Liebert® HPC-S Adiabatic

Adiabatic Freecooling Chillers from 170 to 400kW

Product Documentation

English, Cod. 265444, rev. 26.06.2017

Liebert® HPC-S Adiabatic

Liebert® HPC-S Adiabatic is the top efficiency solution for small and medium data centers.
The fully integrated adiabatic PADs system ensures higher freecooling capacity if compared to a standard freecooling chiller, and on the other side allows a more resilient and efficient mechanical cooling operation.

Liebert® HPC-S Adiabatic combines the outstanding levels of energy efficiency allowed by adiabatic freecooling together with the endless availability guaranteed by the multi-scroll compressors backup.

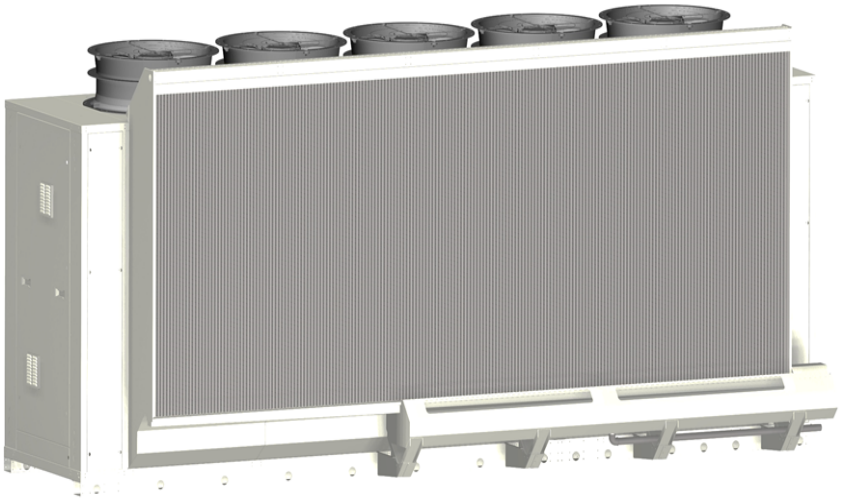
Liebert® HPC-S Adiabatic, with a capacity range from 200 to 400 kW, is designed to guarantee 100% of cooling availability even in the most critical conditions such as high ambient temperatures, unstable power supplies and even during adiabatic water shortages.

Normal tap water is distributed through highly efficient evaporative PADs that consequently get wet. As the air passes through the PADs, water evaporates in the air; the latter is thus humidified and cooled down providing a major increase in the condenser and freecooling capacity.

Liebert® HPC-S Adiabatic does not require any water treatment therefore reducing OPEX compared to evaporative solutions asking for high water treatments.

Liebert HPC- S Adiabatic

Solutions Committed to your Business



Liebert HPC-S Adiabatic

Contents

The product conforms to European Union directives 2006/42/EC; 2014/30/EU; 2014/35/EU; 2014/68/EU.

Units are supplied complete with a test certificate and conformity declaration and control component list.

Liebert® HPC-S Adiabatic units are CE marked as they comply with the European directives concerning mechanical, electrical and electromagnetic safety.

1 Features and Benefits

The Energy Efficiency of Adiabatic Freecooling

Integrated Adiabatic System

Liebert® HPC-S Adiabatic features a fully integrated adiabatic PADs system. The ambient air gets pre-cooled by passing through the wet pads, thus reducing the working temperatures of both freecooling and condensing coils of the unit. The adiabatic effect increases the freecooling capacity and on the other side increases the compressors resiliency and efficiency. The adiabatic PADs are kept wet by an integrated water recirculation system managed automatically by the unit.

Freecooling Module

The “Freecooling” execution allows **Liebert® HPC-S Adiabatic** to take advantage of low outdoor air temperatures in the water cooling process in order to save energy, by avoiding compressors running.

The integrated adiabatic PADs system allows the freecooling coils to operate at lower air temperatures, thus increasing the freecooling capacity and further reducing the operational time of the back-up compressors.

A three-way valve arrangement permits the coolant to be diverted via the additional heat exchangers before being fed into the cooling evaporator.

This means that even if the outside ambient temperature is not low enough to provide the complete cooling load, a significant contribution to the running costs of the system can be made whenever the ambient temperatures falls below the coolant inlet temperature.

Reduced space requirements in comparison with a conventional chiller plus a dry-cooler, are obtained through the “Freecooling” execution’s compact design and the reduction of the compressors working hours offers exceptional saving both in the long and short term.

If compared to a standard air-cooled chiller working at the same conditions, **Liebert® HPC-S Adiabatic** can guarantee an annual energy saving higher than 50%.

Reliability and Low Environmental Impact

Reliability

The **Liebert® HPC-S Adiabatic** series is equipped with four hermetic scroll compressors, which represent state of the art technology in this sector.
They have been designed and optimized for air-cooled water chillers within air conditioning applications.

The high volumetric efficiency ensures excellent performances of the **Liebert® HPC-S Adiabatic** units at full load operation and especially at partial load, thanks to the interlaced-circuit design of the condenser coil.
Extremely low noise operation and the absence of vibrations aid the installation of the unit in city sites requiring strict noise limits.

The wide operating range, bearing lubrication, component oversizing, absence of vibrations and few moving parts, together with the resistance to liquid slugging and compressor electronic control integrated with the machine microprocessor enhance the well- known characteristics of operating reliability and long life typical of this compressors type.

Furthermore, **Liebert® HPC-S Adiabatic** tandem compressor design with two independent refrigeration circuits allows maximum internal redundancy and thus system reliability.
All **Liebert® HPC-S Adiabatic** units are run tested at the factory before shipment.

High outdoor temperature

The oversizing of heat exchangers and the wide operating range of the scroll compressors permit the use of **Liebert® HPC-S Adiabatic** units in high temperature environments as well, up to 48° C at 100% full load.The integrated adiabatic system further enhances the reliability of the mechanical cooling system, by reducing the temperature of the ambient air, and consequently reducing the operating condensing temperature. This results in increased reliability especially at extremely high ambient temperatures.

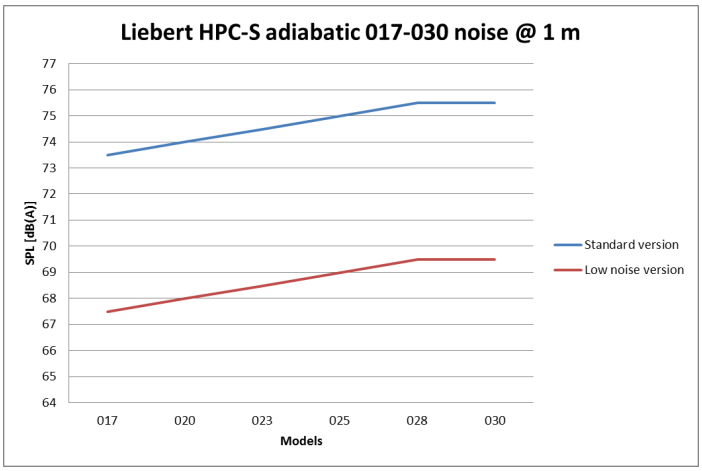
Resistance to liquid slugging

The robust design of the scroll compressors can tolerate/withstand amounts of liquid refrigerant that would severely damage reciprocating compressor valves, piston rods and cylinders.

Low Sound Emission

The **Liebert HPC-S Adiabatic** series is characterized by unrivaled low sound emissions, in particular the models are equipped with the “Quiet” kit (Digit 11=D).
Compressors supported on anti- vibration mounts and positioned in a closed compartment, common to all versions; fans specifically designed to reduce the sound emissions and a special compressor casing on unit configuration.

All the models are equipped with stepless fan speed control, (optional without freecooling), thanks to a special algorithm on the iCOM board, the fan speed could be kept to the minimum.



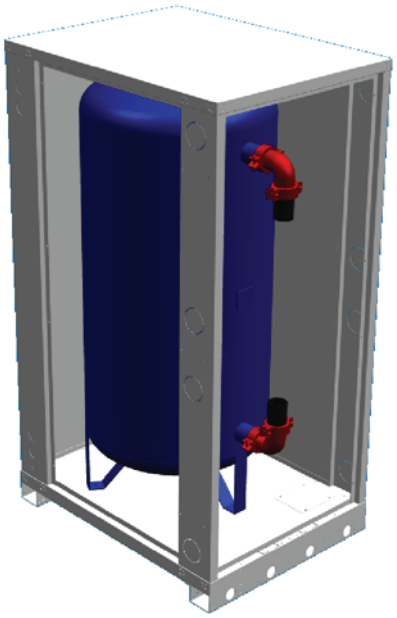
Features and Benefits

Integration with Indoor Air Conditioners

Overall Chilled Water System Optimization - The Super

VERTIV has a unique product portfolio and offers the possibility to integrate in a unique control system both internal CRAC units and external ones.
The entire system logic is then managed to ensure that the internal unit provides the appropriate temperature control required by the application(either return or supply); while the chilled water temperatures are optimized to enhance the overall system's efficiency.

Flexibility: Hydronic Module



In order to match different kinds of installations and applications, **Liebert® HPC-S Adiabatic** units are available with a hydronic module, which can be adapted/adjusted depending on the specific requests.
Based on this philosophy, the units can be equipped with everything that is needed for the correct installation and, in this way, reduce the complexity of the commissioning: 1 or 2 circulating pumps, water filter kit, safety valve, expansion vessel, flow switch. With all these elements included inside the unit, it is just a matter of connecting the chiller to the system. In particular, a buffer tank (whose capacity is 1000 liters for all the models) is available in two different configurations: hydraulically and mechanically connected to the unit (whose length is now increased) or shipped loose for those installations which require more flexibility. But, if some or all of these components are already present in the hydraulic line, **Liebert® HPC-S Adiabatic** can be equipped only with what is not already connected in the system.
This level of flexibility allows true customization of the unit.

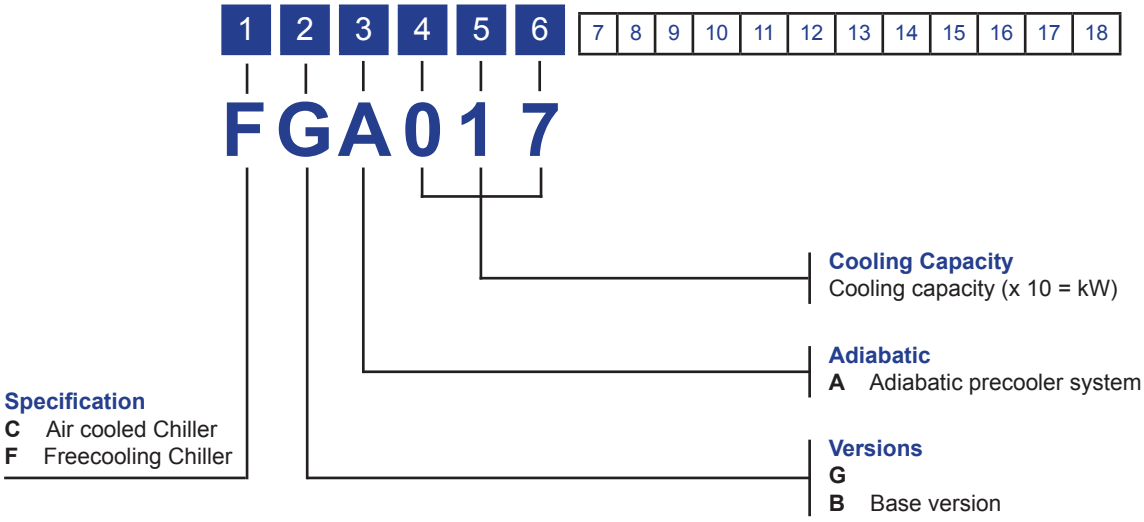
Compactness: Small Footprint

The **Liebert® HPC-S Adiabatic** series achieves the high efficiency performance and low sound emission previously described with a compactness which is one the highest in its category.
This result is possible thanks to the high quality components selected and a design which takes into consideration the different aspects and needs of a chiller installation.
In this way the installation area can be optimized, leaving more space for other building elements. Combining this aspect with the possibility of including all of the hydronic components inside the unit, **Liebert® HPC-S Adiabatic** series is really a leader in terms of easy and compact installation

2 Model Number Description

Digit Nomenclature

The unit is fully defined by eighteen digits.



Digits 1, 2, 3, 4, 5, 6 - Base unit

Base unit main features

- Structure and bearing base in galvanized steel sheet section, with powder-painting and suitable thickness;
- 4 steps capacity control; hermetic scroll compressors;
- Axial fans with modulating fan speed control;
- 2 independent refrigeration circuits;
- HP and LP gauges;
- Electronic expansion valve (EEV)
- 1 water circuit with flow switch;
- 1 evaporator plate heat exchanger;
- International approval 2014/68/EU-PED;
- Electric panel CE compliant and complete with filtered air ventilation, safety equipments, fan motors protection, fuses and protection thermal relays for compressors, power supply 400V/3Ph/50Hz (RST+ PE):
- iCOM board / display control;
- Main switch on each electric board;
- Antiscratch plastic film packaging;
- Color “Grey” (RAL7032).

Digit 7 - Display and Switch

A FTE display
B FTE display + Network Switch
E iCOM Coldfire display large
F iCOM Coldfire display large + Network Switch

Digit 8 - Soft starter

0 None
1 With soft starter

Digit 9 - Monitoring

0 None
1 IS Housing (no IS Card included)
4 IS Unit card for SNMP, MODBUS, BACNET and HTTP(ID-UNITY-DP)

Digit 10 - Tank

0 None
1 With tank

Digit 11 - Fans and noise options

C Standard noise
D Low noise

Digit 12 - Pumps group / Hydraulic kit

0 No pump / No hydraulic kit
1 No pump / With hydraulic kit
2 1 standard head pump / With hydraulic kit
3 1 high head pump / With hydraulic kit
4 2 standard head pumps / With hydraulic kit
5 2 high head pumps / With hydraulic kit
6 1 inverter pump / With hydraulic kit

Digit 13 - Free

Digit 14 - Electric panel options

0 None
1 With electric heaters
A Fast start ramp
B Fast start ramp and electric heaters

Digit 15 - Evaporator electric heaters

Digit 16 - Compressor power factor capacitors

0 None
1 With compressor power factor capacitors

Digit 17 - Condensing coil filter

0 None

Digit 18 - Special request

0 None
X As specified

Model Number Description

Unit Options

- Integrated lifting bars (removable after shipment)

Kits / Accessories shipped loose

- Anti-vibrating mounts (spring or rubber)
- Coldfire on IP40 box
- 1000 lt buffer tank on separate cabinet
- Water filter
- Water check valve

Configuration Rules

In order to give the units the highest flexibility and a high option number, it is necessary to follow the configuration rules indicated here below, so as to select the unit with all compatible options:

Compressor soft starter are not electrically compatible with compressors power factor corrections

D if digit 8 = 1 than digit 16 = 0

3 Operating Range

Working Limits

Minimum temperature of outdoor air entering condenser coils (with standard operating unit):
- 25 ° C for Freecooling models;
Maximum outdoor air temperature is in relation to each model, as indicated in the following tables.
High water flow values (corresponding to a thermal difference at the evaporator lower than 3.5° C - 4° C) may cause corrosions and vibrations inside the plate heat exchanger and in the hydraulic circuit.

The Minimum water flow allowed corresponds to a maximum temperature difference of 8° C.
More extreme operating conditions would active safety devices and the unit would be stopped.
The outlet water temperature must range from 4° C to 15° C.
The maximum allowed water return temperature,when the unit is in full operation, is 20° C; return temperatures over 20° C are allowed only during start-up.

The “G” version with EC fans 900mm (digit 11 = 3) admit Maximum Outlet Water Temperature of 20 ° C and Maximum Water Return Temperature of 26° C when the units are at full power.
The maximum permitted glycol percentage is 50% (35% with standard pump groups fitted).
The necessary minimum glycol percentage depends on the minimum ambient air temperature conditions referred to the place of installation.

The maximum hydraulic working pressure is 6 barg (safety valve set at 6 barg, optional).

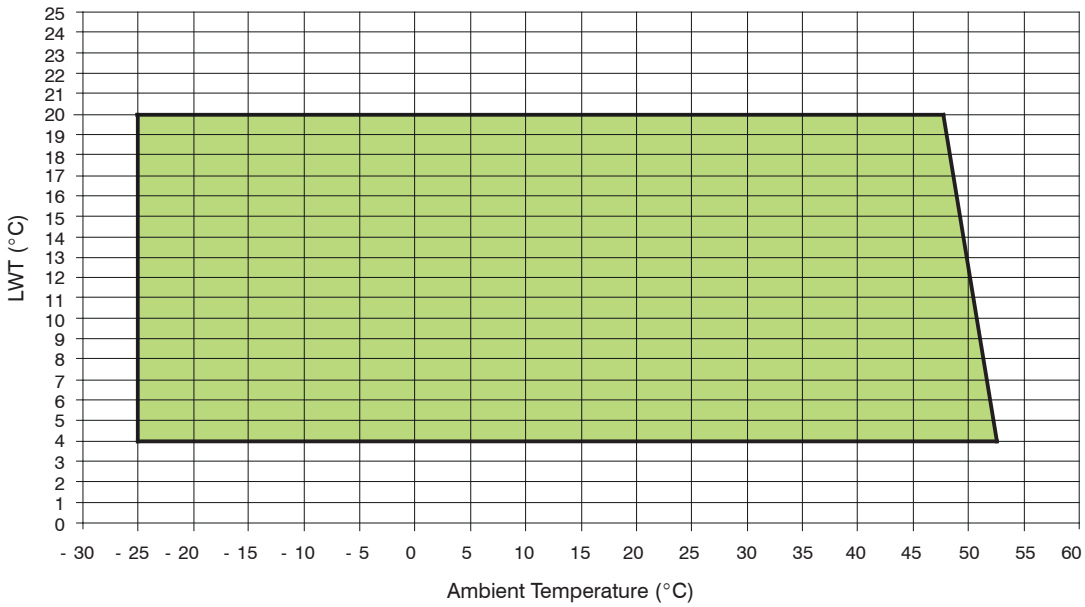
Nominal power supply tolerance: 400V +/- 10%; max. voltage unbalance: 2%.

See “Operation range” table reporting the limits for each model; for different values ask your agent.

All the working limits indicated in both diagrams and tables refer to steady- state operation mode.

Unit storage conditions:
- between - 10 ° C and + 45 ° C for all models; humidity: 80% R.H. non-condensing.

Average HPC-S Adiabatic Working Limits



This diagram shows the average working limits of all the products family.
Refer to table 3 for the working limits of each **unit.**

Operating Range

Tab. 3a - Operating range - Freecooling

Models: FGA 017-030		017	020	023	025	028	030
Operating range							
Max. outdoor temperature (1)	°C	49.5	49.0	50.0	49.5	49.5	49.0
Max. outdoor temperature (2)	°C	46.0	45.0	46.5	46.0	46.0	45.5
Safety devices settings							
High pressure switch	barg	42					
High pressure safety valve	barg	45					
HP safety valve (each circuit)	No	1					
High pressure safety valve connection	inch	3/4” G					
Low pressure switch	barg	5					

(1) - Nominal air flow; outlet water temperature 10°C; full load; refrigerant R410A
(1) - Nominal air flow; outlet water temperature 20°C; full load; refrigerant R410A
(*) - Outdoor temperature for adiabatic versions = Dry bulb air temperature after PAD

Tab. 3b - Operating range - Freecooling Low noise

Models: FGA 017-030 + LN		017	020	023	025	028	030
Operating range							
Max. outdoor temperature (1)	°C	46.5	45.5	47.0	46.5	47.0	46.0
Max. outdoor temperature (2)	°C	42.5	41.5	43.0	42.0	42.5	41.5
Safety devices settings							
High pressure switch	barg	42					
High pressure safety valve	barg	45					
HP safety valve (each circuit)	No	1					
High pressure safety valve connection	inch	3/4" G					
Low pressure switch	barg	5					

(1) - Nominal air flow; outlet water temperature 10°C; full load; refrigerant R410A
(1) - Nominal air flow; outlet water temperature 20°C; full load; refrigerant R410A
(*) - Outdoor temperature for adiabatic versions = Dry bulb air temperature after PAD

Note: The maximum outdoor temperature is higher with adiabatic system ,,ON’’.

Tab. 4a - Technical Data - FGA 017 - 030

Model FGA - R410A - 400/3/50		017	020	023	025	028	030
Smart Aisle Applications							
Mechanical cooling dry performance: water - 30% glycol liquid inlet/outlet 26/20 °C, 35 °C ambient temperature, adiabatic OFF							
cooling capacity	kW	221	246	290	317	365	408
compressors power input	kW	55.8	64.6	71.9	80.2	89.0	103.2
total power input	kW	63.9	72.6	82.7	90.9	102.5	116.5
unit EER	-	3.46	3.39	3.51	3.49	3.56	3.50
coolant fluid flow	m^3/h	34.64	38.45	45.45	49.65	57.21	63.93
hydraulic pressure drop	kPa	138	166	142	167	198	243
Mechanical cooling wet performance: water - 30% glycol liquid outlet 20 °C, 35 °C ambient temperature, 45% relative humidity, adiabatic ON							
cooling capacity	kW	241	268	315	344	397	445
compressors power input	kW	48.6	56.2	63.0	70.1	78.3	90.4
total power input	kW	57.0	64.0	74.0	81.0	92.0	104.0
water consumption	lt/h	187	179	250	238	312	298
unit EER	-	4.25	4.18	4.27	4.27	4.33	4.29
Freecooling performance: liquid inlet temperature 26 °C, 20°C ambient temperature, 55% relative humidity, adiabatic ON							
freecooling capacity	kW	106	105	140	139	179	179
freecooling ZET with 100% load	°C/r.h. %	6/55	4/55	7/55	4/55	7/55	4/55
water consumption	lt/h	187	179	250	238	312	298
unit EER with 100% load 1	-	10.4	9.5	9.8	9.2	9.6	9.4
Freecooling performance: liquid inlet temperature 23 °C, 20°C ambient temperature, 55% relative humidity, adiabatic ON							
freecooling capacity	kW	73	73	97	97	124	124
freecooling ZET with 50% load	°C/r.h. %	16/55	15/55	16/55	15/55	16/55	15/55
unit EER with 50% load 2	-	14.5	14.5	13.3	12.1	12.3	12.1
Legacy Applications							
Mechanical cooling dry performance: water - 30% glycol liquid inlet/outlet 15/10 °C, 35 °C ambient temperature, adiabatic OFF							
cooling capacity	kW	171	191	224	244	281	315
compressors power input	kW	51.0	58.5	76.8	83.8	81.7	93.8
total power input	kW	59.1	66.5	66.0	73.1	95.2	107.1
unit EER	-	2.90	2.87	2.92	2.92	2.95	2.94
coolant fluid flow	m^3/h	32.26	35.89	42.12	45.96	52.85	59.31
hydraulic pressure drop	kPa	126	153	130	152	178	221
Mechanical cooling wet performance: water - 30% glycol liquid outlet 10 °C, 35 °C ambient temperature, 45% relative humidity, adiabatic ON							
cooling capacity	kW	187	208	244	266	306	344
compressors power input	kW	44.3	50.6	57.5	63.4	71.3	81.5
total power input	kW	52.4	58.6	68.3	74.1	84.8	94.8
water consumption	lt/h	187	179	250	238	312	298
unit EER	-	3.56	3.55	3.57	3.59	3.61	3.62
Freecooling performance; liquid inlet temperature 15 °C, 5°C ambient temperature, adiabatic OFF							
freecooling capacity	kW	105	104	138	137	178	177
freecooling ZET with 100% load	°C	-1	-3	-1	-3	-1	-3
unit EER with 100% load 1	-	12	10.8	11.4	10.5	11.3	10.7
Freecooling performance; liquid inlet temperature 12,5 °C, 5°C ambient temperature, adiabatic OFF							
freecooling capacity	kW	78	78	103	103	133	133
freecooling ZET with 50% load	°C	4.0	4.0	3.0	4.0	5.0	4.0
unit EER with 50% load 2	-	12.5	10.7	11	10.5	13.6	10.7
All Applications							
Sound level							
SPL (Sound Pressure Level)3	dB(A)	73.5	74.0	74.5	75.0	75.5	75.5
PWL (Sound Power Level)4	dB(A)	93.2	93.7	94.7	95.2	96.1	96.1
Fans							
number of fans	#	3	3	4	4	5	5
fans power input	kW	2.7	2.7	2.7	2.7	2.7	2.7
air flow rate	m^3/h	57900	54600	77200	72800	96500	91000
Compressors							
number of compressors	#	2+2	2+2	2+2	2+2	2+2	2+2
nominal power (total)	HP	15+15	15+20	15+25	20+25	25+25	25+30

ZET=Zero Equivalent Temperature (ambient temperature where freecooling capacity is equivalent to mechanical one)
Load = thermal load equivalent to dry mechanical cooling capacity @ nominal working conditions

1 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 100% load
2 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 50% load
3 Measured with outdoor temperature 35 °C; 1m from the unit; free field conditions; according to ISO 3744
4 With outdoor temperature 35°C; calculated according to ISO 3744

Technical Data

Tab. 4a - Technical Data - FGA 017 - 030

Model FGA - R410A - 400/3/50		017	020	023	025	028	030
Technical features							
Adiabatic system							
efficiency	%	69.5	70.2	69.5	70.2	69.5	70.2
dimensions for each side (L)x2000(H)x100(W)	mm	3000	3000	4000	4000	5000	5000
internal water volume for each side	l	268	268	285	285	303	303
Refrigeration circuits							
number of refrigeration circuits	#	2	2	2	2	2	2
refrigerant charge for each circuit	kg	15	16	20	21	25	26
Compressors							
number of compressors	#	2+2					
type		Hermetic scroll					
nominal power (total)	HP	15+15	15+20	15+25	20+25	25+25	25+30
Fans							
number of fans	#	3	3	4	4	5	5
type		Axial with EC motor					
wheel nominal diameter	mm	800					
rpm	1/min	1100					
power input [each fan]	kW	2.7	2.7	2.7	2.7	2.7	2.7
Evaporator							
number of evaporators	#	1	1	1	1	1	1
type		Brazed plate heat exchanger					
internal volume [each circuit, refr.side]	l	5.6	5.6	7.2	7.2	9.8	9.8
Condensing coil							
material MPE/fins		Copper / Aluminium					
Rows / Fin space	no/mm	3/1,8					
face area	m^2	5.94	5.94	7.92	7.92	9.90	9.90
internal volume [each circuit]	l	21.5	21.5	28.7	28.7	35.9	35.9
Freecooling coil							
material tubes/fins		Copper / Aluminium					
rows/fin spacing	#/mm	3/2,5					
face area	m^2	5.94	5.94	7.92	7.92	9.90	9.90
Water connections							
diameters	DN-inch	DN 80-3”					
unit volume	l	107	107	126	126	147	147
Dimensions							
length	mm	3,750	3,750	4,750	4,750	5,750	5,750
depth	mm	1,900	1,900	1,900	1,900	1,900	1,900
height	mm	2,625	2,625	2,625	2,625	2,625	2,625
Weights							
net weight	kg	2,199	2,349	2,785	2,935	3,378	3,416
operating weight	kg	2,542	2,692	3,164	3,314	3,796	3,832

ZET=Zero Equivalent Temperature (ambient temperature where freecooling capacity is equivalent to mechanical one)
Load = thermal load equivalent to dry mechanical cooling capacity @ nominal working conditions
1 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 100% load
2 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 50% load
3 Measured with outdoor temperature 35 °C; 1m from the unit; free field conditions; according to ISO 3744
4 With outdoor temperature 35°C; calculated according to ISO 3744

Technical Data

Tab. 4b - Technical Data - FGA 017 - 030 + LN

Model FGA LN - R410A - 400/3/50		017	020	023	025	028	030
Smart Aisle Applications							
Mechanical cooling dry performance: water - 30% glycol liquid inlet/outlet 26/20 °C, 35 °C ambient temperature, adiabatic OFF							
cooling capacity	kW	211	233	277	301	348	386
compressors power input	kW	59.9	70.2	77.0	86.9	95.5	111.9
total power input	kW	63.8	74.0	82.3	92.0	101.9	118.3
unit EER	-	3.30	3.15	3.36	3.27	3.42	3.26
coolant fluid flow	m^3/h	32.87	36.40	43.19	46.99	54.38	60.25
hydraulic pressure drop	kPa	123	150	129	151	179	218
Mechanical cooling wet performance: water - 30% glycol liquid outlet 20 °C, 35 °C ambient temperature, 45% relative humidity, adiabatic ON							
cooling capacity	kW	232	257	304	331	383	426
compressors power input	kW	52.5	61.1	67.5	75.5	83.8	97.6
total power input	kW	56.4	64.9	72.6	80.6	90.2	104.0
water consumption	lt/h	152	146	203	194	253	243
unit EER	-	4.11	3.96	4.18	4.10	4.24	4.09
Freecooling performance: liquid inlet temperature 26 °C, 20°C ambient temperature, 55% relative humidity, adiabatic ON							
freecooling capacity	kW	93	93	124	123	158	156
freecooling ZET with 100% load	°C/r.h. %	4/55	1/55	4/55	2/55	5/55	1/55
water consumption	lt/h	152	146	203	194	253	243
unit EER with 100% load 1	-	11.2	10	10.7	10	10.5	10
Freecooling performance: liquid inlet temperature 23 °C, 20°C ambient temperature, 55% relative humidity, adiabatic ON							
freecooling capacity	kW	65	65	86	86	110	110
freecooling ZET with 50% load	°C/r.h. %	15/55	14/55	15/55	14/55	15/55	14/55
unit EER with 50% load 2	-	15.3	15.2	14.6	12.6	13.1	12.7
Legacy Applications							
Mechanical cooling dry performance: water - 30% glycol liquid inlet/outlet 15/10 °C, 35 °C ambient temperature, adiabatic OFF							
cooling capacity	kW	165	182	215	234	270	302
compressors power input	kW	54.2	62.9	70.1	78.2	86.8	100.4
total power input	kW	58.1	66.7	75.3	83.3	93.2	106.8
unit EER	-	2.84	2.73	2.86	2.81	2.90	2.82
coolant fluid flow	m^3/h	31.03	34.41	40.57	44.16	50.95	56.86
hydraulic pressure drop	kPa	116	142	120	141	165	204
Mechanical cooling wet performance: water - 30% glycol liquid outlet 10 °C, 35 °C ambient temperature, 45% relative humidity, adiabatic ON							
cooling capacity	kW	181	201	237	258	297	332
compressors power input	kW	47.1	54.2	60.8	67.4	75.4	86.8
total power input	kW	51.0	58.0	65.9	72.5	81.8	93.2
water consumption	lt/h	152	146	203	194	253	243
unit EER	-	3.56	3.46	3.59	3.55	3.63	3.57
Freecooling performance; liquid inlet temperature 15 °C, 5°C ambient temperature, adiabatic OFF							
freecooling capacity	kW	91	91	121	120	155	154
freecooling ZET with 100% load	°C	-3.0	-5.0	-3.0	-4.0	-2.0	-4.0
unit EER with 100% load 1	-	12.2	11	11.6	10.7	11.4	10.8
Freecooling performance; liquid inlet temperature 12,5 °C, 5°C ambient temperature, adiabatic OFF							
freecooling capacity	kW	68	68	90	90	116	115
freecooling ZET with 50% load	°C	4.0	3.0	4.0	3.0	4.0	3.0
unit EER with 50% load 2	-	11.2	10.9	11.3	10.7	11.6	10.8
All Applications							
Sound level							
SPL (Sound Pressure Level)3	dB(A)	67.5	68.0	68.5	69.0	69.5	69.5
PWL (Sound Power Level)4	dB(A)	87.2	87.7	88.7	89.2	90.1	90.1
Fans							
number of fans	#	3	3	4	4	5	5
fans power input	kW	1	1.3	1.3	1.3	1.3	1.3
air flow rate	m^3/h	57900	54600	77200	72800	96500	91000
Compressors							
number of compressors	#	2+2	2+2	2+2	2+2	2+2	2+2
nominal power (total)	HP	15+15	15+20	15+25	20+25	25+25	25+30

ZET=Zero Equivalent Temperature (ambient temperature where freecooling capacity is equivalent to mechanical one)
Load = thermal load equivalent to dry mechanical cooling capacity @ nominal working conditions
1 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 100% load
2 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 50% load
3 Measured with outdoor temperature 35 °C; 1m from the unit; free field conditions; according to ISO 3744
4 With outdoor temperature 35°C; calculated according to ISO 3744

Technical Data

Tab. 4b - Technical Data - FGA 017 - 030 + LN

Model FGA LN - R410A - 400/3/50		017	020	023	025	028	030
Technical features							
Adiabatic system							
efficiency	%	72.5	73.1	72.5	73.1	72.5	73.1
dimensions for each side (L)x2000(H)x100(W)	mm	3000	3000	4000	4000	5000	5000
internal water volume for each side	l	268	268	285	285	303	303
Refrigeration circuits							
number of refrigeration circuits	#	2	2	2	2	2	2
refrigerant charge for each circuit	kg	15	16	20	21	25	26
Compressors							
number of compressors	#	2+2					
type		Hermetic scroll					
nominal power (total)	HP	15+15	15+20	15+25	20+25	25+25	25+30
Fans							
number of fans	#	3	3	4	4	5	5
type		Axial with EC motor					
wheel nominal diameter	mm	800					
rpm	1/min	850					
power input [each fan]	kW	1.3	1.3	1.3	1.3	1.3	1.3
Evaporator							
number of evaporators	#	1	1	1	1	1	1
type		Brazed plate heat exchanger					
internal volume [each circuit, refr.side]	l	5.6	5.6	7.2	7.2	9.8	9.8
Condensing coil							
material MPE/fins		Copper / Aluminium					
Rows / Fin space	no/mm	3/1,8					
face area	m^2	5.94	5.94	7.92	7.92	9.90	9.90
internal volume [each circuit]	l	21.5	21.5	28.7	28.7	35.9	35.9
Freecooling coil							
material tubes/fins		Copper / Aluminium					
rows/fin spacing	#/mm	3/2,5					
face area	m^2	5.94	5.94	7.92	7.92	9.90	9.90
Water connections							
diameters	DN-inch	DN 80-3”					
unit volume	l	107	107	126	126	147	147
Dimensions							
length	mm	3,750	3,750	4,750	4,750	5,750	5,750
depth	mm	1,900	1,900	1,900	1,900	1,900	1,900
height	mm	2,625	2,625	2,625	2,625	2,625	2,625
Weights							
net weight	kg	2,199	2,349	2,785	2,935	3,378	3,416
operating weight	kg	2,542	2,692	3,164	3,314	3,796	3,832

ZET=Zero Equivalent Temperature (ambient temperature where freecooling capacity is equivalent to mechanical one)
Load = thermal load equivalent to dry mechanical cooling capacity @ nominal working conditions

1 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 100% load
2 EER is calculated as kWh (delivered cooling) / kWh (absorbed power fans + compressors) in 1 hour of operation at 50% load
3 Measured with outdoor temperature 35 °C; 1m from the unit; free field conditions; according to ISO 3744
4 With outdoor temperature 35°C; calculated according to ISO 3744

5 Mechanical Specifications

Construction and Panels

The **Liebert® HPC-S Adiabatic** small series is designed for outdoor installations, having maximum corrosion protection, with all panels being of heavy gauge, galvanized steel construction, polyester-powder painted in RAL7032.
The base is of 3mmgauge galvanized steel channels, polyester- powder painted in RAL7032, interconnected using special rivets with elevated mechanical characteristics.
The inner hidden frame parts are constructed of galvanized steel.
Holes (ø 56 mm) are seated in the base, where the bars can be fit for lifting the unit.
Panels are made of suitable gauge galvanized steel, polyester- powder painted in RAL7032 and provided with waterproof gaskets. Top front and left side panels are fixed with screws, lower front panels and the access door for the electrical board are fixed with triangular insert locks (the suitable key is supplied).
All screws and rivets are galvanized.
The access to the hydraulic components is ensured by opening the front panels and the left side one.
The compressor and the pumps are located in a closed compartment, protected against outer agents, and insulated from the airflow to avoid noise transmission and heat dissipation to the air stream.
The compartment cooling is ensured by a grille on the lower front closing panel.
The compressors are mounted on anti- vibration mounts to prevent vibration transmission to the structure; in the low noise and quiet versions, the compressors feature a shroud made up of sound-insulating and sound-absorbing materials.

Refrigeration Circuit

All models are equipped with four compressors fitted two by two, in tandem, configured in independent refrigeration circuits.
Each circuit includes double safety pressure switch for high pressure, an electronic safety pressure switch for low pressure, an electronic expansion valve, filter-dryer with disposable anti-acid solid cartridge, moisture indicating sight glass, ”HP” safety valves, charge connections 5/16” SAE - Flare, liquid line, manual shut-off valve; ”HP” and ”LP” pressure gauges.
The units are supplied charged with refrigerantR410A and oil set in the factory according to the operating conditions within the indicated limits.

Refrigerant

The units are designed for being used with refrigerant R410A.

Compressor

The **Liebert® HPC-S Adiabatic** series is equipped with four hermetic, scroll compressors specifically designed for application in refrigeration systems. Each compressor couple (tandem) is fitted in an independent refrigerant circuit to allow maximum redundancy and system reliability.
Tandem compressors consist of two compressors which can be equal or different size models; they offer advantages over single compressors with equivalent capacity such as:

- Efficient capacity control - through cycling one or two compressors.
- Increased reliability - fewer starts/stops than a single larger compressor.
- Redundancy - part load capacity if one compressor fails, reduced replacement costs.
- Superior performances on seasonal efficiency (ESEER) and consequently lower running costs.

Compressors used in tandem are solid mounted by use of steel spacers on two rigid rails to build a unit in order to keep stresses in the tubing connecting the compressors at reasonable levels; compressors are mounted as close as possible to each other so as to keep the gas-oil equalization line as short as possible. The rails are bolted to the chiller basement through anti-vibration mounts. Connection for both oil and gas equalization is made via sight glass of each compressor even when compressors have different capacity; the so called Two-Phase Tube Line (TPTL) for oil and gas equalization balances the pressures between the shells and so maintains the same oil level in each compressor. This configuration is equipped and fitted with an oil sight glass in the equalization (TPTL) line.

Each compressor is featured by:

- Optimized R410A design that ensures:
  - Higher EER.
  - Wide operating range: lower condensation and higher evaporation envelope gives more energy savings.
  - Lower sound emission level.

  - Lighter systems.
  - More compact equipment.
- Axial and Radial scroll compliances for high tolerance to liquid.
- Self-lubricated Teflon bearings for high tolerance to liquid sand low oil level.
- Low leak check valve prevent high side liquid migration and facilitate pressure equalization inside. the compressor (unloaded start-up).
- ASTP or PTC scroll thermal protection.
- Discharge system for low sound emissions an high volumetric efficiency.
- High accuracy balancing system to reduce vibrations.
- Motor cooled by the suction gas with suitably fit thermal probes.
- Motor cooling channels with low flow resistance.
- Reduced weight and overall dimensions.
- Case with electric supply terminals and electronic protection module.
- Efficient oil distribution system.

All these features aim to achieve values of efficiency (EER), sound emission, vibrations, reliability, operating range, resistance to liquid blows and compactness that cannot be compared with those of other compressors with the same capacity but with different technology.
Each compressor is equipped with a three-phase asynchronous two-pole motor cooled by the suction gas. The motor is equipped with electronic protection device.
The compressor is further equipped with:

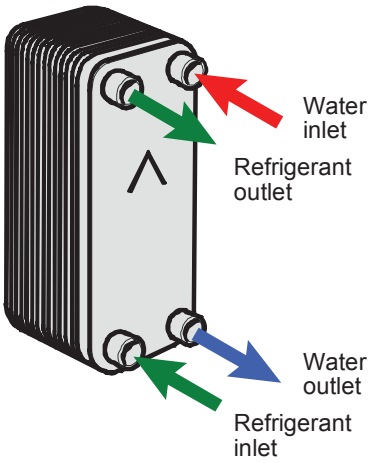
- Rubber anti- vibration mounts;
- Polyester oil charge;
- Oil indicating sight glass;
- Oil charge/discharge connections;
- Crankcase heater.

The iCOM control manages the operation of the compressors so as to ensure always their operation within their limits with top reliability; the “HP” and “LP” alarms, the motor thermal protection, the start times and the min. operation- pause times and their rotation are indeed motor-driven and controlled.

Electronic Expansion Valve

The electronic expansion valve used in -the **Liebert® HPC-S Adiabatic** range enables accurate and min. possible control of the overheating of the gas sucked by the compressor under all load conditions, together with the operation at low condensation and high compressor unloading. Under such application conditions a mechanical expansion valve can never reach the performance ensured by an electronic expansion valve (with energy benefits) nor the functional stability, above all during the transients of the load variations (with benefits as for reliability). The final result of the application of the electronic expansion valve on **Liebert® HPC-S Adiabatic** is therefore an improved energy operating costs and a higher reliability, thanks to its special adjustment features above all on partial loads, conditions under which every chiller operates for most of the time.

Evaporators



Liebert® HPC-S Adiabatic units are equipped with direct expansion, weld-brazed plate type evaporators, designed, constructed, tested (pressure test on both refrigerant and water sides) and documented to comply with PED 2014/68/EU standards.
The corrugation (typical angle) and the design of each plate have been thoroughly analyzed and thus optimized to better meet the physical features of the refrigerant (R410A) and provide for an optimal refrigerant distribution. This means really outstanding performance in the thermal energy transfer.
They incorporate two refrigeration circuits and one water circuit.
The plates are fabricated from seamless carbon stainless steel AISI 316, reciprocally welded with pure copper.

All exchangers are optimized for the refrigerantR410A and are complete with an inner device (distributor) evenly distributing the refrigerant gas on each channel.

The exchangers are of the ”true dual” type, therefore the primary fluid (water) is always cooled in each channel by at least one refrigerant circuit, even when one of the two circuits is off.
They are externally insulated against condensate with closed cell elastomer.
The evaporators are connected with lines equipped with drainage and vent connections.
The evaporators are protected against freezing by a paddle- type flow switch and a standard antifreeze sensor directly managed by the microprocessor.

As an option, thermostatically controlled heaters are applied to prevent freezing with outdoor temperatures below 0ºC without primary flow.
Temperature and pressure working limits and pressure test values are indicated in Tab. 5a .

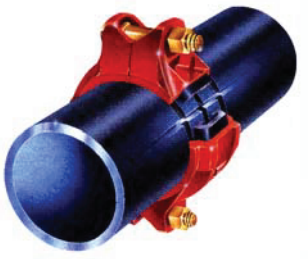
Tab. 5a - Working Limits

Design Temp.	Design Pressure		Test Pressure	
Min./ Max.	Refrigerant	Water	Refrigerant	Water
- 160 / +150 °C	45.0 bar	45.0 bar	74.0 bar	74.0 bar

Condensers

The condensing coils design for R410A refrigerant are made of copper tubes and aluminum fins and are mounted in vertical configuration.
Copper tubes in staggered rows are mechanically expanded in order to have the best contact with fins.
The aluminum fins are manufactured with a special high efficiency rusticate surface that increases the thermal exchange. They are always equipped with an additional sub-cooling circuit which allows to increase the refrigeration performances without loosing the energy efficiency.
The condensing coils are tested at a pressure of 45 bar.

Hydraulic Circuit



The hydraulic circuit - with max. working pressure 6bar - is made up of carbon steel pipes connected with grooved- end (Victaulic) fittings and couplings; gaskets are made of EPDM.
This arrangement permits compensation for thermal expansion, reduces noise and vibration propagating through hydraulic pipelines and facilitates ease of maintenance. The anti-condensate insulation of the hydraulic circuit is by closed cell synthetic elastomer.
The flow switch is a compulsory protection device for the unit fitted as standard on all units versions with or without recirculation pumps.
Expansion Vessel and Safety Valve (Options)
These optional accessories are directly installed on the unit hydraulic circuit. The expansion vessel (charged at 1.5 bar, max. operating pressure 10 bar) has an 12 l volume, the safety valve is calibrated at 6 bar. Their installation positions are indicated in the hydraulic circuit scheme. It is recommended that the total expansion vessel capacity required be always checked, depending on the unit volume, the circuit volume, the glycol percentage in the mixture and the expected maximum temperature variation of the mixture.

Freecooling Execution

Liebert® HPC-S Adiabatic models in the ”Freecooling execution” are designed with an integrated freecooling system consisting of:

- Cooling coils with copper tubes and aluminum fins, mounted in vertical configuration;
- Vent and drainage valves on the freecooling coils;
- Low pressure drop three- way valve with modulating servo-control;
- Calibrate orifice plate installed in the by-pass of the freecooling coils to maintain the circuit pressure drop when the position of the tree-way valve changes to by-pass. This is in order to prevent big variations of the water flow to the evaporator (this component is not fitted in case inverter pump option is selected)

All the freecooling functions are managed by the microprocessor control in three operating modes, according to ambient conditions and thermal load:

- Direct expansion with compressors operation only; 100% water flow through the evaporator;
- Direct expansion and Freecooling; 100% water flow first through the freecooling coils and then through the evaporator, with partial compressor operation;
- Freecooling; 100%water flow through the freecooling coils and then through the evaporator,without compressors operation.

Fan speed control, compressor starting and compressor partialisation are managed by the microprocessor control with different strategies in order to increase the energy saving as much as possible.

Recirculating Pumps (Option)

All the models of the **Liebert HPC-S Adiabatic** series can be equipped with one or two water circulating pumps, factory-piped.
On each **Liebert HPC-S Adiabatic** unit it is possible to select the pump type and quantity (with high or low head) or with inverter, depending on the pressure available from the applications. They are suitable for operation with water-ethylene glycol mixture up to 35%- 65%by weight and mixture temperatures down to 4° C.
The pumps are of the close- coupled centrifugal type, direct driven, two pole electric motor, having IP 54 protection and Class F insulation, with IE3 efficiency according Energy using Products (EuP) motor directive (EC640/2009). The motors with this efficiency class (the highest) ensure a higher energy saving than the pump with lower efficiency class; further, they enable a more silent operation of the motor and can reach very high use limits of the room temperature (up to 60° C).
Pump casings and impellers are in cast iron EN-GJL 200, shafts are in stainless steel, the shaft seal is a unbalanced,mechanical shaft seal with dimensions according to DIN 24 960 and assembly length according to EN 12 756, brass neck ring permits ideal conditions for the use of water mixtures containing ethylene glycol.
The pump housing, the motor stool and the motor stator housing are electro-coated. The motor stool forms connection between the pump housing and the motor, and is equipped with a manual air vent screw for venting of the pump housing and the shaft seal chamber. The circulation of liquid through the duct of the air vent screw ensures lubrication and cooling of the shaft seal.
Between the outlets of the two chambers and the discharge flange, twin-head pumps have a non- return flap valve in EPDM rubber. The flap is opened by the flow of the pumped liquid and cuts off the port of the idle pump chamber.

The electronic pump adjustment algorithm enables to modulate the pump speed to keep the water flow delivery steady through the evaporator even if the hydraulic load changes; in this way, a significant energy saving is achieved and varies depending on the applications. In particular, in the Freecooling units this benefit is obtained above all in summer, when the Freecooling coil is short-circuited. The programming of the adjustment set of the electronic pump can be made in factory or in the installation site thanks to a simple control display fitted in the electrical panel; in case of doubt, contact your dealer.
Microprocessor controls manage the pump rotation and stand-by and automatically start the stand- by pump in case of failure of the primary one.

Mechanical Specifications

Fan Section

Fans are axial type,with blades made of aluminum sheet insert, sprayed with PP plastic statically and dynamically balanced, directly coupled to an electric motor with external rotor. They are balanced G66,3 according toDINISO1940 part 1, have an IP54 degree of protection, Class F winding insulation and internal thermal protection. The characteristics of the motor depend on the unit version:

- ”G”: EC 6-pole motor, propeller diameter 900 mm, 900 rpm as standard, EC 8-pole motor, propeller diameter 800mm, 700 rpm as option

The fans are complete with safety protection grilles and high efficiency nozzles.
Die cast aluminum blades with a sickle-shaped profile are used in order to improve the sound attenuation effect.
Fan speed control is achieved - as standard - by means of a continuous fan speed regulator. This ensures also to run the compressors always with optimum working efficiency.

EC Fans

In all versions, as standard or alternative to the modulating adjustment (TRIAC), it is possible to choose fans with electronic switching motor, with the same aeraulic performance as those installed in the selected unit, as well as the possibility of a fan modulating adjustment entirely managed by the microprocessor control. The EC technology includes a permanent magnet rotor combined with an electronic switching control of the stator magnetic field directly integrated in the motor (brushless motor). Such electronic switching device manages the fan rotation speed modulation. Compared to the traditional induction threephase motors, the inner losses in the iron reduce by 60% and in the copper by 40%, with an electric absorption lower by 20-30% than those of a traditional fan with induction threephase motor, getting the same aeraulic performance. Further, while modulating the speed, the absorbed power can be equal to 50%than one of a traditional fan with phase cutoff adjustment (TRIAC).
A general noise reduction is further obtained, as the EC technology used for the adjustment does not cause magnetic vibrations, not even on special frequencies corresponding to certain rotation speeds.
Finally, the decrease of pickup currents thanks to the EC technology and the absence of sliding contacts for the rotor supply significantly reduce the stresses that negatively influence the component life, increasing the machine overall reliability.

Adiabatic System

Introduction

This technology uses panels called PAD. A film of water is running on their surface and air partially makes it evaporate creating the wished cooling effect.
The PAD consists of corrugates cellulose sheets, reciprocally crossed and bonded with non-toxic adhesives. This configuration creates a large contact surface between air and water and achieves a highly efficient evaporation.
While the adiabatic system is operating, the water distribution system wets the whole panel uniformly, avoiding any dry area that would reduce both efficiency and life.
The humidifying efficiency mainly depends on the environmental operating conditions.
A cellulose panel, if drenched with water, tends to crumble. This crumbling is greatly minimized with the used system.
The cellulose soaking procedure ensures a self-bearing product, with high absorbency and protected from damage, thus with a longer life.

Mechanical Specifications

Furthermore, water tends to flow to the air inlet side of the panel: the most of evaporation occurs there.
The first centimeters of the PAD are treated with a special hardening paint to increase its resistance to the growth of algae and limescale, as well as its mechanical resistance. The water distribution panel, positioned above the cooling panel, ensures a uniform distribution so that no surface is left dry. It is therefore a basic part of a complete system: the distribution panel must be used together with the PAD panels.
The absence of irregular water flow is guaranteed and therefore no special protections on the exchangers of the chiller supporting this device are required.
The average life of the PAD panels (if operated according to the maintenance schedule) is approx. 3-5 years for a use of approx. 4000 h/year.
Other panel types are available and built with materials improving the cellulose features as for fire resistance (UL 900,Class II classified fiberglass), or for cleaning, was hability and other features (flocked PVC sheets).Contact VERTIV for any need for special uses.

Integration of the Adiabatic System

Unlike the currently designed adiabatic pre-cooling systems, only aimed at extending the chiller operating range with higher external temperatures, the **Liebert HPC-S Adiabatic** is aimed at steadily decreasing the external air temperature so as to reduce the condensing temperature and/or increasing the freecooling capacity, for a higher unit efficiency.
As mentioned in the introduction, the used technology involves a PAD wetted with mains water, with external air flowing through it and water evaporating making the air fresher. The hydraulic diagram below explains the operating concept of the adiabatic system and its interaction with the chiller.

Tab. 1 - Adiabatic system performance

Air temperature before PAD [° C]	Air condition after PAD															
	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]	Tdb [° C]	RH [%]
50	30,9	56	34,3	65	37,2	72										
48	29,6	56	32,8	65	35,5	72										
46	28,3	56	31,3	65	33,9	72	36,3	78								
44	27	57	29,8	65	32,3	72	34,5	78								
42	25,7	57	28,4	65	30,7	72	32,8	78	34,7	83						
40	24,4	58	26,9	66	29,1	72	31,1	78	32,9	83	34,6	87				
38	23,1	58	25,4	66	27,5	73	29,4	78	31,2	83	32,8	87	34,2	91		
36	21,8	59	24.0	66	26.0	73	27,8	78	29,4	83	30,9	87	32,3	91	33,7	94
34	20,4	59	22,5	67	24,4	73	26,1	78	27,7	83	29,1	87	30,5	91	31,7	94
32	19,1	60	21.0	67	22,8	73	24,4	78	25,9	83	27,3	87	28,6	91	29,8	94
30	17,8	60	19,6	67	21,2	73	22,8	78	24,2	83	25,5	87	26,7	91	27,9	94
28	16,4	61	18,1	68	19,7	73	21,1	79	22,4	83	23,7	87	24,9	91	26.0	94
26	15,1	61	16,6	68	18,1	74	19,4	79	20,7	83	21,9	87	23.0	91	24.0	94
24	13,7	62	15,2	68	16,5	74	17,8	79	18,9	83	20,1	87	21,1	91	22,1	94
22	12,3	62	13,7	69	14,9	74	16,1	79	17,2	83	18,3	87	19,3	91	20,2	94
20	11.0	63	12,2	69	13,3	74	14,4	79	15,5	83	16,5	87	17,4	91	18,3	94
18	9,8	63	10,8	69	11,7	74	12,7	79	13,7	83	14,7	87	15,5	91	16,4	94
16	8,4	64	9,3	69	10,1	74	11,0	79	12,0	83	12,9	87	13,7	91	14,4	94
14	7,1	64	7,8	70	8,6	75	9,4	79	10,2	83	11,1	87	11,8	91	12,5	94
12	5,8	65	6,3	70	7,0	75	7,7	79	8,5	83	9,2	87	9,9	91	10,6	94
10	4,4	65	4,9	70	5,4	75	6,0	79	6,7	83	7,4	87	8,1	91	8,7	94
8	3,1	66	3,4	71	3,8	75	4,3	80	5,0	83	5,6	87	6,2	91	6,7	94
6	1,8	66	1,9	71	2,2	75	2,7	80	3,2	83	3,8	87	4,3	91	4,8	94
5	1,1	66	1,2	71	1,4	75	1,8	80	2,3	83	2,9	87	3,4	91	3,8	94

10	20	30	40	50	60	70	80
Air R.H. before PAD [%]							

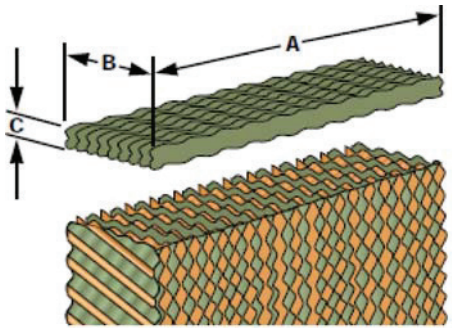
Mechanical Specifications

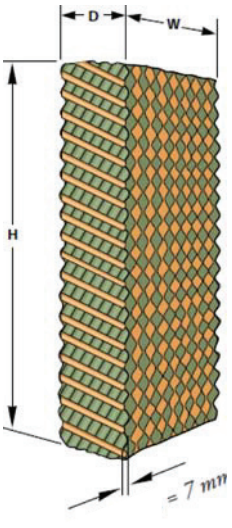
LEGEND
T out > 35 °C
30°C < T out < 35 °C
25°C < T out < 30 °C
20°C < T out < 15 °C
15°C < T out < 20 °C
7°C < T out <15 °C
Freezing Risk !

The **Liebert® HPC-S Adiabatic**, configured for the installation of the PAD pre-cooling system, includes one independent adiabatic sections, one for each **Liebert® HPC-S Adiabatic** side, with shared power supply and adjustment. The adiabatic system includes: curtain panels on the base (so that all the air sucked flows exclusively through the PADs); high efficiency fans (ensuring the air passage through the above panels in all operating conditions); a set of brackets and hooks arranged inside the chiller structure to ensure its fastening (to be made during the below described chiller commissioning); electronically controlled regulator installed on the machine, for both the right and left sections; hydraulic system.
The adiabatic system control, the electrical system and a part of the mechanical structure supporting the PADs are factory-installed on the unit, while the adiabatic panels, the water distribution panels, the additional mechanical structure and the hydraulic system are supplied as a separate kit to be ordered as accessory and installed on site.
Adiabatic system is available with autonomous built-in stand-alone pumping system (system with pump and built-in tanks); the system operated with stand- alone adiabatic hydraulic circuit, including tank and recirculation pump.
The **Liebert® HPC-S Adiabatic** units equipped with adiabatic panels does not include the installation of coil protection metal filters and of compressor compartment protection grids, thanks to the protecting/ filtering function by the PADs that are equipped with a special coating and ensure a protection both in summer and winter without any need to precautionarily remove them.
The adiabatic system is completely factory assembled, except in case of shipment with container.

Description of the PAD panels

The dimensions of the panels are H 2000 mm, W 600 mm, D 100 mm; their dry weight is approx. 3 kg, while the wet weight is approx. 11 kg.
The dimensions of the water distribution panels (to be installed between PAD and the drilled PVC pipe for water distribution) are C 30 mm, A 600 mm, B 100 mm; the dry/wet weight is negligible.





Hydraulic configuration of the adiabatic system

The adiabatic system is available:

- With BUILT-IN stand-alone recirculation system: which includes tank, pump and complete adiabatic water recirculation system, all integrated in the frame of the unit.

The system configuration depends on the number of fans also in the adiabatic systems with built- in tanks.

Mechanical Specifications

Description of the hydraulic section of the adiabatic system with built-in tanks

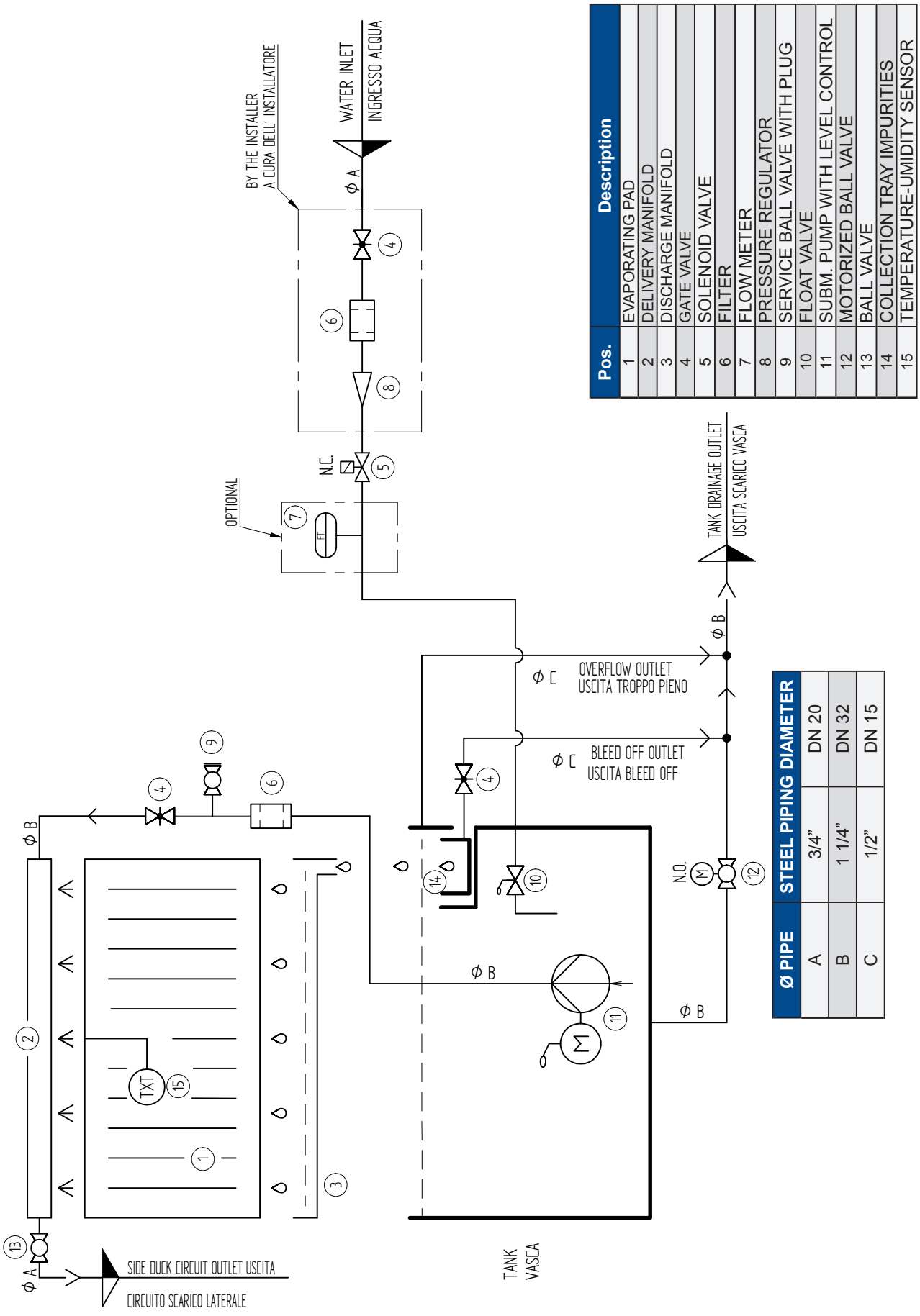
System with built-in tank; on each bank there is one or two tank modules for collecting the water from/ to the adiabatic system combined with each **Liebert® HPC-S Adiabatic**; it includes:

- Water collection modules size and volume, complete with pump support, overflow, predisposition to various hydraulic connections.
- Circulation pump.
- Pump safety switch (level control).
- Water supply cock float-operated.

The components of the hydraulic diagram below are also present:

- Motorized ball valves.
- Hydraulic section including inspectable metal mesh filter, flow rate adjusting manual shutters, press intakes, pipes and connectors.

Mechanical Specifications

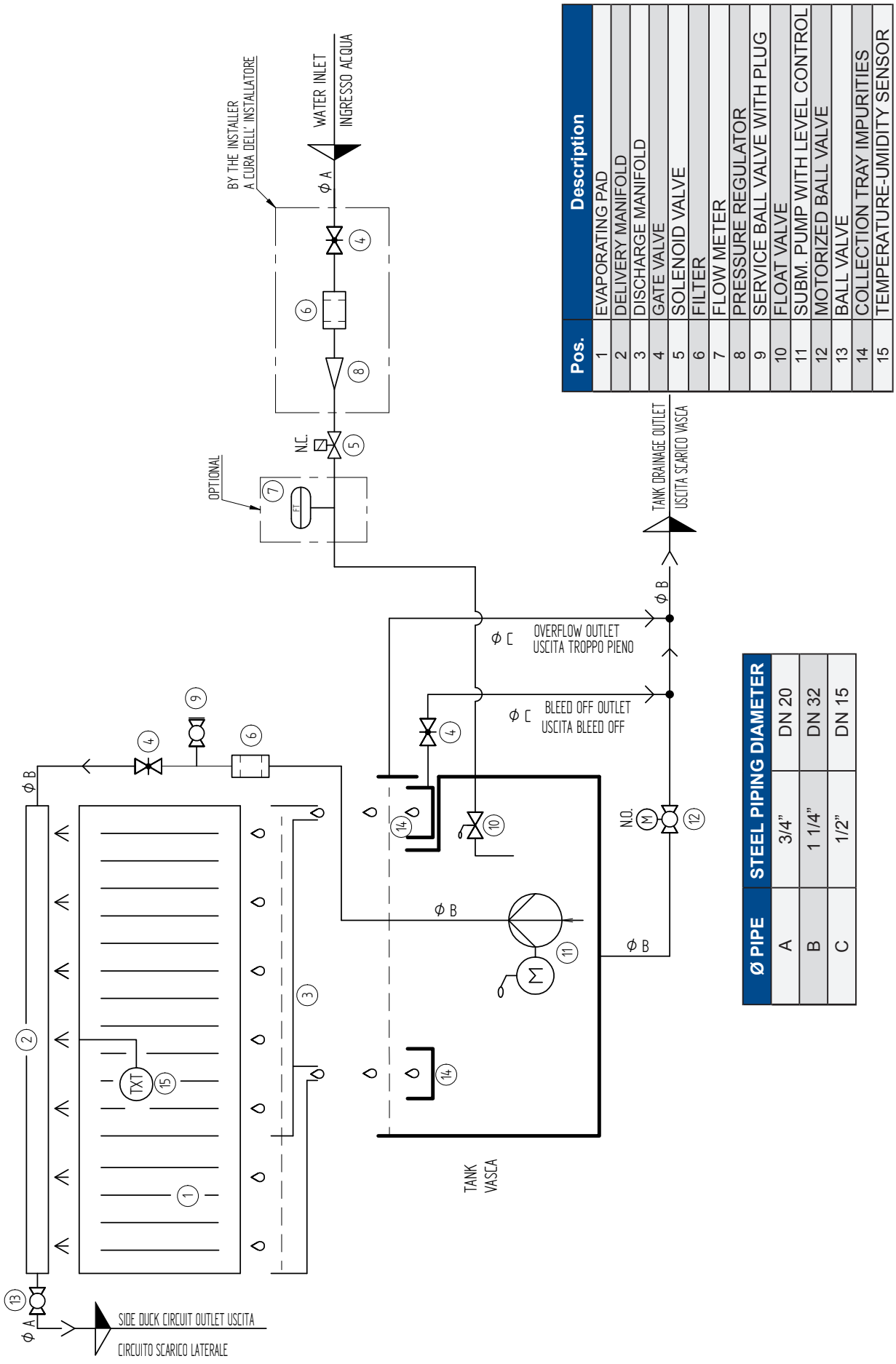


Pos.	Description
1	EVAPORATING PAD
2	DELIVERY MANIFOLD
3	DISCHARGE MANIFOLD
4	GATE VALVE
5	SOLENOID VALVE
6	FILTER
7	FLOW METER
8	PRESSURE REGULATOR
9	SERVICE BALL VALVE WITH PLUG
10	FLOAT VALVE
11	SUBM. PUMP WITH LEVEL CONTROL
12	MOTORIZED BALL VALVE
13	BALL VALVE
14	COLLECTION TRAY IMPURITIES
15	TEMPERATURE-UMIDITY SENSOR

Ø PIPE	STEEL PIPING DIAMETER
A	3/4" DN 20
B	1 1/4" DN 32
C	1/2" DN 15

Fig. 6 - Adiabatic system -hydraulic circuit -3 fans

Mechanical Specifications



Pos.	Description
1	EVAPORATING PAD
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4	GATE VALVE
5	SOLENOID VALVE
6	FILTER
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15	TEMPERATURE-UMIDITY SENSOR

Ø PIPE	STEEL PIPING DIAMETER
A	3/4" DN 20
B	1 1/4" DN 32
C	1/2" DN 15

Fig. 7 - Adiabatic system -hydraulic circuit -4-5 fans

Tab. 5b - Water built-in tank

HPC-S fan no.	PAD no.	Nominal volume of tank [l]	Max volume of tank [l]	Total system volume [l]
3	5	125	215	268
4	7			285
5	9			303

*. PAD section already cut to fill the whole length

Legend

Nominal volume of tank: water volume contained in all tanks for side, from the bottom to the level of the float cock. This is the water volume usually present in the tank while the adiabatic system is operating.

Max. volume of tank: water amount contained in all tanks for each side, from the bottom to the overflow level. This is the max. volume that can be contained in the entire adiabatic system (tanks, hydraulic circuit, lower channel, water in the pads…)

Total system volume: water volume contained in the entire adiabatic system (tanks, hydraulic circuit, lower channel, water in the pad…)

To ensure the healthiness of the adiabatic system, the hydraulic system must be installed by the customer in a way preventing any stagnant water inside the whole system, nor even after emptying the circuit.

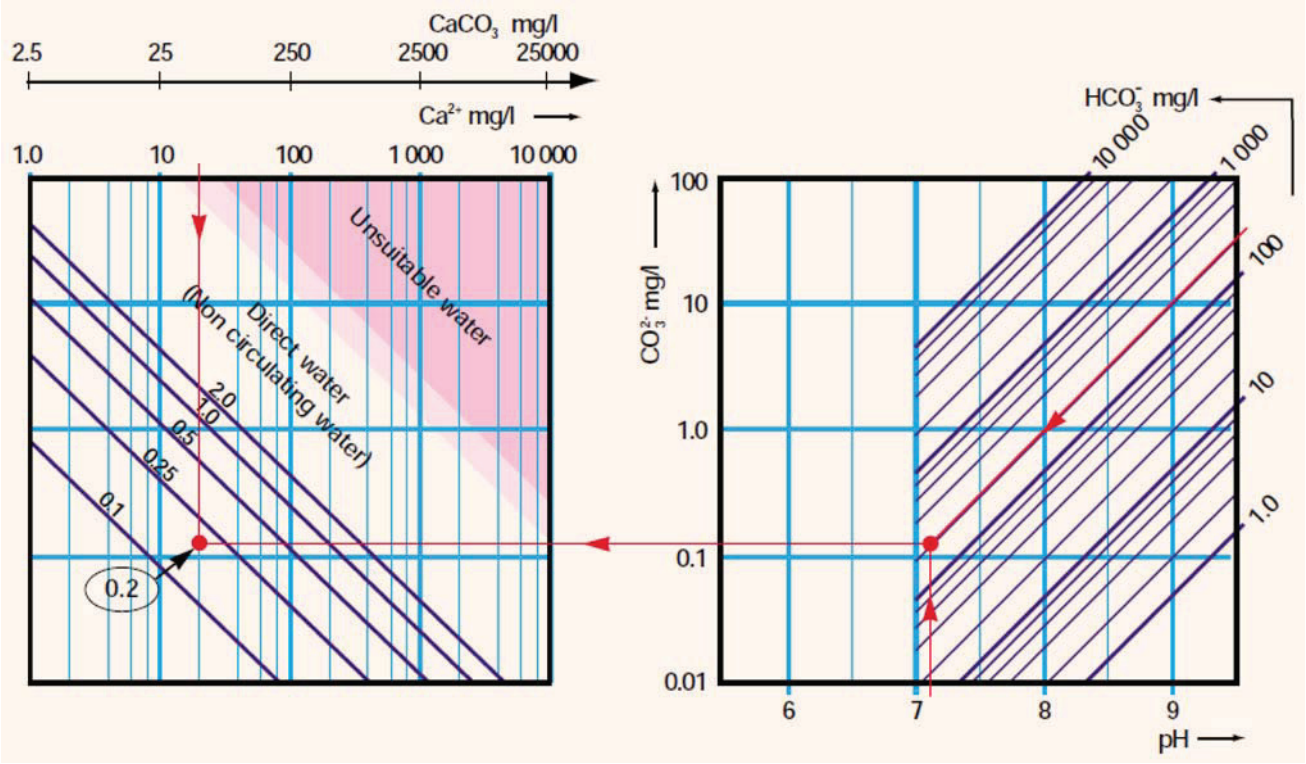
Plug on the drain: it is compulsorily forbidden to place any kind of plug or restriction that might prevent or limit (even momentarily) the tank drain. The customer is responsible for ensuring a correct routing of the adiabatic system drain ducts, for a fast drain of the system and the tank, without any water stagnation.

Scaling control

Adjust also the bleed-off flow rate, to control the mineralization degree of the water in the tank. The bleed-off flow rate depends on the flow rate evaporated in the PADs and on the chemical features of the refill water. The bleed-off flow rate is very important, as a too low value would increase the limescale concentration in the tank water, with problems of deposit in the various components and a subsequent reduction of the system life (PAD included). On the other hand, a too high value would cause an excessive water consumption.
The bleed-off flow rate can be calculated as:

$$B\left[\frac{l}{min}\right] = \frac{c_B \times E}{2}$$

(c_B coefficient that can be determined from the diagram on the next page, according to the water chemical features, and E: evaporated flow rate that can be taken as equal to 1 l/min for each fan arranged on a machine side)



Notice:
In order to calculate the water flow consumption, it is necessary to sum evaporated and bleed-off flow.

Example

Chiller with 5 fans, the water has the following chemical features:

- pH = 7.1
- HCO_3^- ion concentration = 200 mg/l
- Ca_2^+ ion concentration = 20 mg/l

The diagram shows that the coefficient c_B = 0.2. The bleed-off flow rate will therefore be:

$$B\left[l/min\right] = \frac{c_B \times E}{2} = \frac{0{,}2 \times (1 \times 5)}{2} = 0{,}5\,\frac{l}{min}$$

Water quality

The temperature of the water must not be higher than 20° C, to reduce microbiologic proliferation.
The mains water distributed to the PADs must have the required min. features.
The quality of the water must be periodically checked in compliance with the table below:

Tab. 5c - Water quality

Constituent	Limits	Constituent	Limits
Calcium Hardness (as $CaCO_3$)	20 – 150 mg/l	Conductivity	< 750 µmhos
Total Alkalinity (as $CaCO_3$)	20 – 150 mg/l	Suspended solids	< 5 mg/l
Chlorides (as Cl)	< 50 mg/l	pH	6.0 – 8.5
Silica (as SiO_2)	< 25 mg/l	Chlorine	0 – 1.5 mg/l
Iron (as Fe)	< 0.2 mg/l	Bromine	0 – 1.5 mg/l

FAQ-Answers to Frequently Asked Questions

How long is the PADs' life ?

The design life is 3-5 years, with a typical use of 5-6 months/year, if the maintenance and supply specifications for the PADs are complied with.

Can vinegar be used to sanitize the system ?

Vinegar is an organic substance and can cause bacteria and alga growth on the PAD. Moreover, it can decrease the pH too much.

When are the PADs to be replaced ?

PADs are to be replaced when their efficiency (cooling capacity, as indicated in Tab. 1) decreases. This occurs practically when the PAD is worn, when it crumbles, or with dirt or clogging that cannot be removed with the previously described cleaning operation. The best time to replace them is at the end of the usage season.

The water in the storage tank is now greenish-yellow. Does this indicate problems ?

This is normal indeed with completely new PADs. It is a temporary condition that disappears after approximately fifteen days of continuous operation of the adiabatic system.

Electrical Panel

The electrical panel is designed, constructed and tested in compliance with IEC standards (EN60204-1). It is installed on the compressor compartment side and can be accessed through the unit right side panel; it has a degree of protection equivalent to IP54. It is possible to access the iCOM control display without switching the unit off, so as to aid maintenance operations.

The cooling of the electrical panel is achieved through forced ventilation, controlled by the microprocessors board . For low ambient temperatures (below - 5° C) it is possible to have an electric heater fitted inside (optional) and controlled as well by the microprocessor board.

NOTE: Three-phase electric power

Requirements:

The **Liebert® HPC-S Adiabatic** units are equipped with electrical devices (EC motors, power supplies module, inverter pumps, control devices, etc.) that are designed to operate properly with Star-connected power (Wye) with earthed neutral (TN or TT system).

Three-phase distribution Delta-connected (Δ) or Star-connected power (Wye) without ground or floating ground (IT) contact VERTIV **.**

Main features:

- Power supply, 400±10% V/3 ph/50 Hz + PE;
- Auxiliary power supply circuit, 230 V/1 ph/50 Hz and 24 V/1 ph/50 Hz;
- Main switch;
- Main switch for auxiliary circuit and fast start feature (optional);
- Protection MCBs for compressors, fans and pumps;
- Contactors for compressors and pumps;
- Relay for checking phase sequence, minimum voltage, loss one or more phase;
- Manual operation through iCOM controller;
- PFC(Power Factor Correction) for compressors (option);
- Compressors electronic soft start (option);
- Volt-free contacts for remote indication of:
  - Compressors in operation;
  - Pump(s) in operation;
  - General alarm;
  - Warning alarm;
  - Tandem compressor alarm 1/2;

- High temperature inlet/outlet water alarm;
- Water flow alarm;
- Condenser fan failure;
- Configurable free contact;
- External input for remote ON/OFF.

Packing

Units are shipped with plastic film protection.

Warranty Clauses

The warranty does not apply for any damage or malfunction that may occur during or as a result of operation outside of the application range.
The warranty does not apply to the freecooling units for damage due to frost if the hydraulic circuit has not been charged with a water-glycol mixture with % suitable to the minimum temperatures in the application site. The company is not responsible for damage due to incorrect or improper use of the product and it reserves the right to change technical specifications without any prior notice.

Final Tests and Reference Standards

The units are designed, manufactured and tested in compliance with the European directives 2006/42/EC; 2014/30/EU; 2014/35/EU; 2014/68/EU.
The machine is supplied with a final test certificate and a declaration of conformity with the norms.
All **Liebert® HPC-S Adiabatic** units are "CE" marked.

Accessories

Pump Group

Available head pressure values are declared at the unit hydraulic connections and are referred to the nominal working conditions of each unit.
Please contact us for different fluid flow rates or head pressures.
All pumps can work with up to 35% ethylene glycol percentage by weight.
In all chiller and freecooling models with double pumps, one pump is operating and one is in stand-by.
The indicated hydraulic performance refers to the inverter pump in their max. capacities (if available); obviously, they will adapt from such values to the hydraulic load required by the user circuit and by the chiller inner circuit; in case of freecooling unit, they will adapt their performance so as to keep the flow rate crossing the evaporator steady with relevant energy saving.

Tab. 5d - 2 Pole, standard head pressure (data referred to each pump)

Models			017	020	023	025	028	030
FGA	30% glycol- water Mixture Flow	m^3/h	32.26	35.89	42.12	45.96	52.85	59.31
	Available Pressure Head	kPa	93	55	146	111	52	76
Pump/s number		Nr.	1/2	1/2	1/2	1/2	1/2	1/2
Pump Rotor Model		-	65-260/2	65-260/2	65-340/2	65-340/2	65-340/2	65-410/2
Nominal Motor Power		kW	4.0	4.0	5.5	5.5	5.5	7.5
Noise Level (*)		dB(A)	63	63	63	63	63	60

(*) - According to ISO 3744

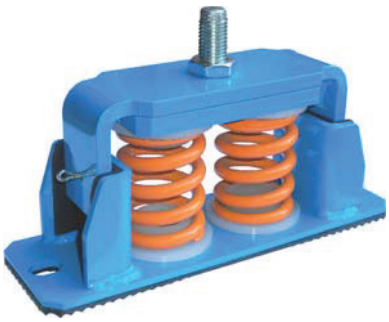
Mechanical Specifications

Tab. 5e - 2 Pole, high head pressure (data referred to each pump)

Models			017	020	023	025	028	030
FGA	30% glycol- water Mixture Flow	m^3/h	32.26	35.89	42.12	45.96	52.85	59.31
	Available Pressure Head	kPa	169	134	235	204	150	148
Pump/s number		Nr.	1/2	1/2	1/2	1/2	1/2	1/2
Pump Rotor Model		-	65-340/2	65-340/2	65-410/2	65-410/2	65-410/2	65-460/2
Nominal Motor Power		kW	5.5	6.0	7.5	7.5	7.5	11.0
Noise Level (*)		dB(A)	63	63	60	60	60	60

(*) - According to ISO 3744

Anti - Vibration Mounts



Rubber anti-vibration supports: ”bell”- type supports with a truncated-conic shape. The support is made up of a vulcanized rubber elastic element, on a metal body in galvanized steel with a base arranged for ground fixing. They are suitable for dampening high frequency vibrations and for limiting cross thrusts.

Spring vibration- damping support made of:

- Base plate in carbon steel; sand-blasted and cataphoresis protected; epoxy powder coated; with welded stiffeners and slots for screwing into ground.
- Cover in carbon steel; sand-blasted and cataphoresis protected; epoxy powder coated; with M16 hole.
- Intermediate plate, to equalize the springs loads; sand-blasted and cataphoresis protected; epoxy powder coated.
- Plastic spring locking rings and guiding profiles to guarantee the insulations from the vibrations.
- Hexagonal head screw and hexagonal nutM16, zinc plated, used to level the unit after positioning.
- Spring steel helicoidal springs (UNI EN 10270 – 1 SH), cataphoresis protected.
- A pad with antislip reliefs stabilizes the damper position by friction.

They are suitable for dampening high and medium frequency vibrations>10Hz, guaranteeing excellent insulation efficiency > 85% from 15Hz.

Inertial Tank

It enables the inertial stabilizer function, for a better compressor operation, summed up in the following two points:

- It reduces the frequency of the compressor start up and consequent high current peaks, which is higher when the system thermal inertia is lower, improving their performance.
- It naturally eliminates the operation troubles caused by sudden load variations (shown by variations of the chilled water temperature).

The buffer tank is supplied complete with manometer and temperature sensor well, air purge valve, discharge valve and sinking connection for electric heaters; max operating pressure: 6 bar.
Built in carbon steel and coated with anti- condensate insulation with PVC film proper for outdoor installation.
It is installed inside a cabinet which can be supplied either already connected to the unit (mechanically and hydraulically jointed to it) or loose (completely separate from the unit).

Technical Data:

- Internal volume: 1000 litres
- Net weight: 400 kg
- Working weight: 1400 kg

Other Accessories

The following accessories can be installed as option:

- Coldfire display fitted on board (as special).
- Metal filters protecting the coils (recommended to aid the coil maintenance-cleaning).

Mechanical Specifications

- Tank, evaporator and piping heaters to protect these components against frost.
- Acoustic option (compressors noise insulation jacket and additional compressors box noise insulation) to be selected according fans speed/diameter in order to have the requested acoustic noise emission level.
- Compressor power factor capacitors: they are able to get “Cosfi” value equal to about 0.9 on the compressors, in rated operating conditions.
- Compressors electronic soft-starter: they are able to reduce inrush current on each single compressor by 45%.
- Monitoring card according to different communications standards.
- “Y”-shaped mechanical filter protecting the hydraulic circuit (recommended to aid the plate exchanger maintenance-cleaning).
- Certified integrated lifting bars (removable after shipment).
- Water check valves necessary for parallel multiple chiller (with one or two pumps fitted on board) hydraulic installation.
- Coldfire on IP40 box.

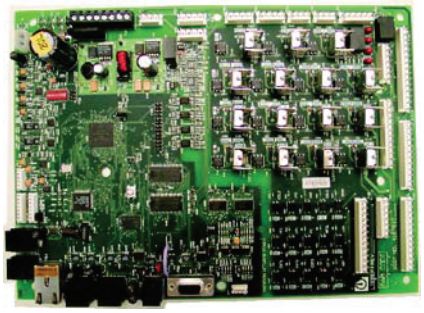
Microprocessor Controls

iCOM Control

Liebert® HPC-S Adiabatic models are controlled by iCOM Large (Fig. 6).
iCOM is the standard on-board control and its advanced features secure system optimization and energy savings.
Full management of the **Liebert® HPC-S Adiabatic** units is granted by the on board control iCOM, which allows the programming of temperature and pressure thresholds as well as the teamwork functionality through Ethernet network.
User set- up can be done with a simple Operating Display that, through symbols and codes, ensures a reliable and flexible man-machine interface.

iCOM

Fig. 6



- The standard software of the **Liebert® HPC-S Adiabatic** Units includes special control algorithms that ensure real energy savings and enhance the reliability of the full system.
- Immediate set- up can be available through the ”Unit Code” system. In case of re-configuration needs, the full configuration of the unit and recalculation of all the thresholds levels (which depend on the refrigerant type) are available by simply enabling the configuration Unit Code.
- Sequential auto- restart timer allows phased units restart after power failure.
- Pumps’ durability is granted by a special auto-rotation start-up function.
- The record of the working hours of compressors, pumps and freecooling is easily available via the CDL iCOM display.
- Auto- selection of the best control strategy at different ambient temperatures is implemented in order to assure an optimized usage of the compressors and condensers fans.
- The ”Ambient compensation” function can be enabled to make the unit set- point rise automatically during warm periods, permitting energy savings.
- For low noise versions with fan speed control there is a special algorithm which, together with the compressor management, keeps the fan speed on the lowest possible value.
- Compressors’ Run/Stop time management is implemented in order to obtain the optimization of compressors’ operations either within the unit, or, in case of networking Ethernet, within the whole of the **Liebert® HPC-S Adiabatic** Units system.
- A special working mode can be established in combination with **VERTIV** HPAC Units to obtain the so called ”Supersaver” system, that enhances the energy saving capabilities. The information on the cooling needs of the air conditioners is available to the **Liebert® HPC-S Adiabatic** units, that will manage its resources (compressors and freecooling) in the most efficient way in order to save additional energy.
- When used with Controls electronic expansion valves board, the **Liebert® HPC-S Adiabatic** provides the control of the superheat in the evaporator. In order to perform this control task, it requires the suction pressure and the suction gas temperature value. These signals can be received through two analogue inputs.
- All settings are protected through a 3-Level Password system.
- Input for Remote on- off and Volt-free contacts for simple remote monitoring of alarms and warnings are available.
- Up to 16 **Liebert® HPC-S Adiabatic** units can be easily linked together on a network to provide teamwork mode, stand-by operation and duty cycling without additional hardware. Reliability is not affected if there are problems on the data communication buses, because the units return automatically to the stand-alone mode.

iCOM Technical Data

Technical Data	iCOM Large
E2prom	4 Mbit + 512 kbit
Flash memory	32 Mbit
RAM memory	128 Mbit
Microcontroller	Coldfire 32 Mbit
Analogue Input	4 x 0- 10V, 0- 5V, 4..20mA (selectable) + 2 PTC/NTC + 2 NTC
Digital Input	15 x opto- coupled
Analogue Output	4 x 0- 10V
Digital Output	15 triacs output and 2 relay output
Time and date	Buffered by an LI- battery
Hirobus Lan connectors	2 RJ45 sockets (for unit in LAN, remote display)
Ethernet network connectors	1 RJ45 socket
CAN bus connectors	2 RJ12 sockets
Hironet connectors	1 RJ10 socket for RS485 (direct connection to proprietary supervision)
RS232 service port	1 db9 socket

CDL Graphic Display

(special option fitted on Electrical Panel chiller board or optional for indoor remote IP40 Box installation)

The CDL graphic display featuring a 24h / 8 days graphic record of controlled parameters as well as the last 200 events occurred.

A back-up battery keeps the data stored in the memory (graphic data record, alarms).

- Large graphic display (320 x 240 pixel).
- System Window: system operation status at a glance.
- Self-explanatory Icons: they are used for the Menu-Layout of the CDL iCOM.
- Online Help: every single parameter has its own multi-page explanation.
- Status Report of the latest 200 event/messages of the unit/system.
- Four different Graphic Data Records.
- Timer and Date mode (electronic timer included in the software).
- Semi or full manual mode software management including all safety devices.
- 4-Level passwords system to protect all the settings.
- Ergonomic design for use also as portable device (start-up and ”flying connections” by service personnel).
- Multi- language menu with on-the-fly language selection.

CDL Technical Data

- Microcontroller: . . . . . Coldfire 32 Mbit;
- Ethernet network connectors: . . . . . 2 RJ45 sockets (for unit in LAN, remote display);
- CAN bus connectors: . . . . . 2 RJ12 sockets;
- Power supply: . . . . . via CAN bus or external 12 Vdc supply.

Liebert® HPC-S Adiabatic Connectivity

iCOM and CDL allow Connectivity with superior levels of control and supervision systems:

Hirovisor IP software

This software allows distance monitoring and telemaintenance, and also the storing in the personal computer of the graphics of water temperature trends and status reports for archiving purposes. Delivery of SMS and e-mail is supported.

BMSs connections

The IS cards and other gateway represent the communication managers portfolio which allow the integration of the **Liebert® HPC-S Adiabatic** units into the most diffused Building Management Systems. The most diffused are: SNMP, HTTP, MODBUS and LONWORK.

Alarm Board

The Alarm Board converts Alarms (high priority) or Warnings (lower priority) from iCOM into Volt- free contacts (up to five, either normally open).
In this way, following Warnings/Alarms are separated: High or Low refrigerant pressure, High water temperature, Low water temperature, Pump failure, Compressor failure, etc.

Correction Factors

Glycol mixture correction factors
The water glycol mixtures are used as a thermal carrier fluid, in very cold climates with temperatures below 0 ° C. The use of low freezing point mixtures causes a modification in the main thermodynamic properties of the units.

The main parameters affected by the use of glycol mixtures are the following:

- Cooling capacity
- Mixture volumetric flow
- Pressure drop
- Compressor power input

In the table below are reported correction factors referred to the most common ethylene glycol mixtures.

Tab. 7a - Chiller Table - CB0 - CG0

Ethylene glycol [% in weight]		0	10	20	30	40	50
Freezing temperature	°C	0	- 4,4	- 9,9	- 16,6	- 25,2	- 37,2
Refrigeration capacity correcting factor	F3	1	0.998	0.993	0.987	0.977	0.969
Mixture volume flow rate correcting factor	F4	1	1,046	1,080	1,098	1,150	1,210
Mixture side pressure drop correcting factor	F5	1	1,053	1,109	1,168	1,234	1,311
Compressor power input correcting factor	F6	1	0.998	0.997	0.995	0.992	0.990

Tab.7b - Freecooling Table - FGA

Ethylene glycol [% in weight]		0	10	20	30	40	50
Freezing temperature	°C	0	- 4,4	- 9,9	- 16,6	- 25,2	- 37,2
Refrigeration capacity correcting factor	F3	1,013	1,007	1,002	1	0.990	0.982
Mixture volume flow rate correcting factor	F4	0.911	0.926	0.956	1	1,048	1,102
Mixture side pressure drop correcting factor	F5	0.856	0.902	0.950	1	1,056	1,122
Compressor power input correcting factor	F6	1,005	1,003	1,002	1	0.997	0.995

We indicate asR0, V0, P0 respectively the unit capacity, volumetric flow rate and compressor power input with 0% ethylene glycol on Chiller models or 30% ethylene glycol on Freecooling models; when we use glycol mixtures with different % with the same inlet and outlet temperatures at the evaporator, the performance will vary as follows:

- Refrigeration capacity = R0 x F3
- Volumetric flow rate = V0 x F3 x F4
- Mixture pressure drop=DP1 x F5, whereDP1 is the unit water pressure drop for the new volumetric mixture flow rate
- Compressor power input = P0 x F6

Fouling correction factors

Tab. 7c - Fouling correction factors

Fouling factors [10^{-4} m^2 °C/W]	Correction factors	
	F1a refrigeration capacity correction factor	F2a compressor power input correction factor
0,18	1	1
0,44	0.996	0.999
1,32	0.984	0.994

Unit performance reported in the tables are given for the condition exchanger with fouling factor corresponding at 0,18 x 10-4 m 2 °C /W. For different fouling factor values, performances should be corrected with the correction factors shown above. For optimum unit operation, proper water treatment must be maintained. Scaling and dirt in a system will vary significantly depending on local water conditions. Water treatment should be based on characteristics of the area's water. Improper or untreated water can lead to scale build up, erosion and corrosion in the evaporator.

VERTIV will not accept responsibility for poorly or improperly treated water.

Performance Adjustment Factors

Sea level correction factors

Tab. 7d - Sea level correction factors

Elevation above sea level [meters]	Correction factors	
	F1b refrigeration capacity correction factor	F2b compressor power input correction factor
0	1	1
600	0.997	1,004
1200	0.993	1,007
1800	0.988	1,015

Unit performance reported in the tables are given for sea level conditions.
For different altitude, performances should be corrected with the correction factors shown above.

Sound Pressure and Power Levels

SPL

The values of Sound Pressure Level SPL for every octave band frequency,measured with unit on full load operation, at nominal working conditions (ambient air temperature 35°C, evaporator water inlet/ outlet temperature 12/7°C), free field conditions and 1m from unit in according to ISO 3744 average method are indicated in the following tables.

PWL

The values of Power Level PWL for every octave band frequency, with unit on full load operation, at nominal working conditions (ambient air temperature 35°C, evaporator water inlet/outlet temperature 12/7°C), calculated in according to ISO 3744 procedure method are indicated in the following tables.

Tab. 8a - SPL FGA

Models	Octave band frequency [Hz]								TOTALE [dB(A)]
	63	125	250	500	1000	2000	4000	8000	
FGA	"SPL" Sound pressure levels [dB]								
017	82.7	75.7	70.7	72.7	67.7	64.7	56.7	49.7	73.5
020	83.2	76.2	71.2	73.2	68.2	65.2	57.2	50.2	74.0
023	83.7	76.7	71.7	73.7	68.7	65.7	57.7	50.7	74.5
025	84.2	77.2	72.2	74.2	69.2	66.2	58.2	51.2	75.0
028	84.7	77.7	72.7	74.7	69.7	66.7	58.7	51.7	75.5
030	84.7	77.7	72.7	74.7	69.7	66.7	58.7	51.7	75.5

Tab. 8b - PWL FGA

Models	Octave band frequency [Hz]								TOTALE [dB(A)]
	63	125	250	500	1000	2000	4000	8000	
FGA	"PWL" Sound power levels [dB]								
017	102.4	95.4	90.4	92.4	87.4	84.4	76.4	69.4	93.2
020	102.9	95.9	90.9	92.9	87.9	84.9	76.9	69.9	93.7
023	103.9	96.9	91.9	93.9	88.9	85.9	77.9	70.9	94.7
025	104.4	97.4	92.4	94.4	89.4	86.4	78.4	71.4	95.2
028	105.3	98.3	93.3	95.3	90.3	87.3	79.3	72.3	96.1
030	105.3	98.3	93.3	95.3	90.3	87.3	79.3	72.3	96.1

Tab. 8c - SPL FGA + LN

Models	Octave band frequency [Hz]								TOTALE [dB(A)]
	63	125	250	500	1000	2000	4000	8000	
FGA + LN	"SPL" Sound pressure levels [dB]								
017	77.4	70.4	66.4	65.4	62.4	57.4	50.4	56.4	67.5
020	77.9	70.9	66.9	65.9	62.9	57.9	50.9	56.9	68.0
023	78.4	71.4	67.4	66.4	63.4	58.4	51.4	57.4	68.5
025	78.9	71.9	67.9	66.9	63.9	58.9	51.9	57.9	69.0
028	79.4	72.4	68.4	67.4	64.4	59.4	52.4	58.4	69.5
030	79.4	72.4	68.4	67.4	64.4	59.4	52.4	58.4	69.5

Tab. 8d - PWL FGA +LN

Models	Octave band frequency [Hz]								TOTALE [dB(A)]
	63	125	250	500	1000	2000	4000	8000	
FGA + LN	"PWL" Sound power levels [dB]								
017	97.1	90.1	86.1	85.1	82.1	77.1	70.1	76.1	87.2
020	97.6	90.6	86.6	85.6	82.6	77.6	70.6	76.6	87.7
023	98.6	91.6	87.6	86.6	83.6	78.6	71.6	77.6	88.7
025	99.1	92.1	88.1	87.1	84.1	79.1	72.1	78.1	89.2
028	100	93	89	88	85	80	73	79	90.1
030	100	93	89	88	85	80	73	79	90.1

Note:
Sound power levels tolerance for each octave band: - 0/+2 dB

9 Electrical Data

Tab. 9a - Electrical data - FGA 017- 030

ModelsFGA		017	020	023	025	028	030
Power supply	V/Ph/Hz	400V / 3Ph + PE / 50Hz					
Total power input (1)	kW	60	68	78	85	96	108
OA (1) (without PFC)	A	110	120	136	144	162	182
cosφ (1) (without PFC)		0.79	0.81	0.83	0.85	0.86	0.86
OA (1) (with PFC)	A	95	108	124	136	154	171
cosφ (1) (with PFC)		0.91	0.90	0.90	0.90	0.90	0.91
Total power input (2)	kW	65	74	84	92	103	118
OA (2) (without PFC)	A	118	128	144	152	174	196
cosφ (2) (without PFC)		0.79	0.83	0.84	0.87	0.86	0.87
OA (2) (with PFC)	A	118	128	144	152	175	196
cosφ (2) (with PFC)		0.79	0.83	0.84	0.87	0.86	0.87
Max. power input	kW	84	96	110	122	136	155
FLA	A	150	162	184	196	219	251
cosφ (without PFC)		0.80	0.85	0.86	0.90	0.90	0.89
FLA (with PFC)	A	135	151	173	189	211	241
cosφ (with PFC)		0.90	0.92	0.92	0.93	0.93	0.93
LRA	A	292	349	409	421	443	497
LRA (with compr. soft-start)	A	213	247	287	299	321	358
Min. cable section	mm²	70	70	95	95	120	150
Max. fuse (gG/aM)	A	315/315	315/315	315/315	500/450	500/450	500/450
Ring terminals with hole	mm	8	8	8	10	10	10
Line screw fixing	Nm	15-22	15-22	15-22	30-44	30-44	30-44
Control power supply (only for option Fast-Start)	V/Ph/Hz	230 (400)V / 2Ph + PE / 50Hz					
Pmax	kW	0.35					
Imax	A	1,5 (0,88)					
Compressor - Power input (1)	kW	51	59	66	73	82	94
Compressor - Nominal current (1)	A	96	106	118	126	140	160
Compressor - Power input (2)	kW	56	65	72	80	89	103
Compressor - Nominal current (2)	A	104	114	126	134	152	174
Single compressor 1/3 - Max. current	A	34	40	49	49	49	65
Single compressor 2/4 - Max. current	A	34	34	34	40	49	49
Fans number	-	3	3	4	4	5	5
EC fans 900 - Power input	kW	2.7					
EC fans 900 - Nominal current	A	4.1					
EC fans 900 - Max. current	A	4.2					
EC fans 800 - Power input (option)	kW	0.8					
EC fans 800 - Nominal current (option)	A	1.3					
EC fans 800 - Max. current (option)	A	4.2					
Std. head pressure pump model (option)	-	65-260/2	65-260/2	65-340/2	65-340/2	65-340/2	65-410/2
Std. head pressure pump - Nominal power	kW	4	4	5.5	5.5	5.5	7.5
Std. head pressure pump - Motor power	kW	4.7	4.7	6.5	6.5	6.5	8.4
Std. head pressure pump - Max. current	A	8.0	8.0	11.2	11.2	11.2	15.2
High head pressure pump model (option)	-	65-340/2	65-340/2	65-410/2	65-410/2	65-410/2	65-460/2
High head pressure pump - Nominal power	kW	5.5	5.5	7.5	7.5	7.5	11
High head pressure pump - Motor power	kW	6.5	6.5	8.4	8.4	8.4	13.3
High head pressure pump - Max. current	A	11.2	11.2	15.2	15.2	15.2	21.4
Adiabatic pump model	-	GXR 13					
Adiabatic pump - Number	-	1					
Adiabatic pump - Nominal power	kW	0.45					
Adiabatic pump - Motor power	kW	0.95					
Adiabatic pump - Max current	A	1.6					

(1) - Outdoor temperature 35° C; fluid inlet/outlet temperature 15/10° C; 70-30% water-glycol mixture; R410A refrigerant; dry pad
(2) - Outdoor temperature 35° C; fluid inlet/outlet temperature 26/20° C; 70-30% water-glycol mixture; R410A refrigerant, dry pad
The cable have to be sized compliance with local standards and according to the type and characteristics of installation. Suggested cables section are reffered to.
PVC insulation with max. working temperature at 70° C and ambient temperature at 30° C
OA, FLA, LRA are calculated for unit without pumps and with fans as standard configuration.
If the unit with EC-FAN or inverter pump is connected to an electric installation where an earthleakage circuit breaker (ELCB) is used as additional protection, the circuit breaker must be of a type marked with the followingsymbols (This circuit breaker is type B.) :
Note: EC fans electrical data are provided with max. operating current (fans at max. speed).

- Nominal power supply: 400V / 3Ph + PE / 50Hz;
- Nominal power supply tollerance: 400V ±10%;
- Max. phase difference: 2%.

Fig. 10a - Support positions and loads

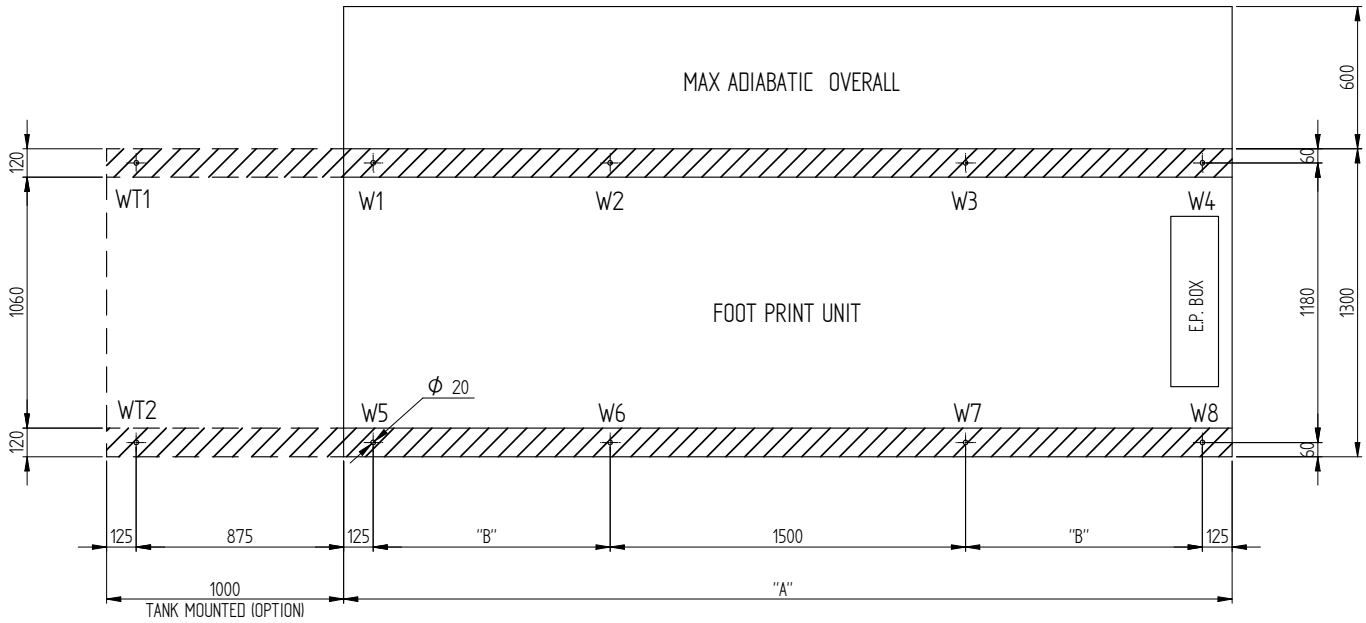
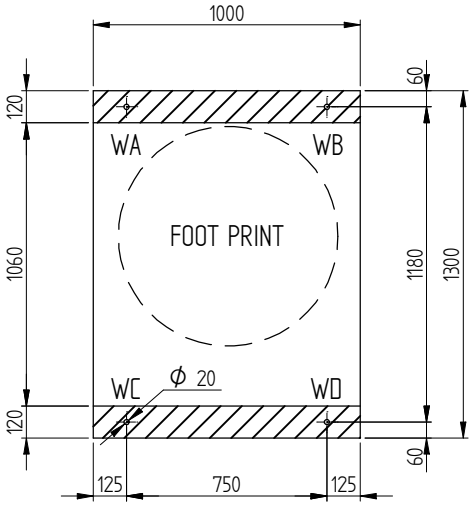


Fig. 10b - Tank (supply not mounted on unit)



WA=WB= 406 Kg
WC=WD= 299 Kg

Tab. 10a - Dimensions

MODELS	SIZE	DIMENSIONS (mm)	
		"A"	"B"
FGA	017-020	3750	1000
	023-025	4750	1500
	028-030	5750	2000

Tab. 10b - Operating weight distribution - Unit without tank

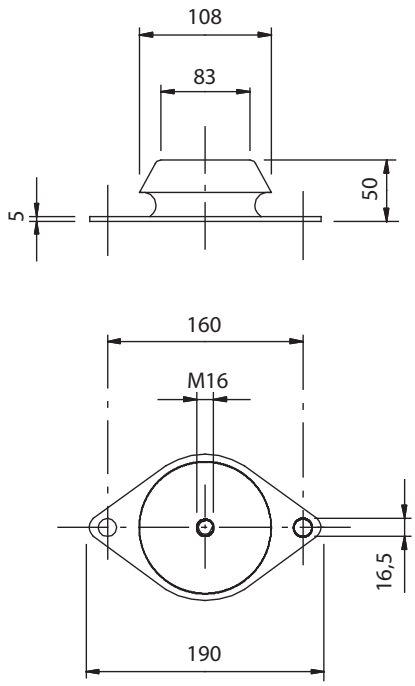
MODEL	SIZE	Weight distribution (kg)								TOT. (kg)
		W1	W2	W3	W4	W5	W6	W7	W8	
FGA	017	430	430	466	466	180	180	195	195	2542
	020	422	422	488	488	202	202	234	234	2692
	023	503	503	567	567	241	241	271	271	3164
	025	506	506	591	591	258	258	302	302	3314
	028	585	585	675	675	296	296	342	342	3796
	030	583	583	682	682	300	300	351	351	3832

Tab. 10c - Operating weight distribution - Unit with tank

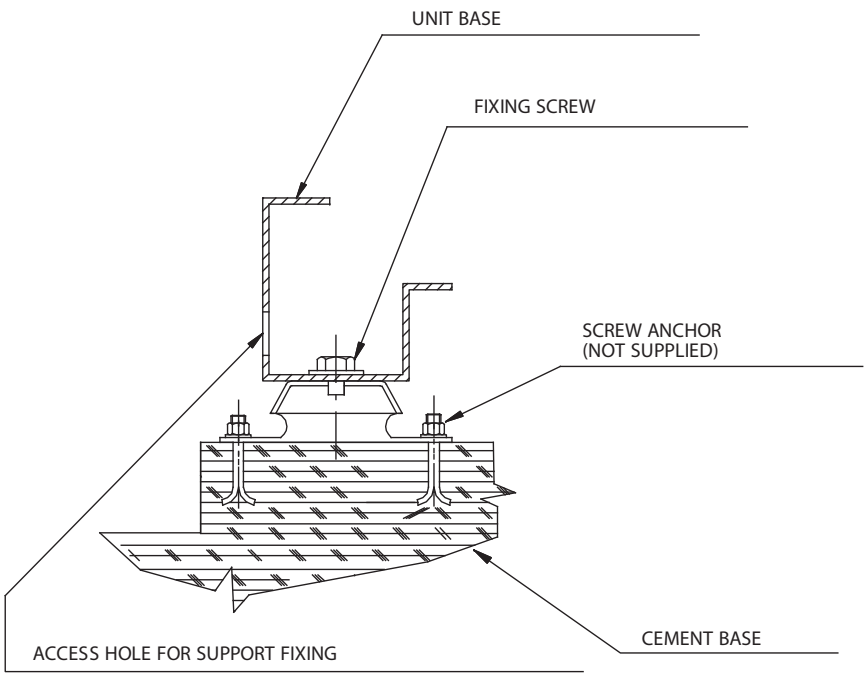
MODEL	SIZE	Weight distribution (kg)										TOT. (kg)
		WT1	W1	W2	W3	W4	WT2	W5	W6	W7	W8	
FGA	017	648	648	436	436	436	343	343	230	230	230	3980
	020	629	629	459	459	459	357	357	261	261	261	4132
	023	671	671	538	538	538	374	374	300	300	300	4604
	025	662	662	562	562	562	384	384	326	326	326	4756
	028	702	702	643	643	643	400	400	367	367	367	5234
	030	698	698	650	650	650	402	402	374	374	374	5272

Fig. 10c - Rubber anti- vibration support

Rubber support dimensions
(Single rubber support code: 270326)



Rubber support installation

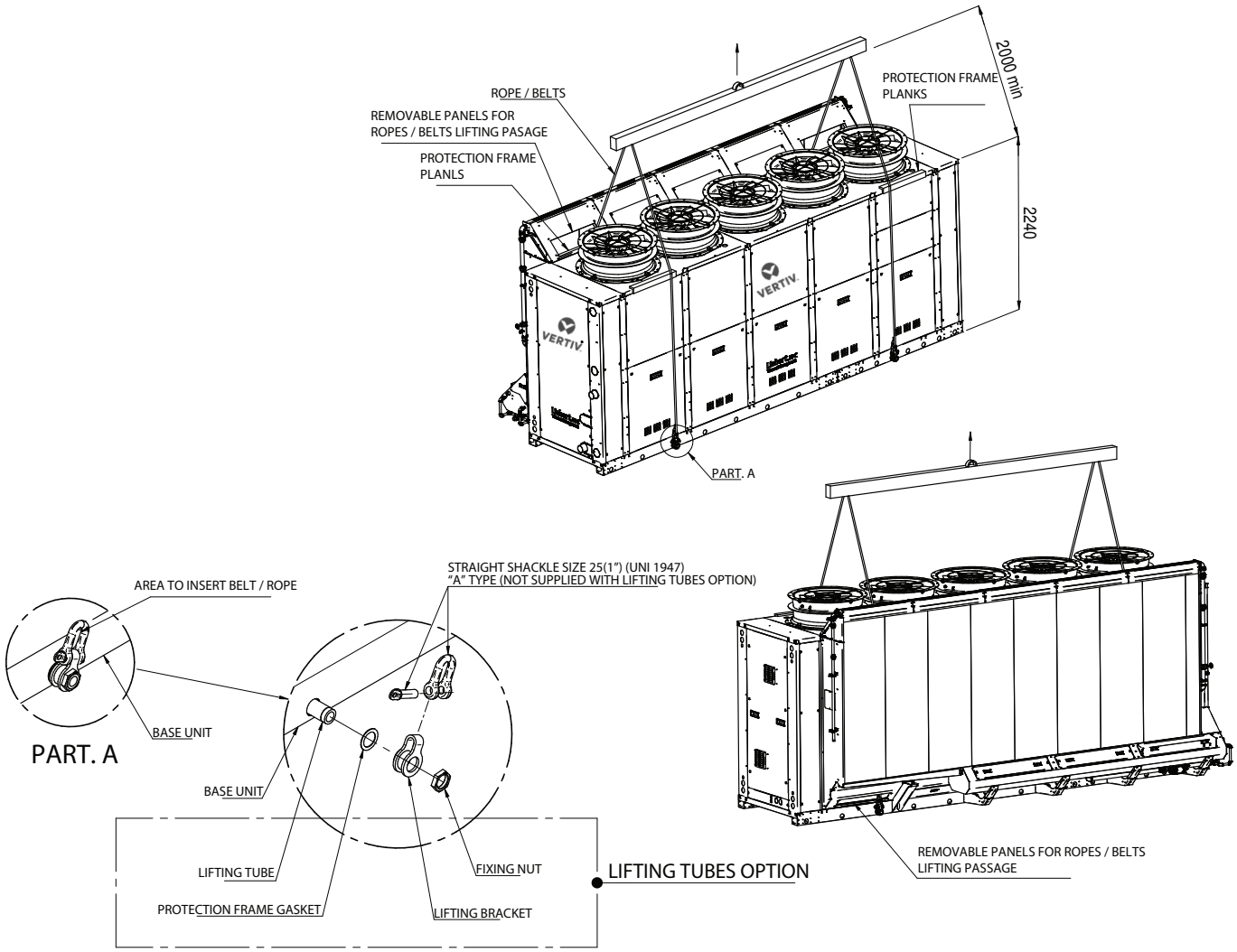


Tab. 10d - Rubber supports + 1000 liters tank

Unit	Configuration	Support kit code	Single support code	Kit support pieces
FGA 017 - 020 - 023 - 025 - 028 - 030	Without tank	485625	270326	8
	With tank	485626	270326	10
1000 liters tank	Loose supplied	485649	270326	4

Each kit is complete with stainless steel fixing screws and plain washers for unit assembly.

Fig. 10d - Lifting instructions with tubes

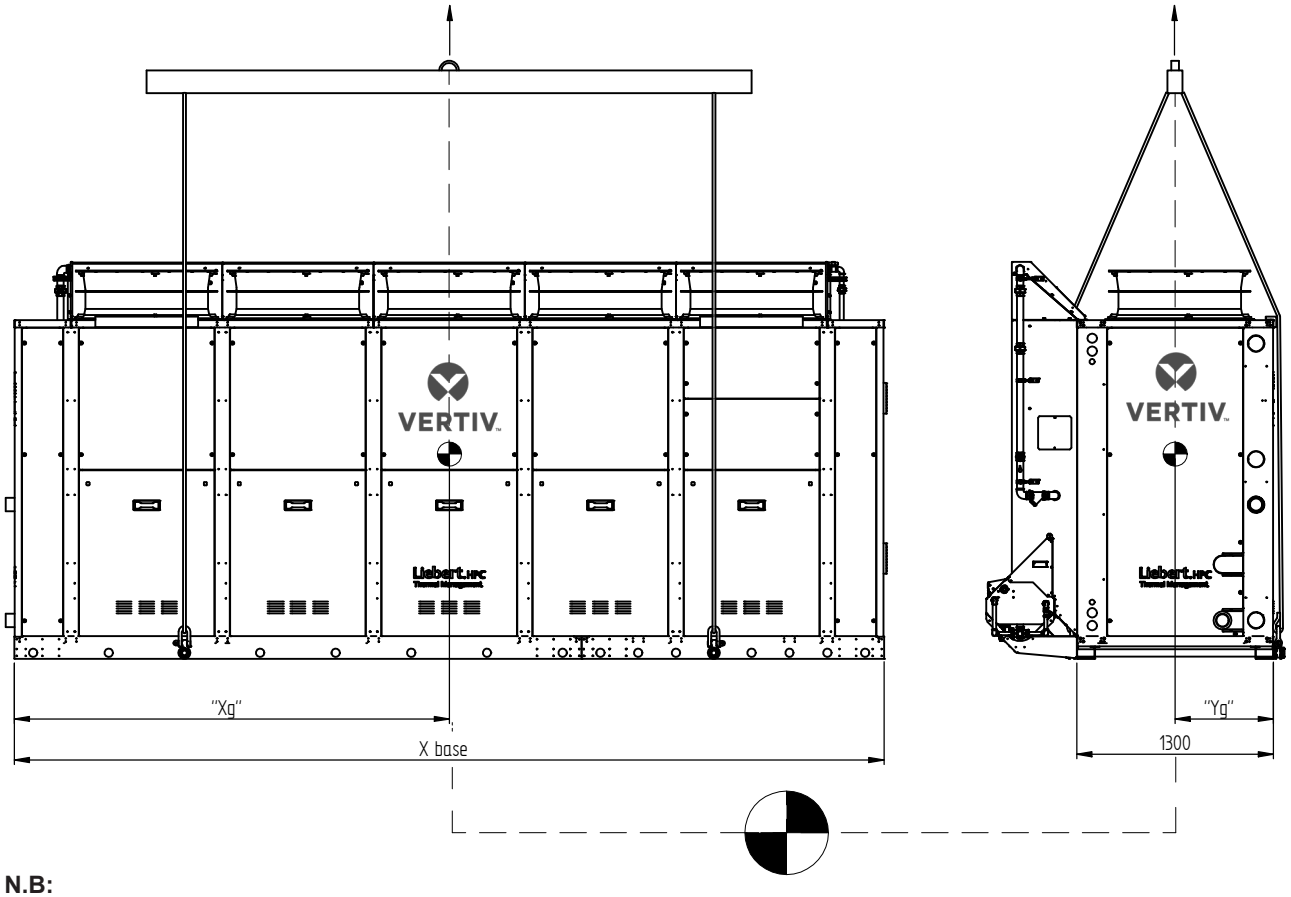


N.B: Place the lifting tubes in the holes in the base indicated by the word 'LIFT HERE'. Lock the ends of the tubes in position with the ring nut as shown above, using 60 mm span.
The capacity of the lifting gear must be adequate to lift the load in question. Check the weight of the units, the capacity of the lifting gear and ropes and the condition and suitability of the aforementioned equipment.
Lift the unit with a speed suitable for the load to be moved, so as not to damage the Liebert® HPC-S Adiabatic structure.
After lifting and positioning the unit, remove lifting accessories (ropes, slings, chains, hooks, brackets and tubes).
Lifting tools as: hooks, lifting gear, ropes, chords, belts, rigid struts, protection plank are not provided with the unit.

Tab. 10e - Lifting

Models	A (mm)	B (mm)	C (mm)
FGA 017 - 020 - 023 - 025 - 028 - 030	1.800	≈5.000	≈9.000

Fig. 10e - Lifting baricentric axis



N.B:
The lifting point has to be on the vertical baricentric axis, which is individualized by symbols indicated on the base.

Tab. 10f - Shipping weight and unit baricentre position - Unit without tank

MODEL	SIZE	X base	Unit without pumps		
		(mm)	Xg (mm)	Yg (mm)	Shipping weight (kg)
FGA	017	3750	1925	795	2199
	020	3750	1970	765	2349
	023	4750	2515	775	2785
	025	4750	2545	760	2935
	028	5750	3090	770	3378
	030	5750	3105	765	3416

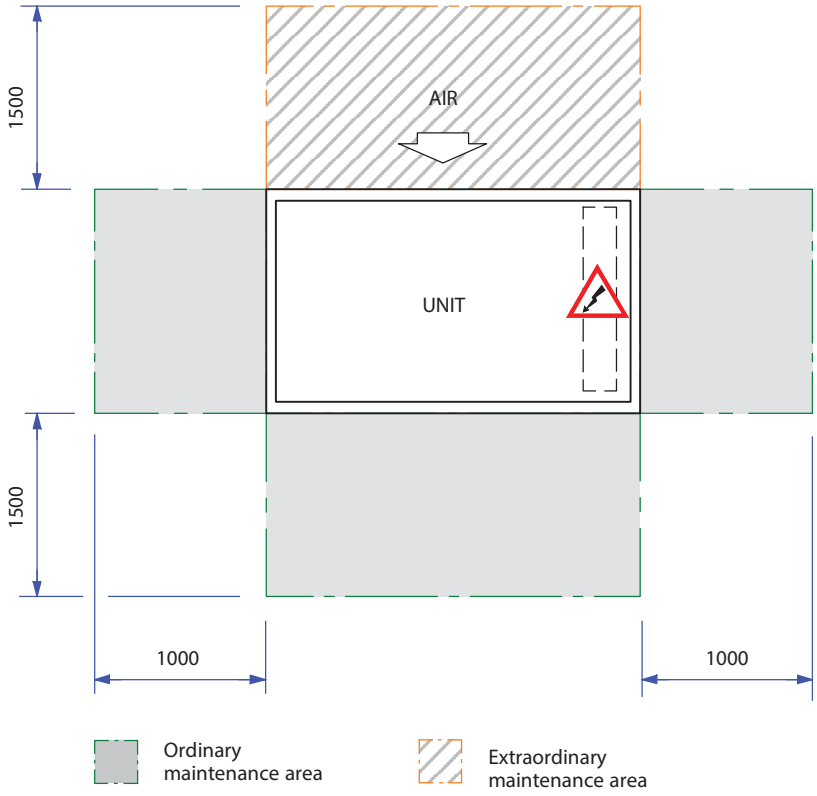
Tab. 10g - Shipping weight and unit baricentre position - Unit with tank

MODEL	SIZE	X base	Unit without pumps		
		(mm)	Xg (mm)	Yg (mm)	Shipping weight (kg)
FGA	017	4750	2520	770	2639
	020	4750	2580	745	2789
	023	5750	3105	760	3225
	025	5750	3145	745	3375
	028	6750	3675	755	3818
	030	6750	3690	750	3856

Tab. 10h - Additional net weights for options (kg)

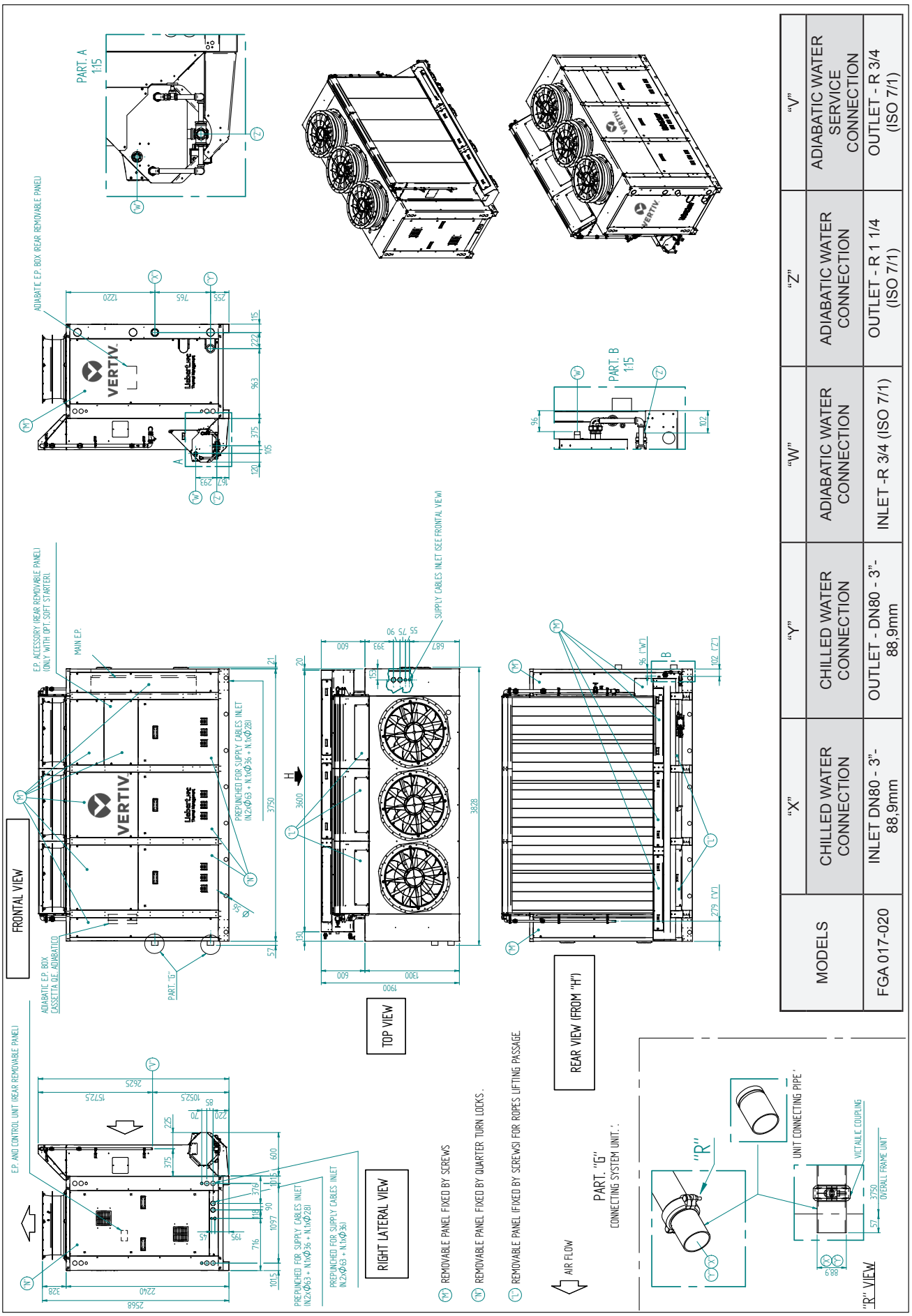
Options	Model FGA	Size					
		017	020	023	025	028	030
	Base unit						
Acoustic option	digit 11 = D	80	80	100	100	115	115
Soft starter	digit 8 = 1	30	30	30	30	30	30
Buffer tank	digit 10 ≠ 0	440	440	440	440	440	440
Pumps group / Hydraulic kit	digit 12 = 1	10	10	10	10	10	10
	digit 12 = 2	95	95	110	110	110	112
	digit 12 = 3	110	110	112	112	112	170
	digit 12 = 4	170	170	200	200	200	204
	digit 12 = 5	200	200	204	204	204	327
	digit 12 = 6	114	114	125	125	125	203

Fig. 10f - Service areas (top view)



Notes:
Minimum distance between 2 units from condensing coil side = 3 m
Do not obstruct the air exiting the fans for a minimum distance of 2.5 m

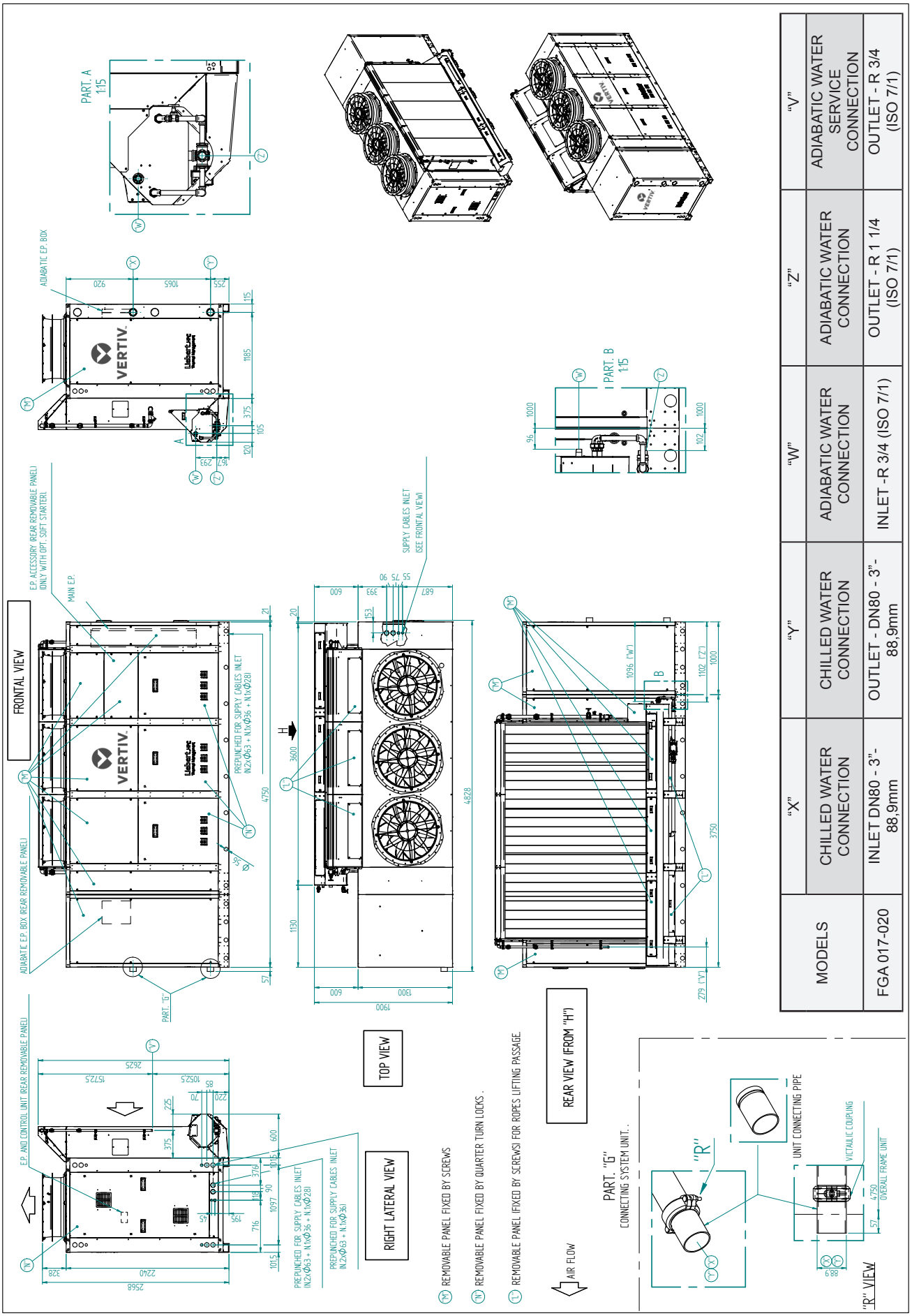
fig. 11a - HPC-S 3 FANS WITHOUT TANK



MODELS	"X"	"Y"	"W"	"Z"	"V"
	CHILLED WATER CONNECTION	CHILLED WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER SERVICE CONNECTION
FGA 017-020	INLET DN80 - 3"- 88,9mm	OUTLET - DN80 - 3"- 88,9mm	INLET -R 3/4 (ISO 7/1)	OUTLET - R 1 1/4 (ISO 7/1)	OUTLET - R 3/4 (ISO 7/1)

Dimensional Data

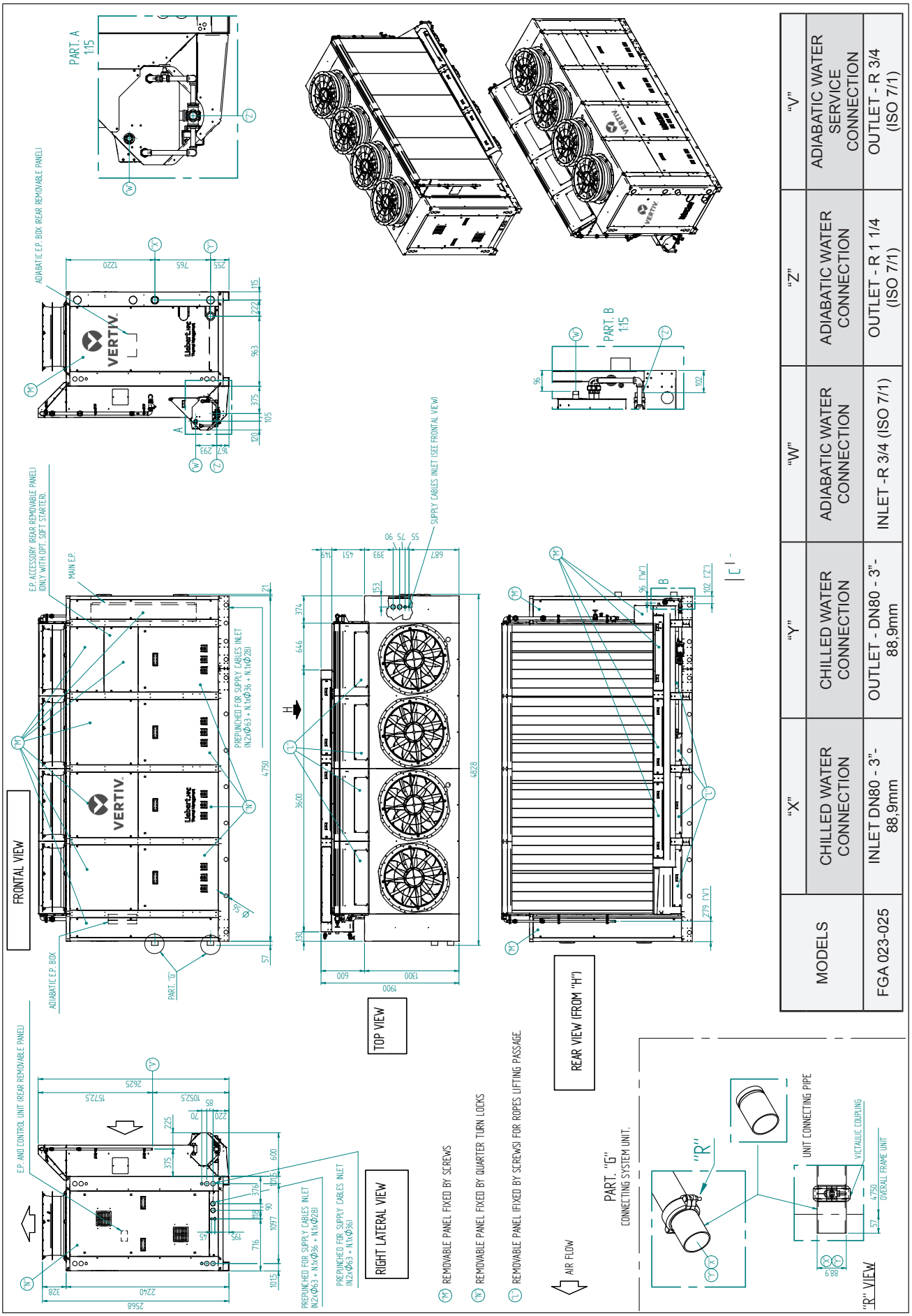
fig. 11b - HPC-S 3 FANS WITH TANK



MODELS	"X"	"Y"	"W"	"Z"	"V"
	CHILLED WATER CONNECTION	CHILLED WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER SERVICE CONNECTION
FGA 017-020	INLET DN80 - 3"- 88,9mm	OUTLET - DN80 - 3"- 88,9mm	INLET -R 3/4 (ISO 7/1)	OUTLET - R 1 1/4 (ISO 7/1)	OUTLET - R 3/4 (ISO 7/1)

Dimensional Data

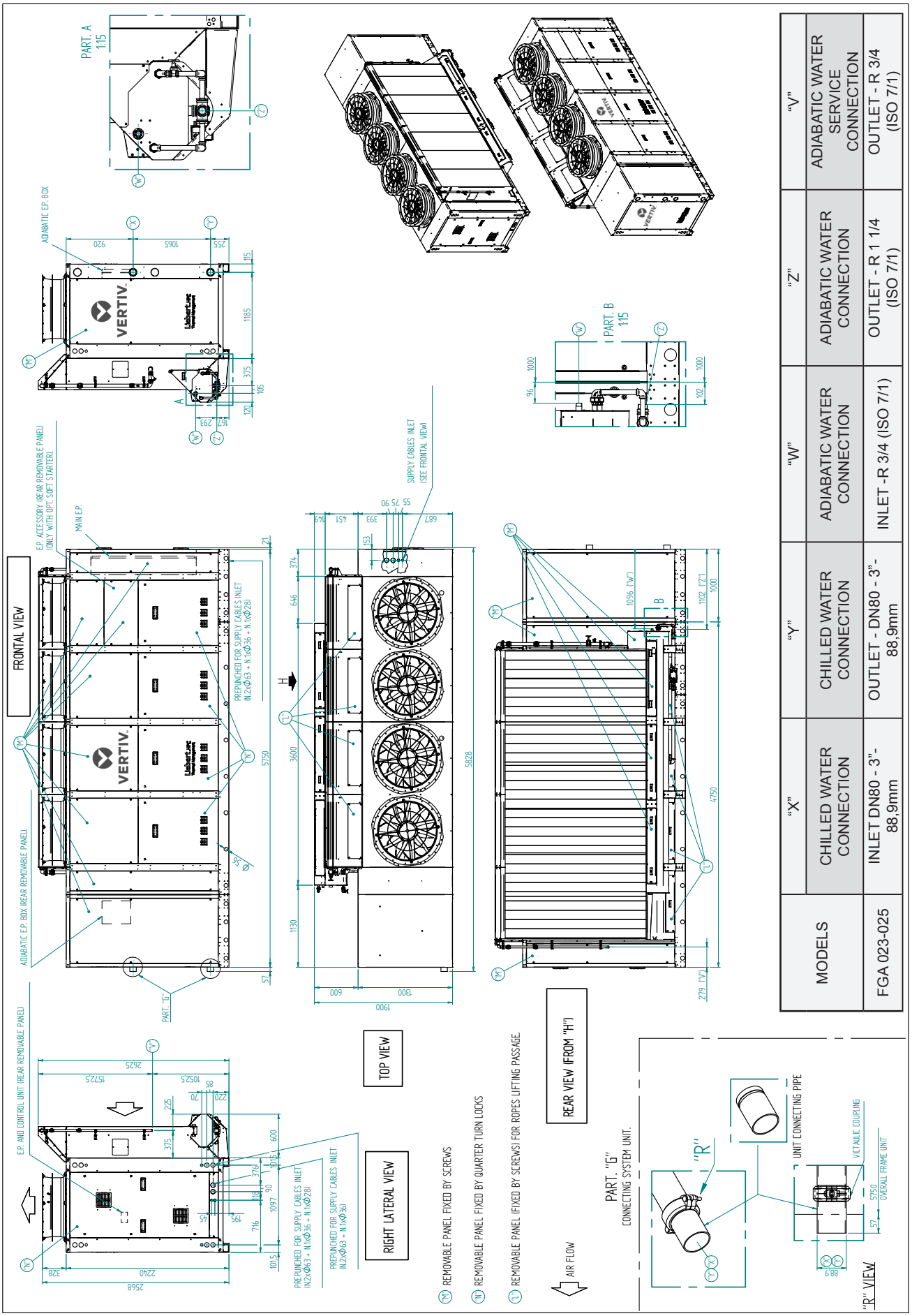
fig. 11c - HPC-S 4 FANS WITHOUT TANK



MODELS	"X"	"Y"	"W"	"Z"	"V"
	CHILLED WATER CONNECTION	CHILLED WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER SERVICE CONNECTION
FGA 023-025	INLET DN80 - 3"- 88,9mm	OUTLET - DN80 - 3"- 88,9mm	INLET -R 3/4 (ISO 7/1)	OUTLET - R 1 1/4 (ISO 7/1)	OUTLET - R 3/4 (ISO 7/1)

Dimensional Data

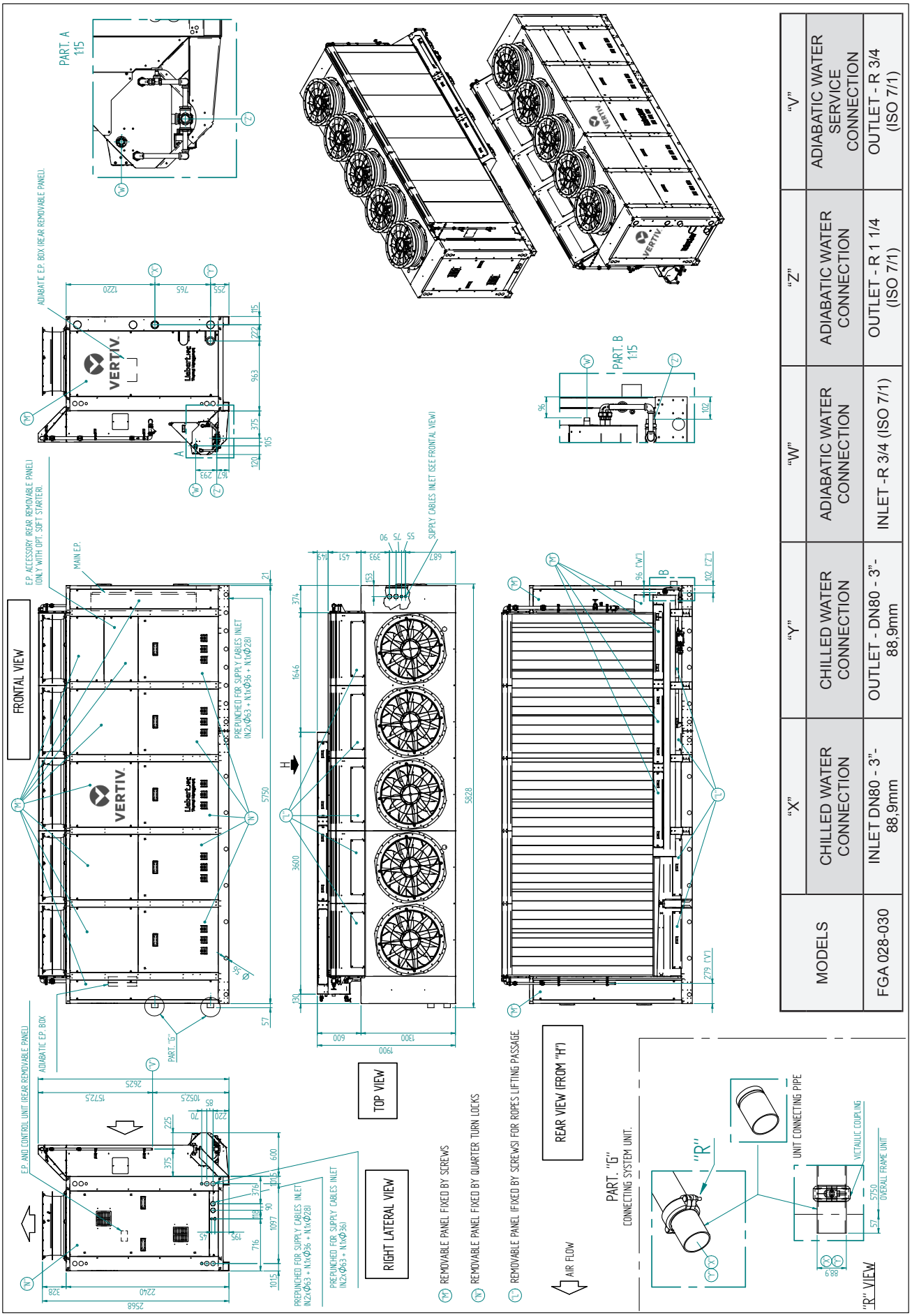
fig. 11d - HPC-S 4 FANS WITH TANK



MODELS	"X"	"Y"	"W"	"Z"	"V"
	CHILLED WATER CONNECTION	CHILLED WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER SERVICE CONNECTION
FGA 023-025	INLET DN80 - 3"- 88,9mm	OUTLET - DN80 - 3"- 88,9mm	INLET -R 3/4 (ISO 7/1)	OUTLET - R 1 1/4 (ISO 7/1)	OUTLET - R 3/4 (ISO 7/1)

Dimensional Data

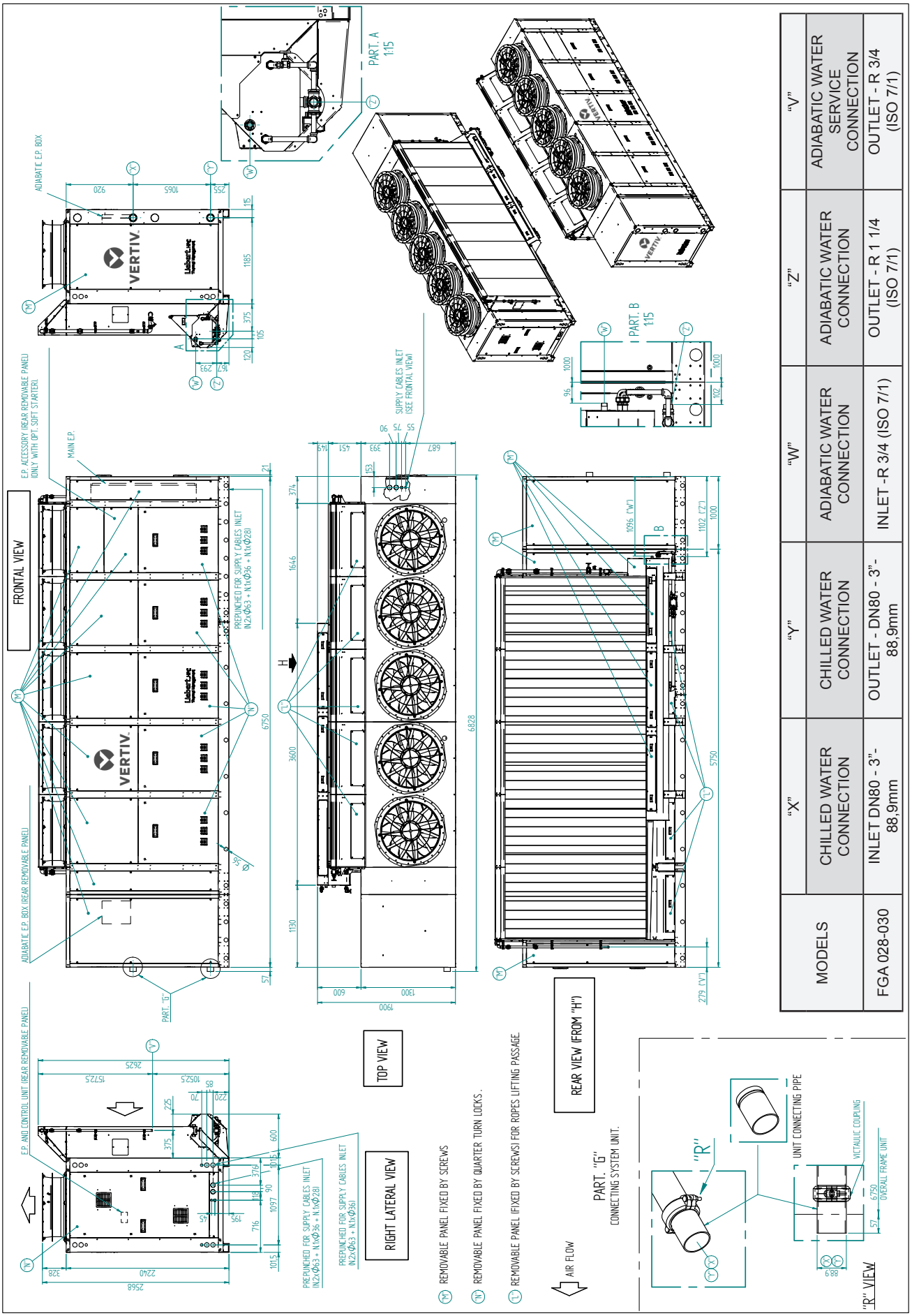
fig. 11e - HPC-S 5 FANS WITHOUT TANK



MODELS	"X"	"Y"	"W"	"Z"	"V"
	CHILLED WATER CONNECTION	CHILLED WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER SERVICE CONNECTION
FGA 028-030	INLET DN80 - 3"- 88,9mm	OUTLET - DN80 - 3"- 88,9mm	INLET -R 3/4 (ISO 7/1)	OUTLET - R 1 1/4 (ISO 7/1)	OUTLET - R 3/4 (ISO 7/1)

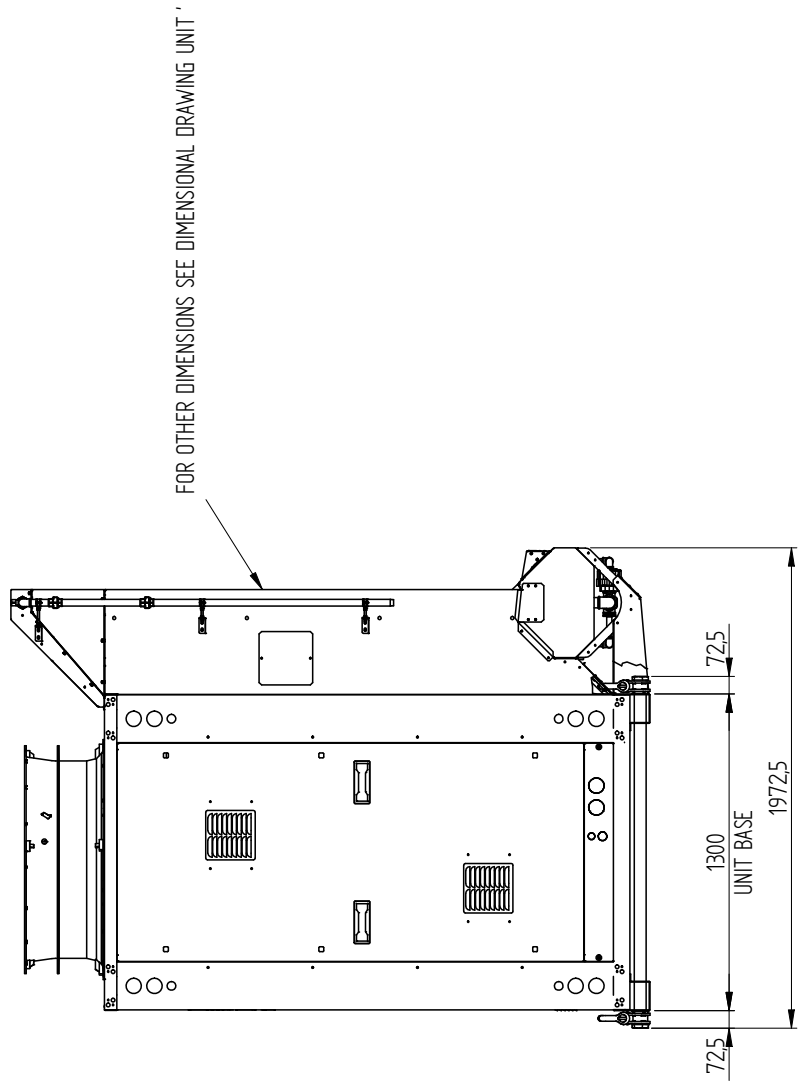
Dimensional Data

fig. 11f - HPC-S 5 FANS WITH TANK



MODELS	"X"	"Y"	"W"	"Z"	"V"
	CHILLED WATER CONNECTION	CHILLED WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER CONNECTION	ADIABATIC WATER SERVICE CONNECTION
FGA 028-030	INLET DN80 - 3"- 88,9mm	OUTLET - DN80 - 3"- 88,9mm	INLET -R 3/4 (ISO 7/1)	OUTLET - R 1 1/4 (ISO 7/1)	OUTLET - R 3/4 (ISO 7/1)

fig. 11g - OVERALL DIMENSION UNIT WITH LIFTING TUBES OPTION



Dimensional Data

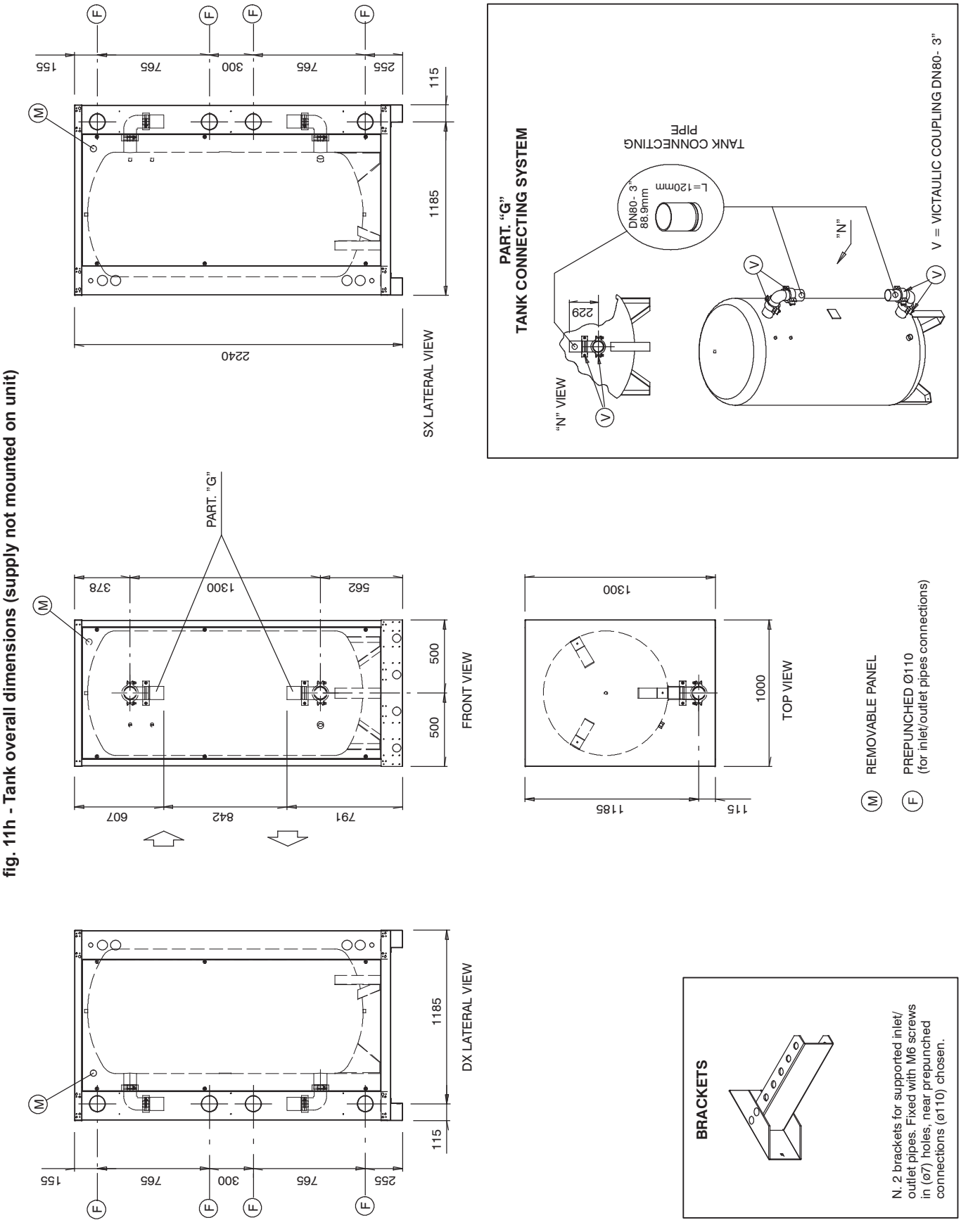
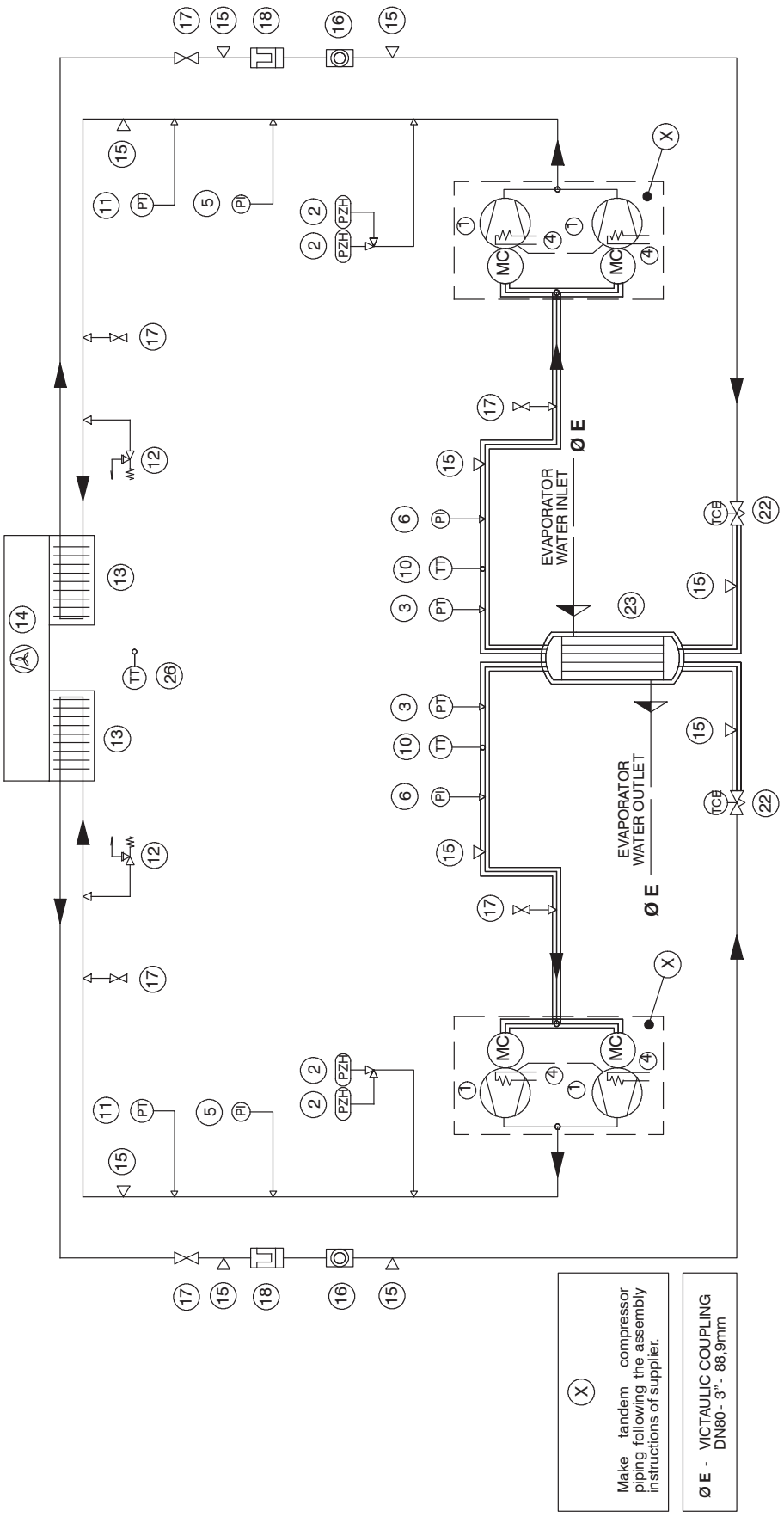


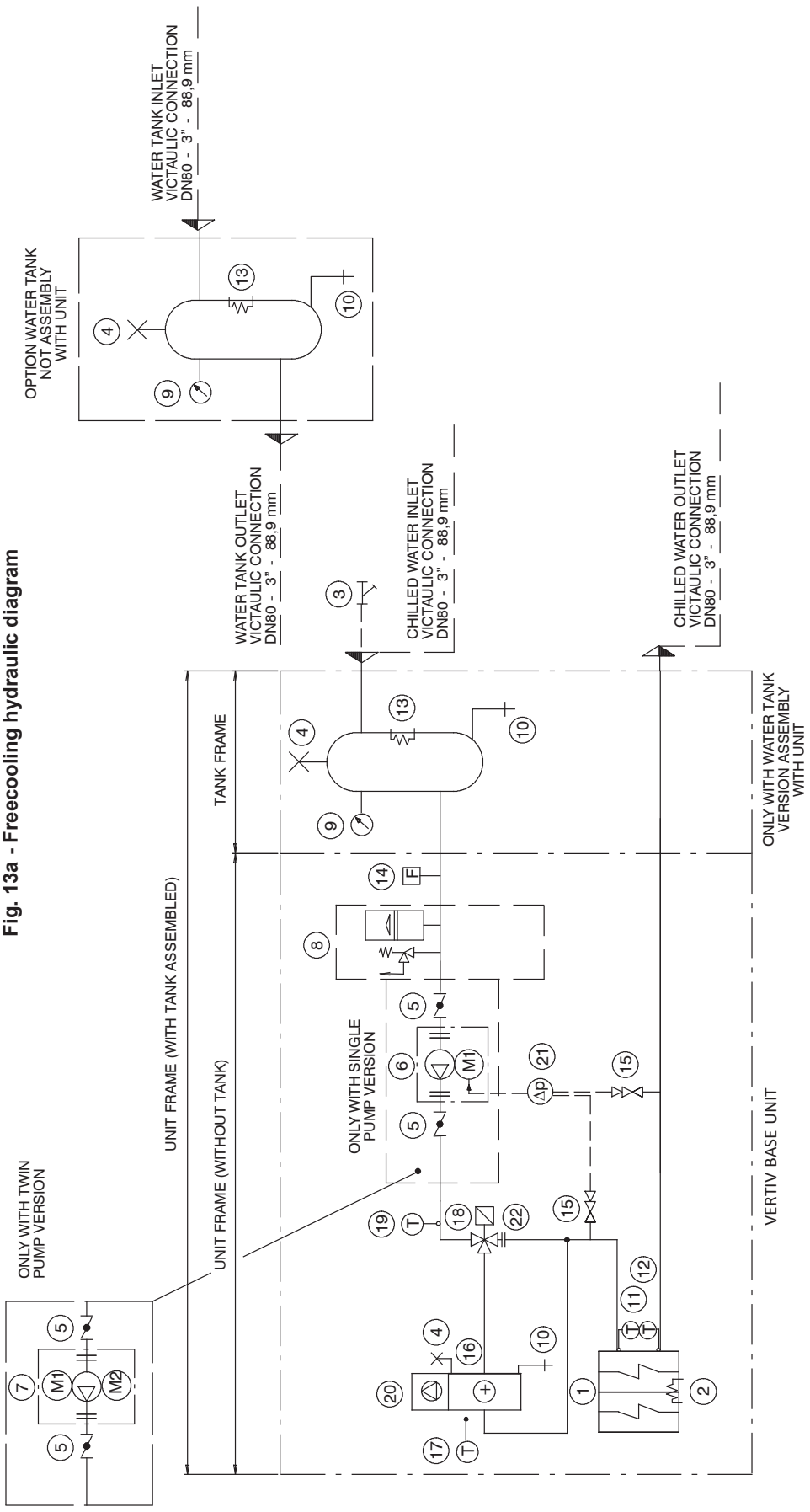
fig. 11h - Tank overall dimensions (supply not mounted on unit)

12 Refrigerant Circuit



Pos.	Description	Pos.	Description
1	Compressor	15	Service connection
2	High pressure switch	16	Sight glass
3	Transducer pressure sensor (Low pressure control)	17	Shut- Off valve
4	Crankcase heater	18	Filter dryer
5	High pressure manometer	19	-
6	Low pressure manometer	20	-
7	-	21	-
8	-	22	Electronic expansion valve
9	-	23	Evaporator
10	Thermostatic temperature sensor	24	-
11	Transducer pressure sensor (High pressure control)	25	-
12	Safety valve	26	External air temperature sensor
13	Condenser	27	-
14	Condenser fans		

Fig. 13a - Freecooling hydraulic diagram



Tab. 13b - Freecooling hydraulic components

Pos.	Description	Pos.	Description
1	Evaporator	12	Water outlet evaporator probe
2	Evaporator antifreeze heater (optional)	13	Tank antifreeze heater (optional)
3	Water filter (optional)	14	Flow switch
4	Manual air valve	15	Service valve with cap
5	Butterfly valve	16	Freecooling coil
6	Single pump	17	Air temperature sensor
7	Twin pump	18	3 way valve
8	Expansion tank + Safety valve (optional)	19	Control freecooling thermostat sensor
9	Manometer	20	Fans
10	Discharge valve	21	Differential transducer (only with electronic pumps)
11	Water inlet evaporator probe	22	Caslibrated bafle

Hydraulic Circuit

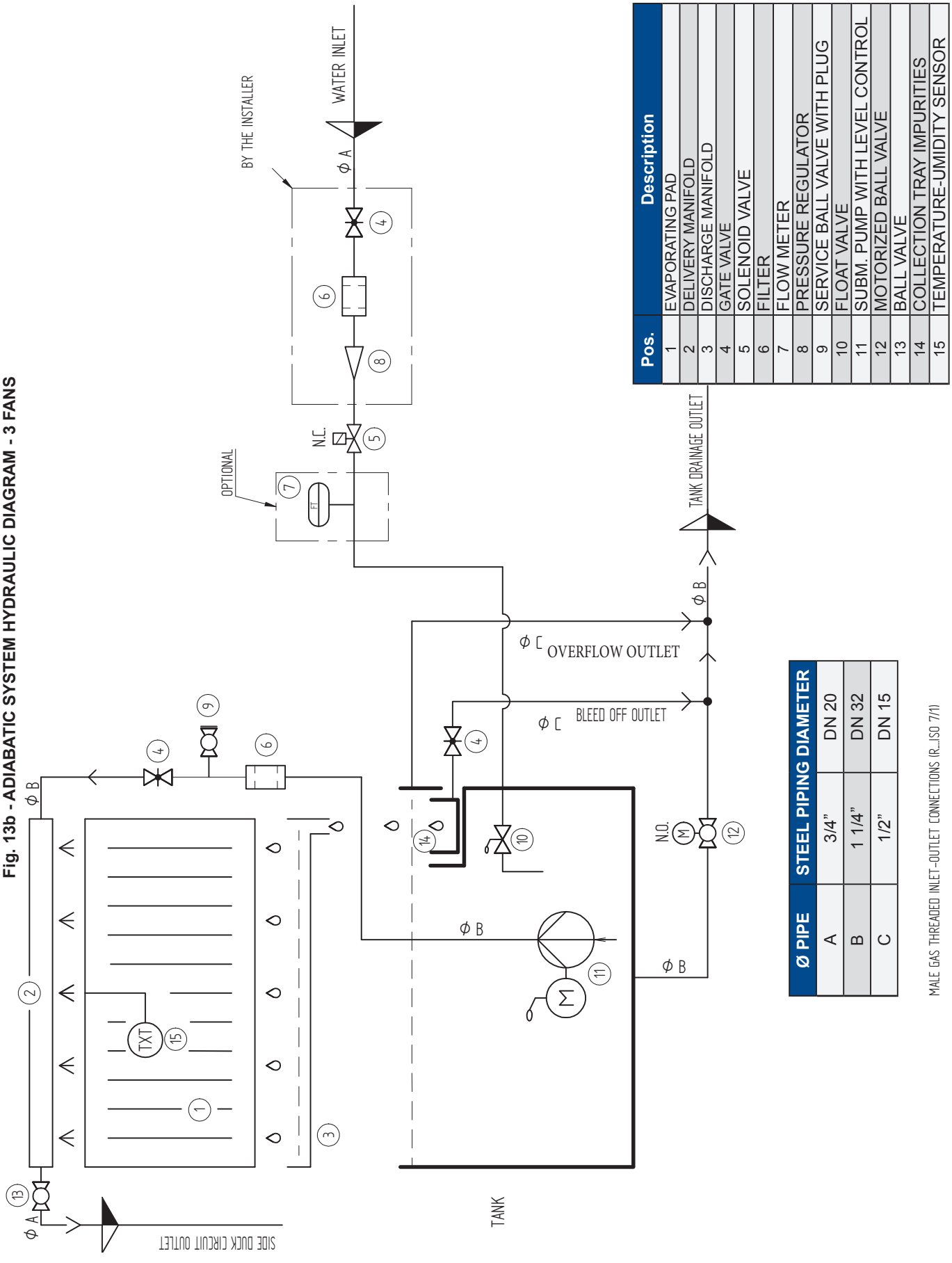


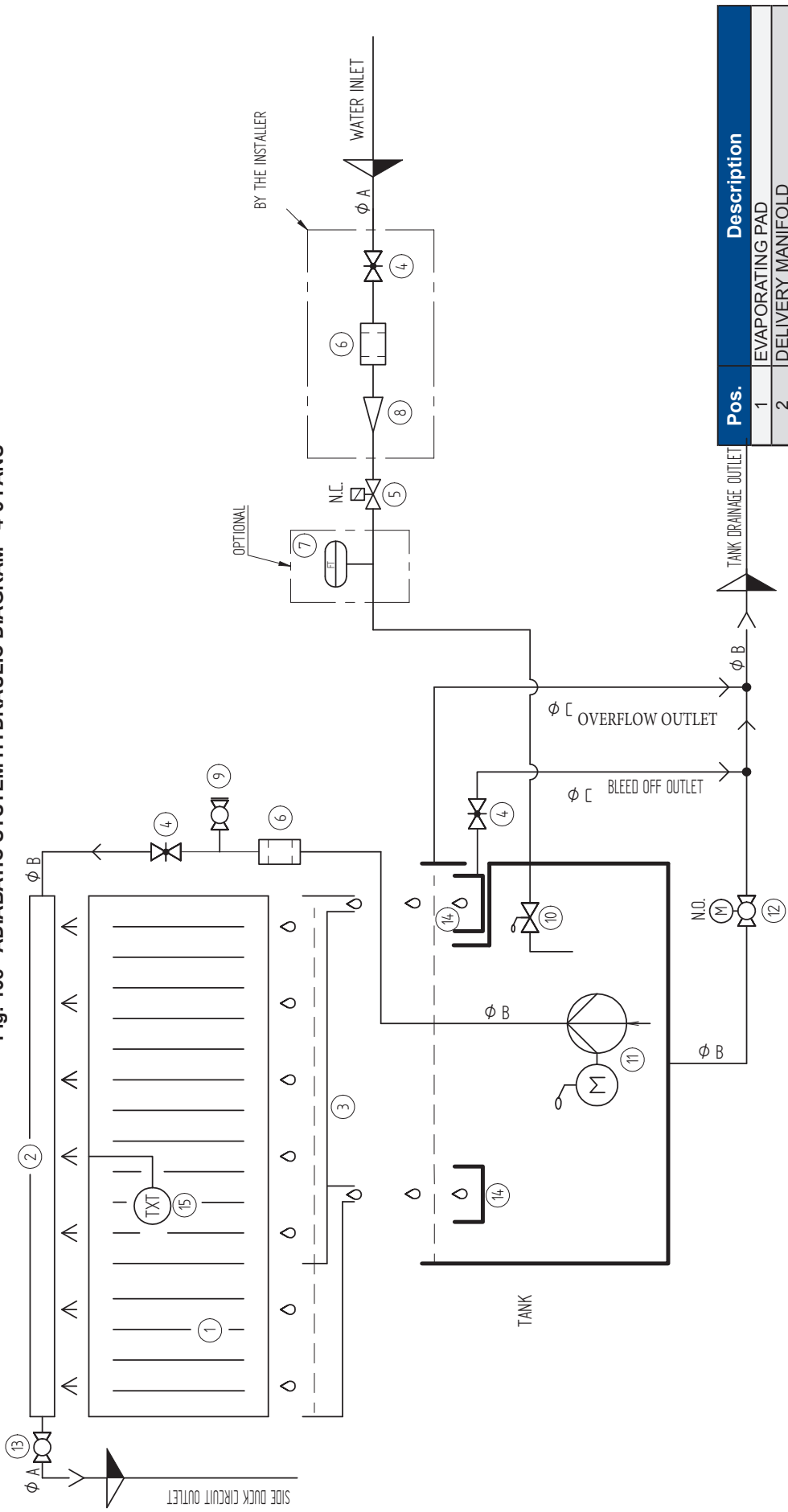
Fig. 13b - ADIABATIC SYSTEM HYDRAULIC DIAGRAM - 3 FANS

Pos.	Description
1	EVAPORATING PAD
2	DELIVERY MANIFOLD
3	DISCHARGE MANIFOLD
4	GATE VALVE
5	SOLENOID VALVE
6	FILTER
7	FLOW METER
8	PRESSURE REGULATOR
9	SERVICE BALL VALVE WITH PLUG
10	FLOAT VALVE
11	SUBM. PUMP WITH LEVEL CONTROL
12	MOTORIZED BALL VALVE
13	BALL VALVE
14	COLLECTION TRAY IMPURITIES
15	TEMPERATURE-UMIDITY SENSOR

Ø PIPE	STEEL PIPING DIAMETER
A	3/4" DN 20
B	1 1/4" DN 32
C	1/2" DN 15

MALE GAS THREADED INLET-OUTLET CONNECTIONS (R...ISO 7/1)

Hydraulic Circuit



Pos.	Description
1	EVAPORATING PAD
2	DELIVERY MANIFOLD
3	DISCHARGE MANIFOLD
4	GATE VALVE
5	SOLENOID VALVE
6	FILTER
7	FLOW METER
8	PRESSURE REGULATOR
9	SERVICE BALL VALVE WITH PLUG
10	FLOAT VALVE
11	SUBM. PUMP WITH LEVEL CONTROL
12	MOTORIZED BALL VALVE
13	BALL VALVE
14	COLLECTION TRAY IMPURITIES
15	TEMPERATURE-UMIDITY SENSOR

Ø PIPE	STEEL PIPING DIAMETER
A	3/4" DN 20
B	1 1/4" DN 32
C	1/2" DN 15

MALE GAS THREADED INLET-OUTLET CONNECTIONS (R...ISO 7/1)

Fig. 13c - ADIABATIC SYSTEM HYDRAULIC DIAGRAM - 4-5 FANS

Fabbricante - Manufacturer - Hersteller - Fabricant - Fabricante
Fabricante - Tillverkare - Fabrikant - Valmistaja - Produsent
Fabrikant - Κατασκεναστηζ - Producent
Vertiv S.r.l. - Zona Industriale Tognana
Via Leonardo da Vinci, 16/18 - 35028 Piove di Sacco - Padova (Italy)

Il Fabbricante dichiara che questo prodotto è conforme alle direttive Europee:
The Manufacturer hereby declares that this product conforms to the European Union directives:
Der Hersteller erklärt hiermit, dass dieses Produkt den Anforderungen der Europäischen Richtlinien gerecht wird:
Le Fabricant déclare que ce produit est conforme aux directives Européennes:
El Fabricante declara que este producto es conforme a las directivas Europeas:
O Fabricante declara que este produto está em conformidade com as directivas Europeias:
Tillverkare försäkrar härmed att denna produkt överensstämmer med Europeiska Uniones direktiv:
De Fabrikant verklaart dat dit produkt conform de Europese richtlijnen is:
Vaimistaja vakuuttaa täten, että tämä tuote täyättää seuraavien EU-direktiivien vaatimukset:
Produsent erklærer herved at dette produktet er i samsvar med EU-direktiver:
Fabrikant erklærer herved, at dette produkt opfylder kravene i EU direktiverne:
Ο ΚατασΛευαστÞj δηλÞνει ütι το παÃüν πÃοÏüν εßναι ΛατασΛευασmÝνο αýmφωνα mε τιj οδηγßεj τηj Ε.Ε.:

2006/42/EC; 2014/30/EU; 2014/35/EU; 2014/68/EU

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