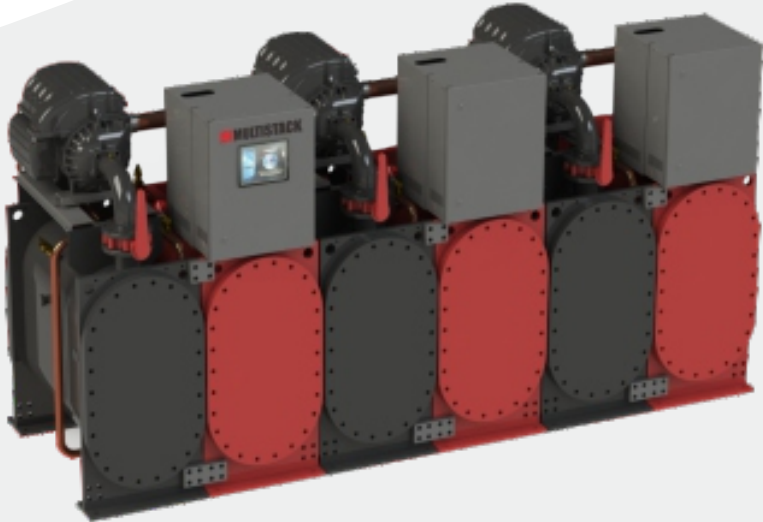


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MTW-MF SERIES

Modular Flooded Oil-free Chillers



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Jiefeng



YuYao
Jiefeng

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We are the creator and leader of modular chillers,
the pioneer of magnetic levitating technology in refrigeration industry.

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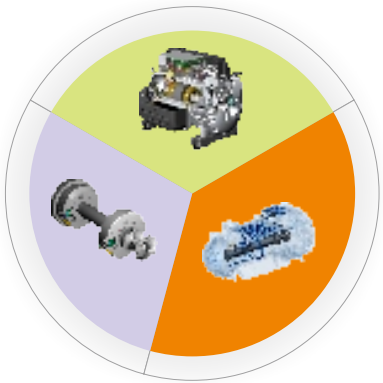
INVENTION OF OIL-FREE CENTRIFUGAL COMPRESSOR

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Research of oil-free centrifugal refrigerant compressor first started in 1993 at the headquarters of MULTISTACK in Melbourne, Australia. It was Dr. Ron Conry, the inventor of MULTISTACK modular chiller, who got the inspiration of oil-free compressor during the process of modular invention and led the technical research of oil-free centrifugal compressor.

After Dr. Ron Conry completed the invention of modular chiller, he devoted to its efficiency improvement. In comparison to conventional chillers, modular chillers have many significant advantages of achieving better part load efficiency and reducing power consumption annually. Some customers, however, were not yet aware of improving part load efficiency in 1990s. Instead, they were more concerned about full load (100%) efficiency rather than energy saving when selecting chillers.

Dr. Ron Conry then came up with the idea of inventing a smaller compressor with higher efficiency. With this revolutionary compressor technology, the chiller was designed to have higher efficiencies at part load conditions and equivalent or even better efficiency at full load than a conventional chiller. This is the original concept of oil-free compressor.



R&D History of TURBOCOR Oil-free Centrifugal Refrigerant Compressor

1992 Research of oil-free centrifugal refrigerant compressor started and led by Dr. Ron Conry of MULTISTACK Australia

1993 TURBOCOR R&D Department established in MULTISTACK, focusing on the application of magnetic bearings in compressors

2003 Succeeded in the research of oil-free centrifugal compressor, widely applied this invention in refrigeration and air-conditioning equipments and was awarded Energy Innovation Award at ASHRAE, AHR Expo in Chicago.



INTRODUCTION

FEATURES of MULTISTACK modular flooded magnetic levitation centrifugal chillers:

Cutting-edge Compressor Technology

Oil-free magnetic levitation centrifugal compressor is the perfect combination of top aerospace technology and advanced digital control technology. It is a 2-stage centrifugal compressor featuring light weight, oil free, ultra-low noise and vibration, excellent IPLV, integrated variable frequency drive (VFD), soft start and green refrigerant R134a, etc.

Ultra-low Noise and Vibration

The oil-free centrifugal compressor uses patented magnetic bearing system. Main shaft of the compressor revolves at high speed without any mechanical contact with the bearing, achieving extremely low noise and vibration.

100% Oil-free Design

The rotor and impellers of the compressor remain levitating in the magnetic field. The proximity sensors on the bearing constantly send feedback to the magnetic bearing system, reposition the rotor and ensure that the rotor is levitating in the center, staying in the best working condition. The system is simple without lubrication oil, which promises quiet and reliable operation, reduces faults and maintenance costs by eliminating complicated oil system and improves efficiency.

Advanced Modular Flooded Heat Exchanger

The evaporator of MTW142MF is constructed in small-footprint modular flooded shell and tube type with finned both Internal and external seamless copper tubes have submerged by boiling refrigerant to access great heat transfer coefficient.

High Reliability

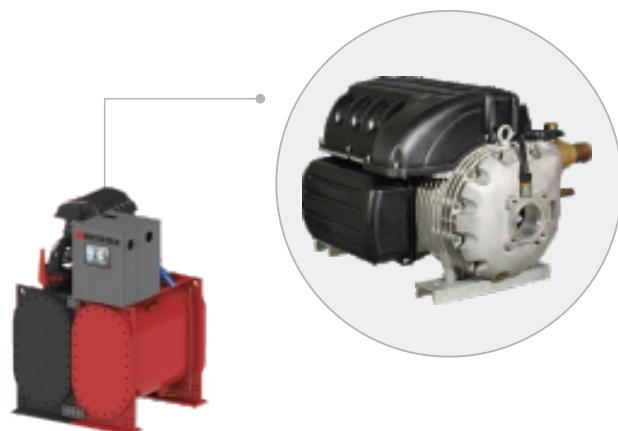
Redundancy design allows every module to work as an independent refrigeration circuit, with adjacent modules operating independently. In the event of a malfunction in the system, the computer selects the next available standby module to provide backup. One failed module will not disrupt the other modules or system.

Simple Installation & Add-on Flexibility

Chillers could be field-assembled without the aid of a large lifting machine and dedicated doorways. It is easy to move a large chiller to rooftop or basement. When necessary, and pipe size has a certain abundance, just add on new modules to increase unit capacity without any change to the system. Similarly, you can also purchase and install the chiller by stages to improve the capital usage.

Advanced Intelligent Control System

MULTISTACK's original modular control system is based on micro-process control technology, combining modules to form a complete and integrated unit. Each module runs smoothly with best efficiency based on system load. The control system features compressor wear leveling control, prolonged service life and automatic capacity control.



DESIGN FEATURES

STRUCTURE

MULTISTACK oil-free centrifugal chillers are designed and constructed under the modular technology patent. A chiller is a bank of individual modules connected in parallel to operate as a complete machine. Cooling capacity is matched to load by varying the number of operating modules. The chiller can be a bank of the same series of modules or a bank of two different series of modules combined. It provides the users with more choices for various capacity and higher flexibility.

Each module operates as a complete independent refrigeration circuit, consisting of an oil-free centrifugal compressor, evaporator, condenser, and other controls and safeties. When total load varies, the controller can change the chiller's capacity accordingly by either adding/subtracting the number of on-line compressors based on wear leveling control or by adjusting the capacity of the last started compressor.

The chiller is enclosed within an attractive and sturdy frame with removable doors for easy access and convenience for maintenance and service. The doors can be lined with acoustic insulation (optional), which further silences the chiller.

ADD-ON FLEXIBILITY

As your needs for cooling increases, MULTISTACK has the solution. Being a modular chiller, it has never been easier to expand the system as larger cooling capacity is needed to meet increased building loads, with no complicated changes to the room, piping system or control system, and all work can be done quite easily.

COMPACT AND SPACE-SAVING

The compact size of each module means easy access via standard doorways and elevators. Users no longer need special access to install the chillers.

In comparison to conventional water cooled chillers users can gain up to 40% more space, meaning larger capacity. Chillers can be easily installed in confined and small places.

SAFE AND RELIABLE

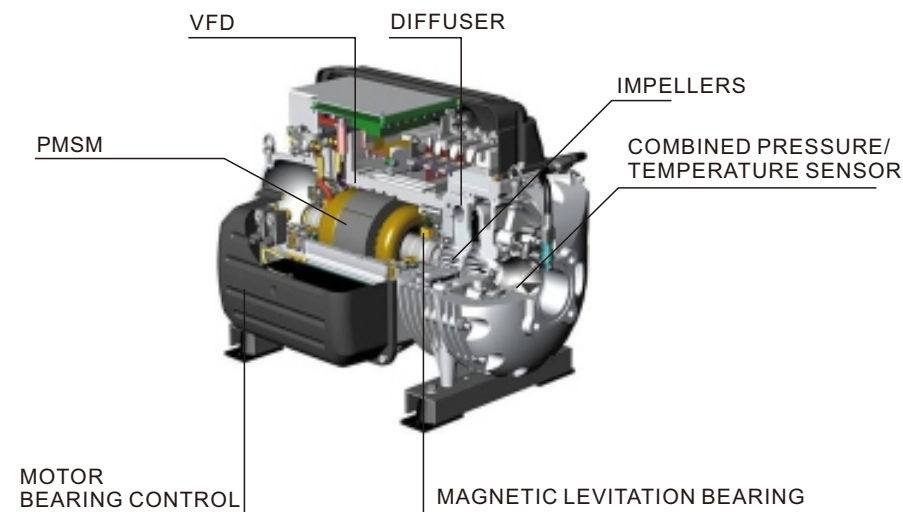
Every module works as an independent refrigeration circuit, with adjacent modules operating independently. In the event of a malfunction in the system, the computer selects the next available standby module to provide back up. One failed module will not disrupt the other modules or system, giving you total piece of mind.

EXCELLENT PART LOAD EFFICIENCY

MTW-MF-chiller features compressors feature optimized part load efficiency. The special design and structure allow the compressors to run at part load condition as long as possible to achieve the best COP (W/W).

When the cooling load decreases, MULTISTACK's unique MS ONE controller will shut down a certain number of compressors if necessary, leaving the rest to run at part load to meet the required capacity at high efficiency.

OIL-FREE MAGNETIC LEVITATION CENTRIFUGAL COMPRESSOR



MTW series chillers use oil free magnetic levitation centrifugal compressors which represent the current leading compressor technology of the 21st Century. The compressors in the oil-free chillers completely eliminate lubrication oil. Conventional mechanical bearings are replaced by highly-sophisticated magnetic bearings using top aerospace technology. The permanent magnet synchronous motor (PMSM), drive shaft and centrifugal impellers all levitate in the magnetic field without any immediate contacts. Mechanical frictions, efficiency loss, vibration and noise are eliminated. The compressor is free from oil pump, oil supply system and at the same time avoids efficiency loss caused by refrigerant-entrained oil in the heat exchanger.



OIL-FREE MAGNETIC LEVITATION CENTRIFUGAL COMPRESSOR

The oil-free centrifugal compressor is a totally digital part with an onboard digital control system monitoring all variables that may affect the safe operation of compressors. The control system consists of several multi-functional modules, including AC-DC inverter module, magnetic bearing control module, soft-start module, inlet guide valve control module and communication module. All these modules are integrated in the compressor and make the compressor an electronic rather than a mechanical part. AC-DC inverter module converts AC voltage to adjustable DC voltage. The compressor speed is smoothly confined within 15,000-38,000 RPM based on load, suction/discharge pressure, running current and other conditions. The soft-start module of the compressor pulls only 2 amps.

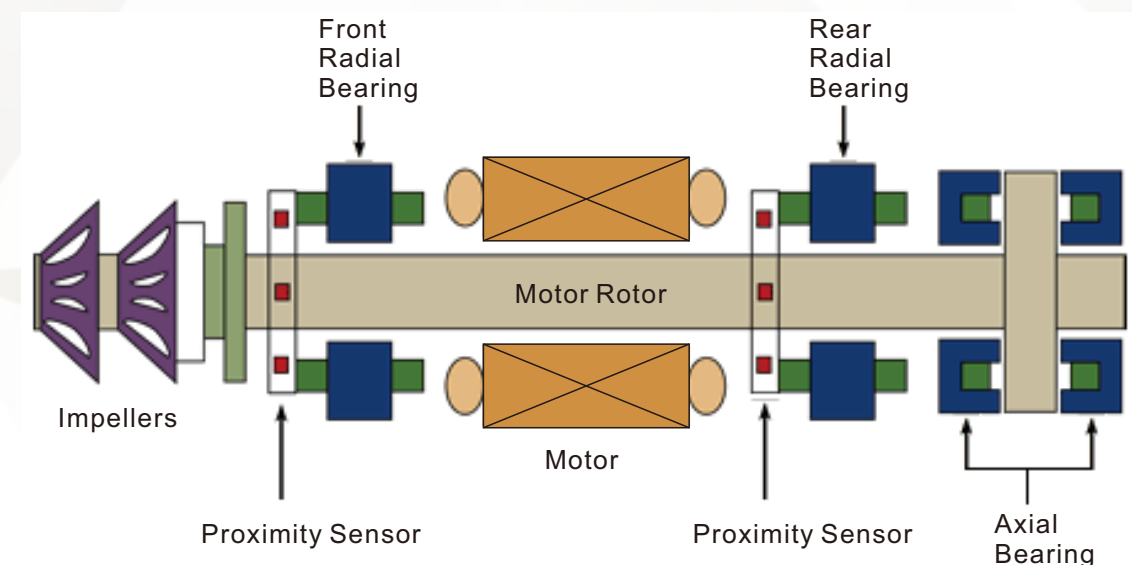
The compressor control system detects capacity required and compression ratio synchronously to match up with the revolving speed. Inlet guide valve control module continuously regulates the inlet guide vane open percentage and suction dynamic pressure in order to maximize operation at compressor sweet spots and avoid surge. In this way, the compressor can remain smooth operation without surge even at 30% part load condition or at low cooling water temperature. The compressor can even run at part load condition closed to 0% if the chiller has load balancing valve.

Proximity sensors in the magnetic bearing control module sense and reposition the impellor shaft 6 million times a minute to ensure the bearing is within a 0.007mm range.

In the event of a shutdown or power outage, the controller will detect power loss and switch the compressor motor to generator mode. In this mode, the bearing and control system are powered by both the power accumulator and the motor power generated by the inertial kinetic energy of the impellers and shaft. The revolving assembly remains levitating until it is brought to a safe stop without any friction. This is an unprecedented reliability feature of the compressor.

The compressor runs very quietly since it seldom generates mechanical friction or mechanical vibration. Sound level of the compressor measured at 5 meters horizontally around the chiller is as low as 65dB(A).

Advanced communication capability of the compressor enables it to connect to the Ethernet and makes it convenient for the users to access to the compressor running data via the browser.



CONTROL SYSTEM

System Overview

MS One Control System consists of a 10.1-inch (optional 15-inch) touch screen and a dedicated HVAC programmable logic control panel. It is designed to provide operator, technical personnel and servicemen with real-time running information such as pressure, temperature, system status, faults, load history, run log and historic data, etc.

MS One Control System has options for duty/standby modules, duty/standby units and others to maximize reliable, stable and safe operation of the HVAC system.

MS One Control System is supported with cloud platform control to enable information exchange via the internet, remote control of the chillers and monitoring running data via VNC and EasyAccess 2.0.

MS One Control System is fitted with Ethernet, RS485, RS232 and USB ports. Enable MS ONE Controller connecting to Building Automation System (BAS) or Distributed Control System (DCS) and various protocols.

Main Screen

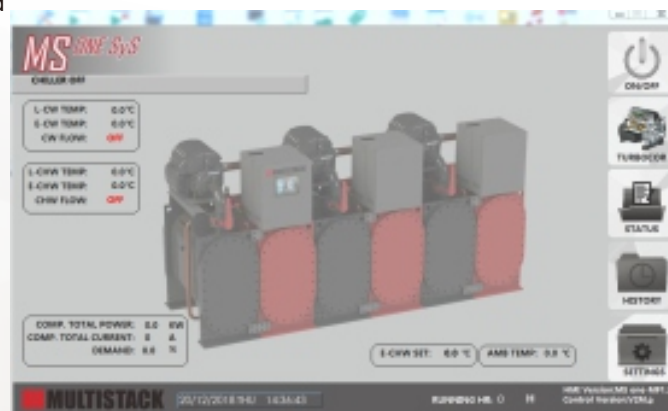
The control system consists of programs, touch screen and system input/output. Features of MS ONE controller mainly includes:

- Chilled Water Temperature Monitor
- Cooling Water Flow Monitor (water-cooled only)
- Compressor Status Index
- Chiller Running Status Index
- Operation History Record Index
- Advanced Setting Index
- COMP. Power Input and Current
- Percentage of Load Demand

Compressor Screen

This is where a detail status for one of the compressors can be found. Features of this page mainly includes:

- Compressor Real-time Status
- Chiller System Status (Refrigerant Side)
- Motor Status (Power, Voltage, Speed, etc.)
- Compressor's Temperature Monitor



VARIABLE WATER FLOW (VWF)

The applications below are for MTW-MV series only. For model selection, please consult your local MULTISTACK.

MTW-MV

The oil-free centrifugal chillers are designed for variable water flow, which not only change cooling capacity but also adjust chilled/cooling water working flow for maximum energy efficiency so that power consumption is greatly reduced. Besides, a simple primary flow system is adopted for both chilled and cooling water circulation instead of using secondary pump water system.

Generally at least two modules (maximum fifteen) are involved in the chiller under the VWF mode.

Flow Regulation Valve

Flow regulation valves are installed between chilled/cooling water headers and evaporator/condenser to regulate water circulation of each module synchronously. The flow regulation valves are open when compressors are working and closed when compressors are off-work. The linear on-off design avoids water hammer as well as rapid change of system pressure. A differential pressure switch is used to prevent the compressors from operating when the flow regulation valves are closed.

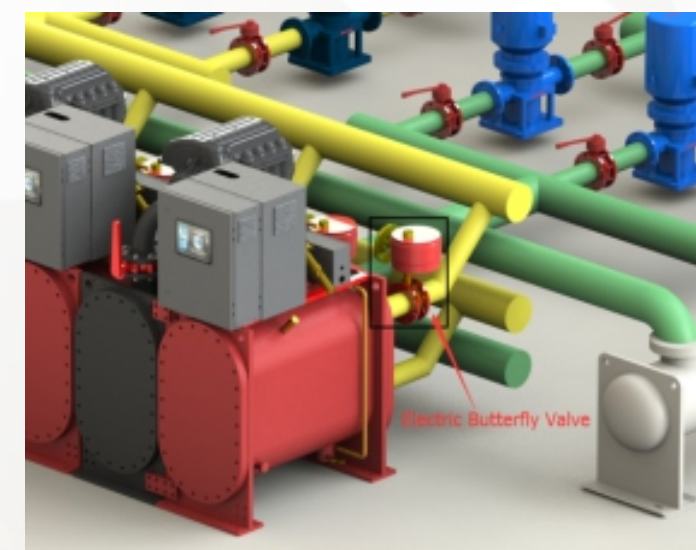
Water Differential Pressure Transducer

Three differential pressure transducers are provided by MULTISTACK to detect the chiller leaving/entering pressure difference of chilled and cooling water as well as pressure difference of chilled water on load side. Differential pressure transducers for the leaving/entering chilled water on load side could be installed at any proper location, including water loop with the greatest flow resistance.

These three transducers are used to monitor water flow changes so that the computer controller can regulate water pump output frequency on demand.

Variable Frequency Pump Control System

MS ONE controller not only dominates chiller operation but also regulates the flow change of chilled/cooling water through differential pressure transducers. By way of PID control, frequency signals are transmitted to the VFDs of chilled/cooling water pumps so that the working flows are in accordance with system load demand and energy is saved ultimately.



MODEL NUMBER DESIGNATION

MTW 150 M F V E A -4
1 2 3 4 5 6 7 8

MODEL NUMBER DESIGNATION:

- 1—Multistack Turbocor Water Cooled
- 2—Model Number (90,120,150,200RT)
- 3—M: Modular Type Chiller
- 4—F: Flooded Shell and Tube Evaporator
- 5—Water Flow Type
Default for constant water flow
V: Variable Water Flow (VWF)
- 6—Refrigerant
E: R134a
- 7—Electrical Specification
A: AC 380~415V / 50Hz / 3Ph
B: AC 380~415V / 60Hz / 3Ph
C: AC440-480V/60Hz/3Ph
- 8—Amount of Unit Modules per Chiller Bank
MTW150MF-1 ~ MTW150MF-14
- 1 ~ 14 modules

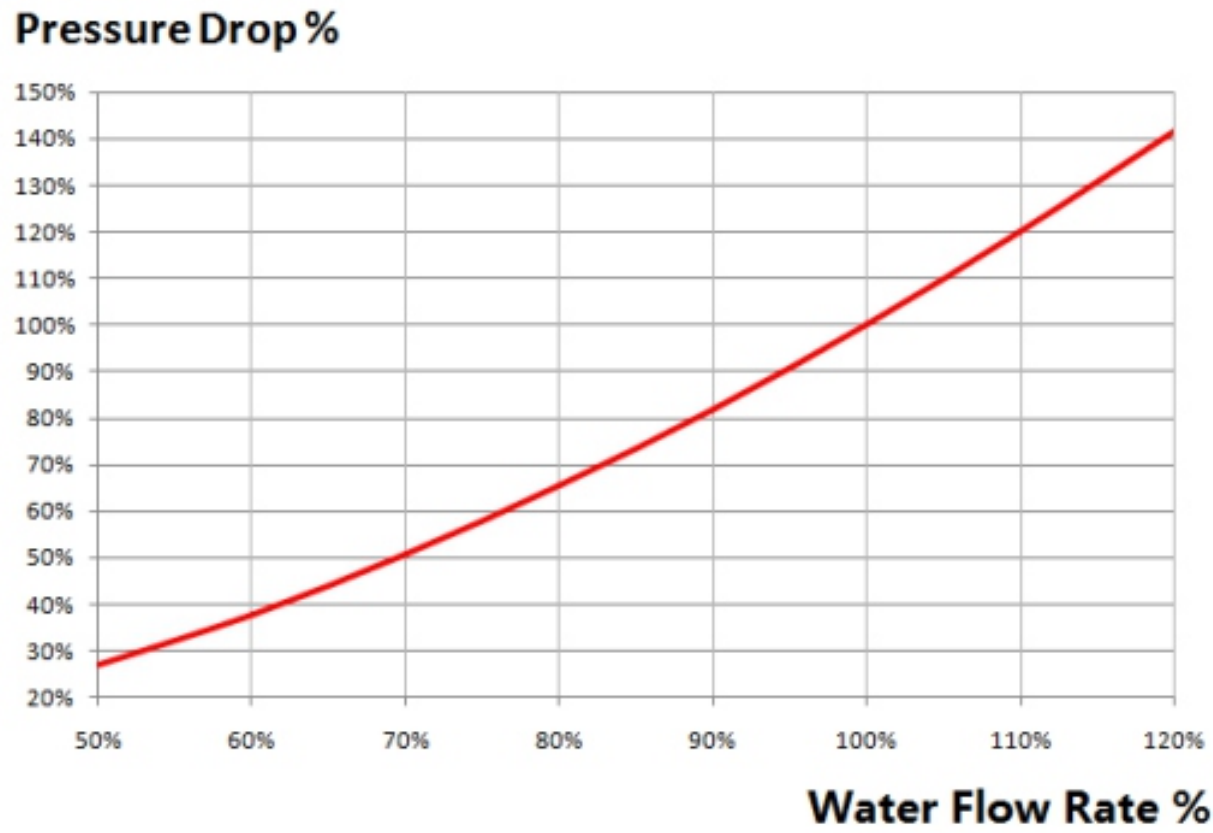
TECHNICAL DATA (PER MODULE)

Model			MTW090MF	MTW120MF	MTW150MF	MTW200MF
Nominal Cooling Capacity		kW	316.5	422.0	527.6	703.4
Nominal Power Input		kW	57.8	73.3	93.6	116.4
COP		kW/kW	5.47	5.76	5.64	6.04
Compressor	Type	-	Oil-free Magnetic Levitation Centrifugal Compressor			
	Starting Mode	-	Soft Start			
	Quantity	-	1 per module			
	Power Supply	-	380V / 50Hz / 3Ph			
	F.L.A	A	145	210	170	206
	R.L.A	A	97.1	127.6	155.8	193.4
	L.R.A	A	160	231	187	227
Refrigerant Type		-	R134a			
Refrigerant Charge		kg	90	120	120	200
Refrigerant Throttling Device		-	Electronic Expansion Valve			
Control System		-	MS ONE			
Evaporator	Type	-	Modular Flooded Shell and Tube			
	Water Side Working Pressure	kPa	1,000			
	Rated Flow	L/s	54.4	72.6	90.7	121.0
	Rated Pressure Drop	kPa	74.8	58.6	84.6	56.9
	Min. Flow	L/s	40.8	54.4	68.0	90.7
	Fouling Factor	m ² k/kW	0.018			
	Connection Size	-	DN100	DN125	DN125	DN150
Condenser	Type	-	Modular Flooded Shell and Tube			
	Water Side Working Pressure	kPa	1,000			
	Rated Flow	L/s	64.4	85.2	106.8	141.0
	Rated Pressure Drop	kPa	66.9	53.7	81.3	47.4
	Min. Flow	L/s	48.3	63.9	80.1	105.7
	Fouling Factor	m ² k/kW	0.044			
	Connection Size	-	DN100	DN125	DN125	DN150
Dimensions	Length	mm	1400	1430	1430	1800
	Width	mm	1200	1200	1200	1200
	Height	mm	1640	1735	1735	1735
Weight	Shipping Weight	kg	2400	3200	3200	4200
	Operating Weight	kg	2500	3430	3430	4500

- Notes:
- 1.F.L.A: Full Load Amperage; R.L.A: Rated Load Amperage; L.R.A: Locked Rotor Amperage
- 2.MTW142MF is rated and constructed in compliance with AHRI Standard 551/591 (SI) *Performance Rating of Water-chilling and Heat Pump Water-heating Packages Using the Vapor Compression Cycle*;
- 3.Nominal working condition: entering/leaving chilled water temperature 12°C/7°C; entering/leaving condenser water temperature 30°C/35°C;
- 4.Customized products are available on request;
- 5.Technical data in this manual may change and shall be subject to the included manual of the chiller;

WATER PRESSURE DROP CORRECTION

Water Pressure Drop Correction Factor for Heat Exchanger Water Circuit
(per module)



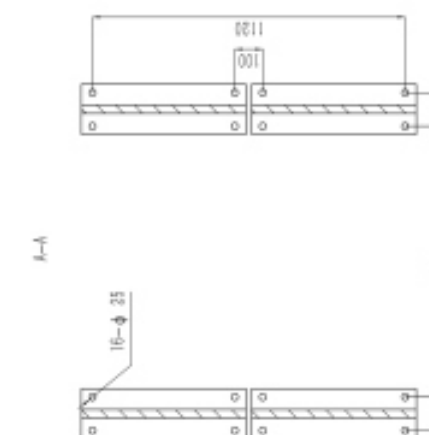
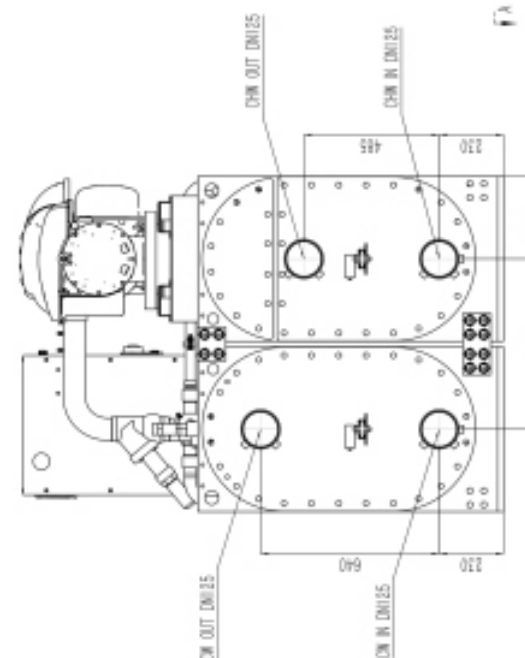
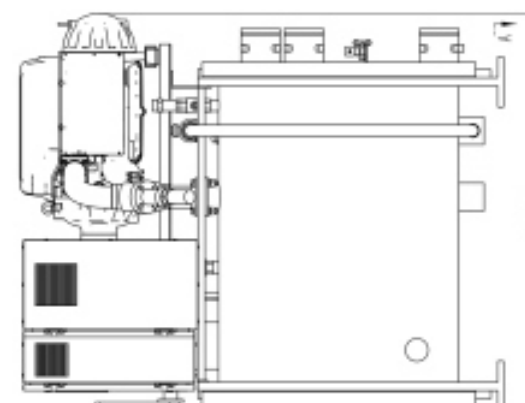
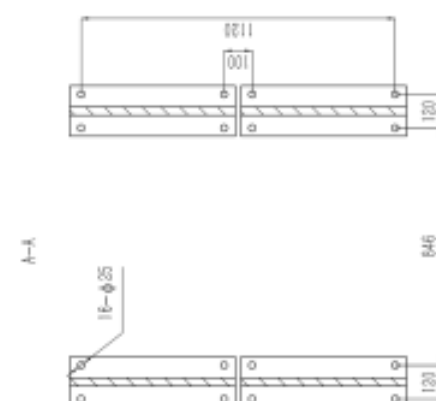
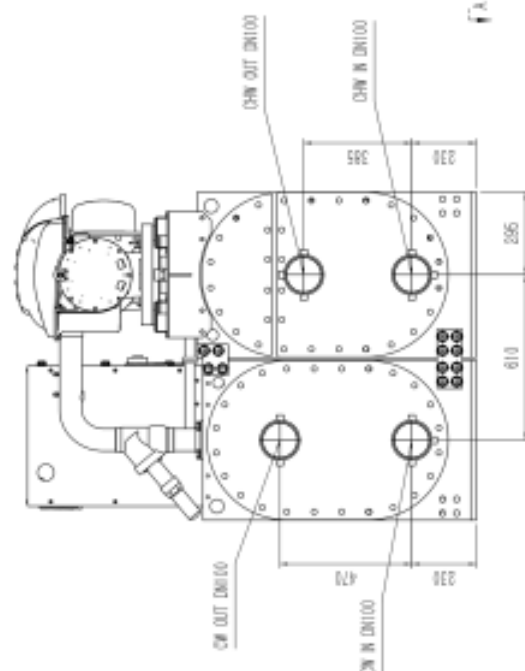
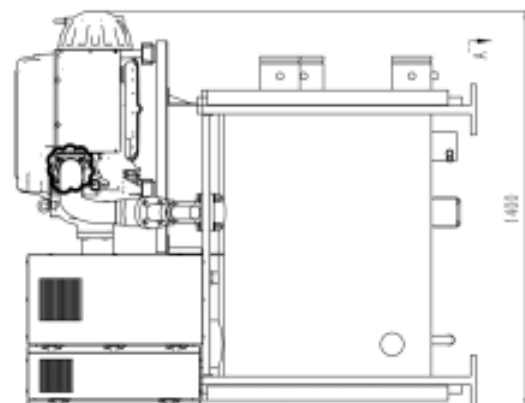
CHILLER VARIABLE WORKING CONDITION CORRECTION FACTOR

Chiller Variable Working Condition Correction Factor

Correction Factors Table								
Leaving Chilled Water Temperature°C	Entering Cooling Water Temperature°C							
	20		25		30		35	
	Cooling Capacity	Power	Cooling Capacity	Power	Cooling Capacity	Power	Cooling Capacity	Power
5	1.00	0.76	1.00	0.93	0.98	1.07	0.87	1.07
6	1.00	0.75	1.00	0.88	1.00	1.06	0.91	1.09
7	1.00	0.71	1.00	0.83	1.00	1.00	0.94	1.09
8	1.00	0.67	1.00	0.79	1.00	0.95	0.97	1.09
9	1.00	0.63	1.00	0.75	1.00	0.90	1.00	1.09
10	1.00	0.60	1.00	0.72	1.00	0.86	1.00	1.03
11	1.00	0.57	1.00	0.68	1.00	0.82	1.00	0.99
12	1.00	0.54	1.00	0.65	1.00	0.78	1.00	0.94

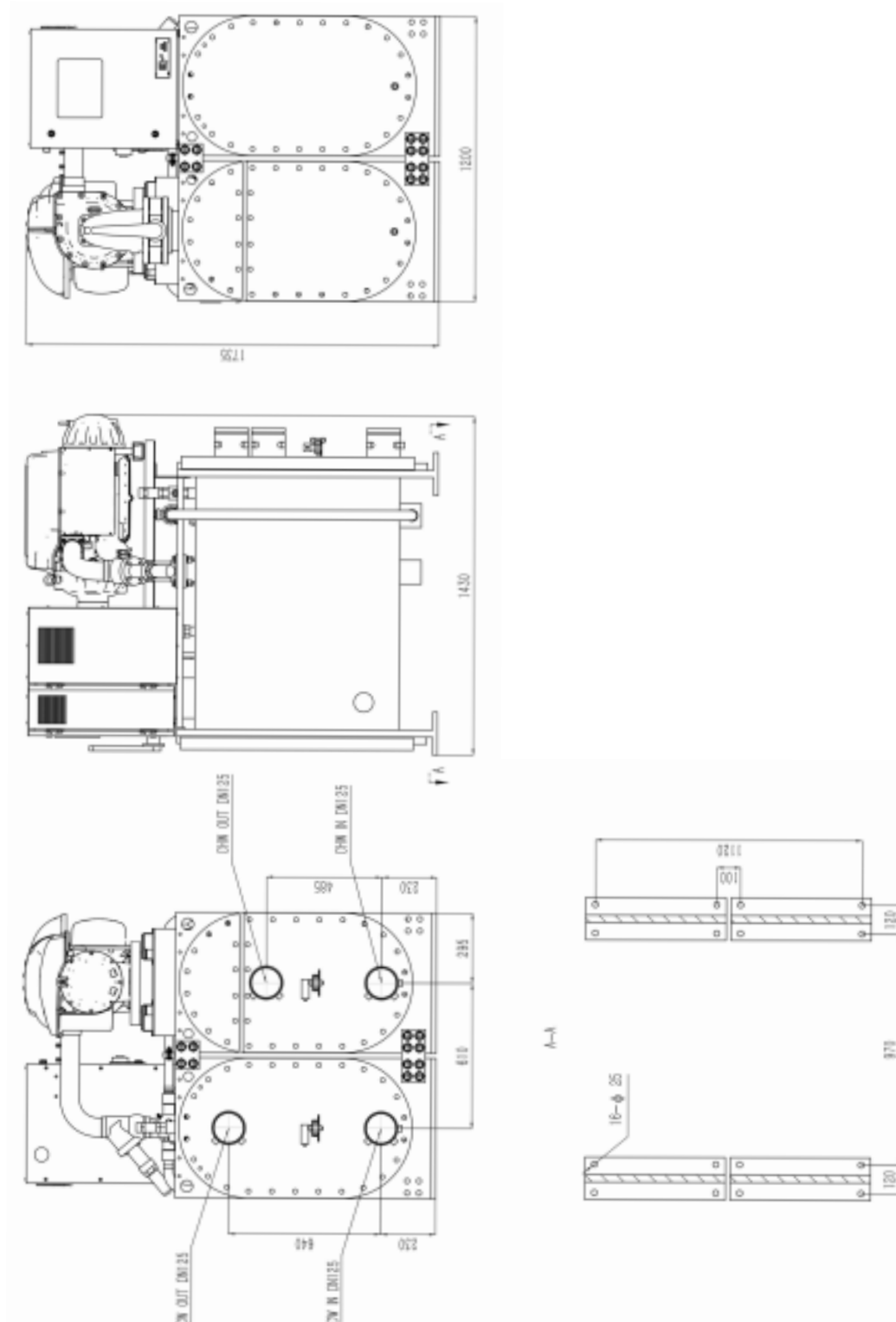
PHYSICAL DIMENSIONS

Technical drawing of the front view of the 1231 pump assembly. The drawing shows a horizontal pump unit on the left, connected to a vertical manifold. The manifold has two large circular ports, each with a flange and multiple bolt holes. Dimensions are indicated: a width of 1231 mm and a height of 1231 mm.



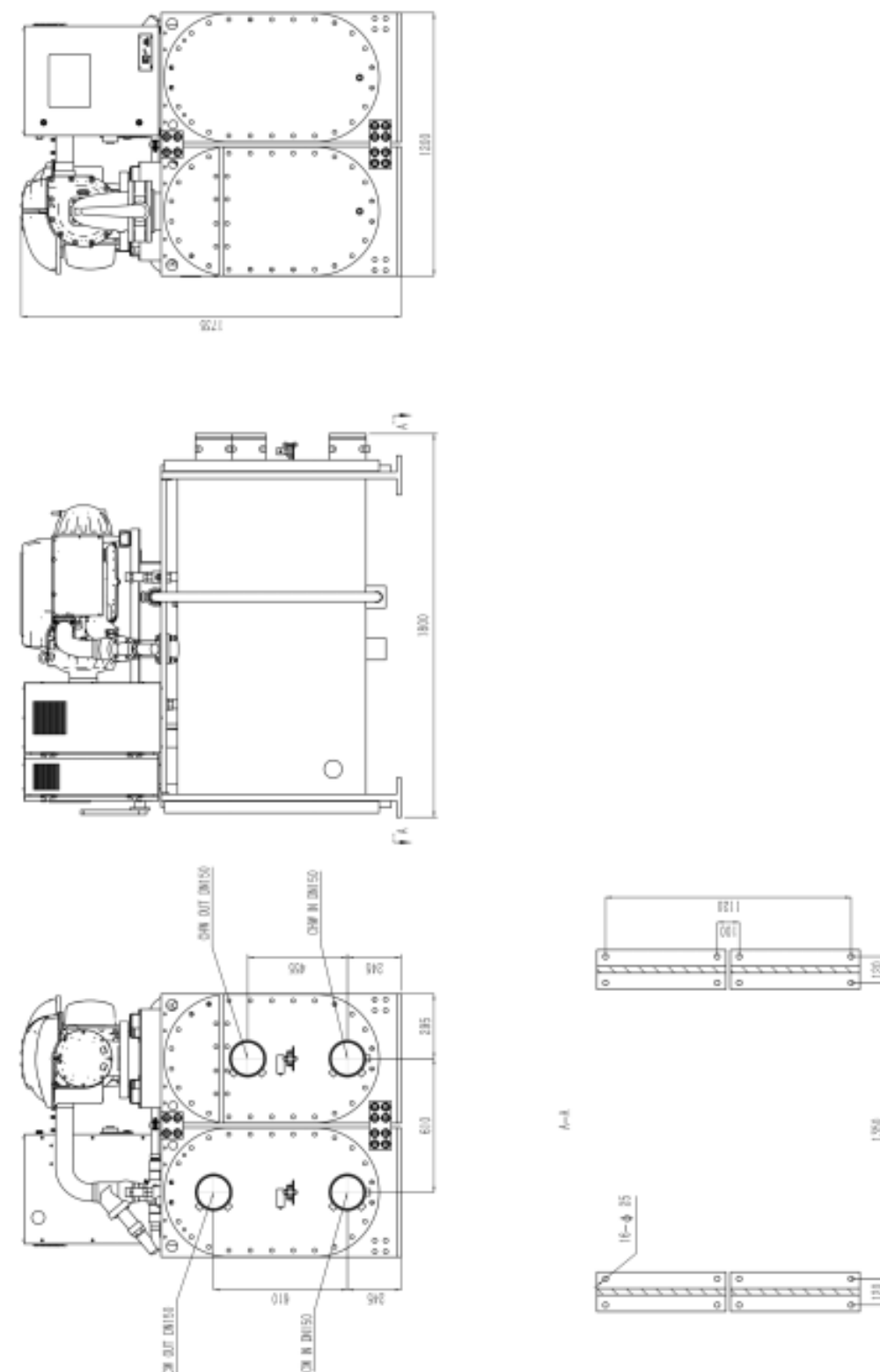
PHYSICAL DIMENSIONS

MTW150MF



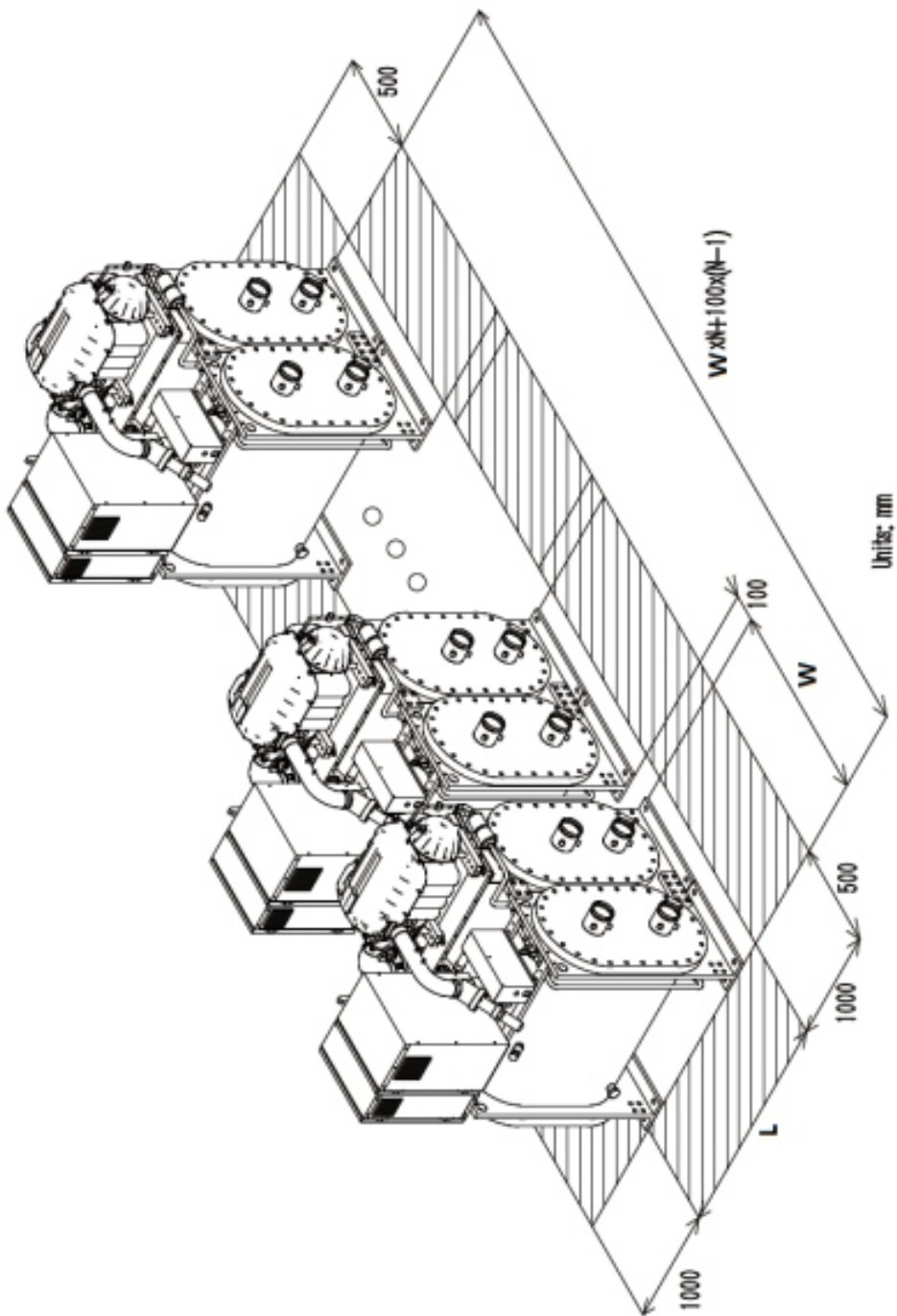
PHYSICAL DIMENSIONS

MTW200MF



PHYSICAL DIMENSIONS

MTW-MF



Unit: mm

PHYSICAL DIMENSIONS

MTW-MF

		Part 1—Evaporator		Part 2—Condenser		Part 3—Compressor		Part 4—Electric Box						
		A	B	C	D	E	F	G	H	I	J	K		
MTW090MF		1266	570	1150	1266	570	1138	788	519	501	535	539		
MTW120MF		1390	590	1245	1390	590	1258	788	519	501	535	539		
MTW150MF		1390	590	1245	1390	590	1258	788	519	501	535	539		
MTW200MF		1800	590	1245	1800	590	1258	788	519	501	535	539		

Inlet and outlet of every part on the chiller are equipped with stop valves. The chiller can be disassembled into four main components, which can be easily transported by elevator, especially suitable for some air-conditioning retrofit projects or projects with difficulties in transporting the chillers through a narrow passage

POWER MAINS CONNECTION

Notes:

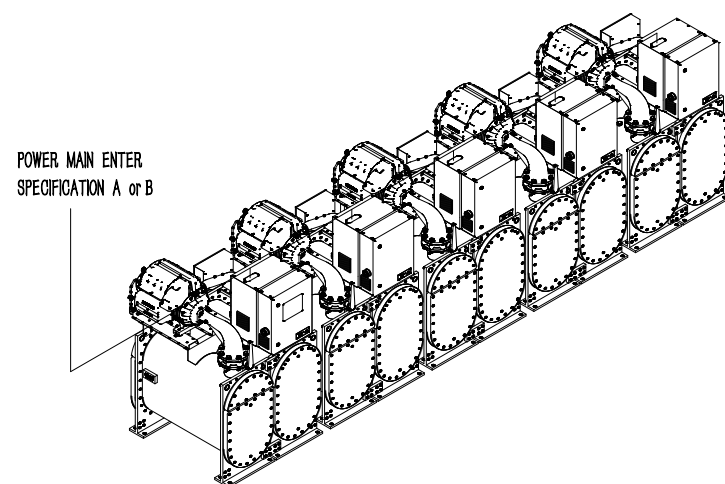
1. When starting the chiller, the compressor will start stage by stage. Chiller starting current is equal to the total current of operating compressors plus the starting current of the compressor(s) being actuated.
2. Each module has its own power circuit. Power mains entry location is as shown in the figure above.
3. The selection of power mains should base on the voltage, MRC, allowable voltage drop and local electrical codes. Cables to the chiller should be of flexible copper cord.
4. Electrical Performance Data

Model	Compressor (Each)			
	Number of Compressor	R.L.A	F.L.A	L.R.A
MTW090MF-1	1	97.1	145	160
MTW120MF-1	1	127.6	210	231
MTW150MF-1	1	155.8	170	187
MTW200MF-1	1	193.4	206	227

R.L.A: Rated Load Ampere F.L.A: Full Load Ampere L.R.A: Locked Rotor Ampere

Power Supply: AC380V/50Hz/3Ph; Allowable Fluctuation Voltage: 10%; 3-Phase Voltage Imbalance: 3%

5. In order to reduce harmonic interference, the chiller should be equipped with special input line reactor to restrict power grid fluctuation or current surge generated during system operation and to smooth out spike impulse in the supply voltage or to rectify phase missing during commutation. Input line reactor can also prevent interference from the grid and reduce impacts on the grid caused by harmonic current of the rectifier unit.
6. Harmonic filter (optional) improves power transmission and utilization, further reducing local parallel harmonic or series resonant and noise created by electrical system, improving system capacity of the transformer, breaker and cables, etc. and ensuring normal functions of safeties and automatic devices. All these configurations comply with GB/T 14549. Total harmonic distortion (THD) is $\leq 5\%$ and automatic compensation power factor of the chiller can reach 0.95.



SHIPPING AND RIGGING

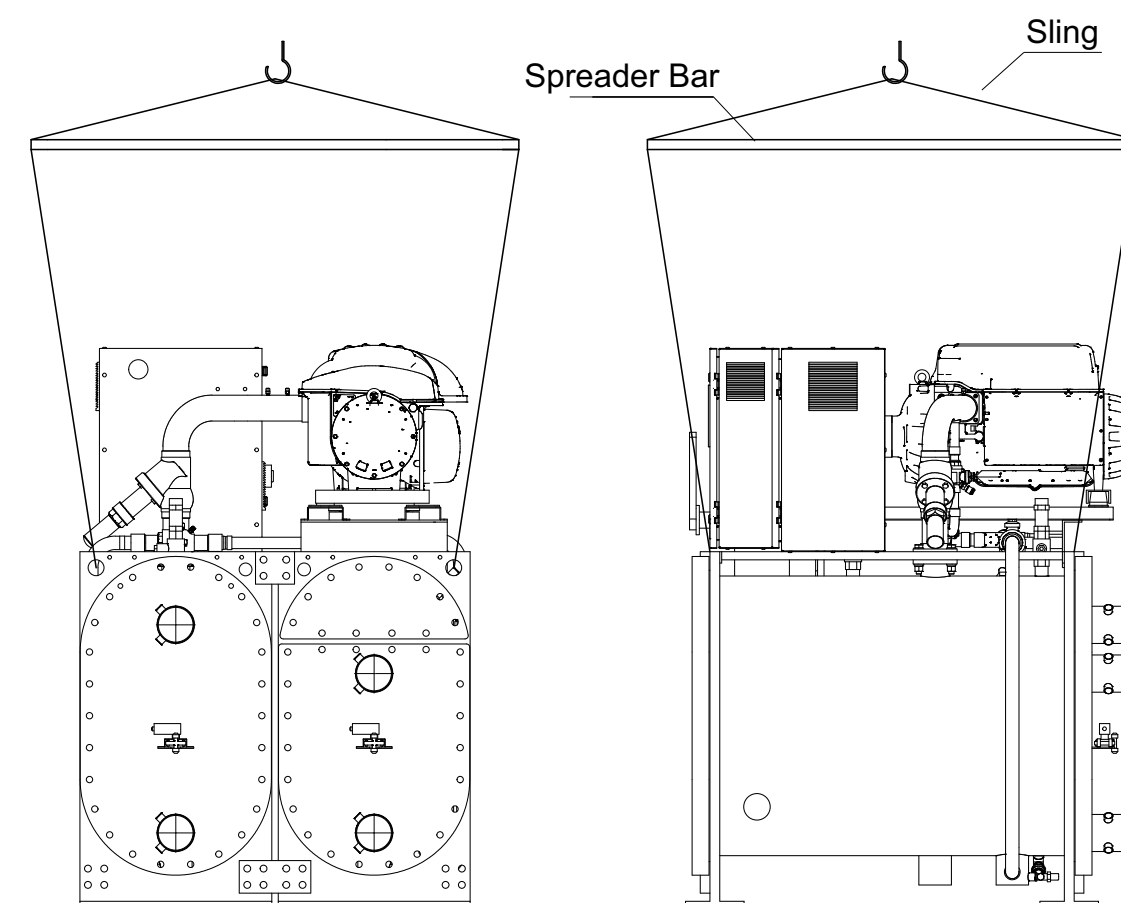
1.1 Rigging

MULTISTACK chillers are designed and constructed for the convenience for rigging and handling, which allow for the use of forklift or slings. Each module has lifting holes. Slings should be spread out by a “#” shape spreader bar on the top of the machine to prevent damage to the components and panels (see figure below).

1.2 Considerations

The gravity center of the module is located in the center the unit (see figure below). Please make sure to balance the unit during handling in case of turnover.

1.3 Hoisting Schematic



1.4 Included Accessories

Accessory types and quantities vary with specific installation and purchase orders. Accessories will be separately packed. Do not unpack the accessories during handling unless they are needed for installation.