MAYA

A YAZAKI CORPORATION JAPAN JOINT VENTURE COMPANY

WATER FIRED ABSORPTION CHILLERS WFC SERIES

COOLING CAPACITY: FROM 17.6 kW TO 352 kW
HEAT MEDIUM TEMPERATURE: FROM 70 °C TO 95 °C

Can be installed outdoor

APPLICATIONS:

Cogeneration - Waste Heat Recovery - Solar Cooling - District Heating
Biomass Boilers - Geotermal

PRODUCT RANGE:

Model	Cooling capacity	Heat input
WFC SC 5	17.6 kW	25 kW
WFC SC 10	35 kW	50 kW
WFC SC 20	70 kW	100 kW
WFC SC 30	105 kW	151 kW
WFC SC 50	176 kW	251 kW
WFC M 100	352 kW	502 kW

YAZAKI

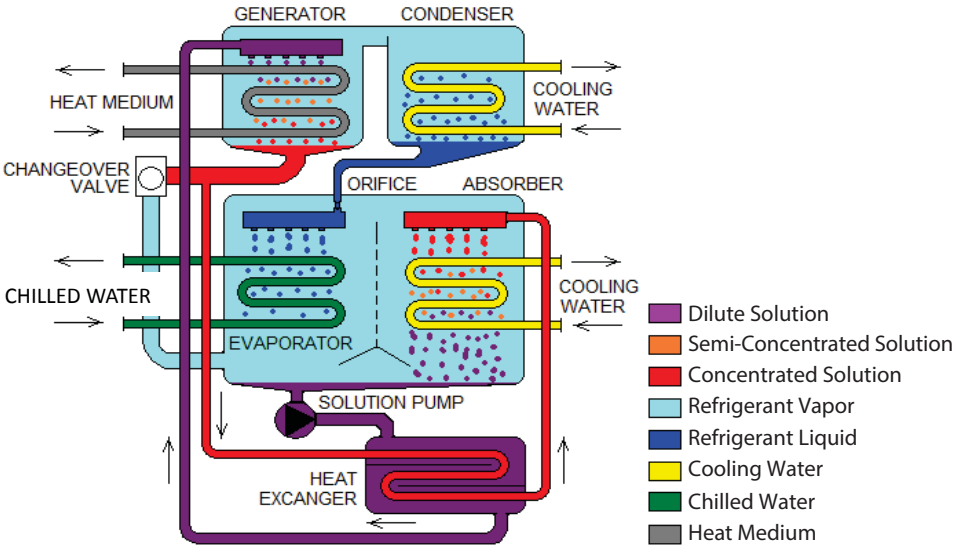
Water-Fired SINGLE-EFFECT Chiller

Yazaki Water-Fired SINGLE-EFFECT chillers have cooling capacities of 17.6, 35.2, 70.3, 105.5, 175.8 and 352 kW (5, 10, 20, 30, 50 e 100 TON).They produce chilled water for cooling in comfort air conditioning applications. The absorption cycle is energized by a heat medium (hot water) ranging from 70 °C to 95 °C from an industrial process, cogeneration system, solar energy, or other heat source.
The condenser circuit is water cooled.

Absorption Principle

The Yazaki absorption chiller uses a solution of lithium bromide and water, as the working fluid. Water is the refrigerant and lithium bromide, a nontoxic salt, is the absorbent

Cooling cycle



GENERATOR

When the heat medium inlet temperature exceeds 68°C, the solution pump forces dilute lithium bromide solution into the generator. The solution boils on the surface of the generator tubing bundle, releasing refrigerant vapor. The vapor rises up and flows over into the condenser. The solution becomes more concentrated as a result and the concentrated solution drops into the generator sump where it drains down through a heat exchanger before entering the absorber section.

EVAPORATOR

In the evaporator, the refrigerant liquid is exposed to a substantially deeper vacuum than in the condenser due to the influence of the absorber. As refrigerant liquid flows over the surface of the evaporator coil, it boils into vapor and removes an amount of heat from the chilled water circuit equivalent to the latent heat of the refrigerant. The recirculating chilled water is cooled to the selected set point and the refrigerant vapor is attracted to the absorber.

CONDENSER

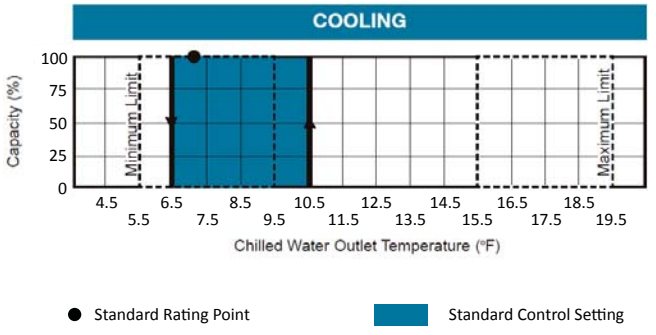
In the condenser, refrigerant vapor is condensed on the surface of the cooling coil and latent heat, removed by the cooling water, is rejected to a cooling tower or ground loop. Refrigerant liquid accumulates in the condenser sump and then passes through an orifice into the evaporator.

ABSORBER

A deep vacuum in the absorber is maintained by the affinity of the concentrated solution from the generator for the refrigerant vapor formed in the evaporator. The refrigerant vapor is absorbed by the concentrated lithium bromide solution flowing across the surface of the absorber coil. The heat of condensation and dilution is removed by the cooling water and rejected to a cooling tower. The resulting dilute solution is preheated in a heat exchanger and returned to the generator where the cycle is repeated.

CHILLED WATER TEMPERATURE RANGE

In WFC-SC groups 5-10-20-30-50 the chilled water supply temperature is set to standard conditions, shown in the next figure.
The authorized technical service YAZAKI can change the values to manage installations with multiple units, or different design temperatures, in the range 5.5 ° C - 15.5 ° C.
The intervention differential, is fixed, equal to 4 ° C.
In WFC-M100, the differential can be changed to 2 ° C, 3 ° C and 4 ° C.



Features and Benefits

• Enable/disable condition can be selected remotely.

• The absorption cycle is energized by hot water. Hot water can be from any source such cogeneration, solar, or any waste heat sources as long as it can be provided to the chiller at a temperature between 70°C to 95°C.

• Extended capacities available when supplied with cooling water colder than design standard 31°C and/or heat medium warmer than design standard of 88°C.

• Faster cold start-up time (as quick as 90 seconds) than similar chillers with flooded generators.

• Working fluids of lithium bromide and water operate under a vacuum at all times and are safe, odorless, and non-toxic.

• Only one rotating part — the hermetically sealed solution pump.

• Vacuum vessel fully hermetically sealed at the factory for a level of vacuum integrity that is unmatched in the industry. No field welding necessary.

• Helps to prevent crystallization by utilizing a solution pump and gravity drain-back design.

• Chilled and hot water outlet temperatures controlled by a built-in microprocessor with outputs to control a 3-way heat medium bypass valve, all relevant pumps, and can even control the cooling tower fan if so desired. (Valves and pumps are field-supplied.)

• Built-in logic will shut down the unit under abnormally high heat medium and/or cooling water temperatures to help prevent crystallization and other service related issues.

• Proprietary solution and inhibitor blends ELIMINATE the need for regular chemical analysis, resulting in much simpler regular maintenance when compared with most other manufacturers.

• All chillers and chiller-heaters are supplied cabinets that are suitable for indoor or outdoor installation without modification.

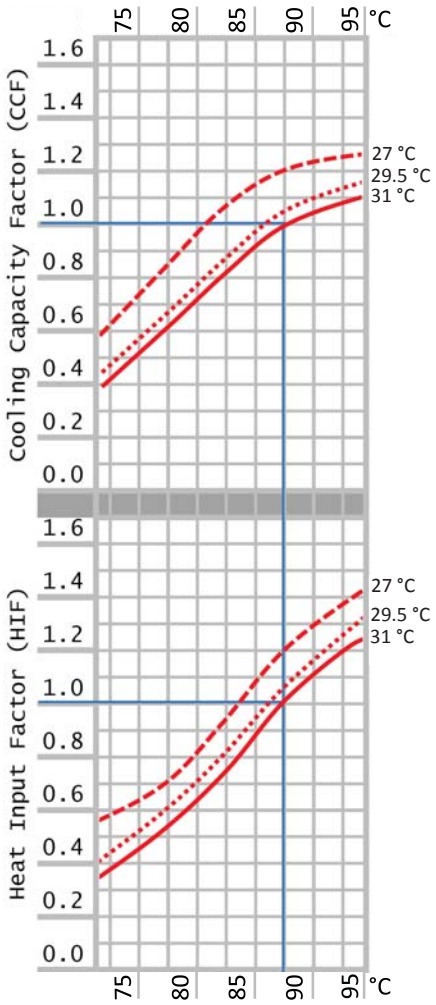
• Factory charged and run tested. Solution balancing done at the factory so that it does not need to be done in the field at startup.

SPECIFICATIONS				SC 5	SC 10	SC 20	SC 30	SC 50	M 100
Cooling Capacity			kW	17.6	35.2	70.3	105.6	175.8	352
Chilled	Cooling Temperature		°C	12.5 In / 7 Out					
	Evaporator Pressure Loss		kPa	52.6	56.1	65.8	70.1	40.2	72.6
	Max Operating Pressure		kPa	588					785
	Rated Water Flow		l/s	0.77	1.52	3.05	4.58	7.64	15.29
	Allowable Water Flow		%	80% - 120%					
	Volume of the exchanger		l	8	17	47	73	120	121
Cooling Water	Heat Rejection		kW	42.7	85.4	170.8	256.2	427	855
	Temperature		°C	31 In / 35 Out					29.4 In 35.4 Out
	Absorber Pressure Loss		kPa	38.3	85.3	45.3	46.4	41.2	66.0
	Fouling factor		$m^2hr°K/kW$	0.086					
	Max Operating Pressure		kPa	588					785
	Rated Water Flow		l/s	2.55	5.1	10.2	15.3	25.5	34.04
	Allowable Water Flow		%	100% - 120%					
	Volume of the exchanger		l	37	66	125	194	335	422
Heat Medium	Heat Input		kW	25.1	50.2	100	151	251	503
	Temperature		°C	88 In / 83 Out					90 In 80 Out
	Allowable Temperature		°C	70 min - 95 max					
	Generator Pressure Loss		kPa	95.8	90.4	46.4	60.4	85.2	29.7
	Max Operating Pressure		kPa	588					785
	Rated Water Flow		l/s	1.2	2.4	4.8	7.2	12	12.01
	Allowable Water Flow		%	30% - 120%					
	Volume of the exchanger		l	10	21	54	84	170	250
Electrical Supply	Power Supply		V/Hz	220 V / 1-phase / 50 Hz	400 V / 3-phases / 50 Hz				
	Consumption[2]		W	48	210	260	310	590	630
	Circuit Amps		A	0.22	0.43	0.92	1.25	2.6	1.83
Heat medium valve check				On - Off					On-Off;Prop.
Construction	Dimensions[2]	Width	mm	594	760	1060	1380	1784	1672
		Depth	mm	744	970	1300	1545	1960	3654
		Height	mm	1736	1900	2010	2045	2085	2200
	Weight	Dry	kg	365	500	930	1450	2100	4947
		Operating	kg	420	604	1156	1801	2725	5740
	Noise Level[3]		dB(A)	46	49	49	46	57	56
Piping	Chilled/hot Water		mm	DN 32	DN 40	DN 50	DN 50	DN 80	DN 100
	Cooling Water		mm	DN 40	DN 50	DN 50	DN 65	DN 80	DN 125
	Hot Water		mm	DN 40	DN 40	DN 50	DN 65	DN 80	DN 100

1 - Power consumption does not include external pumps or motors.
2 - Height does not include removable lifting lugs. Width/Depth does not include the junction box or mounting plates.
3 - Noise level is measured in a free field at a points 1m away from the cabinet and 1.5m above ground level.

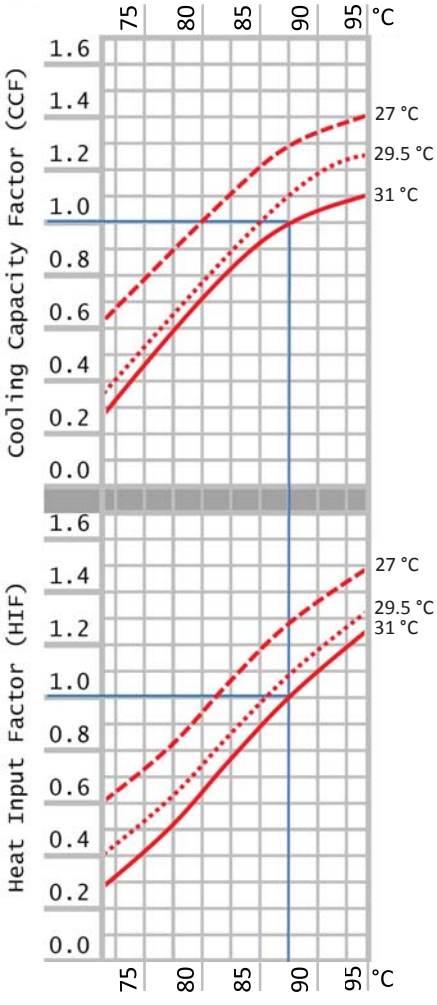
Performance Characteristics (7 °C)

WFC - SC5



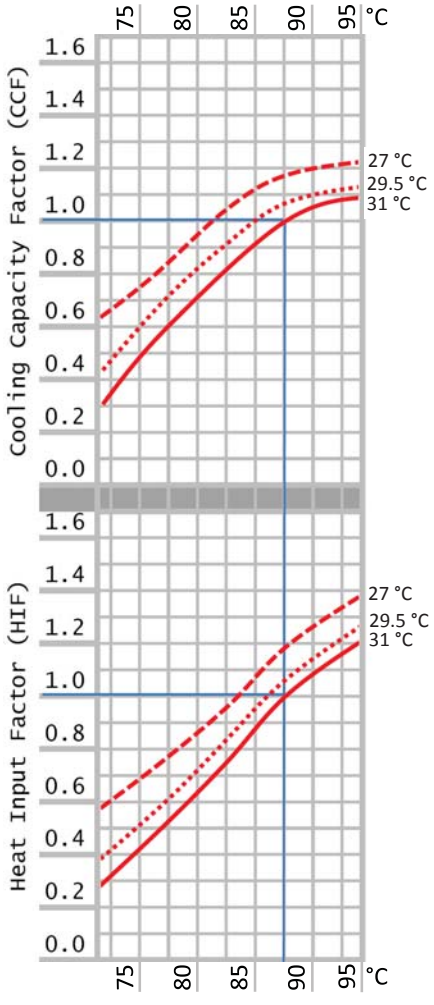
Heat Medium Inlet Temperature

WFC - SC10



Heat Medium Inlet Temperature

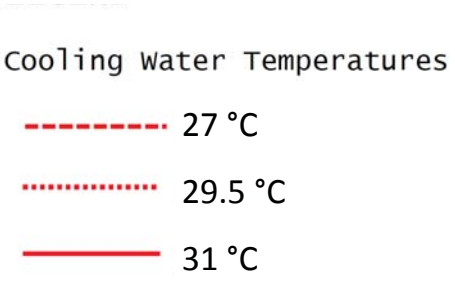
WFC - SC20



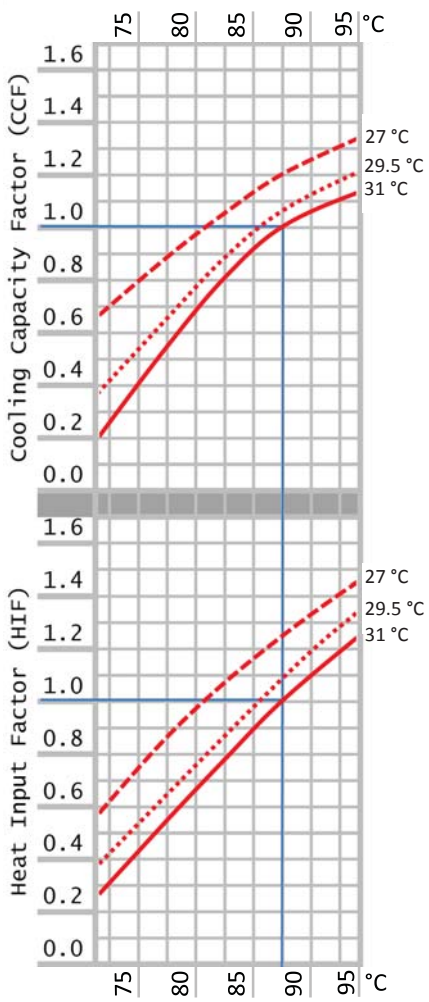
Heat Medium Inlet Temperature

NOTE:

1. Bold blue lines indicate rated design conditions. Where these lines cross designate the Standard Rating Point.
2. All curves are based on water inall circuits flowing at rated design condition flow rates.
3. Performance may be interpolated but must not be extrapolated.
4. Expanded performance curves are provided for reference only. For any other explanation, please, contact Maya.
5. Performance data based upon standard fouling factor of 0,086 $m^2hr°K/kW$.

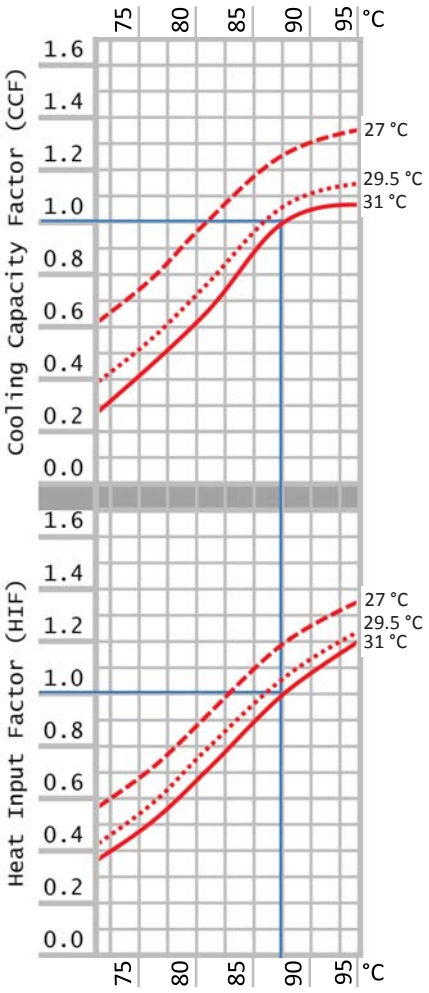


WFC - SC30



Heat Medium Inlet Temperature

WFC - SC50



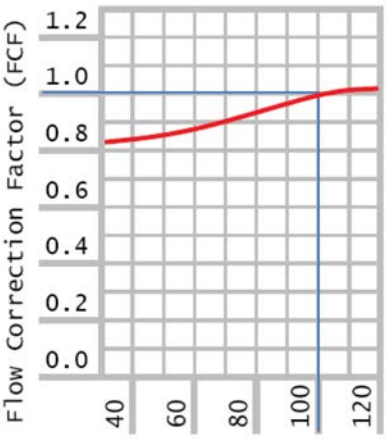
Heat Medium Inlet Temperature

Working Range:

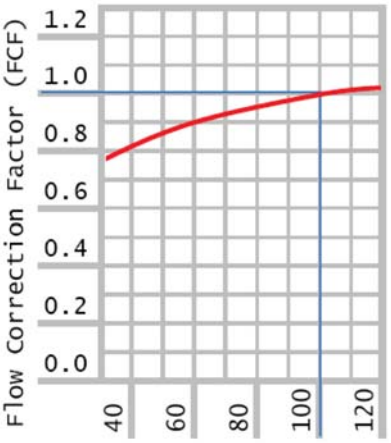
	Nominal Value	Applicable Tolerances
Chilled Water TemperatureT [°C]	7 with Δt 5,5 °C	min. 5,5 °C max 15,5 °C
Chilled Water Flow [%]	100	min. 80% max 120%
Hot Water Temperature T [°C]	88 with Δt 5 °C	min. 70 °C max 95 °C
Hot Water Flow [%]	100	min. 30% max 120%
Cooling Water Temperature T [°C]	31 with Δt 4 °C	min. 27 °C max 32 °C
Cooling Water Flow [%]	100	min. 100% max 120%

Heat medium flow rate
Correction chart

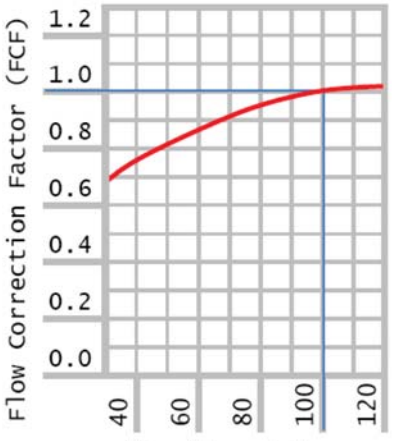
WFC - SC5



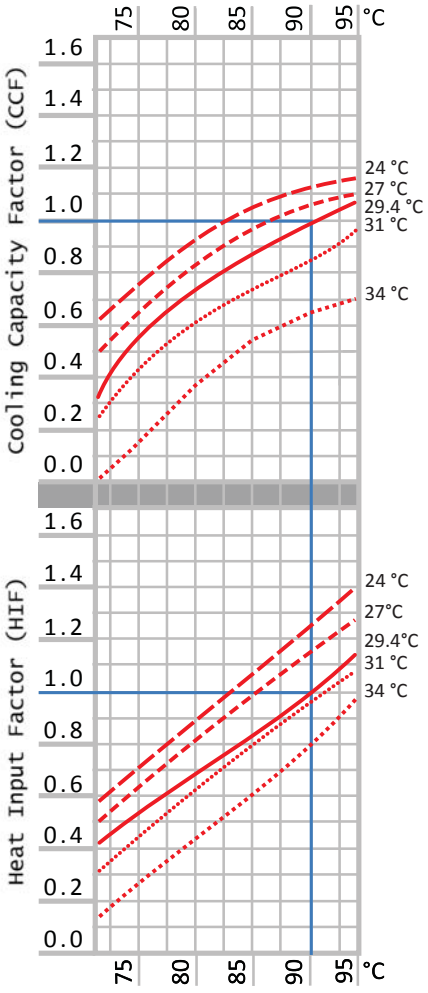
WFC - SC10, 20, 30



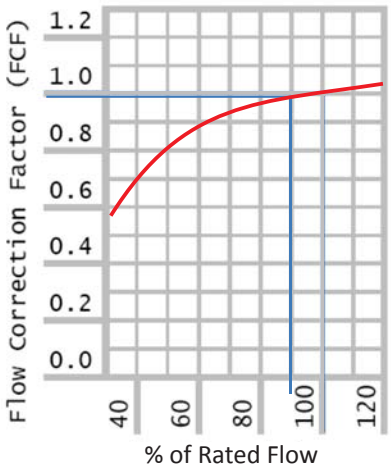
WFC - SC50



WFC - M100



WFC - M100



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Cooling Water Temperature

- 31 °C
- 29.4 °C
- 27 °C
- 24 °C
- 34 °C

Working Range:

	Nominal Value	Applicable Tolerances
Chilled Water TemperatureT [°C]	7 with Δt 5,5 °C	min. 5,5 °C max 15,5 °C
Chilled Water Flow [%]	100	min. 80% max 120%

Hot Water Temperature T [°C]	90 with Δt 10 °C	min. 70 °C max 95 °C
Hot Water Flow [%]	100	min. 30% max 120%

Cooling Water Temperature T [°C]	29.4 with Δt 6 °C	min. 27 °C max 32 °C
Cooling Water Flow [%]	100	min. 100% max 120%

Absorption Chiller Heat Balance

HEAT IN = HEAT OUT

Qg + Qe = Qc

Where:

Qg = Actual Heat Input to Generator
Qe = Actual Cooling Capacity
Qc = Actual Heat Rejected to Tower

COOLING CAPACITY

Qe = CCF x HMFCF x RCC

Where:

Qe = Actual Cooling Capacity
CCF = Cooling Capacity Factor
HMFCF = Flow Correction Factor
RCC = Rated Cooling Capacity

HEAT INPUT (COOLING)

Qg = HIF x HMFCF x RHI

Where:

Qg = Actual Heat Input to Generator
HIF = Heat Input Factor
HMFCF = Flow Correction Factor
RHI = Rated Heat Input

TEMPERATURE DIFFERENCE (°F)

ΔT = Qx in kW / (4.2 x Qa)

Where:

ΔT = Temperature Difference
Qx = Actual power Transferred in kW
Qa =Actual Flow Rate

PRESSURE DROP FOR NONSTANDARD FLOW RATES (kPa)

$\Delta Pa = \Delta Pr \times (Qa / Qr)^2$

Where:

ΔPa = Actual Pressure Drop
ΔPr = Rated Design Pressure Drop
Qa = Actual Flow Rate in l/s
Qr = Rated Design Flow Rate in l/s

EXAMPLE 1

Given: Heat Medium Inlet Temp: 90 °C
Heat Medium Flow: 7.20 l/s
Cooling Water Inlet Temp: 29.5 °C
Cooling Water Flow: 15.30 l/s
Chilled Water Outlet Temp: 7 °C
Chilled/Hot Water Flow: 4.58 l/s
Chiller-Heater Model: WFC-SC30

Refer to Performance Charts for Curves (Page 7) and to Specifications (Page 5) for Rated Design Information on the Model WFC-SC/SH30.

1 AVAILABLE COOLING CAPACITY

CCF at 90 °C Heat Medium = 1.12
Heat Medium Flow 7.2/7.2 = 100%
HMFCF for 100% Flow Rate = 1.0
Rated Cooling Capacity: 105.6 kW
Qe= 1.12 x 1.0 x 105.6 = 118.27 kW
Chilled Water ΔT = 118.27 / (4.2 x 4.58) = 6.15 °C
Chilled Water $\Delta P = 70.1 \times (4.58/4.58)^2 = 70.1$ kPa

2 HEAT INPUT (COOLING):

HIF for 90 °C Heat Medium = 1.15
HMFCF for 100% Flow Rate = 1.0
Rated Heat Input = 151 kW
Qg = 1.15 x 1.0 x 151 = 173.65 kW
Chilled Water ΔT = 173.65 / (4.2 x 7.2) = 5.74 °C
Chilled Water $\Delta P = 60.4 \times (7.2/7.2)^2 = 60.4$ kPa

3 HEAT REJECTED TO COOLING TOWER:

Qc = Qg + Qe
Qc= 173.65 + 118.27 = 291.92 kW
Required minimum flow rate = 15.30 l/s
The cooling tower selected must be capable of rejecting a minimum of 291.92 kW at a minimum flow rate of 15.30 l/s.
Cooling Water ΔT = 291.92 / (4.2 x 15.30) = 4.54 °C
Cooling Water $\Delta P = 46.4 \times (15.30/15.30)^2 = 46.4$ kPa

EXAMPLE 2

Given: Heat Medium Inlet Temp: 95°C
Heat Medium Flow: 3.60 l/s
Cooling Water Inlet Temp: 29.5 °C
Cooling Water Flow: 15.30 l/s
Chilled Water Outlet Temp: 7 °C
Chilled/Hot Water Flow: 4.58 l/s
Chiller-Heater Model: WFC-SC30

Refer to Performance Charts for Curves (Page 7) and to Specifications (Page 5) for Rated Design Information on the Model WFC-SC.

1 AVAILABLE COOLING CAPACITY

CCF at 95 °C Heat Medium = 1.22
Heat Medium Flow 3.6/7.2 = 50%
HMFCF for 50% Flow Rate = 0.86
Rated Cooling Capacity = 105.6 kW
Qe= 1.22 x 0.86 x 105.6 = 110.80 kW
Chilled Water ΔT = 110.8 / (4.2 x 4.58) = 5.76 °C
Chilled Water $\Delta P = 70.1 \times (4.58/4.58)^2 = 70.1$ kPa

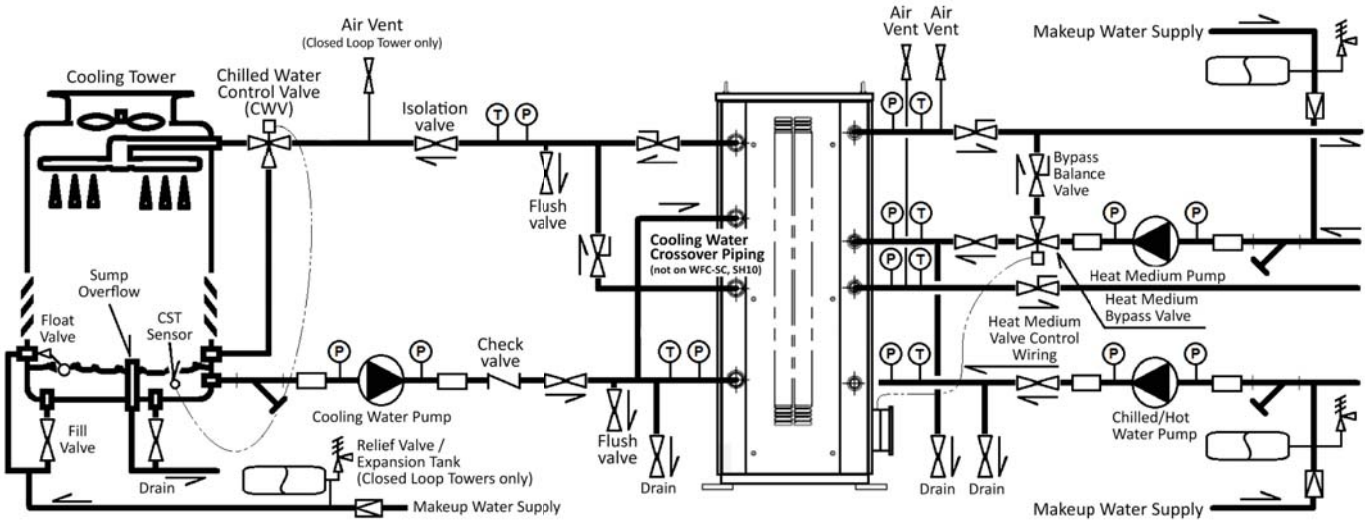
2 HEAT INPUT (COOLING):

HIF for 95 °C Heat Medium= 1.35
HMFCF for 50% Flow Rate = 0.86
Rated Heat Input = 151 kW
Qg = 1.35 x 0.86 x 151 = 175.3 kW
Chilled Water ΔT = 175.3 / (4.2 x 3.6) = 11.6 °C
Chilled Water $\Delta P = 60.4 \times (3.6/7.2)^2 = 15.1$ kPa

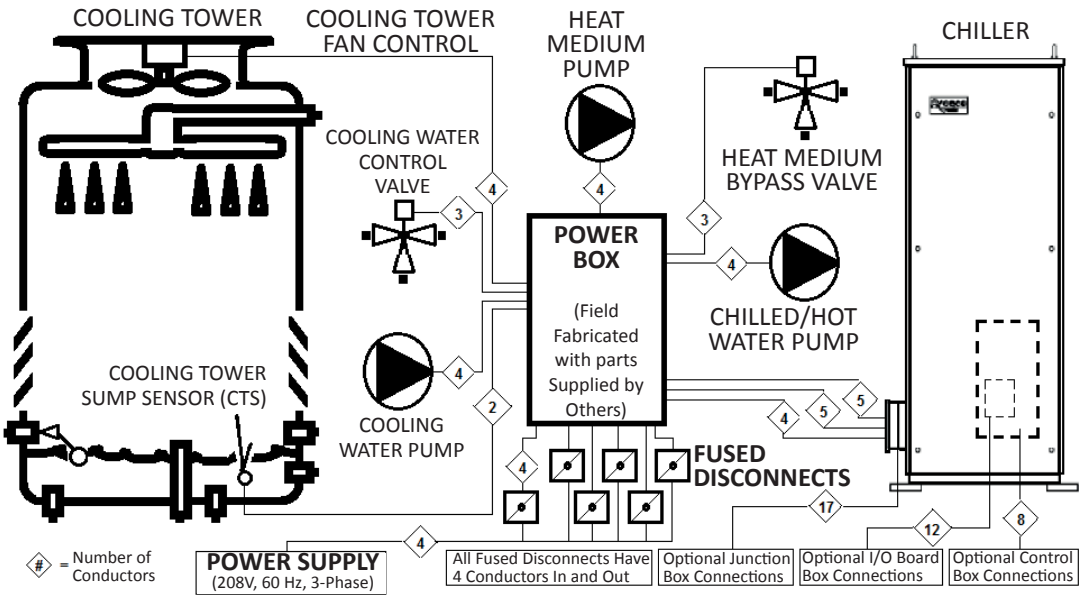
3 HEAT REJECTED TO COOLING TOWER

Qc = Qg + Qe
Qc = 175.3 + 110.8 = 286.1 kW
Required minimum flow rate = 15.30 l/s
The cooling tower selected must be capable of rejecting a minimum of 286.1 kW at a minimum flow rate of 15.30 l/s.
Cooling Water ΔT = 286.1 / (4.2 x 15.30) = 4.45 °C
Cooling Water $\Delta P = 46.4 \times (15.30/15.30)^2 = 46.4$ kPa

Application:
Typical piping WFC - SC5-10-20-30-50

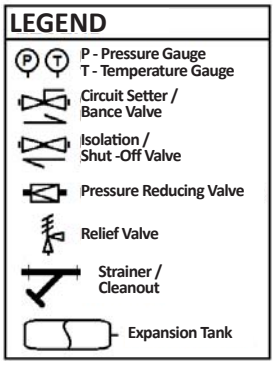


Typical field wiring WFC - SC5-10-20-30-50

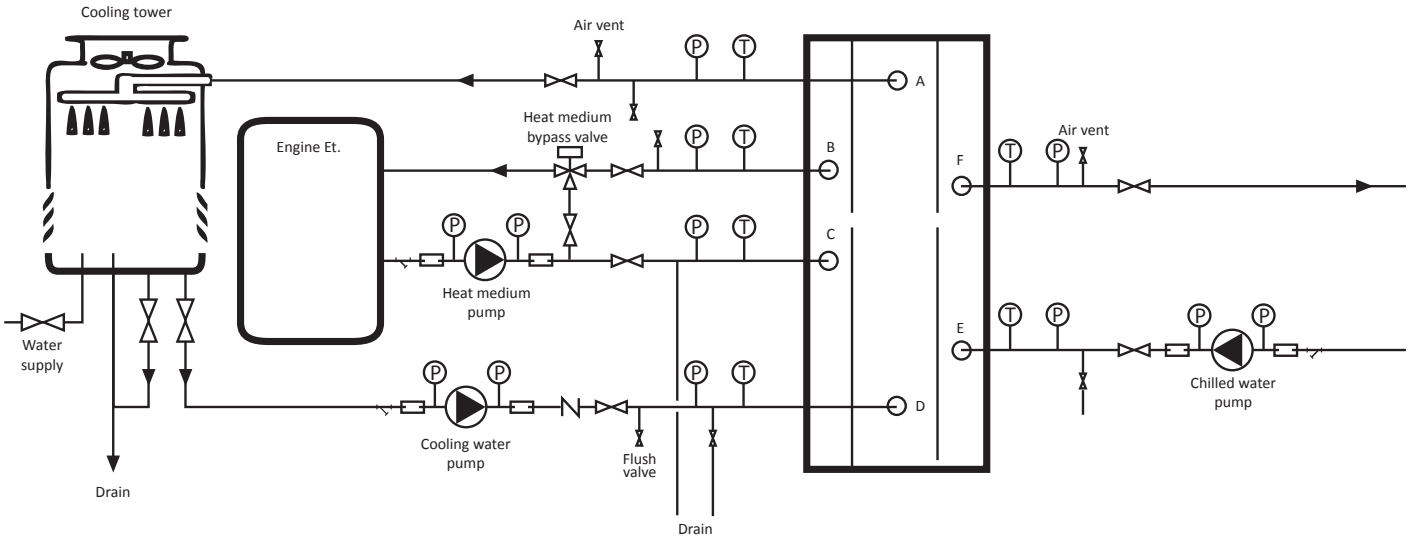


Connection Options:

1. Remote Heat/Cool Mode Selection
2. Remote Enable/Disable Selection
3. Mode Status Feedback
4. Heat Source Control
5. Alarm Indication
6. Cooling Water Flow Switch
7. Freeze Protection

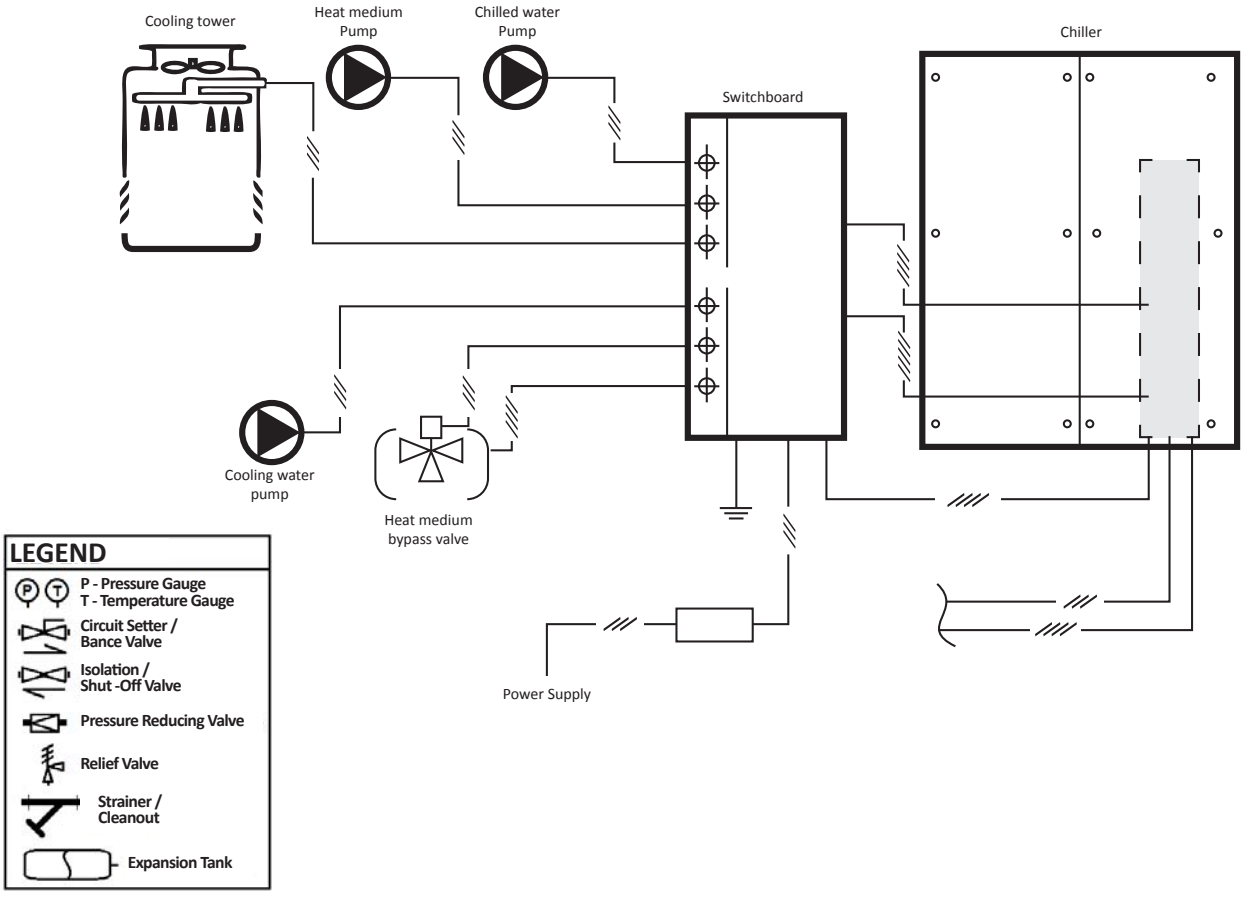


Application:
Typical piping WFC - M100



A	COOLING WATER OUTLET
B	HEAT MEDIUM OUTLET
C	HEAT MEDIUM INLET
D	COOLING WATER INLET
E	CHILLED WATER INLET
F	CHILLED WATER OUTLET

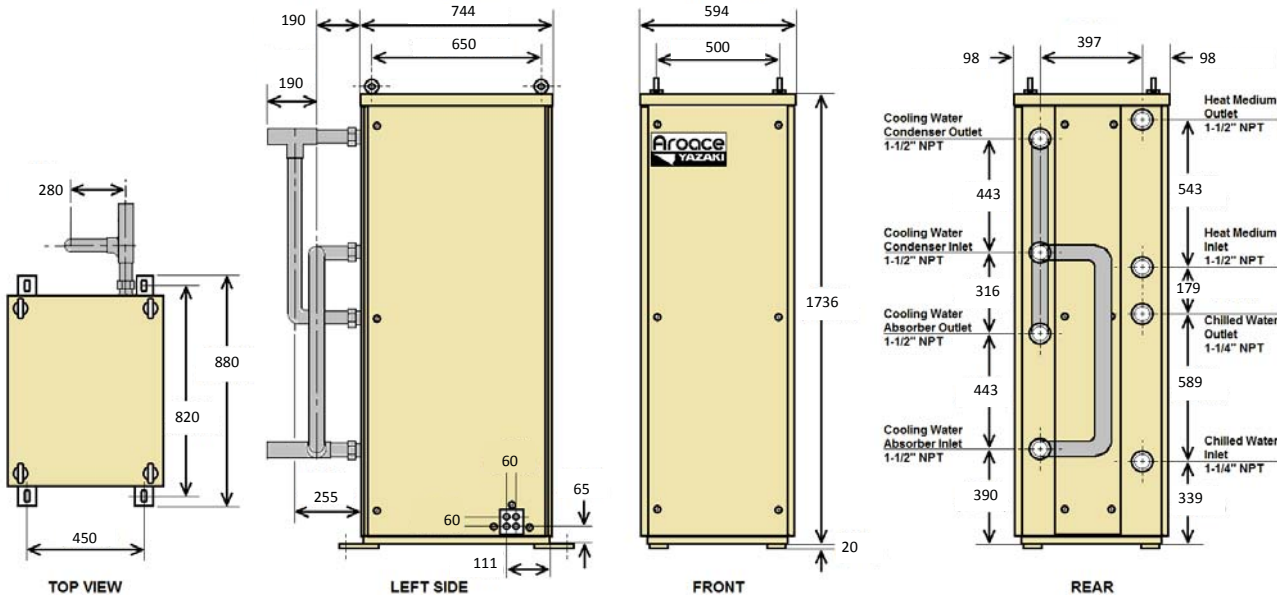
Typical field wiring WFC - M100



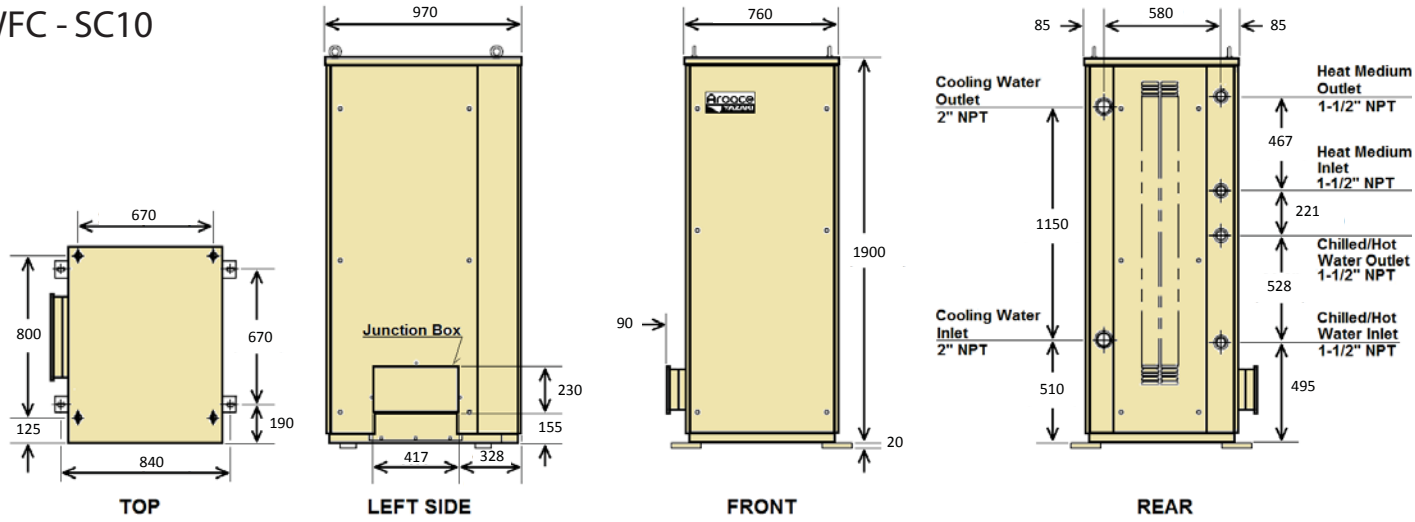
DIMENSIONS

Drawings are not to scale. Piping shown is all Field-Supplied.
The indicated dimensions are in mm.

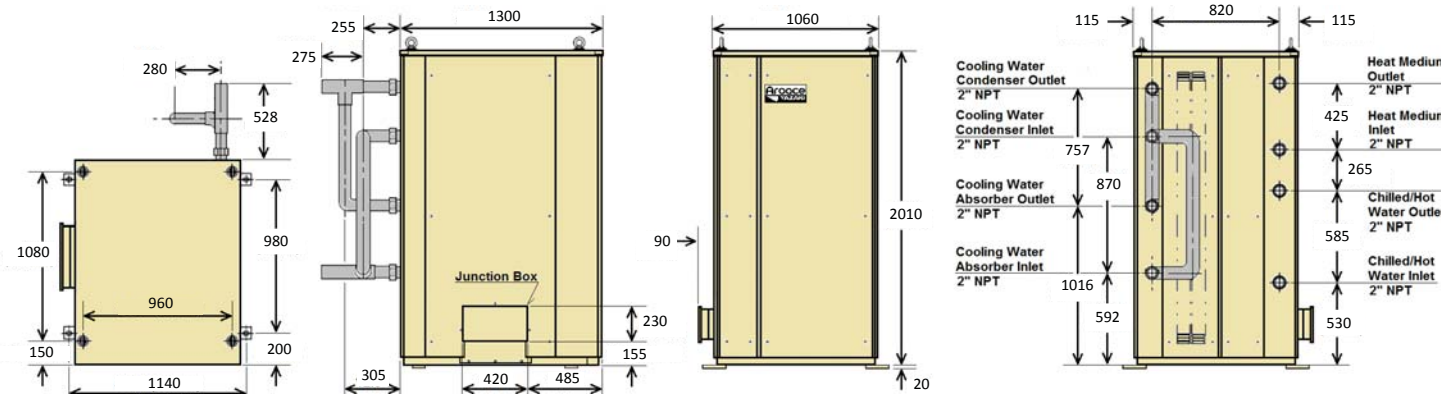
WFC - SC5



WFC - SC10



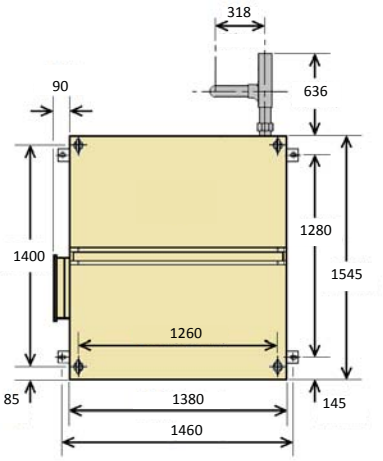
WFC - SC20

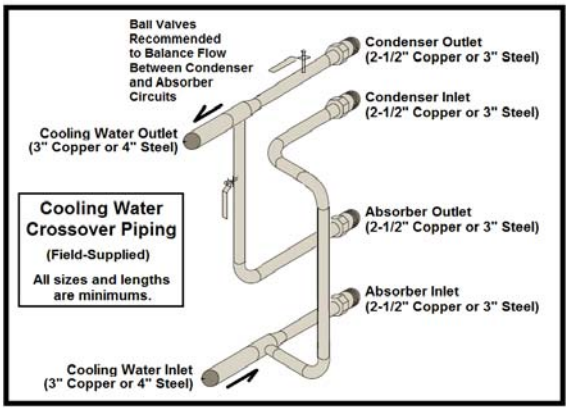


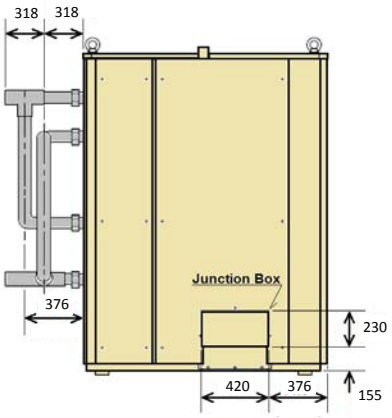
DIMENSIONS

Drawings are not to scale. Piping shown is all Field-Supplied.
The indicated dimensions are in mm.

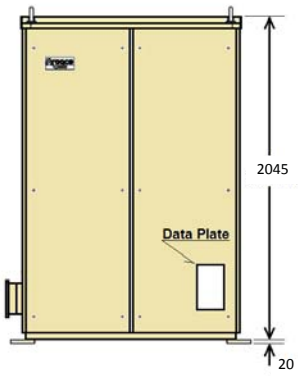
WFC - SC30



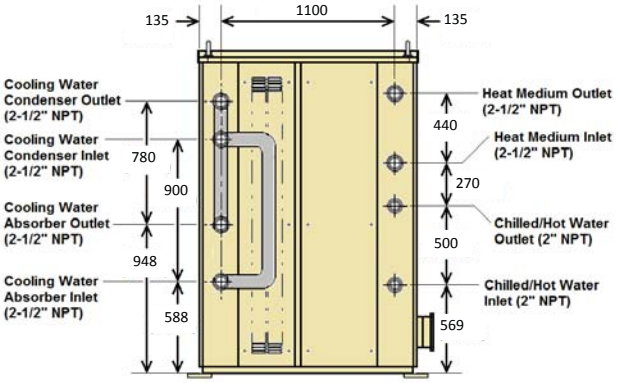




LEFT SIDE

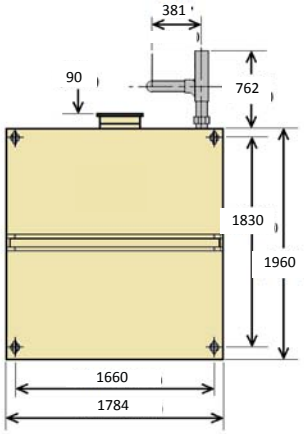


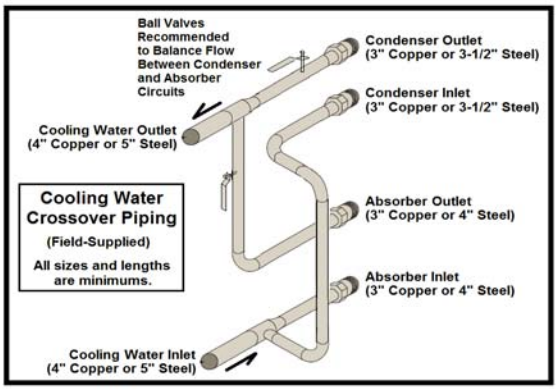
FRONT

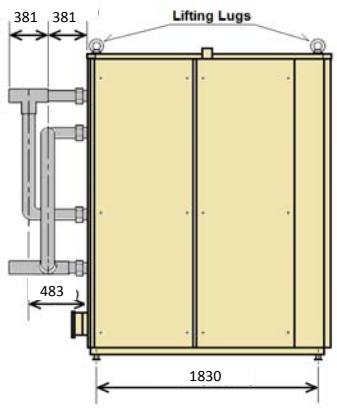


REAR

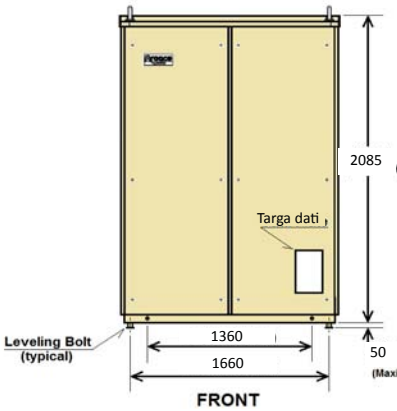
WFC - SC50





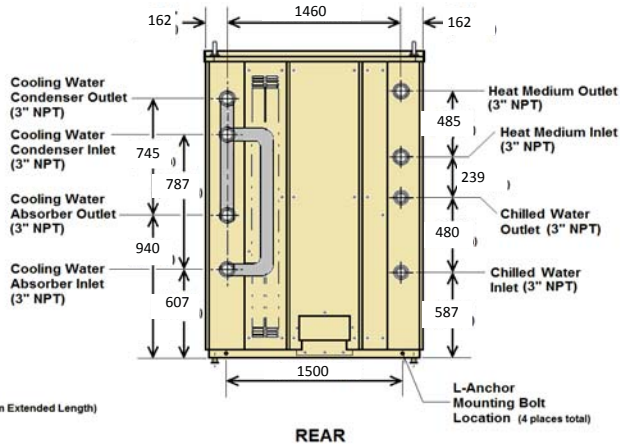


LEFT SIDE



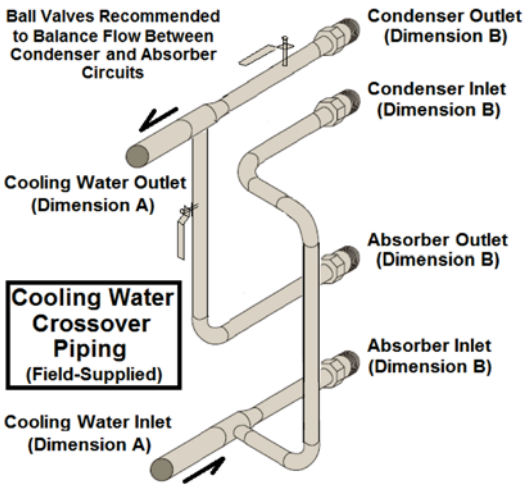
(Maximum Extended Length)

FRONT



REAR

COOLING WATER CROSSOVER PIPING
(Exept mod. WFC-SC10 and M100)



WFC-Model		SC 5	SC 20	SC 30	SC 50
COPPER TUBING	A	DN50	DN80	DN80	DN100
	B	DN40	DN50	DN65	DN80
STEEL TUBING	A	DN50	DN80	DN100	DN125
	B	DN40	DN65	DN80	DN80

Instructions for the correct sizing of the cooling water supply circuit (Exept mod. WFC-SC10 and M100)

The condenser and absorber of the WFC-SC Series are connected in parallel, with double circuit.

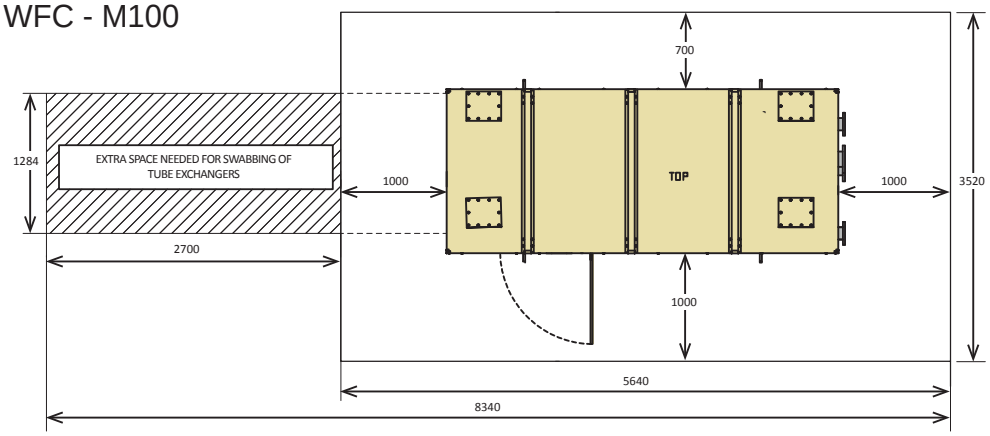
Referring to the nearby figure, some suggestions are listed below in order to obtain a balanced flow between the absorber and the condenser.

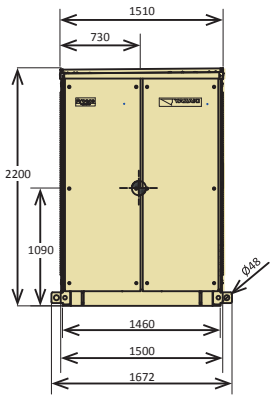
1. The pipes diameter must not be lower than that reported in the figure.
2. The pipes T fitting must be positioned at a proper distance from the nearer regulation valve. The distance must be at least 5 times the pipe diameter.
3. In any case, pipes disposition must permit a comfortable access to the side part of the machinery, in order to allow maintenance operations.

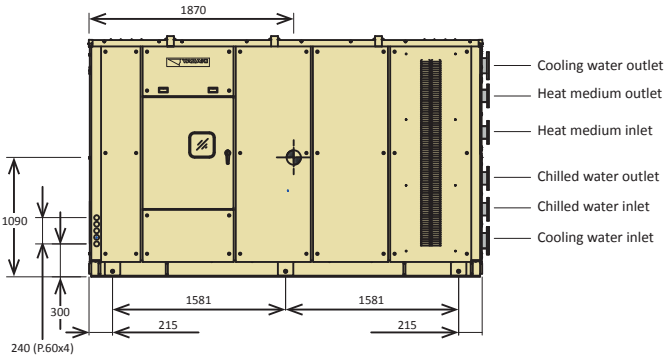
DIMENSIONS

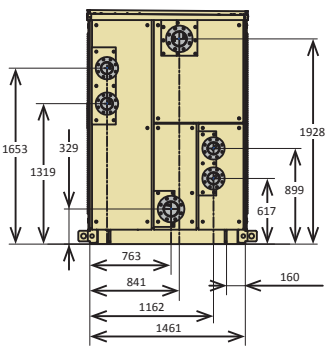
Drawings are not to scale. Piping shown is all Field-Supplied. The indicated dimensions are in mm.

WFC - M100









MAYA

A YAZAKI CORPORATION JAPAN JOINT VENTURE COMPANY

MAYA is a Yazaki Corporation Japan Joint Venture Company located in Milan - Italy - in charge of the distribution of Yazaki Absorption Chillers in Europe, Africa and Middle East.

Today, well over 100,000 YAZAKI units are in operation worldwide, with more than 2,000 installations in the EU alone.

This makes YAZAKI the market leader in non-CFC based central air-conditioning solutions.

The product range include single effect water fired absorption chillers and double effect gas fired absorption chillers that can be used in different projects such as offices, hotels, hospitals and industrial facilities.

The main applications for Yazaki absorption chiller are solar cooling, CCHP (combined cooling, heating and power), heat recovery systems, biomass powered systems and district heating & cooling.

MAYA PARTNER:

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