Installation Operation Maintenance

GVAF

R134a - R1234ze - R513A

Air cooled

High Speed Centrifugal Chiller

450 - 1600 kW

April 2020

CTV-SVX009D-GB

Table of Contents

Introduction 3
Unit model number description 4
General Data 6
Table 1 : General Data GVAF 155-450 : High Efficiency Low Noise and Extra Low Noise -R134a 6
Table 2 : General Data GVAF 190-350 : Extra Efficiency Low Noise and Extra Low Noise -R134a 8
Table 3 : General Data GVAF 125-350 : Extra Efficiency XPG(HFO) Low Noise and Extra Low Noise -R1234ze 10
Installation Requirements 13
Dimensional Data 16
Chilled Water Piping Recommendations 17
Evaporator Piping 18
Optional Integrated Pump Package 22
Optional Free-Cooling 24
General Electrical Recommendations 37
Installer-Supplied Components 39
Operating Principles 41
Controls/Tracer TD7 Operator Interface 43
Pre-Start Checkout 44
Unit Start Up Procedures 47
Periodic Maintenance 49
Condenser Coils MCHE Maintenance 52
Integrated Pump Maintenance (Optional with Pump Package) 53
Log Check Sheet 54

Introduction

Foreword

These instructions are given as a guide to good practice in the installation, start-up, operation, and maintenance by the user, of Trane GVAF chillers, manufactured in France. A separate manual is available for the use and maintenance of the unit's control, Tracer™ UC800. They do not contain full service procedures necessary for the continued successful operation of this equipment. The services of a qualified technician should be employed through the medium of a maintenance contract with a reputable service company. Read this manual thoroughly before unit start-up.

Units are assembled, pressure tested, dehydrated, charged and tested in accordance with factory standard before shipment.

Warnings and Cautions

Warnings and Cautions appear at appropriate sections throughout this manual. Your personal safety and the proper operation of this machine require that you follow them carefully. The constructor assumes no liability for installations or servicing performed by unqualified personnel.

WARNING: Indicates a potentially hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION: Indicates a potentially hazardous situation which, if not avoided, may result in minor or moderate injury. It may also be used to alert against unsafe practices or for equipment or property-damage-only accidents.

Safety Recommendations

To avoid death, injury, equipment or property damage, the following recommendations should be observed during maintenance and service visits:

1. The maximum allowable pressures for system leak testing on low and high pressure side are given in the chapter "Installation". Insure to do not exceed test pressure by using appropriate device.
2. Disconnect all power supplies before any servicing on the unit.
3. Service work on the refrigeration system and the electrical system should be carried out only by qualified and experienced personnel.
4. To avoid any risk, it is recommended to place the unit on an area with limited access.

Reception

On arrival, inspect the unit before signing the delivery note. Specify any visible damage on the delivery note, and send a registered letter of protest to the last carrier of the goods within 7 days of delivery.

Notify the local TRANE sales office at the same time. The delivery note must be clearly signed and countersigned by the driver.

Any concealed damage shall be notified by a registered letter of protest to the last carrier of the goods within 7 days of delivery. Notify the local TRANE sales office at the same time.

Important notice: No shipping claims will be accepted by TRANE if the above mentioned procedure is not respected.

For more information, refer to the general sales conditions of your local TRANE sales office.

Note: Unit inspection in France. Delay to send registered letter in case of visible and concealed damage is only 72 hours.

Loose Parts Inventory

Check all the accessories and loose parts that are shipped with the unit against the shipping list. Included in these items will be the water vessel drain plugs, rigging and electrical diagrams, service literature, which are placed inside the control panel and/or starter panel for shipment.

If optional elastomeric isolators are ordered with the unit (model number digit 42 =1) they are shipped mounted on the horizontal support frame of the chiller. The isolators' location and distribution weight diagram is placed with the service literature inside the starter/control panel.

Warranty

Warranty is based on the general terms and conditions of the manufacturer. The warranty is void if the equipment is repaired or modified without the written approval of the manufacturer, if the operating limits are exceeded or if the control system or the electrical wiring is modified. Damage due to misuse, lack of maintenance or failure to comply with the manufacturer's instructions or recommendations is not covered by the warranty obligation. If the user does not conform to the rules of this manual, it may entail cancellation of warranty and liabilities by the manufacturer.

Refrigerant

Consult the addendum to Manuals for units with refrigerant, for conformity to the Pressure Equipment Directive (PED) 97/23/EC and Machinery Directive 2006/42/EC.

Unit Description

GVAF units are high speed centrifugal, air-cooled chillers designed for outdoor installation. The refrigerant circuits are factory-piped, leak tested and dehydrated. Every unit is electrically tested for proper control operation before shipment.

Chilled water inlet and outlet openings are covered for shipment. GVAF features Trane's exclusive Adaptive Control™ logic, which monitors the control variables that govern the operation of the chiller unit. Adaptive control logic can adjust capacity variables to avoid chiller shutdown when necessary, and keep producing chilled water. The units feature two independent refrigerant circuits. Each refrigerant circuit is provided with filter, sight glass, electronic expansion valve, and charging valves. The shell-and-tube CHIL™ (Compact-High performance-Integrated design-Low charge) evaporator is manufactured in accordance with the Pressure Equipment Directive (PED) code. Each evaporator is fully insulated and equipped with water drain and vent connection.

Units are generally shipped with refrigerant charge.

Unit model number description

Digit 1, 2, 3, 4 - Unit model
GVAF = Air-Cooled Chiller

Digit 5 to 7 - Nominal Tonnage
125 = 125 tons
145 = 145 tons
155 = 155 tons
175 = 175 tons
190 = 190 tons
205 = 205 tons
245 = 245 tons
250 = 250 tons
280 = 280 tons
310 = 310 tons
350 = 350 tons
380 = 380 tons
410 = 410 tons
450 = 450 tons

Digit 8 - Unit Power Supply
D = 400V/50Hz/3ph

Digit 9 - Manufacturing Location
E = Europe

Digit 10, 11 - Design sequence
AA = First Production Release

Digit 12 - Efficiency
X = High Efficiency
P = Extra Efficiency -XP
G = Extra Efficiency HFO -XPG

Digit 13 - Agency listing
C = CE Certification

Digit 14 - Pressure vessel code
2 = PED (Pressure equipment directive)

Digit 15 - Acoustic level
L = Low noise (LN)
Q = Low noise (LN) + Night Noise Setback (NNSB)
E = Extra Low Noise (include NNSB)+Axitop

Digit 16 - Operating map - Unit application
L = Low ambient (-20°C/+46°C)

Digit 17 - Relief valve option
L = Single relief valve high & low Pressure side
D = Dual relief valve with 3 way valve high pressure & low pressure side

Digit 18 - Water connection
X = Grooved pipe connection
W = Grooved pipe with coupling and pipe stub

Digit 19 - Operating map water side (evaporator application)
S = Comfort application
L = Wide application

Digit 20 - Evaporator Configurations
2 = Standard pass evaporator
T = Standard Pass Evaporator + Turbulators

Digit 21 - Thermal Insulation
N = Standard
X = None

Digit 22 - Condenser and Free Cooling Coating
N = all Aluminum
C = E-Coated Micro Channel condenser (Free Cooling excluded)

Digit 23 - Heat Recovery
X = No Heat Recovery

Digit 24 - Hydraulic module
X = Pump signal On/Off
1 = Dual pump standard pressure
3 = Dual pump high pressure

Digit 25 - Free Cooling
X = No Free Cooling
F = Total Free-Cooling Direct
G = Partial Free-cooling Direct
H = Total Free Cooling Glycol Free
J = Partial Free Cooling Glycol Free

Digit 26 - Disconnect switch
F = Disconnnect switch

Digit 27 - Under/Over Voltage
X = None
1 = Included
2 = Included with ground fault protection

Digit 28 - Human Interface language
C = Spanish
D = German
E = English
F = French
H = Dutch
I = Italian
M = Swedish
P = Polish
R = Russian
T = Czech
U = Greek
V = Portuguese
2 = Romanian
6 = Hungarian
8 = Turkish

Digit 29 - Smart com protocol
X = None
B = BACnet interface
M = ModBus interface
L = LonTalk interface

Digit 30 - Communication customer
X = None
A = External set point & capacity outputs

Unit model number description

Digit 31 - Flow switch
X = None
F = Field installed flow switch

Digit 32 - Electrical Panel Protection
X = Enclosure with dead front protection
1 = Enclosure with IP20 protection

Digit 33 - Master Slave
X = Standard Unit

Digit 34 - Unit User Interface
L = Standard, Local UI supplied (TD7)

Digit 35 - Energy meter
X = No energy meter
M = Energy meter installed

Digit 36 - Open for future use = X

Digit 37 - Variable Primary Flow
X = Constant speed Pump - no AFD
F = Constant Speed Pump -AFD Adjustment
P = Variable Speed Pump - Constant delta P
T = Variable Speed Pump - Constant deltaT

Digit 38 - Open for future use = X

Digit 39 - Open for future use = X

Digit 40 - Power socket
X = None
P = Included (230V - 100W)

Digit 41 - Factory tests
X = No final performances test
B = Test A+Visual Inspection
E = Performance test w/o customer

Digit 42 - Installation accessory
X = None
1 = Neoprene Isolators
4 = Neoprene pads

Digit 43 - Literature language
B = Bulgarian
C = Spanish
D = German
E = English
F = French
H = Dutch
I = Italian
M = Swedish
P = Polish
R = Russian
T = Czech
U = Greek
V = Portuguese
2 = Romanian
6 = Hungarian
8 = Turkish

Digit 44 - Shipping package
X = Standard protection
A = Containerization package

Digit 45 - Refrigerant
1 = R134a
2 = R513A
Z= R1234ze(E)

Digit 46 - Open for future use = X

Digit 47 - Open for future use = X

Digit 48 - Design special
X = none
S = special

General Data

Table 1 : General Data GVAF 155-450 : High Efficiency Low Noise and Extra Low Noise - R134a/R513A

		GVAF X										
		155	**175**	**205**	**245**	**250**	**280**	**310**	**350**	**380**	**410**	**450**
Cooling Capacity (1)	**(kW)**	581	642	579	849	885	1001	1119	1235	1376	1475	1580
Unit electrical data (2) (3) (5)												
Maximum Power input in cooling R-134a	**(kW)**	344	344	344	344	512	512	512	512	677	677	677
Unit rated amps (Max compr +Fan+Control)	**(A)**	506	506	506	506	755	755	755	755	998	998	998
Unit start up amps	**(A)**	506	506	506	506	755	755	755	755	998	998	998
Unit displacement power factor		0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Max power cable cross section (mm^2)	**(mm^2)**	2x300	2x300	2x300	2x300	4x185	4x185	4x185	4x185	4x185	4x185	4x185
Disconnect switch size (A)		800	800	800	800	1250	1250	1250	1250	1250	1250	1250
Compressor												
Quantity	**#**	2	2	2	2	3	3	3	3	4	4	4
Type		Centrifugal										
Model (9)		TT350/TT350					TT350-TT350/TT350			TT350-TT350/TT350-TT350		
RPM range (up to)		29461	29461	29461	29461	29461	29461	29461	29461	29461	29461	29461
Max Compr Power input Circuit 1/Circuit 2	**(kW)**	157/157					157-157/157			157-157/157-157		
Max Amps Circuit1 / Circuit 2 (3) (5)	**(A)**	231/231					231-231/231			231-231/231-231		
Start up Amps Circuit1 / Circuit 2 (3) (5)	**(A)**	231/231					231-231/231			231-231/231-231		
Evaporator												
Quantity	**#**	1	1	1	1	1	1	1	1	1	1	1
Type		Flooded shell and tube heat exchanger										
Evaporator model		250-B	250-B	250-B	250-B	300-A	300-A	300-A	300-A	500-B	500-B	500-B
Evaporator Water Content volume	**(l)**	118	118	118	118	120	120	120	120	170	170	170
Antifreeze Heater	**(W)**	2040	2040	2040	2040	2240	2240	2240	2240	2440	2440	2440
Standard pass evaporator												
Evap. Water Flow rate - Minimum	**(l/s)**	17.9	17.9	17.9	17.9	22.8	22.8	22.8	22.8	30.3	30.3	30.3
Evap. Water Flow rate - Maximum (6)	**(l/s)**	66.5	66.5	66.5	66.5	84.8	84.8	84.8	84.8	112.5	112.5	112.5
Nominal water connection size (Grooved coupling)	**(in) -DN**	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	8”-200	8”-200	8”-200
Standard pass with turbulator evaporator												
Evap. Water Flow rate - Minimum	**(l/s)**	14.9	14.9	14.9	14.9	19	19	19	19	25.3	25.3	25.3
Evap. Water Flow rate - Maximum (6)	**(l/s)**	59.7	59.7	59.7	59.7	76.1	76.1	76.1	76.1	101.1	101.1	101.1
Nominal water connection size (Grooved coupling)	**(in) -DN**	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	6” - 150	8” - 200	8” - 200	8” - 200
Hydraulic Module Components												
Standard head pressure pump option												
Available Head Pressure (1)	**(kPa)**	199	182	145	112	159	127	91	51	142	127	109
Max Motor Power input	**(kW)**	11	11	11	11	15	15	15	15	22	22	22
Max Amps	**(A)**	20.8	20.8	20.8	20.8	29	29	29	29	39.7	39.7	39.7
High head pressure pump option												
Available Head Pressure (1)	**(kPa)**	308	293	258	226	286	239	185	121	N/A	N/A	N/A
Max Motor Power input	**(kW)**	18.5	18.5	18.5	18.5	22	22	22	22	N/A	N/A	N/A
Max Amps	**(A)**	34.5	34.5	34.5	34.5	39.7	39.7	39.7	39.7	N/A	N/A	N/A
Expansion Tank Volume	**(l)**	80	80	80	80	160	160	160	160	160	160	160
Max User water loop Volume for factory mounted expansion tank (1)	**(l)**	6000	6000	6000	6000	8000	8000	8000	8000	8000	8000	8000
Max. Water-side Operating Pressure without pump package	**(kPa)**	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Max. Water-side Operating Pressure with pump package	**(kPa)**	450	450	450	450	450	450	450	450	450	450	450
Antifreeze Heater with pump package	**(W)**	3100	3100	3100	3100	4300	4300	4300	4300	4300	4300	4300
Condenser												
Type		**Full aluminum Micro channel heat exchanger**										
Quantity	**#**	7/7/	7/7/	7/7/	7/7/	14/6/	14/6/	14/6/	14/6/	12/12/	12/12/	12/12/
Face area per coil (m^2)		2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Condenser Fan												
Quantity	**#**	14	14	14	14	20	20	20	20	24	24	24
Diameter	**(mm)**	800	800	800	800	800	800	800	800	800	800	800

Table 1 : General Data GVAF 155-450 : High Efficiency Low Noise and Extra Low Noise -R134a/R513A (continued)

		GVAF X										
		155	**175**	**205**	**245**	**250**	**280**	**310**	**350**	**380**	**410**	**450**
Standard / High and Low ambient fan option												
Fan / motor Type		**Propeller fan / Variable Brushless DC motor**										
Airflow per Fan	**(m3/h)**	19340	19340	20000	20000	20000	20000	20000	20000	20000	20000	20000
Max Power input per Motor	**(kW)**	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
Max Amps per Motor	**(A)**	3	3	3	3	3	3	3	3	3	3	3
Motor RPM	**(rpm)**	880	880	910	910	910	910	910	910	910	910	910
Extra Low Noise fan option												
Fan / motor Type		**Propeller fan / Variable Brushless DC motor**										
Airflow per Fan	**(m3/h)**	19302	19302	20000	20000	20000	20000	20000	20000	20000	20000	20000
Max Power input per Motor	**(kW)**	0.9	0.9	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Max Amps per Motor	**(A)**	1.6	1.6	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8	1.8
Motor RPM	**(rpm)**	830	830	860	860	860	860	860	860	860	860	860
System data (8)												
Nb of refrigerant circuit	**#**	2	2	2	2	2	2	2	2	2	2	2
Minimum cooling load % (4)(7)	**%**	36	32	27	24	24	20	18	16	20	19	18
R134a refrigerant charge Circuit1 / Circuit 2 (8)	**(kg)**	75/70	75/70	75/70	75/70	140/75	140/75	140/75	140/75	140/140	140/140	140/140

(1) Indicative performance at Evaporator water temperature: 12°C / 7°C - Condenser air temperature 35°C - for detailed performances consult Order Write Up.
(2) Under 400V/3/50Hz.
(3) Rated Condition without Pump Package.
(4) Percent minimum load may be adjusted around 15%-20% according to operating conditions by local sales office.
(5) Electrical & system data are indicative and subject to change without notice. Please refer to unit nameplate data.
(6) Not applicable for Glycol application - see tables with Minimum Flow with Glycol.
(7) Max speed - range is 60% to 100% of max speed.
(8) Refrigerant charge may vary according to option. For real value refer to unit nameplate.
(9) Data containing information on two circuits shown as follows: ckt1/ckt2.

General Data

Table 2 : General Data GVAF 190-350 : Extra Efficiency Low Noise and Extra Low Noise -R134a/R513A

		GVAF XP				
		190	**205**	**245**	**310**	**350**
Cooling Capacity (1)	(kW)	728.19	767.87	883	1117	1243
Unit electrical data (2) (3) (5)						
Maximum Power input in cooling	(kW)	512	512	512	677	677
Unit rated amps (Max compr +Fan+Control)	(A)	755	755	755	998	998
Unit start up amps	(A)	755	755	755	998	998
Unit displacement power factor		0.98	0.98	0.98	0.98	0.98
Max power cable cross section (mm²)	(mm²)	4x185	4x185	4x185	4x185	4x185
Disconnect switch size (A)		1250	1250	1250	1250	1250
Compressor						
Quantity	#	3	3	3	4	4
Type		Centrifugal				
Model (9)			TT350-TT350/TT350		TT350-TT350/TT350-TT350	
RPM range (up to)		29461	29461	29461	29461	29461
Max Compr Power input Circuit 1/Circuit 2	(kW)		157-157/157		157-157/157-157	
Max Amps Circuit1 / Circuit 2 (3) (5)	(A)		231-231/231		231-231/231-231	
Start up Amps Circuit1 / Circuit 2 (3) (5)	(A)		231-231/231		231-231/231-231	
Evaporator						
Quantity	#	1	1	1	1	1
Type						
Evaporator model		300-A	300-A	300-A	500-B	500-B
Evaporator Water Content volume	(l)	120	120	120	170	170
Antifreeze Heater	(W)	2240	2240	2240	2440	2440
Standard pass evaporator						
Evap. Water Flow rate - Minimum	(l/s)	22.8	22.8	22.8	30.3	30.3
Evap. Water Flow rate - Maximum (6)	(l/s)	84.8	84.8	84.8	112.5	112.5
Nominal water connection size (Grooved coupling)	(in) -DN	6” - 150	6” - 150	6” - 150	8” - 200	8” - 200
Standard pass with turbulator evaporator						
Evap. Water Flow rate - Minimum	(l/s)	19	19	19	25.3	25.3
Evap. Water Flow rate - Maximum (6)	(l/s)	76.1	76.1	76.1	101.1	101.1
Nominal water connection size (Grooved coupling)	(in) -DN	6” - 150	6” - 150	6” - 150	8” - 200	8” - 200
Hydraulic Module Components						
Standard head pressure pump option						
Available Head Pressure (1)	(kPa)	196	188	161	175	160
Max Motor Power input	(kW)	15	15	15	22	22
Max Amps	(A)	29	29	29	39.7	39.7
High head pressure pump option						
Available Head Pressure (1)	(kPa)	335	324	288	N/A	N/A
Max Motor Power input	(kW)	22	22	22	N/A	N/A
Max Amps	(A)	39.7	39.7	39.7	N/A	N/A
Expansion Tank Volume	(l)	160	160	160	160	160
Max User water loop Volume for factory mounted expansion tank (1)	(l)	8000	8000	8000	8000	8000
Max. Water-side Operating Pressure without pump package	(kPa)	1000	1000	1000	1000	1000
Max. Water-side Operating Pressure with pump package	(kPa)	450	450	450	450	450
Antifreeze Heater with pump package	(W)	4300	4300	4300	4300	4300
Condenser						
Type			Full Aluminum Micro channel heat exchanger			
Quantity	#	14/6	14/6	14/6	14/6	14/6
Face area per coil (m²)		2.4	2.4	2.4	2.4	2.4
Condenser Fan						
Quantity	#	20	20	20	24	24
Diameter	(mm)	800	800	800	800	800
Standard / High and Low ambient fan option						
Fan / motor Type			Propeller fan / Variable speed - EC motor			
Airflow per Fan	(m3/h)	20000	20000	20000	20000	20000
Max Power input per Motor	(kW)	1.95	1.95	1.95	1.95	1.95
Max Amps per Motor	(A)	3	3	3	3	3
Motor RPM	(rpm)	910	910	910	910	910

Table 2 – General Data GVAF 190-350 : Extra Efficiency Low Noise and Extra Low Noise -R134a/R513A (continued)

		GVAF XP				
		190	205	245	310	350
Extra Low Noise fan option						
Fan / motor Type						
Airflow per Fan	(m3/h)	20000	20000	20000	20000	20000
Max Power input per Motor	(kW)	1.1	1.1	1.1	1.1	1.1
Max Amps per Motor	(A)	1.8	1.8	1.8	1.8	1.8
Motor RPM	(rpm)	860	860	860	860	860
System data (8)						
Nb of refrigerant circuit	#	2	2	2	2	2
Minimum cooling load % (4)(7)	%	28	26	23	25	22
R134a refrigerant charge Circuit1 / Circuit 2 (8)	(kg)	140/75	140/75	140/75	140/140	140/140

(1) Indicative performance at Evaporator water temperature: 12°C / 7°C - Condenser air temperature 35°C - for detailed performances consult Order Write Up.
(2) Under 400V/3/50Hz.
(3) Rated Condition without Pump Package.
(4) Percent minimum load may be adjusted around 15%-20% according to operating conditions by local sales office.
(5) Electrical & system data are indicative and subject to change without notice. Please refer to unit nameplate data.
(6) Not applicable for Glycol application - see tables with Minimum Flow with Glycol.
(7) Max speed - range is 60% to 100% of max speed.
(8) Refrigerant charge may vary according to option. For real value refer to unit nameplate.
(9) Data containing information on two circuits shown as follows: ckt1/ckt2.

General Data

Table 3 : General Data GVAF 125-350 : Extra Efficiency XPG(HFO) Low Noise and Extra Low Noise - R1234ze

		GVAF XP-G										
		125	**145**	**155**	**175**	**190**	**205**	**245**	**250**	**280**	**310**	**350**
Cooling Capacity (1)	(kW)	457	451	583	646	689	760	881	961	1001	1121	1242
Unit electrical data (2) (3) (5)												
Maximum Power input in cooling	(kW)	254	254	254	254	378	378	378	378	498	498	498
Unit rated amps (Max compr +Fan+Control)	(A)	374	374	374	374	557	557	557	557	734	734	734
Unit start up amps	(A)	374	374	374	374	557	557	557	557	734	734	734
Unit displacement power factor		0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98	0.98
Max power cable cross section (mm²)	(mm²)	2x300	2x300	2x300	2x300	2x300	2x300	2x300	2x300	4x185	4x185	4x185
Disconnect switch size (A)		630	630	630	630	800	800	800	800	1250	1250	1250
Compressor												
Quantity	#	2	2	2	2	3	3	3	3	4	4	4
Type							Centrifugal					
Model (9)			TG310/TG310				TG310-TG310/TG310			TG310-TG310/TG310-TG310		
RPM range (up to)		27957	27957	27957	27957	27957	27957	27957	27957	27957	27957	27957
Max Compr Power input Circuit 1/Circuit 2	(kW)		112/112				112-112/112			112-112/112-112		
Max Amps Circuit1 / Circuit 2 (3) (5)	(A)		165-165				165-165/165			165-165/165-165		
Start up Amps Circuit1 / Circuit 2 (3) (5)	(A)		165-165				165-165/165			165-165/165-165		
Evaporator												
Quantity	#	1	1	1	1	1	1	1	1	1	1	1
Type												
Evaporator model		250-B	250-B	250-B	250-B	300-A	300-A	300-A	300-A	500-B	500-B	500-B
Evaporator Water Content volume	(l)	118	118	118	118	120	120	120	120	170	170	170
Antifreeze Heater	(W)	2040	2040	2040	2040	2240	2240	2240	2240	2440	2440	2440
Standard pass evaporator												
Evap. Water Flow rate - Minimum	(l/s)	17.9	17.9	17.9	17.9	22.8	22.8	22.8	22.8	30.3	30.3	30.3
Evap. Water Flow rate - Maximum (6)	(l/s)	66.5	66.5	66.5	66.5	84.8	84.8	84.8	84.8	112.5	112.5	112.5
Nominal water connection size (Grooved coupling)	(in) -DN	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	8" - 200	8" - 200	8" - 200
Standard pass with turbulator evaporator												
Evap. Water Flow rate - Minimum	(l/s)	14.9	14.9	14.9	14.9	19	19	19	19	25.3	25.3	25.3
Evap. Water Flow rate - Maximum (6)	(l/s)	59.7	59.7	59.7	59.7	76.1	76.1	76.1	76.1	101.1	101.1	101.1
Nominal water connection size (Grooved coupling)	(in) -DN	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	6" - 150	8" - 200	8" - 200	8" - 200
Hydraulic Module Components												
Standard head pressure pump option												
Available Head Pressure (1)	(kPa)	225	208	198	181	201	188	161	139	188	175	160
Max Motor Power input	(kW)	11	11	11	11	15	15	15	15	22	22	22
Max Amps	(A)	20.8	20.8	20.8	20.8	28	28	28	28	39.7	39.7	39.7
High head pressure pump option												
Available Head Pressure (1)	(kPa)	334	318	308	292	341	325	288	256	N/A	N/A	N/A
Max Motor Power input	(kW)	18.5	18.5	18.5	18.5	22	22	22	22	N/A	N/A	N/A
Max Amps	(A)	34.5	34.5	34.5	34.5	39.7	39.7	39.7	39.7	N/A	N/A	N/A
Expansion Tank Volume	(l)	80	80	80	80	160	160	160	160	160	160	160
Max User water loop Volume for factory mounted expansion tank (1)	(l)	6000	6000	6000	6000	8000	8000	8000	8000	8000	8000	8000
Max. Water-side Operating Pressure without pump package	(kPa)	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000	1000
Max. Water-side Operating Pressure with pump package	(kPa)	450	450	450	450	450	450	450	450	450	450	450
Antifreeze Heater with pump package	(W)	3100	3100	3100	4300	4300	4300	4300	4300	4300	4300	4300

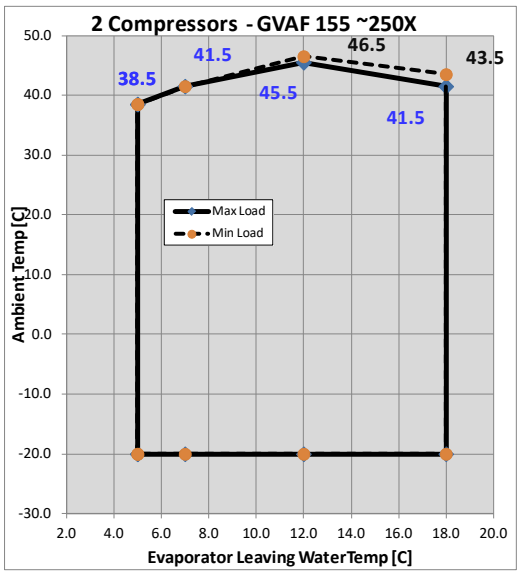
Table 3 – General Data GVAF 125-350 : Extra Efficiency XPG(HFO) Low Noise and Extra Low Noise - R1234ze (continued)

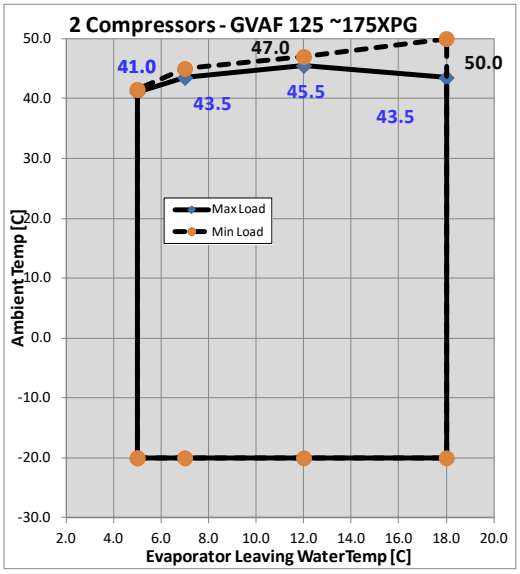
		GVAF XP-G										
		125	**145**	**155**	**175**	**190**	**205**	**245**	**250**	**280**	**310**	**350**
Condenser												
Type		Full aluminum Micro channel heat exchanger										
Quantity	#	7/7/	7/7/	7/7/	7/7/	14/6	14/6	14/6	14/6	12/12/	12/12/	12/12/
Face area per coil (m²)		2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4	2.4
Condenser Fan												
Quantity	#	14	14	14	14	20	20	20	20	24	24	24
Diameter	(mm)	800	800	800	800	800	800	800	800	800	800	800
Standard / High and Low ambient fan option												
Fan / motor Type												
Airflow per Fan	(m3/h)	16703	17802	18901	20000	16703	17802	18901	20000	17802	18901	20000
Max Power input per Motor	(kW)	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95	1.95
Max Amps per Motor	(A)	3	3	3	3	3	3	3	3	3	3	3
Motor RPM	(rpm)	760	810	860	910	760	810	860	910	810	860	910
Extra Low Noise fan option												
Fan / motor Type												
Airflow per Fan	(m3/h)	16512	17674	18837	20000	16512	17674	18837	20000	17674	18837	20000
Max Power input per Motor	(kW)	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1	1.1
Max Amps per Motor	(A)	1	1.2	1.5	1.8	1	1.2	1.8	1.8	1.2	1.5	1.8
Motor RPM	(rpm)	710	760	810	860	710	760	810	860	760	810	860
System data (8)												
Nb of refrigerant circuit	#	2	2	2	2	2	2	2	2	2	2	2
Minimum cooling load % (4)(7)	%	34	29	27	24	20	18	16	16	14	13	12
R134a refrigerant charge Circuit1 / Circuit 2 (8)	(kg)	75/70	75/70	75/70	75/70	140/75	140/75	140/75	140/75	140/140	140/140	140/140

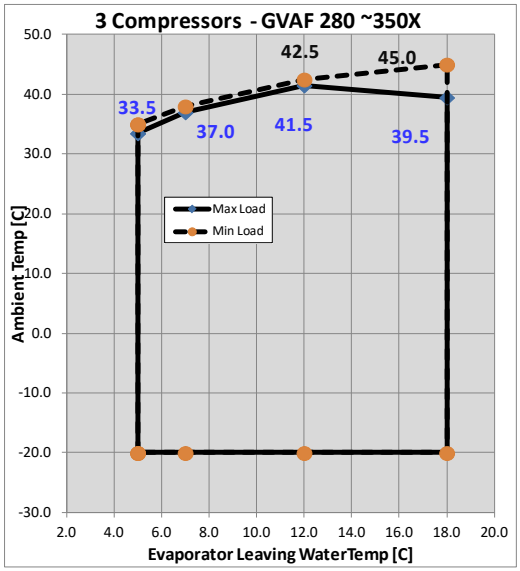
(1) Indicative performance at Evaporator water temperature: 12°C / 7°C - Condenser air temperature 35°C - for detailed performances consult Order Write Up.
(2) Under 400V/3/50Hz.
(3) Rated Condition without Pump Package.
(4) Percent minimum load may be adjusted around 15%-20% according to operating conditions by local sales office.
(5) Electrical & system data are indicative and subject to change without notice. Please refer to unit nameplate data.
(6) Not applicable for Glycol application - see tables with Minimum Flow with Glycol.
(7) Max speed - range is 60% to 100% of max speed.
(8) Refrigerant charge may vary according to option. For real value refer to unit nameplate.
(9) Data containing information on two circuits shown as follows: ckt1/ckt2.

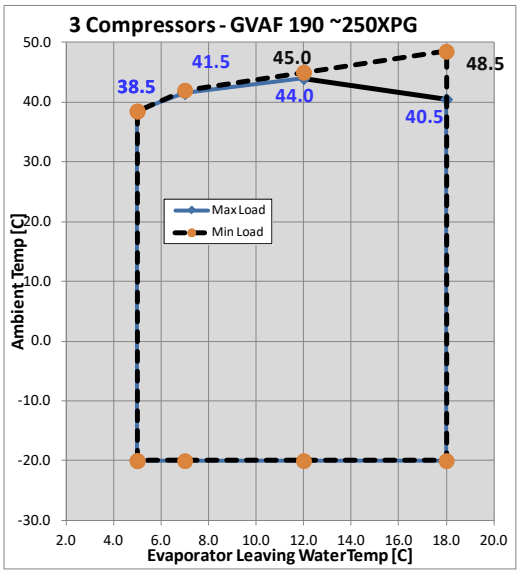
Operating Map

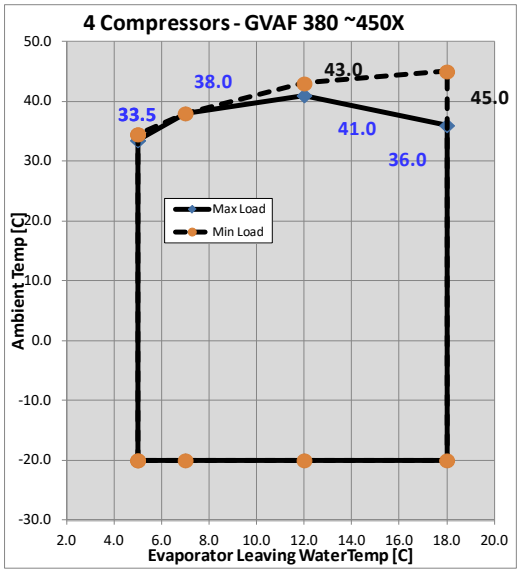
GVAF Operating Map

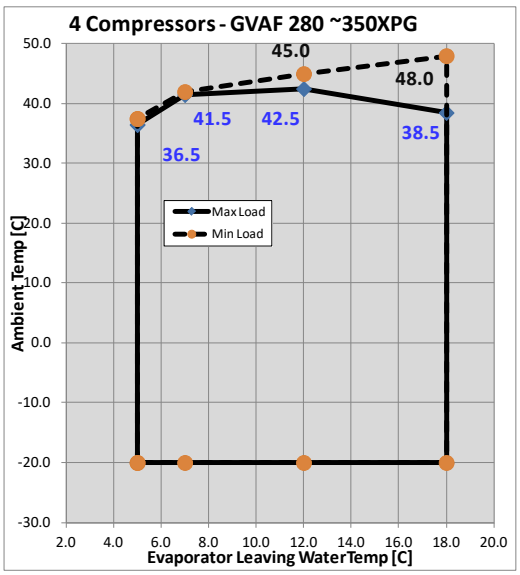












Installation Requirements

Installation Responsibilities

Generally contractor must do the following items when installing an GVAF unit:

1. Install the unit on a flat foundation strong enough to support unit loading and level (within 5 mm across the length and width of the unit).
2. Install the units as per instructions contained in this manual.
3. Where specified, provide and install valves in the water piping upstream and downstream of the evaporator water connections, to isolate the evaporator for maintenance, and to balance and trim the system.
4. Furnish and install a water flow prove device and/or auxiliary contacts to prove chiller water flow.
5. Furnish and install water pressure gauges in the inlet and outlet of the evaporator water box.
6. Supply and install an air vent cock to the top of the evaporator water box.
7. Furnish and install strainers ahead of all pumps and automatic modulating valves.
8. Provide and install field wiring according to schematics provided in the control panel.
9. Install heat tape and insulate the chilled water lines and any other portion of the system, as required, to prevent sweating under normal operating conditions or freezing during low ambient temperature conditions.
10. Start the unit under supervision of a qualified service technician.

Nameplates

The GVAF outdoor unit nameplates are applied to the exterior of the control panel. A compressor nameplate is located on each compressor.

Outdoor Unit Nameplate

The outdoor unit nameplate provides the following information:

- Unit model and size description
- Unit serial number
- Identifies unit electrical requirements
- Lists correct operating charges of R-134a and refrigerant oil
- Lists unit test pressures

Compressor Nameplate

The compressor nameplate provides following information:

- Compressor model number.
- Compressor serial number.
- Compressor electrical characteristics.
- Utilization range
- Recommended refrigerant

Storage

Extended storage of the unit prior to the installation requires the following precautions:

1. Store the unit in a secured area, to avoid intentional damages.
2. Close the suction, discharge and liquid-line isolation valves.
3. At least every three months, connect a gauge and manually check the pressure in the refrigerant circuit. If the refrigerant pressure is below values in the table below, call a qualified service organization and the appropriate Trane sales office.

	R134a/R513A	R1234ze(E)
20°C	4.6 bar	3.2 bar
10°C	3.0 bar	2.0 bar

Note: if the unit is stored before servicing near a construction site it is highly recommended to protect micro channel coils from any concrete and iron element. Failure to do so may considerably reduce reliablity of the unit.

Lifting and Moving Instructions

A specific lifting method is recommended, which can be described as follow:

1. Lifting points are built into the unit, see lifting instruction label on the unit.
2. Slings and spreader bar must be provided by crane operator and attached on the lifting points.
3. Use the 4 or 8 rigging points (according to unit size) which are built into the unit.
4. The minimum lifting capacity of each sling as well as the spreader bar must be higher than the tabulated unit shipping weight.
5. CAUTION! Lift and handle with care. Avoid shocks while handling.

Note: all lifting details are given in lifting instruction documents and submitalls shipped with the unit.

Installation Requirements

Figure 1a – Lifting

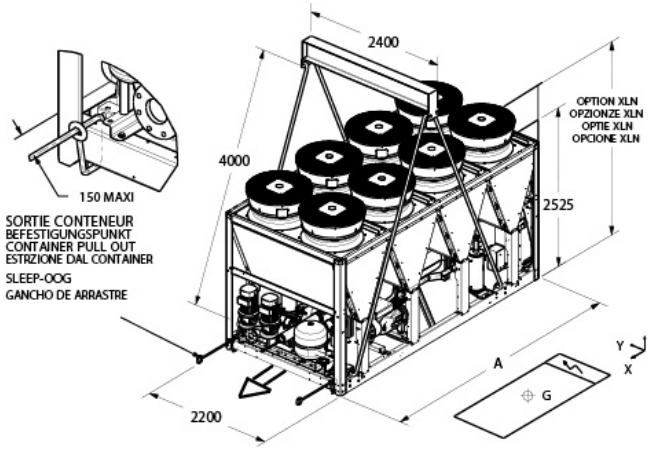
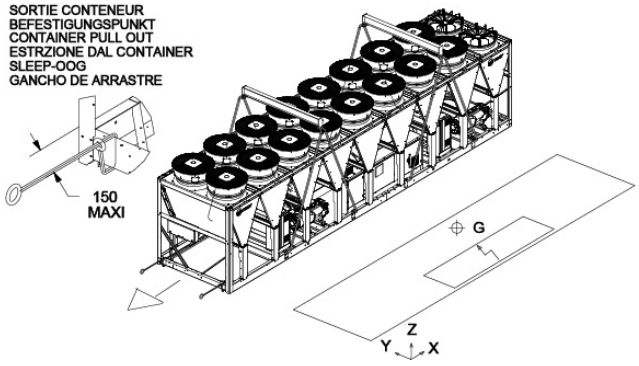


Figure 1b – Lifting



Dimension and Weights

See lifting weight on the submittal on the unit for complete information.

Center of Gravity

See instructions on lifting drawings available on request.

WARNING! Heavy Objects!
Ensure that all the lifting equipment used is properly rated for weight of the unit being lifted. Each of the cables (chains or slings), hooks, and shackles used to lift the unit must be capable of supporting the entire weight of unit. Lifting cables (chains or slings) may not be the same length. Adjust as necessary for even unit lift. Other lifting arrangements could cause equipment or property damage. Failure to follow instructions above or properly lift unit could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury.

WARNING! Improper Unit Lift!
Test lift unit approximately 10 cm to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level. Failure to properly lift unit could result in unit dropping and possibly crushing operator/ technician which could result in death or serious injury and possible equipment or property- only damage.

Clearances

When installing the unit, provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points.
Unobstructed flow of condenser air is essential to maintain chiller capacity and operating efficiency. When determining unit placement, give careful consideration to ensuring a sufficient air flow across the condenser coils heat-transfer surface.
In case of enclosure around the unit, the height of the enclosure must not be higher than the unit itself. If the enclosure is higher than the unit, restrictive airflow louvers should be fitted to ensure fresh air supply.

Unit Isolation and Leveling

Provide a foundation with sufficient strength and mass to support the unit operating weight (that is, including completed piping, full operating charges of refrigerant and oil, and water). Refer to unit operating weights. The unit must be leveled within 5 mm over its length and width. Use shims as necessary to level the unit. For additional reduction of sound and vibration, install the optional elastomeric isolators.

Sound consideration

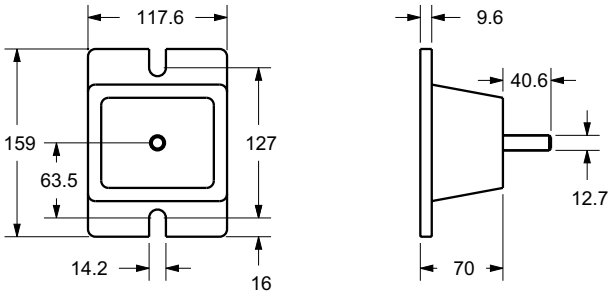
The most effective form of acoustical isolation is to locate the unit away from any sound sensitive area. Structurally transmitted sound can be reduced by elastomeric vibration eliminators. Spring isolators are not recommended. Consult an acoustical engineer in critical sound applications.
For maximum isolation effect, isolate water lines and electrical conduit. Rubber isolated piping hangers can be used to reduce the sound transmitted through water piping. To reduce sound transmitted through electrical conduit, use flexible electrical conduit.
EU and Local Regulations codes on sound emissions should always be considered. Since the environment in which a sound source is located affects the sound pressure, unit placement must be carefully evaluated.

Elastomeric Isolators Installation (Optional)

Isolators are ready to install. Mountings have to be placed on a rigid and level foundation. External equipment should not transmit additional vibration to the chiller. The position of elastomeric isolator and
weight per point are given in the Neoprene isolators installation drawing which is supplied with the chiller. Wrong placement along the unit may result in excessive deflection.

1. Secure the isolators to the mounting surface using the mounting slots in the isolator's base plate. Do NOT fully tighten the isolators mounting bolts at this time. See the isolators submittals for isolators location, maximum weights, and isolators diagrams.
2. Align the mounting holes in the base of the unit with the threaded positioning pins on the top of the isolators.
3. Install the unit on the isolators and secure the isolators to the unit with a nut. The maximum isolators deflection should be 13 mm.
4. Level the unit carefully. Fully tighten the isolator mounting bolts.

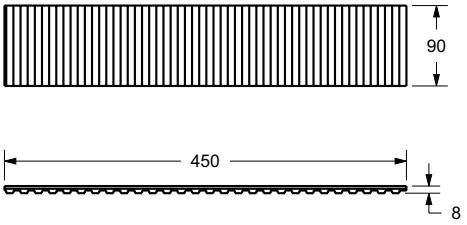
Figure 2 – Elastomeric Isolator



Isolator Pads Installation (Optional)

Isolators are ready to install. Mountings have to be placed on a rigid and level foundation. External equipment should not transmit additional vibration to the chiller. The position of pads isolator is given in the pad isolators installation or selection drawing which is supplied with the chiller.

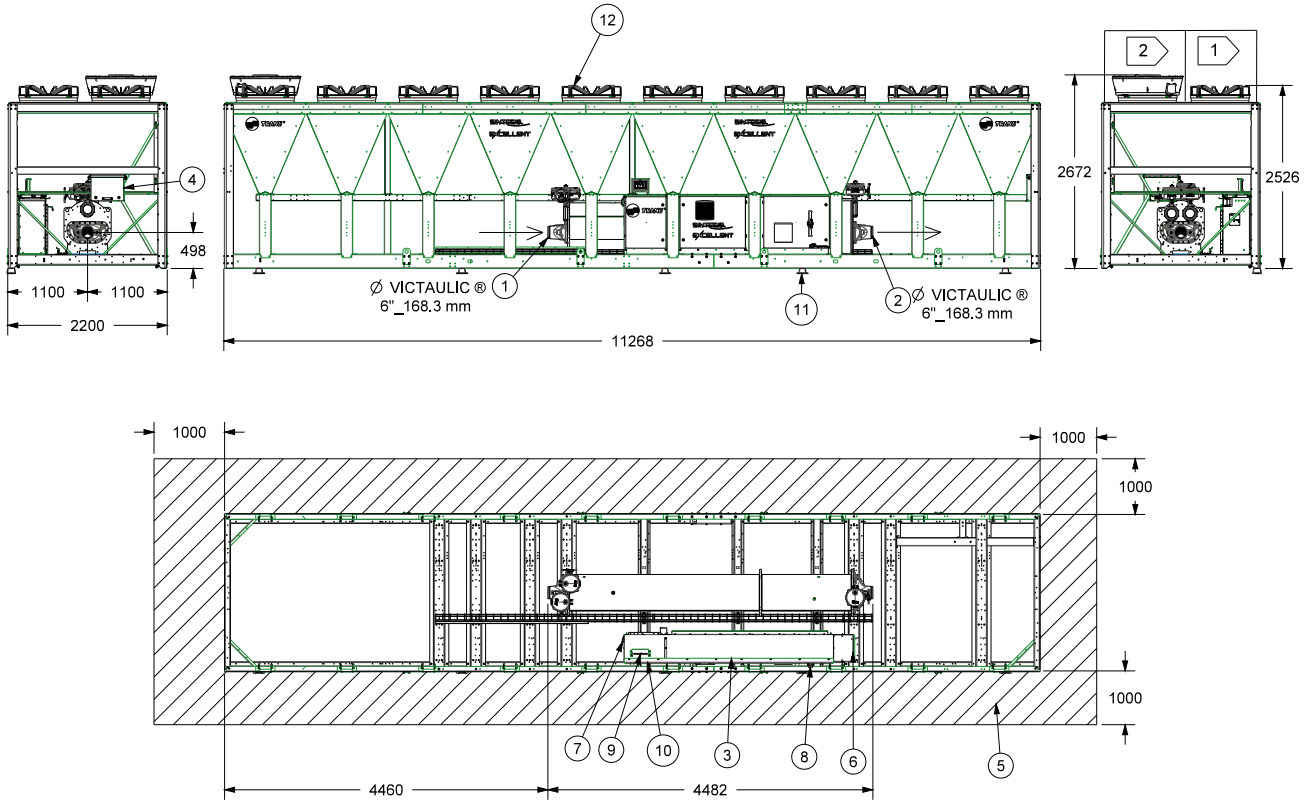
Figure 3 – Isolator pads



Dimensional Data

The dimensional data below are given for example only. Dimensions details, dimensions of hydraulic connections, electrical connections, weights, isolator positioning, specific features for heat recovery and free cooling are included in submittals and diagrams provided in documentation package.

Figure 4 – Typical submittal example: GVAF 250X-350X / GVAF 190XP-245XP / GVAF 190XPG-250XPG



	ENGLISH
①	EVAPORATOR WATER INLET CONNECTION
②	EVAPORATOR WATER OUTLET CONNECTION
③	ELECTRICAL PANEL
④	ELECTRICAL PANEL CONDENSER
⑤	MINIMUM CLEARANCE (AIR ENTERING AND MAINTENANCE)
⑥	POWER CABLE GLAND PLATE FOR CUSTOMER WIRING
⑦	EXTERNAL CONTROL WIRING CABLE GLAND PLATE
⑧	POWER DISCONNECT SWITCH
⑨	DISPLAY MODULE
⑩	MAIN PROCESSOR MODULE
⑪	ISOLATORS
⑫	FANS
1	SN_LN UNIT
2	OPTION XLN

Chilled Water Piping Recommendations

Drainage

A large capacity drain must be provided for water vessel drain-down during shutdown or repair. The evaporator is provided with drain connections. An air vent on top of the evaporator water box prevents vacuum by removing air from evaporator for complete drainage.

Water Treatment

In the evaporator the following material are in contact with water:

- Water boxes are made of cast iron (GJL250 EN-code)
- Tube plates are made of steel (P265GH code)
- Tubes are made of copper
- Turbulators when present in evaporator tubes are made of phosphorous brass.

When the unit is supplied with hydraulic module, the following additional materials are in contact with water:

- Pump frame and connections are made of cast iron
- Water pipes are made of iron
- Pipe sealings are made of EPDM rubber (ethylene propylene diene monomer rubber)
- Pump sealings are made of silicon carbide
- Strainer is made of stainless steel

Dirt, scale, products of corrosion, and other foreign material will adversely affect heat transfer between the water and system components. Foreign matter in the chilled-water system can also increase pressure drop and consequently, reduce water flow. Proper water treatment must be determined locally, depending on the type of system and local water characteristics.

Neither salt nor brackish water is recommended for use in Trane air-cooled chillers. Use of either will lead to an unpredictably shorter life cycle. Trane encourages the employment of a reputable water treatment specialist, familiar with local water conditions, to assist in this determination and in the establishment of a proper water treatment program.

CAUTION! If using an acidic commercial flushing solution, construct a temporary bypass around the unit to prevent damage to internal components of the evaporator. Trane assumes no responsibility for equipment failures which results from untreated or improperly treated water or saline or brackish water. If calcium chloride is used for water treatment, an applicable corrosion inhibitor must also be used. Failure to do so may result in damage to system components. Do not use untreated or improperly treated water. Equipment damage may occur.

Evaporator Piping

Evaporator water connections are grooved.
Thoroughly flush all water piping to the unit before making the final piping connections to the unit. Components and layout will vary slightly, depending on the location of connections and the water sources.

An air vent is located on top of the evaporator at the chiller water outlet. Be sure to provide additional air vents at the highest points in the piping to remove air from the chilled water system. Install necessary pressure gauges to monitor the entering and leaving chilled water pressure.

Provide shut off valves in lines to the gauges to isolate them from the system when they are not in use. Use rubber vibration eliminators to prevent vibration transmission through the water lines.

If desired, install thermometers in the lines to monitor entering and leaving water line to control water flow balance. Install shutoff valves on both the entering and leaving water lines so that the evaporator can be isolated for service.

CAUTION! The chilled-water connections to the evaporator are to be “grooved pipe” type connections. Do not attempt to weld these connections, because the heat generated from welding can cause microscopic and macroscopic fractures on the cast iron water boxes that can lead to premature failure of the water box. An optional grooved pipe stub and coupling is available for welding on flanges.

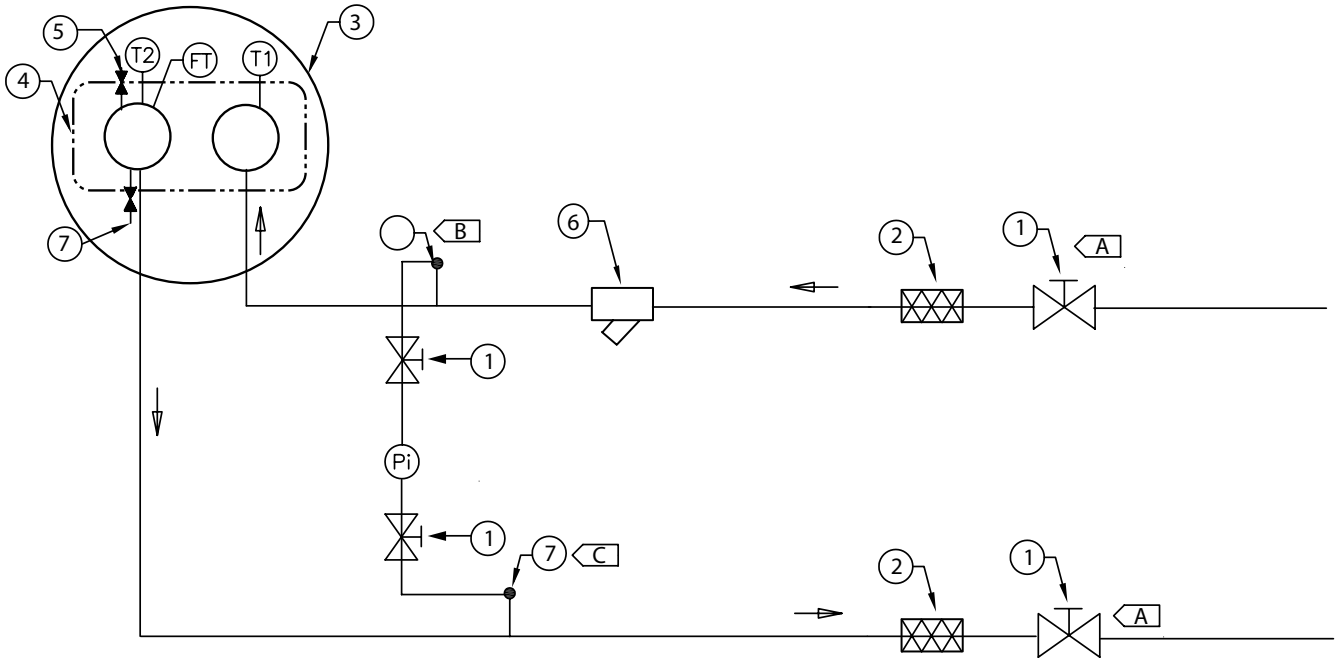
To prevent damage to chilled-water components, do not allow evaporator pressure (maximum working pressure) to exceed 10 Bar. The maximum service pressure depends on free cooling type and potential pump package option. The value of max service pressure is indicated on unit nameplate.

A pipe strainer must be installed in the entering water line. Failure to do so can allow waterborne debris to enter the evaporator.

Evaporator Piping Components

Piping components include all devices and controls used to provide proper water system operation and unit operating safety. A typical GVAF evaporator piping is shown below.

Figure 5 – Typical GVAF evaporator water piping



1 = Isolation valve
2 = Vibration isolators
3 = Evaporator – End view (2-pass)
4 = Evaporator Waterbox
5 = Vent
6 = Strainer
7 = Drain
Pi = Pressure gauge
FT = Water Flow Switch
T1 = Evaporator Water Inlet Temperature Sensor
T2 = Evaporator Water Outlet Temperature Sensor
A = Isolate unit for initial water loop cleaning
B = Vent must be installed at the high point of the line
C = Drain must be installed at the low point of the line

Entering Chilled Water Piping

- Air vents to bleed the air from the system (to be placed on the highest point)
- Water pressure gauges with shutoff valves
- Vibration eliminators
- Shutoff (isolation) valves
- Thermometers if desired (temperature readings available on chiller controller display)
- Clean-out tees
- Pipe strainer

Leaving Chilled Water Piping

- Air vents to bleed the air from the system (to be placed on the highest point)
- Water pressure gauges with shut off valves
- Vibration eliminators
- Shutoff (isolation) valves
- Thermometers (temperature readings available on the chiller controller display)
- Clean-out tees
- Balancing valve
- Flow Proving Device

Evaporator Piping

Drains

GVAF chillers are equipped with 2 drain connections with valves: one located on the input box and the other on the back box of evaporator.

Figure 6 – Drain and vent position on evaporator

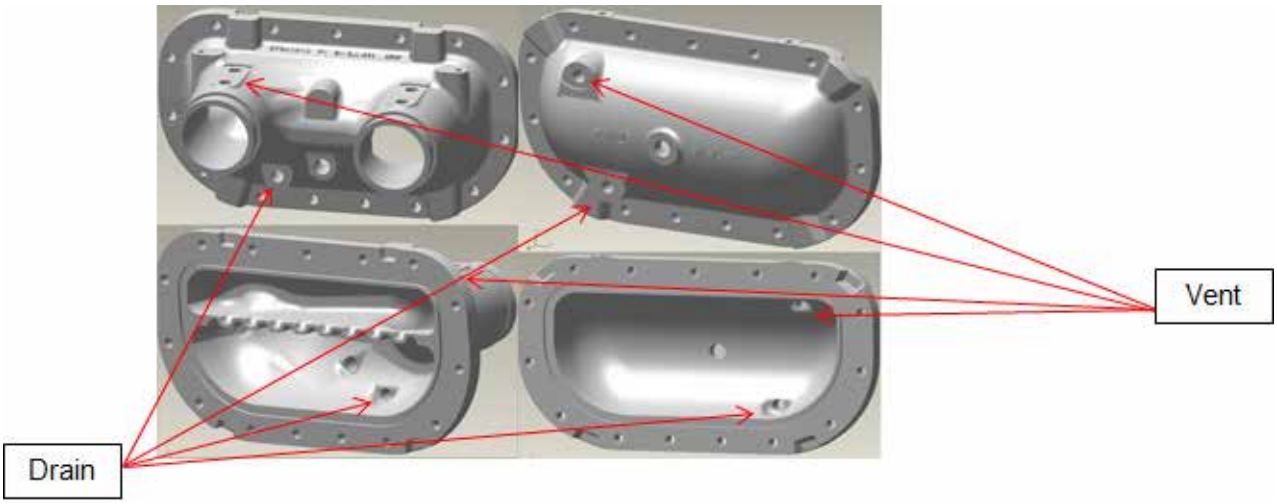
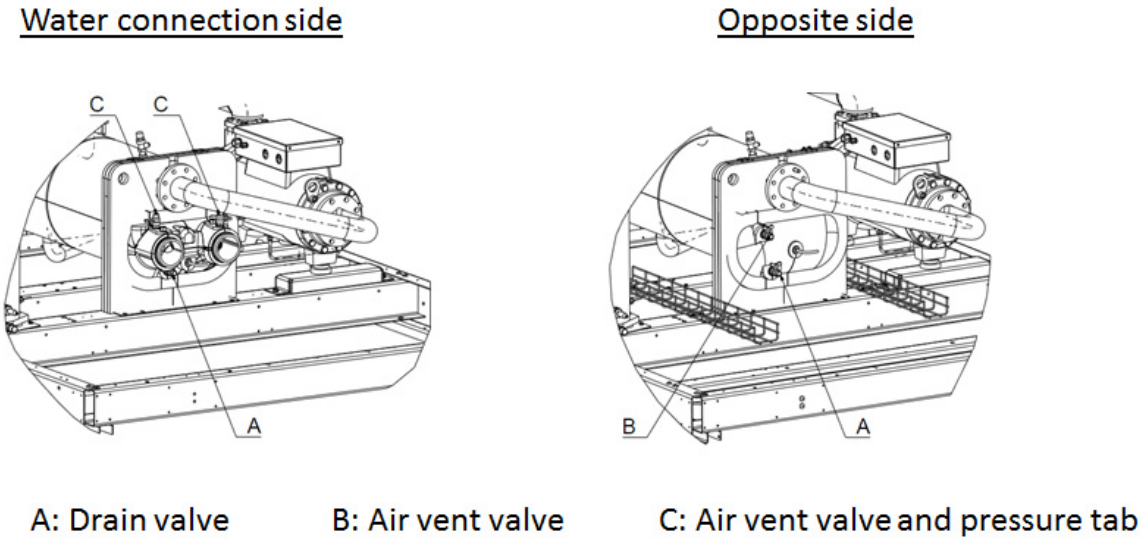


Figure 7 – Drain and air vent fitting location on the evaporator water side



In case of winter water drainage for freeze protection, it is mandatory to disconnect the evaporator's heaters to protect them from burning due to overheat. It is also mandatory to fulfill the drainage, using pressurized air, and ensure that no water stay in the evaporator during winter season. This operation needs to be performed also on unit just delivered by factory.

Pressure Gauges

Install field-supplied pressure components as shown in Figure 6. Locate pressure gauges or taps in a straight run of pipe; avoid placing them near elbow (at least at 10 pipe diameter from discontinuity).
To read manifold pressure gauges, open one valve and close the other (depending on the side of the desired reading), this eliminate errors resulting from differently calibrated gauges installed at unmatched elevations.

Pressure Relief Valves

Install a water pressure relief valve in the evaporator inlet piping between evaporator and the inlet shutoff valve. Water vessels with close-coupled shutoff valves have high potential for hydrostatic pressure buildup on a water temperature increase. Refer to applicable local codes for relief valve installation.

Evaporator Flow Switch

Specific connection and schematic wiring diagram are shipped within the unit. Some piping and control schemes, particularly those using a single water pump for both chilled and hot water, must be analyzed to determine how and/or if a flow sensing device will provide the desired operation.

Flow Switch Installation – Typical Requirements

1. Mount the switch upright, with a minimum of 5 pipes diameters of straight horizontal run on each side. Do not install close to elbows, orifices, or valves. The arrow on the switch must point in the direction of the flow.
2. To prevent switch fluttering, remove all air from the water system. Tracer UC800 provides a 6 second time delay after a "loss-of-flow" diagnostic before shutting the unit down. Contact a Trane service representative if nuisance machine shutdowns persist.
3. Adjust the switch to open when water flow falls below nominal values. Evaporator data is given on the General Information Section. Flow Switch contacts are closed on proof of water flow.
4. Install a pipe strainer in the entering evaporator-water line to protect components.

CAUTION! Control voltage from the chiller to the flow proving device is 110V AC.

Optional Integrated Pump Package

Pump Curves

In the figures below are described Pump Curves with a combination of Standard Head - High Head with standard tubes and turbulators inside the evaporator for the whole unit range.

Figure 8 – Pump Curve

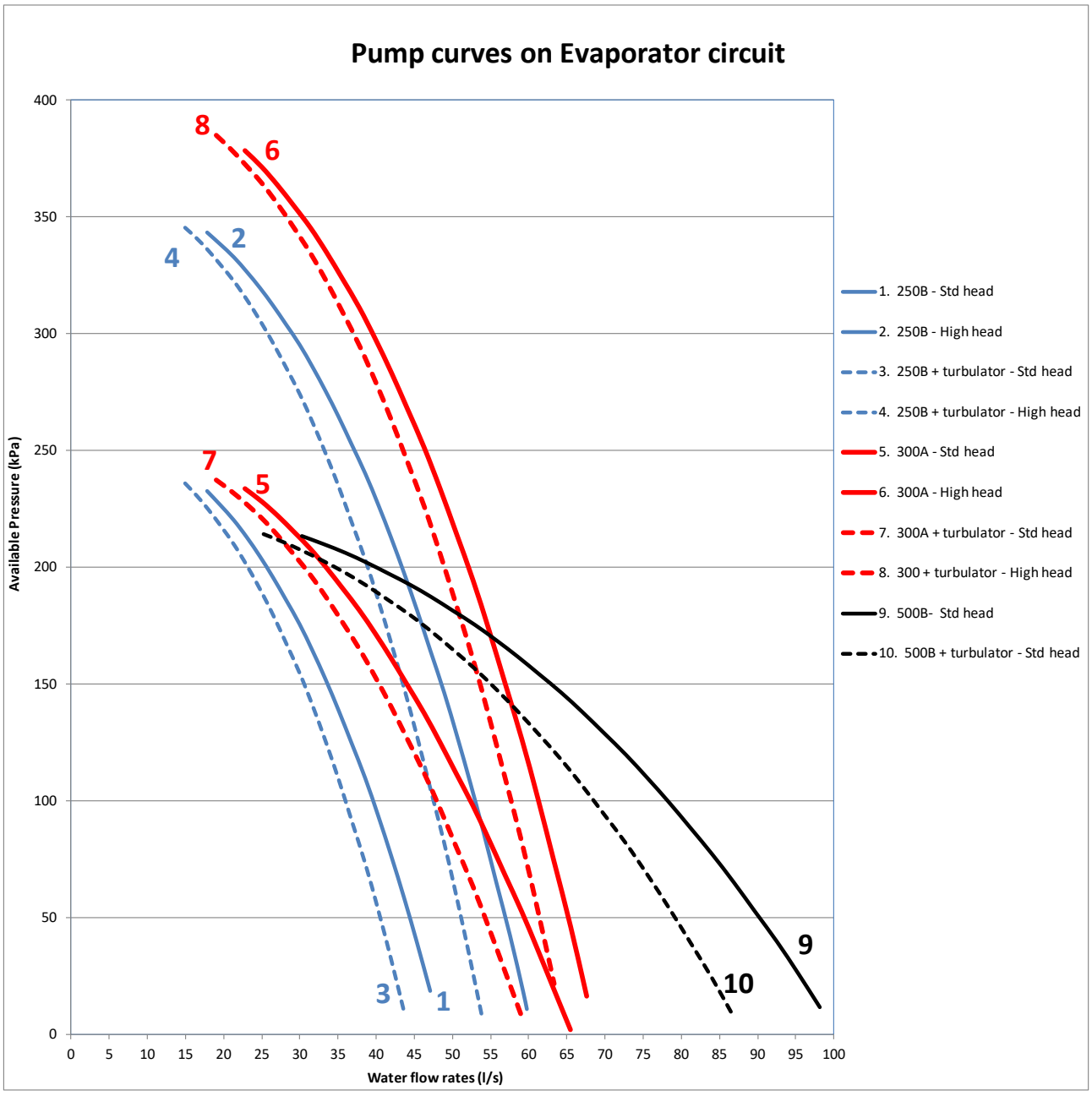
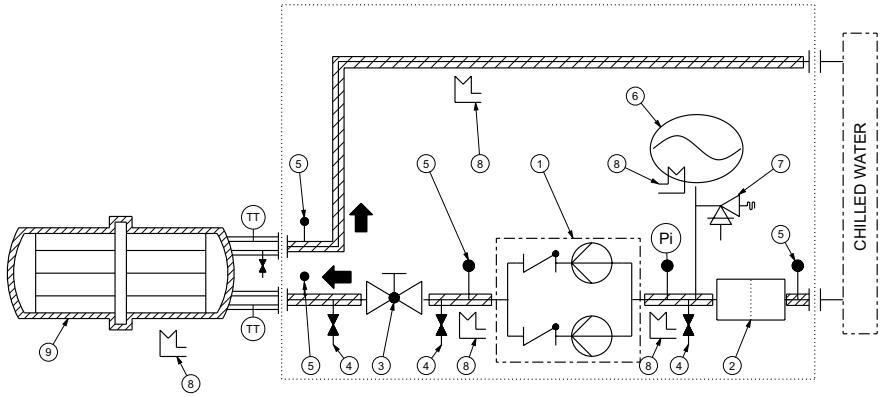


Figure 9 – Hydraulic module water chart



1 = Twin centrifugal pump
2 = Water strainer
3 = Balancing valve
4 = Drain valve
5 = Valve for pressure point
6 = Expansion tank
7 = Pressure relief valve
8 = Antifreeze protection
9 = Evaporator
Pi = Gauge
TT = Temperature sensor

Chiller can be ordered with an optional integrated hydraulic module. In this case, chiller will be provided with the following components factory mounted and tested:

- Twin centrifugal water pump, Low pressure or High pressure (option)
- Water strainer to protect the pump against impurities in the circuit
- Expansion module with expansion vessel and pressure relief valve sufficient to ensure the expansion of the water loop ability
- Thermal insulation for antifreeze protection
- Balancing valve for equilibrate the flow of water circuit
- Drain valve
- Temperature sensor

Note: A pressure switch device to detect lack of water is not included in the pump package. Installation of this type of device is highly recommended to avoid sealing damage due to operation of pump without enough water.

Optional Free-Cooling

Table 4 – Free cooling - General Data GVAF 155-450 - High Efficiency Low Noise and Extra Low Noise

	GVAF X 155	GVAF X 175	GVAF X 205	GVAF X 245	GVAF X 250	GVAF X 280	GVAF X 310	GVAF X 350	GVAF X 380	GVAF X 410	GVAF X 450
Heat-Exchanger Type	Aluminum heat exchanger										
Fan type (1)	EC	EC	EC	EC	EC	EC	EC	EC	EC	EC	EC
Power per Motor (kW)	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
Motor RPM (rpm)	910	910	910	910	910	910	910	910	910	910	910
Fan type (2)	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN
Power per Motor (kW)	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
Motor RPM (rpm)	860	860	860	860	860	860	860	860	860	860	860
Input water connection size (Grooved coupling) (in) - DN	6” - 150									8” - 200	
Output water connection size (Grooved coupling) (in) - DN	6” - 150									8” - 200	
Direct Free Cooling Option											
Total Free Cooling type											
Coils quantity	13	13	13	13	20	20	20	20	20	20	20
Summer nominal water flow (L/s)	27.5	30.5	36.2	40.6	42.2	47.9	53.5	59.2	65.7	70.4	75.5
Summer unit pressure drop (kPa)	69	84	118	148	77	99	123	150	107	122	141
Winter unit pressure drop (kPa)	133	153	196	231	152	183	216	252	178	196	217
Free Cooling weight (kg)	869	869	869	869	1596	1596	1596	1596	1760	1760	1760
Additional water content (without Evap) (L)	338	338	338	338	787	787	787	787	956	956	956
Partial Free Cooling type											
Coils quantity #	6	6	6	6	10	10	10	10	12	12	12
Summer nominal water flow (L/s)	27.5	30.5	36.2	40.6	42.2	47.9	53.5	59.2	65.7	70.4	75.5
Summer unit pressure drop (kPa)	69	84	118	148	77	99	123	150	107	122	141
Winter unit pressure drop (kPa)	131	150	189	222	132	157	184	213	184	203	225
Additional Free Cooling weight (without water) (kg)	580	580	580	580	1112	1112	1112	1112	1112	1112	1112
Additional water content (without Evap) (L)	218	218	218	218	476	476	476	476	582	582	582
Free Cooling Glycol Free Option											
Total Free Cooling type											
Coils quantity #	13	13	13	13	20	20	20	20	20	20	20
Summer nominal water flow (L/s)	27.5	30.5	36.2	40.6	42.2	47.9	53.5	59.2	65.7	70.4	75.5
Summer & Winter unit pressure drop (kPa)	60	73	103	129	68	87	109	133	109	125	143
Glycol Pump Max Power input (kW)											
Glycol Pump Max Amps @ 110 V (A)	20.5	20.5	20.5	20.5	38	38	38	38	38	38	38
Freeze protection - Max Power input kW	1.02	1.02	1.02	1.02	1.8	1.8	1.8	1.8	2.04	2.04	2.04
Freeze protection - Max Amps A	2.55	2.55	2.55	2.55	4.5	4.5	4.5	4.5	5.1	5.1	5.1
Additional Free Cooling weight (without water) (kg)	1561	1561	1561	1561	2595	2595	2595	2595	3013	3013	3013
Additional water content (without Evap) (L)	126	126	126	126	245	245	245	245	311	311	311
Glycol content (L)	396	396	396	396	888	888	888	888	1045	1045	1045
Partial Free Cooling type											
Coils quantity #	6	6	6	6	10	10	10	10	12	12	12
Summer nominal water flow (L/s)	27.5	30.5	36.2	40.6	42.2	47.9	53.5	59.2	65.7	70.4	75.5
Summer & Winter unit pressure drop (kPa)	48	59	82	103	61	79	98	120	92	106	122
Glycol Pump Max Power input (kW) (kW)	5.5	5.5	5.5	5.5	11	11	11	11	11	11	11
Glycol Pump Max Amps @ 110 V (A)	10.2	10.2	10.2	10.2	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Freeze protection - Max Power input kW	0.72	0.72	0.72	0.72	1.32	1.32	1.32	1.32	1.44	1.44	1.44
Freeze protection - Max Amps A	1.8	1.8	1.8	1.8	3.3	3.3	3.3	3.3	3.6	3.6	3.6
Additional Free Cooling weight (without water) (kg)	1019	1019	1019	1019	1547	1547	1547	1547	1736	1736	1736
Additional water content (without Evap) (L)	126	126	126	126	132	132	132	132	182	182	182
Glycol content (L)	396	396	396	396	556	556	556	556	589	589	589

(1) X-LN/XP-LN/XPG-LN/X-NNSB/XPG-NNSB

(2) X-LN/XP-XLN/XPG-XLN

Table 5 – Free cooling - General Data GVAF 190-350 - Extra Efficiency Low Noise and Extra Low Noise

	GVAF XP 190	GVAF XP 205	GVAF XP 245	GVAF XP 310	GVAF XP 350
Heat-Exchanger Type			Aluminum heat exchanger		
Fan type (1)	EC	EC	EC	EC	EC
Power per Motor (kW)	1.47	1.47	1.47	1.47	1.47
Motor RPM (rpm)	910	910	910	910	910
Fan type (2)	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN
Power per Motor (kW)	1.21	1.21	1.21	1.21	1.21
Motor RPM (rpm)	860	860	860	860	860
Input water connection size (Grooved coupling) (in) - DN		6" - 150		8" - 200	
Output water connection size (Grooved coupling) (in) - DN		6" - 150		8" - 200	
Direct Free Cooling Option					
Total Free Cooling type					
Coils quantity	24	24	24	24	24
Summer nominal water flow (L/s)	34.3	36.2	41.9	53.3	59.4
Summer unit pressure drop (kPa)	51	57	76	71	87
Winter unit pressure drop (kPa)	113	122	150	134	155
Free Cooling weight (kg)	1596	1596	1596	1760	1760
Additional water content (without Evap) (L)	787	787	787	956	956
Partial Free Cooling type					
Coils quantity #	10	10	10	12	12
Summer nominal water flow (L/s)	34.3	36.2	41.9	53.3	59.4
Summer unit pressure drop (kPa)	51	57	76	71	87
Winter unit pressure drop (kPa)	100	107	131	137	160
Additional Free Cooling weight (without water) (kg)	1081	1081	1081	1112	1112
Additional water content (without Evap) (L)	476	476	476	582	582
Free Cooling Glycol Free Option					
Total Free Cooling type					
Coils quantity #	24	24	24	24	24
Summer nominal water flow (L/s)	34.3	36.2	41.9	53.3	59.4
Summer & Winter unit pressure drop (kPa)	45	50	67	72	89
Glycol Pump Max Power input (kW)	22	22	22	22	22
Glycol Pump Max Amps @ 110 V (A)	38	38	38	38	38
Freeze protection - Max Power input kW	1.8	1.8	1.8	2.04	2.04
Freeze protection - Max Amps A	4.5	4.5	4.5	5.1	5.1
Additional Free Cooling weight (without water) (kg)	2595	2595	2595	3013	3013
Additional water content (without Evap) (L)	245	245	245	311	311
Glycol content (L)	888	888	888	1045	1045
Partial Free Cooling type					
Coils quantity #	10	10	10	12	12
Summer nominal water flow (L/s)	34.3	36.2	41.9	53.3	59.4
Summer & Winter unit pressure drop (kPa)	41	45	60	61	76
Glycol Pump Max Power input (kW) (kW)	11	11	11	11	11
Glycol Pump Max Amps @ 110 V (A)	20.5	20.5	20.5	20.5	20.5
Freeze protection - Max Power input kW	1.32	1.32	1.32	1.44	1.44
Freeze protection - Max Amps A	3.3	3.3	3.3	3.6	3.6
Additional Free Cooling weight (without water) (kg)	1547	1547	1547	1803	1803
Additional water content (without Evap) (L)	132	132	132	182	182
Glycol content (L)	556	556	556	589	589

(1) X-LN/XP-LN/XPG-LN/X-NNSB/XPG-NNSB

(2) X-LN/XP-XLN/XPG-XLN

Optional Free-Cooling

Table 6 – Free Cooling – General Data GVAF 125 - 350 - Extra Efficiency XPG (HFO) R1234ze Low Noise and Extra Low Noise

	GVAF XP-G 125	GVAF XP-G 145	GVAF XP-G 155	GVAF XP-G 175	GVAF XP-G 190	GVAF XP-G 205	GVAF XP-G 245	GVAF XP-G 250	GVAF XP-G 280	GVAF XP-G 310	GVAF XP-G 350
Heat-Exchanger Type	Aluminum heat exchanger										
Fan type (1)	EC	EC	EC	EC	EC	EC	EC	EC	EC	EC	EC
Power per Motor (kW)	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47	1.47
Motor RPM (rpm)	910	910	910	910	910	910	910	910	910	910	910
Fan type (2)	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN	ECXLN
Power per Motor (kW)	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21	1.21
Motor RPM (rpm)	860	860	860	860	860	860	860	860	860	860	860
Input water connection size (Grooved coupling) (in) - DN	6" - 150									8" - 200	
Output water connection size (Grooved coupling) (in) - DN	6" - 150									8" - 200	
Direct Free Cooling Option											
Total Free Cooling type											
Coils quantity	13	13	13	13	20	20	20	20	24	24	24
Summer nominal water flow (L/s)	21.6	25.6	27.6	30.7	33.0	36.1	41.9	45.9	47.7	53.5	59.3
Summer unit pressure drop (kPa)	42	59	69	85	47	56	76	91	56	71	87
Winter unit pressure drop (kPa)	96	120	133	154	108	122	150	172	115	134	154
Free Cooling weight (kg)	869	869	869	869	1596	1596	1596	1596	1760	1760	1760
Additional water content (without Evap) (L)	338	338	338	338	787	787	787	787	956	956	956
Partial Free Cooling type											
Coils quantity #	6	6	6	6	10	10	10	10	12	12	12
Summer nominal water flow (L/s)	21.6	25.6	27.6	30.7	33.0	36.1	41.9	45.9	47.7	53.5	59.3
Summer unit pressure drop (kPa)	42	59	69	85	47	56	76	91	56	71	87
Winter unit pressure drop (kPa)	96	119	131	151	95	107	131	148	118	138	155
Additional Free Cooling weight (without water) (kg)	577	577	577	577	1081	1081	1081	1081	1112	1112	1112
Additional water content (without Evap) (L)	218	218	218	218	476	476	476	476	582	582	582
Free Cooling Glycol Free Option											
Total Free Cooling type											
Coils quantity #	13	13	13	13	20	20	20	20	24	24	24
Summer nominal water flow (L/s)	21.6	25.6	27.6	30.7	33.0	36.1	41.9	45.9	47.7	53.5	59.3
Summer & Winter unit pressure drop (kPa)	37	51	60	74	42	50	67	80	58	72	89
Glycol Pump Max Power input (kW)	11	11	11	11	22	22	22	22	22	22	22
Glycol Pump Max Amps @ 110 V (A)	20.5	20.5	20.5	20.5	38	38	38	38	38	38	38
Freeze protection - Max Power input kW	1.02	1.02	1.02	1.02	1.8	1.8	1.8	1.8	2.04	2.04	2.04
Freeze protection - Max Amps A	2.55	2.55	2.55	2.55	4.5	4.5	4.5	4.5	5.1	5.1	5.1
Additional Free Cooling weight (without water) (kg)	1561	1561	1561	1561	2595	2595	2595	2595	3013	3013	3013
Additional water content (without Evap) (L)	126	126	126	126	245	245	245	245	311	311	311
Glycol content (L)	396	396	396	396	888	888	888	888	1045	1045	1045
Partial Free Cooling type											
Coils quantity #	6	6	6	6	10	10	10	10	12	12	12
Summer nominal water flow (L/s)	21.6	25.6	27.6	30.7	33.0	36.1	41.9	45.9	47.7	53.5	59.3
Summer & Winter unit pressure drop (kPa)	29	41	48	59	38	45	60	72	49	62	76
Glycol Pump Max Power input (kW) (kW)	5.5	5.5	5.5	5.5	11	11	11	11	11	11	11
Glycol Pump Max Amps @ 110 V (A)	10.2	10.2	10.2	10.2	20.5	20.5	20.5	20.5	20.5	20.5	20.5
Freeze protection - Max Power input kW	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72	0.72
Freeze protection - Max Amps A	1.8	1.8	1.8	1.8	3.3	3.3	3.3	3.3	3.3	3.6	3.6
Additional Free Cooling weight (without water) (kg)	1019	1019	1019	1019	1457	1457	1457	1457	1457	1736	1736
Additional water content (without Evap) (L)	126	126	126	126	132	132	132	132	132	182	182
Glycol content (L)	396	396	396	396	556	556	556	556	556	589	589

(1) X-LN/XP-LN/XPG-LN/X-NNSB/XPG-NNSB

(2) X-LN/XP-XLN/XPG-XLN

Chiller integrated free-cooling operation mode

The power of chiller integrated free-cooling relies on the chiller control to maximize the use of free-cooling when outdoor temperatures are favorable. The choice between compressor refrigeration and Free-Cooling refrigeration will be made and activated depending on three temperature measurements:

- The ambient air temperature
- The evaporator entering and leaving temperature
- The chilled water set point

Free-cooling coils are fit in series with the evaporator, and a set of water regulation valves allows the coils to be by-passed when they are no longer needed due to outdoor temperatures which are favorable for free-cooling.

Three operating modes can be differentiated:

1. Summer operation or Compressor refrigeration mode

In this operation mode, ambient temperature is higher than the temperature of the fluid entering the evaporator. Free-cooling is not activated, compressors are running, and control is done in function of the fan/compressor logic of operation.

2. Mid-season operation or combined refrigeration + Free-cooling mode

In this operation mode, free-cooling will be enabled whenever the outdoor temperature is below the evaporator entering water temperature. The operating logic is described below. The free-cooling system operates combined with the mechanical compressor refrigeration. Most of the time, free-cooling will only partially cover the required cooling duty. In other words, mechanical refrigeration will complete what has already been delivered by free-cooling.

3. Winter operation or Full free-cooling mode

Below a certain ambient temperature, and depending on the chilled water set point requested, the entire cooling duty is delivered by the free-cooling system. Compressors do not operate, since the free-cooling coils will be able to deliver the requested chilled water temperature. The regulation of the capacity is described in the next section. In this mode, only fans are running.

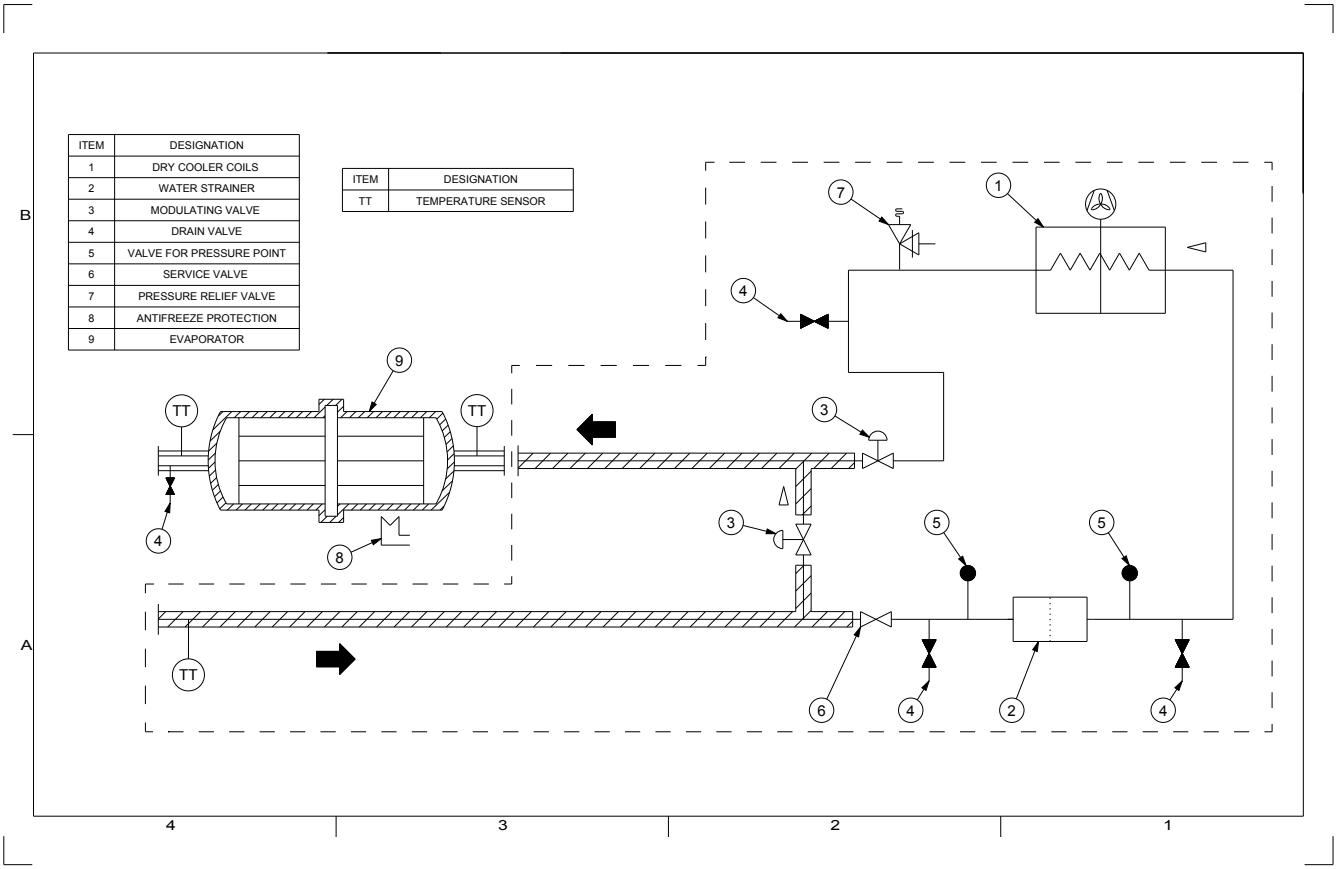
General information

The chiller integrated free-cooling system fluid based consist in a set of “Macro-channels” or “Radiators” coils, fit in the same frame than the MCHE condenser coils of the chiller refrigerant circuit. Free-cooling coils will be full aluminum, flat radiator design type, with low air pressure drop to avoid fan performances degradation.

Free-cooling coils are fit in series with the evaporator, and a set of water regulation valves ensures the system to reach the required free-cooling capacity.

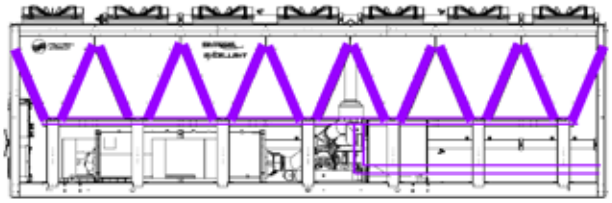
Optional Free-Cooling

Figure 10 – Flow chart – Free-Cooling – Direct free cooling version

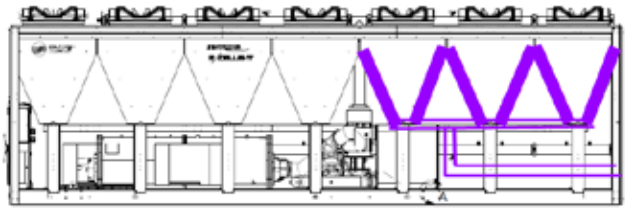


Note: glycol free cooling chilled water setpoint should be in the range of [4°C - 20° C]. Water & Glycol mixture is filled on the free cooling coils on valve item 4 (3/4").

Figure 11 – Total and Partial Free-Cooling option



a. Total Free Cooling, Direct free cooling version



b. Partial Free Cooling, Direct free cooling version

If there is a need to get a definition for partial heat recovery coil distribution, please contact the Trane Sales office.

Free-Cooling Enabling Conditions

To get the free cooling active, condition is to have unit in active cooling mode and that Outdoor temperature low enough according to figure below.

The free cooling function is enabled when outdoor air temperature is below Active chilled water cooling set point minus FC_offset.

A hysteresis should also apply to avoid short cycling of Free Cooling enabling logic. The Free Cooling offset is an adjustable parameter to make free cooling active.

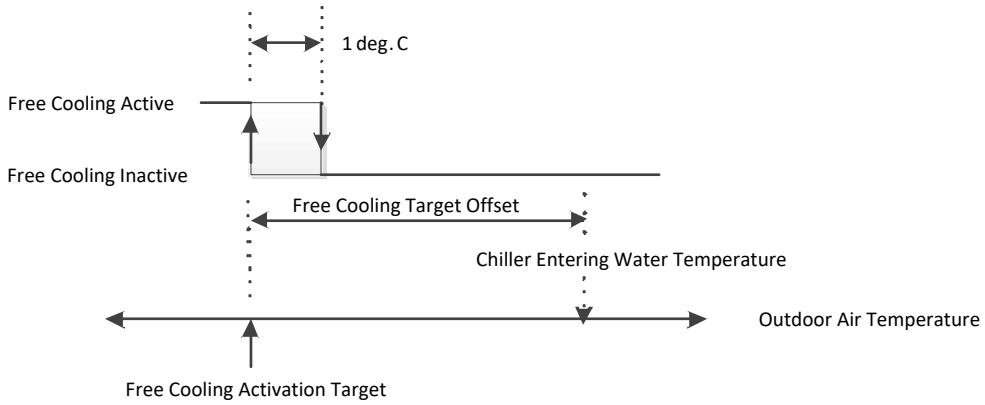
If free cooling function is enabled, free cooling becomes the 1st stage of cooling. Free cooling is the first stage to engage for cooling capacity loading and the last stage to consider in capacity unloading.

In order to maximize tandem operation of free cooling with compressor the following logic is applied:

When unit is configured in "Partial free cooling", when free cooling reaches its full capacity and there is a call for compressor start, then the first circuit to start shall be circuit 2 (if available). This also means compressor balancing function is disabled in these conditions.

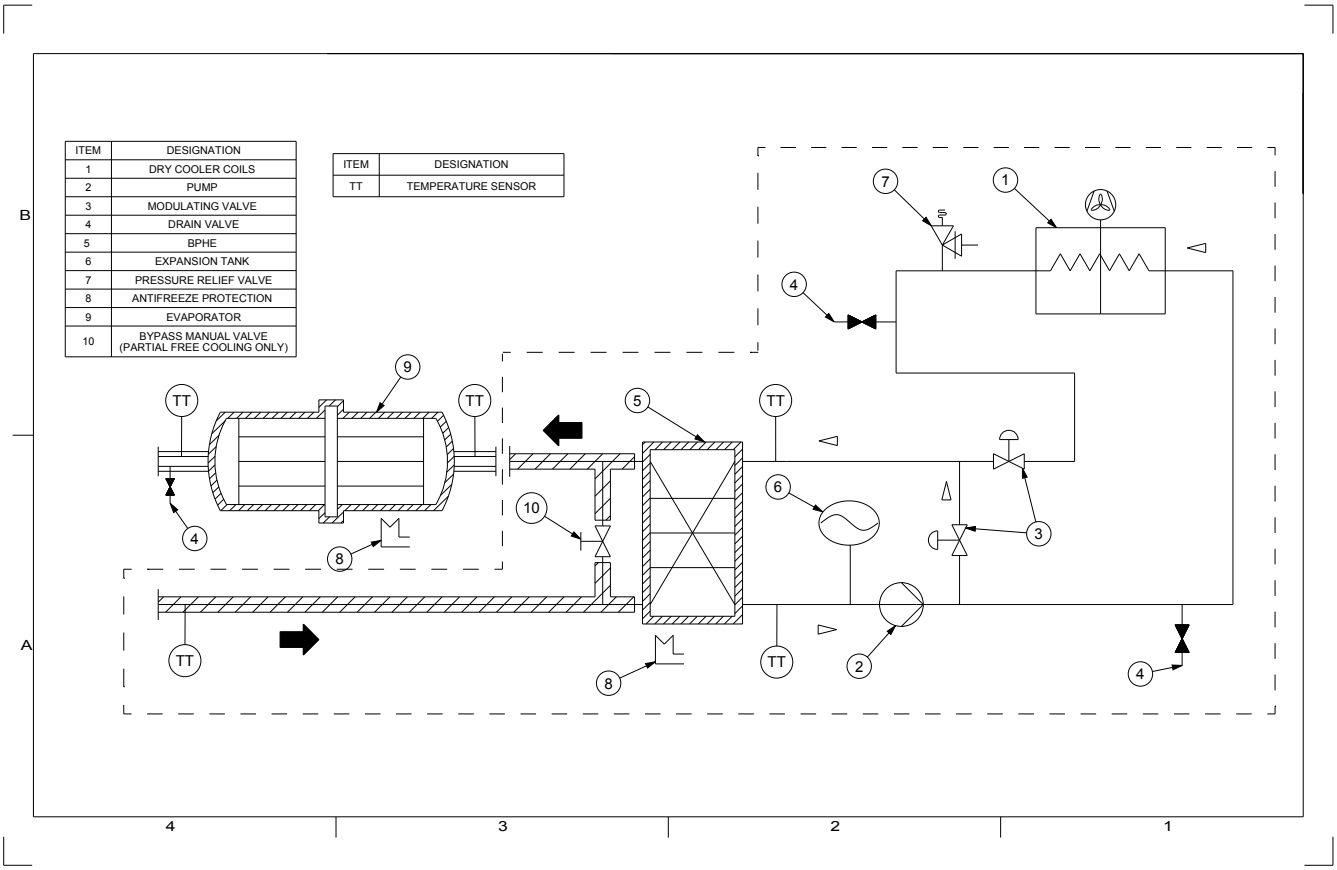
Note: UC800 will not lockout compressor below free cooling change over point, but the compressor is locked out when outdoor air is below "low ambient limit" set at -10°C. So FC will be the only source of cooling below -10°C.

Figure 12 – Free-cooling enabling conditions



Optional Free-Cooling

Figure 13 – Flow chart - Free cooling - Glycol free version



Note: *glycol free cooling chilled water setpoint should be in the range of [4°C - 20° C]. Glycol is filled on the free cooling coils on valve item 4 (3/4").*

Note for installation

All Submittal, lifting diagram, neoprene pads positioning and wiring diagrams have been supplied with chiller order.

The maximum pressure of the Glycol side when unit is equipped with free cooling is 400 kPa for Glycol free option or 600kPa for Direct free cooling except on evaporator side for glycol free 1000 kPa Refer to unit nameplate for rated value.

Pump operation with Glycol free : it is requested to have a minimum water side pressure of 250 kPa to avoid cavitation.

Glycol free option : To avoid component damage, a filter (1 mm mesh) must be supplied by the customer and installed at the unit inlet.

Unit is shipped without glycol content on the free cooling circuit.

Free cooling loop venting must be performed by using Manual override mode to run the free cooling pump and opening free cooling and closing bypass valve.

At 10 to 20°C ambient, the expansion shall be pressurized at 250 kpa. It should be checked when glycol loop is not yet filled or glycol pressure is near zero.

All Free-cooling units must be freeze-protected with at least 30% Ethylene Glycol in the cooling loop circuit which is the most convenient percentage in order to protect the unit against freezing. Upon receipt, make sure that there is no remaining test water in the free cooling circuit as it may freeze during winter periods.

Protection coverage with 30% Ethylene Glycol:

- Freezing point without burst effect = -13°C

- Freezing point with burst effect = -50°C.

Water can be trapped in BPHE and specific care must be taken to remove it completly from BPHE during off mode if drainage is the winter protection chosen.

The free cooling option circuit consists of copper, carbon steel, cast iron, zinc, synthetic rubber, brass, and Aluminum AA3102, AA3003, AA4045 in addition to other materials that may be in the building loop connected to the chiller. The inhibited glycol solution should be selected at desired concentration to ensure adequate inhibitor content. It is not advised to dilute a stronger concentrate due to inhibitor dilution. Glycol fluid should be free from foreign solid particles. A maintenance schedule should be selected per the glycol manufacturer's requirements to insure adequate protection during product usage.

Notice: Equipment Damage!

Failure to follow instructions below could cause equipment damage.
DO NOT USE UNTREATED WATER. Glycol solution must be utilised with the Direct Free Cooling option. Glycol percentage should be based on freeze avoidance requirements. The glycol solution requires an inhibitor package to be carefully chosen with the aid of a qualified water treatment specialist to abate corrosion in a mixed metal system.
The building glycol loop should not be vented to atmosphere. A closed system is required to limit oxidation potential within the loop.
Make-up water should be avoided.

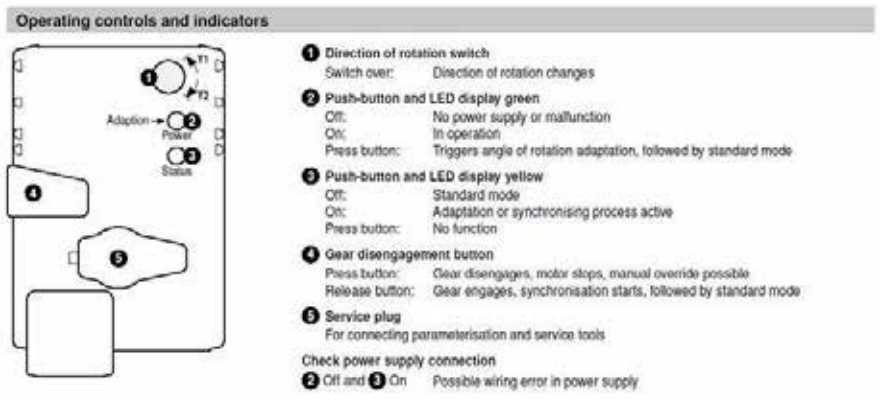
Free cooler by-pass valve adjustment

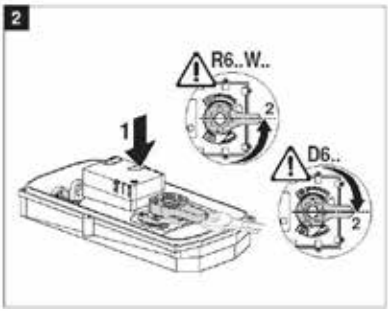
For intervention on free cooler by-pass valve it is recommended to consult the valve service literature.

For every new referencing of the motor end travel, an adaptation of the motor should be done by pushing button 2.

To change the bypass percentage follows below procedure:

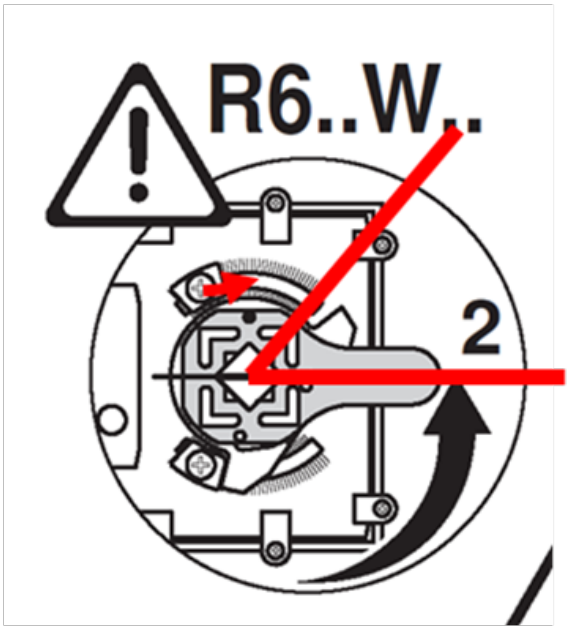
- No tuning is needed on free cooling valve which always stays on full opening/closure.
- For bypass valve Belimo, minimum opening can be adjusted by pushing the release button (4) and by turning handle 5 to 50% opening for instance (45°)





Optional Free-Cooling

With a Phillips screwdriver, move the end of travel. Fix it to always keep an opening between 100% and the minimum desired (50%) in example below.



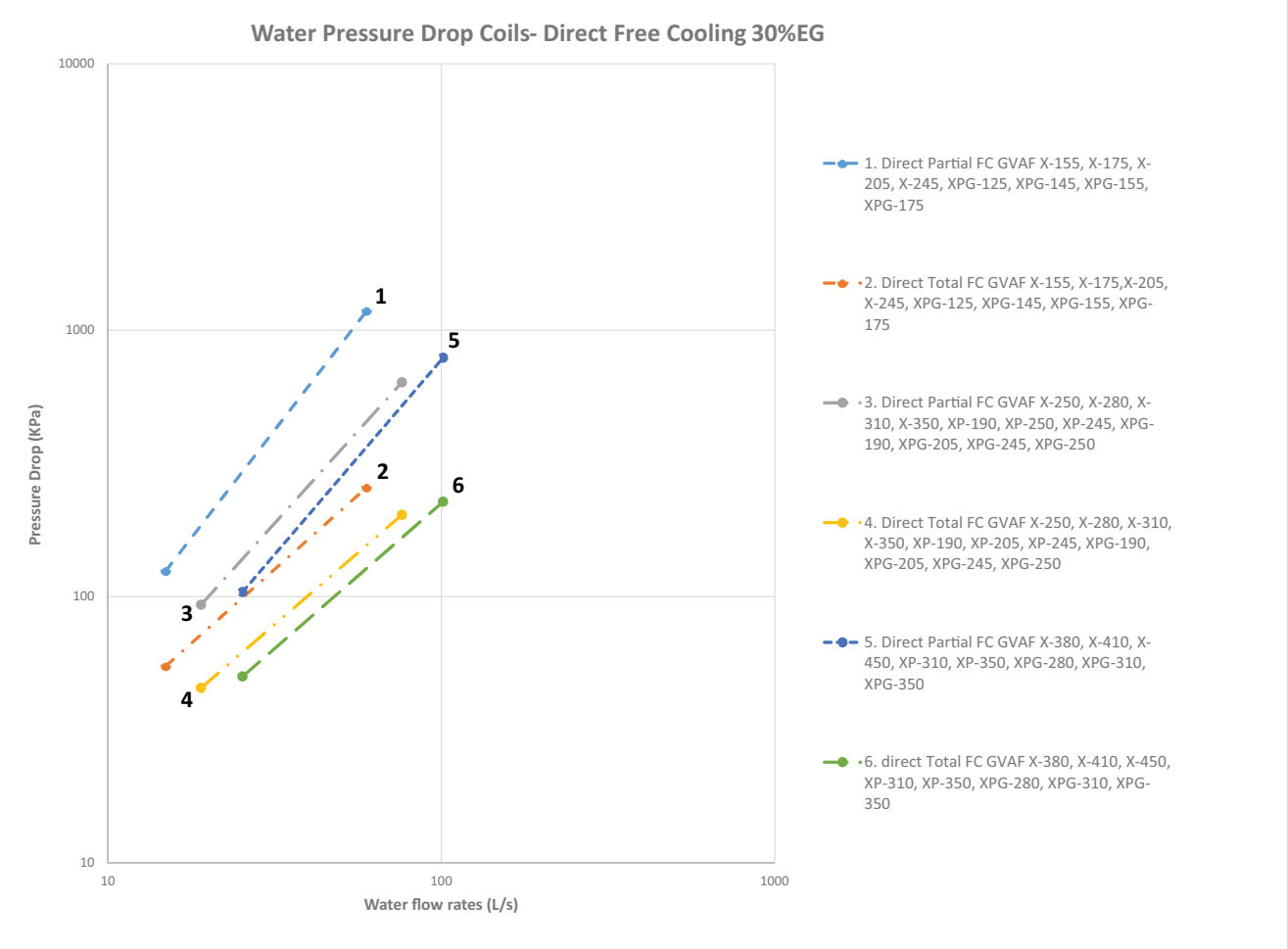
If the minimum opening is modified after the first powering, motor re-calibration is needed to validate the new operating range. When motor is powered, push green led button (2). Motor memorizes the new reference of end of travel position on its signal (2…10 VDC)

Note for maintenance : Check glycol circuit pressure before free cooling operation season starts. Run glycol pump few minutes in manual override during monthly maintenance operation when free cooling is continuously OFF to avoid possible glycol cristalization. Pump Override function is located in TD7 via Button Settings -> Manual Control Settings -> Free Cooling Pump Override.

Water Pressure Drops - Coils

The free cooling water pressure drops given in charts below (coil + valve) should be added to evaporator pressure drop to get full unit pressure drop.

Figure 14 – Water Pressure drop coils - Total and Partial Direct Free cooling



Optional Free-Cooling

Figure 15 – Water Pressure drop coils - Total and Partial Free Cooling - Glycol free

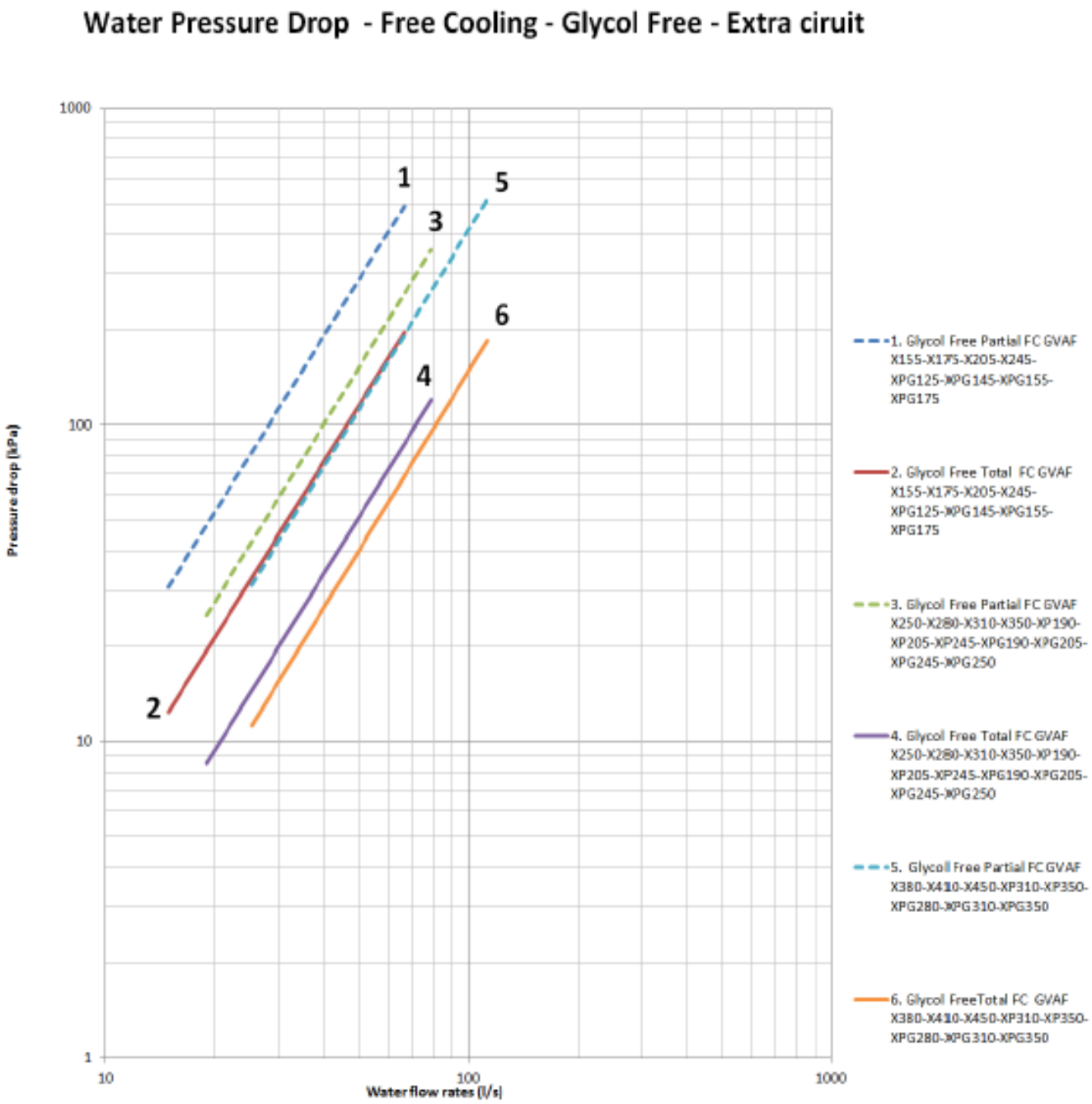
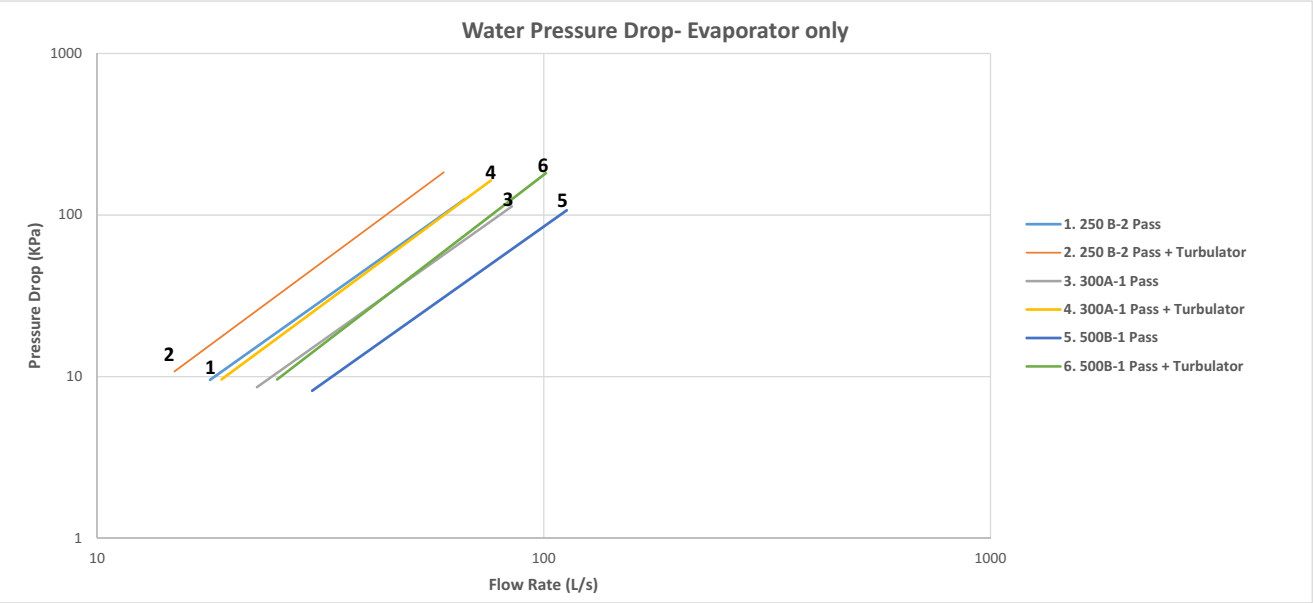


Figure 16 – Evaporator water pressure drop



Evaporator Waterside

Freeze Protection

Depending on the ambient temperature the unit may be exposed to freeze, there are multiple options for freeze protection. They are listed in order of highest ambient (least freeze protection) to the lowest ambient (most freeze protection).

For all chiller running with water under cold ambient temperature (below 0°C), it is extremely important to keep full water flow in the evaporator for an extended time after last compressor stops. This will protect evaporator tube from freezing by refrigerant migration. This is why evaporator water pump output relay must be used to control the chilled water pump. This is not mandatory if glycol is used with protection down to lowest ambient expected.

1. Water pump and heaters

a. Heaters are factory installed on water boxes and evaporator shell. They will protect it from freezing in ambient temperatures down to -20°C. Heaters are installed on the water piping and on the pumps of units equipped with hydraulic module.
b. Install heat tape on all water piping, pumps, and other components that may be damaged if exposed to freezing temperatures. Heat tape must be designed for low ambient temperature applications. Heat tape selection should be based on the lowest expected ambient temperature.
c. Tracer™ UC800 controller can start the pump(s) when freezing conditions are detected. For this option the pumps must be controlled by the GVAF unit and this function validated on the chiller controller.
d. Water circuit valves need to stay open at all times.

Note: *Water pump control and heater combination will protect the evaporator down to any ambient temperature provided power is available to the pump and the UC800 controller. This option will NOT protect the evaporator in the event of power failure to the chiller unless backup power is supplied to the necessary components.*

Note: *When no chiller operation is possible and the pump is already off, UC800 pump control function for freeze protection will command the pump to turn on:*

- *ON if the average of the evaporator entering water temperature, evaporator leaving temperature, and the evaporator refrigerant pool temperature is less than Low Evaporator Refrigerant Temperature Cutout (LERTC) + 2.2°C for a period of time*
- *OFF again if the evaporator refrigerant pool temperature rise above LERTC + 3.3°C for a period of time*

Note: *The period of time referenced for ON and OFF conditions above described is dependent on past running conditions and present temperature measured.*

- *ON if entering OR leaving water temperature < LWTC for 16.2°C-sec*
- *OFF again if water temperature > LWTC for 30 min*

OR

2. Freeze inhibitor

a. Freeze protection can be accomplished by adding sufficient glycol to protect against freezing down to the lowest ambient expected.
b. See “evaporator glycol requirement” section for guidance on determining the glycol concentration.

Note: *Use of glycol type antifreeze reduces the cooling capacity of the unit and must be considered in the design of the system specifications.*

OR

3. Drain water circuit

For ambient temperatures below -20°C and for those installation not including either option 1 or 2 above described
a. Shut off power supply to unit and to all heaters.
b. Purge the water circuit
c. Blow out the evaporator to ensure that no liquid is left inside the evaporator and the water lines. Drain the pump.

CAUTION! Evaporator damage!
If insufficient concentration or no glycol is used, the evaporator water pumps must be controlled by the UC800 to avoid severe damage to the evaporator due to freezing. A power loss of 15 minutes during freezing can damage the evaporator. It is the responsibility of the installing contractor and/or the customer to ensure that a pump will start when called upon by the chiller controls.
Please consult the table named “Recommended Low Evaporator Refrigerant Cutout (LRTC) and % Glycol for GVAF chillers”.
With factory-fitted disconnect switch option, evaporator trace heating is taken from the live side of the isolator. As a consequence, the heaters are energized as long as the main switch is closed. Supply voltage to the heating tapes is 400V.

The warranty will be void, in case of freezing due to the lack of use of either of these protections.

Low Refrigerant Cutout - LRTC

The minimum leaving water temperature cutout is set at 2.2°C and the Low Refrigerant Temperature cutout is set at 0°C.
CAUTION!
1. Additional glycol beyond the recommendations will adversely affect unit performance. The unit efficiency will be reduced and the saturated evaporator temperature will be reduced. For some operating conditions this effect can be significant.
2. If additional glycol is used, then use the actual % glycol to establish the low refrigerant cutout set point.
3. With glycol application, ensure that there is no fluctuation of brine flow versus Order Write Up value, as a reduction of flow will adversely affect unit performance and behaviour.

General Electrical Recommendations

Electrical Parts

When reviewing this manual keep in mind.

- All field-installed wiring must be in accordance with local regulations, CE directives and guidelines. Be sure to satisfy proper equipment grounding requirements according CE
- The following standardized values - Maximum Amps - Short Circuit Amps - Starting Amps are displayed on unit nameplate.
- All field-installed wiring must be checked for proper terminations, and for possible shorts or grounds.

Note: *always refer to wiring diagrams shipped with chiller or unit submittal for specific electrical schematic and connection information.*
Important: *to prevent control malfunctions, do not run low voltage wiring (<30V) in conduit with conductors carrying more than 30 volts.*

WARNING! Hazardous Voltage with Capacitor!
Disconnect all electric power, including remote disconnects and discharge all motor start/run and AFD (Adaptive Frequency™ Drive) capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power cannot be inadvertently energized.

- For variable frequency drives or other energy storing components provided by Trane or others, refer to the appropriate manufacturer's literature for allowable waiting periods for discharges capacitors. Verify with an appropriate voltmeter that all capacitors have discharged
- DC bus capacitors retain hazardous voltages after input power has been disconnected. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized

After disconnecting input power, wait five (5) minutes for units which are equipped with EC fans and wait twenty (20) minutes for units which are equipped with variable frequency drive (0V DC) before touching any internal components.

Failure to follow these instructions could result death or serious injury

For additional information regarding the safe discharge of capacitors, see "Adaptive Frequency™ Drive (AFD3) Capacitor Discharge" and BAS-SVX19B-E4.

Hazardous Voltage – Pressurized Burning Fluid!
Before removing compressor cover for servicing, or servicing power side of control panel, CLOSE COMPRESSOR DISCHARGE SERVICE VALVE and disconnect all electric power including remote disconnects. Discharge all motor start/run capacitors. Follow lockout/tagout procedures to ensure the power cannot be inadvertently energized. Verify with an appropriate voltmeter that all capacitors have discharged.

The compressor contains hot, pressurized refrigerant. Motor terminals act as a seal against this refrigerant.

Note: prior to servicing the centrifugal compressor, please read carefully the service documents for this compressor that are shipped with the unit.

Do not operate compressor without box cover in place.

Failure to follow all electrical safety precautions could result in death or seriously injure.

CAUTION! To avoid corrosion, overheating or general damage, at terminal connections, unit is designed for copper mono-conductors only. In case of multiconductor cable, an intermediate connection box must be added. For cable with alternative material, bi-material connecting devices are mandatory. Cable routing inside control panel should be made case by case by installer. Do not allow conduit to interfere with other components, structural members or equipment. Control voltage (115V) wiring in conduit must be separate from conduit carrying low voltage (<30V) wiring. To prevent control malfunctions, do not run low voltage wiring (<30V) in conduit with conductors carrying more than 30V.

WARNING!
The Warning Label shown in Figure 19 is displayed on the equipment and shown on wiring diagrams and schematics. Strict adherence to these warnings must be observed. Failure to do so may result in personal injury or death.
CAUTION! Units must not be linked to the neutral wiring of the installation. Units are compatible with the following neutral operating conditions:

TNS	IT	TNC	TT
Standard	Special	Special	Standard*

* Differential protection should be suited for industrial machinery with current leak which can be higher than 500 mA (several motors and frequency drives).

General Electrical Recommendations

Electrical data

To get the following electrical data details: Refer to General Data tables for each unit configuration and size.

- Maximum Power input (kW)
- Unit rated amps (Max compr +Fan+Control)
- Unit start up amps (Starting Amps of the largest compr+RLA of 2nd compr+RLA of all fans+ control)
- Compressor Power factor
- Disconnect switch size (A)
- Short Circuit Rating for all sizes =35 kA

For the control of every unit

- Max power input is 1.4 kW
- Max Amps is 3.4 A

Fan data

- Motor AC : I max=4.0 A - P max=1.85 kW
- Motor EC : I max=3.0 A - P max=1.95 kW

Wiring diagrams are shipped with unit and can be found in the unit control panel.

Note : Rating is made for 400 V, 3 phases, 50 Hz power supply.

Circuit labelling

Circuit labelling is done according to the below diagrams

Figure 17 – 2 compressors unit

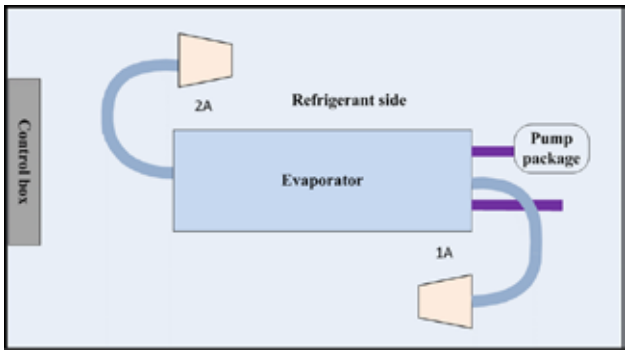


Figure 18 – 3 compressors unit

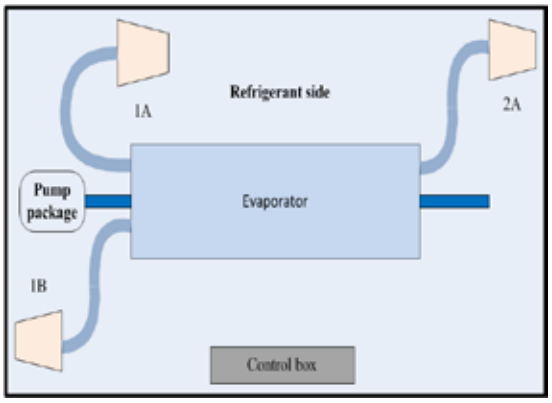
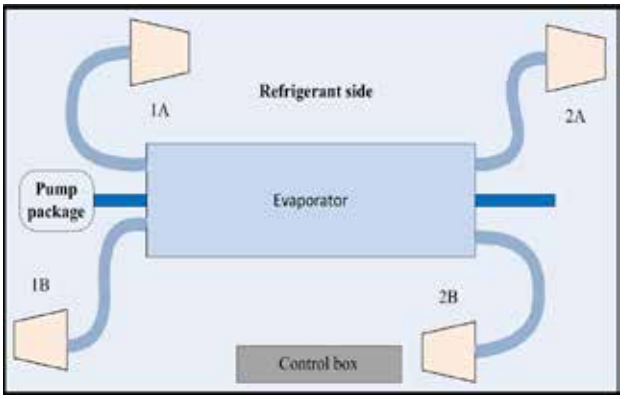


Figure 19 – 4 compressors unit



Installer-Supplied Components

Customer wiring interface connections are shown in the electrical schematics and connection diagrams that are shipped with the unit. The installer must provide the following components if not ordered with the unit:

- Power supply wiring (in conduit) for all field-wired connections
- All control (interconnecting) wiring (in conduit) for field supplied devices
- Fused-disconnect switches

Power Supply Wiring

All power supply wiring must be sized and selected accordingly by the project engineer in accordance with standard IEC 60364. All wiring must comply with local codes. The installing (or electrical) contractor must provide and install the system interconnecting wiring, as well as-the power supply wiring. It must be properly sized and equipped with the appropriate fuse-disconnect switches. The type and installation location(s) of the fused-disconnect switches must comply with all applicable codes.

Cut holes into the sides of the control panel for the appropriately-sized power wiring conduits. The wiring is passed through these conduits and connected to the terminal blocks.

To provide proper phasing of 3 phase input, make connections as shown in field wiring diagrams and as stated on the yellow WARNING label in the starter panel. Proper equipment grounds must be provided to each ground connection in the panel

CAUTION! Customer wiring interface connections are shown in the electrical schematics and connection diagrams that are shipped with the unit. The installer must provide the following components if not ordered with the unit.

WARNING! To prevent injury or death, disconnect all electrical power sources before completing wiring connections to the unit.

CAUTION! The use of copper mono-conductors is the preferred solution to avoid corrosion and overheating at terminal connections.

Control Power Supply

Chiller is provided with control power transformer, it is not necessary to provide additional control power voltage to the unit.

Heater Power Supply

The evaporator shell is insulated from ambient air and protected from freezing for temperature down to -20°C by two thermostatically-controlled immersion heaters combined with evaporator pumps activation through Tracer UC800. Whenever the ambient temperature drops below 0°C the thermostat energizes the heaters and the Tracer UC800 activates the pumps. If ambient temperatures below -20°C are expected, contact your Trane local office.

CAUTION! The control panel main processor does not check for loss of power to the heat tape nor does it verify thermostat operation. A qualified technician must frequently verify power to the heat tape and confirm operation of the heat tape thermostat, to avoid catastrophic damage to the evaporator.

CAUTION! With factory-fitted disconnect switch, trace heating is taken from the live side of the isolator so power remains on. Supply voltage to the heating tapes is 400V. In case of winter water drainage for freeze protection, it is compulsory to disconnect the evaporator heaters to protect them from burning due to overheat.

Water Pump Power Supply

Provide power-supply wiring with fused disconnect switch(es) for the chilled water pump(s).

Interconnecting Wiring

Chilled-Water Flow (Pump) Interlock

GVAF requires a field-supplied, control-voltage contact input through a flow proving switch (6S51) and an auxiliary contact (6K51). Connect the proving switch and auxiliary contact to terminal 2 connector J2 cards (1A14). Refer to the field wiring diagram for details.

Chilled-Water Pump Control

An evaporator water-pump output relay closes when the chiller is given a signal to go into the AUTO mode of operation from any source. The contact is opened to turn off the pump in the event of most machine-level diagnostics, to prevent the buildup of pump heat.

CAUTION! The evaporator water pump output relay must be used to control the chilled water pump and to benefit from the water pump timer function at startup and shutdown of the chiller. This is required when the chiller is in operation under freezing conditions, especially if the chilled water loop does not contain glycol.

CAUTION! Refer to Freeze Protection section for information about the evaporator circulating pump.

Installer-Supplied Components

The relay output from (1A11) is required to operate the evaporator water-pump (CHWP) contactor. Contacts should be compatible with a 115/230V (ac) control circuit. The CHWP relay operates in different modes depending on Tracer UC800 or Tracer BMS commands, if available, or service pumpdown (see maintenance section). Normally, the CHWP relay follows the AUTO mode of the chiller. Whenever the chiller has no diagnostics and is in the AUTO mode, regardless of where the auto command is coming from, the normally-open relay is energized. When the chiller exits the AUTO mode, the relay is timed open for an adjustable (using TU) 0 to 30 minutes. The non-AUTO modes in which the pump is stopped include Reset (88), Stop (00), External Stop (100), Remote Display Stop (600), Stopped by Tracer (300), Low-Ambient Run Inhibit (200), and Ice Building complete (101).

Table 7 – Pump Relay Operations

Chiller mode	Relay Operation
Auto	Instant close
Ice building	Instant close
Tracer Override	Timed Open
Stop	Timed Open
Ice Complete	Instant Open
Diagnostics	Instant Open*

- Exceptions noted in paragraphs following

When going from STOP to AUTO the CHWP relay is energized immediately. If evaporator water flow is not established in 4 minutes and 15 seconds, the Tracer UC800 de-energizes the CHWP relay and generates a non-latching diagnostic. If flow returns (i.e. other system controlling the pump), the diagnostic is cleared, the CHWP is re-energized, and normal control is resumed.

If evaporator water flow is lost after it has been established, the CHWP relay remains energized, the CHWP relay remains energized and a non-latching diagnostic is generated. If flow returns, the diagnostic is cleared and the chiller returns to normal operation.

In general, when there is either a non-latching or latching diagnostic, the CHWP relay is turned off as though there was a zero-time delay. Exceptions where the relay continues to be energized occur with:

1. A low Chilled-Water Temperature diagnostic (non-latching) (unless also accompanied by an Evaporator Leaving-Water Temperature Sensor Diagnostic)

   OR

2. A starter-contactor interrupt-failure diagnostic, in which a compressor continues to draw current even after commanded to shut down.

   OR

3. A Loss of Evaporator Water Flow diagnostic (non-latching) and the unit in the AUTO mode, after initially having proven evaporator water flow.

Alarm and Status Relay Outputs (Programmable Relays)

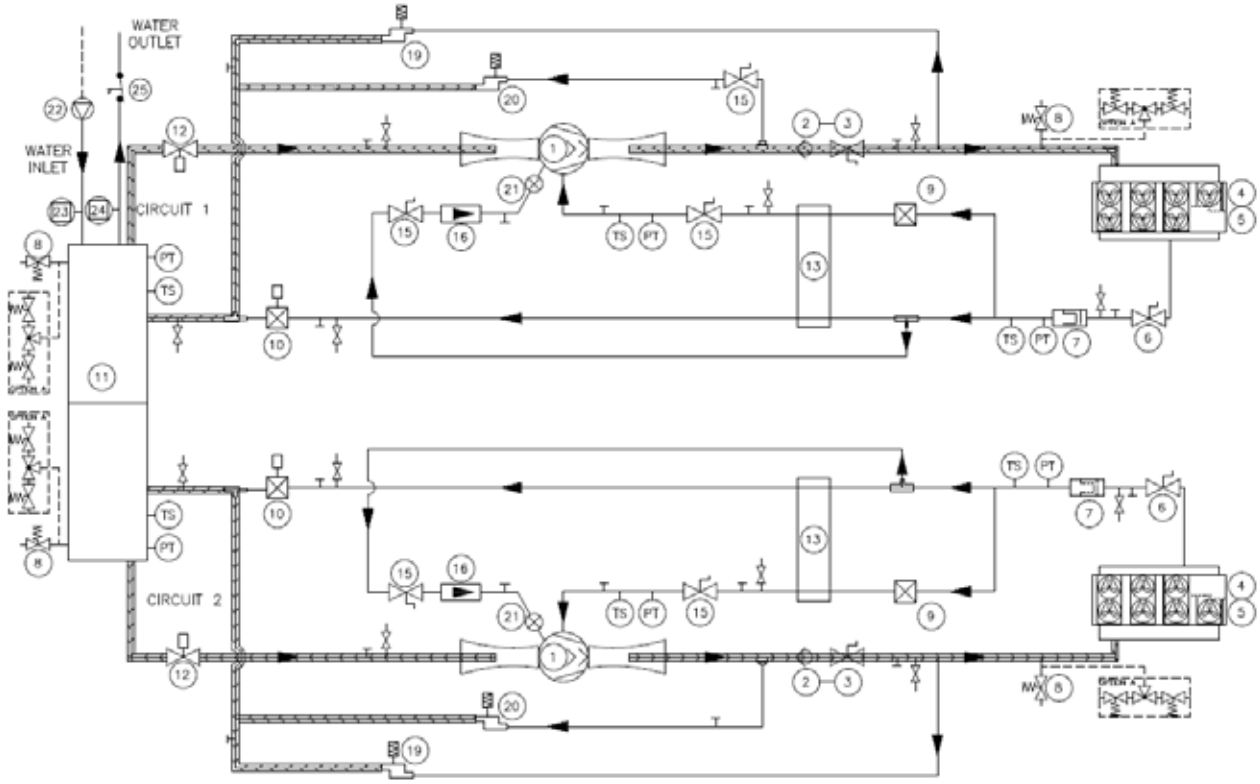
See GVAF **User Guide** for alarm and status relay outputs.

EDLS and ECWS Analog Input Signal Wiring Details

See GVAF **User Guide** for EDLS and ECWS.

This section describes the overall flow chart principle for GVAF. Detailed information for a given order is supplied with order package documentation.

Figure 20 – Example of Typical Refrigerant System Schematic - 2 compressors unit



ITEM	DESIGNATION
1	CENTRIFUGAL COMPRESSOR
2	CHECK VALVE
3	SERVICE VALVE
4	AIR COOLED CONDENSER
5	CONDENSER FAN
6	MANUAL SERVICE VALVE
7	FILTER DRIER
8	SAFETY VALVE
9	EXPANSION VALVE
10	ELECTRIC EXPANSION VALVE
11	EVAPORATOR
12	MOTORIZED SUCTION SERVICE VALVE

ITEM	DESIGNATION
13	ECONOMIZER
15	MANUAL SERVICE VALVE
16	FILTER DRIER
18	ECONOMIZER SHUT OFF VALVE
19	LOAD BALANCING VALVE
20	STAGING VALVE
21	SIGHT GLASS
22	PUMP
23	EWTS
24	LWTS
25	FLOW SWITCH

ITEM	DESIGNATION
PT	PRESSURE TRANSDUCER
TS	TEMPERATURE SENSOR

OPTION A: DUAL SAFETY VALVE

	INSULATION

Operating Principles

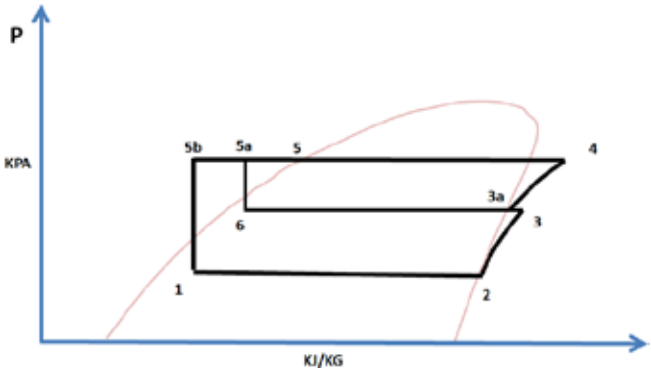
Refrigerant Circuit

Each GVAF unit has two refrigerant circuits, with one or two centrifugal compressor per circuit. Each refrigerant circuit includes a compressor suction and discharge service valve, liquid line shutoff valve, removable core filter, liquid line sight glass with moisture indicator, charging port and electronic expansion valve. Fully modulating compressors and electronic expansion valve provide variable capacity modulation over the entire operating range.

Refrigerant Cycle

Typical refrigerant cycle on the GVAF is represented on the pressure enthalpy diagram shown in the figure below. Key state points are indicated on the figure. The cycle for the full load design point is represented in the plot.

Figure 21 – Pressure enthalpy (P-h) diagram



The GVAF chiller uses a shell and tube evaporator design with refrigerant evaporating on the shell side and water flowing inside tubes having enhanced surfaces (state 1 to 2). The vaporized refrigerant flows into the compressor first stage through compressor inlet guide valves. The first stage impeller accelerates the vapor increasing its temperature and pressure to intermediate state 3. Refrigerant vapor leaving the first stage compressor is mixed with cooler refrigerant vapor from the economizer (BPHE). This mixing lowers the enthalpy of the vapor entering the second stage to stage 3a. The second stage impeller accelerates the vapor, further increasing its temperature and pressure to state point 4. De-superheating, condensing and sub-cooling are accomplished in a micro channel condenser (state 5 and 5a). Liquid refrigerant either leaves the micro channel condenser at point 5a and a part of it flows to the Expansion valve and enters BPHE economizer at point 6 while the major part flows to BPHE economizer acting as an additive subcooler. Refrigerant is cooled down to state 5c and the flow vaporized goes to the compressor economizer port at state 3. The major part of the liquid flow goes through the expansion valve and return to the evaporator at state 1.

Refrigerant

GVAF use R134a / R513A or R1234ze(E), Trane believes that responsible refrigerant practices are important to the environment, our customers, and the air conditioning industry. All technicians who handle refrigerants must be properly qualified. All local and EU regulations in which R134a / R513A / R1234ze(E) are specified as medium pressure refrigerant must be observed. Handling, reclaiming, recovering and recycling instructions must be followed. R1234ze(E) requires specific care and dedicated refrigerant hoses and recovery system have to be used.

Compressor

The centrifugal oil free compressor with frictionless magnetic bearings is a semi hermetic design with twin impellers. It has a 3 phase AC voltage input with built in service inverter for motor speed control.
Compressor control, motor control, motor cooling control and bearing control are handled by embedded electronics. Sensor rings check shaft position 8000 times per second and most of the work is done by permanent magnets while electromagnets are used to fine tune the shaft position within less than 10µm of correction.

Condenser and Fans

The air cooled Microchannel condenser coils use all aluminum brazed fin construction.
The coil is composed of three components: the flat microchannel tube, the fins located between the microchannel tubes, and two refrigerant manifolds. Coils can be cleaned with high pressure water (see Condenser Coils MCHE maintenance for instructions).
The condenser coil has an integral subcooling circuit. The maximum allowable working pressure of the condenser is 25.0 bars. Condensers are factory proof and leak tested at 45 bars.
Direct-drive vertical-discharge airfoil condenser fans are dynamically balanced.

Evaporator

The evaporator is a shell and tube heat exchanger design constructed from carbon steel shells and tube sheets with internally and externally finned seamless copper tubes mechanically expanded into the tube sheets. Tubes are cleanable with dismountable water boxes. Tubes diameter exterior is 19mm. Each tube is individually replaceable.
The evaporator is designed, tested and stamped in accordance with PED 97/23/EC or 2014/68/EU Pressure regulation for a refrigerant side working pressure of 14 bars.
Standard water connections are grooved for Victaulic style pipe couplings. Water boxes are available in 1 or 2 passes configurations according to unit size and include an air vent, a drain and fittings for temperature control sensors.
Evaporator is insulated with closed cell insulation.

Controls/Tracer TD7 Operator Interface

Controls Overview

Sintesis-Excellent GVAF units use the following control/ interface components:

- Tracer™ UC800 Controller
- Tracer TD7 Operator Interface

Communication Interfaces

There are four connections on the UC800 that support the communication interface. See GVAF User Guide to locate the following ports: “Wiring and Ports Description” section.

- BACnet MS/TP
- MODBUS Slave
- LonTalk using LCI-C (from the IPC3 bus)

See chiller User Guide for information on communication interface.

Tracer TD7 Operator Interface

Operator Interface

Information is tailored to operators, service technicians and owners. When operating a chiller, there is specific information you need on a day-to-day basis, like setpoints, limits, diagnostic information, and reports.

Day-to-day operational information is presented at the display. Logically organized groups of information-chiller mode of operation, active diagnostics, settings and reports put information conveniently at your fingertips.

Tracer™ TU

The TD7 operator interface allows for daily operation tasks and setpoint changes. However to adequately service Sintesis Excellent GVAF chillers, Tracer™ TU service tool is required (Non-Trane personnel, contact your local Trane office for software purchase information). Tracer TU adds a level of sophistication that improves service technician effectiveness and minimizes chiller downtime. This portable PC-based service-tool software supports service and maintenance tasks.

Pre-Start Checkout

Installation Checklist

Complete this checklist as the unit is installed, and verify that all recommended procedures are accomplished before the unit is started. This checklist does not replace the detailed instructions given in the "Installation Mechanical" and "Installation Electrical" sections of this manual. In addition, compressor details can be found in the compressor service documentation. Make sure to have this documentation prior to any intervention. Read all sections completely, to become familiar with the installation procedures, prior beginning the work.

General

When installation is complete, before starting the unit, the following prestart procedures must be reviewed and verified:

1. Inspect all wiring connections in the compressor power circuits (disconnects, terminal block, contactors, compressor junction box terminals and so forth) to ensure they are clean and tight.
2. Open all refrigerant valves in the discharge, liquid, and oil return lines.
3. Check the power-supply voltage to the unit at the main-power fused-disconnect switch. Voltage must be within the voltage use range and also stamped on the unit nameplate. Voltage fluctuation must not exceed 10%. Voltage imbalance must not exceed 2%
4. Check the unit power phasing L1-L2-L3 in the starter to ensure that it has been installed in a "A-B-C" phase sequence.
5. Grounding is essential for the safe operation of the unit : failure to do so may result in reliability failure
   1) Verify continuity of all ground connections.
   2) Ensure solid ground connections (both mechanical and electrical).
   3) At one point, usually the entrance of the power supply panel, all grounds should be connected together
   4) All electrical instruments must be rated to 1kVAC and 600VDC. This includes voltage leads and probes.
6. Fill the evaporator chilled-water circuit. Vent the system while it is being filled. Open the vents on the top of the evaporator water box while filling and close when filling is completed.
7. Close the fused-disconnect switch(es) that supplies power to the chilled-water pump starter.
8. Start the chilled-water pump to begin circulation of the water. Inspect all piping for leakage and make any necessary repairs.
9. With water circulating through the system, adjust the water flow and check the water pressure drop through the evaporator.
10. Adjust the chilled-water flow switch for proper operation.
11. Reapply power to complete the procedures
12. Prove all Interlock and Interconnecting Wiring Interlock and External as described in the Electrical Installation section.
13. Check and set, as required, all UC800TD7 menu items.
14. Stop the chilled-water pump.
15. Do not use recycled refrigerant as it may contain oil, which can affect system reliability. The refrigerant should be pure and stored in virgin containers
    - Hoses should be free of oil

Unit Voltage Power Supply

Unit voltage must meet the criteria given in the installation Electrical Section. Measure each lead of the supply voltage at the main power fused-disconnect switch for the unit. If the measured voltage on any lead is not within the specified range, notify the supplier of the power and correct the situation before operating the unit.

Unit Voltage Imbalance

Excessive voltage imbalance between the phases of a three-phase system can cause motors to overheat and eventually fail. The maximum allowable unbalance is 2%. Voltage imbalance is determined using the following calculations:

% Imbalance = [(Vx – Vave) x 100/Vave]

Vave = (V1 + V2 + V3)/3

Vx = phase with greatest difference from Vave (without regard to the sign)

Unit Voltage Phasing

It is important that proper rotation of the compressors be established before the unit is started. Proper motor rotation requires confirmation of the electrical phase sequence of the power supply. The motor is internally connected for clockwise rotation with the incoming power supply phases A-B-C.

When rotation is clockwise, the phase sequence is usually called "ABC", when counterclockwise "CBA"

This direction may be reversed by interchanging any two of the line wires.

1. Stop the unit from TD7/UC800.
2. Open the electrical disconnect or circuit protection switch that provides line power to the line power terminal block(s) in the starter panel (or to the unit mounted disconnect).
3. Connect the phase-sequence indicator leads to the line power terminal block as follows;

Phase Sequence Lead	Terminal
Black (Phase A)	L1
Red (Phase B)	L2
Yellow (Phase C)	L3

4. Turn power on by closing the unit supply-power fused-disconnect switch.
5. Read the phase sequence on the indicator. The ABC LED of the phase indicator will glow.

CAUTION! Humidity : Do not leave compressor uncovered

If the compressor is installed in a humid environment, drip trays may be required to collect condensate. Insulation should be installed on the suction valve/piping and the end cap as this is where condensation is most likely to form.

It is recommended to fit an end cap insulator in a humid environment.

In humid environments, the bell housing of the compressor should be insulated. A bell housing cover thermal insulator is available as a compressor accessory.

WARNING! It is imperative that L1, L2, and L3 in the starter be connected in the A-BC phase sequence to prevent equipment damage due to reverse rotation.

WARNING! To prevent injury or death due to electrocution, take extreme care when performing service procedures with electrical power energized.

CAUTION! Do not interchange any load leads that are from the unit contactors or the motor terminals. Doing so may damage the equipment.

Water System Flow Rates

Establish a balanced chilled-water flow through the evaporator. The flow rates should be between the minimum and maximum values given on the pressure drop curves.

Water System Pressure Drop

Measure the water-pressure drop through the evaporator on the field installed pressure taps on the system water piping. Use the same gauge for each measurement. Do not include valves, strainers, or fittings in the pressure drop readings.

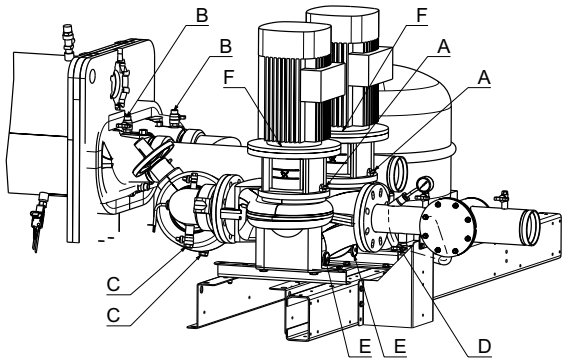
Integrated Pump Package (Optional)

Before starting up the pump, the pipe system must be thoroughly cleaned, flushed and filled with clean water. Do not start the pump until it has been vented. To ensure correct venting, open the vent screw located on the pump housing on the suction side (see next figure).

CAUTION! When using freeze inhibitor, never fill the system with pure glycol; this will damage the shaft seal. Always fill the system with diluted solution. Maximum concentration of glycol is 45% for unit with pump package.

If the chiller is installed in a humid environment or a location with high air humidity, the bottom drain hole on the pump motor should be opened. The enclosure class of the motor is then changed from IP55 to IP44. The function of the drain holes is to drain off water which has entered the stator housing with air humidity.

Figure 22 – Pump Package



A = Pump vent screw
D= Drain and fill valve
B = Air vent valve
E = Pump drain plug
C = Drain valve
F = Motor drain hole plug

Pre-Start Checkout

Expansion Tank (Pump Package Option)

The factory installed expansion tank initial pressure should be adjusted about 0.5 bars higher than the static pressure applied to the chiller water inlet. The static pressure is given by the maximum water circuit height compare to chiller location: example: the chiller is at ground level and the circuit loop goes from basement
(at -4m compare to chiller) to third floor at 10 metres above ground, the static pressure to use is 10 metres of water (1 Bar) and the expansion tank initial pressure should be 1.5 bars.

The expansion tank volume has been selected for typical loop volume. The following table summarizes the maximum volume of the chilled water loop that can be supported by the expansion tank at different conditions. If this maximum volume versus the required volume of the installation is not enough, it will be necessary to add an additional expansion tank located on the low pressure side of the installation.

Table 8 – Maximum water loop volume in function of static pressure of expansion tank

GVAF 125 - 250

Static pressure	1 Bar	2 Bar	3 Bar
Pure water (l)	6342	3996	1370
Ethylene glycol 20% (l)	3409	2148	736
Ethylene glycol 30% (l)	2273	1432	491
Ethylene glycol 45% (l)	1515	955	327

GVAF 280 - 450

Static pressure	1 Bar	2 Bar	3 Bar
Pure water (l)	9292	5854	2007
Ethylene glycol 20% (l)	5689	3584	1229
Ethylene glycol 30% (l)	4912	3095	1061
Ethylene glycol 45% (l)	4073	2566	880

Tracer UC800 Set-Up

Using Tracer TU service tool, adjust the settings. Refer to Tracer TU manual and UC800 user guide for instruction on settings.

CAUTION! To prevent compressor damage, do not operate the unit until all refrigerant valves and oil-line service valves are opened.

IMPORTANT! A clear sight glass alone does not mean that the system is properly charged. Also check system discharge superheat, approach temperature and unit operating pressures.

Unit Start Up Procedures

Daily Unit Start Up

The timeline for the sequence of operation begins with a power-up of the main power to the chiller. The sequence assumes 2 circuits, with one or two compressors, Sintesis Excellent GVAF chiller with no diagnostics or malfunctioning components. External events such as the operator placing the chiller in AUTO or STOP, chilled water flow through the evaporator, and application of load to the chilled-water loop causing loop water-temperature increases, are depicted and the chiller responses to those events are shown, with appropriate delays noted. The effects of diagnostics, and other external interlocks other than evaporator water-flow proving, are not considered.
Note: unless the UC800 TD7 and building automation system are controlling the chilled-water pump, the manual unit start sequence is as follows. Operator actions are noted.

General

If the present checkout, as discussed above, has been completed, the unit is ready to start.

1. Press the STOP key on the TD7 display.
2. As necessary, adjust the set point values on the TD7 menus using Tracer TU.
3. Close the fused-disconnect switch for the chilled-water pump. Energize the pump(s) to start water circulation
4. Check the service valves on the discharge line, suction line, oil line, and liquid line for each circuit. These valves must be open (back seated) before starting the compressors.
5. Verify that chilled-water pump runs for at least one minute after the chiller is commanded to stop (for normal chilled-water systems).
6. Press the AUTO key. If the chiller control calls for cooling, and all safety interlocks are closed, the unit will start. The compressor(s) will load and unload in response to the leaving chilled – water temperature;

After the system has been operating for approximately 30 minutes and has become stabilized, complete the remaining start up procedures, as follows:

1. Check the evaporator refrigerant pressure and the condenser refrigerant pressure under Refrigerant Report on the TD7.
2. Check the EXV sight glasses after enough time has elapsed to stabilize the chiller. The refrigerant flow through the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line, or an expansion valve that is stuck open. A restriction in the line can sometimes be identified by a noticeable temperature differential between the two sides of the restriction. Frost will often form on the line at this point. Proper refrigerant charges are shown in the General Information Section;
3. Measure the system discharge superheat.
4. Clean the air filter located on the door of the control panel of AFD if required.

Note: The system cannot be pumped down due to the surge characteristics of centrifugal compressors.
Inverted Start, commonly called "Monday Morning Start Up", can be a situation containing a high evaporation load (high building heat inertia). This inertia may lead to compressor capacity limitations due to choke at low pressure ratio.
IMPORTANT NOTICE
- Do not use recycled refrigerant as it may contain oil, which can affect system reliability. The refrigerant should be pure and stored in virgin containers
- Hoses should be free of oil
- Do not attempt more than three restarts after a critical fault. Continued attempts may cause the shaft to degmagnetize. Please contact OEM service provider.

Seasonal Unit Startup Procedure

1. Close all valves and reinstall the drain plugs in the evaporator.
2. Service the auxiliary equipment according to the startup and maintenance instructions provided by the respective equipment manufacturers.
3. Close the vents in the evaporator chilled-water circuits.
4. Open all the valves in the evaporator chilled-water circuits.
5. Open all refrigerant valves.
6. If the evaporator was previously drained, vent and fill the evaporator and chilled-water circuit. When all air is removed from the system (including each pass), install the vent plugs in the evaporator water boxes.
7. Check the adjustment and operation of each safety and operating control.
8. Close all disconnect switches.
9. Refer to the sequence for daily unit start up for the remainder of the seasonal start up.

System Restart after Extended Shutdown

1. Verify that the liquid-line service valves, compressor discharge service valves, and optional suction service valves are open (back seated)
2. Fill the evaporator water circuit. Vent the system while it is being filled. Open the vent on the top of the evaporator while filling, and close it when filling is completed.
3. Close the fused-disconnect switches that provide power to the chilled-water pump.
4. Start the evaporator water pump and, while water is circulating, inspect all piping for leakage. Make any necessary repairs before starting the unit.
5. While the water is circulating, adjust the water flow and check the water pressure drops through the evaporator. Refer to "water-system flow rates" and "water-system pressure drop"
6. Adjust the flow switch on the evaporator piping for proper operation
7. Stop the water pump. The unit is now ready for startup as described "Startup procedures"

CAUTION! To prevent damage to the compressor, ensure that all refrigerant valves are open before starting the unit. Do not use untreated or improperly treated water. Equipment damage may occur.

Unit Start Up Procedures

Temporary Shutdown and Restart

Temporary Shutdown is used for control operation, maintenance or to repair the unit typically less than one week.

To shut the unit down for a short time, use the following procedure:

1. Press the STOP key on the TD7. The compressors will continue to operate and, after unloading for 20 seconds, will stop when the compressor contactors de-energize.
2. Stop the water circulation by turning off the chilled water pump at least one minute after the stop of the compressors.

To restart the unit after a temporary shutdown, enable the chilled-water pump and press the AUTO key.

The unit will start normally, provided the following conditions exist:

- The UC800 receives a call for cooling and the differential-to-start is above the set point
- All system operating interlocks and safety circuits are satisfied

CAUTION! Under freezing conditions, the chilled water pump must remain in operation during the full shutdown period of the chiller if the chilled water loop does not contain glycol, to prevent any risk of evaporator freeze-up. Refer to charts 1 and 2.

Extended Shutdown Procedure

The following procedure is to be followed if the system is to be taken out of service for an extended period of time (i.e. seasonal shutdown):

1. Test the unit for refrigerant leaks and repair as necessary
2. Open the electrical disconnect switches for the chilled-water pump. Lock the switches in the “OPEN” position.
3. Close all chilled-water supply valves. Drain the water from the evaporator.
4. Open the unit main electrical disconnect and unit-mounted disconnect (if installed) and lock in the “OPEN” position.
5. At least every three months (quarterly), check the refrigerant pressure in the unit to verify the refrigerant charge integrity.

CAUTION! Lock the chilled-water pump disconnects open to prevent pump damage. Lock the disconnect switch in the “OPEN” position to prevent accidental startup and damage to the system when it has been set up for extended shutdown.

During an extended shutdown period, especially over the winter season, the evaporator and free cooling circuits must be drained of water, if the chilled water loop does not contain glycol, to prevent any risk of evaporator freeze-up.

Periodic Maintenance

General

Perform all maintenance procedures and inspections at the recommended intervals. This will increase the life of the chiller and minimize the possibility of costly failures.

Weekly Maintenance

After the unit has been operating for approximately 30 minutes and the system has stabilized, check the operating conditions and complete the procedures below:

1. Check on the TD7 pressure for evaporator, condenser, and intermediate oil.
2. Inspect the entire system for unusual conditions and inspect the condenser coils for dirt and debris. If the coils are dirty, refer to coil cleaning.

Monthly Maintenance

1. Perform all weekly maintenance procedures.
2. Record the system subcooling.
3. Record the system superheat.
4. Make any repairs necessary.
5. Review compressor service literature for compressor maintenance and record appropriate parameters.

Annual Maintenance

Perform all weekly and monthly procedures.

1. Contact a qualified service organization to leak-test the chiller, to check operating and safety controls, and to inspect electrical components for deficiencies
2. Inspect all piping components for leakage and damage.
3. Inspect unit and also areas under isolation.
4. Clean and repaint any areas that show signs of corrosion.
5. Clean the condenser coils.
6. Clean the air filter located on the door of the control panel of AFD when present
7. Check and tighten all electrical connections as necessary.

CAUTION! A clear sight glass alone does not mean that the system is properly charged. Also check the rest of the system operating conditions.
WARNING! Position all electrical disconnects in the “Open” position and lock them to prevent injury or death due to electrical shock.

Refrigerant Emission Control

Conservation and emission reduction can be accomplished by following recommended Trane operation, maintenance, and service procedures,
with specific attention to the following:

1. Refrigerant used in any type of air-conditioning or refrigerating equipment should be recovered and/or recycled for reuse, reprocessed (reclaimed). Never release refrigerant into the atmosphere.
2. Always determine possible recycle or reclaim requirements of the recovered refrigerant before beginning recovery by any method.
3. Use approved containment vessels and safety standards. Comply with all applicable transportation standards when shipping refrigerant containers.
4. To minimize emissions while recovering refrigerant, use recycling equipment. Always attempt to use methods that will pull the lowest possible vacuum while recovering and condensing refrigerant into containment.
   Note: Do not use recycled refrigerant as it may contain oil, which can affect system reliability. The refrigerant should be pure and stored in virgin containers. Hoses should be free of oil.
5. Refrigerant-system cleanup methods that use filters and dryers are preferred. Do not use solvents that have ozone depletion factors. Properly dispose of used materials.
6. Take extra care to properly maintain all service equipment that directly supports refrigeration service work, such as gauges, hoses, vacuum pumps, and recycling equipment.
7. Stay aware of unit enhancements, conversion refrigerants, compatible parts, and manufacturer’s recommendations that will reduce refrigerant emissions and increase equipment operating efficiencies. Follow the manufacturer’s specific guidelines for conversion of existing system.
8. In order to assist in reducing power-generation emissions, always attempt to improve equipment performances with improved maintenance and operations that will help conserve energy resources.

Periodic Maintenance

Refrigerant Management

Proper refrigerant charge is essential for proper unit operation, unit performances, and environmental protection. Only trained and licensed service personnel should service the chiller.

Some of the symptoms of a refrigerant under-charged unit:

- Larger-than-normal evaporator approach temperatures (leaving water temperature – saturated evaporator temperature). If the refrigerant charge is correct the approch temperature is between 1°C and 1.5°C on circuit 1 and between 2°C and 2.5°C on circuit 2.These values are given for units running at full load and with water without antifreeze
- Low Evaporator-refrigerant temperature limit
- Low Refrigerant-Temperature cutout diagnostic
- Fully-open expansion valve
- Possible whistling sound coming from liquid line (due to high vapor velocity)
- Possible low discharge superheat at high loads
- High condenser + Subcooler pressure drop

Some of the symptoms of a refrigerant over-charged unit

- Condenser Pressure Limit
- High –Pressure Cutout diagnostic
- More-than-normal number of fans running
- Erratic fan control

R134a/R513A/R1234ze(E) Field – Charging Procedure

This procedure should be followed when the unit is empty of all refrigerant and under vacuum. Add the charge through the evaporator service valve.

1. Respect refrigerant type on the nameplate.
2. Note the weight of the amount of charge removed. Compare it to the nameplate value. A difference in charge may indicate a leak.
3. Attach the charging hose to the evaporator service valve (9mm [3/8inch] flare). Open the service valve.
4. Add charge to the evaporator to bring the total circuit charge up to the level indicated in the unit nameplate.
5. Close the service valve and disconnect the charging hose.

Important notice:
-Do not use recycled refrigerant as it may contain oil, which can affect system reliability.The refrigerant should be pure and stored in virgin containers
- Hoses should be free of oil

Chiller settings

Prior starting refrigerant charge optimization, the technician must insure the following chiller conditions:

- Constant water flow on a air purged circuit is strictly necessary during the whole operation (water fl ow to be within allowed operating range)
- A fully loaded chiller is highly recommended for a successful operation. In case the technician is not able to ensure a 2 circuit fully loaded chiller then he must lockout one circuit and perform charge optimization for 1 circuit at a time
- When the refrigerant charge optimization is done per circuit the chiller load must not be lower than 60%

This procedure should be followed when adding refrigerant to an undercharged unit:

1. Attach the charging hose to the evaporator service valve (9mm [3/8inch] flare). Open the service valve.
2. Fix the leaving water set point (water temperature to be steady as much as possible).
3. Adjust water flow within operating range and keep it steady.
   a) Note approach temperature T1
   b) Add 2kg of R134a or R1234ze(E) refrigerant
   c) Note approach temperature T2
   d) If Tn - Tn+1 < 0.2 (with n=1 → charge addition count) then charge is good and optimization is done
   e) If Tn - Tn+1 > 0.2 (with n=1 → charge addition count) then perform steps b) to e) if needed

This procedure should be followed when removing refrigerant to an overcharged unit:

1. Fix the leaving water set point (water temperature to be steady as much as possible)
2. Adjust water flow within operating range and keep it steady
   a) Note approach temperature T1
   b) Remove 2kg of R134a or R1234ze(E) refrigerant
   c) Note approach temperature T2
   d) Keep performing step b until Tm+1 -Tm > 0.5 (with m = 1 > charge removal count)
   e) Once step d) is confirmed remove 4kg of R134a or R1234ze(E) refrigerant and note T3
   f) If T1-Tn < 0.2 (with n = 3 → charge removal count) then charge is good and optimization is done
   g) If T1-Tn > (with n = 3 → charge removal count) then perform step e) to f) if needed

Isolation of the Refrigerant Charge on the Low side of the System

By closing the suction-line service valve, refrigerant charge can be isolated in the evaporator for maintenance on the compressor.

Returning the unit to running conditions:

1. Open all the valves.
2. Manually Open EXV for 15 minutes to allow the refrigerant drain to the evaporator by gravity.

Low side Charge-isolation Procedure

After normal shutdown, most of the charge resides in the evaporator. Running cold water through the evaporator may also drive much of the refrigerant to the evaporator.

1. Make sure the circuit is off.
2. Close the suction-line isolation valve.
3. Close the liquid line service valve.
4. Close the liquid line service valve
5. Manually open the EXV
6. Use a liquid pump or vacuum pump to move refrigerant from the condenser to the evaporator. The liquid pump will only be effective if there is a lot of charge in the condenser. It may be connected to the condenser drain port on the liquid-line isolation valve.

Note: If a pump is to be used, connect it before closing this valve. This port is only isolated when the valve is back seated. If a vacuum pump is used, then connect it to the discharge-line service valve.
A vacuum pump will be required for part of the procedure.

The evaporator is large enough to hold all the charge, for any unit, below the centerline of the shell. Therefore, no special precautions are required to restart the unit after isolating the charge in the evaporator.

Refrigerant Filter Replacement – Changing Procedures

A dirty filter is indicated by a temperature gradient across the filter, corresponding to a pressure drop. If the temperature downstream of the filter is 4,4°C lower than the upstream temperature, the filter should be replaced. A temperature drop can also indicate that the unit is undercharged.
GVAF has economizer and compressor cooling system, besides to close EXV and liquid shutoff valve, any flow to liquid cooling and economizer needs to be cutoff.

Lubrication System

No oil is needed in an oil free centrifugal compressor and the use of oil is prohibited as it can damage internal compressor parts.

Vacuum

Ensure gas removal by vacuum the 3 main areas of the unit (suction side, discharge side and economizer side (between TEXV and economizer shut off valve)).

Condenser Coils MCHE Maintenance

Cleaning Procedures

It is mandatory to clean regularly the coils for a proper unit operation. Eliminate pollution and other residual material help to extend the life of the coils and the unit.

CAUTION! Equipment Damage! Do not use coil cleaning agents to clean uncoated GVAF coils. Use clean water only. Use of coil cleaning agents on uncoated GVAF coils could cause damage to coils.

Regular coil maintenance, including frequent cleaning- enhances the unit's operating efficiency by minimizing compressor head pressure and amperage draw. The condenser coil (non-coated and e-coated) should be cleaned at least once each quarter or more if the unit is located in a "dirty" or corrosive environment. Cleaning with cleansers or detergents is strongly discouraged due to the all-aluminum construction; straight water should prove sufficient. Any breach in the tubes can result in refrigerant leaks.

Important: Only in extreme cases should any type of chemical cleaner or detergent be used on micro channel coils. If it becomes absolutely necessary because water alone did not clean the coil, specify a cleaner that is:

- A is pH neutral cleaner.
- An alkaline cleaner that is no higher than 8 on the pH scale.
- An acidic cleaner that is no lower than 6 on the pH scale.
- Does not contain any hydrofluoric acids.

Be sure to follow the instructions provided with any cleaner chosen. Keep in mind that it is still MANDATORY that the coils are thoroughly rinsed with water after the application of the cleaner even if the instructions specify a "No Rinse" cleaner. Cleaners or detergents that are left on the coil due to improper rinsing will significantly increase the possibility of corrosion damage on the micro channel coil.

Note: Quarterly cleaning (or more for harsh environment) is essential to extend the life of a MCHE coil and is required to maintain warranty coverage. Failure to clean a MCHE coil will void the warranty and may result in reduced efficiency and durability in the environment.

WARNING! Hazardous Voltage! Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/ tagout procedures to ensure the power cannot be inadvertently energized. Failure to disconnect power before servicing could result in death or serious injury.

1. Disconnect Power to the unit.
2. Wear proper personal protection equipment such as a face shield, gloves and waterproof clothing.
3. Remove enough panels from the unit to gain safe access to the micro channel coil.

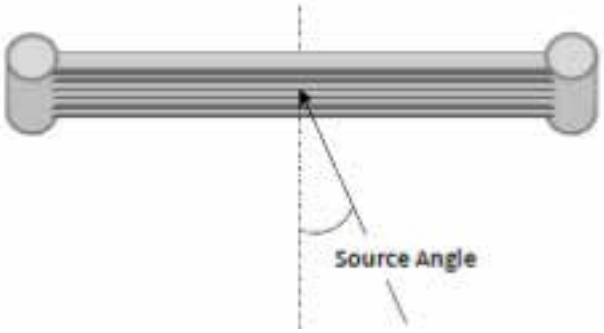
Note: It is better to clean the coil from the opposite direction of normal air flow (inside of unit out) because this allows the debris to be pushed out rather than forced further into the coil.

1. Use a soft brush or vacuum to remove base debris or surface loaded fibers from both sides of the coil.

Note: Remove solid residue is essential to preserve performance of the coil and avoid corrosion over the length of the product life.

2. Using a sprayer and water ONLY, clean the coil following the guidelines below.
   a. Sprayer nozzle pressure should not exceed 40 bars.
   b. The maximum source angle should not exceed 25 degrees (Figure 22) to the face of the coil. For best results spray the micro channel perpendicular to face of the coil.
   c. Spray nozzle should be approximately 5 to 10 cm from the coil surface.
   d. Use at least a 15° fan type of spray nozzle.

Figure 23 – Sprayer source angle



To avoid damage from the spray wand contacting the coil, make sure the 90° attachment does not come in contact with the tube and fin as abrasion to the coil could result.

Maintenance of Flanges Connection

It is mandatory to apply marine grease all around the coil flange connections to the piping on a regular basis (for instance twice a year) to avoid traps of moisture and dirt in the gasket recess.

Repair / Replacement of Micro channel Coil

Micro channel coils are considerably more robust in design than tube and fin condenser coils, however they are not indestructible. When damage or a leak occurs in the field, it is possible to temporarily repair the coil until another coil can be ordered.
If the leak is found to be within the tube area of the coil, a field repair kit (KIT16112) is available through your local Trane parts center. Because of the all-aluminum construction and aluminum's high thermal expansion rate, a leak located at or on the header assembly cannot be repaired.

Integrated Pump Maintenance (Optional with Pump Package)

Water Pump Maintenance

CAUTION! The lifting eyebolts of the motor are suitable for the weight of the motor only. It is not allowed to carry the complete pump on the lifting eyebolts of the motor.

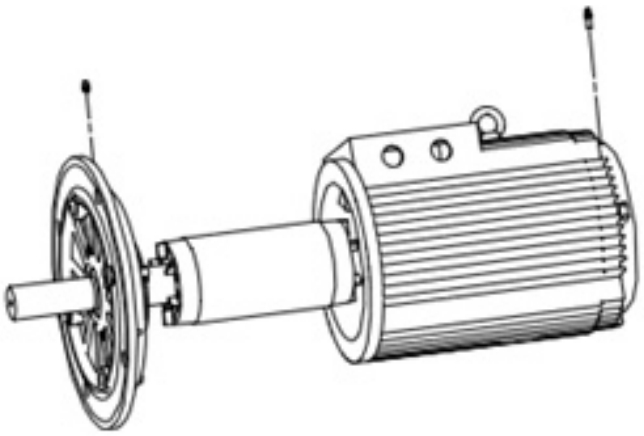
Lubrication

The bearings of motors 5.5kW and 7.5kW are greased for life and require no lubrication. The pump shaft seal does not require any special maintenance. Visual leakage check are however required. Distinctly visible leakage will require an exchange of the seal.

The bearing of motors 11kW and up must be greased every 4000 hours. The required grease quantity is 10g per bearing. The motor must run during lubrication.

Use lithium-based grease.

Figure 24 – Motor bearings



Log Check Sheet

The operator log sheet are included for use as appropriate, for installation completion verification before Trane Start-up is scheduled, and for reference during the Trane Start-up.

Operator Log				
Sintesis GVAF chiller with UC800 Controller - Tracer AdaptiView Reports - Log Sheet				
	Start	**15 minutes**	**30 minutes**	**1 hour**
Evaporator				
Active Chilled Water Setpoint				
Entering Water Temperature				
Leaving Water Temperature				
Ckt 1				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (kPa)				
Approach Temperature (°C)				
Water flow Status				
EXV % Open				
Ckt 2				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (psia)				
Approach Temperature (°C)				
Water flow Status				
EXV % Open				
Condenser				
Outdoor Temperature				
Ckt 1				
Air flow (%)				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (kPa)				
Subcooling in °C				
Ckt 2				
Air flow (%)				
Saturated Refrigerant Temperature (°C)				
Refrigerant Pressure (kPa)				
Subcooling in °C				
Compressor 1A				
Running Status				
Starts				
Running Time (Hr:min)				
Compressor 1B				
Running Status				
Starts				
Running Time (Hr:min)				
Motor 1A				
Active Demand Limit Setpoint				
Average Motor Current (%)				
Percent Speed				
AFD Average Input Current (Amps)				
AFD Average Input Voltage (Volts)				
AFD Input Power (KW)				
AFD Output Power (KW)				
AFD Speed (rpm)				
Motor 1B				
Active Demand Limit Setpoint				
Average Motor Current (%)				
Percent Speed				
AFD Average Input Current (Amps)				
AFD Average Input Voltage (Volts)				
AFD Input Power (KW)				
AFD Output Power (KW)				
AFD Speed (rpm)				
Compressor 2A				
Running Status				
Starts				
Running Time (Hr:min)				
Oil Pressure (psia)				
Compressor 2B				
Running Status				
Starts				
Running Time (Hr:min)				
Motor 2A				
Active Demand Limit Setpoint				
Average Motor Current (%)				
Percent Speed				
AFD Average Input Current (Amps)				
AFD Average Input Voltage (Volts)				
AFD Input Power (KW)				
AFD Output Power (KW)				
AFD Speed (rpm)				
Motor 2B				
Active Demand Limit Setpoint				
Average Motor Current (%)				
Percent Speed				
AFD Average Input Current (Amps)				
AFD Average Input Voltage (Volts)				
AFD Input Power (KW)				
AFD Output Power (KW)				
AFD Speed (rpm)				

Date:	
Technician:	
Owner:	

Notes

Trane - by Trane Technologies (NYSE: TT), a global climate innovator - creates comfortable, energy efficient indoor environments for commercial and residential applications. For more information, please visit trane.com or tranetechnologies.com.

CTV-SVX009D-GB April 2020
Supersedes CTV-SVX009C-GB (June 2019)