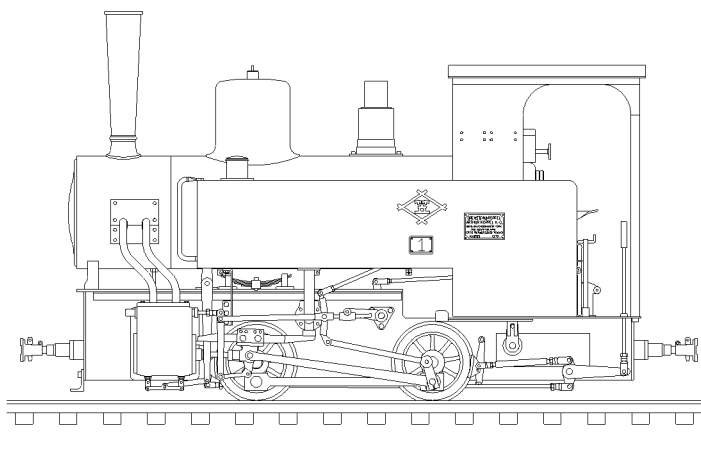


KOPPEL

Operation Manual



CONTENTS

Before Beginning Operation	①
Names of Components (A)	②
Names of Components (B)	③
Names of Components (C)	④
Preparations for Operation (A)	⑤
Preparations for Operation (B)	⑥
Steaming Up	⑦
Procedure Immediately Before Operation	⑧
Operating Procedure (A)	⑨
Operating Procedure (B)	⑩
Continuous Operation	⑪
Completion of Operation (A)	⑫
Completion of Operation (B)	⑬
Operation of Optional Parts (A)	⑭
Operation of Optional Parts (B)	⑮

SPECIFICATIONS

Type	: Narrow gauge steam locomotive, 0-4-0
Gauge	: 127mm (5in.) or 120.6mm (4-3/4in.)
Driving Wheels	: Dia. / 86mm (3.386in.)
Cylinder	: Dia. / 30mm (1.181in.) Stroke / 44mm (1.732in.) Draincocks / 4pcs. (Manual)
Valve type	: Slidevalve Valvetravel / 12.5mm (0.492in.)
Valve gear	: Walschaerts valve gear
Boiler	: For Koppel Materials / copper and copper alloys, Silver soldered Maximum allowable working pressure / 0.6MPa (6bar , 87.02psi) Hydrostatic pressure test / 1.2MPa (12bar , 174psi) Set pressure of safety valve / 0.55MPa (5.5bar , 79.8psi) Maximum allowable working temperature / 159°C (318° F) Minimum allowable working temperature / 0°C (32° F) Capacity / 3.07L Weight / 9.5kg Fuel / Coal or L.P.G.
Regulator valve	: Screw type
Water feed	: Axle driven pump / ϕ 13mm x 12mm (0.512in. x 0.472in.) Hand pump / ϕ 12mm x 17mm (0.472in. x 0.669in.)
Lubricator	: Wakefield type Oil capacity (Steam oil) / 26cc
Whistle	: Steam / ϕ 12.7mm x 125mm
Dry weight	: 43kg
Water tank	: Side tank / 0.8L x 2
Dimensions	: Length / 770mm (30.3in.) Width / 230mm (9.06in.) Height / 440mm (17.323in.) Wheel base / 200mm (7.874in.)
Minimum turning radius	: 3.8m
Maximum hauling	: 5 passengers including a driver

Thank you for your purchase of the KOPPEL steam locomotive. We recommend that you carefully read this operation manual to ensure proper use. You are particularly urged to read the Safety Precautions carefully. Please make sure that you have carefully read this operation manual and have a good understanding of its contents before attempting operation so that you are able to operate this steam locomotive safely. Store this operation manual in a safe location for future reference as necessary.

SAFETY PRECAUTIONS

These safety precautions are for preventing injury to you and others. The contents of these safety precautions are all important matters relating to safety, and should be strictly observed for that reason.

- These precautionary matters are indicated with the terms "WARNING" and "CAUTION" according to the degree of danger or injury that can occur as a result of improper handling or operation.



WARNING

This is used to indicate matters for which there is the possibility of death or serious injury.



CAUTION

This is used to indicate matters for which there is the possibility of minor to moderate injury or physical damage.



WARNINGS

- When using propane gas, do not allow open flames to come near the gas tank. There is the risk of explosion and fire.
- In the case of operating the locomotive using propane gas, securely tighten all connections from the gas tank. If loose, gas may leak causing burns or a fire.
- In the case of operating the locomotive using coal and propane gas, never operate the locomotive indoors. Operation indoors is harmful to your health and may cause a fire.
- Replace the neoprene rubber tubing that connects the propane burner with the cock for adjusting the amount of gas once a year. In addition, replace the tubing with new tubing when there are cracks in it or it has been damaged. If not replaced, gas may leak causing burns or a fire.
- Store the gas tank in a suitably ventilated location not subjected to direct sunlight. There is the risk of explosion and fire.
- When transporting the locomotive during or after assembly, always make sure to use a cart and do not attempt to carry it by hand. There is the risk of injury or damage to the locomotive.
- Only use the propane burner for operating the KOPPEL steam locomotive. Use for any other purpose may cause an accident.



CAUTIONS

- When performing the air test with compressed air, please stand at least 0.5 m away from all rotating parts. There is the risk of getting caught in the rotating parts resulting in injury.
- When performing the air test, do not allow your fingers, rags or tools to come near rotating parts. There is the risk of getting caught in the rotating parts.
- In the case of using coal, propane gas or butane gas, wear welding gloves, protective headgear and safety glasses. Cotton clothing should be worn (preferably old clothes) and the skin should not be exposed. There is the risk of burns and injury from sparks.



CAUTIONS

- When igniting, first check to make sure there is sufficient water in the boiler. Insufficient water in the boiler can cause damage to the boiler and accidents.
- The coupling between the engine and tender should be reinforced with a commercially available chain (made of iron or steel). If the coupling becomes disconnected, the engine may run out of control resulting in injury.
- Do not place your face or hands and so forth above the safety valve. There is the risk of burns caused by steam being blown from the valve.
- Only use the authorized blower of the manufacturer. Use of other types of blowers can result in damage or burns. After operation, completely remove any coal in the fire box and extinguish it. Any coal left burning in the fire box may reignite and cause a fire.
- Discard any burning coal embers and ash into an empty metal can and add water to completely extinguish them. There is the risk of fire since burning coal embers can easily ignite easily flammable objects such as dry leaves and so forth.
- In the case of operating the engine, make sure that other persons and flammable objects are at least 3 meters away to the left and right from the center of the rails. Sparks produced can cause fire and injury.
- During and after assembly of the engine, place the engine on a flat piece of plywood and store it in a location where there is no risk of people tripping over it since this may result in injury.
- Also during and after assembly of the engine, be careful not to touch the corners of parts since this can lead to injury.
- Only attempt to clean and inspect the engine after operation after it has cooled completely. There is the risk of burns.
- When transporting the rails, wear gloves and make sure not to drop them since this can result in burns or injury.
- Prior to operation, lubricate all moving parts with machine oil to prevent malfunctions.
- Wear safety shoes when operating the engine. Operating the engine while wearing sandals or shoes made of a thin material may cause you to trip on the cross ties.
- Do not operate the engine at a speed in excess of 5 km/hr. There is the risk of injury caused by collisions or running off the track.
- When laying the rails, place plywood over the cross ties to reinforce the rails so that the entire rail surface is free of inclinations, and the rails do not bend when the engine and tender pass over them. Failing to do so may cause an accident.
- Do not use any oil other than OS Steam Oil (cylinder lubrication oil). Use of other oil may result in a malfunction.
- Before operating the engine, make to get on the engine properly after checking to make sure it will not leave the tracks since this may result in injury.
- In the case of operating the engine, only operate the engine over the rails since operation on other surfaces may result in damage to the engine as well as injury.

CONTENTS

Before Beginning Operation	1	Operating Procedure (A)	9
Names of Components (A)	2	Operating Procedure (B)	10
Names of Components (B)	3	Continuous Operation	11
Names of Components (C)	4	Completion of Operation (A)	12
Preparations for Operation (A)	5	Completion of Operation (B)	13
Preparations for Operation (B)	6	Operation of Optional Parts (A)	14
Steaming Up	7	Operation of Optional Parts (B)	15
Procedure Immediately Before Operation	8		

Before Beginning Operation ①

The construction and operating principle of O.S. live steam locomotives are completely identical to those of actual steam locomotives. We recommend that you become familiar with the operating procedure so that you will be able to enjoy operating this live steam locomotive while giving top priority to safety.

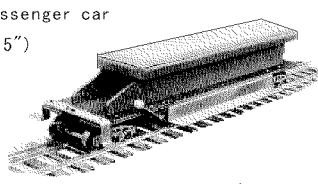
◎ Track

Lay the rails in a location that is free of surface irregularities and as level as possible. Any inclines present in the track can have an extremely detrimental effect on the tractive force of the locomotive. A slight amount of inclination may be present when the track is actually laid, however. Providing a slight downgrade at the start allows the locomotive to start out smoothly. If the locomotive is attempted to be started on an upgrade, the driving wheels may slip and prevent the locomotive from moving. In addition, the driving wheels may also slip if there is oil on the rails. These effects are more pronounced in the case of lightweight locomotives. Wipe any oil from the rails.

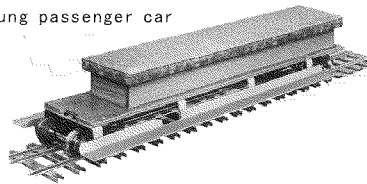
◎ Passenger car

The performance of the car dramatically affects tractive force. When designing your own passenger car, allow enough leeway so that locomotive is able to be operated at a passage radius that is less than the rail radius using ball bearings or needle bearings for the bearings. Always make sure to install a braking device near the operator's seat of the passenger car. The braking device is for avoiding danger within the track layout such as when there is an obstacle on the track, when a person suddenly jumps in front of the locomotive, and when the locomotive running in front of you stops suddenly. The braking device is essential for preventing the occurrence of accidents. The engine and passenger car (including those that are home-made) should be coupled securely to the extent that coupling seems more than adequate. This is because the engine may run away if it becomes uncoupled resulting in an extremely dangerous situation. Please use O.S. coupler pins for coupling. Also make sure to couple the engine and passenger car with a metal chain as a back-up to the coupler pin. This type of chain can be purchased at home improvement stores. O.S. offers a lightweight passenger car (using needle bearings) and a low slung passenger car (using ball bearings) for use as passenger cars.

Lightweight passenger car
(for 3-1/2" and 5")



Low slung passenger car
(for 5")



Braking device (sold separately)

◎ Warranty

All O.S. products are produced under the strictest quality control throughout all phases of production. In the case a malfunction has occurred in this product during the course of proper operation, and that malfunction is determined by the manufacturer to have been caused by a problem with production, repair of the purchased product will be performed free of charge or equivalent warranty will be offered. The manufacturer is unable to take responsibility beyond the scope of that described above. When a malfunction occurs, after informing the manufacturer of details pertaining to use of the product until the time the malfunction occurred, please send the product directly to our locomotive service department as soon as possible. The warranty does not cover products that have been disassembled or modified unnecessarily.

Live Steam Service Department,

O.S. ENGINES MFG. CO., LTD.

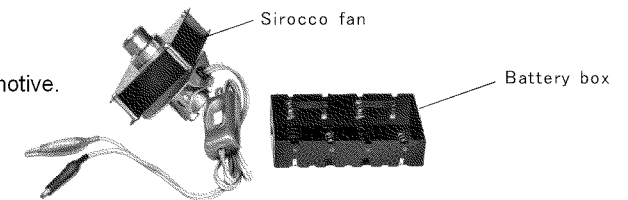
6-15 3-chome Imagawa, Higashi-Sumiyoshi-ku, Osaka-shi, Japan 546-0003
Telephone: 06-6702-0225

[Articles Required for Operation]

- **Passenger car**
This is a car that is ridden in order to operate and ride the locomotive.
- **Fuel**
The locomotive is operated with either coal or propane gas. In the case of operating with LP gas, an optional propane burner, hose and cock are required. (Coal, propane burner, hose and cock are sold separately.)
- **Ignition fuel**
This fuel is used to ignite the coal when using coal for fuel. Although there are various kinds of ignition fuels, solid fuels and wood chips (approx. 1 cm x 1 cm x 4 cm) soaked in gas oil are used most frequently. When using gas, please use a commercially available lighter.
- **Blower**
The blower is a fan that forcibly takes in air required during combustion of coal or LP gas. The blower uses four size D batteries to drive a Sirocco fan.

Blower kit (sold separately)

Required when starting locomotive.



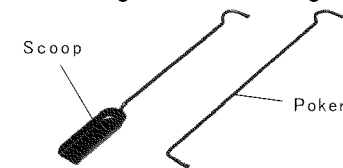
- **OS Steam Oil**
This oil is supplied to the cylinders during operation. OS Steam Oil is exclusively for use in steam locomotives as a result of being able to demonstrate lubricative functions even in the presence of high-temperature steam. Absolutely never use other types of oil.

OS Steam Oil
(150 cc is contained in the kit. 1 liter and 4 liter containers are also sold separately. The photo shows the 1 liter jug)



OS Steam Oil is added to the lubricator (forced lubrication device) in the engine to supply oil to the cylinders during operation. It is also used to lubricate the optional donkey pump.

- **Scoop**
When operating using coal, the scoop is used to scoop up coal while adding coal to the boiler firebox.
- **Poker**
The poker is used to forcibly drop coal that has gone out or is about to go out in the boiler fire box into the ash pan and evenly spread burning coal over the fire grating.

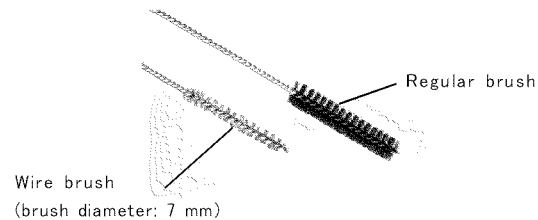


Scoop and poker are sold separately

Names of Components (A) ②

- Smoke tube brushes

When coal is used, soot accumulates in the boiler smoke tubes and fire box forming a layer. Since this layer of soot decreases thermal efficiency, these cleaning brushes are used to remove this layer of soot.



The regular brush and wire brush are sold separately

- Water

Do not use well water or spring water that contain high levels of impurities. Although tap water is used most commonly, since tap water contains calcium and magnesium, these substances become adhered to the inside of the boiler in the form of scale. This scale must be removed with an antscale agent. Purified or distilled water should be used whenever possible. (Purified water is available from O.S.).

Scale: A white solid composed of calcium and magnesium contained in tap water that accumulates on the inside of the boiler and has a detrimental effect on the boiler.

- Lubricating oil

This oil is used to lubricate rotating and sliding parts. Use machine oil (sold separately in 1 liter jugs) or commercially available spray-type lubricant.

- Water tank

This is for supplying water to the side tanks and bottom tank of the locomotive.

- Rust preventive spray

This is sprayed to prevent the formation of rust after operation is completed.

- Welding gloves

Since hot valve handles are operated during operation, these gloves are worn to prevent burns. Cloth gloves should not be worn since they burn easily.

- Cap

A cap should be worn at all times by the operator and persons riding in the back since sparks, ash and oil are discharged from the chimney during operation.

- Long-sleeve shirt and long pants

Long-sleeve shirt and long pants should be worn during operation to prevent burns from sparks. Old clothes should be worn since holes may be burned in them by sparks from the chimney.

- Goggles

Goggles must be worn at all times during operation to protect the eyes of the operator from sparks, ash and oil discharged from the chimney.

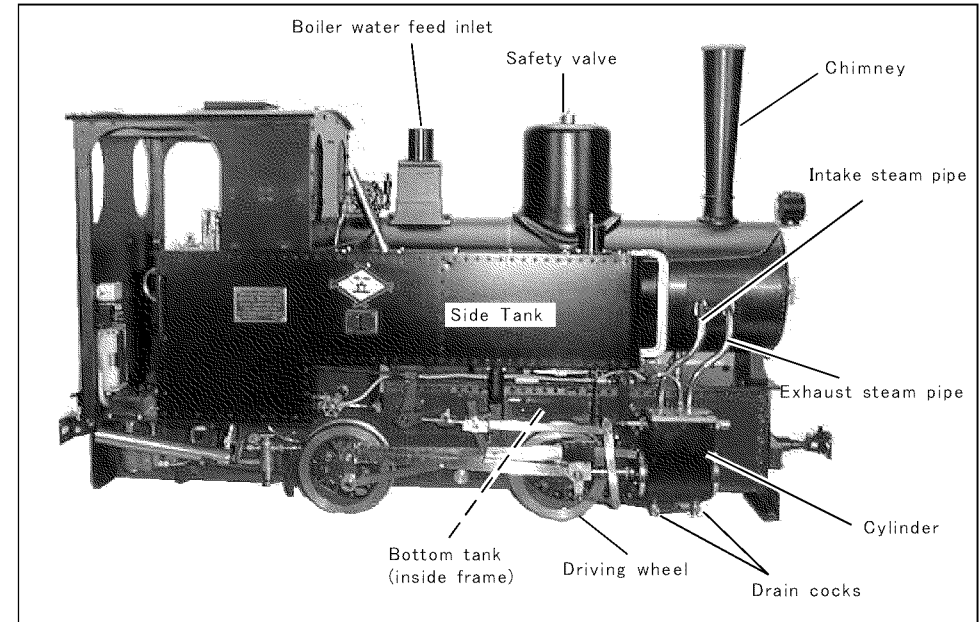
- Maintenance tools

These tools are for performing repairs when a problem has been discovered before or during operation.

- Chimney

The chimney is used to expel smoke following combustion of coal as well as for cylinder exhaust.

Names of Components



- Safety Valve

The safety valve lowers the steam pressure inside the boiler by discharging steam to the outside when the steam pressure inside the boiler reaches approximately 5 kg/cm².

- Boiler Feed Water Inlet

Water is added to the boiler at this location before steaming up.

- Steam Pipes

Intake side: Feeds steam to the cylinder.

Exhaust side: Discharges steam from the cylinder.

- Cylinder

The cylinder piston is moved by the force of the steam, which is turn causes the driving wheels to turn.

- Driving Wheels

The driving wheels transfer the movement of the piston to the rails enabling the locomotive to move forward and backward.

- Side Tank

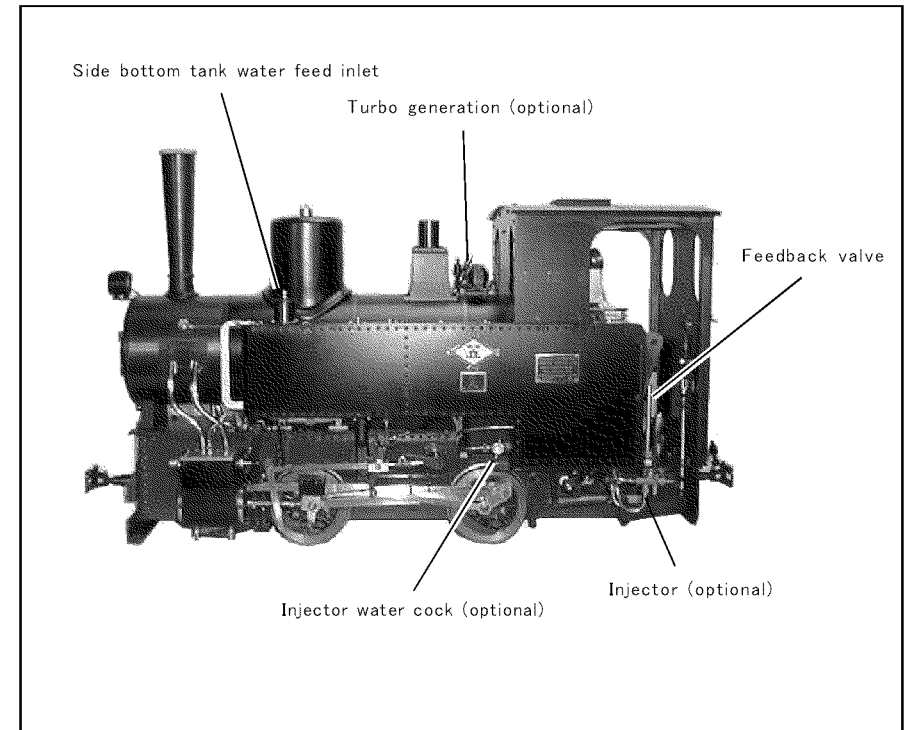
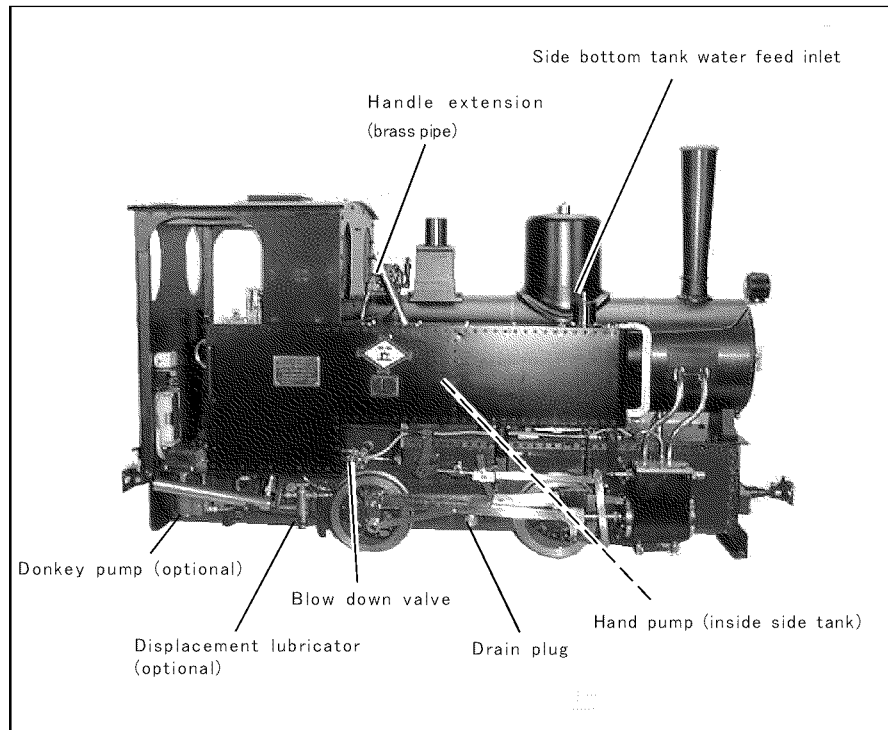
This is a water tank for holding water to be supplied to the boiler.

- Bottom Tank

This is also a water tank for holding water to be supplied to the boiler.

- Drain Cocks

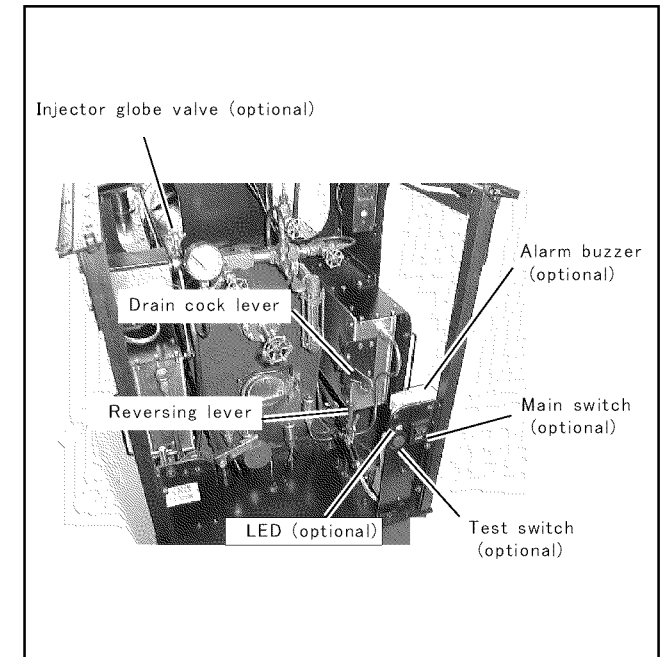
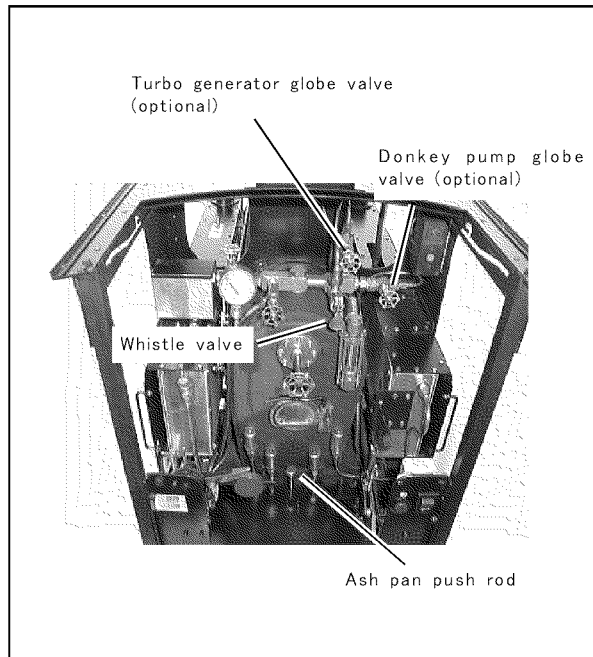
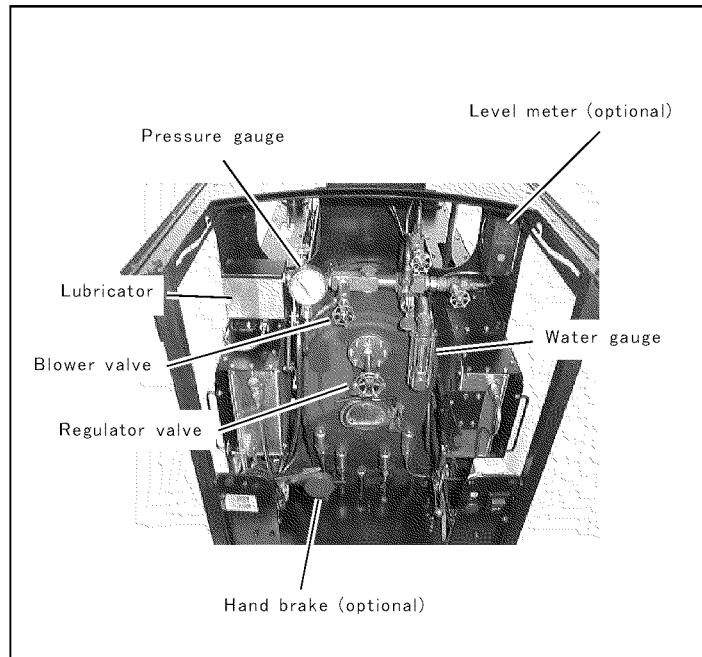
Opening these cocks allows water that has accumulated in the cylinder to be discharged to the outside.



- Side Bottom Tank Water Feed Inlet
Water is added to the side tank and bottom tank through this inlet.
- Blow down Valve
Water in the boiler is drained by opening this valve after completion of operation.
- Drain Plug
Removing this plug enables water to be drained from the side and bottom tanks.
- Handle Extension
This is an extension (brass pipe) for using the hand pump.
- Hand Pump
This pump is for supplying water to the boiler. Water is supplied to the boiler by moving the handle extension back and forth.
- Donkey Pump
This pump is used to supply water to the boiler. Water is supplied to the boiler using steam.

- Displacement Lubricator
This is used to supply lubricating oil (OS Steam Oil) to the donkey pump.
- Feedback Valve
The amount of water fed from the feed pump during operation is adjusted with this valve. When fully closed, all water fed from the feed pump is supplied to the boiler. When fully open, water is not supplied to the boiler and all returns to the side tanks.
- Injector Water Cock
This cock is opened when using the injector to feed water to the injector.
- Injector
This device is for supplying water to the boiler. Water is supplied to the boiler using steam.
- Turbo Generator
Electricity is generated by turning a turbine with steam. This is used to light the optional headlight and room lamp.

Names of Components (C) ④



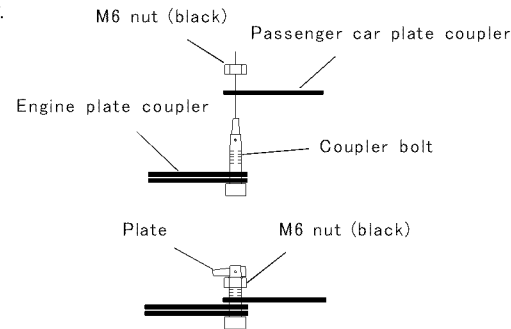
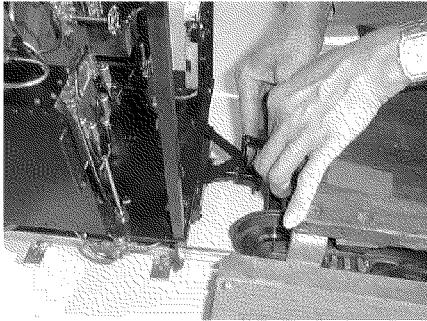
- **Pressure Gauge**
Indicates the steam pressure inside the boiler.
- **Lubricator**
This device forcibly supplies oil inside the cylinder. Special-purpose steam locomotive oil (OS Steam Oil) is added to the tank. Never use any other oils.
- **Blower Valve**
This valve is for forcibly taking in air when coal or gas is burning in the fire box and there is steam pressure.
- **Regulator Valve**
This valve adjusts the amount of steam supplied to the cylinder. The speed of the locomotive is regulated with this valve.
- **Water Gauge**
Indicates the water level inside the boiler.
- **Level Meter**
Indicates the amount of electricity generated by the turbo generator.
- **Hand Brake**
This brake is used to prevent the locomotive from moving when the locomotive is stopped or on display.
- **Whistle Valve**
Pushing on this valve causes the whistle to blow.
- **Ash Pan Push Rod**
Pushing on this rod causes coal and ash that has collected in the ash pan to be discharged to the outside.
- **Turbo Generator Globe Valve**
Opening this valve activates the turbo generator.
- **Donkey Pump Globe Valve**
Opening this valve activates the donkey pump.
- **Injector Globe Valve**
Opening this valve activates the injector.
- **Drain Cock Lever**
Moving this lever up and down opens and closes the drain cock.
- **Reversing Lever**
This reversing gear is for switching the operation of the locomotive between the forward and reverse directions. The locomotive moves forward when this lever is pushed forward and moves in reverse when this lever is pulled back. The middle position is neutral.
- **Main Switch**
This switch is for activating the water level alarm in the bottom tank.
- **LED**
This lamp lights when the water level in the bottom tank is low.
- **Alarm Buzzer**
This buzzer sounds when the water level in the bottom tank is low.
- **Test Switch**
Pushing this button causes the alarm buzzer to sound and the LED to light to test their operation.

◎ Before Preparing for Operation

Since preparation for operation involves actually firing the coal and operating the locomotive, check the operating procedure by looking over the operation manual one more time and take adequate precautions to ensure that accidents do not occur. Those persons using live steam for the first time are strongly recommended to seek the advice of a person who has considerable experience in operating live steam locomotives.

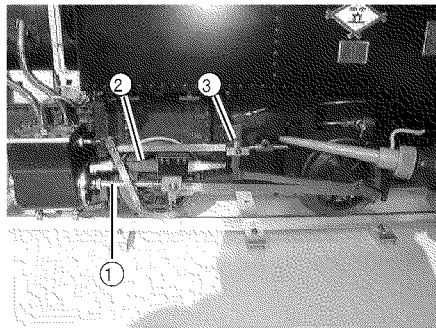
◎ Preparations for Operation

- (1) Place the locomotive on the track.
- (2) Couple the locomotive and passenger car.



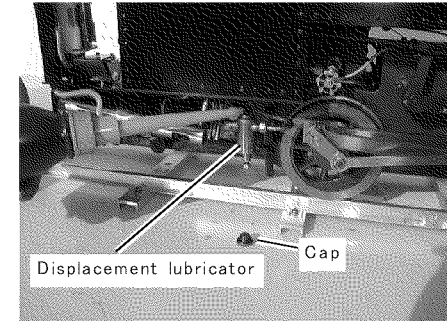
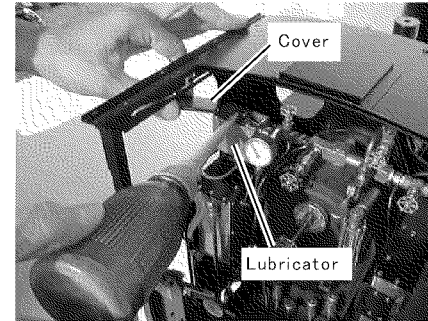
After coupling, bend over the plate of the coupler bolt and clamp down with the M6 nut.

- (3) Apply machine oil to all moving parts on the left and right sides.

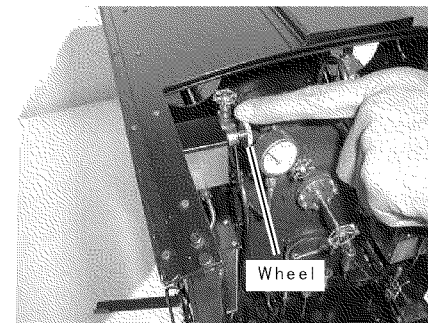


- ① Piston shafts
- ② Slide bars
- ③ Expansions

- (4) Open the cover of the lubricator and add OS Steam Oil. Only use OS Steam Oil. (A 150 cc bottle of OS Steam Oil is contained in the accessories.) In the case the optional donkey pump has been installed, also add OS Steam Oil to the displacement lubricator located towards the back on the right side of the locomotive.

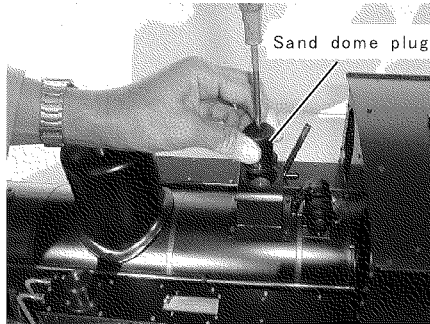


- (5) Turn the wheel on the right side of the lubricator about 20 revolutions toward the front to feed oil to the cylinders.

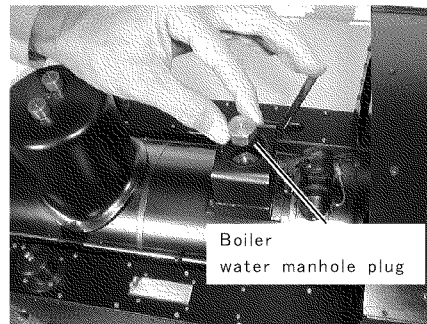
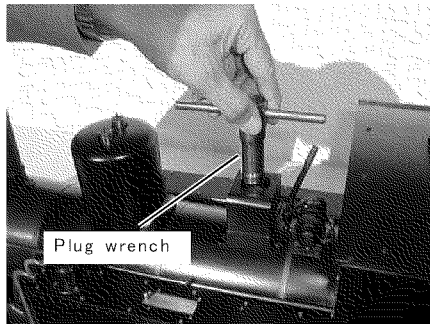


Preparations for Operation (B) ⑥

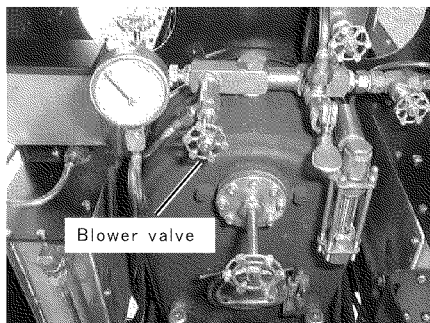
- (6) Remove the sand dome plug.



- (7) Attach a plug wrench and remove the boiler water manhole plug.
(The user is requested to provide his own plug wrench. Size: 18 mm across.)

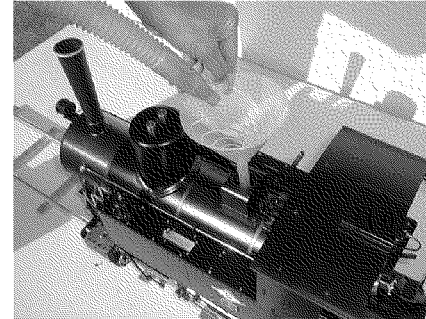


- (8) Open the blower valve two turns.



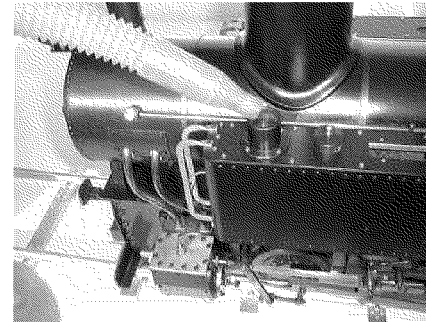
When the blower valve is opened, steam will be vented from the boiler making it easier for water to enter when supplying water.

- (9) Add water (purified water) to the boiler. Add water to the halfway point of the water level gauge.

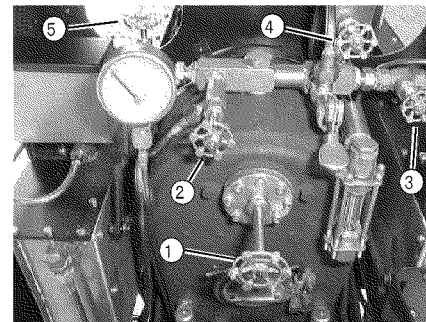


After adding water, reattach the boiler water manhole plug and side dome plug that were previously removed.

- (10) Add water (purified) water to the side tanks and bottom tank.



- (11) Check that all valves are fully closed.



- ① Regulator valve
- ② Blower valve
- ③ Donkey pump globe valve
- ④ Turbo generator globe valve
- ⑤ Injector globe valve

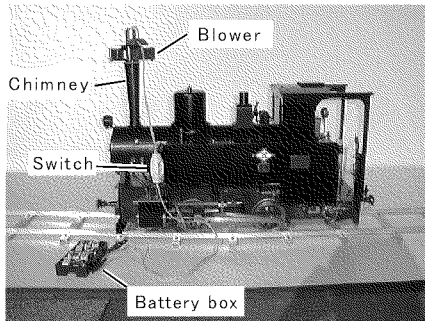
※ Valves ③, ④ and ⑤ are check only when those options have been installed.

© Steaming Up

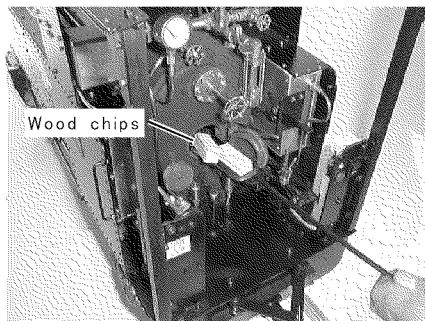
Although the procedure for steaming up (firing the coal) is a little difficult, you should be able to perform it without problem by carefully reading the operation manual. Although the procedure varies slightly depending in the type of coal used, this explanation describes the most commonly used procedure along with relevant precautions.

Be particularly careful when steaming up since the locomotive becomes quite hot. When steaming up, always make sure to wear welding gloves. Also do not allow other persons, and especially children, to come near the locomotive. Since sparks, oil and steam may be sprayed from the chimney, it is also recommended to wear a long-sleeve shirt and long pants as well as goggles to protect your eyes. In addition, make sure that there are no flammable materials in the area around the locomotive before firing the coal.

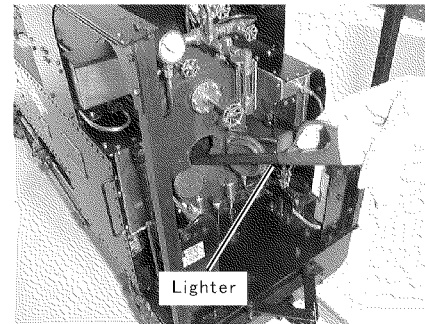
- (1) Place the blower on the top of the chimney. Place four size D batteries in the battery box to power the blower. The sirocco fan will begin to run when the switch is turned on.



- (2) Uniformly place some wood chips soaked in gas oil in the fire box. About eight pieces measuring roughly 1 cm x 1 cm x 3-5 cm should be placed in the fire box.

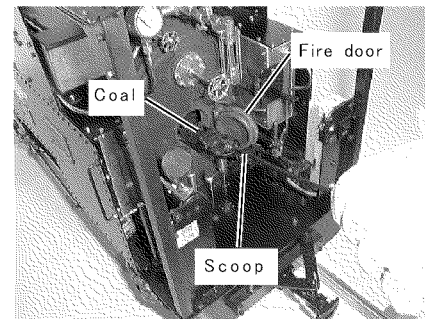


- (3) Light the wood chips with the lighter. Once all of the wood chips in the fire box are burning, turn on the blower switch to start the sirocco fan.



If the fire goes out when the fan is turned on, this indicates that the blowing force of the blower is too strong. Lower the voltage by an amount equivalent to one of the size D batteries. To lower the voltage, move the minus end (black) of the alligator clip attached to the end of the cord over by one battery and reattach.

- (4) After about 30 seconds have passed since the wood chips were lit, add one of 1 cm square pieces of coal to the fire box. The fire may go out if too much coal is added at this time.



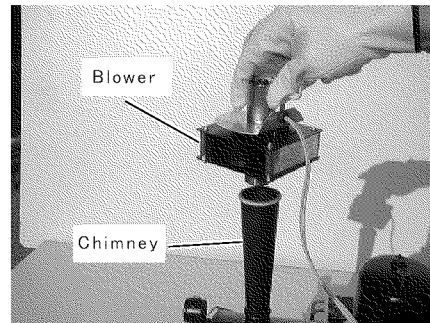
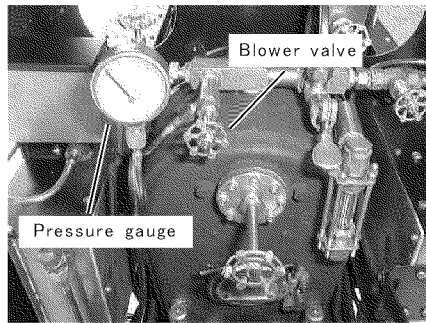
Leave the fire door closed until the coal starts to burn. Once the coal is burning, you will be able to smell the characteristic odor of burning coal from the blower.

- (5) Once the coal is burning, open the fire door and add another scoop of coal to increase the fire intensity. A large amount of smoke coming from the blower indicates that the coal has been fired successfully. Very little smoke will come out of the blower if the coal has not been fired successfully. If the coal is not burning well, repeat the steaming up procedure from step (3). If the coal still does not burn well, remove all wood chips and coal from the fire box and repeat the procedure from step (2).

Procedure Immediately Before Operation ⑧

◎ Steaming Up Under Own Power

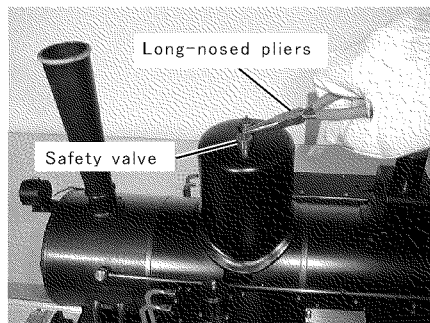
- (1) Since the locomotive will steam up under its own power when the needle of the pressure gauge indicates 0.3MPa, turn the blower valve 45 degrees to the left. Promptly remove the blower from the chimney and turn off the power.



Since the opening of the blower valve is adjusted according to the changes in steam pressure, close the blower valve a little if the pressure is excessively high. Although this adjustment is difficult to explain since it varies according to how well the coal is burning and the characteristics of the locomotive itself, if the blower valve is opened too much, the steam that has been produced will end up being wasted. If the blower valve is closed too much, there will not be enough air for the coal to burn resulting in decreased production of steam. Adjust the blower valve until a gentle hissing sound can be heard from the chimney and the coals are flaming or glowing red when the fire door is opened.

- (2) When the pressure gauge shows 0.4-0.5 MPa, steam will be blown out from the safety valve to maintain the pressure inside the boiler at a constant level. In order to confirm whether or not steam is being blown from the safety valve at this time, grab the valve stem protruding from the top with a long-nosed pliers and pull it up. The safety valve is operating normally if steam is no longer blown from the safety valve when the long-nosed pliers is released.

Next, collect data for the operating range of the safety valve. Increase steam pressure and record the steam pressure on the pressure gauge when steam is blown out from the safety valve. Next record the steam pressure when steam is no longer blown from the safety valve. This data is used to confirm whether or not the safety valve is operating properly.

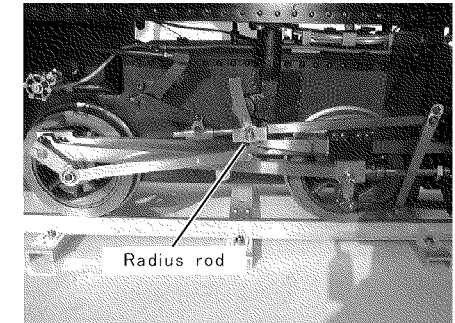
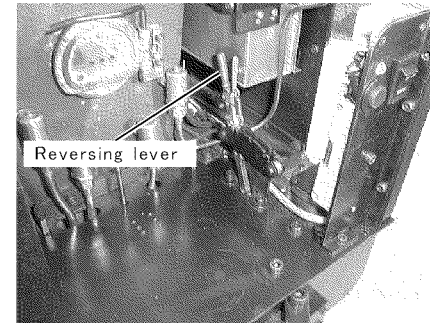


When there is a difference of 0.05 MPa or more between the two steam pressure readings, discontinue operation and return the safety valve to the manufacturer to have a safety test performed. Since continued operation of the locomotive with a malfunctioning safety valve can be extremely dangerous, operation of the locomotive should be discontinued immediately.

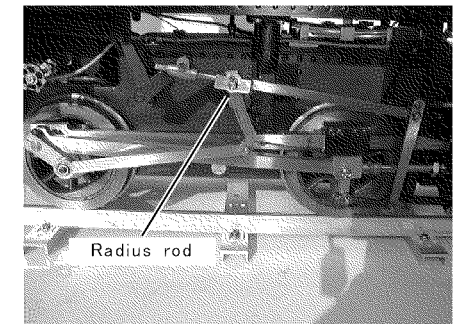
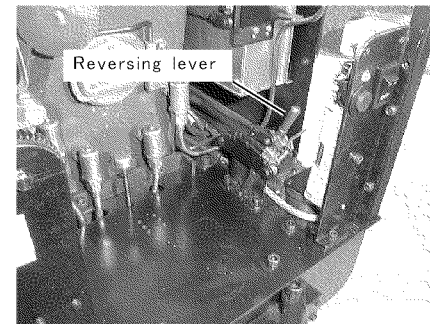
◎ Operation of Reversing Lever

If the safety valve is determined to be operating properly, put the reversing lever in the forward position (or reverse position).

- (1) Push the reversing lever forward to put it in the forward position. When pushed forward, the radius rod will move downward into the forward position.

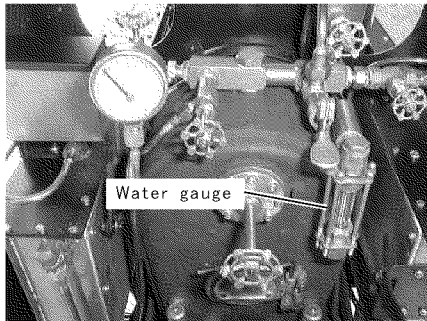


- (2) Pull the reversing lever backward to put it in the reverse position. When pulled backward, the radius rod will move upward into the reverse position.

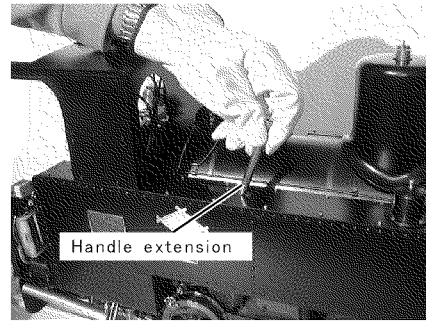


© Starting Out

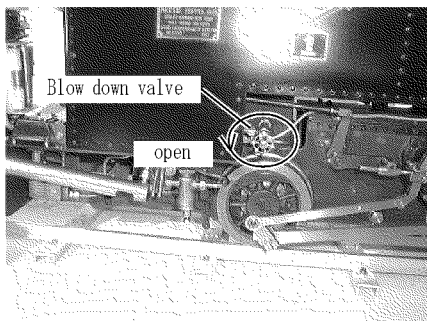
- (1) Check the current water level in the boiler by looking at the water gauge. The optimum level is when the water level is in the center of the water gauge. When the water level cannot be seen in the water gauge, move the locomotive forward or backward by hand. If the water level can then be confirmed in the water gauge, supply water to the boiler using the hand pump until the water level reaches the center of the water gauge. Alternatively, supply water to the boiler with the optional injector or donkey pump. When the water level cannot be seen in the water gauge even after the locomotive has been moved forward or backward by hand, immediately add water to the boiler after pouring water on the coal in the fire box to extinguish the fire. Conversely, when the water level is so high that it cannot be seen in the water gauge, open the blow down valve and drain water from the boiler.



Check the water level with the water gauge.

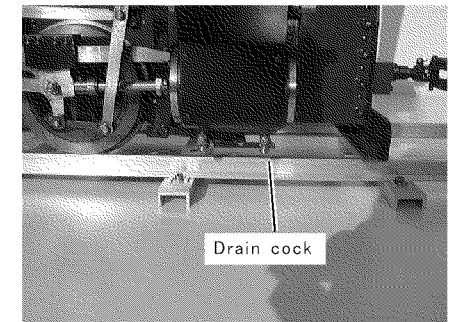
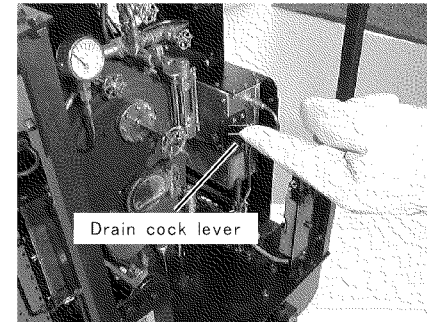


When the water level is low, move the handle extension back and forth to supply water to the boiler with the hand pump.

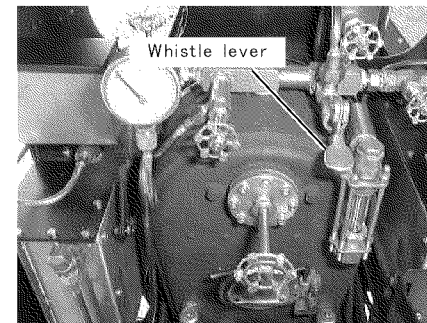


When the water level is high, open the blow down valve and drain water from the boiler.

- (2) Add one scoop of coal to the fire box before starting out.
- (3) Raise up the drain cock lever to open the drain cock. This is for discharging any water that has accumulated in the cylinder when starting out. If the drain cock is not opened, the water accumulated in the cylinder will create resistance that may prevent the locomotive from moving.



- (4) Blow the whistle before starting out and signal other persons in the area to ensure safety. The whistle will continue to blow as long as the whistle lever is pushed.

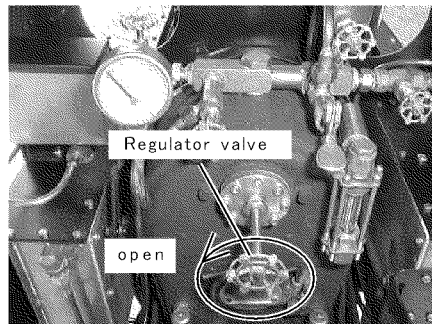


⚠ CAUTION

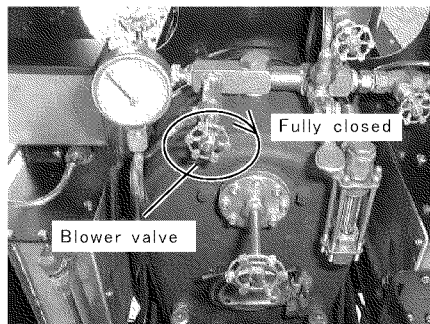
Always make sure to check the water gauge both during operation and when stopped. When the water level has become so low that it cannot be seen in the water gauge, immediately extinguish the fire in the fire box and discontinue operation. If the locomotive is continued to be operated when the water level cannot be confirmed in the water gauge, the boiler will end up being heated without water which can be extremely dangerous. This can also cause serious damage to the boiler.

Operating Procedure (B) ⑩

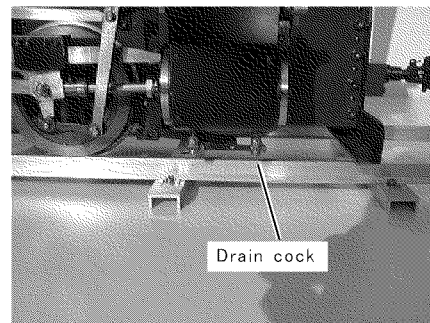
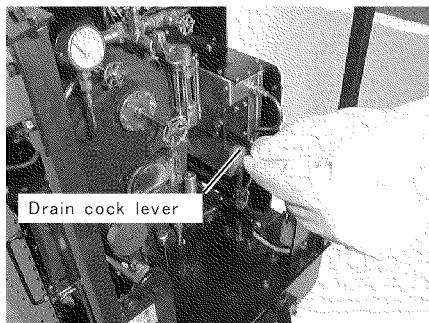
- (5) Slowly open the regulator valve and start out slowly so that the driving wheels do not slip. Slipping of the driving wheels will cause a significant decrease in steam pressure and tractive force.



- (6) After the locomotive has started to move, fully close the blower valve to provide air by using the cylinder exhaust.



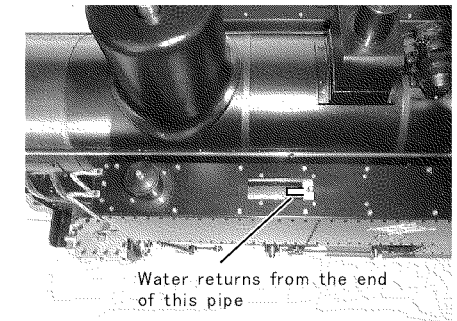
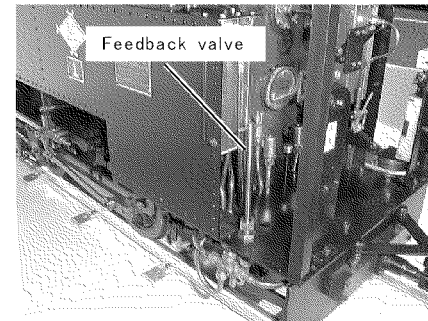
- (7) After the locomotive has started to move, once the discharge from the drain cock changes from a mixture of steam and water to steam only, lower the drain cock lever to close the drain cock. Steam pressure and tractive force will decrease if the locomotive is continued to be operated without closing the drain cock.



◎ Procedure during Operation

During operation of the locomotive, there are various checks that have to be made, including the safety of the surrounding area, the water level inside the boiler, steam pressure and the manner in which the coal is burning. Since there is a tendency to not check the area around the locomotive when it is in operation as a result of being preoccupied with the operating procedure when not familiar with the operating procedure, be careful to also monitor the safety of the locomotive as it travels over the track.

- (1) Although the locomotive will accelerate when the regulator valve is opened, do not operate the locomotive at a speed greater than 5 km/h (the normal walking speed of an adult). Traveling too fast can cause the locomotive to leave the track and tip over. Since there is always some degree of incline in the track layout, close the regulator valve a little to reduce speed when traveling down an incline and just before curves.
- (2) During operation, water is supplied to the boiler by the operation of the feed pump. The amount of water that is supplied is adjusted with the feedback valve. This valve should be adjusted so that the water level is constantly in the center of the water gauge. Opening the feedback valve returns water that has not been supplied to the boiler from the pipe of the left side tank. If only a small amount of water returns, it means that a greater amount is supplied to the boiler. If a large amount of water returns, it means that only a small amount is supplied to the boiler. Before you have become familiar with this operation, fully close the feedback valve and supply water to the boiler when the water level is low, and then fully open the feedback valve to interrupt the supply of water to the boiler if the water level is too high. Repeat this procedure until you become familiar with the operation of the feedback valve.



- (3) When adding coal to the fire box during operation, there is the risk of looking down for a long time which may prevent you from seeing objects in front of the locomotive as it travels. In order to prevent this, only add coal after first checking to make sure that there is no danger in front of the locomotive, and add coal quickly.

© Conditions for Continuous Operation

- The water level in the boiler must remain constant in the water gauge.
- Steam pressure must remain constant.
- The regulator valve must not be operated too actively.
- The size of the pieces of coal should be uniform and measure about 10 mm along one side.
- The driving wheels should not be made to slip.
- The chimney must not be clogged with soot and coal must not be clogged.
- The ash pan must not be clogged with ashes so that it blocks the air holes.
- Ball bearings or needle bearings offering little resistance should be used for the passenger car. (The initial tractive force required until the locomotive begins to move from a standstill on a level track should be 50 g or less.)
- There should be no oil on the rails.
- The rails should be laid on level ground without any steep inclines.

The locomotive will be able to be operated continuously if the above conditions are satisfied. The most difficult condition to satisfy is maintaining constant steam pressure. Steam pressure is significantly affected by changes in the amount of water in the boiler and the timing at which coal is supplied to the fire box. Although the locomotive will most likely repeatedly run and stop in the beginning, you should be able to operate the locomotive continuously once you acquire the feel of locomotive operation.

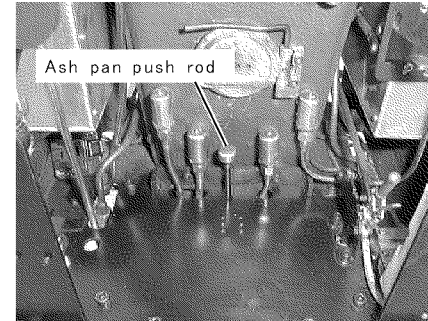
© Helpful Hints for Continuous Operation

(1) Coal Firing and Supplying Coal

In order for the locomotive to run continuously, coal must be burned efficiently. The optimum conditions for burning coal consist of burning coal spread throughout the firebox and black smoke puffing from the chimney. In order to maintain this state of combustion for the duration of operation, the optimum amount of coal must be fed into the fire box at the proper times. In order for the coal to burn steadily, the ash left over after the coal has burned falls into the ash pan. During operation, although nearly all of the ashes will fall into the ash pan due to the vibrations of the locomotive, since some of the ashes may remain in the fire box, use the poker to poke the coal and forcibly cause the ashes to fall into the ash pan to improve the flow of air. This will create new space for supplying coal. Although the timing at which coal is added to the fire box differs according to the status and operation of the locomotive, it is generally good to add one scoop of coal for every 150 meters traveled. (The combustion conditions described above are based on those when using our coal.)

(2) Disposal of Ashes

If ash is left to accumulate in the ash pan, the air holes will be blocked and this will prevent the coal from obtaining the air it needs to burn. Periodically open the door of the ash pan and discard the ashes. Ashes should always be placed in a metal container and covered with water. Since even ashes that have been disposed of are still hot enough to burn paper, do not dispose of them near locations where there are flammable materials.



Pushing on the ash pan push rod causes the ash pan door to open and ashes to fall to the outside.

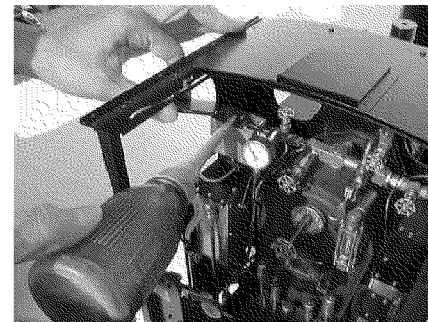
(3) Cleaning the Smoke Tubes

Even though the locomotive may have been running smoothly, the manner in which the coal is burning may gradually become worse. This is either due to the formation of a layer of soot in the boiler smoke tubes or clogging of coal. When this happens, discontinue operation and clean the smoke tubes.

(Refer to section ⑬ of the operation manual for details regarding the procedure for cleaning the smoke tubes.)

(4) Check of Lubricator Operation

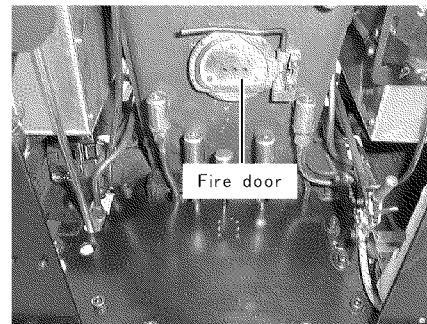
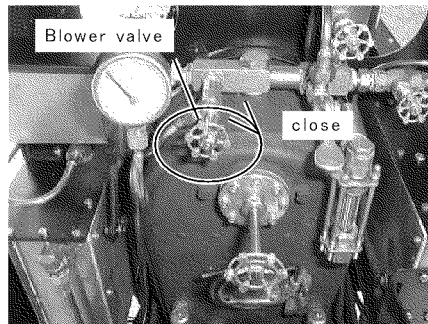
After having traveled for about 200 meters, open the lubricator cover and check that the level of steam oil has gone down. If it has, this means that oil is being supplied to the lubricator normally provided there are no leaks in the line. This can also be determined by the presence of oil on the inside of the chimney.



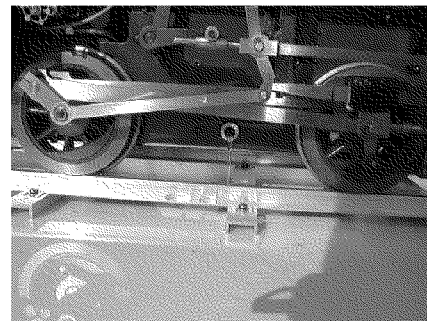
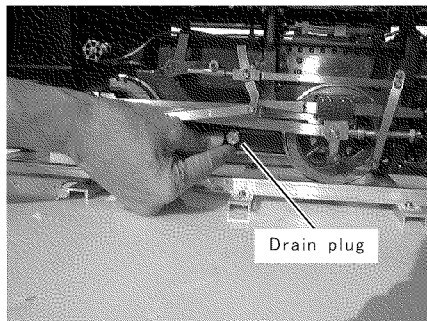
After the locomotive has stopped, check the amount of oil remaining in the lubricator. Add more oil if the level is low.

Completion of Operation (A) 12

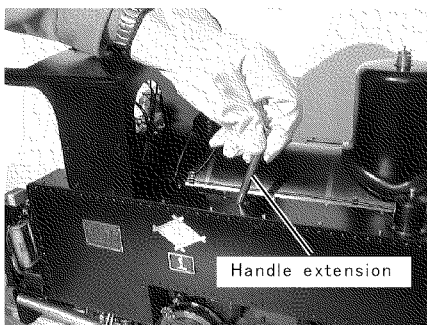
- (1) When operation has been completed, stop the locomotive in a safe location that is free of flammable materials.
- (2) Close the blower valve and the fire door to not allow oxygen to enter the fire box. This will cause the coal to go out.



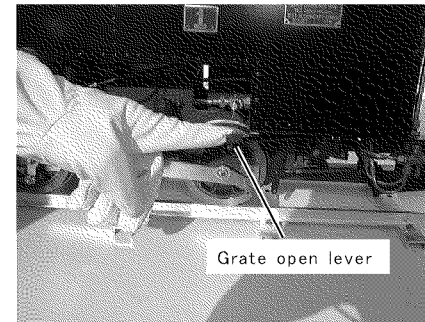
- (3) Remove the drain plug installed between the driving wheels on the right side, and drain the water from the side tanks and bottom tank.



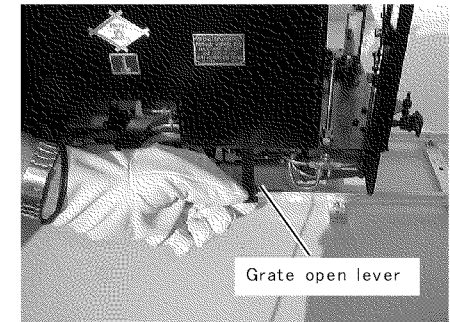
- (4) Move the handle extension back and forth to release any water remaining in the hand pump into the boiler.



- (5) Once the coal has completely gone out, pull out the grate open lever on the left side of the locomotive several times to cause any ash or hot coal remaining on the grating to fall into the ash pan.

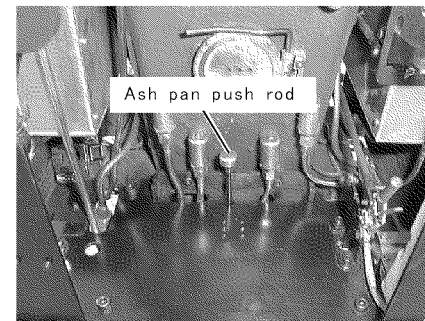


Place your finger on the end of the grate open lever and push it down.



Pull out the grate open lever towards you.

- (6) Push the ash pan push rod several times to discard ashes and hot coal outside.



Push several times

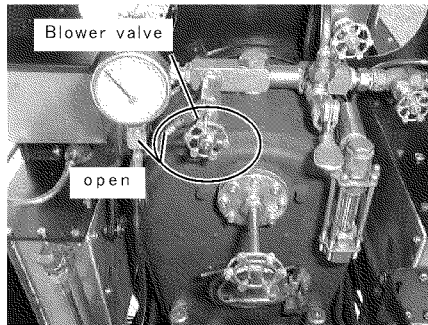


CAUTION

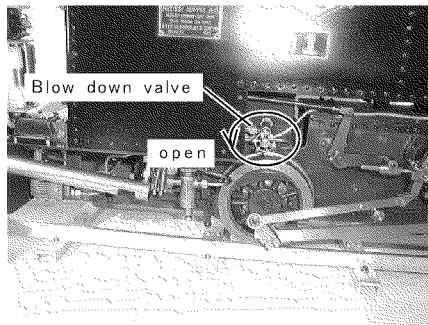
When discarding ashes and hot coal outside, always make sure to place them in a metal container and douse with water. Always make sure to completely remove all ashes and hot coals from the fire box at this time. If any ashes or hot coals are left in the fire box, they may start to burn again when the locomotive is transported or stored resulting in the risk of fire.

Completion of Operation (B) ⑬

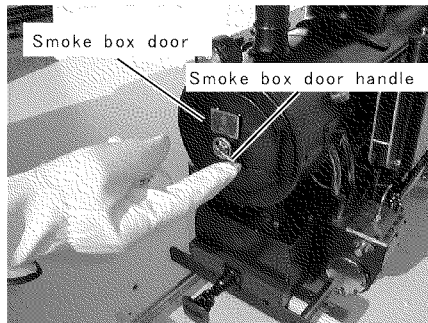
- (7) Open the blower valve and lower the pressure in the boiler.



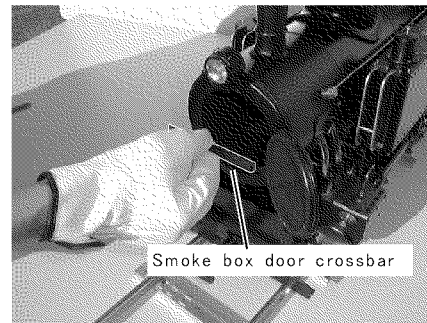
- (8) Open the blow down valve to drain the water from the boiler. Since the boiler discharged from the blow down valve at this time is hot as a result of being heated in the boiler, be careful to not get burned when opening this valve.



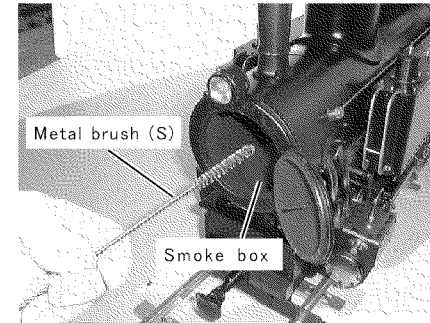
- (9) After allowing the locomotive to stand for at least 30 minutes to cool so that it can be touched with the bare hand, remove any soot that has accumulated in the smoke tubes (there are 18 smoke tubes).



Turn the smoke box door handle to the left to open the smoke box door.



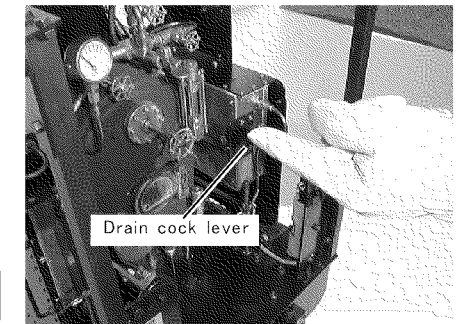
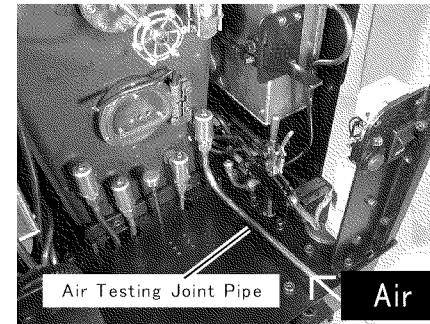
Remove the smoke box door cross bar.



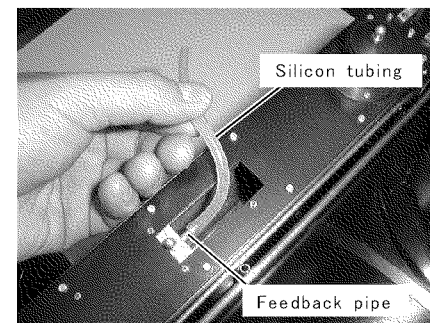
Soot that is removed collects in the smoke box and ash pan. Brush off any accumulated soot with a brush or blow it off with compressed air using a compressor.

Insert the metal brush into the smoke tubes to remove any soot.

- (10) Perform the air test by blowing compressed air through the locomotive. This removes any water remaining in the cylinders, feed pump and pipes.



Raise up the drain cock lever when the driving wheels are turning to open the drain cock and drain water from the cylinders.



Place a piece of commercially available silicon tubing onto the feedback pipe on the left side of the side tank. Open the feedback valve and drain water inside the feed pump to the outside by turning the driving wheels.

- (11) Drain the OS Steam Oil from inside the lubricator.
 (12) Carefully wipe off any oil or dirt on the locomotive with a rag. Be particularly careful about wiping away moisture from the driving wheels and other areas around the bottom of the locomotive. After wiping away moisture, spray with a rust-preventive spray (rust inhibitor).
 (13) Remove the screws on the lower portions of the cylinders and wipe off any oil and water from the cylinders.

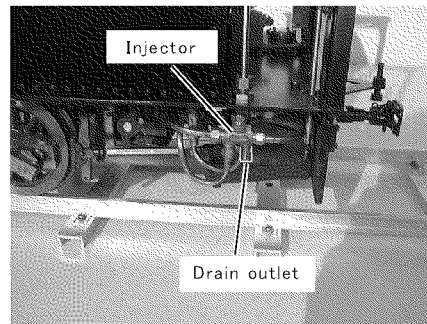
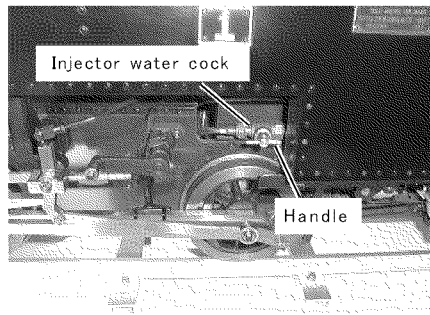
Operation of Optional Parts (A) ⑭

◎ Injector

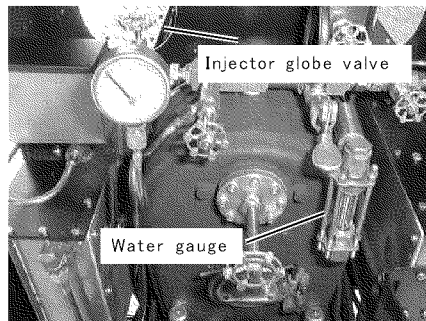
- The injector is used to rapidly supply large amounts of water to the boiler when the locomotive is stopped.
- The injector can be used when the pressure inside the boiler is at least 0.3 MPa.
- The performance of the injector varies according to the temperature of the water to be supplied. Water supply efficiency decreases in the summer when the water temperature rises. It becomes difficult to operate the injector when the water temperature exceeds 35 °C.

Injector Operation

- (1) Open the injector water cock and allow water to drip out from the drain outlet of the injector. The injector water cock is opened by turning the handle so that it is horizontal.



- (2) Slowly open the injector globe valve. When the valve is opened, water will be drained from the drain outlet with considerable force. When the valve is opened further, draining of water will stop and water will be supplied to the boiler.



Using the injector to supply water enables a large amount of water to be rapidly supplied to the boiler. Be careful not to add too much water to the boiler by constantly monitoring the water gauge. Addition of an excessive amount of water will cause steam pressure to drop suddenly thereby preventing the injector from operating.

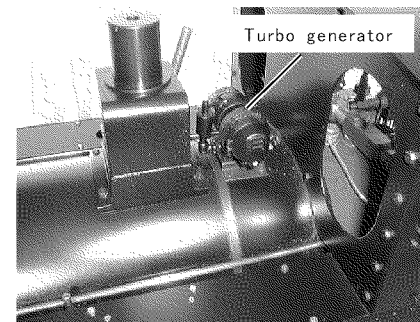
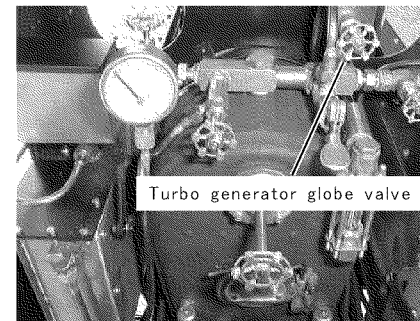
- (3) When discontinuing the supply of water, close the injector globe valve. then close the injector water cock.

◎ Turbo Generator

- The turbo generator serves as the power source for the optional headlight and room lamp.
- The turbo generator will not operate unless the pressure in the boiler is at least 0.3MPa.
- The speed of the turbo generator changes automatically according to the amount of steam to supply a constant voltage.

Turbo Generator Operation

- (1) Opening the turbo generator globe valve causes steam to be sent to the turbo generator and the turbine to rotate.

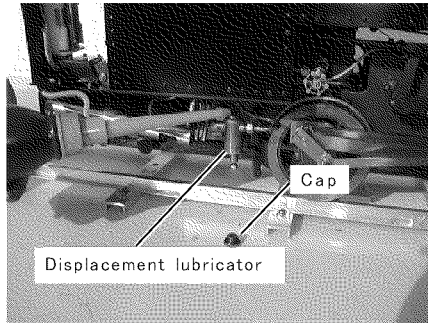


◎ Donkey Pump

- The donkey pump is used to rapidly supply a large amount of water to the boiler when the locomotive is stopped.

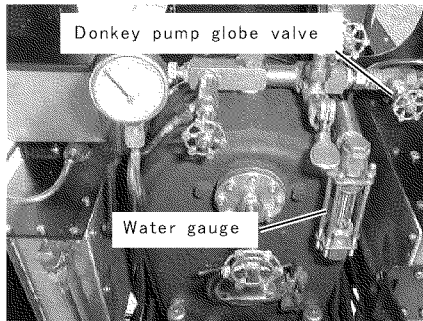
Donkey Pump Operation

- (1) Check that there is OS Steam Oil in the displacement lubricator.



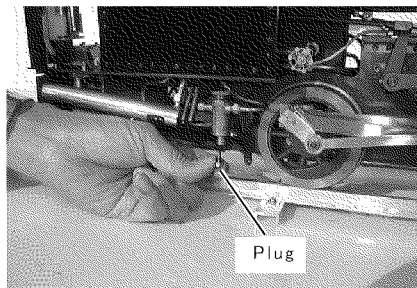
Be careful not to lose the cap.

- (2) Slowly open the donkey pump globe valve, and adjust so that the donkey pump piston reciprocates once per second.



Using the donkey pump to supply water enables a large amount of water to be rapidly supplied to the boiler. Be careful not to add too much water to the boiler by constantly monitoring the water gauge. Addition of an excessive amount of water will cause steam pressure to drop suddenly.

- (3) Periodically remove the plug in the bottom of the displacement lubricator to drain any water inside and add steam oil.

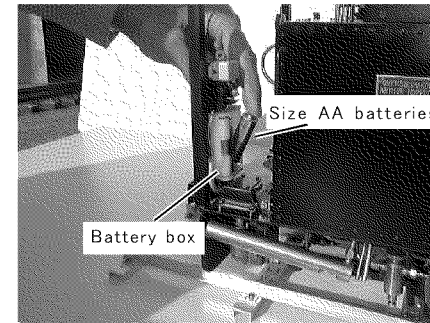


◎ Water Level Alarm

- The water level alarm informs the operator that the water level in the bottom tank, which cannot be checked visually, is low by sounding a buzzer and lighting an LED.

Water Level Alarm Operation

- (1) The water level alarm informs the operator that the water level in the bottom tank, which cannot be checked visually, is low by sounding a buzzer and lighting an LED.



- (2) Push the test switch to check whether the water level alarm circuit is functioning properly. The buzzer will sound and the LED will light when the circuit is operating normally. When it does not operate, check to make sure that the installation of the water level alarm is correct.
- (3) Turn on the main switch of the water level alarm. The buzzer will sound and the LED will light. Add water to the side tank through the water feed inlet with the alarm set in this state.
- (4) When the water level in the bottom tank has risen to a certain extent, the water level alarm will enter the standby state and the buzzer and LED will go off.
- (5) When the water level in the bottom tank decreases during operation, the buzzer will sound and the LED will light. Since the locomotive can still be operated for about 300 meters after the water level alarm has been activated, add water from the water feed inlet of the side tank before traveling 300 meters.

