MB HEAT EXCHANGER

INSTRUCTION MANUAL

WC7035-MB | WC7150-MB

Important Safety Information

Please read this entire instruction manual for important safety information before using your heat exchanger.

⚠WARNING Failure to follow these warnings could result in serious injury or death.

General Precautions:

- *Nuts not sufficiently torqued can cause the heat exchanger to leak.*
- *Follow all instructions and warnings provided with cleaning agents when cleaning and sanitizing.*
- *Pressurized cleaning chemicals can be an eye hazard. Wear goggles while cleaning.*
- *Do not exceed 3 BAR of pressure in any flow path, this can cause damage to your heat exchanger seals.*
- *Do not exceed 1.5 BAR of pressure between paths, this can cause damage to your heat exchanger seals.*

Heat Hazards:

- *Do not touch the heat exchanger during operation. The surfaces may be hot and can cause severe burn damage to skin.*
- *The exit cooling water can scald. Ensure you have the heat exchanger exit plumbed safely so hot water does not come into contact with the operator or bystanders.*
- *Wear rubber gloves and boots while operating to prevent scalding in the event of a loose connection.*

Pressure Hazards:

- *Double check all connections before starting the process.*
- *Contents of the heat exchanger may be under pressure. Confirm that the pressure has been released before detaching any connections.*
- *Nuts not torqued sufficiently can cause the heat exchanger to leak.*

Plate Heat Exchanger

A. Overview of the Plate Exchanger:

1. The Plate Heat Exchanger allows two kinds of fluids with different temperatures to exchange heat indirectly or cool through the plate. A plate exchanger has a number of advantages: efficient thermal exchange, high efficiency, low heat loss, large exchange area, quick assembly, easy and safe to operate, simple connections, and long service life.

2. Examples of Plate exchangers used in food & drink manufacturing:

- Beer Products: beer, wort
- Wine products: rice wine, wine, etc.
- Dairy products: milk, milk powder, milk beverages, yogurt, etc.
- Vegetable protein beverages: peanut milk, milk tea, soy milk, soy milk drinks, etc.
- Fruit drinks: fresh juice, juice tea, etc.
- Tea drinks: beverages of tea, aloes, fruit & vegetables, etc.
- Seasonings: soy sauce, rice vinegar, tomato juice, sweet and pungent sauces, etc.

3. Application to industrial liquids processing, including:

- Pharmaceutical production
- Dyeing
- HVAC thermal exchange
- Chemical industry
- Power stations, heating for swimming and bathing
- Petroleum
- Metallurgy
- Domestic hot water

- Shipbuilding
- Machinery
- Paper-making
- Textile
- Geothermal utilization
- Environmental protection
- Refrigeration, etc.

4. The Plate exchanger transfers heat three to five times more efficiently than a tube-in-tube exchanger. The efficiency of the heat exchange can reach above 90%. .

TIP: For brewery operations, expect to use one batch size of tap water and one batch size of chilled liquor in 30 minutes to cool one batch when the pumps and heat exchanger are properly sized. (i.e.: A 10 bbl brewery would use 10 bbl of cooling water and 10 bbl of chilled liquor to cool 10 bbl of wort).

B. Structure

1. This Heat Exchanger contains a double bracing frame which consists of the following components:
- **a.** End Panels
- **b.** Plates
- **c.** Exchanger Seals
- **d.** Top & Bottom Guides
- **e.** Clamping Bolts
- **f.** Process Connections For Fluids

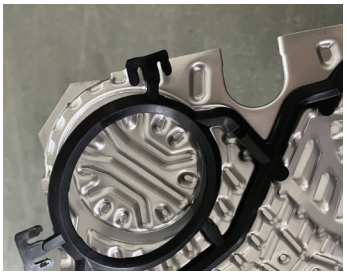
C. Plates

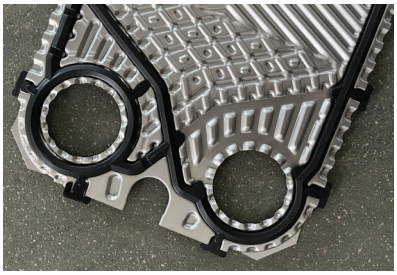
1. The application will determine how many plates a heat exchanger should have. There are gaps between the plates to create flow paths for the fluids to move through. Seals on the plates allow the two different fluids to go in separate directions while allowing the heat exchange to occur.

Plates are cut and pressed from a sheet of stainless steel (SUS304) and have corrugated and chevron shapes, which are used for the following:
- Larger areas of exchange.
- The pressed shapes increase the plates' stiffness, allowing the two fluids to have different pressures.
- The waves speed up the flow, allowing less debris to accumulate.
- The shape allows for turbulent flow at lower velocities, increasing exchange efficiency.

D. Seals

The seals inside the heat exchanger are removable. Seals should be replaced if there are any signs of cracking. If the heat exchanger does not seal before the plate's contact, the seals must be replaced otherwise, the plates may be damaged during the tightening sequence. (Metal on-metal operation is to be avoided.)





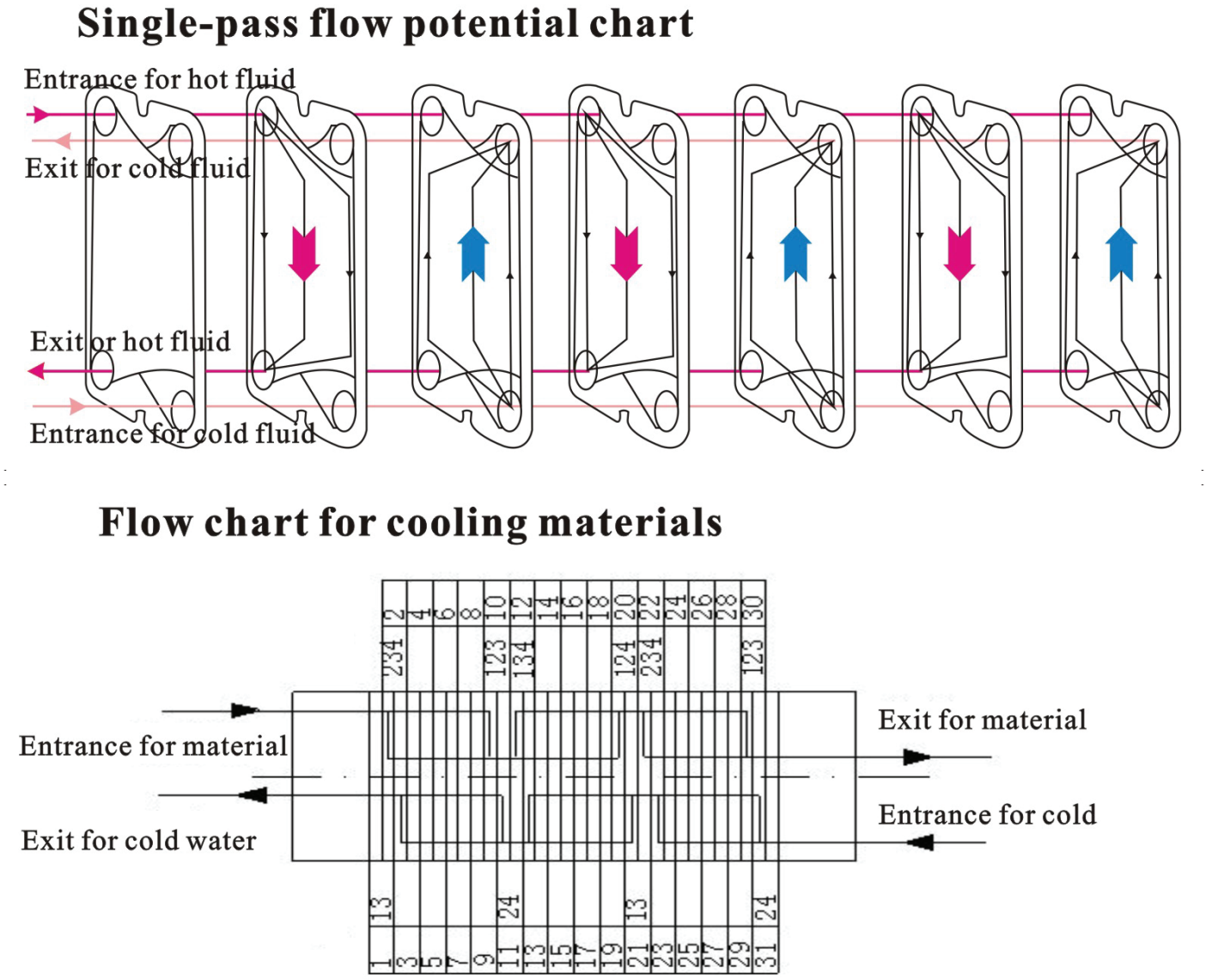
E. Operation

The plate exchanger consists of a series of parallel plates that are placed adjacent to each other to allow the formation of a series of channels for fluids to flow between them. The exchanger is operated with the fluids flowing in opposite directions maximizing the difference in temperature between the fluids and increasing exchange efficiency.

The plates allow hot and cold fluids through alternating channels in the exchanger so that a plate is always in contact on one side with hot fluid and the other with cold fluid. During flow, heat exchange will occur through the plates in proportion to the temperature differential of the two fluids.

See the flow chart on the next page as an example (only one stage is shown):

Flow Chart of Plate Exchanger:



F. Installation

1. There are lifting eyes on the two clamping panels. Lifting ropes should NOT be attached to the connecting pipes, plate guides, or plates.
2. There should be 3 feet of clearance around the exchanger for maintenance.

G. Assembly

⚠WARNING

- *Failure to follow proper assembly will result in poor performance of the heat exchanger.*
- *Nuts not torqued sufficiently can cause the heat exchanger to leak.*

TIP: The connections for using the heat exchanger as a two-stage cooling system are labeled on the unit. The product flow is marked wort in and wort out. The stage one path is marked water in and water out. The stage two path is marked as glycol in and glycol out. Proper connection is required for proper cooling. This is not the only way the heat exchanger can be used. i.e., wort could be circulated from the mash, and hot liquor could be circulated through the water pathway to use the heat exchanger to increase wort temperature.

1. Make the six connections that connect the heat exchanger to product, water, and chilled liquor.
2. An optional vent valve can be used at the exit to bleed air from the heat exchanger. It is important that no trapped air remains in the heat exchanger during operation.
3. It is important to keep the passageways clean. Debris should be kept out of the heat exchanger to avoid blockage.
4. In some applications, you may need to include a filter at the entrance and exit to avoid particles or microfibers in the media.

TIP: If there is no glycol available the stages can be connected in series.

H. Preparation Before Use

⚠WARNING

- *Nuts not sufficiently torqued can cause the heat exchanger to leak.*
- *Sanitizing with hot water is a safety hazard. Ensure hot water does not come into contact with the operator or bystanders.*
- *If sanitizing with chemicals, follow all of the chemical supplier instructions.*

1. Check if the clamp nuts are at sufficient torque to not leak at the intended pressure.
2. Perform a leak test with 1.25x of the intended operating pressure 30 minutes before using.
3. Rinse the exchanger with tap water for 20 minutes.
4. It is important to purge all air from the heat exchanger to maintain efficiency. If needed, add a purging valve to the highest point of the product path.
5. Sanitize with hot water (180–200˚F), and then turn on the product pump to expel all the water in the exchanger until there is no water left. (For beer wort production, the exit of the heat exchanger should be at 180˚F for 30 seconds to be considered sanitized).
6. If the intended use requires the heat exchanger flows to be at different pressures (i.e. for use with steam), turn on the low-pressure valve first and then the high-pressure valve. When done, slowly shut off the high-pressure flow followed by the low-pressure flow when stopping the exchanger. It should be noted that following this procedure will preserve the lifespan of this device by minimizing the stress on the plates.

I. Cleaning After Each Use

1. Rinse thoroughly after each use. Cleaning after each batch is necessary because debris might accumulate on the plates during use. It is unnecessary for the exchanger to be taken apart for cleaning after each use. Since internal debris can be expelled from the device by running water in the opposite direction (back-flow) of the media with a hydraulic pressure lower than the operating pressure. In addition, cleaners that are non-corrosive to the stainless steel can be used. (Non-chlorinated caustic followed by an acid rinse is common practice).

J. Maintenance

1. Disassembly of the heat exchanger will be required to clean all debris from the heat exchanger completely. This maintenance interval needs to be specified based on the facility's processes and should be performed at least every 100 batches in a brewery.
2. After disassembly, clean the surfaces of the plates with a nylon brush. It is very important to maintain the exact order and orientation of the plates during disassembly and cleaning to maintain the proper function of the heat exchanger. Do not scratch the plates during cleaning.
3. During assembly, the plates are pressed between the panels by torquing the bolts. It is essential to torque evenly in a cross pattern to ensure the seals remain parallel and do not leak. Measure the distance between the panels in all four corners and make sure they remain equal.

TIP: It is normal for this measurement to be slightly smaller each time the exchanger is reassembled until finally the plates are metal on metal, and the seals require replacement.

4. Regular inspection of the assembly torque is required to prevent leaks.
5. To replace the seals:
    1. Remove the old seal and any glue that is left on the plate. Ensure the plate is clean and dry.
    2. Apply 3M 1099 glue (can be purchased online or a hardware store) to the back of the new seal and press it into the groove. Wait 72 hours for the glue to dry and then reassemble the device.

Troubleshooting

Before troubleshooting, it is important to know the basic operating parameters of your process. There are six temperatures and three flow rates that are indicative of how the process is running:

- Product inlet temperature
- Product outlet temperature
- Product flow rate
- Cooling water inlet temperature
- Cooling water outlet temperature
- Cooling flow rate
- Chilled liquor inlet temperature
- Chilled outlet temperature
- Chilled liquor flow rate

A change in any of these parameters can indicate a problem in your process. While measuring all of these parameters is not necessary for normal operation, it is crucial for troubleshooting.

TIP: A typical ale cooling run will look something like this:

- Product inlet temperature: 180–212˚F
- Product outlet temperature: 68–72˚F
- Product flow rate: (depends on exchanger size, once measured it should remain consistent batch to batch)
- Cooling water inlet temperature 60–78˚F
- Cooling water outlet temperature 160F–180˚F
- Cooling flow rate: equal to product flow rate
- Chilled liquor inlet temperature 28–32˚F
- Chilled outlet temperature: equal to product outlet temperature or slightly warmer
- Chilled liquor flow rate: as needed to set chilled liquor outlet temperature

Problem:	Cause:
Product outlet temperature is too high	• Product flow rate is too high • Cooling water inlet temperature is too high • Cooling water inlet flow rate is too low • Chilled liquor inlet temperature is too high • Chilled liquor inlet flow rate is too low • Heat Exchanger is contaminated with debris
Cooling water outlet is too low and the product outlet temperature is too high	Cooling water flow rate is too high
Chilled liquor outlet is too low and the product outlet temperature is too high.	Chilled liquor flow rate is too high
Chilled liquor temperature increases during the run	• Insufficient volume of chilled liquor in the process. The process will require the same volume of chilled liquor as product. • The returned chilled liquor is mixing with the tank. Return the chilled liquor with a tangential port in a laminar flow to the top of the chilled liquor tank.

Operator Notes

Operation notes can document changes in the heat exchanger performance. Any performance loss can indicate a blockage in part of the heat exchanger.

Items	Unit	Hot Side	Stage One	Stage Two	Notes
Media					
Temperature at the entrance	F				
Temperature at the exit	F				
Flow	gph				
Operating Pressure	PSI				
Pressure drop permitted	PSI				
Stage one Temperature	F				
Stage one flow rate	gpm				
Stage two temperature	F				
Stage two flow rate	gpm				