AIRMAN

SG

SERVICE MANUAL

ENGINE GENERATOR

SDG25S-8E1
SDG45S-8E1

HOKUETSU INDUSTRIES CO., LTD.

Preface

This service manual explains about the cautions for maintenance jobs and is to serve a guide for the electric system, and troubleshooting for service personnel. Fundamental matters and other things already mentioned in the “Instruction Manual” and the “Parts Catalogue” are omitted to avoid duplication. Therefore, for the operation and handling of this unit, we request you to refer to the instruction manual and caution plates, and further for the structure and components of the unit, please refer to the “Parts Catalogue” separately to be supplied with the unit.

If you should find any description which does not coincide with the instruction manual and parts catalog, we request you to make sure to start the job after clarifying it.

Service personnel is required to safely take quick and proper countermeasures as well as to use correct technology of maintenance in case of field services and periodical maintenance. It is important that service personnel should have proper and sufficient knowledge about the structure and function of the unit and should be well familiar with such technique mentioned in them.

Regarding the part numbers mentioned in this manual, we request you to refer to the Parts catalogue separately supplied together with the unit, because the parts numbers in this manual are sometimes changed.

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※ For the details of operation and installation, see Instruction Manual.

1. Specification

1.1 Specifications

Model			SDG25S-8E1		
Generator	Exciting system		Brushless		
	Armature connection		Star with Neutral		ZigZag
	Phase number		Three		Single
	Power factor	%	80		100
	Frequency	Hz	60		
	Rated output	kVA	25		14.4
	Rated output	kW	20		14.4
	Voltage	V	240	480	240/120
	Current	A	60	30	60
Engine	Model		ISUZU 4LE2T		
	Type		4-cycle, water-cooled, direct injection, turbo charged		
	Number of cylinders		4		
	Total displacement	cu. in. (L)	133 (2.179)		
	Rated output	hp (kW)	33.3 (24.8)		
	Revolution per minute	rpm (min^{-1})	1,800 (1,800)		
	Lubricating oil capacity	gal. (L)	2.75 (10.4)		
	Coolant capacity (including radiator)	gal. (L)	2.75 (10.4)		
	Battery		80D26R (12V)		
	Fuel tank capacity	gal. (L)	52 (195)		
General Specifications	Overall length	in. (mm)	67 (1,690)		
	Overall width	in. (mm)	31 (800)		
	Overall height	in. (mm)	55 (1,400)		
	Net dry mass (weight)	lbs (kg)	1,764 (800)		
	Operating mass (weight)	lbs (kg)	2,161 (980)		
Others	The capacity of oil fence	gal. (L)	26 (100)		

1. Specification

Model			SDG45S-8E1		
Generator	Exciting system		Brushless		
	Armature connection		Star with Neutral		ZigZag
	Phase number		Three		Single
	Power factor	%	80		100
	Frequency	Hz	60		
	Rated output	kVA	45		26
	Rated output	kW	36		26
	Voltage	V	240	480	240/120
	Current	A	108	54	108
Engine	Model		ISUZU 4LE2X		
	Type		4-cycle, water-cooled, direct injection, turbo charged, intercooled		
	Number of cylinders		4		
	Total displacement	cu. in. (L)	133 (2.179)		
	Rated output	hp (kW)	57.7 (43)		
	Revolution per minute	rpm (min^{-1})	1,800 (1,800)		
	Lubricating oil capacity	gal. (L)	3.1 (11.7)		
	Coolant capacity (including radiator)	gal. (L)	2.5 (9.5)		
	Battery		85D26R (12V)		
	Fuel tank capacity	gal. (L)	106 (400)		
General Specifications	Overall length	in. (mm)	82 (2,080)		
	Overall width	in. (mm)	38 (970)		
	Overall height	in. (mm)	61 (1,560)		
	Net dry mass (weight)	lbs (kg)	2,425 (1,100)		
	Operating mass (weight)	lbs (kg)	3,197 (1,450)		
Others	The capacity of oil fence	gal. (L)	37 (140)		

1.2 Outline Drawing

(SDG25S-8E1)

【Unit : in.】

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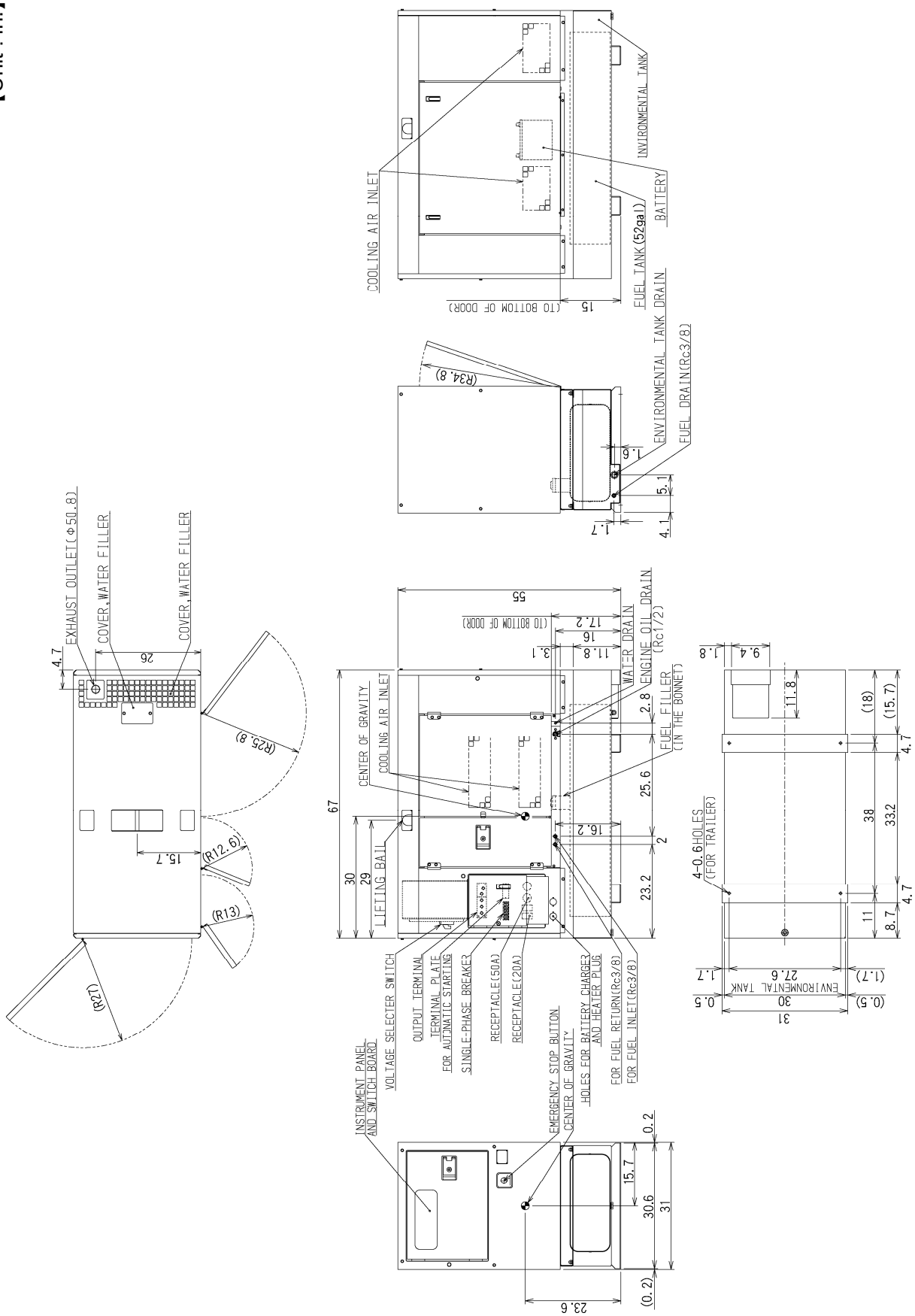

1. Specification

(SDG25S-8E1)

【Unit : mm】

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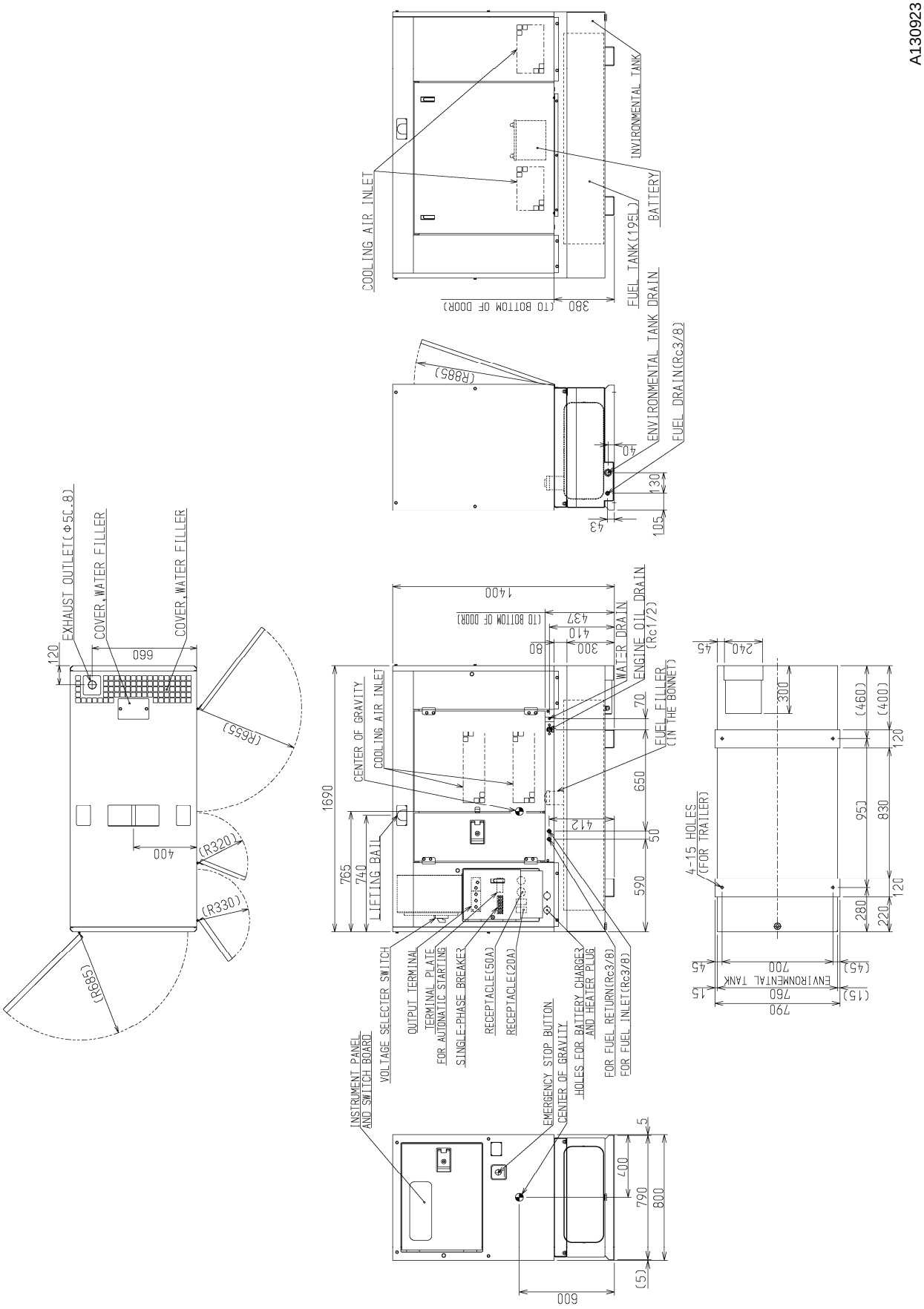

1. Specification

(SDG45S-8E1)

【Unit : in.】

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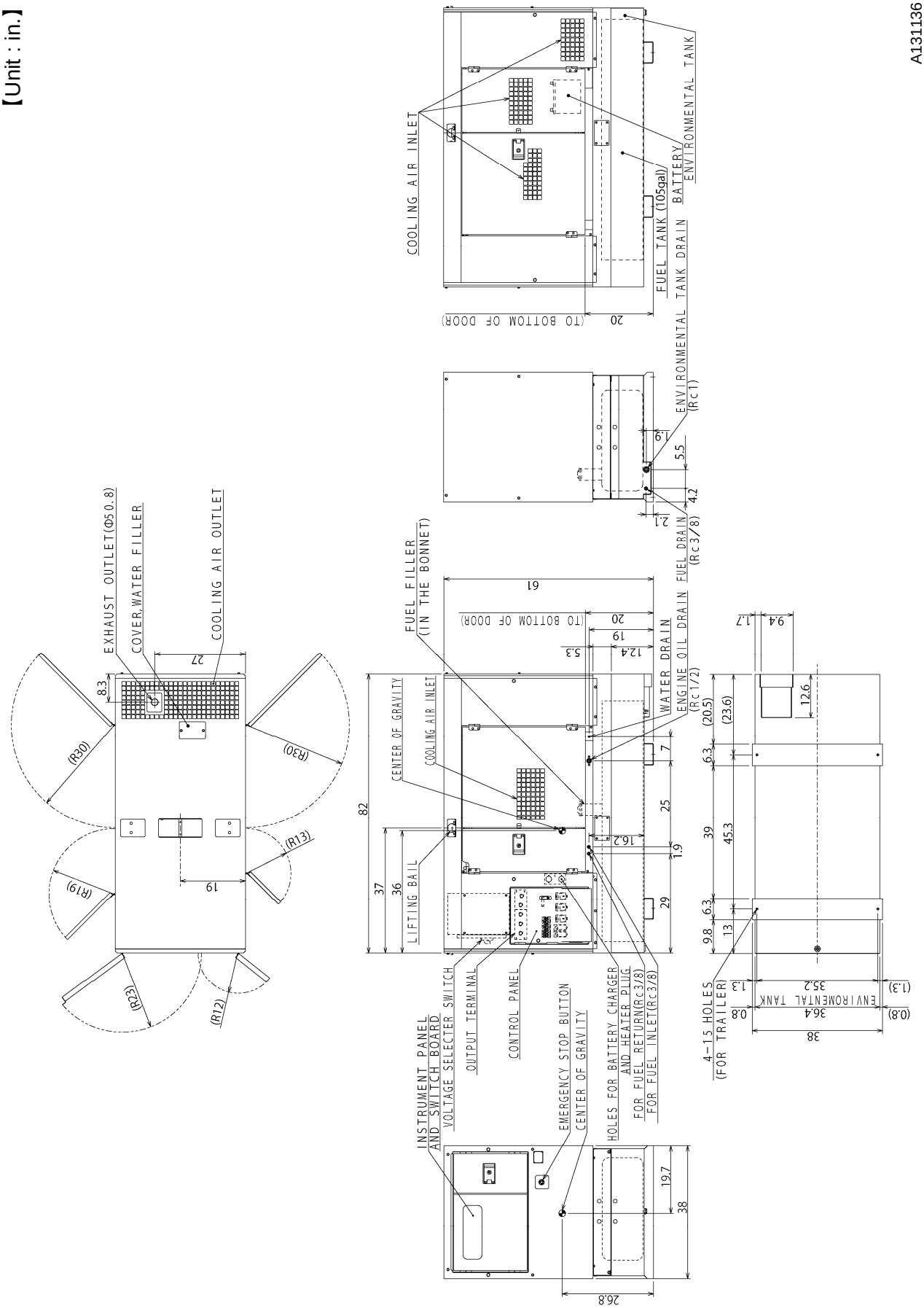

1. Specification

(SDG45S-8E1)

【Unit : mm】

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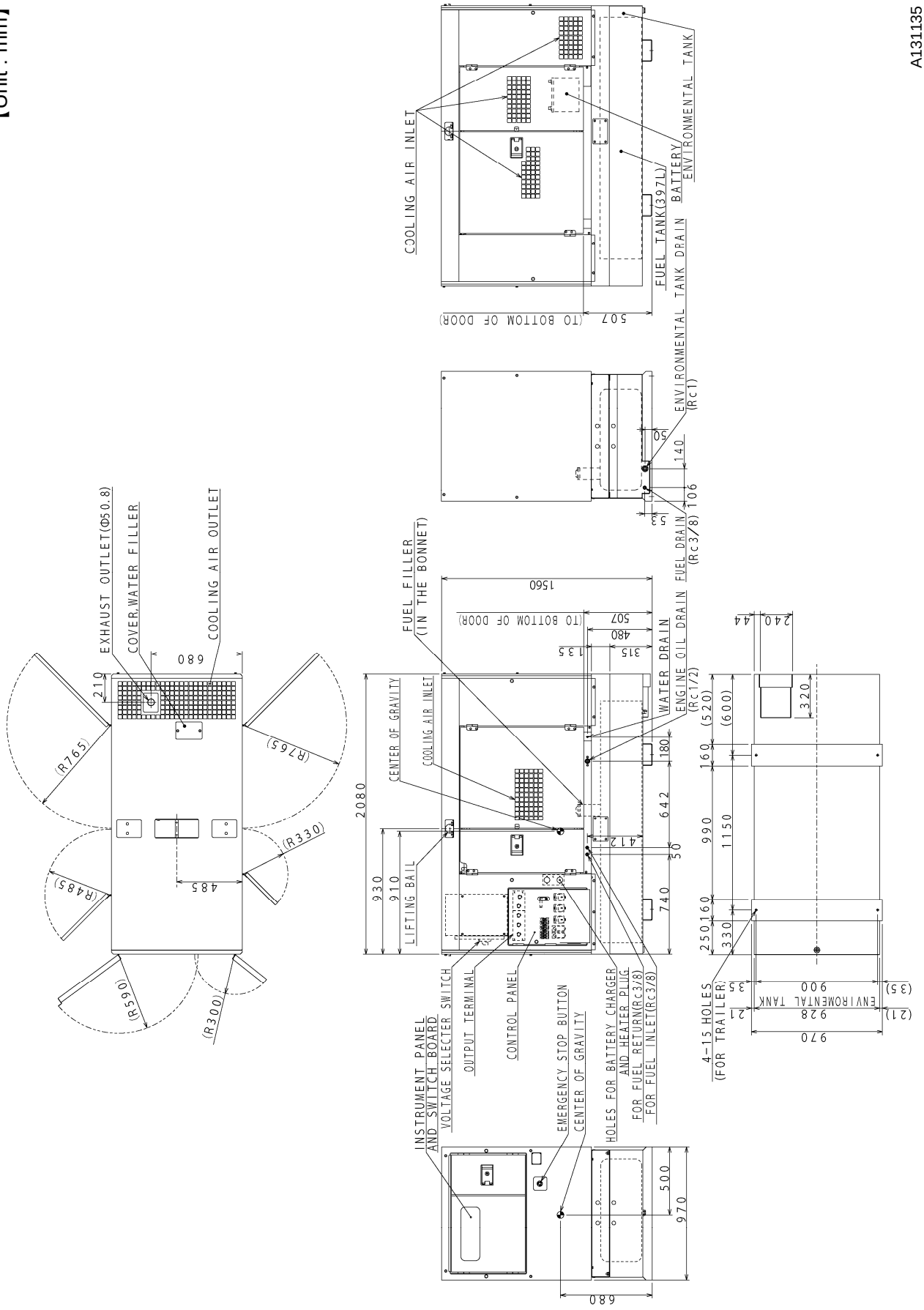
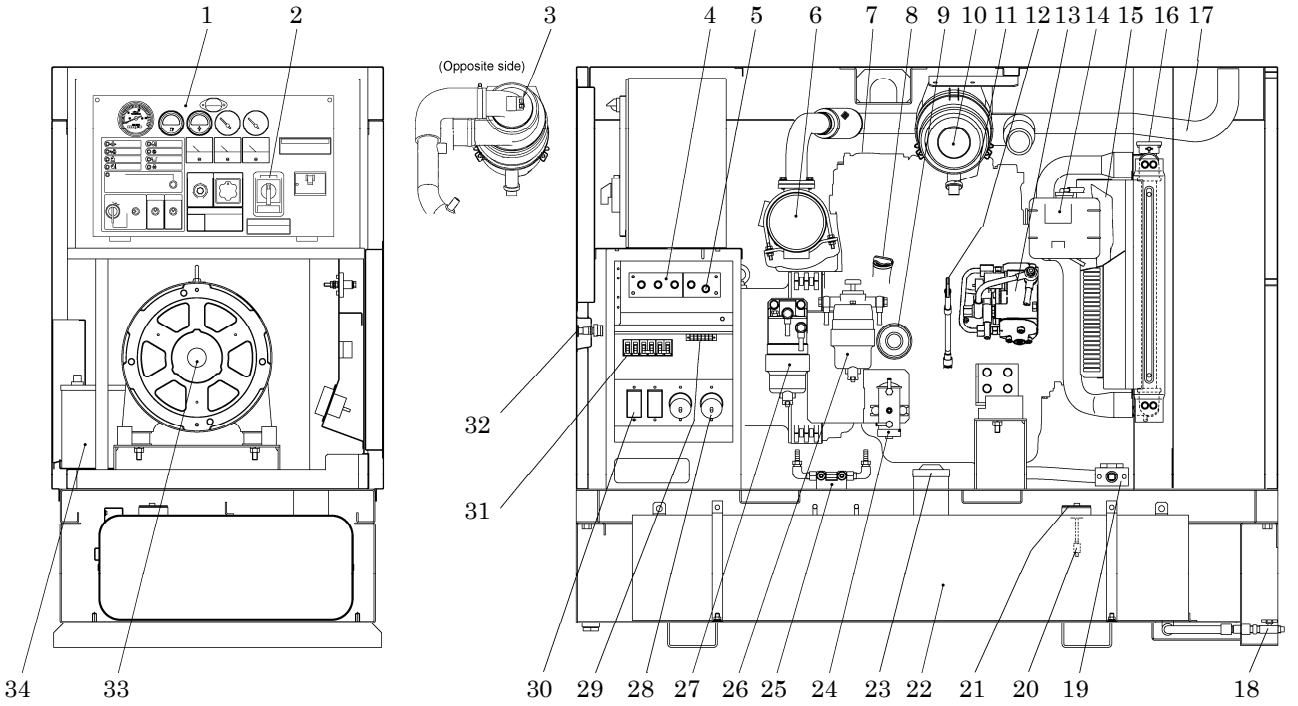


1. Specification

1.3 Internal Components



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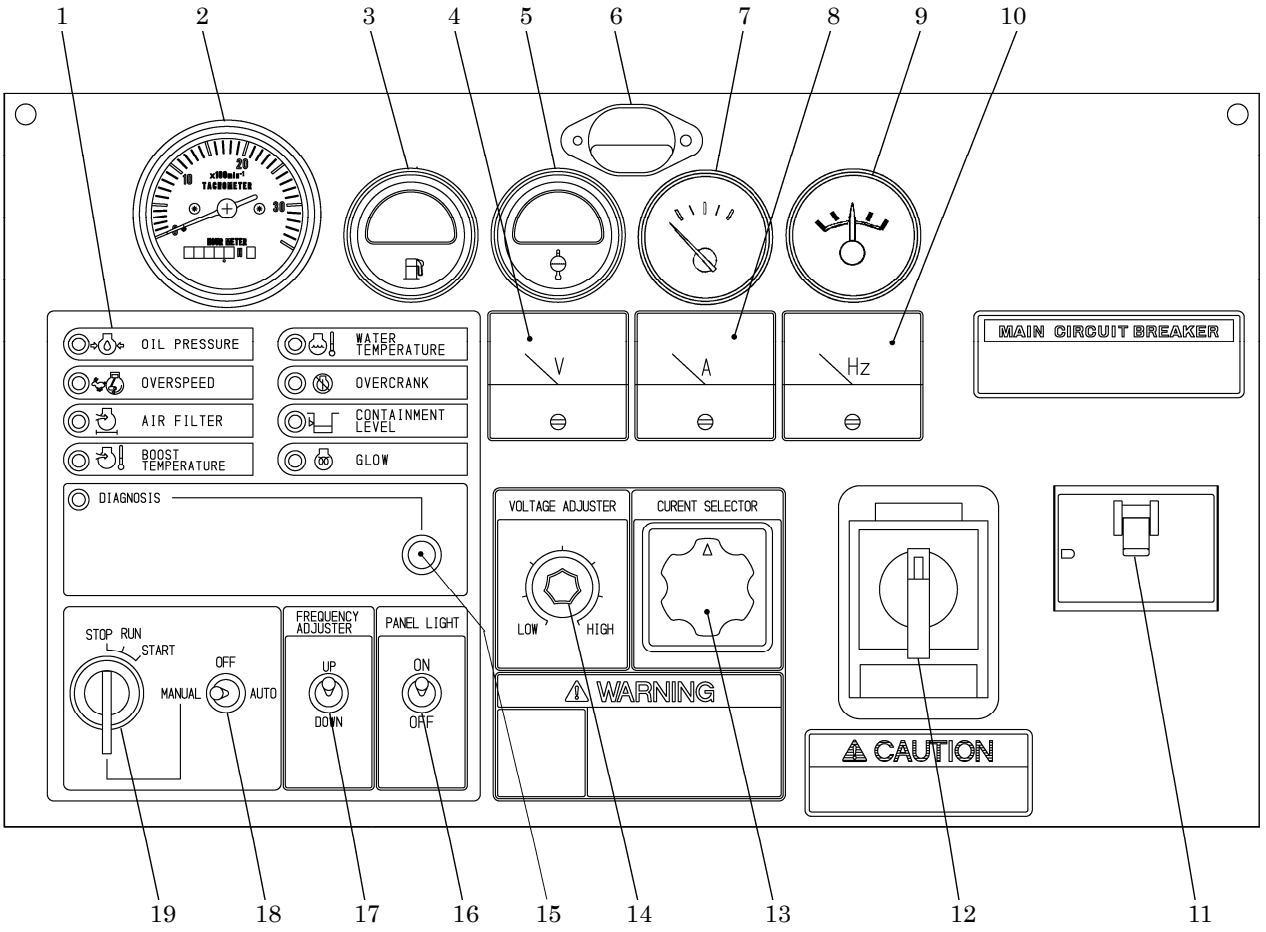
No.	Description	No.	Description
1	Control panel	18	Fuel drain valve
2	Voltage selector switch	19	Engine oil drain valve
3	Air filter differential pressure switch	20	Oil fence level switch
4	Output terminal plate	21	Sending unit
5	Ground terminal	22	Fuel tank
6	DOC (Diesel Oxidation Catalyst)	23	Fuel cap
7	Engine	24	Fuel air-bleeding electromagnetic pump
8	Engine oil filler port	25	Selector valve of fuel pipe
9	Engine oil filter	26	Fuel filter
10	Air filter	27	Fuel pre-filter
11	Vacuator valve	28	Auxiliary receptacles
12	Engine oil level gauge	29	Remote control terminal plate (for automatic operation, battery charger)
13	Supply pump	30	GFCI receptacles
14	Reserve tank	31	GFCI receptacles breaker and auxiliary receptacles breaker
15	Fan	32	Emergency stop switch
16	Radiator	33	Generator main unit
17	Exhaust pipe	34	Battery

1. Specification

1.4 Instrument Panel



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SDG25S-8E1

1. Monitor lamps
2. Tachometer with hour-meter
3. Fuel gauge
4. Voltmeter
5. Engine water temperature gauge
6. Panel light
7. Engine oil pressure gauge
8. Ammeter
9. Ammeter for battery charge
10. Frequency meter
11. Main circuit breaker
12. Voltage selector switch
13. Current selector switch
14. Voltage adjuster
15. Engine diagnosis switch
16. Panel light switch
17. Frequency adjuster switch
18. Manual-automatic selector switch
19. Starter switch

1. Specification

1.5 Protection Device

⚠ WARNING

- For prevention of troubles during operation, this machine is provided with various protection devices. When the engine stops due to function of the protection devices and circuit breaker trips, get rid of the causes of trouble, referring to the trouble shooting clause and then restart operation.

List of protection devices

- This machine is equipped with the following devices in the table. Repair and make necessary treatment in accordance with the item ○.

Item	Engine stops	Three-phase circuit breaker trips	Lamp display	Monitor	Functions
Engine oil pressure drop	○	—	○		When engine oil pressure drops, it functions. Operating pressure: lower than 14.3psi (0.098MPa)
Excessive rotation	○	—	○		When engine rotates excessively, it begins to function. Function rotation: Under operation at 60Hz: 2,070min^{-1} (69Hz)
Clogging of air filter	—	—	○		When air filter is clogged and it becomes necessary to clean or replace it, it functions.
Boost temperature rises	—	—	○		When boost temperature rises higher than 185°F (85℃), monitor lamp goes on.
Water temperature rises	○	—	○		In case of abnormal rise of engine water temperature, it functions. Operating temperature: 212°F (100℃)
Overcrank	○	—	○		This lamp goes on when operator fails to start engine, during automatic operation mode.
* Oil fence	—	—	○		When more condensate (fuel, engine oil and coolant) than 1/3 of capacity in the oil fence is accumulated, monitor lamp lights.
Glow	—	—	○		When starter switch is “ON”, the monitor lamp glows and goes off after preheating is performed.
Overcurrent or short-circuit	—	○	—	—	In case of overload or short-circuit accident, it functions.
Engine troubles	—	—	○	—	Refer to 4.6 “Engine Trouble Diagnosis Function”.

* When the monitor lamp lights in the oil fence, immediately drain it.
(For the capacity of the oil fence, refer to 1.1 Specifications). To protect environment, do not drain it directly into rivers.

1. Specification

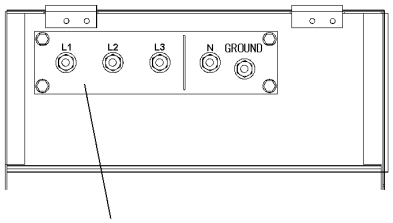
1.6 Terminal

● The unit is equipped with three-phase output terminals, ground terminal, GFCI receptacles and auxiliary receptacles mentioned in the following table.

Item	SDG25S-8E1		SDG45S-8E1	
	Bolt size and length	Quantity	Bolt size and length	Quantity
Three-phase output terminals	(L1, L2, L3 terminal) M8×P1.25	3	(L1, L2, L3 terminal) M14×P2.0	3
	(N terminal) M8×P1.25	1	(N terminal) M14×P2.0	1
Ground terminal	M8×P1.25	1	M14×P2.0	1
Output terminal hole diameter (A)	ϕ 10	—	ϕ 19	—
Single-phase 120V GFCI receptacles ※1	120V 20A Socket	4	120V 20A Socket	4
Single-phase 240/120V Auxiliary receptacles ※2	240/120V 50A Socket	2	240/120V 50A Socket	3

※1 GFCI AC power will be available independently of the position of voltage selector switch.

※2 Auxiliary AC power will be available only when the voltage selector switch is turned to 240/120V.



Three-phase output terminal plate

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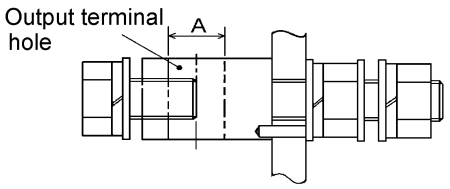

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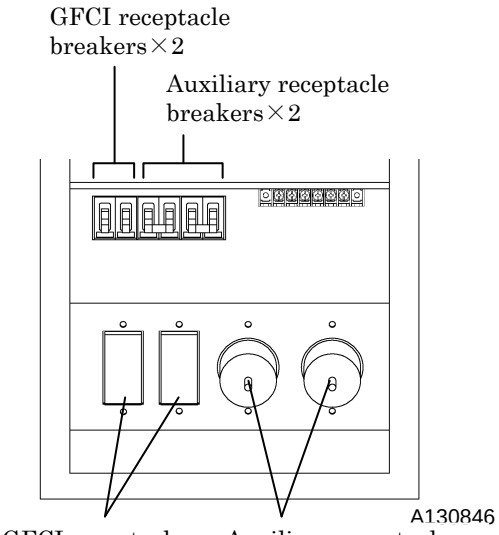

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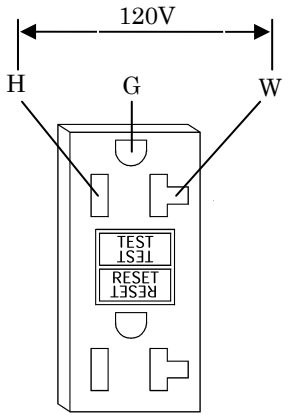
[GFCI]



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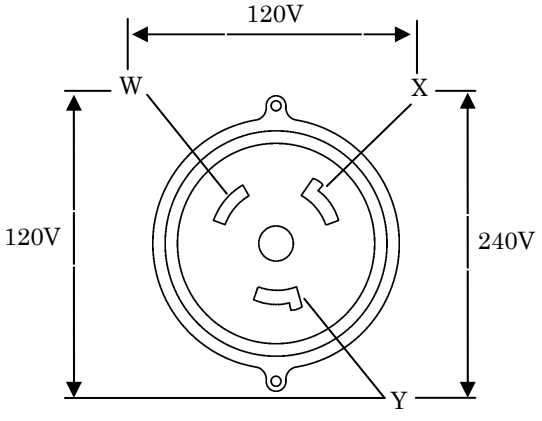

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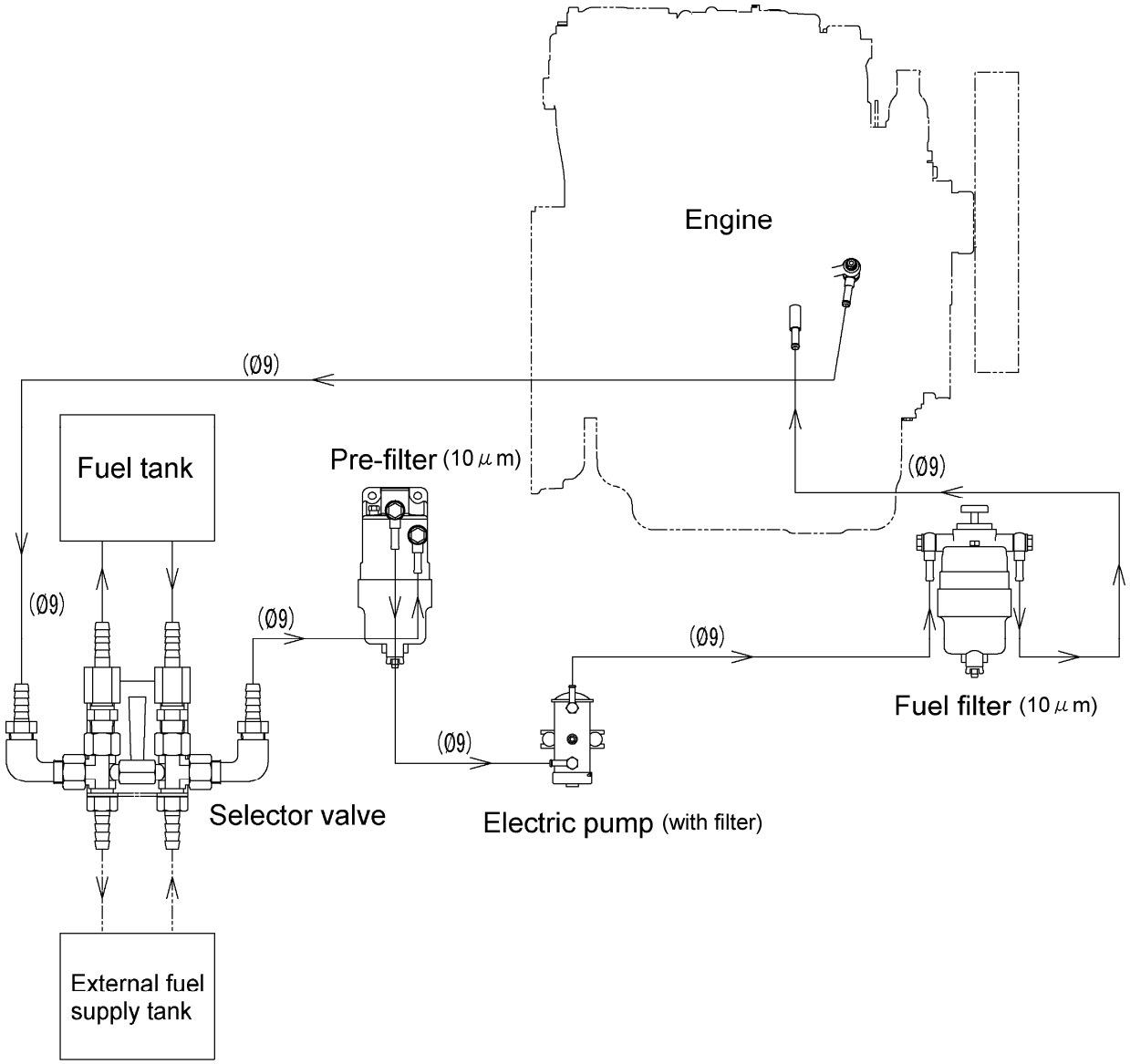
1.7 Fuel Piping



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2. Overhauling

2.1 Cautions for Overhauling

2.1.1 Precautions before starting work

(1) Work to be performed

It is very important to always plan in advance what facilities, tools, instruments, materials, oil, etc. you will need to use; the exact locations and methods of performing inspection, adjustment, or disassembly; and the key points of any repair work to be performed.

(2) Care not to spill oil

Use a pan to collect used engine oil when changing the oil or attaching or detaching an oil line. If a large volume of oil is expected to flow out, make sure to drain any accumulated oil from the engine oil pan in advance.

(3) Care when detaching parts

When disassembling a complicated part, put a matching mark to indicate the position of detached parts for future reference. Make sure that the negative(－) cable is detached from the battery terminals before starting repair work.

(4) Tools to be prepared

① Measuring instruments
(e. g. tester, insulation resistance gauge etc.)
② Tools
③ Torque wrenches
④ Jigs and specialized tools
⑤ Solder and soldering iron
⑥ Cleaning cloths
⑦ Literatures (such as manuals etc.)

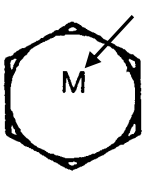
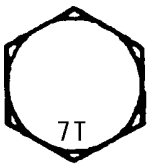
2.1.2 Disassembly and reassembly

① Wash dirt, dust and grime off vinyl tube and fuel hose before removing it, and take necessary steps to cover or tape the openings of vinyl tubes or fuel hoses to prevent any dirt from entering them.
② Perform disassembly work in a dust-free location whenever possible.
③ When disassembling parts, wash their outer surface and place them on a clean sheet of paper or cloth, taking care not to contaminate or damage them.
④ Wash disassembled parts with diesel oil (cleaning solvent) after checking for contamination or discoloration. However, do not wash rubber parts with diesel oil.
⑤ Be careful not to damage disassembled parts, they are precision built.
⑥ Replace consumables such as oil seals, O-rings, filters, oil, etc. with new items when reassembling parts.
⑦ Apply a coating of clean grease to O-rings when installing them in the machine.
⑧ When reassembling parts, place each part in the order of assembly and take care that no parts are missing or misassembled.
⑨ When reassembling an assembled part (set part), be sure to replace it as an assembly.
⑩ Contamination or rusting may occur due to dust or humidity if parts are left in disassembled or partly disassembled condition for a long time. Therefore, be careful to prevent dust or rust from affecting parts if you have to leave the repair incomplete for a long period of time.
⑪ Check tightening torque and clearance when assembling parts.
⑫ Check the direction of rotation, speed, and oil leakage after assembly.
⑬ Before starting the machine after disassembly, run it at low idle to check for unusual noises, etc. to prevent engine or generator damage.

2.2 Tightening Torque

2.2.1 General tightening torque of bolts and nuts

Fasten all the bolts and nuts with the specified tightening torque when assembling.

Type / Strength, classification, and indication example / Torque / Nominal diameter (mm)	Low or medium carbon steel bolt (SS400B, etc.)		High strength steel bolt (SCM435, etc.)	
	4.6－6.8 (4T－6T)  Indication does not appear in some cases.		8.8－12.9 (7T－12T)  	
	Hexagon headed bolt		Socket bolt	Hexagon headed bolt
	lb･ft	N･m (kgf･cm)	lb･ft	N･m (kgf･cm)
6	3.7	5 (51)	7.2	10 (100)
8	9	12 (124)	18	25 (245)
10	18	25 (245)	35	49 (485)
12	31	43 (425)	61	85 (845)
14	49	68 (675)	98	135 (1,350)
16	76	106 (1,055)	152	210 (2,100)
18	105	145 (1,450)	210	290 (2,900)
20	148	205 (2,050)	297	410 (4,100)
22	203	280 (2,800)	405	560 (5,600)
24	250	345 (3,450)	514	710 (7,100)
Applied sections	For general sections such as bonnet and frame.		For specified sections.	

IMPORTANT

- Generally, the abovementioned tightening torques should be followed, but in some points different torque is specified. So use the tightening torque without fail.
- Make sure to remove rust and dust before tightening.

2.2.2 Tightening torque for terminal plate

Should be tighten terminal of thermal relay other electric equipment etc. according to following torque.

Bolt size	Tightening torque		Bolt size	Tightening torque	
	lb･ft	N･m (kgf･cm)		lb･ft	N･m (kgf･cm)
M4	1.1	1.5 (15)	M8	7.2	9.8 (100)
M5	2.1	2.9 (30)	M10	12.7	17.2 (175)
M6	3.6	4.9 (50)	M12	25.1	34 (350)

2.3 Disassembly/Reassembly of Generator Main Unit and Connection of Generator Main Unit and Engine

2.3.1 Disassembly of generator main unit

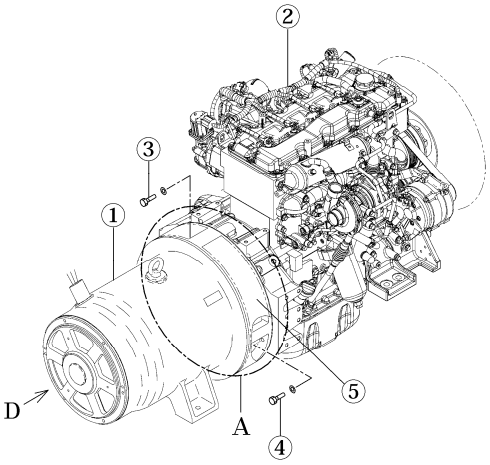
IMPORTANT

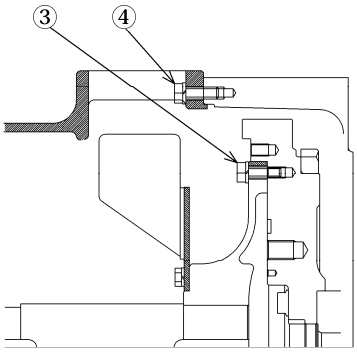
- The generator main unit is unilaterally mounted and the clearance is small, so it must be handled with extreme care to avoid the possibility of damage to the rotor or stator.
- Use hoisting equipment of sufficient capacity when it is necessary to lift up the engine and the generator main unit.

(1) Lifting weight Unit : lbs (kg)

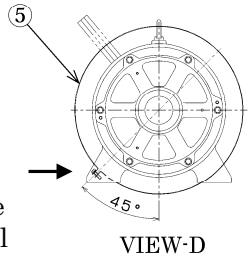
	SDG25S-8E1	SDG45S-8E1
Weight of generator main unit	293 (133)	474 (215)
Weight of engine	420 (190)	476 (216)

① Generator main unit
② Engine
③ Bolts (for coupling of the engine flywheel and the generator coupling)
④ Bolts (for connection of the engine flywheel housing and the generator main unit frame)
⑤ Fan guard





A section (coupling) details



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⑤Fan guard should be fitted at the angle shown for avoidance of its contact with DOC (diesel oxidation catalyst).

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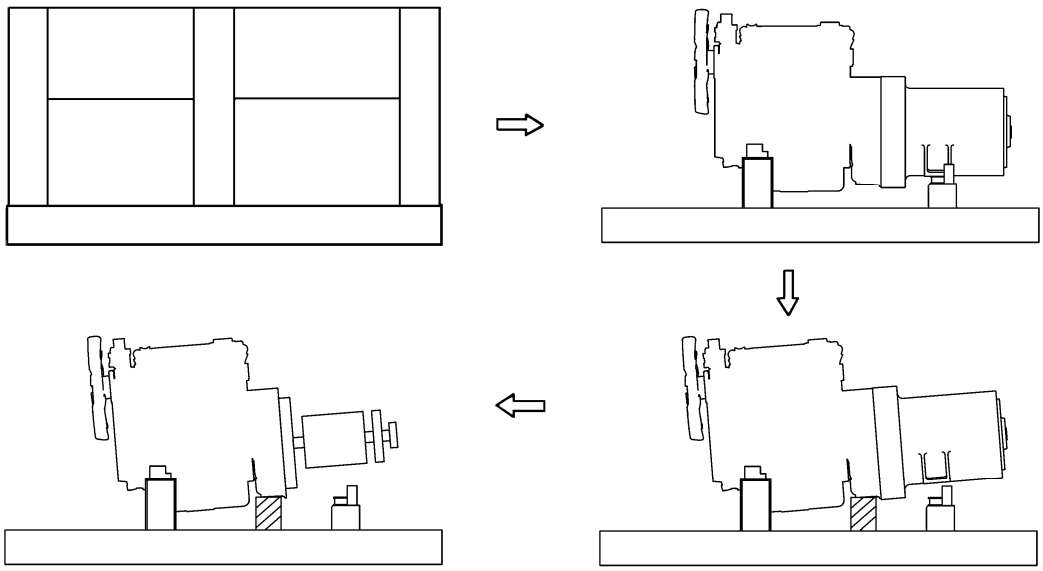
(2) Procedures of disassembly

① Remove cables from battery (−) terminal.
② Remove brackets (or fittings for muffler, air filter and etc.) equipped on the bonnet.
③ Remove top cover and dismantle such parts on the bonnet so that generator main unit can be pulled out.
④ Remove cables and pipes.
⑤ Remove mounting bolts of generator main unit and engine.
⑥ Remove engine cooling fan guard and fan shroud.
⑦ If necessary, remove radiator, radiator hoses, fuel tank and battery.
⑧ Insert an angle timber under the engine housing for inclining the engine.
⑨ Separate engine housing and generator stator.
⑩ Separate engine flywheel and generator rotor.



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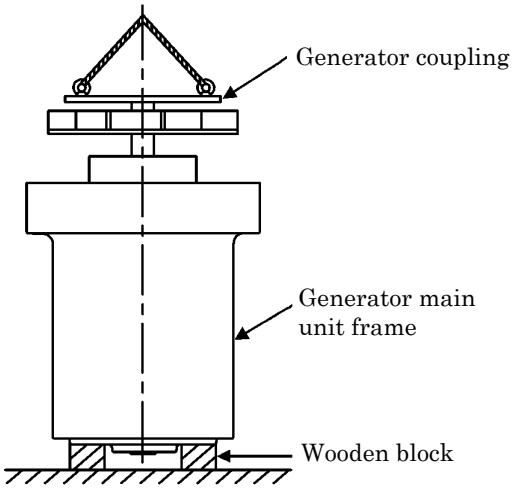
※If insulation film is damaged by contact of stator and rotor during disassembly of generator main unit, perform varnish drying treatment to such portion.

(3) Demounting stator and rotor at the same time from engine

When demounting stator and rotor of generator main unit at the same time from engine, place the generator main unit with the engine coupling face upward, and pull out the rotor.

At this time, stabilize the generator main unit frame padded by wooden block at the bearing side face.

(The generator main unit separated from engine should be kept firm with the rotor in the stator fastened by wire or rope to prevent them from moving. Then start this job.)



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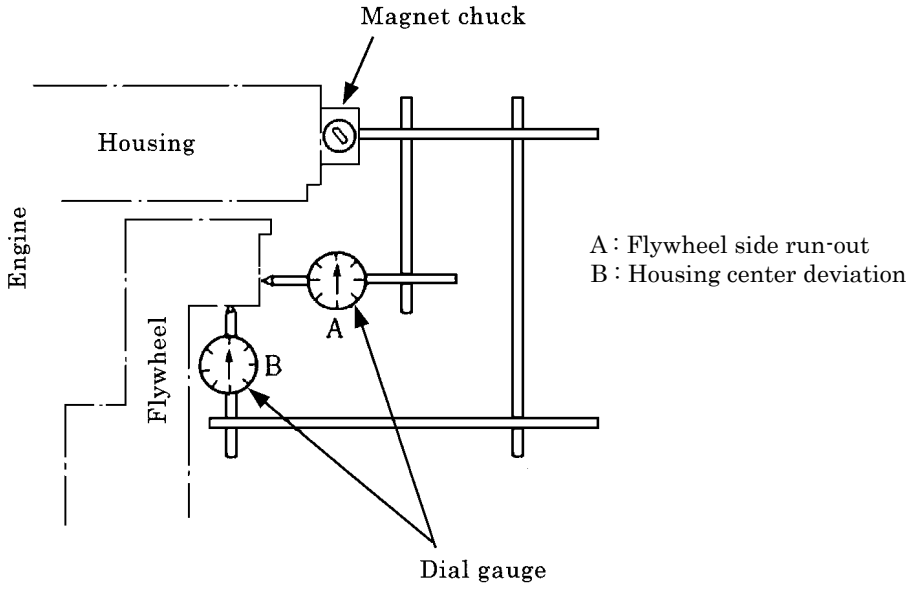
2.3.2 Measuring center deviation and surface deviation

Measure them with a dial gauge pressed to the flywheel.

(1) Measuring the center deviation, turn the rotor with the dial gauge pressed to the circumference of the coupling flange. If the biggest value measured on the same circumference exceeds 0.008in. (0.2mm), it is necessary to repair it.

(2) Measuring the side run-out, turn the rotor with the dial gauge pressed vertically to the coupling flange. If the biggest value measured on the same diameter exceeds 0.008in. (0.2mm), it is necessary to repair it.



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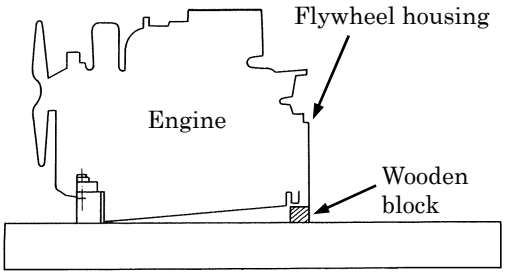
2.3.3 Assembly of engine flywheel and generator coupling (rotor)

IMPORTANT

- The mounting holes are not equally spaced along the circumference. Therefore, position the holes in advance so as to match the coupling counterpart by turning and adjusting the engine flywheel.
- Use guide bolts while centering to mount the assembly.
- Tighten the bolts to the specified torque.

(1) Mounting engine

Mount the engine on the vibration isolator rubbers at the frame side of engine. Put angle wooden block under the engine housing and incline the engine a little.



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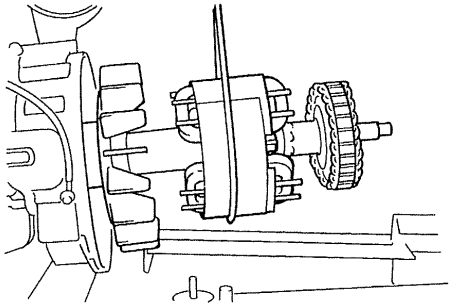
(2) Install rotor

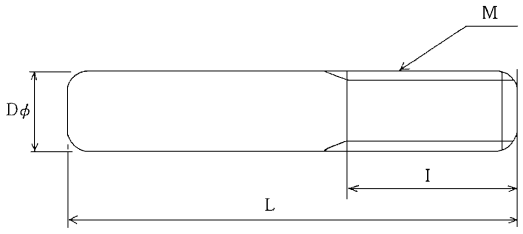
① Hang the center of the rotor with jute rope and bring it near to the flywheel.

② Match the rotor coupling plate to the engine flywheel and then combine them, tightening the coupling connecting bolts.
The coupling connecting bolts shall be high tensile bolts 7T or more. (Use 2 guide bolts for this job.)



SG06073

(3) Size of guide bolt



SG05047

Unit : in. (mm)

	SDG25S-8E1	SDG45S-8E1
D ϕ	0.30 (7.5)	0.37 (9.5)
L	2.36 (60)	1.96 (50)
I	0.98 (25)	0.98 (25)
M	(M8×1.25)	(M10×1.5)

(4) Tightening torque of generator coupling (rotor) (See ③ of 2.3.1 bolts)

	Unit	SDG25S-8E1	SDG45S-8E1
Bolt size	(mm)	(M8×1.25-30)	(M10×1.5-35)
Quantity		8	8
Tightening torque	lb·ft [N·m] (kgf·cm)	18.4 [25.0] (255)	36.1 [49.0] (500)

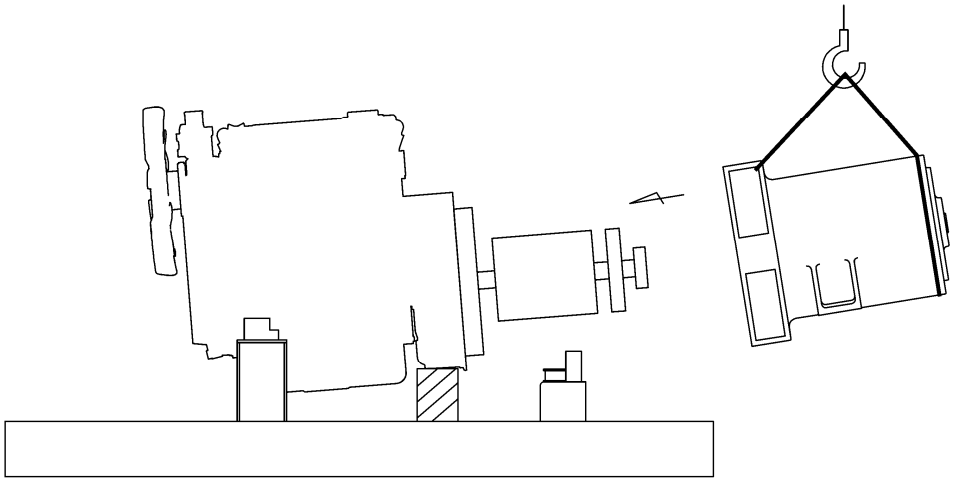
2.3.4 Assembly of flywheel housing and generator main unit frame (stator)

IMPORTANT

- Handle the stator with care after fastening the engine flywheel and generator coupling, to avoid damage to either the rotor or stator.
- Tighten the connections to the specified torque.
- For connection of flywheel housing and generator main unit frame (stator), coat anti-corrosion agent " METAL CLEAR" on the connecting faces to prevent rust and corrosion.

(1) Install the stator

① Remove casing from stator.
② Carefully push into the stator, preventing the stator and rotor from rubbing each other.
③ Install the flywheel housing and the stator, tightening the connecting bolts.
The bolts should be high tensile 7T or more.
④ Remove the angle wooden block from under the flywheel housing, and place the generator main unit and engine horizontally.
⑤ Install the casing to the stator.



SG13057

(2) Tightening torque of generator main unit frame (stator) connecting bolts. (See ④ of 2.3.1 Bolts)

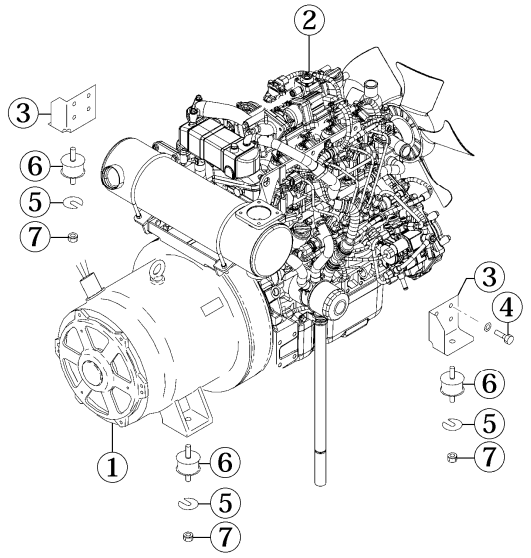
Bolt size	(mm)	(M10×1.5-30)
Quantity		12
Tightening torque	lb·ft [N·m] (kgf·cm)	18.4 [25.0] (260)

2.3.5 Mounting of generator main unit and engine on frame

IMPORTANT

- Perform centering carefully, to avoid deviation in the horizontal leveling caused by distortion of the frame or inaccurate mounting of the generator main unit and engine.
- Running the machine without accurate centering may cause abnormal vibrations.

① Generator main unit
② Engine
③ Bracket
④ Bolt
⑤ Shim
⑥ Cushion rubber
⑦ Nut



SG14131

(1) Centering method

① Mount the brackets on the engine secured to the generator main unit.
(Use only genuine fastening bolts.)

② Place four assembly level plates ※ on the points for mounting the engine and the generator main unit onto the frame.

③ Place the generator main unit with the engine mounted onto it on the assembly level plates on the frame.

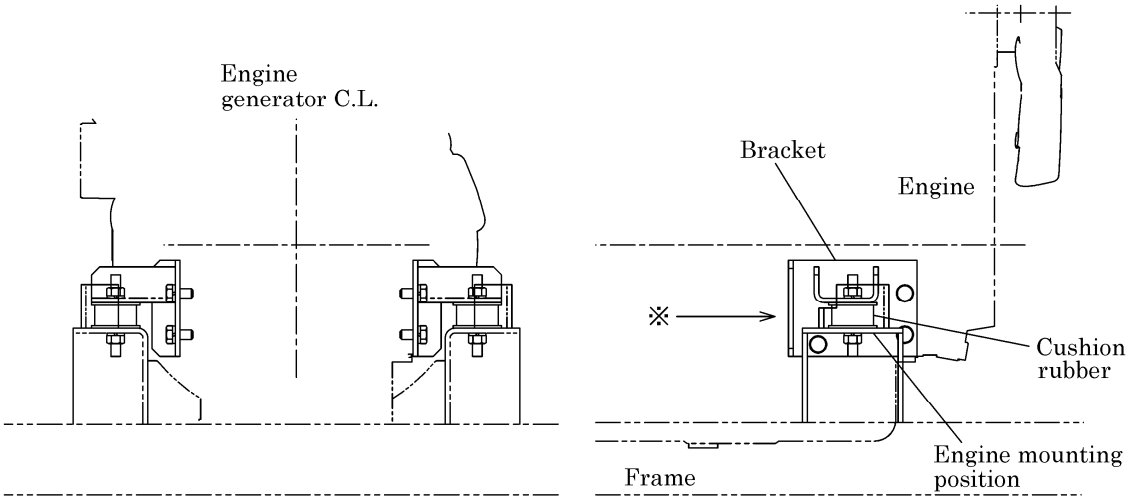
④ Use shims for adjustment if joint gaps are found at any of the four places where the brackets and assembly level plates are to be fixed.

⑤ Lift the engine mounted onto the generator main unit, leaving the shims in the four places after adjustment.

⑥ Remove the assembly level plates and place the cushion rubbers in their respective places on the frame.
(Insert or place adjusting shims on the cushion rubbers of both engine and generator main unit.)

⑦ Place the engine with the generator main unit on the cushion rubbers and fasten it with nuts.

⑧ Make sure to coat the bolts with anti-corrosion agent “Metal Clear” which are tightened for cushion rubbers. (8 points consisting of upper side 4 pieces and under side 4 pieces.)

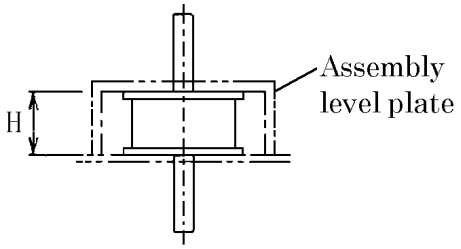


SG13058E

※ Before installing cushion rubbers, place assembly level plate on the position of generator main unit and engine connection and then adjust the clearance between engine mounting bracket and assembly level plate.

Assembling level plates size Unit : in. (mm)

Generator side	1.4 (34)
Engine side	1.4 (34)



SG13088E

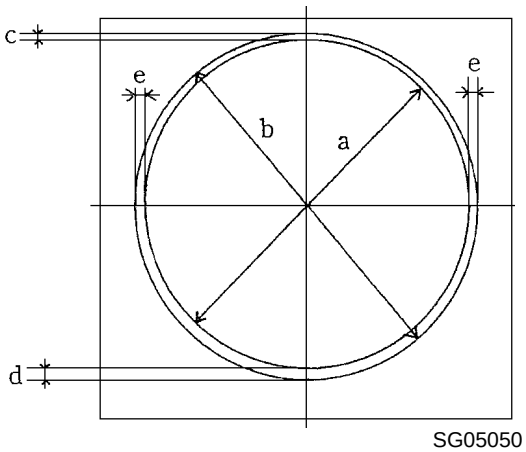
(2) Check the gap between the cooling fan and fan shroud

IMPORTANT

- Maintain an adequate gap in both the vertical and horizontal directions.
- If the fan is mounted incorrectly so that it leans toward one side wall of the shroud, leading to a smaller gap in one direction, the fan may produce abnormal noise due to rubbing against the shroud during starting or stopping and may also overheat.

Gap size Unit : in. (mm)

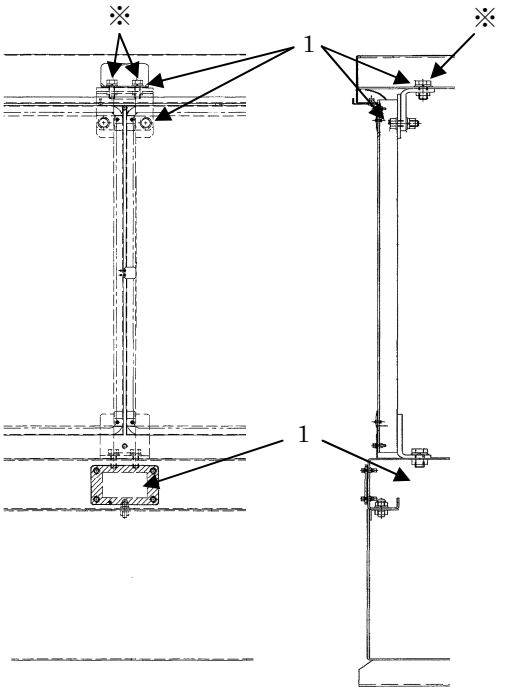
Fan outer diameter	(a)	16.9 (430)
Shroud inner diameter	(b)	18.1 (460)
Top gap	(c)	0.47 (12)
Bottom gap	(d)	0.71 (18)
Side gap	(e)	0.59 (15)



SG05050

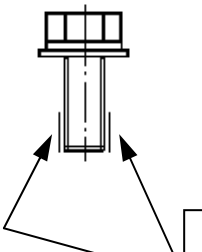
(3) Retighten the bolts at the lifting portions as shown in the figure

- When assembling the bonnet after having mounted the generator unit and engine, retighten the bolts for lifting the bonnet for sure.
  Torque of bolt "1" :SDG25S 50lb·ft (68N·m)
  :SDG45S 110lb·ft (150N·m)
- Coat the tips of the bolts marked ※ with sealant "ThreeBond 1212"as shown in the figure to prevent rain water from entering inside the bonnet.



SG12088

SDG45S-8E1


SG12089

Coat the circumference of the bolt tip with sealant "ThreeBond 1212"

2.3.6 Changing the bearing in the generator main unit

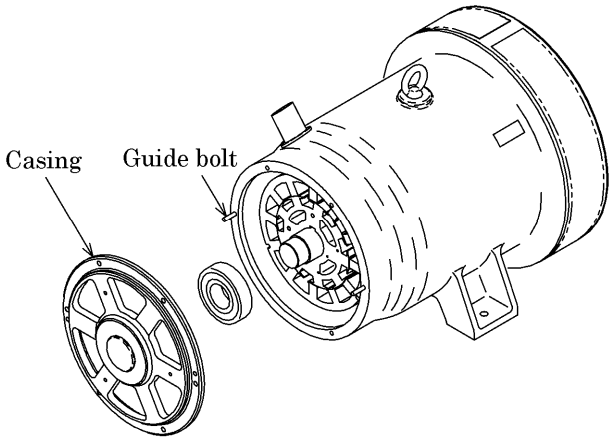
IMPORTANT

- Use guide bolts to avoid the danger of dropping the bearing shield (casing) and to prevent the rotor and stator from rubbing against each other. (Use the guide bolts used to mount the generator main unit.)
- Do not hit the bearing outer race when installing or the bearing may be damaged.

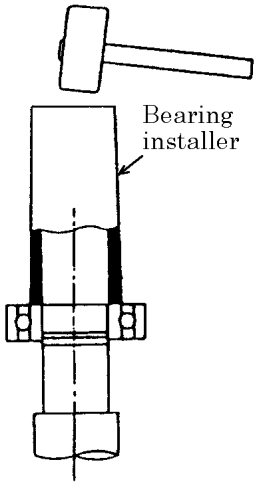
The generator main unit is equipped with fully sealed bearing. It is not necessary to supply grease. But the machine life (4 years or 15,000－20,000 hours of operation) may change, depending upon the conditions such as vibration, ambient temperature and humidity. So always make sure to check for any abnormal noise of the bearing and also to check for any abnormal rise of temperature. Should it become necessary to replace the bearing, follow the under mentioned procedures.

Replacement of bearing

① Remove bearing shield (casing).
② Pull out the bearing from the shaft, using bearing removing tools (gear puller).
③ Clean the surface of the shaft and check for any damages.
④ Prepare a new bearing, and check it by turning it by hand before installing it.
⑤ Bearing is installed by using a bearing heater or a bearing push-in tool.
(The heating temperature of bearing shall be between 100℃ and 118℃, but never over 120℃.)
⑥ Set guide bolts to the generator main unit frame.
⑦ Push in the bearing shield (casing), hitting it with a plastic hammer evenly.



SG14165E



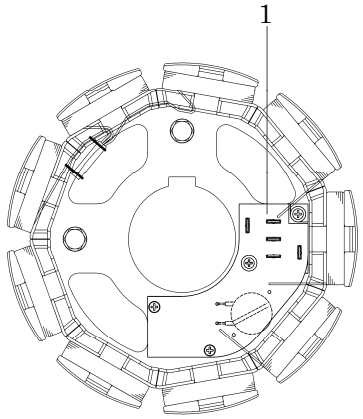
SG05052E

2.3.7 Replacement of rotary rectifier (wiring board)

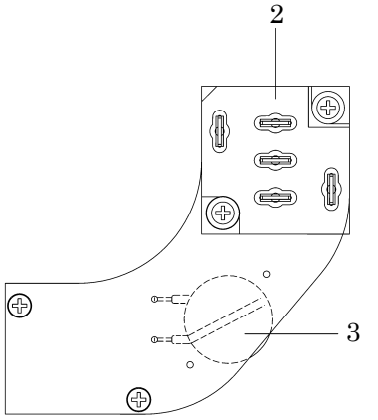
IMPORTANT

- Shorten time to keep soldering iron touch on diode module.
- Degrease such surfaces where thread looseness is prevented by thread locking fluid.
- It is impossible to replace diode module and varistor only because it is built-in rotary rectifier.

① Rotary rectifier (wiring board)
② Diode module
③ Varistor



SG14006



SG12097

(1) Tightening torque

Rotary rectifier	Thread size		M3 (Nut)
	Tightening torque	lb･in [N･m] (kgf･cm)	7.8 [0.9] (9)
	Thread locking fluid		ThreeBond No.1360
Diode module	Model		S30VT80 (M3 Screw)
Varistor	Model		TND20V-471KB

※Substrate (diode module and varistor are installed) is equipped at the side of the core of exciter generator armature.

Replacement procedures of rotary rectifier

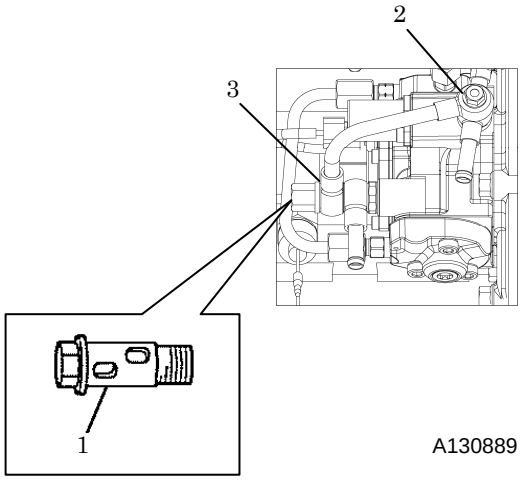
① Remove bearing shield (casing).
② Pull out bearings from the shaft, using bearing removing tools (gear puller).
③ Record positions of cable connection of the rotary rectifier.
④ Remove rotary rectifier, disconnecting cables fitted to the rotary rectifier.
⑤ Install new rotary rectifier.
⑥ Tighten rotary rectifier to the specified torque, using a torque wrench.
⑦ The connections of rotary rectifier (5 point) should be soldered.
Soldering work should not be performed for a long time because they are of semiconductor. (One point should be done in five seconds as aim)

2.4 Check and Cleaning of the Supply Pump Strainer

< Procedure >

- Loosen the supply pump strainer "1" (joint bolt built-in type) and remove it. Then after washing it in diesel oil, blow dust and dirt off with high pressure air. Please be replaced whenever this gasket "2" and "3" .
- In case the conditions of lowered engine power and engine stop will not be improved even after the supply pump strainer (joint bolt built-in type) has been cleaned, it should be replaced.

[NOTE] Supply pump strainer, not part of the decomposition please do not remove the strainer of internal order.



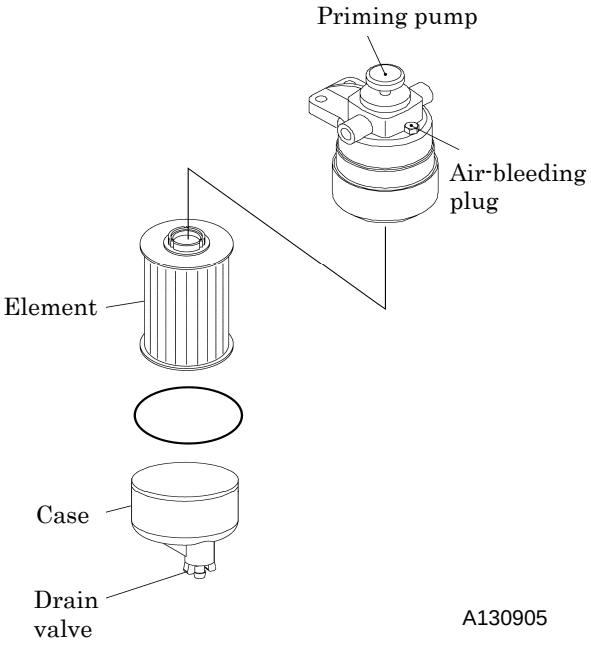
Joint bolt tightening torque	lb·in [N·m] (kgf·cm)	152.2 [17.2] (180)

2.5 Air Bleeding

If the unit runs out of fuel, bleed the air, according to the following procedures.

< Procedure >

① Turn the "MANUAL-AUTO" selector switch to "MANUAL" position.
② Place starter switch to "OPERATION" position to keep electromagnet pump functioning.
③ Loosen "air-bleeding plug" enough to move "priming pump" till fuel comes out.
④ Close "air-bleeding plug" and move "priming pump" (more often than 10 times) till fuel is filled in fuel filter.
⑤ After waiting about 1 minute, loosen "air-bleeding plug" to bleed air from fuel filter.
⑥ Repeat the above procedures ②-④ till air does not come out from "air-bleeding plug" .
(at least more often than three times)
⑦ Perform warming up operation for 3 minutes after engine starts.
⑧ When this machine is not in use or operation, the "MANUAL-AUTO" selector switch should be kept "OFF" .

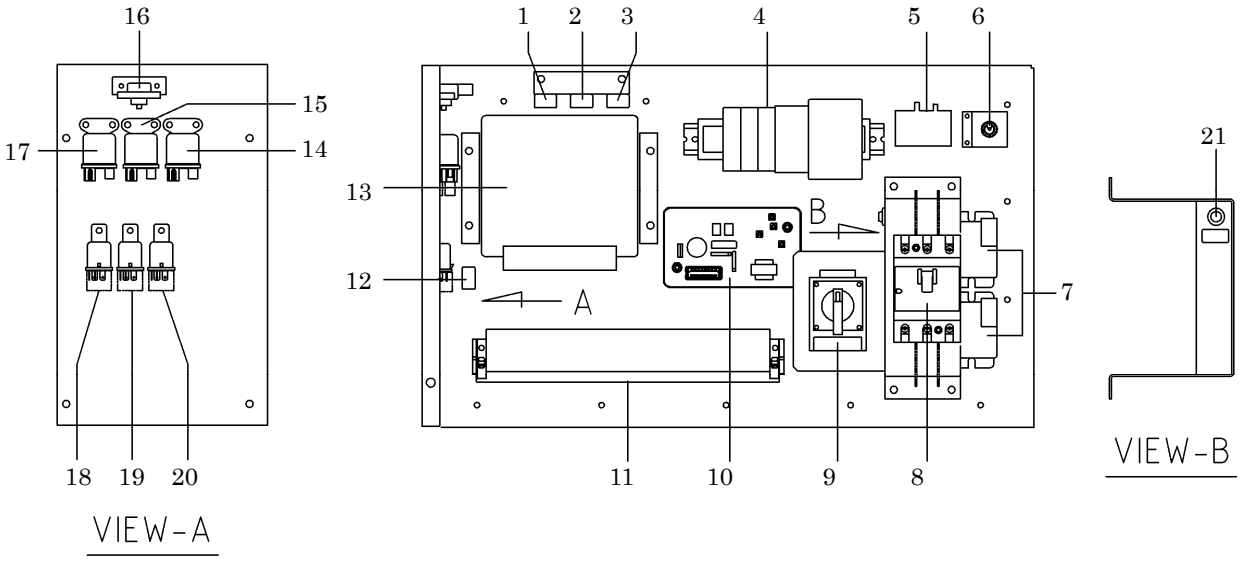


2.6 Engine Maintenance Standards

<table>
<tr><th colspan="2"></th><th>Unit</th><th colspan="2">SDG25S-8E1</th><th>SDG45S-8E1</th></tr>
<tr><td colspan="2">Engine model</td><td></td><td colspan="2">ISUZU
BZ-4LE2TAGD-02</td><td>ISUZU
BP-4LE2XAGD-02</td></tr>
<tr><td colspan="2" rowspan="2">Tightening torque of head bolts</td><td rowspan="2">lb･ft
[N･m]
(kgf･cm)</td><td>1st time
2nd time
3rd time</td><td colspan="2">M12
65 [88] (900)
65 [88] (900)
60° angle tighten</td></tr>
<tr><td>4th time</td><td colspan="2">M8
21 [29] (300)</td></tr>
<tr><td rowspan="2">Valve clearance</td><td>Air intake</td><td>in. (mm)</td><td colspan="3">0.0157 (0.4) [normal temperature]</td></tr>
<tr><td>Discharge</td><td>in. (mm)</td><td colspan="3">0.0157 (0.4) [normal temperature]</td></tr>
<tr><td colspan="2">Firing order</td><td></td><td colspan="3">1-3-4-2</td></tr>
<tr><td colspan="2">Injection timing (BTDC)</td><td>°</td><td colspan="3">Electronic control</td></tr>
<tr><td colspan="2">Nozzle injection pressure</td><td>psi (MPa)</td><td colspan="3">—</td></tr>
<tr><td colspan="2">Compression</td><td>psi (MPa)</td><td colspan="3">442 (3.04)
[Rotation speed 200rpm (200min^{-1})]</td></tr>
<tr><td rowspan="3">Thermostat</td><td>Temperature for start of release</td><td>°F (°C)</td><td colspan="3">180 (82)</td></tr>
<tr><td>Full open temperature</td><td>°F (°C)</td><td colspan="3">203 (95)</td></tr>
<tr><td>Valve lift</td><td>in. (mm)</td><td colspan="3">0.37 (9.5)</td></tr>
</table>

3. Electric System

3.1 Location of Electrical Appliances



SDG25S-8E1

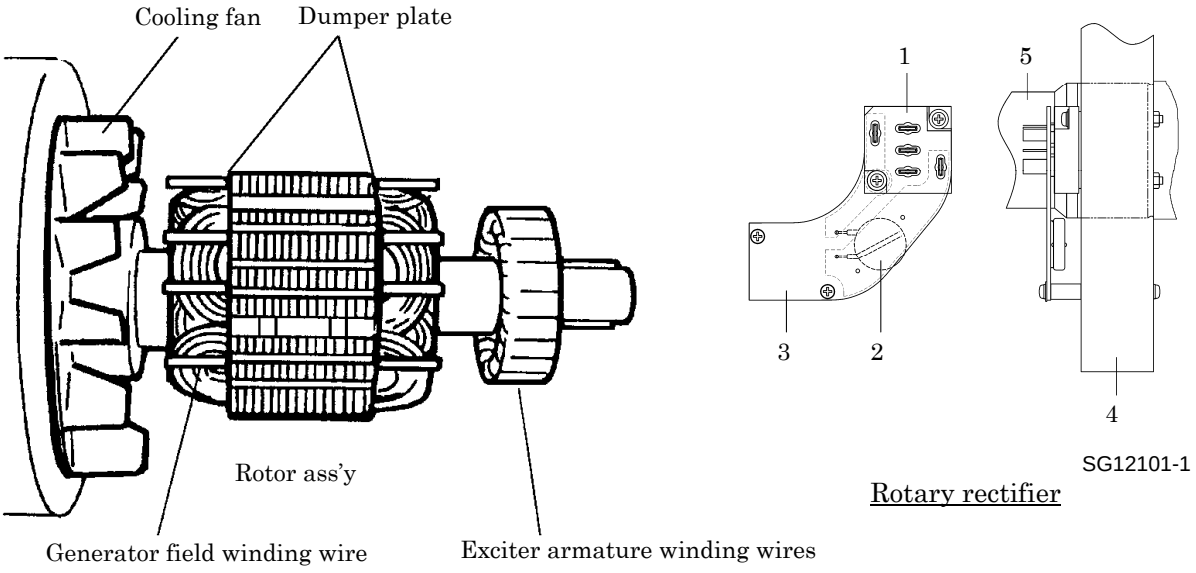
SG14133

1. Fuse (10A)
2. Fuse (15A)
3. Fuse (20A)
4. Auto start unit
5. Thermal relay
6. Frequency selector switch
7. Current transformers
8. Three-phase circuit breaker
9. Voltage selector switch
10. Automatic voltage regulator (AVR)
11. Terminal plate
12. Fuse (60A)
13. Engine controller (ECM)
14. MR1 relay
15. Glow relay
16. Barometric pressure sensor
17. Starter relay
18. Fuel pump relay
19. Starter cut relay
20. MR2 relay
21. Circuit protector (CP)

3.2 Electrical Appliances of Generator

3.2.1 Rotary rectifier

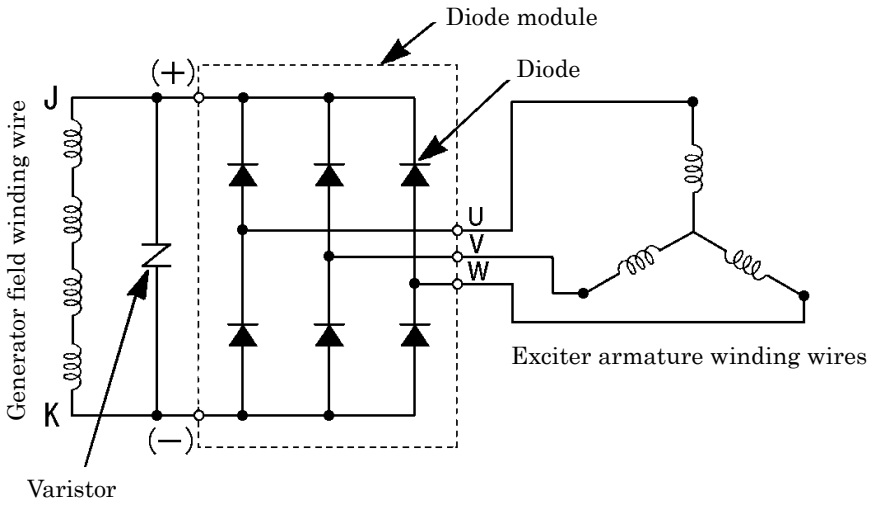
Rotary rectifier (wiring board) is connected to the varistor for the protection of rectifier while direct current is supplied to the generator field windings by three phase full wave rectification.



SG14008

SG12101-1

① Diode module
② Varistor
③ Rotary rectifier (wiring board)
④ Exciter armature core
⑤ Rotor shaft



SG09107-1

How to check whether diode module functions correctly or not

If excessive voltage is applied to diode module, or if excessive current flows, interior diode will be damaged. If diode module damaged, generator does not generate electricity. In order to check whether diode module is in good order or not, it is necessary to check resistance according to the following procedures.

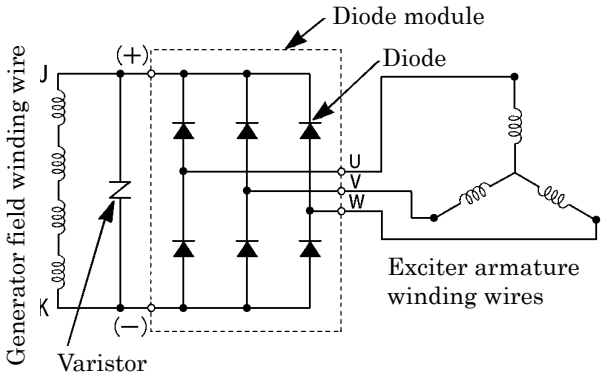
< Procedure >

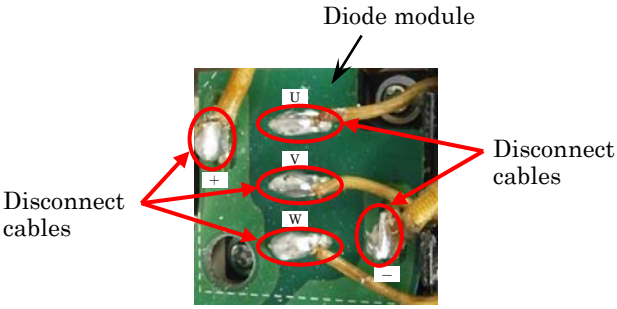
① Remove casing of generator.

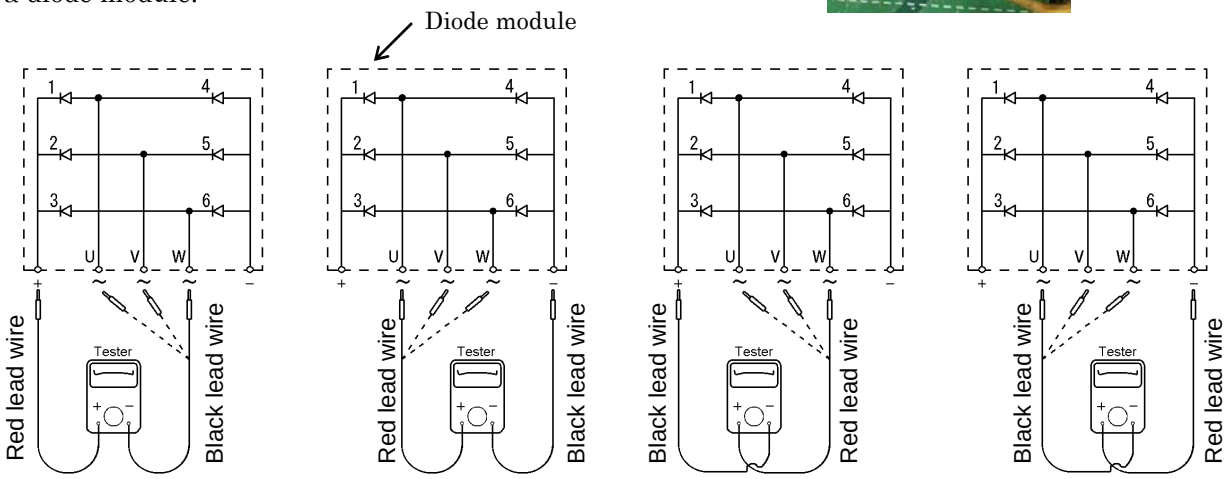
② Record positions of cable connection of the rotary rectifier. Then disconnect all cables connected to the diode module.

③ Availing of resistance measurement range of the tester, measure forward direction resistance and reverse direction resistance of each diode. When forward direction resistance is found less than 10Ω and reverse direction resistance more than 100kΩ, the diode is in good order.
When diode is found electric current flowing in both forward and reverse directions, the diode is judged to be in disorder.

When any diode is judged to be in disorder during the inspection, it is necessary to replace a diode module.







SG08004-1E

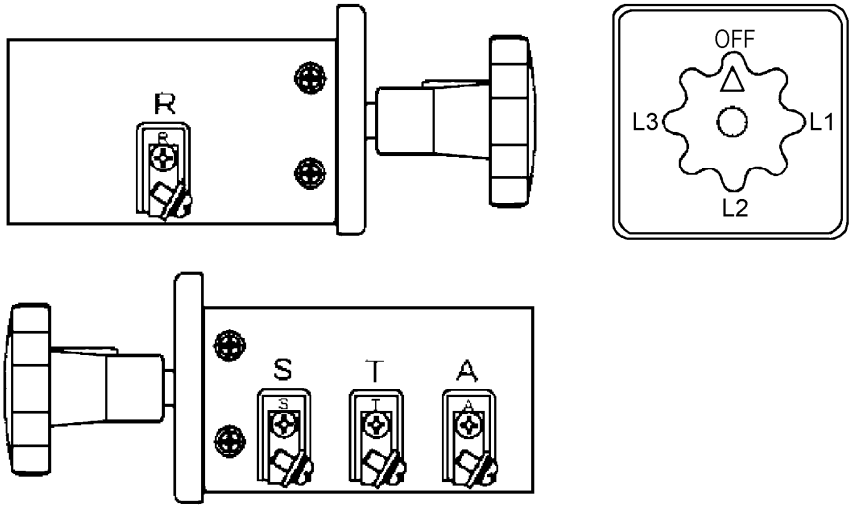
Testing method of resistance of diode module

Direction of diode	Tester lead pole		Tester value
	Red lead wire	Black lead wire	
Forward direction	(+)	U	less than 10Ω
	(+)	V	
	(+)	W	
	U	(−)	
	V	(−)	
	W	(−)	

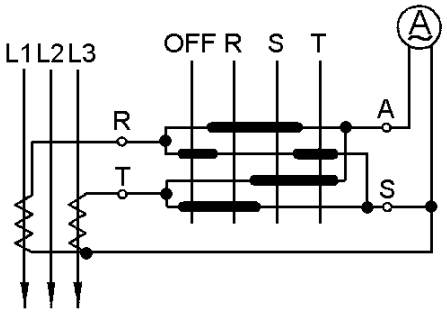
Direction of diode	Tester lead pole		Tester value
	Red lead wire	Black lead wire	
Reverse direction	U	(+)	more than 100kΩ
	V	(+)	
	W	(+)	
	(−)	U	
	(−)	V	
	(−)	W	

3.2.2 AS (Ammeter change-over switch)

Part number:46913 01000



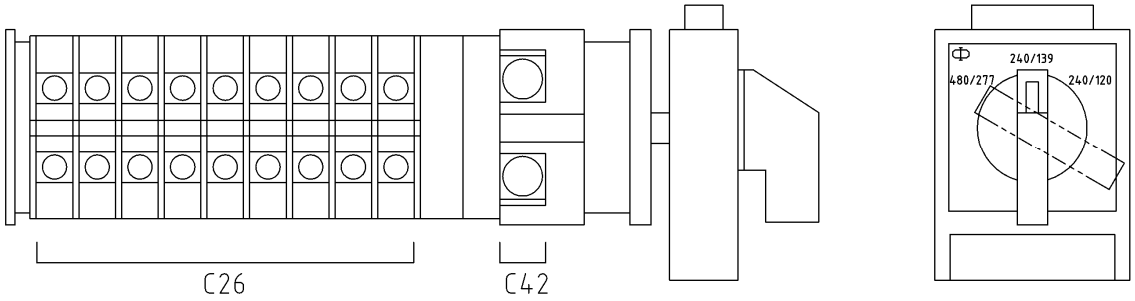
SG13061



SG06068

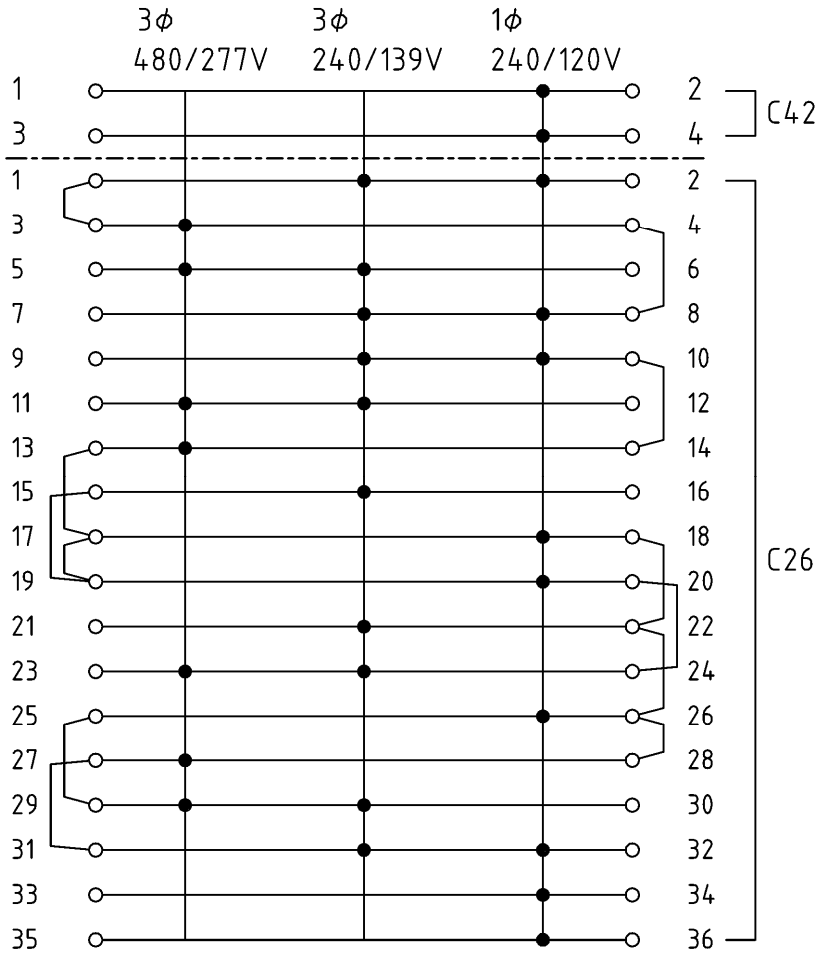
3.2.3 Voltage selector switch

SDG25S-8E1 Part number:46917 00800



SG14134

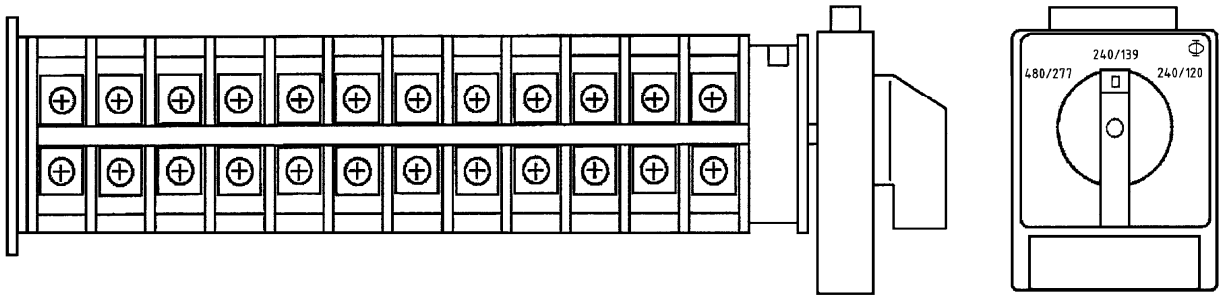
System of contacts arrangement



SG14135

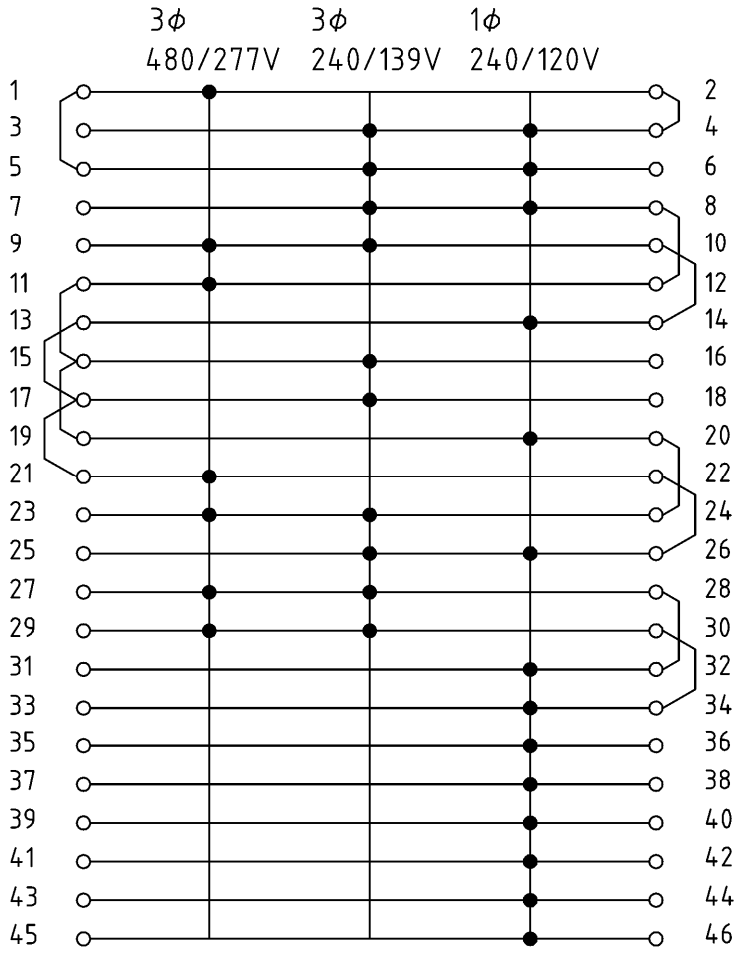
3. Electric System

SDG45S-8E1 Part number:46917 05300



SG14136

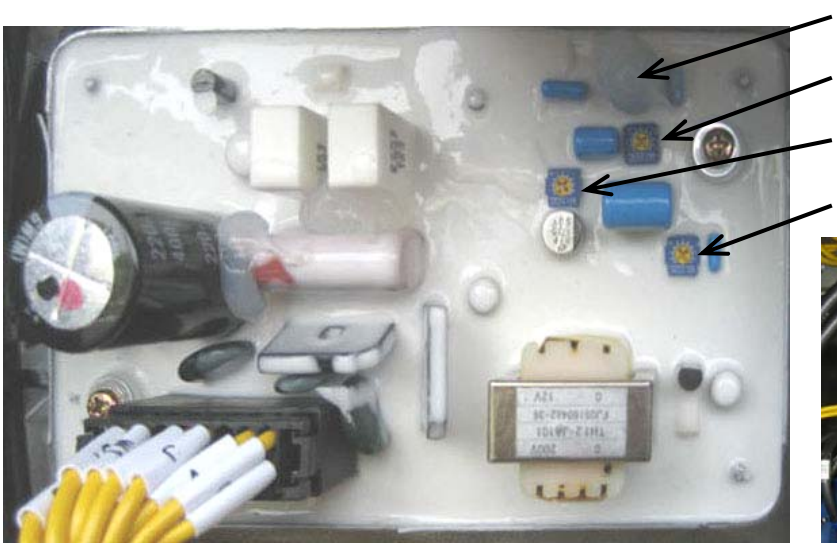
System of contacts arrangement



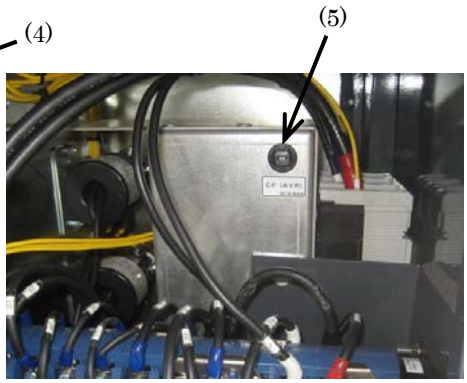
SG14137

3.2.4 AVR (Automatic voltage regulator)

Part number:46950 02901

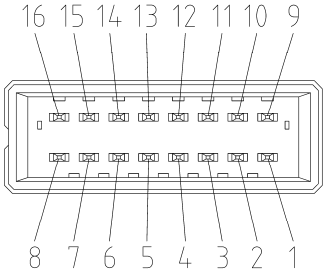


SG12102



SG14138

	Name	Function
(1)	VOLT. ADJ	Adjustment of voltage
(2)	Time constant, ADJ	Adjustment of time constant
(3)	STAB. ADJ	Adjustment of stability
(4)	V. F. ADJ	Adjustment of V/Hz characteristics
(5)	CP	Over-excitation protection circuit protector



SG13021

[AVR CONNECTOR] Line color : yellow all from 1 to 16

	No.	Line No.	Connection	Remarks
16 pins	1	T7	CP	AVR over-excitation protection circuit protector
	2	T10	Generator cable T10	AVR power supply
	3	53	Frequency selector switch	50Hz: Connect to hand trimmer
	4	50	Hand trimmer	Variable resistor 2kΩ 2W
	5	52	Frequency selector switch	60Hz: Connect to hand trimmer
	6	−	NIL	
	7	54	Frequency selector switch	60Hz:Terminal No.54 and 55 connected
	8	55	Frequency selector switch	50Hz:Terminal No.54 and 55 open (open circuit)
	9	U	Generator cable U	Detect generator output voltage
	10	V	Generator cable V	Detect generator output voltage
	11	−	NIL	
	12	J	Generator cable J	Field winding of exciter
	13	K	Generator cable K	Field winding of exciter
	14	−	NIL	
	15	T9	Generator cable T9	AVR power supply
	16	T7	CP	AVR over-excitation protection circuit protector

3. Electric System

AVR is adjusted and set prior to delivery from factory. Accordingly, it is not necessary to adjust it unless the machine equipped with a new AVR functions abnormally. If upon test operation, there is any trouble such as voltage hunting, adjust it according to the following procedures.

[Adjustment of AVR]

1. Start engine, and adjust the frequency to 60Hz at no load operation.
2. Turn the voltage adjuster (hand trimmer) on the instrument panel fully to the right to the maximum position.
3. Under this condition, turn the voltage adjuster of AVR in the control panel, using a driver, so that the upper value of voltage may meet the value mentioned in the following table.

Voltage / Frequency	240V	480V
60Hz	252V	504V

4. The driver slot of voltage adjusting volume of AVR should be coated with silicon caulking paste and fully sealed.

[Adjustment of stability]

It is possible to adjust the response speed of generator output voltage at no load operation by the adjusting volume knob of stability.

1. Turning the volume knob of stability adjustment clockwise reduces the response speed, and voltage overshoot value becomes a little (in the direction of stability).
2. Turning it counterclockwise raises the speed and voltage shooting value becomes bigger (in the direction of instability).

Notch position of stability adjustment volume (STAB.ADJ) : 3/10 ※

[Adjustment of V/Hz characteristics]

As the V/Hz characteristics are set at the best position, any adjustment is not required.

Notch position of V/Hz characteristics adjustment volume (V.F.ADJ) : 8/10 ※

[Adjustment of time constant]

Instantaneous characteristic is set at the best point. So it is not necessary to adjust it. (Adjustment is prohibited.)

Notch position of time constant adjustment volume : 0/10 ※

※ Position of notching

The top of volume resistance is marked " arrow" at the one of the variable cross holes for showing the set up position.

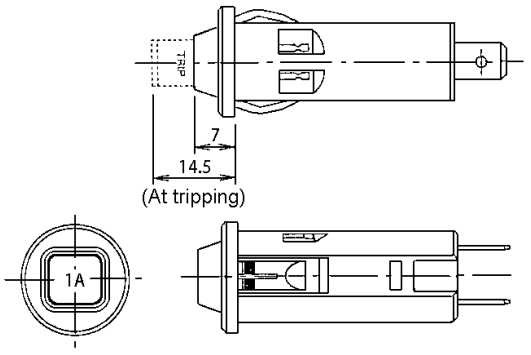
[Over-excitation protection]

A circuit protector (CP) is installed on the side of the circuit breaker board for prevention of AVR from being damaged by the over-excitation current caused due to wrong wiring and disconnection to detective inlet terminal of AVR.

If this device functions, the black push button at the top of CP is kept pressed up. In order to reset it, push the black button on after getting rid of the cause of the excessive exciting current flow.

Model	IDEC NRF110
Rated current	4.0A

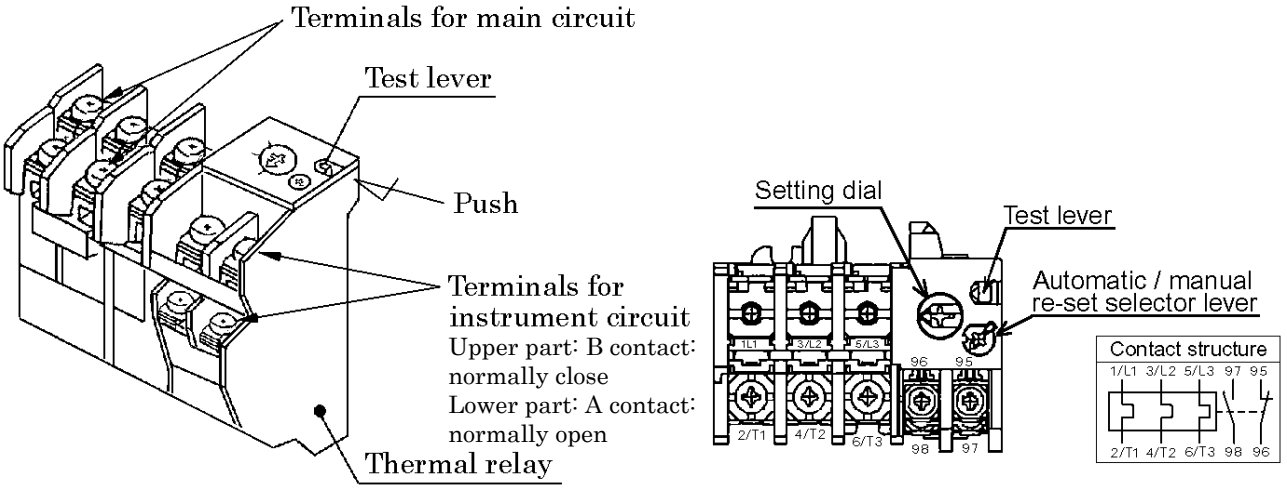
※After tripping you should not switch on again before the bimetal gets cooled. (approx. 60 seconds and more required to be cooled.)



SG12105E

3.2.5 Thermal relay

Part number:46928 01500

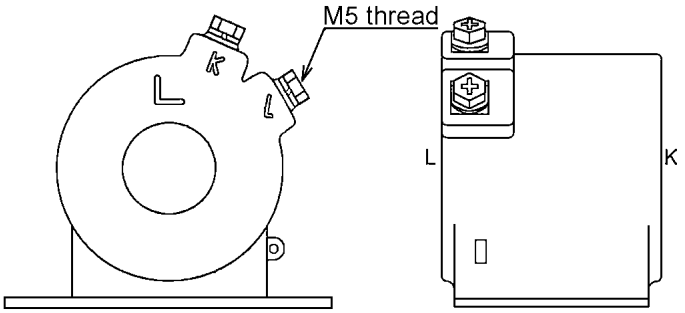


(1) Thermal relay set value

	unit	SDG25S-8E1		SDG45S-8E1	
Rated voltage	V	240	480	240	480
Rated current	A	60	30	108	54
Detected current at rated operation	A	30		54	
CT ratio		100/5A		150/5A	
Wound rolls (Rolls of cables through CT)		2 rolls		←	
Set value	A	2.8		3.3	

Tripping of over current is set to be reset automatically.

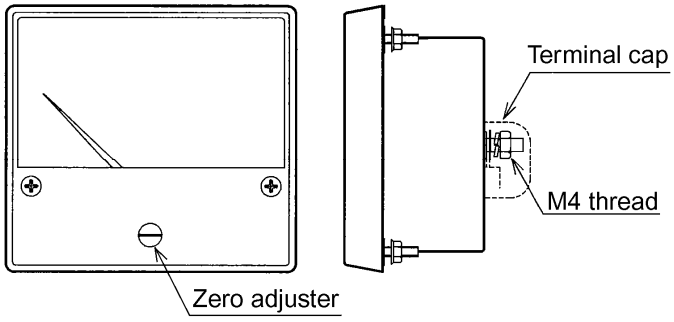
3.2.6 Current transformer :CT



SG12026E

	SDG25S-8E1	SDG45S-8E1
Part number	46923 04700	46923 04500
Specification	5VA, 100/5A	5VA, 150/5A
Model	CW-5L	←
Number of turns	2 turns	←
Maintenance checks	Nothing abnormal is found on its appearance	
	Measurement of insulation resistance More than 2,000MΩ shall exist between secondary coil and mounting bracket	

3.2.7 Ammeter :A



SG12027E

	SDG25S-8E1	SDG45S-8E1
Part number	46154 16000	46154 14500
Specification	0－50A 50/5A 0－100A class 2.5	0－75A 75/5A 0－150A class 2.5
Model	ACF-6	←

3. Electric System

3.3 Electronic Control System of Engine

[Excerpted from ISUZU Engine repair manual]

The engine control system is electronic control system which maintains optimum combustion status of engine all the time according to operating conditions. It consists of the following components.

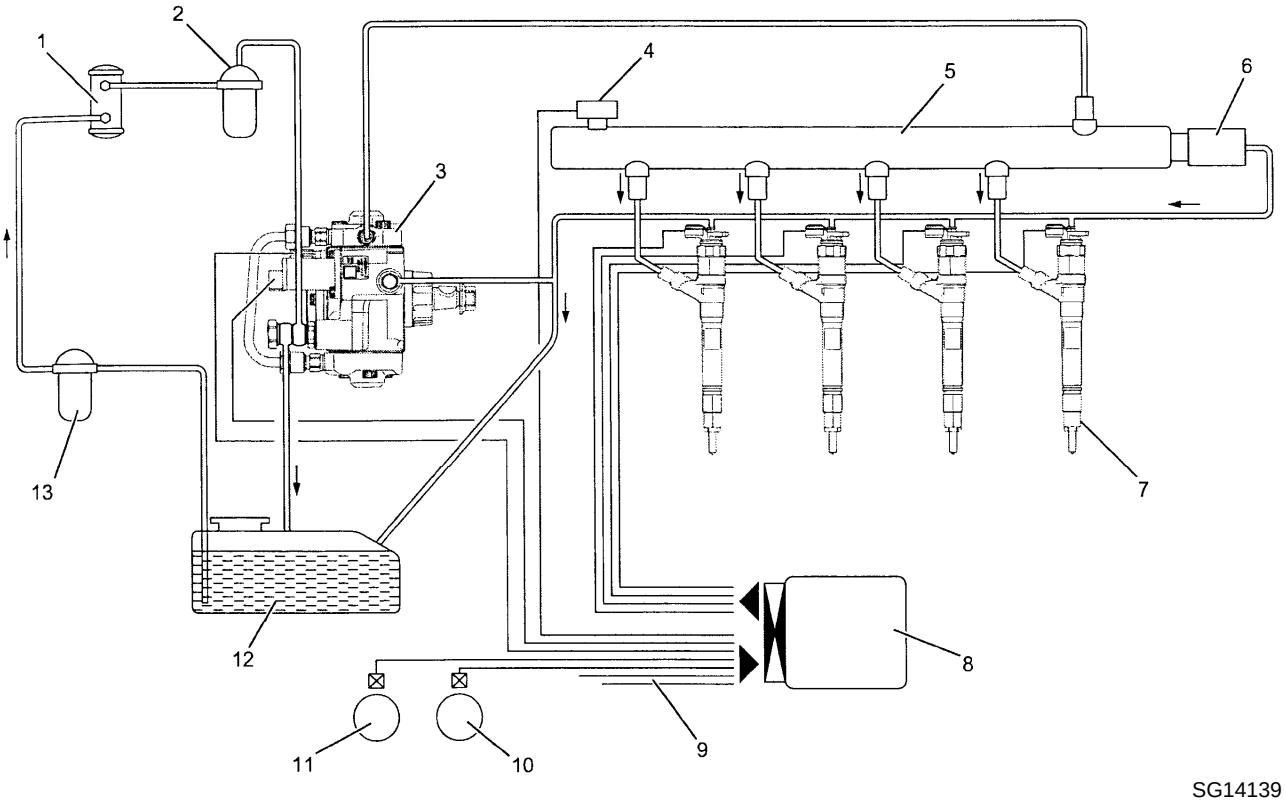
① Electronic control fuel injection system (Common rail type)
② EGR (Exhaust gas recirculation) control
③ Idle speed control

The engine control system also has the following system control functions other than engine control.

④ QOS (Quick On Start) system
⑤ Engine speed signal output
⑥ Self-diagnosis function
⑦ CAN (Controller Area Network) communication

3.3.1 Electronic control fuel injection system (Common rail type)

ECM (engine control module) detects such information as engine RPM, engine load etc (signals from various sensors). Base on the information, ECM sends electrical signal to supply pump and injectors to properly control fuel injection of each cylinder and injection time in this system.



SG14139

1. Electromagnetic pump
2. Fuel filter
3. Supply pump
4. Fuel pressure sensor
5. Common rail
6. Pressure limiter
7. Injector
8. ECM
9. Various sensors (accelerator, boost, and water temperature etc.)
10. CKP sensor
11. CMP sensor
12. Fuel tank
13. Pre-fuel filter

3. Electric System

(1) Fuel system

Fuel is supplied to supply pump from fuel tank and then sent to common rail after it is pressurized by pressure pump. At the time fuel volume supplied to common rail is controlled by suction control valve (SCV).

(2) Injection pressure control

Injection pressure is controlled by controlling the fuel pressure in the common rail. The appropriate pressure in the common rail is calculated based on the engine revolution speed and fuel injected amount, and proper fuel amount is injected by the control of the supply pump and it is sent to the common rail with pressure and being controlled.

(3) Injection time control

This control is conducted by calculation of fuel injection timing mainly based on engine revolution speed and injection amount as a substitute of timer and control of injectors.

(4) Injection rate control

In order to improve combustion in cylinders, at first a little fuel is injected (pre-injection) to ignite, and then once ignited, fuel is injected 2nd time (main injection). Control of injection timing and injection volume is performed by controlling injectors.

(5) Maximum fuel injection amount

This is calculated by adjustment of initial starting injection amount in accordance with water temperature and limitation of this maximum injection amount by boost pressure, and also control of fuel injection amount at high altitude by barometric pressure.

(6) Inter-cylinder correction

This is not used for this model.

3.3.2 EGR (Exhaust gas recirculation) control

EGR system works by recirculating a portion of an engine exhaust gas back into the intake chamber and lowers injection temperature, also controlling occurrence of nitrogen oxide by mixing inert gas into intake air.

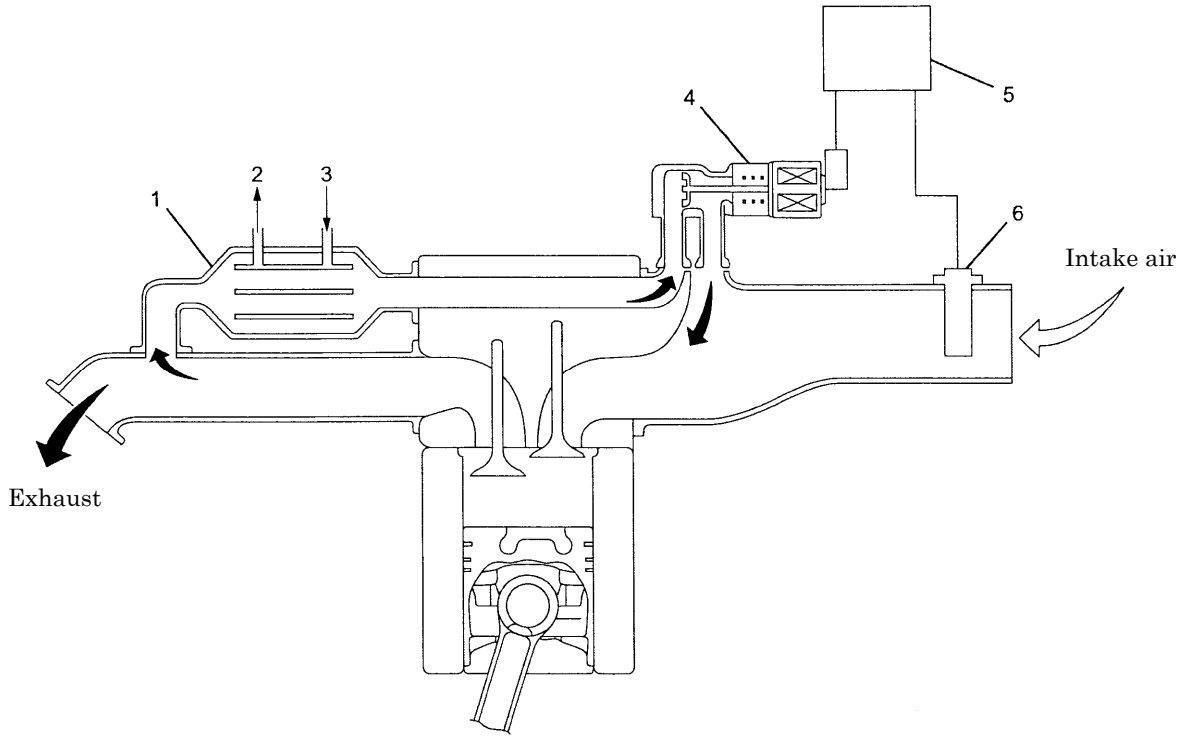
EGR amount is controlled by opening/closing function of the EGR valve provided between exhaust manifold and intake chamber. It is decided by engine revolution speed and engine load factor and controlled by the function of EGR valve.

High temperature EGR gas is cooled by EGR cooler provided in the passage of EGR gas and also the combustion temperature is made further lower than usual EGR temperature by the mixture of fresh air, thus it contributes to reduction of NOx.

Furthermore, the adoption of a check valve for EGR system controls reverse flow of EGR gas and it allows gas flow in one direction only. Thus EGR amount is increased.

EGR function

ECM is to operate EGR motor according to such engine conditions as engine RPM, and engine load, and to control EGR valve lift. Valve lift is detected by EGR position sensor.



SG14140

1. EGR cooler
2. Outlet port of coolant
3. Inlet port of coolant
4. EGR valve
5. ECM
6. Boost pressure / boost temperature sensor

3.3.3 Engine speed adjustment

It is possible to adjust the rated speed and operates “the frequency adjustment switch” during operation.

Frequency adjustment switch

UP

While you are pushing “UP” side, engine speed rises, and it can raise engine speed. (The upper limit of the rotation speed adjustment : 2,080min^{-1})

DOWN

While you are pushing “DOWN” side, engine speed drops and it can lower engine speed, but it can not be lowered lower than the lowest idling speed. (The lower limit of the rotation speed adjustment : 1,000min^{-1})

Control when key switch is OFF

Engine speed which is adjusted by frequency adjustment switch is memorized in ECM and on next start, engine runs at engine speed adjusted when key switch is OFF.

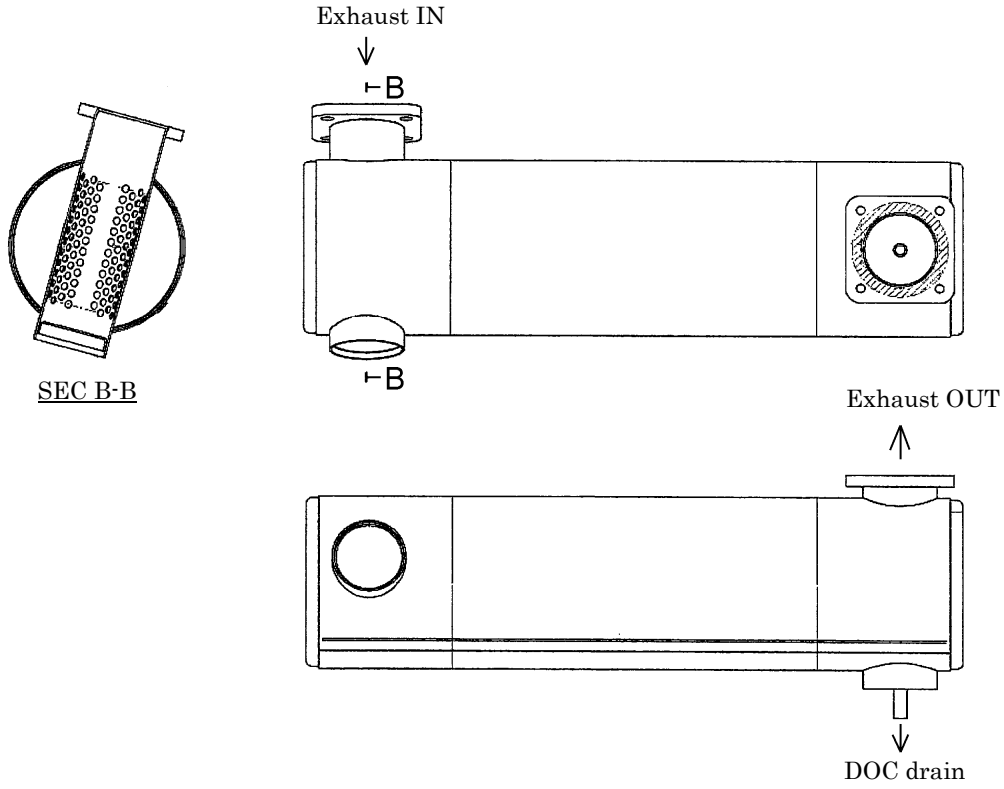
3.3.4 Preheating control

QOS (Quick On Start) system

The ECM determines the period required for glow (pre-glow, after-glow), and operates the glow relay and QOS indicator lamp. QOS system allows to make the starting at cold weather easier and reduce white smoke and noise at starting. When turning the key switch to ON, the ECM detects the engine coolant temperature by signal from engine coolant temperature (ECT) sensor and changes the period for glow so that the proper starting conditions can be achieved all the time. Also, after-glow function allows to stabilize idling immediately after starting.

3.3.5 Diesel oxidation catalyst (DOC)

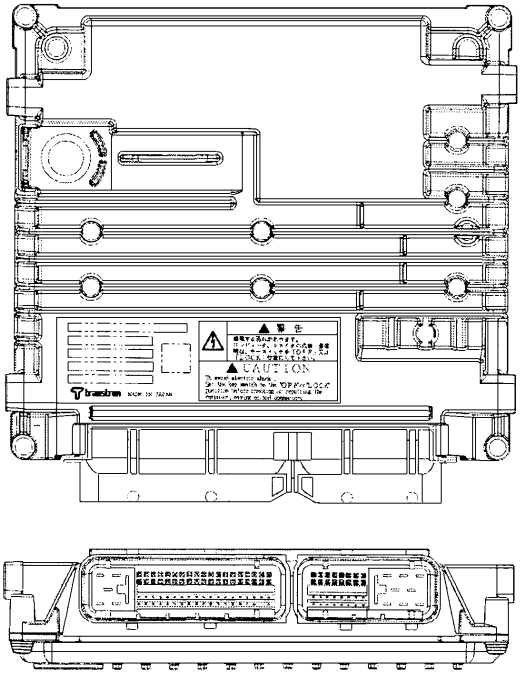
Performing resolved into water and carbon dioxide by a chemical change in the catalyst HC (hydrocarbons) in the exhaust gas, CO (carbon monoxide), DOC is an exhaust muffler of the oxidation catalyst combination. No maintenance of cleaning items or exchanged.

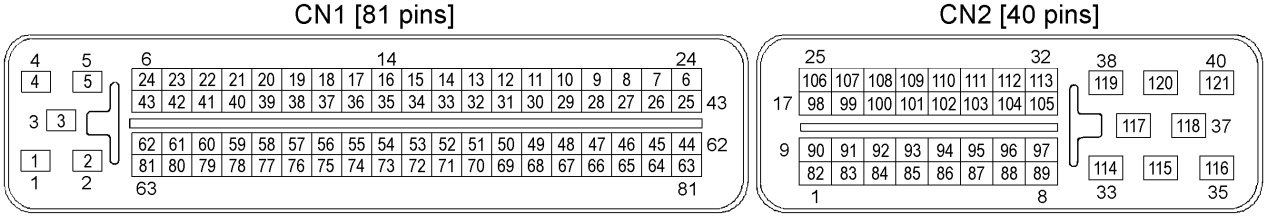


3.4 Electrical Appliances of Engine

3.4.1 Controller (ECM)

SDG25S-8E1 Part number:44390 04200
SDG45S-8E1 Part number:44390 04300





Connector terminal arrangement

SG14142

(1) Controller function (81 pins)

Pin No.	Line color	Connection	Function
CN1-1	B	Grounding	
CN1-2	R/G	To the 20A fuse via main relay Starter cut relay coil Fuel pump relay coil	Power supply
CN1-3	B	Grounding	
CN1-4	B	Grounding	
CN1-5	R/G	To the 20A fuse via main relay Starter cut relay coil Fuel pump relay coil	Power supply
CN1-6	L/B	Monitor lamp CN3-6 terminal (Diagnosis lamp)	When engine fails, it supplies power to CN3-6 terminal to make diagnosis lamp glow.

Pin No.	Line color	Connection	Function
CN1-7	Br/R	Monitor lamp CN3-2 terminal (Boost temperature lamp)	No power exists during usual operation. When boost temperature rises higher than specified one, interior contact in ECM is "ON", and it connects ground to send power. Thus, boost temperature rise warning lamp glows. ●Warning lamp lighting temperature : 185°F (85℃)
CN1-8	Y/L	Auto start unit CN5-2 terminal	It outputs engine speed. ●Revolution ratio (pulse type) : 1 revolution per 4 pulses
CN1-9	—	NIL	
CN1-10	B/G	Glow relay (GR) coil	No power exists during usual operation. When power is sent to CN1-24 terminal, preheating starts. When preheating, interior contact in ECM is "ON", and it connects ground to send power. Thus glow relay (GR) works to preheat. ECM decides glow timing (pre-glow and after-glow), according to engine coolant temperature and it sends power to CN1-10 terminal each time to function glow relay (GR).
CN1-11	L/Y	Monitor lamp CN3-5 terminal (Glow lamp)	No power exists during usual operation. When preheating, interior contact in ECM is "ON", and it connects ground to send power. Thus glow lamp glows. When it starts automatically, it makes glow lamp glow.
CN1-12	—	NIL	
CN1-13	—	NIL	
CN1-14	B/W	Starter cut relay (SR) coil	No power when starting. After starting, engine speed rises and exceeds 750min^{-1} interior contact in ECM is "ON", and it connects ground to send power. Thus starter cut relay (SR) functions to cut power to starter motor.
CN1-15	—	NIL	
CN1-16	G/W	Monitor lamp CN3-7 terminal (Water temperature lamp)	No power exists during usual operation. When engine coolant temperature rises up to emergency stop level, interior contact in ECM is "ON", and it connects ground to send power. Thus engine coolant temperature rise emergency stop lamp glows. ●Emergency stop lamp lighting temperature : 212°F (100℃)
CN1-17	G/R	Monitor lamp CN3-14 terminal (Oil pressure lamp)	No power exists during usual operation. When engine oil pressure drops down to emergency stop level, interior contact in ECM is "ON", and it connects ground to send power. Thus engine oil pressure drop emergency stop lamp glows. ●Emergency stop lamp lighting pressure : 14.3psi (0.098MPa)
CN1-18	B/W	Tool (E-IDSS) No.3 terminal	Tool connection terminal (CAN communication). With connection of diagnostic service tool, it is possible to diagnose engine control system and to check system.
CN1-19	—	NIL	
CN1-20	—	NIL	

Pin No.	Line color	Connection	Function
CN1-21	Y/R	Main relay (MR2) coil	When power is sent to CN1-24 terminal, it works main relay (MR2). Thus main relay (MR2) is switched and when power is supplied to CN1-2 and CN1-5 terminal, voltage is applied to fuel pump relay (FR) to operate the pump.
CN1-22	—	NIL	
CN1-23	—	NIL	
CN1-24	R/W	15A fuse	Switch "ON" starter switch to input (ACC) signal. Preheating starts.
CN1-25	B/R	External input connector No.3 terminal (option)	External input terminal for engine emergency stop. When option connector is placed "ON" between No.3 and No.4 terminals, engine is brought to emergency stop.
CN1-26	B/Y	Frequency adjuster (DOWN)	No power exists during usual operation. When frequency adjuster switch is placed "DOWN", it is switched "ON". Engine speed goes down. Engine speed fall limit : Down to low idle speed.
CN1-27	Gy/R	Frequency adjuster	No power exists during usual operation. When placing frequency adjuster switch "UP"or "DOWN", it is switched "ON". Combination of CN1-26 and CN1-28 terminal switching makes engine speed "UP" and "DOWN".
CN1-28	Br/W	Frequency adjuster (UP)	No power exists during usual operation. When frequency adjuster switch is placed "UP", it is switched "ON". Engine speed goes up.
CN1-29	—	NIL	
CN1-30	—	NIL	
CN1-31	—	NIL	
CN1-32	—	NIL	
CN1-33	W/B	External input connector No.1 terminal (option)	Operation mode switching input terminal. No power exists during usual operation. When power supply of ECM is "ON", and terminal between option connector No.1 and No.4 terminal is placed "ON", operation mode is switched to "Regulation operation" mode.
CN1-34	—	NIL	
CN1-35	—	NIL	
CN1-36	—	NIL	
CN1-37	W/B	Tool (E-IDSS) No.11 terminal	Tool connection terminal (CAN communication). With connection of diagnostic service tool, it is possible to diagnose engine control system and to check system.
CN1-38	Br/G	Tool (E-IDSS) No.7 terminal	
CN1-39	B/W	Shield line	Grounding
CN1-40	Y/R	Main relay (MR2) coil	When power is sent to CN1-24 terminal, it works main relay (MR2). Thus main relay (MR2) is switched and when power is supplied to CN1-2 and CN1-5 terminal, voltage is applied to fuel pump relay (FR) to operate the pump.

Pin No.	Line color	Connection	Function
CN1-41	R/L	Boost temperature / boost pressure sensor	Grounding terminal
CN1-42	R/W	Boost temperature / boost pressure sensor VCC terminal	Power supply for boost temperature / boost pressure sensor (DC5V)
CN1-43	B	Grounding	
CN1-44	—	NIL	
CN1-45	—	NIL	
CN1-46	R/L	Starter switch C terminal Auto start unit CN7-8 terminal	Inputting start signal.
CN1-47	—	NIL	
CN1-48	—	NIL	
CN1-49	R/W	15A fuse	Operation mode (frequency) switching input terminal. "ON" : 60Hz constant (It is possible to change frequency with combination of CN1-49, CN1-50 and CN1-51 terminal switching. This unit is set to 60Hz constant operation with this terminal directly connected to 15A fuse.)
CN1-50	R/B	Auto start unit CN7-9 terminal	It gets start signal from auto start unit CN7-9 terminal in order to perform idling for protection of turbo during 10 seconds after it starts.
CN1-51	R/W	15A fuse	Operation mode (frequency) switching input terminal. "ON" : 60Hz constant (It is possible to change frequency with combination of CN1-49, CN1-50 and CN1-51 terminal switching. This unit is set to 60Hz constant operation with this terminal directly connected to 15A fuse.)
CN1-52	Y/B	Tool (E-IDSS) No.12 terminal Monitor lamp CN3-4 terminal (Diagnosis switch)	When engine stops with starter switch "ON", and diagnosis lamp is "ON", make diagnosis switch "ON" or connect CN1-52 terminal directly to ground. Then diagnosis lamp begins to blink. Blinking pattern shows present and past engine troubles.
CN1-53	G	External input connector No.5 terminal (option)	Resetting terminal of past trouble memory. When terminal is "ON" between option connector No.5 and No.2 (ground) terminals, past trouble memory is reset.
CN1-54	—	NIL	
CN1-55	—	NIL	
CN1-56	—	NIL	
CN1-57	—	NIL	
CN1-58	L/W	Tool (E-IDSS) No.6 terminal	Diagnostic service tool connection.
CN1-59	B/W	Shield line	Grounding
CN1-60	B	Barometric pressure sensor SG terminal, inlet air temperature sensor	Grounding
CN1-61	R	Barometric pressure sensor VC terminal	Power supply for barometric pressure sensor (DC5V)

Pin No.	Line color	Connection	Function
CN1-62	B	Grounding	
CN1-63	—	NIL	
CN1-64	—	NIL	
CN1-65	B/R	Boost temperature / boost pressure sensor	It detects intake air temperature and pressure in intake manifold.
CN1-66	—	NIL	
CN1-67	—	NIL	
CN1-68	W/R	Manifold air temperature sensor	It detects manifold air temperature of unit under operation. In order to optimize fuel injection control with ECM, it detects manifold air temperature at unit in use (In front of engine air intake device).
CN1-69	—	NIL	
CN1-70	W	Oil pressure sensor OUT terminal	It detects engine oil pressure. Pressure detecting voltage signal is high, when pressure is high, and it is low, when pressure is low.
CN1-71	W	Barometric pressure sensor OUT terminal	It detects barometric pressure. It counts barometric pressure from voltage signal, and it corrects fuel injection volume (high altitude compensation).
CN1-72	Lg	Intake air temperature sensor	It detects intake air temperature of unit under operation. In order to optimize fuel injection control with ECM, it detects intake air temperature at unit in use (In front of engine air intake device).
CN1-73	—	NIL	
CN1-74	—	NIL	
CN1-75	—	NIL	
CN1-76	—	NIL	
CN1-77	—	NIL	
CN1-78	W/L	Tool (E-IDSS) No.14 terminal	Diagnostic service tool connection.
CN1-79	B	Oil pressure sensor GND terminal Manifold air temperature sensor	Grounding
CN1-80	R	Oil pressure sensor VCC terminal	Power supply for engine oil pressure sensor (DC5V)
CN1-81	B	Grounding	

(2) Controller function (40 pins)

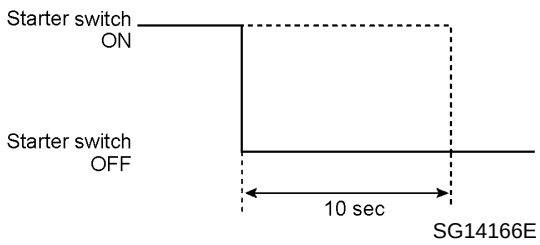
Pin No.	Line color	Connection	Function
CN2-82	W	Common rail pressure sensor OUT terminal	It detects common rail pressure (fuel pressure). It detects fuel pressure in common rail and it converts it voltage signal and inputs it. It is used for fuel injection control. Pressure detecting voltage signal is high, when pressure is high, and it is low, when pressure is low.
CN2-83	Y/G	Fuel temperature sensor	It detects fuel temperature. Fuel temperature sensor changes resistance value according to change of internal thermistor temperature. ECM detects voltage which changes according to temperature change and it counts fuel temperature and uses it for control of supply pump. Voltage is low, when fuel temperature is high and resistance is little, and it is high, when fuel temperature is low, and resistance is large. (Resistance of thermistor is little, when temperature is high, and it is large, when temperature is low.)
CN2-84	R/B	Water temperature sensor	It detects engine water temperature. It detects voltage which changes according to resistance and then it counts engine water temperature.
CN2-85	－	NIL	
CN2-86	－	NIL	
CN2-87	R	CAM angle sensor VCC terminal Common rail pressure sensor VCC terminal EGR motor position sensor power supply terminal	Power supply for left sensors (DC5V)
CN2-88	Y	Monitor lamp CN3-13 terminal	No power exists during usual operation. When engine speed rises up to emergency stop set speed, interior contact in ECM is “ON”, and it connects ground to send power. Thus overspeed warning lamp glows. ●Emergency stop set speed : 2,070min^{-1} (69Hz)
CN2-89	R/B	Suction control valve (SCV)	Grounding
CN2-90	W	Common rail pressure sensor OUT terminal	It detects common rail pressure (fuel pressure). It detects fuel pressure in common rail and it converts it voltage signal and inputs it. It is used for fuel injection control. Pressure detecting voltage signal is high, when pressure is high, and it is low, when pressure is low.
CN2-91	L	Boost temperature / boost pressure sensor OUT terminal	It detects engine intake boost (intake air temperature and pressure). It is a sensor of the thermistor type , the boost temperature sensor send the ECM measure the temperature. It counts boost (intake air pressure) from detected voltage signal for fuel injection control. Voltage is high, when pressure is high, and it is low, when pressure is low.

Pin No.	Line color	Connection	Function
CN2-92	—	NIL	
CN2-93	G/W	EGR motor posision sensor V terminal	It detects valve lift of EGR (exhaust, gas, re-circulation) valve.
CN2-94	G/B	EGR motor posision sensor U terminal	
CN2-95	R	Crank angle sensor VCC terminal	Power supply for crank angle sensor (DC5V)
CN2-96	—	NIL	
CN2-97	R/B	Suction control valve (SCV)	Grounding
CN2-98	W	CAM angle sensor OUT terminal	It inputs camshaft position (CMP) signal. CMP signal is caused when cam position of camshaft passes camshaft angle (CMP) sensor. ECM judges cylinder according to CMP signal, and it decides crank angle and counts fuel injection control and engine speed. This control is performed based on crankshaft position (CKP) signal detected by CN2-107 terminal, but in case crankshaft angle (CKP) sensor is in trouble, it is performed based on camshaft position (CMP) signal.
CN2-99	G/Y	EGR motor posision sensor W terminal	Same as CN2-93 and CN2-94 terminal
CN2-100	B/W	Shield line	Grounding
CN2-101	B	CAM angle sensor GND terminal	Grounding
		Common rail pressure sensor GND terminal	
		EGR motor position sensor GND terminal	
CN2-102	—	NIL	
CN2-103	W/B	EGR DC motor V terminal	It operates EGR DC motor, and it controls valve lift of EGR valve. ECM decides EGR gas volume based on engine speed and engine load ratio (fuel injection volume) and it operates EGR valve by EGR DC motor, and also it controls EGR gas volume to be mixed in engine intake air.
CN2-104	—	NIL	
CN2-105	R/W	Suction control valve (SCV)	When power stays on, fuel is sent to common rail by pressure. Fuel injection volume to common rail is controlled by control of power supply timing of suction control valve (SCV).
CN2-106	—	NIL	
CN2-107	W	Crank angle sensor OUT terminal	It inputs crankshaft position (CKP) signal. CKP signal is caused when convex portion of flywheel passes through sensor position. ECM judges cylinder according to CKP signal, and it decides crank angle and counts fuel injection control and engine speed. This control is performed based on CKP signal, but in case crankshaft angle (CKP) sensor is in trouble, it is performed based on camshaft position (CMP) signal detected by CN2-98 terminal.

Pin No.	Line color	Connection	Function
CN2-108	B/W	Shield line	Grounding
CN2-109	B	Crank angle sensor GND terminal	Grounding
		Water temperature sensor	
CN2-110	W/L	EGR DC motor W terminal	Same as CN2-103 terminal
CN2-111	W/R	EGR DC motor U terminal	
CN2-112	—	NIL	
CN2-113	R/W	Suction control valve (SCV)	Same as CN2-105 terminal
CN2-114	—	NIL	
CN2-115	—	NIL	
CN2-116	R	Injector 2 and 3	Power supply for injector 2 and 3
CN2-117	L/W	Injector 4	When power stays on, it injects fuel to injector 4.
CN2-118	L/R	Injector 2	When power stays on, it injects fuel to injector 2.
CN2-119	L	Injector 1	When power stays on, it injects fuel to injector 1.
CN2-120	L/Y	Injector 3	When power stays on, it injects fuel to injector 3.
CN2-121	W	Injector 1 and 4	Power supply for injector 1 and 4

Power supply “OFF” for ECM

Power in ECM is not yet “OFF” 10 seconds after starter switch is OFF. In case that it is necessary to switch OFF power supply by clear memory, it is necessary that you should wait longer than 10 seconds after switching OFF starter switch of power supply.

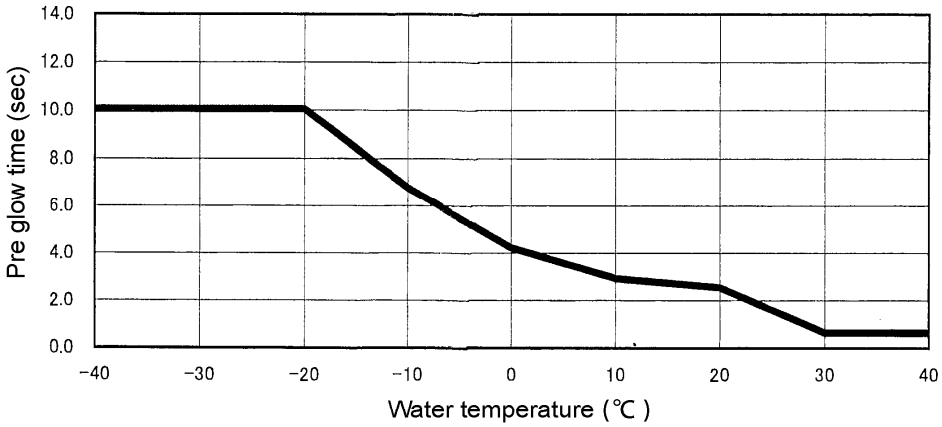


(3) Characteristics of water temperature / glowing time (Key OFF→ON)

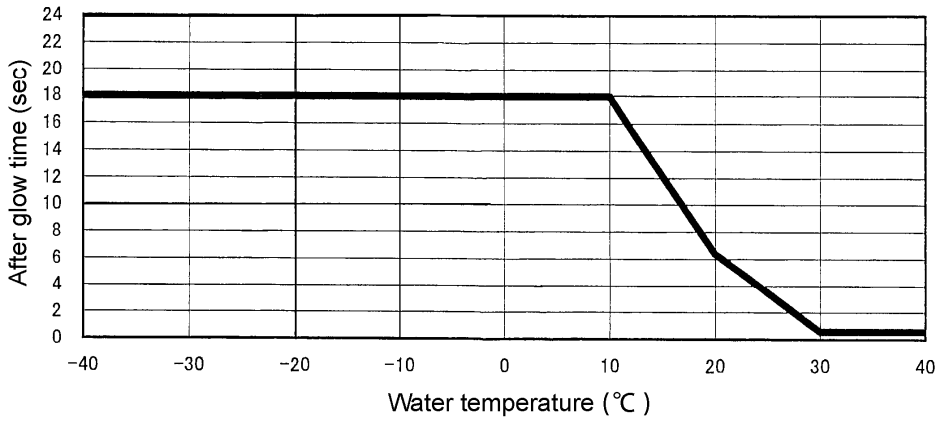
Pre Glow : When starter switch is ON, glow relay functions for a certain time in accordance with engine water temperature.

After Glow : After engine starts, glow relay functions for a certain time in accordance with engine water temperature.

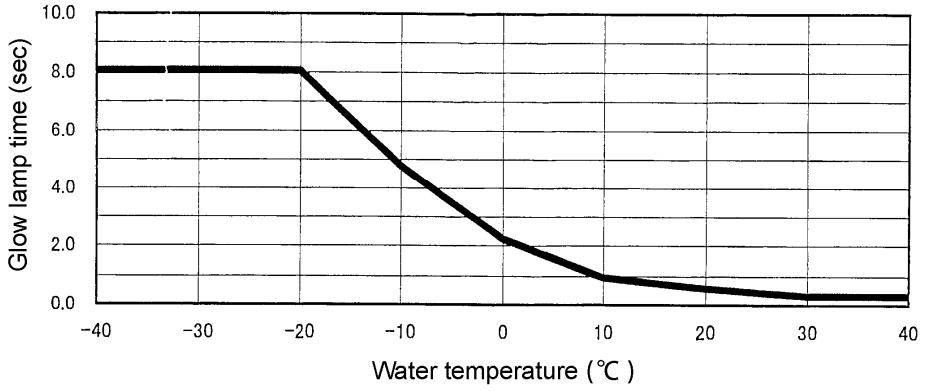
Pre glow time



After glow time



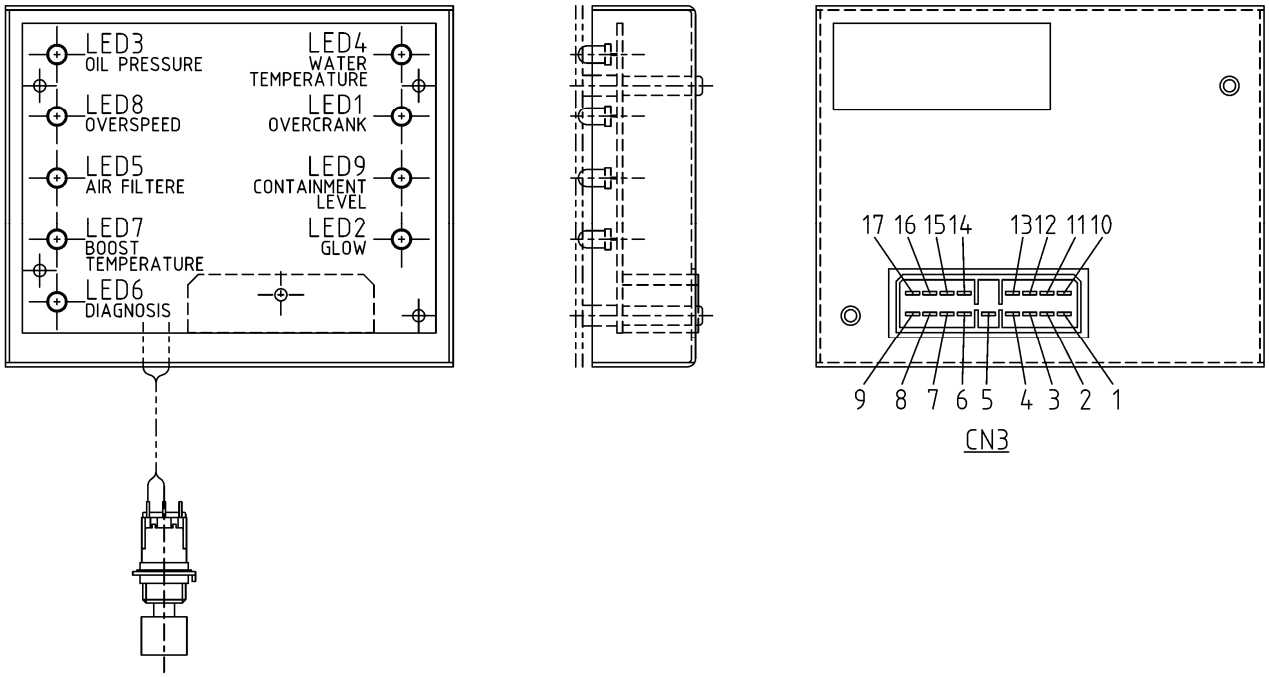
Glow lamp time



SG14143E

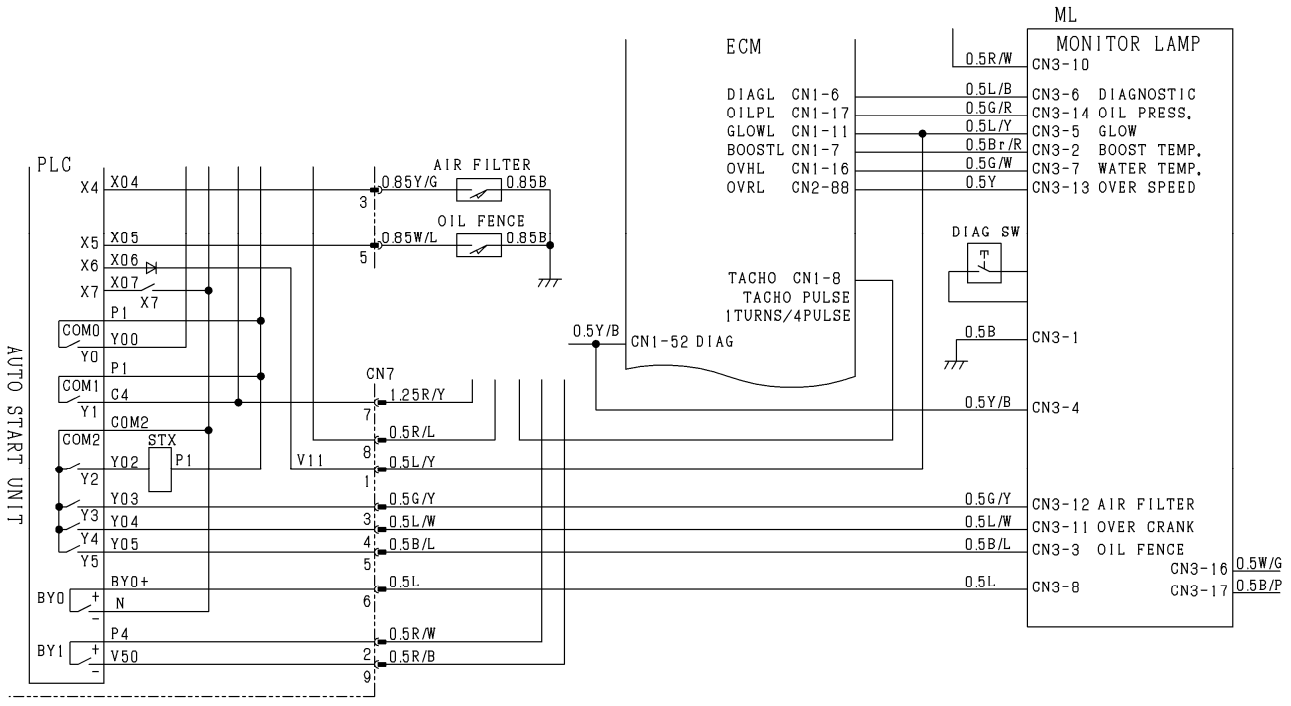
3.4.2 Monitor lamp

Part number:46870 47901



SG14144

(1) External schematic diagram



SG14145

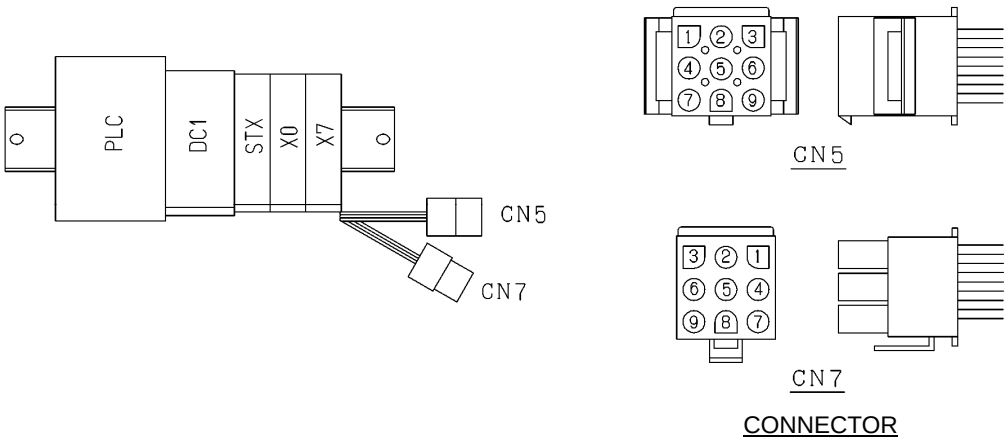
(2) List of functions

Pin No.	Line color	Connection	Function
CN3-1	B	Grounding	
CN3-2	Br/R	ECM CN1-7 terminal (Boost temperature)	No power exists during usual operation. When boost temperature (intake air pressure) rises higher than set temperature, interior contact in ECM is "ON" and boost temperature (intake air pressure) rise warning lamp glows. ●Warning lamp lighting temperature : 185° F (85℃)
CN3-3	B/L	Auto start unit CN7-5 terminal (Oil fence)	No power exists during usual operation. When oil fence level switch is "ON", interior contact of auto start unit Y5 terminal is switched "ON" and warning lamp glows. ●Warning lamp lighting capacity : See 3.4.16.
CN3-4	Y/B	ECM CN1-52 terminal (Diagnosis switch)	When engine stops with starter switch "ON", and diagnosis lamp is "ON", make diagnosis switch "ON" or connect ECM CN1-52 terminal directly to ground. Then, diagnosis lamp begins to blink and present and past engine troubles are shown.
CN3-5	L/Y	ECM CN1-11 terminal (Glow lamp)	No power exists during usual operation. When glowing, interior contact of ECM CN1-11 terminal is "ON", and it connects ground to send power. Thus glow lamp glows.
CN3-6	L/B	ECM CN1-6 terminal (Diagnosis lamp)	No power exists during usual operation. When engine is in disorder, interior contact of ECM CN1-6 terminal is "ON", and it connects ground to send power. Thus diagnosis lamp of monitor glows. When diagnosis lamp glows, it stops engine once. With starter switch "ON", push diagnosis switch to supply power to ECM CN1-52 terminal. Then, diagnosis lamp begins to blink and present and past engine troubles are shown.
CN3-7	G/W	ECM CN1-16 terminal (Water temperature)	No power exists during usual operation. When engine water temperature rises up to emergency stop set temperature, interior contact of ECM CN1-16 terminal is "ON", and it connects ground to send power. Thus engine water temperature rise emergency stop lamp glows. ●Emergency stop lamp lighting temperature : 212° F (100℃)
CN3-8	L	Auto start unit CN7-6 terminal (Engine speed)	It detects engine speed. It detects engine speed converted to tachometer (2 revolutions per 1 pulse).
CN3-9	—	NIL	
CN3-10	R/W	15A fuse	Power supply for monitor lamp

Pin No.	Line color	Connection	Function
CN3-11	L/W	Auto start unit CN7-4 terminal (Overcrank)	It inputs start stall signal. No power exists during usual operation. Upon auto start, interior contact of auto start unit Y2 terminal is "ON". When it outputs start signal to starter relay, X3 terminal detects engine start speed (more than 750 min^{-1}). The engine start will not start even after three times trial, interior contact of auto start unit Y4 terminal is "ON" and output start stall signal to monitor lamp CN3-11.
CN3-12	G/Y	Auto start unit CN7-3 terminal (Air filter)	No power exists during usual operation. When air filter differential pressure indicator is "ON" for 10 seconds, interior contact of auto start unit Y3 terminal is "ON" and air filter clogging warning lamp glows.
CN3-13	Y	ECM CN2-88 terminal (Overspeed)	No power exists during usual operation. When engine speed rises up to emergency stop set speed, interior contact of ECM CN2-88 terminal is "ON" and it connects ground to send power. Thus overspeed warning lamp glows. ●Emergency stop set speed : 2,070min^{-1} (69Hz)
CN3-14	G/R	ECM CN1-17 terminal (Oil pressure)	No power exists during usual operation. When engine oil pressure drops down to emergency stop set pressure, interior contact of ECM CN1-17 terminal is "ON" and it connects ground to send power. Thus engine oil pressure drop emergency stop warning lamp glows. ●Emergency stop lamp lighting pressure : 14.3psi (0.098MPa)
CN3-15	—	NIL	
CN3-16	W/G	Tachometer Engine speed detection terminal	It outputs engine speed. (2 revolutions per 1 pulse)
CN3-17	B/P	Tachometer Grounding terminal for engine speed detection	Grounding terminal for tachometer engine speed detection. In order to show engine speed pulse signal outputted from CN3-16 terminal to tachometer, pulse signal at minus side is necessary and so diode is added at ground circuit, and ground level of tachometer is raised 1.2V higher.

3.4.3 Auto start unit

Part number:46760 73710



SG14146

(1) List of functions

Pin No.	Line color	Connection	Function
CN5-1	B/R	To the 10A fuse via emergency stop switch No. 2 terminal	■Power supply When pressing emergency stop switch also during manual operation, main relay becomes "OFF" and power supply of controller (ECM) and power supply of automatic start unit (ASU) become "OFF". Then it will be brought to emergency stop.
CN5-2	Y/L	ECM CN1-8 terminal	It inputs engine speed. (1 revolution per 4 pulses)
CN5-3	Y/G	Air filter differential pressure indicator	No power exists during usual operation. Air filter differential pressure rises "ON". When air filter differential pressure indicator is "ON" for 10 seconds, interior contact of Y3 terminal is switched "ON" and warning lamp glows. ●Function differential pressure : More than 0.9psi (6.2kPa)
CN5-4	Y/R	Manual-Auto selector switch CN4-3 terminal	Power supply for remote start-stop switch. With CN5-4 terminal power supply input, remote start-stop switch (external output terminal plate A1-A2 terminals) is "ON", XO relay works.
CN5-5	W/L	Oil fence level switch	No power exists during usual operation. Fluid level in oil fence rises "ON". When oil fence level switch is "ON" for 10 seconds, interior contact of Y5 terminal is switched "ON" and warning lamp glows. ●Warning lamp lighting capacity : More than 1/3 of blank capacity

Pin No.	Line color	Connection	Function
CN5-6	Y/W	Remote start-stop switch (Via external output terminal plate A1 terminal)	Remote start-stop switch connector terminal. With auto start unit (ASU) CN6-4 terminal power supply input, remote start-stop switch is "ON", XO relay works. Thus the relay is switched, power is sent to PLC unit via DC12V-DC24V converter. And XO relay works and voltage is applied to PLC unit XO terminal. Then 2 seconds later, interior contact of Y1 terminal is "ON" and preheating starts. Then when X6 terminal detects, preheating finished, interior contact of Y2 terminal is "ON" and starter motor begins cranking and start engine. ■**Stop** Remote start-stop switch is "OFF" to make XO relay switch "OFF", but power is supplied to PLC unit itself for 10 seconds with power input from CN5-1 terminal. Then after engine performs cooling operation for 10 seconds, interior contact between COM0-Y0 terminals is "OFF", and engine is brought to stop. ■**In case pushing emergency stop button** When pushing emergency stop button on operation panel, power supply of auto start unit CN5-1 terminal is shut down to stop immediately.
CN5-7	Y	Generator unit T7 terminal	It detects generator unit (T7-T9) generating power. When engine automatically starts, no power exists on X7 relay coil. And in case no voltage is applied to X7 relay, interior contact of PLC unit Y1, Y2 terminal is "OFF" and to stop engine start and to cancel auto re-start function.
CN5-8	Y	Generator unit T9 terminal	
CN5-9	B	Grounding	

Pin No.	Line color	Connection	Function
CN7-1	L/Y	ECM CN1-11 terminal	It detects preheating finish when starting. While preheating, interior contact of ECM CN1-11 terminal is "ON" and then power flows. When "OFF", preheating is completed.
CN7-2	R/W	To the charge relay (MR1) via 15A fuse	When engine starts, charge relay (MR1) becomes "ON" and interior contact BY1 of PLC unit becomes "ON". Then power is supplied to ECM CN1-50 terminal and idling operation is performed for 10 seconds.
CN7-3	G/Y	Monitor lamp CN3-12 terminal (Air filter clogging warning lamp)	No power exists during usual operation. When air filter differential pressure indicator is "ON" for 10 seconds, interior contact of Y3 terminal is "ON" and air filter clogging warning lamp glows.

Pin No.	Line color	Connection	Function
CN7-4	L/W	Monitor lamp CN3-11 terminal (Overcrank warning lamp)	It outputs start stall signal. No power exists during usual operation. When automatically starting, interior contact of PLC unit Y2 terminal is "ON" and it outputs start signal to starter relay. When starter works and X07 contact is "ON" by generation signal, PLC unit judges that starting is completed, but when X7 contact is not "ON" even after cranking is tried 10 seconds, it stops 8 seconds and cranking operation will be repeated 10 seconds. When engine will not start even after this operation is tried three times, make the interior contact of PLC unit Y4 terminal "ON" and output start stall signal to monitor panel and then overcrank warning lamp goes on.
CN7-5	B/L	Monitor lamp CN3-3 terminal (Oil fence water level rise warning lamp)	No power exists during usual operation. When oil fence level switch is "ON", interior contact of PLC unit Y5 terminal is "ON" and oil fence water level rise warning lamp glows.
CN7-6	L	Tachometer (Via monitor lamp CN3-8 terminal)	It outputs engine speed. (2 revolutions per 1 pulse) Engine speed (1 revolution per 4 pulses) inputted from ECM is converted for tachometer (2 revolutions per 1 pulse) and outputted.
CN7-7	R/Y	Starter switch ACC terminal	Power supply for engine starting when automatically starting. When remote start-stop switch is "ON", XO relay works to supply power to PLC unit XO terminal, and 2 seconds later interior contact of Y1 terminal is "ON". Engine power supply is outputted from CN7-7 terminal. Outputted power from CN7-7 is to activate MR1 relay and supply power to ECM for starting preheating.
		MR1 relay coil	
CN7-8	R/L	Starter switch C terminal	It outputs start signal when automatically starting. When ASU CN7-1 terminal (V11 terminal) detects end of preheating PLC unit Y2 terminal interior contact is "ON" to activate STX relay and it outputs start signal to starter relay SY from ASU CN7-8 terminal. Starter works and cranking operation continues 10 seconds. When generation signal is inputted to ASU CN6-7 and CN6-8 terminals during the time, it makes Y2 terminal interior contact "OFF" to cut power supply and then cranking operation stops. When generation signal is not inputted to ASU CN6-7 and CN6-8 even after cranking operation is tried 10 seconds, it stops 8 seconds and cranking operation is repeated is tried and this operation is repeated three times. When generation signal is not inputted to ASU CN6-7 and CN6-8 terminals, start stall warning is outputted.
		Starter relay coil (SY)	
CN7-9	R/B	ECM CN1-50 terminal	When engine starts automatically, interior contact BY1 of PLC unit is made "ON" for 10 seconds to perform idling operation for protection of turbo.

(2) Operating procedure

※This explains how the unit equipped with automatic power transfer is automatically started.

① Start the generator unit under the procedure of manual operation and adjust the frequency and voltage rating.

② Turn the starter switch to "STOP" position and stop the engine.

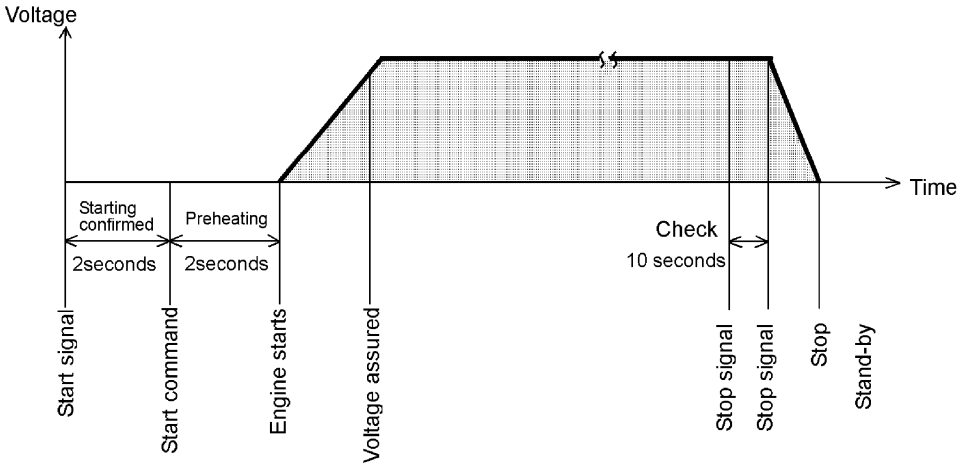
③ Turn the circuit breaker of output terminal "ON" after the generator unit stopped when you use the circuit breaker and single phase receptacle on the control panel.

④ Turn the operating selector switch to "AUTO" position on the control panel.

⑤ The unit will be under stand by and start once the start signal is sensed.

(3) Function

● When start signal activates in stand-by conditions, it starts the generator engine after preheating. When stop signal activates, it continues 10 seconds cooling down operation to stop engine and the machine is placed again in stand-by conditions.

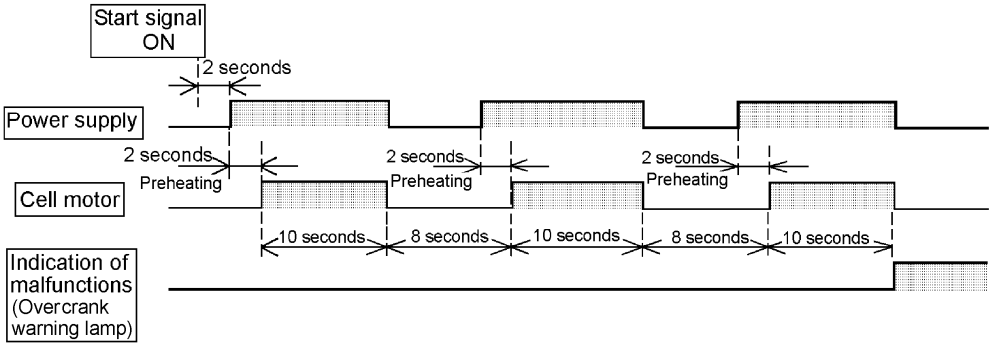


SG13071E

● In order to start generator unit surely, cranking operation is repeated after it stops for 8 seconds, in case that engine will not start even after cranking operation for 10 seconds. In case the engine will not start even after cranking operation is repeated three times, trouble signal goes on showing difficulty in starting.

● In case that the lamp "OVERCRANK" goes on, switch off power supply once, pressing the button "EMERGENCY STOP ". Then after releasing the button "EMERGENCY STOP", get rid of the cause of trouble why engine would not start.

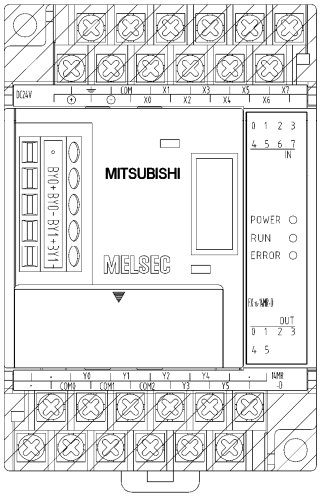
● Try no load operation 5 to 10 minutes once a week.



SG13072E

3.4.4 Sequencer PLC PLC : Programmable Logic Controller

Part number:46879 65300



SG13073

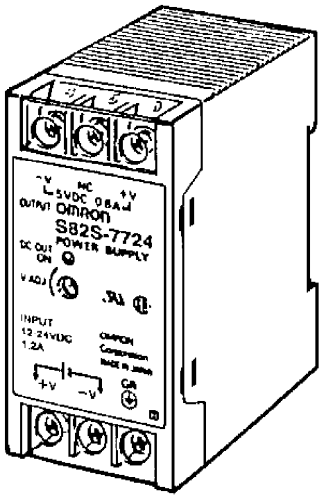
(1) List of functions

Pin No.	Line No.	Connection	Function
(+)	P2	DC-DC converter (+V) DC24V output terminal	24V power supply for sequencer
(−)	N2	DC-DC converter (−V) DC24V output terminal	Grounding
COM	COM	X0 relay No.6 terminal	Grounding
COM	N	PLC (BY0−) terminal	Grounding
X0	X00	X0 relay No.5 terminal	X0 relay (automatic remote starting function)
X2	X02	PLC (X3) terminal and ECM CN1-8 terminal	It inputs engine speed
X3	X02	PLC (X2) terminal	−
X4	X04	Air filter differential pressure indicator	When differential pressure indicator functions, it makes interior contact of PLC (Y3) terminal close.
X5	X05	Oil fence level switch	When oil fence level switch functions, it makes interior contact of PLC (Y5) terminal close.
X6	X06	Diode SD1 is connected to anode side	It transfers preheating completion signal to PLC(X6) terminal from glow lamp circuit. (Check the timing of cranking)
X7	X07	X7 relay No.3 terminal	It decides whether it is to be continued or stopped by detecting generation signal.
COM0	P1	STX relay No.1 terminal	Power supply for STX relay coil (starter relay function)
COM0	P1	STX relay No.4 terminal	Power supply for starter relay SY
Y0	Y00 (P3)	DC-DC converter (+V) DC12V input terminal	Power supply for DC-DC converter 12V
Y0	Y00	X0 relay No.4 terminal	When remote auto start signal is inputted, it closes X0 relay and starts auto start.
COM1	P1	COM0 P1 terminal	Power supply for starter relay SY
COM1	P1	STX relay No.1 terminal	Power supply for STX relay coil (starter relay function)
Y1	C4	Starter switch ACC terminal	Power supply for PLC unit
COM2	COM2	PLC (BY0−) terminal	Grounding

Pin No.	Line No.	Connection	Function
Y2	Y02	STX relay No.5 terminal	Power supply for STX relay coil (starter relay function)
Y3	Y03	Monitor lamp: air filter warning lamp	When air filter gets clogged, warning lamp glows.
Y4	Y04	Monitor lamp: overcrank warning lamp	In case of start stall, it makes warning lamp glow.
Y5	Y05	Monitor lamp: oil fence warning lamp	When condensates in oil fence accumulate more than 1/3 of condensate capacity, it makes warning lamp go on.
BY0＋	BY0＋	Monitor lamp	Engine speed output
BY0－	N	PLC (COM2) terminal	Grounding
BY0－	N	PLC (COM) terminal	Grounding
BY1＋	P4	15A fuse	When engine starts automatically, interior contact BY1 of PLC unit is made “ON” for 10 seconds to perform idling operation for protection of turbo.
BY1－	V50	ECM CN1-50 terminal	
Cathode side of SD1 diode	V11	Monitor lamp: glow lamp	It transmits preheating completion signal to PLC (X6) terminal through SD1 diode from glow lamp circuit. (Check the timing of cranking)

3.4.5 DC-DC Converter (DC POWER SUPPLY)

Part number:46872 01300



OUTPUT

-V	NC	+V	DC24V 0.3A

INPUT

+V	-V	GR	DC12V 1.2A

Pin. No.

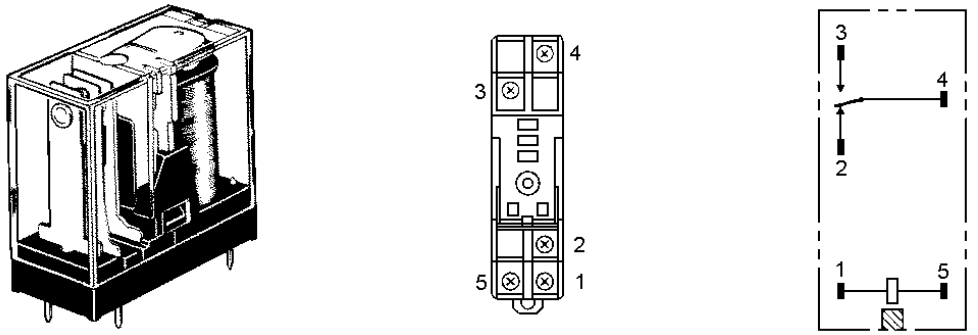
SG13074

(1) List of functions

－	Pin No.	Line No.	Connection	Function
OUT PUT	＋V	P2	PLC (＋) terminal	It supplies DC24 power to PLC
	－V	N2	PLC (－) terminal	Grounding
INPUT	＋V	P3	PLC (Y0) terminal	It supplies DC12V power to DC-DC converter
	－V	N	Grounding	Grounding
	－V	N	PLC (COM2) terminal	Grounding

3.4.6 Power relay (1)

Part number:46177 08500 (X7 relay, AC220V)
Part number:46177 08300 (STX relay, DC12V)



SG13075

(1) List of function (X7 relay): Generating signal relay

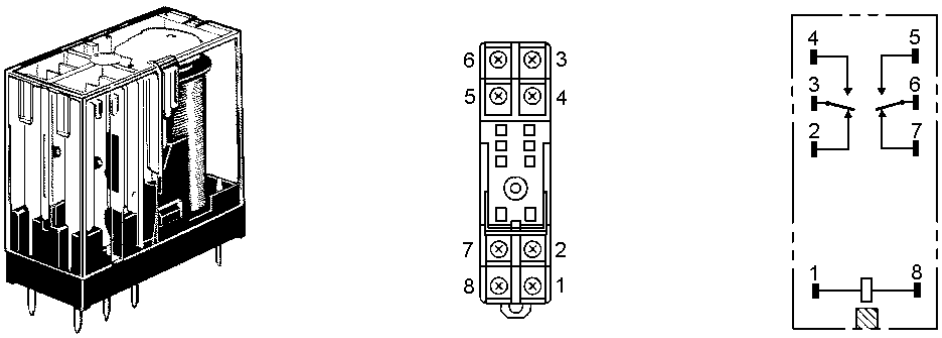
Pin No.	Line No.	Connection	Function
3	X07	PLC (X7) terminal	It sends generation signal to PLC(X7) terminal from X7 relay
4	COM	Grounding	
1	T9	Control panel T9 terminal	Power supply for X7 relay coil
5	T7	Control panel T7 terminal	Power supply for X7 relay coil

(2) List of function (STX relay): Starter relay

Pin No.	Line No.	Connection	Function
3	C6	Starter switch C terminal	When it detects preheating completion at PLC X6 terminal, it makes starter relay function.
4	P1	X0 relay No.3 terminal	Power supply of STX relay and MX relay
4	P1	PLC (COM0) terminal	PLC common power supply (DC12V)
1	P1	Emergency stop button No.2 terminal	Power supply for MX relay coil (preheat function)
1	P1	PLC (COM1) terminal	PLC common power supply (DC12V)
5	Y02	PLC (Y2) terminal	Power supply for STX relay coil (starter relay function)

3.4.7 Power relay (2)

Part number:46177 08400 (X0 relay, DC12V)



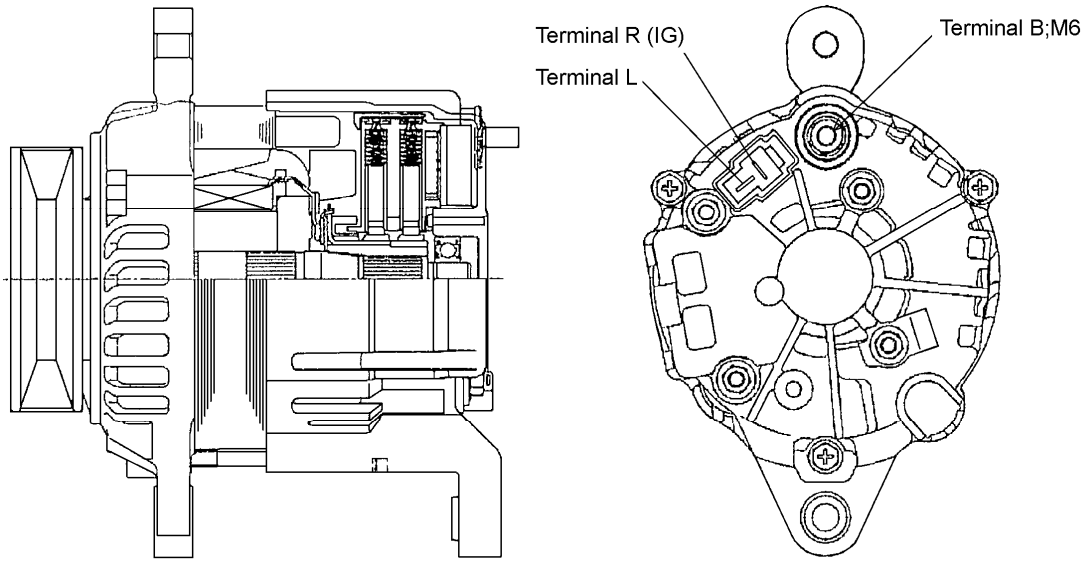
SG13076

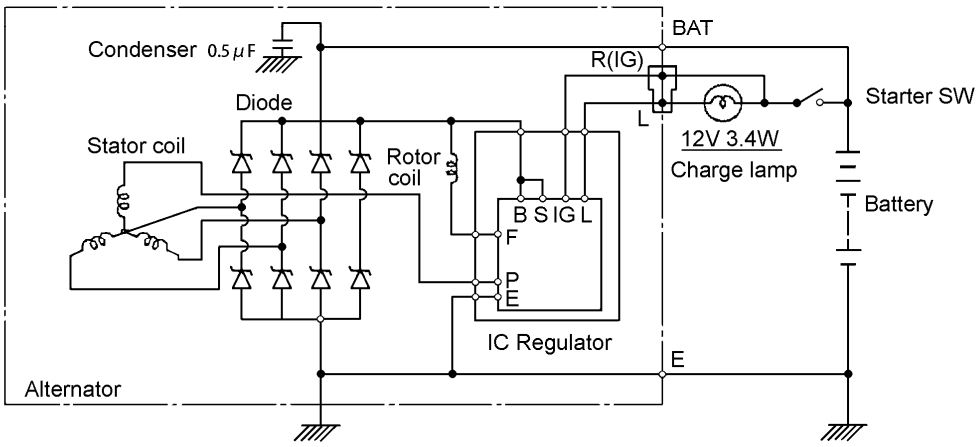
(1) List of function (X0 relay): remote auto start relay

Pin No.	Line No.	Connection	Function
Cathode side of SD2 diode	P3	X0 relay No.4 terminal	Power supply for 12V input to DC-DC converter.
Anode side of SD2 diode	C4	MX relay No.3 terminal	Power supply for 12V input to DC-DC converter.
6	COM	X7 relay No.4 terminal	When generation signal is being transmitted to X7 relay, it closes X7 relay contact and switches "OFF" starter relay power supply to stop starter.
6	COM	PLC (COM) terminal	Grounding
3	P1	STX relay No.4 terminal	When remote auto start switch is "ON", 2 seconds later it makes MX relay function.
5	X00	PLC (X0) terminal	It transmits remote auto start signal to PLC (X0) terminal from X0 relay.
4	P3	PLC (Y0) terminal	When remote auto start switch is "ON", it supplies 12V power to PLC.
4	P3	Cathode side of SD2 diode	It prevents ACC circuit of DC-DC converter input power from throwing power.
1	P0	Manual-Auto selector switch No.3 terminal	Power supply of X0 relay coil is inputted from selector switch No.3 terminal.
8	A1	Remote control terminal plate (A1) terminal	When contact between remote control terminal A1 and A2 is "ON", A1 terminal is grounded and X0 relay functions.

3.4.8 Alternator

ISUZU part number:897228-3181





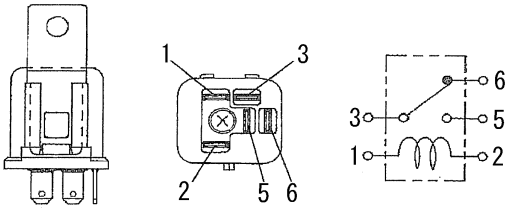
SG14147E

Voltage － Current	DC12V－50A
Regulator adjusted voltage	14.4±0.3V

3.4.9 Main / Starter cut / Fuel pump relay

Part number:44346 08500

Rated voltage	DC12V
Capacity of contact point	20A (lamp load) 25A (others)

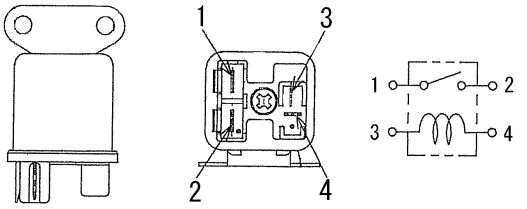


PC12043-1

3.4.10 Starter relay

Part number:44346 16100

Rated voltage	DC12V
Rated load	200A (Rush current) 80A (Braking current)

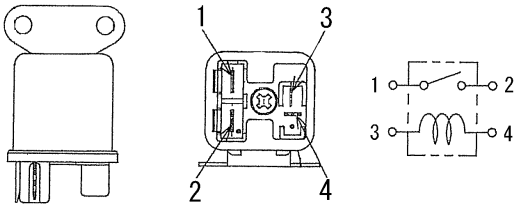


PC12044

3.4.11 Glow relay

Part number:44346 15700

Rated voltage	DC12V
Coil resistance	37Ω
Rated load	100A (Rush current) 40A (Braking current)

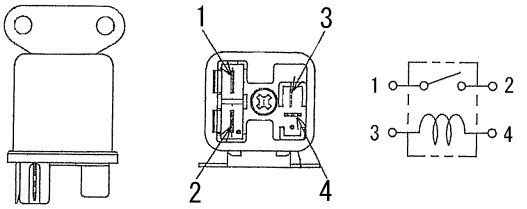


PC12044

3.4.12 Charge relay

Part number:44346 13200

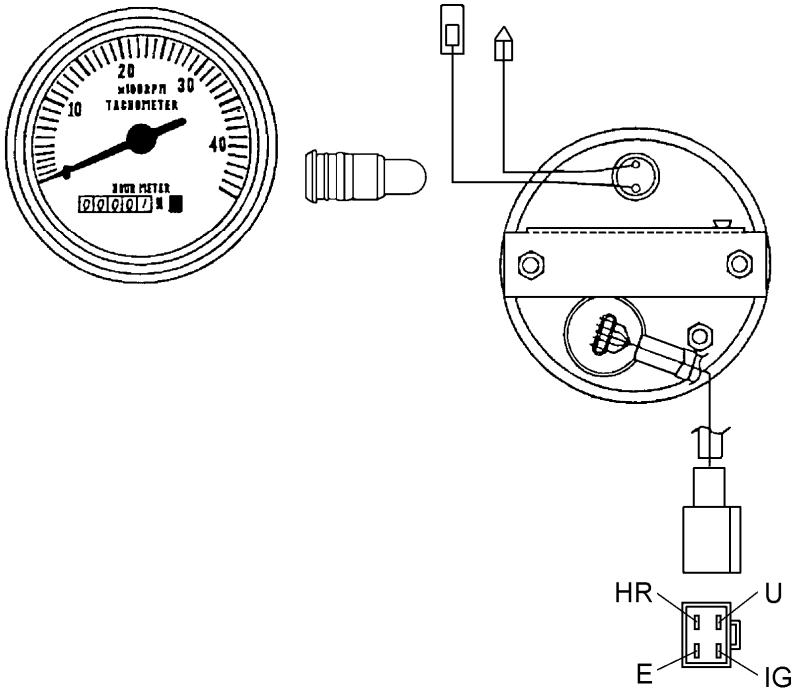
Rated voltage	DC12V
Rated load	Motor load 40A at steady state
Coil resistance	51.5Ω



PC12044

3.4.13 Tachometer (with hour-meter)

Part number:36146 05901



SG12116

(1) Specifications

Operation voltage	DC10－16V
Operation temperature	4°F－140°F (-20℃－60℃)
Revolution ratio (pulse type)	2 revolutions per 1 pulse

(2) List of functions

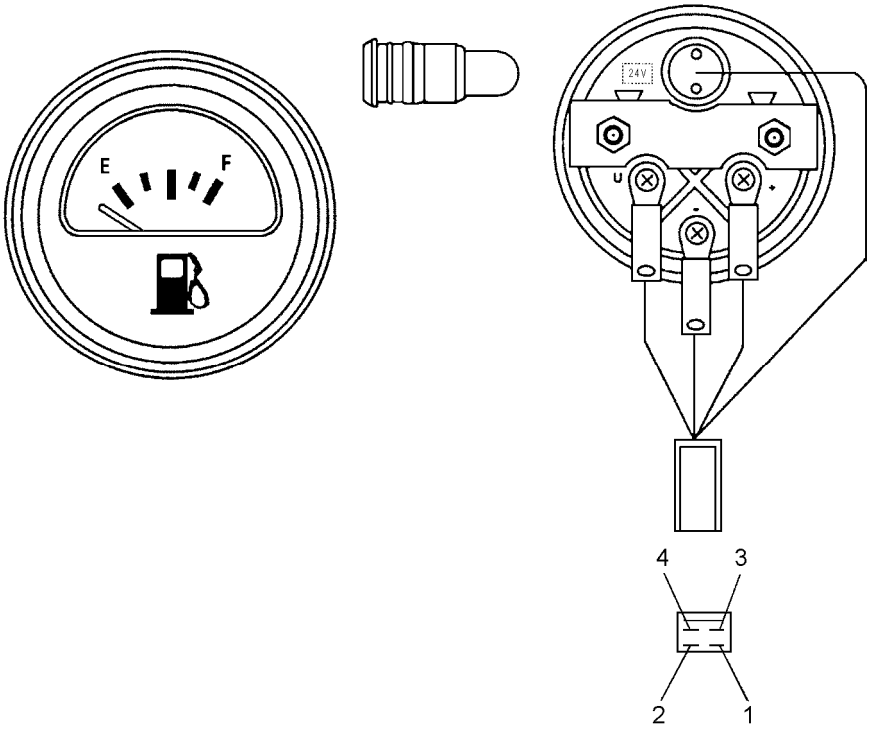
Pin No.	Line color	Connection	Function
E	B/P	Grounding	
HR	W	Alternator L terminal	Input of hour-meter function signal
IG	R/W	15A fuse	Power supply for tachometer
U	W/G	Monitor lamp CN3-16 terminal	Detection of engine revolutions
Male coupler	Y/W	Panel light switch	Power supply for lighting
Female coupler	B	Grounding	Ground for lighting

(3) Lamp specifications

DC12V	3.4W

3.4.14 Fuel gauge

Part number:36158 00500



SG09051

(1) Position of meter pointer

Pointer position	Resistance value (Ω)	Remaining fuel [gal.(L)]	
		SDG25S-8E1	SDG45S-8E1
E	95	9.0(34)	10.0(38)
1/2	32.5	24.0(91)	53.6(203)
F	7	42.5(161)	95.1(360)

(2) List of functions

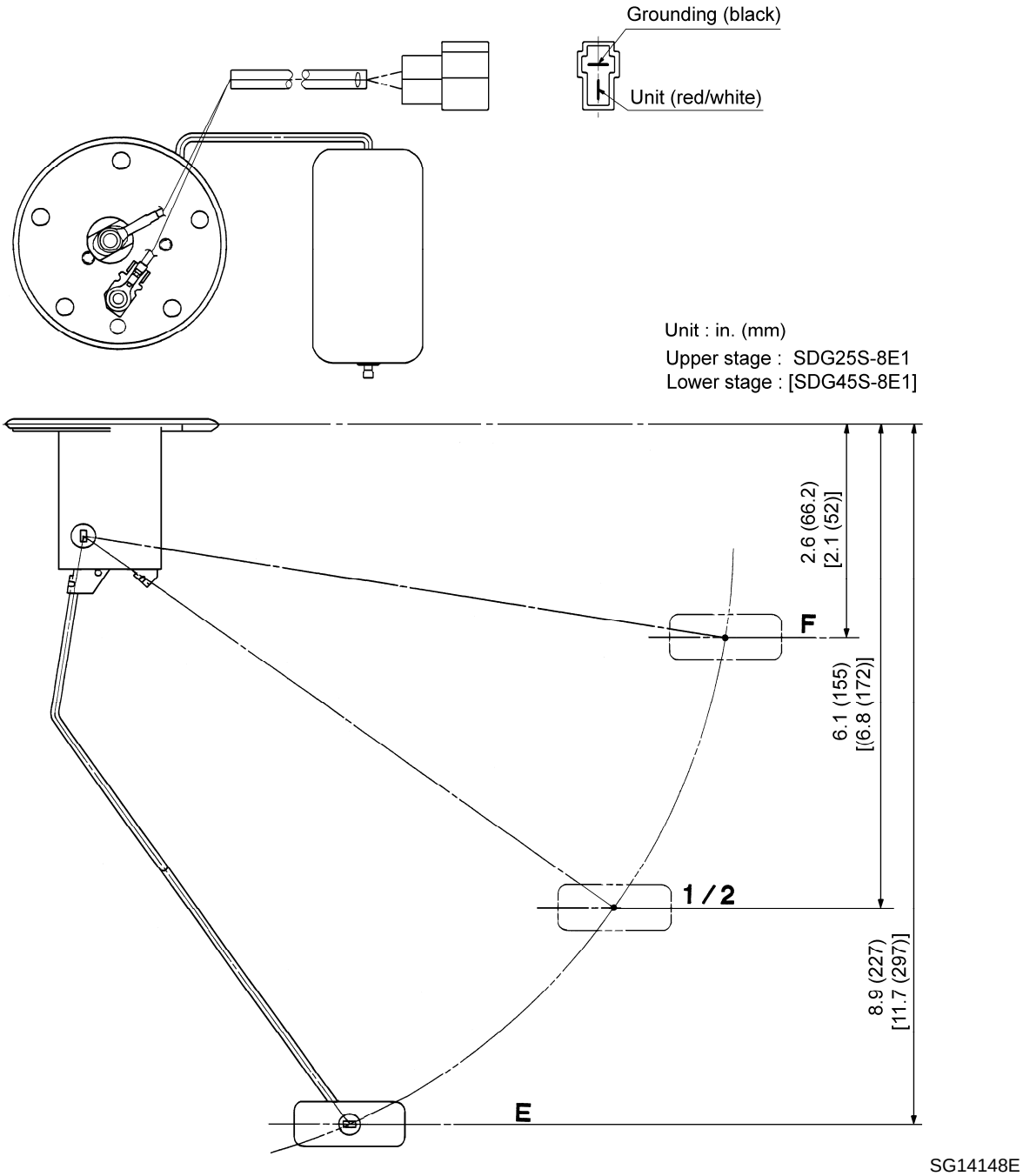
Pin No.	Line color	Connection	Function
1	B	Grounding	
2	R	Panel light switch	Power supply for lamps
3	G	Sending unit	Detector for remaining fuel
4	R/W	15A fuse	Power source

(3) Lamp specifications

DC12V	3.4W

3.4.15 Sending unit

SDG25S-8E1 Part number:36159 02101
SDG45S-8E1 Part number:36159 03000



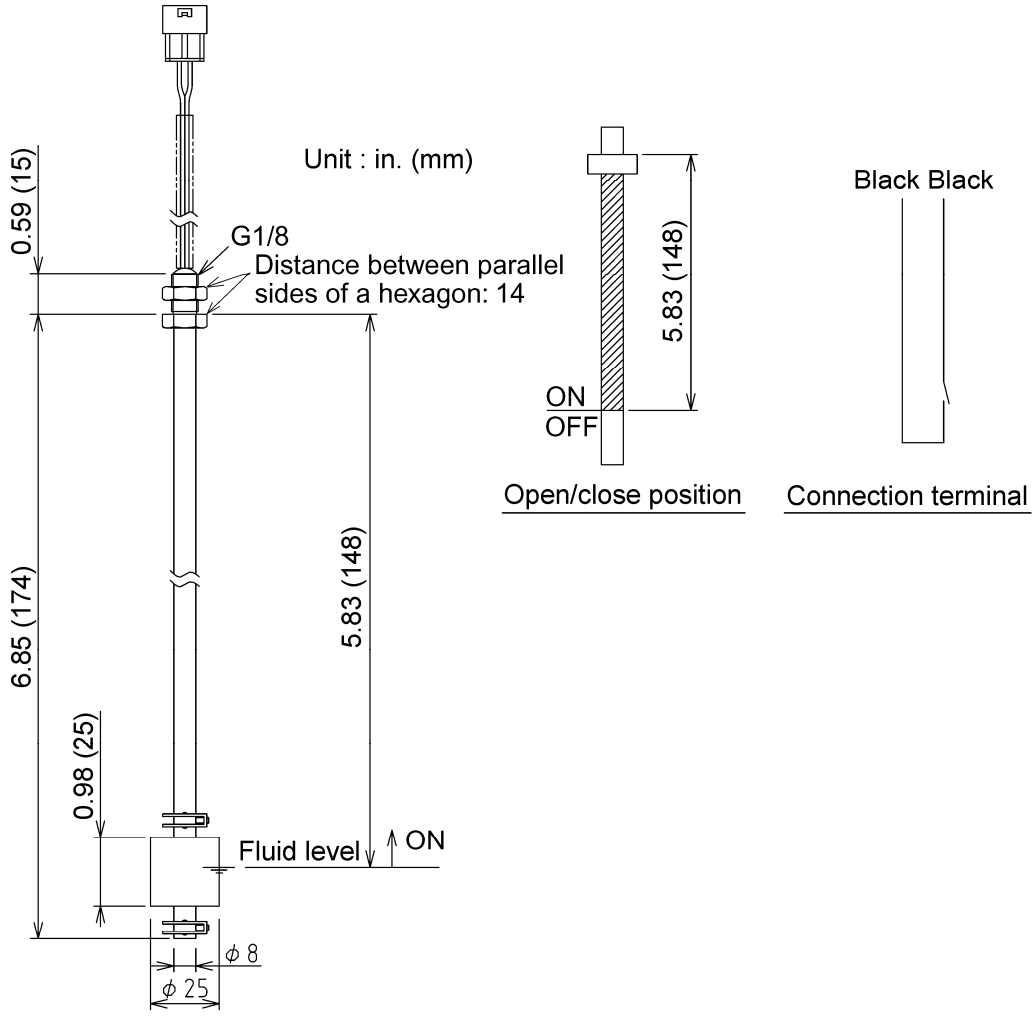
SDG25S-8E1

(1) Position of meter pointer for resistance value

Pointer position	Resistance value (Ω)	Remaining fuel [gal.(L)]	
		SDG25S-8E1	SDG45S-8E1
E	110	9.0(34)	10.0(38)
1/2	32.5	24.0(91)	53.6(203)
F	3	42.5(161)	95.1(360)

3.4.16 Oil fence level switch

Part number:46813 08100



SG13037E

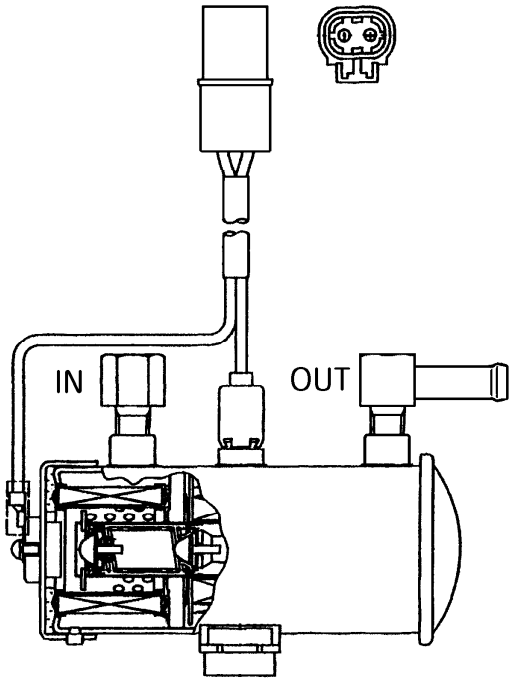
(1) Specifications

Maximum working current	AC 0.5A, DC 0.5A
Maximum primary contact resistance	Less than 100mΩ (excluding lead line)
Fluid level in oil fence when warning lamp glows [gal. (L)] (Level switch is ON)	11 (50)

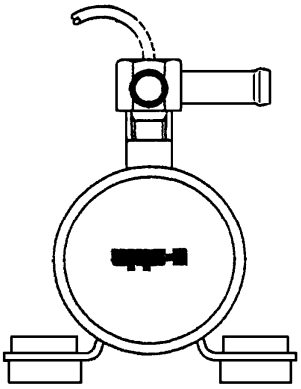
Fluid level in oil fence in above table shows the value calculated, not actually measured.

3.4.17 Fuel air-bleeding electromagnetic pump

Part number:43650 02600 With filter type



Part number of filter
ISUZU part number: 898071-4010



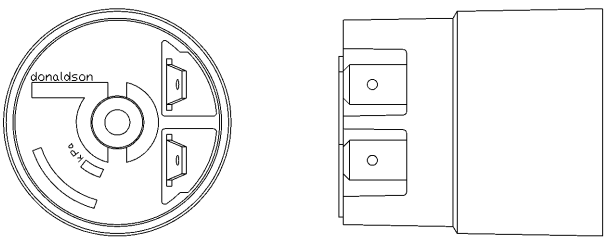
SG12075

(1) Specifications

Rated voltage	DC12V
Max operating current	1.5A (Max)
Discharge volume	More than 0.3gal./min (1.3L/min)

3.4.18 Air filter differential pressure switch

Part number:32148 03000

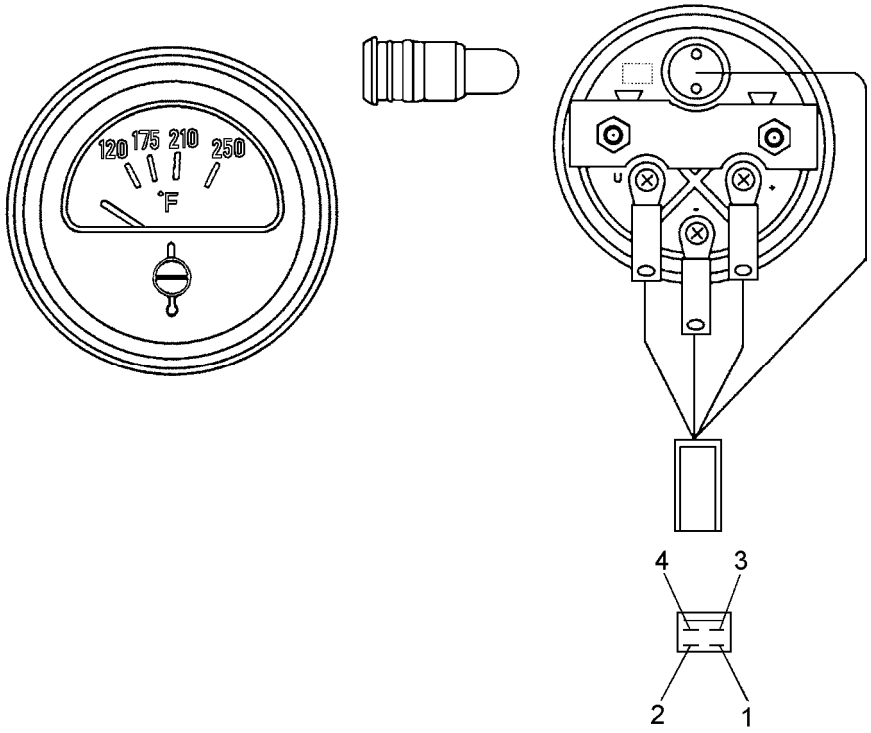


・Operating pressure : 0.9psi (6.2kPa)
・A Contact

SC10016

3.4.19 Water temperature gauge

Part number:36145 06800



SG06040

(1) List of functions

Pin No.	Line color	Connection	Function
1	B	Grounding	
2	Y/W	Panel light switch	Power supply for lighting
3	W/B	Water temperature sensor	Detector for water temperature
4	R/W	15A fuse	Power supply

(2) Temperature and resistance value of sensor

Temperature [°F (℃)]	Resistance value (Ω)
120 (49)	248
160 (71)	「109」
210 (99)	42
250 (121)	「22」

「 」marked: reference value

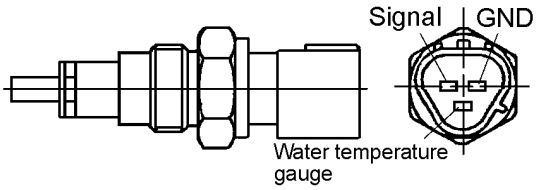
(3) Lamp specifications

DC12V	3.4W

3.4.20 Water temperature sensor (for ECU, emergency stop and gauge)

ISUZU part number:898023-7170

Setting temperature	ON in case of more than 212°F (100℃)



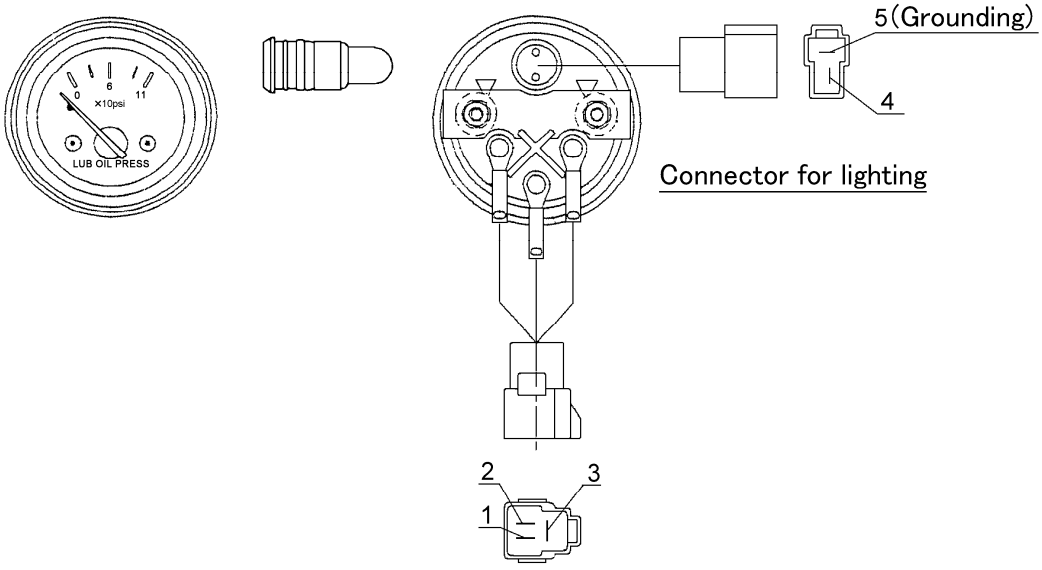
SG14149E

Tightening torque

: 15lb·ft (20N·m)

3.4.21 Oil pressure gauge

Part number:36143 03600



SG13081

(1) Indicated pressure and resistance value

Indicated pressure [psi (MPa)]	0	60 (0.41)	113.8 (0.78)
Resistance value (Ω)	83	43	12.3

(2) List of functions

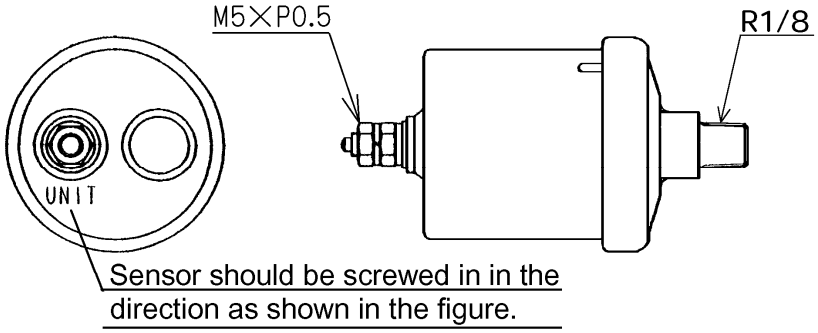
Pin No.	Line color	Connection	Function
1	R/W	15A fuse	Power supply
2	G/B	Oil pressure sensor	Detector for oil pressure
3	B	Grounding	
4	Y/W	Panel light switch	Power supply for lamps
5	B	Grounding	

(3) Lamp specifications

DC12V	3.4W

3.4.22 Oil pressure sensor (for oil pressure gauge)

Part number:44365 00300



SG14057E

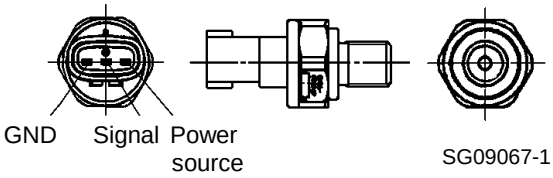
(1) Standard pressure and standard resistance value

Standard pressure [psi (MPa)]	0	60 (0.41)	113.8 (0.78)
Standard resistance value (Ω)	83	43	12.3

3.4.23 Engine oil pressure sensor (for emergency stop)

ISUZU part number:898027-4560

Setting pressure	OFF in case of less than 14.3psi (0.098MPa)



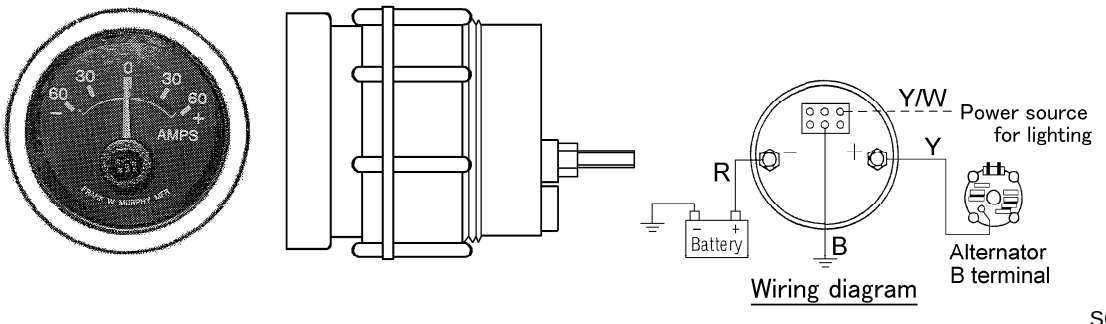
SG09067-1

Tightening torque

: 30lb·ft (41N·m)

3.4.24 Ammeter for battery charge

Part number:46154 15300



SG13082E

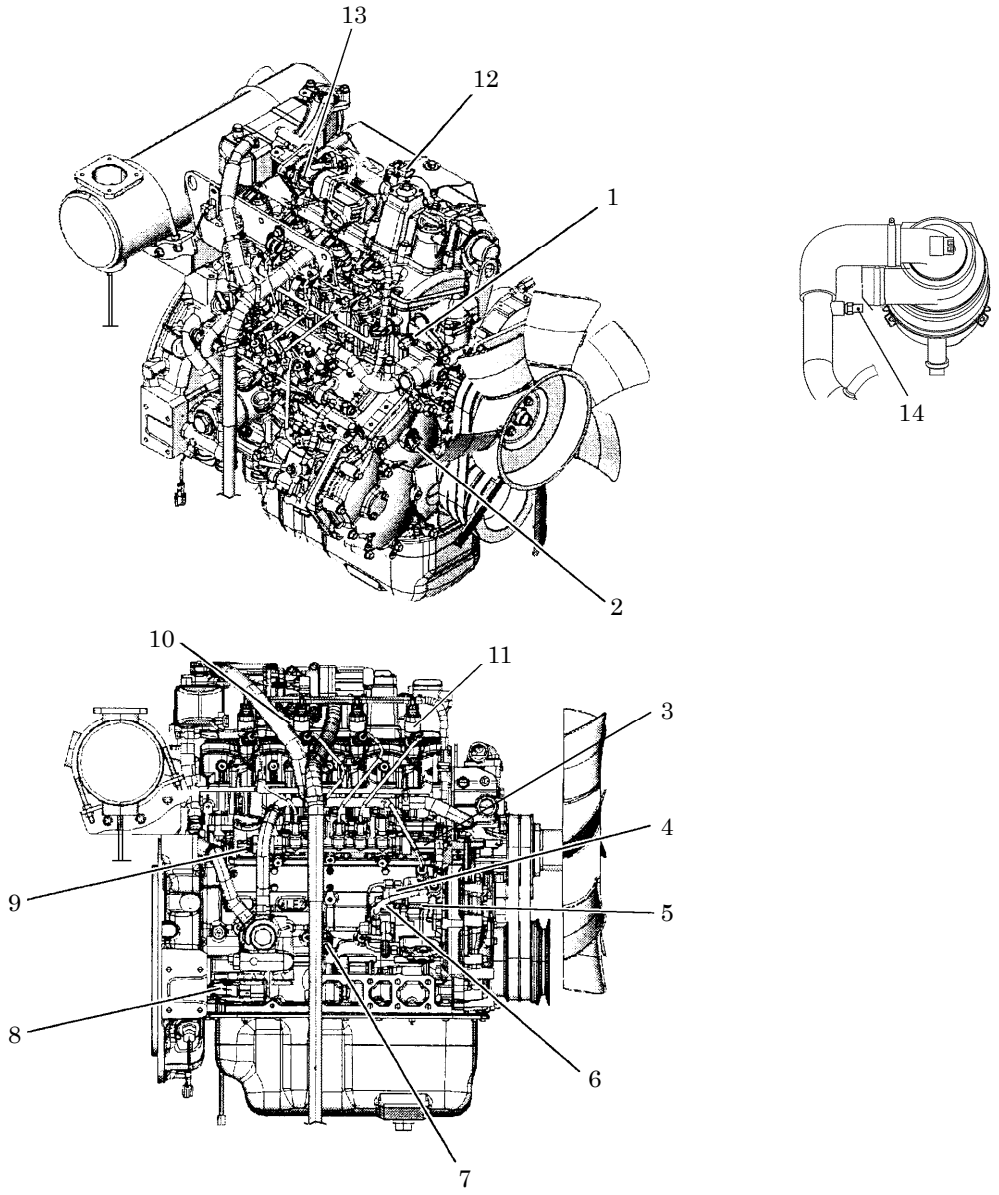
Power supply voltage	DC12V

3. Electric System

3.5 Electronic Control Engine Component

[Excerpted from ISUZU Engine repair manual]

3.5.1 Engine component location diagram



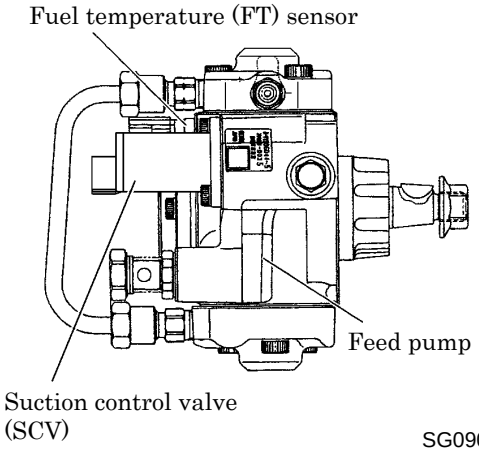
SG14150

1. Water temperature sensor
2. Camshaft angle (CMP) sensor
3. Pressure limiter
4. Suction control valve (SCV)
5. Supply pump
6. Fuel temperature sensor
7. Engine oil pressure sensor
8. Crankshaft angle (CKP) sensor
9. Common rail pressure sensor
10. Intake manifold temperature (IMT) sensor
11. Injector
12. Boost temperature / boost pressure sensor
13. EGR motor position sensor
14. Intake air temperature (IAT) sensor
    ※Mounted to air filter intake air pipe
15. Barometric pressure sensor
    ※Mounted to the inside the control panel

3.5.2 Various parts and sensors

[Supply pump]

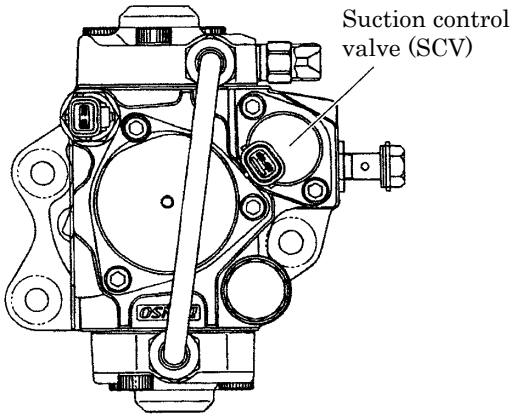
The supply pump pressurizes fuel using engine output, and pressure-feeds fuel to common rail. The supply pump has suction control valve (SCV), fuel temperature (FT) sensor and feed pump.



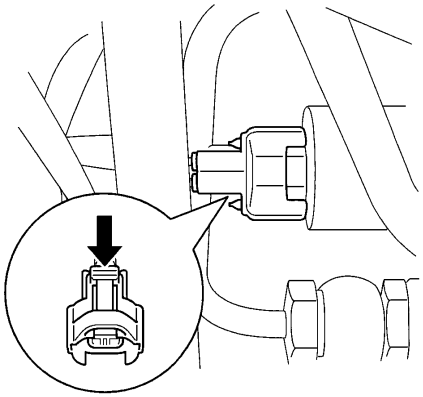
SG09040

[Suction control valve (SCV)]

The suction control valve (SCV) is installed onto supply pump section and controls pressure feed of fuel (discharge amount) to common rail. The engine control module (ECM) regulates period of electric conduction of suction control valve (SCV) to regulate the fuel discharge amount.

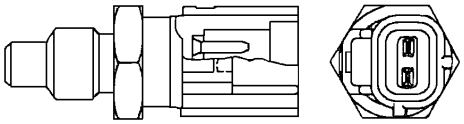


SG09041



SG09042

[Fuel temperature (FT) sensor]


SG09054

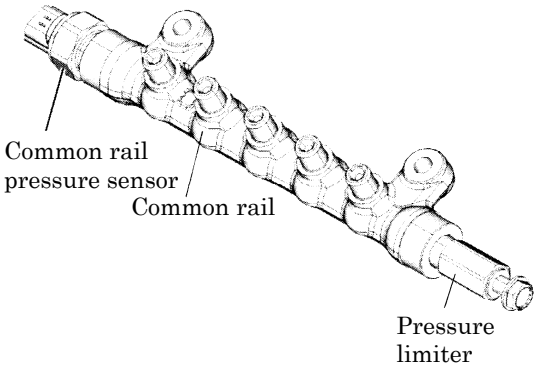
The fuel temperature (FT) sensor is installed onto the supply pump, and the thermistor changes the resistance according to the temperature. The resistance is low when the fuel temperature is high, and is high when the temperature is low. The ECM energizes the voltage 5V to the fuel temperature (FT) sensor through pull up resistance, and calculates fuel temperature based on change of voltage to use for various controls such as supply pump control etc. If the resistance is low (temperature is high), the voltage becomes low; if the resistance is high (temperature is low), the voltage becomes high.

Removal

Do not replace the fuel temperature (FT) sensor.
If it is faulty, replace it as supply pump assembly.

[Common rail]

The common rail receives fuel from supply pump, holds the common rail (fuel) pressure and distributes fuel to each cylinder. The common rail has common rail pressure sensor and pressure limiter.



SG14151

Note:

For common rail replacement procedure, refer to "Engine section" in the service manual.

[Common rail pressure sensor]

The common rail pressure sensor is installed onto common rail, detects fuel pressure in common rail, converts the pressure into the voltage signal and sends it to ECM. Voltage becomes higher as pressure becomes higher, and lower as one dose lower. ECM calculates the actual common rail pressure (fuel pressure) based on the voltage signal sent from sensors and uses it for fuel injection control etc.

Removal

Do not replace the common rail pressure sensor.
If it is damaged, replace it as common rail assembly.

[Pressure limiter]

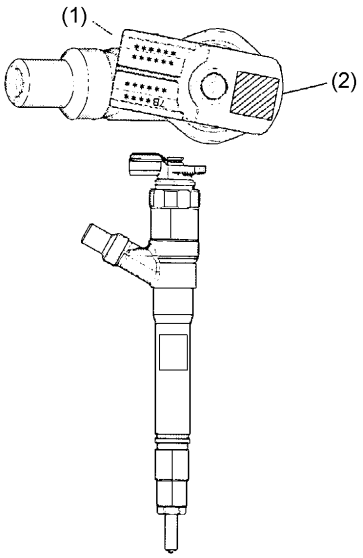
The pressure limiter operates to release the pressure in common rail when the pressure becomes extremely high.

Removal

Do not replace the pressure limiter.
If it is damaged, replace it as common rail assembly.

[Injector]

The injector is installed onto cylinder head section and is conrtolled by ECM to inject fuel. The ECM raises the voltage for operating injectors internally, energizes to injector, and regulates period of electric conduction of injector to control fuel injection amount and injection timing. The injector replacement, rewrite the ID code is required to ECM.

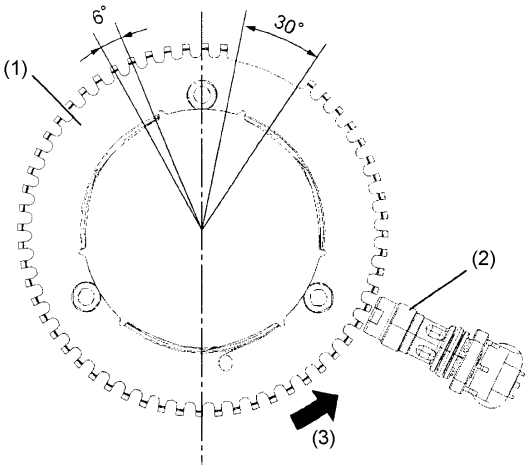


SG14152

(1) ID code (Correction value)
(2) QR code (Product control number)

[Crankshaft angle (CKP) sensor]

The crankshaft angle (CKP) sensor is installed onto cylinder block and produces the CKP signal when the sensor rotor passes the sensor. The ECM distinguishes the cylinders by the CMP signal input from camshaft angle (CMP) sensor, determines the crank angle and uses it to contorl fuel injection and calculate the engine speed. These contorls are performed, usually based on CKP signal. However it is done, based on CMP signal if the crankshaft angle (CKP) sensor is faulty.



SG14153

Removal

Disconnect the connector, and remove the 0.4in. (10mm) mounting bolt and sensor.

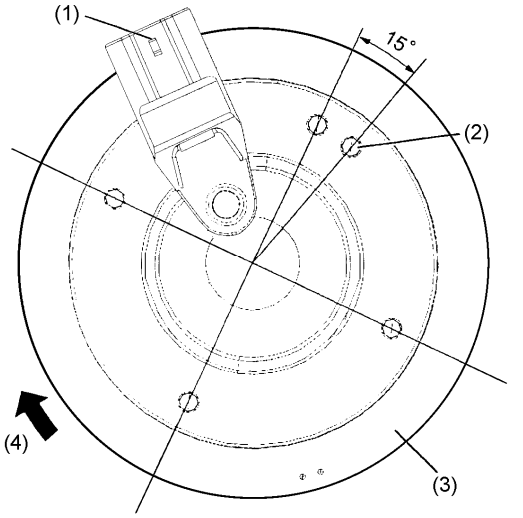
Installation

: 44lb·in (5N·m)

(1) Sensor rotor
(2) CKP sensor
(3) Rotating direction

[Camshaft angle (CMP) sensor]

The camshaft angle (CMP) sensor is installed onto the gear case cover of engine front and produces the CMP signal when the cam portion of camshaft passes the sensor. The ECM distinguishes the cylinders by the CMP signal input from camshaft angle (CMP) sensor, determines the crank angle and uses it to contorl fuel injection and calculate the engine speed. These contorls are performed, usually based on CKP signal. However it is done, based on CMP signal if the crankshaft angle (CKP) sensor is faulty.



SG14154

Removal

Disconnect the connector, and remove the 0.4in. (10mm) mounting bolt and sensor.

Installation

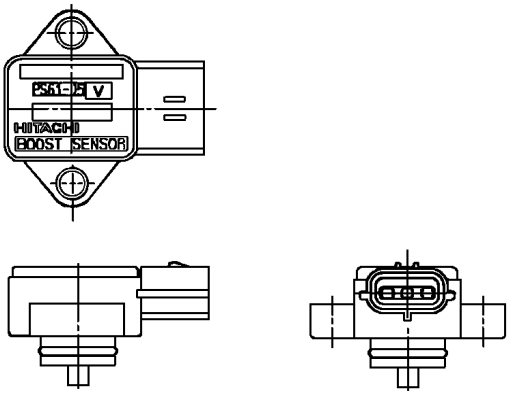
Apply a coat of engine oil to the O-ring.

: 44lb·in (5N·m)

(1) CMP sensor
(2) Protrusions
(3) Timing chain sprocket
(4) Rotating direction

[Barometric pressure sensor]

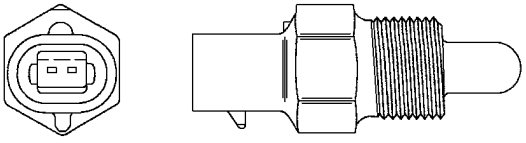
The barometric pressure sensor is installed into the control panel and converts the barometric pressure into voltage signal. The ECM calculates barometric pressure by voltage signal and performs fuel injection amount correction (high-altitude correction) etc. by barometric pressure.



SG09069

[Intake air temperature (IAT) sensor]

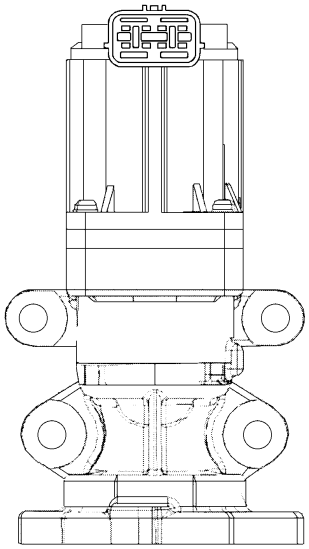
The intake air temperature (IAT) sensor is installed onto the intake air pipe and detects the temperature of intake air for optimum fuel injection control.


SG09070

: 8－12lb·ft (10.8－16.3N·m)

[EGR motor position sensor]

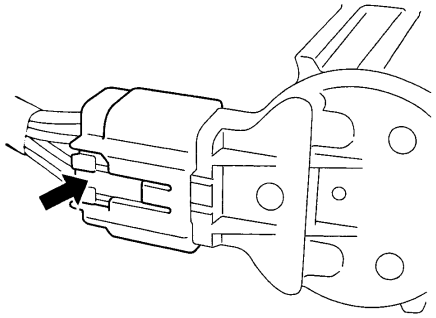
It is installed in EGR valve and detects the valve lift amount of EGR.



SG14155

Note:

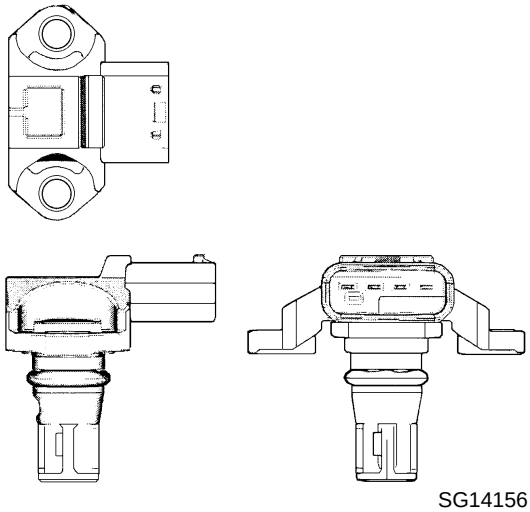
Do not disassemble the EGR motor position sensor. If it is faulty,replace it as EGR valve assembly.



SG09072

[Boost temperature / boost pressure sensor]

This sensor detects boost pressure and boost temperature. Boost pressure sensor changes pressure to voltage signal and it sends the signal to ECM. Voltage becomes higher as pressure becomes higher, and lower as one dose lower. ECM calculates the boost (intake air pressure) based on the voltage signal sent from sensors and uses it for fuel injection control etc. Boost temperature sensor is of thermistor type to measure temperature and to send it to ECM.



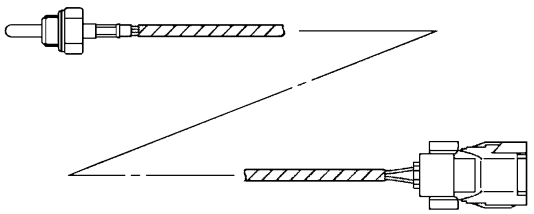
SG14156

Installation

: 44lb·in. (5N·m)

[Intake manifold temperature (IMT) sensor]

This sensor is installed on the intake manifold to measure intake air temperature. The sensor is thermistor type. The resistance in the sensor changes as the temperature changes.



SG14157

Installation

: 15lb·ft (20N·m)

[Water temperature sensor] ·····Refer to 3.4.20

[Engine oil pressure sensor] ·····Refer to 3.4.23

4. Troubleshooting

4.1 Repairing Procedures

When performing failure diagnosis, pay special attention to the followings, observing general cautions.

4.1.1 Safety caution

(1) Removing such cap and/or plug for receiver tank, fuel tanks and pipes where pressure is loaded, stop the machine and relieve all the interior pressure. Install measuring instruments connected firmly.
(2) When doing the job with co-worker(s) together, make sure to give signal to the other person(s) and do not allow other persons to come near to the job site.
(3) Take care not to touch hot portions and not to be involved in turning portions.

4.1.2 Caution during failure diagnosis

(1) Do not make haste to disassemble the unit
If the unit is disassembled urgently,
① You may disassemble the other portions which are not related with the trouble.
② The cause of trouble may be missing.
The unnecessary reparations require more spare parts and man-hours, and reparation costs will increase more. What is worse, you will lose reliance or trust from clients, operators and users.
Therefore, it is absolutely necessary to investigate the trouble more carefully in advance and to follow the required procedures for failure diagnosis.

(2) Ask the clients about the trouble in details
In order to prevent misunderstanding and incorrect judgment about the trouble, it is necessary to ask users or operators about the following questions.
① Is there any other disorder than the trouble he has informed?
② Anything abnormal occurred before this trouble?
③ Did this trouble happen unexpectedly? Or the unit had been operated in bad conditions before?
④ When and how did this trouble occur?
⑤ Had he repaired the unit before this trouble occurred?
⑥ Did he not experience similar trouble before?

(3) Inspection items before starting diagnosis
Sometimes such trouble may be caused owing to routine mishandling of the unit. Before starting failure diagnosis, check the following items.
① The engine runs short of engine oil or its oil is not dirty?
② Check each cable connection for any disconnection.
③ Check the other portions for any damage.

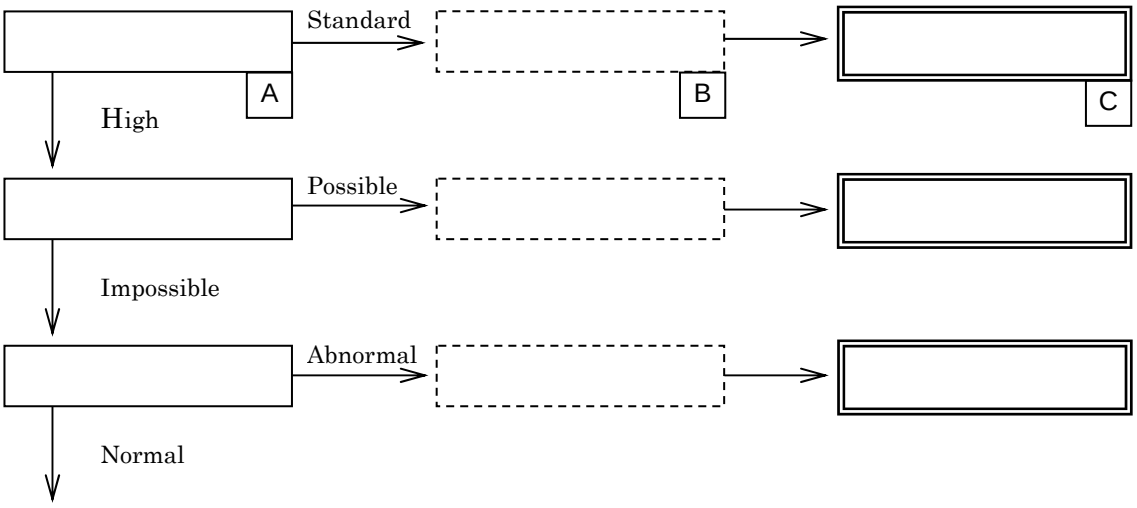
(4) Confirmation of trouble
Discuss with user(s) and/or operator(s) sufficiently about the trouble. As a result, judge whether their judgment is based on the numerical comparison or sentimental basis. Make him (them) understand well the reparation or correction you have finished.
Then check and confirm by yourself the cause of the trouble.
Note) Never proceed any investigation or measurement which may cause further greater damage.

(5) Procedures of diagnosis
When you become well experienced, you can find out the cause easily during the process of confirmation (4). But easy understanding could cause unexpected failure. So check and judge it according to the following procedures.
① Check the easiest thing or portion first.
② Investigate the most possible cause.
③ Check the other things connected to the trouble.
④ Check for the possibility of any other troubles.
⑤ Start proper and careful investigation on this trouble.

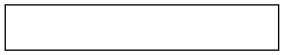
(6) Prevention of repeated occurrence of similar trouble
Even if you have repaired the trouble, unless you get rid of the fundamental cause of the trouble, it will repeatedly occur. Therefore, perform full investigation of the trouble, and it is absolutely necessary to remove the basis of the trouble.

4. Troubleshooting

4.1.3 How to use the failure diagnosis



①In the troubleshooting column something abnormal is mentioned in lined parenthesis.



②In the troubleshooting column the cause of the said trouble is mentioned in dotted parenthesis.

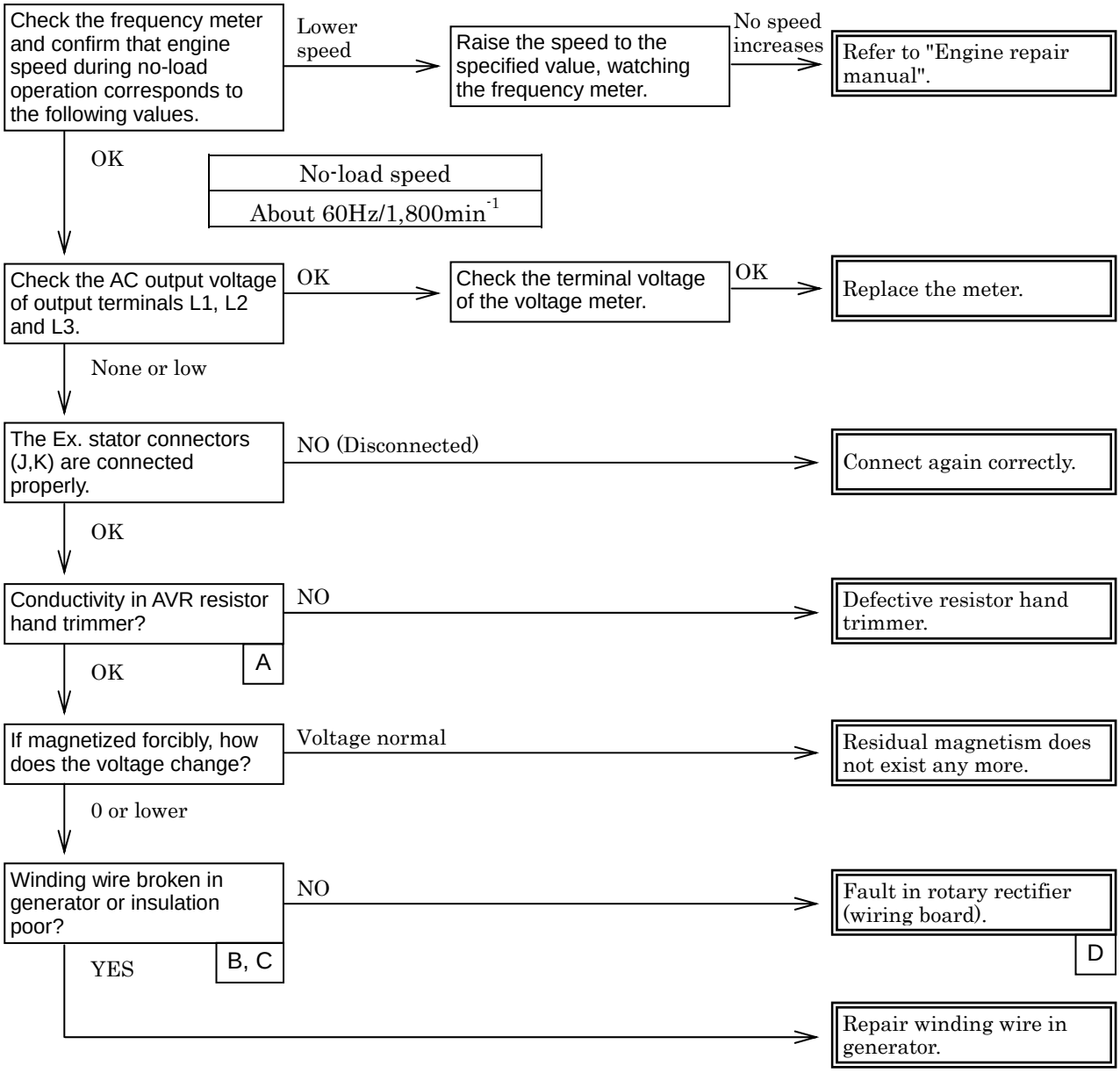
③In the troubleshooting column the countermeasures or treatment are mentioned in the double lined parenthesis.

④ A under each column means the index of explanation. For details see 4.5 “How to Check”.

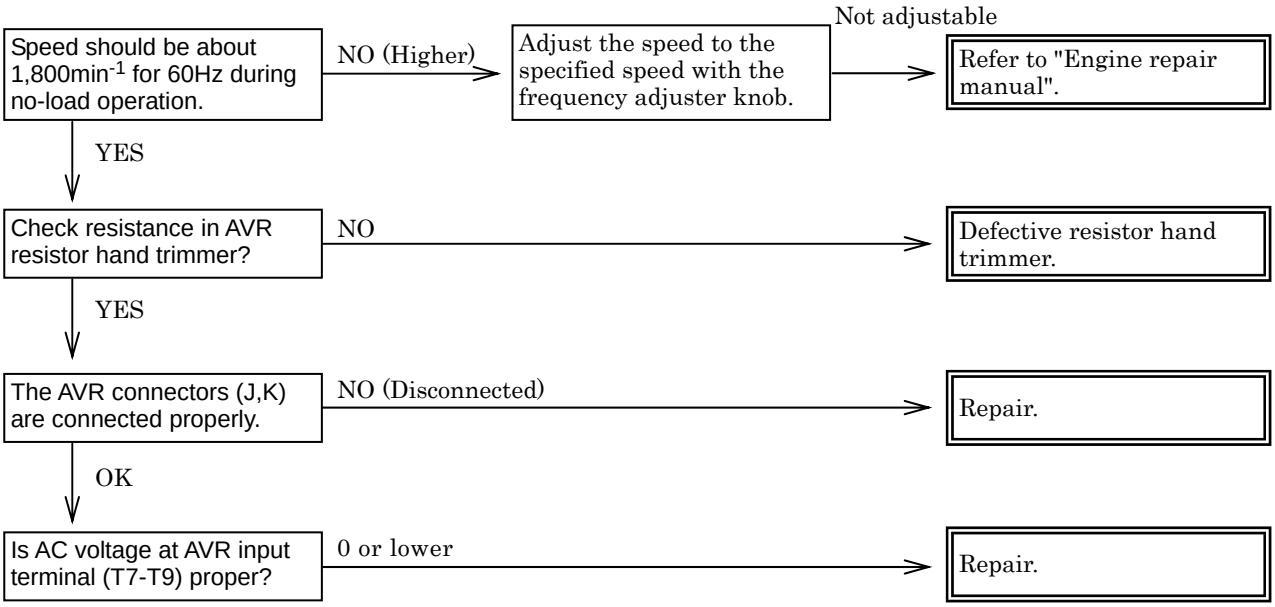
4. Troubleshooting

4.2 Generator Troubleshooting

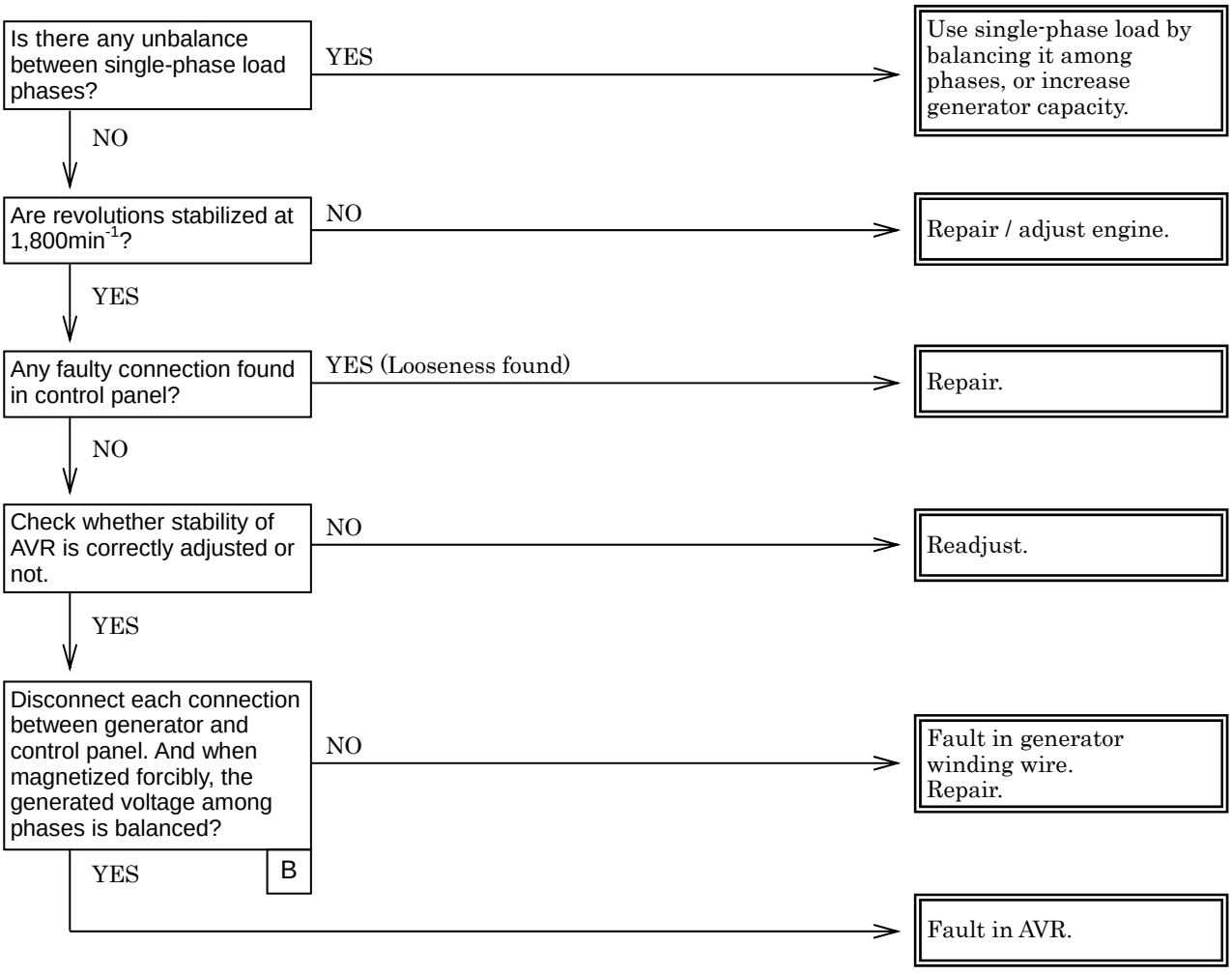
4.2.1 No voltage is generated or voltage too low



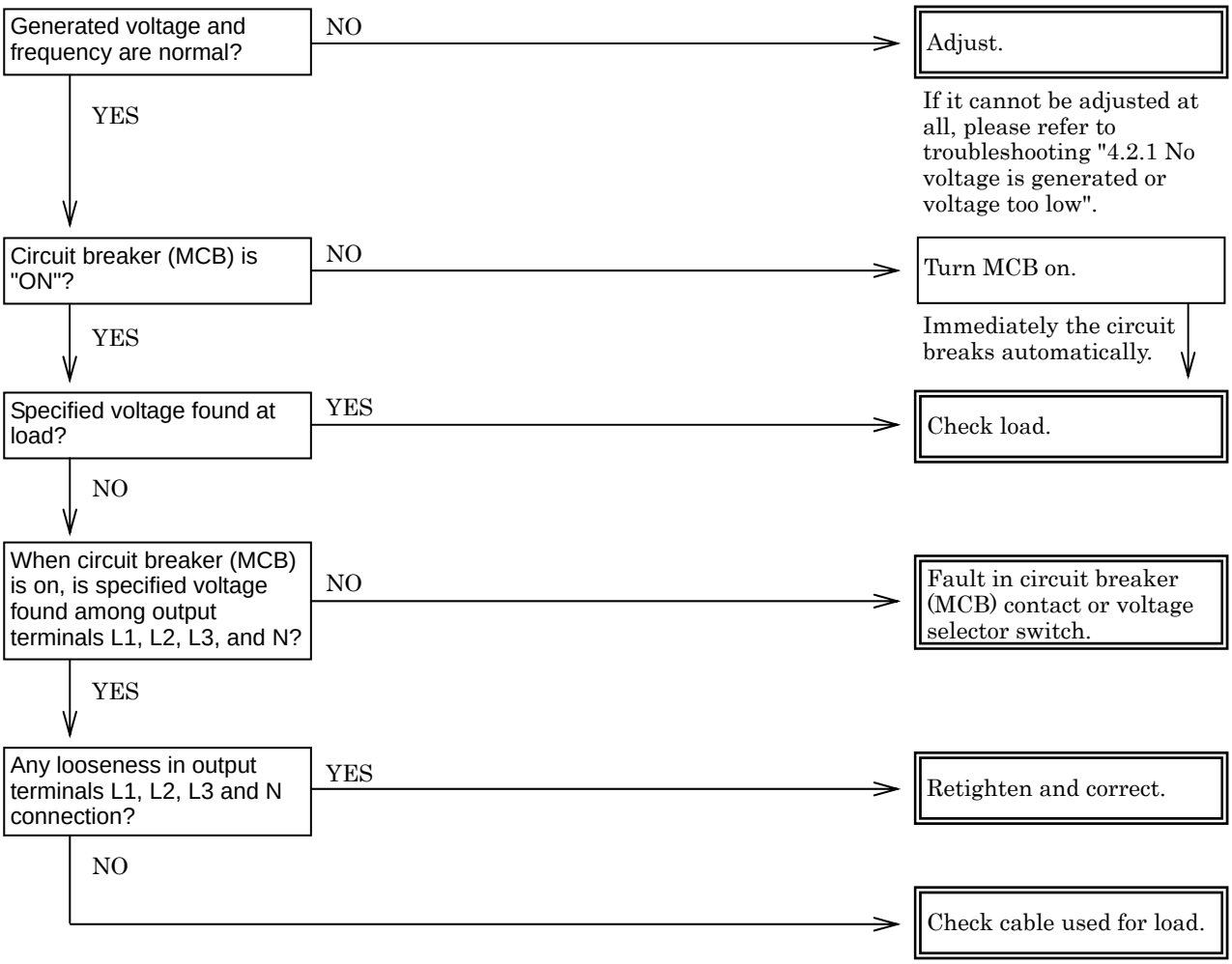
4.2.2 Voltage is very high or it cannot be adjusted



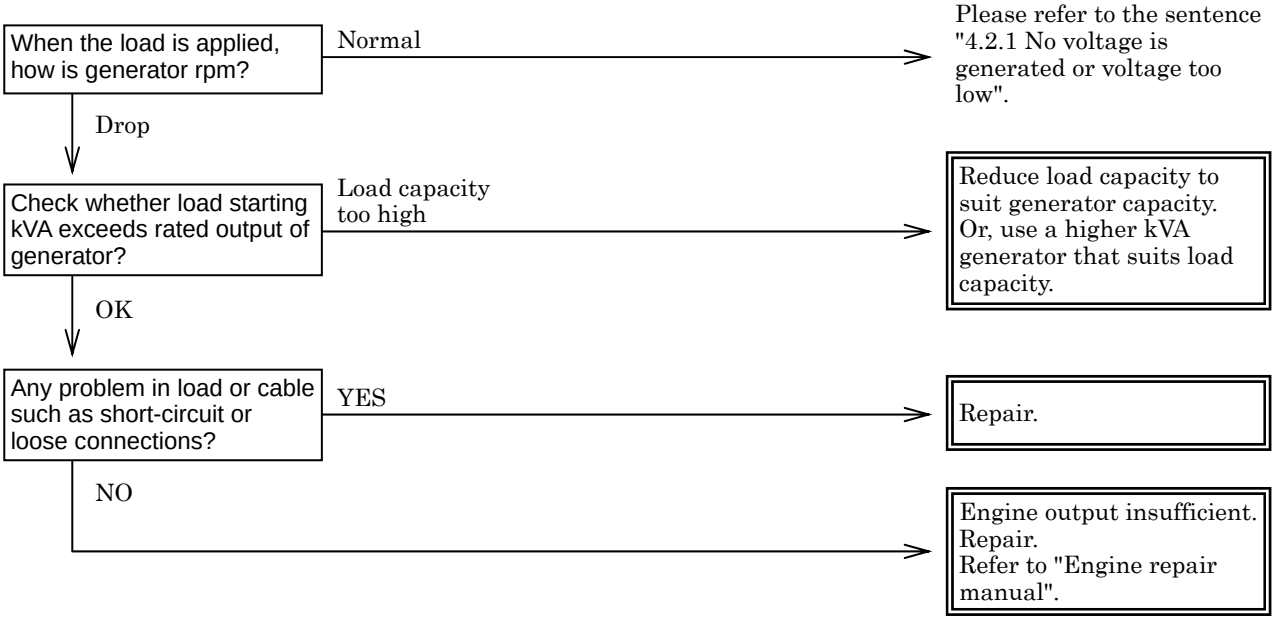
4.2.3 Voltage fluctuates



4.2.4 Load cannot be operated

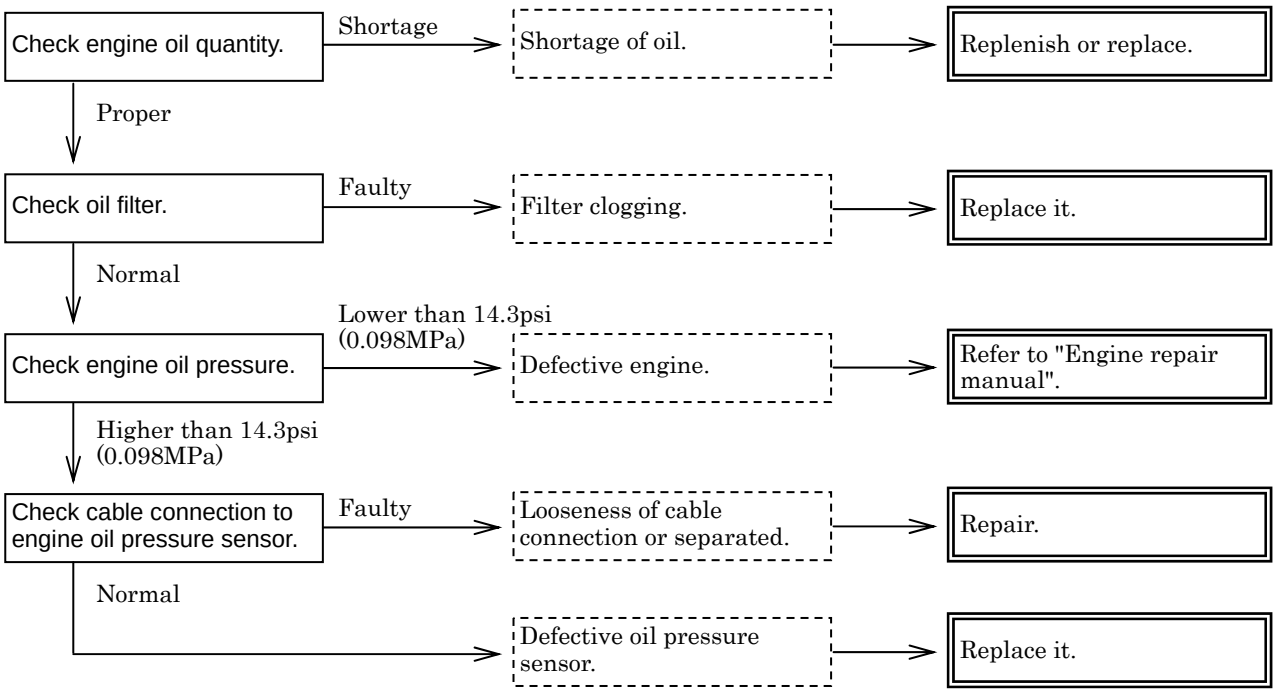


4.2.5 Voltage drops when load is applied

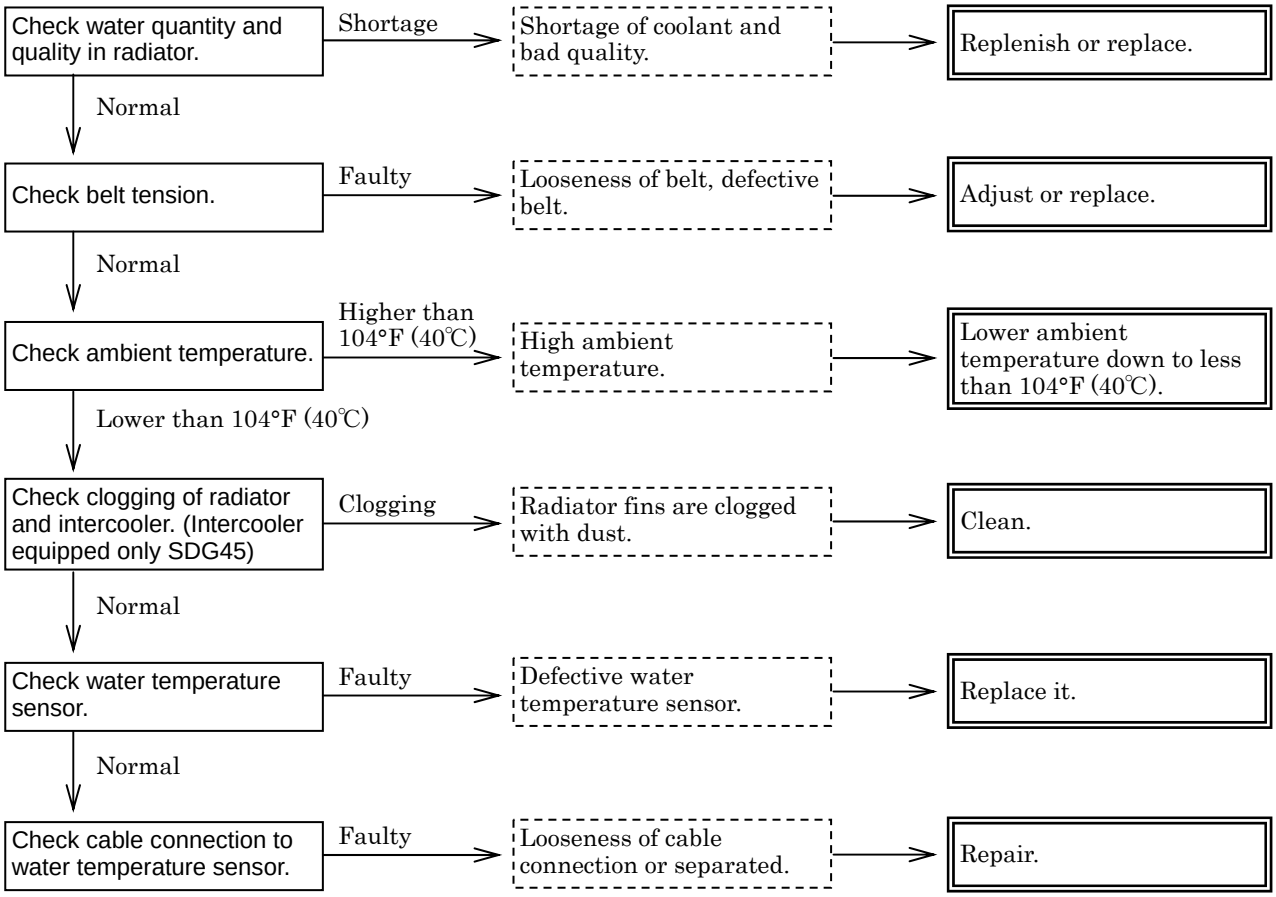


4.3 Emergency Switch Functions

4.3.1 Engine oil pressure drop is displayed in monitor, and engine will stop



4.3.2 Engine water temperature rise is displayed in monitor, and engine will stop

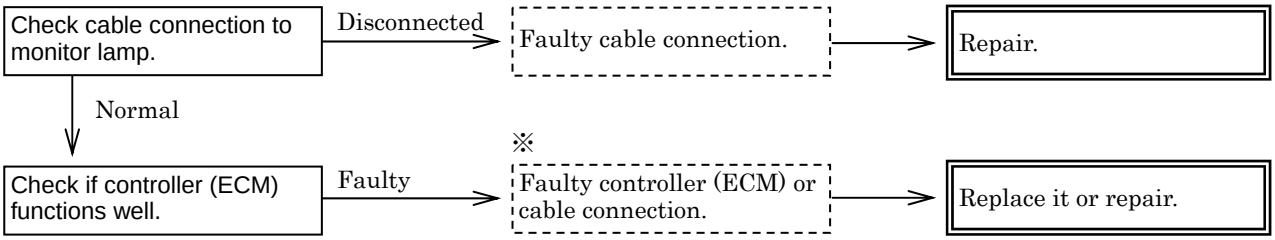


4. Troubleshooting

4.4 Engine Troubleshooting

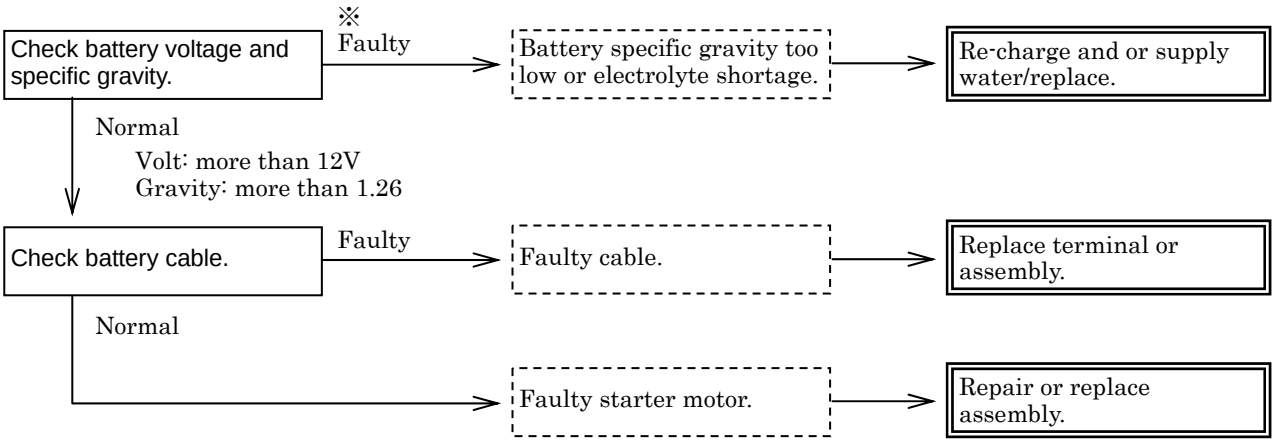
4.4.1 Anything abnormal is not shown, but it sometimes stops without its cause shown

(Excluding the cases of faulty contact of starter switch and fuse broken)



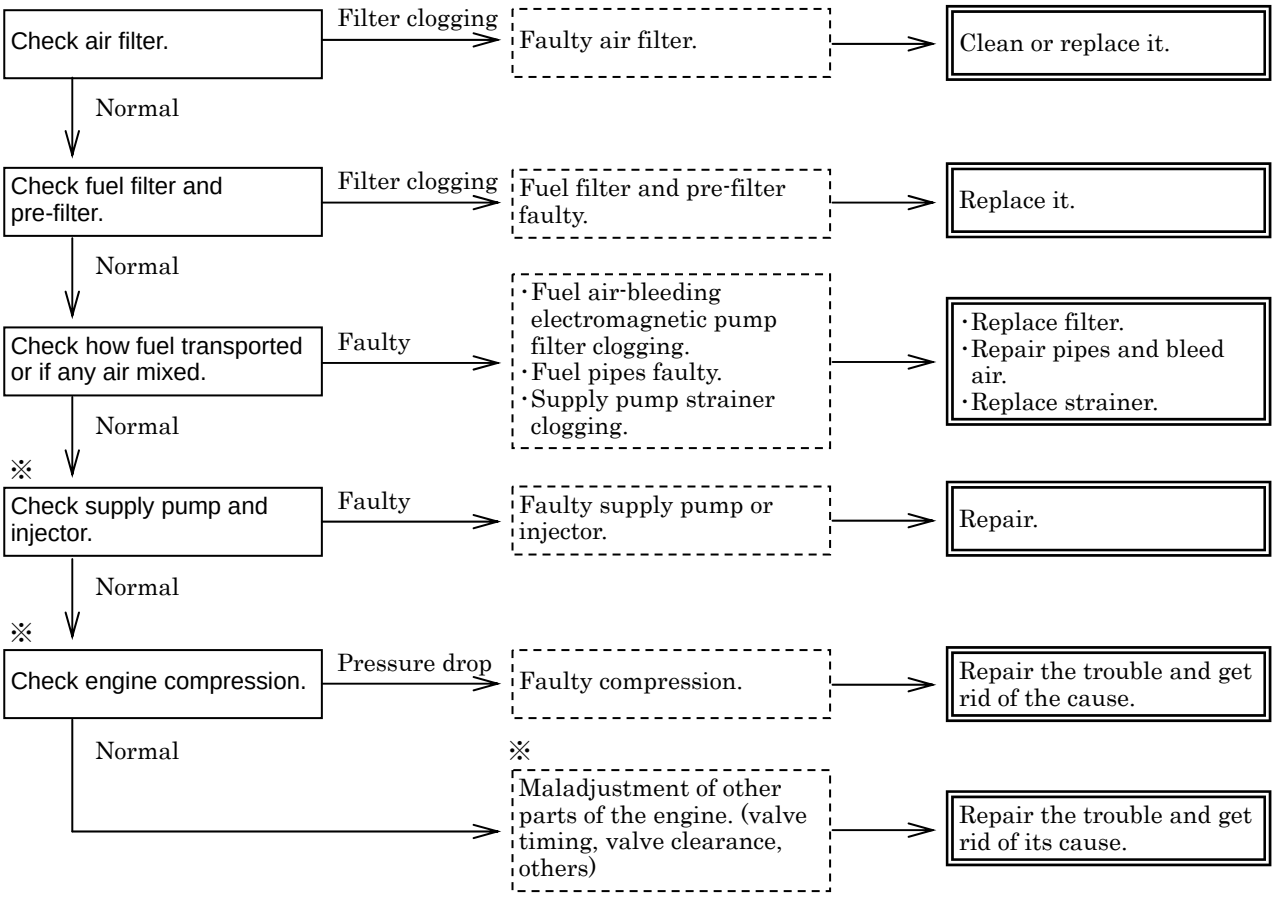
※Please locate engine defective portion referring to 4.6 Engine Trouble Diagnosis Function.
For the details of engine error, please take necessary measure in accordance with "Engine repair manual" by engine maker.

4.4.2 At start-up, starter rotates slowly



※When starter switch is placed at the "START" position, the battery is not normal if B terminal voltage decreases by 10V.

4.4.3 It will not speed up to rated speed



※For the detailed countermeasures, refer to “Engine repair manual” published by engine manufacturer.

4.5 How to Check

[A] Checking for disconnection of voltage adjusting resistor hand trimmer

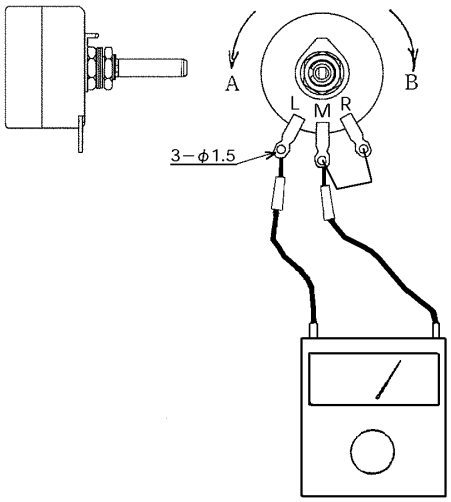
Turn the knob right and left, and check if the resistance changes. It is normal if the resistance value is within the following ranges.

Resistance value : several Ω－2kΩ

The resistance decreases when the knob is turned in the direction of A.

The resistance increases when the knob is turned in the direction of B.

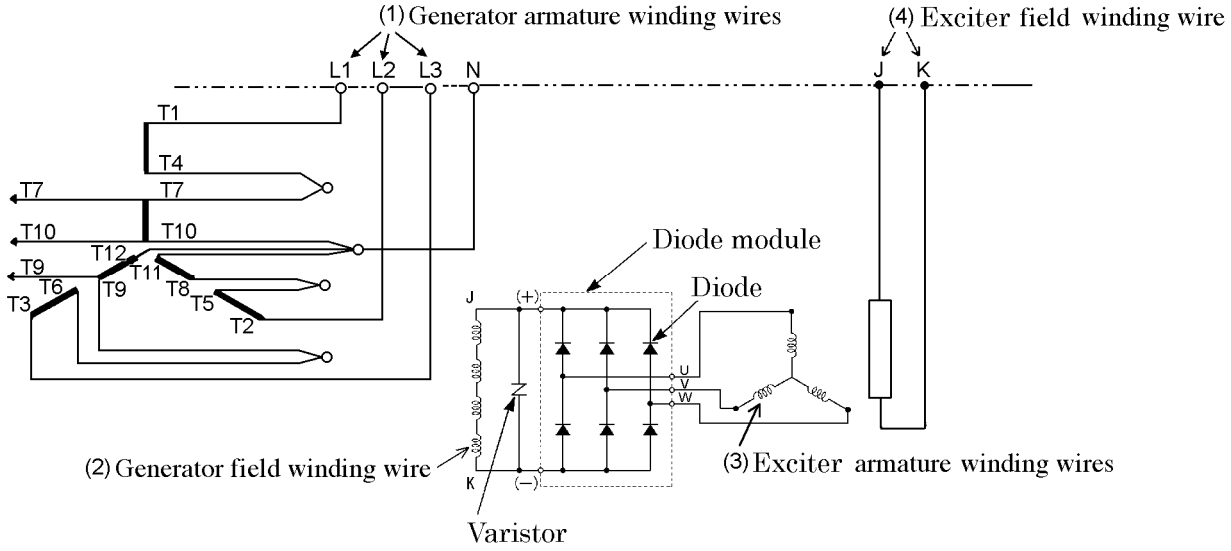
Also make sure resistance varies smoothly.



SG12035-1

[B] Measurement of generator winding wire resistance

The standard resistance value of each wire includes the generator's winding wire resistance value. (Please refer to the sentence "5.1 Generator's Winding Wires Resistance Value".)



Voltage selection switch position 480/277V

SG14043E

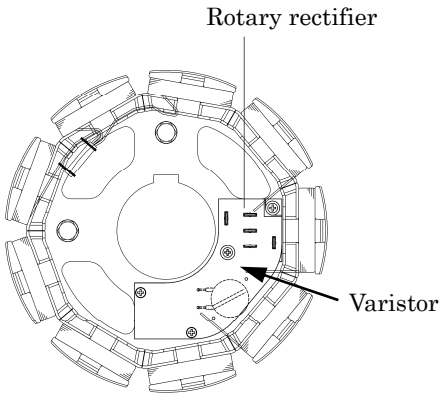
(1) Measurement of generator armature winding wires resistance

Remove all wires leading to the control panel terminal from the generator, and measure the resistance between the wires on the generator side. (Please explain how to check with voltage selector switch circuit.)

T1 terminal－T4 terminal , T7 terminal－T10 terminal
T2 terminal－T5 terminal , T8 terminal－T11 terminal
T3 terminal－T6 terminal , T9 terminal－T12 terminal

(2) Measurement of generator field winding wire resistance

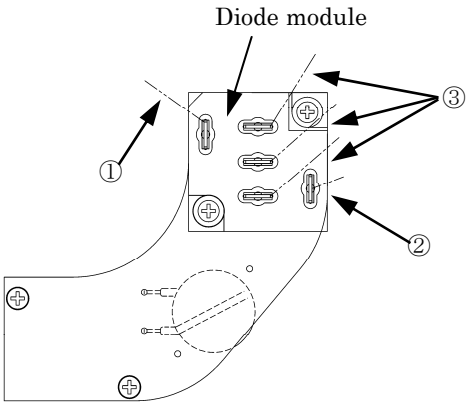
Disconnect the wires ① and ② leading to the rotary rectifier, then measure the resistance between the wires.



SG14006

(3) Measurement of exciter armature winding wires resistance

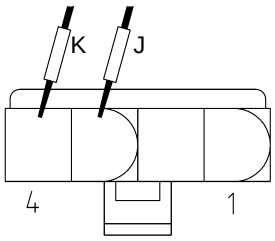
Disconnect the wires ③ (three wires at center of diode module) leading to the rotary rectifier, and measure the resistance between the wires.



SG12120

(4) Measurement of exciter field winding wire resistance

Disconnect 4P connector in the control panel, and measure the resistance at the connector on the generator side.



Between J & K terminal

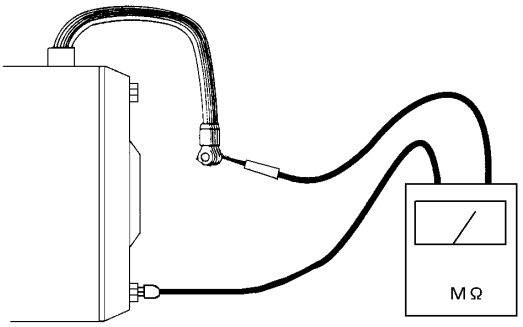
SG12121

[C] Measurement of insulation resistance of generator winding wires

Measurement is performed with a 500V megger. The situation is considered to be satisfactory if the measurement produces a result of 1MΩ or more, while a result of less than that value indicates failure.

(1) Measurement of insulation resistance of generator armature winding wires

Disconnect all wires leading from the generator to the control panel terminals and short-circuit them, then measure the insulation resistance between the wires and the generator body.



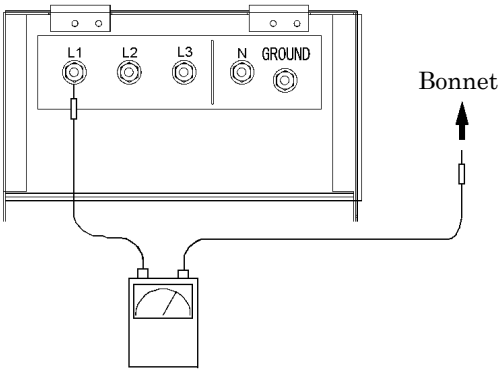
6-18-1

< Method of periodic inspection >

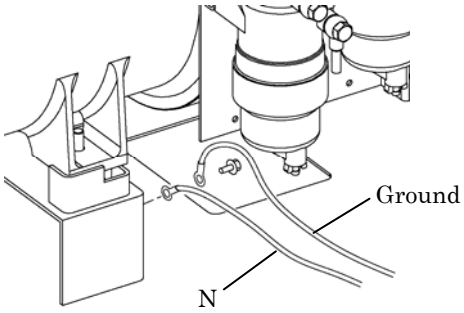
< Procedure >

① Remove the load side cable from the output terminal board.

② Remove the ground cable of the terminal "N" and terminal "GROUND".



A040180-1



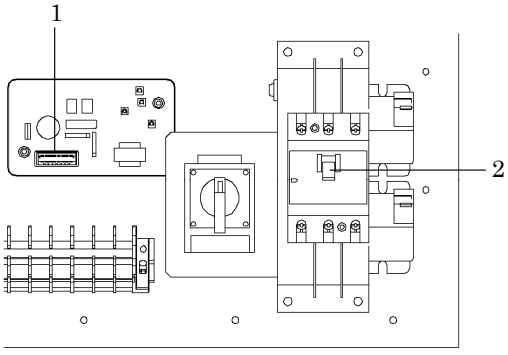
A131009

③ Remove the AVR connector "1" inside the generator control panel.

④ Switch ON the three-phase breaker "2", and then measure each insulation resistance between the terminals L1, L2, L3 terminal and bonnet.

⑤ Insulation resistance when measured with a 500V megger tester must be above 1MΩ.

⑥ After finishing the measurement of insulation resistance, re-connect the ground cable of the terminal "N" and terminal "GROUND".



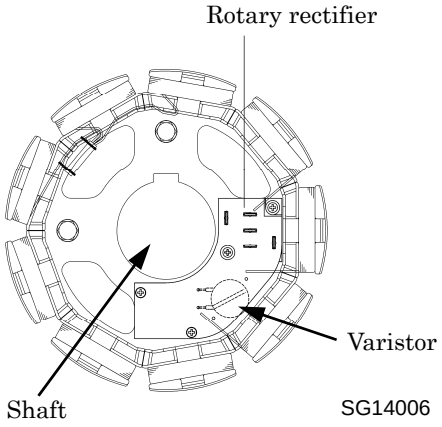
SG14158

⚠ WARNING

- After making sure that the insulation resistance of the generator is higher than 1 MΩ, be sure to re-connect the cable of the terminal "N" and terminal "GROUND" just as it was originally connected. If it is left disconnected, the grounding becomes imperfect so that it could cause electric shock.

(2) Measurement of insulation resistance of generator field winding wire

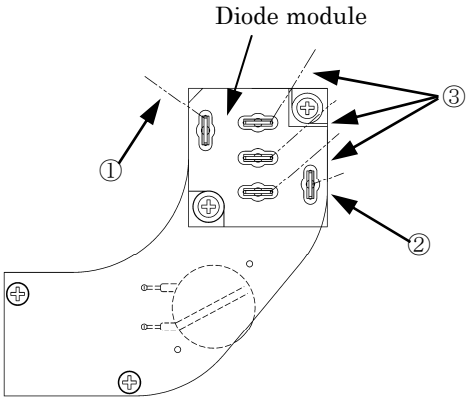
Disconnect the wires ① and ② leading to the rotary rectifier, then measure the insulation resistance between the disconnected wires ①, ② and the shaft.



SG14006

(3) Measurement of insulation resistance of exciter armature winding wires

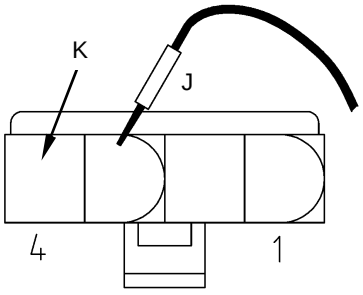
Disconnect the wires ③ (three pieces) and short-circuit them, then measure the insulation resistance between these wires and the shaft.



SG12120

(4) Measurement of insulation resistance of exciter field winding wire

Disconnect 4P connector in the control panel, and measure the resistance at the connector on the generator side.



SG14045

Between J or K terminal & body

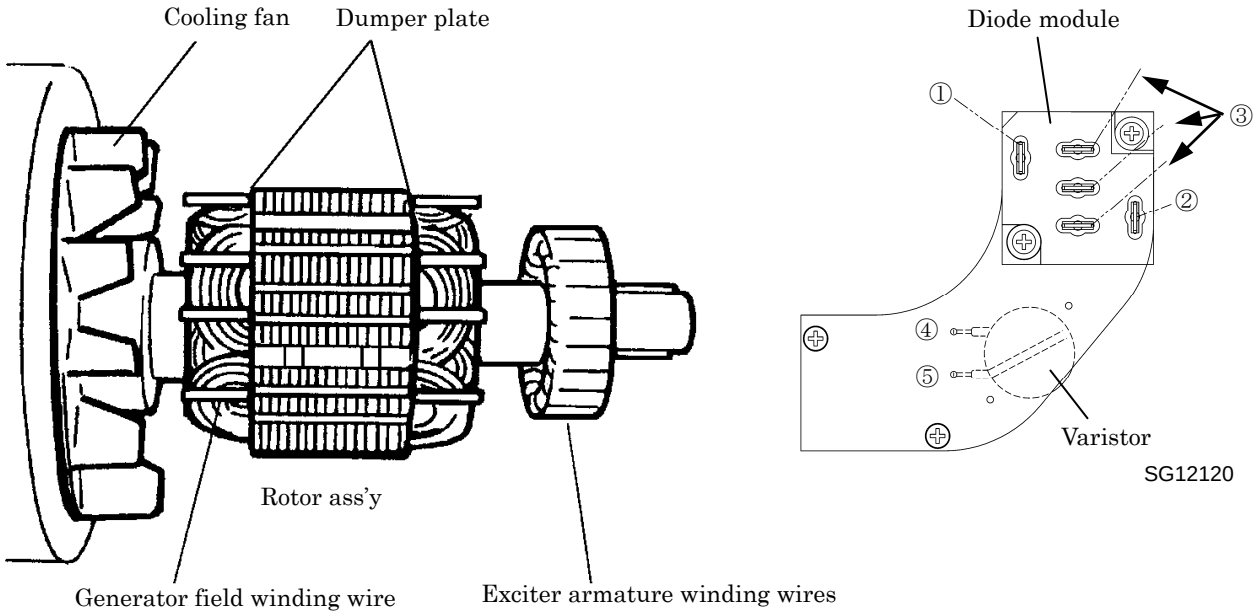
[D] Checking rotary rectifier and varistor

(1) How to check rotary rectifier (diode module)

How to judge whether rotary rectifier (diode module) is in good order or in disorder. For the details, see "3.2.1 Rotary rectifier".

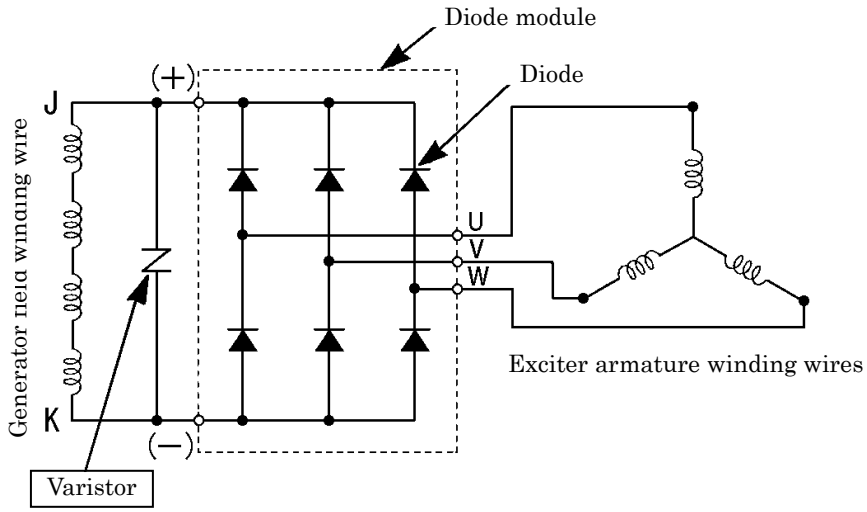
(2) How to check varistor

- Disconnect the wires ①,② and ③ leading to the rotary rectifire.
- Measure the resistance between the terminals of the varister ④,⑤.
- It is good if the measured resistance is more than 100kΩ. (Tester range×kΩ)



SG12120

SG14008



SG09107-1

4. Troubleshooting

4.6 Engine Trouble Diagnosis Function

With regard to this electronic governor engine (Common rail electronic control fuel injection engine), engine controller (ECM) is equipped with trouble diagnosis function.

4.6.1 Engine trouble diagnosis

1. Check and confirmation of trouble

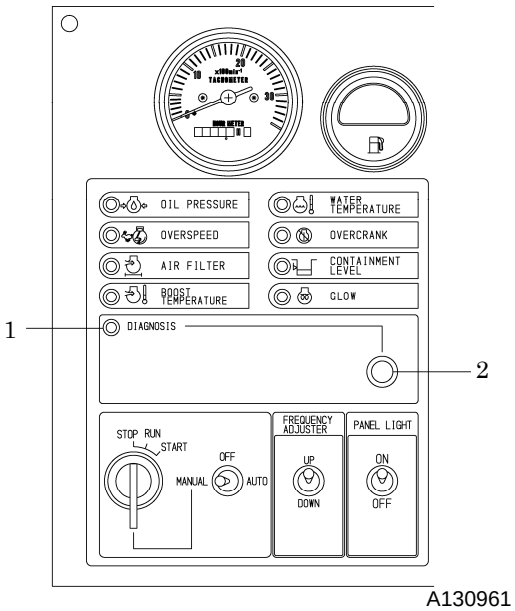
When engine fails, diagnosis lamp "1" on monitor panel lights. For the details of the trouble, press diagnosis switch "2" and then it displays trouble conditions with blinking pattern (flash code).

< Procedure >

① Turn starter switch to "RUN" position.
Fault diagnosis lamp "1" goes out after lighting for 3 seconds for the lamp bulb check out.

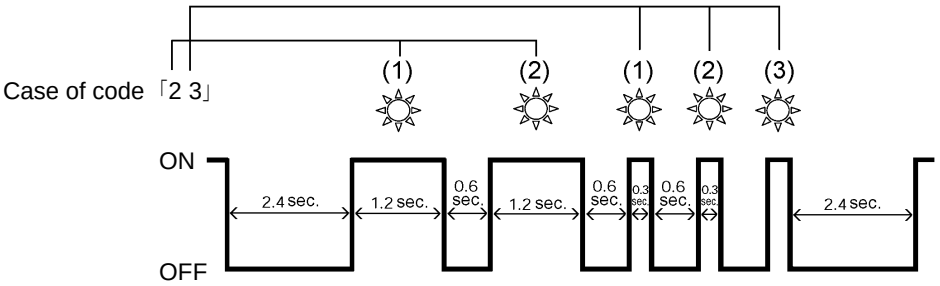
② Continue pressing diagnosis switch "2".

③ When engine is in trouble, it displays trouble conditions with blinking patterns of the diagnosis lamp "1" while diagnosis switch is pressed.

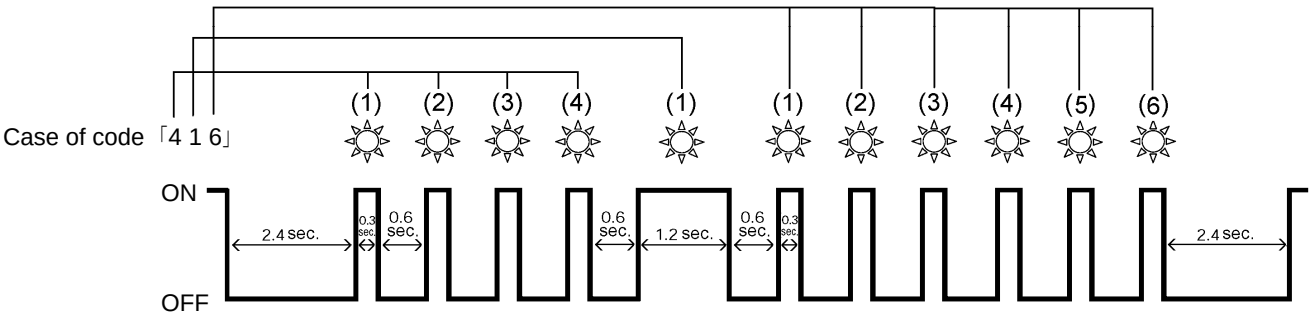


A130961

[Example of blinking pattern (Flash code)]



Long interval blinking 2 times and short interval blinking 3 times mean flash code「23」.



SG09079-2E

Short interval blinking 4 times and long interval blinking 1 time and short interval blinking 6 times mean flash code「416」.

Long interval blinking : approx. 1.2 seconds Short interval blinking : approx. 0.3 seconds

2. Display of diagnostic trouble code (DTC) by diagnosis lamp

Only when diagnostic trouble code (DTC) occurs during engine operation, diagnosis lamp is ON. During engine stop, diagnostic trouble code (DTC) displays both present and past diagnostic trouble code (DTC) by diagnosis lamp blinking pattern.

3. In case that past diagnostic trouble code (DTC) is memorized

It displays three times memorized flash code. In case that more than two flash codes are memorized, it displays them three times each in numerical order. After they are displayed in one round, they are displayed in numerical order again. This display continues while diagnosis switch is being pressed.

4. In case that no diagnostic trouble code (DTC) is memorized

While you pressing diagnosis switch, diagnosis lamp - repeat continuously "the lighting 0.3 seconds 2.4 seconds off".

5. Reading diagnostic trouble code (DTC) by diagnostic service tool

Diagnostic trouble code (DTC) can be read by connecting diagnostic service tool.
Diagnostic trouble code (DTC) list refer to 4.6.3 and diagnostic service tool refer to 4.6.4.

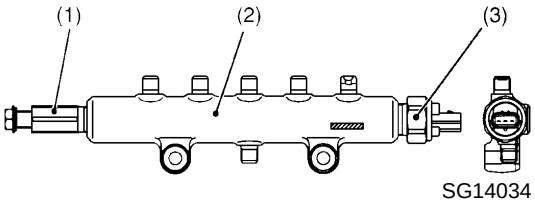
6. Necessary measures for the results of diagnosis trouble

For the detailed countermeasures, refer to "Engine repair manual" published by engine manufacturer. (If diagnostic service tool is fitted, it is possible to read diagnostic trouble code (DTC) by diagnostic service tool operation.)

Take special care in handling fuel system, and so refer to the following cautions.

< Fuel pipes >

- Never use such pipes as used high pressure pipes of fuel system and injector pipes. Make sure to replace used ones by new ones.
- Never change pressure limiter and common rail pressure sensor only. If they are in trouble, change it as an assembly and all fuel pipes.



SG14034

(1) Pressure limiter
(2) Common rail
(3) Common rail pressure sensor

[Cautions about maintenance of fuel system]

- All the parts of fuel system and holes/clearances as fuel passage are precision-machined so that entrance of foreign matters affects so badly them to cause damages to fuel passage. Therefore, you should take special care to prevent them to enter fuel system.
  Before preparing maintenance work, wash your hands and never use working gloves for this job.
- If you remove high pressure pipes in fuel system, make sure to replace them by new ones. If you re-use them, it could damage sealing face and cause fuel leakage.
  Make sure to replace spare parts such as gasket and O-ring by new ones.

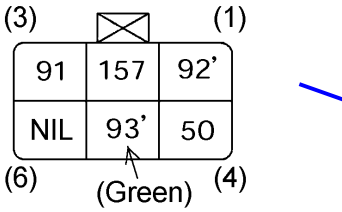
4.6.2 How to delete diagnostic trouble code (DTC)

1. Deletion of diagnostic trouble code (DTC)

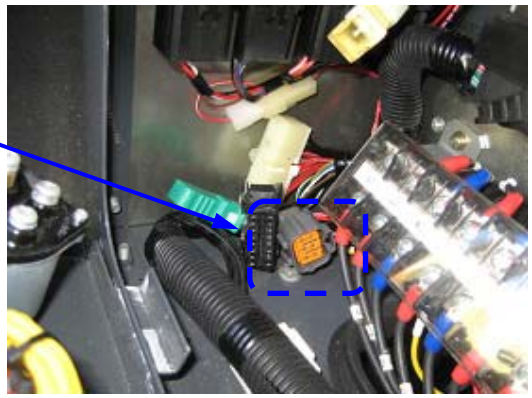
When diagnostic trouble code (DTC) is memorized in engine control module (ECM) in case of system trouble. Even after troubled parts have been repaired, memory of diagnostic trouble code (DTC) will not be deleted in this case. It is necessary to compulsorily delete this memory, according to the following procedures.

2. Memory clear

① Switch ON starter switch. Fault diagnosis lamp goes out after lighting for 3 seconds for the lamp bulb check out.
② Continue pressing diagnosis switch. (Keep pressing until section 6)
③ To ground : [green line color] No.5 terminal of 6-pole connector of the left corner of the control panel inside.



SG13103E


SG14159
Left corner portion inside control panel

④ Wait for more than 3 seconds in the grounding.
⑤ Remove the jumper wire that was grounded.
⑥ Switch OFF diagnosis switch. (Turn off)
⑦ Switch OFF starter switch. (Wait for more than 10 seconds)

[Confirm of memory clear]

⑧ Switch ON starter switch. Fault diagnosis lamp goes out after lighting for 3 seconds for the lamp bulb check out.
⑨ Continue pressing diagnosis switch.
⑩ Fault diagnosis lamp will be bling below if it is memory clear.
While you pressing diagnosis switch, diagnosis lamp - repeat continuously “the lighting 0.3 seconds 2.4 seconds off”.
⑪ Switch OFF diagnosis switch. (Turn off)
⑫ Switch OFF starter switch.

3. While connecting the diagnostic service tool (E-IDSS), can be delete by the tool.

4.6.3 List of diagnostic trouble codes (DTC)

Flash code is a code that indicates the fault condition blinking pattern of lamp failure diagnosis (diagnosis lamp).

DTC is a code that can be read by connecting the diagnostic service tool (E-IDSS).

[Excerpted from ISUZU Engine repair manual]

※Engine failure‥‥Engine stop item

Flash code	DTC	DTC description	※Engine stop
16	P0016	Crankshaft Position-Camshaft Position Correlation	
225	P0087	Fuel Rail/System Pressure-Too Low	
151	P0089	Fuel/Pressure Regulator Performance	
247	P0091	Fuel/Pressure Regulator control Circuit Low	
247	P0092	Fuel/Pressure Regulator control Circuit High	
227	P0093	Fuel System Leak Detected	
214	P0097	Intake Manifold Temperature(IMT) Sensor Circuit Low	
214	P0098	Intake Manifold Temperature(IMT) Sensor Circuit High	
22	P0112	Intake Air Temperature Sensor Circuit Low	
22	P0113	Intake Air Temperature Sensor Circuit High	
23	P0117	Engine Coolant Temperature Sensor Circuit Low	
23	P0118	Engine Coolant Temperature Sensor Circuit High	
211	P0182	Fuel Temperature Sensor Circuit Low	
211	P0183	Fuel Temperature Sensor Circuit High	
245	P0192	Fuel Rail Pressure Sensor Circuit Low	
245	P0193	Fuel Rail Pressure Sensor Circuit High	
271	P0201	Injector Circuit-Cylinder 1	
272	P0202	Injector Circuit-Cylinder 2	
273	P0203	Injector Circuit-Cylinder 3	
274	P0204	Injector Circuit-Cylinder 4	
542	P0217	Engine Coolant Over Temperrature Condition	○
543	P0219	Engine Overspeed Condition	○
32	P0237	Turbocharger Boost Sensor Circuit Low	
32	P0238	Turbocharger Boost Sensor Circuit High	
15	P0335	Crankshaft Position Sensor(CKP) Circuit	
15	P0336	Crankshaft Position Sensor(CKP) Circuit Range/Performance	
14	P0340	Camshaft Position Sensor(CMP) Circuit	
66	P0380	Glow Plug Circuit	
45	P0404	Exhaust Gas Recirculation(EGR)1 Control Circuit Range/Performance	
44	P0409	Exhaust Gas Recirculation(EGR)1 Sensor Circuit	
294	P0521	Engine Oil Pressure Sensor Performance	○
294	P0522	Oil Pressure Sensor Circuit Low Input	
294	P0523	Oil Pressure Sensor Circuit High Input	
35	P0563	System Voltage High	
53	P0601	Internal Control Module Memory Check Sum Error	
154	P0602	Control Module Programming Error	
153	P0604	Internal Control Module Random Access Memory (RAM)	
51	P0606	ECM/PCM Processor	

4. Troubleshooting

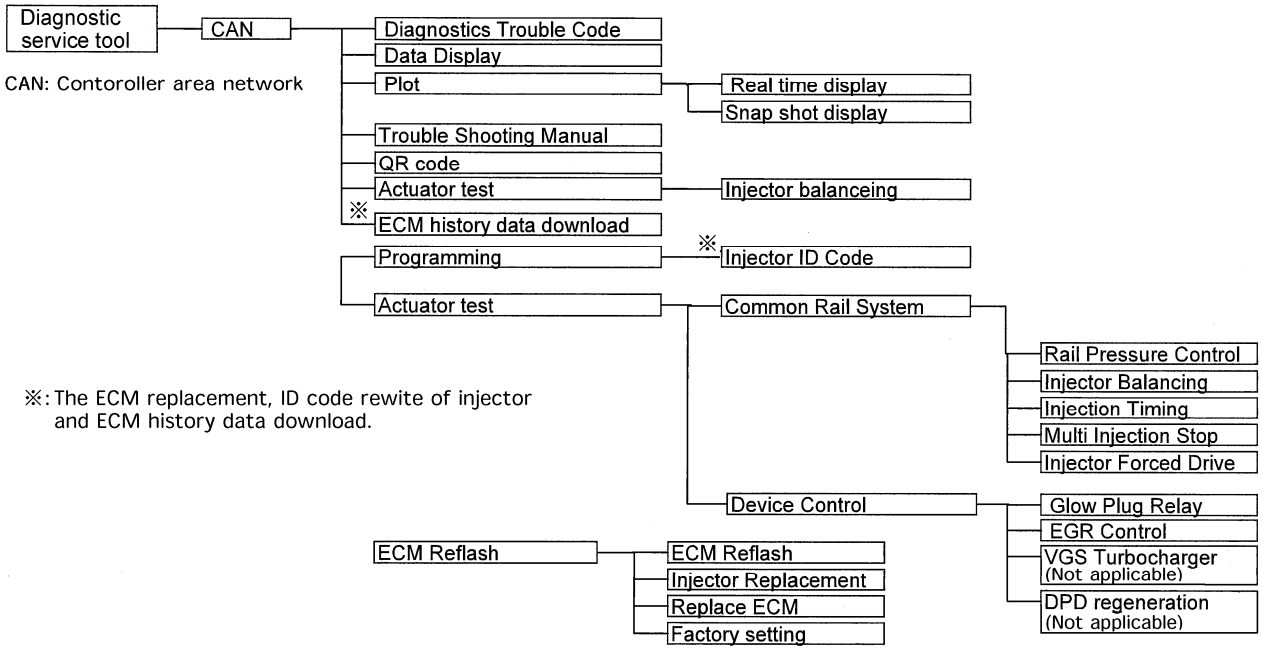
Flash code	DTC	DTC description	※Engine stop
36	P060B	Internal Control Module A/D Processing Performance	
19	P0615	Starter Relay Circuit	
55	P0641	Sensor Reference Voltage 1 Circuit	
56	P0651	Sensor Reference Voltage 2 Circuit	
416	P0685	ECM/PCM Power Relay Control Circuit /Open	
416	P0687	ECM/PCM Power Relay Control Circuit high	
57	P0697	Sensor Reference Voltage 3 Circuit	
277	P06AF	EDU Injector Custom IC	
277	P06AF	EDU Injector Custom IC Check Sum	
277	P06AF	EDU Injector Custom IC Communication Line	
227	P1093	Fuel Rail Pressure (FRP) Too Low	
213	P1097	Boost Temperature Sensor Circuit Low	
213	P1098	Boost Temperature Sensor Circuit High	
34	P1261	Fuel Injector Group 1 Supply Voltage Circuit	
34	P1262	Fuel Injector Group 2 Supply Voltage Circuit	
45	P1404	Exhaust Gas Recirculation (EGR)1 Closed Position Performance	
51	P1606	SW-IC1 Internal failure	
51	P1606	SW-IC1 Internal Communication Line failure	
36	P160B	AD-IC Failure	
54	P1621	Control Module Long Term Memory Performance	
59	P1655	Sensor Reference Voltage 4 Circuit	
158	P2146	Fuel Injector Group 1 Supply Voltage Circuit	
159	P2149	Fuel Injector Group 2 Supply Voltage Circuit	
71	P2228	Barometric Pressure Circuit Low	
71	P2229	Barometric Pressure Circuit High	
84	U0073	CAN-Bus Malfunction	

4.6.4 Diagnostic service tool (E-IDSS) (E-IDSS : Engine-Isuzu Diagnostic Service System)

Using E-IDSS, it is possible to diagnose electrical failure of engine control system and check the system, by reading diagnostic troubles codes (DTC) and referring to troubleshooting manual and retelling injection ID code, download history of ECM and checking and confirming engine various control values.

Permit to use E-IDSS is required and certified by engine manufacturer. User ID and password are required.

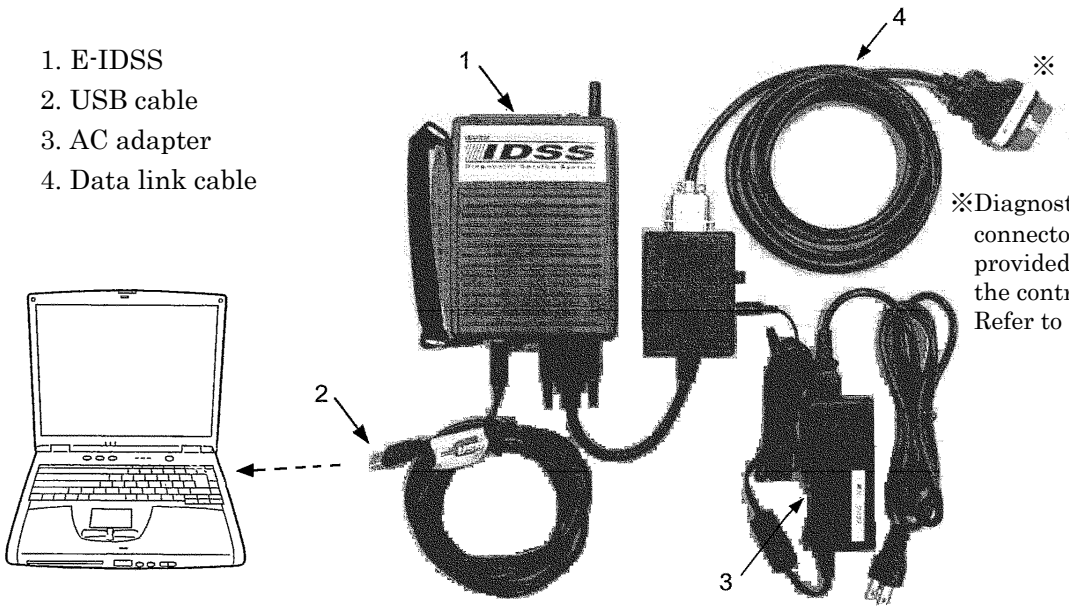
1. E-IDSS of the function



SG14161

2. Appearance

1. E-IDSS
2. USB cable
3. AC adapter
4. Data link cable



Connection to the actual unit

※Diagnostic service tool connector (16 poles) is provided at the left corner in the control panel.
Refer to photograph of 4.6.2

SG13099

5. References

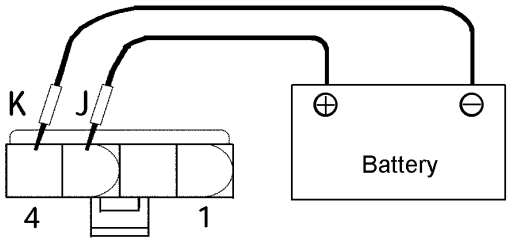
5.1 Generator's Winding Wires Resistance Value

[At the temperature of 68°F (20°C)]

Item		Unit	SDG25S-8E1	SDG45S-8E1
Generator armature winding wires	Voltage selection switch position 480/277V	Ω	0.864 (T1-T2) (T2-T3) (T3-T1)	0.360 (T1-T2) (T2-T3) (T3-T1)
	—	Ω	0.216 (T1-T4) (T7-T10) (T2-T5) (T8-T11) (T3-T6) (T9-T12)	0.090 (T1-T4) (T7-T10) (T2-T5) (T8-T11) (T3-T6) (T9-T12)
Generator field winding wire		Ω	8.65	9.66
Exciter armature winding wires		Ω	1.008	1.112
Exciter field winding wire		Ω	20.94	23.89
Auxiliary winding wires		Ω	2.50	2.21

5.2 Forced Excitation Method

1. Run the generator at the rated r.p.m.
2. Disconnect the field connector in the control panel, and apply the battery voltage to the exciter winding wire.
   J and (+) terminal of battery
   K and (−) terminal of battery



SG14058

3. Magnetize for 1 to 2 seconds, then remove the wires and check if voltage is generated.
   Note: Thickness of lead wires between battery terminal and connector should be the same thickness as exciter field winding wires (J and K wires). It is dangerous that the wire may be overheating, they are too small in thickness.

Generated voltage from forced excitation (at 480/277V) (V)

Voltage generated (V) [at the temperature of 104°F (40℃)]	
SDG25S-8E1	SDG45S-8E1
Battery 12V	Battery 12V
330	370

* The generating voltage is only for reference because it will change due to the ambient temperature.

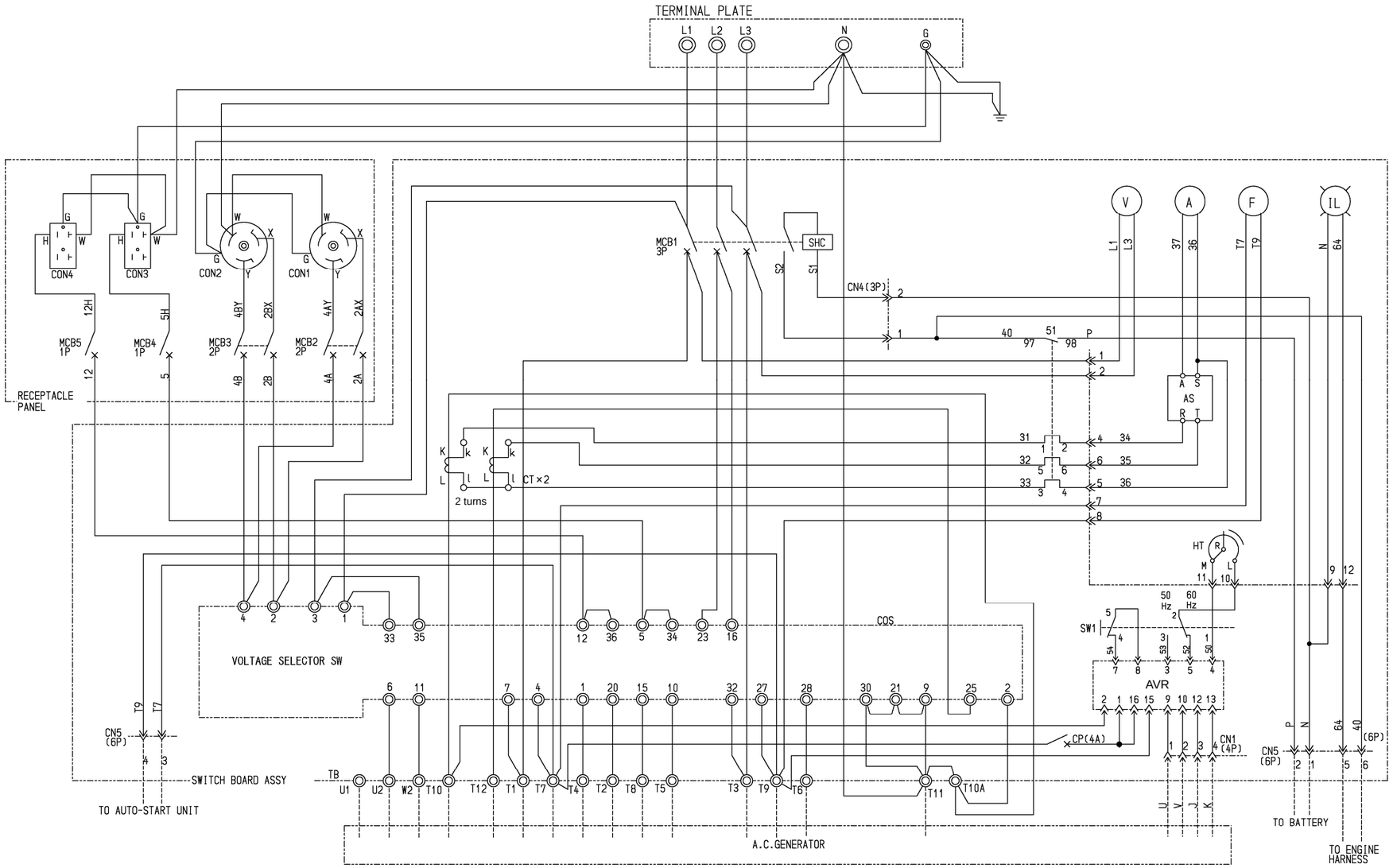
5.3 Idling Revolution Per Minute

It is set to the figure in the table by engine governor.

Revolution per minute	1,000±20 rpm (min^{-1})

5.4 Generator Wiring Diagram

(SDG25S-8E1)



A130904

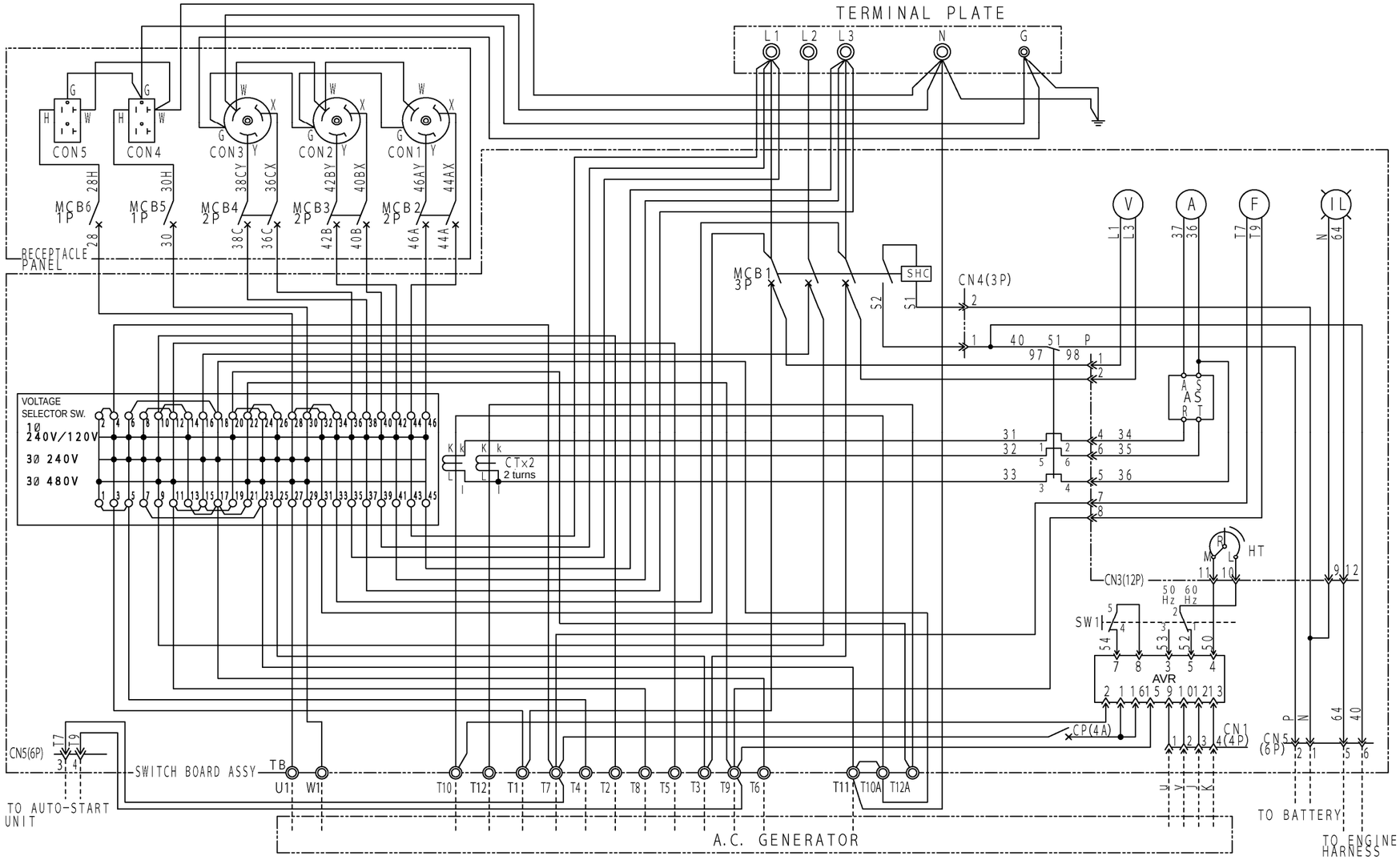
MCB1	Molded case circuit breaker (three-phase)
MCB2－5	Molded case circuit breaker (single-phase)
SHC	Shunt coil
A	Ammeter
V	Voltmeter
F	Frequency meter
IL	Illumination lamp
CT	Current transformer
51	Thermal relay
AVR	Automatic voltage regulator
HT	Hand trimmer (voltage regulator)
AS	Ammeter change-over switch
CP	Circuit protector
SW1	Frequency selector switch

Voltage Selector SW	Voltage/Winding Connection
3 Phase 480/277V	3 Phase 4 Wire Single Star
3 Phase 240/139V	3 Phase 4 Wire Double star
Single Phase 240/120V	Single Phase 3 Wire Parallel Zig-Zag

SG14160

5. References

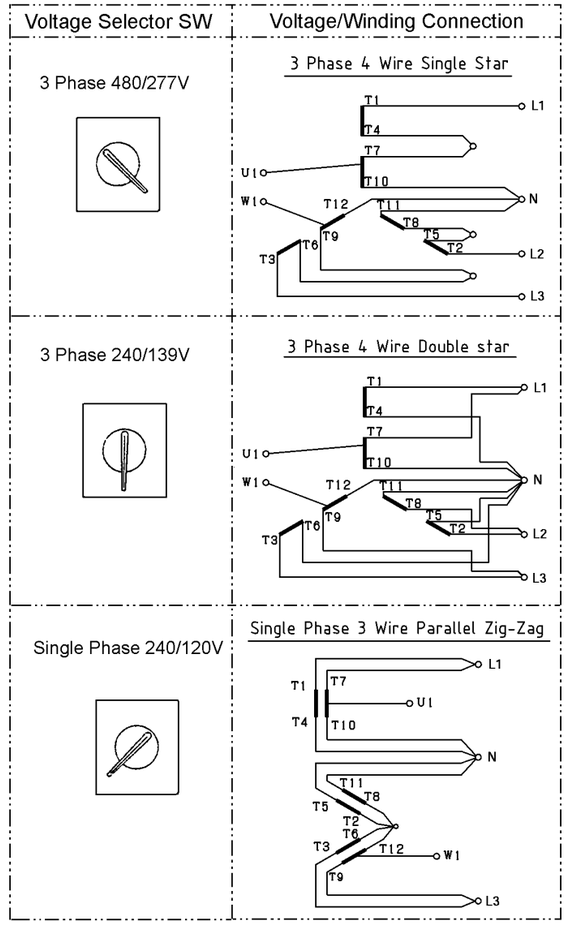
(SDG45S-8E1)



A131089

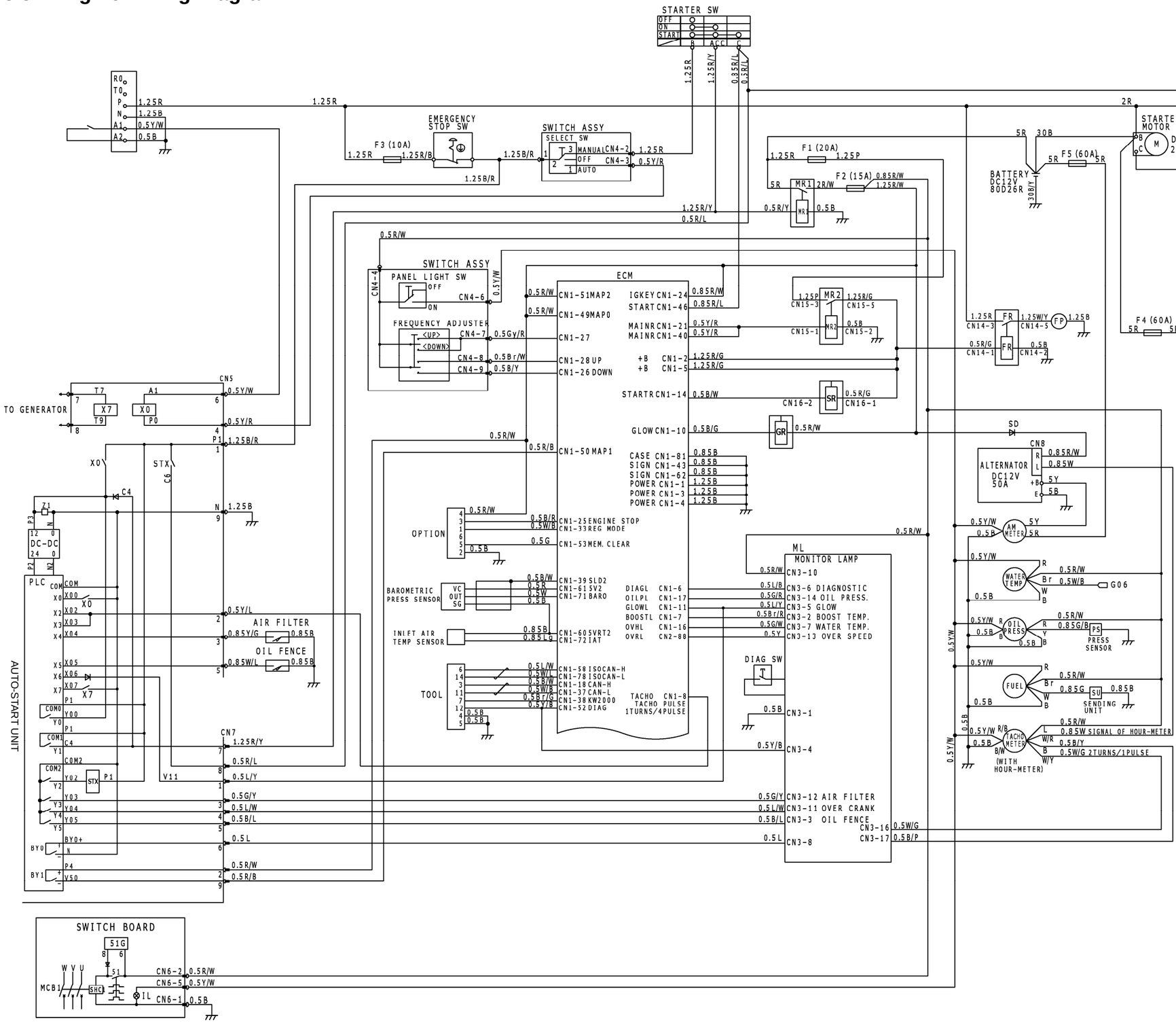
MCB1	Molded case circuit breaker (three-phase)
MCB2－6	Molded case circuit breaker (single-phase)
SHC	Shunt coil
A	Ammeter
V	Voltmeter
F	Frequency meter
IL	Illumination lamp
CT	Current transformer
51	Thermal relay
AVR	Automatic voltage regulator
HT	Hand trimmer (voltage regulator)
AS	Ammeter change-over switch
CP	Circuit protector
SW1	Frequency selector switch

Voltage Selector SW	Voltage/Winding Connection
3 Phase 480/277V	3 Phase 4 Wire Single Star
3 Phase 240/139V	3 Phase 4 Wire Double star
Single Phase 240/120V	Single Phase 3 Wire Parallel Zig-Zag



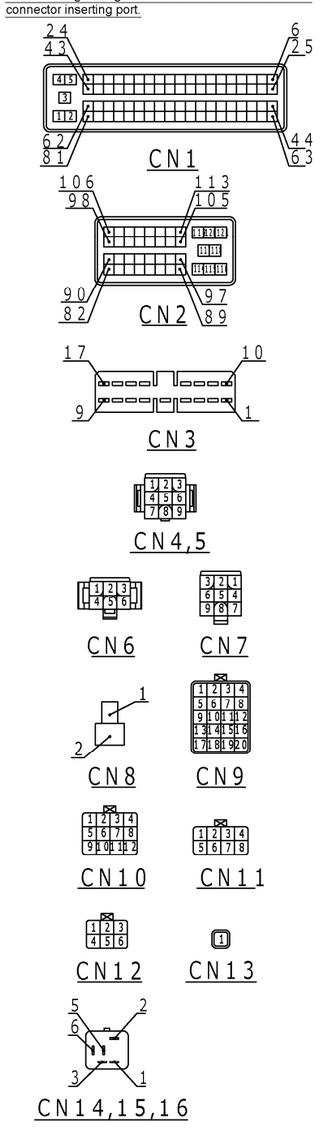
SG14055

5.5 Engine Wiring Diagram

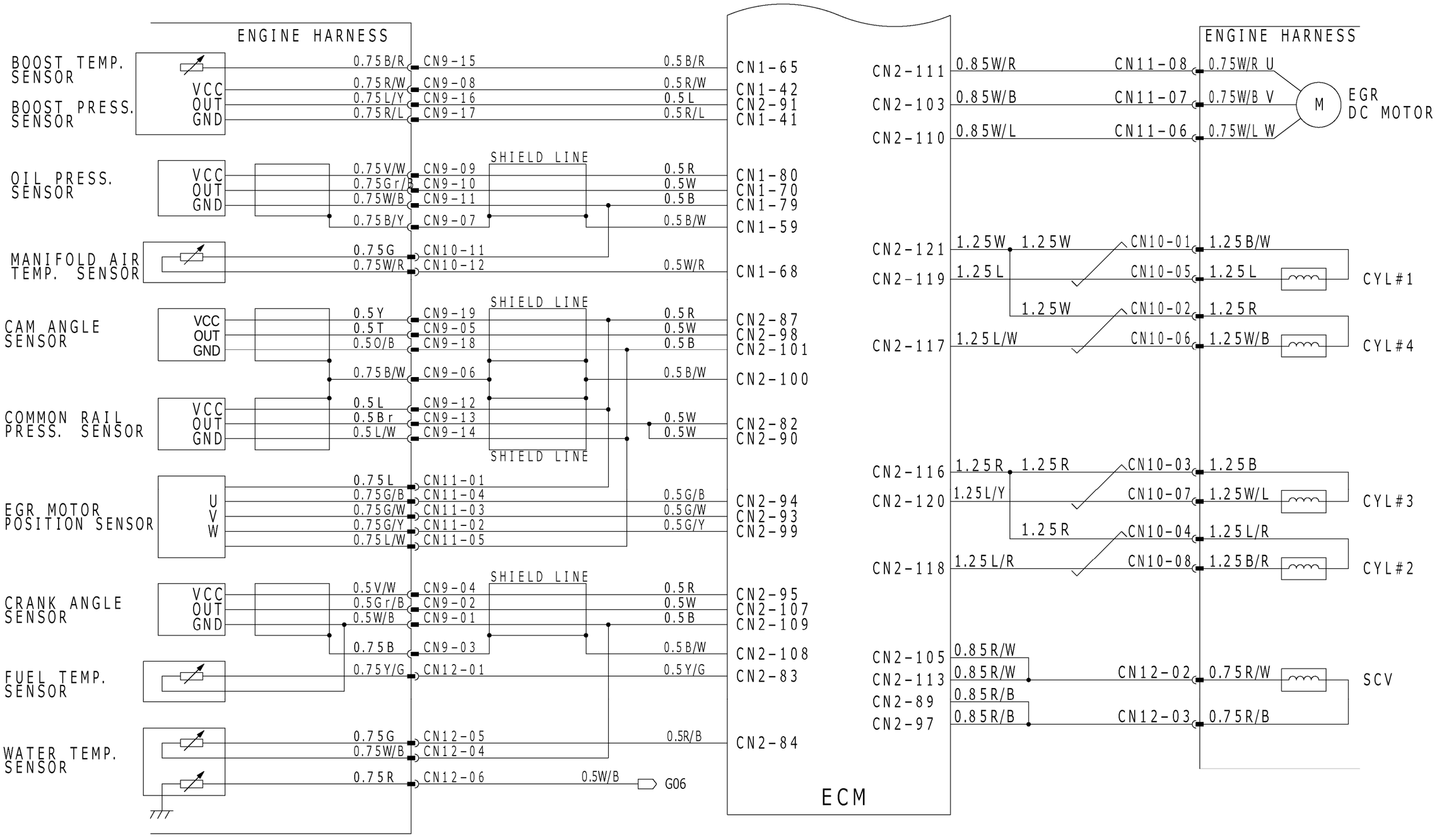


Connector terminal arrangement

The following arrangement is seen from the side of the connector inserting port.



A130920E


ENGINE HARNESS
BOOST TEMP. SENSOR
BOOST PRESS. SENSOR
VCC
OUT
GND
0.75B/R
0.75R/W
0.75L/Y
0.75R/L
CN9-15
CN9-08
CN9-16
CN9-17
0.5B/R
0.5R/W
0.5L
0.5R/L
CN1-65
CN1-42
CN2-91
CN1-41
SHIELD LINE
OIL PRESS. SENSOR
0.75V/W
0.75Gr/B
0.75W/B
0.75B/Y
CN9-09
CN9-10
CN9-11
CN9-07
0.5R
0.5W
0.5B
0.5B/W
CN1-80
CN1-70
CN1-79
CN1-59
MANIFOLD AIR TEMP. SENSOR
0.75G
0.75W/R
CN10-11
CN10-12
0.5W/R
CN1-68
SHIELD LINE
CAM ANGLE SENSOR
0.5Y
0.5T
0.5O/B
0.75B/W
CN9-19
CN9-05
CN9-18
CN9-06
0.5R
0.5W
0.5B
0.5B/W
CN2-87
CN2-98
CN2-101
CN2-100
COMMON RAIL PRESS. SENSOR
0.5L
0.5Br
0.5L/W
CN9-12
CN9-13
CN9-14
0.5W
0.5W
CN2-82
CN2-90
SHIELD LINE
EGR MOTOR POSITION SENSOR
U
V
W
0.75L
0.75G/B
0.75G/W
0.75G/Y
0.75L/W
CN11-01
CN11-04
CN11-03
CN11-02
CN11-05
0.5G/B
0.5G/W
0.5G/Y
CN2-94
CN2-93
CN2-99
SHIELD LINE
CRANK ANGLE SENSOR
0.5V/W
0.5Gr/B
0.5W/B
CN9-04
CN9-02
CN9-01
0.5R
0.5W
0.5B
CN2-95
CN2-107
CN2-109
0.75B
CN9-03
0.5B/W
CN2-108
FUEL TEMP. SENSOR
0.75Y/G
CN12-01
0.5Y/G
CN2-83
WATER TEMP. SENSOR
0.75G
0.75W/B
CN12-05
CN12-04
0.5R/B
CN2-84
0.75R
CN12-06
0.5W/B
G06
ECM
ENGINE HARNESS
CN2-111
CN2-103
CN2-110
0.85W/R
0.85W/B
0.85W/L
CN11-08
CN11-07
CN11-06
0.75W/R U
0.75W/B V
0.75W/L W
M
EGR DC MOTOR
CN2-121
CN2-119
CN2-117
1.25W
1.25L
1.25L/W
CN10-01
CN10-05
CN10-02
CN10-06
1.25B/W
1.25L
1.25R
1.25W/B
CYL#1
CYL#4
CN2-116
CN2-120
CN2-118
1.25R
1.25L/Y
1.25L/R
CN10-03
CN10-07
CN10-04
CN10-08
1.25B
1.25W/L
1.25L/R
1.25B/R
CYL#3
CYL#2
CN2-105
CN2-113
CN2-89
CN2-97
0.85R/W
0.85R/W
0.85R/B
0.85R/B
CN12-02
CN12-03
0.75R/W
0.75R/B
SCV

A130921

5. References

5.6 List of Consumable Parts and Electrical Appliances

Item	SDG25S-8E1	SDG45S-8E1
●Element / Filter / Belt		
Engine oil filter ASS'Y	—	41290 01600 (ISUZU part No.:898075-6710)
Engine oil filter cartridge	37438 07500 (ISUZU part No.:894456-7412)	(ISUZU part No.:898075-6761)
Air filter ASS'Y	32100 40700	←
Air filter element	32143 11700	←
Fuel filter ASS'Y	43540 08700 (ISUZU part No.:898236-9900)	←
Fuel filter cartridge	(ISUZU part No.:898240-2800)	←
Fuel pre-filter ASS'Y	43540 08600 (ISUZU part No.:898236-9910)	←
Fuel pre-filter cartridge	(ISUZU part No.:898240-2790)	←
Fuel air-bleeding electromagnetic pump filter	(ISUZU part No.:898071-4010)	←
Gasket for fuel air-bleeding electromagnetic pump filter	(ISUZU part No.:898071-4040)	←
Engine supply pump strainer	(ISUZU part No.:898074-9550)	←
Gasket for engine supply pump strainer	(ISUZU part No.:109630-0830 × 3)	←
Gasket for engine supply pump strainer	(ISUZU part No.:109630-0850 × 3)	←
Belt	(ISUZU part No.:898049-0340)	(ISUZU part No.:898095-3350)
●Electrical appliances		
Controller (ECM)	44390 04200 (ISUZU part No.:898227-1080)	44390 04300 (ISUZU part No.:898227-1081)
Monitor lamp	46870 47901	←
Auto start unit (AOU)	46760 73710	←
Sequencer (PLC)	46879 65300	←
DC-DC Converter	46872 01300	←
Power relay (X7)	46177 08500	←
Power relay (STX)	46177 08300	←
Power relay (X0)	46177 08400	←
Main, starter cut, fuel pump relay	44346 08500 × 3	←
Starter relay	44346 16100	←
Glow relay	44346 15700	←
Charge relay	44346 13200	←
Tachometer (with hour-meter)	36146 05901	←
Fuel gauge	36158 00500	←
Sending unit	36159 02101	36159 03000
Oil fence level switch	46813 08100	←
Fuel air-bleeding electromagnetic pump	43650 02600 (ISUZU part No.:898068-2750)	←
Air filter indicator	32148 03000	←
Oil pressure gauge	36143 03600	←

5. References

Item	SDG25S-8E1	SDG45S-8E1
Oil pressure sensor (for oil pressure gauge)	44365 00300	←
Oil pressure sensor	(ISUZU part No.:898027-4560)	←
Water temperature gauge	36145 06800	←
Water temperature sensor	44334 17600 (ISUZU part No.:898023-7170)	←
Intake air temperature sensor	44364 06600 (ISUZU part No.:892146-8300)	←
Barometric pressure sensor	44328 21500 (ISUZU part No.:897217-7780)	←
Ammeter for battery charge	46154 15300	←
Emergency stop switch	44336 03001	←
Starter switch	44322 2800 (ISUZU part No.:894402-5000)	←
Fuse (10A)	46934 03200	←
Fuse (15A)	46934 04400	←
Fuse (20A)	46934 03300	←
Fuse (60A)	44470 02300 × 2	←
Silicon rectifier	46921 02300	←
Silicon rectifier, Auto start unit	46921 08600 × 2	←
Surge absorber, Auto start unit	46948 00900	←

There is a case that the part number is changed, such as modification. Please refer to the parts catalog part-number of the latest.

This text book contains the most recent information available at the time of printing, and the contents of the list are based on information in effect at that time and are subject to change without notice.

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