BARONESS®
Quality on Demand

Bunker rake
SP05
Service manual

Serial No.#10151~

Vol.1

Introduction

This manual describes items such as the maintenance and troubleshooting procedures for this machine.
The items described in this manual have been systematically categorized into typical maintenance operations.
This manual does not describe the disassembly procedures for equipment that is designated as requiring repair by its manufacturer, such as the hydraulic equipment and engine. Contact a Baroness dealer or Kyoeisha for repairs.
Refer to the Owner's Manual for a description of how to operate, handle, and adjust the machine. Refer to the Parts Catalog if any parts are required.
Kyoeisha Co., Ltd.

Caution

The information described in this manual is subject to change without prior notice for improvement.

When replacing parts, be sure to use genuine Baroness parts or parts designated by Kyoeisha. Note that the Baroness product warranty may not apply to defects caused by the use of parts from other companies.

696cq5-001

This symbol is accompanied by the word "Danger," "Warning," or "Caution." All labels with this symbol describe important safety precautions, so please read such labels carefully and only operate the machine after you have understood them completely. Failure to adequately follow these safety precautions may cause an accident.

⚠ Danger

This symbol indicates that serious injury or death will occur if the warning is ignored.

⚠ Warning

This symbol indicates that serious injury or death may occur if the warning is ignored.

⚠ Caution

This symbol indicates that injury or damage to property may occur if the warning is ignored.

Contents

Contents

Safety instruction

Safety instructions

⚠ Danger

This machine is designed to ensure safe operation and has been tested and inspected thoroughly before shipment from the factory. The machine is equipped with safety devices to prevent accidents. However, whether the machine demonstrates its original performance level depends on the manner in which it is operated and handled, as well as the manner in which it is managed on a daily basis. Inappropriate use or management of the machine may result in injury or death. Observe the following safety instructions to ensure safe operation.

Before operating the machine

1. Before operating this machine, be sure to read the owner's Manual and make sure that you understand its content thoroughly. Learn how to operate each part and stop the machine in an emergency, and make sure that you are familiar with the safety indications.
2. If the operator cannot understand the Owner's Manual, it is the owner's responsibility to thoroughly explain its content.
3. Never allow children to operate or service the machine. Never allow adults that are unfamiliar with the instructions to operate or service the machine. Follow the age limit specified by the local government.
4. Do not operate the machine under the influence of alcohol or drugs or if you are pregnant.
5. Never operate the machine while people, especially children, or pets are nearby.
6. Keep in mind that the owner, operator, and mechanic are responsible for preventing accidents, and accidents can be prevented with the cooperation of all.
7. All operators and mechanics should receive proper training. The owner is responsible for ensuring that the operators receive training and the following must be thoroughly understood:
   [1] The basic safety precautions for operating a ride-on bunker rake.
   [2] Controlling the machine by applying the brake when it begins to slide on a slope is difficult.
   The main reasons why it may not be possible to control the machine on a slope are:
   - Insufficient tire grip
   - Driving too fast
   - Inadequate brake adjustment
   - The use of a model that is unsuitable for the job
   - Lack of awareness of the ground conditions (bumpy, icy, muddy), in particular, of the angle of gradient
8. Use clothing that is suitable for the job. Wear equipment such as a helmet, protective glasses, protective footwear, long pants and earmuffs. Do not wear a towel around your head or waist, or a scarf around your neck.
9. Make sure that the protection guard and covers are properly installed and undamaged.
10. The safety labels and operation labels should be preserved in their entirety. If they are damaged, become dirty, or peel off, please replace them with new ones.
11. Tighten any nuts, bolts, or screws that become loose to ensure that the machine is always operated under safe conditions.
12. Before starting, thoroughly check that the area where the machine is to be used is free of dangerous objects that can be thrown by the machine, such as rocks and wires.
13. Repair any sensors that are malfunctioning before operating the machine.
14. Check that the interlock system, safety guards, and covers are installed correctly and that they function properly. Repair these parts if there is a malfunction before operating the machine.
15. If the brake operation is faulty or the parking brake lever has noticeable play, be sure to adjust or repair them before operating the machine.
16. Do not use this machine if it has been modified.

17. Fuel is highly flammable so make sure that you take the following precautions when handling it.
    [1] Store fuel in containers specifically designed for this purpose.
    [2] Make sure that the fuel pipe is not damaged.
    [3] Refuel before operating the machine. Do not remove the fuel tank cap when the engine is running or when the engine is hot.
    [4] Refuel outdoors only and do not smoke while refueling.
    [5] Do not add too much fuel.
    [6] If fuel is spilled, do not start the engine. Move the machine away from the area where the fuel was spilled and then start the engine. Dispose of the spilled fuel properly.
    [7] Close the fuel tank and fuel container cap securely.
18. Warm the engine on cold days. Set the parking brake while warming the engine.

When operating or transporting the machine

1. This machine is not authorized for operation as a special motor vehicle. Do not operate it on public roads.
2. Make sure that the operator sits in the operator's seat when operating the machine. Do not carry passengers.
3. Do not start the engine in a closed space for there is a danger of carbon monoxide poisoning.
4. Before starting the engine, disengage all equipment, place the gearshift in neutral, and set the parking brake.
5. Operate the machine during the day or in an area with sufficient lighting. Do not operate the machine at night or in poor visibility.
6. Remember that there is no such thing as a safe slope. Operating on slopes requires particular care.
   To avoid overturning:
   [1] Do not stop or start suddenly on any slope.
   [2] Reduce speed when operating on a slope and when making sharp turns.
   [3] Always stay alert for bumps and other hidden obstacles.
   [4] Never drive the machine across a slope unless the machine is designed to do so.
   [5] Never drive the machine on a slope with an angle of gradient that is greater than that specified or in a place where there is a danger of the machine slipping.
   [6] If instructed to do so in the Owner's Manual, use a counterbalance or wheel balance.
7. Always keep a lookout for hidden hollows or obstacles.
8. Do not take your eyes off the road ahead. Do not operate the machine with no hands.
9. Reduce speed when turning or crossing roads or sidewalks, and pay close attention to your surroundings when proceeding.
10. Use care when approaching blind corners, shrubs, trees, or other objects that may obscure your vision.
11. When using attachments, never direct the discharge at bystanders or allow anyone near the machine while it is operating.
12. Do not crawl under the machine while it is in operation.
13. Before backing up, look down and behind you to check that the path is clear and that you can back up safely. Have someone guide you if it is difficult to check the area behind you.
14. Do not operate the machine with damaged protection guards or with guards not installed properly. Be sure to install the covers.
15. Never remove the interlock systems. Make sure that they are properly adjusted before operation.
16. Do not change the engine governor setting or operate the engine at too high a speed. Doing so could result in an accident causing injury or death, or a malfunction.
17. Do not touch the exhaust system during operation or just after the engine has been turned off. Due to its high temperature, doing so could cause burns.
18. If an unusual vibration occurs, stop the engine immediately, inspect the machine and try to identify the cause. Make repairs if necessary.
19. Wear earmuffs as the noise level experienced in the operator's position during operation may exceed the specified level.

20. Before leaving the operator's seat:
    [1] Move the machine to a level surface.
    [2] Lower the machine.
    [3] Set the parking brake.
    [4] If the machine is equipped with a transmission, place the gearshift in neutral.
    [5] Reduce the engine speed.
    [6] Stop the engine and remove the key.
21. Disengage the drive to each attachment except when operating the machine.
22. Set the parking brake, stop the engine, disengage the drive to each attachment, and remove the key under the following conditions:
    [1] Before refueling
    [2] Before adjusting the machine
    [3] Before removing blockages
    [4] Before checking, cleaning, or servicing the machine
    [5] After striking a foreign object or experiencing an abnormal vibration while operating the machine
23. When turning the engine off, close the throttle and then close the fuel valve if your model is equipped with one.
24. Close the fuel valve before transporting the machine.
25. Take care when loading or unloading the machine onto a trailer or a truck. Load or unload the machine in a flat and safe place. Before loading or unloading, set the parking brake on the truck or trailer, stop the engine, and chock the wheels.
26. When transporting the machine on a truck or a trailer, set the parking brake, stop the engine, and fasten the machine to the truck with a rope or other suitable restraining device that has sufficient strength.
27. When using a running board, select one with sufficient strength, length, and width and that will not cause the machine to slip.

Maintenance and storage

1. Before servicing or adjusting the machine, move the machine to a flat area, set the parking brake, turn the engine off, and then remove the key. Be sure to check that each part has completely stopped operating before servicing or adjusting the machine.
2. Before servicing or adjusting the machine, be sure to disconnect the battery. To remove the battery, disconnect the negative battery cable first. To install the battery, connect the positive battery cable first.
3. To prevent a fire, keep the engine, muffler, and battery areas free of excessive grease, grass, leaves, and dust.
4. Make sure that parts such as wires are not touching each other and that their covers have not come off.
5. When filling the tires with air, do not allow the air pressure in the tires to exceed the specified maximum.
6. Check that all nuts, bolts, and screws are properly tightened to ensure that the machine is always operated under safe conditions.
7. Check whether all parts of the machine are in good working condition.
8. Check whether line connectors in the hydraulic system are properly tightened. Before applying hydraulic pressure, check the connections of the hydraulic pressure lines and the condition of the hoses.
9. Do not modify the machine.
10. Take care that your fingers do not get crushed while servicing or making adjustments to the machine.
11. Keep hands and feet away from moving parts. If possible, avoid making any adjustments while the engine is running. Do not allow people to approach the machine's surroundings.
12. Take care when removing equipment that may have pressure such as that from a spring applied to it.
13. Be sure to depressurize the hydraulic system before performing maintenance operations on it such as removing hydraulic equipment.
14. When checking the hydraulic circuit for pinhole leaks or oil leakage from nozzles, do not use your hands. Use items such as paper or corrugated cardboard to find leakage points. Be extremely careful with high-pressure oil as it may pierce your skin, resulting in an injury.
15. Do not change the engine governor setting or operate the engine at a speed higher than this setting. Check the maximum engine speed using a tachometer.

16. Stop the engine and allow it to cool before checking or refilling the engine oil.
17. When the fuel tank needs to be cleaned, do it outdoors.
18. Charge the battery in a well ventilated area, away from sparks and flames. Unplug the battery charger before connecting it to the battery. Also, wear protective clothing and use insulated tools.
19. Make sure that the electrolyte is between the “UPPER” and “LOWER” limits. Should your skin or clothes come into contact with electrolyte, immediately wash the affected area with water.
20. When necessary, use an appropriate chain block, hoist, or jack to lift the machine. Support the lifted machine securely using a jack stand or an appropriate block.
21. Appropriately manage and correctly use the tools necessary for servicing or adjusting the machine.
22. Consult a Baroness dealer or Kyoeisha when major repairs or assistance is required.
23. For safety and maximum performance, use genuine Baroness parts and accessories. Note that the Baroness product warranty may not apply if parts or accessories from other companies are used.
24. Empty the fuel tank and keep the machine away from ignition sources when storing the machine in a building where sparks and open flames are used.
25. Let the engine cool down before storing the machine in a closed space.
26. When storing the machine, lower the rake.
27. When storing the machine, close the fuel valve.
28. When storing the machine for an extended period of time, remove the battery and the ignition key. If the machine is going to be stored with the battery still attached, disconnect the negative battery cable.
29. Only cover the machine with a sheet after hot parts have sufficiently cooled down.

Jacking up the machine

⚠ Warning

When replacing a tire or beginning any other maintenance or repairs, be sure to chock the wheels to prevent the machine from moving. Before jacking up the machine, park it on a hard, flat surface such as a concrete floor and remove any obstacles that could prevent you from performing the work safely. When necessary, use an appropriate chain block, hoist, or jack. Support the machine securely with jack stands or appropriate blocks. Failure to do so may cause the machine to move or fall, resulting in injury or death.

Use the jack-up points identified in this manual when jacking up the machine.
Only place a jack under the jack-up points specified. Placing a jack at any other point could result in damage to the frame or other parts.

Safety labels and operation labels

⚠ Warning

Safety labels and operation labels are attached to this machine. Make sure that they are preserved in their entirety. If they are damaged, become dirty, or peel off, replace them with new ones.

Part numbers for labels that need to be replaced are listed in the parts catalog. Order them from a Baroness dealer or Kyoeisha.

Disposal

Waste disposal

Make sure that waste generated when servicing or repairing the machine is disposed of in accordance with local regulations.
(e.g. waste oil, antifreeze batteries, rubber products, and wires etc.)

Unit conversion table

Inch–millimeter conversion table

1 mm = 0.03937 in
1 in = 25.4 mm

Fractions			Decimals	mm	Fractions			Decimals	mm
		1/64	0.015625	0.397			33/64	0.515625	13.097
	1/32		0.03125	0.794		17/32		0.53125	13.494
		3/64	0.046875	1.191			35/64	0.546875	13.891
1/16			0.0625	1.588	9/16			0.5625	14.288
		5/64	0.078125	1.984			37/64	0.578125	14.684
	3/32		0.9375	2.381		19/32		0.59375	15.081
		7/64	0.109275	2.778			39/64	0.609375	15.478
1/8			0.1250	3.175	5/8			0.6250	15.875
		9/64	0.140625	3.572			41/64	0.640625	16.272
	5/32		0.15625	3.969		21/32		0.65625	16.669
		11/64	0.171875	4.366			43/64	0.671875	17.066
3/16			0.1875	4.762	11/16			0.6875	17.462
		13/64	0.203125	5.159			45/64	0.703125	17.859
	7/32		0.21875	5.556		23/32		0.71875	18.256
		15/64	0.234375	5.953			47/64	0.734375	18.653
1/4			0.2500	6.350	3/4			0.7500	19.050
		17/64	0.265625	6.747			49/64	0.765625	19.447
	9/32		0.28125	7.144		25/32		0.78125	19.844
		19/64	0.296875	7.541			51/64	0.796875	20.241
5/16			0.3125	7.938	13/16			0.8125	20.638
		21/64	0.328125	8.334			53/64	0.828125	21.034
	11/32		0.34375	8.731		27/32		0.84375	21.431
		23/64	0.359375	9.128			55/64	0.859375	21.828
3/8			0.3750	9.525	7/8			0.8750	22.225
		25/64	0.390625	9.922			57/64	0.890625	22.622
	13/32		0.40625	10.319		29/32		0.90625	23.019
		27/64	0.421875	10.716			59/64	0.921875	23.416
7/16			0.4375	11.112	15/16			0.9375	23.812
		29/64	0.453125	11.509			61/64	0.953125	24.209
	15/32		0.46875	11.906		31/32		0.96875	24.606
		31/64	0.484375	12.303			63/64	0.984375	25.003
1/2			0.5000	12.700	1			1.000	25.400

US unit–SI unit conversion table

To Convert			Into		Multiply By
Linear Measurement	Miles	mi	Kilometers	km	1.609
	Yards	yd	Meters	m	0.9144
	Feet	ft	Meters	m	0.3048
	Feet	ft	Centimeters	cm	30.48
	Inches	in	Meters	m	0.0254
	Inches	in	Centimeters	cm	2.54
	Inches	in	Millimeters	mm	25.4
Area	Square Miles	$mile^2$	Square Kilometers	km^2	2.59
	Square Feet	ft^2	Square Meters	m^2	0.0929
	Square Inches	in^2	Square Centimeters	cm^2	6.452
	Acre	ac	Hectare	ha	0.4047
Volume	Cubic Yards	yd^3	Cubic Meters	m^3	0.7646
	Cubic Feet	ft^3	Cubic Meters	m^3	0.02832
	Cubic Inches	in^3	Cubic Centimeters	cm^3	16.39
Weight	Tons (Short)	sh tn	Metric Tons	ton	0.9078
	Pounds	lb	Kilograms	kg	0.4536
	Cunces (Avdp.)	oz	Grams	g	28.3495
Pressure	Pounds/Sq. In.	psi	Kilopascal	kPa	6.895
	Pounds/Sq. In.	psi	Bar	$mdyn/cm^2$	0.069
Work	Foot-pounds	lb-ft	Newton-Meters	N-m	1.356
	Foot-pounds	lb-ft	Kilogram-Meters	kgf-m	0.1383
	Inch-pounds	lb-in	Kilogram-Centimeters	kgf-cm	1.152144
Liquid Volume	Quarts	qt (us)	Liters	l	0.9463
	Gallons	gal (us)	Liters	l	3.785
Liquid Flow	Gallons/Minute	gal/min	Liters/Minute	l/min	3.785
Temperature	Fahrenheit	°F	Celsius	°C	1. Subract 32° 2. Multiply by 5/9

List of maintenance standards

SP05

Engine	Model	Vanguard 356447	
	Maximum no-load engine speed	3,000±100 rpm	
	Governed idle	1,400±100 rpm	
	Spark plug gap	0.76 mm (0.030 in)	Champion RC12YC
	Spark plug torque	20 N-m (177.02 lb-in)	
	Armature air gap	0.20 - 0.30 mm (0.008 - 0.012 in)	
	Intake valve clearance	0.10 - 0.15 mm (0.004 - 0.006 in)	
	Exhaust valve clearance	0.10 - 0.15 mm (0.004 - 0.006 in)	
	Amount of engine oil	1.6 L (1.7 US quarts) including the filter	Oil classified as SF-grade or higher under the API service classification
	Engine oil viscosity	Normal (ambient temperature of 5° or higher): SAE30	
		Winter (ambient temperature of 5° or less): SAE20	
Main unit	Fuel tank capacity	15 L (3.96 US gallons)	Unleaded gasoline
	Hydraulic tank capacity	15 L (3.96 US gallons)	Shell Tellus Oil 46 or equivalent (ISO VG46)
	Pump belt tension	Adjust the belt tension so that the spring cover is not lifted.	H-PXSB43
	Tire pressure	Front wheel: 70 kPa (0.71 kgf/cm^2) (10.15 psi)	21×11.00-10
		Rear wheels: 40 kPa (0.41 kgf/cm^2) (5.80 psi)	25×13.00-9
	Outer distance of the thread part of lever adjusting fitting for pump neutal lever from the nut	10 mm (0.39 in)	
	Steering chain play	5 mm (0.20 in)	
	Brake pedal switch clearance	2 mm (0.079 in) or more	When the parking brake is set
		6 mm (0.24 in) or less	When the brake is fully depressed
	Forward/reverse pedal proximity switch clearance	5 mm (0.20 in) or less	Clearance between the switch and detection magnet
	Battery	46B19R (40B19R)	
Work machine	Number of links in the suspension chain (standard)	7 links	
	Rake fork depth (standard)	15 mm (0.59 in)	
	Arm stopper of the front blade	23 mm (0.91 in)	
	Height of the front blade when raised	200 mm (7.87 in)	
	Distance between the ends of the L-ball and screw shaft	65 mm (2.56 in)	

Work machine	Exposed threaded portion of the connecting shaft	20 mm (0.79 in)	
	Screw-in depth of the L-ball for the front blade	15 mm (0.59 in)	

Tightening torques

Standard tightening torques

Bolts and screws

Unless otherwise instructed, tighten bolts or nuts by the specified torque using an appropriate tool. Excessive tightening of a screw may cause it to become loose or damaged. The appropriate tightening torque depends on factors such as the type of screw, its strength, and the friction of its thread and bearing surface.
The following list is for galvanized and parkerized bolts only. The values given in this list do not apply to low-strength female screws.
Do not use a screw that has rusted or has foreign matter such as sand on it. Such a screw cannot be fully tightened even if it is tightened by the specified torque. The friction on the thread surface increases, causing a loss of torque that results in an insufficient tightening torque being exerted. If a screw is wet or oily, do not tighten it by the specified torque. If a screw gets wet, the torque coefficient decreases, resulting in excessive tightening of the screw if it is tightened by the specified torque.
Excessive tightening of a screw may cause it to elongate, resulting in the screw becoming loose or damaged. Do not use a screw that has already been subjected to a large load.
Tightening a bolt with an impact wrench requires skill. Practice tightening bolts to ensure you are able to tighten them reliably.

Nominal diameter	General bolts		
	Strength class: 4.8		
	 tib3yb-001		
	N-m	kgf-cm	lb-in
M5	3 - 5	30.59 - 50.99	26.55 - 44.26
M6	7 - 9	71.38 - 91.77	61.96 - 79.66
M8	14 - 19	142.76 - 193.74	123.91 - 168.17
M10	29 - 38	295.71 - 387.49	256.68 - 336.34
M12	52 - 67	530.24 - 683.20	460.25 - 593.02
M14	70 - 94	713.79 - 958.52	619.57 - 831.99
M16	88 - 112	897.34 - 1142.06	778.89 - 991.31
M18	116 - 144	1,182.85 - 1,468.37	1,026.72 - 1,274.54
M20	147 - 183	1,498.96 - 1,866.05	1,301.10 - 1,619.73
M22	295	3,008.12	2,611.05
M24	370	3,772.89	3,274.87
M27	550	5,608.35	4,868.05
M30	740	7,545.78	6,549.74

Nominal diameter	Heat-treated screws					
	Strength category: 8.8			Strength category: 10.9		
	 tib3yb-002			 tib3yb-003		
	N-m	kgf-cm	lb-in	N-m	kgf-cm	lb-in
M5	5 - 7	50.99 - 71.38	44.26 - 61.96	7 - 10	71.38 - 101.97	61.96 - 88.51
M6	8 - 11	81.58 - 112.17	70.81 - 97.36	14 - 18	142.76 - 183.55	123.91 - 159.32
M8	23 - 29	234.53 - 295.71	203.57 - 256.68	28 - 38	285.52 - 387.49	247.83 - 336.34
M10	45 - 57	458.87 - 581.23	398.30 - 504.51	58 - 76	591.43 - 774.97	513.36 - 672.68
M12	67 - 85	683.20 - 866.75	593.02 - 752.34	104 - 134	1,060.49 - 1,366.40	920.50 - 1186.03
M14	106 - 134	1,080.88 - 1,366.40	938.21 - 1,186.03	140 - 188	1,427.58 - 1,917.04	1,239.14 - 1,663.99
M16	152 - 188	1,549.94 - 1,917.04	1,345.35 - 1,663.99	210 - 260	2,141.37 - 2,651.22	1,858.71 - 2,301.26
M18	200 - 240	2,039.40 - 2,447.28	1,770.20 - 2,124.24	280 - 340	2,855.16 - 3,466.98	2,478.28 - 3,009.34
M20	245 - 295	2,498.27 - 3,008.12	2,168.50 - 2,611.05	370 - 450	3,772.89 - 4,588.65	3,274.87 - 3,982.95
M22	–	–	–	530	5,404.41	4,691.03
M24	–	–	–	670	6,831.99	5,930.17
M27	–	–	–	1,000	10,197.00	8,851.00
M30	–	–	–	1,340	14,628.78	11,860.34

Note: The above values also apply for fine screw threads.

Hydraulic hose

The tightening torques for union joints and union adaptors with parallel pipe threads (G, PF) are shown in the table below.
A union joint or adaptor will not become loose or leak as long as it is tightened by the specified torque. If fluid leaks from the sealed portion, do not attempt to tighten the union joint or adaptor forcibly. Examine whether any foreign matter or scratches are present on the seat surface.
Tightening a union joint or adaptor forcibly could damage the connection of the joints.
When tightening a union joint or adaptor, use a torque wrench where possible and firmly tighten it by an appropriate torque.

Nominal diameter	Nominal diameter of the parallel pipe threads	Tightening torque		
		N-m	kgf-cm	lb-in
5.5	1/4	24.50	250	221.28
8.9	3/8	49.03	500	564.91
12.0	1/2	58.84	600	677.89
15.0	3/4	117.68	1200	1,355.78
19.0	3/4	117.68	1200	1,355.78
25.0	1	137.30	1400	1,581.74
32.0	1-1/4	166.72	1700	1,920.69
38.0	1-1/2	205.94	2100	2,372.61
50.0	2	245.17	2500	2,824.54

Fittings with parallel threads (O-ring seal type)

The tightening torques for fittings with parallel threads (O-ring seal method) are shown in the table below.
Tightening an adjustable joint forcibly with a spanner or other such tool to secure it to a set position could damage the adjustable joint, its washers, and other parts. Be sure to tighten an adjustable joint to the torque appropriate to its size.

Nominal diameter of thread	Tightening torque		
	N-m	kgf-cm	lb-in.
1/4	34.32 - 49.03	350 - 500	309.79 - 442.55
3/8	68.65 - 78.45	700 - 800	619.57 - 708.08
1/2	98.07 - 117.68	1000 - 1200	885.10 - 1,062.12
3/4	147.10 - 176.52	1500 - 1800	1,327.65 - 1,593.18
1	245.17 - 274.59	2500 - 2800	2,212.75 - 2,478.28
1-1/4	294.20	3000	2,655.30
1-1/2	294.20	3000	2,655.30
2	392.27	4000	3,540.40

Principal tightening torques

SP05
When tightening the following bolts and nuts, tighten them by the torques specified below.
As for adhesive agent, apply mid-strength screw lock (ThreeBond 1322, anaerobic extra-strength sealants).

Section	Code	Part name	Tightening torque			Adhesive agent
			N-m	kgf-cm	lb-in.	
Two-wheel drive: Front wheel section	K0006100202	10 bolt 20S	29 - 38	295.71 - 387.49	256.68 - 336.34	–
	K0034120302	12 heat-treated bolt 30P1.5	67 - 85	683.20 - 866.75	593.02 - 752.34	–
	K0661205000	Rhombic flange unit UCFL205	–	–	–	Threaded portion of M6 set screws
Three-wheel drive: Front wheel section	K0006100202	10 bolt 20S	29 - 38	295.71 - 387.49	256.68 - 336.34	–
	K0160000492	24 special nut P1.5	180 - 200	1835.46 - 2039.40	1593.18 - 1770.20	–
	K0014120602	12 heat-treated bolt 60P1.5	67 - 85	683.20 - 866.75	593.02 - 752.34	–
	K0014120452	12 heat-treated bolt 50P1.5	67 - 85	683.20 - 866.75	593.02 - 752.34	–
	K0661205000	Rhombic flange unit UCFL205	–	–	–	Threaded portion of M6 set screws
Front wheel Arm section	K0013100502	10 heat-treated bolt 50	29 - 38	295.71 - 387.49	256.68 - 336.34	–
Rear wheel section	K0034120302	12 heat-treated 8T bolt 30P1.5	67 - 85	683.20 - 866.75	593.02 - 752.34	–
	K0160000492	24 special nut P1.5	180 - 200	1,835.46 - 2,039.40	1,593.18 - 1,770.20	Threaded portion

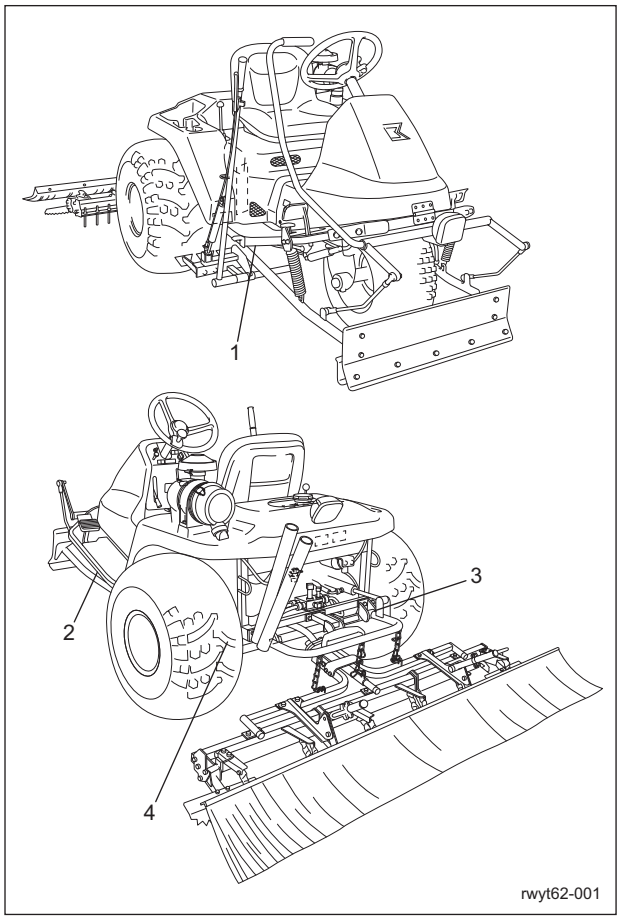
Jacking up the machine

Warning

When replacing a tire or beginning any other maintenance or repairs, be sure to chock the wheels to prevent the machine from moving. Before jacking up the machine, park it on a hard, flat surface such as a concrete floor and remove any obstacles that could prevent you from performing the work safely. When necessary, use an appropriate chain block, hoist, or jack. Support the machine securely with jack stands or appropriate blocks. Failure to do so may cause the machine to move or fall, resulting in injury or death.

Use the jack-up points identified in this manual when jacking up the machine.
Only place a jack under the jack-up points specified. Placing a jack at any other point could result in damage to the frame or other parts.

Jack-up points

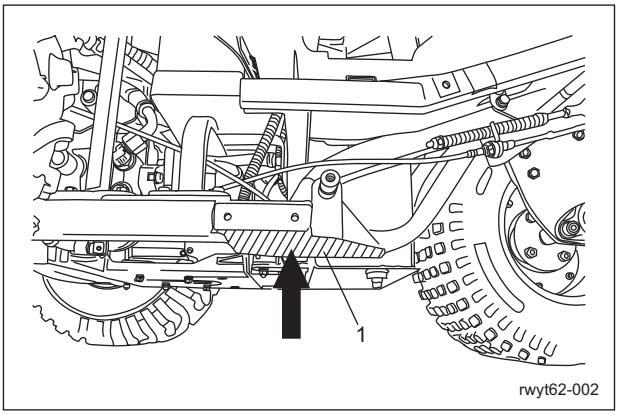


Jack-up points_001

	Jack-up point

1	Front right frame
2	Front left frame
3	Rear right frame
4	Rear left frame

1. Front right frame



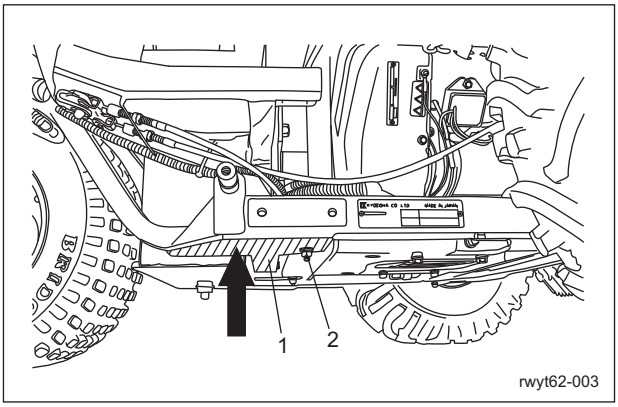
Jack-up points_002

1	Reinforcing plate

2. Front left frame

Important

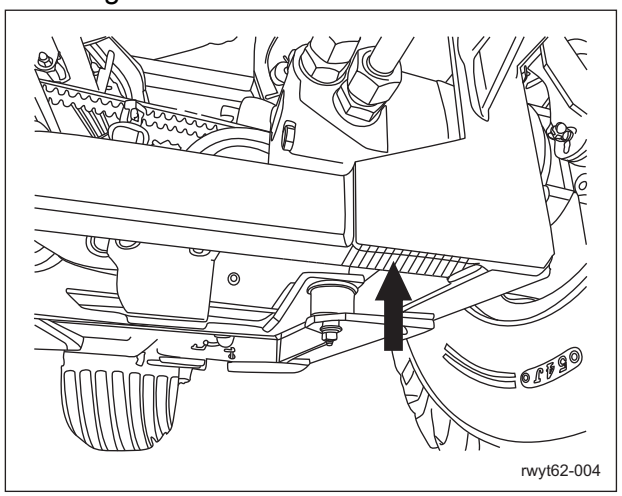
The reinforcing plate (1) is secured with a nut (2). Make sure that the jack does not strike the nut (2).



Jack-up points_003

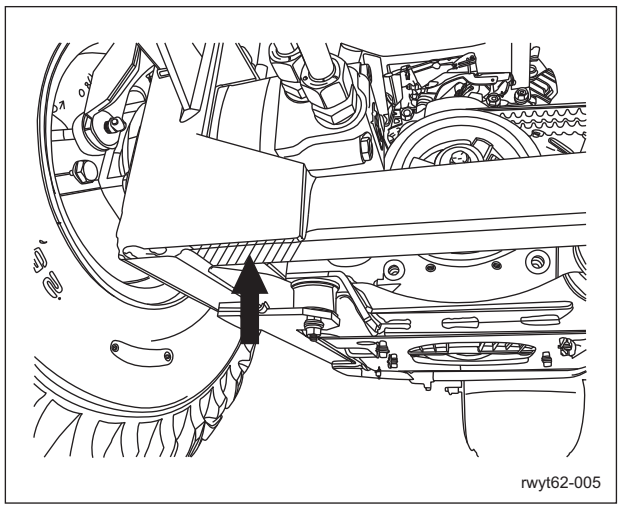
1	Reinforcing plate
2	Nut

3. Rear right frame



Jack-up points_004

4. Rear left frame



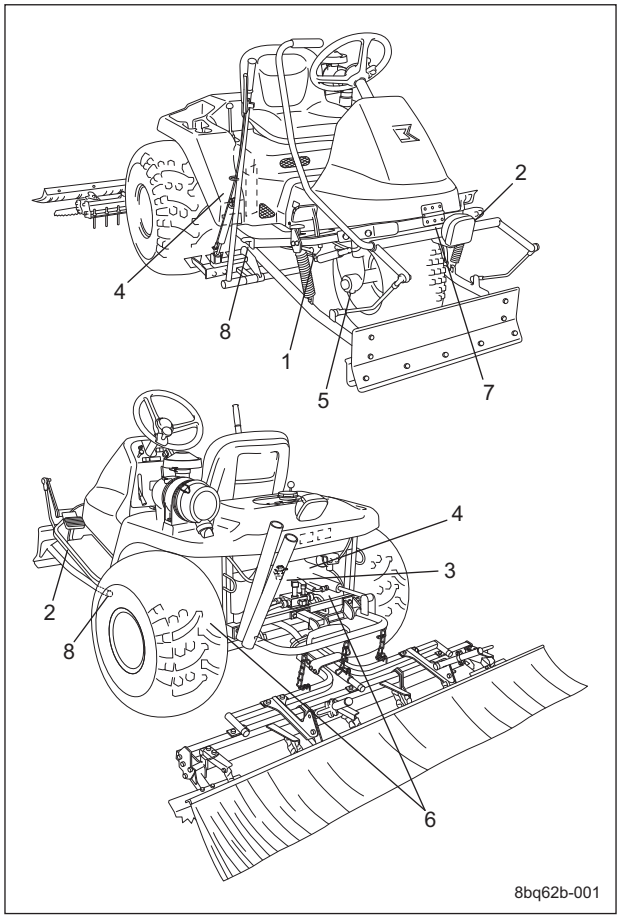
Jack-up points_005

Lubrication

The moving parts of this machine need to be lubricated as a lack of grease on such parts could cause them to seize or be damaged. Grease the moving parts according to the maintenance schedule.

Grease points

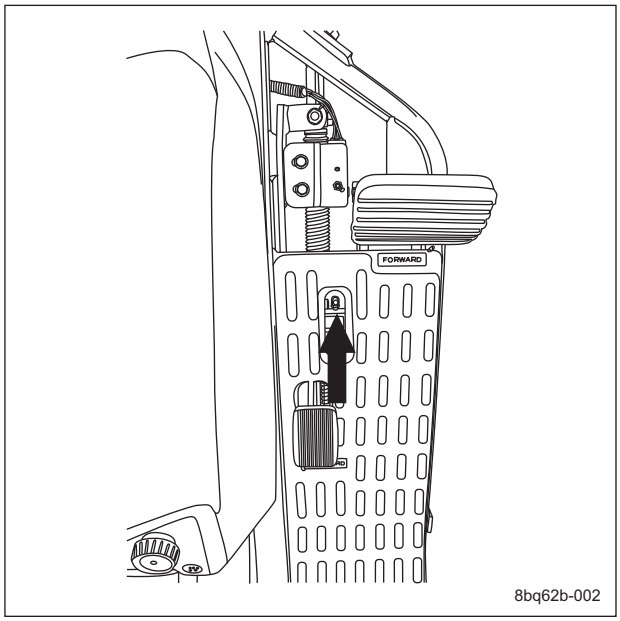
Grease nipples are installed in the following positions. Grease them every 50 hours.



Grease points_001

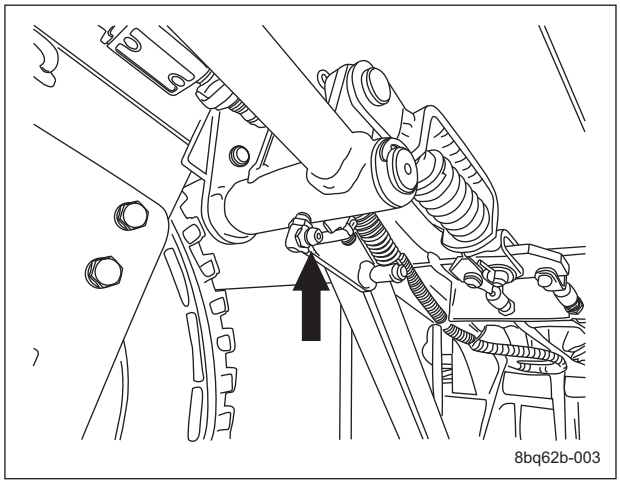
	Parts	Number of grease points	
		Two-wheel drive	Three-wheel drive
1	Forward/reverse pedals fulcrum	1	1
2	Brake pedal fulcrum	1	1
3	Belt tension lever	1	1
4	Pump neutral lever fulcrum	1	1
5	Front wheel axle's rhombic flange unit	2	1
6	Rear wheel brake lever fulcrum	2	2
7	Front blade lever fulcrum	1	1
8	Front blade arm fulcrum	2	2

1. Forward/reverse pedals fulcrum



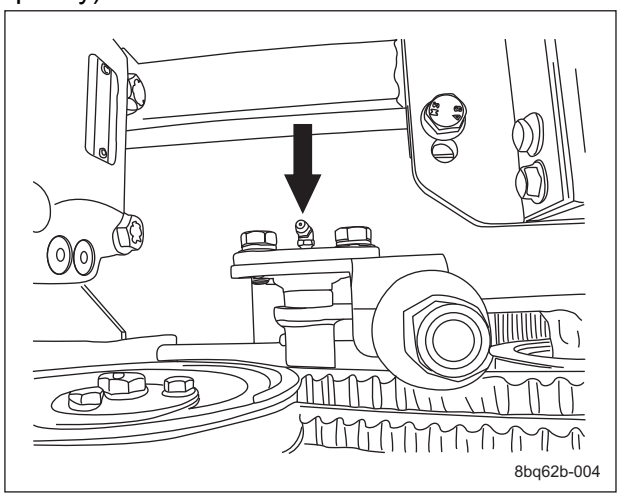
Grease points_002

2. Brake pedal fulcrum



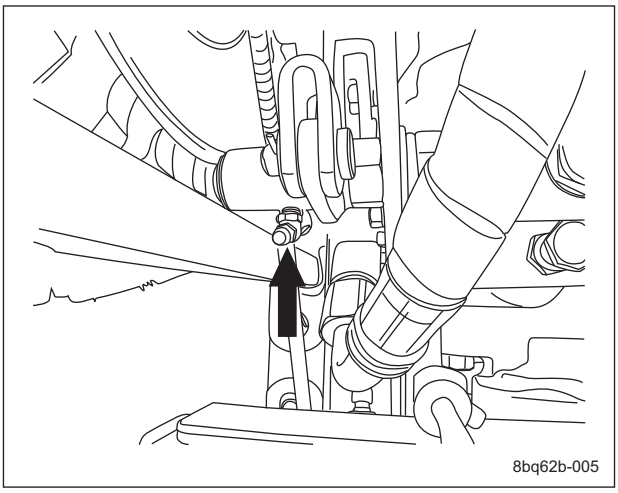
Grease points_003

3. Belt tension lever fulcrum (lower part of pump pulley)



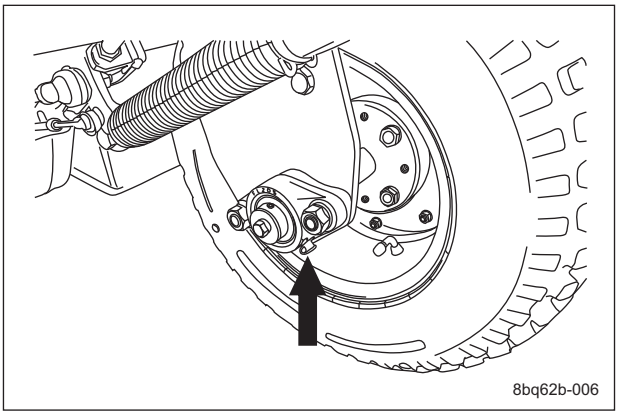
Grease points_004

4. Pump neutral lever fulcrum (upper part of piston pump)



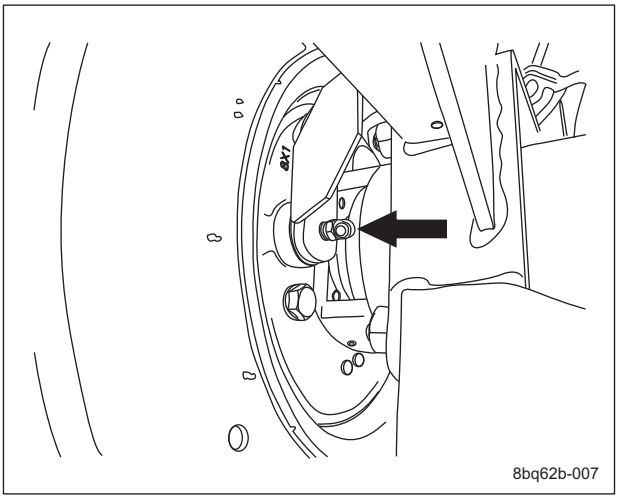
Grease points_005

5. Front wheel axle's rhombic flange unit

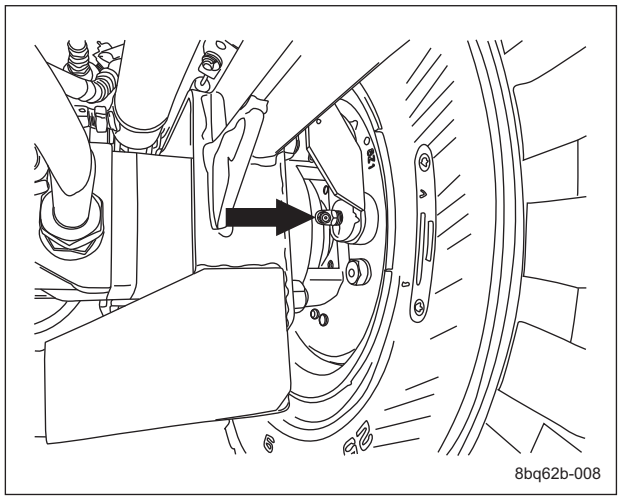


Grease points_006

6. Rear wheel brake lever fulcrum

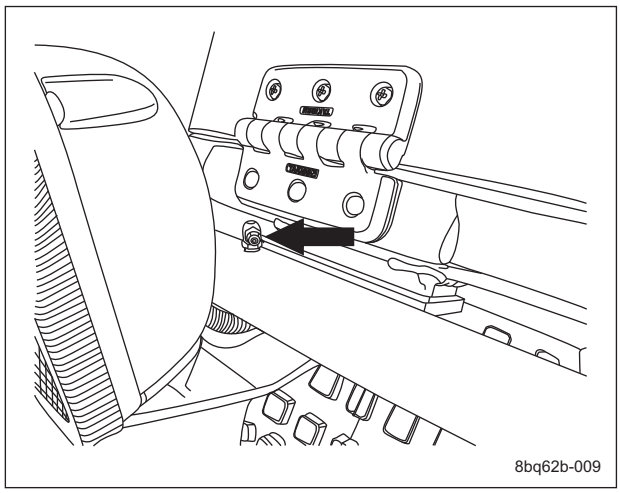


Grease points_007



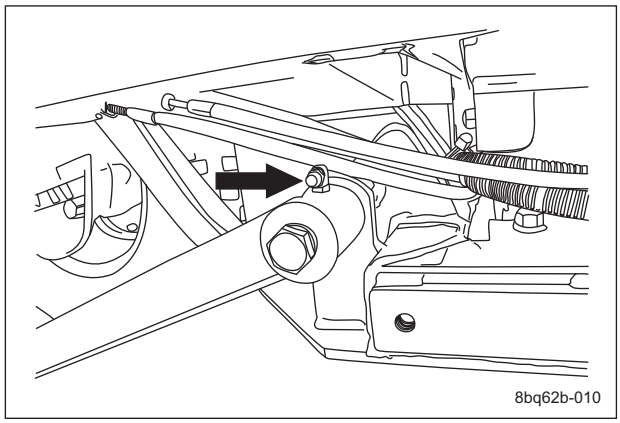
Grease points_008

7. Front blade lever fulcrum



Grease points_009

8. Front blade arm fulcrum



Grease points_010

Engine

Maintenance

Briggs & Stratton Vanguard 356447 engine is mounted on this equipment.
Refer to the owner's and service manual for engine details.

⚠ Danger

Observe the following safety instructions for safe inspection and maintenance.

1. Move the machine to a level surface to prepare for adjustment and maintenance. Apply the parking brake, stop the engine and remove the key. Make sure that each part has completely stopped moving before starting the procedures for adjustment, maintenance and so on.
2. Keep away from moving parts. Avoid adjustment as much as possible while the engine is running. Keep people away from the area.
3. Use an appropriate chain block, hoist and jack as needed. Securely support the lifted machine with a jack stand or an appropriate block.
4. Use only BARONESS genuine parts for replacement and accessories.
5. Do not start the engine in a enclosed room, poisoning by carbon monoxide may occur.
6. Do not touch the exhaust system while the engine is running or right after the engine has stopped. Its high temperature may cause a burn.
7. Keep flames away from the battery. Batteries emit hydrogen gas and mishandling may ignite it and cause an explosion.
8. The electrolytic solution in the battery is sulfuric acid. Contact with the electrolytic solution (sulfuric acid) may cause blindness or burns. Also, if it comes into contact with the vehicle, it may damage it.

Specifications

Engine model	Briggs and Stratton, 4-cycle, V-Twin Cylinder, OHV, Air Cooled, Gasoline Engine
Model	Vanguard 356447
Bore	72 mm (2.83 in)
Stroke	70 mm (2.75 in)
Displacement	570 cm^3 (34.8 in^3)
Fuel	Lead-free gasoline
Fuel pump	Diaphragm type
Carburetor	Float type
Governor	Mechanical
No-load max. RPM	3,000 ± 100 rpm
Governed idle	1,400 ± 100 rpm
Lubricating system	Forced lubrication by oil pump
Oil capacity	1.6 L (1.7 US quarts) including filter
Grade of Engine oil	API "service grade SF" or higher quality
Viscosity of Engine oil	Normal (Outside air temperature of 5 ° C or above) SAE30 Winter (Outside air temperature of 5 ° C or below) SAE20
Spark plug	Champion RC12YC
Starter	12 V starter motor
Alternator	Alternator with 16 amps regulator

Important

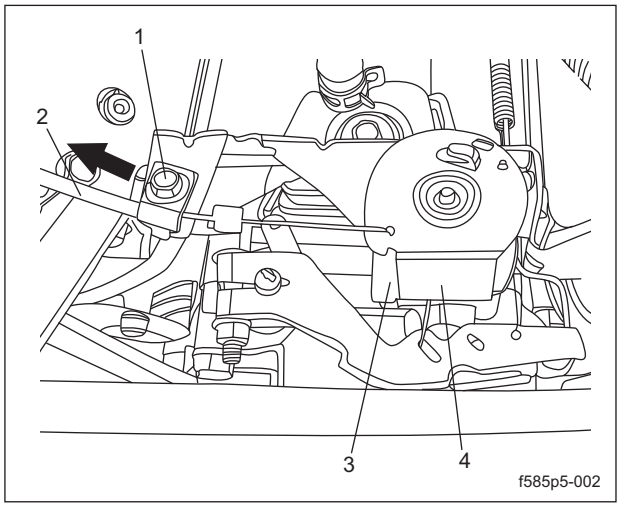
Engine output decreases 3.5% for every 300 m (1,000 feet) of altitude above sea level and 1% for every 5.6 ° C (10 ° F) at temperatures over 25 ° C (77 ° F).

Adjustment

Throttle wire

Adjustment of the speed control

Maneuver the speed control lever of the operating machine to control the engine speed. Set the control lever of the operating machine at “High Speed.” The swivel (4) on the control bracket must touch the stopper (3). To adjust, loosen the casing clamp screw (1). Move the casing wire (2) in the direction of the arrow until the swivel touches the stopper. Tighten the casing clamp screw.



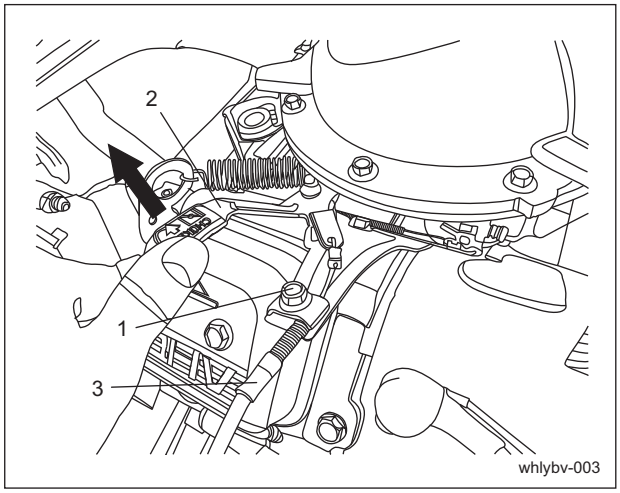
Adjustment of the speed control_001

1	Casing clamp screw
2	Casing wire
3	Stopper
4	Swivel

Choke wire

Adjustment of the choke control

Move the choke control lever of the operating machine to the “Choke” position. Loosen the casing clamp screw (1). Move the choke lever (2) until the choke closes completely. Then move the casing wire (3). Tighten the casing clamp screw.



Adjustment of the choke control_001

1	Casing clamp screw
2	Choke lever
3	Casing wire

General inspection and repair

Cooling system

Air-cooled engine

To prevent the engine from overheating, always keep the screen, cooling fin and other external surfaces clean.
Reference: Refer to the owner's manual for the cleaning cycle, procedures and the like of.

Important

Starting the engine with a blower housing with a dirty screen or cooling fin may cause the engine to overheat and become faulty.

1. Move this equipment to a level surface. Apply the parking brake, stop the engine, and remove the key.

Warning

Do not touch the engine and exhaust system maintenance. When hot the high temperature may cause injury. Let them cool before performing work.

Important

Do not clean the engine with a pressure washer. Water may enter its electrical system.

2. Clean the cooling fins over the cylinder head.

3. Clean the screen and fan housing of dust and impediments.
4. If the fan housing needs to be removed from the cooling system, the engine should be removed.

Important

Do not start the engine while the fan housing is not attached.

5. If the screen and fan housing have been removed, re-install them.

Air cleaner

A dirty air cleaner element could cause the engine to malfunction. Clean it properly to prolong the engine life.

Important

A properly maintained air cleaner protects the parts inside the engine from dust particles in the air. If cautionary notes on handling the air cleaner are not strictly observed, dirt and dust may be drawn into the engine and mix with the oil. Dirt in the oil forms a composite with abradability, and will wear out the rotating parts rather than protecting them. Be sure to inspect and clean the air cleaner.

Reference: Cleaning cycle, procedures and the like of are described in the Owner's manual.

Fuel tank

⚠ Danger

Handle fuel carefully since it is highly flammable. Always fill fuel outside and make sure there are no flames present during work. Do not open the fuel tank lid while the engine is running or is still hot. Feed fuel before starting work. Do not start the engine when fuel has been spilled. Start the engine only after moving it some distance away from any spilled fuel, and properly treat the spilled fuel. Securely close the lid of the fuel tank and fuel container.

Checking of the fuel line and connection

Check the fuel line and its connection regularly. Check for deterioration, damage, leakage or poor connections, and replace the hose, stopper and connector part as appropriate.

Draining of fuel and cleaning of the fuel tank

Important

Make sure that fuel is drained outside.

Drain fuel and clean the fuel tank regularly. Drain fuel and clean the fuel tank if the fuel system is dirty or if equipment is to be stored for a long time.
Use a pure solvent such as kerosene to clean the fuel tank and fuel hose. Sediment causes the fuel tank to get dirty.

Muffler

⚠ Warning

Do not touch the engine or exhaust system. The high temperature may cause injury. Start work only after they have cooled down.

Important

Do not clean the engine with a pressure washer. Water may penetrate into the electrical system.

Check the welded part of the muffler fitting bracket and muffler adaptor for cracks or damage. Check for cracks in the muffler joint, loosening of inner parts, or cracks of welded parts. Replace if broken.
Inspect and clean the area around the muffler and make sure it is free from scraps or dust.

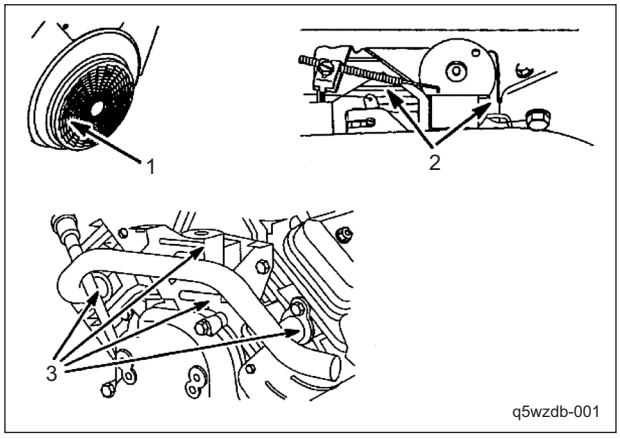
Inspection and repair of each section

Cooling system

Cleaning of the cooling system

After mowing dry grass or long operation in contaminated air, particles of grass, litter, dirt or the like of may clog the cooling system. Further operation with a clogged cooling system may cause the engine to overheat and result in a broken engine.
To reduce the risk of overheating and prevent any accumulated dust from catching fire, remove the engine dust regularly after the engine has cooled down.
Clean the finger guard (1). Always keep the linkage and spring, the control part (2) and the area around the muffler (3) free from dust.
(See "Cleaning of the cooling system_001.")

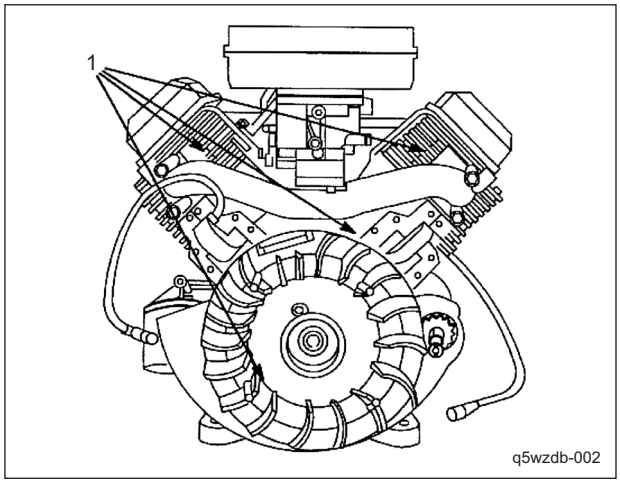
> **Caution**
>
> Clean with a brush or compressed air. Do not use water for cleaning engine parts, because water may enter the electrical system. Use a brush or dry cloth.



Cleaning of the cooling system_001

1	Finger guard
2	Control part
3	Around the muffler

Particularly after it has been used for a long time, the cooling system of the engine may get clogged with dust. To prevent overheating of and damage to the engine, remove the fan housing and clean the built-in cooling fins (1) and its surface every 100 hours or at the start of every season.

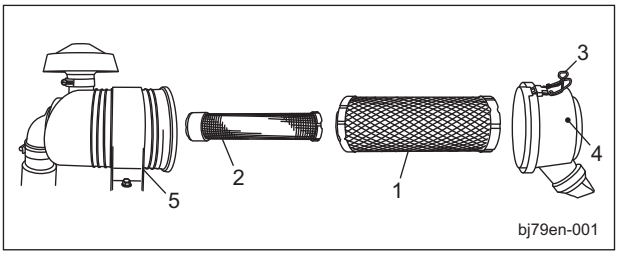


Cleaning of the cooling system_002

1	Cooling fins

Air cleaner

The air cleaner is a device that removes dust contained in the suctioned air, thereby reducing wear of cylinder liners and piston rings to keep the engine in good condition.
This air cleaner has a double layer composed of an outer and inner elements.
Clean the outer element (1) every 50 hours and replace it every 400 hours. Cleaning and replacement need to be done at shorter intervals if the contamination is heavy. Replace elements after one year of use regardless of the specified hours.
Replace the inner element (2) either at every 400 hours or after one year, whichever comes first.



Air cleaner_001

1	Outer element
2	Inner element
3	Clip
4	Cover
5	Air cleaner body

Cleaning and replacement of the air cleaner element

1. Remove the clip (3), cover (4), and outer element (1). (See “Air cleaner_001.”)
2. Taking care not to damage the element, tap on the solid part of the outer element (1) to remove dust and scraps.
   If the outer element is extremely dirty or its replacement time has arrived, replace it with a new one.

> **Caution**
>
> Do not clean the element with compressed air because that may impair the performance of the element.

3. When the inner element (2) reaches its replacement time, remove it from the air cleaner body (5) for replacement with a new one.

Caution

The inner element cannot be cleaned.
When replacing, take care not to let dust or scraps enter the engine.

4. Fit the inner element (2) to the air cleaner body (5).
5. Fit the outer element (1) over the inner element (2), put the cover (4) on, and securely lock with the clip (3).

Fuel cock

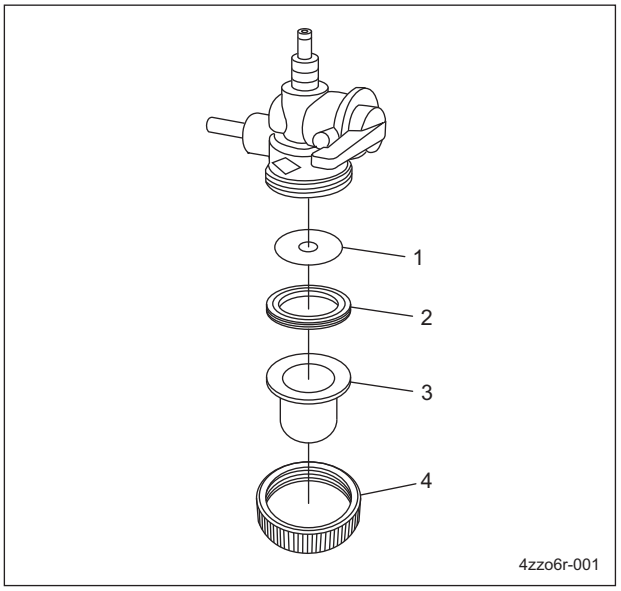
Cleaning of the fuel cock

Danger

No fire during operation.

The fuel cock is fitted beneath the fuel tank and acts to stop the flow of fuel to the carburetor. Clean inside the fuel cock after every 50 hours of use. Do so in a clean place free from dust or waste and with the fuel cock closed.

1. Remove the filter pot (3) to wash inside the filter pot and filter (1) with a nonflammable solvent such as kerosene, and dry them with an air blower.
2. Fit them back securely so as not to cause any fuel leakage.



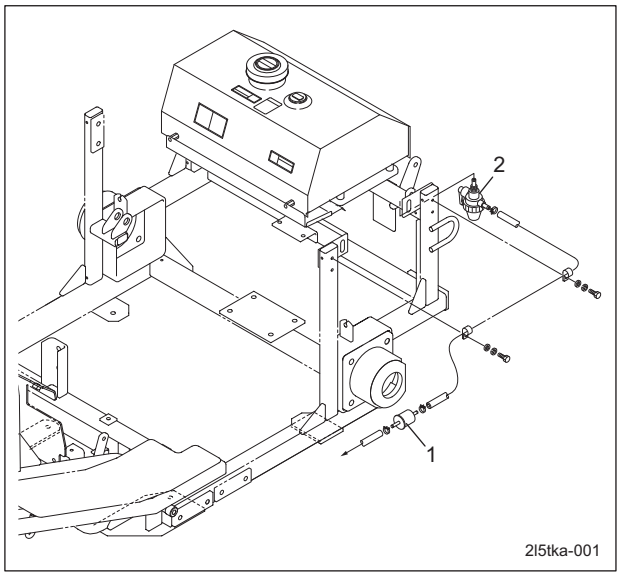
Cleaning of the fuel cock_001

1	Filter
2	Packing
3	Filter pot
4	Ring

Fuel filter

Inspection and replacement of the fuel filter

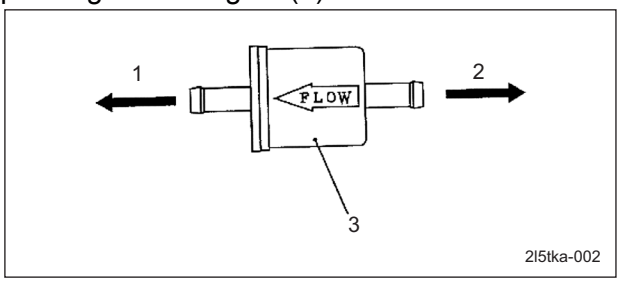
The fuel filter (1) can be found on the left side of the chassis when the rear cover is opened.



Inspection and replacement of the fuel filter_001

1	Fuel filter
2	Fuel cock

Replace the fuel filter (3) every year or whenever the fuel flow is not smooth. It cannot be disassembled and cleaned. When replacing, fit it with the arrow on the filter pointing to the engine (1).



Inspection and replacement of the fuel filter_002

1	Engine side
2	Fuel cock side
3	Fuel filter

Fuel pipe

Inspection and replacement of the fuel pipe

Danger

A damaged fuel pipe may cause fuel leakage and may catch fire.

Clamping of the fuel pipe is to be checked every 100 hours. Check every 6 months if 100 hours have not elapsed in 6 months.
The fuel pipe is a rubber product. It deteriorates even when this equipment is not operated, so replace it with a new one every two years or when it is damaged. Also replace the clamping band with a new one at the same time for secure clamping.

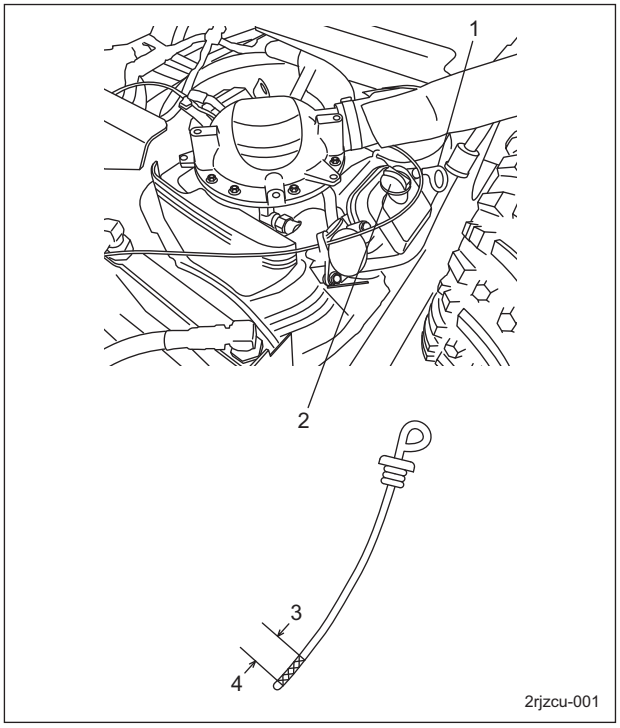
Engine oil

Inspection of and refilling the engine oil

1. Keep the engine horizontal and fully insert the oil level gauge (1) to check the amount of oil. The amount is appropriate if the gauge indicates between the upper limit (3) and the lower limit (4).
2. Refill if the oil is low, and change if it is dirty.
3. Inspect the oil level 10 to 20 minutes after the engine has stopped. Take care to avoid having excess engine oil which may damage or cause problems with the engine.
4. Refill the engine oil through the oil filler hole (2).
5. It takes some time for the refilled engine oil to go down to the oil pan.
6. Recheck the amount of oil 10 to 20 minutes after you have refilled the oil.

Important

Do not mix different kinds of engine oil.

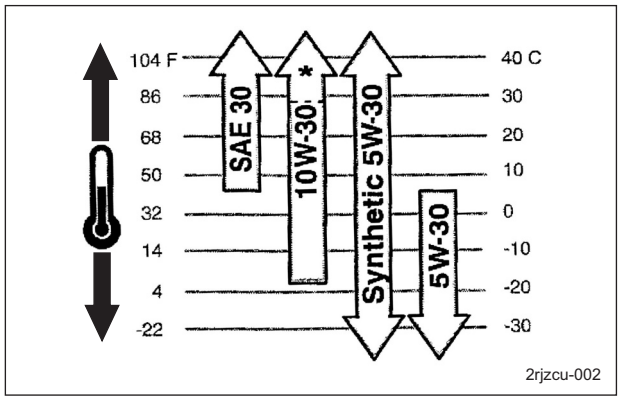


Inspection of and refilling with the engine oil_001

1	Oil level gauge
2	Oil filler hole
3	Upper limit
4	Lower limit

Recommended oil

Use oil with high-quality cleanliness, classified as API “Service grade SF” or better. Do not use special additives.
SAE30 is suitable for multi-purpose applications at 5 ° C or above. The engine will become sluggish if it is used below 5 ° C.
10W-30 for -18 to 38 ° C is suitable for a wide temperature range. This oil grade makes it easier to start the engine in a cold climate, but oil consumption may increase at a temperature of 27 ° C or above. When using the engine in a high temperature condition, check the oil level frequently.
Synthetic oil 5W-30 for -30 to 40 ° C ensures the best protection in all temperature ranges, starts the engine smoothly and consumes less oil. 5W-30 for 5 ° C or below is recommended for winter use. It functions effectively in low temperature conditions.



Recommended oil_001

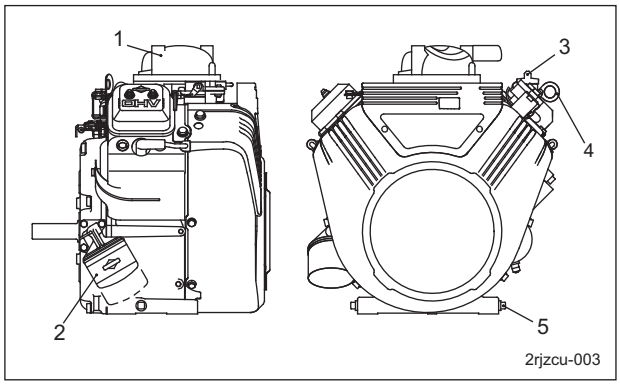
Change of the engine oil

Change of the engine oil	First time	After 8 hours of operation
	From the second time onward	For every 50 hours of operation
Change of the oil filter	For every 100 hours of operation or at the start of the season, whichever comes first.	
Amount of engine oil	For oil change only	1.0 - 1.2 L (1.06 - 1.27 US quarts)
	When changing together with the filter	1.6 L (1.7 US quarts)
Viscosity of engine oil	Normal (outside air temperature of 5 ° C or above)	SAE30
	Winter season (outside air temperature of 5 ° C or below)	SAE20
Grade of engine oil	API “Service grade SF” or higher quality	

Caution

Take care to avoid hot oil touching your skin, which may cause burns.
Always check the amount of engine oil (oil surface) to ensure it is between the upper limit and the lower limit of the oil level gauge as specified.
Securely screw in the cap of the oil level gauge and oil filler hole. Insufficiently screwing of the cap or a defective seal will fail to maintain negative pressure in the crankcase, which may raise the oil level and result in the emission of white smoke or break the engine.
Inspect the oil level regularly. Change after first 8 hours of operation and for every 50 hours of operation thereafter. Increase the frequency of oil change if the engine oil gets dirty, or the engine is operated in a dusty environment, worked hard or operated at high temperature. Change the oil filter for every 100 hours of operation.

1. Move the machine to a level surface, stop the engine, remove the drain plug (5) while the engine oil is still warm, and drain the engine oil into a container.
2. Fit the drain plug (5) and remove the oil level gauge (4).
3. Fully insert the oil level gauge to check the amount of oil. Feed the new engine oil through the oil filler hole until the oil surface comes between the upper and lower limits of the oil level gauge (4).
4. Close the cap of the oil filler hole (3).



Change of the engine oil_001

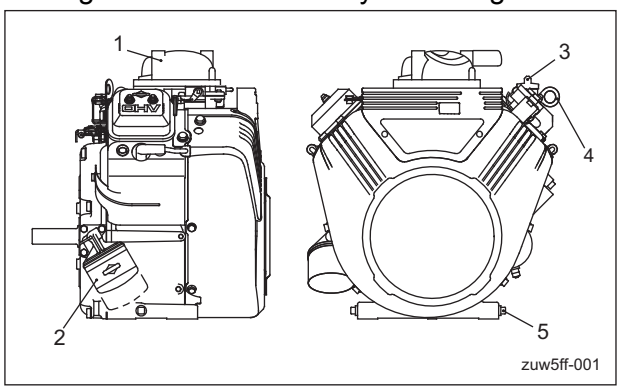
1	Engine
2	Oil filter
3	Oil filler hole
4	Oil level gauge
5	Drain plug

Engine oil filter

Replacement of the engine oil filter

> ⚠ Caution
> Be careful to prevent hot oil from touching your skin and causing burns.

1. Remove the old oil filter (2).
2. Lubricate the gasket of the new oil filter (2) lightly with engine oil, and screw in the oil filter until the gasket touches the adaptor. Tighten for a further 1/2 to 3/4 turn from there with a wrench.
   Reference: Use of an oil filter wrench (option) enables oil filter replacement without removing the engine.
3. Pull out the oil level gauge (4) and feed new proper oil (recommended oil) little by little. When checking the oil level, screw in the oil level gauge until it reaches the bottom and then remove to check. Start the engine and check for any oil leakage.



Replacement of the engine oil filter_001

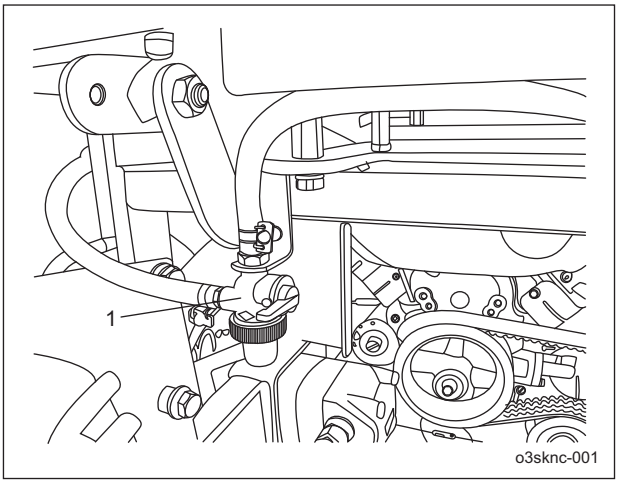
1	Engine
2	Oil filter
3	Oil filler hole
4	Oil level gauge
5	Drain plug

Removal and installation of each section

Engine

Removal of the engine

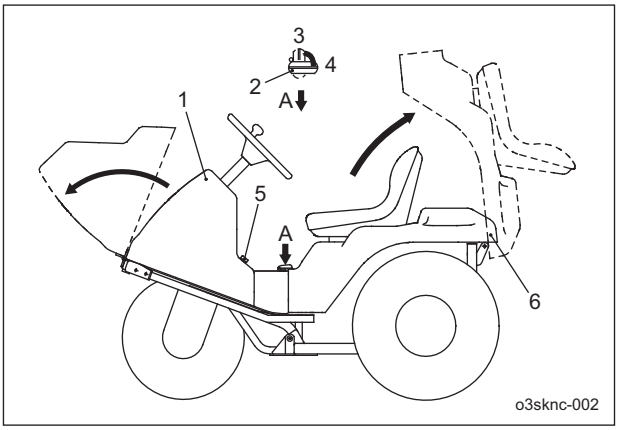
1. Move the machine to a level surface. Lower the rake. Apply the parking brake, stop the engine, and remove the key. Make sure that each part has completely stopped moving before starting work.
2. Turn off the fuel cock (1).



Removal of the engine_001

1	Fuel cock

3. Lift the rear cover ass'y (6).



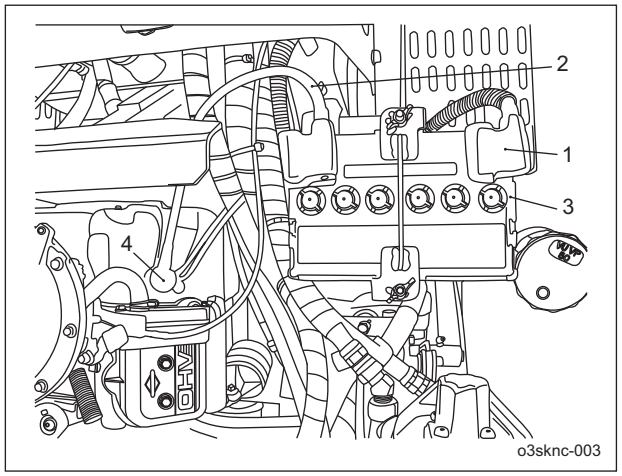
Removal of the engine_002

1	Front cover ass'y
2	Cover stopper
3	Release
4	Lock
5	Dimple knob
6	Rear cover ass'y

Warning

Do not touch the engine and exhaust system because the high temperature may cause injury. Let them cool before starting work.

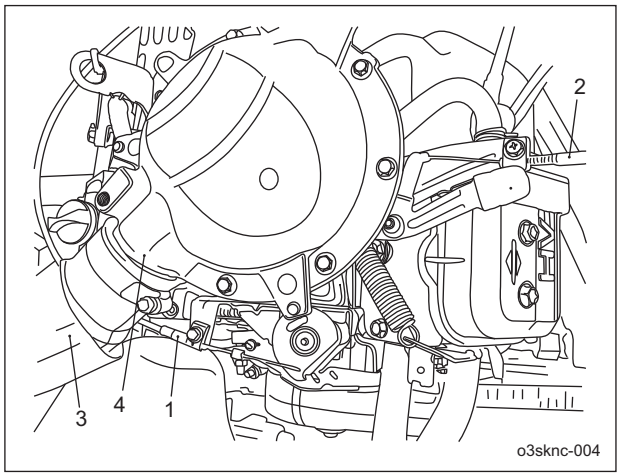
4. Detach the connection of the battery (3). Start detaching the battery cable from the negative side (2) then detach the positive side (1).
5. After detaching the battery cables from the battery, remove the engine bolt (4) and detach the minus battery cable (2) together with the two black cables.
6. Remove the battery (3) from the machine.



Removal of the engine_003

1	Plus battery cable
2	Minus battery cable
3	Battery
4	Bolt

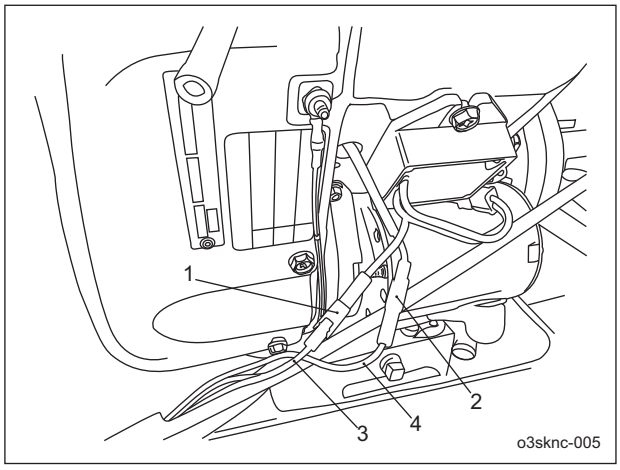
7. Remove the throttle wire (1), choke wire (2), and cleaner hose COMP (3) from the engine. Cover to prevent dust from entering the intake manifold (4) and cleaner hose.



Removal of the engine_004

1	Throttle wire
2	Choke wire
3	Cleaner hose COMP
4	Intake manifold

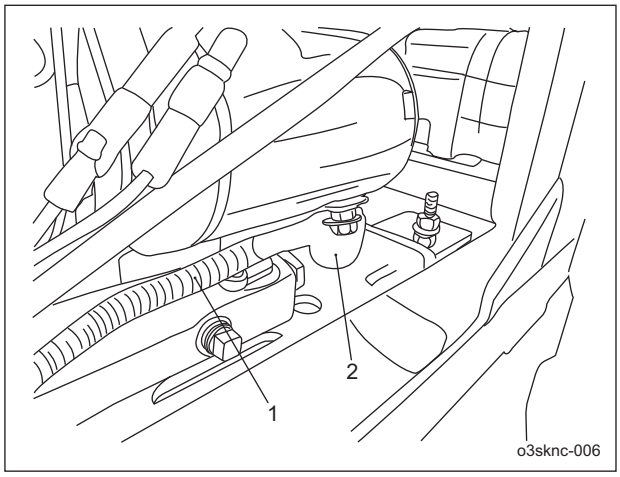
8. Remove the red connector (1) of the engine regulator and white connector (2) of the stop solenoid.



Removal of the engine_005

1	Red connector (for regulator)
2	White connector (for stop solenoid)
3	Wiring red
4	Wiring red and blue

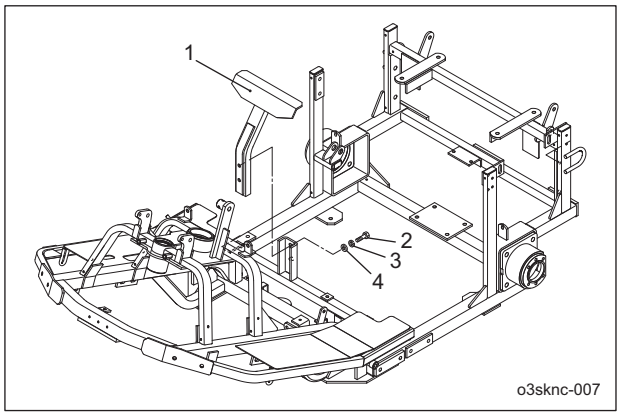
9. Detach the cable (1) from the starter motor.



Removal of the engine_006

1	Starter motor cable
2	Red cap

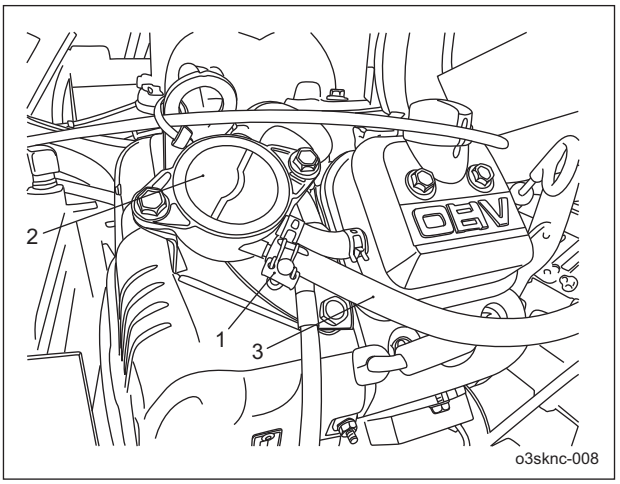
10. Remove the bolt (2), spring washer (3), washer (4), and then remove the seat mount support fitting (1).



Removal of the engine_007

1	Seat mount support fitting
2	Bolt
3	Spring washer
4	Washer

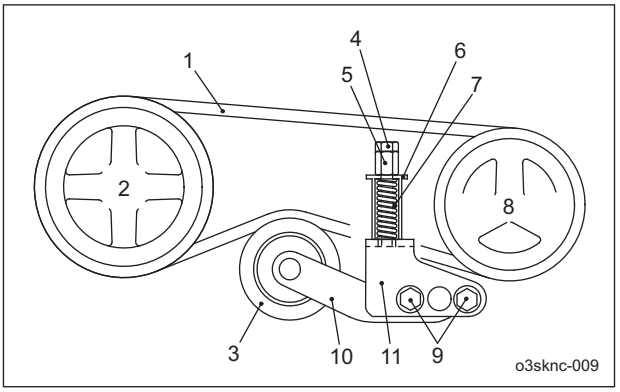
11. Loosen the fuel hose clamp (1) and remove the fuel hose (3) from the fuel pump (2) of the engine.
Plug to prevent dust from entering the fuel pump and fuel hose.



Removal of the engine_008

1	Fuel hose clamp
2	Fuel pump
3	Fuel hose

12. Remove the nut (4) and high nut (5) in order to make it easier to remove the tension ass'y (10). Next, remove the two bolts (9), tension ass'y, and two belts (1).

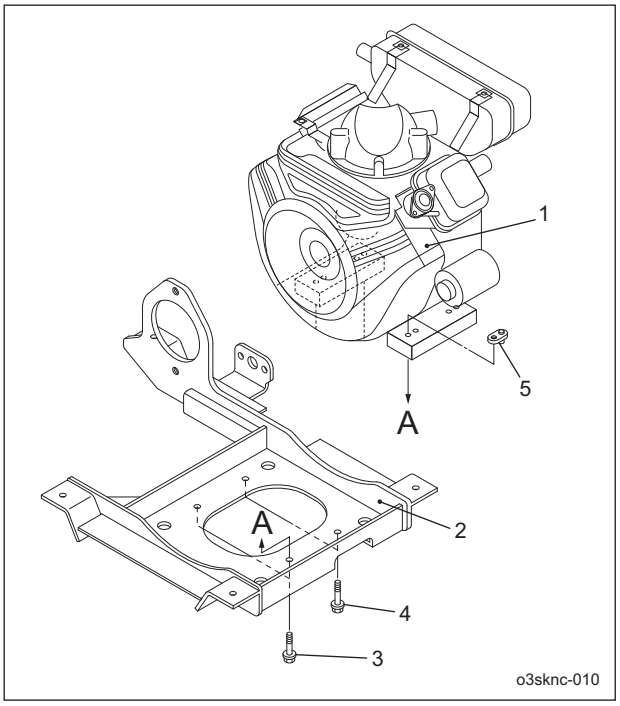


Removal of the engine_009

1	Belt
2	Engine pulley
3	Tension pulley
4	Nut
5	High nut
6	Spring cover
7	Spring
8	Pump pulley
9	Bolt
10	Tension ass'y
11	Tension fulcrum

13. Remove the two bolts (3) and two bolts (4) used for mounting the engine (1) onto the engine base (2).

Do not lose the four engine mounting eyes (5) left on the engine.



Removal of the engine_010

1	Engine
2	Engine base
3	Bolt
4	Bolt
5	Engine mounting eye

Important

When removing the engine from the machine, take care to prevent damage to the engine, fuel hose, wiring or other parts.

14. Remove the engine (1) from this equipment.
(See “Removal of the engine_010.”)

Installation of the engine

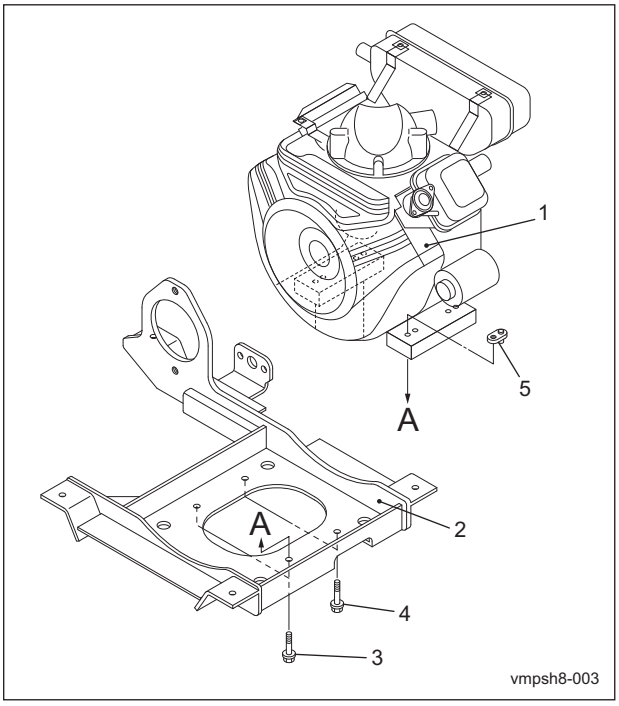
Install the engine in the opposite sequence of removing it.

1. Move the machine to a level surface. Apply the parking brake, put the sprag in place and remove the key.
2. Check to see if all the parts that were removed for engine repair are now installed as before.

Important

When installing the engine in the machine, take care not to damage the engine, fuel hose, wiring or other parts.

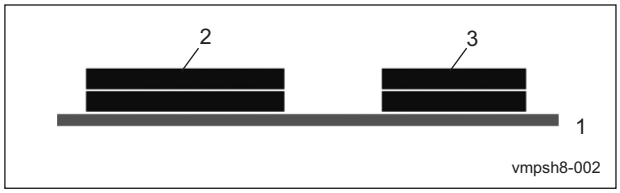
3. Mount the engine (1) on the engine base (2) of the machine.
4. Temporarily tighten with four engine mounting eyes (5), two bolts (3), and two bolts (4).



Installation of the engine_001

1	Engine
2	Engine base
3	Bolt
4	Bolt
5	Engine mounting eye

5. Obtain centering with a block gauge (1) so that the pump pulley (3) and engine pulley (2) are parallel to each other.
Out of centering will lead to abnormal wear of parts such as the V belt.



Installation of the engine_002

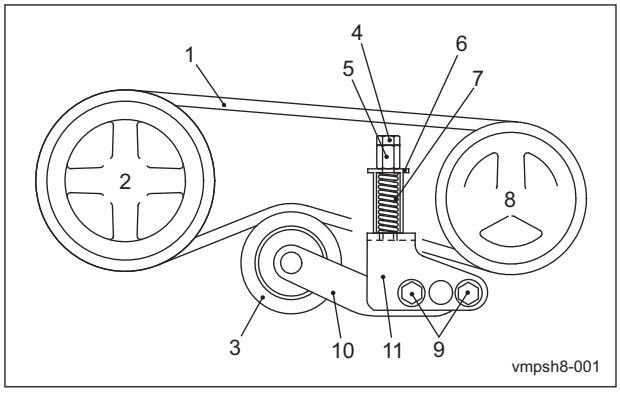
1	Block gauge
2	Engine pulley
3	Pump pulley

6. Fix the engine with the two bolts and the other two bolts which have been temporarily tightened. Torque to between 14 and 19 N-m (123.91 - 168.17 lb-in).

Important

Fit the engine while paying attention to the centering of the pump pulley and engine pulley.

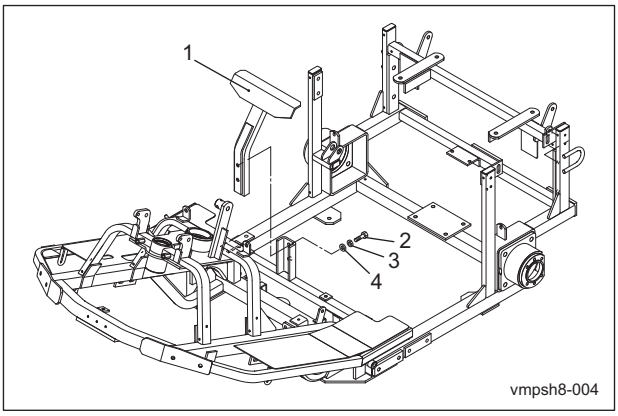
7. Fit two belts (1) and tighten the tension ass'y (10) with two bolts (9). Torque to between 29 and 38 N-m (256.68 - 336.34 lb-in). Tighten with a high nut (5) to the extent that the spring cover (6) lightly touches the tension fulcrum (11) and fix the high nut (5) with the nut (4).



Installation of the engine_003

1	Belt
2	Engine pulley
3	Tension pulley
4	Nut
5	High nut
6	Spring cover
7	Spring
8	Pump pulley
9	Bolt
10	Tension ass'y
11	Engine fulcrum

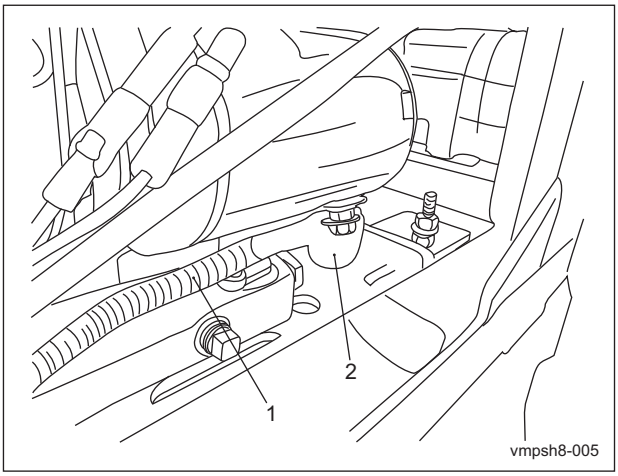
8. Tighten the seat mount support fitting (1) with two bolts (2), two spring washers (3) and two washers (4). Torque to between 29 and 38 N-m (256.68 - 336.34 lb-in).



Installation of the engine_004

1	Seat mount support fitting
2	Bolt
3	Spring washer
4	Washer

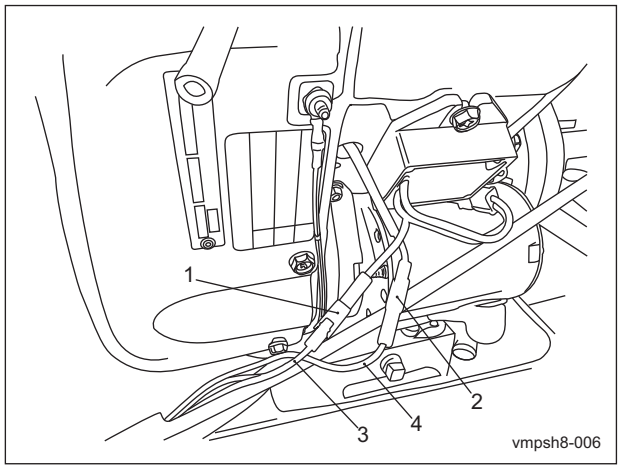
9. Fit cable (1) to the starter motor and put the RED cap (2) on.



Installation of the engine_005

1	Starter motor cable
2	RED cap

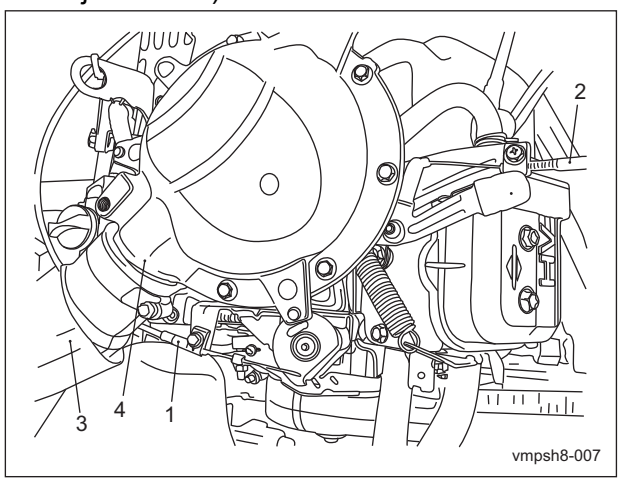
10. Connect the RED connector (1) of the engine regulator with the RED lead (3) of this equipment, and the WHITE connector (2) of the stop solenoid with the RED & BLUE lead (4) of this equipment, respectively.



Installation of the engine_006

1	RED connector (for regulator)
2	WHITE connector (for stop solenoid)
3	Wiring RED
4	Wiring RED & BLUE

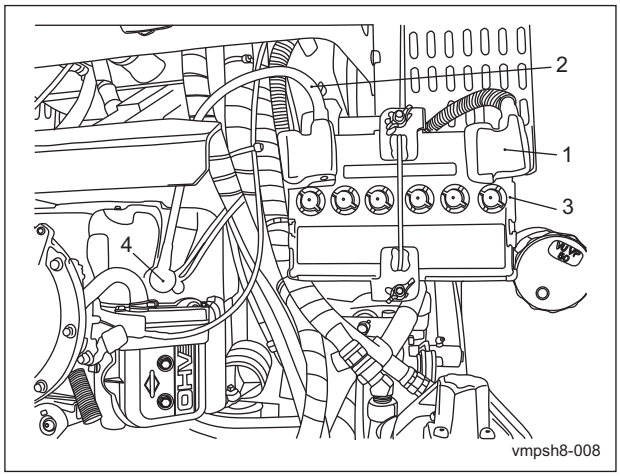
11. Fit the throttle wire (1), choke wire (2) and cleaner hose COMP (3). (See “Engine – Adjustment.”)



Installation of the engine_007

1	Throttle wire
2	Choke wire
3	Cleaner hose COMP
4	Intake manifold

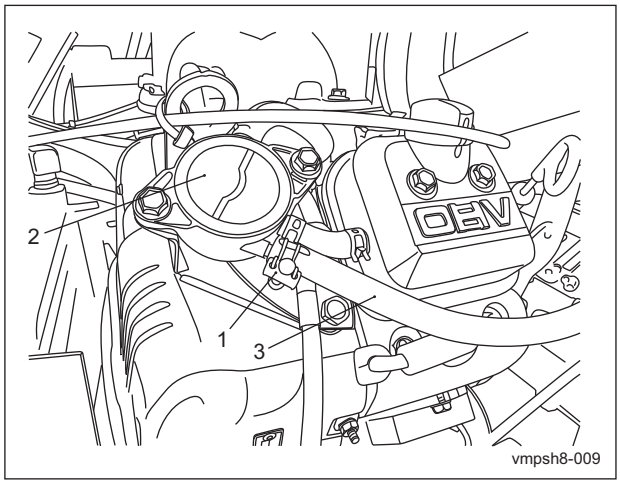
12. Tighten the negative battery cable (2) and two BLACK cables onto the engine with the bolt (4). Torque to between 29 and 38 N-m (256.68 - 336.34 lb-in).
13. Mount the battery (3) on this equipment and fit. Connect the positive battery cable (1) to the battery. Next, connect the negative battery cable (2). (See “Electrical system – General repair – Battery.”)



Installation of the engine_008

1	Plus battery cable
2	Minus battery cable
3	Battery
4	Bolt

14. Fit the fuel hose (3) to the fuel pump (2) of the engine and fix it with the fuel hose clamp (1). Open the fuel cock.



Installation of the engine_009

1	Fuel hose clamp
2	Fuel pump
3	Fuel hose

15. Check the oil level of the engine and adjust. (See “Engine – Inspection and repair of each part – Engine oil.”)
16. Check the operation of the throttle and adjust. (See “Engine – Adjustment – Throttle wire.”)
17. Check the operation of the choke and adjust. (See “Engine – Adjustment – Choke wire.”)

Hydraulic system

Maintenance

This chapter describes the main inspection and maintenance methods of the SP05 hydraulic system. Refer to the SP05 Owner's manual and parts catalog for daily inspection, maintenance and handling of this machine.
In addition, hydraulic equipment cannot basically be disassembled for maintenance with a view to maintaining performance. For components specified for repair by manufacturers, procedures for disassembly and maintenance are not described. Contact either the dealer or us for repair. Note that disassembly and maintenance may constitute a waiver of product warranty.

⚠ Danger

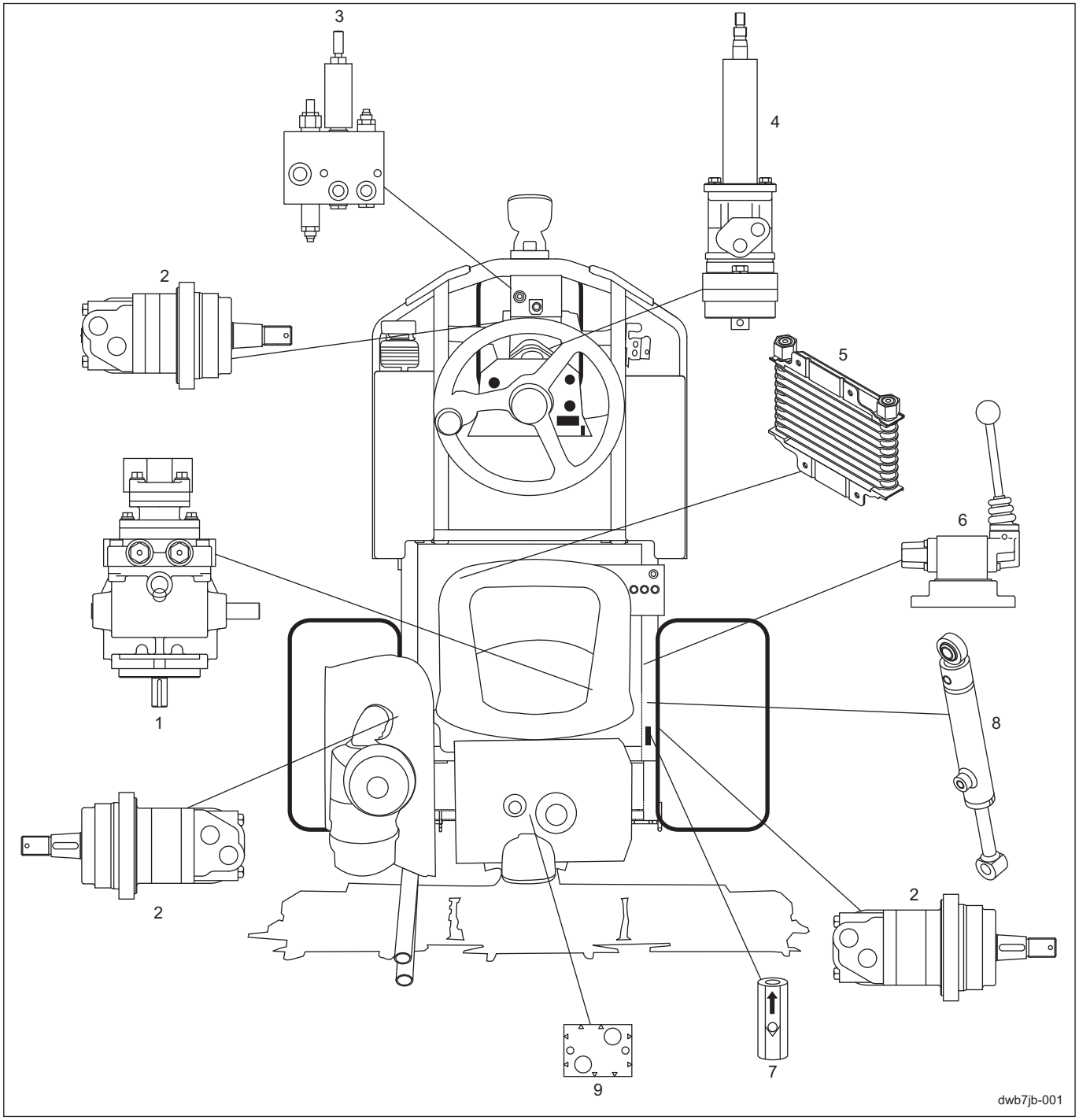
Follow the instructions below for safe inspection and maintenance.

1. Move the equipment to a level surface to prepare for adjustment and maintenance. Apply the parking brake, stop the engine and remove the key. Make sure that each part has completely stopped its motion before starting procedures for adjustment, maintenance and so on.
2. Keep away from moving parts. Avoid adjustment as much as possible with the engine running. Keep people away from the area.
3. Use an appropriate chain block, hoist and jack as needed. Securely support the lifted machine with a jack stand or an appropriate block.
4. Use BARONESS genuine parts for replacement and accessories.
5. Never start the engine in a enclosed room, or poisoning by carbon monoxide may occur.
6. Never touch the exhaust system while the engine is running or right after the engine has stopped. Its high temperature may cause a burn.
7. Keep flames away from the battery. Batteries emit hydrogen gas, and mishandling may ignite it and cause an explosion.
8. The electrolytic solution in the battery is sulfuric acid. Contact with the electrolytic solution (sulfuric acid) may cause blindness or a burn. Also, if it comes into contact with the vehicle, it may damage it.

Specifications

HST		PSV-16AHG-2 made by KYB
Piston pump	Displacement	0 - 16.4 cm^3/rev (1.00 in^3/rev)
	High-pressure relief set pressure	20.6 MPa (2,987 psi)
Charge pump	Displacement	4.9 cm^3/rev (0.30 in^3/rev)
	Relief set pressure	1.0 MPa (145 psi)
Gear pump	Displacement	5.45 cm^3/rev (0.33 in^3/rev)
Wheel motor		Orbit motor made by Eaton Fluid Power
Front wheel motor		2-100BS4S
	Displacement	97 cm^3/rev (5.92 in^3/rev)
Rear wheel motor		2-200BS4S
	Displacement	195 cm^3/rev (11.90 in^3/rev)
Valve module	Relief set pressure	10.0 MPa (1,450 psi)
Hydraulic tank capacity (Oil gauge center)		15 L (3.96 US gallons)
Hydraulic line filter (Cartridge type)		10 μm
Hydraulic oil		Equivalent of Shell Tellus 46 (ISO VG46)

Hydraulic equipment layout



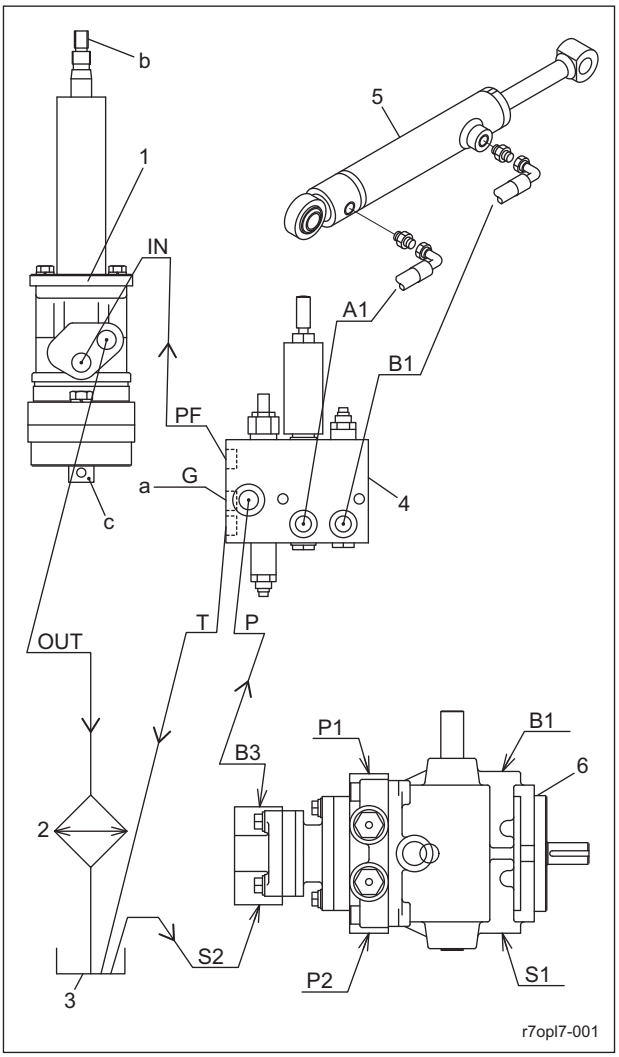
Hydraulic equipment layout_001

1	Piston pump	6	Drive switching valve
2	Wheel motor	7	Check valve
3	Valve module	8	Raise/lower cylinder
4	Torque generator	9	Branch fitting
5	Oil cooler		

1. Piston pump
   This is to convert mechanical energy of the motor to fluid energy through reciprocal movement of the piston. It is positioned on the right-hand side of the engine and driven by the V belt. Gear pump is equipped as an operation pump.
2. Wheel motor
   This is to convert fluid energy from the pump to mechanical energy (revolving movement) and directly drive the vehicle body. Wheel motors are positioned at each of the two rear wheels for two-wheel-drive vehicles and at all three wheels for three-wheel-drive vehicles.
3. Valve module
   This is composed of functionally independent valves put together into one block.
   This equipment consists of many valves including those for mainly setting the pressure, for raising/lowering the rake and for supplying hydraulic oil to the steering circuit constantly on a priority basis. It is positioned in the center inside the front cover.
4. Torque generator
   This is to obtain high torque revolution from output axis generated through hydraulic power by low torque revolution of input axis. It is positioned beneath the steering wheel inside the front cover.
5. Oil cooler
   This is to cool high temperature oil. It is positioned under the left-side of the seat in front of the engine.
6. Drive switching valve
   This is to switch between two-wheel-drive and three-wheel-drive by switching the direction of oil flow. It is positioned within reach on the right-hand when seated.
7. Check valve
   This is to freely pass the oil in one direction and completely block the oil flow in the opposite direction. It is used for three-wheel-drive only and positioned inside the right-rear tire, underneath the hydraulic oil filter.
8. Raise/lower cylinder
   This is to convert fluid energy from the pump to mechanical energy (reciprocal movement) for raising/lowering of the rake. It is positioned inside the right-rear tire.
9. Branch fitting
   This is to divide or collect the flow of oil. It is positioned almost in the center between the right and left rear tires.

Valve module

- Flow of hydraulic oil



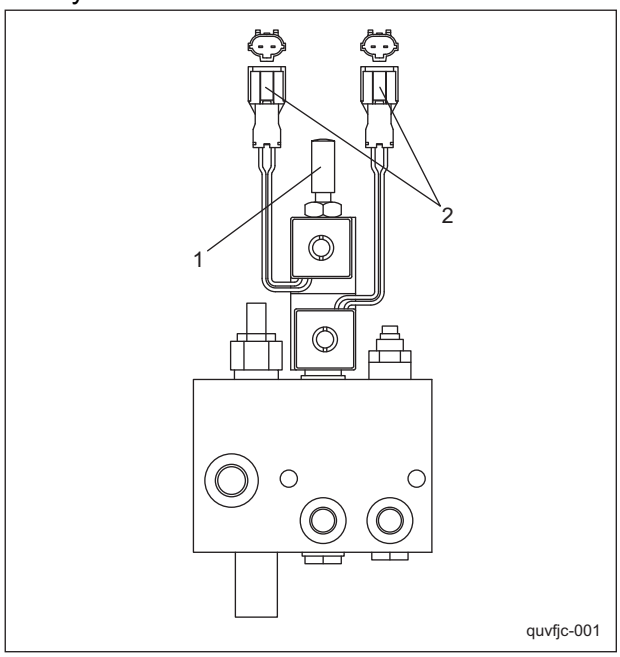
Flow of hydraulic oil_001

1	Torque generator
2	Oil cooler
3	Hydraulic tank
4	Valve module
5	Raise/lower cylinder
6	Piston pump
a	Measurement port
b	Input axis
c	Output axis

Valve module (A1)	→	Raise/lower cylinder lowering port
Valve module (B1)	→	Raise/lower cylinder raising port
Piston pump (B3)	→	Valve module input (P)
Valve module (PF)	→	Torque generator input (IN)
Valve module (T)	→	Return to hydraulic tank
Gauge port (G)	=	Pressure measurement port for raise/lower cylinder about 10 MPa (1,450.38 psi, 101.97 kgf/cm^2)

■Manual valve

The manual valve is a component of the valve module and used for checking the cause of failure when the rake cannot be raised or lowered.
Check while the engine is at maximum speed or more.
Remove the coupler (2) of the magnetic valve.
Push the manual lever (1) for raising and pull it for lowering.
If the rake is raised with a manual lever, the hydraulic system is likely to be normal and the problem can be attributed to the electrical system.
If the rake cannot be raised with a manual lever, the hydraulic system is likely to be faulty.



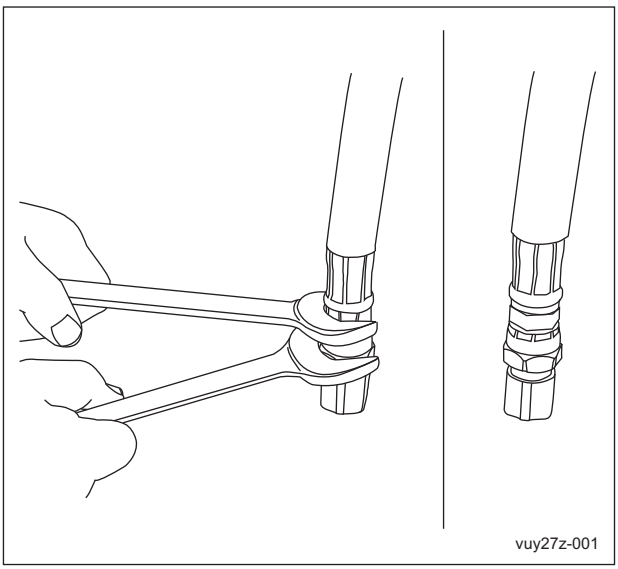
Manual valve_001

1	Manual lever
2	Coupler

General instructions

Hydraulic hose

Hydraulic hoses are subjected to excessive load when weathered, exposed to the sun or chemicals, stored in a very hot storage environment, or handled roughly during operation or maintenance work. These factors may cause damage to hoses or facilitate their deterioration. Since a hydraulic hose is more sensitive to external conditions than other components, check it frequently for damage, deterioration or the like of.
When replacing the hydraulic hose, check that the hose is straight (not twisted before fitting).
When replacing the hydraulic hose, use two wrenches. First, support the hose at a designated point with the first wrench. Next, fasten the hose swing nut to the fitting with the second wrench.



Hydraulic hose_001

Warning

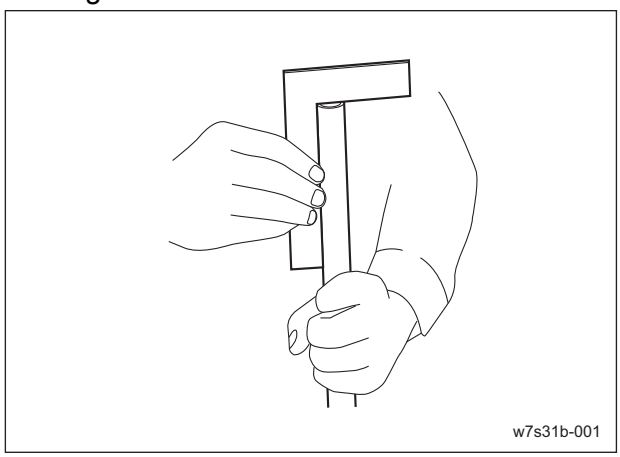
Be sure to depressurize the hydraulic system before maintaining or repairing it.
Stop the engine, and lower the rake.
When checking for pinhole leakage of the hydraulic circuit or oil leakage of the nozzle, search for a leakage point using something like paper or cardboard, never with your bare hands. Be careful about high-pressure oil which may pierce your skin, resulting in physical injury.

Hydraulic fitting

Bite type tube fitting

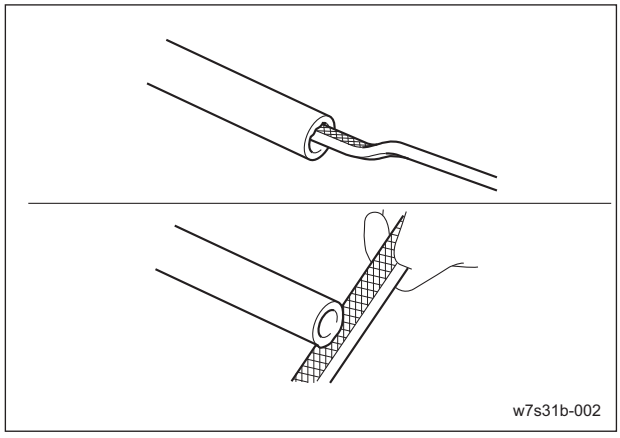
Preliminary tightening (Preset)

1. Directly cut the tube at the designated length.



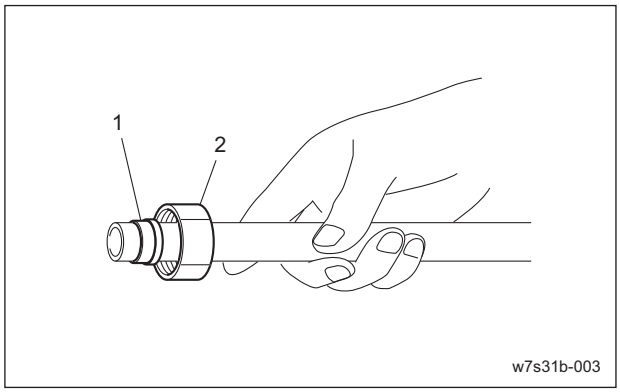
Bite type tube fitting_001

2. Remove burrs on the inside and outside of the tube with a file or the like of.



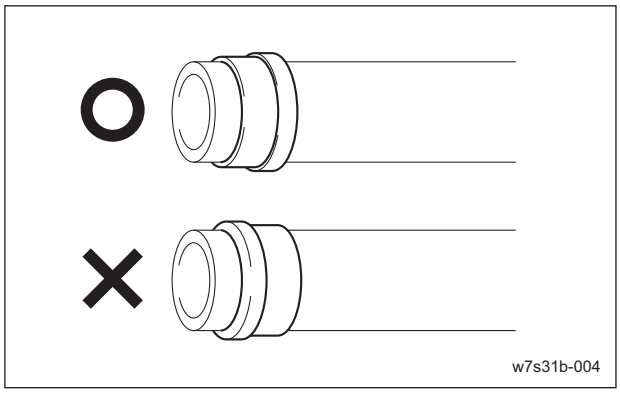
Bite type tube fitting_002

3. Insert the nut and sleeve into the tube. Note the direction of the sleeve.



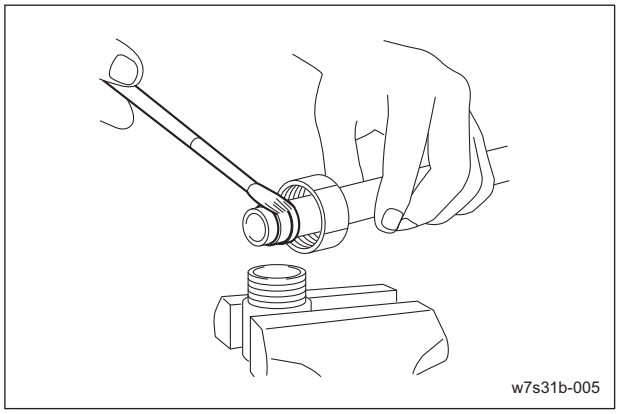
Bite type tube fitting_003

1	Sleeve
2	Nut



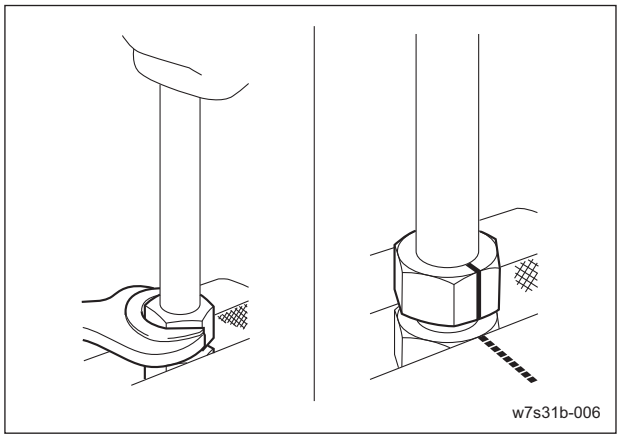
Bite type tube fitting_004

4. Fix the temporary tightening jig onto the vice and apply hydraulic oil to the threads, tapered part, and sleeve.



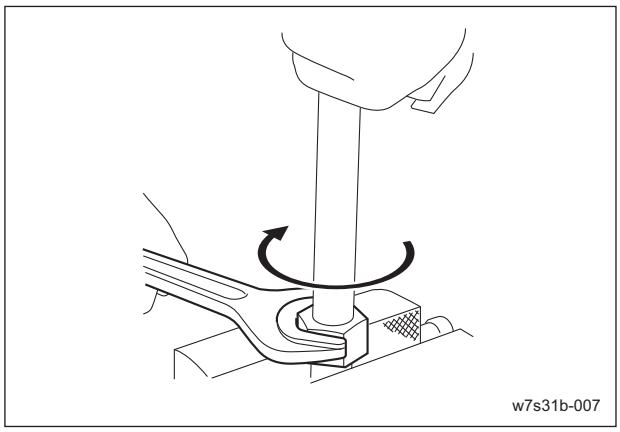
Bite type tube fitting_005

5. Put the tube end onto the hole bottom of the temporary tightening jig and tighten the nut slowly to the point where the tube can no longer be rotated by hand. This point is called the “zero point.”



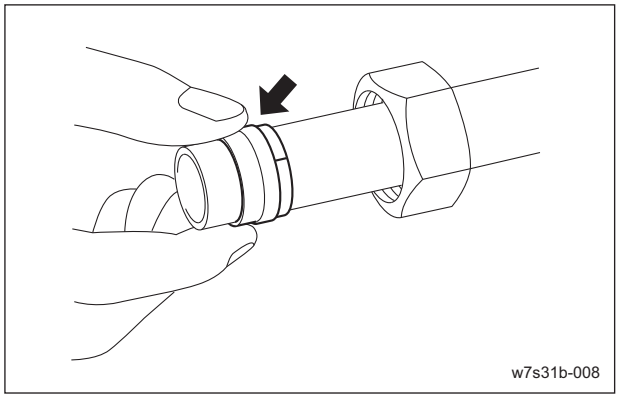
Bite type tube fitting_006

6. Matchmark the zero point and further tightening of 3/4 to one turn will cause the sleeve to bite into the tube.



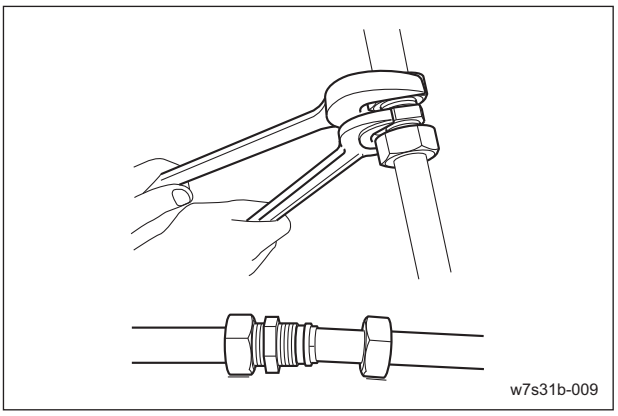
Bite type tube fitting_007

7. Fasten the nut and check that the sleeve end is a few mm apart from the tube end and the sleeve will not move in axial direction (it is allowed to move in the circumferential direction).



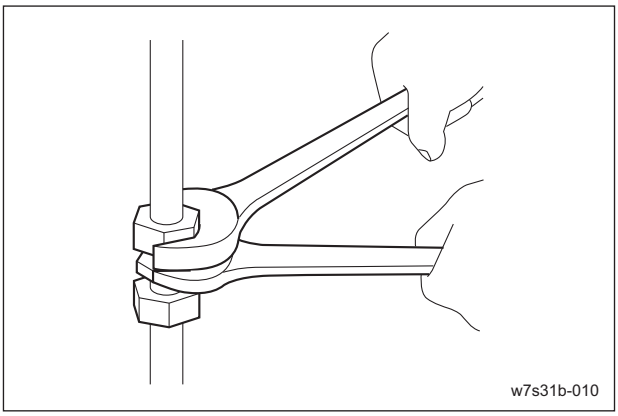
Bite type tube fitting_008

Final tightening (Reset)
Fit the preliminary tightened tube onto the fitting body. Tighten with a spanner to the point where some resistance is suddenly felt, then further tighten with the nut for a 1/4 turn.



Bite type tube fitting_009

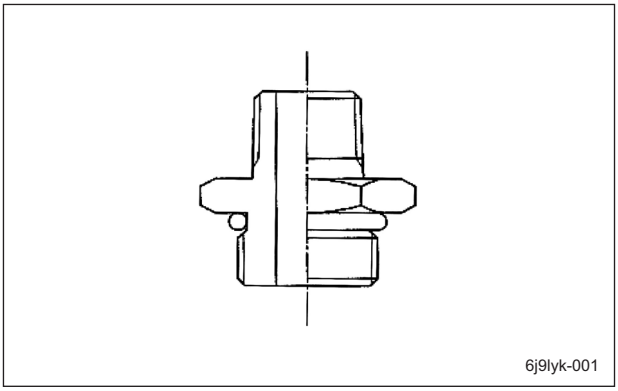
Reference: For direct tightening, use the fitting body to follow procedures 1 to 5 when using a temporary tightening jig, and set the zero point. Further tighten for 1/4 to one turn from the zero point.



Bite type tube fitting_010

Reuse of piping
Bite type fitting can be reused if an inspection finds no flaw or other damage on the sleeve surface. Done properly, disassembly and retightening can be carried out up to five times or so.

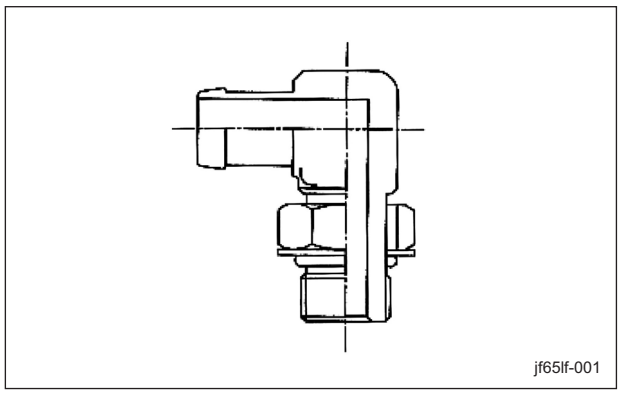
Fitting with parallel pipe threads (O ring sealing system)



Fitting with parallel pipe threads (O ring sealing system)_001

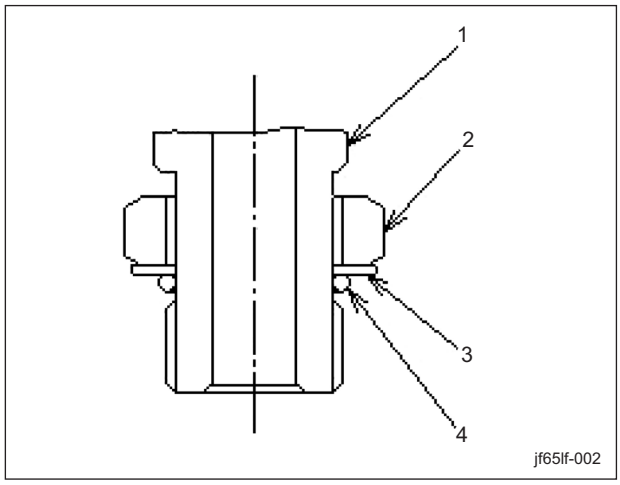
1. Check to see if the O ring is properly fitted to the groove of the main body.
2. Check to see that the thread part, seat surface of O ring port and O ring are free from flaws or foreign matter.
3. Before fitting, apply hydraulic oil or grease to the O ring.
4. For fitting, screw in by hand till the main body touches the other side lightly, then tighten securely with a tool such as a spanner.

■Adjustable joint



Adjustable joint_001

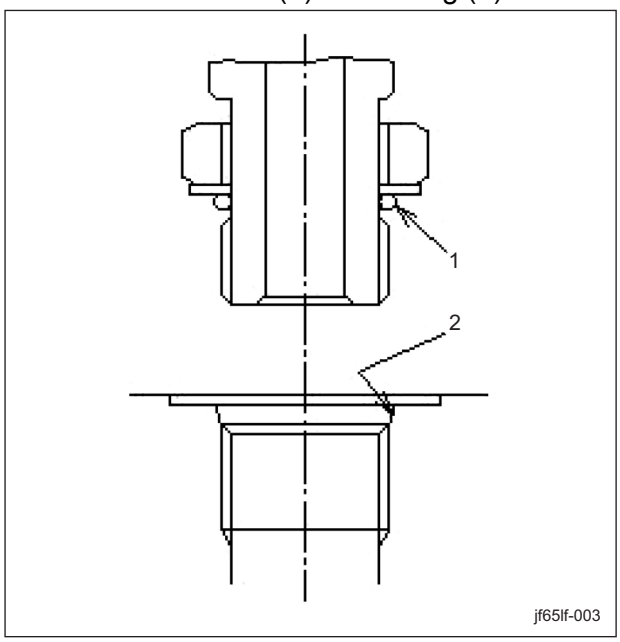
1. Check to see if the lock nut (2), washer (3), and O ring (4) are in the correct position. The correct position is where the washer is pressed onto the upper end of the groove of the main body (1).



Adjustable joint_002

1	Main body
2	Lock nut
3	Washer
4	O ring

2. Check to see that there is no foreign matter on the thread part, seat surface of the O ring port (2), or O ring (1). Before fitting, apply hydraulic oil or grease onto the seat surface (2) and O ring (1).



Adjustable joint_003

1	O ring
2	Seat surface

3. To fit, screw in the main body by hand till the washer face touches lightly, and turn from that position in the loosening direction to the preset position.

⚠ Caution

Be careful never to turn more than once. Turning more than once will worsen the fit between the other port and the thread of the lock nut, and reduce the strength of the thread. Too much penetration of the washer into the other port will cause the washer to deform, leading to the leakage of oil.
Forced fitting results in too much load on the main body and nut, and may cause deformation. Be sure to follow the fitting procedures.

4. After fitting the opposite screw, tighten the lock nut while holding the main body with a spanner to ensure that the preset position does not change.

Towing

In the event of loss of mobility due to engine trouble or the like of, movement is possible through towing or hand driving. Take the shortest route when towing or hand driving the

machine. Transport on a trailer if you have to transport the machine a long way.
For the towing method, see the Owner's manual.

Important

Going over the limit of towing may lead to the failure of hydraulic equipment. Also, if the machine is towed at high speed, the wheel may cease its motion. Stop towing in case of wheel lock. Resume towing at low speed after the pressure has been stabilized.

Neutral

If the machine goes forward or in reverse without pressing on the forward/reverse pedals, the neutral is not working. Adjust accordingly. Refer to the Owner's manual for adjustment of the neutral.

Depressurization

Be sure to depressurize the hydraulic system before inspecting and repairing it.
For depressurizing, move the machine to a level place. Apply the parking brake and lower the rake. Then, stop the engine and remove the key. To depressurize the hydraulic circuit, set the forward/reverse pedals and all the drives of the operating machine in the neutral position. To depressurize the steering circuit, turn the steering wheel from side to side.

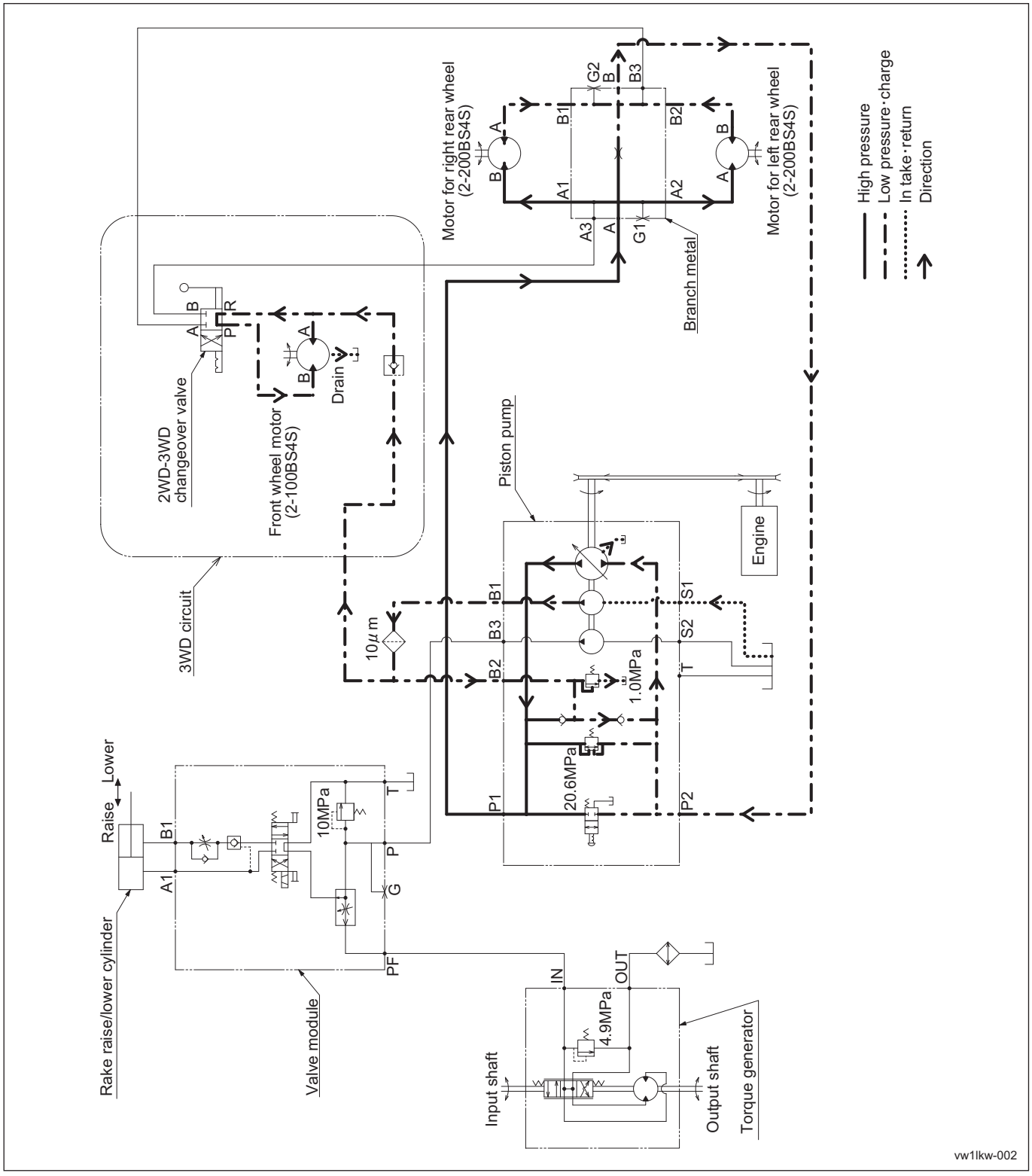
Hydraulic circuit failure

The hydraulic traveling circuit of this equipment is made up of a closed circuit.
In the event of failure of the hydraulic equipment of the hydraulic circuit, debris and contaminant from the faulty hydraulic equipment will circulate to every part of the circuit. Since this contaminant causes damage to other hydraulic equipment, such debris and contaminant must be removed to prevent further failure of other hydraulic equipment.
In the event that failure of hydraulic equipment is found in the hydraulic circuit, remove hydraulic hoses and piping of the whole hydraulic circuit and elean them well with kerosene and soon. Drain all the hydraulic oil from hydraulic tank and hydraulic equipment other than the hydraulic hoses and piping and clean well.
We recommend to replace the hydraulic oil, hydraulic oil filter and defective hydraulic equipment with new ones.

Hydraulic circuit flow

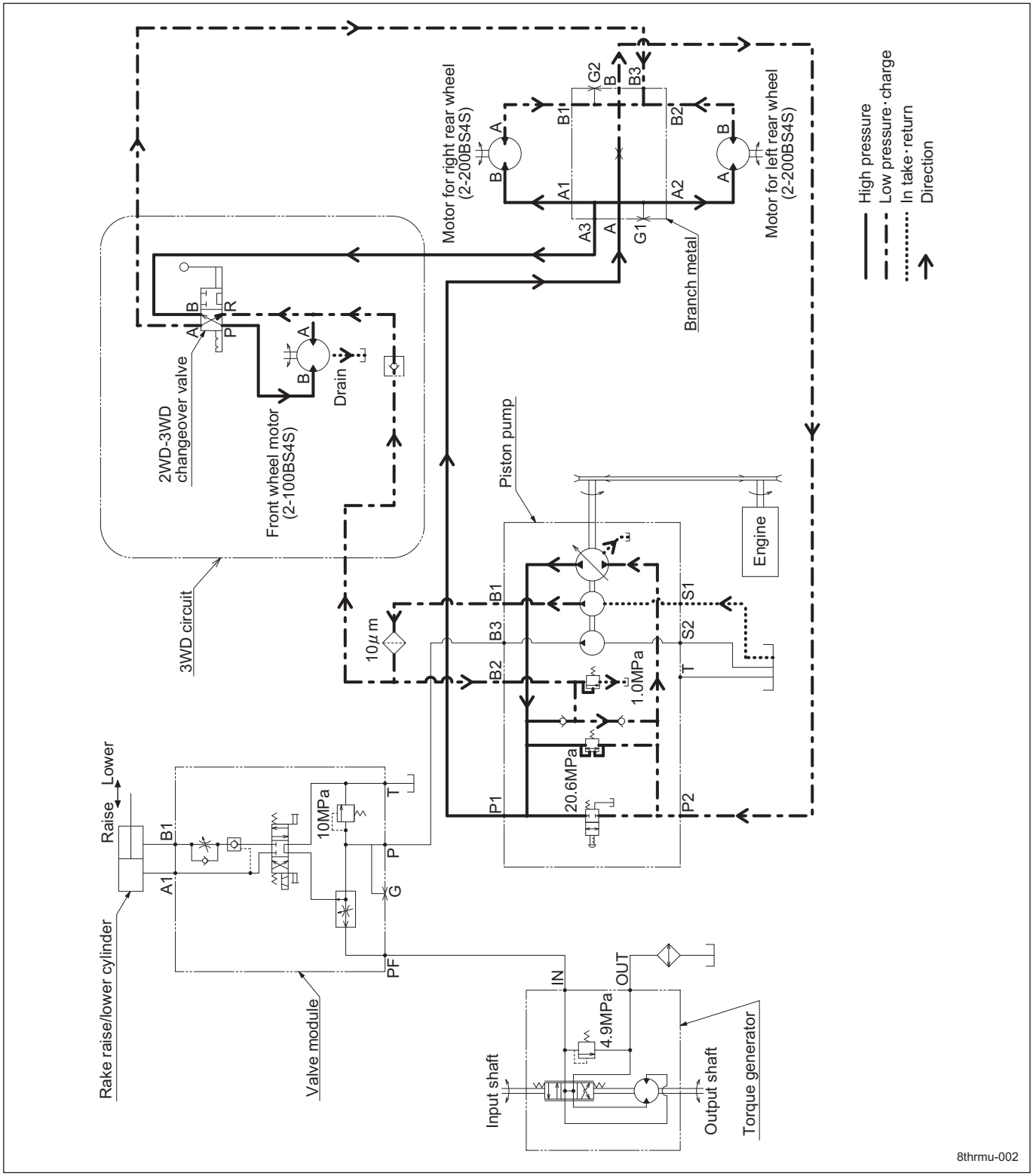
Traveling circuit

Two-wheel-drive forward



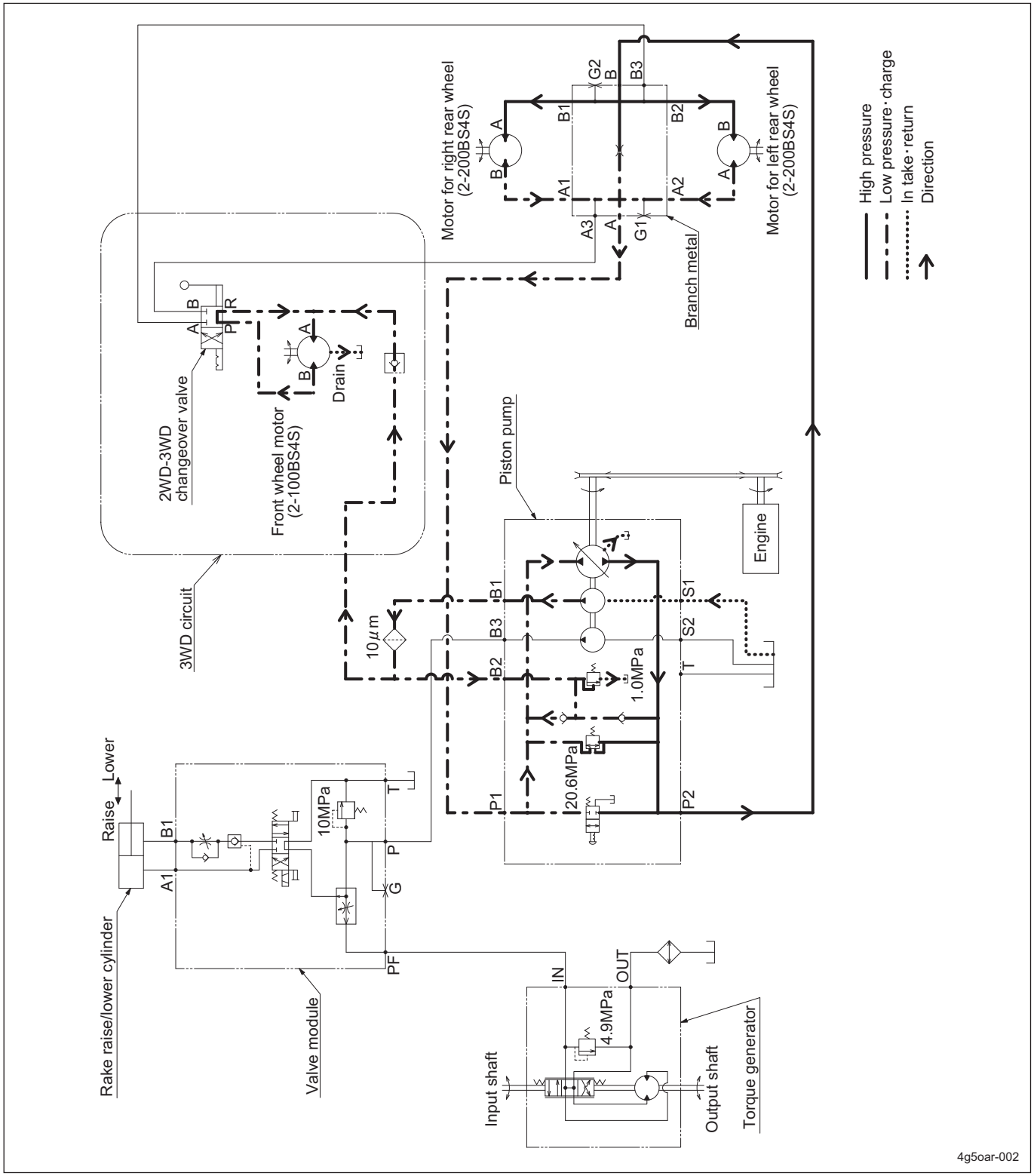
Two-wheel-drive forward_001

Three-wheel-drive forward



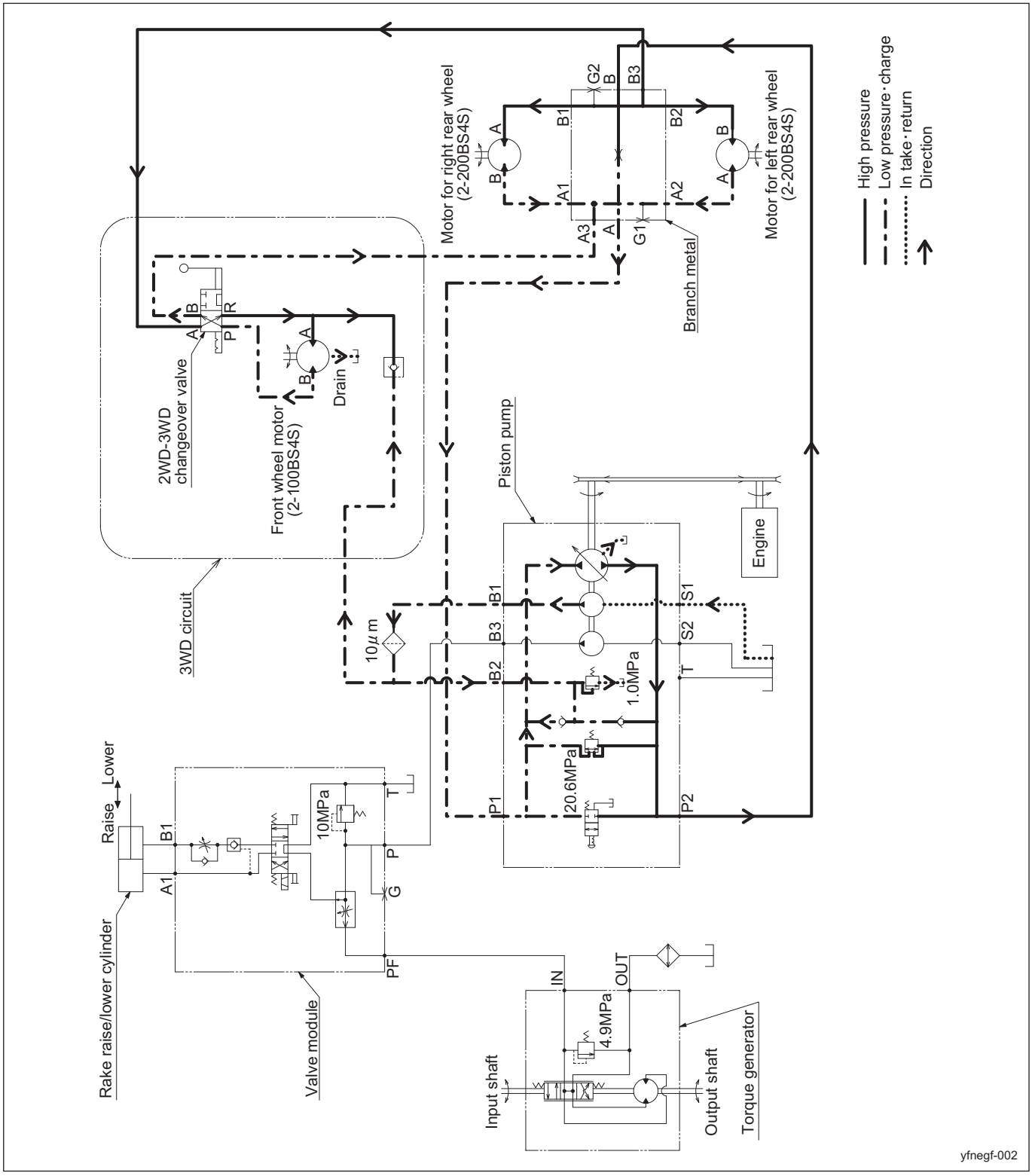
Three-wheel-drive forward_001

Two-wheel-drive reverse



Two-wheel-drive reverse_001

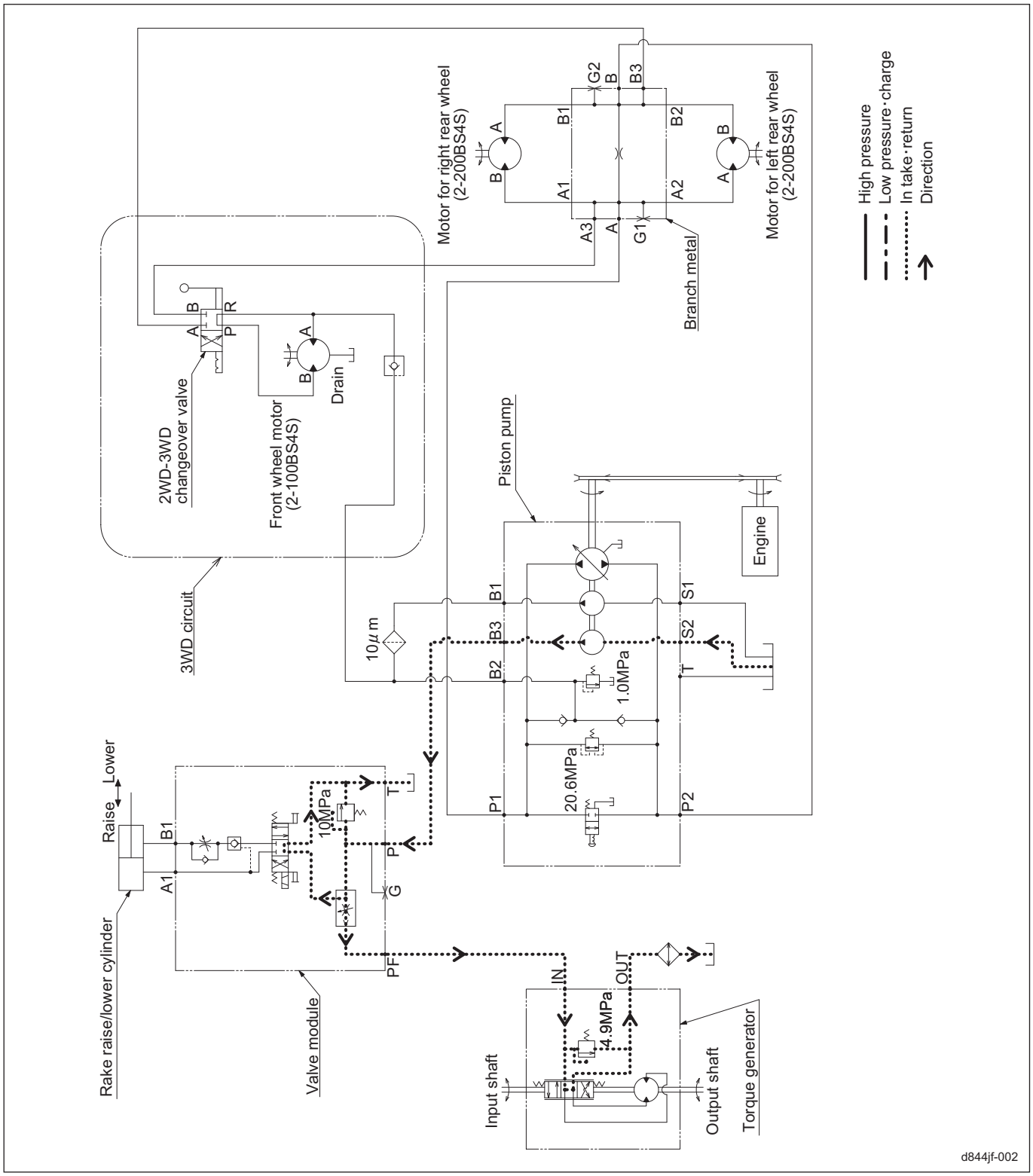
Three-wheel-drive reverse



Three-wheel-drive reverse_001

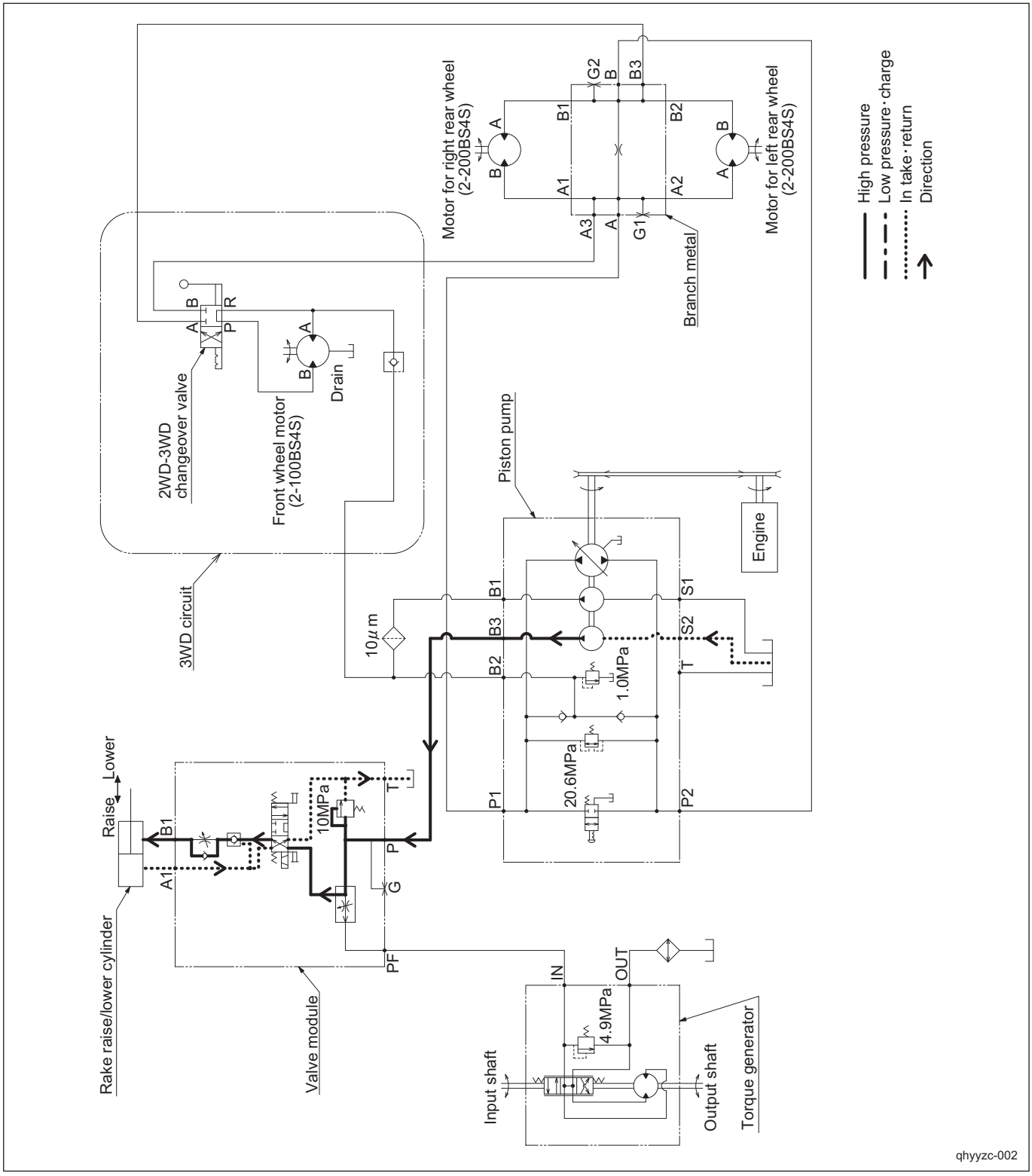
Raise/lower circuit

Raise/lower cylinder neutral



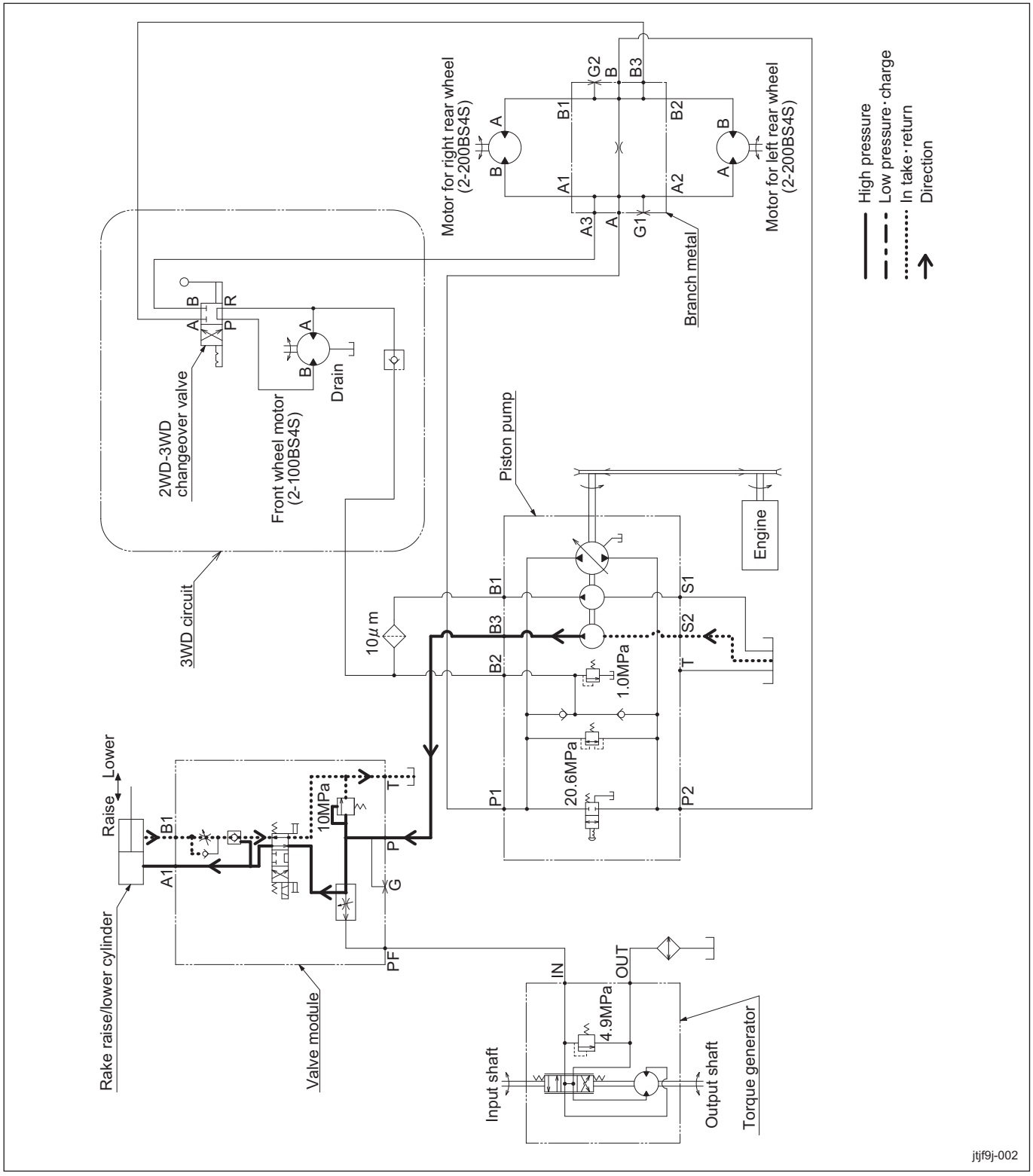
Raise/lower cylinder neutral_001

Raise/lower cylinder raising



Raise/lower cylinder raising_001

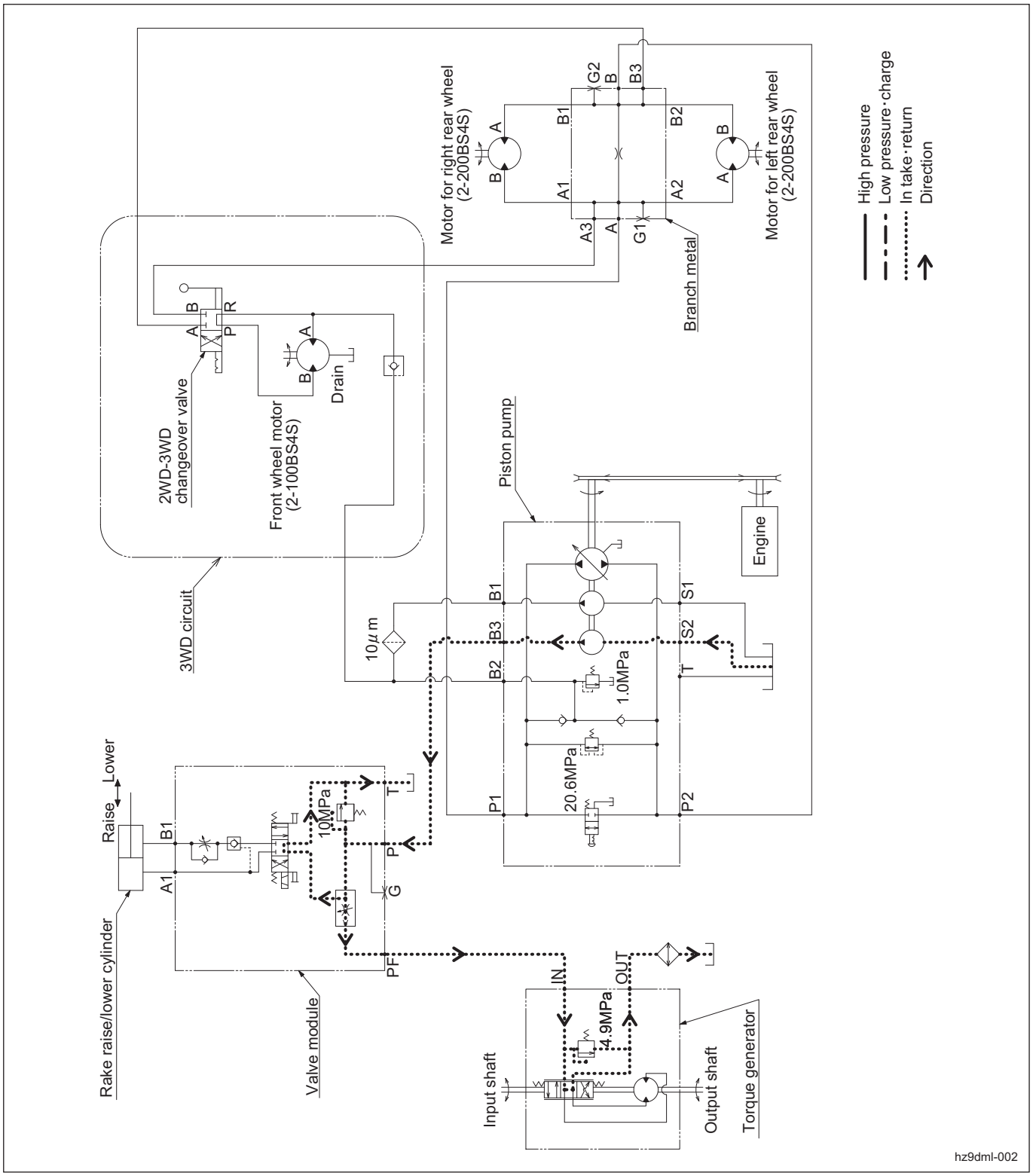
Raise/lower cylinder lowering



Raise/lower cylinder lowering_001

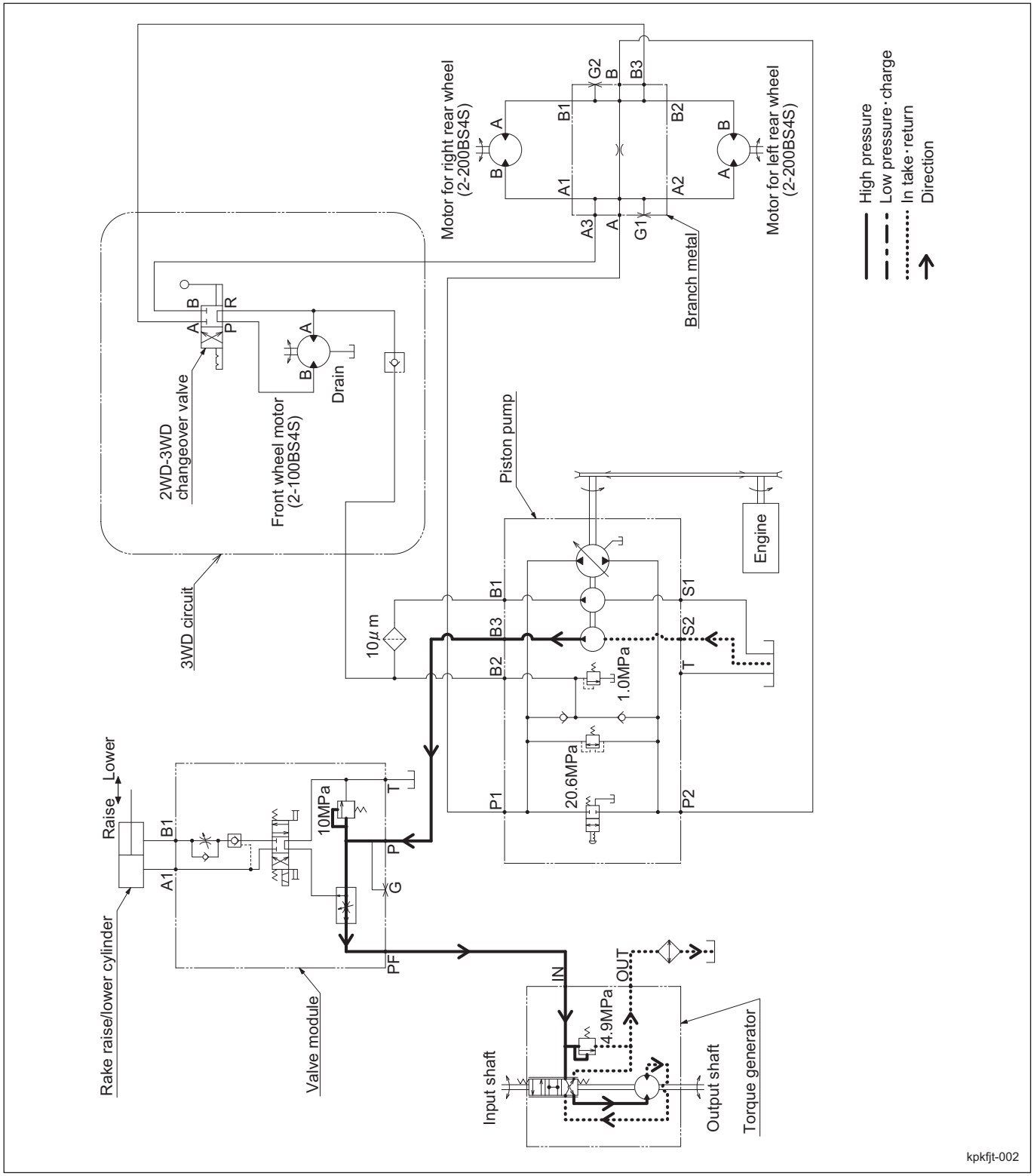
Steering circuit

Torque generator neutral



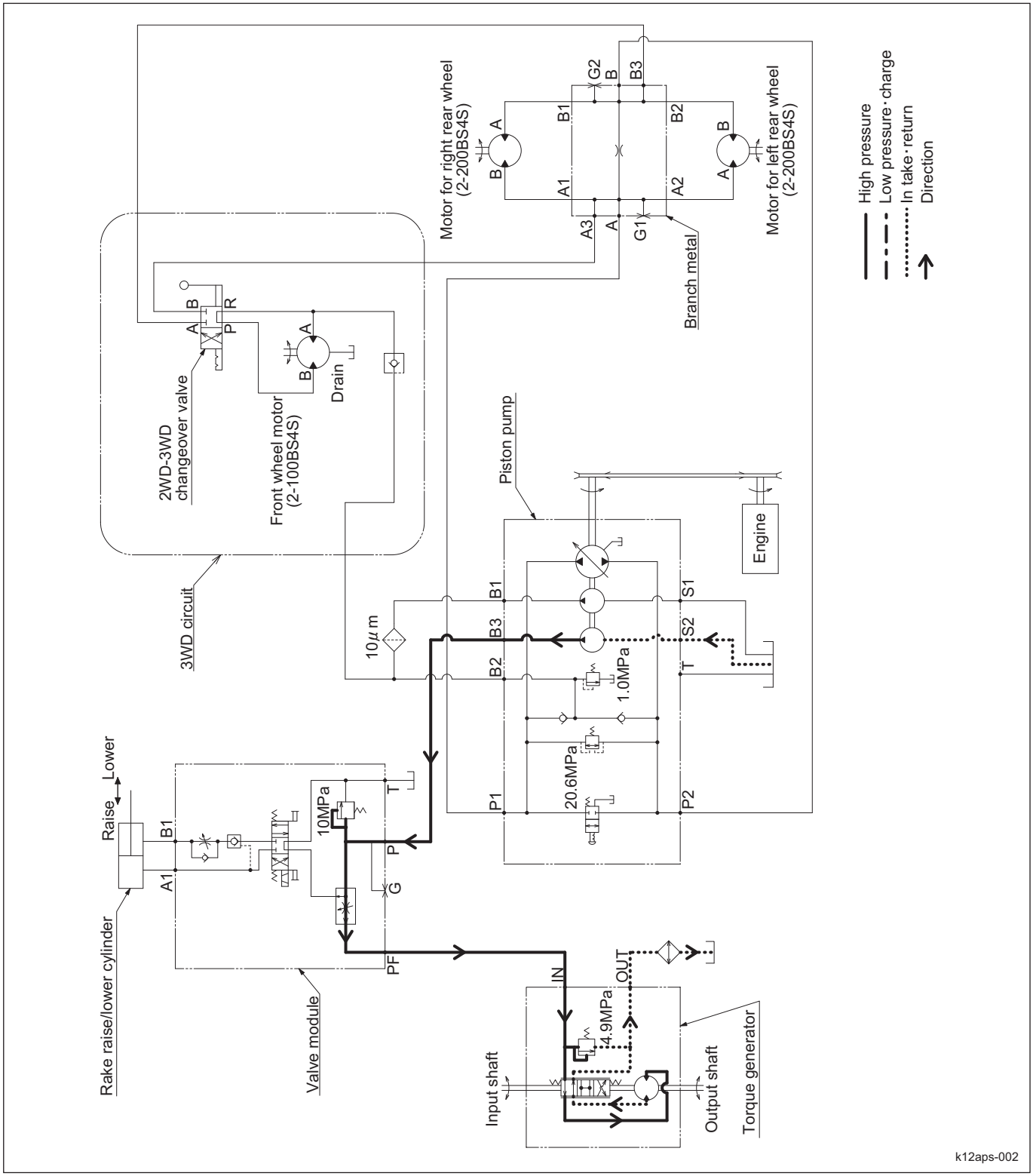
Torque generator neutral_001

Torque generator A rotation



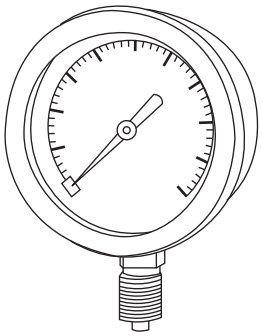
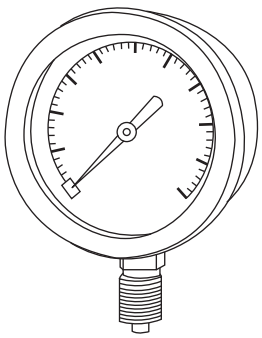
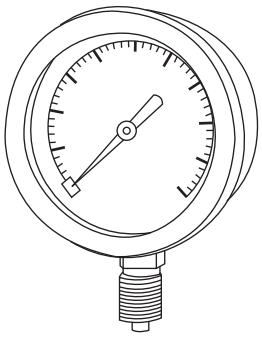
Torque generator A rotation_001

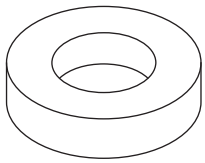
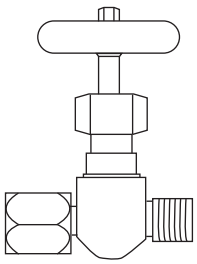
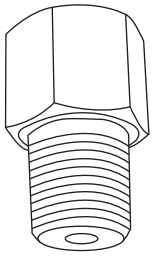
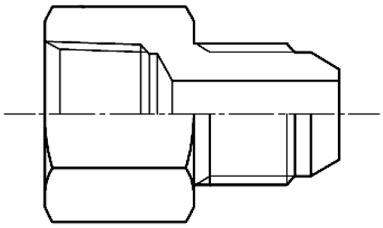
Torque generator B rotation

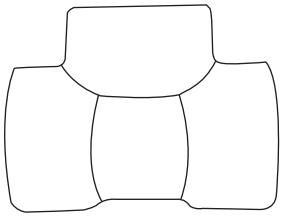
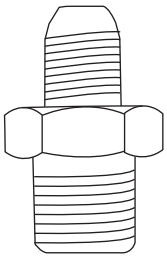
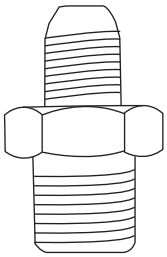
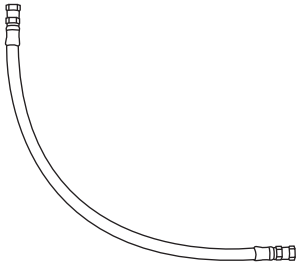


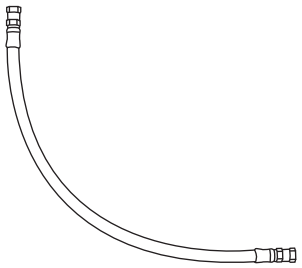
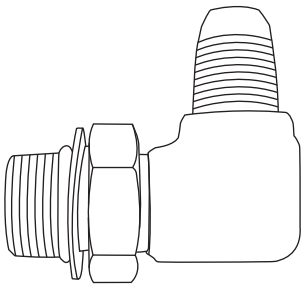
Torque generator B rotation_001

Special tools

Pressure gauge for high-pressure measurement  vasdfi-004	K4701000010	Pressur: For 0 - 35 MPa For 0 - 5,076.40 psi For 0 - 350.90 kgf/cm^2 Used mainly for measurement of the pressure on the high side.
Pressure gauge for low-pressure measurement  vasdfi-004	K4701000020	Pressure: For 0 - 15 MPa For 0 - 2,175.60 psi For 0 - 152.96 kgf/cm^2 Used mainly for measurement of the pressure on the low side.
Pressure gauge for ultralow-pressure measurement  vasdfi-004	K4701000030	Pressure: For 0 - 5 MPa For 0 - 725.20 psi For 0 - 50.99 kgf/cm^2 Used mainly for measurement of the pressure on the ultralow side.

Packing for pressure gauge  vasdfi-005	K4701000050	Used by inserting between the pressure gauge and the joint for the pressure gauge.
Guage valve  vasdfi-016	K4701000060	Used for temporarily blocking fluid of measurement for pressure gauge maintenance, inspection, repair etc.
Joint for pressure gauge  vasdfi-006	K4701000040	Used as a joint for pressure piping.
Female connector 1015-04  vasdfi-007	K3009000290-Y	Used as a connector when fitting the hydraulic hose to the pressure gauge.

Cast iron screw T shape fitting PT3/8 PF3/8  vasdfi-013	K3024000042-Y	Used when pressure gauge used between hydraulic hoses.
Special adapter PF1/4 PT3/8  vasdfi-015	K3009000042-Y	Used for extension of screw T shape fitting for pressure measurement.
Special adapter 1013-9  vasdfi-015	K3009000010-Y	2 pieces used for extension of screw T shape fitting for pressure measurement.
WP280-6 Hose 1-600  vasdfi-008	K3107210600	Used as a hydraulic hose for measurement of high-pressure to ultralow-pressure.

WP210-9 Hose 1-490  vasdfi-008	K3105310490	Used as a hydraulic hose for measurement of high-pressure to ultralow-pressure.
90 Adjuster elbow 1086-9  vasdfi-014	K3008000032-Y	Used for extension when pressure gauge fitted to pressure measurement port.

Measurement method

Note

The most effective way of solving problems in the hydraulic system is to use a measuring instrument such as a pressure gauge for measurement.
Before hydraulic measurement

Important

Before concluding that the problem in the hydraulic system is caused by the hydraulic equipment, every part of the hydraulic system must be checked for issues related to oil fill, oil filter, loosening of fasteners, lack of adjustment and so on.

Note on hydraulic measurement

Warning

As mentioned in the testing procedure, the use of a pressure gauge not meeting the pressure measurement standard may result in damage to the pressure gauge or leakage of high-pressure oil. Be careful about high-pressure oil which may pierce your skin, resulting in physical injury.

Warning

Carry out hydraulic measurement with two or more persons. One person should be in the driver's seat to operate the machine and the other person should engage in measurement and recording.

Caution

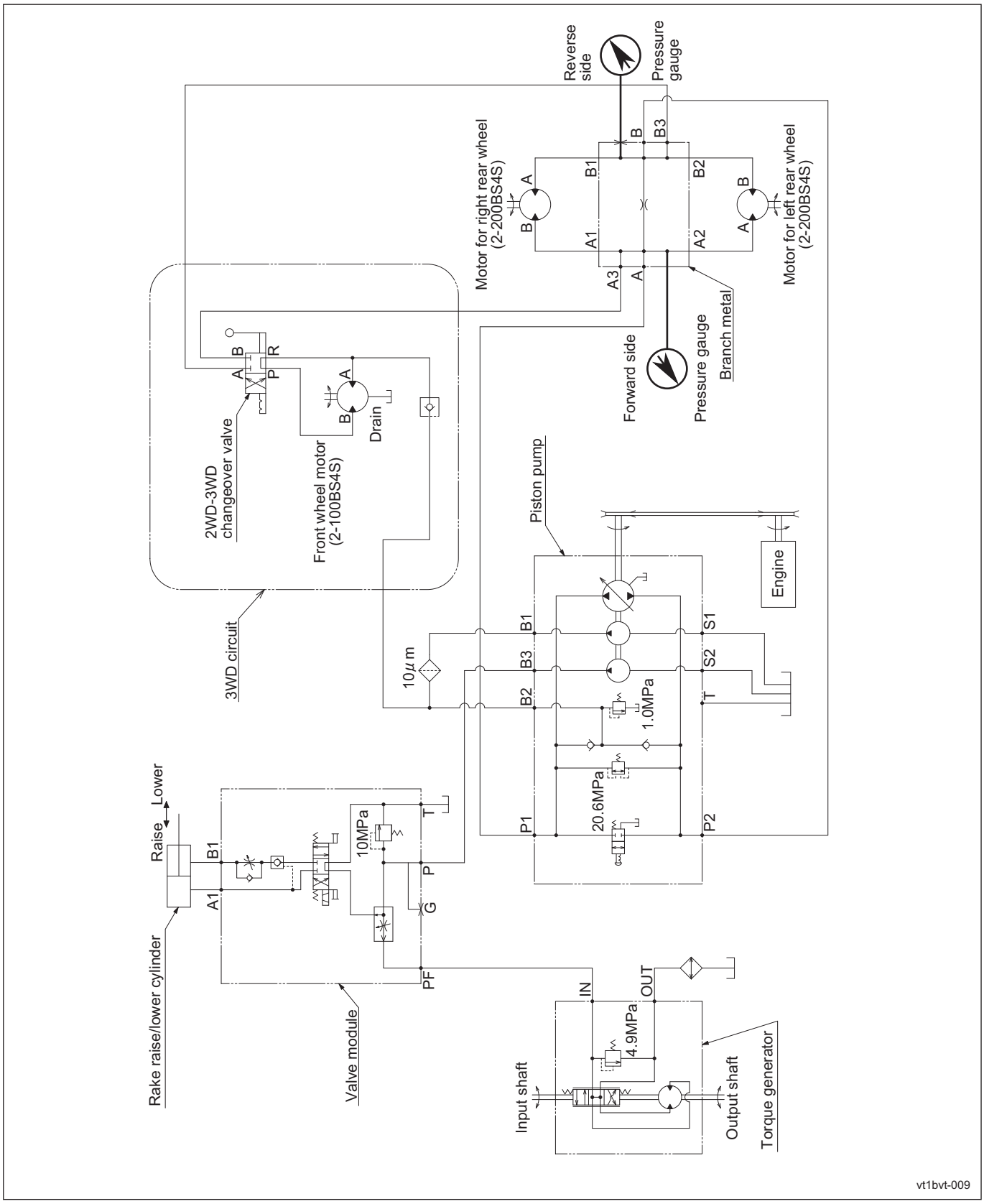
When checking for pinhole leakage of the hydraulic circuit or oil leakage of the nozzle, search for a leakage point using something like paper or cardboard, never with your bare hands. Be careful about high-pressure oil which may pierce your skin, resulting in physical injury.

1. Always clean the machine before hydraulic measurement. Remember that the machine must always be kept clean for hydraulic measurement. Contamination may lead to clogging or breakage of the hydraulic circuit.
2. Review the measuring method before starting measurement.
3. Before measurement, check for maladjustment, clogging or breakage.
4. Warm up the hydraulic oil before starting hydraulic measurement.

> ⚠ Warning
>
> Be sure to depressurize the hydraulic system before inspecting or repairing it.

5. When hydraulic equipment is removed, cap or plug it to prevent contamination of the hydraulic system.
6. When using a measuring instrument such as a pressure gauge, connect the in/out hoses correctly. Never connect the other way round to prevent breakage of the hydraulic system and measuring instrument.
7. Screw in the hydraulic fitting by hand till it touches the other side lightly, then fasten with a wrench.
8. Fit hoses and measuring instruments in such a way as to avoid contact with the driving part of the machine.
9. After connecting a measuring instrument, check the amount of oil in the hydraulic tank.
10. Check to see that the engine is in good condition. Carry out hydraulic measurement with the engine running at maximum speed.
11. In case there is any problem in the traveling circuit, carry out the following measurement.
    [1] Charge relief valve pressure
    [2] Traveling relieve valve pressure
12. In case there is any problem in the raise/ lower or steering circuit, carry out the following inspection.
    [1] Relief valve pressure
    [2] Oil leakage inside the hydraulic cylinder

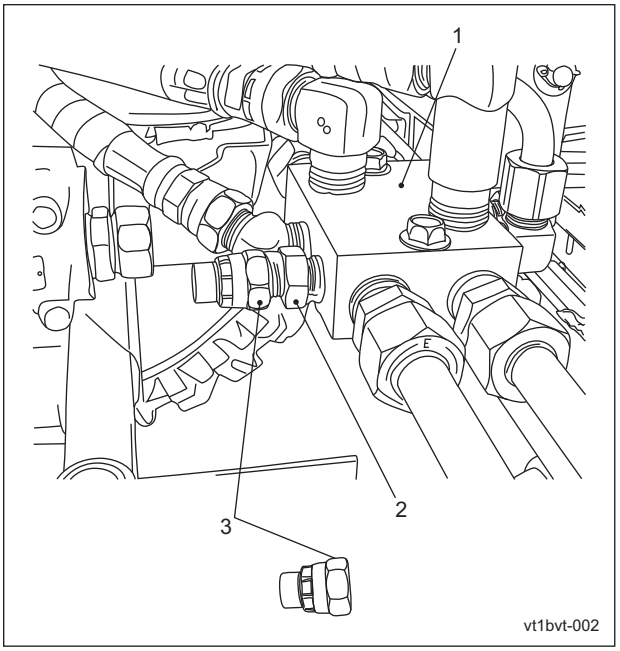
Traveling circuit



Traveling circuit_001

In the case of forward side

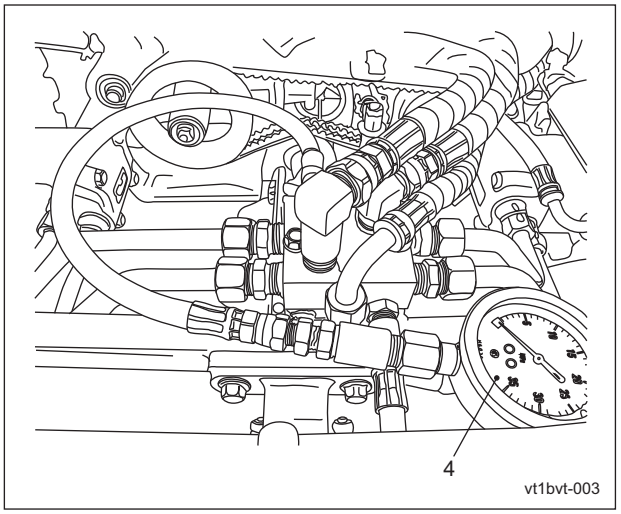
1. Remove the cap (3) of the forward side measurement port (2) of the hydraulic branch fitting (1).



In the case of forward side_002

1	Hydraulic branch fitting
2	Forward side measurement port
3	Cap

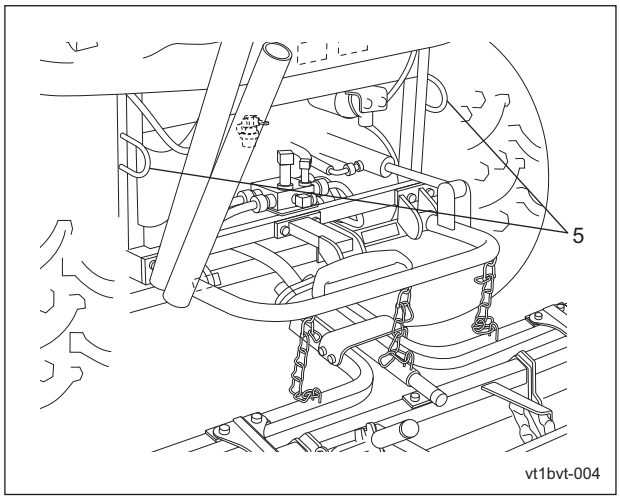
2. Fit the pressure gauge for high-pressure measurement (4) to the forward side measurement port (2).



In the case of forward side_003

4	Pressure gauge for high-pressure measurement

3. Apply resistance to the machine by applying a shoe link or the like to the rear hook (5).



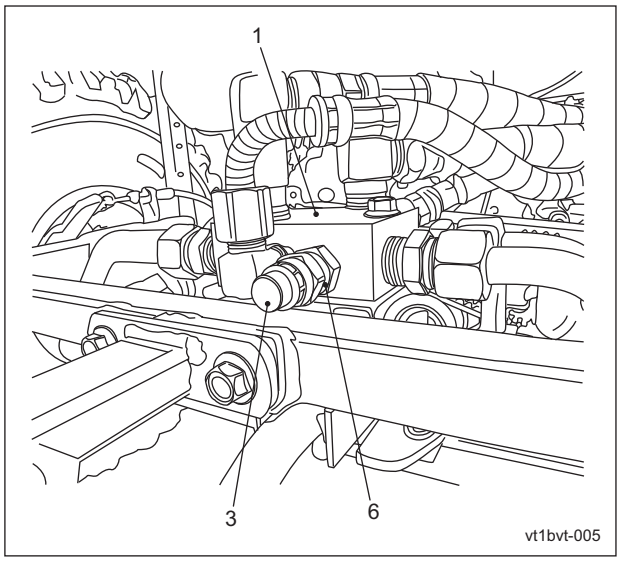
In the case of forward side_004

5	Rear hook

4. Start the engine and accelerate to the maximum speed. Press on the traveling pedal for forward direction. It is considered normal if the pressure is 20.6 MPa (210.06 kgf/cm^2) with the tires in a locked and nonslip condition.

In the case of reverse side

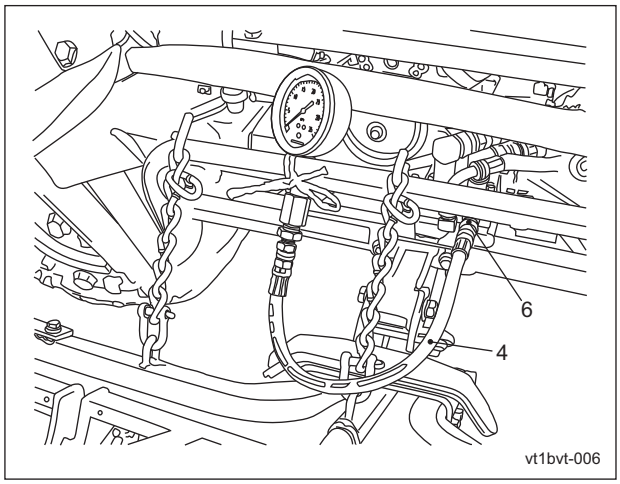
1. Remove the cap (3) of the reverse side measurement port (6) of the hydraulic branch fitting (1).



In the case of forward side_006

1	Hydraulic branch fitting
3	Cap
6	Reverse side measurement port

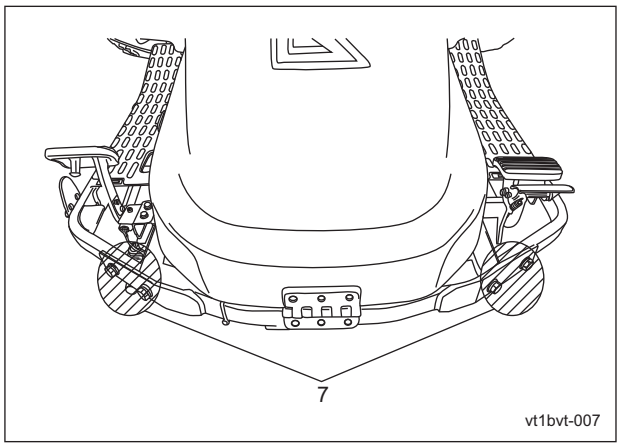
2. Fit the pressure gauge for high-pressure measurement (4) to the reverse side measurement port (6).



In the case of forward side_007

4	Pressure gauge for high-pressure measurement
6	Reverse side measurement port

3. Apply resistance to the machine by applying a shoe link or the like of to the front hook point (7).

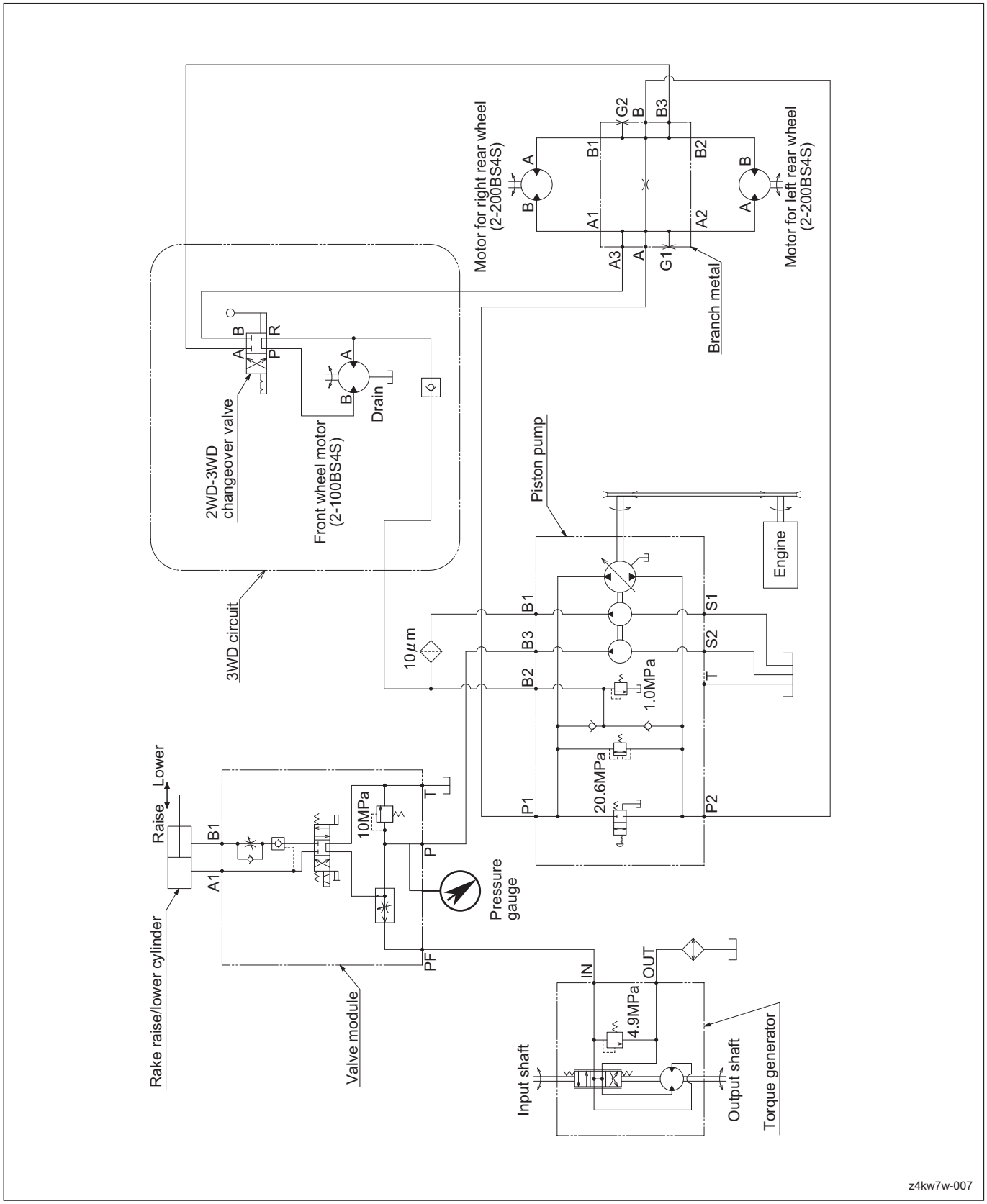


In the case of forward side_008

7	Front hook point

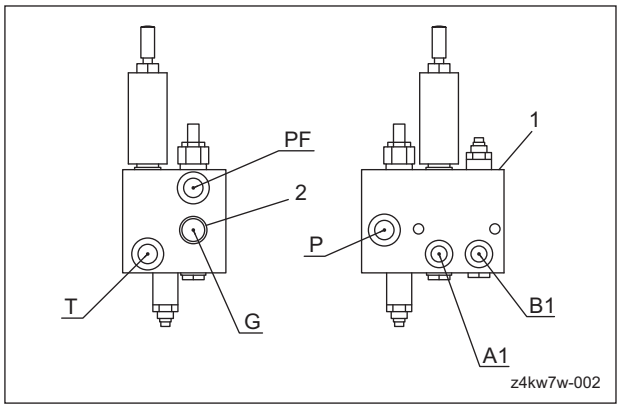
4. Start the engine and accelerate to the maximum speed. Press on the reverse pedal and check the pressure. It is considered normal if the pressure is 20.6 MPa (210.06 kgf/cm^2) with the tires in a locked and nonslip condition.

Raise/lower circuit



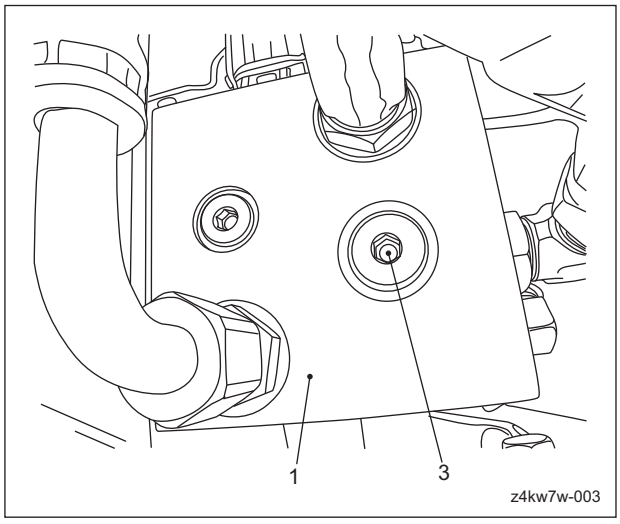
Raise/lower circuit_001

1. Lower the operating machine, stop the engine and remove the cap (3) on the oil pressure measurement port G (2) of the valve module (1) with a hexagonal wrench (4).



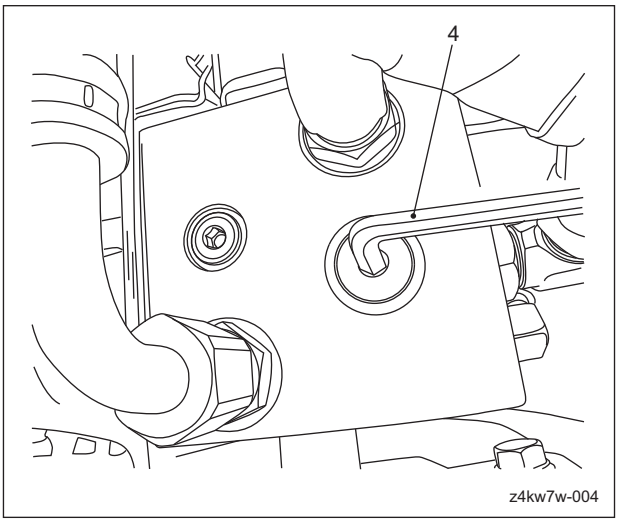
Raise/lower circuit_002

1	Valve module
2	Hydraulic measurement port G



Raise/lower circuit_003

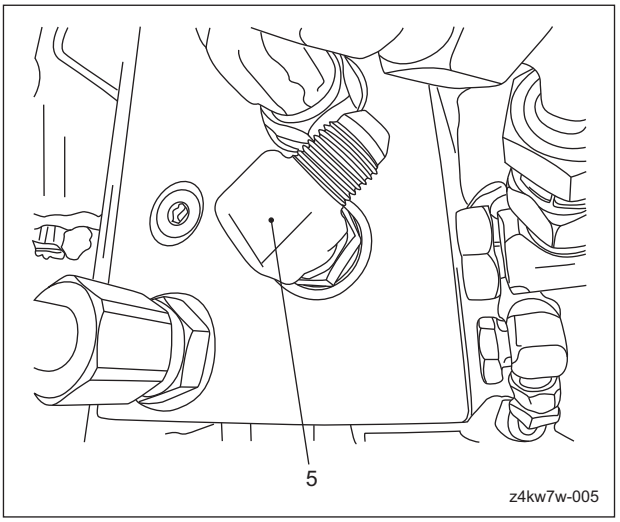
1	Valve module
3	Cap



Raise/lower circuit_004

4	Hexagonal wrench

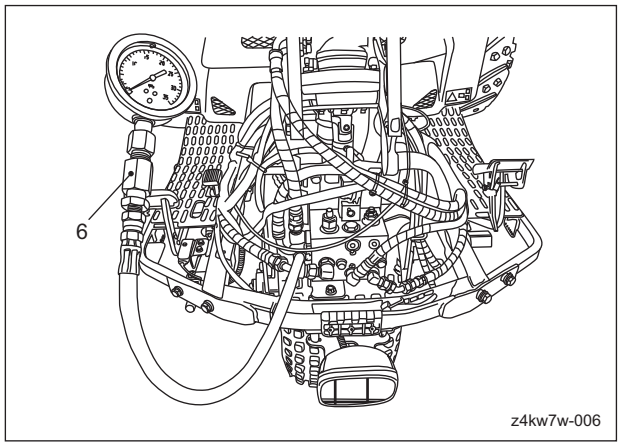
2. Fit the elbow (5) to the hydraulic measurement port G (2).



Raise/lower circuit_005

5	Elbow

3. Fit the pressure gauge for low-pressure measurement (6) to the elbow (5).

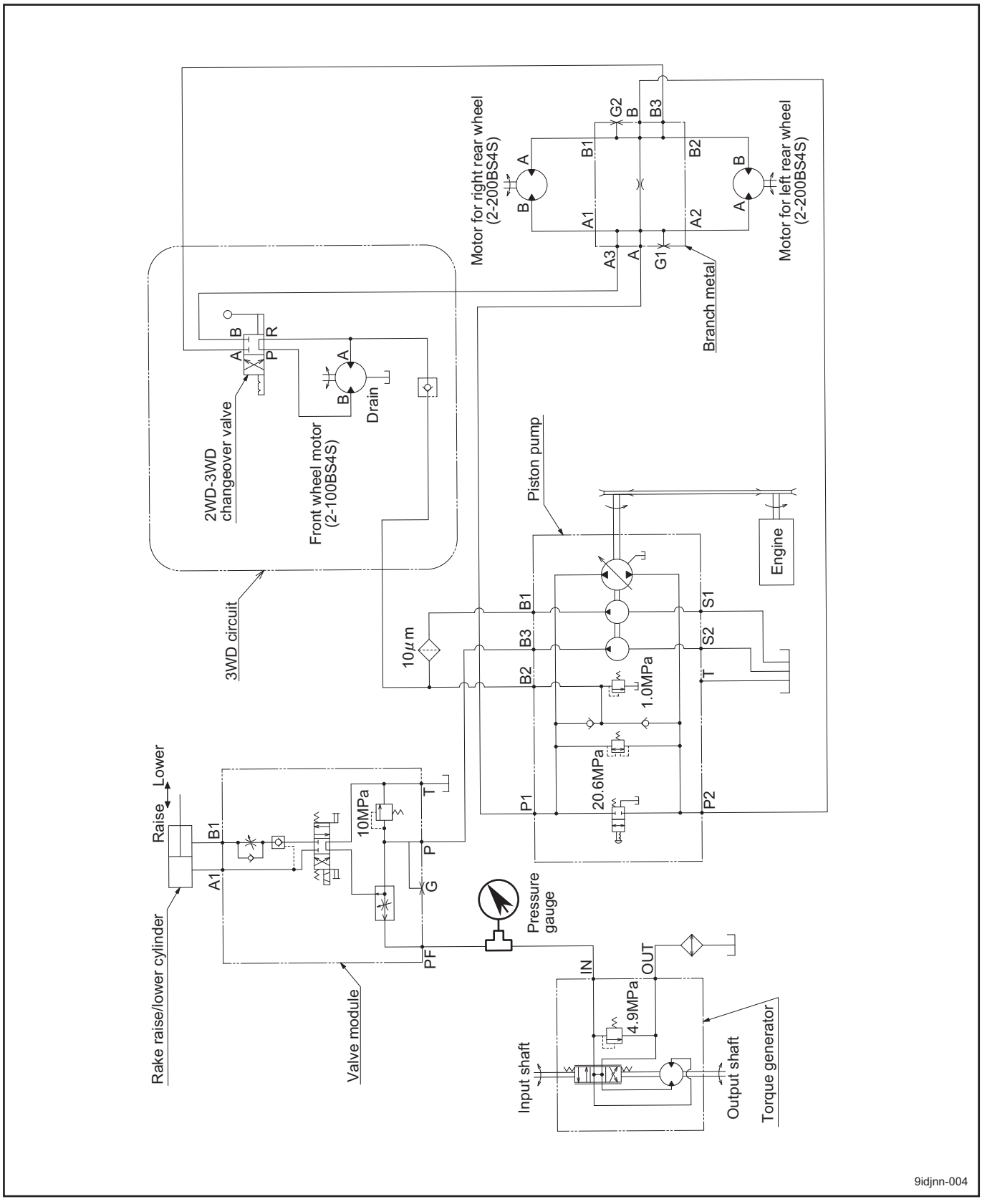


Raise/lower circuit_006

6	Pressure gauge for low-pressure measurement

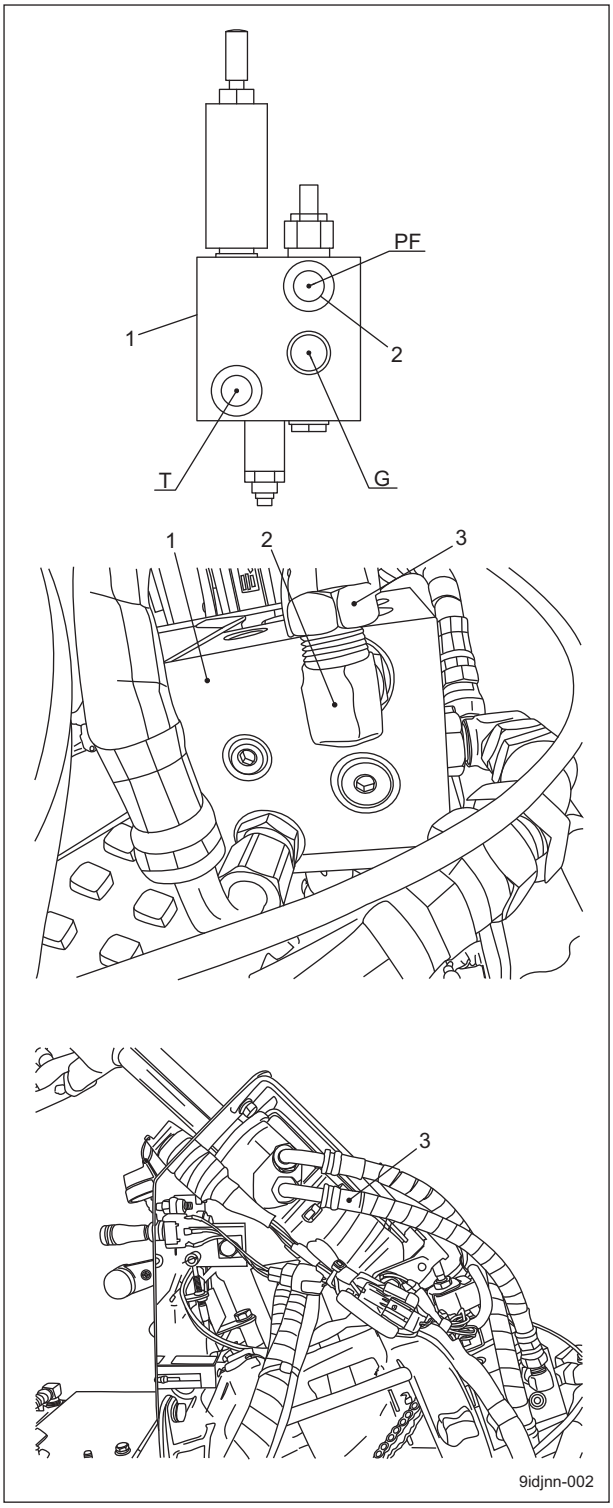
4. Start the engine and with the rake lowered, accelerate the engine to max. rpm. Turn the raise/lower switch to “Raise.” It is considered normal if the pressure gauge (6) reads about 10 MPa (101.97 kgf/cm^2) when the raise/lower cylinder is retracted fully. (The pressure should be the same when the raise/lower switch is turned to “Lower” and the raise/lower cylinder is extended fully.) (See “Raise/lower circuit_006.”)

Steering circuit



Steering circuit_001

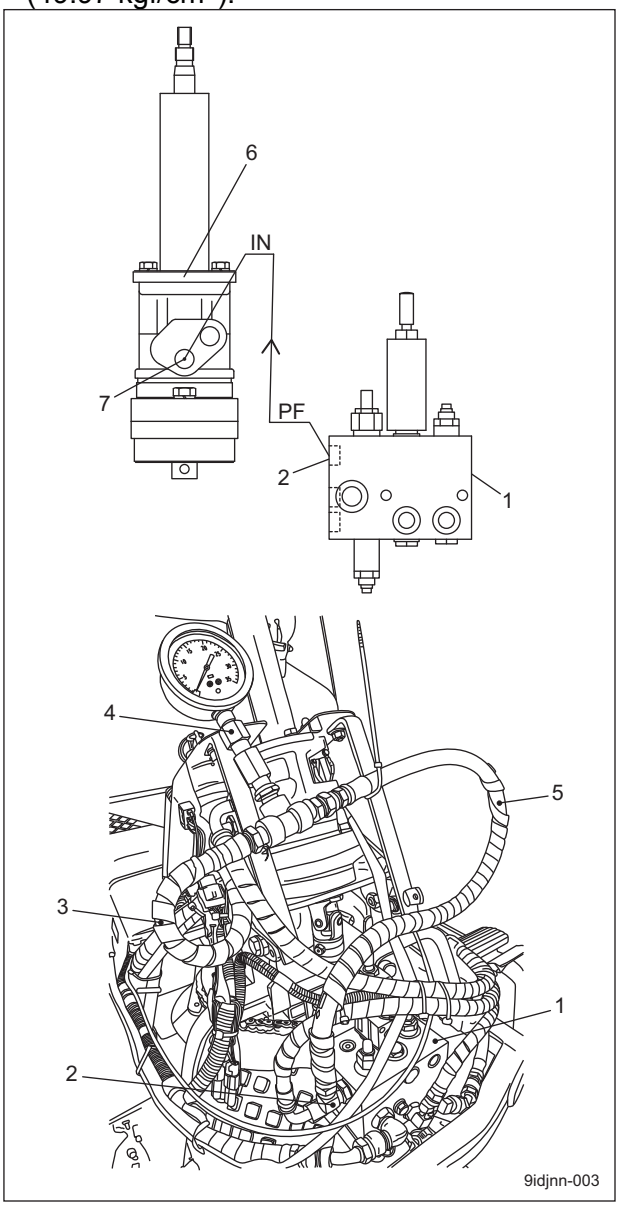
1. Remove the hydraulic hose (3) of the PF port (2) of the valve module (1).



Steering circuit_002

1	Valve module
2	PF port
3	Hydraulic hose

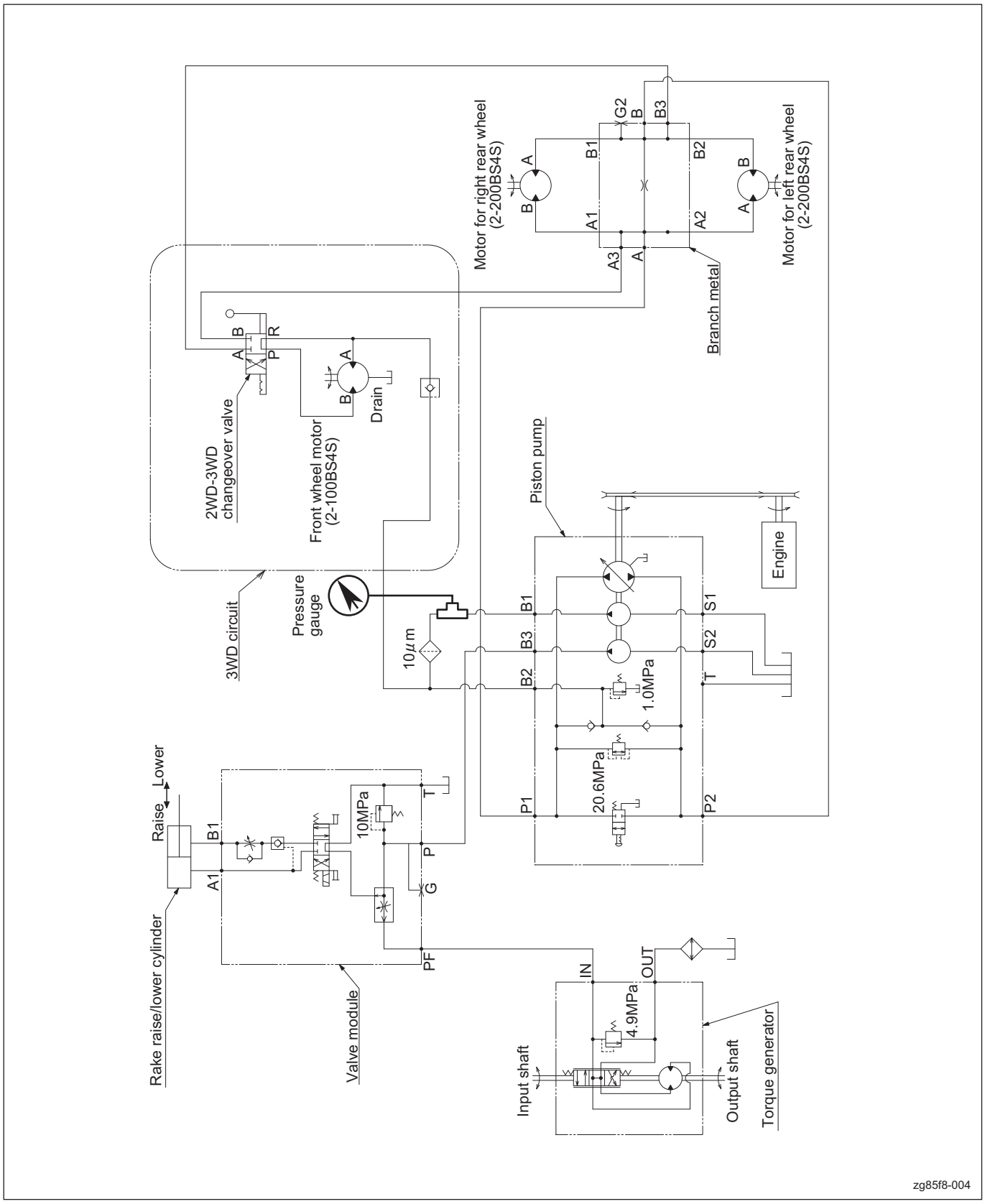
2. Fit the pressure gauge for low-pressure measurement (4) to the removed hydraulic hose (3).
3. Fit the pressure gauge hose (5) to the PF port (2) of the valve module (1).
4. Measure by inserting the pressure gauge (4) between the input (IN) (7) of the torque generator (6) and the PF port (2) of the valve module.
5. Start the engine, turn the steering wheel fully, and accelerate to max. rpm. The pressure is considered normal if the pressure gauge (4) reads about 4.9 MPa (49.97 kgf/cm^2).



Steering circuit_003

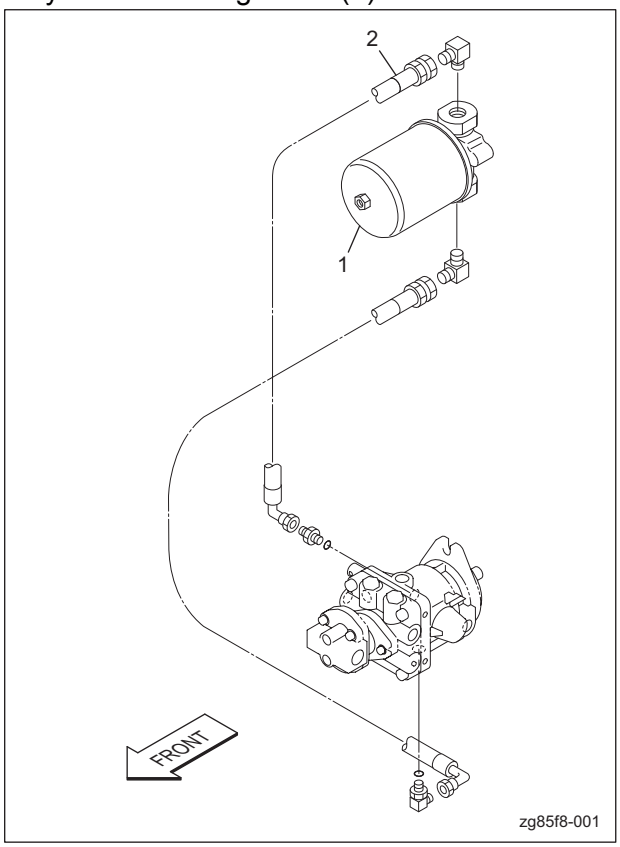
1	Valve module
2	PF port
3	Hydraulic hose
4	Pressure gauge for low-pressure measurement
5	Pressure gauge hose
6	Torque generator
7	Input (IN)

Charge circuit



Charge circuit_001

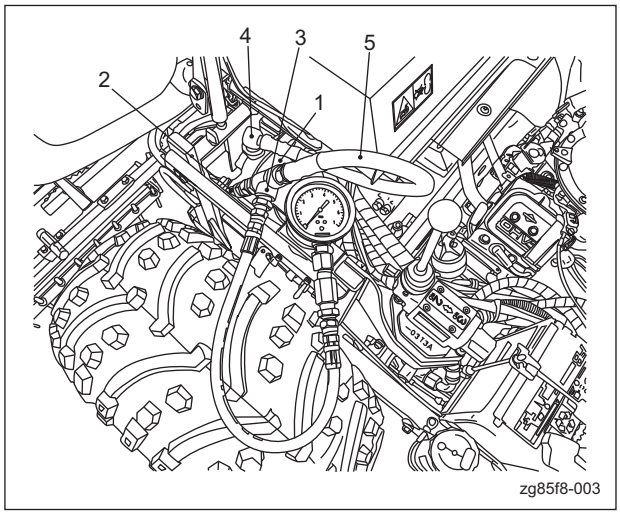
1. Remove the upper hydraulic hose (2) of the hydraulic cartridge filter (1).



Charge circuit_002

1	Hydraulic cartridge filter
2	Hydraulic hose

2. Fit the removed hydraulic hose (2) to the pressure gauge for ultralow-pressure measurement (3).



Charge circuit_003

1	Hydraulic cartridge filter
2	Hydraulic hose
3	Pressure gauge for ultralow-pressure measurement
4	Elbow
5	Hose

3. Fit the hose (5) of the pressure gauge to the elbow (4) of the hydraulic cartridge filter. (See “Charge circuit_003.”)
4. Start the engine and accelerate to medium speed or more. The pressure is considered normal if the pressure gauge reads about 1.0 MPa (10.20 kgf/cm^2).

General inspection and repair

Note

Before inspection and repair

1. Move the machine to a level place. Apply the parking brake and lower the rake. Then, stop the engine and remove the key.
2. Clean the machine. Be sure to clean parts such as the piping, hoses, and hydraulic fittings. Remember that cleaning is always necessary upon inspection and repair of hydraulic systems.

Warning

Be sure to depressurize the hydraulic system before inspecting and repairing it.

3. When piping and hoses are removed, put a cap or plug in its place to prevent contamination of the hydraulic systems.
4. Attach labels or other identifications to the removed piping and hoses so that they can be correctly refitted.
5. When removing piping and hoses, pay special attention to the connection part. If necessary, mark the piping and hoses to ensure correct fitting.

After inspection and repair

Caution

Check to see if there is any hydraulic oil leakage in each part after installation. Refer to the tightening torque list. We are not responsible for failure due to abnormal tightening, excessive torque tightening and so on.

1. Check the amount of oil in the hydraulic tank and fill if necessary. In the event that failure or contamination is found in the hydraulic circuit, replace the hydraulic oil and filter.
2. When fitting hydraulic fittings, apply hydraulic oil onto the O ring and seal.
3. Fit hoses and hydraulic fittings only after removing the cap and plug.
4. When fitting hoses and hydraulic fittings, follow the proper procedure for tightening.
5. After repair, check to see whether the hydraulic system functions normally and whether there are any broken parts.
6. When the hydraulic system has been repaired or replaced, operate the machine slowly, idling the engine, to allow the air to go out of the circuit.
7. Check to see if there is any oil leakage. In the event of leakage, stop the engine, set the oil stopper, and check the amount of oil in the hydraulic tank. Add oil if necessary.

Hydraulic hose, piping

Warning

When checking for pinhole leakage of the hydraulic circuit or oil leakage of the nozzle, search for a leakage point using something like paper or cardboard, never with your bare hands. Be careful about high-pressure oil which may pierce your skin, resulting in physical injury.

Check the piping and hose every day for oil leakage, damage to the circuit, looseness, abrasion, loosening of connecting part, weather-related deterioration and chemical-related deterioration. If necessary, repair before operating the machine.

Hydraulic oil

Important

In the event of hydraulic circuit failure, be sure to clean the circuit.

In the event of contamination or failure of the hydraulic circuit, clean and/or replace the parts. Since the hydraulic traveling circuit is closed, any contaminant will remain within the circuit and may lead to other failures unless cleaned.

Caution

Exercise adequate care since hot oil adhered to your skin can cause burn injury.

1. Drive and maneuver the machine and warm up the hydraulic oil.
2. Move the machine to a level place. Apply the parking brake and lower the rake. Then, stop the engine and remove the key.

Warning

Be sure to depressurize hydraulic systems before inspecting and repairing them.

Important

Be sure to clean the circuit connecting part to be repaired.

3. Drain the oil from the hydraulic tank.
4. Drain the oil from the hydraulic hoses and piping while the oil is still warm.
5. Replace the hydraulic oil and filter.
6. Check the hydraulic tank and clean.
7. Fit the hydraulic hoses, piping and hydraulic fittings that have been removed.

Caution

Use only the specified hydraulic oil. Use of other hydraulic oil may lead to the failure of hydraulic circuit or the like of.

8. Supply new hydraulic oil.
9. Check to confirm that the forward/reverse pedals and all the drives of the operating machine are in the neutral position.
10. Start and run the engine for 10 seconds to see if there is any oil leakage, etc. Repeat this procedure.

11. Start the engine and let it run idle for at least two minutes, then run at the maximum speed for one minute.
12. Raise and lower the the rake, and turn the steering wheel side to side.
13. Stop the engine and check to see if there is any oil leakage. Check the amount of hydraulic oil and fill if necessary.
14. Operate for two hours under normal operating conditions.
15. Check the condition of hydraulic oil. If it is contaminated, repeat the procedures from 1 through 13 until the oil becomes clean.
16. If no abnormality is found, operate normally and maintain according to the maintenance schedule.

Bleeding

⚠ Caution

Whenever the motor, pump, cylinder or the like of is replaced or repaired, check to see that the hydraulic system is properly connected. Be sure to bleed in order to prevent failures.

Important

Whenever hydraulic parts are replaced or repaired, replace the oil filter.

1. Move the machine to a level place. Apply the parking brake and lower the rake. Then, stop the engine and remove the key.
2. Check to see that the hydraulic equipment and hydraulic fittings are securely fastened.
3. In the event of failure or contamination of hydraulic system, clean the hydraulic system and hydraulic tank, and replace the hydraulic oil.
4. Check the amount of hydraulic oil and fill if necessary.
5. Adjust and connect properly, and check for damage to parts or leakage of oil.
6. Check to see that the forward/reverse pedals and all the drives of the operating machine are in the neutral position.
7. Start and run the engine for 10 seconds and check for oil leakage or the like of. Repeat this procedure once again.

⚠ Warning

When jacking up the machine, check the “Safety – Jack up.”

8. Jack up all the wheels of the machine and support securely with a jack stand or proper block.
9. Check to see that the forward/reverse pedals and all the drives of the operating machine are in the neutral position.
10. Start the engine and slightly depress the forward/reverse pedal. The charge pump will purge the air from the hydraulic system in 30 seconds or so, and the circuit will be primed for operation.
11. As soon as the oil begins to fill the hydraulic circuit, maneuver the raise/lower lever and the switch to operate the raise/lower cylinder several times. In the event that the cylinder does not operate in 10 to 15 seconds or the pump makes an abnormal noise, stop the engine immediately and investigate the cause. Then, proceed with the following inspection.
    [1] Looseness/failure of filter or suction line
    [2] Looseness/failure of pump coupler
    [3] Clogging of suction line
    [4] Failure of charge relief valve
    [5] Failure of charge pump
12. If the raise/lower cylinder operates in 10 to 15 seconds, proceed to the next step.
13. Maneuver the forward/reverse pedals and check to see if the wheel rotates in proper direction.
    [1] If the wheel rotates in the wrong direction, stop the engine and switch the motor line to modify the rotation direction.
    [2] If the rotation direction is correct, stop the engine.
14. Return the forward/reverse pedals to the neutral position.
15. Check the neutrality of traveling and adjust. (Refer to Owner’s operating manual.)
16. Lower the machine to the ground.
17. If the traveling pump or wheel motor is removed, proceed with the following operation.
    [1] Operate for 10 minutes and let the wheel rotate slowly.

[2] In the following 10 minutes, drive with the workload being gradually increased.

[3] Stop the machine, check the amount of hydraulic oil, and fill the oil if necessary. Check for oil leakage. Check every connection part thoroughly.

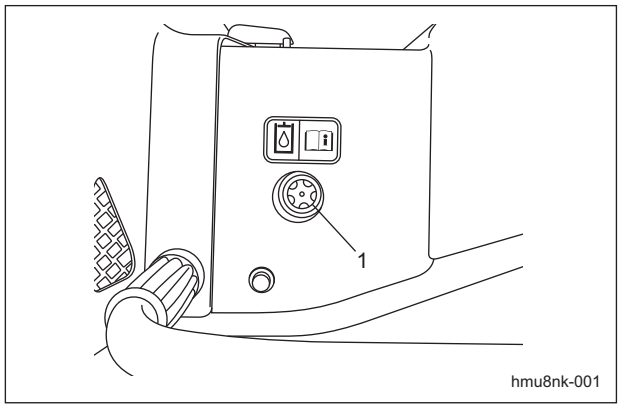
[4] Check the neutrality of traveling. If adjustment is needed, jack up all the wheels of the machine and support securely with a jack stand or proper block.

Inspection and repair of each section

Hydraulic oil

Inspection of hydraulic oil

1. On a level surface, check to see if the hydraulic oil is up to the center of the oil gauge (1). Replenish oil as appropriate.
2. Check underneath the machine body for oil leakage.



Inspection of hydraulic oil_001

1	Oil gauge

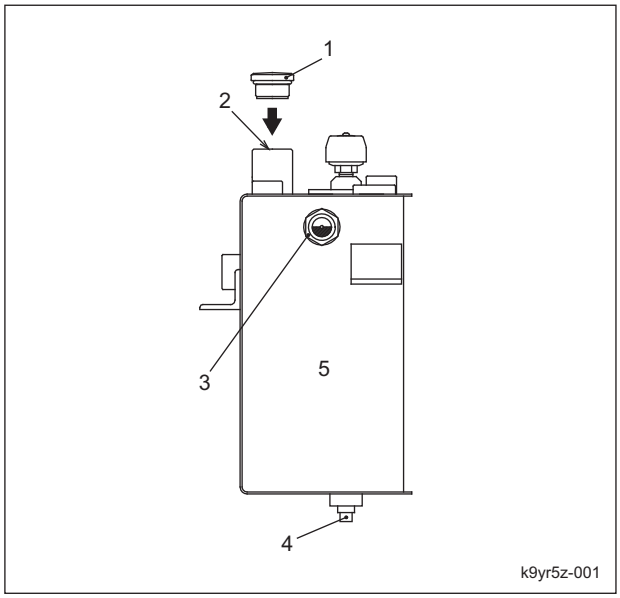
Change of hydraulic oil

> **Caution**
>
> If hydraulic oil has emulsified or lost any of its clarity, change immediately.

Contamination of hydraulic oil leads to the failure of hydraulic equipment. Change hydraulic oil regularly.

Change period	First time	After 100 hours of operation
	From the second time onward	For every 500 hours of operation
Specified hydraulic oil	Shell Tellus 46 (Equivalent)	
Capacity of hydraulic tank	About 15 L (3.96 US gallons)	

1. Start the engine to warm up the oil, and remove the drain plug (4) of the hydraulic tank (5) on a level place to drain the old hydraulic oil.
2. Rewind a new seal tape around the drain plug (4); fit the plug onto the hydraulic tank (5); add new hydraulic oil till the oil surface reaches the center of the oil gauge (3) of the hydraulic tank; and fit the oil cap (1).
3. Start the engine, raise/lower the rake, and turn the steering wheel from side to side. Repeat forward and reverse several times.
4. Check to see if the oil surface is in the center of the oil gauge and replenish as appropriate.



Change of hydraulic oil_001

1	Oil cap
2	Oil filler hole
3	Oil gauge
4	Drain plug
5	Hydraulic tank

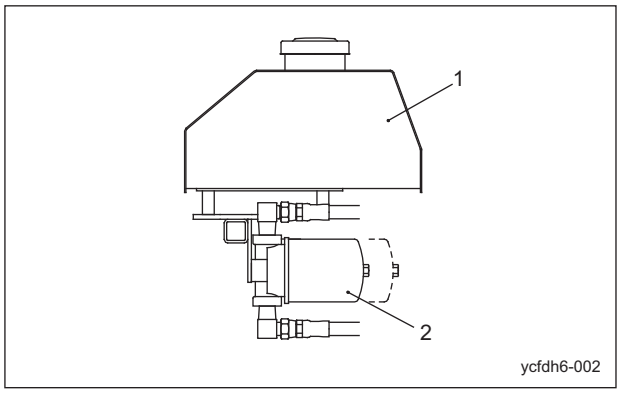
Hydraulic oil filter

Change of hydraulic oil filter

Contamination of the hydraulic oil causes a failure of the hydraulic equipment. Change the hydraulic oil filter regularly.

Change period	First time	After 100 hours of operation
	From the second time onward	For every 500 hours of operation

1. Remove old cartridge filter (2).
2. Apply clean hydraulic oil onto the packing of new filter for replacement.
3. Screw in the filter by hand till the packing touches the fitting surface. Then, further tighten for 1/2 turn.
4. After fitting, start the engine to warm up the oil. Then, stop the engine and check for the leakage of oil.



Change of hydraulic oil filter_001

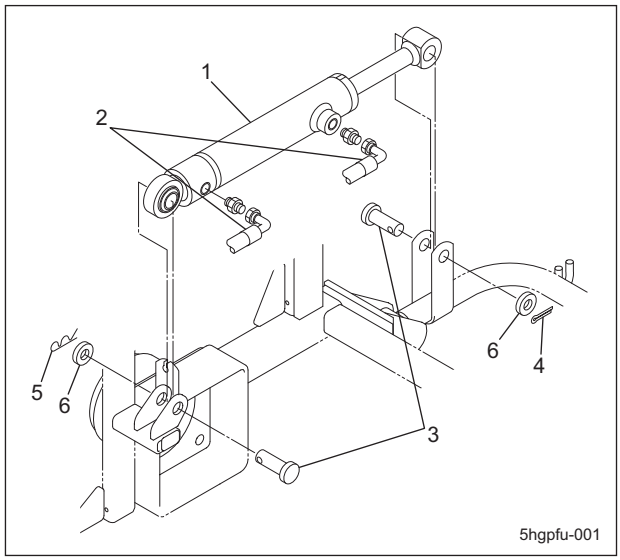
1	Fuel tank
2	Cartridge filter

Removal and installation of each section

Raise/lower cylinder

Removal of raise/lower cylinder

1. Lower the rake part.
2. Remove the hydraulic hoses (2) fitted to the raise/lower cylinder (1).
3. Remove the split pin (4), snap pin (5) and washers (6), then remove the hardened flat head pins (3).
4. Remove the raise/lower cylinder (1).



Removal of raise/lower cylinder_001

1	Raise/lower cylinder
2	Hydraulic hose
3	Hardened flat head pin
4	Split pin
5	Snap pin
6	Washer

Fitting of raise/lower cylinder

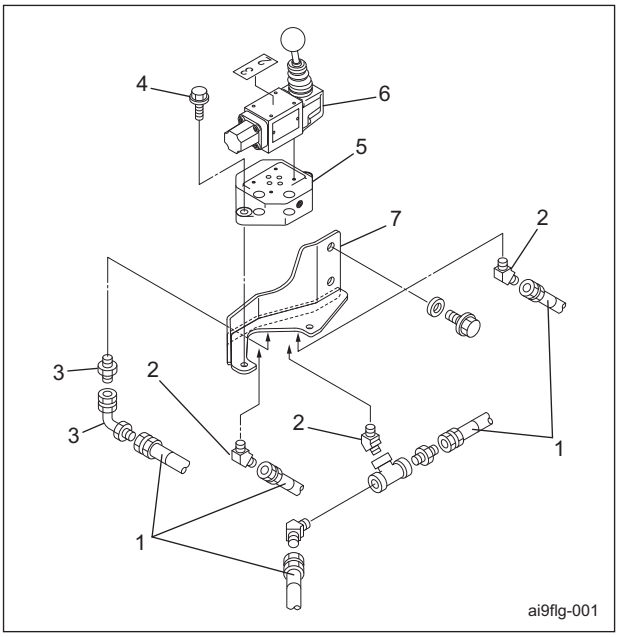
For fitting, follow the opposite procedure of removal.

> **Caution**
>
> After fitting, check for hydraulic oil leakage at each part.
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Drive switching valve

Removal of drive switching valve

1. Remove the hydraulic hose (1) fitted to the drive switching valve (6).
2. Remove the elbow (2) and the adapter (3).
3. Remove the bolt (4).
4. Remove the drive switching valve (6) together with the sub-plate (5).



Removal of drive switching valve_001

1	Hydraulic hose
2	Elbow
3	Adapter
4	Bolt
5	Sub-plate
6	Drive switching valve
7	Switching valve mount

Fitting of drive switching valve

1. Mount on the switching valve mount (7) the drive switching valve (6) which was removed together with the sub-plate (5). (See “Removal of drive switching valve_001.”)
2. Fit with the bolt (4).
3. Fit the elbow (2) and the adaptor (3).
4. Fit the hydraulic hose (1).

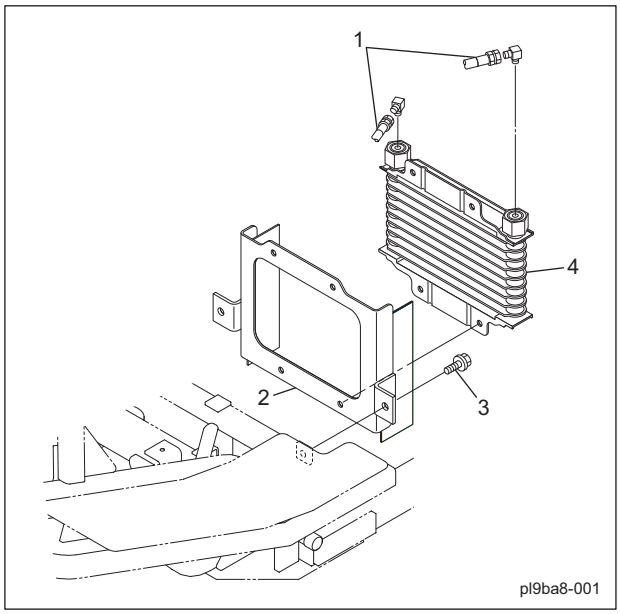
Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Oil cooler

Removal of oil cooler

1. Turn the cover stopper and open the rear cover.
2. Remove the hydraulic hose (1) fitted to the oil cooler (4).
3. Remove the fitting bolt (3) of the oil cooler bracket (2).
4. Remove the oil cooler (4) together with the oil cooler bracket (2).



Removal of oil cooler_001

1	Hydraulic hose
2	Oil cooler bracket
3	Fitting bolt
4	Oil cooler

Fitting of oil cooler

For fitting, follow the opposite procedure of removal.

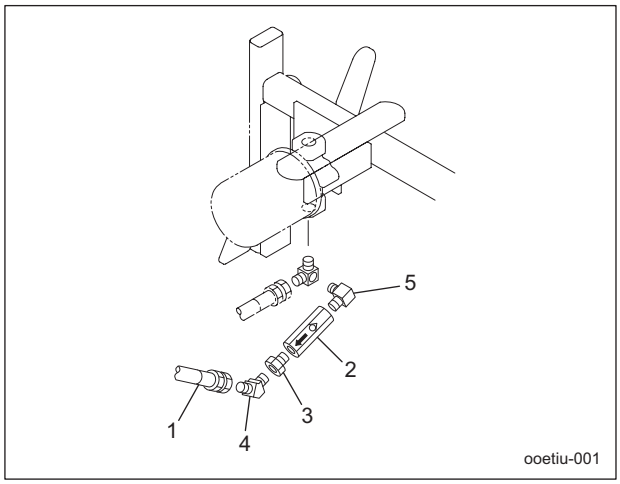
Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

In-line check valve

Removal of in-line check valve

1. Turn the cover stopper and open the rear cover.
2. Remove the hydraulic hose (1) fitted to the in-line check valve (2).
3. Remove the elbow (4) and the bushing (3).
4. Loosen the in-line check valve (2) and remove.



Removal of in-line check valve_001

1	Hydraulic hose
2	In-line check valve
3	Bushing
4	Elbow
5	Elbow

Fitting of in-line check valve

1. Fit the bushing (3) while paying attention to the direction of the in-line check valve (2).
2. Fit the in-line check valve (2) fitted with the bushing (3) to the elbow (5).
3. Fit the elbow (4), aligning the angle, to the bushing (3). (See “Removal of in-line check valve_001.”)
4. Fit the hydraulic hose (1) to the elbow (4).

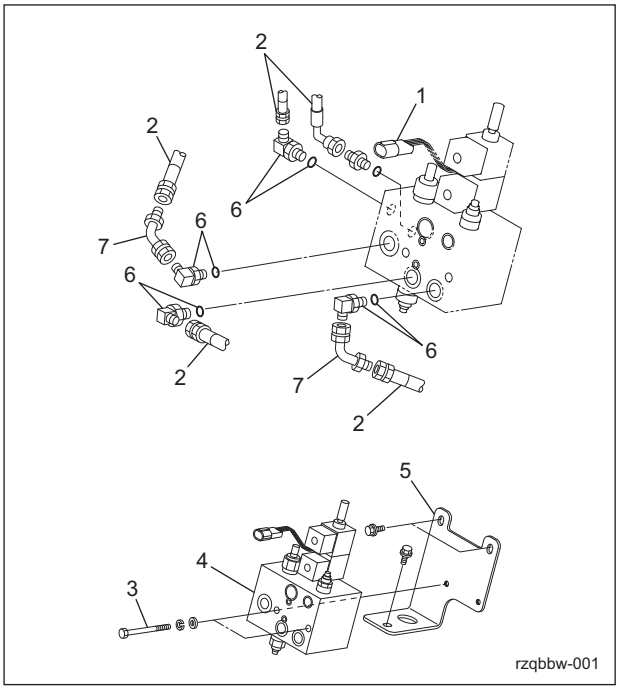
⚠ Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Valve module

Removal of valve module

1. Remove the dimple knob and open the front cover.
2. Pull out the wiring connector (1).
3. Remove the hydraulic hose (2) fitted to the valve module.
4. Remove the pipe adapter (7) and the adjuster elbow (6).
5. Remove the valve module fitting bolt (3).
6. Remove the valve module (4).



Removal of valve module_001

1	Wiring connector
2	Hydraulic hose
3	Fitting bolt
4	Valve module
5	Valve mount
6	Adjuster elbow
7	Pipe adaptor

Fitting of valve module

1. Fit the valve module (4) onto the valve mount (5) with the bolt (3). (See “Removal of valve module_001.”)
2. Fit the adjuster elbow (6) to the valve module (4).
3. Fit the pipe adaptor (7) to the adjuster elbow (6).
4. Fit the hydraulic hose (2).
5. Connect the wiring connector (1) to the connector.

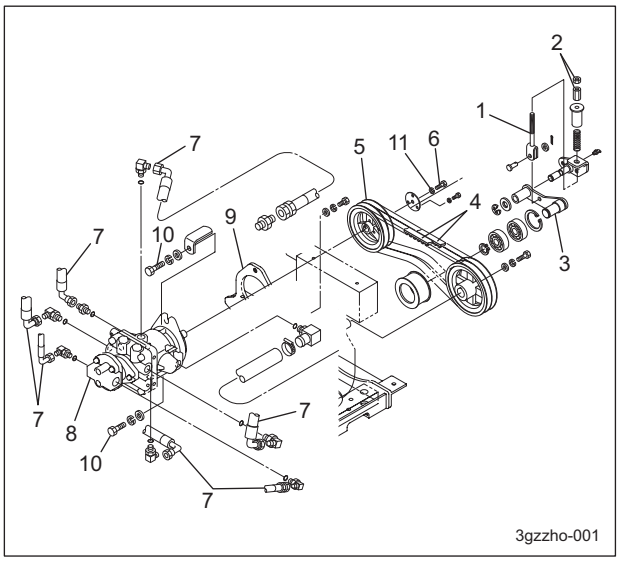
⚠ Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Piston pump

Removal of piston pump

1. Remove the rear cover. (See “Main body – Removal of rear cover.”)
2. Loosen the nut (2) of the tension lever adjuster (1) and loosen the tension lever (3).
3. Remove the two pieces of the V belt (4).
4. Remove the fitting bolt (6) and spring washer (11) of the B2V pulley (5).
5. Remove the B2V pulley (5).
6. Remove the hydraulic hose (7) fitted to the piston pump (8).
7. Remove the bolt (10) used for fitting the piston pump (8) and the frame (9).
8. Remove the piston pump (8).



Removal of piston pump_001

1	Tension lever adjuster
2	Nut
3	Tension lever
4	V belt
5	B2V pulley
6	Fitting bolt
7	Hydraulic hose
8	Piston pump
9	Frame
10	Bolt
11	Spring washer

Fitting of piston pump

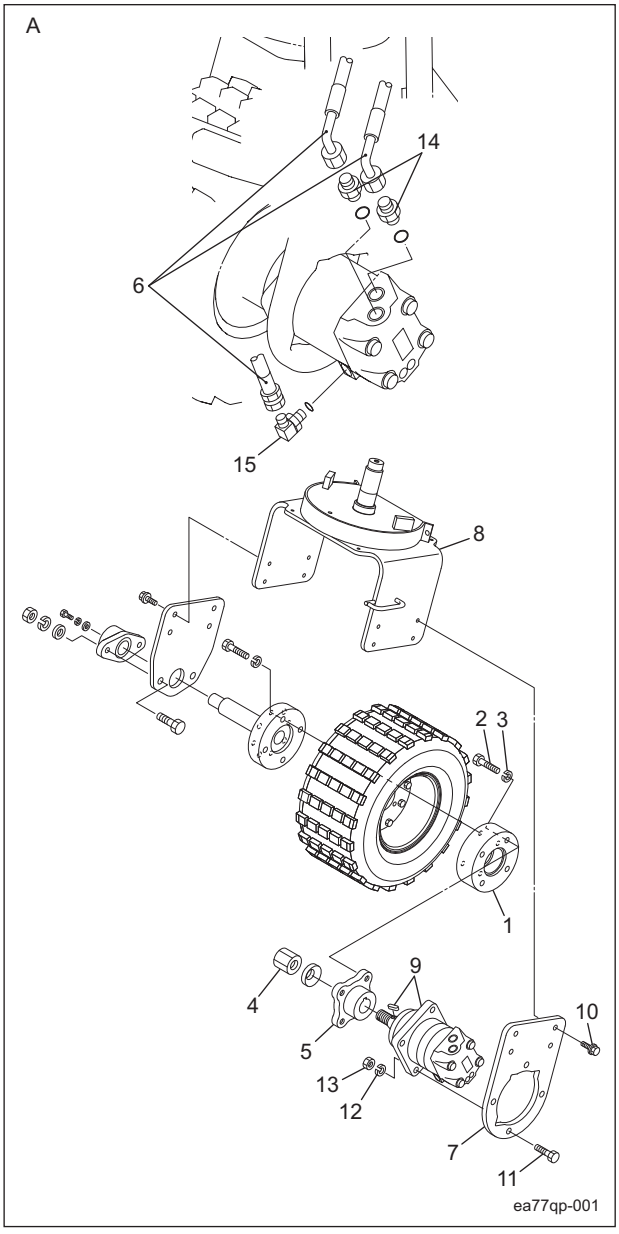
For fitting, follow the opposite procedure of removal. For belt adjustment, refer to Engine-Fitting of Engine.

> **Caution**
>
> After fitting, check for hydraulic oil leakage at each part.
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Wheel motor

Removal of front wheel motor

1. Remove the hydraulic hose (6) fitted to the wheel motor.
2. Remove the adapter (14) and adjuster elbow (15).
3. Remove the front wheel. (See “Main body – Removal of front wheel.”)
4. Remove the bolt (2) and spring washer (3) used for fitting the motor mounting eye (1).
5. Remove the center nut (4) of the wheel motor.
6. Set a gear puller to the wheel mounting eye (5) and remove it.
7. Remove the bolt (10) used for fitting the motor bracket (7) and the front wheel arm (8).
8. Remove the bolt (11), spring washer (12) and nut (13) used for fitting the motor bracket (7) and wheel motor (9).



Removal of front wheel motor_001

A	Three-wheel-drive specifications
1	Motor mounting eye
2	Bolt
3	Spring washer
4	Center nut
5	Wheel mounting eye
6	Hydraulic hose
7	Motor bracket
8	Front wheel arm
9	Wheel motor
10	Bolt
11	Bolt
12	Spring washer
13	Nut
14	Adapter
15	Adjuster elbow

Fitting of front wheel motor

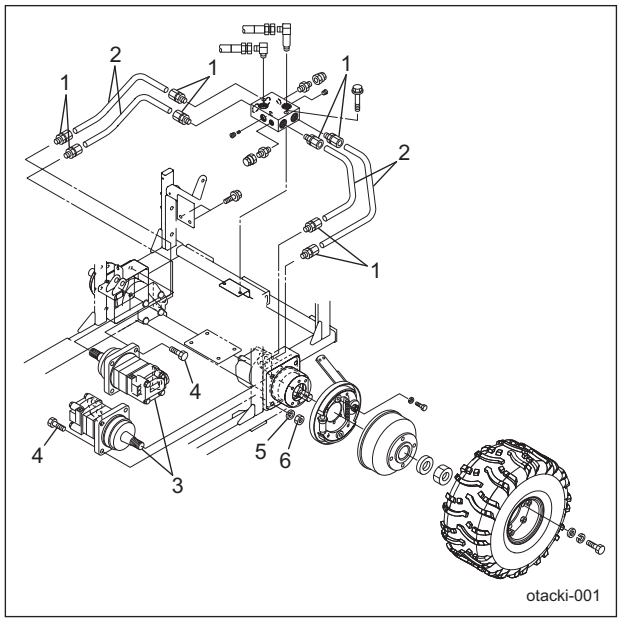
For fitting, follow the opposite procedure of removal.

Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Removal of rear wheel motor

1. Remove the rear wheel. (See “Main body – Removal of rear wheel.”)
2. Remove the brake. (See “Main body – Removal of brake drum.”)
3. Loosen the connector (1) fitted to the wheel motor and remove the piping (2).
4. Remove the bolt (4), spring washer (5), and nut (6) used for fitting the wheel motor (3).
5. Remove the wheel motor (3).



Removal of rear wheel motor_001

1	Connector
2	Piping
3	Wheel motor
4	Bolt
5	Spring washer
6	Nut

Fitting of rear wheel motor

For fitting, follow the opposite procedure of removal. For fitting of piping, refer to Hydraulic system-General instructions.

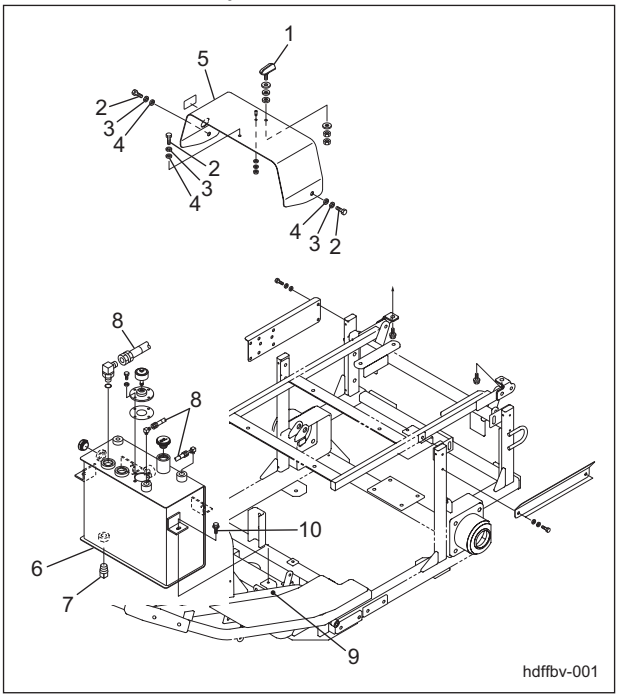
Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Hydraulic tank

Removal of hydraulic tank

1. Remove the dimple knob and open the front cover.
2. Turn the cover stopper (1) and open the rear cover.
3. Remove the bolt (2), spring washer (3) and washer (4) and remove the hydraulic tank cover (5).
4. Remove the drain plug (7) under the hydraulic tank (6) and drain all the hydraulic oil.
5. Remove the hydraulic hose (8) fitted to the hydraulic tank (6).
6. Remove the bolt (10) used for fitting the frame (9) and the hydraulic tank (6).
7. Remove the hydraulic tank (6).



Removal of hydraulic tank_001

1	Cover stopper
2	Bolt
3	Spring washer
4	Washer
5	Hydraulic tank cover
6	Hydraulic tank
7	Drain plug
8	Hydraulic hose
9	Frame
10	Bolt

Fitting of hydraulic tank

1. Fit the drain plug (7) to the hydraulic tank (6). (See “Removal of hydraulic tank_001.”)
2. Fit the frame (9) and the hydraulic tank (6) with the bolt (10).
3. Fit the hydraulic hose (8).
4. Fit the hydraulic tank cover (5) with the bolt (2), spring washer (3), and washer (4).

⚠ Caution

After fitting, check for hydraulic oil leakage at each part.
Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Maintenance

This chapter briefly describes how to inspect and maintain the electrical systems of “SP05.” For daily inspection, maintenance, and handling of this machine, refer to the owner’s manual and parts catalogue for “SP05.”
For details on handling the battery, refer to the instruction manual provided with it.

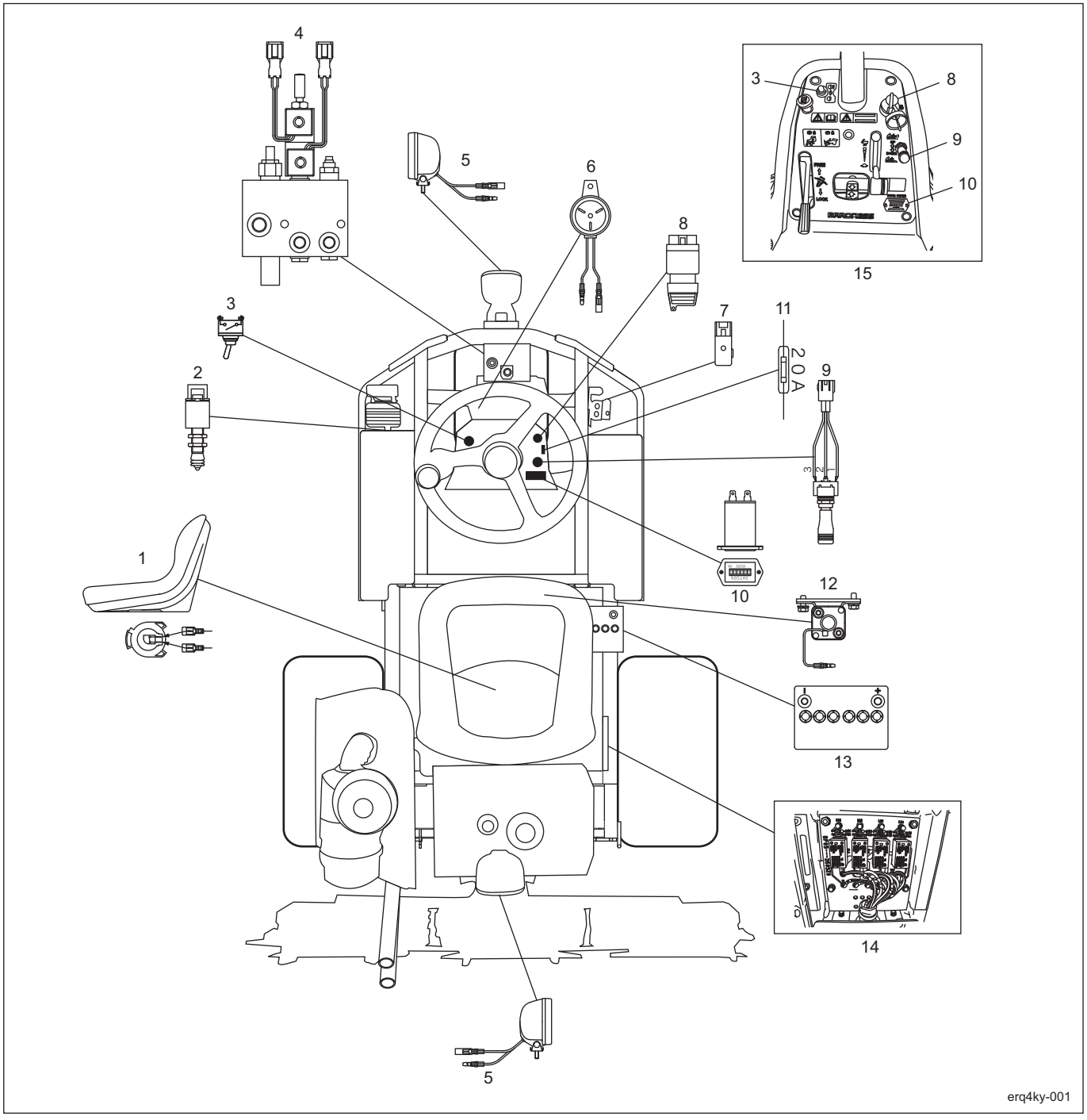
⚠ Danger

When performing inspection and maintenance, follow these safety instructions:

1. Before performing adjustments or maintenance, etc., park the machine on a level area. Set the parking brake, stop the engine and remove the key. Before performing adjustments or maintenance, etc., ensure that each component of the machine has completely stopped.
2. Keep your hands and feet away from moving parts. Avoid performing work with the engine running. Keep other people away from the machine during work.
3. If necessary, use appropriate chain blocks, hoists, or a jack. If the machine is lifted up, ensure that it is supported by jack stands or appropriate blocks.
4. When replacing parts or installing accessory parts, use genuine BARONESS parts.
5. Never start the engine in a closed room. Doing so could cause carbon monoxide poisoning.
6. Never touch the exhaust system while the machine is operating or immediately after the engine has stopped. Doing so could cause burns resulting from the extreme heat.
7. Never use open flames near the battery. Hydrogen gas may be generated from the battery. Improper handling of the battery could cause an explosion.
8. The electrolyte contained in the battery is sulfuric acid. Contact of the electrolyte (sulfuric acid) with the skin could cause blindness or burns. Contact of the electrolyte with the machine etc. could cause damage to the machine.

Specifications

Layout of electrical components



Layout of electrical components_001

1	Seat switch	6	Buzzer	11	Fuses
2	Brake pedal switch	7	Forward/reverse pedal proximity switch	12	Magnet switch
3	Light switch	8	Key switch	13	Battery
4	Solenoid valve	9	Raise/lower switch	14	Interlock relays
5	Lights	10	Hour meter	15	Control panel

1. Seat switch [NC type (Off when pressed)]
   The seat switch is one of the safety switches of the interlock system and is located in the seat cushion.
2. Brake pedal switch [NO type (On when pressed)]
   The brake pedal switch is one of the safety switches of the interlock system, and is located in the brake pedal fulcrum.
3. Light switch
   The light switch is used to turn the headlights on and off (the front and rear lights are linked to each other), and is located in the upper left of the operation panel.
4. Solenoid valve
   When the raise/lower switch for the rake is operated, the solenoid valve is activated to switch the hydraulic path in the valve module. It is installed in the valve module, and is located behind the front cover.
5. Lights (12V55W)
   The lights can be turned on and off by operating the light switch. The lights are located at the front and rear of the machine. These lights are daytime lights. Do not operate the machine during nighttime or when visibility is poor.
6. Buzzer
   The brake pedal switch and forward/reverse pedal proximity switch are linked to each other, and the buzzer sounds intermittently when the forward or reverse pedal is depressed with the brake applied. The buzzer is located at the back of the operation panel behind the front cover.
7. Forward/reverse pedal proximity switch
   A plastic detection magnet is installed in the forward/reverse pedal arm in order to detect that the proximity switch is not in contact with the magnet. The forward/reverse pedal proximity switch is one of the safety switches of the interlock system, and is located close to the forward/reverse pedals on the frame.
8. Key switch
   The key switch is used to start and stop the engine. This switch is located in the upper right of the operation panel.
9. Raise/lower switch
   The raise/lower switch is connected to the solenoid valve in the valve module, and is used to switch the solenoid valve. This switch is located on the middle right of the operation panel.
10. Hour meter
    The hour meter indicates the number of hours the engine has run and is located in the lower right of the operation panel. Perform periodic inspection and maintenance based on the number of hours the engine has run as indicated on this meter.
11. Fuses
    There is a main fuse for the entire circuitry (20A) and a fuse for the lighting system (20A). These fuses are located in the lower right corner behind the front cover.
12. Magnetic switch
    When the key switch is in the “START” position, power is supplied to the magnetic switch so that the switch allows current to flow through the starter motor. This switch is located below the battery behind the rear cover.
13. Battery
    When the engine starts, the battery supplies power to the starter and electrical components. The battery is located on the right side behind the rear cover.
14. Interlock relay
    The interlock relays are linked with the forward/reverse pedal proximity switch, and the control status can be confirmed by LED indicators. These relays make up the control board of the interlock system which is located behind the drive selector valve located on the right side behind the rear cover.

Special tools

No use of special tools is required.

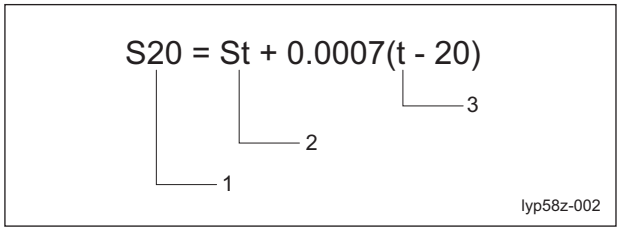
Measurement method

Battery

Battery specific gravity measurement

Because the specific gravity of the electrolyte decreases almost in proportion to the amount of electricity discharged from the battery, it is possible to ascertain the remaining battery capacity by measuring the specific gravity of the electrolyte using a hydrometer.
The specific gravity measured by the hydrometer needs to be temperature-

corrected. The standard temperature for the specific gravity of battery electrolyte is 20°C, and the specific gravity increases or decreases by 0.0007 as the temperature increases or decreases by 1°C. Use the following formula to obtain a temperature-corrected specific gravity:



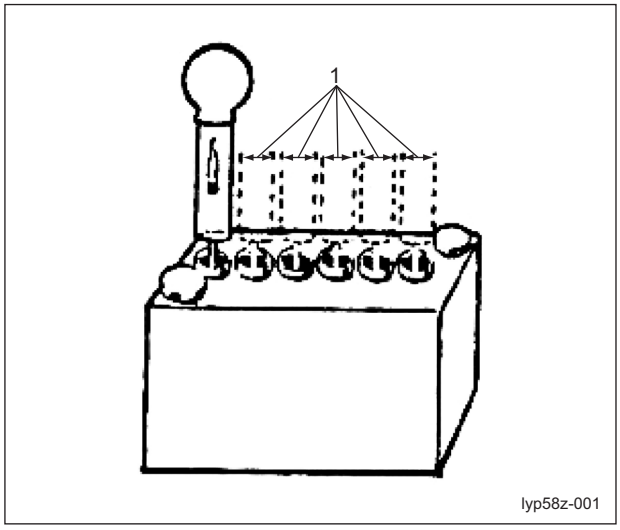
Battery specific gravity measurement_001

1	Specific gravity at 20°C
2	Measured specific gravity
3	Electrolyte temperature

Temperature-corrected specific gravity and remaining battery capacity		
Specific gravity (20°C)	Amount of electricity discharged (%)	Remaining battery capacity (%)
1.28	0	100
1.24	25	75
1.20	50	50
1.16	75	25
1.12	100	0

12-V battery specific gravity measurement

1. After charging the battery, measure the specific gravity of all the cells.
2. If the specific gravity is 1.225 or less, or the difference in specific gravity between cells is 0.05 or more, replace the battery.



Battery specific gravity measurement_002

1	Cells

Battery charging

Follow this procedure to fully charge the battery.

Warning

When charging the battery, do not use a current in excess of one tenth of the rated current. With regard to the maximum recommended charging current, follow the battery manufacturer's instructions.

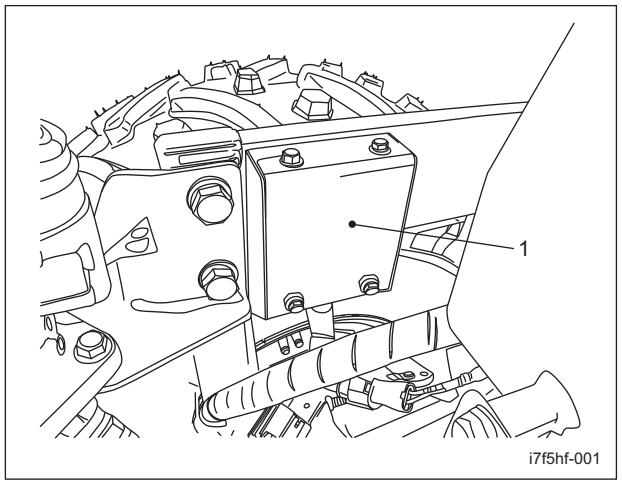
Caution

If the battery gets extremely hot or releases a significant amount of gas during charging, unplug the battery charger at regular intervals.

1. Use a taper battery charger, which automatically reduces the charging rate during charging.
2. After charging is completed, fill the battery cells with distilled water (if the battery is in use).
3. After charging is completed, measure and record the specific gravity of each cell using a battery hydrometer. (See "Battery specific gravity measurement_002.")
4. If the measured specific gravity is 1.225 or less, or the difference between the cells is equal to or exceeds 0.05, replace the battery with a new one.

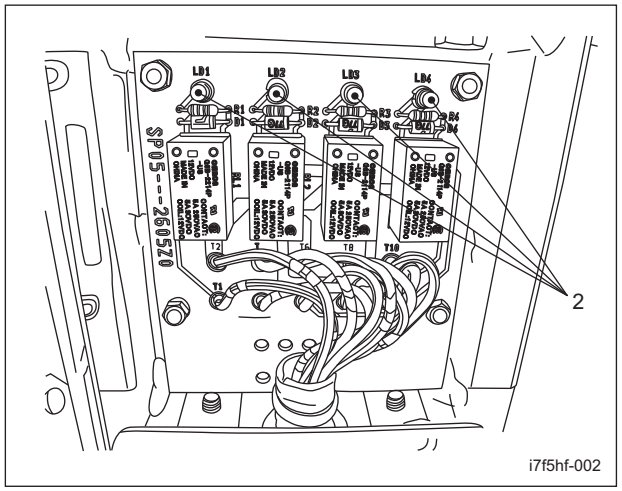
Interlock system

The interlock system is a safety device that is controlled by switches and sensors to prevent injuries and accidents due to operator carelessness.
The control board (interlock relays) (1) of the interlock system has LED indicator lights (2) that inform the operator of the status of the interlock system.
The interlock relays are linked to the seat switch, brake pedal switch, and forward/reverse pedal proximity switch.



Interlock system_001

1	Control board



Interlock system_002

2	LED indicator lights

Interlock system activation conditions

	Conditions			Safety device activation				Relay status indication			
	Seat	Brake	Forward/ reverse pedals	Engine status			Buzzer	LED status			
	Occupied	Depressed	Neutral	Start	Run	Stop	Sound	LD1	LD2	LD3	LD4
1	○	○	○	○						○	
2	○	○			○		○	○	○	○	
3	○		○		○						
4	○				○			○	○		
5		○	○		○					○	○
6		○				○	○	○	○	○	○
7			○			○					○
8						○		○	○		○

Seat switch (NC): Electrical continuity exists when the seat is not occupied.

Brake pedal switch (NO): Electrical continuity does not exist when the brake pedal switch is not depressed.

Forward/reverse pedal proximity switch (NC): Electrical continuity exists when the forward and reverse pedals are not depressed.

1. The engine starts only when the seat is occupied, the parking brake is set, and the forward and reverse pedals are in the neutral position (interlock system activation condition 1).
2. The buzzer sounds (intermittently) when the seat is occupied, the parking brake is set, and the forward or reverse pedal is depressed (interlock system activation condition 2).
   Be sure to release the parking brake before moving the machine (interlock system activation conditions 3 and 4).
3. The engine will stop if you leave the seat without the parking brake being set (interlock system activation conditions 7 and 8).
   Be sure to set the parking brake when you leave the seat with the engine running (interlock system activation condition 5).
4. Even when you leave the seat with the brake applied, the buzzer will sound (intermittently) and the engine will stop if the forward or reverse pedal is depressed (interlock system activation condition 6).

How to check the status of the interlock system

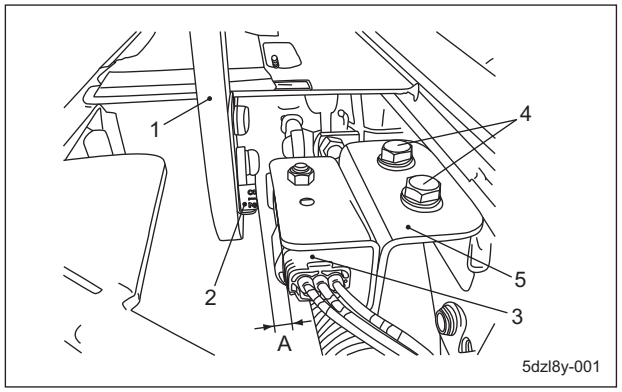
The status of the interlock system can be checked using “Relay status indication” (Table 1).
With the LED indicators, check the status of the interlock system in each condition.

Adjustment

Forward/reverse pedal proximity switch

Adjust the position of the forward/reverse pedal proximity switch so that gap A is 5 mm (0.20 in) or less when the forward and reverse pedals are in the neutral position. (See “Forward/reverse pedal proximity switch_001.”)

1. Loosen the bolts (4) and adjust the sensor mounting plate (5) by moving it parallel to the plastic magnet (2).
2. Tighten the bolts (4) while taking care not to move the sensor mounting plate (5).
   Tighten the bolts to a torque of 7 N-m (61.96 lb-in).

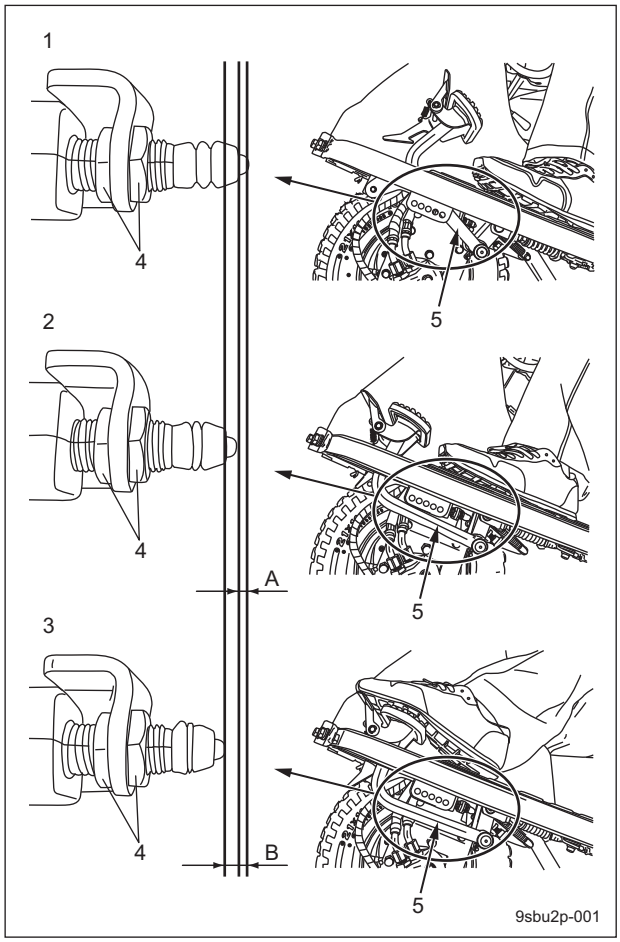


Forward/reverse pedal proximity switch_001

1	Forward/reverse pedal
2	Plastic detection magnet
3	Forward/reverse pedal proximity switch
4	Bolts
5	Sensor mounting plate

Brake pedal switch

Adjust the brake pedal switch by loosening the nuts (4) so that A is 2 mm (0.079 in) or more when the parking brake is not engaged (2), and B is 6 mm (0.24 in) or less when the brake pedal (5) is fully depressed (3).
Tighten the nuts (4), taking care not to move the position of the adjusted pedal brake switch.



Brake pedal switch_001

1	When the brake pedal is released (non-contact)
2	When the parking brake is set
3	When the brake pedal is fully depressed
4	Nuts
5	Brake pedal
A	2 mm (0.079 in) or more
B	6 mm (0.24 in) or less

Electrical components

Warning

When servicing electrical components, be sure to disconnect the negative battery cable.

Safety switches

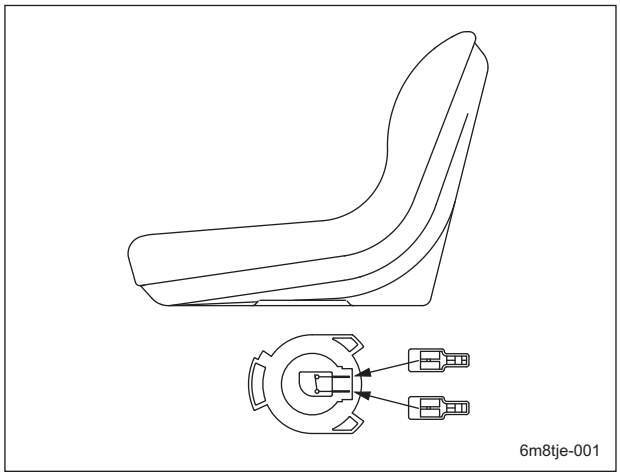
1. The seat switch is “OFF” when the seat is occupied.
2. The brake pedal switch is “ON” when the brake pedal is depressed.

3. The forward/reverse pedal proximity sensor is “OFF” when the forward and reverse pedals are in the neutral position.

The engine does not start unless these three conditions are met. The same is true for the starter motor.

Seat switch

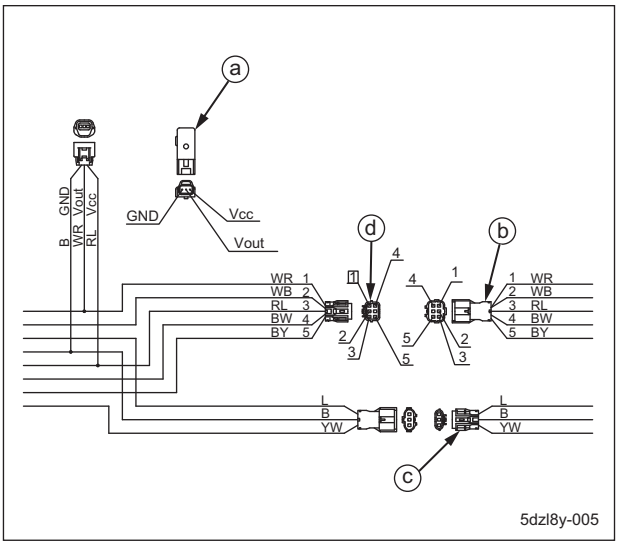
The seat switch is located immediately below the seat, and electrical continuity normally exists. The seat switch is considered to be normal if electrical continuity is lost when the seat is occupied.



aSeat switch_001

Forward/reverse pedal proximity switch

The forward/reverse pedal proximity switch is located near the forward/reverse pedals on the frame, and a plastic detection magnet is installed in the forward/reverse pedal arm. Disconnect 6-line connector (b) from counterpart 6-line connector (d). Apply the parking brake in key switch ON position and set the forward/ reverse pedal in the neutral position (the proximity switch (a) detects the magnet). The switch is considered to be normal if there is no battery voltage (0V) between 1 (white/red) of counterpart 6-line connector (d) and the vehicle body (earth) and also there is battery voltage (12V) in working the forward/reverse pedal (the proximity switch (a) does not detect the magnet).

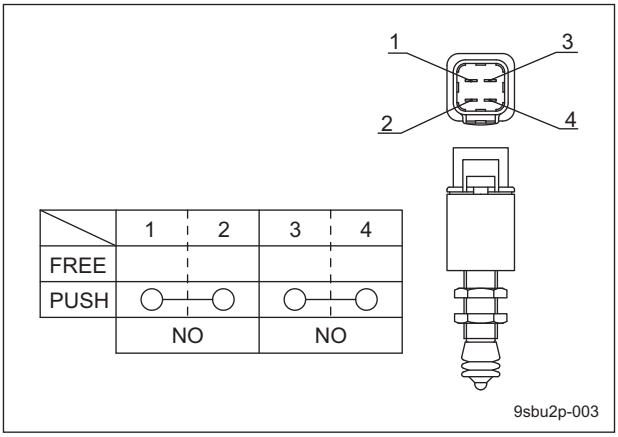


Forward/reverse pedal proximity switch_001

a	Proximity switch
b	6-line connector (Safety circuit board)
c	3-line connector (Safety circuit board)
d	Counterpart 6-line connector

Brake pedal switch

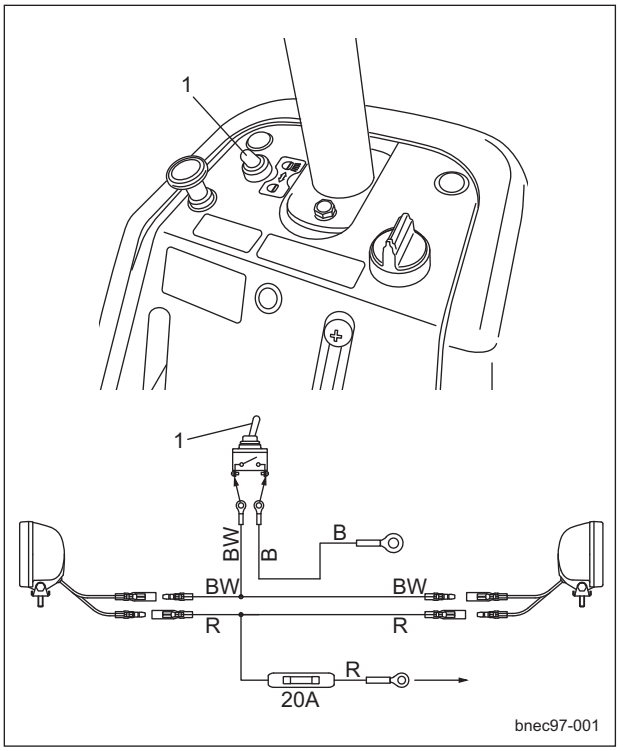
The brake pedal switch is located on the fulcrum of the brake pedal, and electrical continuity does not exist when the tip of the switch is released. The switch is considered to be normal if electrical continuity exists when the brake pedal is depressed and the tip of the switch is pushed down.



Brake pedal switch_001

Light switch

The light switch (1) is located in the upper left of the operation panel, and is considered to be normal if electrical continuity exists when the switch is pushed upward (ON) and if electrical continuity does not exist when the switch is pushed downward (OFF). The front and rear lights are linked to each other.

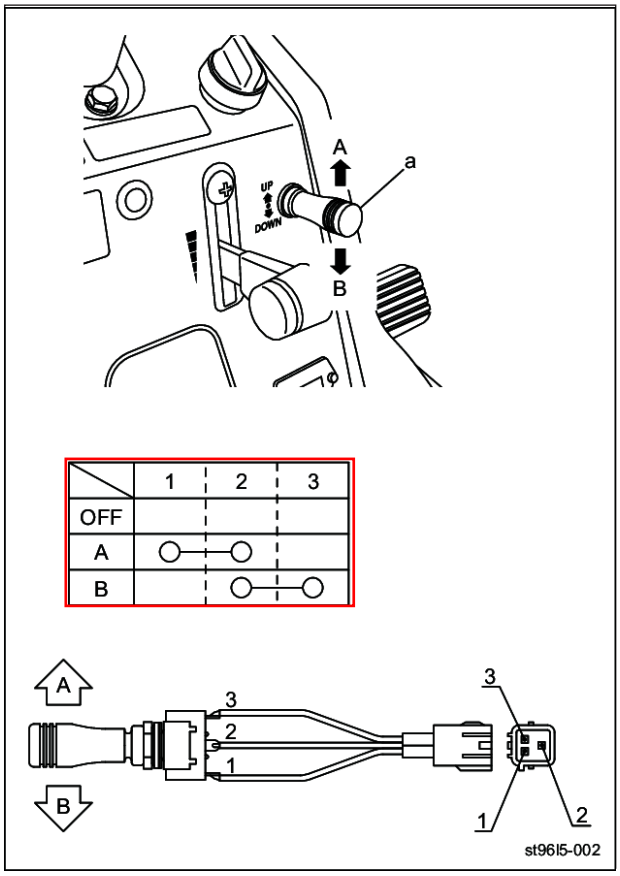


Light switch_001

1	Light switch

Raise/lower switch

The raise/lower switch (a) is located on the middle right of the operation panel, and electrical continuity does not exist between terminals when the switch is in the neutral position. The raise/lower switch is considered to be normal if electrical continuity exists between terminals 1 and 2 when the switch is in the “UP” position (A) and if electrical continuity exists between terminals 2 and 3 when the switch is in the “DOWN” position (B).

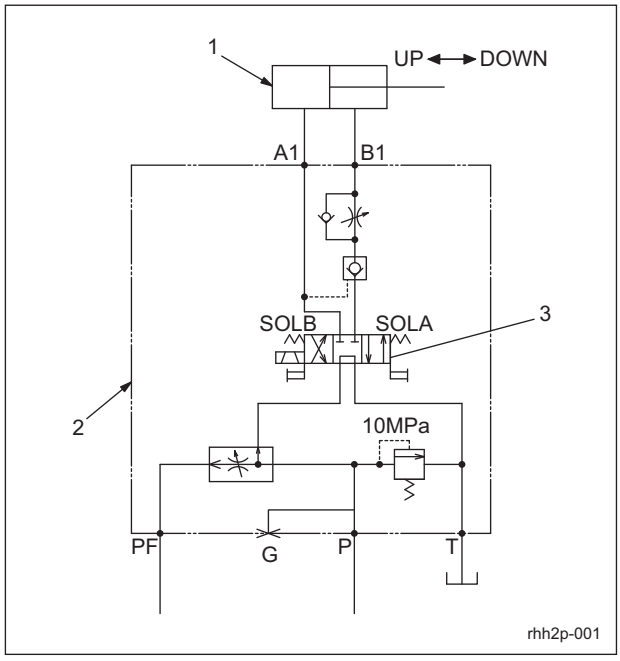


Raise/lower switch_001

a	Raise/lower switch lever

Solenoid valve

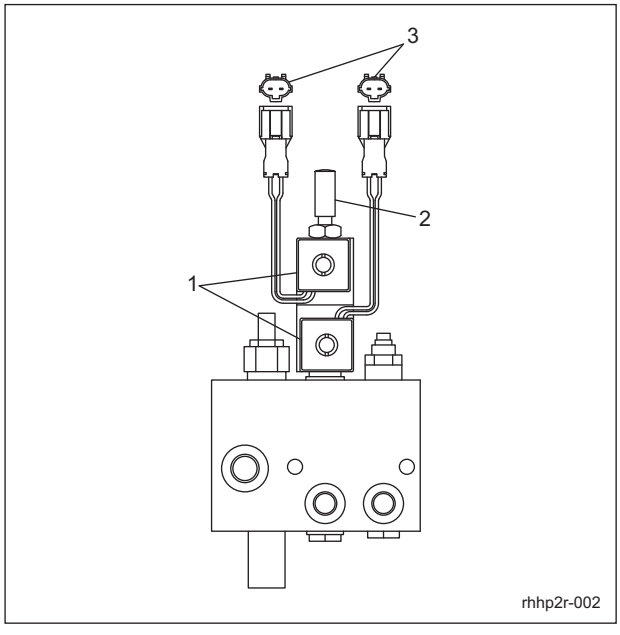
The solenoid valve (3) is located behind the front cover, and installed in the valve module (2).
The solenoid valve is considered to be normal if SOLB in the solenoid valve is energized, the spool is moved by a magnetic force, and the rake moves up when the engine runs at a medium speed or higher, and the raise/lower switch is set in the “UP” position (A) (see “Raise/lower switch_001”). In addition, the solenoid valve is considered to be normal if SOLA in the solenoid valve is energized and the rake moves down when the raise/lower switch is set in the “DOWN” position (B) (see “Raise/lower switch_001”).



Solenoid valve_001

1	Rake raise/lower cylinder
2	Valve module
3	Solenoid valve

If the rake does not move up or down when the raise/lower switch is operated (see “Raise/lower switch_001”), remove the two connectors (3) of the solenoid valve (1). The hydraulic pressure is considered to be normal if the rake moves up when the manual button (2) is pressed and the rake moves down when the manual button is pulled.



Solenoid valve_002

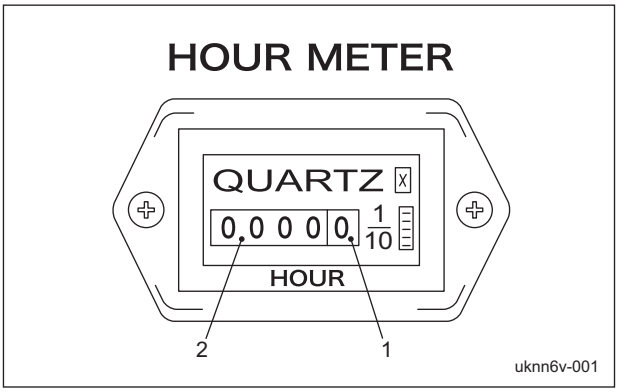
1	Solenoid valve
2	Manual button
3	Connectors

Solenoid coil specification

Voltage	Resistance	Holding current
DC12V	7.6Ω	1.58A

Hour meter

The hour meter is located in the lower right of the operation panel, and indicates the total number of hours the engine has run. The number in black figures on a white background is incremented every six minutes. The number in white figures on a black background is incremented every hour.
Odometer
1/10 wheel … black figures on a white background
Hour wheel … white figures on a black background

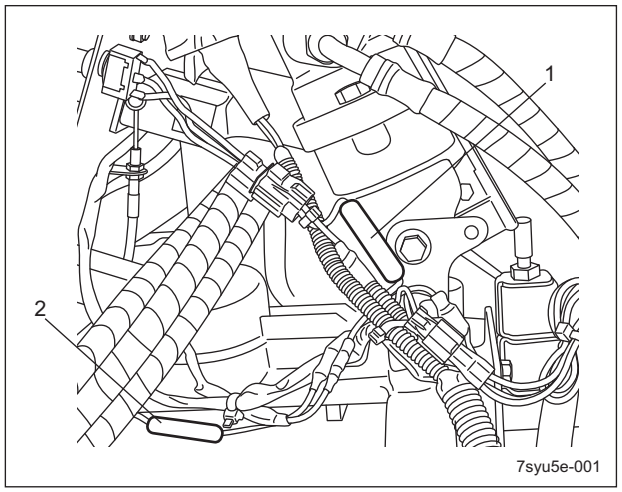


Hour meter_001

1	1/10 wheel
2	Hour wheel

Fuses

Fuses are located in the lower right corner behind the front cover, and include a main fuse (1) for the entire circuitry and a fuse (2) for the lights. Both are 20A glass tube fuses (φ6.4 × 30 mm).



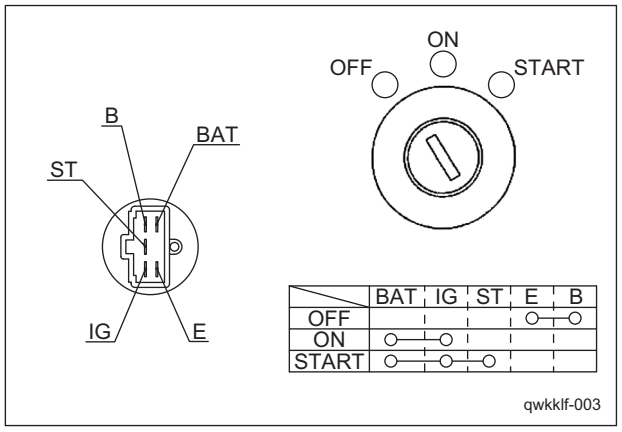
Fuses_001

1	Main harness fuses
2	Light harness fuses

If a fuse blows, there is a possibility that one of the circuits has short circuited. Check for faulty terminal connections, damaged cables or terminals, and wrong cable connections, etc.

Key switch

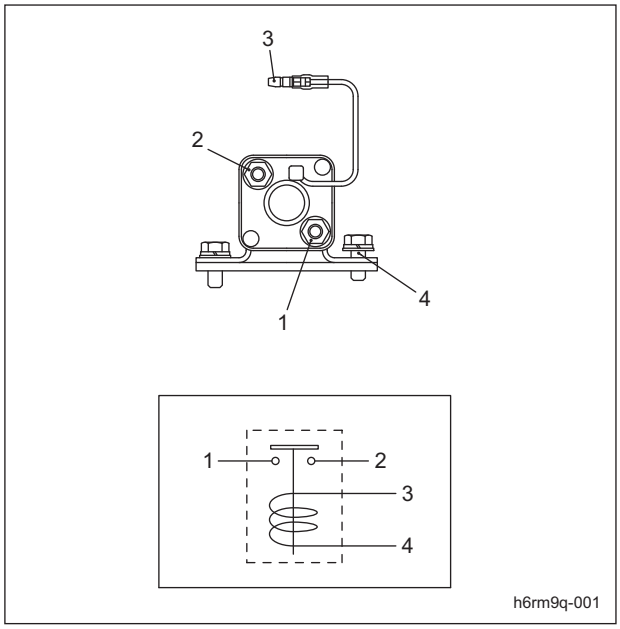
The key switch is located in the upper right of the operation panel. Measurements must be made with each cable disconnected from the key switch. If electrical continuity exists between the terminals in each key switch position, the switch is considered to be normal. If there is no electrical continuity between the terminals for any of the key switch positions, replace the key switch ass'y with a new one.



Key switch_001

Magnetic switch

The magnetic switch is located on the right side behind the rear cover. When the key switch is set to the “START” position (see “Key switch_001”), the coil in the magnetic switch magnetically attracts the plunger. When the plunger comes into close contact with (1) and (2) a large current flows to the starter motor from the battery, the starter motor starts to turn and the engine starts. When the key switch is set to the “ON” position, the magnetic force in the magnetic switch disappears, causing the starter motor to stop.



Magnetic switch_001

1	To the starter motor
2	To the battery
3	To the key switch (ST)
4	Ground

General inspection and repair

Battery

For details on handling the battery, refer to the instruction manual provided with it.

Handling of the battery

For safe use of the battery, observe the following precautions:

1. Keep the battery away from open flames. Hydrogen gas may be generated from the battery. Improper handling of the battery could cause a fire or explosion.

⚠ Danger

Do not handle the battery near open flames or in a poorly ventilated area. Keep the battery away from lit cigarettes and other open flames.
Do not short-circuit the battery. The battery will short-circuit if the positive and negative terminals are connected to each other by a metallic tool, a short-circuit will also result if the positive terminal contacts another metallic part (machine body etc.).

2. The electrolyte contained in the battery is sulfuric acid. Contact of the electrolyte (sulfuric acid) with the skin could cause blindness or burns. Contact of the electrolyte with the machine etc. could cause damage to the machine.

⚠ Danger

Do not throw, drop, tilt or upset the battery, or allow it to undergo physical impact. Doing so could cause the electrolyte to leak. If contact of the electrolyte with the eye, skin, or clothing occurs, immediately wash it off with plenty of water. In particular, if eye contact or ingestion occurs, immediately seek medical treatment. If the electrolyte spills over the machine etc., wipe away with a wet cloth and flush the affected area with plenty of water.

3. Use extra care when handling the battery, and if any problems are found, replace the battery with a new one. Carry or store the battery with care so that it does not fall or become damaged.

⚠ Danger

Do not allow anyone to handle the battery who does not fully understand the correct battery handling procedures and relevant dangers.
When handling the battery, wear protective glasses and rubber gloves, etc.
If the battery has an unusual odor, the electrolyte level goes down unusually fast, or the electrolyte leaks, do not continue to use the battery. Doing so could cause a fire or explosion, etc.

⚠ Caution

If the electrolyte overflows, neutralize it with bicarbonate etc. until the bubbles disappear, and wash out with plenty of water. Failure to do so could cause corrosion of the surrounding area or environmental pollution.
If deformation of the exterior of the battery is observed, do not continue to use it. Doing so could result in damage to the battery or electrolyte leaks.

Inspection of the battery

To ensure safe use of the battery, inspect it at least once a month.
Before inspecting the battery, be sure to stop the engine and remove the key.

⚠ Danger

Do not allow anyone to handle the battery who does not fully understand the correct battery handling procedures and relevant dangers.
When handling the battery, wear protective glasses and rubber gloves, etc. The electrolyte may cause blindness or burns.
Never use an open flame when inspecting the battery. Do not connect the positive and negative battery terminals to each other using a metallic tool etc. Doing so could cause a fire or explosion.
Always keep the electrolyte level above the LOWER (minimum level line) limit. Failure to do so could cause the battery life to be shortened or cause explosion.
Loose connections between cable and terminal, or corroded terminals could cause a fire or explosion.

⚠ Warning

Before handling the battery such as for purposes of inspection etc, touch a metal part of the machine body with your bare hand in order to remove static electricity. Static electricity could cause a fire.
When cleaning the battery, do not use dry cloth or tissue paper, etc. Static electricity could cause a fire.
When adding distilled water, keep the electrolyte level below the UPPER (maximum level line) limit. Failure to do so could cause the electrolyte to leak.

Caution

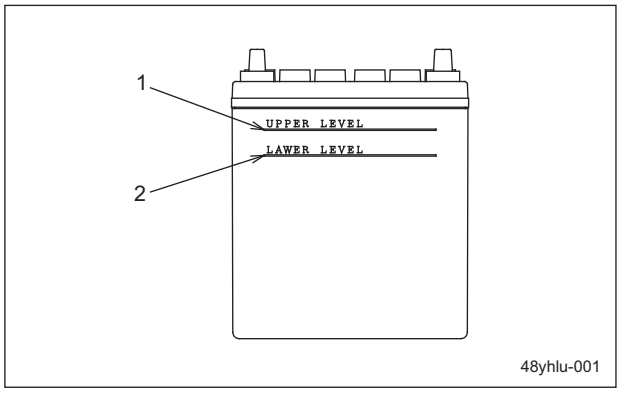
If the electrolyte overflows from the battery, wipe it with a wet cloth. Failure to do so could cause damage to the instruments.
When cleaning the battery, do not use organic solvents such as benzene, thinner or gasoline and refrain from using cleaner, or chemical cloth. Doing so could damage the battery case, resulting in electrolyte leaks.
Do not add anything but distilled water to the battery. Adding anything other than distilled water could cause the battery to become extremely hot or generate toxic gases due to impurities.
Do not add sulfuric acid to the battery. Doing so could cause the specific gravity of the electrolyte to exceed the specified value, causing the battery life to be shortened.
After adding distilled water to the battery, firmly tighten the vent plug.

When inspecting the battery, inspect the following items:

1. Visual inspection
   Visually inspect the battery case for cracks, chips and deformation, and check that there are no electrolyte leaks. If any of the above are found, investigate what has caused them and replace the battery.
2. Cleaning of the exterior
   When cleaning the battery, use cloth that has been dampened with water.
   Inspect the vent plug or vent hole on the side. If the plug or hole is clogged with mud etc., wash it with water. A clogged vent hole could cause the internal pressure to increase due to gases generated inside the battery, causing the battery to burst.
3. Inspection of the mounting bracket
   Ensure that the battery is firmly secured by the mounting bracket. If it is not, tighten the nuts securing the battery until it is firmly secured. If the battery is not firmly secured by the mounting bracket, the battery could move due to vibration while the machine is moving, resulting in damage to the battery case or electrolyte leaks.
4. Inspection of the cable terminals for looseness
   If a connection between a battery terminal and machine-side cable terminal is loose, tighten the nut securing the cable terminal until it is firmly secured. Loose connections could result in an insufficiently charged battery, damaged terminals, or explosion.
   Note: If a terminal has corroded, polish it using a wire brush or fine sandpaper, and apply a small amount of anti-rust grease.
5. Inspection of the electrolyte level and addition of distilled water
   Check the electrolyte level by looking from the side of the battery. If the electrolyte level has fallen to less than halfway between the “UPPER” (maximum level line) and “LOWER” (minimum level line) limits, add distilled water to the battery immediately until the “UPPER” limit is reached.
   When adding distilled water, loosen and remove the vent plug and add distilled water up to the “UPPER” (maximum level line) limit.
   After adding distilled water, firmly tighten the vent plug.

Important

When adding distilled water, be careful not to add an excessive amount.



Inspection of the battery_001

1	Upper limit
2	Lower limit

Replacement of the battery

When replacing the battery, note the following precautions and be sure to turn off the power switch etc., stop the engine, and remove the key before replacement.

⚠ Danger

Do not replace the battery near open flames or in a poorly ventilated area. Keep the battery away from lit cigarettes and other open flames. Failure to observe these precautions could cause a fire or explosion.
Do not short-circuit the battery. If the positive and negative terminals are connected to each other by a metallic tool the battery will short-circuit, a short-circuit will also result if the positive terminal contacts another metallic part (machine body etc.).
When connecting a machine-side cable terminal to a battery terminal, ensure that the nut is firmly tightened. A loose nut could cause a fire or explosion.

⚠ Warning

When connecting the machine-side cable terminals to the battery, ensure that they are correctly connected to the positive and negative terminals.
Secure the battery firmly with the mounting bracket. Failure to do so could cause damage to the battery, leakage of the electrolyte, fire or explosion.
Do not modify the battery terminals.
Ensure that the vent plug or vent hole on the side of the battery is not covered by the connection cables etc.
Do not connect any electrical devices directly to the battery.

⚠ Caution

Select a battery that has the same terminal positions (the positions of the positive and negative terminals) as the old one. Installing a battery that has different terminal positions could cause damage to the cables.
Do not use organic solvents such as benzene, thinner or gasoline and refrain from using cleaners.
Do not allow the battery to come in contact with vinyl chloride containing plasticizer etc.
When handling the battery, keep it in a horizontal position and install it on the mounting so that it is horizontal.

If the battery has terminal covers or heat shield plates attached, re-install them in their original positions after replacing the battery.

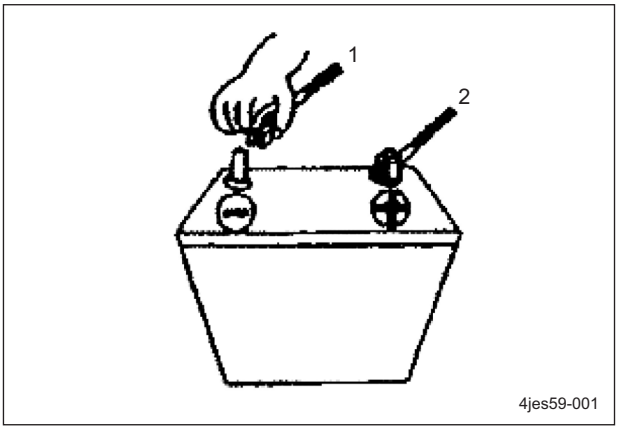
When mounting the battery on the machine, never hold the battery terminals. Doing so could cause the terminals to deform, resulting in poor connections or electrolyte leaks from around the terminals.

⚠ Caution

Replace the battery with one that is the same size.

When replacing the battery, follow these steps:
Removing the old battery

1. Stop the engine and remove the key.
2. Disconnect the negative cable (1).
3. Disconnect the positive cable (2).
4. Loosen the mounting bracket and remove the old battery.

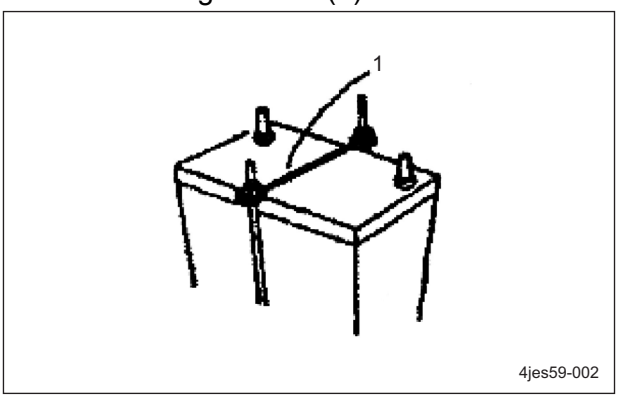


Replacement of the battery_001

1	Negative (-) cable
2	Positive (+) cable

Installing a new battery

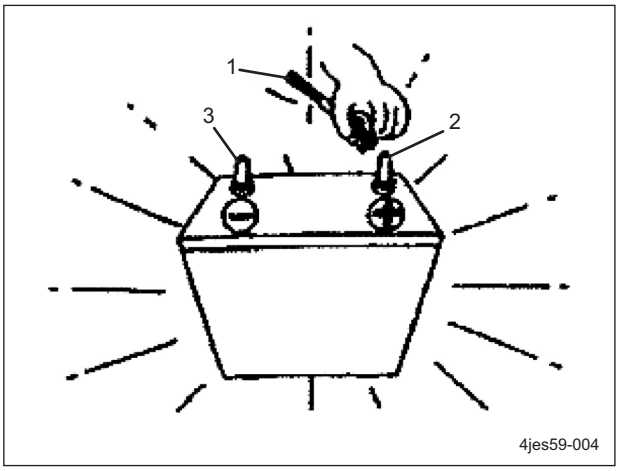
1. Install the new battery with the correct polarities and firmly secure the battery with the mounting bracket (1).



Replacement of the battery_002

1	Mounting bracket

2. Remove the protection cap from the new battery.
3. Firmly secure the positive cable (1) to the positive terminal (2).
4. Firmly secure the negative cable to the negative terminal (3).



Replacement of the battery_003

1	Positive (+) cable
2	Positive (+) terminal
3	Negative (-) terminal

Important

Be careful when handling the used battery as it still contains electrical energy.

Battery charging

When charging the battery with a battery charger, follow the instructions described in the instruction manual provided with the battery charger.

⚠ Danger

Do not charge the battery near open flames or in a poorly ventilated area. Keep the battery away from lit cigarettes and other open flames. Failure to observe these precautions could cause a fire or explosion.
Do not connect the battery clip to the battery, or disconnect it from the battery during charging with the battery charger switched on. Doing so could cause a fire or explosion.
If the battery charger is equipped with a voltage selection switch, select the appropriate voltage range. Failure to do so could cause the battery charger to become extremely hot, resulting in a fire or explosion.

⚠ Warning

Charging the battery while it is mounted on the machine could cause a fire or explosion, or damage to the machine or it's instruments. If unavoidable, be sure to disconnect the negative battery cable from the machine.
When connecting the battery charger to the battery, firmly secure the positive clip to the positive battery terminal and the negative clip to the negative battery terminal. Wrong or loose connections could cause a fire or explosion, cause the battery charger to fail, or cause a polarity inversion, resulting in damage to the machine or it's instruments.
Set the charging current to one tenth of the rated capacity or less. For a quick charge, set the charging current to the rated capacity or less. An excessive charging current could cause the electrolyte to leak or become dry, resulting in a fire or explosion.
Do not mount the battery on the machine immediately after charging is completed. First, leave the battery for 30 minutes. Failure to do so could cause a fire or explosion.

Important

Quick charge is not recommended for charging batteries that have been left unused for a long period of time.

⚠ Caution

While charging the battery, keep the electrolyte temperature below 45°, or for a quick charge, below 55°. Failure to do so could cause the battery to deform or cause the electrolyte to leak.
When charging the battery, remove the vent plug if it is detachable so that the hydrogen gas generated can disperse more easily. Avoid electrolyte on the vent plug contacting the skin or clothing.
If the electrolyte level has fallen to less than halfway between the "UPPER" and "LOWER" limits, add distilled water to the battery immediately until the "UPPER" limit is reached. Adding distilled water to above the "UPPER LEVEL" could cause the electrolyte to leak.

Important

If the electrolyte gets extremely hot, the electrode plates or other parts in the battery could deteriorate, resulting in a shorter service life.

Maintenance

This chapter describes the main inspection and maintenance methods of the SP05 main body. Refer to the SP05 Owner's manual and parts catalog for daily inspection, maintenance and handling of this equipment.

⚠ Danger

Follow the instructions below for safe inspection and maintenance.

1. Move the equipment to a level surface to prepare for adjustment and maintenance. Apply the parking brake, stop the engine and remove the key. Make sure that each part has completely stopped its motion before starting procedures for adjustment, maintenance and so on.
2. Do not touch moving parts. Avoid adjustment as much as possible while the engine is running. Keep people away from the area.
3. Use an appropriate chain block, hoist and jack as needed. Securely support the lifted machine with a jack stand or an appropriate block.
4. Use BARONESS genuine parts for replacement parts and accessories.
5. Never start the engine in a enclosed room, for poisoning by carbon monoxide may occur.
6. Never touch the exhaust system while the engine is running or right after the engine has stopped. Its high temperature may cause a burn.
7. Keep flames away from the battery. Batteries emit hydrogen gas and mishandling may cause an explosion.
8. The electrolytic solution in the battery is sulfuric acid. Contact with the electrolytic solution (sulfuric acid) may cause blindness or a burn. Also, it may damage the vehicle if it comes into contact with it.

Specifications

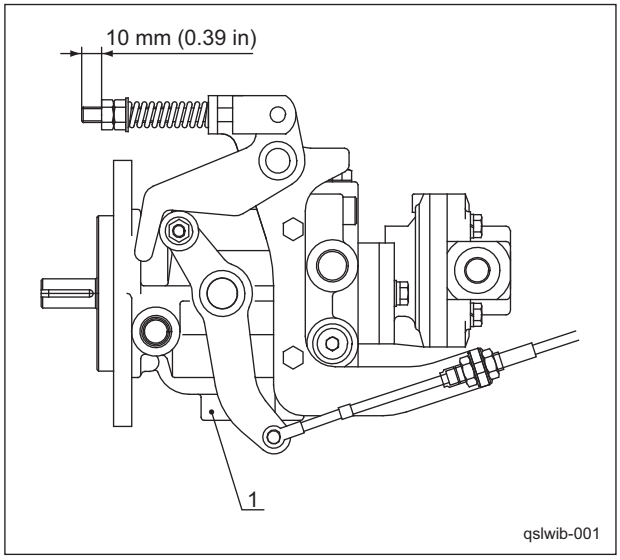
Tire pressure

	kPa	kgf/cm^2	psi
Front wheel	70	0.71	10.15
Rear wheel	40	0.41	5.80

Adjustment value

	mm	in
Outer distance of the thread part of lever adjusting fitting for pump neutral lever from the nut	10	0.39
Steering chain loosening	5	0.20

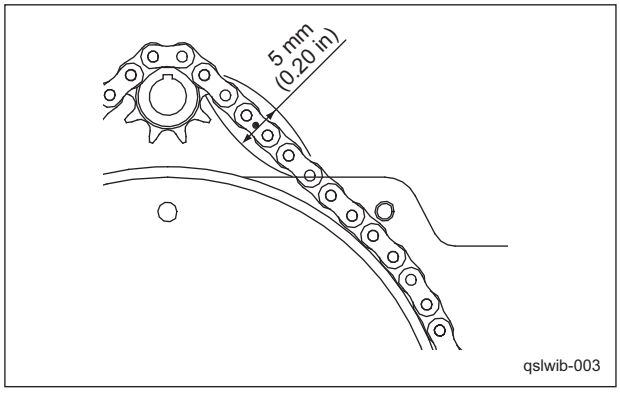
Tension adjustment value of pump neutral lever is 10 mm (0.39 in).



Adjustment value_001

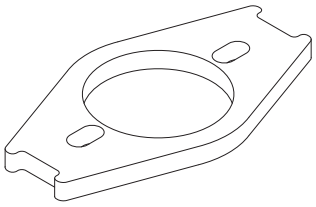
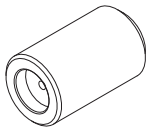
1	Piston pump

Steering drain loosening should be 5 mm (0.20 in).



Adjustment value_002

Special tools

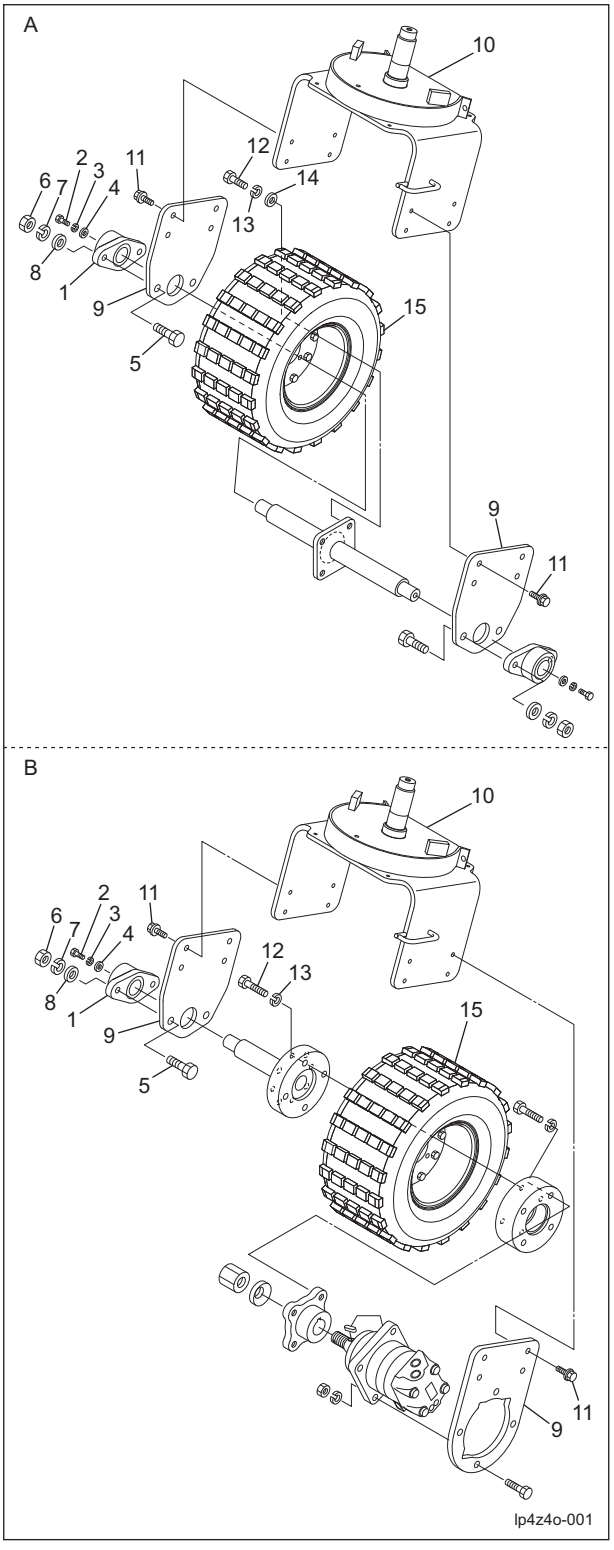
Drum removal jig A  vasdfi-009	K480200044D	Used for the hanging pulley when removing the wheel mounting eye.
Drum removal jig B  vasdfi-010	K4802000452	Used for the center hole when removing the wheel mounting eye.

Removal and installation of each section

Wheel

Removal of front wheel

1. Securely set a jack at the jack-up points of the right and left of the front wheel part, and lift the tire off the ground. (See “Overhaul standard and maintenance – Jack-up point.”)
2. Loosen the lock bolt (2 points) of the right rhombic flange unit (1) and remove the bolt (2), spring washer (3), and washer (4).
3. Remove the bolt (5), nut (6), spring washer (7), and washer (8) from the right rhombic flange unit (1) to remove the right rhombic flange unit (1).
4. Remove the bolt (11) from the front wheel bracket (9) and the front wheel arm (10) on both sides and lower the front wheel part onto the floor.
5. Remove the wheel mounting bolt (12), spring washer (13), and washer (14) to remove the front wheel (15).



Removal of front wheel_001

A	Two-wheel-drive specifications
B	Three-wheel-drive specifications
1	Rhombic flange unit
2	Bolt
3	Spring washer
4	Washer
5	Bolt
6	Nut
7	Spring washer
8	Washer
9	Front wheel bracket
10	Front wheel arm
11	Bolt
12	Wheel mounting bolt
13	Spring washer
14	Washer
15	Front wheel

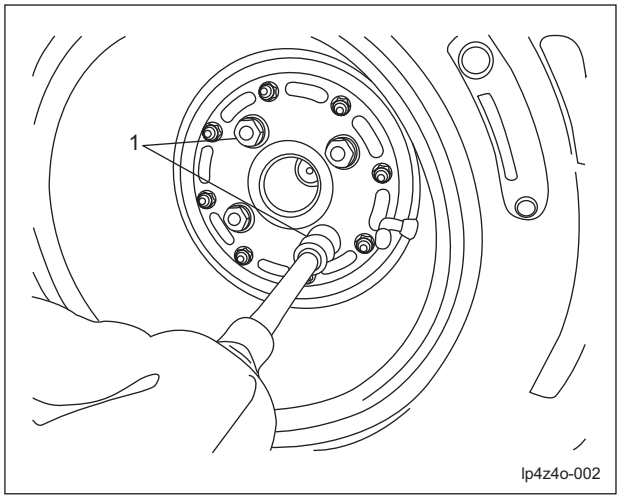
Fitting of front wheel

For fitting, follow the opposite procedure of removal.

> **Caution**
>
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Removal of rear wheel

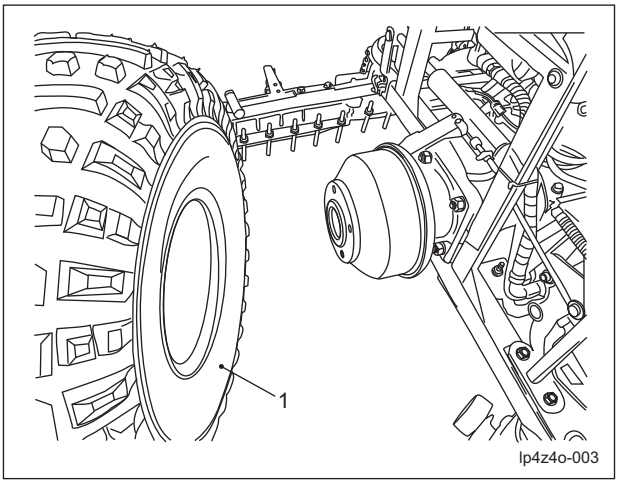
1. Securely set a jack at the jack-up points of the right and left of the rear part, and lift the tire off the ground. (See “Overhaul standard and maintenance – Jack-up point.”)
2. Remove four heat-treated bolts (1).



Removal of rear wheel_001

1	Heat-treated bolt

3. Remove the rear wheel (1).



Removal of rear wheel_002

1	Rear wheel

Fitting of rear wheel

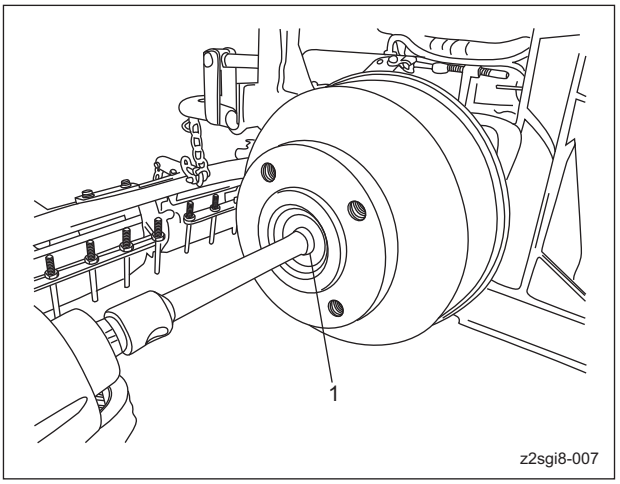
For fitting, follow the opposite procedure of removal.

> **Caution**
>
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Brake

Removal of brake drum

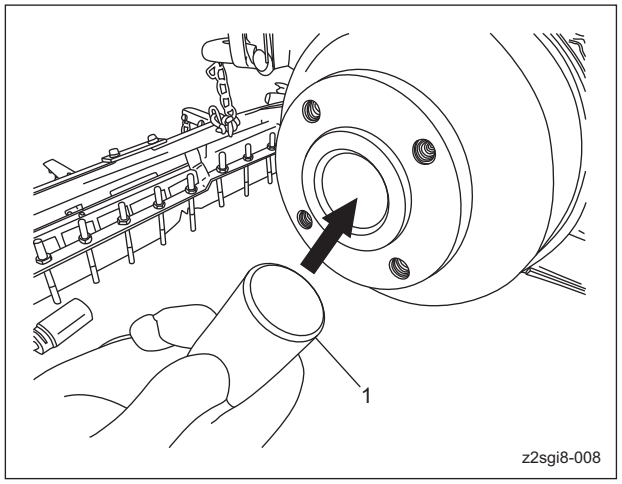
1. Remove the rear wheel. (See “Wheel – Removal of rear wheel.”)
2. Remove the special nut (1) in the center.



Removal of brake drum_001

1	Special nut

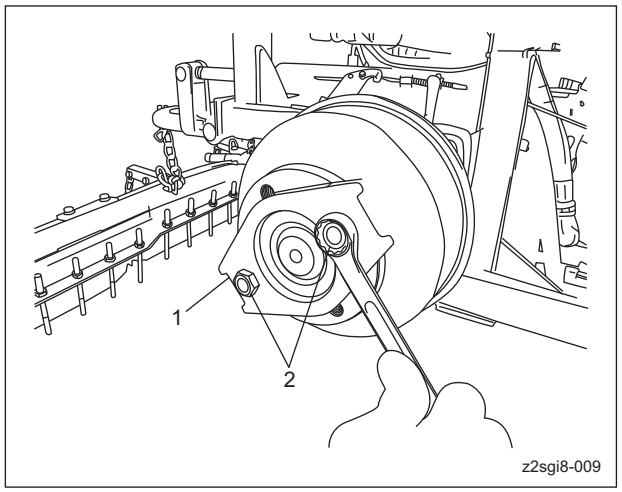
3. Insert the drum removal jig B (1).



Removal of brake drum_002

1	Drum removal jig B

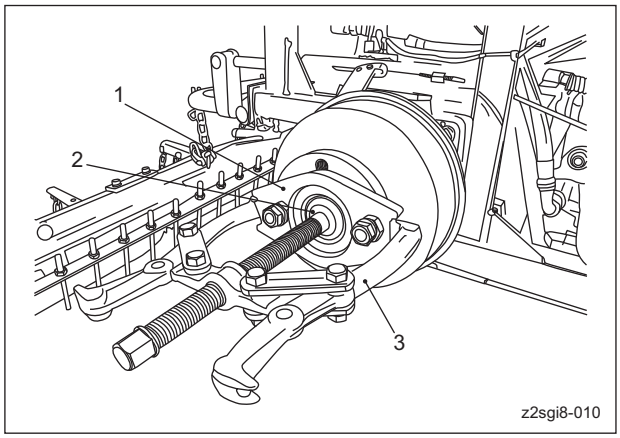
4. Fit the drum removal jig A (1) with the heat-treated bolt (2).



Removal of brake drum_003

1	Drum removal jig A
2	Heat-treated bolt

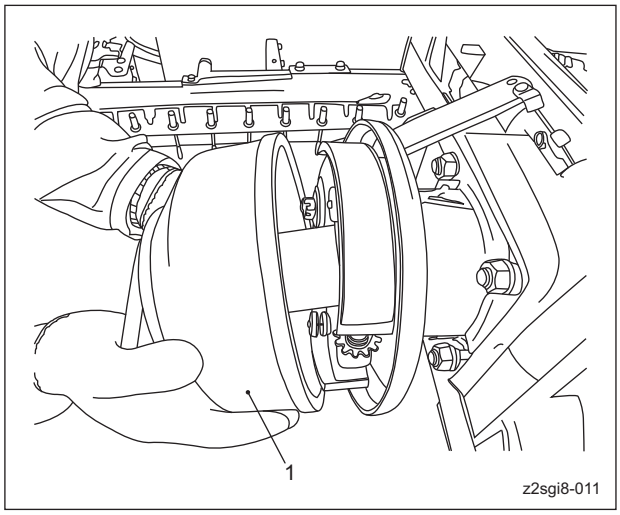
5. Release the parking brake, set and fix the gear puller (3) onto the drum removal jig A (1) and the drum removal jig B (2), and turn.



Removal of brake drum_004

1	Drum removal jig A
2	Drum removal jig B
3	Gear puller

6. Remove the wheel mounting eye (1) from the plate.



Removal of brake drum_005

1	Wheel mounting eye

Fitting of brake drum

For fitting, follow the opposite procedure of removal.

⚠ Caution

Apply mid-strength screw lock onto the wheel motor screws.

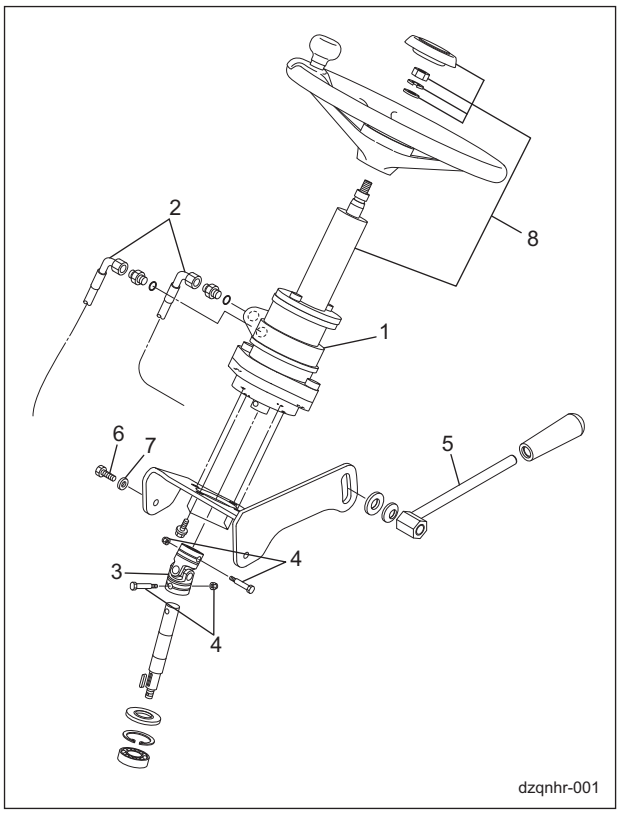
⚠ Caution

Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Steering

Removal of steering column

1. Remove the front cover. (See “Cover – Removal of front cover.”)
2. Remove the hydraulic hose (2) attached to the torque generator (1).
3. Remove the joint pins (4) at two points of the joint (3).
4. Turn the tilt lever (5) to remove.
5. Remove bolt (6) and washer (7).
6. Hold the steering wheel (8) and pull it up to remove.



Removal of steering column_001

1	Torque generator
2	Hydraulic hose
3	Joint
4	Joint pin
5	Tilt lever
6	Bolt
7	Washer
8	Steering wheel

Fitting of steering column

For fitting, follow the opposite procedure of removal.

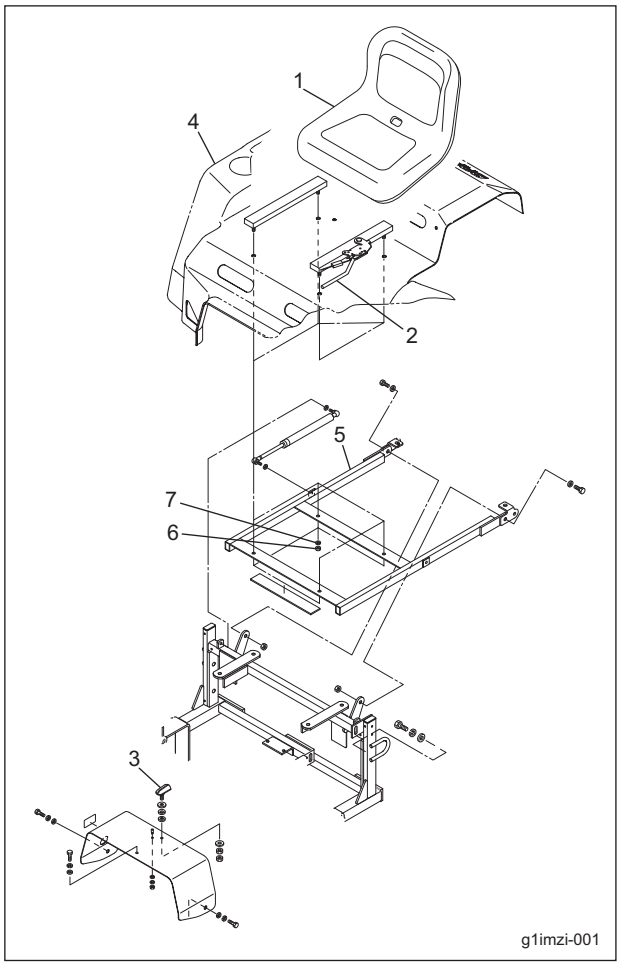
> **Caution**
>
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Seat

Removal of seat

1. Hold the slide handle (2) of the seat (1) and move the seat (1) all the way to the back.
2. Turn the cover stopper (3) to open the rear cover (4).
3. Remove the nut (6) and spring washer (7) fitted to the seat mount (5) and remove the seat.

> **Caution**
>
> When working alone, be careful about the seat weight.



Removal of seat_001

1	Seat
2	Slide handle
3	Cover stopper
4	Rear cover
5	Seat mount
6	Nut
7	Spring washer

Fitting of seat

For fitting, follow the opposite procedure of removal.

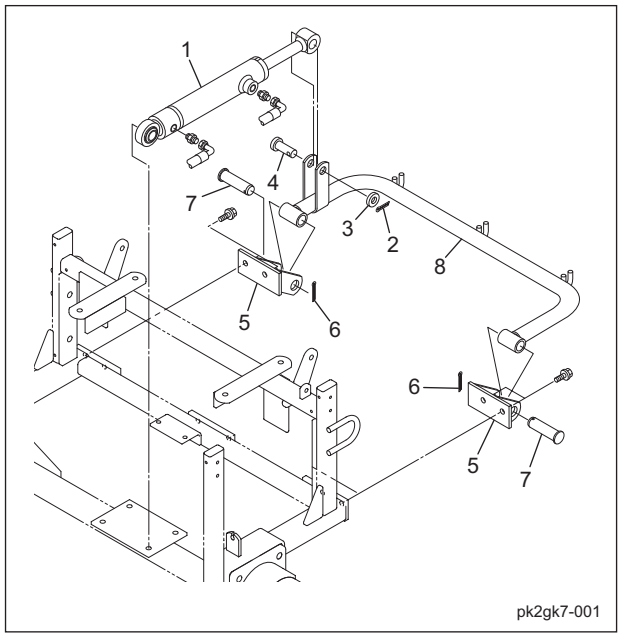
Caution

Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Lift arm

Removal of rake hanging arm

1. Lower the rake part.
2. Remove the rake part. (See “Operating machine – Removal of the rake part.”)
3. Remove the split pin (2), washer (3) and hardened flat head pin (4) from the cylinder (1).
4. Remove the split pin (6) and hardened flat head pin (7) fitted at both sides of the arm mounting fitting.
5. Remove the rake hanging arm (8).



Removal of rake hanging arm_001

1	Cylinder
2	Split pin
3	Washer
4	Hardened flat head pin
5	Arm mounting fitting, right and left
6	Split pin
7	Hardened flat head pin
8	Rake hanging arm

Fitting of the rake hanging arm

For fitting, follow the opposite procedure of removal.

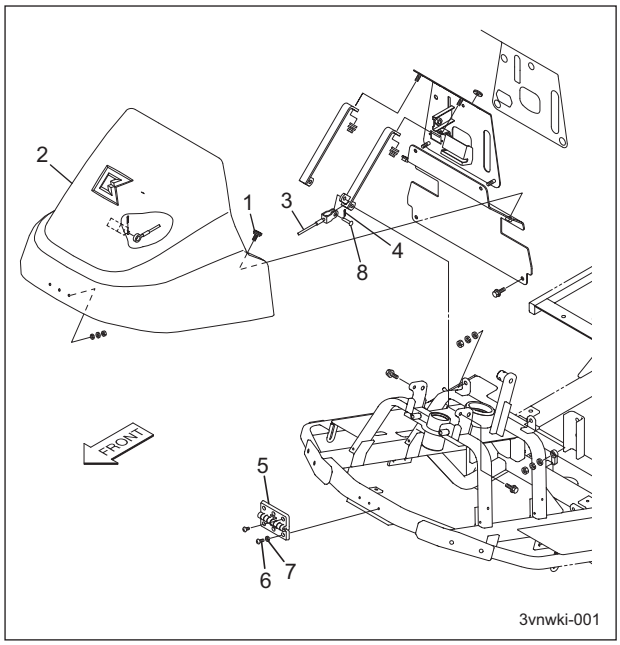
Caution

Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like.

Cover

Removal of front cover

1. Remove the dimple knob (1).
2. Open the front cover (2) and remove the split pin (4) and the round head pin (8) on one side of the cable (3).
3. Remove the small round screws (6) and the washers (7) from the resin hinge (5) to remove the front cover (2).



Removal of front cover_001

1	Dimple knob
2	Front cover
3	Cable
4	Split pin
5	Resin hinge
6	Small round screw
7	Washer
8	Round head pin

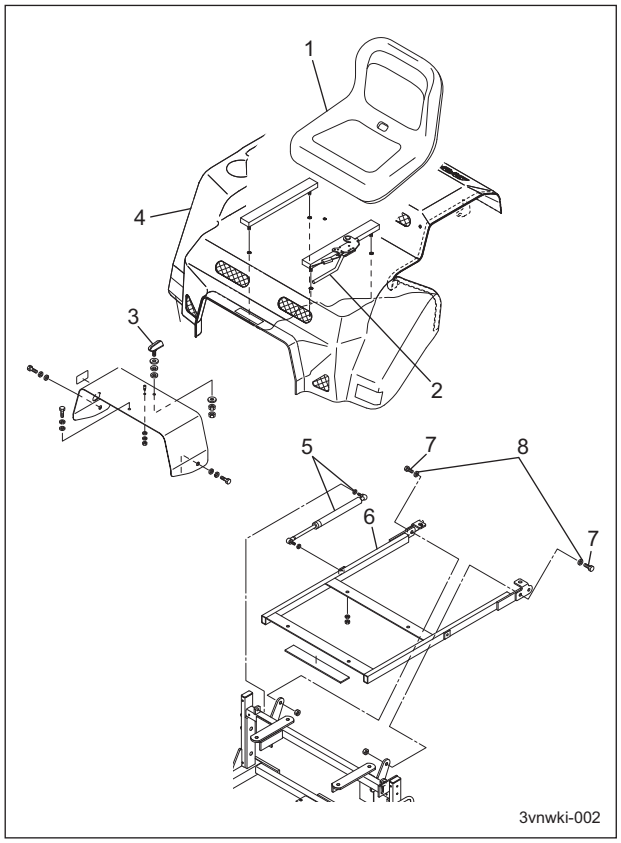
Fitting of front cover

For fitting, follow the opposite procedure of removal.

> ⚠ Caution
>
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Removal of rear cover

1. Hold the slide handle (2) of the seat (1) and move the seat (1) all the way to the back.
2. Turn the cover stopper (3) to open the rear cover (4).
3. Remove one side of the gas spring (5) fitted to the rear cover (4).
4. Remove the bolts (7) and washers (8) from the seat mount (6).



Removal of rear cover_001

1	Seat
2	Slide handle
3	Cover stopper
4	Rear cover
5	Gas spring
6	Seat mount
7	Bolt
8	Washer

Fitting of rear cover

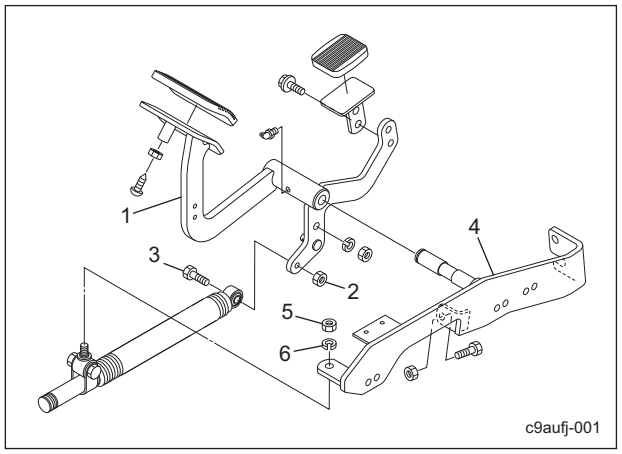
For fitting, follow the opposite procedure of removal.

> ⚠ Caution
>
> Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Damper

Removal of damper

1. Remove nut (2) and bolt (3) from forward/ reverse pedals (1).
2. Remove nut (5) and washer (6) from forward/reverse pedals fulcrum (4).



Removal of damper_001

1	Forward/reverse pedals
2	Nut
3	Bolt
4	Forward/reverse pedals fulcrum
5	Nut
6	Washer

Fitting of damper

For fitting, follow the opposite procedure of removal.

Caution

Refer to the tightening torque list. We assume no responsibility for problems caused by abnormal tightening, tightening with excessive torque or the like of.

Inspection and repair of each section

Tire

Inspection of tire

A worn tire tread may hamper the primary operation of this equipment or result in bursting or slippage of the tire. Check the tires for any abnormality as described below.

1. Tire pressure
2. Crack, damage
3. Abnormal abrasion

Caution

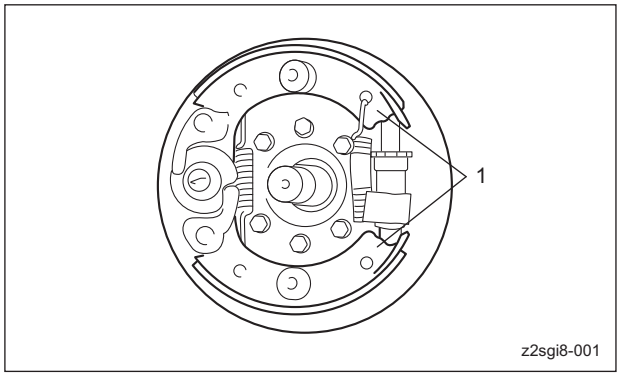
Check “Main body: Specifications” for tire pressure. Do not pump up a tire more than the specified pressure.

Brake

A worn brake shoe will increase the amount of brake pedal depression, and may cause the pedal to touch the floor or result in uneven braking. Inspect the brake accordingly.
Adjust the brake shoe clearance to be even on both sides. A brake shoe is gradually worn down like an eraser as the brake is applied. Check the remaining shoe amount upon inspection and replace as needed.

Disassembly and assembly of brake

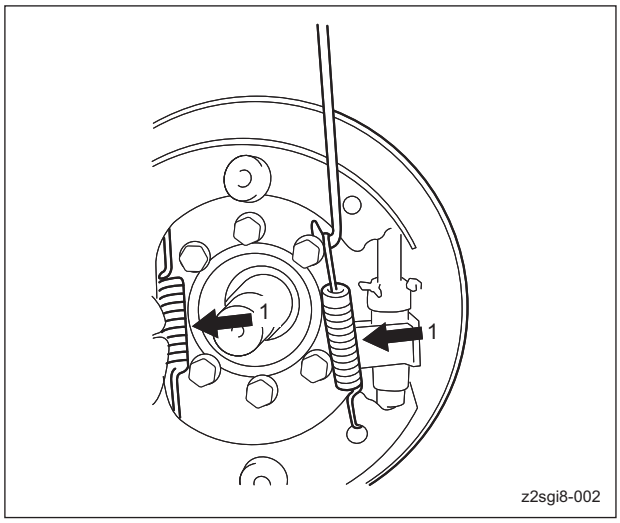
A brake shoe can be replaced with this equipment fitted.



Disassembly and assembly of brake_001

1	Shoe

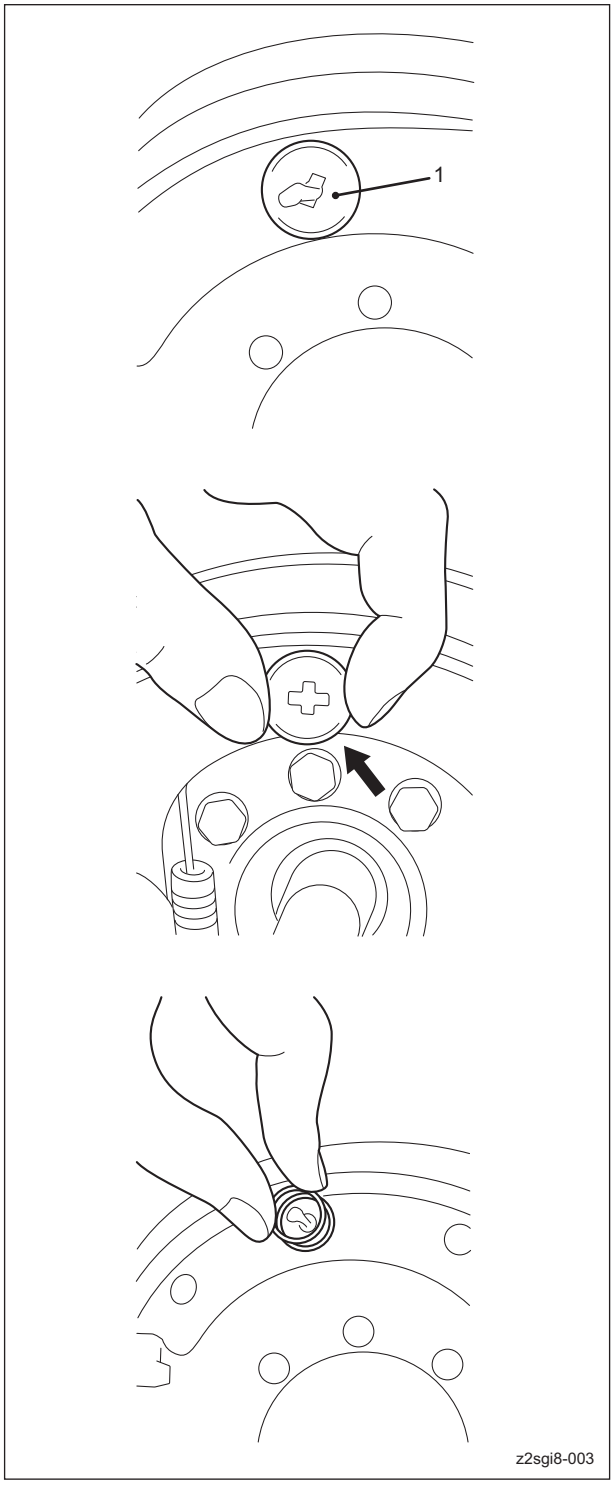
1. Remove the springs (1) on both sides. They are different in size.



Disassembly and assembly of brake_002

1	Spring

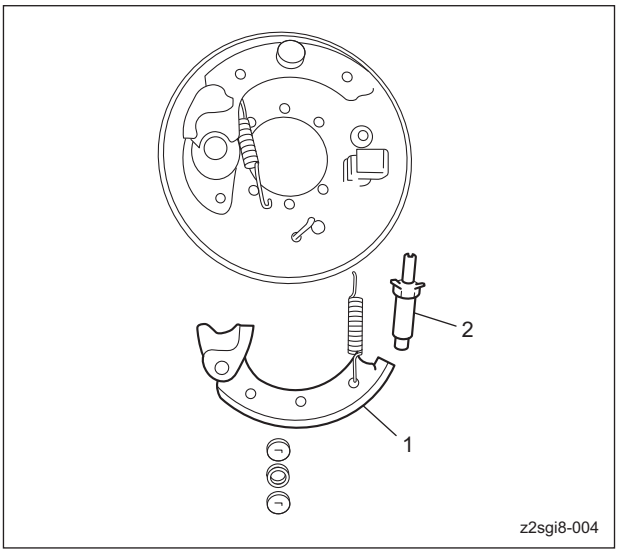
2. Remove the shoe support.
3. Turn the spring support (1) 90° while pushing it in.



Disassembly and assembly of brake_003

1	Spring support

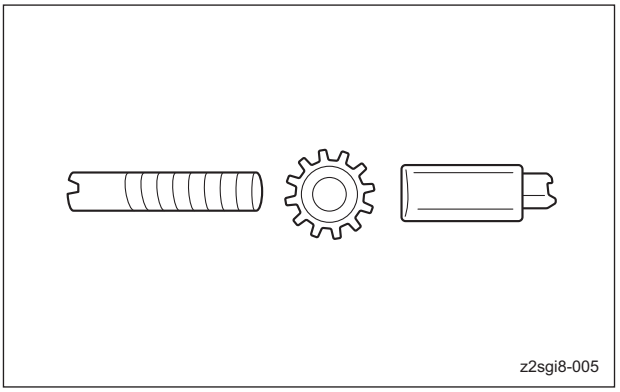
4. Remove the shoe (1) and the adjuster screw (2).



Disassembly and assembly of brake_004

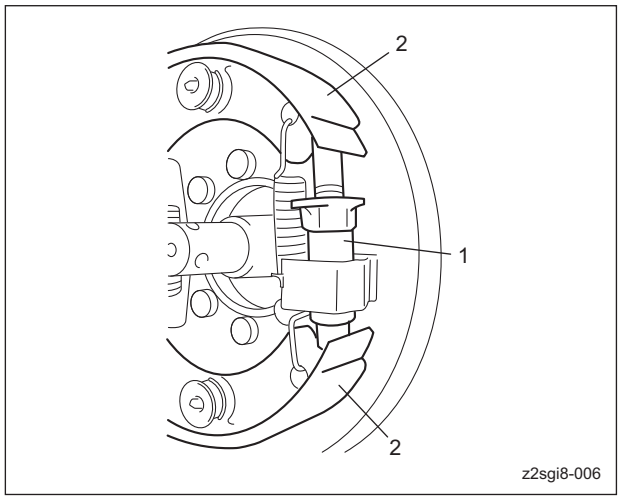
1	Shoe
2	Adjuster screw

5. When assembling, apply grease to the sliding part. Use grease that is exclusively for brakes and never apply onto the shoe friction surface. If it adhered on the surface, remove it with brake cleaner etc.



Disassembly and assembly of brake_005

6. Adjust the shoe clearance. Turn the adjuster screw (1) and adjust the width of the shoe (2). Check by trial assembly without inserting a key into the motor shaft.



Disassembly and assembly of brake_006

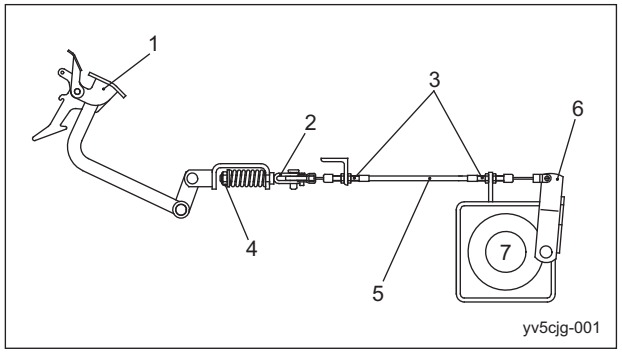
1	Adjuster screw
2	Shoe

Brake wire, rod

Warning

Check to see that the brake wire is free from cracks or damage.
Check to see that the parking brake is effective on a slope and is set free when released. If any abnormality is found, adjust the brake wire and inspect the parking brake system.

Adjust the brake by tightening the adjuster bolt of the brake wire and the nut (4) of the spring rod.



Brake wire, rod_001

1	Brake pedal
2	Spring rod
3	Adjuster bolt
4	Nut
5	Brake wire
6	Brake lever
7	Rear wheel part

Adjustment of brake wire adjuster bolt

Elongation of the brake wire may cause its stroke to be full, resulting in the brake being weak or locking.
Adjust the pull length of the brake lever (6) with the adjuster bolt (3) of the brake wire (5).
Minimize play of the brake lever (6) to adjust the brake so it is set free when the lever is released. (See “Brake wire, rod_001.”)

1. Allowing more play on the brake lever causes the braking power to be weaker and the brake pedal to feel lighter.
2. Allowing less play of the brake lever causes the braking power to be stronger and the brake pedal to feel heavier.

Adjustment of spring rod

Spring contraction by depressing the brake pedal may cause the brake to be weaker.
Adjust the braking power and the control force of brake pedal with the nut (4) of the spring rod (2). (See “Brake wire, rod_001.”)

1. Loosening reduces the braking power and the brake pedal feels lighter.
2. Tightening increases the braking power and the brake pedal feels heavier.

Traveling cable, rod

Depending on the use frequency of forward/ reverse pedals, there may be insufficient return of the pedal neutral rod compression spring. Inspect and implement adjustment and other measures if needed.

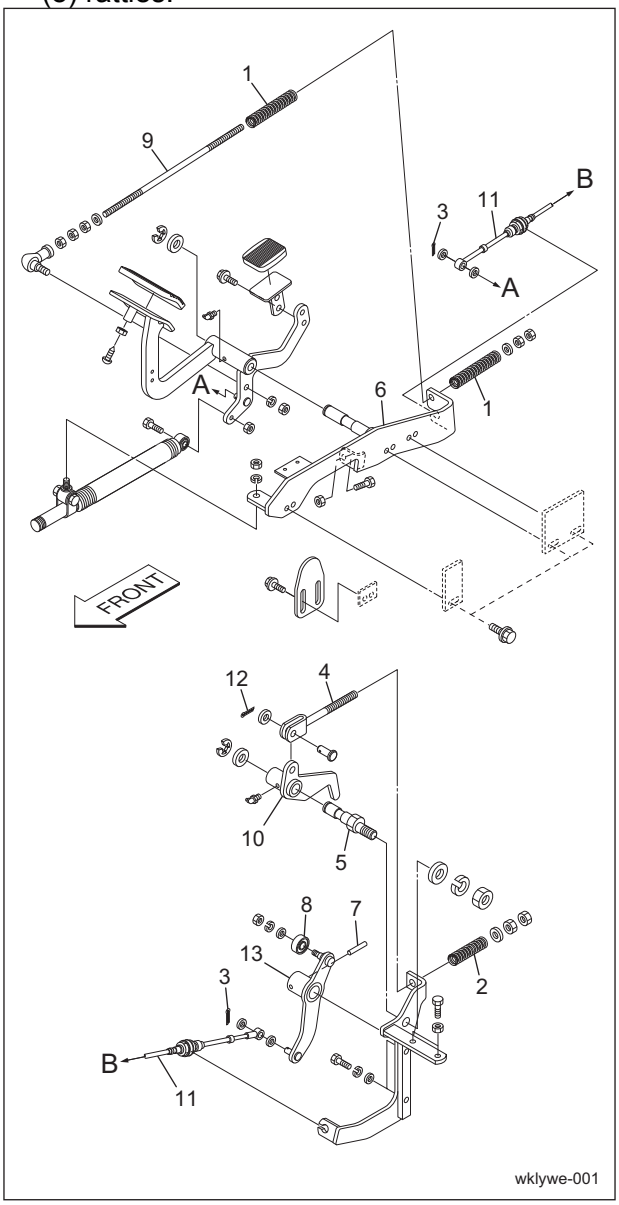
Important

For neutral adjustment measures, refer to Owner’s operating manual.

Inspection of traveling cable and rod

1. Check to see if the compression spring (1) of the pedal neutral rod (9) is bent or has shrunk.
2. Check to see if the compression spring (2) of the pump neutral lever (10) is bent or has shrunk. (See Main body-specification)
3. Check to see if the split pin (3) of the push-pull cable (11) comes off.
4. Check to see if the split pin (12) of the lever adjuster (4) comes off.
5. Check to see if the pump neutral lever shaft (5) is bent or worn.

6. Check to see if the forward/reverse pedals fulcrum has any looseness.
7. Check to see if the spiral pin (7) of the trunnion lever (13) comes off, or the bearing (8) rattles.



Inspection of traveling cable and rod_001

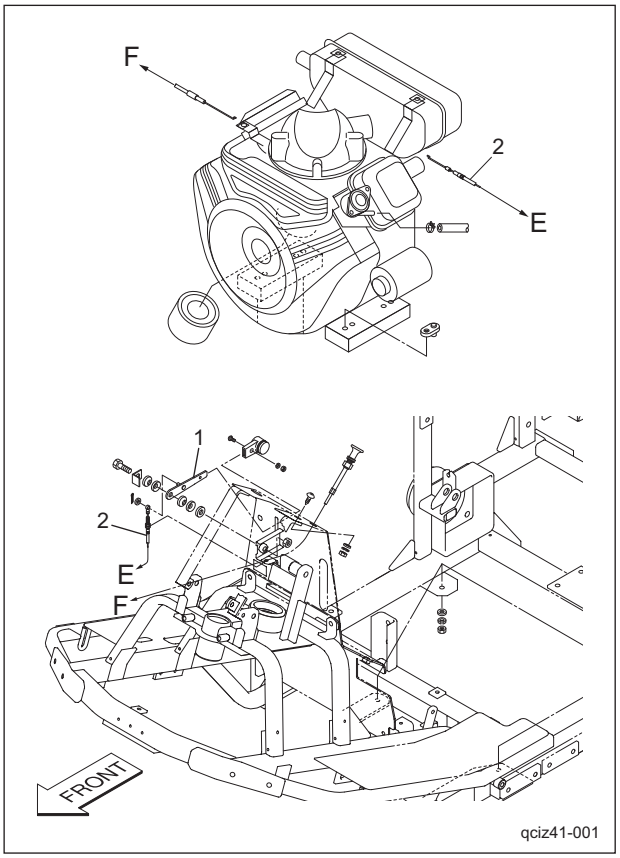
1	Compression spring
2	Compression spring
3	Split pin
4	Lever adjuster
5	Pump neutral lever shaft
6	Forward/reverse pedals fulcrum
7	Spiral pin
8	Bearing
9	Pedal neutral rod
10	Pump neutral lever
11	Push-pull cable
12	Split pin
13	Trunnion lever

Throttle wire, rod

Depending on the frequency of use, the lever movement may become slow, or the inner wire may change its play or elongate due to the Right angle of the outer wire. Inspect and adjust accordingly.

Inspection of throttle lever and wire

1. Check to see if the throttle lever (1) goes up and down smoothly.
2. Check to see if the throttle lever (1) comes down from the top at the maximum speed of the engine.
3. Check to see if the throttle wire (2) is bent or broken.



Inspection of throttle lever and wire_001

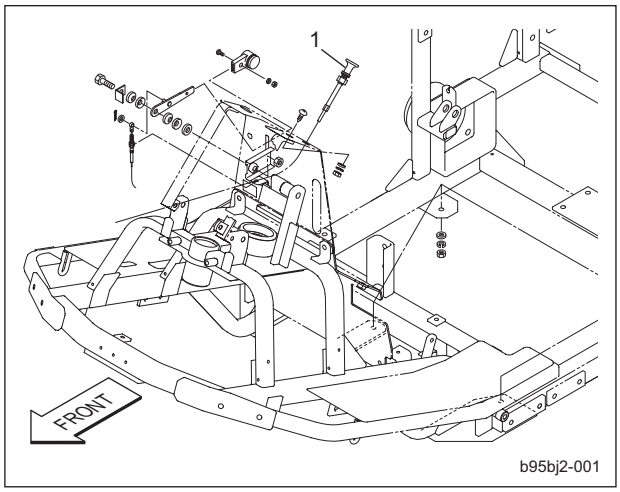
1	Throttle lever
2	Throttle wire

Choke wire, rod

Depending on the frequency of use, the lever movement may become slow, or the inner wire may change its play or elongate due to the Right angle of the outer wire. Inspect and adjust accordingly.

Inspection of choke wire

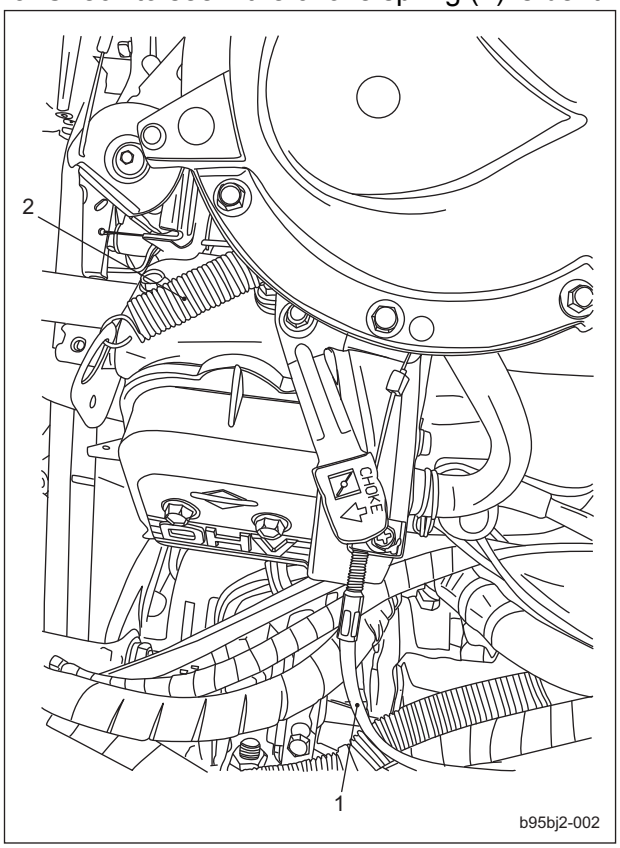
1. Check to see if the choke lever (1) moves smoothly.



Inspection of choke wire_001

1	Choke lever

2. Check to see if the choke wire (1) is bent or broken.
3. Check to see if the choke spring (2) is bent.



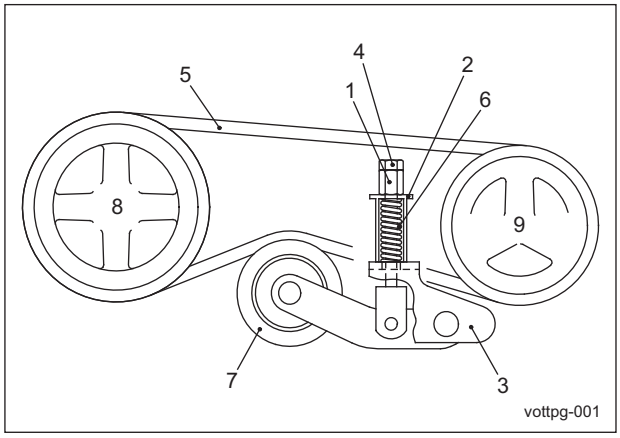
Inspection of choke wire_002

1	Choke wire
2	Choke spring

V belt

Adjustment of V belt

A loose belt may hop or slip. In contrast, too much tension may facilitate damage.
Adjust the belt tension as follows: fasten the high nut (1) to such an extent as to allow no gap between the spring cover (2) and the tension fulcrum (3); and lock with the nut (4). Since the gap will reappear as tension is loosened by use, adjust it accordingly.



Adjustment of V belt_001

1	High nut
2	Spring cover
3	Tension fulcrum
4	Nut
5	Belt
6	Spring
7	Tension pulley
8	Engine pulley
9	Pump pulley

Steering chain

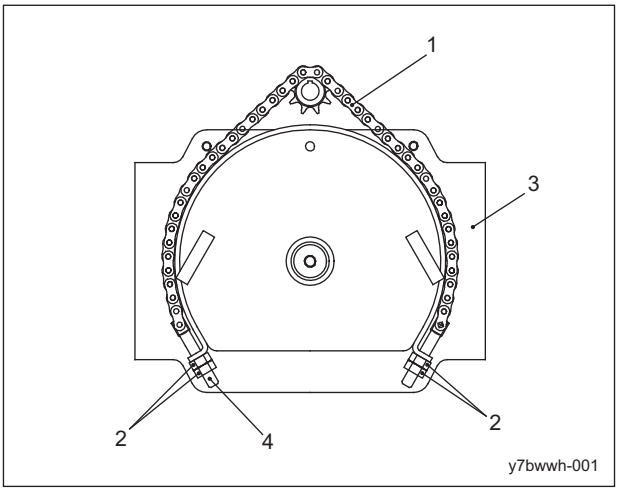
Adjustment of steering chain

A loose steering chain may cause more play for further elongation and too tight a steering chain may cause the handle to be heavy and result in faster abrasion of the chain and wheel. Open the front cover to see if there is looseness or damage of steering chain, and adjust as appropriate.

Important

For steering chain loosening, check Main body-specification.

1. Open the front cover.
2. Adjust the nuts (2) at both ends of steering chain (1) so that the chain is neither too tight nor slack. Lock the nuts (2) securely after adjustment.



Adjustment of steering chain_001

1	Steering chain
2	Nut
3	Front wheel arm
4	Adjustment screw

Maintenance

This chapter briefly describes how to inspect and maintain the SP05 work machine. For daily inspection, maintenance, and handling of the main unit, refer to the Owner's Manual and Parts Catalogue for the SP05.
For details on installing and removing optional equipment and attachments, refer to the instruction manual for the relevant attachment.

⚠ Danger

For safety reasons, follow the safety instructions below when performing an inspection or maintenance.

1. Before servicing or adjusting the machine, move the machine to a flat area, set the parking brake, turn the engine off, and then remove the key. Be sure to check that each part has completely stopped operating before servicing or adjusting the machine.
2. Keep hands and feet away from moving parts. If possible, avoid performing any work on the machine while the engine is running. Do not allow people to approach the machine's surroundings.
3. When necessary, use appropriate chain blocks, hoists, or a jack to lift the machine. Support the machine securely by using jack stands or appropriate blocks.
4. When replacing parts or installing accessory parts, use genuine BARONESS parts.
5. Never start the engine in a closed room. Doing so could result in carbon monoxide poisoning.
6. Do not touch the exhaust system during operation or just after the engine has been stopped. Due to its high temperature, doing so could cause burns.
7. Do not use an open flame near the battery. The battery may generate hydrogen gas so improper handling of the battery could cause it to catch fire and explode.
8. The electrolyte contained in the battery is sulfuric acid. The electrolyte (sulfuric acid) coming into contact with the skin could result in blindness or burns. The electrolyte coming into contact with the machine or its parts could result in damage to them.

Specifications

Adjustment values

Rake	mm	in
Fork depth (standard)	15	0.59

Front blade section	mm	in
Arm stopper	23	0.91
Height when raised	200	7.87
Distance between the ends of the L-ball and screw shaft	65	2.56
Exposed threaded portion of the connecting shaft	20	0.79
Screw-in depth of the L-ball	15	0.59

Special tools

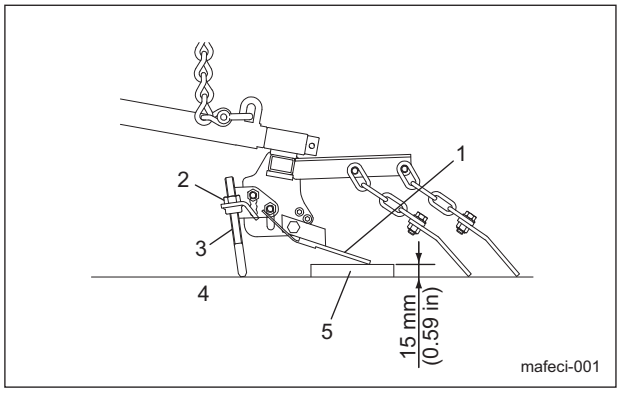
The use of special tools is not required.

Adjustments

Rake

Inspect the rake fines, warp board, and other parts to ensure that they are not worn, and that the bolts and nuts are not loose. Perform the following adjustments:

1. Park the machine on a level surface, lower the rake, and move the machine 200 mm (7.87 in) forward.
2. Insert a wooden board or the like of with a thickness of 15 mm (0.59 in) under the warp board.
3. Adjust the position of the rake fine so that the weight of the rake is supported by the wooden board and the tip of the rake fine is just in contact with the ground surface and then tighten the nut.

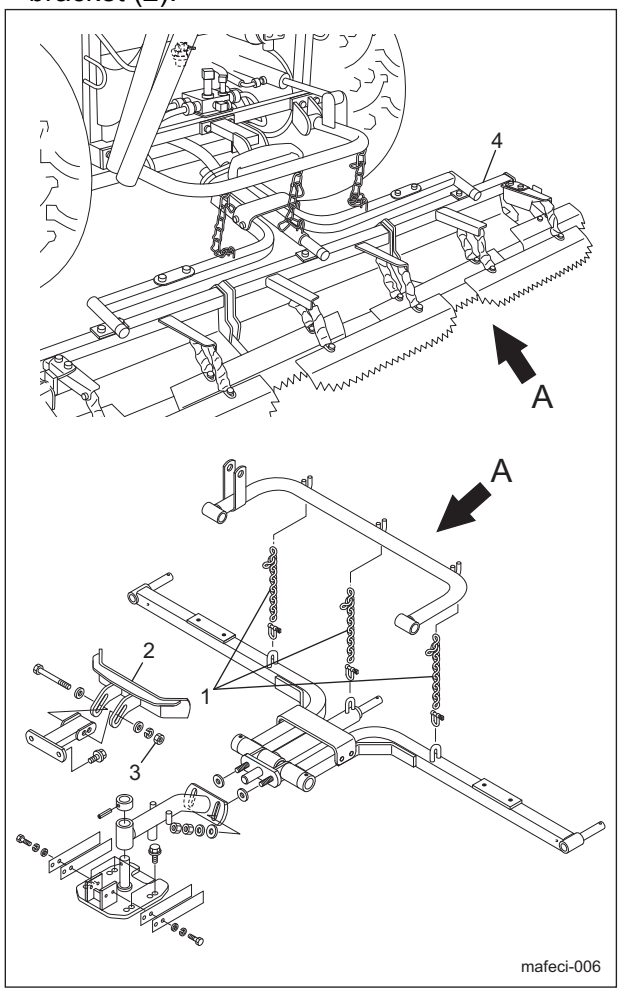


Rake_001

1	Warp board
2	Nut
3	Rake fines
4	Level concrete surface
5	Wooden board or the like

Rake mounting bracket
When adjusting the cross-link chains (1), adjust the rake mounting bracket (2). The standard number of links for a cross-link chain is 7.

1. Loosen the nut (3).
2. Raise the rake (4).
3. Adjust the position of the rake (4) so that it is just in contact with the rake mounting bracket (2) and then tighten the nut (3).
4. Raise or lower the rake (4) to ensure that it is just in contact with the rake mounting bracket (2).

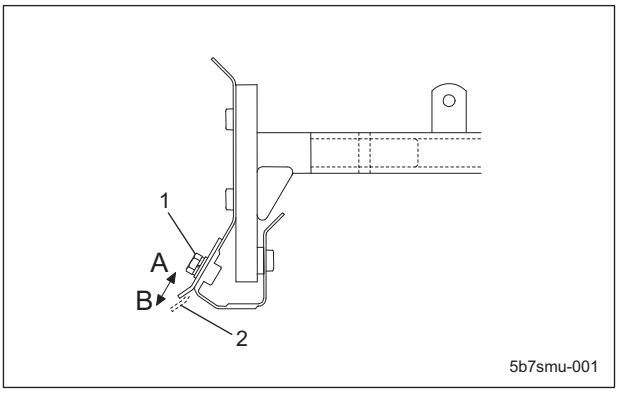


Rake_002

1	Cross-link chains
2	Rake mounting bracket
3	Nut
4	Rake

Front blade section

1. Loosen the bolt (1) to set the small front blade (2). Set it in direction A to carry a thin layer from the surface of the sand or in direction B to carry a thicker layer from the surface of the sand and then tighten the bolt (1).

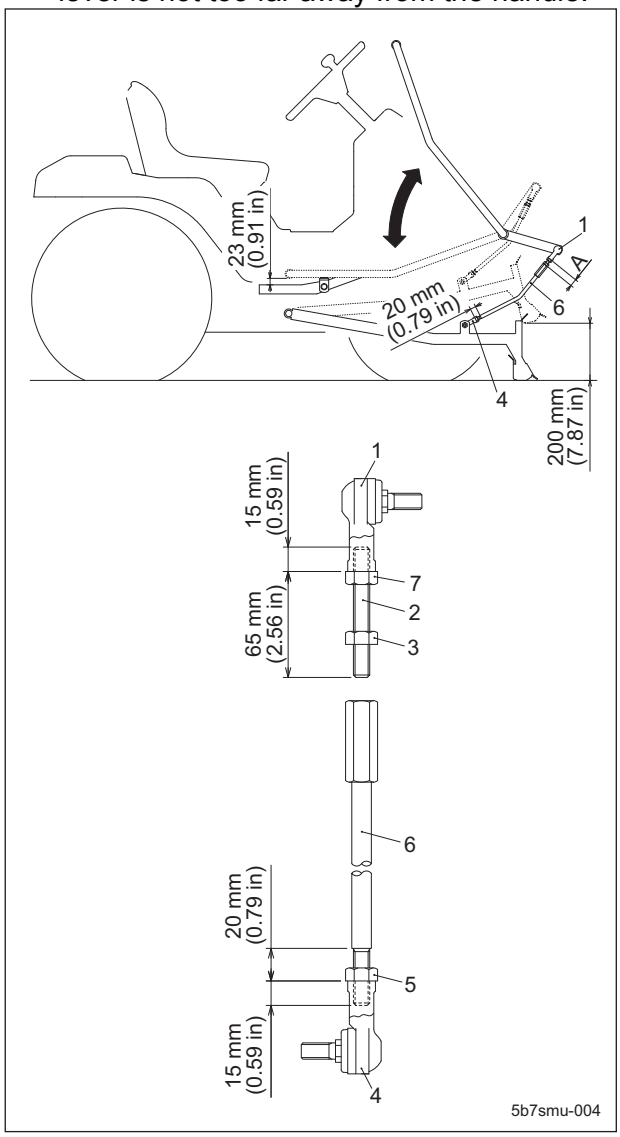


Front blade section_001

1	Bolt
2	Small front blade

2. Install and adjust the connecting shaft and L-ball. (Refer to “Specification: Adjustment values.”)
   [1] Attach the nut (3) to the screw shaft (2) to install the screw shaft to L-ball 2 (1).
   [2] Secure L-ball 2 (1) and the screw shaft (2) in place with the nut (7) so that the distance between the ends of the L-ball 2 (1) and the screw shaft (2) is 65 mm (2.56 in).
   [3] Secure L-ball 1 (4) and the connecting shaft (6) in place with the nut (5) so that the exposed threaded portion of the connecting shaft is 20 mm (0.79 in) from the end of L-ball 1 (4).
   [4] Adjust so that the front blade lever is held and the distance between the bottom of the front blade and the ground surface is 200 mm (7.87 in) when the front blade is fully lowered.
   [5] Adjust so that the left and right sides of the front blade move synchronously when the front blade is lowered on a level surface.

[6] Adjust so that the grip of the front blade lever is not too far away from the handle.



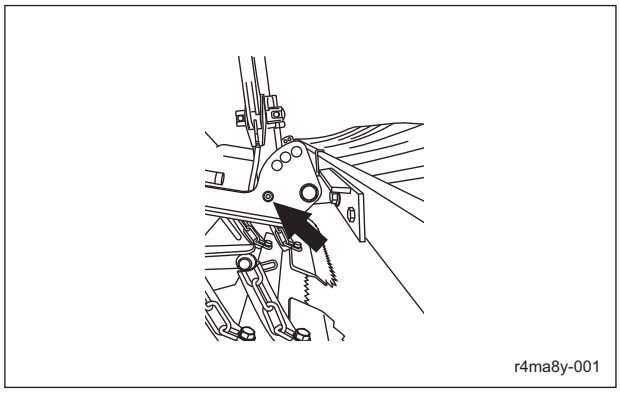
Front blade section_002

1	L-ball 2
2	Screw shaft
3	Nut
4	L-ball 1
5	Nut
6	Connecting shaft
7	Nut

Finishing brush section

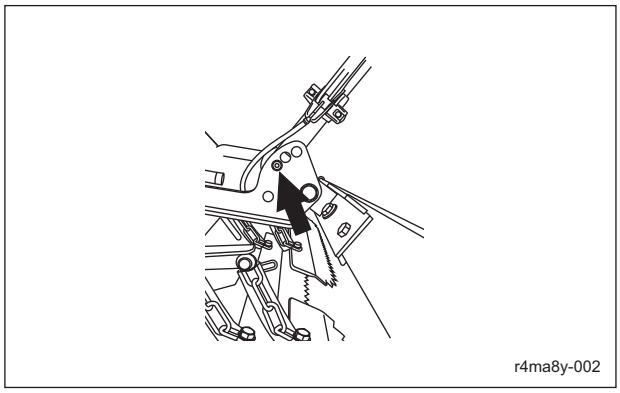
Adjust the height of the brush from the ground to suit the bunker conditions by holding the lever. The brush height can be adjusted to four levels by adjusting the pin position.

1. Lowest (Travel)



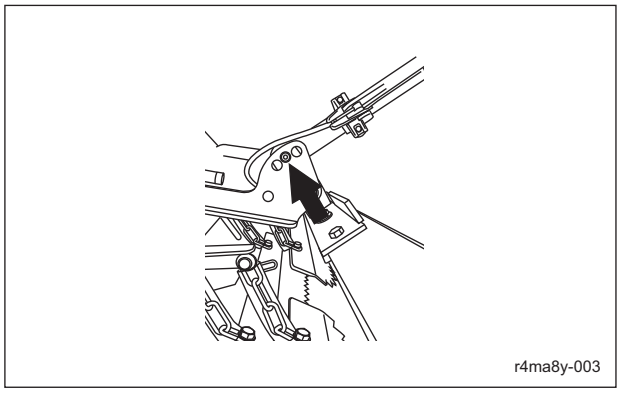
Finishing brush section_001

2. Second from bottom (Light finishing)



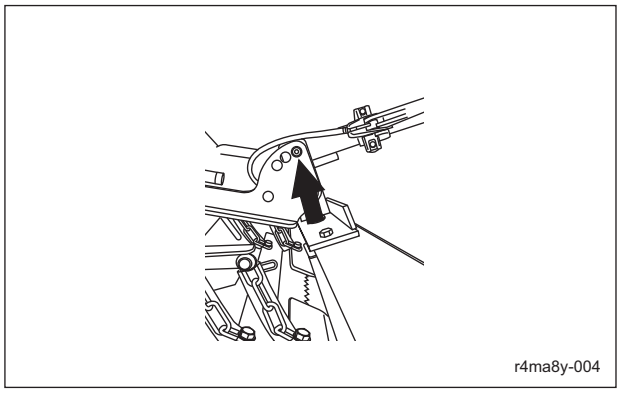
Finishing brush section_002

3. Third from bottom (Medium finishing (normal use))



Finishing brush section_003

4. Highest (Heavy finishing)



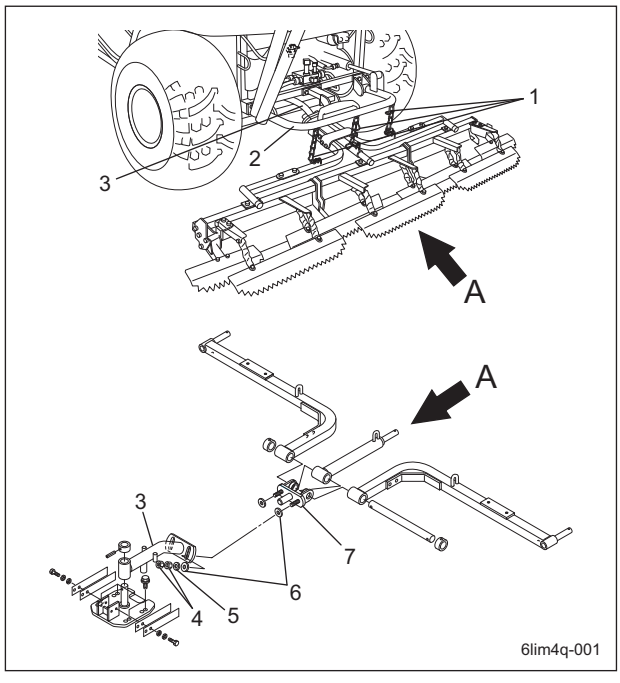
Finishing brush section_004

Removal and installation of each section

Rake

Removing the rake

1. Park the machine on a level surface and lower the rake.
2. Unhook the cross-link chains (1) from the rake holding arm (2).
3. Loosen the nuts (4) on the rake fulcrum pipe (3) and remove washers A (5) and B (6).



Removing the rake_001

1	Cross-link chains
2	Rake holding arm
3	Rake fulcrum pipe
4	Nuts
5	Washer A
6	Washer B
7	Fulcrum swing fitting

Installation of the rake

Install the rake by reversing the steps for its removal.

Caution

Refer to the list of tightening torques. We do not accept responsibility for problems resulting from improper or excessive tightening.

Important

When tightening the nuts, make sure that there is a little play between the rake fulcrum pipe and the fulcrum swing fitting. (See “Removing the rake_001.”)

Front blade section

For details on how to remove and install the front blade section, refer to the procedure for handling it.

Sand cultivator section

For details on how to remove and install the cultivator, refer to the procedure for handling it.

Finishing brush section

For details on how to remove and install the finishing brush section, refer to the procedure for handling it.

Cargo box section

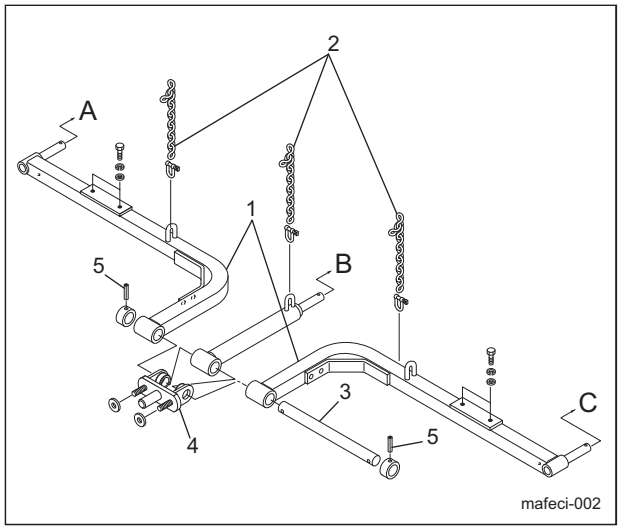
For details on how to remove and install the cargo box, refer to the procedure for handling it.

Inspection and repair of each section

Rake

Excessive use or damage to the rake caused during its operation or while the machine is traveling may result in tire tracks on the ground after the work has been completed. Perform the following inspection and replace or repair parts if necessary.

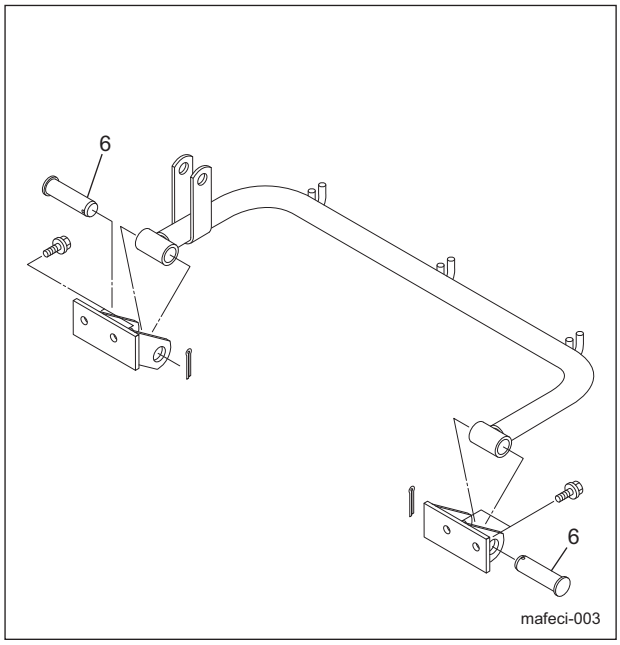
1. Inspect the rake pipe (1) to ensure that it is not bent (90°).
2. Inspect the cross-link chains (2) (standard: 7 links) to ensure that they are not twisted or worn.
3. Inspect the rake shaft (3) to ensure that it is not worn.
4. Inspect the center shaft of the fulcrum swing fitting (4) to ensure that it is not worn.
5. Inspect the spring pin (5) of the rake shaft to ensure that it has not come off.



Rake_001

1	Rake pipe
2	Cross-link chains
3	Rake shaft
4	Fulcrum swing fitting
5	Spring pin

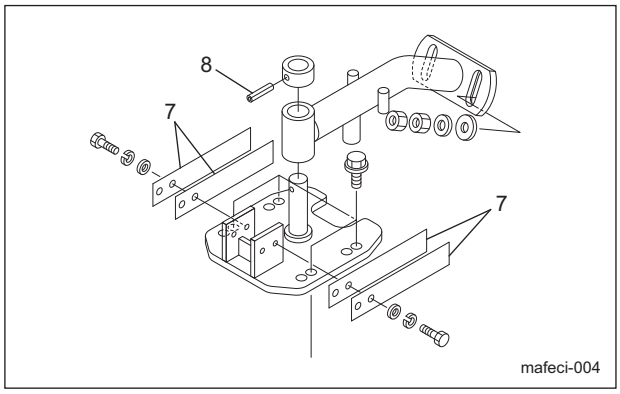
6. Inspect the hardened flat-head pin (6) of the rake hanging arm to ensure that it is not worn.



Rake_002

6	Hardened flat-head pin

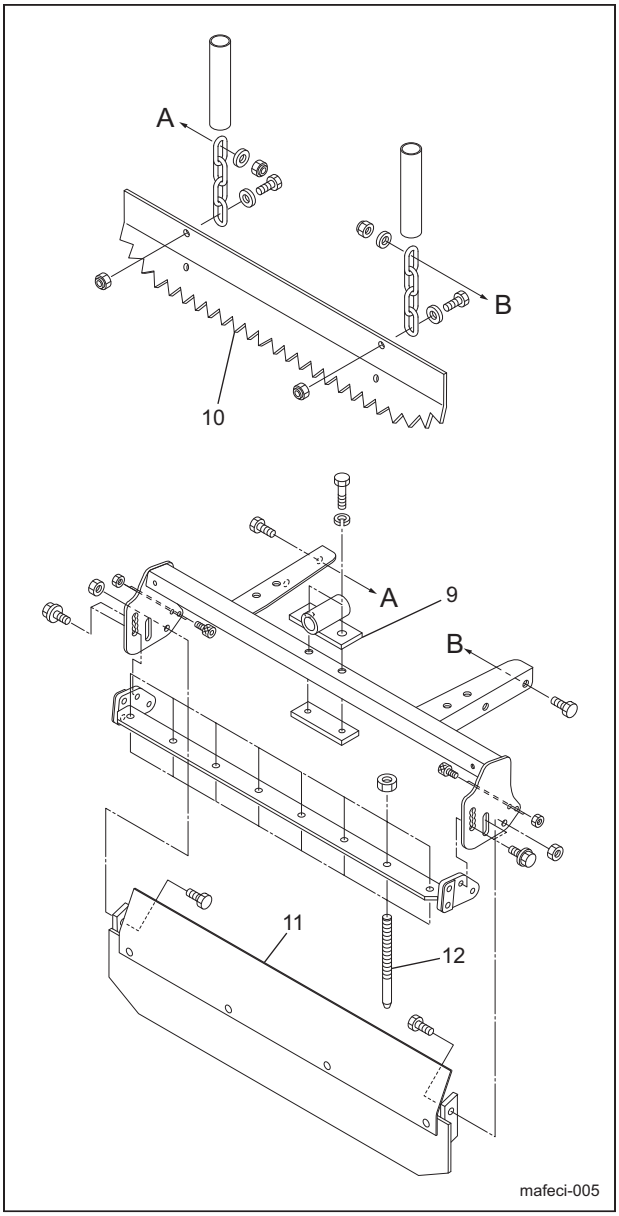
7. Inspect the plate spring (7) to ensure that it is not cracked or bent.
8. Inspect the spring pin (8) of the rake fulcrum to ensure that it has not come off.



Rake_003

7	Plate spring
8	Spring pin

9. Inspect the rake mounting bracket (9) to ensure that it is not bent.
10. Inspect the smoother plate (10) to ensure that it is not bent or cracked and check that grooves on the ground surface are spaced at regular intervals.
11. Inspect the warp board (11) to ensure that it is not cracked or worn.
12. Inspect the rake fines (12) to ensure that it is not worn.



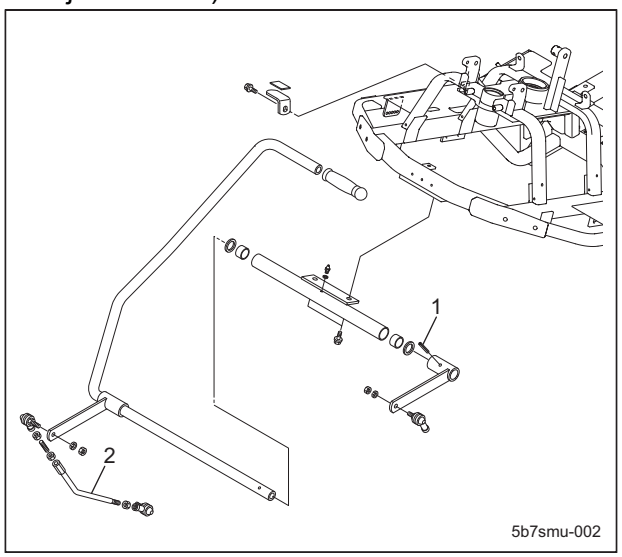
Rake_004

9	Rake mounting bracket
10	Smoother
11	Warp board
12	Rake fines

Front blade section

Excessive use or damage to the front blade caused during its operation or while the machine is traveling may make it harder for the machine to push or pull sand. Perform the following inspection and replace or repair parts if necessary.

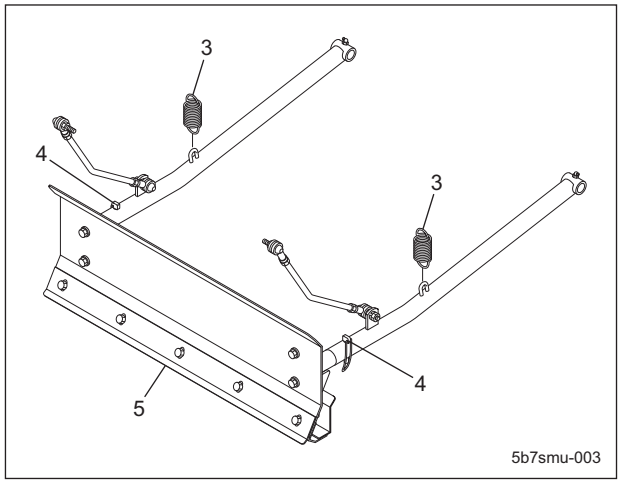
1. Inspect the spring pin (1) of the lever arm to ensure that it has not come off.
2. Inspect the connecting shaft (2) to ensure that it is not bent. Check whether the adjusted clearance in the L-ball of the front blade and the adjusted height of the front blade when raised are within the specified values. (Refer to “Specifications: Adjustments.”)



Front blade section_001

1	Spring pin
2	Connecting shaft

3. Inspect the spring hooks (3) to ensure that they are not bent and have not stretched. Check whether the adjustment value of the front blade arm stopper is within the specified value. (Refer to “Specifications: Adjustments.”)
4. Inspect the delta pins (4) to ensure that they have not come off.
5. Inspect the small front blade (5) to ensure that it is not cracked or worn.



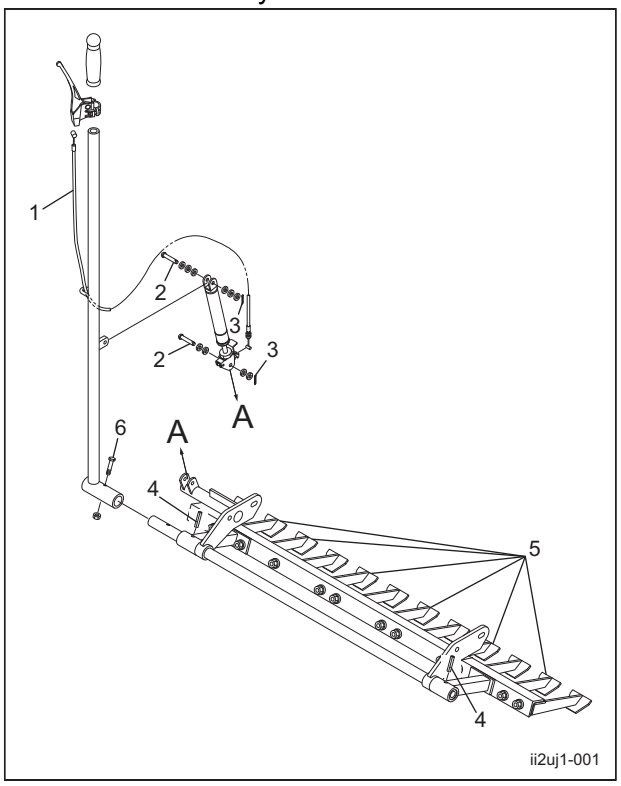
Front blade section_002

3	Spring hooks
4	Delta pins
5	Small front blade

Sand cultivator section

Excessive use or damage to the sand cultivator caused during its operation or while the machine is traveling may make it harder to adjust the sand depth at which the sand cultivator is pushed. Perform the following inspection and replace or repair parts if necessary.

1. Inspect the cultivator wire (1) to ensure that it is not broken.
2. Inspect the free-lock hardened round head pins (2) and split pins (3) to ensure that they have not come off.
3. Inspect the spring pins (4) and joint pin (6) to ensure that they have not come off.
4. Inspect the trapezoidal cultivator fittings (5) to ensure that they are not worn.

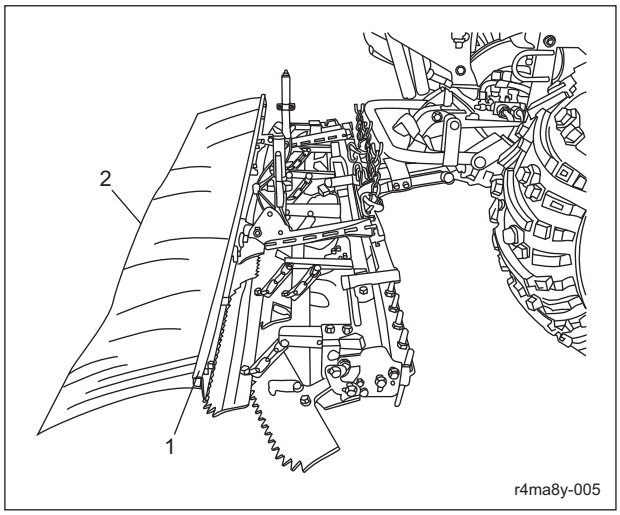


Sand cultivator section_001

1	Cultivator wire
2	Hardened round head pins
3	Split pins
4	Spring pins
5	Trapezoidal cultivator fittings
6	Joint pin

Finishing brush section

1. Inspect the brush mounting frame (1) to ensure that it is not bent.
2. Inspect the brush (2) to ensure that it is not bent, worn, or otherwise damaged.



Finishing brush section_001

1	Brush mounting frame
2	Brush

Engine problems

Problem	Cause	Reference
The magnetic switch does not work.	The interlock system has been activated. (The seat is not occupied, the brake is not depressed, or the forward or reverse pedal is not in the neutral position.)	Electrical system - Measurement methods - Interlock system
	A component in the interlock system has failed. (Seat switch, brake pedal switch, or forward/ reverse pedal proximity switch)	Electrical system - Electrical components
	The battery level is low or the battery has failed.	Electrical system - Measurement methods - Battery
	A battery cable has been disconnected.	Electrical system - General inspection and repair - Battery
	A starter circuit wire has been disconnected or broken.	
	The main harness fuse has blown.	Electrical system - Electrical components - Fuses
	The magnetic switch is not properly grounded.	
	The key switch has failed.	Electrical system - Electrical components - Key switch
	The magnetic switch has failed.	Electrical system - Electrical components - Magnetic switch
The starter does not turn. (Other than because of the above-mentioned causes)	The starter motor has failed.	Maintenance manual for engine
	A battery cable is loose.	Electrical system - General inspection and repair - Battery
The engine cranks but will not start.	The battery level is low.	Electrical system - Measurement methods - Battery
	Improper grounding	
	A spark plug has failed.	Maintenance manual for engine
	The key switch has failed.	Electrical system - Electrical components - Key switch
	The ignition coil has failed.	Maintenance manual for engine
	The stop switch wiring has short-circuited.	Electrical system - Electrical components - Key switch
	The fuel tank is empty.	Instruction manual for engine
	The fuel cock is not open.	Engine - Inspection and repair of each section - Fuel cock
	The fuel filter is clogged.	Engine - Inspection and repair of each section - Filter
	The fuel stop solenoid has failed.	Maintenance manual for engine

Problem	Cause	Reference
The engine cranks but will not start.	The air cleaner element is clogged.	Engine - Inspection and repair of each section - Air cleaner
	The engine is not compressing properly.	Maintenance manual for engine
	The fuel type is incorrect.	Instruction manual for engine
The engine starts but stops immediately.	The interlock system has been activated. (The forward or reverse pedal is being depressed while the seat is not occupied.)	Electrical system - Measurement methods - Interlock system
	The interlock system has been activated. (The operator has left the seat without the parking brake being set.)	Electrical system - Measurement methods - Interlock system
	A component of the interlock system has failed. (Seat switch, brake pedal switch, or forward/ reverse pedal proximity switch)	Electrical system - Electrical components
	The fuel level is low.	Instruction manual for engine
	The fuel filter is clogged.	Engine - Inspection and repair of each section - Fuel filter
	The fuel cock is not open.	Engine - Inspection and repair of each section - Fuel filter
	The air cleaner element is clogged.	Engine - Inspection and repair of each section - Air cleaner
	The carburetor is clogged.	Maintenance manual for engine
	The engine speed is low.	
The battery cannot be charged.	A battery cable is loose.	Electrical system - General inspection and repair - Battery
	A battery terminal has corroded.	Electrical system - General inspection and repair - Battery
	A charging circuit wire has been disconnected or broken.	
	The current from an accessory is too large.	
	The alternator has failed.	Maintenance manual for engine
	The regulator has failed.	Maintenance manual for engine
	The flywheel has been damaged.	Maintenance manual for engine
	The battery has failed.	Electrical system - Measurement methods - Battery

Traveling problems

Problem	Cause	Reference
The machine does not move forward or backward.	The hydraulic oil level is low.	Hydraulic system - General inspection and repair - Hydraulic oil
	The pump V-belt is loose.	Main unit - Inspection and repair of each section - V-belt
	The unload valve is being pressed.	Owner's Manual for this machine
	The traveling pump lever does not operate.	Main unit - Inspection and repair of each section - Traveling cables and rods
	The hydraulic oil filter is clogged.	Hydraulic system - Inspection and repair of each section - Hydraulic oil filter
	The charge pump has failed.	Hydraulic system - Measurement methods - Charge circuit
	The piston pump has failed.	Hydraulic system - Measurement methods - Traveling circuit
	The traveling motor has failed.	Hydraulic system - Installation and removal of each section - Wheel motor
Power is not sufficient to travel. (Other than because of the above-mentioned causes)	The engine speed is low.	
	The engine does not work properly.	Maintenance manual for engine
	The parking brake is set.	Main unit - Inspection and repair of each section - Brake wires and rods
	The travel distance of the actuating pump lever is small.	Main unit - Inspection and repair of each section - Traveling cables and rods
	The hydraulic oil is too cold.	Owner's Manual for this machine
	The hydraulic oil is dirty (foreign matter, water, or bubbles).	Hydraulic system - General inspection and repair - Hydraulic oil
	The viscosity of the hydraulic oil is incorrect.	Hydraulic system - General inspection and repair - Hydraulic oil
	The hydraulic oil cooler does not cool the oil sufficiently.	Owner's Manual for this machine
The machine moves forward or backward even when the forward or reverse pedal is not being depressed.	The forward or reverse pedal is difficult to press.	Main unit - Inspection and repair of each section - Traveling cables and rods
	The traveling pump is not in the neutral position.	Owner's Manual for this machine

Steering problems

Problem	Cause	Reference
The steering wheel is difficult to turn.	The engine speed is low.	
	The tire pressure is low.	Main unit - Inspection and repair of each section - Tires
	The steering chain is too tight.	Main unit - Inspection and repair of each section - Steering chain
	The front arm bearing is faulty.	Main unit - Removal and installation of each section - Wheels
	The pump V-belt is loose.	Main unit - Inspection and repair of each section - V-belt
	The hydraulic oil level is low.	Hydraulic system - General inspection and repair - Hydraulic oil
	The hydraulic oil is too cold.	Owner's Manual for this machine
	The hydraulic oil is dirty (foreign matter, water, or bubbles).	Hydraulic system - General inspection and repair - Hydraulic oil
	The viscosity of the hydraulic oil is incorrect.	Hydraulic system - General inspection and repair - Hydraulic oil
	The hydraulic oil cooler does not cool the oil sufficiently.	Owner's Manual for this machine
	The valve module has failed.	Hydraulic system - Measurement methods - Steering circuit
	The torque generator has failed.	Hydraulic system - Measurement methods - Steering circuit
	The working pump has failed.	Hydraulic system - Removal and installation of each section - Piston pump
The steering wheel can be turned but the wheels do not turn. (Other than because of the above-mentioned causes)	The steering chain has broken.	Main unit - Inspection and repair of each section - Steering chain
	The steering chain is loose.	Main unit - Inspection and repair of each section - Steering chain
	The pin in the steering joint has come off.	Main unit - Removal and installation of each section - Steering

Work machine and mower unit problems

Problem	Cause	Reference
The rake section cannot be raised/lowered.	The engine speed is low.	
	The chain suspending the rake section has come off.	Work machine and mower unit - Adjustments - Rake section
	A pin for the raise/lower cylinder has fallen off.	Hydraulic system - Removal and installation of each section - Raise/lower cylinder
	A raise/lower circuit wire has been disconnected or broken.	Electrical system - Electrical components - Raise/lower switch, Solenoid valve
	The raise/lower switch has failed.	Electrical system - Electrical components - Raise/lower switch
	The pump V-belt is loose.	Main unit - Inspection and repair of each section - V-belt
	The hydraulic oil level is low.	Hydraulic system - General inspection and repair - Hydraulic oil
	The hydraulic oil is too cool.	Owner's Manual for this machine
	The hydraulic oil is dirty (foreign matter, water, or bubbles).	Hydraulic system - General inspection and repair - Hydraulic oil
	The viscosity of the hydraulic oil is incorrect.	Hydraulic system - General inspection and repair - Hydraulic oil
	The hydraulic oil cooler does not cool the oil sufficiently.	
	The valve module has failed.	Hydraulic system - Measurement methods - Raise/lower circuit
	The raise/lower cylinder has failed.	Removal and installation of the hydraulic system - Raise/lower cylinder
	The working pump has failed.	Removal and installation of the hydraulic system - Piston pump
The rake section falls due to gravity.	The raise/lower cylinder has failed.	Hydraulic system - Removal and installation of each section - Raise/lower cylinder
	The valve module has failed.	Hydraulic system - Removal and installation of each section - Valve module
The raked surface is not smooth.	The rake section is not fully lowered.	Owner's Manual for this machine
	When the machine is moved to the right or left, the rake section does not follow. (Faulty plate spring or loose support pin)	Work machine and mower unit - Inspection and repair of each section - Rake section

Problem	Cause	Reference
The raked surface is not smooth.	The warp board of the rake section has become worn.	Work machine and mower unit - Inspection and repair of each section - Rake section
	A fork blade has become worn.	Work machine and mower unit - Inspection and repair of each section - Rake section
	The angle or depth of a fork blade has been incorrectly adjusted.	Work machine and mower unit - Adjustments - Rake section
	The tire pressure is high.	Main unit - Inspection and repair of each section - Tires

Specifications

SP05

Machine dimensions	Total length	215 cm (846.46 in)
	Total width	190 cm (748.03 in)
	Total height	120 cm (472.44 in)
	Wheelbase	105 cm (413.39 in)
	Tread	107 cm (421.26 in)
Gross mass (with rakes)		480 kg (1,058.22 lb)
Speed	Two-wheel drive	0 - 16.0 km/h (0 - 13.1 m/ph)
	Three-wheel drive	0 - 12.8 km/h (0 - 8.0 m/ph)
Front wheels	Size	21×11.00-10
	Air pressure	70 kPa (0.71 kgf/cm^2) (10.5 psi)
Rear wheels	Size	25×13.00-9
	Air pressure	40 kPa (0.41 kgf/cm^2) (5.80 psi)
Brake		Internal expanding brake (rear wheels)
Steering system		Torque generator power steering
Engine	Model	Vanguard 356447
	Type	V2 engine
	Total stroke volume	570 cm^3 (34.8 in^3)
	Engine speed (with no load)	1,400 - 3,000 rpm
	Maximum output	11 kW (15 PS)/3,000 rpm (15 HP/3,000 rpm)
	Engine oil amount (including engine filter)	1.6 L (1.7 US quarts)
Battery		46B19R (40B19R)
Fuel tank capacity		15 L (3.96 US gallons)
Oil tank capacity		15 L (3.96 US gallons)
Working range	Rake	190 cm (748.03 in)

Maintenance schedule

The maintenance schedule is as follows:

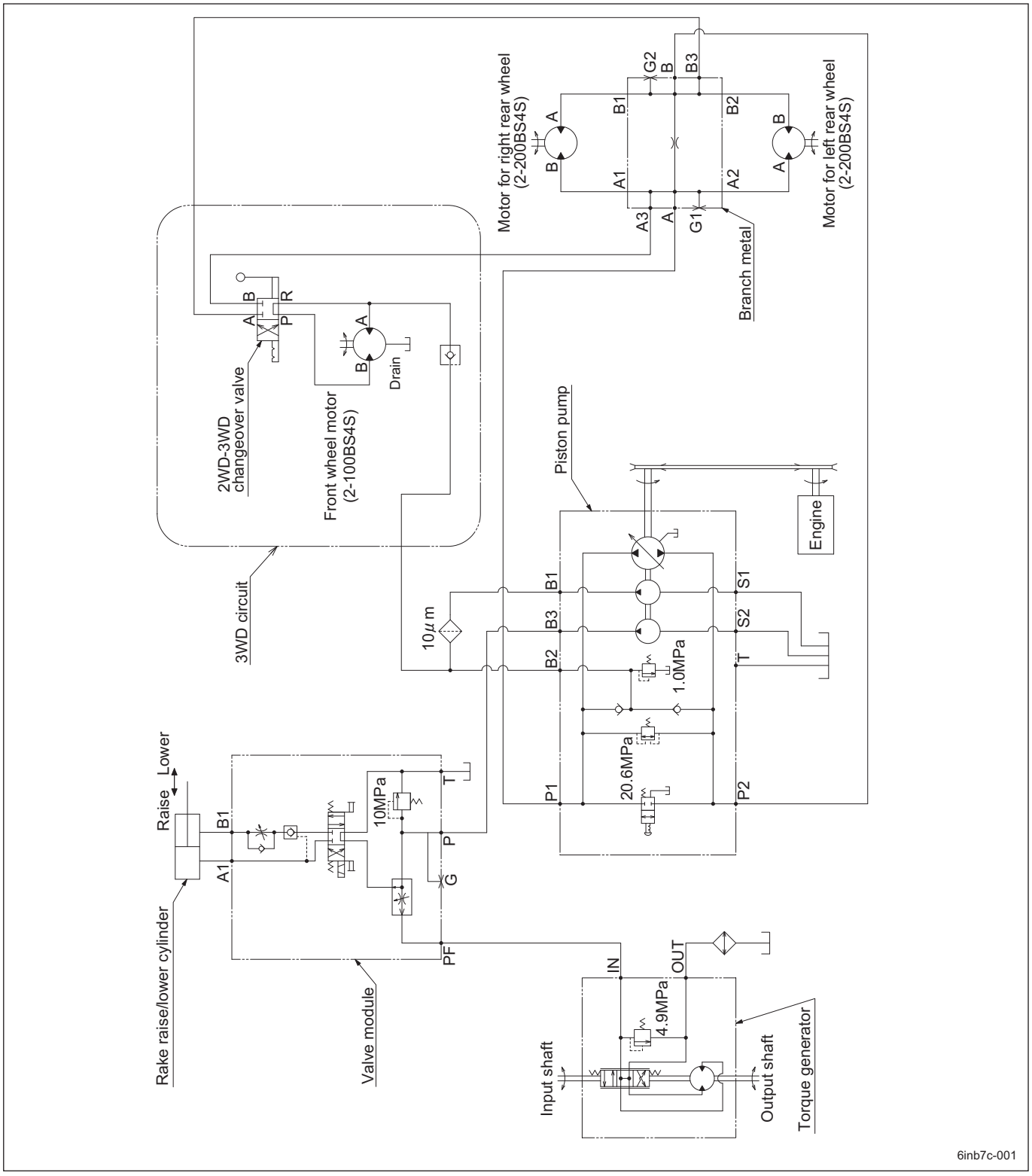
> ⚠ Caution
>
> When performing maintenance, use appropriate tools, suitable for the purpose.

○ … Inspection, adjustment, refill, and cleaning
● … Replacement

Maintenance items		Before work	After work	Every 8 hours	Every 50 hours	Every 100 hours	Every 400 hours	Every 500 hours	Every year	Remarks
Engine	Engine oil	○		● First time	●					
	Engine oil filter					●				
	Fuel filter								●	
	Spark plugs								●	
	Valve clearance								○	
	Cleaning of exterior		○							
Main unit	Air cleaner/outer				○		●			Every 400 hours or every year, whichever comes first
	Air cleaner/inner						●			Every 400 hours or every year, whichever comes first
	Fuel cock					○				
	Hydraulic oil	○				● First time		●		
	Hydraulic cartridge filter					● First time		●		
	Hydraulic hose	○								Replace every 4 years.
	V-belt	○							●	
	Grease-up				○					
	Tire pressure/cracks	○								
	Brake effectiveness	○								
	Play of steering chain								○	
	Battery electrolyte				○					
	Tightening of each part	○								
	Oil leaks from each part	○								

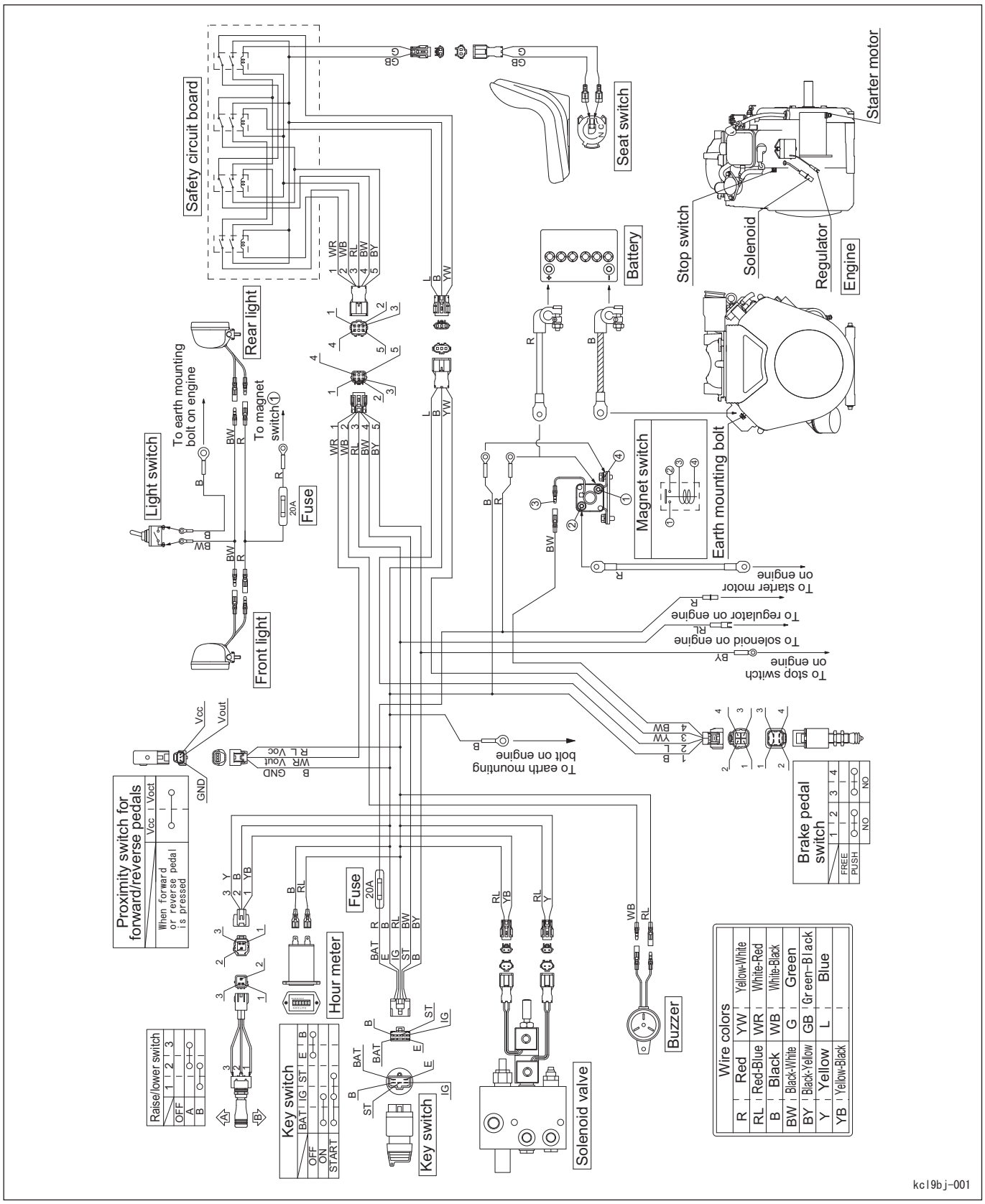
Maintenance items		Before work	After work	Every 8 hours	Every 50 hours	Every 100 hours	Every 400 hours	Every 500 hours	Every year	Remarks
Main unit	Cleaning/inspection of each part		○							
	Activation of safety devices	○								
Work machine	Tightening of each part	○								
	Cleaning/inspection of each part	○								
	Wear of fork blade	○								
	Wear of warp board	○								

Hydraulic circuit diagram



Hydraulic circuit diagram_001

Electric wiring diagram



Electric wiring diagram_001

Consumable parts list

The consumable parts are follows:

> ⚠ Caution
>
> Use appropriate tools, suitable for the purpose for maintenance.

		Code	Part name	Qty	Remarks
Engine	Engine oil filter	PL492932S	Oil filter (57 mm/standard)	1	
	Fuel filter	PL691035	Fuel filter	1	
	Spark plug	PL491055S	CHAMPION RC12YC	1	
Main body	Fuse	K3631000040	Cartridge fuse 20A	2	
	Air cleaner/outer	PL841497	Air cleaner cartridge (outer)	1	
	Air cleaner/inner	PL821136	Air cleaner cartridge (inner)	1	
	Hydraulic cartridge filter	K3412000050	Replacement filter C-SP04-10	1	
	Hydraulic oil	K2913100200	Shell Tellus 46 20-liter can	−	
	Shoe upper right	P741-8007-00	Shoe	1	
	Shoe lower right	P741-8005-00	Shoe	1	
	Shoe upper left	P741-8008-00	Shoe	1	
	Shoe lower left	P741-8006-00	Shoe	1	
	Brake wire right	K1120145200	Brake wire 1452	1	
	Brake wire left	K1120086210	Brake wire 862	1	
	V-belt	K2374200430	Low-edge cogged belt H-PXSB43	1	
	Push-pull cable	K1160075500	Push-pull cable 755	1	
	Throttle wire	K1110143000	Throttle wire 1430	1	
	Chalk wire	K1100178500	Chalk wire 1785	1	
	Steering chain	K2210000440	EK428SH chain 45JJ	1	
Machine	Plate spring	K1090000110	2 plate spring 40200	4	
	Fork blade	K6175000218	Fork blade	24	
	Finishing brush	SP05---1002Z0	Finishing brush 1.0 (NY)	1	
	Finishing brush adjustment wire	K1160089000	Adjustment wire 890	2	
	Trapezoidal cultivator fitting	SP05---0909ZD	Trapezoidal cultivator fitting	6	
	Cultivator wire	K1160082000	Cultivator wire 820	1	
	Smoother plate	SP05---0722ZD	Smoother plate 20-15°	5	

BARONESS®

Quality on Demand

Kyoeisha USA, Inc.

1301 Rand Street, Suite D・Petaluma, CA 94954

Phone: 707.283.0610 Fax:070.283.0613

URL:http://www.baroness.us