

MHI CHILLER

Two Stage  
Centrifugal Liquid Chiller



AART  
series



Capacity range: 756 - 14,066 kW [215 - 4,000 RT]

# HFC-134a HIGH EFFICIENT TYPE

# MITSUBISHI HEAVY INDUSTRIES TWO STAGE CENTRIFUGAL LIQUID CHILLER

# AART Series from 756 kW to 14,066 kW (215 to

**COP**  
**6.4\***

## Extremely High Efficiency Chiller

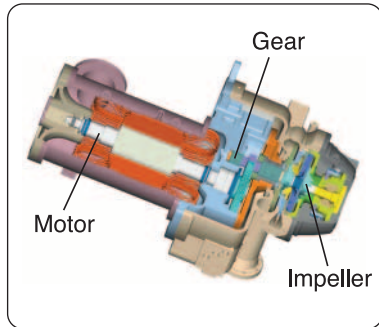
The advanced technologies are used to achieve the low energy consumption and preserve the environment.

\*JIS STANDARD Chilled Water Temperature: 12°C/7°C **NEW** 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

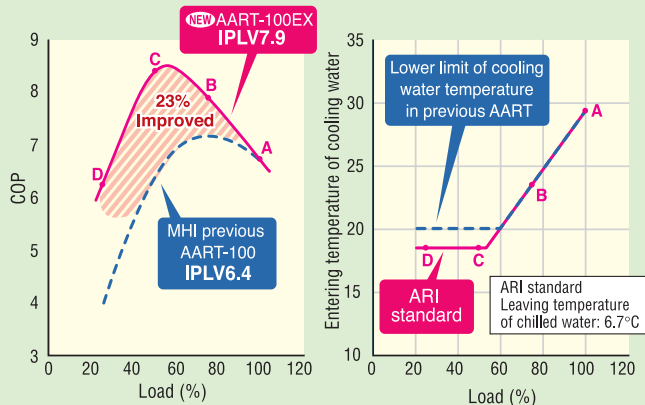
23% higher than previous AART

Realization of further high efficiency and stable operation at low load by improvement of capacity control mechanism 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\*)

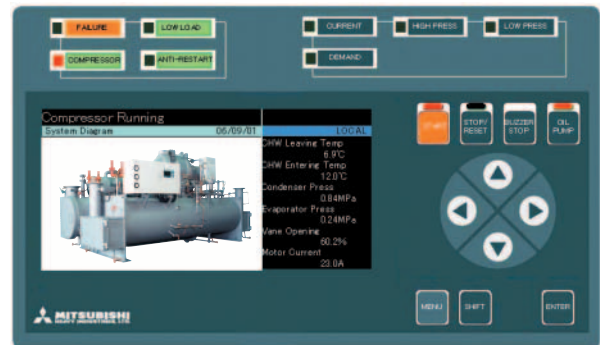
Leaving temperature of chilled water: 6.7°C \*: Entering temperature of cooling water

### 4 Improved microcomputer control panel

Improved control panel is able to control chiller operation precisely with display easily to read.

- TFT color liquid crystal display with 32,000 colors, width 7 inch (8.9 cm by 15.6 cm) is easy to see and easy to operate.
- Improved microcomputer control achieves energy saving operation.
- Maintenance cost can be reduced with various function including programmed weekly operation, function to avoid irregular stop.

#### Operation board of microcomputer control panel



#### Followings are displayed

- Operation data
- Selected operating data
- Failure records
- Selected programmed weekly operation mode

#### 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 (maximum 4 chillers) with control panel of master chiller.

Note: Meeting with BAS and controlling several chillers are not available simultaneously.

#### 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.

#### Application to Low Brine Temperature Cooling

- Applicable for industrial use and ice storage system by adopting two stage compressor.

### 3 HFC-134a Chlorine free refrigerant

Ozone Depletion Potential (ODP) is zero.

# 4,000 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 F	○
	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	100-20%, Controlling compressor inlet guide vane, diffuser width of second stage and hot gas bypass valve	○
		100-10%, Larger hot gas bypass valve than standard	△
	Heat Exchanger	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	○
		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)	△
	Safety Device	Design pressure of water box: Over than 1.0 MPa	△
		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	○
	Microcomputer Control Panel	Mounted on heat exchanger, indoor non hazardous type with color liquid crystal display, lamps and control switches on microcomputer operation board *Please prepare 200/220 V three-phase as an auxiliary power. In case of other voltage, please 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	○
		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)	△	
	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 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, Chemical anchor bolt, Special insulation tape of compressor motor terminal, Flow switch of chilled water and cooling water	○	
	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	Factory Performance Test	To be tested in accordance with JIS B8621	○
	Witness Test	To be tested in accordance with ARI 550/590	△
	Owner and/or representative witness test in factory		△
Painting	Chiller	Rust preventing paint (one coat)	○
		Finish coat	△
	Control Panel 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.)		○
	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	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 and starter panel	×
	Commissioning	Supervisor for site commissioning	△
Others	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	○
	Documents	Sequence diagram	○
		Operation and maintenance instruction	○
		Test and inspection record	△

# 4,000 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	905	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	155	187	223	273	307	378	429	535	608	750	929	1,070	1,280	1,422
	Pressure drop	kPa	77	89	94	101	86	94	62	61	61	62	55	55	106	103
	Piping connection / Nozzle size	A	150	200	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	165	197	239	261	318	363	447	520	633	787	895	1,051	1,169
		60Hz	143	169	201	242	265	321	367	451	527	638	797	903	1,059	1,180
Motor output	kW	50Hz	118	142	171	208	233	286	325	404	461	566	708	810	974	1,086
		60Hz	118	142	171	208	233	286	324	404	463	566	710	810	975	1,088
COP	50Hz	5.43	5.54	5.53	5.59	5.79	5.87	5.81	5.91	5.75	5.83	5.81	5.89	6.02	6.01	
	60Hz	5.29	5.41	5.44	5.51	5.71	5.80	5.76	5.85	5.67	5.79	5.74	5.84	5.97	5.96	
Max. cooling capacity	RT	240	280	310	400	450	550	820	850	1,180	1,250	1,500	1,800	1,880	2,150	

### 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	271	320	380	452	543	603	814	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	164	185	227	262	318	374	446	529	637	706	954	1,023	1,266	1,407
	Pressure drop	kPa	85	87	98	94	92	92	59	60	59	64	58	51	103	101
	Piping connection / Nozzle size	A	150	200	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	138	153	188	214	254	294	356	415	511	558	755	800	973	1,080
		60Hz	142	157	192	217	257	298	359	420	517	562	764	807	982	1,089
Motor output	kW	50Hz	117	131	163	187	227	264	317	373	453	497	679	721	900	1,002
		60Hz	118	132	163	187	227	264	317	374	455	496	681	721	901	1,003
COP	50Hz	5.86	5.96	5.98	6.07	6.23	6.34	6.23	6.35	6.19	6.31	6.28	6.37	6.50	6.51	
	60Hz	5.71	5.82	5.87	6.00	6.15	6.26	6.18	6.28	6.12	6.25	6.21	6.32	6.45	6.46	
Max. cooling capacity	RT	240	320	340	410	460	560	880	900	1,260	1,300	1,550	1,850	1,900	2,200	

Notes:

- Chilled/Cooling water fouling factor:  
0.000086 m²/KW (0.001 m²/h² C/kcal)
- Maximum working pressure (Chilled water and Cooling water):  
0.7 MPa (7 kg/cm²G)
- Unit capacity of 2,000 RT up to 4,000 RT  
with dual compressors are available.
- 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		○
6000 V/6600		○

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

## ●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	12.3	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	m <sup>3</sup> /h	136	163	193	231	272	321	387	452	544	653	773	926	980	1,160	
	Pressure drop	kPa	102	107	102	109	115	107	52	53	50	52	55	53	81	90	
	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	Leaving temperature	°C	29.4														
	Entering 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	34.5
	Flow rate	m <sup>3</sup> /h	171	205	243	291	342	403	485	567	684	820	971	1,162	1,230	1,456	
	Pressure drop	kPa	91	106	110	114	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	50Hz	139	170	194	237	267	311	371	435	525	637	738	892	910	1,087		
	60Hz	143	173	197	241	270	314	375	437	530	642	747	900	919	1,096		
Motor output	50Hz	118	147	168	207	234	279	331	392	467	571	663	809	834	1,009		
	60Hz	118	146	169	207	235	280	331	392	467	571	664	809	835	1,009		
COP	50Hz	6.32	6.20	6.44	6.30	6.59	6.68	6.73	6.70	6.70	6.62	6.76	6.70	6.95	6.89		
	60Hz	6.16	6.09	6.33	6.21	6.51	6.60	6.66	6.68	6.64	6.57	6.68	6.64	6.89	6.83		
Max. cooling capacity	RT	270	320	365	430	505	620	820	920	1,180	1,300	1,600	1,850	1,970	2,220		

### Notes:

- This specification is based on ARI 500-98 conditions for temperature and fouling factor of chilled water and cooling water.
- Maximum working pressure (Chilled water and Cooling water): 0.7 MPa (7 kgf/cm<sup>2</sup>G)
- Unit capacity of 2,000 RT up to 4,000 RT with dual compressors are available.
- The above specification is not data of max. cooling capacity.

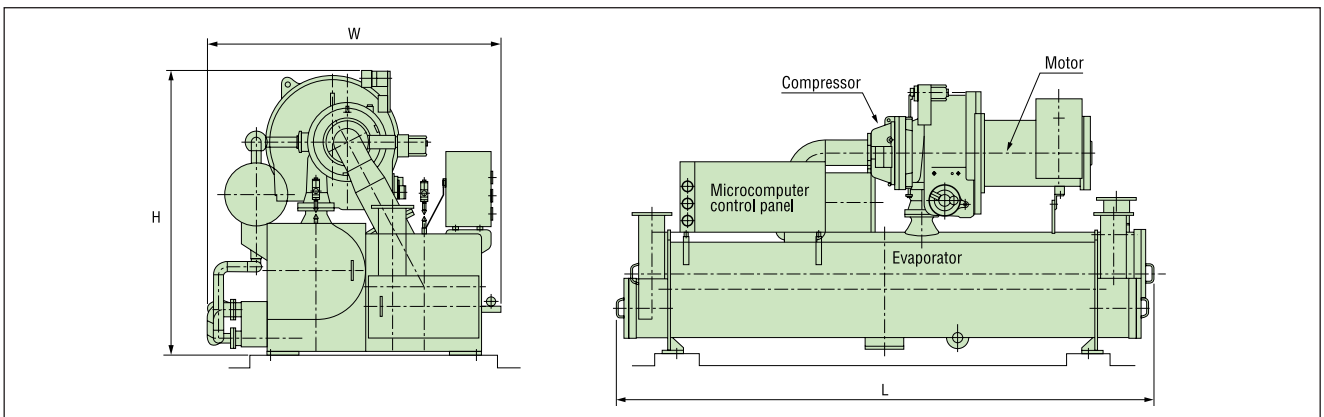
### 5. Power source applicable is as follows.

Voltage	Chiller capacity	
	Less than 700 RT (Does not include 700)	More than 700 RT
380 V	<input type="radio"/>	Option
3000 V/3300	<input type="radio"/>	
6000 V/6600	<input type="radio"/>	

Please 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	5.6	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
	Machinery 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	



# AART series 756 - 14,066 kW [215 - 4,000 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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Because of our policy of continuous improvement, we reserve right to make changes in all specifications without notice.

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