

INSTALLATION, OPERATION AND MAINTENANCE MANUAL

EMERGENCY RELEASE CHLORINE SCRUBBER SERIES – LT1

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EMERGENCY CHLORINE SCRUBBER IOM

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INTRODUCTION

This Scrubber Installation, Operation and Maintenance manual has been written for you, the Installer, Operator and Maintenance Personnel. Due to the many different possible installation configurations it is not possible for all potential issues to be covered. If you require any additional information that is not covered in this manual do not hesitate to contact Harrington or your Sales Representative.

1.1 General Information

1. All parts of the scrubber equipment have been thoroughly inspected and pre-tested at the factory. Upon receipt of shipment, a complete inspection of the equipment is recommended to determine if any damage was sustained during shipment or parts have vibrated loose. If any damage is found, a claim should be immediately filed against the freight carrier.
2. It is advisable to have equipment installed by personnel familiar with the installation of air handling equipment. In most cases, your sales person can recommend a qualified contractor.
3. Check the nameplates and tags on equipment for special instructions.
4. The scrubber should be mounted on a solid surface, which completely supports the bottom of the scrubber. When the scrubber is to be mounted on a platform, the platform should be thoroughly braced. If the scrubber is roof mounted, consult a structural engineer to prevent overloading the roof structure. Refer to the scrubber drawing for the operating weight. Finally we recommend the scrubber be mounted on a six-(6) inch housekeeping pad. This will simplify the drain connection and assist in drainage. Harrington as part of the scrubber system can provide a six-inch high structural steel scrubber base.
5. This type of scrubber is designed to operate in an ambient temperature environment. Excessive heat may damage the internals of the scrubber and result in equipment failure.
6. Equipment is constructed of fiberglass reinforced plastic (FRP) and thermoplastic materials. Care must be taken during handling and installation to prevent damage, which may be caused by external stress or shock.
7. Certain accessory items such as pressure gauges, solenoid valves, controls and instrumentation may have been shipped loose to prevent damage in transit.

Install these items to the scrubber system as required.

8. Refer to Appendix B for the start-up checklist procedures. Refer to Appendix C for the scrubber spare parts list. Refer to Appendix D for an exploded view of the chlorine scrubber.



INSTALLATION

2.01 Unloading and Rigging

Lifting lugs are provided on all units to aid in the lifting and placing of these units. Nylon straps can be used instead of lifting lugs if so desired. Use all lifting lugs supplied when lifting to prevent lifting lug failure and possible equipment damage.

2.02 Packing Installation Procedure (when shipped loose)

Generally speaking these units are shipped pre-packed at the factory. Occasionally, there may be an extenuating circumstance requiring the packing to ship loose. Refer to the manufacturer's Handling/Installation/Operation Instructions provided with this document for proper storage requirements.

There are many ways to install plastic random fill packing. Generally, if common sense is used, problems can be avoided. The installation procedure is as follows:

1. Distribute packing pieces in a random manner and never let them freefall more than four (4) feet. In cold weather (below 45 deg F) particular care must be taken in handling and installing plastic packing since the brittleness of the plastic resin will be greatly increased.
2. Make sure the packing fills all the space in the packed bed section. Pay particular attention to the access doors and irregular spaces.
3. If workmen are in the scrubber, use plywood to distribute load over as large an area as possible. Never exert a concentrated load onto a few of the individual packing pieces. Check the structural integrity of the packing supports before placing men inside the tower.
4. Be careful not to leave any foreign materials in the packed bed section. Verify all plywood, boxes and bags are removed from the scrubber before closing the packing access ports.

2.03 Packing inspection

Inspect the packing material to determine if damage, shifting or settling has occurred during shipment. Remove the spray nozzle inspection ports located on the top of the scrubber for easy verification of packing installation (see Appendix D). The packing should be even across the top surface to prevent dry spots in the packing. Approximately 5" to 6" distance should exist between the end of the nozzles and the packing

surface. Adjust as required. Should you require additional packing due to excessive settling, please contact Harrington.

2.04 Mist Eliminator Section

Inspect the mist eliminator section. The scrubber is supplied with an Amistco mesh pad mist eliminator. The mist eliminator is oversized to ensure a snug fit between the vessel wall and the mesh. The mesh pad has polypropylene grids on the inlet and outlet to keep the mesh pad in place. A tight fit ensures optimum mist eliminator performance.

The Amistco mesh pad is located below the inlet box to the fan (see Appendix D). Access to the mist eliminator is achieved through square flanged ports on either side of the scrubber. By removing the flange cover, the mist eliminator will slide horizontally out of its location for easy inspection.

2.05 Inlet Connection

Connect incoming duct to the inlet of the scrubber using a FRP bond. This is generally performed by the contractor installing the FRP ductwork. Flex connectors are generally not needed nor recommended.

HINT: Be sure to slope the transition into scrubber to allow proper drainage of any liquid from the inlet duct and to prevent the scrubber recirculating liquid from running into the inlet duct.

2.06 Outlet Connections

On most units the outlet connection consists of a stack, which ships loose. The stack is factory matched drilled to the fan, and hardware and caulking is provided. In some installation duct will need to be joined from the fan discharge transition to the discharge ducting. It is generally recommended that a flex connection be made between the fan and the discharge ducting.

2.07 Hold Down Lugs

Seismic hold down lugs are provided on the scrubber bottom. Use suitable hardware to secure these lugs.

CAUTION: Harrington does not recommend cast-in-place concrete anchors. Set the scrubber in place, mark the location of each hole, and either core drill the cement or use expansion hardware.



Chemical Storage System

The LT1-1 Chlorine scrubber has an approximate 2,300 Gallon sump capacity. It is intended to store 2,200 gallons of 20% wt technical grade sodium hydroxide. Once the scrubber is installed the sump should be rinsed with fresh water to remove any debris that may have collected in the sump during transportation and installation. The scrubbers are factory tested with water so there may be residual water stains present. Once the sump has been cleaned it should be filled by qualified personnel. 20% wt sodium hydroxide is very corrosive and should be handled with caution. The fill level is approximately seven inches from the top. The sump should **NOT** be filled with chemical until all of the steps outlined in this section have been completed. Refer to Appendix B for the start-up checklist.

2.08 Overflow and Drain Fitting

Install 2" drainage piping to the overflow flange and drain flange. A ball valve must be installed between the drain flange and the tee that ties the overflow flange into the drain line. The line from the overflow flange must be open to the drain, while, the line from the drain flange must be closed. Reference the drawing in Appendix D for proper drain/overflow piping installation.

2.09 Valve Position

The drain valve should be closed, with the handle perpendicular to the fluid flow.

2.10 Electrical Connections

These systems are factory wired and only require 380V/3ph/50Hz power be brought into the panel. The panel will require 60-amp service. Make the necessary electrical connections as required using qualified personnel. All electrical work should be done according to the National Electrical Code. Also, check with the city for the proper codes.

2.11 Pressure Gauge Assembly

A pressure gauge assembly and a pressure switch has been included in the scrubber system. The pressure gauge consists of an isolation valve, gauge guard filled with glycerin, and a liquid filled pressure gauge. The assembly has been shipped loose for field installation. Prior to installation, check the level of glycerin in the gauge guard. Remove the pressure gauge and bleed screw and fill with glycerin to remove all air. This can be achieved by pouring the oil into the upper gauge cavity and tilting the gauge guard in several positions to be sure that no air is trapped within. After filling

completely, turn the gauge guard over quickly and screw in the pressure gauge. Any excess oil will come out of the bleed screw. Install the bleed screw and assemble the pressure gauge assembly to the recirculating line. If a pressure gauge was not included in your system, Harrington can offer one to suit your needs.

The pressure switch is screwed into the recirculation plumbing to sense the fluid pressure on the discharge of the pump. The sensor has been factory set and tested to insure proper operation of the pumps and control panel.

2.12 Removal of Debris

The scrubber should be thoroughly cleaned after installation is complete to remove any construction debris and foreign objects. Spray water on the packed bed, mist eliminator section, scrubber body, and transition with a hose spray nozzle and wash the material out of the scrubber. The scrubbers are factory tested with water so there may be residual water stains present.

2.13 Pump Rotation

A Vanton SG-PY2400HA vertical sump pump is used for the recirculating system. Prior to adding the sodium hydroxide to the scrubber sump, check the pump rotation. The motor should operate in a clockwise direction when viewed from the top. The label on the motor also indicates the proper rotation.

2.14 Fan Rotation

The LT1 Scrubber system is provided with a Clockwise-rotating fan when viewed from the back of the fan. The rotation of the fan must be verified during the installation process. A circular arrow on the back of the scroll indicates the proper rotation of the fan.

2.15 Motor Rotation-Three Phase

If either of the three phase motors rotate in the incorrect direction, interchange any two main power leads to reverse the rotation.

WARNING: Reverse rotation will damage the fiberglass vertical sump pumps. Check pump rotation before filling the scrubber sump!

2.16 Check for Leaks and Loose Fittings

Prior to operating the recycle pump check for loose flanges, fittings, and unions. Use appropriate tools to tighten any fittings that may have vibrated loose during shipment.



3.01 Principles of Operation

A wet packed bed scrubber is designed to promote the contact of a gas and a liquid stream. Chlorine is removed from the gas stream by absorbing it into the liquid and neutralized via a simple acid base reaction.

The process of absorption depends on intimate contact of gas and liquid under conditions, which maximize the exposure of surfaces of gas, and/or liquid to each other. This requires breaking up the liquid into many tiny slow-flowing films, which form and re-form through a volume of gas.

3.02 Mist Eliminator

The scrubber has a polypropylene mesh type mist eliminator manufactured by Amistco. The mist eliminator is capable of removing droplets down to 5 microns at a velocity of 1000 FPM. The mist eliminator is designed to remove any entrained scrubber solution from the scrubber exhaust.

3.03 Caustic Makeup

Weekly testing of the chlorine system will result in the absorption of atmospheric carbon dioxide. This will cause the consumption of some sodium hydroxide from the sump. As such based on a 15 minute weekly test of the scrubber annual amount of 12 gallons of 50% wt sodium hydroxide should be added to the sump.

3.04 Pumps

In most applications, vertical sump pumps are used for recirculating scrubbing liquid. These vertical pumps are either CPVC or 316 stainless steel. Since they have no seals, they can operate dry without harm. As a result, they are virtually maintenance free.

3.05 Liquid Level

For vertical sump pumps, the correct pump box liquid level is very important. A liquid level, which is too high, could cause motor damage since liquid could enter the weep hole in the pump housing and cause the lower motor bearing to fail.

Once the pump is primed, the sump water level will drop since the water is being pumped into the plumbing lines and packing area, this is the normal mode of operation.

3.06 Pressure Gauge

The pressure reading is unique for each system and will measure the hydraulic pressure at the installation point, not the pump discharge pressure.

3.07 Start-up Procedure

Once the sump has been cleaned it should be filled by qualified personnel. 20% wt sodium hydroxide is very corrosive and should be handled with caution. The fill level is approximately seven inches from the top. The sump should **NOT** be filled with chemical until all of the steps outlined in this section have been completed.

Refer to the start-up procedure and check-out list given in Appendix B for proper operation.



MAINTENANCE

4.01 General Maintenance Instructions

Adequate access has been engineered into the unit to create a minimum of work when cleaning or servicing is required. Reference to the exploded view drawings (Appendix D) will help to identify the scrubber components.

Appendix A contains the recommended maintenance frequency for the various scrubber components and devices.

4.02 Mist Eliminator Access

Solids in a mist eliminator will eventually cause plugging, leading to excessive pressure drop and reduced performance. Periodic inspections should be performed before accumulations or plugging severely affects mist eliminator performance.

Access to the mist eliminator is available by removing the side access door of the unit. The mist eliminator is a one-piece unit that slides out by hand.

The maintenance should include:

1. Visually check the mesh pad for solids build-up.
2. Clean all areas with high-pressure water as required.

When re-installing the flange covers, use butyl caulking on the flanges for proper sealing.

4.03 Pumps - Removal and Replacement

The pump should rarely require maintenance because they have no seals in the fluid to wear out. There are times when, due to inadvertent installation or maintenance miscalculations, removal and replacement may be required.

The pump is mounted on a FRP plate that is bolted to the sump box. The pump is plumbed to the spray piping with a 4" Diameter 150# flange. To remove the pump:

1. Turn off electrical power to the pump at the main disconnect switch.
2. Disconnect electrical wiring from pump motor.
3. Disconnect the ANSI 150# flange.
4. Remove bolts that attach pump plate to sump box.
5. Remove pump and return to factory for repair or replacement.
6. Reverse above steps to re-install pump(s).
7. Be sure to reconnect wiring for proper pump rotation. Turn the ball valve back on.

CAUTION: All electrical power to the motor should be disconnected prior to pump removal.

For additional information on pump maintenance, refer to the installation, operation and maintenance manual provided with this document.

HINT: If a change in flow reading is observed, it probably indicates the presence of debris or foreign material in the pump inlet housing. This condition can also cause pump cavitation as indicated by excessive pump noise. This condition must be corrected to prevent pump impeller damage. Finally, the debris may also have lodged in another part of the recirculating system.

4.04 Pump Motor Maintenance

Cleaning and Inspection: A clean motor runs cooler. The motor should be cleaned and inspected at regular intervals. Always check motor shaft bearings when any unusual noise or vibration develops in the motor.

Inspect bearing for roughness by removing the pump from the sump box and turning the pump impeller by hand, if the bearings feel "rough" or stick in spots, replace them.

Please reference the OEM manual provided by the pump manufacturer for more specific information.

4.05 Caustic Makeup

Weekly testing of the chlorine system will result in the absorption of atmospheric carbon dioxide. This will cause the consumption of some sodium hydroxide from the sump. As such based on a 15 minute weekly test of the scrubber annual amount of 12 gallons of 50% wt sodium hydroxide should be added to the sump.

4.06 Pressure Gauge

The pressure reading should be checked weekly and recorded. An increase in pressure indicates a gradual plugging of the recirculating system. Usually, the spray nozzles should be inspected for debris and possible scale buildup.

4.07 Packing Access

Packing is accessed and removed via the bolted access doors located along the bottom of the packed section of the unit. Packing can be viewed through the flanged covers located along the top of the unit.

4.08 Spray Nozzle Access

The spray nozzles are threaded into a spray header network permanently mounted in the unit. If the nozzles become fouled or clogged the following process can remove them.



1. Disable the unit by placing the unit in the off position at the control panel. Turn the main disconnect on the panel to off and place a lock on the equipment to ensure it is not activated while the system is in service.
2. Remove the bolts on the flanged lids at the top of the unit.
3. Remove the lid once the bolts have been removed.
4. The inside on the vessel may be wet with liquid sodium hydroxide. Protective clothing / eye protection should be used while servicing the unit.
5. The orientation of the nozzles must be marked by stripping the nozzle and the associated fitting with a continuous line. This line will be used to orientate the fitting during installation.
6. The spray nozzles can be removed by unscrewing them from the header.
7. Repeat steps in reverse order to install the nozzles. Take care to correctly orientate the nozzle when it is re-installed.

4.09 Spray Nozzles

If required, the spray nozzles can be removed for cleaning. A scale buildup can usually be removed by soaking the spray nozzles in a dilute solution of 3-5% hydrochloric acid. A small stainless steel wire brush can also be used.

HINT: It is always a good idea to keep some spare nozzles in stock. This will allow you to thoroughly soak and clean the plugged up spray nozzles, and continue normal scrubber operation.

4.10 System Cleaning

The entire scrubber system should be completely cleaned once every third year. During this process, the liquid should be drained and the entire scrubber interior be cleaned. If there is ever a major release of

chlorine the system must be cleaned and recharged with fresh caustic. The customer may request an inspection by the manufacturer if there is a major release before the system is reinstated.

APPENDIX A

MAINTENANCE FREQUENCY*

	Weekly	Monthly	Semi Annual	Annual
Operate system to verify operation (5 – 15 minutes)				
Record operating pressure				
Check liquid level – Add 20% sodium hydroxide if necessary				
Operate system to verify operation (5 – 15 minutes)				
Verify pressure switch is operational				
Operate system to verify operation (5 – 15 minutes)				
Check Pump Motor Amps				
Clean and Inspect Pump Motor				
Inspect Packing for Build Up				
Add Chemical to Sump				
Inspect Mist Eliminator for Build Up				

* Suggested frequency until some history of your specific application can be created.

NOTE: Use the recommended schedules supplied in the manufacturer’s O&M manuals for lubricating the pump, pump motor, fan motor, and bearings.

Appendix B

CHECK LIST FOR INITIAL START-UP PROCEDURES

- Verify proper packing installation
- Inspect Mist Eliminator for proper installation
- Verify duct transition and flange bolts are tight
- Open spray header butterfly valve
- Verify spray nozzles installed and tightened
- Verify overflow and drain piped properly. Close drain valve.
- Verify proper power to control panel
- Turn panel on and test lights (HOA and ON/OFF switches in OFF position)
- Add water/caustic to sump (2200 gallons 20% wt. Sodium Hydroxide)
- Check pump rotation (CW viewed from top of motor)
- Run recirculation pump and check for leaks
- Listen for unusual noises or vibrations from pump
- Verify flex connector for fan properly installed
- Verify bearings, belts, and sheaves are tightened properly
- Verify proper rotation of fan (CW viewed from back of fan)
- Verify motor cover installed properly
- Turn fan on
- Listen for unusual noises or vibration

CHECK LIST FOR SHUT DOWN PROCEDURE

- Turn fan off
- Turn recirculation pump off
- Check concentration of caustic solution in sump
- Recharge sump if necessary with sodium hydroxide.

CHECK LIST FOR INITIAL START-UP PROCEDURES

- Verify sump filled with 2200 gallons of 20%wt sodium hydroxide
- Verify chlorine sensor properly installed and operational
- Verify duct transition and flange bolts are tight
- Open spray header butterfly valve
- Verify proper power to control panel
- Turn panel on and test lights (HOA and ON/OFF switches in OFF position)
- Place fan and pump in AUTO setting