INDUSTRIAL USE THYRISTOR CONVERTER UNIT

Varispeed-505 Z3 Drive

INSTRUCTIONS

MODEL CDMR-Z3□□□□

YASKAWA

NS505-01T0E1

When properly installed, operated and maintained, this equipment will provide a lifetime of optimum operation. It is mandatory that the person who operates, inspects, and maintains this equipment thoroughly read and understand this manual.

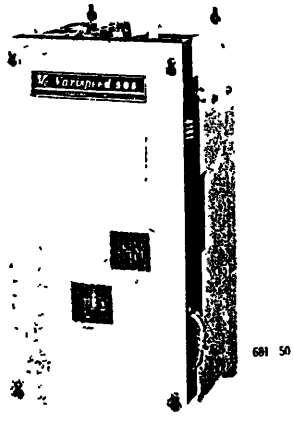
IMPORTANT

- Make no withstand voltage test on the VS-505Z3 because it incorporates semi-conductor electronic circuits.
- If megger tests are necessary, make them only in accordance with the instructions given in this manual.
- Do not tamper with potentiometers of the power units since they were pre-set at the factory before shipment.

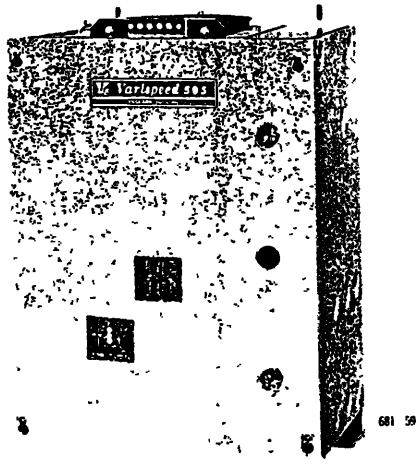
Varispeed-505Z3 (VS-505Z3) is a thyristor converter unit for varispeed non-reversing operation of industrial DC motors.

For correct operation of VS-505Z3, users must throughly read these instructions. This manual is also necessary for maintenance and troubleshooting, and therefore should be kept field for ready reference.

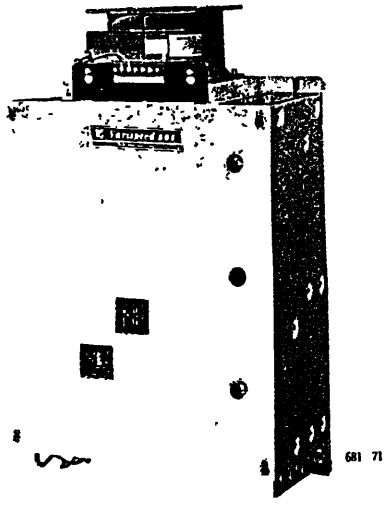
For details on DC motors, refer to "Instructions for Industrial DC Motors" (TOE-C435-3).



Type CDMR-Z32105
(Type S)
230V, 105A



Type CDMR-Z32260
(Type M)
230V, 260A



Type CDMR-Z32550
(Type L)
230V, 550A

CONTENTS

RECEIVING

The equipment has been put through severe tests at the factory before shipped. After unpacking, however, check and see the following.

- Its nameplate data meets your requirements.
- It has sustained no damage while in transit.
- Fastening bolts and screws are not loosened.
- Devices built in the cabinet are not damaged or missing.

STORAGE

If the equipment is temporarily stored or machine stops for an extended length of time, the following precautions should be taken.

LOCATION

Store the equipment under the following conditions.

- Free from rainfall and drops of water
- Clean and dry
- Free from corrosive gas and liquid
- Ambient temperature: -10°C to 40°C
- Less vibration

INSTALLATION

Select a location described in STORAGE and install the equipment by proper procedure in keeping the equipment in good working condition.

WIRING

Make connections in reference to the interconnection diagram furnished on your order and the following.

COMPONENT ARRANGEMENT IN VS-505Z3

Figs. 2 to 4 show component arrangement in the VS-505Z3

TERMINAL SIZES AND CARRYING CURRENTS

Table 1 shows the size and the current carrying capacities of the terminals of VS-505Z3. Select leads with sufficient current carrying capacity. Refer to Cautions when Wiring.

Table 1 Terminal Size and Current Capacity

CIMR-Z3 □□□		AC Main Circuit		AC Main Circuit		Field Circuit		Ground
Rated Voltage (V)	Rated Output (kw)	Terminal Size	Carrying Current (A)	Terminal Size	Carrying Current (A)	Terminal Size	Carrying Current (A)	Terminal Size
230	25	M 6	21	M 5	25	M 4	12	M 6
	35	M 6	29	M 8	35			
	45	M 6	37	M 8	45			
	90	M 8	74	M 8	90			
	105	M 8	86	M 8	105			
	180	M10	147	M10	180	M 4	22	M 4
	260	M10	213	M10	260			
	420	M12	343	M12	420	M 4	25	
	550	M12	449	M12	550			
460	50	M 8	41	M 8	50	M 4	12	M 6
	90	M 8	74	M 8	90			
	105	M 8	86	M 8	105			
	180	M10	147	M10	180	M 4	22	M 4
	260	M10	213	M10	260			
	420	M12	343	M12	420	M 4	25	
	550	M12	449	M12	550			

Note
1. Terminal size other than listed above is M3.5 and current capacity is 2A or below
2. Rule of thumb of AC main circuit power capacity $12 \times \sqrt{3} \times E \times I$ (VA)
   E: Supply voltage
   I AC main circuit current

INTERCONNECTIONS

Make connections of VS-505Z3 with associate units according to the interconnection diagram separately furnished.

CAUTIONS WHEN WIRING

Main Circuits

Use 600 V PVC insulated wires or cabtyre cables with the current carrying capacities of the combined DC motor for AC main circuit terminals (U, V, W) and DC main circuit terminals (P, N).

Field Circuits

Use 600 V PVC insulated wires or cabtyre cables with the current carrying capacities of the combined DC motor for field power circuit terminals (U_0, W_0, U_1, W_1) and field circuit terminals (J, K). Use stranded wires of cross-section 5.5 mm² or larger for field circuit terminals (J, K).

Signal Circuits

Use shielded wires or twisted wires of twisting pitches 20 mm or smaller for the speed setting circuit terminals (11 to 16), speed feedback terminals (3 to 5), tachometer circuit terminals (38 to 40).

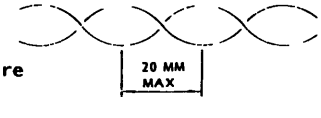


Fig. 1 Pitch of Twisted Wire

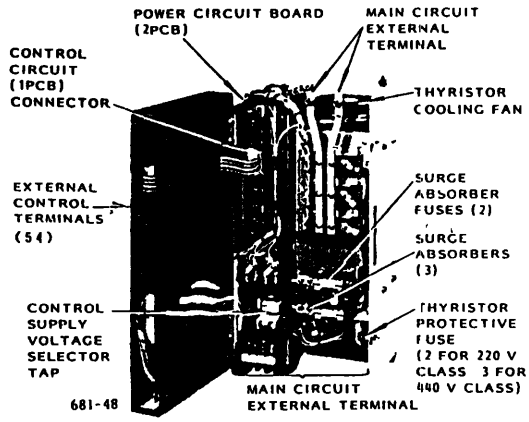


Fig. 2 Type CDMR-Z32105,-S (230V, 105A)

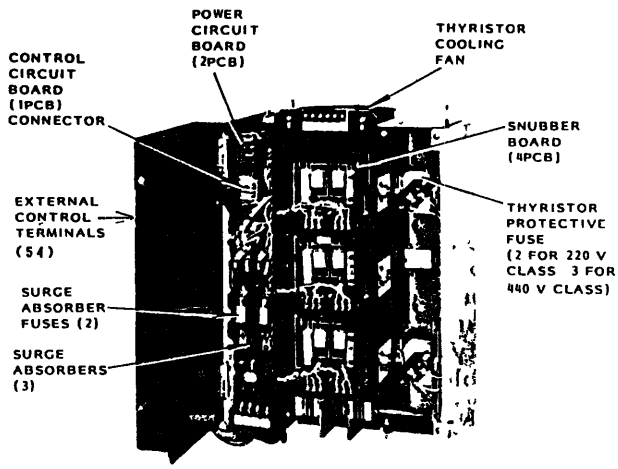


Fig. 3 Type CDMR-Z 32260,-M (230V, 260A)

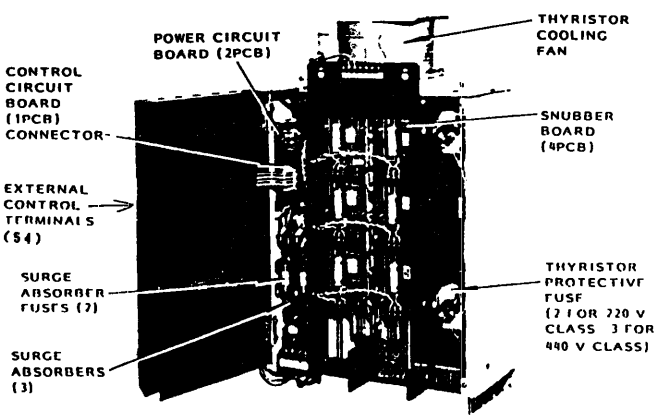


Fig. 4 Type CDMR-Z 32550 ,-L (230V, 550A)

WIRING (Cont'd)

Separation of Signal Cables from Main Circuit Cables

To avoid inductive interference from other cables, run the shielded or twisted wires (1 to 53) separate from main circuit cables (U, V, W: U_0, W_0; U_1, W_1; P, N; J, K) in a bundle or thru a duct.

CAUTION

After wiring, check interconnections. Make insulation resistance tests using a 500V megger. Connect VS-505Z3 main circuit terminals (U, V, W; U_0, W_0; U_1, W_1; P, N; J, K) with common lead. Measure the insulation resistance between common lead and the ground. When the test result is 2 MΩ or more, it means that wiring is successful.

TEST RUN

When the VS-505Z3 has been correctly installed and wired, the unit shall be tested through a test run as follows.

If trouble is found during the test run, refer to "Check Before Test Run" and "Troubleshooting Guide" for necessary measures. If the cause of the trouble cannot be located, or repair is impossible, notify our service station, giving the details of trouble conditions.

CHECK BEFORE TEST RUN

Make the following checks prior to the test run.

Table 2 Check before Test Run

Check Points	Check Items
Interconnections between VS-505Z3 and Associate Units	· Correct wiring. · Tightening of terminal screws
DC Motor	· Disconnection from the driven machine. · Removal of thrust block. · Remove inspection covers and blow out with air to clean commutator. (Fig. 5)
VS-505Z3	· Adhesion of dirt or dust on the enclosure. · Smooth hand rotation of thyristor cooling fan.* · **Correct adjustment of control board. (Table. 7)** · Correct connection of the shunt connector to the voltage selecting tap. (Fig. 6) · Corrent setting of the frequency selector switch. (Fig. 7) · Correct adjustment of potentiometers on the control board (1PCB) Refer to red paint.
Supply Voltage at Input Terminals of VS-505Z3	Voltages of any two of phases U, V, W are within the values on Table 3. Check with a tester. · Terminals (U0) and (U1) and (W0) and (W1) are connected. Rotating direction of the motor blower meets with the arrow marked on the blower.

*VS-505Z3 of larger capacity than 230V, 45A or 460V, 90A are provided with a thyristor cooling fan.

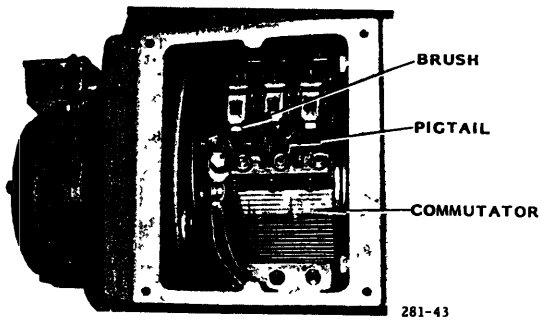
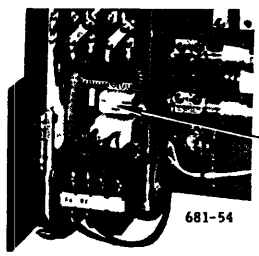
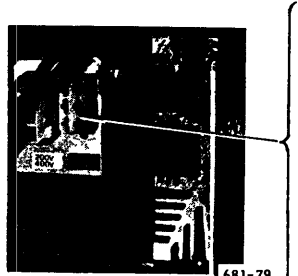


Fig. 5 Inspection Window of DC Motor



Either 230V or 460V at 105A or below



Either 230V or 460V at 180A or below

When supply voltage is 200 or 400 V, plug the housing in the upper tap.

200V 400V

220V 440V

When supply voltage is 220 or 440 V, plug the housing in the lower tap

200V 400V

220V 440V

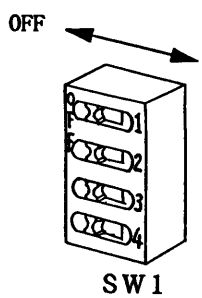
When supply voltage is 200 or 400 V, plug the housing in the left tap

200V 400V 220V 440V

When supply voltage is 220 or 440 V, plug the housing in the right tap

200V 400V 220V 440V

Fig. 6 Tap Selection of Control Supply Voltage



SW1

No.	50Hz	60Hz
1	ON	OFF
2	ON	OFF
3	OFF	ON
4	ON	OFF

Set SW1 as stated above.

Fig. 7 Selection of Supply Frequency

Table 3 Supply Voltage Allowable Range

Nominal Supply Voltage	Supply Frequency	Permissible Voltage Variation	Voltage Selectoer Tap
220 V	50/60 Hz	170 - 220 V	200 V
220 V	50/60 Hz	187 - 242 V	220 V
400 V	50/60 Hz	340 - 440 V	400 V
440 V	50/60 Hz	374 - 484 V	440 V

NO-LOAD OPERATION

After making the checks specified before test run, thoroughly check the environment to the system for safety.

Check the polarity of DC tachometer generator feedback voltage. When the motor is running forward, the polarity of VS-505Z3 signal terminal 3 (4: 0V) is minus and it is plus during reverse running of the motor.

Then, run the motor without load according to Table 4.

Before starting full-load operation, stop the power supply, couple the DC motor to the driven machine, and check the motor and the driven machine for safe and obstruction-free conditions. Table 5 gives full-load operation procedure.

Table 5 Full-load Operation

Order	Operation
1	Set the speed at zero
2	Turn on the main circuit power supply.
3	Turn on operation signal and gradually increase the speed. Check to be sure that the motor and driven machine are correctly running.
4	Turn off the operation signal.
5	Turn off main circuit power supply.

Table 4 No-load Operation

Order	Operation	Check Items
1	Set the speed reference at zero.	-
2	Turn on main circuit power supply.	Smooth rotation of the thyristor cooling fan * Smooth rotation of the blower for DC motor. Rotating direction of the blower meets with the marking on the blower.
3	Make an operational sequence and check to be sure that operation is ready. (Turn on ready signal, motor cooling fan ON/OFF signal.)	-
4	Turn-on the operation signal.	-
5	Gradually, increase the speed setting value.	Smooth acceleration of DC motor. No abnormal odor, smoke, vibration and noise on DC motor.
6	Remove the hand-hole cover and check the commutator.	No brush chattering and sparking at the brushes
	To avoid excessive temperature rise of DC motor winding in frame 112, 132, reclose the window within 5 minutes.	
7	Gradually, turn the speed setting potentiometer clockwise.	Smooth acceleration of DC motor.
8	Increase the speed setting value to the maximum.	DC motor rotates at the maximum speed. Check with a speedometer.
9	Change the speed to various values.	Turning speed setting potentiometer rapidly during acceleration or deceleration changes motor speed smoothly.
10	Turn off the operation signal.	DC motor stops. (It stops suddenly by VS-505Z3 with a dynamic braking function.)
11	Turn off the main circuit power supply.	-

*VS-505Z3, rated 230V, 45A and above and 460V, 90A and above are provided with a thyristor cooling fan.

TEST RUN (Cont'd)

ADJUSTMENT

Do not tamper unnecessarily with the potentiometers on the control circuit board since they have been adjusted at the factory before shipped.

Adjuster Locations and Functions

Adjuster locations on the control circuit board and functions are shown in Fig. 8 and Table 7. The characteristics of control circuit board check terminals are shown in Fig. 9 and Table 6.

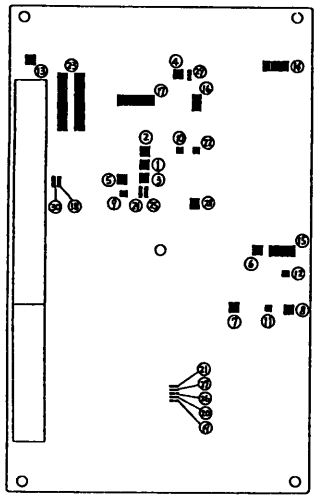


Fig. 8 Adjuster Locations on Control Circuit Board

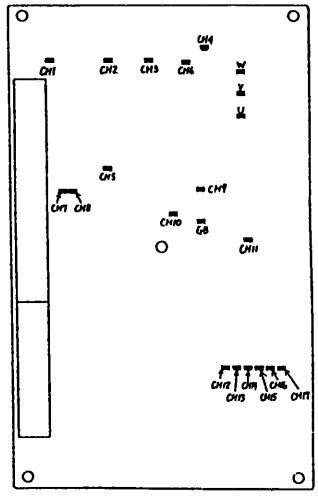


Fig. 9 Control Circuit Board Check Terminals

Table 6 Control Circuit Board Check Terminals

	Signal Names	Check Terminals	Normal Values	
Main circuit power	Phase shifter input	CH4	Approx +5 5 V at 60 Hz, approx +6 5 V at 50 Hz when gate blocked	+1 to +5 5 V at 60 Hz, +1 to +6 5 V at 50 Hz when controlling
	Current limit	CH5	+3 V/100% current limit	
	Speed feedback	CH6	-6 V/100% speed	
	Current command	CH7	-3 V/100% command	
	Speed command	CH8	+6 V/100% command	
	Gate block	CH9	(Gateblock by OCL) 0 V normal, -24 V at gateblock	
		GB	0 V normal, +12 V at gateblock	
	Current controller output	CH10	Approx -1 V at gateblock	0 to +6 V when controlling
	Current feedback	CH11	+3 V/100% current	
	Stable power supply	CH12	0 V (SG)	
		CH13	+15 V	
		CH14	-15 V	
		CH18	+ 5 V	
	Unstable power supply	CH15	+24 V	Allowable variation range ±20%
		CH16	-24 V	
		CH17	+24 V (pulse amplifier power supply)	
Field power	Current command	CH1	Voltage value according to field current	Ex: -6 V/5 A
	Current feedback	CH2		Ex: +3 V/5 A
	Phase shifter input	CH3	Approx +5 V at 60 Hz, approx +6 V at 50 Hz when field blocked	+1 to +5 V at 60 Hz, +1 to +6 V at 50 Hz when controlling

Table 7 Control Circuit Board Adjuster Locations and Functions

Type of Adjusters	Adjuster Location	Adjuster Names	Adjuster Functions	Adjusting Method		Specifications
Potentiometers	1	ACCEL	Acceleration time adjustment	Clockwise rotation increases acceleration time		3 - 75 sec
	2	DECEL	Deceleration time adjustment	Clockwise rotation increases deceleration time		3 - 75 sec
	3	GAIN	ASR Gain adjustment	Clockwise rotation increases gain		—
	4	NMAX	Speed feedback adjustment	Clockwise rotation decreases speed		-6/100% speed
	5	LIMIT	Current limitation	Clockwise rotation increases limit value		0 - 250%
			Speed limitation			0 - 125%
	6	IFB	Main circuit current feedback adjustment	Clockwise rotation decreases current		+3V/100% current
	7	SM	Speedometer adjustment	Clockwise rotation increases pointer swing.		1 mADC max
	8	AM	Ammeter adjustment	Clockwise rotation decreases pointer swing.		1 mADC max
	9	BIAS	ASR offset adjustment	⊖ voltage ⊕ voltage		—
	10	KIPP	Phase shift lag limit adjustment	Clockwise rotation advances shift lag		155°el (Standard)
	11	OL%	Setting overload detection start point	Clockwise rotation increases overload detection start point		110% (Standard)
	12	OLT	Setting overload	Clockwise rotation increases operation time		150%, 60 sec (Standard)
	13	I REF	Setting field current	Clockwise rotation increases the current		—
	22	PSB	Phase shifter operating point adjustment	Clockwise rotation advances phase		Adjustable between 90 and 160°el
Potentiometers selection (Open)	14	1FBR-4FBR	Rough adjustment of field current detection voltage level	Open the resistor according to specifications		Refer to motor specifications
	15	5FBR-9FBR	Routh adjustment of main circuit detection voltage level			
Slide switch	16	1SW	Supply frequency selector	Refer to Fig.7.		—
Plug selection	23	ACTG/DCTG	Selection of ACTG and DCTG according to Type of TG.	For AC tach-gen, select ACTG, and for DC tach-gen, select DCTG.		—
	17	A - D	Rough adjustment of speed detection voltage level	Selection of the voltage level according to type of tach-gen and motor rated speed.		—
	18	E	Selection of soft start operation	E_1	—	—
				E_2	Soft start	—
	24	F	Selection of BIAS	F_1	ASR BIAS Adjustment	—
				F_2	ACR BIAS Adjustment	—
	25	H	Selection of LIMIT	H_1	Current limitation	—
				H_2	Speed limitation	—
	19	J	Selection of start interlock zero-speed condition	J_1	Possible	—
				J_2	—	—
	20	K	Selection of motor stopping method	K_1	Gate block at zero speed when decelerating to stop.	—
				K_2	Gate block at stop command	—
	26	L	Selection of use of exciter according to motor field	L_1	Exciter used	—
				L_2	Exciter not used	—
	27	M	Selection of field block due to motor overheat	M_1	Field blocked	—
				M_2	Field not blocked	—
	21	N	Selection of zero-speed condition at motor cooling fan stopping	N_1	Field half-reduced after motor zero-speeds by stop operation	—
				N_2	Field half-reduced (Gate block)	—
	28	P	Selection of PI and P of ACR control	P_1	PI control	—
				P_2	P control	—
Short-circuit jumper	29	OPN	—	Open	Speed control by voltage detection. Speed control by AC tach-gen	—
				Short	Except for the above	—
	30	OPS	—	Open	Special application	—
				Short	Except for the above	—

TEST RUN (Cont'd)

Adjustment Procedure

NMAX (Speed feedback adjustment)

To adjust the DC motor speed exactly to the reference speed, proceed as follows.

1. Prepare the tachometer having required accuracy.

2. Operate the DC motor at no load (or less variation).

3. Measure the speed reference voltage with a voltmeter. Correct the voltage to that of desired motor speed.

4. Measure the motor speed with a tachometer.

5. If the speed does not reach the desired speed, turn NMAX counterclockwise to increase the speed.

6. If speed exceeds the desired speed, turn NMAX clockwise to decrease the speed.

LIMIT (Limit value adjustment)

1. Current limitation (Speed control)

Connect the plug-connectors F and H to F1 and H1 on the control circuit board, respectively. When the voltage at CH5 is +3V, 100% current limit value is obtained. Current limit value can be set within the range of 0% to 250% by LIMIT.

2. Speed limitation (Current control)

Connect the plug-connectors F and H to F2 and H2 on the control circuit board, respectively. When the voltage at CH5 is +6V, 100% current limit value is obtained. Current limit value can be set within the range of 0% to 125% by LIMIT.

PSB (Phase shifter operating point adjustment)

PSB sets the phase shifter operating point.

1. When the current controller (ACR) is integral-controlled

Connect the plug selector P on the control circuit board at P1. Turn PSB fully counterclockwise.

2. When the current controller (ACR) is ratio-controlled

Connect the plug selector P on the control board at P2. Turn PSB clockwise gradually with reference current at 0V (0V at CH10), and set at the position where main circuit current is ready to start.

Adjustment of Field Current

The manner of adjusting field current when field current is constant differs from that when field weakening control is made.

Constant Field Current

1. Connect DC ammeter to field circuit.

2. Adjust the potentiometers (1FBR to 4FBR) and IREF on the control circuit board so that ammeter indicates rated field current.

Field Weakening Control

Proceed as follows to adjust field current in combination with field adjuster type JGSM-51-[ ].

1. Connect DC ammeter to field circuit and DC voltmeter to output terminals (P) and (N).

2. Select the potentiometer (from 1FBR to 4FBR) which corresponds to the desired voltage level of field current detection. Remove those potentiometers not being used.

3. Turn the potentiometer IREF on the control board and FORCE FLD and V LIMIT of the field adjuster fully counterclockwise.

4. Set the minimum field weakening current using I REF. Set-value should be 80% field weakening current at maximum speed.

5. Set the rated field current (field intensifying) using FORCE FLD of field adjuster.

6. Increase speed reference gradually after motor starts.

The voltage across terminals (P) and (N) increases as speed rises and reaches the limited value.

Turn V LIMIT clockwise gradually so that the limited value is motor rated voltage (220V or 440V).

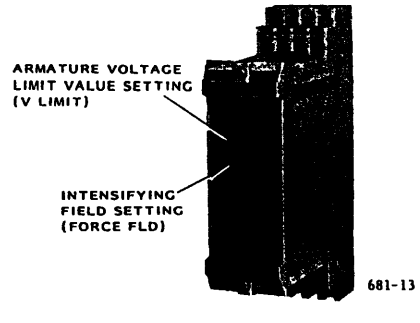


Fig. 10 Field Adjuster Type JGSM-51-[ ]

MAINTENANCE

VS-505Z3 requires almost no daily inspection. To keep the correct and successful operation, periodic maintenance operations should be performed. The users should prepare their own maintenance programs based on the following guidelines.

PERIODIC INSPECTION

Table 8 shows the minimum inspection items and the procedures.

Table 8 Periodic Inspection

Inspection Item	Inspection Item	Inspection Procedure	What to do
Thyristor cooling fan	· Noise Vibration	· Check for any intermittent or unusual noise. · Feel by hand.	Replace Rule of thumb for cooling fan replacement. 15,000 hours of operation
General	Dust or dirt.	Check for dust clogging or dirt adhesion. · Check for loosening of screws or nuts	Clean with an electrical cleaner Tighten

PARTS REPLACEMENT

Field Thyristor

With all the Models, thyristor modules consisting of a thyristor and a diode are used as the field thyristor. Replace them as follows.

The same replacement procedure applies to all the models.

1. Loosen the bus bar screws and the lead clamping screws, and unclamp the leads. In this case, mark all the terminals for identification. (Fig. 11)

2. Loosen the two clamping screws, and remove the thyristor module.

3. Check the replacement thyristor module for type and capacity, and install it by reversing the removal procedure, making connections to the terminals identified by the marks made before removing the old thyristor module.

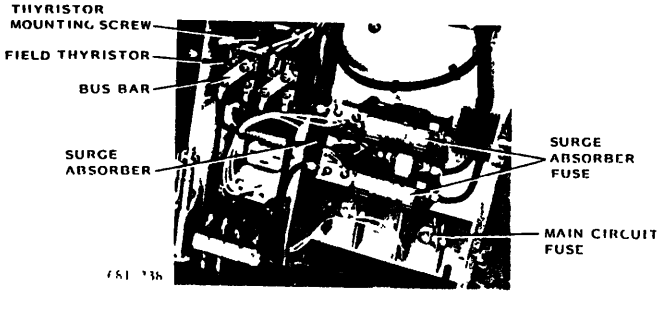


Fig. 11 Field Thyristor (230V, 25A)

Main Circuit Thyristor

230V, 25A System (Fig. 12)

The system uses a thyristor module comprising two thyristors. Replace it as follows.

1. Remove the 6 bus bar clamping screws, and remove the bus bar.

2. Loosen all the thyristor lead screws, and unclamp all the leads. In this case, mark the terminals for identification.

3. Remove the two thyristor clamping screws

4. Check the replacement thyristor module for type and capacity, and reinstall it by reversing the disassembly procedure, identifying the terminals by means of the marks made prior to disassembling

NOTE

When installing the thyristor module, apply thermal compound JOINTAL Z (made by Nippon Light Metal Co., Ltd.) to the thyristor mounting surface (reverse side).

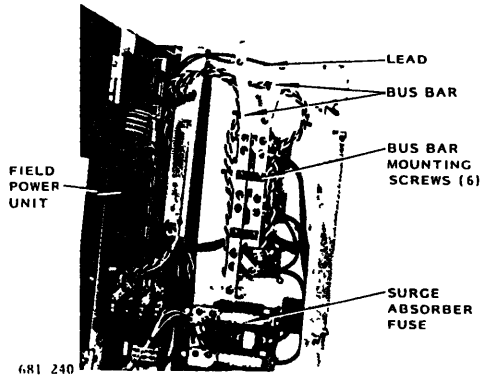


Fig. 12 Main Circuit Thyristor

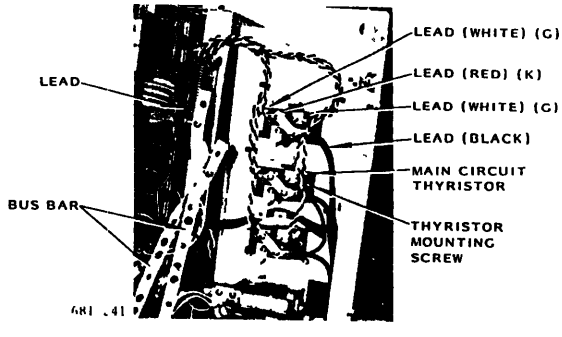


Fig. 13 Bus Bar Removal

MAINTENANCE (Cont'd)

230V, 35 to 105A System, 460V, 50 to 105A System

1. Remove the 6 bus bar mounting screws, and remove the bus bar. The leads connected to the bus bar need not be removed. (Fig. 14)

2. Loosen the thyristor connecting screws, and unclamp the leads. In this case, mark the terminals for identification.

3. Remove the two thyristor clamping screws.

4. Check the replacement thyristor for type and capacity, and reinstall it by reversing the disassembly procedure, identifying the terminals by means of the marks made prior to disassembling.

NOTE

When installing the thyristor, apply thermal compound JOINTAL Z (made by Nippon Light Metal Co., Ltd.) to the thyristor mounting surface (reverse side).

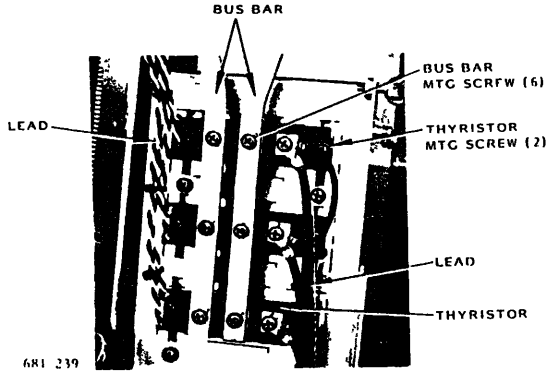


Fig. 14 Main Circuit Thyristor (230V, 105A)

230V, 180 to 550A, 460V, 180 to 550A System

In these systems, flat thyristors are used. The thyristor modules differ in shape depending upon capacity, but their replacement procedure is the same, as given below.

1. Remove the 6 clamping screws for thyristor gate cathode terminal, and free the leads. In this case, mark the terminals for identification. (Fig. 15)

2. Remove the mounting bolts (5 for 260A and below and 7 for 420A and larger systems) for the thyrisotr module, and remove the main circuit thyristor.

3. Place the main circuit thyristor module on a work bench, and loosen the control circuit board mounting screws (Fig. 16) for the thyristor assembly to be replaced, and then, loosen the gate wiring screws.

4. Loosen the fin mounting nuts alternately, turning 1/4 turn at a time. Then, remove the leaf spring.

5. Remove the fin and take out the thyristor.

6. Clean the contact surfaces of the new thyristor and the fin, and thinly coat these surfaces with thermal joint compound JOINTAL Z (made by Nippon Light Metal Co., Ltd.).

7. Align the fin locating pin and the thyristor locating hole, after making sure that the polarity of the thyristor is correct.

8. Keeping the leaf spring and the fin parallel, finger-tighten the clamping nuts. Then, tighten them alternately through 1/4 turn at a time, three times each with a socket wrench. Now, the thyristor fin has been installed.

9. Tighten the control circuit board mounting screws, Then, mount the thyristor module by reversing the disassembling procedure, tightening the screws firmly.

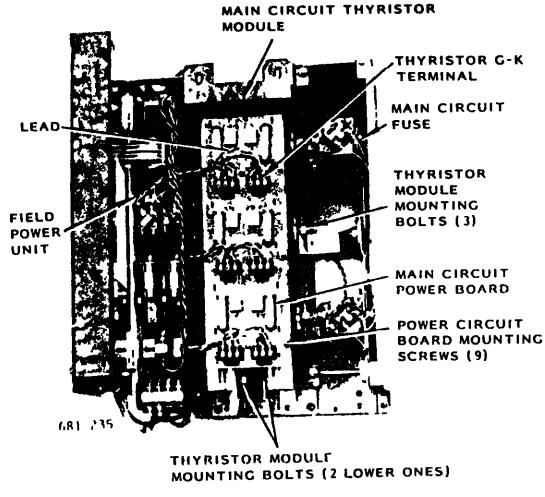
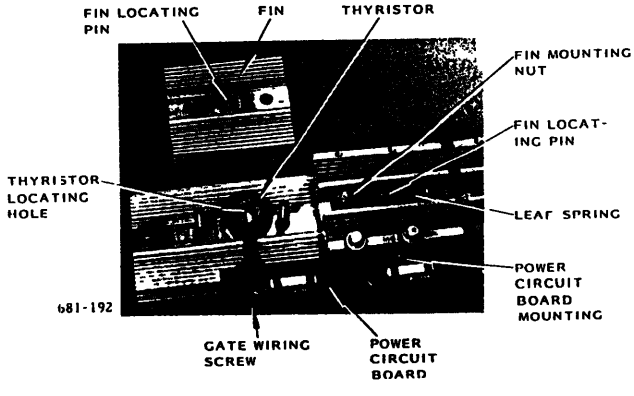
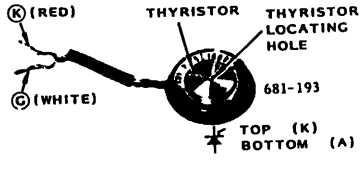


Fig. 15 Main Circuit Thyristor Assembly (230V, 260A System)



(a) With Thyristor Removed



(b) Thyristor

Fig. 16 Thyristor Replacement

Replacement of Main Circuit Fuse

230V, 25 to 105A, 460V, 50 to 105A System

1. Remove the fuse blown indicating microswitch with the leads by pulling upward. (Fig. 17)

2. Remove the two fuse mounting bolts.

3. Mount a replacement fuse by reversing the removing procedure, after checking its model and capacity.

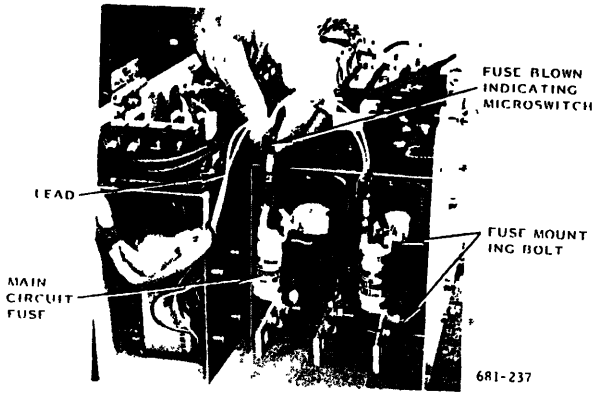


Fig. 17 Main Circuit Fuse (230V, 25A)

230V, 180 to 550A, 460V, 180 to 550A systems (Fig. 15)

1. Loosen the two lead clamping screws, and free the four leads of the fuse-blown indicating microswitch. (Fig. 18)

2. Remove the two fuse mounting bolts, and remove the fuse together with the fuse-blown indicating microswitch.

3. Check the replacement fuse for model and capacity, and install it by reversing the disassembling procedure.

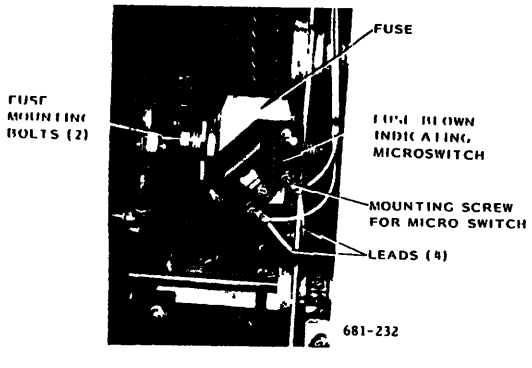


Fig. 18 Main Circuit Fuse Assembly

Surge Absorber Fuse Replacment

1 Pull the fuse element and remove it. (Fig. 19)

2. Mount the replacement fuse, after checking its model and capacity.

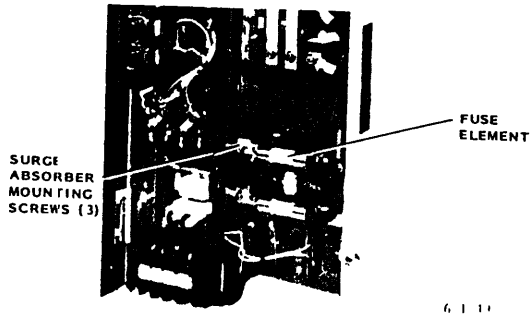


Fig 19 Surge Absorber Fuse

Surge Absorber Replacement

1 Remove three surge absorber mounting screws and remove surge absorber.

2. Check the replacement surge absorber for model and capacity. Mount three surge absorbers after connecting M4 pressure terminals to their leads as shown in Fig. 20.

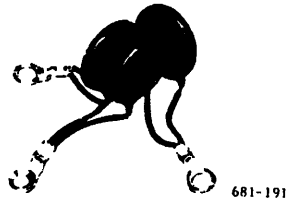


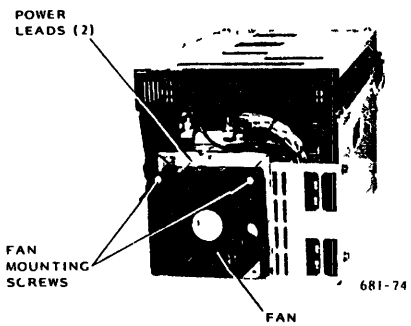
Fig. 20 Surge Absorber with Pressure Terminals Connected to Leads

MAINTENANCE (Cont'd)

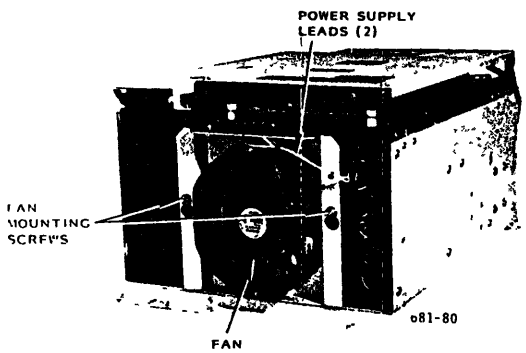
Thyristor Cooling Fan

Using for 230V, 25A and 460V, 50A ratings are self-cooled Replace the fans as follows (Fig 21)

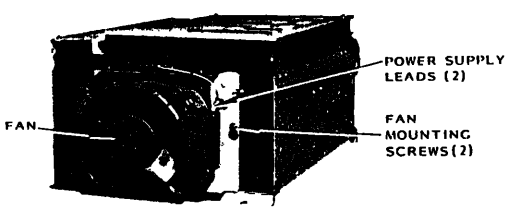
1. Disconnect the power leads
2 Unscrew the two fan mounting screws, and dismount the fan
3 Remove the fan by reversing the disassembling procedure



(a) 230V, 45 - 105A
460V, 90 - 105A



(b) 230V, 180 - 260A
460V, 180 - 260A



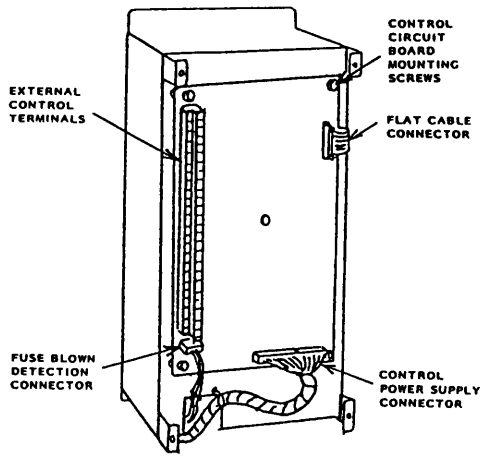
(c) 230V, 420/550A; 460V, 420/550A

Fig. 21 Thyristor Cooling Fan

Control Circuit Board Replacement

Disconnect all the leads from the terminals In this case mark the terminals for identification Then, unplug the connectors shown in Fig 22, and loosen the 5 control circuit board mounting screws

Mount the replacement board by reversing the disassembling procedure Plug-in the connectors firmly

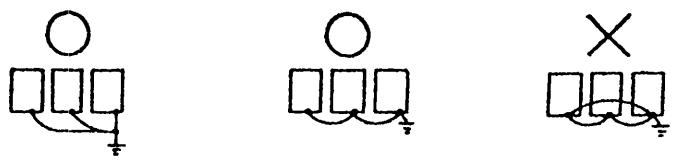


Type JPDC-C049

Fig. 22 Control Circuit Board

Grounding

- Ground resistance
  200V class 100Ω or less, 400V class 10 Ω or less
- Never ground VS-505Z3 in common with welding machines, motors. or other large-current electrical equipment. Run all the ground wires in a conduit separate from wires for large-current erectrical equipment.
- The ground wires keep the length as short as possible.
- When using several VS-505Z3 units side by side, guound the units as shown in Fig 22A, (a)or(b). Do not loop the ground wires as shown in (c).



(a) Acceptable (b) Acceptable (c) Not Acceptable

CAUTIONS IN REPLACING CONTROL CIRCUIT BOARD

Make sure that the type of the new control circuit board agrees with the nameplate and potentiometer settings of new control circuit board are the same as the old one Refer to the nameplate "Cautions in Operation" posted on the inside of the control board door of VS-505Z 3 See Table 7 Adjuster Locations on the Control Circuit Board and Functions

Table 9 Troubleshooting Guide

	Trouble	Possible Cause		Check Method	What to do	
Motor does not run	OCL lamp ON	Control circuit board	Too low setting of "OL$_2$," "OL$_1$"	Is setting dial at the positions indicated by lock paint?	Set the setting dial to the position of lock paint	Reset
			Too high setting of "LIMIT."	Refer to Table 6 and 7	Readjust	
			Incorrect setting of "IFB"			
		Thyristor	Defective (deteriorated)	Check thyristor (Fig 25)	Replace thyristor (See Main Circuit Thyristor on page 9 .)	
		Motor and driven machine	Overloaded	Check load current.	Adjust load	
			Locking	Run motor without load, and see if it locks	Repair motor	
				Check load for locking	Repair driven machine	
			Layer shorting in motor	Run motor with terminals (P) and (N) disconnected If OCL lamp does not light, the motor and its circuit are defective	Repair motor.	
			Grounding of motor circuit	Measure resistance between terminal (P) (or N) and ground (E) with a multitester If the reading is nearly ∞ on the largest scale of the tester, the circuit is normal	· Repair motor Correct wiring	
	FU lamp ON	Thyristor	Defective (deteriorated)	Check thyristor (Fig. 25)	Replace thyristor (See Main Circuit Thyristor on page 9 .)	
		Motor	Layer shorting in motor	Operate only board with (P) and (N) disconnected If fuse is not blown, motor circuit is defective	Repair motor · Correct wiring	To replace fuses (1FU, 2FU, 5FU), refer to Replacement of Thyristor Protection Fuse.
			Grounding of motor circuit	Measure resistance across terminal (P) (or N) and ground (E) with a multitester, and if the reading is nearly ∞ on the largest scale of the tester, the circuit is normal. (See Note)	Repair motor Correct wiring	
		Control circuit board	Defective (phase control circuit)	——	If the motor is normal, replace control circuit board Refer to Replacement of Control Circuit Board on page 12	
		Fuse	Defective (deteriorated)	——	——	
	FI lamp ON	Motor	Layer shorting in field winding	Disconnect terminals (J) and (K), and measure resistance between terminal (J) and (K) of motor with a multitester If the reading is ∞, field circuit is disconnected	· Repair motor · Replace fuse (3FU or 4FU)	
			Grounding of field circuit.	Measure resistance across terminal (J or K) and ground (E) with a multitester, and if the reading is nearly ∞ on the largest scale of the tester, the circuit is normal		
		Control circuit board	Defective	——	If the motor is normal, replace control board. See Replacement of Control Circuit Board on page 12	
	THG lamp ON	Motor	Over loading: Main circuit	Check load current.	Adjust load.	
			Over loading: Field circuit	Check field current	Readjust See Adjustment on page 6	
			Locking	Run motor without load, and see if it locks	Repair motor	
				Check load for locking	Adjust load.	
			Blocked air filter	——	Refer to the instructions for Industrial DC Motors (TOE-C435-3).	
			Insufficient cooling with blower.	Check the blower for correct running direction	Correct wiring.	
	MCF lamp ON	Motor	Cooling blower stop	Check fan for locking or overloading. Check thermal relay for tripping	Repair or replace fan.	
	TCF lamp ON	Thyristor cooling fan stop Where the fan is provided with failure senser		Check fan for locking or overloading	Replace the thyristor cooling fan See Replacement of Thyristor Cooling Fan, on page 12	
	Surge absorber fuse blown	Main CKT	Excessive surge	Check fuses (3FU, 4FU).	Eliminate cause of surge. Replace surge and fuse. See Replacement of Surge of Absorber Fuse and Replacement of Surge Absorber.	

Note: If the reading is not ∞, accurate measurement with a 500 V megger is required Reading must be 3 megohms or above

SPARE PARTS

Table 10 lists the recommended spare parts for one VS-505Z3, keep always minimum insurance spare parts on hand to protect the unit against costly downtime. When ordering spare parts, specify complete nameplate rating and description (type, code no., etc.) of the parts required, and quantity desired.

Table 10 Spare Parts for Control Panel

Thyristor Converter Unit Type CDMH-Z3□□□□		Main Circuit Thyristor		Thyristor Protective Fuse		Surge Absorber Fuse		Fan		Field Thyristor Diodo		Surge Absorber		Control Circuit Board	
		Type (Code No.)	Q'ty	Type (Code No.)	Q'ty	Type (Code No.)	Q'ty	Type (Code No.)	Q'ty	Type (Code No.)	Q'ty	Type (Code No.)	Q'ty	Type (Code No.)	Q'ty
Type SS	230 V 25 A	TM20DA H (SCR195)	3	60FHS-55 (FU642)	2	FCF2-20 (FU599)	2	—	1	TM20RA-H (SCR192)	2	TNR23G-471K (XX140)	3	JPDC-C049 (ETC00986X)	1
Type S	230 V 35 A	TM25DZ-H (SCR196)						4715PS-22T-B30-B00 (FAN130)							
	230 V 45 A														
	230 V 90 A	TM55DZ-H (SCR197)		60FHS-110 (FU644)											
	230 V 105 A	TM90DZ-H (SCR198)		60FHS-150 (FU645)											
Type M	230 V 180 A	N105CH08 (SCR259)	6	CS5F-200 (FU609)		FCF2-30 (FU600)		5915PC-22T-B30-B00 (FAN131)							
	230 V 260 A	N195CH08 (SCR261)		CS5F-350 (FU612)											
Type L	230 V 420 A			CS5F-450 (FU614)				MRW18-DTA (FAN107)							
	230 V 550 A	N280CH08 (SCR265)		CS5F-600 (FU616)											
Type S	460 V 50 A	PK55HB-160 (SCR244)	3	60FHS-110 (FU644)	3	FCF2-20 (FU599)	2	—	1	TM20RA-H (SCR192)	2	TNR23G-102K (XX167)	3	JPDC-C049 (ETC00986X)	1
	460 V 90 A	TM55DZ-2H (SCR201)						HN4556MV (FAN110)							
	460 V 105 A	PK90HB-160 (SCR245) TM90DZ-2H (SCR202)		60FHS-150 (FU645)											
Type M	460 V 180 A	N105CH16 (SCR260)	6	CS5F-200 (FU609)		FCF2-30 (FU600)		T756DKV (FAN206)							
	460 V 260 A	N195CH16 (SCR262)		CS5F-350 (FU612)											
Type L	460 V 420 A			CS5F-450 (FU614)				MRW18-DTA (FAN107)							
	460 V 550 A	N280CH16 (SCR266)		CS5F-600 (FU616)											

〈REFERENCE〉

ROUGH CHECK OF THYRISTORS

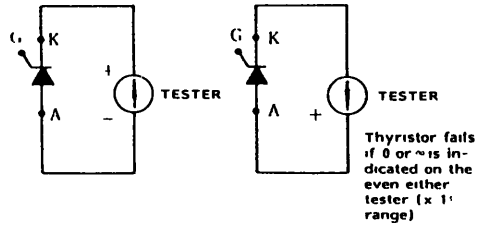
Where thyristors normally function, the following values are obtained.

More than several hundreds of kiloohms across (A) and (K).

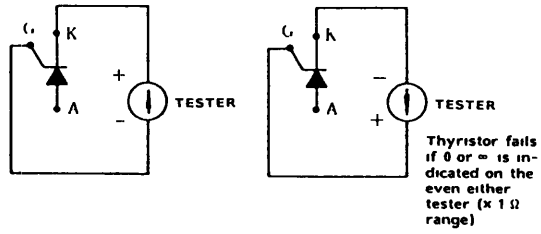
Several ohms to several hundreds of ohms across (G) and (K).

CAUTION IN CHECKING FLAT THYRISTORS

Apply pressure 5 to 10 kg across thyristor polarities A and K so as to insure positive thyristor internal connections. Measure the resistance using a tester as shown in Fig. 23 (a) and (b).



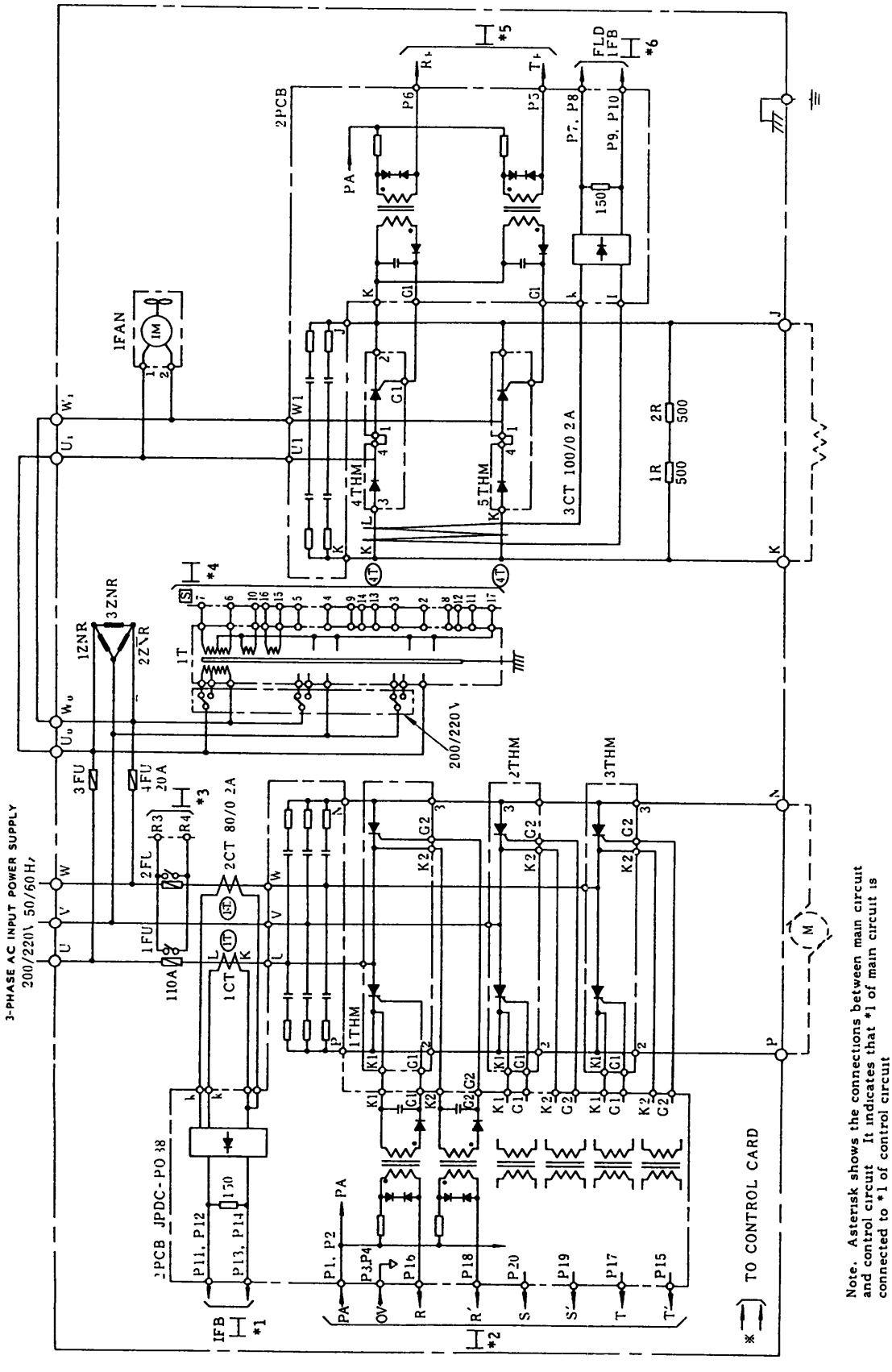
(a) Resistance across Thyristor Terminals (A) and (K)



(b) Resistance across Thyristor Terminals (G) and (K)

Fig. 23 Rough Check of Thyristors

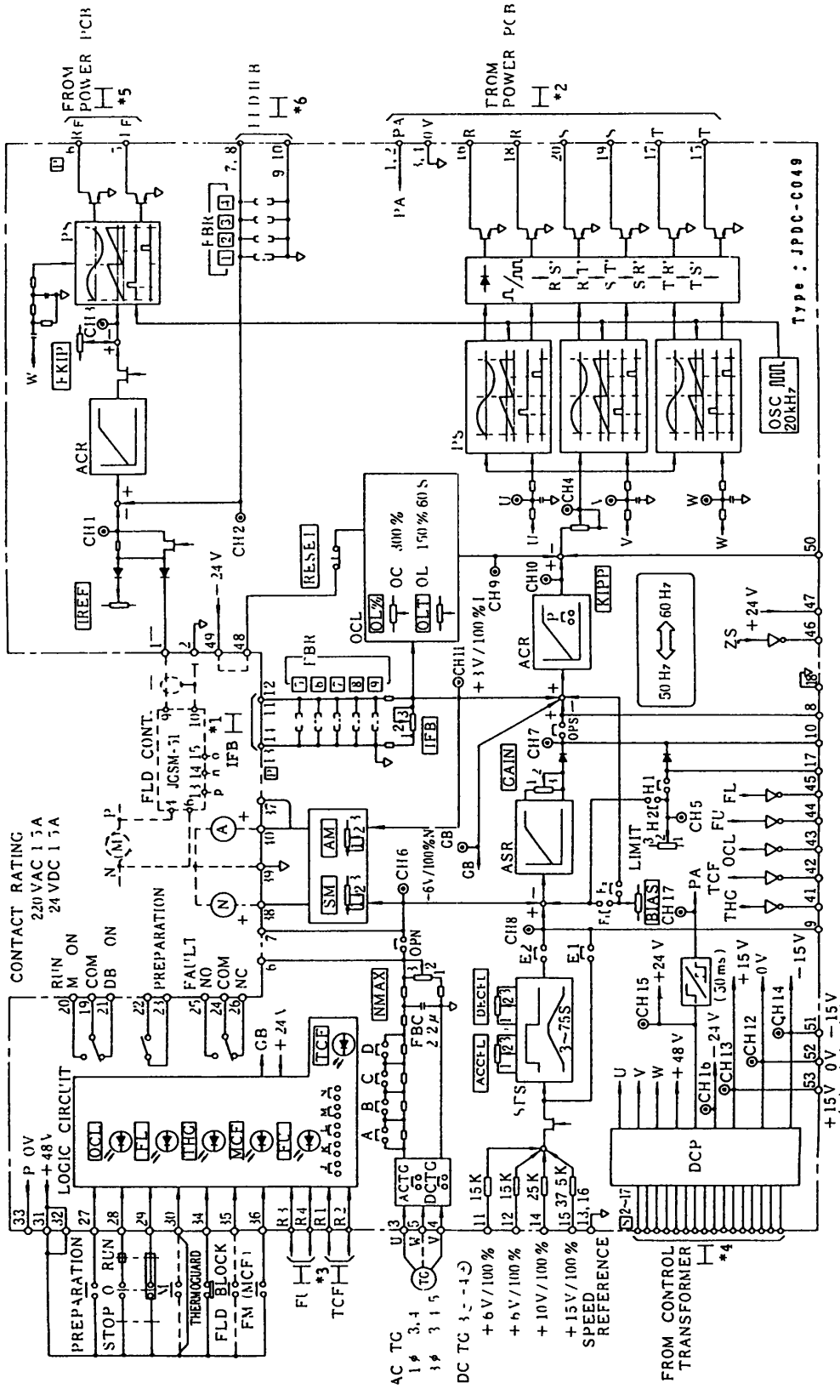
ELEMENTARY DIAGRAM OF THYRISTOR CONVERTER UNIT (TYPE CDMR-Z32090, 230V, 90A)



Note. Asterisk shows the connections between main circuit and control circuit. It indicates that *1 of main circuit is connected to *1 of control circuit

Fig. 24 Main Circuit

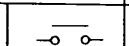
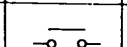
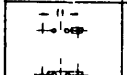
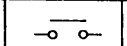
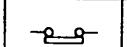
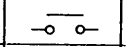
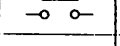
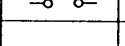
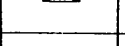
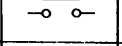
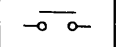
ELEMENTARY DIAGRAM OF THYRISTOR CONVERTER UNIT (TYPE CDMR-Z32090 , 230V, 90A) (CONT'D)



Note Asterisk shows the connections between main circuit and control circuit. It indicates that *1 of main circuit is connected to *1 of control circuit.

Fig. 25 Control Circuit
Type JPDC-C049

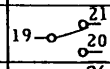
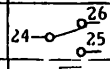
Table 11 Functions of External Control Terminals for Input

	Signal Name		Terminal No.	Function	
1	Ready signal		27	"Close" --- Field intensifying "Open" --- Gate block → Field half-reduced	
2	Operation signal		28	"Close" --- Speed reference "ON" → Acceleration to speed reference value. "Open" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
			28 29	"RUN" --- Speed reference "ON" → Acceleration to speed reference value "STOP" --- Speed reference "OFF" → Stop by regenerative braking → Gate block.	
3	Main circuit M input answer back signal		30	"Close" --- Gate block released	Terminals 30 and 31 (or 32) short-circuited unless used
4	Motor overheat signal		34	"Open" --- Gate block. "Close" --- Normally	
5	Field block signal		35	"Close" --- Field block (Field circuit clipped at KIPP phase.)	
6	Motor blower ON/OFF signal		36	"Close" --- Field intersifying. "Open" --- Gate block → Field current half-reduced.	
7	External gate block signal		49 - 50	"Close" --- Gate block.	
8	External (OCL) failure reset		48 - 49	"Close" --- Normally. "Open" --- Reset	Terminals 48 and 49 short-circuited when reset button in the unit is used.
9	Fuse blown detection signal (inside)		R1 - R2	With failure detection cooling fan (option) "Open" --- Normally "Close" --- Gate block.	
10	Thyristor cooling fan stop signal (inside)		R3 - R4	"Open" --- Normally. "Close" --- Gate block.	
11	Speed reference		11	+6V/100%N	· Soft start command possible. · 3 to 75 sec (Variable) Accel. time, decel time adjustable independently.
			12	+6V/100%N	
			14	+10V/100%N	
			15	+15V/100%N	
			13, 16	0V (SG)	
12	External current reference (+ Forward torque. - Reverse torque)		17	±3V/100% Ia	
			18	0V (SG)	
13	Speed feedback signal		3 - 4 - 5	ACTG 3, 4 --- 1φ, 3, 4, 5 --- 3φ DCTG 3(-), 4(+)	
14	Automatic field weakening current command		1	Output received from field controller Type JGSM-51.	
			2	0 V (SG)	

Note:

1. Use highly reliable contact for input interface signal considering that the load is 48VDC, 10mA.
2. Provide a noise killer at both ends of coil when relay, contactors, etc. are used.

Table 12 Functions of External Control Terminals for Output

	Signal Name		Terminal No.	Function	
1	Ready signal		22-23	Contact signal closed when operation is ready. (PREP light ON.)	Allowable contact capacity: 220VAC, 1.5A 24VDC, 1.5A
2	Operation signal		19-20-21	NO contact --- For M input command. NC contact --- For DB input command	
3	Failure signal		24-25-26	Contact signal closed (or opened) when failure occurs.	
4	Zero-speed detection signal	 *	46	"ON" at motor speed 1% or below (-6V/100% NFB)	
5	Main circuit current detection signal		37	+6V/100% Ia (Allowable load impedance: 3 kΩ)	
6	Individual failure detection signal: Motor overheat		41	"ON" by motor overheat.	
	Thyristor cooling fan stop		42	"ON" by thyristor cooling fan stop.	
	Thyristor overcurrent and overload		43	"ON" by thyristor overcurrent overload.	
	Fuse blown		44	"ON" by fuse-blown.	
	Field lost		45	"ON" by field loss.	
7	Speedometer		38-39	Connected to 1 mA DC meter (2 kΩ or below). (Full scale at maximum speed)	
8	Main circuit ammeter		40-39	Connected to 1 mA DC meter (2 kΩ or below). (Full scale at 150% load)	
9	Control power supply		51	-15V	
			52	0V (SG)	
			53	+15V	
			47	+24V	
			31,32	+48V	Isolated from other control power supply.
			33	0V (POWER 0V)	

*Allowable rating 24VDC, 50mA.

Varispeed-505 Z3 Drive
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