



# MFH

## WATER-COOLED MAGLEV® 8-PIPE HEAT PUMP SEQUENCE



MULTISTACK.COM

### Key Features

- Operating algorithm automatically matches building heating and cooling load requirements by closing and/or opening the appropriate 8-PIPE valves-maximizing efficiency, all in coordination with the Building Automation System.
- Eliminates reversing valves designs, increasing simultaneous heating and cooling efficiency by up to 30%.

### BAS Points:

- **Chiller Enable:** Command from BAS to enable the chiller.
- **Cooling/Heating Enable:** Commands from BAS to position valves for cooling or heating.

### Mode Control

- **Modes:** Cooling-only, Heating-only, and DHRC (Simultaneous).
- **Mode Calculation:** Based on Chilled Water and Hot Water temperature monitoring, the MS-8 determines the system's needs and aligns itself with those needs by entering the proper mode. The mode calculation is a comparison of (return temperatures and delta T's) cooling, heating, and chiller enable statuses.

### Valve Control

- 4 of the 8 system connection points are open at any time.
  - Cooling Only ▪ CHWR, CHWS, Sink Return, Sink Supply
  - Heating Only ▪ HWR, HWS, Source Return, Source Supply
  - Simultaneous ▪ CHWR, CHWS, HWR, HWS
- We create a path through the 2 pass heat exchangers by opening a bypass valve on the opposite end from the corresponding open CHW, HW, or Source / Sink Valves
- The Chilled Water Circuit will NEVER be connected to the Source Circuit. Thus there will always be at least 1 set of valves close on the Evaporator Side
- The Hot Water circuit will NEVER be connected to the Sink Circuit. Thus there will always be at least 1 set of valves close on the Condenser Side
- Below are safety rules that all isolation valves should follow when the chiller is enabled.
  - Evaporator Chilled Water isolation valve states are always inverse to Source side isolation valves when the chiller is running or enabled
  - Condenser Hot Water isolation valve states are always inverse to Sink side isolation valves when the chiller is running or enabled.

- Bypass valves are used in conjunction with the isolation valves to maintain building flow (avoid "dead heading")
- **Safety Interlocks:** Ensures the valve transitions (from a "Commanded" state to "Closed" and "Stable" state prior to operation of the compressors).
  - When the MS-8 transitions from one mode to another - we stop compressors and close valves to avoid a hydronic path that connects CHW to Source or HW to Sink. This avoids pumps from different systems having conflict as well as avoids pressure migration.
  - We then open the new desired mode valves, prove valve position, prove flow and then start compressors.
  - The mode calculation avoids a "short cycling" of transitions between modes.)

### Start-up and Mode Change

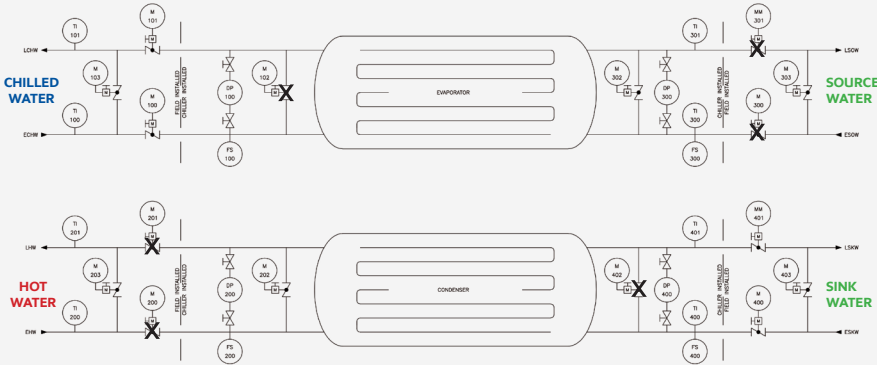
- **Start-up Safeties:** Checks for various conditions before starting the chiller.
- **Mode Change Sequence:** Steps to ensure safe transition between modes.

### Water Temperature Checks

- Continuous monitoring of leaving water temperatures depending on its different mode



### 1 Chiller running in Cooling-Only Mode



#### VALVE POSITION AT **COOLING-ONLY MODE:**

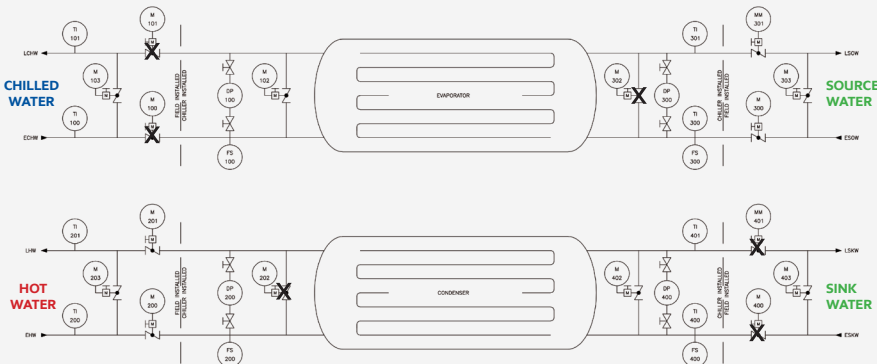
##### System Isolation Valves:

- Evaporator Chilled Water Isolation Valve (M100 & M101): **OPEN**, Source Isolation Valve (M300 & M301): **CLOSE**
- Condenser Hot Water Isolation Valve (M200 & M201): **CLOSE**, Sink Isolation Valve (M400 & M401): **OPEN**

##### Shell-pass Valves:

- Evaporator Chilled Water Shell-pass Valve (M102): **CLOSE**, Source Shell-pass Valve (M302): **OPEN**
- Condenser Hot Water Shell-pass Valve (M202): **OPEN**, Sink Shell-pass Valve (M402): **CLOSE**

### 2 Chiller running in Heating-Only Mode



#### VALVE POSITION AT **HEATING-ONLY MODE:**

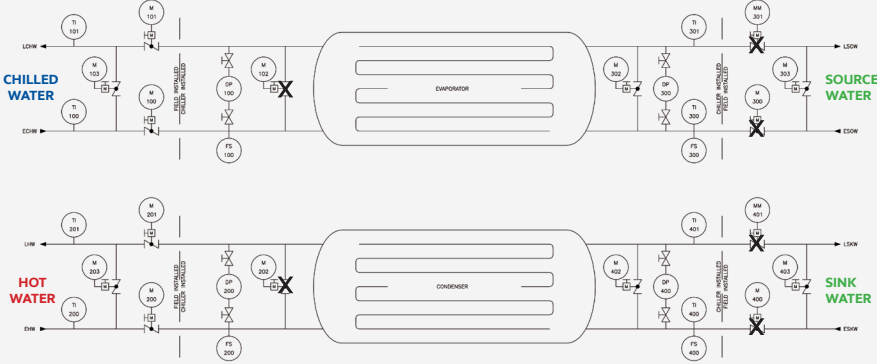
##### System Isolation Valves:

- Evaporator Chilled Water Isolation Valve (M100 & M101): **CLOSE**, Source Isolation Valve (M300 & M301): **OPEN**
- Condenser Hot Water Isolation Valve (M200 & M201): **OPEN**, Sink Isolation Valve (M400 & M401): **CLOSE**

##### Shell-pass Valves:

- Evaporator Chilled Water Shell-pass Valve (M102): **OPEN**, Source Shell-pass Valve (M302): **CLOSE**
- Condenser Hot Water Shell-pass Valve (M202): **OPEN**, Sink Shell-pass Valve (M402): **CLOSE**

### 3 Chiller running in Simultaneous Mode



#### VALVE POSITION AT **SIMULTANEOUS MODE:**

##### System Isolation Valves:

- Evaporator Chilled Water Isolation Valve (M100 & M101): **OPEN**, Source Isolation Valve (M300 & M301): **CLOSE**
- Condenser Hot Water Isolation Valve (M200 & M201): **OPEN**, Sink Isolation Valve (M400 & M401): **CLOSE**

##### Shell-pass Valves:

- Evaporator Shell-pass Valve (M102): **CLOSE**, Source Shell-pass Valve (M302): **OPEN**
- Condenser Hot Water Shell-pass Valve (M202): **CLOSE**, Sink Shell-pass Valve (M402): **OPEN**

# The Multistack Group

## Customer Driven Innovation<sup>SM</sup>

### The right choice for the future... today.

#### OUR MISSION

To design and build reliable, energy-efficient equipment that fully supports the transition from fossil fuels to renewables through electrification.

#### OUR VISION

To create a world where environmentally sensitive design practice, reliability, and redundancy coexist and are embodied in the worlds most advanced HVAC equipment.

#### SUSTAINABLE CHOICES

At **Multistack**, we recognize and respect the importance of providing HVAC solutions that promote energy and water efficiency, utilize the best refrigerant choices available, and embrace the transition from fossil fuels to electrification.

Water and air-cooled **MagLev**<sup>®</sup> chiller platforms achieve superb efficiency across their full range of operation. Our unique **MagLev** chiller design and unrivaled Transitional Efficiency chiller control algorithms deliver outstanding part-load performance at all condenser-water or ambient temperature conditions.

**MagLev** chillers offer refrigerant choices recognized worldwide as safer for the environment: R-1234ze, R-513A, and R-515B. **Multistack** scroll chillers offer R-454B as the replacement for the high GWP R-410A. R-454B has a GWP of 466, which is 78 percent lower than R-410A. We encourage you to explore our natural refrigerant offering as well.

Our modular product's design allows you the freedom to use just enough energy to meet your current needs, while offering you the flexibility of incorporating additional modules as your operations grow. Minimizing embodied energy is an important design focus and we pride ourselves that our modular chillers deliver the industry's highest cooling and heating output per pound. If you're looking to cool and heat your building with as little environmental impact as possible, look no further than **Multistack**!

Reach out to your local **Multistack** design professional to discuss how we can help you realize your design goals for:

- Decarbonization
- Electrification
- Energy efficiency
- Water usage efficiency
- Energy & heat recovery
- Choosing sustainable refrigerants
- Minimizing refrigerant charge
- Minimizing embodied energy
- Minimizing environmental and physical footprint