Installation, Operation, and Maintenance

Trane Rental Services

25 to 120 Tons

Model: CGAM

⚠ SAFETY WARNING

Only qualified personnel should install and service the equipment. The installation, starting up, and servicing of heating, ventilating, and air-conditioning equipment can be hazardous and requires specific knowledge and training. Improperly installed, adjusted or altered equipment by an unqualified person could result in death or serious injury. When working on the equipment, observe all precautions in the literature and on the tags, stickers, and labels that are attached to the equipment.

February 2023 **TEMP-SVX001A-EN**

Introduction

Read this manual thoroughly before operating or servicing this unit.

Warnings, Cautions, and Notices

Safety advisories appear throughout this manual as required. Your personal safety and the proper operation of this machine depend upon the strict observance of these precautions.

The three types of advisories are defined as follows:

⚠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, could result in minor or moderate injury. It could also be used to alert against unsafe practices.
NOTICE	Indicates a situation that could result in equipment or property-damage only accidents.

Important Environmental Concerns

Scientific research has shown that certain man-made chemicals can affect the earth's naturally occurring stratospheric ozone layer when released to the atmosphere. In particular, several of the identified chemicals that may affect the ozone layer are refrigerants that contain Chlorine, Fluorine and Carbon (CFCs) and those containing Hydrogen, Chlorine, Fluorine and Carbon (HCFCs). Not all refrigerants containing these compounds have the same potential impact to the environment. Trane advocates the responsible handling of all refrigerants-including industry replacements for CFCs and HCFCs such as saturated or unsaturated HFCs and HCFCs.

Important Responsible Refrigerant Practices

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 certified according to local rules. For the USA, the Federal Clean Air Act (Section 608) sets forth the requirements for handling, reclaiming, recovering and recycling of certain refrigerants and the equipment that is used in these service procedures. In addition, some states or municipalities may have additional requirements that must also be adhered to for responsible management of refrigerants. Know the applicable laws and follow them.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

⚠WARNING

Personal Protective Equipment (PPE) Required!

Failure to wear proper PPE for the job being undertaken could result in death or serious injury. Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the instructions below:

- **Before installing/servicing this unit, technicians MUST put on all PPE required for the work being undertaken (Examples; cut resistant gloves/sleeves, butyl gloves, safety glasses, hard hat/bump cap, fall protection, electrical PPE and arc flash clothing). ALWAYS refer to appropriate Safety Data Sheets (SDS) and OSHA guidelines for proper PPE.**
- **When working with or around hazardous chemicals, ALWAYS refer to the appropriate SDS and OSHA/GHS (Global Harmonized System of Classification and Labeling of Chemicals) guidelines for information on allowable personal exposure levels, proper respiratory protection and handling instructions.**
- **If there is a risk of energized electrical contact, arc, or flash, technicians MUST put on all PPE in accordance with OSHA, NFPA 70E, or other country-specific requirements for arc flash protection, PRIOR to servicing the unit. NEVER PERFORM ANY SWITCHING, DISCONNECTING, OR VOLTAGE TESTING WITHOUT PROPER ELECTRICAL PPE AND ARC FLASH CLOTHING. ENSURE ELECTRICAL METERS AND EQUIPMENT ARE PROPERLY RATED FOR INTENDED VOLTAGE.**

⚠WARNING

Follow EHS Policies!

Failure to follow instructions below could result in death or serious injury.

- **All Trane personnel must follow the company's Environmental, Health and Safety (EHS) policies when performing work such as hot work, electrical, fall protection, lockout/tagout, refrigerant handling, etc. Where local regulations are more stringent than these policies, those regulations supersede these policies.**
- **Non-Trane personnel should always follow local regulations.**

⚠WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.
Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

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Revision History

- Updated Unit Description section in General Information chapter.
- Added Accessories and General Data section to General Information chapter.
- Added Pre-Installation chapter.
- Added Service Clearances section to Dimensions and Weights chapter.
- Updated Unit Drawings section in Dimensions and Weights chapter.
- Added and updated Table 4. (Unit weights) in Dimensions and Weights chapter.
- Moved Rigging section from Dimensions and Weights chapter to Installation chapter.
- Updated Leveling section in Installation chapter.
- Updated Table 6. (Unit water connection sizes) in Installation chapter.
- Added Integral Pump Package section in Installation chapter.
- Updated Table 10. (Unit performance, reference only) in Installation chapter.
- Added Start-Up and Shutdown chapter.
- Updated Checking Operating Conditions section and added Start-up and Shutdown section in Installation chapter.
- Added Maintenance and Diagnostics as a chapter.
- Removed Refrigerant Charge Information section from Start-up and Shutdown chapter and added it to Maintenance and Diagnostics chapter.

Table of Contents

Model Number Description

Digit 1, 2 — Unit Model

CS = Rental Services

Digit 3, 4 — Unit Type

CA = Air-Cooled Chiller

Digit 5, 6, 7, 8 — Unit Capacity

0025 = 25 Nominal Tons
0040 = 40 Nominal Tons
0060 = 60 Nominal Tons
0080 = 80 Nominal Tons
0100 = 100 Nominal Tons
0120 = 120 Nominal Tons

Digit 9, 10 — Design Sequence

Note: *See the table below.*

Digit 11, 12 — Incremental Designator

AA

	Electrical Connection Type	Power Connection	Over-Head Frame	Pump Bypass	Premium Efficient Pump Motors
F0-F1	Lugs or Series 16 Cam-Type Connections	Single Point	Yes	Yes	No
F2	Series 16 Cam-Type Connections	Single Point	Yes	Yes	Yes
F3	Series 16 Cam-Type Connections	Single Point	No	Yes	Yes

General Information

Unit Description

CGAM units are scroll type, air-cooled, liquid chillers, designed for installation outdoors. The 25 ton units have a single independent refrigerant circuit, with two compressors per circuit. The 40 ton and larger units have two independent refrigerant circuits, with two compressors per circuit. The CGAM units are packaged with an evaporator and condenser.

Note: *Each CGAM unit is a completely assembled, hermetic-compressors, packaged unit that is factory-piped, wired, leak-tested, dehydrated, charged, and tested for proper control operations prior to shipment. The chilled water inlet and outlet openings are covered for shipment.*

The CGAM series features Trane's exclusive Adaptive Control logic with CH530 controls. It monitors the control variables that govern the operation of the chiller unit. Adaptive Control logic can correct these variables, when necessary, to optimize operational efficiencies, avoid chiller shutdown, and keep producing chilled water.

Each refrigerant circuit is provided with filter, sight glass, electronic expansion valve, and charging valves on the CGAM.

The evaporator is a brazed plate heat exchanger which is equipped with a water drain and vent connections in the water piping. The condenser is a micro-channel or tube-and-fin coil.

Trane Rental Services modifications include:

- Unit frame
- Cam-type electrical connections
- Integral pump piped, wired, and mounted within the unit frame
- 115V shore-power connection to power the CH530 controller
- Evaporator heat tape
- Sump heaters
- Additional fine-mesh strainer for evaporator piping

Accessories

For flexible hose data, refer to CHS-SVX01*-EN.

Electrical Cable

For electrical cable data, refer to **Electrical Cable** in CHS-PRB005*-EN.

Pig-Tail Connectors

Each cable box has pigtails for non cam-type connections. There is a cam-type on one end and a barrel lug on the other. The barrel lug end allows for connection into a power distribution panel or non cam-type equipment. The pig-tail can be connected to the standard cam-type cable (see Figure 1, p. 7).

Figure 1. Electrical connector overview

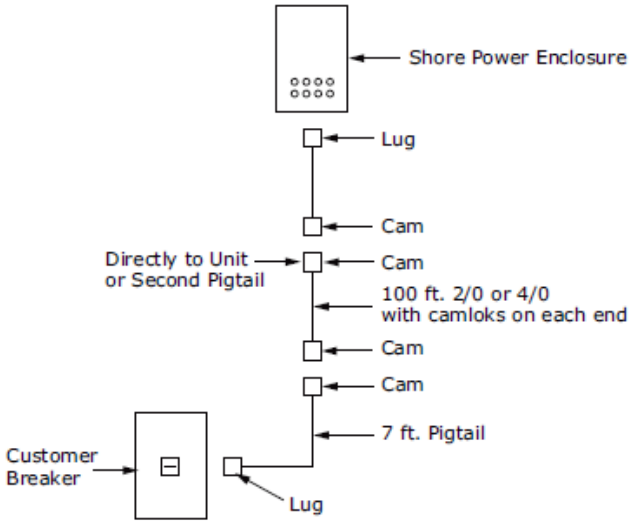
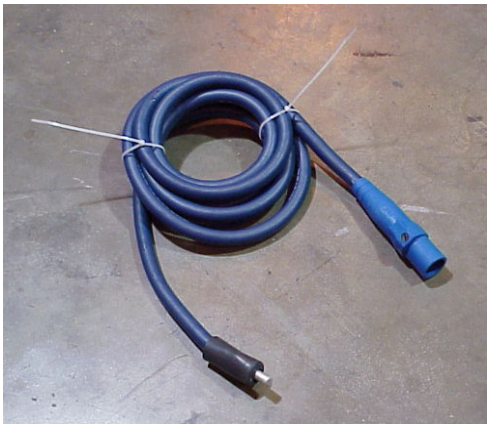


Figure 2. Pig-tail connectors



General Data

Table 1. General data, 60 Hz, high efficiency (I-P)

Size	Unit	25	40	60	80	100	120
Compressor							
Number	#	2	4	4	4	4	4
Tonnage/ckt[a]		13+13	10+10	15+15	20+20	25+25	30+30
Evaporator							
Water storage	(gal)	2.2	2.4	5.0	7.0	10.3	11.5
"Min. flow[b] (LWT ≥ 42°F)	(gpm)	29.8	45.4	67.1	91.8	115.5	135.9
Min. flow[b] (LWT 40 to 41.9°F)	(gpm)	37.2	56.7	83.9	114.7	144.4	169.9
Max. flow[b]	(gpm)	89.0	136.0	201.0	275.0	346.0	407.0
Water connection	(in)	2.5	3.0	3.0	4.0	4.0	4.0
Condenser **Round Tube and Plate Fin Coils**							
Quantity of coils	#	1	2	2	4	4	4
Coil length	(in)	91	91	127	121	144	144
Coil height	(in)	68	68	68	42	42	42
Number of rows	#	2	2	2	3	3	3
Fins per foot	(fpf)	192	192	192	192	192	192
Microchannel Coils							
Quantity of coils	#	1	2	2	8	8	8
Coil length	(in)	91	91	127	68+46	68+68	68+68
Coil height[c]	(in)	42+10	42+10	42+10	34+7	34+7	34+7
Tube width	(in)	1	1	1	1	1	1
Fan							
Quantity	#	2	4	6	6	8	8
Diameter	(in)	28.8	28.8	28.8	28.8	28.8	28.8
Airflow per fan	(cfm)	9420	9413	9168	9470	9094	9098
Power per motor	(HP)	1.3	1.3	1.3	1.3	1.3	1.3
Motor RPM	(rpm)	840	840	840	840	840	840
Tip speed	(ft/min)	6333	6333	6333	6333	6333	6333
General Unit							
Refrig circuits	#	1	2	2	2	2	2
Capacity steps	%	50-100	25-50-75-100	25-50-75-100	25-50-75-100	25-50-75-100	25-50-75-100
Min ambient - wide	(°F)	0	0	0	0	0	0
Min ambient - high	(°F)	32	32	32	32	32	32
Min ambient - extreme low	(°F)	-20	-20	-20	-20	-20	-20
Size	**Unit**	**26**	**40**	**60**	**80**	**100**	**120**
Round Tube and Plate Fin Coils							
Refrig charge/ckt[a]	(lbs)	34	32	44	74	90	86
Oil charge/ckt[a]	(gal)	1.7	1.7	1.9	3.5	3.5	3.8
Microchannel Coils							
Refrig charge/ckt[a]	(lbs)	27.5	24	33	50	54	55
Oil charge/ckt[a]	(gal)	1.4	1.4	1.6	2.9	2.9	3.1

Note: Pump available head pressure is based on 44/54°F evaporator with water, 0001 hr-ft2-°F/Btu, 95°F ambient and 0 ft elevation.

(a) Data shown for one circuit only. The second circuit always matches.
(b) Minimum and maximum flow rates apply to constant-flow chilled water system running at AHRI conditions, without freeze inhibitors added to the water loop.
(c) Microchannel coils are split horizontally between the condenser and subcooler coil.

Pre-Installation

Inspection Checklist

When the unit is delivered, verify that it is the correct unit and that it is properly equipped.

Inspect all the exterior components for visible damage. Report any apparent damage or material shortage to the carrier and make a “unit damage” notation on the carrier's delivery receipt.

Specify the extent and type of damage found and notify Trane.

Do not proceed with installation of a damaged unit without Trane approval.

To protect against loss due to damage incurred in transit, complete the following checklist upon receipt of the unit.

- Inspect the individual pieces of the shipment before accepting the unit. Check for obvious damage to the unit or packing material.
- Inspect the unit for concealed damage as soon as possible after delivery and before it is stored.
- Notify the carrier's terminal of the damage immediately, by phone and by mail. Request an immediate, joint inspection of the damage with the carrier and the consignee.
- Notify the Trane sales representative and arrange for repair. Do not repair the unit, however, until damage is inspected by the carrier's representative.

Unit Storage

If the chiller is to be stored in ambients of 32°F or less, evaporator and pump should be blown out to remove any liquid.

If the chiller is to be stored for more than one month prior to installation, observe the following precautions:

- Do not remove the protective coverings from the electrical panel.
- Store the chiller in a secure area.
- Units charged with refrigerant should not be stored where temperatures exceed 140°F.
- At least every three months, attach a gauge and manually check the pressure in the refrigerant circuit. If the refrigerant pressure is below 200 psig at 70° F (or 145 psig at 50° F), call a qualified service organization and the appropriate Trane sales office.

Installation Requirements

A list of the contractor responsibilities typically associated with the unit installation process is provided.

Table 2. Installation requirements

Type	Trane Supplied		Field Supplied Field Installed
	Trane Installed	Field Installed	
Foundation			• Meet foundation requirements
Rigging			• Safety chains • Clevis connectors • Lifting beam
Electrical	• Circuit breakers (optional) • Unit mounted starter		• Circuit breakers (optional) • Electrical connections to unit mounted starter • Wiring sizes per submittal and NEC • Terminal lugs • Ground connection(s) • BAS wiring (optional) • Control voltage wiring • Option relays and wiring
Water Piping	• Flow switch • Water strainer • Taps for thermometers and gauges • Thermometers • Water flow pressure gauges • Isolation and balancing valves in water piping • Vents and drain • Pressure relief valves		
Insulation	Insulation		Insulation
Water Piping Connection Components	Grooved pipe		

Dimensions and Weights

Service Clearances

Figure 3. CGAM service clearances

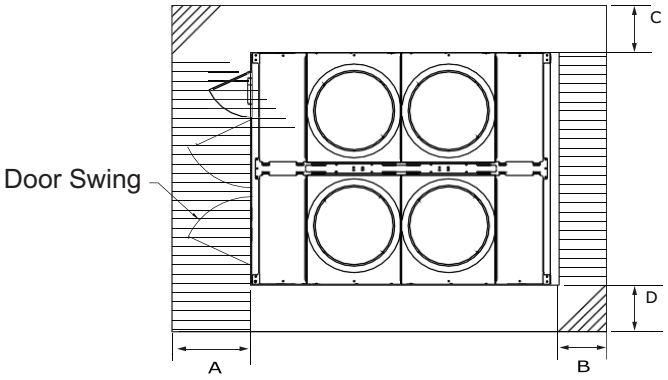


Table 3. CGAM service clearance dimensions

Unit Size	A		B		C		D	
	in.	mm	in.	mm	in.	mm	in.	mm
25 ton	47.2	1200	31.5	800	23.6	600	39.4	1000
40 to 60 ton	47.2	1200	31.5	800	39.4	1000	39.4	1000
80 to 120 ton	47.2	1200	39.4	1000	39.4	1000	39.4	1000

Notes:

- *Number of fans and panel doors shown does not represent the number of fans installed.*
- *More clearance may be needed for airflow, depending on installation.*

Unit Drawings

Figure 4. 25T CGAM (CSCA0025F0)

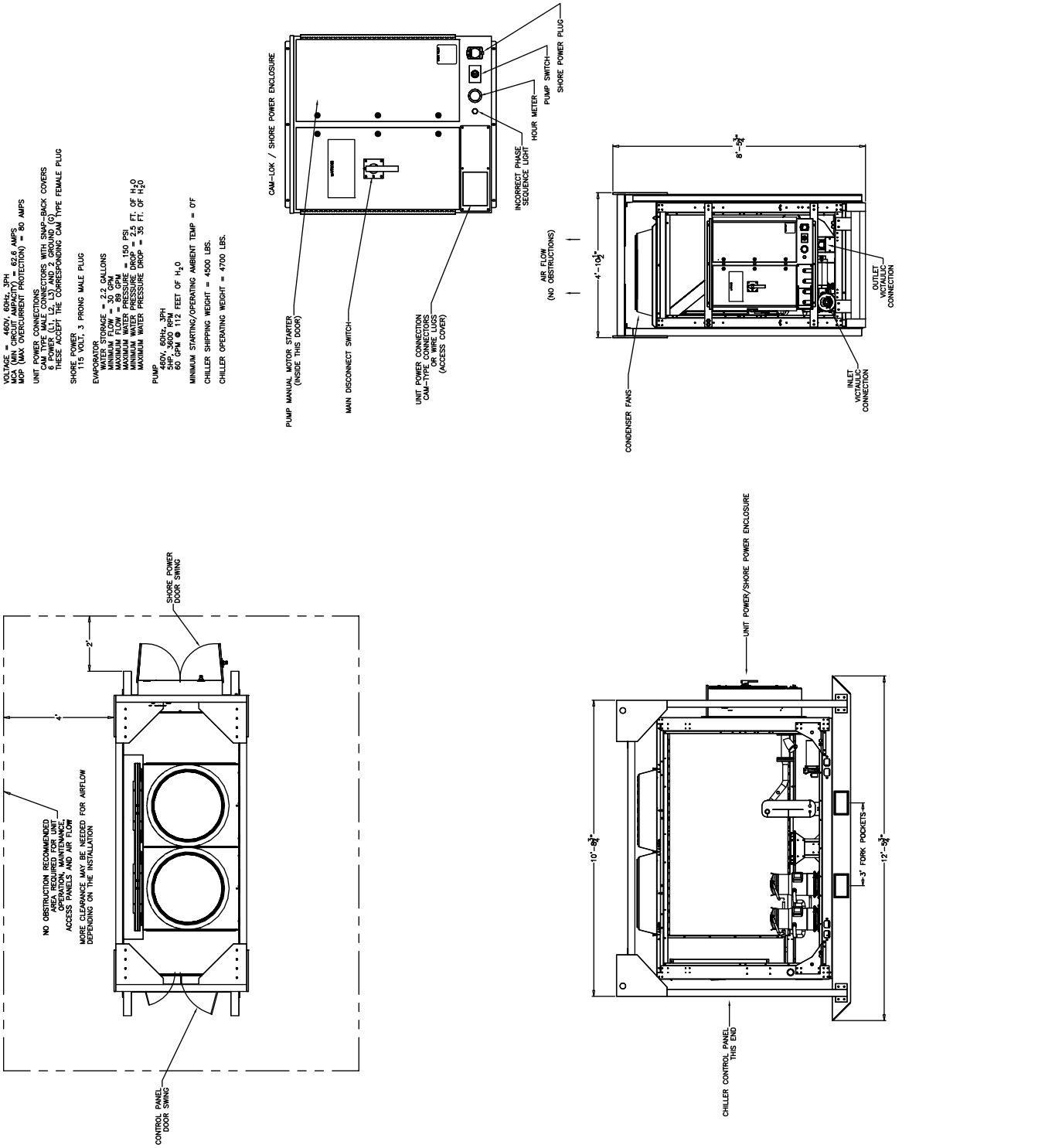


Figure 5. 25T CGAM (CSCA0025F2)

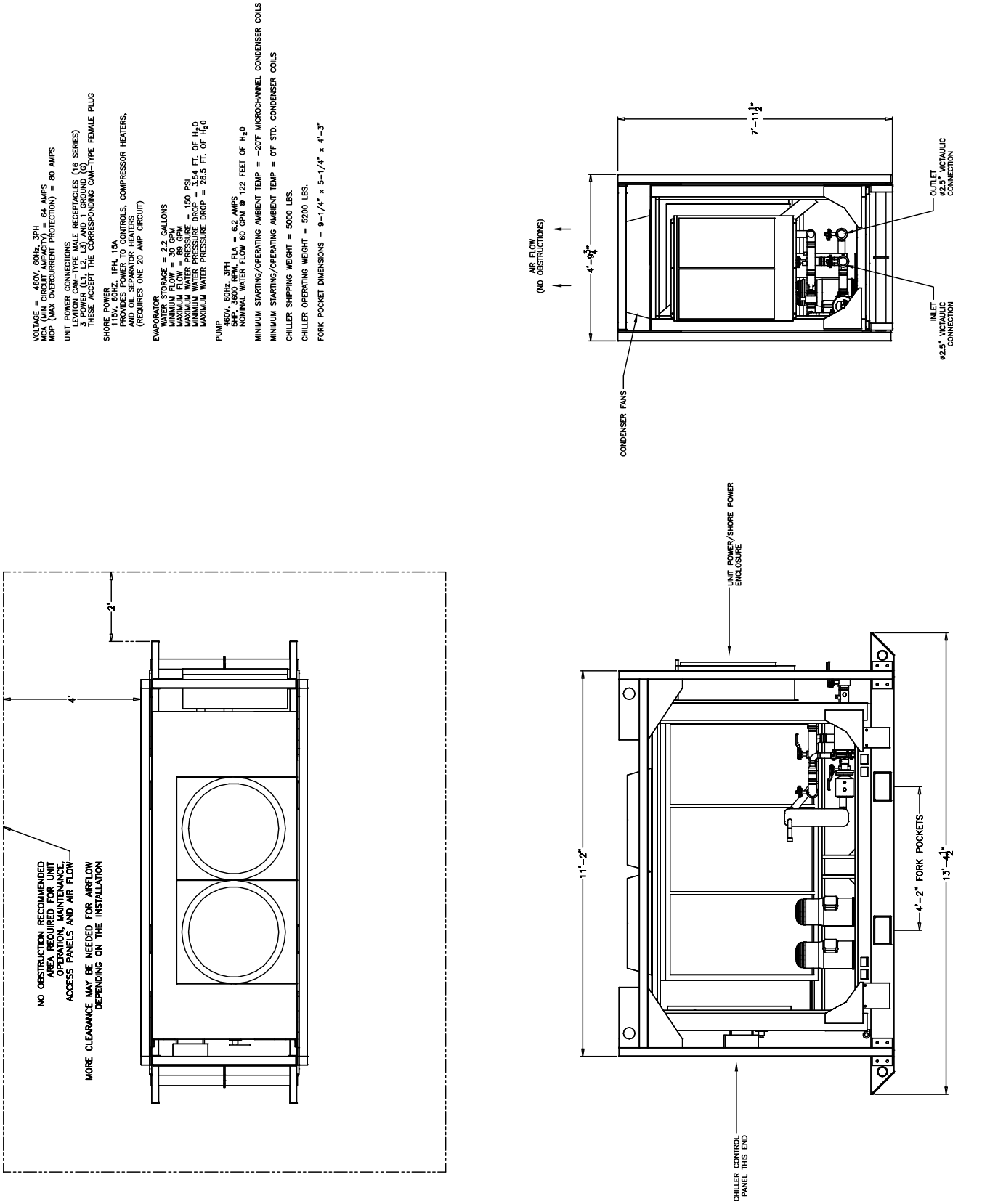


Figure 6. 40T CGAM (CSCA0040F0)

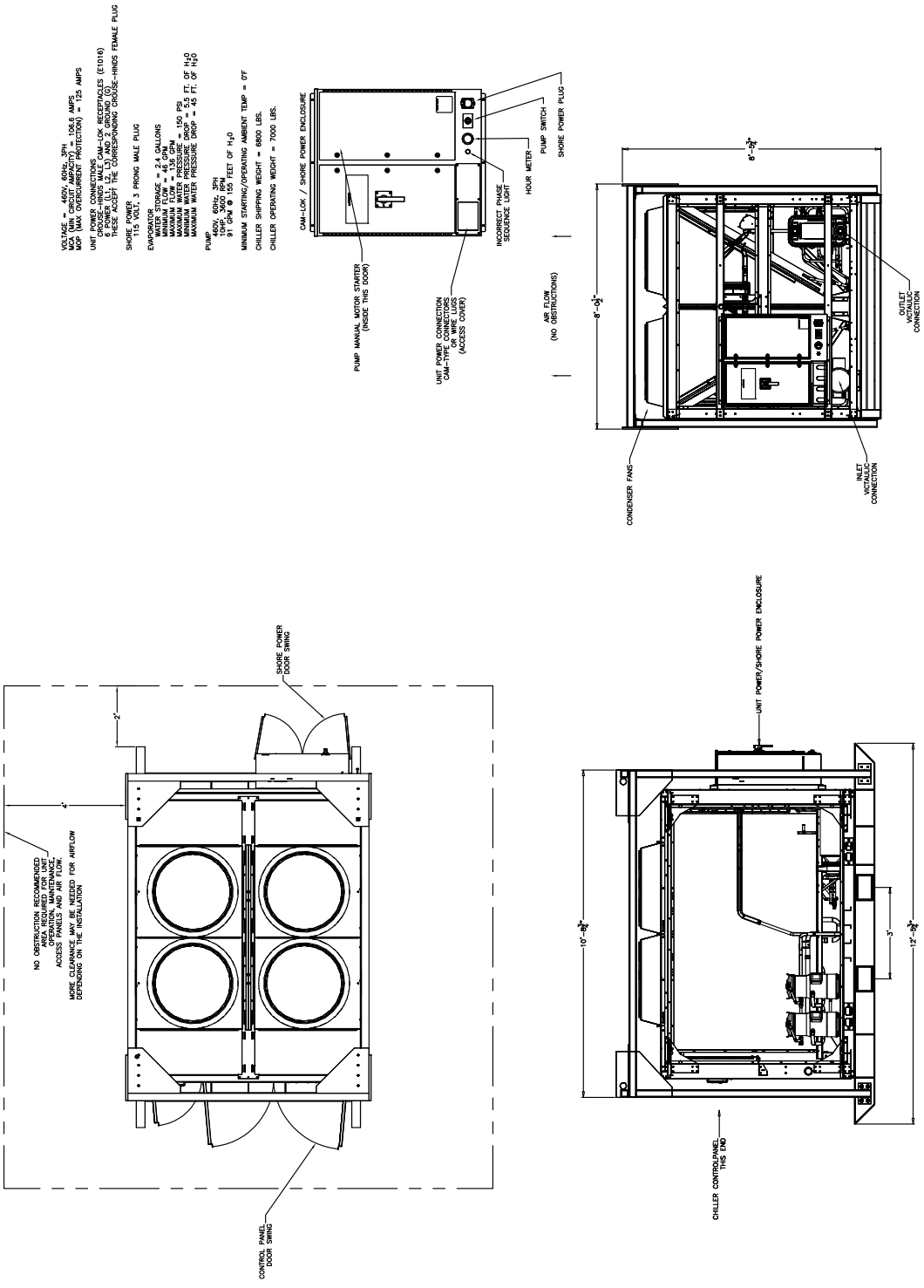


Figure 7. 40T CGAM (CSCA0040F2)

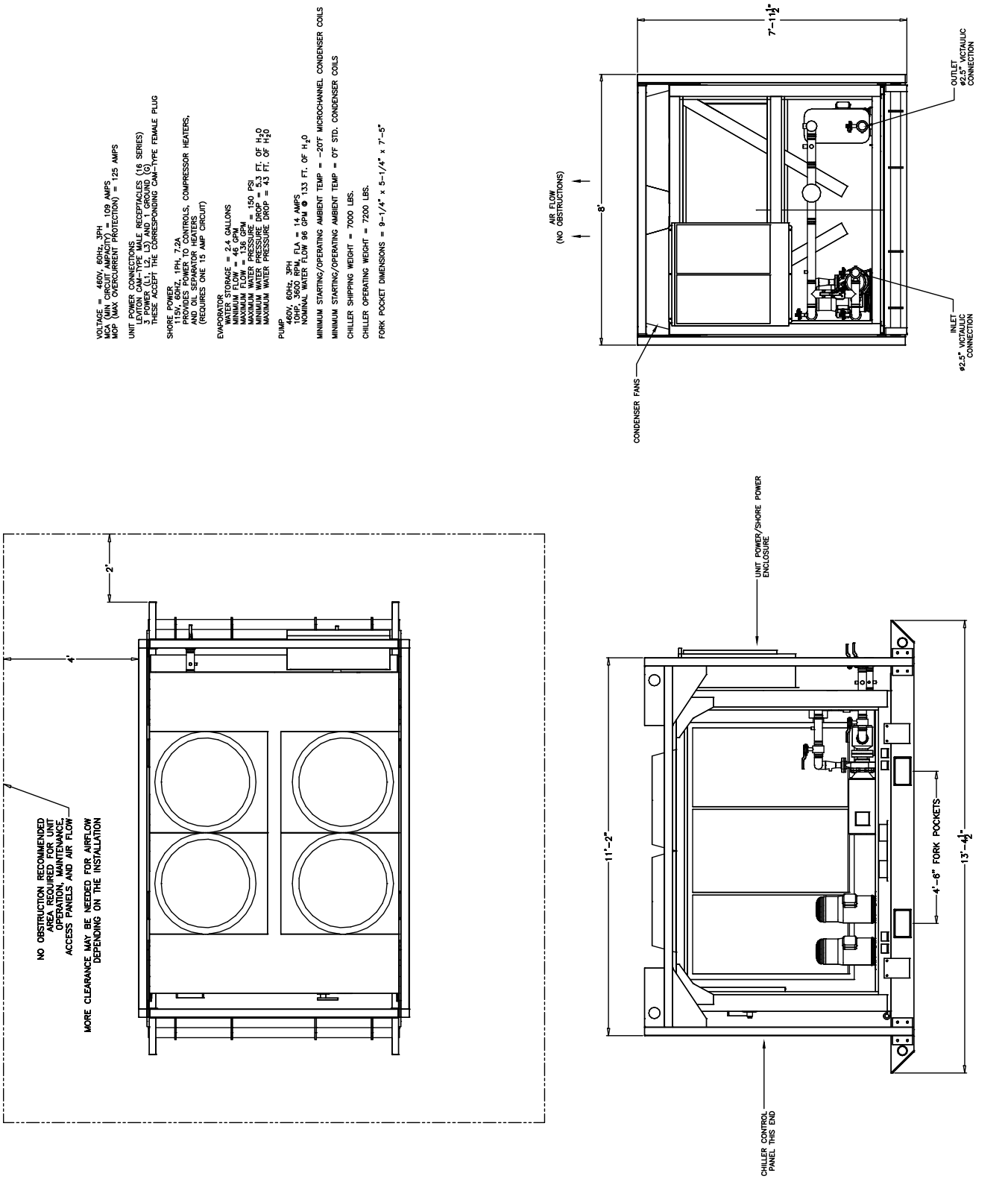


Figure 8. 60T CGAM (CSCA0060F0)

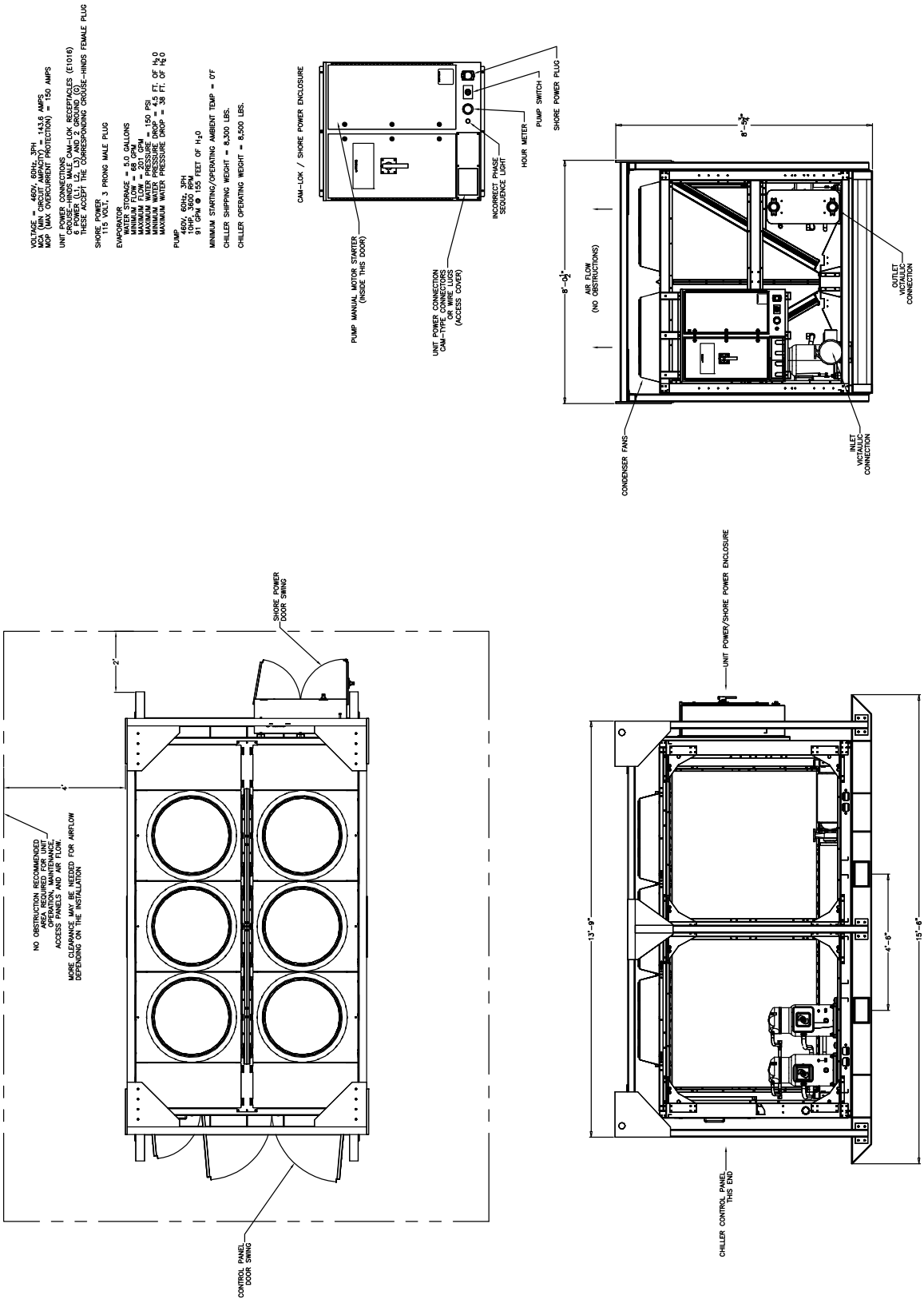


Figure 9. 60T CGAM (CSCA0060F2)

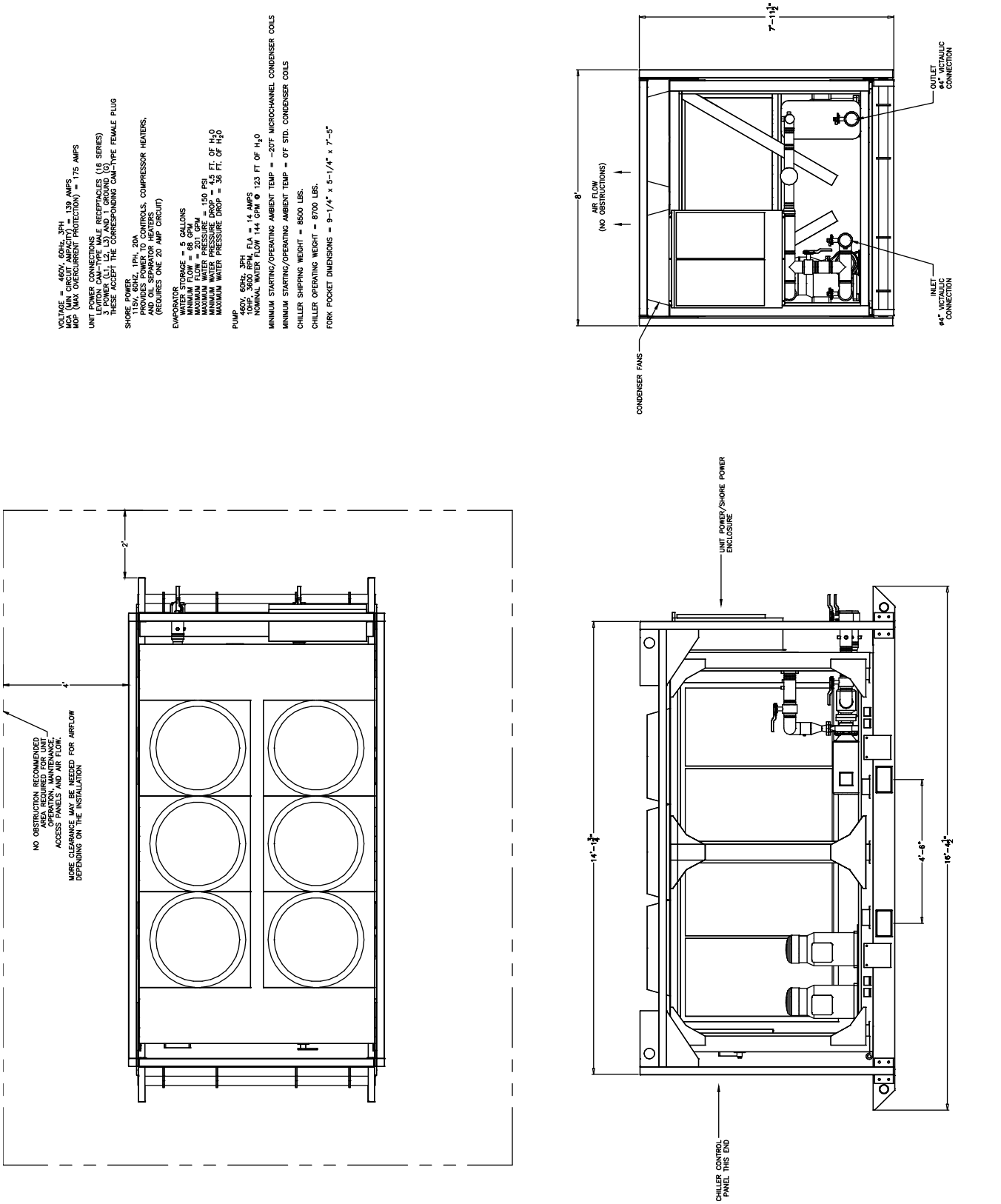


Figure 10. 60T CGAM (CSCA0060F3)

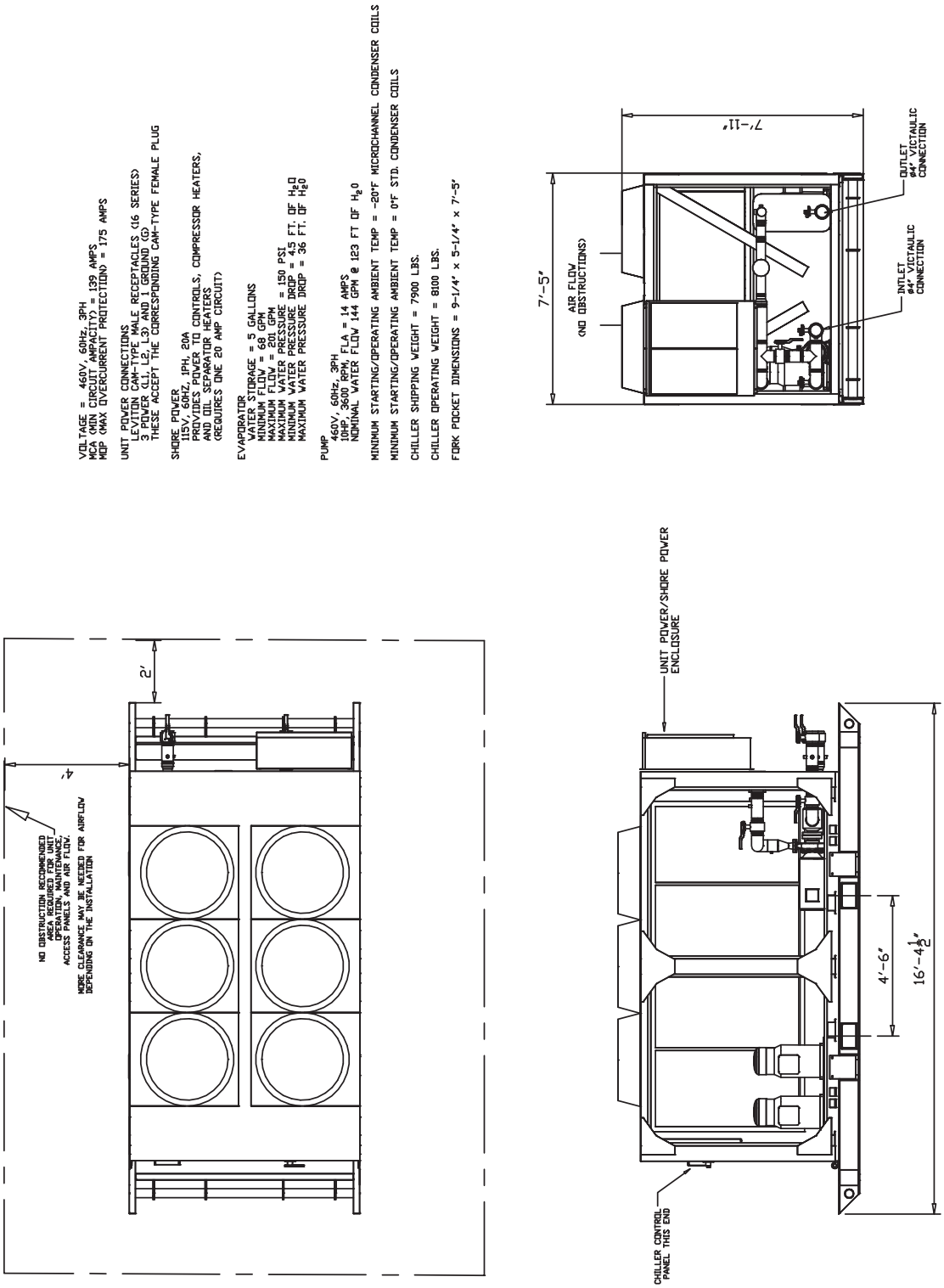


Figure 11. 80T CGAM (CSCA0080F1)

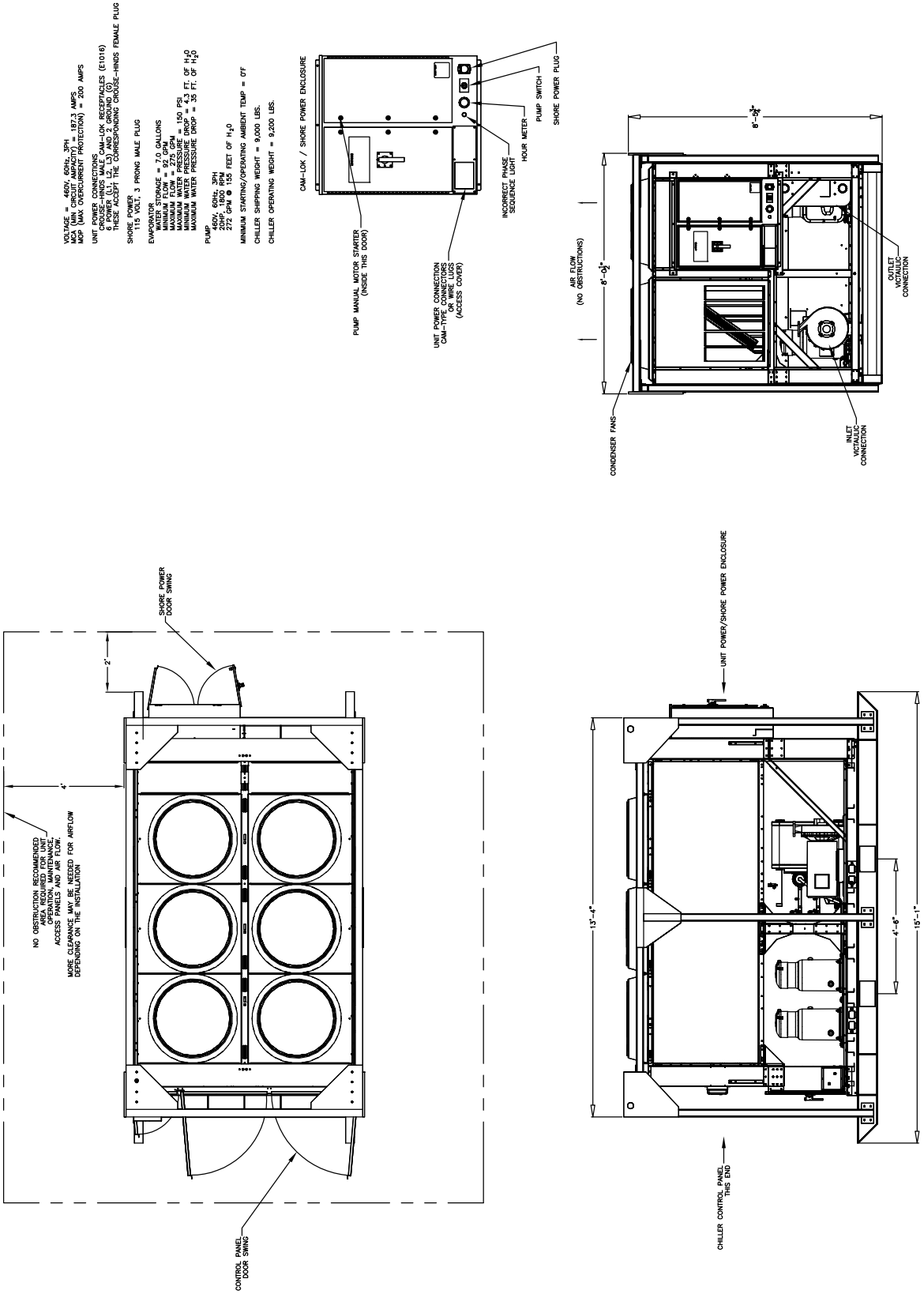


Figure 12. 80T CGAM (CSCA0080F2)

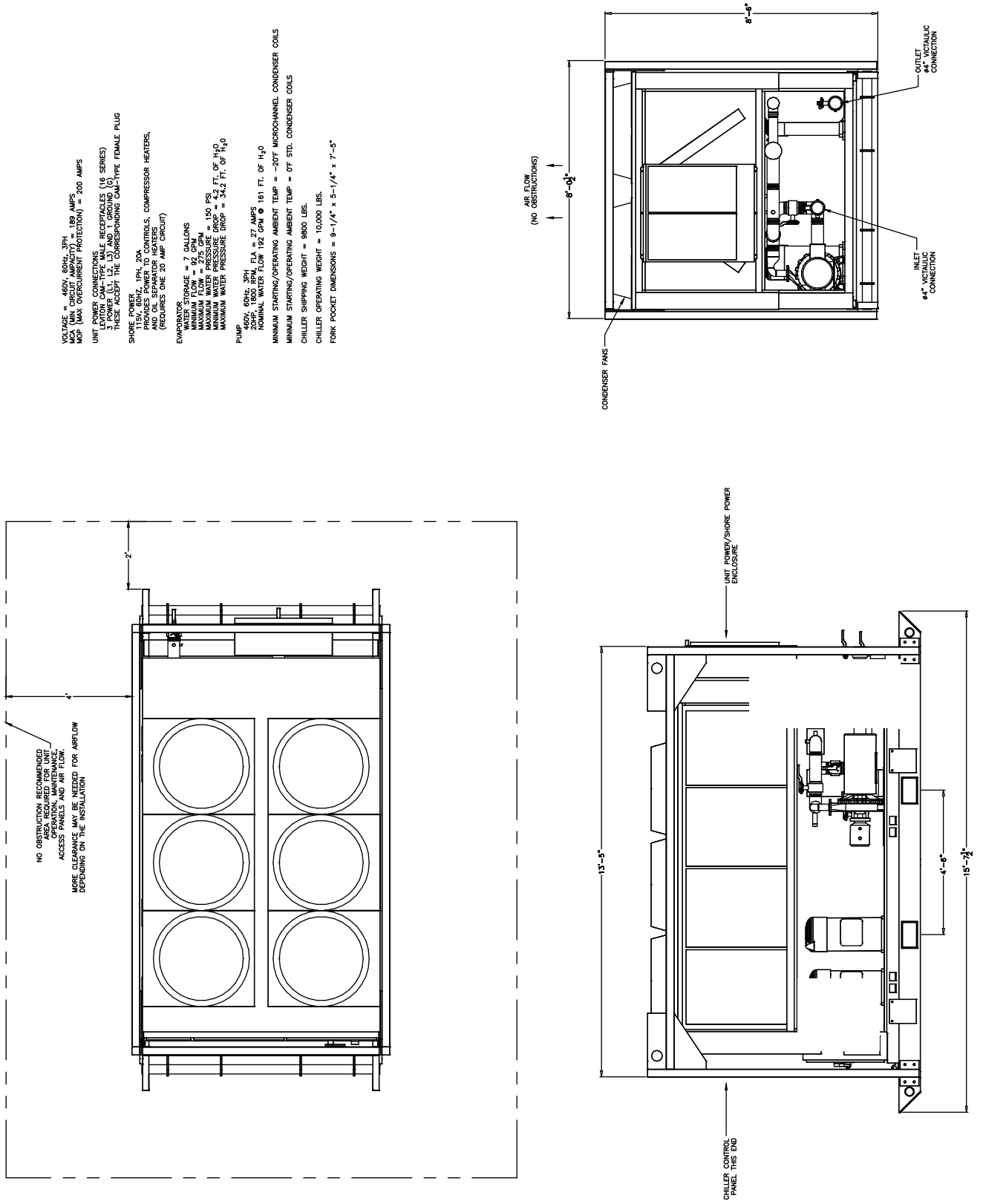


Figure 13. 100T CGAM (CSCA0100F1)

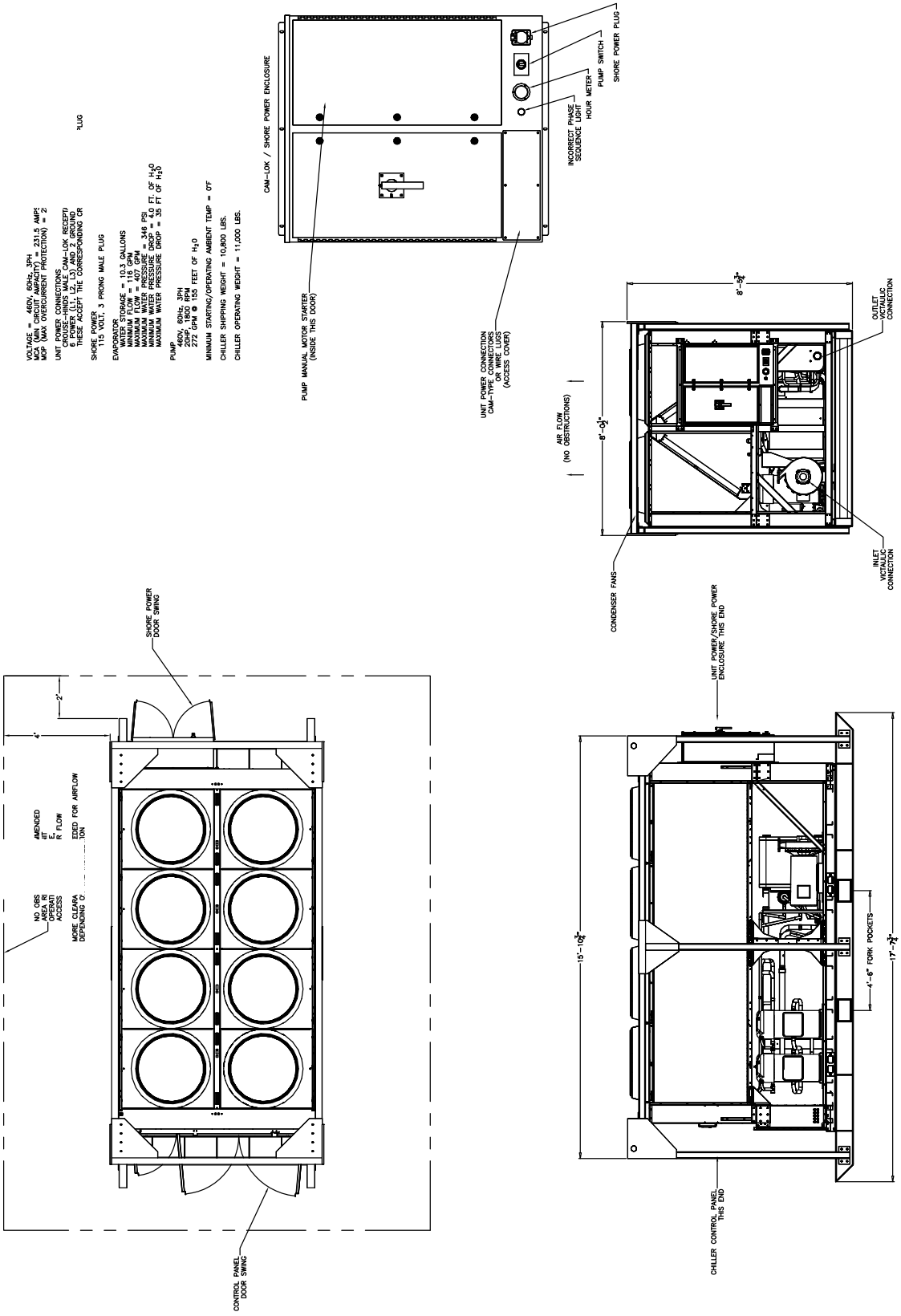


Figure 14. 100T CGAM (CSCA0100F2)

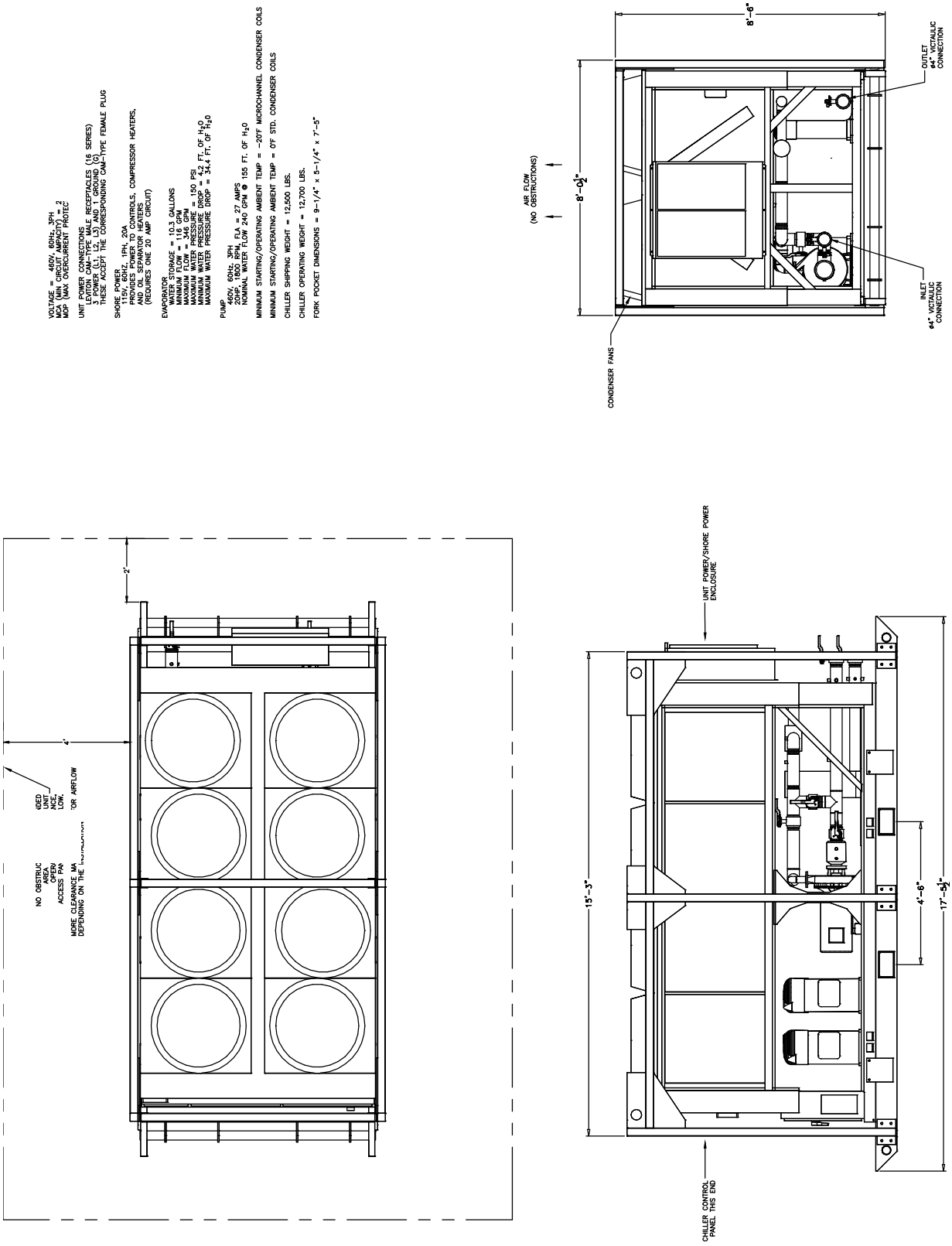


Figure 15. 100T CGAM (CSCA0100F3)

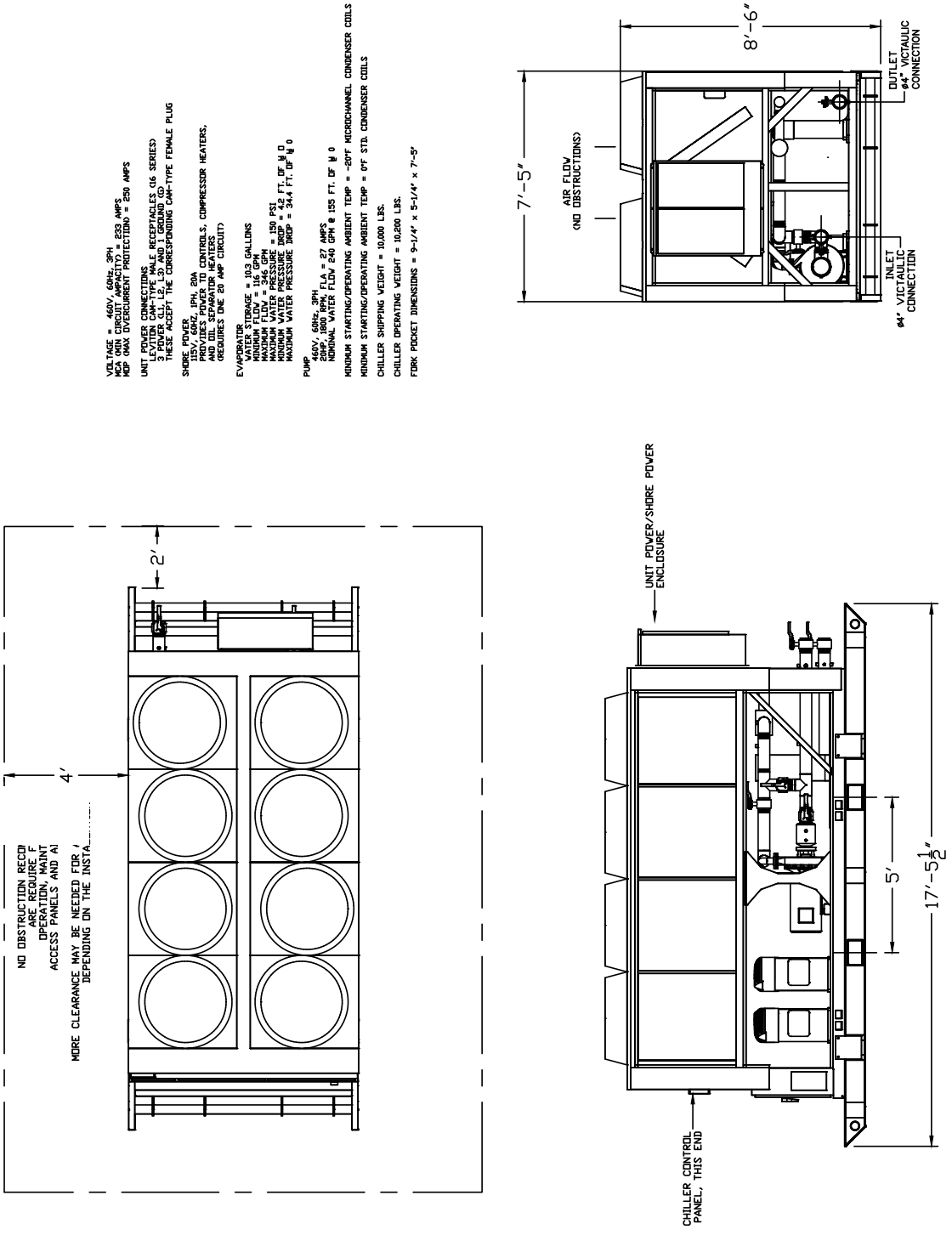


Figure 16. 120T CGAM (CSCA0120F1)

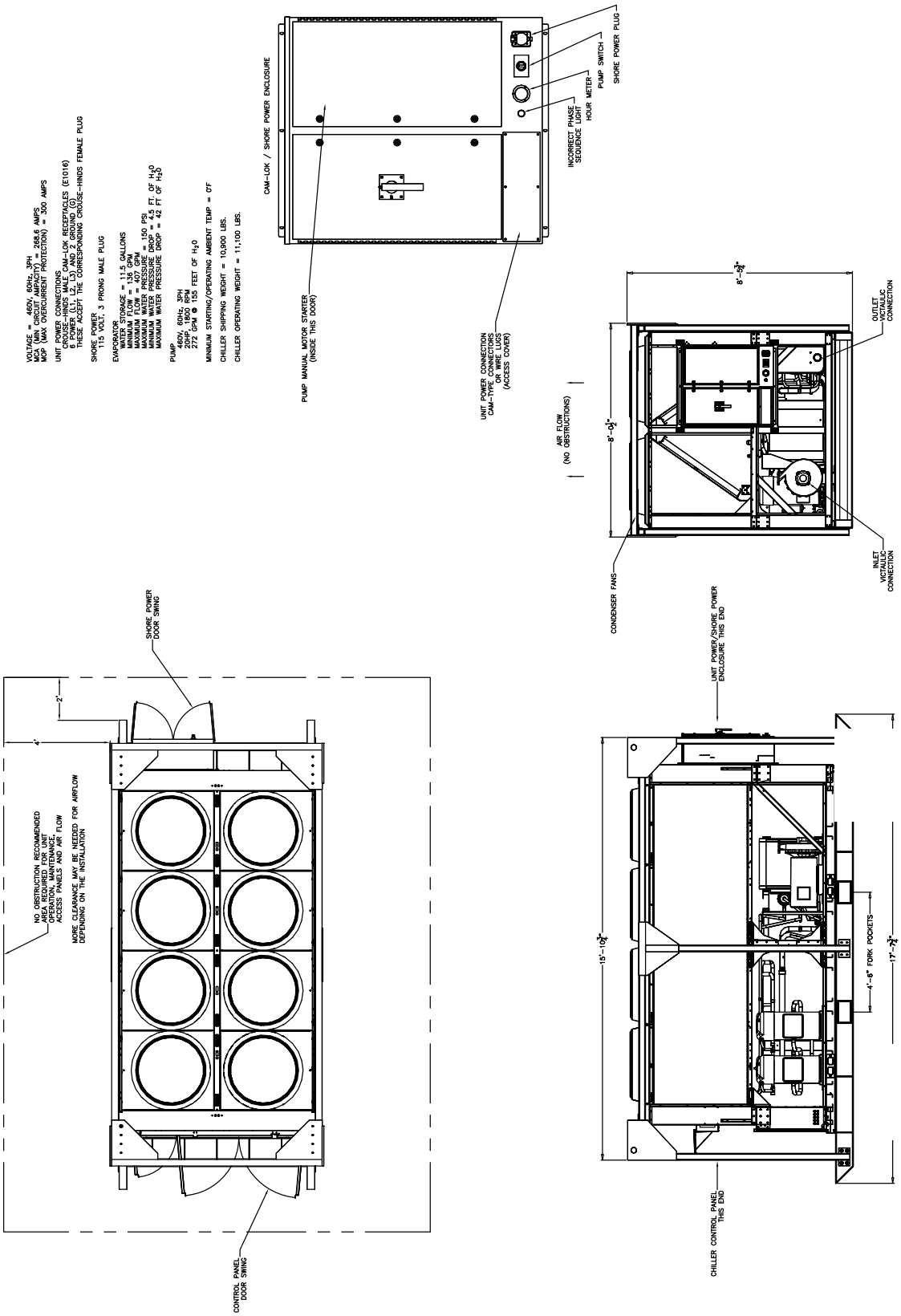


Figure 17. 120T CGAM (CSCA0120F2)

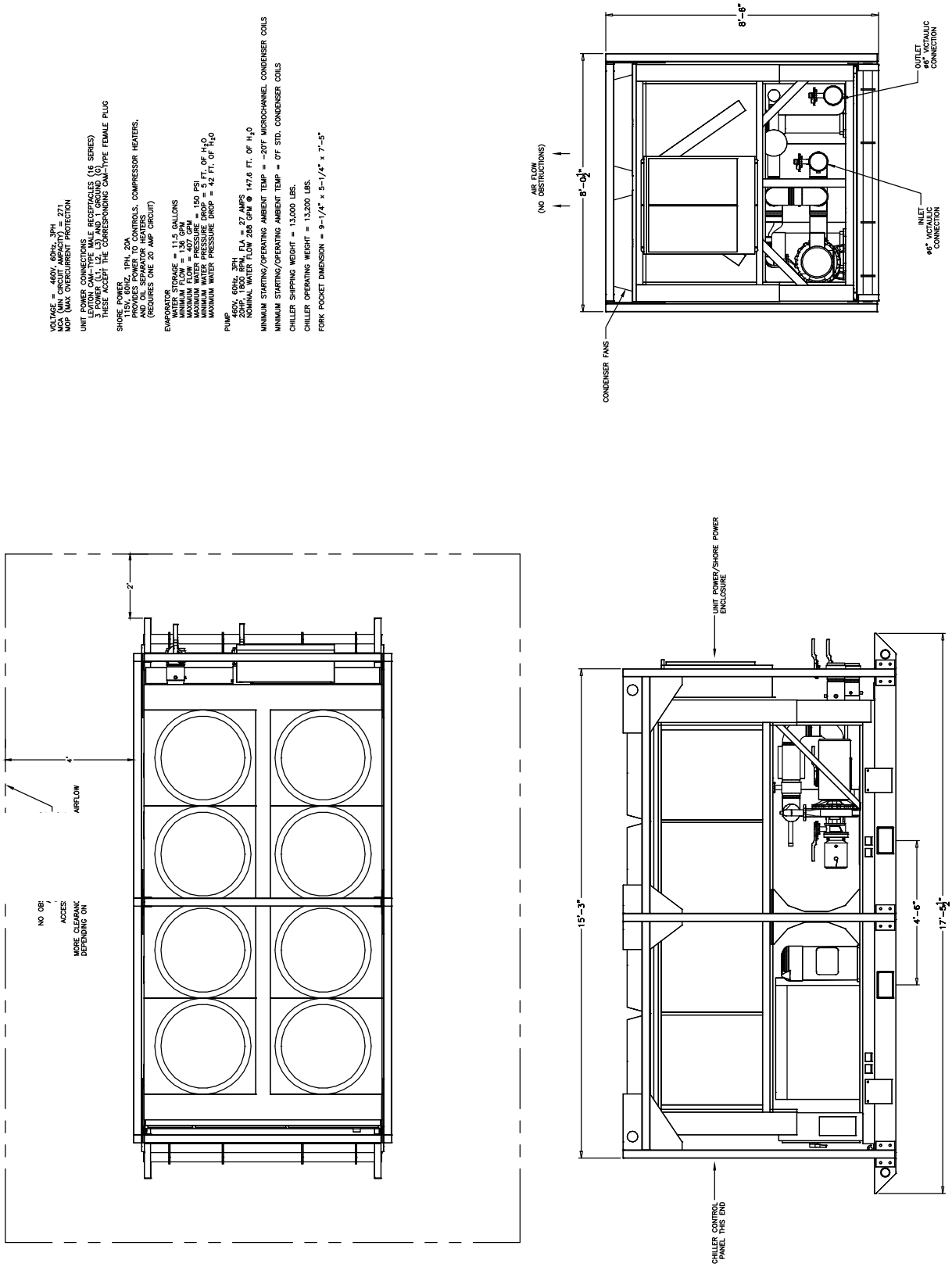
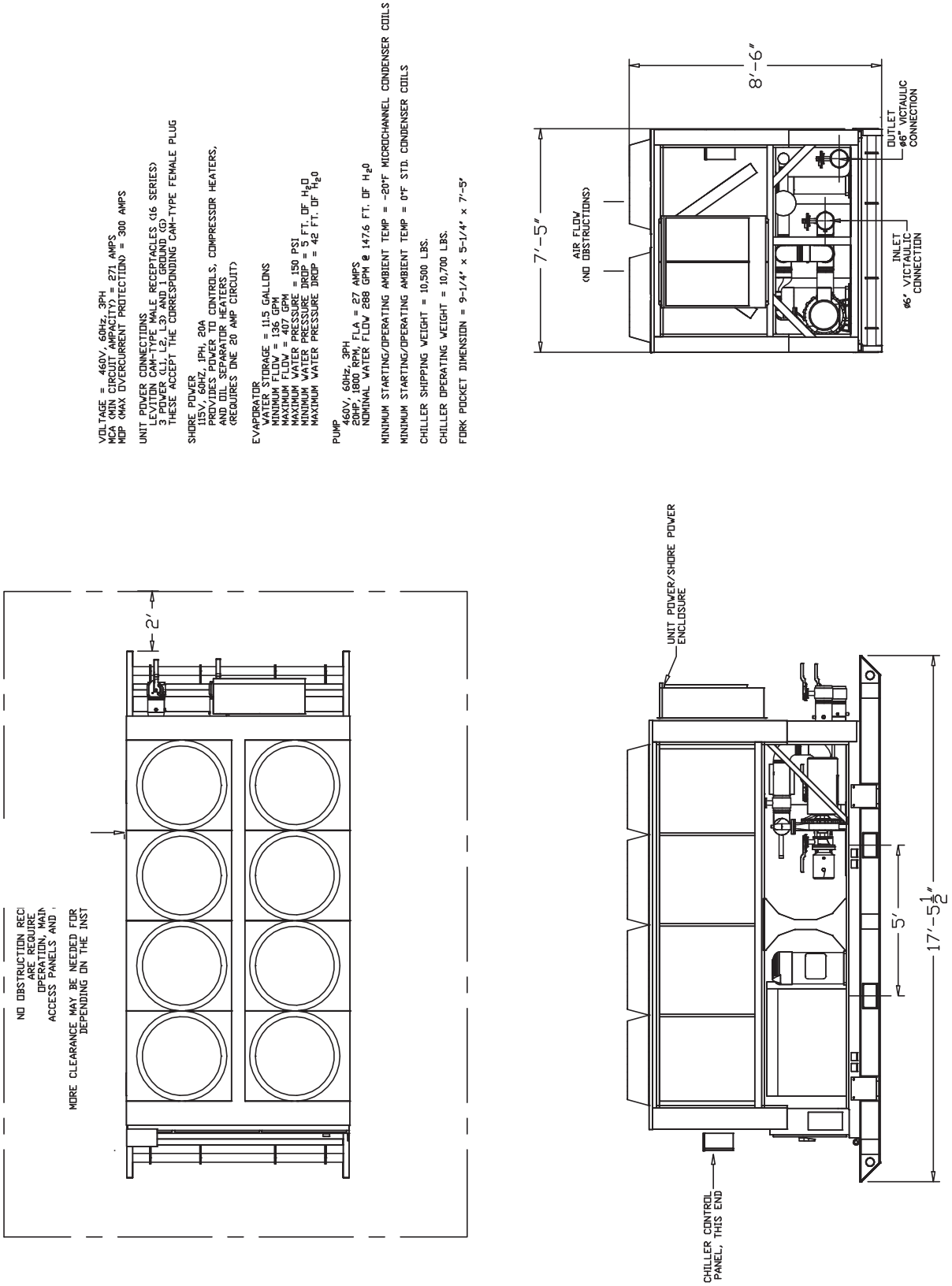


Figure 18. 120T CGAM (CSCA0120F3)



Unit Weights

Table 4. Unit weights

Unit	Weight (lb)	
	Shipping	Operational
CSCA0025F0	5,200	5,400
CSCA0025F2	5,000	5,200
CSCA0040F0	7,600	7,800
CSCA0040F2	7,000	7,200
CSCA0060F0	9,000	9,200
CSCA0060F2	8,500	8,700
CSCA0060F3	7,900	8,100
CSCA0080F1	10,100	10,300
CSCA0080F2	9,800	10,000
CSCA0100F1	11,200	11,400
CSCA0100F2	12,500	12,700
CSCA0100F3	10,000	10,200
CSCA0120F1	11,200	11,400
CSCA0120F2	13,000	13,200
CSCA0120F3	10,500	10,700

Installation

Location Requirements

Sound Considerations

- Refer to *Trane Engineering Bulletin Chiller Sound Ratings and Installation Guide* CG-PRB010*-EN for sound consideration applications.
- Locate the unit away from sound-sensitive areas.
- Chilled water piping should not be supported by chiller frame.
- Install rubber vibration isolators in all water piping.
- Seal all wall penetrations.

Note: *Consult an acoustical engineer for critical applications.*

Unit Location and Mounting

- Inspect the location for installation and verify service access clearances.
- Provide adequate blocking to level unit or trailer.

Foundation

Provide rigid, non-warping mounting pads or a concrete foundation of sufficient strength and mass to support the applicable operating weight (i.e., including completed piping, and full operating charges of refrigerant, oil and water). Refer to the chapter on "Dimensions and Weights," p. 10 for unit operating weights. Once in place, the unit must be level within 1/4-inch (6.4 mm) over its length and width. The Trane Company is not responsible for equipment problems resulting from an improperly designed or constructed foundation.

Clearances

Provide enough space around the unit to allow the installation and maintenance personnel unrestricted access to all service points. Refer to submittal drawings for the unit dimensions, to provide sufficient clearance for the opening of control panel doors and unit service. See "Service Clearances," p. 10 for minimum clearances. In all cases, local codes which require additional clearances will take precedence over these recommendations.

Rigging

See Table 4, p. 26 for typical unit lifting weights. Refer to the rigging label attached to the unit for further details.

⚠WARNING

Heavy Objects!

Failure to follow instructions below could result in unit dropping which could result in death or serious injury, and equipment or property-only damage.
Ensure that all the lifting equipment used is properly rated for the 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 the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

⚠WARNING

Improper Unit Lift!

Failure to properly lift unit in a LEVEL position could result in unit dropping and possibly crushing operator/technician which could result in death or serious injury, and equipment or property-only damage.
Test lift unit approximately 24 inches (61 cm) to verify proper center of gravity lift point. To avoid dropping of unit, reposition lifting point if unit is not level.

NOTICE

Equipment Damage!

To prevent damage to unit, do not fork lift or allow lifting cables to contact unit during lift.

Lifting using either a single spreader bar or an H-type spreader is acceptable. Attach chains or cables to lifting beam. Lifting beam crossbars **MUST** be positioned so lifting cables do not contact the sides of the unit.

Important: *The center of gravity (CG) is never at the midpoint of the base rail lifting strap holes. A level unit lift is required for a safe lift and to prevent unit damage.*

Lifting a unit with equal length straps will NOT produce a level unit during the lift because the CG will not be at the midpoint between the base lifting holes. The following adjustments must be made to produce a level lift:

- Single spreader bar lifting method.
  - Several adjustments of the strap length may be required to produce a level unit during lift.
- H-type spreader bar lifting method.
  - If the straps from the H bar to the unit base are the same length, the crane lifting point on the center web of the H bar must be adjusted to produce a level unit lift. See Figure 19, p. 28.

Figure 19. H-type spreader bar adjustment for level unit lift

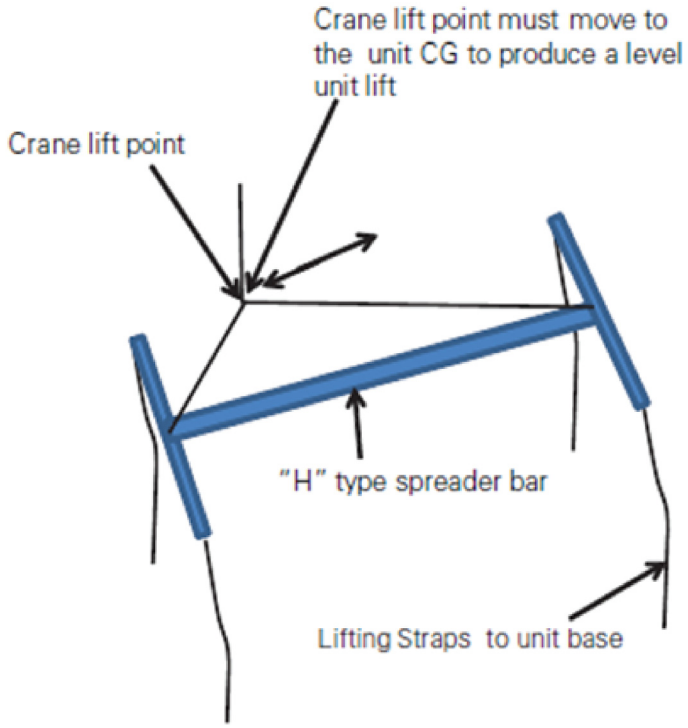


Figure 20. 25T CGAM rigging diagram

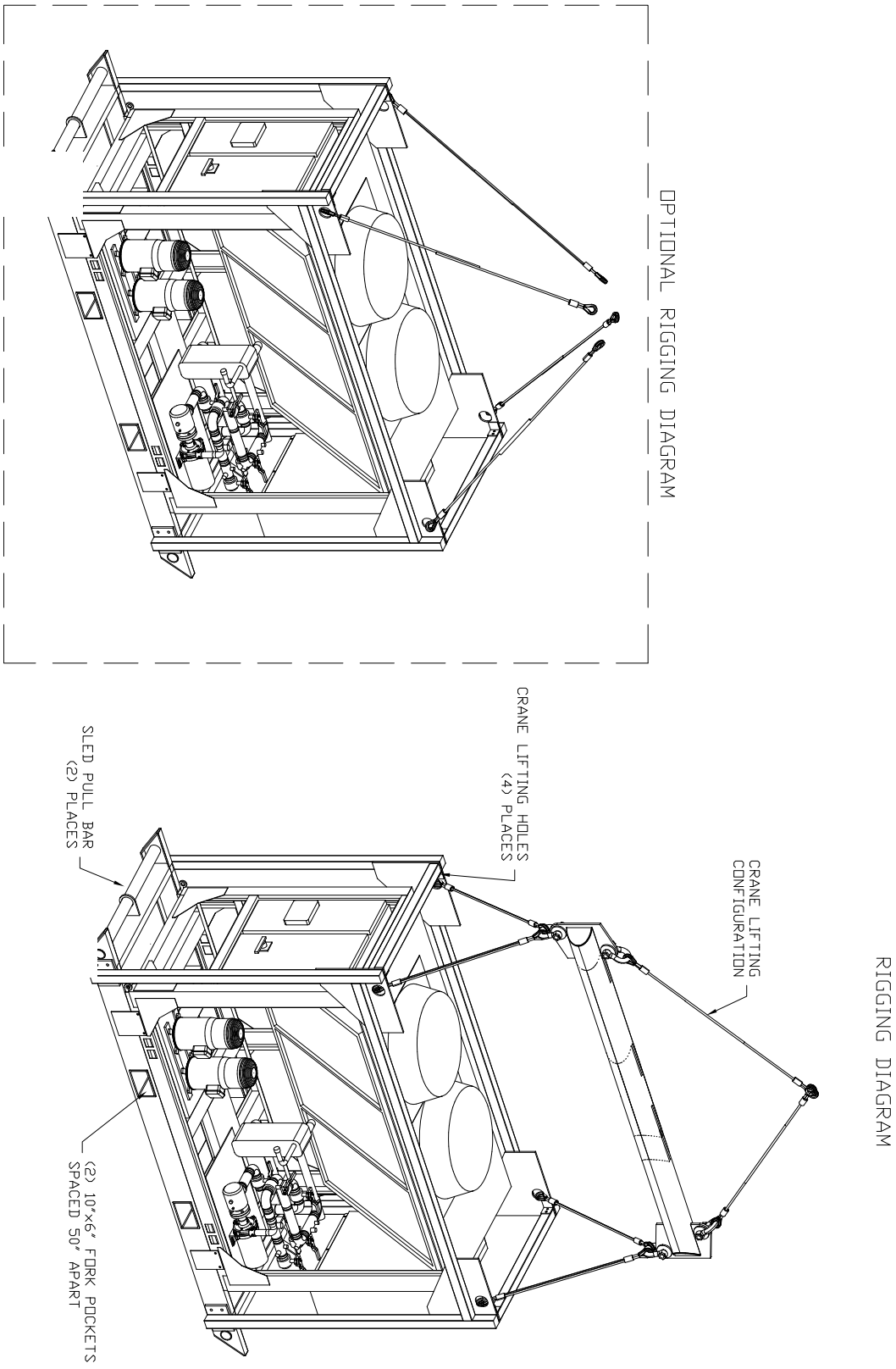


Figure 21. 40T CGAM rigging diagram

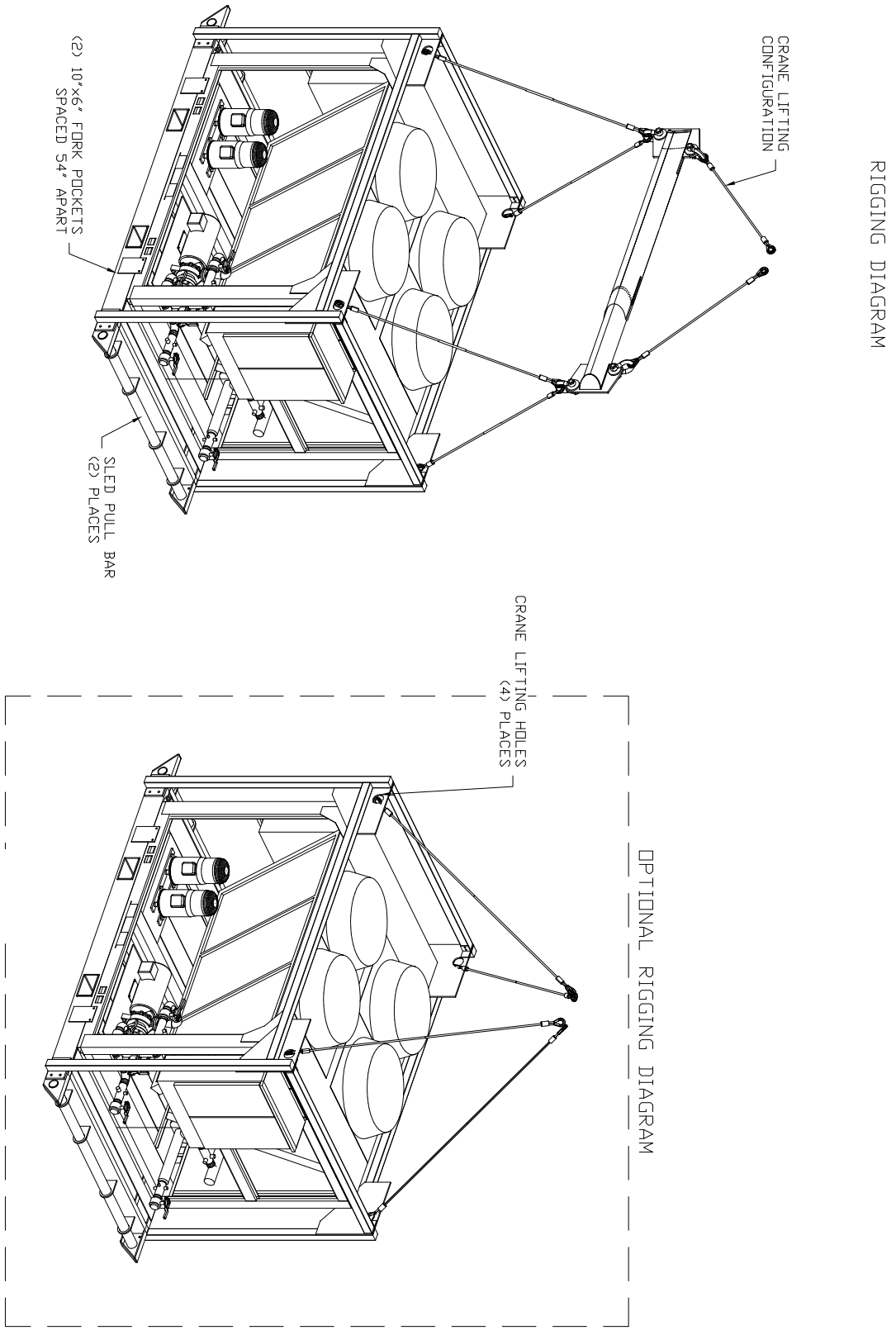


Figure 22. 60T CGAM rigging diagram

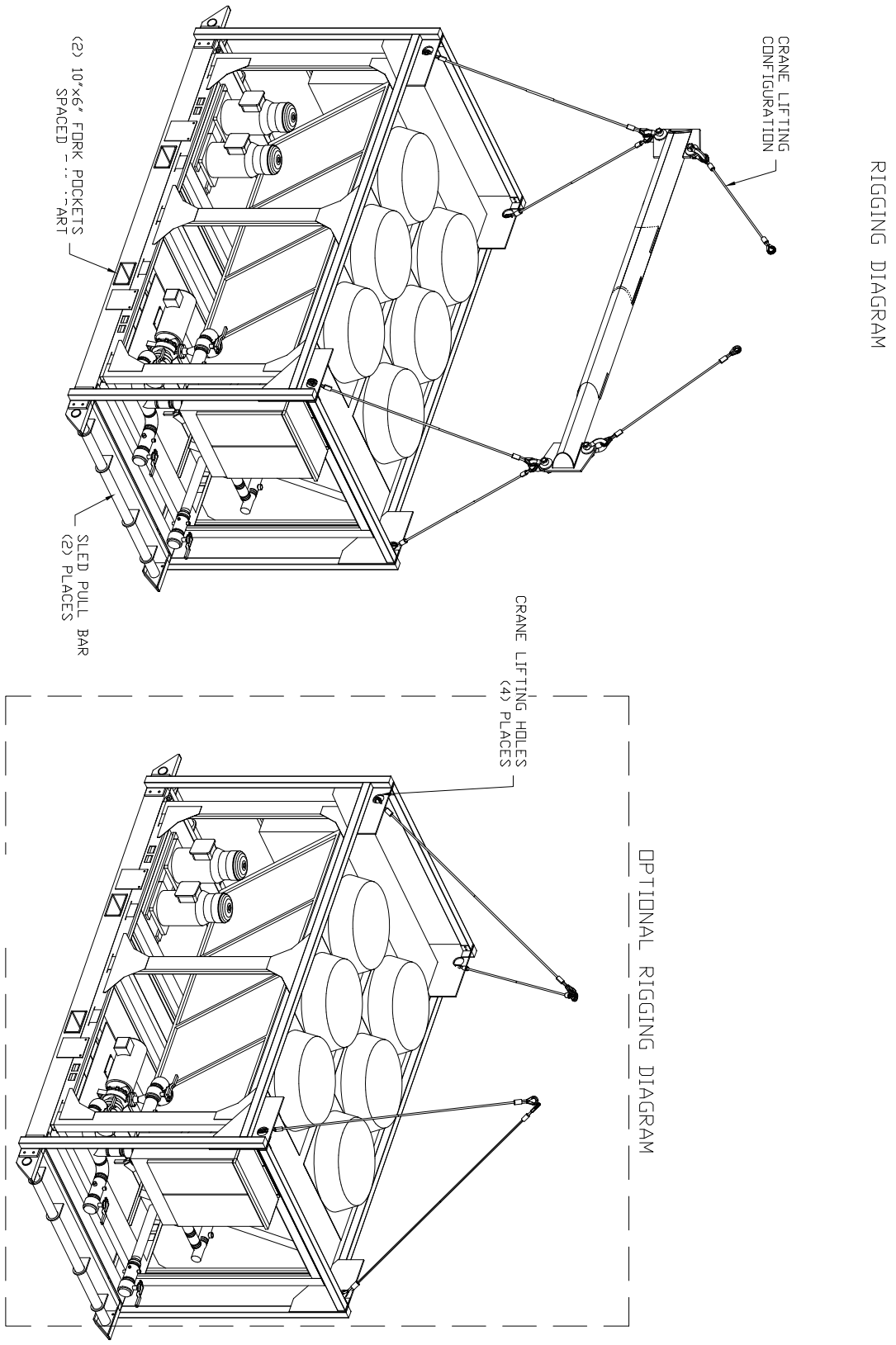


Figure 23. 80T CGAM rigging diagram

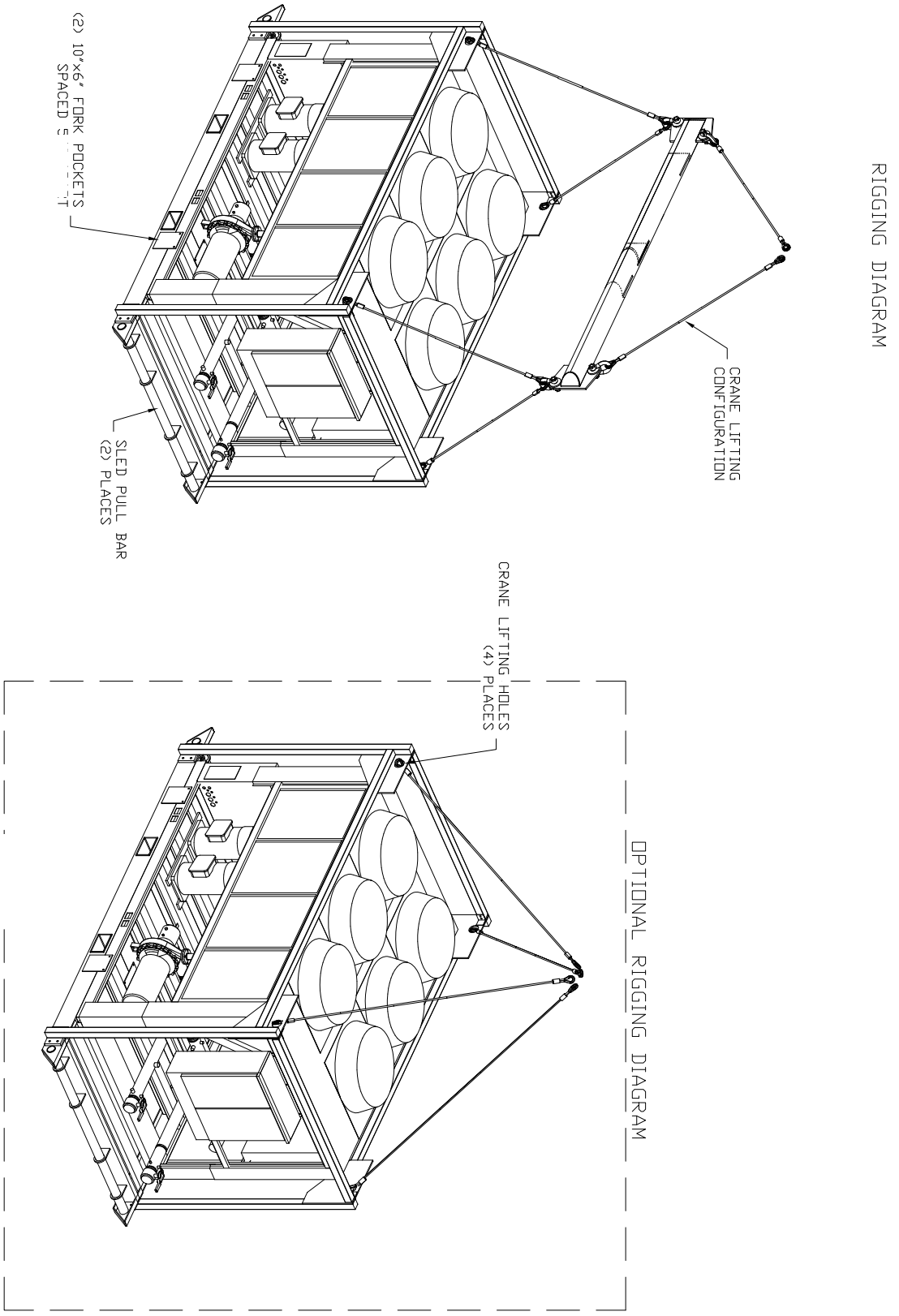


Figure 24. 100T CGAM rigging diagram

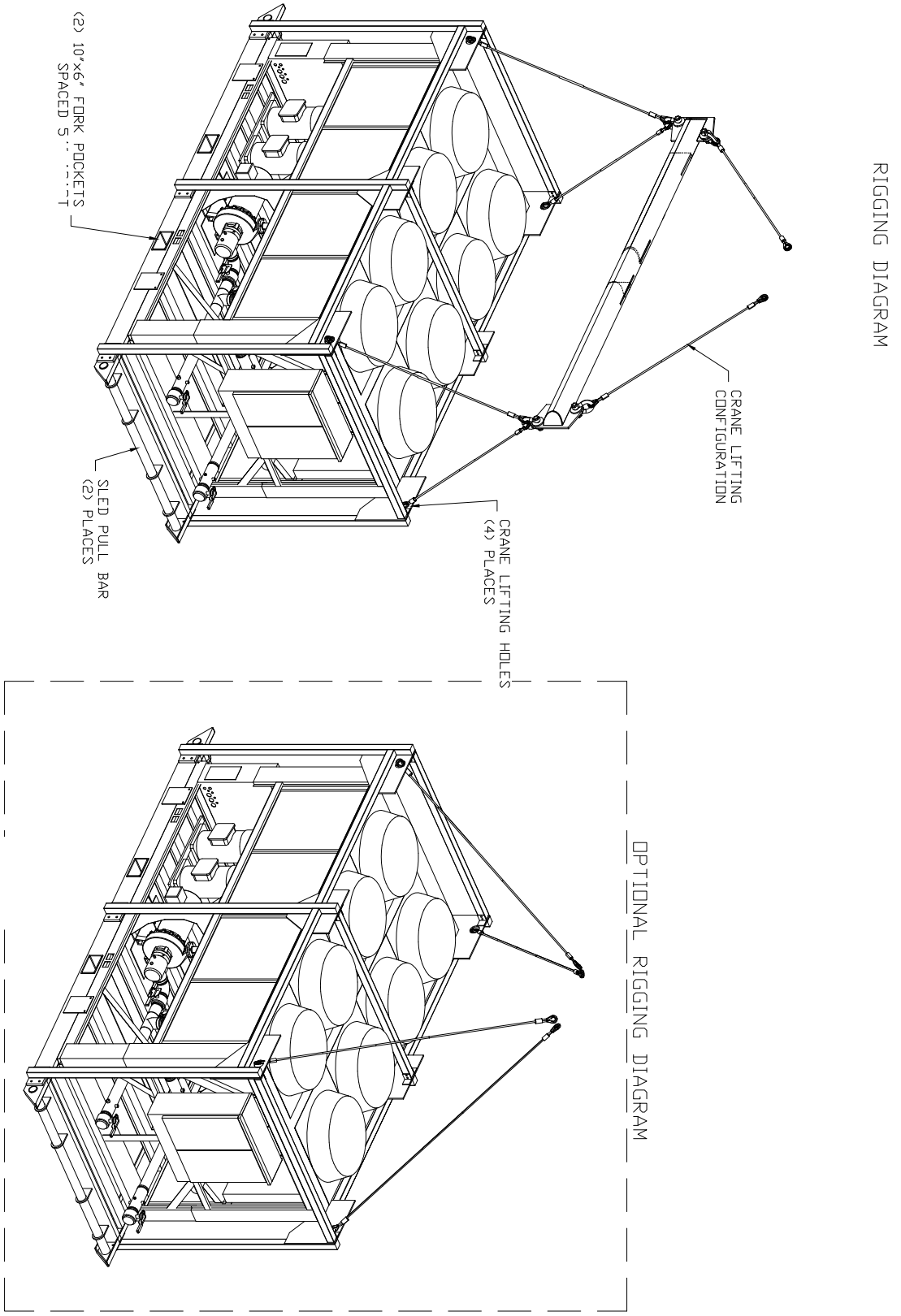
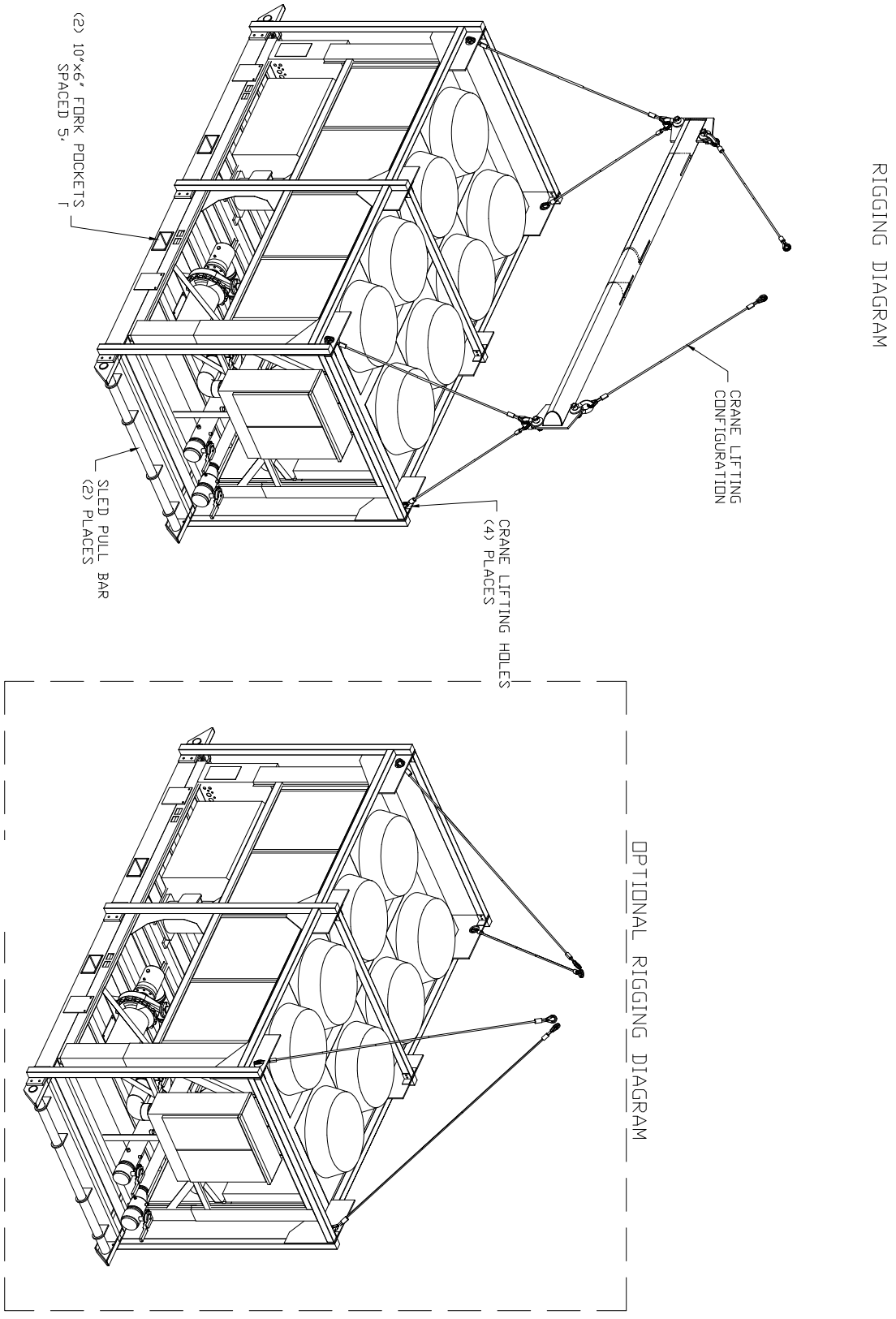


Figure 25. 120T CGAM rigging diagram



Handling

⚠WARNING

Heavy Objects!

Failure to follow instructions below could result in unit dropping which could result in death or serious injury, and equipment or property-only damage.
Ensure that all the lifting equipment used is properly rated for the 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 the unit. Lifting cables (chains or slings) may not be of the same length. Adjust as necessary for even unit lift.

Units can be left on the trailer or removed from the trailer for rental. Remove units by the forklift pockets that are easily accessible for wide forklift trucks. See Table 4, p. 26 to determine if a forklift truck has the capacity to lift the unit. Some units can also be lifted by an overhead-lifting frame and spreader bars. See "Unit Drawings," p. 11 to determine which models include overhead lifting frames.

Leveling

Level the unit using the base rail as a reference. The unit must be level within 1/4-inch over the entire length (end-to-end as well as side-to-side). Use shims as necessary to level the unit.

Evaporator Piping

NOTICE

Equipment Damage!

Failure to follow these instructions could result in equipment damage.
All heaters have separate power from the unit. All heaters must be energized or the unit controller must control the pumps when the unit is off (unless the water circuit is drained or sufficient glycol is used). In the event of prolonged power loss, neither heaters nor unit control of the pumps will protect the evaporator from catastrophic damage. In order to provide freeze protection in the event of a power loss you MUST drain the evaporator, use sufficient freeze inhibitor in the evaporator or provide back-up power for pump.

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

Drainage

Locate the unit near a large capacity drain for water vessel drain-down during shutdown or repair. Drain connections are provided in the chilled water outlet line of evaporator. All local and national codes apply.

⚠WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

How to drain the water circuit (for protection with ambients below -20°F):

1. Shut-off the power supply to the unit and to all heaters.
2. Purge the water circuit.
3. Blow out the evaporator to confirm no liquid is left in the evaporator.

Air Vents

A vent port is located on top of the chiller near the return end. Additional vents must be installed at high points in the piping system to facilitate air purging during the filling process.

Evaporator Piping Components

NOTICE

Evaporator Damage!

Do not exceed 150 psig evaporator pressure as it could result in damage to the evaporator.

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime. Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Piping components include all devices and controls used to provide proper water system operation and unit operating safety.

Water Pressure Gauges

A water pressure gauge is installed across the brazed plate heat exchanger with appropriate piping to measure the differential pressure.

Water Shut-off Valves

Shut-off valves are provided in the **supply** and **return** pipe near the chiller so the gauge(s), thermostats, sensors, strainer, etc., can be isolated during service.

Pipe Unions and Connectors

Pipe unions and Victaulic® connectors are used to simplify disassembly for system service.

Thermometers

Temperature gauges are used in the lines to monitor the evaporator entering and leaving water temperatures.

Flow Sensor

A flow sensor is installed on this CGAM unit near the outlet piping. The purpose of the flow sensor is to determine if there is adequate flow to prevent the evaporator from freezing. This flow sensor is wired into the controls of this CGAM unit. The CGAM unit has a pump interlock control that requires flow to operate. If there is no flow through the evaporator of the CGAM unit, the chiller will not start or will shut down if the evaporator loses flow. For more information about chilled water flow, refer to the **Chilled Water Flow (Pump) Interlock** section in CG-SVX17*-EN.

Liquid Sensing Switch

A liquid sensing switch and relay have been installed on each unit. The purpose of this liquid sensing switch is to prevent the immersion heater operation in the absence of liquid.

Balancing Valves

A balancing valve is installed in the leaving water line. It will be used to establish a balanced flow.

Note: *Both the entering and leaving water lines have shut-off valves installed to isolate the evaporator for service.*

Water Strainer

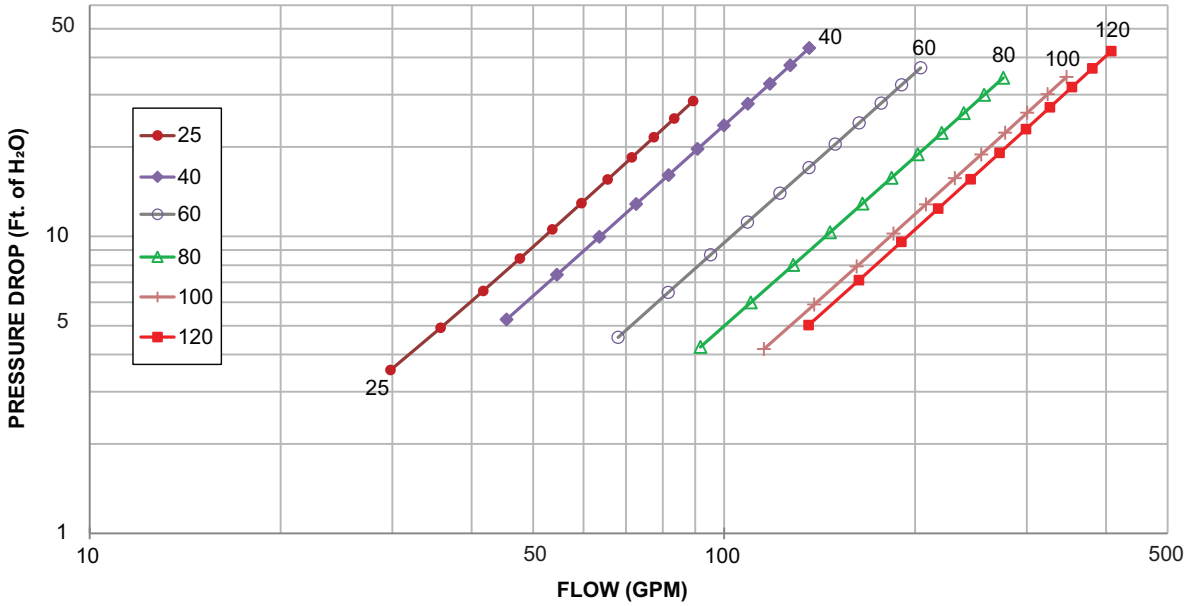
The water strainer is factory-installed with taps for the pressure gauges on the inlet and outlet. Install pressure gauges in order to measure differential pressure across the filter. This will help to determine when it is necessary to clean the water strainer.

Chiller Drain

The chiller drain is piped with a ball shut-off valve to facilitate evaporator draining during service or shutdown procedures.

Pressure Drop Curve

Figure 26. Total unit pressure drop curves



Water Piping Connections

1. All water piping to the system should be flushed thoroughly before making the final connections.

NOTICE

Pump Damage!

Failure to follow instruction could result in pump damage.
If using any commercial flushing/cleaning solution, construct a temporary bypass around the unit to prevent damage to internal components of the evaporator/condenser. Trane assumes no responsibility for equipment damage caused by flushing/cleaning solutions or water-borne debris.

2. Connect the water pipe to the chilled water piping connections.
3. Confirm the drain shut-off valve is closed.
4. While filling the chiller system with solution, vent the air from the system at the highest points.

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime. Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

Table 5. Unit water connection sizes

CGAM Unit Model	Piping Connection Size
CSCA0025F0-F2	2.5 in. Victaulic
CSCA0040F0-F2	2.5 in. Victaulic
CSCA0060F0-F3	4 in. Victaulic
CSCA0080F1-F2	4 in. Victaulic
CSCA0100F1-F3	4 in. Victaulic
CACS0120F1-F3	6 in. Victaulic

NOTICE

Evaporator Damage!

Do not exceed 150 psig evaporator pressure as it could result in damage to the evaporator.

NOTICE

Pump Damage!

Failure to follow these instructions could result in pump or unit damage.
Do not reverse system water piping connections to the unit or pump.

To prevent unit or pump damage, do NOT reverse system water piping connections to the unit or pump; water entering the evaporator is pre-piped to the discharge of the pump.

Flexible Hose and Hard Pipe Installation

To minimize premature or catastrophic failure of flexible hose provided as part of a Trane Rental Services rental or hard pipe, refer to CHS-SVX01*-EN for installation data.

Hard Pipe Guidelines

Certain installations may require the use of hard pipe (steel or PVC). Hard pipe is typically recommended for semi-permanent installations (three months or more), installations with space limitations, and/or between connection and pump inlet.

When installing hard pipe:

- Construct and install the piping according to local and national codes.
- Isolate and support the piping as required to prevent stress on the unit and vibration to building piping.

If there are any questions regarding how to install water piping, contact Trane Rental Services Technical Service Support.

Exceptions

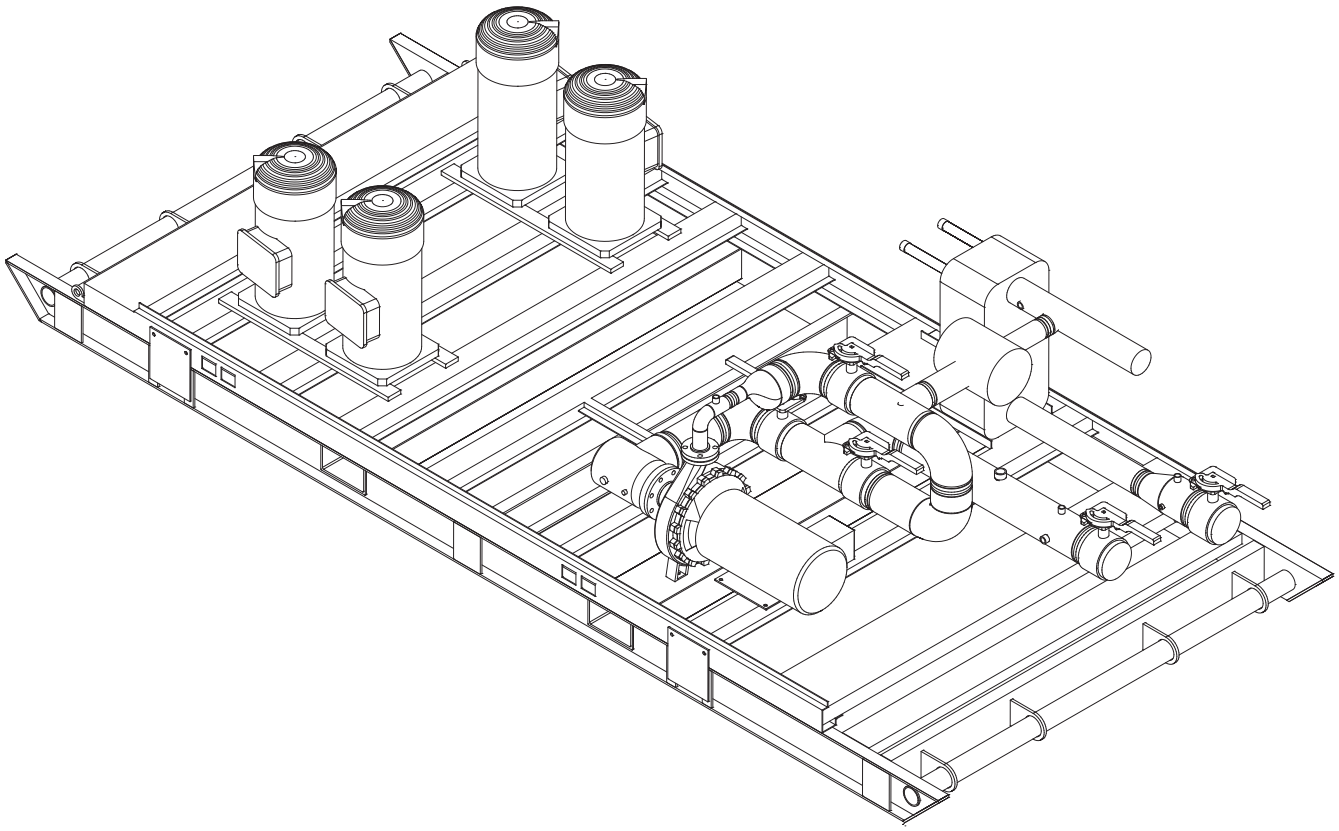
Trane Rental Services Support must authorize any exceptions to the guidelines established in this bulletin in writing.

Material disposition

In the event the hose fails or leaks:

1. Call Trane Rental Services Support.
2. Tag the hose **BAD**.
3. Place it back in the shipping box.

Figure 27. Water inlet/outlet connections



Note: *When installing water pipes, route them away from the compressor access panels to allow for compressor servicing or replacement.*

Ambient Freeze Avoidance

A glycol type anti-freeze may be required for freeze protection. For more information, refer to the Freeze Protection section in CG-SVX17*-EN.

Note: *CGAM chillers use brazed plate heat exchanges, which are NOT at risk for refrigerant migration freeze. Chiller must only be protected from freeze due to low ambient conditions.*

One or more of the ambient freeze avoidance methods in Table 6, p. 38 must be used to protect the CGAM chiller from ambient freeze damage.

Table 6. CGAM ambient freeze avoidance methods

Method	Protects to ambient temperature	Notes
Water pump control	Down to 0°F	• CH530 controller can start the pump when the ambient temperature drops to prevent freezing. For this option the pump must be controlled by the CGAM unit and this function must be validated. • Water circuit valves need to stay open at all times. • ***If dual high head pump package option is selected, the chiller MUST control the pumps.***
Heaters	Down to -20°F	• ***This option is not applicable for units ordered with "No Freeze Protection" (model number digit 18 = X). Factory mounted heaters are NOT installed on these units, and one of the other forms of freeze protection must be used.*** • For units with freeze protection selected (model number digit 18 is "1"), heaters are factory-installed on the evaporator and water piping and will protect them from freezing in ambient temperatures down to -20°F (-29°C). • 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. • ***See NOTICE below for important information.***
Freeze Inhibitor	Varies. See "Low Evaporator Refrigerant Cutout/Percent Glycol Recommendations," p. 39	Freeze protection can be accomplished by adding sufficient glycol to protect against freezing below the lowest ambient expected.

Table 6. CGAM ambient freeze avoidance methods (continued)

Method	Protects to ambient temperature	Notes
Drain Water Circuit	Below -20°F	• Shut-off the power supply to the unit and to all heaters. • Purge the water circuit. • Blow out the evaporator to ensure no liquid is left in the evaporator. • ***By default, the CH530 freeze protection control is enabled and will request the start of the chilled water pump with ambient temperatures less than the evaporator low leaving water temperature setpoint. The pump remains ON until the minimum evaporator water temperature is greater than low leaving water temperature setpoint plus 7°C. The minimum on time for the pump is 5 minutes. If you do NOT want the CH530 to start the pump when the ambient temperature drops to freezing, disable this freeze protection control.***

NOTICE

Equipment Damage!

All heaters must be energized or the CH530 must control the pumps when the unit is off (unless the water circuit is drained or sufficient glycol is used). In the event of prolonged power loss, neither heaters nor CH530 control of the pumps will protect the evaporator from catastrophic damage. In order to provide freeze protection in the event of a power loss you MUST drain the evaporator, use sufficient freeze inhibitor in the evaporator or provide back-up power for pump.

Low Evaporator Refrigerant Cutout/ Percent Glycol Recommendations

The tables below shows the low evaporator temperature cutout for different glycol levels.

Additional glycol beyond the recommendations will adversely effect 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.

If additional glycol is used, then use the actual percent glycol to establish the low refrigerant cutout setpoint.

Table 7. Low evaporator refrigerant temperature cutout and low water temperature cutout — ethylene glycol

% Glycol	Solution Freeze Point (°F)	Low Refrig Temp Cutout (°F)	Low Water Temp Cutout (°F)	FLOW >= 1.2 GPM/TON		FLOW >= 1.5 GPM/TON	
				Min Chilled Water Setpoint (°F)		Min Chilled Water Setpoint (°F)	
				Number of compressors		Number of compressors	
				2	4	2	4
0	32	22	36	42	42	41	40
1	31.6	21.6	35.6	42	40.1	40.6	39.1
2	31.0	21.0	35.0	42	39.5	40.0	38.5
3	30.3	20.3	34.3	41.3	38.8	39.3	37.8
4	29.7	19.7	33.7	40.7	38.2	38.7	37.2
5	29.0	19.0	33.0	40.0	37.5	38.0	36.5
6	28.3	18.3	32.3	39.3	36.8	37.3	35.8
7	27.6	17.6	31.6	38.6	36.1	36.6	35.1
8	26.9	16.9	30.9	37.9	35.4	35.9	34.4
9	26.2	16.2	30.2	37.2	34.7	35.2	33.7
10	25.5	15.5	29.5	36.5	34.0	34.5	33.0
11	24.7	14.7	28.7	35.7	33.2	33.7	32.2
12	23.9	13.9	27.9	34.9	32.4	32.9	31.4
13	23.1	13.1	27.1	34.1	31.6	32.1	30.6
14	22.3	12.3	26.3	33.3	30.8	31.3	29.8
15	21.5	11.5	25.5	32.5	30.0	30.5	29.0
16	20.6	10.6	24.6	31.6	29.1	29.6	28.1
17	19.7	9.7	23.7	30.7	28.2	28.7	27.2
18	18.7	8.7	22.7	29.7	27.2	27.7	26.2
19	17.8	7.8	21.8	28.8	26.3	26.8	25.3
20	16.8	6.8	20.8	27.8	25.3	25.8	24.3
21	15.8	5.8	19.8	26.8	24.3	24.8	23.3
22	14.7	4.7	18.7	25.7	23.2	23.7	22.2

Table 7. Low evaporator refrigerant temperature cutout and low water temperature cutout — ethylene glycol (continued)

% Glycol	Solution Freeze Point (°F)	Low Refrig Temp Cutout (°F)	Low Water Temp Cutout (°F)	FLOW >= 1.2 GPM/TON		FLOW >= 1.5 GPM/TON	
				Min Chilled Water Setpoint (°F)		Min Chilled Water Setpoint (°F)	
				Number of compressors		Number of compressors	
				2	4	2	4
23	13.7	3.7	17.7	24.7	22.2	22.7	21.2
24	12.5	2.5	16.5	23.5	21.0	21.5	20.0
25	11.4	1.4	15.4	22.4	19.9	20.4	18.9
26	10.2	0.2	14.2	21.2	18.7	19.2	17.7
27	9.0	-1.0	13.0	20.0	17.5	18.0	16.5
28	7.7	-2.3	11.7	18.7	16.2	16.7	15.2
29	6.4	-3.6	10.4	17.4	14.9	15.4	13.9
30	5.1	-4.9	9.1	16.1	13.6	14.1	12.6
31	3.7	-6.3	7.7	14.7	12.2	12.7	11.2
32	2.3	-7.7	6.3	13.3	10.8	11.3	9.8
33	0.8	-9.2	4.8	11.8	9.3	9.8	8.3
34	-0.7	-10.7	3.3	10.3	7.8	8.3	6.8
35	-2.3	-12.3	1.7	8.7	6.2	6.7	5.2
36	-3.9	-13.9	0.1	7.1	4.6	5.1	3.6
37	-5.6	-15.6	-1.6	5.4	2.9	3.4	1.9
38	-7.3	-17.3	-3.3	3.7	1.2	1.7	0.2
39	-9.0	-19.0	-5.0	2.0	0.0	0.0	0.0
40	-10.8	-20.8	-6.8	0.2	0.0	0.0	0.0
41	-12.7	-21.0	-7.0	0.0	0.0	0.0	0.0
42	-14.6	-21.0	-7.0	0.0	0.0	0.0	0.0
43	-16.6	-21.0	-7.0	0.0	0.0	0.0	0.0
44	-18.6	-21.0	-7.0	0.0	0.0	0.0	0.0
45	-20.7	-21.0	-7.0	0.0	0.0	0.0	0.0
46	-22.9	-21.0	-7.0	0.0	0.0	0.0	0.0
47	-25.1	-21.0	-7.0	0.0	0.0	0.0	0.0
48	-27.3	-21.0	-7.0	0.0	0.0	0.0	0.0
49	-29.7	-21.0	-7.0	0.0	0.0	0.0	0.0
50	-32.1	-21.0	-7.0	0.0	0.0	0.0	0.0
51	-34.5	-21.0	-7.0	0.0	0.0	0.0	0.0
52	-37.1	-21.0	-7.0	0.0	0.0	0.0	0.0
53	-39.7	-21.0	-7.0	0.0	0.0	0.0	0.0
54	-42.3	-21.0	-7.0	0.0	0.0	0.0	0.0
55	-45.0	-21.0	-7.0	0.0	0.0	0.0	0.0

Table 8. Low evaporator refrigerant temperature cutout and low water temperature cutout — propylene glycol

% Glycol	Solution Freeze Point (°F)	Low Refrig Temp Cutout (°F)	Low Water Temp Cutout (°F)	FLOW >= 1.2 GPM/TON		FLOW >= 1.5 GPM/TON	
				Min Chilled Water Setpoint (°F)		Min Chilled Water Setpoint (°F)	
				Number of compressors		Number of compressors	
				2	4	2	4
0	32	22	36	42	42	41	40
1	31.6	21.6	35.6	42	40.1	40.6	39.1
2	31.0	21.0	35.0	42	39.5	40.0	38.5
3	30.4	20.4	34.4	41.4	38.9	39.4	37.9
4	29.9	19.9	33.9	40.9	38.4	38.9	37.4
5	29.3	19.3	33.3	40.3	37.8	38.3	36.8
6	28.7	18.7	32.7	39.7	37.2	37.7	36.2
7	28.1	18.1	32.1	39.1	36.6	37.1	35.6
8	27.6	17.6	31.6	38.6	36.1	36.6	35.1
9	27.0	17.0	31.0	38.0	35.5	36.0	34.5
10	26.4	16.4	30.4	37.4	34.9	35.4	33.9
11	25.7	15.7	29.7	36.7	34.2	34.7	33.2
12	25.1	15.1	29.1	36.1	33.6	34.1	32.6
13	24.4	14.4	28.4	35.4	32.9	33.4	31.9
14	23.8	13.8	27.8	34.8	32.3	32.8	31.3
15	23.1	13.1	27.1	34.1	31.6	32.1	30.6
16	22.4	12.4	26.4	33.4	30.9	31.4	29.9
17	21.6	11.6	25.6	32.6	30.1	30.6	29.1
18	20.9	10.9	24.9	31.9	29.4	29.9	28.4
19	20.1	10.1	24.1	31.1	28.6	29.1	27.6
20	19.3	9.3	23.3	30.3	27.8	28.3	26.8
21	18.4	8.4	22.4	29.4	26.9	27.4	25.9
22	17.6	7.6	21.6	28.6	26.1	26.6	25.1
23	16.7	6.7	20.7	27.7	25.2	25.7	24.2
24	15.7	5.7	19.7	26.7	24.2	24.7	23.2
25	14.8	4.8	18.8	25.8	23.3	23.8	22.3
26	13.8	3.8	17.8	24.8	22.3	22.8	21.3
27	12.7	2.7	16.7	23.7	21.2	21.7	20.2
28	11.6	1.6	15.6	22.6	20.1	20.6	19.1
29	10.5	0.5	14.5	21.5	19.0	19.5	18.0
30	9.3	-0.7	13.3	20.3	17.8	18.3	16.8
31	8.1	-1.9	12.1	19.1	16.6	17.1	15.6
32	6.8	-3.2	10.8	17.8	15.3	15.8	14.3
33	5.5	-4.5	9.5	16.5	14.0	14.5	13.0
34	4.1	-5.9	8.1	15.1	12.6	13.1	11.6
35	2.7	-7.3	6.7	13.7	11.2	11.7	10.2
36	1.3	-8.7	5.3	12.3	9.8	10.3	8.8
37	-0.3	-10.3	3.7	10.7	8.2	8.7	7.2
38	-1.8	-11.8	2.2	9.2	6.7	7.2	5.7
39	-3.5	-13.5	0.5	7.5	5.0	5.5	4.0
40	-5.2	-15.2	-1.2	5.8	3.3	3.8	2.3

Table 8. Low evaporator refrigerant temperature cutout and low water temperature cutout — propylene glycol (continued)

% Glycol	Solution Freeze Point (°F)	Low Refrig Temp Cutout (°F)	Low Water Temp Cutout (°F)	FLOW >= 1.2 GPM/TON		FLOW >= 1.5 GPM/TON	
				Min Chilled Water Setpoint (°F)		Min Chilled Water Setpoint (°F)	
				Number of compressors		Number of compressors	
				2	4	2	4
41	-6.9	-16.9	-2.9	4.1	1.6	2.1	0.6
42	-8.8	-18.8	-4.8	2.2	0.0	0.2	0.0
43	-10.7	-20.7	-6.7	0.3	0.0	0.0	0.0
44	-12.6	-21.0	-7.0	0.0	0.0	0.0	0.0
45	-14.6	-21.0	-7.0	0.0	0.0	0.0	0.0
46	-16.7	-21.0	-7.0	0.0	0.0	0.0	0.0
47	-18.9	-21.0	-7.0	0.0	0.0	0.0	0.0
48	-21.1	-21.0	-7.0	0.0	0.0	0.0	0.0
49	-23.4	-21.0	-7.0	0.0	0.0	0.0	0.0
50	-25.8	-21.0	-7.0	0.0	0.0	0.0	0.0
51	-28.3	-21.0	-7.0	0.0	0.0	0.0	0.0
52	-30.8	-21.0	-7.0	0.0	0.0	0.0	0.0
53	-33.4	-21.0	-7.0	0.0	0.0	0.0	0.0
54	-36.1	-21.0	-7.0	0.0	0.0	0.0	0.0
55	-38.9	-21.0	-7.0	0.0	0.0	0.0	0.0

Performance Adjustment Factors

Concentration and type of glycol used will affect unit performance. If operating conditions, including concentration of freeze inhibitor, have changed since the unit was ordered, contact sales representative to rerun selection. See Figure 28, p. 42 through Figure 33, p. 43 for approximate adjustment factors.

Figure 28. Ethylene – compressor power adjustment

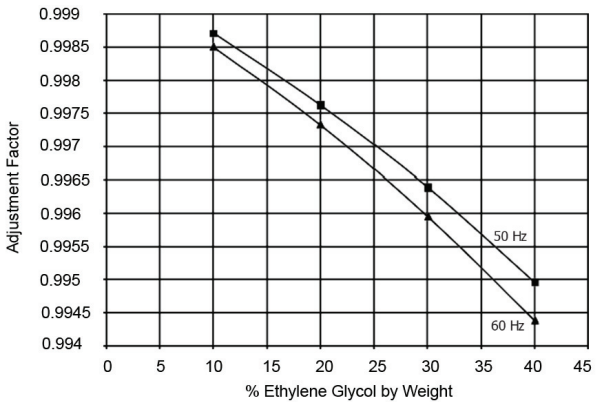


Figure 29. Propylene – compressor power adjustment

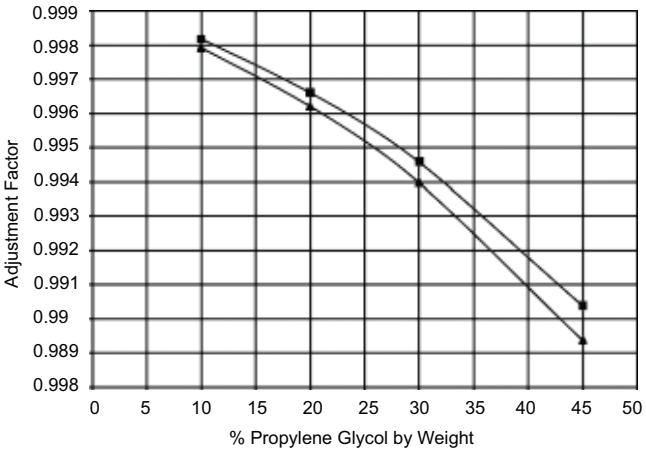


Figure 30. Ethylene – GPM adjustment

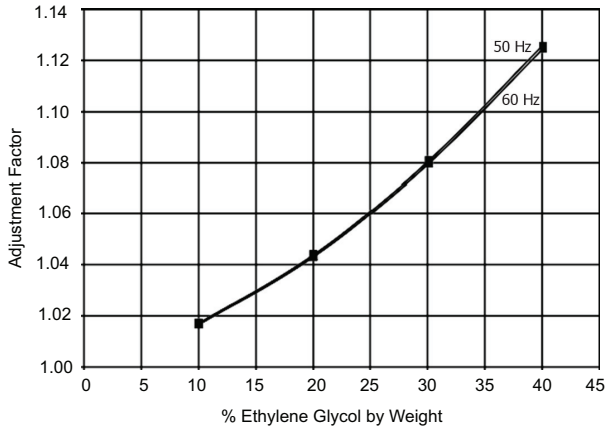


Figure 31. Propylene – GPM adjustment

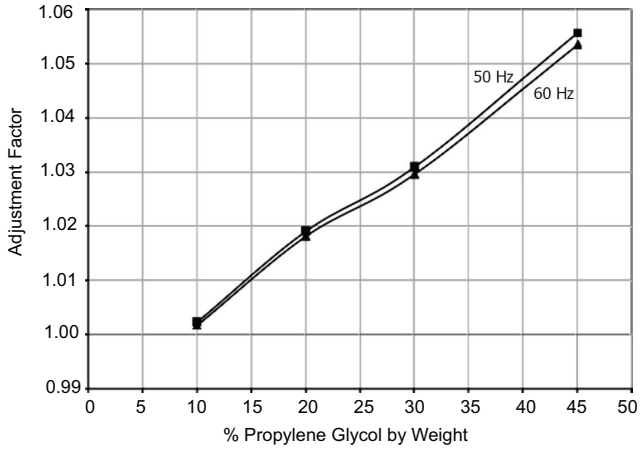


Figure 32. Ethylene – capacity adjustment

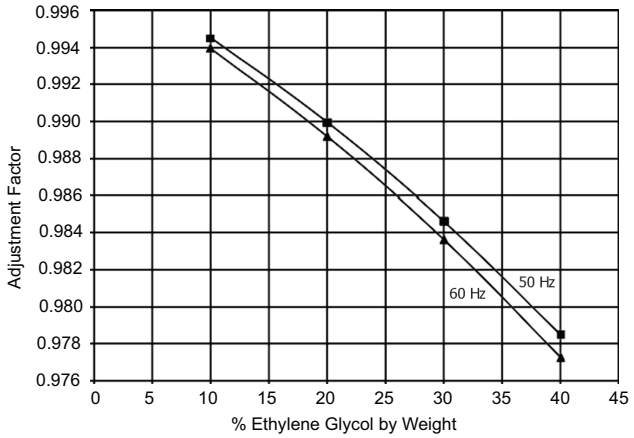
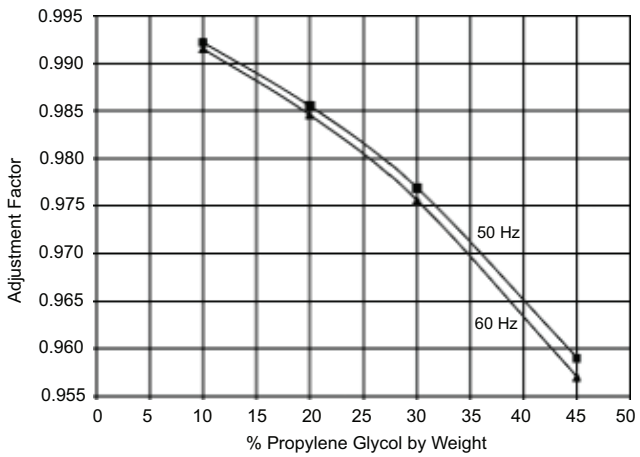


Figure 33. Propylene - capacity adjustment



Integral Pump Package

Integral pump package includes: integral pump, drainage valves, shut-off valves at entering and leaving connections. See Figure 35, p. 44 through Figure 38, p. 47 for specific model schematics.

The pump package is single point power integrated into the chiller unit power with a separate factory wired control panel. The control of the pump is integrated into the chiller controller.

Figure 34. Field water piping pump package unit

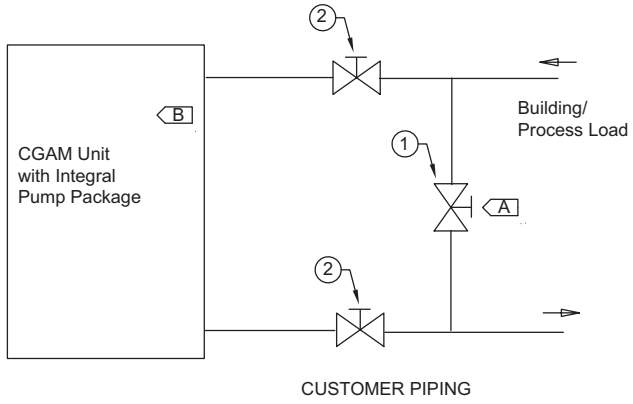


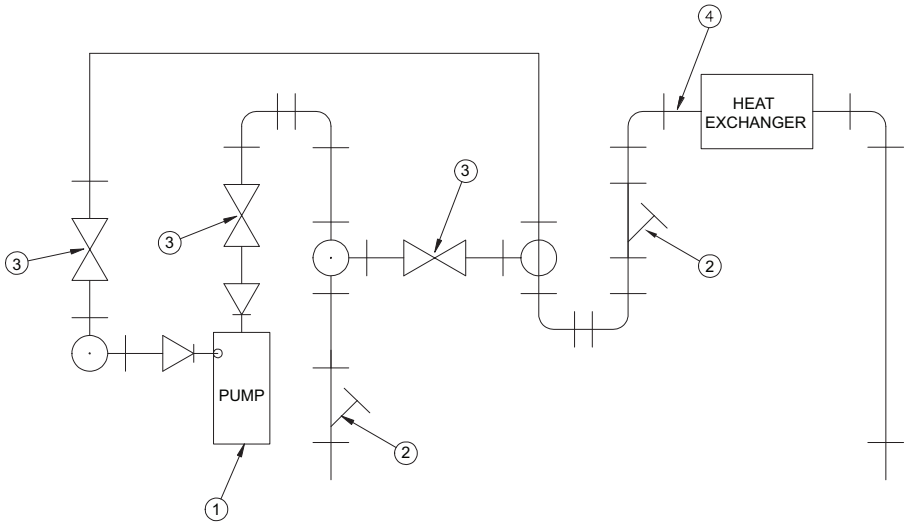
Table 9. Field water piping components

Item	Description
1	Bypass Valve
2	Isolator Valve
A	Isolate unit for initial water loop cleaning
B	See Figure 35, p. 44 through Figure 38, p. 47 for CGAM integral pump schematics

Figure 35. Pump package unit schematic – CSCA0025F0 - CSCA0060F0

CSCA0025F0, CSCA0040F0 and CSCA0060F0 PIPING DIAGRAM

Item	Description
1	PUMP MOTOR
2	STRAINER
3	BUTTERFLY VALVE
4	FLOW SWITCH



CSCA0025F0, CSCA0040F0 and CSCA0060F0 INSTRUMENTATION DIAGRAM

Item	Description
1	BALL VALVE
2	GAUGE; PRESSURE 0 - 160 PSI
3	GAUGE; TEMPERATURE

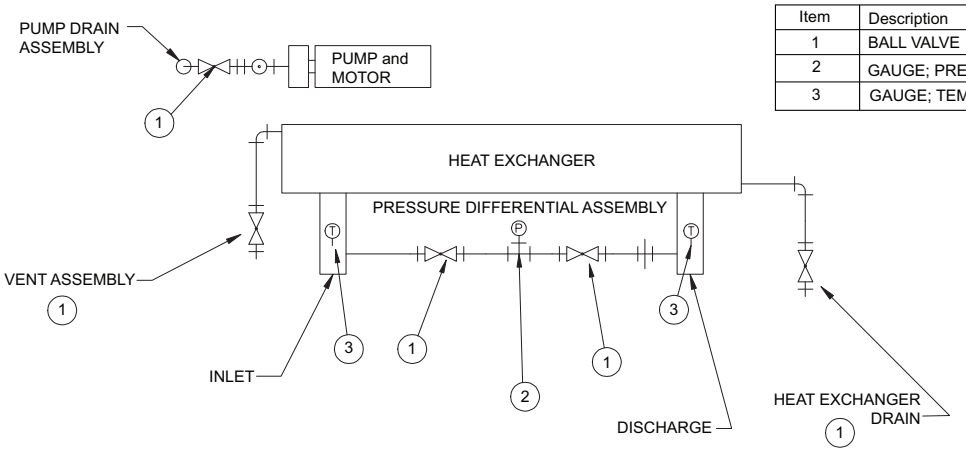


Figure 36. Pump package unit schematic – CSCA0025F2 - CSCA0060F3

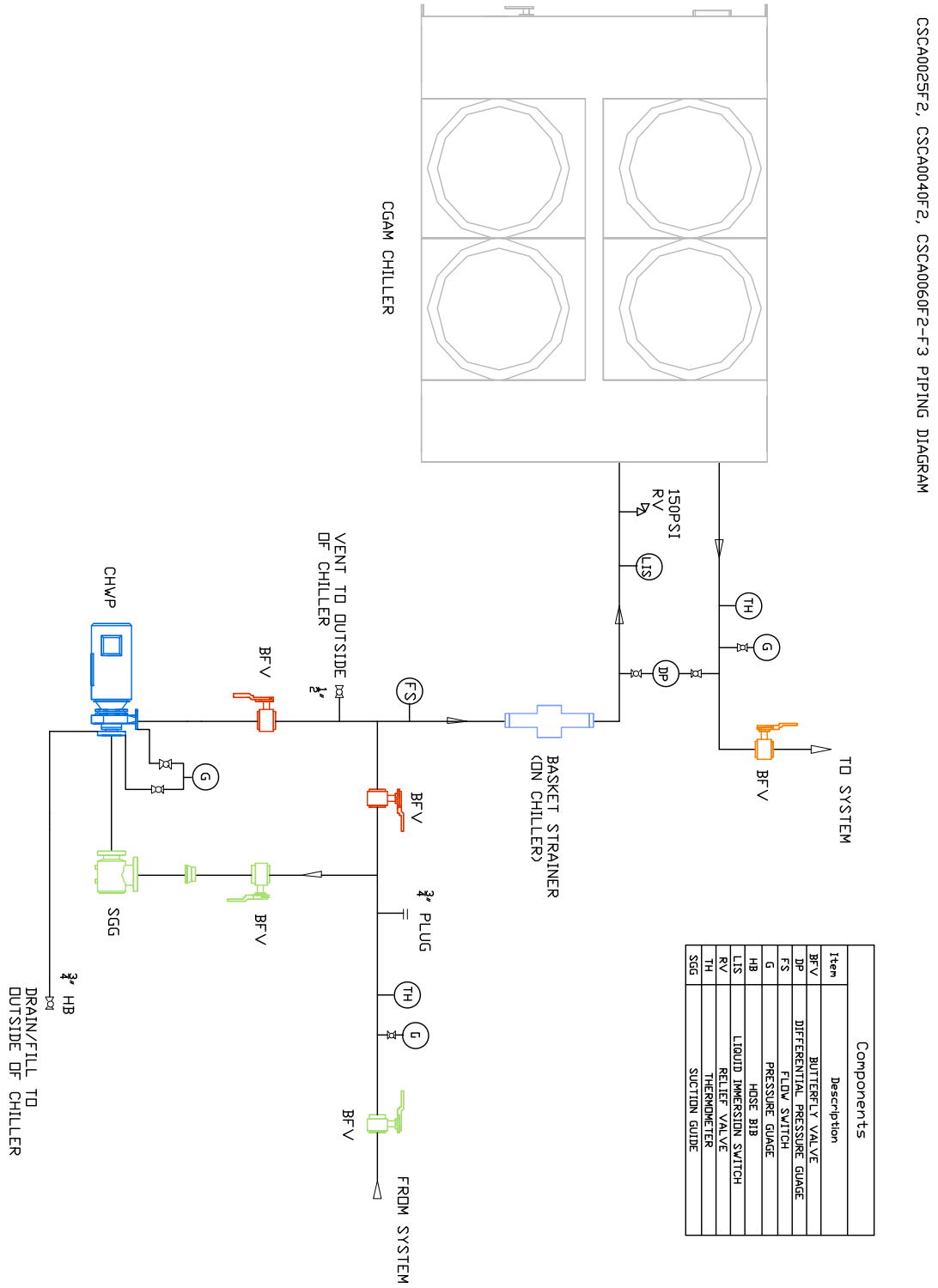
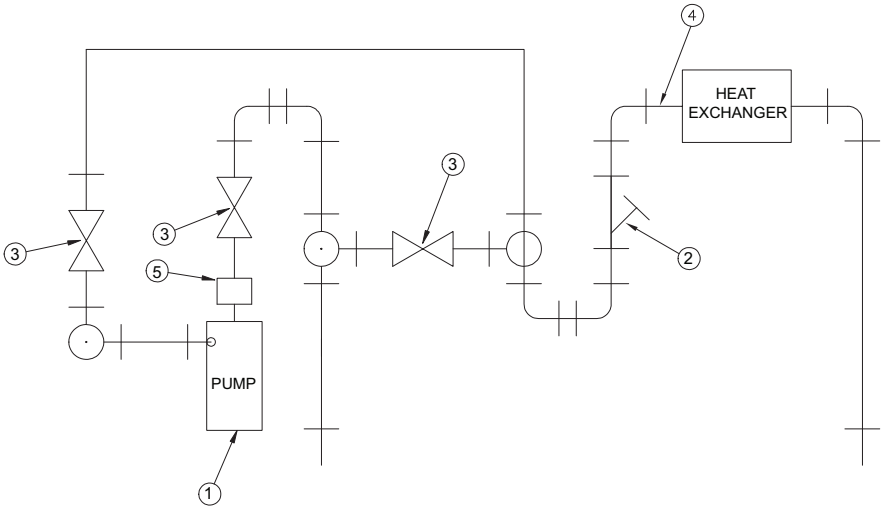


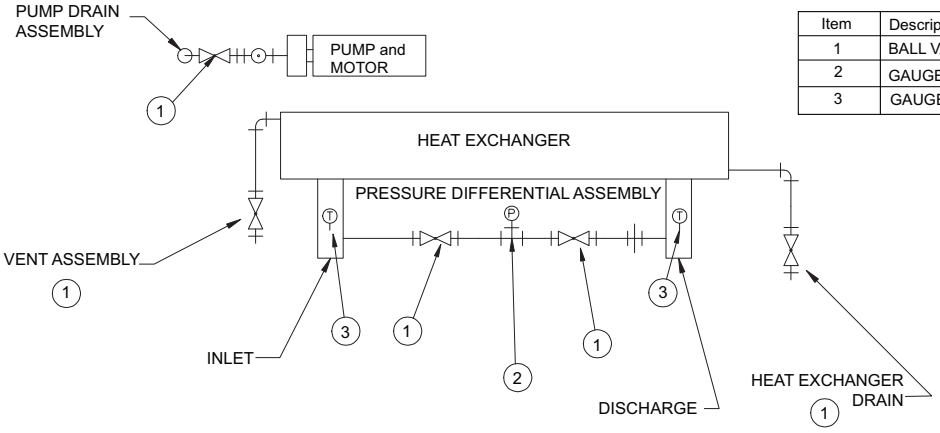
Figure 37. Pump package unit schematic – CSCA0080F1 - CSCA0120F1

CSCA0080F1, CSCA0100F1 and CSCA01200F1 PIPING DIAGRAM



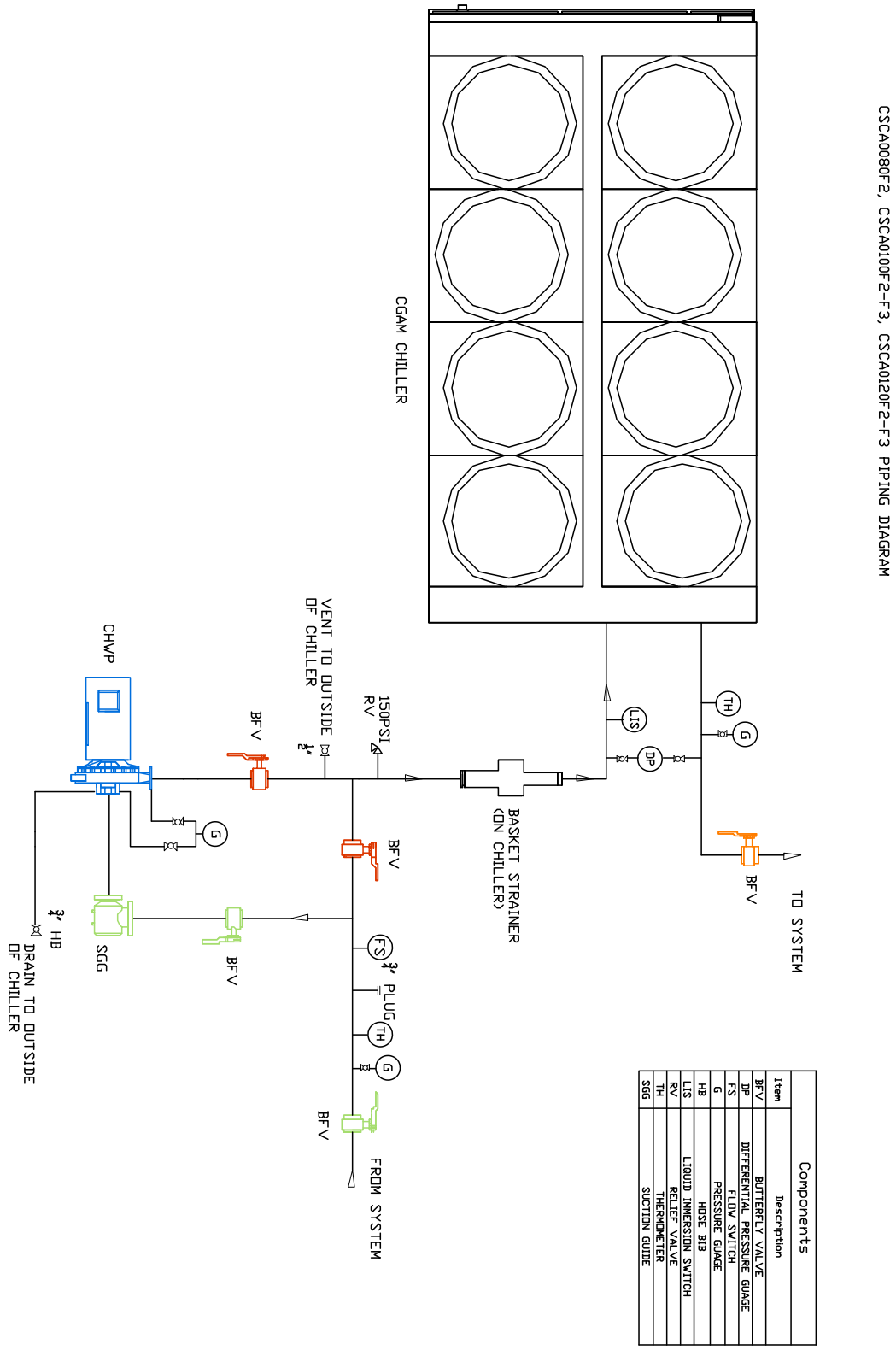
Item	Description
1	PUMP MOTOR
2	STRAINER
3	BUTTERFLY VALVE
4	FLOW SWITCH
5	SUCTION GUIDE

CSCA0080F1, CSCA0100F1 and CSCA01200F1 INSTRUMENTATION DIAGRAM



Item	Description
1	BALL VALVE
2	GAUGE; PRESSURE 0 - 160 PSI
3	GAUGE; TEMPERATURE

Figure 38. Pump package unit schematic - CSCA0080F2 - CSCA0120F3



Pump Curves

Figure 39. 25T CGAM pressure curve

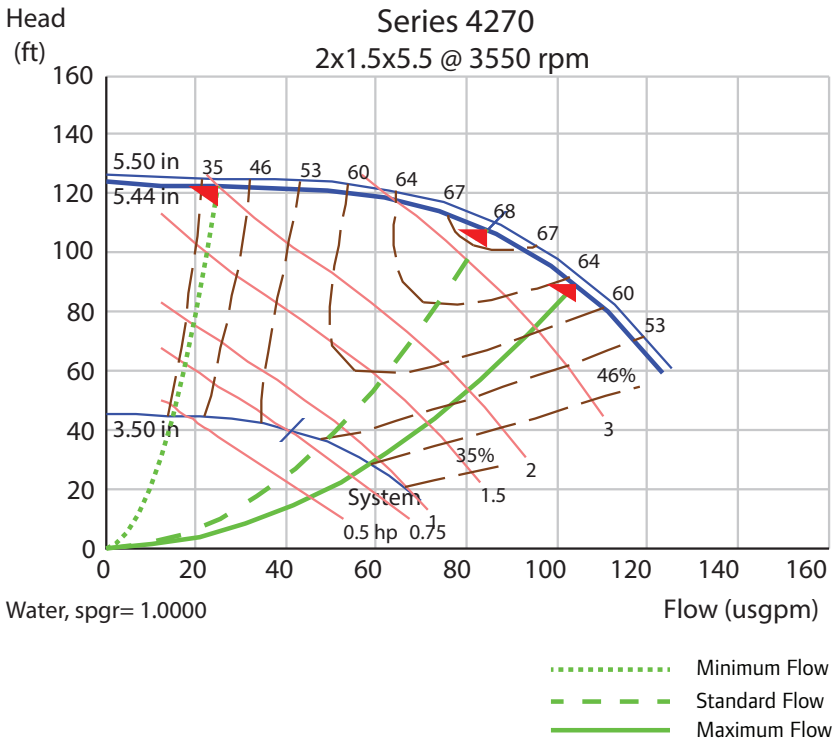


Figure 40. 40 to 60T CGAM pressure curve

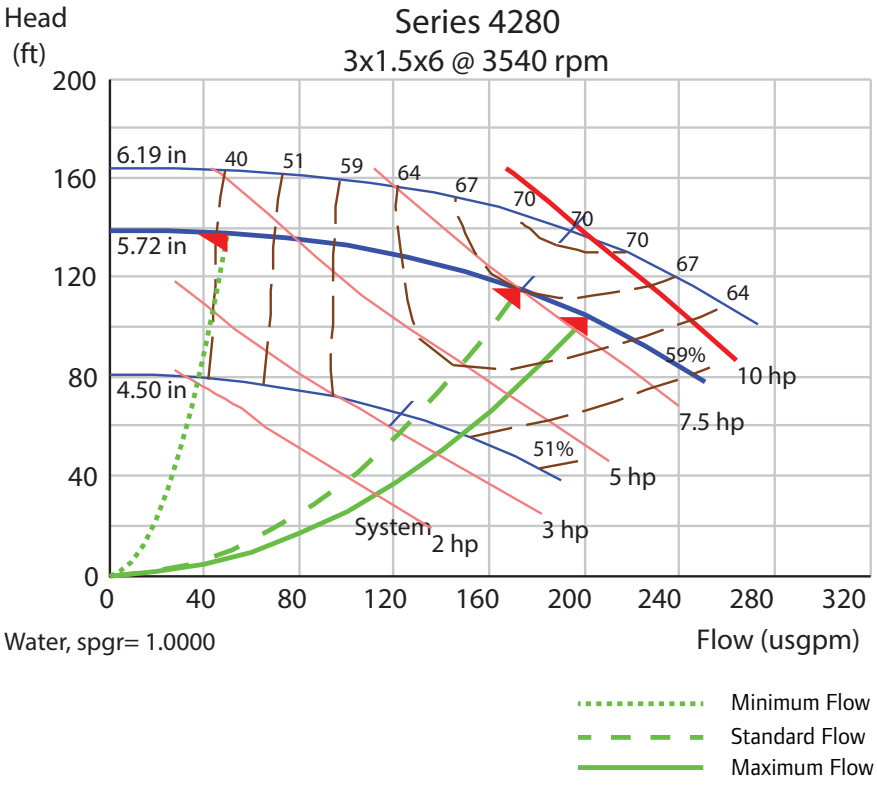
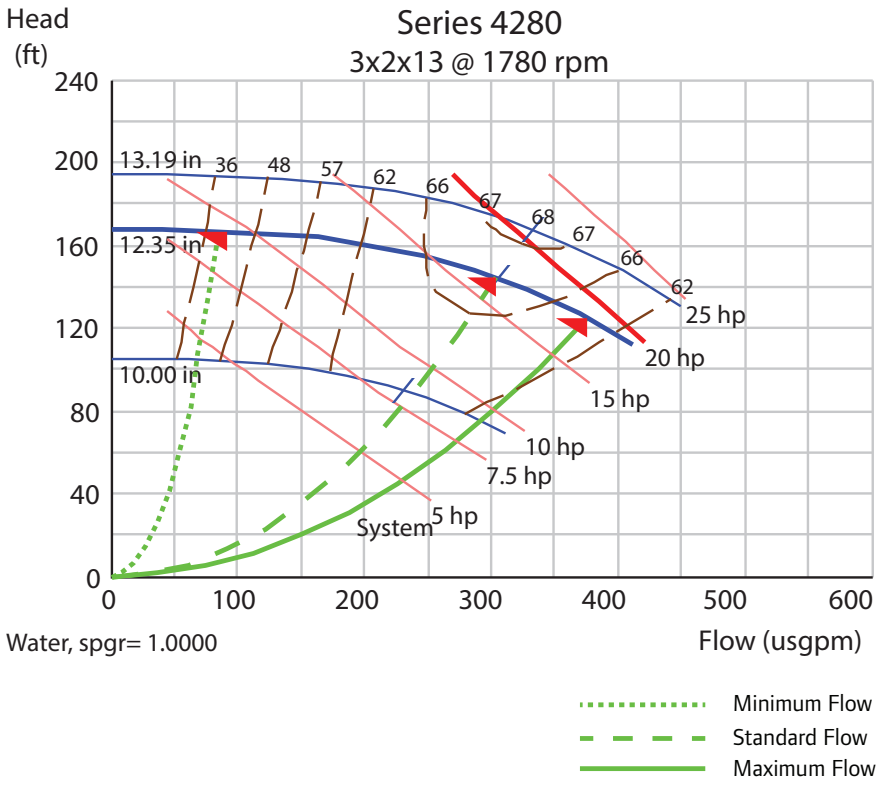


Figure 41. 80 to 120T CGAM pressure curve



Pump Package Requirements

The following requirements must be met for proper operation of pump package:

- Maximum working pressure 150 psig
- Fluid type shown in Table 10, p. 49

Table 10. Working fluid

Fluid Type	Fluid Percent (of weight)
Water	100%
Ethylene Glycol	0–50%
Propylene Glycol	0–50%

Electrical Connections

The breaker for the CGAM unit is located in the shore power enclosure at the opposite end of the main panel. Main power is supplied to the CGAM unit by only one of the two following:

- Cam-type electrical connections.
- Power distribution blocks accept up to 500 kcmil wire (only available on F0 and F1-series CGAM models).

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

All wiring must comply with National Electric Code (NEC) and state and local requirements. Outside the United States, the national and/or local electrical requirements of other countries shall apply. The installer must provide properly sized system interconnecting and power supply wiring with appropriate fused disconnect switches. Type and locations of disconnects must comply with all applicable codes.

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

Figure 4, p. 11 through Figure 18, p. 25 show the locations of the unit electrical access openings.

Shore Power Supply (115 Vac)

Each CGAM Trane Rental Services unit comes with a shore power enclosure. The shore power enclosure supplies power to the CGAM controls and the CGAM controls interface. The shore power circuit is powered by a 115 Volt 20 A max 60 Hz circuit where power is supplied to a pin connection on the shore power enclosure, from the building, with an extension cord. The 25, 40, and 120 ton size CGAM units have only one shore power enclosure, located at the opposite end of the main CGAM control panel.

The shore power enclosure powers the following components:

Shore Power Plug (115 Vac)

This plug powers:

- Compressor heaters
- Evaporator piping heater
- Evaporator heater
- Compressor heater transformer
- VFD heater blanket
- CH530 interface
- CH530 controls

Important: *If the door on the right side of the shore power is opened, the shore power plug circuit will disengage and the listed devices (above) will not be powered. The door must remain closed for these devises to operate. If the shore power doors are opened for service, they should be closed as soon as service is completed.*

⚠WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

Refer to unit schematics to check the number of disconnects required to de-energize the unit.

When electrically troubleshooting the compressor make sure electrical power is NOT applied.

- Inspect all wiring connections; electrical connections should be clean and tight.
- Stop the chilled water pump.
- Open all circuit breakers.

Unit Voltage and Amperage Checks

⚠WARNING

Live Electrical Components!

Failure to follow all electrical safety precautions when exposed to live electrical components could result in death or serious injury.
When it is necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been properly trained in handling live electrical components perform these tasks.

Electrical power to the unit must meet stringent requirements for the unit to operate properly. Total voltage supply and voltage imbalance between phases should be within the following tolerances.

Voltage Supply

Measure each leg of supply voltage at all line voltage on circuit breaker. Readings must fall within the voltage utilization range shown on the unit nameplate. If voltage on any leg does not fall within tolerance, notify the power company to correct this situation before operating the unit. Inadequate voltage to the unit will cause control components to malfunction and shorten the life of electrical components and compressor motors.

Voltage Imbalance

Excessive voltage imbalance between phases in a three-phase system will cause motors to overheat and eventually fail. Maximum allowable imbalance is 2 percent.

If the voltage imbalance is over 2 percent, notify the proper agencies to correct the voltage problem before operating this equipment.

Field-Installed Power Wiring

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

An overall layout for the field installed wiring entrance into the unit is illustrated in Figure 4, p. 11 through Figure 18, p. 25. Follow the guidelines outlined below to confirm the unit supply power wiring is properly sized and installed.

Note: *All field installed wiring must conform to NEC guidelines as well as State and Local codes.*

Verify that the power supply available is compatible with the unit nameplate ratings. The available supply power must be within 10 percent of the rated voltage stamped on the nameplate. Use only copper conductors to connect the 3-phase power supply to the unit.

NOTICE

Use Copper Conductors Only!

Failure to use copper conductors could result in equipment damage as the equipment was not designed or qualified to accept other types of conductors.

Circuit Breaker External Handle

Units are provided with an externally mounted circuit breaker handle. This allows the operator to disconnect power from the unit without having to open the control panel door. The handle locations and its three positions are described below:

- **ON** – The circuit breaker is closed, allowing the main power supply to be applied at the unit.
- **OFF** – The circuit breaker is open, interrupting the main power supply to the unit controls.
- **OPEN COVER/RESET** – Turn the handle to this position to release the handle from the circuit breaker, allowing the control panel door to be opened.

Once the door has been opened, it can be closed with the handle in any one of the three positions outlined above, provided it matches the circuit breaker position.

Refer to the wiring diagram that shipped with the unit for specific electrical schematic and connection information.

Before Supplying Power

⚠WARNING

Hazardous Service Procedures!

Failure to follow all precautions in this manual and on the tags, stickers, and labels could result in death or serious injury.
Technicians, in order to protect themselves from potential electrical, mechanical, and chemical hazards, MUST follow precautions in this manual and on the tags, stickers, and labels, as well as the following instructions: Unless specified otherwise, disconnect all electrical power including remote disconnect and discharge all energy storing devices such as capacitors before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. When necessary to work with live electrical components, have a qualified licensed electrician or other individual who has been trained in handling live electrical components perform these tasks.

NOTICE

Compressor Damage!

Failure to follow instructions below could result in compressor failure due to lack of refrigerant and/or oil flow. Fully open all compressor service valves (suction, discharge, liquid line, and oil line) prior to start-up.

NOTICE

Heater Damage!

Failure to ensure that there is water in the evaporator before turning on heaters could result in equipment-only-damage. Heaters will overheat and burn out without water in the evaporator.

NOTICE

Proper Water Treatment Required!

The use of untreated or improperly treated water could result in scaling, erosion, corrosion, algae or slime. Use the services of a qualified water treatment specialist to determine what water treatment, if any, is required. Trane assumes no responsibility for equipment failures which result from untreated or improperly treated water, or saline or brackish water.

- Inspect the interior of the unit for tools and debris.
- Fill the chilled water system.
- Vent the chilled water system at the highest points in the system. Vent the air out of the chiller barrel by opening the vent, located on the top of the chiller barrel. Close the vent when the chiller barrel is full of water.
- Once the system has been filled, inspect the entire chilled water piping system for leaks. Make any necessary repairs before proceeding.

Electrical Wiring

⚠WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

- Check for tight connections for the unit power supply wiring with the circuit breaker to the terminal block.
- Check interlock wiring, chilled water pump control, chilled water flow interlock and external auto stop (required). For further details, refer to CG-SVX17*-EN or refer to unit wiring schematics.

NOTICE

Equipment Damage!

Failure to follow all instructions could result in equipment damage. Follow instructions for the chilled water pump interlock and external auto/stop.

- Control power wiring isolated in control panel/starter enclosure.
- Required - chilled water pump controlled by CH530.
- Inspect all wiring connections. Connections should be clean and tight.
- Energize oil sump heaters 24 hours prior to start up.

  Note: *Connecting shore power to the unit without main power energizes the crankcase and oil separator heaters. DynaView™ is powered at the same time.*
- Confirm all service and isolation valves are open.

Chilled Water Pump Performance and Operation

Each unit comes with a 460 volt, 3-phase, 60 Hertz, centrifugal water pump permanently installed on the unit. The pump contactor is located in the shore power panel and has a control switch with an indication light that will be lit when the pump is running.

The pump switch can be used to select between three operating modes: Off, On, and Auto.

- **Auto** – The pump is controlled through the chiller controls.
- **On** – The pump will run until the operating mode is changed.
- **Off** – The pump will remain off until the operating mode is changed.

Table 11. Unit performance, reference only

CGAM Unit Size	Motor Size (hp)	Evaporator Flow (gpm)			Pump Flow (gpm)			Discharge Head Pressure (ft)		
		Min.	Nominal	Max.	Min.	Nominal	Max.	at Min. Flow	Nominal	at Max. Flow
25T	5	30	62	89	25	84.5	104.0	122.2	107.9	89.3
40T	10	46	96	136	50	173.4	201.6	137.7	115.0	104.1
60T	10	68	144	201	50	173.4	201.6	137.7	115.0	104.1
80T	20	92	192	275	91	304.4	376.0	162.9	144.2	124.5
100T	20	116	240	346	91	304.4	376.0	162.9	144.2	124.5
120T	20	136	288	407	91	304.4	376.0	162.9	144.2	124.5

Chilled Water Pump Control

Water Pump Power Supply

For units not using the onboard pump package, provide power supply wiring with disconnect for the chilled water pump(s).

For units with the onboard pump package, power is provided through a separate factory-wired control panel, integrated into the chiller unit power.

Chilled Water Flow (Pump) Interlock

All CGAM model chillers have a factory-installed flow switch.

Chilled Water Pump Control

An external HOA (Hand-Off-Auto) switch is installed on the rental power panel for control of the on- board pump. It is recommended to use the pump in the Auto position so that the chiller controller will control the pump.

With the pump switch in Auto, 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.

The relay output from 1A9 is required to operate the Evaporator Water Pump (EWP) contactor. Contacts should be compatible with 115/240 Vac control circuit. Normally, the EWP 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 to open in an adjustable (using TechView™) 0 to 30 minutes. The non-AUTO modes in which the pump is stopped, include Reset, Stop, External Stop, Remote Display Stop, Stopped by Tracer®, Start Inhibited by Low Ambient Temp, and Ice Building complete.

NOTICE

Equipment Damage!

If the microprocessor calls for a pump to start and water does not flow, the evaporator may be damaged catastrophically. It is the responsibility of the installing contractor and/or the customer to ensure that a pump will always be running when called upon by the chiller controls.

Table 12. Pump relay operation

Chiller Mode	Relay Operation
Auto	Instant close
Tracer® Override	Close
Stop	Timed to open
Diagnostics	Instant open

When going from Stop to Auto, the EWP relay is energized immediately. If evaporator water flow is not established in 4 minutes and 15 seconds, the CH530 de-energizes the EWP relay and generates a non-latching diagnostic. If flow returns (e.g. someone else is controlling the pump), the diagnostic is cleared, the EWP relay is re-energized, and normal control resumed.

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

NOTICE

Equipment Damage!

Do NOT enable/disable the chiller by removing water flow or equipment damage can occur.

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

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

or

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

Note: *If pump control is used for freeze protection, then the pump MUST be controlled by the CGAM CH530 control. If another method of freeze protection is used (i.e. glycol, heaters, purge, etc) then the pump may be controlled by another system.*

Alarm and Status Relay Outputs (Programmable Relays)

A programmable relay concept provides for enunciation of certain events or states of the chiller, selected from a list of likely needs, while only using four physical output relays, as shown in the field wiring diagram. The four relays are provided (generally with a Quad Relay Output LLID) as part of the Alarm Relay Output Option. The relay's contacts are isolated Form C (SPDT), suitable for use with 120 Vac circuits drawing up to 2.8 amps inductive, 7.2 amps resistive, or 1/3 HP and for 240 Vac circuits drawing up to 0.5 amp resistive.
The list of events/states that can be assigned to the programmable relays can be found in Table 13, p. 54. The relay will be energized when the event/state occurs.

Table 13. Alarm and status relay output configuration

	Description
Alarm - Latching	This output is true whenever there is any active diagnostic that requires a manual reset to clear, that affects either the Chiller, the Circuit, or any of the Compressors on a circuit. This classification does not include informational diagnostics.
Alarm - Auto Reset	This output is true whenever there is any active diagnostic that could automatically clear, that affects either the Chiller, the Circuit, or any of the Compressors on a circuit. This classification does not include informational diagnostics.
Alarm	This output is true whenever there is any diagnostic affecting any component, whether latching or automatically clearing. This classification does not include informational diagnostics
Alarm Ckt 1	This output is true whenever there is any diagnostic effecting Refrigerant Circuit 1, whether latching or automatically clearing, including diagnostics affecting the entire chiller. This classification does not include informational diagnostics.
Alarm Ckt 2	This output is true whenever there is any diagnostic affecting Refrigerant Circuit 2 whether latching or automatically clearing, including diagnostics effecting the entire chiller. This classification does not include informational diagnostics.
Chiller Limit Mode (with a 20 minute filter)	This output is true whenever the chiller has been running in one of the Unloading types of limit modes (Condenser, Evaporator, Current Limit or Phase Imbalance Limit) continuously for the last 20 minutes.
Circuit 1 Running	This output is true whenever any compressor is running (or commanded to be running) on Refrigerant Circuit 1, and false when no compressors are commanded to be running on that circuit.
Circuit 2 Running	This output is true whenever any compressor is running (or commanded to be running) on Refrigerant Circuit 2, and false when no compressors are commanded to be running on that circuit.
Chiller Running	This output is true whenever any compressor is running (or commanded to be running) on the chiller and false when no compressors are commanded to be running on the chiller.
Maximum Capacity	This output is true whenever the chiller has all compressors on. The output is false once one compressor is shut-off.

Relay Assignments Using TechView™

CH530 Service Tool (TechView™) is used to install the Alarm and Status Relay Option package and assign any of the above list of events or status to each of the four relays provided with the option. The relays to be programmed are referred to by the relay's terminal numbers on the LLID board 1A18.

The default assignments for the four available relays of the CGAM Alarm and Status Package Option are:

Table 14. Default relay assignments

Relay	
Relay 1 Terminals J2 -12,11,10:	Compressor Running
Relay 2 Terminals J2 - 9,8,7:	Latching Alarm
Relay 3 Terminals J2-6,5,4:	Chiller Limit Mode
Relay 4 Terminals J2-3,2,1:	Warning

If any of the Alarm/Status relays are used, provide electrical power, 115 Vac with fused-disconnect to the panel and wire through the appropriate relays (terminals on 1A13. Provide wiring (switched hot, neutral, and ground connections) to the remote annunciation devices. Do not use power from the chiller's control panel transformer to power these remote devices. Refer to the field diagrams which are shipped with the unit.

Low Voltage Wiring

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

The remote devices described below require low voltage wiring. All wiring to and from these remote input devices to the Control Panel must be made with shielded, twisted pair conductors. Be sure to ground the shielding only at the panel.

Note: *To prevent control malfunctions, do not run low voltage wiring (<30 V) in conduit with conductors carrying more than 30 Volts.*

Emergency Stop

CH530 provides auxiliary control for a customer specified/ installed latching trip out. When this customer-furnished remote contact 6K5 is provided, the chiller will run normally when the contact is closed. When the contact opens, the unit will trip on a manually resettable diagnostic. This condition requires manual reset at the chiller switch on the front of the control panel.

Connect low voltage leads to terminal strip locations on 1A13, J2-3 and 4. Refer to the field diagrams that are shipped with the unit.

Silver or gold-plated contacts are recommended. These customer-furnished contacts must be compatible with 24 Vdc, 12 mA resistive load.

External Auto/Stop

If the unit requires the external Auto/Stop function, the installer must provide leads from the remote contact 6K4 to the proper terminals on 1A13, J2-1 and 2.

The chiller will run normally when the contact is closed. When the contact opens, the compressor(s), if operating, will go to the RUN:UNLOAD operating mode and cycle off. Unit operation will be inhibited. Closure of the contact will permit the unit to return to normal operation.

Field-supplied contacts for all low voltage connections must be compatible with dry circuit 24 Vdc for a 12 mA resistive load. See the field diagrams that are shipped with the unit.

NOTICE

Equipment Damage!

Do NOT enable/disable the chiller by removing water flow or equipment damage can occur.

Communications Interface Options

Tracer® Communications Interface

This option allows the Tracer® CH530 controller to exchange information (e.g. operating setpoints and Auto/ Standby commands) with a higher-level control device, such as a Tracer® Summit or a multiple-machine controller. A shielded, twisted pair connection establishes the bi- directional communications link between the Tracer® CH530 and the building automation system.

Note: *To prevent control malfunctions, do not run low voltage wiring (< 30 V) in conduit with conductors carrying more than 30 Volts.*

⚠WARNING

Proper Field Wiring and Grounding Required!

Failure to follow code could result in death or serious injury. All field wiring MUST be performed by qualified personnel. Improperly installed and grounded field wiring poses FIRE and ELECTROCUTION hazards. To avoid these hazards, you MUST follow requirements for field wiring installation and grounding as described in NEC and your local/state/national electrical codes.

Field wiring for the communication link must meet the following requirements:

- All wiring must be in accordance with the NEC and local codes.
- Communication link wiring must be shielded, twisted pair wiring (Belden 8760 or equivalent). See the table below for wire size selection.

Table 15. Wire size

Wire Size	Maximum Length of Communication Wire
14 AWG (2.5 mm2)	5,000 FT (1525 m)
16 AWG (1.5 mm2)	2,000 FT (610 m)
18 AWG (1.0 mm2)	1,000 FT (305 m)

- The communication link cannot pass between buildings.
- All units on the communication link can be connected in a **daisy chain** configuration.

BACnet® Interface (BCI-C)

Optional BACnet® Communication Interface for Chillers (BCI-C) is comprised of a Tracer® UC400 controller with interface software. It is a non-programmable communications module that allows units to communicate on a BACnet® communications network.

Note: *For more information, see BAS-SVP05*-EN.*

Start-Up and Shutdown

NOTICE

Equipment Damage!

Failure to follow instructions could result in equipment damage.
Improper phasing can result in equipment damage due to reverse rotation.

1. Confirm phase sequencing “A-B-C”.

   Note: *Unit is equipped with auxiliary phase monitors. If the Phase Indicator pilot light is on, the phasing is incorrect. Phase Indicator (red) pilot lights are located in the door of the shore power enclosure.*

2. Emergency stop diagnostic must be manually reset.
3. Fill the chilled water system.
4. Turn pump switch to **On** if integral chilled water pump is used.
5. Vent air from system, and check for leaks and repair.

NOTICE

Freeze Damage to Unit!

Improper adjustment of the flow switch could cause equipment damage due to freezing. To prevent equipment damage, refer to CG-SVX17*-EN.

NOTICE

Equipment Damage!

Snow, ice, or debris build up on fans could cause excessive imbalance and equipment damage.
Clear fans of build up prior to machine start-up.

Contact Trane Rental Services for any questions.

6. With water running, adjust water flow, check pressure drop and adjust flow switch.
7. Add appropriate amount of glycol to system, if required. Run pump to thoroughly mix solution.
8. Return pump to automatic position.
9. Set local atmospheric pressure in DynaView.
10. Front panel lockout feature should be disabled.

Checking Operating Conditions

If required, once 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 CH530 TechView™.

Note: *The pressures are referenced to sea level (14.6960 psia). This value is adjustable in TechView.*

2. Check the EXV sight glasses after sufficient time has elapsed to stabilize the chiller. The refrigerant flow past the sight glasses should be clear. Bubbles in the refrigerant indicate either low refrigerant charge or excessive pressure drop in the liquid line or a stuck open expansion valve. 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 General Data tables.

Important: *A clear sight glass alone does not mean that the system is properly charged. Also check system sub-cooling, liquid level control and unit operating pressures.*

If chiller is limited by any limiting conditions, contact local Trane Rental Services for more information.

Start-Up Procedure

1. Verify/close all drain valves.
2. Service the auxiliary equipment according to the start-up/maintenance instructions provided by the respective equipment manufacturers.
3. Remove all air from the system (including each pass). Close the vents in the evaporator chilled water circuits.
4. Open all valves in evaporator chilled water circuits.

NOTICE

Equipment Damage!

Failure to follow instructions could result in equipment damage.
Ensure that the compressor and oil sump heaters have been operating properly for a minimum of 24 hours before starting.

Shutdown

1. Perform normal unit stop sequence using <Stop> key.

Note: *Starter disconnect switch must remain closed to provide power to compressor oil sump heaters.*

2. Verify that compressor oil sump heaters are installed tightly around compressor. Energize and verify heaters are operational using a temperature probe.
3. Once the unit is secured, perform maintenance identified in “Maintenance and Diagnostics,” p. 60.

Sequence of Operation

This section will provide basic information on chiller operation for common events. With microelectronic controls, ladder diagrams cannot show today's complex logic, as the control functions are much more involved than older pneumatic or solid state controls.

Adaptive control algorithms can also complicate the exact sequence of operations. This section illustrates common control sequences.

Software Operation Overview

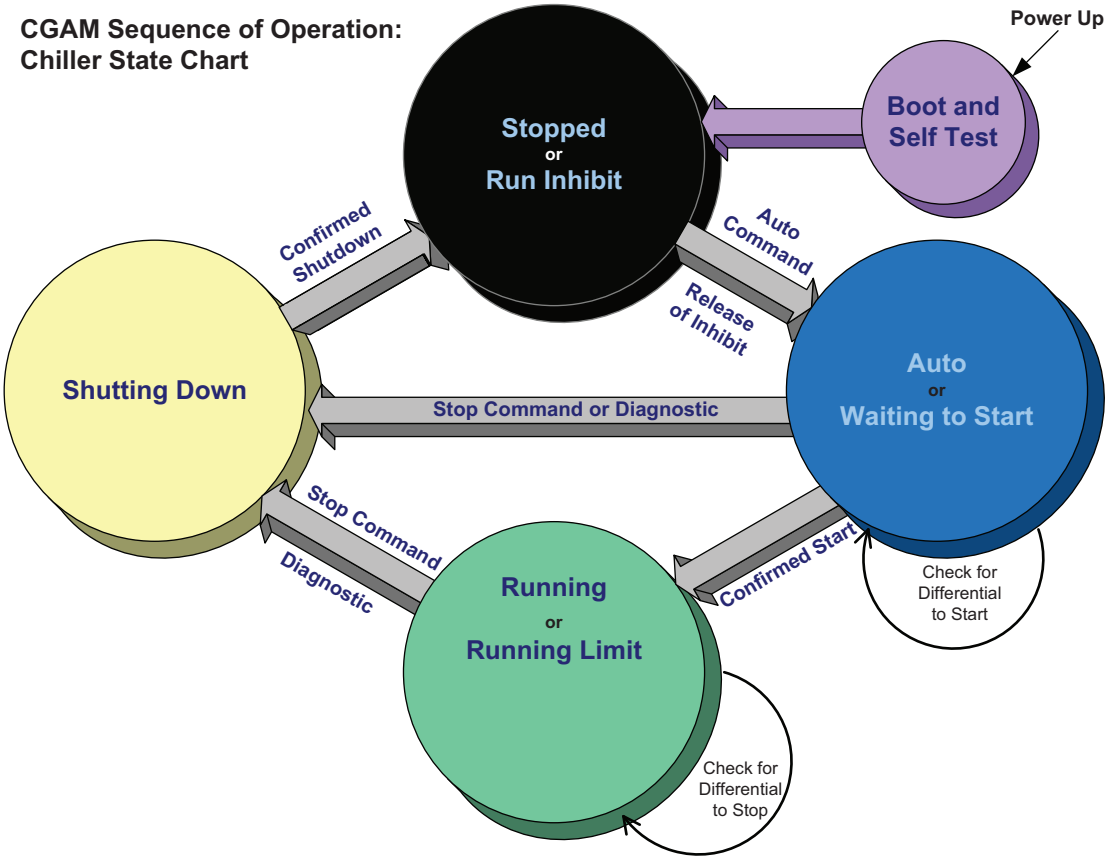
The Software Operation Overview shown in Figure 42, p. 57 is a diagram of the five possible software states. This diagram can be thought of as a state chart, with the arrows and arrow text depicting the transitions between states.

- The text in the circles is the visible top level operating mode displayed on DynaView Main tab.
- The shading of each software state circle corresponds to the shading on the time lines that show the state the chiller is in.

There are five generic states that the software can be in:

- Power Up
- Stopped
- Starting
- Running
- Stopping

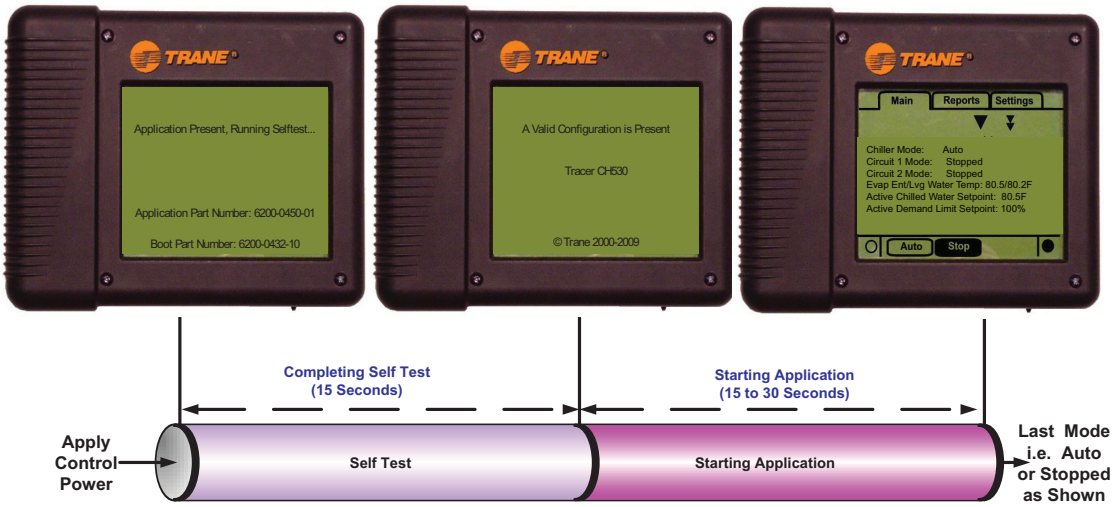
Figure 42. Chiller state chart



Power Up

The Power up chart shows the respective DynaView screens during a power up of the main processor. This process takes from 30 to 45 seconds depending on the number of installed Options. On all power ups, the software model will always transition through the **Stopped** Software state independent of the last mode. If the last mode before power down was **Auto**. the transition from **Stopped** to **Starting** occurs, but it is not apparent to the user.

Figure 43. Power up



Note: The variation in DynaView Power up time is dependent on the number of installed options.

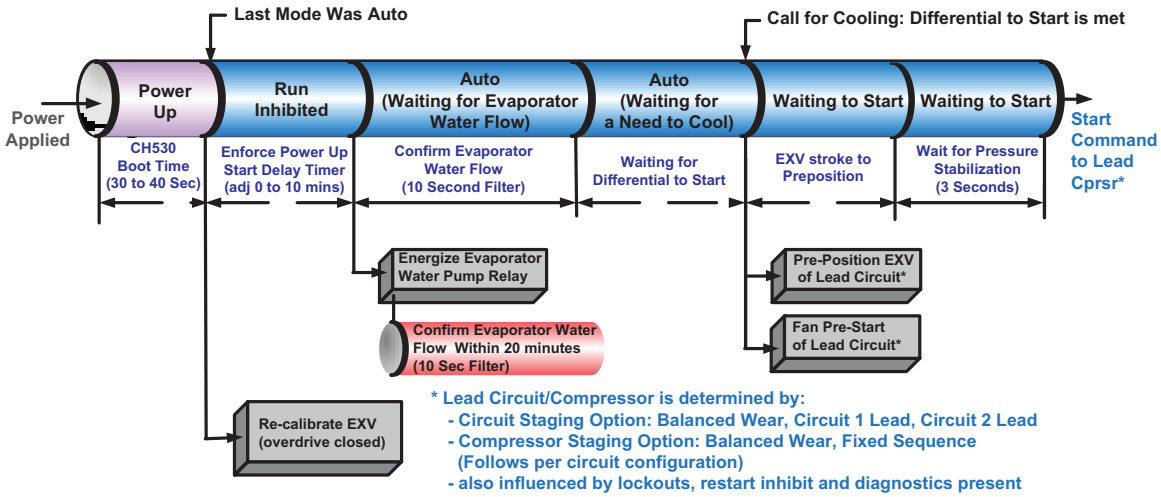
Power Up to Starting

Power up to starting diagram shows timing from a power up event to energizing the first compressor. The shortest allowable time would be under the following conditions:

- No motor restart inhibit
- Evaporator Water flow occurs quickly with pump on command
- Power up Start Delay setpoint set to 0 minutes
- Need to cool (differential to start) already exists

The above conditions would allow for a minimum power up to starting the first compressor time of about 85 seconds, depending on options installed.

Figure 44. Power up to starting



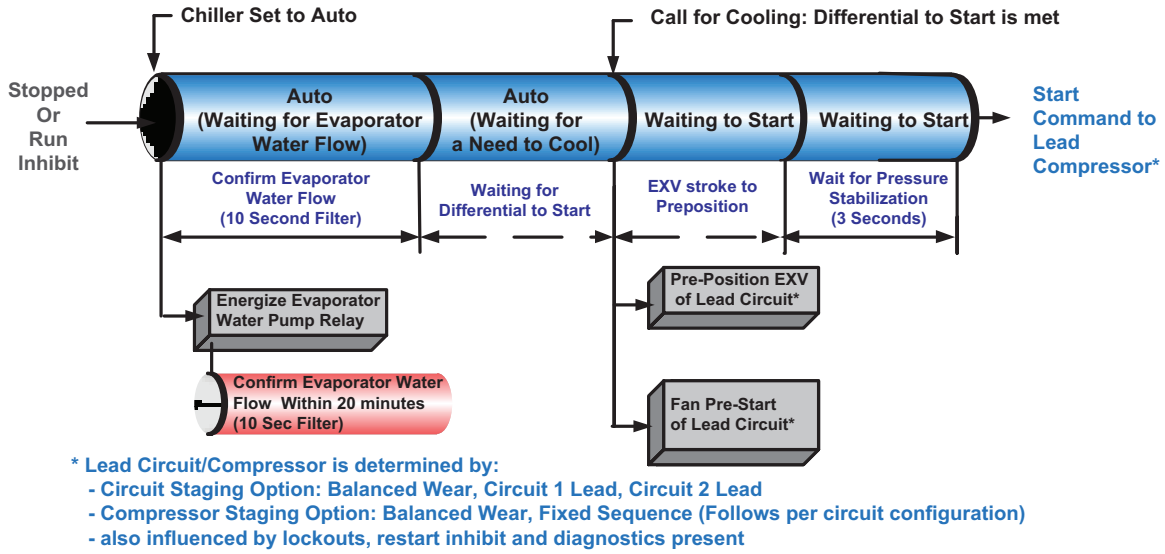
Stopped to Starting

The stopped to starting diagram shows the timing from a stopped mode to energizing the compressor. The shortest allowable time would be under the following conditions:

- No motor restart inhibit
- Evaporator Water flow occurs quickly with pump on command
- Need to cool (differential to start) already exists

The above conditions would allow the compressor to start in about 35 seconds.

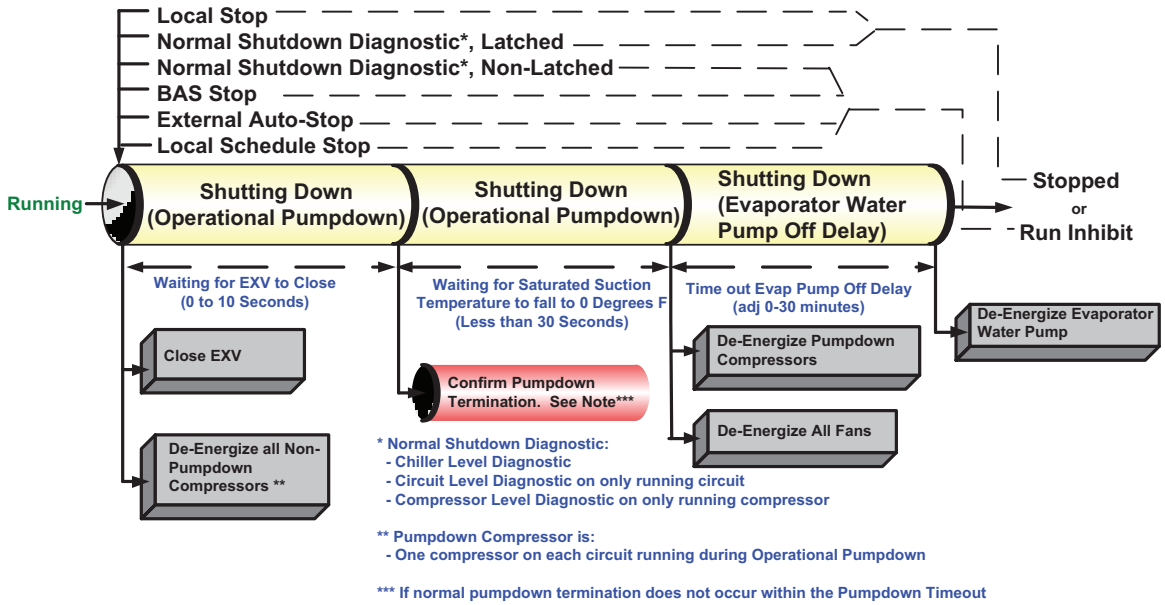
Figure 45. Stopped to starting



Normal Shutdown to Stopped

Figure 46, p. 59 shows transition from Running through a Normal (friendly) Shutdown. Dashed lines on top attempt to show final mode if you enter stop via various inputs.

Figure 46. Normal shutdown to stopped or run inhibit



Controls Interface

For controls interface information, refer to CG-SVX17*-EN.

Maintenance and Diagnostics

For maintenance procedures, refer to the **Weekly Maintenance** and **Monthly Maintenance** sections in CG-SVX17*-EN.

Refrigerant Charge Information

For refrigerant charge information, refer to CG-SVX17*-EN.

Decommissioning Procedure

1. Press **STOP** key on the CH530 DynaView control. Allow enough time for compressors to go through the unload sequence and shut down.
2. Turn the chilled water pump to **OFF**.

Note: *Local codes and regulations apply for disposal of glycol or anti-freeze solutions.*

⚠WARNING

Hazardous Voltage!

Failure to disconnect power before servicing could result in death or serious injury.
Disconnect all electric power, including remote disconnects before servicing. Follow proper lockout/tagout procedures to ensure the power can not be inadvertently energized. Verify that no power is present with a voltmeter.

3. Put unit disconnect in the **OFF** or **OPEN** position and locate and disconnect utility power source. Verify system is not energized before proceeding with next steps.
4. Drain solution from system. If the system has glycol or other anti-freeze solution, flush hoses and evaporator with water. Leave vent and drain valve(s) open.
5. Secure any loose panels. Replace any sheet metal screws or bolts to prevent panel from blowing off during transportation.
6. Return hose, fittings or cables (if furnished by Trane Rental Services) to appropriate containers for return shipment.
7. Notify Trane Rental Services if unit needs repairs or has damage.

Diagnostics

For diagnostic information, refer to CG-SVX17*-EN.

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.

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