

Operation Manual

Maruyama Ride-on Control Machine

B S A — 5 0 0

Be sure to read before use.

Introduction

Thank you for purchasing a Maruyama product. This Operation Manual explains the correct handling of the product and how you can easily inspect and care for it, so that you can carry out your work safely and comfortably using the machine.

Before using the product, read this manual carefully and understand the contents fully so that the product will continue to demonstrate excellent performance.


After reading this manual, keep it in a safe place and reference it every time you have a question. Please note that information contained in this manual may not exactly match the product you purchased due to specification changes of the product, etc.

If you have any feedback on this product, please contact the Maruyama dealer or sales office near you.


■ Scope of Use


- This product is designed primarily for spraying chemicals over paddy fields and crop fields. Maruyama shall assume no responsibility for any accident caused by using the product outside the foregoing scope of use or accident arising from an unauthorized modification or disassembly.


■ Precautions

- The precautions contained in this manual and warning labels bearing  you see on the machine provide important items that may cause injury if neglected. Read these precautions and labels carefully and be sure to follow the instructions.

In this Operation Manual, particularly important handling precautions are denoted as follows:

 **Danger** --- Failure to follow this instruction will lead to death or serious injury.

 **Warning** --- Failure to follow this instruction may lead to death or serious injury.

 **Caution** --- Failure to follow this instruction may lead to injury.

Caution --- Failure to follow this instruction may lead to machine damage.

■ Lending the Machine to a Third Party

- Pass this Operation Manual/Safety Manual together with the machine and instruct the user to carefully read these manuals to understand the contents and get the hang of handling the machine, so that your friendly gesture will not turn into a tragedy. Same thing goes with your family. In particular, spend time explaining the prohibited items.



■ International Units

- This Operation Manual uses the units based on the new measuring system. Carefully read the table below to understand the conversion values before use.

Conversion Table

Item	Unit indication under new measuring system	Conversion	Conventional unit indication	Remarks
Area	[m ²] (square meters) [a] (are) [ha] (hectare)	10000 [m ²] = 1 [ha] = 100 [a] = 10 tanbu = 3,000 tsubo	[a] (are) [ha] (hectare) Tsubo, chobu, hanpo	*[1]
Rotational speed	[rpm] (revolutions per minute) [min ⁻¹] (per minute)	1 [min ⁻¹] = 1 [rpm]	[rpm]	*[2]
Force	[N] (Newton)	9.8 [N] = 1 [kgf]	[kgf] (weight kilogram)	
Moment of force	[N·m] (Newton meter)	9.8 [N·m] = 1 [kgf·m]	[kgf·m]	
Pressure	[Pa] (Pascal)	0.98 [MPa] = 10 [kgf/cm ²] 9.8 [Pa] = 1 [mmH ₂ O]	[kgf/cm ²] [mmH ₂ O]	
Work ratio/ drive power	[W] (watt)	735.5 [W] = 1 [PS] 9.8 [W] = 1 [kgf·m/s]	[PS] [kgf·m/s]	

* Notes

[1] [a] and [ha] may be used to indicate land areas.



[2] The number of revolutions per unit time is indicated as “rotational speed” not as “revolutions.”

Specifications

In this Operation Manual, products of different specifications are indicated as follows. Confirm the specification of the product you purchased to make sure you are referring to the correct product. All explanations apply to the BSA-500S, as a rule, and any difference in handling from the BSA-500S is explained by additional text every time.

- Specifications by tread Specification S (Tread 1200 mm)
Specification A (Tread 1320 mm)
Specification E (Tread 1500 mm)

Table of Contents

1	 For Safe Work	4
2	Name of Each Part	6
3	Main Specifications	8
4	 Handling of Warning Labels	9
5	Name and Function of Each Device	12
6	How to Travel/Transport	19
7	Pest Control Work	23
8	Maintenance	29
9	Piping Diagram	39
10	Causes of Failures and Remedial Actions	40

1 For Safe Work

The precautions you must observe to ensure safe work are explained below.

Other precautions are found in the main text, accompanied by  **Danger**,  **Warning**,  **Caution** and **Caution**.

Use this machine at an inclination angle of within 5° except when entering a field or installing the machine on a truck.

(1) Overview

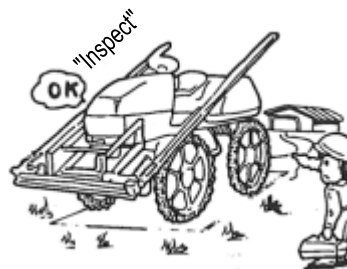
Carefully read the “Operation Manual (and operation manual of each option installed),” “Safety Manual” and instruction of the agrichemical used, to carry out work correctly and safely.

- [1] When carrying out work, be sure to wear protective gears appropriate for each work (helmet, mask and gloves) and proper clothes.
- [2] Before inspecting/servicing or repairing the machine, stop the engine on flat ground, apply the parking brake and remove the ignition key. Failure to do so may cause the machine to suddenly move, resulting in an accident.
- [3] **Keep non-operators (especially children) away from the area where pest control work is performed. Failure to do so may lead to an accident.**
- [4] Exercise due caution not to pollute water supply systems, rivers, ponds, lakes, etc.
- [5] Never refuel near a fire source as it may cause fire. Refueling while smoking is strictly prohibited.



(2) Items to Note before Operation

- [1] Carefully read the Operation Manual and become familiar with the machine operation.
- [2] Apply the parking brake on flat ground and be sure to perform startup inspection to prevent problems during pest control work. Maintenance, P. 29
- [3] Wipe clean all spilled fuel or oil. If not, fire may occur.
- [4] Dust, fuel or mud attached or deposited on the wires, muffler and engine area may cause fire, so inspect and clean these areas before starting the day's work.



(3) Starting the Engine

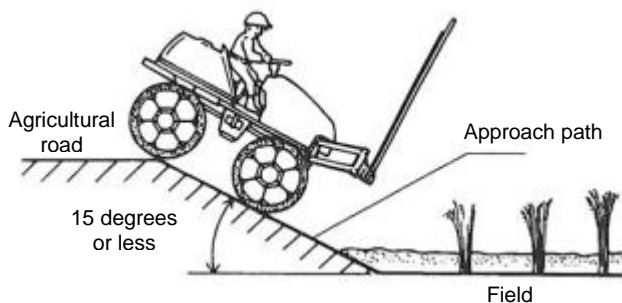
- [1] If the machine is operated indoors, exhaust gas will pollute the air and may cause gas poisoning. Open the windows and doors and provide sufficient exhaust ventilation.
- [2] Before starting the engine, look around carefully and give a cue to others indicating that the machine “will start moving.”

(4) Traveling

- [1] This machine cannot travel on local road and must be carried on a truck, etc., to the field.
- [2] This machine can carry only one person. No one except for the driver can ride the machine. Any consequence of the machine carrying a person or persons other than the driver will be the responsibility of the user.
- [3] Do not drive at high speed, take off suddenly, accelerate rapidly, apply emergency braking or make a sharp turn unless necessary.
- [4] Do not carry a load exceeding the maximum payload (reagent tank filled with water and attachments installed). Excessive loading will not only lead to machine damage, but it may also cause an accident.

(5) Entering/Exiting a Field (Refer to P. 23.)

- [1] Enter the field at low speed by orienting the machine vertically to the furrows.
- [2] If there are large height gaps or the approach path is soft, be sure to use footboards as you enter/exit the field. Failure to do so may cause the machine to tip over, creating a very dangerous situation.
- [3] Maintain the approach path so that the inclination angle of approach to the field is kept within 15 degrees.



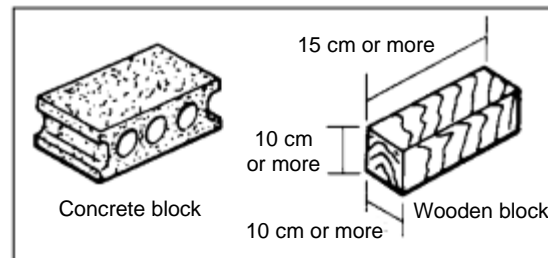
(6) Loading/Unloading to/from a Truck

(Refer to P. 22.)

- [1] When loading the machine to a truck, empty the reagent tank and drive the machine head in. When unloading the machine, drive the machine slowly in reverse.
- [2] Use a truck whose payload is 2,000 kg or more.
- [3] Move the machine slowly using anti-slip footboards of sufficient strength, length and width (30 cm or more).
- [4] Securely hook the footboards by leaving no height gap or misalignment on the load-carrying platform.
- [5] If the engine of the machine stalls during loading or unloading, immediately step on the brake pedal and then gradually release the brake to lower the machine onto the road.
- [6] Choose flat ground and load/unload the machine in the presence of/with guidance from the assistant.

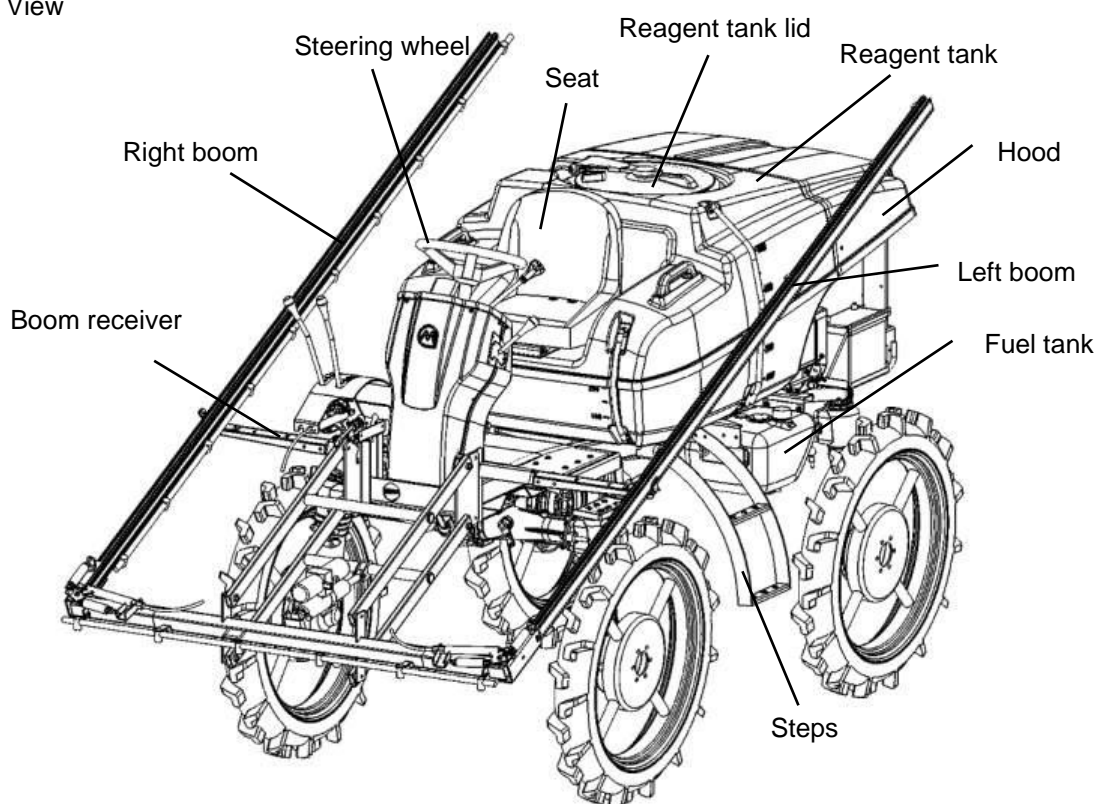
(7) Chocking the Tires

Prepare concrete blocks, wooden blocks or other objects that can be used to chock the tires so that the machine can be parked safely.

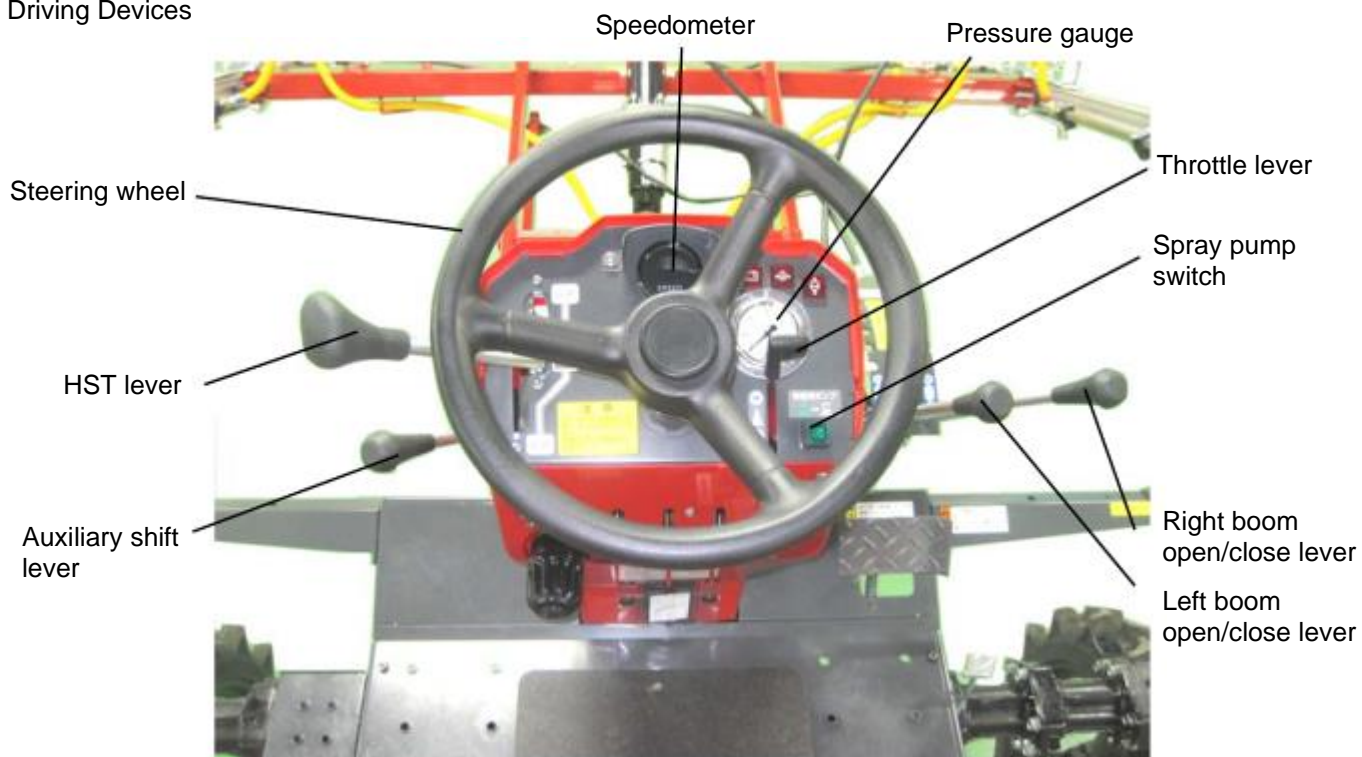


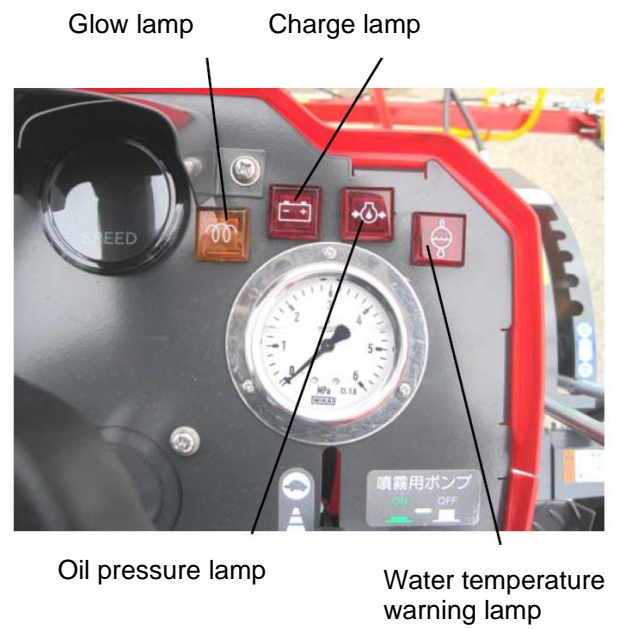
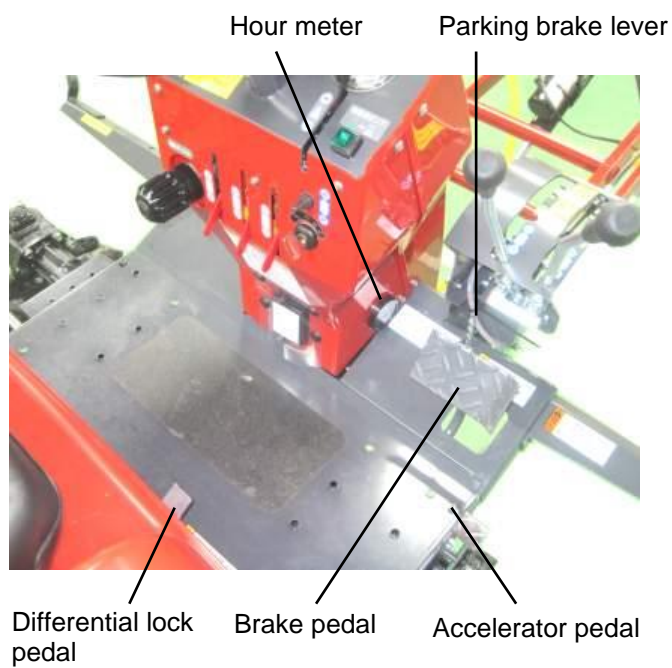
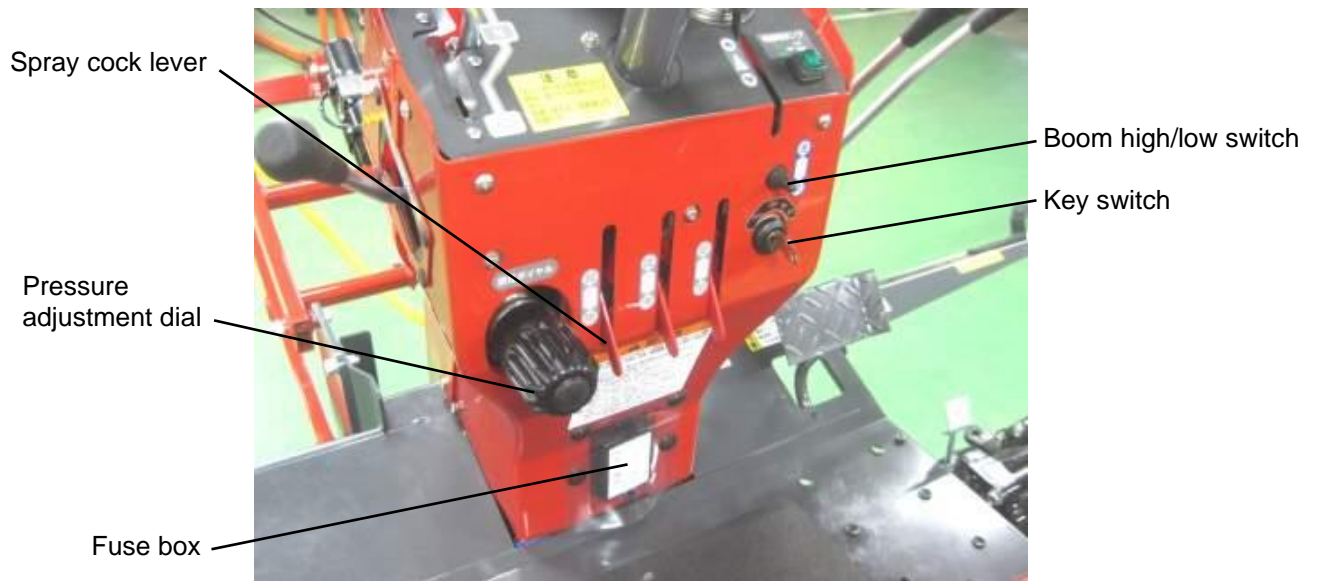
2 Name of Each Part

(1) External View



(2) Driving Devices





3 Main Specifications

Name		BSA-500		
Category		S	A	E
Machine dimensions *1	Overall length (mm)	3360		
	Overall width (mm)	1700		
	Overall height (mm)	2065		
	Wheelbase (mm)	1570		
	Tread (mm)	1200	1320	1500
	Effective ground clearance (mm)	800 (axle hosing)		
	Minimum ground clearance (mm)	755		
Mass (kg)		780	795	800
Engine	Name	D722-E3B-SSMR-2		
	Type	Water-cooled 4-cycle, 3-cylinder standing diesel engine		
	Total displacement (L)	0.719		
	Rated output (kW(PS)/rpm)	10.7(14.5)/2900		
	Fuel tank capacity (L)	20		
	Starting method	Cell starter		
Traveling gears	Type	4WD·4WS		
	Steering system	Full hydraulic power steering		
	Shift gears	HST (variable shift), 2 auxiliary shift gears		
	Traveling speed (km/h)	Moving: 0 to 10 / Spraying: 0 to 4.0		
	Brake (also used as parking brake)	Wet, multi-disk, mechanical type		
	Tires (front/rear)	120/90-26 4PR (Air pressure: 240 kPa)		
	Battery	60B24R		
Reagent tank capacity (L)		500 (545 max.)		
Agitation method		Jet agitation		
Spray pump	Name	MS620S		
	Type	Lateral triple piston type		
	Rotational speed (rpm)	1470		
	Water absorption (L/min)	60		
	Pressure (MPa)	2.5		
Pest control devices	Boom device type	Both arms can be manually opened/closed, up/down movements are powered		
	Nozzle type	Ceramic cone nozzle		
	Number of nozzles	26		
	Number of divisions	3		
	Spray width (m)	7.8		
	Ground clearance of nozzle (mm)	475 to 1545		

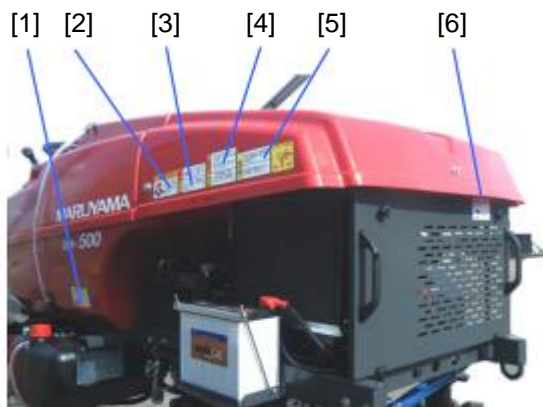
*1. The dimensions assume that the booms are stored on the boom receivers.

4 ⚠ Handling of Warning Labels

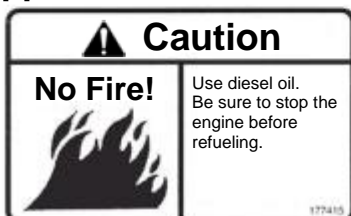
* Warning labels are attached on this machine. Carefully read these labels and understand the contents before commencing work. Peruse the following information provided on the labels.

⚠ Warning

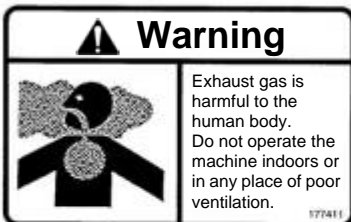
- Constantly remove soiling and mud over the labels so that the information provided on them remains clearly visible.
- Replace damaged warning labels with new ones.
- If a part on which a warning label is attached has been replaced, be sure to attach a new label on the new part at the same location.



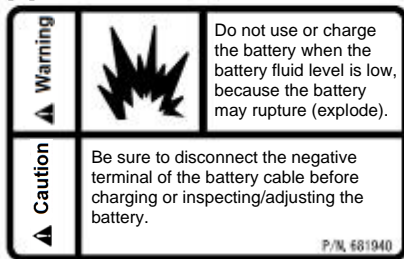
[1] Part No. 177415



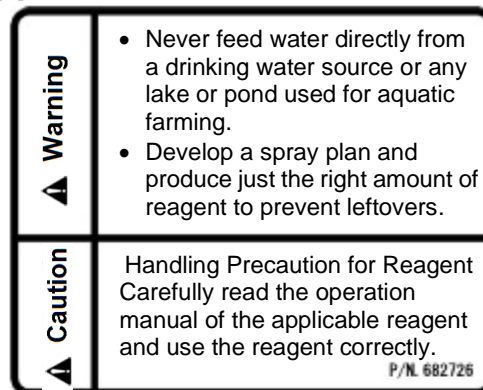
[2] Part No. 177411



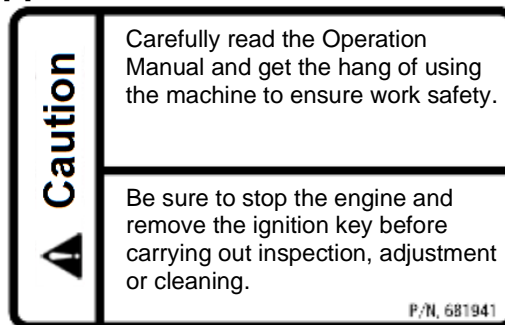
[3] Part No. 681940



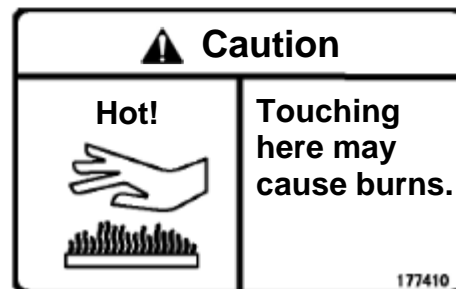
[4] Part No. 682726



[5] Part No. 681941



[6] Part No. 177410

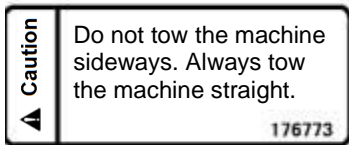


[7]



[8]

[7] Part No. 176773

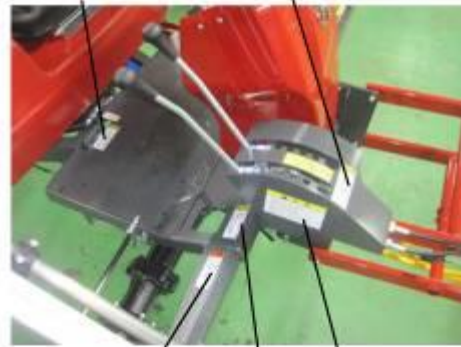


[8] Part No. 178056



[9]

[13]

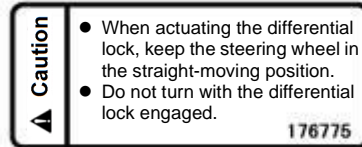


[10]

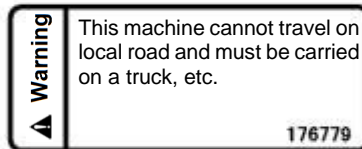
[11]

[12]

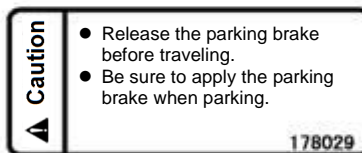
[9] Part No. 176775



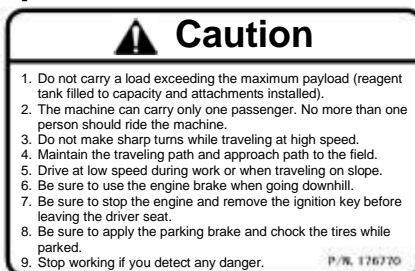
[10] Part No. 176779



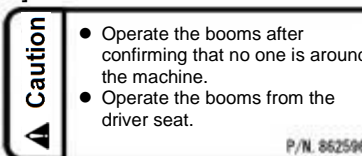
[11] Part No. 178029



[12] Part No. 176770



[13] Part No. 862596





[14]

[14] Part No. 681939



Warning

Wear clothes that properly fit your body. Prepare protective clothes, protective mask, protective glasses, rubber gloves, work shoes (boots), etc., and dress safely during work.

Be sure to follow the instructions below when loading/unloading the machine to/from a truck:

1. Load/unload the machine on flat ground in the presence of/with guidance from the assistant.
2. Keep people away from the machine.
3. Use anti-slip footboards of sufficient strength, length and width.
4. Keep the inclination angle of footboards to 15 degrees or less.
5. Empty the reagent tank and load/unload the machine at low speed.
6. If the engine of the machine stalls during loading or unloading, immediately step on the brake pedal and then gradually release the brake to lower the machine onto the road. Never step on the clutch pedal first.
7. Once the machine has been loaded, stop the engine, put the shift lever in a gear other than Neutral, apply the parking brake, and pass ropes over the specified locations to secure the machine.

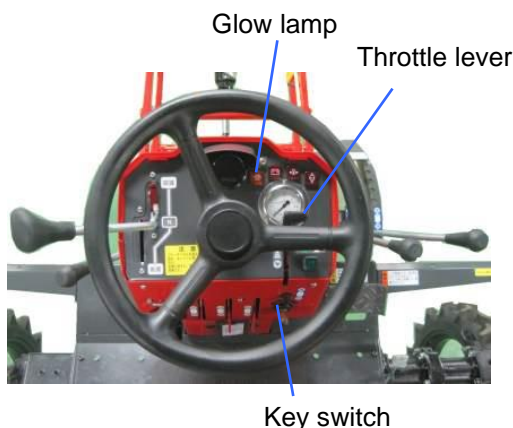
Be sure to follow the instructions below when entering/exiting a field:

1. Enter/exit the field at low speed by orienting the machine perpendicular to the inclination.
2. Never enter the field diagonally as the machine may tip over.
3. Keep the inclination angle of approach to the field to within 15 degrees and if the approach path is soft, firm up the foundation with pebbles, concrete, etc.

P.N. 681939

5 Name and Function of Each Device

■ Relating to Engine Operation



(1) Key Switch

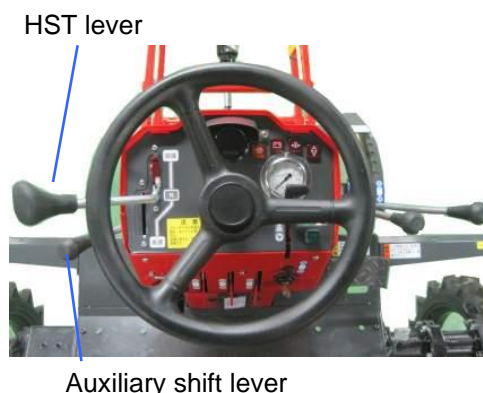
- "OFF" --- The engine is stopped.
Current does not flow. The ignition key is inserted and removed in this position.
- "ON" --- The engine is turning.
Current flows to each electrical component.
- "GL" --- The glow lamp turns on. When the hand is released in this position, the switch will automatically return to the "ON" position.
- "ST" --- The cell motor turns to start the engine.
When the engine has started, immediately release the hand. When the hand is released, the switch will automatically return to the "ON" position.

● Because of the starting safety device, the engine will not start unless the auxiliary shift lever is put in the "N – Start" position.

(2) Throttle Lever

Pull the throttle lever toward you to turn the engine at high speed, or tilt it forward for low speed operation. When traveling on the machine, use the accelerator pedal to adjust the engine speed.

■ Traveling Operation



(1) HST Lever

Tilt the lever forward from the "N" position to move forward, or tilt it rearward to move in reverse. The more you tilt the lever, the higher the machine speed becomes.

(2) Auxiliary Shift Lever

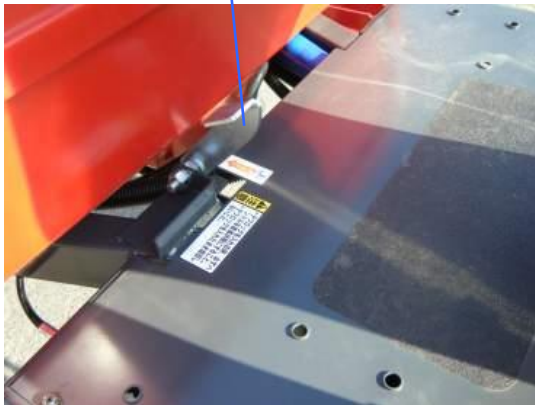
There are two shift gears: one for traveling (high speed) and the other for spraying (low speed). To start the engine, put the auxiliary shift lever in the "N – Start" position.

Caution

- To perform auxiliary shift operation, put the HST lever in the "N" position and be sure to stop the machine. If the auxiliary shift lever is operated before the machine stops completely, the auxiliary transmission may be damaged.

(3) Differential Lock Pedal

Differential lock pedal



The differential lock device allows the front and rear tires on the left and right to be driven at the same speed. This is useful in preventing slips. The differential lock is actuated when the differential lock pedal is depressed, and cancelled when the pedal is released.

Use this function in the following situations:

- [1] The wheels on one side slip when going up/down an agricultural road or going over a furrow and the machine cannot move straight.
- [2] The machine gets into an area of soft ground in the field and encounters difficulty traveling due to slipping wheels.

Caution

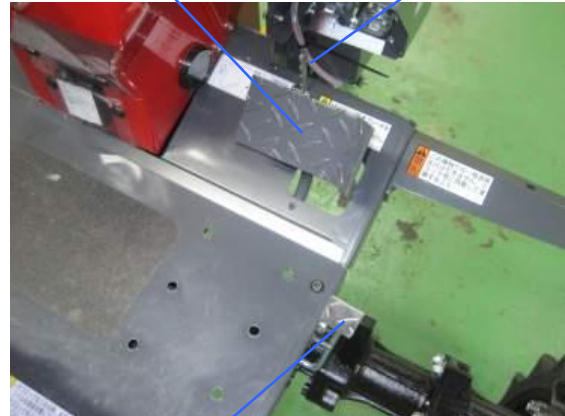
- Before actuating the differential lock, be sure to adjust the steering wheel to the straight-moving position. Also remember not to turn while the differential lock is actuated. The machine may not turn in the intended direction.

Caution

- Be sure to cancel the differential lock before turning. If the machine is turned forcibly with the differential lock on, the drivetrain may be damaged.

Brake pedal

Parking brake lever



Accelerator pedal

(4) Brake Pedal

Stepping on this brake applies brake to the machine.

(5) Parking Brake

Depress the brake pedal fully and hook the parking brake lever to the brake pedal. To release the brake, depress the brake pedal fully once again.

Caution

- Before leaving the machine, stop the engine and be sure to apply the parking brake, remove the ignition key, and chock the tires.

(6) Accelerator Pedal

While traveling, use the accelerator pedal to adjust the engine speed. Step on the accelerator pedal to raise the engine speed, or release it to run the engine idle.

(7) Power Steering Wheel

This hydraulic steering wheel is used to turn the machine or change its course.

Caution

- **Avoid static steering (turning the steering wheel when the machine is not traveling), because it will cause the tires, rims, etc., to wear quickly.**

(8) Speedometer

Speedometer

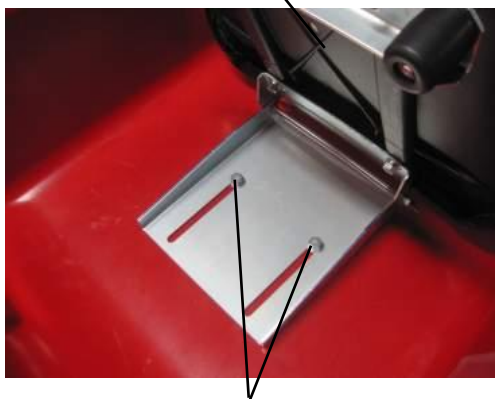


The traveling speed (km/h) is indicated.

- * The indicated speed assumes a tire slip factor of 5%.
- * If the tires are slipping in a field, etc., the actual traveling speed may differ from what is indicated by the speedometer.

(9) Seat

Seat

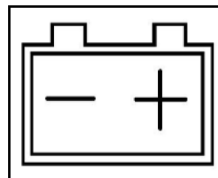


Hexagonal bolts

You can loosen the hexagonal bolts to slide the seat forward and backward. Once the seat position has been adjusted, securely tighten the hexagonal bolts.

(10) Warning Lamp

- Charge lamp (charge warning lamp)

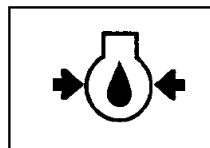


This lamp turns on to warn when a charge system error is detected while the engine is turning.

Caution

- **If this lamp turns on, stop the engine and inspect the fan belt. If the belt is normal, have the machine inspected by the Maruyama dealer near you.**

- Oil pressure lamp (oil pressure warning lamp)

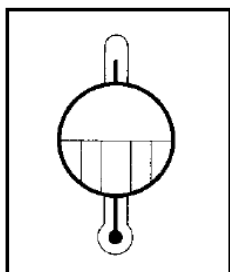


This lamp turns on to warn when the pressure of oil lubricating the engine interior drops while the engine is turning.

Caution

- **If this lamp turns on while the engine is turning, immediately stop the machine in a safe place and stop the engine, and contact the Maruyama dealer near you.**
 - **Continuing to travel on the machine despite the lamp remaining on may damage the engine.**
 - **The oil pressure warning lamp does not indicate insufficiency of oil. Check the oil amount using the oil level gauge.**
- Checking/adding engine oil: P. 33**

● Water Temperature Warning Lamp



This lamp turns on to warn when the engine is overheated.

Caution

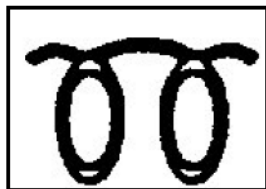
- Never remove the radiator cap immediately after the engine has stopped or while the engine is turning, because it will cause burns. Wait for the water temperature to drop, and then put a piece of cloth, etc., over the radiator cap and remove the cap slowly.

Caution

- If this lamp turns on, move the machine to a well-ventilated place and keep the engine idle. When the water temperature warning lamp turns off, stop the engine and check if the engine oil or cooling water level is low, check the fan belt tension, and also check the radiator core and air cleaner for clogging. If the lamp turns on frequently, have the machine inspected by the Maruyama dealer near you.

(11) Monitor Lamp
(operation status check indicator lamp)

● Glow lamp (preheating indication)



This lamp turns on if the key switch is in the "GL" position when starting the engine. It turns off once preheating is complete.

■ Relating to Pest Control

(1) Pressure Adjustment Dial

Adjust the discharge pressure of the spray pump. While monitoring the pressure gauge, turn the pressure adjustment dial to a desired pressure.



Pressure adjustment dial

(2) Pressure Gauge

The pressure adjusted with the pressure adjustment dial is indicated.

Pressure Gauge



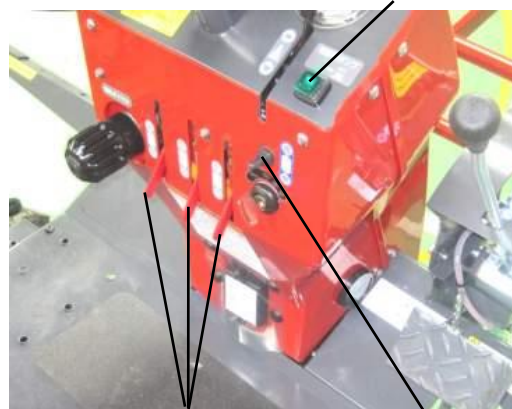
(3) Spray Cocks

Raising the lever causes reagent to be sprayed from the boom nozzle. A desired spray location can be selected from among the left, center and right bottom nozzles.

(4) Spray Pump Switch

Pressing the pump button turns the spray pump.

Spray pump switch



Spray cocks

Boom high/low switch

(5) Boom High/Low Switch

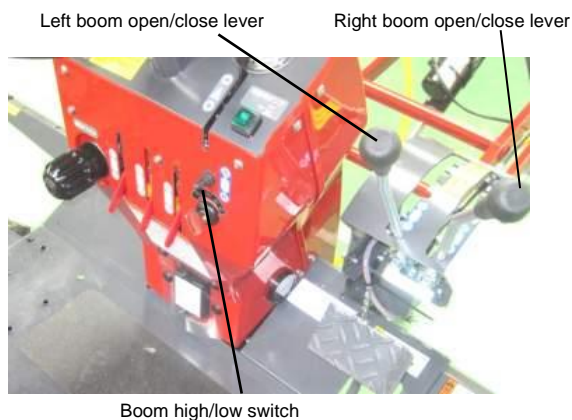
Turn this switch up/down to adjust the height of the entire boom.

(6) Left Boom Open/Close Lever

Tilt the lever to the left and remove it from the cutout groove and then press it forward to open the left boom. Pull the lever backward to close the left boom. After the operation, make sure the lever is securely engaged in the cutout groove.

(7) Right Boom Open/Close Lever

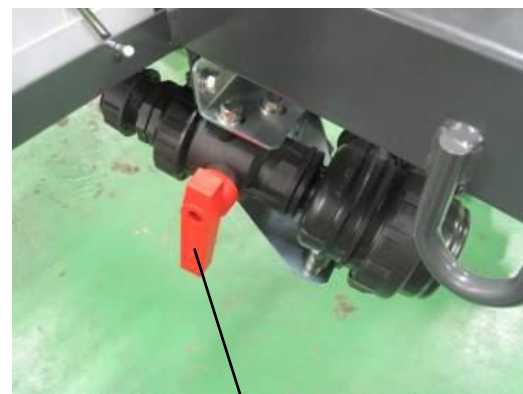
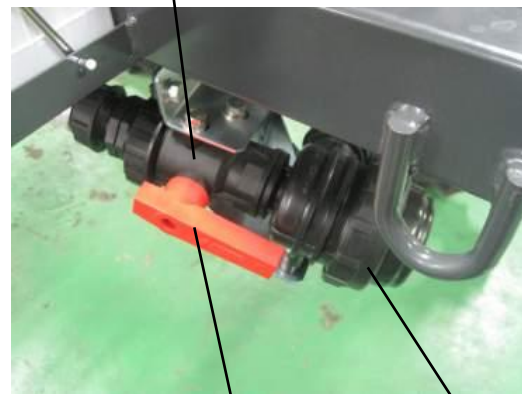
Tilt the lever to the left and remove it from the cutout groove and then press it forward to open the right boom. Pull the lever backward to close the right boom. After the operation, make sure the lever is securely engaged in the cutout groove.



- Sit in the driver seat and if operating the lever of each boom is difficult, stop the machine temporarily and apply the parking brake, and then stand on the driver seat and operate the lever.
- The switch can be operated with a small force. Do not apply an excessive force on the switch.

(8) Water Absorption Strainer/Water Filter Net

Water absorption strainer



Water filter net



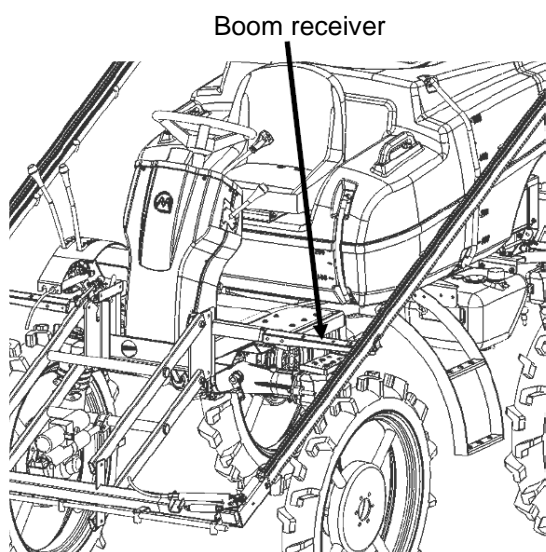
Caution

- The water strainer/water filter net filters dust, etc., so be sure to clean the strainer/net after work.

- [1] Keep the two-way cock in the “Spray” position during spraying or while the jet pump (optional) is used.
- [2] When cleaning the water absorption strainer, keep the two-way cock in the “Stop” position if the reagent tank contain reagent.
- [3] To discharge the remaining liquid from the reagent tank, put the two-way cock in the “Stop” position to remove the cap, and then put it in the “Spray” position to discharge the remaining liquid.

(9) Boom Receiver

Keep the left and right booms on the boom receivers while traveling or during transport.



Caution

- Do not operate the booms while the booms are secured on the boom receivers with ropes, etc., because doing so may damage the booms.

■ Other

(1) How to Install/Remove the Rear Cover



[1] To remove the rear cover, loosen the two knob bolts on the left and right and hold the left and right handles of the rear cover to remove the cover.

⚠ **Caution**

- Never open the rear cover while the engine is turning. Since the rotating parts are exposed, injury accidents may occur.
- Do not touch the muffler while hot. It may cause burns.
- After installing the rear cover, be sure to tighten the knob bolts strongly. If the knob bolts are not tightened sufficiently, they may detach and fall during transport, causing accidents.

(2) Tires

The wheelbase can be adjusted by reversing the tires or adding spacers (optional).

⚠ **Caution**

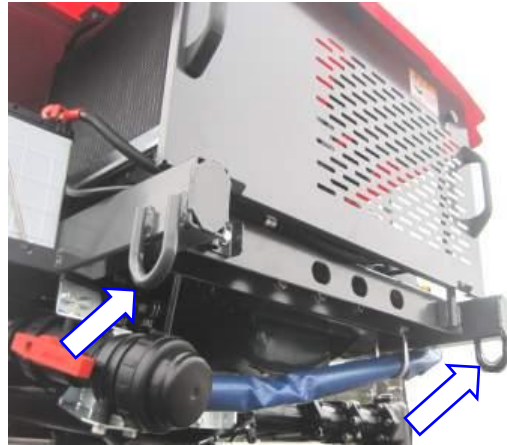
- Never use spacers other than those provided as options.

(3) Towing Hooks

[Front of Frame]



[Rear of Frame]



If the machine gets stuck in a field, use these hooks to pull the machine forward/backward. When doing this, keep the booms at the top positions.

⚠ **Warning**

- Do not use the towing hooks to tow other machine, etc. It may cause the machine to tip over.

⚠ **Caution**

- Never pull the towing hooks sideways. The hooks may detach easily and also cause the machine to tip over.

Caution

- Never pass ropes, etc., over the boom devices and pull the ropes. The machine will be damaged.

6 How to Travel/Transport

■ How to Start/Stop the Engine

(1) How to Start

Warning

- To ensure safety, apply the parking brake, put the auxiliary shift lever in the “N – Start” position and put the HST lever in the “N” position before starting the engine.
- Provide sufficient ventilation when starting the engine indoors. Failure to do so may cause exhaust gas poisoning.

Caution

- Before starting the engine, check the surrounding areas to ensure safety and also confirm that the cover is closed.

Caution

- Once the engine is started, do not apply load but simply warm up the engine for approx. 5 minutes so as to spread oil to each metal area fully. Take note that, if load is applied immediately after the engine is started, breakdown may occur due to seizure, damage, etc.

Start the engine from the driver seat after giving a cue to people around the machine and also checking the surroundings to ensure safety.

- [1] Apply the parking brake.
- [2] Put the HST lever in the “N” position and auxiliary shift lever in the “N – Start” position.
- [3] Insert the ignition key in the key switch.
- [4] Tilt the throttle lever forward for “low speed” operation.
- [5] Turn the key switch to the “GL” position and keep it in this position until the glow lamp turns off.
- [6] Turn the key switch key to the “ST” position. Once the engine has started, release the switch. The key switch will automatically return to the “ON” position.
- [7] Check each warning lamp to confirm that the engine is normal. If any warning lamp is on, immediately stop the engine and take an appropriate measure. If you hear abnormal noise different from what you hear every day, stop the engine and investigate the cause. If the cause cannot be identified, contact your Maruyama dealer.
- [8] Warm up the engine for 5 minutes before commencing work.

Warning

- Warm up the engine outdoors to prevent exhaust gas poisoning.

Caution

- Be sure to apply the parking brake and keep your eyes on the machine while the engine is warming up.
- If the engine does not start with the first try on a cold day, etc., repeat preheating and try starting the engine. Do not turn the cell motor for more than 10 to 15 seconds. Before restarting the engine, wait for 30 seconds to restore the battery voltage.
- Do not turn the key switch to the “ST” position while the engine is turning.
- The engine is still cold immediately after the start, so do not rev up the engine or raise the engine speed unnecessarily. It may cause breakdown.
- Check the exhaust condition for abnormality and if any abnormality is found, immediately stop the engine and change fuel or oil, or contact your Maruyama dealer.

(2) How to Stop

- [1] Push the throttle lever forward to lower the engine speed.
- [2] Let the engine operate at the low speed for approx. 5 minutes to cool down.
- [3] Turn the key switch to the “OFF” position.

(3) Break-In Operation

Caution

- How the machine is handled when new (during initial 50 hours) affects the life and performance of the machine. In particular, pay attention to the items specified below during this period.

- [1] Fully warm up the engine before commencing work.
- [2] Change oils according the Oil Change Table after initial 50 hours of operation. (Refer to P. 32.)

■ How to Travel

Warning

- This machine cannot travel on local road and must be carried on a truck, etc., to a field.

Caution

- When taking off, check the surroundings to ensure safety.
- Before leaving the machine, be sure to apply the parking brake, stop the engine and remove the ignition key. Otherwise, an unexpected person may touch the machine when no one is around and cause an accident.

(1) Taking Off

- [1] Put the HST lever in the “N” position and auxiliary shift lever in the required position.
- [2] Release the parking brake.
- [3] Gradually tilt the HST lever in the required position to take off.

Caution

- When taking off, thorough check not only the rear, but also the left and right and be careful not to let the booms contact people or obstacles.
- Operate the HST lever slowly. Quick operation may cause the machine to take off or stop suddenly, creating a dangerous situation.
- While traveling, do not keep your foot on the brake pedal.

(2) How to Travel

Caution

- Do not carry anyone other than the driver, or objects.
- Wear a helmet to ensure safety.
- Exercise due caution and lower the speed when going through a narrow agricultural land or on a road with shoulders, Trim weeds to expose the road shoulders.

- Adjust the traveling speed using the HST lever, throttle lever and accelerator pedal.
- Drive according to the traffic rules even on private roads or on agricultural land.

Caution

- When traveling, be sure to store the booms on the boom receivers. If the booms are floating on the boom receivers, the booms will be damaged as a result of traveling.

(3) How to Stop

- [1] Slowly return the HST lever to the “N” position to stop the machine.
- [2] Tilt the throttle lever forward to lower the engine speed.

Caution

- After you have stepped on the brake pedal and the machine has stopped, be sure to put the HST lever in the “N” position; otherwise, the machine may take off suddenly and create a dangerous situation.
- Before leaving the machine, remove the ignition key to ensure safety.

(4) Auxiliary Shift Operation

- [1] Stop the machine fully.
- [2] Shift the auxiliary shift lever to the required position.

Caution

- Do not perform shift operation while traveling. It may cause breakdown.

(5) How to Park

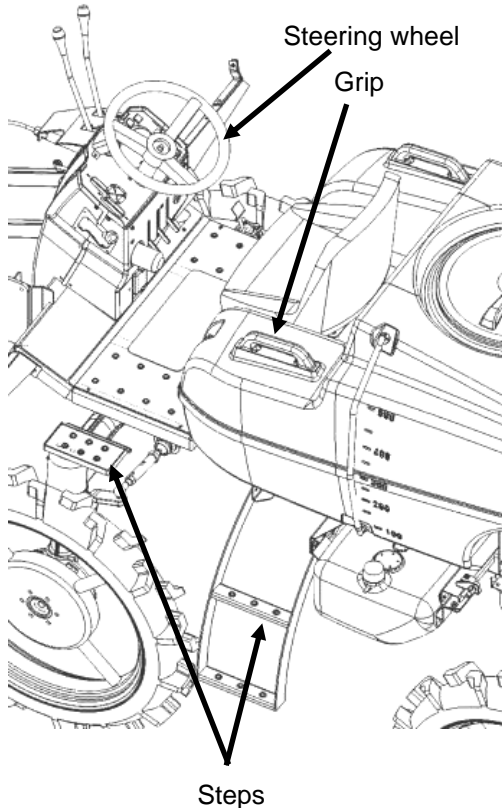
- [1] Apply the parking brake.
- [2] Stop the engine.
- [3] Chock the wheels.

Caution

- When parking, stop the engine, apply both the parking brake and chocks, and be sure to remove the ignition key.

(6) How to Get In/Out

- [1] Get in/out of the machine using the grip and steps.
- [2] When getting out of the machine, operate the boom high/low switch to move each boom to the highest possible position and get off facing backward (in the same posture in which you got in the machine).



Caution

- Do not grab the steering wheel. The machine may tip over.
- Be sure to get off the machine facing backward. If you get off the machine facing forward, the machine may tip over.

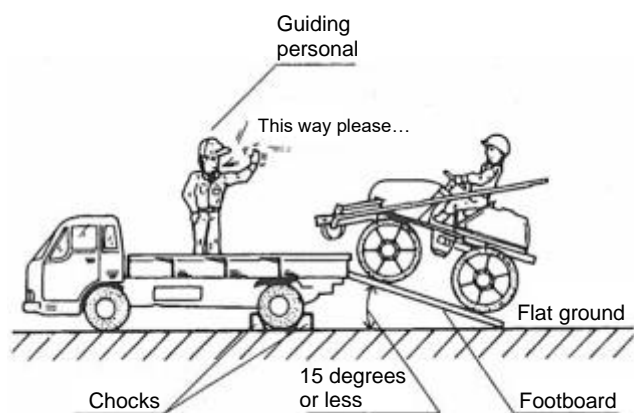
■ ⚠ How to Load/Unload to/from a Truck

Loading/unloading the machine to/from a truck involves great danger. Observe the following instructions and exercise due caution to safety when loading/unloading the machine to/from a truck.

⚠ Warning

- Load/unload the machine on flat ground in the presence of/with guidance from the assistant. Also, keep people away from the machine.
- The guiding person must not stand immediately in front of or at the back of the machine.
- Load/unload the machine when the reagent tank is empty.
- Use anti-slip, hook-type footboards of sufficient strength, length and width.
- Securely hook the footboards by leaving no height gap or misalignment on the load-carrying platform.

Length	At least four times the load-carrying platform of the machine
Width	30 cm or more
Quantity	2 pcs
Strength	Each board should be able to withstand at least 750 kg of mass.



- [1] Use a truck whose maximum payload is 2,000 kg or more.
- [2] Put the shift lever on the truck in the "1st" or "R" position, pull the parking brake, and apply chocks.
- [3] Empty the reagent tank and drive forward to load the machine. Move at a very low speed by tilting the HST lever forward slightly, with the auxiliary shift lever in the spray position. When unloading, drive in reverse in the same manner.
- [4] If the engine of the machine stalls during loading or unloading, immediately step on the brake pedal and then gradually release the brake to lower the machine onto the road.
- [5] Once the machine has been loaded onto the truck, apply the parking brake.
- [6] During transport, secure the booms to the boom receivers with ropes, etc., to prevent the booms from opening.
- [7] Pass ropes at the front and rear towing hooks to secure the machine.
- [8] Be sure to close the gate of the truck.

Caution

- If ropes are passed at positions other than the towing hooks, the machine may be damaged.
- When securing the machine to the truck, do not tighten the wire ropes with an excessive load exceeding 500 kg.
- Do not operate the booms while they are secured to the boom receivers with ropes, etc., because the booms may be damaged.

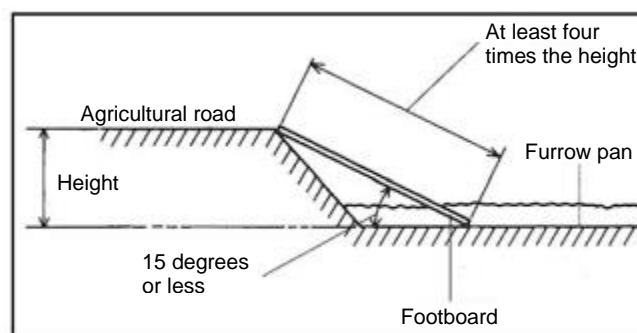
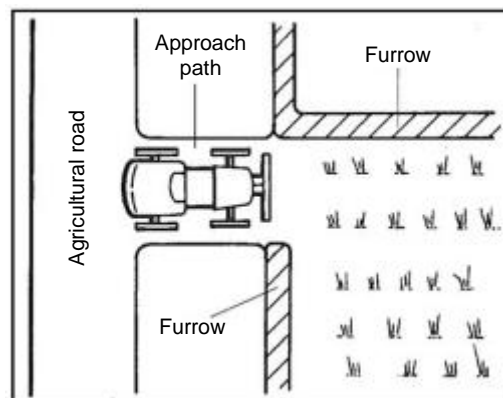
7 Pest Control Work

■ ⚠ How to Enter/Exit a Field

Pay due attention when entering a field from road.

⚠ Warning

- Enter/exit a field at a very slow speed by tilting the HST lever forward slightly, with the auxiliary shift lever in the spray position. When entering, also orient the machine perpendicular to the furrows. If the machine is diagonal, it may tilt sideways and tip over, causing an accident.
- Maintain the approach path so that the inclination angle of approach to the field is kept within 15 degrees.
- If the approach path to the field is soft, or the inclination angle is 15 degrees or more, be sure to use footboards to keep the inclination angle within 15 degrees.
- * If the length of the approach path is at least four times the height of the road from the field, the inclination angle is within 15 degrees.
- When going over a furrow, be sure to approach by orienting the machine perpendicular to the furrow and use footboards whenever possible. Move slowly with the auxiliary shift lever in the spray position.



■ How to Feed Water

(1) Adding the Required Amount of Water in the Reagent Tank

- * If no water supply facility is available, a jet pump (optional (sold separately)) would be useful.

(2) How to Operate the Jet Pump

- [1] Prime around 20 L of water into the reagent tank.
- [2] Connect the pipe from the jet pump to the cock connected to the spray pump, and open the cock.



Cock

- [3] Throw the strainer end of the jet pump into the water source and insert the opposite end to the water inlet of the reagent tank.
- [4] Close the spray cock fully.
- [5] Put the throttle lever in the idling position and press the spray pump switch to start feeding water.

⚠ Warning

- Never feed water directly from a drinking water source or any lake or pond used for aquatic farming.

■ Reagent Preparation and Handling

(1) Reagent Preparation

- [1] Before preparing the reagent, check the spray condition with water.
(Refer to P. 25.)
- [2] Prepare only the required amount using a dedicated container.
- [3] Dissolve the water-dispersible powder well with a small amount of water and then add the diluted powder.
- [4] Confirm that the spray cock is in the "Closed" position and liquid feed valve is "Open," and then press the spray pump switch. The spray pump will actuate and agitation will start in the reagent tank at the same time.
- [5] Put the reagent in the reagent tank by making sure it does not spill out of the tank, and agitate the reagent fully.

⚠ Caution

- The spray pump and jet agitation are interlocked. Once the spray pump stops, jet agitation also stops. Do not stop the spray pump while reagent remains in the tank, because chemical damage may occur.

Caution

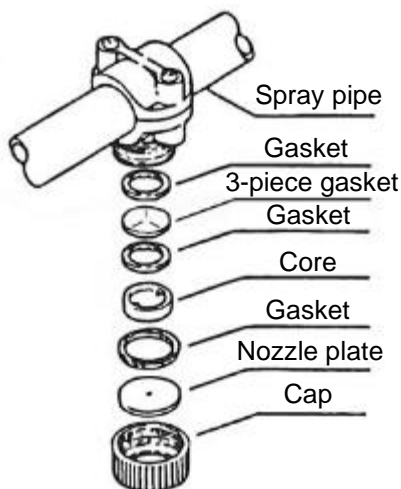
- Carefully read the operation manual of the applicable reagent and use the reagent correctly.
- Be sure to use the water filter net and when the spraying is over, clean the net together with the water absorption strainer.

■ Spray Inspection

(1) Opening the Spray Cock and Checking the Spray Condition

- [1] Inspect the nozzle for clogging due to dust, etc.
- [2] Check the open/close condition of each spray cock (left nozzle, center nozzle and right nozzle).

- Long hours of use causes the nozzle plate to wear and discharge flow rate to increase. When this happens, replace the nozzle plate.



- Types and quantities of standard factory-set nozzles

Left boom	φ1.6 x 10 pcs
Center boom	φ1.6 x 6 pcs
Right boom	φ1.6 x 10 pcs

- Table of nozzle discharge flow rates (per nozzle)
(L/min)

	1.0MPa	1.5MPa	2.0MPa
φ 1.0	0.53	0.66	0.77
φ 1.1	0.60	0.73	0.85
φ 1.2	0.66	0.82	0.96
φ 1.3	0.73	0.89	1.05
φ 1.4	0.78	0.98	1.12
φ 1.5	0.86	1.09	1.28
φ 1.6	0.96	1.20	1.39

⚠ Caution

- Be sure to use water when inspecting the spray condition.

■ Spray Plan

⚠ Warning

- Make the spray planning so that there won't be any chemical left.

(1) Spray Planning

In spray planning, determine the spray amount per unit area (spray amount per 10 a) first, and then select the spray speed and obtain the nozzle pressure. The nozzle pressure can be obtained using quick calculation diagrams.

(2) How to Use the Quick Calculation Diagrams

You can use the quick calculation diagrams to obtain the nozzle pressure with ease.

“Example”

- [1] Spray speed: 2.7 km/h
- [2] Spray amount: 100 L per 10 a
- [3] Use a standard cone (ceramic) φ1.6 nozzle.
- [4] From the quick calculation diagrams, the nozzle pressure is obtained as 1.6 (MPa).

[Supplement]

The quick calculation diagrams assume a tire slip factor of 10% for the boom sprayer. Depending on the conditions of the field, however, the tire slip factor of the ride-on control machine may change. In this case, the slip factor must be corrected.

Depending on the state of the field, the tire slip factor may vary and the spray speed may deviate, in which case the nozzle spray amount must be set according to these different slip factor/spray speed.

For more accurate spraying measure the actual slip factor in the field.

- Rough guide for slip factor

- 5% --- General crop field where the depth to the furrow pan is approx. 10 cm

- 10% --- Field where the depth to the furrow pan is approx. 15 to 20 cm (where a ride-on rice planting machine can be used without problems)

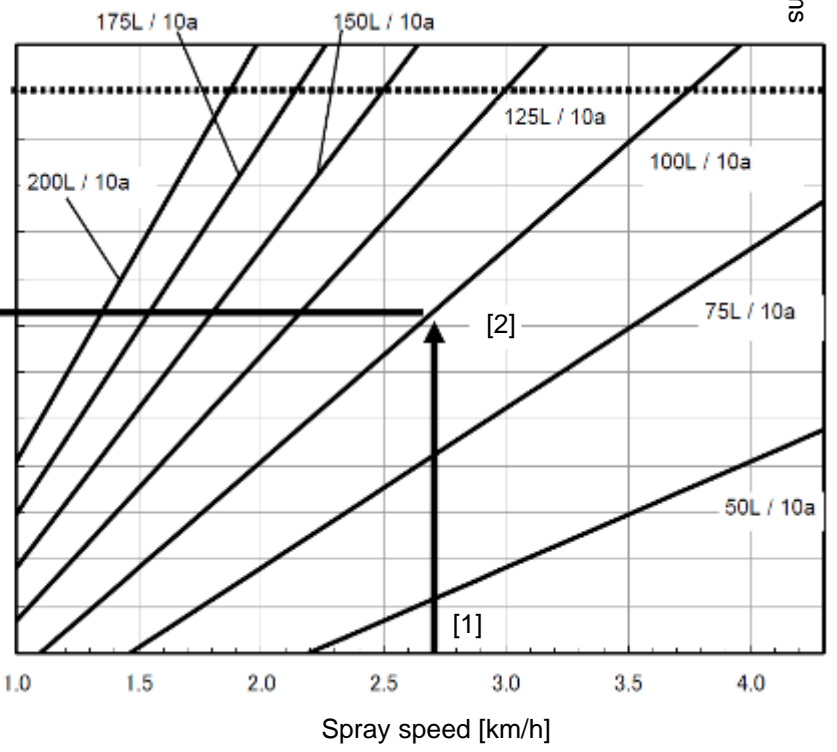
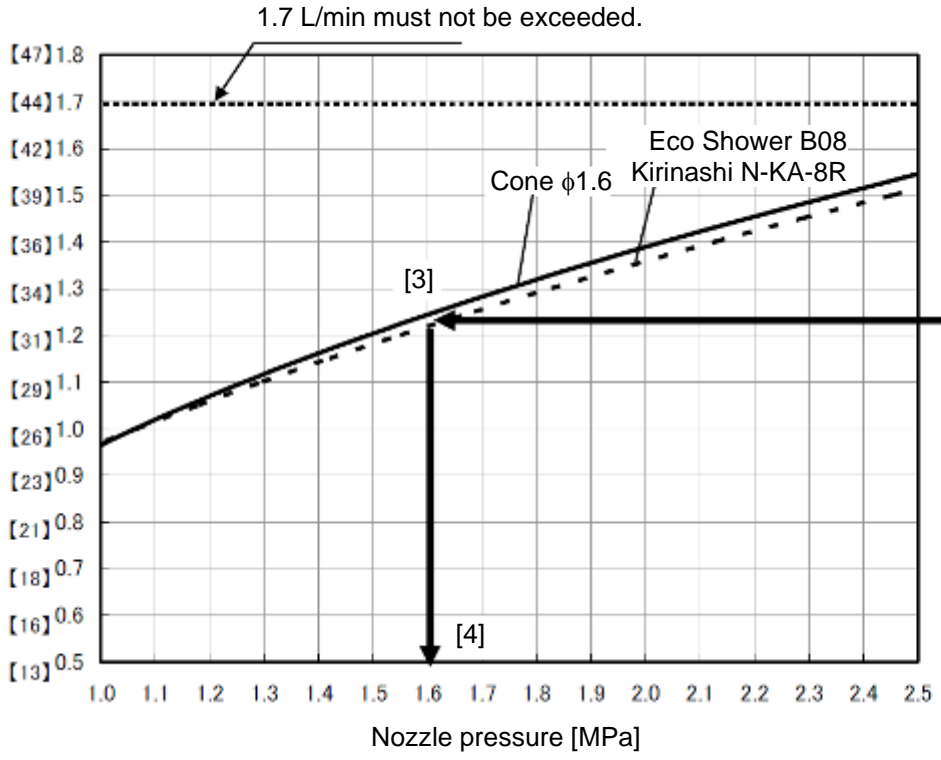
- 15% --- Field where the depth to the furrow pan is approx. 20 to 25 cm

- * Take note that the machine may not be able to travel in a field where the depth to the furrow pan is 25 cm or more. Also remember that the machine can travel more smoothly when the field is filled with water.

Caution

- When spraying in a field of a higher slip factor (greater depth to the furrow pan), reduce the amount of water added to the tank.
- Adjust the nozzle pressure within a range of 1.0 to 2.5 MPa.

Spray flow rate by nozzle [L/min] (Total discharge flow rate in [] [L/min])



■ Spray Method

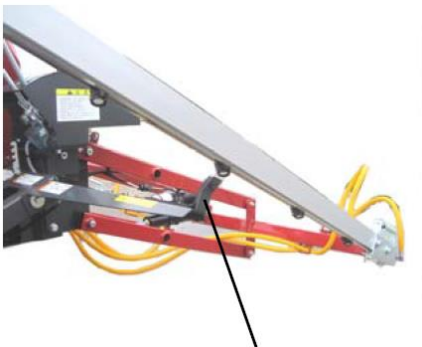
Warning

- **Wear clothes that properly fit your body. Prepare protective clothes, pest control mask, protective glasses, rubber gloves, work shoes, etc., and dress safely during work.**

- [1] Spray safely using a method appropriate for the terrain and field condition.
- [2] The person performing spraying should wear protective gears for agrichemical spraying (such as a pest control mask, protective glasses, boots, rubber gloves, work uniform and helmet) to prevent the reagent from coming in direct contact with the body.
- [3] Whenever possible, spray early in the morning or in the event when there is no wind.
- [4] Do not enter the areas where agrichemical has already been sprayed.
- [5] Keep only the required amount of spray agent in the reagent tank to prevent leftovers.
- [6] Check the applicable spray amount, spray pressure and traveling speed beforehand.
- [7] Remove obstacles from the traveling path beforehand and make preparations to ensure safe traveling, and provide wide enough turning areas so that the machine can turn without problems.

■ Spraying

- [1] Press the spray pump switch to operate the spray pump.
- [2] Pull the throttle lever fully to set the engine to a normal speed.
- [3] Check if the reagent has been agitated fully.
- [4] Adjust the pressure using the pressure adjustment dial. Since the pressure when the spray cock fully closed is different from the pressure during spraying, adjust the pressure once again to a desired level during spraying.
- [5] Open the booms.
 - 1) Operate the boom high/low switch to move each boom to a position higher than the fold-back part at the tip of the boom receiver.



Fold-back part

- 2) Operate the left and right boom open/close levers to open the booms.
- [6] Put the auxiliary shift lever in the spray position.
 - [7] Open the spray cock and slowly tilt the HST lever in the moving direction until a desired speed is achieved. Thereafter, open/close the spray cock to switch between spraying and stopped modes.
 - [8] When the spraying is over, lower the engine speed and press the spray pump switch to stop the spray pump.

Caution

- **Do not close the left and right booms at low positions. The booms may contact the tires, boom receivers, etc., and get damaged.**

■ After Spraying

- [1] Remove the cap on the water absorption strainer and collect the remaining liquid.
- [2] Open the reagent tank lid and remove the water filter net, and wash the net together with the water absorption strainer.
- [3] Install the water absorption strainer/water filter net once again, add around 100 L of freshwater in the reagent tank, close the reagent tank lid, and operate the spray pump.
- [4] Spray freshwater from the nozzle to perform cleaning of pipe interior.
- [5] When the reagent tank becomes empty, run the spray pump idle for approx. 30 seconds with the engine running at low speed, to drain water from the tank.
- [6] Remove the water absorption strainer and collect the remaining liquid.

Caution

- **Do not perform cleaning while the tank lid is open. Agitated liquid may splash and scatter.**

8 Maintenance

■ Maintenance and Inspection (Inspection and Servicing Methods)

So that this machine can be used safely, perform the necessary periodic servicing based on the methods explained here.

The inspection and servicing methods are divided into "Startup inspection" and "Period inspection." Applicable methods are explained under each grouping.

Caution

- Before performing inspection and servicing, be sure to stop the engine, apply the parking brake, remove the ignition key, and disconnect the negative terminal end of the battery cable from the battery.
- If any inspection or servicing item requires the engine to remain running, do not perform such item on your own, but always contact the service personnel at your Maruyama dealer instead.
- Dispose of the battery, oils, coolant, etc., properly after consulting your Maruyama dealer, etc.

Periodic Inspection Standards

1. The applicable inspection timing is indicated by ○.

2. The timing of initial inspection is indicated by *.

Inspection item			Inspection timing				Judgment criterion
			Start of work	Every 6 months	Every 12 months	Hours	
Steering operation	Steering wheel handle	Play, looseness, rattling	○	○	○	*50	
		Operating feel	○	○	○	*50	
	Rods and arms	Looseness, rattling, damage		○	○	*50	
	Knuckle	Rattling of joint			○		
	Steering device	Wheel, alignment			○		Toe-in: 0 mm
	Steering wheel	Looseness, rattling, damage		○	○	*50	
	Power steering	Clogging of oil filter			○		
		Hose damage, amount of oil	○	○	○		
Brake	Brake pedal (also used as clutch)	Catching by parking brake lever	○	○	○		
		Brake effect	○	○	○	*50	
		Activation of clutch	○	○	○		
	Rods and cables	Looseness/rattling and damage		○	○		
Running gears	Wheel	Tire pressure	○	○	○	*50	240 kPa
		Tire cracks and damage	○	○	○		
		Abnormal wear of tire	○	○	○		
		Metal pieces, stones and other foreign matters on tire	○	○	○		
		Cracks, rattling		○	○		
		Looseness of bolt		○	○	*50	Wheel bolt tightening torque: 92 N·m
		Rim damage		○	○		
		Rattling of wheel bearing			○		

Periodic Inspection Standards

1. The applicable inspection timing is indicated by ○. 2. The timing of initial inspection is indicated by *.

Inspection item			Inspection timing				Judgment criterion
			Start of work	Every 6 months	Every 12 months	Hours	
Drivetrain	HST	Leakage of oil	○	○	○		
	Auxiliary transmission	Rattling of operating mechanism		○	○		
		Leakage of oil	○	○	○		
	Propeller shaft	Looseness of link		○	○	*50	
		Rattling of spline			○	*50	
		Rattling of bearing			○	*50	
		Run-out of propeller shaft			○	*50	
	Differential	Leakage of oil	○	○	○		
Hydraulics	V-belt	Looseness and damage of belt	○	○	○	*50	
	Oil tank	Amount and leakage of oil	○	○	○		
	Oil cooler	Clogging of cooling fan	○	○	○		
		Leakage of oil	○	○	○		
	Filter	Clogging			○		
Mechanical devices	Piping	Looseness of joint and leakage of oil	○	○	○		
	Starting device	Degree of pinion meshing			○		
	Charge device	Charge action		○	○		
	Battery	Fluid level		○	○	*50	Fully charged: 1.260 (20°C) Fully discharged: 1.060 (20°C)
		Specific gravity of fluid			○		
	Electrical wirings	Loose and damaged connection parts		○	○		
	Main body	Ease of starting and abnormality	○	○	○		
		Condition at low speed and during acceleration		○	○		
		Exhaust condition	○	○	○		
		Condition of air cleaner element	○	○	○		Replace every year.
		Compressive pressure			○		
		Valve gap			○		0.1 mm to 0.2 mm
	Lubrication device	Leakage of oil	○	○	○		
		Dirtiness and amount of oil	○	○	○	*35	Replace every 100 hours.
		Clogging of oil filter			○	*35	Replace every 150 hours.
	Fuel device	Leakage of fuel		○	○		
		Fuel strainer		○	○	*25	
		Fuel line cracks/damage	○	○	○		
	Cooling device	Leakage of water	○	○	○		
		Amount of water	○	○	○		
		Function of radiator cap		○	○		Open/close pressure: 90 kPa
		Looseness and damage of fan belt	○	○	○	100	Deflection when the center of the belt is pushed with a force of 100 N: 7 mm

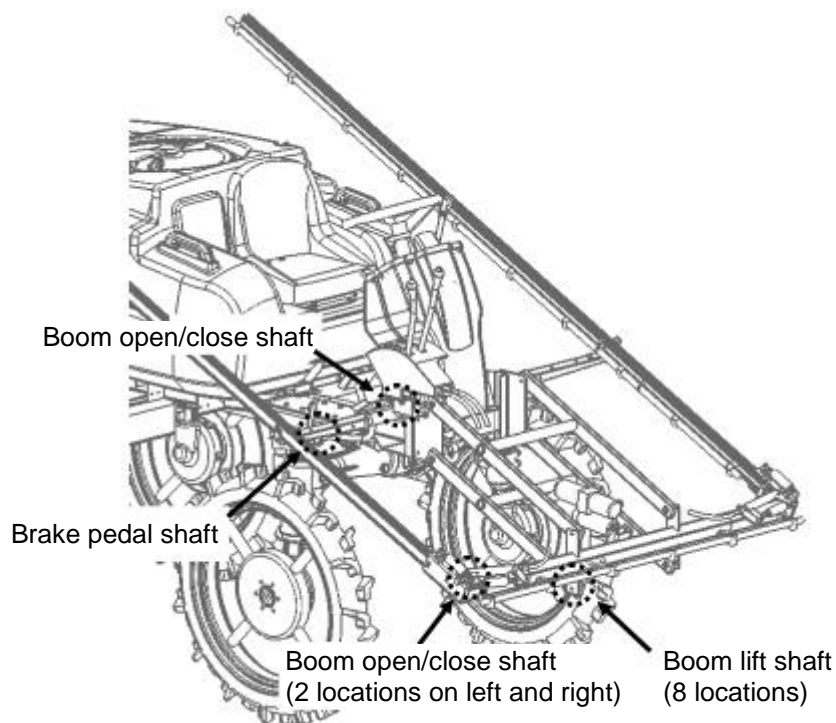
Periodic Inspection Standards						
1. The applicable inspection timing is indicated by ○. 2. The timing of initial inspection is indicated by *.						
Inspection item		Inspection timing				Judgment criterion
		Start of work	Every 6 months	Every 12 months	Hours	
Instruments	Operation	○	○	○		
	Soiling and damage		○	○		
Exhaust pipe and muffler	Looseness and damage of mount		○	○		
	Muffler function			○		
Machine frame and body	Looseness and damage	○		○		
Location where abnormality was found during operation the day before	Confirm that the applicable location is free from abnormality.	○				
Other	Lubrication condition at each part of chassis		○	○		
Other items	Fuel tank	○		○		
	Water absorption strainer	○ Note1				Clean.
	Tank water filter net	○ Note1				Clean.
	Nozzle	○		○		Inspect for clogging and wear, and replace.
	Boom	○		○		Operating condition
	Each fastening part	○	○			Tighten securely.

Note 1. Clean after every operation.

■ Oil Change Table

No.	Item	Applicable oil	Volume	Initial change (hours)	Periodic change and adding (after every specified hours)
1	Fuel	Diesel oil (JIS No. 2)	20 L	-	-
2	Engine oil	SAE10W-30 API CF grade or better	2.5 L	50	100
3	Oil tank	Hydraulic oil (wear resistance) VG32 (ISO)	13 L		200
4	Auxiliary transmission oil	Gear oil SAE 90	2.0 L		600
5	Front/rear differential oil		1.0 L		
6	Spray pump, crank case	SAE10W-30 API SJ grade or better	0.6 L		100
7	Spray pump, cylinder base metal		3 to 5 drips	Every 100 hours or every year	Every 100 hours or every year
8	Each wire			At start of work	At start of work
9	Brake pedal shaft	Chassis grease	Appropriate amount	20	20
10	Boom lift & open/close shaft				
11	Radiator	LLC	2.6 L	-	600

● Greasing locations



■ Inspection Procedures

(1) Engine Oil

[Check] With the machine horizontal, pull out the oil gauge, wipe the tip with a clean cloth and put back the gauge, and pull it out again to check the oil level. If oil is at the LOWER level or below, add oil to the specified level. (Check the oil level before the engine is started or at least 5 minute after the engine has stopped.)

[Change] Remove the drain plug, drain oil, and fill new engine oil.

[Engine oil] SAE10W-30 API CF grade for diesel engine

[Amount of oil] 2.5 L

[When to change] Initial change: 50 hours
Periodic change: Every 100 hours

Used oil can be drained easily when the engine is hot.



Oil gauge



Drain plug

⚠ Caution

● When draining oil, exercise caution not to get burned. Do not touch any of the parts directly with your hand.

● Oil filter cartridge

Replace every 150 hours (or after 50 hours initially).

- [1] The oil filter is of cartridge type, so remove the entire case with a filter wrench and replace it with a new one.
- [2] After the new oil filter has been assembled, operate the engine to check for leakage of oil.
 - After the oil change, stop the engine after (5 minutes of) idling, wait for 10 to 20 minutes and then check the oil level. If there is not enough oil, add oil.

(2) Air Cleaner

⚠ Caution

● Be sure to remove and clean the air cleaner element before operating the machine.

- [3] To clean the element, spray air (0.21 MPa or less) onto the inner side of the element or shake the element gently to remove dust.
- [4] Replace the element once a year.
- [5] When installing the cup, be sure to assemble with the top side facing up.

TOP

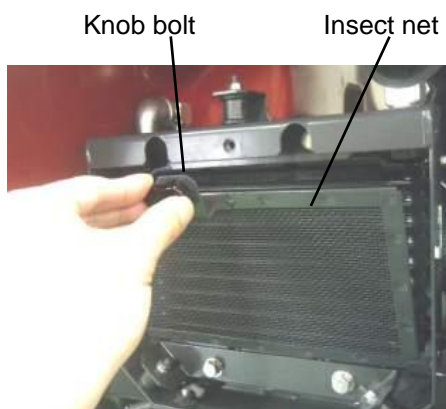
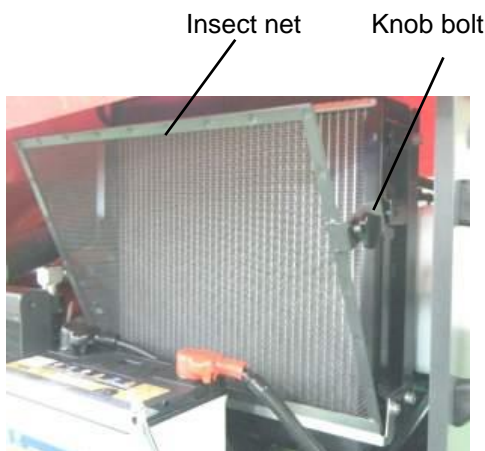


Vacuator valve

* Cleaning the Vacuator valve
Open the Vacuator valve and remove large dust particles.

(3) Inspecting the Insect Net

If the net is clogged, loosen the knob bolts to remove the insect net and remove insects and other contaminants attached on the surface.



(4) Inspecting the Fuel System

■ Fuel tank

Check if the tank contains enough diesel oil (JIS No. 2 Diesel Oil). If not, add diesel oil.
(Tank capacity: Approx. 20 L)

Drain water from the tank from the fuel filler port or fuel filter every 100 hours.

Add fuel before the fuel tank becomes empty and should the fuel tank become empty, immediately add fuel and bleed air.

■ Bleeding air

- [1] Fill the fuel tank with diesel oil.
- [2] Loosen fuel filter screw A and bleed air trapped between the fuel tank and fuel filter.
- [3] When only fuel starts to come out from the screw, tighten screw A.

- [4] Next, loosen screw B and bleed air trapped between the fuel filter and solenoid pump in the same manner.
- [5] Turn the key switch to "ON." Operate the solenoid pump for approx. 10 seconds in this condition to bleed air trapped between the solenoid pump and engine.

⚠ Caution

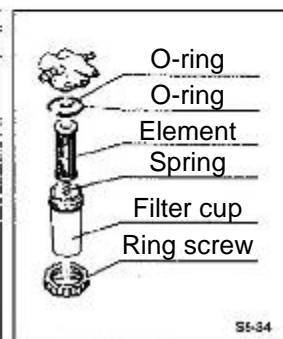
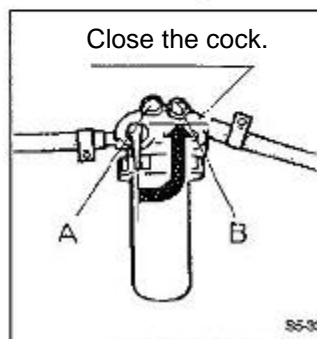
- When bleeding air, put clothes underneath and wipe off any spilled fuel.
- Stop the engine during refueling.

■ Fuel filter

Clean the fuel filter every 100 hours or so of operation, and replace the element every 400 hours.

The cleaning method is as follows:

- [1] Close the fuel filter cock.
- [2] Remove the ring screw and take out the filter cup.
- [3] Rinse the element in diesel oil. Also clean the inside of the filter cup with diesel oil.
- [4] After the cleaning, assemble the filter cup correctly as before by paying attention not to let dust or dirt attach to the element.
- [5] Open the cock.
- [6] Bleed air.



(5) Inspecting the Cooling System

Caution

- If the radiator cap is removed while the engine is hot, hot water gushes out. Wait for the engine to cool and remove the radiator carefully by putting a cloth over it.

[1] Cooling water level

Check the cooling water level based on the amount in the reserve tank. The level is normal if between FULL and LOW. If cooling water is low, add to the FULL level. After cooling water has been added, press the top lid and make sure the lid is securely latched.



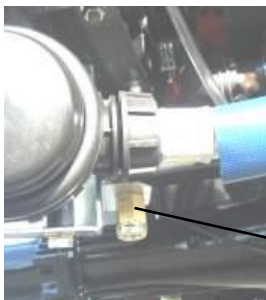
Reserve tank

- * Do not open the radiator cap except when checking and changing cooling water.
- * Long-life coolant that does not freeze until -20°C has been charged at the factory prior to shipment. Adjust the concentration of coolant according to the outside air temperature.

-10°C or above	30%
-10 to -25°C	40%

[2] Cleaning the inside of the radiator

Open the drain plug and drain cooling water fully. Thereafter, clean the inside with tap water until the flushed water no longer contains rust.



Drain plug

(6) Changing the Auxiliary Transmission Oil

Remove the plug on the oil check port and drain plug at the bottom of the auxiliary transmission and drain oil.

Add oil from the oil filler port until oil overflows from the oil check port.

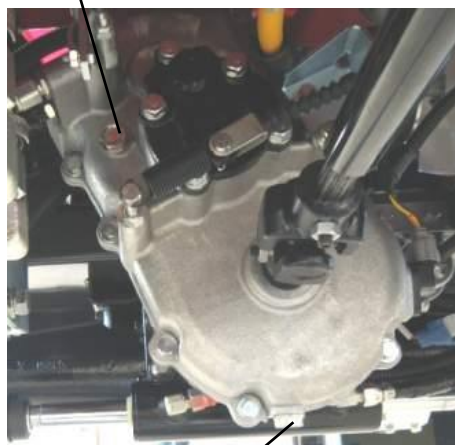
[Type of oil] Gear oil SAE 90

[Amount of oil] Approx. 2.0 L

[When to change] Initial change: 50 hours

Periodic change: Every 600 hours

Oil check port



Drain plug

Oil filler port



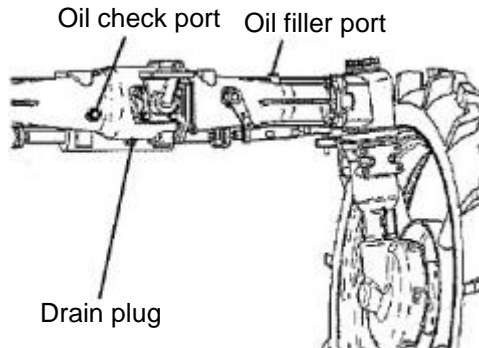
Caution

- After oil has been added, confirm that the drain plug and oil check port plug are securely tightened, and firmly tighten the oil filler cap to prevent loosening.

(7) Changing the Front/Rear Differential Oil

Remove the drain plug and plug on the oil check port to drain oil.
Add oil from the oil filler port until oil overflows from the oil check port.

[Type of oil] Gear oil SAE 90
[Amount of oil] Approx. 1.0 L
[When to change] Initial change: 50 hours
Periodic change: Every 600 hours



(8) Checking the Oil Level in the Hydraulic Oil Tank

Check the oil level using the level gauge provided on the side face of the oil tank. The level is normal if between H and L.

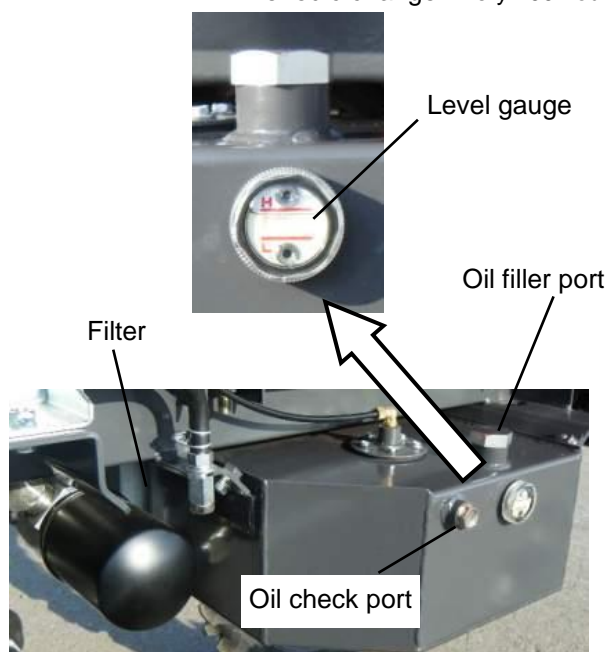
If the level is low, open the oil check port and add oil from the oil filler port until oil overflows from the oil check port.

When changing oil, replace the filter also.

[Type of oil] Hydraulic oil (wear resistant) VG32

[Amount of oil] Approx. 13 L

[When to change] Initial change: 50 hours
Periodic change: Every 200 hours



Drain plug



(9) Inspecting the Spray Pump

Oil in the crank case

Check if oil is filled to near the center of the level gauge.

If the level is low, add oil from the oil filler port.

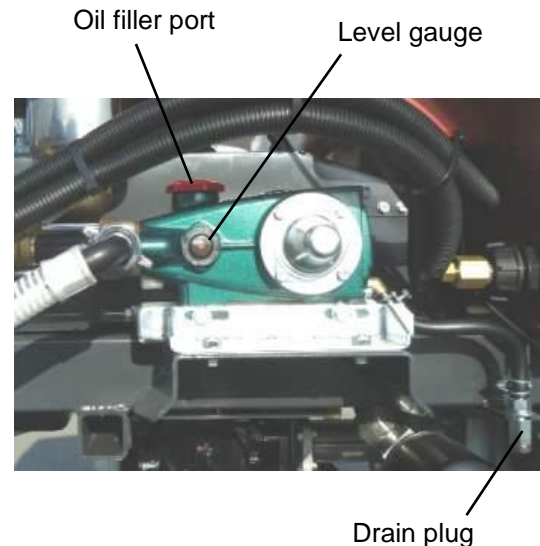
To change oil, remove the drain plug and plug on the oil filler port to drain oil.

When filling oil, refuel it from the oil filler port just like when the oil is insufficient.

[Type of oil] SAE 10W-30SJ grade or above

[Amount of oil] Approx. 0.6 L

[When to change] Initial change: 50 hours
Periodic change: Every 100 hours



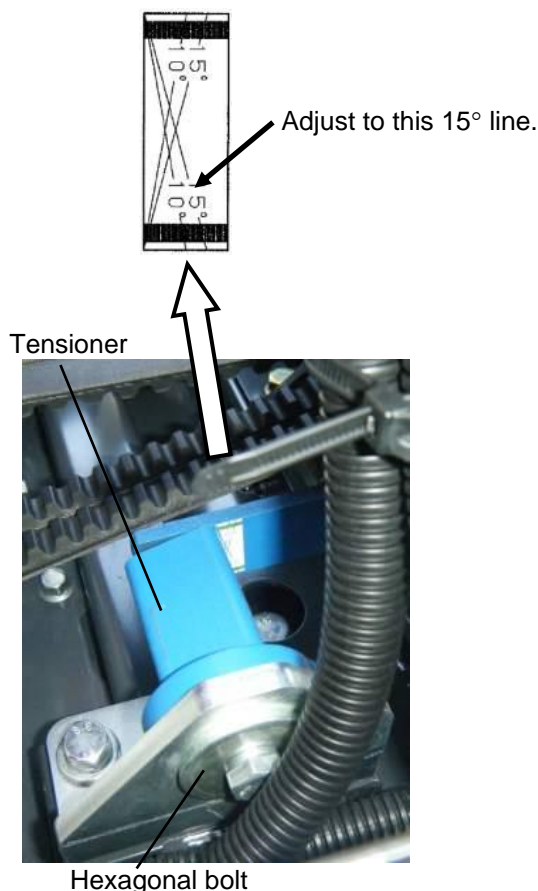
(10) Greasing

Refer to the Oil Change Table (P. 32).

(11) Adjusting the Belt Tension

[1] Engine ⇔ HST

Loosen the hexagonal bolt and twist the main body until the tensioner mounting angle becomes 15°. After the adjustment, tighten the hexagonal bolt loosened earlier, to a torque of 43 to 53 N·m.



[2] Engine ⇔ dynamic injection

Make adjustment so that when the center of the belt is pressed with a force of 15 to 19 (N), the amount of deflection becomes approx. 5 mm.

(12) Inspecting the Battery

⚠ Warning

- Do not use or charge the battery when the battery fluid level is low, because the battery may rupture (explode) or ignite.

⚠ Caution

- When inspecting the battery terminals, do not let the terminals get short-circuited.
- When disconnecting the battery cable, be sure to disconnect the negative terminal end first.
- Battery fluid is very corrosive, so do not spill the fluid. If battery fluid attached to your hand, clothes or any metal part, rinse the affected area thoroughly with water.

◆ Maintenance-free battery

The battery without top cap is a maintenance-free battery.

- [1] Look at the charge indicator vertically.
- [2] If the charge indicator is clear or yellow, gently tap the battery to remove air bubbles and then check again.
- [3] Take an appropriate action according to the table below based on the indicator color.

Color	Charge state	Action
Green	Normal	The battery can be used.
Black	Insufficient	Auxiliary charge is required.
Clear	Not enough fluid	Replace the battery if the engine does not start.

* There is no need to inspect the battery at the start of work.

◆ Conventional battery

- [1] Check if the battery fluid level is between UPPER and LOWER. If the level is low, add distilled water to the UPPER level.
- [2] After distilled water has been added, securely tighten the cap.
- [3] Inspect the battery terminals and if loose, securely tighten the terminals. If white powder is attached to the terminals, clean with hot water and tighten the terminals, and then apply a small amount of grease on the terminals.

Caution

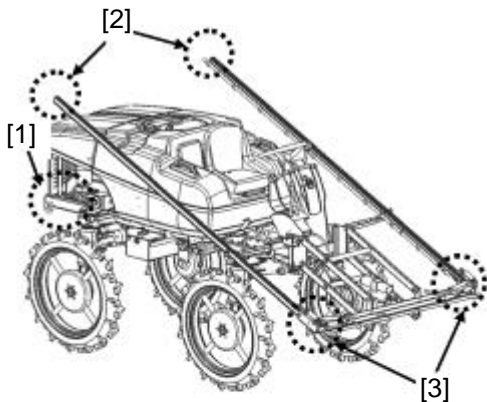
- Do not continue using the machine once the electrolyte level in the battery has dropped to or below the lower limit (LOWER level) indicated on the side face of the battery. Deterioration of each part of the battery cell will be promoted.

■ Method for Long-term Storage

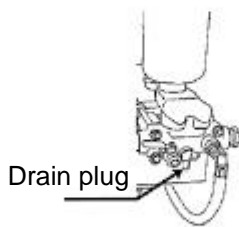
If the machine is not used for a long period of time, follow the care procedure below:

- (1) Run through all maintenance and inspection items.
- (2) Service problem locations, if any.
- (3) Inspect the bolt and nut in each part and tighten them if loose.
- (4) Run the pump at low speed using freshwater and circulate the water for 3 to 4 minutes to clean the inside of the tank, piping, nozzle, etc. To prevent damage caused by freezing, drain all liquid from the spray pump and piping by removing the drain plugs and running the pump idle. Drain the pump and inside the pipe.

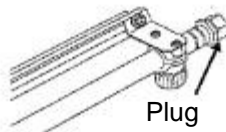
◆ How to drain water



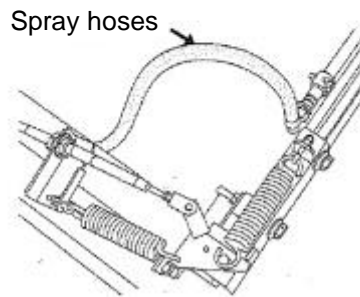
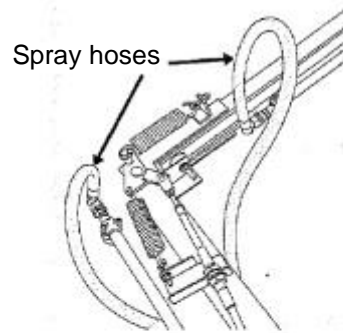
- [1] Remove the drain plug from the spray pump.



- [2] Remove the plugs at the tips of left and right booms.



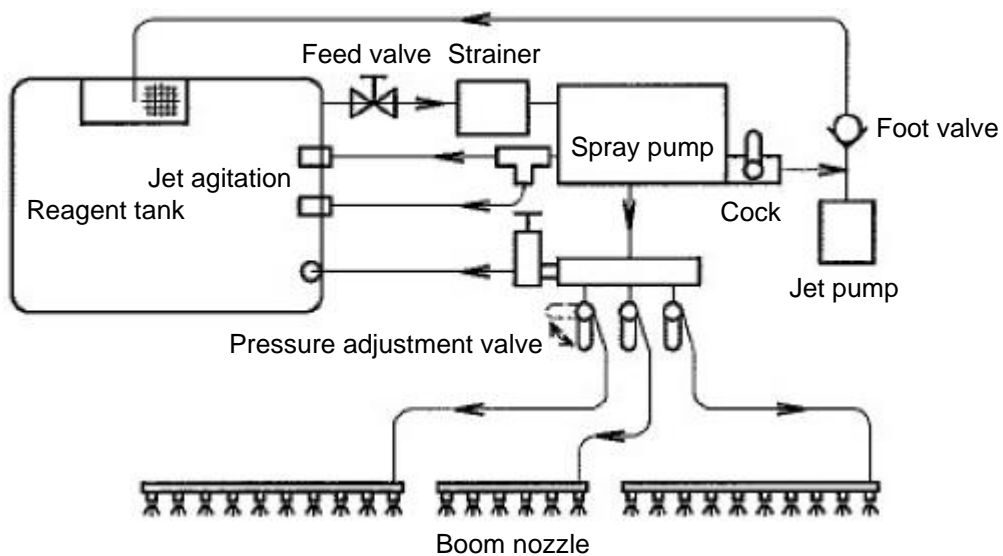
- [3] Disconnect the spray hose at the bases of right and left booms to drain water.



- (5) Remove the nozzle cap and drain water remaining inside the nozzle.
- (6) Clean the exterior of the machine.
- (7) Change engine oil with new oil and operate the engine for around 5 minutes to spread oil to each part.
- (8) Be sure to keep the throttle lever in the "Low speed" position.
- (9) Fill up the fuel tank with fuel (diesel oil).
- (10) Store each boom on the boom receiver.
- (11) Use sandpaper, etc., to remove rust from areas where paint has peeled, and apply a fresh coat of paint.
- (12) Keep each cock in the "Open" position.
- (13) Disconnect the battery cable or remove and store the battery in a dark, dry place.
- (14) The battery will self-discharge during storage, so perform auxiliary charge once every month.
- (15) Select a dry place for storage and cover the machine with a sheet, etc., to prevent attachment of dust, etc.

9 Piping Diagram

Piping Diagram



Each arrow in the piping diagram indicates the flow direction of water or reagent.

* The jet pump shown in the diagram is optional (sold separately).

10 Causes of Failures and Remedial Actions

Caution

- If the machine malfunctions, be sure to stop the engine, apply the parking brake and remove the ignition key and then diagnose the problem by referring to the table below.

Phenomenon		Cause	Action
Engine	The starter does not turn when the key switch is turned.	The auxiliary shift lever is not in the "Start" position.	Put the auxiliary shift lever in the "Start" position and then turn the key switch to the "ST" position.
		Loose or disconnected wire terminal, or loose, disconnected or corroded battery terminal	Retighten or reconnect the terminals. Clean and securely tighten the terminals. Apply grease to prevent rusting.
		Blown fuse	Replace the fuse with new one.
		Low battery voltage	Add battery fluid and charge the battery. Replace the battery.
		Faulty key switch	Contact the dealer where you purchased your machine from.
		Faulty cell motor	Contact the dealer where you purchased your machine from.
		Faulty switch	Contact the dealer where you purchased your machine from.
	The starter turns, but the engine does not start.	No fuel. Air is mixed into fuel.	Add fuel to the fuel tank and bleed air.
		Fuel does not flow.	Contact the dealer where you purchased your machine from.
		The battery is almost flat and does not provide enough rotational force to turn the engine.	Charge the battery. If the battery does not charge, replace it with new one.
	Engine revolutions are irregular.	Air has entered the fuel system.	Bleed air.
		Water is mixed into fuel.	Drain fuel from the fuel tank/fuel filter and add new fuel.
		Clogged fuel injection nozzle	Contact the dealer where you purchased your machine from.
		Clogged fuel filter	Contact the dealer where you purchased your machine from.
Engine related	Insufficient engine output	Insufficient fuel	Inspect the fuel system (for entry of air).
		Clogged air cleaner	Contact the dealer where you purchased your machine from.
		Insufficient compression	Contact the dealer where you purchased your machine from.
		Deterioration of fuel injection state	Contact the dealer where you purchased your machine from.
		Inappropriate intake/exhaust valve gap	Contact the dealer where you purchased your machine from.
	Undesirable exhaust color	Low-grade fuel	Change to high-grade fuel.
		Too much engine oil	Adjust the amount of oil to the specified level.
		Deterioration of fuel injection state	Contact the dealer where you purchased your machine from.
	The engine overheated (the water temperature warning lamp turned on).	Insufficient cooling water or leakage of water	Contact the dealer where you purchased your machine from.
		Loose fan belt	Contact the dealer where you purchased your machine from.
		Insufficient engine oil	Add oil to the specified level.
		Low engine oil viscosity	Change to oil of appropriate viscosity.
		Faulty pressure switch	Contact the dealer where you purchased your machine from.
		Faulty oil lamp	Contact the dealer where you purchased your machine from.
	The glow lamp does not turn on.	Blown bulb	Replace the bulb with new one.
		Blown fuse	Replace the fuse with new one.
	The charge lamp turned on during operation.	Faulty regulator	Contact the dealer where you purchased your machine from.
		Loose or damaged fan belt	Contact the dealer where you purchased your machine from.

Phenomenon		Cause	Action
Electrical related	A lamp does not turn on.	Blown bulb	Replace the bulb with new one.
		Blown fuse	Replace the fuse with new one.
		Loose or disconnected wire terminal	Reconnect and retighten after inspection.
		Faulty switch	Contact the dealer where you purchased your machine from.
	The speed is not indicated.	Loose or disconnected wire terminal	Reconnect and retighten after inspection.
		Faulty speed sensor	Contact the dealer where you purchased your machine from.
Pedal related	The clutch does not disengage.	Faulty switch	Contact the dealer where you purchased your machine from.
		Loose or disconnected wire terminal	Reconnect and retighten after inspection.
	Poor brake effect	Improperly adjusted brake wire	Contact the dealer where you purchased your machine from.
	The differential locks only on one side of front and rear wheels.	Improperly adjusted differential lock wire	Contact the dealer where you purchased your machine from.
Lever related	The engine speed drops.	Improperly adjusted throttle lever	Contact the dealer where you purchased your machine from.
	Gears disengage.	Improperly adjusted shift cable	Contact the dealer where you purchased your machine from.
	The HST lever returns.	Faulty lever retention mechanism	Contact the dealer where you purchased your machine from.
	The engine does not stop when the HST lever is in the N (Stop) position.	Improperly adjusted cable system	Contact the dealer where you purchased your machine from.
Steering wheel related	The steering wheel is heavy.	Insufficient tire pressure	Adjust the pressure to the reference level.
		Hydraulic device malfunction	Contact the dealer where you purchased your machine from.
	Steering control is lost.	Uneven pressures of tires	Adjust the pressures of all tires evenly.
		Poor straight-rolling property of tire	Contact the dealer where you purchased your machine from.
Spray device related	The spray amount is small. The pressure does not rise.	No reagent in the tank	Add the required amount of reagent.
		Closed suction valve	Open the suction valve.
		Low engine speed	Operate the throttle lever to raise the speed.
		Pressure adjustment valve malfunction	Contact the dealer where you purchased your machine from.
		Clogged water absorption strainer	Clean.
		Slipped spray pump belt	Contact the dealer where you purchased your machine from.
		Worn piston gasket, discharge valve or suction valve of the spray pump	Replace the affected part with new one.
		Damaged metal joint gasket of the suction hose or spray hose, or damaged hose	Replace the affected part with new one.
		Worn nozzle	Replace the affected part with new one.
		Clogged nozzle	Clean.
	Poor spray state	Worn or cracked nozzle	Replace the affected part with new one.
		Clogged nozzle	Clean.
		Insufficiently tightened nozzle cap	Tighten additionally.
		Damaged metal joint gasket of the suction hose or spray hose, or damaged hose	Replace the affected part with new one.
Boom device	The boom does not operate.	Loose or detached wire terminal	Reconnect and retighten after inspection.
		Faulty hydraulic device	Contact the dealer where you purchased your machine from.

● List of Key Consumables

Location of use	Item name	Part number	Quantity used	Remarks
Engine	Air cleaner element	647156	1	Kubota 1G659-1122-0
	Oil filter	642984	1	Kubota 15853-3246-0
	V-belt	577467	1	FM33
Fuel piping	Filter assembly	196770	1	Kubota 1G313-43011
	Element assembly	407460	1	Kubota 1T021-43560
Hydraulic piping	Oil filter	864679	1	F-903-1 Taisei
Harness	Slow-blow fuse	685844	1	40A
Fuse box	Fuse 30A	641496	1	
	Fuse 20A	191744	2	
	Fuse 15A	185012	1	
	Fuse 10A	641262	3	
	Fuse 5A	191738	2	
Water temperature lamp	Bulb	595551	1	Meter wedge bulb 12V3.4WT10
Oil pressure lamp	Bulb			
Charge lamp	Bulb			
Glow lamp	Bulb			
Spray pump	Piston gasket set	634031	3	
	Seal gasket	100015	3	
Pressure adjustment valve	Sleeve	117252	1	
	Piston gasket	022442	1	
	Valve seat	117251	1	
Traveling gears	V-belt	864857	2	RCLB47
Pump drive	V-belt	154393	2	LA41

Appendix

● Standard Accessories

Name	Part number	Quantity	Remarks
Pest control mask	129738	1	
Protective glasses	221460	1	
Coat	179981	1	L
Operation manual	864860	1	BSA-500
Wiring diagram	864861	1	
Safety manual	177230	1	
Warranty card	-	1	
Special warranty card	-	1	2-year warranty for power sprayer
Accident insurance application form	827997	1	
Nylatch	865943	4	
Scrivet	189746	4	

● Quick Reference Table for Reagent Tank

Input amount of reagent (g)

Dilution factor (times)	Amount of water in reagent tank (L)		
	300	400	500
150	2000	2667	3333
300	1000	1333	1667
500	600	800	1000
800	375	500	625
1000	300	400	500
1500	200	267	333
2000	150	200	250

● List of Options (Sold Separately)

Part number	Item name	Remarks	Applicable model		
			BSA-500		
			S	A	E
667886	Wheel cover assembly		○	○	○
862716	Shield assembly *1		○	○	○
681484	Spacer assembly	Installed on 4 wheels/60 mm	○	○	○
863431	Spacer assembly	Installed on 4 wheels/40 mm	○	○	○
862525	Working lamp set		○	○	○
864237	Inter-ridge spray device	Triple type	○	○	○
864243	Inter-ridge spray device	Quintuple type	○	○	○
198306	Rear weeding nozzle assembly		○	○	○
682186	Eco Shower B08	Yamaha 451061, green	○	○	○
188492	Kirinashi nozzle	Yamaha N-KA-8R	○	○	○
681679	2-way switching nozzle assembly	1 pc, no nozzle, 2-way switching	○	○	○
170820	Jet pump assembly		○	○	○
865330	Jet pump extension piping		○	○	○
864452	Hose reel	8.5 mm x 20 m	○	○	○
865493	Sunshade		○	○	○
866187	Container box assembly		○	○	○

*1. The shield assembly and rear weeding nozzle assembly cannot be installed at the same time on the rear wheels.

Memo

Memo

Service and Warranty

■ Warranty Card

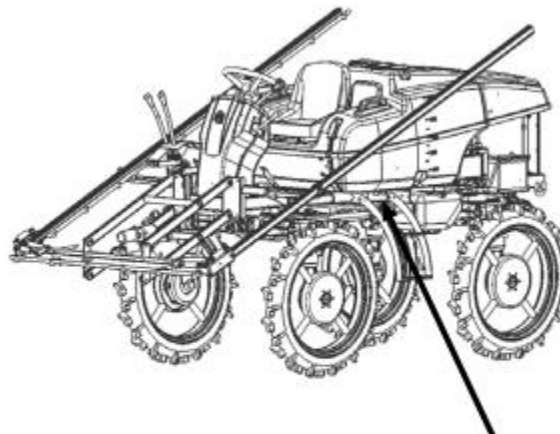
The customer must present the warranty card to receive warranty repair during the warranty period. After you have read the information provided on the warranty card, keep the warranty card in a safe place.


Warning

- Do not modify the machine as it may create dangerous situations. Please note that the manufacturer's warranty will become void if the machine is modified or used wrongly or for any purpose different from the correct purpose of use as described in the Operation Manual.

■ After Service

- If a problem is found during the startup inspection or use, proper servicing must be carried out immediately. Contact the dealer where you purchased your machine from.
- Provide the following information to the dealer:
 - Model
 - Category
 - Serial number
 - Description of failure
Explain in detail what happened when such-and-such was operated in which way in which condition.



Agricultural machine type: Ride-on control machine	
Model	XXXXXXXXXX
Category	XXXXXXXXXX
Serial number	XXXXXXXXXX
Manufactured by	 MARUYAMA MFG. CO., INC. 4-15 Uchikanda 3-Chome, Chiyoda-Ku, Tokyo

- So that it can be used safely, this product must be operated correctly and serviced periodically. Have your machine inspected and serviced at least once a year by the dealer where you purchased your machine from.
This servicing is chargeable.

■ Supply Period of Spare Parts

Spare parts for this product will be supplied for 9 years after the discontinuation of this product. Even during the supply period, we may consult you on the delivery schedule and other supply conditions of special parts. As a rule, supply of spare parts will cease at the end of the above supply period. Even after the expiration of the supply period, we may be able to supply certain parts, upon request, based on the delivery schedule and price to be negotiated.

If you have any question or inquiry regarding this product, consult first the dealer where you purchased your machine from.

You can also call the following toll-free number from anywhere in Japan.

Maruyama Support Center

Toll-free number **0120-898-114**

Lines are open from 9:00 to 17:00 (excluding Saturday, Sunday and public holidays)

So that we can accurately assess the situation, have the following information ready when you contact us regarding your product:

- [1] Product model and serial number
- [2] Date of purchase
- [3] Dealer



MARUYAMA MFG. CO., INC.

4-15 Uchikanda 3-Chome, Chiyoda-Ku, Tokyo 101-0047 Japan TEL (03) 3252-2281 (Sales Main)

The part number of this Operation Manual is 864860.

P/N. 864860-01 Aug. 2011