



*Whirl Wet<sup>®</sup>*  
*Model X-X*

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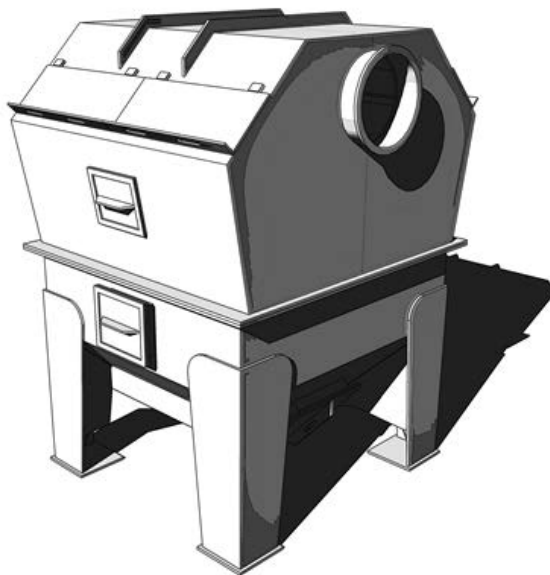
**Operation and  
Maintenance Manual**

**COMPANY NAME**

PO #XXXXX

Job #XXXX

Serial #XXXX



## Revision Information

Revision	For Product Serial #	Changes	Date

## Notice: Operate According to Set-Up Form

This manual was originally shipped with a product set-up form written for treating the exhaust of a specific process chemistry. Before changing the process or adjusting any operating parameters, contact Tri-Mer® Corporation for a new set-up form.

## Legal Notice

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# Table of Contents

<b>1</b>	<b>Introduction .....</b>	<b>5</b>
1.1	Scope of this Manual .....	5
1.2	Warning Symbols Used in This Manual .....	5
1.3	Principle of Operation .....	5
<b>2</b>	<b>Safety .....</b>	<b>6</b>
2.1	Hazards Inherent in the Equipment.....	6
2.1.1	Safety Accessories.....	6
2.1.2	In General .....	6
<b>3</b>	<b>System Operation.....</b>	<b>7</b>
3.1	System Overview.....	7
3.2	Handling and Storage .....	7
3.3	Location of Equipment .....	8
3.4	Installation Guidelines.....	8
3.4.1	Pipe and Fittings .....	9
3.4.2	Duct and Fittings .....	10
3.4.3	Electrical Equipment.....	10
3.5	Assembly of the Scrubber System .....	11
3.6	Start Up and Operation .....	11
3.7	Timed Drain Down .....	12
3.8	Shut Down .....	12
3.9	Maintaining Equipment .....	13
3.10	Scrubber Cleaning .....	13
<b>4</b>	<b>Components of a Whirl Wet® Dust Collector .....</b>	<b>14</b>
<b>5</b>	<b>Maintenance.....</b>	<b>18</b>
5.1	Service and Assistance.....	18
5.2	Spare Parts.....	18
5.2.1	Recommended List of On-Site Spare Parts.....	18
5.3	Maintaining Equipment .....	18
5.4	Recommended Maintenance Schedule .....	18
5.4.1	Daily Inspection.....	18
5.4.2	Weekly Inspection .....	19
5.4.3	Monthly Inspection .....	19
5.4.4	Semiannual Inspection .....	19
5.4.5	Tri-Mer® Annual Service Agreement.....	19

5.5	Troubleshooting Guide.....	20
5.5.1	Low Removal Efficiency .....	20
5.5.2	Improper Air Flow Rate .....	21
5.5.3	Fouled Internals .....	21

## List of Tables

Table 1:	Troubleshooting Low Removal Efficiency .....	20
Table 2:	Troubleshooting Improper Air Flow Rate .....	21
Table 3:	Troubleshooting Fouled Internals .....	21

# 1 Introduction

## 1.1 Scope of this Manual

This manual is provided as an aid for the operation and maintenance of the Whirl Wet® Scrubber, including adjustment of the physical settings and set-up of system alarms and automatic controls. This information should be routed to the personnel who will have responsibility for operating and maintaining the equipment.

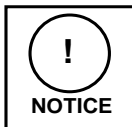
These instructions are intended to supplement good general practices. The Purchaser must ensure that installation and maintenance of this equipment are handled by personnel who are experienced in such work. Those persons must read and understand these instructions prior to installation and start-up. Service personnel from Tri-Mer® Corporation are available to supervise installation or to ensure that the system is ready for start-up.

Technical Data Sheets describe the operating parameters for the mechanical and electrical equipment that has been purchased. Parts Lists will help to clearly identify the component parts should it be necessary to obtain replacements.

This manual does not cover installation of the system.

## 1.2 Warning Symbols Used in This Manual

The following icons are used in this manual to draw attention to particularly important information:



Indicates important information that is not hazard-related.



Warns about hazards that may cause minor to moderate personal injury or property damage.



Warns about hazards that may cause serious personal injury, death or major property damage.

## 1.3 Principle of Operation

In a wet scrubber, the water or scrubbing solution is the media which removes the pollutant from the air. The liquid level must be maintained in order to achieve the specified performance.

A sufficient purge rate must be maintained to prevent excessive accumulation of contaminant. The flow can be continuous or intermittent. It can be controlled manually or automatically. Operating without sufficient purge will result in plugging of the elements or failure of the unit.

## 2 Safety

### 2.1 Hazards Inherent in the Equipment

Because of the potential hazards, it is important that the Owner install the system by the proper methods and with the proper materials for the intended service.



**Do not modify the equipment to override or defeat any of the safety mechanisms.**



**Accessing the inside of the control cabinet with the power energized presents a high voltage exposure hazard. Only appropriately trained personnel should perform work in this mode.**

#### 2.1.1 Safety Accessories

The responsibility for providing safety accessories and warning notices for equipment supplied by Tri-Mer® Corporation belongs to the installer and Owner of the equipment. The Owner must consider:

1. The location of the equipment.
2. The proximity of the equipment to employees and other persons and the danger which this presents.
3. Requirements of applicable building codes and of the Occupational Safety and Health Act.

#### 2.1.2 In General:

- ✓ Wear safety glasses or goggles, gloves and protective clothing when working with the chemicals or equipment which contains or transports them.
- ✓ Always assume that the system is under pressure. Use relief valves prior to disassembly in order to reduce risk of injury or release of chemical.
- ✓ Do not add water to concentrated chemical solutions. Dilution is accomplished by adding the chemical to water. Since much heat may be released by this action, take care to control the rate of addition to allow the heat to dissipate.
- ✓ Do not add acids to solutions of hypochlorite, chlorite or sulfide. Toxic vapors may be produced.
- ✓ Do not mix strong acids with strong alkali. Heat of reaction could cause the solution to boil.
- ✓ Do not mix strong oxidizing agents with organic chemicals. Explosive reactions may result.
- ✓ When disposing of chemicals, treat them as hazardous wastes.
- ✓ Before discharging the contents of any reservoir, tank or piping assembly make sure that the tank or utility that is to receive the discharge is properly prepared. Do not allow mixing of wastes that could react violently or with generation of toxic vapors.

## 3 System Operation

### 3.1 System Overview

The purpose of these instructions is to aid in the installation and operation of equipment manufactured by Tri-Mer® Corporation. This information should be routed to the personnel who will have the responsibility for operating and maintaining this equipment.

These instructions are intended to supplement good general practices and are not intended to give detailed procedures. The Owner must ensure that installation and maintenance of this equipment are handled by personnel who are experienced in such work. Those persons must read and understand these instructions prior to installation and start-up. Service personnel from Tri-Mer® Corporation are available to supervise installation or to ensure that the system is ready for start-up.

Technical Data Sheets describe the operating parameters for the mechanical and electrical equipment that you have purchased. Parts Lists will help you to clearly identify the component parts and obtain replacements, if required.

### 3.2 Handling and Storage

All equipment is thoroughly inspected prior to shipment in order to ensure proper operation of all components. It is shipped on skids or in crates to comply with trucking requirements. It is firmly secured and protected from the weather where required.

Inspect all equipment carefully when it is received. Note any damage on the carrier's bill of lading and immediately file a claim with the freight company. Keep a record of all equipment that has been received, including the date of receipt and details of inspection.

If you receive damaged equipment, contact Tri-Mer® Corporation for repair or replacement service. No material or equipment may be returned without Tri-Mer®'s prior written consent, which if granted, will contain shipping instructions that must be followed.

When unloading or moving equipment, take care to prevent injury to personnel or damage to the equipment.

If equipment is on a skid, use a fork lift with forks that span the full length of the skid.

When using a crane or similar lifting device, use a spreader bar. Apply only vertical force on lifting lugs. Use nylon straps or well-padded chains and cables which protect the equipment.

Open crates and unpack the equipment carefully. Plastic components may be damaged if not handled properly, especially at colder temperatures.

Consult prints, submittals and scope of supply when checking for completeness of delivered items.

If equipment must be stored before installation:

- Store it in the original container in a clean, dry, safe area.
- Protect from direct sunlight and from the elements. Use a reflective covering and arrange it in such a manner that air is allowed to circulate around the equipment in order to protect it from excessive heat and moisture.
- Cover flanges and couplings in order to prevent accumulation of dirt and moisture in the unit.
- Periodically rotate shafts on equipment like fans and pumps in order to protect the bearings.

### **3.3 Location of Equipment**

Locate equipment near service utilities such as water, sewer and electrical power. Make sure that the area is properly drained.

Do not crowd the equipment. Leave room for maintenance personnel to gain access.

Do not locate the equipment in a high-traffic area unless it is protected from collisions.

Mount equipment on a foundation which uniformly supports the base and has sufficient inertial mass to prevent problems due to vibration.

The foundation must be free of debris in order to prevent damage to the bottom of the base. It should extend beyond the outline of the base by at least twelve inches in order to accommodate anchoring.

The equipment must be level and plumb in order to prevent liquid distribution problems. Use shims where necessary to level it.

Poured concrete foundations are recommended. For equipment that is located above ground level, mounting on a rigid structural platform is required. Columns for suspended equipment must be cross-braced for support of live loads in order to prevent side sway.

### **3.4 Installation Guidelines**

The following are general guidelines for installation of this equipment.

Remove foreign material from within components before assembly.

Grout or shim under hold-down flanges or lugs to prevent applying excessive force to the vessel when anchor bolts are tightened.



Do not apply excessive force when tightening bolts on any plastic flanges.

Do not tighten threaded plastic fittings more than 1-1/2 turns past hand-tight, since excessive force will damage threads. Use a strap wrench rather than a pipe wrench.

Place adequate guards around equipment with moving parts to protect personnel from injury.

When equipment is located outside, provisions must be made to protect it from freezing in cold weather.

### **3.4.1 Pipe and Fittings**

All piping connections should be made using good general practices for the materials involved. For pipe that is made from PVC or other thermoplastic materials, follow guidelines established by the Plastic Pipe Institute. Before continuous operation is attempted, all connections should be checked for leaks using water.

Use care in attaching all pipe connections to avoid excessive piping stresses, especially if the dust collector is of plastic construction. A flexible type of connection, such as hose connection, is generally preferred.

To prevent air becoming entrapped, pipe should rise in the direction of flow and be fitted with a vent valve at each high point. Pipe the vent to a drain.

Install a dirt trap and drain valve at every low point and the bottom of every riser to permit flushing. Pipe to a drain.

Drain fittings must be isolated from each other. Use a plumber's P-trap or submerge the end of each drain line. Either method will prevent air from flowing in the drain line. Such flows can cause by-passing or they can interfere with proper drainage of the vessel.

Support and anchor all pipe and fittings in order to prevent damage to the equipment or to the pipe itself. Piping should never be supported by the flanges on equipment. It should be supported independently. This will prevent deformation or twisting of the equipment.

Heat trace pipe and fittings, if necessary, to prevent freezing.

### **3.4.2 Duct and Fittings**

For duct made from PVC or other thermoplastic materials, follow guidelines provided by the Sheet Metal and Air Conditioning Contractors' National Association (SMACNA) in their publication entitled *Thermoplastic Duct Construction Manual*.

Support and anchor all duct and components in order to prevent damage to the equipment or to the duct itself. Duct should never be supported by the flanges on vessels or air moving equipment. It should be supported independently to prevent deformation or twisting of the equipment. Use a flexible connection whenever vibration isolators are used, and to minimize noise.

Avoid sudden changes in duct size. The included angle of an inlet transition should be 14 degrees or less. The outlet transition should be not more than 30 degrees. Elbows should be kept to a centerline radius of at least one and one-half duct diameters.

Branches entering a trunk line should be spaced so that they do not enter directly opposite each other. They should enter at an angle of no greater than 45 degrees.

Place access doors in the ductwork just ahead of the vessel inlet and outlet connections. These doors should never be opened when the system is running to avoid equipment damage or personal injury.

Slope duct toward the equipment to prevent splash, spray or condensate from getting into the duct system.

Stack height should be sufficient to avoid introducing exhaust air into windows or air intakes. Use guy wires to brace against wind loads. Guy wires and hardware should be stainless steel or other corrosion-resistant material.

### **3.4.3 Electrical Equipment**

Electrical connections should be made only by a qualified electrician. Make sure that all electrical work is done in accordance with applicable codes.

Lock out the power source prior to any work being done. Be sure to follow the wiring diagram on the nameplate or terminal box of the electrical equipment.

Make sure that motors are wired for the correct supply voltage. Provide ample overload protection and other safety devices.

After electrical connections have been made, check the rotation the fan. Arrows show proper direction of rotation.

### **3.5 Assembly of the Scrubber System**

Install the scrubber as shown on the provided assembly drawing.

Connect the drain port to waste water using a butterfly valve for isolation.

Connect fresh water to the water fill and make-up assembly (see Fig. 5).

Install the exhaust fan, inlet and outlet duct.

### **3.6 Start Up and Operation**

#### **Level Switches**

Close the bottom drain valve (see Fig. 8). Open the water fill valve (see Fig. 5) and fill the scrubber reservoir until 1/4" of liquid appears in the round sight glass on the side of the unit (see Fig. 9). Once this level is achieved, turn off the water fill.

Liquid level is maintained using a photohelic gauge the gauge must be set up by dialing in the set-points that will control the solenoid for make-up water (see Fig. 1). When set up correctly, the photohelic gauge will read 8" of differential pressure while the unit is running.

Step 1 - Use a flat head screw driver to zero out the photohelic gauge. This must be done while the unit is not in operation.

Step 2 - Using the left hand dial on the photohelic gauge set the low pressure indicator to 7.5" w.g. This will control the pressure at which the solenoid valve will open up and add water to the sump.

Step 3 - Using the right hand dial on the photohelic gauge set the high pressure indicator to 8.5" w.g. This will control the pressure at which the solenoid valve will shut off and cease to fill the sump.

Open the make-up water ball valve (see Fig. 4).

Start the fan and adjust the inlet duct balance until you achieve the specified air flow and 8" of differential pressure across the Whirl Wet®.

Static pressure above 8.5" indicates that the liquid level is too high and some liquid must be drained out. Static pressure below 7.5" indicates that the liquid level is too low and liquid must be added.

Restore water to proper level.

### **Setting the Alarms**

With the fan running, drain the hopper until the photohelic gauge reads 6.5" of differential pressure. Loosen the low level alarm switch assembly and position the switch until the low level alarm sounds. Tighten the assembly at this level.

Fill the hopper up with water until the photohelic gauge reads 9.5" of differential pressure. Loosen the high level alarm assembly and position it so the alarm sounds at this point. Tighten the assembly at this level.

The scrubber system is now ready to operate.

### **3.7 Timed Drain Down**

An optional feature of the Whirl Wet® Dust Collector is the automatic sludge removal system. It consists of an electric or air-actuated valve with associated timer controls. One timer regulates the frequency at which the valve opens and another timer controls the amount of time that the valve remains open.

If the scrubber is not equipped with a timed drain down system, this operation must be preformed manually.

The timers must be adjusted in the field to accommodate the dust loading and scrubber volume. The drain frequency timer is generally set between 15 and 180 minutes. The drain interval timer must be adjusted so that the low liquid level alarm is not activated during drain down.

### **3.8 Shut Down**

Stop operation of the exhaust fan. Stop addition of make-up water by closing both hand valves in the plant water line (see Fig. 5).

If the system is to be down for an extended period (two to four weeks or more) or for cold weather, follow these additional steps:

Drain liquid from the system (see Fig. 8); flush blades, mist eliminator (see Fig. 6) and hopper with clean water to remove accumulated sludge. To prevent damage from freezing, do not leave liquid in the hopper.

Lock out power to the control panel.

## **3.9 Maintaining Equipment**

### **Pressure Taps**

Several openings to the inside of the dust collector have been made in order that differential pressure may be measured (see Fig. 7). These holes may have to be cleaned periodically to prevent plugging. Use a small, blunt object (3/8" round rod or dowel) to remove debris that may have accumulated (see Fig. 12).

### **Daily Inspection**

Measure and record pressure drop across the scrubber. Consult the factory if values are out of range (see Start Up and Operation).

Check the rotation pattern of liquid within the scrubber blades. There should be a smooth turning motion of liquid as seen through the window on the side of the scrubber (see Fig. 10).

### **Weekly Inspection**

Check the fan for excessive vibration and excessive bearing temperature. Follow the manufacturer's instructions for maintenance of this equipment.

### **Semiannual Inspection**

Inspect mist eliminator (see Fig. 6) for accumulation of sludge, scale or slime. Over a long period of time, it is not unusual for these elements to become fouled. The result is increased pressure drop and decreased efficiency. Clean or replace as necessary.

## **3.10 Scrubber Cleaning**

The scrubber must not be in operation for cleaning.

The frequency of cleaning blades, mist eliminator (see Fig. 6) and hopper bottom depends on the rate of particulate buildup and solubility of the particulate that is collected.

To clean the unit, open the bottom valve (see Fig. 8) completely and let all water drain out. Then, flush the unit thoroughly. Take out the mist eliminator (see Fig. 6) and rinse the elements. Be sure to re-install the mist eliminator in the proper orientation.

## 4 Components of a Whirl Wet® Dust Collector

Fig. 1



**Photohelic Gauge** -- The photohelic gauge is the instrument used to control the liquid level in the sump of the collector. It does this by monitoring the differential pressure of the collector.

Fig. 2



**Level Alarms/Level Alarm Box** -- The level alarms are used to monitor the liquid levels in the sump via mechanical floats. If the liquid in the sump reaches a critical level (high/low) an alarm will in turn sound. The 4" threaded plug in the level alarm box may be removed to clean the box and equalization hole but only when the system is not running.

Fig. 3



**Solenoid Valve** -- The solenoid valve is an electrically actuated valve controlled by the photohelic gauge. The solenoid valve will automatically add water to the sump when the liquid level gets low.

**Fig. 4**



**Ball Valve** -- The ball valve is a manual valve (shown here in the off position) used to isolate the solenoid valve (see Fig. 3).

**Fig. 5**



**Water Fill/Make Up Water Assembly** -- The water fill valve is located to the left in figure 5 and is labeled as such. The purpose of this valve is to add plant water at start up. Make up water is located to the right in figure 5 and is controlled by the Photohelic gauge.

**Fig. 6**



**Mist Eliminator** -- The mist eliminator is the cartridge that removes any entrained water in the air stream and allows it to drain back into the sump.

**Fig. 7**



**Pressure Tap** -- The pressure tap is the point at which the collector's wall is penetrated to allow for the measurement of differential pressure. The threaded cap may be removed to allow for cleaning dust and debris but only when the scrubber is not running.

**Fig. 8**



**Drain** -- The drain is used to drain sludge from the bottom of the unit.

**Fig. 9**



**Round Sight Glass** -- The round sight glass is used to monitor what is happening inside the unit as well as to see how much liquid is in the sump.



**Fig. 10**



**Cut Away View of a Scroll** -- This is the internal view of the scroll with water moving properly through it.

**Fig. 11**



**Sight Gauge** -- The sight gauge is used to monitor how much liquid is in the sump.

**Fig. 12**



**Cleaning of Pressure Taps** -- The threaded cap is removed and a 3/8" rod is being used to remove any debris plugging the pressure tap.

## 5 Maintenance

### 5.1 Service and Assistance

To locate a Tri-Mer® technician, contact Tri-Mer®'s main office at:

Tri-Mer® Corporation  
1400 East Monroe Street  
Owosso, MI 48867  
Phone: (989) 723-7838  
Fax: (989) 723-7844

### 5.2 Spare Parts

Parts may need to be ordered from a component vendor. We understand that an extended lead time for parts is not acceptable. Therefore, we recommend that our customers purchase the recommended spare parts kit with the equipment so that service parts can be kept on-site for immediate use.

#### 5.2.1 Recommended List of On-Site Spare Parts

See Master Parts List on CD for recommended spare parts.

### 5.3 Maintaining Equipment

Except for components that need periodic lubrication, preventive maintenance is not required for this system. Periodic inspection as outlined below is encouraged in order that corrective maintenance is not postponed.

#### WARNING

Before working on the scrubber or its components, be sure that the power has been shut off and locked out.

#### WARNING

Before discharging contents of the sump, make sure that the tank or utility that is to receive the discharge is properly prepared. Do not allow wastes to mix that could react violently or with generation of toxic vapors.

### 5.4 Recommended Maintenance Schedule

Note: This schedule provides a general guideline for system maintenance. Ideal maintenance may vary slightly from facility to facility and from machine to machine.

#### 5.4.1 Daily Inspection

- Measure and record pressure drop across the scrubber. Consult factory if values are excessive.

- Check the rotation pattern of liquid within scrubber plates. There should be a smooth turning motion of liquid as seen through the window on the side of the scrubber.

#### **5.4.2 Weekly Inspection**

- Check the fan for excessive vibration and excessive bearing temperature. Follow the manufacturer's instructions for maintenance of this equipment.
- Check all piping components for leaks.

#### **5.4.3 Monthly Inspection**

- Perform all daily and weekly inspections plus the following.
- Check fasteners and tighten as necessary.
- Measure and record motor amperages. Consult the factory if these parameters exceed the nameplate value.
- Inspect the pressure taps and associated fittings and tubing for wear or plugging. Clean or replace as necessary.
- Inspect the sight gauge and fittings, and the equalization hole in the level control box. Clean or replace as necessary.
- Lubricate bearings on the exhaust fan using a lithium-base NLGI, Grade II grease. Follow the manufacturer's instructions.
- Check belts and drives for wear, and proper tension and alignment. Adjust or replace as necessary.
- Inspect the fan impeller for wear or signs of fatigue.

#### **5.4.4 Semiannual Inspection**

- Perform all daily, weekly and monthly inspections plus the following.
- Inspect mist pads and filter packs for accumulation of sludge, scale, or slime. Over a long period of time, it is not unusual for the elements to become fouled. The result is increased pressure drop and decreased efficiency. Clean or replace as necessary.

#### **5.4.5 Tri-Mer® Annual Service Agreement**

Tri-Mer® Corporation offers an annual service plan that includes two one-day visits per year for preventative maintenance. The scope of activities and terms of the Agreement will be provided upon request.

Contact information:

Tri-Mer® Corporation  
1400 East Monroe Street  
Owosso, MI 48867  
Phone: (989) 723-7838  
Fax: (989) 723-7844

## 5.5 Troubleshooting Guide

This guide should help you to resolve problems which operators may have if various parts of the system fail or are not maintained. Problems with auxiliary equipment should be resolved by consulting manuals for the particular component.

### 5.5.1 Low Removal Efficiency (Poor Exhaust Quality)

If the unit is not removing contaminants in accordance with the design basis, you should check for:

Problem	Likely Causes
Improper air flow rate	See the discussion of this problem which is outlined below.
Low water level	Increase the level of the water to keep blades covered and pressure drop around 8.0" w.g.
Low Blowdown/Overflow rate	Increase blowdown/overflow to prevent excessive accumulation of sludge.
Fouled Internals	See the discussion on this problem which is outlined below.
Air by-pass	Check for tears or gaps in the mist eliminator.

Table 1: Troubleshooting Low Removal Efficiency

### 5.5.2 Improper Air Flow Rate

Variations in air flow rate can have both good and bad effects. If the air flow rate deviates from the design flow by more than five percent, you should check for:

<b>Problem</b>	<b>Likely Causes</b>
Incorrect system static pressure	Obstructions such as narrow duct, closed dampers, fouled packing, or foreign objects in the air pathway hinder the flow of air. Changes to the system, such as additional duct or equipment, may increase the static pressure losses. Remove the obstruction or adjust the air-moving device to accept a higher system loading.
Incorrect fan speed	Loose belts, wrong drive sheaves, and motor faults contribute to this problem. Make adjustments as necessary.
Foaming scrubbing solution	The contaminants being absorbed may cause foaming, which increases resistance to flow of air through the media. This is corrected by use of antifoam or by changes in the process.

**Table 2: Troubleshooting Improper Air Flow Rate**

### 5.5.3 Fouled Internals

Some scale formation or sludge accumulation is to be expected. Periodic cleaning of spray nozzles, mist eliminator elements, and water filter elements may be necessary to prevent it from becoming excessive. Scale formation or sludge accumulation may be excessive because:

<b>Problem</b>	<b>Likely Causes</b>
Make-up (purge) rate is too low	Clean the affected parts and increase the purge rate.
Make-up water has high scale potential	Clean the affected parts and install water conditioning equipment.
Growth of micro-organisms is excessive	Clean the affected parts and maintain residual of disinfectant or inhibitor in solution.
Ambient air has high dust load	Clean the affected parts, then install a filter on the air inlet or in the recycle loop, or increase the purge rate to flush solids out of the system.

**Table 3: Troubleshooting Fouled Internals**

## TRI-MER® ONE YEAR WARRANTY

TRI-MER® CORPORATION (hereinafter referred to as “Tri-Mer®”) warrants each of their products, manufactured by Tri-Mer®, against manufacturing defects within one (1) year from date of start-up or eighteen (18) months from shipment, whichever occurs first. During the first year, a product, or any part thereof deemed defective by the user, may, upon prior approval by Tri-Mer®, be returned to 1400 East Monroe Street, Owosso, Michigan 48867.

Tri-Mer®’s obligation under this warranty is limited to the furnishing of replacement parts (FOB your plant) determined to be defective. This warranty does **not** cover, and no allowance or payment will be made, for labor other expenses involved with the removal, repair, installation or replacement of any defective part or component, or any damages or other costs relating to such product. No warranty is made, and neither Tri-Mer® nor any of its employees or agents shall be liable to any owner or user of any product shipped by it for any consequential damages arising out of operation, possession, loss or use of any product or equipment in which it is installed. No warranty of fitness of a Tri-Mer® product for any particular purpose is made except where the application and method of use is approved in writing by Tri-Mer® in advance.

The Warranty of any equipment or component not manufactured by Tri-Mer®, but supplied to Tri-Mer® for use in its product, is limited to the specific warranty of the manufacturer involved. Tri-Mer® makes no warranty or guarantee of any nature with respect thereto.

The warranty contained herein is the only warranty applicable to any product sold or shipped by Tri-Mer®, and, except as set forth herein, all warranties (expressed or implied) are hereby disclaimed. No other agreements, guarantees or warranties, oral or written, are made or intended to be made by Tri-Mer®.

### Parts and Service

For replacement parts or service, call

[astgroup.ca](http://astgroup.ca)



905-821-8860



