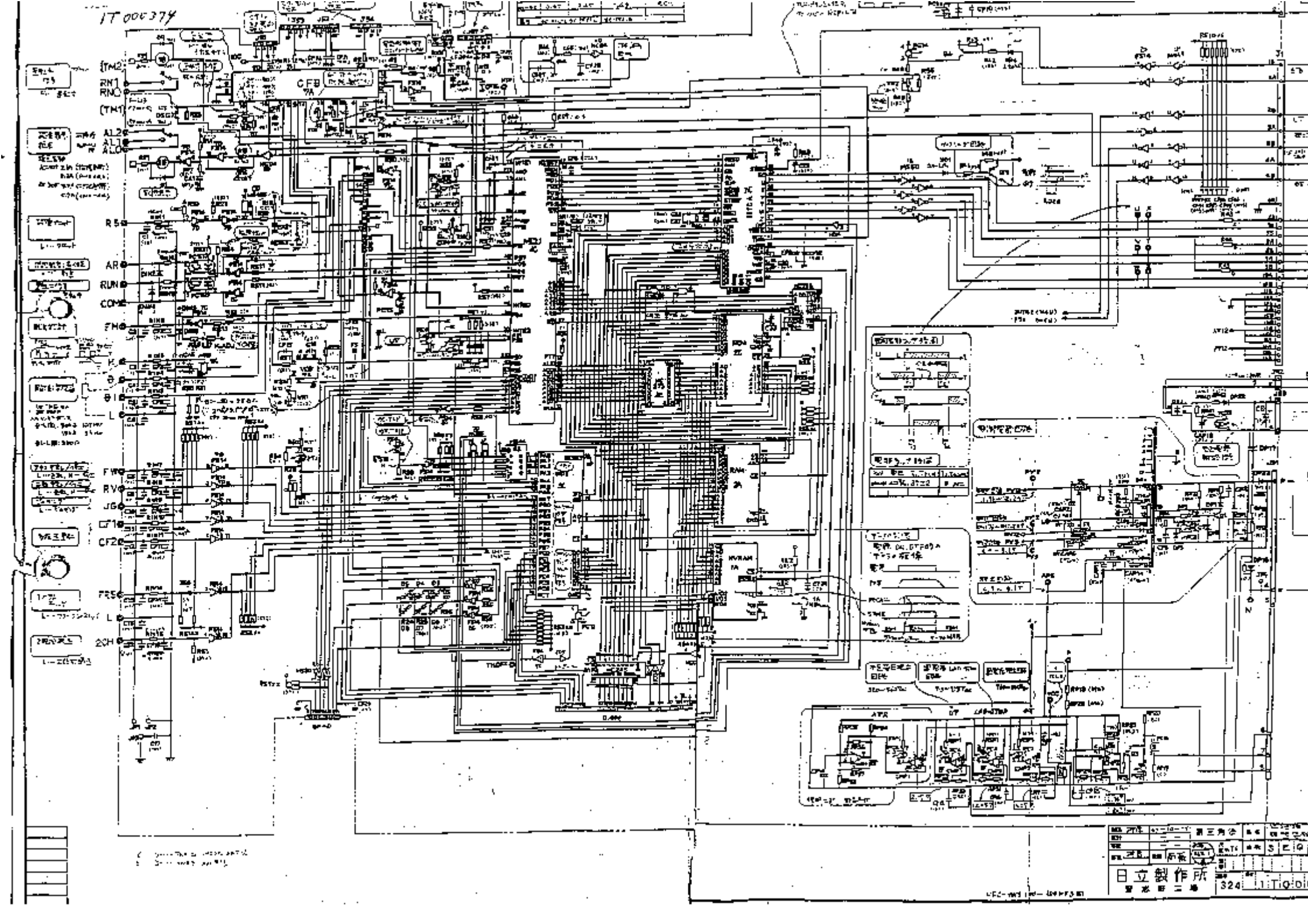
The measured efficiency of the inverter is defined as the ratio of the output active power and the input active power of the inverter.

$$\text{Measured efficiency (\%)} = \frac{\text{Output active power}}{\text{Input active power}} \times 100\ (\%)$$

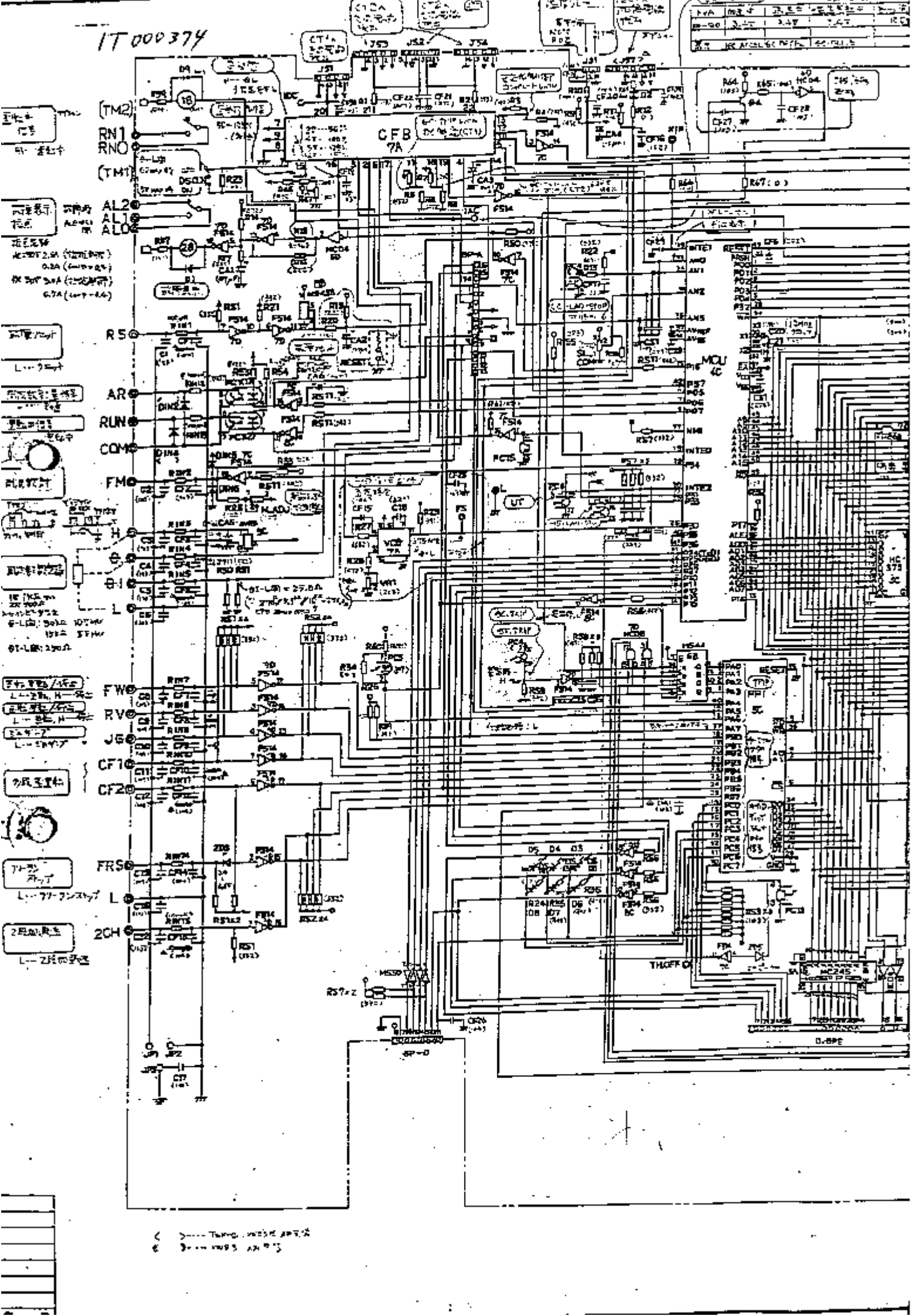
(6) Output frequency

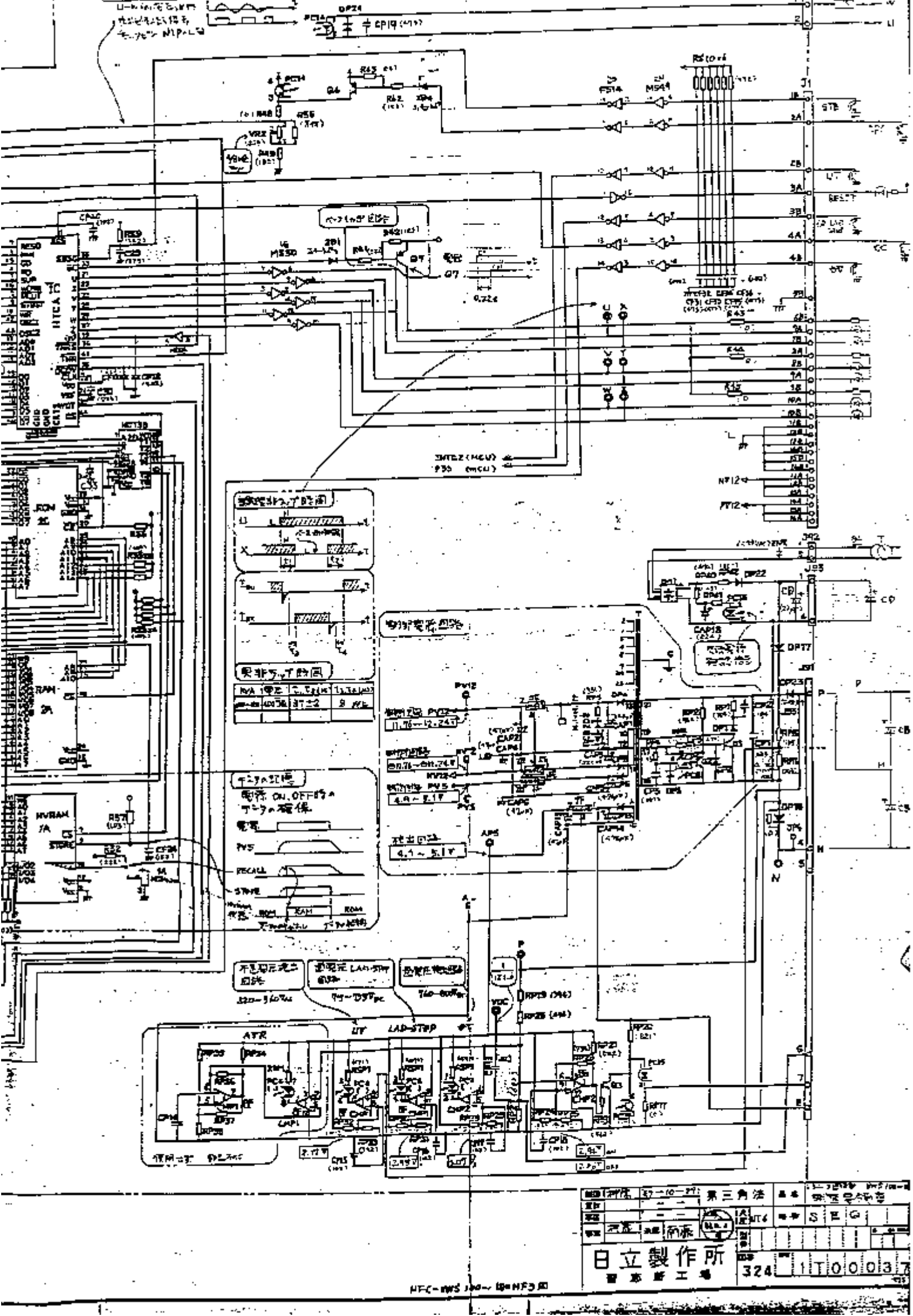
In many cases the output frequency of the inverter is output from the inverter as the analogeue voltage or the pulse signal of frequency control. So the output frequency is not measured directly by the output voltage but measured by the frequency control signal.

The pulse signal is measured by a counter. The ratio of the pulse signal and the output frequency is different among the manufacture. When you measure it,it is necessary to ask the manufacturter.


IT 006374
(TM2)
RN1
RN0
(TM1)
AL2
AL1
AL0
R50
AR
RUN
COM
FH0
K
B
B1
L
FWD
RVS
JG
CF1
CF2
FRS
L
2CH
CFB
RAM
NVRAM
ATR
DT
日立製作所
324

IT000374


(TM2)
RN1
RNO
(TM1)
AL2
AL1
AL0
R5
AR
RUN
COM
FM
H
E
B-1
L
FW
RV
JG
CF1
CF2
FRS
L
2CH
CFB
7A
MCU
4C
UT
THOFF



日立製作所		第三角法			
習志野工場					
324	1T0003				

END OF PAGE