LM315GC

Triple Greens Mower

Service manual

BARONESS®

Quality on Demand

Serial No.30001-

Ver.1.0

Introduction

This manual describes about the procedures of maintenance and malfunction diagnosis etc. of this machine.
Items of description are categorized per system for representative maintenance contents.
As for repair items specified by the manufacturers in the hydraulic system, engine, etc., their respective disassembling and maintenance procedures are not described.
For repair, please contact your sales dealer or Kyoeisha.
For operation, handling and adjustment instruction, please refer to the Owner's Operating Manual.
Be sure to also read the Owner's Operating Manual for the engine, battery, etc.
See the parts catalog for required parts.

Kyoeisha Co., Ltd.

Caution

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

Warning Symbols

This manual uses the following warning symbols for handling precautions that are important for your safety.

 696cq5-001	Warning symbol

This symbol indicates the articles regarding “Danger,” “Warning,” or “Caution.”
Those articles describe important safety precautions and so read them carefully to understand completely before operating the machine.
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.

Important

This symbol indicates precautions on the mechanism of the machine.

Contents

Contents

Failure to adequately follow these safety precautions may cause an accident resulting in injury or death.

⚠ 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.

Safe Operating Practices

The following instructions include the ones from CEN standard EN 836: 1997, ISO standard 5395: 1990, and ANSI B71.4-2004.

Training

1. Read the Owner's operating Manual and other training material carefully. Be familiar with the controls, safety signs, and the proper use of the equipment.
2. If the operator or mechanic can not read English it is the owner's responsibility to explain this material to them.
3. All operators and mechanics should seek and obtain professional and practical instruction.
   The owner is responsible for training the users.
   Such instruction should emphasize.
   [1] The need for care and concentration when working with ride-on machines.
   [2] Control of a ride-on machine sliding on a slope will not be regained by the application of the brake.
   The main reasons for loss of control are
   - Insufficient wheel grip
   - Being driven too fast
   - Inadequate braking
   - The type of machine is unsuitable for its task
   - Lack of awareness of the effect of ground conditions, especially slopes
   - Incorrect hitching and load distribution
4. Never allow untrained personnel to service machine.
   Local regulations may restrict the age of the operator.
5. The owner/use can prevent and is responsible for accidents or injuries occurring to themselves, other people, or property.
6. Keep in mind that the owner, operator, and mechanic are responsible for accidents or hazards occurring to other people or their property.

Preparation

1. Evaluate the terrain to determine what accessories and attachments are needed to properly and safety perform the job. Only use accessories and attachments approved by the manufacturer.
2. While operating, always wear substantial footwear, long trousers, hard hat, safety glasses, and ear protection. Long hair, loose clothing, or jewelry may get tangled in moving parts. Do not operate the equipment when barefoot or wearing open sandals.
3. Inspect the area where the equipment is to be used and remove all objects such as rocks, toys and wire which can be thrown by the machine.
4. Exercise care in the handling of fuel.

⚠ Warning

Warning-Fuel is highly flammable. Take the following precautions.

[1] Store fuel in containers specifically designed for this purpose.

[2] Add fuel before starting the engine. Never remove the cap of the fuel tank or add fuel while the engine is running or when the engine is hot.

[3] Refuel outdoors only and do not smoke while refueling.

[4] If fuel is spilled, do not attempt to start the engine but move the machine away from the area of spillage and avoid creating any source of ignition until petrol vapours have dissipated.

[5] Replace all fuel tanks and container caps securely.

5. Check that operator’ s presence controls, safety switches and shields are attached and functioning properly. Do not operate unless they are functioning properly.
6. 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.
7. Replace faulty mufflers.

Operation

1. Do not operate the engine in a confined space where dangerous carbon monoxide fumes can collect.
2. Only operate in good light, keeping away from holes and hidden hazards.
3. Before attempting to start the engine, disengage all attachments, shift into neutral, and engage the parking brake.
   Only start engine from the operator`s position.
   Use seat belts if provided.
4. Remember there is no such thing as a safe slope. Travel on grass slopes requires particular care.
   To guard against overturning:

   [1] Do not stop or start suddenly when going up or downhill.

   [2] Engage clutch slowly, always keep machine in gear, especially when traveling downhill.

   [3] Machine speeds should be kept low on slopes and during tight turns.

   [4] Stay alert for humps and hollows and other hidden hazards.

   [5] Never operate across the face of the slope, unless the machine is designed for this purpose.

   [6] 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.
5. Never operate the machine with damaged guards, shields, or without safety protective devices in place.
   Be sure all interlocks are attached, adjusted and functioning properly.
6. Do not change the engine governor settings or overspeed the engine. Operating the engine at excessive speed may increase the hazard of personal injury.
7. Do the following before leaving the operator`s position.

   [1] Stop on level ground.

   [2] Disengage the power take-off and lower the attachments.

   [3] Change into neutral and set the parking brake.

   [4] Stop the engine and remove the key.
8. Disengage the drive to attachments, stop the engine, and remove the ignition key in the following conditions.

   [1] Before refueling.

   [2] Before removing the grass catcher/ catchers.

   [3] Before making height adjustment unless adjustment can be made from the operator’ s position.

   [4] Before cleaning blockages.

   [5] Before checking, cleaning, or working the machine.

   [6] After striking a foreign object or if an abnormal vibration occurs.
   Inspect the machine for damage and make repairs before restarting and operating the equipment.
9. Keep hands and feet away from the cutting units and the rotating parts.

10. Look behind and down before backing up to be sure of a clear path.
11. Do not carry passengers.
12. Never operate while people, especially children, or pets are nearby.
13. Slow down and use caution when making turns and crossing roads and sidewalks.
14. Stop the blades rotating before crossing surfaces other than grass.
15. Disengage drive to attachments when transporting or not in use.
16. When using any attachments, never direct discharge of material toward bystanders nor allow anyone near the machine while in operation.
17. Do not operate the machine under the influence of alcohol or drugs.
18. Take care when loading or unloading the machine into 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.
    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.
    When using a running board, select one with sufficient strength, length, and width and that will not cause the machine to slip.
19. Close the fuel valve before transporting the machine.
20. Use care when approaching blind corners, shrubs, trees, or other objects that may obscure vision.
21. Do not take your eyes off the road ahead. Do not operate the machine with no hands.
22. Reduce the throttle setting during engine run-out and, if the engine is provided with a shut-off valve, turn the fuel off at the conclusion of operation.

Maintenance and storage

1. Disengage drives on level ground, lower the attachments, set parking brake, stop engine and remove key from ignition. Wait for all movement to stop before adjusting, cleaning or repairing.
2. When machine is to be parked, stored, or left unattended, lower the cutting units unless a positive machanical lock is provided.
3. To reduce the fire hazard, keep the engine, silencer/muffler, battery compartment fuel storage area, cutting unit and drives free of grass, leaves, or excessive grease. Clean up oil or fuel spillage.
4. Allow the engine to cool before storing in any enclosure.
5. Only cover the machine with a sheet after hot parts have sufficiently cooled down.
6. Never store the equipment with fuel in the tank inside a building where fumes may reach an open flame or spark.
7. If the engine is provided with a shut-off valve, shut off valve while storing or transporting.
8. Do not store fuel near flames.
9. Never allow untrained personnel to service machine.
10. Allow the engine/muffler to cool before checking/maintenance.
11. Appropriately manage and correctly use the tools necessary for servicing or adjusting the machine.
12. Use jack stands to support components when required.
13. Carefully release pressure from components with stored energy.
14. Be sure to depressurize the hydraulic system before performing maintenance operations on it such as removing hydraulic equipment.
15. 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.

16. 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.
    If fluid is injected into the skin it must be surgically removed within a few hours by a doctor familiar with this form of injury or gangrene may result.
17. Disconnect battery before making any repairs. Disconnect the negative terminal first and the positive last. Reconnect positive first and negative last.
18. Make sure that parts such as wires are not touching each other and that their covers have not come off.
19. Use care when checking the cylinders/reels and bed knifes.
    [1] Wear gloves and use caution when seruicing them.
    [2] Be careful durig adjustment of the machine to prevent entrapment of the fingers between moving blades and fixed parts of the machine.
20. On multi-cylinder/multi-reel machines take care as rotating one cylinder/reel can cause other cylinder/reels to rotate.
21. Keep hands and feet away from moving parts. If possible, do not make adjustments with the engine running.
22. Charge batteries in an open well ventilated area, away from spark and flames. Unplug charger before connecting or disconnecting from battery. Wear protective clothing and use insulated tools.
23. Keep all parts in good working condition and all hardware tightened. Replace all worn or damaged decals.
24. Keep all nuts, bolts and screws tight to be sure the equipment is in safe working condition.
25. Check the grass catcher frequently for wear or deterioration.
26. If the fuel tank has to be drained, do this outdoors.

Safety Signs and Instruction Signs

About Safety Signs and Instruction Signs

⚠ Warning

Safety decals and instruction decals 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 decals that need to be replaced are listed in the parts catalog. Order them from a Baroness dealer or Kyoeisha.

Disposal

Waste Disposal

About the 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

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
	Ounces (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

Maintenance standards

List of Maintenance Specifications

LM315GC

Engine	Engine model	Kubota D722-E4B	
	No load rpm	1,500 - 3,270 rpm	
	Quantity of engine oil	2.8 dm^3 (2.8 L) (0.74 U.S. gal.) (including filter)	API Service grade class CF or higher, SAE Viscosity grade 10W-30
	Coolant capacity	3.0 dm^3 (3.0 L) (0.79 U.S. gal.) (including reserve tank)	
Main body (including hydraulic and electrical systems)	Fuel tank capacity	20.0 dm^3 (20.0 L) (5.28 U.S. gal.)	JIS No. 2 diesel fuel (Low sulfur or ultra-low sulfur diesel fuel only)
	Hydraulic tank capacity	16.0 dm^3 (16.0 L) (4.23 U.S. gal.)	Shell Tellus S2M46 or equivalent (ISO VG46)
	Parking Brake Switch	Slight clearance	A clearance between the switch contact point and the parking brake lever when the parking brake lever is at the 4th notch
	Proximity Sensor (Reel rotation start position detection)	0 mm (0 in)	Horizontal distance between the sensor tip and the tip of the right front up/down cylinder when the mower unit is lowered
		1.0 - 2.5 mm (0.04 - 0.10 in)	Clearance between the sensor detection part and the tip of the right front up/down cylinder when the mower unit is lowered
	Proximity Sensor (Mower unit up position detection)	415.0 mm (16.34 in)	Distance between the tip of the rear mower arm and the floor when the mower unit is raised
		1.0 - 2.5 mm (0.04 - 0.10 in)	Clearance between the sensor detection part and the cam when the mower unit is raised
		192.0 mm (7.56 in)	Length of the mower up/down cam adjustment rod
	Proximity Sensor (Mower unit down position detection)	285.0 mm (11.22 in)	Distance between the tip of the rear mower arm and the floor when the mower unit is lowered
		1.0 - 2.5 mm (0.04 - 0.10 in)	Clearance between the sensor detection part and the cam when the mower unit is lowered
		192.0 mm (7.56 in)	Length of the mower up/down cam adjustment rod

Main body (including hydraulic and electrical systems)	Proximity Switch	5.0 mm (0.20 in)	Clearance between the switch and the plastic magnet when the traveling pedal is neutral
	Electromagnetic clutch	0.3 - 0.6 mm (0.01 - 0.02 in)	Clearance between the clutch rotor main body and the armature board when the electromagnetic clutch is not energized
	Limit switch (mower pedal switch)	75.0 mm (2.95 in)	Distance between the pedal back joint and the step when the mower pedal is released
	Battery	Diesel Model: 55B24 L (BCI GROUP SIZE 51R: Recommended equivalent product EXIDE 51R-60) Gasoline Model: 40B19L (BCI GROUP SIZE U1R: Recommended equivalent product EXIDE GTX-R)	
	Tire pneumatic pressure	Front wheel: 80 kPa (11.60 lb-in^2)	Smooth 18 x 9.50-8 2P
		Front wheel (option) 100 kPa (14.50 lb-in^2)	Pillow Dia 18 x 8.50-8 4P
		Rear wheel: 80 kPa (11.60 lb-in^2)	Smooth 18 x 9.50-8 2P
	Spring compression length (neutral adjustment)	55 mm (2.17 in)	Compression spring

* The factory default maximum engine rpm is 3,000 rpm.

Tightening torques

Standard tightening torques

Bolts and Nuts

Important

A number of bolts are used in each part of this machine.
Be sure to re-tighten the bolts and nuts, because they may be loosened at the earlier stage of the use.

As to the bolts and nuts without any special instruction, tighten them in appropriate tightening torque with proper tool.
Too much tightening may cause the looseness or damage of the screw.
The strength of tightening is determined by types of screws, strength, the friction of thread face or base face and others.
The table below is for the galvanized or parkerized bolts.
In case that the strength of internal thread is weak, it is not applied.
Do not use rusty or sand attached "screw."
Otherwise, it may cause insufficient tightening even if you apply the specified tightening torque.
The friction of the screw face becomes higher and the tightening torque is canceled out by the friction, therefore sufficient tightening cannot be applied.
If "screw" is wet by water or oil, do not tighten it with normal tightening torque.
If the screw is wet, the torque coefficient will get smaller and it may result in too much tightening.
Too much tightening may cause looseness by the screw stretched or result in damage.
Do not use a bolt experienced too much burden.
Using the impact wrench requires the skill.
Do exercise as much as possible for steady tightening.

Nominal diameter	General bolt		
	Strength classification 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 bolt					
	Strength classification 8.8			Strength classification 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 same values are applied to "fine screw thread."

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 of the hose size	Nominal diameter of the parallel pipe threads (PF)	Tightening torque		
		N-m	kgf-cm	lb-in
6	1/4	24.50	250	221.28
9	3/8	49.03	500	564.91
12	1/2	58.84	600	677.89
15	3/4	117.68	1200	1,355.78
19	3/4	117.68	1200	1,355.78
25	1	137.30	1400	1,581.74
32	1-1/4	166.72	1700	1,920.69
38	1-1/2	205.94	2100	2,372.61
50	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

Tightening Torque by Model

LM315GC
Tighten the following bolts and nuts at the torque specified in the table.
For thread locking adhesive, apply a middle strength thread locker (ThreeBond 1322 anaerobic adhesives).

Location		Code	Part name	Tightening torque			Thread locking adhesive
				N-m	kgf-cm	lb-in	
Front frame		K0010080202	Bolt, heat-treated M8-20	23 - 38	234.53 -387.49	203.57 - 336.34	-
Engine coupling	Joint	K0010080152	Bolt, heat-treated M8-15	23 - 38	234.53 -387.49	203.57 - 336.34	-
	Belt collar	K0010080302	Bolt, heat-treated M8-30	23 - 38	234.53 -387.49	203.57 - 336.34	-
Gasoline engine	Engine rack	K0000080402	Bolt, M8-40	14 - 19	142.76 - 193.74	123.91 - 168.17	○
		K0003080452	Bolt, M8-45	14 - 19	142.76 - 193.74	123.91 - 168.17	○
Diesel engine	Engine mount	K0017100252	Bolt, heat-treated, small, 10-25 P1.25	45 - 57	1835.46 - 2039.40	1593.18 - 1770.20	-
	Wire mounting adjuster	K0011100302	Bolt, heat-treated M10-30P1.25	45 - 57	1835.46 - 2039.40	1593.18 - 1770.20	-
	Muffler mounting adjuster	K0011100352	Bolt, heat-treated M10-35P1.25	45 - 57	1835.46 - 2039.40	1593.18 - 1770.20	-
	Pulley mounting adjuster	K0010080202	Bolt, heat-treated M8-20	23 - 38	234.53 -387.49	203.57 - 336.34	-
	Engine pulley D	K0010080202	Bolt, heat-treated M8-20	23 - 38	234.53 -387.49	203.57 - 336.34	-
Front wheel	Wheel	K0010100302	Bolt, heat-treated M10-30	58 - 76	591.43 - 774.97	513.36 - 672.68	-
	Wheel mounting base	K0138240002	24 slotted nut high P1.5	180 - 200	1835.46 - 2039.40	1593.18 - 1770.20	-
3WD rear wheel	Motor	K0000120502	Bolt, M12-50	52 - 67	530.24 - 683.20	460.25 - 593.02	-
	Wheel	K0013101202	Bolt, heat-treated M10-120	58 - 76	591.43 - 774.97	513.36 - 672.68	-
	Wheel mounting base	K0138240002	24 slotted nut high P1.5	180 - 200	1835.46 - 2039.40	1593.18 - 1770.20	-

Maintenance standards and maintenance

Location		Code	Part name	Tightening torque			Thread locking adhesive
				N-m	kgf-cm	lb-in	
3WD rear wheel	Brake Assy	K0010080252	Bolt, heat-treated M8-25	14 - 19	142.76 - 193.74	123.91 - 168.17	-
2WD rear wheel	Wheel	K0010100302	Bolt, heat-treated M10-30	45 - 57	1835.46 - 2039.40	1593.18 - 1770.20	-
2WD rear wheel	Brake drum	K0010100302	Bolt, heat-treated M10-30	45 - 57	1835.46 - 2039.40	1593.18 - 1770.20	-
Mower	Reel shaft	LM315GB2102Z0	Reel gear fixing nut	7	71.38	61.96	-
Mower	Reel shaft (with Groomer)	LM315GB2101Z0	20-tooth reel gear	7	71.38	61.96	-
Mower	Bed knife (Bottom blade)	K0071000222	Screw, heat-treated flathead M6-12	7 - 9	71.38 - 91.77	61.96 -79.66	-
Mower	Groomer reel	K0160000602	17 special nut P1M4	5 - 10	50.99 - 101.97	44.26 - 88.51	-
Mower	Gearbox	LM315GA1817Z0	Reverse shaft	52 - 67	530.24 - 683.20	460.25 - 593.02	○
Mower	Gearbox	LM315GA1816Z0	Intermediate shaft	52 - 67	530.24 - 683.20	460.25 - 593.02	○
Mower	Front roller	K6083000042	Connected pin, 15-19	29 - 38	295.71 - 387.49	256.68 - 336.34	-
Mower	Front roller	K0071000152	Bolt, Left-handed Thread	29 - 38	295.71 - 387.49	256.68 - 336.34	-
Mower	Groomer mounting	K6809000270	Screw	18	183.55	159.32	-
Mower	Groomer mounting	LM315GA1835Z0	Mower mounting bolt, left	20	203.94	177.02	-
Mower	Groomer mounting	LM315GA1836Z0	Mower mounting bolt, right	20	203.94	177.02	-
ROPS pillar right/left		K0010120402	Bolt, heat-treated M12-40	58 - 76	591.43 - 774.97	513.36 - 672.68	-

Jacking up the machine

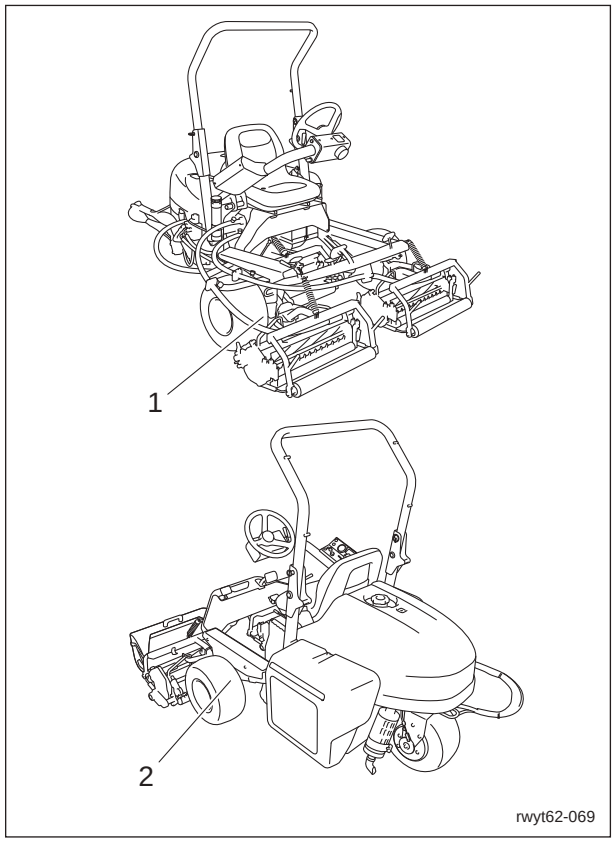
About the Jacking up the machine

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.

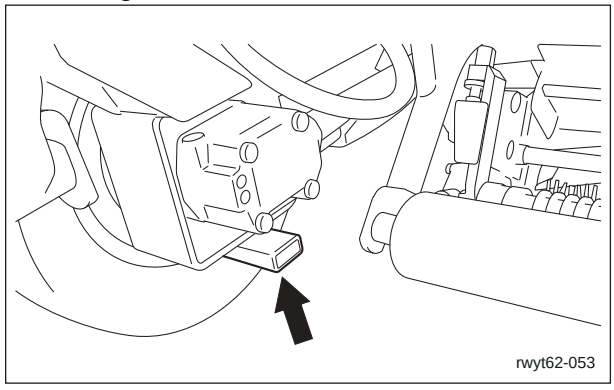
Jack-up Points



Jack-up Points_001

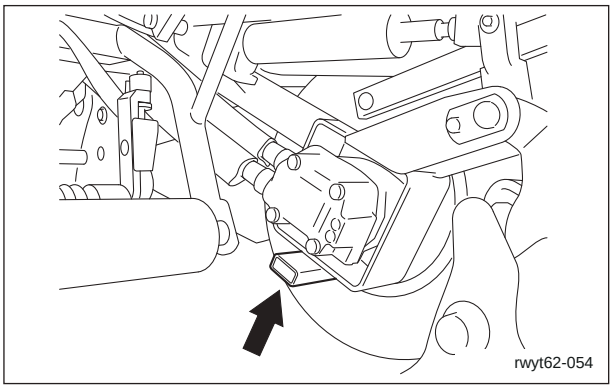
1	Front right frame
2	Front left frame
3	Engine mount frame

1. Front right frame



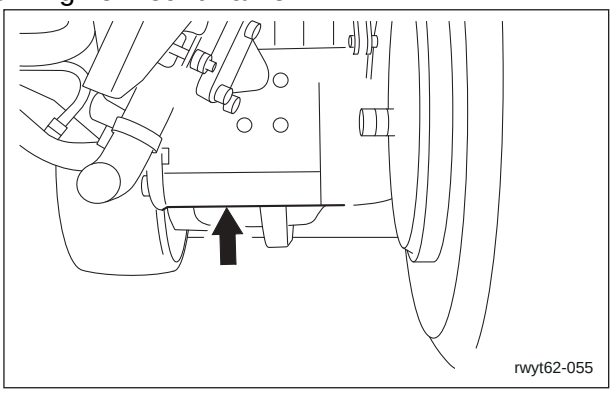
Jack-up Points_002

2. Front left frame



Jack-up Points_003

3. Engine mount frame



Jack-up Points_004

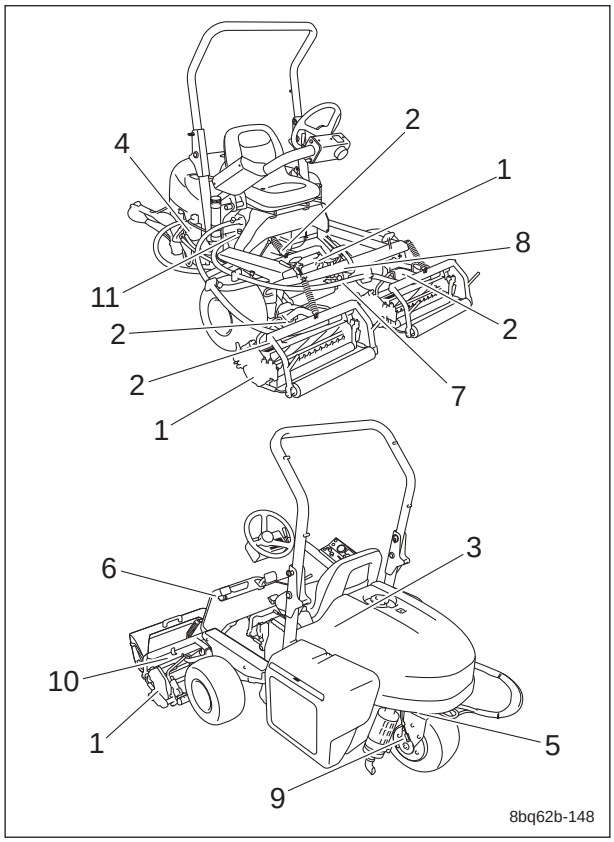
Greasing

About Greasing

Since there may be adhesion or damage due to lack of grease on moving parts, they must be greased.
Add urea-based No. 2 grease in accordance with the Maintenance Schedule.
Other locations where the specified grease or lubricant is used are indicated in "Greasing Points".
Add grease using the specified grease or lubricant.

Greasing Points

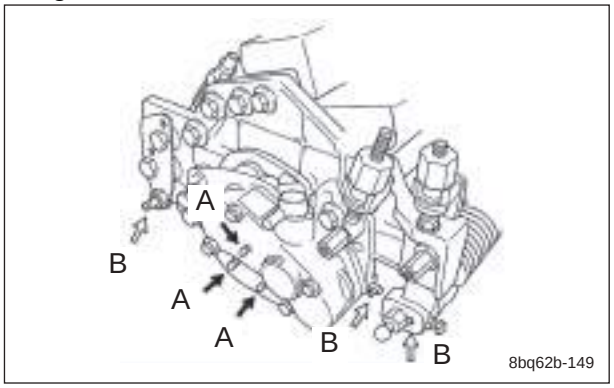
Grease nipples are installed in the following locations.



Greasing Points_001

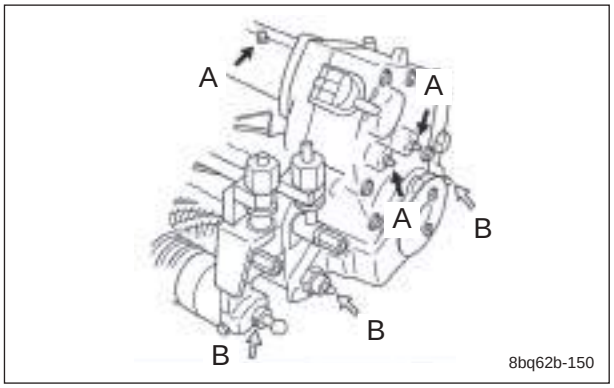
	Location	No. of greasing points
1	Mower unit	36
2	Mower arm fulcrum	6
3	Belt tension lever	1
4	Neutral position area	1
5	Rear wheel pivot	1
6	Mower pedal shaft fulcrum	1
7	Flexible wire bracket	1
8	Traveling pedal shaft fulcrum	1
9	Rear wheel brake lever shaft	1
10	Flexible wire edge	3
11	Flexible wire	6

1. Mower unit
   Each mower unit has 12 points (6 A and 6 B points).
   Add grease to A and B every 8 and 50 hours, respectively.
   Right



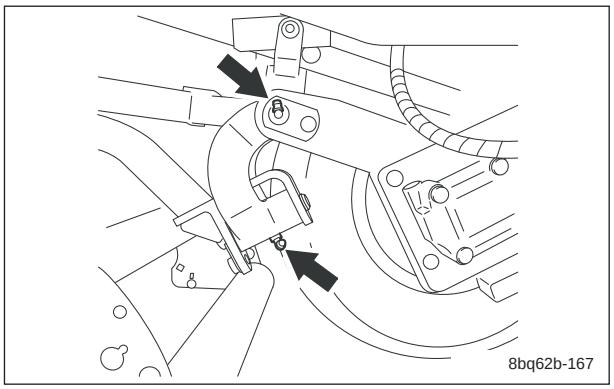
Greasing Points_002

Left



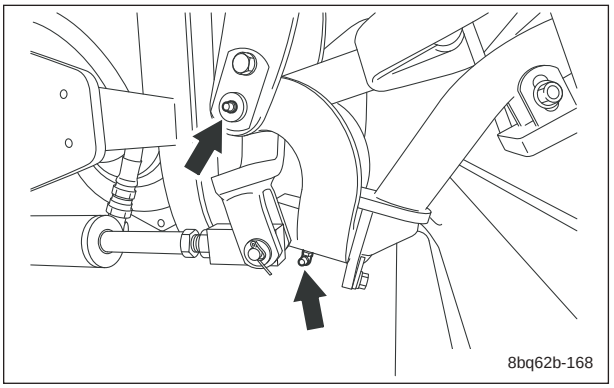
Greasing Points_003

2. Mower arm fulcrum
   [1] Front mower unit
   There are two greasing points on each mower unit.



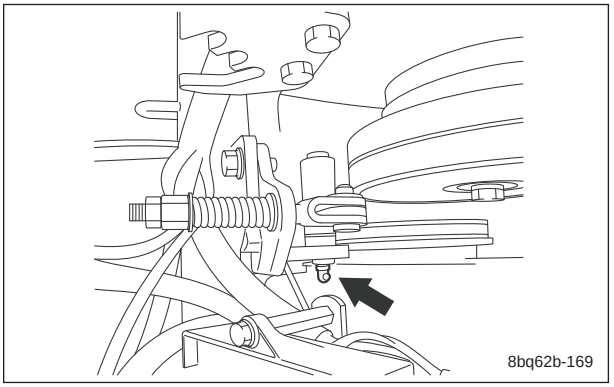
Greasing Points_004

[2] Rear mower unit
There are two locations.



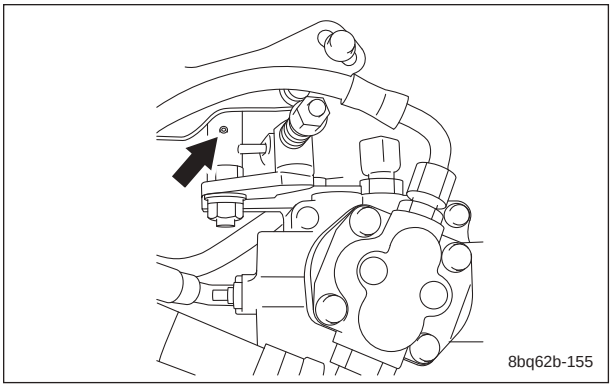
Greasing Points_005

3. Belt tension lever



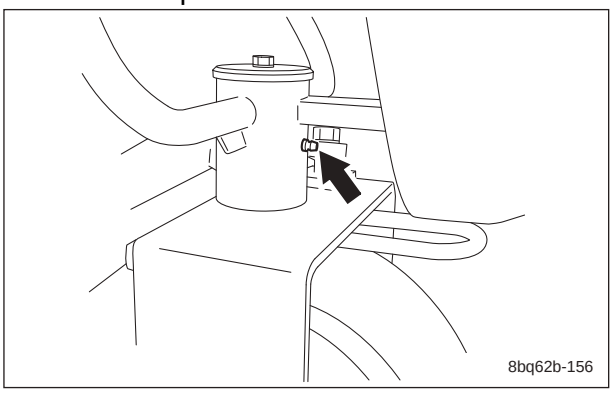
Greasing Points_006

4. Neutral position area



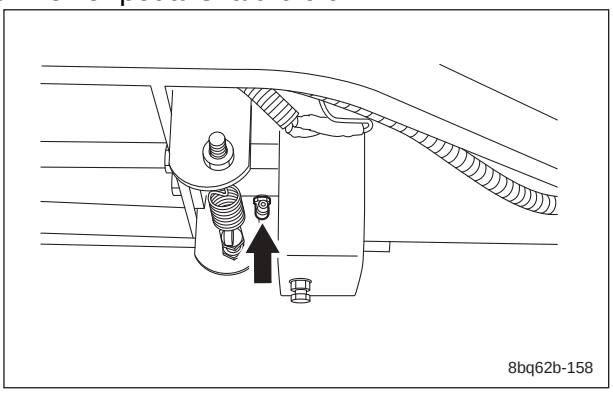
Greasing Points_007

5. Rear wheel pivot



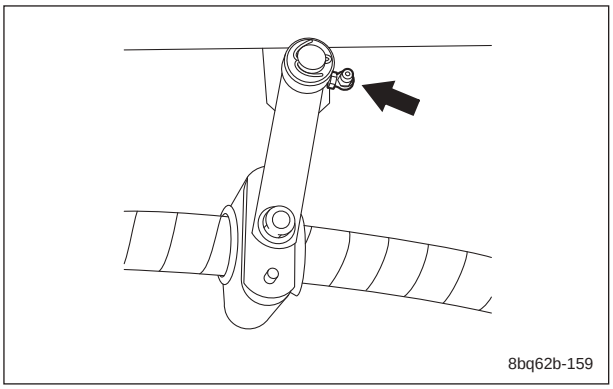
Greasing Points_008

6. Mower pedal shaft fulcrum



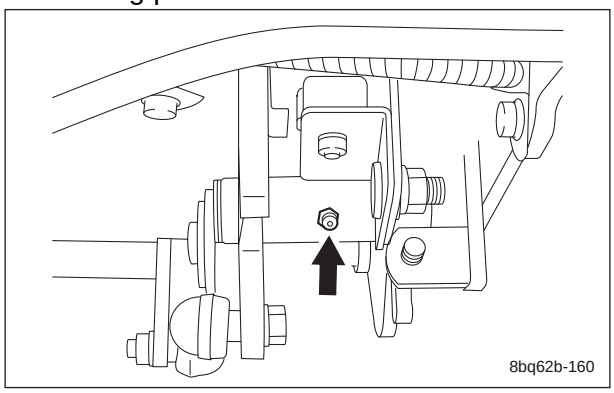
Greasing Points_009

7. Flexible wire bracket



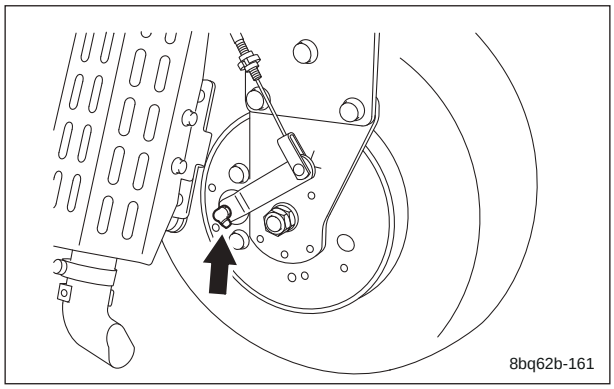
Greasing Points_010

8. Traveling pedal shaft fulcrum



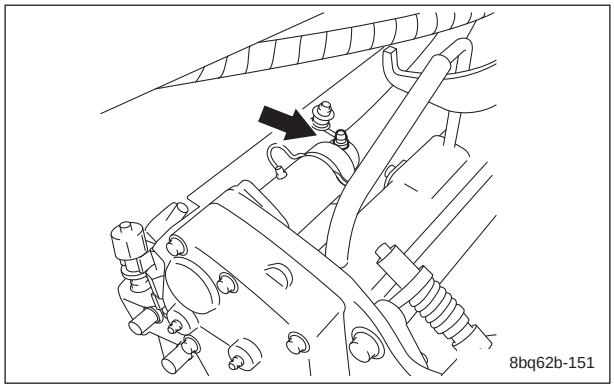
Greasing Points_011

9. Rear wheel brake lever shaft



Greasing Points_012

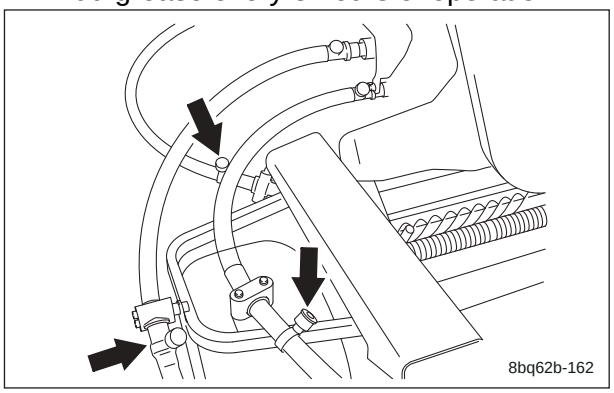
10. Flexible wire edge
There is one greasing point on each flexible wire.



Greasing Points_013

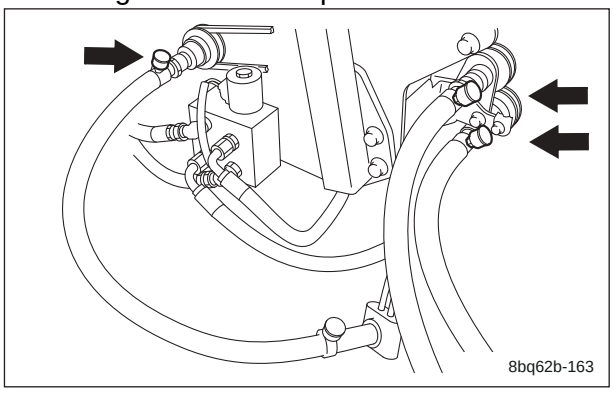
11. Flexible wire
    Use Moly speed grease No.2
    Screw in the grease cup 360 degrees and add grease.

    Central part
    Add grease every 8 hours of operation.



Greasing Points_014

    Main body side
    Add grease before operation.



Greasing Points_015

Hydraulic system

Maintenance

Maintenance

This chapter describes primary checking and maintenance operations for the LM315GC hydraulic system.
For information on daily checks, maintenance and handling of the machine, please refer to the separate LM315GC Owner's Operating Manual and Parts Catalog.
To maintain the integrity of the hydraulic device, you must not overhaul the device for maintenance.
For those parts that must be repaired by the manufacturer, the overhaul procedure is not described in this manual. Request repairs for those parts from your dealer or Baroness.
Please note that our product warranty may be void if you overhaul the device.

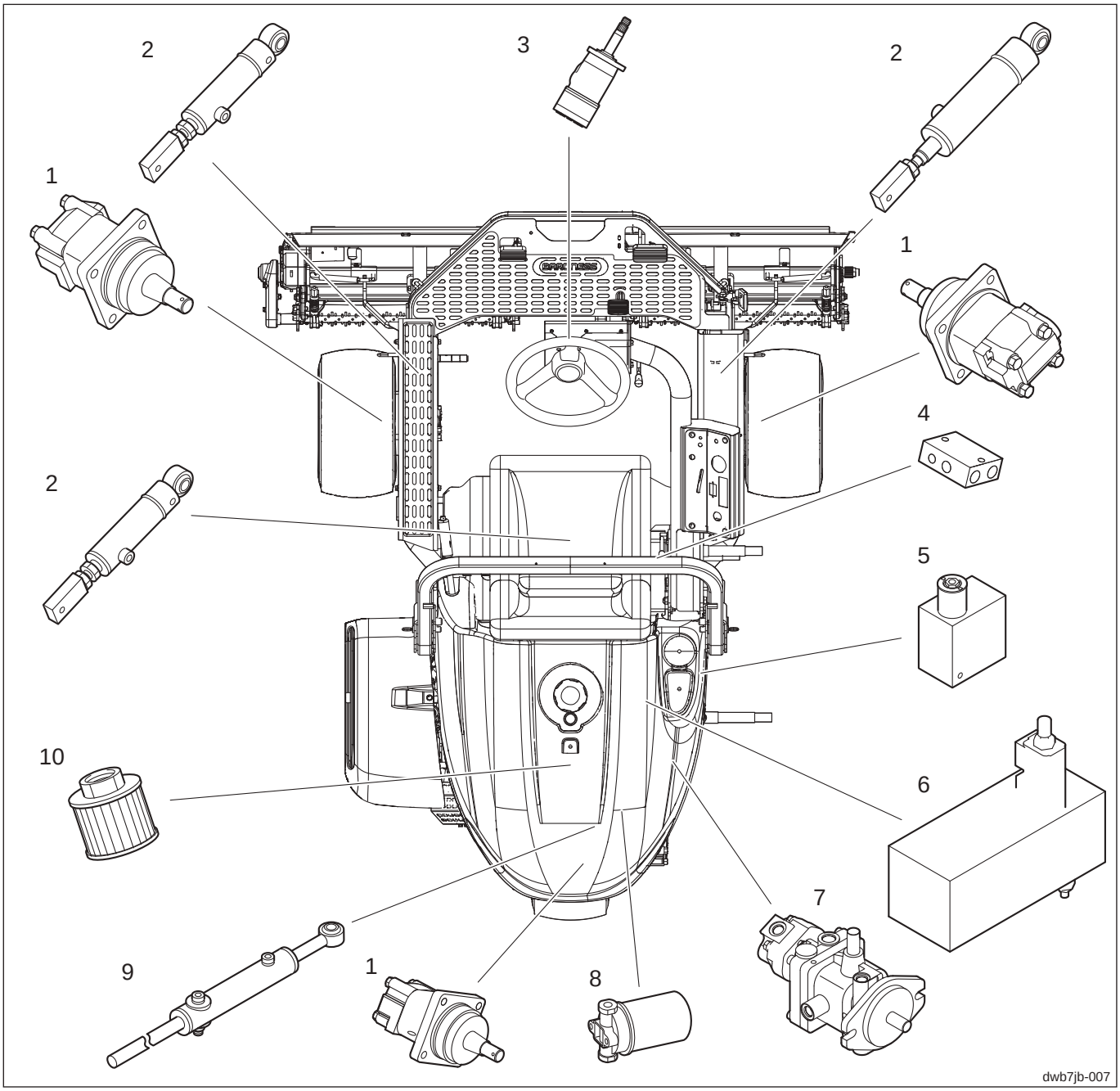
Specifications

Specifications

HST	KYB PSV-16CHG-2		
	Piston pump	Displacement	0 - 16.4 cm^3/rev (1.00 in^3/rev)
		High-pressure relief set pressure	20.6 MPa (2,987.7 psi)
	Charge pump	Displacement	4.9 cm^3/rev (0.30 in^3/rev)
		Relief set pressure	0.58 MPa (84.1 psi)
	Gear pump	Displacement	5.45 cm^3/rev (0.33 in^3/rev)
Wheel motor	EATON orbit motor		
	Front wheel motor 2-125BS4V	Displacement	123 cm^3/rev (7.51 in^3/rev)
	Rear wheel motor 2-160BS4S	Displacement	158 cm^3/rev (9.64 in^3/rev)
Steering control unit	EATON RV074 orbitrol	Displacement	74.0 cm^3/rev (4.52 in^3/rev)
		Relief set pressure	4.4 MPa (638.1 psi)
Valve module		Relief set pressure	5.0 MPa (725.2 psi)
Hydraulic tank capacity (oil gauge center)		16.0 L (4.23 US gallons)	
Hydraulic line filter (cartridge type)		10 μm	
Hydraulic oil		Shell Tellus S2M46 or equivalent (ISO VG46)	

Hydraulic system

Hydraulic System Layout



Hydraulic System Layout_001

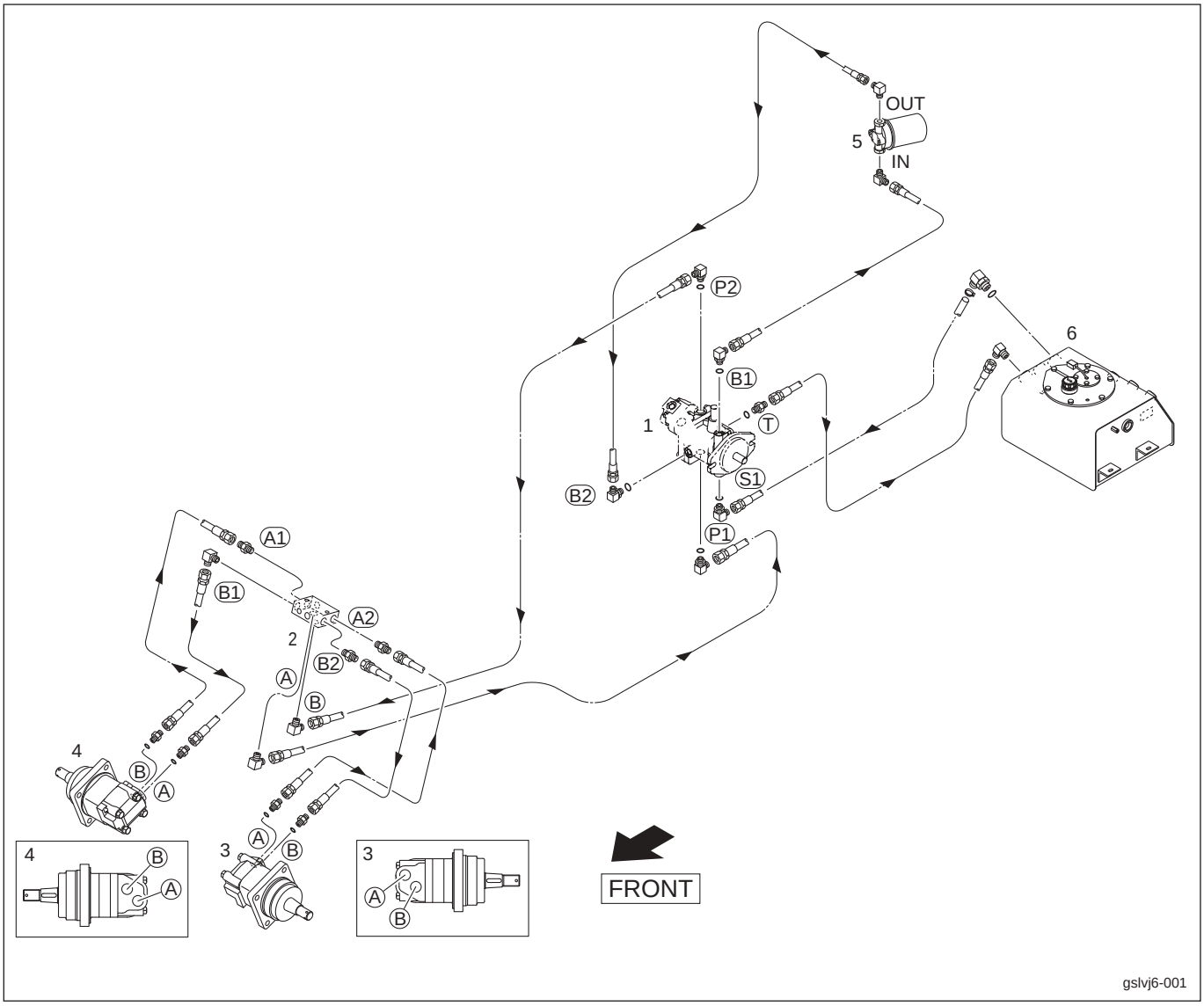
1	Wheel motor	5	2WD/3WD Changeover Valve	9	Steering cylinder
2	Up/down cylinder	6	Valve module	10	Suction filter
3	Orbitrol	7	Piston pump		
4	Manifold valve	8	Oil filter		

1. Wheel motor
   These convert the fluid energy from the piston pump to mechanical energy (rotary motion) in order to directly drive the machine.
   These are located at each wheel.
2. Up/down cylinder
   These convert the fluid energy from the piston pump to mechanical energy (reciprocating motion) in order to raise the mower units.
   These are located near the mower arms.
3. Orbitrol
   In a fully hydraulic power steering unit, switching of the internal valve depending on the rotational input from the steering wheel causes oil from the hydraulic pump to be fed to the steering cylinder.
   It is located at the steering wheel installation part.
4. Manifold valve
   This has a path through which oil flows and a connection port outside.
   It is located in front of the piston pump.
5. 2WD/3WD Changeover Valve
   This controls the vehicle drive switching the passage of fluid energy from the piston pump to wheel motors at either three wheels or two wheels in parallel.
   It is located in the center of the right side of the body.
6. Valve module
   This controls the up/down motions of the mower units switching the passage of fluid energy from the piston pump to the up/down side of the up/down cylinder.
   It is located to the right of the fuel tank.
7. Piston pump
   This converts the mechanical energy of the engine to fluid energy by using the reciprocating motion of the piston.
   It is located to the right of the center of the main body.
8. Oil filter
   This removes dirt or dust in the outgoing fluid.
   This fulfills an essential role since elements that could cause major problems may be circulated if there was no filter.
   It is located to the right of the rear wheel.
9. Steering cylinder
   According to the control valve that is activated depending on the steering operation, this changes the flow of the fluid from the hydraulic pump to steer the vehicle to the left or right.
   It is located above the rear wheel.
10. Suction filter
    Installed at the suction side of the pump, this fulfills the major role of preventing the oil from being contaminated with impurities.
    This is located in the hydraulic tank.

Flow of Hydraulic Oil

Flow of Oil during Forward Traveling

▪2WD



2WD_001

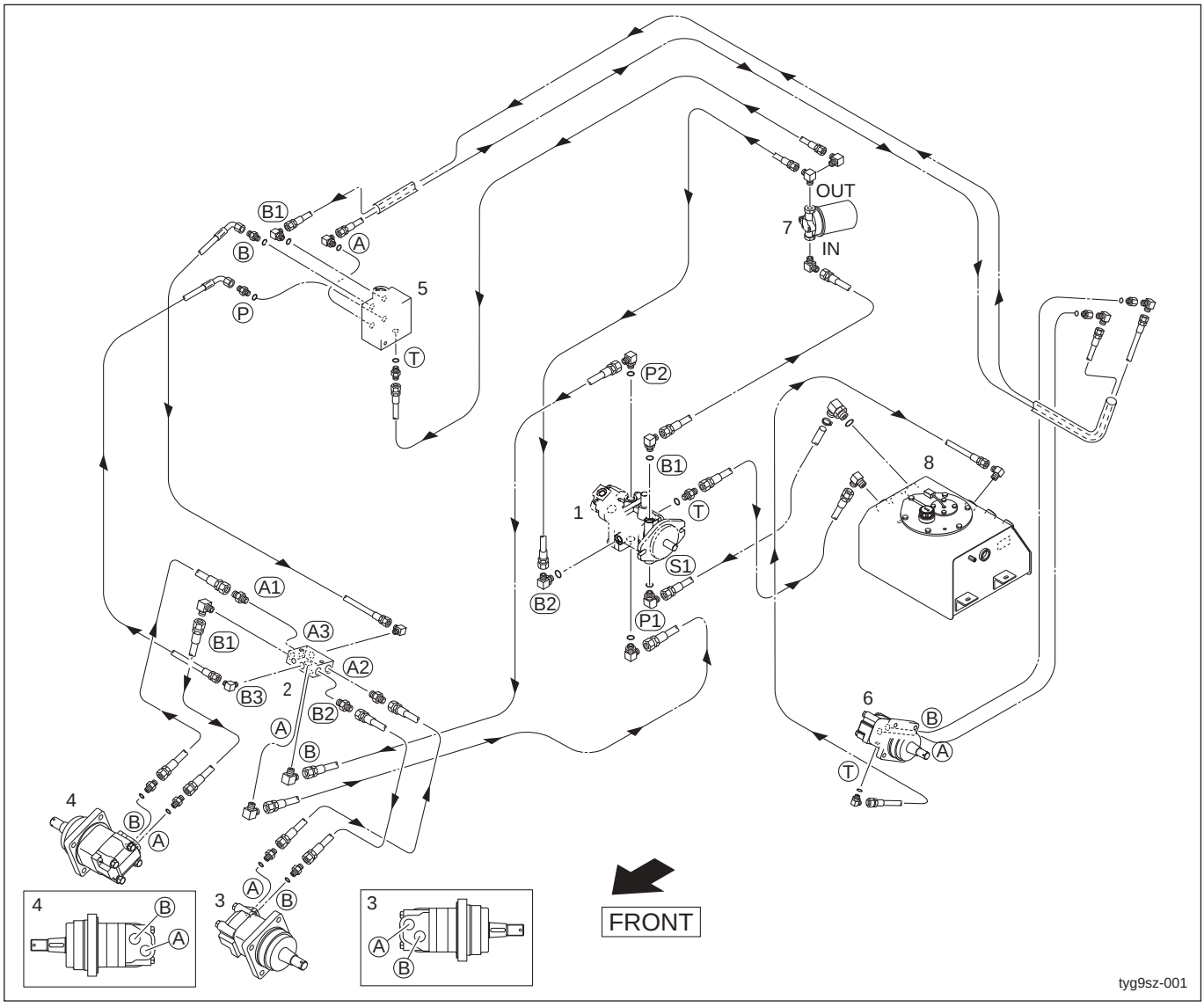
⟶·— shows flow of oil.

The flow of oil shows that for 2WD forward traveling.

Name in ◯ above shows port name.

1	Piston pump	3	Left front wheel motor	5	Oil filter
2	Manifold valve	4	Right front wheel motor	6	Hydraulic tank

■3WD



3WD_001

shows flow of oil.

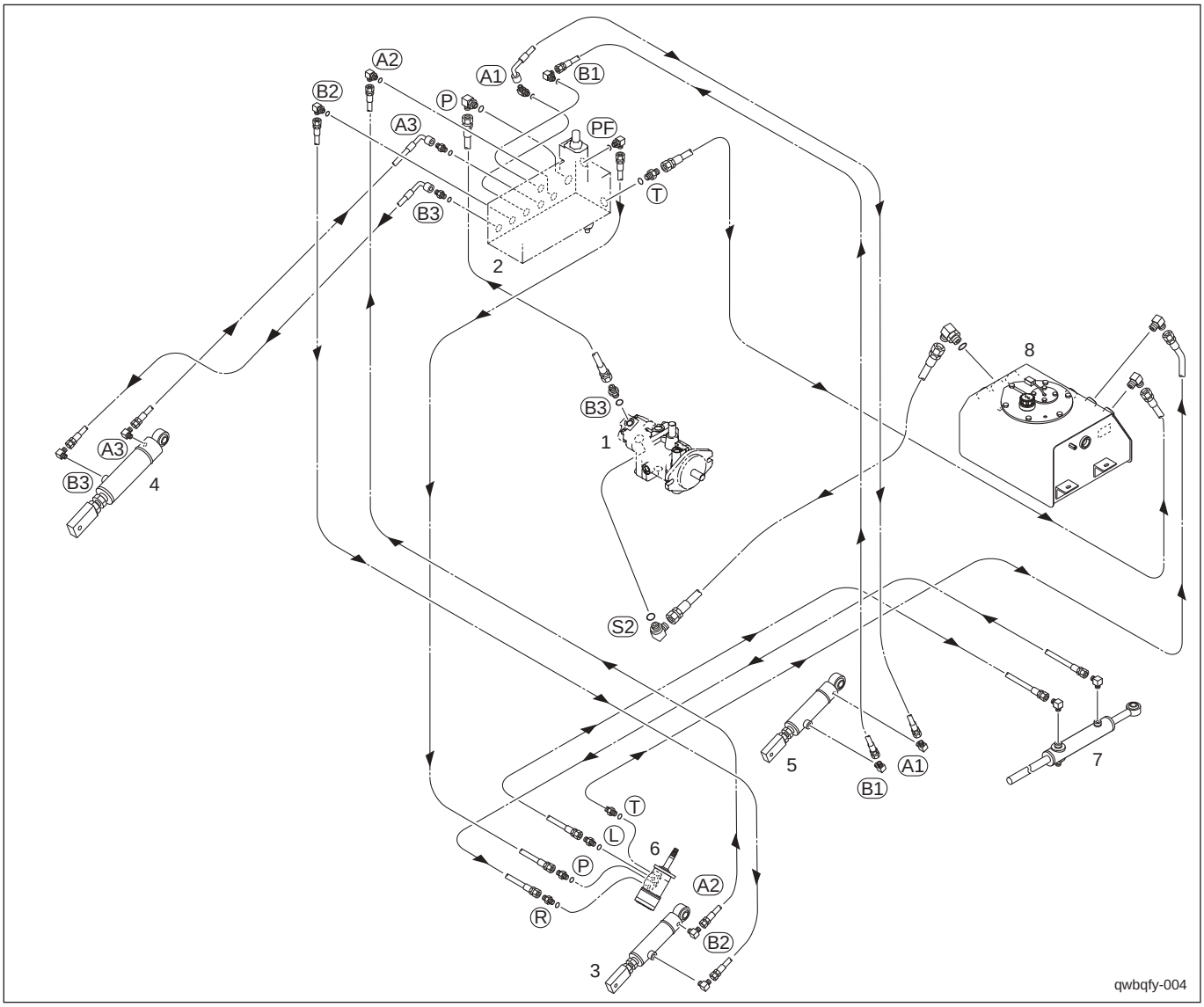
The flow of oil shows that for 3WD forward traveling.

Name in ◯ above shows port name.

1	Piston pump	4	Right front wheel motor	7	Oil filter
2	Manifold valve	5	2WD/3WD Changeover Valve	8	Hydraulic tank
3	Left front wheel motor	6	Rear wheel motor		

Hydraulic system

Flow of Oil during Raising Mower Unit, with Power Steering Turning to Left



Flow of Oil during Raising Mower Unit, with Power Steering Turning to Left_001

⟶ shows flow of oil.

The flow of oil shows that for raising the mower unit, turning the power steering to left.

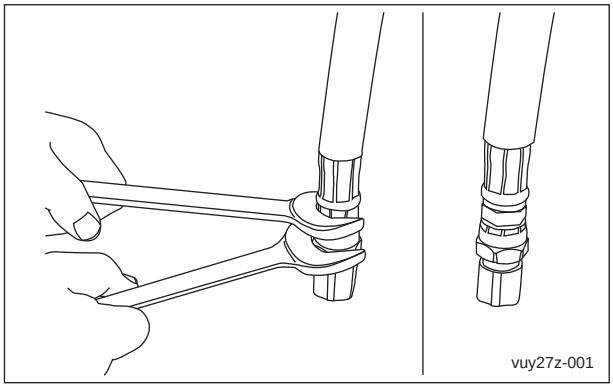
Name in ⬭ above shows port name.

1	Piston pump	4	Up/down cylinder of the right front mower unit	7	Steering cylinder
2	Valve module	5	Up/down cylinder of the rear mower unit	8	Hydraulic tank
3	Up/down cylinder of the left front mower unit	6	Orbitrol		

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

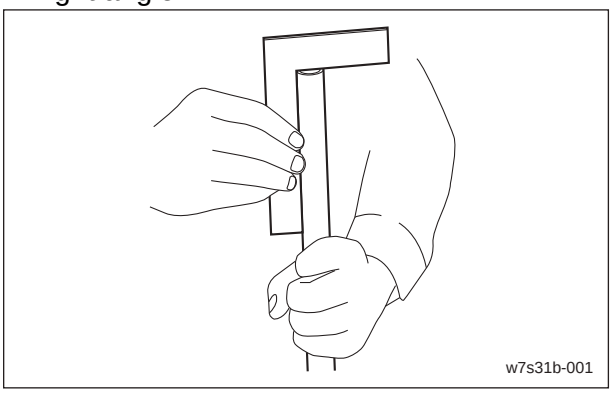
Be sure to depressurize the hydraulic system before maintaining or repairing it.
Stop the engine, and lower the rake.
When checking for pinhole leakage of the hydraulic circuit or oil leakage of the nozzle, search for a leakage point using something like paper or cardboard, never with your bare hands.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

Hydraulic fitting

Bite type tube fitting

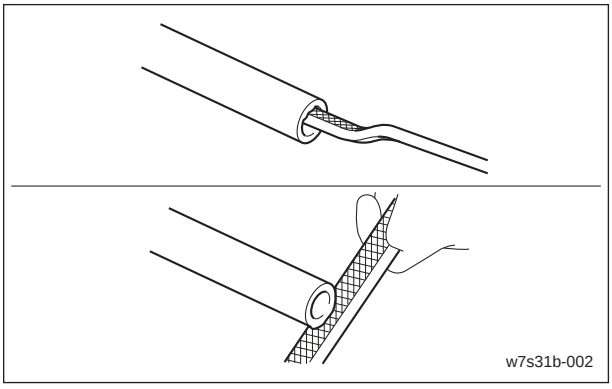
Preliminary tightening (Preset)

1. Cut the tube at the designated length at a right angle.



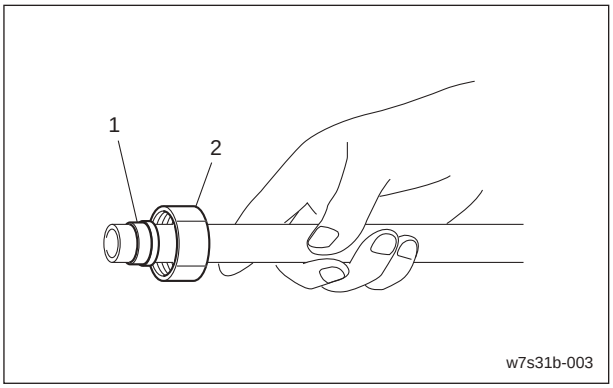
Bite type tube fitting_001

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



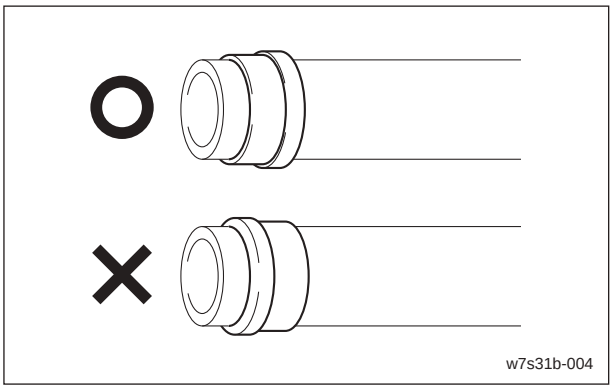
Bite type tube fitting_002

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



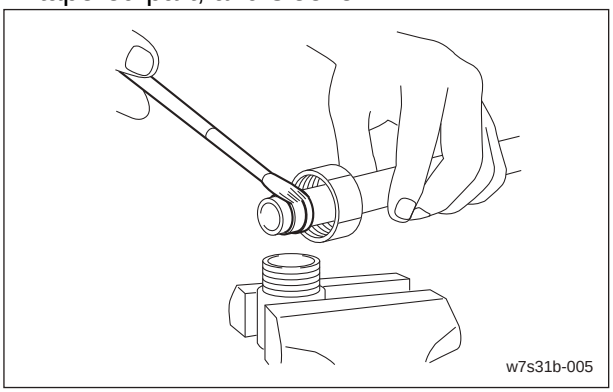
Bite type tube fitting_003

1	Sleeve
2	Nut



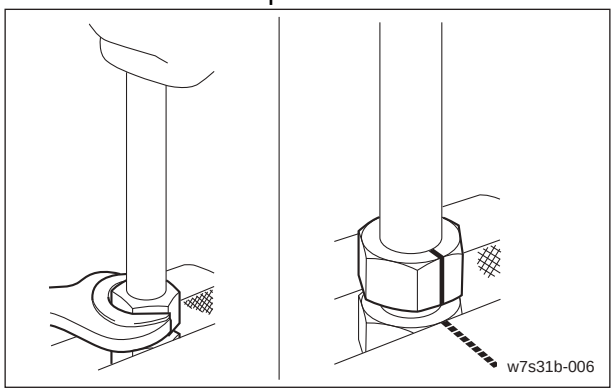
Bite type tube fitting_004

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



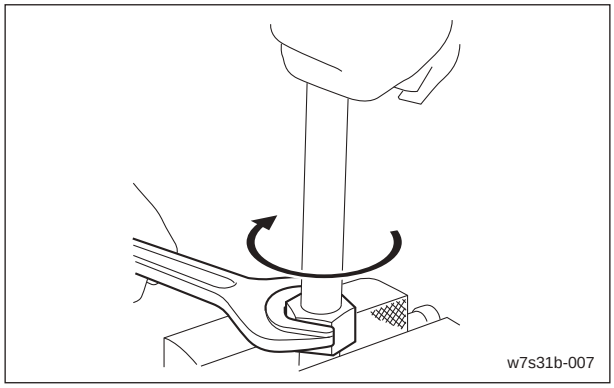
Bite type tube fitting_005

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.”



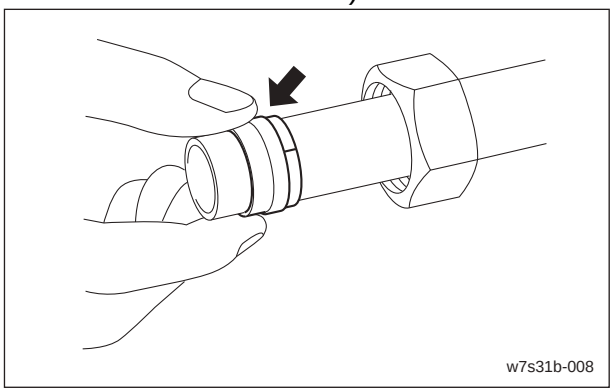
Bite type tube fitting_006

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

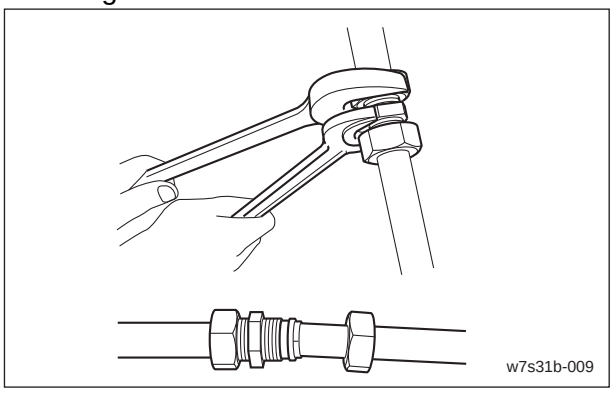
7. Fasten the nut and check that the sleeve end is a few mm apart from the tube end and the sleeve will not move in axial direction (it is allowed to move in the circumferential direction).



Bite type tube fitting_008

Final tightening (Reset)

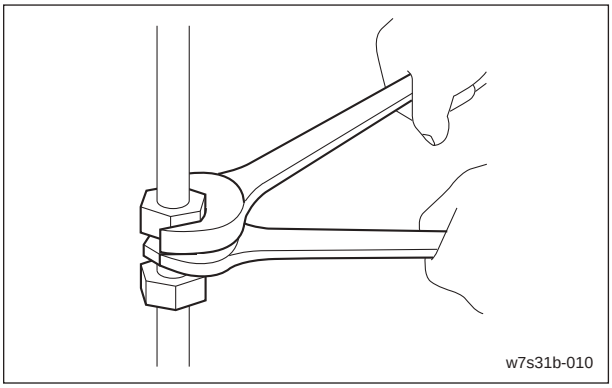
Fit the preliminary tightened tube onto the fitting body. Tighten with a spanner to the point where some resistance is suddenly felt, then further tighten with the nut for a 1/4 turn.



Bite type tube fitting_009

Note:

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 1 turn from the zero point.

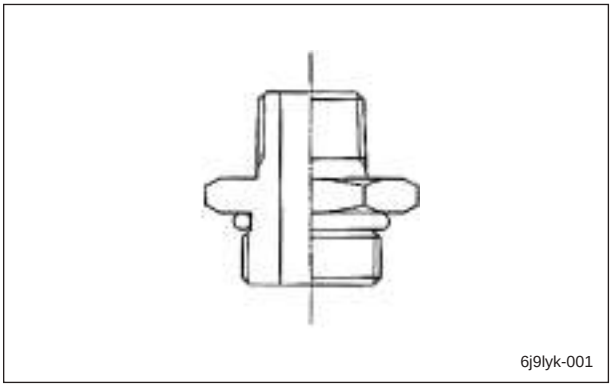


Bite type tube fitting_010

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.

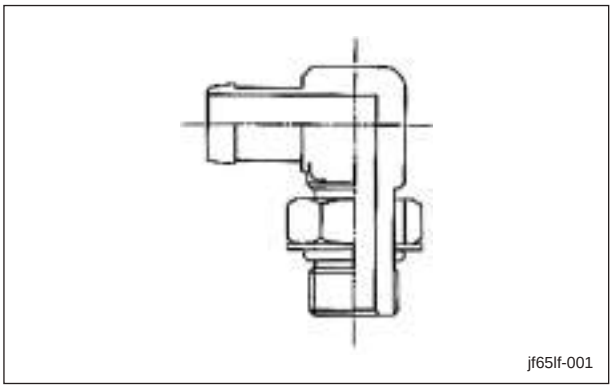
Fitting with parallel pipe threads (O ring sealing system)



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

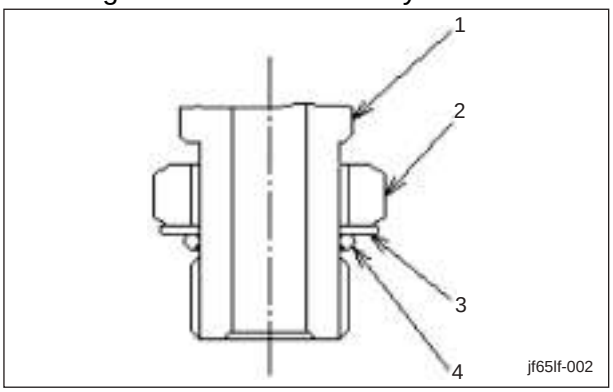
1. Check to see if the O ring is properly fitted to the groove of the main body.
2. Check to see that the thread part, seat surface of O ring port and O ring are free from flaws or foreign matter.
3. Before fitting, apply hydraulic oil or grease to the O ring.
4. For fitting, screw in by hand till the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

■Adjustable Elbow



Adjustable Elbow_001

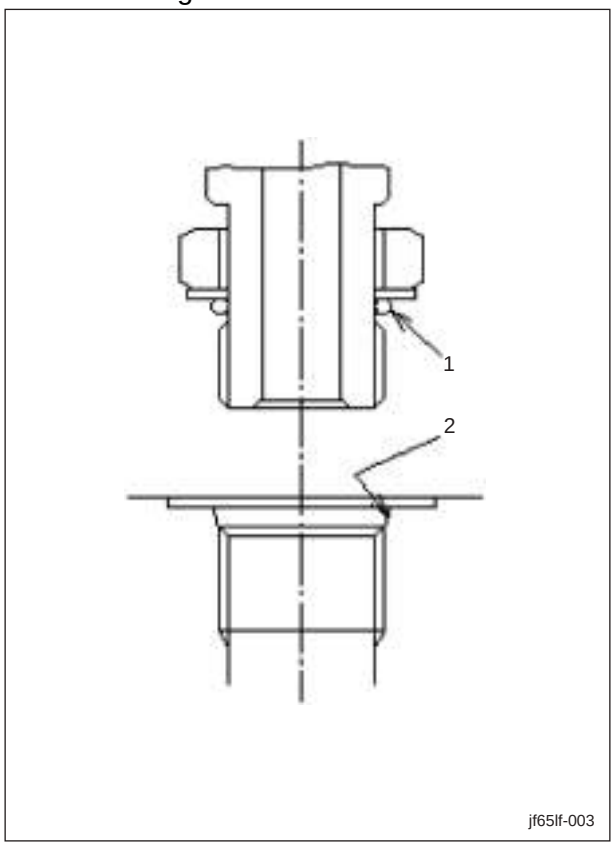
1. Make sure that the positions of the nut, washer, and O-ring are correct.
   If they are in the correct positions, the washer is pressed into the upper end of the groove of the main body.



Adjustable Elbow_002

1	Main body
2	Lock nut
3	Washer
4	O-ring

2. Make sure that the thread portion, sheet surface of the O-ring port, and O-ring are not contaminated with foreign objects. Apply oil or grease to the sheet surface and O-ring before installation.



Adjustable Elbow_003

1	O-ring
2	Sheet surface

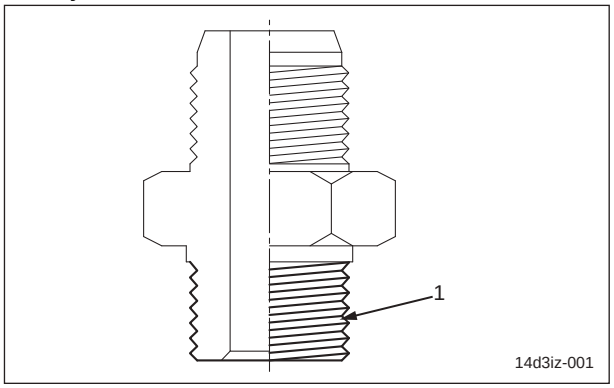
Caution

Be careful to never give the locknut more than one turns. If you give it more than one turn, the thread fit between the other side port and locknut becomes loose, which reduces the thread strength.
If the washer goes too deeply into the other side port, the washer gets deformed, which leads to oil leakage.
Rough installation makes the main body and nut overloaded, which leads to deformation.
Be sure to observe the installation procedure.

3. To fit, screw the main body by hand till the washer face touches lightly, and turn from that position in the loosening direction to the setting position.
4. After fitting the opposite screw, tighten the lock nut while holding the main body with a spanner etc. to ensure that the setting position does not change.

Taper Pipe (PT) Thread Joint (Sealing Tape Method)

1. Make sure that the taper thread portion is not damaged or contaminated with foreign objects.



Taper Pipe (PT) Thread Joint (Sealing Tape Method)_001

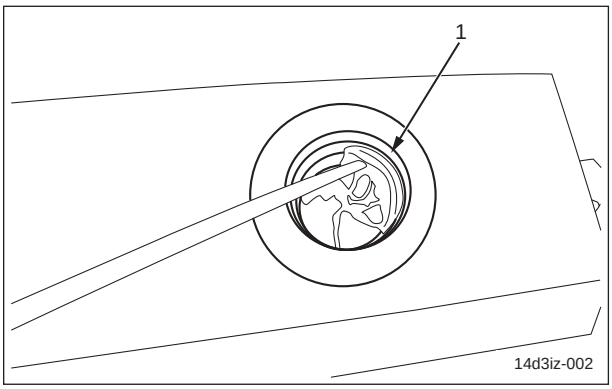
1	Taper (PT) thread portion

Important

If a used taper pipe (PT) thread joint retains the residue of old sealing tape, using it again for assembly may cause machine problems or oil leakage.

Important

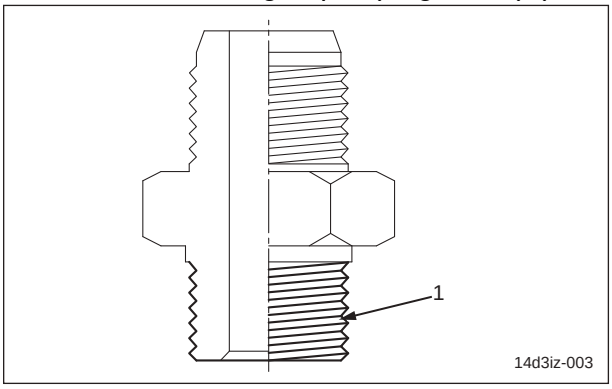
If you remove a taper thread joint, remove the sealing tape residue from the joint and connecting portion, so that the tape residue will not enter the hydraulic system.



Taper Pipe (PT) Thread Joint (Sealing Tape Method)_002

1	Taper (PT) thread connecting portion

2. Before connecting the joint, wind sealing tape on the taper thread portion. (See "How to Use the Sealing Tape" (Page 4-14) .)



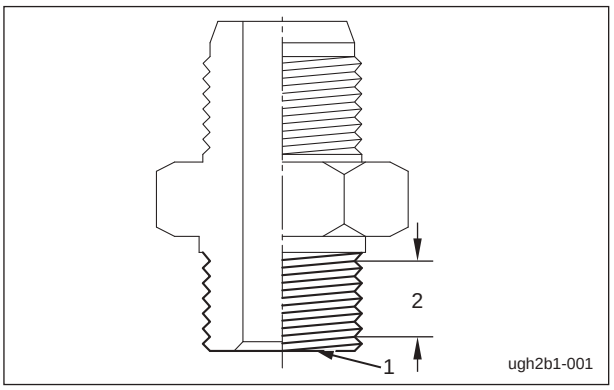
Taper Pipe (PT) Thread Joint (Sealing Tape Method)_003

1	Taper (PT) thread portion

■How to Use the Sealing Tape

Important

Using the sealing tape with its end out of the edge face may cause a trouble of the machine due to its debris invading the hydraulic circuit.



How to Use the Sealing Tape_001

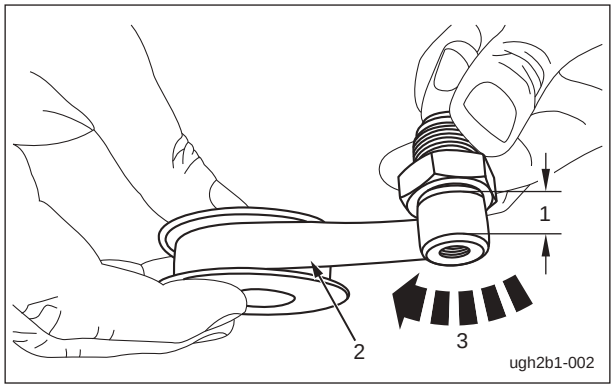
1	Edge face
2	Sealing area

Important

Loosening again the taper thread joint which has been tightened may reduce its sealing effect to cause leakage of oil.

Note:
Pay attention to the following precautions when you use the sealing tape.

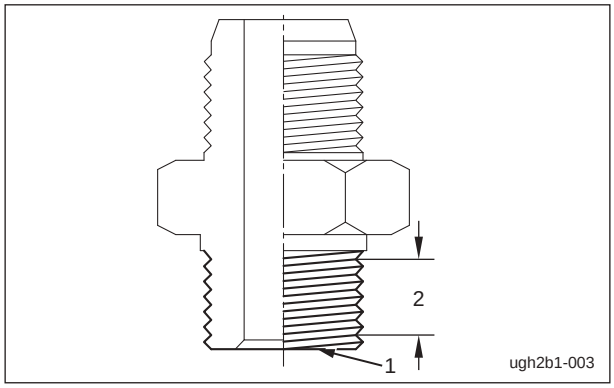
- Slightly pull the sealing tape (as tight as you can clearly see the thread mark on the tape) while you wrap it and overlap a half of its width to the previous round.
- Wrap it in clockwise direction (direction to tighten the screw).
  Wrapping in the opposite direction may cause the tape to be easily peeled off.



How to Use the Sealing Tape_002

1	Sealing area
2	Sealing tape
3	Clockwise direction

1. Wrap it in clockwise direction (direction to tighten the screw) about 1.5 to 2 turns from edge to root, starting from the point of 1 to 2 threads apart from the edge face of the thread.



How to Use the Sealing Tape_003

1	Edge face
2	Sealing area

Towing

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.

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

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 or repairing it.
When performing depressurization, move the machine to level surface.
Apply the parking brake, and then lower the operating machine.
Then, stop the engine and remove the key.
To depressurize the hydraulic circuit, set the traveling pedal and all the drives of the operating machine to the neutral position.
To depressurize the steering circuit, turn the steering wheel side to side.

Hydraulic circuit failure

The hydraulic traveling circuit of this equipment is made up of a closed circuit.

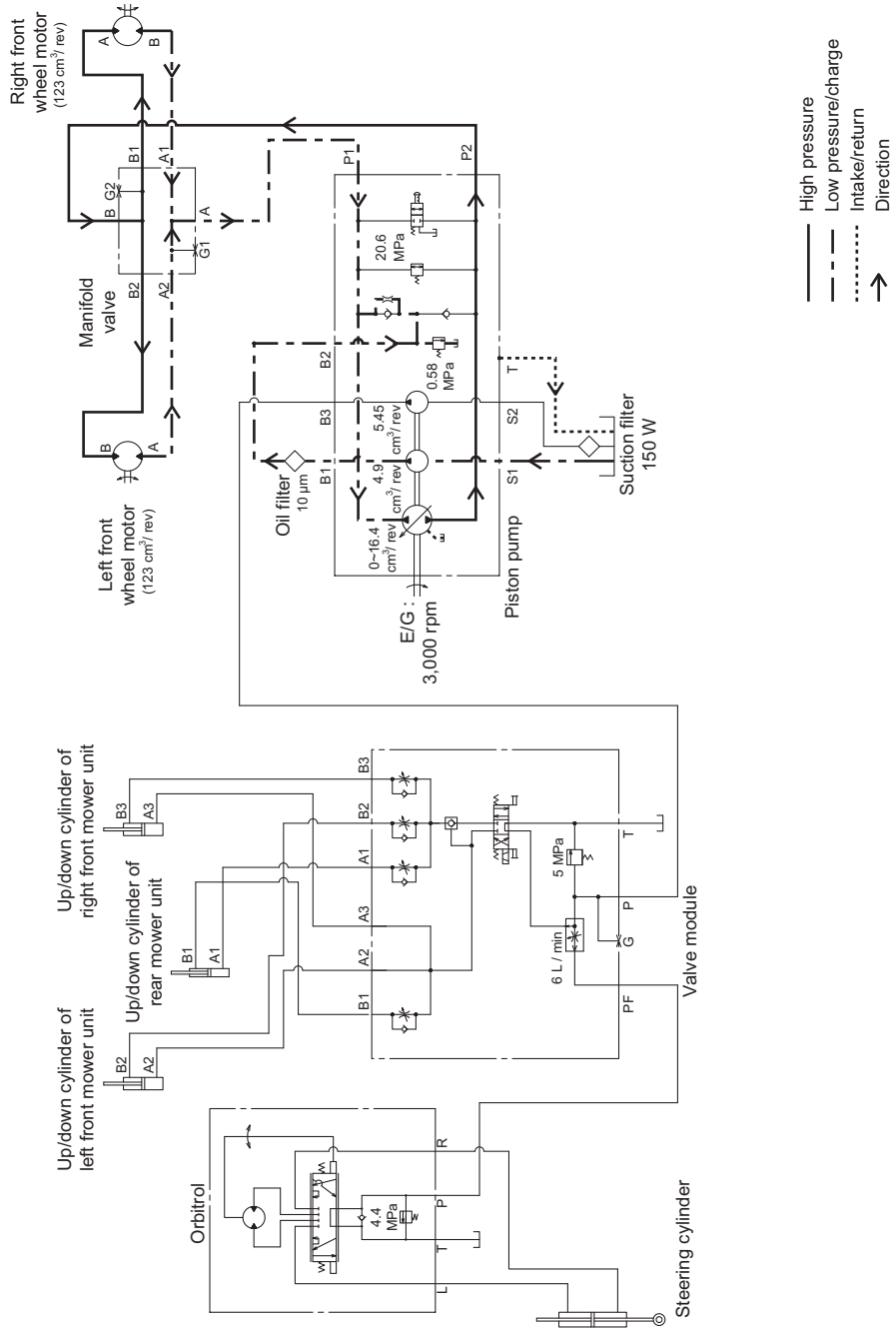
In the event of failure of the hydraulic equipment of the hydraulic circuit, debris and contaminant from the faulty hydraulic equipment will circulate to every part of the circuit.
Since this contaminant causes damage to other hydraulic equipment, such debris and contaminant must be removed to prevent 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 clean them well with kerosene.
Drain all the hydraulic oil from hydraulic tank and hydraulic equipment other than the hydraulic hoses and piping and clean them well.
We recommend to replace the hydraulic oil, hydraulic oil filter and defective hydraulic equipment with new ones.

Hydraulic circuit flow

Traveling circuit

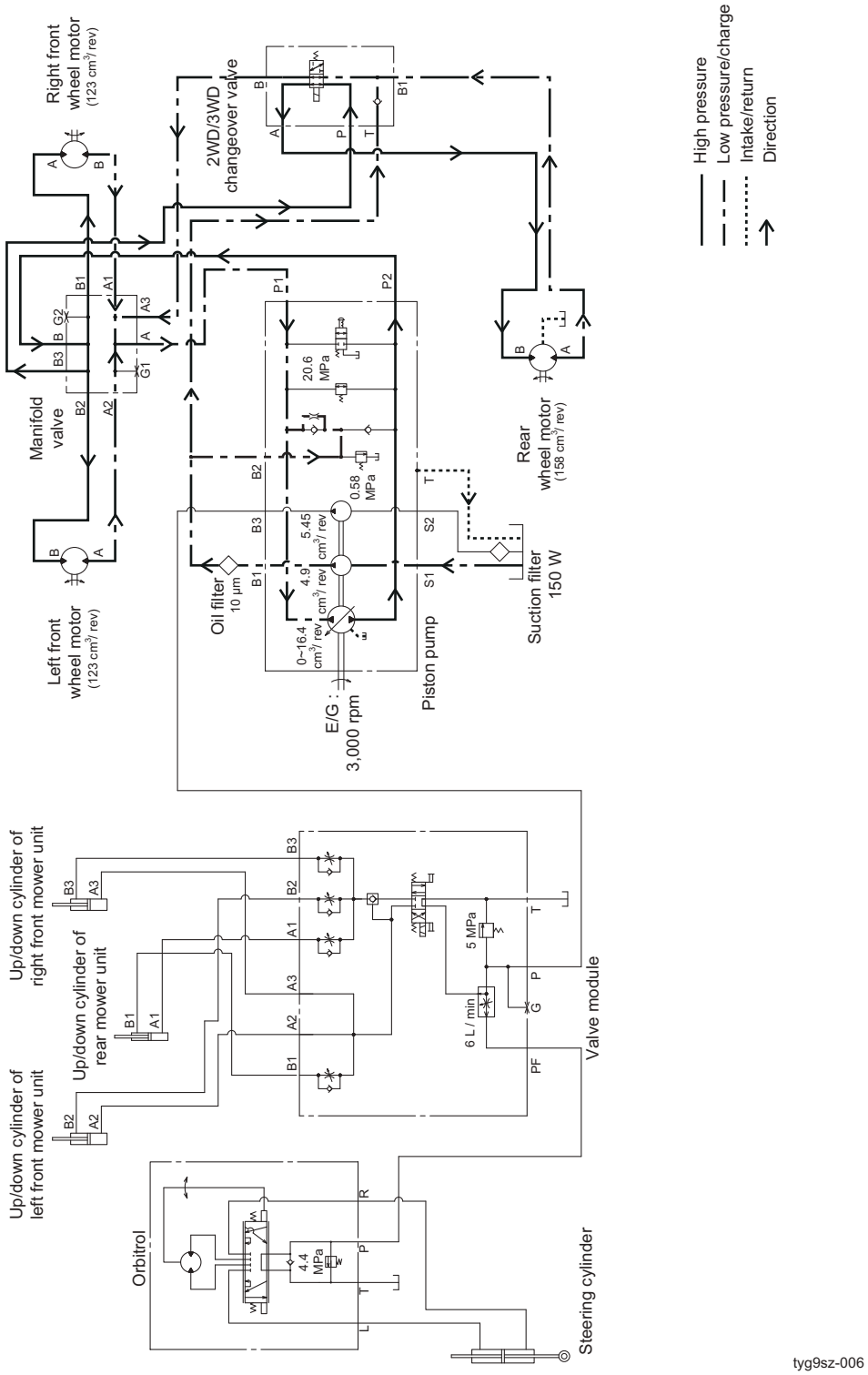
Forward

- 2WD



2WD_001

■3WD

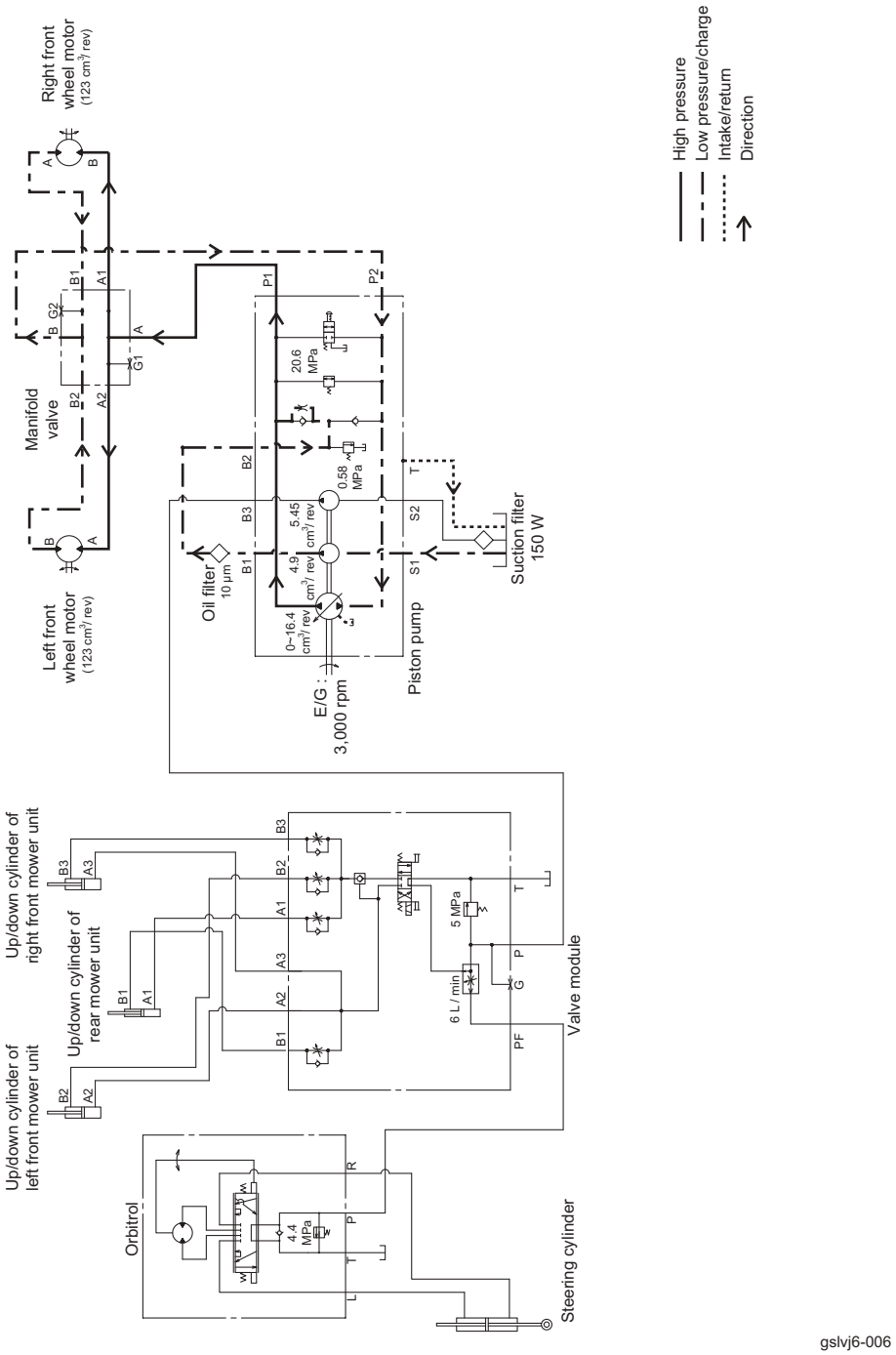

High pressure
Low pressure/charge
Intake/return
Direction
Right front wheel motor (123 cm³/rev)
2WD/3WD changeover valve
Manifold valve
Left front wheel motor (123 cm³/rev)
Rear wheel motor (158 cm³/rev)
Oil filter 10 µm
Suction filter 150 W
Piston pump
E/G : 3,000 rpm
0~16.4 cm³/rev
4.9 cm³/rev
5.45 cm³/rev
20.6 MPa
0.58 MPa
5 MPa
6 L/min
4.4 MPa
Orbitrol
Steering cylinder
Valve module
Up/down cylinder of right front mower unit
Up/down cylinder of rear mower unit
Up/down cylinder of left front mower unit
tyg9sz-006

3WD_001

Hydraulic system

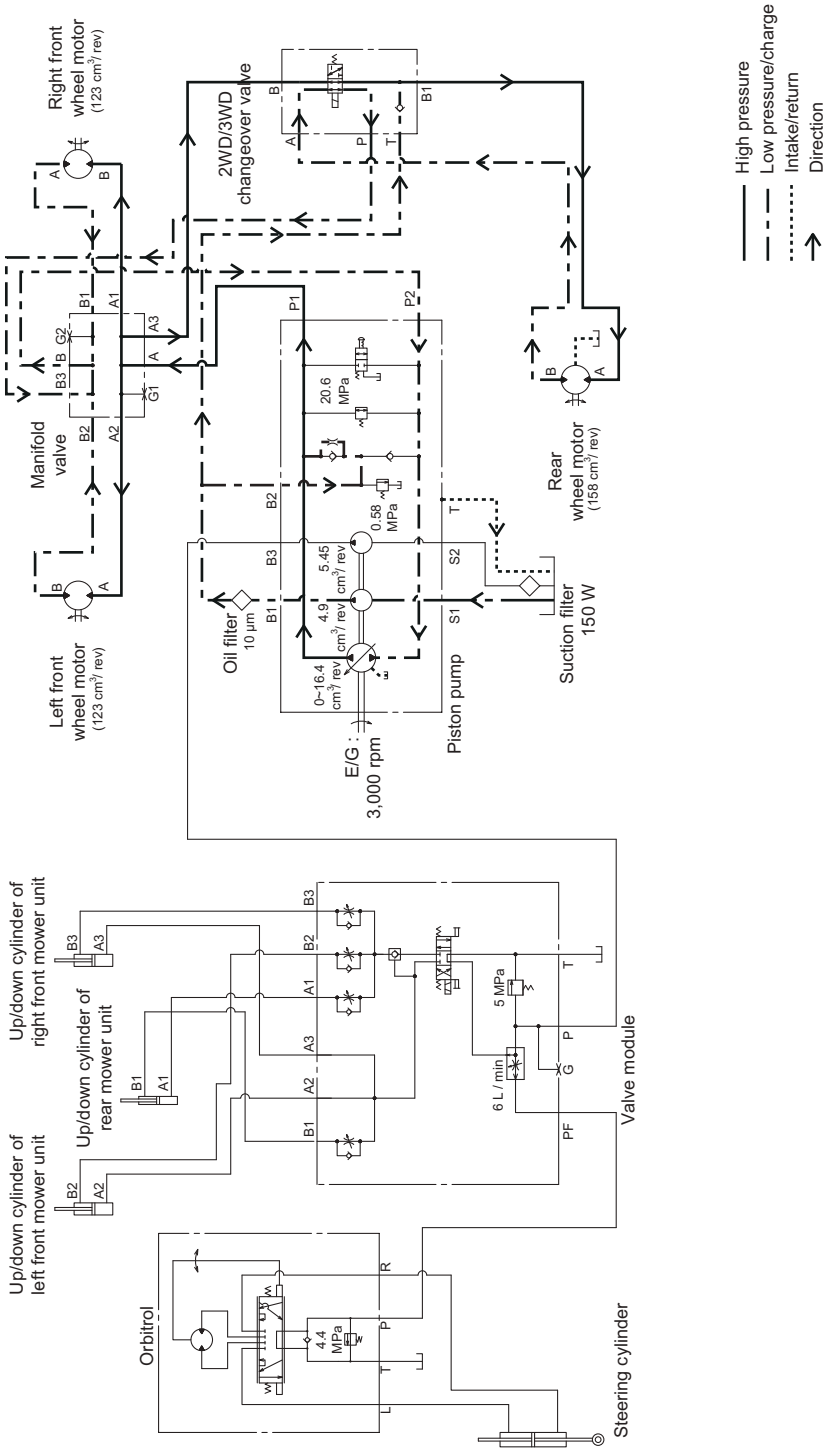
Backward

- 2WD



2WD_001

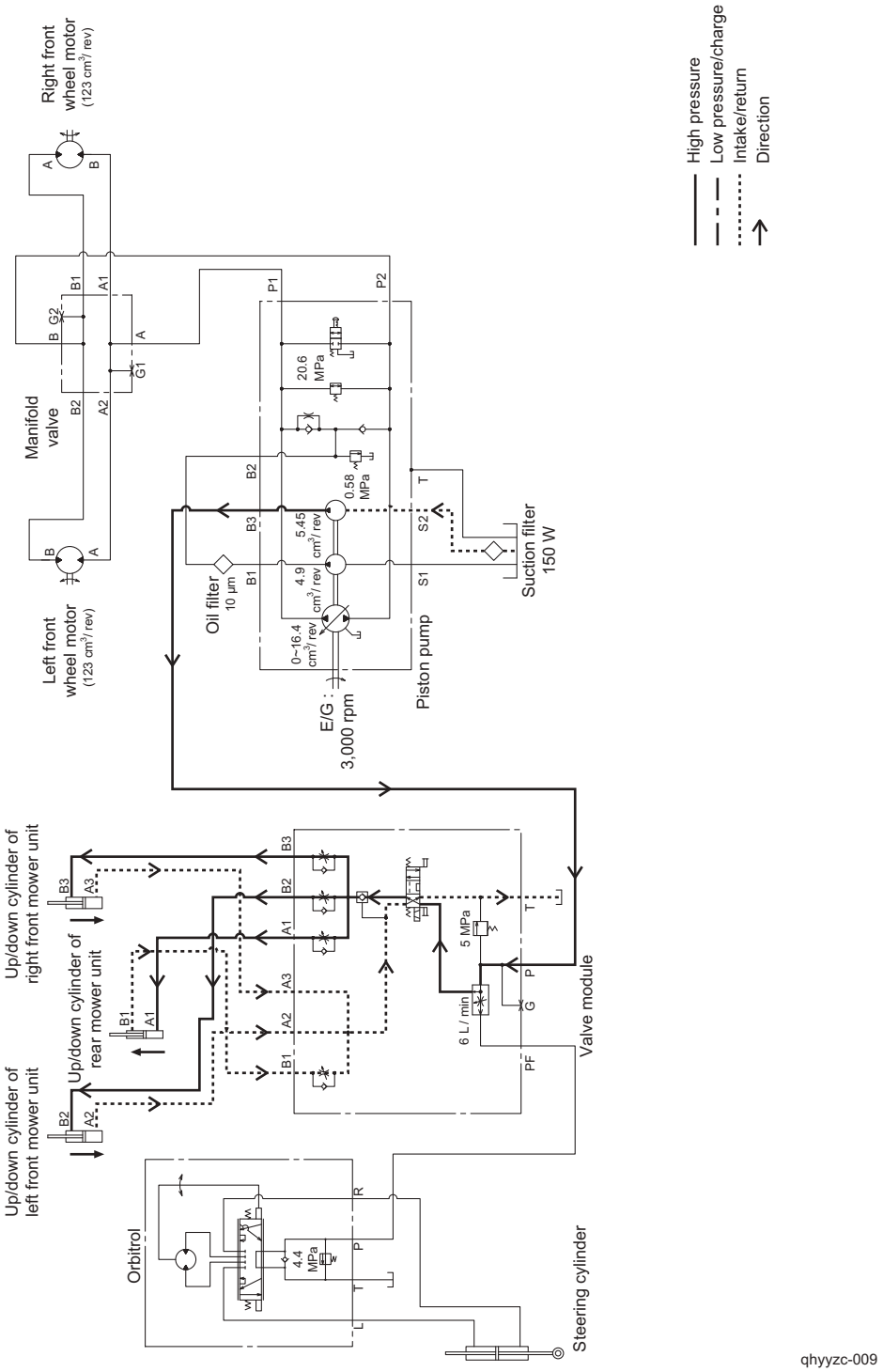
■3WD


High pressure
Low pressure/charge
Intake/return
Direction
Right front wheel motor (123 cm³/ rev)
2WD/3WD changeover valve
Manifold valve
Left front wheel motor (123 cm³/ rev)
Rear wheel motor (158 cm³/ rev)
Oil filter 10 µm
Suction filter 150 W
Piston pump
E/G : 3,000 rpm
0–16.4 cm³/ rev
4.9 cm³/ rev
5.45 cm³/ rev
0.58 MPa
20.6 MPa
Up/down cylinder of right front mower unit
Up/down cylinder of rear mower unit
Up/down cylinder of left front mower unit
Valve module
5 MPa
6 L / min
Orbitrol
4.4 MPa
Steering cylinder
tyg9sz-007

3WD_001

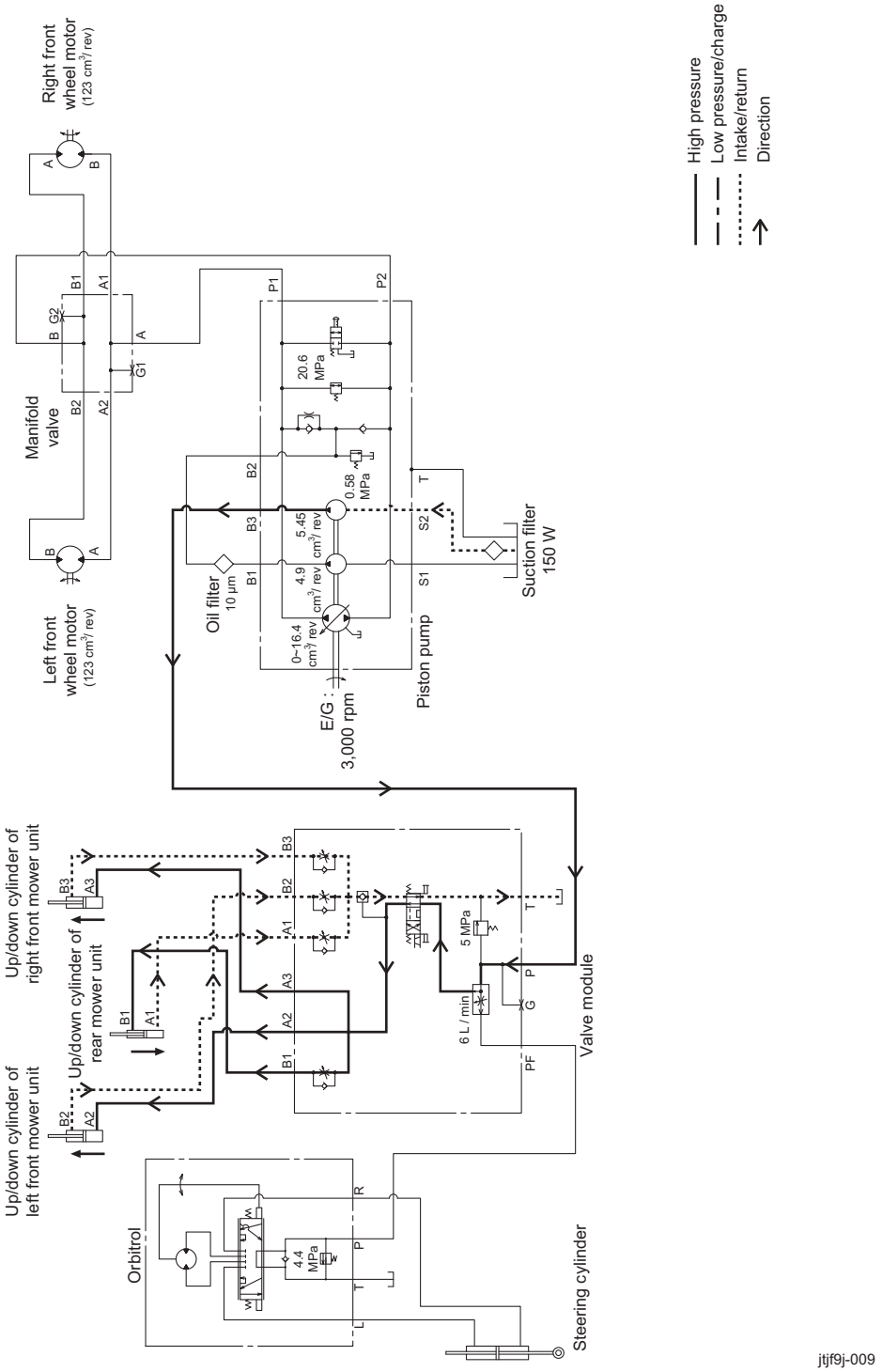
Raise/lower circuit

Rising of up/down cylinder



Rising of up/down cylinder_001

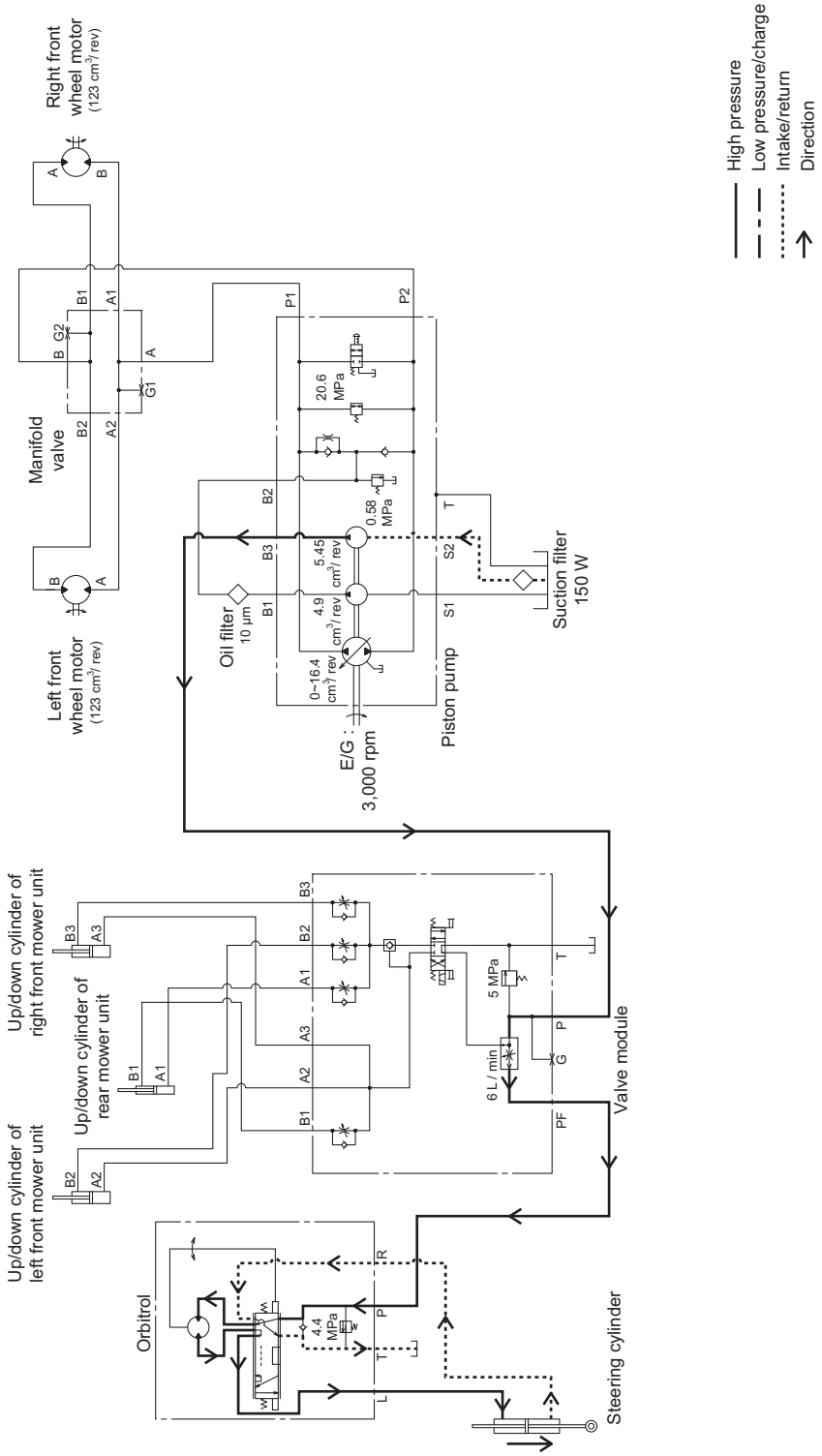
Up/down cylinder lowering (operation)



Up/down cylinder lowering (operation)_001

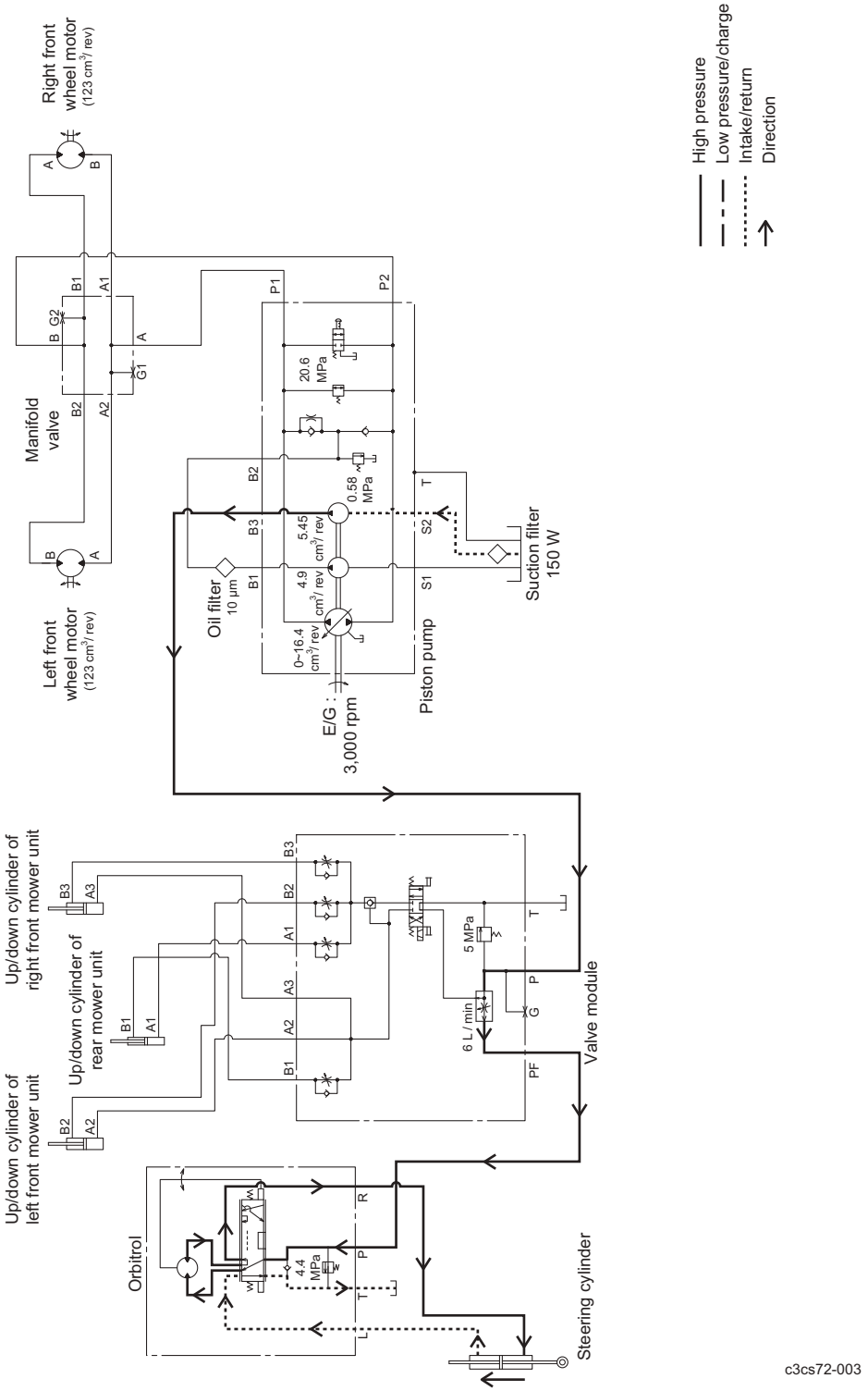
Steering circuit

Steering cylinder counter-clockwise turning



Steering cylinder counter-clockwise turning_001

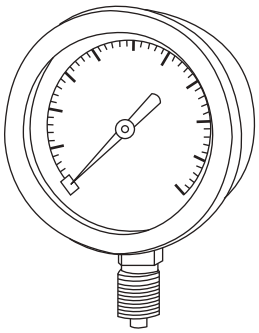
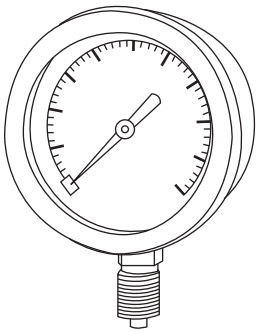
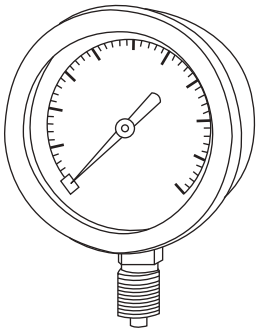
Steering cylinder clockwise turning

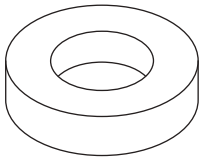
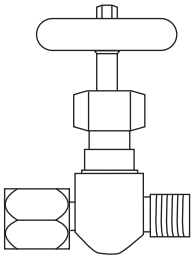
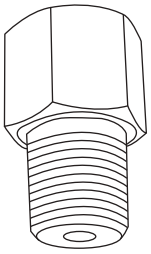


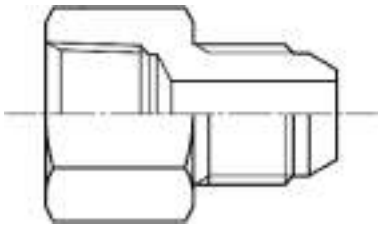
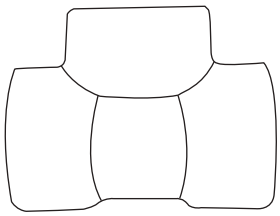
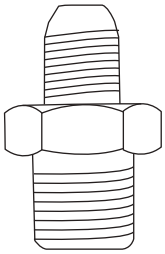
Steering cylinder clockwise turning_001

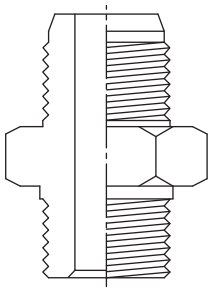
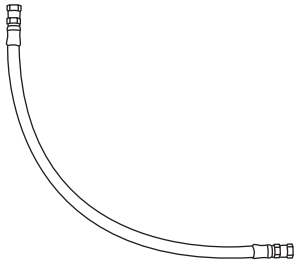
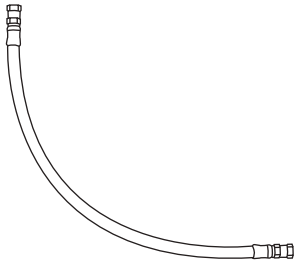
Special Tool

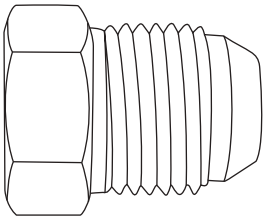
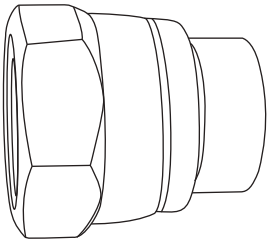
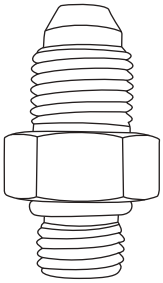
List of Special Tools

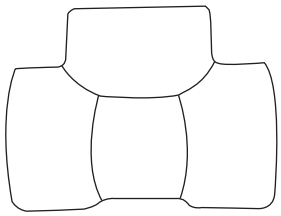
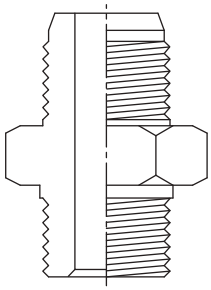
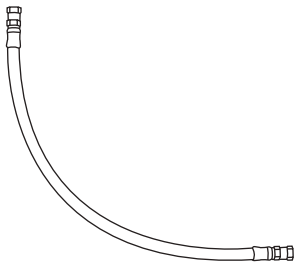
Pressure gauge for high pressure measurements  vasdfi-004	K4701000010	Pressure: For the range of 0 - 35 MPa For the range of 0 - 5,076.40 psi For the range of 0 - 356.90 kgf/cm^2 Primarily used for measuring the pressure of high-pressure parts.
Pressure gauge for low pressure measurements  vasdfi-004	K4701000020	Pressure: For the range of 0 - 15 MPa For the range of 0 - 2,175.60 psi For the range of 0 - 152.96 kgf/cm^2 Primarily used for measuring the pressure of low-pressure parts.
Pressure gauge for extremely low pressure measurements  vasdfi-004	K4701000030	Pressure: For the range of 0 - 5 MPa For the range of 0 - 725.20 psi For the range of 0 - 50.99 kgf/cm^2 Primarily used to measure the pressure of extremely-low-pressure parts.

Pressure gauge seal  vasdfi-005	K4701000050	Inserted between the pressure gauge and the gauge joint.
Gauge valve  vasdfi-016	K4701000060	Used to temporarily shut off the fluid to be measured during maintenance, check, or repair etc. of the pressure gauge.
Pressure gauge joint  vasdfi-006	K4701000040	Used as a joint for pressure pipes.

Female connector 1015-04  vasdfi-007	K3009000290-Y	Used as a connector to attach the hydraulic hose to the pressure gauge.
Cast iron T-joint PT3/8 PF3/8  vasdfi-013	K3024000042-Y	Used to insert the pressure gauge between the hydraulic hoses.
Special adapter PF1/4 PT3/8  vasdfi-015	K3009000042-Y	Used as an elbow for the T-joint during pressure measurements.

Adapter 1013-9  q9c6v6-008	K3000090002-Y	Two of these are used as an elbow for the T-joint during pressure measurements.
WP280-6 hose 1-600  vasdfi-008	K3107210600	High pressure measurement - Used as a hydraulic hose for pressure measurement of 0 - 27.5 MPa.
WP210-9 hose 1-490  vasdfi-008	K3105310490	High pressure measurement - Used as a hydraulic hose for pressure of 0 - 20.5 MPa.

Screw cap (male) PF1/2  q9c6v6-001	K3008000542-Y	Used as a plug when the hydraulic hose is removed.
Screw cap (female) PF1/2  q9c6v6-002	K3008000502-Y	Used as a plug when the hydraulic hose is removed.
O-ring connector 1096-6  q9c6v6-005	K3008000342-Y	Used as a connector when installing the pressure gauge to the hydraulic measurement port.

T-joint TEFPT1/4  vasdfi-013	K3021040002-Y	Used to insert the pressure gauge between the hydraulic hoses.
Adapter 1013-6  q9c6v6-008	K3000060002-Y	Used as an elbow for the T-joint during pressure measurements.
WP140-6 hose 1-480  vasdfi-008	K3103210480	Low pressure measurement - Used as a hydraulic hose for pressure measurement of 0 - 14.0 MPa.

Measurement

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 extremely careful with high-pressure oil as it may pierce your skin, resulting in personal accidents.
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 the hydraulic circuit for pinhole leaks or oil leakage from nozzles, never 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 personal accidents.

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.

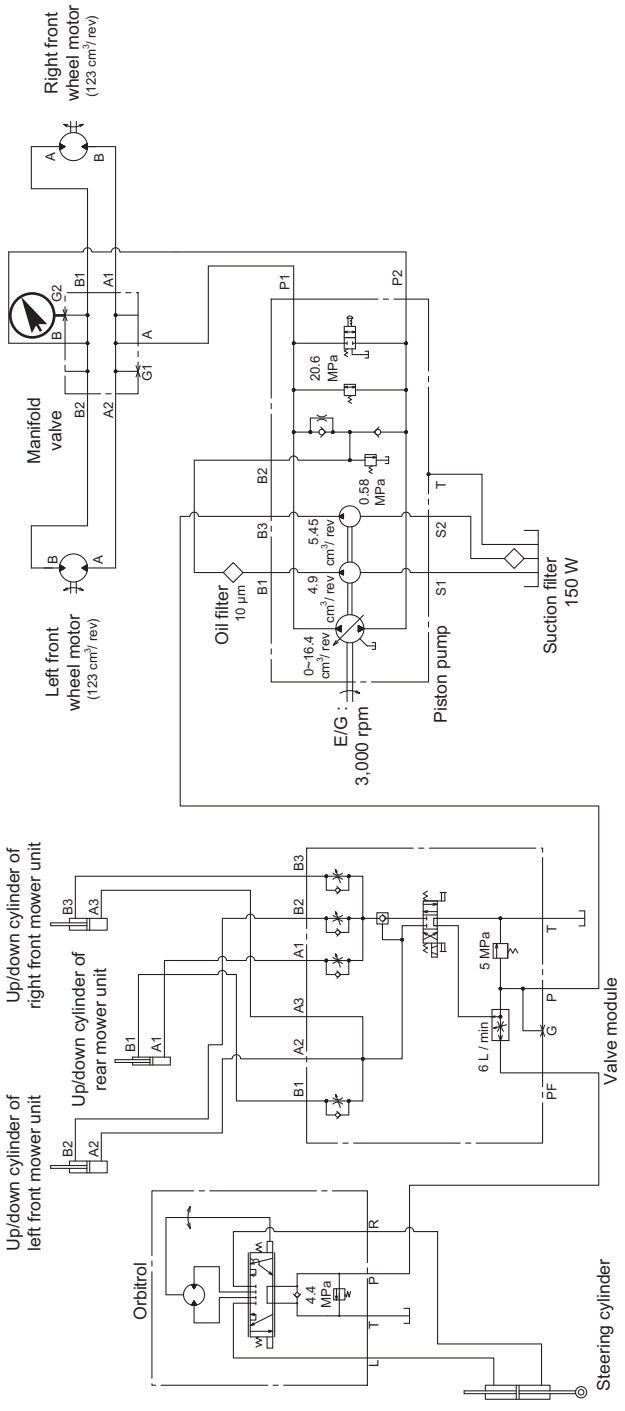
⚠ Warning

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 it 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

Forward

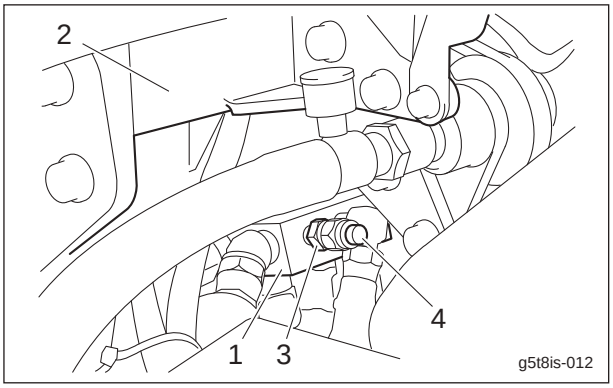


Forward_001

> **Caution**
>
> Before starting pressure measurement, make sure that there is no people around the machine.

1. The forward side measuring port connector is located in front of the manifold valve. Remove the screw cap of forward side measuring port connector.

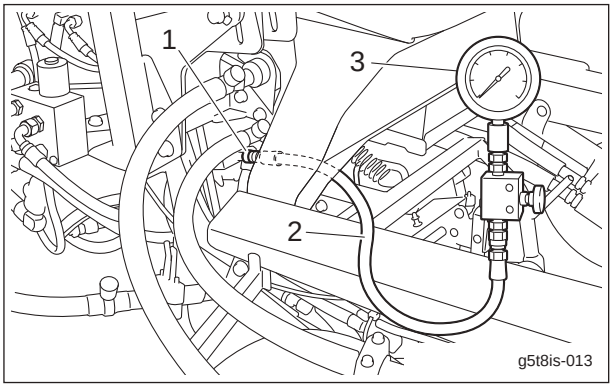
> **Caution**
>
> Use a pressure gauge and hydraulic hose which can bear 25 MPa (3,625.8 psi) or more.



Forward_002

1	Manifold valve
2	Frame
3	Forward side measuring port connector
4	Screw cap

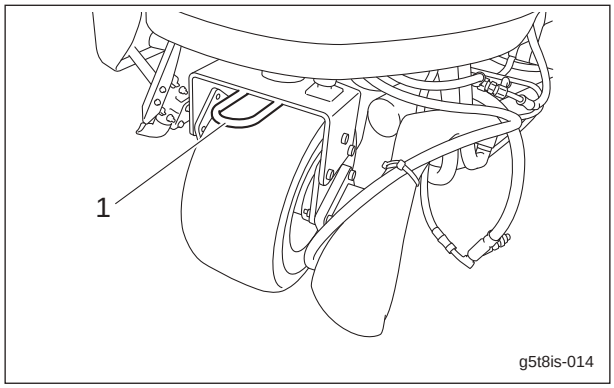
2. Attach the pressure gauge for high pressure measurements on the forward side measuring port connector.



Forward_003

1	Forward side measuring port connector
2	Hydraulic hose
3	Pressure gauge for high pressure measurements

3. Use a shrink etc. to apply resistance on the rear hook so that the machine does not move forward.

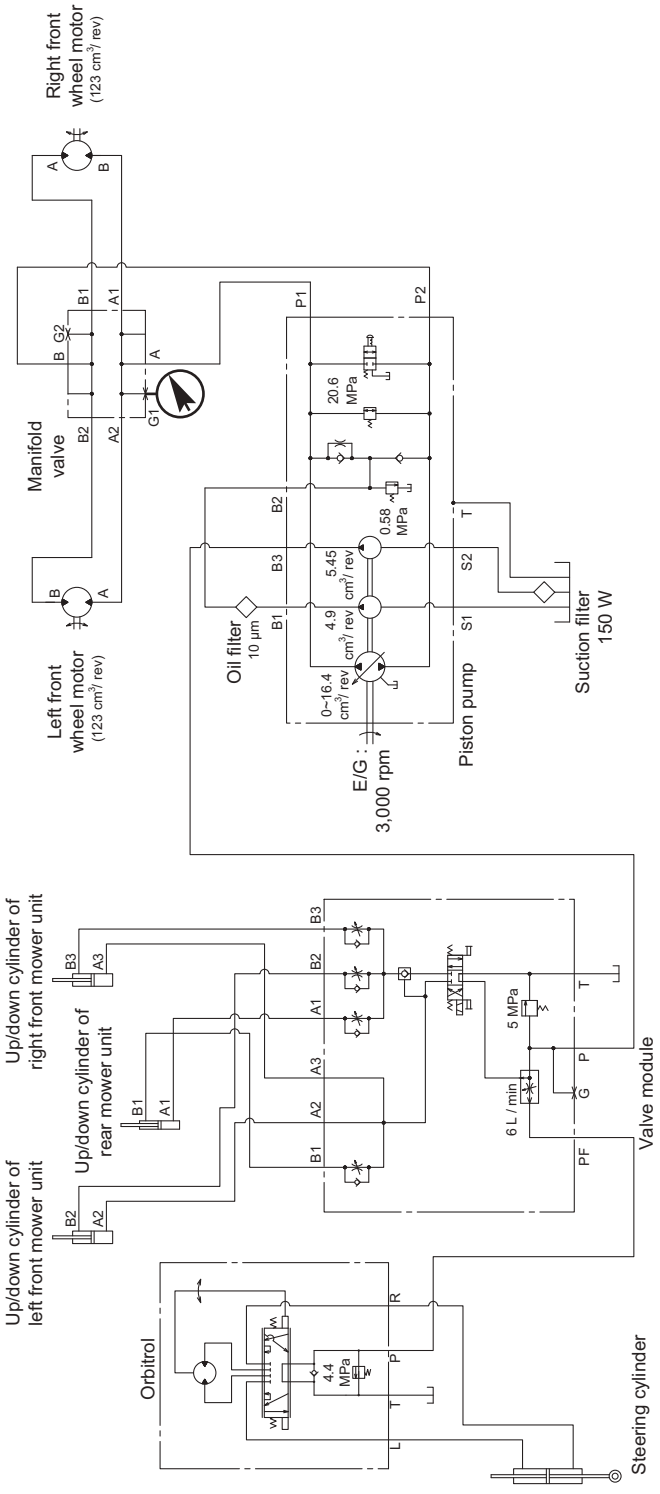


Forward_004

1	Rear hook

4. Make sure that the parking brake is applied.
5. Start the engine, and rev it up to the maximum rpm.
6. Depress the forward pedal, and it is normal if the pressure becomes 20.6 MPa (2,987.7 psi) with the tires locked without slipping.

Backward

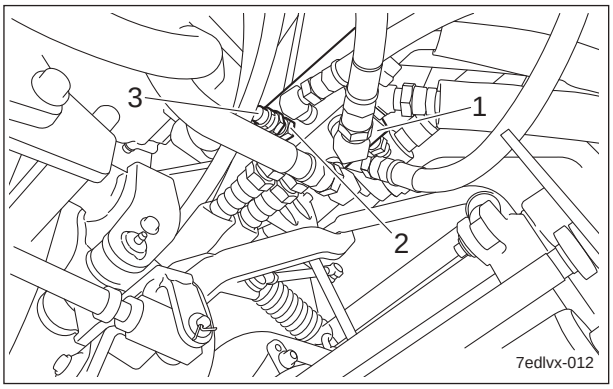


Reverse_001

> **Caution**
>
> Before starting pressure measurement, make sure that there is no people around the machine.

1. The reverse side measuring port connector is located at the rear part of the manifold valve.
   Remove the screw cap of reverse side measuring port connector.

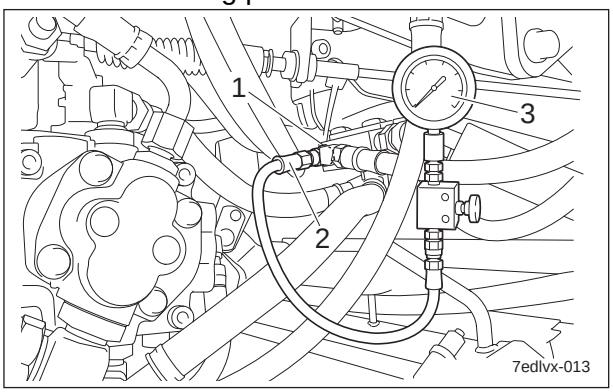
> **Caution**
>
> Use a pressure gauge and hydraulic hose which can bear 25 MPa (3,625.8 psi) or more.



Reverse_002

1	Manifold valve
2	Reverse side measuring port connector
3	Screw cap

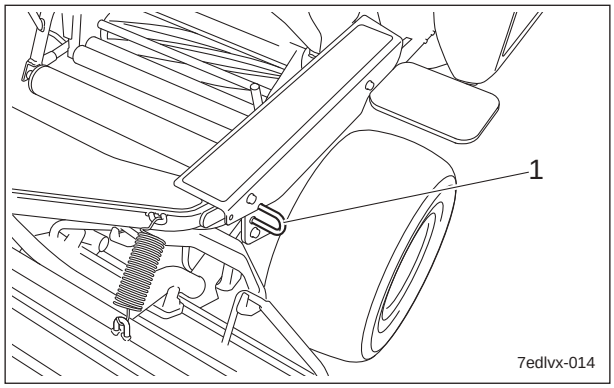
2. Attach the pressure gauge for high pressure measurements on the reverse side measuring port connector.



Reverse_003

1	Reverse side measuring port connector
2	Hydraulic hose
3	Pressure gauge for high pressure measurements

3. Use a shrink etc. to apply resistance on the front hook so that the machine does not move backward.

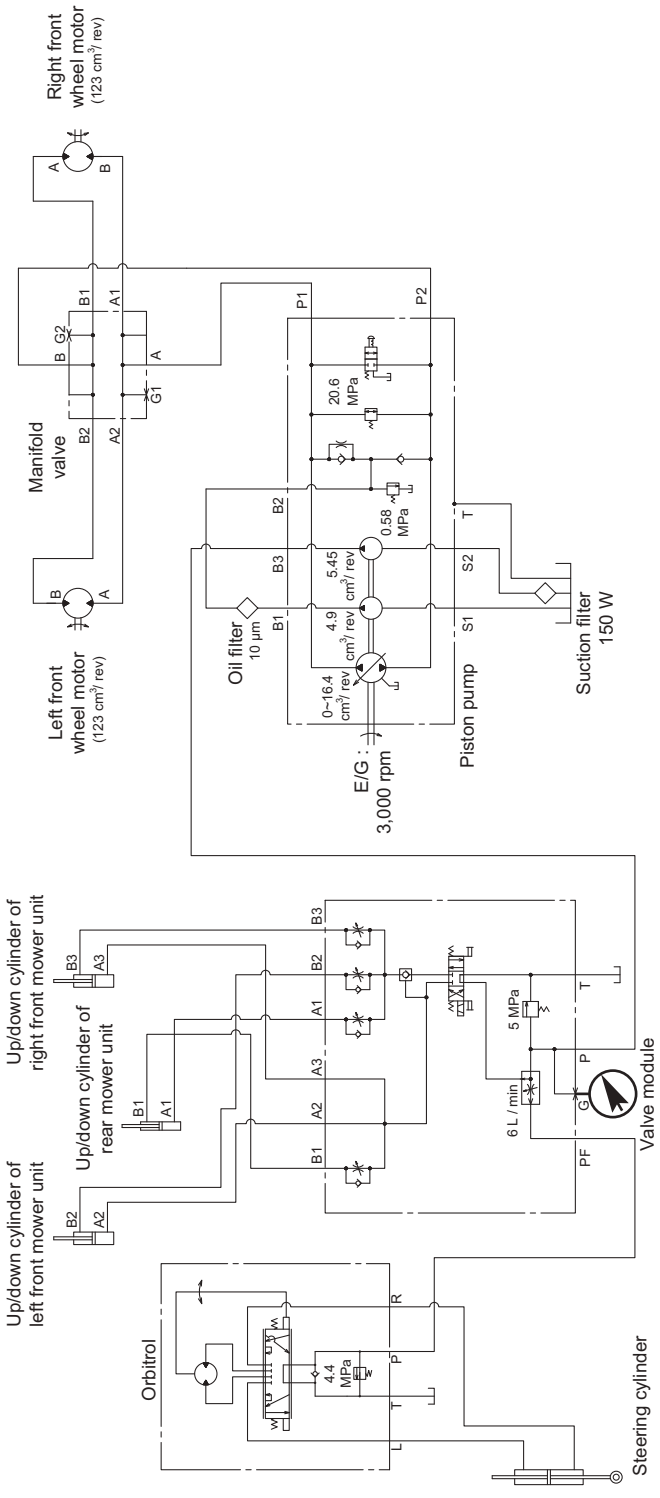


Reverse_004

1	Front hook

4. Make sure that the parking brake is applied.
5. Start the engine, and rev it up to the maximum rpm.
6. Depress the backward pedal, and it is normal if the pressure becomes 20.6 MPa (2,987.7 psi) with the tires locked without slipping.

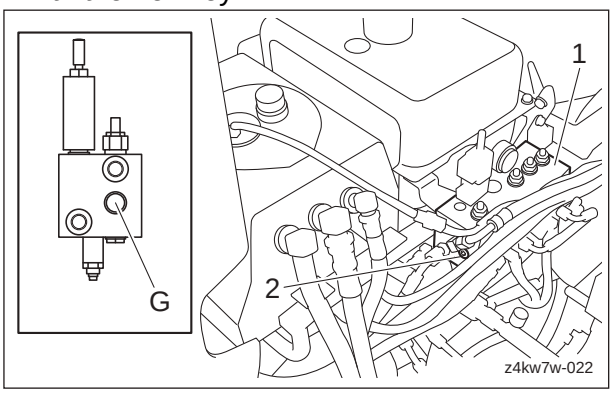
Up/Down circuit



Up/Down circuit_001

> **Caution**
>
> Before starting pressure measurement, make sure that there is no people around the machine.

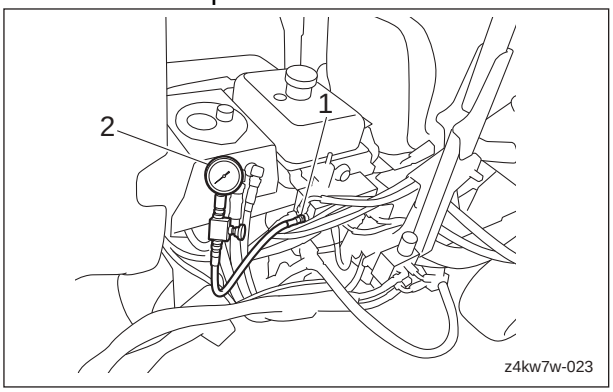
1. Lower the mower units.
2. Remove the cap of the hydraulic measurement port G of the valve module with the hex key.



Up/Down circuit_002

1	Valve module
2	Cap

3. Install the adapter and pressure gauge for low pressure measurements at the hydraulic measurement port G.

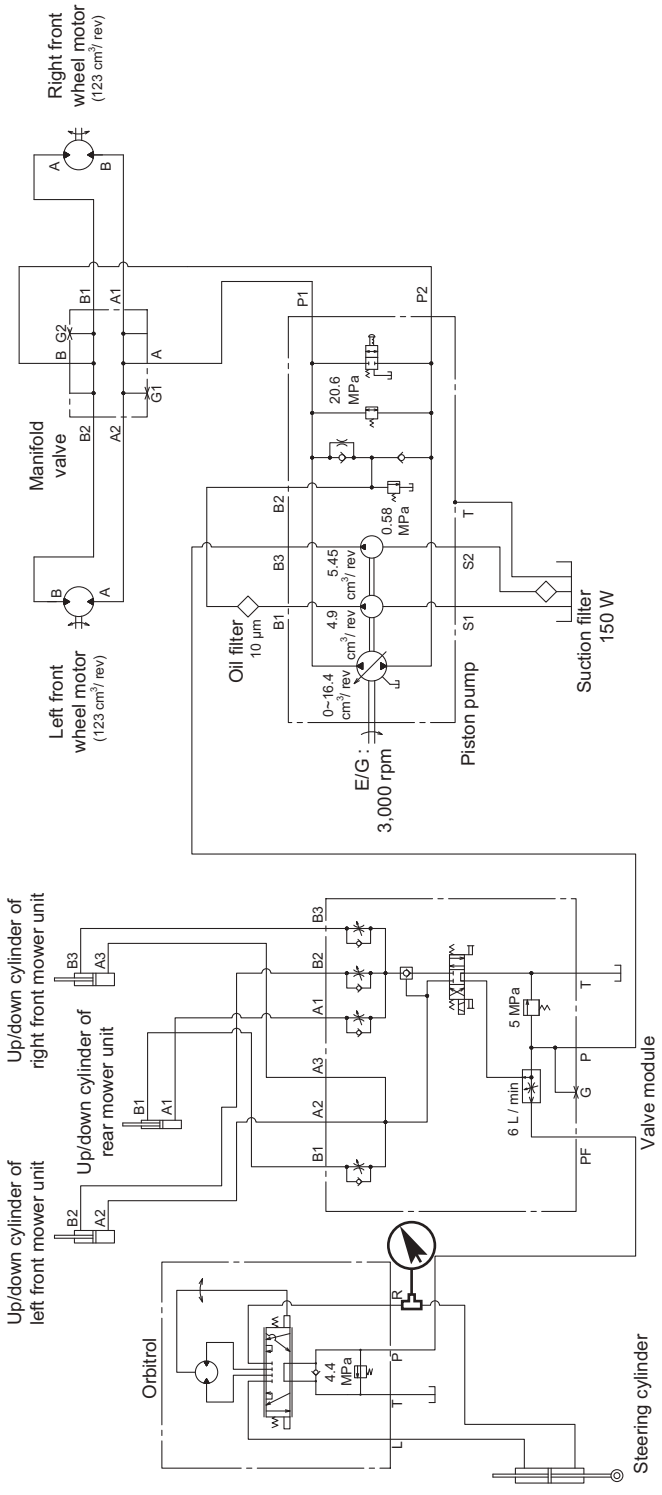


Up/Down circuit_003

1	Adapter
2	Pressure gauge for low pressure measurements

4. Make sure that the parking brake is applied.
5. Start the engine, and then raise the mower units.
6. Rev the engine up to the maximum rpm.
7. The normal pressure is 5.0 MPa (725.2 psi) when the up button is pressed and the hydraulic cylinder is shorten to the maximum extent.

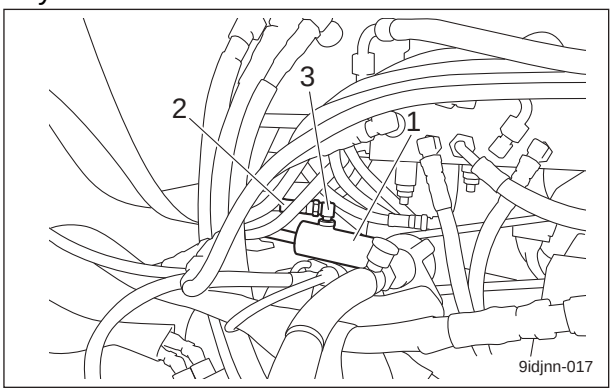
Steering Circuit



Steering Circuit_001

> **Caution**
>
> Before starting pressure measurement, make sure that there is no people around the machine.

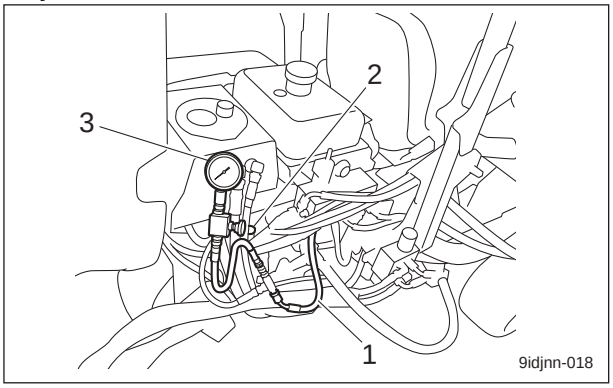
1. Remove the hydraulic hose from the elbow attached to the rear part of the steering cylinder.



Steering Circuit_002

1	Steering cylinder
2	Hydraulic hose
3	Elbow

2. Install the pressure gauge for low pressure measurements between the removed hydraulic hose and the elbow.

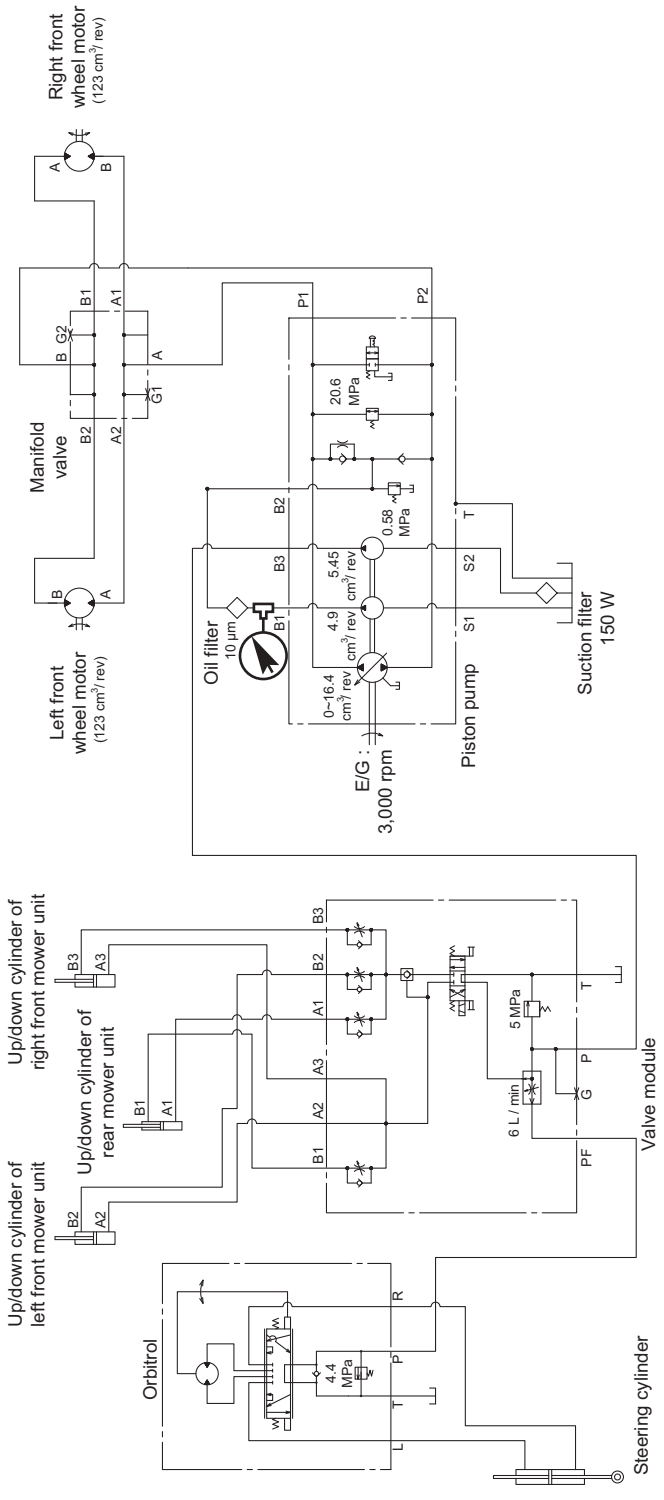


Steering Circuit_003

1	Hydraulic hose
2	Elbow
3	Pressure gauge for low pressure measurements

3. Make sure that the parking brake is applied.
4. Start the engine, and rev it up to the maximum rpm.
5. The normal pressure is 4.4 MPa (638.1 psi) when the handle is turned rightward completely.

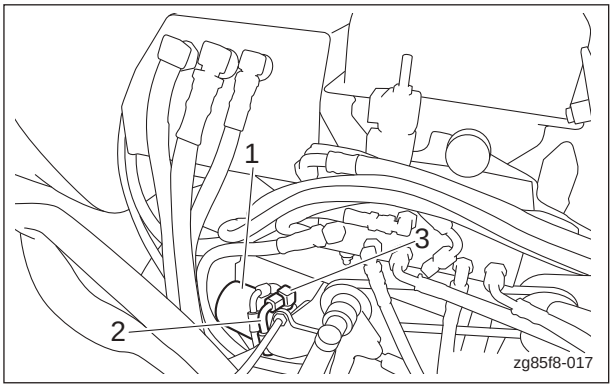
Charge Circuit



Charge Circuit_001

> **Caution**
>
> Before starting pressure measurement, make sure that there is no people around the machine.

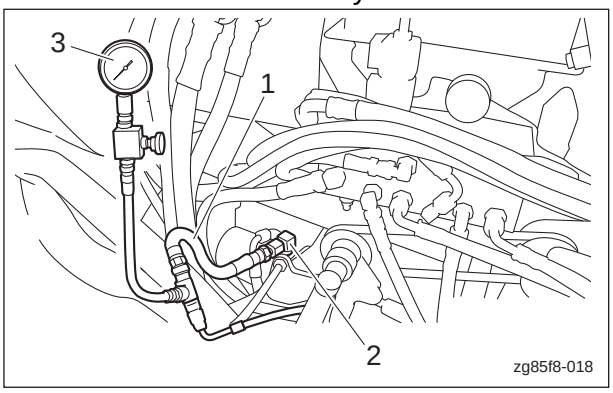
1. Remove the hydraulic hose from the elbow attached to the oil filter.



Charge Circuit_002

1	Oil filter
2	Hydraulic hose
3	Elbow

2. Install the pressure gauge for extremely low pressure measurements between the removed elbow and the hydraulic hose.



Charge Circuit_003

1	Hydraulic hose
2	Elbow
3	Pressure gauge for extremely low pressure measurements

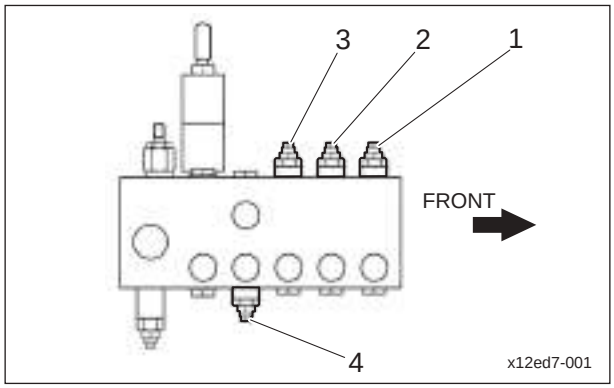
3. Make sure that the parking brake is applied.
4. Start the engine, and rev it up to the maximum rpm.
5. The normal pressure is 0.58 MPa (84.1 psi).

Adjustment

Adjusting Mower Unit Up/Down Speed

The Up/Down circuit of the mower unit has 4 sets of flow control valves to adjust the up/down speed.
Follow the steps below to make adjustments.

1. Warm up the hydraulic oil before the adjustment.
2. Open the hood and loosen the locknut for the flow control valve that you want to adjust.
3. To slow the speed, turn the screw to the right (direction for tightening).
   To quicken the speed, turn the screw to the left (direction for loosening).
4. Once the adjustment has completed, be sure to lock with the nut.



Adjusting Mower Unit Up/Down Speed_001

1	Up/down cylinder of the right front mower unit (down)
2	Up/down cylinder of the left front mower unit (down)
3	Up/down cylinder of the rear mower unit (down)
4	Up/down cylinder of the rear mower unit (up)

General inspection and repair

Note

Before inspection and repair

1. Move the machine to level surface.

2. Apply the parking brake, and then lower the operating machine.
3. Stop the engine, and then remove the key.
4. 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 or repairing it.

5. When piping and hoses are removed, put a cap or plug in its place to prevent contamination of the hydraulic systems.
6. Attach labels or other identifications to the removed piping and hoses so that they can be correctly refitted.
7. 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**
>
> After the installation, check if there is no hydraulic oil leakage in each part.
> See the list in "Tightening torques" (Page 3-6) .
> Note that the Baroness product warranty may not apply to defects caused by incorrect or overtorque tightening etc.

1. Check the amount of oil in the hydraulic tank. Add as 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. Make sure that there is no 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 circuit is a closed circuit, any contaminant will remain within the circuit and may lead to other failures unless cleaned.

⚠ Caution

Be careful with hot oil, which could cause burns if it contacts your skin.

1. Drive and maneuver the machine and warm up the hydraulic oil.
2. Move the machine to level surface.
3. Apply the parking brake, and then lower the operating machine.
4. Stop the engine, and then remove the key.

⚠ Warning

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

Important

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

5. Drain the oil from the hydraulic tank.
6. Drain the oil from the hydraulic hoses and piping while the oil is still warm.
7. Replace the hydraulic oil and filter.
8. Check the hydraulic tank and clean.
9. 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.

10. Supply new hydraulic oil.
11. Make sure that the traveling pedal and all the drives of the operating machine are in neutral position.
12. Start and run the engine for 10 seconds to check that there is no oil leakage or else. Perform this operation twice.
13. Start the engine.
    Let it run idle for at least two minutes, then run at the maximum speed for one minute.
14. Raise and lower the operating machine, and turn the steering wheel side to side.
15. Stop the engine, and check for any oil leakage.
    Check the amount of hydraulic oil. Add as necessary.
16. Operate for two hours under normal operating conditions.
17. Check the condition of hydraulic oil.
    If it is contaminated, repeat the procedures from 1 through 15 until the oil becomes clean.

18. If no abnormality is found, operate normally and maintain according to the maintenance schedule.

Air bleeding

> **Caution**
>
> When you replace or repair the motor, pump, cylinder, etc, make sure that the hydraulic system is properly connected.
> Make sure that air is bled to avoid malfunction.

> **Important**
>
> When you replace or repair hydraulic parts, be sure to replace the oil filter.

1. Move the machine to level surface.
2. Apply the parking brake, and then lower the operating machine.
3. Stop the engine, and then remove the key.
4. Make sure that the hydraulic equipments and hydraulic fittings are securely tightened.
5. When there is any malfunction of the hydraulic system or any dirt, clean the hydraulic system and the hydraulic tank, and then replace the hydraulic oil.
6. Check the amount of hydraulic oil. Add as necessary.
7. Make proper adjustment and connection, and make sure that there are neither broken parts nor oil leakage.
8. Make sure that the traveling pedal and all the drives of the operating machine are in neutral position.
9. Start and run the engine for 10 seconds to check that there is no oil leakage or else. Perform this operation twice.

> **Warning**
>
> Check " "Jacking up the machine" (Page 3-11) " when you jack up the machine.

10. Raise all the wheels of the machine, and then use jack stands or any proper blocks to support it firmly.
11. Make sure that the traveling pedal and all the drives of the operating machine are in neutral position.
12. Start the engine and depress the traveling pedal while it is running at low rpm.
    The charge pump sucks oil, air in the hydraulic system will be bled in about 30 seconds,and then the circuit will be filled with oil.
13. After the hydraulic circuit is filled with oil, operate the up/down lever and switches to operate the up/down cylinder several times.
    Stop the engine immediately when the cylinder does not move within 10 to 15 seconds or if there is any noise from the pump. And then check the cause.
    Then carry out the following inspections.
    [1] Loose, malfunction of the filter or suction line
    [2] Loose, malfunction of the pump coupler
    [3] Block of the suction line
    [4] Block of the charge relief valve
    [5] Malfunction of the charge pump
14. Proceed to the following operation when the up/down cylinder moves within 10-15 seconds.
15. Operate the traveling pedal for forward and reverse to check if the wheels rotate in correct direction.
    [1] When the wheels rotate in wrong direction, stop the engine and then swap the lines for the motor to correct rotation direction.
    [2] Stop the engine when the rotation direction is correct.
16. Return the traveling pedal into the neutral position.
17. Check neutral of the traveling and make adjustment. (See the Owner's Operating Manual)
18. Lower the machine to the ground.
19. Carry out the following operations when the traveling pump or the wheel motor has been removed.
    [1] Run for 10 minutes so as to rotate the wheels slowly.

[2] Then, gradually increase operation load while running for 10 minutes.

[3] Stop the machine, check the amount of hydraulic oil and add it as necessary. Make sure that there is no oil leakage. Check all of the connections.

[4] Check that the traveling is in neutral position.
When any adjustment is needed, raise all wheels of the machine, and then use jack stands or any proper blocks to support it firmly.

Maintenance

About Maintenance

This chapter provides descriptions of the main inspection and maintenance procedures for the LM315GC electrical system.
For daily inspections and maintenance as well as machine handling, refer to the LM315GC Operator's Manual and Parts Catalog.
Also, for details for handling of the battery, please refer to the separate Battery Instruction Manual.

Specifications

Adjusted Value

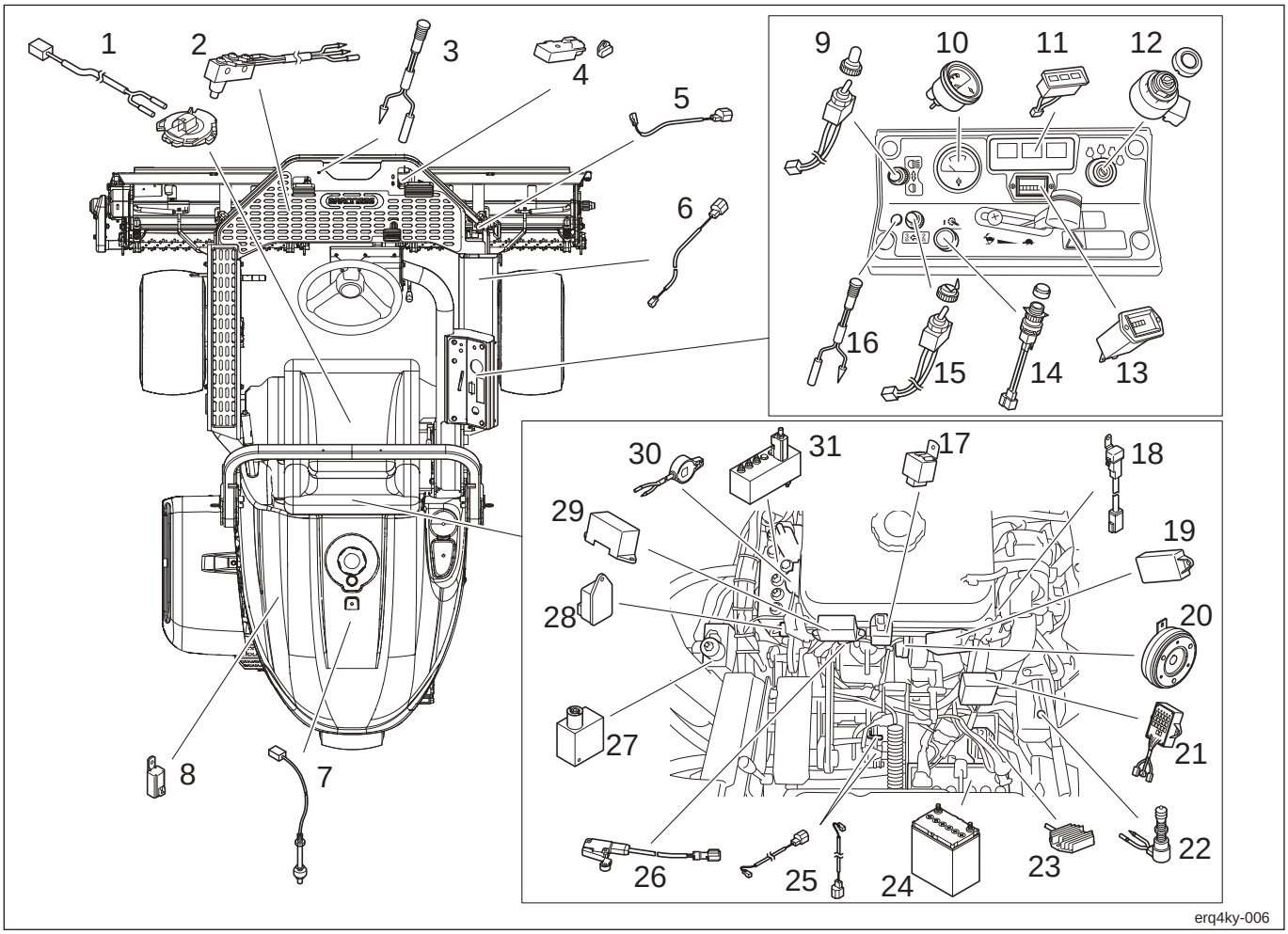
Parking brake switch	Slight clearance	A clearance between the switch contact point and the parking brake lever when the parking brake lever is at the 4th notch
Proximity sensor (Reel rotation start position detection)	0 mm (0 in)	Horizontal distance between the sensor tip and the joint end of the tip of the right front up/ down cylinder when the mower unit is lowered
	1.0 - 2.5 mm (0.04 - 0.10 in)	Clearance between the sensor detection part and the joint of the tip of the right front up/ down cylinder when the mower unit is lowered
Proximity sensor (Mower unit up position detection)	415.0 mm (16.34 in)	Distance between the tip of the rear mower arm and the floor when the mower unit is raised
	1.0 - 2.5 mm (0.04 - 0.10 in)	Clearance between the sensor detection part and the cam when the mower unit is raised
	192.0 mm (7.56 in)	Length of the mower up/down cam adjustment rod
Proximity sensor (Mower unit down position detection)	285.0 mm (11.22 in)	Distance between the tip of the rear mower arm and the floor when the mower unit is lowered
	1.0 - 2.5 mm (0.04 - 0.10 in)	Clearance between the sensor detection part and the cam when the mower unit is lowered
	192.0 mm (7.56 in)	Length of the mower up/down cam adjustment rod
Proximity switch	5.0 mm (0.20 in)	Clearance between the switch and the plastic magnet when the traveling pedal is neutral
Electromagnetic clutch	0.3 - 0.6 mm (0.01 - 0.02 in)	Clearance between the clutch rotor main body and the armature board when the electromagnetic clutch is not energized
Limit switch (mower pedal switch)	75.0 mm (2.95 in)	Distance between the pedal back joint and the step when the mower pedal is released

Adjustment of Safety Switch

See " "Adjustment" (Page 4-40) " for method for adjustment.

Electrical system

Electrical Part Layout



Electrical Part Layout_001

1	Seat switch	12	Key switch	23	Regulator
2	Limit switch (mower pedal switch)	13	Hour meter	24	Battery
3	LED lamp (green)	14	Up switch	25	Proximity sensor (mower unit up/down position detection)
4	Proximity switch	15	Toggle switch (2WD/3WD changeover switch)	26	Limit switch (back lapping switch)
5	Proximity sensor (reel rotation switch)	16	LED lamp (red)	27	2WD/3WD changeover valve
6	Proximity sensor (reel rotation start position detection)	17	Key stop timer	28	Glow lamp timer
7	Level Switch	18	Fusible link	29	Fuse box
8	Starter relay	19	Mower unit control relay unit	30	Buzzers
9	Toggle switch (light switch)	20	Electromagnetic clutch	31	Mower unit up/down valve
10	Water temperature gauge	21	Interlock relay unit		
11	Pilot lamps	22	Parking Brake Switch		

1. Seat switch
   This is one of the safety switches that constitute the interlock system. It is located in the center of the seat cushion.
2. Limit switch (mower pedal switch)
   The mower pedal switch is used to raise and lower the mower pedal and located in the mower pedal fulcrum.
3. LED lamp (green)
   When it switches to Down position, this LED turns on. And it is located in the right side of the mower pedal.
4. Proximity switch
   This is one of the safety switches that constitute the interlock system. It detects that the traveling pedal is in the neutral position.
   The plastic magnet for detection is installed in the traveling pedal arm part.
   It is located near the traveling pedal of the step of the operator’ s foot.
5. Proximity sensor (reel rotation switch)
   This is one of the safety switches that constitute the interlock system. It is used for the "rotation" and "stop" of the reel cutter.
   It is located in the right side of the step of the operator’ s foot.
6. Proximity sensor (reel rotation start position detection)
   This is one of the safety switches that constitute the interlock system. It detects that the right front mower unit is in the down position.
   It stops the rotation of the reel cutter when the mower unit is raised.
   It is located in the right front mower up/down cylinder.
7. Level Switch
   The level switch is connected to the buzzer (oil level).
   The switch will be engaged and continuous buzzer alarm will sound if the oil volume in the hydraulic tank decreases (the float descends) by 1.2 liters (0.32 U.S.gals).
8. Starter relay
   Only if the engine activation conditions of the interlock system are satisfied, the starter motor can be activated.
   This is located in the left side of the hydraulic tank.
9. Toggle switch (light switch)
   This is used to turn on/off the light and located on the control panel.
10. Water temperature gauge
    The water temperature gauge is connected to the water temperature sensor of the engine. It indicates the temperature of engine coolant.
    It is located on the control panel.
11. Pilot lamps
    Status of charge of the engine, glow, and oil pressure is displayed with illumination of the lamps.
    It is located on the control panel.
12. Key switch
    This switch enables you to start, thermo-start, run, or stop the engine.
    It is located on the control panel.
13. Hour meter
    The hour meter indicates total operation time of the engine.
    It is located on the control panel.

14. Up switch
    This is used if the height of the mower unit is not sufficient. It is located on the control panel.
15. Toggle switch (2WD/3WD changeover switch)
    This is used to switch between 2WD and 3WD and located on the control panel.
16. LED lamp (red)
    This is turned on when 3WD is selected and located on the control panel.
17. Key stop timer
    This controls the engine stop solenoid when the key switch is set to the "OFF" position.
    It is located in front of the fuel tank.
18. Fusible link
    The fusible link functions as the main fuse for the entire electrical circuit, and as the fuse for the charge circuit.
    It is equipped with a specialized fuse (50A) cartridge.
    It is located in the left front area of the fuel tank.
19. Mower unit control relay unit
    This controls the Up/Down of the mower unit and Rotate/Stop of the reel cutter. The control can be confirmed with the light of LED.
    It is located in the left front area of the fuel tank.
20. Electromagnetic clutch
    This transmits/blocks the drive of the engine to the transmission.
    It is located in the left side of the transmission.
21. Interlock relay unit
    This is associated with various safety switch. The control can be confirmed with the light of LED.
    It is located above the frame of the rear part of the battery.
22. Parking Brake Switch
    The seat switch is one of the safety switches that constitute the interlock system. It is located in the fulcrum of the parking brake lever.
23. Regulator
    This controls the amount of charge from the alternator. It is located above the frame of the rear part of the battery.
24. Battery
    The battery supplies power to the starter motor at the start of the engine, as well as to all electrical parts.
    This is located under the seat.
25. Proximity sensor (mower unit up/down position detection)
    This detects the rear mower arm stop position when the mower unit is raised.
    It is located under the seat and two units are installed to detect the up and down positions.
26. Limit switch (back lapping switch)
    This is one of the safety switches that constitute the interlock system. It detects that the transmission selector lever is in the "LAP" position.
    It is located near the transmission selector lever.
27. 2WD/3WD changeover valve
    You can activate the 2WD/3WD changeover valve to enable "2WD" or "3WD" driving by operating the 2WD/3WD changeover switch.
    It is located in the center of the right side of the body.

28. Glow lamp timer
    This controls illumination of the thermo-start lamp inside the pilot lamp.
    When the ignition key switch is set and held to "GLOW" position, the thermo-start lamp turns on for 5 seconds.
    It is located on the control panel.
29. Fuse box
    Each electrical device is connected through the fuse from the key switch.
    Fuse standards are the same as those of "mini fuses for automobiles."
    It is located in front of the fuel tank.
30. Buzzers
    The buzzers sound when overheating, abnormal hydraulic oil level, or traveling while the parking brake is applied is detected. (intermittent tone)
31. Mower unit up/down valve
    This is activated by the operation of the limit switch (mower pedal switch) and switches the hydraulic circuit inside the valve module.
    It is composed of two solenoids for up and down motions.
    It is located in the valve module.

Special Tool

Special tools list

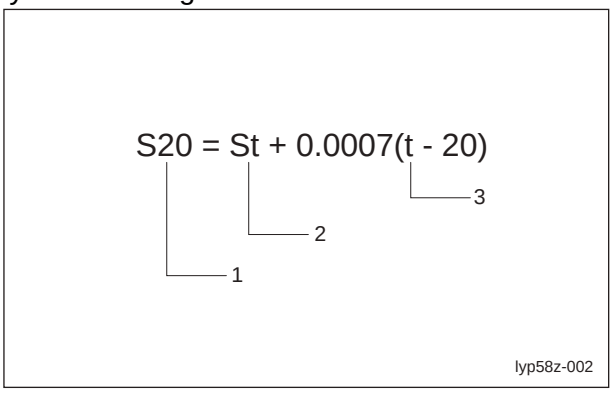
No use of special tools is required.

Measurement

Battery

Measurement of Battery Specific Weight

Specific weight of electrolyte tends to reduce in linear proportion with the discharged electrical quantity of the battery and so checking the specific weight of electrolyte with a hydrometer can tell the remaining capacity of the battery. Temperature compensation is required for the specific weight measured with a hydrometer. The standard temperature for the specific weight of battery electrolyte is 20 ° C, and the specific weight increases or decreases by 0.0007 in accordance with the temperature change of 1 ° C. Thus it can be compensated by the following formula.



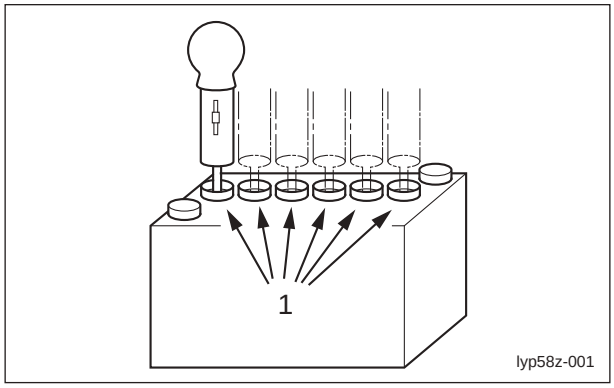
Measurement of Battery Specific Weight_001

1	Specific weight converted for 20 ° C
2	Measured specific weight
3	Fluid temperature at measurement

Specific weight and remaining capacity of battery		
Specific weight (20 ° C)	Discharged electrical quantity (%)	Remaining capacity (%)
1.28	0	100
1.24	25	75
1.20	50	50
1.16	75	25
1.12	100	0

Measurement of specific weight of 12V battery

1. Check all the cells after charge.
2. Replace it when the specific weight is 1.225 or less, or gap of that between each cell is 0.05 or more.



Measurement of Battery Specific Weight_002

1	Cell

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 "Measurement of Battery Specific Weight" (Page 5-8) .)
4. Replace it when the specific weight is 1.225 or less, or gap of that between each cell is 0.05 or more.

Interlock system

The interlock system is a safety system to prevent injury or accident caused by lack of caution of operator using combined control with multiple switches and sensors.

The engine stop solenoid operates simultaneously with the seat switch, parking brake switch, proximity switch, proximity sensor (reel rotation switch) and back lapping switch. In addition the electromagnetic clutch operates simultaneously with the seat switch, proximity sensor (reel rotation switch) and limit switch (back lapping switch).

To start the engine,

[1] An operator sits on the seat.

[2] The parking brake is applied.

[3] Set the position of the proximity switch (reel rotation switch) to "OFF."

[4] Take the foot off the traveling pedal (forward or reverse pedal).

To drive,

[1] An operator sits on the seat.

[2] Release the parking brake.

[3] Hit the traveling pedal (forward or reverse pedal).
In the following case, the engine is stopped.

- Apply the parking brake, leave the driver's seat, and hit the traveling pedal (forward or reverse pedal).
- Release the parking brake without sitting on the driver's seat.
- Apply the parking brake, and turn the proximity switch (reel rotation switch) "ON" without sitting on the driver's seat.

To operate (reel rotation),

[1] An operator sits on the seat.

[2] Turn the proximity sensor (reel rotation switch) "ON."

- If the operator leaves the driver's seat, the engine is stopped.

[3] Lower the mower units.

When the machine is parked or stopped,

[1] Apply the parking brake.

[2] In the event the operator leaves the seat, set the proximity sensor (reel rotation switch) to the "OFF" position.

[3] Take the foot off the traveling pedal (forward or reverse pedal).
- Unless the operator leaves the driver's seat, the engine is not stopped.
- However, unless all of the above-mentioned conditions are satisfied, the interlock system is activated and the engine is stopped.

Maintenance of back lapping (The reel cutter rotates reversely)

[1] Lower the mower units.

[2] Stop the engine.

[3] Set the reel reverse lever to "Reverse" position, then set the transmission selector lever to "LAP" position.
- For the mower units not to back lap, set the reel reverse lever to the "N" position.

[4] An operator sits on the seat.

[5] Apply the parking brake.

[6] Take the foot off the traveling pedal (forward or reverse pedal).

[7] Start the engine, and run it at a low rpm.

[8] Set the proximity sensor (reel rotation switch) to the "ON" position.

Interlock System Operation Requirements

	Seat	Parking brake	Transmission selector lever	Reel rotation switch	Traveling pedal
To start the engine,	ON (Sitting)	ON (Applied)	-	OFF	OFF (Take the foot off)
To drive,	ON (Sitting)	OFF (Released)	-	-	ON (Forward or reverse)
To operate (reel rotation),	ON (Sitting)	OFF (Released)	-	ON	-
When the machine is parked or stopped,	-	ON (Applied)	-	OFF	OFF (Take the foot off)
Maintenance of back lapping (The reel cutter rotates reversely)	-	ON (Applied)	ON (LAP)	ON	OFF (Take the foot off)

Confirming Operation of Interlock System

1. For the status of the engine start, check if the engine will stop when even one of the operation conditions on the seat, the parking brake, the reel rotation switch and traveling pedal is not met.
2. For the status of the back lapping maintenance, check if the electromagnetic clutch will be separated or the engine will stop when even one of the operation conditions on the parking brake, the reel rotation switch, traveling pedal and transmission selector lever is not met.

Adjustment

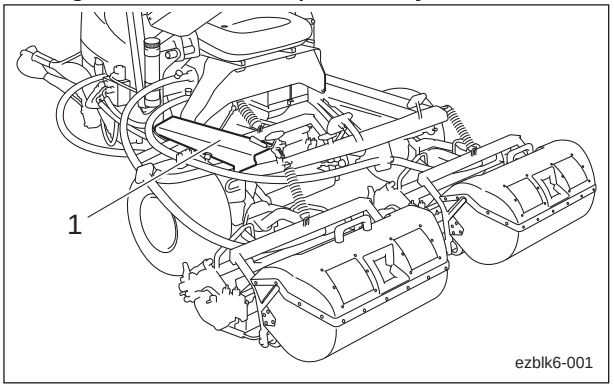
Proximity Sensor

Reel Rotation Circuit

■Adjustment of Reel Rotation Start Position

The rotations/stops of the reel associated with the up/down motions of the mower unit are adjusted by the joint of the tip of the right front mower unit up/down cylinder and proximity sensor (reel rotation start position detection).

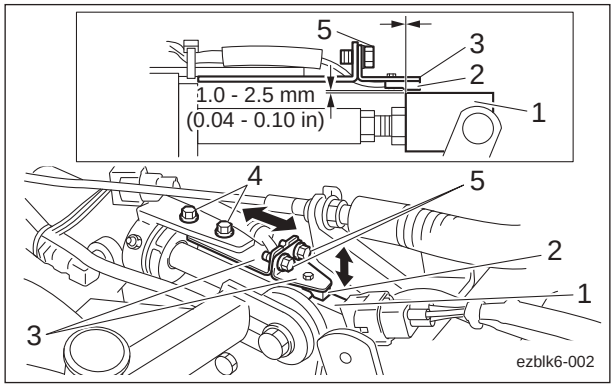
1. Start the engine.
2. Lower the mower units.
3. Stop the engine.
4. Remove the cover in the upper part of the right front mower up/down cylinder.



Adjustment of Reel Rotation Start Position_001

1	Cover

5. Adjust the position of the proximity sensor (reel rotation start position detection) by the following steps.
   [1] Loosen bolt A so that the sensor mounting plate can be moved.
   [2] Move the sensor mounting plate in the front/back direction and then tighten bolt A in the position where the joint end of the up/down cylinder tip fits the sensor detection part end.
   [3] Loosen bolt B so that the sensor mounting plate can be moved.
   [4] Tighten bolt B in the position where the clearance between the up/down cylinder tip and proximity sensor is 1.0 - 2.5 mm (0.04 - 0.10 in).



Adjustment of Reel Rotation Start Position_002

1	Up/Down cylinder tip joint
2	Proximity sensor (reel rotation start position detection)
3	Sensor mounting plate
4	Bolt A
5	Bolt B

6. Install the cover in the upper part of the right front mower up/down cylinder.

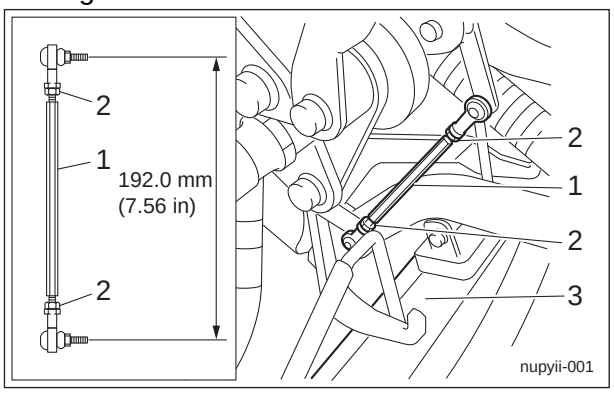
Mower Unit Up/Down Circuit

■Adjustment of Up/Down Position

The mower arm stop position when the mower unit is raised/lowered is adjusted by the cam under the seat and two proximity sensors (mower up/down position detection).

1. Loosen the nut and rotate the rod to adjust the mower up/down cam adjustment rod to 192.0 mm (7.56 in).

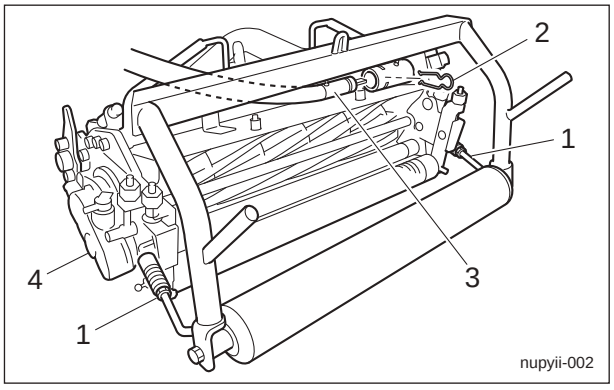
2. Tighten the nut.



Adjustment of Up/Down Position_001

1	Mower up/down cam adjustment rod
2	Nut
3	Rear mower unit

3. Start the engine.
4. Lower the mower units.
5. Stop the engine.
6. Remove the mower mounting bracket and the flexible wire of the rear mower unit and then the rear mower unit.



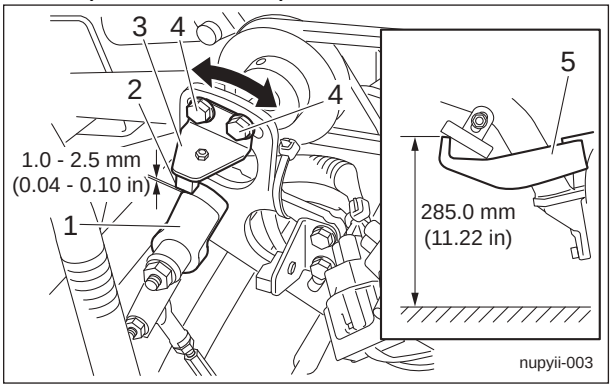
Adjustment of Up/Down Position_002

1	Mower mounting bracket
2	Clip
3	Flexible wire
4	Rear mower unit

7. Adjust the position of the proximity sensor (mower down position detection) by the following steps.
   [1] Loosen the bolt so that the sensor mounting plate can be moved.
   [2] Move the sensor mounting plate in the front/back direction and then tighten the bolt in the position where the distance from the rear mower arm tip to the ground is 285.0 mm (11.22 in).

> **Important**
>
> Adjust the proximity sensor to detect the front end of the cam.

   [3] Make sure that the clearance of the cam and proximity sensor is 1.0 to 2.5 mm (0.04 to 0.10 in).



Adjustment of Up/Down Position_003

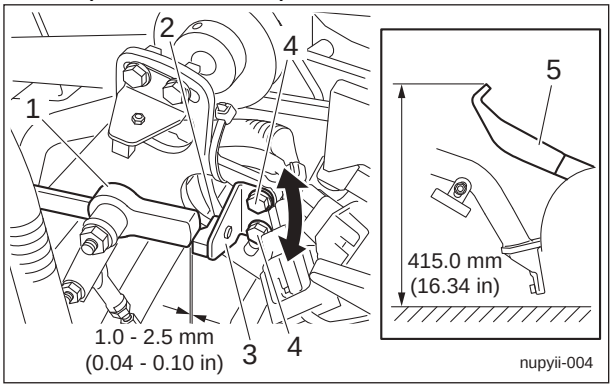
1	Cam
2	Proximity sensor (mower down position detection)
3	Sensor mounting plate
4	Bolt
5	Rear mower arm

8. Start the engine.
9. Raise the mower units.
10. Adjust the position of the proximity sensor (mower up position detection) by the following steps.
    [1] Loosen the bolt so that the sensor mounting plate can be moved.
    [2] Move the sensor mounting plate in the up/down direction and then tighten the bolt in the position where the distance from the rear mower arm tip to the ground is 415.0 mm (16.34 in).

Important

Adjust the proximity sensor to detect the rear end of the cam.

[3] Make sure that the clearance of the cam and proximity sensor is 1.0 to 2.5 mm (0.04 to 0.10 in).



Adjustment of Up/Down Position_004

1	Cam
2	Proximity sensor (mower up position detection)
3	Sensor mounting plate
4	Bolt
5	Rear mower arm

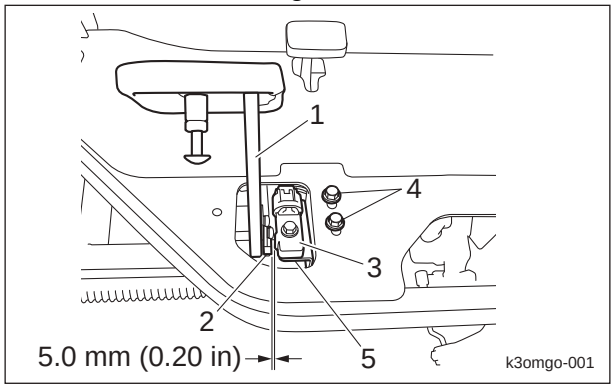
11. Start the engine.
12. Lower the mower units.
13. Install the rear mower unit.

Proximity Switch

Neutral Position of Traveling Pedal

Adjust the position of the proximity switch so that the clearance between the proximity switch and plastic magnet becomes within 5.0 mm (0.20 in) when the traveling pedal is in the neutral position.

1. Adjust it by loosening the bolt and by moving the sensor mounting board parallel to the plastic magnet.
2. Tighten the bolt being careful not to move the sensor mounting board.



Neutral Position of Traveling Pedal_001

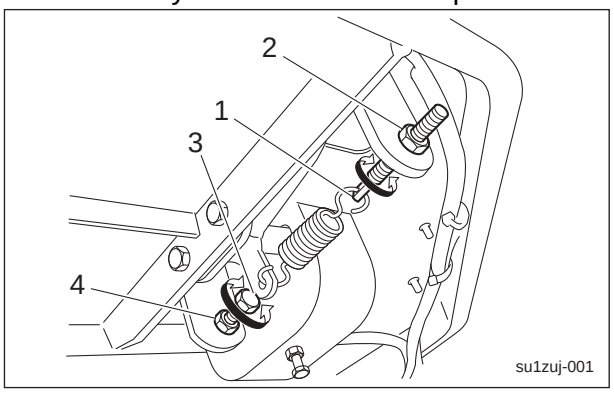
1	Traveling pedal
2	Plastic magnet for detection
3	Proximity switch
4	Bolt
5	Sensor mounting board

Limit Switch

Adjustment of Mower Pedal Switch

1. Loosen the nut and rotate the spring adjustment screw to the extent that there is no play in the spring.
2. Tighten the nut being careful not to rotate the spring adjustment screw.
3. Set the key switch to the "ON" position.
4. Loosen the nut and rotate the mower pedal stopper bolt to adjust the mower pedal, so that it stops in the position where it is tighten one revolution from the position where the switch is turned "ON" (LED (green) is turned on).
5. Tighten the nut being careful not to rotate the mower pedal stopper bolt.

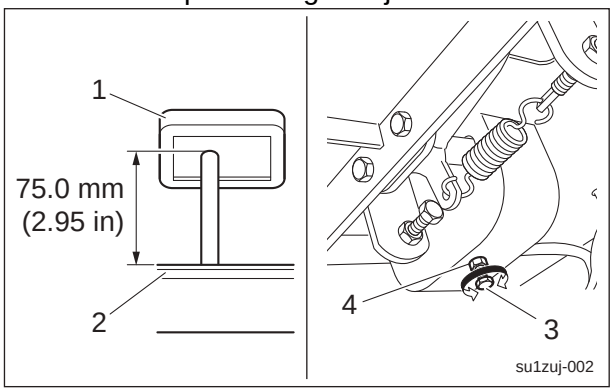
6. Set the key switch to the "OFF" position.



Adjustment of Mower Pedal Switch_001

1	Spring adjustment screw
2	Nut (for spring adjustment screw)
3	Mower pedal stopper bolt
4	Nut (for mower pedal stopper bolt)

7. Adjust the distance between the pedal back joint and the step to 75.0 mm (2.95 in) by loosening the nut and rotating the mower pedal height adjustment bolt.
8. Tighten the nut being careful not to rotate the mower pedal height adjustment bolt.



Adjustment of Mower Pedal Switch_002

1	Mower pedal
2	Step
3	Mower pedal height adjustment bolt
4	Nut (for mower pedal height adjustment bolt)

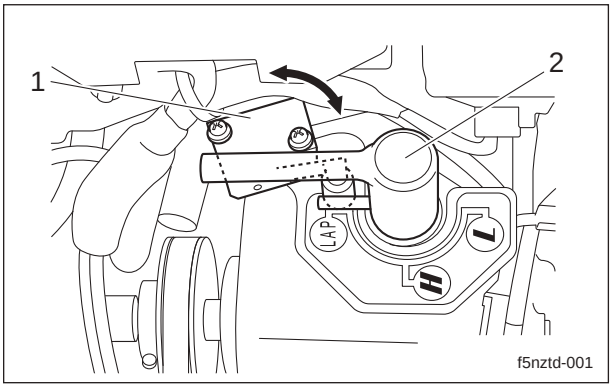
Adjustment of Back Lapping Switch

1. Loosen the back lapping switch attaching screw.
2. Set the transmission selector lever to the "LAP" position.
3. Adjust the switch angle so that the back lapping switch becomes "ON."

Important

Keep the lever part of the back lapping switch not touching the main body of the switch.
If the switch contact point is pressed more than a stroke of the switch, the switch may be damaged.

4. Tighten the back lapping switch attaching screw.



Adjustment of Back Lapping Switch_001

1	Limit switch (back lapping switch)
2	Transmission selector lever

Parking Brake Switch

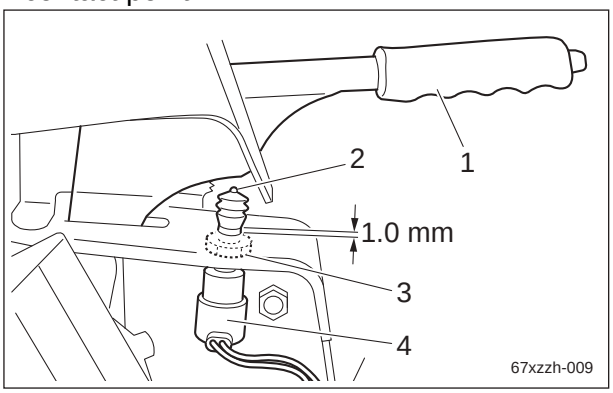
The parking brake is equipped with a parking brake switch, one part of the interlock system. The switch contact point is activated through the operation of the parking brake lever, controlling starting and stopping of the engine.

1. Apply the parking brake lever.

Important

After adjusting the parking brake wire, check that the machine is firmly stopped at notch 4 - 5.

2. With the parking brake at notch 4, adjust the adjustment nut of the parking brake switch to create a slight clearance at the switch contact point.



Parking Brake Switch_002

1	Parking Brake Lever
2	Switch contact point
3	Adjustment nut
4	Parking Brake Switch

Important

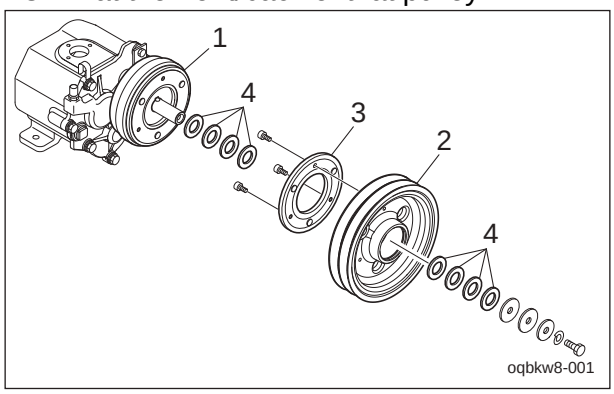
The screw part of the parking brake switch should not protrude by 1.0 mm (0.04 in) or more.
If the switch contact point is pressed more than a stroke of the switch, the switch may be damaged.

3. Release the parking brake, and then make sure that the switch contact point is pressed.
4. Follow the steps below to check the operation of the parking brake switch.
   [1] While sitting on the seat with the parking brake set to at least notch 4 and the reel switch set to the OFF position, check that the engine starts.
   [2] Check that the engine is stopped when you release the parking brake and leave the seat. (See " "Interlock system" (Page 5-9) ")

Electromagnetic Clutch

The electromagnetic clutch is composed of the main body of the clutch rotor and armature board.
It is installed between the transmission and the transmission driver pulley, and connected with the armature board installed to the pulley when the main body of the clutch is conducted, and transmits the drive of the engine to the transmission.

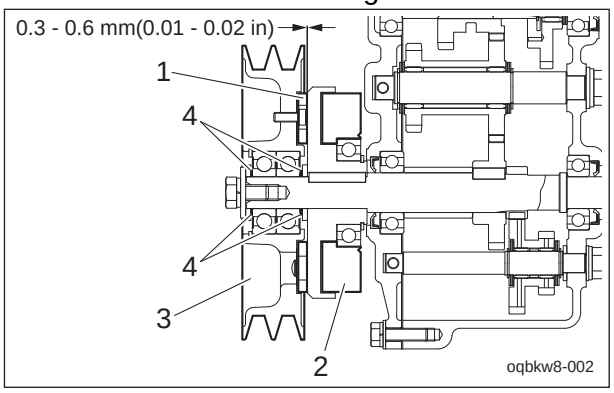
1. Remove the transmission drive belt and transmission drive pulley.
2. Install the pulley with placing two 0.1 mm shims, one 0.3 mm shim and one 0.5 mm shim at the front/back of that pulley. .



Electromagnetic Clutch_001

1	Main body of the clutch rotor
2	Pulley
3	Armature board
4	Shim

3. Measure the clearance between the main body of the clutch rotor and armature board to make sure that it is 0.3 - 0.6 mm (0.01 - 0.02 in).
   If it is out of the range, remove the pulley again and then adjust it by rearranging the shims in front/back of that pulley so that the clearance is within the range.



Electromagnetic Clutch_002

1	Armature board
2	Main body of the clutch rotor
3	Pulley
4	Shim

4. Install the transmission drive belt.
5. Make sure that the electromagnetic clutch works properly. "See "Electromagnetic Clutch" (Page 5-26) "

Electrical components

About the Electrical components

Warning

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

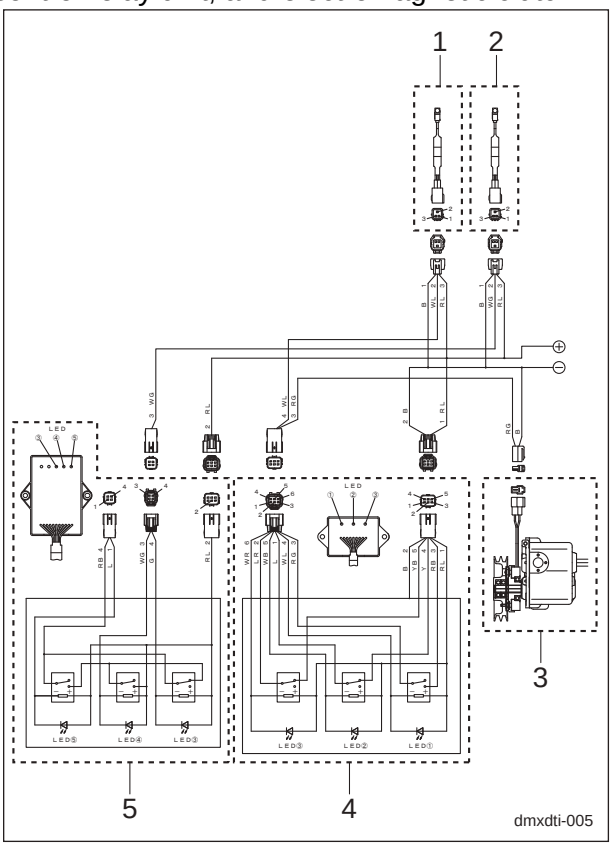
Safety Switches

The following devices are used as safety switches to prevent injuries and accidents due to operator inattentiveness.
Related to engine starting and operation (See " "Interlock system" (Page 5-9) ".)

- Seat switch
- Parking Brake Switch
- Proximity sensor (reel rotation switch)
- Proximity switch
- Limit switch (back lapping switch)

Reel Rotation Circuit

The rotation of the reel cutter is controlled by the proximity sensor (reel rotation switch), proximity sensor (reel rotation start position detection), interlock relay unit, mower unit control relay unit, and electromagnetic clutch.

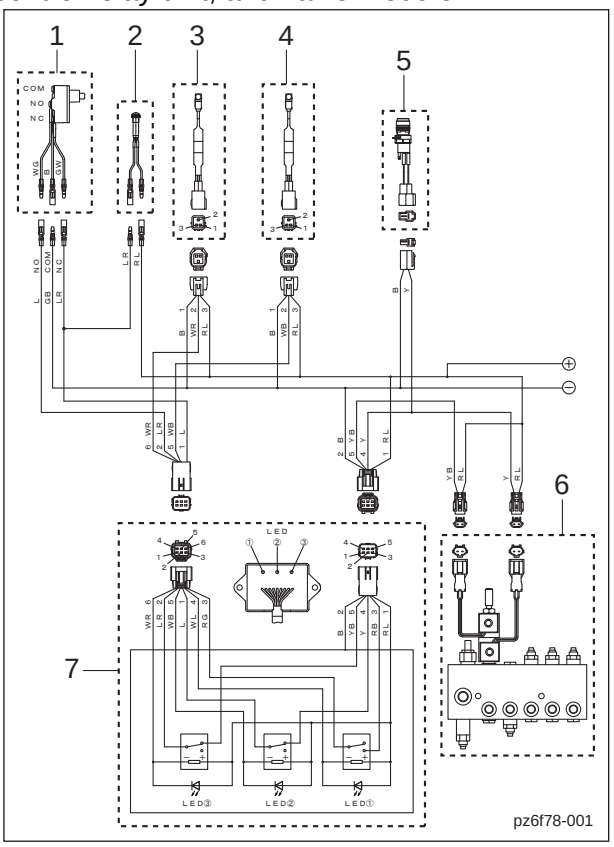


Reel Rotation Circuit_001

1	Proximity sensor (reel rotation start position detection)
2	Proximity sensor (reel rotation switch)
3	Electromagnetic clutch
4	Mower Unit Control Relay Unit
5	Interlock Relay Unit

Mower Unit Up/Down Circuit

The up/down motion of the mower unit is controlled by the limit switch (mower pedal switch), proximity sensor (mower unit up/down position detection), up switch, mower unit control relay unit, and valve module.

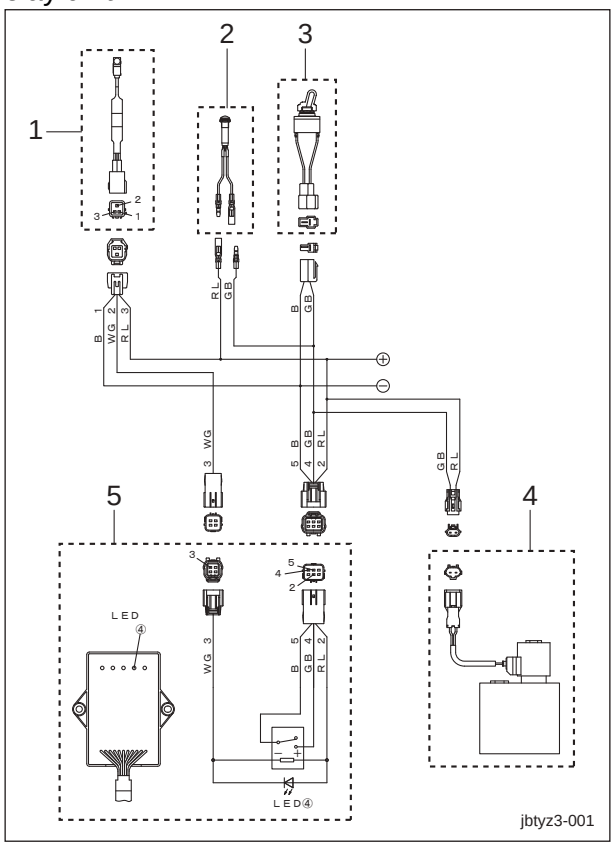


Mower Unit Up/Down Circuit_001

1	Limit switch (mower pedal switch)
2	LED lamp (green)
3	Proximity sensor (mower unit down position detection)
4	Proximity sensor (mower unit up position detection)
5	Up switch
6	Valve module
7	Mower Unit Control Relay Unit

2WD/3WD Changeover Circuit

2WD/3WD changeover is controlled by the proximity sensor (reel rotation switch), toggle switch (2WD/3WD changeover switch), 2WD/3WD changeover valve, and interlock relay unit.



2WD/3WD Changeover Circuit_001

1	Proximity sensor (reel rotation switch)
2	LED lamp (red)
3	Toggle switch (2WD/3WD changeover switch)
4	2WD/3WD Changeover Valve
5	Interlock relay unit