

**Exhaust Gas Treatment Equipment**

Models: TRS

**INSTRUCTION MANUAL**

<For Customers>

**SEIKOW CHEMICAL ENGINEERING & MACHINERY, LTD**  
**Environmental Device Division**

## INTRODUCTION

We thank you for your purchase of our Exhaust Gas Treatment Equipment TRS Type. In using this exhaust gas treatment equipment, carefully read this instruction manual, circulating pump instruction manual, fan (air blower) instruction manual and auxiliary equipment instruction manual, and operate this equipment correctly and efficiently always in the optimum condition over a long period of time. It should be noted that your modification or alteration of the operation conditions and inadvertent handling there of may give rise to unexpected accidents.

**Always keep this instruction manual, fan instruction manual, circulating pump instruction manual and auxiliary equipment instruction manual ready to your hand.**

### <PRECAUTIONS>

**When handling, maintaining and inspecting this exhaust gas treatment equipment, give care to the following:**

1. Since dangerous chemicals and detrimental gas & mist or the like are handled, a person having the related expert (technical) knowledge (The Fire Services Act Article 13 - Dangerous Article Handling Person, etc.) should be responsible for handling these items.
2. When the fan is suspended, the exhausted place (near the hood) is filled with gas and mist, which may be placed in a dangerous state. In this case, stop the occurrence of detrimental gas, for example, and then stop fan operation.
3. In this equipment, the major portions are made of FRP (fiberglass reinforced plastics) and PVC (polyvinyl chlorideresin). Avoid applying external impact and keep them away from fire, flame or inflammables.
4. If you change the original operating conditions, the performance may down grade or an accident can be caused. At that time, therefore, be sure to contact our company.
5. The marks in the document have the following meanings:
  - DANGER** : This indicates the limited contents in which a user may possibly sustain a death or a serious wound in the case of inadvertent handling, and the warning urgency (imminence degree) when a danger occurred is high.
  - WARNING** : This indicates the contents in which a user may possibly sustain a death or a serious wound in the case of inadvertent handling.
  - CAUTION** : This indicates the contents in which a danger that a user is wound and physical damage may occur in the case of inadvertent handling.

## 1. Exhaust Gas Treatment Equipment Structure

- (1) This treatment equipment is manufactured, using FRP (fiberglass reinforced plastics) and PVC (polyvinyl chlorideresin) in the critical points. Shocks given thereto may cause damage to these parts.

## 2. Exhaust Gas Treatment Equipment Installation & Setup Conditions

- (1) Do not install the treatment equipment in a place near fire or flammables and where it may be flooded.

**WARNING** : If fire or flammables are near, deformation and ignition may result.

**CAUTION** : If the equipment is flooded, the motor and electric system may fail, and leakage may arise.

- (2) Provide a space for maintenance at least 600 mm around the treatment equipment.

**WARNING** : Maintenance and inspection work are dangerous.

- (3) Give off gas exhausted from the treatment equipment to the outdoors.

Keep the exhaust port sufficiently away from the window and air intake.

**WARNING** : Harmful gas may be exhausted.

- (4) The drain discharged from the treatment equipment should be applied with the required treatment in accordance with the Water Pollution Prevention Act, which should be then discharged as stipulated.

**CAUTION** : Drain contains dangerous chemicals.

- (5) When the equipment may suck up foreign matter, take care not to allow the inlet port to suck up foreign matter.

**WARNING** : If foreign matter is sucked up, the fan impellers will be damaged, causing a serious accident.

- (6) Supply water to the treatment equipment at 78.5 kPa (0.8kgf/cm<sup>2</sup>) max.

Where the water supply pressure is high, attach the pressure-reducing valve.

- (7) When moving the treatment equipment and using it under other than the original operation conditions, please contact our company; otherwise, the eliminating performance may lower and resistance to corrosion may be impaired.

**CAUTION** : A serious trouble may be given to the equipment.

- (8) When the treatment equipment is disposed of, be sure to contact our company.

**WARNING** : The interior equipment is polluted with chemicals, which could be very dangerous.

## 3. Delivery Method for Exhaust Gas Treatment Equipment

### 3.1 Delivery of treatment equipment

The treatment equipment is divided as follows for delivery; therefore, the reassembly and installation are required at customer's end.

Also, the customer is requested to assemble the special accessories.

- (1) Scrubber main body, fan, circulation pump and circulating tank are assembled for delivery.

- (2) Parts box:

This box contains the instruction manual, foundation bolt and other specially ordered

accessories.

(3) Special accessories:

The special accessories attached to the scrubbing tower and circulating tank are assembled for delivery. However, the large special accessories (inspection landing steps) are shipping by dividing them properly.

### 3.2 Checkup during delivery

When the treatment equipment arrives, check to see if:

- (1) each product is as ordered, confirming the nameplate;
- (2) all products are delivered correctly;
- (3) the accessories are attached or delivered correctly, using the specifications and drawings; and
- (4) no product is damaged due to an accident during transportation.

If you should find an abnormal condition and short parts or units in this treatment equipment, enter the details in the receipt, and inform our company promptly.

### 3.3 Storage of treatment equipment

Where the treatment equipment is not reassembled and installed immediately after your receipt thereof, give care to the following. (Where the standard storage period exceeds one week)

- (1) Scrubber main body, fan, circulation pump and circulating tank are assembled for delivery.
- (2) Always store this equipment all together so that the product is not lost.
- (3) Store the fan, circulating pump and accessories according to the respective instruction manuals.

## 4. Exhaust Gas Treatment Equipment Assembly & Installation Work

### 4.1 Assembling & installing precautions

- (1) Lifting operations should be carried out under the instructions of a person having the slinging qualification.

**WARNING** : Lifting operations involve a danger, such as a fall.

- (2) Assembling operations should be carried out in as safe a place as possible (a wide place on the ground).

**CAUTION** : Operations work in a dangerous place may cause an accident.

- (3) Operations work in an elevated place should be done with the working floor provided.

**WARNING** : Operations work in an elevated place may give rise to a fall accident.

- (4) Special care should be exercised in operations work in rainy weather.

**CAUTION** : The working floor is slippery, which may give rise to a fall accident.

- (5) No shock should be given to the treatment equipment.

**CAUTION** : Shocks given thereto may damage the treatment equipment.

- (6) Do not get on the circulating tank, fan and motor during operations work.

**CAUTION** : Damage and equipment errors may result.

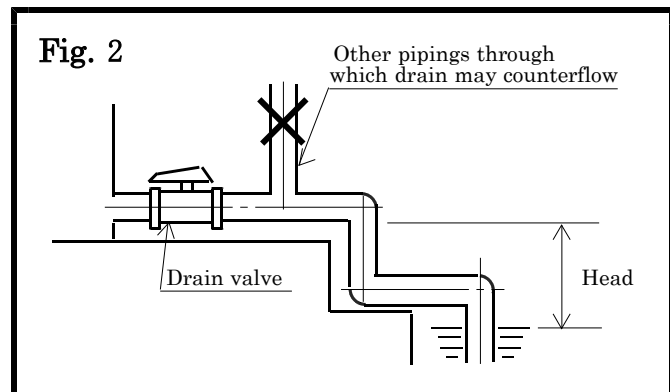
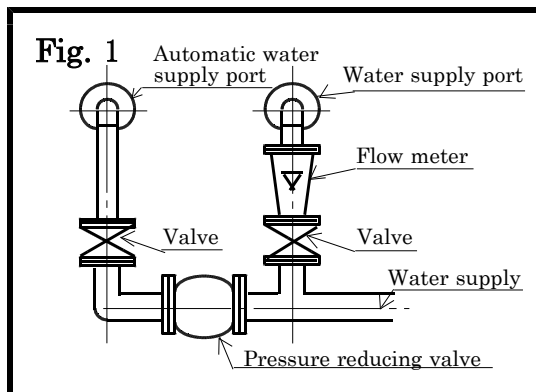
## 4.2 Long Storage

When assembling the treatment equipment stored over a long period of time (where the standard storage period exceeds one week), give care to the following:

- (1) Ensure that the main body and internal parts are not damaged and do not deform.
- (2) Check the insulation resistance value for electrical equipment, such as a motor.
- (3) Read the instruction manuals for the fan and pump, and ensure that no abnormality is present in the driving section or the like.
- (4) Ensure that the accessories are not damaged or missing.

## 4.3 Connection works

- (1) Supply water to the scrubber at the water supply pressure 78.5 kPa (0.8 kgf/cm<sup>2</sup>) max. Measure the water supply pressure; if high, attach the pressure reducing valve since the automatic water supply device (ball tap) may not cut off water. (See Fig. 1.)
- (2) Attach valves to the water supply and automatic water supply pipes. Attach a flow meter to the water supply inlet piping so that the scrubbing liquid volume refilled can be known. (See Fig. 1.)



- (3) Install the drain piping with an adequate head or inclination as illustrated to insure complete draining. (See Fig. 2.)

In the case of connection with other drain pipings, arrange piping connections so that no drain counterflows.

Also, if acid and alkaline drains are mixed with each other, bubbles and crystals will arise, thereby causing the piping to become clogged.

- (4) For fan drain, the piping is required. In the case of connection with other drain pipings, piping connection is required so that no drain counterflows. Make provision so that no drain counterflows and no gas is blown off; for example, liquid sealing is recommended. The liquid sealing height should be made greater than the maximum static pressure ( $\Delta P$ ) of the fan.
- (5) Electrical wiring should be executed pursuant to the Electric Equipment Engineering Standard (Ministerial Ordinance of MITI) and electric power company's rules.

**CAUTION** : For the electric motor, grounding (earthing) should be provided to prevent possible electric leakage and shocks or the like.

## 5. Exhaust Gas Treatment Equipment Operation & Stop

Utilize the attached sheet "Operation & Stop Procedure Table".

### 5.1 Preparations and adjustments before operation

- (1) The scrubber should be controlled and managed by a person having expert knowledge (dangerous articles handling person, etc.) as a person responsible for handling.

Make arrangements so as to keep the person not associated with this equipment away from the machine.

**CAUTION** : For this equipment, dangerous gas and chemicals are used.

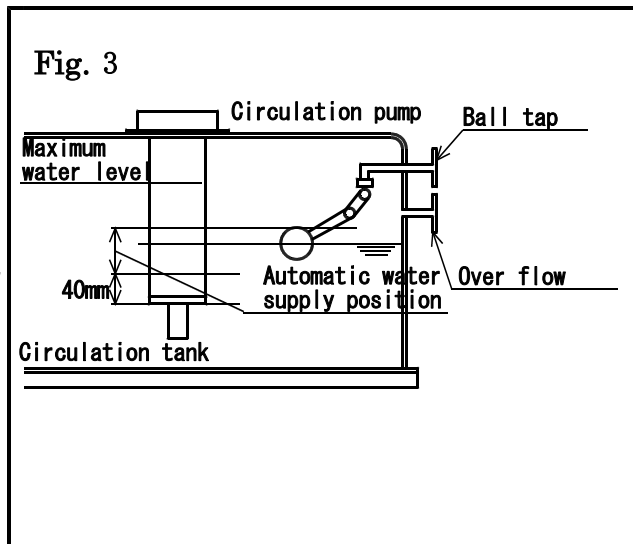
- (2) Check to see if the treatment equipment is installed, and the duct, water supply piping, drain piping and electrical works are executed securely.
- (3) Check to see if there is nothing left behind inside the duct and an object that may be sucked in is not put near the hood.

**WARNING**: If foreign matter is sucked in, damage will be caused to the fan impeller.

- (4) Where the fan bearing is an oil bearing, check the oil amount (level).  
If the oil runs short, refill oil according to the fan instruction manual.
- (5) Operate the fan for a very short period of time to check the rotation direction in the motor unit. If the rotation direction is reverse, re-connect the wiring.
- (6) Operate the circulating pump for a very short period of time with the circulating tank not filled up with water, and check the rotation direction in the electric motor unit.  
If the rotation direction is reverse, re-connect the wiring.
- (7) Check to see if no abnormality is found with the circulating tank filled up with water; for example, the tank abnormally swells out and water leaks. If any abnormal condition is present, contact our company.

- (8) Adjust the automatic water supply device (ball tap) so that water stops at 40 mm below the casing top surface and overflow lower surface mid position as illustrated. The water level should not exceed the maximum water level. (See Fig. 3.)  
Where automatic water supply adjustment is high, water does not stop, while the circulating pump performs no-load operation where it is low.

**CAUTION** : No-load operation results  
in circulating pump  
failure.



- (9) Where water is used for scrubbing liquid, use the water supply valve for adjustment to the specified water supply volume while checking the flow meter always during operation, and supply water.
- (10) Where chemicals are used for scrubbing liquid, a person having expert knowledge on chemicals (dangerous articles handling person, etc.) should handle these chemicals.

For adjustment, supply the chemicals prepared to the specified concentration in advance.

**WARNING**: (a) For chemicals handling, put on a proper protector or guard, such as rubber gloves, goggles.

- (b) Do not confuse or mistake the chemicals.
- (c) If chemicals should splash on your body or intrude into your eyes, immediately wash them away with lots of water and consult a medical specialist.
- (d) When the stock solution of chemicals is diluted, heat may be generated; it is, therefore, prohibited to perform sudden dilution.
- (e) Heat may deform and damage the equipment. When the scrubbing liquid temperature is high, cool it down to the outside air temperature, and then start operation.

**CAUTION :** (a) If the stock solution of chemicals comes into contact direct with FRP, the FRP may deteriorate.

- (b) If extra chemicals are charged to the circulating tank, those chemicals will overflow, which could be very dangerous.

- (11) If high-temperature gas and treated gas are used at more than the specified concentration (indicated in the catalog or specification), the circulating liquid temperature will rise, thereby deforming and damaging the treatment equipment internal parts, fan and circulating pump. Be sure to use these gases under the prescribed conditions.

**CAUTION :** High-temperature gas and high-concentration gas may cause thermal deformation to the treatment equipment.

- (12) Check to see if the electrical equipment accessories are attached securely and the operation is normal.

For adjustments of the accessories, follow the respective instruction manuals.

## 5.2 Operation and Stop Procedures

- (1) After completion of preliminary arrangements and adjustments or alignment before operation, start operation.

**WARNING :** If all preparations and adjustments before operation are not completed, an unexpected accident may result.

- (2) Operate the circulating pump.

If abnormal vibration and abnormal noise arise in the circulating pump, immediately stop the operation and check the circulating pump in accordance with its instruction manual.

After the operation, ensure that the current value is smaller than the rated current value of the motor.

- (3) Close the damper for air flow control.

- (4) Operate the fan.

If abnormal vibration and abnormal noise arise in the fan, immediately stop the operation and check the fan in accordance with its instruction manual.

**WARNING :** If the damper is operated in the closed state for 5 minutes or more, agitating heat may cause damage to the impeller.

- (5) After operation start, open the air flow adjusting damper gradually and adjust it to the predetermined air flow.

If there should occur an abnormal vibration or noise during air flow adjustment, stop the operation promptly and check the fan according to the instruction manual for the fan.

Measure the treatment air flow with an anemometer or the like, and adjust the air flow.

After adjusting the air flow, ensure that the current value is smaller than the rated current

value of the motor.

- (6) With the treatment equipment in operation, check to see if no liquid is leaking from the flange and drain units, etc. If any leakage is found, stop equipment operation and take proper action; for example, re-tighten the bolts and nuts.

**CAUTION** : Leaking liquid contains chemicals, which could be extremely dangerous.

Further, this leakage causes the treatment equipment to corrode.

- (7) In the case of scrubbing with water, use the flow meter at the water supply port for adjustment to the desired flow rate (new water replenishment).
- (8) If scrubbing liquid deteriorates where chemicals are used for scrubbing liquid, stop equipment operation and adjust the circulating liquid newly.

**CAUTION** : If stock solution is added when the chemicals deteriorate, refined salt and liquid contamination give rise to clogging and circulating pump failure.

- (9) During treatment equipment operation, avoid no-discharge (shut-off) operation of the fan.

**WARNING** : No-discharge operation may damage the impeller due to agitating heat.

- (10) Do not operate the equipment with the duct closed.
- (11) Where the treatment equipment is suspended, first stop fan operation. Next, stop the circulating pump.

**WARNING** : If the circulating pump is stopped first, the scrubbing liquid may overflow.

- (12) At equipment stop due to power failure, turn all switches OFF.

### **5.3 Long Stop of Treatment Equipment and Storage Method**

The equipment is to be stored where its operation is suspended for approx. one week or more. Even if the storage period is shorter according to circumstances, however, store the equipment as follows:

- (1) Wash interior treatment equipment satisfactorily with fresh water.  
Chemicals precipitate inside, causing the clogging. Caustic soda reacts with carbon dioxide (CO<sub>2</sub>) gas in the air in particular, precipitating sodium carbonate.
- (2) Since freezing may occur in winter seasons, drain scrubbing liquid.
- (3) For the fan, protect the bearing and motor units with a sheet or the like. Also, store the belt after removal. For other units, follow the fan instruction manual.
- (4) For the circulating pump, protect the motor unit with a sheet or the like. For other units, follow the circulating pump instruction manual.
- (5) Store the accessories according to the respective instruction manuals.

### **5.4 Operation re-start after long shutdown**

Where the treatment equipment has been stopped for many hours (approx. one week or more), check the following as well, then start operation again.

- (1) Ensure that no abnormality is present in the treatment equipment and duct, such as damage and deformation.
- (2) Ensure that no looseness is found in the treatment equipment bolts.
- (3) Ensure that no clogging is found in the drain piping.
- (4) Ensure that no abnormality and foreign matter are present inside the tank.
- (5) According to the fan instruction manual, check the bearing unit, etc.
- (6) According to the circulating pump instruction manual, carry out checkup.



- (7) For the motor and electrical equipment, check the driving condition and insulation resistance according to the respective instruction manuals.
- (8) Check the specially ordered accessories according to the respective instruction manuals.

## 6. Exhaust Gas Treatment Equipment Maintenance Check and Troubleshooting

### 6.1 Preparations for Maintenance Check

- (1) During inspection or checkup and maintenance, be sure to wear a protector or guard, such as rubber gloves and goggles.

**WARNING** : Chemicals and rotor handling is very dangerous.

- (2) When carrying out treatment equipment internal checkup and maintaining or checking the driving portion, do not fail to turn the power "OFF", and put up a signboard "Now Working", for example.

**DANGER** : Re-start of operation during maintenance and inspection is very dangerous.

- (3) For inspection and operations work in an elevated place, secure a safe scaffolding.

**DANGER** : Operation work in an elevated place gives rise to a fall accident.

- (4) Avoid giving any shock to the treatment equipment.

- (5) Do not get on the fan and tank.

**CAUTION** : Fall and slip accidents, and equipment breakdown may result.

- (6) When the measurement port is opened during treatment equipment operation, gas may be blown off and something may be sucked in.

Keep your face away from the measurement port to open the lid.

**WARNING** : Harmful gas, if sucked in, is dangerous. Also, foreign matter, if sucked in from the measurement port, may interfere with the fan.

- (7) When the inspection port is opened, the packing may adhere closely.

In such a case, do not open it forcedly. Insert a screwdriver or the like to open it gradually.

- (8) Since harmful gas and scrubbing liquid remain inside the treatment equipment, wash the interior sufficiently with fresh water.

Also, send clean air with the fan to give off internal gas, and stop equipment operation, then fully close the damper. The damper cannot be closed completely.

Since gas may flow out even when the damper is fully closed, take adequate action for gas outflow; for example, remove the duct.

It is dangerous to get on the filler support inside the treatment equipment; it is, therefore, necessary to lay a curing plate or the like.

**DANGER** : The treatment equipment interior is dangerous due to gas and chemicals.

- (9) If the interior treatment equipment is washed with chemicals, the mixture may react with the residue and scrubbing liquid, generating harmful gas; for example, if sodium hypochlorite and acid react, chlorine gas will generate.

For details, contact our company.

**DANGER** : Harmful gas may generate.

- (10) After maintenance check, completely restore the treatment equipment.

Replace the packing at the inspection port, etc. during opening.

As standard packing, PVC sponge packing 5 mm is used for this purpose.

## 6.2 Daily Checking

Routine inspection should be carried out daily.

- (1) Check to see if no liquid leaks from the treatment equipment.
- (2) Check to see if no abnormal deformation is found in the treatment equipment.
- (3) Check the tank liquid level and scrubbing liquid condition.
  - (a) Check to see if the operation is performed at the normal liquid level: if the level is low, adjust the water stop position of ball tap at the automatic water supply port and check the water supply volume.
  - (b) Check to see if the ball tap at the automatic water supply port cuts off water in the specified position.
  - (c) Check to see if the water supply amount is normal.
  - (d) Check to see if the scrubbing liquid is not contaminated. In the presence of sediments and suspended matter, change scrubbing liquid newly.
- (4) Check to see if abnormal vibration, noise and odor are not present in the treatment equipment, and also check the equipment periphery.
- (5) Check the fan current value.
- (6) Check the circulating pump current value.
- (7) Check the accessories according to each instruction manual.
- (8) Where a foreign matter preventive net is attached to the food unit, visually check for its clogging. If it becomes clogged, clean it.

## 6.3 Periodical Checking

- (1) Check to see if the scrubbing efficiency is not lowering: measure it in the treatment equipment discharge section once per month, using a detecting tube or the like.
- (2) Check to see if no abnormal condition is present in exhaust air flow and pressure: measure the air flow and pressure at the duct measuring port once a week, using an anemometer and Pitot tube or the like.
- (3) Check to see visually if the FRP member does not deteriorate, once per 3 months.
- (4) Visually check to see if the steel material area, such as the base and frame, is not corroded, once per 3 months: re-paint if corroded.

Remove corrosive rust from the zinc galvanized area and apply ROVAL paint.  
Scrape off corrosive rust from the painted area, and paint this area. (Our standard paint is SHINTO PAINT NEO-GOSE #500: the paint color is N-7.)
- (5) Check to see once per 6 months if the vibrationproof joint does not deteriorate.

If it is found hard when pressed by hand, it follows that it deteriorates: replace it newly.
- (6) Check the accessories according to the respective instruction manuals.

## 6.4 Action Taken for Error

- (1) During maintenance check operations:
  - (a) If an abnormality is found during inspection, immediately stop treatment equipment operation.

Where harmful gas and mist may stay in the exhaust place by stopping the fan, always check for safety in the exhausting place before stopping fan operation.

**DANGER** : Gas and mist, if present in the exhaust place, are dangerous.

- (b) Prior to treatment equipment maintenance, do not forget to turn the main power "OFF", and put up a signboard "Now Working", for example.

**DANGER** : Inadvertent operation during work is very dangerous.

- (2) Where liquid leaks from the treatment equipment:

- (a) Leakage from flange unit

- a-1 Re-tighten the bolts if loose.

- a-2 Replace the packing if it deteriorates.

For the standard packing, PVC sponge packing 5 mm is used.

- (b) Leakage from FRP

Repair the FRP material if it is cracked or pierced.

Our standard FRP resin used is non-saturated polyester resin.

- (3) Where abnormal deformation is present in the treatment equipment main body:

Treatment equipment main body deformation is assumed to result from FRP deterioration.

Repair is required.

- (4) Where scrubbing liquid is abnormal:

Where scrubbing liquid is contaminated and sediments & suspended matter are present, drain all tank scrubbing liquids and wash the interior, then re-adjust (prepare) the scrubbing liquid again.

If the tank interior is washed with chemicals, the mixture may react with residues and scrubbing liquid, generating harmful gas; for example, if sodium hypochlorite and acid react with each other, chlorine gas will generate.

When cleaning the tank interior with chemicals, therefore, consult our company.

**DANGER** : Harmful gas may generate.

- (5) Where abnormal vibration, noise and odor or smell arise from the treatment equipment:

- (a) Where an abnormality arises from the treatment equipment main body:

- a-1 These abnormalities may be transferred from the fan and circulating pump.

- a-1 Check the fan and circulating pump.

- a-2 Where the bolt is loose, re-tighten the bolt in the area from which vibration and noise arise.

- a-3 When the filler and mist catcher become clogged, take them out for cleaning.

- (b) Where an abnormality arises from the fan:

These abnormalities are assumed to result mainly from the bearing, belt, impeller and motor, etc.

Check these units according to the fan instruction manual.

- (c) Where an abnormality arises from the circulating pump:

These abnormalities are assumed to result mainly from the motor, foreign matter sucking and piping clogging or the like.

Check these units according to the circulating pump instruction manual.

- (d) Where an abnormality arises due to foreign matter intrusion:

Check the treatment equipment main body and fan interior and remove foreign matter therefrom.

Check for internal damage: if found, contact us.

After remedy, take action so that no foreign matter enters again; for example, provide an anticorrosive foreign matter sucking prevention net in the hood section.

- (6) Where the fan current value is abnormal:
- (a) Where the current value is lower than the specified one, the air flow decreases.  
Re-adjust the air flow with the damper.
  - (b) Where the current value is higher than the specified one, the air flow increases.  
Re-adjust the air flow with the damper.
  - (c) Since there are other causes as well, check the current as per the fan instruction manual.
- (7) Where the circulating pump current value is abnormal:
- (a) Where the current value is lower than the specified one, the possible causes are as follows:
    - a-1 The water spraying device becomes clogged.  
Check the water spraying condition and clean the water spraying device.
    - a-2 Foreign matter is sucked into the circulating pump suction inlet.  
Discharge the tank scrubbing liquid to remove foreign matter from the circulating pump.
- (8) Where the treatment efficiency lowers:
- (a) Scrubbing liquid deteriorates.  
Take scrubbing liquid from the circulating tank inspection port, and measure pH, etc, to check to see if it falls inside the predetermined range.  
Where scrubbing liquid deteriorates, take the following measures:
    - a-1 In the case of water scrubbing, change scrubbing liquid if it deteriorates and refill new water as specified.
    - a-2 In the case of scrubbing with chemicals, adjust the chemicals to the specified chemicals concentration.
  - (b) The scrubbing water spraying level is low.
    - b-1 Check the water spraying condition from the water spraying device inspection port: clean the water spraying device if clogged.
    - b-2 Measure the current value of the circulating pump: if it is lower than the specified current value, it follows that foreign matter is sucked into the circulating pump suction port, for example. Remove foreign matter if present.
    - b-3 Where an abnormality is found in the circulating pump, check it as per the circulating pump instruction manual.
  - (c) The treatment air flow is too large.  
Measure the air flow with an anemometer and Pitot tube, etc. and adjust for the specified air flow with the air flow adjusting damper.
  - (d) The filler and mist catcher become clogged.  
Measure the pressure loss of treatment equipment main body: if it is higher than the specified pressure loss, take out the filler and mist catcher to wash them with fresh water.
- (9) Where an abnormality is present in the treatment air flow:
- (a) Check to see if the damper is opened securely.
  - (b) Measure the pressure loss of treatment equipment main body.  
Where the pressure loss <average: Pa ( mmAq) Max.> is high, it follows that the filler and mist catcher become clogged. Take out the filler and mist catcher and clean them with fresh water.

- (c) Check to see if the foreign matter suction preventive net attached to the hood unit does not become clogged.  
Clean if clogged.
- (10) Where an abnormality is present, such as material deterioration:
  - (a) If the FRP material deteriorates due to corrosion or the like, contact our company.  
For the corrosion condition, refer to "FRP Appearance Change and Grade" as attached and stop the equipment when grade 2 is reached to repair it.
  - (b) If the steel material unit corrodes, re-coating is required.
- (11) When there occurs an abnormal condition in the accessories, take proper measures according to the respective instruction manuals.

### **6.5 Inspection Records**

For inspection recording, utilize the attached "Daily Check List".  
Always retain the inspection records.

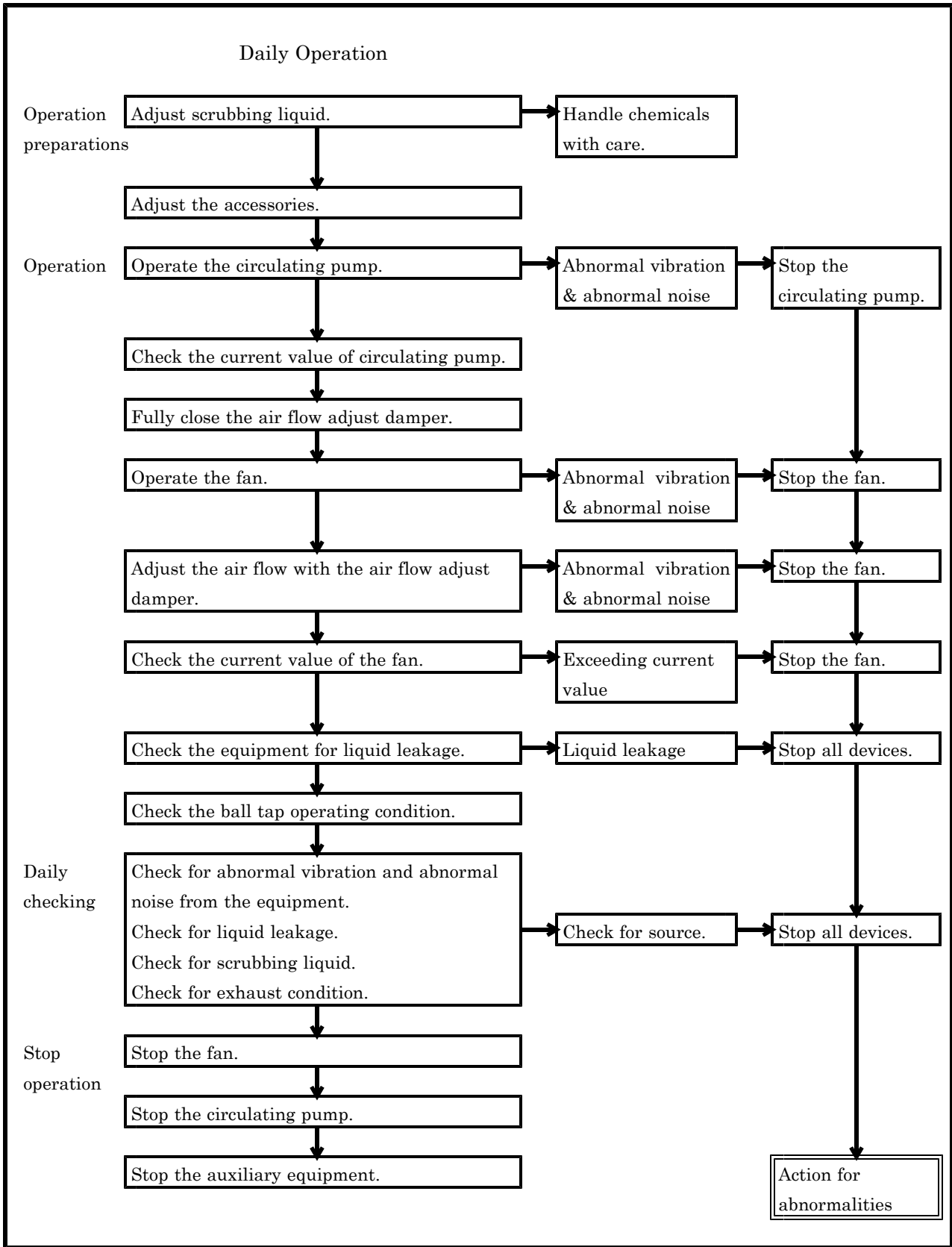
### **7. Inquiry for Unclear Points**

When making inquiries at our company, inform our Sales Office or Environmental Equipment Division of the following items.

Our company's sales offices and manufacturing divisions are described at the end of this manual.

- (1) Type of scrubbing tower
- (2) Date of manufacture
- (3) Serial No.
- (4) Operating condition (Objective gas name, gas temperature, installation condition and operation time)
- (5) Error status

## Operation & Stop Procedure Table



## Daily Check List

After "Preparations for Maintenance Check" given in para. 6.1, start operations work.

Checking Unit	Checking Item	Checking Method	Checking Period	Checked Results			
Entire treatment equipment	1. Check for eliminating performance	a. Concentration measurement at entrance and exit	Measurement	Once/month			
		b. pH & concentration of scrubbing liquid (chemicals)	Measurement	Once/day			
	2. Check for scrubbing tower main body bulging & concave	a. Clogging inside the scrubbing tower	Visual check	Once/day			
		b. Presence or absence of heat source	Visual check	Once/day			
	3. Check for abnormal vibration in the scrubbing tower mainbody	a. Loose foundation & mounting bolts	Visual check	Once/day			
		b. Transfer from the fan	Visual check	Once/day			
	4. Check for liquid leakage	a. Loose tightening bolt	Visual check	Once/day			
		b. Packing deterioration	Visual check	Once/day			
		c. Damage and cracking	Visual check	Once/day			
	5. Check for treatment air flow	a. Treatment air flow measurement	Measurement	Once/week			
		b. Check for damper	Visual check	Once/day			
		c. Scrubbing tower & duct pressure loss	Measurement	Once/day			
	6. Check for spraying liquid amount	a. No-load operation of circulating pump	Visual check	Once/day			
		b. Foreign matter ingress into the circulating pump	Visual check	Once/day			
		c. Water spraying device clogging	Visual check	Once/day			
	7. Check for pressure loss	a. Filler clogging	Visual check	Once/week			
		b. Treatment air flow	Measurement	Once/week			
	8. Check for circulating liquid contamination & sediment accumulation	a. Abnormal contamination due to foreign matter	Visual check	Once/day			
b. Sediment by reaction product		Visual check	Once/day				
9. Check for new water supply amount	a. Check for new water supply amount	Visual check	Once/day				
Pump	1. Check for abnormal noise and abnormal vibration	a. Intrusion of foreign matter	Measurement	Once/day			
		b. Loose mounting bolt	Visual check	Once/week			
2. Check for operating current value	a. Check for current value	Measurement	Once/day				
Fan	1. Check for abnormal noise and abnormal vibration	a. Intrusion of foreign matter	Visual check	Once/day			
		b. Loose mounting bolt	Visual check	Once/week			
		c. Worn bearing	Measurement	Once/week			
		d. V-belt deterioration & wear	Visual check	Once/week			
		e. Bearing oil decrease & deterioration	Visual check	Once/week			
	2. Check for operating current value	a. Check for current value	Measurement	Once/day			
Motor	1. Check for motor heat generation	a. Check for frame temperature	Measurement	Once/day			
		b. Worn bearing	Measurement	Once/month			

## Troubleshooting

### (1) Entire Treatment Equipment

For remedy in case of an abnormality, stop equipment operation and put up a notice board "Now Working" or the like.

Abnormal State	Probable Cause	Checkup Investigation & Suggested Remedy
1. Decline of removal rate	1. Scrubbing liquid (chemicals) deteriorates	1. Measure the chemicals concentration or pH inside the circulating tank, and investigate whether it is within the specified range. Where it falls outside the specified range, re-adjust it so that it is inside the specified range.
	2. The treatment air flow is too large.	2. Using an air flow measuring tool (hot-wire anemometer), measure the air flow and re-adjust it so that it falls within the specified range, using the damper.
	3. Scrubbing liquid is not sprayed.	3. Visually check the water spraying pipe and check for its spraying. Where no such spraying is carried out, check the circulating pump.
	4. Filler clogging	4. Visually check the filler or measure and investigate the pressure loss of the scrubbing tower: where is outside the specified range, use fresh water for cleaning, then take out the filler and wash it. Where deformation is found, replace the filler.
2. Scrubbing tower main body bulging or concave	1. Scrubbing tower main body clogged due to deformation caused by heat or abnormal operation.	1. Investigate for deformation or clogging inside the scrubbing tower main body: replace the filler if it deforms. Clean or replace it where it is clogging.
3. Vibration from scrubbing tower main body	1. Loose foundation bolts and mounting bolts	1. Check for foundation & mounting bolts tightening: re-tighten if loose.
	2. Transfer from fan	2. Investigate for transfer from the fan: take measures for vibration proofing if vibration is transferred from the fan.
4. Liquid leakage	1. Loose tightening bolt	1. Check the tightened condition of tightening bolts: re-tighten if loose.
	2. Packing deterioration	2. Check to see if the flange packing does not deteriorate: replace if it deteriorates.
	3. Damage and crack	3. Check for damage and cracking: repair if damaged and cracked. If not repairable, contact our company.
5. Pressure loss increases.	1. Filler clogging	1. Check the filler: clean or replace if clogged.
	2. Increase in treatment air flow	2. Measure the treatment air flow: adjust for the specified air flow with the damper if the specified air flow is exceeded.
6. Circulating liquid contaminated	1. Contamination caused by foreign matter	1. Investigate the cause of foreign matter, and prevent foreign matter from ingress, and remove the foreign matter.
7. Sediments accumulated in the circulating tank	1. Sedimentation of reaction product that is caused by long use of scrubbing liquid	1. Investigate the time for using scrubbing liquid: change scrubbing liquid in the case of excessive reaction.
	2. Sedimentation of foreign matter (dust or dirt)	2. Investigate the intrusion of foreign matter (dust or dirt) in order to prevent foreign matter from entering and remove foreign matter.
	3. New water supply amount insufficient	3. Investigate the new water supply amount, and adjust for the specified new water supply amount.
8. New water not supplied	1. Valve "closed" or new water piping shortcircuited	1. Investigate the valve or piping: open the valve or repair the damaged piping.



(2) Circulating Pump (For details, refer to the instruction manual for the circulating pump.)

Abnormal State	Probable Cause	Checkup Investigation & Suggested Remedy
1. Abnormal vibration or abnormal noise	1. Intrusion of foreign matter into the pump casing	1. Investigate the interior casing of the circulating pump: remove foreign matter if it intrudes.
	2. Occurrence of cavitation due to entry of air	2. Investigate whether the circulating tank liquid level reaches the chasing position: if the liquid level is low, supply liquid up to the position where the casing is immersed.
	3. Loose mounting bolt	3. Check the mounting bolts: re-tighten if loose.
	4. Worn motor bearing	4. Check the motor bearing: replace if worn.
2. Lift amount or lift zero	1. No-load operation is performed.	1. Investigate whether the circulating tank liquid level reaches the casing position: if the liquid level is low, supply liquid up to the position in which the casing is immersed.
	2. The casing becomes clogged with foreign matter.	2. Investigate the interior casing of the circulating pump, and remove foreign matter if it intrudes.
3. Current value high	1. Overloaded operation is performed.	1. Check the circulating liquid amount, and where the liquid amount is large, adjust for the specified liquid amount.
4. Motor heated	1. Overloaded operation is performed.	1. Check the circulating liquid amount, and where the liquid amount is large, adjust for the specified liquid amount.
	2. Worn motor bearing	2. Check the motor bearing: replace if worn.

(3) Fan (For details, refer to the fan instruction manual.)

Abnormal State	Probable Cause	Checkup Investigation & Suggested Remedy
1. Abnormal vibration or abnormal noise	1. Intrusion of foreign matter into casing or poor balance of impellers by attachment	1. Investigate the interior casing of the fan: remove foreign matter or attachments if present.
	2. Worn bearing	2. Measure bearing vibration, disassemble and investigate the bearing: replace if worn.
	3. Bearing grease or oil deterioration and decrease	3. Disassemble and investigate the bearing: replace if grease or oil deteriorates or refill if the level is lower.
	4. V-belt deterioration or worn	4. Check V-belt: replace if it deteriorates or is worn.
	5. Worn motor bearing	5. Check the motor bearing: replace if worn.
2. Air flow small	1. The damper is closed.	1. Check the damper: if closed, adjust for the specified air flow.
3. Current value high	1. The fan is in overloaded operation.	1. Check the air flow: if large, adjust for the specified air flow with the damper.
4. Motor heated	1. The fan is in overloaded operation.	1. Check the air flow: if large, adjust for the specified air flow with the damper.
	2. Worn motor bearing	2. Check the motor bearing: replace if worn.

## FRP Appearance Change and Grade

Damage Configuration	Definition & Range	Grade 1	Grade 2	Grade 3	Grade 4
Crack & break	A fine flaw on the surface is referred to as "crack".	Cracks and break are not present.	Fine cracks are locally identified.	A large break can be identified even in one place or a crack is expanding over the entire surface.	A large break is identified over the entire surface.
Peeling	Layer peeling in the lamination	No peeling is identified.	No peeling is identified.	Local peeling arises inside the lamination layer, and discoloration occurs or the surface is flabby or spongy at a strong push.	The peeled portion develops into the entire surface.
Discoloration & decoloring		Only discoloration on the surface; no other damages are involved.	Discoloration on the surface is identified, but no change of properties or deterioration such that the surface is rubbed out is found.	Discolors and properties change, and the surface is rubbed out.	The whole test piece discolors, which is rubbed out.
Blister	Blister on the surface and blister inside the lamination layer	No blistering	Blister like sesame seeds is identified.	Large blister is identified on the test piece.	A number of large blisters are identified on the test piece.
Wear & test	Abrasion and erosion	No wear & tear are identified.	Luster on the surface disappears and traces are identified.	The surface and part of the intermediate layer are worn and torn.	The surface and part of the intermediate layer are worn and torn.
Reinforcing material whitening	The reinforcing material inside the lamination layer should look white.	No whitening is identified.	Whitening is identified locally on the test piece, but no other damages are involved.	Whitening is identified in the wide range of the test piece.	Whitening is identified over the entire surface of the test piece.
Swelling	FRP increasing in thickness due to penetration of contents	No swelling is identified.	No swelling is identified.	Approx. 20% or more increase in thickness is identified.	30% increase in thickness is identified.
Elution	Some component in the material starts to elute. (incls. melting and decomposition)	No elution is identified.	Elution of component in the material of the surface is identified, but no other damages are involved.	The surface is reduced in thickness or lost, and glass fiber in the intermediate layer is exposed.	The test piece elutes over the entire surface.
Pinhole & pit	Micro holes or dents in the laminated plate	No micro hole is identified.	A micro hole is identified on the surface, which does not pass through the intermediate layer.	A micro hole passes through the intermediate layer.	