

MHI Centrifugal Chiller Variable Speed Drive

ETI series



Capacity range: 527 - 1,231 kW [150 - 350 RT]



Capacity range: 1,231 - 2,461 kW [350 - 700 RT]

Variable Speed Drive

ETI series

<150 RT ~ 700 RT>

Save Energy

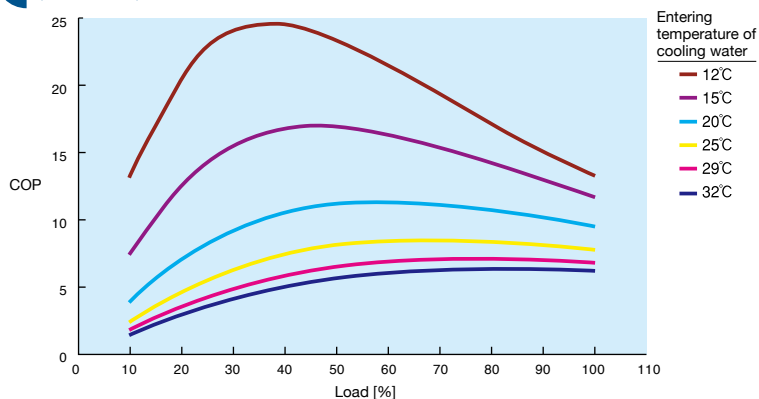
Save Cost & CO₂

Save Space



SAVE ENERGY Inverter control

Performance Characteristic (ETI-60A)



Energy Performance

IPLV

11.2 (700RT)

NPLV (Non-Standard Part Load Value) can be calculated based on requested conditions.

Max. COP at part load

24.4

Entering temperature of cooling water: 12°C

COP

6.76
AHRI

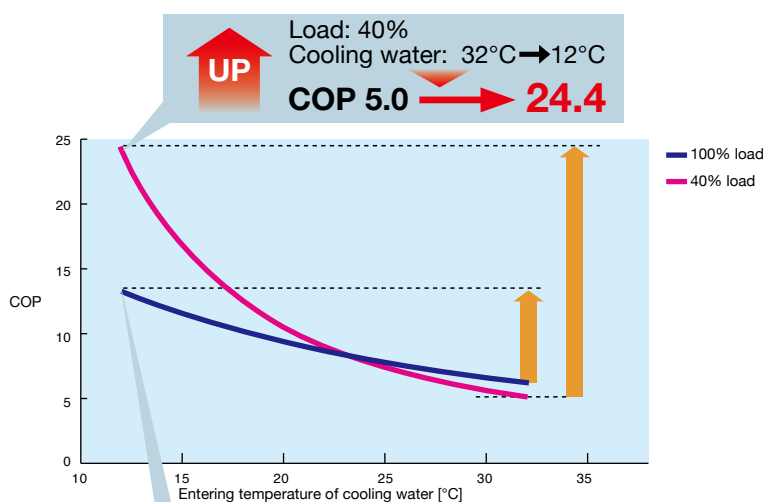
6.2 (600RT)
JIS

Capacity control range

100% - 10%

Controlled until near 0% as option

COP Characteristic by Cooling Water Variance (ETI-60A)



UP
Load: 100%
Cooling water: 32°C → 12°C
COP 6.2 → 13.3

IPLV

IPLV is the formula developed by AHRI to measure the efficiency of chillers under an actual annual operating conditions. IPLV is calculated when the unit is operating at 25%, 50%, 75% and 100% of capacity and at different cooling water temperature. (AHRI Standard 550/590-2003)

IPLV: Integrated Part Load Value
AHRI: Air-Conditioning, Heating and Refrigeration Institute

$$IPLV = 0.01A + 0.42B + 0.45C + 0.12D$$

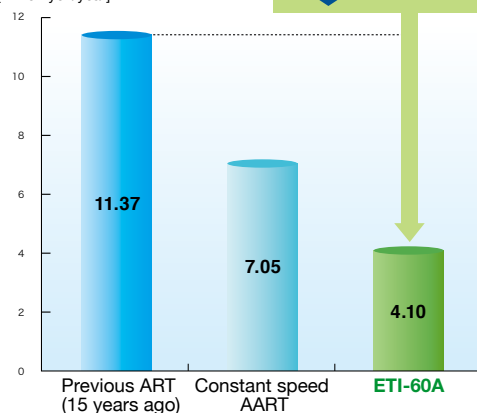
A = COP at 100% load (29.4°C*) B = COP at 75% load (23.9°C*)
C = COP at 50% load (18.3°C*) D = COP at 25% load (18.3°C*)
Leaving temperature of chilled water: 6.7°C
*: Entering temperature of cooling water

SAVE COST & CO₂

Annual Electricity Cost Reduction (600 RT)

Building air conditioners use

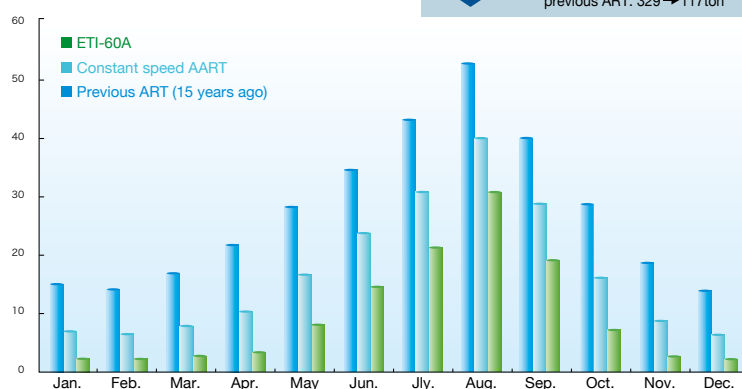
Annual electricity power cost
[million yen/year]



Annual CO₂ Emission Reduction (600 RT)

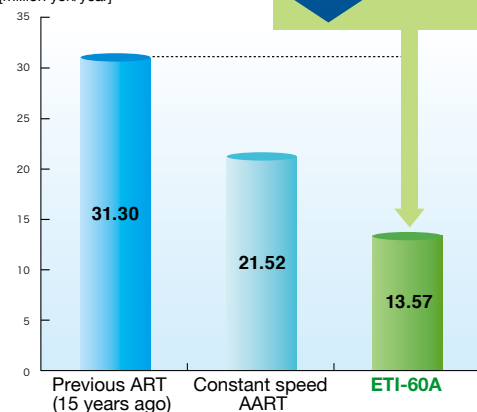
Building air conditioners use

CO₂ emission
[ton-CO₂/month]



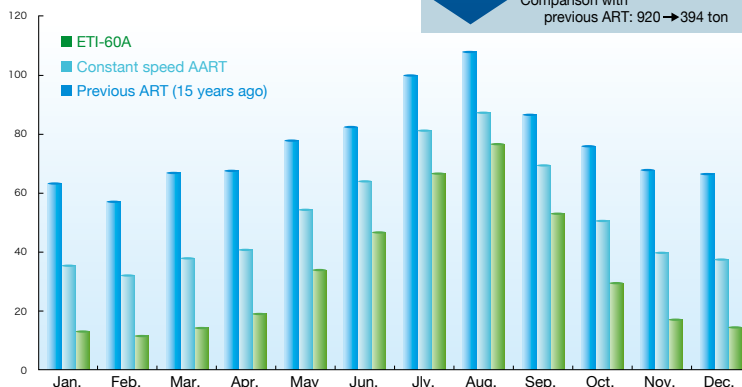
Industrial use

Annual electricity power cost
[million yen/year]



Industrial use

CO₂ emission
[ton-CO₂/month]



* Sample of Save Cost & Save CO₂ in Japan

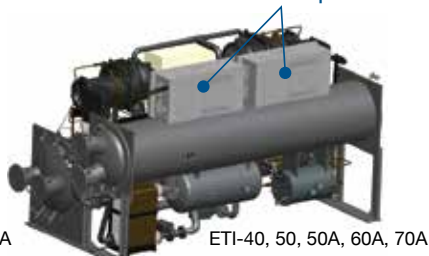
SAVE SPACE Built-in Inverter Panel

Self standing starter panel is not required.
Wiring work can be minimized.

Inverter panel



Inverter panel

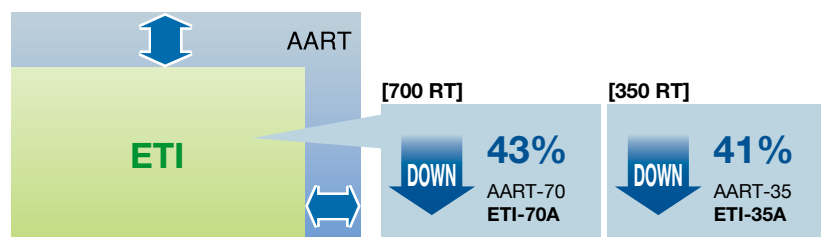


Other Features

High performance
microcomputer control panel

HFC-134a chlorine free
refrigerant
Ozone Depletion Potential
(ODP) is zero.

Low noise



Comparison of square space

*MTH: Mitsubishi Heavy Industries Thermal Systems, Ltd.

Standard Ratings

■ AHRI 550/590-2003 Condition

Model		ETI-	15	20	25	25A	30A	35A	40	50	50A	60A	70A
Cooling capacity	RT		150	200	250	250	300	350	400	500	500	600	700
	kW		527	703	879	879	1055	1231	1407	1758	1758	2110	2461
Chilled water	Entering temperature	°C	12.2										
	Leaving temperature	°C	6.7										
	Flow rate	m³/h	82.3	109.7	137.1	137.1	164.5	192.0	219.4	274.2	274.2	329.1	383.9
	Pressure drop	kPa	26	43	65	35	48	64	49	74	46	64	84
	Piping connection / Nozzle size	inch	6	6	6	6	6	6	8	8	10	10	10
Cooling water	No. of pass	—	2										
	Entering temperature	°C	29.4										
	Leaving temperature	°C	34.5										
	Flow rate	m³/h	103.3	136.9	171.9	171.3	205.3	240.2	273.8	343.0	342.2	410.1	479.6
	Pressure drop	kPa	17	28	41	15	21	28	41	61	29	40	53
Inverter input	Piping connection / Nozzle size	inch	6	6	6	8	8	8	8	8	10	10	10
	No. of pass	—	2										
Motor output	kW		82	106	136	132	157	188	210	266	262	312	372
COP	—		72	94	121	119	142	169	186	238	236	280	334
	—		6.43	6.63	6.46	6.66	6.72	6.55	6.70	6.61	6.71	6.76	6.62

Notes:

1. This specification is based on AHRI STANDARD 550/590-2003 conditions for temperature and fouling factor of chilled water and cooling water.
2. Max. working pressure (Chilled water and Cooling water): 1 MPa (G)
3. Installation environment: Inside installation
Install in a place avoiding rain, wind, direct sunlight, salinity, and steam. Do not install in a place where oil mist, dust, corrosive gas, and flammable gas, etc. are suspended.
Ambient temperature must be between 0°C and 40°C and ambient humidity must be between 5% and 95%.
4. Design and specifications are subject to change without notice.

■ JIS B8621: 2011 Condition

Chilled Water 12°C/7°C, Cooling Water 32°C/37°C

Model		ETI-	15	20	25	25A	30A	35A	40	50	50A	60A	70A
Cooling capacity	RT		150	200	250	250	300	350	400	500	500	600	700
	kW		527	703	879	879	1,055	1,231	1,407	1,758	1,758	2,110	2,461
Motor output	kW(50Hz)		83	102	130	131	153	182	202	256	256	306	360
Inverter input	kW(50Hz)		94	115	146	144	170	203	228	288	286	338	400
Auxiliary power	kW(50Hz)		0.4	0.4	0.4	0.4	0.4	0.4	0.64	0.64	0.64	0.64	0.64
Chilled water	Flow rate	m³/h	90.4	120.5	150.7	150.7	180.8	211	241.1	301.4	301.4	361.6	421.9
	No. of pass	—	2	2	2	2	2	2	2	2	2	2	2
	Pressure drop	kPa	30	51	77	41	58	76	59	88	54	76	100
	Piping connection / Nozzle size	A	150	150	150	150	150	150	200	200	250	250	250
Cooling water	Flow rate	m³/h	107.4	141.5	177.2	176.9	211.9	247.7	282.6	353.6	353.3	423.2	494.5
	No. of pass	—	2	2	2	2	2	2	2	2	2	2	2
	Pressure drop	kPa	18	29	43	16	22	29	43	64	30	42	55
	Piping connection / Nozzle size	A	150	150	150	200	200	200	200	200	250	250	250
COP (Include auxiliary power)	—		5.59	6.09	6.00	6.09	6.19	6.05	6.15	6.09	6.13	6.23	6.14
IPLV	—		6.7	8.0	8.8	7.8	8.3	8.4	8.0	8.9	7.9	8.4	9.0

Notes:

1. Chilled/Cooling water fouling factor: 0.000086 m²K/W (0.0001 m²h°C/kcal)
2. Max. working pressure (Chilled water and Cooling water): 1 MPa (G)
3. Installation environment: Inside installation
Install in a place avoiding rain, wind, direct sunlight, salinity, and steam. Do not install in a place where oil mist, dust, corrosive gas, and flammable gas, etc. are suspended.
Ambient temperature must be between 0°C and 40°C and ambient humidity must be between 5% and 95%.
4. Design and specifications are subject to change without notice.

Dimensions and Weight

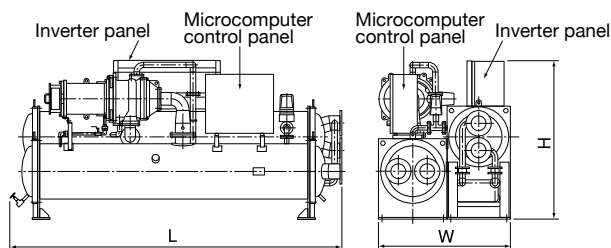
Model		ETI-	15	20	25	25A	30A	35A	40	50	50A	60A	70A
Chiller	Length (L)	m	3.7			3.5			4.4		4.2		
	Width (W)	m	1.5			1.8			1.9		2.1		
	Height (H)	m	1.8			2.0			2.2		2.3		
	Shipping weight	t	3.9			5.1			7.4		9.6	9.7	
	Operation weight	t	4.7			6.2			9.0	9.1	11.8		11.9

Notes: 1. Above data is only for reference.

2. Shipping weight is data for integrated shipping style.

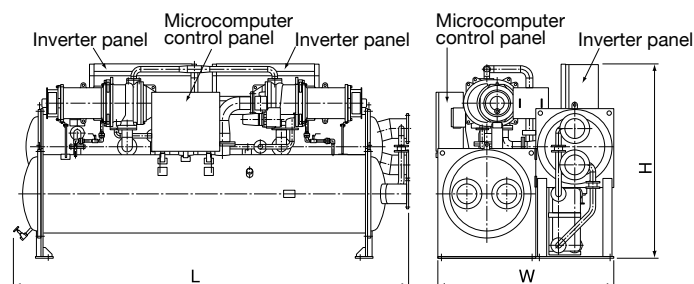
ETI-15, 20, 25, 25A, 30A, 35A

25A, 30A, 35A: water box with hinge



ETI-40, 50, 50A, 60A, 70A

50A, 60A, 70A: water box with hinge

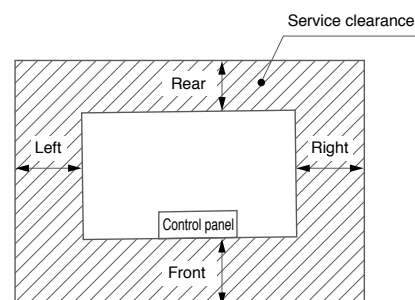


Service Clearance

Model	ETI-	15	20	25	25A	30A	35A	40	50	50A	60A	70A
Front	mm	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200	1,200
Both end (Right / Left)	mm	900 (3,050)	900 (3,050)	900 (3,050)	Right:1,000 Left:900 (2,850)	Right:1,000 Left:900 (2,850)	Right:1,000 Left:900 (2,850)	900 (3,650)	900 (3,650)	1,200 (3,500)	1,200 (3,500)	1,200 (3,500)
Rear	mm	900	900	900	900	900	900	900	900	1,200	1,200	1,200

Notes:

- Service clearance must be provided more than above and more than 900mm for upside.
- The data in () of both end is dimension for tube removal space. It must be provided at either end of left and right.
- The piping must be arranged with offsets for flexibility, and adequately supported and balanced independently to avoid strain and vibration transmission on the chiller unit.
- Piping connections of chilled water and cooling water for monitoring are made by welding flanges rating : JIS-10K
- Thermometers of chilled water and cooling water are furnished by purchaser.
- Prepare the hook for lifting compressor and motor unit.
(for removing compressor at overhauling)
- Refer to dimension of chiller for planning suitable and adequate entrance for machine installation, enough clearance should be provided.
(caution: the above dimension data are the size without insulation, After insulation, the size will increase by the thickness of insulator)
- Antivibration rubber and rubber bushing installation are supplied by MTH*. (standard accessories)
Scope of anchor bolt, anchor bolt's accessories, washers and nuts shall be confirm with the specification.(not standard accessories)
- The construction of foundation bed and installation work of foundation bolts is purchaser's scope.
Please complete fondation work before installation chiller with reference to MTH*'s drawing "INSPECTION RECORD".
- Safety valve should connect the piping for exposing to the atmosphere refrigerant to safety by purchaser.
Use the flexible-joint for the part which connect the safety valve and the piping, and install appropriately a support at the piping.



*MTH: Mitsubishi Heavy Industries Thermal Systems, Ltd.

MICROCOMPUTER CONTROL PANEL

Big

.....10.4 inch Display

Clear

.....Digital Display

Smooth

.....Quick Response

Save Energy

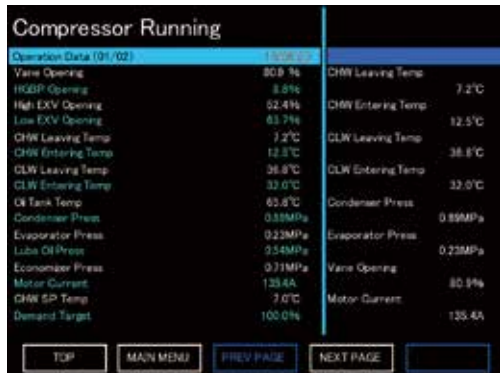
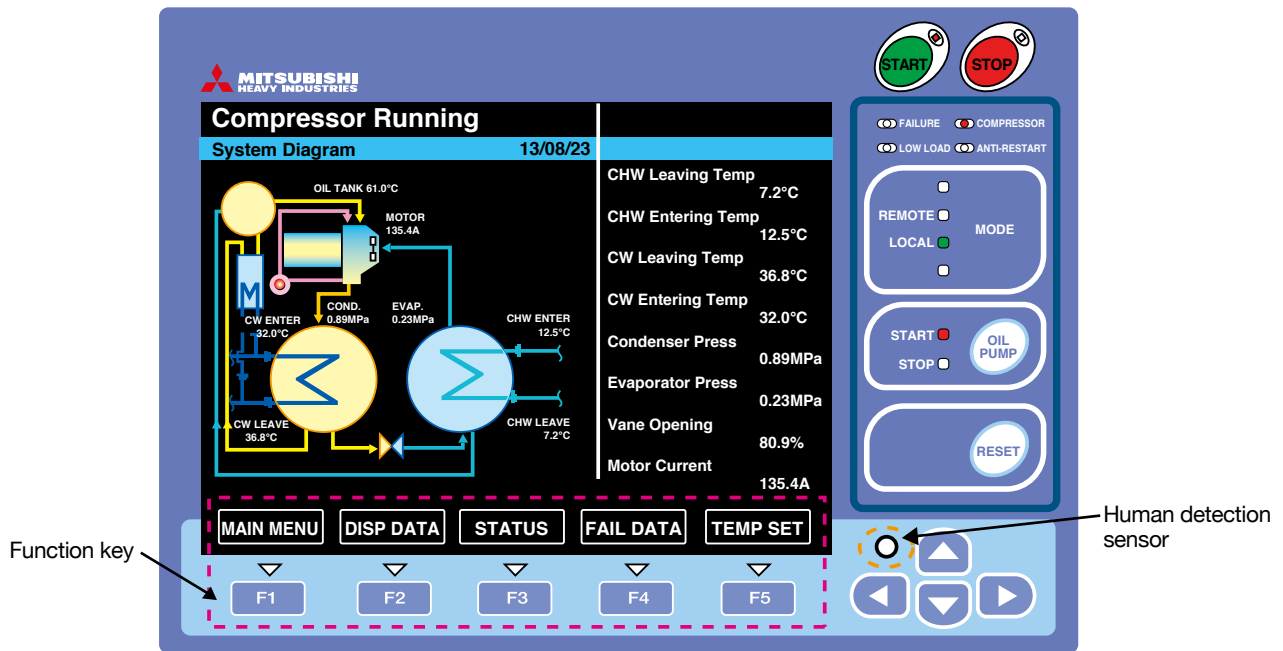
Liquid Crystal Display (LCD) with automatic lighting-up function.

Light up by human detection sensor without touching panel

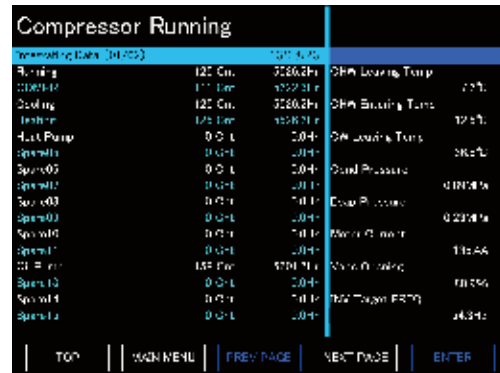
For environmental standards

Uses lead-free substrate

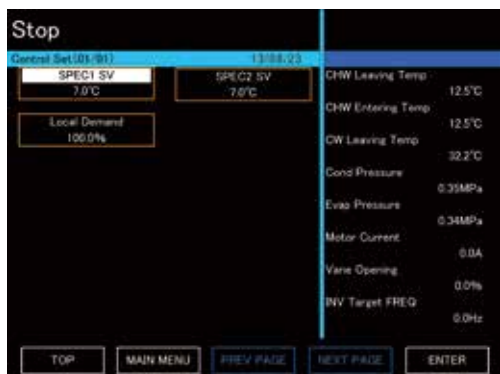
RoHS compliant



Operation Data Screen
Display max. 24 data at one time.



Integrating Data Screen
Display max. 16 integrating operation number and hours.



Temperature Control Screen
The Chilled water leaving temperature and demand control limit can be set.



Failure Data Screen
Display max. the latest 16 troubles with contents, data and time of failure at one time.

Scope of Supply

○: Standard ×: Out of MTH* scope △: Option —: Not available

Item		Specifications	
Equipment	Chiller 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, squirrel cage, 3-phase, induction type motor, 2 pole, insulated grade B	○
	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	○
		Double oil filter	—
	Capacity Control	100-10%, Controlling compressor speed, compressor inlet guide vane (1st and 2nd stage) and hot gas bypass valve	○
		100-0%, Larger hot gas bypass valve than standard	△
	Flow rate Control	Rated flow rate: 100%	○
		Variable flow rate: 100% - 50%	△
		Flow rate signal input & Charge of flow switch are necessary	△
		Excess flow rate	△
	Evaporator & Condenser	Japanese High Pressure Gas Safety Law and JIS	○
		Horizontal shell and tube type with copper tube (5/8"OD) Design pressure of water side: 1.0 MPa (G)	○
		Marine type water box with hinge	—
		Tube material other than copper (ex: cupronickel, admiralty brass, titanium)	—
		Tube sheet material other than steel (ex: naval brass clad steel, titanium clad steel)	—
		Design pressure of water side: Over than 1.0 MPa (G)	—
	Safety Device	High condenser pressure, Low evaporator pressure, Low oil pressure, Low chilled water outlet temperature, Low chilled water flow rate, Low cooling water flow rate, High oil temperature, High compressor motor coil temperature, Low voltage, Compressor motor over load, Abnormal inverter	○
	Microcomputer Control Panel	Mounted on heat exchanger, indoor non hazardous type with color liquid crystal display, lamps and control switches on microcomputer operation board	○
	Inverter Panel	Mounted on heat exchanger	○
		Integrating watt meter	—
		Power fuse medium voltage	—
		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	—
		Tie transformer for control power (ex: 400/200 V)	—
Test	Material	JIS (Japan Industrial Standard), JEC (Japanese Electrotechnical Committee), JEM (The Standard of Japan Electrical Manufacture's Association)	○
		ASME ASTM (Steel Material only)	—
	Refrigerant	HFC134a in cylinder for one (initial) charge	○
	Lubrication Oil	Ester oil in can for one (initial) charge	○
	Accessory	A thermometer of oil reservoir, Sight glasses, Pressure gauges of condenser, Evaporator and oil pressure, Rubber pad of vibration isolating, Flow switch of chilled water and cooling water	○
		Foundation bolt	△
		Spring pad for vibration isolating	△
		General tool and tool box	△
	Other	Mesh for tube cleaning	△
	Factory Performance Test	To be tested in accordance with JIS B8621	○
Painting	Witness Test	To be tested in accordance with AHRI 550/590	—
		Owner and/or representative witness test in factory	△
	Chiller	Rust preventing paint (three coat)	○
		Finish coat	△
Insulation	Control Panel	Rust preventing and finish coat (color: Munsel 5Y7/1)	○
	Inverter Panel	Rust preventing and finish coat (color: Munsel 5Y7/1)	○
		Not provided (Purchaser's scope. Insulation shall be carried out in accordance with MTH* insulation procedure.)	×
		FOB Kobe port in Japan	○
Delivery		Ex warehouse at Kobe port in Japan (on truck)	△
		CIF port near site	△
	Shipping Style	Integrated style	○
		Divided style	△
Site Works	Installation	Chiller installation, fabrication, setting of anchor bolt, water pipe and piping works, and cable and wiring works at site	×
		Supervisor for site installation	△
	Foundation	Chiller	×
	Commissioning	Supervisor for site commissioning	△
Others	Code and Standard	JIS (Japan Industrial Standard), JEC (Japan Electrotechnical Committee), JEM (The Standard of Japan Electrical Manufacture's Association)	○
		DOSH (Malaysia), MOM (Singapore)	△
		ASME ASTM	—
	Instantaneous restart		△
	Output of signal (Digital)	Signal of "Run Operation", "Failure", "Operation Mode Remote", "Alarm", "Inverter running", "Low Load"	○
		Signal of each failure; "Low Chilled Water Entering Temperature", "High Oil Temperature", "High Condenser Pressure", "Low Evaporator Pressure", "Sensor Error", etc.	△
	Output of signal (Analog)	Signal of "Condenser Pressure", "Evaporator Pressure", "Chilled Water Leaving Temperature", "Chilled Water Entering Temperature"	△
	Drawings	Specification and scope of supply	○
		General arrangement (including foundation)	○
		Outline of control panel	○
Application		Sequence diagram	○
	Documents	Operation and maintenance manual	○
		Performance test report	○
		Ice thermal storage	—

*MTH: Mitsubishi Heavy Industries Thermal Systems, Ltd.

ISO 9001



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

MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD. is an ISO (International Organization for Standardization) 9001 quality management system certified organization.

ISO 14001



Certificate number: YKA4003622/3
Date of certificate: April 6, 2006

TAKASAGO WORKS, MITSUBISHI HEAVY INDUSTRIES THERMAL SYSTEMS, LTD. is an ISO (International Organization for Standardization) 14001 environmental management system certified organization.

www.mhi-mth.co.jp/en/



(Wholly-owned subsidiary of MITSUBISHI HEAVY INDUSTRIES, LTD.)

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· Because of our policy of continuous improvement, we reserve right to make changes in all specifications without notice.
· Option items are included in the pictures of chiller. · Unauthorized reproduction is prohibited.

MTHSS002, 1610 (1.0) R6



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