MHI CHILLER

Two Stage Centrifugal Chiller

High Efficiency Type

AART series

Capacity range: 809 - 17,581 kW [230 - 5,000 RT]

MITSUBISHI HEAVY INDUSTRIES, LTD.

Our Technologies, Your Tomorrow

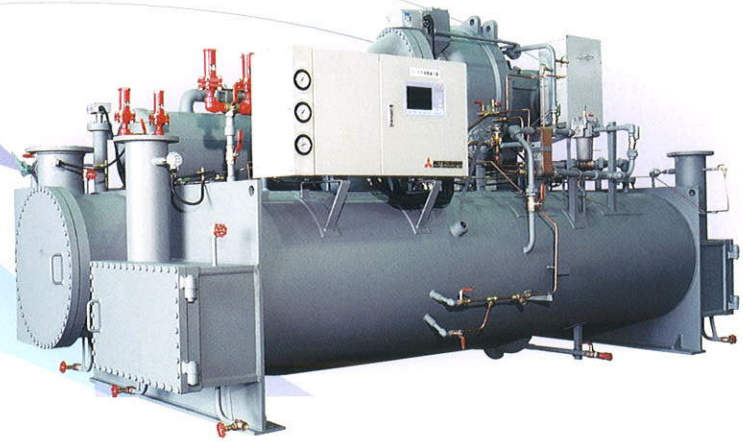
Two Stage Centrifugal Chiller

AART series

<230 RT ~ 5,000 RT>

Save Cost & CO_2

Extremely High Efficiency



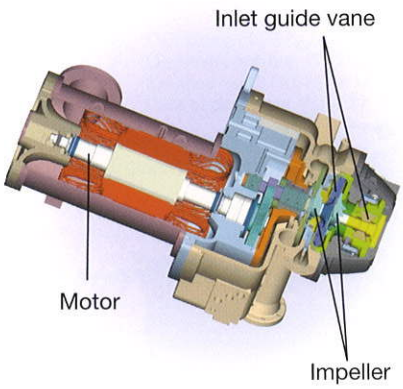
COP	IPLV
6.4*	7.9

*JIS STANDARD
Chilled Water Temperature: 12°C/7°C
AART-145, 180, 200

The advanced technologies are used to achieve the low energy consumption and preserve the environment.

FEATURES

COP 6.4



HFC-134a Chlorine free refrigerant

Ozone Depletion Potential (ODP) is zero.

IPLV 7.9 (COP)
Further improvement of extremely high part load performance

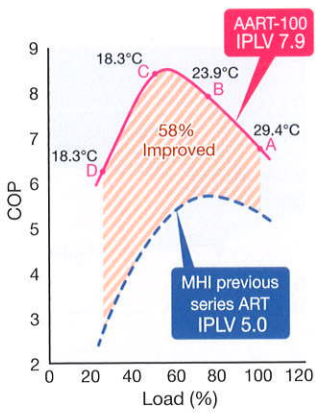
58% higher than previous series of 15 years ago

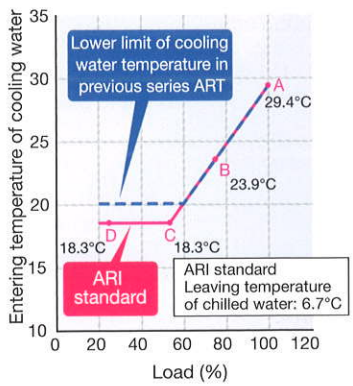
Realization of further high efficiency and stable operation at low load by improvement of capacity control mechanism (inlet guide vane) of compressor

IPLV

IPLV is based standards of ARI and is part load rating study of load variation of annual operation. It should be measured under load proportion near practical conditions and condition of cooling water temperature. (ARI Standard 550/590-2003)

IPLV: Integrated Part Load Value
ARI: Air-Conditioning 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

MICROCOMPUTER CONTROL PANEL

More improved microcomputer control panel NEW

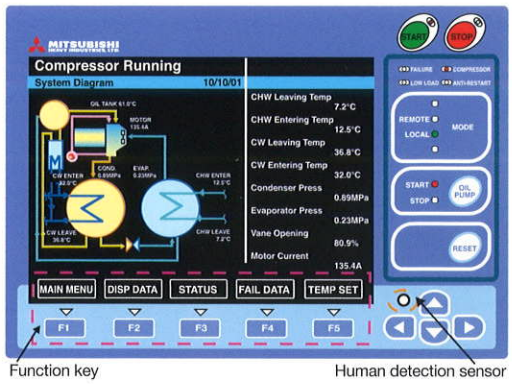
10.4 inch Display — Big
Digital Display — Clear
Quick Response — Smooth
Save Energy

Display (liquid crystal) with automatic lighting-up function

Relight-up by human detection sensor without touching panel

For environmental standards

Realize lead-free substrate Match RoHS electric environmental regulation



Function key — Human detection sensor

Followings are displayed

- Operation data - Setup schedule operation condition - Failure data
- Real time trend (max. 5 operational data and max. 3 situational data)

Other Features

- **Expansion of Entering Temperature of Cooling Water**
  - Applicable down to 12°C
- **Advanced Control Function (Option)**
  - Meeting with BAS (Building Automation System) requirement. Our chiller is compatible with LonWorks® networks.
    * LonWorks® is the registered trademark of Echelon company in the United States of America and other countries.
  - Control a number of chillers (max. 4 chillers) with control panel of master chiller.
    Note: Meeting with BAS and controlling several chillers are not available simultaneously.
  - Automatic restart correspondence shall be to instantaneous voltage drop.
- **Reliability**
  - Stability of lubrication oil level and oil temperature improved with oil-cooler for refrigerant and high efficient oil recovering system.
  - Chillers are produced at our factory certificated authentication ISO 9001 and 14001.
- **Maintenance**
  - Overhaul interval is 50,000 hour in operating time or 7 years in elapsed time, which comes earlier.
  - Water box with hinge is provided as standard scope of supply for easier maintenance and inspection.
    Please contact with MHI about overhaul.
    The above overhaul time and operation time is for reference only.
- **Application to Low Brine Temperature Cooling**
  - Applicable for industrial use and ice storage system by adopting two stage compressor.

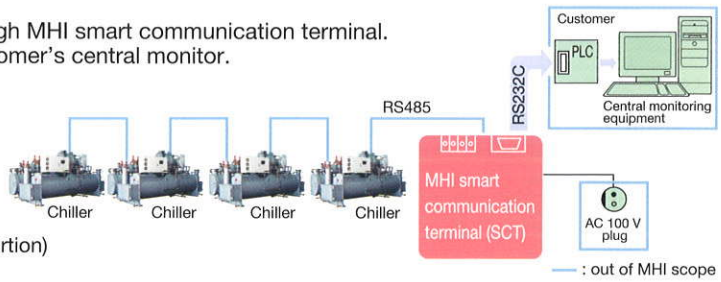
OPTIONS

Central Monitoring Program

Connect to customer's central monitoring equipment

Features

1) Output operation data at customer's central monitor through MHI smart communication terminal.
2) Operation data can be used for the following items at customer's central monitor.
   - Trend
   - Operation status of chillers
   - Daily report and monthly report etc.
3) Total connection/transmission distance of RS485 with max. 500 m



Feature of MHI specialized communication tool

- Compact size (W230 x H50 x D244 mm: excluding projection portion)
- Connected to AC 100 V plug
- High speed data processing by 32 bit CPU

Remote Monitoring Program

24-hour and 365-day remote monitoring program is suitable for maintaining the performance and function of the centrifugal chiller.

Features

The remote monitoring program enables various performances.

1) Monitoring the operation status
2) Emergency response/treatment and report of the result
3) Submission of monthly report of data and customer's observation
4) Proposal for preventive maintenance and economical use based on the result of the analysis of accumulated data

Standard Ratings

ARI 550-98 Condition

Item (unit) \ Model		AART-	25	30	35	40	45	50	60	70	90	100	120	145	180	200
Cooling capacity		RT	250	300	355	425	500	590	710	830	1,000	1,200	1,420	1,700	1,800	2,130
		kW	879	1,055	1,248	1,494	1,758	2,075	2,497	2,919	3,516	4,220	4,993	5,978	6,329	7,490
Chilled water	Entering temperature	°C	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2	12.2
	Leaving temperature	°C	6.7													
	Flow rate	m³/h	136	163	193	231	272	321	387	452	544	653	773	926	980	1,160
	Pressure drop	kPa	101	106	101	107	112	106	54	55	52	54	57	55	81	89
	Piping connection / Nozzle size	inch	6	6	6	8	8	8	10	10	12	14	14	14	16	18
	No. of pass	–	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Cooling water	Entering temperature	°C	29.4													
	Leaving temperature	°C	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5	34.5
	Flow rate	m³/h	171	205	243	291	342	403	485	567	684	820	971	1,162	1,230	1,456
	Pressure drop	kPa	91	106	110	113	105	106	56	54	54	54	60	65	99	108
	Piping connection / Nozzle size	inch	6	6	8	8	8	10	10	12	12	14	14	14	16	18
	No. of pass	–	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Motor input		kW 50Hz	139	168	191	233	265	308	369	433	523	633	735	887	911	1,092
		kW 60Hz	143	173	194	236	268	312	373	437	527	638	743	895	920	1,102
Motor output		kW 50Hz	118	145	165	203	233	277	329	390	464	567	659	804	830	1,003
		kW 60Hz	118	146	166	203	233	278	329	390	464	567	660	804	831	1,004
COP		50Hz	6.32	6.28	6.54	6.41	6.63	6.74	6.77	6.74	6.72	6.67	6.79	6.74	6.95	6.86
		60Hz	6.15	6.10	6.43	6.33	6.56	6.65	6.69	6.68	6.67	6.61	6.72	6.68	6.88	6.80

Notes:
1. This specification is based on ARI 550-98 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. Unit capacity of over 2,000 RT up to 5,000 RT with dual compressors are available.
4. The above specification is not data of max. cooling capacity.
5. Power source applicable is as follows.

Voltage	Chiller capacity	
	Less than 700 RT (Does not include 700)	More than 700 RT
380 V	○	Option
3000 V/3300 V	○	
6000 V/6600 V	○	

Consult with MHI in case chiller capacity is more than 700 RT with 400 V class because it depends of motor output.

6. Design and specifications are subject to change without notice.

Dimensions and Weights

Chiller

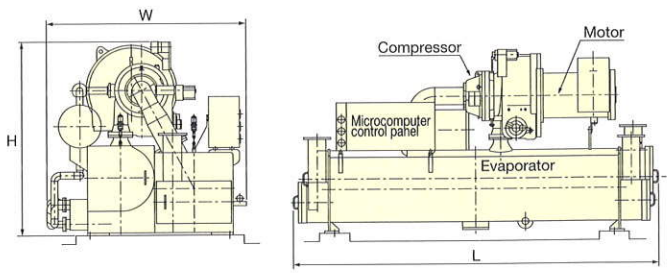
Item (unit) \ Model		AART-	25	30	35	40	45	50	60	70	90	100	120	145	180	200
Chiller	Dimension Length	m	4.5	4.5	4.6	4.6	4.6	4.7	5.4	5.5	5.5	5.5	5.6	5.6	6.4	6.4
	Dimension Width	m	2.2	2.3	2.3	2.4	2.5	2.7	2.8	2.9	3.3	3.5	3.5	3.5	3.8	4.2
	Dimension Height	m	2.2	2.2	2.3	2.4	2.4	2.5	2.6	2.6	2.9	2.9	3.1	3.2	3.5	3.6
	Shipping weight	t	8.4	8.6	9.6	10.1	11.1	11.9	15.2	15.9	19.6	21.8	24.7	26.9	32.2	34.5

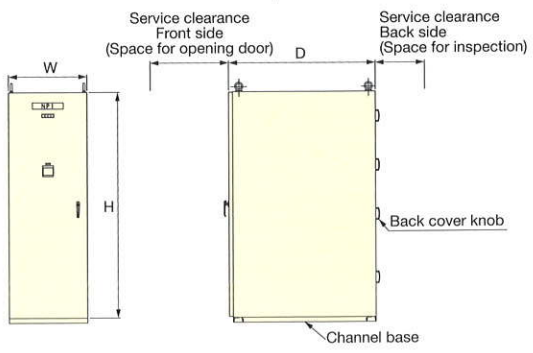
Starter Panel

Voltage			400 V class	3 kV class	6 kV class
Dimensions	Width (W)	m	0.8	0.8	
	Depth (D)	m	1.2	1.5	
	Height (H)	m	2.35	2.35	
Shipping weight		t	0.6	0.8	
Service clearance	Front side	m	0.8	0.8	
	Back side	m	0.5	0.5	
Starting method		—	Star-delta	Reactor (65% TAP)*	

*Auto-transformer (65% TAP) starting as option

Notes:
1. Refer to MHI drawing "MACHINE LAYOUT" and "STARTER PANEL OUTLINE" at installation.
2. The above shipping weight of chiller is weight of 1 piece shipment.
3. Shipping weight of starter panel is approximate weight of standard specification.
4. Design and specifications are subject to change without notice.





Scope of Supply

○: Standard scope of supply　　△: To be supplied as option
×: Not within scope of work of supply　　—: Not available

Item		Specifications	
Equipment	Chiller Assembly	Indoor type (including control panel)	○
		Outdoor type (including control panel)	△
	Compressor	Hermetic, two-stage, 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	△
	Evaporator & Condenser	Japanese High Pressure Gas Safety Law and JIS	○
		Horizontal shell and tube type with copper tube (3/4"OD) Design pressure of water box: 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 box: Over 1.0 MPa (G)	△
	Safety Device	High condensing pressure, Low evaporating 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	○
	Microcomputer Control Panel	Mounted on heat exchanger, indoor non hazardous type with color liquid crystal display, lamps and control switches on microcomputer operation board *Prepare 200/220 V three-phase as an auxiliary power. In case of other voltage, consult with MHI.	○
	Starter Panel	Self standing, indoor, non hazardous type with a multi meter	○
		Self standing outdoor, hazardous type with a multi meter	△
		Star-delta starter of low voltage, reactor starter of high voltage	○
		Auto-transformer starter Line starter	△
		Power fuse medium voltage	△
		Capacitor for power factor improvement	△
		380 V power for compressor motor (less than 710 kW)	○
		10, 11 kV/50 Hz power for compressor motor	△
		Tie transformer for control power (ex: 400/200 V)	△
	Refrigerant	HFC134a in pressure bottles 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, Special insulation tape of compressor motor terminal, Flow switch of chilled water and cooling water	○
		Foundation bolt	△
		Spring pad for vibration isolating	△
		Thermometer for chilled water and cooling water	△
		Charging hose for refrigerant	△
		General tool and tool box	△
	Spare Parts	An oil filter element, A filter drier, A fuse for control panel	○
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	△
Painting	Chiller	Rust preventing paint (two coat)	○
		Finish coat	△
	Control Panel	Rust preventing and finish coat (color: Munsel 5Y7/1)	○
	Starter Panel	Rust preventing and finish coat (color: Munsel 5Y7/1)	○
Insulation of Chiller		Not provided (Purchaser's scope. Instruction for insulation to be submitted.) Please follow our INSULATION PROCEDURE.	—
		Polystylen form covered by Colored steel sheet 0.3 mm	△
Delivery		FOB Kobe port in Japan	○
		Ex warehouse at Kobe port in Japan (on truck)	△
		CIF port near Site	△
Shipping Style of Chiller		Integrated style	○
		Divided style	△
Site Works	Foundation	Customer's scope	×
	Installation	Chiller installation, setting of anchor bolt, water pipe and piping works, and cable and wiring works at site	△
		Supervisor for site installation	×
	Commissioning	Supervisor for site commissioning	△
Others	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	100-20%, Controlling compressor inlet guide vane (1st & 2nd stage) and hot gas bypass valve	○
		100-10%, Larger hot gas bypass valve than standard	△
	Control Interface	Interface and communication to Building Control System (Available only for LONWORKS®)	△
	Drawings	Specification and scope of supply	○
		General arrangement (including foundation)	○
		Outline of control panel	○
		Sequence diagram	○
	Documents	Operation and maintenance instruction	○
		Test and inspection record	△

Two Stage Centrifugal Chiller

AART series

ISO 9001

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

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

PED

Certificate: PED97/23/EC Module H1
Certificate number: 01 202J/Q-010001
Certified by: TÜV CERT (Germany)
Date of certificate: April 22, 2001

Our Air-Conditioning & Refrigeration Systems Headquarters 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 Headquarters is an ISO (International Organization for Standardization) 14001 environmental management system certified organization.

DJK

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