MHI CHILLER

Two Stage
Centrifugal Chiller

AART

series

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

MITSUBISHI
HEAVY INDUSTRIES, LTD.

HFC-134a HIGH EFFICIENT TYPE
MITSUBISHI HEAVY INDUSTRIES TWO STAGE CENTRIFUGAL CHILLER
AART Series from 809 kW to 17,581 kW (230 to

COP **6.4***

Extremely High Efficiency Chiller

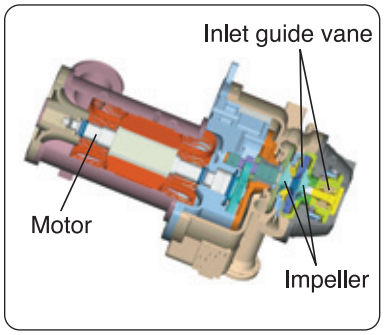
The advanced technologies are used to achieve the low energy consumption and preserve the environment.

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

FEATURES

1 COP 6.4

Another 5% higher COP than our high energy efficient type NART series centrifugal chillers.



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

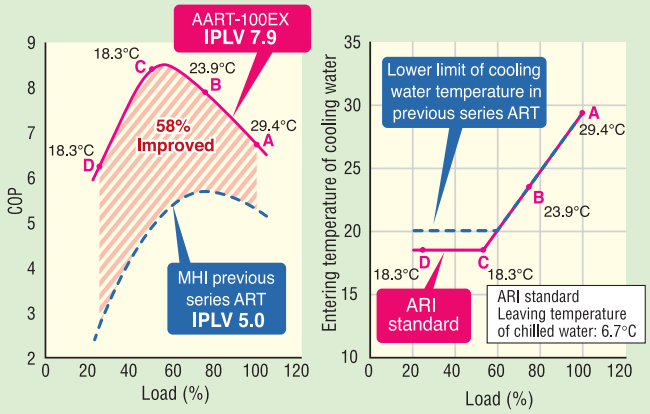
58% higher than previous ART of 15 years ago

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

3 HFC-134a Chlorine free refrigerant

Ozone Depletion Potential (ODP) is zero.

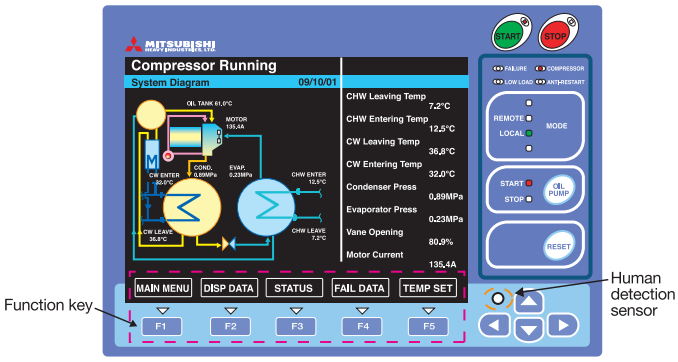
4 More improved microcomputer control panel NEW

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

Operation board of microcomputer control panel



Followings are displayed

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

● ***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.*
- *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.*

5,000 RT)

Standard Ratings

●Chilled Water Leaving Temperature 5°C

Item (unit) \ Model		AART-	25EX	30EX	35EX	40EX	45EX	50EX	60EX	70EX	90EX	100EX	120EX	145EX	180EX	200EX
Cooling capacity		RT	215	260	310	380	430	530	600	750	850	1,050	1,300	1,500	1,800	2,000
		kW	756	914	1,090	1,336	1,512	1,864	2,110	2,637	2,989	3,692	4,571	5,274	6,329	7,033
Chilled water	Entering temperature	°C	10	10	10	10	10	10	10	10	10	10	10	10	10	10
	Flow rate	m³/h	130	157	187	229	259	319	362	452	512	633	784	904	1,085	1,205
	Pressure drop	kPa	94	100	96	107	105	106	62	55	61	52	59	53	98	97
	Piping connection / Nozzle size	A	150	150	150	200	200	200	250	250	300	350	350	350	400	450
	No. of pass	–	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Cooling water	Entering/Leaving temperature	°C	Entering 32°C / Leaving 37°C													
	Flow rate	m³/h	156	188	223	273	309	379	430	535	609	751	929	1,071	1,282	1,426
	Pressure drop	kPa	77	90	95	101	87	94	62	61	61	62	55	55	106	104
	Piping connection / Nozzle size	A	150	150	200	200	200	250	250	300	300	350	350	350	400	450
	No. of pass	–	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Motor input		kW 50Hz	141	167	195	237	268	318	368	447	523	634	788	896	1,066	1,182
		kW 60Hz	145	170	199	240	271	322	371	451	530	638	797	903	1,076	1,195
Motor output		kW 50Hz	120	143	169	206	235	286	327	404	464	567	709	811	976	1,088
		kW 60Hz	120	144	170	206	235	286	327	404	466	567	711	811	977	1,090
COP		50Hz	5.36	5.47	5.59	5.64	5.64	5.86	5.73	5.90	5.71	5.82	5.80	5.89	5.94	5.95
		60Hz	5.21	5.38	5.48	5.57	5.58	5.79	5.69	5.85	5.64	5.79	5.74	5.84	5.88	5.88

●Chilled Water Leaving Temperature 7°C

Item (unit) \ Model		AART-	25EX	30EX	35EX	40EX	45EX	50EX	60EX	70EX	90EX	100EX	120EX	145EX	180EX	200EX
Cooling capacity		RT	230	260	320	370	450	530	630	750	900	1,000	1,350	1,450	1,800	2,000
		kW	809	914	1,125	1,301	1,582	1,864	2,215	2,637	3,165	3,516	4,747	5,099	6,329	7,033
Chilled water	Entering temperature	°C	12	12	12	12	12	12	12	12	12	12	12	12	12	12
	Flow rate	m³/h	139	157	193	223	272	320	380	453	543	603	815	875	1,086	1,207
	Pressure drop	kPa	104	99	100	101	112	105	52	55	52	65	62	50	97	96
	Piping connection / Nozzle size	A	150	150	150	200	200	200	250	250	300	350	350	350	400	450
	No. of pass	–	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Cooling water	Entering/Leaving temperature	°C	Entering 32°C / Leaving 37°C													
	Flow rate	m³/h	165	186	228	263	319	375	446	530	638	707	955	1,024	1,268	1,410
	Pressure drop	kPa	86	88	99	94	93	92	60	60	60	64	58	51	104	101
	Piping connection / Nozzle size	A	150	150	200	200	200	250	250	300	300	350	350	350	400	450
	No. of pass	–	3	3	3	3	3	3	2	2	2	2	2	2	2	2
Motor input		kW 50Hz	139	154	187	212	260	294	358	415	513	559	759	802	987	1,092
		kW 60Hz	143	158	191	215	263	298	361	420	519	564	768	809	997	1,102
Motor output		kW 50Hz	118	132	162	185	228	264	319	373	455	498	682	723	903	1,003
		kW 60Hz	119	133	163	185	228	264	318	374	456	498	684	723	904	1,004
COP		50Hz	5.82	5.94	6.02	6.14	6.09	6.34	6.19	6.35	6.17	6.29	6.25	6.36	6.41	6.44
		60Hz	5.66	5.79	5.89	6.05	6.02	6.25	6.14	6.28	6.10	6.23	6.18	6.30	6.35	6.38

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. *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.

Contact MHI for over 2,000 RT chiller.

●ARI 550-98 Condition

Item (unit) \ Model		AART-	25EX	30EX	35EX	40EX	45EX	50EX	60EX	70EX	90EX	100EX	120EX	145EX	180EX	200EX
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.*

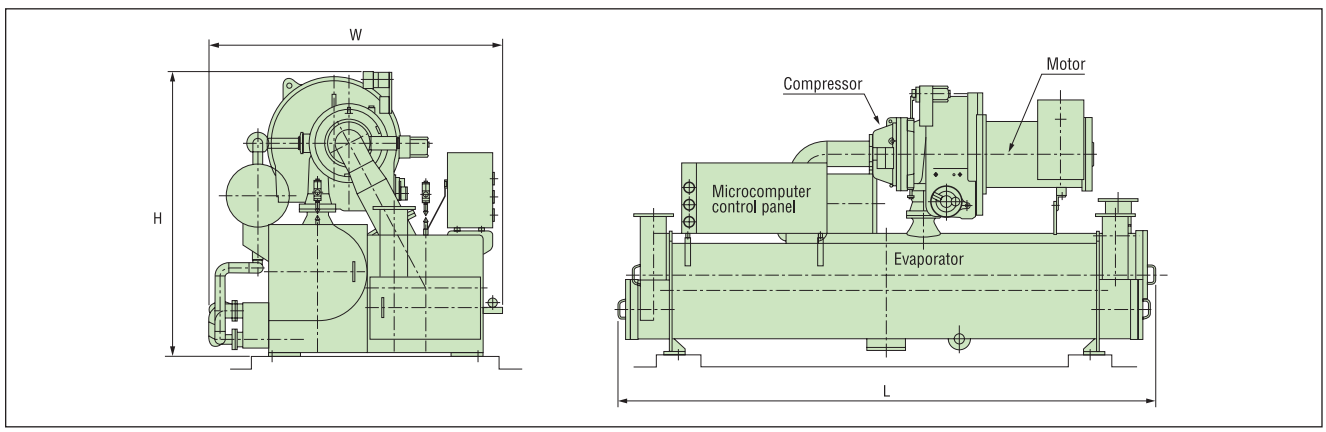
5. Power source applicable is as follows.

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.

■Dimensions and Weights

Item (unit) \ Model			AART-	25EX	30EX	35EX	40EX	45EX	50EX	60EX	70EX	90EX	100EX	120EX	145EX	180EX	200EX
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
		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
		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



5,000 RT)

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 volt meter	○
		Self standing outdoor, hazardous type with a volt meter	△
		Star delta starter of low voltage, reactor starter of high voltage	○
		Auto-transformer starter Line starter	△
		Ammeter	△
		Integrating watt meter	△
		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	△

AART series 809 - 17,581 kW [230 - 5,000 RT]

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

MITSUBISHI HEAVY INDUSTRIES, LTD.

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

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