SARMAAFARIN

Air-Cooled Scroll Chillers

ISO 9001

Certificate No.: 9190.C308

FORM SSI - 30RC (1403)

30RC
15-50

(53 to 176 Nominal kWR)
15 to 50 Nominal Tons

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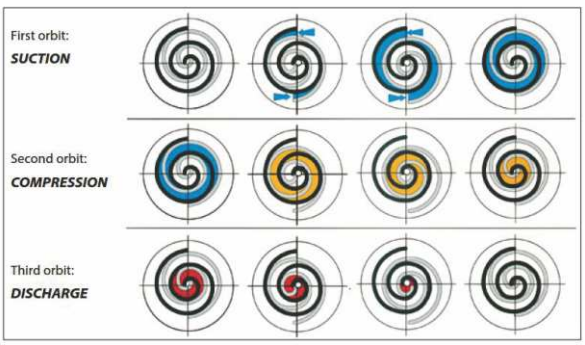
Features and Benefits:

SarmaAfarin 30RC chillers are devised for different cooling applications such as air-conditioning and ventilation, process cooling, laboratory usage, medical, metal finishing, food processing, agriculture, and wastewater treatment which need flexible and reliable chillers.

- 30RC series are available in six sizes:15, 20, 25, 30, 40, and 50 TR
- Positive displacement, twin scroll compressor.
- Quiet axial condenser fan system
- Microchiller used to control the compressors and fans.
- The continuous process of suction, compression and discharge through the twin-scroll compressor
- Ozone-friendly R407C and R-134a refrigerants.
- Rated according to AHRI Standard 550/590 and 551/591
- Developed based on Carrier System Design Manual
- Ready to install with least piping and electrical wiring work.
- High and low-pressure switches to maintain chiller in its envelope
- Static pressure for field piping and heat exchangers
- Thermostatic expansion valve with pressure drop equalization
- Self-stand power and control electrical box for ready to plugin
- Full load EER up to 11.5 and COP up to 3.34
- Intelligence and connectivity (coupled PLC and BMS)
- Superior reliability and versatility

30RC Scroll Chillers

Commercial and residential chillers are introduced as 30RC series with united parts of refrigerant. The refrigerant circuit works with orbiting scroll compressor which provides chilled water by an efficient evaporator. 30RC is an all-in-one package that is easy to install and live with.



SARMAAFRIN Coupling Products

The 30RC chillers can be used with wide choices of SarmaAfarin terminal fan coil units; 42A/42H/42NZ room units, 42GT cassettes, 42HA/42NF under-ceiling units, and 42D ducted units.

Some HVAC applications require filtration and fresh air which is achievable by 39HX (manufactured according to BS/EN-13053). This type of air handling unit can be coupled with 30RC liquid chiller in order to deliver conditioned air to customers.

Special applications

We provide cooling solutions for Medical devices, metal finishing like lasers, furnaces cooling, food production, and so much more.

Metal Finishing

It is vital to use the best cooling solution in metal processing like laser cutting, welding, or marking to cool down the main parts. SaramaAfarin offers different features and benefits such as conductivity elimination, corrosion level, and dual temperatures which are recommended by the laser manufacturers. Also, water circuits are copper and ferrous free which is a great solution to operate reliable and safe in the metal finishing industry.

Medical Cooling Solutions

SarmaAfarin delivers cooling solutions in a wide range of medical applications where temperature control is critical. Different models of chillers suited to diverse medical applications such as

- Radiotherapy Chillers
- MRI Chillers
- CT Chillers
- Blood Bank Refrigeration
- Custom Linear Accelerator Chillers
- Laboratory Operations, and more

In commercial (RC) chillers, it is used integrated temperature and pressure sensors that can bring a close temperature tolerance with reliable operation and minimal downtime.

Chiller models

You have already know the 30XD, 30RAN series which are well branded in the HVAC market. SarmaAfarin research and development has also brought experience and knowledge to 30RC series

30RC

30RC liquid chillers are spatial optimized, reliable and efficient solutions where installers, consultants, and building owners require maximum performance and quality.

This series uses the right components including the compressor, condenser assembly, electrical and control parts, instruments like temperature, pressure transducer sensor, and metering device. This idea leads to a product that our customers can pursue and trust.

30RC specifications

Pressure boosting of refrigerant is done by AHRI-rated scroll compressors. Twin-scrolls compressor benefits from different components like oil pump, pump heater, internal relief valve, high discharge temperature protection, PTFE Spring, and heat shield.

- Reliable and efficient orbiting scroll compressor
- Heatshield isolates high-temperature discharge gas from the low-temperature side and leads to higher motor performance.
- Heatshield plays an acoustic dampener role in the compressors
- Efficient air-cooled condenser leads to low condensing pressure and temperature
- Pressure equalizer is used to make useful superheat more adjustable as a result evaporator with higher suction pressure
- Thermostatic expansion device permitting operation at a lower condensing pressure and improving utilization of the evaporator heat exchange surface (superheat control)
- Cleanliness of oil and refrigerant is achieved by a filter drier that can eliminate moisture and acid.
- High-pressure relief valve is used for the safety of compressors, heat exchangers, and piping.
- High and low-pressure switches to maintain compressor in its application envelope

Additional Technical data

Low Operation Sound Levels

- **Compressors**
  - Residential and light commercial version
  - Full hermetic welds shell
  - Wide range with wide application envelope for varied applications
  - Discharge check valve prevents reverse rotation, resulting in no shutdown noise
  - Special design of counterweight that rotates with the crankshaft in a scroll compressor has an interaction with the surrounding gas.
  - Low sound level
- **Condenser section**
  - Suction noise elimination
  - Low-noise axial fans customized with diffusers to reduce sound levels by up to 7.2 dB(A)
  - Rigid fan mounting preventing start-up noise

Micro Controller

Micro chiller controller is a logic controller which limits the chiller to operate in its envelope range.

Condenser fan, compressor, receive logical commands from controller to run in sequence based on a logic flow chart.

There are some limitations and safety precautions that are considered to prevent the chiller from disruption.

Due to changes in outdoor air temperature and cooling load, some parameters are watched by Microcontroller. The following parameters are under examination by Controller:

- Leaving and entering cooler water temperature controls chiller
- Pressure transducer for suction and discharge gas of the compressor.
- pressure transducer sensor

Factory Testing

All SSI applied scroll chillers are factory-tested prior to shipment. Operating and safety controls are checked for correct settings and operation. This testing helps reduce field start-up issues and maintain critical construction schedules.

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.

Furthermore, 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.

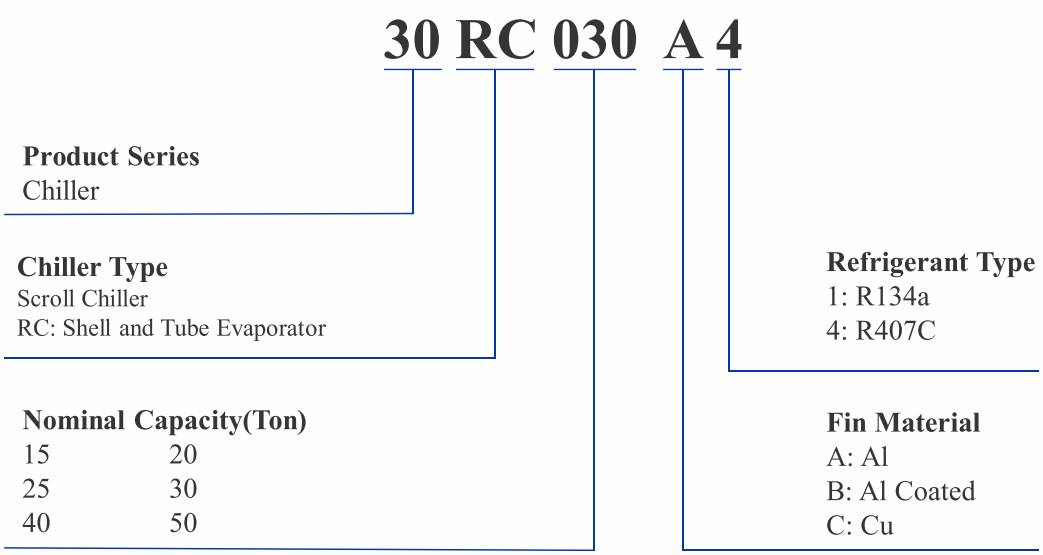
Fast and simple installation and service

Easy access to all internal components: simply undo screws to remove the complete front panel to access the refrigerant piping connections. For control box and electrical connections mounted aseparate access door for inspection and wiring work. Advanced circuit design and component selection have resulted in a compact unit with an exceptionally small footprint that is easy to transport even through narrow doors. Reduced operating weight and a handle on the unit panels to facilitate transport. Chiller is protected from high/low-temperature refrigerant by two transducers that are connected to the Microcontroller. Water Differential Pressure Sensor measures the pressure drop across the shell and tube heat exchanger to ensure that the circuits contain enough water to operate correctly. Various power cable outlet options: pre-punched holes in the cabinet panels permit cable exit on the side. Installer with electrical and control specialty can access water inlet and outlet temperature and refrigerant discharge pressure.

Reservoir Tank

Some applications including highly variable load, special temperature, and four seasonal require a reservoir between chiller and demand which plays role as energy storage providing by customers.

Options	Description	Advantageous
Refrigerants	R407C/ R134a	Refrigerant with Low ODP and GWP
Coils, Coatings and Protection	Al / Cu	Improved corrosion resistance, recommended for industrial and severe marine environments
	Al / Cu Coat	
	Cu / Cu	
	Cu / Cu Coat	
Ambient Temperature Range	R407C: up to 45°C	Easy to choose suitable chiller for various temperature situation
	R134a: up to 52°C	
Corrosion protection	Special coating on fins of condenser coil	Improved corrosion resistance, recommended for industrial, rural and severe marine environments



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. The 30RC 015-050 units feature a single power connection point. Recommended is power supply: 380V~3-phase-50Hz which voltage variation tolerance and frequency variation tolerance are ±10% and ±2Hz respectively. All 30RC units are protected to IP54 against dust and water.

30RC - R407C (380V±10% ~50Hz - 3ph)							
30RC Model‡		**15**	**20**	**25**	**30**	**40**	**50**
Compressor 1 :							
MOC	**A**	35	24	31	35	47	58
LRA	**A**	175	130	145	175	215	270
Compressor 2 :							
MOC	**A**	----	24	31	35	47	58
LRA	**A**	----	130	145	175	215	270
Total Pcons : **	**kW**	18	24	31	35	49	58
Total FLA : **	**A**	33	43	53	61	80	96

30RC - R134a (380V±10% ~50Hz - 3ph)							
30RC Model‡		**15**	**20**	**25**	**30**	**40**	**50**
Compressor 1 :							
MOC	**A**	35	24	31	35	47	58
LRA	**A**	175	130	145	175	215	270
Compressor 2 :							
MOC	**A**	----	24	31	35	47	58
LRA	**A**	----	130	145	175	215	270
Total Pcons : **	**kW**	13	17	22	25	35	43
Total FLA : **	**A**	26	35	41	47	61	77

LEGEND
FLA - Full Load Amperage
MOC : Maximum Operating Current
LRA - Locked Rotor Amperage
Pcons : Power Consumption
‡- Rated in accordance with Danfoss Compressor at standard rating conditions.
**- Total Pcons and FLA include fans and compressors.

UNIT 30RC- R407C		15	20	25	30	40	50
General	AHRI Rated Capacity*(kWR)	40	54	72	82	113	132
	AHRI Rated COP*	3.3	3.1	3.4	3.2	3.3	3.0
	IPLV (Seasonal COP)	4.2	5.2	5.0	5.3	5.4	5.1
	Refrigerant Type	R407C					
Compressor	Type	Scroll Compressor					
	%CAP Circuit 1	100	50	50	50	50	50
	%CAP Circuit 2	-	50	50	50	50	50
	Control Steps	1	2	2	2	2	2
Cooler	Type	Dry Expansion Shell & Tube With Enhanced Copper Tubes					
	Size	15	25	25	30	30	30
	Water flow* (l/s)	1.9	2.6	3.5	4.0	5.5	6.4
	Pressure drop* (kPa)	10.9	13.0	23.1	18.6	34.3	46.0
	Net Shell Volume (liter)	19.7	37.4	37.4	51.9	51.9	51.9
	Water Connection (in)	1 1/2 NPT	2 NPT	2 NPT	2 1/2 ASA	2 1/2 ASA	2 1/2 ASA
Condenser	Type	Multi-Pass Cross ,Corrugated Fin & Tube(14 FPI), V-Type					
	Condenser Fan	Axial Flow Fan, Vertical Discharge					
	Quantity	2					
	Total Air flow(CMH)x1000	16.8	17.2	27.0	27.0	37.4	37.4
	Total Face Area (sq. m.)	1.6	1.6	3.2	3.2	4.4	4.4
Weight ‡	Al Fin (kg)	950	1130	1180	1250	1440	1460
	Cu Fin(kg)	990	1190	1250	1330	1590	1600
Dimension ‡	Length(m)	2.3					
	Width(m)	1.2					
	Height(m)	2.4	2.4	2.4	2.4	2.7	2.7

LEGEND

kWR – kilowatt of Refrigeration
CAP – Capacity
CMH – Cubic meter per hour
COP – Coefficient of Performance
FPI – Fin per inch
IPLV - Integrated Part Load Value (Seasonal COP)
NPT - National pipe thread

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: 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.

Physical Data

UNIT 30RC-R134a		15	20	25	30	40	50
General	AHRI Rated Capacity*(kWR)	29	38	49	61	80	96
	AHRI Rated COP*	3.8	3.7	3.7	3.8	3.8	3.5
	IPLV (Seasonal COP)	4.8	5.4	5.4	5.5	5.0	5.0
	Refrigerant Type	R134a					
Compressor	Type	Scroll Compressor					
	%CAP Circuit 1	100	50	50	50	50	50
	%CAP Circuit 2	-	50	50	50	50	50
	Control Steps	1	2	2	2	2	2
Cooler	Type	Dry Expansion Shell & Tube With Enhanced Copper Tubes					
	Size	15	25	25	30	30	30
	Water flow* (l/s)	1.4	1.9	2.4	2.9	3.9	4.6
	Pressure drop* (kPa)	19.7	37.4	37.4	51.9	51.9	51.9
	Net Shell Volume (liter)	6.0	7.2	11.2	10.1	17.7	24.3
	Water Connection (in)	1 1/2 NPT	2 NPT	2 NPT	2 1/2 ASA	2 1/2 ASA	2 1/2 ASA
Condenser	Type	Multi-Pass Cross ,Corrugated Fin & Tube(14 FPI), V-Type					
	Condenser Fan	Axial Flow Fan, Vertical Discharge					
	Quantity	2					
	Total Air flow(CMH)x1000	16.8	17.2	27.0	27.0	37.4	37.4
	Total Face Area (sq. m.)	1.6	1.6	3.2	3.2	4.4	4.4
Weight ‡	Al Fin (kg)	950	1130	1180	1250	1440	1460
	Cu Fin(kg)	990	1190	1250	1330	1590	1600
Dimension ‡	Length(m)	2.3					
	Width(m)	1.2					
	Height(m)	2.4	2.4	2.4	2.4	2.7	2.7

LEGEND

kWR – kilowatt of Refrigeration
CAP – Capacity
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Fouling Factor: 0.000018 m^2×K/W

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R407C	Condenser Entering Air Temperature°C															
LCWT: 7°C	30				35				40				45			
MODEL 30RC	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
15	12.0	42	11	2.0	11.4	40	12	1.9	10.7	37	13	1.8	9.9	35	15	1.7
20	16.2	57	15	2.8	15.2	54	17	2.6	14.2	50	19	2.4	13.1	46	22	22
25	21.5	76	19	3.7	20.4	72	21	3.5	19.2	67	24	3.3	17.9	63	27	3.1
30	24.9	88	23	4.2	23.4	82	26	4.0	21.9	77	29	3.7	20.2	71	32	3.4
40	33.9	119	30	5.8	32.1	113	34	5.5	30.2	106	38	5.1	28.2	99	42	4.8
50	39.7	140	39	6.8	37.6	132	44	6.4	35.3	124	49	6.0	32.8	115	54	5.6

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×K/W
Performances in accordance with AHRI 551/591

Performance Data

R134a	Condenser Entering Air Temperature°C											
LCWT: 7°C	30				35				40			
MODEL 30RC	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
15	8.5	30	7	1.4	8.1	29	8	1.4	7.7	27	8	1.3
20	11.4	40	9	1.9	10.9	38	10	1.9	10.3	36	12	1.8
25	14.4	51	12	2.5	13.8	49	13	2.4	13.1	46	15	2.2
30	18.1	64	14	3.1	17.3	61	16	2.9	16.4	58	18	2.8
40	23.9	84	19	4.1	22.8	80	21	3.9	21.6	76	23	3.7
50	28.6	101	25	4.9	27.3	96	28	4.6	25.9	91	30	4.4

R134a	Condenser Entering Air Temperature°C											
LCWT: 7°C	45				50				52			
MODEL 30RC	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
15	7.3	26	9	1.2	6.8	24	10	1.2	6.7	23	11	1.1
20	9.7	34	13	1.7	9.1	32	15	1.5	8.8	31	15	1.5
25	12.5	44	16	2.1	11.7	41	18	2.0	11.5	40	19	2.0
30	15.4	54	19	2.6	14.5	51	21	2.5	14.1	49	22	2.4
40	20.5	72	26	3.5	19.3	68	28	3.3	18.8	66	29	3.2
50	24.4	86	33	4.2	22.9	81	37	3.9	22.3	78	38	3.8

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×K/W
Performances in accordance with AHRI 551/591

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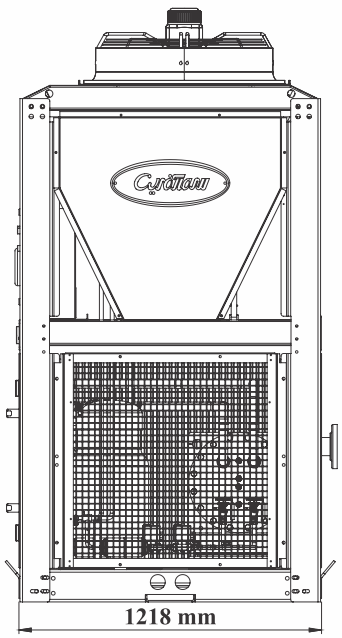
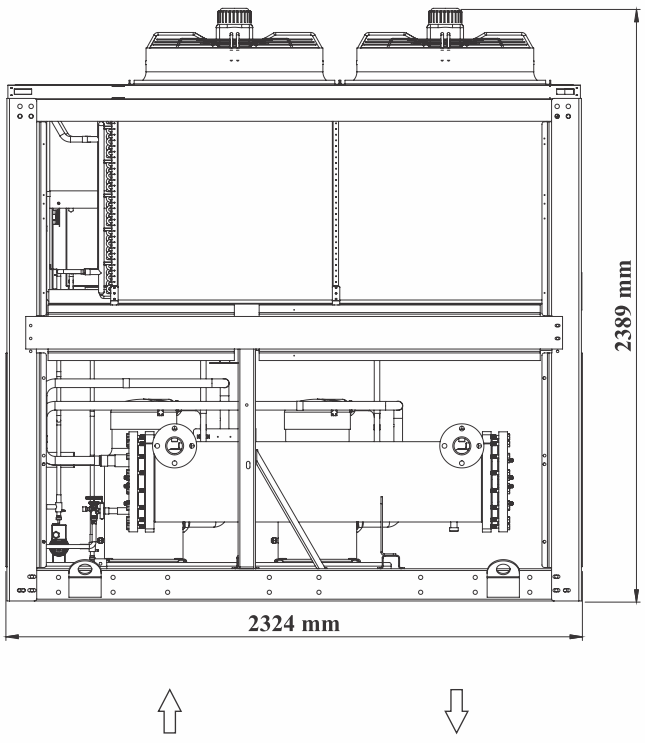


Front View



Right View

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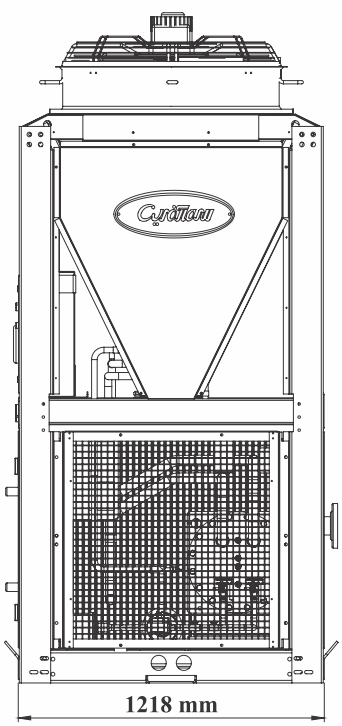
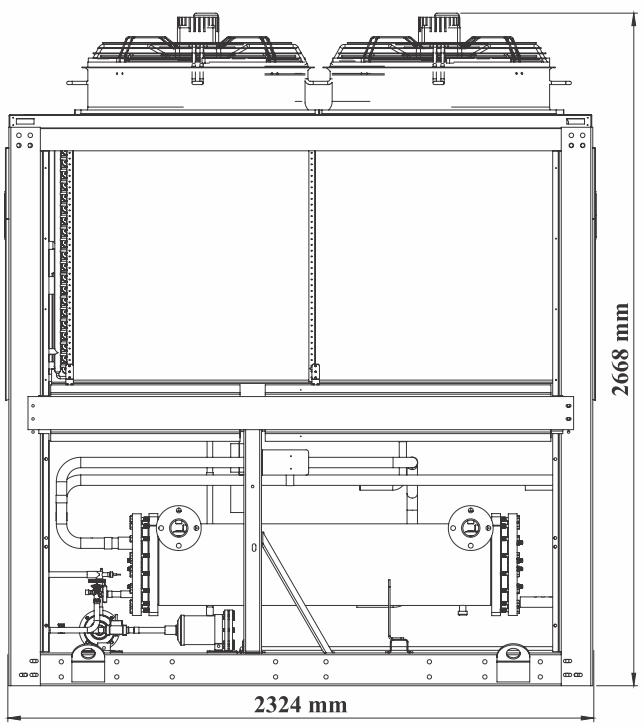


Front View



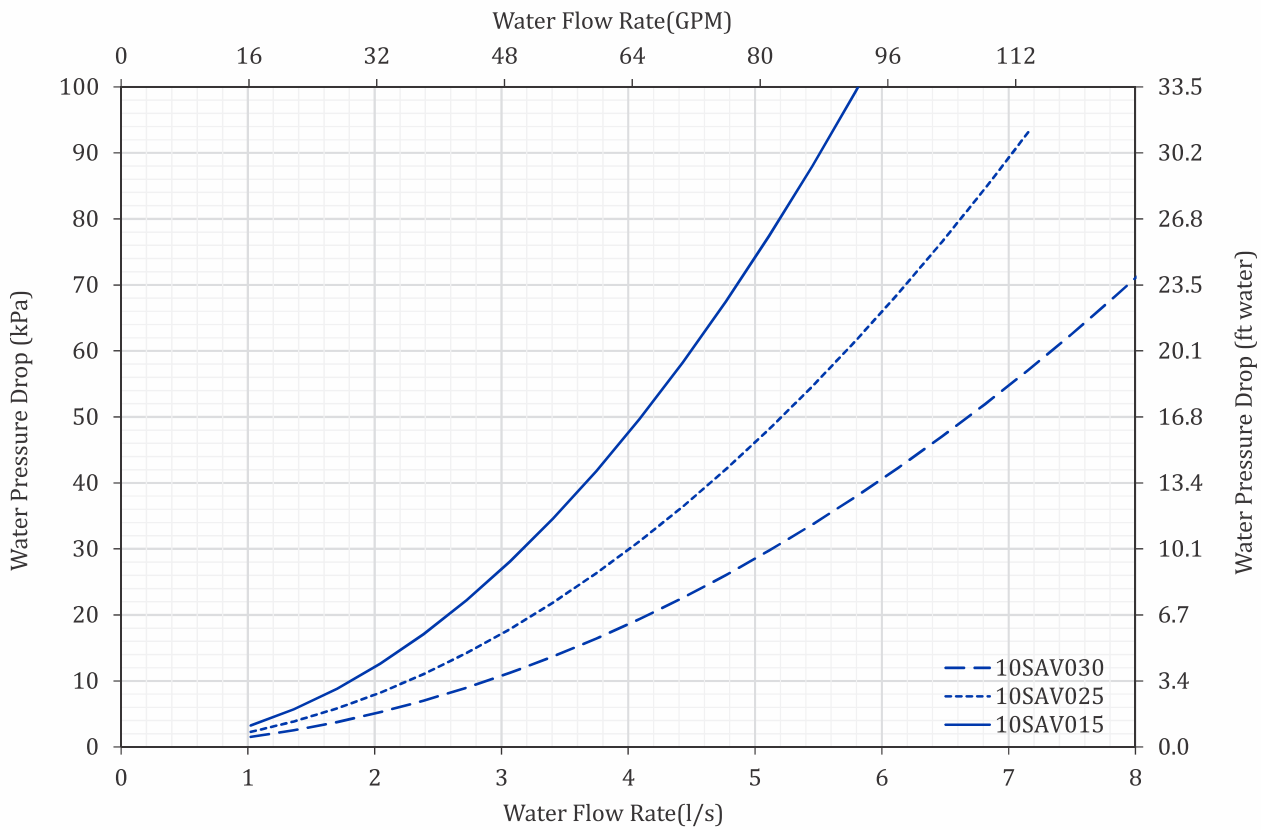
Right View

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.

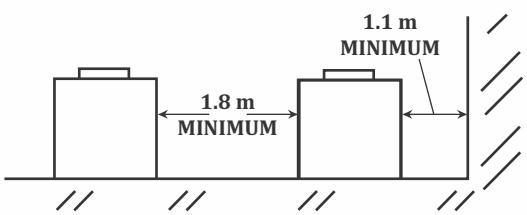


Cooler Pressure drop for different size of evaporator

Chiller Location and Clearances

The 30RC 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. When parallel chillers are aligned and coils face each other a minimum of 1.8m is recommended. When parallel chillers have no coil facing each other a minimum clearance of 1.2m must be maintained on the side of the chiller that has an electric box. 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

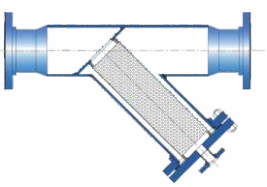
The recommended minimum clearance to ensure proper airflow through the condenser coils and to allow fan maintenance is as shown above.
There are applications, however, in which recommended minimum clearances are not available. In these situations, customers should contact SarmaAfarin after Sales Department 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 m^2xK/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 3m from the unit to prevent debris from damaging internal tubes of the cooler.



Typical Strainer

Cooler Water Temperature

The 30RC chillers have been meticulously crafted to align with the guidelines set forth by the AHRI Standard 551/591. 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 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°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 4.5°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 30RC 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.

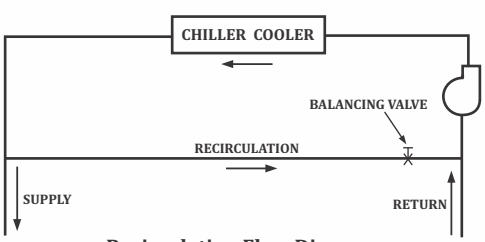
The 30RC chillers are designed for a full load temperature rise of (3.5-8.3°C). Contact Sarma Afarin's Sales Engineering Department to obtain performance data if a temperature rise other than 5°C is being considered.

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.



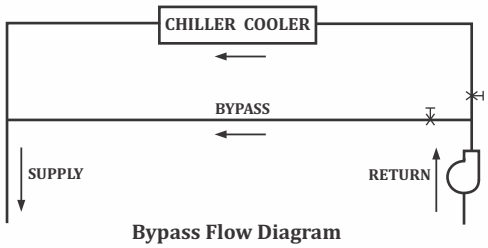
Recirculation Flow Diagram

Maximum Cooler Flow

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.

NOTE: Recirculation flow is shown below



Bypass Flow Diagram

Variable Cooler Flow Rates

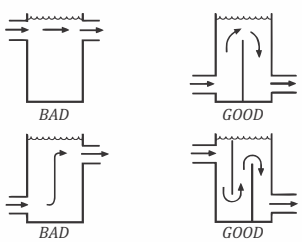
Variable rates may be applied to a standard chiller. The unit will, however, attempt to maintain a constant leaving chilled water temperature. In such cases, the following consideration should be followed:

- 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.



Baffle arrangement in Buffer Tank

Cooler Fouling Factor

The fouling factor used to calculate tabulated performance ratings is 0.000018 m^2xK/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 30RC 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 4.5°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 1.1°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.*

Minimum and Maximum Cooler Flow Rates -R407C

Model	30RC Flow Rate (l/s)		
	Design	Minimum	Maximum
15	1.9	1.2	4.0
20	2.6	1.9	6.6
25	3.5	1.7	6.6
30	4.0	1.9	8.5
40	5.5	2.7	8.8
50	6.4	3.0	9

Minimum and Maximum Cooler Flow Rates -R134a

Model	30RC Flow Rate (l/s)		
	Design	Minimum	Maximum
15	1.4	0.9	4.0
20	1.9	1.2	6.6
25	2.4	1.5	6.6
30	2.9	1.6	8.5
40	3.9	2.3	8.8
50	4.6	2.6	9

Altitude Correction Factors

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

Altitude		Capacity Multiplier	Compressor Power Multiplier
(ft)	(m)		
2000	610	0.99	1.01
4000	1219	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 0.2 in.wg (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 30RC 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)

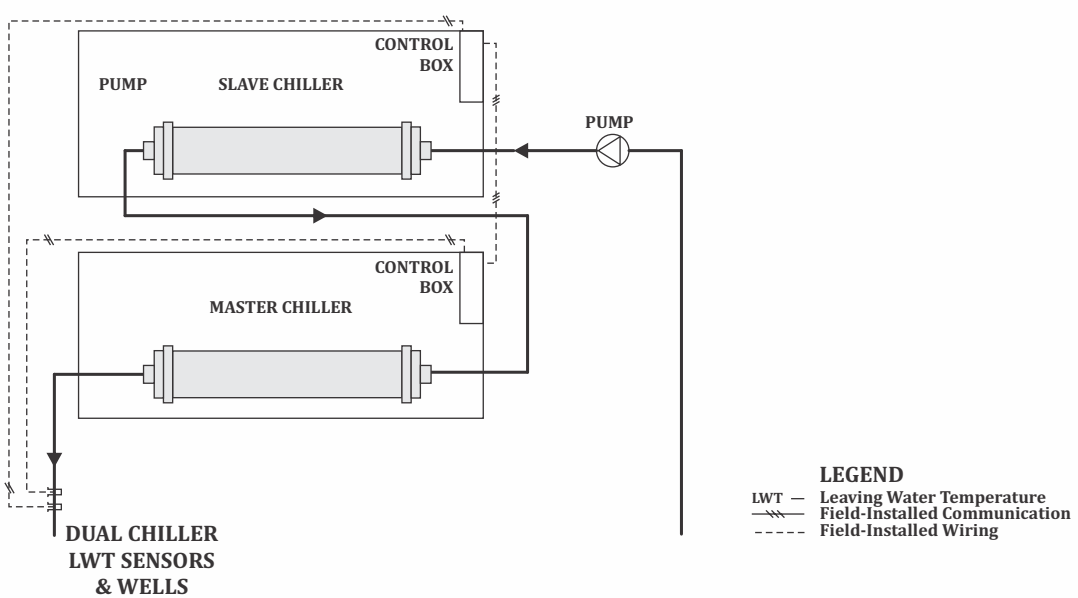
Parallel dual chiller operation

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.

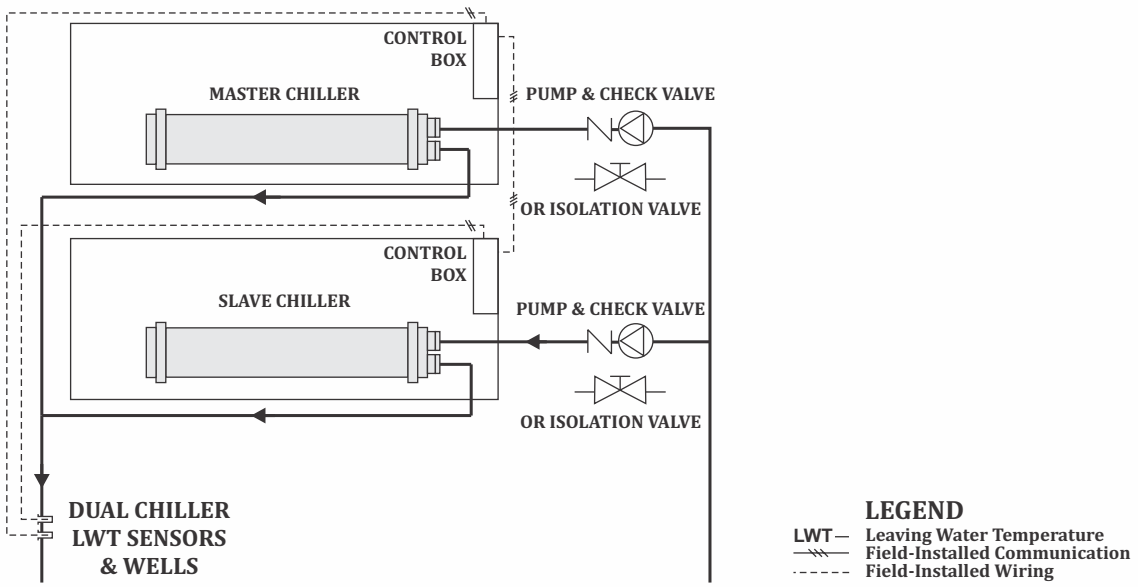
Series Dual Chiller Operation

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

SERIES DUAL CHILLER OPERATION



PARALLEL DUAL CHILLER OPERATION



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

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 to satisfy actual dynamic load conditions. The control maintains leaving-fluid temperature set point shown on the display device through intelligent 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.

The following temperature sensors are provided on 30RC units:

- Cooler leaving chilled fluid temperature
- Cooler entering fluid (return) temperature

Two refrigerant pressure transducers are used in each circuit for sensing suction and discharge pressure. The microprocessor uses these inputs to control capacity and fan cycling.

Start-up

After control circuit switches on, the prestart process takes place, then microprocessor checks itself, checks the flow switch signal and waits for temperature to stabilize. The controlled pull down feature limits compressors 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 number of the compressors is increased to meet the desired capacity parameters.

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