SARMAFARIN

Air-Cooled Liquid Screw Chillers

AEROACOUSTIC

ISO 9001

Certificate No.: 9190.C308

FORM SSI - 30XD (1404)

30XD

060-640

60 to 640 Nominal Tons
(211 to 2250 Nominal kWR)

Features and benefits:

SarmaAfarin 30XD chillers were designed to meet the efficiency demands of today and the future. It provides premium air-cooled chiller packages for contractors, consulting engineers, and building owners.

- Positive displacement, twin screw compressor.
- Chlorine free R-134a HFC Refrigerant
- Quiet axial condenser fan system
- Self-management and smart control and monitor.
- Intelligence and connectivity (coupled PLC and BMS)
- Electronic expansion valve
- Full load EER and COP up to10.9/3.8.
- The Integrated Part Load Value (IPLV) up to 20.3
- Rated according to AHRI Standard 550/590 and 551/591
- Integrated with building management system(BMS)
- Superior reliability and versatility

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30XD liquid Chillers

The 30XD liquid chillers are a premium solution for industrial and commercial applications that require optimum performance and maximum quality. They are designed to meet current and future requirements in terms of energy efficiency and operating sound levels, utilizing the best technologies available today.

The chillers feature twin-rotor screw compressors with a variable capacity valve, low noise generation fans, a PLC-based control system, and an electronic expansion valve. They offer very economical operation with extremely high full load and part load energy efficiency. The new twin-rotor screw compressor is equipped with a high-efficiency motor and a variable capacity slider valve that permits exact matching of the cooling capacity to the load.

Optimizing fan speed based on cooling load results in energy savings and improved efficiency. The Electronic Expansion Valve (EEV) provides precise control of refrigerant flow, preventing flooding or overheating problems.

Atmospheric Coil Protection

Utilizing round tube plate fin (RTPF) coils for refrigerant heat removal, the X-side of the coil interfaces with atmospheric air. We offer a range of coating and protection options, including Al/Cu, Al/Cu Coat, Cu/Cu, and Cu/Cu Coat. These options boast enhanced corrosion resistance, making them ideal for industrial, rural, urban, and marine/coastal environments.

In the context of round tube plate fin condenser coils, galvanic corrosion, a localized form of corrosion, occurs when dissimilar metals are in contact within an electrolytic environment. Standard RTPF coils feature copper tubes mechanically bonded to aluminum fins, ensuring high thermal efficiency through direct metallic contact. Galvanic corrosion initiates at the copper/aluminum interface, leading to aluminum fin deterioration and reduced thermal performance. Aluminum oxide deposits, a byproduct, hinder air flow through the coil, further diminishing performance.

Sound-Sensitive Applications

Great performance is delivered in a low sound unit that will be quiet enough for any application including hospitals, schools and other sites located in residential neighborhoods. The 30XD chiller's fan has a quiet design. In part load operation, such as cooler weather or nighttime duty, the fans on most units operate at lower speed. This results in even quieter operation.

The CSH compressor series offer an oil separator integrated into the compressor casing, which eliminates the pulsation and turbulence at the discharge that results in attenuation of the noise carried with flow. Suction and discharge piping with flexible connections are considered to prevent noise and vibration transmission.

Sarmaafarin offers a sound enclosure option for its 30XD chillers. This enclosure is designed to reduce the noise generated by the chiller compressor, making it ideal for applications where noise reduction is a critical factor.

The Sarmaafarin sound enclosure is made of heavy-duty galvanized steel and is lined with enhanced sound-absorbing material. It features a double-door design for easy access for maintenance and service. The enclosure is also equipped with ventilation fans to ensure that the chiller operates properly. This feature can reduce the noise generated noticeably.

The fan's blades are made using a unique design that enables them to withstand high condensing temperatures. This design helps to reduce noise and improve efficiency. The fan's housing and impeller result in optimized airflow and reduced turbulence.

30XD benefits from an open angle of the V-shape which helps reduce noise by allowing the air to flow more freely across the coil and preventing it from creating turbulence. This configuration can reduce noise by up to 5 dBA compared to a traditional flat condenser coil. Furthermore, mounting fans on V-shape provides a rigid configuration that helps prevent noise by keeping the fan in place and preventing it from vibrating.

Sarmaafarin customizes axial fans with diffusers to reduce sound levels by up to 7.2 dB(A), lower energy consumption by up to 27%, and increase air performance by up to 9% with comparable energy consumption.

Power and Control Enclosure

SarmaAfarin screw chillers are designed to withstand harsh environments and climates. They are equipped with two separate enclosures, one for power and the other for control. The body is made of cold rolled steel, which can withstand solid intrusions such as dust and liquids such as splashing water.

Each motor or power demand in the power box has its own line, which ensures safe and reliable operation during different situations and conditions. Additionally, the enclosure boasts the capability to regulate both temperature and air circulation effectively.

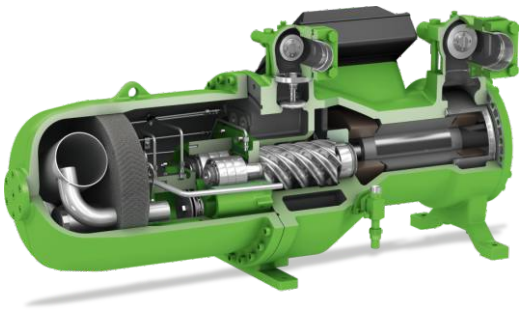
The control box contains different control apparatuses, including a factory-programmed microprocessor, also known as a programmable logic controller (PLC). The PLC controller is an advanced numeric control system that combines intelligence with great operating simplicity. It constantly monitors all machine parameters and precisely manages the operation of compressors, electronic expansion devices, fans, and evaporator water temperatures for optimum energy efficiency. The PLC is a logic controller that limits the chiller to operate within its envelope range. The condenser fans, compressor, and metering devices receive logical commands from the controller to run in sequence based on a logic flow chart.

To prevent disruption, there are some limitations and safety precautions that are considered. Due to changes in outdoor air temperature and cooling load, all parameters are watched by the PLC. Energy management is accomplished through the use of the PLC controller, which ensures optimum energy efficiency.

- Leaving or entering cooler water temperature controls chiller on/off.
- Continuously control compressor capacity to match required load
- Chiller PLC system can be integrated with building management system (BMS)
- User interface with large screen for intuitive access to the operating parameters. The information is in clear text.

Benefits of Screw Compressors

Compact Screws are of two shaft rotary displacement design with newly-developed profile geometry. The main parts of these compressors are the two rotors which are fitted into a closed housing. The rotors are precisely located at both ends in rolling contact bearings (radial and axial) which, in conjunction with the generously sized oil supply chambers, provides optimum emergency running characteristics. Owing to the specific design this type of compressor does not require any working valves. To protect against reverse running when the compressor is switched off (expansion operation) a check valve is incorporated in the discharge chamber (this valve does not however replace any check valves).



Screw Compressor cross section

A primary benefit is that the compressors are started slowly, requiring more than six minutes to go from a stop to full-speed condition. This reduces vibration and compressor stresses for longer life. If liquid refrigerant is present at the compressor intake, the slow acceleration easily moves the liquid out without damaging the compressor.

Fully equipped

- Capacity control/start unloading
- Discharge shut-off valve
- Suction flange with brazing/welding bushing
- Check valve in discharge gas outlet
- Insertion type oil heater with sleeve
- Oil sight glass
- Oil service valve
- Suction gas filter with large surface area and fine mesh
- Internal pressure relief valve, an internal pressure relief valve is fitted as burst protection.
- Less vibration
- Fewer moving parts

Factory Testing

SarmaAfarin's applied screw chillers undergo rigorous factory testing to ensure optimal performance and minimize field start-up issues. Operating and safety controls are meticulously checked for correct settings and functionality, contributing to the adherence of critical construction schedules.

Before shipment, all units undergo a comprehensive run test in the factory. A systematic factory operation test is conducted, including a Quick-test function for step-by-step verification of instruments, expansion devices, fans, and compressors.

30XD chillers undergo a thorough functional test at the factory, utilizing a computer-based program to check

sensors, wiring, electrical components, microprocessor function, communication capability, expansion valve performance, and fans. This meticulous testing ensures that the chiller arrives at the job site fully tested and prepared for operation.

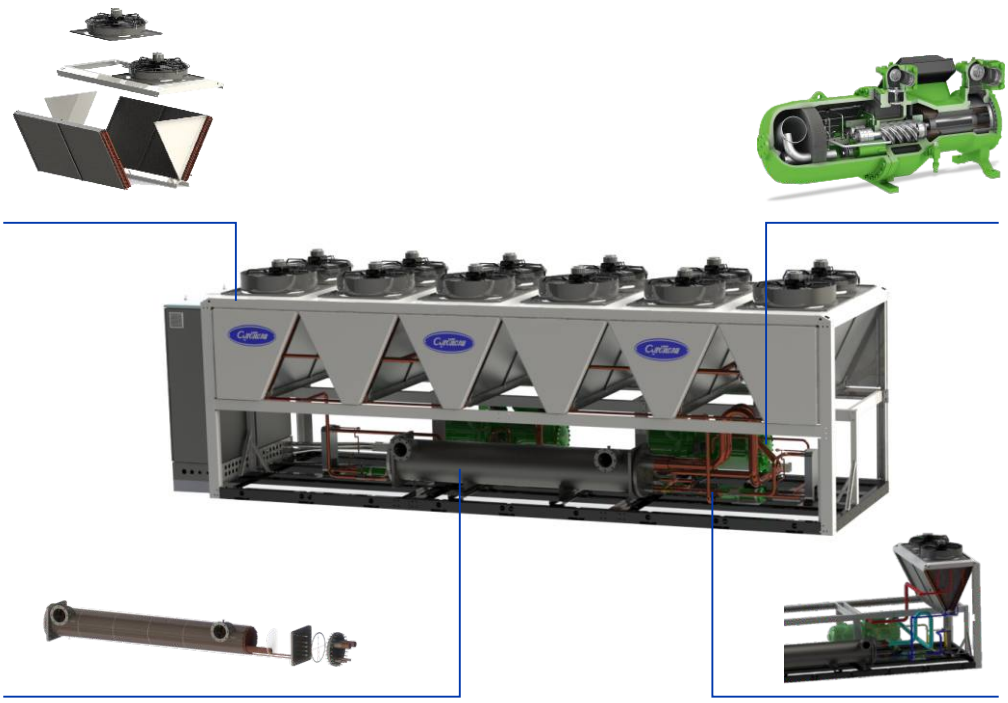
Indeed, the chiller is designed, manufactured, and tested in a facility with a quality assurance system certified ISO 9001, ensuring a commitment to high standards throughout the entire process.

Environmental Care

30XD chillers prioritize environmental care through their design and features. Utilizing the environmentally friendly R134a refrigerant from the HFC group, these chillers boast a leak-tight refrigerant circuit, reducing leaks by eliminating on-site refrigerant connections.

The verification of pressure transducers and temperature sensors is accomplished without transferring refrigerant charge. Maintenance is simplified with the inclusion of a discharge shut-off valve and liquid line service valve.

Notably, these chillers are designed to lower environmental impact by employing a F-Gas generation, low global warming potential (GWP) refrigerant, coupled with high-efficiency operation. The use of R134a ensures zero ozone depletion potential (ODP), and the overall design minimizes the quantity of refrigerant employed, addressing both direct and indirect environmental impacts on the environment.



Exploaded view of chiller

OPTIONS AND ACCESSORIES

Options	Description	Advantageous
Refrigerants	R134a / R407C	Easy to choose between different refrigerant.
Coils, Coatings and Protection	Al / Cu Al / Cu Coat Cu / Cu Cu / Cu Coat	Improved corrosion resistance, recommended for industrial and severe marine environments
Ambient Temperature Range	Standard and Tropical Climates S: up to 45 °C T: 45 to 52 °C	Easy to choose suitable chiller for various temperature situation
Compressor Sound box	A box for reducing the noise of compressor.	-Removable door for access to the compressor Reducing noise in place where sound is a major issue.
Fan Diffuser	Air Diffuser for Fans	Increasing fan efficiency with higher pressure on fan impeller Reducing noise emission for noise sensitive applications.
Corrosion protection	Special coating on fins of condenser coil	Improved corrosion resistance, recommended for industrial, rural and severe marine environments
Brine	Mixture of water and EG	Outlet liquid temperature down to -10°C
Accumulator	Preventing refrigerant liquid flooding problem to compressor.	Safe and reliable chiller operation
Winter toolkit	Applicable for low ambient temperatures	Safe and reliable chiller operation in cold climate.
Wind Baffle	Protection against intense wind	Protection against cold wind blast during winter season
Monitoring applications	Local and remote	Integrated with building management system(BMS)

Model number nomenclature

30 XD 280 B 1 3 A S

Products Series
Chiller

Chiller Type
XD: Air Cooled Screw

Nominal Capacity
60 80 100 120 140 160
180 200 220 235 250 265
280 300 320 340 360 390
420 450 480 520 560 600
640

Compressor Brand
B: BITZER
H: Alternative

Climate
S: Standard
T: Tropical

Fin material
A: Aluminum
B: Al Coated
C: Cu

Design Series

Refrigerant Type
1: R134a
4: R407C

ELECTRICAL DATA

When designing electrical equipment, we carefully consider the IEC 60204-1 standards, which cover machine safety and general regulations for electrical machine components. All 30XD units are protected according to IP54 standards.

30XD - R134a (380V±10% ~50Hz - 3ph)

30XD Model (S / T)‡		60	80	100	120	140	160	180	200	220	235	250	265
Panel A *													
Compressor 1 :													
Pmax	kW	65	88	51	65	78	88	96	110	110	120	120	131
MOC	A	103	151	90	103	130	151	163	191	191	226	226	243
LRA	A	280 Δ/ΔΔ	414 Δ/ΔΔ	229 Δ/ΔΔ	280 Δ/ΔΔ	305 Δ/ΔΔ	414 Δ/ΔΔ	462 Δ/ΔΔ	546 Δ/ΔΔ	546 Δ/ΔΔ	643 Δ/ΔΔ	643 Δ/ΔΔ	698 Δ/ΔΔ
Compressor 2 :													
Pmax	kW	----	----	51	65	78	88	96	96	110	110	120	120
MOC	A	----	----	90	103	130	151	163	163	191	191	226	226
LRA	A	----	----	229 Δ/ΔΔ	280 Δ/ΔΔ	305 Δ/ΔΔ	414 Δ/ΔΔ	462 Δ/ΔΔ	462 Δ/ΔΔ	546 Δ/ΔΔ	546 Δ/ΔΔ	643 Δ/ΔΔ	643 Δ/ΔΔ
Panel B *													
Compressor 1 :													
Pmax	kW	----	----	----	----	----	----	----	----	----	----	----	----
MOC	A	----	----	----	----	----	----	----	----	----	----	----	----
LRA	A	----	----	----	----	----	----	----	----	----	----	----	----
Total Pcons : **													
Panel A	kW	60	83	95	119	134	167	188	201	215	229	243	258
Panel B	kW	----	----	----	----	----	----	----	----	----	----	----	----
Total FLA : **													
Panel A	A	105	139	168	210	233	278	322	349	376	402	428	453
Panel B	A	----	----	----	----	----	----	----	----	----	----	----	----

LEGEND

Pmax - Maximum Power Input
MOC - Maximum Operating Current
LRA - Locked Rotor Amperage
Pcons - Power Consumption
FLA - Full Load Amperage
Y/Δ - Star-Delta Start
Δ/ΔΔ - Part Winding Start

‡- Rated in accordance with BITZER Compressor at standard/tropical rating conditions.
*- 30XD 60-360 units have a single power connection point located upstream of the main disconnect switches (Panel A).
30XD 390-640 units have two power connection points located upstream of the main disconnect switches (Panel A & Panel B).
**- Total Pcons and FLA include fans and compressors.

ELECTRICAL DATA

30XD - R134a (380V±10% ~50Hz - 3ph) (cont)													
30XD Model (S / T)‡		**280**	**300**	**320**	**340**	**360**	**390**	**420**	**450**	**480**	**520**	**560**	**600**	**640**
Panel A *														
Compressor 1 :														
Pmax	**kW**	131	155	155	175	175	204	204	222	222	254	254	277	277
MOC	**A**	243	294	294	326	326	336	336	378	378	435	435	471	471
LRA	**A**	698 Δ/ΔΔ	479 Y/Δ	479 Y/Δ	506 Y/Δ	506 Y/Δ	650 Y/Δ	650 Y/Δ	683 Y/Δ	683 Y/Δ	845 Y/Δ	845 Y/Δ	965 Y/Δ	965 Y/Δ
Compressor 2 :														
Pmax	**kW**	131	131	155	155	175	----	----	----	----	----	----	----	----
MOC	**A**	243	243	294	294	326	----	----	----	----	----	----	----	----
LRA	**A**	698 Δ/ΔΔ	698 Δ/ΔΔ	479 Y/Δ	479 Y/Δ	506 Y/Δ	----	----	----	----	----	----	----	----
Panel B *														
Compressor 1 :														
Pmax	**kW**	----	----	----	----	----	175	204	204	222	222	254	254	277
MOC	**A**	----	----	----	----	----	326	336	336	378	378	435	435	471
LRA	**A**	----	----	----	----	----	506 Y/Δ	650 Y/Δ	650 Y/Δ	683 Y/Δ	683 Y/Δ	845 Y/Δ	845 Y/Δ	965 Y/Δ
Total Pcons : **														
Panel A	**kW**	273	292	311	329	346	203	203	229	229	257	257	278	278
Panel B	**kW**	----	----	----	----	----	173	203	203	229	229	257	257	278
Total FLA : **														
Panel A	**A**	479	509	539	566	592	354	354	398	398	446	446	485	485
Panel B	**A**	----	----	----	----	----	296	354	354	398	398	446	446	485

LEGEND
Pmax - Maximum Power Input
MOC - Maximum Operating Current
LRA - Locked Rotor Amperage
Pcons - Power Consumption
FLA - Full Load Amperage
Y/Δ - Star-Delta Start
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*- 30XD 60-360 units have a single power connection point located upstream of the main disconnect switches (Panel A).
30XD 390-640 units have two power connection points located upstream of the main disconnect switches (Panel A & Panel B).
**- Total Pcons and FLA include fans and compressors.

UNIT PHYSICAL DATA

	Unit 30XD-S	60	80	100	120	140	160	180	200	220	235	250	265
General	AHRI Rated Capacity* (kWR)	135	174	220	259	309	359	415	456	483	510	548	574
	AHRI Rated COP†	3.8	3.3	3.5	3.6	3.7	3.4	3.5	3.6	3.5	3.5	3.6	3.5
	IPLV(Seasonal COP)†	4.9	4.4	4.8	4.8	4.9	4.6	4.7	4.7	4.7	4.9	5.0	4.8
	Refrigerant Type	R134a											
Compressor	Type	Compact Screw											
	%CAP Circuit 1	100		50	50	50	50	50	55	50	53	50	53
	%CAP Circuit 2	-		50	50	50	50	50	45	50	47	50	47
	Control Steps	4		8									
Cooler	Type	Dry Expansion Shell & Tube With Enhanced Copper Tubes											
	Size	40		70		160			200			220	
	Water Flow (l/s)*	6.5	8.4	10.6	12.5	15.0	17.4	20.1	22.1	23.4	24.7	26.5	27.8
	Pressure Drop (kPa)*	35	56	26	36	24	32	41	40	45	49	40	43
	Net Shell Volume (liter)	66		91		206			234			240	
	Water Connection (in)	3 ASA		4 ASA		6 ASA							
Eco	Sub-Cooler (BPHE)	Not Applicable											
Condenser	Type	Corrugated Fin & Tube(14 FPI), V-Type											
	Condenser Fan	Axial 800 mm Diameter, Vertical Discharge											
	Quantity	3	3	4	6	6	6	8	8	8	9	10	10
	Total Air flow(CMH)x1000	61	61	82	122	122	122	163	163	163	184	204	204
	Total Face Area (sq. m.)	6.6	6.6	8.8	13.2	13.2	13.2	17.7	17.7	17.7	19.9	22.1	22.1
Weight‡	Al Fin (kg)	2800	3100	3200	4200	4600	5300	5700	5800	5800	6300	6600	6600
	Cu Fin(kg)	3000	3400	3400	4500	4900	5600	6200	6300	6300	6900	7200	7200
Dimension‡	Length(m)	3.2	3.2	3.2	4.4	4.4	4.4	5.6	5.6	5.6	6.8	6.8	6.8
	Width(m)	2.3											
	Height(m)	2.6											

LEGEND

kWR – kilowatt of Refrigeration
COP – Coefficient of Performance
CAP – Capacity
FPI – Fin per inch
BPHE – Brazed plate heat exchanger
CMH – Cubic meter per hour

ASA (American Standard Association) Flat Face Flange
Rated in accordance with AHRI Standard 551/591 at standard rating conditions.
Standard rating conditions are as follows:
*Chilled Water Entering Temperature: 12°C, Leaving Temperature: 7°C
*Condenser Entering Air Dry Bulb Temperature in S series: 35°C
† IPLV and COP Calculations are according to standard performances AHRI
Fouling Factor: 0.000018 $m^2 \times K/W$
‡ Data is not contractually binding and for information only. The values are rounded.

UNIT PHYSICAL DATA

	Unit 30XD-T	60	80	100	120	140	160	180	200	220	235	250	265
General	AHRI Rated Capacity* (kWR)	103	142	168	198	231	293	323	358	384	407	437	457
	AHRI Rated COP†	3.8	3.6	3.4	3.5	3.6	3.7	3.5	3.6	3.7	3.7	3.8	3.7
	IPLV(Seasonal COP)†	4.9	4.5	4.7	4.7	4.9	4.9	4.6	4.6	4.7	4.9	5.1	5.0
	Refrigerant Type	R134a											
Compressor	Type	Compact Screw											
	%CAP Circuit 1	100		50	50	50	50	50	55	50	53	50	53
	%CAP Circuit 2	-		50	50	50	50	50	45	50	47	50	47
	Control Steps	4		8									
Cooler	Type	Dry Expansion Shell & Tube With Enhanced Copper Tubes											
	Size	40		70		160			200			220	
	Water Flow (l/s)*	5.0	6.9	8.2	9.6	11.2	14.2	15.6	17.4	18.6	19.7	21.2	22.1
	Pressure Drop (kPa)*	21	38	16	22	14	22	26	26	30	33	26	28
	Net Shell Volume (liter)	66		91		206			234			240	
	Water Connection (in)	3 ASA		4 ASA		6 ASA							
Eco	Sub-Cooler (BPHE)	Not Applicable											
Condenser	Type	Corrugated Fin & Tube(12 FPI), V-Type											
	Condenser Fan	Axial 800 mm Diameter, Vertical Discharge											
	Quantity	3	4	4	6	6	8	8	9	10	11	12	12
	Total Air flow(CMH)x1000	61	82	82	122	122	163	163	184	204	224	245	245
	Total Face Area (sq. m.)	6.6	8.8	8.8	13.2	13.2	17.7	17.7	19.9	22.1	24.3	26.5	26.5
Weight‡	Al Fin (kg)	2800	3200	3200	4200	4600	5700	5700	6300	6300	6800	6900	6900
	Cu Fin(kg)	3000	3400	3400	4500	4900	6200	6200	6900	6900	7500	7600	7700
Dimension‡	Length(m)	3.2	3.2	3.2	4.4	4.4	5.6	5.6	6.8	6.8	8.0	8.0	8.0
	Width(m)	2.3											
	Height(m)	2.6											

LEGEND

kWR – kilowatt of Refrigeration
COP – Coefficient of Performance
CAP – Capacity
FPI – Fin per inch
BPHE – Brazed plate heat exchanger
CMH – Cubic meter per hour

ASA (American Standard Association) Flat Face Flange
Rated in accordance with AHRI Standard 551/591 at standard rating conditions.
Standard rating conditions are as follows:

*Chilled Water Entering Temperature: 12°C, Leaving Temperature: 7°C
*Condenser Entering Air Dry Bulb Temperature in T series: 52°C
† IPLV and COP Calculations are according to standard performances AHRI
Fouling Factor: 0.000018 $m^2 \times K/W$

‡ Data is not contractually binding and for information only. The values are rounded.

UNIT PHYSICAL DATA

	Unit 30XD-S	280	300	320	340	360	390	420	450	480	520	560	600	640
General	AHRI Rated Capacity* (kWR)	662	713	808	860	911	1002	1062	1117	1172	1211	1250	1296	1342
	AHRI Rated COP†	3.4	3.4	3.5	3.6	3.6	3.6	3.6	3.6	3.6	3.5	3.4	3.4	3.4
	IPLV(Seasonal COP)†	5.0	4.6	4.8	4.8	4.8	5.1	5.1	4.9	4.7	4.6	4.6	4.8	5.0
	Refrigerant Type	R134a												
Compressor	Type	Compact Screw												
	%CAP Circuit 1	50	54	50	53	50	54	50	53	50	54	50	53	50
	%CAP Circuit 2	50	46	50	47	50	46	50	47	50	46	50	47	50
	Control Steps	8												
Cooler	Type	Dry Expansion Shell & Tube With Enhanced Copper Tubes												
	Size	220	220	300	300	300	150, 190	2×190						
	Water Flow (l/s)*	32.1	34.5	39.2	41.6	44.1	48.5	51.4	54.1	56.8	58.7	60.5	62.8	65.0
	Pressure Drop (kPa)*	56	64	53	59	66	48	37	41	45	47	50	54	57
	Net Shell Volume (liter)	240			421		474	480						
	Water Connection (in)	6 ASA			8 ASA		6 ASA	6 ASA						
Eco	Sub-Cooler (BPHE)	Available												
Condenser	Type	Corrugated Fin & Tube(14 FPI), V-Type												
	Condenser Fan	Axial 800 mm Diameter, Vertical Discharge												
	Quantity	12	13	14	15	16	17	18	19	20	21	22	23	24
	Total Air flow(CMH)x1000	245	265	286	306	326	347	367	388	408	428	449	469	490
	Total Face Area (sq. m.)	26.5	28.7	30.9	33.1	35.3	37.5	39.7	41.9	44.1	46.3	48.6	50.8	53.0
Weight‡	Al Fin (kg)	7800	8900	10100	10600	10800	11900	12200	12800	12900	13600	13900	14400	14500
	Cu Fin(kg)	8600	9800	10900	11600	11700	12900	13300	14000	14100	14900	15200	15800	15900
Dimension‡	Length(m)	8.0	9.2	9.2	10.4	10.4	12.4	13.6	13.6	13.6	14.8	16.0	16.0	16.0
	Width(m)	2.3												
	Height(m)	2.6												

LEGEND
kWR – kilowatt of Refrigeration
COP – Coefficient of Performance
CAP – Capacity
FPI – Fin per inch
BPHE – Brazed plate heat exchanger
CMH – Cubic meter per hour
ASA (American Standard Association) Flat Face Flange
Rated in accordance with AHRI Standard 551/591 at standard rating conditions.
Standard rating conditions are as follows:
*Chilled Water Entering Temperature: 12°C, Leaving Temperature: 7°C
*Condenser Entering Air Dry Bulb Temperature in S series: 35°C
† IPLV and COP Calculations are according to standard performances AHRI
Fouling Factor: 0.000018 m^2×K/W
‡ Data is not contractually binding and for information only. The values are rounded.

UNIT PHYSICAL DATA

	Unit 30XD-T	280	300	320	340	360	390	420	450	480	520	560	600	640
General	AHRI Rated Capacity* (kWR)	477	511	565	608	651	740	802	848	894	920	947	990	1034
	AHRI Rated COP†	3.6	3.5	3.7	3.7	3.7	3.9	3.9	3.9	3.8	3.7	3.6	3.6	3.6
	IPLV(Seasonal COP)†	4.9	4.8	4.6	4.7	4.8	5.0	5.1	5.1	5.1	4.8	4.6	4.8	5.0
	Refrigerant Type	R134a												
Compressor	Type	Compact Screw												
	%CAP Circuit 1	50	54	50	53	50	54	50	53	50	54	50	53	50
	%CAP Circuit 2	50	46	50	47	50	46	50	47	50	46	50	47	50
	Control Steps	8												
Cooler	Type	Dry Expansion Shell & Tube With Enhanced Copper Tubes												
	Size	220	220	300	300	300	150, 190	2×190						
	Water Flow (l/s)*	29	31	35	37	40	44	46	49	51	53	54	56	59
	Pressure Drop (kPa)*	47	53	43	49	54	40	31	34	37	39	41	44	47
	Net Shell Volume (liter)	240			421		474	480						
	Water Connection (in)	6 ASA			8 ASA		6 ASA	6 ASA						
Eco	Sub-Cooler (BPHE)	Not Applicable												
Condenser	Type	Corrugated Fin & Tube(12 FPI), V-Type												
	Condenser Fan	Axial 800 mm Diameter, Vertical Discharge												
	Quantity	12	13	14	15	16	18	20	21	22	23	24	25	26
	Total Air flow(CMH)x1000	245	265	286	306	326	367	408	428	449	469	490	510	530
	Total Face Area (sq. m.)	26.5	28.7	30.9	33.1	35.3	39.7	44.1	46.3	48.6	50.8	53.0	55.2	57.4
Weight‡	Al Fin (kg)	7800	8900	10100	10600	10800	11900	12800	13400	13600	14100	14300	14900	15200
	Cu Fin(kg)	8500	9700	10900	11600	11700	13000	14000	14700	14900	15600	15800	16500	16800
Dimension‡	Length(m)	8.0	9.2	9.2	10.4	10.4	12.4	13.6	14.8	16.0	16.0	16.0	17.2	18.4
	Width(m)	2.3												
	Height(m)	2.6												

LEGEND

kWR – kilowatt of Refrigeration
COP – Coefficient of Performance
CAP – Capacity
FPI – Fin per inch
BPHE – Brazed plate heat exchanger
CMH – Cubic meter per hour

ASA (American Standard Association) Flat Face Flange

Rated in accordance with AHRI Standard 551/591 at standard rating conditions.

Standard rating conditions are as follows:

*Chilled Water Entering Temperature: 12°C, Leaving Temperature: 7°C

*Condenser Entering Air Dry Bulb Temperature in T series: 52°C

† IPLV and COP Calculations are according to standard performances AHRI

Fouling Factor: 0.000018 m^2×K/W

‡ Data is not contractually binding and for information only. The values are rounded.

PERFORMANCE DATA

R134a	Condenser Entering Air Temperature °C															
LCWT: 7°C	30				35				40				45			
Model 30XD-S	CAPACITY		INPUT	CLR. FLOW	CAPACITY		INPUT	CLR. FLOW	CAPACITY		INPUT	CLR. FLOW	CAPACITY		INPUT	CLR. FLOW
	Ton	kWR	kW	l/s	Ton	kWR	kW	l/s	Ton	kWR	kW	l/s	Ton	kWR	kW	l/s
60	40.8	143	33	6.9	38.4	135	35	6.5	35.9	126	39	6.1	33.2	117	43	5.7
80	52.3	184	48	8.9	49.4	174	53	8.4	46.3	163	58	7.9	43.1	152	65	7.3
100	66.5	234	57	11.3	62.5	220	62	10.6	58.4	205	68	9.9	54.4	191	74	9.3
120	78.2	275	65	13.3	73.6	259	71	12.5	68.8	242	78	11.7	63.7	224	87	10.9
140	93.6	329	76	16.0	87.9	309	84	15.0	81.8	288	92	13.9	75.6	266	102	12.9
160	107.9	380	97	18.4	102.0	359	106	17.4	95.6	336	118	16.3	88.9	313	132	15.2
180	124.9	439	106	21.3	118.0	415	117	20.1	110.9	390	129	18.9	103.4	364	144	17.6
200	137.3	483	116	23.4	129.6	456	128	22.1	121.3	427	142	20.7	112.8	397	158	19.2
220	145.8	513	126	24.8	137.3	483	138	23.4	128.2	451	153	21.8	118.7	418	170	20.2
235	153.8	541	131	26.2	145.0	510	144	24.7	135.7	477	160	23.1	126.1	444	178	21.5
250	165.3	581	137	28.2	155.8	548	151	26.5	146.0	513	167	24.9	135.7	477	186	23.1
265	173.3	610	149	29.5	163.2	574	164	27.8	152.8	537	182	26.0	142.1	500	202	24.2
280	195.4	687	172	33.3	188.2	662	192	32.1	180.2	634	216	30.7	171.4	603	244	29.2
300	210.9	742	186	35.9	202.6	713	209	34.5	193.5	680	234	33.0	183.4	645	262	31.2
320	239.8	844	205	40.9	229.8	808	229	39.2	218.5	769	256	37.2	206.2	725	286	35.1
340	254.9	896	216	43.4	244.4	860	240	41.6	232.5	818	267	39.6	219.4	772	297	37.4
360	269.9	949	227	46.0	259.0	911	252	44.1	246.5	867	279	42.0	232.6	818	308	39.6
390	296.4	1042	248	50.5	284.8	1002	275	48.5	271.6	955	304	46.3	256.8	903	337	43.7
420	314.0	1104	266	53.5	301.8	1062	295	51.4	288.1	1013	327	49.1	272.9	960	363	46.5
450	330.5	1162	280	56.3	317.6	1117	312	54.1	303.1	1066	346	51.6	287.2	1010	384	48.9
480	347.0	1220	295	59.1	333.3	1172	328	56.8	318.1	1119	365	54.2	301.5	1060	404	51.4
520	359.3	1264	316	61.2	344.4	1211	350	58.7	328.0	1153	387	55.9	309.9	1090	427	52.8
560	371.6	1307	337	63.3	355.4	1250	372	60.5	337.8	1188	409	57.5	318.4	1120	449	54.2
600	384.8	1353	346	65.6	368.6	1296	382	62.8	350.7	1233	421	59.7	331.3	1165	463	56.4
640	398.1	1400	355	67.8	381.7	1342	393	65.0	363.6	1279	433	61.9	344.2	1211	476	58.6

LEGEND
Input – Compressors Absorbed Power Input
LCWT – Leaving chilled water temperature
CLR FLOW-Cooler water flow rate
Evaporator temperature rise: 5 K
Evaporator fluid: chilled water fouling factor: 0.000018 $m^2 \times K/W$
Performances in accordance with AHRI 551/591

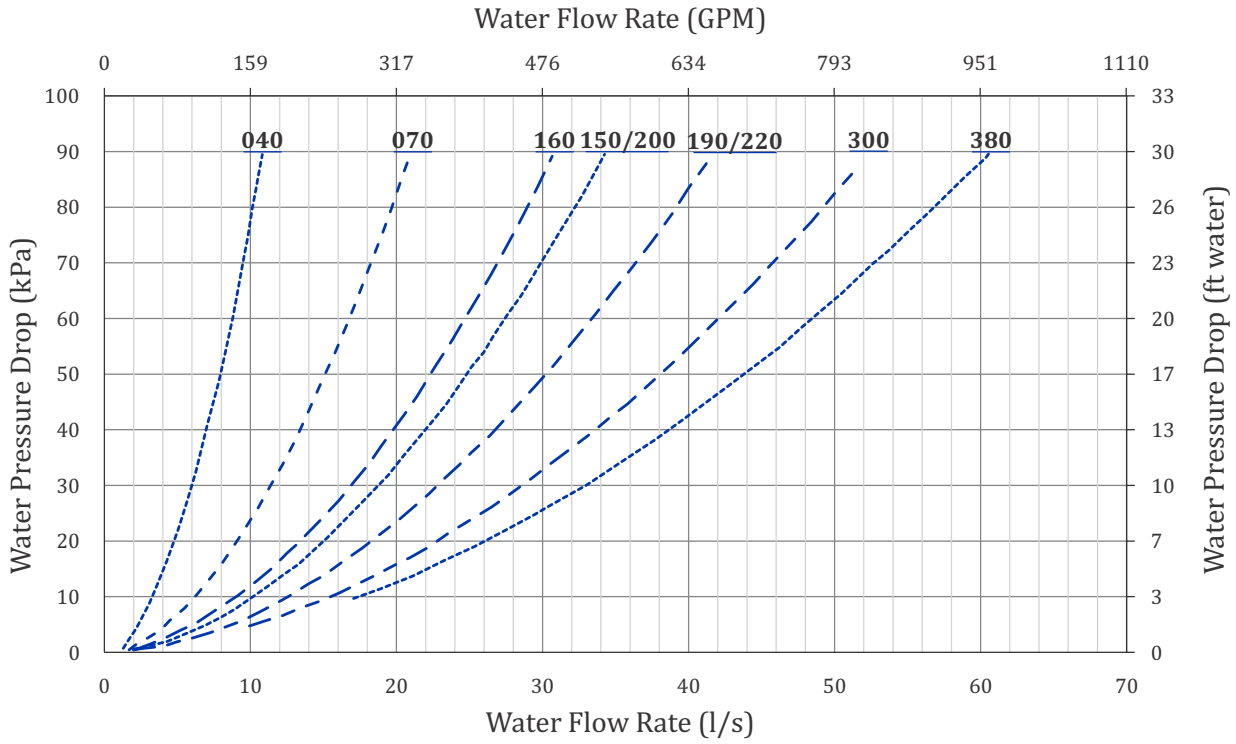
PERFORMANCE DATA

R134a	Condenser Entering Air Temperature °C															
LCWT: 7°C	45				47				49				52			
Model 30XD-T	CAPACITY		INPUT	CLR. FLOW	CAPACITY		INPUT	CLR. FLOW	CAPACITY		INPUT	CLR. FLOW	CAPACITY		INPUT	CLR. FLOW
	Ton	kWR	kW	l/s	Ton	kWR	kW	l/s	Ton	kWR	kW	l/s	Ton	kWR	kW	l/s
60	33.1	116	43	5.6	32.0	112	45	5.4	30.9	109	47	5.3	29.2	103	50	5.0
80	44.9	158	61	7.7	43.6	153	64	7.4	42.3	149	67	7.2	40.3	142	72	6.9
100	54.0	190	75	9.2	52.2	184	78	8.9	50.5	178	81	8.6	47.9	168	86	8.2
120	63.0	222	88	10.7	60.9	214	92	10.4	58.8	207	96	10.0	56.2	198	100	9.6
140	74.9	263	103	12.8	72.3	254	107	12.3	69.7	245	112	11.9	65.7	231	119	11.2
160	92.9	327	123	15.8	90.2	317	129	15.4	87.5	308	135	14.9	83.3	293	144	14.2
180	102.5	361	146	17.5	99.7	351	151	17.0	96.6	340	158	16.5	91.9	323	170	15.6
200	114.4	402	154	19.5	110.9	390	161	18.9	107.4	378	169	18.3	101.9	358	181	17.4
220	122.8	432	162	20.9	119.1	419	169	20.3	115.2	405	177	19.6	109.3	384	190	18.6
235	129.7	456	170	22.1	125.8	442	178	21.4	121.8	428	186	20.7	115.8	407	199	19.7
250	138.9	488	180	23.7	134.7	474	188	23.0	130.6	459	196	22.2	124.2	437	210	21.2
265	145.6	512	195	24.8	141.2	496	204	24.0	136.7	481	213	23.3	130.0	457	228	22.1
280	152.2	535	210	25.9	147.6	519	220	25.1	142.9	503	230	24.3	135.7	477	246	23.1
300	163.3	574	227	27.8	158.2	556	237	26.9	153.0	538	247	26.1	145.2	511	263	24.7
320	182.0	640	245	31.0	176.0	619	255	30.0	169.9	598	265	28.9	160.7	565	282	27.4
340	195.0	686	258	33.2	188.9	664	268	32.2	182.5	642	278	31.1	172.9	608	296	29.4
360	208.1	732	271	35.5	201.8	710	280	34.4	195.1	686	292	33.2	185.1	651	310	31.5
390	235.4	828	294	40.1	228.3	803	306	38.9	221.1	778	318	37.7	210.4	740	337	35.8
420	253.3	891	314	43.2	246.0	865	327	41.9	238.7	840	340	40.7	227.9	802	360	38.8
450	267.8	942	336	45.6	260.3	915	349	44.3	252.6	888	363	43.0	241.0	848	384	41.1
480	282.3	993	357	48.1	274.5	965	371	46.8	266.5	937	385	45.4	254.1	894	408	43.3
520	291.3	1025	379	49.6	283.1	996	393	48.2	274.6	966	408	46.8	261.6	920	432	44.6
560	300.3	1056	400	51.2	291.7	1026	415	49.7	282.8	995	430	48.2	269.2	947	455	45.8
600	313.1	1101	416	53.3	304.2	1070	431	51.8	295.4	1039	446	50.3	281.5	990	472	48.0
640	325.8	1146	431	55.5	316.7	1114	448	53.9	307.9	1083	463	52.5	293.9	1034	489	50.1

LEGEND
Input – Compressors Absorbed Power Input
LCWT – Leaving chilled water temperature
CLR FLOW-Cooler water flow rate
Evaporator temperature rise: 5 K
Evaporator fluid: chilled water fouling factor: 0.000018 $m^2 \times K/W$
Performances in accordance with AHRI 551/591

Cooler Pressure Drop

In shell and tube heat exchangers, it is essential to avoid both excessively high and excessively low fluid flow rates. When fluid flow rates are excessively high, resulting in correspondingly high tube velocities, several issues arise. These include a significant fluid pressure drop, increased pumping power requirements, and the potential for tube erosion or corrosion damage.
On the other hand, excessively low fluid flow rates and corresponding low velocities should also be avoided. These conditions lead to poor heat transfer efficiency, higher compressor power consumption, sediment accumulation, and tube fouling.
In the following diagram, the pressure drop of the evaporator is presented in terms of water flow rate.
The pressure drop for each cooler size is provided in both the imperial and metric systems. In the physical data tables, you can find the cooler size corresponding to each chiller.

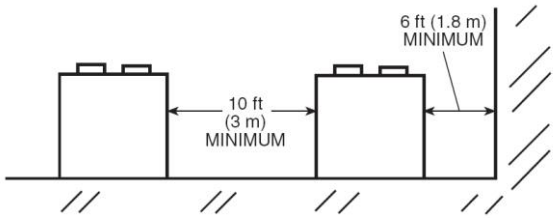


Cooler Pressure drop for different evaporator sizes

Chiller Location and Clearances

The 30XD unit must be installed outdoors.

Do not locate near sound sensitive areas without proper acoustic consideration. For applications requiring mounting a chiller on a building rooftop, consideration should be given to using rubber-in-shear or spring isolators to minimize structure borne transmission. Unit must be level when installed to ensure proper oil return to the compressors. Clearances must be provided around chillers for airflow, service and local code requirements. See dimensional drawings for specific unit clearance requirements. Ensure adequate clearance between adjacent chillers is maintained. A minimum of 3.0 m is recommended. Chiller fan discharge is strongly recommended to be at least as high as adjacent solid walls. Installation in pits is not recommended.



Multiple Unit Separation Aligned Side By Side

Minimum Clearances

The recommended minimum clearance to ensure proper airflow through the condenser coils and to allow fan maintenance is as shown below. Acceptable clearance between the chiller and a single wall may be reduced to 1000 mm on one side or end opposite the control panel without sacrificing performance. Clearances between chillers in dual chiller applications may be reduced to 1.8 m on one side without sacrificing performance.

Acceptable clearance on the cooler connection side or end opposite the control box of the unit can be reduced to 1.5 m without sacrificing performance as long as the remaining three sides are unrestricted. Acceptable clearance on the side with a control box can be reduced to 1.3 m without sacrificing performance as long as the remaining three sides are unrestricted. Clearance between chillers in dual chiller applications may be reduced to 2.0 m without sacrificing performance provided the remaining sides are unrestricted.

There are applications, however, in which recommended minimum clearances are not available. In these situations, customers should contact SarmaAfarin After Sales Department to request a prediction of the chiller performance within the confined space.

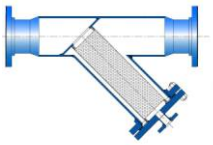
Water Treatment

The use of untreated or improperly treated water may result in scaling, erosion, corrosion, and algae or slime buildup. This will adversely affect heat transfer between the water and system components. Proper water treatment must be determined locally and depends on the type of system and local water characteristics. Neither salt nor brackish water is recommended for use in SarmaAfarin chillers. Use of either will lead to a shortened life. SarmaAfarin encourages the employment of a qualified water treatment specialist, familiar with local water conditions, to assist in the establishment of a proper water treatment program.

Foreign matter in the chilled water system can also increase pressure drop and, consequently, reduce water flow. For this reason it is important to thoroughly flush all water piping to the unit before making the final piping connections to the unit. However, a fouling factor, which is 0.000018 m2 °C/W, used to calculate tabulated ratings. As fouling factor is increased, both unit capacity and COP decrease. The impact of the fouling factor on performance varies significantly with chiller size and application conditions.

Strainers

A screen strainer with a minimum screen size of 20 mesh must be installed a maximum of 3.0 m from the unit to prevent debris from damaging internal tubes of the cooler.



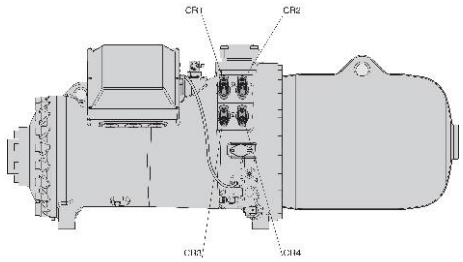
Typical Strainer

Over Sizing Chillers

Over sizing chillers by more than 15% at design conditions must be avoided as the system operating efficiency is adversely affected (resulting in greater or excessive electrical demand). When future expansion of equipment is anticipated, install a single chiller to meet present load requirements and add a second chiller to meet the additional load demand. It is also recommended that 2 smaller chillers be installed where operation at minimum load is critical. The operation of a smaller chiller loaded to a greater percentage over minimum is preferred to operating a single chiller at or near its minimum recommended value. Minimum load control should not be used as a means to allow over sizing chillers. Minimum load control should be given consideration where substantial operating time is anticipated below the minimum unloading step.

When selecting a chiller, it is advisable to account for both the highest and lowest cooling demands. If capacity control is needed below the standard minimum unloading step, please reach out to SarmaAfarin Engineering Sales Department for further

consultation.
Typically, each chiller is equipped with two compressors, each having four control steps (25%, 50%, 75%, and 100%). This results in a total of eight control steps. The diagram below illustrates the four solenoid valves. By activating the solenoid valves, you can choose the desired operating mode.



Control Steps with Selenoid Valves

Cooler Water Temperature

The 30XD chillers have been meticulously crafted to align with the guidelines set forth by the AHRI Standard 550/590. This standard defines the standard rating conditions for water chillers, specifying an entering temperature of 12°C and a leaving temperature of 7°C.
Although these temperature could vary which depends on the saturation suction and discharge temperature envelope of refrigeration cycle. In the following some data for convenience is presented otherwise contact SarmaAfarin after sales department.
Although these temperatures may vary, they depend on the saturation suction and discharge temperature envelope of the refrigeration cycle.
Below, we present some data for customer convenience; alternatively, users should contact SarmaAfarin's after-sales department for further assistance.
1. Maximum leaving chilled water temperature (LCWT) for the unit is 15.5 °C Unit can start and pull down with up to 35 °C entering-water temperature. It is recommended that entering-water temperature not exceed 21°C.
2. Minimum LCWT for a standard unit is 4.4°C. For leaving-water temperatures below 4.4°C an inhibited antifreeze solution is required. Application of chiller at leaving fluid temperatures lower than -1.1°C is possible by ordering the factory installed medium temperature brine option.
NOTE: Water flowing through cooler should not exceed 38 °C.
Cooler flow /range
Ratings and performance data in this publication are for a cooling temperature rise of 5°C. The 30XD chillers may be operated at a different temperature rise, providing flow limits are not exceeded and corrections to system guidelines are made. For minimum and maximum cooler flow rates, see the Minimum and Maximum Cooler Flow Rates table. A high flow rate is generally limited by the maximum pressure drop and mechanical design that can be tolerated by the unit.
The 30XD chillers are designed for a full load temperature rise of 3.5° to 8.3° C. Contact SarmaAfarin's Sales Engineering Department to obtain performance data if a temperature rise other than 5°C is being considered.

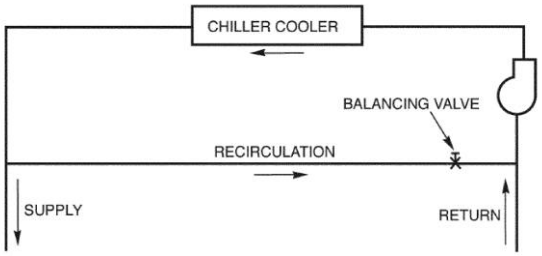
Minimum cooler flow

(Maximum cooler temperature rise)

The minimum cooler flow for standard units is shown in the Minimum and Maximum Cooler Flow Rates table. When system design conditions require a lower flow (or higher rise) than the minimum allowable cooler flow, follow the recommendations below.

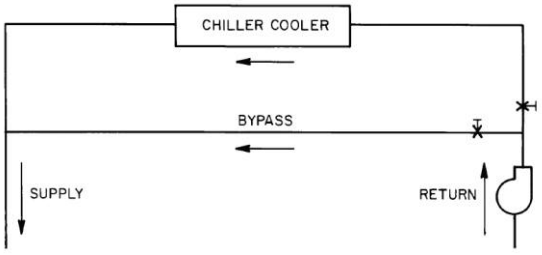
- Chiller in Series Configuration: Multiple smaller chillers may be applied in series, each providing a portion of the design temperature rise.
- Recirculation flow: Cooler fluid may be recalculated to raise the flow rate to the chiller. The mixed temperature entering the cooler must be maintained to a minimum of at least 3.5° C above the LCWT and a maximum of no more than 8.3° C above the LCWT.

NOTE: Recirculation flow is shown below



Recirculation Flow Diagram

The maximum cooler flow (approximately 3.5° C rise) results in a practical maximum pressure drop through cooler.
Return fluid may bypass the cooler to keep the pressure drop through the cooler within acceptable limits. This permits a higher delta T in chiller with lower fluid through cooler and mixing after cooler.



Bypass Flow Diagram

Variable Cooler Flow Rates

Variable rates may be applied to a standard chiller. The unit will, however, attempt to maintain a constant leaving chilled water temperature. In such cases, the following consideration should be followed:

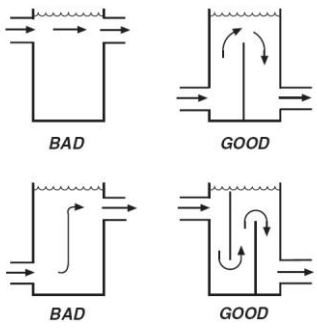
- Minimum flow must be in excess of minimum flow given in the Minimum Maximum Cooler Fluid Flow Rates table.
- Minimum loop water volume must be in excess of 6.5 l/kW.
- Flow rate must change in steps of less than 10% per minute.
- Consider a higher water loop volume if flow rate changes more rapidly.

Water Loop Volume

The volume in circulation must equal or exceed 3.2 l/kW of cooling for temperature stability and accuracy in normal air conditioning applications. In process cooling applications, or for operation at ambient temperature below 0° C with low loading conditions, there should be from 6.5 to 10.8 l/kW. To achieve this volume, it is often necessary to install a tank in the loop.

To prevent stratification and ensure effective mixing, it is recommended to install baffles in the tank. These baffles help prevent swirling patterns and promote top-to-bottom fluid movement. As water or brine enters the tank, it should be adequately mixed with the existing liquid. The flow then proceeds through the cooler and undergoes further mixing after passing the cooler.

The piping between the chiller and the fluid loop volume tank can be done to allow the tank to be on the return side of the chiller (tank piped to chiller inlet). This configuration helps to buffer any changes in load, allowing more stable chiller operation.



Tank Installation Configuration

Cooler Fouling Factor

The fouling factor used to calculate tabulated performance ratings is 0.000018 m2 °C/W. As fouling factor is increased, both unit capacity and EER decrease.

The impact of the fouling factor on performance varies significantly with chiller size and application conditions. Consult with the SarmaAfarin Sales Engineering Department for further information.

Cooler Freeze Protection

All 30XD air-cooled chillers come with standard freeze protection for the cooler. The controller will automatically maintain the temperature above freezing. When the temperature drops below 1.1°C, it is advisable to use heater tapes on the cooler to prevent freezing. It is recommended to allow water to flow through the piping system; this helps prevent freezing in the system.

Since power is sometimes lost for extended periods during winter storms, freeze protection provided by heater tapes will be effective only if a back-up power supply can be assured for the unit's control circuit, heater and cooler pump. If not protected with an anti-freeze solution, draining the cooler and outdoor piping is recommended if the system will not be used during freezing weather conditions.

Antifreeze Specification

Consider both leaving water set point and ambient freeze conditions when determining antifreeze concentration. Both of these parameters can help determine the recommended concentration level. Higher concentration must be used to adequately protect the machine.

NOTE: Use only antifreeze solutions approved for heat exchanger duty.

For applications in which the leaving fluid temperature set point is less than 4.4 °C, a suitable inhibited antifreeze solution must be used. The solution concentration must be sufficient to protect the chilled water loop to a freeze protection (first crystals) concentration of at least 8.3°C below the leaving fluid temperature set point.

If the chiller refrigerant or fluid lines are in an area where ambient conditions fall below 1.1º C, it is highly recommended that an antifreeze solution be added to protect the unit and fluid piping to a temperature of 8.3 °C below the lowest anticipated ambient temperature.

Select concentration based on either burst or freeze protection as dictated by the application. If the chiller does not operate during the winter, and a start-up is not expected, a burst protection concentration is recommended. This concentration may not be high enough to pump the fluid through the unit. Burst protection is typically a lower concentration that will provide better performance from the machine. If the chiller does operate during winter, a freeze protection concentration is recommended. This concentration will be high enough to keep the fluid in a condition that it can be pumped at low ambient conditions. Consult glycol fluid manufacturers for burst protection recommendations and fluid specifications.

Note: Glycol antifreeze solutions are highly recommended since heater tapes provide no protection in the event of a power failure.

Model	30XD-S Flow Rate (l/s)			30XD-T Flow Rate (l/s)		
	Design	Minimum	Maximum	Design	Minimum	Maximum
60	6.5	3.9	9.2	5.6	3.3	7.9
80	8.4	5.0	11.8	7.7	4.5	10.8
100	10.6	6.3	15.0	9.2	5.4	12.9
120	12.5	7.4	17.6	10.7	6.4	15.1
140	15.0	8.9	21.1	12.8	7.6	18.0
160	17.4	10.3	24.5	15.8	9.4	22.3
180	20.1	11.9	28.3	17.5	10.3	24.6
200	22.1	13.1	31.1	19.5	11.5	27.4
220	23.4	13.9	32.9	20.9	12.4	29.5
235	24.7	14.6	34.8	22.1	13.1	31.1
250	26.5	15.7	37.4	23.7	14.0	33.3
265	27.8	16.5	39.1	24.8	14.7	34.9
280	32.1	19.0	45.1	25.9	15.4	36.5
300	34.5	20.5	48.6	27.8	16.5	39.2
320	39.2	23.2	55.1	31.0	18.4	43.6
340	41.6	24.7	58.6	33.2	19.7	46.8
360	44.1	26.1	62.1	35.5	21.0	49.9
390	48.5	28.8	68.3	40.1	23.8	56.4
420	51.4	30.5	72.4	43.2	25.6	60.8
450	54.1	32.1	76.2	45.6	27.0	64.2
480	56.8	33.6	79.9	48.1	28.5	67.7
520	58.7	34.8	82.6	49.6	29.4	69.9
560	60.5	35.9	85.2	51.2	30.3	72.0
600	62.8	37.2	88.4	53.3	31.6	75.1
640	65.0	38.5	91.5	55.5	32.9	78.1

Ambient Temperature Limitations

30XD chillers are designed for year-round operation over a range of ambient temperatures. For operation outside of these ranges, contact the local sales office.

According to chiller models, the range of ambient temperature could be varied:

- 30XD-S Series: up to 45 °C
- 30XD-T Series: up to 52 °C

High Ambient Temperature Operation

High outdoor ambient chiller start-up and operation is possible for 30XD-T chillers at ambient temperatures up to 52°C, at nominal voltage, and up to 55°C on part load operation. For applications approaching these temperatures, it may be advisable to select the high ambient temperature option to increase fan airflow.

Low ambient temperature operation

For low ambient temperature consider the following parameters:

- Low ambient temperature head pressure control
- Wind baffles or wind enclosures
- Consider higher loop volumes
- Loop freeze protection

Units will start and operate down to 0 °C as standard. Operating down to –29°C, as well as start-up at ambient temperatures as low as –15°C, requires optional low ambient head pressure control. Additionally, wind baffles should be installed based on site conditions, taking into account the intensity of weather temperature variation, wind velocity, and direction. It's important to note that wind baffles are mandatory for operations below 0°C. If wind velocity is anticipated to be greater than 8 km/h use the either Wind baffles or wind enclosures to reduce the cold wind blast.

Inhibited ethylene glycol or other suitable corrosion-resistant antifreeze solution must be field supplied and installed in all units for unit operation below 1.1°C. Solution must be added to fluid loop to protect loop down to 8.3 °C below minimum operating ambient temperature. Concentration should be based on expected minimum temperature and either “Burst” or “Freeze” protection levels. At least 6.5 l/kW of water volume is the recommended minimum for a moderate system load.

Louvered Enclosures

Enclosures, particularly louvered ones, serve as beneficial additions to chiller units when they meet the criteria for chiller performance. Louvered enclosures, architectural in nature, are designed for installation around chillers.

The design of louvered enclosures should comply with the clearance criteria specified for air-cooled chillers. Adequate airflow for each unit must be ensured by allowing passage through the louvers.
The utilization of louvered enclosures serves various purposes, including:

- Acting as noise barriers
- Providing protection against cold winds
- Shielding from salty weather conditions
- Offering aesthetic screening for enhanced visual appeal

The enclosure's structure should incorporate high-sound attenuating materials to effectively reduce noise levels.
Air-cooled chillers are suitable for year-round operation, yet during winter, drastic drops in air temperature can occur. Harsh winds may accompany these conditions, potentially affecting chiller stability. Louvered enclosures serve as barriers to mitigate such events.
Chillers utilized in maritime and coastal environments are particularly vulnerable to corrosion due to exposure to salty winds, which can easily corrode metal components. While coil protection is recommended, louvered enclosures provide an additional layer of defense against corrosion.
Moreover, these enclosures can be aesthetically utilized to conceal chillers, thereby enhancing the building's exterior appearance.

Altitude Correction Factors

Correction factors must be applied to standard ratings at altitudes above 600 meter using the following multipliers:

Altitude correction Multiplier			
Altitude		Capacity Multiplier	Compressor Power Multiplier
(ft)	(m)		
2000	610	0.99	1.01
4000	121	0.98	1.02
6000	1829	0.97	1.03
8000	2438	0.96	1.04
10000	3048	0.95	1.05

Condenser Airflow

Airflow restrictions on units with standard fans will affect the unit capacity, condenser head pressure, and compressor power input. Correction factors to be applied for external static restrictions up to 50 Pa are as follows:

External static pressure drop correction Multiplier			
Altitude		Capacity Multiplier	Compressor Power Multiplier
In.Wg	Pa		
0.0	0	1.000	1.00
0.1	25	0.986	1.01
0.2	50	0.968	1.03

Multiple chillers

Where chiller capacities greater than can be supplied by a single 30XD chiller are required, or where stand-by capability is desired, chillers may be installed in parallel or series. Units may be of the same or different sizes with this piping arrangement. However, for parallel chiller applications, cooler flow rates must be balanced to ensure proper flow to each chiller. Unit software is capable of controlling two units as a single plant by making use of the dual chiller control feature.
If the dual chiller algorithm is used, and the machines are installed in parallel, an additional chilled water sensor must be installed for each chiller (to provide the required hardware, a dual chiller accessory kit is available from the factory). Install one thermistor and well per chiller in the common leaving water header. Chillers installed in series do not require additional sensors.
Parallel chiller control with dedicated pumps is recommended. The chiller must start and stop its own water pump located in its own piping. Check vales are required at the discharge of each pump.
If pumps are not dedicated for each chiller, then isolation valves are required. Each chiller must open and close its own isolation valve through the unit control (the valve must be connected to the pump outputs).

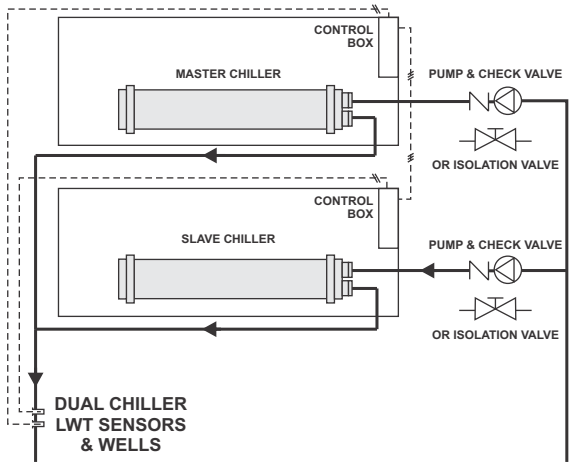
Dual chiller control

There are several advantages to this type of control:

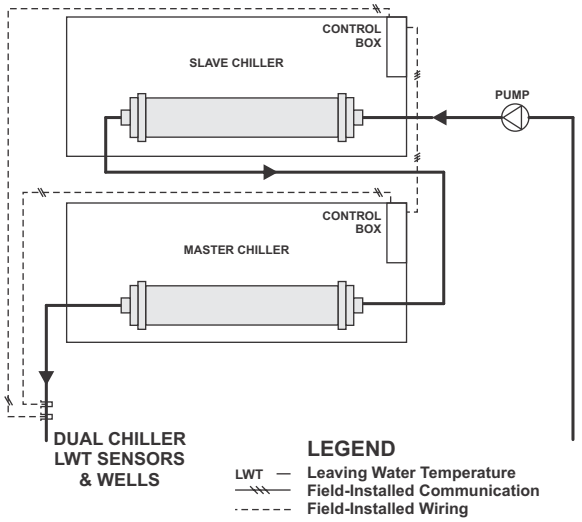
- Redundancy (multiple circuits)
- Better low load control (lower tonnage capability)
- Lower rigging lift weights (2 machines rather than 1 large machine)
- Chiller lead-lag operation (evens the wear between the two machines)

Parallel dual chiller operation

Parallel chiller operation is the recommended option for dual chiller control. In this case, each chiller must control its own dedicated pump or isolation valve. Balancing valves are recommended to ensure proper flow in each chiller. Two field supplied and installed leaving water temperature sensors are required, one for each module, for this function to operate properly. Consider adding additional isolation valves to isolate each chiller to allow for service on a machine, and still allow for partial capacity from the other chiller.



Parallel Dual Chiller Operation



Series Dual Chiller Operation

Series Dual Chiller Operation

Series chiller operation is an alternate control. Certain applications might require that the two chillers be connected in series.

Condenser Coil Protection

Aluminum fin/copper tube coils are constructed of seamless copper tubes mechanically bonded to aluminum fins. The fins have corrugated enhancements. These coils are not recommended for corrosive environments.

Coated aluminum-fin coils have a durable epoxy-phenolic coating applied to the fin to provide protection in mildly corrosive coastal environments. Coated coils provide superior protection with unmatched flexibility, edge coverage, metal adhesion, thermal performance and most importantly, corrosion resistance. This economical option provides substantial corrosion protection beyond the standard uncoated coil construction.

Copper-fin coils provide increased corrosion resistance compared to aluminum fin coils. All-copper coils eliminate bimetallic construction to eliminate the potential for galvanic corrosion. Application in industrial environments is not recommended due to potential attack from sulfur, sulfur oxide, nitrogen oxides, carbon and several other industrial airborne contaminants.

Air separation

For proper system operation, it is essential that water loops be installed with proper means to manage air in the system. Free air in the system can cause noise, reduce terminal output, stop flow, or even cause pump failure due to pump cavitation. For closed systems, equipment should be provided to eliminate all air from the system.

Controls

Microprocessor

The PLC microprocessor controls overall unit operation and controls a number of processes simultaneously. These processes include internal timers, reading inputs, analog to digital conversions, fan control, display control, diagnostic control, output relay control, demand limit, capacity control, head pressure control, and temperature reset. Some processes are updated almost continuously, others every 2 to 3 seconds, and some every 30 seconds. The microprocessor routine is started by switching the Emergency ON-OFF switch to ON position.

When the unit receives a call for cooling (based on a deviation from chilled water set point), the unit stages up in capacity to maintain the cooler fluid set point. The first compressor starts 1 to 3 minutes after the call for cooling. The PLC microprocessor controls the capacity of the chiller by varying the number of compressors on and each loading capacity to satisfy actual dynamic load conditions. The control maintains leaving-fluid temperature set point shown on the display device through intelligent positioning of the slide valve and compressor cycling. Accuracy depends on loop volume, loop flow rate, load, and outdoor-air temperature. No adjustment for cooling range or cooler flow rate is required, because the control automatically compensates for cooling range by measuring both return-fluid temperature and leaving-fluid temperature. This is referred to as leaving-fluid temperature control with return-fluid temperature compensation.

Sensors

Thermistors are used to control temperature-sensing inputs to the microprocessor. No additional thermistor sensors are required for optional leaving chilled water temperature, return water, or outdoor air reset.

Start-up

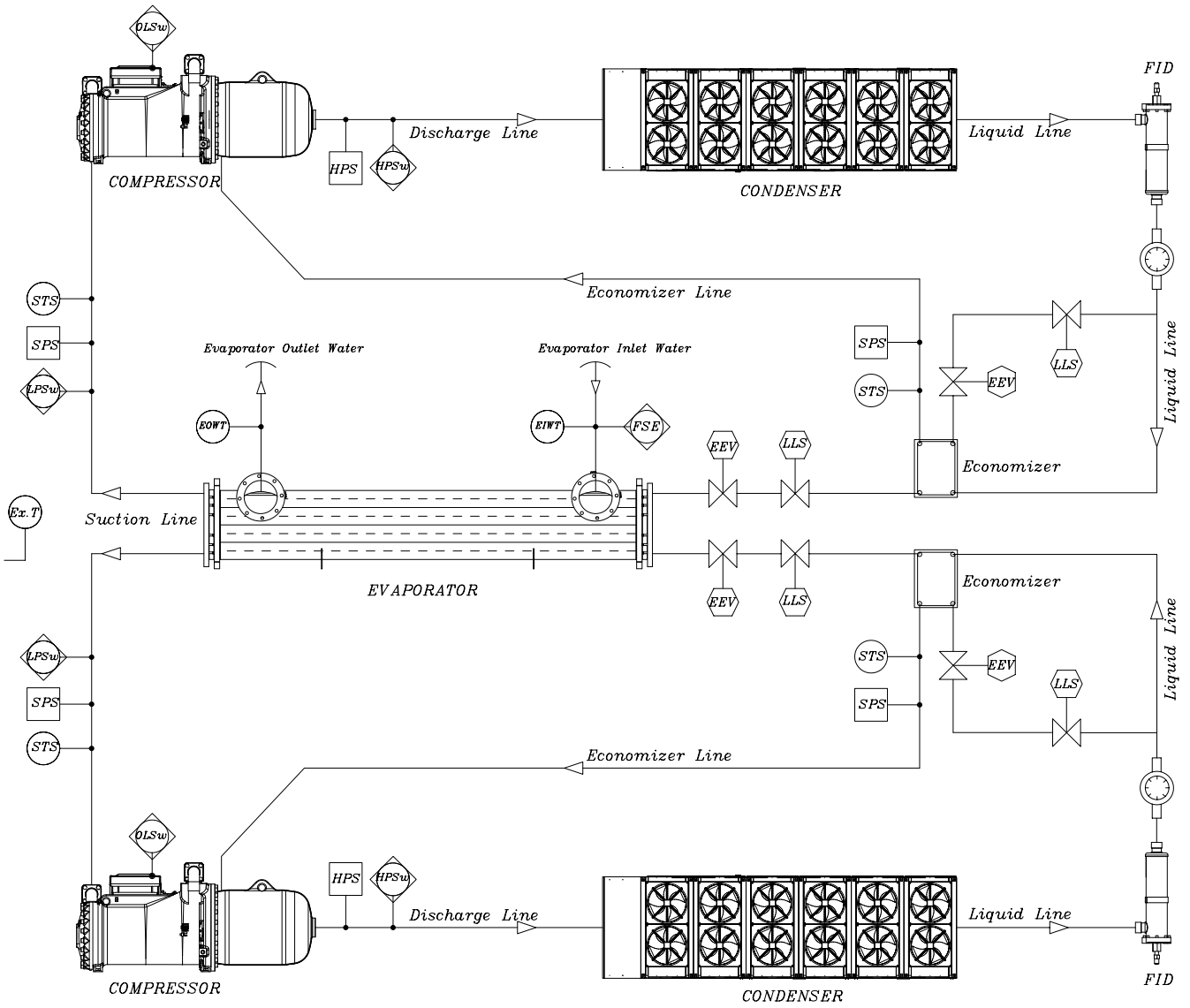
After control circuit switches on, the prestart process takes place, then microprocessor checks itself, starts pump (if configured) and waits for temperature to stabilize. The controlled pull down feature limits compressor loading on startup to reduce demand on start-up and unnecessary compressor usage.

Capacity control

On the first call for cooling, the microprocessor starts initial compressor and fan stage on lead circuit.

As additional cooling is required, the capacity of the compressor is increased by changing the position of the slide valve. As the load increases above the compressor's capacity, another compressor is started and both are staged together.

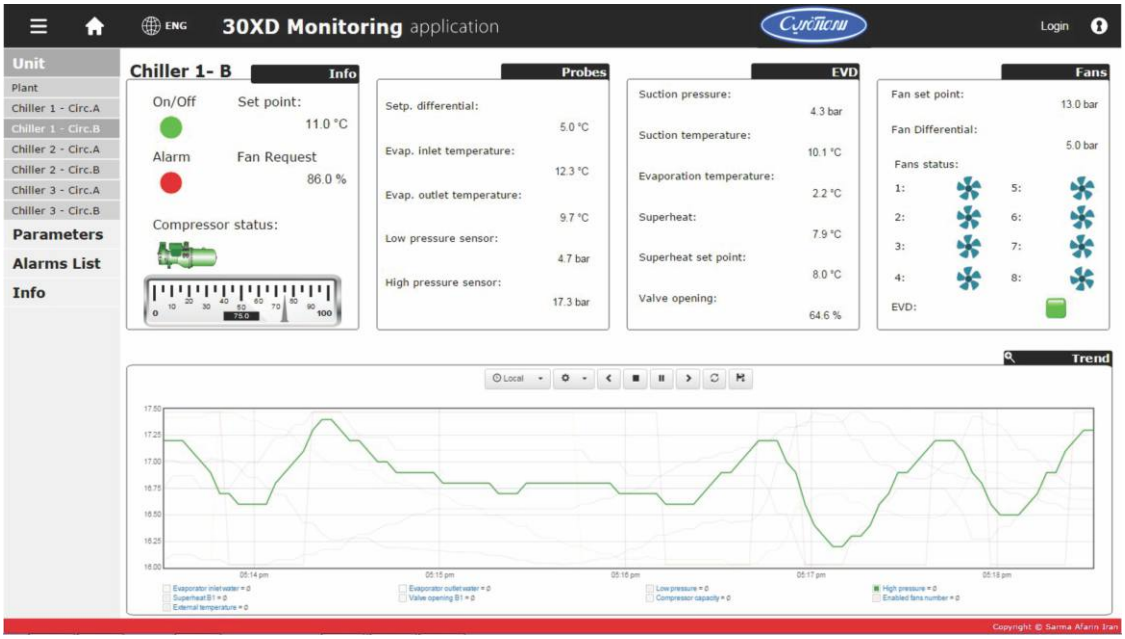
PIPING AND INSTRUMENTATION DIAGRAM



Symbol	Description
HPS	High Pressure Sensor
HPSw	High Pressure Switch
SPS	Suction Pressure Sensor
STS	Suction Temperature Sensor
LPSw	Low Pressure Switch
DLSw	Oil Level Switch
EIWT	Evaporator Inlet Water Temperature Sensor
EOWT	Evaporator Outlet Water Temperature Sensor
Ex.T	External Temperature Sensor
FSE	Evaporator Flow Switch
EEV	Electronic Expansion Valve
LLS	Liquid Line Solenoid Valve
	Filter Drier
	Compressor
	Condenser
	Evaporator
	Indicator

REMOTE MONITORING APPLICATION

The remote monitoring system is provided by Sarmaafarin on its chillers and packages on request of customers. By directly connecting the monitoring system to the main control unit, all information and alarms can be transmitted to any location via a fixed connection line. Real time monitoring of operating conditions on installed units, recording of data in abnormal situations, maintenance management and setting desired temperature in the home from a smart phone, are just some of many opportunities provided to designers and users of home systems at any time and from anywhere. Storing customer information for at least one year has a significant impact on the proper functioning and operational life of the system, making it easier to maintain the system.



Monitoring Application

Features and Benefits of Monitoring

- Observation of important parameters at any moment
- Displaying the current status of system on a chart based on live data
- Recording important values in the case of abnormal events
- Quick diagnosis of system faults and troubleshooting from anywhere
- Customized pages for the customer
- Selecting important parameters, notifications and warnings by the custom
- Applicable settings via PC or Smart phone
- Different access levels with specific passwords for users
- Collecting and building an annual archive of information

Remote Monitoring Schematic

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