

The Leader in Modular

**MTW – MF SERIES** 

### Modular Flooded Oil-free Centrifugal Water Cooled Chiller





Nominal Cooling Capacity 500 to 7500 kW (R) Refrigerant: R134a

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## **Features** Modular Magnetic Levitation Centrifugal Chiller:

#### 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 MTW145MF 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.



#### 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.

#### 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.

### 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.

# EXCELLENT PART

MTW-MF 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.

#### 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 module or system, giving you total piece of mind.

#### 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 65 dB(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 Easy Access 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





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COMPRESSOR 1.8		-					HON
COMPRESSOR STATUS	STITU	STAT		MOTOR STAT	VI I	TIMP WORTOR	
Operation Calibration	054	4.8	k/wp	Raq Power 0.0	<b>KW</b>	BMCC Temp 0.0 TC	
Interfacts CLOSE	087	8.0	4	Actual Peacer 0.0	NW.	Downer Temp 6.0 C	NEX
EV OPENIX 6.4 N	DEIT Seture	6.0	τ.	Vellage 0	V	308 Temp 0.0 10	4
DEMAND 6.0 %	5009	6.0	1Pag	Correct p	A	Cavity Temp 6.8 C	
CARACITY 6.0 %	1040	6.0	*	Surge Speed 0	rpra	14LVE,OHW DD TC	1
Sinit US	SUCT Satura	6.0	×.	Actual Speed o	rpra	Coating No Coating	PRI
OLEV Open 8.8 %	Supervent	6.0	3	Choice Speed 0	riper.		
Unputed Garvert IE-D To	Ratio	6.00	_				
DIV Open 8.8 %	1.		1			STISTEM STATUS	
	-	-	TATUS	(Constant)		LOWTIMP: 64 Y	
	1448 0.05	-	CI.			LOWTINE AS T	
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## **VWF - VARIABLE WATER FLOW (Optional)**

The applications below are for MTW-MFV 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 four) 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**

MT	W	142	М	F	-	6	А	E	V	
1	2	3	4	5		6	7	8	9	
<ol> <li>Multistack Turbocor compressor</li> <li>Cooling type:         <ul> <li>A: Air cooled</li> <li>W: Water cooled</li> </ul> </li> </ol>					8. Refrigerant E: R134a 9. Water System: Blank for standard - Constant Water Flow					
3. Model Number					V: Variable Water Flow*					
4. M: Modular Chiller					*VWF price to be advised on request					
5. F: Flooded Shell & Tube Evaporator										
6. The number of modules per chiller bank: (1-15)										
7. Electrical Specifications										
A: AC400V ± 10% / 50Hz / 3Ph										
B: AC380V / 60Hz / 3Ph										
C: AC440-460V / 60Hz / 3Ph										

## **PHYSICAL DATA**

#### Per Module

	Model	MTW142			
Nominal Cooling Capac	city (kW)	500			
Power Input (kW)		90.3			
COP (kW/kW)		5.54			
	Туре	Oil-Free Magnetic Levitation Centrifugal			
	Starting Mode	Soft Start			
	Number	1			
Compressor	Power Supply	415V/50Hz/3Ph			
	F.L.A. (A)	170			
	R.L.A. (A)	150			
	L.R.A. (A)	187			
	Туре	R134a			
Refrigerant	Charge (KG)	120			
	Throttling Device	Electronic Expansion Valve			
	Туре	Modular Flooded Shell & Tube			
	Water Side working Pressure (kPa)	1000			
	Nominal Water Flow (L/s)	23.9			
Evaporator	Nominal Water Pressure Drop (kPa)	77.4			
	Min. Flow (L/s)	17.9			
	Fouling Factor (m <sup>2</sup> k/kW)	0.018			
	Pipe size	5″			
	Туре	Modular Flooded Shell & Tube			
	Water Side working Pressure (kPa)	1000			
	Nominal Water Flow (L/s)	28.2			
Condoncor	Nominal Water Flow (L/s)	28.2			
Condenser	Nominal Water Pressure Drop (kPa)	74.0			
	Min. Flow (L/s)	21.1			
	Fouling Factor (m <sup>2</sup> k/kW)	0.044			
	Pipe size	5″			
Dimensions	L x W x H (mm)	1430 x 1200 x 1735			
Shipping weight (kg)		3200			
Operation weight (kg)		3430			

F.L.A. = Full Load Amperage

R.L.A. = Rated Load Amperage

L.R.A. = Locked Rotor Amperage

Nominal Values based on:

- Chilled Water Leaving Temp. 7°C
- Chilled Water Entering Temp. 12°C
- Condenser Water Leaving Temp. 35°C
- Condenser Water Entering Temp. 30°C

**MTW-MF** Series Chiller is rated and constructed in compliance with ARHR Standard 551/591 (SI) Performance rating of Waterchilling and Heat Pump Water-heating Packages using the Vapor Compression Cycle.

#### PRESSURE DROP CORRECTION FACOTOR



# Water Pressure drop correction factor for Heat Exchanger water circuit (per module)

## **PHYSICAL DIMENSIONS**



#### Note:

Rubber vibration pads should be applied with 300mm intervals (not supplied by MULTISTACK)



#### Four Main Components Breakdown



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.

### WATER PIPING PARTS

Chilled & Condenser Water Piping



### **POWER 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:

	Compressor (each)						
Model	AC400V ±10% /50Hz/3Ph						
	No. of Compressor	RLA (A)	FLA (A)	LRA (A)			
MTW142MF	1	150	170	187			

F.L.A. = Full Load Amperage R.L.A. = Rated Load Amperage L.R.A. = Locked Rotor Amperage

- 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 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 ≤5% and automatic compensation power factor of the chiller can reach 0.95.

### **SHIPPING & 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.





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01/2019 Rev. 1.0