

INSTRUCTION MANUAL

DENYO

DIESEL GENERATING SETS

DCA-SP SERIES

110SP ~ 180SP CLASS



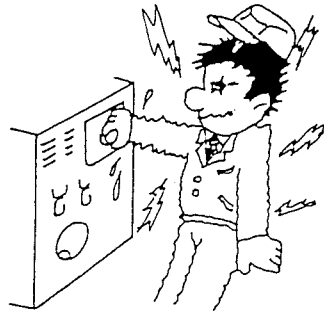
This instruction manual gives a detailed description of the operation, routine inspection, maintenance, and troubleshooting of the generator, and other items required for proper operation. We therefore recommend that all users read this manual carefully before actually operating the generator to ensure proper operation. For detailed operation, disassembly, reassembly and repair of the engine, please refer to the "Engine Instruction Manual" supplied by the engine manufacture.

CONTENTS

1. PRECAUTIONS FOR SAFE OPERATION -----	1
2. MAJOR SPECIFICATIONS -----	3
3. PARTS DESIGNATION -----	6
4. PREPARATION FOR OPERATION -----	12
5. OPERATION -----	19
6. PARALLEL OPERATION -----	22
7. STORAGE -----	24
8. INSPECTION AND MAINTENANCE -----	25
9. TROUBLESHOOTING -----	27
10. OUTLINE DRAWING -----	29
11. GENERATOR CONNECTION DIAGRAM -----	37
12. ENGINE WIRING DIAGRAM -----	42
13. SAFETY PRECAUTIONS FOR DIESEL GENERATING SETS AND EQUIPMENT -----	49
14. OPTIONS INSTRUCTION MANUAL -----	52

1. PRECAUTIONS FOR SAFE OPERATION

This machine is designed with highest consideration to safety. Safest and most efficient operation, however, can be attained by paying attention to the following items.



(1) Operate Properly

Operate the machine properly according to the Instruction Manual to ensure safety.

Give proper guidance in operation.

In allowing other personnel to use the machine, be sure to give them proper guidance in its operation and advise them to read the "Instruction Manual" before actually operating it.

(2) Keep Free From Moisture

The operation of the machine in a place exposed to rain, moisture or wetness may cause electrocution. For operation under such conditions, be sure to ground the machine and the load side.

(3) Housekeeping, The First Step

Do not place any unnecessary items around the machine.

When the machine is to be located on an uneven or soft surface, install it horizontally so that it will not tilt during operation.

(4) Clean Carefully And Frequently

The machine must be treated properly as your business partner.

Note that the insulation of the generator may deteriorate depending on the place where it is used. If it is to be used in a place where dust and moisture are excessive, be sure to clean and dry it periodically.

(5) Pay Attention To Sufficient Ventilation

The exhaust gas discharged from the machine contains hazardous substances. When the machine is to be used in such a place as a tunnel, ventilate the place thoroughly during operation. When it is to be operated on the road, take care that the exhaust is away from pedestrians, nearby buildings, etc.

(6) Shut Down Operation Immediately If Any Abnormality Occurs

If the machine is found to operate improperly, or produce any abnormal odor, noise, or vibration, immediately shut down the operation for troubleshooting to correct the abnormality.

(7) Maintain Electrical Instrument Cables Properly

Damaged cables of the electrical instruments are very dangerous, causing electrocution and leakage. Therefore, if such a cable is found, immediately repair or replace it.

(8) Avoid Overloading

The generator is provided with a breaker for overload protection, which is actuated when it is overloaded. When the breaker has been actuated, reduce the load before turn a breaker "ON" again.

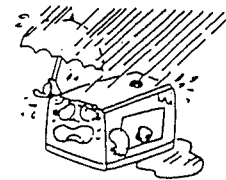


(9) Never Touch The Output Terminal

Never touch the output terminal during the operation. Be sure to shut down the operation before touching the terminal for wiring, etc.

(10) Pay Attention To Storage And Transportation
During Inclement Weather

The machine is designed for dripproofing, but not for rainproofing. When it is to be stored or transported on an inclement day, take care to cover it.



(11) Wash The Machine Carefully

Wash the machine taking care that the control panel and the inlet and outlet ports are not exposed to water to prevent possible failure of the internal instruments.

(12) Take Precautions Against Fire

Handle fuel, oils and antifreeze (undiluted) with care because they are dangerous materials with high flammability. Do not bring any naked light such as lit tobacco or a burning match close to them. In addition, do not install and store the machine in a place near where fire is used.

(13) Connect Securely

Damaged cables and loosened screws result in machine failure and electrocution. Therefore, immediately repair such cables and tighten such screws securely, if any.

(14) Perform Inspection And Maintenance Work
Perfectly

Keep the machine clean and its inside free from dust and moisture. In addition, perform its inspection and maintenance perfectly in accordance with the "Instruction Manual".



2. MAJOR SPECIFICATION

MODEL		DCA-	110SPN	115SPK	125SPK2.3	125SPM
A C G E N E R A T O R	MODEL	DB-	DB-1381M	DB-1381K	DB-1381K	DB-1381M
	RATED OUTPUT		95/110 kVA	100/115	100/125	
			76/88 kW	80/92	80/100	
	RATED VOLTAGE		200/220 V			
			400/440 V			
	RATED CURRENT		274/289 A	289/302	289/328	
			137/144 A	144/151	144/164	
	FREQUENCY		50/60 Hz			
	POWER FACTOR		0.8 (lagging)			
	NO. OF PHASES		Three-phase (four wire)			
	EXCITATION		Brushless type (with automatic voltage regulator)			
	NO. OF POLES		4			
	SPEED		1500/1800 min ⁻¹ (rpm)			
	INSULATION		class F			
SINGLE PHASE OUTPUT	TERMINAL OUTPUT	10 kVA × 2 (contain receptacles 1.5 kVA × 2)				
	VOLTAGE	100/110 V				
E N G I N E	MANUFACTURE		NISSAN	KOMATSU	KOMATSU	MITSUBISHI
	MODEL		A-FE6T	S6D102E-1-A	SA6D102E-1-A	6D16-TE2
	TYPE		4-cycle water cooled diesel engine direct injection type with turbocharger			
	RATED OUTPUT (1500/1800min ⁻¹)		84.6/106 kW	92.7/104	97.8/115.5	107/122
			115/144 PS	126/142	133/157	145/166
	NO. OF CYLINDERS		6-	6-	6-	6-
	BORE × STROKE (mm)		108 × 126	102 × 120	102 × 120	118 × 115
	TOTAL DISPLACEMENT		6.925 L	5.88	5.88	7.545
	BATTERY (DOMESTIC STANDARD)		115F51 × 2	65D31R × 2	95E41R × 2	
	FUEL		DIESEL FUEL ASTM No. 2 or equivalent			
	FUEL TANK CAP.		210 L	240	250	250
	LUBRICATING OIL *1	OVERALL	12.5 L	22.0	22.0	13.5
		FILTER	0.5 L	0.5	0.5	2.1
	COOLANT QUANTITY*2	OVERALL	27.4 L	22.9	23.9	28.3
RESERVE TANK		2.4 L	2.4	2.4	2.3	
S E T	LENGTH OVERALL		2850 mm	2900	3000	3100
	WIDTH OVERALL		1050 mm	1050	1080	1080
	HEIGHT		1400 mm	1450	1500	1500
	DRY WEIGHT		2000 kg	2020	2120	2180
	TOTAL WEIGHT		2270 kg	2280	2390	2560

The above specifications and set dimensions are subject to change.

*1 Overall of lubricating oil contains filter.

*2 Overall of coolant quantity contains reserve tank.

MODEL		DCA-	150SPK. 3	150SPM	150SPH	180SPK1. 3
A C G E N E R A T O R	MODEL		DB-1651K	DB-1651M	DB-1651H	DF-1950K
	RATED OUTPUT		125/150 kVA			150/180
			100/120 kW			120/144
	RATED VOLTAGE		200/220 V 400/440 V			
	RATED CURRENT		361/394 A 180/197 A			433/472 217/236
	FREQUENCY		50/60 Hz			
	POWER FACTOR		0.8 (lagging)			
	NO. OF PHASES		Three-phase (four wire)			
	EXCITATION		Brushless type (with automatic voltage regulator)			
	NO. OF POLES		4			
	SPEED		1500/1800 min ⁻¹ [rpm]			
	INSULATION		class F			
	SINGLE PHASE OUTPUT	TERMINAL OUTPUT VOLTAGE	10 kVA × 2 (contain receptacles 1.5 kVA × 2)			1.5 kVA × 2 only receptacle
		100/110 V				
E N G I N E	MANUFACTURE		KOMATSU	MITSUBISHI	HINO	KOMATSU
	MODEL		S6D108E-2-A	6D24-E1	M10C-TB	SA6D108E-2-A
	TYPE		4-cycle water cooled diesel engine direct injection type with turbocharger	4-cycle water cooled diesel engine direct injection type	4-cycle water cooled diesel engine direct injection type with turbocharger	4-cycle water cooled diesel engine direct injection type with turbocharger and after-cooler
	RATED OUTPUT (1500/1800 min ⁻¹)		113/135 kW			136/162
			153/183 PS			185/220
	NO. OF CYLINDERS		6-	6-	6-	6-
	BORE × STROKE (mm)		108 × 130	130 × 150	127 × 130	108 × 130
	TOTAL DISPLACEMENT		7.150 L	11.945	9.88	7.150
	BATTERY (DOMESTIC STANDARD)		95E41R × 2	115F51 × 2	95E41R × 2	115F51 × 2
	FUEL		DIESEL FUEL ASTM No. 2 or equivalent			
	FUEL TANK CAP.		250 L	250	250	300
	LUBRICATING OIL *1	OVERALL	31.0 L	37.0	26.5	31.0
		FILTER	1.5 L	4.0	4.7	1.5
COOLANT QUANTITY*2	OVERALL	29.4 L	40.3	33.2	30.4	
	RESERVE TANK	2.4 L	2.3	2.4	2.4	
S E T	LENGTH OVERALL		3350 mm	3350	3270	3300
	WIDTH OVERALL		1200 mm	1200	1180	1200
	HEIGHT		1500 mm	1500	1500	1500
	DRY WEIGHT		2740 kg	2900	2500	2900
	TOTAL WEIGHT		3050 kg	3310	2930	3240

The above specifications and set dimensions are subject to change.

*1 Overall of lubricating oil contains filter.

*2 Overall of coolant quantity contains reserve tank.

2 - 1 . AC GENERATOR SPECIFICATIONS (FOR CUSTOM VOLTAGE)

DCA-110SP		50Hz			60Hz		
RATED	kVA	95	95	85.5	99	110	110
OUTPUT	kW	76	76	68.4	79.2	88	88
RATED VOLTAGE (V)		190/380	415	220/440	190/380	200/400	240/480
RATED CURRENT (A)		289/144	132	224/112	301/150	318/159	265/132
1phase	VOLTAGE (V)	100	100	110	100	100	120
OUTPUT	CURRENT (A)	100	100	90.9	100	100	83.3

DCA-115SP		50Hz			60Hz		
RATED	kVA	100	100	90	103.5	115	115
OUTPUT	kW	80	80	72	82.8	92	92
RATED VOLTAGE (V)		190/380	415	220/440	190/380	200/400	240/480
RATED CURRENT (A)		304/152	139	236/118	315/157	332/166	277/138
1phase	VOLTAGE (V)	100	100	110	100	100	120
OUTPUT	CURRENT (A)	100	100	90.9	100	100	83.3

DCA-125SP		50Hz			60Hz		
RATED	kVA	100	100	90	112.5	125	125
OUTPUT	kW	80	80	72	90	100	100
RATED VOLTAGE (V)		190/380	415	220/440	190/380	200/400	240/480
RATED CURRENT (A)		304/152	139	236/118	342/171	361/180	301/150
1phase	VOLTAGE (V)	100	100	110	100	100	120
OUTPUT	CURRENT (A)	100	100	90.9	100	100	83.3

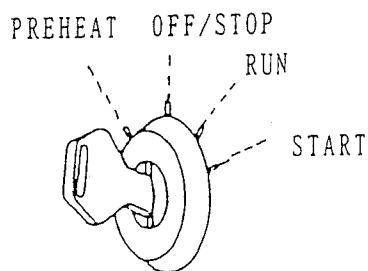
DCA-150SP		50Hz			60Hz		
RATED	kVA	125	125	112.5	135	150	150
OUTPUT	kW	100	100	90	108	120	120
RATED VOLTAGE (V)		190/380	415	220/440	190/380	200/400	240/480
RATED CURRENT (A)		380/190	174	295/148	410/205	433/217	361/180
1phase	VOLTAGE (V)	100	100	110	100	100	120
OUTPUT	CURRENT (A)	100	100	90.9	100	100	83.3

DCA-180SP		50Hz			60Hz		
RATED	kVA	150	150	150	180	180	180
OUTPUT	kW	120	120	120	144	144	144
RATED VOLTAGE (V)		190/380	415	220/440	190/380	200/400	240/480
RATED CURRENT (A)		456/228	209	394/197	547/273	520/260	433/217
1phase	VOLTAGE (V)	100	100	110	100	100	120
OUTPUT	CURRENT (A)	15	15	13.6	15	15	12.5

3. PARTS DESIGNATION

3-1. Description of Engine Control Devices

(1) Starter Switch



① OFF/STOP

Keep the switch at this position except during operation.

This position allows the key to be inserted into and removed from the switch.

The engine of machines of type other than 150SPK, 150SPK3, 180SPK II and 180SPK3 stop at this position.

② RUN

Keep the switch standing at this position during operation.

③ START

Turn the switch to this position for startup.

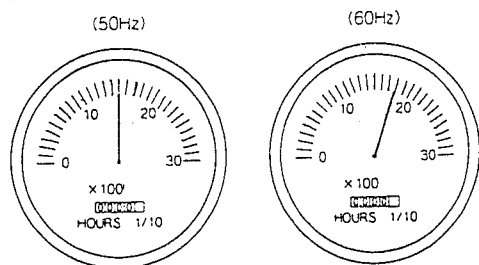
When the key is released after startup, it automatically returns to "RUN" position.

④ PREHEAT

For startup at low air temperature, set the switch at this position until the PREHEAT lamp becomes red-heated just before turning the key to "START" position.

NOTE : It should be noted that 110SPN, 125SPM and 150SPM are designed that the PREHEAT lamp lights up when the switch is held at the "RUN" position. When the lamp goes off, immediately turn the key to the "START" position. Also note that the preheating time automatically changes according to the water temperature of the engine.

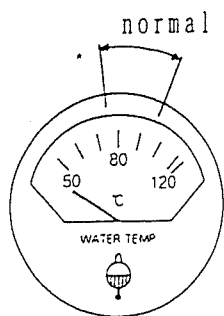
(2) Tachometer



The tachometer indicates engine speed in number of revolutions per minute. Set the engine speed that the meter indicates 1500min^{-1} at 50Hz or 1800min^{-1} at 60Hz. The tachometer has a built-in integrating hour meter.

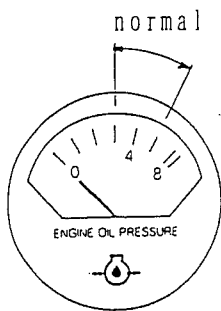
The integrating hour meter has been set for use at 1500min^{-1} . Accordingly, when the meter is used at 180min^{-1} , it indicates an integrated hour value approximately 20% more than the actual operation time.

(3) Cooling Water Temperature Gauge



If machine is in normal operation, the indicator should be between 75-95°C. If it indicates temperature above this range, turn off the load and adjust the throttle handle for cold operation (at approximately 750~900min⁻¹) to reduce the cooling water temperature.

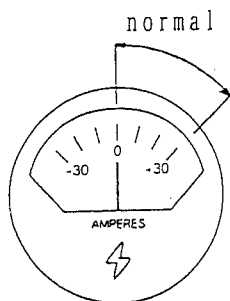
(4) Lubricating Oil Pressure Gauge



If the machine is in normal operation, the pressure gauge indicates 3~6×100kPa (3~6 kg/cm²).

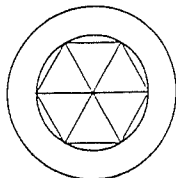
When the engine is cold, the pressure may rise above this range just after startup. In such cases, perform warming-up until the normal pressure is attained.

(5) Charging Ampere Meter



If the machine is in normal operation, the meter points to 0 or + range values (indicating its charged state).

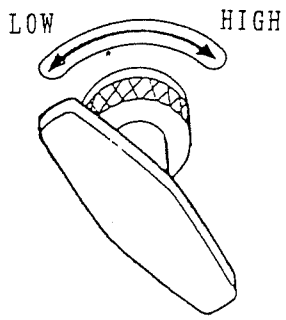
(6) Preheat Lamp



This lamp, when the key switch is turned to "PREHEAT" position, goes red-heated in about 30 seconds, indicating that the machine has been preheated to be ready for startup.

In the case of 110SPN, 125SPM and 150SPM, if water temperature is low, please turn the Starter Switch to "Run" position. If so, it will automatically preheat with the Preheat Indicator Lamp on. When preheating is completed, the lamp will go off.

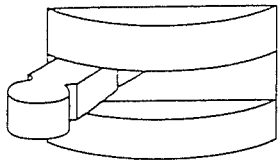
(7) Throttle handle (Speed Control Handle)



Turn the handle toward the "HIGH" side to increase the speed and toward the "LOW" side to decrease it.

In the case of type 150SPK, 150SPK3, 180SPKI and 180SPK3, the engine stop by turning the handle fully toward "LOW" side.

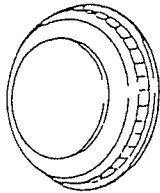
(8) Battery Switch



During operation, never turn the switch to "OFF" position, keeping it at "ON".

If the engine is shut down, be sure to place the switch in "OFF" position.

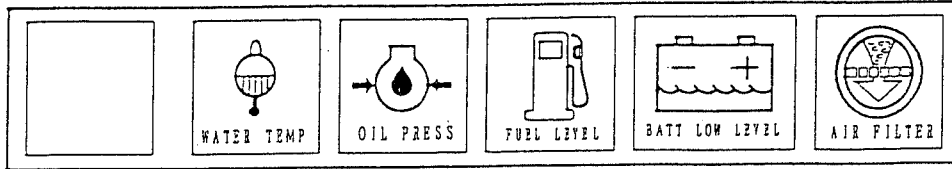
(9) Emergency Stop Button



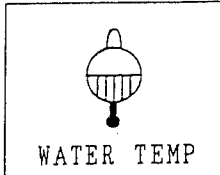
This is a pushbutton to stop the engine urgently on emergency case. Do not push the button without emergency case.

(10) Warning Lamp Unit

This monitor indicates the following failures, if any one of them occurs.



① Overheat (WATER TEMP)



This lamp goes on when the cooling water temperature rises abnormally. If the lamp goes on during operation, the emergency stop device immediately operates to shut down the engine automatically.

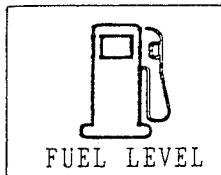
② Oil Pressure Failure (OIL PRESS)



If the machine is in normal operation, this lamp stays off. When the starter switch is turned to "RUN" position to start the engine, the lamp goes on, and when the oil pressure rises after startup, it goes off. If this lamp goes on during operation, the emergency stop device immediately operates to shutdown the engine automatically. After the engine stops, the lamp stays on unless the key switch is turned to "OFF" position.

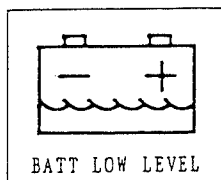
It should be noted, however, that 150SPH is designed that this lamp does not go on even if the starter switch is set at the "RUN" position to startup the engine.

③ Fuel Level Failure (FUEL LEVEL)



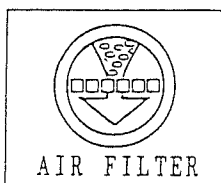
When fuel is running low, this lamp goes on, and the tank should be supplied.

④ Battery Fluid Level Failure (BATT LOW LEVEL)



When battery fluid is running low, this lamp goes on, and distilled water should be supplied to the battery.

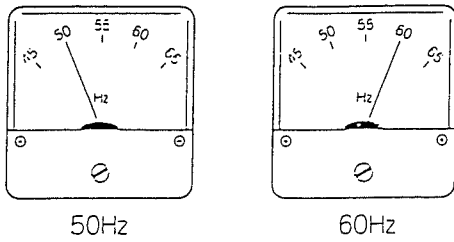
⑤ Air filter Blinding (AIR FILTER)



When the air element is blinded, this lamp goes on. Indicating that the element should be immediately cleaned or replaced. Setting the starter switch at the "STOP" position causes the lamp indication to be automatically reset.

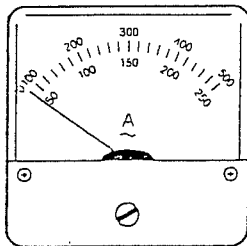
3-2. Description of Generator Control Devices

(1) Frequency Meter



This meter indicates the power frequency. Make sure that the meter pointer stands at 50 or 60Hz during operation.

(2) AC Ammeter



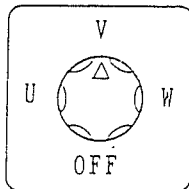
AC Ammeter

The ammeter indicates the value of current flowing in the load connected. Make sure that the current value is below that rated.

If both of the three phase and single phase loads are used simultaneously, the meter indicates the total of their respective current values.

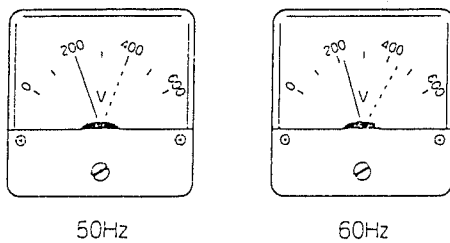
If either the three phase or single phase load is used singly, the meter indicates its current value.

Use the ammeter change over switch to check each phase for current value.



Ammeter change over switch

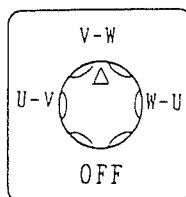
(3) AC Voltmeter



AC Voltmeter

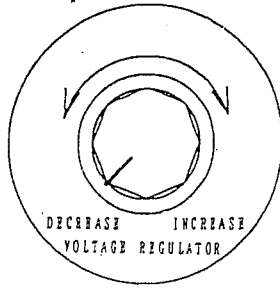
The voltmeter indicates the output voltage. Make sure that the voltmeter pointer stands at the rated voltage.

Use the voltmeter change over switch to check each phase for voltage value.



Voltmeter change over switch

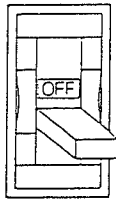
(4) Voltage Regulator



This regulator is used to control the output voltage. Turn the regulator clockwise to increase the voltage and counter-clockwise to decrease it.

Adjust the voltage to the rated voltage with this regulator.

(5) Breaker



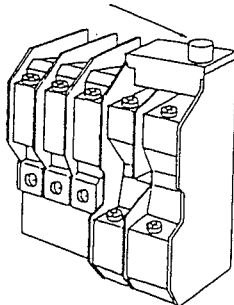
This breaker serves both as the main switch for supply of power generated from the generator to the load connected to the output terminal, and as the protector of the generator when a short or overload occurs in the load side. Do not use this breaker to turn the load "ON" or "OFF".

If the breaker trips by over current, handle of breaker stays center of "ON" and "OFF".

In such case, the breaker will not turn "ON" until handle is pushed down the "OFF" position.

(6) Overcurrent Relay

RESET BUTTON



If the actuation of the overcurrent relay causes the breaker not to be turned on, open the control panel and press the reset button as shown in the following drawing.

4. PREPARATION FOR OPERATION

4-1. Precautions In Installation

Install the machine horizontally on solid ground.

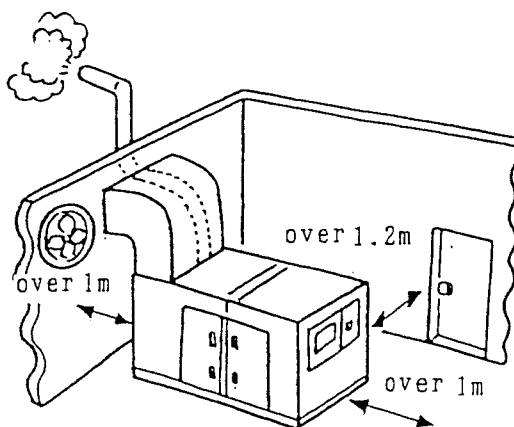
In addition, when the machine is installed in a place where dust and salt are excessive, pay close attention to its maintenance and care to prevent radiator clogging and failure, and electrical-part insulation failure possibly caused by operation under such circumstances.

(1) Precautions In Outdoor Installation

When the machine is installed outdoors such as on the road, pay attention to the wind direction and the exhaust port position so that the exhaust gas is away from pedestrians and nearby buildings.

(2) Precautions In Indoor Installation

- ① Leave enough space for easy operation and control on the control-panel side (at least 1m).
- ② Leave enough space for engine inspection, lubrication, connection of cable to the load, fuel supply and other operations on the right, left and opposite sides views from the control panel (at least 1.2m).
- ③ Install an exhaust pipe so that exhaust gas is discharged through it to an open area.
- ④ Leave enough space for exhaust of warm air discharged through the radiator, supply of water to the radiator, and arrangement of the exhaust pipe above the machine.
- ⑤ Note that the connection of the generator to indoor wiring not only infringes the law, but also may cause electrocution or generator failure.
- ⑥ Note that the machine can be installed directly on a foundation such as concrete.
- ⑦ Install the machine in such a place as can be thoroughly ventilated to prevent a considerable rise in the indoor temperature, which has an adverse effect on the engine generator.



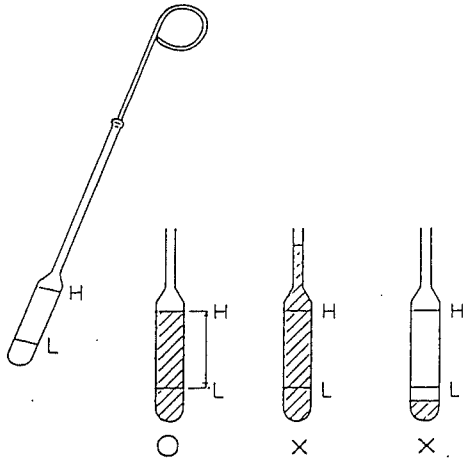
4-2. Check Before startup

Be sure to check the machine especially for the following points before startup to minimize machine failure.

(1) Check Oil

* Be sure to check the oil level before startup every day.

Note : Some engine manufactures provide a level gauge with such H/L marks on both sides, which allows the oil level to be checked during idling. When using such a level gauge, carefully check which of the two H/L marks is used at down time or during idling.



Oil level gauge

* Check engine oil with an oil level gauge to see that the oil level is between marks H and L of the level gauge, and replenish or replace it if necessary.

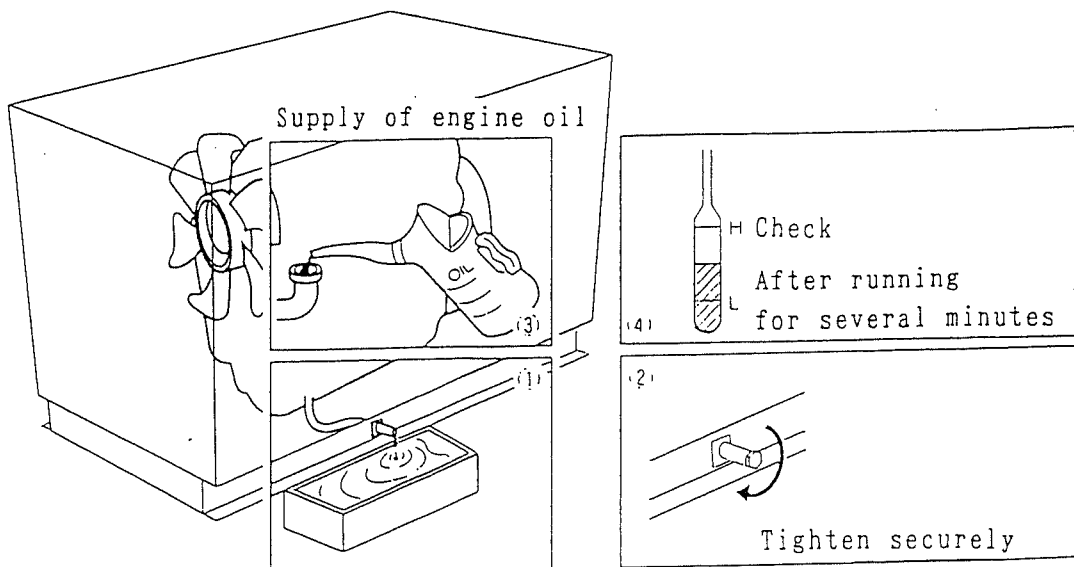
* For oil replenishment, supply a given amount of oil from the oiling port provided on the engine.

For oil replacement, remove the oil drain plug provided on the machine base to drain the oil. After the oil draining is complete, tighten the oil drain plug securely.

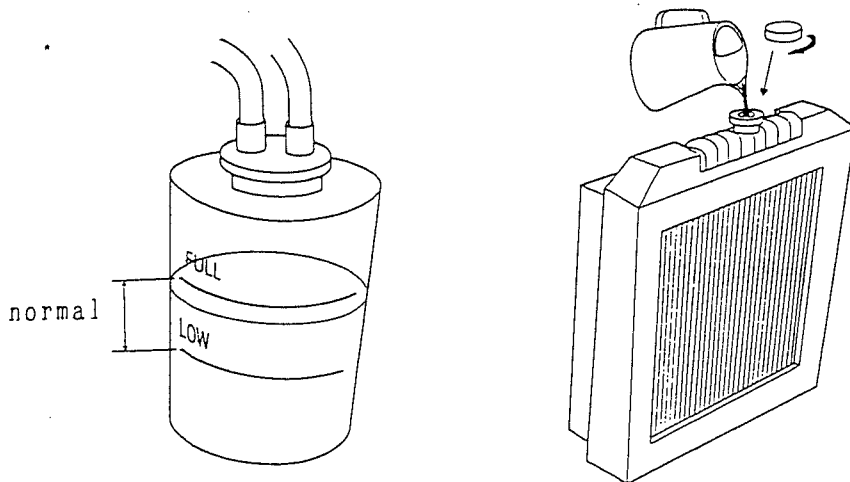
Some engines have a valve provided in the bonnet. Open this valve when the oil is to be drained and close it after the drainage is completed.

* After a specified amount of engine oil is supplied, run the engine for several minutes and then stop it to check again to see that the oil level stands in between marks H and L of a level gauge.

Notes : For specified quantity of lubricating oil, refer to the Specifications Table.



(2) Check Cooling Water



In checking or supplying cooling water, make sure that the engine is cold. For cooling water in winter, refer to the "Engine Instruction Manual". Use tap water as cooling water and put it up to the root of the filling port. All machines are provided with a reserve tank. Put tap water in it up to the "FULL" mark.

In setting the radiator cap after the cooling water check or supply, take care to turn it clockwise to full position so that the radiator can be used with its inside kept in a pressurized state. Insecurely-tightened radiator cap may result in serious engine trouble.

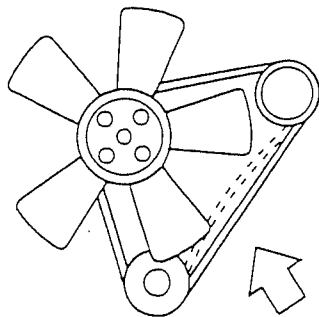
Notes : For specified quantity of cooling water, refer to the Specifications Table.

(3) Check Fan Belt

Check the belt for tension and elongation. Adjust them if necessary. If any abnormality is found on the belt, replace it.

Perform the adjustment and replacement as directed in "Engine Instruction Manual".

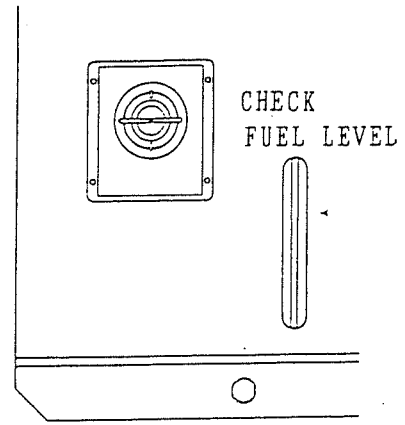
The belt tension is considered to be proper if the flexing level is within 10-15 mm when the arrow-indicated portion (belt center) is pressed with the thumb (approximately 6kg).



(4) Check Fuel

Be sure to check the fuel level before startup to prevent fuel shortage during operation.

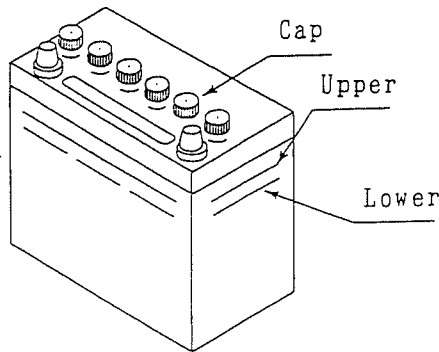
Occasionally remove sediment and contaminated water collected in the bottom of the fuel tank by loosening its drain plug.



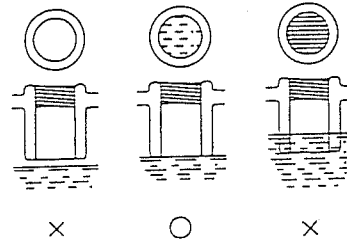
FUEL DRAIN PLUG

(5) Check Battery Fluid Level

Take off the cap of battery and check battery fluid level. When battery fluid level is low, supply distilled water.



Battery fluid level

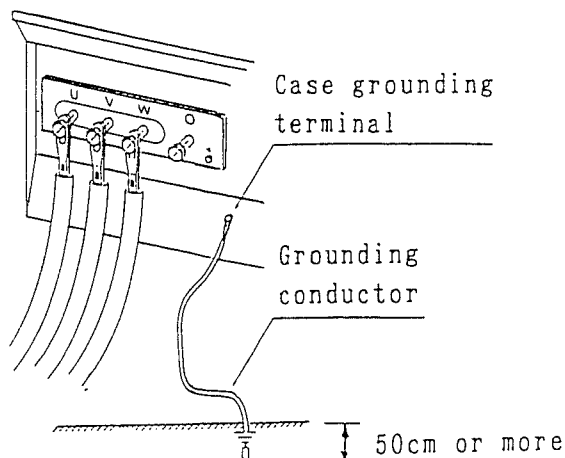


(6) Check Generator Case Grounding

When the generator is installed in a moist place, or on highly conductive material such as iron plates or steel work, be sure to connect the grounding conductor terminal provided near the output terminal block and bury the wire 50 cm or deeper in the ground securely.

Do not directly ground terminal "0".

Recommended grounding wire sectional area: 5.5 mm² or larger



(7) Check For Water And Oil Leakage

Check the engine periphery for water and oil leakage.

If such leakage is found, identify the leak spot and repair it.

(8) Check Bolts And Nuts For Looseness

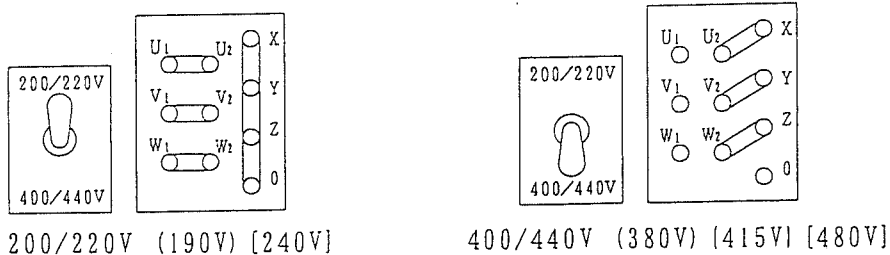
Check bolts and nuts, especially on the air cleaner, muffler and turbocharger mounting portion, for looseness and tighten them if necessary.

(9) Check Electrical Wiring For Disconnection, Short And Terminal Looseness.

4-3. Load Connection

(1) Method For Selecting Output Voltage

Select voltage according to the voltage of the load to be used.



* Method For Selecting Output Voltage

The output voltage of 200/220V or 400/440V can be selected with the voltage change over plates.

These generators are shipped from the plant with their output voltage set at 200/220V unless otherwise specified.

Change over to the desired output voltage according to the following procedure, if necessary.

① In the case of 150SPK, 150SPK3, 180SPK1 and 180SPK3, the voltage change over panel is located on the left-hand side of the control box.

In the case of 110SPN, 115SPK, 125SPK2, 125SPK3, 125SPM, 150SPM and 150SPH, the voltage change over panel is located on the right-hand side of the control box.

Remove the protecting cover of the voltage change over panel first.

② Change over to the desired output voltage by setting the change over plates and the change over switch on its side as shown in the above drawing. (115SPK, 125SPK2, 125SPK3 and 125SPM are not equipped with the change over switch.)

Note that insecure tightening of the locking bolts results in burning.

③ In changing the output voltage over to 400/440, take care not to lose superfluous change over plates by, for example, setting them together with the actually used ones.

④ Mount the protecting cover of the voltage selecting panel again.

To prevent danger, the protecting cover should be covered anytime during the operate.

(2) Three-phase Output

In connecting a load, tighten locking bolts securely with a spanner, etc. to prevent burning.

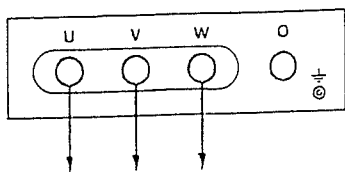
Use U/V/W for three-phase load

200/220V or 400/440V

(190V) (380V)

(415V)

[240V] [480V]



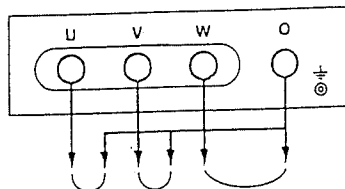
Use O/U, O/V, O/W for single-phase load

115/127V or 231/254V

(110V) (220V)

(240V)

[139V] [277V]



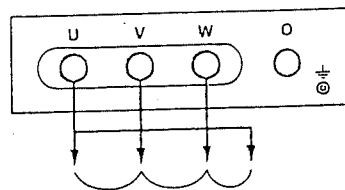
Use U/V, V/W, W/U for single-phase load

200/220V or 400/440V

(190V) (380V)

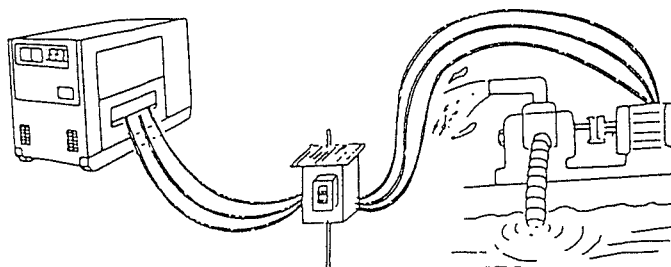
(415V)

[240V] [480V]



☆ Precautions In Load Connection

- ① Be sure to provide a switch for turning the load ON and OFF between the output terminal block and the load.
Note that the use of the generator breaker for turning the load ON and OFF may result in breaker failure.
- ② In connecting the load, be sure to stop the engine and turn OFF the breakers on the control panel and output terminal block (single-phase output) before load connection. In the case of 115SPK, 180SPK1 and 180SPK3, the breaker of single-phase output is on the control panel.
- ③ Don't contact the connecting cable to the output terminal of other phase on the output terminal block.
- ④ When the load connection is finished, close the cover of output terminal and tighten by the bolts.

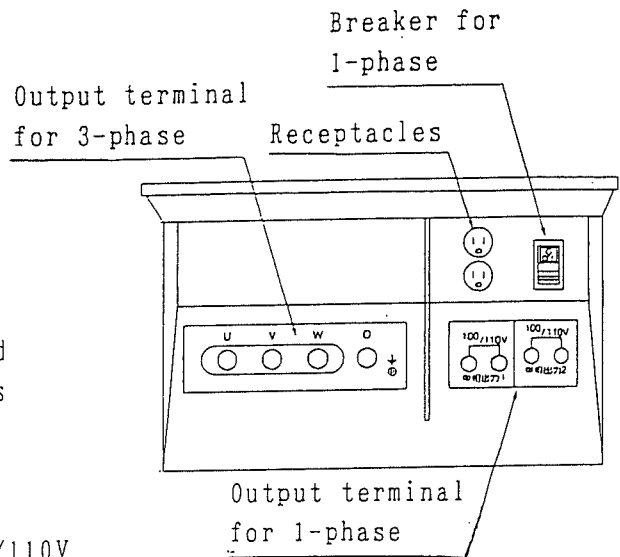


(3) Single-phase Output (100/110V)

The output terminal section is equipped with two single-phase output terminals, two receptacles (50/60Hz, 100/110V), and a breaker for them. In the case of 180SPKII and 180SPK3, its output terminal section is equipped with only two receptacles.

In the case of 115SPK, 180SPKII, and 180SPK3 their single phase breakers are equipped on the control panel.

When the AC voltmeter indicates 200/220V or 400/440V, the single phase output voltage stands at 100/110V.

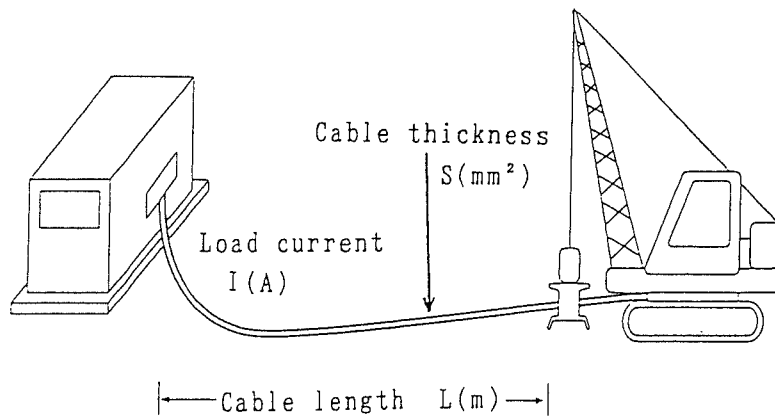


Output terminal block of DCA-125SPM

4-4. Cable Selection

Select a properly-thick cable taking into consideration its allowable current and the distance between the generator and the load.

The load current flowing through a cable in excess of its allowable current may cause overheating with resultant burning, and the use of a cable that is too thin for its length may result in decreased input voltage to the electrical instruments, causing them to operate with low power or be inoperative.



The voltage drop across a cable can be determined from its load current, length and thickness according to the following simplified equation for three-phase three-line system:

$$e = 1/58 \times L/S \times I \times \sqrt{3}$$

where e; Voltage drop (V), L; Cable length (m)
S; Cable thickness (mm²) and I; Load current (A).

Select the cable length and thickness so that the voltage drop can be held to within 5%.

5. OPERATION

5-1. Operation before and after start up

① Make sure that generator and load side breaker are turned "OFF".

② Turn on the battery switch and turn the throttle handle toward the HIGH SPEED (clockwise) two or three times.

③ Turn the starter switch to "PREHEAT" position. When the PREHEAT lamp goes red-heated, turn the starter switch to "START" position to start the engine. When the engine starts, let the starter switch free. *1
Note that no preheating is needed when the engine is hot enough. *2
Make sure that the indicator lamp of WARNING LAMP UNIT for "OIL PRESSURE FAILURE" goes out after the start of the engine.

*1 In the case of types 110SPN, 125SPM and 150SPM, change the starter switch to "START" position after the going out of the indicator lamp for preheating at the position of "RUN".

*2 In the case of types 110SPN, 125SPM and 150SPM, the duration of preheating differs according to the temperature of cooling water. When the temperature of cooling water is high enough, the indicator lamp for preheating does not light because no preheating is needed.

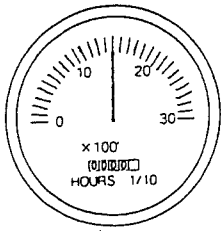
④ Adjust the revolution frequency of the engine within the range of 750 to 900 min^{-1} by adjusting the throttle handle.
Drive the machine for warming up for approximately five minutes.

⑤ After warming up the engine, adjust the revolution frequency to the values listed below by adjusting the throttle handle and monitoring the tachometer or frequency meter.

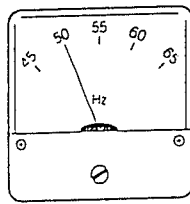
	Frequency (Idling speed)	
Operation at 50Hz	52.5Hz	(1575 min^{-1})
Operation at 60Hz	62.5Hz	(1875 min^{-1})

⑥ By adjusting the output voltage to the rated voltage and by turning ON the circuit breaker, the generator starts its power transmission state.

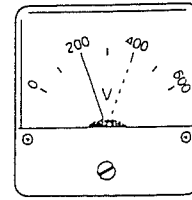
- ⑦ By adjusting the voltage regulator and the throttle handle, adjust the frequency meter, the tachometer and the AC voltmeter to the values shown in the figures below respectively during the loaded drive.



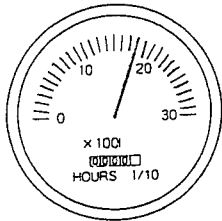
Tachometer
1500min⁻¹



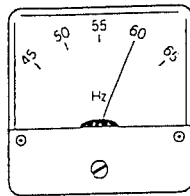
Frequency meter
50Hz



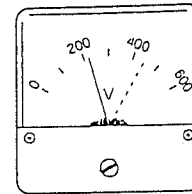
AC voltmeter
200/400V
(380V) (415V)



Tachometer
1800min⁻¹



Frequency meter
60Hz



AC voltmeter
220/440V

5-2. Check After Start up

- (1) Check the gauges and lamps for normal operation.
- (2) Check the engine for exhaust color, sound and vibration.
- (3) Check for oil, fuel and water leakage.
- (4) Precautions During Operation
 - ① Note that the generator voltage and frequency stand so low during idling operation that the loading instruments may operate but function improperly.
 - ② Do not turn off the battery switch or remove the battery during operation.
 - ③ If the operation, stopped by operations other than the starter-switch "STOP/OFF" operation (eg. use of "EMERGENCY STOP" button, actuation of the emergency stop device, fuel shortage, engine failure) is to be restarted, first turn the starter switch to "STOP/OFF" position or the battery switch to "OFF" position before performing the ordinary startup operation.

5-3. Shutdown

- (1) Turn the load-side breaker to the "OFF" side.
- (2) Turn the generator breaker to the "OFF" side.
- (3) Turn the throttle handle to LOW SPEED (counter clockwise) to adjust the revolution frequency within the range of 750 to 900min⁻¹, and drive the engine for approximately five minutes.
- (4) Turn the "STARTER" switch to the "STOP" position to stop the engine. In the case of types 150SPK, 150SPK3, 180SPKII, and 180SPK3 turn the throttle handle fully to "LOW SPEED" until the engine stops and return the starter switch to "STOP" position.
- (5) After stop the engine, turn OFF the battery switch.
- (6) For emergency stop, keep pushing the emergency stop button until the engine stops.

Note: Just after the beginning of the drive of type 150SPM, the engine may not stop soon after the turning of the starter switch to "STOP". It is not abnormal.

The engine will stop approximately half minute later. In the case of emergency or trouble, continue to press the emergency stop button until the engine stops.

5-4. Emergency Stop Device

If any abnormal engine oil pressure failure or water temperature rise occurs during operation, this device shuts down the engine automatically.

6. PARALLEL OPERATION

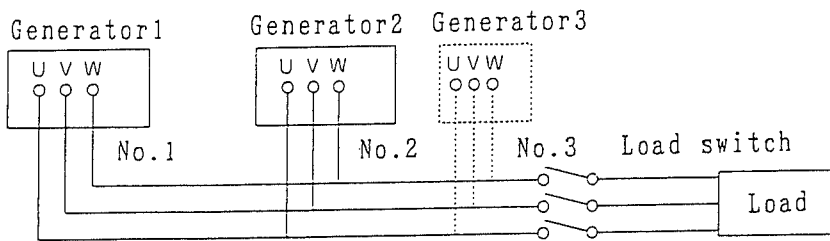
This section describes the parallel operation of DCA-SP SERIES.
Use the same type engine generators for parallel operation.

6-1. Preparation For Parallel Operation

(1) Make connection between generators and wire them to the load according to the terminal symbols as shown in the following drawing.

* The generators are shipped with the phase sequence set in the order of U, V and W.

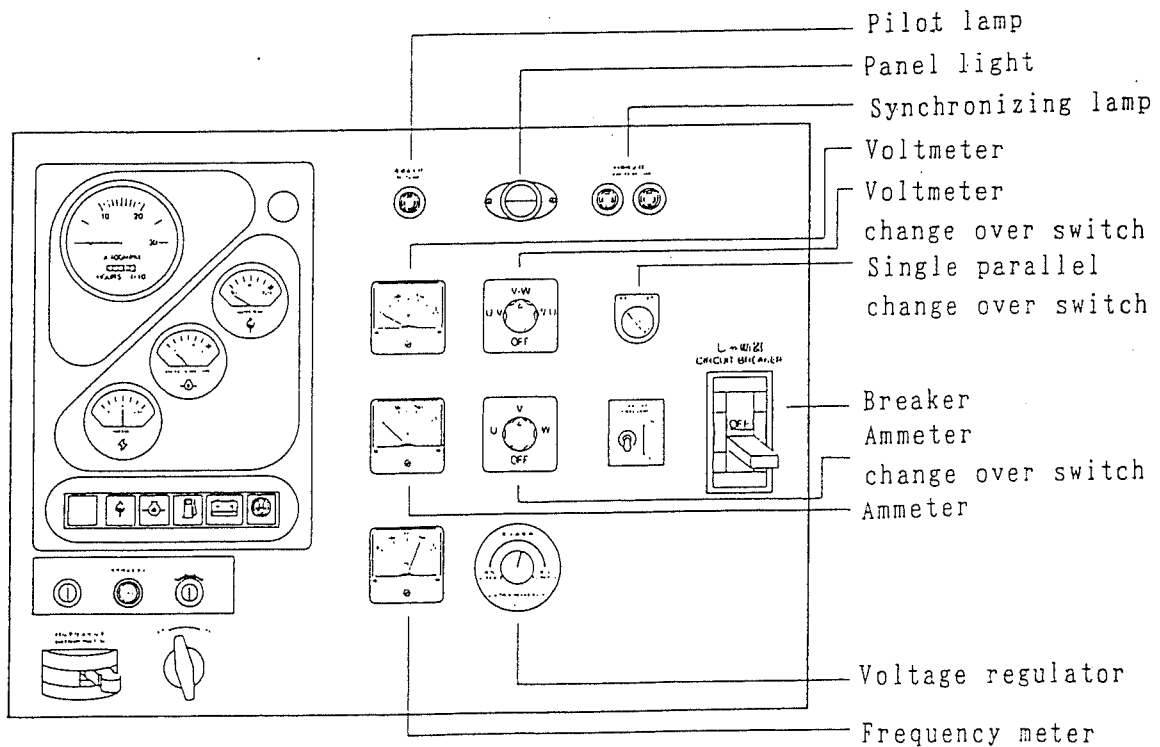
Check the phase sequence with a phase meter.



(2) Change all of their output voltages over to the operating voltage.

(3) Turn the "SINGLE-PARALLEL" change over switches on the control panels of all the generators to "PAR" position.

(4) Turn the breakers of all the generators "OFF".

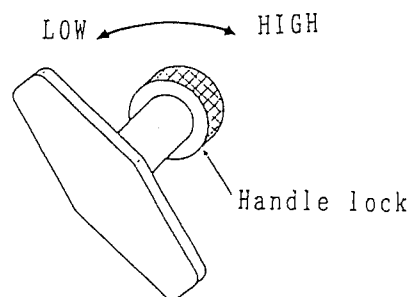


6-2. Operation

- (1) Turn the load breaker "OFF".
- (2) Warm up all the generators.
- (3) Set the all-generator frequency (speed) and voltage to the same values with the throttle handle and voltage regulator, respectively. This setting requires little subsequent adjustment with the voltage regulator.
- (4) Turn the breaker of No.1 generator "ON".
- (5) Adjust the throttle handle so that the synchronizing lamp of No.2 generator goes on and off at intervals of as long as 5 to 10 seconds. Then, turn the breaker of No.2 generator "ON" the moment the synchronizing lamp of this generator goes off for parallel operation. Repeat the same operation to put No.3 and the following generators, if any, in parallel operation.
Note : The synchronizing lamp of No.2 generator goes on and off simultaneously with that of No.1 generator if both are synchronized with each other in the phase sequence. If not, they alternately go on and off. In such cases, reverse any two of connections U , V and W between the generators.
- (6) Note that the generators should have no load applied to them under this condition with no AC current flow.
If the ammeter pointer stands out of "0", mark the zero point adjustment with the voltage regulator.
- (7) Turn on the load switch. If the generators are found not to be uniform in load current, make adjustments by changing the engine speed with the throttle handle. Turn the throttle handle to "HIGH" side to increase the load share and to "LOW" to decrease it.

6-3. Precautions

- (1) Adjust the throttle handle so that the generators are equal in their load shares during parallel operation.
- (2) Turn the lock of the throttle handle lock clockwise to lock the handle so that it won't loosen and turn during operation.



- (3) In operating the generators individually, be sure to turn the "SINGLE - PARA" change over switches to "SINGLE" side.

6-4. Shutdown

- ① Turn the breaker of load "OFF".
- ② Turn the breaker of generator "OFF" respectively.
- ③ Stop the engine respectively, refer to 5-3 Shutdown.

7. STORAGE

7-1. Daily Storage

Store the generator horizontally in a place where it will not be exposed to moisture, salt and dust.

7-2. Long-term Storage

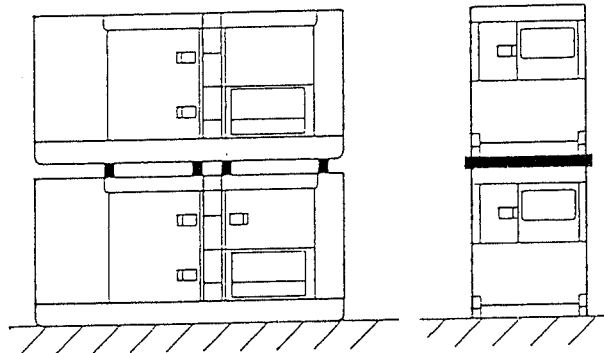
Observe the same precautions as taken for daily storage.

For long-term storage of the engine, refer to "Engine Instruction Manual" supplied by the manufacture.

7-3. Two-tier Stacking of Generators

The generator is designed for two-tier stacking to allow effective place utilization. In stacking the generators in two tiers, observe the following points.

- (1) Stack the generators horizontally on a firm ground.
- (2) Do not stack any machine heavier than this machine.
- (3) Place square bars between the generators as illustrated in the drawing.
- (4) Stack the generators so that the weight of the upper is applied to the lower uniformly.
- (5) In stacking the generators, place one on the other as gently as possible.



8. MAINTENANCE AND INSPECTION

8-1. Bearing

Sealed type bearing is provided so that it requires no maintenance. And thermo label is provided to facilitate inspection for the bearing. When the thermo label is changed from "white" to "dark brown" by high temperature, it shows that the bearing should be replaced.

8-2. Generator

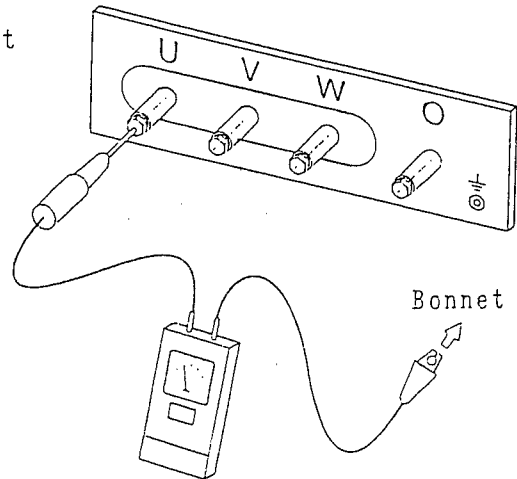
(1) Insulation Resistance

Measure the insulation resistance with a 500V-megger at least once every month to check for not less than 1 M Ω .

* Measuring method and allowable limit

As illustrated in the following drawing, remove the load-side wire from the output terminal block, turn the breaker "ON" and measure the insulation resistance between the output terminal bolt and bonnet.

If the insulation resistance thus measured is found to be 1 M Ω or below, repair the trouble spot to prevent electrocution and fire.



8-3. Control Box

Check the measuring instruments for normal operation.

8-4. Engine

Perform daily and periodic inspections according to the attached "Engine Instruction Manual".

8-5. Table of maintenance and inspection

◇:Check or Clean ○:Exchange ☆:Only first time

	List of maintenance and inspection	daily	first 50h	every 250h	every 500h	every 1000h	every 2year
Engine	Check oil level and stain of oil	◇					
	Check cooling water	◇					○
	Check fan belt	◇					
	Check fuel and drain	◇		◇			
	Check battery fluid level	◇					
	Check for water and oil leakage	◇					
	Check bolts and nuts for looseness	◇					
	Check exhaust color, sound and vibration	◇					
	Check meters and warning lamps	◇					
	Replenish oil		☆○	○			
	Exchange oil filter cartridge		☆○	○			
	Clean air cleaner element			◇			
	Check specific gravity of battery			◇			
	Clean radiator				◇		
	Exchange fuel filter cartridge				○		
	Clean fuel tank					◇	
	Exchange air cleaner element					○	
	※Check engine valve clearance				☆◇		◇
	※Adjust fuel injection nozzle						◇
	※Check timing of fuel injection						◇
Check rubber suspension						◇	
Check nylon and rubber hose						◇	
Check lining						◇	
Generator	Check generator case grounding	◇					
	Check insulation resistance			◇			
	Check terminal and connected section				◇		

※ Contact our service plant.

☆ This symbol represent first time of inspection, next time is ordinary cycle.

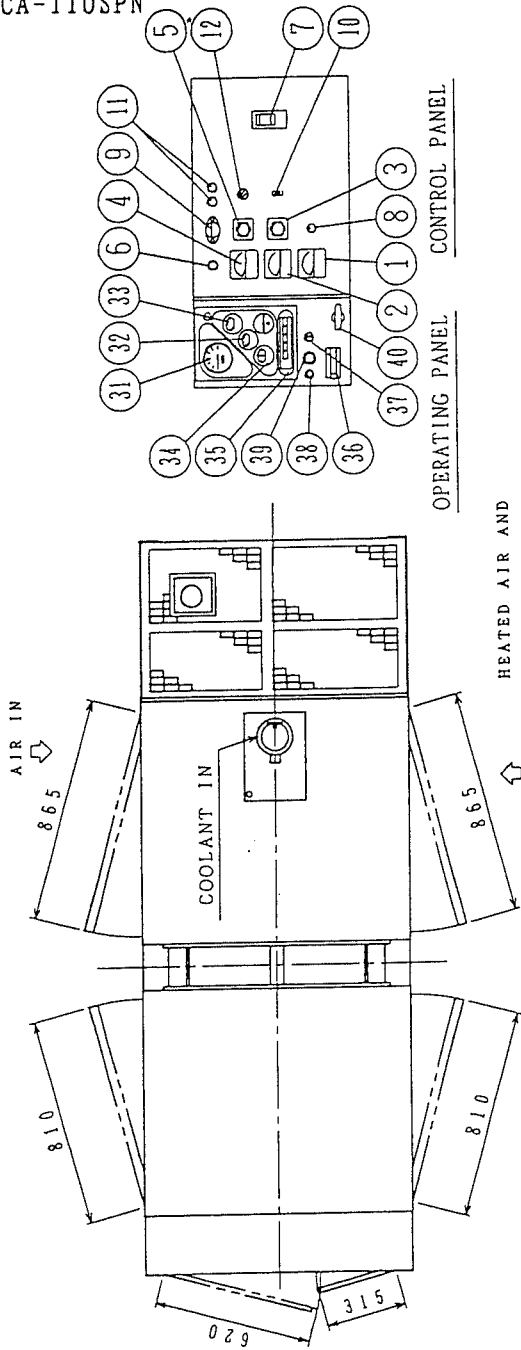
Note: Inspection time is different by the engine, in detail, please refer "Engine Instruction Manual" supplied by the engine manufacture.

9. TROUBLESHOOTING

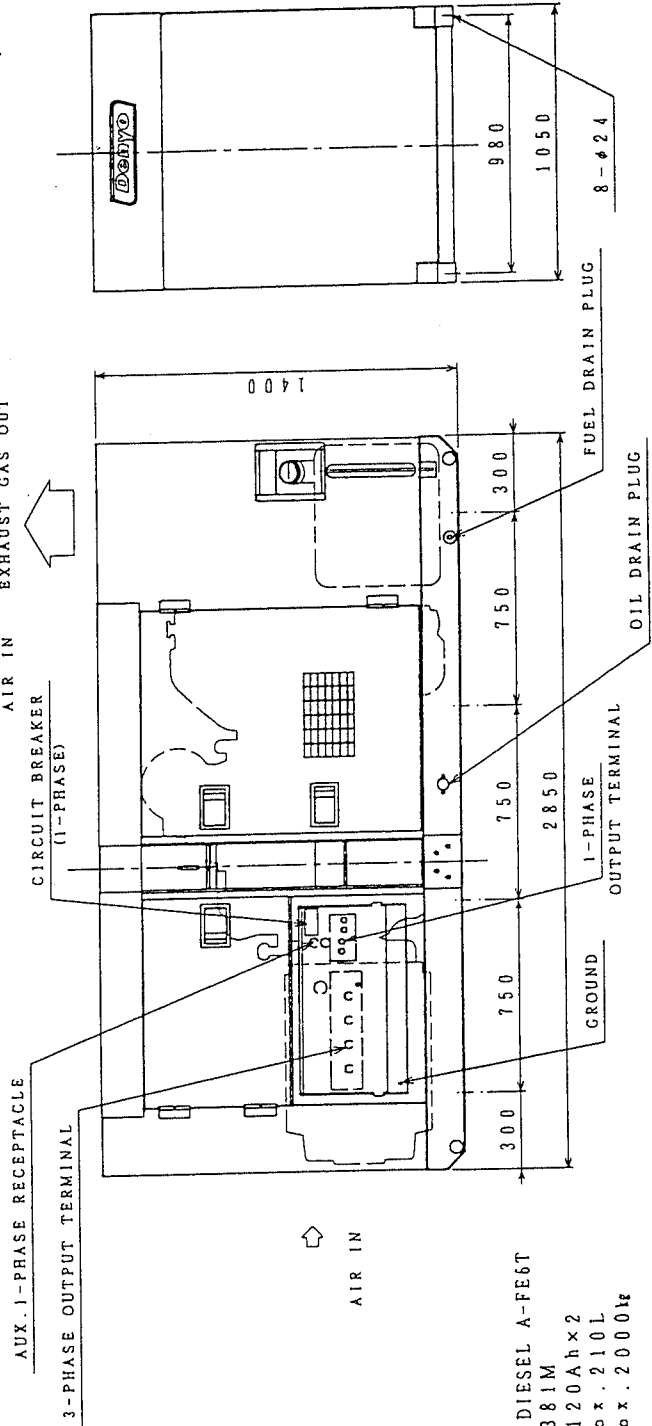
Phenomenon		Assumed cause	Action
Engine will not start up	Cell motor will not run or revolution speed is low	Improper grounding	Repair
		Detached or loosened or corroded battery terminal	Repair
		Battery switch set at OFF position	Turn ON
		Discharged battery	Charge or Replace
		Improper starter switch	Replace
		Improper starter	Replace
		Broken lead wire	Repair
	Cell motor runs	Governor malfunction	To service plant
		Fuel shortage	Supply
		Blinded fuel filter	Replace element
Air in fuel system		Remove	
Speed will not rise	Compression failure	Repair engine	
	Air in fuel system	Remove	
	Blinded fuel filter	Replace element	
	Clogged air cleaner	Replace element	
Engine stop by oil failure	Oil shortage	Supply	
	Oil pressure switch failure	Replace	
	Blinded oil filter	Replace element	
Over heat	Cooling water shortage	Supply	
	Fan belt looseness	Adjust	
	Blinded core of radiator	Clean	
	Engine thermostat failure	Repair	
Voltmeter will not operate	Voltmeter failure	Replace	
	AVR failure	To service plant	
	Burned ZNR (except 180SPKⅡ, K3) or resistor to discharge (180SPKⅡ, K3)		
	Quenched residual magnetism		
	Burned rotary rectifier		
	Disconnected rotor wiring		
Burned generator wiring			
Rated voltage will not be reached	Voltmeter failure	Replace	
	AVR failure	To service plant	
	VR failure		
	Burned rotary rectifier		
	Burned ZNR (except 180SPKⅡ, K3) or resistor to discharge (180SPKⅡ, K3)		
	Burned generator wiring		
	Low speed	Increase	

Phenomenon	Assumed cause	Action
Voltage goes too high	Voltmeter failure	Replace
	AVR failure	To service plant
	VR failure	
Applied load causes large voltage drop	Burned rotary rectifier	To service plant
	AVR failure	
	Burned main field, exciter field wiring	
	Unbalanced load	Balance

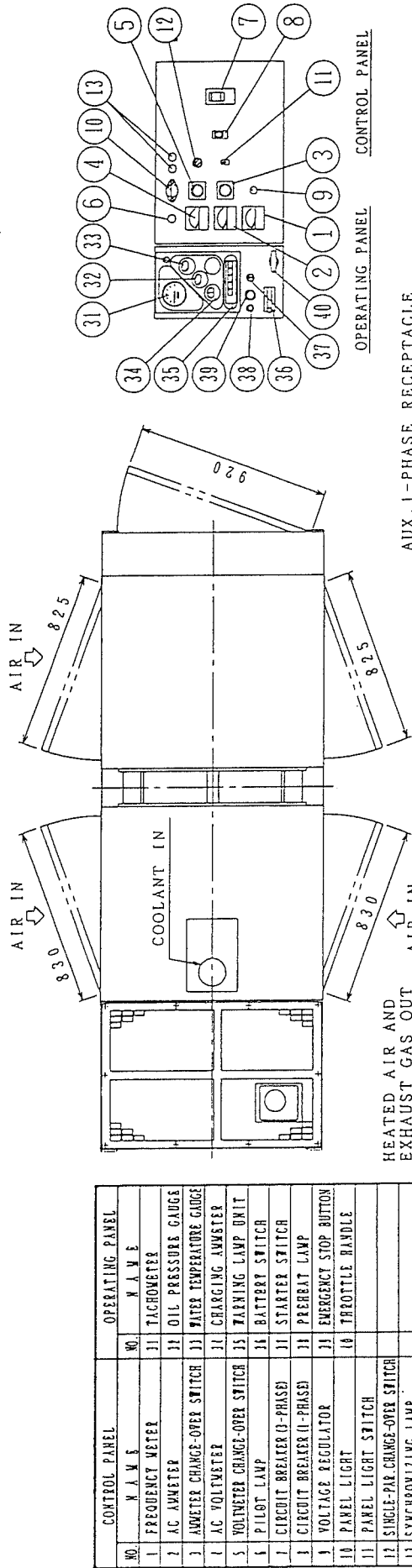
1 O. OUTLINE DRAWING
DCA-110SPN



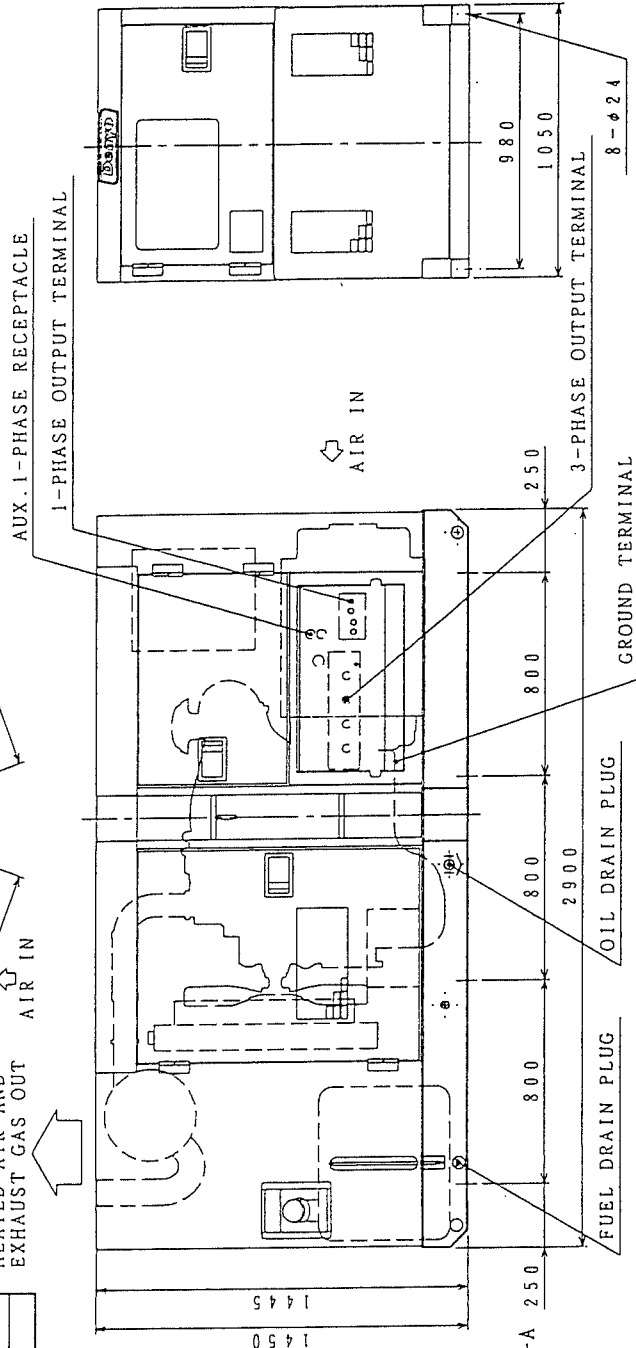
CONTROL PANEL		OPERATING PANEL		
NO	A M E	NO.	N A M	E
1	FREQUENCY METER	3 1	TACHOMETER	
2	AC AMPMETER	3 2	OIL PRESSURE GAUGE	
3	AMMETER CHANGE-OVER SWITCH	3 3	WATER TEMP. GAUGE	
4	AC VOLTMETER	3 4	CHARGING AMMETER	
5	VOLTMETER CHANGE-OVER SWITCH	3 5	WARNING LAMP UNIT	
6	PILOT LAMP	3 6	BATTERY SWITCH	
7	CIRCUIT BREAKER	3 7	STARTER SWITCH	
8	VOLTAGE REGULATOR	3 8	PREHEAT LAMP	
9	PANEL LIGHT	3 9	EMERGENCY STOP BUTTON	
1 0	PANEL LIGHT SWITCH	4 0	THROTTLE HANDLS	
1 1	SYNCHRONIZING LAMP			
1 2	SINGLE PHASE CHANGE-OVER SWITCH			



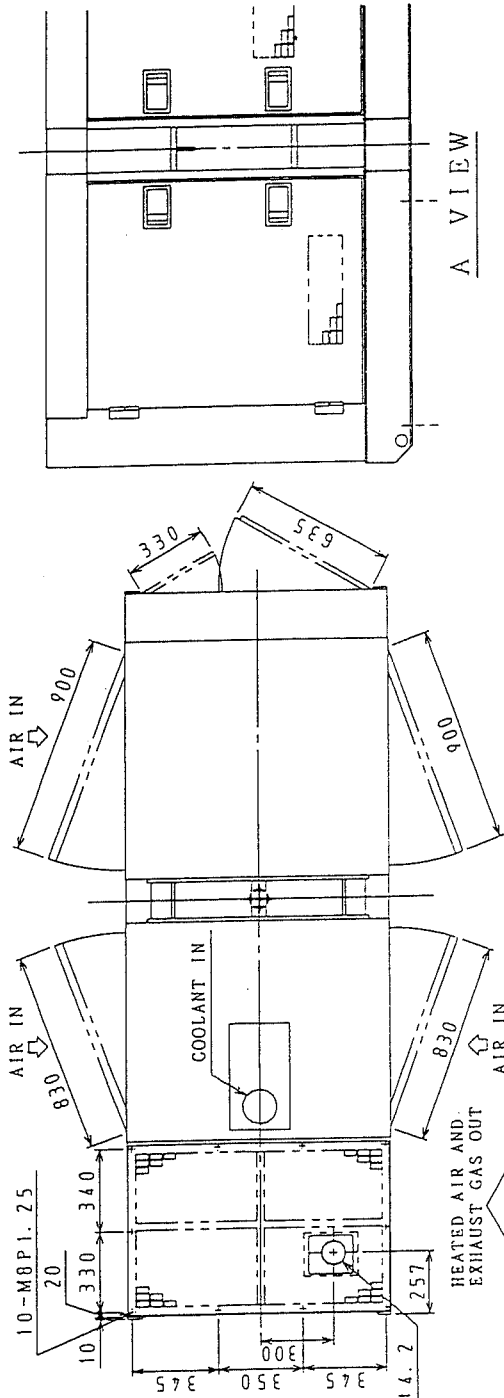
ENGINE : NISSAN DIESEL A-FE6T
 GENERATOR : DB-1381M
 BATTERY : 12V-120Ahx2
 FUEL TANK : Approx. 210L
 DRY WEIGHT : Approx. 2000kg



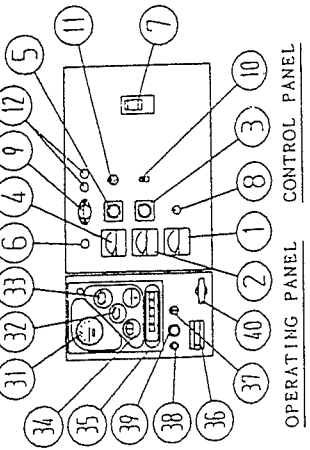
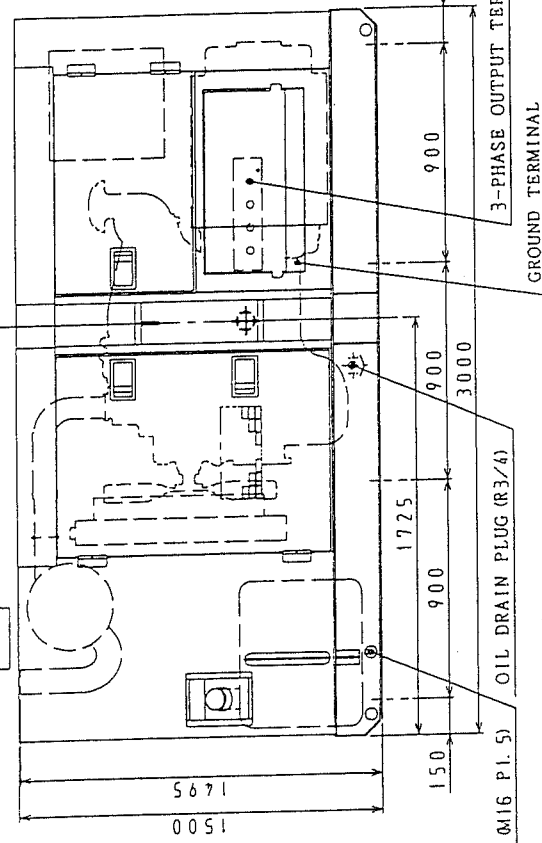
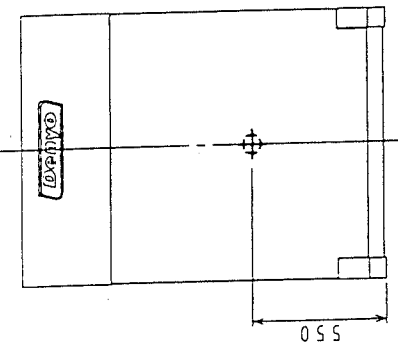
CONTROL PANEL		OPERATING PANEL	
NO.	N.A.M.E.	NO.	N.A.M.E.
1	FREQUENCY METER	31	TACHOMETER
2	AC AMMETER	32	FUEL GAUGE
3	AMMETER CHANGE-OVER SWITCH	33	FUEL GAUGE SWITCH
4	AC VOLTMETER	34	FUEL GAUGE LIGHT
5	VOLTMETER CHANGE-OVER SWITCH	35	FUEL GAUGE LIGHT SWITCH
6	PILOT LAMP	36	FUEL GAUGE LIGHT SWITCH
7	CIRCUIT BREAKER (3-PHASE)	37	FUEL GAUGE LIGHT SWITCH
8	CIRCUIT BREAKER (1-PHASE)	38	FUEL GAUGE LIGHT SWITCH
9	VOLTAGE REGULATOR	39	FUEL GAUGE LIGHT SWITCH
10	PANEL LIGHT	40	FUEL GAUGE LIGHT SWITCH
11	PANEL LIGHT SWITCH		
12	SINGLE-PHASE CHANGE-OVER SWITCH		
13	SYNCHRONIZING LAMP		



ENGINE : KOMATSU S6D102E-1-A 250
 GENERATOR : DB-1381K
 BATTERY : 12V-70Ahx2
 FUEL TANK : Approx. 240 L
 DRY WEIGHT : Approx. 2020tr

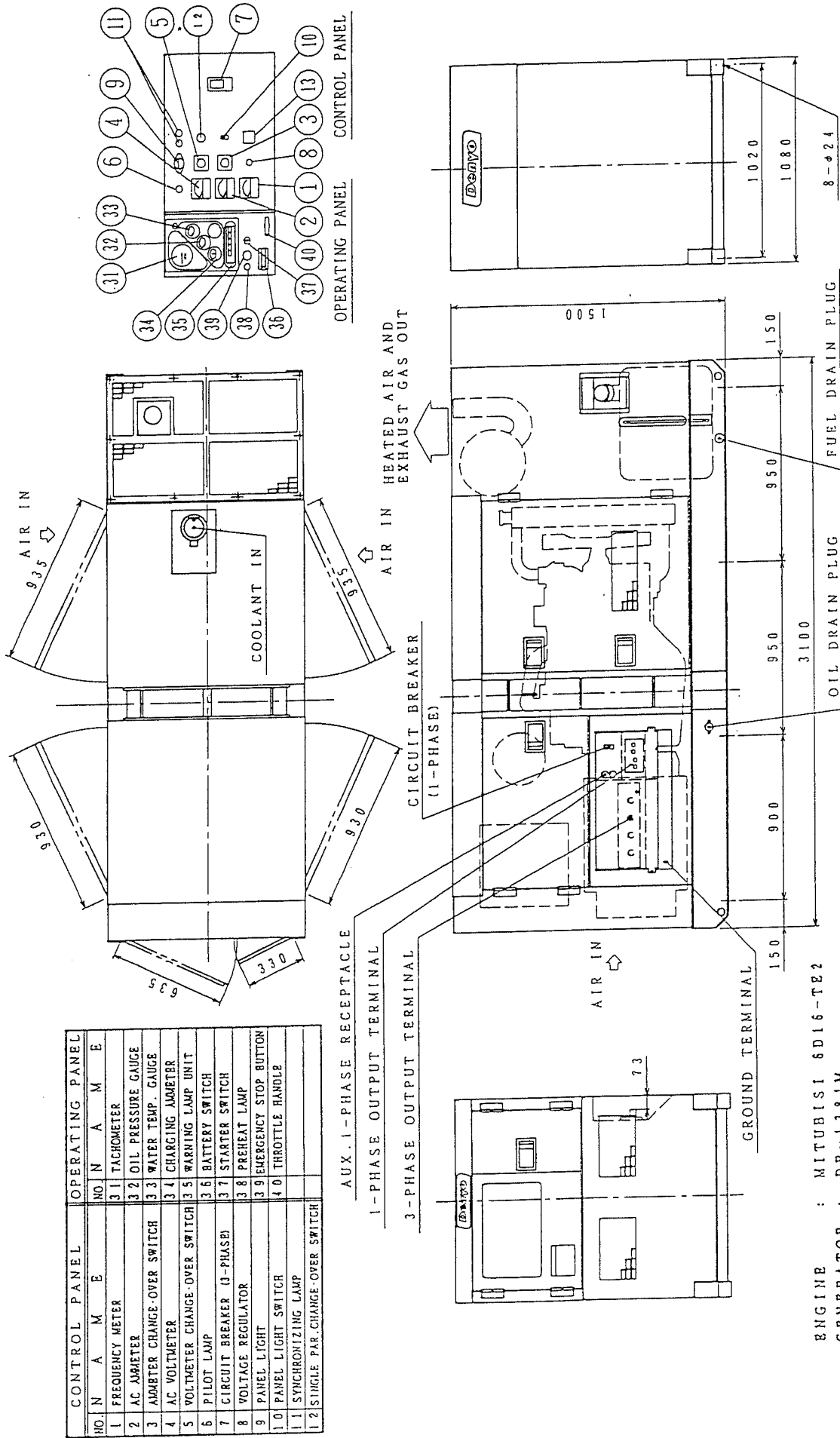


A VIEW



ENGINE : KOMATSU SA6D102E-1-A
 GENERATOR : DB-1381K
 BATTERY : 95E41R×2
 FUEL TANK : Approx. 250 L
 DRY WEIGHT : Approx. 2120 kg

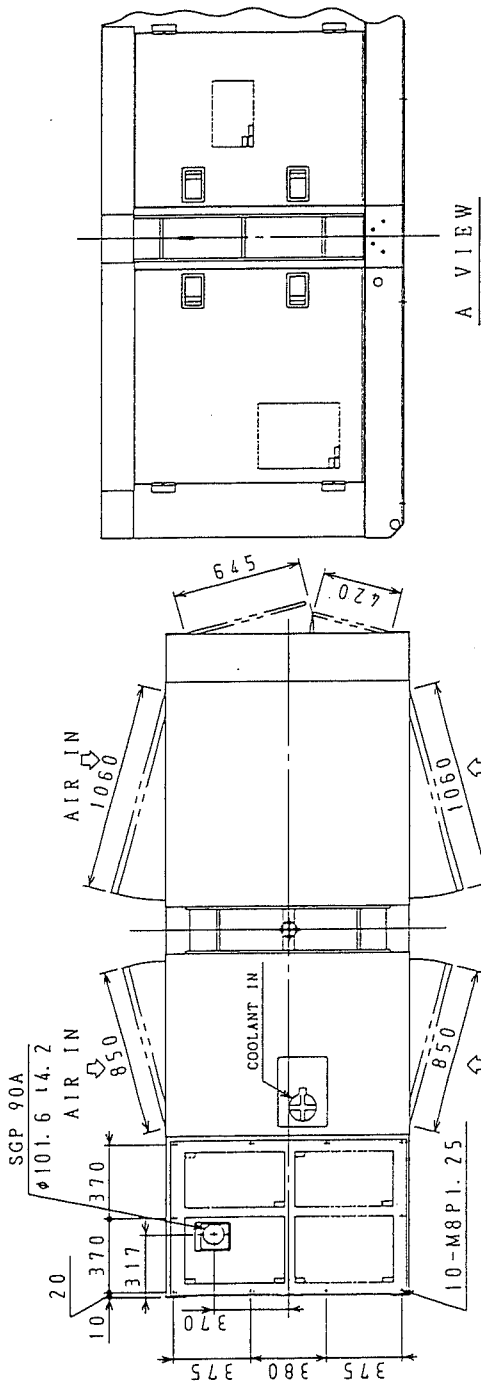
CONTROL PANEL		OPERATING PANEL	
10	N A M E	10	N A M E
1	FREQUENCY METER	31	TACHOMETER
2	AC AMMETER	32	OIL PRESSURE GAUGE
3	AMMETER CHANGE-OVER SWITCH	33	WATER TEMPERATURE GAUGE
4	AC VOLTMETER	34	CHARGING AMMETER
5	VOLTMETER CHANGE-OVER SWITCH	35	WARNING LAMP UNIT
6	PILOT LAMP	36	BATTERY SWITCH
7	CIRCUIT BREAKER (3-PHASE)	37	STARTER SWITCH
8	VOLTAGE REGULATOR	38	PREHEAT LAMP
9	PANEL LIGHT	39	EMERGENCY STOP BUTTON
10	PANEL LIGHT SWITCH	40	THROTTLE HANDLE
11	SINGLE PHASE CHANGE-OVER SWITCH		
12	SYNCHRONIZING LAMP		



CONTROL PANEL		OPERATING PANEL	
NO.	A M E	NO.	A M E
1	FREQUENCY METER	31	TACHOMETER
2	AC AMMETER	32	OIL PRESSURE GAUGE
3	AMMETER CHANGE-OVER SWITCH	33	WATER TEMP. GAUGE
4	AC VOLTMETER	34	CHARGING AMMETER
5	VOLTMETER CHANGE-OVER SWITCH	35	WARNING LAMP UNIT
6	PILOT LAMP	36	BATTERY SWITCH
7	CIRCUIT BREAKER (3-PHASE)	37	STARTER SWITCH
8	VOLTAGE REGULATOR	38	PREHEAT LAMP
9	PANEL LIGHT	39	EMERGENCY STOP BUTTON
10	SYNCHRONIZING LAMP	40	THROTTLE HANDLE
11	SINGLE PAR. CHANGE-OVER SWITCH		

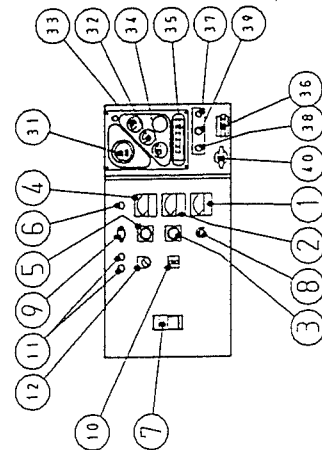
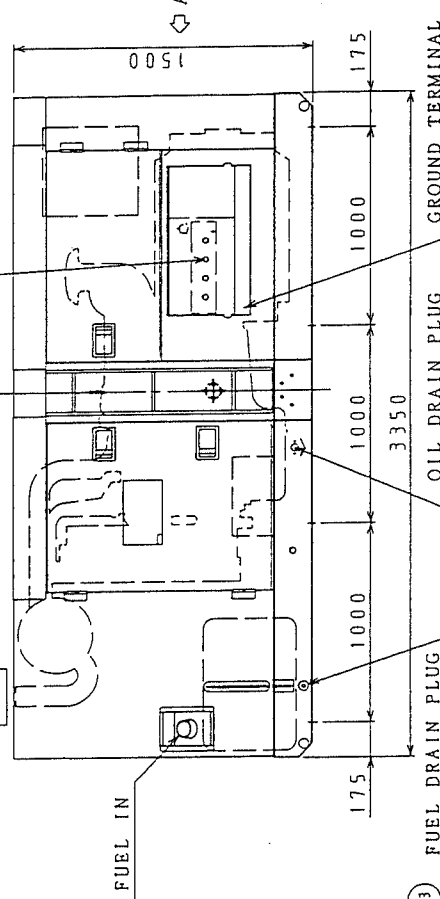
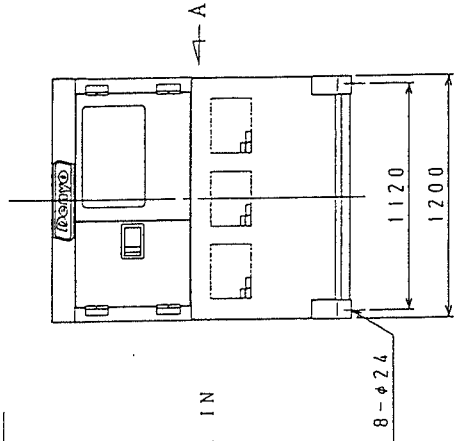
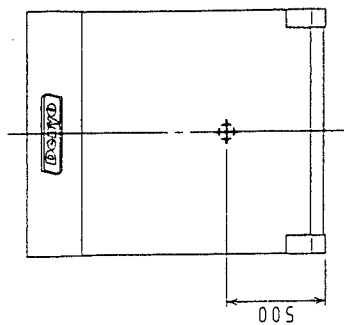
ENGINE : MITSUBISHI 6DI6-TE2
 GENERATOR : DB-1381M
 BATTERY : 12V-100Ahx2
 FUEL TANK : Approx. 250 L
 DRY WEIGHT : Approx. 2180 kg

CONTROL PANEL		OPERATING PANEL	
N.	A M E	N.	A M E
1	FREQUENCY METER	31	TACHOMETER
2	AC AMMETER	32	OIL PRESSURE GAUGE
3	AMMETER CHANGE-OVER SWITCH	33	WATER TEMP. GAUGE
4	AC VOLTMETER	34	CHARGING AMMETER
5	VOLTMETER CHANGE-OVER SWITCH	35	WARNING LAMP UNIT
6	PILOT LAMP	36	BATTERY SWITCH
7	CIRCUIT BREAKER	37	STARTER SWITCH
8	VOLTAGE REGULATOR	38	PREHEAT LAMP
10	PANEL LIGHT	39	EMERGENCY STOP BUTTON
11	SYNCHRONIZING LAMP	40	THROTTLE HANDLE
12	SINGLE PAR. CHANGE-OVER SWITCH		



A VIEW

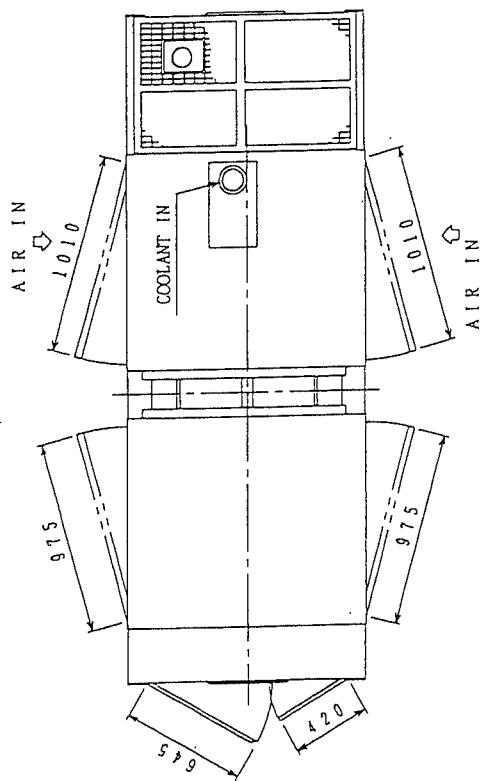
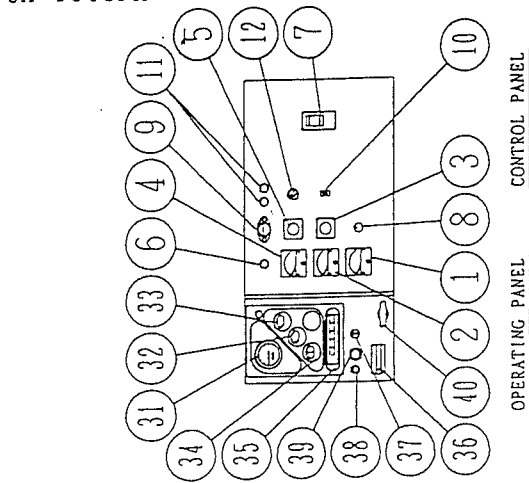
HEATED AIR AND AIR IN
EXHAUST GAS OUT



CONTROL PANEL OPERATING PANEL

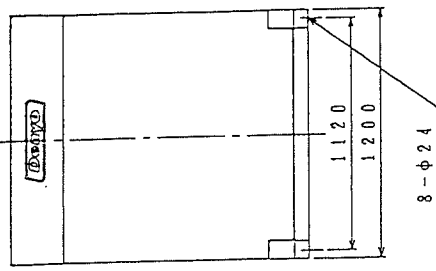
ENGINE : KOMATSU S6D108E-2-A
 GENERATOR : DB-1651K
 BATTERY : 95E41R×2
 FUEL TANK : Approx. 250L
 DRY WEIGHT : Approx. 2740kg

⊕: CENTER OF GRAVITY

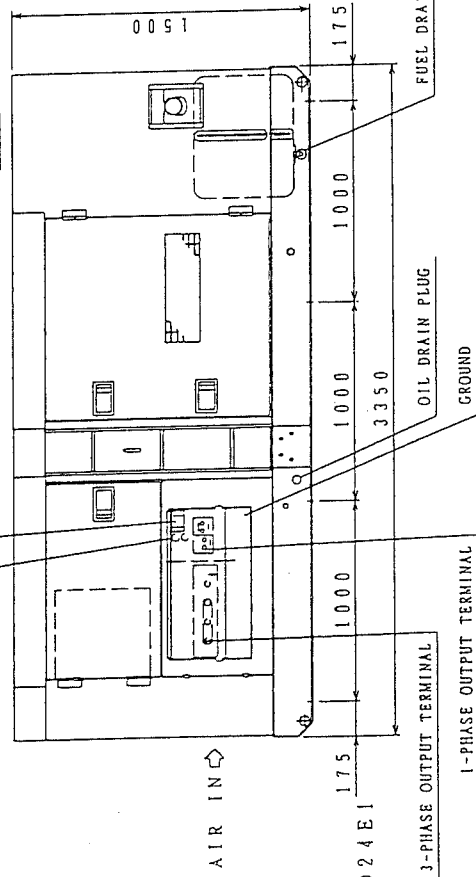


HEATED AIR AND EXHAUST GAS OUT

OPERATING PANEL CONTROL PANEL

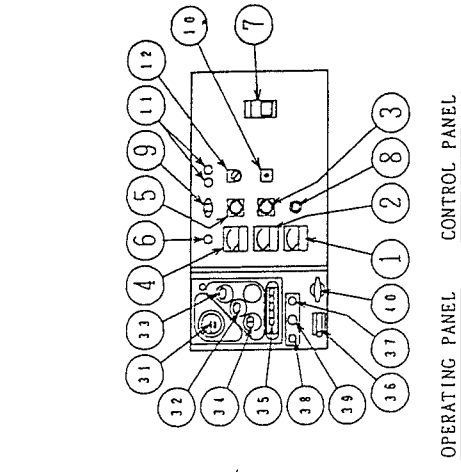


AUX. 1-PHASE RECEPTACLE CIRCUIT BREAKER (1-PHASE)

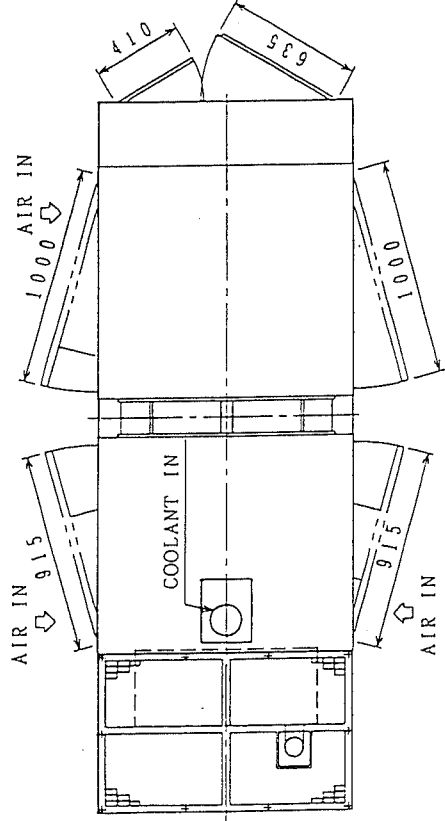


CONTROL PANEL		OPERATING PANEL			
NO.	A M E	NO.	N A M E		
1	FREQUENCY METER	31	TACHOMETER		
2	AC AMMETER	32	OIL PRESSURE GAUGE		
3	AMMETER CHANGE-OVER SWITCH	33	WATER TEMP. GAUGE		
4	AC VOLT-METER	34	CHARGING AMMETER		
5	VOLTMETER CHANGE-OVER SWITCH	35	WARNING LAMP UNIT		
6	PILOT LAMP	36	BATTERY SWITCH		
7	CIRCUIT BREAKER	37	STARTER SWITCH		
8	VOLTAGE REGULATOR	38	PREHEAT LAMP		
9	PANEL LIGHT	39	EMERGENCY STOP BUTTON		
10	PANEL LIGHT SWITCH	40	THROTTLE HANDLE		
11	SYNCHRONIZING LAMP				
12	SINGLE PAR. CHANGE-OVER SWITCH				

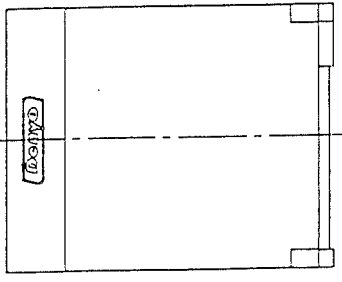
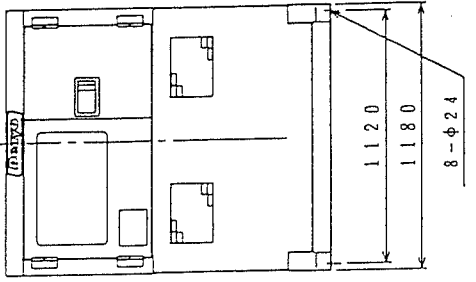
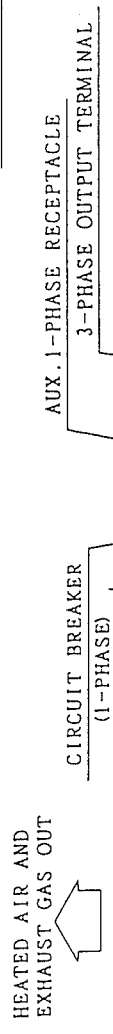
ENGINE : MITSUBISHI 6D24E1
 GENERATOR : DB-1651M
 BATTERY : 12V-150Ah x 2
 FUEL TANK : Approx. 250L
 DRY WEIGHT : Approx. 2900kg



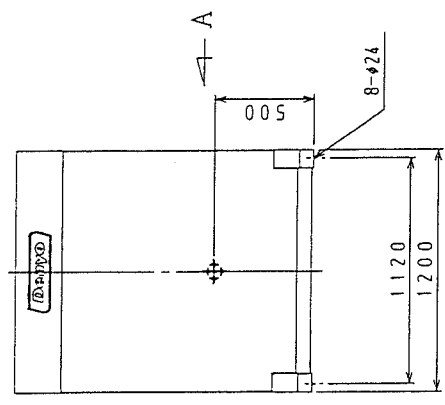
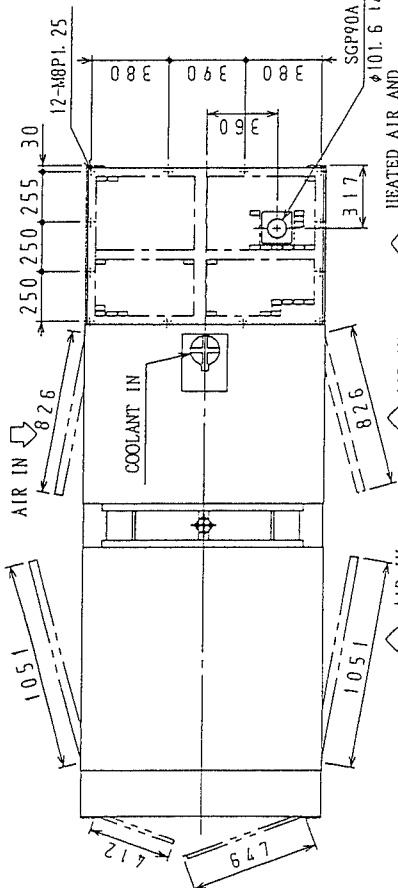
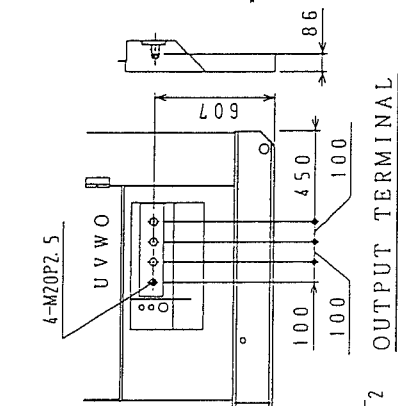
OPERATING PANEL CONTROL PANEL



CONTROL PANEL		OPERATING PANEL	
NO.	N A M E	NO.	N A M E
1	FREQUENCY METER	31	TACHOMETER
2	AC AMMETER	32	OIL PRESSURE GAUGE
3	AMMETER CHANGE-OVER SWITCH	33	WATER TEMP. GAUGE
4	AC VOLTMETER	34	CHARGING AMMETER
5	VOLTMETER CHANGE-OVER SWITCH	35	WARNING LAMP UNIT
6	PILOT LAMP	36	BATTERY SWITCH
7	CIRCUIT BREAKER	37	STARTER SWITCH
8	VOLTAGE REGULATOR	38	PREHEAT LAMP
9	PANEL LIGHT	39	EMERGENCY STOP BUTTON
10	PANEL LIGHT SWITCH	40	THROTTLE HANDLE
11	SYNCHRONIZING LAMP		
12	SINGLE PAR. CHANGE-OVER SWITCH		



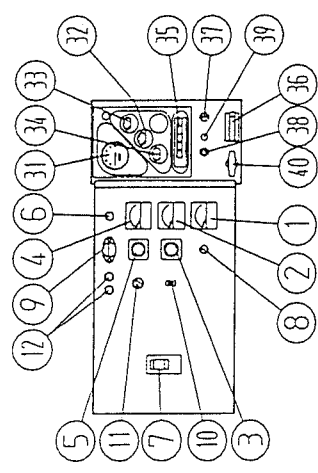
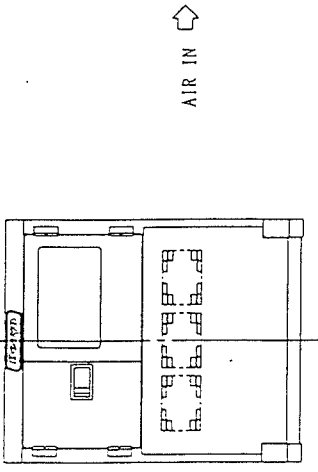
ENGINE : HINO M10C-TB
 GENERATOR : DB-1651H
 BATTERY : 12V-100Ah x 2
 FUEL TANK : Approx. 250L
 DRY WEIGHT : Approx. 2500kg



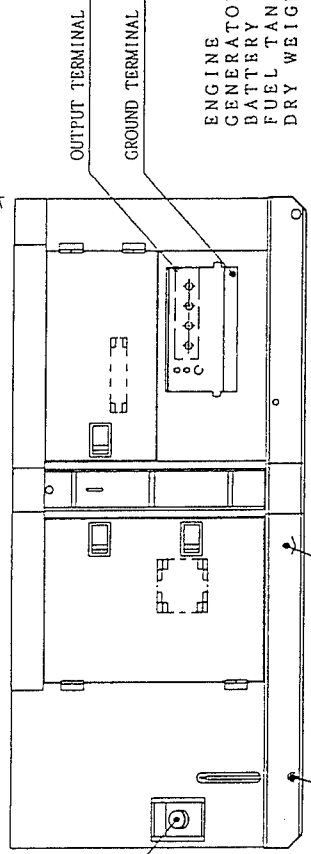
⊕ : CENTER OF GRAVITY

ENGINE : KOMATSU SA6D108E-2-A
 GENERATOR : DF-1950K
 BATTERY : 115F51x2
 FUEL TANK : Approx. 300 L
 DRY WEIGHT : Approx. 2900 kg

CONTROL PANEL		OPERATING PANEL	
NO.	N A M E	NO.	N A M E
1	FREQUENCY METER	31	TACHOMETER
2	AC AMMETER	32	OIL PRESSURE GAUGE
3	AMMETER CHANGE-OVER SWITCH	33	WATER TEMPERATURE GAUGE
4	AC VOLTMETER	34	CHARGING AMMETER
5	VOLTMETER CHANGE-OVER SWITCH	35	WARNING LAMP BHIT
6	PILOT LAMP	36	BATTERY SWITCH
7	CIRCUIT BREAKER (3-PHASE)	37	STARTER SWITCH
8	VOLTAGE REGULATOR	38	PREHEAT LAMP
9	PANEL LIGHT	39	EMERGENCY STOP BUTTON
10	PANEL LIGHT SWITCH	40	THROTTLE HANDLS
11	SINGLE PHASE CHANGE-OVER SWITCH		
12	SYNCHRONIZING LAMP		



CONTROL PANEL OPERATING PANEL

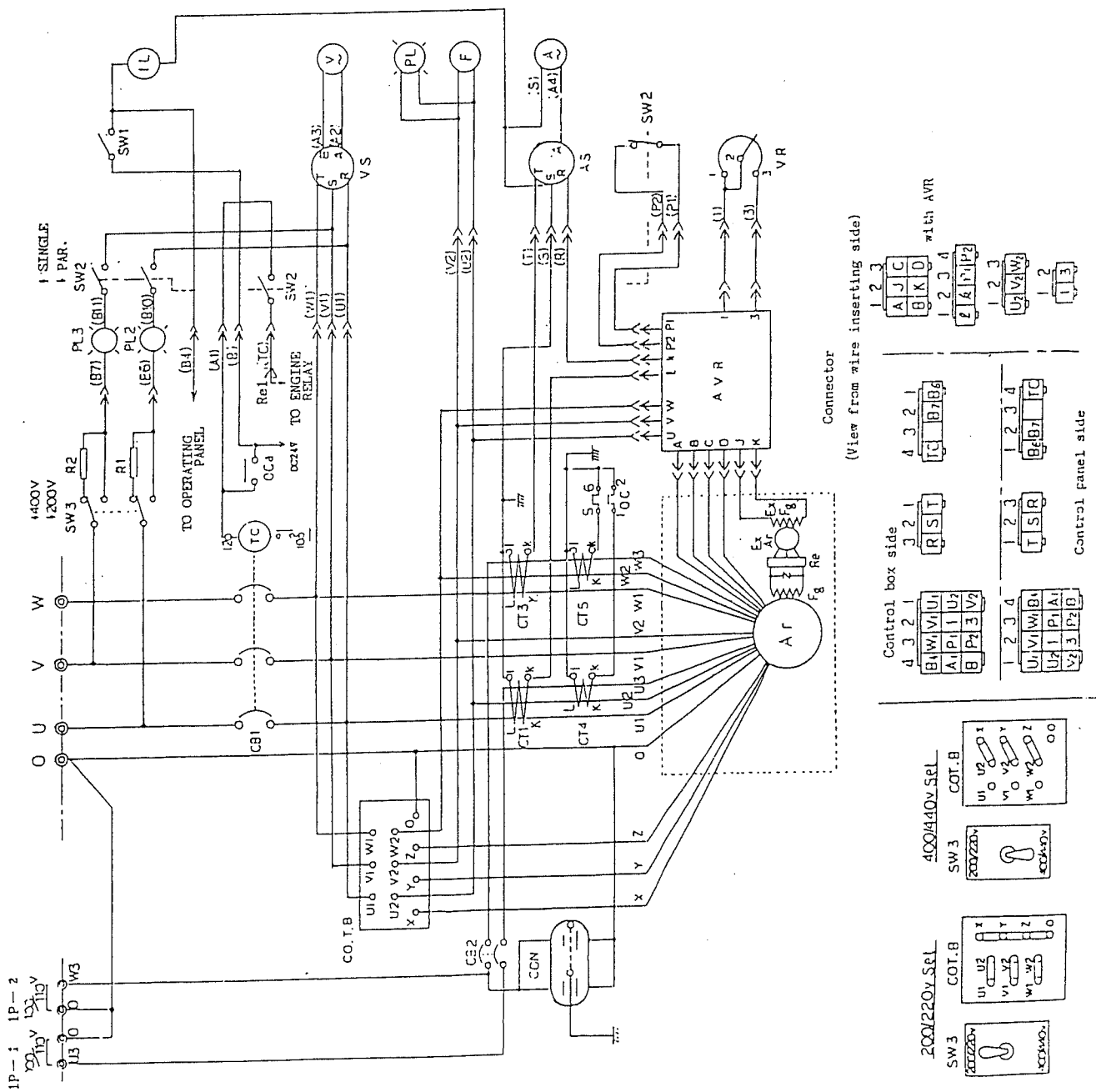


A VIEW

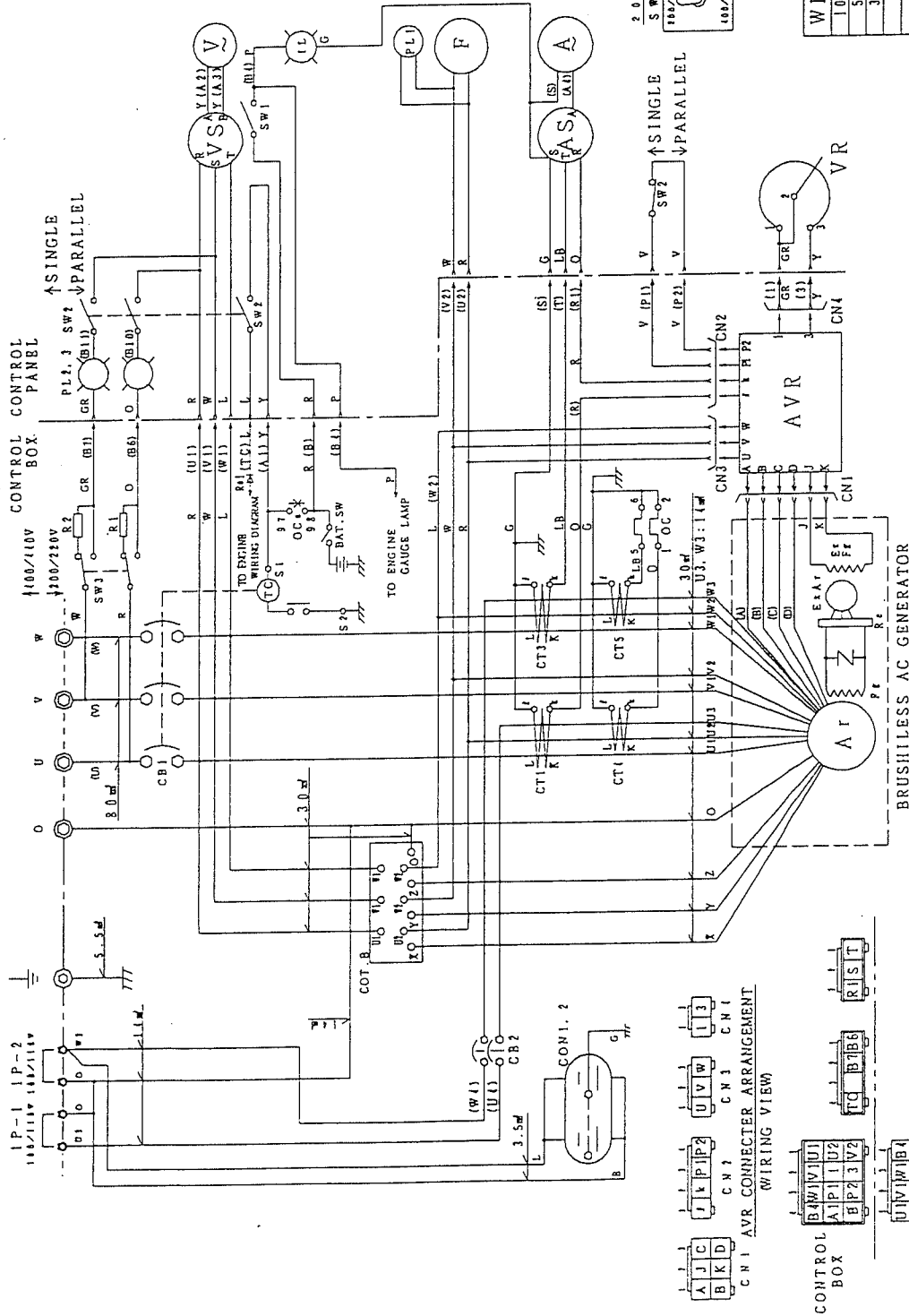
1 1. GENERATOR CONNECTION DIAGRAM

DCA-110SP

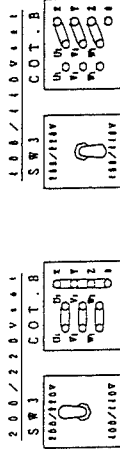
MARK	NAME
Ar	MAIN GENERATOR ARMATURE WINDING
Fg	MAIN GENERATOR FIELD WINDING
Ex.Ar	EXCITER ARMATURE WINDING
Ex.Fg	EXCITER FIELD WINDING
Re	RECTIFIER
AVR	AUTOMATIC VOLTAGE REGULATOR
VR	VOLTAGE REGULATING RHEOSTAT
CT1,3	CURRENT TRANSFORMER 400/5 A
CT4,5	CURRENT TRANSFORMER 250/5 A
OC	OVER CURRENT RELAY
Re1	RECTIFIER
R1,2	RESISTOR
AS	ANNMETER CHANGE-OVER SWITCH
V	A.C. ANNEMETER 0~200,0~400 A
VS	VOLTMETER CHANGE-OVER SWITCH
V	A.C. VOLTMETER 0-600V
F	FREQUENCY METER 45-65Hz
PL1	PILOTLAMP
PL2,3	SYNCHRONIZING LAMP
CB1	CIRCUIT BREAKER 300 A
CB2	CIRCUIT BREAKER 1 φ 100A
COM	RECEPTACLE 1 φ
SW1	PANEL LIGHT SWITCH
SW2	SINGLE PAR. CHANGE-OVER SWITCH
SW3	VOLTAGE CHANGE-OVER SWITCH
IL	PANEL LIGHT



MARK	N A M E
AT	MAIN GENERATOR ARMATURE WINDING
FT	MAIN GENERATOR FIELD WINDING
EAT	EXCITER ARMATURE WINDING
BEPE	EXCITER FIELD WINDING
RE	RECTIFIER
CB1	CIRCUIT BREAKER (I-PHASE) 350A
PL2.3	SYNCHRONIZING LAMP
SW2	SYNGLE PAR. CHANGE-OVER SWITCH
RL.3	RESISTOR
SW3	VOLTAGE CHANGE-OVER SWITCH
CR2	CIRCUIT BREAKER (I-PHASE) 100A
CON.3	AUX POWER RECEPTACLE
CT1.3	CURRENT TRANSFORMER 100/5A
CT4.5	CURRENT TRANSFORMER 100/5A
OC	OVER CURRENT RELAY
V	AC. VOLTMETER 0 ~ 600V
VS	VOLTMETER CHANGE-OVER SWITCH
A	AC. ADJUSTER 0 ~ 100. 100A
AS	AMMETER CHANGE-OVER SWITCH
P	FREQUENCY METER 15 ~ 65Hz
PL1	PILOT LAMP
AVR	AUTOMATIC VOLTAGE REGULATOR
VR	VOLTAGE REGULATING RHODSTAT
IL	PANBL LIGHT
COT. B	VOLTAGE CHANGE-OVER BOARD
RE1	RECTIFIER
SW1	PANBL LIGHT SWITCH

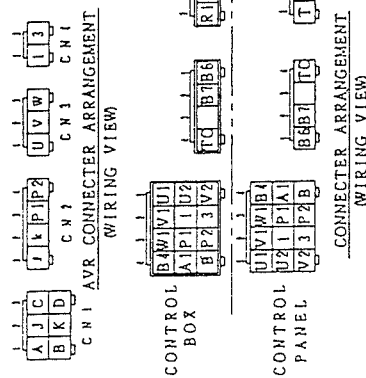


VOLTAGE CHANGE OVER BOARD



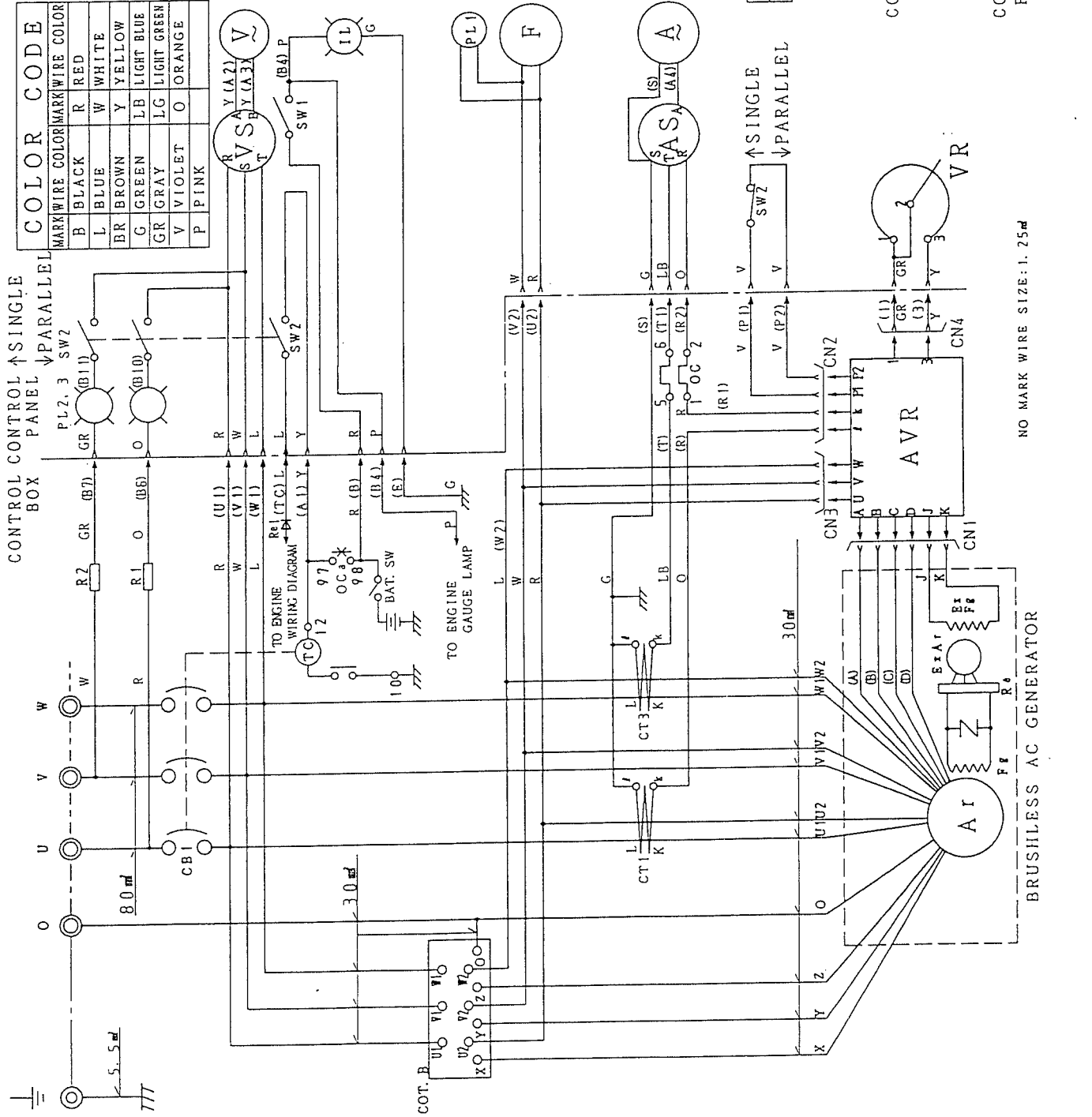
NO MARK WIRE SIZE: 1.25#

WIRE SIZE	COLOR CODE
100: 100#	MAIN WIRE COLOR WIRE COLOR
50: 50#	B BLACK R RED
38: 38#	L BLUE W WHITE
2: 2#	BR BROWN Y YELLOW
	G GREEN LB LIGHT BLUE
	GR GRAY LG LIGHT GREEN
NO MARK WIRE SIZE	V VIOLET O ORANGE
1.25#	P PINK



MARK	N A M E
AT	MAIN GENERATOR ARMATURE WINDING
FG	MAIN GENERATOR FIELD WINDING
Ex. At	EXCITER ARMATURE WINDING
Ex. Fg	EXCITER FIELD WINDING
Re	RECTIFIER
CBI	CIRCUIT BREAKER (3-PHASE) 350A
PLZ.3	SYNCHRONIZING LAMP
SWZ	SINGLE-PAR. CHANGES-OVER SWITCH
R.I.2	RESISTOR
CTI.3	CURRENT TRANSFORMER 500/5A
OC	OVER CURRENT RELAY
V	AC. VOLTMETER 0~600V
VS	VOLTMETER CHANGE-OVER SWITCH
A	AC. AMMETER 0~250.500A
AS	AMMETER CHANGE-OVER SWITCH
F	FREQUENCY METER 45~65Hz
PLI	PILOT LAMP
AVR	AUTOMATIC VOLTAGE REGULATOR
VR	VOLTAGE REGULATOR
IL	PANEL LIGHT
COT. B	VOLTAGE CHANGE BOARD
Re1	RECTIFIER
SWI	PANEL LIGHT SWITCH

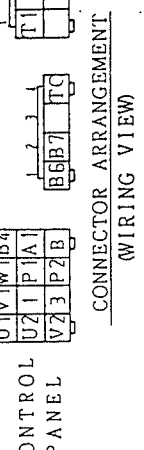
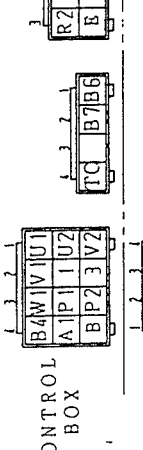
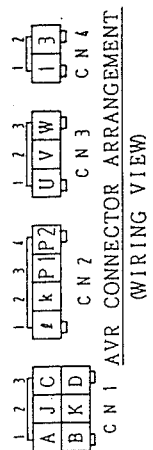
COLOR CODE	
MARK WIRE COLOR	MARK WIRE COLOR
B	BLACK
L	BLUE
BR	BROWN
G	GREEN
GR	GRAY
V	VIOLET
P	PINK
R	RED
W	WHITE
Y	YELLOW
LB	LIGHT BLUE
LG	LIGHT GREEN
O	ORANGE



4 0 0 / 4 4 0 V s e t 2 0 0 / 2 2 0 V s e t

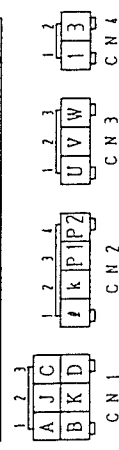


VOLTAGE CHANGE BOARD

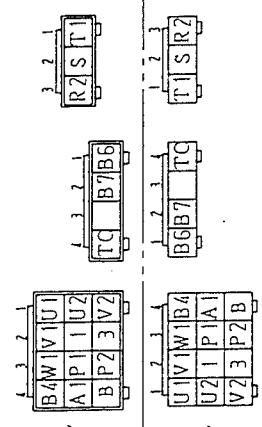


NO MARK WIRE SIZE: 1.25mm

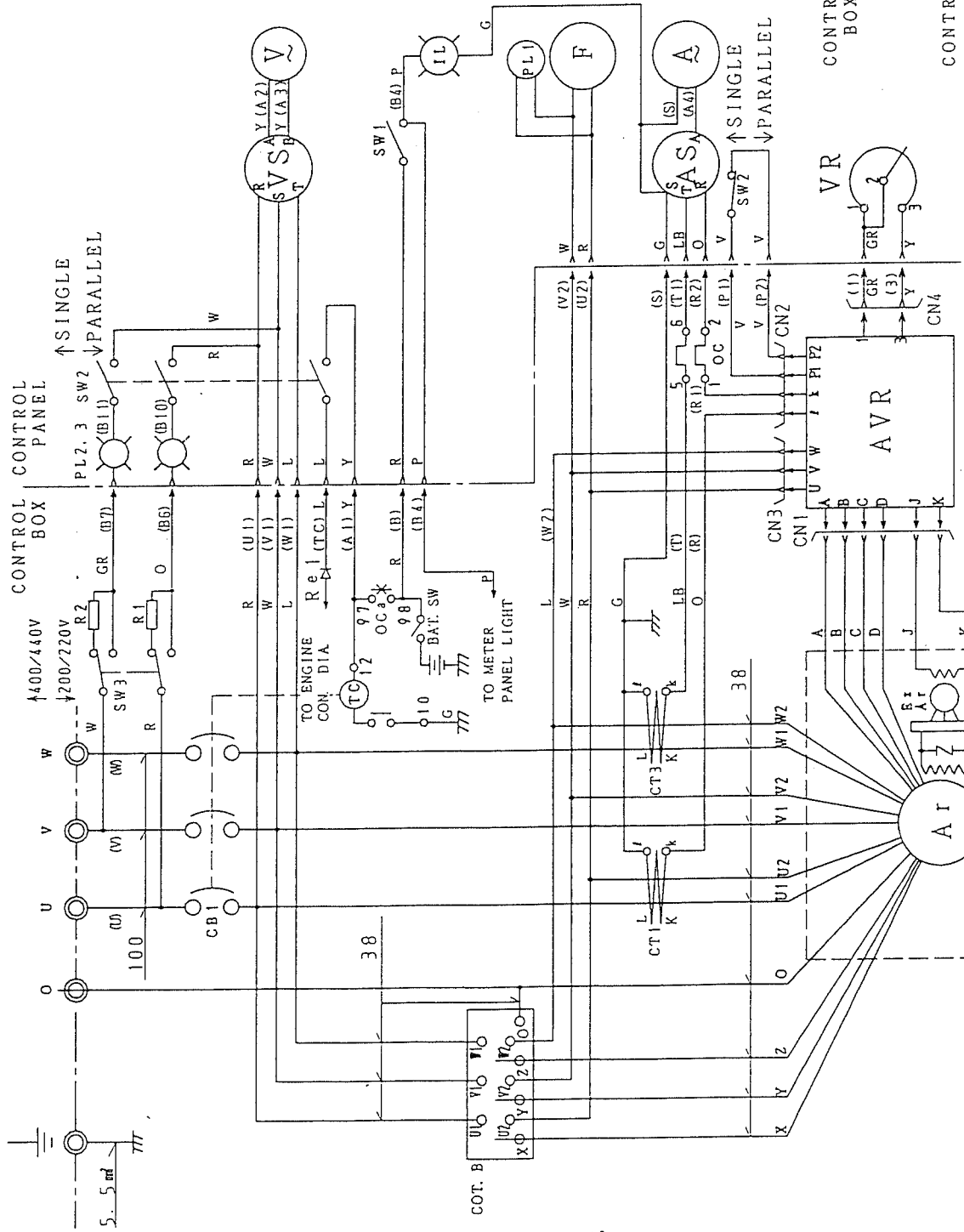
MARK	N	A	M	E
Ar				MAIN GENERATOR ARMATURE WINDING
F8				MAIN GENERATOR FIELD WINDING
ExAr				EXCITER ARMATURE WINDING
ExF8				EXCITER FIELD WINDING
AVR				AUTOMATIC VOLTAGE REGULATOR
VR				VOLTAGE REGULATING RHEOSTAT
Re				RECTIFIER
CT1, 3				CURRENT TRANSFORMER 600/5A
AS				AMMETER CHANGE-OVER SWITCH
A				AC. AMMETER 0-300. 600A
VS				VOLTMETER CHANGE-OVER SWITCH
V				AC. VOLTMETER 0-600V
F				FREQUENCY METER 45-65Hz
PL1				PILOT LAMP
PL2, 3				SYNCHRONIZING LAMP
CB1				CIRCUIT BREAKER 400A
OC				OVER CURRENT RELAY
IL				PANEL LIGHT
SW1				PANEL LIGHT SWITCH
SW2				SINGLE PAR. CHANGE-OVER SWITCH
SW3				VOLTAGE CHANGE-OVER SWITCH
R1, 2				RESISTOR
COT. B				VOLTAGE CHANGE BOARD
Re1				RECTIFIER



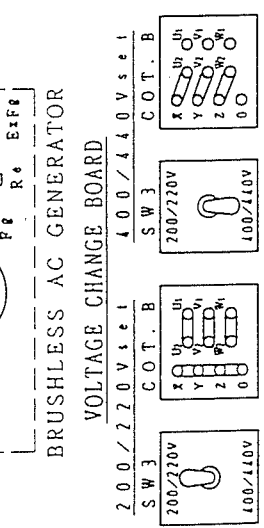
AVR CONNECTOR ARRANGEMENT (WIRING VIEW)



CONNECTOR ARRANGEMENT (WIRING VIEW)

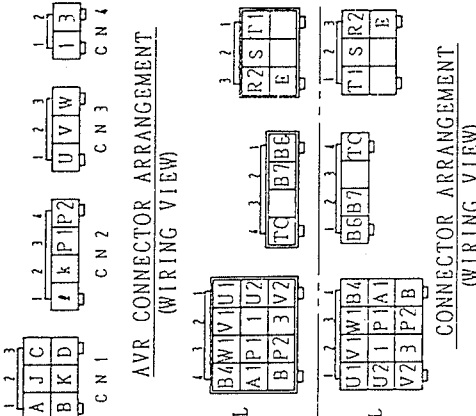
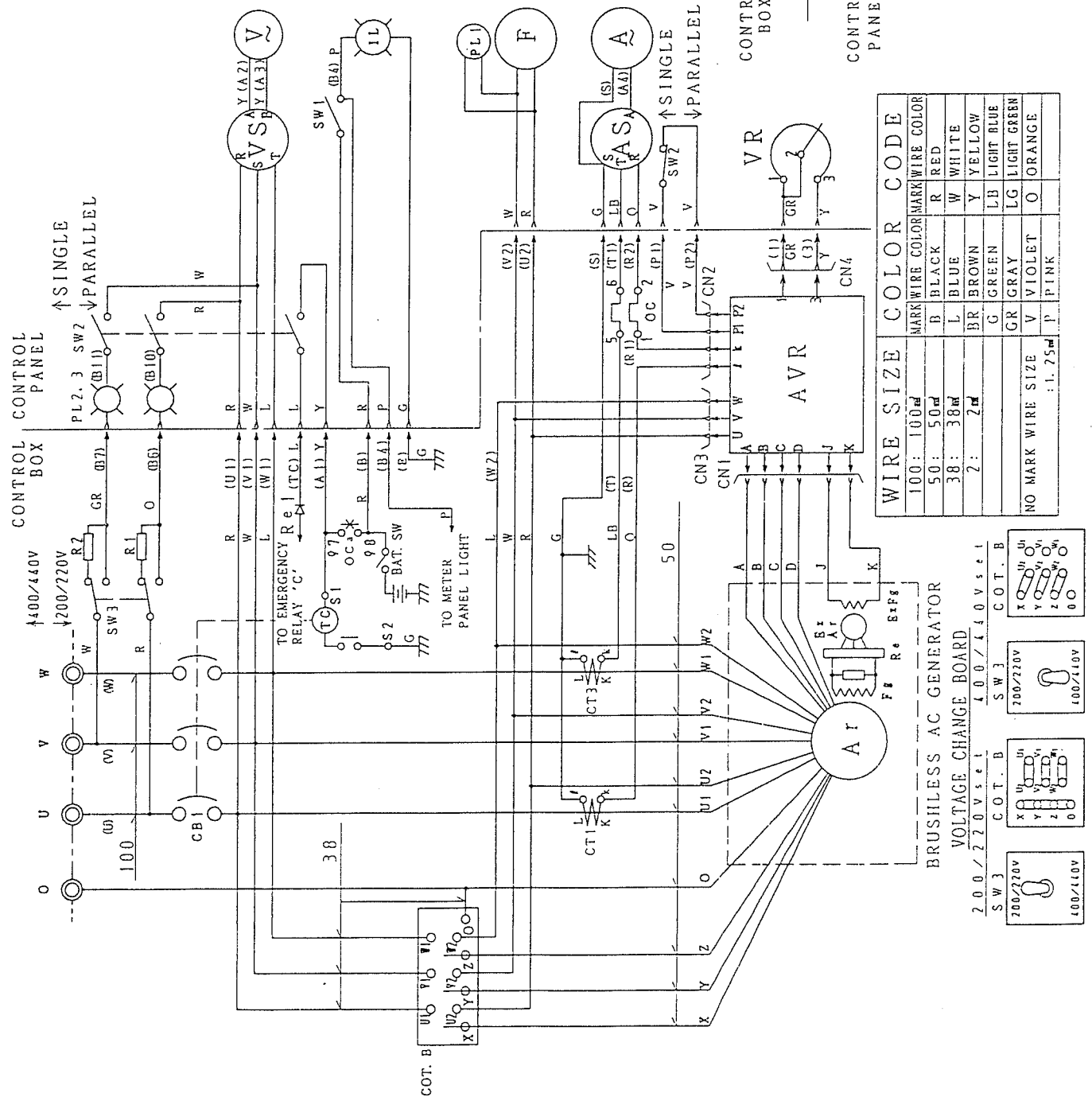


WIRE SIZE	COLOR CODE
100: 100m	MARK WIRE COLOR MARK WIRE COLOR
50: 50m	B BLACK R RED
38: 38m	L BLUE W WHITE
2: 2m	BR BROWN Y YELLOW
	G GREEN LB LIGHT BLUE
	GR GRAY LG LIGHT GREEN
NO MARK WIRE SIZE	V VIOLET O ORANGE
	P PINK

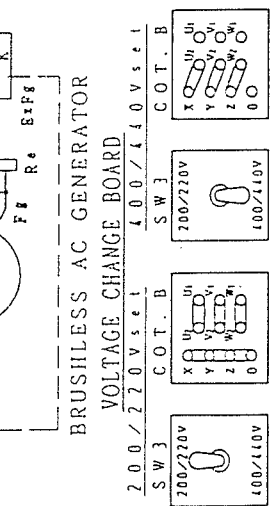


BRUSHLESS AC GENERATOR VOLTAGE CHANGE BOARD

MARK	N A M E
At	MAIN GENERATOR ARMATURE WINDING
Fg	MAIN GENERATOR FIELD WINDING
E*At	EXCITER ARMATURE WINDING
E*Fg	EXCITER FIELD WINDING
AVR	AUTOMATIC VOLTAGE REGULATOR
VR	VOLTAGE REGULATING RHEOSTAT
Re	RECTIFIER
CT1.3	CURRENT TRANSFORMER 300/5A
AS	AMMETER CHANGE-OVER SWITCH
A	AC. AMMETER 0 ~ 300. 600A
VS	VOLTMETER CHANGE-OVER SWITCH
V	AC. VOLTMETER 0 ~ 600V
F	FREQUENCY METER 45 ~ 65Hz
PL1	PILOT LAMP
PL2.3	SYNCHRONIZING LAMP
CBI	CIRCUIT BREAKER 500A
OC	OVER CURRENT RELAY
IL	PANEL LIGHT
SW1	PANEL LIGHT SWITCH
SW2	SINGLE PAR. CHANGE-OVER SWITCH
SW3	VOLTAGE CHANGE-OVER SWITCH
R1.2	RESISTOR
COT. B	VOLTAGE CHANGE BOARD
Re1	RECTIFIER

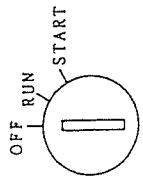
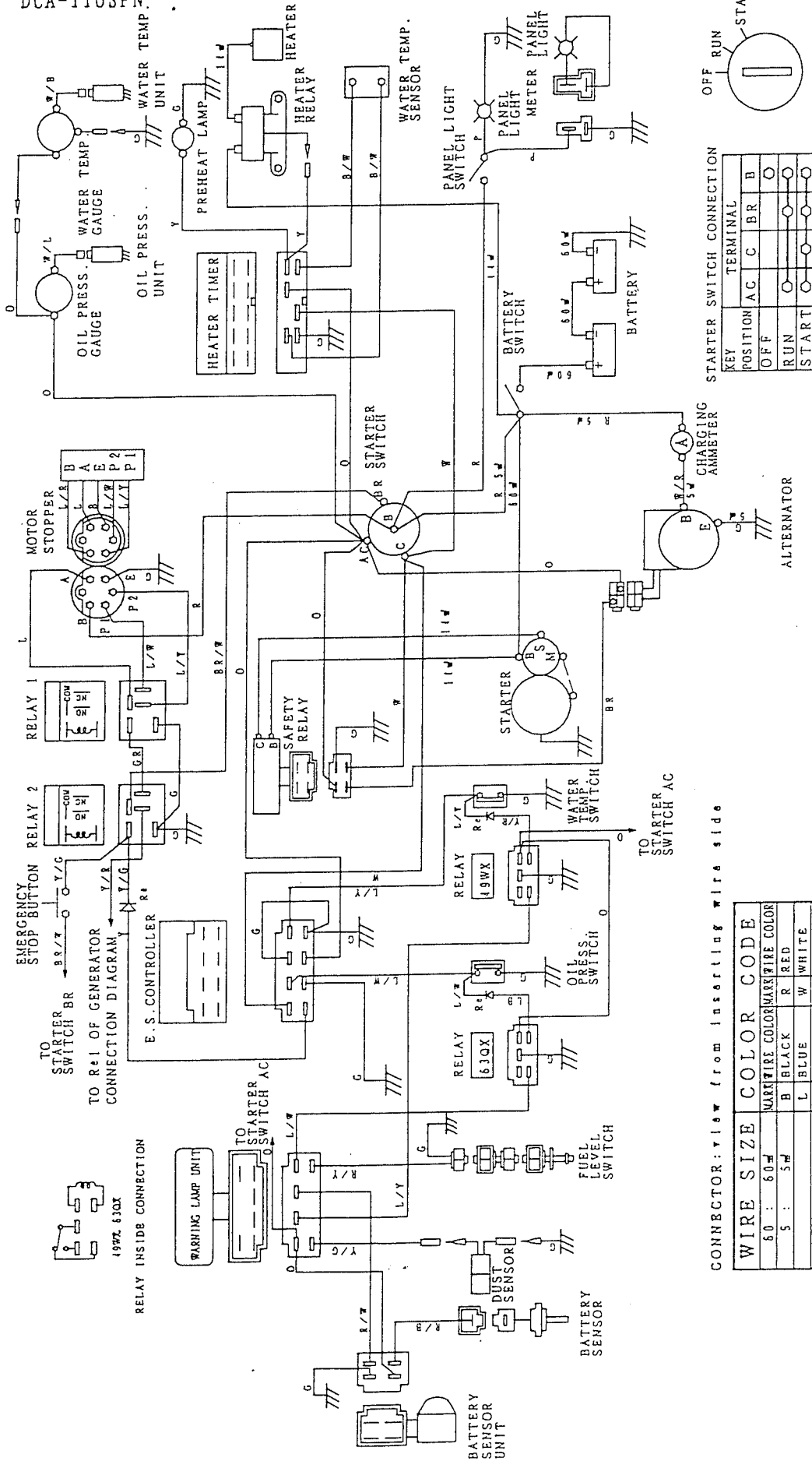


MARK	WIRE COLOR	MARK	WIRE COLOR
D	BLACK	R	RED
L	BLUE	W	WHITE
BR	BROWN	Y	YELLOW
G	GREEN	LB	LIGHT BLUE
GR	GRAY	LG	LIGHT GREEN
V	VIOLET	O	ORANGE
P	PINK		



1 2. ENGINE WIRING DIAGRAM

DCA-110SPN.



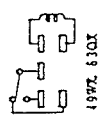
STARTER SWITCH CONNECTION

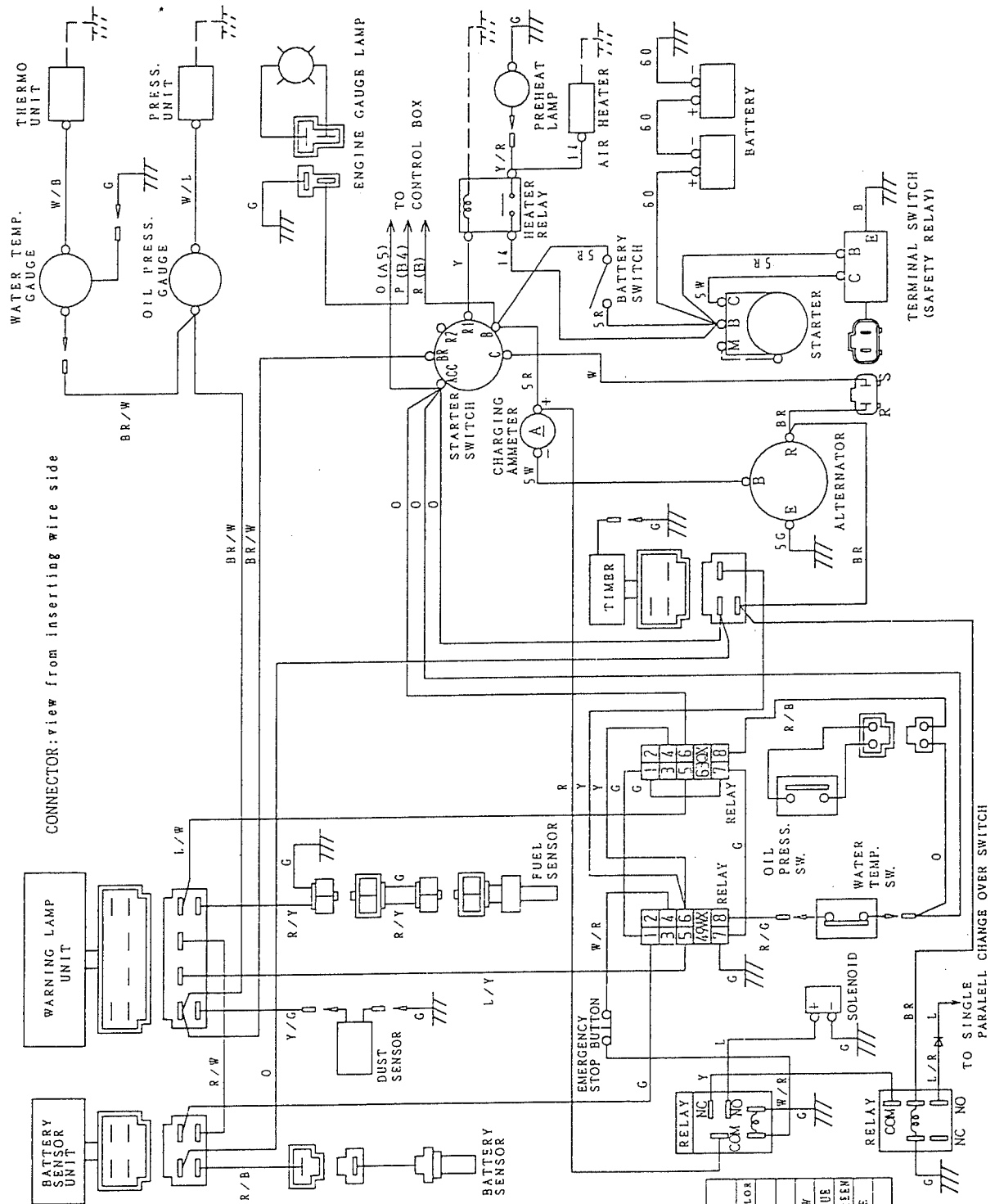
KEY POSITION	AC	C	BR	B
OFF	○	○	○	○
RUN	○	○	○	○
START	○	○	○	○

CONNECTOR: view from inserting wire side

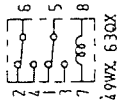
WIRE SIZE	COLOR CODE	WIRE COLOR	MARKING
60 : 60#	B	BLACK	R
5 : 5#	L	BLUE	W
	BR	BROWN	Y
	G	GREEN	LB
	GR	GRAY	LG
NO MARK	V	VIOLET	O
	P	PINK	

RELAY INSIDE CONNECTION

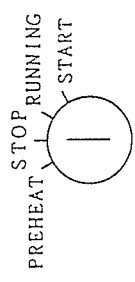




CONNECTOR: view from inserting wire side



RELAY INSIDE CONNECTION

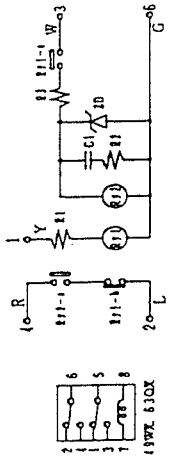
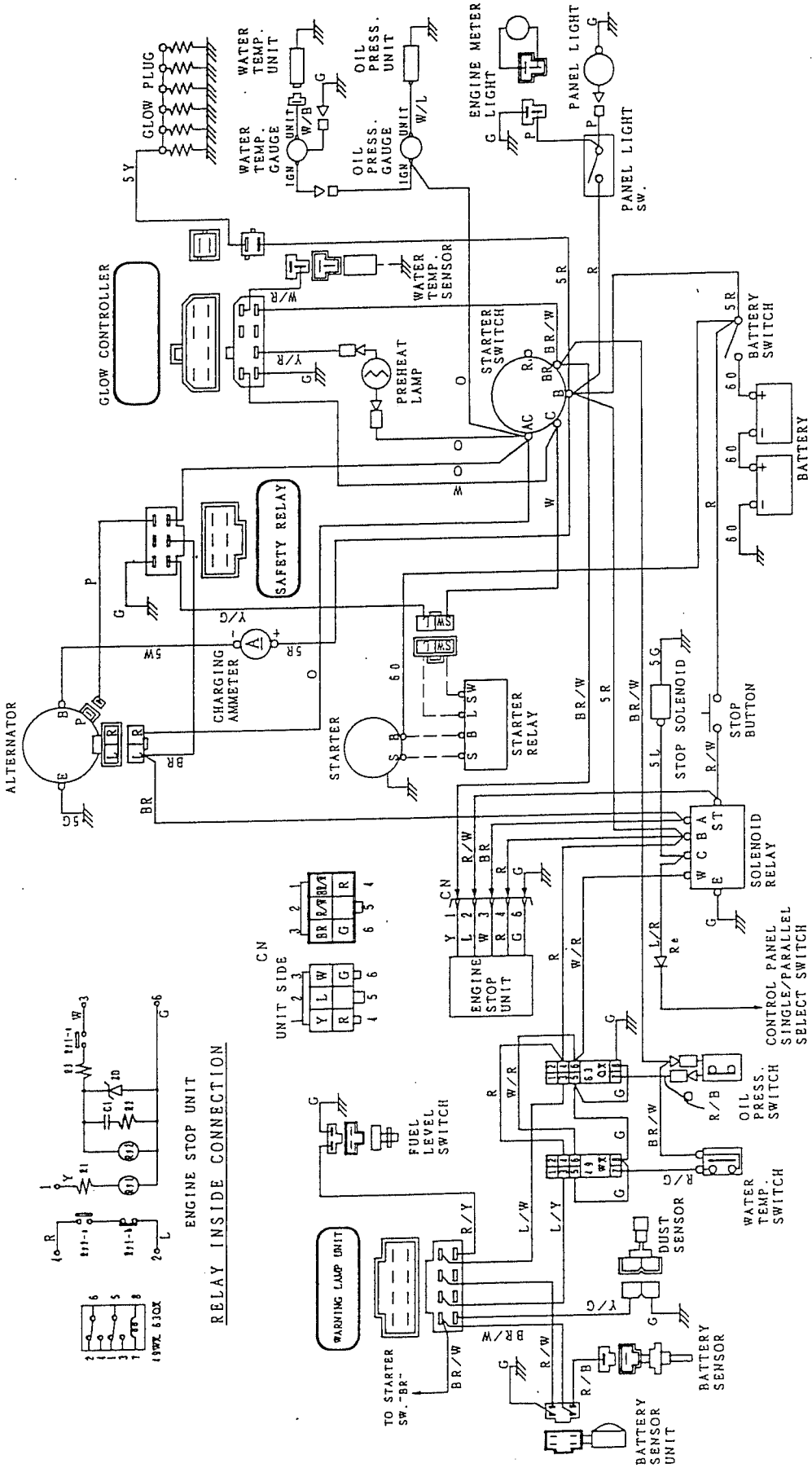


STARTER SW CONNECTION

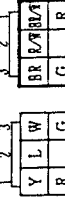
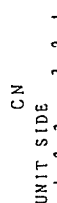
	B	BR	R1	R2	C	ACC
PREHEAT	○	○	○	○	○	○
STOP	○	○	○	○	○	○
RUNNING	○	○	○	○	○	○
START	○	○	○	○	○	○

WIRE SIZE COLOR CODE

WIRE SIZE	WIRE COLOR	WIRE COLOR
5	BLACK	R
1.6	BLUE	W
60	BROWN	Y
	GREEN	LB
	GRAY	LG
	VIOLET	O
OTHERS: 1.25mm²	PINK	P

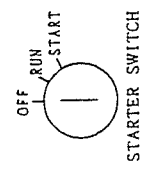


ENGINE STOP UNIT
RELAY INSIDE CONNECTION

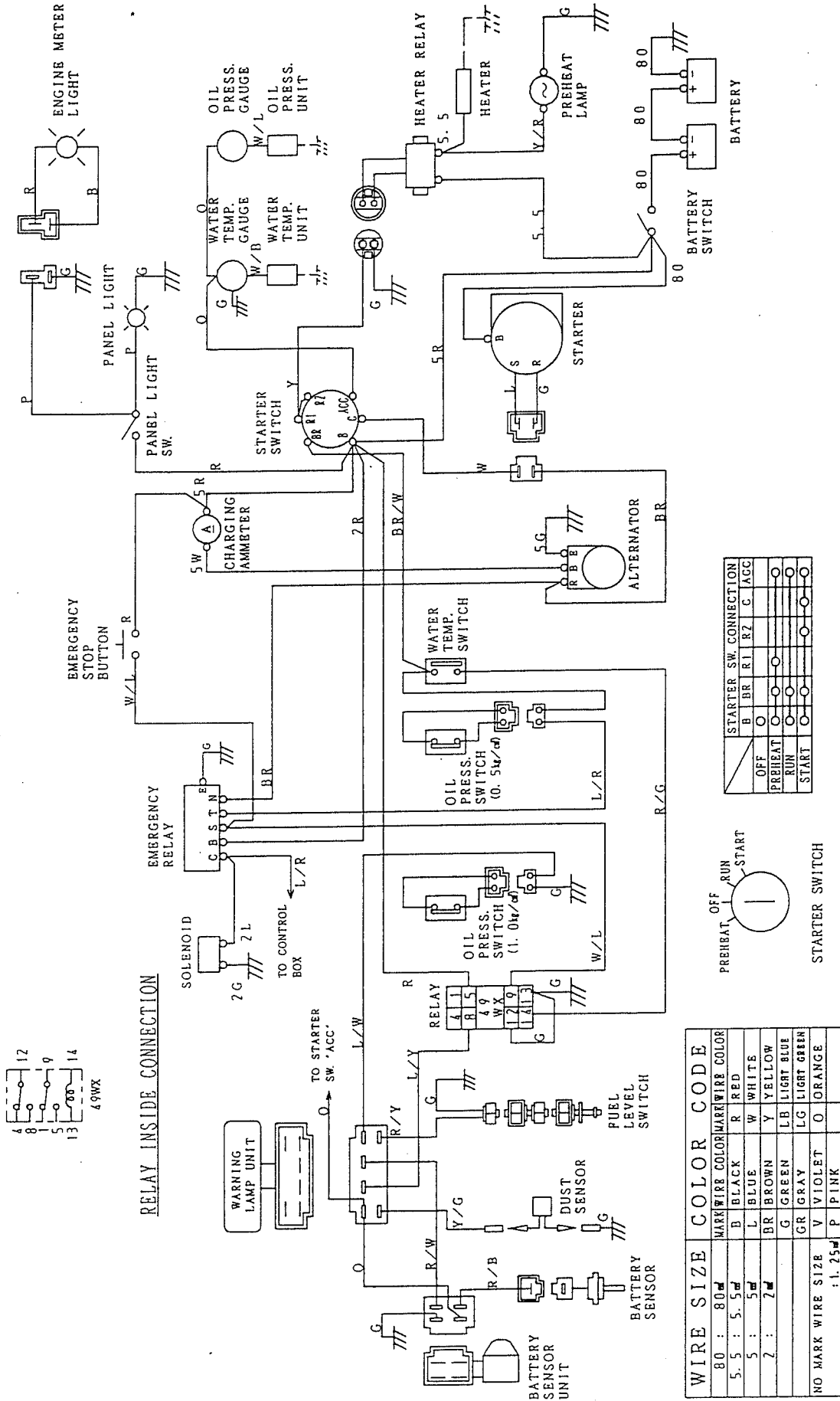


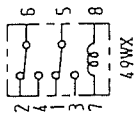
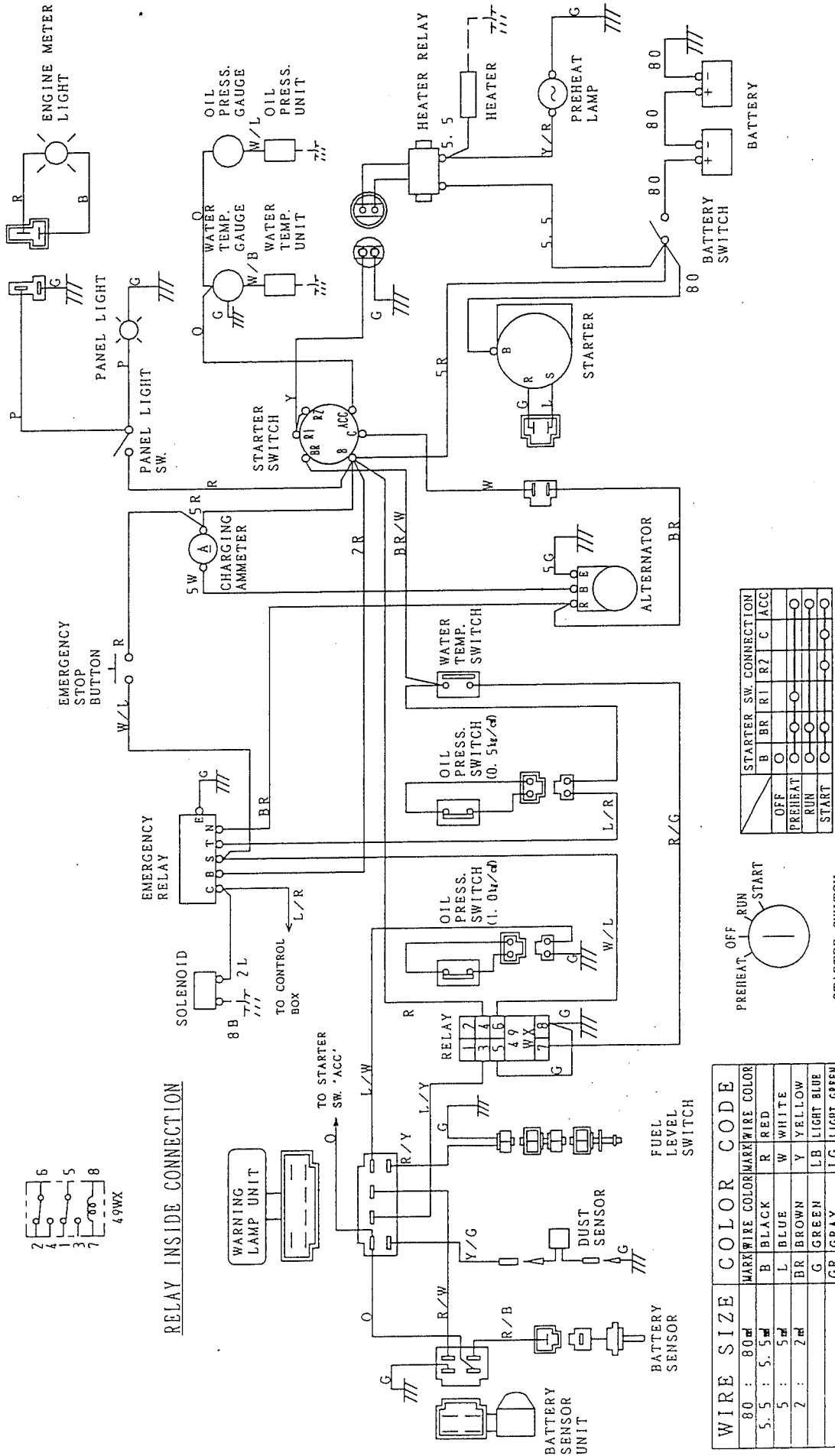
CONNECTOR: view from inserting wire side

WIRE SIZE	COLOR	WIRE COLOR	WIRE COLOR
60	60	BLACK	RED
5	5	BLUE	WHITE
		BROWN	YELLOW
		GREEN	LIGHT BLUE
		GRAY	LIGHT GREEN
		VIOLET	ORANGE
		PINK	



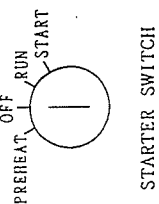
STARTER SW CONNECTION	B	AC	BR	C
OFF	○	○	○	○
RUN	○	○	○	○
START	○	○	○	○



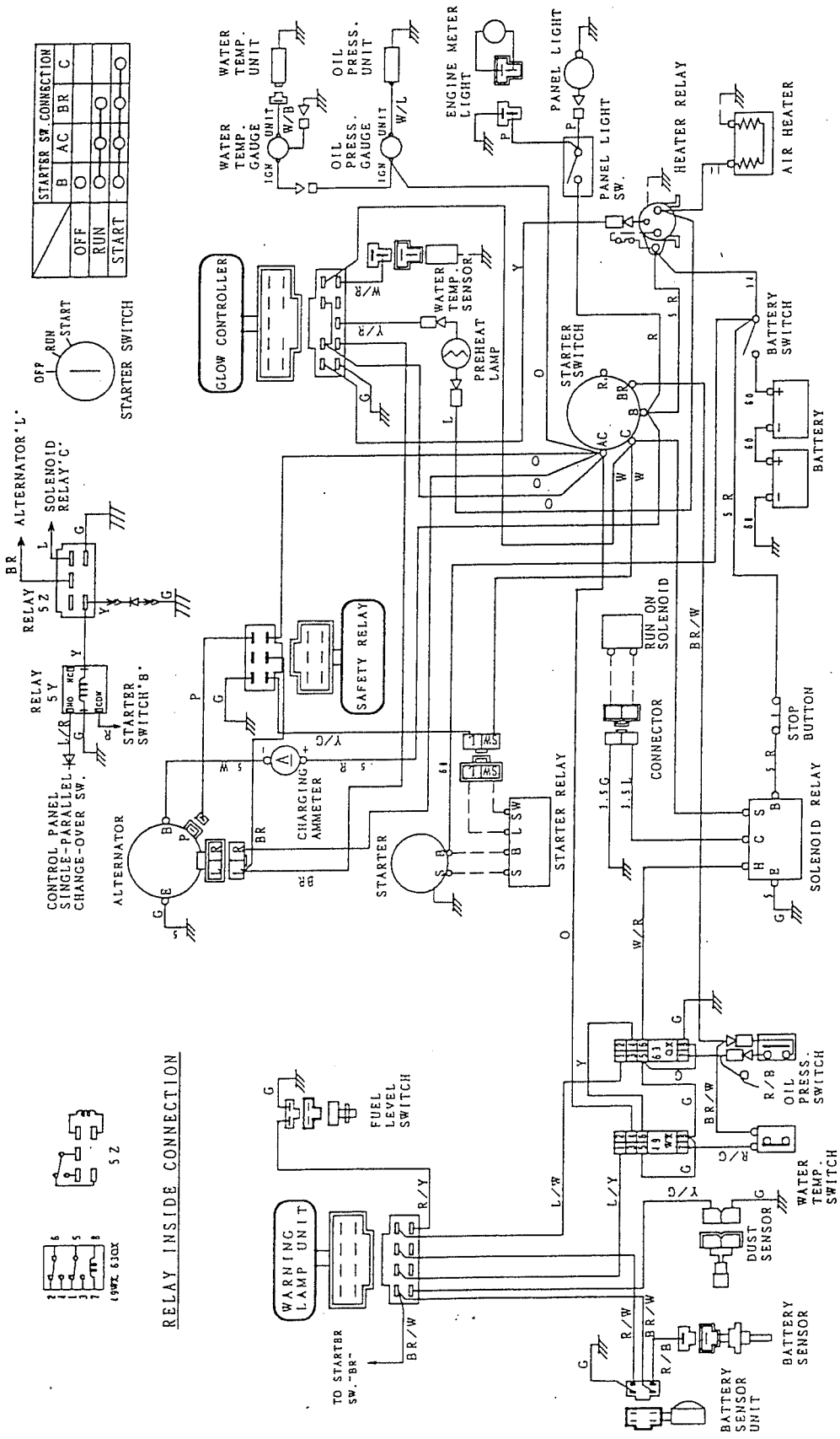


RELAY INSIDE CONNECTION

WIRE SIZE	MAX WIRE COLOR	MARK WIRE COLOR	WIRE COLOR
80	B	BLACK	RED
5.5	L	BLUE	WHITE
5	BR	BROWN	YELLOW
2	G	GREEN	LIGHT BLUE
NO MARK WIRE SIZE	GR	GRAY	LIGHT GREEN
	V	VIOLET	ORANGE
	P	PINK	

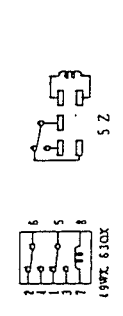
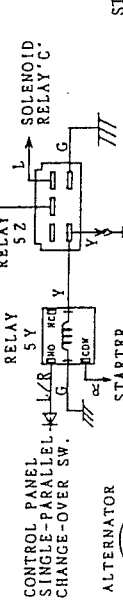
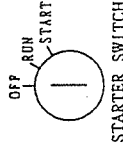


	B	BR	R1	R2	C	ACC
OFF	○	○	○	○	○	○
PREHEAT	○	○	○	○	○	○
RUN	○	○	○	○	○	○
START	○	○	○	○	○	○



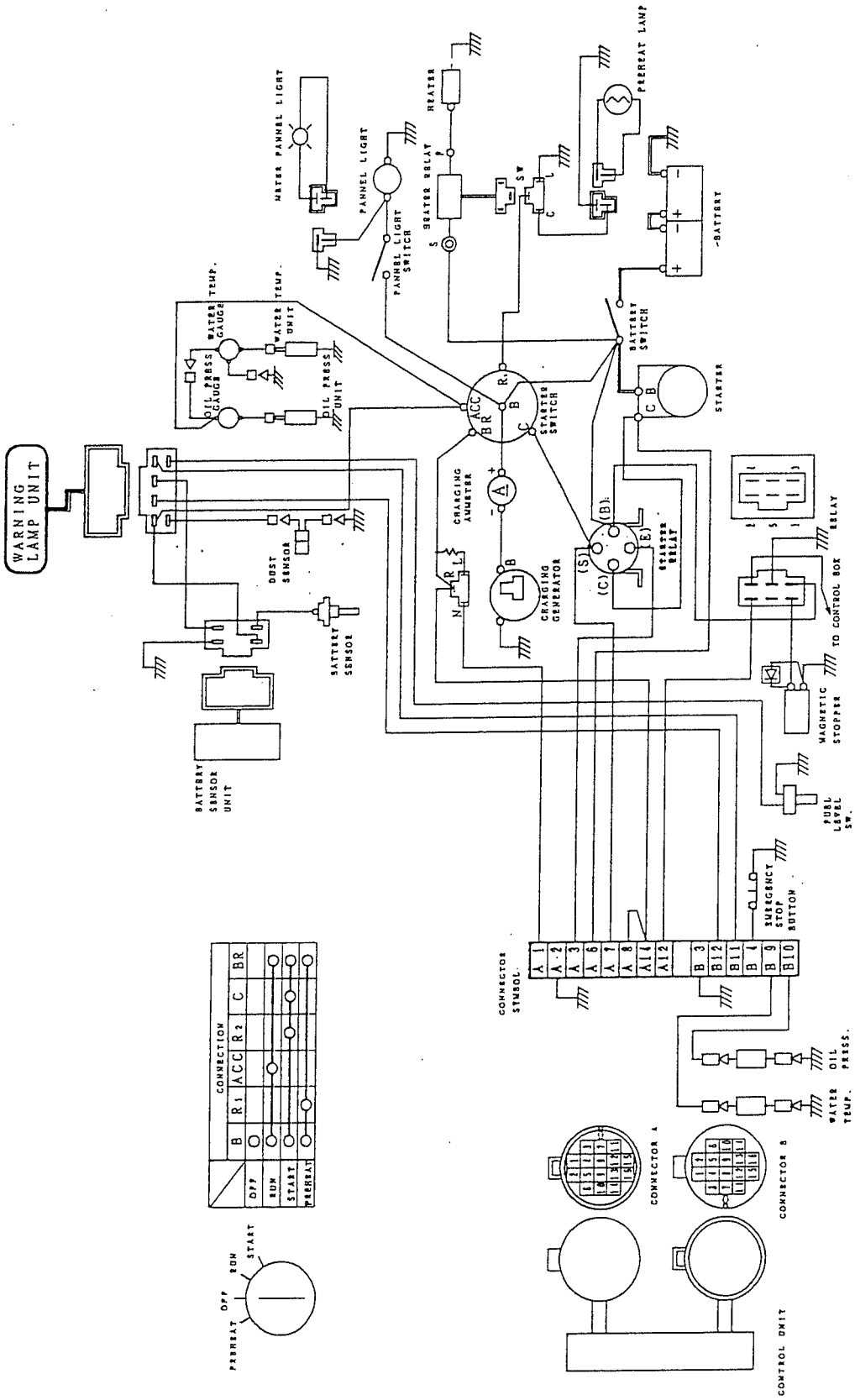
STARTER SW CONNECTION

OFF	AC	BR	C
RUN	○	○	○
START	○	○	○

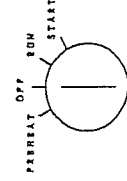


CONNECTOR: view from intertag wire side

WIRE SIZE	COLOR CODE	WIRE COLOR	WIRE COLOR	
60 : 60M	B	BLACK	R	RED
5 : 5M	L	BLUE	W	WHITE
	BR	BROWN	Y	YELLOW
	G	GREEN	LB	LIGHT BLUE
	GR	GRAY	LG	LIGHT GREEN
NO MARK WIRE SIZE	V	VIOLET	O	ORANGE
	.1.15M	P	P	PINK

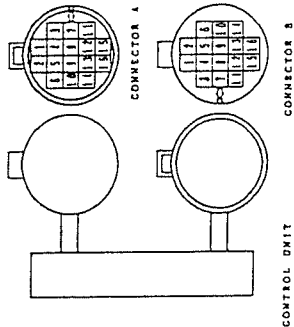


		CONNECTION					
		B	R	ACC	R2	C	BR
OFF	○	○	○	○	○	○	○
RDN	○	○	○	○	○	○	○
START	○	○	○	○	○	○	○
PREHEAT	○	○	○	○	○	○	○



CONNECTOR SYMBOL.

- A 1
- A 2
- A 3
- A 6
- A 7
- A 8
- A 11
- A 12
- B 3
- B 12
- B 11
- B 4
- B 9
- B 10



CONNECTOR: view from inserting wire side

WIRE SIZE	WIRE COLOR	WIRE COLOR	WIRE COLOR
50 : 50#	B	BLACK	R
5 :	L	BLUE	W
	BR	BROWN	Y
	G	GREEN	LB
	GR	GRAY	LG
	V	VIOLET	O
	P	PINK	

NO MARK WIRE SIZE : 1.25#

1 3 . SAFETY PRECAUTIONS FOR DIESEL GENERATING SETS AND EQUIPMENT

To be read attentively before installing, operating or repairing the unit.

- * In addition to general safety rules which should be observed with diesel generating sets and equipment, the following safety directions and precautions are of special importance.
- * When operating this unit, the operator is expected to employ safe working practices and to observe all related local work safety requirements and ordinances.
- * The owner is responsible for maintaining the unit in a safe operating condition. Parts and accessories shall be replaced if unsuitable for safe operation.
- * Installation, operation, maintenance and repair shall only be performed by authorized, trained, competent personnel.
- * If any statement in this book, especially with regard to safety, does not comply with local legislation, the stricter of the two shall apply.
- * These precautions are general and cover several machine types and equipment: hence some statements may not apply to the unit(s) described in this book.

13-1. Installation

Apart from general engineering practices that conform with the local safety regulations, the following directives are especially stressed:

- ① Engine exhaust contains noxious elements.
Therefore, pay close attention to ventilation when operating the generator set inside tunnels, buildings, or other enclosed areas.
- ② For outdoor operation, install the generator on where the exhaust is not discharged in the direction of nearby homes or other enclosed areas.
- ③ When the generator sets is installed in a dusty or corrosive atmosphere, frequently inspect it for radiator clogging and other abnormal conditions.
- ④ Provide adequate space for engine inspection, lubrication, refueling, cable connection to the load, and operation.
- ⑤ Never remove or tamper with the safety devices, guards or insulations fitted on the unit.
- ⑥ Be sure that the generating set is on secure and level ground.

13-2. Operation

- ① Select cables of proper thickness according to the load capacity and distance to the load. Then, securely connect them.
Do not use any cable whose cover is broken and degraded.
In connecting the cable, be sure to shut down the operation.
Cover or tape the connections to prevent leakage and direct contact with the human body.
- ② Always set voltmeter and frequency meter at the rated.
Set ammeter below rated current.
- ③ All canopy doors should be shut during operation.
- ④ People staying in environments or rooms where the sound pressure level reaches or exceeds 90 dB(A) shall wear ear protectors.
- ⑤ The following items should be checked before startup:
 - a) All guards should be in place and securely fastened.
 - b) Water, engine oil or fuel leakage
 - c) That all fasteners are tight
 - d) That all electrical leads are secure and in good order
 - e) Oil level and cleanliness
 - f) Cooling water level (radiator and reserve tank) and radiator cap securely tightened
 - g) Fuel level
 - h) Tension of all V-belts
- ⑥ Provide a switch between the generator and load to operate or stop the load.
- ⑦ Always keep battery switch turned ON while operating the engine.
Also, always keep it OFF when engine is not running.
- ⑧ Do not wire the generator set the interior circuit.
- ⑨ Avoid low-load operation for long periods of time.
- ⑩ Coolant: Use clean water.
When the temperature drops to 0°C or below, the following measures must be taken:
 - a) Use antifreeze
 - b) When antifreeze is not used.
Open drain cocks of the engine and radiator to completely drain off cooling water after engine operation.
- ⑪ Fill the fuel tank frequently.
Periodically open the drain plug to drain moisture and contaminants.
- ⑫ Avoid high speed operation immediately after starting.
- ⑬ Never turn the starter switch to "START" position while the engine is running.
- ⑭ Never stop the engine suddenly except in an emergency.
- ⑮ Never touch any rotating, hot, and live parts during operation.

13-3. Maintenance

Maintenance and repair work shall only be carried out under supervision of someone qualified for the job.

- ① Use only the correct tools for maintenance and repair work.
- ② Use only genuine spare parts.
- ③ All maintenance work, other than routine attention, shall only be undertaken when the unit is stopped.
- ④ Never use flammable solvents or carbon tetrachloride for cleaning parts. Take safety precautions against toxic vapours of cleaning liquids.
- ⑤ Scrupulously observe cleanliness during maintenance and repair. Keep dirt away by covering the parts and exposed openings with a clean cloth, paper or tape.
- ⑥ Make sure that no tools, loose parts or rags are left in or on the unit.
- ⑦ Protect the electrical and regulating components, etc. to prevent moisture from entering these parts, e. g. when steam-cleaning.
- ⑧ Do not remove or tamper with the lining in order to maintain the proper sound pressure level.

All responsibility for any damage or injury resulting from neglecting these precautions or by non-observance of ordinary caution and due care required in handling, operating, maintenance or repair, even if not expressly mentioned in this book, will be disclaimed by Denyo Co., LTD.

1 4 . OPTIONS INSTRUCTION MANUAL

1. AUTOMATIC OILER -----	53
2. AUTOMATIC IDLING DEVICE -----	54
3. SLOWDOWN DEVICE -----	57
4. EARTH LEAKAGE RELAY -----	61
5. AUTOMATIC LOAD SHARE CONTROLLER -----	64
6. WATTMETER -----	65
7. REVERSE POWER RELAY -----	65

1. AUTOMATIC OILER

1-1. Applicable Models

DCA-SP SERIES

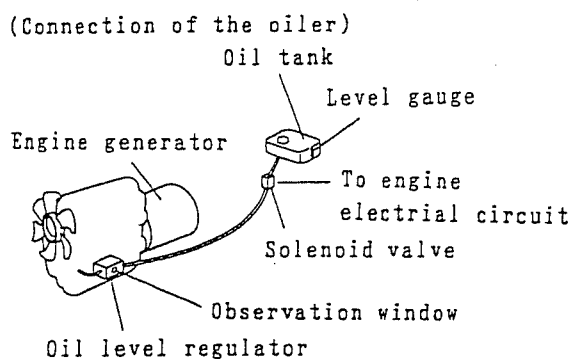
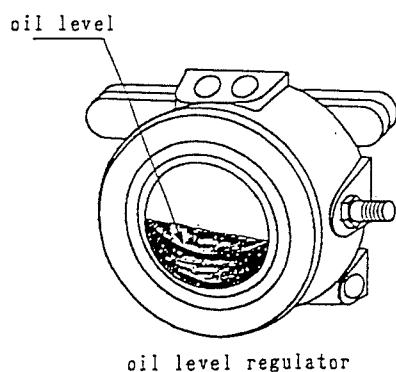
1-2. Description of the Oiler

This device is designed to maintain the engine oil consumed during operation at a proper level.

The use of the oiler only requires observation of the oil level of the built-in oil tank, eliminating the otherwise required trouble of checking the level with an oil level gauge and also contributing to decreased frequency of oil supply with resultant reduction in maintenance cost for oil control.

1-3. System of the Oiler

The system of the oiler is based on an oil level regulator produced by a U.S.-based company, MURPHY. This regulator is normally installed on the side of the oil pan so that the oil level is controlled by the float and valve on the communicating tube. The oil level regulator is provided with an "observation window" for visual inspection of the oil level in the oil pan.



1-4. Directions for Use of the Oiler

Check the level gauge of the oil tank as a "Daily Check Item" to make sure that the oil level of the engine oil pan with an oil level gauge at intervals of a few days. Install the machine, its inclination is held within 3 degrees. It should also be noted that the oil level regulator location must not be changed.

The installation of the oiler does not affect the replacement interval of the engine oil and its replacement procedure, which should be based on the "Instruction Manual" supplied by the engine manufacture.

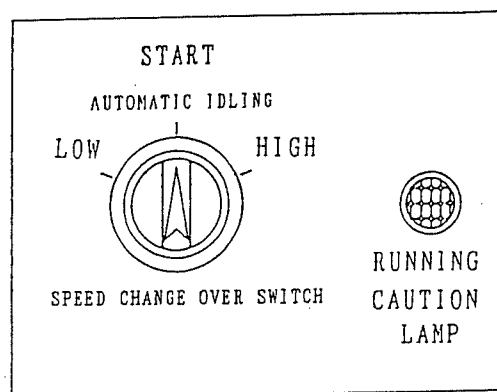
If the piping system is clogged with dust, clean the oil tank drain and piping.

2. AUTOMATIC IDLING DEVICE

2-1. Applications Models DCA-SP SERIES

2-2. Description of the Device

This device is designed to provide for automatic idling of the engine for its warming-up after startup and for its cooling before shutdown.



2-3. Directions for Use of the Device

(1) For automatic operation

① Make preparations for operation according to Section 4 "PREPARATION FOR OPERATION" in the Instruction Manual.

② Turn the speed change over switch on the control panel to the "AUTOMATIC IDLING" position.

③ Set the throttle handle at the desired speed position.

④ Be sure to turn the starter and battery switches to the "OFF" position before following that described in Section 5 "OPERATION" in the Instruction Manual.

When the engine start up, it automatically idles at a low speed with the lighting-up of the "RUNNING CAUTION" lamp.

In about one minute, the engine automatically changes from low-speed idling to high-speed operation at the speed preset with the throttle handle.

⑤ If the idling speed is not correct, rectify it according to the following table.

	Frequency (Idling speed)	
Operation at 50Hz	52.5Hz	(1575min ⁻¹)
Operation at 60Hz	62.5Hz	(1875min ⁻¹)

(2) To continue low-speed operation

Change the speed change over switch on the control panel over to the "LOW" position.

① If the above change over is made before startup of the engine, its low-speed operation performed after its startup will continue even after the passage of the idling time until the speed change over switch is turned to the "AUTOMATIC IDLING" position.

② If this switch change over is made during the operation, the engine will immediately change over to low-speed operation.

(3) When low-speed operation is not required

Turn the speed change over switch on the control panel to the "HIGH" position.

This causes the automatic idling device to be inoperative, allowing the engine to always run at a speed set by the throttle handle.

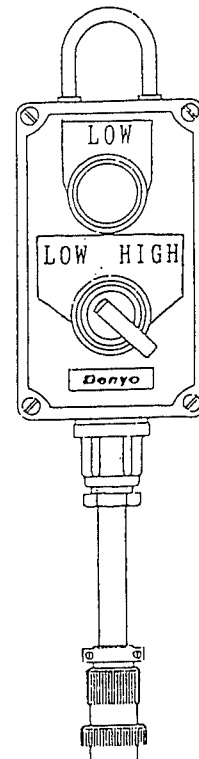
(4) For operation by remote control

① Connect the remote control device to the remote control receptacle on the output terminal block and turn the speed change over switch to the "AUTOMATIC IDLING" position.

② When the selector switch on the remote control device is turned to the "LOW" side, the engine immediately change over to low-speed operation with the lighting-up of the "LOW" lamp on remote control device and the "RUNNING CAUTION" lamp on the control panel. If the selector switch is turned to the "HIGH" side, the engine immediately change over to high-speed operation with the lighting-out of the "LOW" lamp on the remote control device.

③ When the speed change over switch in the control panel has been set at the "LOW" position, even if the remote control device gives a command that the engine change over to high-speed operation, the engine speed will not change in accordance to the command from the remote control device.

Such a command from the control device can only be executed when the change over switch in the control panel has been set at the "AUTOMATIC IDLING" position.



(5) Shutdown

- ① To shut down the engine generator after the end of the work, be sure to turn the breaker of the generator to the "OFF" position before turning the starter switch to the "STOP" position.

The above operation causes the engine to idle at a low speed for a set time period of several seconds before stopping automatically, irrespective of the setting of the speed change over switch in the control panel and the "HIGH-LOW" speed selector switch on the remote control device.

It is not necessary the throttle handle to lower the engine to the idling speed. After the shutdown operation is completed, the "RUNNING CAUTION" lamp will light up and stay lit for about 30 seconds.

It should be noted, however, that the machine models other than 150SPK, 150SPK3, 180SPK1 and 180SPK3 are designed that the engine immediately stops when the starter switch is turned to the "STOP" position, therefore requiring the speed change over switch to be set in the "LOW" side to cause the engine to idle for a specified time period before the starter switch is turned to the "STOP" position.

- ② For emergency stop of the engine, continue to press the "EMERGENCY STOP" button until it stops.

(6) Precautions during Operation

- ① Do not change the speed change over switch in the control panel and selector switch on the remote control device over to the "LOW" side while the engine is in load operation. In addition, do not start up the engine with the generator and load side breakers set up in the "ON" position.

While the engine is idling, it must be noted that the generator voltage and frequency are so low that the load equipment voltage properly, so well as may be broken down. When the machine is under such a condition, the "RUNNING CAUTION" lamp stays lit to warn of this condition.

- ② While the machine is running, do not turn off the battery switch not remove the battery.
- ③ To restart the engine after it is stopped by any operation other than the starter switch "STOP" operation (including use of "EMERGENCY STOP" button, activation of the emergency stop device, fuel shortage and engine failure), turn the starter switch to the "STOP" position or the battery switch to the "OFF" position before taking the ordinary startup procedure.

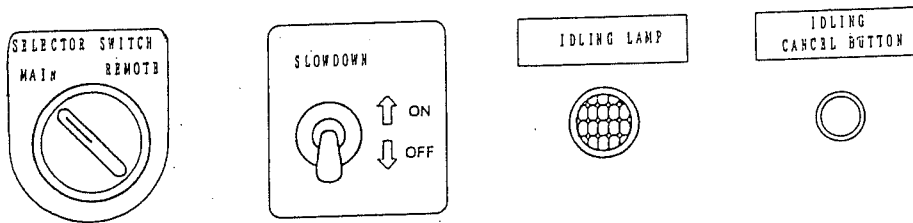
3. SLOWDOWN DEVICE

3-1. Applicable Models

DCA-SP SERIES

3-2. Description of the Device

This device is provided with the function for automatic idling of the engine, as the function of detecting whether the engine has been connected to or disconnected from the load, and changes from high speed operation to low speed idling when it has been disconnected from the load. In addition, the device, when combined with the startup remote control device (optionally available), allows the "START-STOP" of the engine and its slowdown "ON-OFF" to be operated by remote control.



3-3. Operating Procedure

(1) For operation on the generator side

(without use of remote control device)

- ① Make necessary preparation for operation according to section 4 "PREPARATION FOR OPERATION" in the Instruction Manual.
- ② Turn the "MAIN-REMOTE" selector switch to the "MAIN" side.
- ③ Set the throttle handle to the desired high-speed position.

When the engine starts up, it automatically idles at a low speed with the lighting up the "IDLING" lamp.

In five seconds to three minutes (depending on the engine cooling water temperature), the engine immediately changes from idling to high speed operation if the "SLOWDOWN" switch has been set the "OFF" position and continues its low speed operation if the "SLOWDOWN" switch is at the "ON" position.

Don't turn ON the load during engine idling. If load running is needed during engine idling by all means, push idling cancel button.

(2) Slowdown Function

- ① When the "SLOWDOWN" switch is set at the "ON" position, the device automatically detects whether the engine has been connected to or disconnected from the load. Operation is changed from high speed operation to low speed idling, when generator is disconnected from the load.
- ② While the engine is running at a low speed, the voltage stands at a low level. When the load is turned on, the device automatically detects it and changes the engine over to high speed operation in two or three seconds with the voltage returned to that rated.

- ③ If, while the engine is running with the load turned on, the load is turned off, the device automatically detects the absence of load and changes the engine over to low speed operation in about 10 seconds.
(Load detection current :Approx. 1A)

(3) Stop Function

- ① Make sure that all of the loads are stopped and turn the breaker of the generator to the "OFF" position.
- ② Turn the starter switch to the "STOP" position.
This operation causes the device to automatically change the engine over to idling for cooling with the lighting up of the "IDLING" lamp.
After the idling for about 30 seconds, the engine stops.
Note : The machine models other than 150SPK, 150SPK3, 180SPK1 and 180SPK3 are designed so that the engine immediately stops when the starter switch is turned to the "STOP/OFF" position, therefore requiring the "SLOWDOWN" switch to be set in the "ON" side to cause the engine to idle for a specified time period before the starter switch is turned to the "STOP/OFF" position.
- ③ For emergency stop of the engine, continue to press the "EMERGENCY STOP" button until it stops.

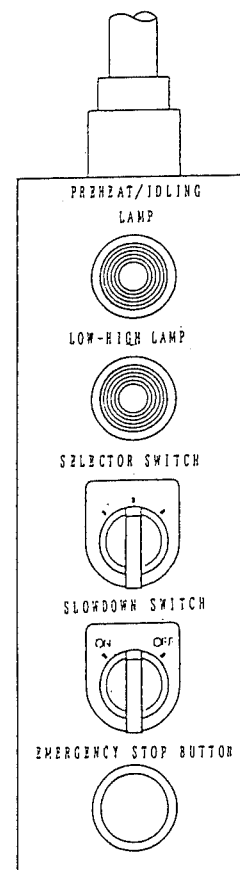
3-4. For Operation by Remote Control

(1) Connection of remote control device

- ① Make sure that the engine is at a stop and the switch on the remote control device set at the "STOP" position.
- ② Turn the "MAIN-REMOTE" selector switch on the engine control panel to the "REMOTE" position and set the starter switch in the "RUN" position.

(2) Operating

- ① Make necessary preparations for operation according to Section 4 "PREPARATION FOR OPERATION" in the Instruction Manual
- ② Turn the remote control switch to the "START" position.
- ③ This operation causes the engine to be preheated with the "PREHEAT/IDLING" lamp going on and off. In preheating the engine, the buzzer attached to the generator sounds to announce that the machine will be soon ready for startup.
- ④ After the engine is preheated for about 20 seconds, the engine starter operates to start up the engine.
- ⑤ When the engine starts up, the "PREHEAT/IDLING" lamp goes on and the engine automatically idles at low speed.
- ⑥ After the idling for five seconds to three minutes (depending on the engine cooling water temperature).



(3) Slowdown by Remote Control (ON-OFF)

If the "SLOW DOWN" switch on the remote control device is set in the "ON" position, the slowdown function becomes operative.

During the low-speed operation effected by this slowdown function, the "LOW-HIGH" lamp goes on and off. This lamp stays on during the high speed operation.

(4) Stop by Remote Control

① Make sure that all of the loads are stopped and turn the breaker of generator to the "OFF" position.

② Turn the switch on the remote control device to the "STOP" position. This causes the "LOW-HIGH" lamp to go off and the "PREHEAT/IDLING" lamp to light up.

Upon the lighting-up of this lamp, the engine starts idling for cooling and stops in about 30 seconds.

It should be noted, however, that 150SPH is designed that the engine immediately stops when the remote control switch is turned to the "STOP" position, therefore requiring the "SLOW DOWN" switch to be set in the "ON" position to cause the engine to idle for the specified time period with "PREHEAT/IDLING" lamp goes on before turn the remote control switch to the "STOP" position.

③ For emergency stop of the engine, continue to press the "EMERGENCY STOP" button until it stops.

(5) Precautions in Operation

① Do not operate the "MAIN-REMOTE" selector switch while the machine is running. If the operation of this switch is inevitable while the machine is running, pay attention to the following points:

● When changing the switch from "MAIN" to "REMOTE", make sure that the remote control switch is at the "RUN" position. This switch change with the remote control switch at the "STOP" position causes the engine to enter its stopping process.

● Make sure that the "SLOW DOWN" switch has been set at the desired position. For example, if the "MAIN-REMOTE" switch change is made during the low-speed operation effected by the slowdown function, the engine immediately over to high-speed operation when the "SLOWDOWN" switch on the switch changed side is at the "OFF" side.

② Note that the switches on the remote control device only function when the "MAIN-REMOTE" selector switch is in the "REMOTE" side and the starter switch is in the "RUN" side.

③ The starter switch functions to shut down the engine, irrespective of the setting of the "MAIN-REMOTE" selector switch. However, when starting up the engine, be sure to set the selector switch in the "MAIN" side.

④ Do not turn off the battery switch while the machine is running. This may result not only in engine alternator and/or regulator failure, but also malfunction or failure of this device.

- ⑤ When the machine is connected to a motor as the load with an electromagnetic switch used as its starter, the device may fail to detect the connection of the load even if it is turned on with consequent failure to change the engine over to high speed operation. In such cases, temporarily turn the "SLOWDOWN" switch to the "OFF" position to put the engine generator in high speed operation for startup of the motor before turning the "SLOWDOWN" switch to the "ON" position. When the load is turned off, the device automatically detects that the machine has been disconnected from the load, changing the engine over to low speed operation.
- ⑥ Note that, even during the slowdown (low speed operation) of the engine, the output voltage is present.

4. EARTH LEAKAGE RELAY

4-1. Applicable Models

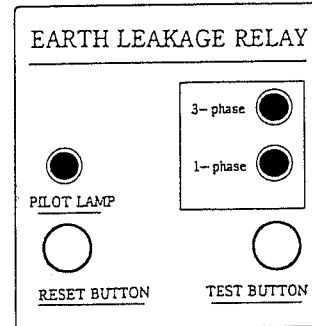
DCA-SP SERIES

4-2. General Description of the Device of Leakage Relay

The machine is provided with a leakage relay to detect any leakage produced due to such trouble as insulation failure of the load while the machine is running and to cut off the circuit for protection against any accident such as electrocution resulting from the trouble. However, to ensure further safety, install a leakage relay for each load at the position near the load.

This relay detects any leakage on either three phase or single phase output and it immediately trips the circuit breaker where that leakage occurs.

The current sensitivity of this relay is 30 mA.



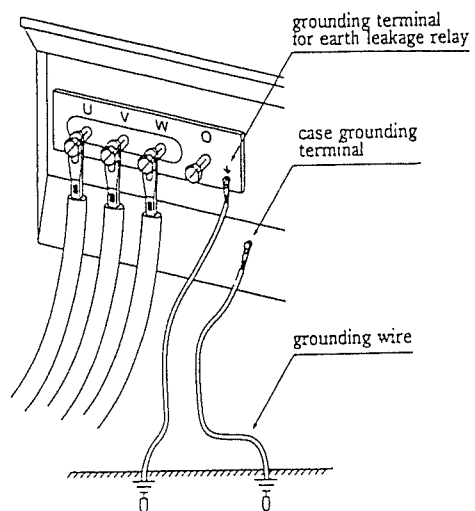
4-3. Directions for Use of Leakage relay

To ensure safe operation of the leakage relay, observe the following matters.

In addition, if the leakage relay should be activated, immediately identify the leak spot and repair it before pressing the RESET button on the relay or shut down the generator to repair the leak spot before turning on the breaker again.

(1) Grounding of generator

- ① Ground the generator by connecting the attached grounding rod to the grounding terminal for the leakage relay in the output terminal block. Grounding resistance shall be less than $100\ \Omega$.
- ② Also, ground the generator case by connecting a grounding conductor to the case grounding terminal provided in the terminal block.
- ③ Avoid such places as listed below for burying of grounding rod:
 1. Places near underground installations such as gas pipes, water pipes, leading wires and underground cables.
 2. Places within 2m of lightning conductor grounding location.



- ④ Select a shady and highly moist place burying of the grounding rod and burry it in such a way that its top end is completely hidden in the ground.

Pay attention to the following points:

1. Do not use a telephone set grounding conductor.
 2. When the grounding rod is to be burried in a muchfrequented place, fasten the lead wire securely.
- ⑤ Connect the grounding rod paying attention to the following point:
1. Connect the lead wire of the grounding rod to the grounding terminal for the earth leakage relay.
 2. If the lead wire is not long enough for the connection, connect it as directed below:
 - (1) A lead to be connected to the grounding rod shall be more than 5.5 mm² at cross sectional area so that its grounding resistance will be less than 100 Ω.
 - (2) Connect the lead wire and the extension wire by soldering or sleeve coupling securely and apply insulating tape to the connection.
 - (3) Do not burry the connection in the ground.

(2) Grounding of load equipment

As in the case of the generator, execute grounding work on the load equipment case.

Note: The installation of a leakage relay on the generator can not become a reason for elimination of the need for the load side grounding.

The load side grounding is indispensable for earliest possible detection of any leakage caused in the generator. The absence of such grounding requires any leakage to be detected by current flowing through the human body and is very dangerous because the sensitivity of the leakage relay provided on the machine is not sufficient for detection of such current. The load side grounding resistance shall be less than 500 Ω.

(3) Operation check

For safety reasons, check the leakage relay for operation on a periodic basis according to the procedure described below:

- ① Start up the generator according to the operating instruction and adjust the voltage rated.
- ② Make sure that all breakers of the load side are "OFF".
- ③ Set the breaker of three phase and single phase to "ON".
- ④ Press the TEST button on the leakage relay. If this causes the LEAK lamp (red) on the leakage relay to go on and the breakers to be activated, the leakage relay can be regarded as operating normally.
- ⑤ Press the RESET button and return the breaker to the "OFF" position. This allows the breaker to be turned to "ON" again.

The leakage relay, once it is activated, holds its activated state until the RESET button is pressed or the generator is stopped.

(4) Action for operation of the leakage relay

When the leakage relay is activated, then stop the engine, and measure the insulation resistance several parts and repair the leak spot before restart the engine.

5. AUTOMATIC LOAD SHARE CONTROLLER

5-1. Applicable Models

DCA-SP SERIES (150kVA or higher)

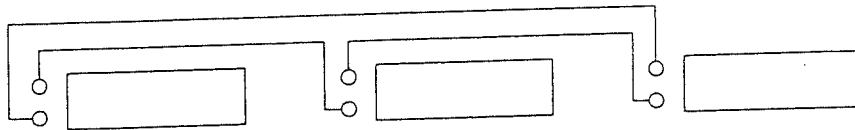
5-2. Description of Device

This device is designed for automatic control of the generators in parallel operation to equalize their load shares, as well as for regulation of their frequency at a constant level.

5-3. Operation

- (1) In addition to the ordinary connection for parallel operation of the generators, connect their parallel operation connectors with the attached parallel operation cable.

The connector is located on the side of the output terminal block. Make this connection in loop as illustrated in the following drawing.



- (2) Set the "50Hz-60Hz" selector on the control panel in the desired frequency side.
- (3) Then, put the generators in parallel operation according to the ordinary parallel operation procedure.
- (4) When the generators are put into parallel operation, the controller automatically function to equalize their load shares.

5-4. Precautions in Operation

- (1) The controller functions effectively only for parallel operation of generators equipped with this device.
- (2) When generator without this device is used for parallel operation, open the control panel and remove fuses F1 and F2, shortcircuit across k_1 and k_2 in automatic load share controller current transformer CTX.
- (3) The device's function of regulating the frequency at a constant level also operates while the generators are running on an individual basis. This function starts when the breaker is turned to the "ON" position.

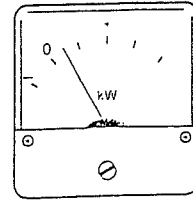
6. WATTMETER

6-1. Applicable Models

DCA-SP SERIES

6-2. Description of the Wattmeter

This wattmeter indicates the generator output in kW. Use the wattmeter below the rated of the generator. Note that the wattmeter pointer moves to the (-) direction when reverse power flows in the generator while it is in parallel operation.



7. REVERSE POWER RELAY

7-1. Applicable Models

DCA-SP SERIES

7-2. Description of the Relay

This relay is designed to detect any reverse power flowing in the generator while it is load operation such as parallel operation and trip the breaker.

7-3. Setting

Reverse power -----

setting 15% of rated power

Time setting -----

10 sec for 102% of revers power setting