

MHI HEAT PUMP

Water to Water
Centrifugal Heat Pump
Heat Recovery Type

ETW



Capacity: 627 kW

Hot Water 90°C Supply



Our Technologies, Your Tomorrow

Water to Water Centrifugal Heat Pump

Heat Recovery Type

ETW

<627 kW>

ETW-L Supplied chilled water & hot water at the same time

Save Energy

Save Cost & CO₂



Proposing solution for heat source equipment

Supply of max. 90°C hot water utilizing exhausted waste heat at wide temperature range (10°C ~ 50°C)*

When heat source water is low, chilled water and hot water can be supplied at the same time.

Reduction of running cost & CO₂ emission

Compared to oil boiler, annual CO₂ emission is about 70% and annual running cost is about 40%.

Constant control of hot water leaving temp. (Option)

Entering temp. of hot water is flexible and leaving temp. of hot water is fixed

High Efficiency

Short start-up time

Remote control operation

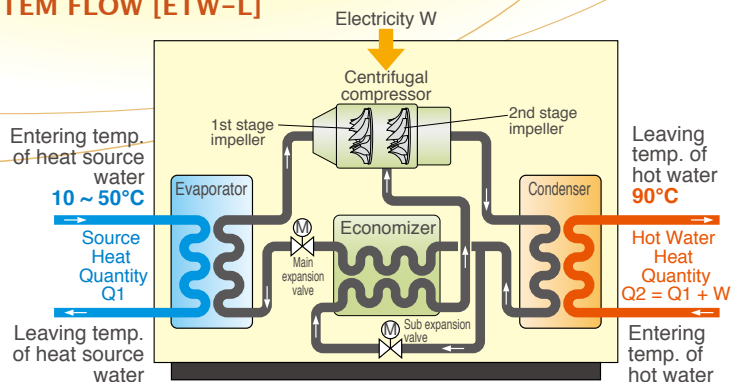
Controllable distance: max. 500 m

Remote monitoring system by web (option)

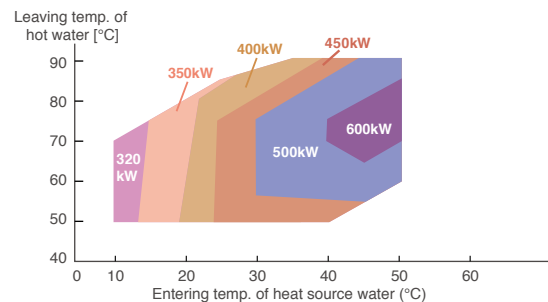
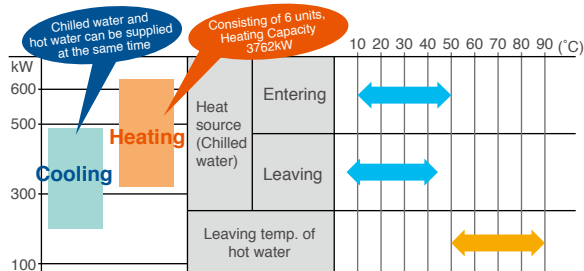
Inverter control

Equivalent to 1-ton once-through steam boiler

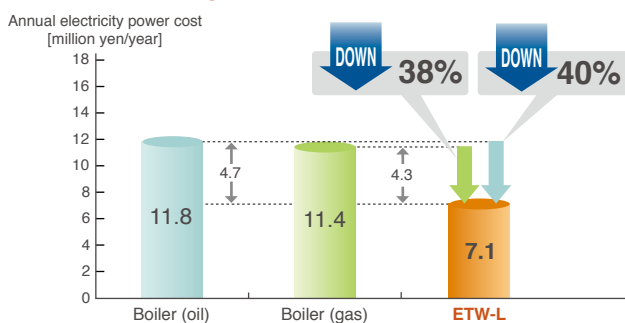
SYSTEM FLOW [ETW-L]



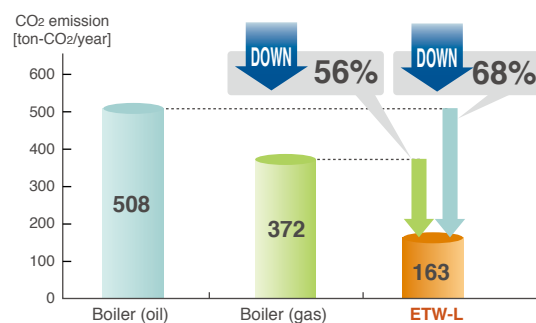
CAPACITY & TEMPERATURE RANGE



Annual Running Cost Reduction



Annual CO₂ Emission Reduction



Standard Rating

Model		ETW-L		
Capacity	Heating capacity	kW	376	545
	Cooling capacity	kW	266	400
Dimensions	Length	m	1.55	
	Width	m	1.2	
	Height	m	2.065(including lifting Lug)	
Weights	Shipping weight	kg	2500	
	Operation weight	kg	2700	
	Lubrication oil		JOMO FREOL ALPHA 68B	
	Refrigerant		R134a	
Electricity specification	Retained water quantity	kg	102	
	Power source	V	400 V class (380~440 V), 50/60 Hz free	
	Starting current	A	Less than rated current value	
	Inverter capacity	kW	160	
Compressor	Model		MCM150L	
	Quantity		1	
	Motor output	kW	104	136
	Starting method		Soft starter by inverter	
Evaporator	Water side design pressure	MPa(G)	1.0	
	Entering temperature of heat source water	°C	15	35
	Leaving temperature of heat source water	°C	10	30
	Flow rate of heat source water	m³/h	44.3	69.3
	Nozzle size		100A	
	Pressure drop	kPa	18	43
	Drain/Vent size		15A/15A	

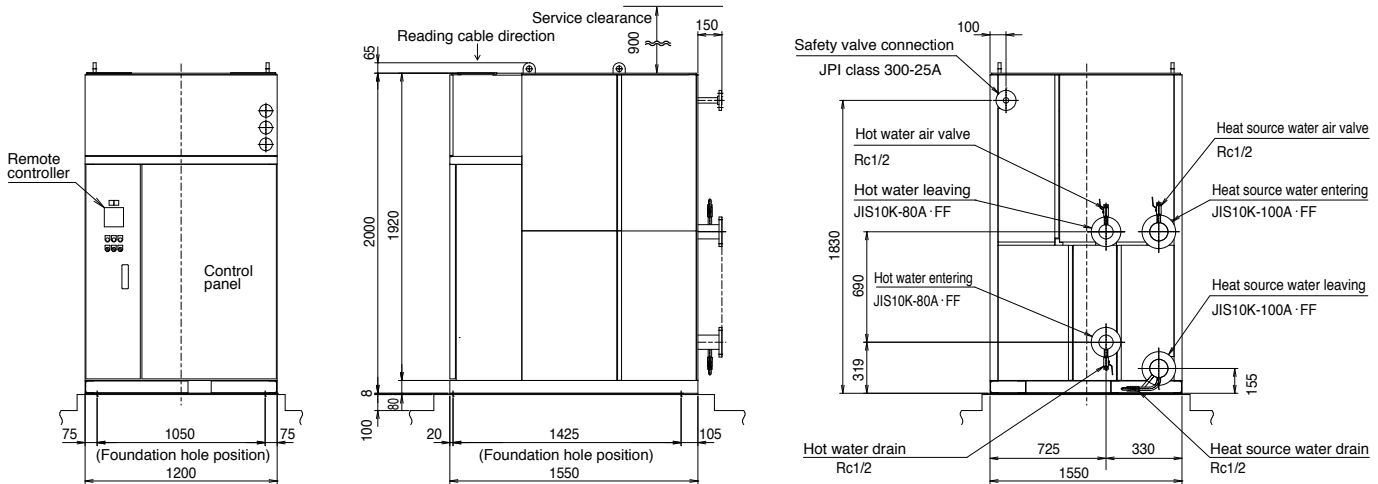
- Note:
1. Difference of temperature between leaving and entering heat source water: 5°C
 2. Ranges of hot water & heat source water temperature are as follows.
Lower limit of temperature of heat source at startup: 5°C
Lower limit of temperature of hot water at startup: 10°C

Model		ETW-L		
Condenser	Water side design pressure	MPa(G)	1.0	
	Entering temperature of hot water	°C	50	65
	Leaving temperature of hot water	°C	60	75
	Flow rate of hot water	m³/h	32.3	47.9
	Nozzle size		80A	
	Pressure drop	kPa	20	41
	Drain/Vent size		15A/15A	
Control	Control equipment		Microcomputer control panel	
	Control method		Control of 1st-stage vane, control of motor speed, control of hot gas bypass	
	Protecting circuit		High trip condenser pressure, Low trip evaporator pressure, Inverter failure, Oil differential low pressure, High temperature of oil, Low temperature of oil, Current limit, High temperature of motor, Oil pump error, Sensor error, Stop of heat source water, Stop of hot water, Low temperature of heat source water, High temperature of hot water, Position error of control valve	
	Auxiliary machine		Oil pump: 0.4 kW, Heater: 0.5 kW	
	Capacity control range		Min. ~ Max. : continuous control *Capacity control range shall be changed depending on temperature condition, etc. Less than lower limit: control by ON/OFF switch	
	Display		Liquid crystal display on remote control board	
	Remote control function		Start/Stop, Hot water temperature setting, Status display (pressure, Temperature, Operation, Alarm, Current, Estimated operation hour), Operation schedule setting	

3. Installation environment are follows
Indoor installation: To be installed in place away from rain, wind, direct sunlight, salt and steam.
To be installed in place away from oil-mist, dust, corrosive gas and flammable gas etc.
To be used in place where ambient temperature is 0°C~40°C, and ambient humidity is 5%~95%.
4. Design and specifications are subject to change without notice.

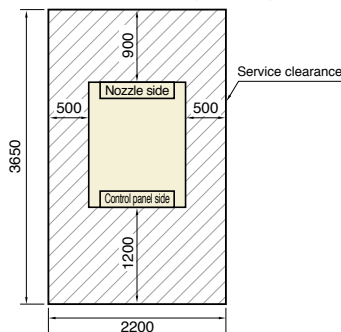
Machine Layout

[unit: mm]

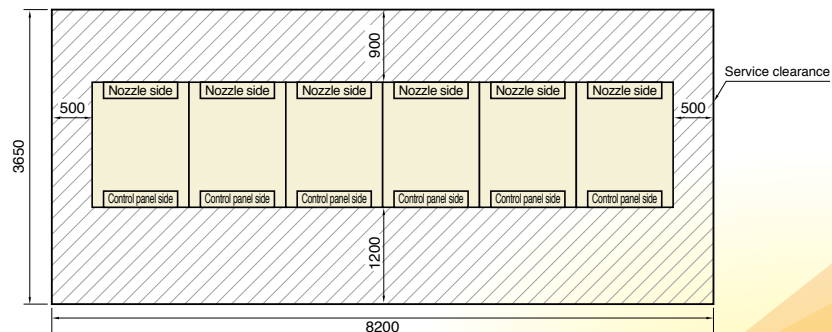


Maintenance Space

1 Unit Installation (ETW-L)



6 Units Parallel Installation (ETW-L)

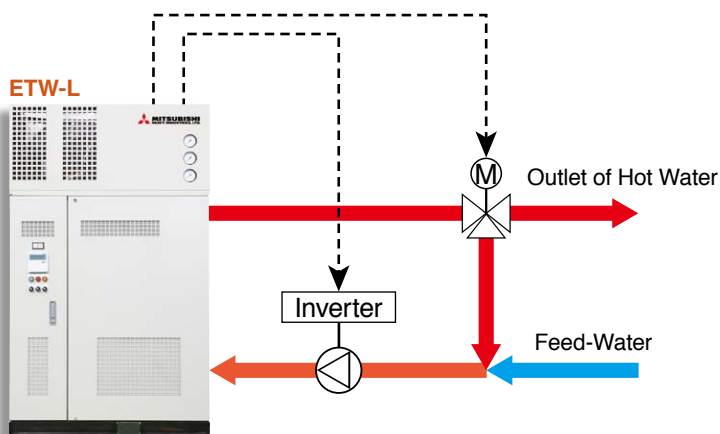


- Note:
1. Service clearance must be provided as follows:
ETW-L: 1200 mm for control panel side, 900 mm for nozzle side, 500 mm for the rest of two sides and 900 mm for overhead.
 2. The piping and flexible joint must be arranged with offsets for flexibility, and adequately supported and balanced independently to avoid strain and vibration transmission on the unit.
 3. Plumbing connections of the hot water and the heat source water are made by welding flanges rating: JIS-10K.
 4. Thermometers of chilled water and cooling water are furnished by purchaser.
 5. Refer to this figure to plan suitable and adequate entrance for machine installation, enough clearance should be provided.
 6. The construction of foundation bed and installation work of foundation bolts is purchaser's scope.
 7. The piping from the safety valve to outdoor is purchaser's scope.
 8. Drainage must be furnished around the foundations by purchaser.
 9. Dimensions, nozzle positions, anchor size, anchor hole positions, and power source cable position are subject to change without notice for design progress.

Option

Item	Standard	Option
Control	Individual control for 1 unit of centrifugal heat pump	Interlocked control for 2 to 6 units is possible by installing another panel.
Voltage	380 to 440v	Standard Specification only (Voltage out of standard specification is not covered.) However, MHI can prepare a 200V/400V level step-up transformer or a 6600V/400V level step-down transformer.
Restart after instantaneous power failure	—	It automatically restarts after stopping when an instantaneous power failure occurs for two seconds or less.
Individual Error Display	Error code is displayed on the display of remote controller	Individual error signal can be output through Communication.
Remote Start/Stop Signal	No-voltage pulse signal (Start contact "a", stop contact "a")	No-voltage pulse signal (Start contact "a", stop contact "b")
		Voltage pulse signal (Start contact "a", stop contact "a")
		Voltage pulse signal (Start contact "a", stop contact "b")
		No-voltage continuous signal, voltage continuous signal
Remote Setting leaving temperature	The hot water leaving temperature and the heat source water leaving temperature of the centrifugal heat pump can be set by remote controller included as standard.	The hot water leaving temperature and the heat source water leaving temperature of the centrifugal heat pump can be set from the remote location such as the central monitoring room.
External Signal Output (Digital)	Signals for "operation", "error", "start/stop position remote=", "alarm data", "inverter startup" and "low load" can be output.	Individual output can be made by communication. Consult with MHI for detail.
External Signal Output (Analog)	—	Individual output can be made by communication. Consult with MHI for detail.
Communication System	—	"Remote Monitoring System", "Web Communication", and "Sequencer Communication" can be used.
Variable Flow Rate Function	Constant flow rate only (P/S Control Trip at 80% of rated flow rate.)	Flow rate of heat source water and hot water can be changed. There are two methods as follows: ① Customer performs the flow rate change. Then the centrifugal heat pump will follow it. ② If the hot water entering temperature decreases, the centrifugal heat pump can keep the hot water entering temperature constant by controlling the hot water flow rate. For the flow rate range, consult with MHI.
Hot Water · Heat Source Water Bypass Unit	—	Refer to the following figure. Consult with MHI for details.
Countermeasure against Vibration	Anti-vibration rubber is attached	Spring mat can be prepared. For any other inquiries, consult with MHI.
Water Side Design Pressure	1 MPa(G)	Up to 1.6MPa(G) is allowable. If the pressure is higher than 1.6MPa(G), consult with MHI.
Water Side Piping Material (Stainless Steel Piping)	Water side nozzle piping is made of SUS304, air-release valve and drain valve are made of brass, differential pressure sensor connecting pipe is made of copper. Condenser and evaporator have brazing structure.	The material of air-release valve, drain valve and differential pressure sensor connecting pipe for water side piping can be changed to stainless steel. Brazing structure of condenser and evaporator cannot be changed. Consult with MHI for details.
Outdoor type	—	Consult with MHI for details

Heat Water/Heat Source Water-Bypass Unit (Option)



*On the heat source water side, the same system can be built.

Merit

- (1) Supply Large temperature difference hot water (heat source water) by bypassing the hot water (heat source water).
- (2) Keep hot water (heat source water) outlet temperature constant with max. capacity in case of changing feed-water temperature or flow rate of hot water (heat source water).
- (3) Ensure the minimum flow rate by circulating hot water, if the supply flow rate is lower minimum ETW flow rate.

(Note) Consult with MHI about scope of supply

Hot Water Demand and Exhaust Heat Source

Sources of Exhaust Heat

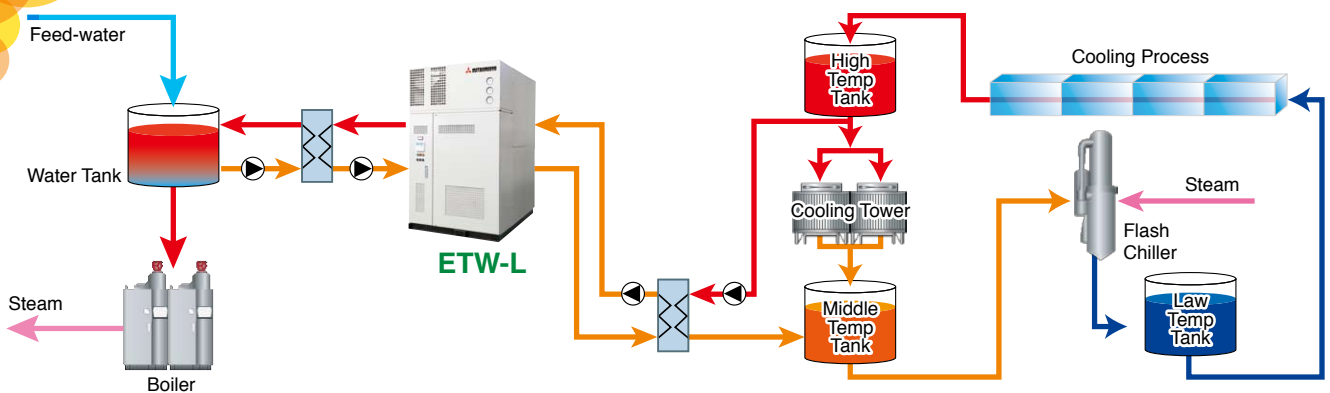
Category	Semiconductor/ Precision equipment	Automobile/ Machinery	Food	Chemical	Medical	Textiles/ Spinning	Oil, Pulp, Iron & Steel	Hotel, Hot spring
Cooling water of chiller	●	●	●	●	●	●	●	●
Cooling water of compressor		●	●					
Cooling tower		●	●	●			●	
Drying oven	●	●		●				
Drainage from desulfurization equipment							●	
Drainage of hot-water bath		●	●		●	●		●
Reaction tank			●	●				
Sewage water/ Sea water	●	●	●	●	●	●	●	●

Applications of Hot Water

Category	Semiconductor/ Precision equipment	Automobile/ Machinery	Food	Chemical	Medical	Textiles/ Spinning	Oil, Pulp, Iron & Steel	Hotel, Hot spring
Feed-water preheating	●	●	●	●	●	●	●	●
Cleaning	●	●	●		●			
Produce pure water	●			●	●			
Sterilization			●					
Dew condensation prevention			●					
Drying of powder			●		●			
Painting/Coating		●					●	
Dyeing process						●		
Heating								●
Hot-water supply								●

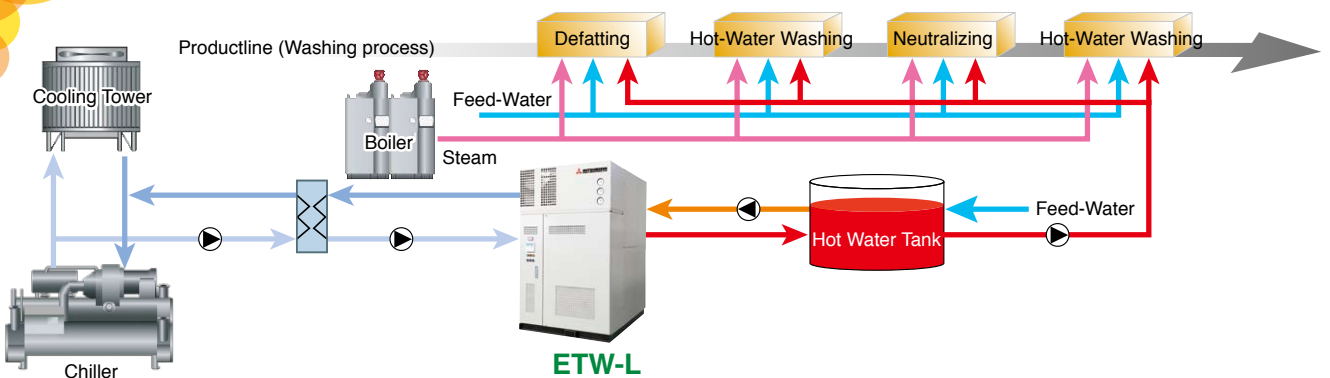
Sample 1

Food Factory



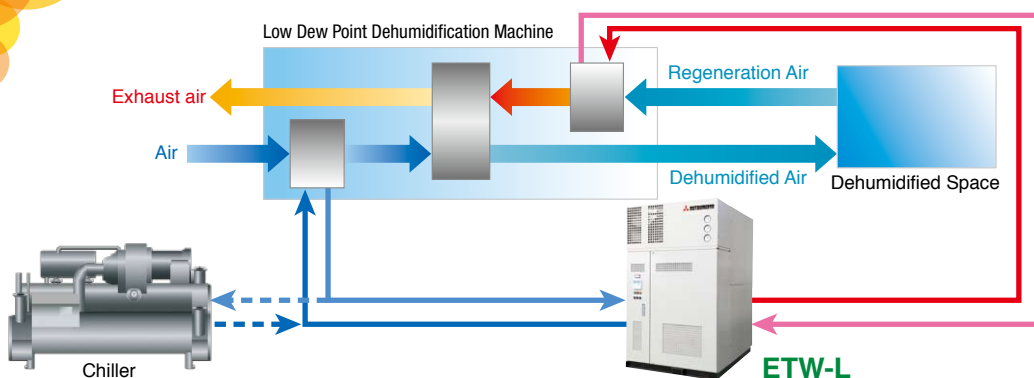
Sample 2

Cleaning Process in Factory



Sample 3

Descicant Air-Conditioning (Regeneration heat source)



What's Descicant Air Conditioning?
This system controls humidity and a temperature separately. This control saves energy consumption.

Scope of Supply

○: Standard
X: Out of MHI scope

△: Option
—: Not available

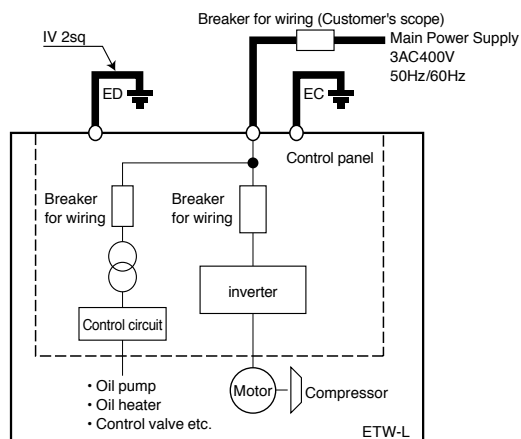
Item		Specifications	
Equipment	Heat Pump Assembly	Indoor type (including control panel)	○
		Outdoor type (including control panel)	△
	Compressor	Hermetic, two-stage, single suction, centrifugal type	○
	Compressor Motor	Liquid refrigerant cooled, hermetic cage type, 3-phase induction motor, 2 pole	○
	Step-up Gear	Integrated inside compressor housing, single helical gear	○
	Lubrication System	Trochoid pump with submerged motor, refrigerant cooled oil cooler, single oil filter, oil heater with temperature control	○
	Oil Mist Separator Tank	Cylinder type, Horizontal	○
	Evaporator & Condenser	Japanese High Pressure Gas Safety Law and JIS	○
		Brazed plate heat exchanger, Design pressure of water side: 1.0 MPa (G)	○
		Design pressure of water side: Over 1.0 MPa (G)	△
	Safety Device	High condensing pressure, Low evaporating pressure, Low oil pressure, Hot and heat source water temperature, Hot and heat source water flow rate, High oil temperature, High compressor motor coil temperature, Low voltage, Compressor motor over load, Inverter failure	○
	Control Panel	Mounted on unit, lamps and control switches	○
	Remote Control Board	Wired remote control board	○
		Wired remote control board with max. 500 m cable	△
	Inverter Panel	Mounted on unit	○
		DC reactor for power factor improvement and harmonic mitigation	○
		380 - 440 V power for compressor motor	○
		200 V, 3 kV, 6 kV, 10 kV and 11 kV power for compressor motor	—
		Integrated watt meter	—
		Power fuse medium voltage	○
		The transformer for control power (380-440/200 V)	○
	Refrigerant	HFC134a in cylinder for one (initial) charge	○
	Lubrication Oil	Ester oil in can for one (initial) charge	○
	Accessory	Pressure gauges of condenser, Evaporator and oil pressure, Rubber pad of vibration isolating, One oil filter element (for spare parts)	○
		Foundation bolt	△
		Spring mat for vibration isolating	△
		Thermometer for leaving temperature of hot water	○
Test	Shop Test	Test in accordance with JIS B8621	○
		Test in accordance with ARI 550/590	—
	Witness Test	Witness test at manufacture's (MHI) site	△
Delivery		FOB Kobe port in Japan	○
		Ex warehouse at Kobe port in Japan (on truck)	△
		CIF port near site	△
Shipping Style		Integrated style	○
		Divided style	—
Site Works	Foundation	Customer's scope	X
	Installation	Heat pump installation, setting of anchor bolt, water pipe and piping works, and cable and wiring works at site	X
		Supervisor for site installation	△
	Insulation	Customer's scope : hot water and heat source water nozzle	X
Others	Commissioning	Supervisor for site commissioning	△
	Drawings	Specification and scope of supply	○
		Machine layout (including foundation)	○
		Outline of control panel	○
		System diagram	○
	Documents	Operation and maintenance manual	○
	Code and Standard	JIS (Japan Industrial Standard), JEC (Japanese Electrotechnical Committee), JEM (The Standard of Japan Electrical Manufacture's Association)	○
		ASME ASTM (Steel Material only)	—
	Capacity Control	Controlling compressor speed, compressor inlet guide vane (1st stage) and hot gas bypass valve	○
	Sequential Control	Control 1 unit	○
		Control 2~6 units by "MHI SYSTEM CONTROL PANEL"	△
	Variable Flow Rate Control	Constant flow rate	○
	Flow Rate Detection	Variable flow rate control of heat source water and hot water Contact MHI about range of flow rate.	○
		Differential pressure sensor	—
Instantaneous Restart		To be enable disable instantaneous function	○
		In case of instantaneous power failure within 2 seconds, ETW restarts automatically after stop	△

Item		Specifications	
Others	Display of Each Failure	Display failure code on remote control board	○
		Output of failure signal by communication	△
	Remote Start-Stop Signal	No-voltage pulse signal (a contact point for start, a contact point for stop)	○
		No-voltage pulse signal (a contact point for start, b contact point for stop)	△
		Voltage pulse signal (a contact point for start, a contact point for stop)	
		Voltage pulse signal (a contact point for start, b contact point for stop)	
	Communication System	No-voltage continuous signal, voltage continuous signal	○
		—	
		Remote monitoring system, communication by WEB, Communication by sequencer	
		Interface and communication to Building Automation System (Available only for LonWORKS®)	
	Output of Signal (Digital)	Output operation data to central monitor by MHI's smart communication terminal	△
		Signal of "Run Operation", "Failure", "Operation Mode Remote", "Alarm", "Compressor running", "Low Load"	○
	Output of Signal (Analog)	Output status data of individual are able to be supported by the communication device.	△
		Output operation data of individual are able to be supported by the communication device.	△
	Control Circuit of Hot-water Flow Rate and Hot-water Temperature	Control start-stop of heat source water pump and hot-water pump by micro control panel (excluding pump motor circuit)	○
		Output of inverter control hot-water pump and bypass valve signals, input of hot-water flow rate signal by customer.	△
	Prevention of Vibration	Rubber pad	○
		Spring mat. Contact MHI about other options.	△
	Constant Control of Hot Water Leaving Temperature	Supply of hot water bypass unit	△

Power Supply Construction Procedure

The power to be supplied by the customer is main power (400V level) only

Model	Power Supply	Power capacity	Rated Current of Breaker for Wiring [A]	Customer Side Main Power Supply Wire Size [Tightening Torque N/m]	Grounding Conductor
ETW - L	Main Power Supply	254kVA or more	400AF 400AT	CV 80sq × 2 or CV 200sq or more	30sq



SPEC CHECK LIST for MHI WTW Centrifugal Heat Pump [ETW]

Please fill in the below blanks (_____ underlined, _____ boxed and check ☐)

____ day / ____ month / ____ year

Company name: _____ Project name: _____

Site location: _____

Contact person: _____ Tel: _____

Fax: _____ E-mail: _____

Purpose of usage of heat pump: _____

Estimated delivery date: _____

1 Conditions of HEAT RECOVERY and HOT WATER SUPPLY

HEAT RECOVERY

Temp. : _____ °C

Flow rate: _____ m³/hr

Pressure: _____ MPa

Exhaust heat source:

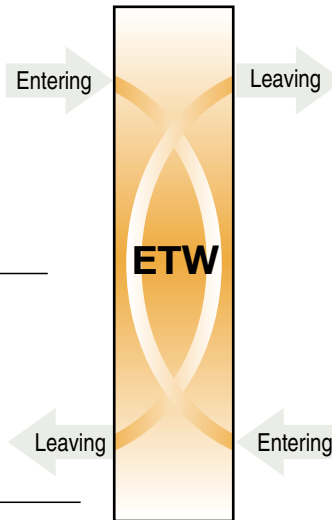
- ☐ Processed water
☐ Circulating water
☐ Boiler
☐ Other _____

Water quality: _____

PH: _____

Leaving temp.: _____ °C

Regulation or emission cap temp.: _____



HOT WATER SUPPLY

Temp. : _____ °C

Flow rate: _____ m³/hr

Heating capacity:

_____ kW

Purpose of use:

- ☐ Manuf. process
☐ Circulation
☐ Boiler
☐ Other _____

Temp. : _____ °C

Pressure: _____ MPa

Water quality: _____

PH: _____

Water source:

- ☐ Ground water
☐ Urban water
☐ Industrial water
☐ Soft water
☐ Other _____

Necessary information

2 Utility

Power source: _____ V 50/60 Hz, 3 phase

Installation location (Non-hazardous):

Indoor _____

3 Energy Cost

Currency: _____

Electricity: _____ /kWh

Fuel: ☐ Heavy oil (_____ /Lit) ☐ LPG (_____ /kg)
☐ LNG (_____ /Nm³) ☐ Other _____

Operating hours: _____ hr/day,
 _____ days/month,
 _____ hr/year

4 Scope of Supply

- ☐ Heat pump unit
☐ Site fabrication work
 (Piping · Wiring · Installation)
☐ Auxiliary (Pumps · Tanks)
☐ Other _____

5 Other Information/Special Requirement

ISO 9001



Certificate number: JQA-0709
 Date of certificate: December 16, 1994

Our Air-Conditioning & Refrigeration Systems is an ISO (International Organization for Standardization) 9001 quality management system certified organization.

PED



Certificate: PED97/23/EC Module H1
 Certificate number: 01 2021/Q-010001
 Certified by: TÜV CERT (Germany)
 Date of certificate: April 22, 2001

Our Air-Conditioning & Refrigeration Systems is a PED (Pressure Equipment Directive) 97/23/EC Module H1 certified organization.

ISO 14001



Certificate number: YKA 0771887
 Date of certificate: June 26, 1998

Our Production Shop, Centrifugal & Absorption Chiller Dept., Air-Conditioning & Refrigeration Systems is an ISO (International Organization for Standardization) 14001 environmental management system certified organization.

www.mhi.co.jp/en/products/category/centrifugal_chiller.html

MITSUBISHI HEAVY INDUSTRIES, LTD.

Air-Conditioning & Refrigeration Systems
 Centrifugal & Absorption Chiller Department
 Sales & Marketing Section
 16-5, Konan 2-chome, Minato-ku, Tokyo 108-8215, Japan
 Phone : 81-3-6716-4272

Because of our policy of continuous improvement, we reserve right to make changes in all specifications without notice.

TB62021E1-C-0, (2.0) 12-11, R



To protect the environment, this brochure is printed with non-VOC inks (containing no Volatile Organic Compounds), by a waterless printing method that generates no harmful wastewater.

Printed in Japan