A few Words About Safety

Service Information

The service and repair information contained in this manual is intended for use by qualified, professional technicians. Attempting service or repairs without the proper training, tools, and equipment could cause injury to you and/or others. It could also damage this Honda product or create an unsafe condition.

This manual describes the proper methods and procedures for performing service, maintenance, and repairs. Some procedures require the use of special tools. Any person who intends to use a replacement part, service procedure, or a tool that is not recommended by Honda must determine the risks to their personal safety and the safe operation of this product.

If you need to replace a part, use Honda Genuine parts with the correct part number or an equivalent part. We strongly recommend that you do not use replacement parts of inferior quality.

For Your Customer's Safety

Proper service and maintenance are essential to the customer's safety and the reliability of this product. Any error or oversight while servicing this product can result in faulty operation, damage to the product, or injury to others.

⚠WARNING

Improper service or repairs can create an unsafe condition that can cause your customer or others to be seriously hurt or killed.

Follow the procedures and precautions in this manual and other service materials carefully.

For Your Safety

Because this manual is intended for the professional service technician, we do not provide warnings about many basic shop safety practices (e.g., Hot parts-wear gloves). If you have not received shop safety training or do not feel confident about your knowledge of safe servicing practices, we recommend that you do not attempt to perform the procedures described in this manual.

Some of the most important general service safety precautions are given below. However, we cannot warn you of every conceivable hazard that can arise in performing service and repair procedures. Only you can decide whether or not you should perform a given task.

⚠WARNING

Failure to properly follow instructions and precautions can cause you to be seriously hurt or killed.

Follow the procedures and precautions in this manual carefully.

Important Safety Precautions

Make sure you have a clear understanding of all basic shop safety practices and that you are wearing appropriate clothing and using safety equipment. When performing any service task, be especially careful of the following:

- Read all of the instructions before you begin, and make sure you have the tools, the replacement or repair parts, and the skills required to perform the tasks safely and completely.
- Protect your eyes by using proper safety glasses, goggles, or face shields anytime you hammer, drill, grind, or work around pressurized air, pressurized liquids, springs, or other stored-energy components. If there is any doubt, put on eye protection.
- Use other protective wear when necessary, for example gloves or safety shoes. Handling hot or sharp parts can cause severe burns or cuts. Before you grab something that looks like it can hurt you, stop and put on gloves.
- Protect yourself and others whenever you have equipment hoisted in the air. Anytime you lift this product with a hoist, make sure that the hoist hook is securely attached to the product.

Make sure the engine is off before you begin any servicing procedures, unless the instruction tells you to do otherwise. This will help eliminate several potential hazards:

- Carbon monoxide poisoning from engine exhaust. Be sure there is adequate ventilation whenever you run the engine.
- Burns from hot parts. Let the engine and exhaust system cool before working in those areas.
- Injury from moving parts. If the instruction tells you to run the engine, be sure your hands, fingers, and clothing are out of the way.

Gasoline vapors and hydrogen gasses from batteries are explosive. To reduce the possibility of a fire or explosion, be careful when working around gasoline or batteries.

- Use only a nonflammable solvent, not gasoline, to clean parts.
- Never store gasoline in an open container.
- Keep all cigarettes, sparks, and flames away from the battery and all fuel-related parts.

CONTENTS

INTRODUCTION

This manual covers the service and repair procedures for the Honda EU7000is generator.

All information contained in this manual is based on the latest product information available at the time of printing. We reserve the right to make changes at anytime without notice.

As you read this manual, you will find information that is preceded by a NOTICE symbol. The purpose of this message is to help prevent damage to this Honda product, other property, or the environment.

SAFETY MESSAGES

Your safety and the safety of others are very important. To help you make informed decisions, we have provided safety messages and other safety information throughout this manual. Of course, it is not practical or possible to warn you about all the hazards associated with servicing these products. You must use your own good judgment.

You will find important safety information in a variety of forms, including:

- Safety Labels – on the product.
- Safety Messages – preceded by a safety alert symbol ⚠ and one of three signal words, DANGER, WARNING, or CAUTION. These signal words mean:

⚠DANGER You WILL be KILLED or SERIOUSLY HURT if you don't follow instructions.

⚠WARNING You CAN be KILLED or SERIOUSLY HURT if you don't follow instructions.

⚠CAUTION You CAN be HURT if you don't follow instructions.

- Instructions – how to service these products correctly and safely.

© Honda Motor Co., Ltd.
SERVICE PUBLICATION OFFICE

Date of Issue: June 2017

SERVICE RULES

- Use Honda Genuine or Honda-recommended parts and lubricants or their equivalents. Parts that do not meet Honda's design specifications may damage the unit.
- Use the special tools designed for the product.
- Install new gaskets, O-rings, etc. when reassembling.
- When torquing bolts or nuts, begin with larger-diameter or inner bolts first and tighten to the specified torque diagonally, unless a particular sequence is specified.
- Clean parts in cleaning solvent upon disassembly. Lubricate any sliding surfaces before assembly.
- After assembly, check all parts for proper installation and operation.
- Many screws used in this machine are self-tapping. Be aware that cross-threading or overtightening these screws will strip the threads and ruin the hole.

Use only metric tools when servicing this unit. Metric bolts, nuts and screws are not interchangeable with non-metric fasteners. The use of incorrect tools and fasteners will damage the unit.

SYMBOLS

The symbols used throughout this manual show specific service procedures. If supplementary information is required pertaining to these symbols, it will be explained specifically in the text without the use of the symbols.

	Replace the part(s) with new one(s) before assembly.
	Use the recommend engine oil, unless otherwise specified.
	Use molybdenum oil solution (mixture of the engine oil and molybdenum grease in a ratio of 1:1).
	Use multi-purpose grease (lithium based multi-purpose grease NLGI #2 or equivalent).
	Use marine grease (water resistant urea based grease).
	Apply a locking agent. Use a medium strength locking agent unless otherwise specified.
	Apply sealant.
	Use automatic transmission fluid.
(○ x ○) (○)	Indicates the diameter, length, and quantity of metric bolts used.
page 1-1	Indicates the reference page.

ABBREVIATIONS

Throughout this manual, the following abbreviations are used to identify the respective parts or systems.

Abbreviated term	Full term
AAT	Ambient Air Temperature
ACG	Alternator
API	American Petroleum Institute
Assy.	Assembly
ATDC	After Top Dead Center
ATF	Automatic Transmission Fluid
ATT	Attachment
BAT	Battery
BDC	Bottom Dead Center
BTDC	Before Top Dead Center
BARO	Barometric Pressure
CKP	Crankshaft Position
Comp.	Complete
CMP	Camshaft Position
CYL	Cylinder
DLC	Data Link Connector
EBT	Engine Block Temperature
ECT	Engine Coolant Temperature
ECM	Engine Control Module
EMT	Exhaust Manifold Temperature
EOP	Engine Oil Pressure
EVAP	Evaporative
EX	Exhaust
F	Front or Forward
GCU	Generator Control Unit
GFCI	Ground Fault Circuit Interrupter
GND	Ground
HO2S	Heated Oxygen Sensor
IAC	Idle Air Control
IAT	Intake Air Temperature
I.D.	Inside Diameter
IG or IGN	Ignition
IN	Intake
INJ	Injection
L.	Left
MAP	Manifold Absolute Pressure
MIL	Malfunction Indicator Lamp
O.D.	Outside Diameter
OP	Optional Part
PGM-FI	Programmed-Fuel Injection
P/N	Part Number
Qty	Quantity
R.	Right
SAE	Society of Automotive Engineers
SCS	Service Check Signal
STD	Standard
SW	Switch
TDC	Top Dead Center

Bl	Black	G	Green	Br	Brown	Lg	Light green
Y	Yellow	R	Red	O	Orange	P	Pink
Bu	Blue	W	White	Lb	Light blue	Gr	Gray

HOW TO READ A WIRING DIAGRAM & RELATED INFORMATION

The wiring diagram, connector general layout drawing, connector drawings, and the symbols used in troubleshooting are explained in this section.

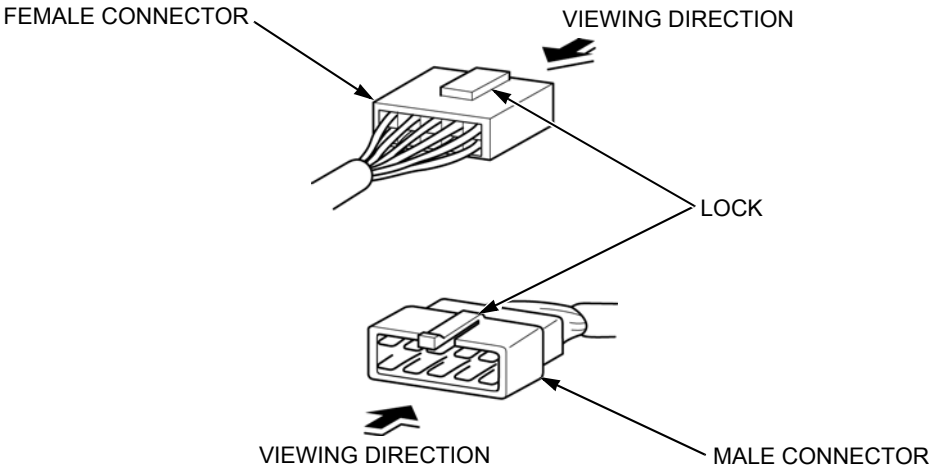
HOW TO READ CONNECTOR DRAWINGS

Connector drawings show the terminal arrangement, terminal No., number of pins, and the shape of terminal (male or female).

Both the male and female connectors are shown for the common connectors, while only the main wire harness side connectors are shown for the dedicated connectors.

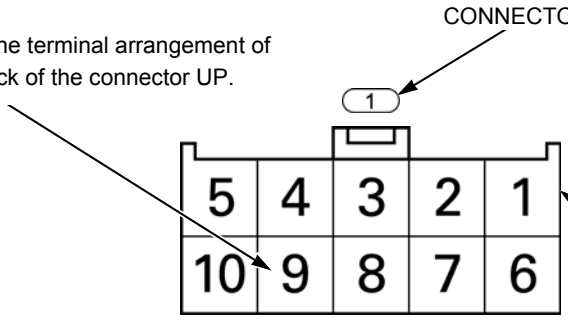
The double frame connectors represent the male connectors and the single frame connectors represent the female connectors.

Both the male and female connectors are shown by viewing them from the terminal side.



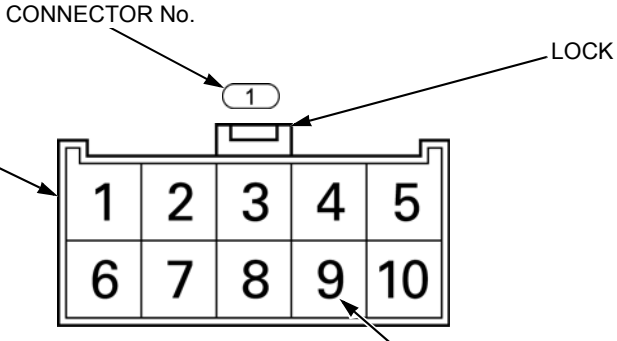
TERMINAL ARRANGEMENT

The connector drawing shows the terminal arrangement of the (1) connector with the lock of the connector UP.



FEMALE CONNECTOR DRAWING (SINGLE FRAME)

Female connector viewed from the terminal side.



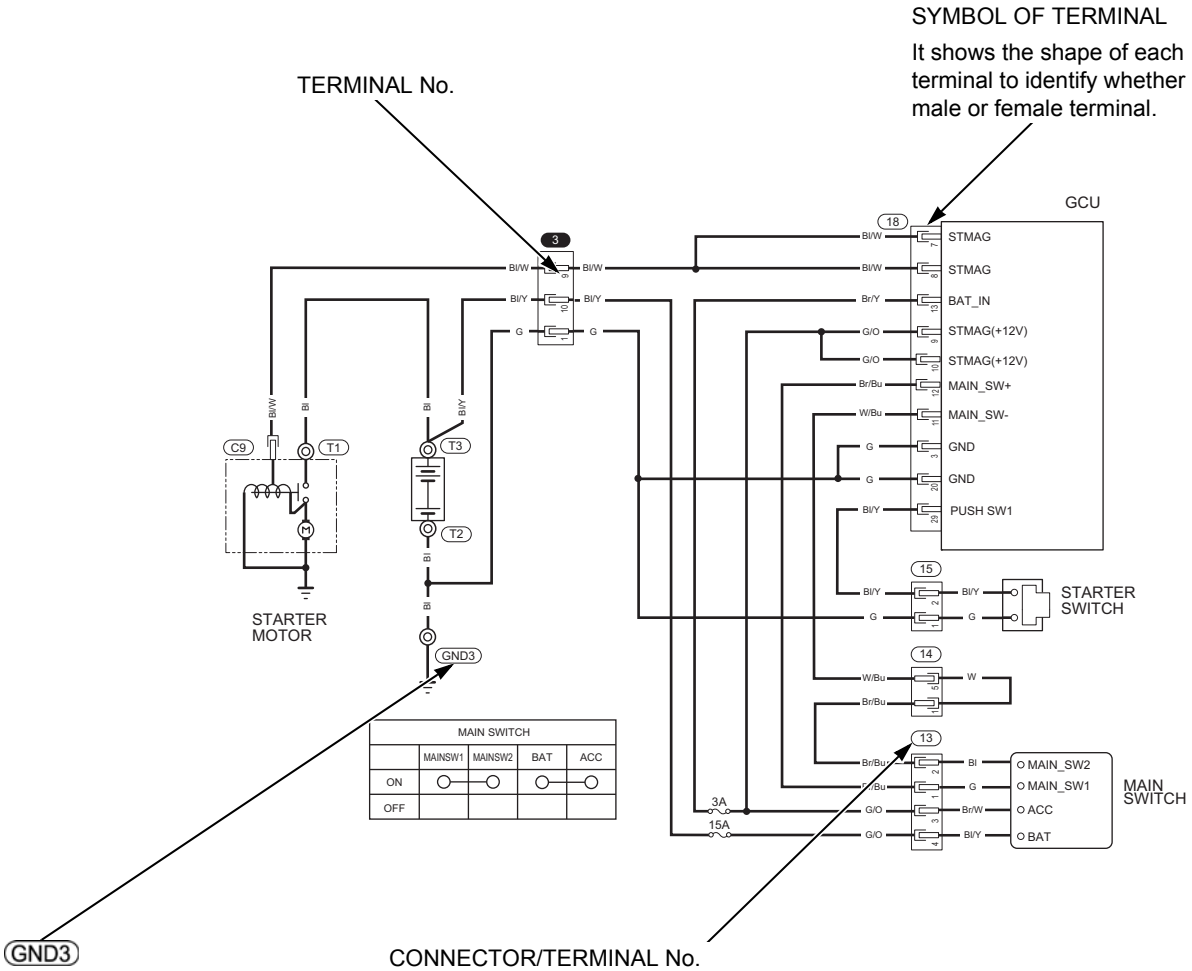
MALE CONNECTOR DRAWING (DOUBLE FRAME)

Male connector viewed from the terminal side.

TERMINAL No.

The system drawing shows the No.9 terminal of the (1) connector.

HOW TO READ A WIRING DIAGRAM



GND3

Indicates the ground.
(Circled GND followed with No. in white background)

CONNECTOR/TERMINAL No.

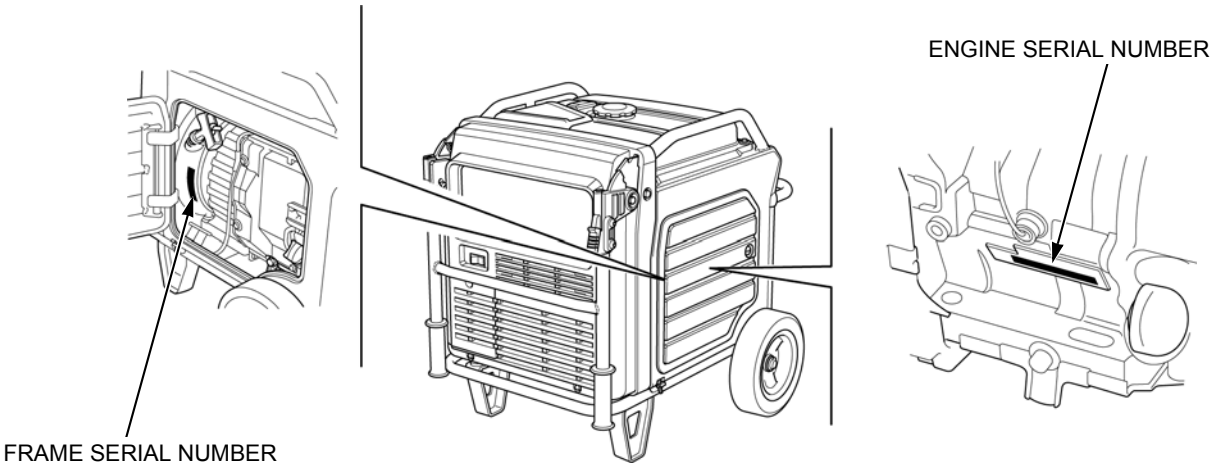
Every connector and terminal has a number to help the users find the location and shape of the connector and the terminal arrangement by referring to the “Connector general layout drawing” and/or the “Connector drawing.” All the connector/terminal numbers shown in this Service Manual are either of those shown in this section.

- 1 : Connector that joins a harness to a harness (Circled No. in black background)
- 1 : Connector that connects to electrical equipment (Circled No. in white background)
- C1 : Connector (Circled C followed with No. in white background)
- T1 : Terminal (Circled T followed with No. in white background)
- GND1 : Ground (Circled GND followed with No. in white background)

1. SPECIFICATIONS

SERIAL NUMBER LOCATION

The engine serial number is located on the cylinder block on the starter grip side of this unit, and the frame serial number is located on the front frame on the starter grip side of this unit. Refer to them when ordering parts or making technical inquiries.



SPECIFICATIONS

TYPE DESCRIPTION

It may be necessary to refer to this chart for reference purposes when reading this manual.

Model	EU7000is		
Type	AT	AT1	CT
EVAP control system	○	○	
GFCI		○	
Breather heater system			○

NOTE: "AT, AT1" and "CT" are Destination Code: AT, AT1 = U.S.A.

CT = Canada

DIMENSIONS AND WEIGHTS

Model		EU7000is
Description code		EEJD
Overall length		1,198 mm (47.2 in)
Overall width		700 mm (27.6 in)
Overall height		721 mm (28.4 in)
Dry weight	AT, AT1 type	118.6 kg (261.5 lbs)
	CT type	118.1 kg (260.4 lbs)
Operating weight	AT, AT1 type	133.6 kg (294.5 lbs)
	CT type	133.1 kg (293.4 lbs)

ENGINE

Engine model	GX390T2
Description code	GCAGD
Type	4 stroke, overhead valve, single cylinder, inclined by 25°
Displacement	389 cm^3 (23.7 cu-in)
Bore x stroke	88 x 64 mm (3.5 x 2.5 in)
Compression ratio	8.2: 1
Cooling system	Forced air
Ignition system	Full Transistorized ignition
Ignition timing	20° B.T.D.C. / 3,300 min^{-1} (rpm) (No load)
Spark plug	BPR6ES (NGK)
Fuel system	Electronically controlled fuel injection
Air cleaner	Dual type
Governor	Electric system
Lubrication system	Forced spray system
Oil capacity	1.1 Liter (1.16 US qt, 0.97 Imp qt)
Recommended oil	SAE 10W-30 API service classification SJ or higher
Starting system	Recoil and electric starter
Stopping system	Ignition primary circuit open
Recommended fuel	Unleaded gasoline with a pump octane rating 86 or higher and an ethanol content of no more than 10%

GENERATOR

Model	EU7000is
Description code	EEJD
Generator type	Multi-electrode field rotation type
Generator structure	Self-ventilation, drip-proof type
Excitation	Self-excitation
Voltage regulation system	PWM (Pulse width modulation)
Phase	Single phase
Rated output	5.5 kVA
Rated frequency	60 Hz
Rated voltage	120/240 V
Rated current	45.8/22.9 A
Power factor	1.0 Cosθ

CHARACTERISTICS

Model		EU7000is	
Type		AT, AT1	CT
Voltage variation rate	Momentary	10% max.	
	Average	6% max.	
	Average time	3 sec. max.	
Voltage stability		Within ± 1%	
Frequency variation rate	Momentary	1% max.	
	Average	1% max.	
	Average time	3 sec. max.	
Frequency stability		Within ± 0.3 Hz	
Insulation resistance		10 MΩ min.	
AC circuit protector		64.1/32.1 A	
Insulation type		E	B
Rated rpm		2,400 – 3600 min^{-1} (rpm) 3,300 – 3,600 min^{-1} (rpm) *1	
Fuel tank capacity		19.2 Liters (5.07 US gal, 4.22 Imp gal)	
Fuel consumption		2.95 Liters (0.779 US gal, 0.649 Imp gal)/Hr.	
Max. operating hours at rated load without refueling		Approx. 6.5 Hr.	
Guaranteed sound power level (L_{WA})		L_{WA} 91 dB (A)	

*1: At Eco-Throttle™ OFF

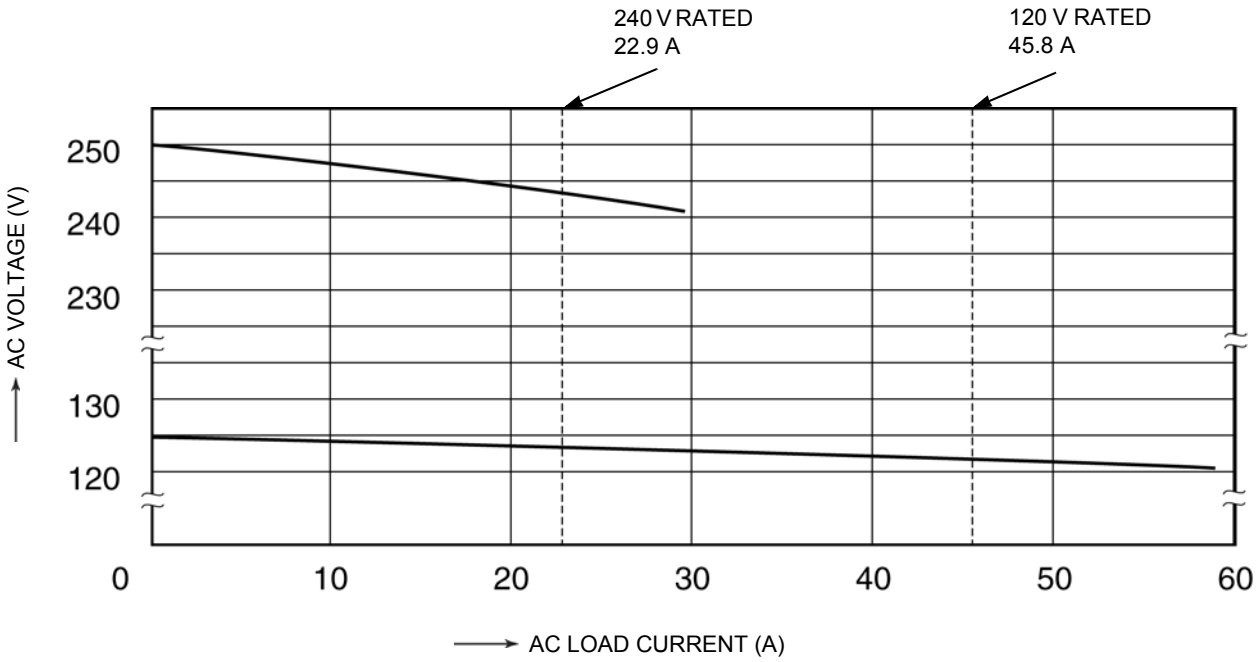
PERFORMANCE CURVES

The curve shows performance of the generator under average conditions.

Performance may vary to some degree depending on ambient temperature and humidity.

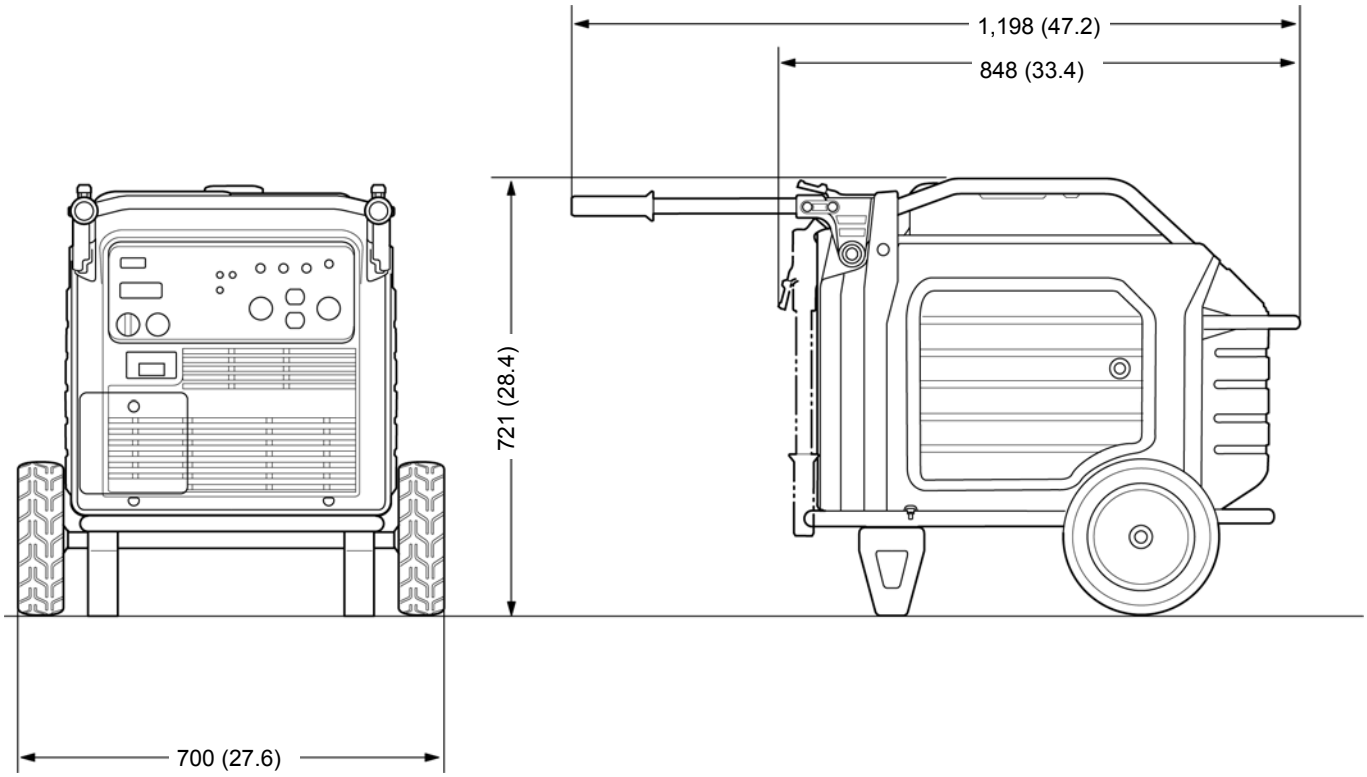
The output voltage will be higher than usual when the generator is still cold, immediately after the engine starts.

AC EXTERNAL CHARACTERISTIC CURVE



DIMENSIONAL DRAWINGS

Unit: mm (in)



MEMO

2. SERVICE INFORMATION

MAINTENANCE STANDARDS

ENGINE

Unit: mm (in)

Part	Item		Standard	Service limit
Engine	Engine speed		3,300 – 3,600 min^{-1} (rpm) *1	–
	Cylinder compression		0.46 – 0.64 MPa (4.7 – 6.5 kgf/cm^2, 67 – 92 psi) at 600 min^{-1} (rpm)	–
Cylinder	Sleeve I.D.		88.000 – 88.017 (3.4646 – 3.4652)	88.17 (3.471)
Cylinder head	Warpage		–	0.10 (0.004)
Piston	Skirt O.D.		87.975 – 87.985 (3.4636 – 3.4640)	87.85 (3.459)
	Piston-to-cylinder clearance		0.015 – 0.042 (0.0006 – 0.0017)	0.12 (0.005)
	Piston pin bore I.D.		20.002 – 20.008 (0.7875 – 0.7877)	20.042 (0.7891)
Piston pin	Pin O.D.		19.994 – 20.000 (0.7872– 0.7874)	19.950 (0.7854)
	Piston pin-to-piston pin bore clearance		0.002 – 0.014 (0.0001 – 0.0006)	0.08 (0.003)
Piston rings	Ring side clearance	Top	0.030 – 0.060 (0.0012 – 0.0024)	0.15 (0.006)
		Second	0.060 – 0.090 (0.0024 – 0.0035)	0.15 (0.006)
	Ring end gap	Top	0.200 – 0.350 (0.0079 – 0.0138)	1.0 (0.04)
		Second	0.350 – 0.500 (0.0138 – 0.0197)	1.0 (0.04)
		Oil (side rail)	0.20 – 0.70 (0.008 – 0.028)	1.0 (0.04)
	Ring width	Top	1.160 – 1.175 (0.0457 – 0.0463)	1.140 (0.0449)
		Second	1.130 – 1.145 (0.0445 – 0.0451)	1.110 (0.0437)
Connecting rod	Small end I.D.		20.005 – 20.020 (0.7876 – 0.7882)	20.07 (0.790)
	Big end I.D.		36.025 – 36.039 (1.4183 – 1.4189)	36.07 (1.420)
	Big end oil clearance		0.040 – 0.064 (0.0016 – 0.0025)	0.12 (0.005)
	Big end side clearance		0.1 – 0.4 (0.004 – 0.016)	1.0 (0.04)
Crankshaft	Crank pin O.D.		35.975 – 35.985 (1.4163 – 1.4167)	35.93 (1.415)
	Runout		–	0.1 (0.004)
Valves	Valve clearance	IN	0.15 ± 0.02 (0.006 ± 0.001)	–
		EX	0.20 ± 0.02 (0.008 ± 0.001)	–
	Valve stem O.D.	IN	6.575 – 6.590 (0.2589 – 0.2594)	6.44 (0.254)
		EX	6.535 – 6.550 (0.2573 – 0.2579)	6.40 (0.252)
	Valve guide I.D.	IN/EX	6.600 – 6.615 (0.2598 – 0.2604)	6.66 (0.262)
	Guide-to-stem clearance	IN	0.010 – 0.040 (0.0004 – 0.0016)	0.11 (0.004)
		EX	0.050 – 0.080 (0.0020 – 0.0032)	0.13 (0.005)
	Valve seat width		1.0 – 1.2 (0.04 – 0.05)	2.0 (0.08)
	Valve spring free length		39.0 (1.54)	37.5 (1.48)
	Valve spring perpendicularity		–	1.5°
Camshaft	Camshaft O.D.		15.966 – 15.984 (0.6286 – 0.6293)	15.92 (0.627)
	Cam height	IN	32.448 – 32.748 (1.2775 – 1.2893)	32.198 (1.2676)
		EX	31.935 – 32.235 (1.2573 – 1.2691)	29.886 (1.1766)
Cylinder barrel	Camshaft holder I.D.		16.000 – 16.018 (0.6299 – 0.6306)	16.05 (0.632)
Crankcase cover	Camshaft holder I.D.		16.000 – 16.018 (0.6299 – 0.6306)	16.05 (0.632)
Spark plug	Gap		0.70 – 0.80 (0.028 – 0.031)	–
CKP sensor	Air gap		0.2 – 0.6 (0.01 – 0.02)	–
Starter motor	Brush Length		10 (0.4)	6 (0.2)
	Mica depth		–	0.2 (0.01)

*1: At Eco-Throttle OFF

ELECTRICAL PARTS

Part	Connector	Terminal number	Standard
Throttle control motor	(8)	1 – 3	65 – 75 Ω
		2 – 4	
Generator (Master)	(4)	1 – 2	0.44 – 0.62 Ω
		2 – 3	
		1 – 3	
Generator (Slave)	(5)	1 – 2	0.44 – 0.62 Ω
		2 – 3	
		1 – 3	

Part	Item	Standard
Fuel pump	Fuel pressure	294 kPa (3.0 kgf/cm^2, 43 psi)
	Fuel flow	55 cc (1.9 US oz, 1.9 Imp oz) minimum/10 seconds
	Fuel pump motor resistance	0 – 20 Ω (at 20 °C/68 °F)
Fuel injector	Resistance	11 – 13 Ω (at 24 °C/75 °F)
EBT sensor	Resistance	1.6 – 2.9 kΩ (at 20 °C – 30 °C/68 °F – 86 °F)
Breather heater *1	Resistance	0.8 – 1.2 kΩ (at 25 °C/77 °F)
Ignition coil	Resistance (Primary side)	1.8 – 2.2 Ω
	Resistance (Secondary side)	5.6 – 6.9 Ω
Spark plug cap	Resistance	7.5 – 12.5 kΩ
CKP sensor	Resistance	297 – 363 Ω (at 20 °C/68 °F)

*1: CT type only

TORQUE VALUES

ENGINE TORQUE VALUES

Item	Thread Dia. and pitch (mm)	Torque values			Remarks
		N·m	kgf·m	lbf·ft	
Spark plug	M14 x 1.25	18	1.8	13	
Drain plug bolt	M12 x 1.5	22.5	2.3	17	
Cylinder head bolt	M10 x 1.25	35	3.6	26	Apply engine oil to the threads and seating surface.
Rocker arm pivot lock nut	M6 x 0.5	10	1.0	7	
Rocker arm pivot bolt	M8 x 1.25	24	2.4	18	Apply engine oil to the threads and seating surface.
Flywheel nut	M16 x 1.5	113	11.5	83	Degrease the crankshaft and flywheel tapered surface. Apply engine oil to the threads and seating surface.
Crankcase cover bolt	M8 x 1.25	24	2.4	18	
Connecting rod special bolt	M8 x 1.25	14	1.4	10	Apply engine oil to the threads and seating surface.
Exhaust pipe nut	M8 x 1.25	24	2.4	18	
EBT sensor	M8 x 1.25	9	0.92	6.6	
Starter motor nut washer	M8 x 1.25	8.8	0.90	6.5	
Fuel injector joint bolt	M5 x 0.8	5.1	0.52	3.8	
O2 sensor	M12 x 1.25	24.5	2.5	18	
Oil level switch joint nut	M10 x 1.25	10	1.0	7	

FRAME TORQUE VALUES

Item	Thread Dia. and pitch (mm)	Torque values			Remarks
		N·m	kgf·m	lbf·ft	
Bottom rubber mount nut	M10 x 1.25	34	3.5	25	
Bottom rubber mount nut	M8 x 1.25	24	2.4	18	
Fuel pump mount nut	M6 x 1.0	12	1.2	9	
Fuel meter mount screw	M5 x 0.8	4	0.41	3.0	
Silencer chamber nut	M6 x 1.0	8.5	0.87	6.3	
Air cleaner connecting tube band screw	M4 x 0.7	0.7	0.07	0.5	
Handle pipe mount bolt	M8 x 1.25	21.5	2.2	16	
Handle holder mount bolt	M8 x 1.25	21.5	2.2	16	
Front frame mount bolt	M8 x 1.25	24	2.4	18	
Muffler mount bolt	M8 x 1.25	27	2.8	20	
Muffler mount nut	M8 x 1.25	24	2.4	18	
Tail pipe mount screw	M5 x 0.8	3.5	0.36	2.6	
Head cover lower shroud mount bolt	M6 x 1.0	8.5	0.87	6.3	
Plug cover mount bolt	M6 x 1.0	2.3	0.24	1.7	
Front cover mount bolt	M6 x 1.0	8.5	0.87	6.3	
Front cover mount nut	M6 x 1.0	8.5	0.87	6.3	
Battery maintenance cover mount bolt	M6 x 1.0	2.3	0.24	1.7	
Fan cover mount nut	M6 x 1.0	8.5	0.87	6.3	
Control panel mount nut	M6 x 1.0	8.5	0.87	6.3	
Parallel operation outlets terminal nut	M4 x 0.7	1.1	0.11	0.8	
Receptacle terminal screw	M4 x 0.7	1.3	0.13	1.0	
Receptacle mounting nut	M4 x 0.7	1.3	0.13	1.0	
Circuit protector mounting nut	M11 x 1.0	1.8	0.18	1.3	
Ground terminal (GND10) screw (CT type)	M5 x 0.8	2.3	0.24	1.7	
Ground terminal (GND9) screw (AT, AT1 type)	M5 x 0.8	2.3	0.24	1.7	
Voltage selector switch nut	M4 x 0.7	1.3	0.13	1.0	
GCU mounting nut	M4 x 0.7	1.3	0.13	1.0	
Ground terminal (GND14) screw (CT Type only)	M6 x 1.0	2.3	0.24	1.7	
Circuit protector mounting screw	M3 x 0.5	0.6	0.06	0.4	
Circuit protector terminal screw	M4 x 0.7	1.1	0.11	0.8	
High tension cord holder mount screw	M5 screw	3.4	0.35	2.5	
Generator rotor mount nut	M16 x 1.5	170	17.3	125	Degrease the crankshaft and rotor tapered surface. Apply engine oil to the threads and seating surface.
Stator mount bolt	M6 x 1.0	11	1.1	8	CT Bolt
Ignition coil mount bolt	M6 x 1.0	10	1.0	7	
CKP sensor mount bolt	M5 x 0.8	6	0.6	4.4	
Throttle control motor screw	–	2.1	0.21	1.5	
Ground terminal (GND7) mounting nut	M6 x 1.0	3	0.31	2.2	
Ground cable (GND4) mounting nut	M6 x 1.0	8.5	0.87	6.3	

STANDARD TORQUE VALUES

ENGINE

Item	Thread dia. (mm)	Torque values		
		N·m	kgf·m	lbf·ft
Screw	4 mm	2.0	0.20	1.5
	5 mm	4.3	0.44	3.2
	6 mm	9	0.92	6.6
Bolt and nut	5 mm	5.3	0.54	3.9
	6 mm	10	1.0	7
	8 mm	22	2.2	16
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	5 mm	5.3	0.54	3.9
	6 mm	12	1.2	9
	8 mm	23	2.3	17
	10 mm	39	4.0	29
SH (Small head) flange bolt	6 mm	9	0.92	6.6
CT (Cutting threads) flange bolt (Retightening)	6 mm	12	1.2	9

FRAME

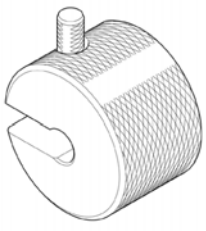
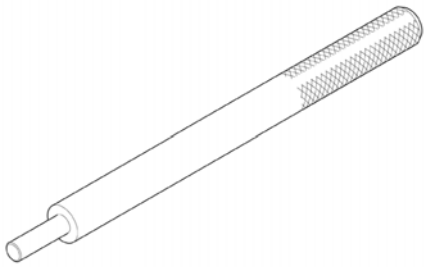
Item	Thread dia. (mm)	Torque values		
		N·m	kgf·m	lbf·ft
Screw	3 mm	1.0	0.10	1.5
	4 mm	2.0	0.20	1.5
	5 mm	4.3	0.44	3.2
	6 mm	9	0.92	6.6
Bolt and nut	5 mm	5.3	0.54	3.9
	6 mm	10	1.0	7
	8 mm	22	2.2	16
	10 mm	34	3.5	25
	12 mm	54	5.5	40
Flange bolt and nut	4 mm	3.4	0.54	3.9
	5 mm	5.3	0.54	3.9
	6 mm	12	1.2	9
	8 mm	27	2.8	20
	10 mm	39	4.0	29
SH (Small head) flange bolt	6 mm	9	0.92	6.6
CT (Cutting threads) flange bolt (Retightening)	6 mm	10	1.0	7

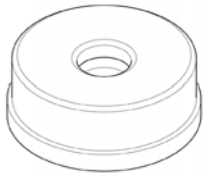
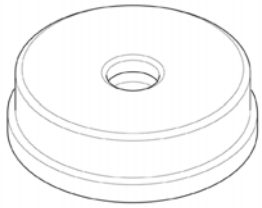
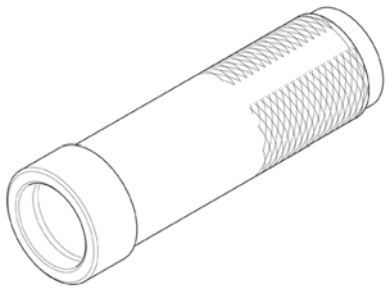
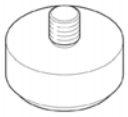
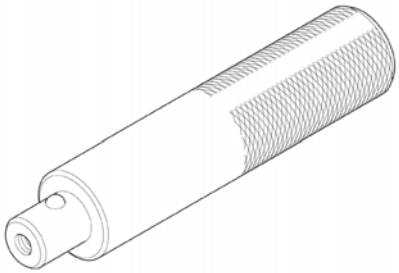
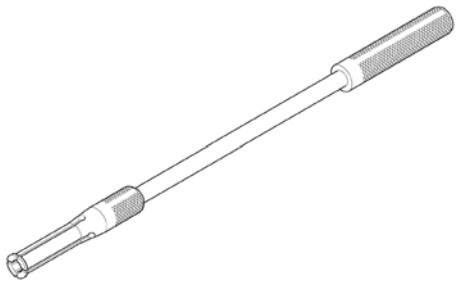
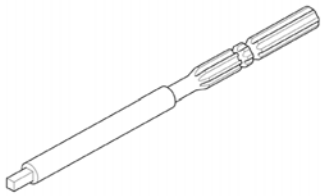
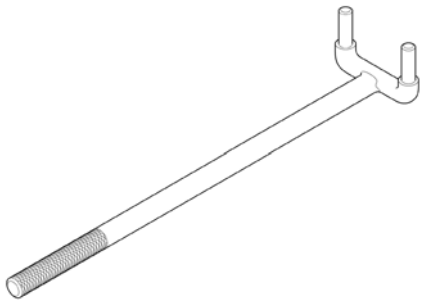
LUBRICATION & SEAL POINTS

Material	Location	Remarks
Engine oil	Crankshaft pin and gear teeth	
	Piston outer surface, ring groove, and piston pin hole	
	Piston pin outer surface	
	Piston ring entire surface	
	Cylinder inner surface	
	Connecting rod big and small end bearing	
	Camshaft cam lobes and journal	
	Balancer shaft gear teeth and bearing	
	Valve lifter pivot, pivot end, and slipper surface	
	Valve stem sliding surface and stem end	
	Valve rocker arm tappet surface and pivot	
	Rocker arm pivot threads and pivot	
	Fuel injector O-ring whole surface	
	Each O-ring whole surface	
Multi-purpose grease	Oil seal lips	
	Recoil starter case cut out	3 g (0.1 oz)
	Recoil starter ratchet	0.03 g (0.001 oz)
	Recoil starter ratchet cover (ratchet sliding portion)	0.5 – 1.0 g (0.02 – 0.04 oz)
	Recoil starter ratchet cover (cover bolt sliding portion)	0.05 g (0.002 oz)
	Recoil starter ratchet cover (Friction spring sliding portion)	0.05 g (0.002 oz)
	Recoil starter ratchet cover (cam sliding portion)	0.05 g (0.002 oz)
	Left maintenance cover hinge pin whole surface	
	Right cover hinge and hinge pin whole surface, hinge spring contact area	
Use molybdenum oil solution (mixture of the engine oil and molybdenum grease in a ratio of 1:1)	Camshaft cam profile	When installing a new camshaft
Adhesive (LOCTITE® #495)	Front cover	See page 5-5

TOOLS

SPECIAL TOOLS

Remover weight 07936-371020A	Valve guide driver, 6.6 mm 07942-6570100	Attachment, 32 × 35 mm 07746-0010100
		

Attachment, 52 × 55 mm 07746-0010400 	Attachment, 72 × 75 mm 07746-0010600 	Driver, 40 mm I.D. 07746-0030100 
Driver attachment, 35 mm I.D. 07746-0030400 	Pilot, 15 mm 07746-0040300 	Pilot, 35 mm 07746-0040800 
Driver handle 07749-0010000 	Bearing remover shaft, 15 mm 07936-KC10500 	Valve guide reamer, 6.612 mm 07984-ZE20001 
Crank pulley holder 47 07925-6570000 	Fuel pressure gauge 07APJ-Z37A100 	

COMMERCIALLY AVAILABLE TOOLS

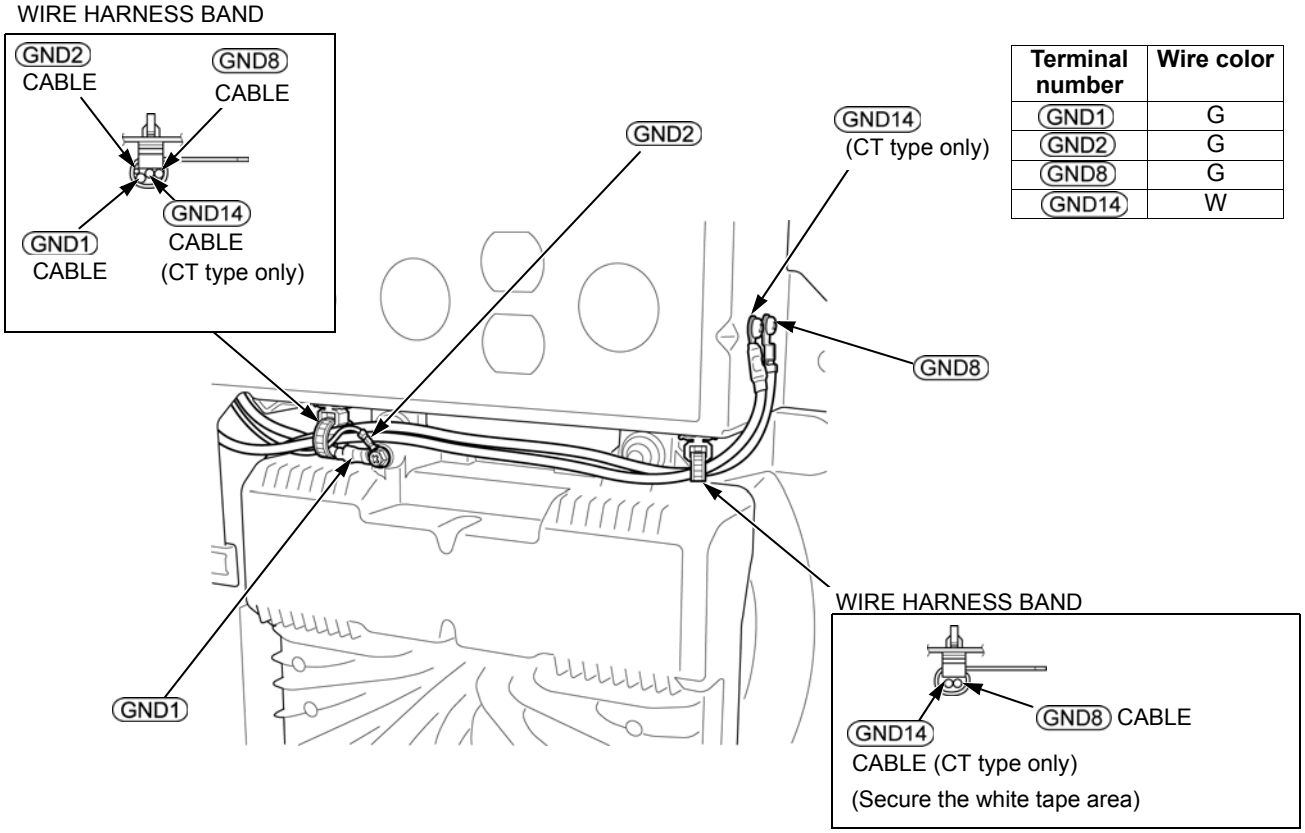
Tool name	Tool number	Application
Digital multimeter	FLU87V	Electrical testing
Battery tester	BM310 (YUASA)	Battery testing
Valve seat cutter, 30 x 45 degree	NWYCU128	Valve seat reconditioning
Valve seat cutter, 60 degree	NWYCU114	
Solid pilot bar, 6.6 mm	NWY100-6.60	
T handle	NWYTW505	
Valve lapper	LIL21100	
Flywheel puller	OTC7403	Flywheel removal
Strap wrench	S-17	
Compression gauge	EEPV303A	Compression testing
Leak down tester	KLIAT1006M	Cylinder leak down
Ring compressor	LIL18500	Piston installation

There are two convenient ways to order, online or by toll-free phone.

- To order online, go to the IN: SERVICE > Tools > Tool and Equipment Program > Online Catalog, and then search by model number.
- To order by phone, call 1-888-424-6857.

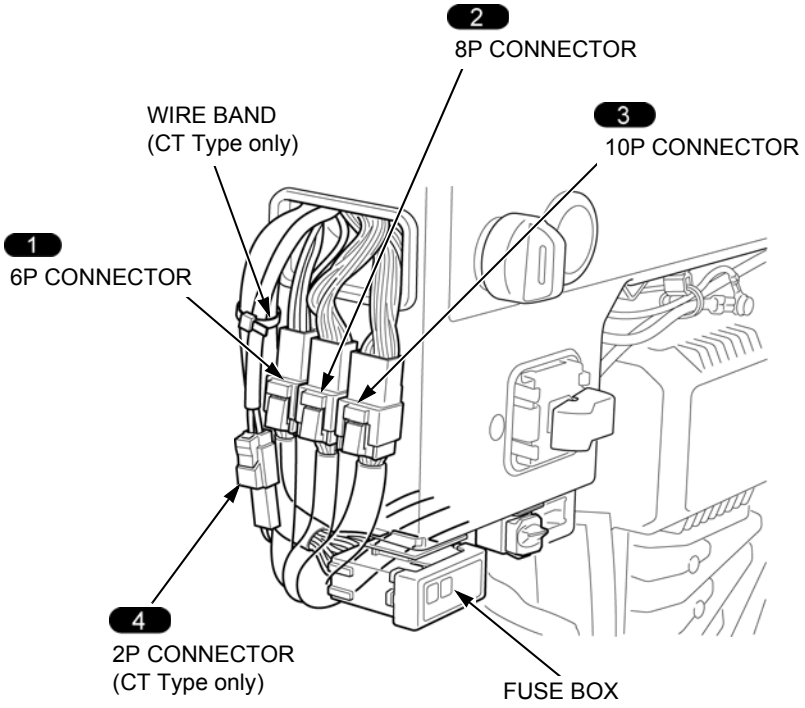
  Customer service representatives are available from 7:30 AM until 7:00 PM CT, Monday through Friday.

CABLE/HARNESS ROUTING



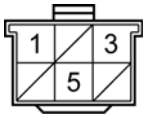
Terminal number	Wire color
GND1	G
GND2	G
GND8	G
GND14	W

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

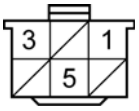


Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

1



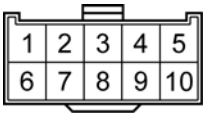
Control wire harness side



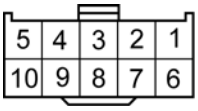
Generator wire harness side

Terminal number	Wire color
1	R
3	W
5	Bu

3



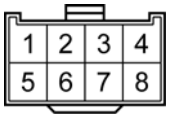
Control wire harness side



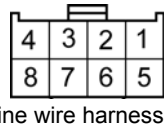
Engine wire harness side

Terminal number	Wire color
1	G
2	Bl
3	Y/R
4	Y/Bl
5	W
6	R
7	Y
8	Bu
9	Bl/W
10	Bl/Y

2



Control wire harness side



Engine wire harness side

Terminal number	Wire color
1	Bu
2	Y
3	Y/Bu
4	Y
5	R
6	W
7	Bl
8	Bl/G

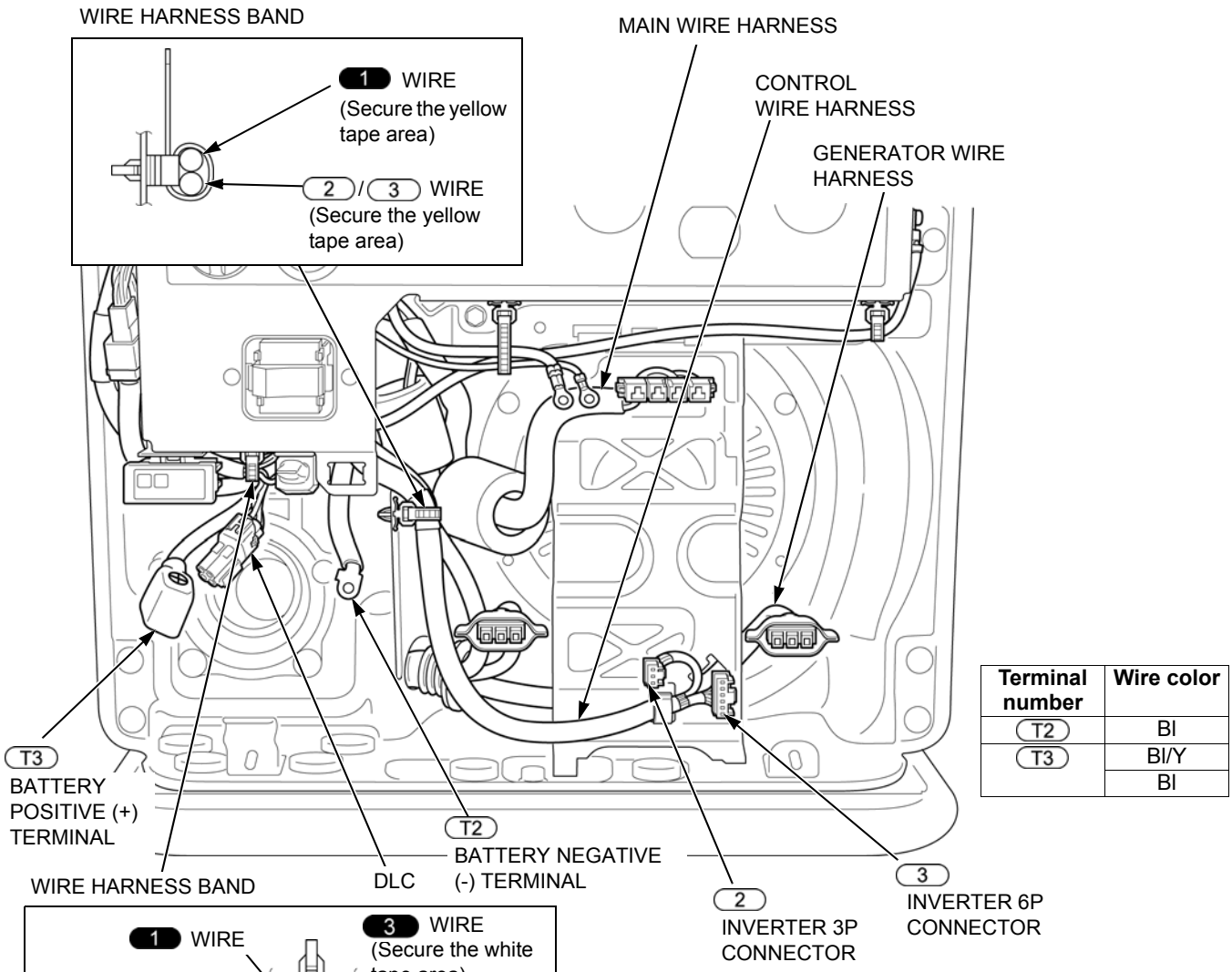
4

Receptacle terminal side

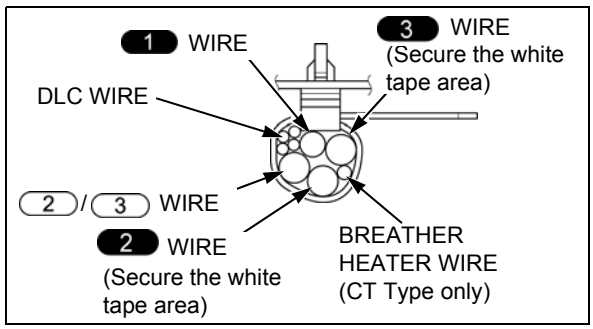
Terminal number	Wire color
1	W
2	R

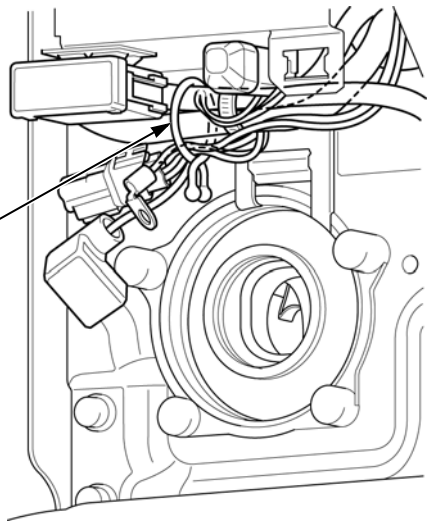
Breather heater wire harness side

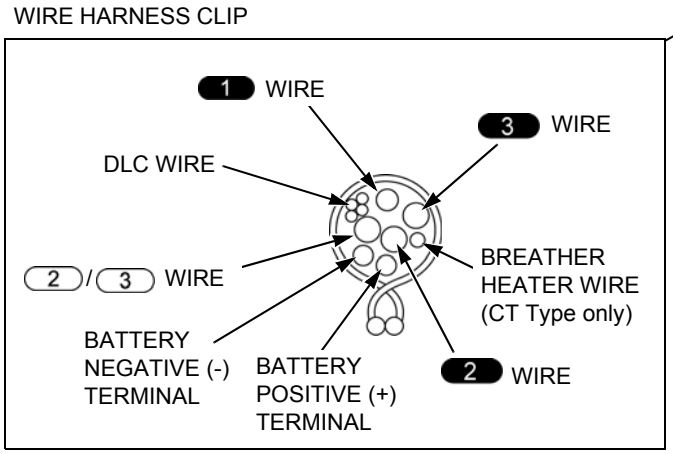
Terminal number	Wire color
1	R
2	R

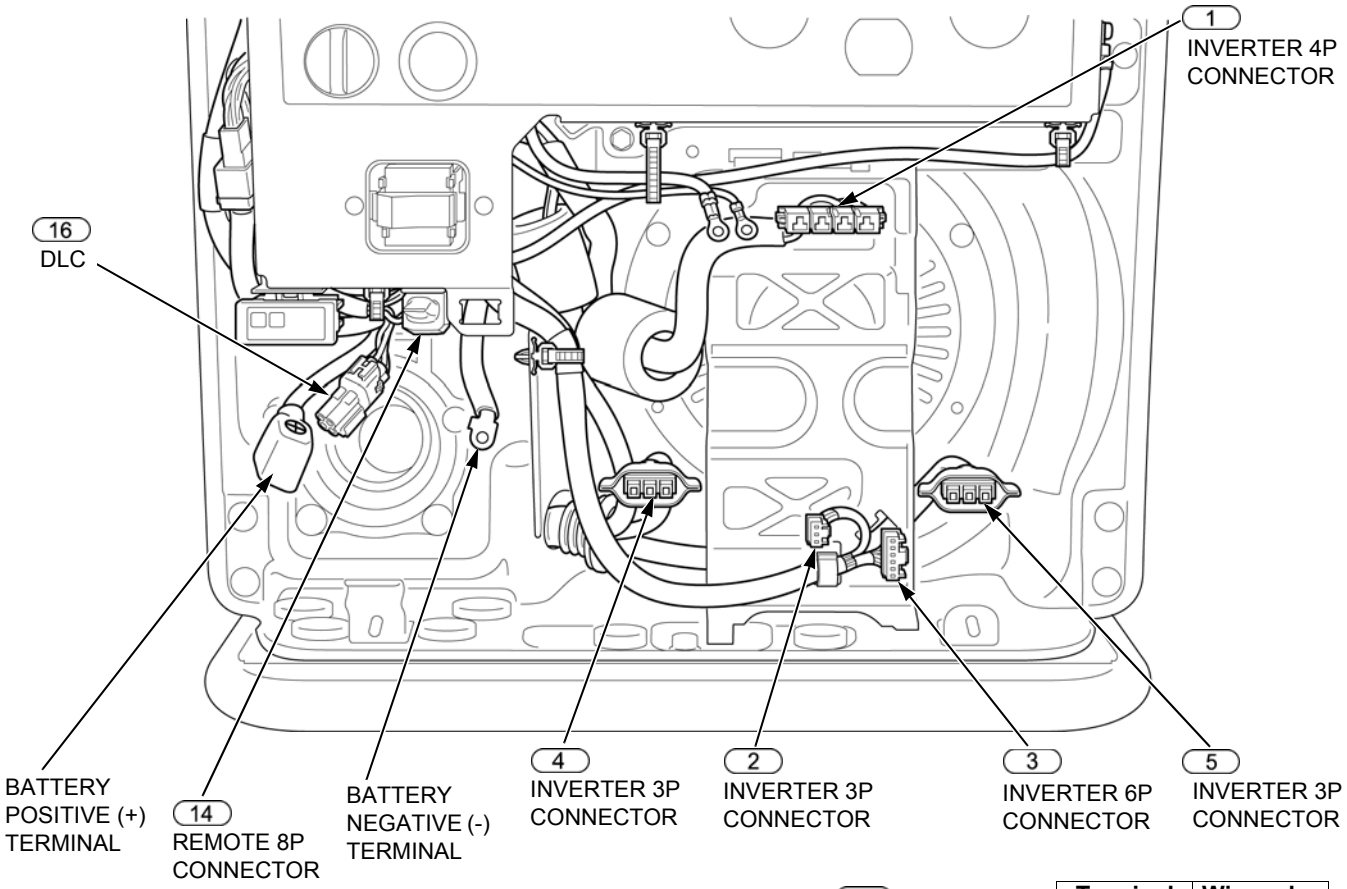


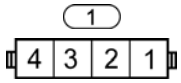
Terminal number	Wire color
T2	Bl
T3	Bl/Y
	Bl





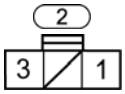






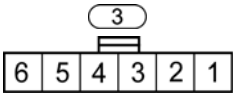
Main wire harness side

Terminal number	Wire color
1	Gr
2	Bu
3	R
4	W



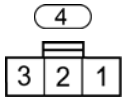
Control wire harness side

Terminal number	Wire color
1	R/W
3	R



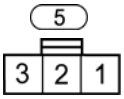
Control wire harness side

Terminal number	Wire color
1	G/O
2	G/Bu
3	O/W
4	Bu/Y
5	Bu/R
6	R



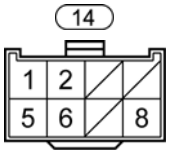
Generator wire harness side

Terminal number	Wire color
1	R
2	W
3	Bu



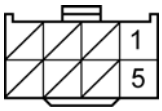
Generator wire harness side

Terminal number	Wire color
1	R
2	W
3	Bu



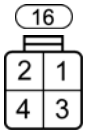
Control wire harness side

Terminal number	Wire color
1	Br/Bu
2	G/Bu
5	W/Bu
6	W/G
8	G



Connector side

Terminal number	Wire color
1	W
5	W

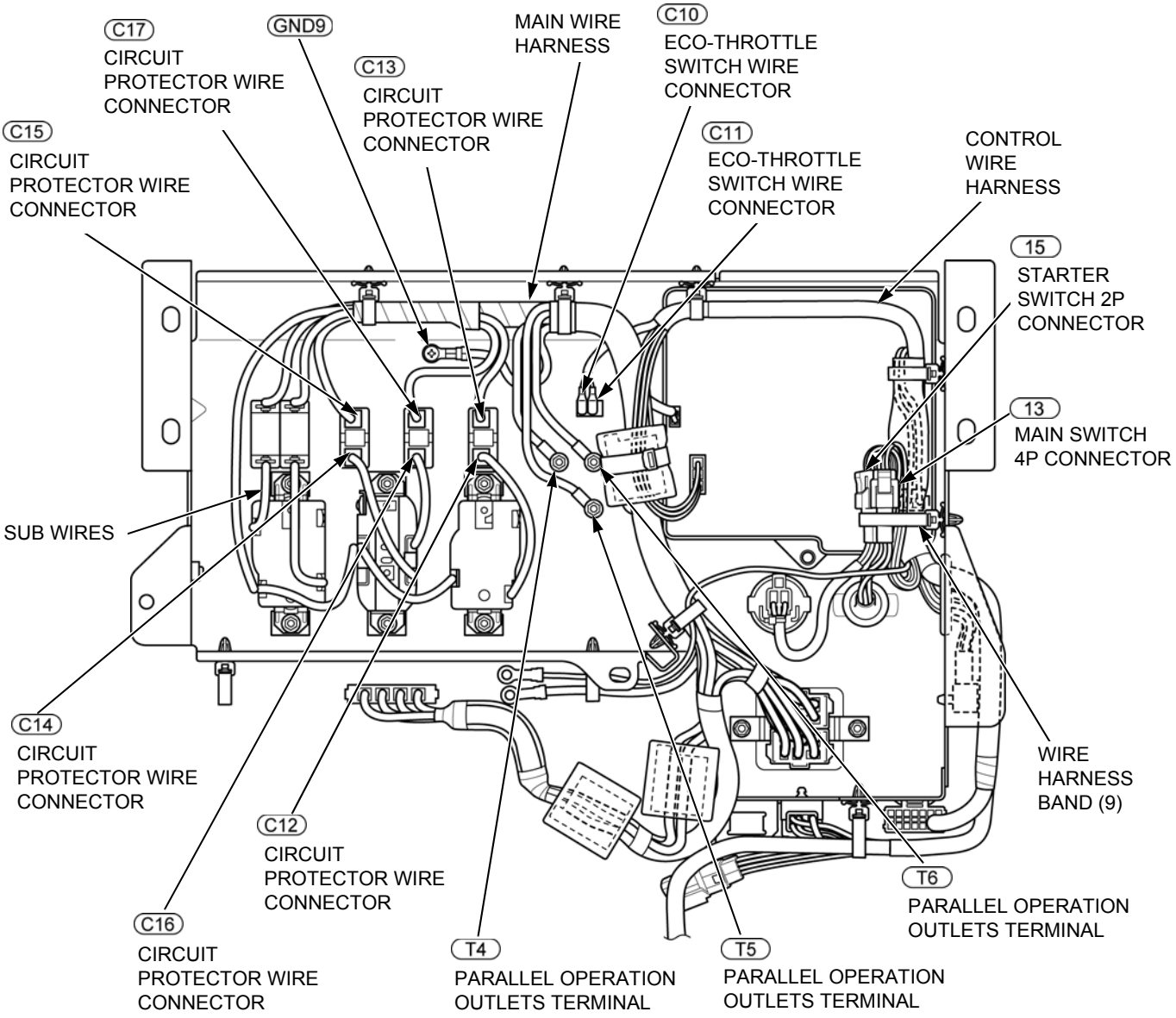


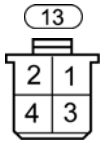
Control wire harness side

Terminal number	Wire color
1	Bu/R
2	G
3	Br/W
4	Bu/Y

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

AT Type:





Control wire harness side

Terminal number	Wire color
1	Br/Bu
2	Br/Bu
3	G/O
4	G/O

Main switch side

Terminal number	Wire color
1	G
2	Bl
3	Br/W
4	Bl/Y

Control wire harness side

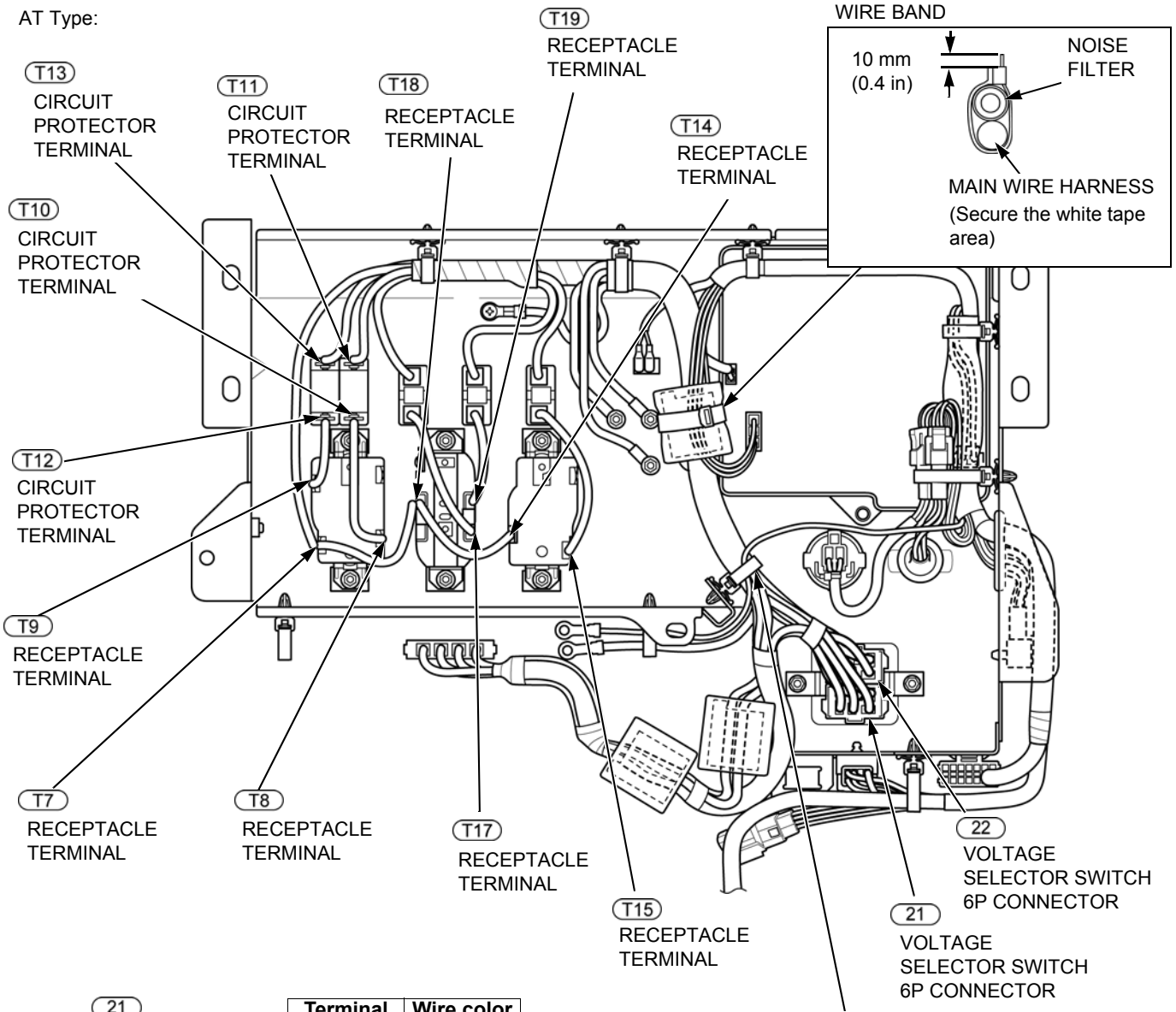
Starter switch side

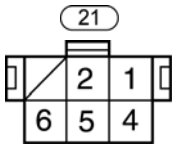
Terminal number	Wire color
1	G
2	Bl/Y

Terminal number	Wire color
GND9	G

Terminal number	Wire color
C10	R/W
C11	R
C12	Bu
C13	Bu
C14	Bu
C15	Bu
C16	R
C17	R
T4	Bu
T5	W
T6	R

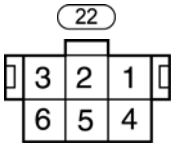
Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray





Main wire harness side

Terminal number	Wire color
1	R
2	R
4	Bu
5	Bu
6	R



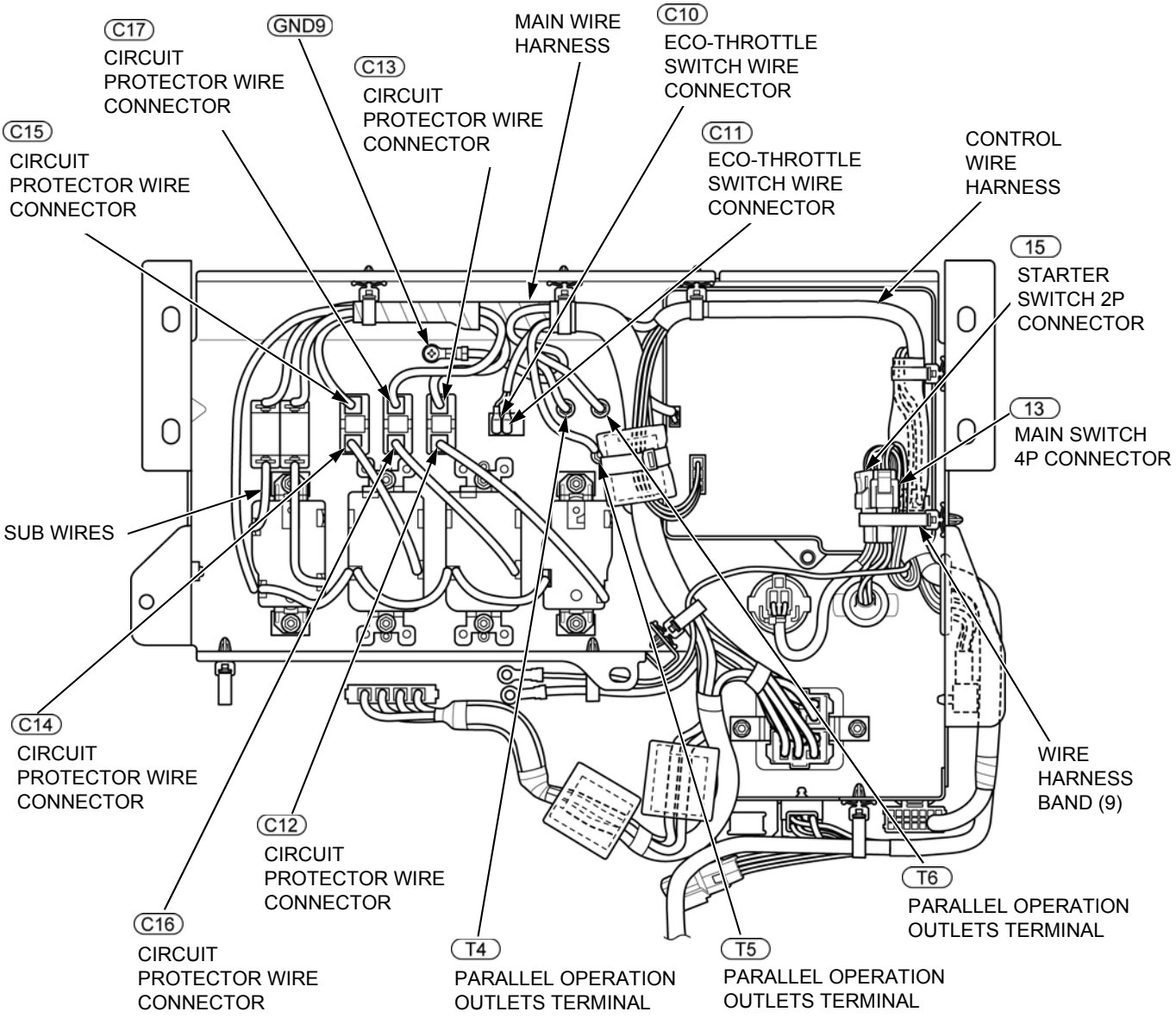
Main wire harness side

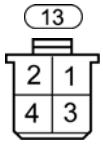
Terminal number	Wire color
1	Bu
2	W
3	Gr
4	Gr
5	Bu
6	Bu

Terminal number	Wire color
T7	W
T8	Bu
T9	R
T10	Bu
T11	Bu
T12	R
T13	R
T14	W
T15	Bu
T17	Bu
T18	W
T19	R

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

AT1 Type:





Control wire harness side

Terminal number	Wire color
1	Br/Bu
2	Br/Bu
3	G/O
4	G/O

Control wire harness side

Starter switch side

Terminal number	Wire color
1	G
2	Bl/Y

Terminal number	Wire color
C10	R/W
C11	R
C12	Bu
C13	Bu
C14	Bu
C15	Bu
C16	R
C17	R
T4	Bu
T5	W
T6	R

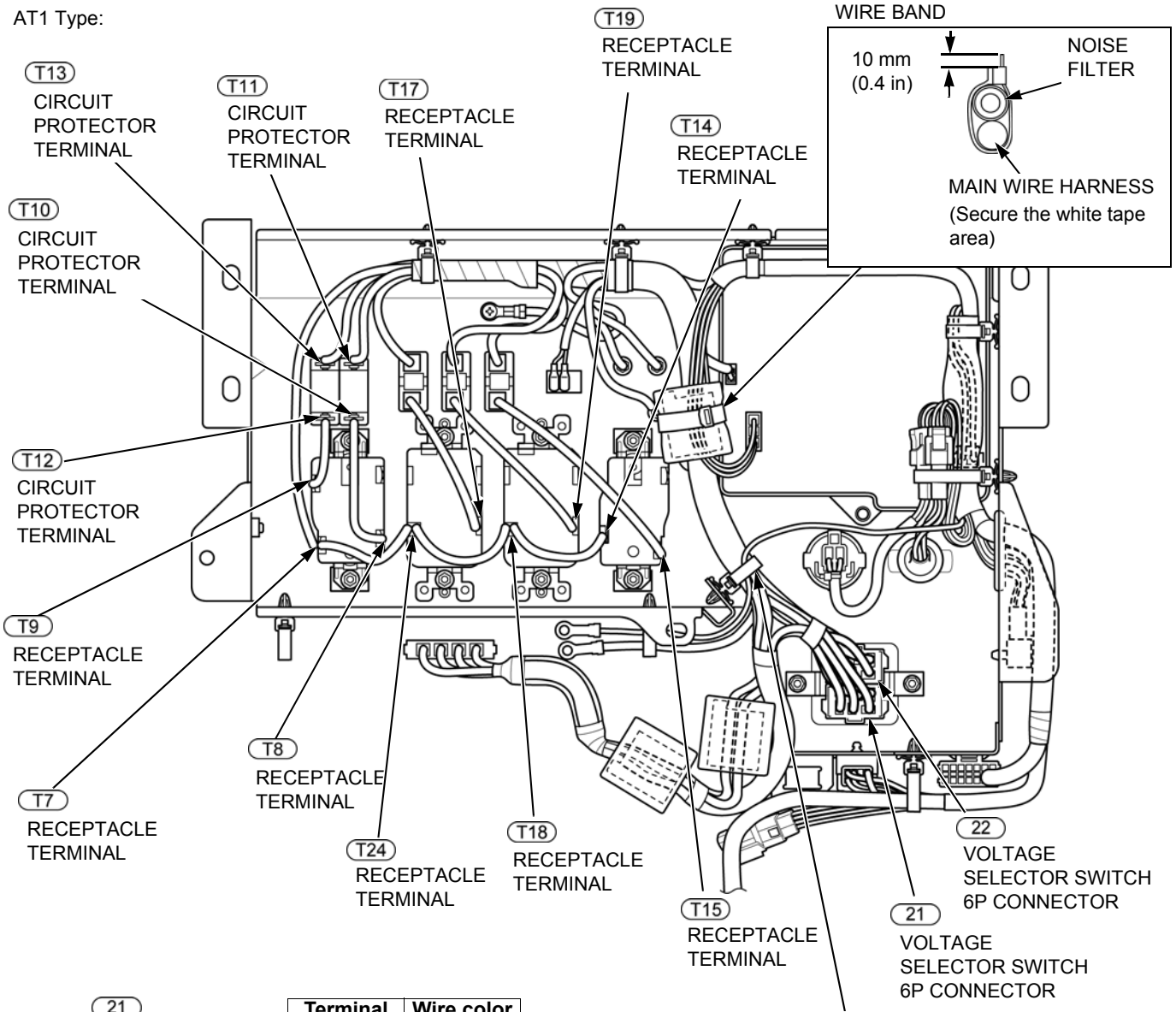
Main switch side

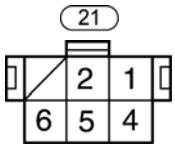
Terminal number	Wire color
1	G
2	Bl
3	Br/W
4	Bl/Y

Terminal number	Wire color
GND9	G

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

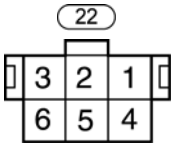
AT1 Type:





Main wire harness side

Terminal number	Wire color
1	R
2	R
4	Bu
5	Bu
6	R



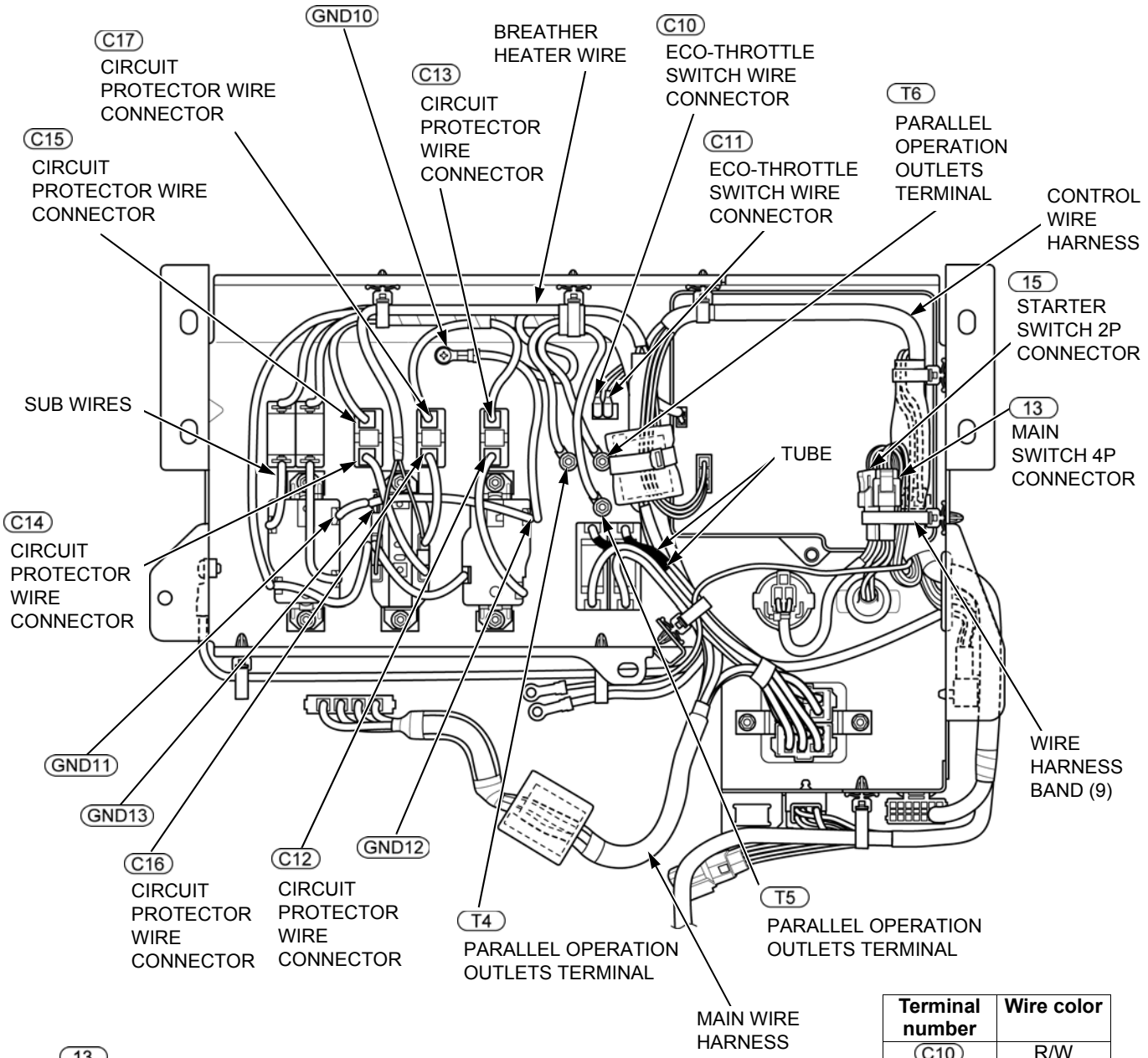
Main wire harness side

Terminal number	Wire color
1	Bu
2	W
3	Gr
4	Gr
5	Bu
6	Bu

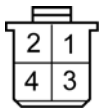
Terminal number	Wire color
T7	W
T8	Bu
T9	R
T10	Bu
T11	Bu
T12	R
T13	R
T14	W
T15	Bu
T17	Bu
T18	W
T19	R
T24	W

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

CT Type:



13



Control wire harness side

Terminal number	Wire color
1	Br/Bu
2	Br/Bu
3	G/O
4	G/O

15

Control wire harness side

Terminal number	Wire color
1	G
2	Bl/Y

Main switch side

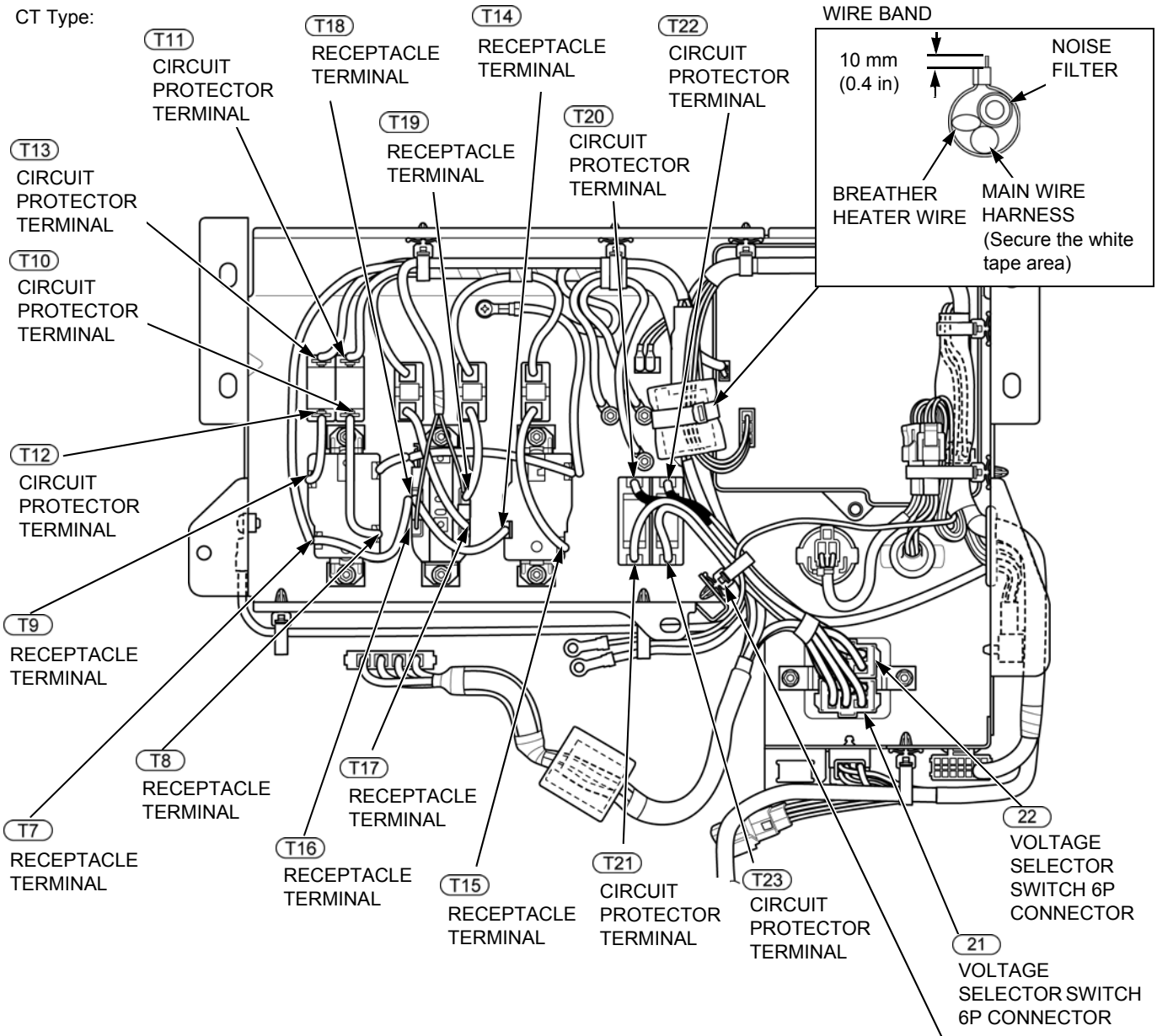
Terminal number	Wire color
1	G
2	Bl
3	Br/W
4	Bl/Y

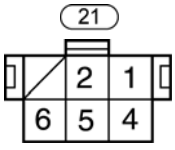
Starter switch side

Terminal number	Wire color
C10	R/W
C11	R
C12	Bu
C13	Bu
C14	Bu
C15	Bu
C16	R
C17	R
T4	Bu
T5	W
T6	R

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

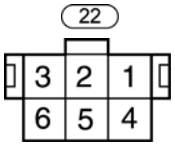
Terminal number	Wire color
GND10	G
GND11	G
GND12	G
GND13	G





Main wire harness side

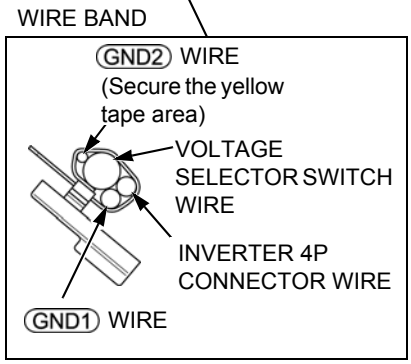
Terminal number	Wire color
1	R
2	R
4	Bu
5	Bu
6	R



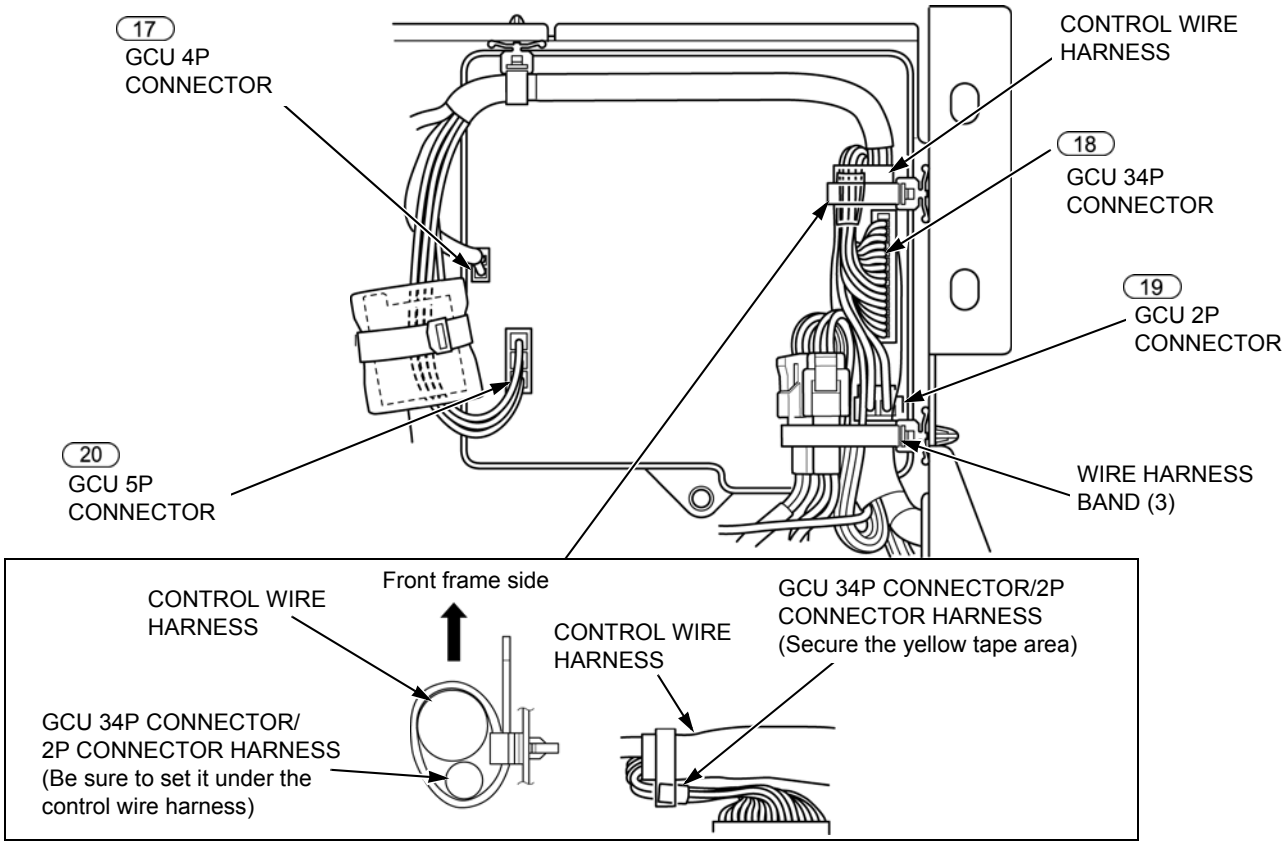
Main wire harness side

Terminal number	Wire color
1	Bu
2	W
3	Gr
4	Gr
5	Bu
6	Bu

Terminal number	Wire color
T7	W
T8	Bu
T9	R
T10	Bu
T11	Bu
T12	R
T13	R
T14	W
T15	Bu
T16	W
T17	Bu
T18	W
T19	R
T20	Bu
T21	Bu
T22	R
T23	R



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray



18

17	16	15	14	13	12	11	10	9	8	7	6	5	4	3		1
	33	32	31	30	29	28	27	26	25	24	23	22	21	20		18

Control wire harness side

Terminal number	Wire color
1	R
3	G
4	Bu
5	W/G
6	G/Bu
7	Bl/W
8	Bl/W
9	G/O

Terminal number	Wire color
10	G/O
11	W/Bu
12	Br/Bu
13	Br/Y
14	W
15	R
16	Bu
17	Y

Terminal number	Wire color
18	W
20	G
21	Y
22	O/W
23	G/O
24	G/Bu
25	Bu/R
26	Bu/Y

Terminal number	Wire color
27	Y/Bl
28	Y
29	Bl/Y
30	R
31	Bl
32	Y/R
33	Y/Bu

17

4	3	2	1

Control wire harness side

Terminal number	Wire color
1	G
2	Bu/R
3	Bu/Y
4	Br/W

20

5		3		1

Control wire harness side

Terminal number	Wire color
1	Bu
3	W
5	R

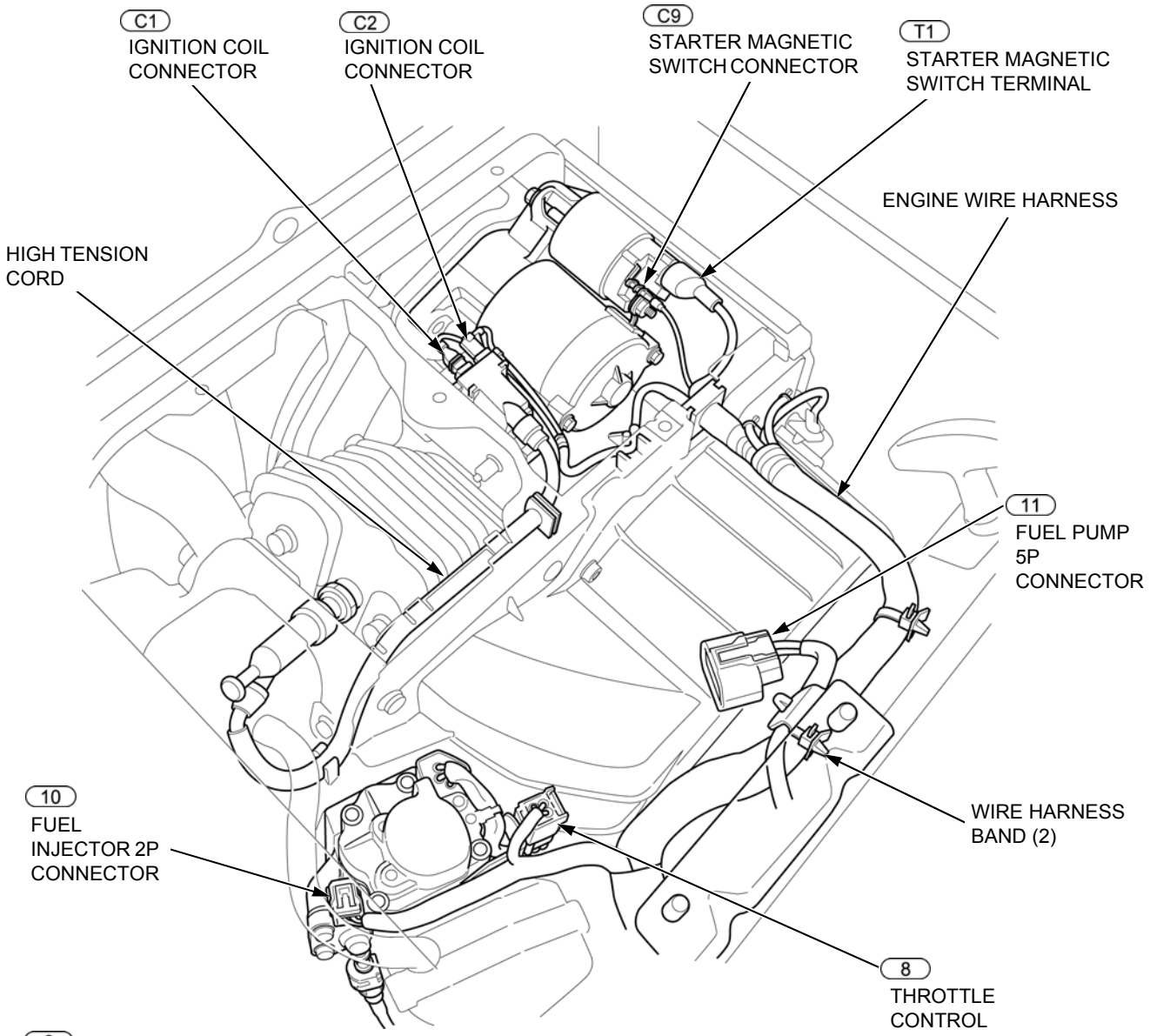
19

2	1

Control wire harness side

Terminal number	Wire color
1	Bl/G
2	Bl

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray



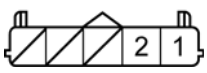
8

Engine wire harness side

Terminal number	Wire color
1	Y
2	W
3	Bu
4	R

Throttle control motor side

11



Engine wire harness side

Terminal number	Wire color
1	Bu
2	R

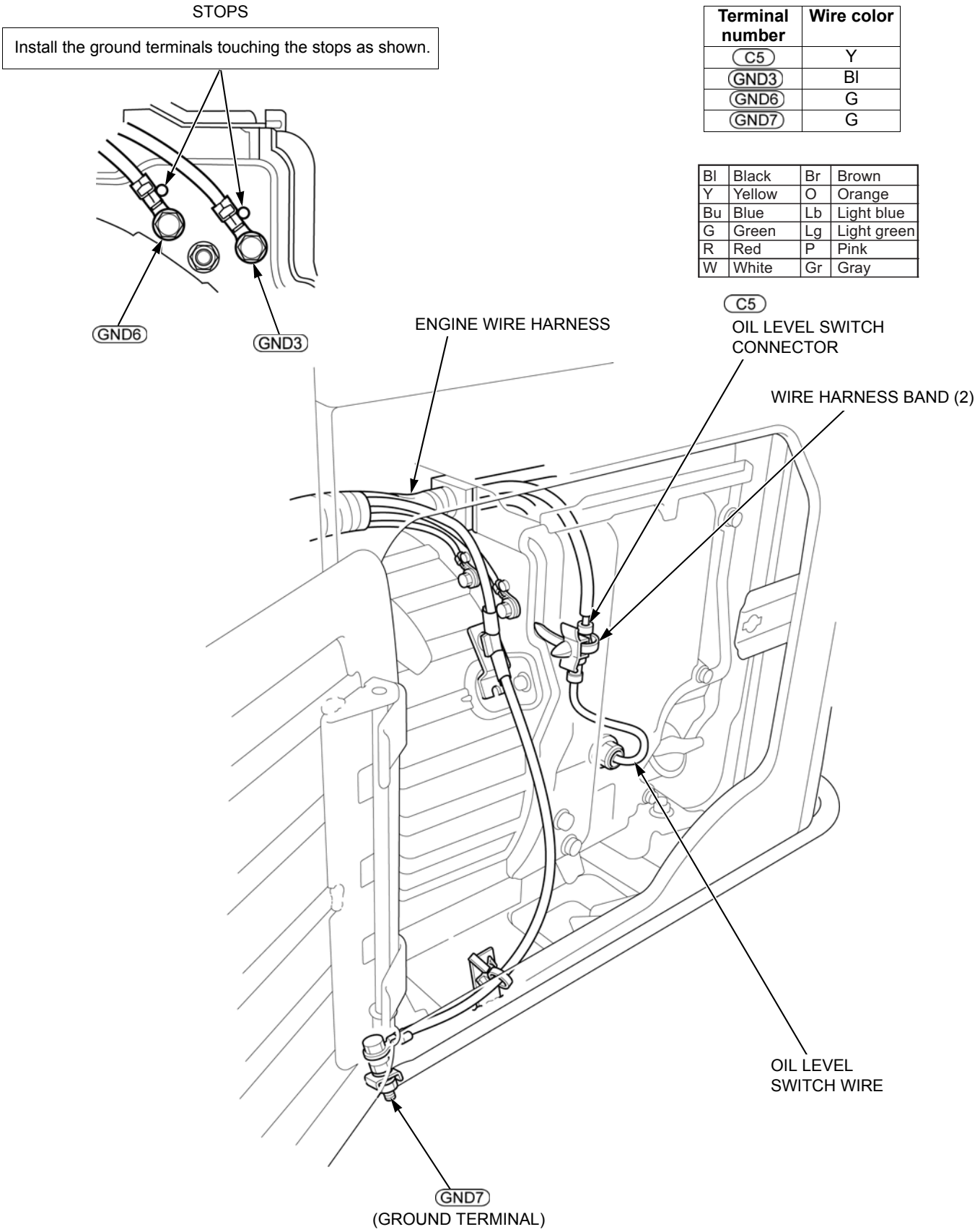
Terminal number	Wire color
T1	Bl
C1	Bl
C2	Bl/G
C9	Bl/W

10

Engine wire harness side

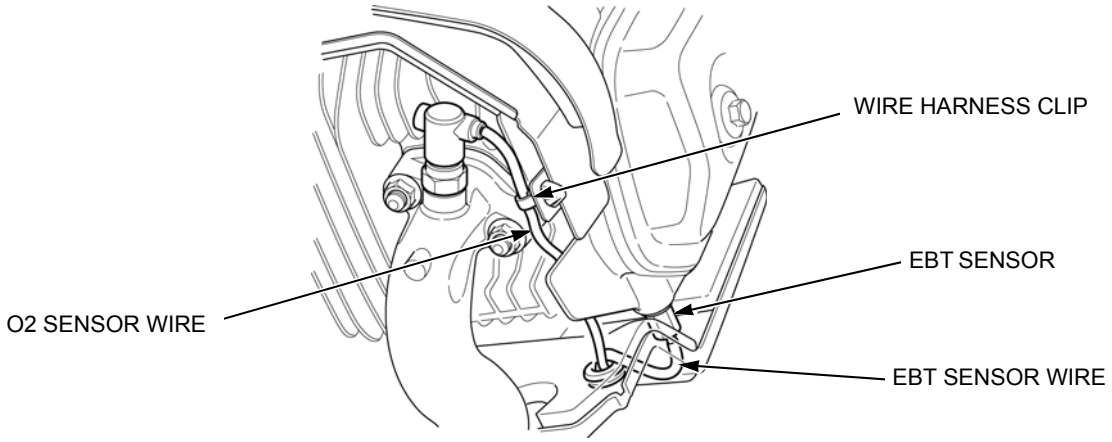
Terminal number	Wire color
1	Y
2	W

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

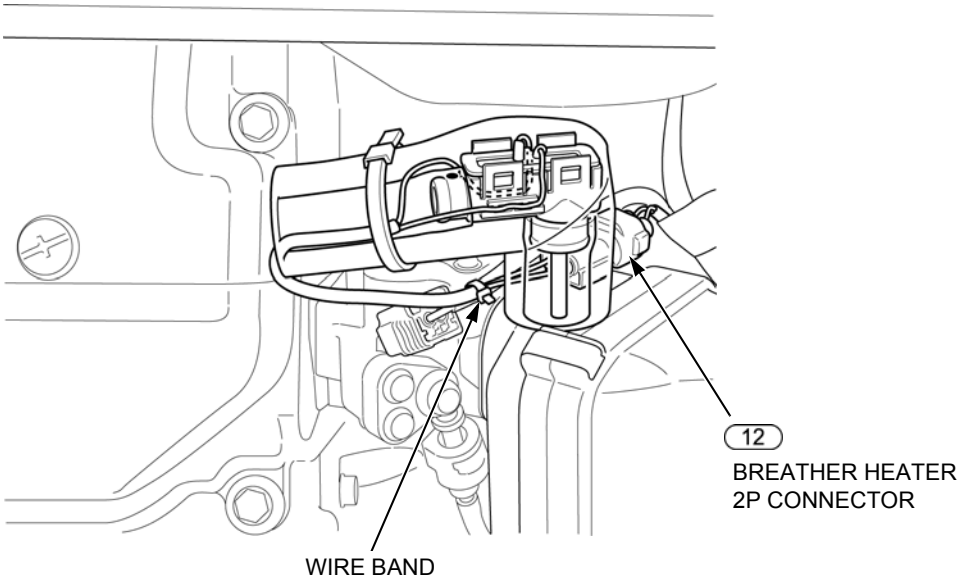


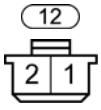
Terminal number	Wire color
C5	Y
GND3	Bl
GND6	G
GND7	G

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray



CT Type only:



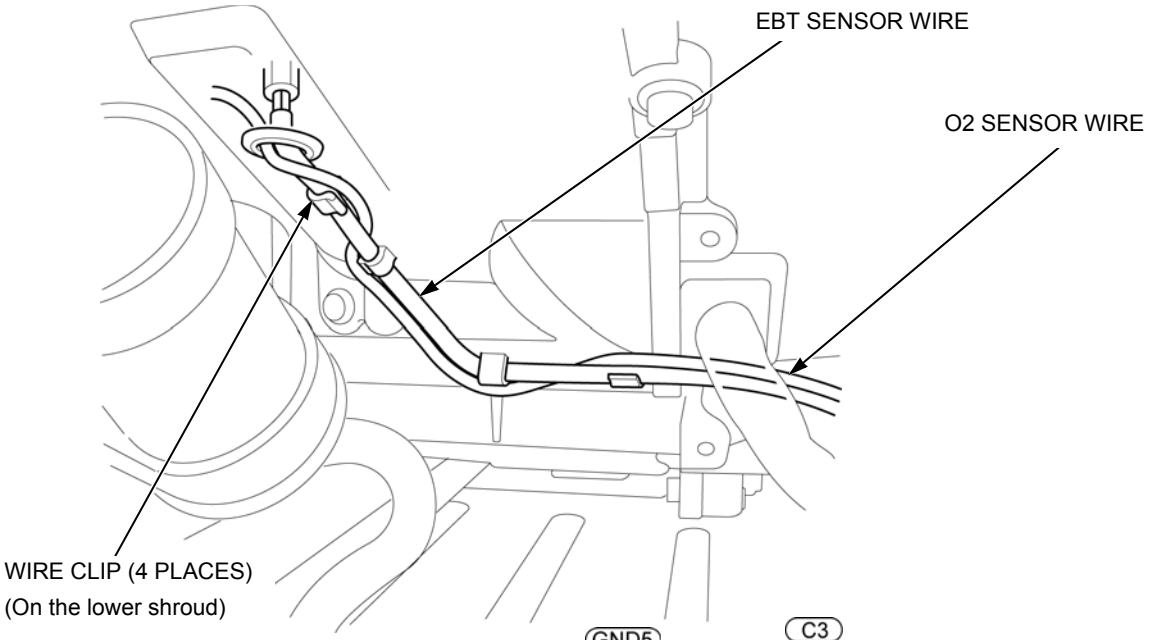


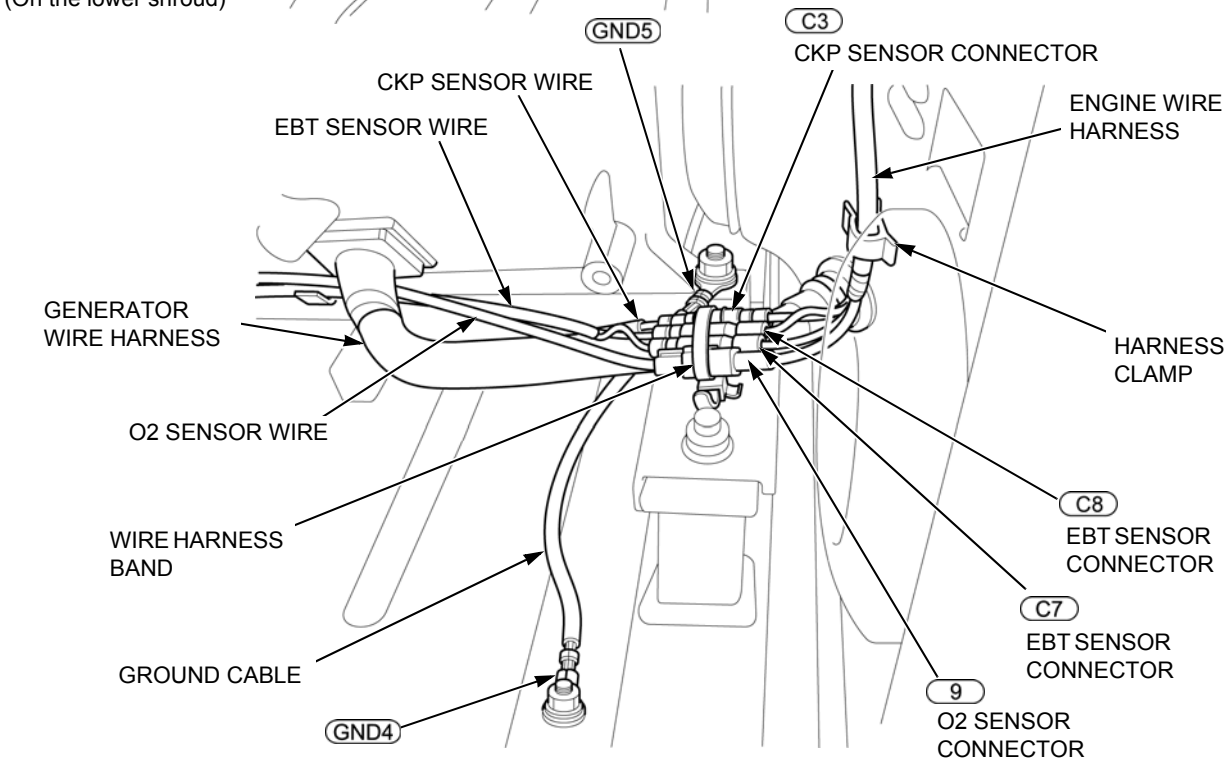
Engine wire harness side

Breather heater harness side

Terminal number	Wire color
1	R
2	R

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray





O2 sensor wire harness side

Terminal number	Wire color
1	Bl

Engine wire harness side

AT Type

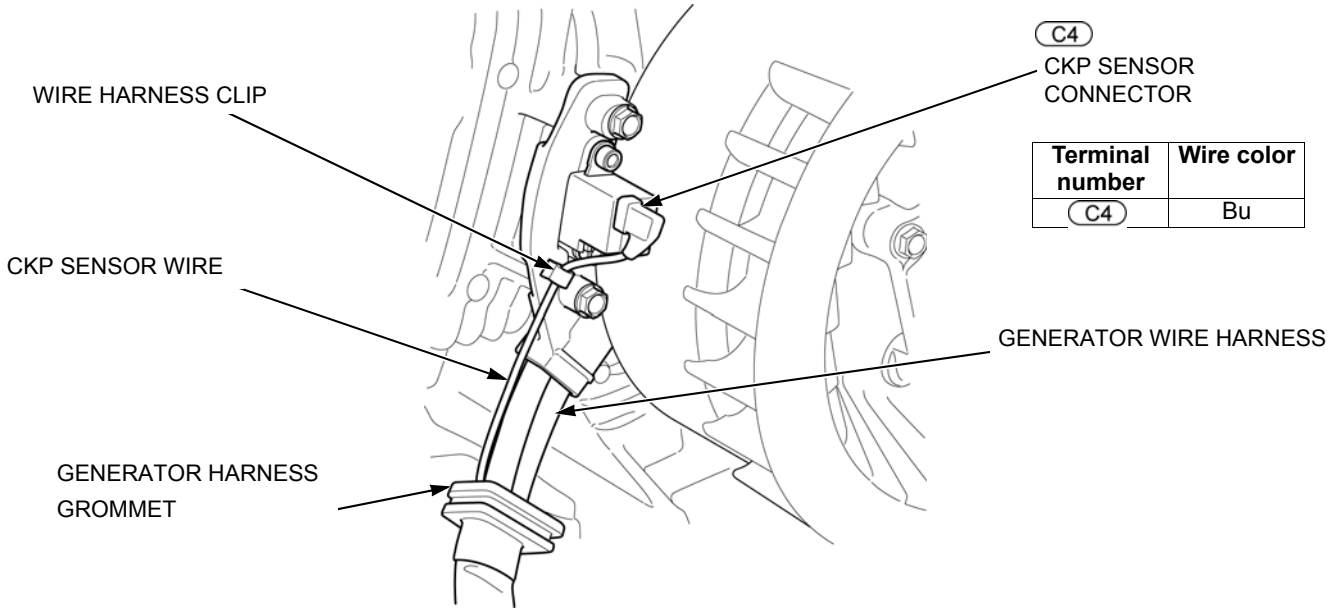
Terminal number	Wire color
GND4	Bl
GND5	Bl

CT Type

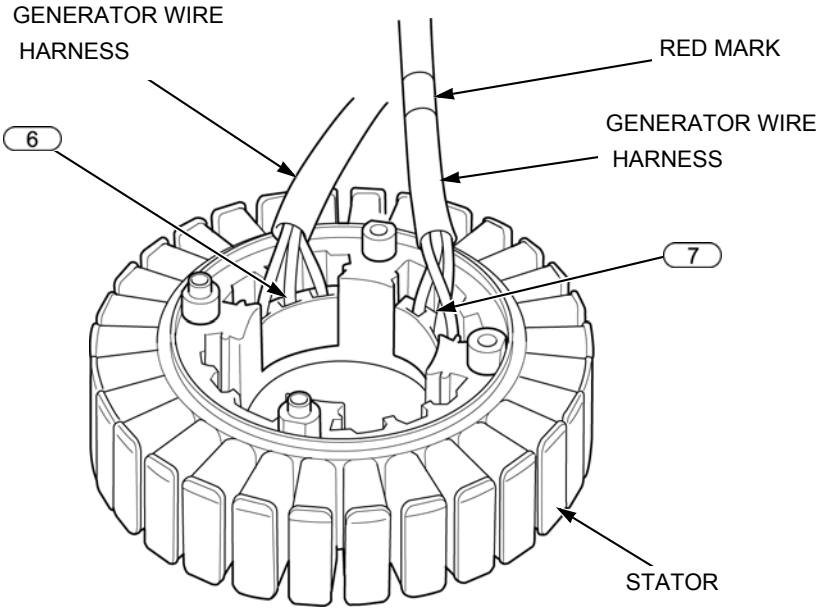
Terminal number	Wire color
GND4	G
GND5	G

Terminal number	Wire color
C3	Y/Bu
	Bu
C7	Y/R
	Bl
C8	Y/Bl
	Bl

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray



Terminal number	Wire color
C4	Bu



Generator wire harness side

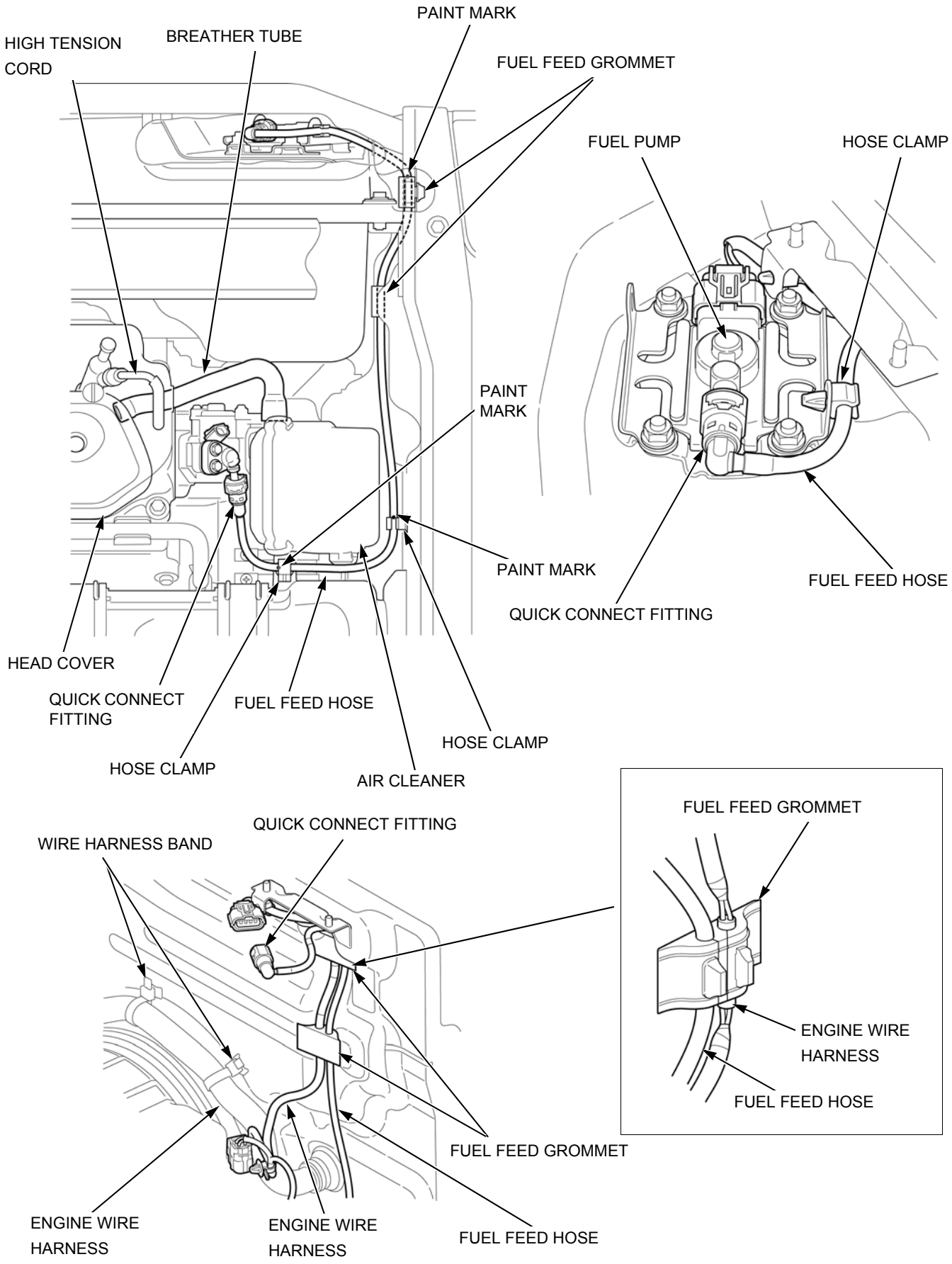
Terminal number	Wire color
1	Bu
2	W
3	R

Generator wire harness side

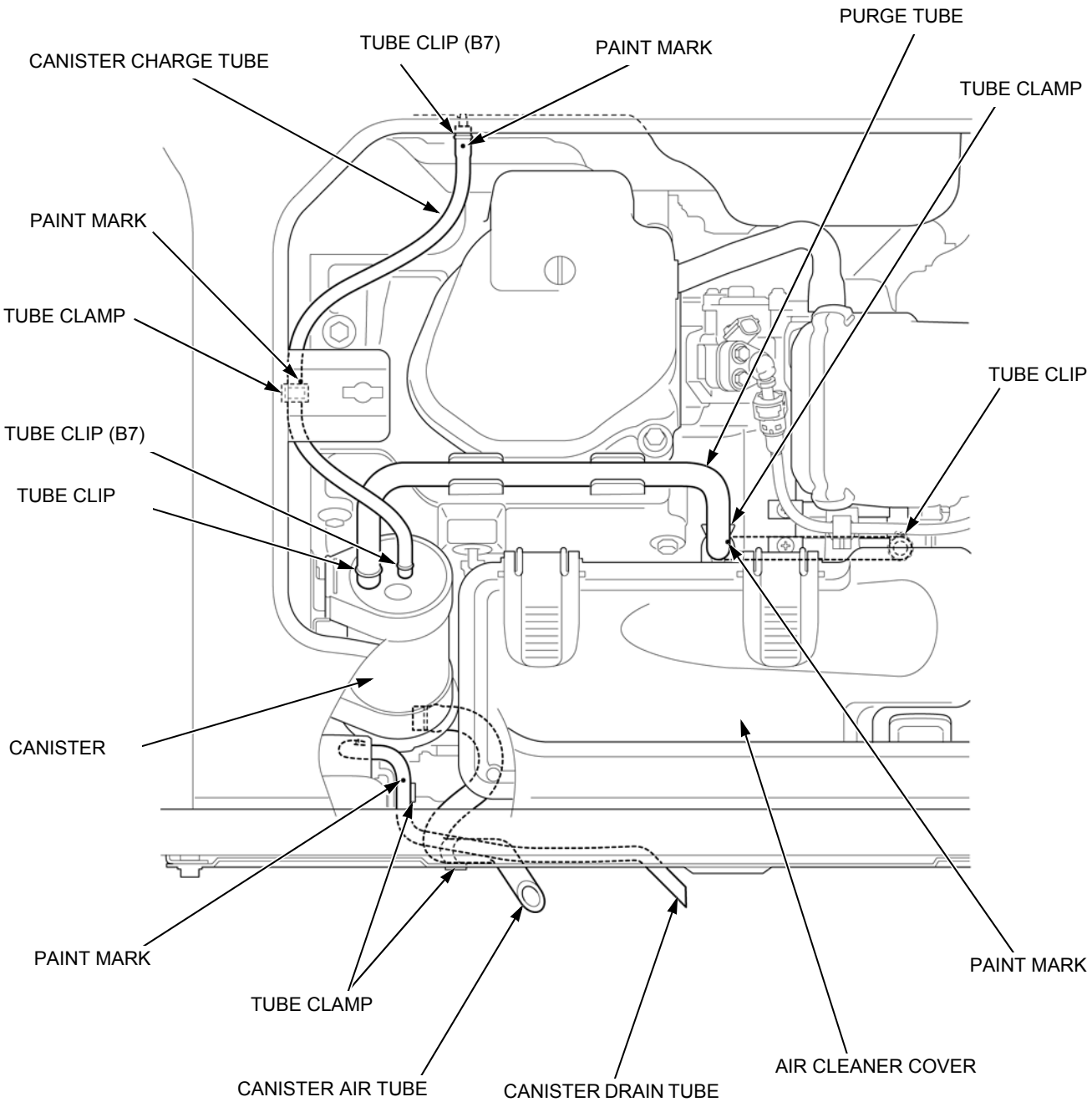
Terminal number	Wire color
1	Bu
2	W
3	R

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

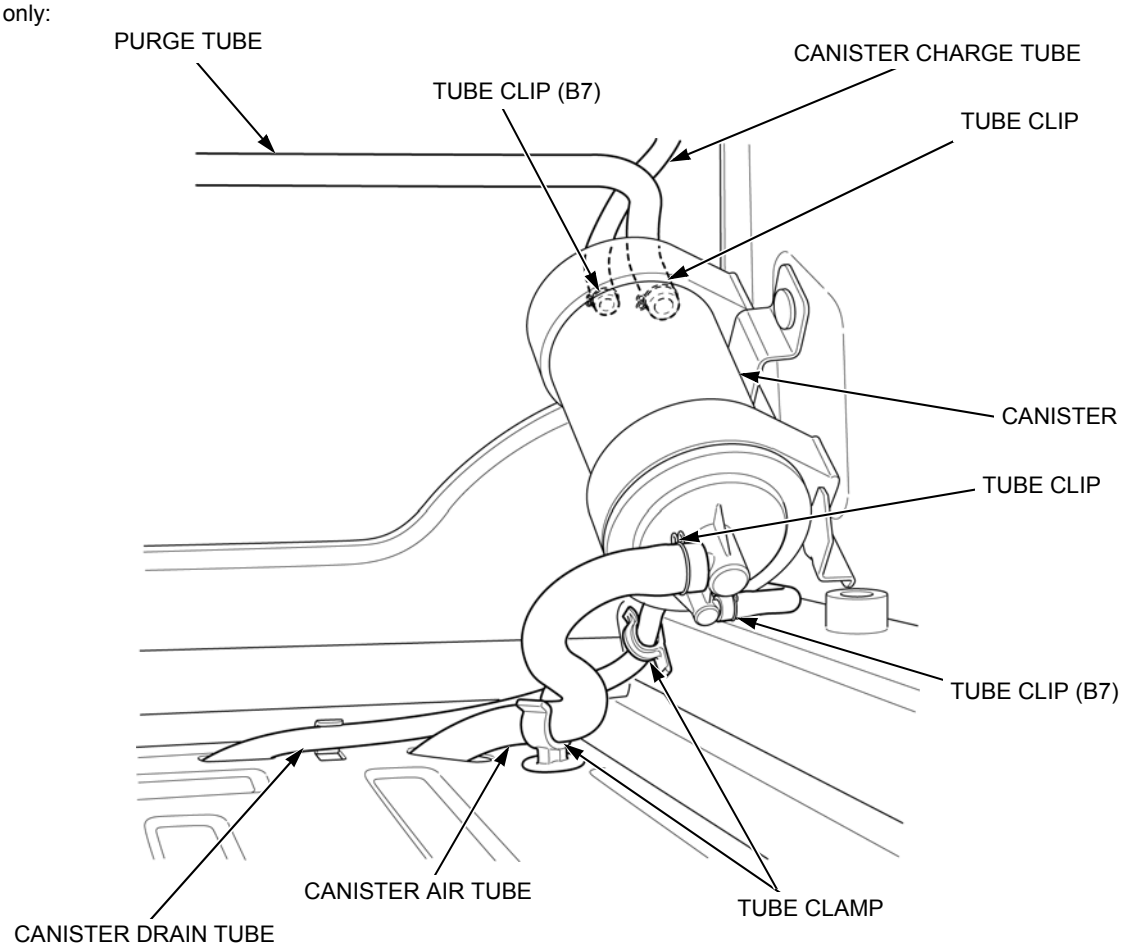
TUBE ROUTING



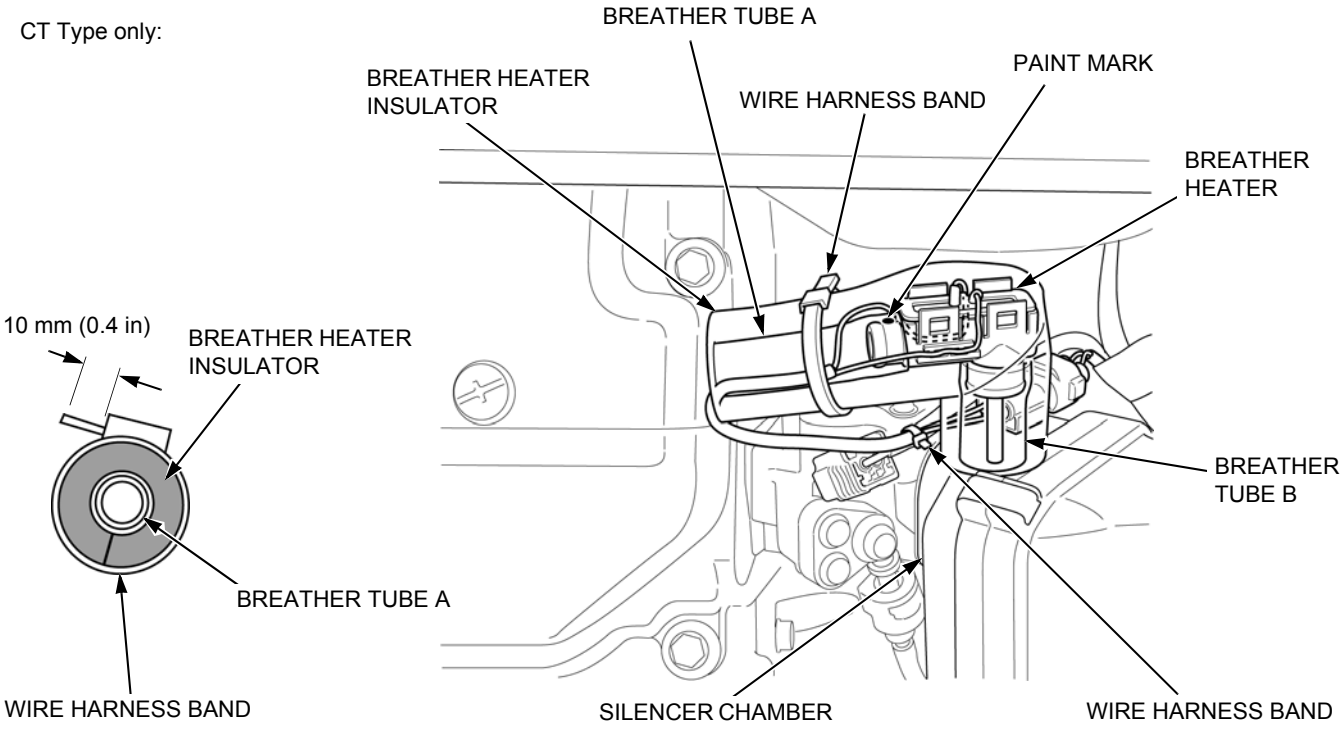
AT, AT1 Type only:



AT, AT1 Type only:



CT Type only:



MAINTENANCE SCHEDULE

AT, AT1 TYPE

ITEM	Perform at every indicated month or operating hour interval, whichever comes first.	REGULAR SERVICE PERIOD (2)					Refer to page
		Each use	First month or 20 hrs.	Every 3 months or 50 hrs.	Every 6 months or 100 hrs.	Every year or 300 hrs.	
Engine oil	Check level	○					3-4
	Change		○		○		3-5
Air cleaner	Check	○					3-6
	Clean			○ (1)			
	Replace					○ *	
GFCI operation (AT1 type only)	Check	○					3-7
Canister	Check	Every 2 years					3-7
Purge tube	Check	Every 2 years					
Charge tube	Check	Every 2 years					
Spark plug	Check–adjust				○		3-9
	Replace					○	
Spark arrester	Clean				○		3-10
Valve clearance	Check–adjust					○	3-10
Combustion chamber	Clean	After every 1,000 hrs.					3-12
Fuel tank	Clean	Every 2 years or 1,000 hrs					3-12
Fuel pump filter	Change	Every 2 years or 1,000 hrs					3-13
Fuel feed hose	Check	Every 2 years (Replace if necessary)					3-14

* Replace paper element type only.

(1) Service more frequently when used in dusty areas.

(2) For commercial use, log hours of operation to determine proper maintenance intervals.

- This generator is equipped with a catalytic converter. If the engine is not properly maintained, the catalyst in the muffler may lose effectiveness.

CT TYPE

ITEM	Perform at every indicated month or operating hour interval, whichever comes first.	REGULAR SERVICE PERIOD (2)						Refer to page
		Each use	First month or 20 hrs.	Every 10 hrs.	Every 3 months or 50 hrs.	Every 6 months or 100 hrs.	Every year or 300 hrs.	
Engine oil	Check level (Operation other than in winter)	○						3-4
	Check level (Operation in winter)	○		○ (3)				3-4
	Change		○			○		3-5
Air cleaner	Check	○						3-6
	Clean				○ (1)			
	Replace						○ *	
Spark plug	Check–adjust					○		3-9
	Replace						○	
Spark arrester	Clean					○		3-10
Valve clearance	Check–adjust						○	3-10
Combustion chamber	Clean	After every 1,000 hrs.						3-12
Fuel tank	Clean	Every 2 years or 1,000 hrs						3-12
Fuel pump filter	Change	Every 2 years or 1,000 hrs						3-13
Fuel feed hose	Check	Every 2 years (Replace if necessary)						3-14

* Replace paper element type only.

(1) Service more frequently when used in dusty areas.

(2) For commercial use, log hours of operation to determine proper maintenance intervals.

(3) If the machine is operated with a light load in a cold climate for a prolonged period, the engine oil may become mixed with gasoline causing engine seizure.
When using in cold district, check the oil level every 10 hours of operation, and change the oil if it flows out from the oil filler neck.

- This generator is equipped with a catalytic converter. If the engine is not properly maintained, the catalyst in the muffler may lose effectiveness.

ENGINE OIL LEVEL CHECK/CHANGE

CHECK

Place the generator on a level surface.

Open the right maintenance cover.

Remove the oil filler cap/dipstick [1], and check the oil level.
If it is below the upper limit [2], fill with the recommended oil to the upper limit of the oil filler neck. If the oil level is low, fill to the top of the oil filler neck with the recommended oil. Do not overfill.

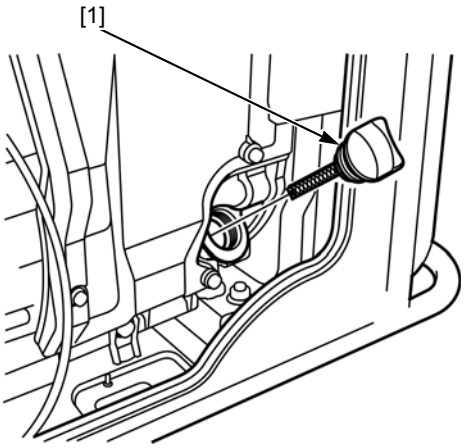
Oil is a major factor affecting performance and service life.

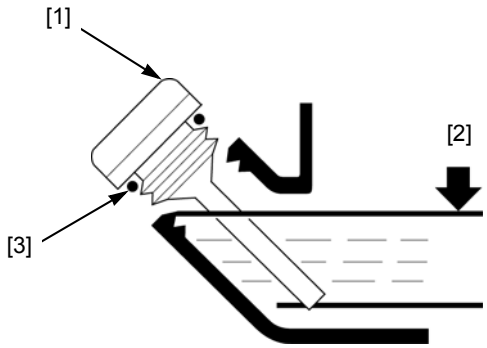
Use 4-stroke automotive detergent oil. 10W-30 is recommended for general use.
Other viscosities shown in the chart may be used when the average temperature in your area is within the recommended range.

Recommended oil:
SAE 10W-30 API service classification SJ or higher

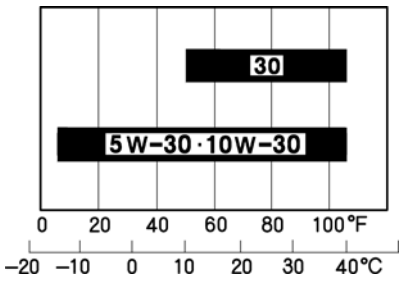
Check that the oil filler gasket [3] is in good condition; replace it if necessary.

Tighten the oil filler cap/dipstick securely, and close the right maintenance cover.





SAE VISCOSITY GRADES



AMBIENT TEMPERATURE

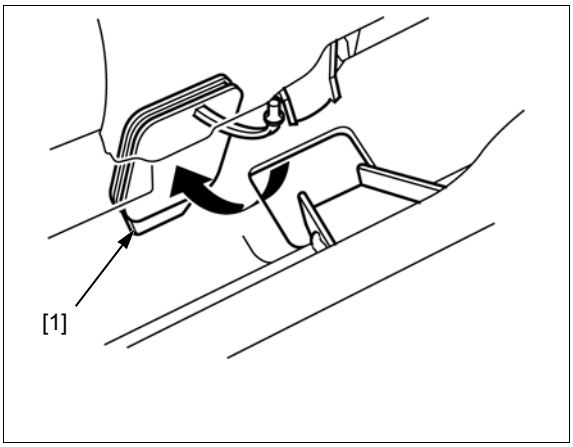
CHANGE

Drain the used engine oil while the engine is warm. Warm oil drains quickly and completely.

Place the generator on a level surface and stop the engine.

Open the right maintenance cover.

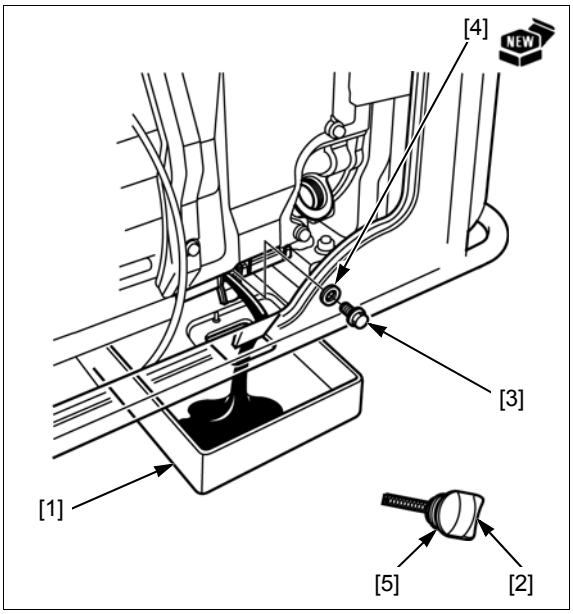
Push the drain hole rubber cover [1] out from the bottom plate.



Place a suitable container [1] under the oil drain bolt.

Remove the oil filler cap/dipstick [2], drain bolt [3], and sealing washer [4]. Drain the oil into the suitable container.

Dispose of the used engine oil in a manner that is compatible with the environment. We suggest you take the used oil in a sealed container to your local recycling center or service station for reclamation. Do not throw it in the trash, pour it on the ground, or pour it down a drain.



⚠ CAUTION

Used engine oil contains substances that have been identified as carcinogenic. If repeatedly left in contact with the skin for prolonged periods, it may cause skin cancer. Wash your hands thoroughly with soap and water as soon as possible after contact with used engine oil.

Install the drain bolt and new sealing washer, and tighten the drain bolt to the specified torque.

TORQUE: 22.5 N·m (2.3 kgf·m, 17 lbf·ft)

With the generator on a level surface, fill with the recommended oil to the top of the oil filler neck.

Engine oil capacity:
1.1 Liter (1.16 US qt, 0.97 Imp qt)

Check that the oil filler gasket [5] is in good condition; replace it if necessary.

Tighten the oil filler cap/dipstick securely.

Clean the oil drain guide and install the oil drain hole rubber cover.

Close the right maintenance cover.

AIR CLEANER CHECK/CLEANING/ REPLACEMENT

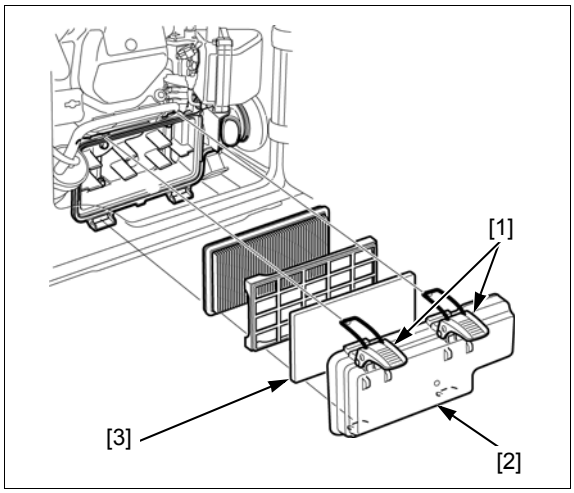
- A dirty air cleaner will restrict air flow to the throttle body, reducing engine performance. If the engine is operated in dusty areas, clean the air cleaner more often than specified in the MAINTENANCE SCHEDULE.

NOTICE

- *Operating the engine without an air filter element or with a damaged air filter element will allow dirt to enter the engine, causing rapid engine wear.*

Open the left maintenance cover.

Open the air cleaner cover lever [1] and remove the air cleaner cover [2] and foam element [3].



Clean the foam element in warm soapy water [1], rinse, and allow to dry thoroughly, or clean with a high flash point solvent and allow to dry.

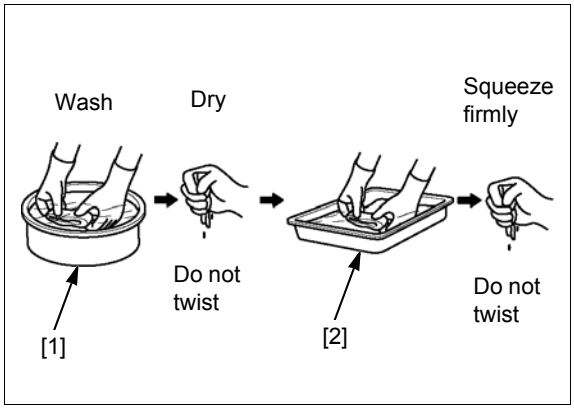
Dip the element in clean engine oil [2] and squeeze out the excess oil.

NOTE:

- Excess oil will restrict air flow through the foam element and may cause the engine to smoke at startup.

NOTICE

- *Do not twist the foam element to remove the excess oil. Twisting the element can damage it.*



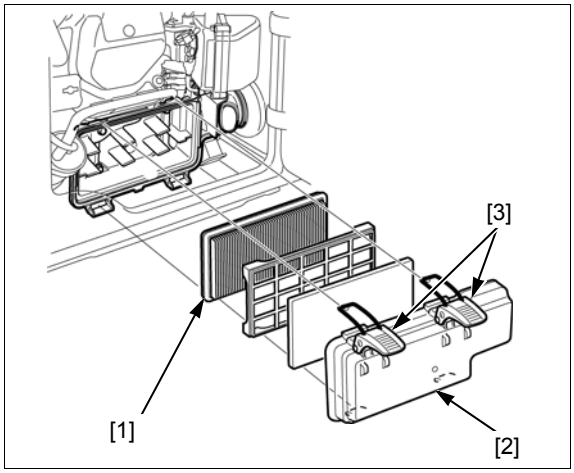
Install the foam element in the air cleaner cover.

Inspect the paper element [1]. If the paper element is dirty or damaged, replace it with a new one.

Remove any dirt from the inside of the air cleaner cover [2] using a moist clean rag. Be careful to prevent dirt from entering the air duct that leads to the throttle body.

Install the air cleaner cover [2] and latch the air cleaner cover levers [3] securely.

Close and latch the left maintenance cover.



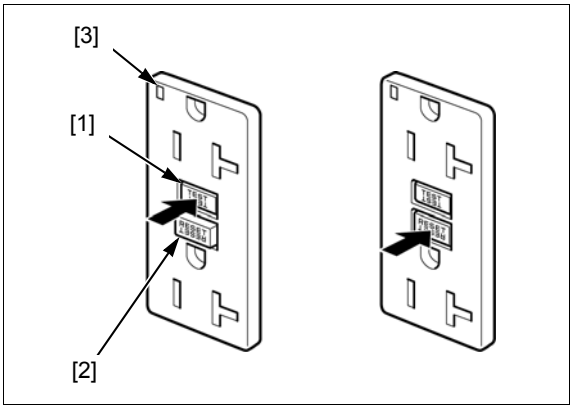
GFCI OPERATION (AT1 TYPE ONLY)

1. Unplug all tools and appliances from the generator.
2. Start the engine.
3. Make sure that the circuit protector is ON.
4. Press the TEST button [1]:

- The RESET button [2] should extend.
- If the GFCI does not function as described, replace the GFCI receptacle [3].

5. Press the RESET button:

- The RESET button should be flush with the base.
- If the RESET button is not flush with the TEST button, replace the GFCI receptacle.



LED operation:

- If there is no fault current, the LED is lit.
- If there is a fault current or you press the GFCI TEST button, the LED goes out.
- If the GFCI is faulty, the LED does not come on. Replace the GFCI receptacle.

EVAP CANISTER/EVAP CHARGE TUBE/EVAP PURGE TUBE INSPECTION (AT, AT1 TYPE ONLY)

NOTE:

- Perform this inspection while the engine is stopped.
- Before inspection, check the EVAP canister charge tube and EVAP canister purge tube for deterioration or damage.

EVAP CANISTER CHARGE TUBE INSPECTION

Remove the fuel filler cap.

Open the left maintenance cover.

Disconnect the EVAP canister charge tube [1] from the EVAP canister.

Connect a commercially available hand-operated vacuum pump [2] to the EVAP canister charge tube.

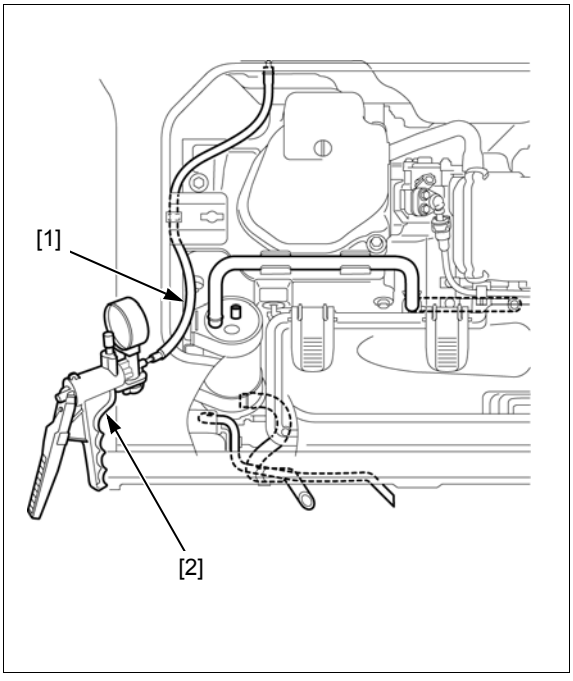
Operate the vacuum pump and be sure that there is airflow between the fuel tank and the EVAP canister charge tube.

If there is no airflow, check the EVAP canister charge tube.

Connect the EVAP canister charge tube to the EVAP canister.

NOTE:

- Route the charge tube properly (page 2-24).



EVAP CANISTER PURGE TUBE INSPECTION

Open the left maintenance cover.

Disconnect the EVAP canister purge tube [1] from the EVAP canister.

Connect a commercially available hand-operated vacuum pump [2] to the EVAP canister purge tube.

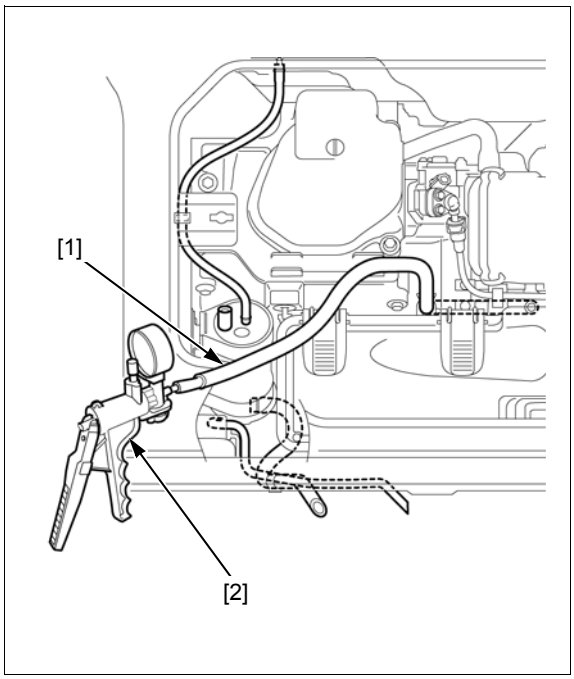
Operate the vacuum pump and be sure that there is airflow between the air cleaner and the EVAP canister purge tube.

If there is no airflow, check the EVAP canister purge tube.

Connect the EVAP canister purge tube to the EVAP canister.

NOTE:

- Route the purge tube properly (page 2-24).



EVAP CANISTER ASSEMBLY INSPECTION

Open the left maintenance cover.

Remove the EVAP canister [1].

Check the EVAP canister for damage or deformations, and replace it if necessary.

Check the EVAP canister drain pipe [2] and EVAP canister air tube [3] for restrictions, and clean them if necessary.

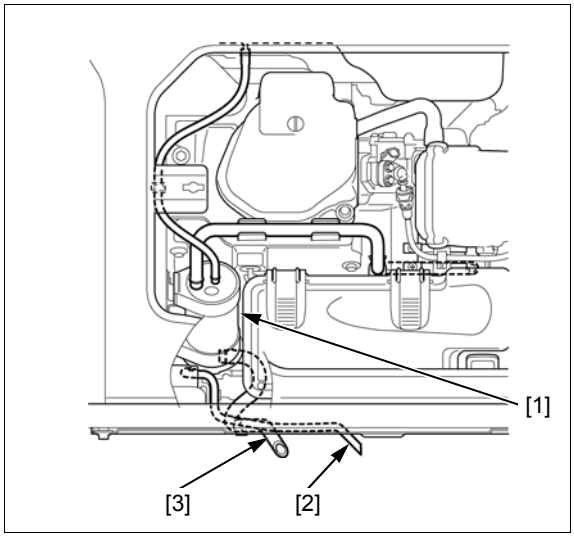
NOTICE

- *Do not use compressed air to clean the EVAP canister assembly, or it may be damaged.*

Install the EVAP canister.

NOTE:

- Route the EVAP canister drain pipe and EVAP canister air tube properly (page 2-24).



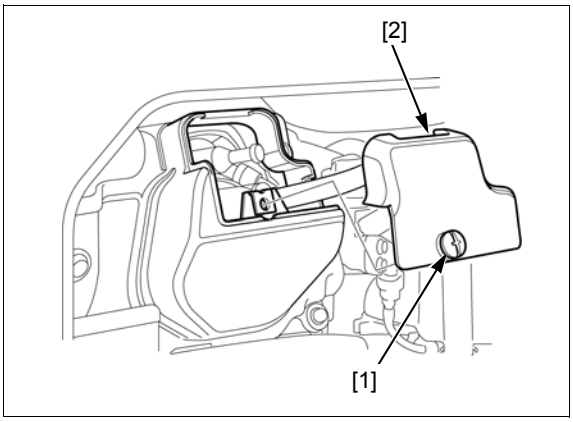
SPARK PLUG CHECK/ADJUSTMENT/ REPLACEMENT

⚠ CAUTION

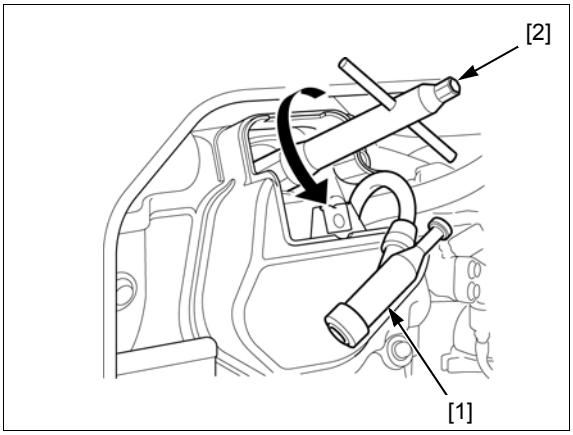
If the engine has been running, the engine will be very hot. Allow it to cool before proceeding.

Open the left maintenance cover.

Loosen the plug cover bolt [1] and remove the plug cover [2].



Remove the spark plug cap [1], and remove the spark plug using a spark plug wrench [2].



Visually inspect the spark plug. Discard the plug if the insulator is cracked, chipped, or heavily fouled.

SPARK PLUG: BPR6ES (NGK)

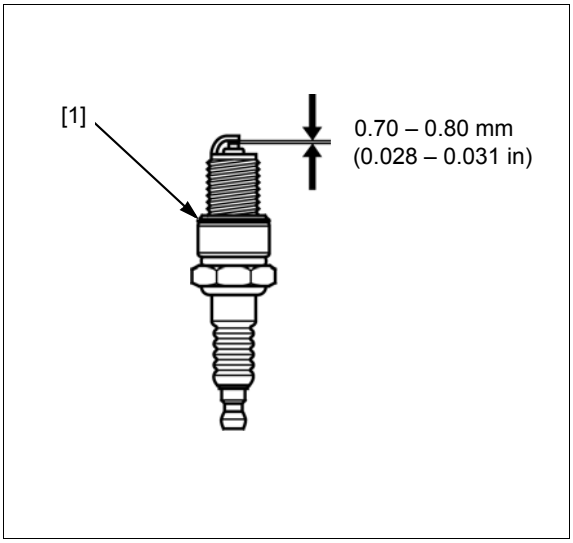
Check the sealing washer for damage. Replace the spark plug if the sealing washer [1] is damaged.

Measure the plug gap with a wire-type feeler gauge. If the measurement is out of specification, adjust by bending the side electrode.

PLUG GAP: 0.70 – 0.80 mm (0.028 – 0.031 in)

Install the spark plug finger tight to seat the washer, and then tighten with a plug wrench to the specified torque.

TORQUE: 18 N·m (1.8 kgf·m, 13 lbf·ft)



NOTICE

- *A loose spark plug can become very hot and can damage the engine. Overtightening can damage the threads in the cylinder head.*

Install the plug cap and plug cover.

SPARK ARRESTER CLEANING

⚠CAUTION

The engine and muffler becomes very hot during operation and they remain hot for a while after operation. Be sure that the engine is cool before servicing the spark arrester.

Remove the two screws [1], tail pipe [2], and spark arrester [3] from the muffler.

Clean the carbon deposits from the spark arrester screen with a wire brush.

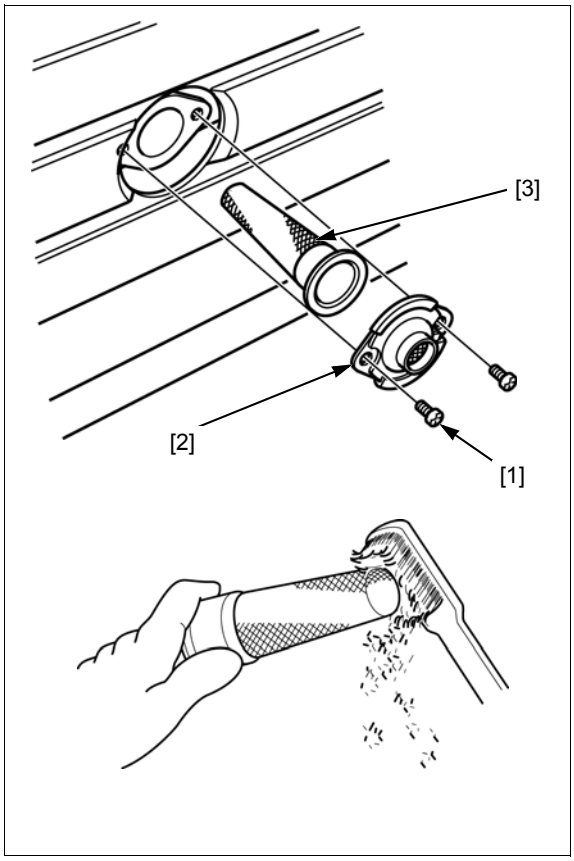
NOTICE

- *Be careful to avoid damaging the screen.*

Check the spark arrester screen for damage. Replace the spark arrester if it is damaged.

Clean the tail pipe screen to remove carbon deposits. Install the spark arrester and tail pipe, and then tighten the two screws to the specified torque.

TORQUE: 3.5 N·m (0.36 kgf·m, 2.6 lbf·ft)



VALVE CLEARANCE CHECK/ ADJUSTMENT

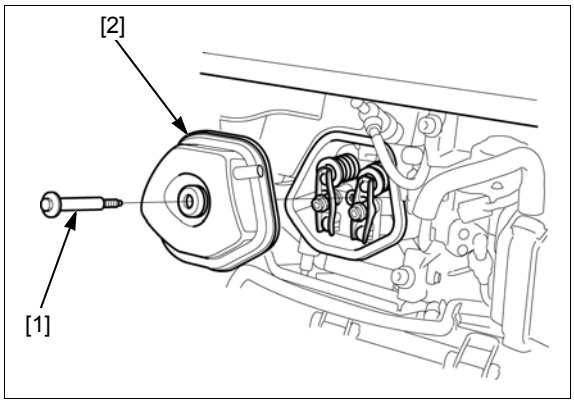
NOTICE

- *Valve clearance inspection and adjustment must be performed when the engine is cold.*

Open the left and right maintenance covers.

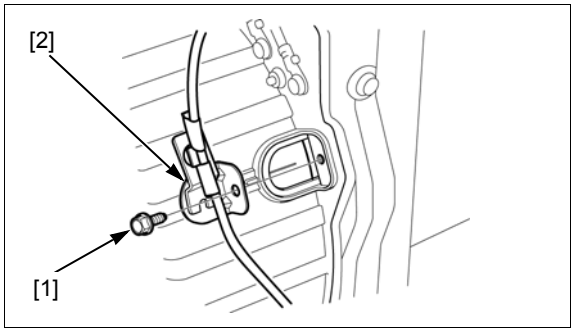
Remove the head cover shroud (page 5-7).

Remove the head cover bolt [1] and cylinder head cover [2].

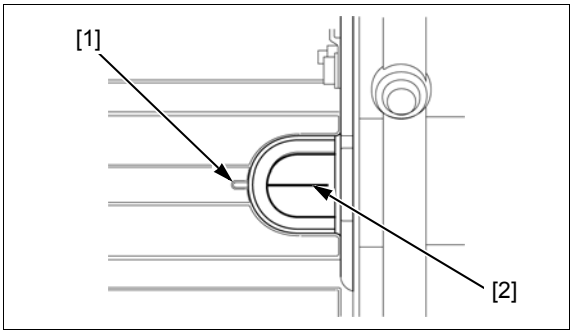


Remove the bolt [1] and slide off the timing inspection hole cover [2].

Turn the crankshaft by pulling the recoil starter gently and set the piston at top dead center of the compression stroke (both valves fully closed).



The TDC mark [1] on the rotor will align with the timing mark [2] on the fan cover when the piston is at top dead center of the compression stroke.



Insert a feeler gauge [1] between the rocker arm [2] and valve [3] to measure valve clearance.

VALVE CLEARANCE:
IN: 0.15 ± 0.02 mm (0.006 ± 0.001 in)
EX: 0.20 ± 0.02 mm (0.008 ± 0.001 in)

If adjustment is necessary, proceed as follows:

Hold the rocker arm pivot [4] and loosen the rocker arm pivot lock nut [5].

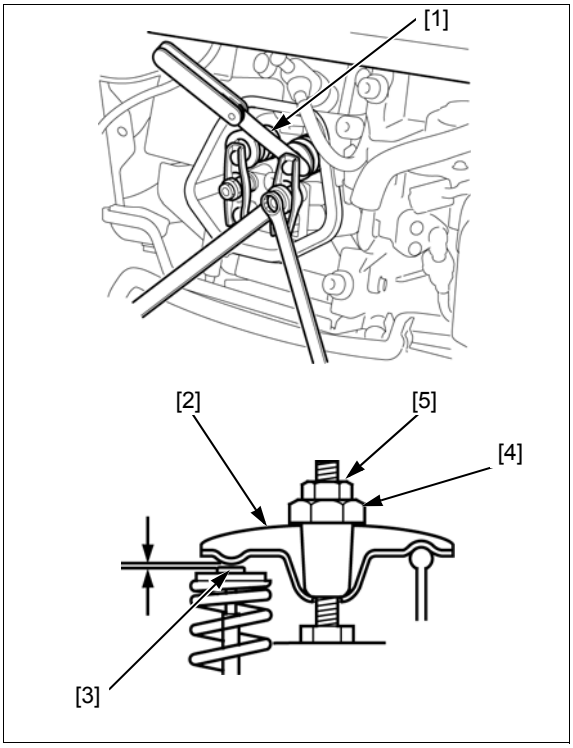
Turn the rocker arm pivot to obtain the specified clearance.

Tighten the rocker arm pivot lock nut while holding the rocker arm pivot.

TORQUE: 10 N·m (1.0 kgf·m, 7 lbf·ft)

Recheck the valve clearance after tightening the rocker arm pivot lock nut.

After adjustment, reinstall the removed parts in the reverse order of removal.

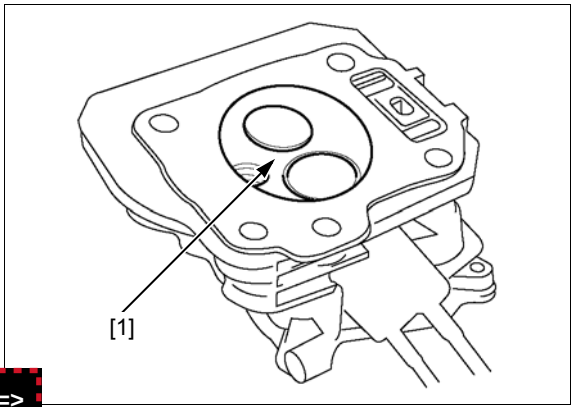


COMBUSTION CHAMBER CLEANING

Remove the cylinder head (page 13-3).

Clean any carbon deposits from the combustion chamber [1].

After cleaning, reinstall the removed parts in the reverse order of removal.



SERVICE BULLETIN #55 =>

FUEL TANK CLEANING

⚠WARNING

Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

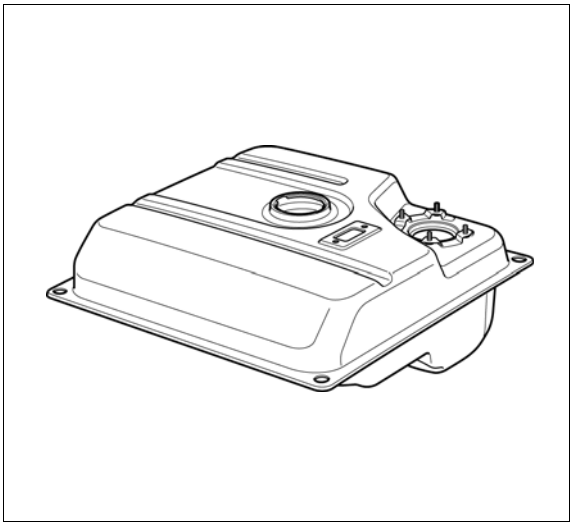
Disassemble the fuel tank (page 6-11).

Drain the fuel into a suitable container.

Clean the fuel tank with a non-flammable solvent, and allow it to dry thoroughly.

Assemble the fuel tank.

Install the fuel tank (page 6-10) and check the fuel tank for any sign of fuel leakage.



FUEL PUMP FILTER CHANGE

SERVICE BULLETIN #55 =>

⚠WARNING

Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- Replace the fuel filter in accordance with the maintenance schedule (page 3-2).

Remove the fuel pump (page 6-9).

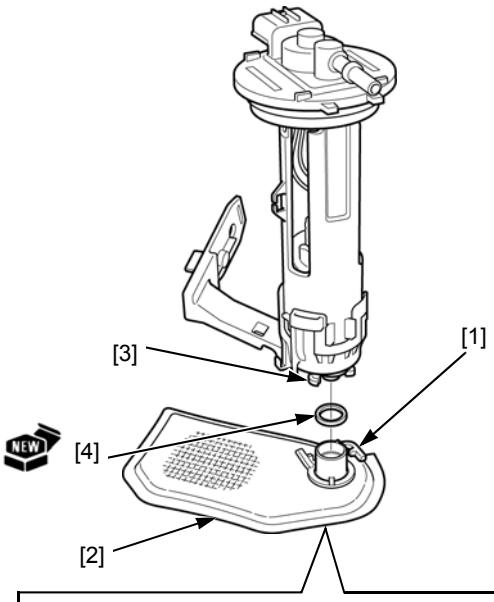
Release the hooks [1] of the fuel filter [2] from the stoppers [3] by slightly spreading the hooks, and then turn the filter clockwise.
Pull the filter off of the fuel pump.

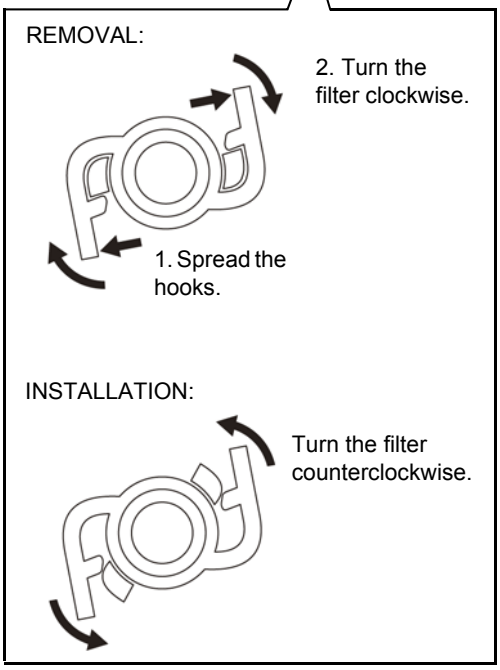
Remove the O-ring [4].

Install a new O-ring and then install a new filter in the correct direction so that the triangle marks on the filter and fuel pump body will be aligned when it is attached.

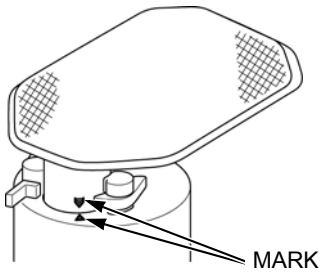
Turn the filter counterclockwise until the hooks are completely secured by the stoppers, being careful not to damage them.

Install the fuel pump (page 6-9).





Align the marks of the fuel filter shown.



FUEL FEED HOSE CHECK

⚠WARNING

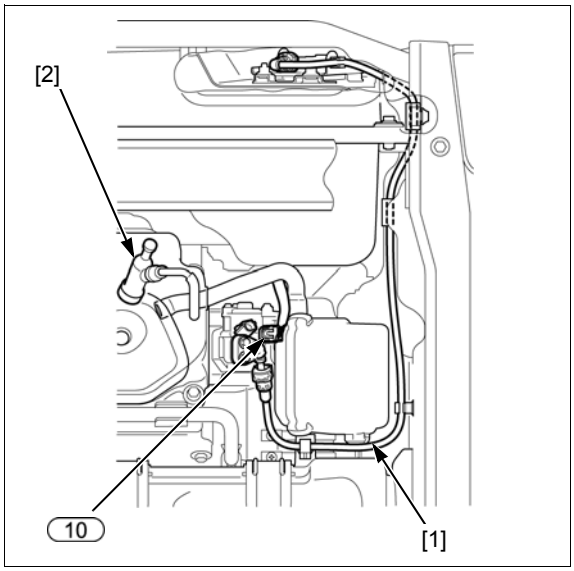
Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

Check the fuel feed hose [1] for deterioration, cracks, or signs of leakage.

Disconnect the spark plug cap [2] and fuel injector 2P connector (10).

Turn the main switch ON and push the starter switch to operate the fuel pump and check for fuel leakage.

Replace the fuel feed hose if there is damage, fuel leakage, corrosion, etc.



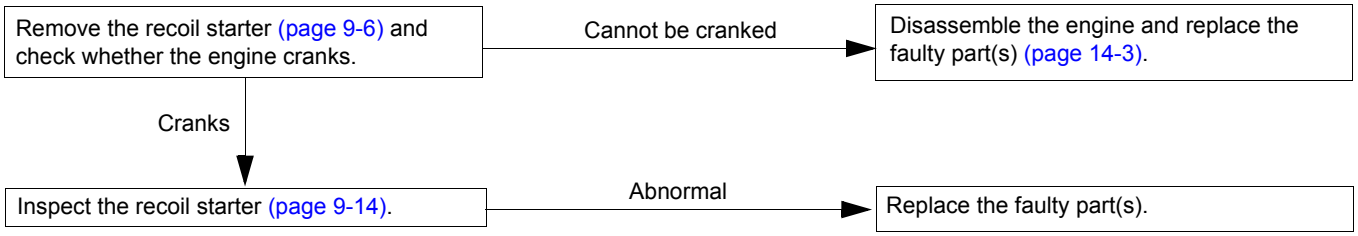
4. TROUBLESHOOTING

ENGINE STANDARD TROUBLESHOOTING

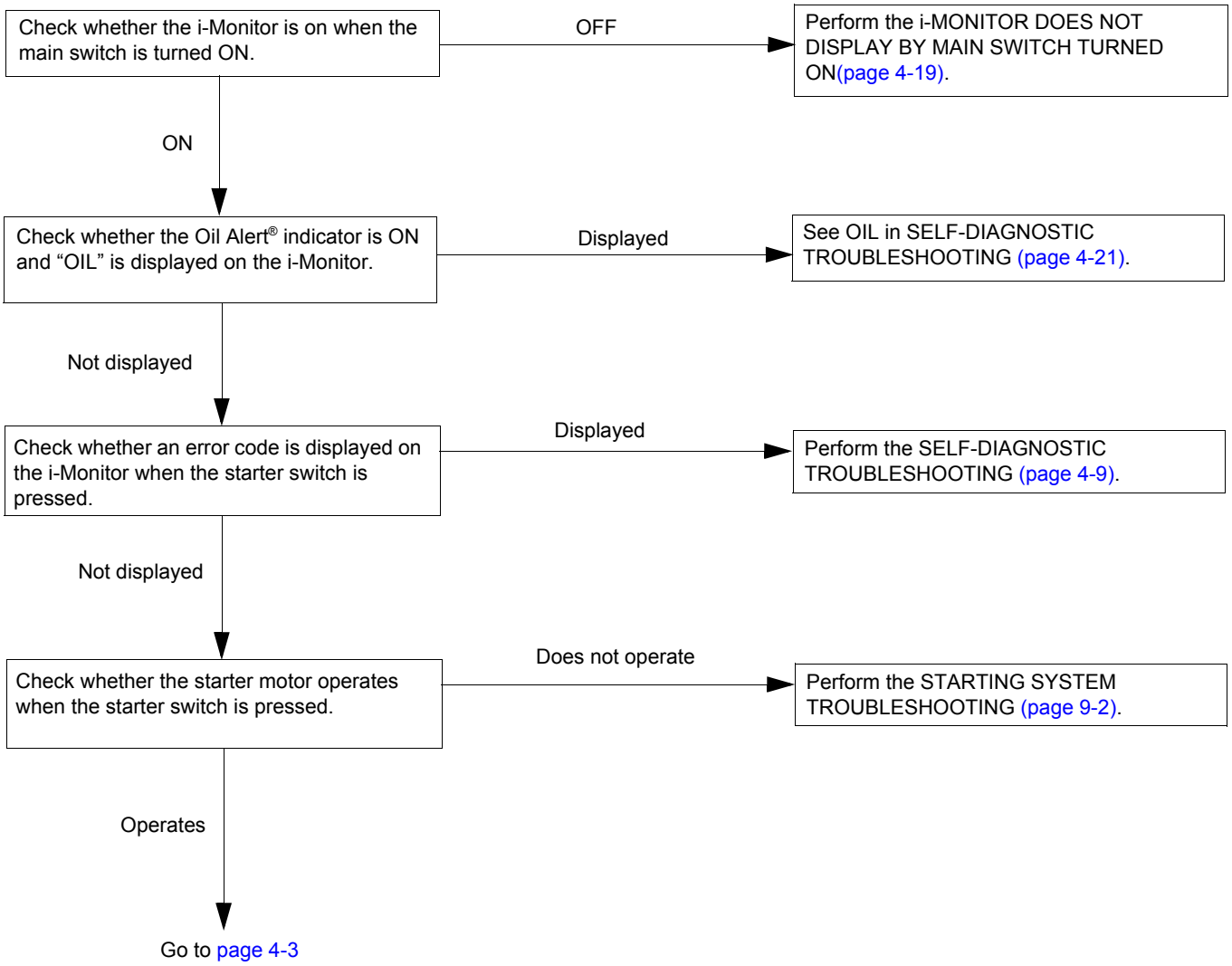
- Use a known-good battery for troubleshooting.
- Check that the connectors are connected securely.
- Check for sufficient fresh fuel in the fuel tank.
- Read the circuit tester's operation instructions carefully, and observe the instructions during inspection.

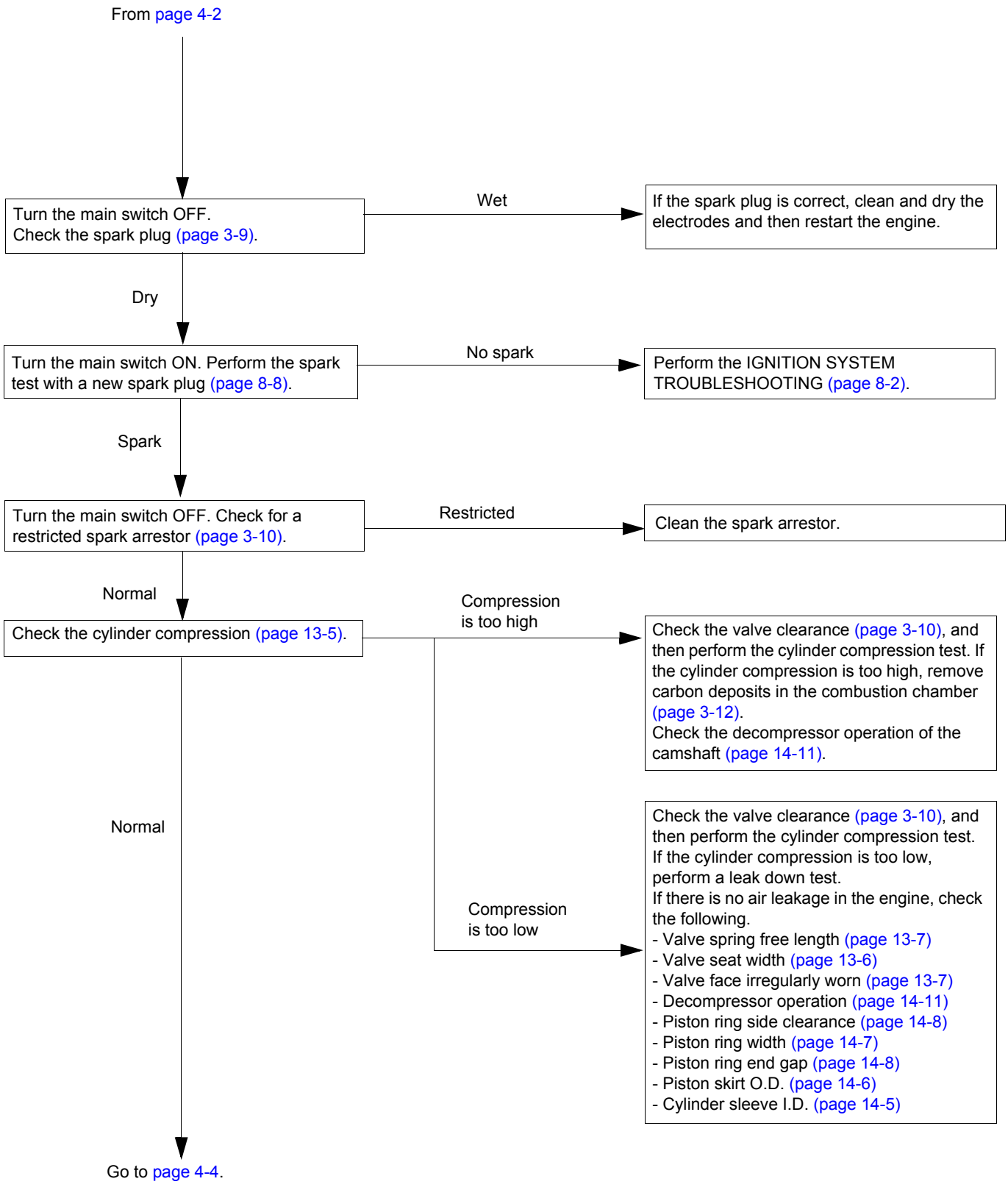
ENGINE DOES NOT CRANK AT THE RECOIL STARTER

SERVICE BULLETIN #55 =>



ENGINE CRANKS BUT WON'T START




From page 4-2
Turn the main switch OFF.
Check the spark plug (page 3-9).
Wet
If the spark plug is correct, clean and dry the electrodes and then restart the engine.
Dry
Turn the main switch ON. Perform the spark test with a new spark plug (page 8-8).
No spark
Perform the IGNITION SYSTEM TROUBLESHOOTING (page 8-2).
Spark
Turn the main switch OFF. Check for a restricted spark arrestor (page 3-10).
Restricted
Clean the spark arrestor.
Normal
Check the cylinder compression (page 13-5).
Compression is too high
Check the valve clearance (page 3-10), and then perform the cylinder compression test. If the cylinder compression is too high, remove carbon deposits in the combustion chamber (page 3-12).
Check the decompressor operation of the camshaft (page 14-11).
Normal
Compression is too low
Check the valve clearance (page 3-10), and then perform the cylinder compression test.
If the cylinder compression is too low, perform a leak down test.
If there is no air leakage in the engine, check the following.
- Valve spring free length (page 13-7)
- Valve seat width (page 13-6)
- Valve face irregularly worn (page 13-7)
- Decompressor operation (page 14-11)
- Piston ring side clearance (page 14-8)
- Piston ring width (page 14-7)
- Piston ring end gap (page 14-8)
- Piston skirt O.D. (page 14-6)
- Cylinder sleeve I.D. (page 14-5)
Go to page 4-4.

From page 4-3

Check the fuel flow (page 6-20).

Abnormal

- Check the fuel pump circuit (page 6-2).
- Check whether the fuel feed hose is leaking.
- Check whether the fuel feed hose is pinched or clogged.
- Check whether the fuel tank cap breather is pinched or clogged.
- Check whether the fuel pump filter is clogged.
- Replace the fuel pump.

Normal

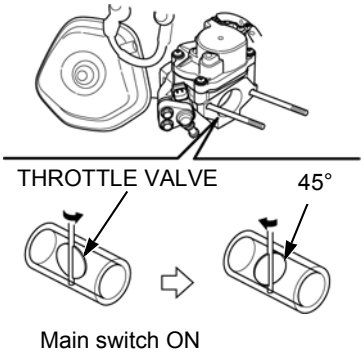
Check the fuel pressure (page 6-20).

Abnormal

- Check whether the fuel pump filter is clogged.
- Check whether the fuel feed hose is pinched or clogged.
- Replace the fuel pump.

Normal

Turn the main switch OFF.
Disconnect the fuel injector 2P connector and spark plug cap.
Check whether the throttle valve position changes from fully open to half open when the main switch is ON and the starter switch is pressed.



Abnormal

Check the throttle control motor (page 6-21).

Normal

Turn the main switch OFF.
Check the fuel injector system (page 6-4).

Abnormal

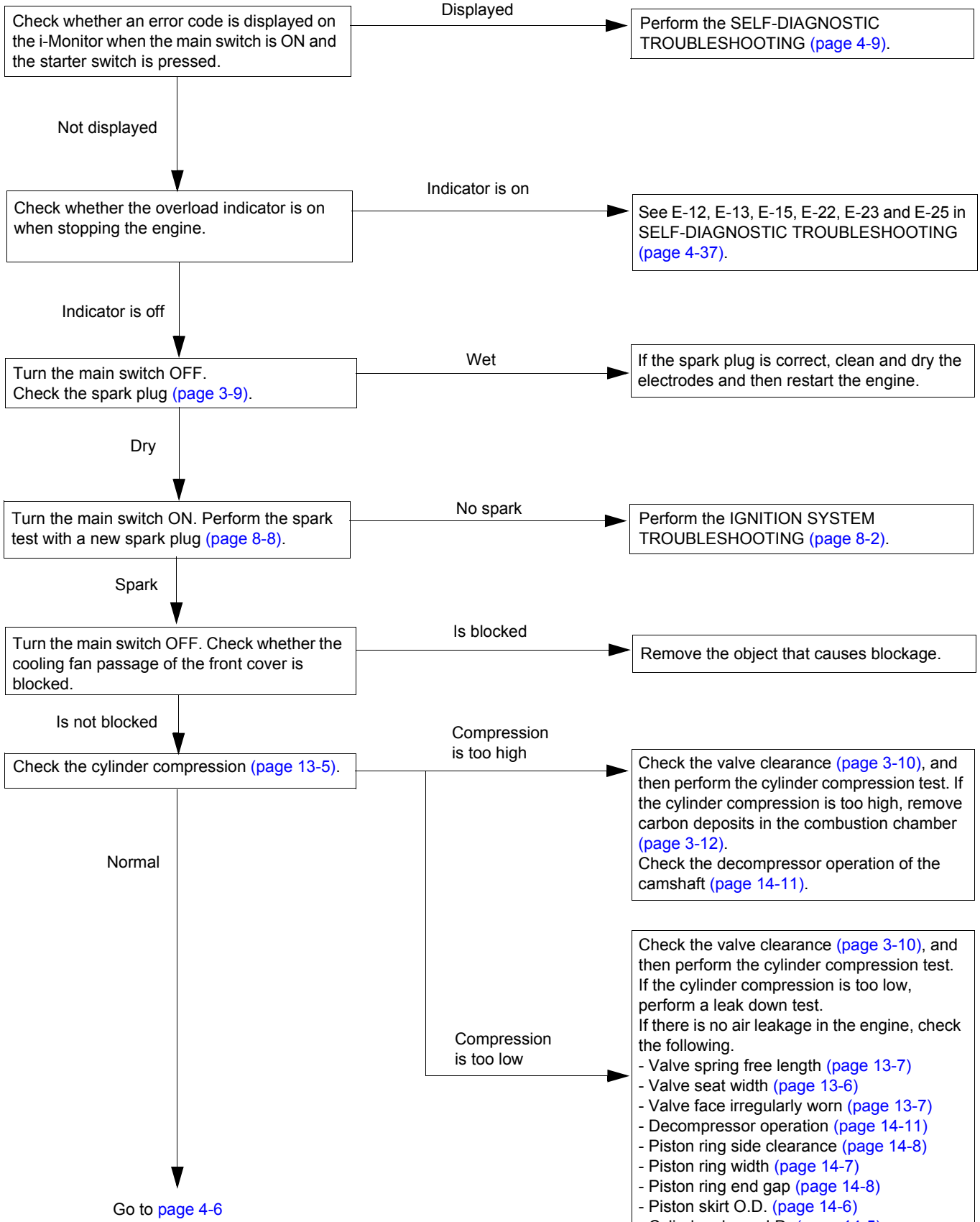
- Replace or repair the fuel injector circuit
- Replace the fuel injector

Normal

Replace the GCU and recheck.

ENGINE STARTS BUT THEN STALLS

SERVICE BULLETIN #55 =>



From page 4-5

Check the fuel flow (page 6-20).

Abnormal

- Check whether the fuel feed hose is leaking.
- Check whether the fuel feed hose is pinched or clogged.
- Check whether the fuel tank cap breather is pinched or clogged.
- Check whether the fuel pump filter is clogged.
- Replace the fuel pump.

Normal

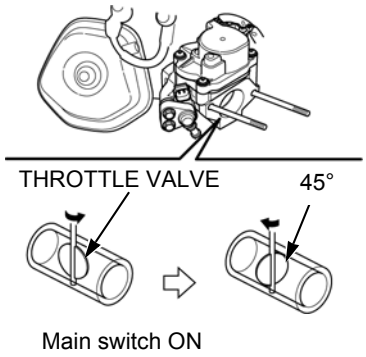
Check the fuel pressure (page 6-20)

Abnormal

- Check whether the fuel pump filter is clogged.
- Check whether the fuel feed hose is pinched or clogged.
- Replace the fuel pump.

Normal

Turn the main switch OFF.
Disconnect the fuel injector 2P connector and spark plug cap.
Check whether the throttle valve position changes from fully open to half open when the main switch is ON and the starter switch is pressed.



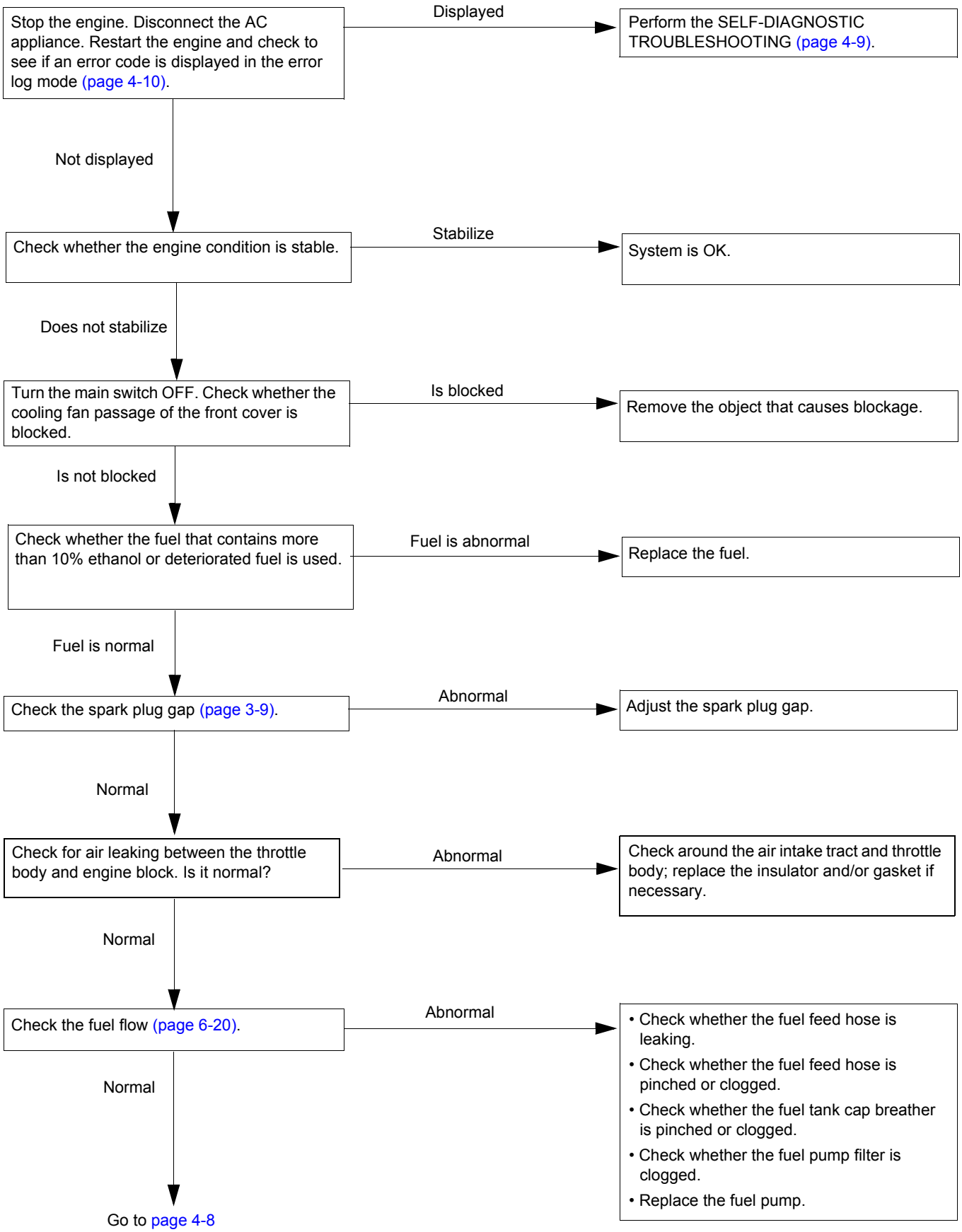
Abnormal

Check the throttle control motor (page 6-21).

Normal

Turn the main switch OFF.
Replace the GCU and recheck.

ENGINE SPEED DOES NOT STABILIZE



From page 4-7

Check the fuel pressure (page 6-20).

Abnormal

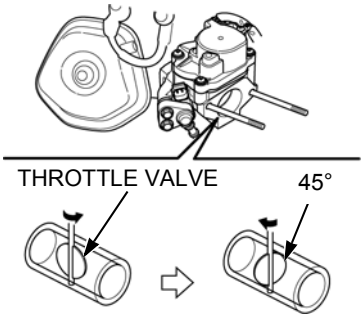
- Check whether the fuel pump filter is clogged.
- Check whether the fuel feed hose is pinched or clogged.
- Replace the fuel pump.

Normal

Turn the main switch OFF.
Disconnect the fuel injector 2P connector and spark plug cap.
Check whether the throttle valve position changes from fully open to half open when the main switch is ON and the starter switch is pressed.

Abnormal

Check the throttle control motor (page 6-21).



Normal

Turn the main switch OFF.
Replace the fuel injector (page 6-15).
Turn the main switch ON. Start the engine and check whether the engine condition is stable.

Stabilize

Faulty original fuel injector.

Does not stabilize

Replace the O2 sensor (page 6-18).
Start the engine and check whether the engine condition is stable.

Stabilize

Faulty original O2 sensor.

Does not stabilize

Turn the main switch OFF.
Check for loose or poor contact on the fuel injector 2P connector, throttle control motor 4P connector and GCU 34P connector.
Repair or replace if necessary.
Turn the main switch ON. Start the engine and check whether the engine condition is stable.

Stabilize

Faulty connector connection.

Does not stabilize

Turn the main switch OFF.
Replace the GCU and recheck.

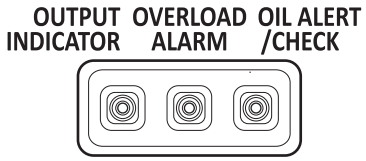
SELF-DIAGNOSTIC TROUBLESHOOTING

SELF-DIAGNOSTIC FUNCTION

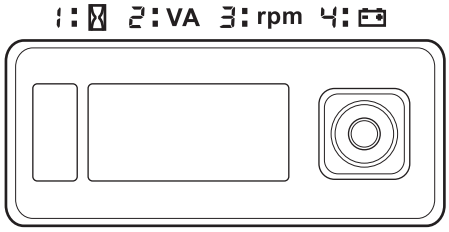
The generator control unit (GCU) has a self-diagnosis function.

When it detects a fault, it notifies the operator by flashing an error code and turning on or flashing the overload indicator.

When an error code appears on the i-Monitor, troubleshoot using the error code index.



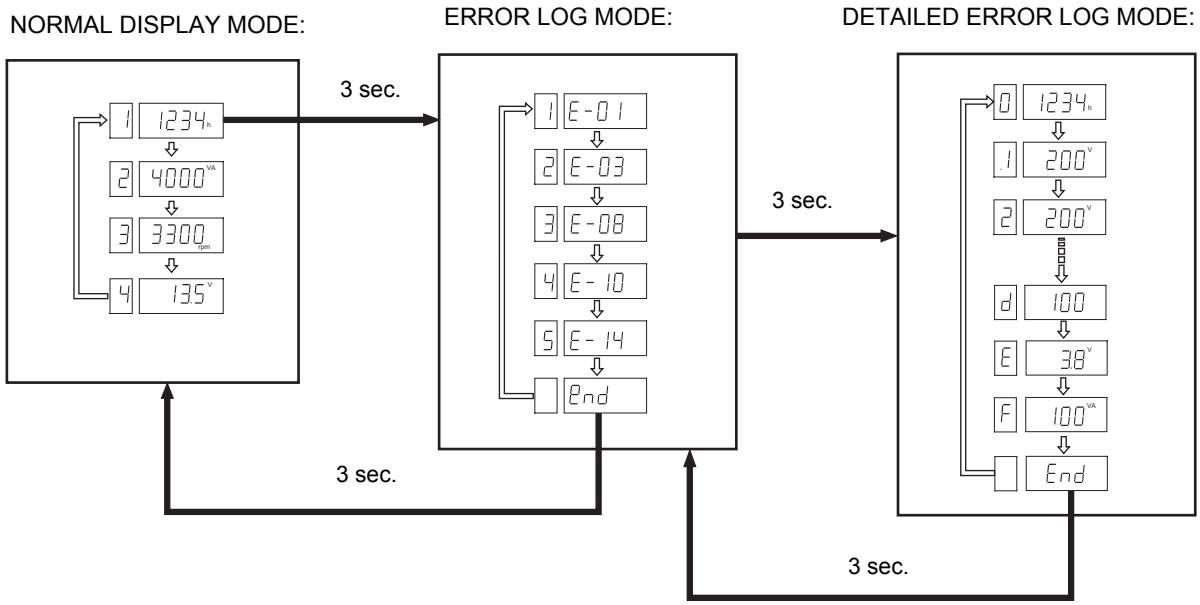
I-MONITOR ERROR LOG =>



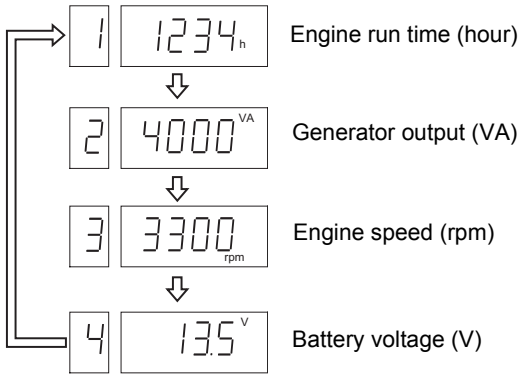
LAMP	COLOR	Content/Signal
Output indicator	Green	Turns on when there is AC voltage output from the receptacle
Overload indicator	Red	Turns on when an external abnormality such as excessive current is detected
Check/Oil alert indicator	Red	Turns on when the oil level is low, or blinks when a GCU malfunction is detected

HOW TO DISPLAY THE ERROR LOG

I-MONITOR ERROR LOG =>

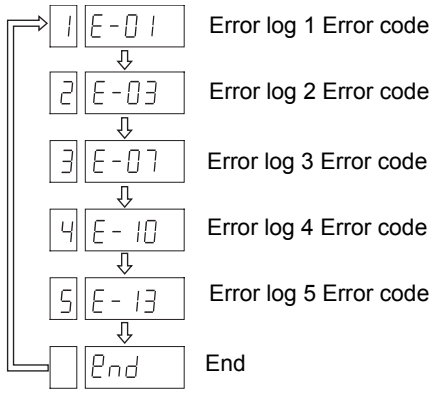


NORMAL DISPLAY MODE:



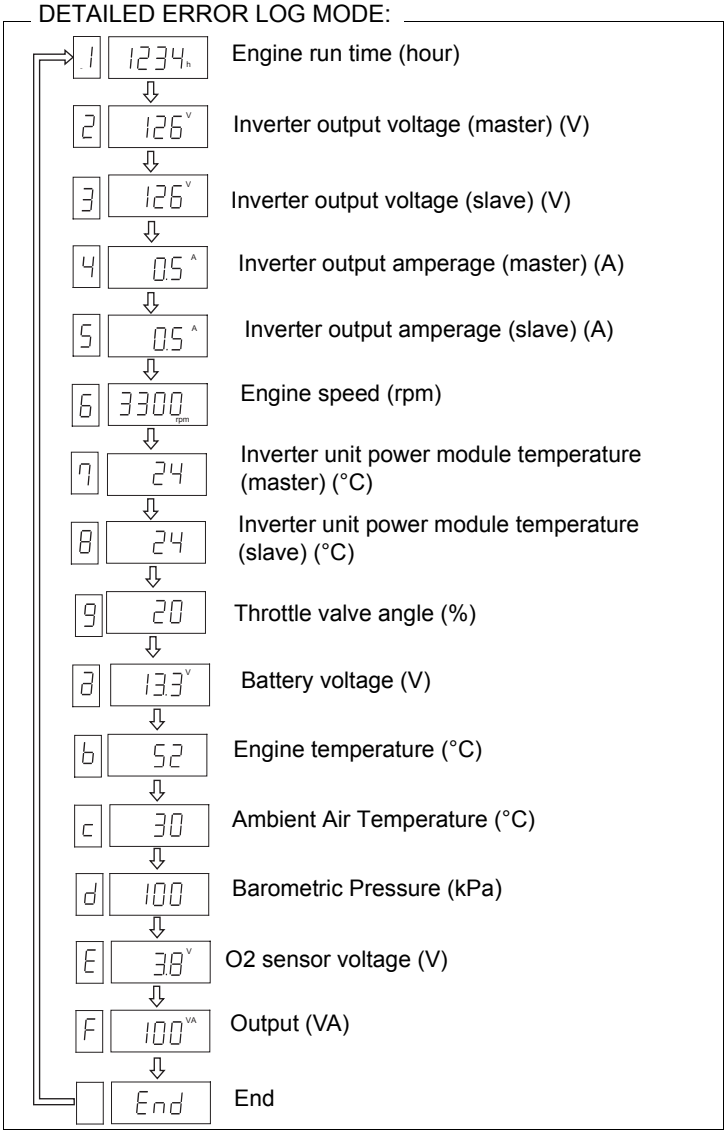
When you turn the main switch to the ON position, the i-Monitor displays the engine run-time.
Every time you press the display button, the display will show the generator output, the engine speed, and the battery voltage in this sequence.

ERROR LOG MODE:



When you press the display button longer than 3 seconds, while in the Engine run time (hour) mode, the i-Monitor goes into the error log mode, displaying error codes for previous incidents.
Every time you press the display button, the display will show the five latest error codes in the order from the newest to the oldest. When END appears in this mode, press the display button longer than 3 seconds to change the display back to the normal display mode.

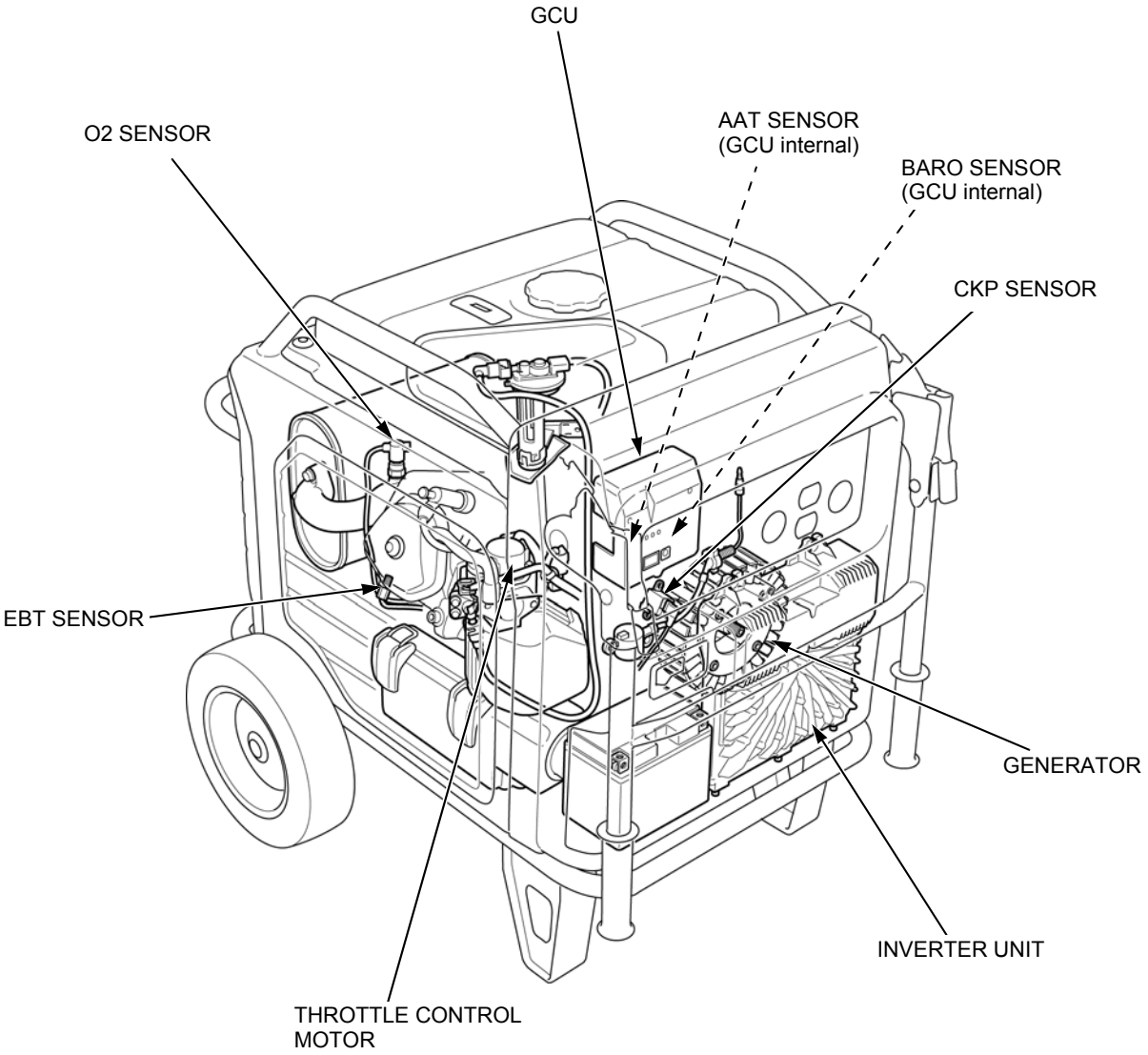
DETAILED ERROR LOG MODE:



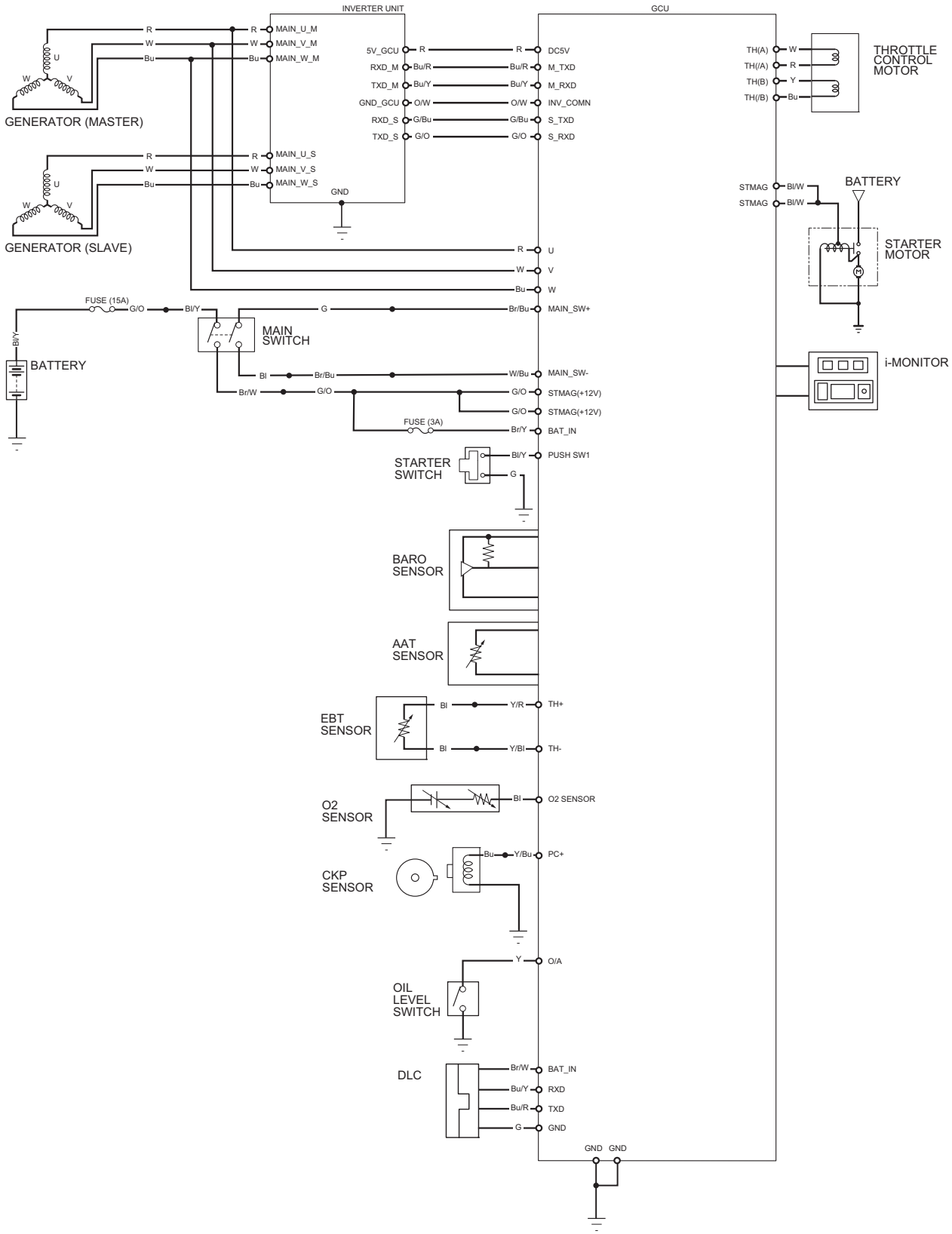
When you press the display button longer than 3 seconds on an error code, the display goes into a detailed error log mode, and it shows the engine run-time, generator output, engine speed, inverter temperature, throttle angle, battery voltage engine temperature, outside air temperature, barometric pressure, O2 sensor voltage, and generator output in volt-amperes (VA) for the incident in this sequence.

When END appears in this mode, press the display button longer than 3 seconds to change the display back to the error log mode.

SYSTEM LOCATION

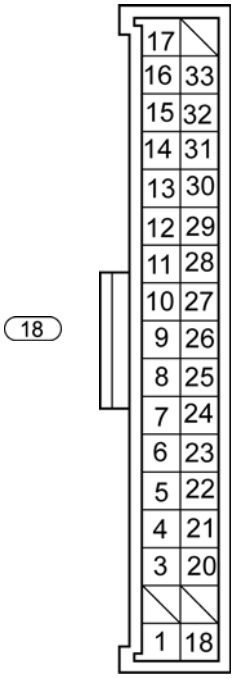


SYSTEM DIAGRAM



TERMINAL ARRANGEMENT

GCU 34P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

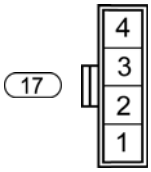
Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	R	FFP (+)	Fuel pump	Fuel pump power
3	G	GND	GND2	GCU ground
4	Bu	FFP (-)	Fuel pump	Fuel pump output
5	W/G	PUSH_SW2	Remote control box	Remote control starter switch input
6	G/Bu	PL (REM)	Remote control box	Remote control indicator light output
7	Bl/W	STMAG	Starter magnetic switch	Stater motor output
8	Bl/W	STMAG	Starter magnetic switch	Stater motor output
9	G/O	STMAG (+12 V)	Main switch	Starter magnetic switch power
10	G/O	STMAG (+12 V)	Main switch	Starter magnetic switch power
11	W/Bu	MAIN_SW-	Main switch	Main switch minus side
12	Br/Bu	MAIN_SW+	Main switch	Main switch plus side
13	Br/Y	BAT_IN	Main switch	Battery 12V input voltage
14	W	TH (A)	Throttle control motor	Throttle control motor phase (A) output
15	R	TH (/A)	Throttle control motor	Throttle control motor phase (/A) output
16	Bu	TH (/B)	Throttle control motor	Throttle control motor phase (/B) output
17	Y	TH (B)	Throttle control motor	Throttle control motor phase (B) output
18	W	INJ (+)	Fuel injector	Fuel injector power
20	G	GND	GND2	GCU ground
21	Y	INJ (-)	Fuel injector	Fuel injector output
22	O/W	INV_COMN	Inverter unit	Inverter unit ground
23	G/O	S_RXD	Inverter unit	Inverter communication (Slave receive)
24	G/Bu	S_TXD	Inverter unit	Inverter communication (Slave transmit)
25	Bu/R	M_TXD	Inverter unit	Inverter communication (Master transmit)
26	Bu/Y	M_RXD	Inverter unit	Inverter communication (Master receive)
27	Y/Bl	TH-	EBT sensor	EBT sensor ground
28	Y	O/A	Oil level switch	Oil level switch input
29	Bl/Y	PUSH_SW1	Starter switch	Starter switch input
30	R	DC5V	Inverter unit	5V supply to Inverter
31	Bl	O2 SENSOR	O2 sensor	O2 sensor input
32	Y/R	TH+	EBT sensor	EBT sensor input
33	Y/Bu	PC+	CKP sensor	CKP sensor input

GCU 2P CONNECTOR

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	Bl/G	IGN-	Ignition coil	Ignition coil output
2	Bl	IGN+	Ignition coil	Ignition coil power

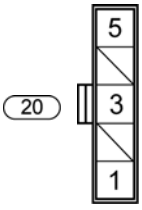
GCU 4P CONNECTOR FOR OPTIONAL Dr.H



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	G	GND	DLC	Dr.H communication ground
2	Bu/R	TXD	DLC	Dr.H communication transmit
3	Bu/Y	RXD	DLC	Dr.H communication receive
4	Br/W	BAT_IN	DLC	Dr.H communication power

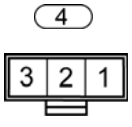
GCU 5P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	Bu	W	Generator (Master)	Generator (W-phase input)
3	W	V	Generator (Master)	Generator (V-phase input)
5	R	U	Generator (Master)	Generator (U-phase input)

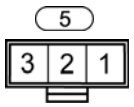
INVERTER UNIT 3P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	R	MAIN_U_M	Generator (Master)	Generator Master (U-phase input)
2	W	MAIN_V_M	Generator (Master)	Generator Master (V-phase input)
3	Bu	MAIN_W_M	Generator (Master)	Generator Master (W-phase input)

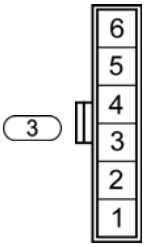
INVERTER UNIT 3P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	R	MAIN_U_S	Generator (Slave)	Generator Slave (U-phase input)
2	W	MAIN_V_S	Generator (Slave)	Generator Slave (V-phase input)
3	Bu	MAIN_W_S	Generator (Slave)	Generator Slave (W-phase input)

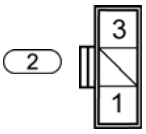
INVERTER UNIT 6P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	G/O	TXD_S	GCU	Generator (Slave) signal transmit
2	G/Bu	RXD_S	GCU	Generator (Slave) signal receive
3	O/W	GND_GCU	GCU	Communication ground
4	Bu/Y	TXD_M	GCU	Generator (Master) signal transmit
5	Bu/R	RXD_M	GCU	Generator (Master) signal receive
6	R	5V_GCU	GCU	5 V input voltage

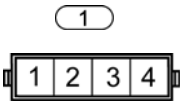
INVERTER UNIT 3P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	R/W	GND	Eco-Throttle switch	Eco-Throttle switch ground
3	R	ECO_SW	Eco-Throttle switch	Eco-Throttle switch output signal

INVERTER UNIT 4P CONNECTOR



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Terminal number	Wire color	Terminal mark	Connection	Signal (function)
1	Gr	AC2_S	Voltage selector switch	Sine wave output (–)
2	Bu	AC1_S	Voltage selector switch	Sine wave output (+)
3	R	AC1_M	Receptacle	Sine wave output (+)
4	W	AC2_M	Receptacle	Sine wave output (–)

ERROR CODE INDEX

○ : Indicator OFF ◐ : Indicator blinks ● : Indicator stay ON

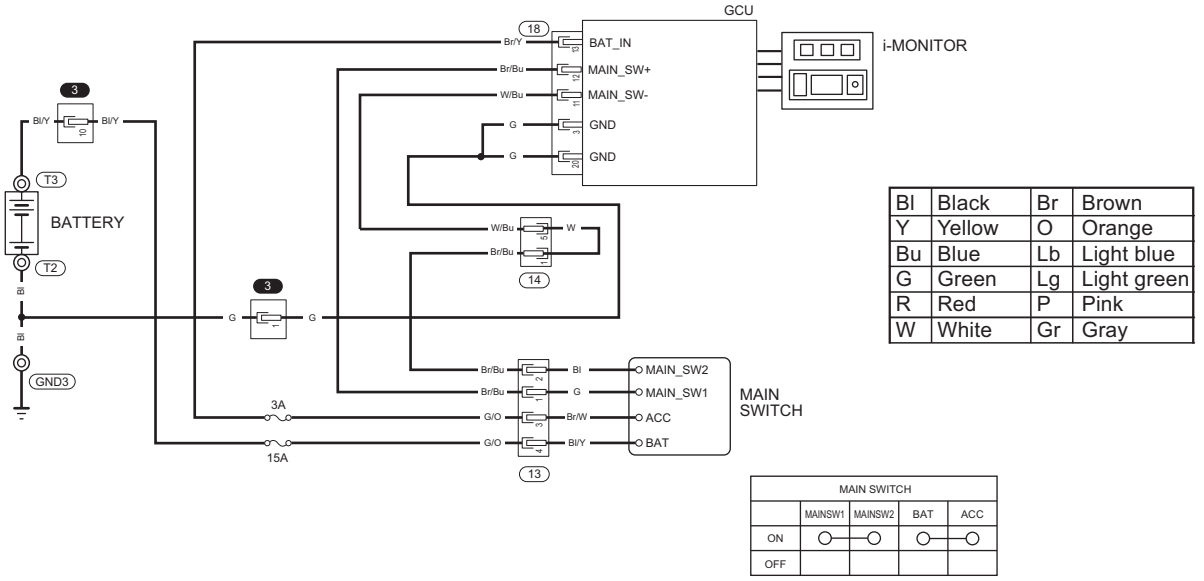
Error code	Overload indicator	Check/ Oil alert indicator	Error name	Detection condition	Error recognition number of times	Fail-safe	Ref. page
bAtt	○	○	Battery under charged	Battery voltage is less than specification for 1.5 seconds or more; cannot crank the engine.	1	When pushing the starter switch with main switch turned ON, the starter motor is stopped	4-20
OIL	○	●	Insufficient oil	Engine oil level is lower than specification, or there is a short circuit in oil level switch circuit.	1	Engine is stopped	4-21
E-00	○	◐	Starting system failure	Engine speed pulse cannot be detected when the engine is cranked with starter motor.	1	When pushing the starter switch with main switch turned ON, the starter motor is stopped	4-22
E-01	○	◐	Starter switch input failure	Starter switch remains ON for more than specified period.	1	Display only	4-25
E-02	○	◐	Abnormal battery voltage	Battery voltage is high.	1	Engine is stopped	4-26
E-03	○	◐	EBT sensor failure	Engine temperature is higher than specification, or an open or short circuit in sensor circuit is detected.	1	Engine is stopped	4-27
E-04	○	◐	Engine speed failure	Engine speed is higher than specification.	2	Engine is stopped	4-28
E-05	○	◐	GCU internal failure (SW power output error)	Voltage at GCU internal power switch is higher or lower than specification.	2	Engine is stopped	4-29
E-06	○	◐	Generator pulse failure	Difference between the speed at generator and CKP sensor is detected.	2	Engine is stopped	4-31
E-07	○	◐	GCU internal failure (RAM error)	GCU internal memory registry error is detected.	1	Engine is stopped	4-32
E-0A	○	◐	Air/fuel ratio failure	Programmed air/ fuel ratio is not obtained.	3	Engine is stopped	4-33

*: No error code displayed. Can be displayed in Error log mode (page 4-10).

Error code	Overload indicator	Check/ Oil alert indicator	Error name	Detection condition	Error recognition number of times	Fail-safe	Ref. page
E-10 E-20	○	◐	Inverter unit and GCU communication error	Communication error between the inverter and GCU is detected.	2	Engine is stopped	4-34
E-11 E-21	○	◐	Inverter unit internal communication error	Communication error between the master inverter and slave inverter is detected.	1	Engine is stopped	4-36
* E-12 E-22	●	○	Inverter unit excessive current protection activated	Excessive current caused by overload is detected.	1	After shutting down the AC output, the engine is left running at 2,400 min^{-1} (rpm).	4-37
* E-13 E-23	●	○	Inverter unit excessive voltage protection activated	Excessive voltage caused by internal failure is detected.	1	After shutting down the AC output, the engine is left running at 2,400 min^{-1} (rpm).	4-37
* E-15 E-25	●	○	Inverter unit overheated protection activated	FET device/power module temperature in the inverter exceeds the specified value.	1	After shutting down the AC output, the engine is left running at 2,400 min^{-1} (rpm).	4-38
E-16 E-26	○	◐	Inverter unit internal failure (A/D input error)	There is abnormality in the figure monitored by the inverter unit.	2	Engine is stopped	4-38
E-17 E-27	○	◐	Inverter unit internal failure (FET open)	There is abnormality in the FET device in the inverter.	2	Engine is stopped	4-39
E-19 E-29	○	◐	Inverter unit internal failure (FET short)	There is abnormality in the FET device in the inverter.	1	Engine is stopped	4-39
E-1A E-2A	○	◐	Inverter unit internal failure (Diode line short)	There is abnormality in the diode in the inverter.	1	Engine is stopped	4-39
E-1b E-2b	○	◐	Inverter unit internal failure (SCR short)	There is abnormality in the SCR in the inverter.	1	Engine is stopped	4-39
E-1c E-2c	○	◐	RAM/ROM failure	Inverter internal memory registry error is detected.	1	Engine is stopped	4-39
* E-1E E-2E	●	○	Inverter unit short protection activated	Excessive current caused by a short circuit is detected.	1	After shutting down the AC output, the engine is left running at 2,400 min^{-1} (rpm).	4-40
E-50	○	◐	AAT sensor (GCU internal) failure	AAT sensor in the GCU abnormality is detected.	1	Display only	4-41
E-51	○	◐	BARO sensor (GCU internal) failure	BARO sensor in the GCU abnormality is detected.	1	Display only	4-41
E-53	○	◐	O2 sensor failure	An open or short circuit in O2 sensor circuit is detected.	3	Engine is stopped	4-42

i-MONITOR DOES NOT DISPLAY WITH MAIN SWITCH TURNED ON

When turning the main switch to ON, the i-Monitor is on if use a known-good battery is used.



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

MAIN SWITCH				
	MAINSW1	MAINSW2	BAT	ACC
ON	○	○	○	○
OFF				

Turn the main switch OFF. Check the fuses. → Blown → Replace the fuse.

↓ Good

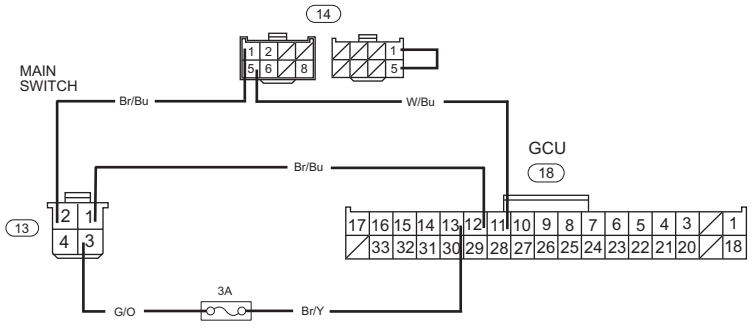
Check the " i-MONITOR DOES NOT DISPLAY" of the GCU inspection (page 10-9). → Abnormal → Replace the GCU.

↓ Normal

Check the main switch (page 10-6). → Abnormal → Replace the main switch.

↓ Normal

Turn the main switch OFF. Check the wire harness between the main switch and GCU for an open or short circuit. → Abnormal → Replace or repair the wire harness.



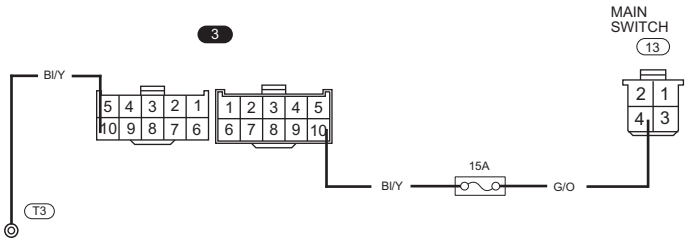
↓ Normal

Go to page 4-20

From page 4-19

Check the wire harness between the battery and main switch for an open or short circuit.

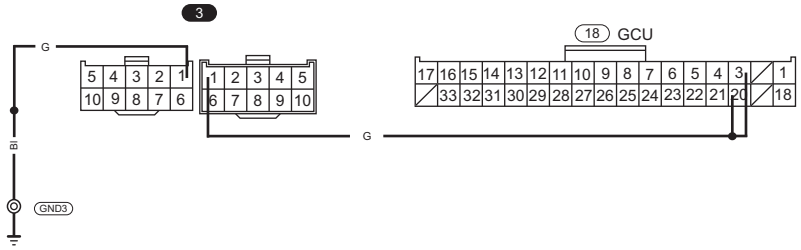
Abnormal → Replace or repair the wire harness.



Normal

Check the wire harness between the GCU and ground for an open circuit.

Abnormal → Replace or repair the wire harness.



Normal

Replace the GCU and recheck.

bAtt (Battery under charged)

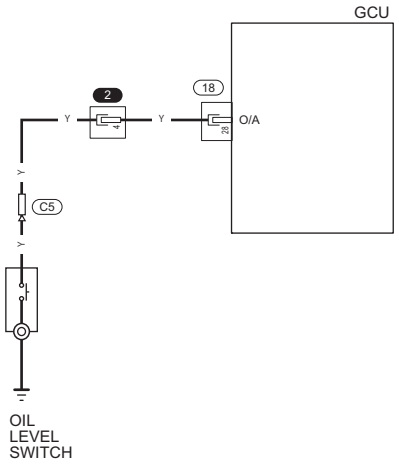
Turn the main switch OFF. Check the battery condition, using a battery tester (page 7-16).

Abnormal → Replace or recharge the battery (page 7-16).

Normal

Perform the engine start procedure and check to see if an error code is displayed. If the same condition exists, replace the GCU and recheck.

OIL (Insufficient oil)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Check the oil level (page 3-4).

Abnormal → Add the recommended oil to the proper level.

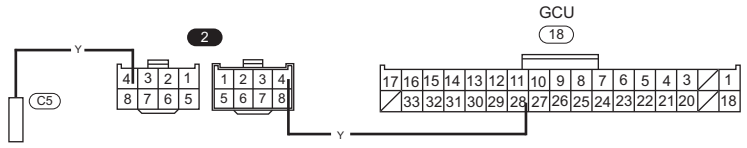
Normal

Check the oil level switch (page 8-10).

Abnormal → Replace the oil level switch.

Normal

Turn the main switch OFF. Check the wire harness between the battery and GCU for an open or short circuit.

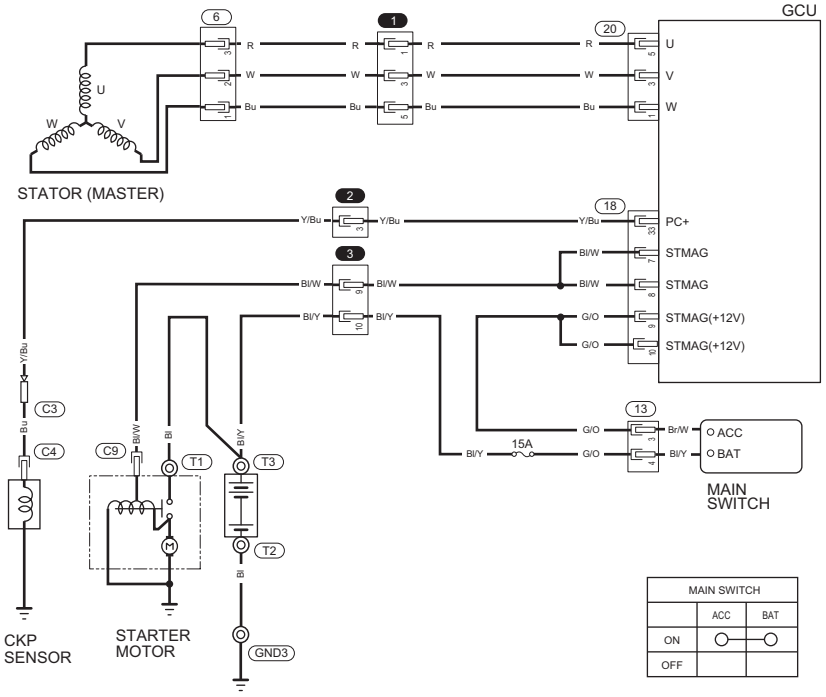


Abnormal → Replace or repair the wire harness.

Normal

Perform the engine start procedure and check to see if an error code is displayed. If the same condition exists, replace the GCU and recheck.

E-00 (Starting system failure)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Check the battery condition, using a battery tester (page 7-16).

Abnormal → Replace or recharge the battery (page 7-16).

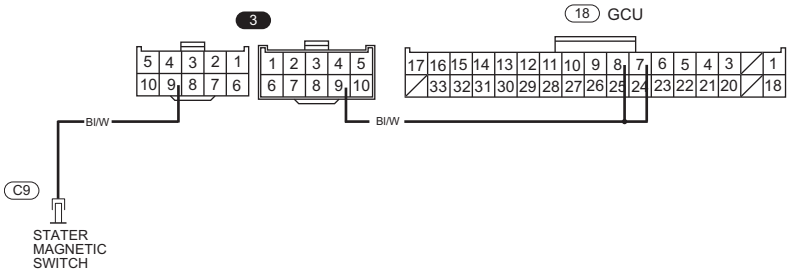
Normal ↓

Check the "PUSH THE STARTER SWITCH BUT STARTER MOTOR DOES NOT TURN" of the GCU inspection (page 10-9).

Abnormal → Replace the GCU.

Normal ↓

Check the wire harness between the starter motor and GCU for an open or short circuit.



Abnormal → Replace or repair the wire harness.

Normal ↓

Check the CKP sensor (page 8-9).

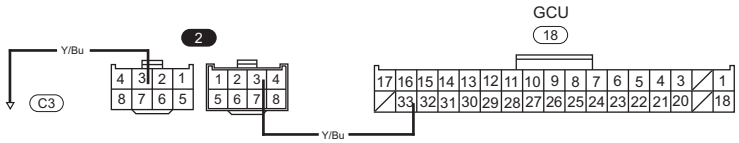
Abnormal → Replace the CKP sensor (page 8-7).

Normal ↓

Go to page 4-23

From page 4-22

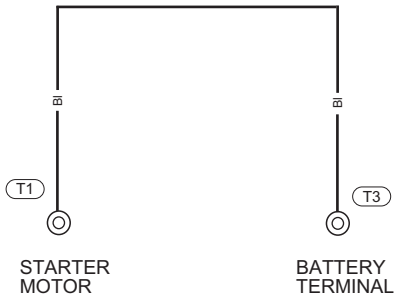
Check the wire harness between the CKP sensor and GCU for an open or short circuit.



Abnormal → Replace or repair the wire harness.

Normal

Check the motor cable between the battery and starter motor for an open circuit.



Abnormal → Replace or repair the wire harness.

Normal

Check the starter motor (page 9-16).

Abnormal → Replace or repair the starter motor.

Normal

Check the CKP sensor air gap (page 8-8).

Abnormal → Adjust the CKP sensor air gap.

Normal

Go to page 4-24

From page 4-23

Check the flywheel ring gear (page 9-10).

Abnormal → Replace the flywheel.

Normal

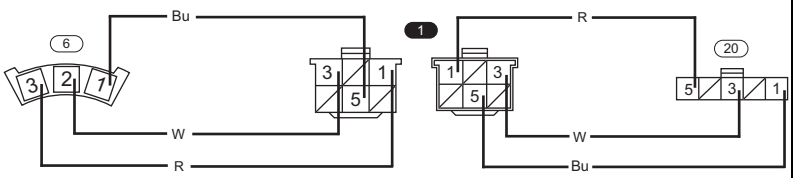
Check the stator coil resistance (page 7-17).

Abnormal → Replace the stator.

Normal

Turn the main switch OFF. Check the wire harness between the generator and GCU for an open or short circuit.

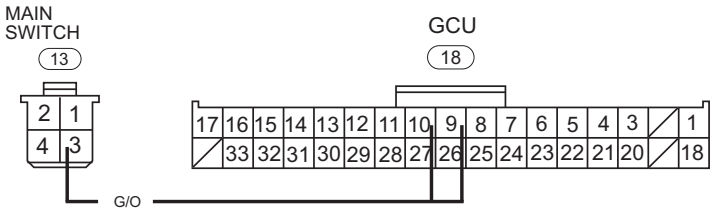
Abnormal → Replace or repair the wire harness.



Normal

Check the wire harness between the main switch and GCU for an open circuit.

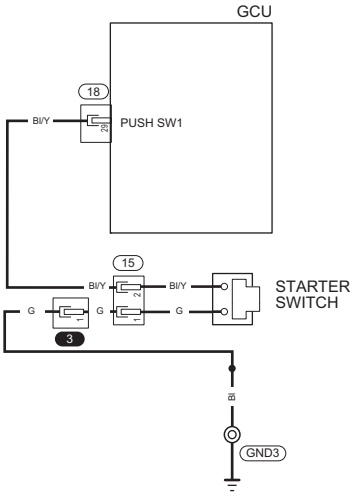
Abnormal → Replace or repair the wire harness.



Normal

Perform the engine start procedure and check to see if an error code is displayed. If the same error code occurs, replace the GCU and recheck.

E-01 (Starter switch input failure)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Check the starter switch (page 10-9).

Abnormal → Replace the starter switch.

Normal ↓

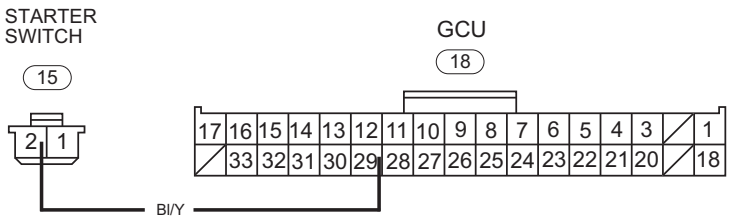
Check the "STARTER MOTOR TURNS AT THE MAIN SWITCH TURNED ON" of the GCU inspection (page 10-9).

Abnormal → Replace the GCU.

Normal ↓

Check the wire harness between the starter switch and GCU for a short circuit.

Abnormal → Replace or repair the wire harness.



Normal ↓

Perform the engine start procedure and check to see if an error code is displayed. If the same error code occurs, replace the GCU and recheck.

E-02 (Abnormal battery voltage)

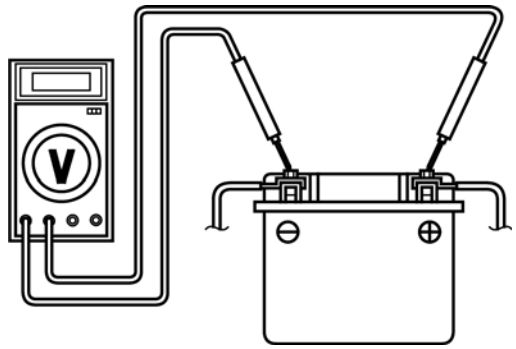
Turn the main switch OFF. Check the battery voltage. Normal battery voltage should be 12.3 V to 13.2 V.

Abnormal → Replace the battery.

Normal ↓

Turn the main switch ON. With the engine running at normal operating temperature, measure the battery voltage.

The battery voltage should not exceed 14.5 V while the engine is running.



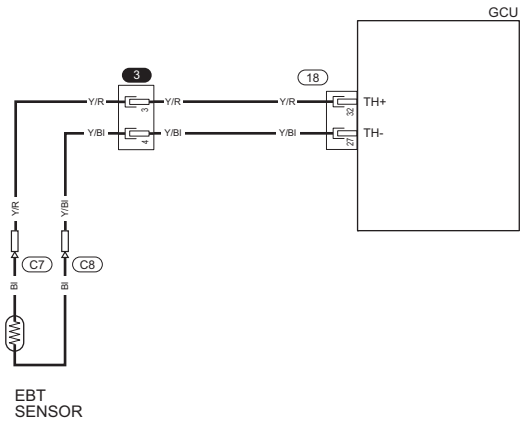
Abnormal → Replace the GCU and recheck.

Normal ↓

Perform the engine start procedure and check to see if an error code is displayed. If the same error code occurs, replace the GCU and recheck.

E-03 (EBT sensor failure)

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray



Turn the main switch OFF. Check the front cover for blockages in the cooling air passage.

Is blocked → Remove the blockage.

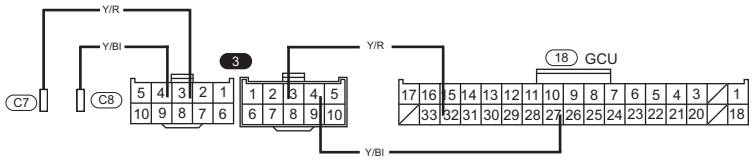
Is not blocked

Check the EBT sensor (page 6-22).

Abnormal → Replace the EBT sensor.

Normal

Turn the main switch OFF. Check the wire harness between the EBT sensor and GCU for an open or short circuit.

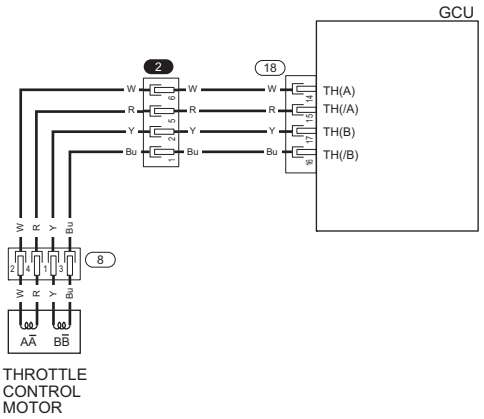


Abnormal → Replace or repair the wire harness.

Normal

Perform the engine start procedure and check to see if an error code is displayed. If the same error code occurs, replace the GCU and recheck.

E-04 (Engine speed failure)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Measure the resistance at the throttle control motor (page 6-21).

Abnormal → Replace the throttle control motor.

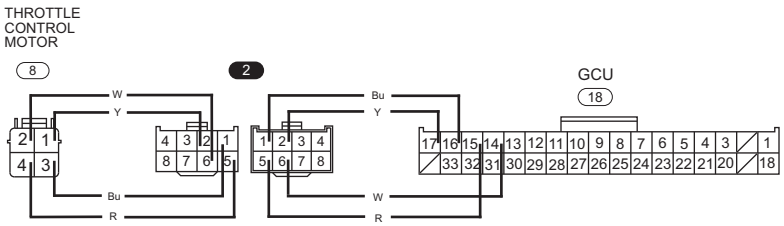
Normal ↓

Check the "THROTTLE CONTROL MOTOR DOES NOT MOVE" of the GCU inspection (page 10-9).

Abnormal → Replace the GCU.

Normal ↓

Turn the main switch OFF. Check the wire harness between the throttle control motor and GCU for an open or short circuit.

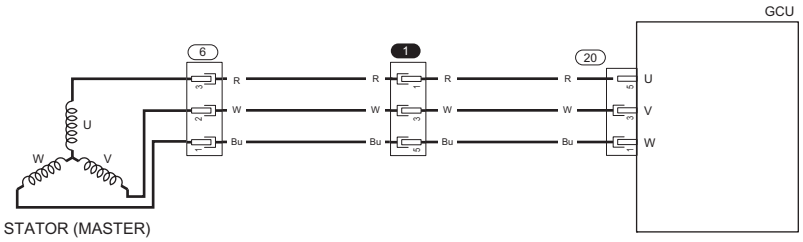


Abnormal → Replace or repair the wire harness.

Normal ↓

Perform the engine start procedure twice and check to see if an error code is displayed. If the same error code occurs, replace the GCU and recheck.

E-05 (GCU internal failure: SW power output error)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF.
Check the stator coil resistance (master) (page 7-17).

Abnormal → Replace the stator.

Normal ↓

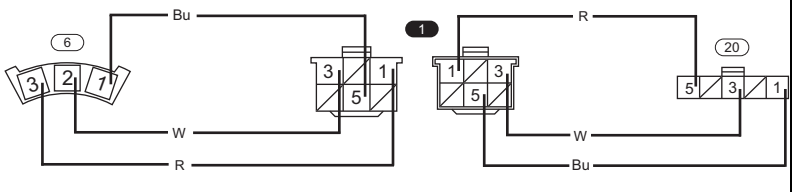
Check the inverter unit ((page 7-18).

Abnormal → Replace the inverter unit.

Normal ↓

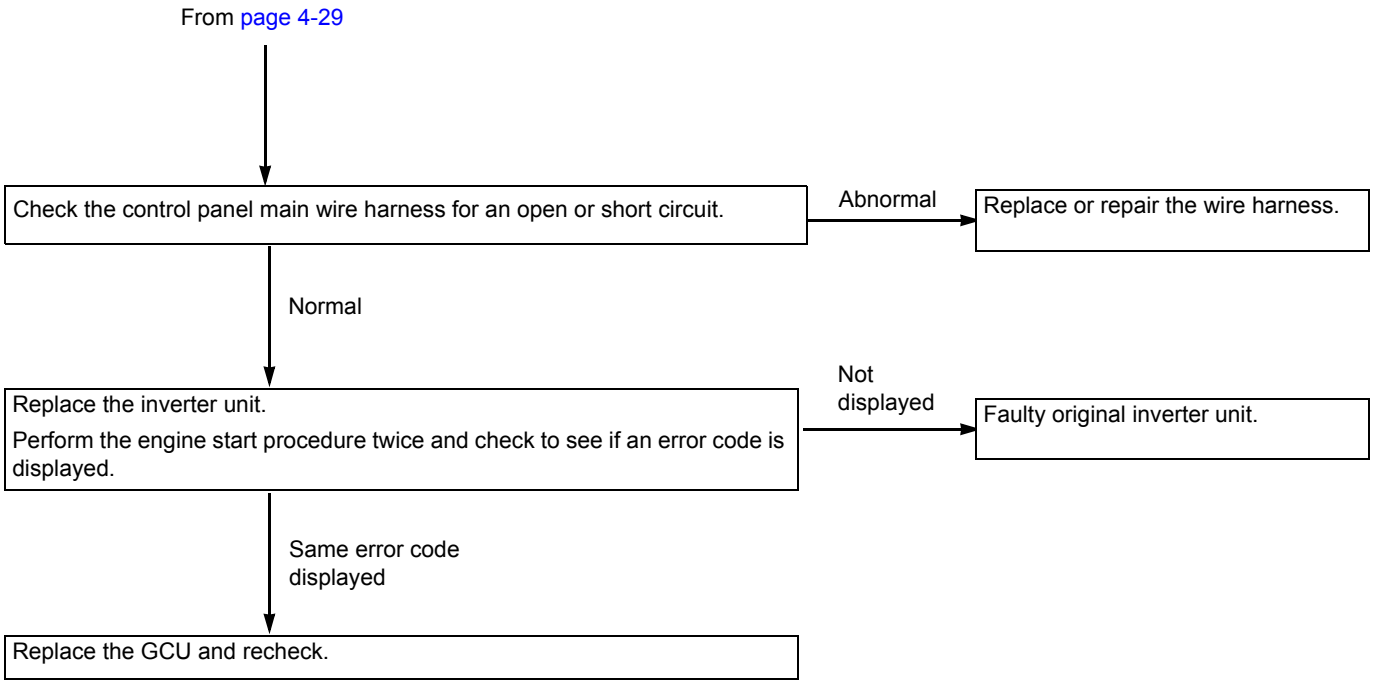
Turn the main switch OFF. Check the wire harness between the generator and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.

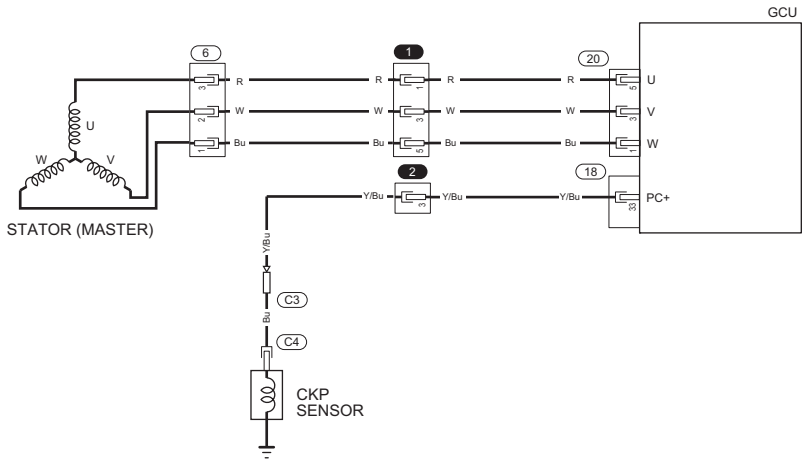


Normal ↓

Go to page 4-30


From page 4-29
Check the control panel main wire harness for an open or short circuit.
Abnormal
Replace or repair the wire harness.
Normal
Replace the inverter unit.
Perform the engine start procedure twice and check to see if an error code is displayed.
Not displayed
Faulty original inverter unit.
Same error code displayed
Replace the GCU and recheck.

E-06 (Generator pulse failure)



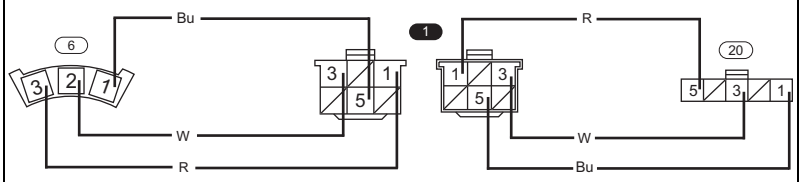
Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Check the stator coil resistance (page 7-17).
- Abnormal → Replace the stator.
- Normal ↓

Check the "E-06 IS DISPLAYED BY ENGINE STARTS" of the GCU inspection (page 10-9).
- Abnormal → Replace the GCU.
- Normal ↓

Check the inverter unit (page 7-18).
- Abnormal → Replace the inverter unit.
- Normal ↓

Check the wire harness between the generator and GCU for an open or short circuit.
- Abnormal → Replace or repair the wire harness.



- Normal ↓

Go to page 4-32

From page 4-31

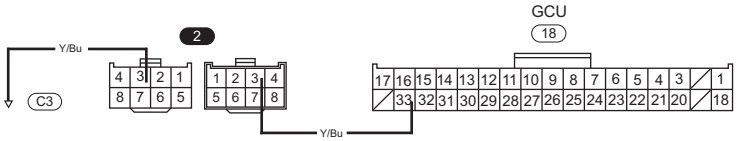
Check the CKP sensor (page 8-9).

Abnormal → Replace the CKP sensor (page 8-7).

Normal

Turn the main switch OFF. Check the wire harness between the CKP sensor and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.



Normal

Check the control panel main wire harness for an open or short circuit.

Abnormal → Replace or repair the wire harness.

Normal

Replace the inverter unit.

Perform the engine start procedure twice and check to see if an error code is displayed.

Not displayed → Faulty original inverter unit.

Same error code displayed

Replace the GCU and recheck.

E-07 (GCU internal failure: RAM error)

1. Perform the engine start procedure.
2. Check to see if an error code is displayed.
   If the same error code occurs, replace the GCU and recheck.

E-0A (Air/fuel ratio failure)

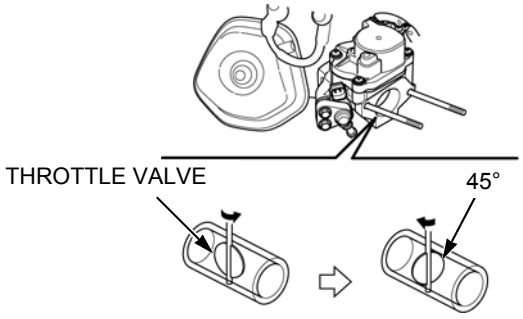
Turn the main switch OFF. Check the fuel quality.
- No good → Replace the fuel.
- Good ↓

Check the air cleaner element (page 3-6).
- Dirty → Replace the air cleaner element.
- Clean ↓

Check the fuel flow (page 6-20).
- Abnormal →
  - Check whether the fuel feed hose is leaking.
  - Check whether the fuel feed hose is pinched or clogged.
  - Check whether the fuel tank cap breather is pinched or clogged.
  - Check whether the fuel pump filter is clogged.
  - Replace the fuel pump.
- Normal ↓

Check the fuel pump pressure (page 6-20).
- Abnormal →
  - Check whether the fuel pump filter is clogged.
  - Check whether the fuel feed hose is pinched or clogged.
  - Replace the fuel pump.
- Normal ↓

Turn the main switch OFF.
Disconnect the fuel injector 2P connector and spark plug cap.
Check whether the throttle valve position changes from fully open to half open when the main switch is ON and the starter switch is pressed.



- Abnormal → Check the throttle control motor (page 6-21).
- Normal ↓

Turn the main switch OFF. Check the O2 sensor (E-53: page 4-42).
- Abnormal →
  - Replace or repair the O2 sensor circuit.
  - Replace the O2 sensor
- Normal ↓

Go to page 4-34

From page 4-33

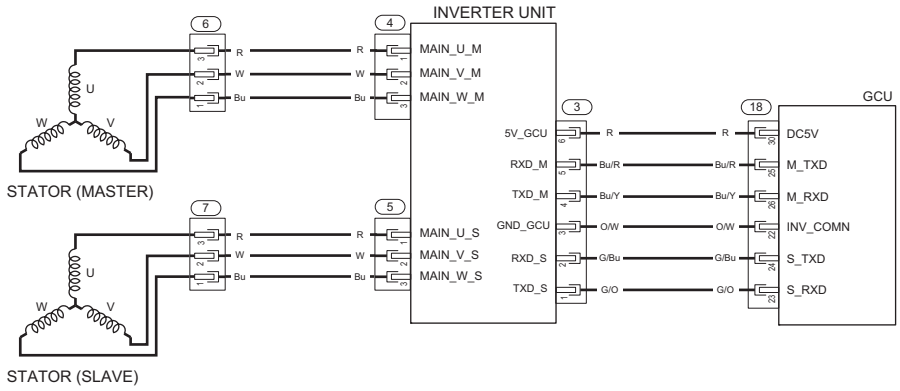
Replace the fuel injector.
Perform the engine start procedure three times and check to see if an error code is displayed.

Not displayed → Faulty original fuel injector.

Same error code displayed

Replace the GCU and recheck.

E-10, E-20 (Inverter unit and GCU communication error)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Check the stator (page 7-17). → Abnormal → Replace the stator.

Normal

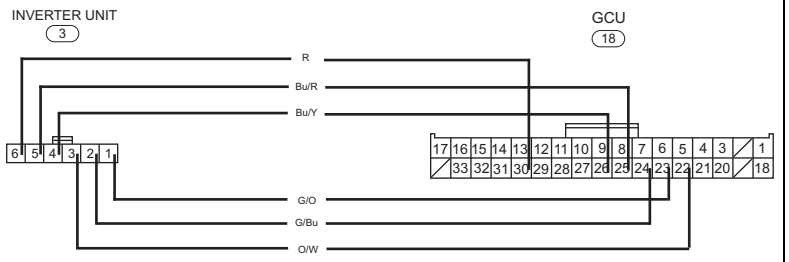
Check the inverter unit inspection (page 7-18). → Abnormal → Replace the inverter unit.

Normal

Go to page 4-35

From page 4-34

Check the wire harness between the inverter unit and GCU for an open or short circuit.



Abnormal → Replace or repair the wire harness.

Normal

Replace the inverter unit.

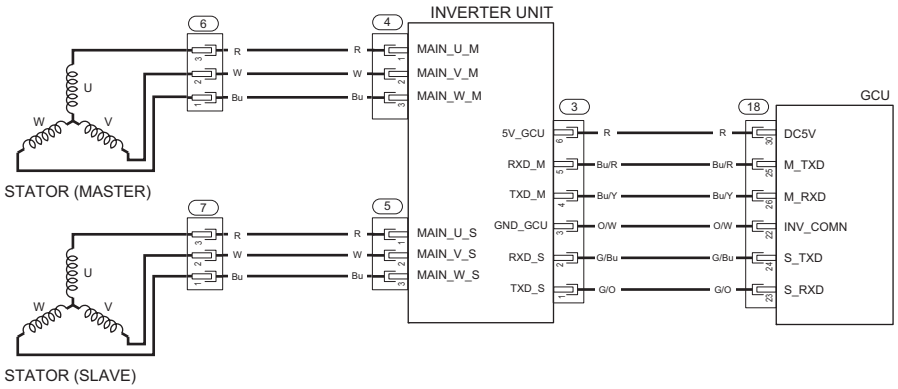
Perform the engine start procedure twice and check to see if an error code is displayed.

Not displayed → Faulty original inverter unit.

Same error code displayed

Replace the GCU and recheck.

E-11, E-21 (Inverter unit internal communication error)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF. Check the stator (page 7-17).

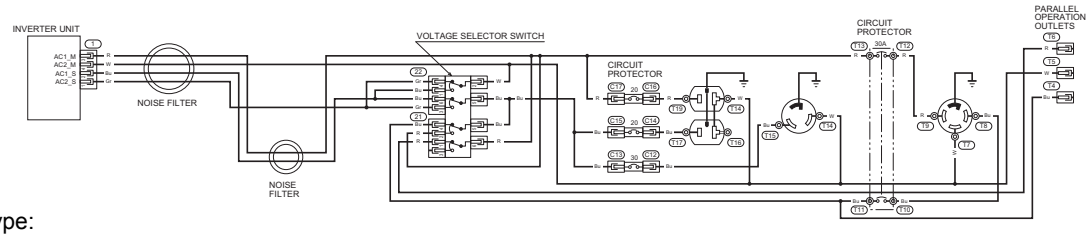
Abnormal → Replace the stator.

Normal ↓

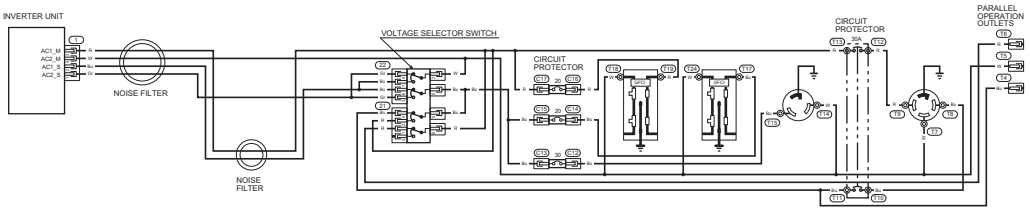
Perform the engine start procedure and check to see if an error code is displayed. If the same error code occurs, replace the inverter unit and recheck.

E-12, E-13, E-22, E-23
(Inverter unit excessive current protection activated/ Inverter unit excessive voltage protection activated)

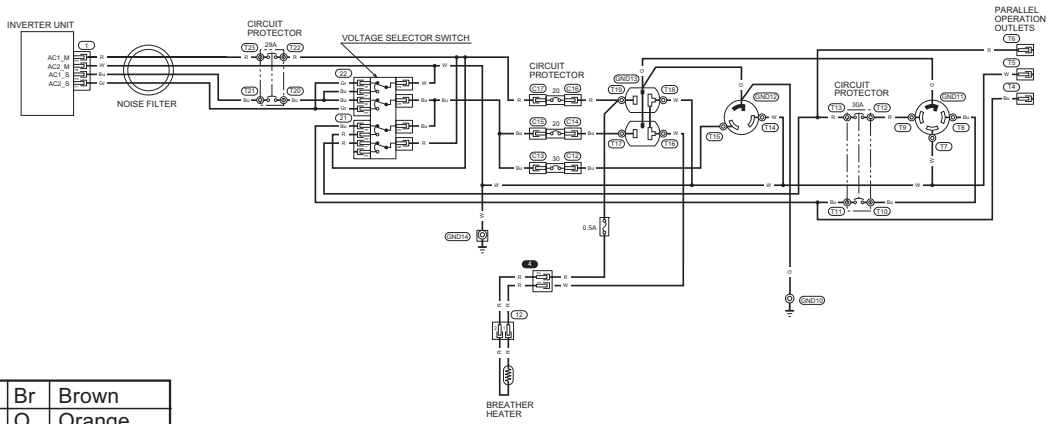
AT Type:



AT1 Type:



CT Type:



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF.

Disconnect the AC appliance and stop the engine. Restart the engine and check to see if an error code is displayed in the error log mode (page 4-10).

Not displayed → System is OK (error is cleared).

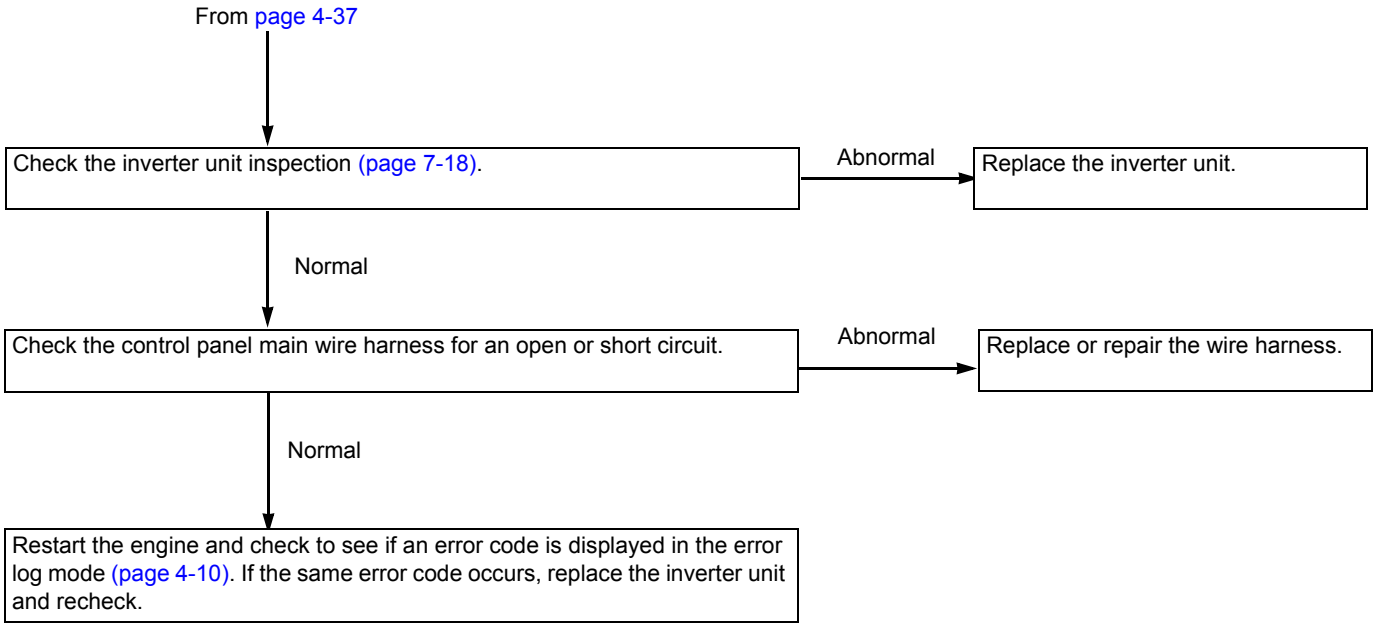
Same error code displayed ↓

Check the stator (page 7-17).

Abnormal → Replace the stator.

Normal ↓

Go to page 4-38



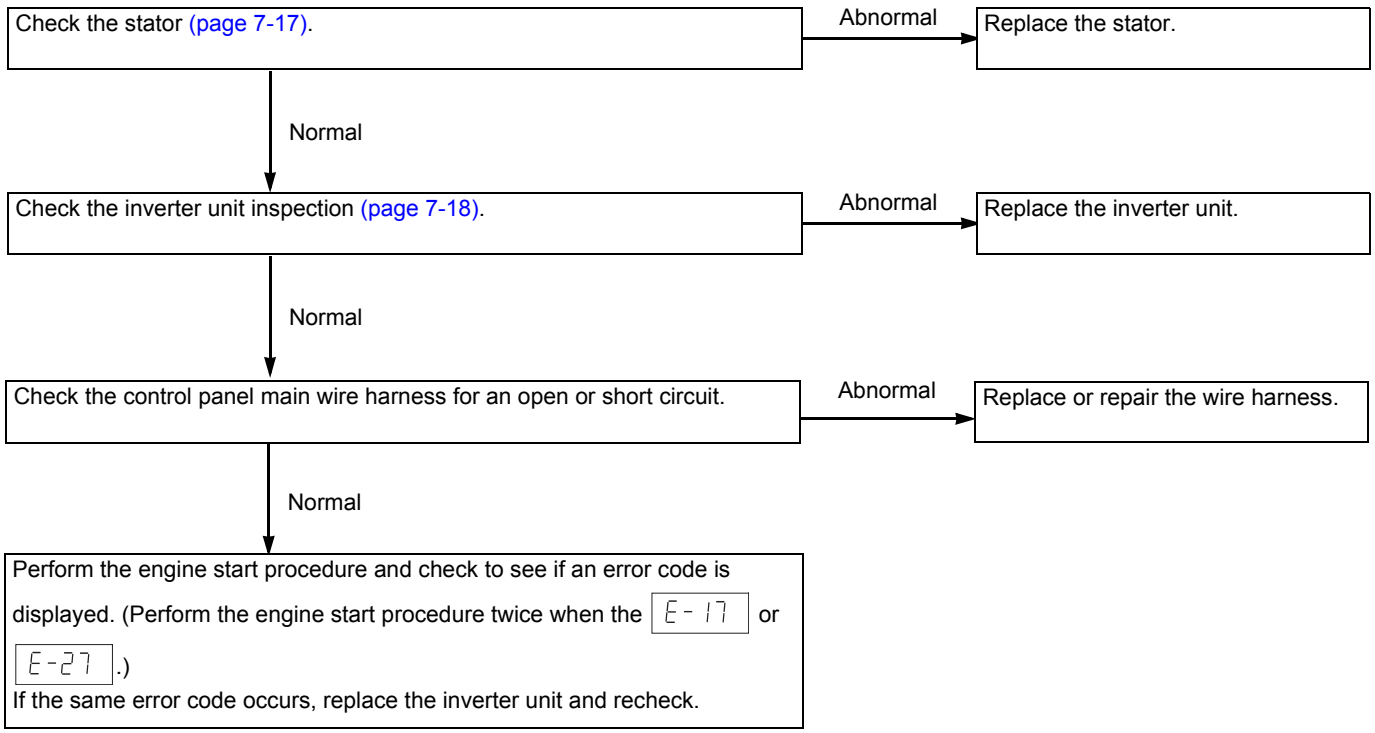
E-15, E-25 (Inverter unit overheated protection activated)

1. Stop the engine and disconnect the AC appliance.
2. Check the front cover cooling air passage for blockages. Remove any blockages.
3. Wait for several minutes.
   With the engine running at normal operating temperature, check to see if an error code is displayed in the error log mode (page 4-10). If the same error code occurs, replace the inverter unit and recheck.

E-16, E-26 (Inverter unit internal failure: A/D input error)

1. Perform the engine start procedure twice.
2. Check to see if an error code is displayed.
   If the same error code occurs, replace the inverter unit and recheck.

E-17, E-19, E-1A, E-1b, E-27, E-29, E-2A, E-2b, (Inverter unit internal failure: FET open/FET short/Diode line short/SCR short)

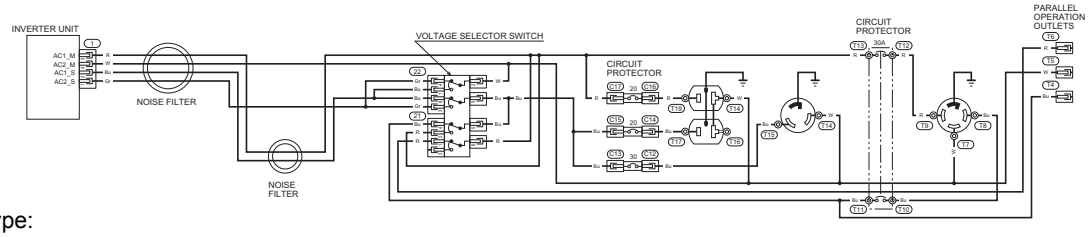


E-1c, E-2c (Inverter unit internal failure: RAM/ROM failure)

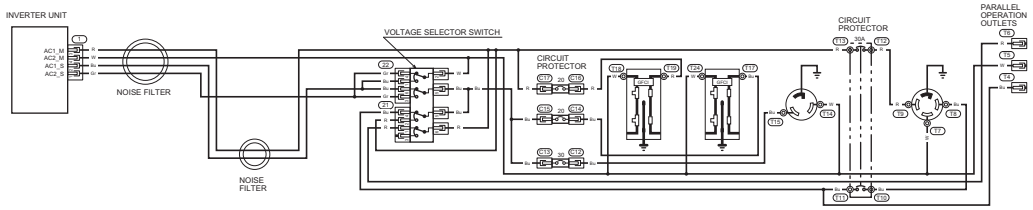
1. Perform the engine start procedure.
2. Check to see if an error code is displayed.
   If the same error code occurs, replace the inverter unit.

E-1E , E-2E (Inverter unit short protection activated)

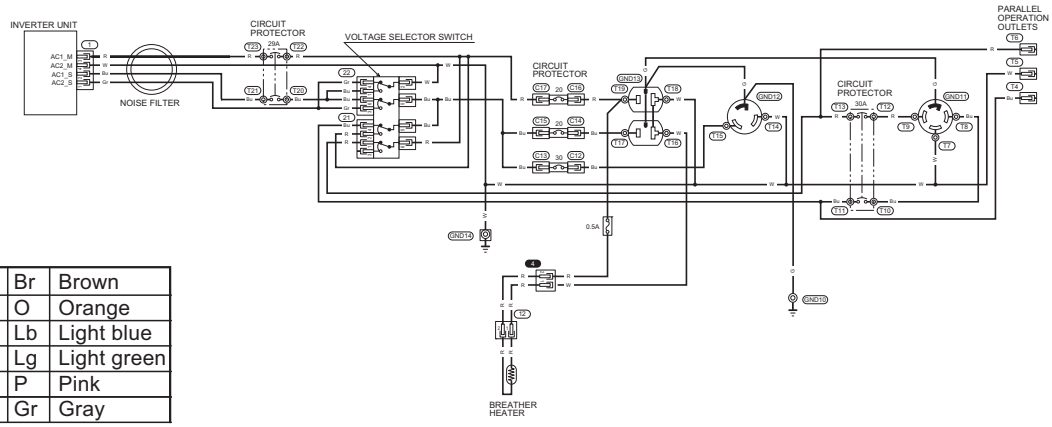
AT Type:



AT1 Type:



CT Type:



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Stop the engine and disconnect the AC appliance. Restart the engine and check to see if an error code is displayed in the error log mode (page 4-10).

Not displayed → System is OK (error is cleared).

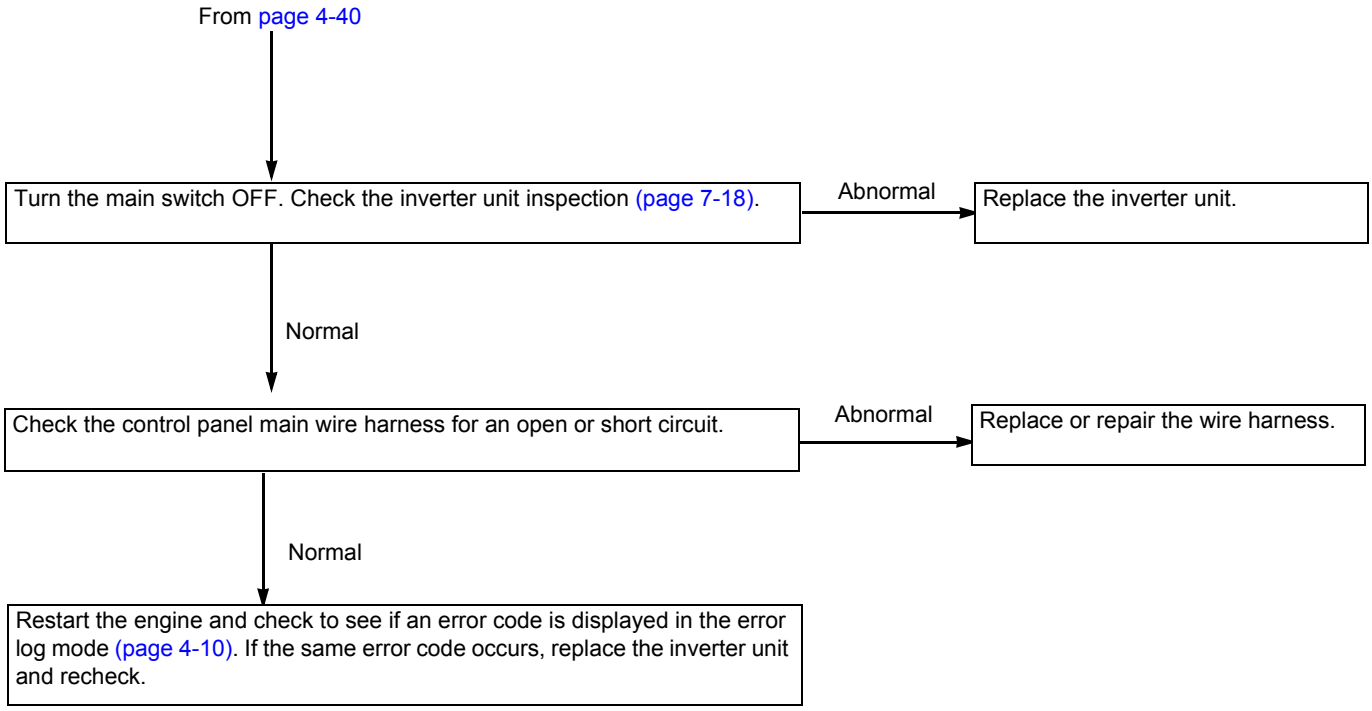
Same error code displayed ↓

Turn the main switch OFF. Check the stator (page 7-17).

Abnormal → Replace the stator.

Normal ↓

Go to (page 4-41)



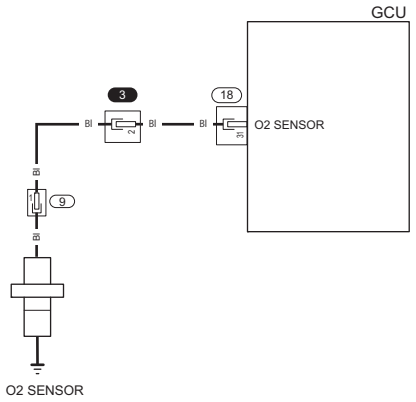
E-50 (AAT sensor failure)

With the engine running at normal operating temperature, check to see if an error code is displayed.
If the same error code occurs, replace the GCU and recheck.

E-51 (BARO sensor failure)

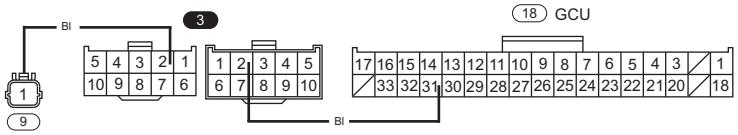
With the engine running at normal operating temperature, check to see if an error code is displayed.
If the same error code occurs, replace the GCU and recheck.

E-53 (O2 sensor failure)



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Turn the main switch OFF.
Check the wire harness between the O2 sensor and GCU for an open or short circuit.



Abnormal → Replace or repair the wire harness.

Normal ↓

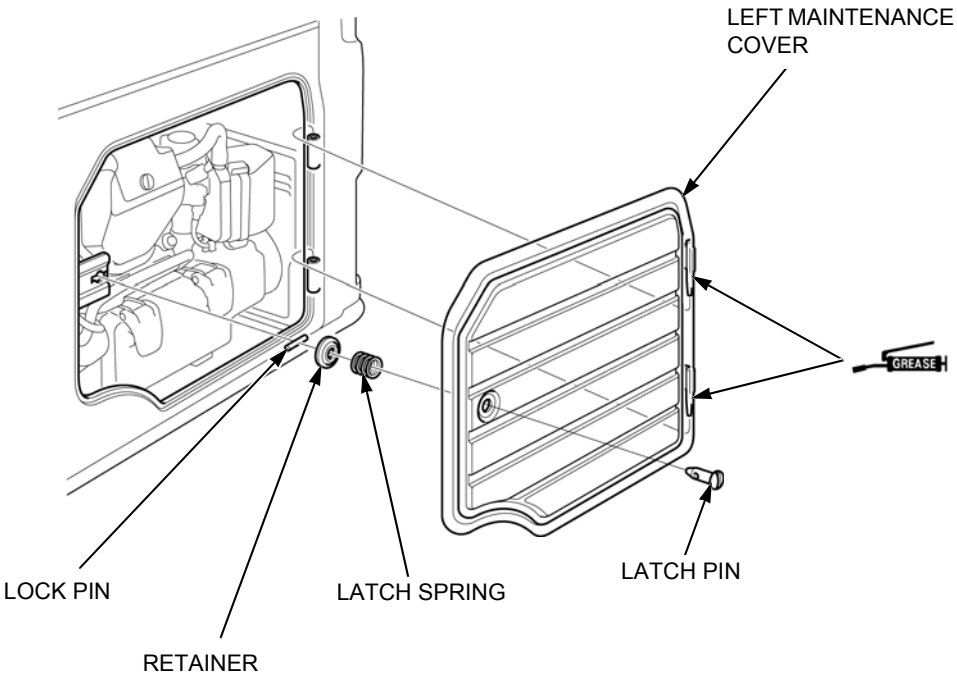
Replace the O2 sensor.
Start the engine and keep it running for more than 90 seconds. Do it three times and check to see if an error code is displayed.

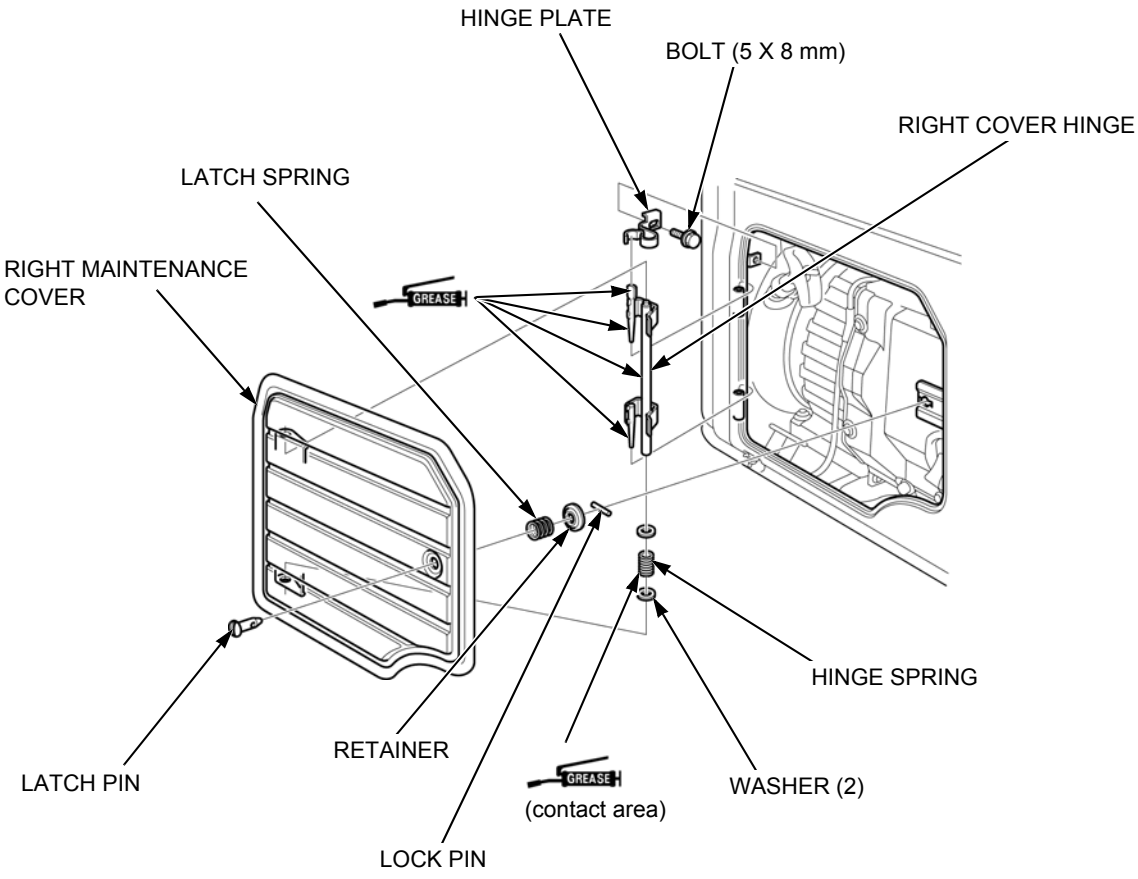
Not displayed → Faulty original O2 sensor.

Same error code displayed ↓

Turn the main switch OFF.
Replace the GCU and recheck.

MAINTENANCE COVER REMOVAL/INSTALLATION



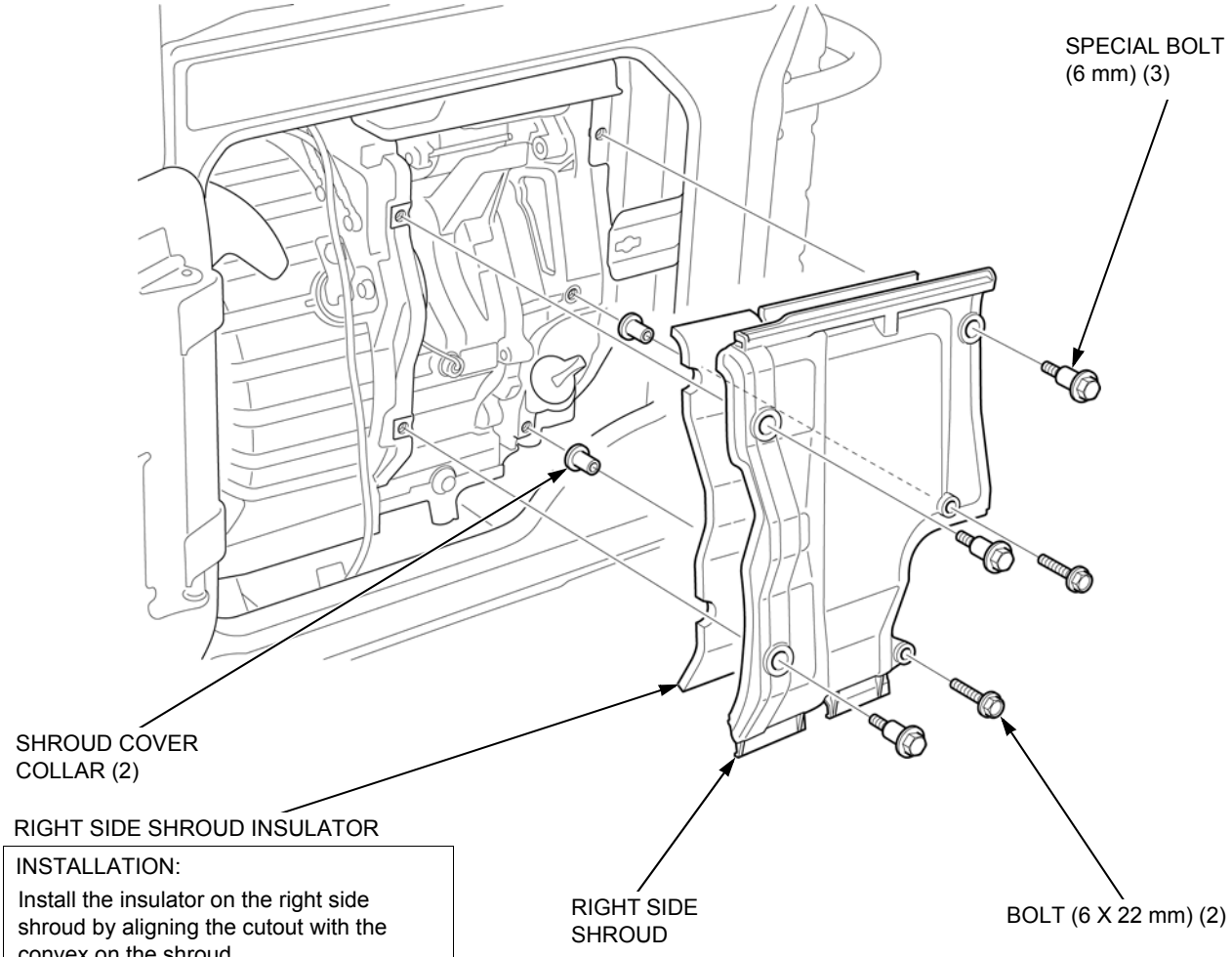


RIGHT SIDE SHROUD REMOVAL/INSTALLATION

⚠ CAUTION

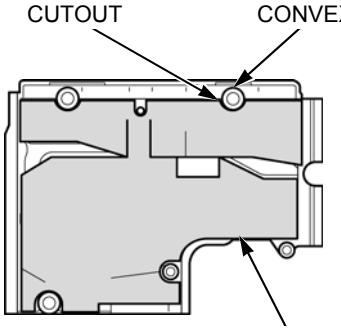
Do not touch the insulator with bare hands. The glass wool of the material sticks in the skin and is dangerous.

Open the right maintenance cover.



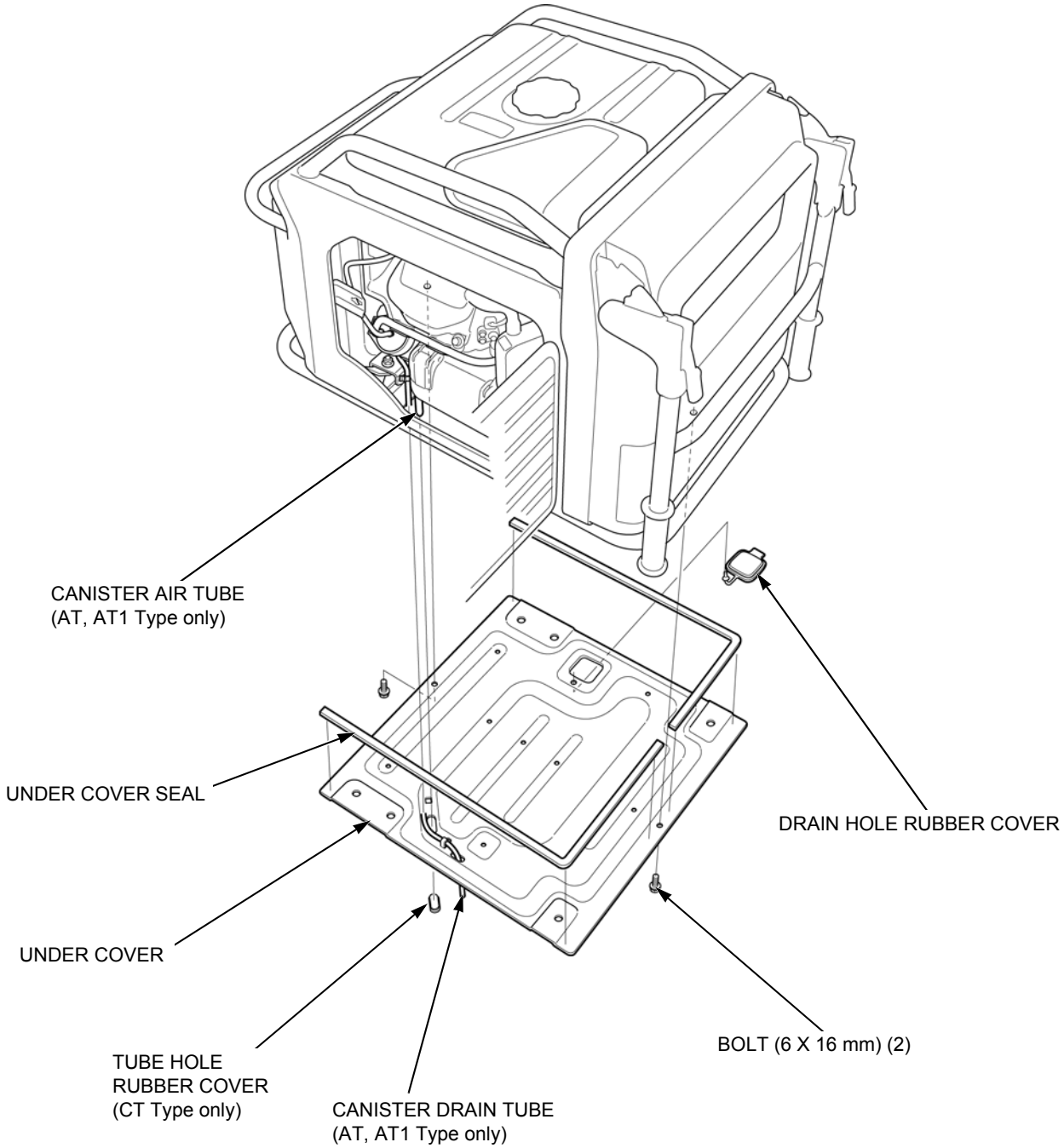
INSTALLATION:

Install the insulator on the right side shroud by aligning the cutout with the convex on the shroud.



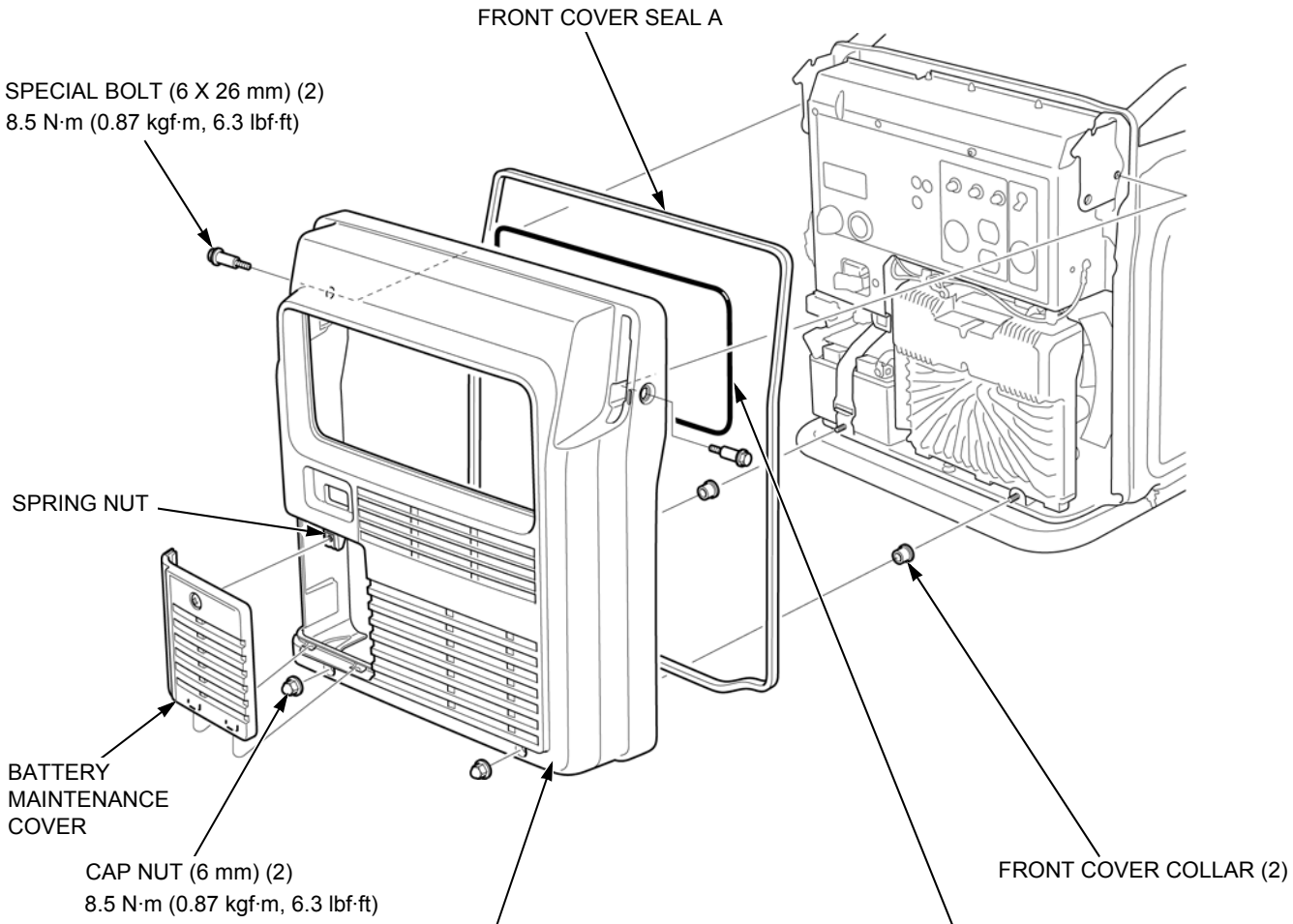
UNDER COVER REMOVAL/INSTALLATION

Remove the wheel shaft (page 15-2).

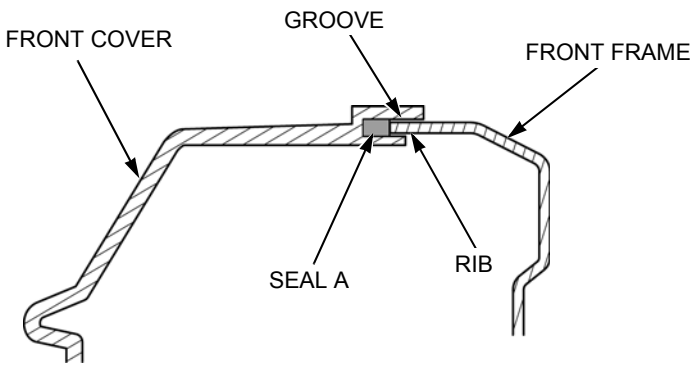


FRONT COVER REMOVAL/INSTALLATION

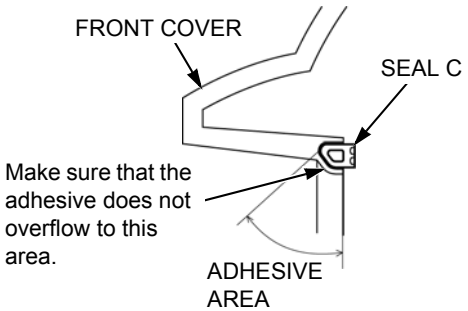
Remove the handle (page 15-3).



INSTALLATION:
Align the groove of the front cover with the rib of the front frame.



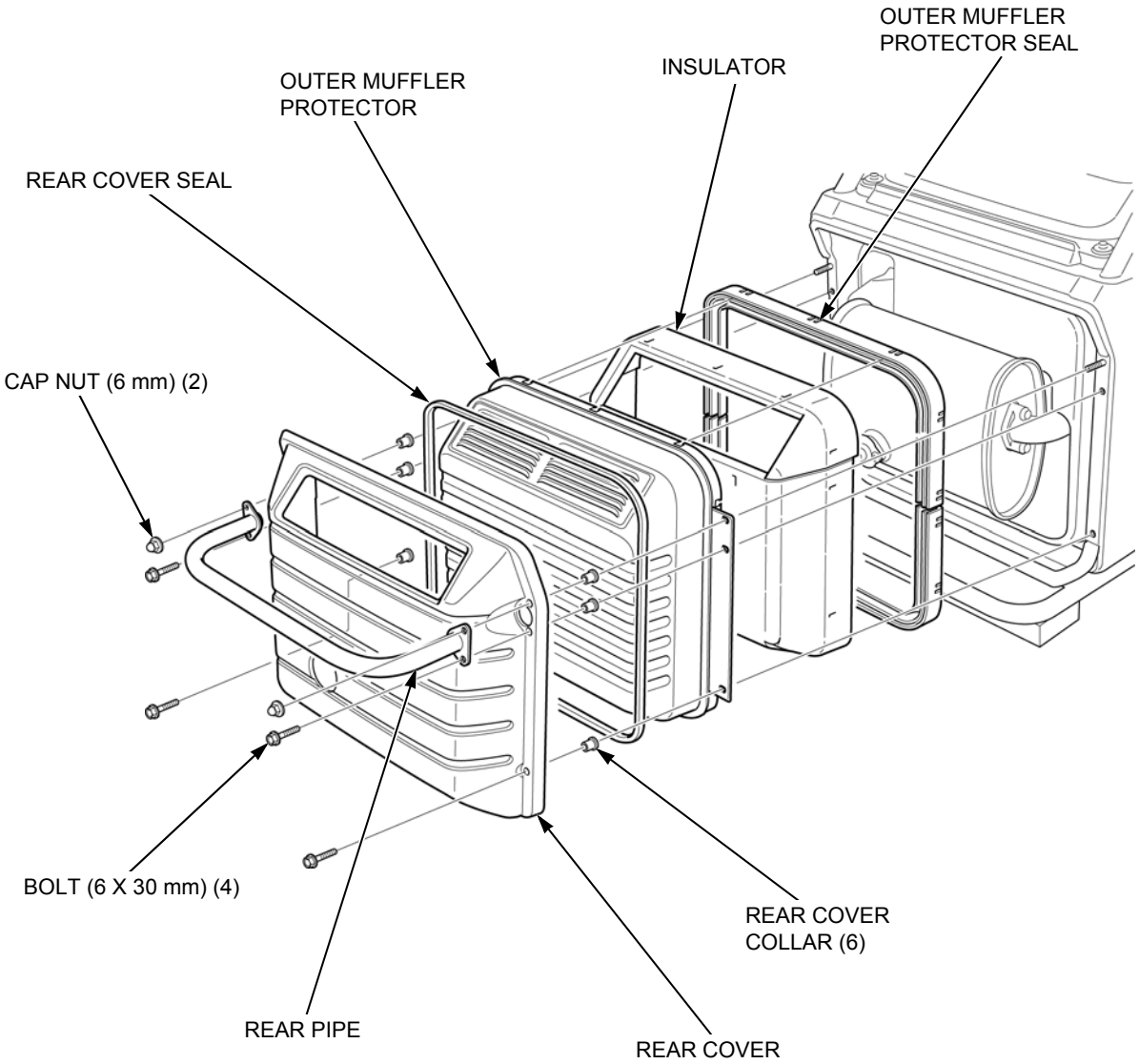
- Apply adhesive (LOCTITE® #495) to the cover installation area.
- Before applying the adhesive, degrease the adhesive area.
- After applying the adhesive, press the seal for 10 to 30 seconds.



REAR COVER/OUTER MUFFLER PROTECTOR REMOVAL/ INSTALLATION

⚠CAUTION

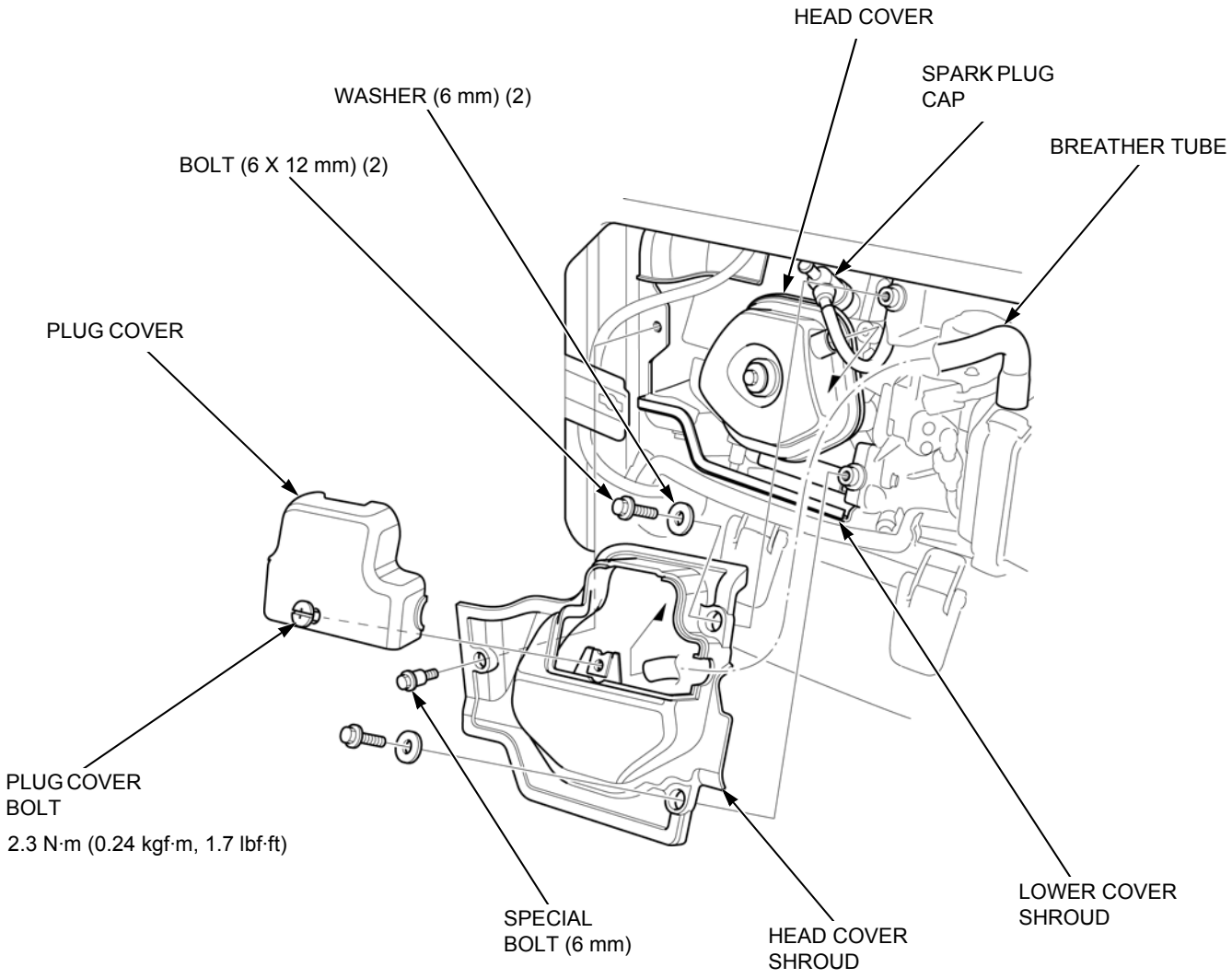
- The muffler becomes very hot during operation and remains hot for a while after stopping the engine. Be careful not to touch the muffler while it is hot. Allow it to cool before proceeding.
- Do not touch the insulator with bare hands. The glass wool of the material sticks in the skin and is dangerous.



SERVICE BULLETIN #50 =>

HEAD COVER SHROUD REMOVAL/INSTALLATION

Open the left maintenance cover.

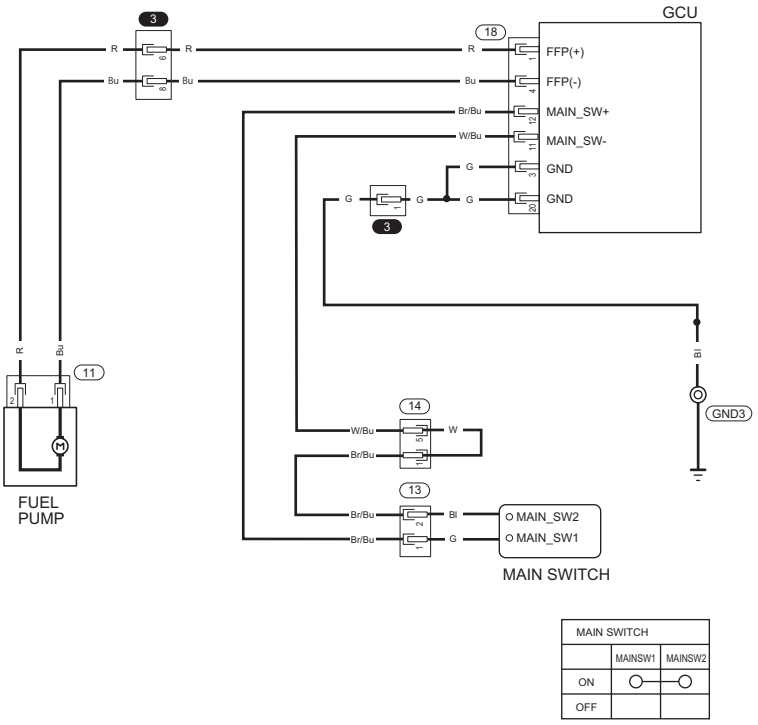


MEMO

FUEL PUMP SYSTEM TROUBLESHOOTING

FUEL PUMP DOES NOT OPERATE

SERVICE BULLETIN #55 =>



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

MAIN SWITCH		
	MAINSW1	MAINSW2
ON	○	○
OFF		

Check whether the i-Monitor is on when the main switch is turned ON.

OFF → Perform the i-MONITOR DOES NOT DISPLAY BY MAIN SWITCH TURNED ON (page 4-19).

ON

Check whether an error code is displayed on the i-Monitor when the main switch is ON and the starter switch is pressed.

Displayed → Perform the SELF-DIAGNOSTIC TROUBLESHOOTING <xRef

Not displayed

Go to page 6-3

From page 6-2

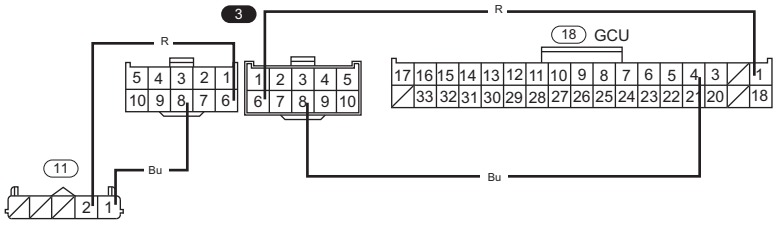
Measure the resistance at the fuel pump (page 6-21).

Abnormal → Replace the fuel pump (page 6-9).

Normal

Check the wire harness between the fuel pump and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.

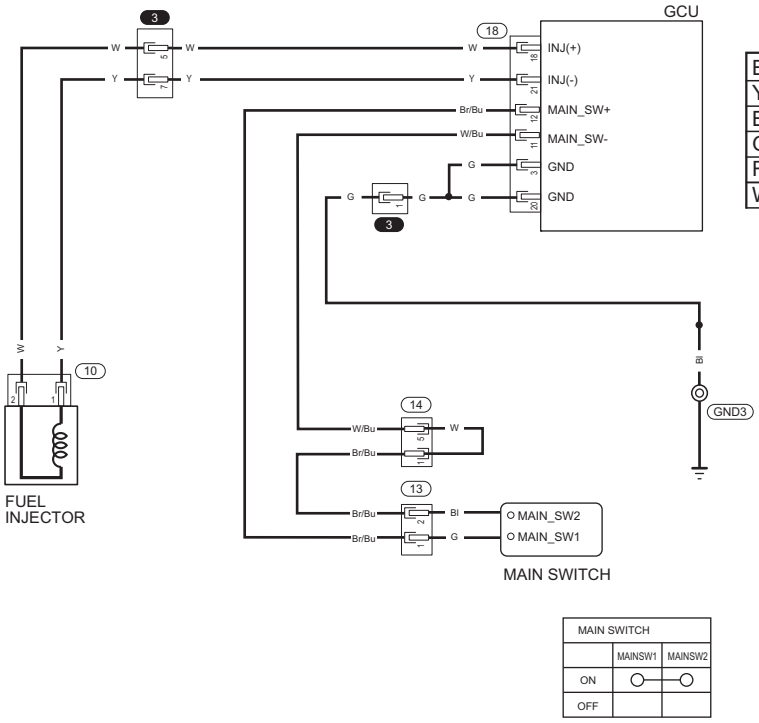


Normal

Replace the GCU and recheck.

FUEL INJECTOR SYSTEM TROUBLESHOOTING

FUEL INJECTOR DOES NOT OPERATE



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

MAIN SWITCH		
	MAINSW1	MAINSW2
ON	○	○
OFF		

Check whether the i-Monitor is on when the main switch is turned ON.

OFF → Perform the i-MONITOR DOES NOT DISPLAY BY MAIN SWITCH TURNED ON (page 4-19).

ON

Check whether an error code is displayed on the i-Monitor when the main switch is ON and the starter switch is pressed.

Displayed → Perform the SELF-DIAGNOSTIC TROUBLESHOOTING (page 4-9).

Not displayed

Go to page 6-5

From page 6-4

Measure the resistance at the fuel injector (page 6-21).

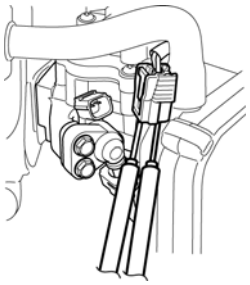
Abnormal → Replace the fuel injector (page 6-15).

Normal

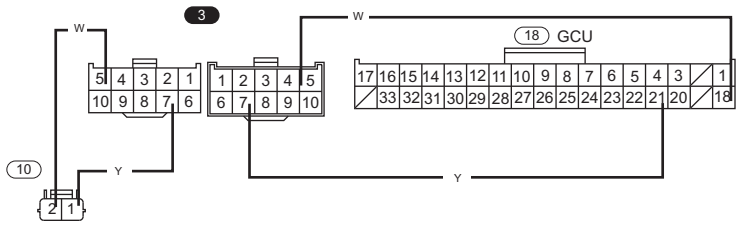
Turn the main switch ON and the starter switch is pressed.

Measure the voltage at the fuel injector 2P connector (10).

STANDARD: Voltage exist



Abnormal → Check the wire harness between the fuel injector and GCU for an open or short circuit.



Normal → Replace the GCU.

Abnormal → Replace or repair the wire harness.

Normal

Replace the fuel injector (page 6-15).

Start the engine.

Engine starts → The original injector is stuck.

Engine does not start

Replace the GCU and recheck.

FUEL PRESSURE RELIEVING

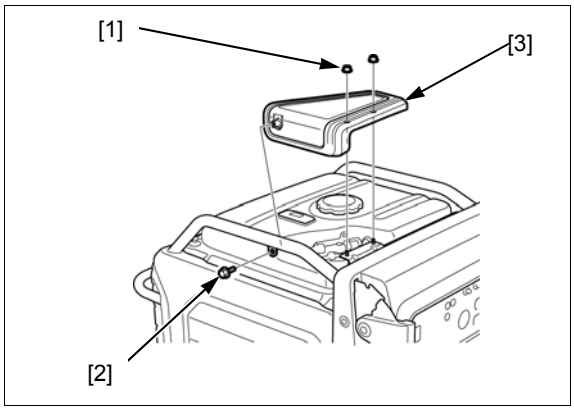
QUICK CONNECT FITTING REMOVAL

⚠WARNING

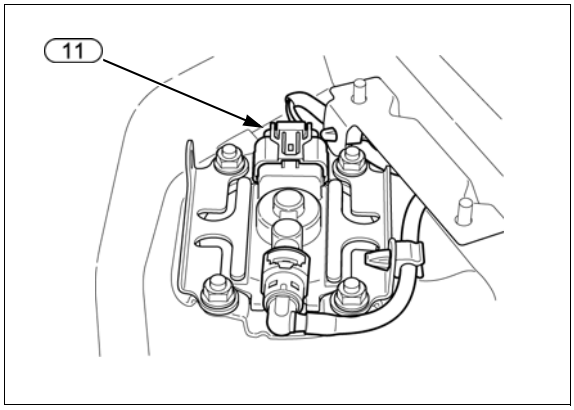
Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- Before disconnecting fuel feed hose, relieve pressure from the system by following the procedures below.
- This generator uses resin for part of the materials in the fuel feed hose. Do not bend or twist the fuel feed hose.

1. Turn the main switch OFF.
2. Remove the nut [1], bolt [2], and the fuel pump cover [3].



3. Disconnect the fuel pump 5P connector (11).
4. Disconnect the battery negative (–) cable (page 7-9).



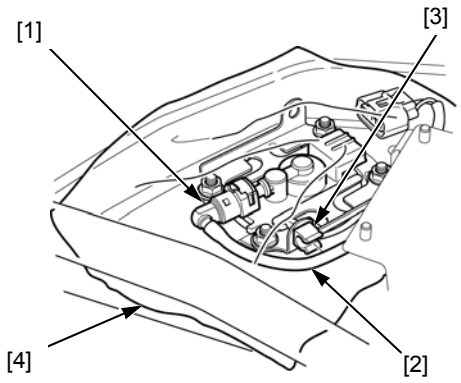
5. Check the fuel quick connect fitting [1] for dirt, and clean if necessary.

- To disconnect the injector side quick connect fitting, open the left maintenance cover.

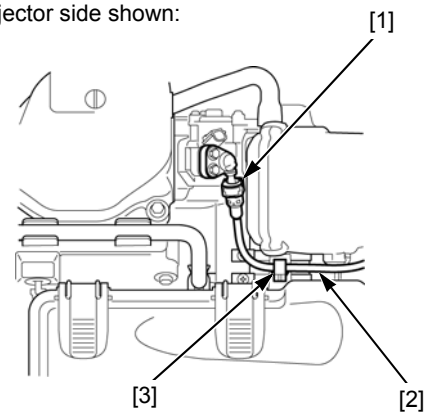
6. Remove the fuel feed hose [2] from the hose clip [3].

   Place a shop towel [4] over the quick connect fitting.

Fuel pump side shown:

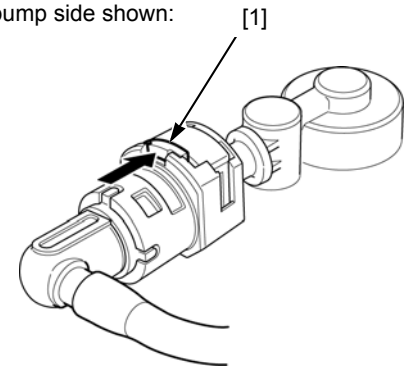


Fuel injector side shown:



7. Push the retainer tab [1] forward.

Fuel pump side shown:



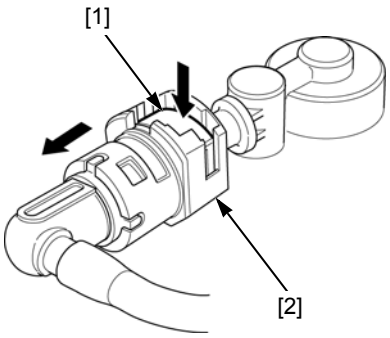
8. Press the retainer [1] down and hold it.

   Disconnect the connector [2] from the fuel pump joint/injector joint.

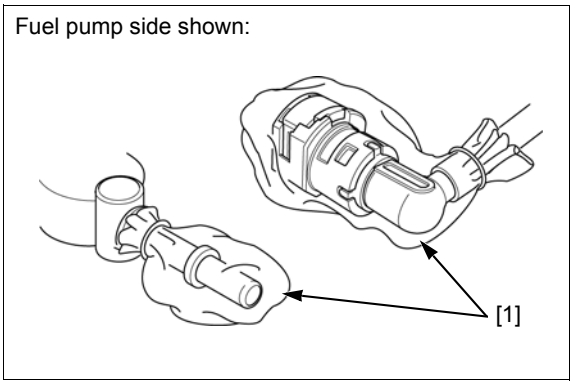
   Check the condition of the retainer and replace it if necessary.

- Use a shop towel to prevent the remaining fuel in the fuel feed hose from flowing out.
- Be careful not to damage the hose or other parts.
- Do not use tools.
- If the connector does not move, alternately pull and push the connector until it comes off easily.

Fuel pump side shown:



9. To prevent damage and keep foreign matter out, cover the disconnected connector and pipe end with plastic bags [1].

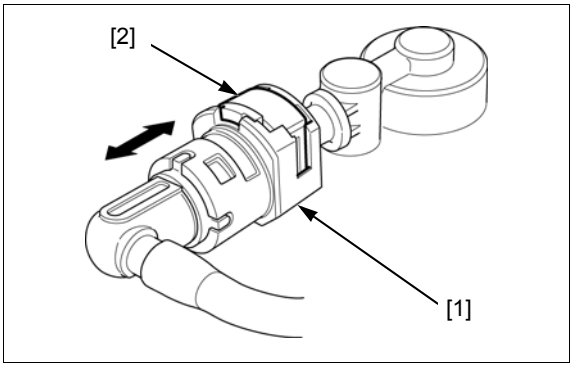


QUICK CONNECT FITTING INSTALLATION

- Do not bend or twist the fuel feed hose.

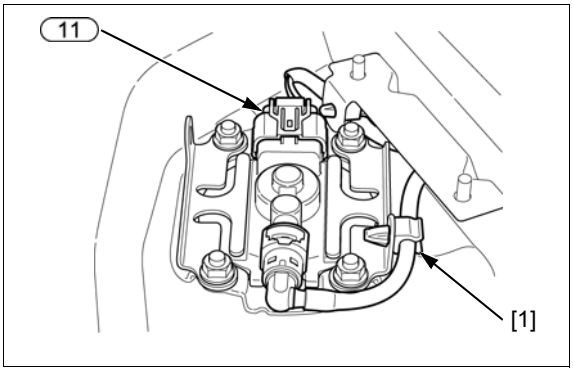
1. Press the connector [1] onto the fuel pump joint/ injector joint until the retainer [2] locks with a "CLICK".
   - Align the quick connect fitting with the pipe.

     If it is hard to connect, put a small amount of engine oil on the pipe end.
2. Make sure the connection is secure; check visually and by pulling the connector.



3. Set the fuel feed hose to the hose clip [1].
4. Connect the fuel pump 5P connector (11).

   Connect the negative (–) cable to the battery (page 7-5).



5. Disconnect the spark plug cap [1] and fuel injector 2P connector (10).

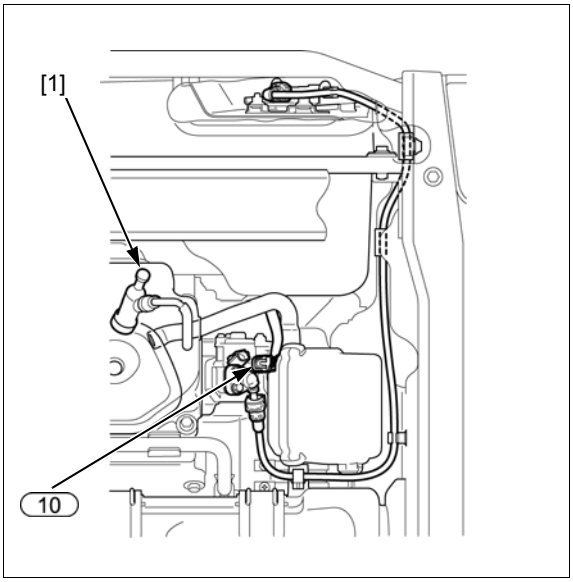
   Turn the main switch ON.

   Push the starter switch.

   The fuel pump will run for about 5 seconds, and fuel pressure will rise.
   Check that there is no leakage in the fuel supply system.

   Turn the main switch OFF.
6. Install the fuel pump cover.

   Connect the spark plug cap and fuel injector 2P connector (10).



FUEL PUMP UNIT REMOVAL/INSTALLATION

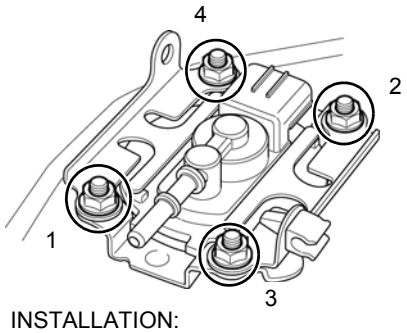
⚠WARNING

Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

- This generator uses resin for part of the materials in the fuel feed hose. Do not bend or twist the fuel feed hose.
- Be careful not to damage the fuel pump.
- Be careful not to pinch the dirt and debris between the fuel pump unit, O-ring, and dust seal.

Relieve the fuel pressure and disconnect the fuel pump side quick connect fitting (page 6-6).

NUT (6 mm) (4)



INSTALLATION:

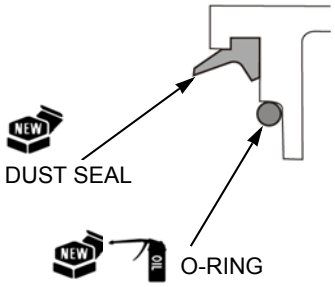
Install and tighten the fuel pump mounting nuts in the sequence shown.

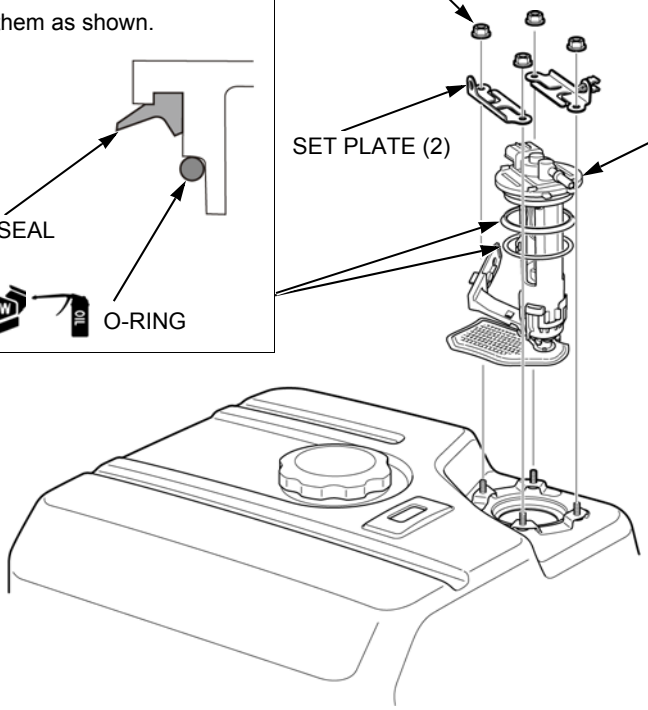
TORQUE 12 N·m (1.2 kgf·m, 9 lbf·ft)

DUST SEAL/O-RING

INSTALLATION:

Install them as shown.



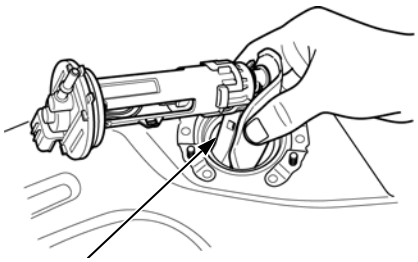


FUEL PUMP

REMOVAL:

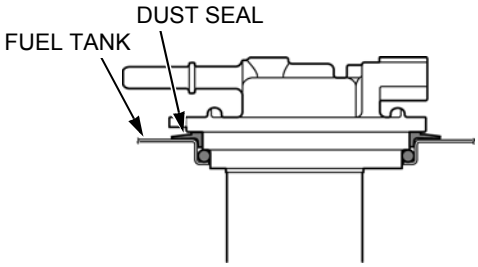
Pull up the fuel pump unit until the fuel pump stay comes out of the hole while folding the filter to prevent damage as shown.

Turn the fuel pump and pull out the fuel pump stay and remove the fuel pump unit.

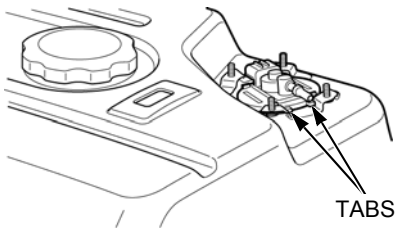


INSTALLATION:

Push the fuel pump until the gap between the dust seal and the fuel tank disappears.



Align the tabs of the fuel pump as shown.



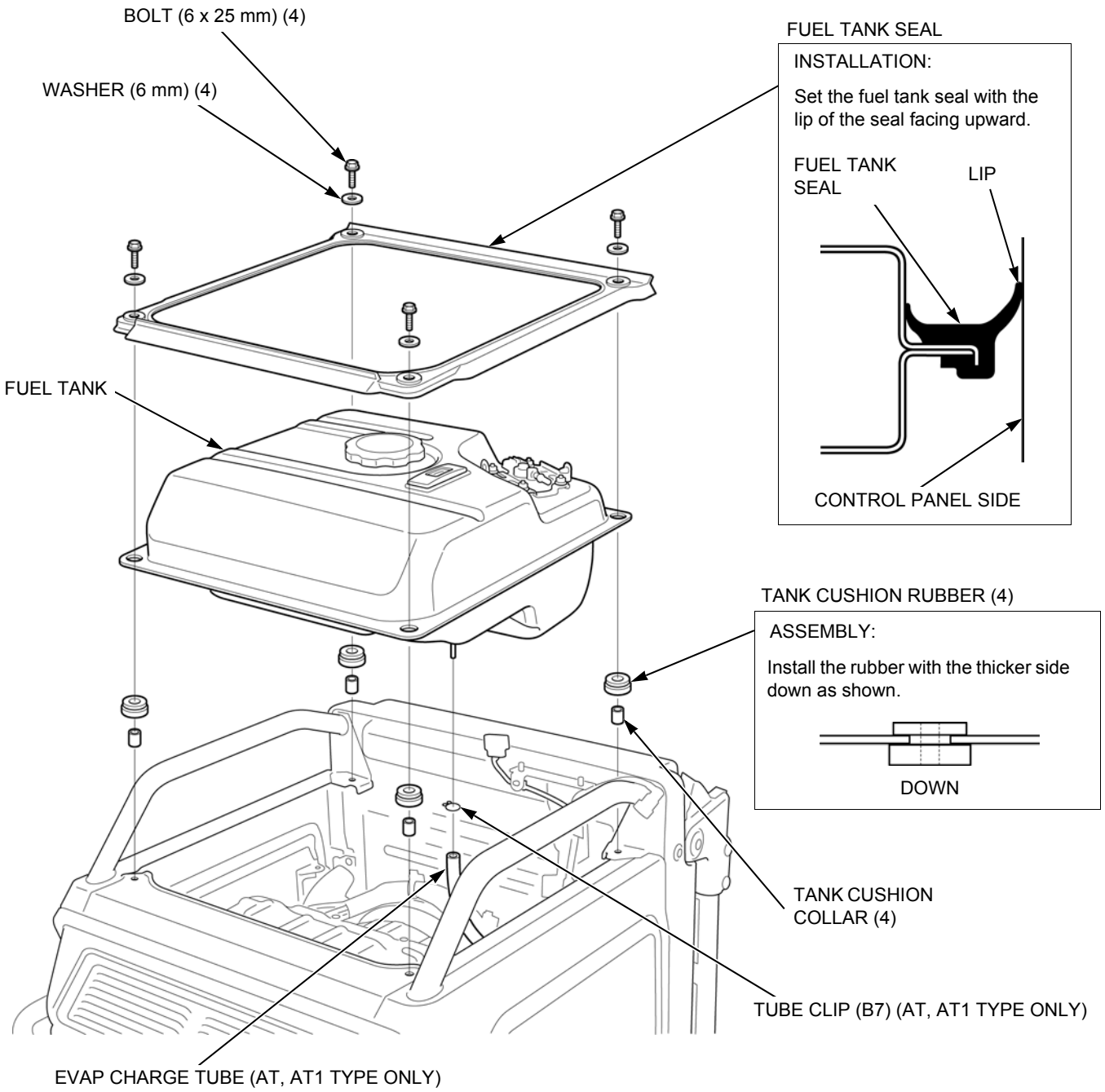
FUEL TANK REMOVAL/INSTALLATION

⚠WARNING

Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

SERVICE BULLETIN #55 =>

Relieve the fuel pressure and disconnect the fuel pump side quick-connect fitting (page 6-6).



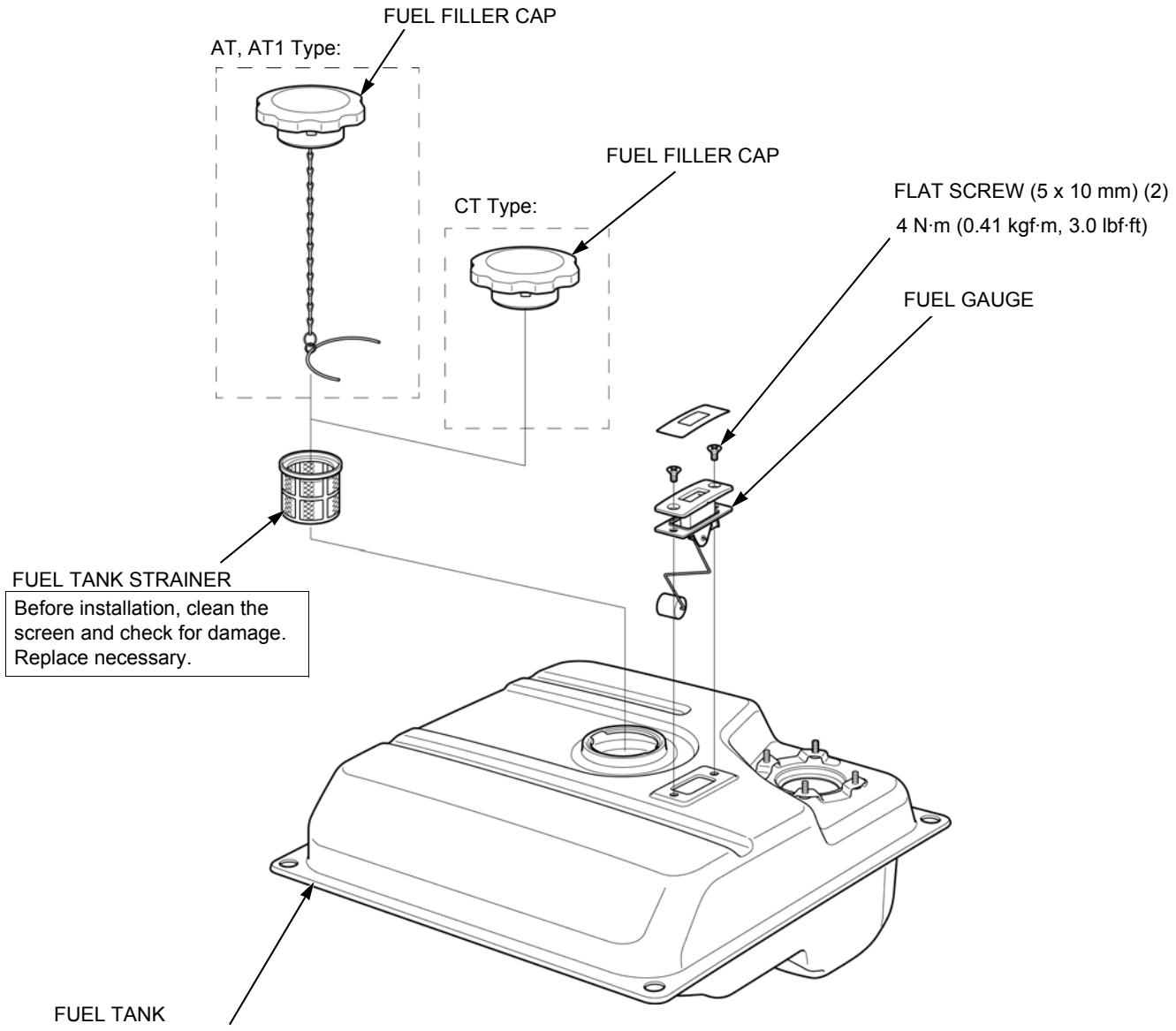
FUEL TANK DISASSEMBLY/ASSEMBLY

⚠ WARNING

Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

Remove the following:

– fuel tank (page 6-10)
– fuel pump (page 6-9)

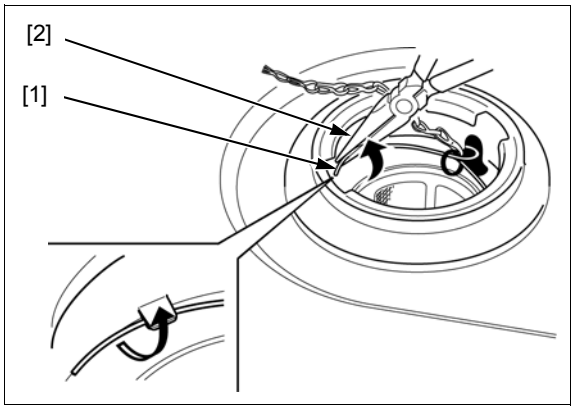


FUEL TANK CAP REMOVAL/INSTALLATION (AT, AT1 TYPE ONLY)

REMOVAL

Open the fuel tank cap.

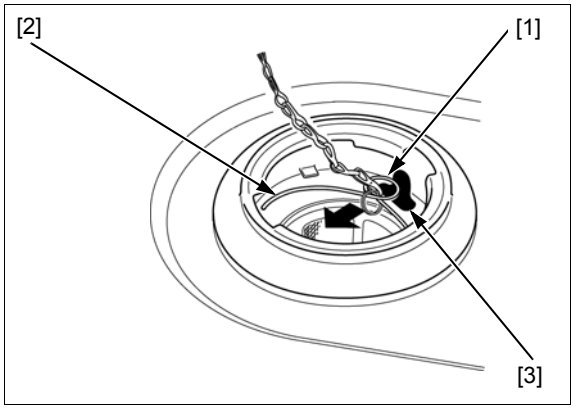
Unhook one tip of the anchor [1] using pliers [2], and then unhook the other tip in the same manner.



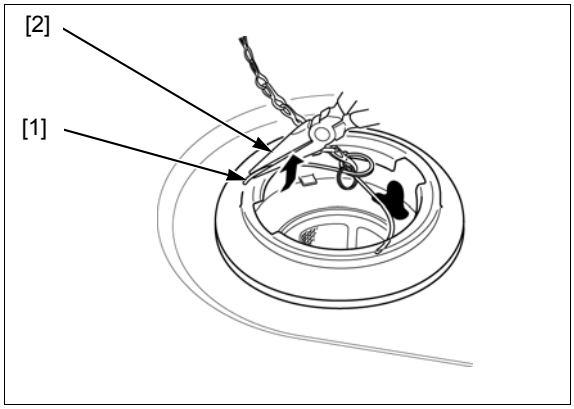
NOTICE

Never try to force the anchor when removing it.

Draw the loop [1] of the anchor [2] from the hole [3] of the fuel filler neck using pliers.



Pull one tip of the anchor [1] out of the fuel filler neck using pliers [2], and then pull the other tip out in the same manner.



NOTICE

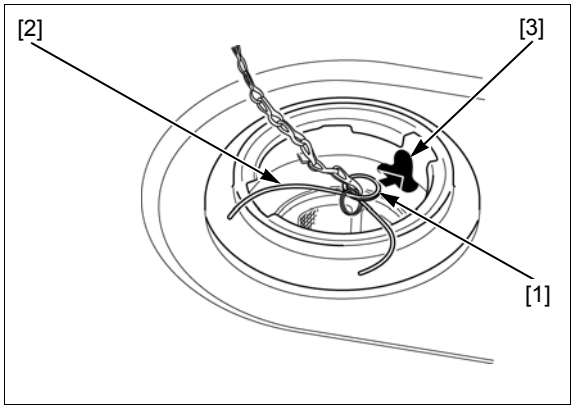
Be careful to avoid damaging the breather pipe in the fuel filler neck.

Remove the anchor from the filler neck.

INSTALLATION

Attach the loop part [1] of the anchor [2] in the hole [3] of the fuel filler neck.

Hook the tips of the anchor in the reverse order of removal.



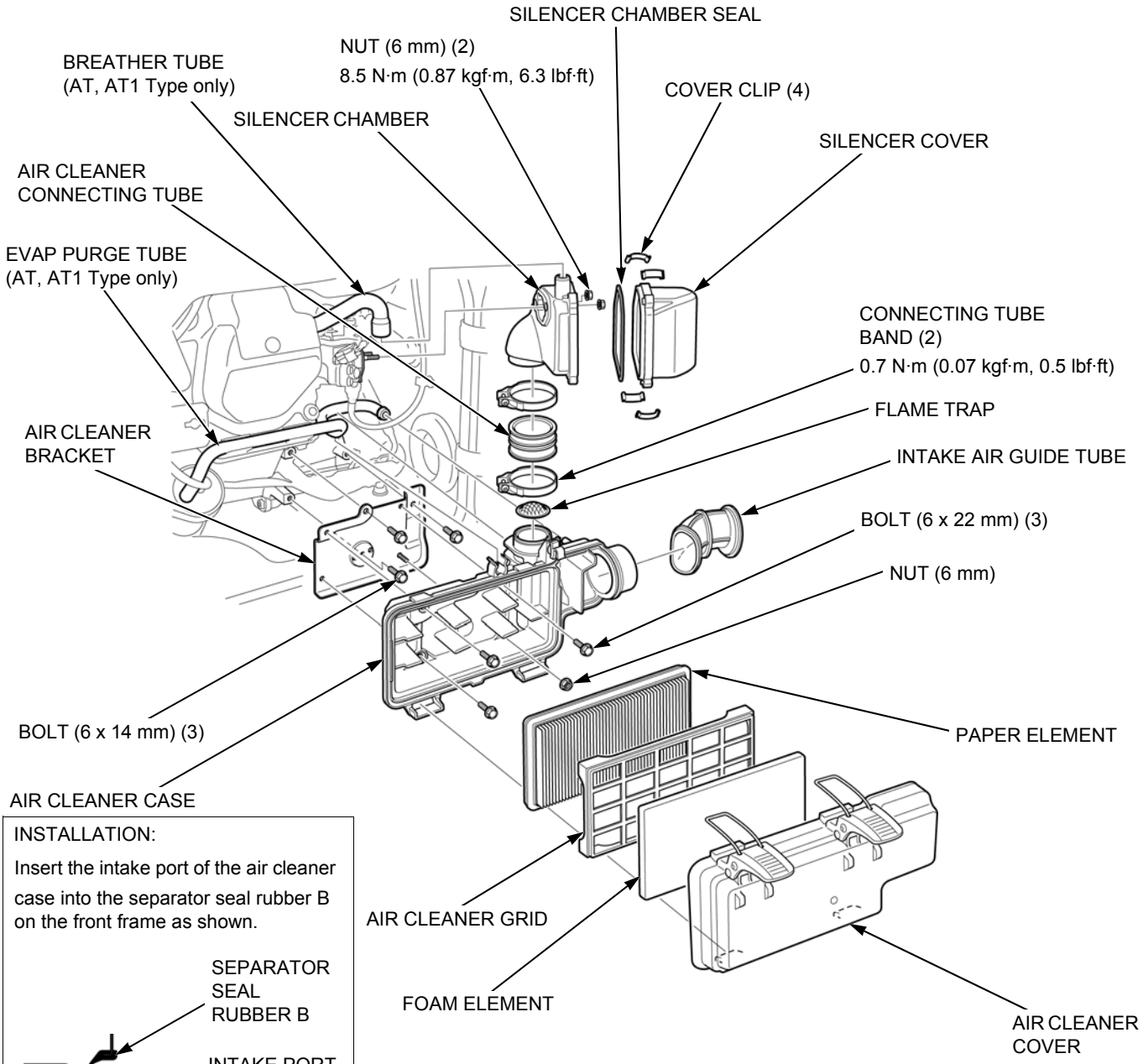
AIR CLEANER REMOVAL/INSTALLATION

Open the left maintenance cover.

Remove the breather heater (CT Type only: page 6-19).

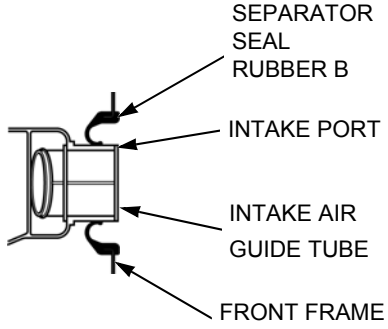
NOTE:

- When installing, route the tubes properly (page 2-24).



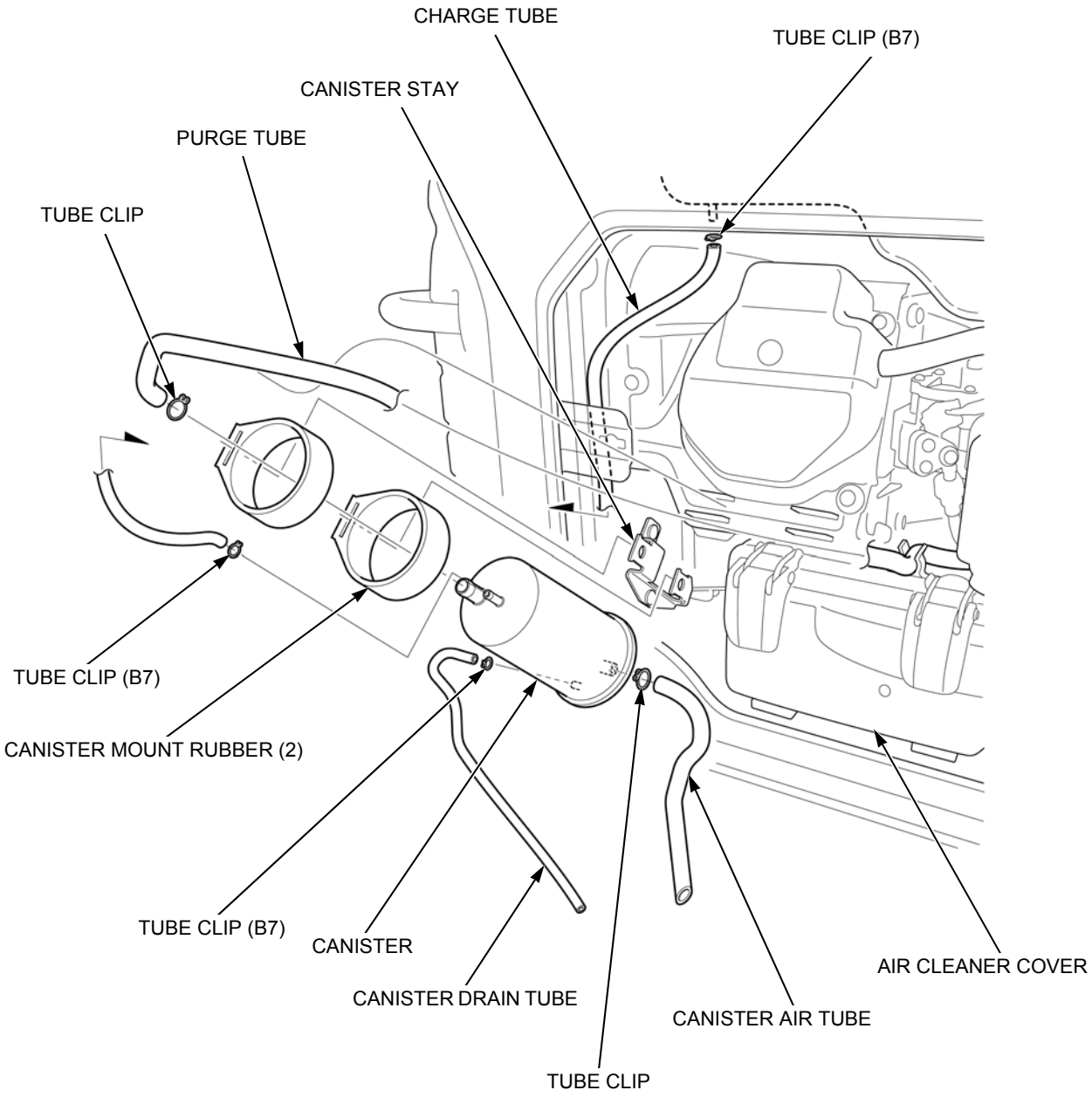
INSTALLATION:

Insert the intake port of the air cleaner case into the separator seal rubber B on the front frame as shown.



EVAP CANISTER REMOVAL/INSTALLATION (AT, AT1 TYPE ONLY)

Open the left maintenance cover.



FUEL INJECTOR REMOVAL/INSTALLATION

⚠WARNING

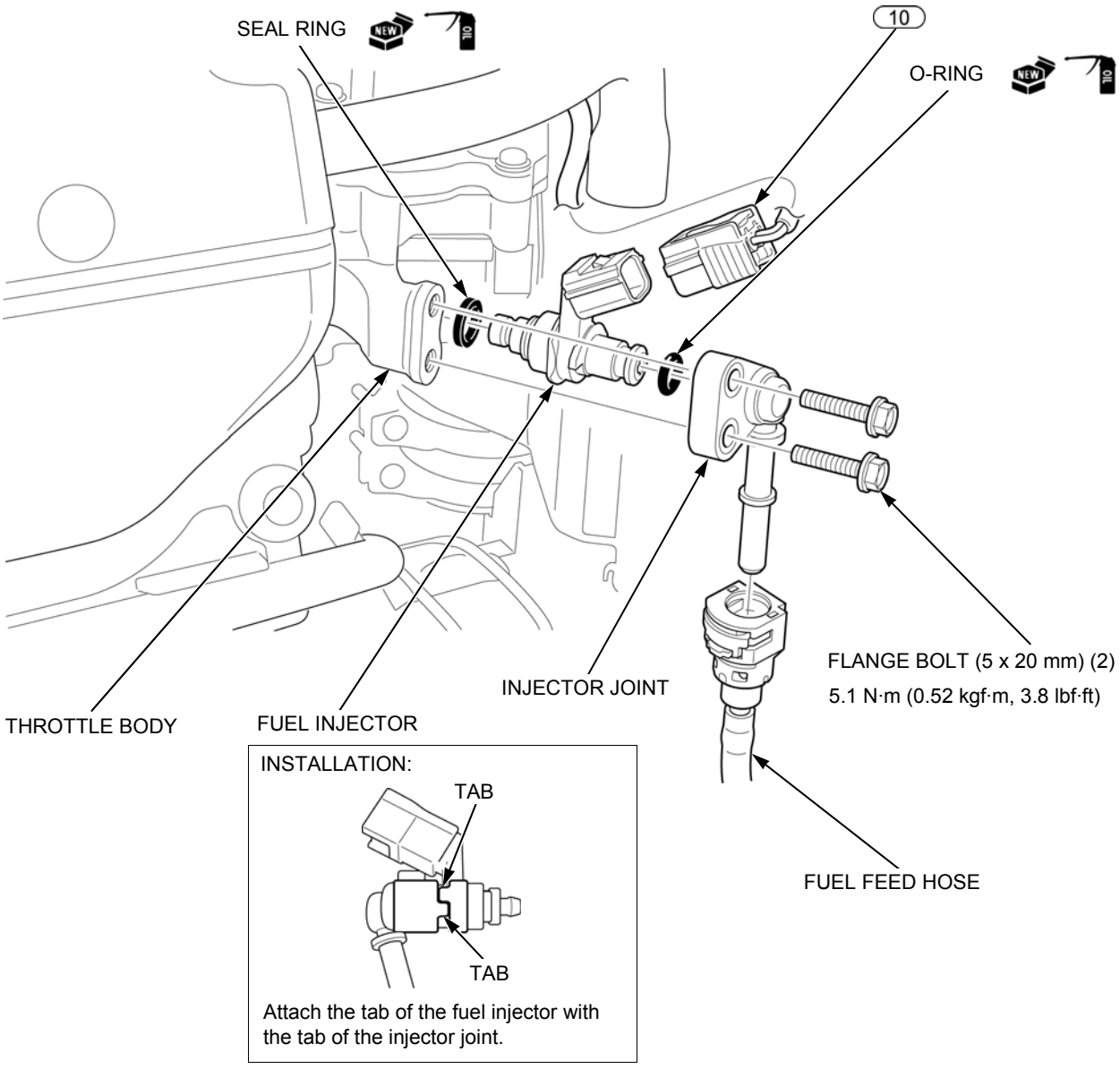
Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

NOTICE

Be careful not to allow dirt and debris between the injector and O-ring.

Open the left maintenance cover.
Disconnect the throttle body side quick connect fitting (page 6-6).

NOTE:
- When installing, route the fuel feed hose properly (page 2-24).
- Replace the O-ring and seal ring with new ones as a set.



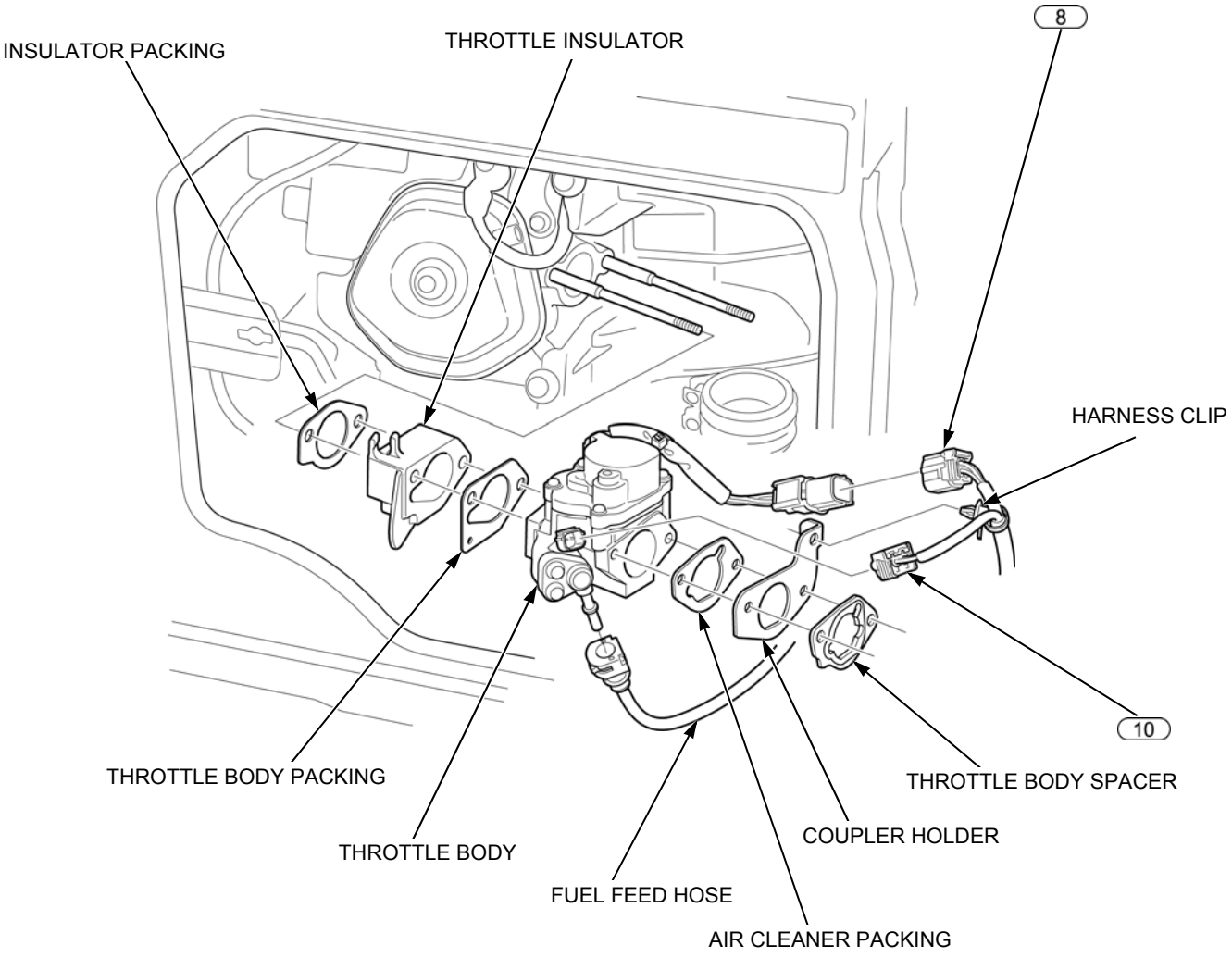
THROTTLE BODY REMOVAL/INSTALLATION

⚠WARNING

Gasoline is highly flammable and explosive. You can be burned or seriously injured when handling fuel.
- Keep heat, sparks, and flame away.
- Handle fuel only outdoors.
- Wipe up spills immediately.

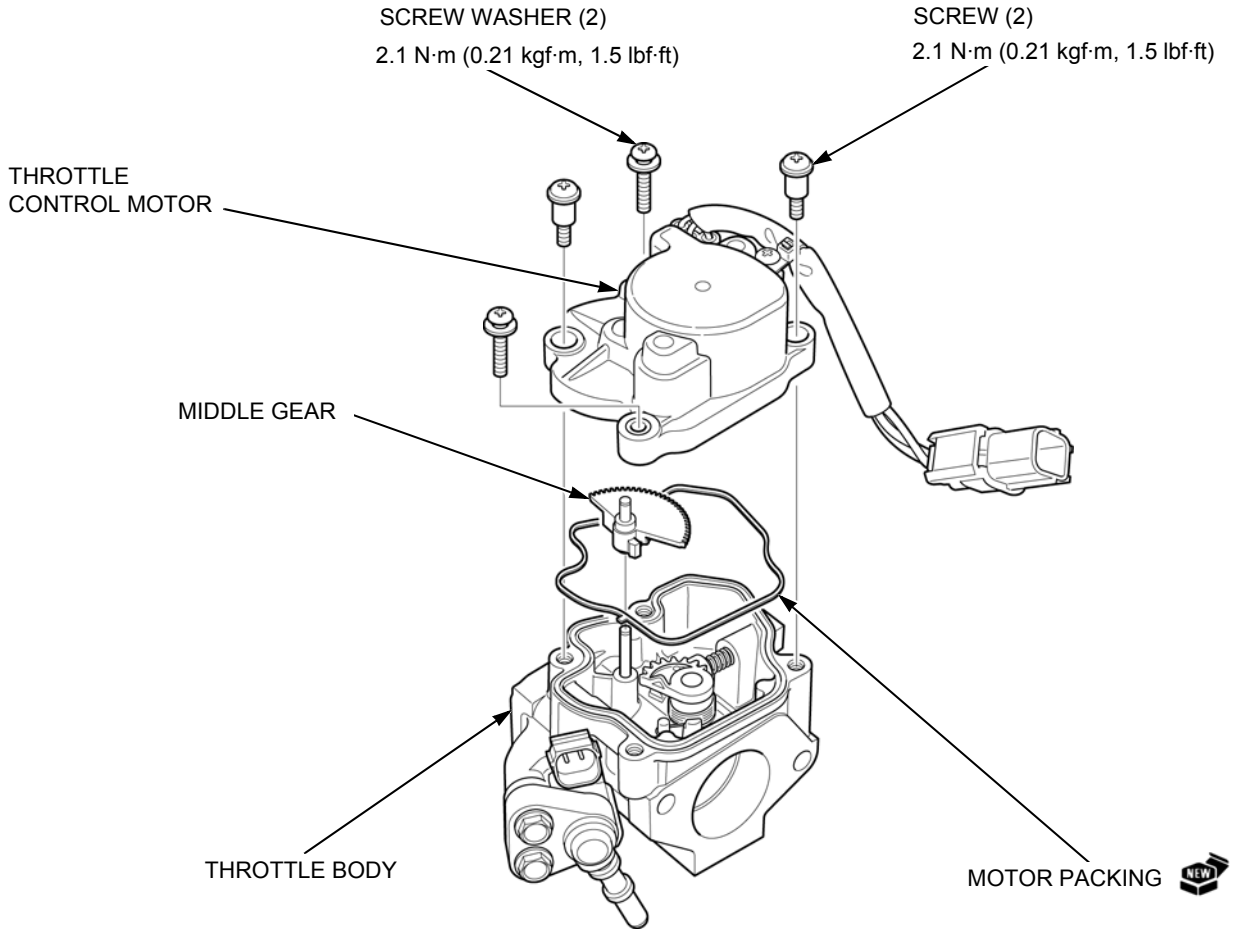
Remove the silencer chamber (page 6-13).
Relieve the fuel pressure and disconnect the throttle body side quick-connect fitting (page 6-6).

NOTE:
- When installing, route the fuel feed hose properly (page 2-24).



THROTTLE BODY DISASSEMBLY/ASSEMBLY

- The throttle body is factory pre-set. Do not disassemble in a way other than shown in this manual.
- Do not damage the throttle body. It may cause incorrect throttle valve operation.
- Be careful not to drop dirt and debris into the throttle body.



O2 SENSOR REMOVAL/INSTALLATION

NOTICE

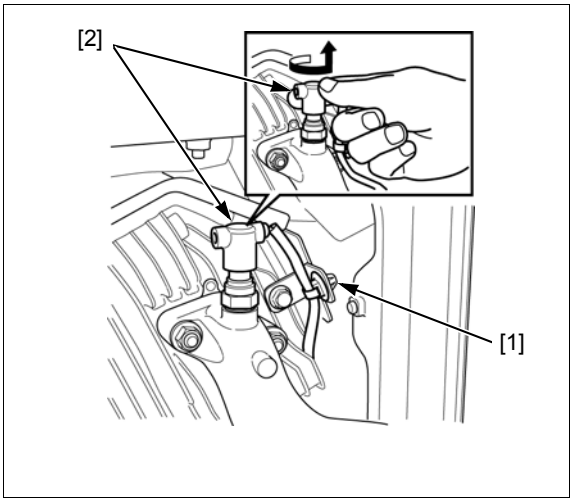
- *Replace the O2 sensor if grease, oil, water, or other materials get in the air hole or inside the sensor. Do not reuse the contaminated sensor.*
- *Do not get any cleaning agents inside the O2 sensor.*
- *The O2 sensor may be damaged if dropped. Replace it with a new one, if dropped.*

Remove the muffler and air guide insulator (page 11-2).

Remove the O2 sensor wire clamp [1].

Hold the center of the O2 sensor cap [2] as shown.

Disconnect the cap from the sensor while slightly turning it less than 1/2 of a turn.



NOTICE

- *Do not use pliers or other tools when disconnecting the O2 sensor cap.*
- *Do not pull the O2 sensor wire.*

Remove the O2 sensor.

- Do not use an impact wrench when removing or installing the O2 sensor, or it may be damaged.

Install the O2 sensor onto the exhaust pipe.
Tighten the O2 sensor to the specified torque.

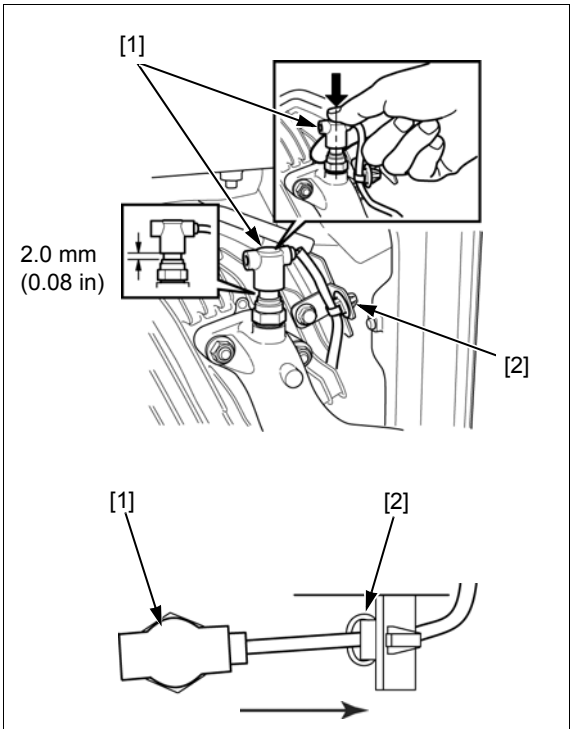
TORQUE: 24.5 N·m (2.5 kgf·m, 18 lbf·ft)

Connect the O2 sensor cap [1] to the O2 sensor by pushing it straight down as shown.

Install the O2 sensor wire clamp [2].

NOTICE

- *Be careful not to tilt the O2 sensor cap when connecting the cap to the O2 sensor.*
- *Make sure that the gap between the O2 sensor and sensor cap is less than 2.0 mm (0.08 in).*



The O2 sensor cap facing the harness band side.

EBT SENSOR REMOVAL/ INSTALLATION

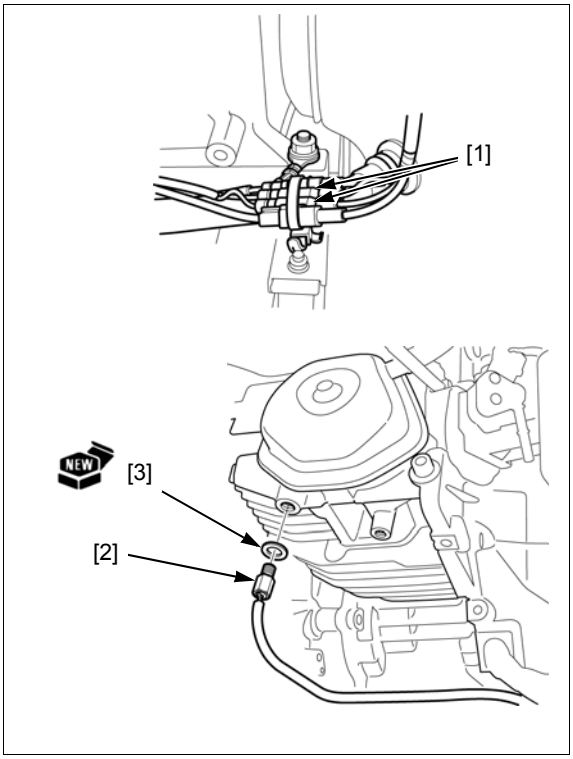
Remove the head cover lower shroud (page 13-2).

Disconnect the EBT sensor wire connectors [1].

Remove the EBT sensor [2].

Install the EBT sensor and new sealing washer [3], and tighten the EBT sensor to the specified torque.

TORQUE: 9 N·m (0.92 kgf·m, 6.6 lbf·ft)



BREATHER HEATER REMOVAL/ INSTALLATION (CT TYPE ONLY)

Open the left maintenance cover.

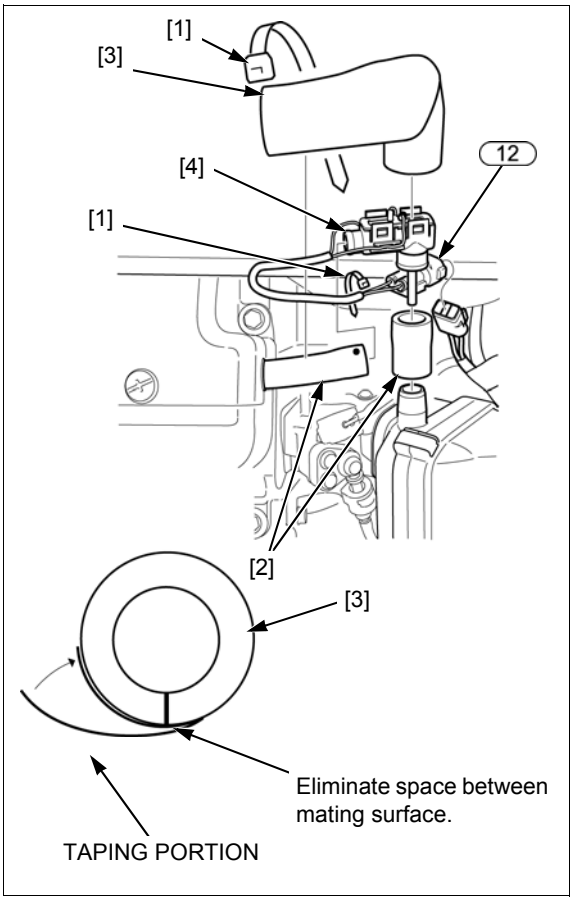
Disconnect the breather heater 2P connector (12).

Remove the wire bands [1].

Disconnect the breather tubes [2] and remove the breather heater insulator [3].

Remove the breather heater [4].

Installation is in the reverse order of removal.



FUEL LINE INSPECTION

SPECIAL TOOL #8 =>

FUEL PRESSURE TEST

Open the left maintenance cover.

Remove the fuel feed hose [1] from the hose clip [2].

Relieve the fuel pressure and disconnect the injector side quick-connect fitting (page 6-6).

Attach the fuel pressure gauge.

TOOLS:

Fuel pressure gauge [3] 074APJ-Z37A100

Connect the fuel pump 5P connector and negative (-) battery terminal.
Start the engine using the electric starter and read the fuel pressure.

STANDARD: 294 kPa (3.0 kgf/cm², 43 psi)

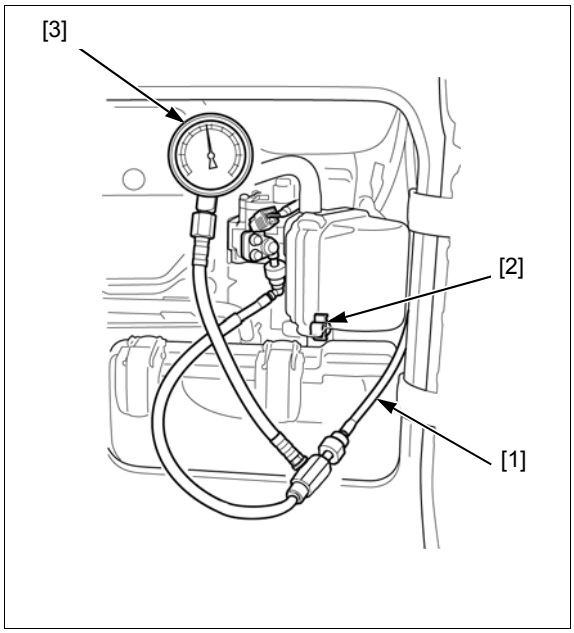
If the fuel pressure is higher than specified, replace the fuel pump assembly. See NOTE below.

If the fuel pressure is lower than specified, inspect the following:
– Leaking fuel line
– Pinched or clogged fuel feed hose or fuel tank cap breather
– Clogged fuel filter (page 3-13)
– Fuel pump unit (page 6-21)

NOTE:

A fuel pressure reading that is greater or less than the standard fuel pressure may not be an indication of a faulty fuel pump. Inspect all other fuel system components for problems before replacing the fuel pump. Contact Techline for assistance.

After inspection, relieve the fuel pressure (page 6-6).
Remove the fuel pressure gauge from the injector.
Reconnect the quick connect fitting onto the injector (page 6-8).



FUEL FLOW INSPECTION

Open the left maintenance cover.

Relieve the fuel pressure and disconnect the injector side quick-connect fitting (page 6-6).

Place the end of the fuel feed hose into an approved gasoline container.
• Wipe up any spilled gasoline.

Temporarily connect the fuel pump 5P connector and battery cables.

Turn the main switch ON and push the START button.
Measure the amount of fuel flow.

NOTE:

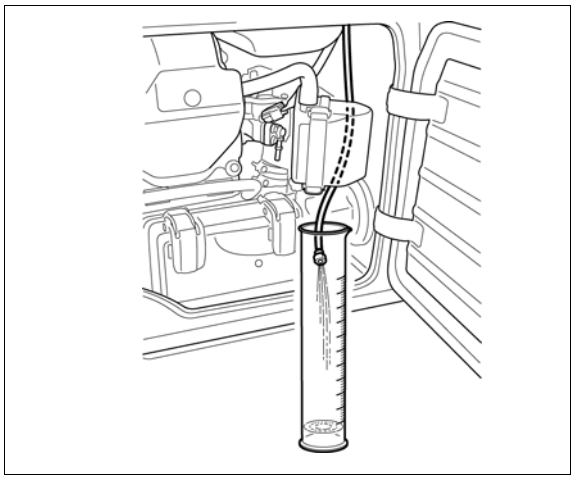
• The fuel pump operates for 5 seconds. Repeat 2 times to meet the total measuring time.
• After measuring the fuel flow, pour the fuel back into the fuel tank.

Amount of fuel flow:

55 cc (1.9 US oz, 1.9 Imp oz) minimum/ 10 seconds

If fuel flow is less than specified, inspect the following:
– Fuel pump unit (page 6-21)
– Clogged fuel filter (page 3-13)
– Pinched or clogged fuel feed hose.

Connect the quick connect fitting (page 6-8).



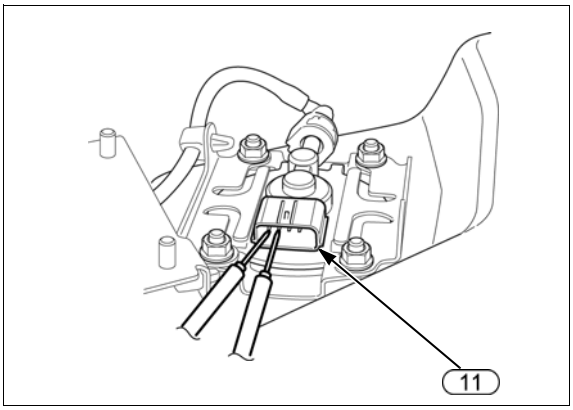
FUEL PUMP INSPECTION

Remove the fuel pump cover (page 6-6).

Disconnect the fuel pump 5P connector (11).

Measure the resistance between the terminals of the 5P connector.

Standard resistance: 0 – 20 Ω (at 20 °C/68 °F)

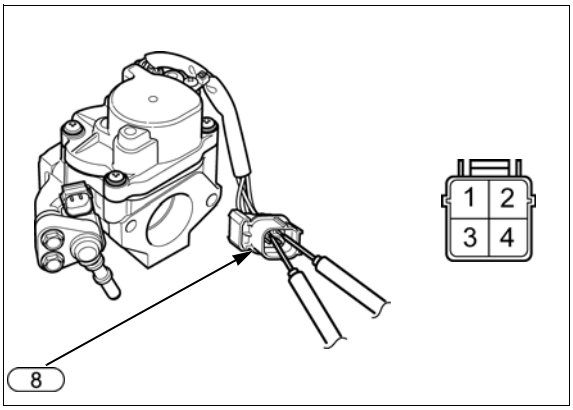


THROTTLE CONTROL MOTOR INSPECTION

Remove the throttle body (page 6-16).

Measure the resistance between the terminals of the 4P connector (8).

Connector	Terminal	Ω
(8)	1 – 3	65 – 75
	2 – 4	65 – 75



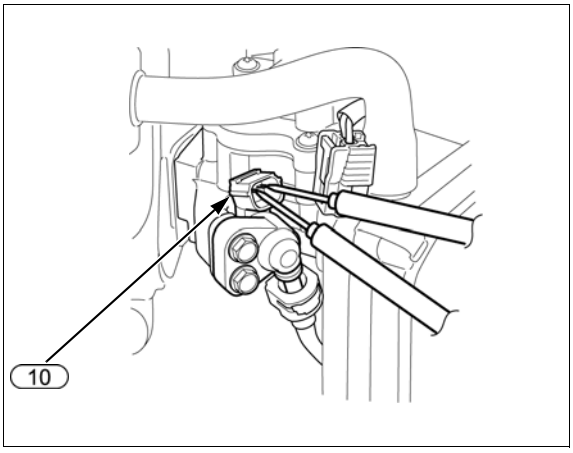
FUEL INJECTOR INSPECTION

Open the left maintenance cover.

Disconnect the fuel injector 2P connector (10).

Measure the resistance between the terminals of the 2P connector.

Standard resistance: 11 – 13 Ω (at 24 °C/75 °F)



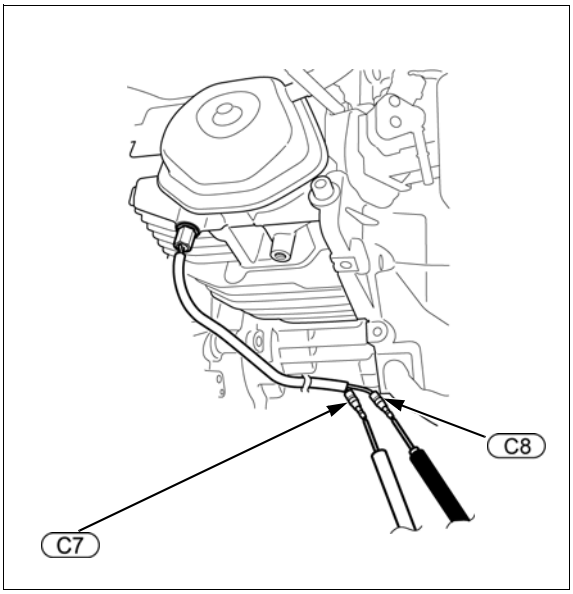
EBT SENSOR INSPECTION

Remove the air cleaner case and air cleaner bracket (page 6-13).

Disconnect the EBT sensor wire connectors (C7 and C8).

Measure the resistance between the terminals.

Standard resistance: 1.6 – 2.9 kΩ
(at 20 °C – 30 °C/68 °F – 86 °F)



BREATHER HEATER INSPECTION (CT TYPE ONLY)

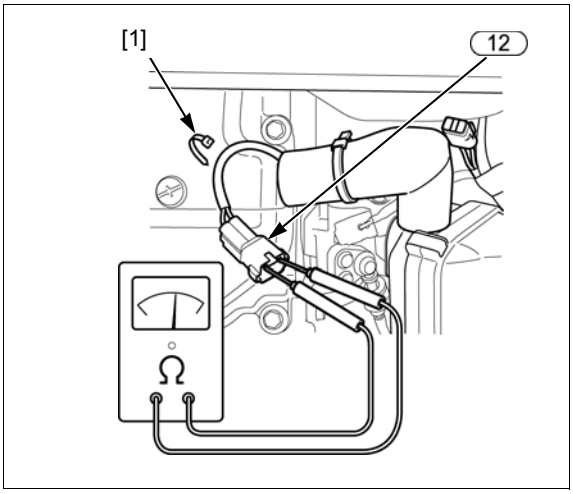
Open the left maintenance cover.

Remove the wire band [1].

Disconnect the breather heater 2P connector 12.

Measure the resistance between the terminals of the 2P connector.

Standard resistance: 0.8 – 1.2 kΩ (at 25 °C/77 °F)



7. GENERATOR/CHARGING SYSTEM

GENERATOR TROUBLESHOOTING

⚠WARNING

High voltage and electrical current present. Touching the non-insulated portions of the meter leads or generator wiring can cause shock or electrocution.
Wear insulated gloves and avoid handling non-insulated wiring.

MECHANICAL TROUBLESHOOTING

When presented with an EU7000is inverter generator exhibiting error codes or unusual running problems, follow the steps below BEFORE troubleshooting by the error code(s) found on page 4-9.

Remember, mechanical problems can lead to error codes and replacement of expensive electronic components that may not be faulty. Some of these steps, hints, and directions may seem irrelevant or an inefficient use of time. It has been shown that following these steps leads to easier and earlier identification of the actual problem or faulty component.

Follow these steps and, when necessary, contact Techline or your District Service Manager if additional assistance is necessary.

REMINDER: All major component replacement requires prior warranty authorization from Techline or your District Service Manager. Major components include the inverter, GCU, stator, rotor, and major engine components.

It may not be necessary to perform all of the following troubleshooting steps:

- Always complete sections 1 and 2.
- If the generator starts and immediately stalls or runs less than 10 seconds, refer to sections 3 to 5.
- If the generator runs for more than 10 seconds, refer to sections 6 and 7.

1. QUESTION THE CUSTOMER

When an EU7000is generator is brought in for repair, be sure to fill out the i-Monitor Detail Error Log (found in the back of this manual). This document is required before your DSM or Techline representative can authorize warrantable inverter generator repairs.

Important information to get from the customer:

- Description of generator usage at the time of the failure
- Receptacles used
- Loads (manufacturer, model, volts, and amps of each load)
- Extension cord length and gauge

EU7000iS i-MONITOR DETAIL ERROR LOG
FAX this page to Techline at (678) 339-2519 or email to petl@ahm.

Dealer name:_____ Dealer number:_____
Contact:_____ Telephone number: (
Generator Model: Frame serial number (including prefix): Date of purchase:

1. **Describe the failure:** _____
2. **Describe how the generator was being used at the time of the failure.**
3. **Extension cord gauge _____ and length _____ (if applicable).**
4. **i-Monitor error log (see READING THE ERROR CODES and error detail code definitions on pa**

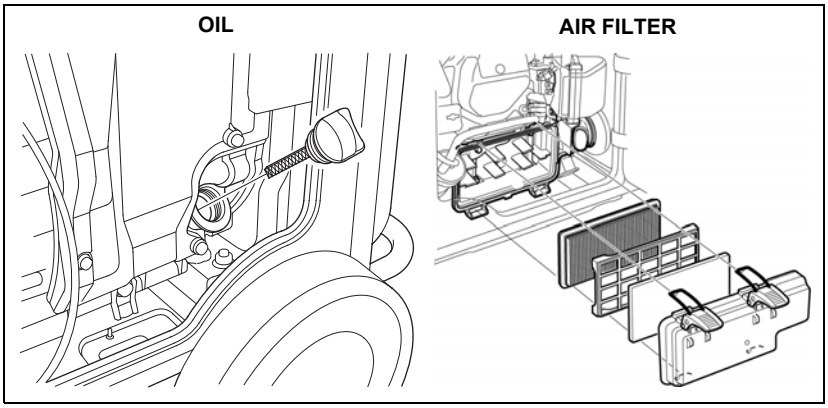
Error Code #1 _____		
Error Detail #	Number in display	Units
1		Hour
2		Volts

Error Code #2 _____		
Error Detail #	Number in display	Units
1		Hour
2		Volts

Error Code #3 _____		
Error Detail #	Number in display	Units
1		Hour
2		Volts

2. CHECK THE CONDITION OF THE GENERATOR

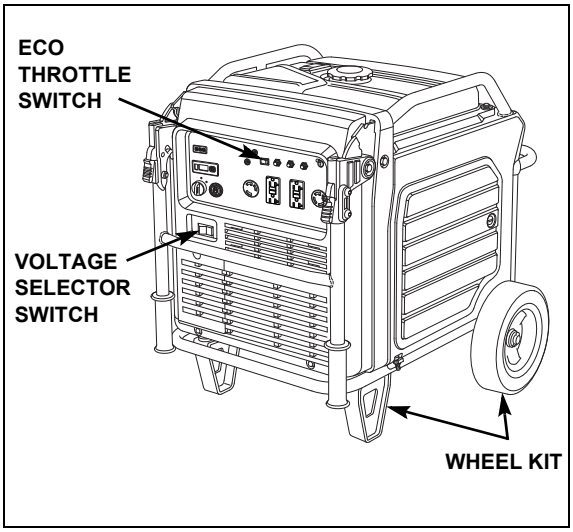
With the customer present, document the condition of the fuel, oil (level, color, odor) and air filter.



Note the position of the Eco Throttle® switch and the voltage selector switch at the time the unit is brought in.

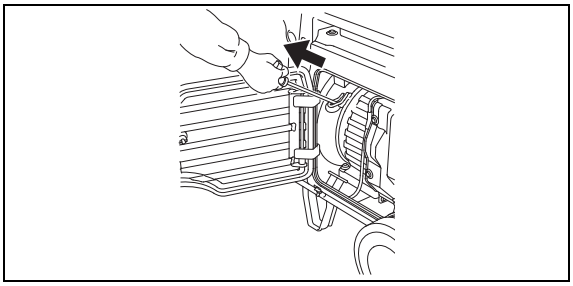
Is the wheel kit installed? The unit requires open space under and around the generator for cooling purposes.

Is there evidence of the unit being run in an enclosure or restricted area? Exhaust soot on painted surfaces is a good indicator.

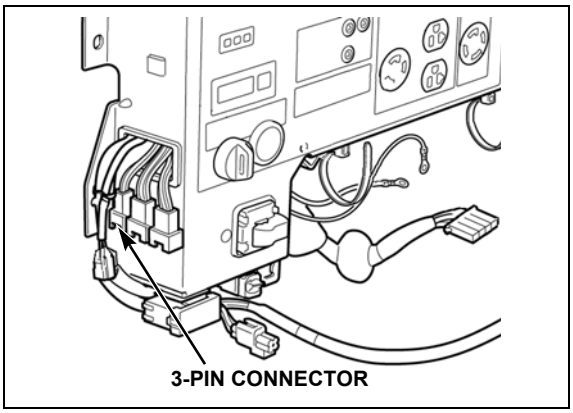


3. NOTE ANY UNUSUAL RECOIL RESISTANCE

Use the recoil starter to determine the presence of an electronic brake load on the generator. If such a load is present, the unit will be difficult to pull over by hand.



Disconnecting the GCU (Generator Control Unit) from the stator normally relieves this load. Disconnecting the 3-pin connector (red, white, blue wires) on the left side of the control panel also relieves the load. A faulty GCU could cause the problem, and may not force error codes from the i-Monitor.

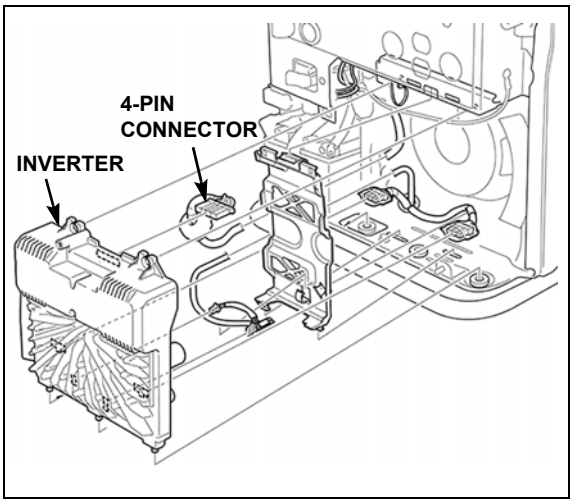


4. CHECK THE VOLTAGE SELECTOR SWITCH

If the engine starts and the green output indicator light illuminates for several seconds, followed by the green light going out and the red overload indicator light illuminating while the engine defaults to a low idle speed, there may be a problem with the voltage selector switch. There may also be a buzzing noise coming from the switch when it is in either position.

Turn the unit off and disconnect the 4-pin connector from the inverter as shown. Restart the unit. If the green output indicator stays illuminated and the Eco Throttle switch functions properly, the voltage selector switch may be faulty.

Test the voltage selector switch according to the shop manual procedure.

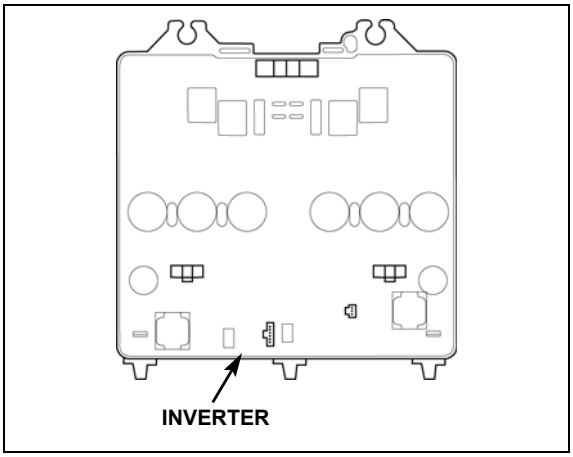


5. INSPECTION

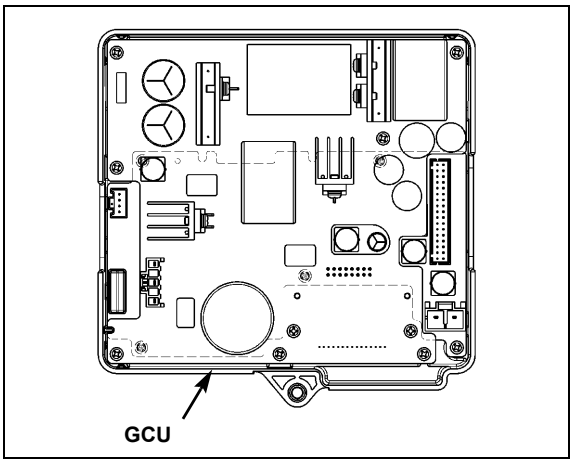
Perform a visual inspection of the GCU and inverter. Component inspection is listed in the order in which they need to be removed to access the next component.

Inverter: Visually inspect the back of the inverter for any discolored or damaged wiring, capacitors, or connectors, and note any bubbling, corrosion, or other unusual conditions. If any of these issues are present, the inverter is likely faulty.

While the inverter may be faulty, it may not be the cause for the overall generator failure. Some other circumstance, or other component failure, may have caused the inverter to fail. Contact Techline or your District Service Manager for further instruction.



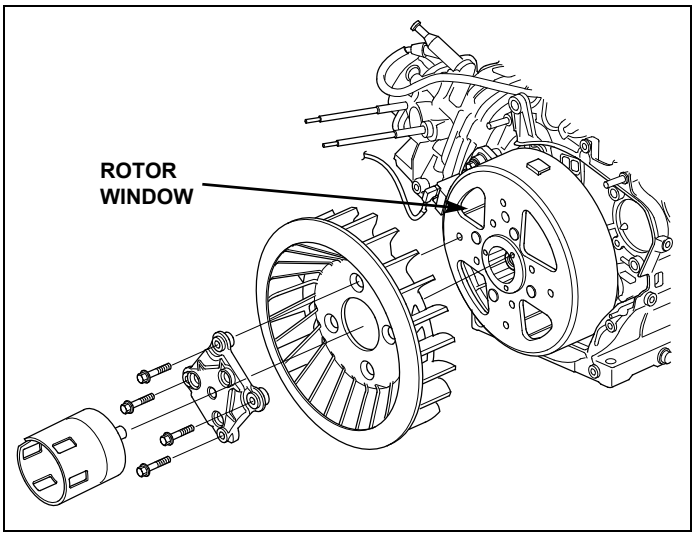
GCU: To visually inspect the GCU, remove the front cover and the control panel. Visually inspect the circuit board on the backside of the GCU for any discolored spots, deterioration, contamination, or deformed capacitors.



Stator: The output and resistance tests performed in the Generator Troubleshooting Guide or the appropriate shop manual should be enough to determine if the stator is good or not. The stator resistance readings should be consistent. If there is more than 0.2 Ω of difference between readings, the stator has failed.

The stator can also be visually inspected by removing the spark plug, inverter, recoil starter, and cooling fan, and then looking through the rotor windows at the stator windings. Rotate the rotor by hand and slowly look for any signs of overheated or discolored stator windings.

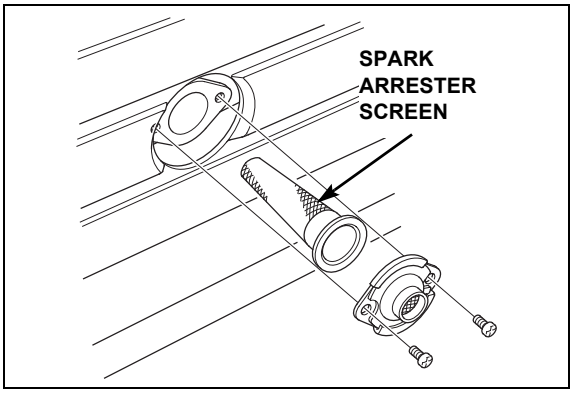
If the wheel kit had been removed and the unit was mounted on a service truck, look for broken, damaged, or loose rotor magnets due to excessive vibration.



6. CHECK THE SPARK ARRESTER SCREEN

Clean or replace as necessary. A badly clogged screen could also be an indicator that the muffler passages are clogged or reduced due to carbon buildup. Excess carbon buildup may indicate high engine hours, operation with a restricted air cleaner, or operating the generator in an enclosure.

If the spark arrester was heavily clogged, run the generator outdoors on the load bank for 30 minutes at 50 ~ 60% load to dynamically decarbon the combustion chamber. Let the generator cool down, and then reinstall the spark arrester.



7. FUEL PRESSURE TEST

If the generator displays an E-0A code, surges under load, or surges and stalls, the fuel system needs to be inspected.

Test the fuel pressure:

- Remove the fuel feed hose from the hose clip.
- Relieve the fuel pressure by disconnecting the injector side quick-connect fitting.
- Attach the fuel pressure gauge.

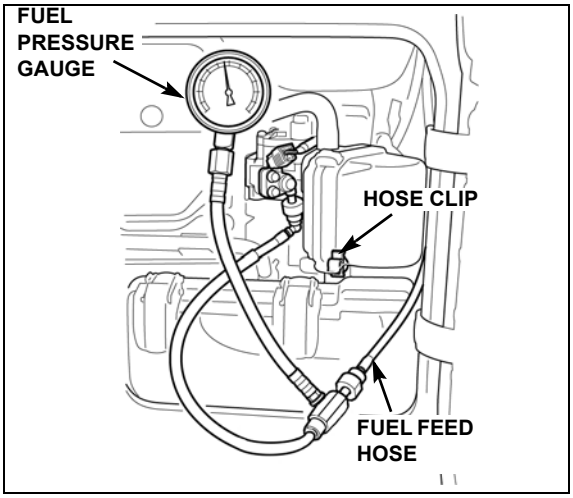
  TOOL: Fuel pressure gauge
  P/N 074APJ-Z37A100

- Start the engine using the electrical starter and read the fuel pressure.

  STANDARD: 43 psi (294 kPa, 3.0 kgf/cm^2)

If the fuel pressure is lower than specified, inspect the fuel filter. If the fuel filter is clean, contact Techline.

Refer to page 4-33 for additional information.



8. START AND LOAD TEST THE GENERATOR

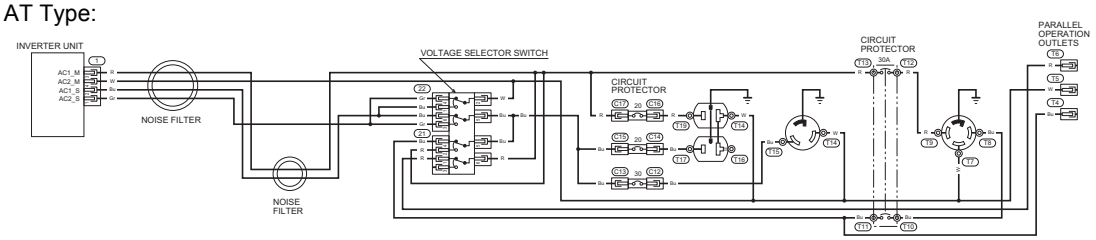
Note any changes in the way the engine runs.

- If the problem is now resolved, be sure to note the hours and any stored error codes on the repair order.
- If a problem remains after the above steps have been taken, refer to page 7-6 to troubleshoot the generator. Perform the visual inspection (step 5 on page 7-4) when removing the control panel and inverter.
- If the generator starts and runs but does not carry the rated load during the load bank test, check the following:
  - Throttle control motor not functioning properly
  - Engine compression

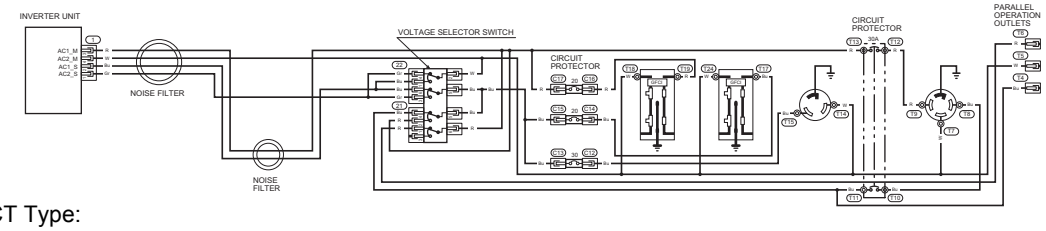
Repair as necessary and repeat load bank test.

NO AC OUTPUT

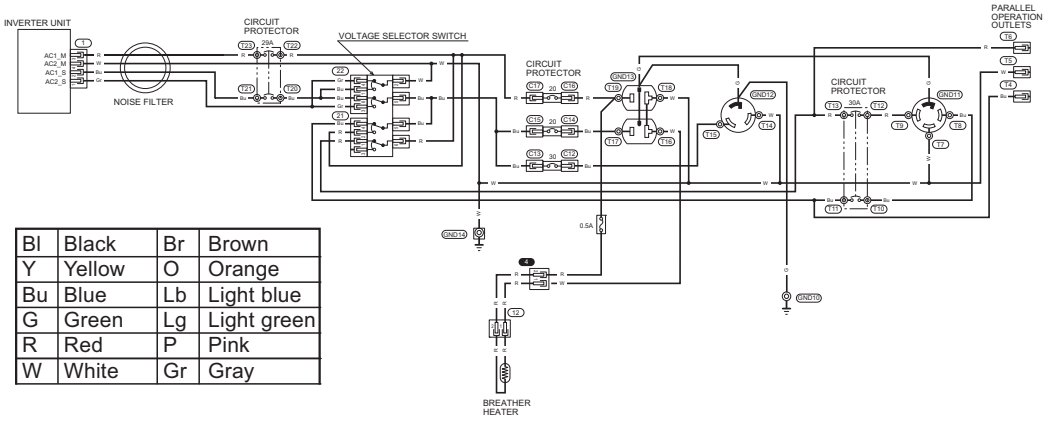
AT Type:



AT1 Type:



CT Type:



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Check for error codes on the i-Monitor while the engine running.

Displayed → Perform the SELF-DIAGNOSTIC TROUBLESHOOTING (page 4-9).

Not displayed

Check to see if the overload indicator is ON with the engine running.

ON → Perform the INVERTER UNIT EXCESSIVE CURRENT PROTECTION ACTIVATED/ INVERTER UNIT EXCESSIVE VOLTAGE PROTECTION ACTIVATED (page 4-37).

OFF

Go to page 7-7

From page 7-6

Check the stator (page 7-17).
- Abnormal → Replace the stator.
- Normal ↓

Check the inverter unit (page 7-18).
- Abnormal → Replace the inverter unit.
- Normal ↓

Check the following control panel parts:
- Receptacles
- Circuit protectors
- Voltage selector switch
- Main wire harness in the control panel for open circuit

- Abnormal → Replace or repair the faulty part(s).
- Normal ↓

Replace the inverter and recheck.

LOW AC OUTPUT

Check whether an error code is displayed on the i-Monitor with the engine running.
- Displayed → Perform the SELF-DIAGNOSTIC TROUBLESHOOTING (page 4-9).
- Not displayed ↓

Check the engine speed with the circuit protector in the ON position, and the Eco-Throttle switch in the OFF position, Check the voltage selector switch in the "120/240" position.

Check the engine speed.
STANDARD: 3,300 – 3,600 min^{-1} (rpm)

- Abnormal → Perform the ENGINE SPEED DOES NOT STABILIZE (page 4-7).
- Normal ↓

Check the stator inspection (page 7-17).
- Abnormal → Replace the generator.
- Normal ↓

Replace the inverter.

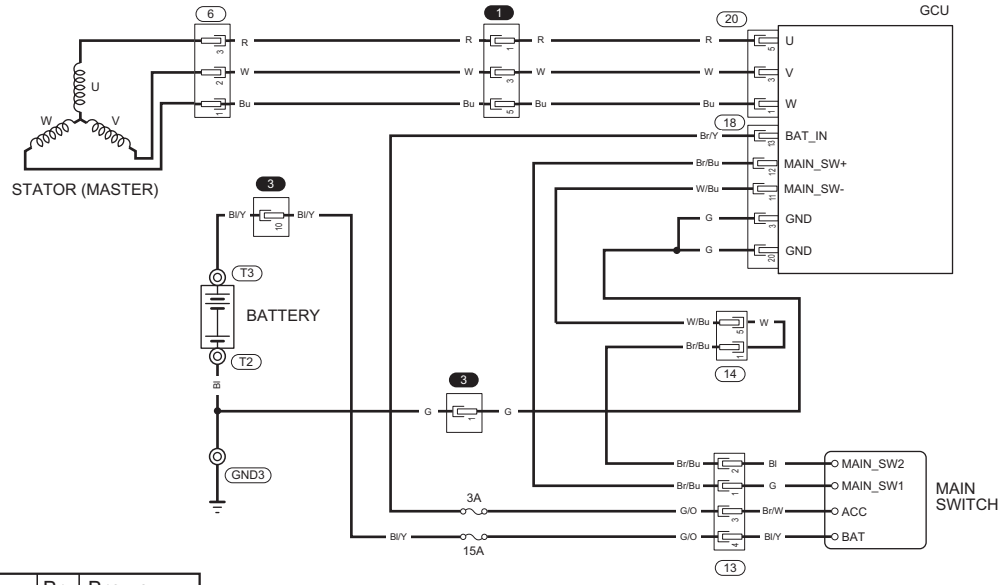
Restart the engine and warm up the engine to operating temperature.
Recheck the AC voltage at the AC output.

- Normal → Faulty original inverter unit.
- Abnormal ↓

Replace the GCU and recheck.

CHARGING SYSTEM TROUBLESHOOTING

BATTERY IS DAMAGED OR WEAK



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

MAIN SWITCH				
	MAINSW1	MAINSW2	BAT	ACC
ON	○	○	○	○
OFF				

Check whether the i-Monitor is on when the main switch is turned ON.

OFF → Perform the i-MONITOR DOES NOT DISPLAY BY MAIN SWITCH TURNED ON (page 4-19).

ON ↓

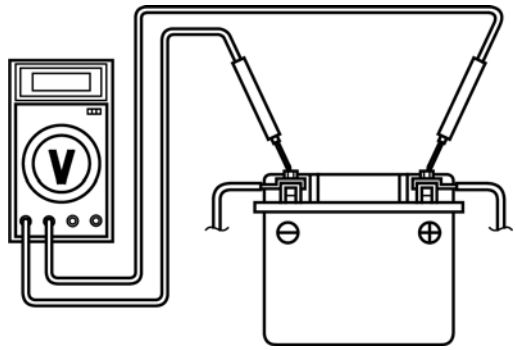
Check the battery condition, using a battery tester (page 7-16).

Abnormal → Replace or recharge the battery.

Normal ↓

With the engine running at normal operating temperature, measure the battery voltage.

The battery voltage should not exceed 14.5 V while the engine is running.



Abnormal → Replace the GCU and recheck.

BATTERY REMOVAL/INSTALLATION

⚠WARNING

Hydrogen gas from batteries is highly flammable and explosive.
You can be burned or seriously injured when charging the battery.
- Keep heat, sparks, and flame away.

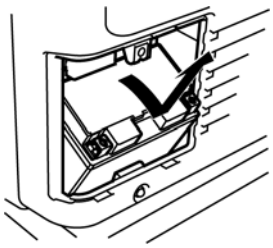
- The battery is a Valve Regulated Lead Acid (VRLA) maintenance-free battery. Do not open or tamper with the battery.
- The YTZ-14S battery specially designed for use in this generator. Other batters must not be used.
- When removing the battery, turn the main switch to the off position.
- When removing the battery, disconnect the negative (–) cable first, then disconnect the positive (+) cable
- When installing the battery, connect the positive (+) cable first, then the negative (–) cable.

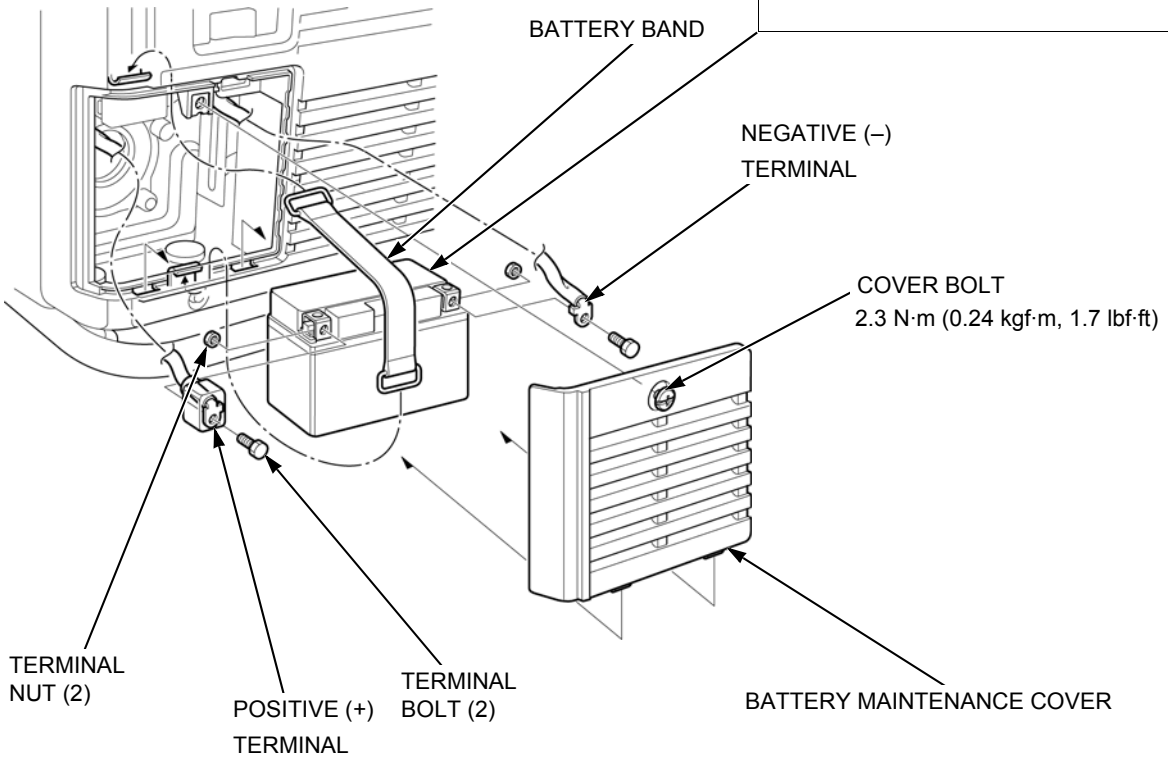
BATTERY (YTZ-14S)

REMOVAL/
INSTALLATION:

Remove or install the battery by tipping it as shown.

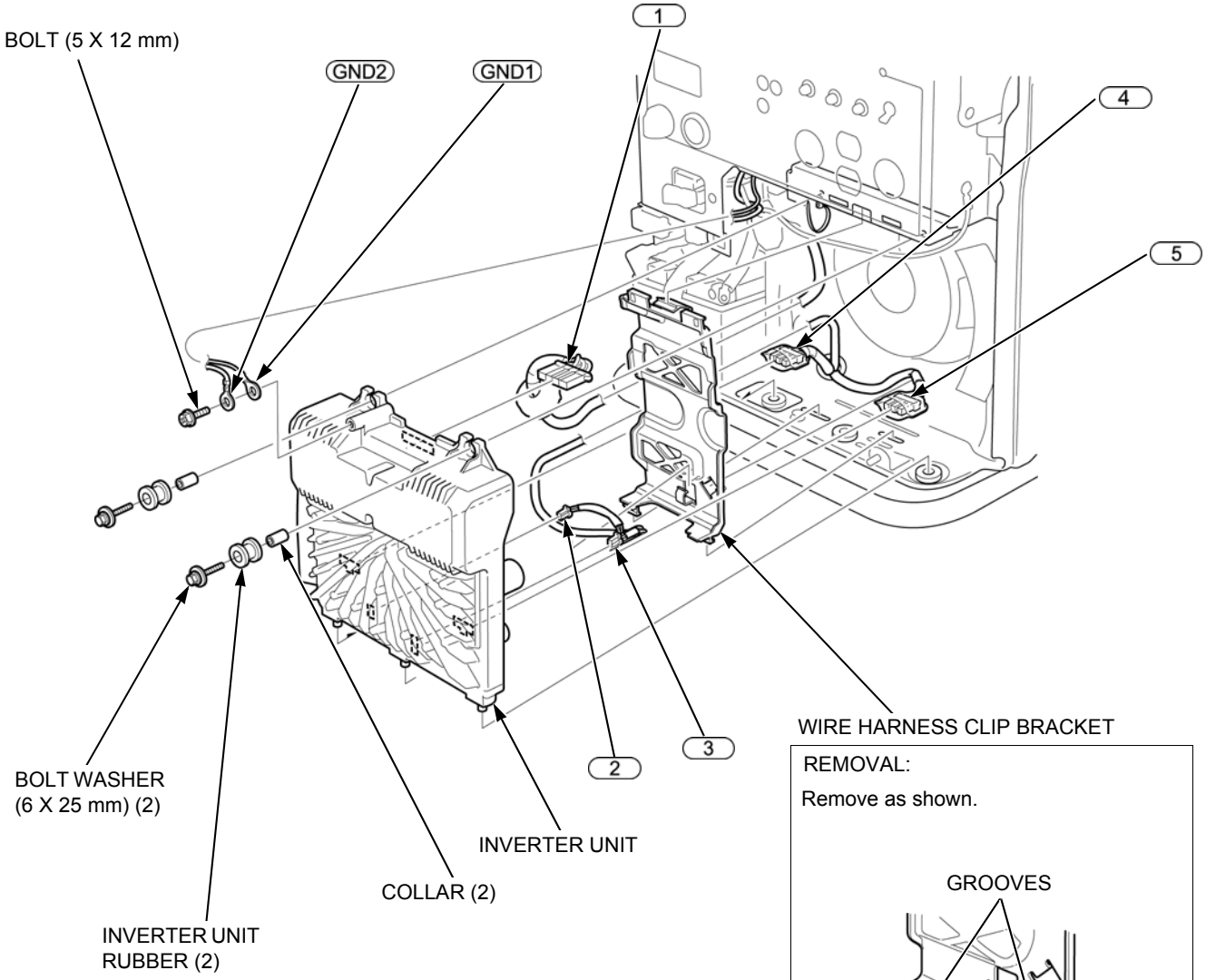
Install the battery with the terminals facing to the front.





INVERTER UNIT REMOVAL/INSTALLATION

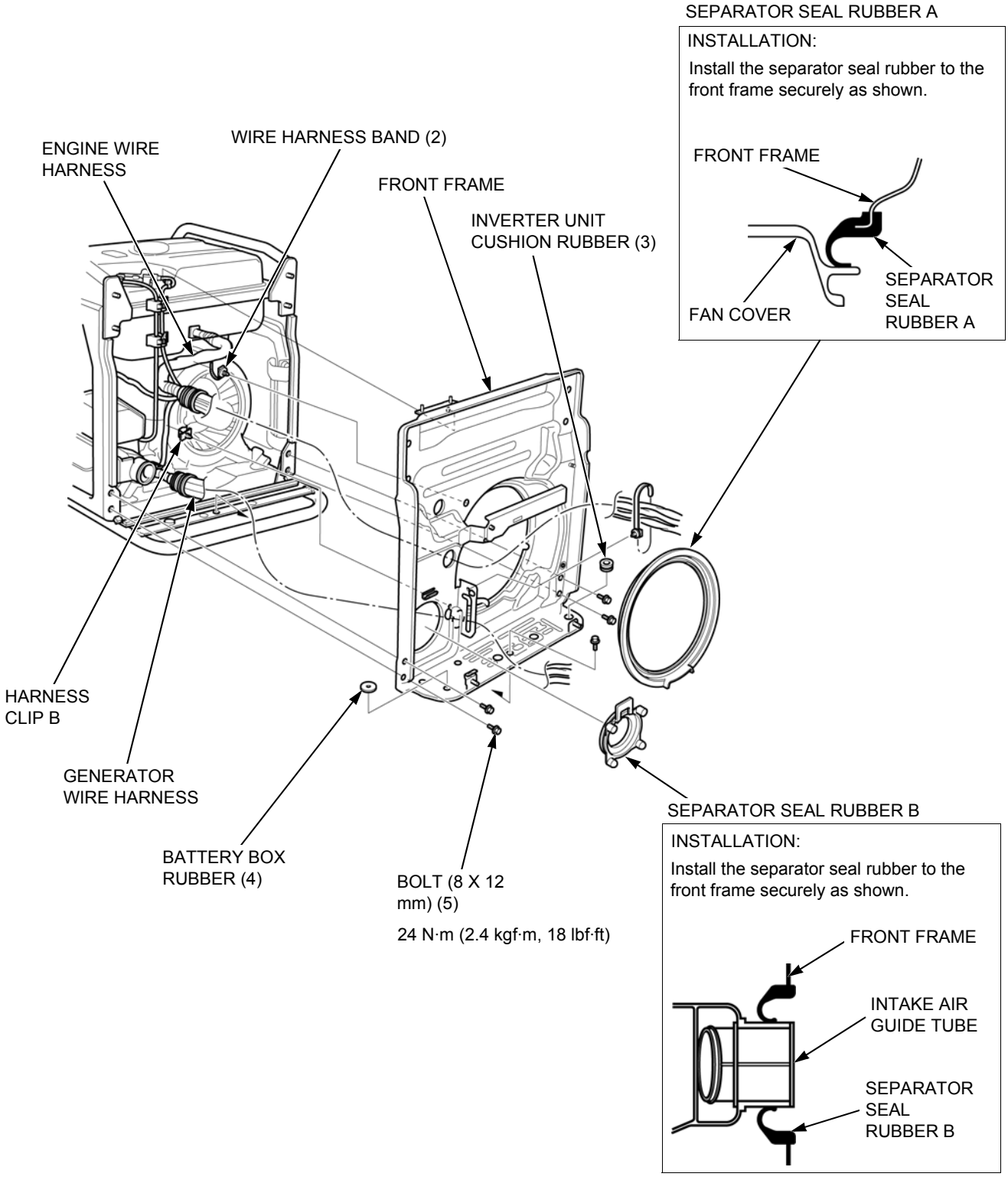
Remove the front cover (page 5-5).



FRONT FRAME REMOVAL/INSTALLATION

Remove the following:

- Front cover (page 5-5)
- Inverter unit (page 7-10)
- Control panel (page 10-2)
- Recoil starter (page 9-6)



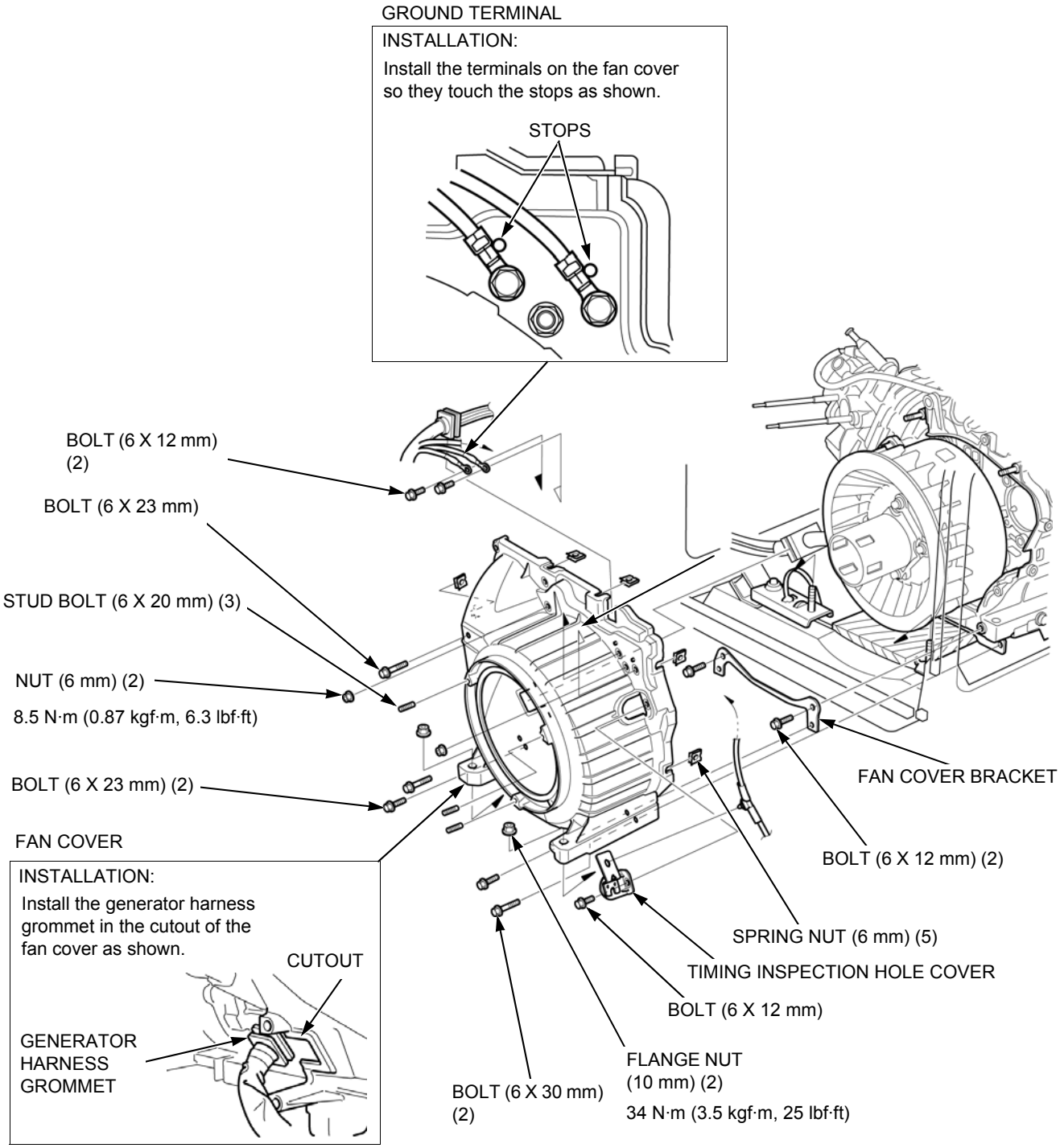
FAN COVER REMOVAL/INSTALLATION

- The fan cover can be removed with the engine in the frame.

Remove the following:

– Front frame (page 7-11)
– Fuel tank (page 6-10)
– Recoil starter (page 9-6)

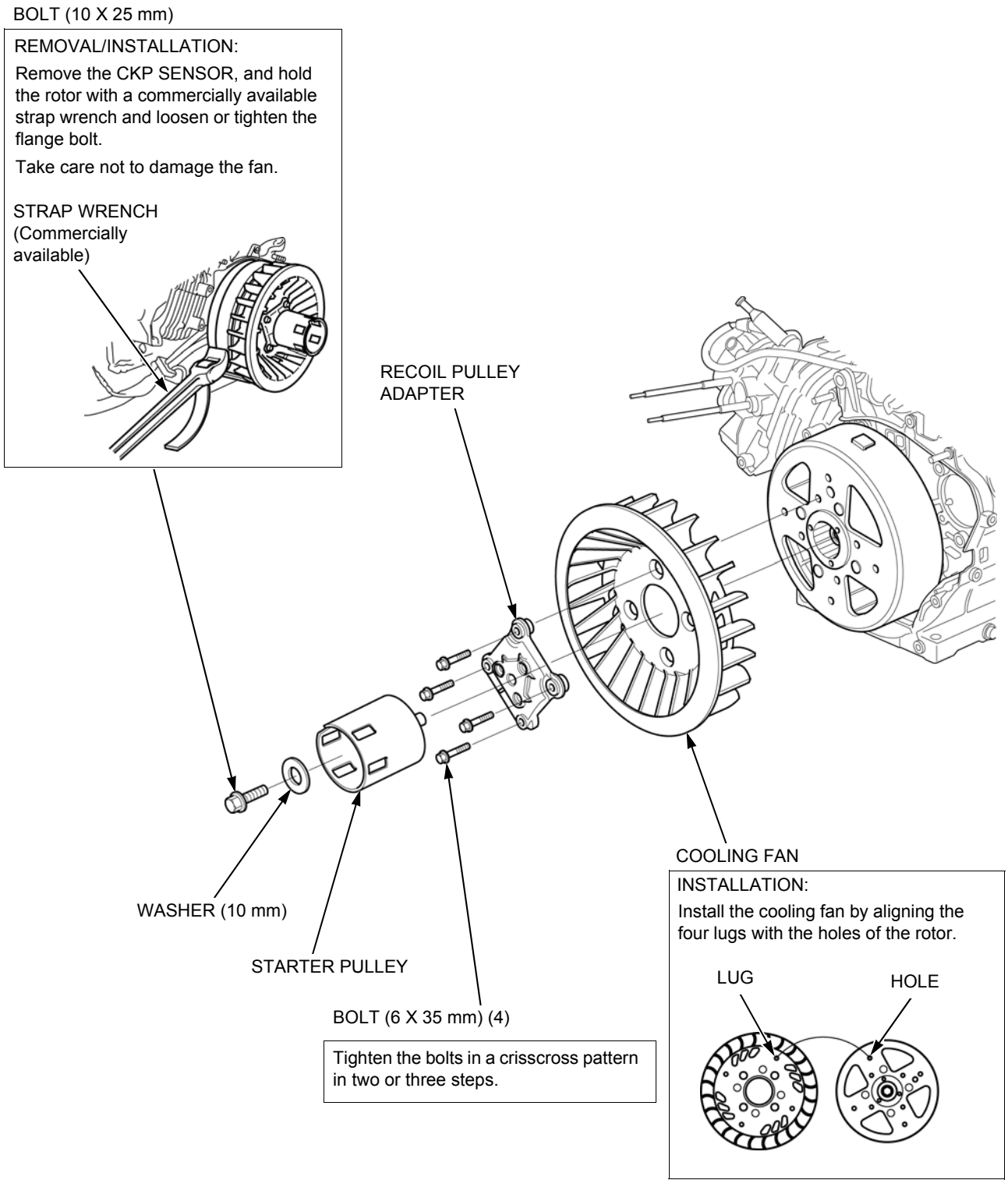
Remove the nuts (10 mm) and raise the fan cover until the stud bolt of the bottom rubber is clear from the fan cover by placing wooden blocks under the engine.



COOLING FAN REMOVAL/INSTALLATION

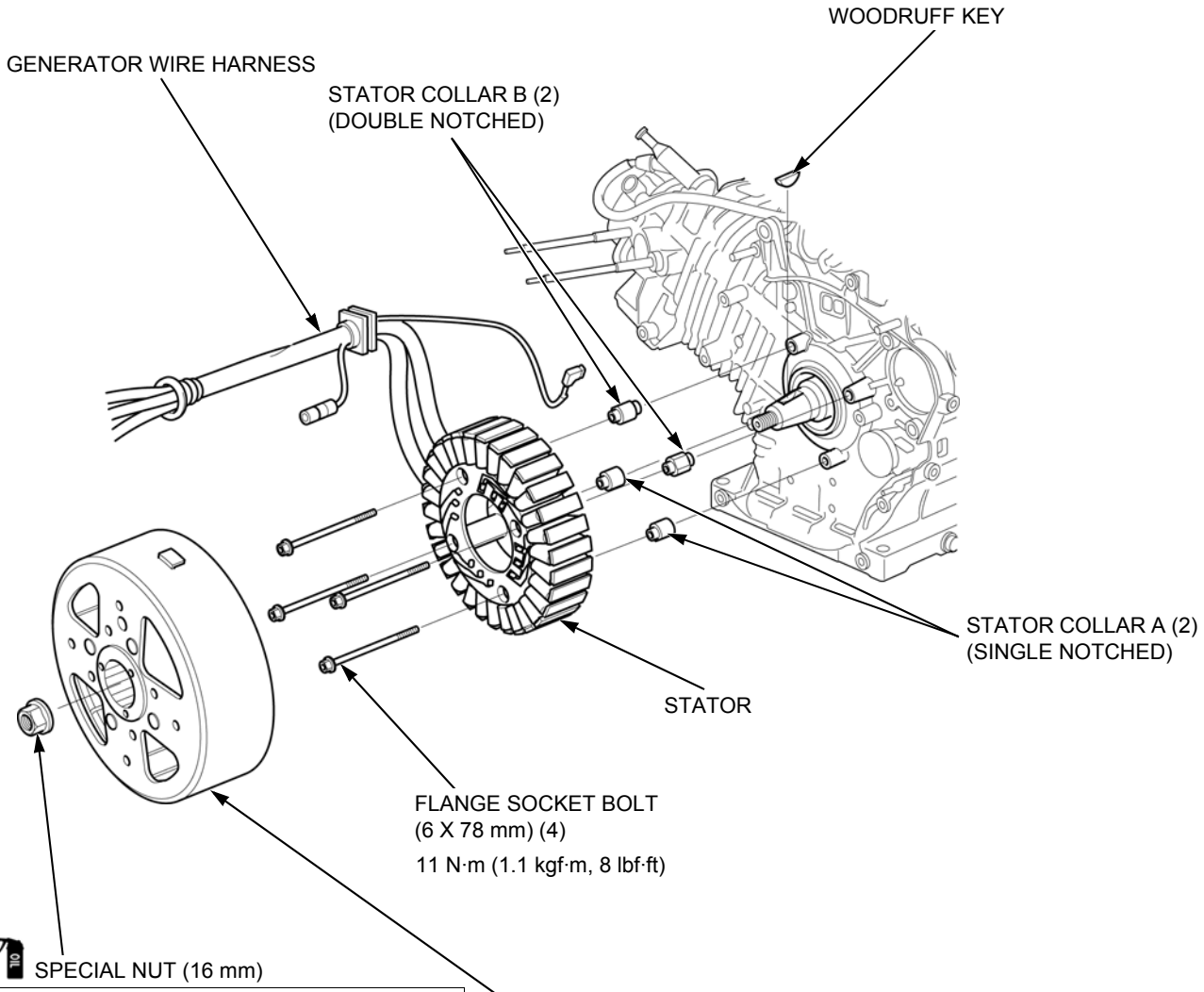
Remove the following:

- Fan cover (page 7-12)
- CKP sensor (page 8-7)



GENERATOR REMOVAL/INSTALLATION

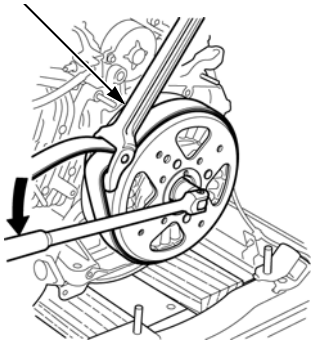
EXPLODED VIEW



REMOVAL/INSTALLATION:

Hold the rotor with a commercially available strap wrench, and then loosen or tighten the special nut.

STRAP WRENCH
(Commercially available)



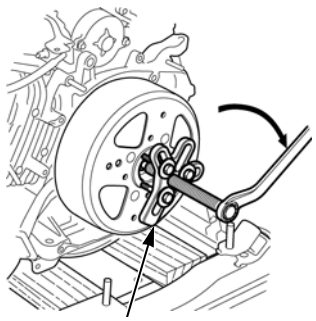
TORQUE:

170 N·m (17.3 kgf·m, 125 lbf·ft)

REMOVAL:

Remove the rotor using a commercially available flywheel puller.

Do not remove the rotor by tapping it with a hammer.

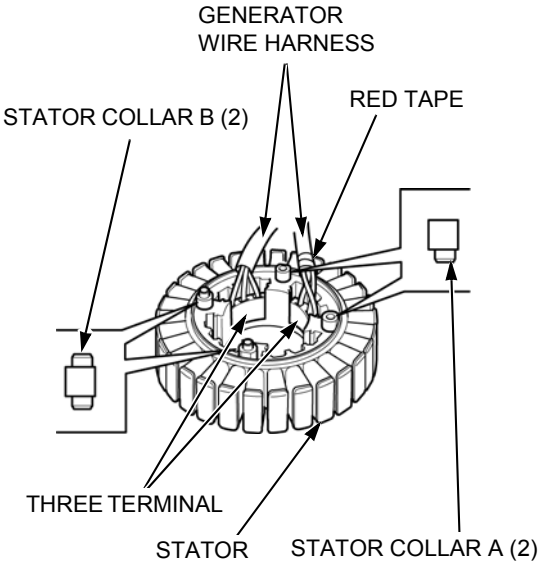


FLYWHEEL PULLER
(Commercially available)

GENERATOR INSTALLATION

Install the stator collars on the stator as shown.

- Do not interchange the double-notched collars with the single notched collars.
- When the generator wire harness is removed, connect the generator wire harness as shown.



Clean off any oil or grease from the crankshaft taper and tapered hole in the rotor. Install the woodruff key on the crankshaft.

Install the stator while placing the generator wire harness as shown and tighten the four flange socket bolts (6 x 78 mm).

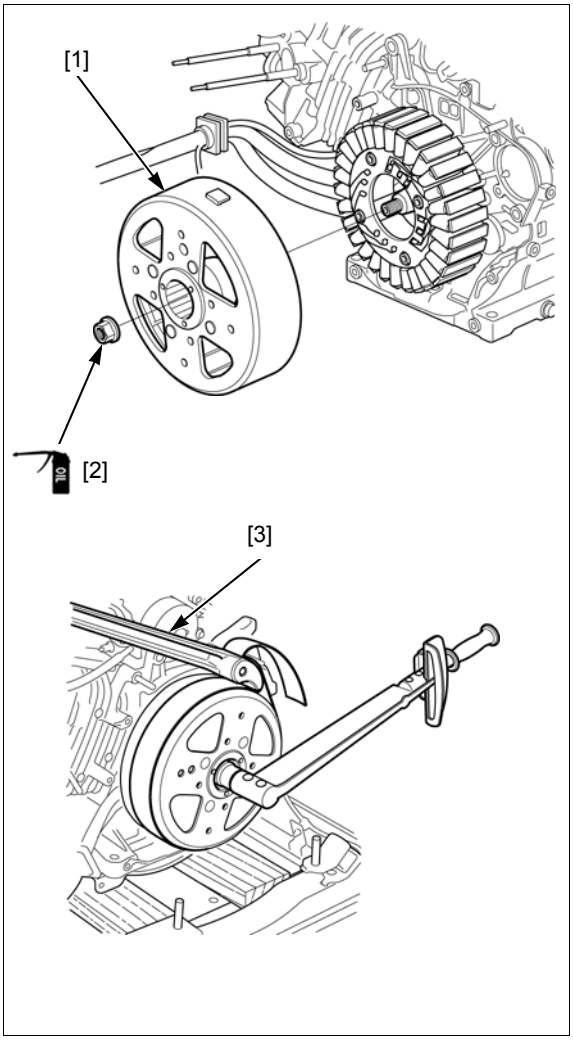
Check for any foreign material attached to the inside of the rotor before installation. Install the rotor [1] by aligning the key groove with the woodruff key on the crankshaft.

⚠ CAUTION

Note that the magnetic force of the rotor is very strong. Take care not to pinch your fingers during installation.

Apply engine oil to the threads of the special nut [2]. Holding the rotor with a commercially available strap wrench [3], tighten the special nut to the specified torque.

TORQUE: 170 N·m (17.3 kgf·m, 125 lbf·ft)

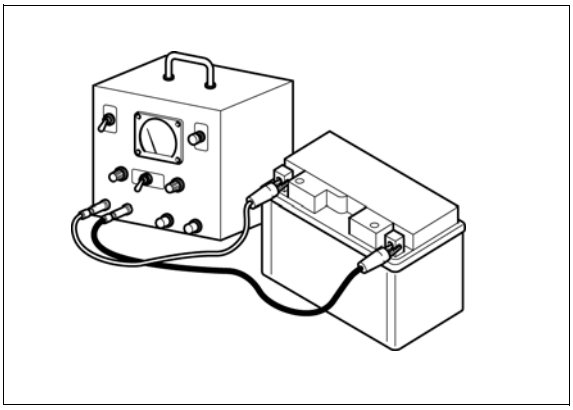


BATTERY CHARGING

Remove the battery (page 7-9).

Connect the positive (+) terminal of the charger to the positive terminal of the battery, and connect the negative (–) terminal of the charger to the negative terminal of the battery.

Charging time: 1.1 A: 5 - 10 hours (Slow-charging)
5.5 A: approx. 1.0 hours (Quick-charging)



⚠WARNING

- Only use the battery charger in a sufficiently ventilated room with no flammable material in the area.
- Keep fire and sparks away from a charging battery.
- Turn power ON/OFF at the charger, not at the battery terminals.
- Discontinue charging if the battery feels hot to touch (electrolyte temperature exceeds 45 °C/ 113 °F).

NOTICE

- *Use the battery charger designed for maintenance-free batteries.*
- *Quick-charging should only be done in an emergency; slow-charging is preferred.*
- *Wait for approximately 30 minutes after charging before measuring the battery voltage.*

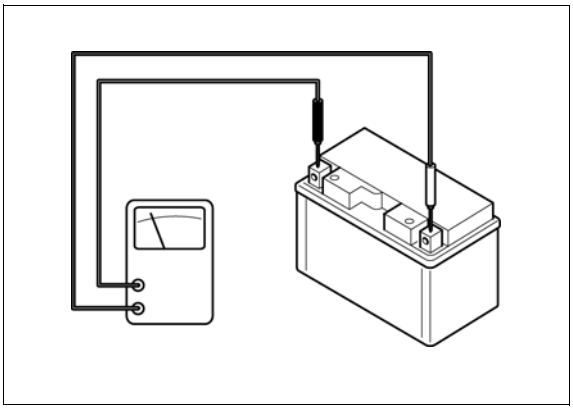
BATTERY INSPECTION

Remove the battery (page 7-9).

RECOMMENDED BATTERY TESTER:
BM-310 (YUASA) or equivalent.

Battery voltage: 13.0 - 13.2 V (Fully charged)

If the battery voltage is less than 12.3 V, charge the battery.

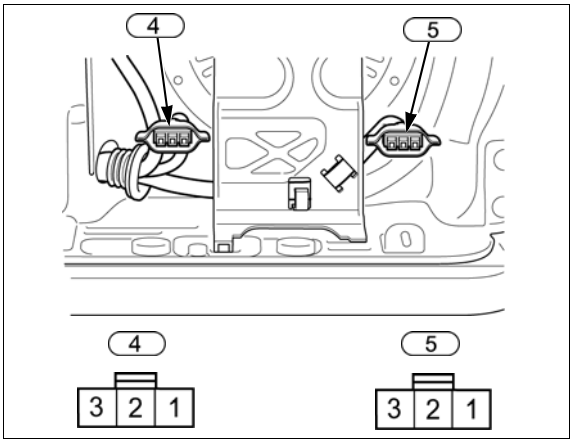


STATOR INSPECTION

Turn the main switch OFF.

Remove the inverter unit (page 7-10).

Pull the recoil starter and measure the voltage between the terminals of the generator 3P connectors (4 and 5) with the generator mounted.



Generator	Connector	Terminal number	Specific voltage
Master	4	1 - 2	AC 15 V or more
		2 - 3	
		1 - 3	
Slave	5	1 - 2	AC 15 V or more
		2 - 3	
		1 - 3	

If the output voltage is less than the standard voltage, Measure the resistance between the terminals of the generator 3P connectors (4 and 5) according to the table below.

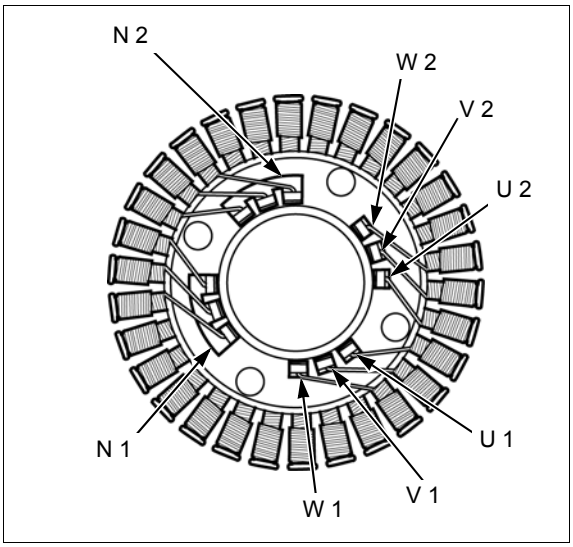
Generator	Connector	Terminal number	Standard resistance
Master	4	1 - 2	0.44 - 0.62 Ω
		2 - 3	
		1 - 3	
Slave	5	1 - 2	0.44 - 0.62 Ω
		2 - 3	
		1 - 3	

If the resistance is out of the specification, check the stator coil resistance according to the table below.

Stator	Terminal number	Standard resistance
Master	N 1 - U 1	0.22 - 0.31 Ω
	N 1 - V 1	
	N 1 - W 1	
Slave	N 2 - U 2	0.22 - 0.31 Ω
	N 2 - V 2	
	N 2 - W 2	

If all resistances are OK, replace or repair the generator wire harness.

If the resistance is out of specification, replace the stator.

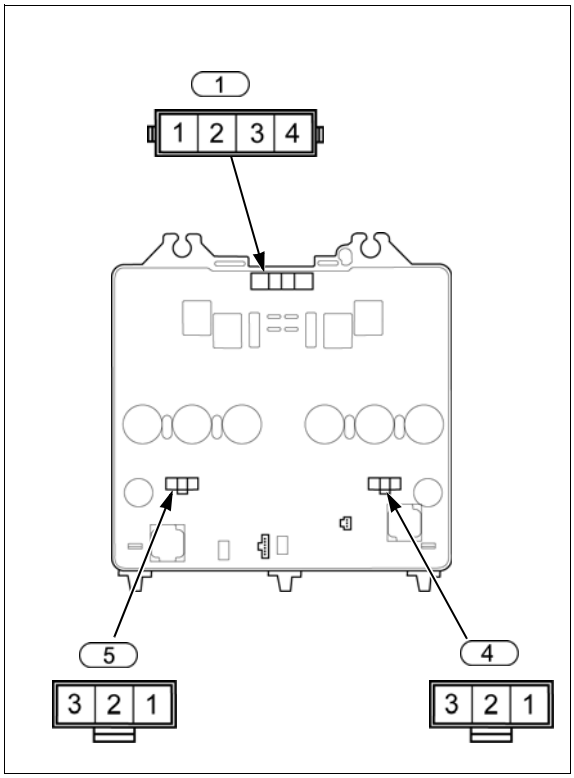


INVERTER UNIT INSPECTION

Remove the inverter unit (page 7-10).

Check for continuity between the terminals.

- Use a recommended analog multi-tester.
  SP-15D (SANWA) or equivalent
  SP-18D (SANWA) or equivalent
  TH-5H (KOWA) or equivalent



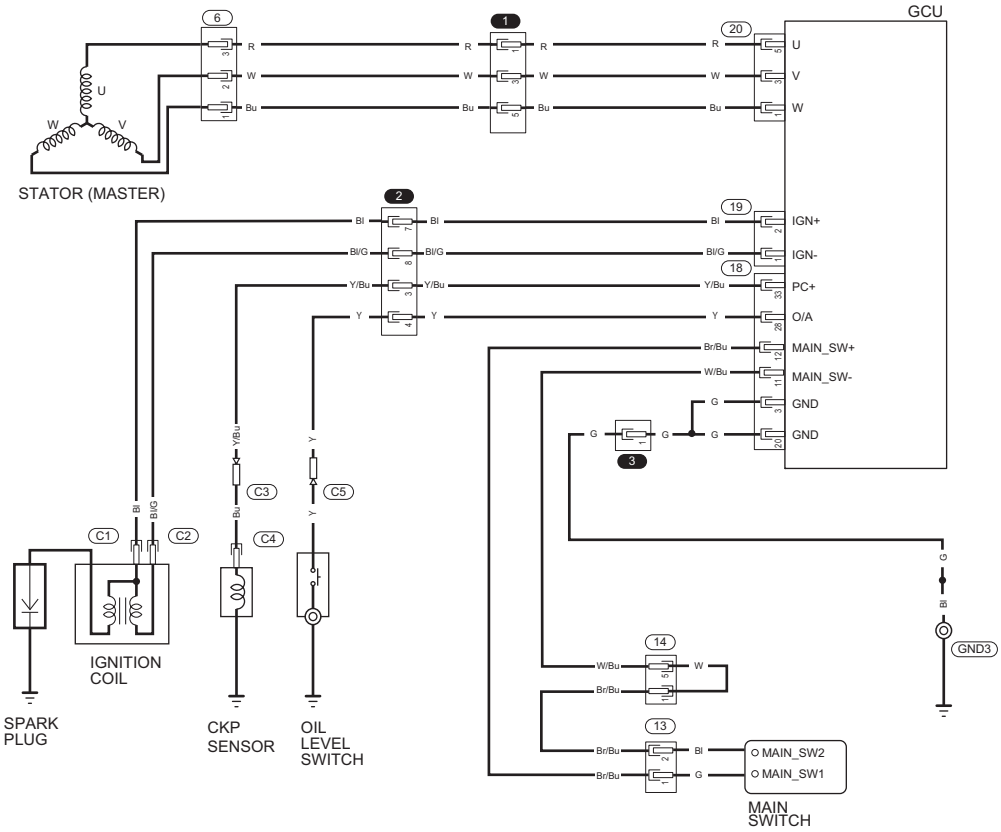
		Tester probe (-)				
		Connector	1			
	Connector	Terminal No.	1	2	3	4
Tester probe (+)	4	1	No Continuity	No Continuity	No Continuity	No Continuity
		2	No Continuity	No Continuity	No Continuity	No Continuity
		3	No Continuity	No Continuity	No Continuity	No Continuity
	5	1	No Continuity	No Continuity	No Continuity	No Continuity
		2	No Continuity	No Continuity	No Continuity	No Continuity
		3	No Continuity	No Continuity	No Continuity	No Continuity

		Tester probe (+)				
		Connector	1			
	Connector	Terminal No.	1	2	3	4
Tester probe (-)	4	1	No Continuity	No Continuity	No Continuity	No Continuity
		2	No Continuity	No Continuity	No Continuity	No Continuity
		3	No Continuity	No Continuity	No Continuity	No Continuity
	5	1	No Continuity	No Continuity	No Continuity	No Continuity
		2	No Continuity	No Continuity	No Continuity	No Continuity
		3	No Continuity	No Continuity	No Continuity	No Continuity

8. IGNITION SYSTEM

IGNITION SYSTEM TROUBLESHOOTING

NO SPARK AT THE SPARK PLUG



MAIN SWITCH		
	MAINSW1	MAINSW2
ON	○	○
OFF		

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

Check whether the i-Monitor is on when the main switch is turned ON.

OFF → Perform the i-MONITOR DOES NOT DISPLAY BY MAIN SWITCH TURNED ON (page 4-19).

ON

Check whether the Oil Alert indicator is ON and “OIL” is displayed on the i-Monitor with the main switch is turned ON and the starter switch is pressed.

Displayed → See OIL in SELF-DIAGNOSTIC TROUBLESHOOTING (page 4-9).

Not displayed

Check whether an error code is displayed on the i-Monitor with the main switch is turned ON and the starter switch is pressed.

Displayed → Perform the SELF-DIAGNOSTIC TROUBLESHOOTING (page 4-9).

Not displayed

Check the oil level switch (page 8-10).

Abnormal → Replace the oil level switch (page 14-3).

Normal

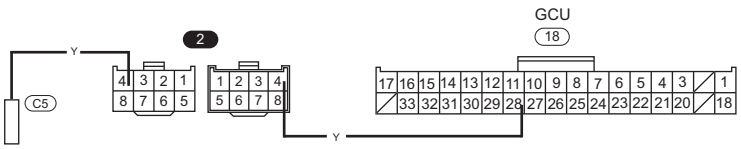
Check the "NO SPARK AT SPARK PLUG" of the GCU inspection (page 10-9).

Abnormal → Replace the GCU.

Normal

Check the wire harness between the oil level switch and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.



Normal

Go to page 8-4

From page 8-3

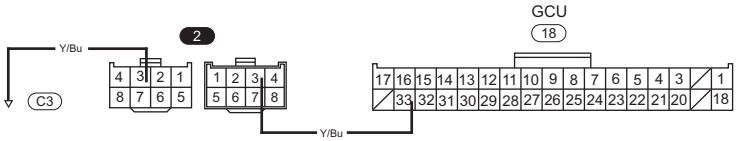
Check the CKP sensor (page 8-8).

Abnormal → Replace the CKP sensor (page 8-7).

Normal

Check the wire harness between the CKP sensor and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.



Normal

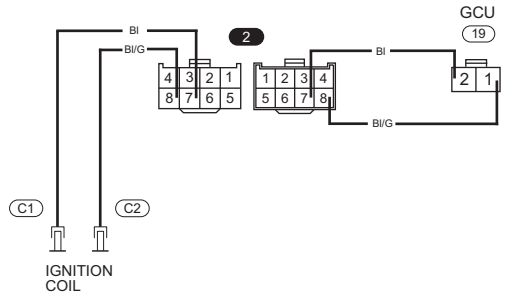
Check the ignition coil (page 8-9).

Abnormal → Replace the ignition coil (page 8-6).

Normal

Check the wire harness between the ignition coil and GCU for an open circuit.

Abnormal → Replace or repair the wire harness.



Normal

Go to page 8-5

From page 8-4

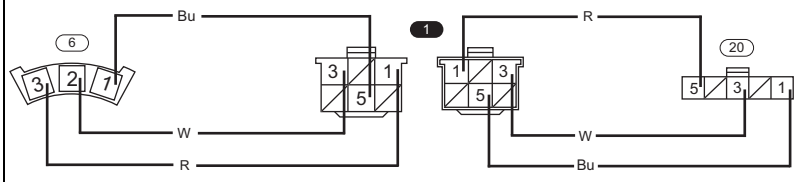
Check the stator coil resistance (master) (page 7-17).

Abnormal → Replace the stator.

Normal

Check the wire harness between the generator and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.



Normal

Check the CKP sensor air gap (page 8-8).

Abnormal → Adjust the CKP sensor (page 8-8).

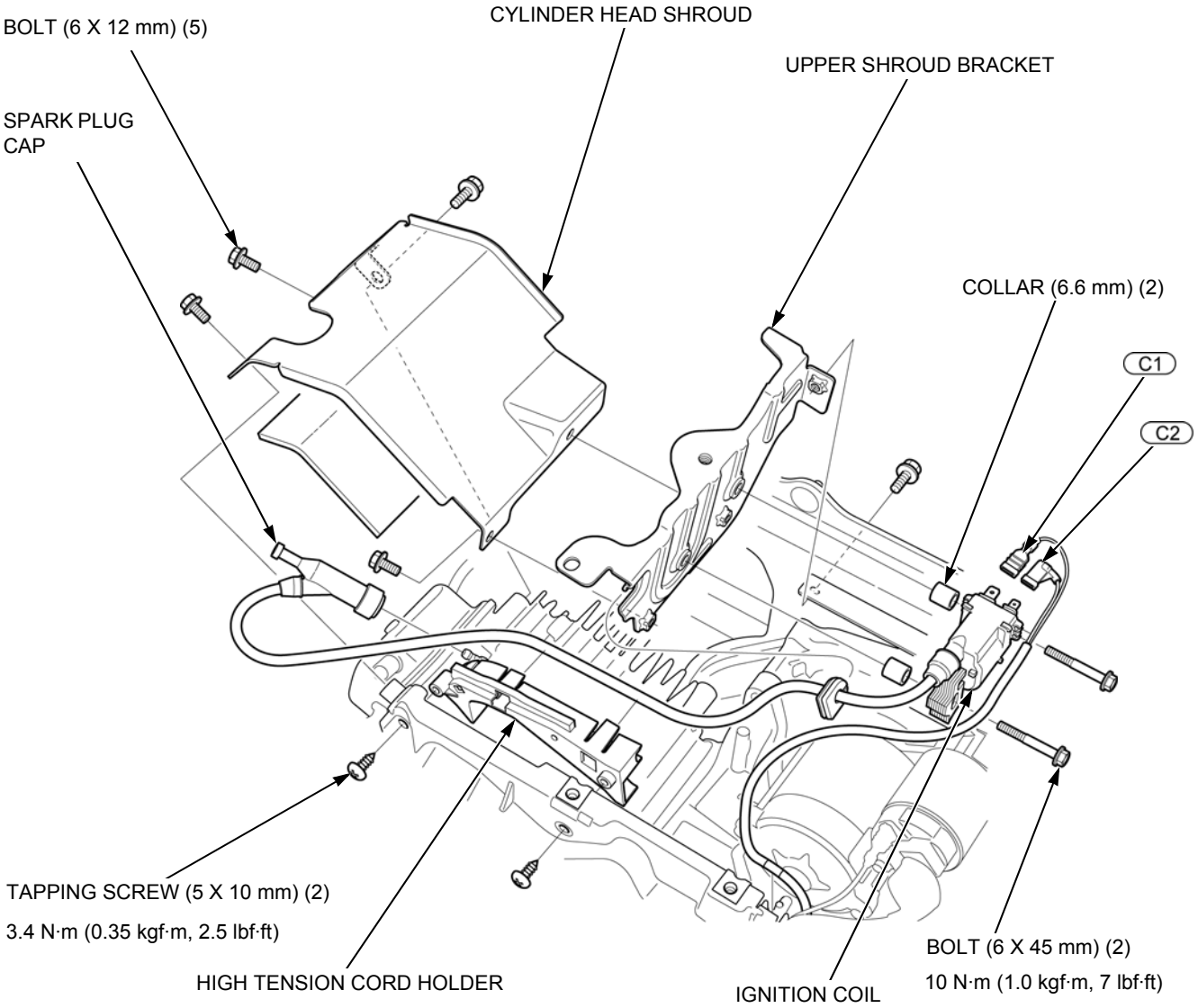
Normal

Replace the GCU and recheck.

IGNITION COIL REMOVAL/ INSTALLATION

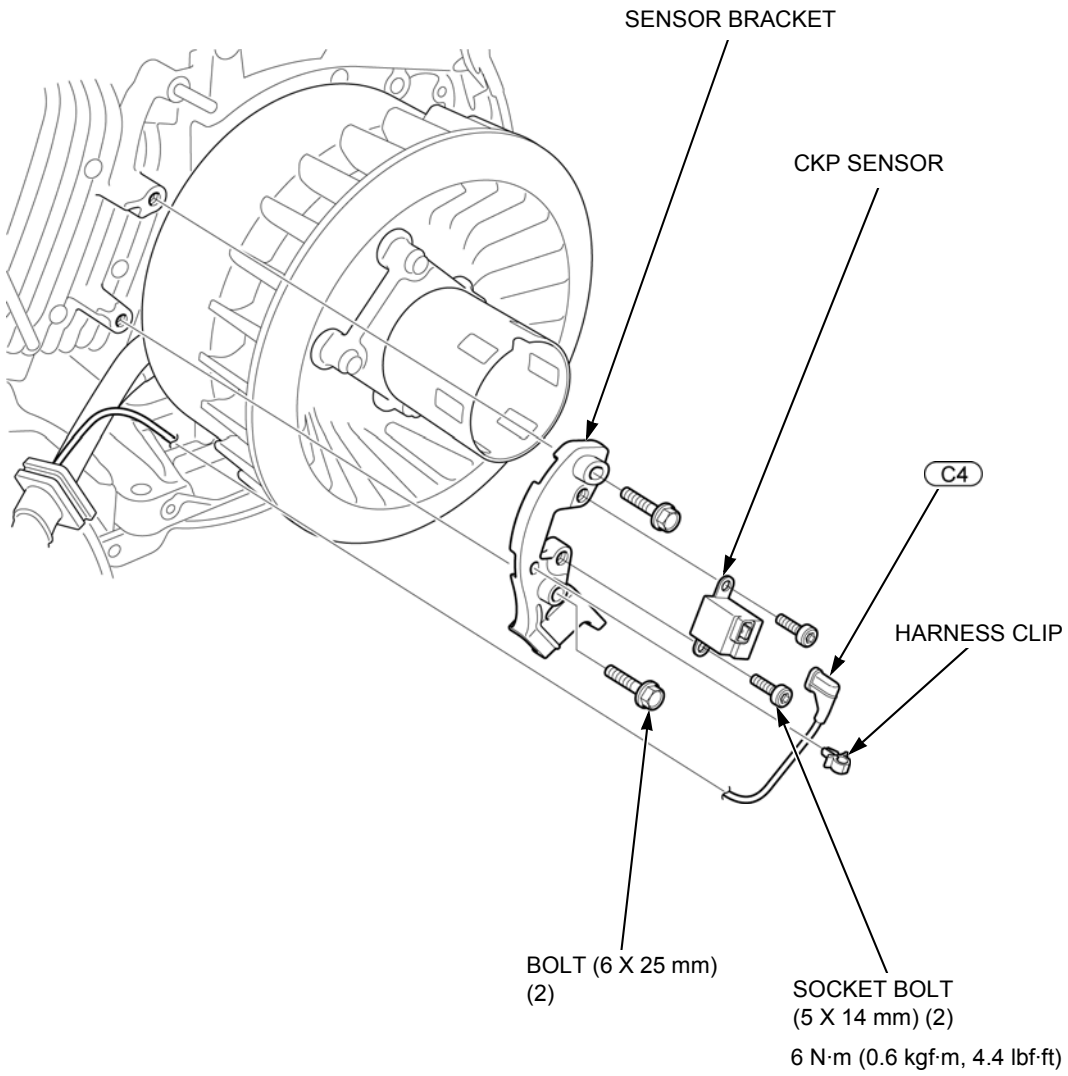
Remove the following:

- Fuel tank (page 6-10)
- Rear cover and outer muffler protector (page 5-6)
- Muffler (page 11-2)
- Air guide insulator (page 11-2)
- Upper shroud (page 9-7)



CKP SENSOR REMOVAL/ INSTALLATION

Remove the fan cover (page 7-12).



CKP SENSOR AIR GAP ADJUSTMENT

Install the CKP sensor/sensor bracket [1] and loosely install the sensor bracket mounting bolts [2].

- Take care not to pinch the generator wire harness with the sensor bracket.

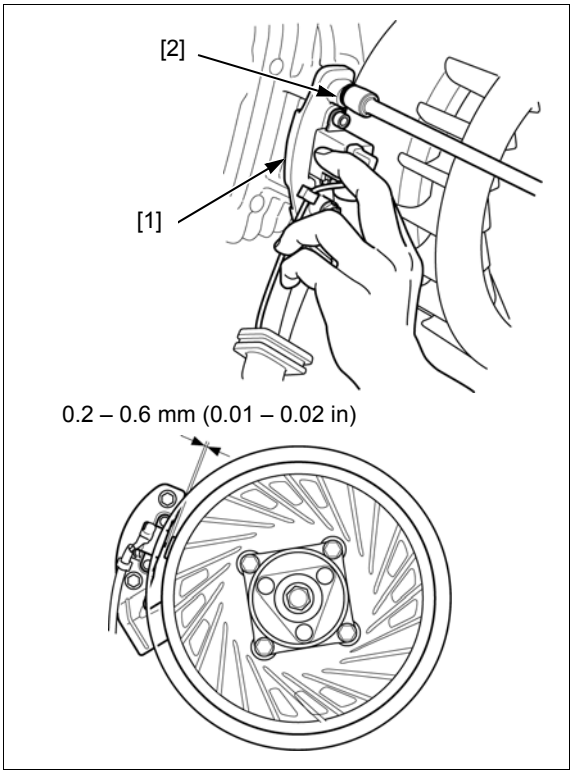
Insert an appropriate thickness gauge between the CKP sensor and projection part of the rotor.

CKP SENSOR AIR GAP:
0.2 – 0.6 mm (0.01 – 0.02 in)

Push the CKP sensor firmly against the rotor and tighten the pulser coil bracket mounting bolt.

TORQUE: 6 N·m (0.6 kgf·m, 4.4 lbf·ft)

Remove the thickness gauge.



SPARK TEST

Check for the following before performing the spark test.

- Faulty spark plug
- Loose spark plug cap
- Water in the spark plug cap (causing the ignition coil secondary voltage to leak)
- Loose ignition coil connector

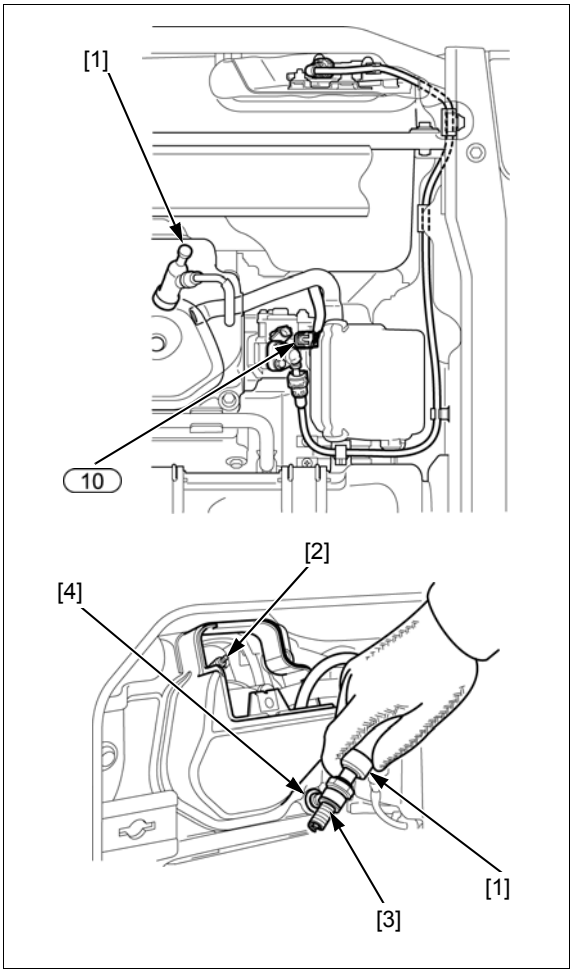
Open the left maintenance cover.

Disconnect the spark plug cap [1] from the spark plug [2].

Disconnect the fuel injector 2P connector (10).

Connect a known-good spark plug [3] to the spark plug cap and ground the side electrode against the cylinder head cover [4].

Turn the main switch to the ON position, crank the engine by pulling the recoil starter forcefully, and check for a spark across the electrodes.



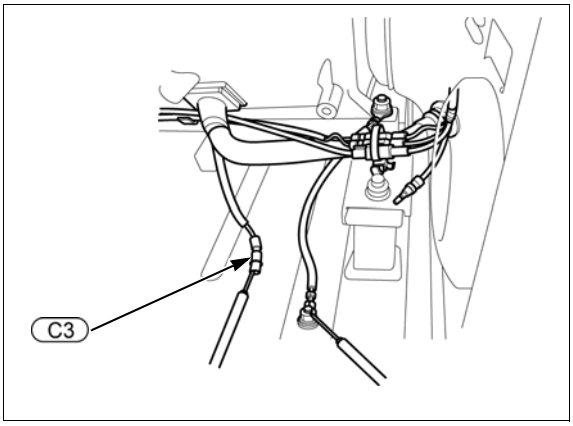
CKP SENSOR INSPECTION

Remove the air cleaner bracket (page 6-13).

Disconnect the CKP sensor wire connector (C3).

Measure the resistance between the terminal and ground.

Specified resistance: 297 - 363 Ω (at 20 °C/68 °F)



IGNITION COIL INSPECTION

PRIMARY SIDE

Remove the upper shroud (page 9-7).

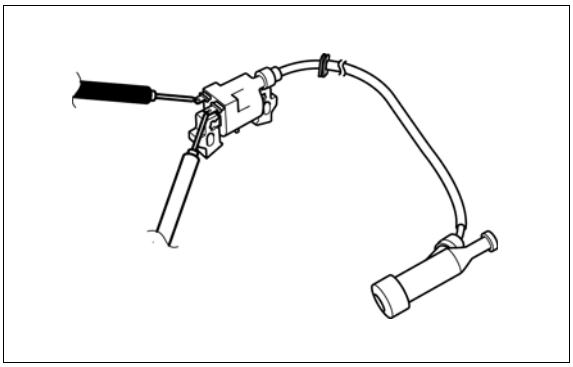
Disconnect the ignition coil primary wire connectors ((C1) and (C2)).

Measure the resistance of the primary coil by attaching the ohmmeter leads to the ignition coil wire terminals.

- Use a recommended analog multi-tester.
  SP-15D (SANWA) or equivalent
  SP-18D (SANWA) or equivalent
  TH-5H (KOWA) or equivalent

RESISTANCE: 1.8 – 2.2 Ω

If the measured resistance is out of specification, replace the ignition coil.



SECONDARY SIDE

Remove the upper shroud (page 9-7).

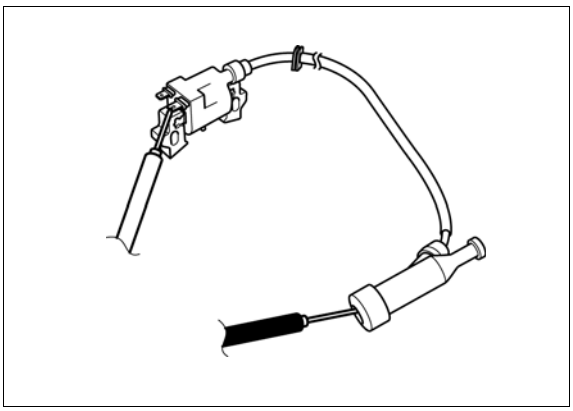
Disconnect the ignition coil primary wire connectors ((C1) and (C2)).

Measure the resistance of the secondary coil by attaching one ohmmeter lead to the ignition coil wire terminal (Black) and the other to the spark plug cap end.

- Use a recommended analog multi-tester.
  SP-15D (SANWA) or equivalent
  SP-18D (SANWA) or equivalent
  TH-5H (KOWA) or equivalent

RESISTANCE: 5.6 – 6.9 kΩ

If the measured resistance is out of specification, replace the ignition coil.



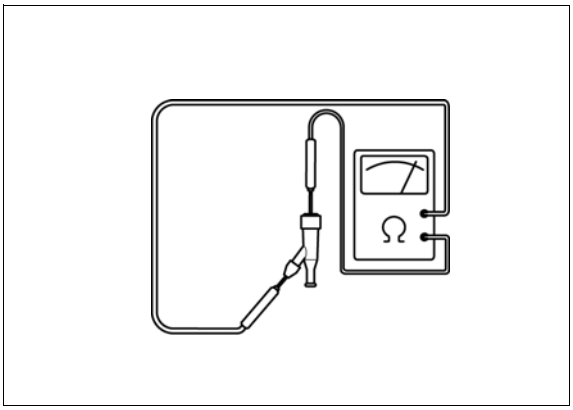
SPARK PLUG CAP INSPECTION

Remove the spark plug cap from the high tension cord.

Measure the resistance of the spark plug cap by attaching one ohmmeter lead to the terminal in the spark plug cap and the other to the terminal connected to the high tension cord terminal.

RESISTANCE: 7.5 – 12.5 kΩ

If the measured resistance is out of specification, replace the spark plug cap.



OIL LEVEL SWITCH INSPECTION

SYSTEM INSPECTION

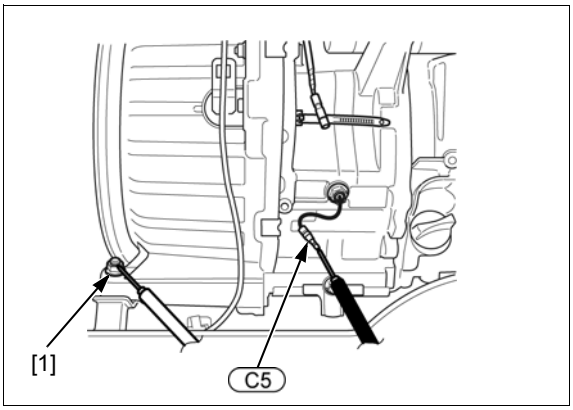
Remove the right side shroud (page 5-3).

Disconnect the oil level switch wire connector C5.

Check continuity between the oil level switch wire connector C5 switch side (Yellow) terminal and engine ground [1].

There should be no continuity when the engine is full of oil.

If the correct continuity is not obtained, inspect the oil level switch.

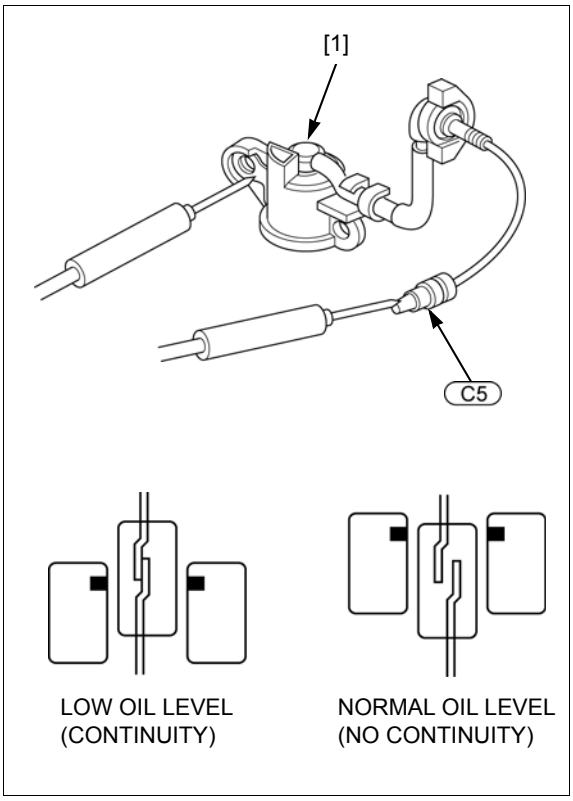


SWITCH INSPECTION

Remove the oil level switch (page 14-3).

Check continuity between the oil level switch [1] wire connector C5 (Yellow) terminal and switch body with an ohmmeter.

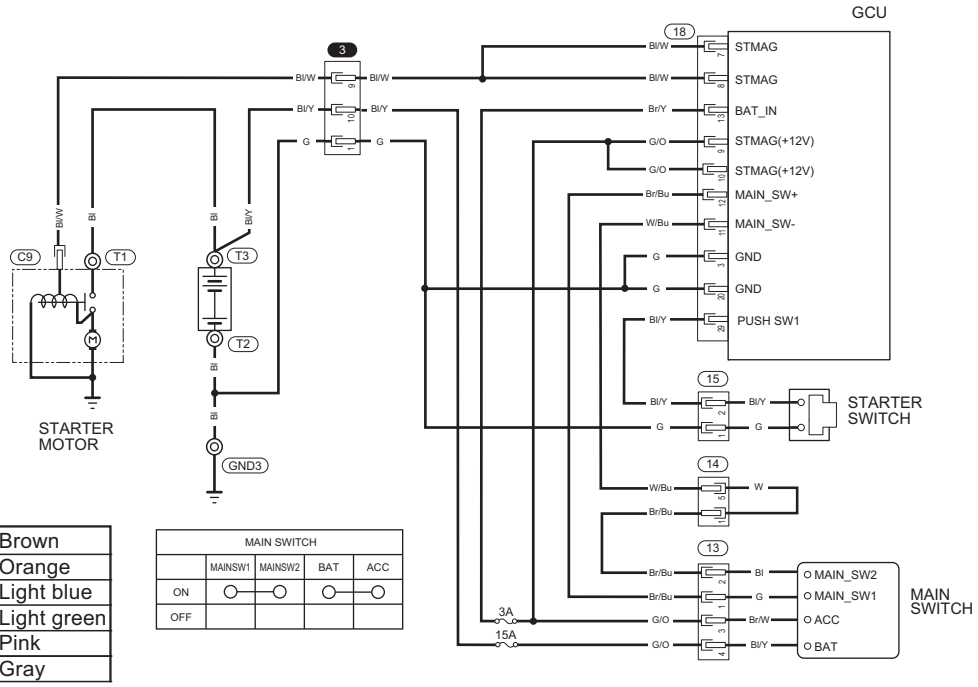
Check the float by dipping the switch into a container of oil. The ohmmeter reading should go from continuity to no continuity as the switch is lowered into the oil.



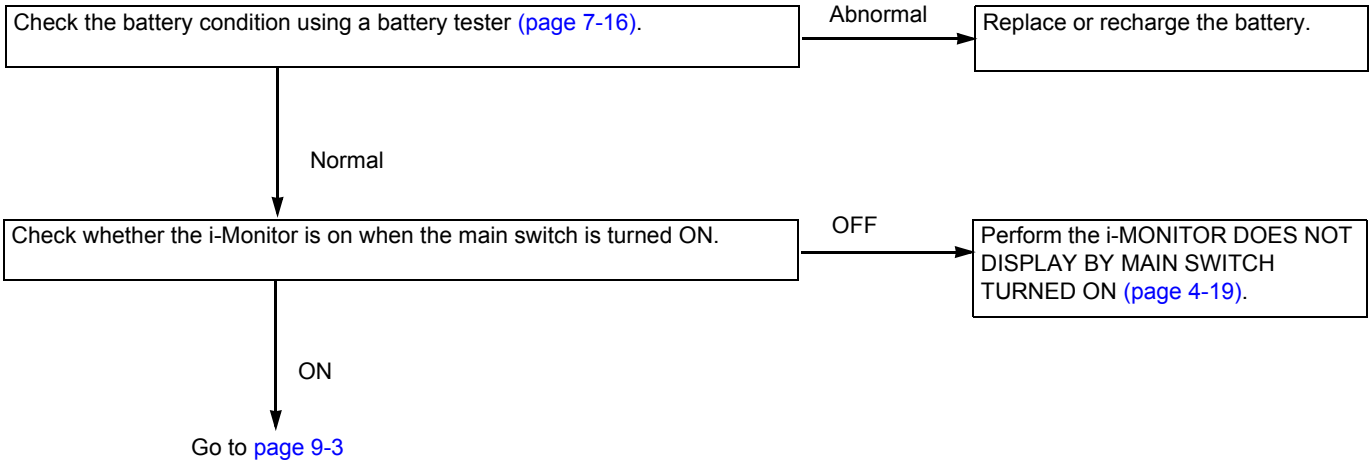
9. STARTING SYSTEM

STARTING SYSTEM TROUBLESHOOTING

STARTER MOTOR DOES NOT TURN



Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray



From page 9-2

Check whether an error code is displayed on the i-Monitor when the main switch is ON and the starter switch is pressed.

Displayed → Perform the SELF-DIAGNOSTIC TROUBLESHOOTING (page 4-9).

Not displayed

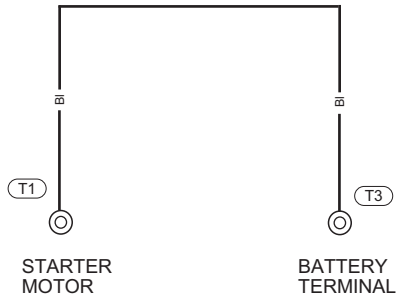
You should hear the starter magnetic switch “CLICK” when the starter switch is pushed.

Not “CLICK” heard

Go to page 9-4

“CLICK” heard

Check the wire harness between the battery and starter motor for an open circuit.



Normal

Abnormal → Replace or repair the wire harness.

Check the starter magnetic switch (page 9-16).

Normal

Abnormal → Replace the starter magnetic switch (page 9-15).

Check the starter motor

From page 9-3

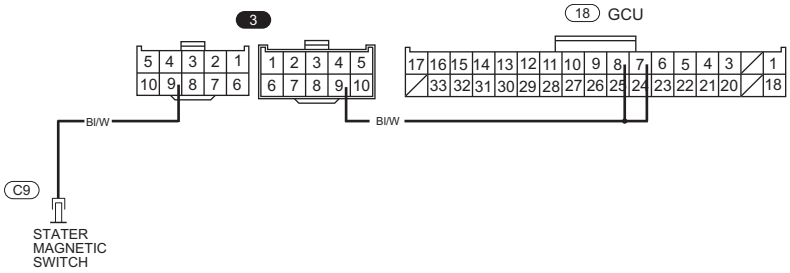
Check the "PUSH THE STARTER SWITCH BUT STARTER MOTOR DOES NOT TURN" of the GCU inspection (page 10-9).

Abnormal → Replace the GCU.

Normal

Check the wire harness between the starter motor and GCU for an open or short circuit.

Abnormal → Replace or repair the wire harness.



Normal

Check the starter switch (page 10-9).

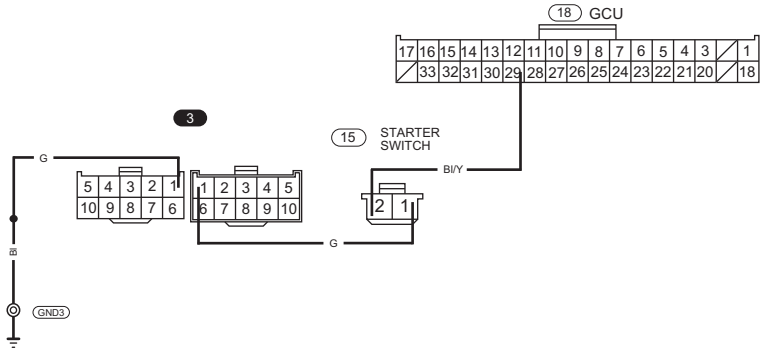
Abnormal → Replace the starter switch (page 10-3).

Normal

Check the wire harness between the starter switch and GCU for an open circuit.

Check the wire harness between the starter switch and ground for an open circuit.

Abnormal → Replace or repair the wire harness.



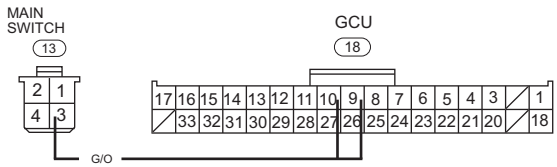
Normal

Go to page 9-5

From page 9-4

Normal

Check the wire harness between the main switch and GCU for an open circuit.



Abnormal → Replace or repair the wire harness.

Normal

Check the starter magnetic switch page 9-16.

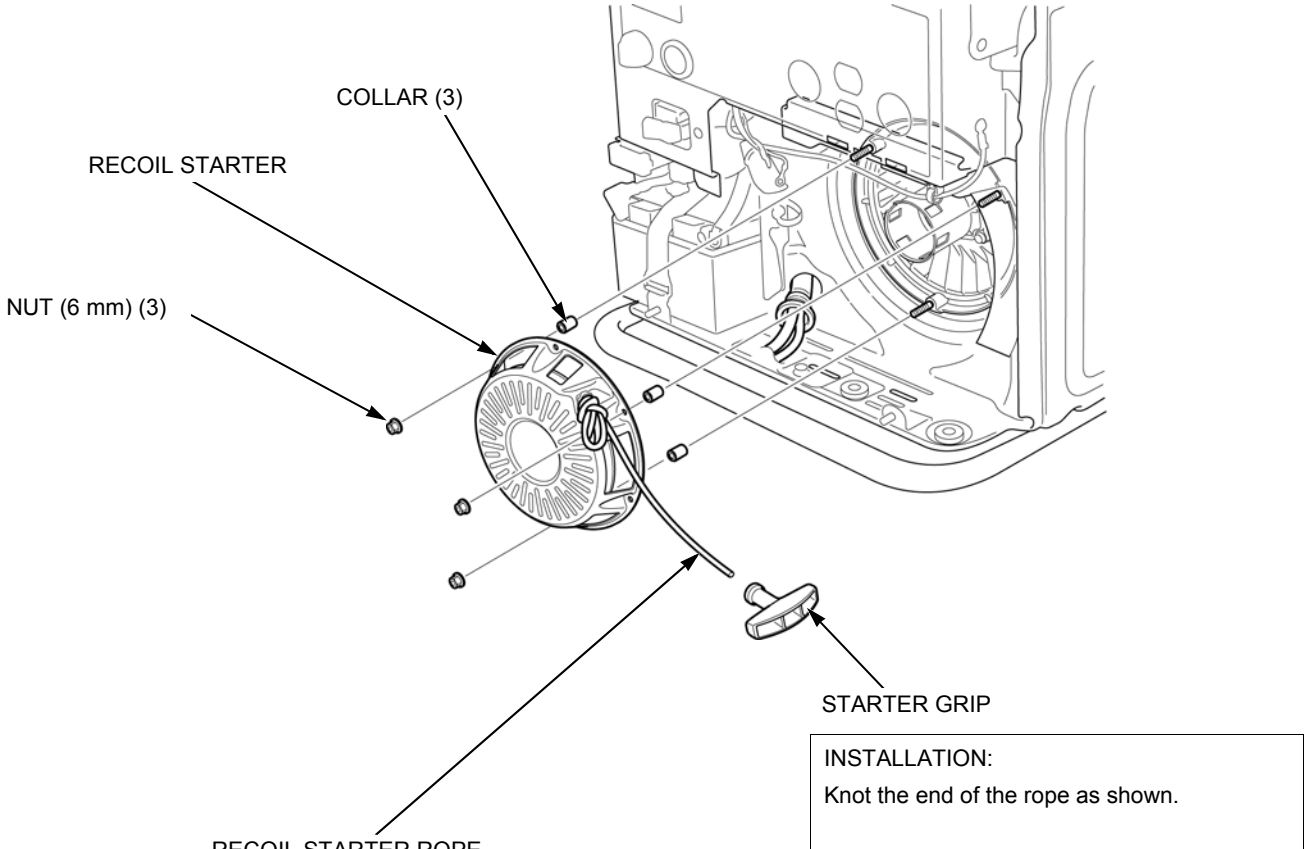
Abnormal → Replace the starter magnetic switch (page 9-15).

Normal

Replace the GCU and recheck.

RECOIL STARTER REMOVAL/INSTALLATION

Remove the inverter unit (page 7-10).

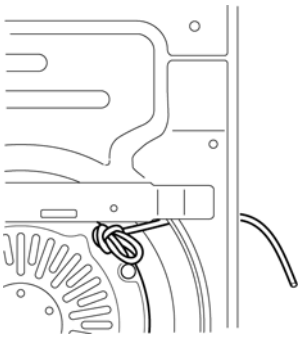


INSTALLATION:

Knot the end of the rope as shown.

REMOVAL/INSTALLATION:

Make a knot between the recoil starter case and front frame before removing or installing the starter grip.



UPPER SHROUD REMOVAL/INSTALLATION

⚠ CAUTION

Do not touch the insulator with bare hands. The glass wool of the material sticks in the skin and is dangerous.

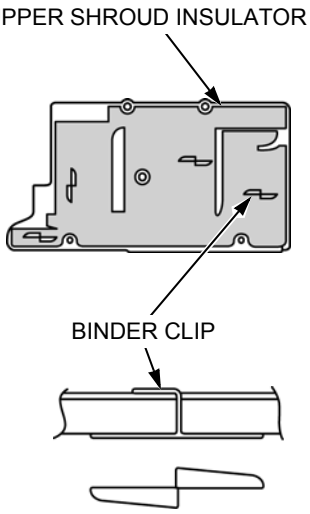
Remove the following:

- Fuel tank (page 6-10)
- Head cover shroud (page 13-2)

UPPER SHROUD INSULATOR

ASSEMBLY:

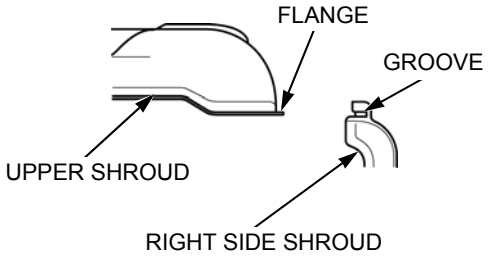
Install the insulator on the upper shroud with the binder clip bent as shown.

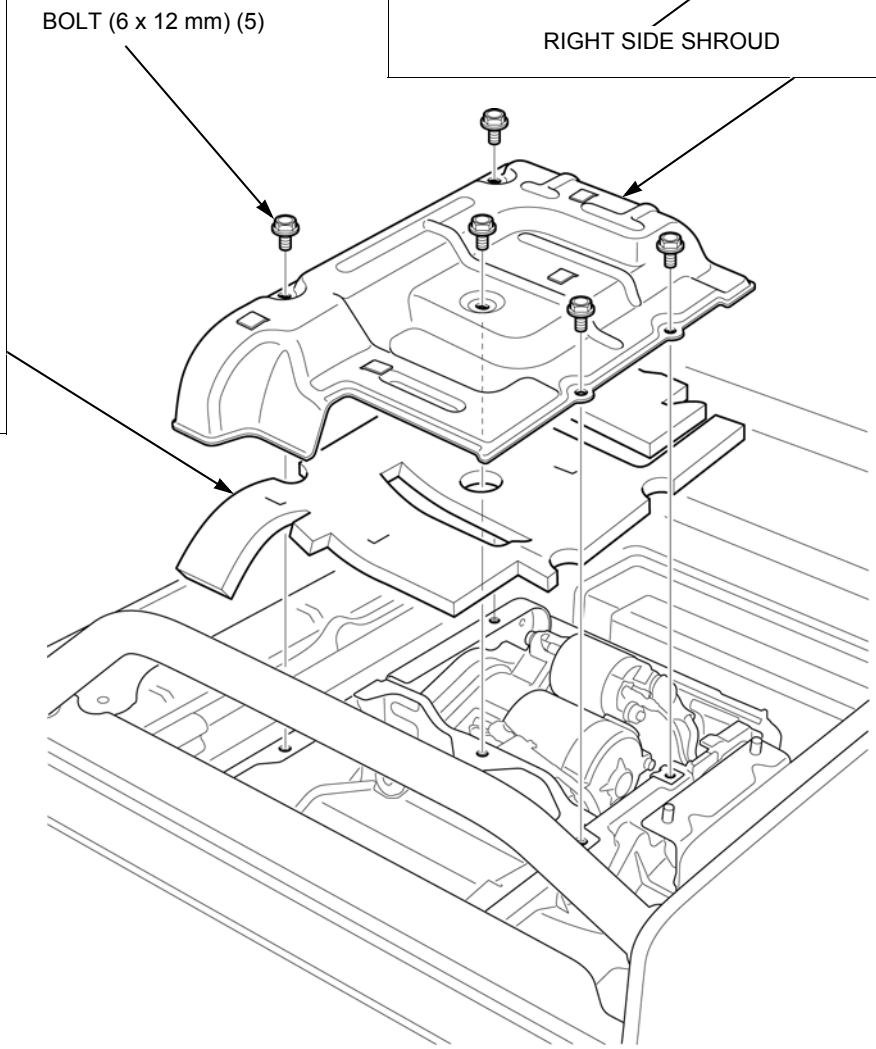


UPPER SHROUD

INSTALLATION:

Insert the flange of the upper shroud into the groove of the right side shroud.

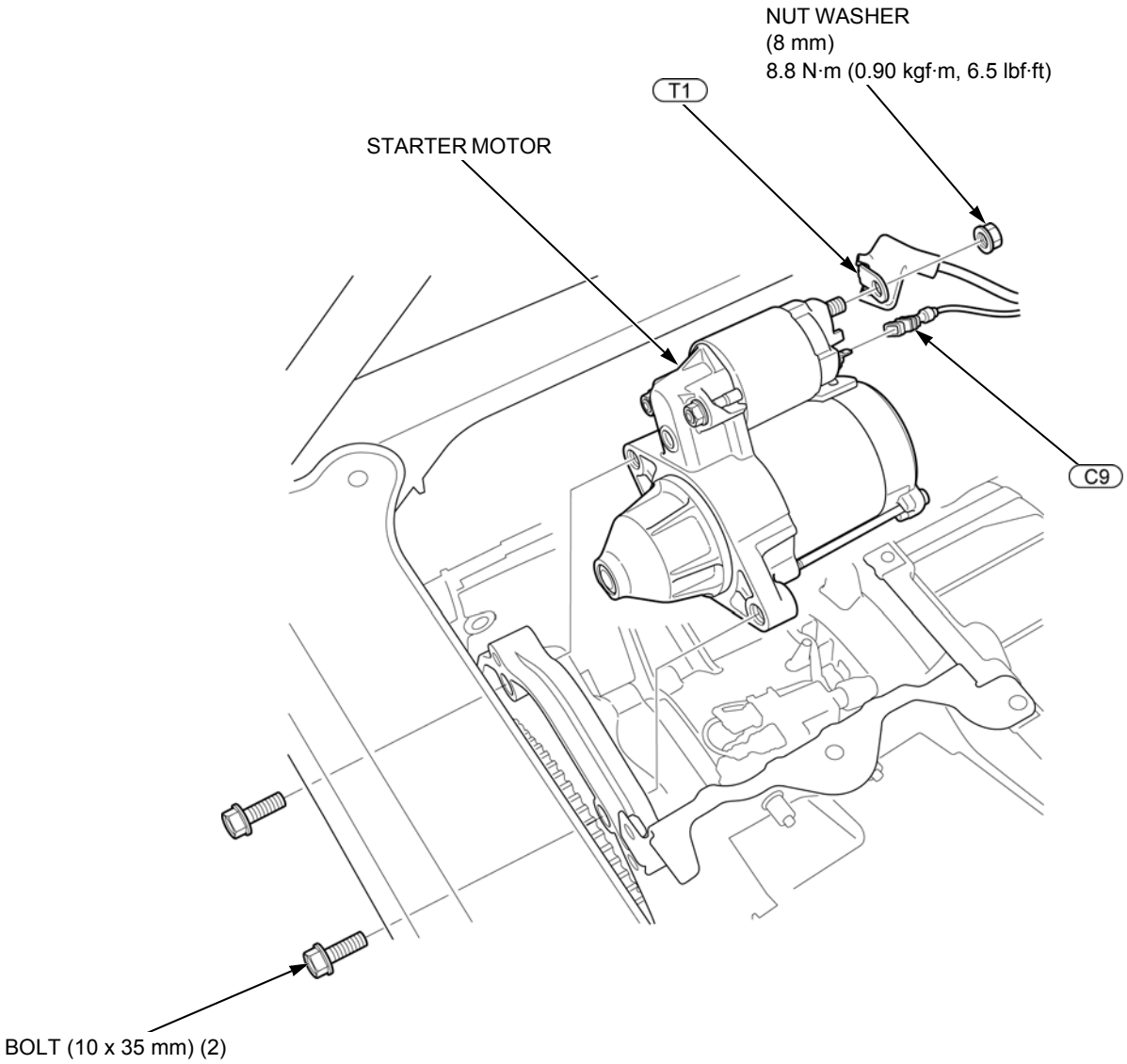




STARTER MOTOR REMOVAL/ INSTALLATION

Remove the following:

- Fuel tank (page 6-10)
- Rear cover and outer muffler protector (page 5-6)
- Muffler (page 11-2)
- Inner muffler protector (page 9-9)
- Upper shroud (page 9-7)



INNER MUFFLER PROTECTOR REMOVAL/INSTALLATION

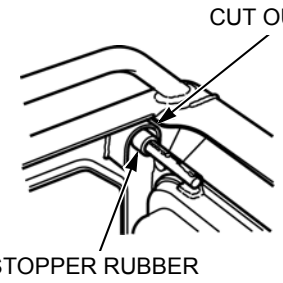
Remove the following:

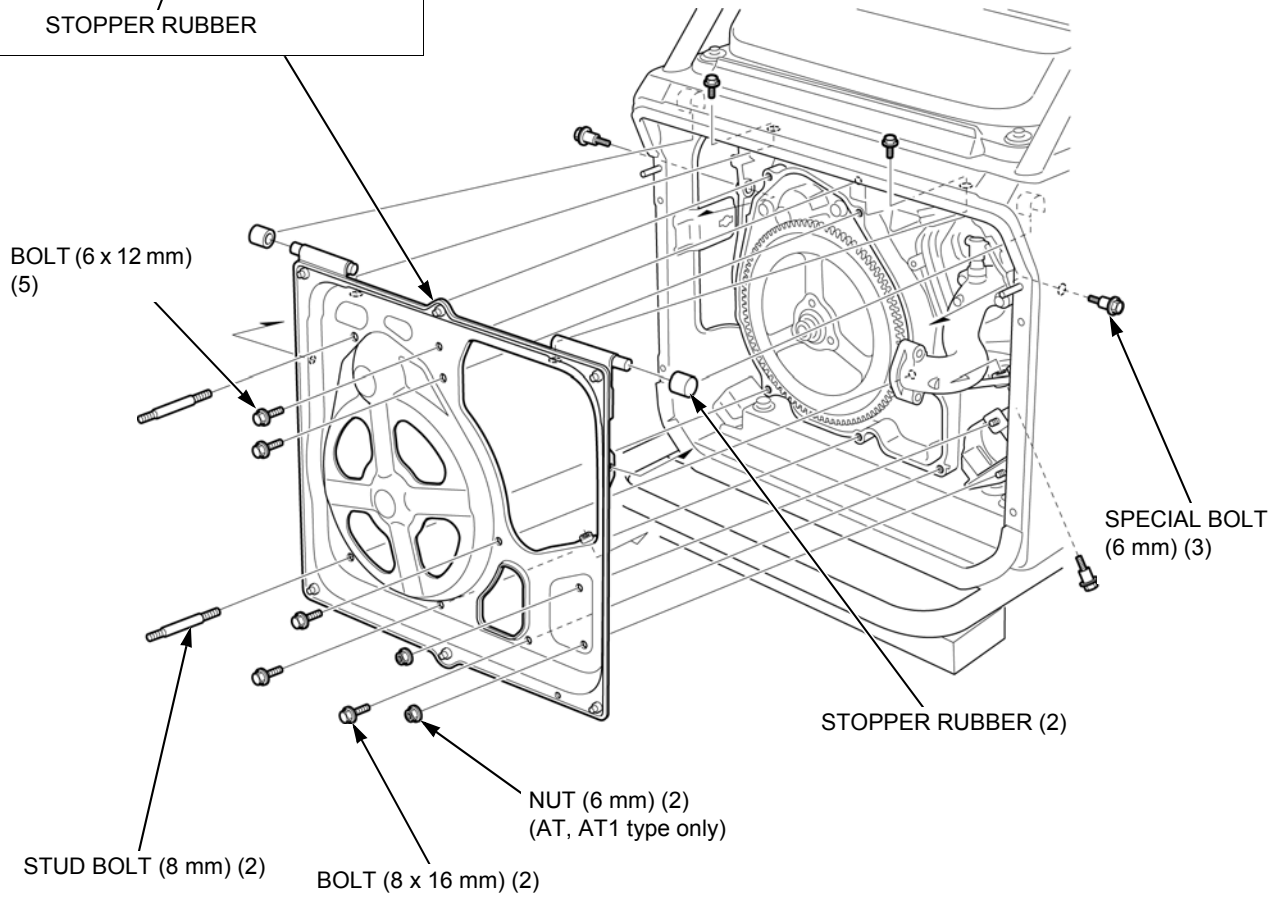
- Rear cover and outer muffler protector (page 5-6)
- Muffler (page 11-2)

INNER MUFFLER PROTECTOR

INSTALLATION:

Install the inner muffler protector by aligning the stopper rubber with the cutout on the frame side channel.

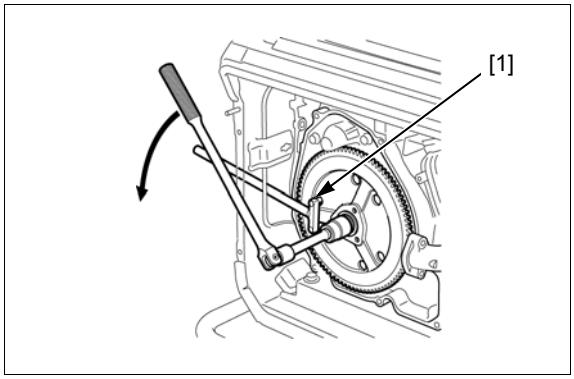




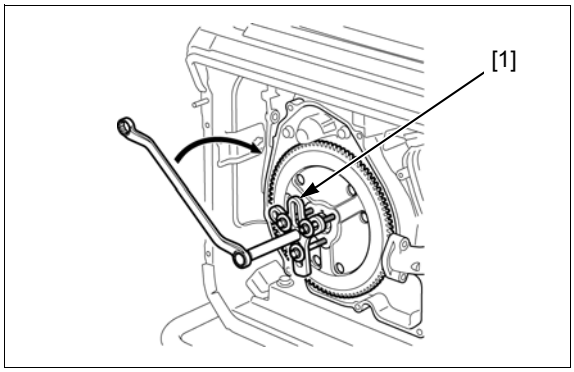
FLYWHEEL REMOVAL

Holding the flywheel with the crank pulley holder, loosen the special nut.

TOOL:
CRANK PULLEY HOLDER 47 [1] 07925-6570000



Remove the flywheel using the commercially available flywheel puller [1].



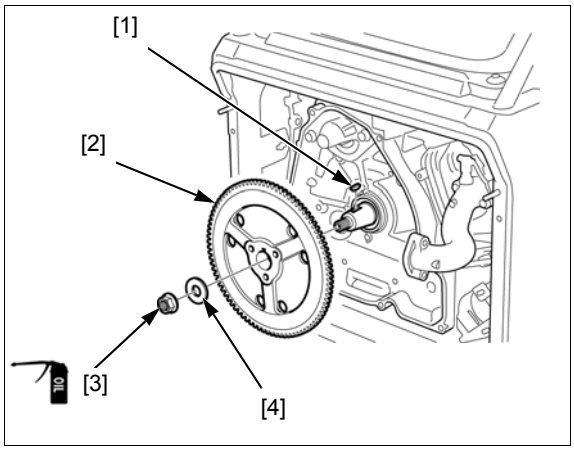
FLYWHEEL INSTALLATION

Clean off any grease or oil from the taper in the crankshaft or the tapered hole in the flywheel.

Install the woodruff [1] key on the crankshaft and then install the flywheel [2].

Apply engine oil to the threads of the special nut [3].

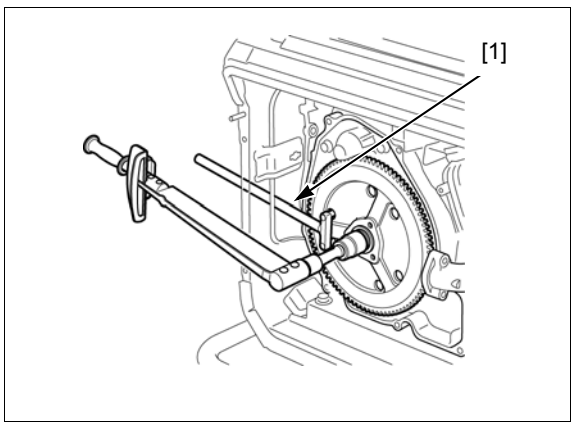
Install the special nut and washer [4].



Holding the flywheel with the crank pulley holder, tighten the 16 mm special nut.

TORQUE: 113 N·m (11.5 kgf·m, 83 lbf·ft)

TOOL:
CRANK PULLEY HOLDER 47 [1] 07925-6570000

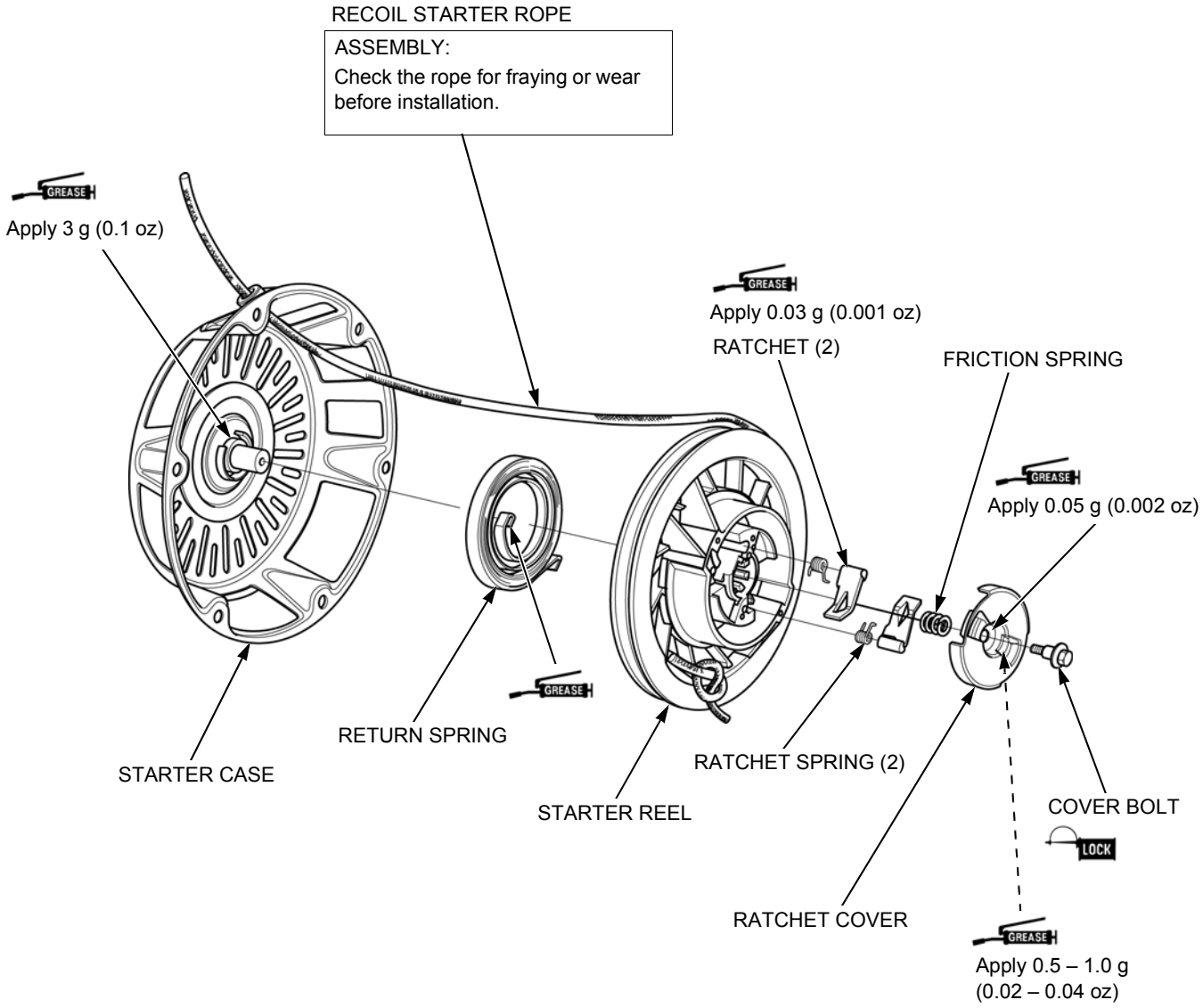


RECOIL STARTER DISASSEMBLY/ASSEMBLY

⚠ CAUTION

- Wear gloves and eye protection.
- During disassembly, take care not to allow the return spring to come out from the spring cover.

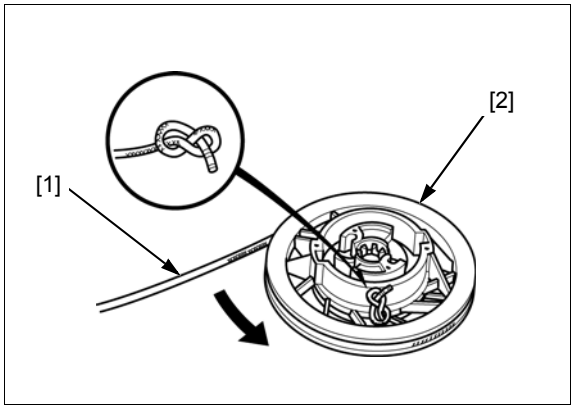
EXPLODED VIEW



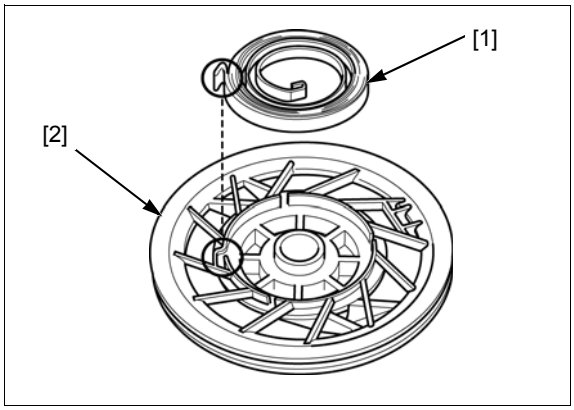
RECOIL STARTER ASSEMBLY

Insert the starter rope [1] into the recoil starter reel [2] and tie the rope as shown.

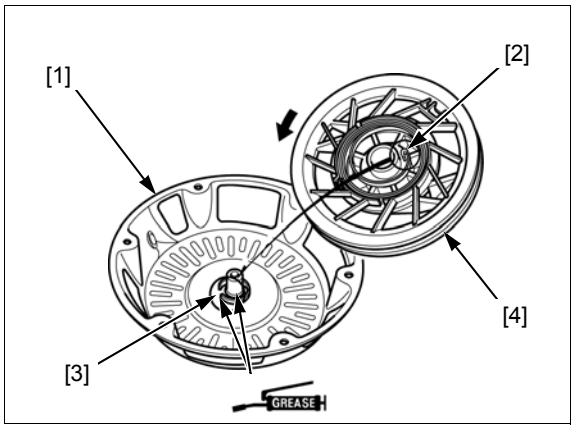
Wind the rope counterclockwise onto the reel.



Wind the spring [1] and install it to the recoil starter reel [2] by aligning the outer end to the groove of the reel.

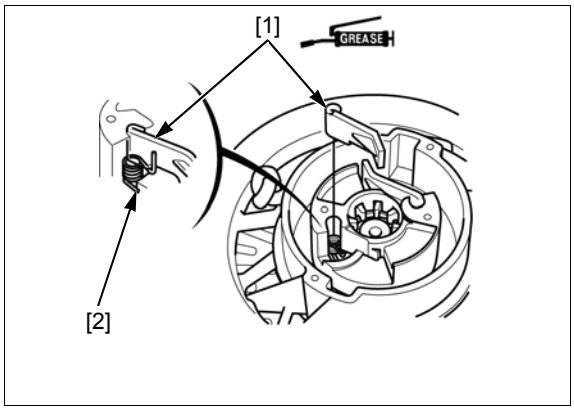


Apply 3 g (0.1 oz) of grease to the case claw and boss of the starter case [1]. Align the spring inner hook [2] to the case claw [3] on the case by turning the starter reel [4] counterclockwise.



Apply 0.03 g (0.001 oz) of grease to the two ratchets [1].

Install the ratchet spring [2] and ratchet as shown.



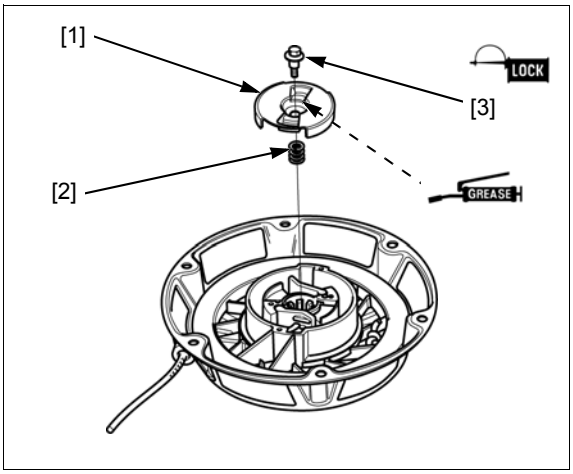
Apply 0.5 – 1.0 g (0.02 – 0.04 oz) of grease to the ratchet sliding portion of the ratchet cover [1].

Apply 0.05 g (0.002 oz) of grease to the following of the ratchet cover:

– Cover bolt sliding portion
– Friction spring sliding portion
– Cam sliding portion

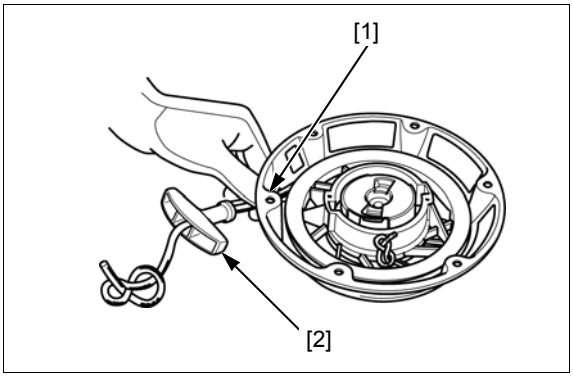
Install the friction spring [2] and ratchet cover.

Apply locking agent to the thread of the cover bolt [3]. Tighten the cover bolt.

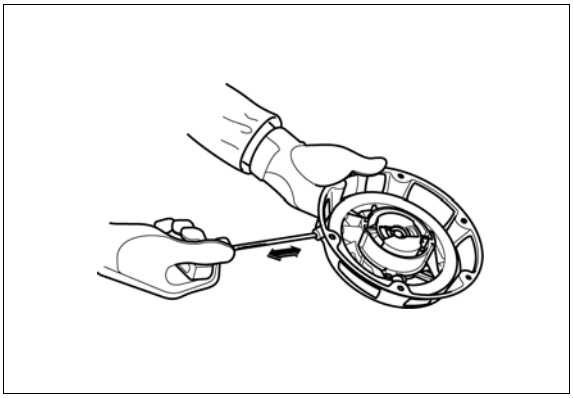


Turn the reel three full turns counterclockwise to preload the return spring.

Pass the rope through the starter case hole [1] and starter grip [2] and knot the end of the rope as shown.



Check the operation of the ratchet by pulling the starter rope out several times.

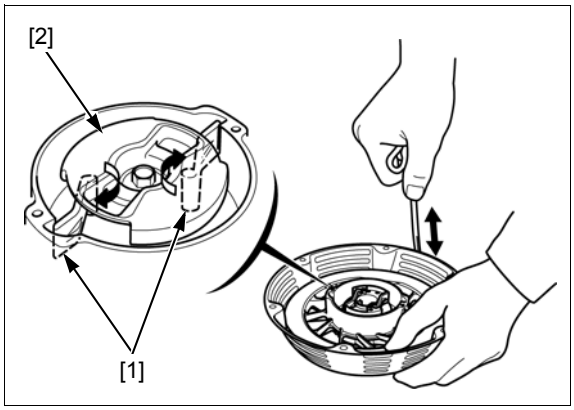


RECOIL STARTER INSPECTION

RECOIL STARTER OPERATION

Remove the recoil starter (page 9-6).

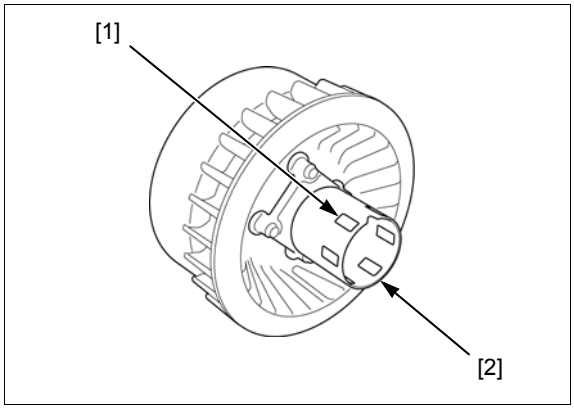
Pull the recoil starter rope several times to inspect that the ratchets [1] operate properly (the ratchet ends come out from the ratchet cover [2].



STARTER PULLEY

Remove the recoil starter (page 9-6).

Inspect all of the square holes [1] of the starter pulley [2] for deformation.



STARTER MOTOR DISASSEMBLY/ ASSEMBLY

LOCK RING

DISASSEMBLY:

Hold the armature upright, place an offset wrench over the pinion stopper, and drive the collar down exposing the lock ring. Remove the lock ring; then remove the collar and drive assembly.

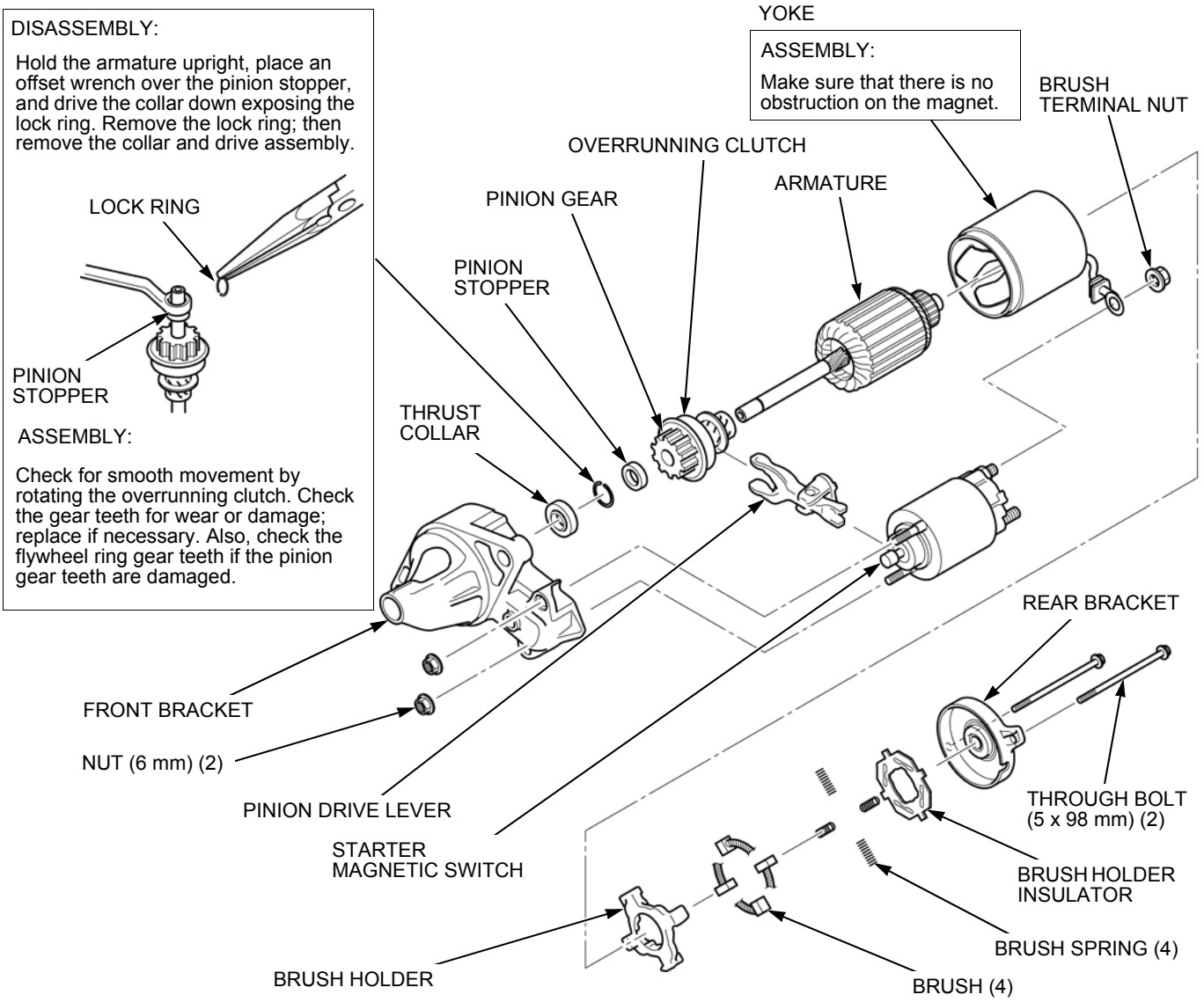
ASSEMBLY:

Check for smooth movement by rotating the overrunning clutch. Check the gear teeth for wear or damage; replace if necessary. Also, check the flywheel ring gear teeth if the pinion gear teeth are damaged.

YOKE

ASSEMBLY:

Make sure that there is no obstruction on the magnet.



FRONT BRACKET/REAR BRACKET INSTALLATION

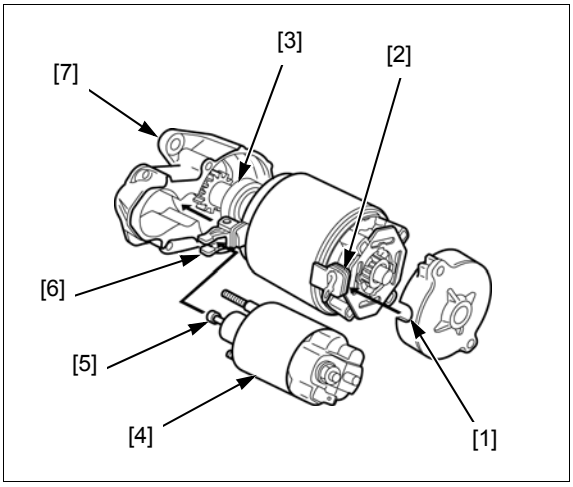
Install the armature in the yoke.

Align the cutout [1] of the rear bracket with the brush terminal grommet [2] and install the rear bracket.

Install the pinion drive lever to the overrunning clutch [3].

Set the starter magnetic switch [4] by aligning the magnetic switch pin [5] with the pinion drive lever [6].

Install the front bracket [7] and two through bolts and tighten the flange nuts.



STARTER MOTOR INSPECTION

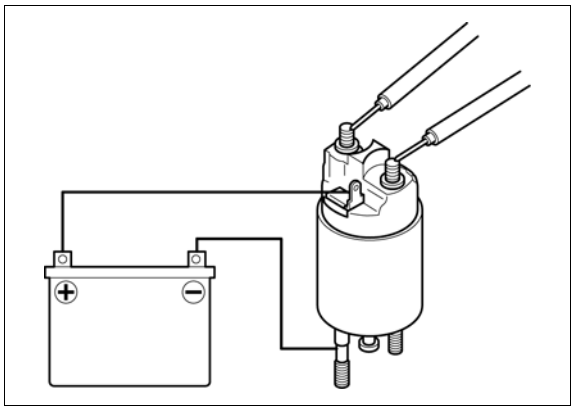
STARTER MAGNETIC SWITCH

Connect a 12V battery to the magnetic switch terminal and switch body as shown.

There should be continuity between the battery and starter motor terminals.

There should be no continuity when the battery is disconnected.

Be sure the battery is in good condition before performing this test.

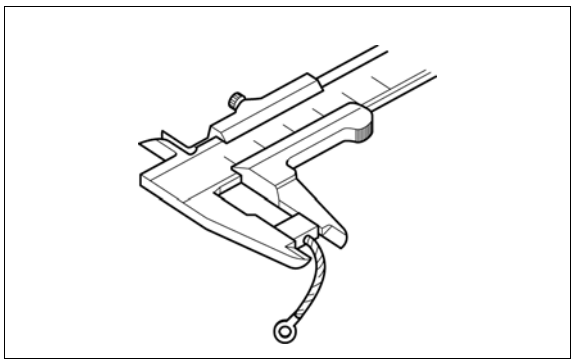


BRUSH LENGTH

Measure the brush length.

If the brush length is less than the service limit, replace the brush.

STANDARD: 10 mm (0.4 in)
SERVICE LIMIT: 6 mm (0.2 in)

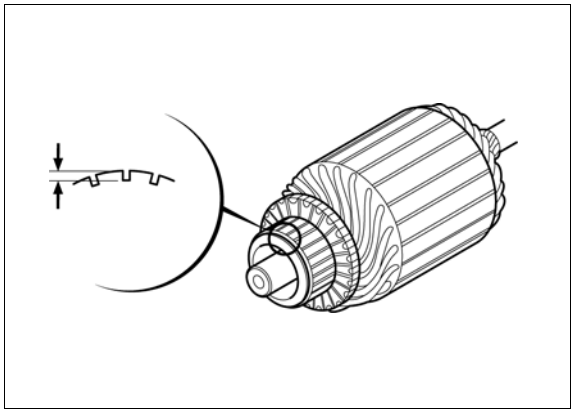


ARMATURE MICA DEPTH

Visually inspect the commutator surface for dust, rust, or other damage. If necessary, wipe it with a clean lint-free cloth. If rusted or damaged, dress with a fine emery cloth.

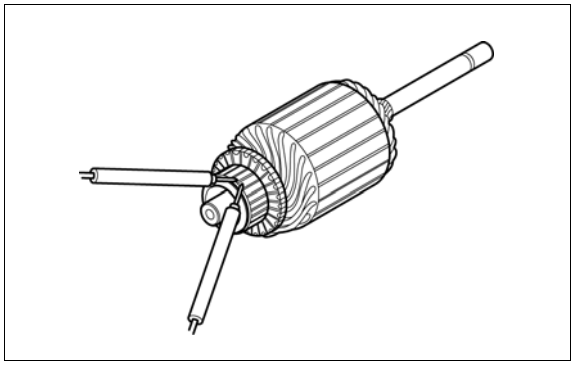
When the mica is clogged, or its depth is smaller than the service limit value, recut the grooves using a hacksaw blade or a small file.

SERVICE LIMIT: 0.2 mm (0.01 in)



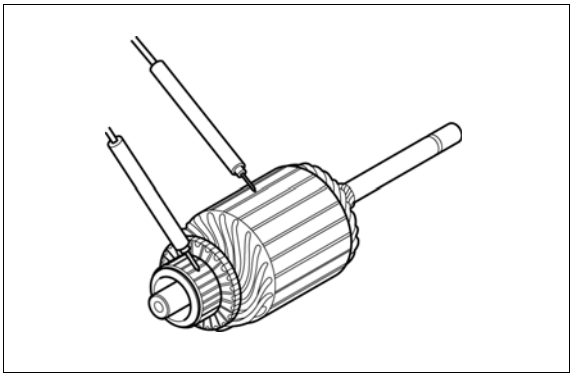
ARMATURE CONTINUITY CHECK - COMMUTATOR SEGMENTS

Check for continuity between segments. If an open circuit (no continuity) exists between any two segments, replace the armature.



ARMATURE CONTINUITY CHECK - COMMUTATOR TO CORE

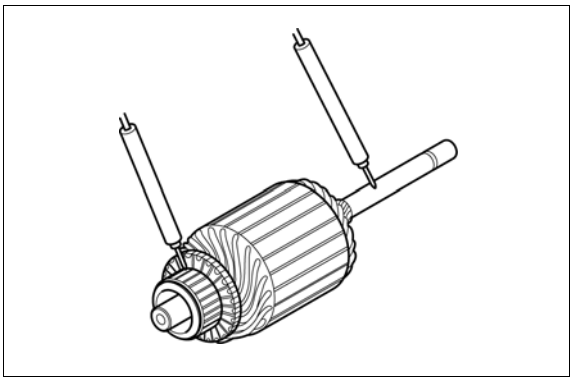
Check for continuity between the commutator segments and the armature coil core.
Replace the armature if continuity exists.



ARMATURE CONTINUITY CHECK - COMMUTATOR TO SHAFT

Check for continuity between the commutator and the armature shaft.

Replace the armature if continuity exists between any of the commutator segments and the armature shaft.

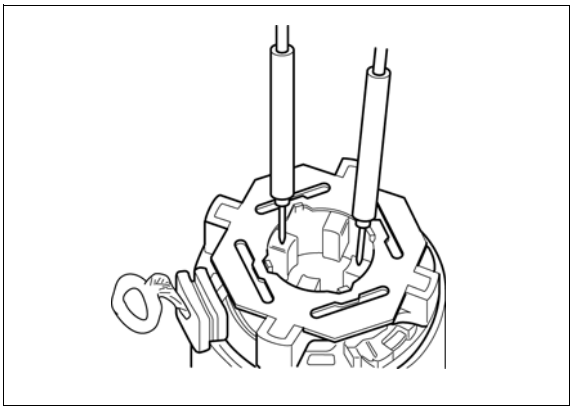


BRUSH CONTINUITY CHECK

Check for continuity between the brushes.

There should be continuity between both the positive brushes.
There should be continuity between both the negative brushes.
There should be no continuity from either positive brush to either negative brush.

If necessary, replace the yoke assembly.

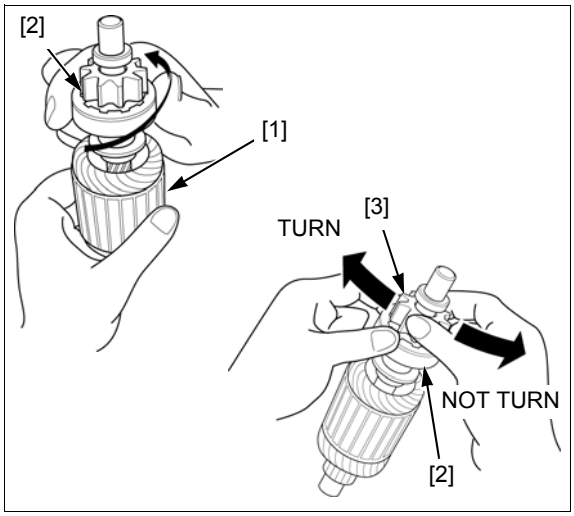


OVERRUNNING CLUTCH

Hold the armature [1] as shown and check that the overrunning clutch [2] turns counterclockwise and slides smoothly. If necessary, apply oil or replace the overrunning clutch (page 9-15).

Hold the overrunning clutch as shown and check that the pinion gear [3] turns clockwise freely and does not turn counterclockwise. If necessary, apply oil or replace the overrunning clutch (page 9-15).

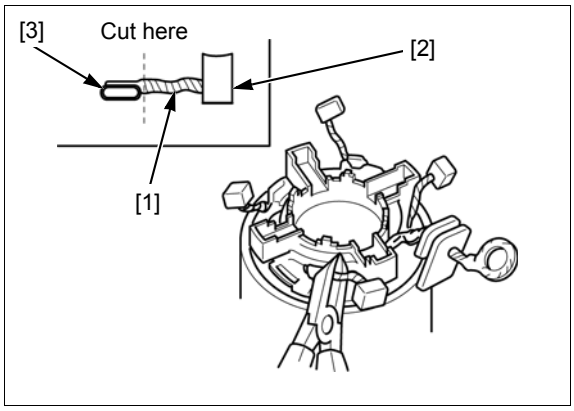
Check the pinion gear for wear or damage and replace the over running clutch if necessary (page 9-15).
If the pinion gear is worn or damaged, the flywheel ring gear must be inspected.



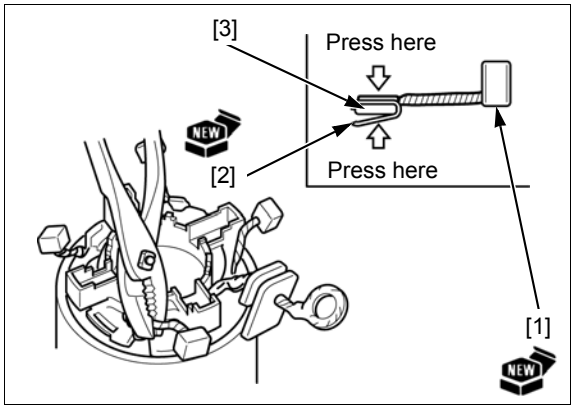
BRUSH REPLACEMENT

Cut off the brush lead [1] at the point shown and remove the brush [2].

Remove the remaining brush lead and deposited solder from the terminal [3].

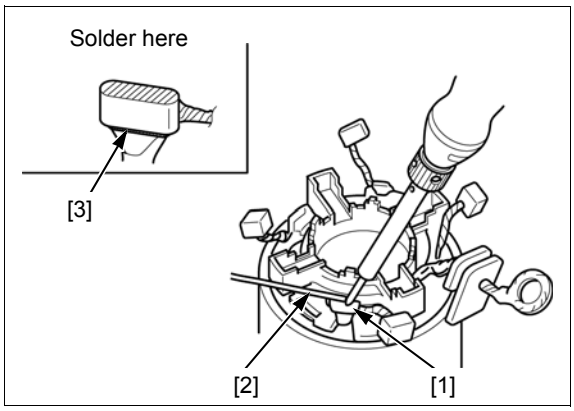


Hold a new brush [1] in the same direction as the removed brush and put a new plate [2] over the new brush and terminal [3], and press it using a pair of pliers as shown.



Solder the plate on the terminal [1].

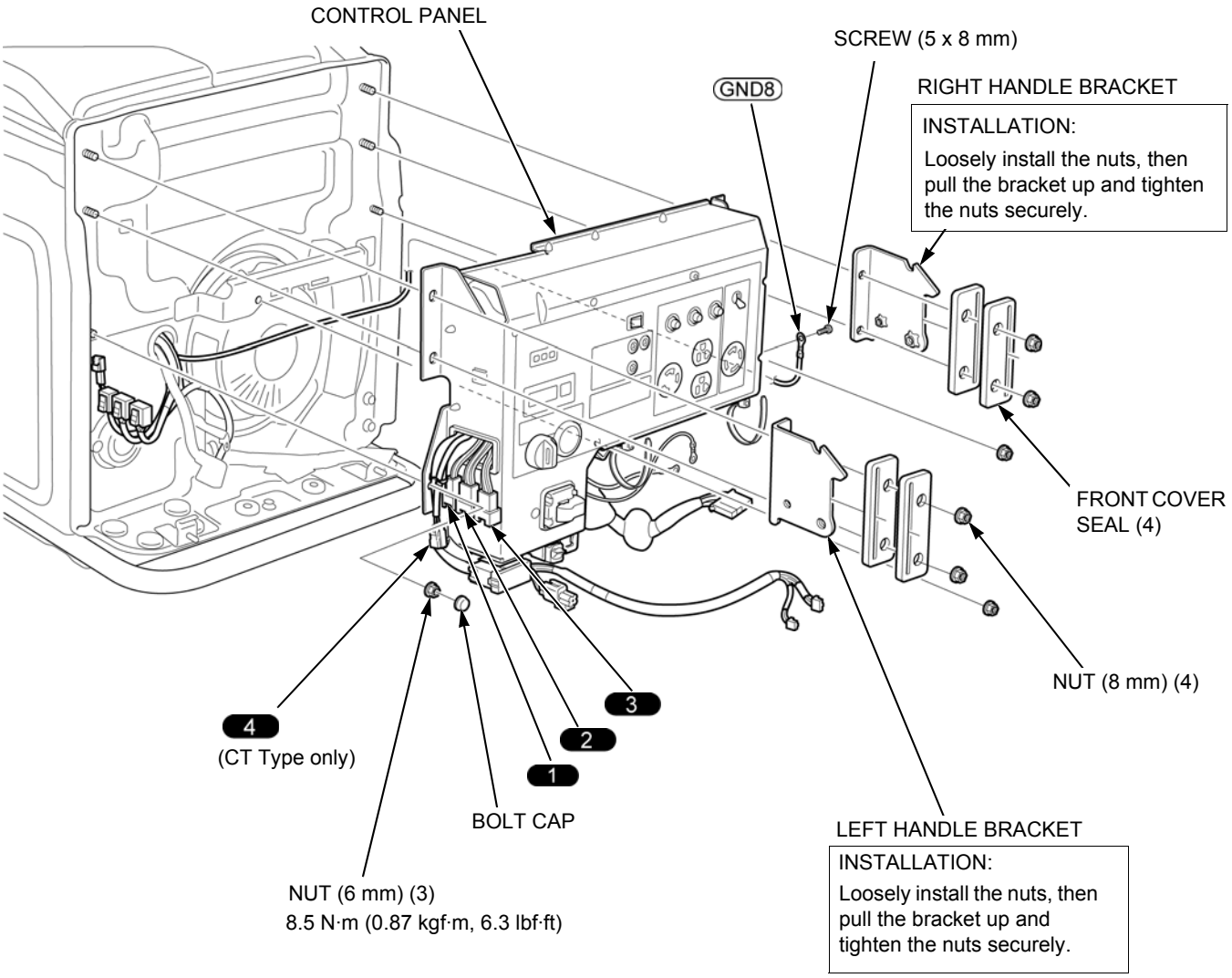
- Before soldering, heat the pressed part of the plate enough to make sure solder [2] reaches the end of the pressed part [3].
- Prevent solder from flowing down the brush lead.
- Do not allow solder to run down onto the field winding of the yoke.



CONTROL PANEL REMOVAL/ INSTALLATION

Remove the following:

- Battery (page 7-9)
- Front cover (page 5-5)
- Inverter unit (page 7-10)

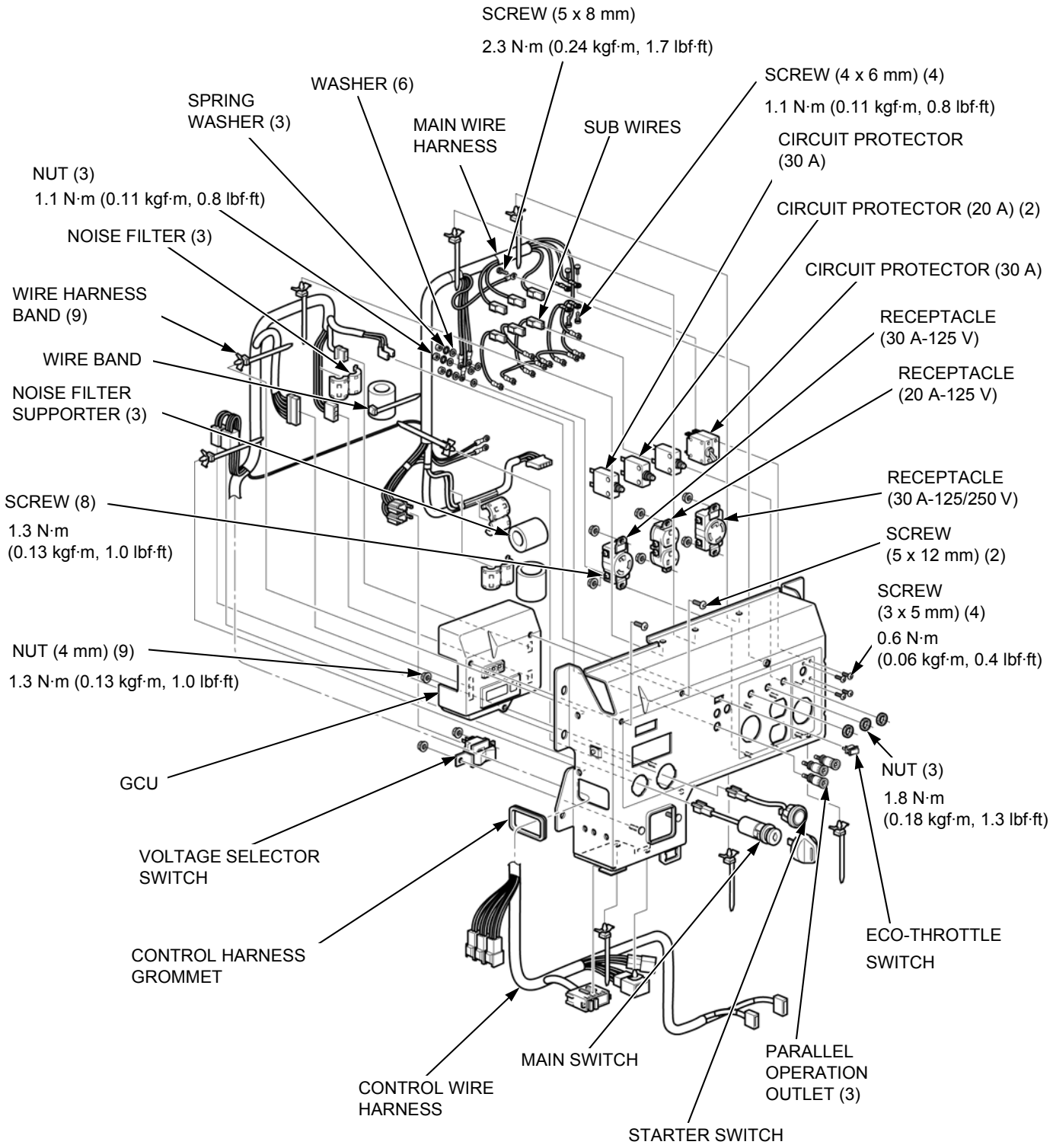


CONTROL PANEL DISASSEMBLY/ASSEMBLY

AT TYPE

NOTE:

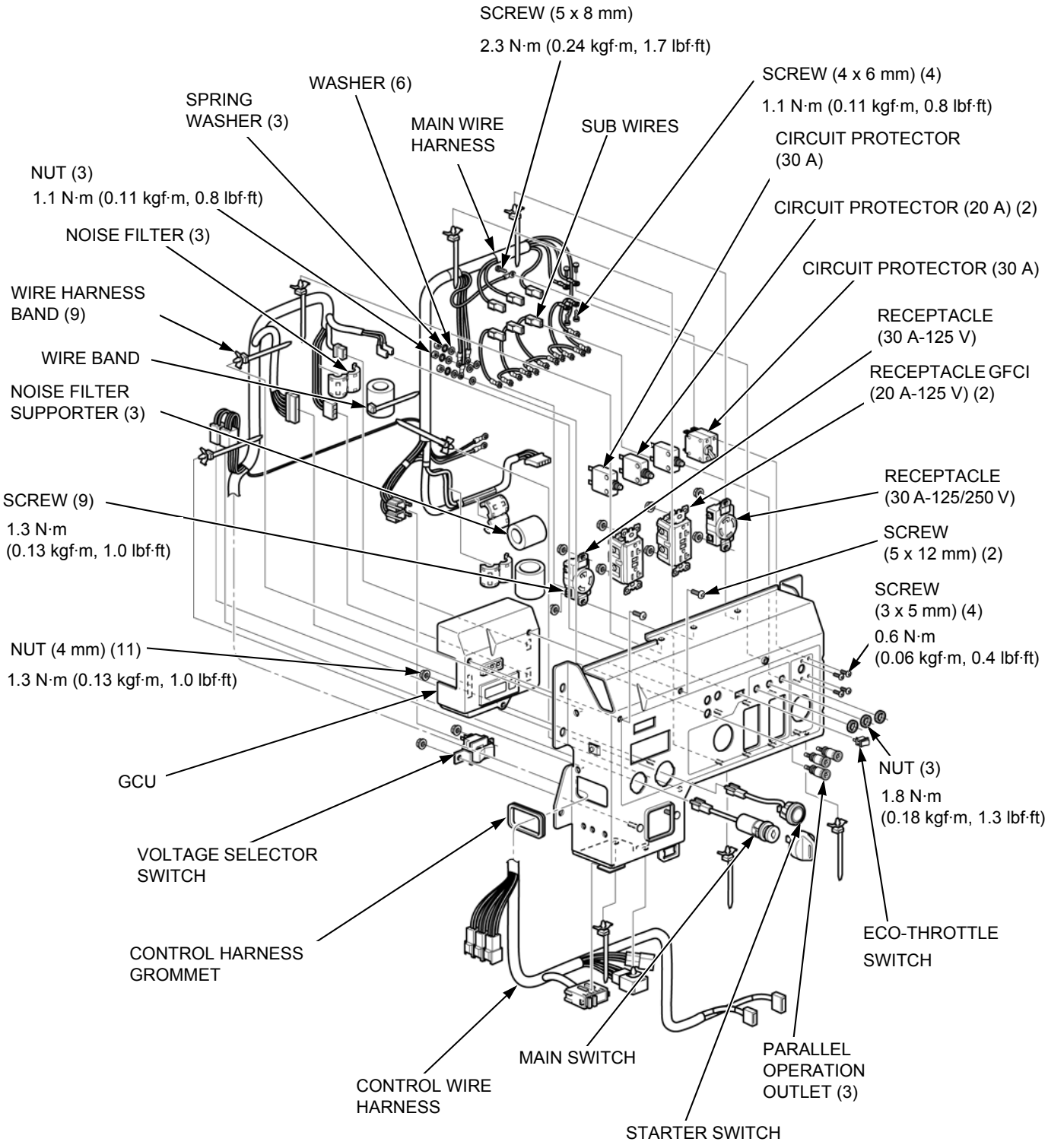
- When installing, route the harness connections properly (page 2-8).



AT1 TYPE

NOTE:

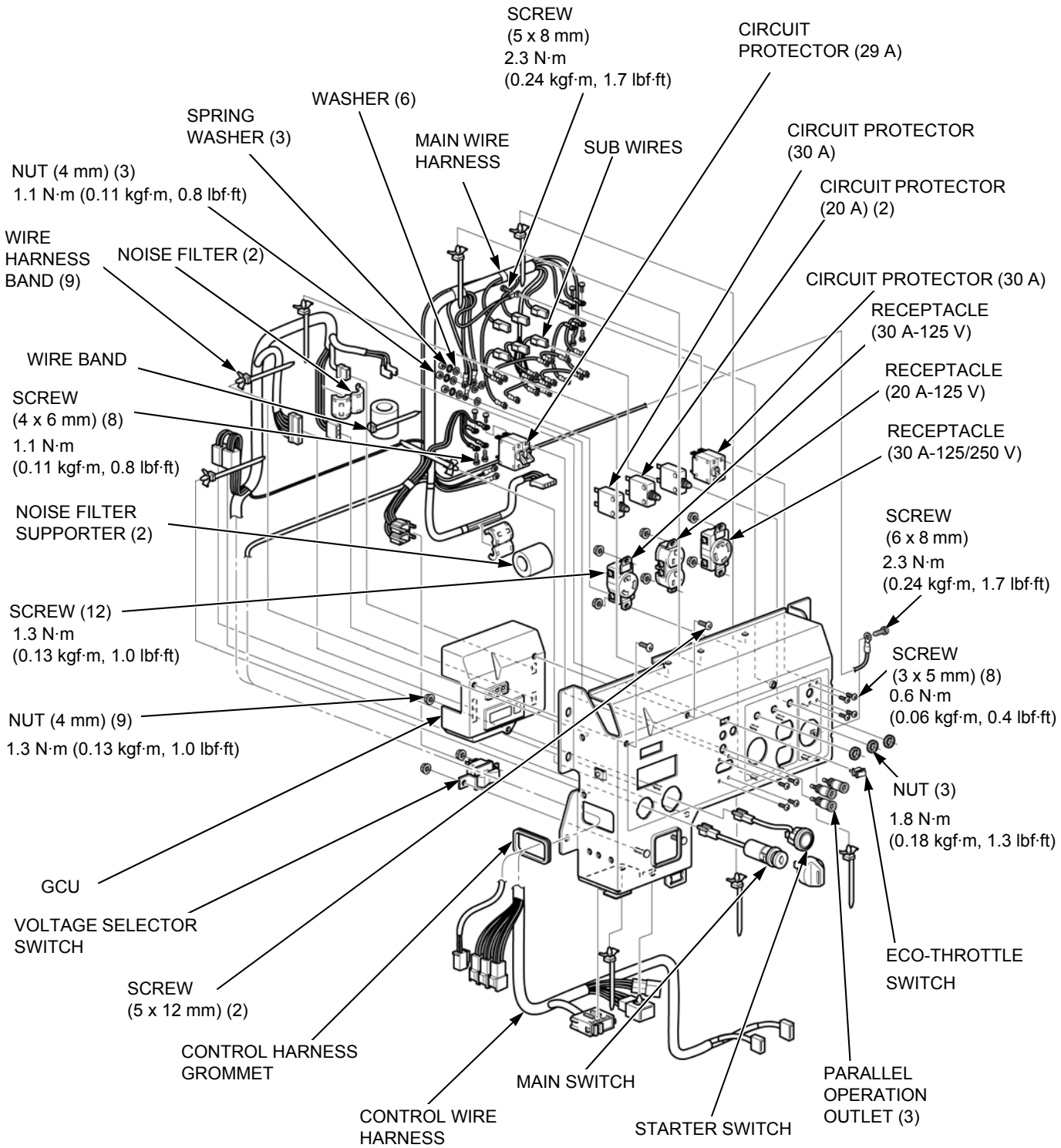
- When installing, route the harness connections properly (page 2-8).



CT TYPE

NOTE:

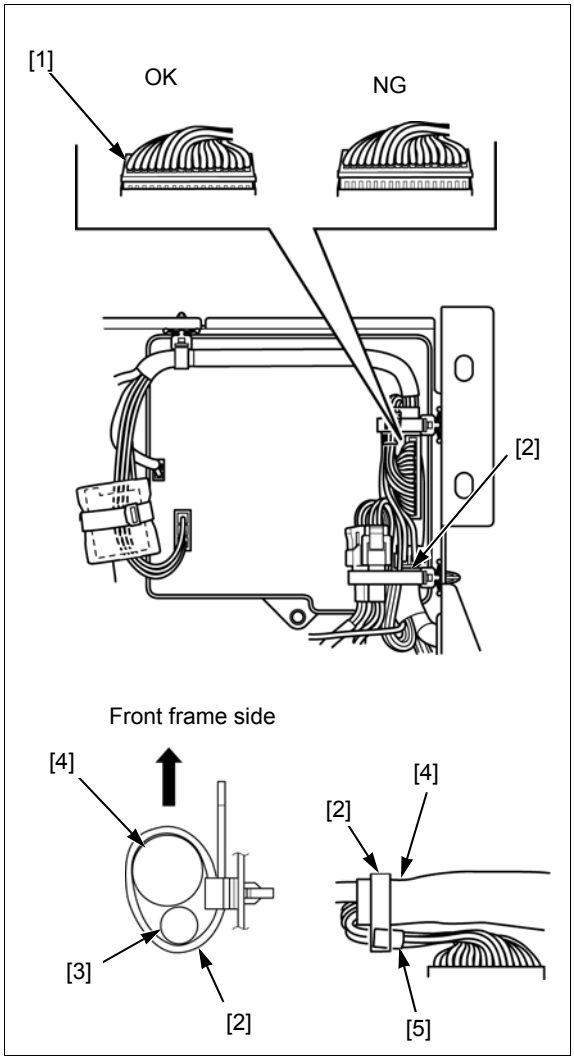
- When installing, route the harness connections properly (page 2-8).



GCU 34P CONNECTOR CONNECTION

You should hear the connector "CLICK" when the GCU connector 34P connector [1] is connected.
After connecting the GCU 34P connector, make sure the connector is completely seated as shown.

- After connecting the GCU 34P connector, secure the wire band [2].
- When securing the wire band, be sure to set the GCU 34P connector harness [3] under the control wire harness [4].
- Secure the wire band at the outer end [5] of the yellow tape of the GCU 34P connector harness to prevent stress to the harness.

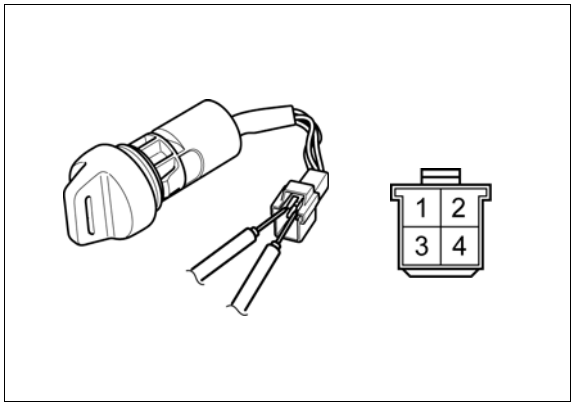


MAIN SWITCH INSPECTION

Check for continuity between the switch terminals.

There should be continuity between the terminals with the switch in the ON position and no continuity with the switch in the OFF position.

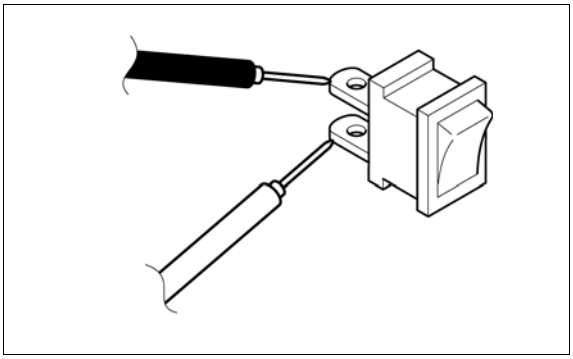
Terminal / Position	1	2	3	4
ON	○	○	○	○
OFF				



ECO-THROTTLE SWITCH INSPECTION

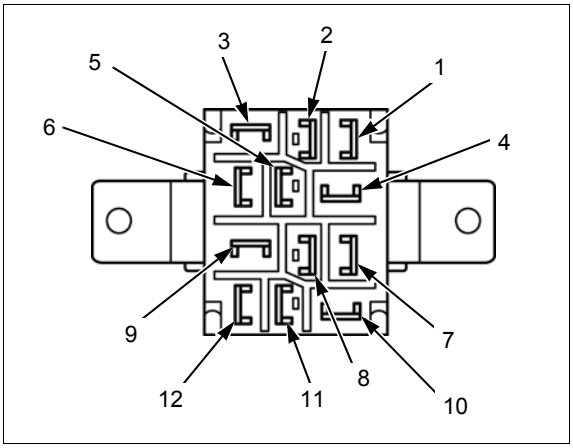
Check for continuity between the switch terminals.

There should be no continuity between the terminals with the switch in the ON position and continuity with the switch in the OFF position.



VOLTAGE SELECTOR SWITCH INSPECTION

Check for continuity between the terminals according to the table below.



Terminal / Position	1	2	3	4	5	6
120 V only		○	○		○	○
120 V/240 V	○	○		○	○	

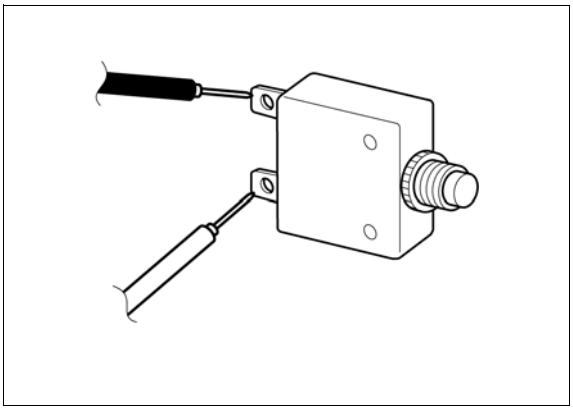
Terminal / Position	7	8	9	10	11	12
120 V only		○	○		○	○
120 V/240 V	○	○		○	○	

CIRCUIT PROTECTOR INSPECTION

CIRCUIT PROTECTOR 30 A/20 A

Check for continuity between the terminals.

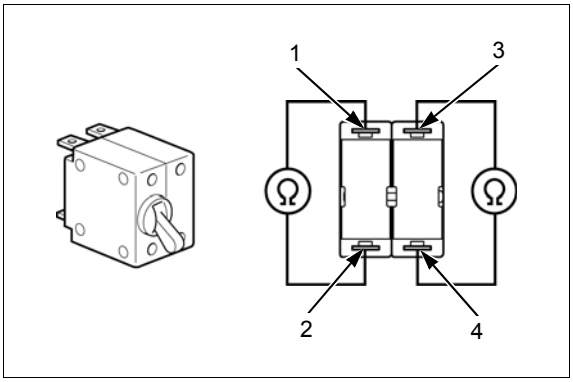
There should be continuity between the terminals with the switch in the ON position.



CIRCUIT PROTECTOR 30 A

Check for continuity between the terminals according to the table below.

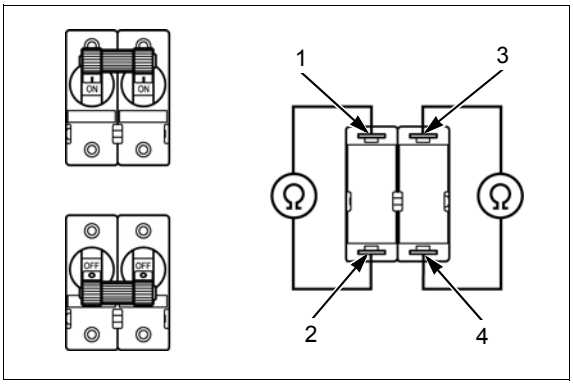
	Position	
Terminal	OFF	ON
1	No Continuity	Continuity
2		
3	No Continuity	Continuity
4		



CIRCUIT PROTECTOR 29 A (CT TYPE ONLY)

Check for continuity between the terminals according to the table below.

	Position	
Terminal	OFF	ON
1	No Continuity	Continuity
2		
3	No Continuity	Continuity
4		

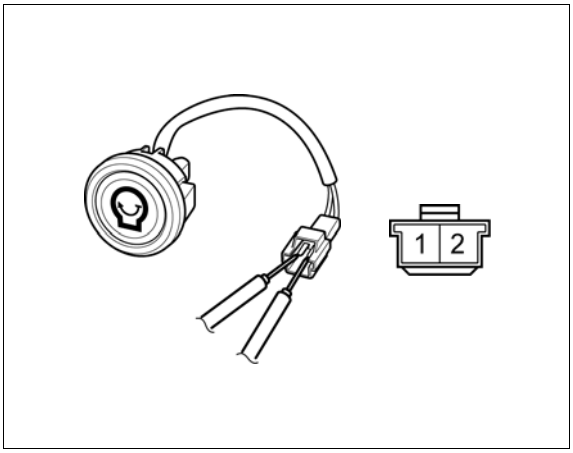


STARTER SWITCH INSPECTION

Check for continuity between the terminals.

There should be continuity between the terminals with the switch in the Push position.

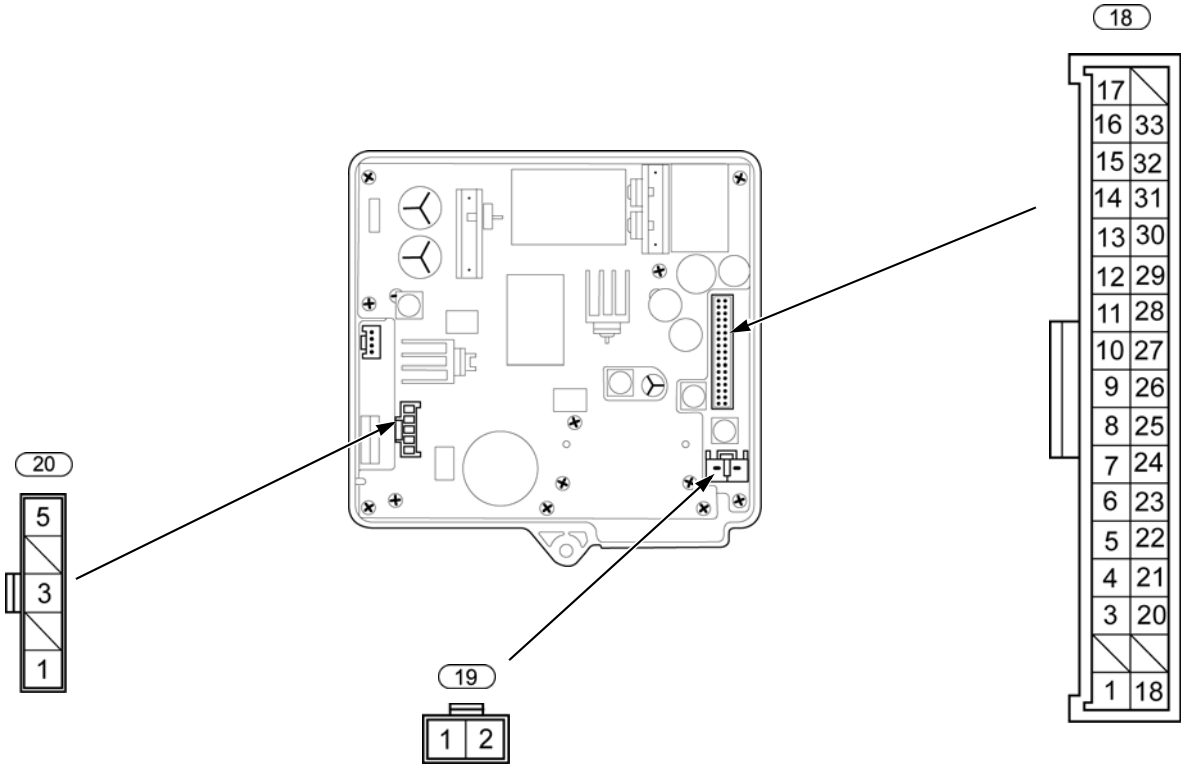
Position \ Terminal	1	2
Push	○	○
Free		



GCU INSPECTION

Remove the GCU (page 10-3).

Check for continuity between the terminals.



Symptom	Inspection terminals	Standard
i-monitor does not display	Between the connector (20) No.1, No.3 and No.5	No continuity
No spark at spark plug	Between the connector (18) No.3 and connector (19) No.1	No continuity
	Between the connector (20) No.1, No.3 and No.5	No continuity
Push the starter switch but starter motor does not turn	Between the connector (18) No.3 and No.29	720 – 880 Ω
Throttle control motor does not move	Between the connector (18) No.14, No.15, No.16 and No.17	No continuity
Starter motor turns at the main switch turned ON	Between the connector (18) No.7 and No.9	No continuity
E-06 is displayed by engine starts	Between the connector (20) No.1, No.3 and No.5	No continuity

MEMO

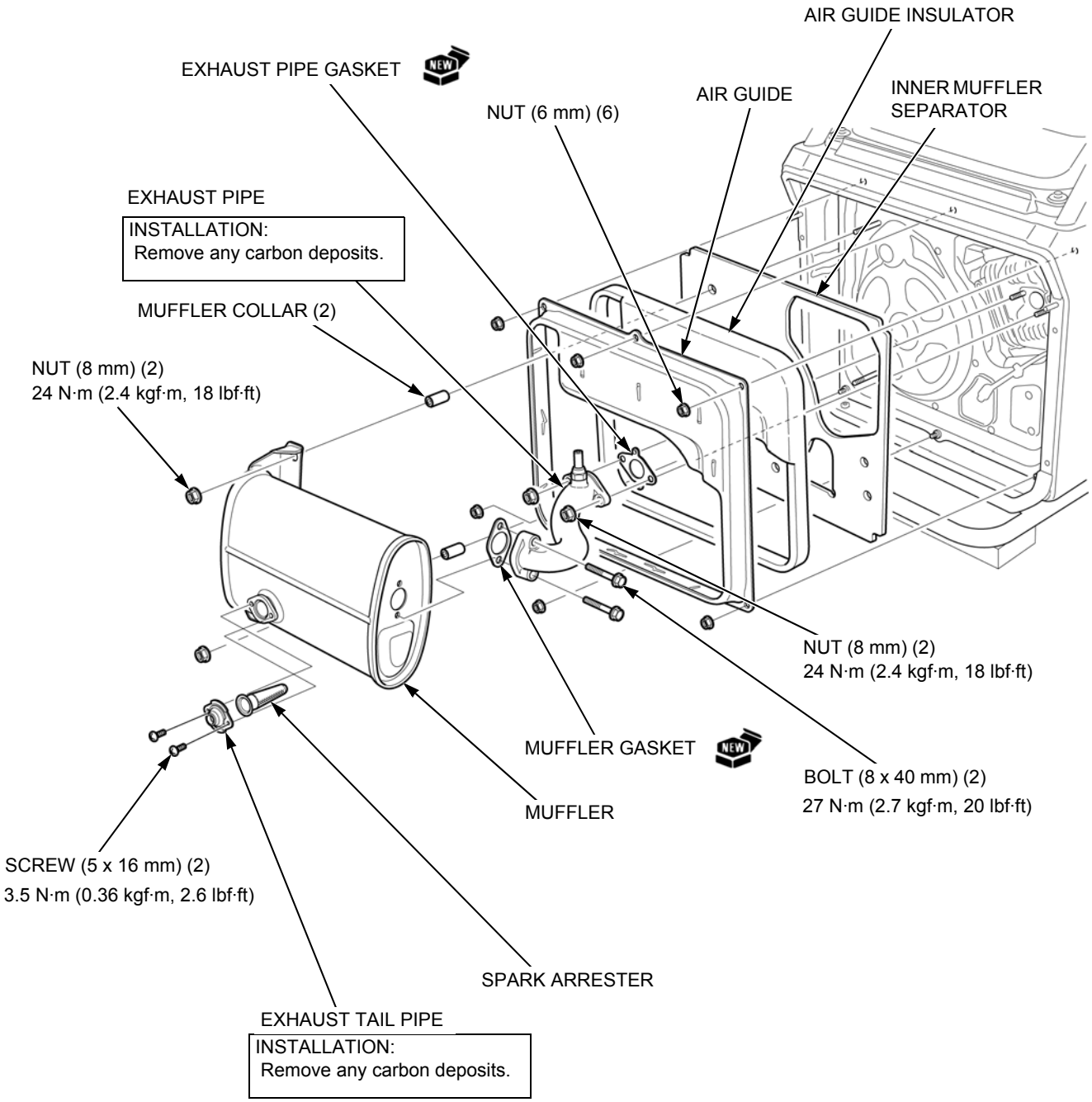
11. MUFFLER

MUFFLER REMOVAL/INSTALLATION

⚠ CAUTION

The muffler becomes very hot during operation and remains hot for a while after stopping the engine. Be careful not to touch the muffler while it is hot. Allow it to cool before proceeding.

Remove the rear cover/outer muffler protector (page 5-6).



12. GENERATOR/ENGINE REMOVAL/INSTALLATION

GENERATOR/ENGINE REMOVAL/INSTALLATION

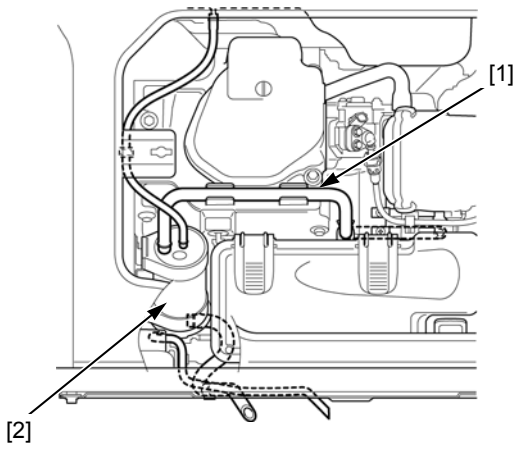
REMOVAL

Remove the following:

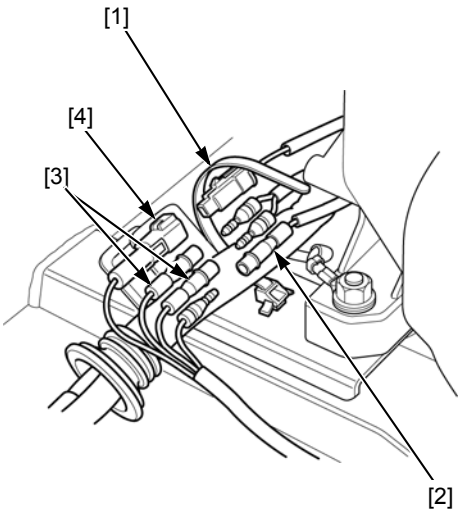
- Left and right maintenance cover (page 5-2)
- Fuel tank (page 6-11)
- Front cover (page 5-5)
- Inverter unit (page 7-10)
- Control panel (page 10-2)
- Recoil starter (page 9-6)
- Rear cover and outer muffler protector (page 5-6)
- Muffler (page 11-2)
- Inner muffler protector (page 9-9)
- Air cleaner bracket (page 6-13)

AT, AT1 Type only:
Disconnect the EVAP canister purge tube [1] from the EVAP canister assembly [2].

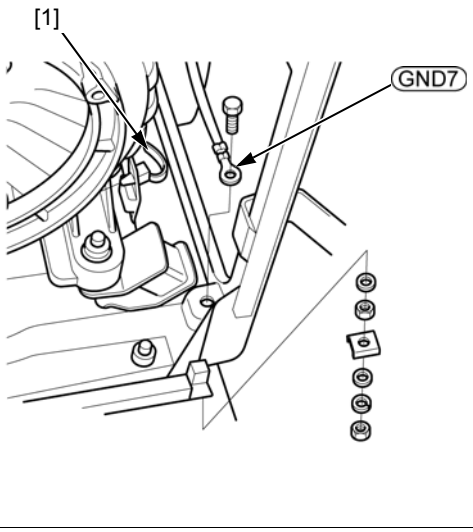
AT, AT1 TYPE ONLY:



Open the wire harness band [1] and disconnect the CKP sensor wire connector [2] and EBT sensor wire connectors [3] and O2 sensor 1P connector [4].

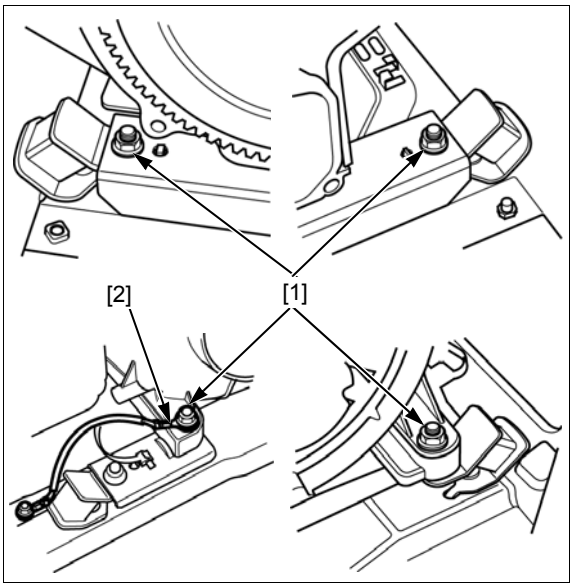


Remove the ground terminal (GND7) and open the wire harness band [1].

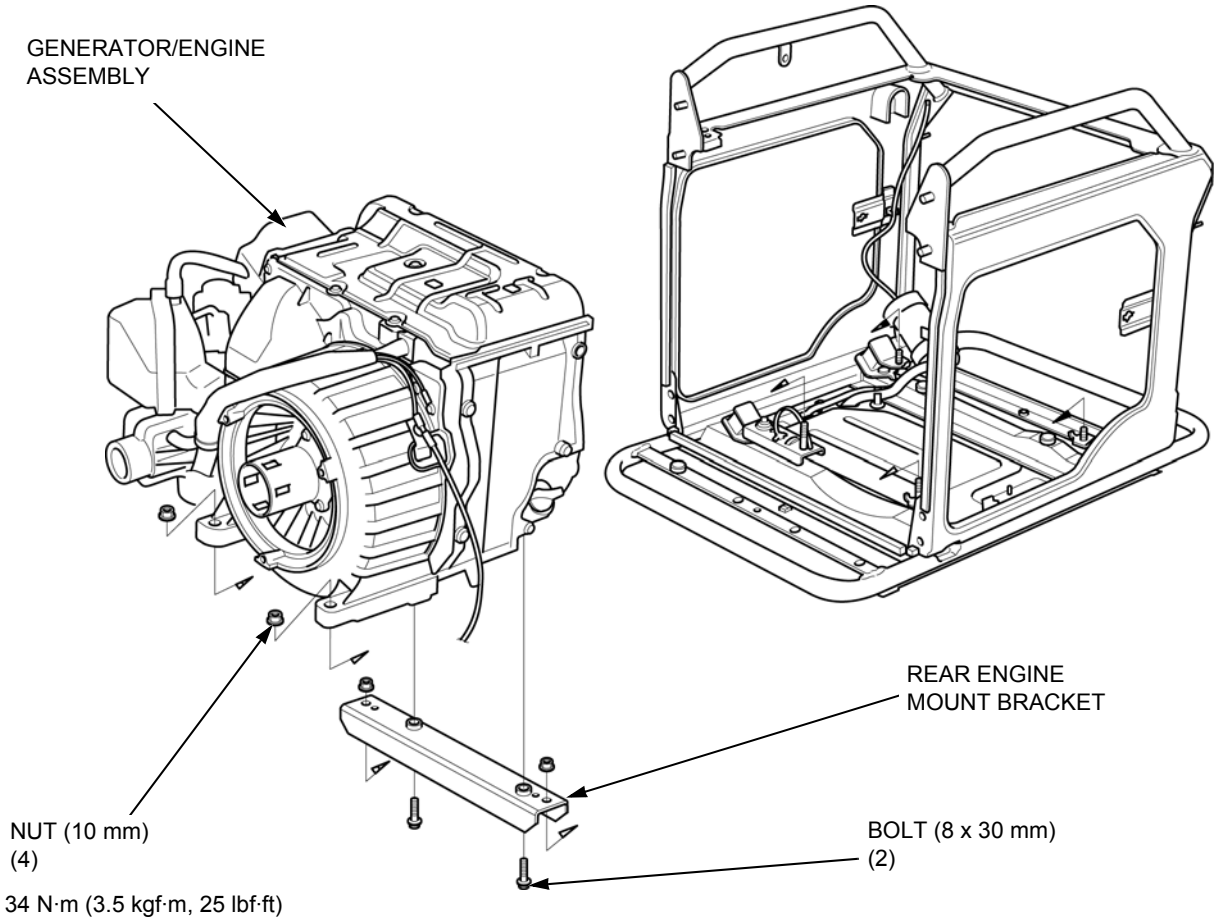


Remove the four nuts [1] and the ground cable terminal [2].

Remove the generator/engine assembly.



INSTALLATION



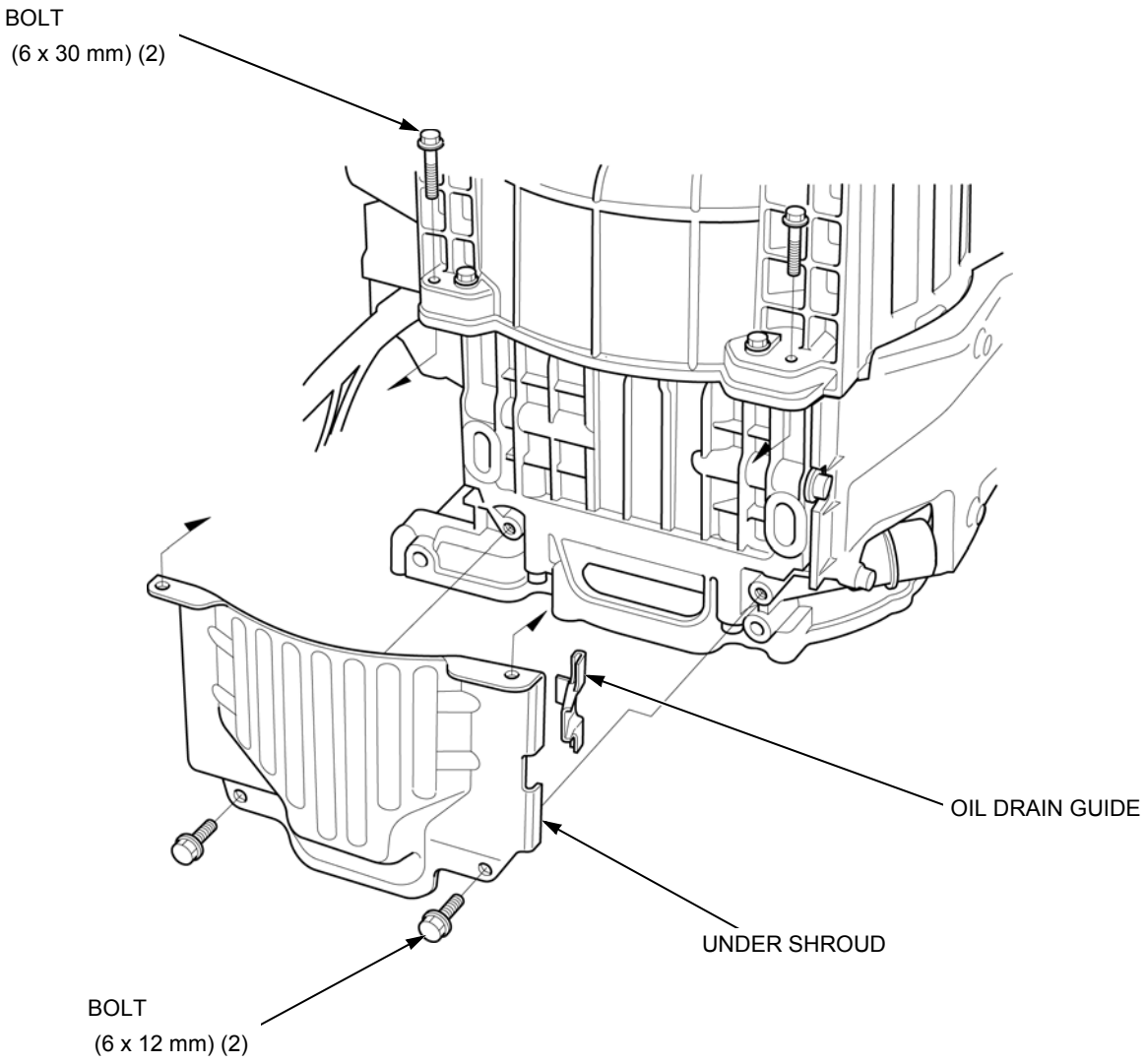
Installation is the reverse order of removal.

- Remember to reattach the ground cable when bolting the generator to the frame.

TORQUE: Ground terminal (GND7) mounting nut: 3 N·m (0.31 kgf·m, 2.2 lbf·ft)

UNDER SHROUD REMOVAL/INSTALLATION

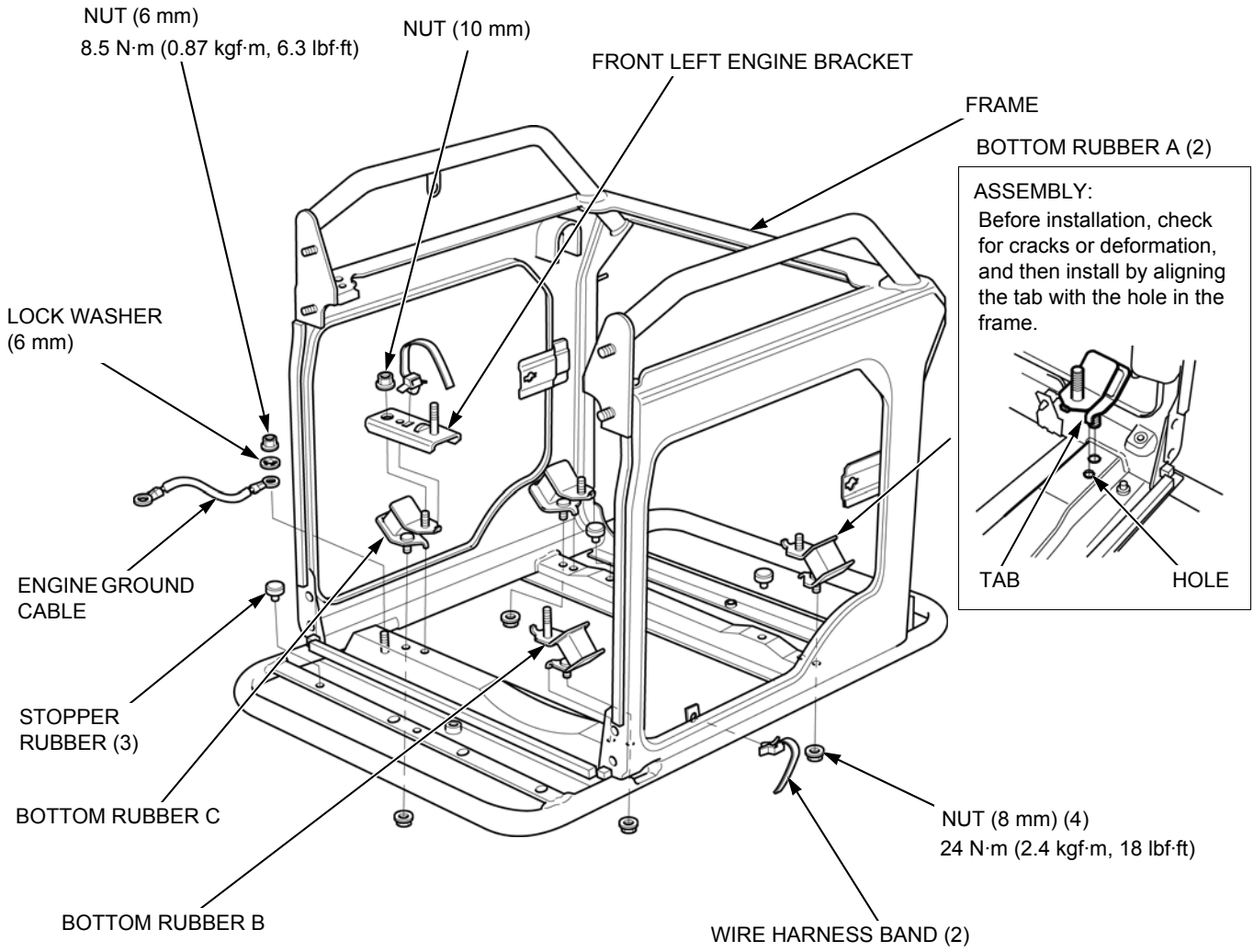
Remove the generator/engine assembly from the frame (page 12-2).



FRAME BOTTOM RUBBERS REMOVAL/INSTALLATION

Remove the generator/engine assembly (page 12-2).

Remove the stand and wheels shaft (page 15-2).



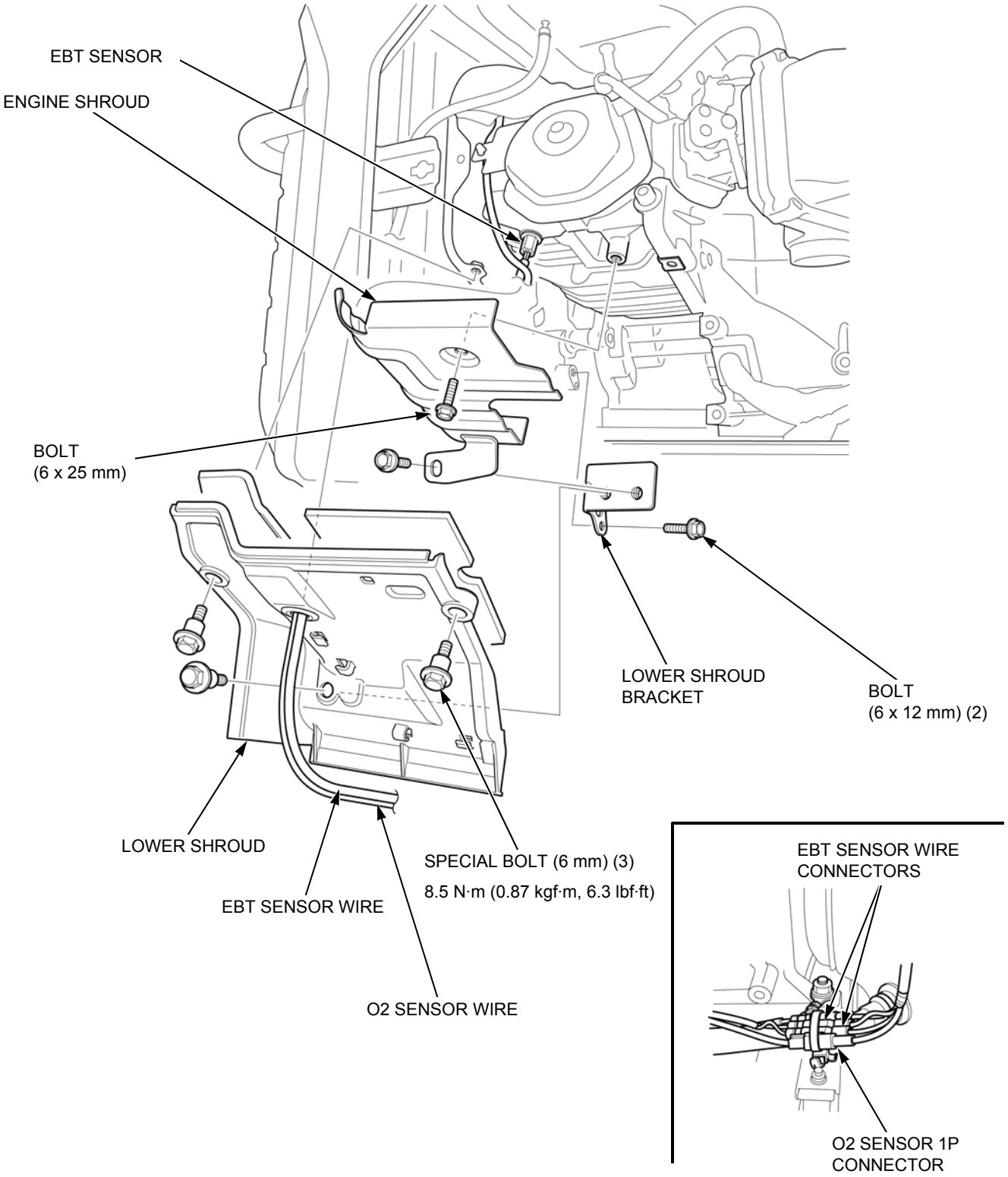
MEMO

13. CYLINDER HEAD

HEAD COVER LOWER SHROUD REMOVAL/INSTALLATION

Remove the following:

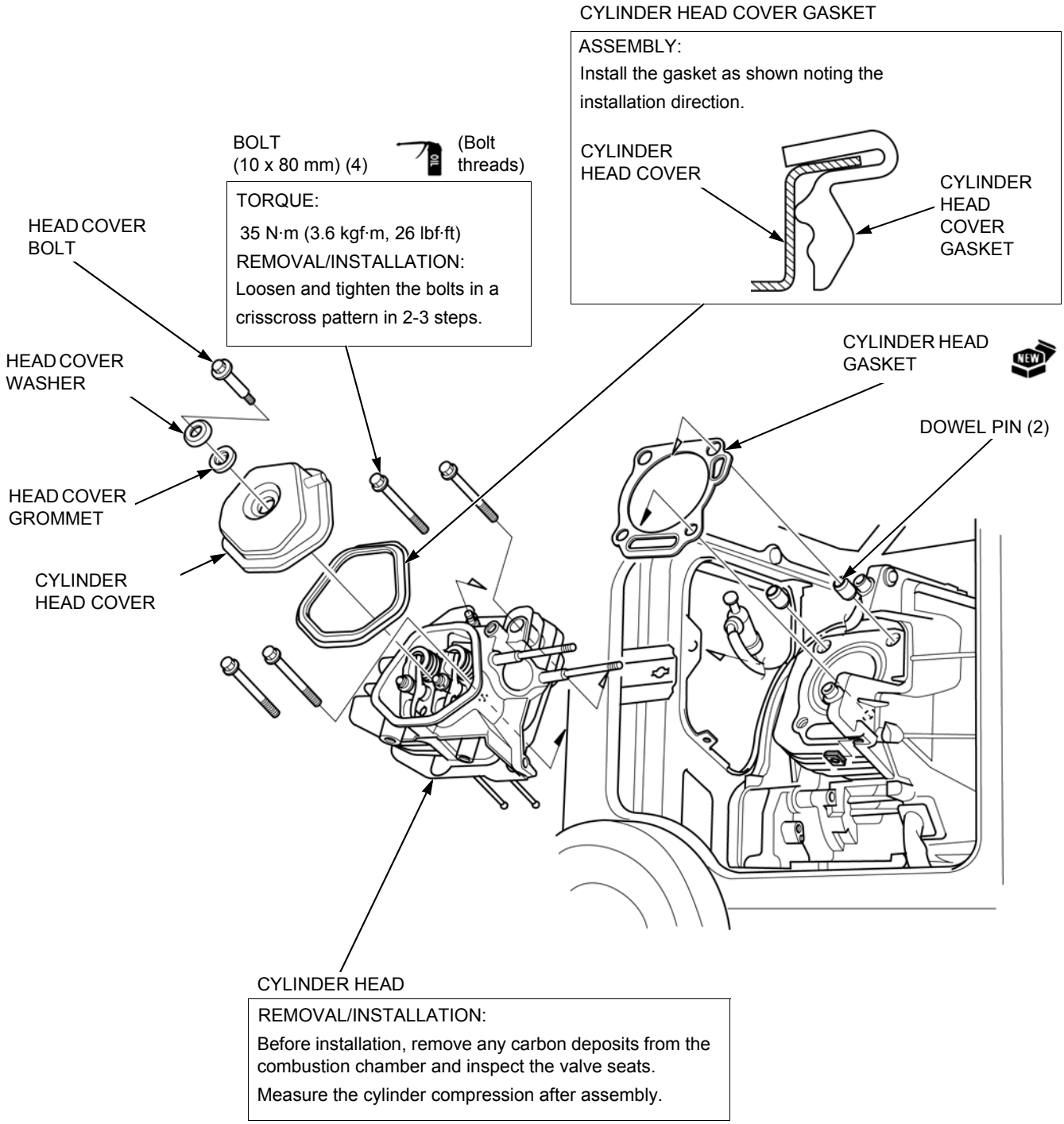
- Head cover shroud (page 5-7)
- Air cleaner bracket (page 6-13)



CYLINDER HEAD REMOVAL/INSTALLATION

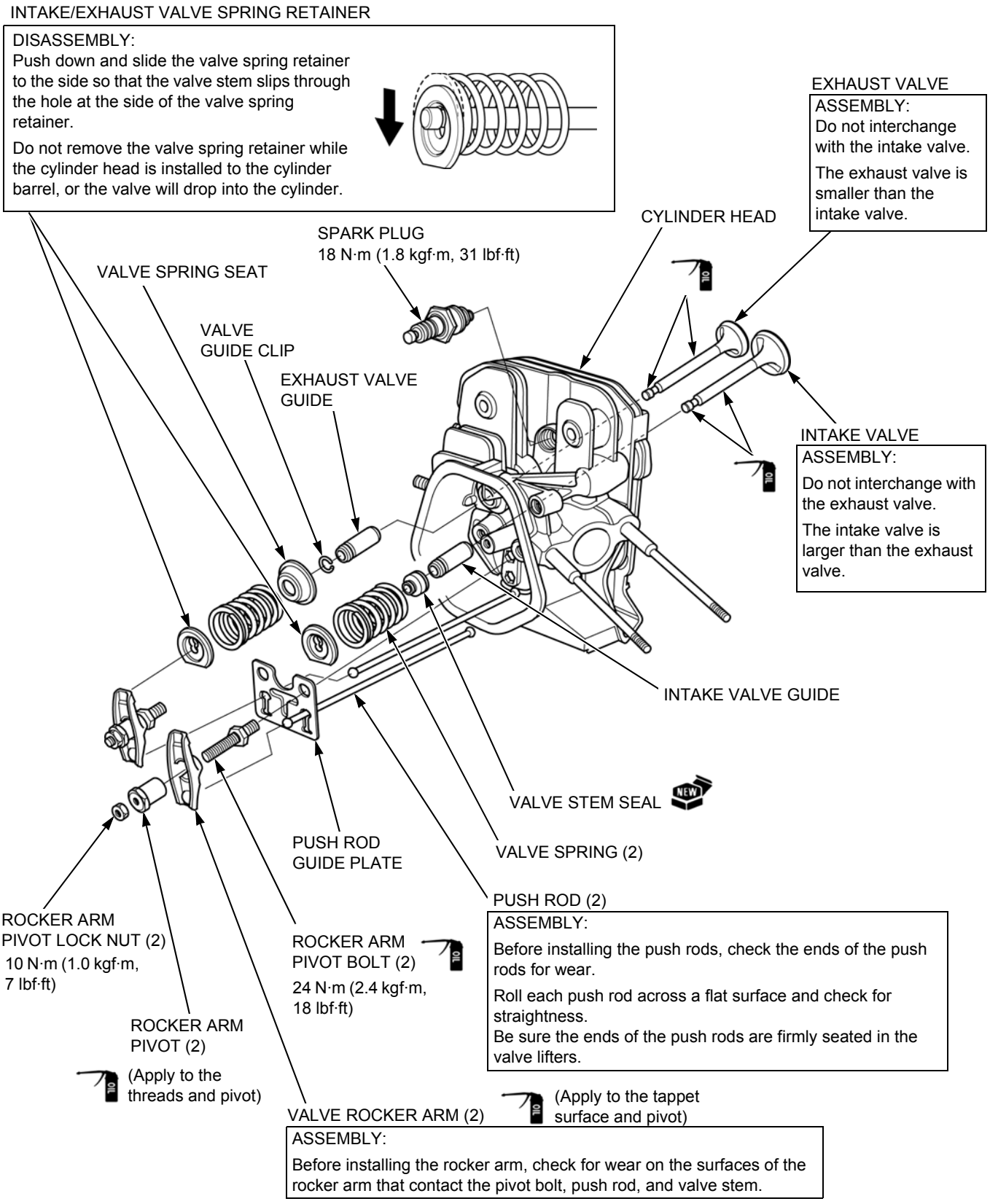
Remove the following:

- Fuel tank (page 6-10)
- Air guide insulator/exhaust pipe (page 11-2)
- Cylinder head shroud/upper shroud bracket (page 5-7)
- Air cleaner bracket (page 6-13)
- Throttle body (page 6-16)
- Head cover lower shroud (page 13-2)
- EBT sensor (page 6-22)



CYLINDER HEAD DISASSEMBLY/ ASSEMBLY

Remove the cylinder head (page 13-3).



CYLINDER HEAD/VALVES INSPECTION

CYLINDER COMPRESSION CHECK

Start the engine and warm up to normal operating temperature.

Turn the main switch to the OFF position.

Disconnect the spark plug cap [1] from the spark plug.

Remove the spark plug using a spark plug wrench.

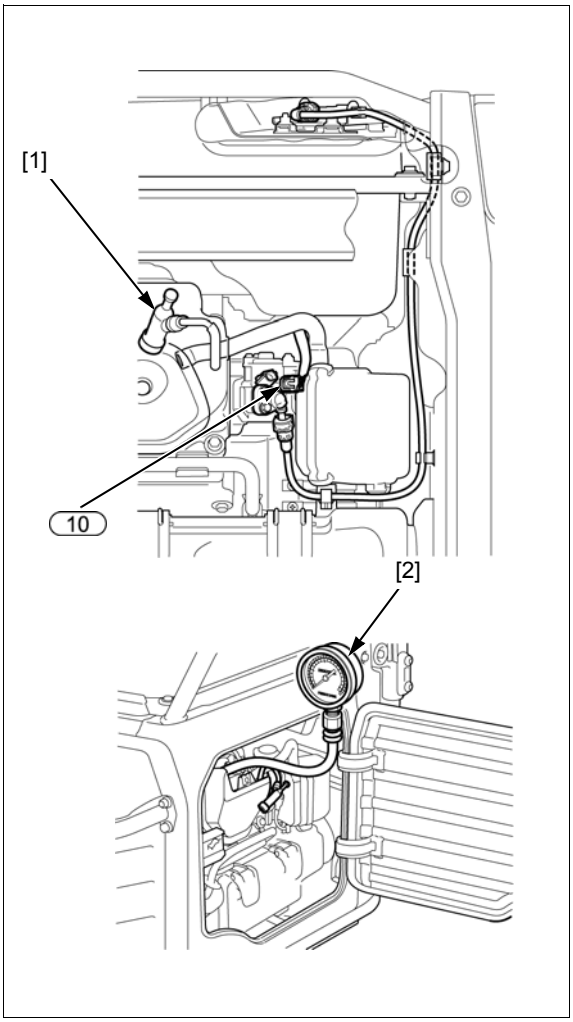
Pull the recoil starter several times to expel unburned gas.

Attach a commercially available compression gauge set EEPV303A [2] to the spark plug hole.

Disconnect the fuel injector 2P connector (10).

Turn the main switch ON and push the starter switch. Measure the cylinder compression.

CYLINDER COMPRESSION:
0.46 – 0.64 MPa (4.7 – 6.5 kgf/cm^2, 67 – 92 psi) at 600 min^{-1} (rpm)



CYLINDER HEAD WARPAGE

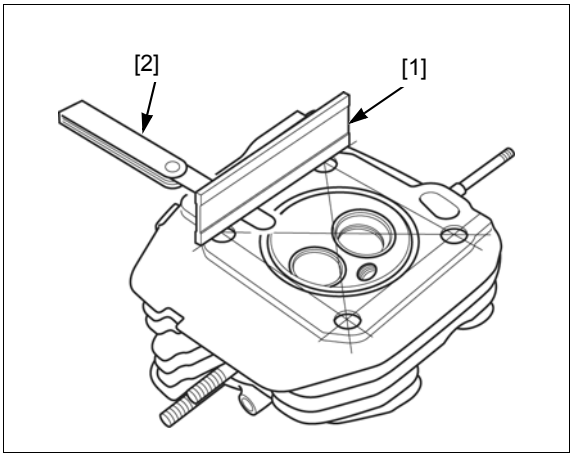
Remove the carbon deposits from the combustion chamber.

Check the spark plug hole and valve areas for cracks.

Check the cylinder head warpage using a straightedge [1] and feeler gauge [2].

SERVICE LIMIT: 0.10 mm (0.004 in)

If the measurement is more than the service limit, replace the cylinder head.



VALVE SEAT WIDTH

Remove the carbon deposits from the combustion chamber.

Inspect each valve face for irregularities.

If necessary, replace the valve.

Apply a light coat of Prussian Blue or erasable felt-tipped marker ink to each valve seat.

Insert the valve, and snap it closed against its seat several times. Be sure the valve does not rotate on the seat.

The transferred marking compound will show any area of the valve face that is not concentric.

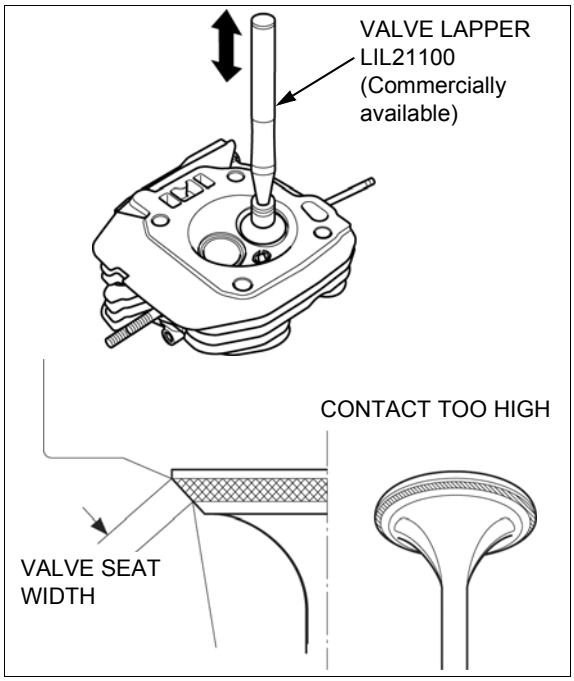
Measure the valve seat width of the cylinder head.

STANDARD: 1.0 – 1.2 mm (0.04 – 0.05 in)
SERVICE LIMIT: 2.0 mm (0.08 in)

If the measurement is more than the service limit, recondition the valve seat (page 13-10).

Check whether the valve seat contact area of the valve is too high.

If the valve seat is too high or too low, recondition the valve seat (page 13-10).



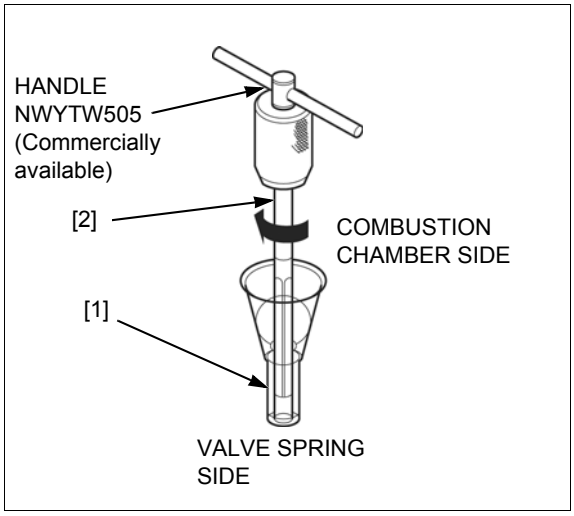
VALVE GUIDE I.D.

Ream the valve guide [1] to remove any carbon deposits before measuring.

TOOL:
Valve guide reamer 6.612 mm [2] 07984-ZE20001

NOTICE

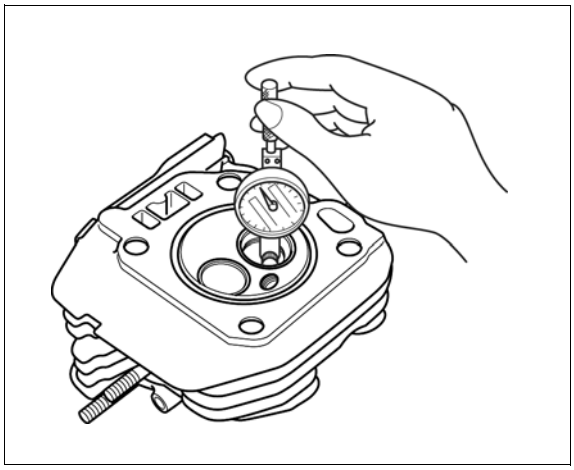
- *Turn the special tool (valve guide reamer) clockwise, never counterclockwise.*
- *Continue to rotate the special tool while removing it from the valve guide.*



Measure and record each valve guide I.D.

STANDARD: 6.600 – 6.615 mm (0.2598 – 0.2604 in)
SERVICE LIMIT: 6.66 mm (0.262 in)

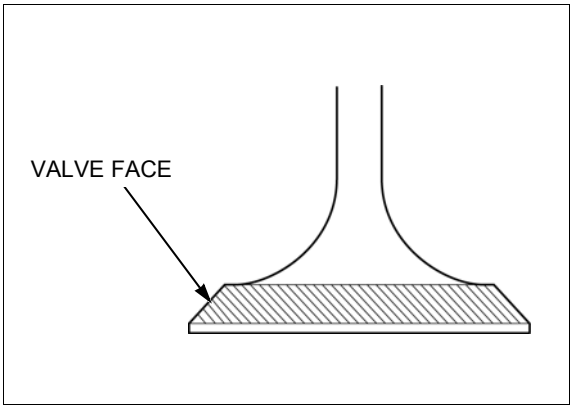
If the measured valve guide I.D. is more than the service limit, replace the valve guide (page 13-8).



VALVE FACE

Inspect each valve for face irregularities.

If necessary, replace the valve (page 13-4).



VALVE STEM O.D.

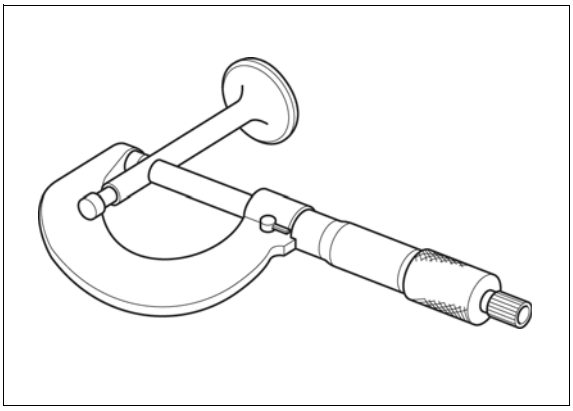
Inspect each valve for bending or abnormal stem wear.

If necessary, replace the valve (page 13-4).

Measure and record each valve stem O.D.

STANDARD:	**IN:**	**6.575 – 6.590 mm (0.2589 – 0.2594 in)**
	EX:	**6.535 – 6.550 mm (0.2573 – 0.2579 in)**
SERVICE LIMIT:	**IN:**	**6.44 mm (0.254 in)**
	EX:	**6.40 mm (0.252 in)**

If the measurement is less than the service limit, replace the valve (page 13-4).



GUIDE-TO-STEM CLEARANCE

Subtract each valve stem O.D. from the corresponding guide I.D. to obtain the stem-to-guide clearance.

STANDARD:	**IN:**	**0.010 – 0.040 mm (0.0004 – 0.0016 in)**
	EX:	**0.050 – 0.080 mm (0.0020 – 0.0032 in)**
SERVICE LIMIT:	**IN:**	**0.11 mm (0.004 in)**
	EX:	**0.13 mm (0.005 in)**

If the calculated clearance is more than the service limit, replace the following:

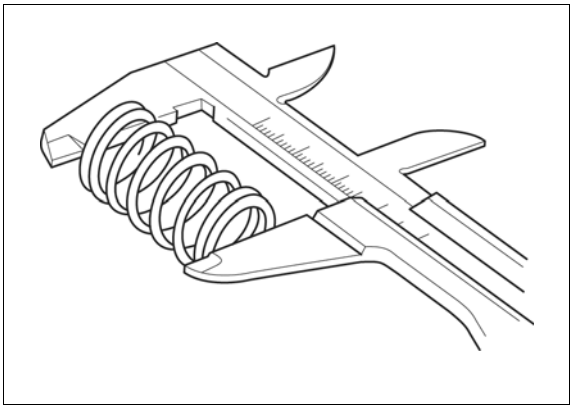
– Valves (page 13-4)
– Valve guide (page 13-8)

VALVE SPRING FREE LENGTH

Measure the valve spring free length.

STANDARD:	**39.0 mm (1.54 in)**
SERVICE LIMIT:	**37.5 mm (1.48 in)**

If the measured length is less than the service limit, replace the valve spring (page 13-4).

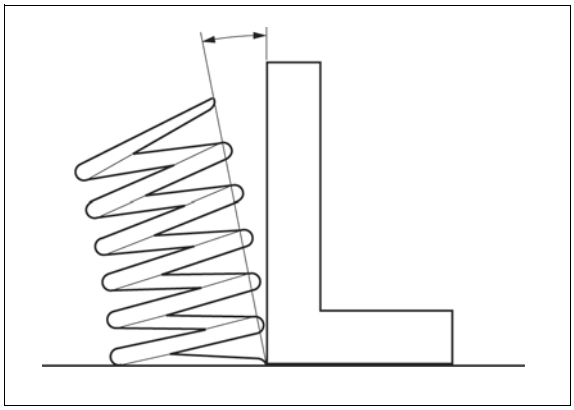


VALVE SPRING PERPENDICULARITY

Measure the valve spring perpendicularity.

SERVICE LIMIT: 1.5° max.

If the measured perpendicularity is more than the service limit, replace the valve spring (page 13-4).

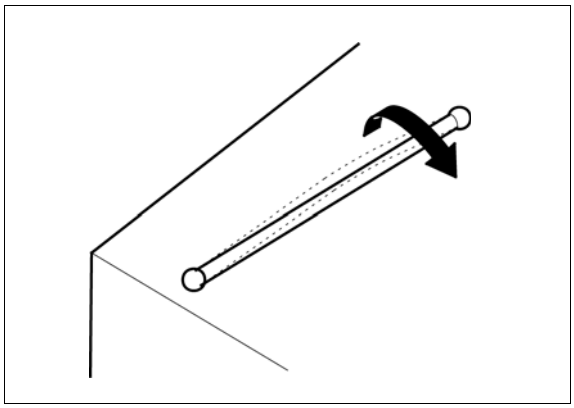


PUSH ROD RUNOUT

Check both ends of the push rod for wear.

Check the push rod for straightness.

If necessary, replace the push rod (page 13-4).



VALVE GUIDE REPLACEMENT

Chill the replacement valve guides in the freezer section of a refrigerator for about an hour.

Use a hot plate or oven to heat the cylinder head evenly to 150 °C (300 °F).

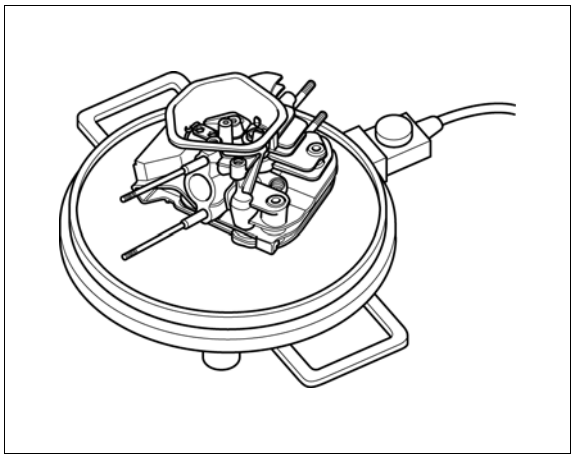
⚠CAUTION

To avoid burns, use heavy gloves when handling the heated cylinder head.

NOTICE

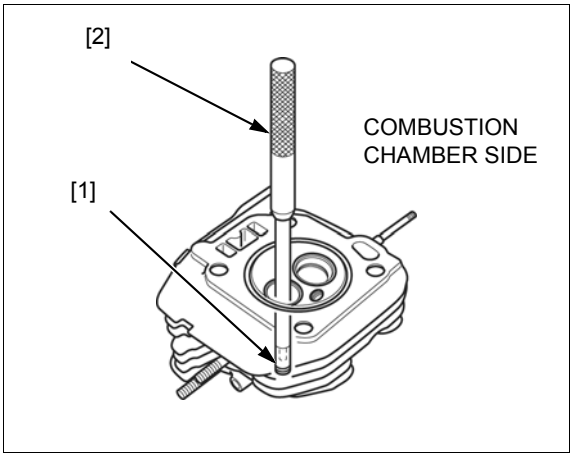
- *Do not use a torch to heat the cylinder head; warpage of the cylinder head may result.*
- *Do not get the cylinder head hotter than 150 °C (300 °F); excessive heat may loosen the valve seat.*

Remove the heated cylinder head from the hot plate and support it with wooden blocks.



Drive the valve guides [1] out of the cylinder head from the combustion chamber side.

TOOL:
Valve guide driver, 6.6 mm [2] 07942-6570100



NOTICE

When driving the valve guides out, be careful not to damage the cylinder head.

Remove the new valve guides from the refrigerator one at a time as needed.

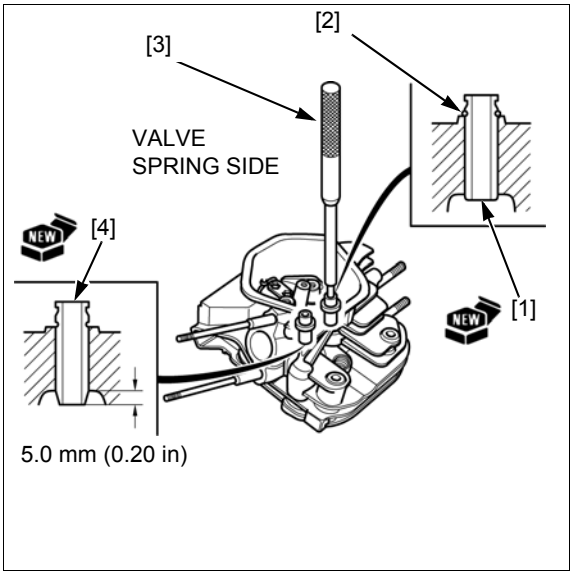
Drive the exhaust valve guide [1] until the valve guide clip [2] is fully seated as shown from the valve spring side of the cylinder head.

TOOL:
Valve guide driver, 6.6 mm [3] 07942-6570100

Drive the intake valve guide [4] to the specified height (measured from the end of the valve guide to the cylinder head as shown) from the valve spring side of the cylinder head.

TOOL:
Valve guide driver, 6.6 mm 07942-6570100

INTAKE VALVE GUIDE INSTALLATION HEIGHT:
5.0 mm (0.20 in)



After installing the valve guide, check the guide for damage.

Replace the valve guide if damaged.

Let the cylinder head cool to room temperature.

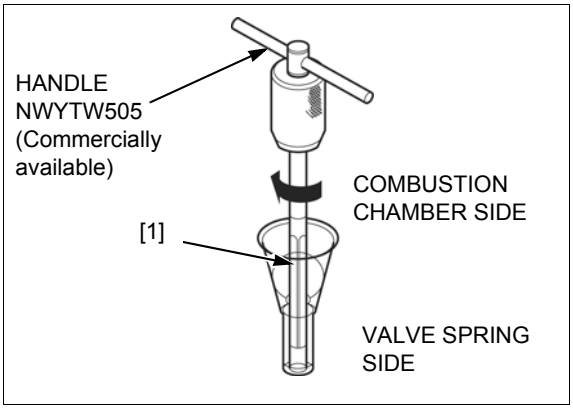
Ream the valve guide.

VALVE GUIDE REAMING

For best results, be sure the cylinder head is at room temperature before reaming valve guides.

Coat the reamer and valve guide with cutting oil.

TOOL:
Valve guide reamer 6.612 mm [1] 07984-ZE20001



Rotate the reamer clockwise through the valve guide the full length of the reamer.

NOTICE

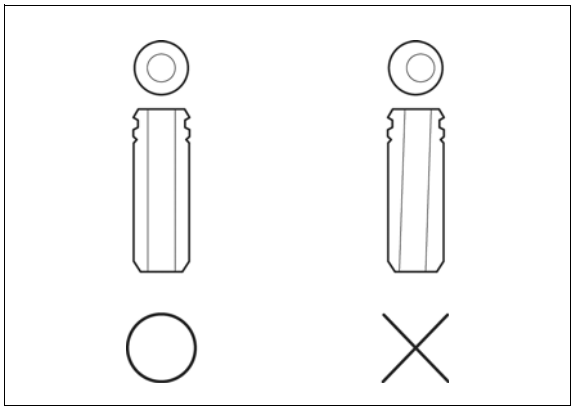
- *Turn the special tool (valve guide reamer) clockwise, never counterclockwise.*
- *Continue to rotate the special tool while removing it from the valve guide.*

Thoroughly clean the cylinder head to remove any cutting residue.

Check the valve guide bore; it should be straight, round, and centered in the valve guide. Insert the valve and check operation. If the valve does not operate smoothly, the guide may have been bent during installation.

Replace the valve guide if it is bent or damaged.

Check the valve guide-to-stem clearance (page 13-7).



VALVE SEAT RECONDITIONING

Thoroughly clean the combustion chamber and valve seats to remove carbon deposits.

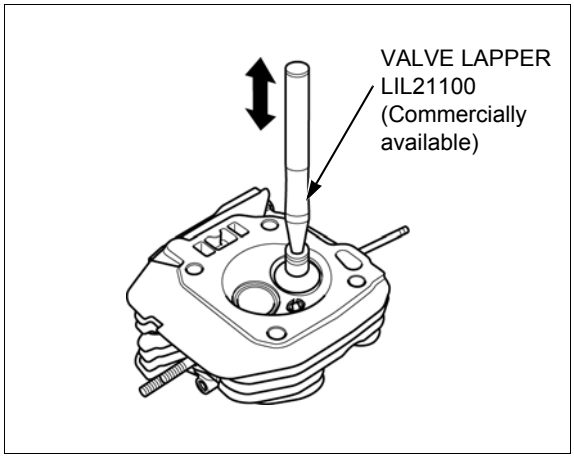
Apply a light coat of Prussian Blue or erasable felt-tipped marker ink to the valve seat.

Insert the valve, and snap it closed against its seat several times. Be sure the valve does not rotate on the seat. The transferred marking compound will show any area of the seat that is not concentric.

Measure the valve seat width of the cylinder head.

STANDARD: 1.0 – 1.2 mm (0.04 – 0.05 in)
SERVICE LIMIT: 2.0 mm (0.08 in)

If the measurement is more than the service limit, recondition the valve seat.



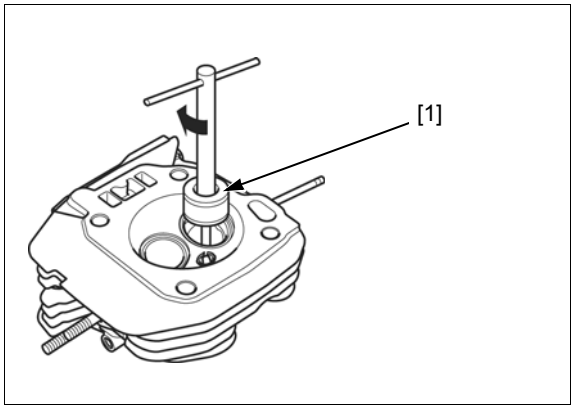
Check whether the valve seat contact area of the valve is too high.

If the valve seat is too high or too low, recondition the valve seat.

Valve seat cutters/grinders [1] or equivalent valve seat refacing equipment is recommended to correct a worn valve seat.

NOTICE

- *Turn the cutter clockwise, never counterclockwise.*
- *Continue to turn the cutter as you lift it from the valve seat.*



The 32° cutter removes material from the top edge (contact too high).

TOOLS:

Solid pilot bar, 6.6 mm	**NWY100-6.60**
Cutter, 30 x 45 degree	**NWYCU128**

The 60° cutter removes material from the bottom edge (contact too low).

TOOLS:

Solid pilot bar, 6.6 mm	**NWY100-6.60**
Cutter, 60 degree	**NWYCU114**

Be sure that the width of the finished valve seat is within specification.

STANDARD: **1.0 – 1.2 mm (0.04 – 0.05 in)**
SERVICE LIMIT: **2.0 mm (0.08 in)**

Make a light pass with the 45° cutter to remove any possible burrs at the edge of the seat.

TOOLS:

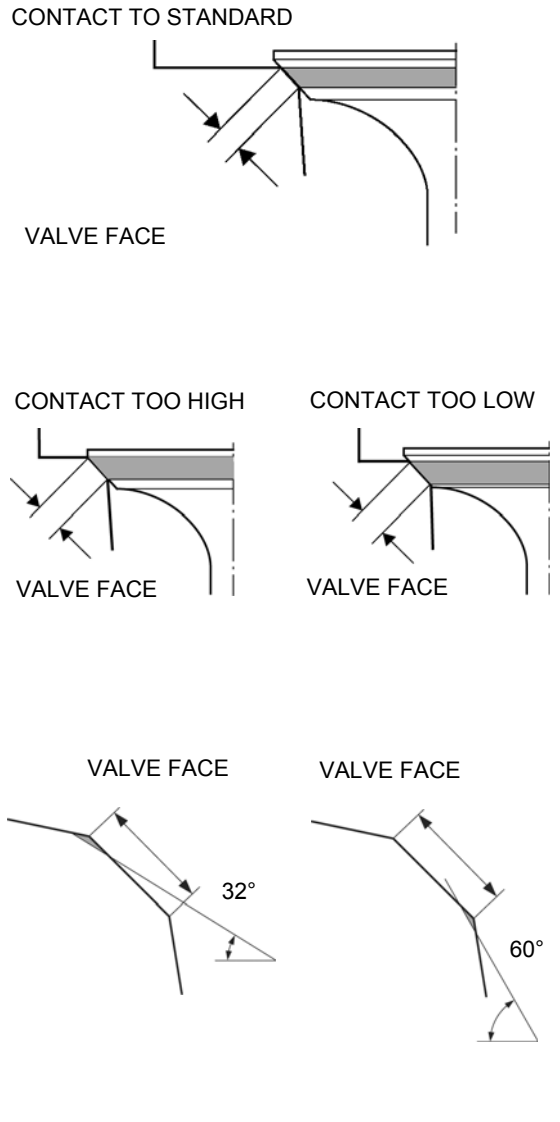
Solid pilot bar, 6.6 mm	**NWY100-6.60**
Cutter, 30 x 45 degree	**NWYCU128**

After resurfacing the seats, inspect for even valve seating.

Apply Prussian Blue compound or erasable felt-tipped marker ink to the valve seat. Insert the valve, and snap it closed against its seat several times. Be sure the valve does not rotate on the seat.

The seating surface, as shown by the transferred marking compound, should have good contact all the way around.

Thoroughly clean the cylinder head to remove any cutting residual.



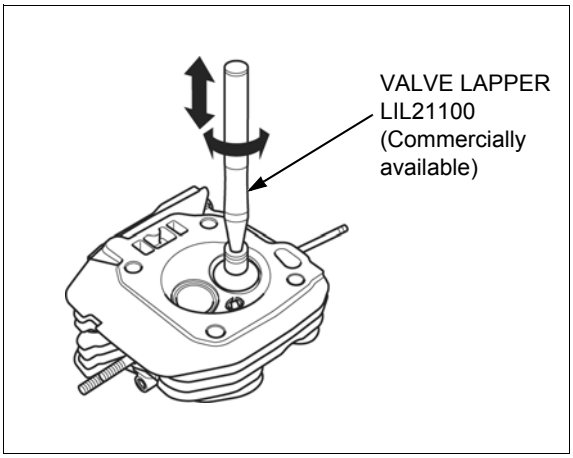
Lap the valves into their seats, using a commercially available valve lapper and lapping compound.

After lapping, wash all residual compound off the cylinder head and valve.

NOTICE

- *Do not push the valve against the seat with force during lapping. Apply a light pass with the valve lapper.*
- *Avoid lapping the valve in the same position as it causes uneven wear. Lap the valve by turning the lapper slowly.*
- *Take care not to allow the lapping compound to enter the gap between the stem and guide.*

Adjust the valve clearance after assembly (page 3-10).



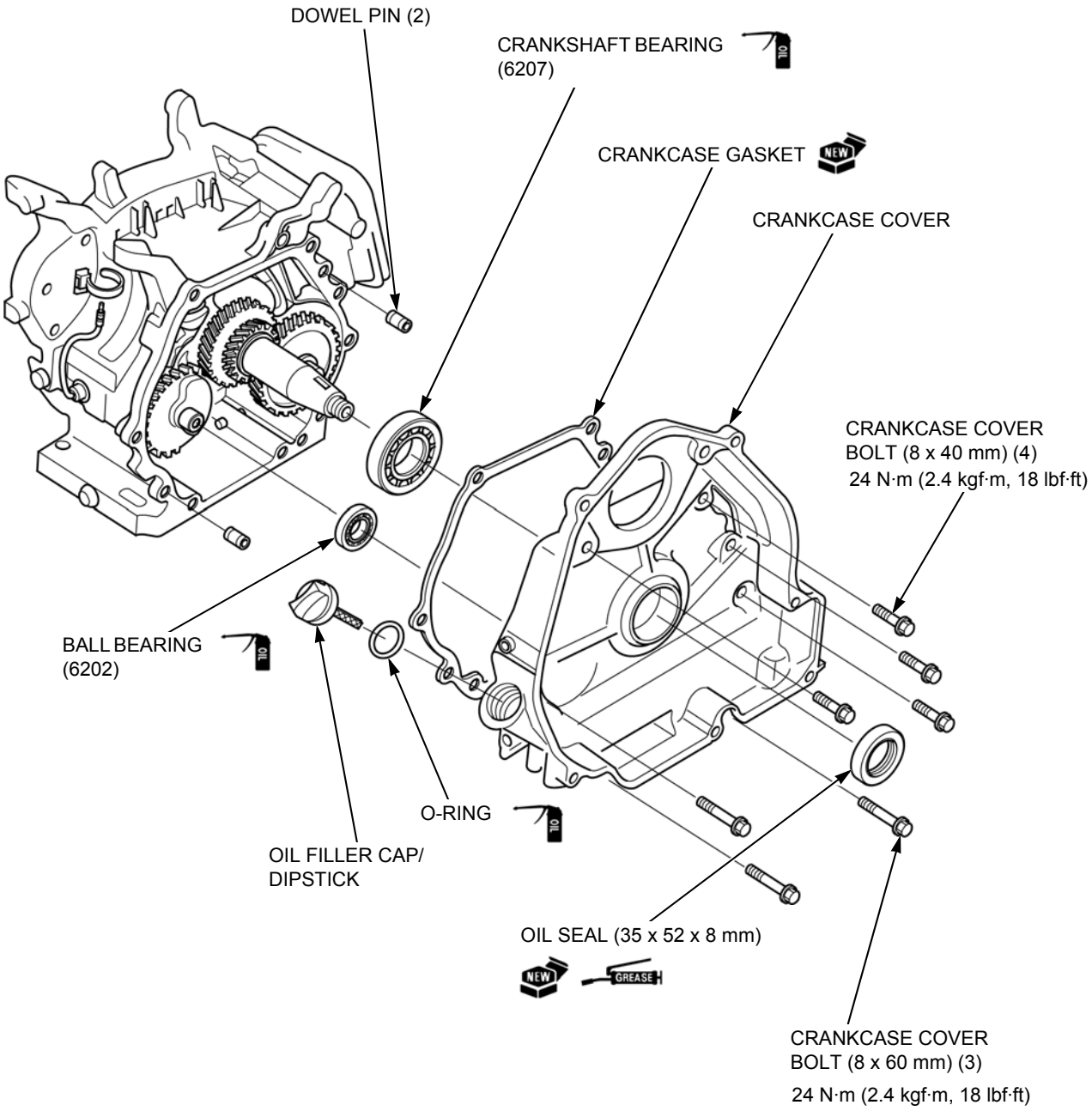
MEMO

14. CYLINDER BLOCK

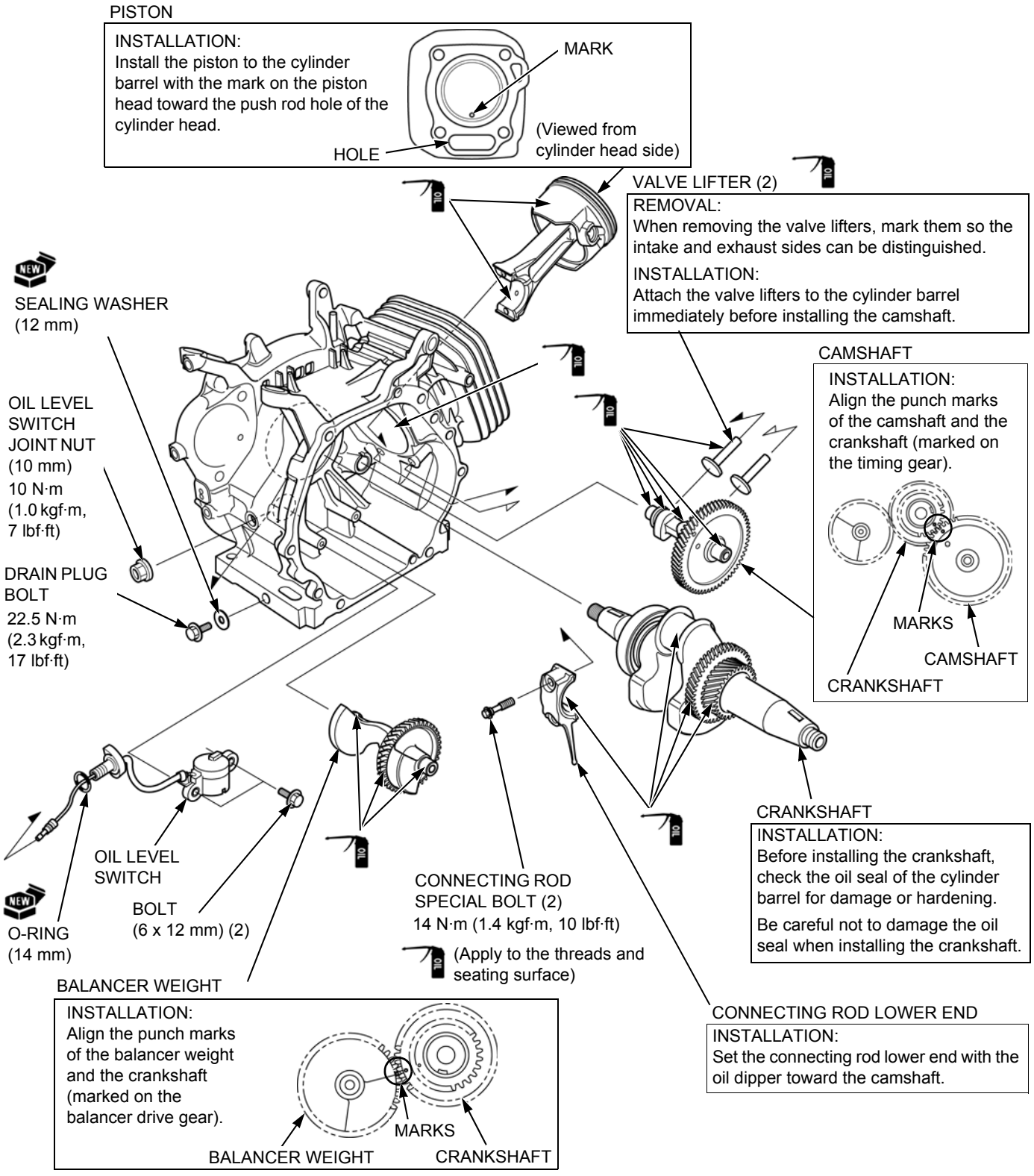
CRANKCASE COVER REMOVAL/ INSTALLATION

Remove the following:

- Engine/generator (page 12-2)
- Generator (page 7-14)
- Flywheel (page 9-10)
- Cylinder head (page 13-3)



CRANKSHAFT/CAMSHAFT/BALANCER WEIGHT/PISTON REMOVAL/ INSTALLATION



PISTON DISASSEMBLY/ASSEMBLY

Remove the piston (page 14-3).

PISTON RING SET

ASSEMBLY:

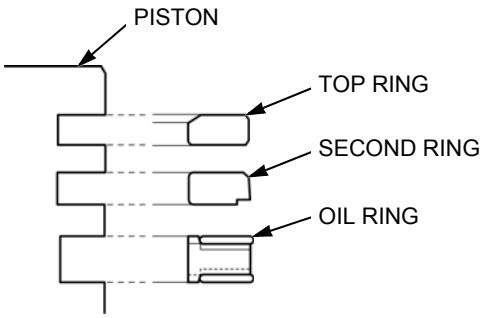
To install the oil ring, install the spacer first, and then install the side rails.

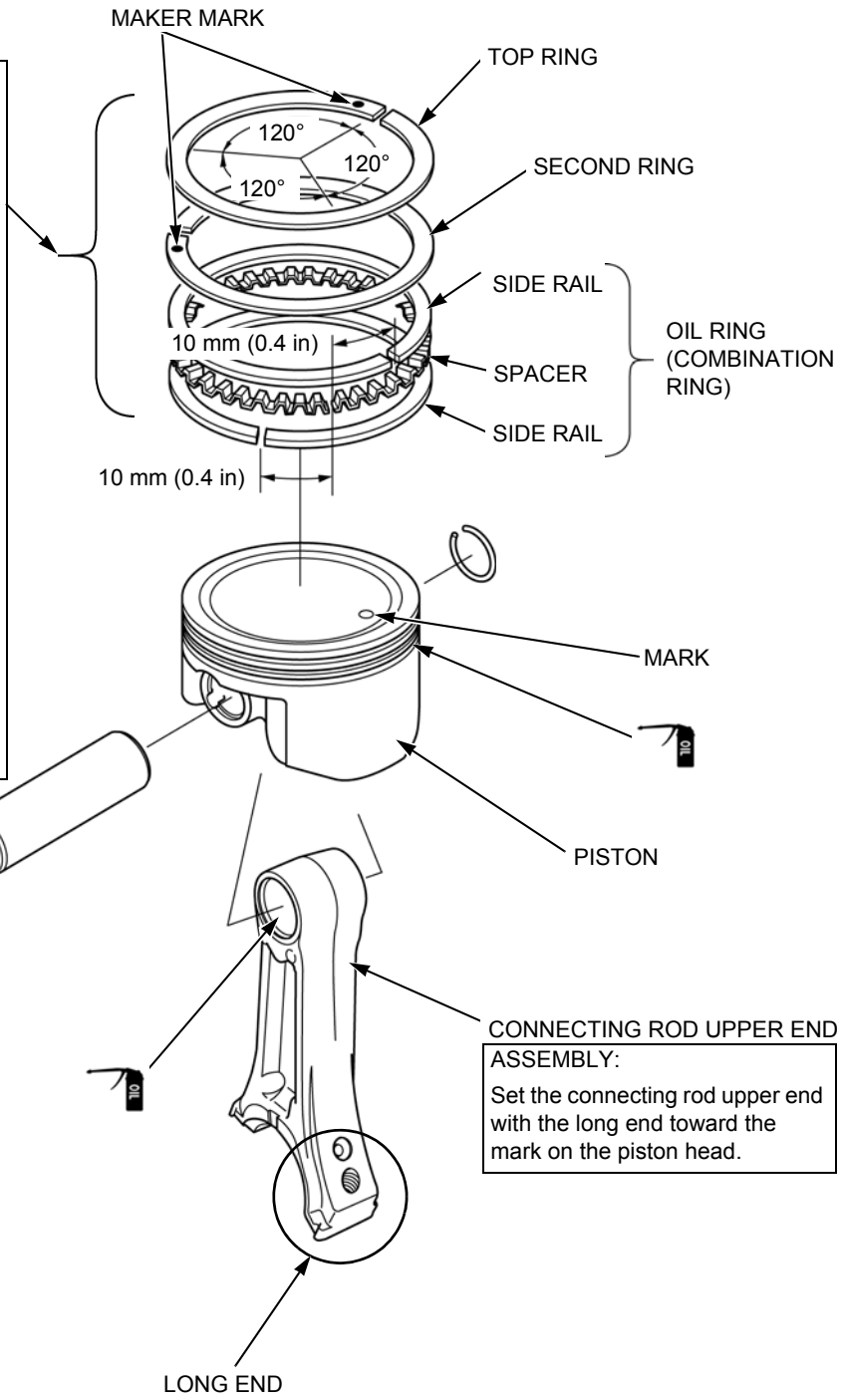
Be sure that the top ring and second ring are not interchanged.

Install the top ring and second ring on the piston with the maker mark side facing up.

Check that the piston rings rotate smoothly after installing them.

Space the piston ring end gaps 120 degrees apart, and do not align the ring end gaps with the piston pin bore.



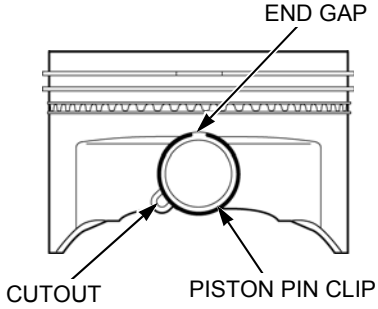


ASSEMBLY:

Set the connecting rod upper end with the long end toward the mark on the piston head.

ASSEMBLY:

Install by setting one end of the piston pin clip in the groove of the piston pin bore, holding the other end with long needle nose pliers, and rotating the clip in.
Install the piston pin clip as shown.
Do not align the end gap of the piston pin clip with the cutout of the piston pin bore.



CYLINDER BLOCK INSPECTION

CAM SHAFT HOLDER I.D.

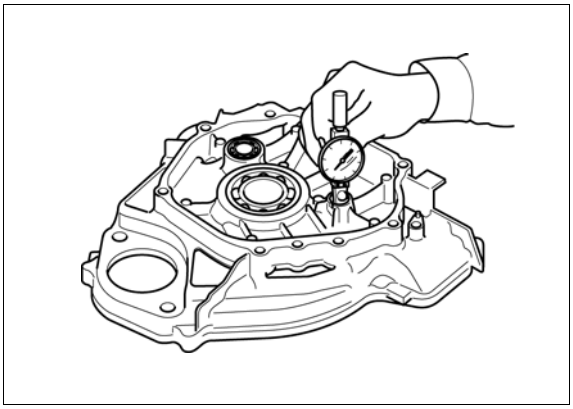
CRANKCASE COVER SIDE

Measure the camshaft holder I.D. of the crankcase cover.

STANDARD: 16.000 – 16.018 mm (0.6299 – 0.6306 in)
SERVICE LIMIT: 16.05 mm (0.632 in)

If the measurement is more than the service limit, replace the crankcase cover (page 14-2).

Inspect the camshaft O.D. (page 14-10) with this inspection.



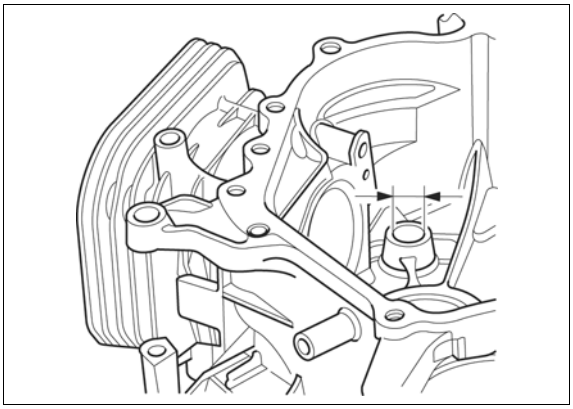
CYLINDER BARREL SIDE

Measure the camshaft holder I.D. of the cylinder barrel.

STANDARD: 16.000 – 16.018 mm (0.6299 – 0.6306 in)
SERVICE LIMIT: 16.05 mm (0.632 in)

If the measurement is more than the service limit, replace the cylinder barrel (page 14-3).

Inspect the camshaft O.D. (page 14-10) with this inspection.



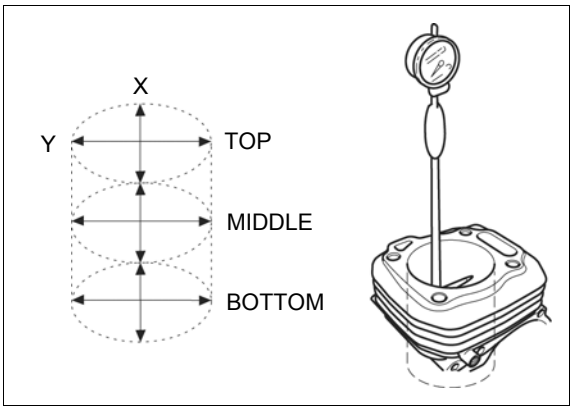
CYLINDER SLEEVE I.D.

Measure and record the cylinder I.D. at three levels in both the “X” axis (perpendicular to crankshaft) and the “Y” axis (parallel to crankshaft). Take the maximum reading to determine cylinder wear and taper.

STANDARD: 88.000 – 88.017 mm (3.4646 – 3.4652 in)
SERVICE LIMIT: 88.17 mm (3.471 in)

If the measurement is more than the service limit, replace the cylinder barrel (page 14-3).

Inspect the piston skirt O.D. (page 14-6) with this inspection.



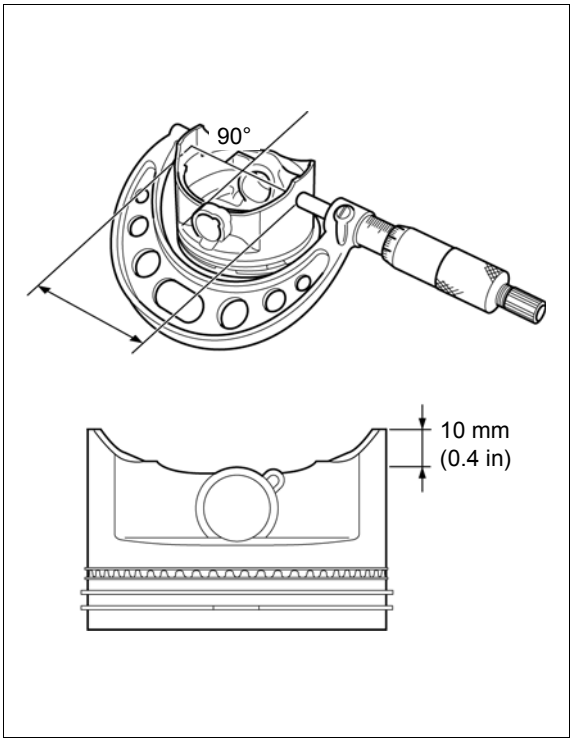
PISTON SKIRT O.D.

Measure and record the piston O.D. at a point 10 mm (0.4 in) from the bottom of the skirt and 90 degrees to the piston pin bore.

STANDARD: **87.975 – 87.985 mm (3.4636 – 3.4640 in)**
SERVICE LIMIT: **87.85 mm (3.459 in)**

If the measurement is less than the service limit, replace the piston (page 14-4).

Inspect the cylinder sleeve I.D. (page 14-5) with this inspection.



PISTON-TO-CYLINDER CLEARANCE

Subtract the piston skirt O.D. from the cylinder sleeve I.D. to obtain the piston-to-cylinder clearance.

STANDARD: **0.015 – 0.042 mm (0.0006 – 0.0017 in)**
SERVICE LIMIT: **0.12 mm (0.005 in)**

If the calculated clearance is more than the service limit, replace the piston (page 14-4) and recheck the clearance.

If the clearance is still more than the service limit with the new piston, replace the cylinder barrel (page 14-3).

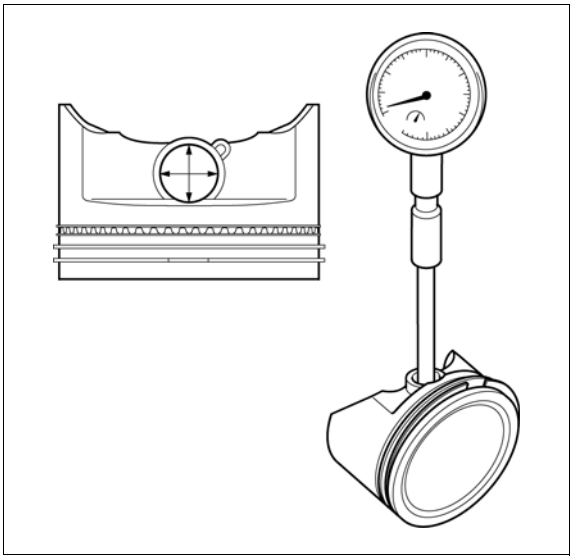
PISTON PIN BORE I.D.

Measure and record the piston pin bore I.D. of the piston.

STANDARD: **20.002 – 20.008 mm (0.7875 – 0.7877 in)**
SERVICE LIMIT: **20.042 mm (0.7891 in)**

If the measurement is less than the service limit, replace the piston (page 14-4).

Inspect the piston pin O.D. (page 14-7) with this inspection.



PISTON PIN O.D.

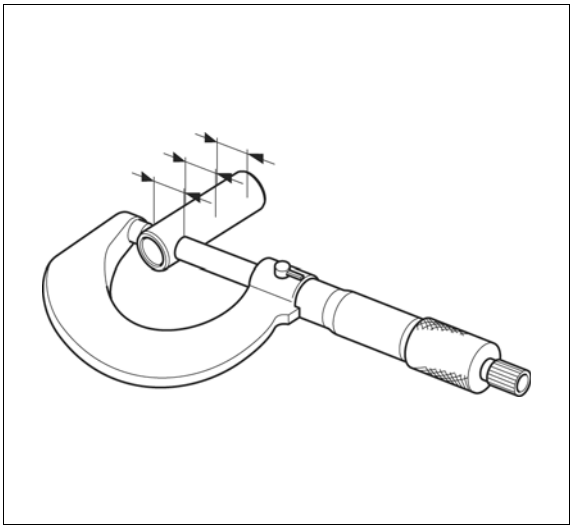
Measure and record the piston pin O.D. at three points (both ends and middle). Take the minimum reading to determine piston pin O.D.

STANDARD: **19.994 – 20.000 mm (0.7872 – 0.7874 in)**
SERVICE LIMIT: **19.950 mm (0.7854 in)**

If the measurement is less than the service limit, replace the piston pin.

Inspect the piston pin bore I.D. (page 14-6).

Inspect the connecting rod small end I.D. (page 14-8) with this inspection.



PISTON PIN-TO-PISTON PIN BORE CLEARANCE

Subtract the piston pin O.D. from the piston pin bore I.D. to obtain the piston pin-to-piston pin bore clearance.

STANDARD: **0.002 – 0.014 mm (0.0001 – 0.0006 in)**
SERVICE LIMIT: **0.08 mm (0.003 in)**

If the calculated clearance is more than the service limit, replace the piston pin (page 14-4) and recheck the clearance.

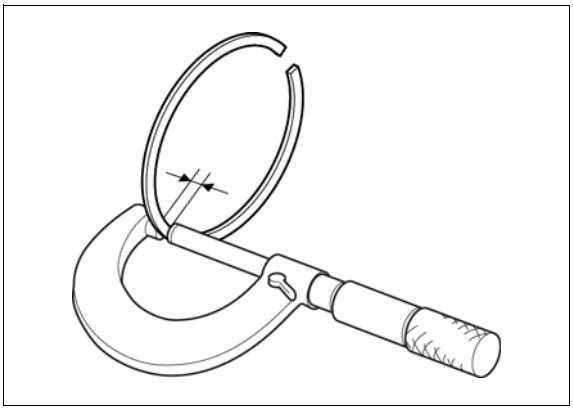
If the clearance is still more than the service limit with the new piston pin, replace the piston (page 14-4).

PISTON RING WIDTH

Measure each piston ring width.

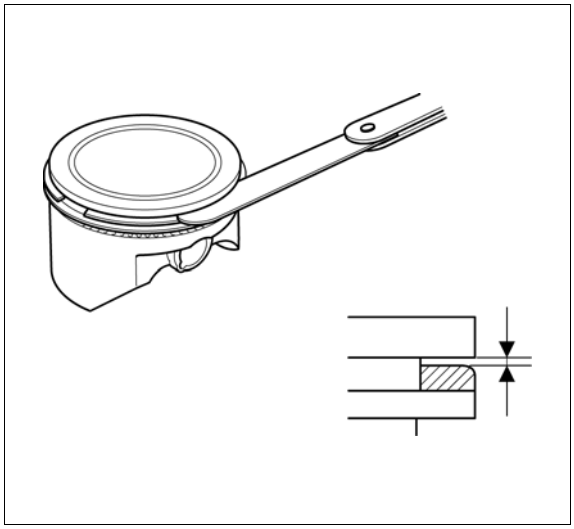
STANDARD:
Top: **1.160 – 1.175 mm (0.0457 – 0.0463 in)**
Second: **1.130 – 1.145 mm (0.0445 – 0.0451 in)**
SERVICE LIMIT:
Top: **1.140 mm (0.0449 in)**
Second: **1.110 mm (0.0437 in)**

If any measurement is less than the service limit, replace the piston rings (top, second, oil) as a set (page 14-4).



PISTON RING SIDE CLEARANCE

Measure the clearance between each piston ring and ring groove of the piston using a feeler gauge.



STANDARD:

Top:	**0.030 – 0.060 mm (0.0012 – 0.0024 in)**
Second:	**0.060 – 0.090 mm (0.0024 – 0.0035 in)**

SERVICE LIMIT:

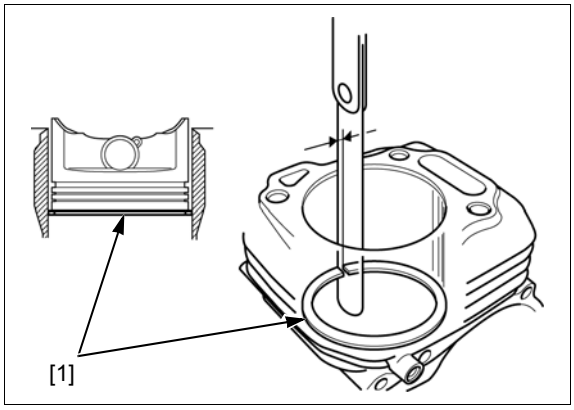
Top:	**0.15 mm (0.006 in)**
Second:	**0.15 mm (0.006 in)**

If any measurement is more than the service limit, inspect the piston ring width.

If the piston ring width is normal, replace the piston (page 14-4) and reinspect the clearance.
If necessary, replace the piston rings (top, second, oil) as a set (page 14-4) and reinspect the clearance.
If any measurement is still more than the service limit with the new piston rings, replace the piston (page 14-4).

PISTON RING END GAP

Before inspection, check whether the cylinder sleeve I.D. (page 14-5) is within the specification.



Measure each piston ring [1] end gap using a feeler gauge.

STANDARD:

Top:	**0.200 – 0.350 mm (0.0079 – 0.0138 in)**
Second:	**0.350 – 0.500 mm (0.0138 – 0.0197 in)**
Oil (side rail)	**0.20 – 0.70 mm (0.008 – 0.028 in)**

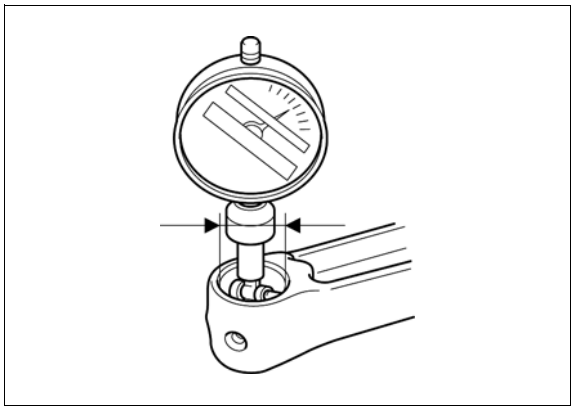
SERVICE LIMIT:

Top/Second:	**1.0 mm (0.04 in)**
Oil (side rail)	**1.0 mm (0.04 in)**

If any measurement is more than the service limit, replace the piston rings (top, second, oil) as a set (page 14-4).

CONNECTING ROD SMALL END I.D.

Measure the connecting rod small end I.D.



STANDARD:	**20.005 – 20.020 mm (0.7876 – 0.7882 in)**
SERVICE LIMIT:	**20.07 mm (0.790 in)**

If the measurement is more than the service limit, replace the connecting rod (page 14-4).

Inspect the piston pin O.D. (page 14-7) with this inspection.

CONNECTING ROD BIG END I.D.

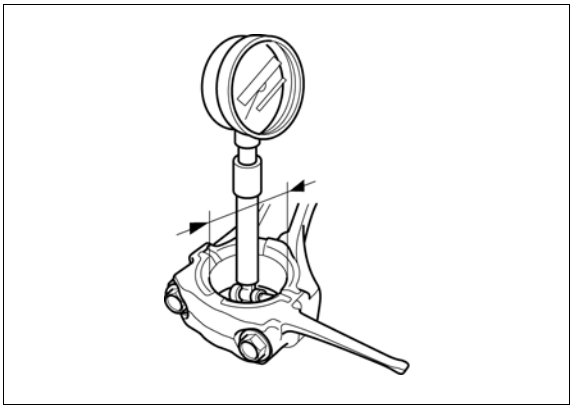
Set the connecting rod lower end to the connecting rod upper end.
Apply engine oil to the connecting rod bolt threads and seating surface.
Tighten the connecting rod bolts to the specified torque.

TORQUE: 14 N·m (1.4 kgf·m, 10 lbf·ft)

Measure the connecting rod big end I.D.

STANDARD:	**36.025 – 36.039 mm (1.4183 – 1.4189 in)**
SERVICE LIMIT:	**36.07 mm (1.420 in)**

If the measurement is more than the service limit, replace the connecting rod (page 14-4).



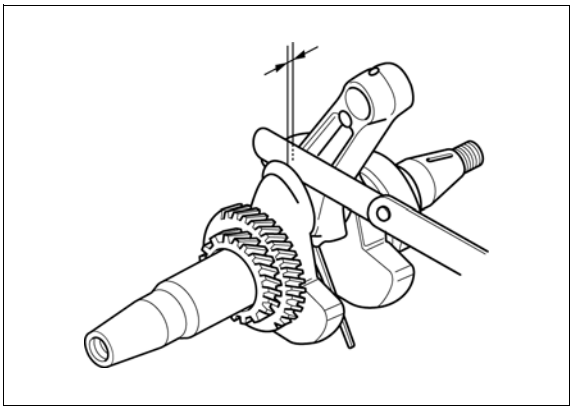
CONNECTING ROD BIG END SIDE CLEARANCE

Measure the clearance between the connecting rod big end and crankshaft using a feeler gauge.

STANDARD:	**0.1 – 0.4 mm (0.004 – 0.016 in)**
SERVICE LIMIT:	**1.0 mm (0.04 in)**

If the measurement is more than the service limit, replace the connecting rod (page 14-4) and recheck the clearance.

If the clearance is still more than the service limit with the new connecting rod, replace the crankshaft (page 14-3).



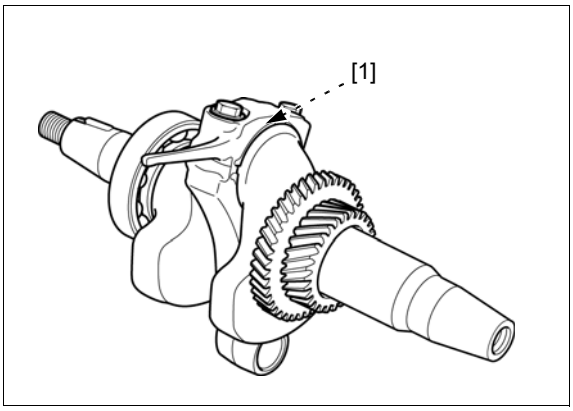
CONNECTING ROD BIG END OIL CLEARANCE

Clean all oil from the crank pin and connecting rod big end surface.

Place a piece of Plastigauge® [1] on the crank pin, install the connecting rod upper end and the connecting rod lower end.
Apply engine oil to the connecting rod bolt threads and seating surface.
Tighten the connecting rod bolts to the specified torque.

TORQUE: 14 N·m (1.4 kgf·m, 10 lbf·ft)

NOTE:
Do not rotate the crankshaft while the Plastigauge is in place.



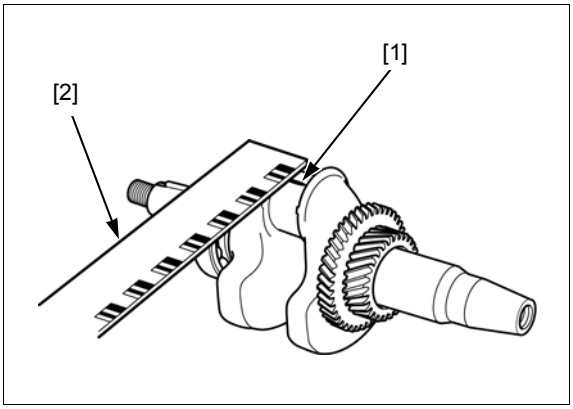
Remove the connecting rod and measure the Plastigauge [1] using the Plastigauge scale [2].

STANDARD:	**0.040 – 0.064 mm (0.0016 – 0.0025 in)**
SERVICE LIMIT:	**0.12 mm (0.005 in)**

If the clearance is more than the service limit, inspect the following:

- Connecting rod big end I.D. (page 14-9)
- Crank pin O.D. (page 14-10)

If the part that is not within the service limit is replaced, reinspect the clearance.

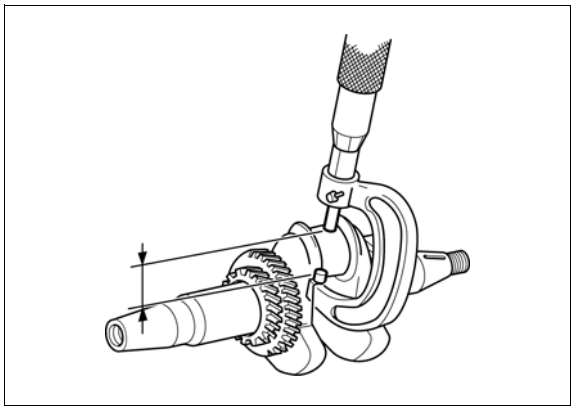


CRANK PIN O.D.

Measure the crank pin O.D. of the crankshaft.

STANDARD: **35.975 – 35.985 mm (1.4163 – 1.4167 in)**
SERVICE LIMIT: **35.93 mm (1.415 in)**

If the measurement is less than the service limit, replace the crankshaft (page 14-3).

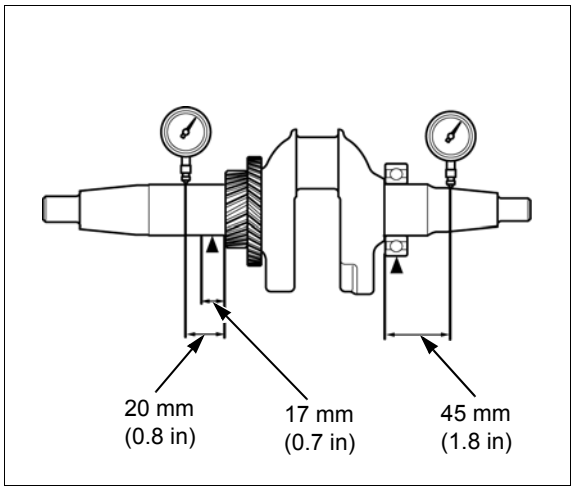


CRANKSHAFT RUNOUT

Set the crankshaft on V-blocks and measure the runout using a dial indicator.

SERVICE LIMIT: **0.1 mm (0.004 in)**

If the measured runout is more than the service limit, replace the crankshaft (page 14-3).

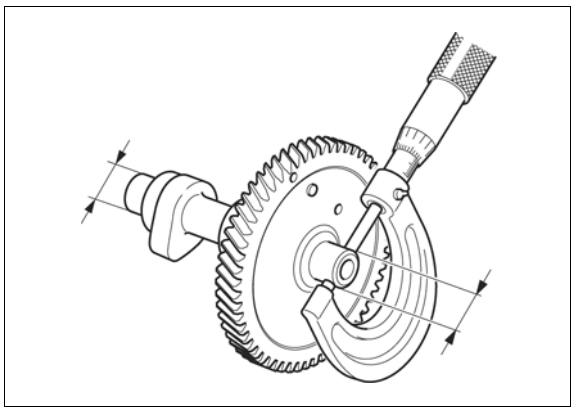


CAMSHAFT O.D.

Measure the camshaft O.D. of the camshaft.

STANDARD: **15.966 – 15.984 mm (0.6286 – 0.6293 in)**
SERVICE LIMIT: **15.92 mm (0.627 in)**

If the measurement is less than the service limit, replace the camshaft (page 14-3).

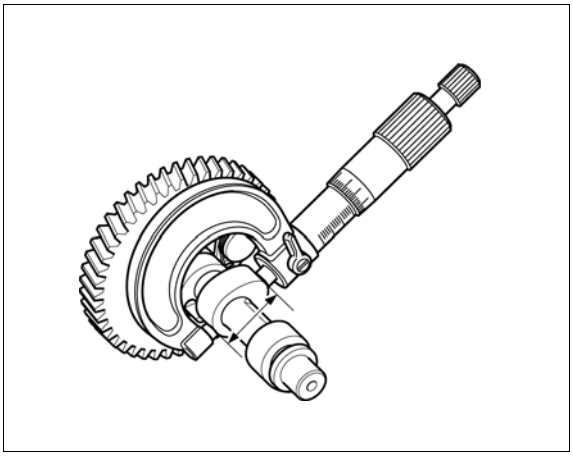


CAMSHAFT CAM HEIGHT

Measure the cam height of the camshaft.

STANDARD:	**IN:**	**32.448 – 32.748 mm (1.2775 – 1.2893 in)**
	EX:	**31.935 – 32.235 mm (1.2573 – 1.2691 in)**
SERVICE LIMIT:	**IN:**	**32.198 mm (1.2676 in)**
	EX:	**29.886 mm (1.1766 in)**

If the measurement is less than the service limit, replace the camshaft (page 14-3).

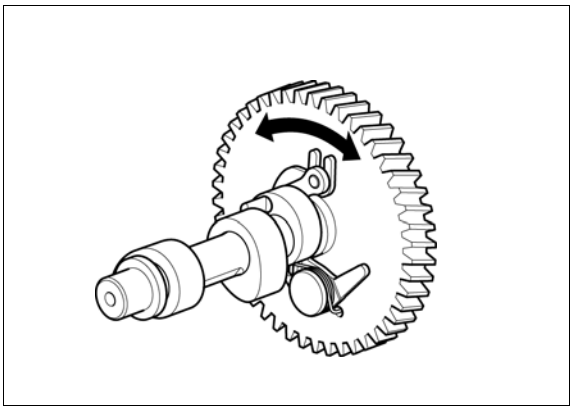


DECOMPRESSOR WEIGHT

Check for a worn and weakened spring.

Check that the decompressor weight moves smoothly.

If the decompressor weight does not move correctly, replace the camshaft (page 14-3).

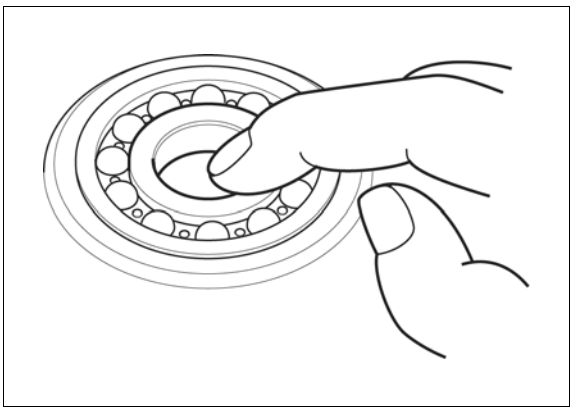


RADIAL BALL BEARING

Clean the bearing with solvent and dry it thoroughly.

Turn the inner race (outer race: cylinder barrel side crankshaft bearing only) of the radial ball bearing with your finger and check for play.

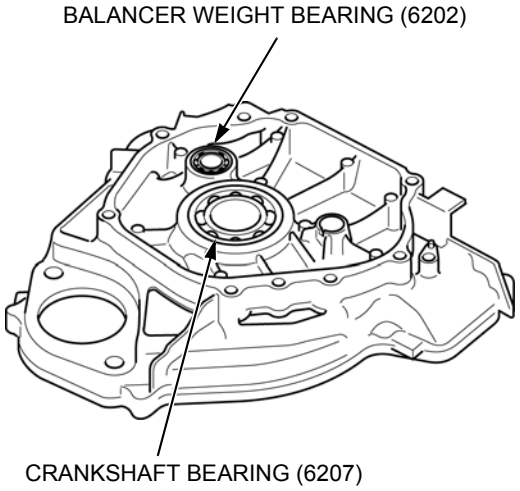
If it is noisy or has excessive play, replace the radial ball bearing (page 14-12).

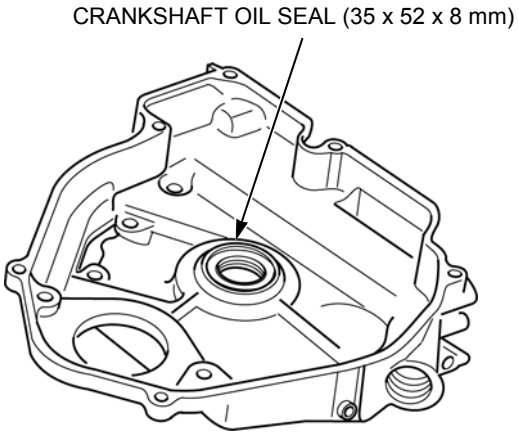


BEARING/OIL SEAL REPLACEMENT

CRANKCASE COVER

LOCATION





BALANCER WEIGHT BEARING

Pull out the bearing [1] using the special tools.

TOOLS:

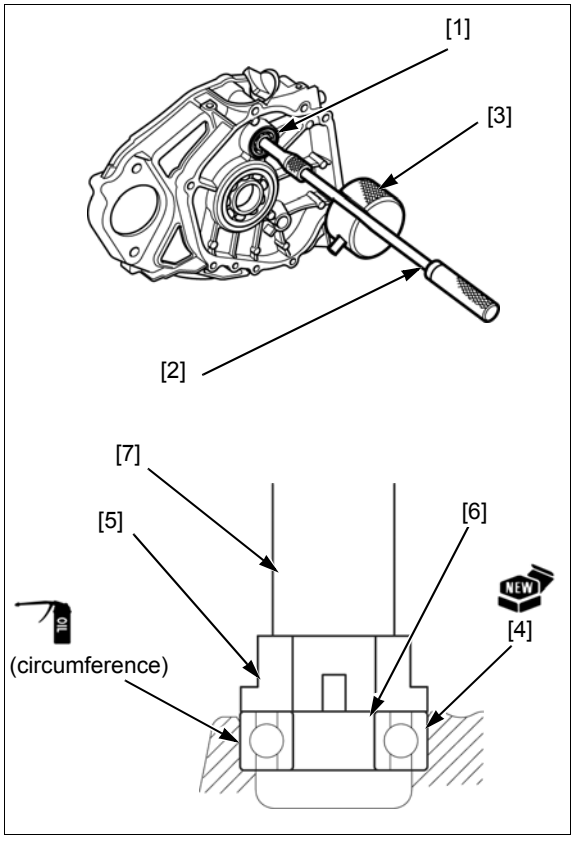
Bearing remover shaft, 15 mm [2]	**07936-KC10500**
Remover weight [3]	**07936-371020A**

Apply oil to the circumference of a new bearing (4).

Drive the bearing until it is fully seated on the end using the special tools.

TOOLS:

Attachment, 32 × 35 mm [5]	**07746-0010100**
Pilot, 15 mm [6]	**07746-0040300**
Driver handle [7]	**07749-0010000**



CRANKSHAFT BEARING

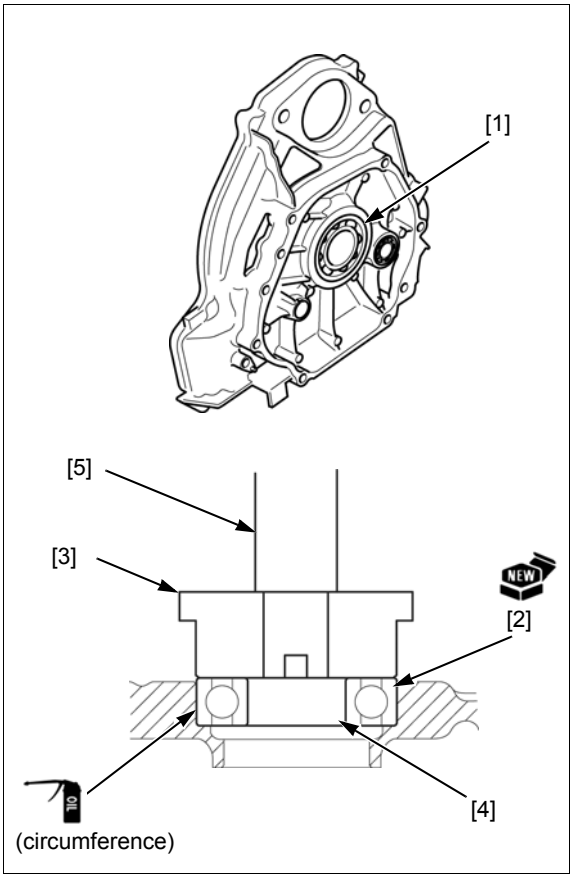
Drive out the bearing [1].

Apply oil to the circumference of a new bearing [2].

Drive the bearing until it is fully seated on the end using the special tools.

TOOLS:

Attachment, 72 × 75 mm [3]	**07746-0010600**
Pilot, 35 mm [4]	**07746-0040800**
Driver handle [5]	**07749-0010000**



CRANKSHAFT OIL SEAL

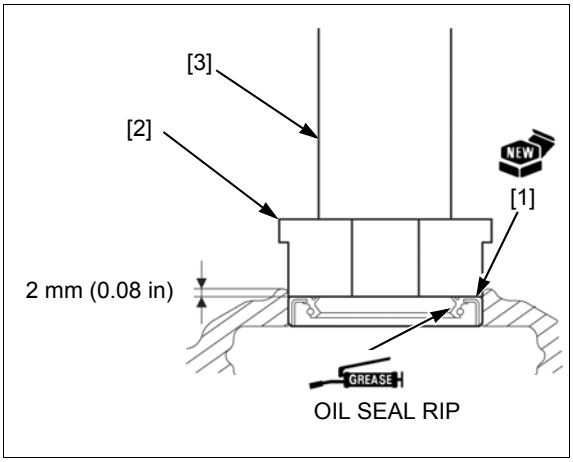
Remove the oil seal from the crankcase cover.

Apply grease to the lip of a new oil seal [1].

Drive the oil seal in the position as shown using the special tools.

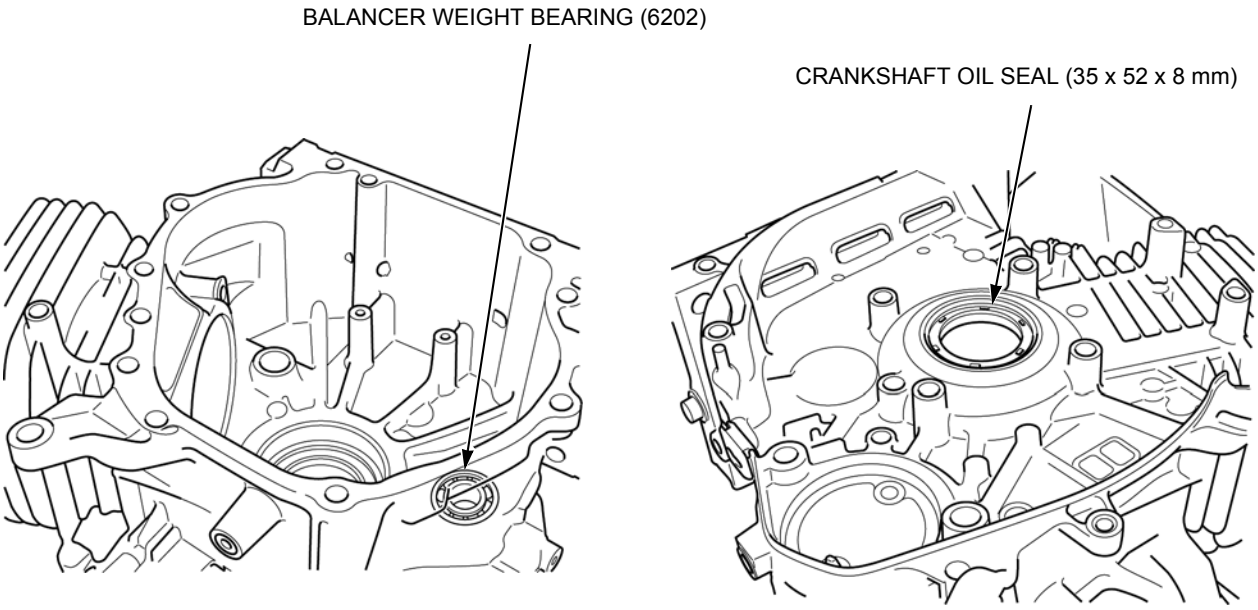
TOOLS:

Attachment, 52 × 55 mm [2]	**07746-0010400**
Driver handle [3]	**07749-0010000**



CYLINDER BARREL

LOCATION



BALANCER WEIGHT BEARING

Pull the bearing [1] out using the special tools.

TOOLS:

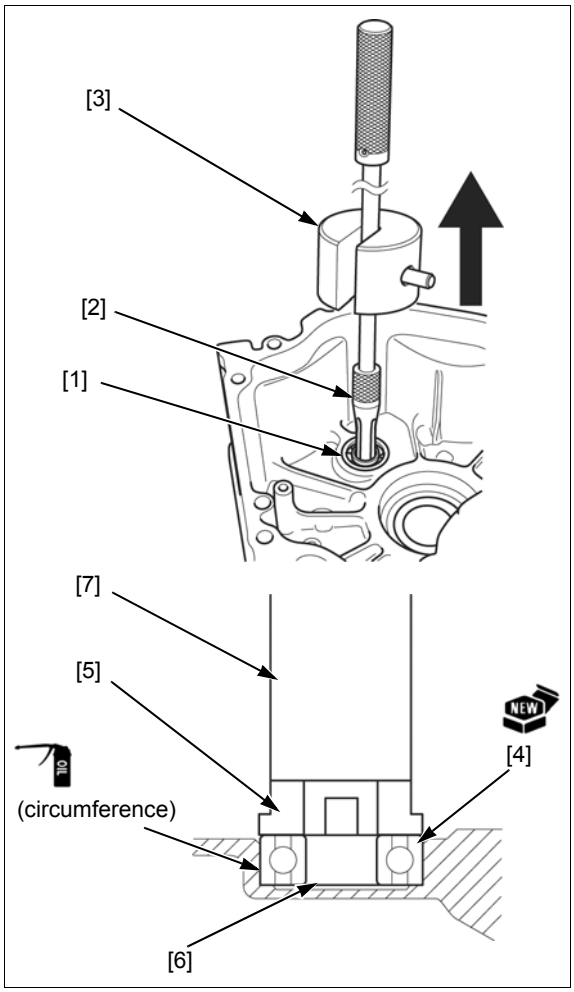
Bearing remover shaft, 15 mm [2]	**07936-KC10500**
Remover weight [3]	**07936-371020A**

Apply oil to the circumference of a new bearing [4].

Drive the bearing in until it is fully seated in the cylinder barrel using the special tools.

TOOLS:

Attachment, 32 × 35 mm [5]	**07746-0010100**
Pilot, 15 mm [6]	**07746-0040300**
Driver handle [7]	**07749-0010000**



CRANKSHAFT OIL SEAL

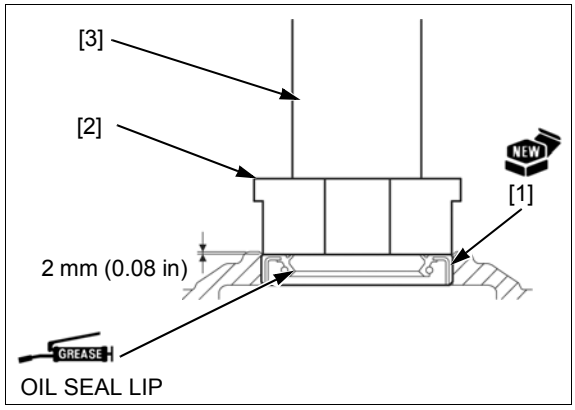
Remove the oil seal from the cylinder barrel.

Apply grease to the lip of a new oil seal [1].

Drive the oil seal in the position shown using the special tools.

TOOLS:

Attachment, 52 × 55 mm [2]	**07746-0010400**
Driver handle [3]	**07749-0010000**



CRANKSHAFT

CRANKSHAFT BEARING

Install the 16 mm flywheel nut [1] to protect the crankshaft threads.

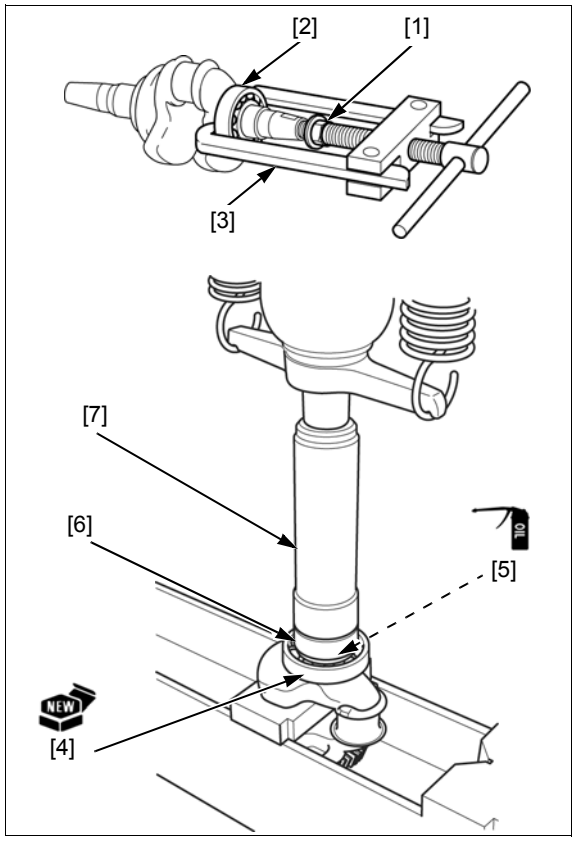
Pull off the bearing [2] using a commercially available bearing puller [3].

Apply oil to the inner surface of the new bearing [4] inner race [5].

Drive the bearing in until it is fully seated on the end using the special tools and a hydraulic press.

TOOLS:

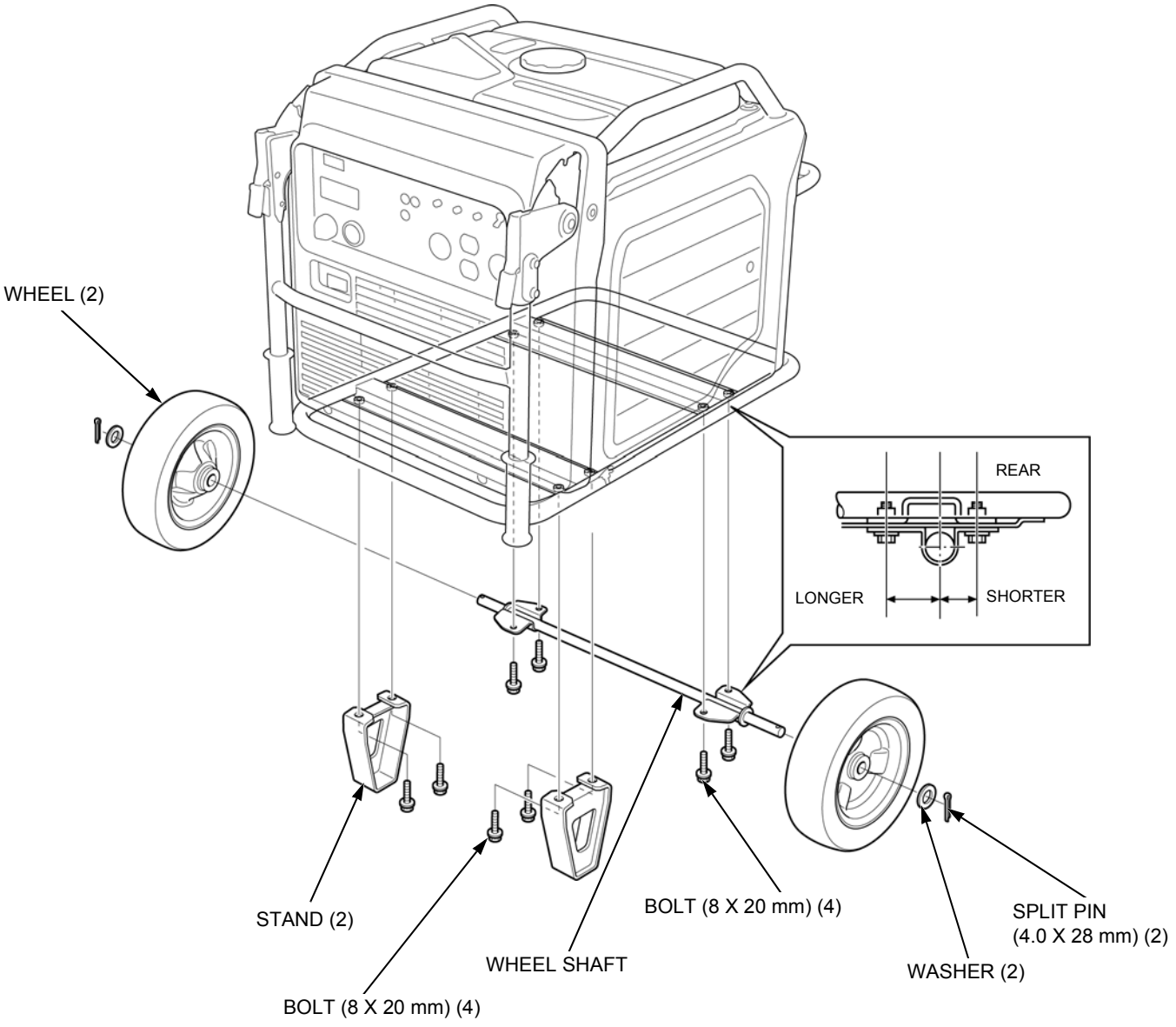
Driver attachment, 35 mm I.D. [6]	**07746-0030400**
Driver, 40 mm I.D. [7]	**07746-0030100**



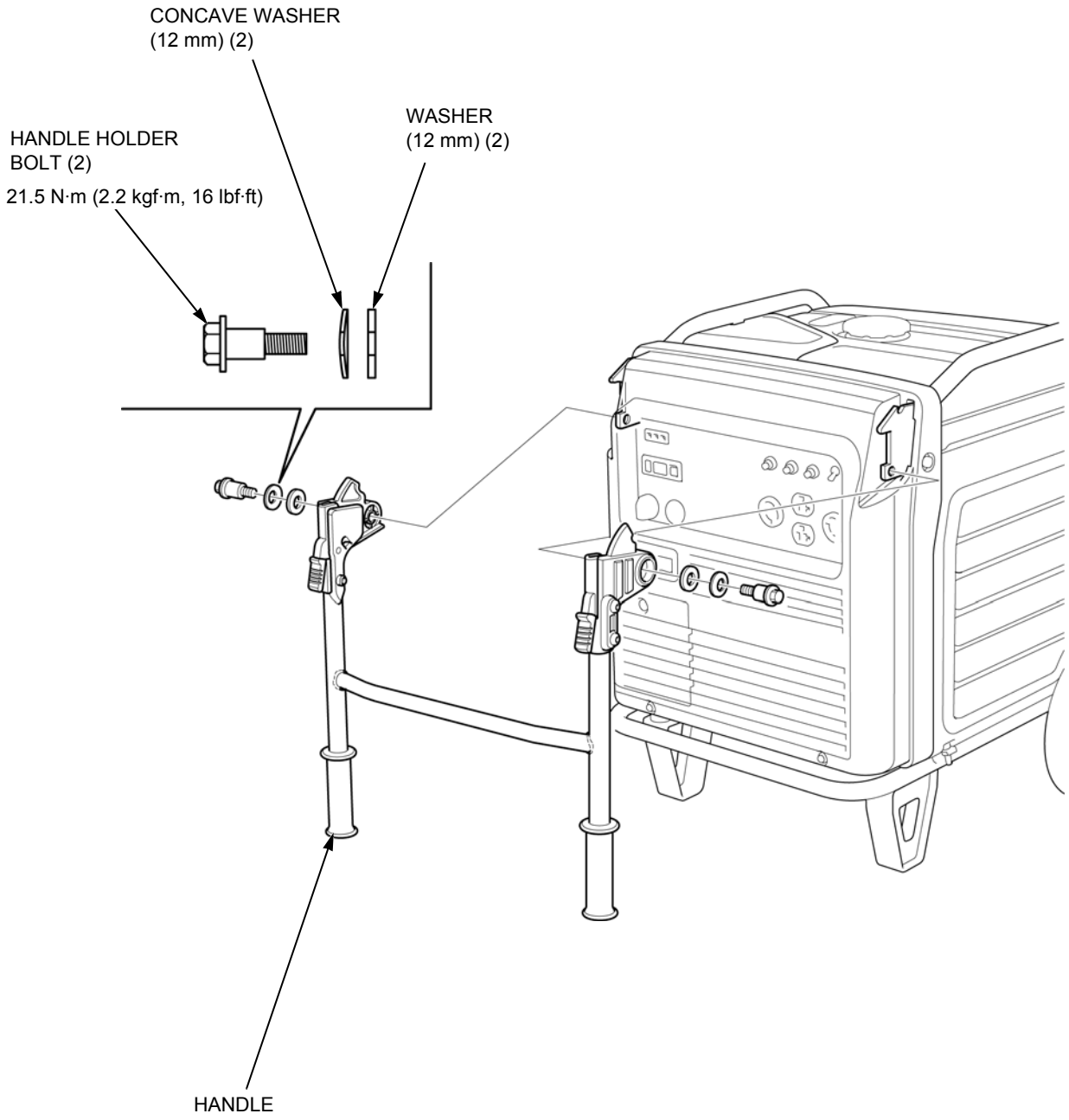
MEMO

15. HANDLE/WHEELS

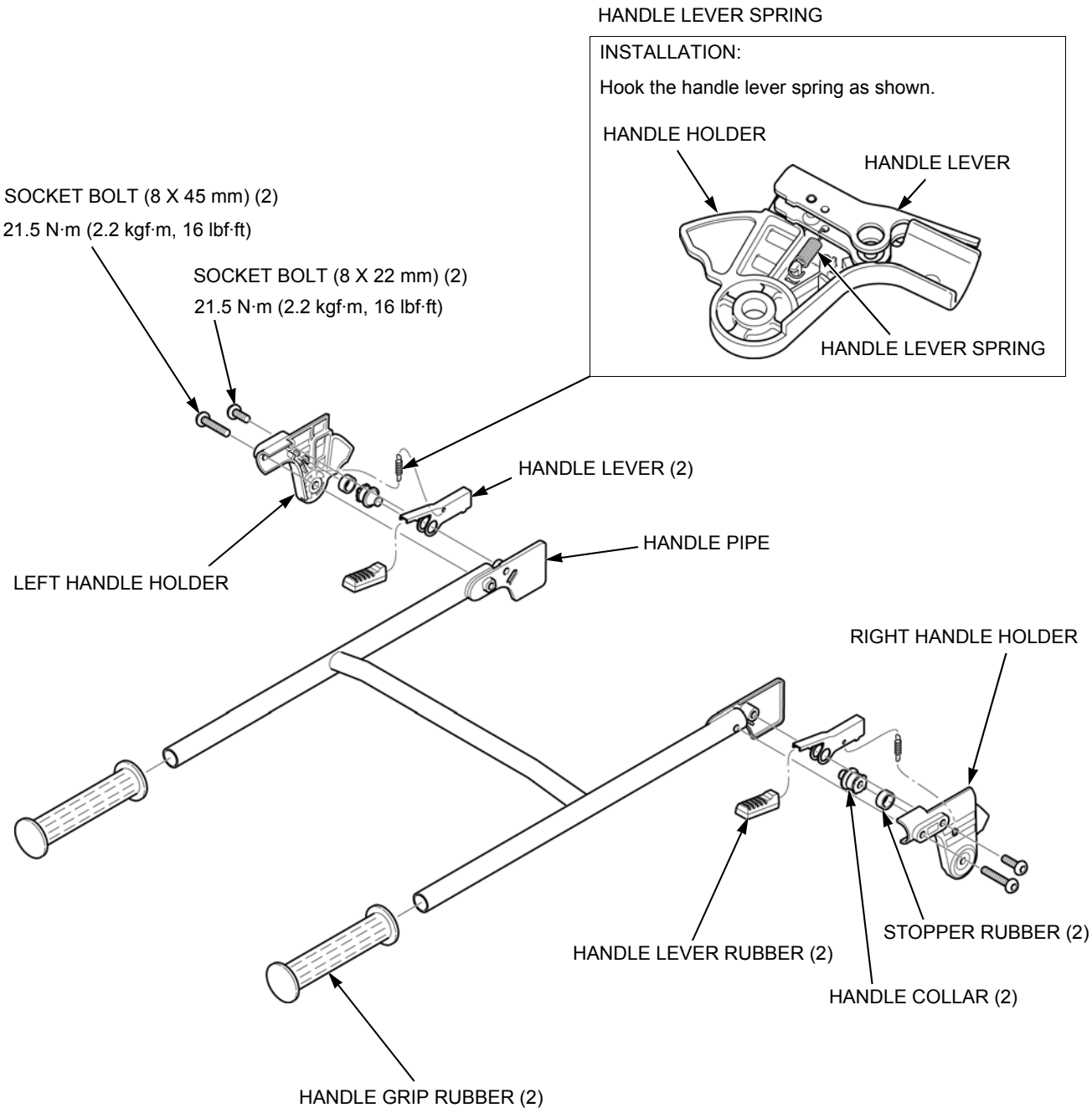
WHEEL/STAND REMOVAL/INSTALLATION



HANDLE REMOVAL/INSTALLATION



HANDLE DISASSEMBLY/ASSEMBLY

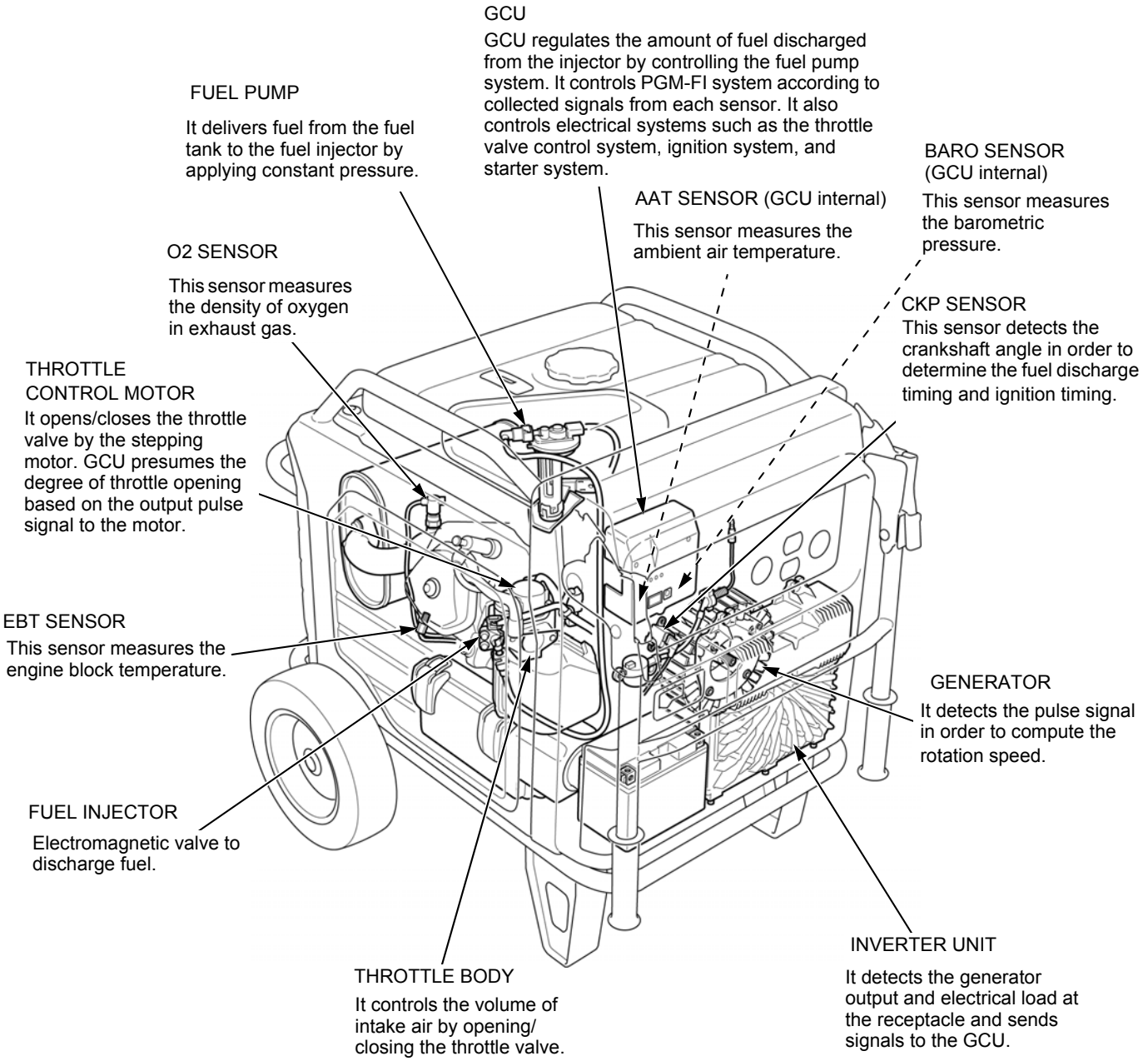


16. TECHNICAL FEATURES

PGM-FI (PROGRAMMED-FUEL INJECTION) SYSTEM

SYSTEM COMPONENTS

This model utilizes a PGM-FI (Programmed-Fuel Injection) system, instead of a conventional carburetor system. This system consists of the following: Fuel injector, throttle body, GCU, inverter unit, fuel pump, CKP sensor, generator, BARO sensor (GCU internal), AAT sensor (GCU internal), EBT sensor, and O2 sensor.



PGM-FI	Programmed-Fuel Injection	AAT SENSOR	Ambient Air Temperature Sensor
BARO SENSOR	Barometric Pressure Sensor	CKP SENSOR	Crankshaft Position Sensor
EBT SENSOR	Engine Block Temperature Sensor	GCU	Generator Control unit

COMPARISON BETWEEN ELECTRICALLY CONTROLLED CARBURETOR AND PGM-FI SYSTEM

BASIC OPERATION

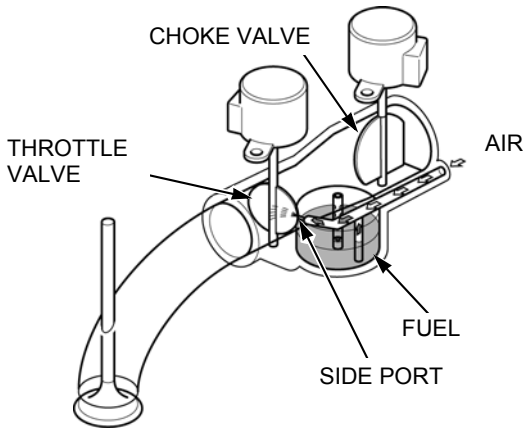
The electrically controlled carburetor and PGM-FI system change the volume of incoming air-fuel mixture by opening/closing the throttle valve in order to regulate the engine speed. The carburetor changes the amount of mixture by sucking fuel into the carburetor bore in accordance with the volume of incoming air; the PGM-FI system by controlling the volume of fuel discharged from the injector.

NO LOAD TO LOW LOAD

When there is no load to low load at the receptacle, the engine runs at the pre-set target rotation (2,400 rpm).

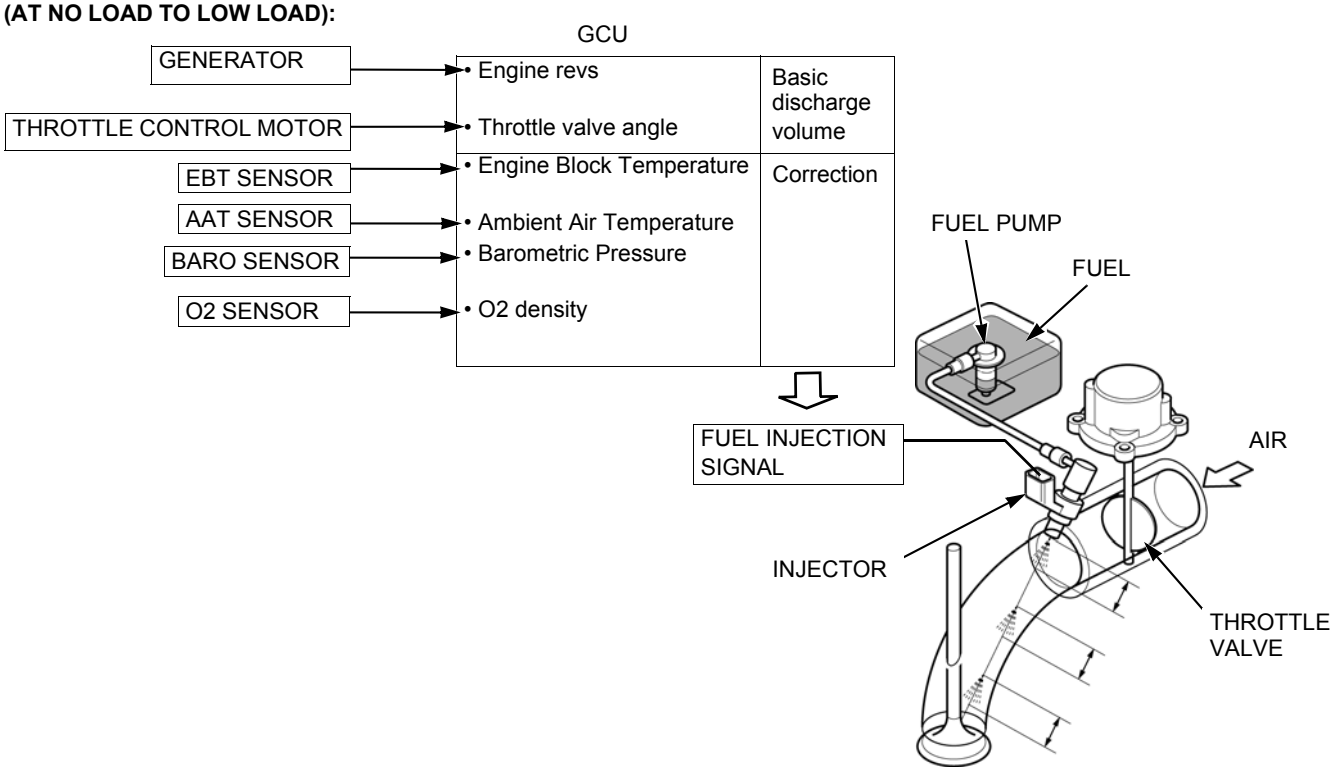
ELECTRICALLY CONTROLLED CARBURETOR (AT NO LOAD TO LOW LOAD):
- The mixture is supplied from the side port as the GCU opens the throttle valve partially.

CARBURETOR (AT NO LOAD TO LOW LOAD):



PGM-FI (AT NO LOAD TO LOW LOAD):
- The GCU opens the throttle valve partially. The discharge volume from the fuel injector is determined by GCU according to the throttle position and engine speed with corrections based upon the signals from inverter, EBT sensor, AAT sensor, BARO sensor, and O2 sensor.

PGM-FI THROTTLE BODY (AT NO LOAD TO LOW LOAD):



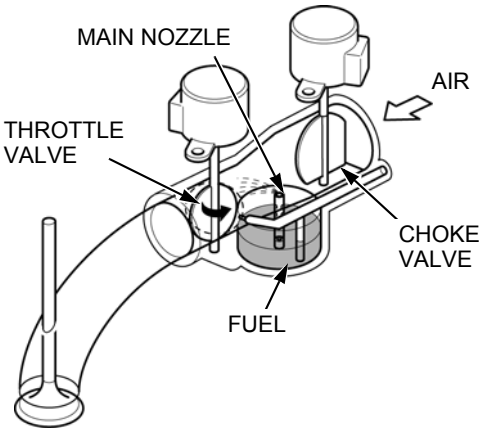
LOW LOAD TO HIGH LOAD

When the load at the receptacle increases, the engine speed starts decreasing as the resistance caused by the load increases.

ELECTRICALLY CONTROLLED CARBURETOR (AT LOW LOAD TO HIGH LOAD):

- When the engine speed starts decreasing under high load, GCU increases the volume of incoming air by opening the throttle valve. The amount of fuel sucked from the main nozzle increases in accordance with the increasing volume of incoming air. The engine speed increases as the target rotation is set to high speed in order to meet the demand of the load.

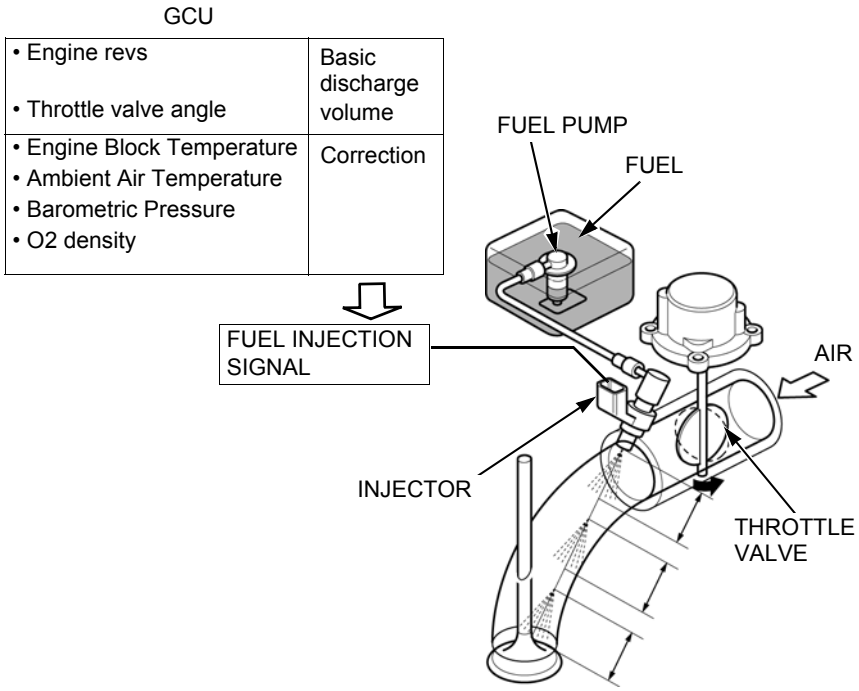
CARBURETOR
(AT LOW LOAD TO HIGH LOAD):



PGM-FI (AT LOW LOAD TO HIGH LOAD):

- When the engine speed starts decreasing under high load, the GCU increases the volume of incoming air by opening the throttle valve. The GCU controls the discharge volume from the fuel injector according to the throttle position. The engine speed increases as the target rotation is set to high speed in order to meet the demand of the load.

PGM-FI THROTTLE BODY
(AT LOW LOAD TO HIGH LOAD):



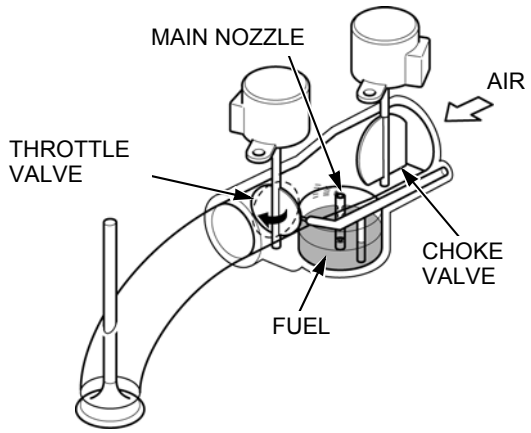
HIGH LOAD TO LOW LOAD

When the load at the receptacle decreases, the engine speed starts increasing as the resistance caused by the load becomes less.

ELECTRICALLY CONTROLLED CARBURETOR (AT HIGH LOAD TO LOW LOAD):

- When the engine speed starts increasing under low load, GCU limits the volume of incoming air by closing the throttle valve from the current position as required. The amount of fuel sucked from the main nozzle decreases in accordance with the decreasing volume of incoming air. The engine speed decreases as the target rotation is set to low speed enough to satisfy the demand of the load.

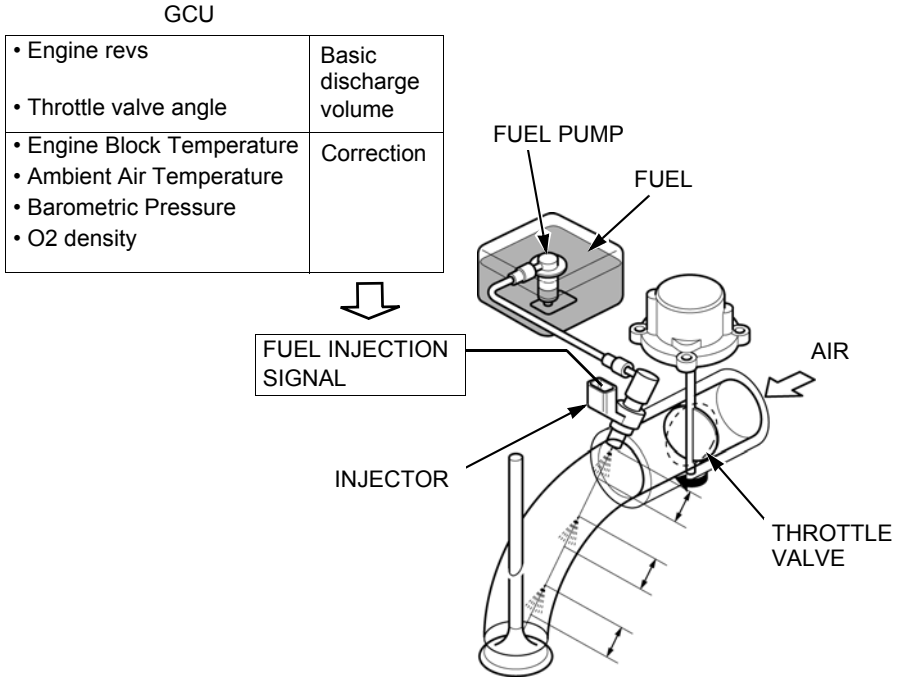
CARBURETOR (AT HIGH LOAD TO LOW LOAD):



PGM-FI (AT HIGH LOAD TO LOW LOAD):

- When the GCU detects the increasing engine speed based upon the signal from the generator, it limits the volume of incoming air by closing the throttle valve from the current position as needed. The discharge volume from the fuel injector is controlled according to the throttle position. The engine speed decreases as the target rotation is set to low speed enough to satisfy the demand of the load.

PGM-FI THROTTLE BODY (AT HIGH LOAD TO LOW LOAD):

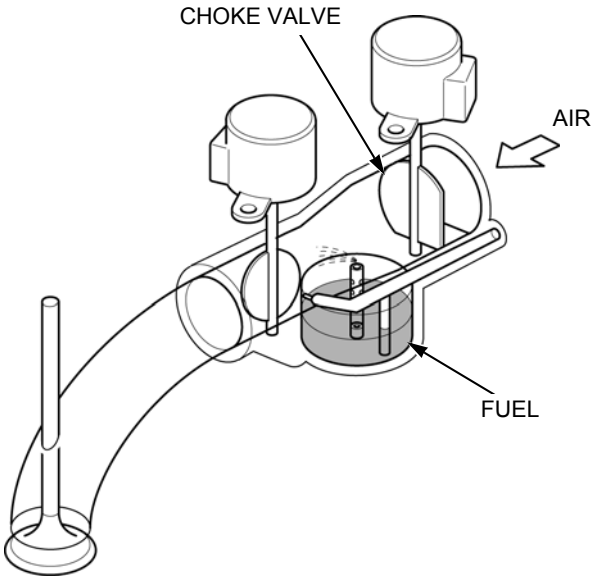


FUEL ENRICHMENT FOR COLD ENGINE

ENGINE RUNNING CONDITION WHEN IT IS STILL COLD:
Fuel does not vaporize well in a cold engine and air-fuel ratio becomes very lean, causing unstable engine speed.

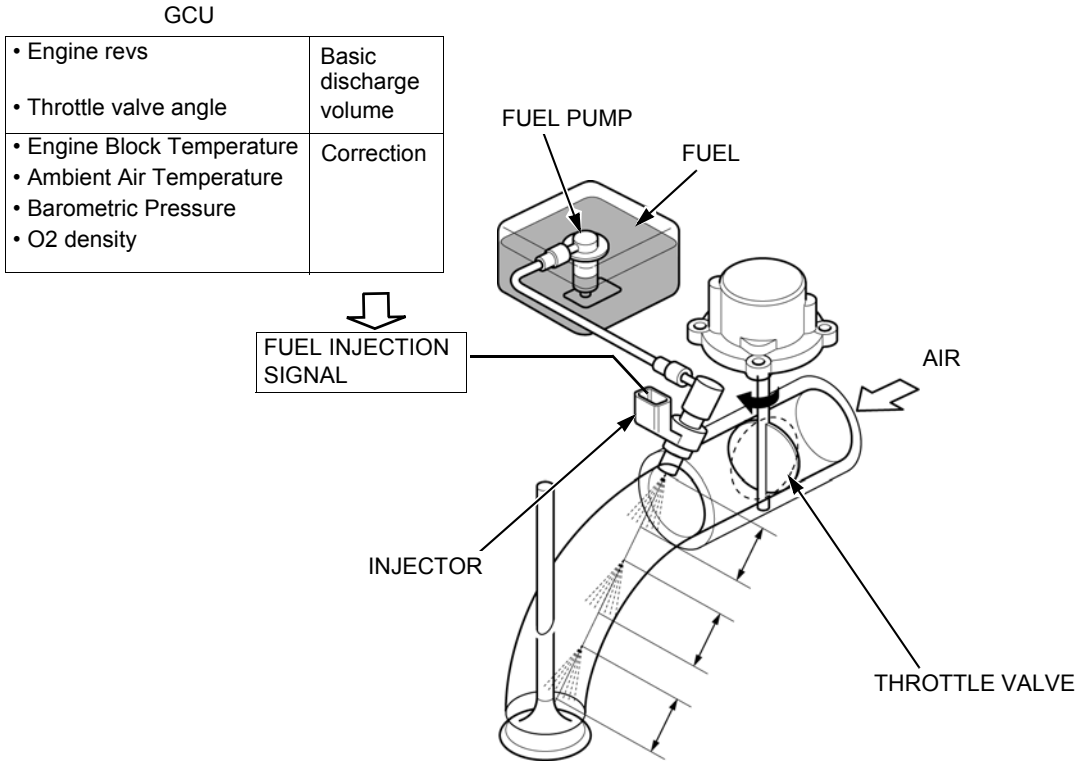
COLD ENGINE WITH CARBURETOR:
When the GCU detects a cold engine, it enriches the mixture in order to stabilize the engine speed by closing the choke valve to increase the vacuum pressure to discharge more fuel from the main nozzle.

CARBURETOR:



COLD ENGINE WITH PGM-FI:
When the GCU detects a cold engine, it enriches the mixture by increasing the fuel discharge duration.

PGM-FI THROTTLE BODY:

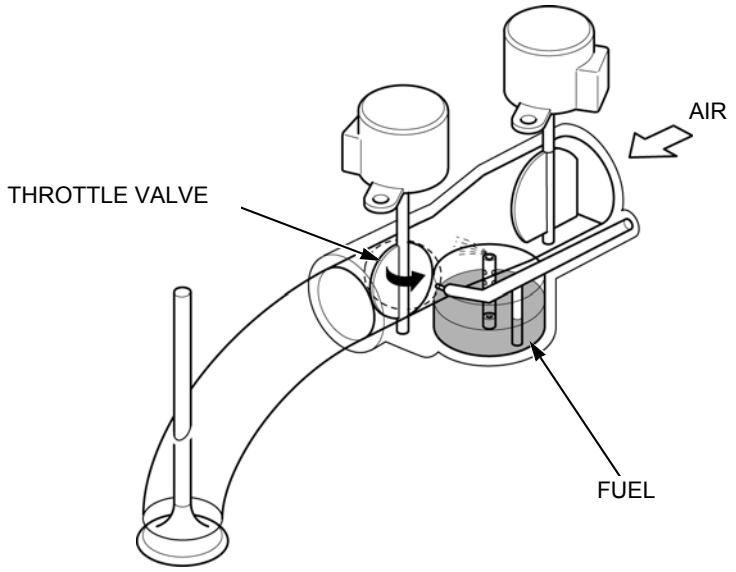


FUEL SUPPLY CUT ON ENGINE STOPPING

ENGINE CONDITION WHEN STOPPING:
When you turn the main switch to the OFF position, the GCU stops the engine by shutting down the ignition system and opening the throttle valve as the engine speed decreases.

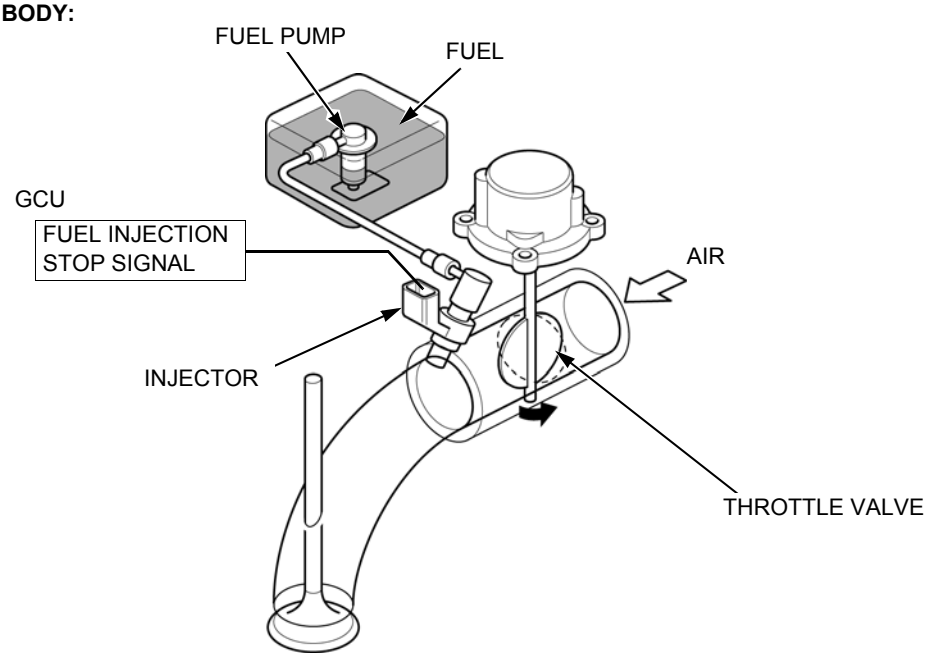
ENGINE STOPPING WITH CARBURETOR:
When you turn the main switch to the OFF position, the unburned air-fuel mixture is released into atmosphere as the GCU cuts off the ignition. As the engine speed goes down to certain point, the throttle valve opens fully and the engine stops.

CARBURETOR:



ENGINE STOPPING WITH PGM-FI:
When you turn the main switch to the OFF position, the GCU cuts off the ignition system and fuel supply to prevent the unburned air-fuel mixture from being released into the atmosphere. As the engine speed goes down to certain point, the throttle valve opens fully and the engine stops.

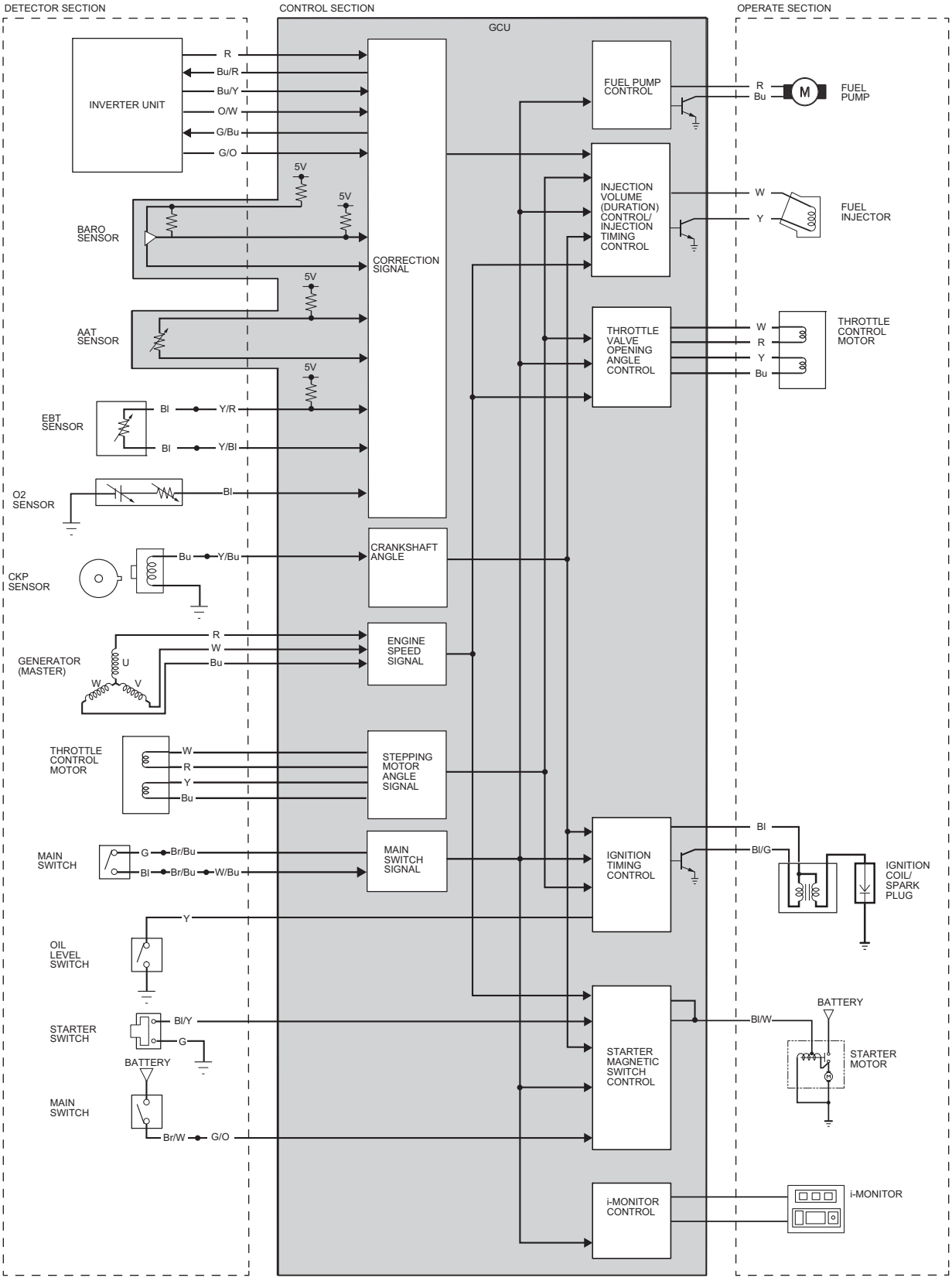
PGM-FI THROTTLE BODY:



PGM-FI ELECTRICAL CONTROL SYSTEM

SYSTEM OVERVIEW

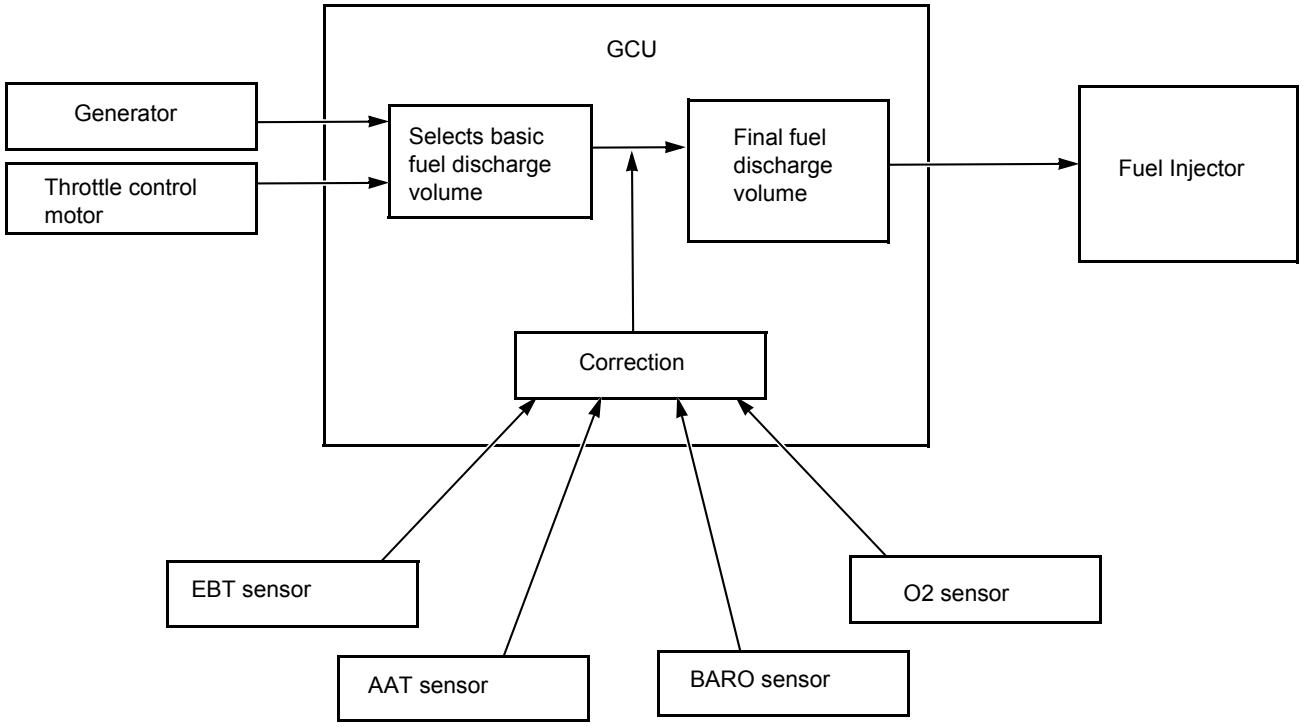
GCU controls engine's running condition by operating the components such as fuel injector and fuel pump, depending on output signals from each sensor.



FUEL INJECTION CONTROL

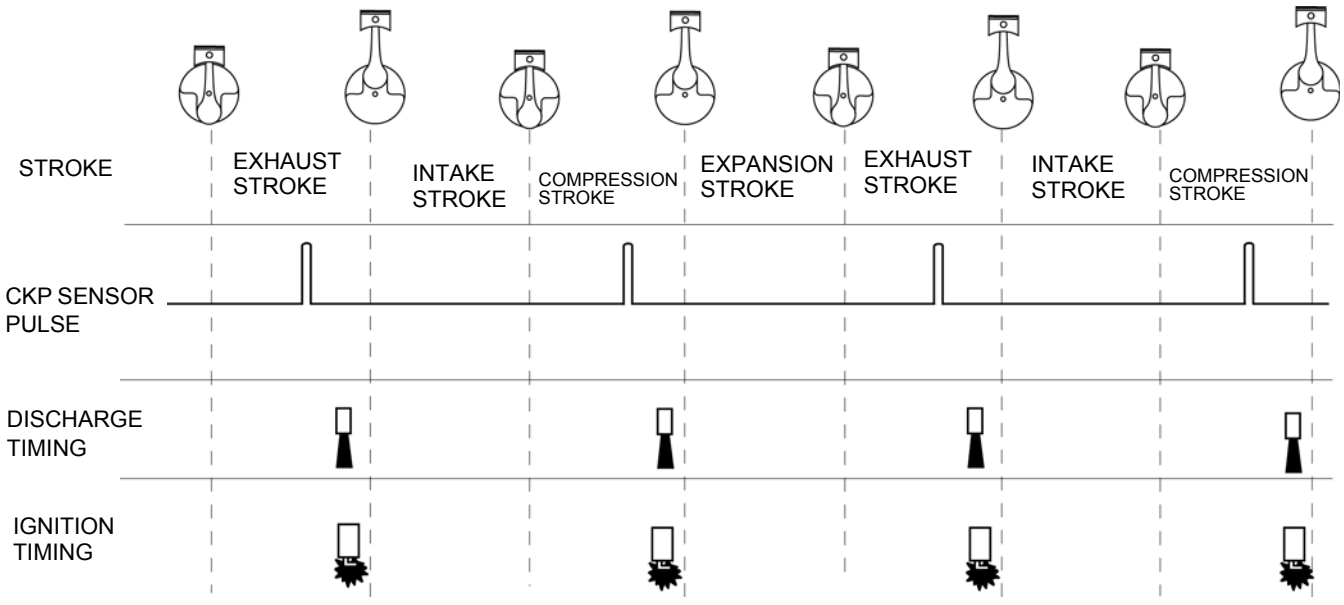
BASIC FUEL DISCHARGE VOLUME

The PGM-FI system uses a set of pre-programmed fuel injection quantity values and chooses the most appropriate value according to engine speed and throttle position. The chosen value is referred to as the basic fuel discharge volume, which is modified according to correction signals from various sensors to determine the final injection volume. The amount of fuel that flows through the injector is controlled by the length of time the valve stays open, as the injector has only two positions, fully open or fully closed.



FUEL DISCHARGE TIMING

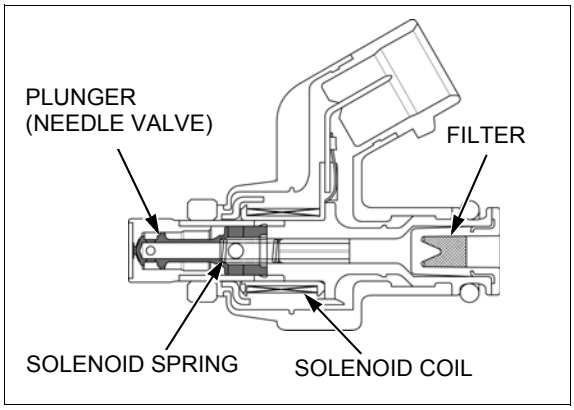
The GCU presumes the TDC by one pulse signal per one revolution of the crankshaft from the CKP sensor, and then injects an equal amount of fuel at the exhaust stroke and the compression stroke.



FUEL INJECTOR

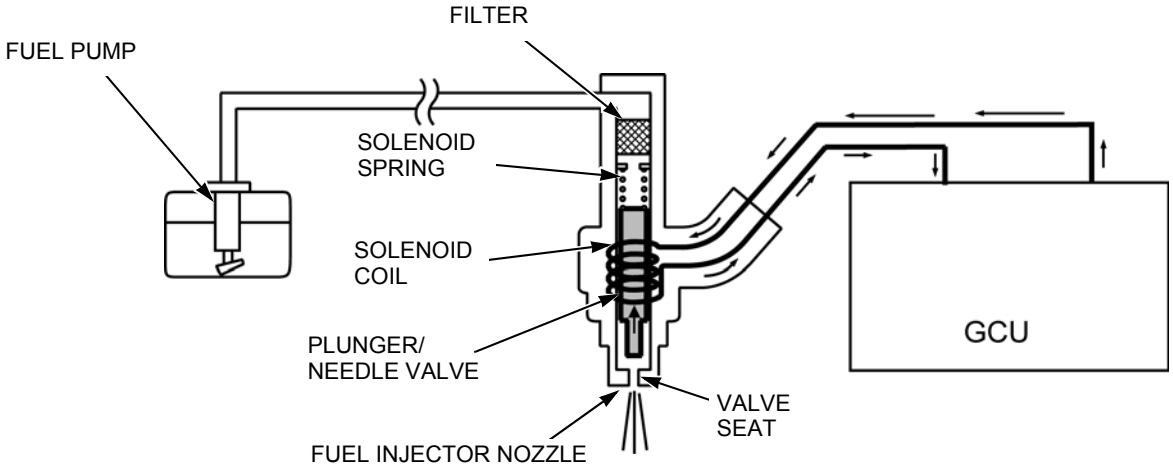
SUMMARY:

- A fuel injector is a solenoid valve that consists of a needle valve/plunger, solenoid coil, solenoid spring, and filter.
- Constantly pressurized fuel (294 kPa (3 kgf/cm^2, 43 psi) is supplied to the fuel injector.
- The fuel injector is either fully closed or fully open with a fixed stroke. The amount of fuel injected is dependent on how long the fuel injector is kept open.
- The GCU applies voltage to the fuel injector to open it while the generator is generating the voltage.

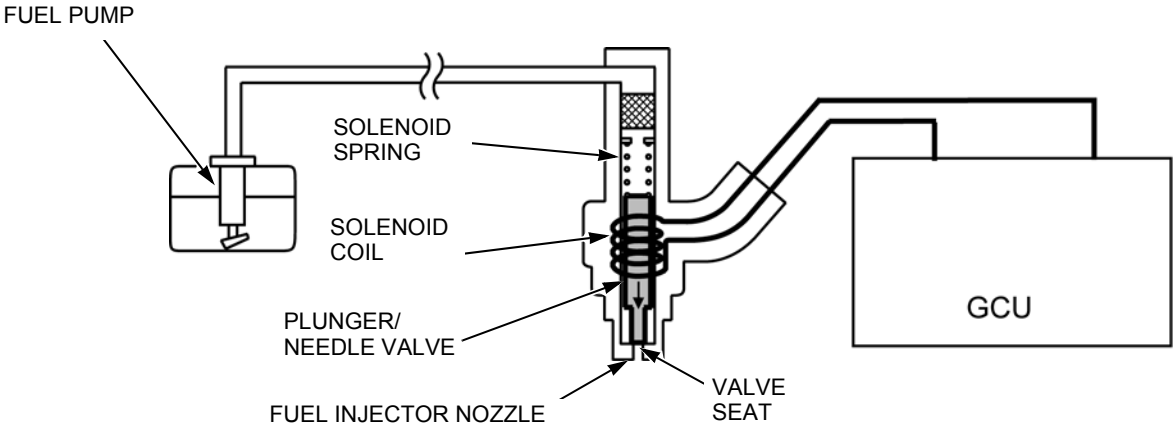


OPERATION:

1. The fuel pressurized by the fuel pump is blocked at the fuel injector nozzle that consists of a plunger/needle valve and valve seat.
2. When the GCU applies current to the solenoid coil in the fuel injector, the coil becomes an electromagnet that pulls the plunger/needle valve while compressing the solenoid spring.
3. The nozzle opens as the plunger/needle valve lifts up. The fuel blocked at the fuel injector nozzle passes the filter and then sprays into the intake port.



4. When the GCU stops current to the solenoid coil in the fuel injector, the coil is no longer electromagnetic and the nozzle will be shut by the returning force of the solenoid spring, which blocks the fuel.



FUEL PUMP

SUMMARY:

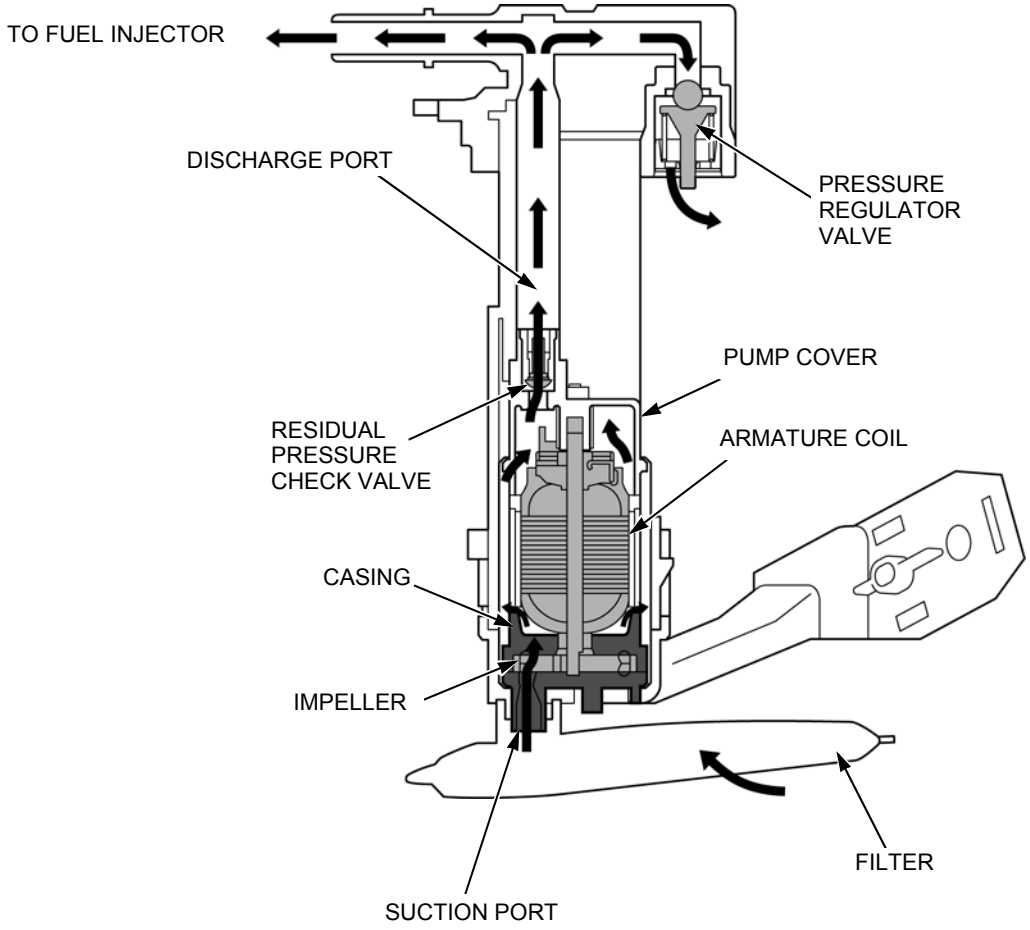
- The fuel pump is located inside the fuel tank.
- The fuel pump draws in the fuel via the fuel filter and delivers it to the fuel injector.
  The pressure regulator maintains a constant fuel pressure of 294 kPa (3 kgf/cm^2, 43 psi).

FUEL PUMP CONSTRUCTION:

The fuel pump assembly consists of a pump section, residual pressure check valve, suction port, and discharge port.
The pump section consists of a motor-driven impeller and pump chamber composed of a pump casing and pump cover.

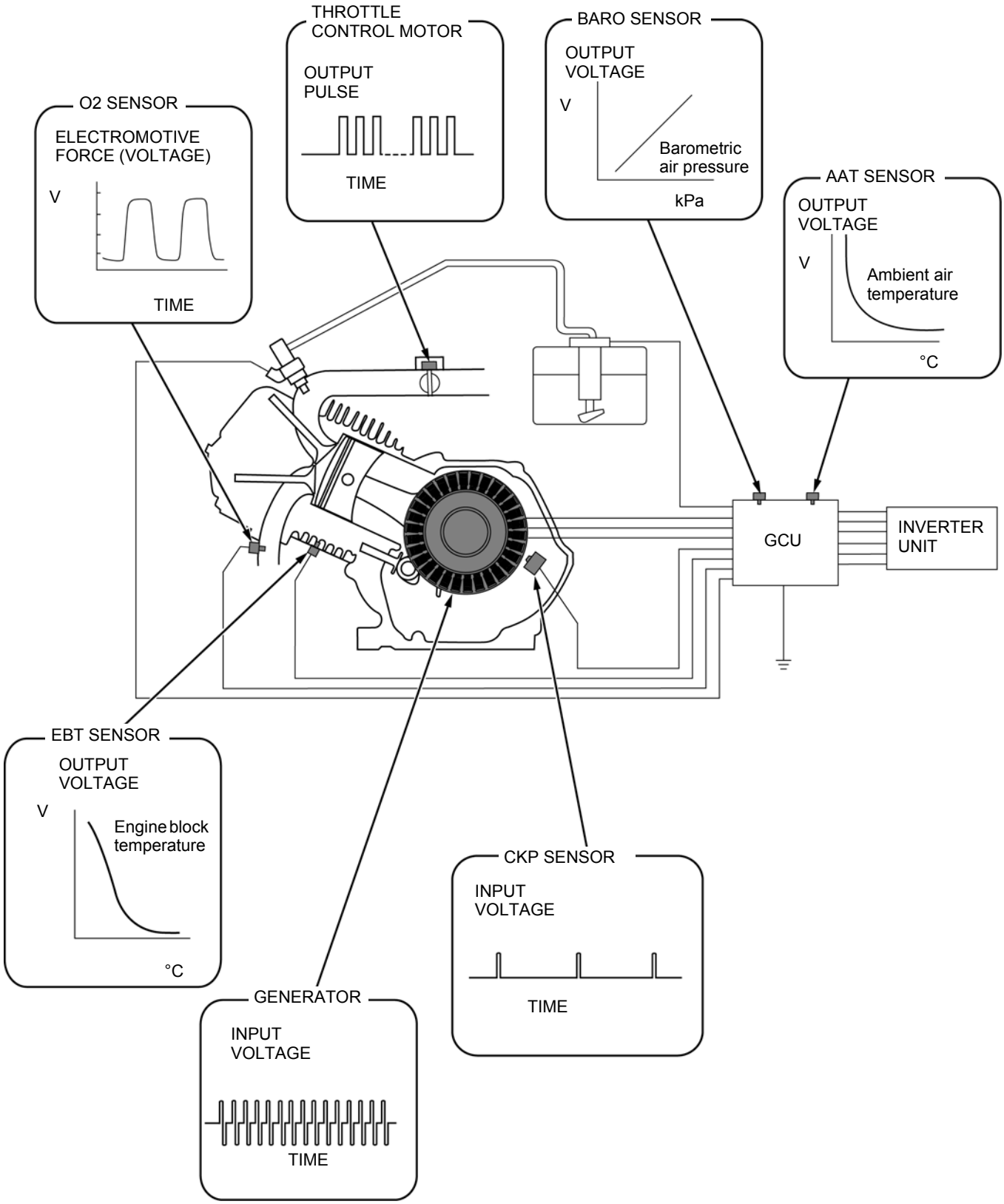
FUEL PUMP OPERATION:

- When the motor turns, fin grooves located on impeller circumference produce a pressure difference due to hydro-friction force. Fuel is drawn into the pump, and then delivered out of the pump.
- The drawn fuel via the filter circulates inside the motor and passes the residual pressure check valve, then is delivered through the discharge port.
- When engine is turned OFF and fuel pump is not operating, the check valve maintains residual fuel pressure to ease engine restarting.
- The fuel pressure regulator maintains fuel pressure by the regulator valve that opens when fuel pressure in the discharge circuit (between the pump and fuel injector) becomes higher than a certain value.



ROLE OF EACH SENSOR

Each sensor provides information to the GCU by interpreting physical information such as temperature and pressure into electronic signals (voltage).

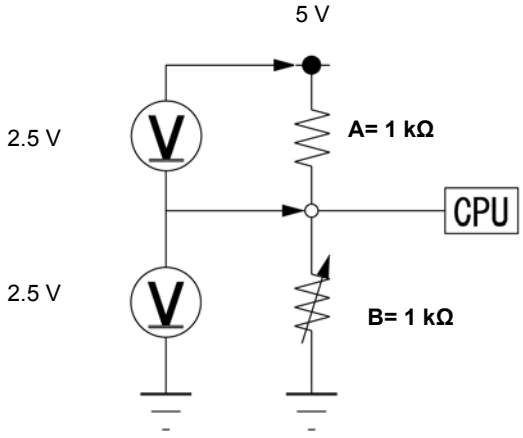


SENSORS

There are two kinds of sensor output: One translates changes of the electrical resistance into changes of voltage, the other produces its own voltage or current.

OUTPUT VOLTAGE SENT TO GCU

As shown on the diagram below, two resistors divide the source voltage when connected to the source in series.



When resistor A and B have the same resistance value, source voltage would be divided equally. When one of them has a larger resistance value than the other, it would receive a larger share of the load.

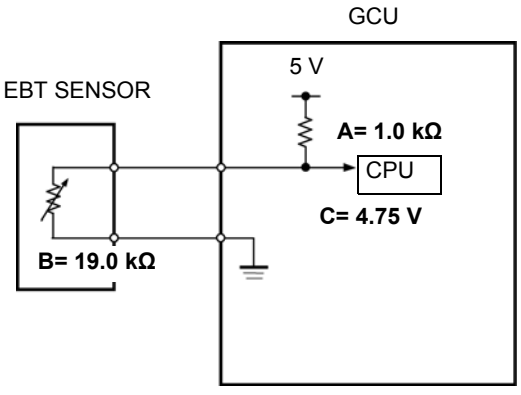
The EBT sensor and AAT sensor utilize this principle.

The GCU receives changes of physical information (changes of temperature, pressure etc.) as variable voltage by reading it at both ends of resistor B (Resistor A: fixed resistor/Resistor B: variable resistor that reacts to physical changes).

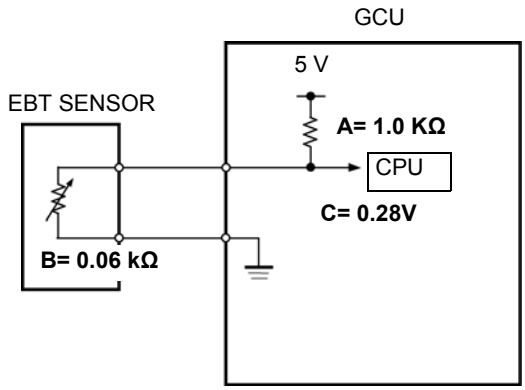
For example, when the source voltage is 5 V, the resistance value of resistor A is 1.0 kΩ, and the resistance value of resistor B is 19.0 kΩ, the voltage measured at point C would be 4.75 V, as shown below. If the value of resistor B is 0.06 kΩ, the voltage measured at point C would be 0.28 V.

e.g. EBT (engine block temperature) SENSOR

When engine block temperature is – 25 °C:

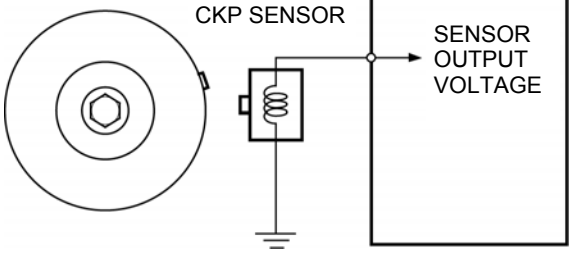


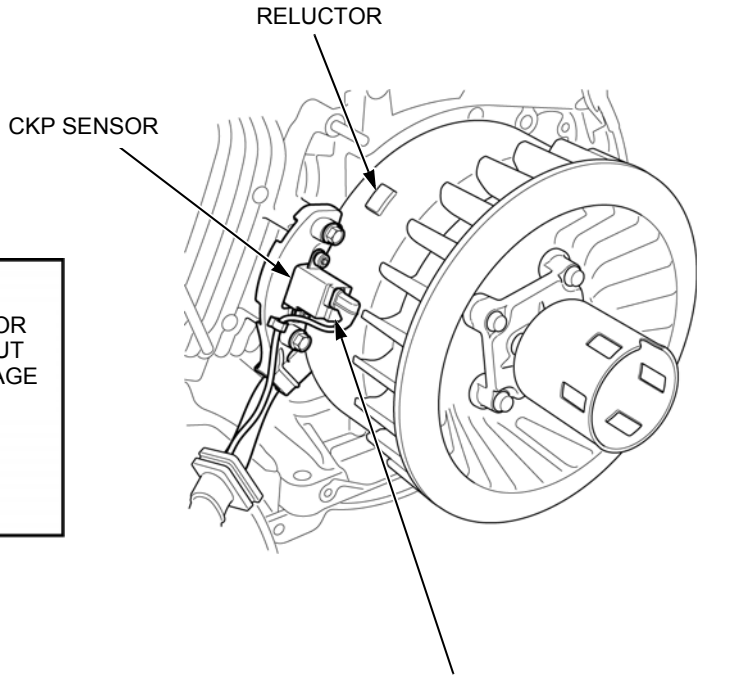
When engine block temperature is 150 °C:

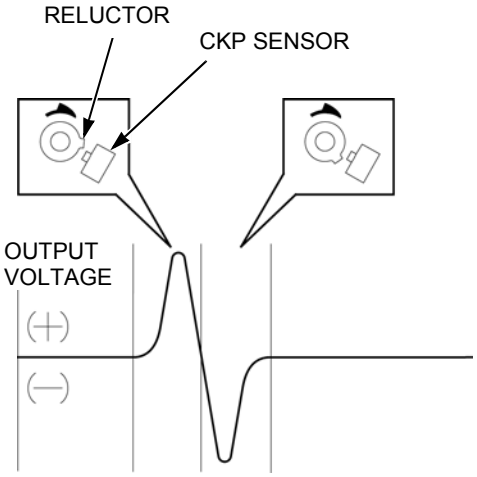


CKP SENSOR

- The CKP sensor detects crankshaft angle.
- The CKP sensor consists of the reluctor on the flywheel and the pickup in the CKP sensor with a built-in permanent magnet and coil.
- When reluctors on the flywheel cross the CKP sensor as the crankshaft rotates, changes of magnetic flux in the pickup coil occur. The CKP sensor detects the changes by converting them into pulse voltages and inputs the pulse into GCU (one pulse per one crankshaft rotation).
- Depending on the signal, the GCU controls the following:
  – timing of fuel discharge
  – ignition timing

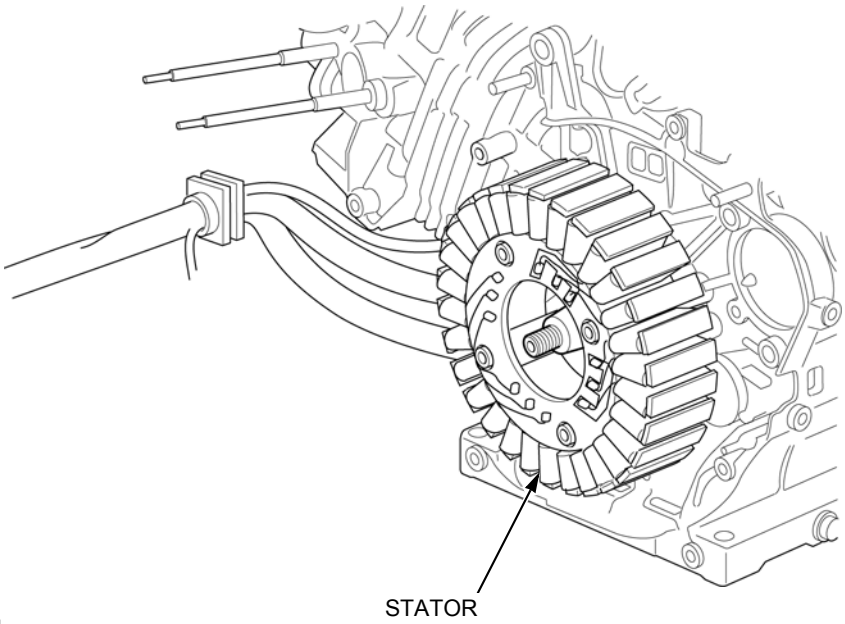


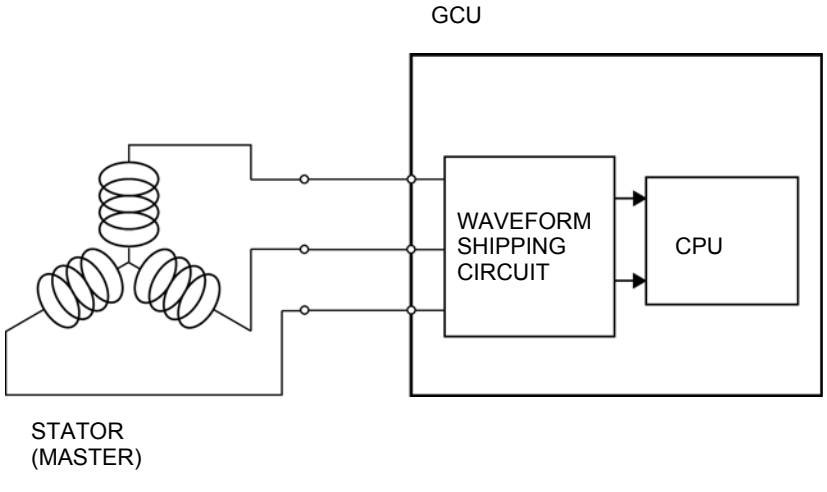


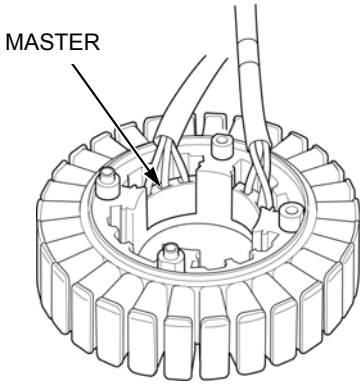


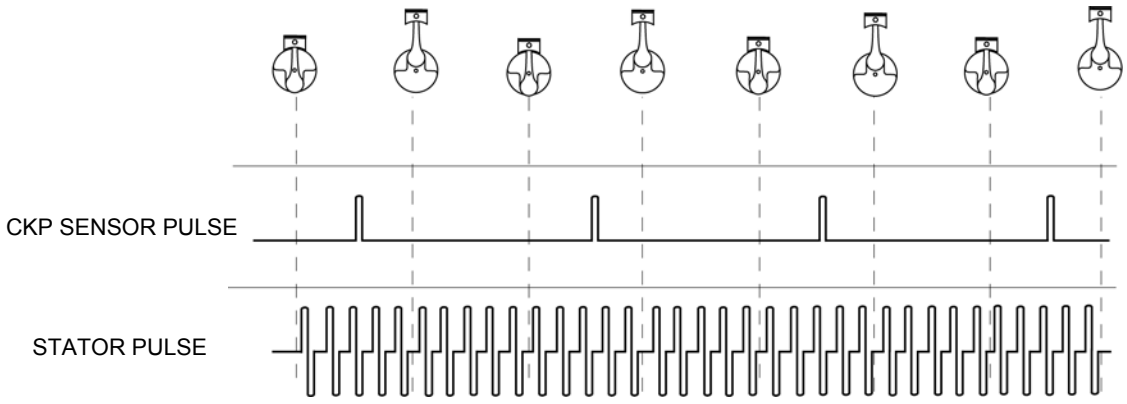
GENERATOR

- The stator detects the engine speed.
- The stator outputs ten pulse signals to the GCU per one revolution of the crankshaft.
- Depending on these signals, the GCU controls the following:
  – degree of throttle opening
  – amount of fuel discharge (duration)



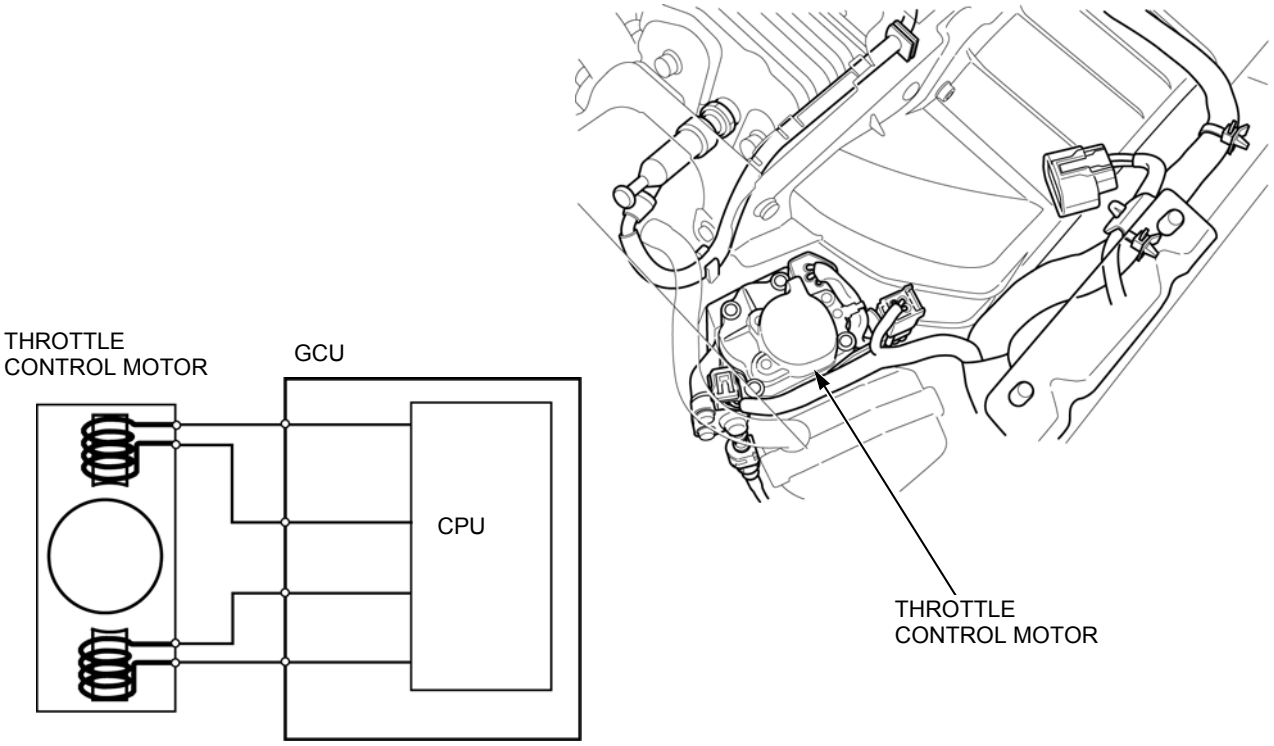




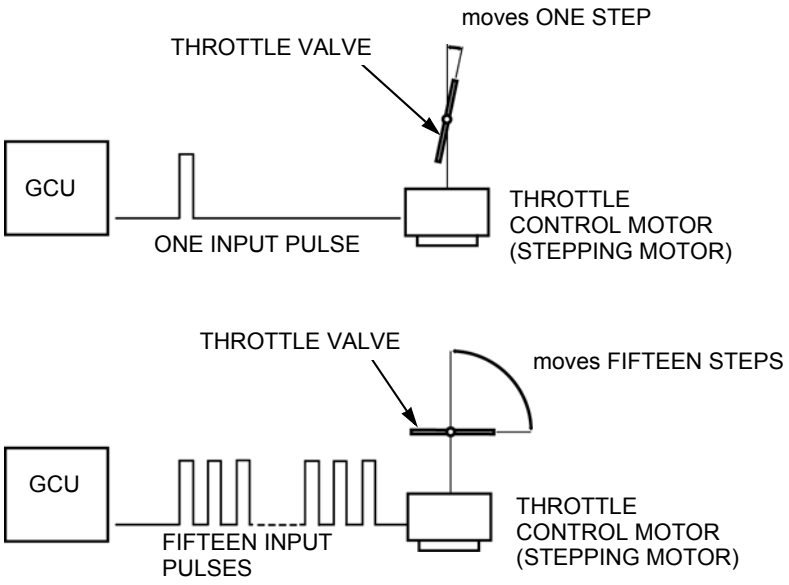


THROTTLE CONTROL MOTOR

- The throttle control motor consists of a stepping motor that controls the throttle valve angle.
- The stepping motor operates in steps according to the number of pulse signal output from the GCU. The GCU can presume the throttle valve position according to the number of output pulses.
- The signals from the throttle control motor are used to control the basic fuel discharge volume and basic ignition timing.

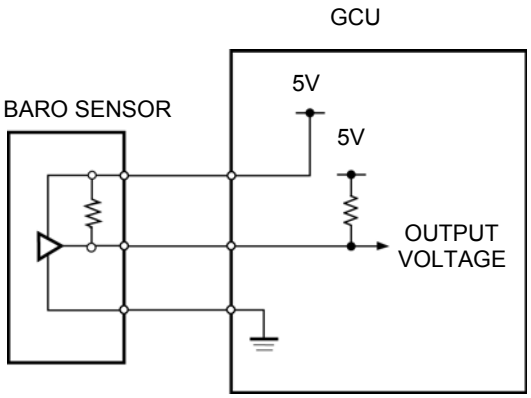


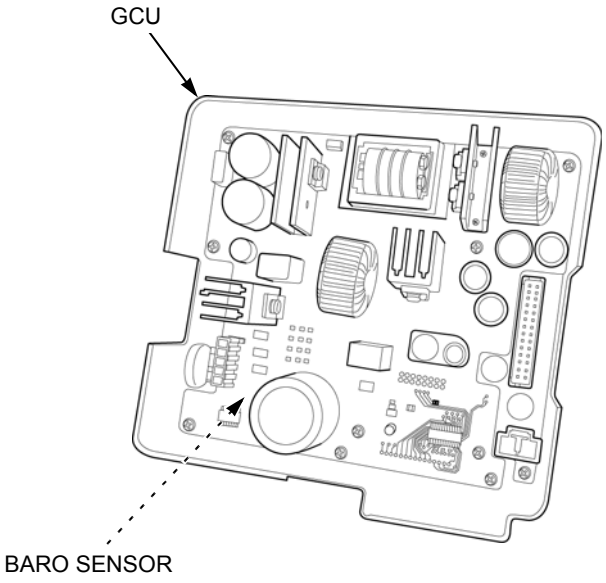
EXAMPLE OF STEPPING MOTOR ANGLE PRESUMPTION:

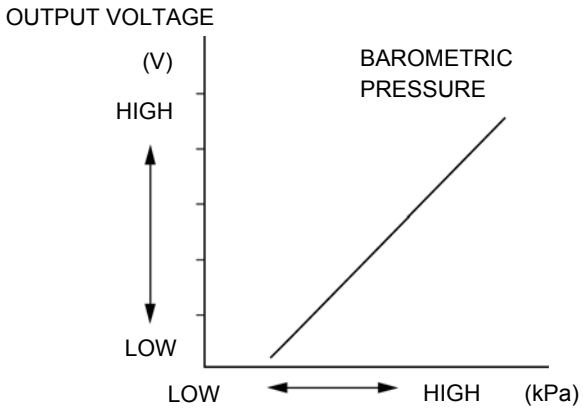


BARO SENSOR

- The BARO sensor measures the barometric pressure in order to detect the air density.
- The BARO sensor consists of a pressure sensing device (silicone diaphragm) that varies the resistance values when pressure is applied, and an amplifier that amplifies the voltage.
- The output voltage from the BARO sensor becomes lower at high altitude where the barometric pressure is low (the air is thin) and becomes higher at low altitude where the pressure is high (the air is dense).
- Depending on sensor output voltage, the GCU corrects the discharge duration corresponding to the barometric pressure.

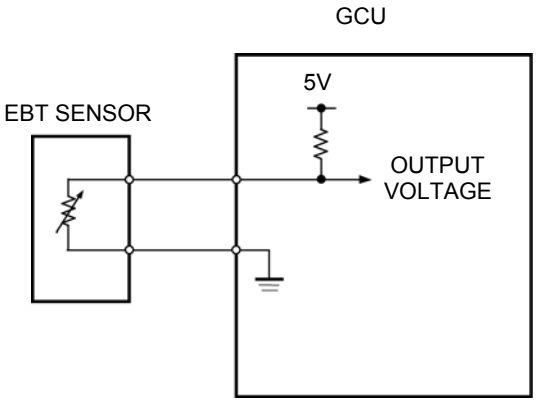


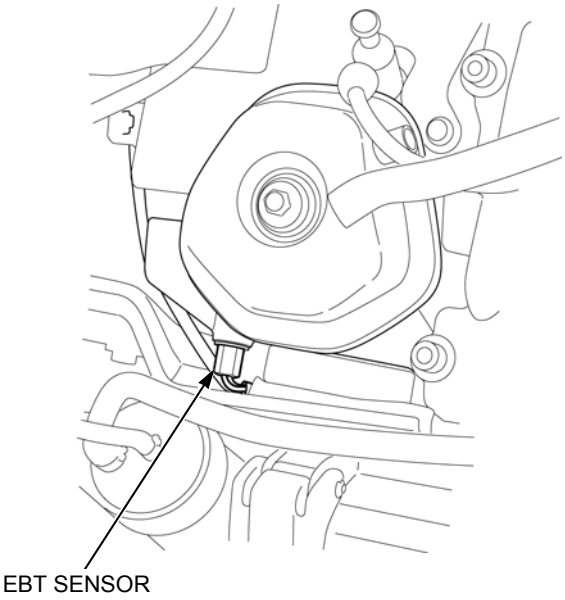


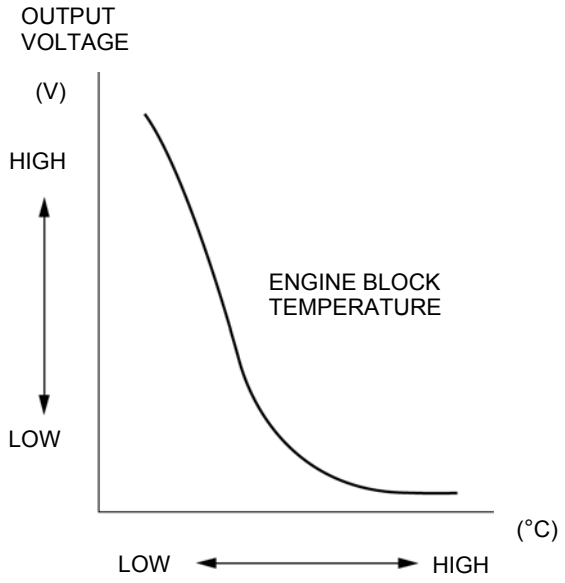


EBT SENSOR

- The EBT sensor detects engine block temperature.
- The EBT sensor consists of a thermistor that varies its resistance value according to changes in temperature.
- Output voltage from the EBT sensor is high when the engine block temperature is low. The voltage becomes lower as temperature increases.
- Depending on sensor output voltage, the GCU corrects the discharge duration corresponding to the engine block temperature.

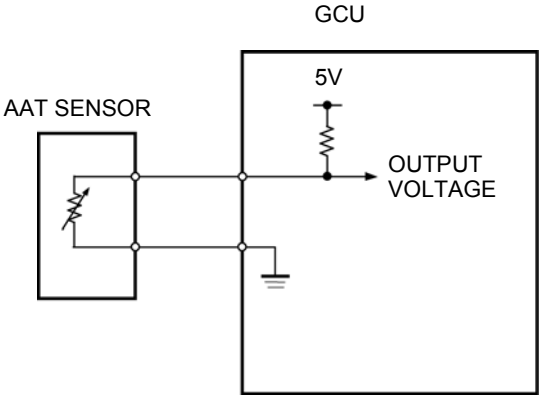


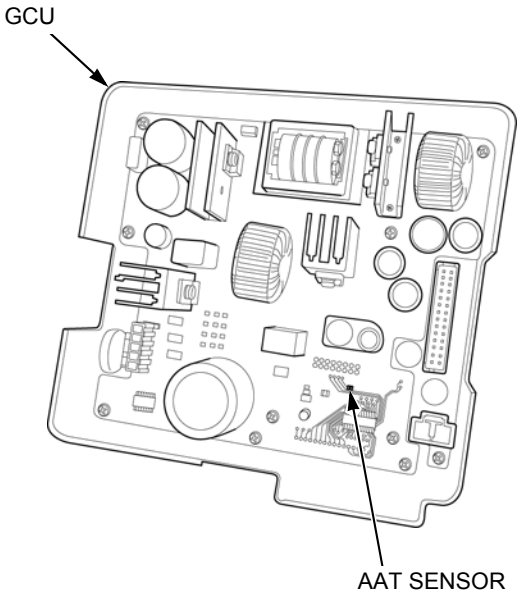


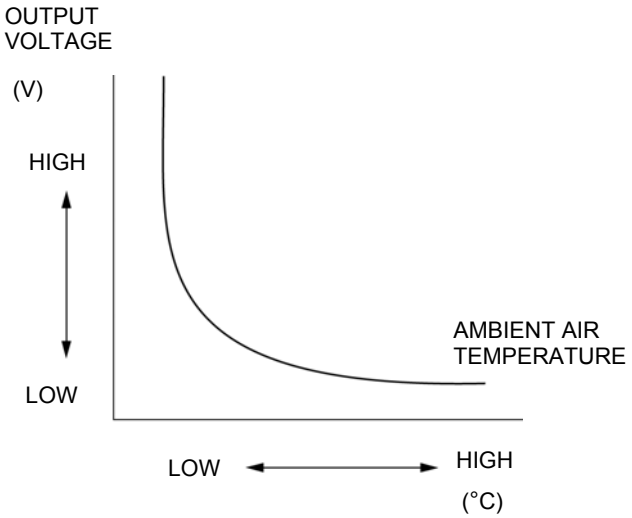


AAT SENSOR

- The AAT sensor detects the ambient air temperature.
- The AAT sensor consists of a thermistor that varies its resistance value according to changes in temperature.
- Output voltage from the AAT sensor is high when intake air temperature is low. The voltage becomes lower as temperature increases.
- Depending on sensor output voltage, the GCU corrects the discharge duration corresponding to the ambient air temperature.

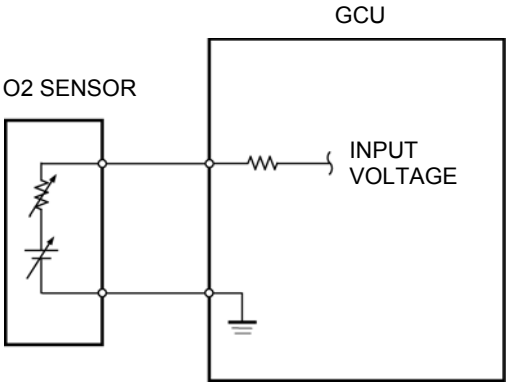


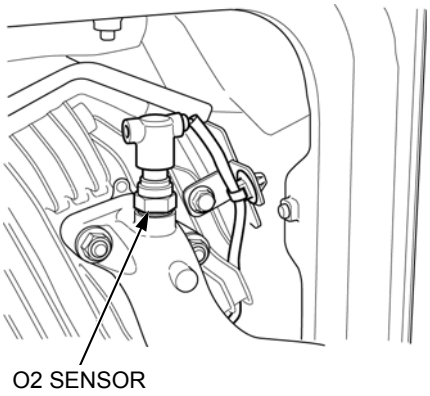


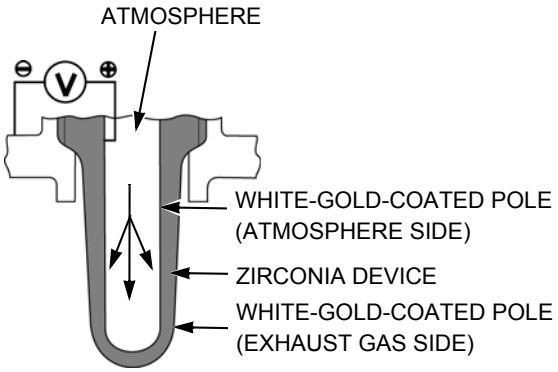


O2 SENSOR

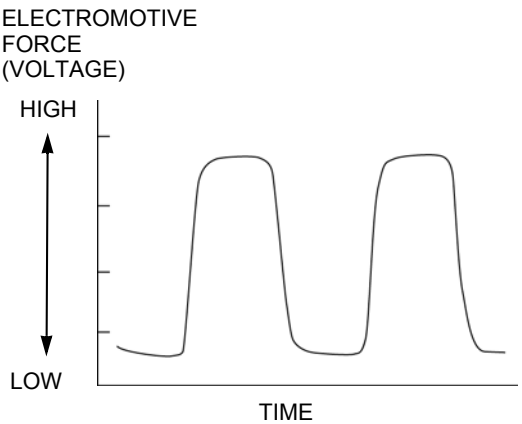
- The O2 sensor detects the amount of oxygen in exhaust gas.
- The O2 sensor consists of a cylindrical-shaped, white-gold-coated zirconia device. The inside of the device is exposed to the atmosphere, whereas its outside is exposed to exhaust gas.
  The zirconia device: produces electromotive force by difference in the oxygen concentration between the atmosphere and the exhaust gas when the temperature is higher than a certain value.
- The O2 sensor detects changes in oxygen concentration in the exhaust gas by measuring the electromotive force. The GCU inputs the values as voltages.
- The output voltage of the O2 sensor is approximately 0 V when the difference of oxygen concentration between the atmosphere and the exhaust gas is very small (when air/fuel ratio is lean), whereas the output voltage is approximately 1 V when the difference is very big (when air/fuel ratio is rich).
- Depending on the sensor output voltage, the GCU corrects discharge duration corresponding with the oxygen concentration in the exhaust gas.



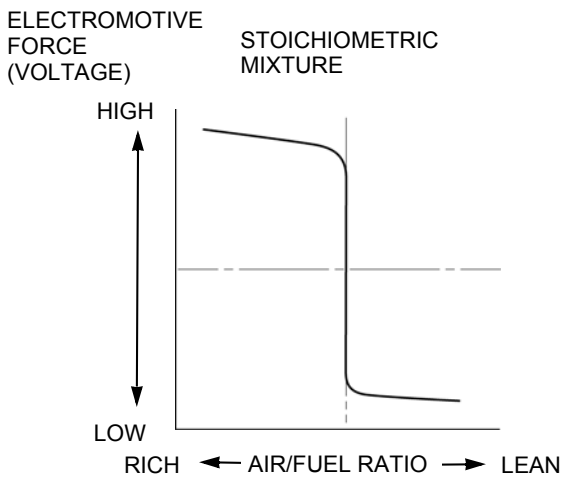




O2 SIGNAL VOLTAGE CHARACTERISTICS:

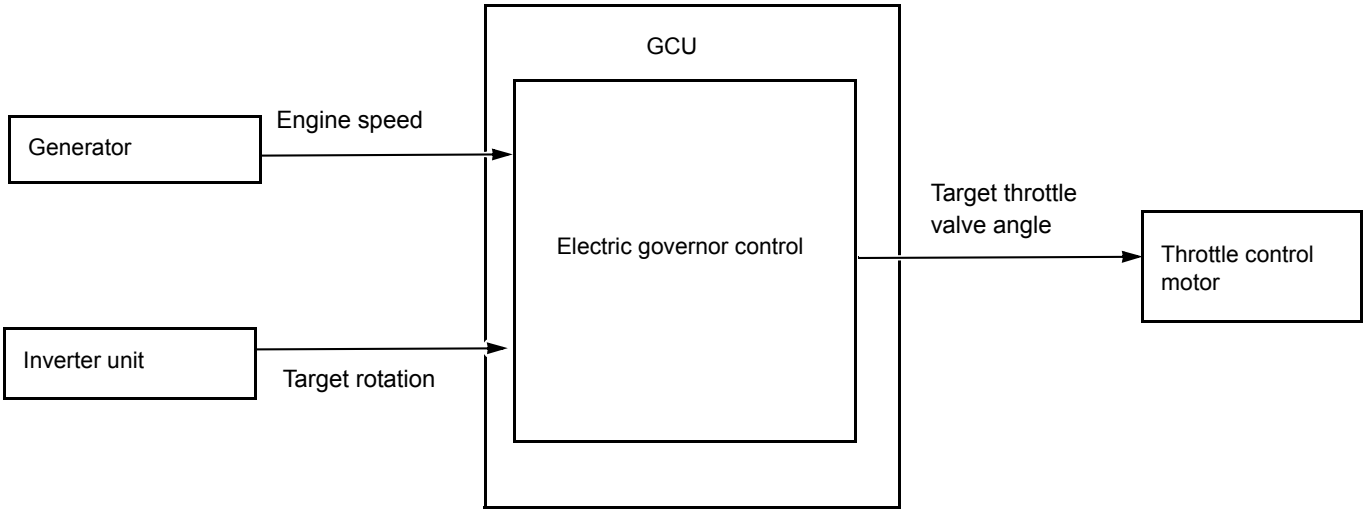


ELECTROMOTIVE FORCE CHARACTERISTICS:



TARGET ROTATION CONTROL

The GCU controls the volume of incoming air by opening/closing the throttle valve in order to obtain the target rotation that the inverter unit requires.



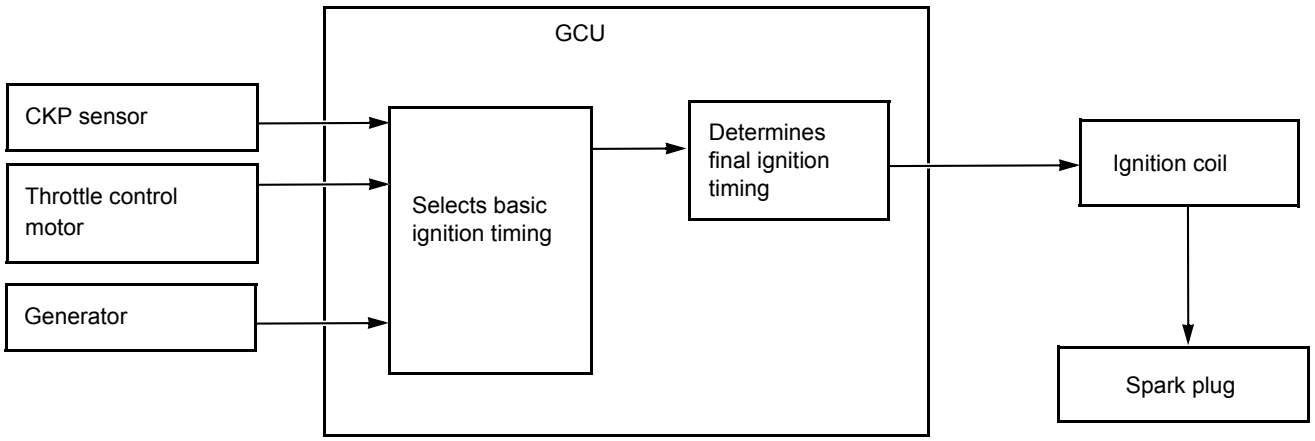
IGNITION SYSTEM

IGNITION TIMING CONTROL

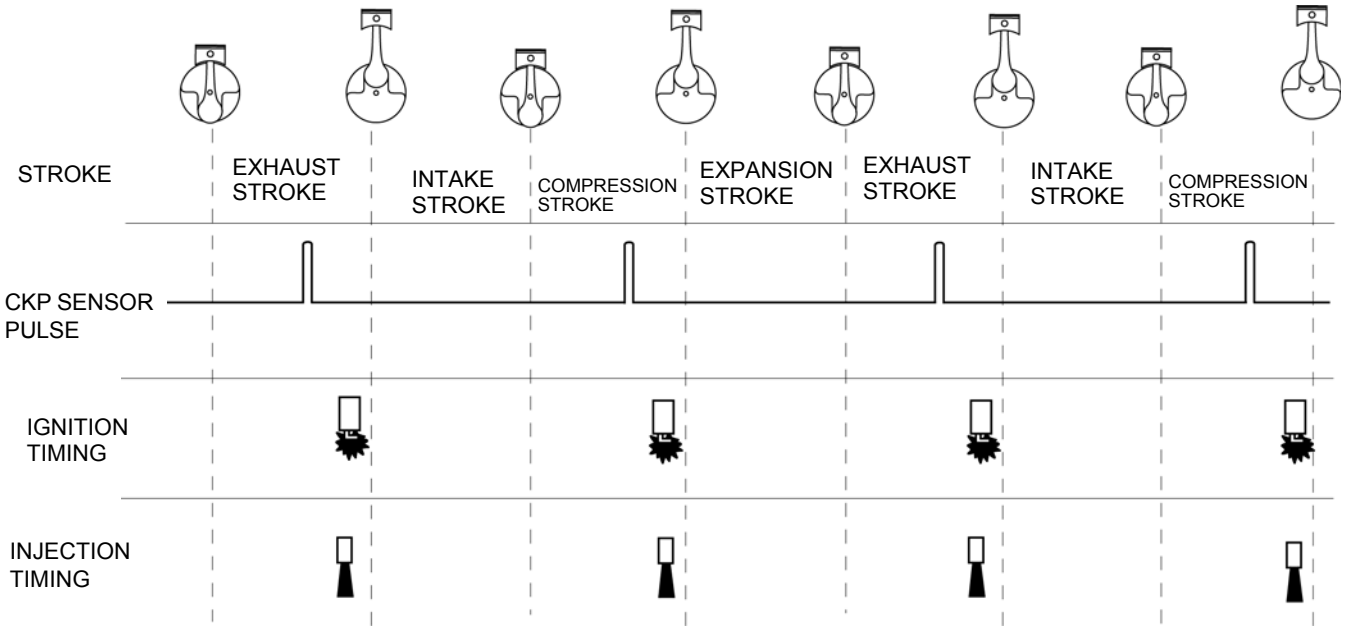
BASIC IGNITION TIMING

The ignition system uses a set of pre-programmed ignition timing values and chooses the most appropriate value according to the engine speed and throttle position. The GCU detects the engine speed by receiving ten pulse signals per one revolution of the crankshaft from the generator, and the throttle valve position according to the number of input pulses sent to the throttle control motor (stepping motor).

The GCU chooses the most appropriate ignition timing in order to gain the optimal balance of fuel economy and durability of the unit in any engine speed and output voltage.



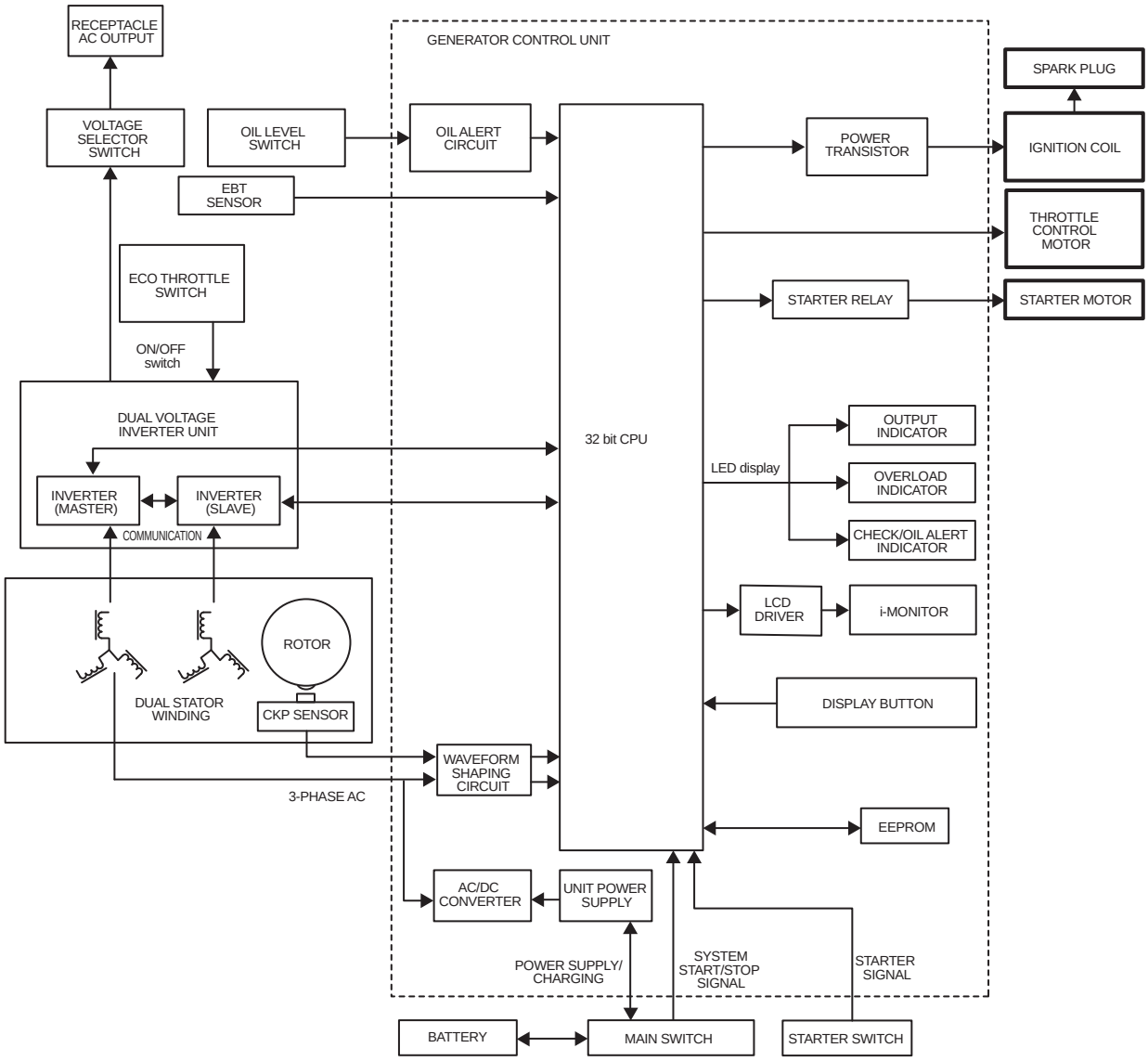
The GCU presumes the standard angle of ignition timing (TDC) based on one pulse signal per one revolution of the crankshaft from the CKP sensor, and then makes the spark plug ignite at the exhaust stroke and compression stroke.



The power for the ignition coil is supplied from the generator output in order to make battery-less operation possible.

OTHER GCU OPERATION

COMPONENT DIAGRAM



PRINCIPLE OF OPERATION

NORMAL START

Starting with the starter motor:

- When you turn the main switch to the ON position and press the starter switch, the CPU and the throttle valve are initialized by the battery.
  After they are initialized, the signal enters the CPU, operating the starter relay and the starter motor. When the generator coils generate voltage by engine rotation, the ignition system starts functioning and the engine starts.

Starting with the recoil starter:

- When the main switch is turned to the ON position and the recoil starter is operated, the generator coils generate voltage to activate the CPU and the throttle valve.
  The ignition system begins operating at this time so the engine can be started.

NORMAL STOP

When you turn the main switch to the OFF position, the stop signal is transmitted to the GCU and to the inverter unit. The inverter unit stops generator output. The GCU shuts off the fuel supply and ignition in order to stop the engine.

ENGINE SPEED LIMITER

The ignition is cut off when the engine speed exceeds 4,400 rpm, and ignition is resumed when engine speed goes below 4,400 rpm, which protects the generator system from engine over-speeding. However, if the engine speed exceeds 3,900 rpm for more than 3 seconds, the i-Monitor will display an error code and the engine will be shut down.

OIL ALERT

When the engine oil runs low, activating the oil level switch, the ignition is cut off. At the time the engine is stopped, the Oil Alert indicator (red) comes ON and the i-Monitor displays “OIL”.

STARTER MOTOR

When you press the starter switch, the CPU receives the signal, operating the starter relay and the starter motor. The starter relay is controlled so that it cannot be activated when the engine is running.

COMMUNICATION WITH INVERTER

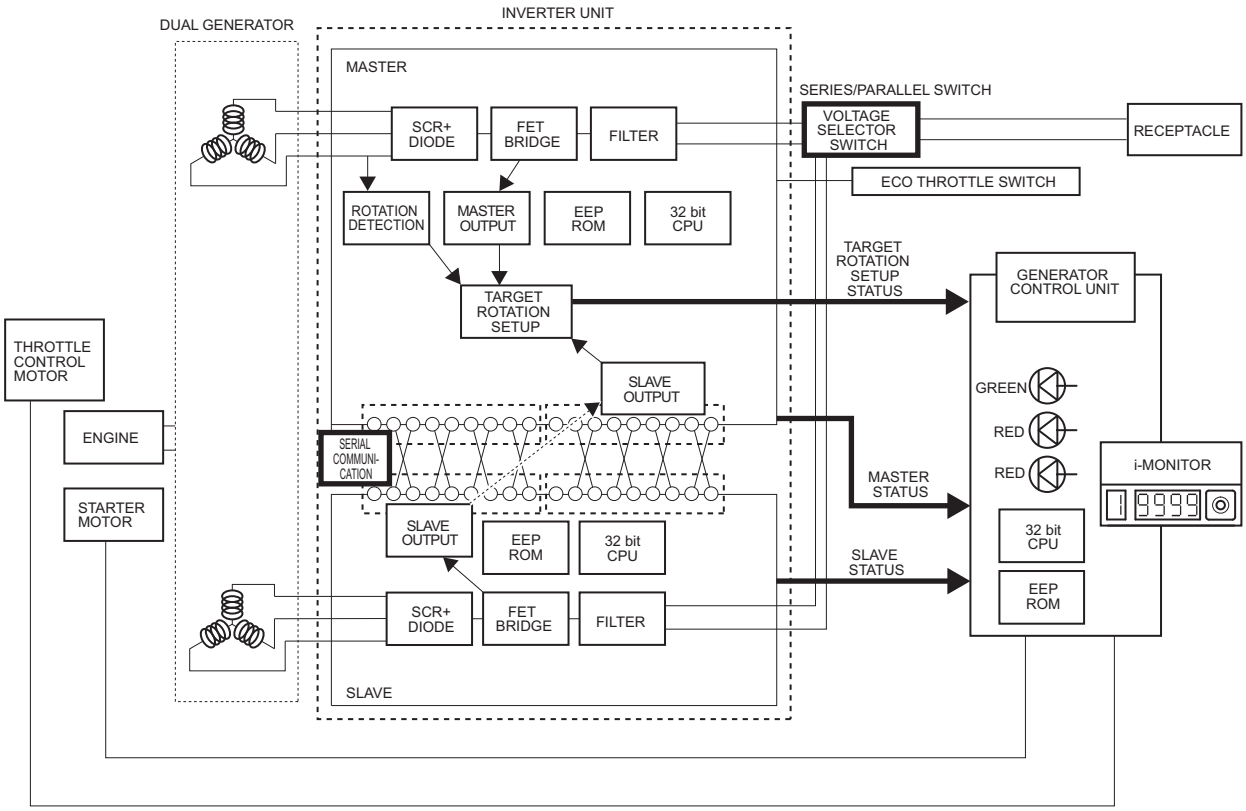
The control unit and inverters are constantly communicating during operation, transmitting signals for inverter problem detection and generator output status. When the communication line is disconnected or the inverter breaks down, a fail-safe procedure will be performed.

BATTERY CHARGE

When the generator is operating, the battery is charged by the inverter with a controlled output of 0.6 A. The charging is stopped when the battery voltage reaches 14.5 V. The charging is also stopped when the battery voltage becomes less than 3 V, assuming the battery terminals are disconnected.

INVERTER UNIT

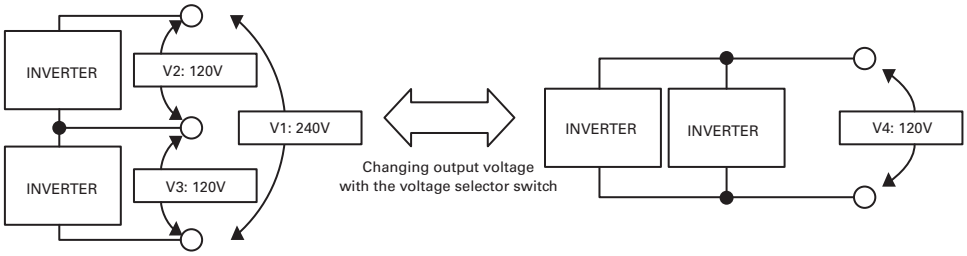
COMPONENT DIAGRAM



PRINCIPLE OF OPERATION

DUAL VOLTAGE INVERTER

Two 3-phase alternators are built in the generator.
The inverter unit consists of two inverters, a master and a slave, and it maintains synchronization by having them communicate with each other.
You can obtain power at two levels of voltage by connecting the two inverters in series or in parallel.
When the inverters are connected in series, you can obtain 120 volt output from either inverter. The output in this case is one half of the rated power.

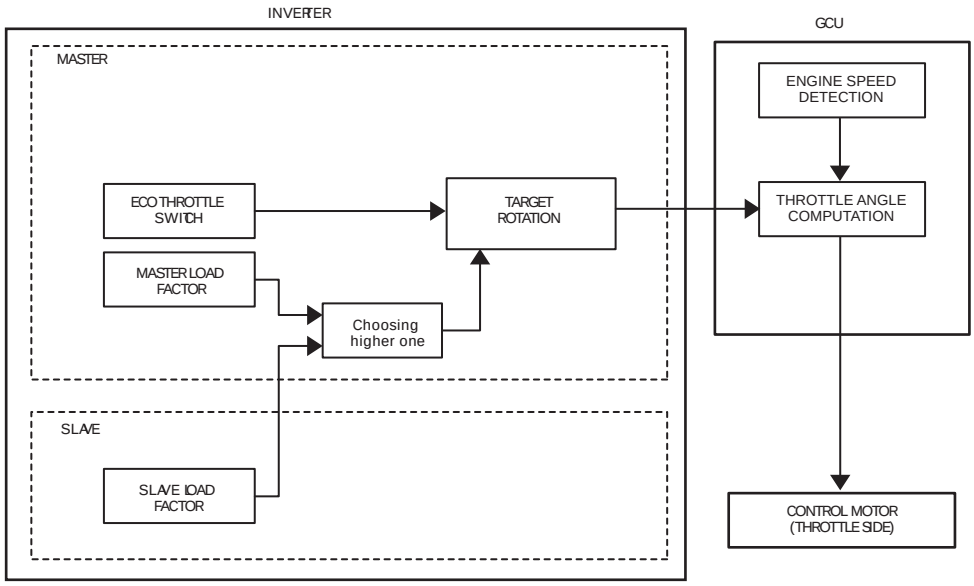


AC OVERLOAD PROTECTION

Each of these two inverters is equipped with an over-current protection function. The output indicator (green) is turned on during the normal operation, and if an overload is detected, the overload indicator (red) will be turned on by the output current detector circuit. If the overload lasts 10 seconds or more, the AC output from the generator is shut down in order to protect the generator. When the inverters are connected in series with only one inverter generating output, the over-current protection function operates at about one half of the rated power to shut down AC output.

ECO THROTTLE

The Eco Throttle sets the engine speed based upon the engine load factor and temperature. When the inverters are connected in series generating output only from one inverter, the engine speed is controlled based upon the inverter with the high load factor. The 3-phase AC output supplies power for the engine speed control.

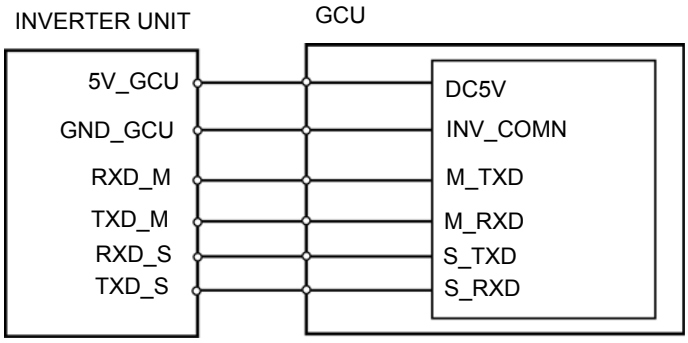


ENGINE STALL PREVENTION

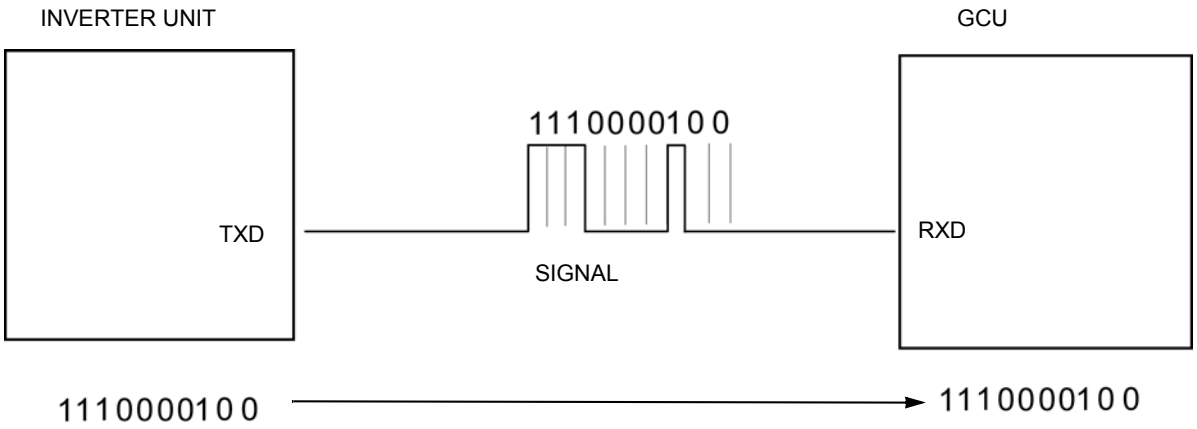
The engine load is detected by the GCU based on the throttle angle and engine speed. When the engine load exceeds engine capacity, the inverter limits the output voltage.
This function prevents the reduction of engine speed in order to realize the efficient use of engine power, improving the maximum output and providing enough output to keep up with a heavy load such as an electric motor.

COMMUNICATION WITH GCU

The communication between the inverter unit and GCU is done via a serial communication line that sends data signals one bit at a time.

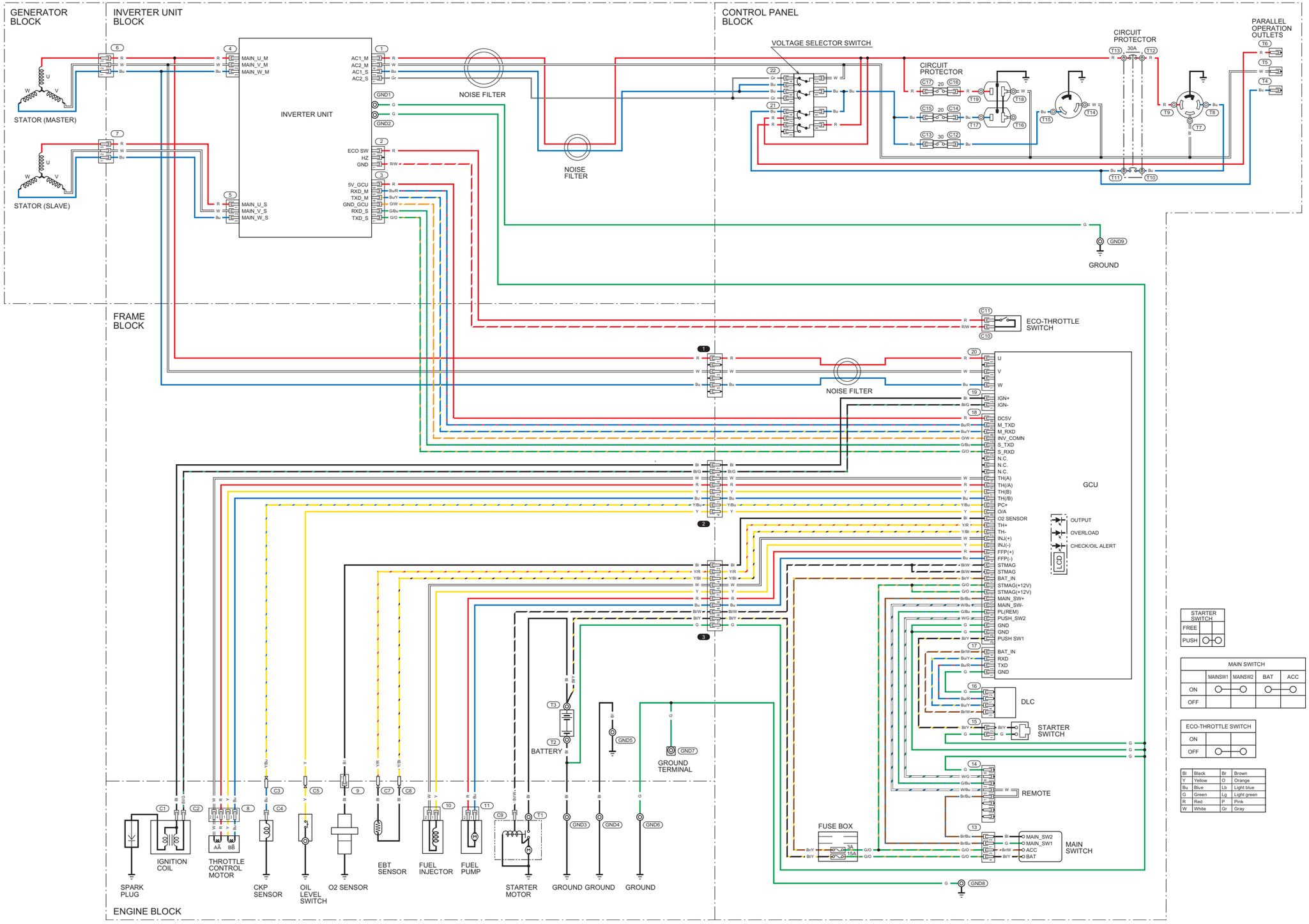


EXAMPLE OF SERIAL COMMUNICATION:



17. WIRING DIAGRAMS

WIRING DIAGRAM (AT TYPE)



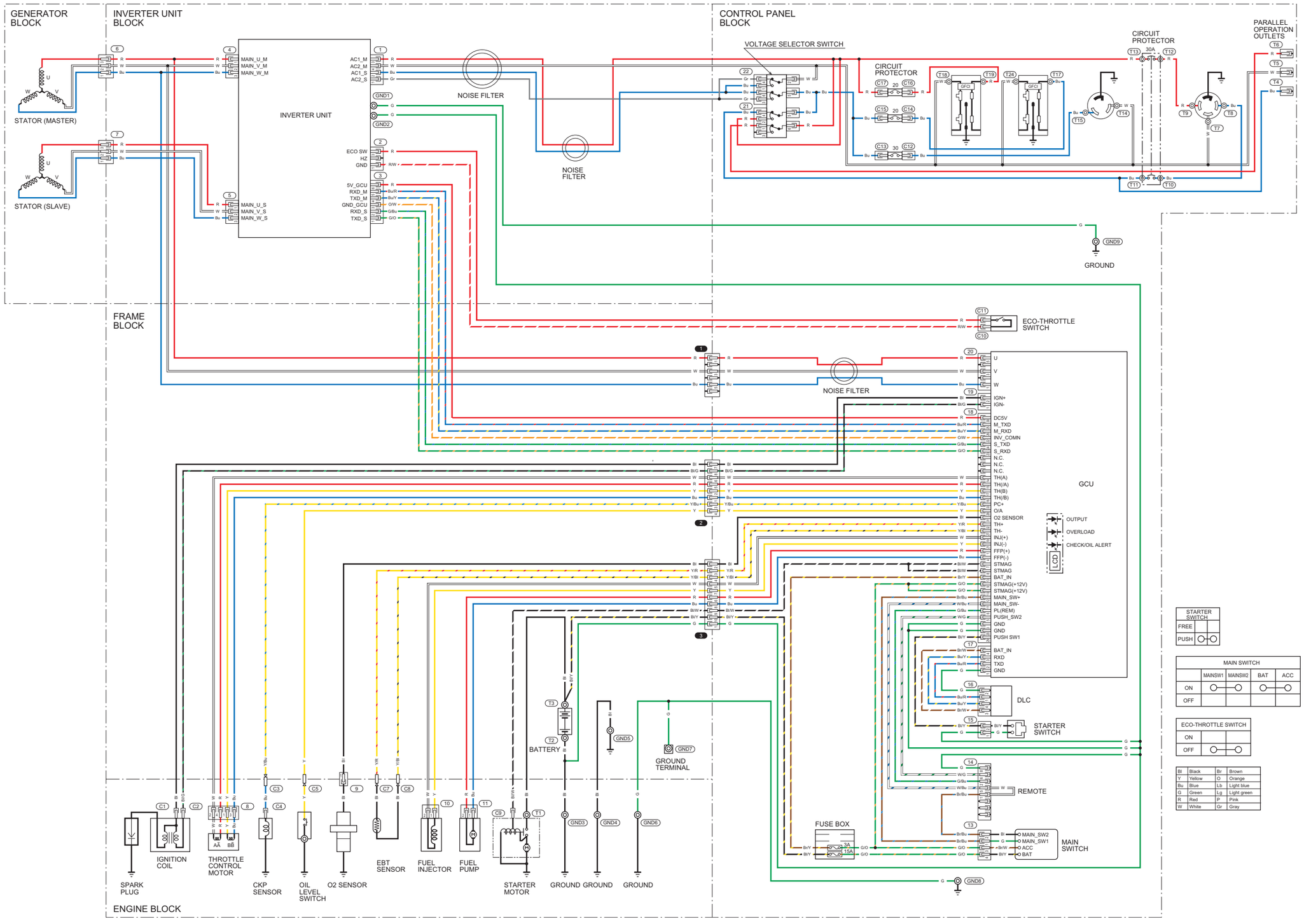
STARTER SWITCH		
FREE		
PUSH	○	○

MAIN SWITCH				
	MAINSW1	MAINSW2	BAT	ACC
ON	○	○	○	○
OFF				

ECO-THROTTLE SWITCH		
ON		
OFF	○	○

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

WIRING DIAGRAM (AT1 TYPE)



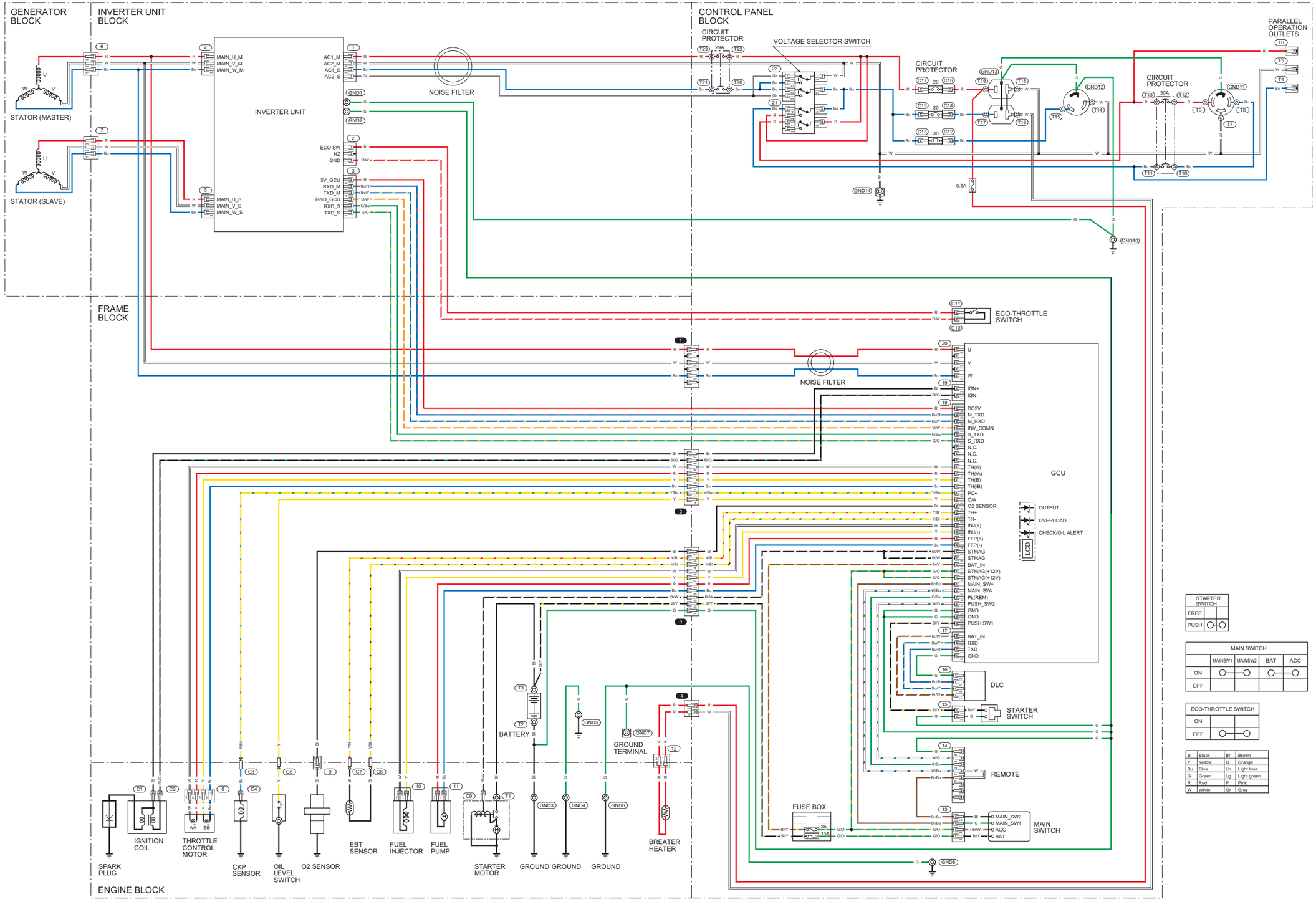
STARTER SWITCH		
FREE		
PUSH	○	○

MAIN SWITCH				
	MAINSW1	MAINSW2	BAT	ACC
ON	○	○	○	○
OFF				

ECO-THROTTLE SWITCH		
ON		
OFF	○	○

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

WIRING DIAGRAM (CT TYPE)



STARTER SWITCH		
FREE		
PUSH	○	○

MAIN SWITCH				
	MAINSW1	MAINSW2	BAT	ACC
ON	○	○	○	○
OFF				

ECO-THROTTLE SWITCH		
ON		
OFF	○	○

Bl	Black	Br	Brown
Y	Yellow	O	Orange
Bu	Blue	Lb	Light blue
G	Green	Lg	Light green
R	Red	P	Pink
W	White	Gr	Gray

MEMO

INDEX

MEMO