MICHIGAN STATE
UNIVERSITY

INFRASTRUCTURE PLANNING AND FACILITIES
PLANNING, DESIGN AND CONSTRUCTION

August 1, 2025

TITLE OF PROJECT: 887611 104686.01- MANLY MILES CHILLER REPLACEMENT

PROJECT ISSUE DATE: July 14, 2025

PROJECT NUMBER: 887611

ADDENDUM NO: 2

GENERAL

This Addendum is issued prior to receipt of Proposals to amend the Contract Documents identified as 887611 104686.01- MANLY MILES CHILLER REPLACEMENT
Except as otherwise specifically mentioned, the general character of the work required by this Addendum shall be the same as originally specified, and all incidentals required in connection with the work hereinafter described shall be included even though not specifically mentioned. When an item is mentioned with additional specifications given, reference shall be made to the original specifications.

Drawing(s) accompanying this Addendum include: List individual sheet numbers or indicate full set

49307 - MSU Manly Miles Alfa Laval Heat Exchanger Submittal
49307 - MSU Manly Miles Armstrong Pumps and Accessories Submittal (1)
49307 - MSU Manly Miles Chiller System - CH-01 - Chillers Submittal (1)
49307 - MSU Manly Miles Unisource Flex Connectors Submittal (1)

TRADES – Mechanical

ITEM NO.	DESCRIPTION
1	Due Date August 8, 2025
2	MSU will perform a TAB report on the system post construction.
3	MSU will provide control valves
4	MSU will provide all equipment
5	Eyewash is necessary and must to be included in the bid
6	Pipe depth is spelled out in the MSU standards. The pipe must be 7’ down unless it’s insulated. The insulation needs to be 3”. The pipe must be backfilled with sand to cover the pipe by 1’, then the hole can be back filled with topsoil from the sight. This is included in MSU standards.
7	MSU will shut down and isolate heating system for the removal of the radiator
8	The vendor will flush the piping, provide and fill the system with glycol.
9	Vendor should provide insulation according to our standards
10	The bushes will be removed, the trees will be trimmed to allow equipment access, as well as barricading the ones near the excavation site.

HEDRICK

2360 Oak Industrial Drive ne . Grand Rapids, Michigan 49505
tel 616.454.1218 . fax 616.454.5336 . www.hedrickassoc.com

POWER
THERMAL
PARTS
SERVICE

MSU Manly Miles
Alfa Laval Heat Exchanger
East Lansing, MI

SUBMITTAL FOR APPROVAL

Company: Michigan State University
Attn: Salem Mangles
Email:
Prepared By: David Craig / Derek Witt
Date: 3/28/2025
Quote#: 49307

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TEL 616.454.1218 . FAX 616.454.5336
THERMAL

Company: Michigan State University
Attention: Salem Mangles
Email:
Provided By: Dave Craig / Derek Witt

Project Name: MSU Manly Miles

Proposal #: 49307
Date: 3/28/2025

Alfa Laval Heat Exchanger Selection:

Quantities: (1) Heat Exchanger

HX-1

- Alfa Laval Gasketed Single Walled Plate and Frame Heat Exchanger, Model AQ4L-FG Designed with the following conditions/features:

		Hot Side	Cold Side
Fluid:		Water	33% P.G.
Volume Flow Rate:	GPM	362.6	325
Inlet Temperature:	°F	54	41
Outlet Temperature:	°F	44	53
Pressure Drop:	PSI	3.6	4.0
Heat Exchanged:	kBtu/h	1,822.2	
Number of Plates:		417	
Plate Material/Thickness:		ALLOY 304/0.4 mm	

Technical specification

Gasketed plate heat exchanger

Project ref.:	49307 - MSU Manly Miles Chiller System	ALICE 5.0.1.01
Line ref.:	HX-1	AHRI LLHE PHE 1.4
Model:	AQ4L-FG	Page: 1(2)
No. of units:	1	Date: 12/11/2024

		Hot side		Cold side
Fluid:		Water		33.0% Prop.glycol IIR
Density:	lb/ft³	62.43		64.41
Specific heat capacity:	Btu/(lb·°F)	1.00		0.90
Thermal conductivity:	Btu/(ft·h·°F)	0.339		0.244
Viscosity inlet:	cP	1.23		6.43
Viscosity outlet:	cP	1.44		4.71
Volume flow rate:	GPM	362.6		325.0
Inlet temperature:	°F	54.0		41.0
Outlet temperature:	°F	44.0		53.0
Pressure drop:	psi	3.6		4.0
Heat exchanged:	kBtu/h		1,822.2	
LMTD:	°F		1.8	
Heat transfer coefficient:	Btu/(ft²·h·°F)		448.1	
Heat transfer area:	ft²		2,233.5	
Relative directions of fluids:			Countercurrent	
Connection positions and flow directions:		S1->S2		S3->S4
Connections: S1,S2,S3,S4			FLANGE ASME B16.5 150# NPS 4 Unlined	
Number of passes:		1		1
Effective margin:	%		0.1	
Effective fouling resistance * 10000:	ft²·h·°F/Btu		0.017	
Design pressure (MAWP):	psi	150		150
Test pressure:	psi	195		195
Design temperature max.:	°F	150.1		150.1
Design temperature min. (MDMT):	°F	-18.0		-18.0
Channel arrangement:		1*(201H+7ML)		1*(201H+7MH)
Pressure vessel approval:			ASME	
Number of plates:			417	
Nominal A-measurement:	mm		1010	
Extension capacity:			18 plates	
Plate material/thickness:			ALLOY 304/0.40 mm	
Gasket material and attachment:			NBRP Clip-on	
Approx. outer dimensions (L x W x H)	in		92.3 x 18.9 x 75.7	
Approx. weight, empty/operating:	lb		3,178 / 4,019	
Approx. weight, full of water:	lb		4,006	
Type of package:			SKID BASE STANDING	
Approx. packed weight:	lb		3,387.44	

Technical specification

Gasketed plate heat exchanger

Project ref.:	49307 - MSU Manly Miles Chiller System	ALICE 5.0.1.01
Line ref.:	HX-1	AHRI LLHE PHE 1.4
Model:	AQ4L-FG	Page: 2(2)
No. of units:	1	Date: 12/11/2024

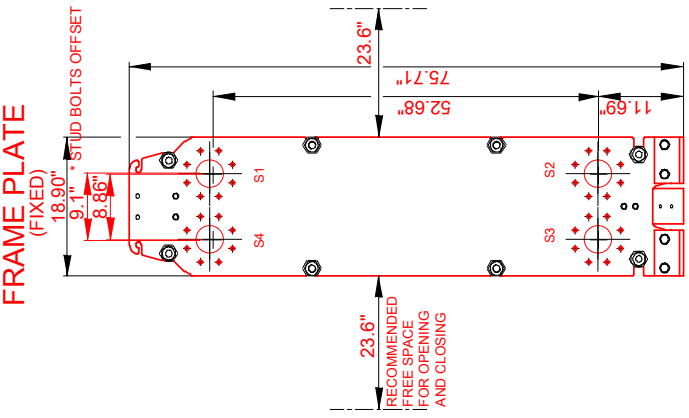
Accessories added to configuration — Quantity

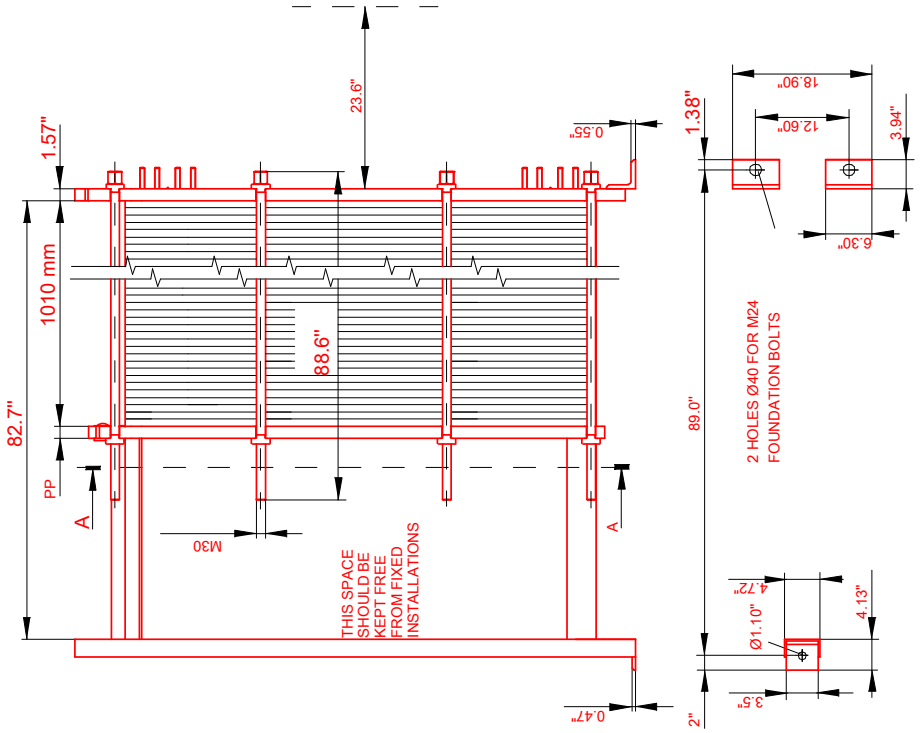
Accessories

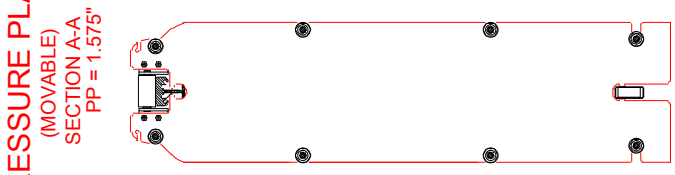
Equipment

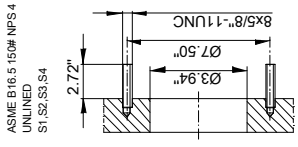
Feet Standard	1
C_Standard_ProtectionSheet AL	1

	SIDE 1	SIDE 2
TEST PRESSURE	195.0 psi	195.0 psi
DESIGN PRESSURE	150 psi	150 psi
MAX TEMPERATURE	150.1 °F	150.1 °F
MIN TEMPERATURE	-18.0 °F	-18.0 °F
GASKET	NBRP Clip-on	
PLATE MATERIAL	ALLOY 304	
PLATE THICKNESS	0.40 mm	
HEAT LOAD	1822.2 kBtu/h	









ALL DIMENSIONS IN INCHES

Do not use this drawing for foundation bolting, piping layout or planning of lifting and handling of the equipment

SIDE	MEDIA		INLET	TEMP.	OUTLET	TEMP.	FLOW RATE	PRESSURE DROP
1	Water		S1	54.0 °F	S2	44.0 °F	362.6 GPM	3.6 psi
2	33.0% Prop.glycol	IR	S3	41.0 °F	S4	53.0 °F	325.0 GPM	4.0 psi

PLATE HEAT EXCHANGER PRESSURE VESSEL APPROVAL ASME N/A

AQ4L-FG

www.alfalaval.com

CUSTOMER NAME / REF. NO.

COMPANY / REF.
Hedrick Associates Inc
49307 - MSU Manly Miles Chiller System
HX-1

TOTAL LENGTH	92.3 in
TOTAL WIDTH	18.9 in
TOTAL HEIGHT	75.7 in
WEIGHT WITH WATER	4006 lb

AHRI CERTIFIED® www.ahridirectory.org
Liquid to Liquid Heat Exchangers
AHRI Standard 400

DATE 12/11/2024
REV 0

2360 Oak Industrial Drive ne . Grand Rapids, Michigan 49505
tel 616.454.1218 . fax 616.454.5336 . www.hedrickassoc.com

POWER
THERMAL
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MSU Manly Miles
Armstrong Pumps and Accessories
Advantage Control Glycol Feeder & Bypass Feeder
Amtrol Buffer Tank
East Lansing, MI

SUBMITTAL FOR APPROVAL

Company: Michigan State University
Attn: Salem Mangles
Email:
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THERMAL

Company: Michigan State University
Attention: Salem Mangles
Email:
Provided By: Dave Craig / Derek Witt

Project Name: MSU Manly Miles

Proposal #: 49307
Date: 3/28/2025

Armstrong Pump Selection:

Quantities: (2) Pumps

Tag	Description	Model	HP	rpm	Flow	Head	Inlet	Outlet	Power	Fluid
CHWP-1 & 2	Design Envelope End Suction with Sensorless Control	4200H-2505-005.0	2 @ 5HP each	3078	325 gpm	45 ft	2"	2"	460/3/60	33% PG
- Includes SG-42 4"x2" suction guide										

Note: Factory Authorized Start-up/Commissioning Included. Pumps have on-board variable speed controls.

Armstrong Accessory Selection:

Quantities: (1) Expansion Tank, (1) Air/Dirt Separator

ET-1

- Armstrong Pre-charged Bladder Expansion Tank, Model A300-L Designed with the following conditions/features:
  - Max Working Temp: 250°F
  - Max Working Pressure: 125 PSI
  - Tank Volume: 80 Gal.
  - Acceptance Volume: 80 Gal.
  - System Connection: 1.5” NPT

AS-1

- Armstrong Dirt & Air Separator with Removable Head, Model VAS-6-U Designed with the following conditions/features:
  - Max Working Temp: 80°F
  - Max Working Pressure: 160 PSI
  - Connection Size: 6”
  - Standard Flow: 360 GPM
  - Coalescing Medium: Stainless Steel

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THERMAL

Advantage Control Selection – Glycol Feeder:

(1) Tag(s): GMU-1

- Advantage Control Glycol Feeder –Model GF-1A2A1MS - Designed with the following conditions/features:
  - 55 Gallon Tank
  - Powder Coated Steed Stand
  - 3.3 GPM at 150 PSI – 1/2hp Motor
  - Standard Configuration
  - Sch. 80 PVC Loop – 100PSI max – 100°F max
  - NANO w/alarm buzzer & contact, ETL, 0-100 PSI Sensor, single loop
  - ON/OFF Switch

Advantage Control Selection – Bypass Feeder:

(1) Tag(s): PF-1

- Advantage Control Bypass Feeder –Model BF-05-D2 - Designed with the following conditions/features:
  - 5 Gallon Capacity
  - Dome with legs and bottom port
  - 18” bag filter basket (25-micron bag included)
  - Includes BFK-FUNASM – ¾” tee isolation valve and funnel

Amtrol Chilled Water Buffer Tank:

(1) Tag(s): BT-1

- Amtrol Chilled Water Buffer Tank – Model CWBT850-6 - Designed with the following conditions/features:
  - 850 Gallon Tank
  - 6” Connection Size
  - Internal Baffle
  - Maximum Working Pressure: 125 PSI
  - Maximum Operating Temperature: 450°F
  - **If Installed Outdoors, Insulation for Exterior Installation by Insulation Contractor**

Submittal

Ref. #: SQGMR001851_2

Design Envelope Split-Coupled Horizontal Base-Mounted End Suction Pump

Model: Series Design Envelope Sensorless 4200H 2505-005.0 with Suction Guide

Project name:	49307 - MSU Manly Miles Chiller System	**Representative:**	
Location:		**Phone number:**	
Date submitted:	3/28/2025 12:51 PM	**e-mail:**	
Engineer:		**Submitted by:**	Kuzma, Thaddeus

Application design data

Tag number:	CHWP-3, 4	Piping configuration:	Single + Standby
Service:	Chiller glycol side	Suction pressure:	0 ft
Equipment Location:		Fluid:	Propylene Glycol: 33
Qty:	2	Operating temperature:	60 °F
Total system flow:	325 USgpm	Duty flow per pump:	325 USgpm
System head:	45 ft	Viscosity:	31 SSU
Environment:	Indoors	Specific gravity:	1.0066
Total dissolved solids:	0 ppm	Safety factor % flow:	0 %
Efficiency at Design:	81.61 %	Safety factor % head:	0 %
NPSHR:	13.96 ft	Total Absorbed Power:	4.56 hp
Min. maintained pressure*:	18 ft	Impeller diameter:	4.43 in
PElvl:	0.46	ERvl:	54
Standby qty:	1	Pump/motor run qty:	1
Outlet velocity:	21.77 ft/s	Load Profile Location:	NA
Climate Zone Type:	NA	Building Type:	NA
Time Period:	8760 (1 Year)		
Redundancy %:	N/A		

*If minimum maintained system pressure is not known, default is 40% of design head.

Materials of construction

Construction:	Low Pressure Ductile Iron	Impeller:	316 Stainless Steel
Rating:	ANSI-125	Pump shaft:	316 Stainless Steel
Connections:	ANSI-125 Flanges Inlet: 3in, Outlet: 2.5in	Flush line:	Braided Stainless Steel
Casing (volute):	Ductile Iron, E-coated	Casing o-ring:	EPDM
		Stub Shaft:	N/A

Mechanical seal data

Seal type:	Outside Balanced	Rotating face:	Resin Bonded Carbon
Manufacturer code:	C-SSC AB2	Stationary seat:	Sintered Silicon Carbide
Springs:	Stainless Steel	Secondary seal:	Viton
Rotating hardware:	Stainless Steel	Maximum total dissolved solids (TDS)****:	2000 PPM

Electrical data

Supplier:	Armstrong	Insulation class:	Class F Insulation
Size:	5 hp	Motor type:	Permanent Magnet
Frame size:	IEC90	Efficiency:	IE5
Enclosure:	TEFC	Power supply:	460/3/60
Operating speed @ 100%	3078 rpm	Operating speed @ 50%	2126 rpm

flow:	flow***:

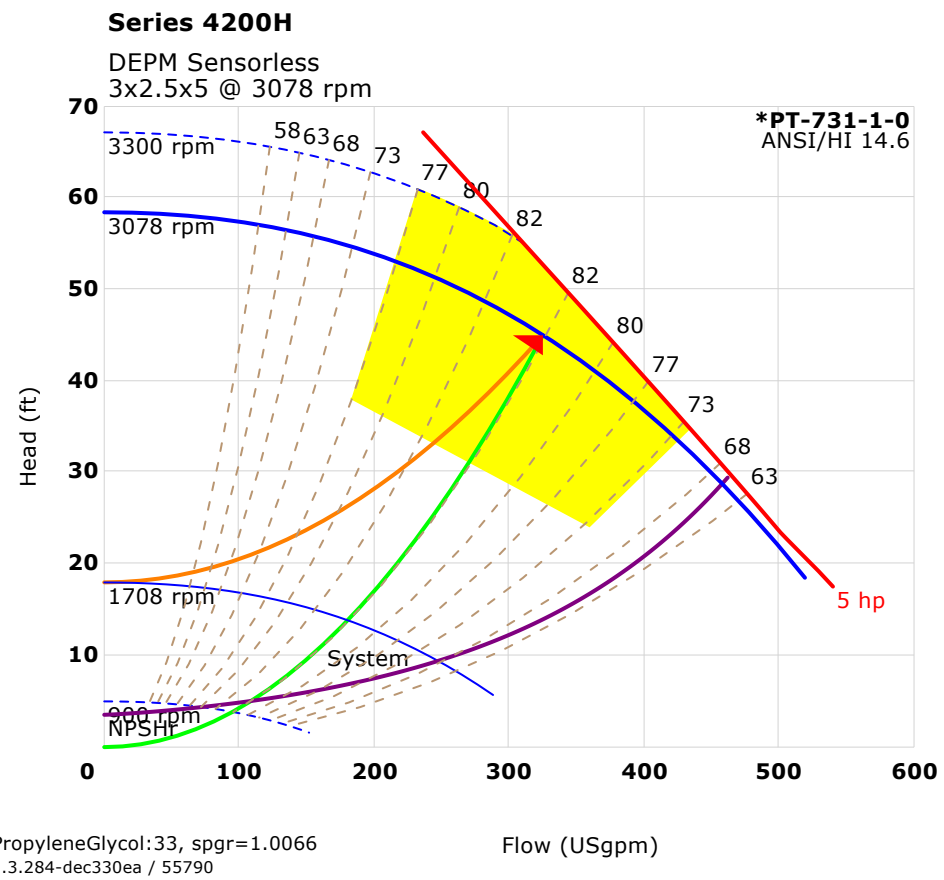
***Based on minimum pressure setting of 40% of design head.
****Note: Please ensure proper seal is selected by inputting Total Dissolved Solids (TDS) in PPM in ADEPT if water quality is poor at site. Also select Flush Line Filter or Cyclone Separator if there are other contaminants in the fluid

DEPM controller data

Sensorless control:	Yes - Quadratic press control	Communication port:	RS 485
Communication protocol (*):	BACnet MS/TP	Analog inputs:	2 (current or voltage)
Enclosure:	UL Type 12/IP55	Analog outputs:	1 (current or voltage)
Fused disconnect switch:	None	Digital inputs:	2 (programmable)
Control orientation:	STD	Digital outputs:	2 (programmable)
Expansion card:	None	Cooling:	Not Applicable
Absorbed Power/BHP at 50% load/flow and 55% of design head:	2.51 hp	Ambient temperature:	14˚F to 113˚F (up to 3280 ft elevation)
Meets ASHRAE 90.1:	Yes	EMI/RFI control:	Integrated filter to meet EN61800-3
		Harmonic suppression:	Integrated DC link reactor**

(*): If Default - Field reconfigurable is selected, Default from factory will be BACnet MS/TP and can be reconfigured in the field.
** The IVS control is a low harmonic control with a built-in DC link reactor equivalent in performance to a 5% AC line reactor. This does not guarantee performance to any system wide harmonic specification or the costs to meet a system wide specification. If supplied with the system electrical details, Armstrong will run a computer simulation of the system wide harmonics. If system harmonic levels are exceeded, Armstrong can also recommend additional harmonic mitigation and the cost for such mitigation.

Performance curve



PropyleneGlycol:33, spgr=1.0066
3.3.284-dec330ea / 55790

--Control Data—

1. Hmax @ 2565 rpm:
NPSHR: 13.96 ft
Intersection Pt: 325 usgpm @ 45 ft
bhp=4.56 hp, eff=81.61 %%, %bepq=105 %%

2. Control (QPC) @ 2804 rpm:
NPSHR: 10.87 ft
Intersection Pt: 284.38 USgpm @ 38.67 ft
bhp=3.42 hp, eff=81.78%, %bepq=100.72%

3. Control (QPC) @ 2530 rpm:
NPSHR: 8.02 ft
Intersection Pt: 240.5 USgpm @ 32.79 ft
bhp=2.45 hp, eff=81.66%, %bepq=94.18%

4. Control (QPC) @ 2256 rpm:
NPSHR: 5.46 ft
Intersection Pt: 191.75 USgpm @ 27.4 ft
bhp=1.66 hp, eff=80.55%, %bepq=84.11%

5. Control (QPC) @ 1982 rpm:
NPSHR: 3.25 ft
Intersection Pt: 133.25 USgpm @ 22.54 ft
bhp=1.01 hp, eff=75.55%, %bepq=66.57%

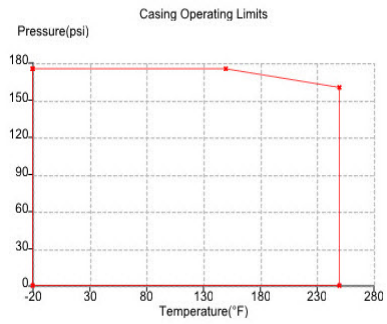
6. Hmin: 18 ft 1708 rpm:
NPSHR: 1.09 ft
Intersection Pt: 0 USgpm @ 18 ft
(Head Q Min) Setting= 40% Hmax

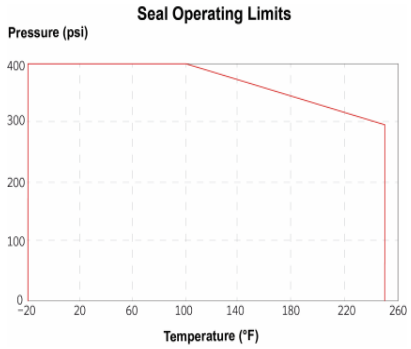
Design envelope pumping unit capability

Operating point	Flow	Head	Efficiency

Full capability at 100% design flow	325 USgpm	52.72 ft	81.79%
Design point	325 USgpm	45 ft	81.61 %
50% average flow (with default load profile)	162.5 USgpm	24.75 ft	78.76 %
Motor Capability @ Rated Speed	5.29 hp		

Operating limits (temperature - pressure)





Maximum pressure: 175 psi

Maximum temperature: 250 ˚F

All Pump casings are hydrostatically tested to requirements of ANSI/HI 14.6 standard.

Options

Sensorless Bundle:	Yes	DEPC Parallel Sensorless:	No
Energy Performance Bundle:	No	Protection Bundle:	No
Dual Season Setup:	No	Zone Optimization Bundle:	No

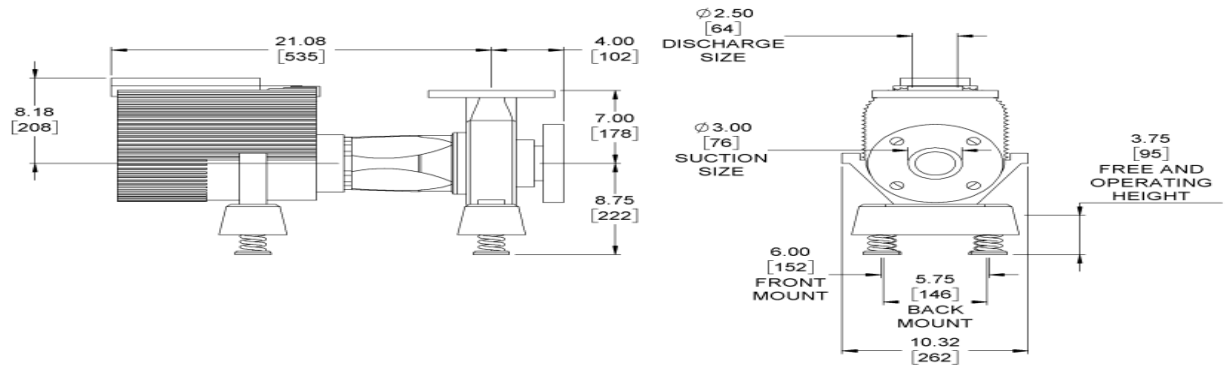
Cooling		Heating	
Q1:	N/A	Q2:	N/A
H1:	N/A	H2:	N/A
H1min:	N/A	H2min:	N/A
Maximum Flow:	N/A	Minimum Flow:	N/A

Optional Services

On-Site Pump Commissioning:	Cost not Included	Extended Warranty:	No
Pump Manager:	Yes,Standard (1 Year Pump Manager Professional	Include Spare Parts Qty:	0

Dimensional data (not for construction)

Side view	Front view



Weight: 122.29 lb [55.47 kg], Units of measure: inches [millimeters]
· R = minimum lifting clearance required above motor
· Coupling guard and flush line (not shown) are supplied
· Tolerance of ± 0.125 inch (± 3 mm) should be used
· For certified dimensions, please contact your Armstrong representative
· Pump equipped with casing drain plug and ¼ inch NPT suction and discharge gauge ports
· Rated Capacity per Spring - 76 lb [34.47 kg]
· Rated Deflection - 1.02 in [25.91 mm]
· Mount Constant - 73 lb/in [1.3 kg/mm]
· Max HorizontalStatic G Rating - N/A

Connection details

Connection	Size	Rating	OD	Bolt quantity*	BCD	Bolt size
Inlet	3	ANSI-125	7.50	4	6.00	0.625
Outlet	2.5	ANSI-125	7.00	4	5.50	0.625

*Equally spaced straddling centreline

Flow Readout Accuracy

The Design Envelope model selected will provide flow reading on the pump touchscreen & digitally for the BMS. The flow readout will be factory tested to ensure ± 5% accuracy.

Special instructions

Reference Motor Specification AES 05007.
UL STD 778 & CSA STD C22.2 no.108 certified

Note: Design Envelope end suction pumps with integral springs do not require inertia bases to isolate vibration.

Selected options

Testing: No Test Certification Required
Seal Environment Accessories: None
Pre-Wired Control Bridge: No
Sensorless Bundle: Sensorless control
Constant flow control
Constant pressure control
Flow readout
Touch Screen Cover: Yes

Design Envelope pumps offer industry-leading efficiency and performance management capabilities for significantly reduced

energy consumption. Armstrong has undertaken a multi-year project to transition our pump offering to an integrated design that use Design Envelope Permanent Magnet technology for even greater operating cost savings. In the sizes currently equipped with Design Envelope Permanent Magnet motors, the pumps are also more compact and lighter than our standard Design Envelope pumps.

Please note that depending on the pump sizes, your shipment may include a combination of:

- Design Envelope Permanent Magnet pumps
- Design Envelope Permanent Magnet pumps with IVS controls
- Design Envelope Pumps with Premium efficiency induction motors and IVS controls

Submittal

Ref. #: SQGMR001851_2

Suction guide

Model: SG-63

Project name:		**Representative:**	Thaddeus Kuzma
Location:		**Phone number:**	6162880822
Date submitted:	3/28/2025 12:51 PM	**e-mail:**	kuzmat@hedrickassoc.com
Engineer:		**Submitted by:**	Kuzma, Thaddeus

Application design data

Tag	Qty	Model	Pipe Conn.size	Pump Conn.size	Design flowrate	Pressure Drop*	Associated pump
CHWP-3, 4	2	SG-63	6 in	3 in	325 USgpm	0.5 ft	Design Envelope Sensorless 4200H 2505-005.0

*at design flow

Materials of construction

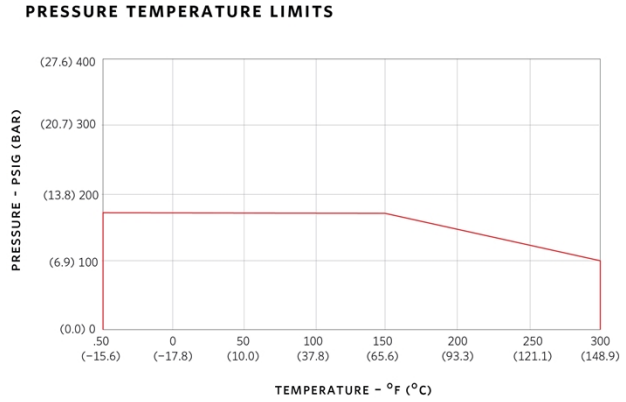
SG-63

Body:	Cast Iron	Cover gasket:	Synthetic fiber
Guide vanes:	Cast Iron	Strainer:	Stainless Steel,0.188"(5mm)Perf..
Cover plate:	Cast Iron	Start-up strainer*:	Fine Mesh Galvanized Steel

*Remove start up strainer after 24 hours of pump operation

Operating limits (temperature - pressure)

SG-63-Suction Guide-ANSI-125

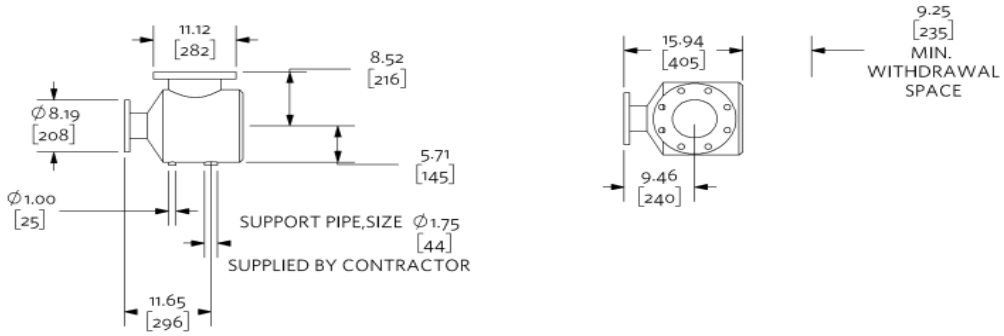


Maximum pressure: 175 psi
Maximum temperature: 300 F

Units are hydrostatically tested to 150% of maximum working pressure

Dimensional data (not for construction)

SG-63	Weight: 107.45 lb [48.74 kg]
Side view	Top view



Not to scale
Units of measure: inches [millimeters]
Tolerance of +/- 0.125 inch (+/- 3 mm) should be used
For certified dimensions, please contact your Armstrong representative

Submittal

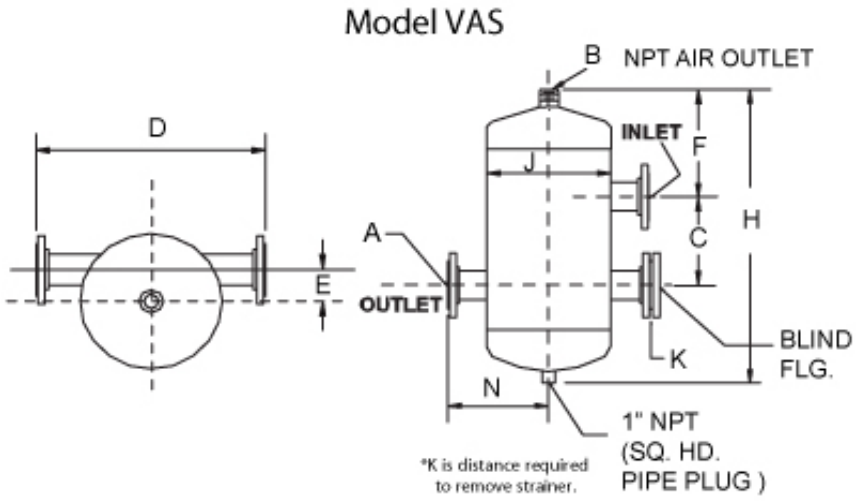
Ref. #: SQGMR001851_2

Product: VASASME

Model: VAS-6-U

Project name:		**Representative:**	Thaddeus Kuzma
Location:		**Phone number:**	6162880822
Date submitted:	3/28/2025 12:51 PM	**e-mail:**	kuzmat@hedrickassoc.com
Engineer:		**Submitted by:**	Kuzma, Thaddeus

Technical Data		Materials of Construction	
Max.Working Temperature	80 ˚F	Shell	4in-6in Models:Cast Iron, 8in-12in Models:Fabricated Steel
Connection Type	150# flange	Gasket	Non-Asbestos
Max.working Pressure	160 psi	Strainer	Yes



Dimensional Data (in, lb) Not for Construction									
A	**B**	**C**	**D**	**E**	**F**	**H**	**J**	**K**	**N**
6	1.5	12.5	24	4	9.85	32.24	16	22	12

Weight	Flow IN USGPM
306 lb [138.8 kg]	360 USgpm

Submittal

Ref. #: SQGMR001851_2

Product: Expansion

Model: A300-L

Project name:		**Representative:**	Derek.Witt
Location:		**Phone number:**	6162880822
Date submitted:	3/28/2025 12:51 PM	**e-mail:**	kuzmat@hedrickassoc.com
Engineer:		**Submitted by:**	Kuzma, Thaddeus

System Data			
Tag Num:	ET-1	Service:	Glycol side
Location:		Qty:	1

Application: N/A			
Fluid:	Propylene Glycol	Contents:	1500 us gal
Flow Temperature:	40 ˚F	Return Temperature:	100 ˚F
Static Height:	0	Max System Press. :	40 psi

Expansion Tank			
Tank Model:	A300-L	Tank Qty:	1
Tank Volume:	79.25 us gal	Max. Working Pres.:	125 psi
Charge Pressure : 22 psi Standard factory charge is 12 psi (83 kPa) unless otherwise specified.		· Not for Domestic Potable Water Systems. · Designed and constructed per ASME, Section VIII, Division 1. · California Code Sight-glass available upon request. · Allow a minimum of 18" (457 mm) clearance for system piping.	
Shell:	Carbon Steel	Working Temperature:	35˚F - 240˚F (1.7˚C - 115˚C)
Bladder:	Heavy Duty Butyl	Working Pressure:	125 psi(862 kPa)

L SERIES | PRE-CHARGED (ASME) EXPANSION TANK | SUBMITTAL

File No: 37.52
Date: FEBRUARY 11, 2022
Supersedes: 37.52
Date: JANUARY 31, 2022

Job: _____ Representative: _____

_____ Order no.: _____ Date: _____

Engineer: _____ Submitted by: _____ Date: _____

Contractor: _____ Approved by: _____ Date: _____

DATA

Model no. ordered: _____ Qty: _____

Tag no.: _____ Charge pressure: _____ psi/kPa

Optional California sight-glass and seismic clips: ☐ Yes ☐ No

Standard factory charge is

☐ A200L-1400L: 12 psi (83 kPa)
☐ 1600L-4000L: 40 psi (276 kPa)

MATERIALS OF CONSTRUCTION

Shell: Carbon steel
Bladder: Heavy Duty Butyl

OPERATING CONDITIONS

Temperature Range

☐ A200L-1400L: 40°F — 240°F (4.4°C — 115.5°C)
☐ 1600L-4000L: -20°F — 240°F (-29°C — 115.5°C)

Maximum Pressure: 125 psi (862 kPa)

NOTES

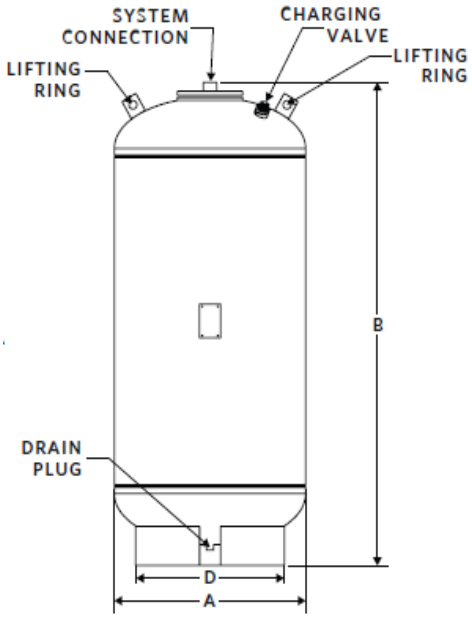
- Not for Domestic Potable Water Systems.
- Designed and constructed per ASME, Section VIII, Division 1.
- California code sight-glass and seismic clips available as an option.
- Allow a minimum of 18" (457 mm) clearance for system piping.

TYPICAL SPECIFICATION

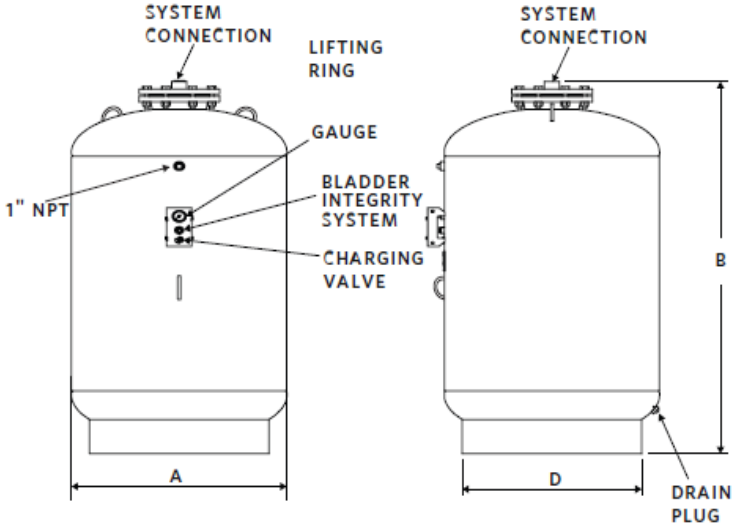
Furnish and install, as shown on the plans, Armstrong Model _____-L ASME pre-charged bladder Expansion Tank, stamped for 125 psi (862 kPa) workingpressure. Each tank will be supplied with a heavy duty butyl replaceable bladder. Tank shall be supplied with a ring base, lifting rings, and NPT system connection.An air charging valve connection (standard tire valve) shall be provided tofacilitate adjusting pre-charge pressure to meet actual system conditions.

2

MODEL	TANK VOLUME	MAXIMUM ACCEPTANCE VOLUME	A	B	D	SYSTEM CONNECTION NPT	DRAIN PLUG	CHARGING VALVE	SHIPPING WEIGHT
	gal.(L)		inches (mm)			inches (mm)			lbs.(kg)
A200-L	53 (200)	53 (200)	24.00 (610)	38.40 (1475)	19.00 (483)	1.50 (38)	0.75 (19)		225 (102.1)
A300-L	80 (300)	80 (300)	24.00 (610)	52.27 (1328)	19.00 (483)	1.50 (38)	0.75 (19)		285 (129.3)
A400-L	106 (400)	106 (400)	24.00 (610)	66.14 (1680)	19.00 (483)	1.50 (38)	0.75 (19)		350 (158.8)
A500-L	132 (500)	132 (500)	24.00 (610)	80.14 (2036)	19.00 (483)	1.50 (38)	0.75 (19)		410 (186.0)
A600-L	158 (600)	158 (600)	30.00 (762)	64.75 (1645)	24.00 (610)	1.50 (38)	0.75 (19)	—	430 (195.0)
A800-L	211 (800)	211 (800)	30.00 (762)	82.44 (2094)	24.00 (610)	1.50 (38)	0.75 (19)		525 (238.1)
A1000-L	264 (1000)	264 (1000)	36.00 (914)	73.90 (1877)	28.00 (711)	1.50 (38)	0.75 (19)		565 (256.3)
A1200-L	317 (1200)	317 (1200)	36.00 (914)	86.00 (2184)	28.00 (711)	1.50 (38)	0.75 (19)		680 (308.4)
A1400-L	370 (1400)	370 (1400)	36.00 (914)	98.50 (2502)	28.00 (711)	1.50 (38)	0.75 (19)		750 (340.2)
1600-L	422 (1600)	422 (1600)	48.00 (1219)	74.00 (1880)	42.00 (1067)	1.50 (38)	0.75 (19)		1046 (474.4)
2000-L	528 (2000)	528 (2000)	48.00 (1219)	86.00 (2184)	42.00 (1067)	1.50 (38)	0.75 (19)		1150 (521.6)
2500-L	660 (2495)	660 (2495)	48.00 (1219)	104.00 (2642)	42.00 (1067)	2.00 (51)	0.75 (19)	0.302"-32NC	1444 (655.0)
3000-L	792 (2994)	792 (2994)	48.00 (1219)	124.00 (3150)	42.00 (1067)	2.00 (51)	0.75 (19)		1658 (752.1)
4000-L	1056 (3992)	1056 (3992)	60.00 (1524)	105.00 (2667)	54.00 (1372)	2.00 (51)	0.75 (19)		2238 (1015)



MODELS A200-L TO A1400-L



MODELS 1600-L TO 4000-L

Quote Reference: SQGMR001851_2
Quote Name: 49307 - MSU Manly Miles Chiller System
Project Name:
Date: 2025-03-28

Recommended Spare Parts and Kits

Item No.	Description
1.0	**Design Envelope and Commercial Pumps** **Available spare parts and kits for Design Envelope Sensorless 4200H 2505-005.0 with Suction Guide**

Part/Kit	Armstrong Part number	Includes
Design Envelope Seal Parts	8975002-324	Mechanical Seal
Design Envelope Seal Parts Kits	8975002-324K	Mech Seal, Seal Cover, Bush, Carbon Bushing, Capscrew & Washer
Design Envelope Clamp Ring Parts Kits	8945800-814K	V- Clamp, O-ring
Design Envelope Split Coupling Parts Kit	8428582-000K	Split Coupling, Collar, set screw, Key, Capscrew & Washer
Design Envelope Touchscreen Cover Replacement Kit	880103-000	Door Cover, Frame cover, Cover Pin
Design Envelope Spring Isolator Parts	8975004-913	Spring - Isolator
Design Envelope Shroud Parts	8428656-003	Shroud
Design Envelope Pump Controller Parts Kit	880100-015	PCB, LCD Touchscreen holder, Mylar, Bracket support, Front Cover, Front cap cover, Front Cover O-ring, Mounting Bracket, Front Cover Gasket, Round hex M4, Hex Nut M5, M5x20
Design Envelope Standard Flush Line Replacement Kit	880000-010K	Elbow, Adapter,Hose
Design Envelope Flush Line- 50micron Sediment Filter w/ Sight Flow Indicator (300PSI) Parts Kit	880000-020K	Nipple, Ball Valve, Adapter, Hose, Flow Indicator, Elbow, bushing, Filter housing & cartridge, Filter Bracket, capscrew Washer
Design Envelope 50micron Sediment Filter w/ Flow Indicator Replacement Parts Kit	880000-044K	Sediment Filter, Filter Cartridge, Filter Bracket, Capscrew & Washer

Note: List above is the complete list of all available spare parts or kits for the pump size mentioned and not a commitment of inclusion in project supply scope.
Ensure required spare parts and kits are configured with pump separately. More details of those selected parts/kits (if any) shall be included in earlier page(s).

2.0	**Vortex Air Separator** Recommended Spare Parts and Kits not available for this Product.

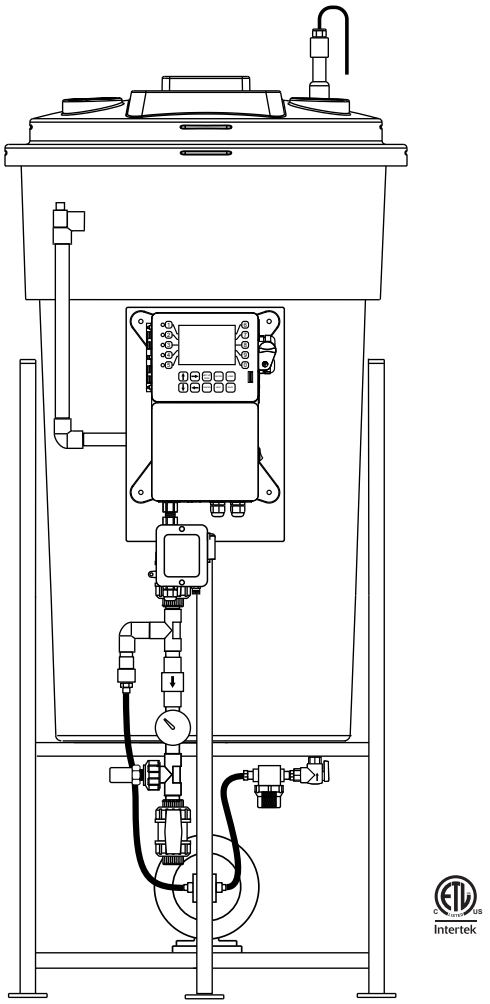
Quote Reference: SQGMR001851_2
Quote Name: 49307 - MSU Manly Miles Chiller System
Project Name:
Date: 2025-03-28

Recommended Spare Parts and Kits

3.0	**Expansion Systems** Recommended Spare Parts and Kits not available for this Product.

Advantage Pumps — Data Sheet

Digital Glycol Feeder



For Closed Loop Systems Now With MegaTron XS & Nano-N Controller Options

Key Features

- Digitally Displayed Pressure
- Simple Set Point Control
- Low Level Pump Cut Off
- Audible Alarm
- High Flow Feed Pump
- Preplumbed and Prewired
- ETL Approved (XS models)
- 3mil Powdercoated Steel Frame
- Multi System
- Optional BMS Interface

Application

Our glycol feeders maintain a consistent pressure in closed loop systems automatically feeding based on a pressure drop.

Digitally displays the actual pressure of the loop and has a user settable control point for pump activation and pressure relief.

The feeder is constructed on a rugged 3mil powdercoated steel frame with a polyethylene tank, high flow feed pump, prewired controller, low level cut-off, audible alarm, motor starter/high amp relay and preplumbed piping assembly with pressure gauge, pressure transducer, back check and relief valve.

Optional: Dry contact output for low tank level and pump on, plus BACnet and ModBus compatibility.

BUILD A MODEL GF - 1 A 2 A 1 M -S

TANK SELECTION
1 = 55 gal (208L) poly
2 = 100 gal (378L) poly
3 = 30 gal (113L) poly
4 = 50 gal (189L) carbon steel
7 = 150 gallon poly (567L)

STAND SELECTION
A = Painted steel stand
B = Painted steel stand w/ mixer bracket
C = Tank top mount (no tank included)
D = Portable stand with built in rollers

PUMP SELECTION
*Dual pump sys. require 2 pump selections (i.e., -11)
0 = No pump
1 = 2 gpm at 150 PSI; ⅓ hp
2 = 3.3 gpm at 150 PSI; ½ hp
3 = 5.5 gpm at 100 PSI; ¾ hp
4 = 10 gpm at 100 PSI; 1½ hp

PUMP CONFIGURATION
A = Standard configuration
B = Alternating pumps for single loops (requires 2 pump selections)
C = Pump plumbed for transfer duty into tank

LOOP SELECTION
*Dual loop sys. require 2 loop selections (i.e., -11)
0 = No loop
1 = Sch 80 PVC loop; 100 PSI max; 100°F max
2 = Copper loop; 100 PSI max; 180°F max
3 = Carbon steel loop; 100 PSI max

CONTROL SELECTION
M = ETL listed NANO-N with alarm buzzer & contact, single loop
G = Pre-configured ETL listed XS Series controller prewired for a single pump system.
H = Pre-configured ETL listed XS Series controller prewired for a dual pump system.
D = Pressure transducer, level wand, & pump starter relay for use w/ separately ordered MegaTron or SS w/ 4-20mA input ability
E = Manual pump control; no pressure switch or level wand

OPTIONS
1 = 240V
5 = Position back check to use tank for expansion
C1 = Communications card **Internet** (XS controller only)
C11 = Communications card **Modbus** TCP/IP
C12 = Communications card **BacNet** TCP/IP (read only)
C22 = Communications card **BacNet** (read/write)
H = 0-200 PSI pressure transducer and gauge
M = Mixer controls (order mixer separate)
O4 = Four 4-20mA outputs (XS controller only)
S = ON/OFF switch (included on control options G & H)

Specifications

Electrical
- Input 120 VAC, 60 Hz
- Alarm Dry Contact
- Motor: 1/3 HP Pump: 1.5 GPM

Plumbing
- Standard Schedule 80 PVC
- Optional Copper or Black Iron

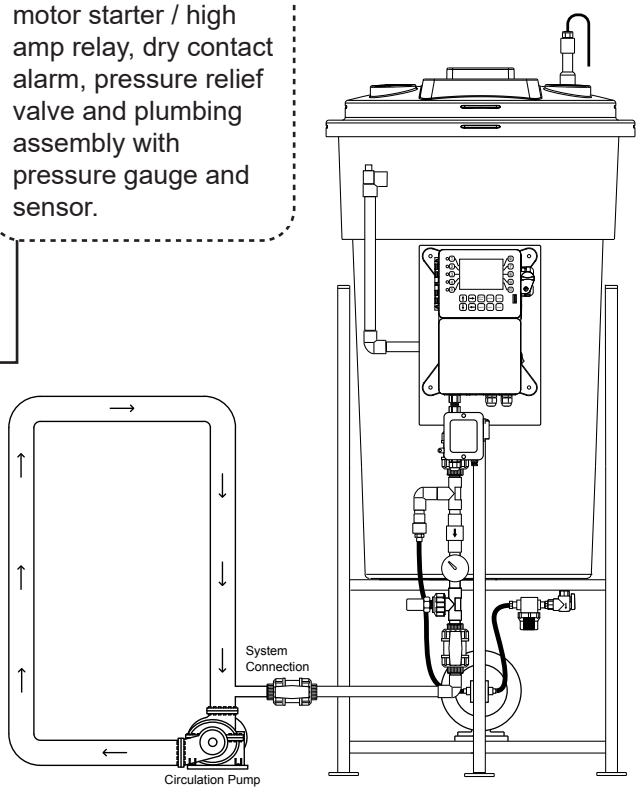
Enclosure
Heavy Duty NEMA 4X style, high impact thermoplastic with padlockable gasketed Lexan viewing door

Pressure Gauge 0-100 psi (0-6.9 bar)

Dimensions (55 gal XS model)
W 27.5" (69.8 cm)
H 65" (165.1 cm)
D 32" (81.2 cm)

Shipping Weight of GF-1A1A1G
160 lbs (77.57 kg) approx.
Note: Options can change model's weight.

Most units include poly tank and stand, low level switch with audible alarm (100db), motor starter / high amp relay, dry contact alarm, pressure relief valve and plumbing assembly with pressure gauge and sensor.



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800-743-7431 Phone
888-686-6212 Fax
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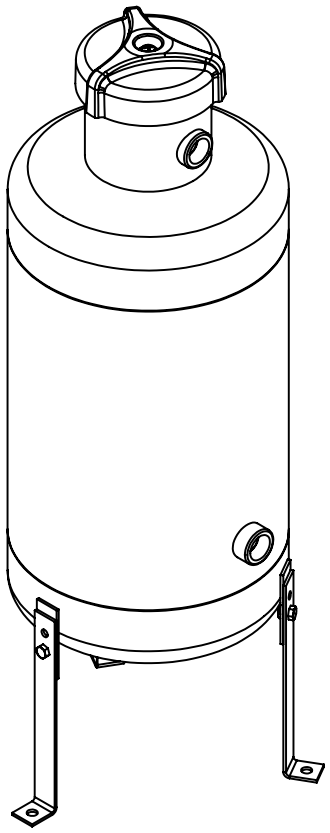
03/2021

Bypass Feeder

Chemical Addition and Filtering



Key Features

- Powder Coated
- Handle-top filter holder
- Full bottom drain
- Flat and dome bottom models
- Custom configurations
- Adjustable leg kit
- ACME cap

Application

Bypass Feeders are designed to provide a dependable means of introducing treatment chemicals into hot and cold water or other liquid streams with a large filtration capacity.

Bypass Feeders have a simple design that provides easy installation and operation with precise filtering capabilities. The course ACME thread cap design provides better sealing and quick opening.

Build a Model

Select the desired capacity, bottom, and filter, plus any options. (Example: BF-05DX)

BF- 05 D 2

Capacity
02 = 2 gallon
05 = 5 gallon
12 = 12 gallon

Bottom
D = Dome with legs and bottom port
F = Flat

Filter
X = no filter
1 = 10” cartridge filter holder (20 micron hot filter included)
2 = 18” bag filter basket (25 micron bag included)
3= 18” bag filter basket (5 micron bag included)
4= 18” bag filter basket (no handle or filter)

Accessory Kits

BFK-ISOVALVES	¾” brass isolation valves w/ unions & nipples
BFK-DBDRAIN	¾” brass drain valve & fittings for dome bottom
BFK-FBDRAIN	¾” brass drain valve & fittings for flat bottom
BFK-GAUGEX	¾” cross w/ 0-300 psi gauge, sample/relief valve 180°F & fittings
BFK-FUNASM	¾” tee, isolation valve and funnel

Parts

BF-BAG0518	18” x 3” bag filter, 05 micron
BF-BAG2518	18” x 3” bag filter, 25 micron
BF-BGCAGE18	Bypass feeder SS bag filter cage, 18”
BF-BGCAGE18-F	Bypass feeder SS bag filter cage, no handle
BF-CF05-10	10” cold water cartridge filter, 05 micron
BF-CF20-10	10” cold water filter, 20 micron
BF-HF05-10	10” hot water cartridge filter, 05 micron
BF-HF20-10	10” hot water filter, 20 micron
BF-CFCAGE10	Bypass feeder SS cartridge filter holder, 10”
BF-CAP	Bypass feeder cap assembly
BF-FUNNEL	Poly funnel with ¾” MNPT
BF-LEGS	Bypass feeder leg kit
BF-ORING	Bypass feeder cap o-ring
BF-PG	0-300 psi pressure gauge
BF-PLATE	Bypass feeder cap plate
FLOW-2HT	¾” flow indicator; 145 psi, 212°F max
SFS-BV	¼” brass bleed valve, 180°F max

Specifications

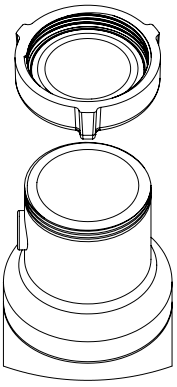
Pressure
200 psi (13.6 bar) @ 225 °F (107.2 °C)
300 psi (20.6 bar) @ 150 °F (65.5 °C)

Shipping Weight (approximately)

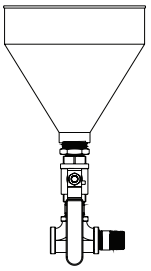
2 gallon (including legs)	= 24.5 lbs (11.11 kg)
5 gallon (including legs)	= 35.5 lbs (16.1 kg)
12 gallon (including legs)	= 52 lbs (23.59 kg)
Basket	= 0.6 lb (0.27 kg)
Filter Holder	= 0.85 lb (0.39 kg)

Dimensions

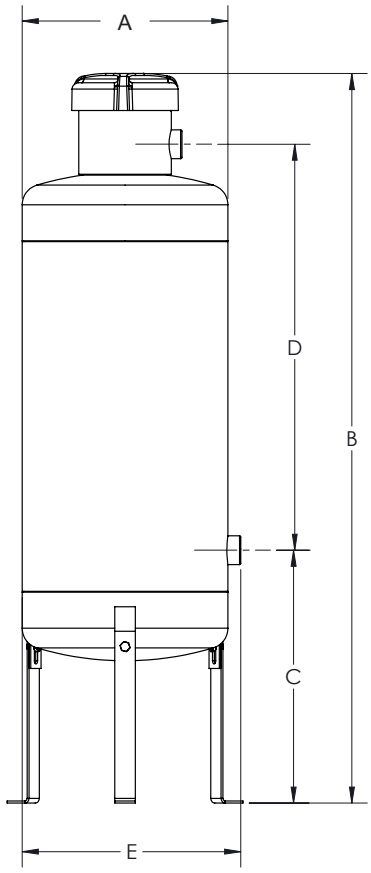
Model	A	B	C	D	E
BF-02D	6”	34”	10.8”	19.7”	6.6”
BF-02F	6”	26.7”	3.6”	19.7”	6.6”
BF-05D	10”	35.5”	12.3”	19.8”	10.6”
BF-05F	10”	27.5”	4.3”	19.8”	10.6”
BF-12D	10”	49.5”	12.3”	37.2”	10.6”
BF-12F	10”	45”	4.3”	37.2”	10.6”

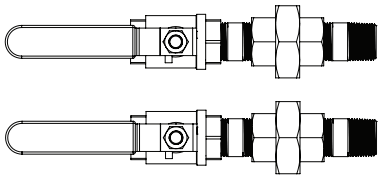


ACME Cap

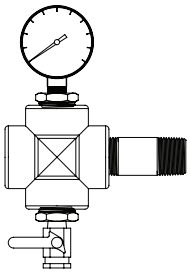


BFK-FUNASM

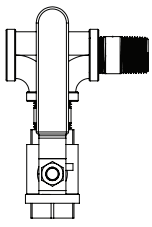




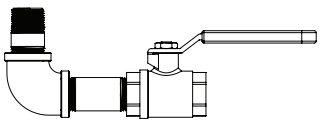
BFK-ISOVALVES



BFK-GAUGEX



BFK-FBDRAIN



BFK-DBDRAIN

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www.advantagecontrols.com

04/2019

BUFFER TANKS

Amtrol ASME Buffer Tanks add capacity to non-potable, closed systems to help reduce cycling, improve temperature control and provide more consistent system operation. Available for chilled water and hot water applications, these Buffer Tanks are all made in the USA at our ISO 9001:2008 registered facilities.

Chilled Water Buffer Tank CWBT Series

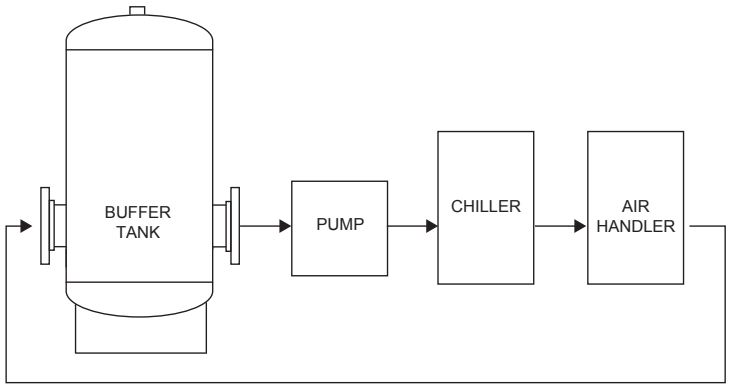
- Meets all ASME Section VIII, Division I standards.
- Available up to 1,040 gallons.
- Connections from 3" to 12".
- Internal baffle helps properly circulate water.
- Maximum Working Pressure: 125 or 150 psig.
- Maximum Operating Temperature: 450° F.

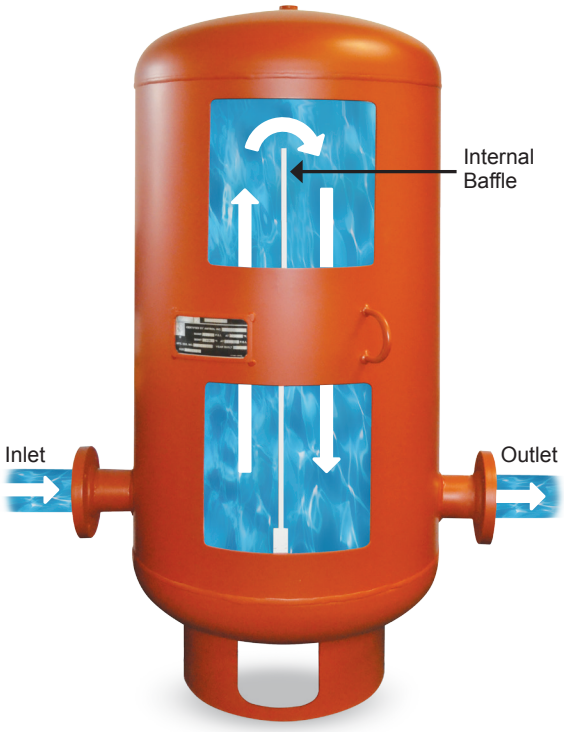
How It Works

Water enters the buffer tank and is diverted up and over the internal baffle to circulate the water and take full advantage of the tank volume.

If installed outdoors, Insulation for Exterior Installation by Insulation Contractor

Typical Installation





for Chilled and Hot Water Systems

Hot Water Buffer Tank HWBT Series

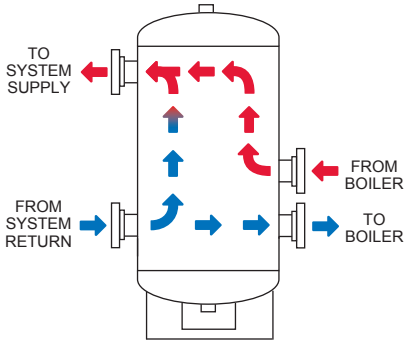
- Meets all ASME Section VIII, Division I standards.
- Available in 2 or 4 port options.
- Available up to 300 gallons.
- Available in 2", 3" & 4" connections.
- Maximum Working Pressure: 125 or 150 psig.
- Maximum Operating Temperature: 450° F.

How It Works

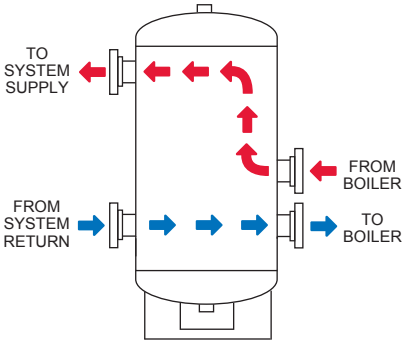
Tank provides added capacity in high efficiency systems that incorporate small, modular, low-mass condensing boilers.

- 4-port tanks allow for primary / secondary flow through the vessel. This is usually required for systems with multiple small or low volume zones to maximize boiler efficiency and overall system performance.
- 2-port tanks are typically used in standard applications where all zones are similarly sized.

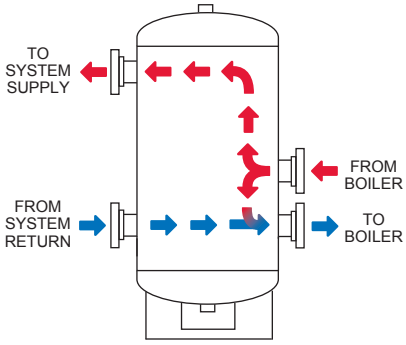
System Flow > Boiler Flow



System Flow = Boiler Flow

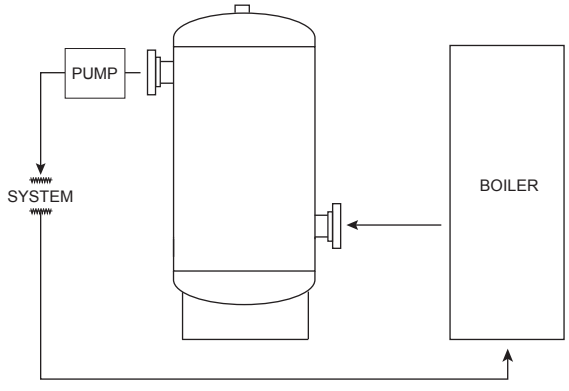


System Flow < Boiler Flow

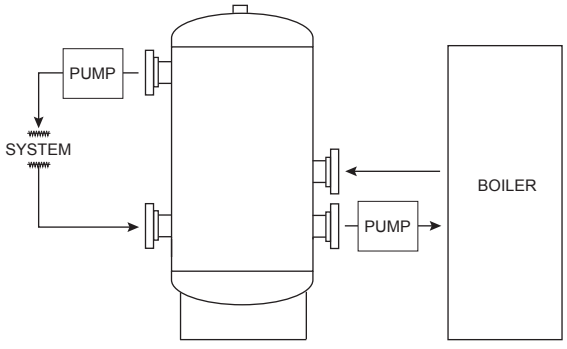


Typical Installations

2 Port Installation



4 Port Installation



Sizing Chilled Water Buffer Tanks

For Adding Capacity to Closed, Non-Potable Chilled Water Systems

Required Information

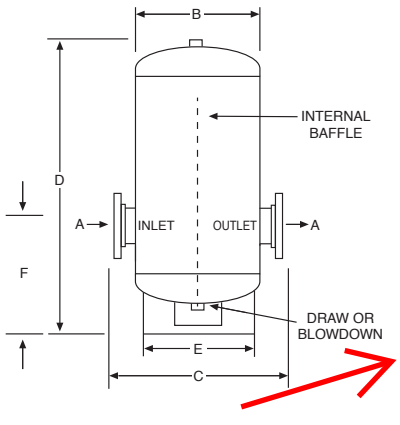
Total Chilled Capacity in Tons = C
System Volume per Ton* = V_R
Actual System Volume in Gallons = V_A

*Check with Chiller Manufacturer for specific requirements. Typical HVAC chiller systems are between 3 and 6 gallons per ton. Applications where temperature accuracy is critical requires 6 to 10 gallons.

(Total Chilled Capacity □ Tons (C) x System Volume Per Ton □ Gallons/Ton (V_R)) - System Volume □ Gallons (V_A) = Buffer Tank Size □ Gallons

Example:

Total Chilled Capacity (C): 100 Tons
System Volume (V_R): 10 Gallons Per Ton
Actual System Volume (V_A): 800 Gallons
Pipe Size: 4"
Relief Valve: 50 PSI
(100 x 10) - 800 = 200 Gallons*
Recommendation: CWBT200-4-125
*Select tank equal to or greater



CWBT Series Specifications

Model Number	Tank Volume (Gallons)	Dimensions (Inches)						Shipping Weight (lbs.)	
		Connection Size A	B	C	D	E	F	125 PSI	150 PSI
CWBT120-3	120	3	24	33⅛	55¾	16	15	294	323
CWBT120-4	120	4	24	33⅛	55¾	16	15½	315	347
CWBT120-6	120	6	24	33⅛	55¾	16	16½	333	366
CWBT200-3	200	3	30	39⅛	62⅜	24	21½	527	580
CWBT200-4	200	4	30	39⅛	62⅜	24	22	547	602
CWBT200-6	200	6	30	39⅛	62⅜	24	23	566	623
CWBT300-4	300	4	36	45	80⅜	30	32⅛	753	828
CWBT300-6	300	6	36	45	80⅜	30	33⅛	772	849
CWBT300-8	300	8	36	45	80⅜	30	34⅛	801	881
CWBT500-6	500	6	42	51	99½	30	36½	1,366	1,503
CWBT500-8	500	8	42	51	99½	30	37½	1,395	1,535
CWBT500-10	500	10	42	51	99½	30	38½	1,490	1,639
CWBT850-6	850	6	54	64⅛	114 7/16	42	39½	2,707	2,978
CWBT850-8	850	8	54	64⅛	114 7/16	42	40½	2,736	3,010
CWBT850-10	850	10	54	64⅛	114 7/16	42	41½	2,771	3,048
CWBT1040-8	1040	8	60	70	107⅞	45	36	3,136	3,450
CWBT1040-10	1040	10	60	70	107⅞	45	37	3,171	3,488
CWBT1040-12	1040	12	60	70	107⅞	45	38	3,283	3,611

HEDRICK

2360 Oak Industrial Drive ne . Grand Rapids, Michigan 49505
tel 616.454.1218 . fax 616.454.5336 . www.hedrickassoc.com

POWER
THERMAL
PARTS
SERVICE

MSU Manly Miles
Quantech Air Cooled Screw Chiller
East Lansing, MI

SUBMITTAL FOR APPROVAL

Company: Michigan State University
Attn: Salem Mangles
Email:
Prepared By: David Craig / Derek Witt
Date: 3/28/2025
Quote#: 49307

HEDRICK
2360 Oak Industrial Drive NE . Grand Rapids, Michigan 49505
TEL 616.454.1218 . FAX 616.454.5336

THERMAL

Company: Michigan State University
Attention: Salem Mangles
Email:
Provided By: Dave Craig / Derek Witt

Project Name: MSU Manly Miles

Proposal #: 49307
Date: 3/28/2025

Quantech Air Cooled Scroll Chiller Selection:

Quantity (1) – Model: QTC40200B0

ITEM	QTY	TAGS	DESCRIPTION
1	1	(1)CH-01	DIRECT EXPANSION - AIR COOLED SCREW CHILLER

EQUIPMENT DESCRIPTIONS

EQUIPMENT PROPOSAL

Items Included

- Provide Model QTC40200B0 Qty: 1
- Refrigerant Type: R-513A
- Power: 460/3/60.0 Application
- Power Connection: SP NF Disconnect Switch w/ Lockable Handle
- Starter Type: Standard VSD
- TEAO Fan Motors
- Low Sound Fans With Variable Speed Control
- 3/4 Inch Single Thickness Insulation of Evaporator
- 4G Microchannel Coil - 25mm
- Suction Service Valve
- Compressor Parts and Labor Warranty: 78 Month (2-6 Year) from date of Shipment.
- Refrigerant Warranty: 66 Month (2-5 Year)
- Control Transformer
- Brine Application
- Standard Factory Sound Kit (Level 0 Reduction)
- Discharge Pressure Readout Kit ASME Pressure Vessel Codes
- Flow Switches One Thermal Dispersion Switch
- Low Ambient Kit Standard Factory Sound Kit (Level 0 Reduction)
- Suction Service Valve
- Wire/Louvered Encl Panels (Factory)

NOTES:

- *Installation of equipment by others.*
- *Specifications NOT provided, additional cost will apply if changes are needed to meet Specifications per engineer/contractor/Owner/or Municipality.*
- *Additional accessories by others unless otherwise specified.*
- *Control wiring & installation by others.*
- *Any integration to BMS/BAS will be by others.*
- *Startup included.*

EQUIPMENT SUBMITTAL FOR APPROVAL

PROJECT: **49307 - MSU Manly Miles Chiller System**

LOCATION:

Air-Cooled Chiller

EQUIPMENT	QTC4 Chiller
UNIT TAGS	CH-01
QUANTITY	1

SOLD TO:

CONSULTING ENGINEER:

PREPARED BY:

DATE:
Friday, 28 March 2025

REVISION:
0

TABLE OF CONTENTS

(QTC4 - Air-Cooled Chiller)

BOM Data

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

BID DATE: 03/28/2025 **LAST ADDEDNUM:** None
PROJECT: **49307 - MSU Manly Miles Chiller System** **NOTE(S)**
TO: Interested Bidders

BILL OF MATERIAL

ITEM	QTY	TAGS	DESCRIPTION
I	1	(1)CH-01	DIRECT EXPANSION - AIR COOLED SCREW CHILLER

EQUIPMENT DESCRIPTIONS

EQUIPMENT PROPOSAL

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- Provide Model QTC40200B0 Qty: 1
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- Power: 460/3/60.0 Application
- Power Connection: SP NF Disconnect Switch w/ Lockable Handle
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- Low Sound Fans With Variable Speed Control
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- Discharge Pressure Readout Kit ASME Pressure Vessel Codes
- Flow Switches One Thermal Dispersion Switch
- Low Ambient Kit Standard Factory Sound Kit (Level 0 Reduction)
- Suction Service Valve
- Wire/Louvered Encl Panels (Factory)

Items Included but Installed by Others

Items NOT Included

- Hauling or Rigging Equipment Into Place.

Performance Ratings

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

Full Load - Design

PIN								
QTC40200B0	846AHVNAXX	SAXLXUSNXD	BXXXSAXIFL	BW1SXGA2S4	XVA0404XXX	XXNSGAXVX3	IFLBFFSAX2	0041626200
....5...10	....5...20	....5...30	....5...40	....5...50	....5...60	....5...70	....5...80	....5...90
41626XXXXY	XMPG334153	0950150189	00060ABXX					
....5...100	....5...110	....5...120	....5...130					

Unit	
Model No.	QTC40200
Number of Compressors	2
Compressor Type	VSD Screw - Semi Hermetic
Number of Compressor Circuits	2
Capacity Control	10% - 100%
Refrigerant	R-513A
Performance Data	
Net Cooling Capacity [tons.R]	150.0
Total Input Power [kW]	234.0
EER [Btu/W.h]	7.691
NPLV.IP [Btu/W.h]	15.49
A-Weighted Sound Power [dB(A)]	100.0
Sound Pressure (Hemispherical Method) [dB(A)]	77.0
Sound Pressure Measured at [ft]	10.0
Electrical Data	
Nominal Voltage / Voltage Limits	460/3/60.0 / 414V - 508V
Compressor kW (each circuit)	108.1 / 113.6
Compressor RLA (each circuit) [A]	149.8 / 155.9
Fan QTY (each circuit)	4 / 4
Fan FLA (each circuit) [A]	3.4 / 3.4
Min. Circuit Ampacity [A]	375.7
Max. Fuse / CB Rating [A]	500.0
Unit Short Circuit Withstand [kA]	50 kA
Displacement Power Factor	0.95
Control kVA	2.000

Performance Impacting Options	
Compressor Style	Maximum Part Load Efficiency
Condenser Coil	4G Microchannel Coil - 25mm
Fan	Low Sound Fans With Variable Speed Control
Sound Attenuation	Standard Factory Sound Kit (Level 0 Reduction)
Weight & Dimensional Data	
Shipping Weight [lbs]	11812
Operating Weight [lbs]	12328
Refrigerant Charge [lbs]	134 / 131
Length [in]	203.3
Width [in]	88.3
Height [in]	92.8

Heat Exchanger Performance			
Evaporator		**Condenser (Air Cooled)**	
Heat Exchanger Type	Hybrid Falling Film	Ambient Air Temperature* [ºF]	95.0
Entering Fluid Temperature* [ºF]	53.00	Altitude* [ft]	0.00
Leaving Fluid Temperature* [ºF]	41.00	Condensing Temperature [ºF]	124.56 / 127.58
Flow Rate [USGPM]	320.9	Number of Fans (Circuit 1 / Circuit 2)	4 / 4
Fouling Factor* [h ft2 F/Btu]	0.000100	Total Air Flow [cfm]	92816
Fluid Type* / Concentration* [%]	Propylene Glycol / 33.0	Total Fan Power [kW]	12.32
Passes*	2		
Pressure Drop [ft H2O]	10.7		
Fluid Volume [USGAL]	62.1		
Evaporating Temperature [ºF]	21.46 / 28.11		
Minimum Flow Rate [USGPM]	197.0		
Maximum Flow Rate [USGPM]	640.0		
Bundle Code (System 1 / System 2)	Tube Bundle 1 (1") / Tube Bundle 1 (1")		

* Designates user specified input

Certified in accordance with the AHRI Air-Cooled Water-Chilling Packages Certification Program, which is based on AHRI Standard 550/590 (I-P) and AHRI Standard 551/591 (SI). Certified units may be found in the AHRI Directory at www.ahridirectory.org. Unit contains freeze protection fluids in the evaporator with a leaving chilled fluid temperature above 32 DEG F [0 DEG C] and is certified when rated per the Standard with water. Auxiliary components included in total KW - Oil heaters, Chiller controls. Auxiliary power is already included in the compressor and fan power

Part Load Performance (Based on Standard AHRI Unloading)				
Percent Load	**Ambient [ºF]**	**Capacity [tons.R]**	**Power Input [kW]**	**Unit Efficiency [Btu/W.h]**
100.0	95.0	150.0	234.0	7.691
75.0	80.1	112.5	113.5	11.89
50.0	65.1	74.98	50.67	17.76
25.0	55.0	37.49	22.27	20.20

Sound Power Levels (In Accordance with AHRI 370)										
Percent Load	Ambient [°F]	Octave Band Center Frequency [Hz]								LWA
		63	125	250	500	1000	2000	4000	8000	
100.0	95.0	95.0	96.0	96.0	99.0	96.0	88.0	84.0	80.0	100.0
75.0	80.1	95.0	96.0	96.0	96.0	92.0	87.0	83.0	79.0	97.0
50.0	65.1	92.0	94.0	93.0	93.0	90.0	84.0	80.0	75.0	94.0
25.0	55.0	89.0	89.0	90.0	90.0	87.0	81.0	77.0	72.0	91.0

Note:Unit is equipped with Low Sound Fans With Variable Speed Control.

Measurement of sound pressure used to obtain the sound power data presented is based on AHRI-370.

Air-cooled chillers are rated in terms of sound power not sound pressure. Johnson Controls provides estimates of sound pressure, but this is not the rating metric.

For an air-cooled chiller, sound pressure calculated from sound power varies depending on how the chiller is assumed to behave, i.e. the radiation model. In other words, determining sound pressure from sound power requires making assumptions that result in different answers at a given distance from the chiller. The environment also influences sound pressure in the field installation. Sound pressure estimation radiation models pertaining to air-cooled chillers include the ‘traditional’ hemispherical model, parallelepiped model and equivalent hemispherical model.

Regarding sound power, Johnson Controls references tolerance limits based on ASHRAE guidelines. These are +/- 6dB in the 63Hz octave band, +/- 4dB in all other octave bands and +/- 3dB for the overall dBA.

Tolerance limits are based on uncertainties associated with:

1. Measurement Test Procedure

2. Repeatability

3. Production / Manufacturing Variability

Standard deviation associated with air-cooled chiller sound data is a measure of spread i.e. it indicates the range of probability of sound levels. Note that for operating conditions other than AHRI’s Standard Rating Condition, higher levels of uncertainty can be expected.

Lead times for factory performance testing depend on test laboratory availability. Please confirm with Johnson Controls Customer Service.

Estimated Sound Pressure Levels at 10.0 ft (Derived from AHRI 370 Sound Power using Hemispherical Method)										
Percent Load	Ambient [°F]	Octave Band Center Frequency [Hz]								LpA
		63	125	250	500	1000	2000	4000	8000	
100.0	95.0	72.0	73.0	74.0	76.0	74.0	65.0	61.0	57.0	77.0
75.0	80.1	73.0	73.0	74.0	73.0	69.0	64.0	60.0	56.0	74.0
50.0	65.1	69.0	71.0	70.0	70.0	67.0	61.0	57.0	52.0	72.0
25.0	55.0	66.0	67.0	67.0	67.0	64.0	58.0	54.0	49.0	68.0

Performance at AHRI Conditions			
Evaporator		**Condenser**	
EFT [°F]	54.00	Ambient Temp. [°F]	95.0
LFT [°F]	44.00	Altitude [ft]	0.00
Flow Rate [USGPM]	359.1	**Performance**	
Pressure Drop [ft H2O]	13.4	EER [Btu/W.h]	9.805
Fluid Type	Water	IPLV.IP [Btu/W.h]	18.22
Fouling Factor [h ft2 F/Btu]	0.000100	Net Cooling Capacity [tons.R]	150.0
Fluid Volume [USGAL]	62.1		

Note:Unit rated at design condition capacity.

Part Load Performance (Based on AHRI 550/590 - 2023 (IP))				
Percent Load	**Ambient [ºF]**	**Capacity [tons.R]**	**Power Input [kW]**	**Unit Efficiency [Btu/W.h]**
100.0	95.0	150.0	183.6	9.805
75.0	80.0	112.5	99.80	13.53
50.0	65.0	75.01	42.81	21.03
25.0	55.0	37.51	18.12	24.84

Notes:

Country of Origin:Mexico

Displacement Power Factor refers to compressor only. Unit Power Factor depends on fan option selected. Calculated value is available by request.

Use Copper Conductors only

Minimum and maximum evaporator flow information are for full load ratings with Propylene Glycol.

Evaporator Passes:2, Condenser Type:4, Fan Type:V

Compliant with ASHRAE 90.1 - 2010,2013,2016,2019,2022.

Compliant with IECC - 2012,2015,2018.

Field Provided Wiring for Water Box Heaters (one connection per chiller):120-1-60, 6A.

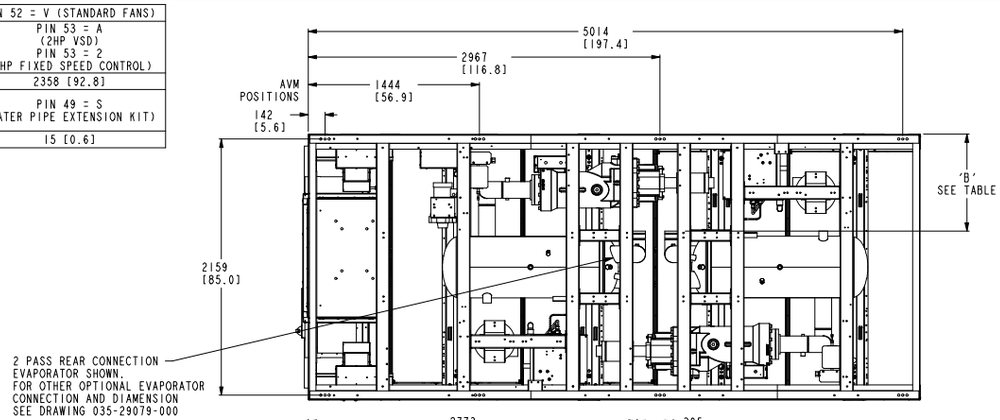
The product image shown is for illustrative purposes only and is not representative of selected options.

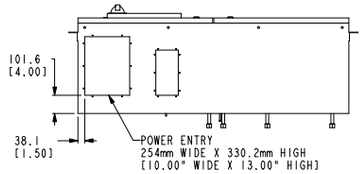
Unit Drawings

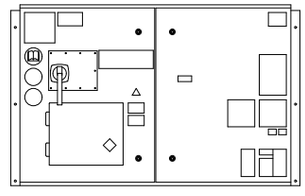
Product Type: QTC4 - Air-Cooled Chiller

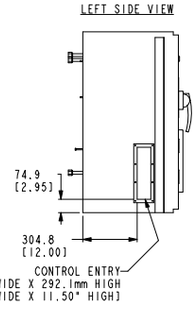
Unit Tags: CH-01

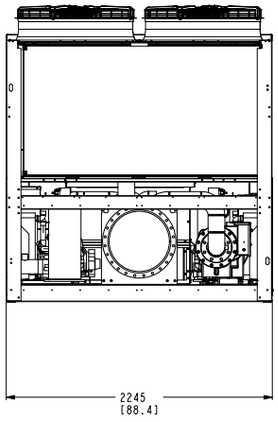
	PIN 52 = E (EBM FANS)	PIN 52 = V (STANDARD FANS)
DIMENSION	PIN 53 = F (3HP EC MOTOR)	PIN 53 = A (2HP VSD) PIN 53 = 2 (2HP FIXED SPEED CONTROL)
'A'	2501 [98.5]	2358 [92.8]
DIMENSION	PIN 49 = R (NO WATER PIPE EXTENSION KIT)	PIN 49 = S (WATER PIPE EXTENSION KIT)
'B'	818 [32.2]	15 [0.6]

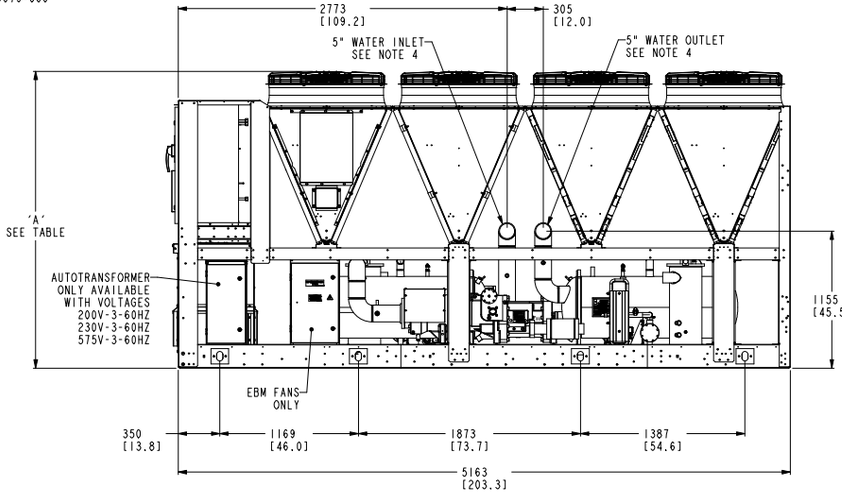


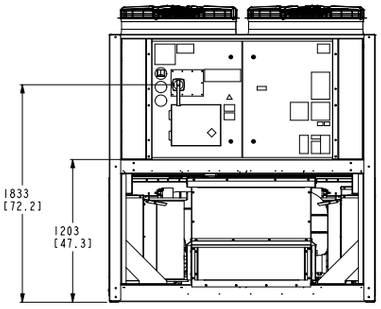


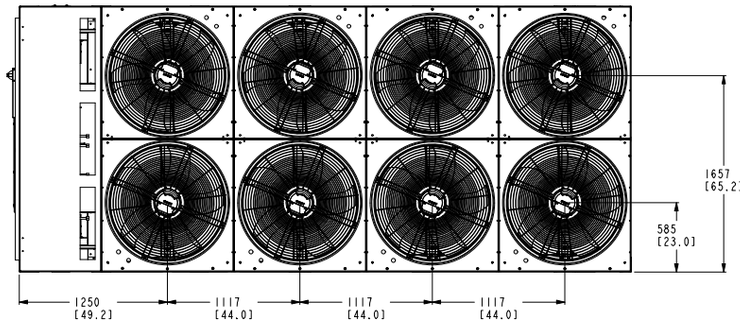












NOTES
1. PLACEMENT ON A LEVEL SURFACE FREE OF OBSTRUCTIONS (INCLUDING SNOW,FOR WINTER OPERATION) OR AIR RE-CIRCULATION ENSURES RATED PERFORMANCE, RELIABLE OPERATION AND EASE OF MAINTENANCE. SITE RESTRICTIONS MAY COMPROMISE MINIMUM CLEARANCES INDICATED BELOW, RESULTING IN UNPREDICTABLE AIR FLOW PATTERNS AND POSSIBLE DIMINISHED PERFORMANCE. JOHNSON CONTROLS UNIT CONTROLS WILL OPTIMIZE OPERATION WITHOUT NUISANCE HIGH PRESSURE SAFETY CUTOUT, HOWEVER,THE SYSTEM DESIGNER MUST CONSIDER POTENTIAL PERFORMANCE DEGRADATION.
   1.1. RECOMMENDED MINIMUM CLEARANCES:
      1.1.1. SIDE TO WALL-1828.8mm[6']
      1.1.2. REAR TO WALL-1828.8mm[6']
      1.1.3. CONTROL PANEL TO WALL-1800mm[6']
      1.1.4. TOP-NO OBSTRUCTIONS ALLOWED.
      1.1.5. DISTANCE BETWEEN ADJACENT UNITS-3048mm[10']
      1.1.6. NO MORE THAN ONE ADJACENT WALL MAY BE HIGHER THAN UNIT.
2. WEIGHT AND CENTER OF GRAVITY-REFER TO AVM REPORT.
3. INSTALLING CONTRACTOR MUST INCLUDE VENT AND DRAIN ACCOMMODATIONS IN CHILLED WATER PIPING NEAR THE EVAPORATOR.
4. VICTAULIC STYLE GROOVED CONNECTIONS ARE TYPICALLY SUPPLIED FOR ALL REGIONS UNLESSOPTIONAL ASME FLANGE OPTION IS SELECTED. CHILLERS PRODUCED IN CHINA ARE TYPICALLY SUPPLIED WITH GB FLANGED CONNECTIONS.
5. VIEWS SHOWING CUSTOMER WATER CONNECTIONS ON RIGHT HAND SIDE OF UNIT ARE STANDARD.CONNECTIONS ON LEFT HAND SIDE OF UNIT MAY BE AVAILABLE BY SPECIAL ORDER.
6. EBM FAN OPTION SHOWN. OVERALL UNIT HEIGHT CHANGES WITH 2HP FAN OPTION. REFER TO DIMENSION 'A'. SEE TABLE ABOVE.
7. THIS DRAWING COVERS THE FOLLOWING UNITS: QTC0160 & QTC0200

NOTE:
PRIMARY DIMENSIONS ARE ISO STANDARD MILLIMETERS.
IMPERIAL INCH DIMENSIONS ARE SHOWN IN BRACKETS.

REV.	DATE	EC. NO.	DR.	CHK.	ENG.
-		ECN23-0115			
NEW					

DO NOT SCALE

DRAWN	E.JONES	27-JAN-2023
MODELER	E.JONES	27-JAN-2023
CHKD	M.LOGAN	27-JAN-2023
ENG	R.RUSKEY	27-JAN-2023

SCALE: 0.050 MASS (kg): 0.000

FIRST ANGLE

QUANTECH

PRODUCT DRAWING QTC0160 & QTC0200 8 FAN UNITS

MATERIAL
ENG. STD.
PART NO.
CUT SIZE

CAGE NUMBER A1

DRAWING NUMBER 035-29072-008

REVISION VERSION 2 Released

ORIG. NO.: 035-28493-008

SHEET 1 OF 1

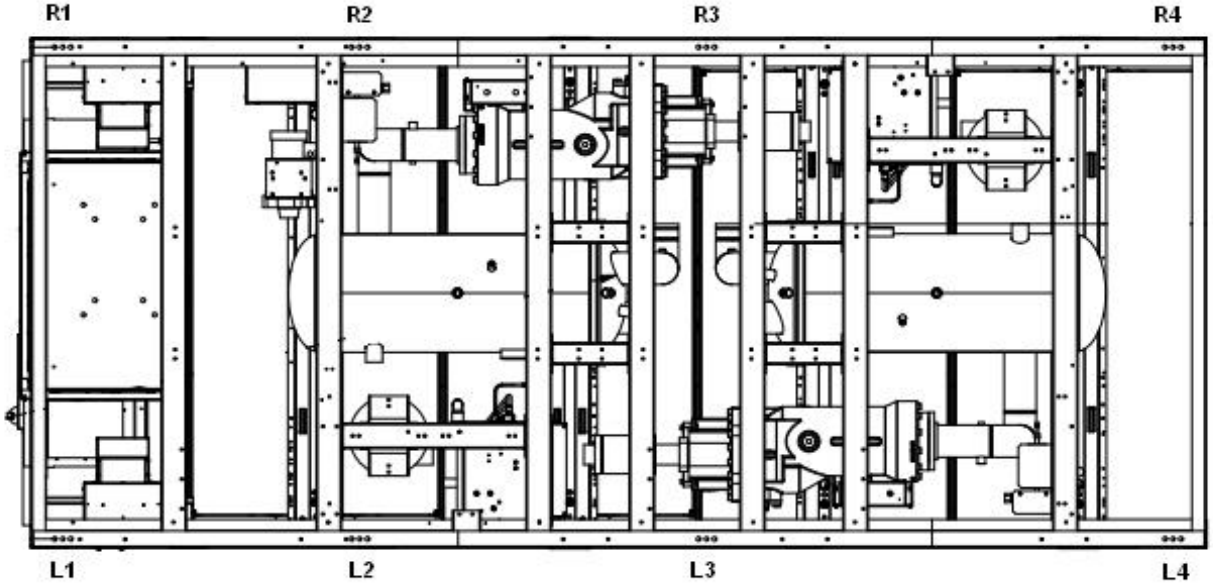
Wiring Diagrams

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

Project Name: **49307 - MSU Manly Miles Chiller System** | Unit Tag: **CH-01** | Qty.: **1** | Model: **QTC40200**

PIN								
QTC40200B0	846AHVNAXX	SAXLXUSNXD	BXXXSAXIFL	BW1SXGA2S4	XVA0404XXX	XXNSGAXVX3	IFLBFFSAX2	0041626200
....5...10	....5...20	....5...30	....5...40	....5...50	....5...60	....5...70	....5...80	....5...90
41626XXXXY	XMPG334153	0950150189	00060ABXX					
....5...100	....5...110	....5...120	....5...130					



AVM Data					
Location	**X-Distance [in]**	**Y-Distance [in]**	**PartNumber**	**Color**	**Operating Weight [lbs]**
L1	5.6	86.6	029-25335-001	Charcoal	705
R1	5.6	1.6	029-25335-001	Charcoal	694
L2	56.9	86.6	029-25335-002	Brick Red	1373
R2	56.9	1.6	029-25335-002	Brick Red	1541
L3	116.8	86.6	029-25335-004	Charcoal	2798
R3	116.8	1.6	029-25335-004	Charcoal	2696
L4	197.4	86.6	029-25335-002	Brick Red	1287
R4	197.4	1.6	029-25335-002	Brick Red	1232

Weight Data			
Total Weight [lbs]		**Center of gravity [in]**	
Shipping	11812	Xg	106.5
Operating	12328	Yg	44.1

Pressure Relief Devices

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

Unit Specifications Text

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

Air Cooled Screw Liquid Chiller - Quantech QTC4 R-513A 60Hz

I. GENERAL

a. GENERAL REQUIREMENTS

i. The requirements of this Section shall conform to the general provisions of the Contract, including General and Supplementary Conditions, Conditions of the Contract, and Contract Drawings.

b. SCOPE

i. Provide Microprocessor controlled, twin-screw com¬pressor, air-cooled, liquid chillers of the scheduled capacities as shown and indicated on the Drawings, including but not limited to:

1. Chiller package
2. Charge of refrigerant and oil
3. Electrical power and control connections
4. Chilled liquid connections
5. Manufacturer start-up

c. QUALITY ASSURANCE

i. Products shall be Designed, Tested, Rated and Certified in accordance with, and Installed in compliance with applicable sections of the following Standards and Codes:

1. AHRI 550/590 – Water Chilling Packages Using the Vapor Compression Cycle
2. AHRI 370 – Sound Rating of Large Outdoor Refrigerating and Air-Conditioning Equipment
3. ANSI/ASHRAE 15 – Safety Code for Mechanical Refrigeration
4. ANSI/ASHRAE 34 – Number Designation and Safety Classification of Refrigerants
5. ASHRAE 90.1 – Energy Standard for Buildings Except Low-Rise Residential Buildings
6. ANSI/NFPA 70 – National Electrical Code (N.E.C.)
7. ASME Boiler and Pressure Vessel Code, Section VIII, Division 1
8. OSHA – Occupational Safety and Health Act
9. Manufactured in facility registered to ISO 9001
10. Conform to Intertek Testing Services for construction of chillers and provide ETL/cETL Listed Mark

ii. Factory Run Test: Chiller shall be pressure-tested, evacuated and fully charged with refrigerant and oil, and shall be factory operational run tested with water flowing through the vessel.

iii. Chiller manufacturer shall have a factory trained and supported service organization.

iv. Warranty: Manufacturer shall Warrant all equipment and material of its manufacture against defects in workmanship and material for a period of eighteen (18) months from date of shipment or twelve (12) months from date of start-up, whichever occurs first.

d. DELIVERY AND HANDLING

i. Unit shall be delivered to job site fully assembled with all interconnecting refrigerant piping and internal wiring ready for field installation and charged with refrigerant and oil by the Manufacturer.

ii. Provide protective covering over vulnerable components for unit protection during shipment. Fit nozzles and open ends with plastic enclosures.

iii. Unit shall be stored and handled per Manufacturer’ s instructions.

II. PRODUCTS

a. MANUFACTURERS

i. The design shown on the Drawings is based on Quantech model chiller manufactured by Johnson Controls. Alternate equipment will be acceptable if the manufacturer' s equipment meets the scheduled performance and complies with these specifications. If equipment manufactured by a manufacturer other than that scheduled is utilized, then the Mechanical Contractor shall be responsible for coordinating with the General Contractor and all affected Subcontractors to insure proper provisions for installation of the furnished unit. This coordination shall include, but not be limited to, the following:

1. Structural supports for units.

2. Piping size and connection/header locations.

3. Electrical power requirements and wire/conduit and overcurrent protection sizes.

4. Chiller physical size on plant layout.

5. Site noise considerations.

ii. The Mechanical Contractor shall be responsible for all costs incurred by the General Contractor, Subcontractors, and Consultants to modify the building provisions to accept the furnished alternate equipment.

iii. The equipment manufacturer must specialize in the design and manufacture of the products specified and shall have a minimum of five (5) years of experience in supplying variable speed driven compressor technology on the type of equipment and refrigerant specified.

b. GENERAL

i. Description: Furnish, Install, and Commission factory assembled, charged, and operational run tested air-cooled screw compressor chiller as specified herein and shown on the Drawings. Chiller shall include, but is not limited to: a complete system with multiple independent refrigerant circuits, semi hermetic twin screw compressors, shell and tube hybrid falling film type evaporator, air-cooled condenser, R-513A refrigerant, lubrication system, interconnecting wiring, safety and operating controls including capacity controller, control center, motor starting components, and special features as specified herein or required for safe, automatic operation.

ii. Operating Characteristics:

1. Provide low and high ambient temperature control options as required to ensure unit is capable of starting and operating from -10°F to 125°F (-23°C to 52°C) ambient temperature.

2. Provide capacity control system capable of reducing unit capacity to 10% of full load for 2 compressor units. Compressor shall start in unloaded condition. Hot gas bypass shall not be acceptable to meet specified minimum load.

iii. Cabinet: Unit panels, structural elements, control boxes and heavy gauge structural base shall be constructed of painted galvanized steel. All exposed sheet steel shall be coated with baked on powder paint to meet 500-hour salt spray test in accordance with the ASTM B117 standard.

iv. Shipping: Unit shall ship in one piece and shall require installer to provide only a single evaporator inlet and outlet pipe connection. If providing chiller model that ships in multiple pieces, bid shall include all the material and field labor costs for factory authorized personnel to install a trim kit to connect the pieces as well as all interconnecting piping and wiring.

c. COMPRESSORS

i. Compressors: Shall be direct drive, semi hermetic, rotary twin-screw type, including: muffler, temperature actuated 'off-cycle' heater, rain-tight terminal box, discharge shut-off service valve, suction shut-off service valve for each compressor and precision machined cast iron housing. Design working pressure of entire compressor, suction to discharge, shall be 350 psig (24 barg) or higher. Compressor shall be U.L. Recognized.

ii. Compressor Motors: Refrigerant suction-gas cooled accessible hermetic compressor motor, full suction gas flow through 0.006" (0.1524 mm) maximum mesh screen, with inher-ent internal thermal overload protection and external current overload on all three phases.

iii. Balancing Requirements: All rotating parts shall be statically and dynamically balanced.

iv. Lubrication System: External oil separators with no moving parts, 450 psig (31 barg) design working pressure, and ETL listing shall be provided on the chiller. Refrigerant system differential pressure shall provide oil flow through service replaceable, 0.5 micron, full flow, cartridge type oil filter internal to compressor. Filter bypass, less restrictive media, or oil pump not acceptable.

v. Capacity Control: Compressors shall start at minimum load. Provide Microprocessor control to command compressor capacity to balance compressor capacity with cooling load.

d. REFRIGERANT CIRCUIT COMPONENTS

i. Refrigerant: R-513A. Classified as Safety Group A1 according to ASHRAE 34.

ii. Equipment supplied shall comply with LEED Energy & Atmosphere Credit 4, Enhanced Refrigerant Management.

iii. Each independent refrigerant circuit shall incorporate all components necessary for the designed operation including: liquid line shut-off valve with charging port, low side pressure relief device, removable core filter-drier and sight glass with moisture indicator.

iv. Chiller manufacturer shall provide an independent circuit for each compressor to provide maximum redundancy during chiller operation. If equipment does not have independent circuits per compressor, manufacturer shall provide owner one spare compressor of each unique size.

v. Discharge lines shall be provided with manual compressor shut-off service valves.

e. HEAT EXCHANGERS

i. Evaporator:

1. Evaporator shall be shell and tube, hybrid falling film type with 2 pass arrangement to optimize efficiency and refrigerant charge. Tubes shall be high-efficiency, internally and externally enhanced type copper tubes with 0.035" (0.89 mm) minimum wall thickness at all intermediate tube supports to provide maximum tube wall thickness at the support area. Each tube shall be roller expanded into the tube sheets providing a leak proof seal, and be individually replaceable. Independent refrigerant circuits shall be provided per compressor.

2. Constructed, tested, and stamped in accordance with applicable sections of ASME pressure vessel code for minimum 235 psig (16 barg) refrigerant side design working pressure and 150 psig (10 barg) liquid side design working pressure.

3. Water boxes shall be removable to permit tube cleaning and replacement. Water boxes shall include liquid nozzle connections suitable for ANSI/AWWA C-606 couplings, welding, or flanges.

4. Provide vent and drain fittings.

5. Provide thermostatically controlled shell heaters and water box immersion heaters to assist in preventing freeze damage. A separate power connection for evaporator water box heaters is required and shall be provided by the Contractor

ii. Air-cooled Condenser:

1. Unit shall include Louvered/Wire Panels: Louvered steel panels on external condenser coil faces, painted to match unit panels. Heavy gauge, welded wire mesh, coated to resist corrosion, around base of machine to restrict unauthorized access.

2. Low Sound Fans with Variable Speed Drives. All fans shall be powered by VSDs. Fans shall provide vertical air discharge from extended orifices. Fans shall be composed of corrosion resistant aluminum hub and glass-fiber-reinforced polypropylene composite blades molded into a low-noise airfoil section. Fan impeller shall be dynamically balanced for vibration-free operation. Fan guards of heavy gauge, PVC (polyvinyl chloride) coated or galvanized steel.

3. Fan Motors: High efficiency, direct drive, 3-phase, insulation class "F", current protected, Totally Enclosed Air-Over (TEAO), with double sealed, permanently-lubricated ball bearings. Open Drip Proof (ODP) fan motors will not be acceptable.

f. INSULATION

i. Material: Closed-cell, flexible, UV protected, thermal insulation complying with ASTM C 534 Type 2 (Sheet) for preformed flexible elastomeric cellular thermal insulation in sheet and tubular form.

ii. Thickness: 3/4 (19mm).

iii. Thermal conductivity: 0.26 (BTU/HR-Ft2-°F/in) maximum at 75°F mean temperature.

iv. Factory-applied insulation over cold surfaces of liquid chiller components including evaporator shell, water boxes, and suction line. Liquid nozzles shall be insulated by Contractor after pipe installation.

v. Adhesive: As recommended by insulation manufacturer and applied to 100 percent of insulation contact surface including all seams and joints.

g. ACOUSTICAL DATA

i. Provide acoustical sound power or sound pressure level data in decibels (dB) at the scheduled eight (8) octave band center frequencies. A-weighted sound data alone is not acceptable.

ii. Provide all sound power or sound pressure level data at 100%, 75%, 50%, and 25% load.

iii. Supplied equipment shall not exceed scheduled sound power or sound pressure level data at any load point. The mechanical Contractor shall be responsible for any additional costs associated with equipment deviation.

iv. Acoustical performance ratings shall be in accordance with AHRI Standard 370.

h. POWER AND ELECTRICAL REQUIREMENTS

i. Power/Control Panel:

1. Factory installed and wired NEMA 3R, powder painted steel cabinets with tool lockable, hinged, latched, and gasket sealed outer doors equipped with wind struts for safer servicing. Provide main power connection(s), compressor starters and fan motor contactors, current overloads, and factory wiring.

2. Panel shall include control display access door.

ii. Single Point Power:

1. Provide single point power connection to chiller, shall be 3 phase of scheduled voltage.

2. Single Point Disconnect: A non-fused disconnect and lockable external handle shall be provided at the point of incoming single point connection for field connection, interconnecting wiring to the compressors, and isolating the unit power voltage for servicing. Separate external fusing must be supplied, by others, in the incoming power wiring which must comply with local codes.

iii. Control Transformer: Power panel shall be supplied with a factory mounted and wired control transformer that will supply all unit control voltage from the main unit power supply. Transformer shall utilize scheduled line voltage on the primary side and provide 115V/1Ø on secondary.

iv. Short Circuit Withstand Rating of the chiller electrical enclosure shall be (380, 400, & 460V: 50,000 Amps). Rating shall be published in accordance with UL508.

v. Motor Starters: Motor starters shall be Variable Frequency Drive type with zero electrical inrush current. Wye-Delta, Solid State, and Across the Line type starters will not be acceptable.

vi. Motor Starters: Motor starters shall be zero electrical inrush current (Variable Frequency Drives) or reduced inrush type (Closed transition Wye-Delta or Solid State) for minimum electrical inrush. Open transition Wye-Delta and Across the Line type starters will not be acceptable.

vii. Motor Starters: Motor starters shall be Variable Frequency Drive type with zero electrical inrush current. Wye-Delta, Solid State, and Across the Line type starters will not be acceptable.

viii. Power Factor:

1. Provide equipment with power factor correction capacitors as required to maintain a displacement power factor of 95% at all load conditions.

2. The installing contractor is responsible for additional cost to furnish and install power factor correction capacitors if they are not factory mounted and wired.

ix. All exposed power wiring shall be routed through liquid-tight, UV-stabilized, non-metallic conduit.

x. Supplied equipment shall not exceed scheduled Minimum Circuit Ampacity (MCA.) The mechanical Contractor shall be responsible for any additional costs associated with equipment deviation.

i. CONTROLS

i. General:

1. Provide automatic control of chiller and waterside economizer operation including compressor start/stop and load/unload, anti-recycle timers, condenser fans, evaporator pump, evaporator heater, waterside economizer bypass value, unit alarm contacts and run signal contacts.

2. Provide dry contacts for chilled fluid pump control and evaporator shell heaters to assist in preventing freeze damage due to migration of refrigerant at ambient temperatures below 32°C (0°C).

3. Chiller shall automatically reset to normal chiller operation after power failure.

4. Unit operating software shall be stored in non-volatile memory. Field programmed set points shall be retained in lithium battery backed regulated time clock (RTC) memory for minimum 5 years.

5. Alarm contacts shall be provided to remote alert for any unit or system safety fault.

ii. Display and Keypad:

1. Provide minimum 80 character liquid crystal display that is both viewable in direct sunlight and has LED backlighting for nighttime viewing. Provide one keypad and display panel per chiller.

2. Display and keypad shall be accessible through display access door without opening main control/electrical cabinet doors.

3. Display shall provide a minimum of unit setpoints, status, electrical data, temperature data, pressures, safety lockouts and diagnostics without the use of a coded display.

4. Descriptions in English (or available language options), numeric data in English (or Metric) units.

5. Sealed keypad shall include unit On/Off switch.

iii. Programmable Setpoints (within Manufacturer limits): Display language, chilled liquid cooling mode, local/remote control mode, display units mode, system lead/lag control mode, remote temperature reset, remote current limit, remote sound limit, low ambient temperature cutout enable/disable, leaving chilled liquid setpoint and range, maximum remote temperature reset.

iv. Display Data: Chilled liquid leaving and entering temperatures; outside ambient air temperature; lead system; evaporator pump status; active remote control; compressor suction, discharge, and oil pressures per refrigerant circuit; compressor discharge, motor, and oil temperatures per refrigerant circuit; saturation temperatures per refrigerant circuit; compressor speed; condenser fan status; condenser subcooling temperature; condenser drain valve percentage open; compressor capacity in percentage of Full Load Amps; compressor number of starts; run time; operating hours; evaporator heater status; history data for last ten shutdown faults; history data for last 20 normal (non-fault) shutdowns.

v. Predictive Control Points: Unit controls shall avoid safety shutdown when operating outside design conditions by optimizing the chiller controls and cooling load output to stay online and avoid safety limits being reached. The system shall monitor the following parameters and maintain the maximum cooling output possible without shutdown of the equipment: motor current, suction pressure, discharge pressure, starter internal ambient temperature, and starter baseplate temperature.

vi. System Safeties: Shall cause individual compressor systems to perform auto-reset shut down if: high discharge pressure or temperature, low suction pressure, low motor current, high/low differential oil pressure, low discharge superheat, high motor temperature, system control voltage.

vii. Unit Safeties: Shall be automatic reset and cause compressors to shut down if: high or low ambient temperature, low leaving chilled liquid temperature, under voltage, flow switch operation. Contractor shall provide flow switch and wiring per chiller manufacturer requirements.

viii. Manufacturer shall provide any controls not listed above, necessary for automatic chiller operation. Mechanical Contractor shall provide field control wiring necessary to interface sensors to the chiller control system.

j. ACCESSORIES AND OPTIONS

i. Some accessories and options supersede standard product features. All options are factory-mounted unless otherwise noted.

ii. CONTROLS OPTIONS:

1. Building Automation System Interface: Chiller to accept BACnet MS/TP, N2 and Modbus protocol from BAS (by others). BACnet to be BACnet Testing Laboratories (BTL) listed and support BACnet Automatic Discovery to eliminate field commissioning of chiller controls.

iii. GENERAL OPTIONS:

1. Vibration Isolation (All Options Field Mounted by Contractor):

a. Provide Elastomeric Isolators.

III. EXECUTION

a. INSTALLATION

i. General: Rig and Install in full accordance with Manufacturer’ s requirements, Project drawings, and Contract documents.

ii. Location: Locate chiller as indicated on drawings, including cleaning and service maintenance clearance per Manufacturer instructions. Adjust and level chiller on support structure.

iii. Components: Installing Contractor shall provide and install all auxiliary devices and accessories for fully operational chiller.

iv. Electrical: Coordinate electrical requirements and connections for all power feeds with Electrical Contractor.

v. Controls: Coordinate all control requirements and connections with Controls Contractor.

vi. Finish: Installing Contractor shall paint damaged and abraded factory finish with touch-up paint matching factory finish.

Additional Data Sheets

Product Type: QTC4 - Air-Cooled Chiller

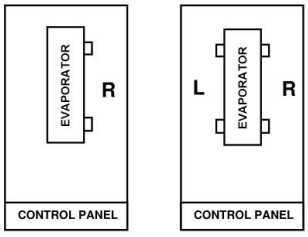
Unit Tags: CH-01

CHILLER Equipment Release / Configuration Process

Attached you will find preliminary drawings and performance representing the unit(s) we are submitting on this project. Please review these forms, make any required modifications, sign each page indicating your approval and then fax them back to my attention. Please note that equipment cannot be released for fabrication until these forms are completed and returned with your signature of approval. Please feel free to contact me if you have any questions regarding the attached information.

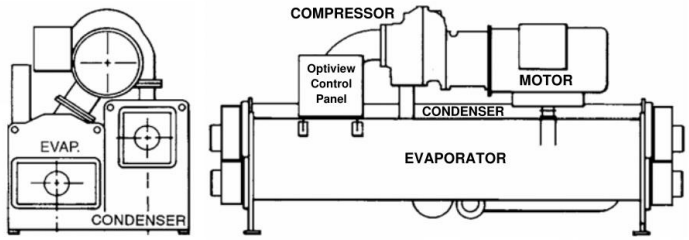
Unit Section	Items for Review	Potential Configurations
Electrical	Main unit voltage	208, 230, 460, 480, or 4160
	Control Voltage	115, 208, 230, 460, 480, Single or Three Phase
	Type of Electrical Connection	Single or Multiple Point
	Connection	Lugs per Phase
	Starter	Unit Mounted or Remote Mounted
	Electrical Protection	Breaker or Disconnect Size
	Electrical Protection Type	Terminal Block, Disconnect or Circuit Breaker
Evaporator & Condenser	Walter Cooled Chiller Piping Connections	One or Two
	Connnection Type	Victaulic or Flanged
	Passes	One, Two or Three
	Water Box Type	Compact or Marine
	Waterside Pressure	150 psig or 300 psig
	Proof of Flow	Flow Sensors or Flow Switches
	Evaporator Insulation	None, 3/4" or 1-1/2"
General	Unit Height	Please review contract drawings to approve attached dimensions
	Unit Width	Please review contract drawings to approve attached dimensions
	Unit Length	Please review contract drawings to approve attached dimensions
	Unit Weight	Please review contract drawings and approve
	Form 1 Shipment	Completely Assembled w/ Refrigerant in Unit
	Form 2 Shipment	Completely Assembled w/ Refrigerant Shipped Loose
	Form 3 Shipment	Two Piece Shipment: Driveline and Shell Assembly
	Form 7 Shipment	Three Piece Shipment: Driveline, Evaporator and Condenser
	Form 8 Shipment	Completely Assembled w/ Oil Separator Shipped Loose

AIR COOLED



NOTE: Evaporator hand is determined by facing the control section

WATER COOLED



Important Notes:

1) Actual fabrication release cannot commence until this form is **confirmed by the customer**
2) The release process cannot commence until **written** release notification is issued by customer including **want date** and **ship to address**
3) Equipment "**lead-time" does not start** until confirmed release documentation is received
4) Modifications to equipment configurations after fabrication release may impact cost and lead-time
5) Configurations noted below are as shown in the approved equipment submittals or as defined in superseding customer correspondence
6) Material handling of loose refrigerant between delivery truck and chiller room is customer's responsibility
7) Note that once this document is confirmed, the equipment configurations defined by this document take precedence over all other documents
8) "Want date" and/or "ship to address" changes made after this document is confirmed may impact cost and lead-time

Warranties

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

QUANTECH	STANDARD LIMITED WARRANTY ENGINEERED SYSTEMS EQUIPMENT	
SERVICE POLICY	Su persed es: 50.05-NM2 (812)	Form 50.05-NM2 (1212)

POLICY STATEMENT

Johnson Controls (JCI) warrants all equipment and associated factory supplied materials or start-up services performed by Johnson Controls in connection therewith, against defects in workmanship and material for a period of eighteen (18) months from date of shipment, or twelve (12) months from date of start up, whichever occurs first. Subject to the exclusions listed below, Johnson Controls, at its option, will repair or replace, FOB point of shipment, such products or components as it finds defective.

Except for reciprocating replacement compressors, which Johnson Controls warrants for a period of twelve (12) months from date of shipment, Johnson Controls warrants Johnson Controls reconditioned or replacement materials, or installation or start-up services performed by Johnson Controls in connection therewith, against defects in workmanship and material for a period of (90) days from date of shipment.

The above represents the minimum warranty policy Johnson Controls will extend to customers. Additional product specific coverage is provided as outlined in related warranty policies. No warranty repairs or replacements will be made until payment for all equipment, materials, or components has been received by Johnson Controls.

EXCLUSIONS:

Unless specifically agreed to in the contract documents, this warranty does not include the following costs and expenses:

1. Labor to remove or reinstall any equipment, materials or components.
2. Shipping, handling or transportation charges, including cranes, safety walks or other safety requirements specific to jobsites.
3. Cost of refrigerant.
4. Freight damage.
5. Field applied coatings added to any surface or heat exchanger
6. Rental Chillers.

ALL WARRANTIES ARE VOID IF:

1. Equipment is used with refrigerants, oil, additives, or antifreeze agents other than those authorized by supplying factory.
2. Equipment is used with any material or any equipment such as evaporators, tubing, other low side equipment or refrigerant controls not approved by supplying factory
3. Equipment has been damaged by freezing because it was not properly protected during cold weather or damaged by fire or any other conditions not ordinarily encountered.
4. Equipment is not installed, operated, maintained and serviced in accordance with instructions issued by Johnson Controls.
5. Equipment is damaged due to dirt, air, moisture, or other foreign matter entering the refrigerant system.
6. Equipment is not properly stored, protected, or inspected by the customer during the period from date of shipment to date of initial start-up.
7. Field coating of coil has occurred.
8. Equipment is damaged due to acts of god, abuse, including shipping damage, neglect, sabotage, or acts of terrorists.
9. Equipment has modifications carried out that have an effect on the original design of the product without such work being authorized by the factory. Any on site design changes or unit modification/replacement shall be authorized in advance by the factory.

THIS WARRANTY IS IN LIEU OF ALL OTHER WARRANTIES AND LIA BILITIES, EXPRESS OR IMPLIED IN LAW OR IN FACT, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE WARRANTIES CONTAINED HERE IN SET FORTH BUYER" S SOLE AND EXCLUSIVE REMEDY IN THE EVENT OF A DEFECT IN WORKMANSHIP OR MATERIALS. IN NO EVENT SHALL JOHNSON CONTROLS" LIABILITY FOR DIRECT OR COMPENSATORY DAMAGES EXCEED THE PAYMENTS RECEIVED BY JOHNSON CONTROLS FROM BUYER FOR THE MATERIAL OR EQUIPMENT INVOLVED, NOR SHALL JOHNSON CONTROLS BE LIABLE FOR ANY SPECIAL, INCIDENTAL, OR CONSEQUENTIAL DAMAGES. THESE LIMITATIONS ON LIABILITY AND DAMAGES HALL APPLY UNDER ALL THEORIES OF LIABILITY OR CAUSES OF ACTION, INCLUDING BUT NOT LIMITED TO, CONTRACT, WARRANTY, TORT, (INCLUDING NEGLIGENCE) OR STRICT LIABILITY.THE ABOVE LIMITATIONS SHALL INURE TO THE BENEFIT OFJOHNSON CONTROLS SUPPLIERS AND SUBCONTRACTORS.

66 MONTH (2-5 YEAR) PARTS AND LABOR WARRANTY
FOR THE ENTIRE UNIT
QUANTECH
ENGINEERED SYSTEMS

PRODUCT TYPE: Air Cooled Scroll Chillers
CONTRACT NO.:
UNIT MODEL NUMBER: QTC40200
UNIT SERIAL NUMBER:
UNIT TAG ID: CH-01
UNIT LOCATION:

COMPRESSOR SERIAL NUMBER(S):

PROJECT NAME: 49307 - MSU Manly Miles Chiller System
INSTALLATION ADDRESS:

Shipping Date

The term of this agreement is 66 MONTH (2-5 YEAR), commencing _____ and expires _____.

LIMITED WARRANTY

WHEN PROPERLY ENDORSED, THIS PROTECTION PLAN BETWEEN QUANTECH AND CUSTOMER, WARRANTS, TO THE CUSTOMER NAMED HEREIN, FOR THE . IT DOES NOT COVER REFRIGERANT COST, FREIGHT CHARGES, OR ANY OTHER COSTS.

THIS WARRANTY EXCLUDES IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND WE DO NOT ASSUME, OR AUTHORIZE ANY OTHER PERSON TO ASSUME OTHER WARRANTIES FOR US. THIS WARRANTY IS OFFERED AS AN EXTENSION TO THE STANDARD LIMITED WARRANTY (FORM 50.05-NM2) AND IS SUBJECT TO THE SAME LIMITATIONS AND EXCLUSIONS, EXCEPT WHERE NOTED.

THIS PROTECTION PLAN DOES NOT COVER FAILURE OR DAMAGE RESULTING FROM FIRE, FLOOD, ABUSE, OR ACT OF GOD. ALSO EXCLUDED ARE DAMAGES OR FAILURES CAUSED BY INSTALLATION, OPERATION, OR MAINTENANCE CONTRARY TO QUANTECH RECOMMENDATIONS, OR THOSE OF THE MANUFACTURER IF OTHER THAN QUANTECH. IN NO EVENT SHALL QUANTECH BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, OR INDIRECT DAMAGE, LOSS, OR INJURY. WARRANTY FOR EXCHANGE OR PARTS PROCUREMENT SERVICE SHALL BE AVAILABLE THROUGH THE SERVICER LISTED HEREIN DURING NORMAL WORKING HOURS.

DISTRICT SERVICE OFFICE:

OFFRED BY:
Quantech Selling Representative Print/Sign — Date

APPROVED BY:
Quantech Area Service Manager Print/Sign — Date

ACCEPTED BY:
(Manufacturer's Use Only)
Customer Signature — Date

AUTHORIZED BY:
Robert D. Kalczynski
Manager, Warranty Administration — 2025-03-28 Date

Product CodeRef:

78 MONTH (2-6 YEAR) PARTS AND LABOR WARRANTY
FOR THE COMPRESSOR
QUANTECH
ENGINEERED SYSTEMS

PRODUCT TYPE: Air Cooled Scroll Chillers
CONTRACT NO.:
UNIT MODEL NUMBER: QTC40200
UNIT SERIAL NUMBER:
UNIT TAG ID: CH-01
UNIT LOCATION:

COMPRESSOR SERIAL NUMBER(S):

PROJECT NAME: 49307 - MSU Manly Miles Chiller System
INSTALLATION ADDRESS:

Shipping Date

The term of this agreement is 78 MONTH (2-6 YEAR), commencing _____ and expires _____.

LIMITED WARRANTY

WHEN PROPERLY ENDORSED, THIS PROTECTION PLAN BETWEEN QUANTECH AND CUSTOMER, WARRANTS, TO THE CUSTOMER NAMED HEREIN, FOR THE . IT DOES NOT COVER REFRIGERANT COST, FREIGHT CHARGES, OR ANY OTHER COSTS.

THIS WARRANTY EXCLUDES IMPLIED WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE, AND WE DO NOT ASSUME, OR AUTHORIZE ANY OTHER PERSON TO ASSUME OTHER WARRANTIES FOR US. THIS WARRANTY IS OFFERED AS AN EXTENSION TO THE STANDARD LIMITED WARRANTY (FORM 50.05-NM2) AND IS SUBJECT TO THE SAME LIMITATIONS AND EXCLUSIONS, EXCEPT WHERE NOTED.

THIS PROTECTION PLAN DOES NOT COVER FAILURE OR DAMAGE RESULTING FROM FIRE, FLOOD, ABUSE, OR ACT OF GOD. ALSO EXCLUDED ARE DAMAGES OR FAILURES CAUSED BY INSTALLATION, OPERATION, OR MAINTENANCE CONTRARY TO QUANTECH RECOMMENDATIONS, OR THOSE OF THE MANUFACTURER IF OTHER THAN QUANTECH. IN NO EVENT SHALL QUANTECH BE LIABLE FOR CONSEQUENTIAL, INCIDENTAL, OR INDIRECT DAMAGE, LOSS, OR INJURY. WARRANTY FOR EXCHANGE OR PARTS PROCUREMENT SERVICE SHALL BE AVAILABLE THROUGH THE SERVICER LISTED HEREIN DURING NORMAL WORKING HOURS.

DISTRICT SERVICE OFFICE:

OFFRED BY:
Quantech Selling Representative Print/Sign — Date

APPROVED BY:
Quantech Area Service Manager Print/Sign — Date

ACCEPTED BY:
(Manufacturer's Use Only)
Customer Signature — Date

AUTHORIZED BY:
Manager, Warranty Administration — 2025-03-28 Date

Product CodeRef:

66 MONTH (2-5 YEAR) WARRANTY
FOR THE REFRIGERANT
QUANTECH
ENGINEERED SYSTEMS

PRODUCT TYPE: Air Cooled Scroll Chillers
CONTRACT NO.:
UNIT MODEL NUMBER: QTC40200
UNIT SERIAL NUMBER:
UNIT TAG ID: CH-01
UNIT LOCATION:

COMPRESSOR SERIAL NUMBER(S):

PROJECT NAME: 49307 - MSU Manly Miles Chiller System
INSTALLATION ADDRESS:

Shipping Date

The term of this agreement is 66 MONTH (2-5 YEAR), commencing _____ and expires _____.

LIMITED WARRANTY

WHEN PROPERLY APPROVED AND AUTHORIZED BELOW, QUANTECH WARRANTS TO THE CUSTOMER NAMED HEREIN, THAT QUANTECH WILL PROVIDE THE CUSTOMER FREE OF CHARGE, WITH REPLACEMENT REFRIGERANT IN THE CASE OF ANY REFRIGERANT LOSS DUE TO ACCIDENTAL SYSTEM LEAKS. SERVICES TO RECYCLE CONTAMINATED REFRIGERANT ARE ALSO INCLUDED IN THE EVENT OF SYSTEM CONTAMINATION. THIS WARRANTY IS OFFERED ON PACKAGED STATIONARY WATER CHILLERS WITHIN THE EXTENDED WARRANTY PERIOD STATED ABOVE, AND IS TO BE OFFERED IN CONJUNCTION WITH A QUANTECH 'MAINTENANCE CONTRACT' OR A QUANTECH 'REFRIGERANT CONSERVATION SERVICE CONTRACT.' WE DO NOT AUTHORIZE ANY OTHER ENTITY TO PERFORM WARRANTY SERVICE ON OUR BEHALF. THIS WARRANTY IS OFFERED AS AN EXTENSION TO THE STANDARD LIMITED WARRANTY (FORM 50.05-NM2) AND IS SUBJECT TO THE SAME LIMITATIONS AND EXCLUSIONS STATED THEREIN, WHICH ARE HEREBY INCORPORATED HEREIN BY REFERENCE REMOTE EVAPORATOR, REMOTE CONDENSER, FINNED TUBE, AND MOBILE UNITS ARE EXCLUDED FROM THIS COVERAGE.

THIS WARRANTY DOES NOT COVER REFRIGERANT LOSS RESULTING FROM FIRE, FLOOD, ABUSE, OR ACT OF GOD. ALSO EXCLUDED ARE DAMAGES OR FAILURES CAUSED BY OPERATION OR MAINTENANCE CONTRARY TO THE RECOMMENDATIONS OF THE EQUIPMENT MANUFACTURER. IN NO EVENT SHALL QUANTECH BE LIABLE FOR SPECIAL CONSEQUENTIAL, INCIDENTAL, OR INDIRECT DAMAGE, LOSS OR INJURY OF ANY NATURE. WARRANTY SERVICE SHALL BE PROVIDED THROUGH THE SERVICER LISTED HEREIN DURING NORMAL WORKING HOURS AND AFTER SYSTEM FAULTS HAVE BEEN REPAIRED.

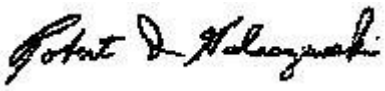
THE WARRANTY AND LIABILITY SET FORTH ABOVE ARE IN LIEU OF ALL OTHER WARRANTIES AND LIABILITIES, EXPRESS OR IMPLIED IN LAW OR IN FACT, INCLUDING THE WARRANTIES OF MERCHANTABILITY AND FITNESS FOR A PARTICULAR PURPOSE. THE WARRANTIES CONTAINED HEREIN SET FORTH BUYER' S SOLE AND EXCLUSIVE REMEDY IN THE EVENT OF A DEFECT IN WORKMANSHIP OR MATERIALS.

DISTRICT SERVICE OFFICE:

OFFRED BY:
Quantech Selling Representative Print/Sign — Date

APPROVED BY:
Quantech Area Service Manager Print/Sign — Date

ACCEPTED BY:
(Manufacturer' s Use Only)
Customer Signature — Date

AUTHORIZED BY:

Manager, Warranty Administration — 2025-03-28 Date

Product CodeRef:

Equipment Release Approval Form

SUBMITTAL NOTES

Product Type: QTC4 - Air-Cooled Chiller

Unit Tags: CH-01

The following table must be completed prior to releasing the equipment for fabrication. Please initial the column indicating the information contained in this submittal has been verified, or indicate to refer to a marked-up page.

SUBMITTAL VERIFICATION	
	Purchaser Initials
Electrical voltage and electrical connections are compatible with jobsite requirements.	
Piping / Ductwork connections shown in this submittal are correct .	
Unit tag designations are correct.	
Equipment dimensions (length, width, and height) and weights have been verified to comply with jobsite conditions and rigging requirements. Please indicate approval by your initials on all included drawings.	
Verify “Unit Hand” of any Air Handling Equipment per the definition provided on the **“Equipment Release / Configuration Process”** form.	

SUBMITTAL VERIFICATION	
	Purchaser Initials
Indicate equipment configuration choices on the **Equipment Release /Configuration Process** form (if included on this Submittal package), and sign the form.	

Important Notes:

1) Actual fabrication release cannot commence until this form is signed by the customer and returned to JCI along with a release notification want date and ship to address.

2) Equipment "lead-time" does not start until confirmed release documentation is received, and the order is actually released to the factory.

3) Modifications to equipment configurations after fabrication release may impact cost and lead-time

4) Attached configurations are as shown in the approved equipment submittals or as defined in superseding customer correspondence.

5) AHU "Side" / "Hand" orientation is relative to a person standing inside an AHU with air hitting the back of the head.

6) Note that once this document is confirmed, the equipment configurations defined by this document take precedence over all other documents.

7) "Want date" and/or "ship to address" changes made after this document is confirmed may impact cost and lead-time.

8) Air handler drawings also include shipping split explosions with corresponding weights and dimensions. If additional splits are required, there will be additional costs and the unit length will increase.

Please fill out the following table and refer to the receiving/rigging instructions in this submittal to help ensure a smooth delivery and installation of the equipment.

DELIVERY INFORMATION	
	Please fill out information below
Contact name for coordinating delivery of equipment with transportation company	
Contact phone number	
Advance notice required from transportation company prior to delivering equipment (typically 48 hours)	
Ship to address:	
Other special shipping instructions or requirements	

CUSTOMER APPROVAL:

Customer Name: _____

Signature (*) _____

Date: _____

HEDRICK

2360 Oak Industrial Drive ne . Grand Rapids, Michigan 49505
tel 616.454.1218 . fax 616.454.5336 . www.hedrickassoc.com

POWER
THERMAL
PARTS
SERVICE

MSU Manly Miles
Unisource Flex Connectors
East Lansing, MI

SUBMITTAL FOR APPROVAL

Company: Michigan State University
Attn: Salem Mangles
Email:
Prepared By: David Craig / Derek Witt
Date: 3/28/2025
Quote#: 49307

HEDRICK
2360 Oak Industrial Drive NE . Grand Rapids, Michigan 49505
TEL 616.454.1218 . FAX 616.454.5336
THERMAL

Company: Michigan State University
Attention: Salem Mangles
Email:
Provided By: Dave Craig / Derek Witt

Project Name: MSU Manly Miles

Proposal #: 49307
Date: 3/28/2025

SIX (6) - UNISOURCE, Stainless Steel pump flex connectors

Qty: 6 – Series 402 Flex Connectors:

- Model: 402-600
- 6” Nominal Pipe Size
- 11” Long
- Carbon Steel Class 150 Plate Flanges
- Hose: Series 300 Stainless Steel Corrugated Hose
- Braid: Series 300 Stainless Steel One Braid
- 44 lbs

Stainless Steel Braided

Series 401 & 402 Pump Connectors

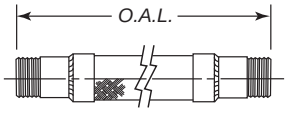
Seris 401 & 402 stainless steel braided pump connectors are the standard of the industry for a rugged, versatile flex product to connect piping to vibrating mechanical equipment.

Series 401 & 402 stainless steel connectors combine 300 series corrugated stainless steel hose and braid with weld-on carbon steel end fittings for a high-pressure assembly. Standard connectors with stainless steel end fittings are also available. Unisource starts with a high corr-count inner hose for greater flexibility and better noise and vibration control efficiency. Many manufacturers utilize a less expensive wide-pitch corrugated hose. A tightly woven stainless steel braid provides high pressure ratings, even in high temperature heating water applications. In sizes 8" and larger, Unisource provides braided-braid reinforcing. This style of premium braiding translates to better strength and safety—vital considerations in large size pipelines where pressure thrust forces are greatest.

Series 401 threaded, and **Series 402 flanged** are made to traditional industry standard overall lengths. These connectors are designed to provide good efficiency for noise and vibration control. **Series 401-L** and **Seris 402-L** are longer length connectors, built for even greater noise and vibration control, and a minimum of 2" permanent lateral offset.

Series 401 & 401-L

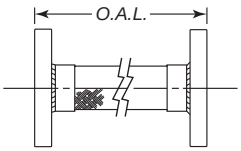
Hose & Braid: 300 Series Stainless Steel
Ends: Painted Carbon Steel Male NPT-welded to hose, braid & collar



Size (Inches)	401 OAL (Inches)	401-L OAL (Inches)	WP @ 70° F (PSI)	WP @ 250° F (PSI)	Min. Bend Rad. Static (Inches)	Min. Bend Rad. Dynamic (Inches)	Max. Perm. Offset - 401 (Inches)	Max Perm. Offset - 401-L (Inches)	Approx Weight (Lbs)
1/2	6-1/2	10	990	911	1.75	7	0.38	2.0	0.4
3/4	7	11	750	690	2.5	9.5	0.38	2.0	0.5
1	8	12	605	557	3	11	0.38	2.0	0.8
1-1/4	8-1/2	13	570	524	4	12	0.38	2.0	1.0
1-1/2	9	14	410	377	5.5	13	0.38	2.0	1.3
2	10-1/2	15	455	419	7	16	0.38	2.0	2.0
2-1/2	12	N/A	345	317	8	18	0.38	N/A	5.0
3	14	N/A	290	267	10	22	0.38	N/A	8.0
4	16	N/A	250	230	13	26	0.38	N/A	13.0

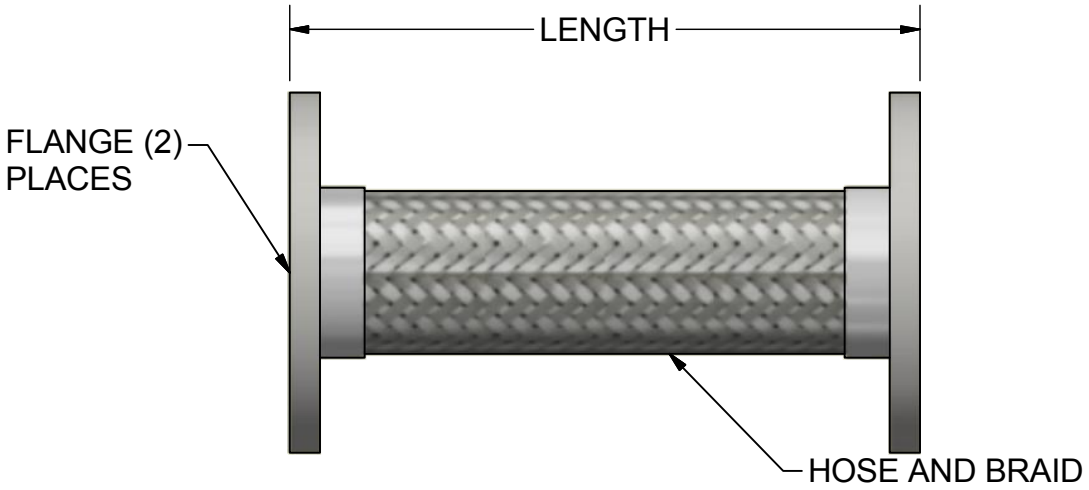
Series 402 & 402-L

Hose & Braid: 300 Series Stainless Steel
Ends: Painted Carbon Steel 150# Plate Flanges



Size (Inches)	402 OAL (Inches)	402-L OAL (Inches)	WP @ 70° F (PSI)	WP @ 250° F (PSI)	Min. Bend Rad. Static (Inches)	Min. Bend Rad. Dynamic (Inches)	Max. Perm. Offset - 402 (Inches)	Max Perm. Offset - 402-L (Inches)	Approx Weight (Lbs)
1-1/2	9	N/A	410	377	5.5	13	0.38	N/A	10.0
2	9	N/A	455	419	7	16	0.38	N/A	12.0
2-1/2	9	12	345	317	8	18	0.38	2.0	13.5
3	9	13	290	267	10	22	0.38	2.0	15.0
4	9	14	250	230	13	26	0.38	2.0	21.0
5	11	15	200	184	17	34	0.38	2.0	29.0
6	11	16	210	193	19	41	0.38	2.0	33.0
8	12	18	190	175	23	50	0.38	2.0	60.0
10	13	22	150	138	29	67	0.38	2.0	81.0
12	14	N/A	140	129	34	70	0.38	N/A	108.0
14	14	N/A	150	138	42	79	0.38	N/A	118.0

Note: Sizes 8" and larger are constructed with braided-braid reinforcing.



ASSEMBLY MATERIALS:
HOSE: SERIES 300 STAINLESS STEEL CORRUGATED HOSE
.008 TO .012 WALL
BRAID: SERIES 300 STAINLESS STEEL ONE BRAID
(8" AND LARGER IS A BRAIDED-BRAID)
ENDS: CARBON STEEL CLASS 150 PLATE FLANGES

MAXIMUM PERMANENT OFFSET FROM CENTERLINE: 3/8"
MAXIMUM INTERMITTENT OFFSET FROM CENTERLINE: 3/8"

QTY	SIZE	MODEL	LENGTH (IN)	WORKING PRESSURE @70°F (PSIG)	WORKING PRESSURE @250°F (PSIG)	STATIC BEND (IN)	DYNAMIC BEND (IN)	APPROXAMENT WEIGHT (LBS)
	1.50"	402-150	9	410	377	6	13	10.0
	2.00"	402-200	9	300	273	6.69	18.50	9.90
	2.50"	402-250	9	345	313	3.14	9.84	13.42
	3.00"	402-300	9	289	262	3.54	13.77	14.92
	4.00"	402-400	9	300	273	5.11	15.74	20.0
	5.00"	402-500	11	220	200	13.77	21.65	33.0
6	6.00"	402-600	11	200	182	19.68	21.65	44.0
	8.00"	402-800	12	199	181	29.52	33.46	61.60
	10.00"	402-1000	13	150	138	29	67	76.0
	12.00"	402-1200	14	140	129	34	70	108.0
	14.00"	402-1400	14	150	138	42	79	118.0

NOTES: GO TO WWW.UNISOURCE-MFG.COM FOR INSTALLATION INSTRUCTIONS. PRESSURES LISTED ARE AT 70°F. MAX WORKING TEMPERATURE 800°F.

CUSTOMER: _____

PROJECT: _____

ENGINEER: _____

REV	DESCRIPTION	DATE	APPROVED
0	RELEASED	02/18	BC

REVISION HISTORY

UNISOURCE MFG.
8040 N.E. 33rd Dr
Portland, OR 97211
Ph: 503.281.4673, Fax 503.281.5845

UNISOURCE 402 METAL FLEX HOSE
FLANGED ENDS

DRAWN BY:	DATE:
SG	02/16/18
DWG NO: 402.idw	SCALE: NONE