Technical Literature
MAXCHANGER®

Installation And Operation Manual

MAXCHANGER®
WELDED HEAT EXCHANGER

TRANTER
The heat transfer people

TABLE OF CONTENTS

EQUIPMENT LOG SHEET

Upon delivery of your MAXCHANGER® unit(s), be sure to record the following information from the nameplate (see Figure 5.2., Page 14) on each unit. You will need this information whenever you contact the factory.

Equipment Tag #	Serial #*	Drawing #*	Model*

* Tranter must have serial or drawing number to properly identify your equipment.

ATTENTION: When ordering additional or replacement units, always provide the manufacturer's serial number of the exchanger. This information appears in the General Assembly Drawing and on the exchanger's nameplate.

For parts, service or performance ratings, contact one of Tranter's authorized Service Centers (see contact information in Section 6.4.).

1. INTRODUCTION

This manual is intended as your general guide for the proper installation, operation and maintenance of your MAXCHANGER® Welded Heat Exchanger. You should study this manual thoroughly before operating the unit and follow the instructions with care.

WARNING: Tranter accepts no responsibility or liability for damage caused by incorrect installation, operation or maintenance attributed to failure to observe these instructions.

1.1. Product Description And Types

MAXCHANGER Welded Plate Heat Exchangers provide a high heat transfer rate in a very compact space. They are designed for challenging applications involving liquids, gases, steam and two-phase mixtures, at temperatures and pressures that are beyond the capability of gasketed plate & frame units. For every individual MAXCHANGER unit, be sure to compare the operational ratings stamped on the nameplate (Figure 5.2., Page 14) with the process design specifications before installation to avoid the possibility of damage.

1.1.1. MAXCHANGER Design

The MAXCHANGER dimpled plates are arranged alternately and welded together at the sides to form channels for hot and cold media. Spacers isolate the channels and induce countercurrent flow. The numerous dimples provide maximum pressure resistance and heat transfer. Corner angles or half-pipes are welded to the plate pack points and to the top and bottom plates, forming inlet and outlet headers.

1.1.2. MAXCHANGER Configurations

Two plate lengths are available, 305 mm (12 in.) and 610 mm (24 in.) with NPT-M or RF connections. Mounting brackets may be provided.

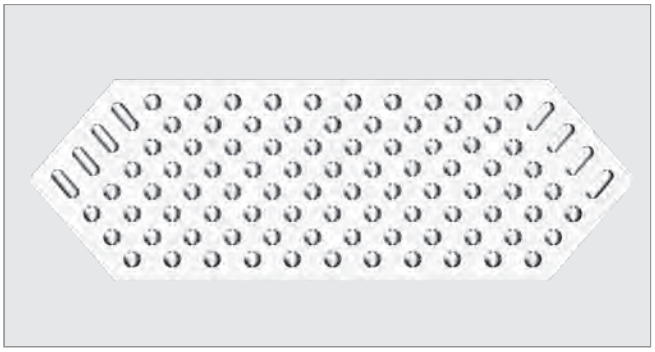
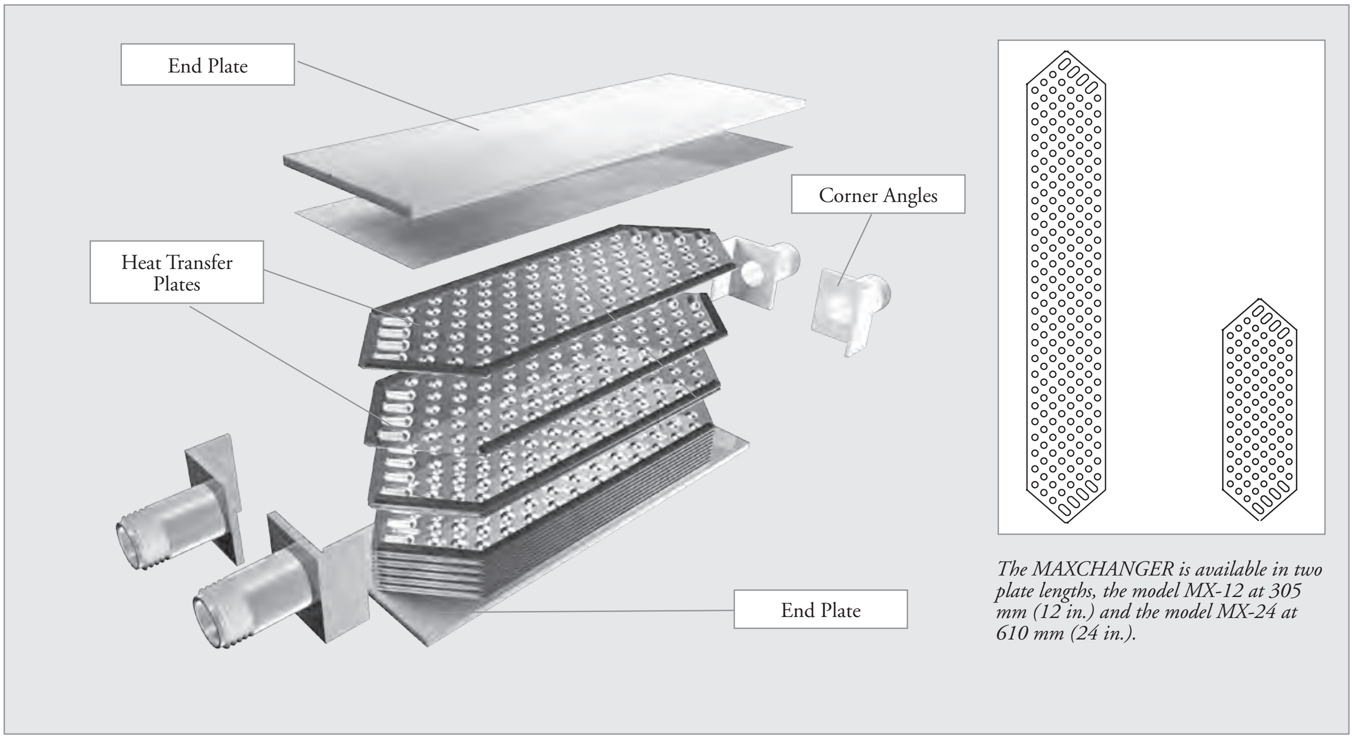


Figure 1.1.
MAXCHANGER® dimpled plate.



The MAXCHANGER is available in two plate lengths, the model MX-12 at 305 mm (12 in.) and the model MX-24 at 610 mm (24 in.).

Figure 1.2.
Exploded view of welded MAXCHANGER.

1. INTRODUCTION (continued)

1.2. Service Limits

1.2.1. Design Conditions

Design operating conditions for each MAXCHANGER heat exchanger appear stamped on the exchanger's nameplate (see Figure 5.2., Page 14) and are shown on the general arrangement drawing furnished with the unit. The MAXCHANGER exchanger should never be operated under conditions that exceed those stamped on the nameplate.

The MAXCHANGER is a welded design. Intermixing is possible in the event of a plate or weld failure. For critical applications where any possibility of fluid intermixing must be avoided, a secondary heat exchanger with an intermediate loop should be used.

1.2.2. Maximum Differential Temperatures

The MAXCHANGER Welded Heat Exchanger is limited to a maximum differential temperature (hot fluid inlet temperature minus cold fluid inlet temperature) of 538°C (1,000°F). Exceeding this limitation may result in mechanical damage to the equipment.

1.2.3. Flow Rate Considerations

The minimum flow rate is 10% of the rated flow rate as shown on the specifications sheet shipped with each unit. With units using steam, superheated water or thermal fluid in the hot circuit, it is necessary to maintain a minimum of 20% of the rated flow rate in the cold circuit. In applications where the temperature of the hot circuit fluid is higher than the saturation temperature of the cold circuit fluid, low flow rate alarms should be built into the control circuit, since a drop below the 20% threshold could cause flashing in the MAXCHANGER and condensation in the piping. This could result in destructive water hammer that could damage the MAXCHANGER, other system components or nearby personnel.

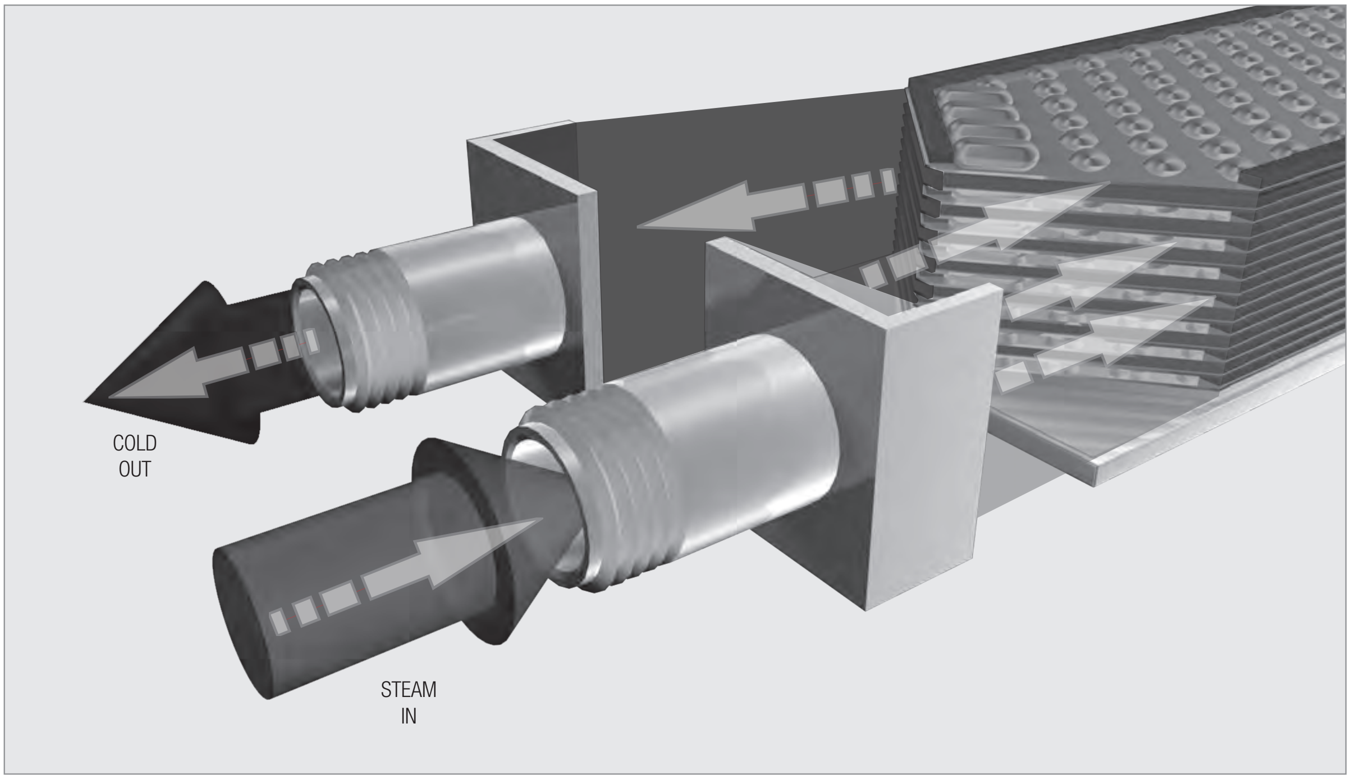


Figure 1.3.
In steam heating applications, ensure that cold circuit flow rate alarms are set to prevent a drop below the 20% threshold to avoid flashing in the MAXCHANGER and subsequent condensation in the piping.

2. INSTALLATION

2.1. Mounting And Flow Control

2.1.1. General Recommendations

Always follow generally accepted piping and equipment control practices. Observing the following recommendations will help ensure long operating life and trouble-free maintenance.

2.1.2. Location And Mounting

1. The unit should be mounted so that it fully drains and can be vented.
2. Locate the exchanger in an area free of interference from piping or other equipment.
3. Mount the unit securely to a support structure.

2.1.3. Piping

1. Employ elbows and expansion couplings to accommodate thermal expansion, pulsation and hydrodynamic shock that could damage the exchanger or its nozzles.
2. Flush all approach piping thoroughly before connecting the unit.
3. Make provisions for thermal expansion and/or vibration, if necessary. Never expose the unit to pulsations or excessive cyclic pressure or temperature changes. It is also important that no vibrations are transferred to the heat exchanger. If there is a risk of this, install vibration absorbers. For large connection diameters, it is advised that an expansion joint be used in the pipeline.
4. Pipe in accordance with the labels fixed to the unit (hot in, cold out, etc.).
5. Provisions for monitoring pressure drop and temperatures are recommended. Install so unit will operate full of liquid. Trapped air will diminish the heat transfer coefficient.

2.1.4. Valving And Pumps

1. In high-pressure class application, operating pressures must be as stable as possible. One circuit's pressure should be higher than the other circuit by at least 1 bar (14.5 psig). Pressure fluctuations resulting in pressure inversions between the channels may damage the plate pack and lead to intermixing.
2. In process applications, position shut-off valves such that the exchanger can be unbolted and removed without having to remove the valves.
3. Globe or butterfly valves are recommended; these should be maintained in good working order.
4. To prevent water hammer, two-stage valves or slow-acting, throttling-capable valves should be used.
5. Do not oversize control valves; this can create "on/off" behavior, which may damage the heat exchanger.
6. Control sequences should be planned to prevent thermal or mechanical stresses from occurring during start-up, load swings and shut-down. See Section 3.1 for guidelines.
7. Pumps serving the heat exchanger should be equipped with throttling valves.
8. Positive displacement pumps (especially reciprocating pumps) should be equipped with vibration dampers to minimize harmonics and pulsation.
9. Positive displacement pumps must also be equipped with a pressure relief valve between the pump discharge and the heat exchanger inlet.
10. Provisions for back-flushing and/or chemical in-place cleaning are recommended.

WARNING: **When the maximum pump discharge pressure exceeds the maximum design pressure of the exchanger, a pressure-reducing valve should be installed at the exchanger inlets.**

2. INSTALLATION (continued)

2.1.5. Filters

The MAXCHANGER is designed for use with clean fluids; thus, fibers or particulate matter can plug the unit. External filters should be used when solids are present.

Contact your factory representative to determine proper filtration procedures/devices.

2.1.6. Special Recommendations For Steam Service

1. For use in condensing applications, such as steam, be sure the unit is oriented for gravity drainage of condensate. Good steam practices (e.g., steam trap below the unit, vacuum breakers, etc.) should be followed. A sample steam schematic is shown (Figure 2.2.). Welded PHEs will not be warranted if the schematic is not followed.

2. Install pressure relief valves and float & thermostatic (F&T) steam traps to prevent condensate accumulation in the plate pack channels. This will protect the exchanger from possible water hammer damage.

3. When the unit is operating with partial vacuum or when back pressure may exceed steam pressure, condensate pumps should be used to prevent backflow of condensate into the exchanger and system-induced "stall" conditions.

4. Vacuum breakers and air vents should be installed at the inlet to prevent condensate backflow due to the vacuum produced by condensation of steam during shut-down.

If the MAXCHANGER is used as a steam condenser, control the process on the steam side. If it must be controlled on the condensate side and the system has back pressure on the condensate line, install a condensate return pump. If the MAXCHANGER is drained to a condensate system open to the atmosphere with no back pressure and a falling gradient all the way to the condensate tank or drain, effective drainage can be achieved by installing an air vent, a drain and an F&T steam trap.

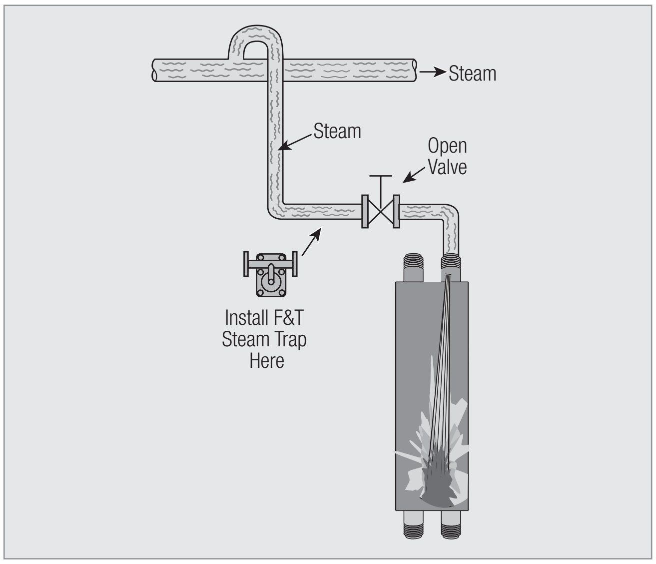


Figure 2.1.
MAXCHANGER units can sustain water hammer damage in low-pressure steam applications and non-continuous process systems if there is not adequate steam trapping at critical points in the steam distribution system.

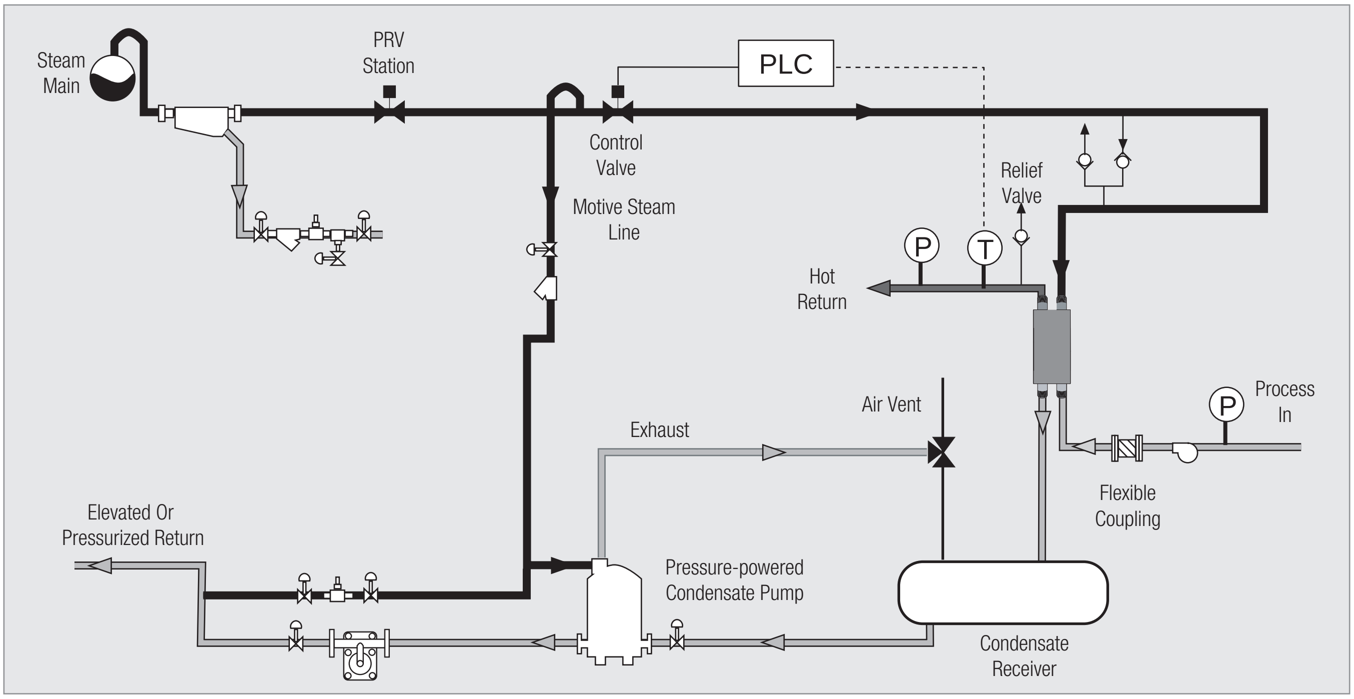


Figure 2.2.
Correctly engineered condensate handling will prevent system-induced "stall" conditions, protect equipment from damage, improve thermal control and save energy.

2.1.7. Vacuum Operation

If the MAXCHANGER exchanger will operate under either constant or intermittent vacuum (e.g., under upset conditions), install a vacuum break at the outlets to prevent liquid backflow and water hammer problems.

ATTENTION: Tranter is not a steam system design company. Accordingly, Tranter is not liable for MAXCHANGER units that fail when employed in substandard steam system designs. Buyers should consult professional steam system engineers.

2.2. Common System Hookups

Only typical control systems are shown. The user must design and install process control systems to meet the needs of the specific application.

2.2.1. Liquid/Liquid

In a basic system, the temperature transducer signal at the process outlet controls the control valve at the service inlet through a PID-based controller. The control valve must not be oversized, eliminating the possibility of "on/off" operation that could damage the exchanger through fatigue and stress.

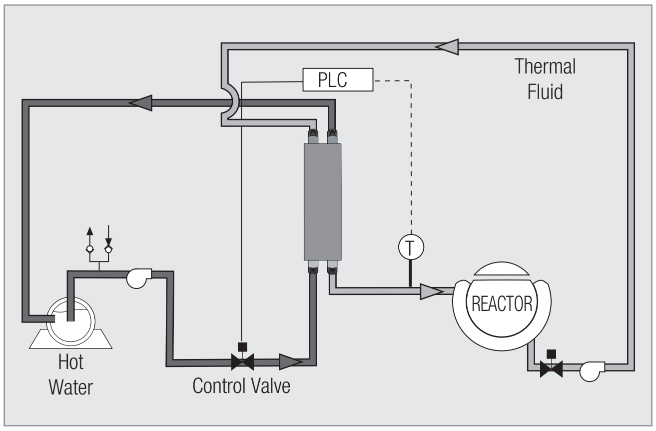


Figure 2.3.
A basic liquid/liquid control scheme.

2.2.2. Process Fluid Heating–Constant Flow Rate

The control strategy is based on condensate control. Energy delivered to the process fluid will be steady and constant, which is an ideal application for the MAXCHANGER. The cold channel process flow rate must be coordinated with the hot channel heat transfer rate specified for the exchanger.

The temperature signal at the process outlet processed by a PID-based loop controller regulates the condensate control valve downstream of the steam trap. This valve must not be oversized, operating within 80–110% of its range to avoid "on/off" behavior. For balanced flow velocities, the condensate outlet must be much smaller than the steam inlet; a ratio of 1:4 is generally acceptable. Consult steam tables for accurate sizing.

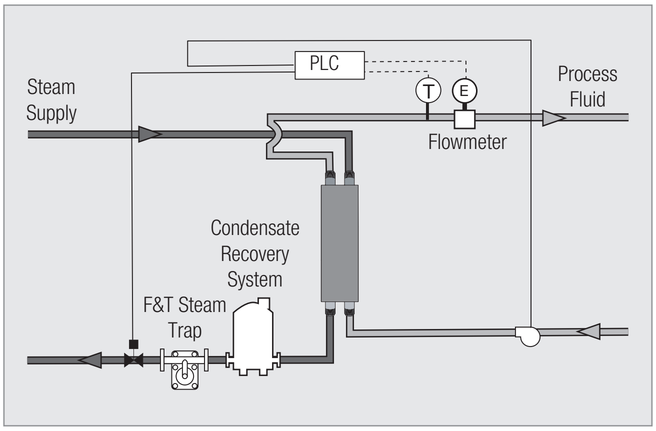


Figure 2.4.
A basic fluid heating control scheme using condensate control.

2. INSTALLATION (continued)

2.2.3. Steam Or Vapor Condensing/Liquid

In a continuous process, steam condenses within the exchanger while heating a fluid. As a process condenser, the exchanger uses chilled water to condense vapor. Generally no control is installed, since systems usually operate with a constant cooling medium flow rate. The return temperature is dependent on the heat load.

Be sure to install traps upstream of the MAXCHANGER to prevent damage from water hammer. This is particularly important in low-pressure steam applications and on non-continuous process systems.

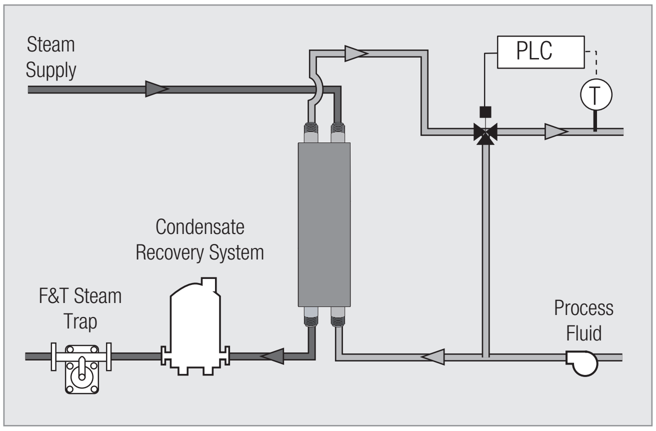


Figure 2.5.
A basic heating (steam condensing) control scheme.

2.2.4. Process Fluid Heating–Variable Flow Rate

If the process flow rate varies, a bypass system should be configured for more accurate process control. In this strategy, the hot channel flow is set but not controlled. The loop controller regulates the recirculation flow rate to attain the target outlet temperature, irrespective of the steam flow rate.

In heating applications, always maintain a minimum of 20% maximum flow rate in the cold channel to prevent the possibility of flashing, recondensing and water hammer in the piping.

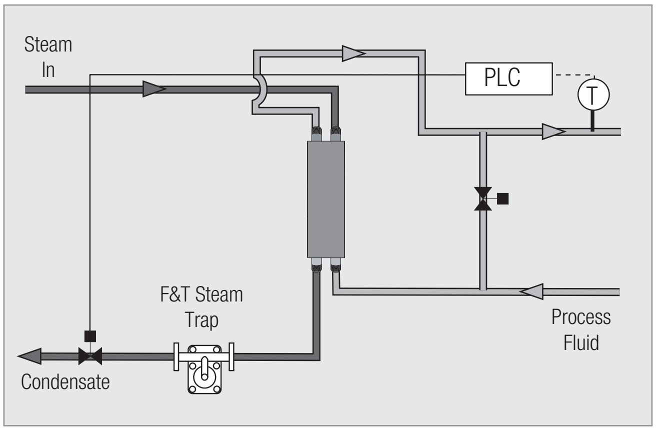


Figure 2.6.
A basic fluid heating control scheme using bypass loop control.

<u>ATTENTION:</u> Tranter assumes no liability for or relating to the delay, failure, interruption or corruption of any MAXCHANGER unit in connection with use of this IOM. Before relying on the information contained in this IOM, buyers should independently verify its accuracy, currency, completeness and relevance for individual applications. Buyers should obtain appropriate professional advice from a professional process design company.

2.2.5. Refrigeration

The MAXCHANGER can be used in chiller or refrigeration systems as both condensers and evaporators.

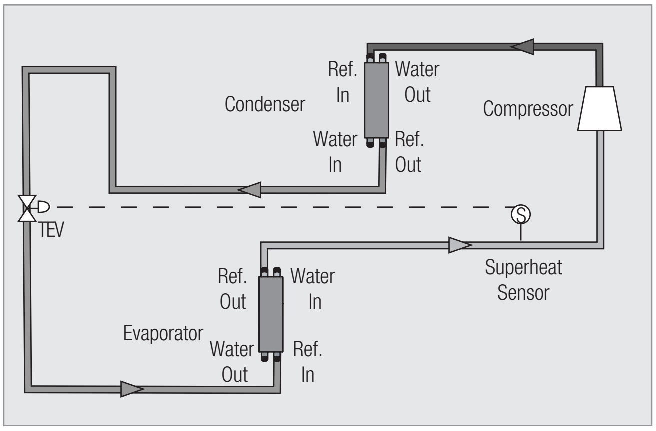


Figure 2.7.
Refrigeration schematic for typical DX system.

2.2.6. Multiple Units

The nature of and compact size of the MAXCHANGER allows multiple units to be connected in series or in parallel.

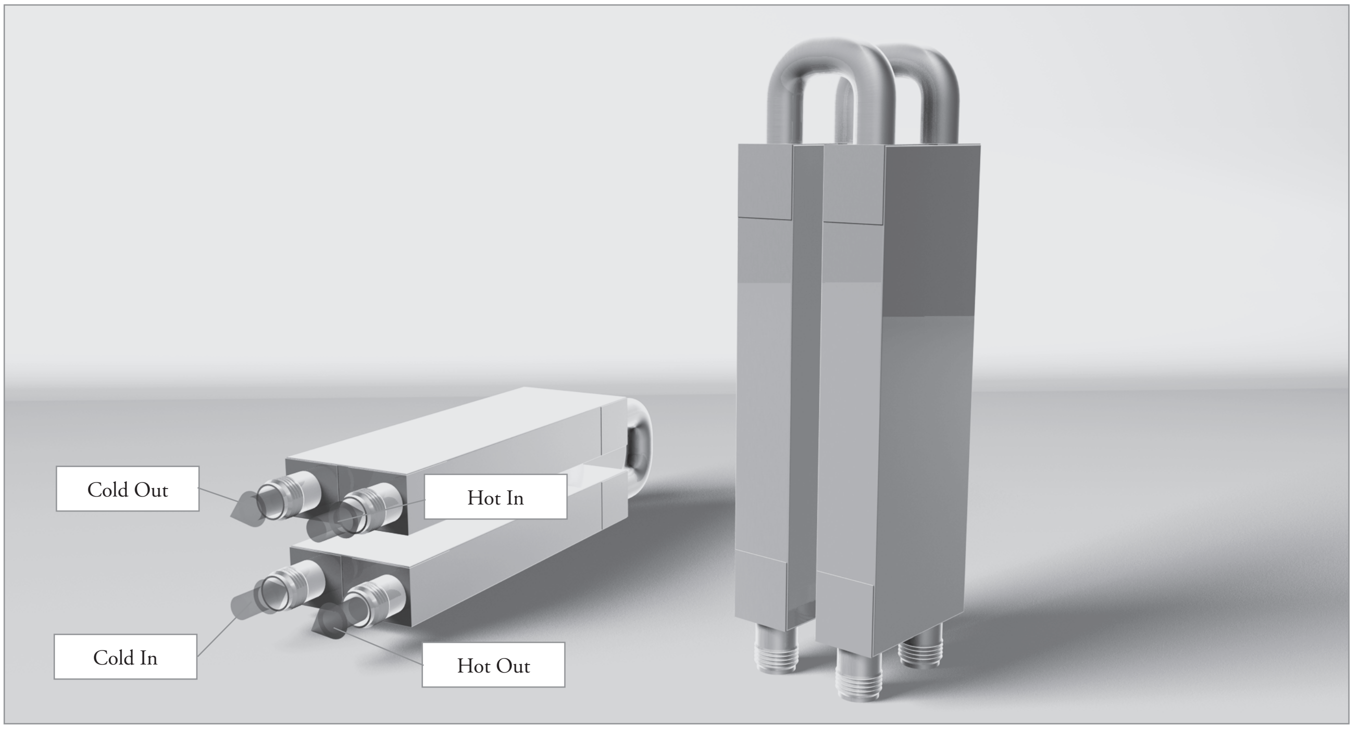


Figure 2.8.
Two MAXCHANGER units may be connected in series for additional heat transfer.

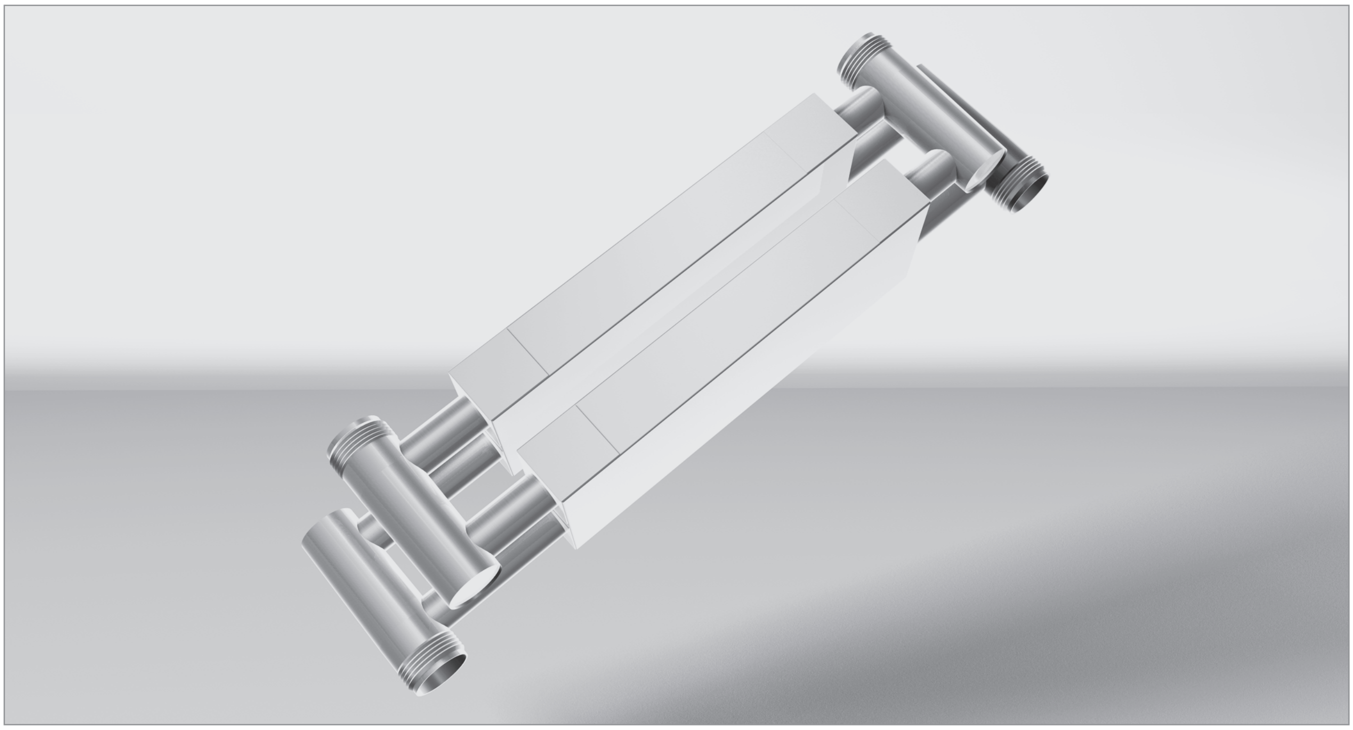


Figure 2.9.
Two MAXCHANGER units may be connected in parallel for higher flow rates.

3. OPERATION

3.1. Critical Operating Principles

All operators should familiarize themselves with the following operating principles, which are critical in preventing damage to the unit.

1. Water hammer, if suspected, must be diagnosed and eliminated, or damage may result to the MAXCHANGER.
2. Pumps should always be started against closed valves.
3. Valves must be set to open and close gradually. Sudden opening and closing of the valves will subject the exchanger to mechanical and thermal shock and may cause material fatigue.
4. Starting up and shutting down should be managed to minimize differential expansion between the channels. Follow the stated start-up and shut-down steps in order.
5. The maximum temperature rise measured at the hot channel outlet should be no more than approximately 30°C (55°F) per min. If feasible, the temperature rise should be as slow as possible.

<u>CAUTION:</u> In steam applications, never leave the steam on with the liquid side turned off. Turn the steam off first and on last.

3.2. Starting Up

1. Inspect the unit carefully for integrity.
2. After extended storage or time off-line, ensure that the approach piping is free of scale or contamination that may clog the fluid passages.
3. Make sure that all inlet and outlet connections are tight.
4. Always establish the cold side flow first, then the hot side flow.
5. Make sure the cold side inlet valve between the pump and MAXCHANGER unit is closed.
6. Fully open the shut-off valve at the outlet (if one was installed).
7. Open the vent valve to evacuate air.
8. Start the pump.
9. Slowly open the feed valve. Close the vent valve when all air has been removed.
10. Wait several minutes, then repeat Steps 5–9 for the hot side, taking approximately 5 min. to fully open the inlet valve. The maximum temperature rise measured at the hot channel outlet should be no more than approximately 10°C (18°F) per min. If feasible, the temperature rise should be as slow as possible.

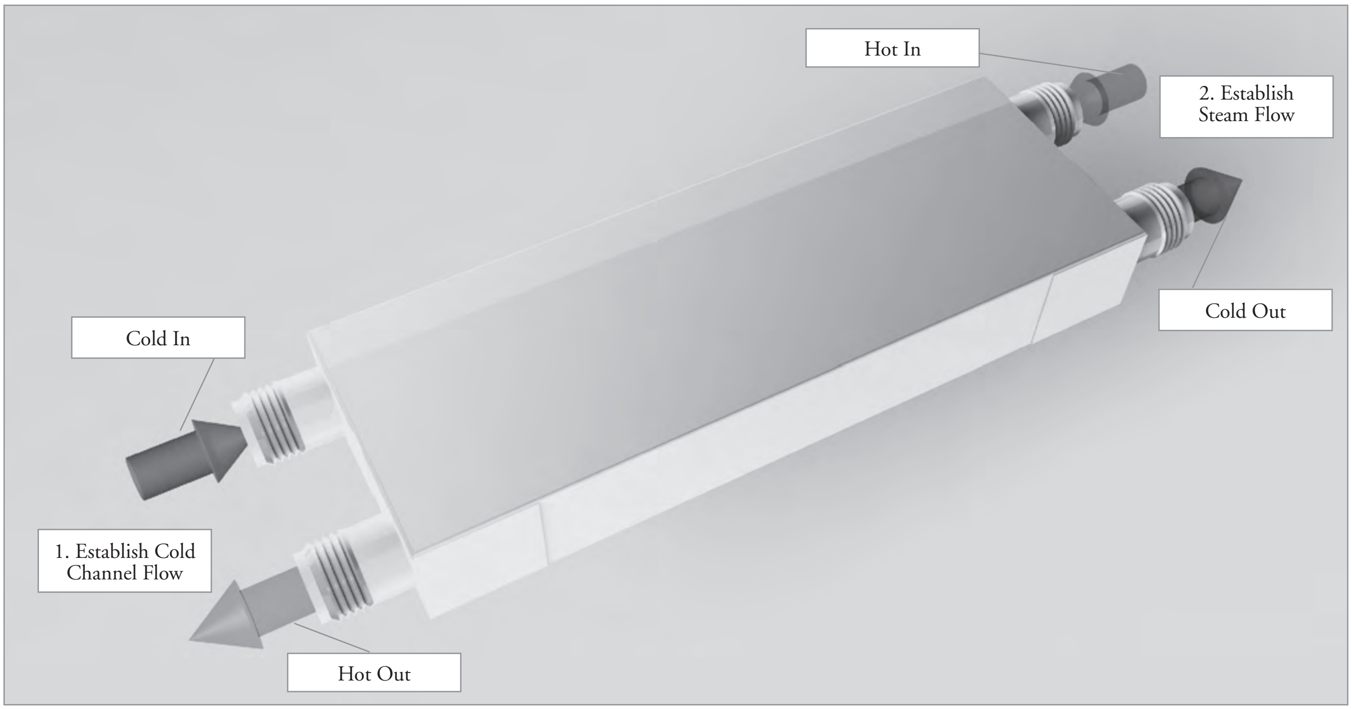


Figure 3.1.
Always start the cold side first, then the hot side.

3.3. Shutting Down

Follow Steps 1–4 for the hot side first, then repeat the procedure for the cold side. Always decrease the flow to the hot side until closed. Then shut down the cold side flow.

1. Slowly close the hot side inlet valves.
2. Switch off the pump.
3. Close the outlet valves.
4. Drain and vent the unit.

Repeat Steps 1–4 for the cold side.

3.4. Periodic Flow Rate Increases

The rate of heat transfer surface fouling is affected by fluid velocity. Tranter recommends that the flow rate be increased if possible at regular intervals. The increased turbulence within the channel retards the rate of fouling. The frequency and duration of this preventive cleaning practice will vary depending on operating fluid velocities and fouling tendencies of the medium.

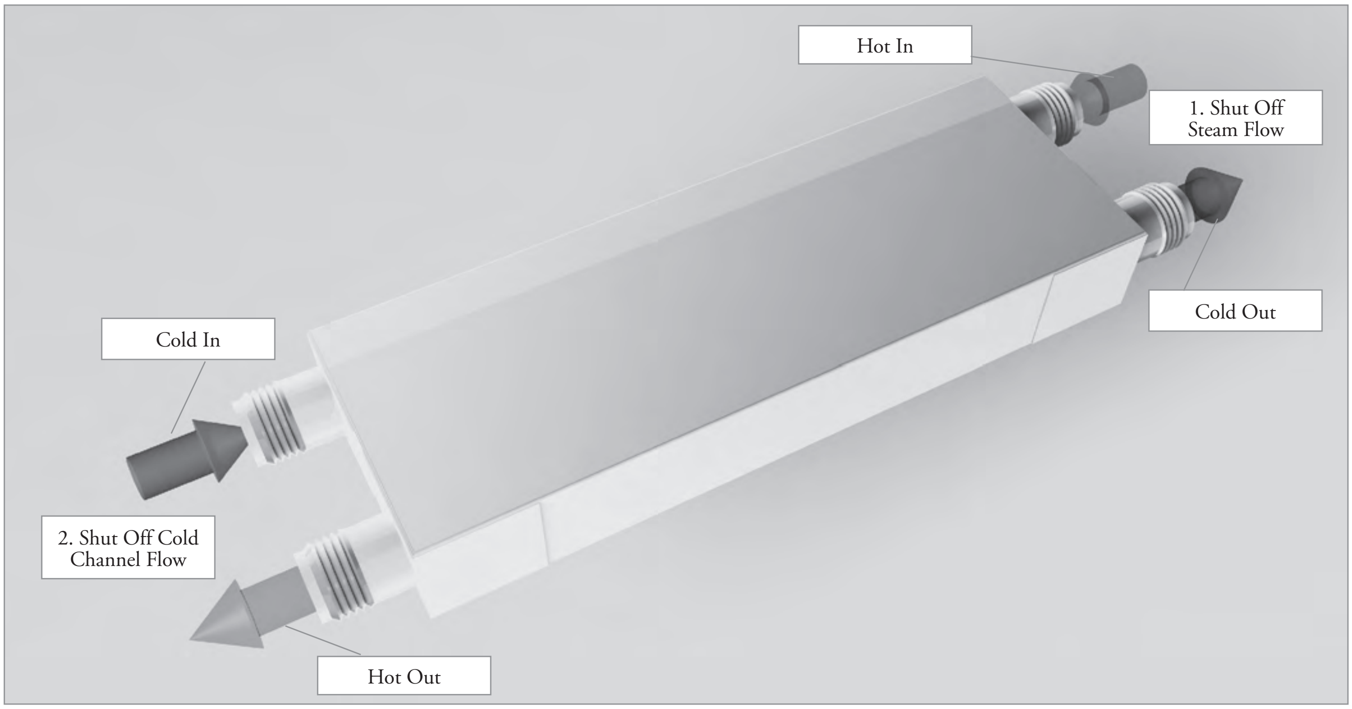


Figure 3.2.
Always shut down the hot side first, then the cold side.

4. MAINTENANCE

The MAXCHANGER is a very simplified plate heat exchanger that, by its nature, requires little or no maintenance. It can, however, as with any heat exchanger, plug or have scale form on the heat transfer surfaces. Provisions for eliminating or correcting these problems are best provided for during installation (see Page 6).

If there are any questions about installation, chemical cleaning or recommended strainer or screen sizes for filters, be sure to consult the representative or manufacturer.

4.1. Cleaning The MAXCHANGER

The MAXCHANGER heat exchanger is engineered and constructed for many years of reliable performance. Some fluids under certain temperature and pressure conditions, while compatible with MAXCHANGER technology, can tend to scale or foul the plates over time.

The MAXCHANGER, as a welded unit, is essentially a welded pressure vessel that cannot be disassembled in its standard configuration. The same design that gives the MAXCHANGER its performance also makes in-line maintenance the only practical cleaning strategy.

Accumulation of deposits inside the process circuit reduces the heat transfer rate and causes excessive pressure drops through the system. The operator must establish optimal methods, frequency and cleaning solutions to remove deposits without damaging the plates.

Following are some general guidelines for cleaning:

1. Do not use hydrochloric acids, or water containing in excess of 300 ppm chlorides, with stainless steel.
2. Do not use phosphoric or sulfamic acid for cleaning titanium plates.

Limit the cleaning solution concentration to 4% by volume in strength, with temperatures not exceeding 60°C (140°F) unless otherwise specified.

CAUTION:

1. **When handling any cleaning solutions, closely follow the safety recommendations provided by the cleaning solution manufacturer.**
2. **Always wear protective goggles and rubber gloves.**
3. **When diluting acid, always add acid to water.**
4. **Do not use hydrochloric acid (HCl or muriatic acid) for cleaning stainless steel plates.**
5. **Caustic soda and concentrated nitric acid can cause serious injuries to skin and mucous membrane.**

4.2. Clean-in-place (CIP) Guidelines And Procedures

1. Drain both channels and flush the process circuit with cold, fresh water. If the cooling circuit uses seawater, flush this channel also.
2. Flush both channels with warm water, 40–50°C (100–120°F), until the effluent water is clear.
3. When mixing the cleaning solution, use chloride-free or low chloride water with a low hardness value.
4. If possible, pump the cleaning solution opposite the normal flow direction for back-flushing action.
5. Pump the cleaning solution at flow rates up to 1.5 times the normal working flow rate, where possible, without exceeding the maximum nozzle velocity of 8.5 m/sec (28 ft/sec).

   If high CIP flow rates cannot be attained, use a solution capable of dissolving deposits at lower flow rates and/or lengthen the CIP cleaning cycle.
6. Hydraulic shock must be avoided; use centrifugal CIP pumps that can attain the CIP flow rate and operating pressure gradually.

After completing the cleaning cycle, flush the exchanger and approach piping with clean water.

Table 4.1. CIP Cleaning Solutions

TYPE OF FOULING	SUGGESTED CLEANERS
Calcium sulphate, silicates	Citric, nitric, phosphoric or sulfamic acid
Calcium carbonate	10% nitric acid (1 volume concentrated nitric acid with specific gravity 1.41 to 9 volumes of water), Oakite 131
Alumina, metal oxides, silt	Citric, nitric, phosphoric or sulfamic acid (To improve cleaning add detergent to acid.)
Biological growth	Sodium carbonate or sodium hydroxide

CAUTION: Always add cleaning solution concentrates to the dilution water and mix well before circulation begins.

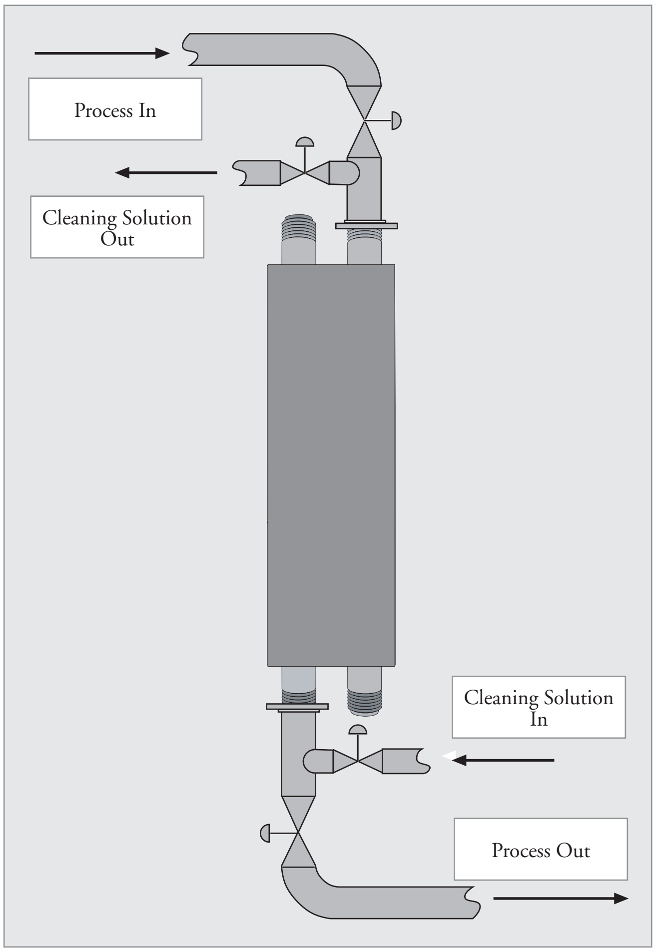


Figure 4.1.
Basic CIP configuration for one MAXCHANGER channel, showing isolation valves and countercurrent cleaning.

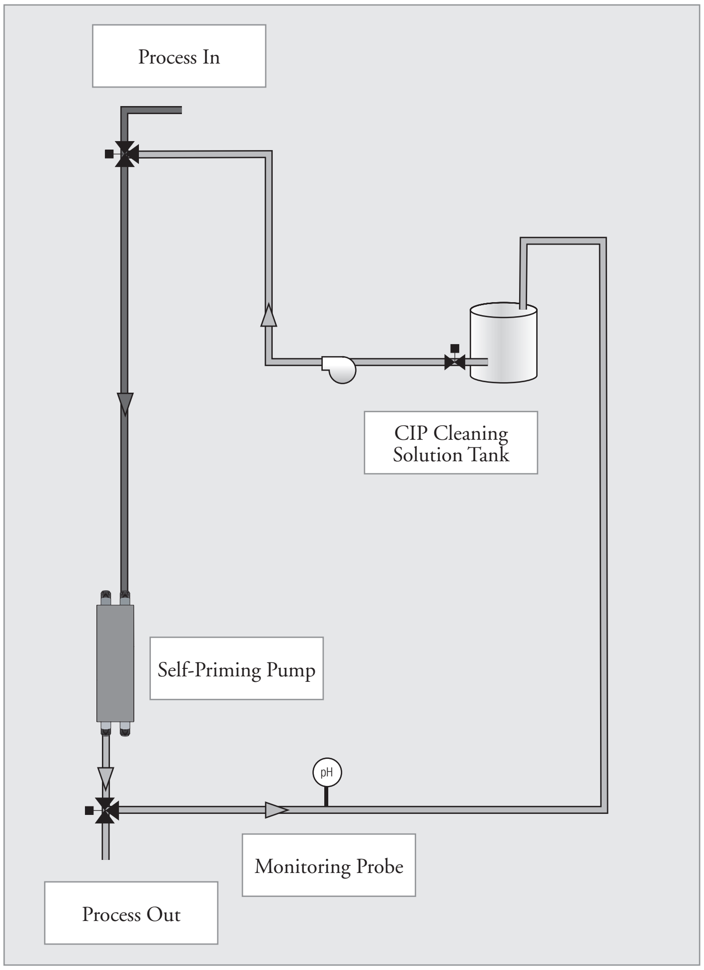


Figure 4.2.
The elements of a CIP system under pH control.

4.3. Preparation For Storage

If the MAXCHANGER is shut down during winter or placed into storage, be certain the unit is completely drained to avoid freezing-induced fracture.

For extended shut-downs, thoroughly flush both channels using fresh water with low chloride content to prevent pitting corrosion of the stainless steel plates.

5. NOMENCLATURE

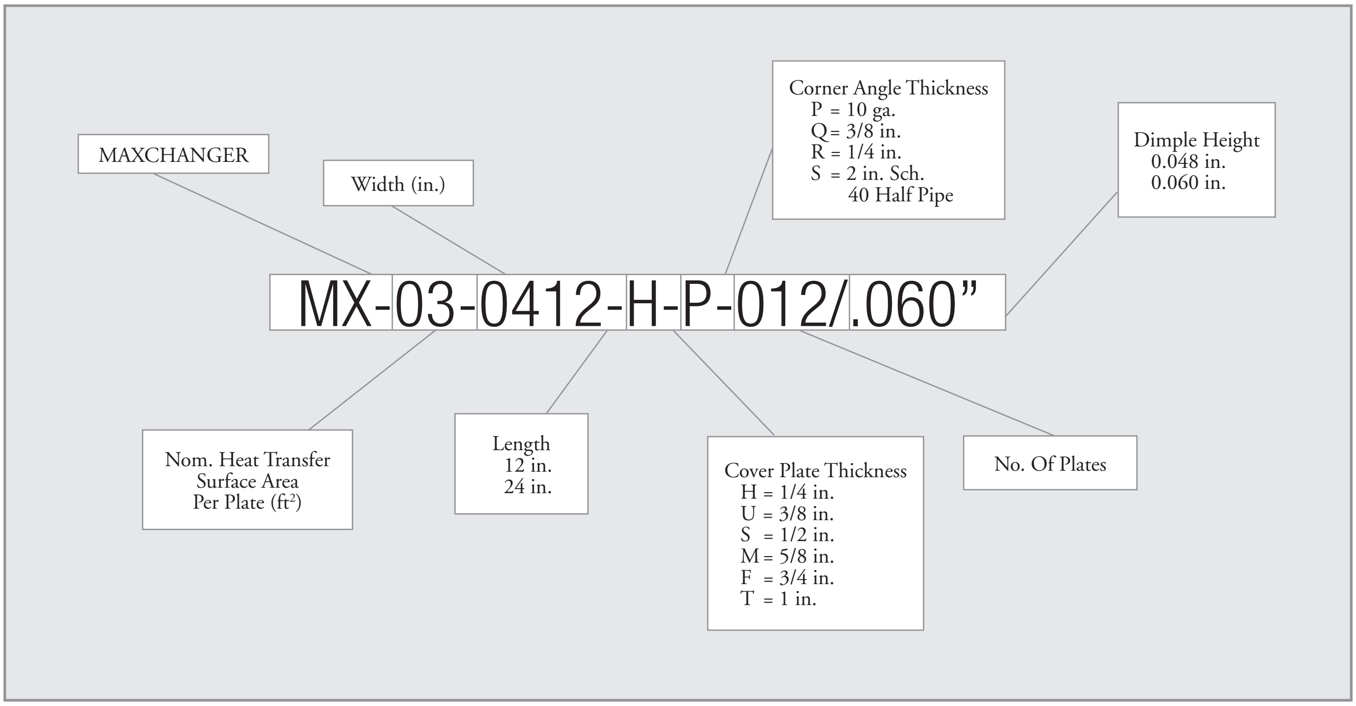


Figure 5.1.
MAXCHANGER model code sequence.

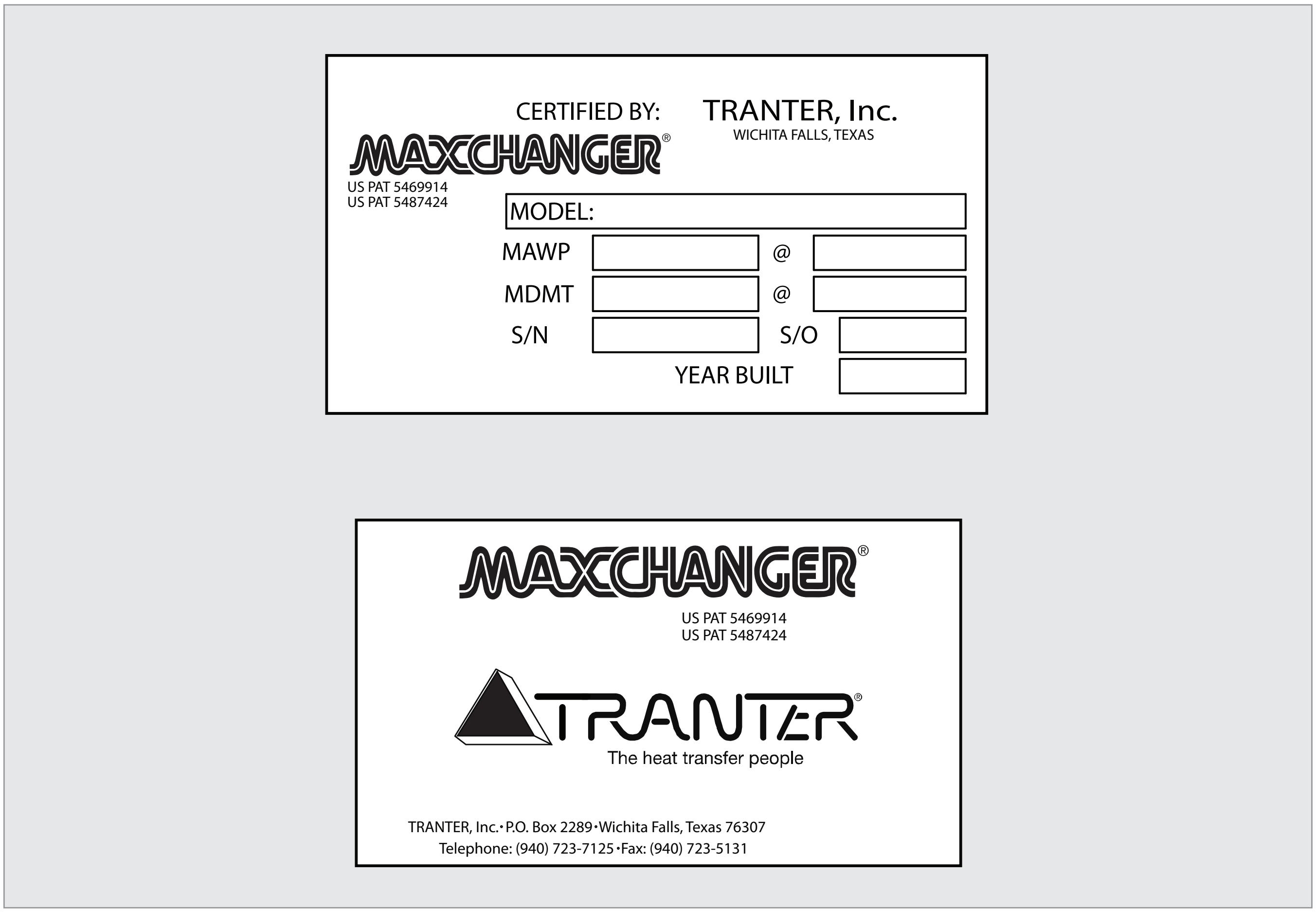


Figure 5.2.
MAXCHANGER identity plate and nameplate.

6. ADDITIONAL INFORMATION

6.1. Damaged Shipments

Our equipment is carefully packaged and shipped in good condition. Shipments are made at the consignee's risk. Upon receipt of shipments, carefully inspect the packaging and equipment for damage. In the event of loss or damage all claims should be made to the carrier.

6.2. Returns

Units are not to be returned without first obtaining permission from your nearest Tranter plant. Units authorized for return must be properly packaged and labeled and in good condition upon arrival at the Tranter plant. All credits for returned units will be subject to restocking and transportation charges.

6.3. Information And Support

This manual is also available on-line at www.tranter.com. Visit our website at www.tranter.com for support options, or e-mail us directly at sales@tranter.com.

6.4. Authorized Service Centers

To obtain additional information on operation and maintenance, contact your local Tranter representative or the nearest Tranter factory-authorized Service Center.

Tranter Service Center (USA)
Factory/Sales/Engineering Office
1900 Old Burk Highway
Wichita Falls, TX 76306
Tel: 1-800-414-6908 • Fax: 940-723-5131
E-mail: aftermarket@tranter.com

Tranter Midwest Service Center (USA)
30241 Frontage Road
Farmersville, IL 62533
Tel: 217-227-3470
E-mail: aftermarket@tranter.com

Tranter Service Center (USA)
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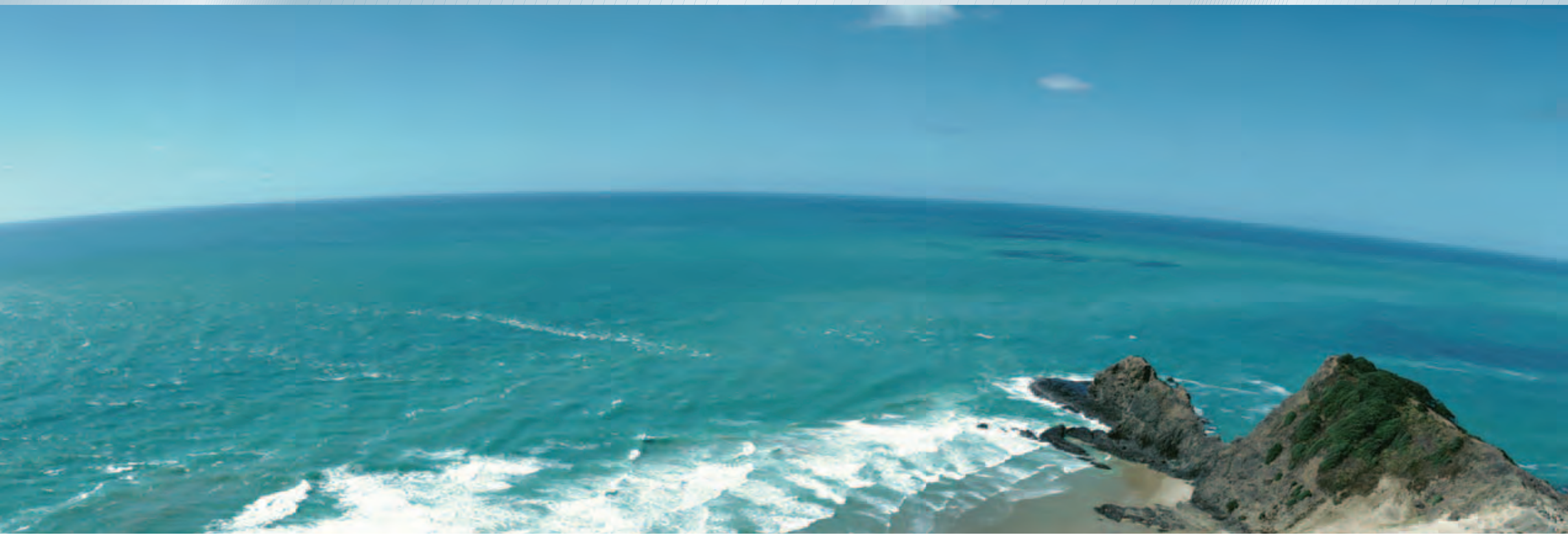

At the forefront of heat exchanger technology for more than 70 years

Tranter top quality, high-performance, proprietary products are on the job in demanding industrial and commercial installations around the world. Backed by our comprehensive experience and worldwide presence, Tranter offers you exceptional system performance, applications assistance and local service. Tranter is close to its customers, with subsidiary companies, agents, distributors and representatives located worldwide. Contact us for a qualified discussion of your needs.

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