MULTISTACK ®

Originators. Innovators. Never the Imitators.sm

Water Cooled MagLev Chiller: Gen 2 Product Data Catalog

For Chillers: MS0122F through MS1002F

Table of Contents

A New Generation of Multistack MagLev™ Centrifugal Chillers Is Here!

The world's best chiller is now even better! Since its introduction in 2009 the Multistack MagLev flooded chiller has been a leader in efficiency, reliability, redundancy, sustainability and serviceability. Now there's a new generation of Multistack MagLev chillers!

- Unrivaled efficiency—complies with ASHRAE 90.1 2010 and proposed 2015 standards
- Qualifies for USGBC LEED credits
- Among the industry's lowest per ton refrigerant charge.
- Unequaled flexibility and control—able to control multiple compressors of different capacities with optimum performance and efficiency at full load and part load
- Industry's best unloading capability without condenser water temperature relief.
- Fast control response—can unload from full load to minimum flow in one minute, run at reduced flow for a minute, then reload to full load a minute later!
- Smallest footprint per ton of capacity. Ideal for retrofit or new construction projects—units up to 330 tons capacity fit through a 36-inch door.
- Sustainability—oil-free compressor technology means no refrigerant-entrained oil to hinder heat transfer and reduce efficiency. No lubrication system means fewer parts, greater reliability, and lower maintenance costs.
- Redundancy achieved thru multiple compressor design featuring lowest failure rate in the industry
- All MagLev chillers are run-tested on Multistack's AHRI Certified test loop
- Lowest total cost of ownership

Overall, the Multistack MagLev chiller offers sustainable, documentable high performance with reliability, redundancy, low maintenance and lowest total cost of ownership—all in a compact chiller built in the U.S.A!

Model Number Nomenclature

MS 0332 F C 1 L 2 W 2 H 1 A A 1 1 F A -134a

MS	Series
0300	Model Number (up to 4 digits, the number "2" in the last digit indicates Gen II)
F	Evaporator Type (F for Flooded)
C/N	AHRI Certified (C - certified, N - Not certified)
1	Frame Style (1,2,3, 4, 5, 6 or V-other)
L	Shell Length (F-5 foot, S - 6 foot, M-10 foot, L - 12 foot, V-Other)
2	Number of evaporator water passes
W	Condenser Type (W for water cooled, R - remote air cooled, E - remote evap cooled)
2	Number of condenser water passes
H	Voltage (see voltage codes)
1	Version number of AHRI Certification
A	Evaporator tube type[1]
A	Condenser Tube Type[2]
1	Evaporator (entering)[3]
1	Condenser (entering)[4]
F	Controller Option[5]
A	Amperage Code (see amperage codes)
-134a	Refrigerant

[1] A - B4 copper, B- B4 Cu-Ni, C - B5 copper, D - C5 Cu-Ni, V - other
[2] A - C4 copper, B- C4 Cu-Ni, C - C5 copper, D - C5 Cu-Ni, V - other
[3] 1- std left/mwb right, 2 - std right/mwb left, 3 - mwb left/std right, 4 - mwb right/std left, 5 - both MWB left, 6 - both MWB right, 7 - both std left, 8 both std right
[4] 1- std left/mwb right, 2 - std right/mwb left, 3 - mwb left/std right, 4 - mwb right/std left, 5 - both MWB left, 6 - both MWB right, 7 - both std left, 8 both std right
[5] F - FlexSys base, G - FlexSys with options, V - Other

Amperage Codes/MOP

A	70	I	200	Q	600
B	80	J	225	R	700
C	90	K	250	S	800
D	100	L	300	T	350/500
E	110	M	350	U	400/500
F	125	N	400	V	450/500
G	150	O	450	W	450/600
H	175	P	500	X	500/600

Voltage Codes

C	575/3/60
E	380 - 415/3/50
F	380/3/60
H	460/3/60
V	OTHER

Features—Software

The MagLev™ FlexSys Controller includes these unique software features:

- Control of up to five (5) MagLev compressors of varying capacities.
- On-site individual compressor and system fine tuning using the MagLev™ FlexSys touch-screen display panel.
- Two (2) year data log, trend graphing in five-second intervals, without overwriting data.
- Controller logs over 200 data separate points with 17,280 lines of data per day.
- Fault logging features a calendar mode with the ability to sort by alarm type, time stamp or by individual compressor.
- MagLev™ FlexSys features on-board manuals, wiring diagrams and support data that are all accessible through the touch-screen panel.
- On-board Danfoss Turbocor (DTC) software eliminates the need for a service technician to carry a portable computing device.
- EXV control is integrated into system I/O to eliminate additional hardware.
- FlexSys System can save and recall all of the chiller settings that have been programmed.
- Flexsys features an auto set feature that allows for I/O for auxiliary device control to be done effortlessly. Control functionality for auxilary devices achieved thru simple drop down menu.
- Chiller will continue to run even if there is a problem with the built-in software or touch-screen.

Optional Software Features

- Proprietary MagLev™ FlexSys optimization logic maintains energy balances for all systems maximizing energy and operational performance.
- MagLev™ FlexSys can be reconfigured via the touch-screen to control chilled water system auxiliary devices such as valves, bypasses, pumps, towers, etc.
- Full BAS connectivity including Modbus®, BacNet® and Lon®.

Features—Hardware

Multistack® selected high-end, fail-safe hardware features:

- Control system to uses the Danfoss Turbocor Monitoring Software on board so there is no need for a laptop.
- Features optional auxiliary device control that communicates with the plant, allowing for lower total install cost (when compared to a chiller with BAS upgrades).
- Dual drive design ensures reliability.
- Solid state drives have no moving parts, eliminating the possibility of mechanical failure.
- 15-inch TFT touch-screen display has 1024 x 768 resolution.
- DC Power ensures maximum resistance to on-site EMI and RFI noise.
- Modular I/O design simplifies troubleshooting by utilizing LED indicators for all inputs and outputs.
- Wiring uses spring capture technology to assure positive connections and eliminate traditional terminal blocks.
- Full remote communication when internet connection* available (provided by others).

Optional Hardware Features

- User interface allows control point tags to match between BAS and Chiller, allowing for greater flexibility and better system integration.
- On-board industrial grade battery back-up for power outage protection.

Home Screen

The Master Control Panel is where you will find the processor, touch screen, and all system input and outputs for the chiller. The FlexSys compressor controller contains the following system points:

- Remote Start/Stop Input
- Emergency Stop Input
- Chiller Run Status Contact Output
- Chiller Fault Status Contact Output
- Compressor Lockout Fault Status Contact Output
- Load Limit Input (4-20mA)
- Chilled Water Reset Input (4-20mA)
- Outside Air Temperature and Humidity Input (Contact Multistack)
- Chiller KW Output (0-10VDC)
- Chiller Amps Output (0-10VDC)
- Condenser 3 Way Valve Output (0-10VDC)
- Tower Setpoint Output (0-10VDC)

Dashboard

Referred to as the dash board, this is where a general system summary is found. Features of this screen include:

- 24 user defined text boxes
- System On/Off switch
- Compressor override controls
- Compressor hub status information
- Navigation buttons-
    - User Menu (requires no pass word) includes: trend Graphs, I/O overview, fault logs, list of alarms, manuals, log book, and exit button
    - Service Menu (requires password) includes: edit system, edit I/O, edit I/O controls, edit alarms, Modbus set-up for BAS interface, edit main screen, and Turbocor software
- Summary of most recent events
- Power Bar and Capacity read out
- System Messages, System Faults, Alarms, and Status
- Compressor Messages, Faults, Alarms, and Status

Multi-Graphs

- Remote accessibility with the Multi-Graph destop program
- Over 160,000 points of data stored daily
- All data logged in five-second intervals
- 32 GB of storage data
- Over two years of data can be stored
- Zoom-In / Zoom-Out feature
- Jpg export feature
- Different groupings for system points, compressors, I/O, energy analysis
- User defined viewpoints
- User can change color of trend lines
- Monitors the compressors
- Allows accurate system analyzation to identify problems
- Exportable via a .csv file to excel

Example of a typical Home Screen with chiller graphics.

Example of a typical Dashboard
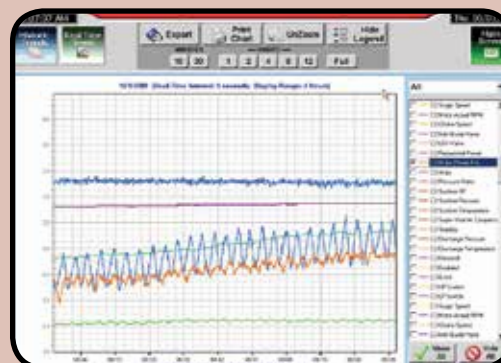
Example of a typical trend analysis.

The software in the FlexSys control system works in conjunction with the compressors, creating the next generation of chiller control. Most control systems look at leaving water temperature with a single PID loop and convert this into a single demand signal that is applied to all compressors. This affects loading characteristics of the chiller, that can either be too slow or too fast. Too slow can create thermal lag, which eventually forces a chiller to load harder to catch the set point of the chilled water loop. Too fast causes a rubber band effect where the chiller loads very aggressively, becomes unstable, and ultimately forces the chiller to unload rapidly once you have made set point. This type of control logic can create amperage alarms and faults, suction alarms or faults, high pressure alarms or faults, and energy spikes. This can affect the chiller's reliability, energy efficiency, and overall performance in the chilled water system.

With FlexSys controls, each compressor is individually controlled in conjunction with the chiller. This allows for precise, individual control of each compressor, creating a unique system balance where it can run each compressor in the sweet spot to optimize energy efficiency. Sophisticated control like this compensates for any differences in manufacturing tolerances between compressors; allowing for the chiller to adapt to the load efficiently, and preventing thermal lag or drastic overshoot.

Typical control logic architecture on a FlexSys control system:

Controls: Optional Auxiliary Control
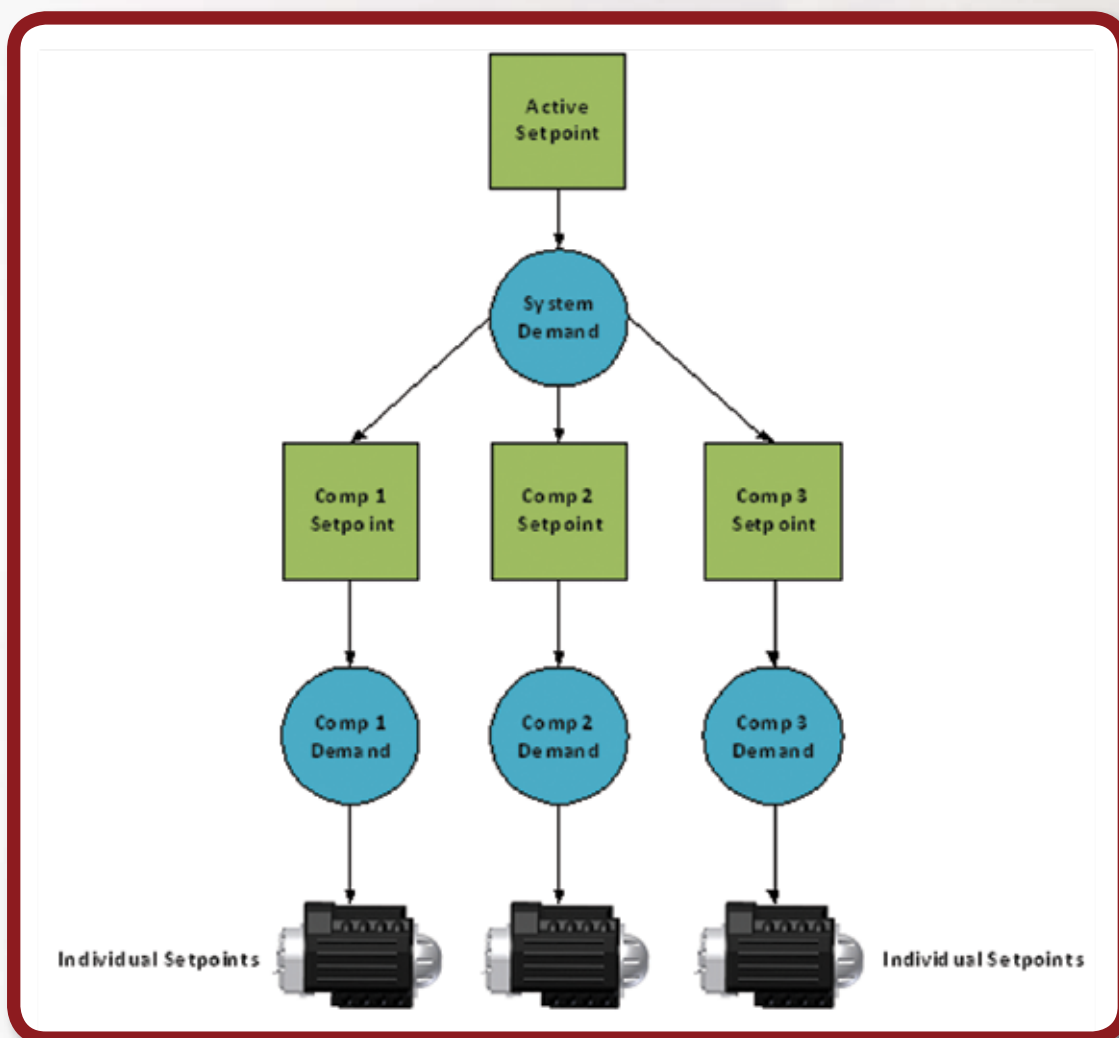
Let us control your chiller plant!

The advantage of Multistack's auxiliary device control system is that it eliminates costly custom controls work. Predictable, reliable, energy efficient control is easily available through Multistack's unique a la carte menu system. Simply select the hardware required for the application and choose one of the predefined control methods. This information is then entered into the chiller sales order when built. The chiller comes from factory "plug and play." Wiring diagrams, sequence of operation and BAS lists are completed up front, eliminating guess work and waiting.

If the auxiliary device control is not ordered at time of chiller purchase, these functions can be easily added in the field.

Small Hub

A small hub is intended for controlling one set of chiller isolation valves (on/off), one chilled water pump, one condenser water pump and one cooling tower. Small hubs can be used for these control options:

Option 1- Chilled water isolation valves

Option 2- Condenser water isolation valves

Option 3- Chilled water bypass*

Option 4- 1 Constant speed pump on evaporator

Option 5- 1 Single VFD-driven pump on evaporator*

Option 9- 1 Constant speed pump on condenser

Option 10- 1 Single VFD-driven pump on condenser*

Option 13- Standard cooling tower fan control

Option 14- Optimized cooling tower fan VFD**

Requires a differential pressure transducer for control feedback, available from Multistack.
**Requires a combination Outside Air Temperature/Humidity Sensor for control feedback, available from Multistack.*

All I/O (input/output) points in the small hub are integrated into the chiller controller and values are passed through to the field server portal for BAS reference. Remote control of auxiliary devices by the BAS, such as changing set points, lead/lag, etc., is not available. However, changing set points, lead/lag, etc., can be accomplished via VNC connection to the chiller control panel.

Large Hub

A large hub controls one set of chiller isolation valves (on/off), two chilled water pumps, two condenser water pumps and two cooling towers. Large hubs can be used for these control options:

Option 1- Chilled water isolation valves

Option 2- Condenser water isolation valves

Option 3- Chilled water bypass*

Option 4- One constant speed pump on evaporator

Option 5- One single VFD-driven pump on evaporator*

Option 6- Dual constant speed pump on evaporator

Option 7- Dual VFD-driven pumps on evaporator*

Option 8- Dual pump primary/secondary on evaporator (one pump constant speed; the other VFD driven)*

Option 9- One constant speed pump on condenser

Option 10- One single VFD-driven pump on condenser*

Option 11- Dual constant speed pump on condenser

Option 12- Dual VFD-driven pump on condenser*

Option 13- Standard cooling tower fan control (floating)

Option 14- Optimized cooling tower fan VFD**

Option 15- Dual standard cooling tower fan control (floating)

Option 16- Dual optimized tower fan VFD**

Requires a differential pressure transducer for control feedback, available from Multistack
**Requires a combination Outside Air Temperature/Humidity Sensor for control feedback, available from Multistack*

All I/O points in the large hub are integrated into the chiller controller and values are passed through to the field server portal for BAS reference. Remote control of auxiliary devices by the BAS, such as changing set points, lead/lag, etc., is not available. However, changing set points, lead/lag, etc., can be accomplished via VNC connection to the chiller control panel.

Remote Condenser Hub:

A remote condenser hub may only be used when a remote condenser is applied to a flooded chiller. This can be in the form of a customer-supplied evaporative condenser or a Multistack-supplied remote air-cooled condenser.

When using an evaporative condenser, the remote hub can control two spray pumps, two tower fans, and provide some remote temperatures such as sump, liquid temperature, etc.

With an air-cooled condenser, the remote hub can handle up to 16 air-cooled condenser fans and all must be ECM- or VFD-driven and are staged in groups of four. Each group has a dedicated start signal for the group and a common signal for that group of fans.

Remote hubs can be used for these control options:

Option 17- One spray pump on evaporative condenser

Option 18- Two spray pumps on evaporative condenser

Option 19- One evaporative condenser fan VFD**

Option 20- Two evaporative condenser fan VFDs**

Option 21- Remote air-cooled condenser fan VFDs with eight fans

Option 22- Remote air-cooled condenser fan VFDs with 12 fans

Option 23- Remote air-cooled condenser fan VFDs with 16 fans

*** Requires a combination Outside Air Temperature/Humidity Sensor for control feedback, available from Multistack.*

Cross Talk

Cross Talk allows multiple Multistack chillers to communicate and start an available off-line or idle chiller, if the chiller is enabled. If the chiller is off, it must be enabled via the remote start/stop. If the chiller is controlling the pumps and cooling towers, it will start them and then start the chiller. The advantage of Cross Talk is that it increases central plant overall efficiency by spreading the load among multiple chillers rather than fully loading one chiller.

In the new world of multiple compressor operation, the ability to adapt and fine-tune both the compressors and the HVAC system is critical to achieving optimum performance over a broad spectrum of operating environments.

Multistack FlexSys™ controls are the only data-based chiller controllers in the HVAC market. This data-based structure allows FlexSys controls to provide a multitude of control options.

With Multistack Generation 2 chillers, customers can choose from 16 standard control methods with pre-programmed control sequences. These standard control options take the guess work out of the controls integration with Multistack chillers. Adding these control options is as simple as selecting either a small hub or large hub and using the appropriate drop down menus in the chiller controller to select the functionality required.

For purposes of comparison, we have outlined the capabilities of the three most common control systems in use today against our FlexSys Controller.

Control System Comparison				
Hardware Comparison				
Features	FlexSys™ Controller	Kiltech Controller	McQuay Microtech II	Danfoss MCX by Artic Cool
Modular I/O for ease of expansion	√	X	X	X
LED Indicators for status of all inputs & outputs	√	X	X	X
Computer Based Controller (as opposed to PLC)	√	√	X	X
Intel Processor on board	√	X	X	X
All Hardware DC Power (less susceptibility to EMI noise)	√	√	X	√
Split Industrial Grade Hard Drives (2 GB minimum)	√	X	X	X
Trend Data,Fault Logs, Alarms can be downloaded via USB	√	√	√	X
All Hardware CE & UL Approved	√	X	√	√
15 inch Touch Screen	√	X	√	X
Built In EXV Drivers	√	√	X	X
Dedicated ethernet connection to each compressor	√	X	X	X
Dedicated RS-232 & RS-485 to each compressor	√	X	X	X
If touch screen is disconnected or fails, system will continue to run	√	X	√	X
Dedicated One-to-One Compressors simplify interfacing	√	X	X	X
Each Compressor has its own interlock circuit with proof from compressor	√	X	X	X
All hardware features spring captured terminals (no loose connections)	√	X	X	X
One to One Compressor Hardware concept (provides maximum redundancy)	√	X	X	X

√ = Included
X = Not Available

For purposes of comparison, we have outlined the capabilities of the three most common control systems in use today against our FlexSys Controller.

Control System Comparison				
Software Comparison				
Features	FlexSys™ Controller	Kiltech Controller	McQuay Microtech II	Danfoss MCX by Artic Cool
I/O layout can be field customized to match system integration	√	X	X	X
System runs Turbocor software on-board to each compressor	√	√	X	X
Capable of controlling mis-matched compressor sizes	√	X	X	X
Natural Progression Control Algorithms for maximum system reliability & energy savings	√	X	X	X
Adaptive Start logic which doesn't require compressors to unload to start	√	X	X	X
Able to control up to 5 compressors	√	X	X	X
Fixed PID control of leaving chilled water	X	√	√	√
Cascade control logic for chilled water control	√	X	X	X
Webcontrol Standard on all control systems (requires dsl or mobile broadband)	√	X	X	X
User selectable interface for main screen, I/O, & trend graphing	√	X	√	X
User selectable I/O control for auxillary devices (optional)	√	X	√	X
Tower Control with Fixed Setpoint (optional)	√	√	X	√
Optimized Tower Control Standard (without authorization code)	√	X	X	X
Operating Manuals & Technical Documentation Stored in controller	√	X	√	X
Two (2) year of trend data stored at 5 second intervals with calender recall	√	X	X	X
Modbus TCP/IP or RTU server standard for BAS integration	√	√	X	√
Compatiable with Lon & BAC Net	√	√	X	X
Controller Logs everytime a setting is changed & stores data to event log	√	X	X	X
Controller Logs up to 250 data points	√	X	X	X
Color Coded Interface (green=good, yellow=alarm, red=fault)	√	X	X	X
Control Settings & can be saved, recalled & transferred	√	X	X	X
Ability to give specific names to controller, compressor, valves, I/O points,	√	√	X	X
Control of Refrigerant Economizer thru modulating EXV	√	√	X	X
Individual Load Balance Valve Control per compressor (modulating valve)	√	X	X	X
Variable Speed Pump Control for evap & condenser (optional)	√	√	X	X
Real time energy monitoring of chiller when equipped with flow meter	√	X	X	X

√= Included
X = Not Available

GENERAL DATA TABLE OF WATER COOLED MAGLEV CHILLER: GEN 2, MS0122 - MS0192

	MS0122	MS0132	MS0152	MS0162	MS0192
Compressor Type	TT400	TT300	TT400	TT300	TT500
Quantity	1	2	1	2	1
Refrigerant Type	R-134a	R-134a	R-134a	R-134a	R-134a
Charge (lbs.)	255	255	319	321	415
Operating Weight	4869	5379	5587	6099	6460
Shipping Weight	4595	5105	5209	5721	5955

GENERAL DATA TABLE OF WATER COOLED MAGLEV CHILLER: GEN 2, MS0202-MS0392

	MS0202	MS0242	MS0292	MS0332	MS0392
Compressor Type	TT300/TT400	TT300/TT400	TT400	TT400/TT500	TT500
Quantity	1/1	1/1	2	1/1	2
Refrigerant Type	R-134a	R-134a	R-134a	R-134a	R-134a
Charge (lbs.)	415	544	644	663	757
Operating Weight	6970	7830	9077	9185	11,026
Shipping Weight	6465	7204	8274	8383	10,007

GENERAL DATA TABLE OF WATER COOLED MAGLEV CHILLER: GEN 2, MS0412 - MS0622

	MS0412	MS0482	MS0542	MS0602	MS0622
Compressor Type	TT400	TT400/TT500	TT400/TT500	TT500	TT400/TT500
Quantity	3	2/1	1/2	3	3/1
Refrigerant Type	R-134a	R-134a	R-134a	R-134a	R-134a
Charge (lbs.)	903	1061	1223	1428	1449
Operating Weight	12,465	14,099	15,649	17,300	17,991
Shipping Weight	11,283	12,671	13,933	15,338	16,029

GENERAL DATA TABLE OF WATER COOLED MAGLEV CHILLER: GEN 2, MS0702 - MS1002

	MS0702	MS0802	MS1002
Compressor Type	TT400/TT500	TT500	TT500
Quantity	1/3	4	5
Refrigerant Type	R-134a	R-134a	R-134a
Charge (lbs.)	1628	1913	2298
Operating Weight	19,969	22,015	26,411
Shipping Weight	17,628	19,323	23,088

MS0122

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
4890	5120	5400
(2218kg)	(2322kg)	(2449kg)
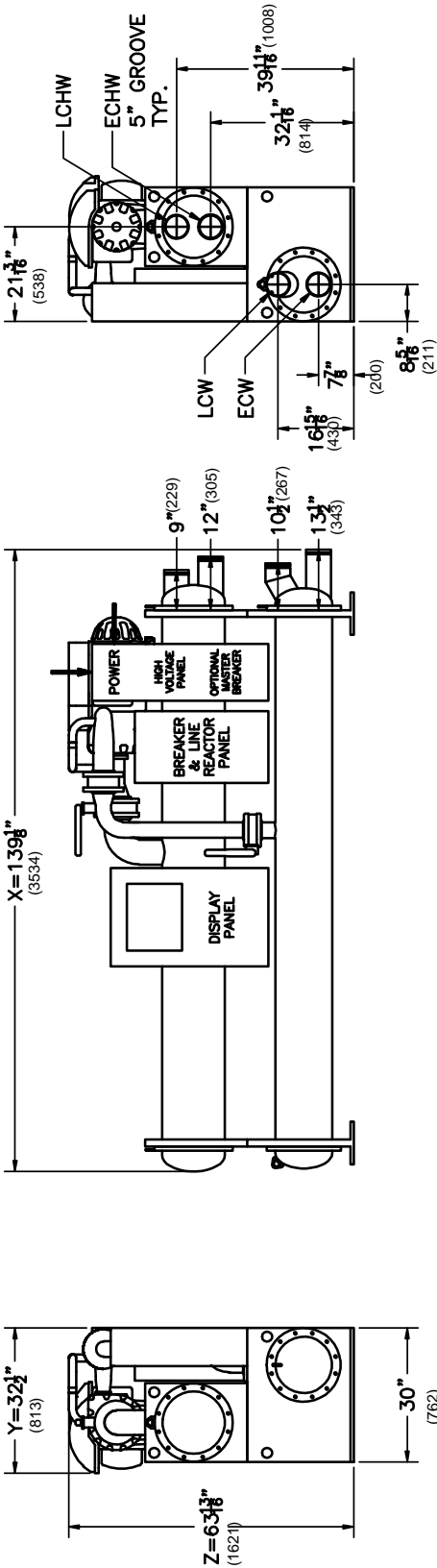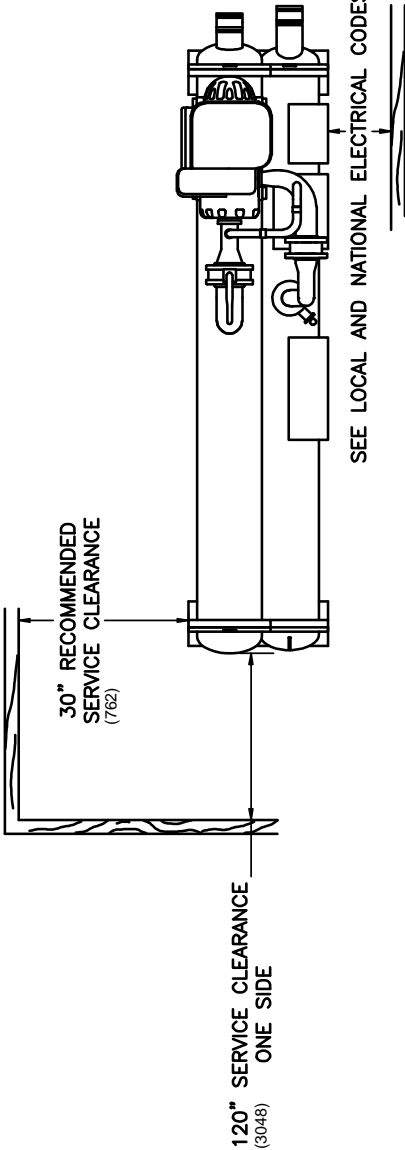
LCHW
ECHW
5" GROOVE TYP.

$39\frac{11}{16}$" (1008)
$32\frac{1}{16}$" (814)

$21\frac{3}{16}$" (538)

LCW
ECW

$8\frac{5}{16}$" (211)
$7\frac{7}{8}$" (200)
$16\frac{15}{16}$" (430)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

9" (229)
12" (305)
$10\frac{1}{2}$" (267)
$13\frac{1}{2}$" (343)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MASTER BREAKER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL

$X=139\frac{1}{8}$" (3534)

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

$Y=32\frac{1}{2}$" (813)

30" (762)

$Z=63\frac{13}{16}$" (1621)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

MS0132

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
5620	5850	6130
(2549kg)	(2654kg)	(2781kg)

LCHW
ECHW
5" GROOVE TYP.

$39\frac{11}{16}$" (1008)

$32\frac{1}{16}$" (814)

$21\frac{3}{16}$" (538)

LCW
ECW

$8\frac{5}{16}$" (211)

$7\frac{7}{8}$" (200)

$16\frac{15}{16}$" (430)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

9" (229)
12" (305)
$10\frac{1}{2}$" (267)
$13\frac{1}{2}$" (343)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MASTER BREAKER

BREAKER & LINE REACTOR PANEL

DISPLAY PANEL

BREAKER & LINE REACTOR PANEL

X=$139\frac{1}{8}$" (3534)

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

Y=$32\frac{1}{2}$" (813)

Z=$63\frac{3}{4}$" (1619)

30" (762)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

MS0152

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
5580	5890	6270
(2531kg)	(2672kg)	(2844kg)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

LCHW
5" GROOVE TYP.
ECHW
LCW
ECW

$51\frac{3}{16}$" (1300)
$43\frac{11}{16}$" (1110)
$21\frac{5}{16}$" (538)
$8\frac{3}{16}$" (208)
$8\frac{13}{16}$" (224)
$15\frac{13}{16}$" (402)

10" (254)
13" (330)
9" (229)
12" (305)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MASTER BREAKER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL

X=$139\frac{1}{8}$" (3534)

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

Y=$34\frac{5}{8}$" (879)
Z=$77\frac{1}{16}$" (1957)
$31\frac{1}{4}$" (794)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

15

MS0162

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
6310	6610	6990
(2862kg)	(2998kg)	(3171kg)

LCHW
5" GROOVE TYP.
ECHW
LCW
ECW

$51\frac{3}{16}"$ (1300)
$43\frac{11}{16}"$ (1110)
$21\frac{3}{16}"$ (538)
$8\frac{3}{16}"$ (208)
$8\frac{13}{16}"$ (224)
$15\frac{13}{16}"$ (402)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

$X=139\frac{1}{8}"$ (3534)

10" (254)
13" (330)
9" (229)
12" (305)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MASTER BREAKER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL
BREAKER & LINE REACTOR PANEL

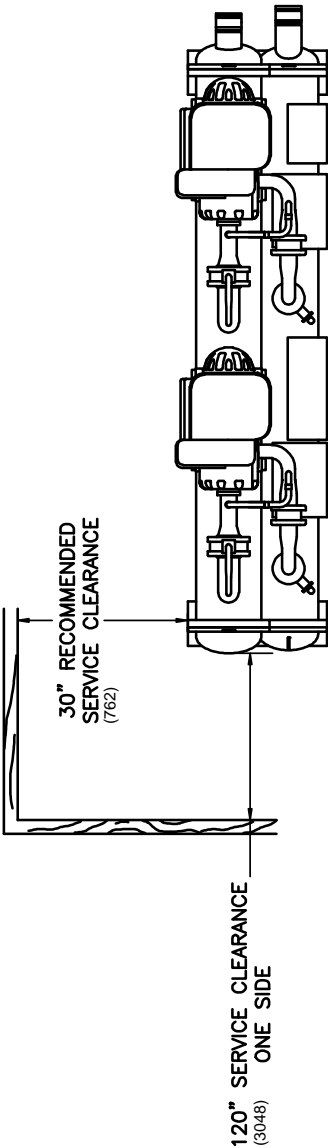$Y=34\frac{5}{8}"$ (879)
$31\frac{1}{4}"$ (795)
$Z=77"$ (1956)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
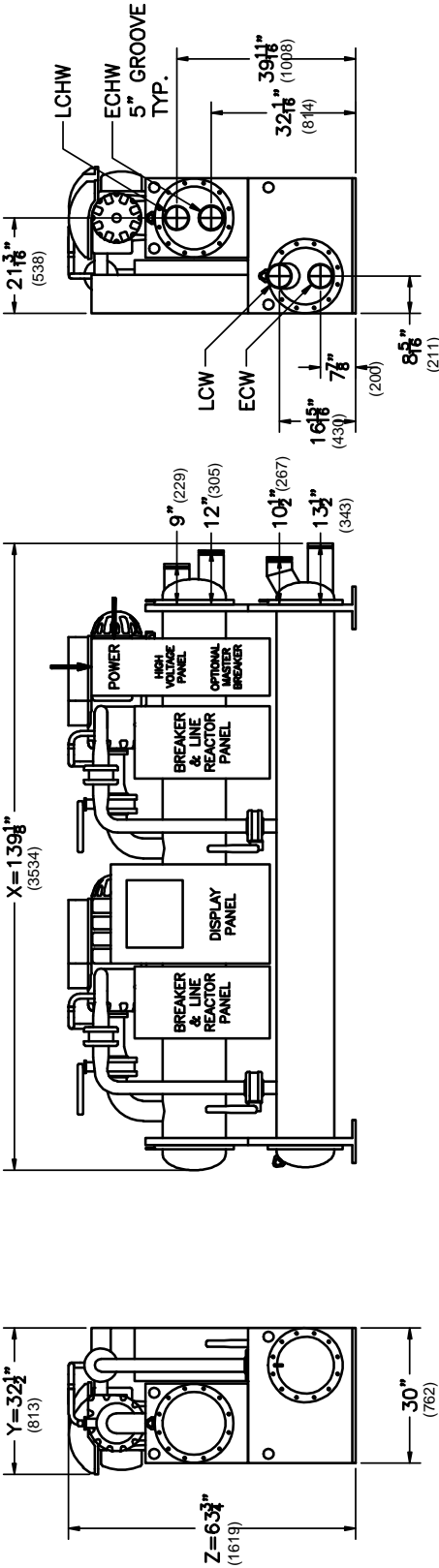(Note: Bracketed dimensions provided in mm)

MS0192

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
6240	6640	7150
(2830kg)	(3011kg)	(3243kg)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

50$\frac{1}{2}$" (1283)

42$\frac{1}{4}$" (1327)

22$\frac{1}{4}$" (565)

9$\frac{15}{16}$" (252)

9$\frac{1}{16}$" (230)

17$\frac{3}{16}$" (437)

LCHW 5" GROOVE
ECHW 5" GROOVE
LCW 6" GROOVE
ECW 6" GROOVE

11" (279)

14" (356)

10" (254)

13" (330)

X=140$\frac{11}{16}$" (3573)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MASTER BREAKER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL

30" RECOMMENDED SERVICE CLEARANCE (762)

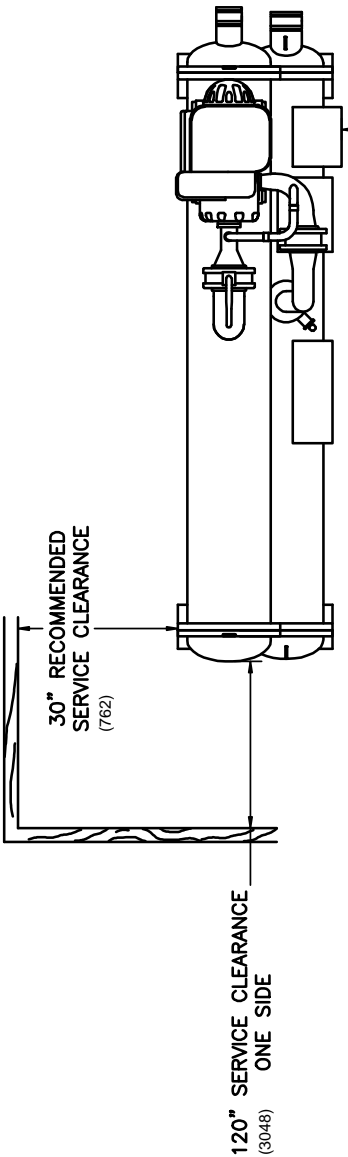120" SERVICE CLEARANCE ONE SIDE (3048)

Y=35$\frac{9}{16}$" (903)

33$\frac{1}{4}$" (845)

Z=77$\frac{3}{16}$" (1961)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
(Note: Bracketed dimensions given in mm)

MS0202

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
6960	7350	7860
(3157kg)	(3333kg)	(3565kg)

50$\frac{1}{2}$" (1283)

42$\frac{1}{4}$" (1327)

22$\frac{1}{4}$" (565)

(252)

(280)

9$\frac{1}{16}$"

9$\frac{15}{16}$"

17$\frac{3}{16}$" (437)

LCHW 5" GROOVE

ECHW 5" GROOVE

LCW 6" GROOVE

ECW 6" GROOVE

11" (279)

14"(356)

10" (254)

13" (330)

POWER

HIGH VOLTAGE PANEL

OPTIONAL MASTER BREAKER

BREAKER & LINE REACTOR PANEL

DISPLAY PANEL

BREAKER & LINE REACTOR PANEL

X=140$\frac{11}{16}$" (3573)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

Y=35$\frac{9}{16}$" (903)

Z=77$\frac{3}{16}$" (1961)

33$\frac{1}{4}$" (845)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
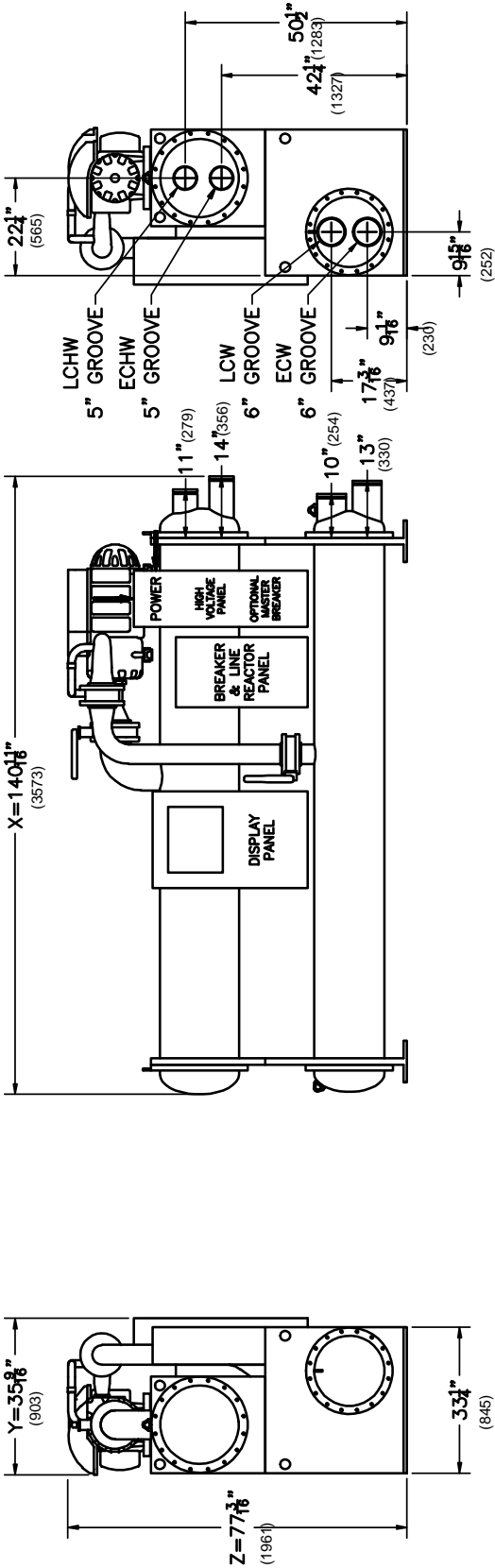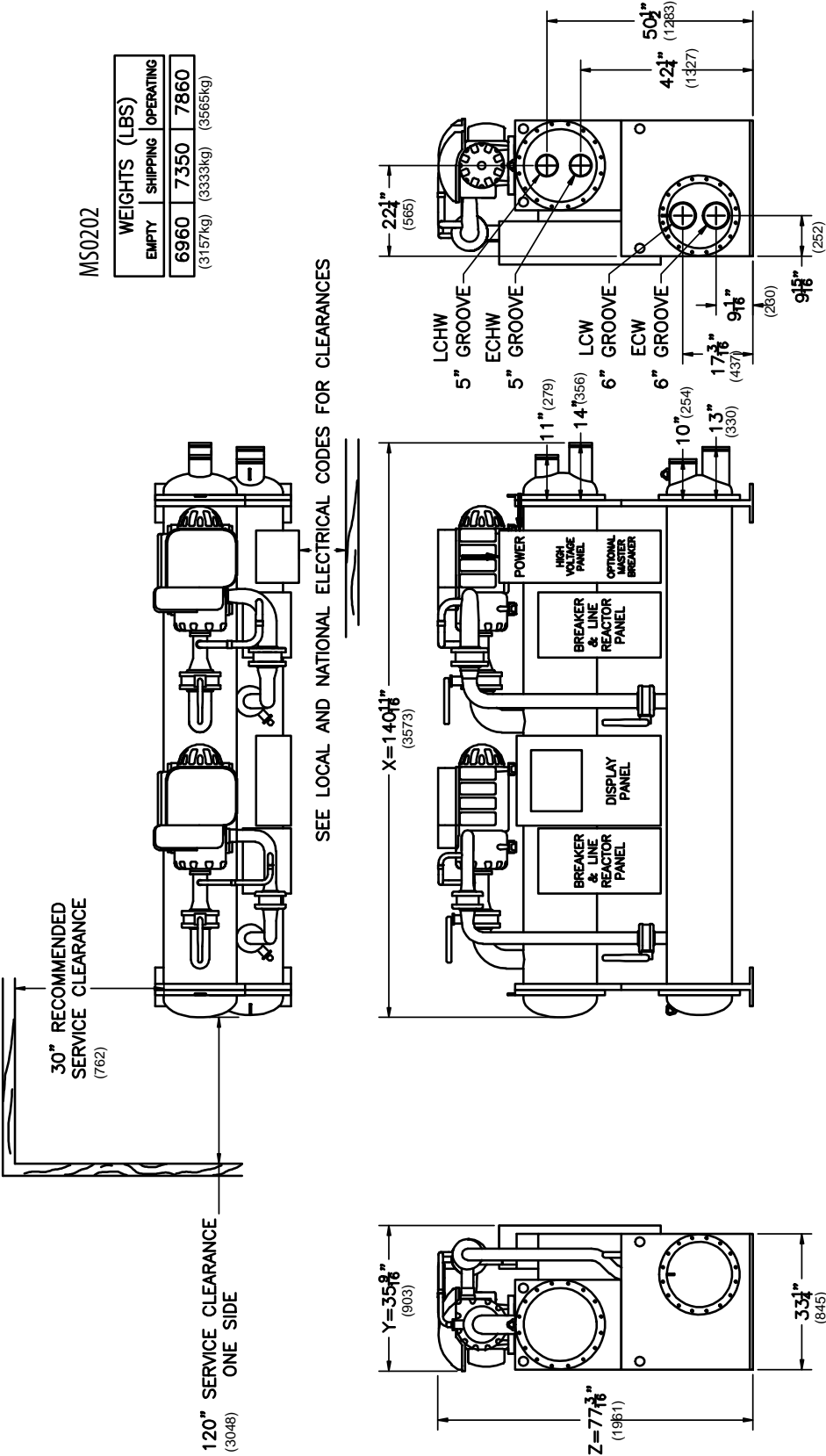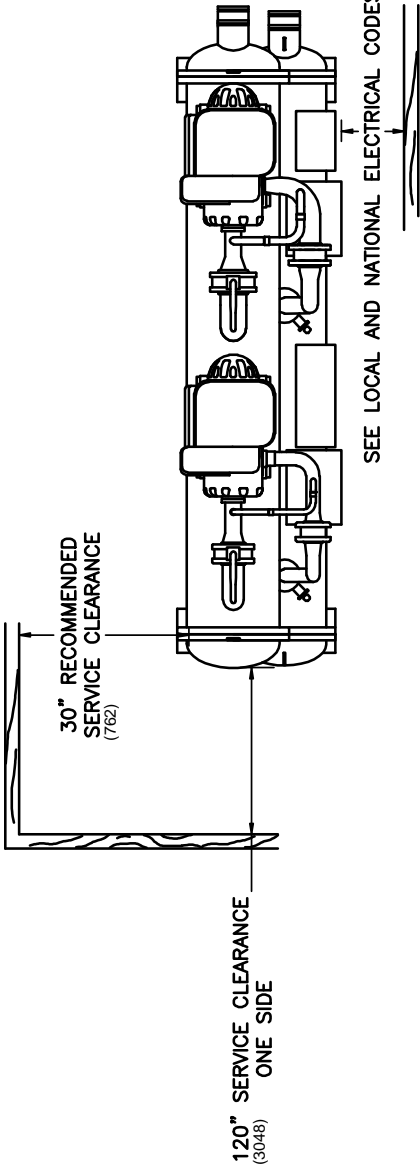
(Note: Bracketed dimensions provided in mm)

MS0242

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
7540	8040	8670
(3420kg)	(3647kg)	(3933kg)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)
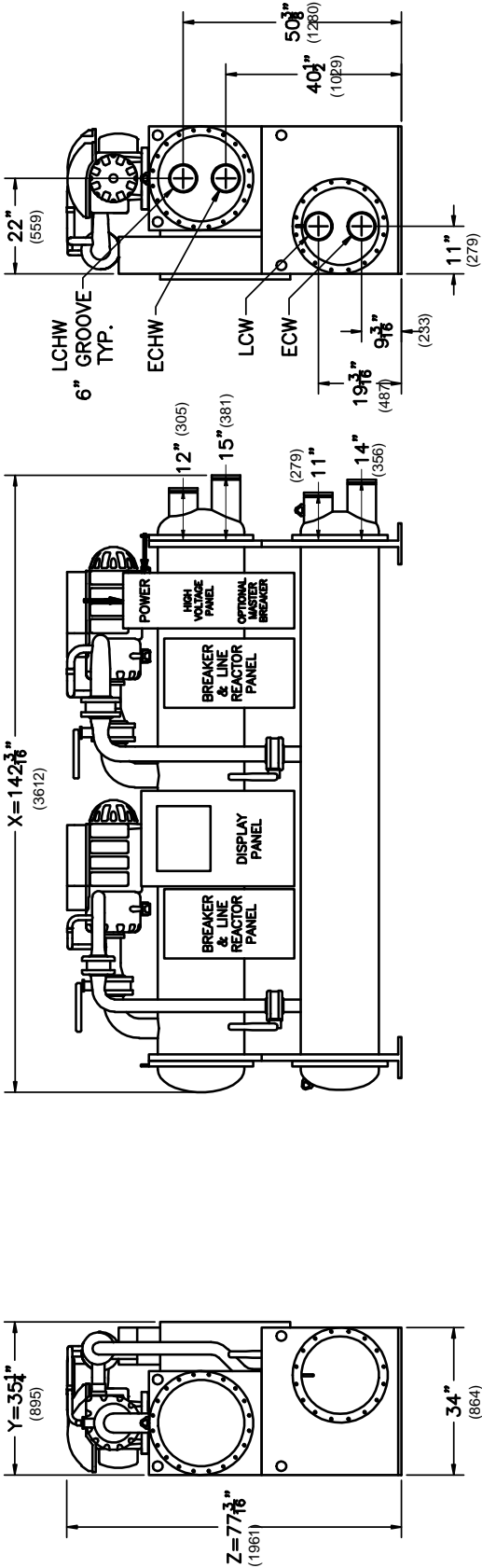
120" SERVICE CLEARANCE ONE SIDE (3048)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
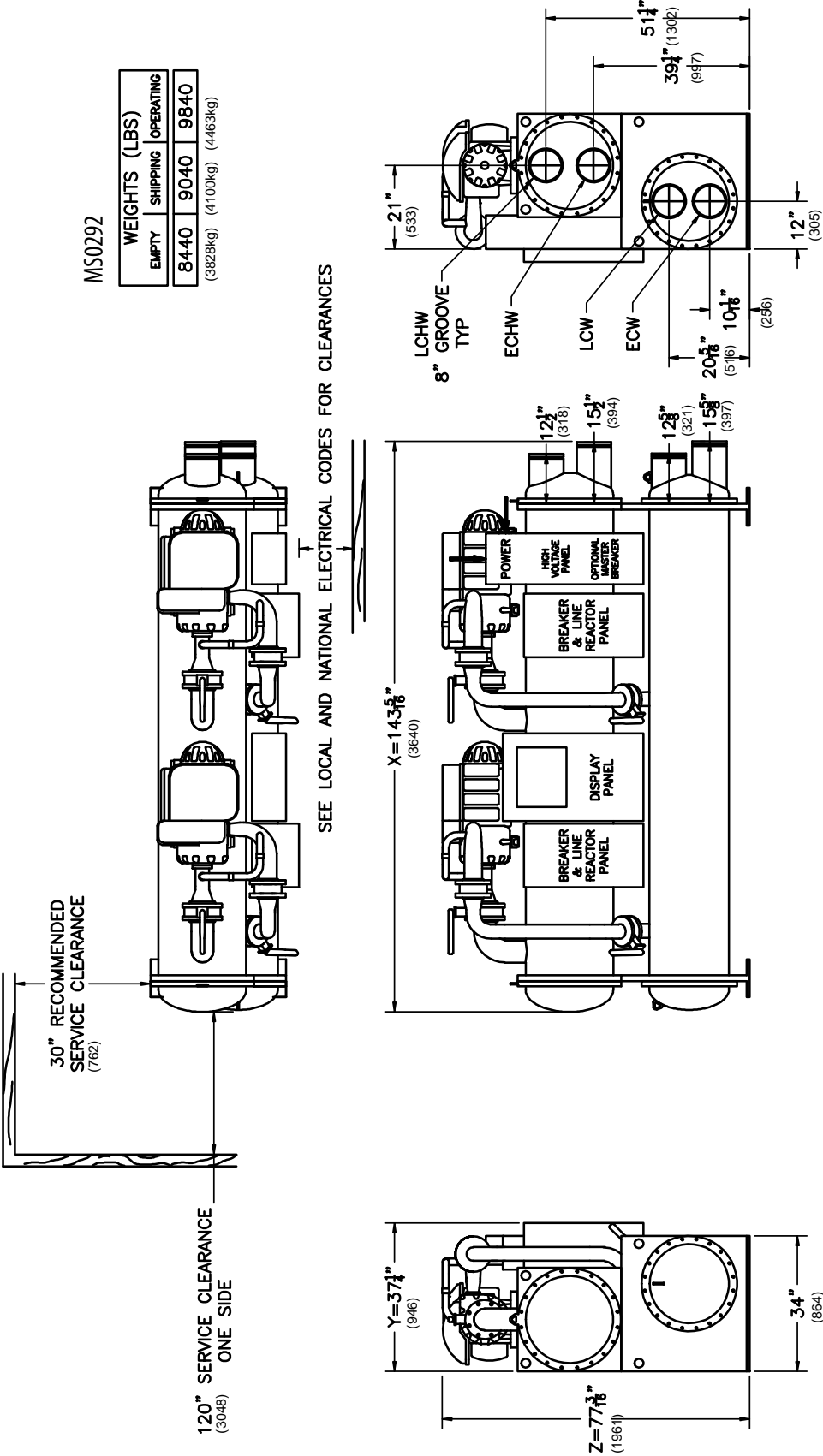(Note: Bracketed dimensions provided in mm)

MS0292

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
8440	9040	9840
(3828kg)	(4100kg)	(4463kg)

51$\frac{1}{4}$" (1302)

39$\frac{1}{4}$" (997)

21" (533)

12" (305)

10$\frac{1}{16}$" (256)

20$\frac{5}{16}$" (516)

LCHW

8" GROOVE TYP

ECHW

LCW

ECW

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

12$\frac{1}{2}$" (318)

15$\frac{1}{2}$" (394)

12$\frac{5}{8}$" (321)

15$\frac{5}{8}$" (397)

X=143$\frac{5}{16}$" (3640)

POWER

HIGH VOLTAGE PANEL

OPTIONAL MASTER BREAKER

BREAKER & LINE REACTOR PANEL

DISPLAY PANEL

BREAKER & LINE REACTOR PANEL

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

Y=37$\frac{1}{4}$" (946)

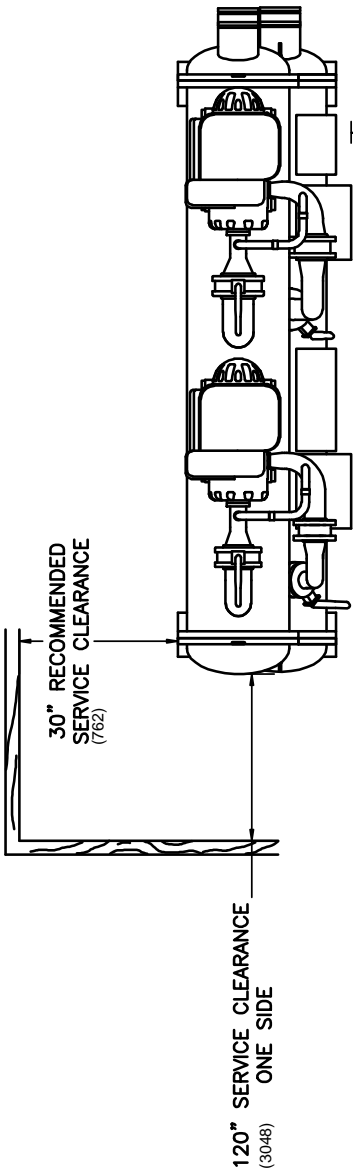34" (864)

Z=77$\frac{3}{16}$" (1961)

(Note: Bracketed dimensions provided in mm)

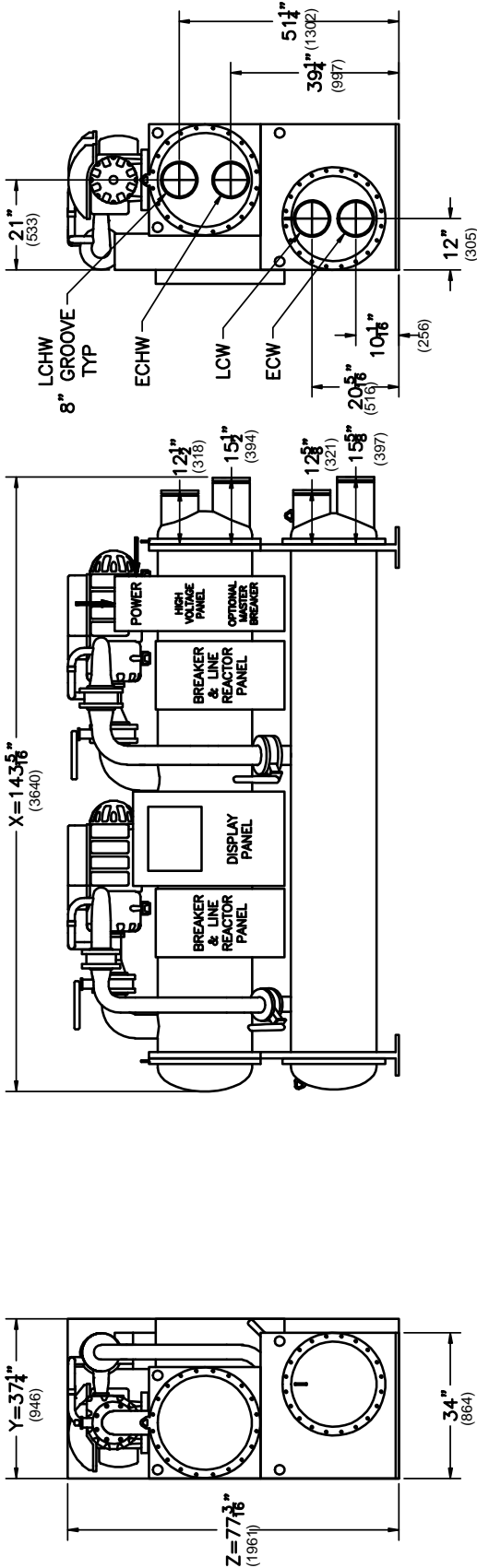**DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.**

MS0332

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
8560	9160	9960
(3883kg)	(4155kg)	(4518kg)

LCHW
8" GROOVE TYP
ECHW
LCW
ECW

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

51¼" (1302)
39¾" (997)
21" (533)
12" (305)
10⅛" (256)
20⅝" (516)

12¼" (318)
15¼" (394)
12⅝" (321)
15⅝" (397)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MASTER BREAKER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL
BREAKER & LINE REACTOR PANEL

X=143 5/16" (3640)

30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

Y=37¼" (946)
34" (864)
Z=77 3/16" (1961)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
(Note: Bracketed dimensions provided in mm)

MS0392

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
9620	10330	11350
(4364kg)	(4686kg)	(5148kg)
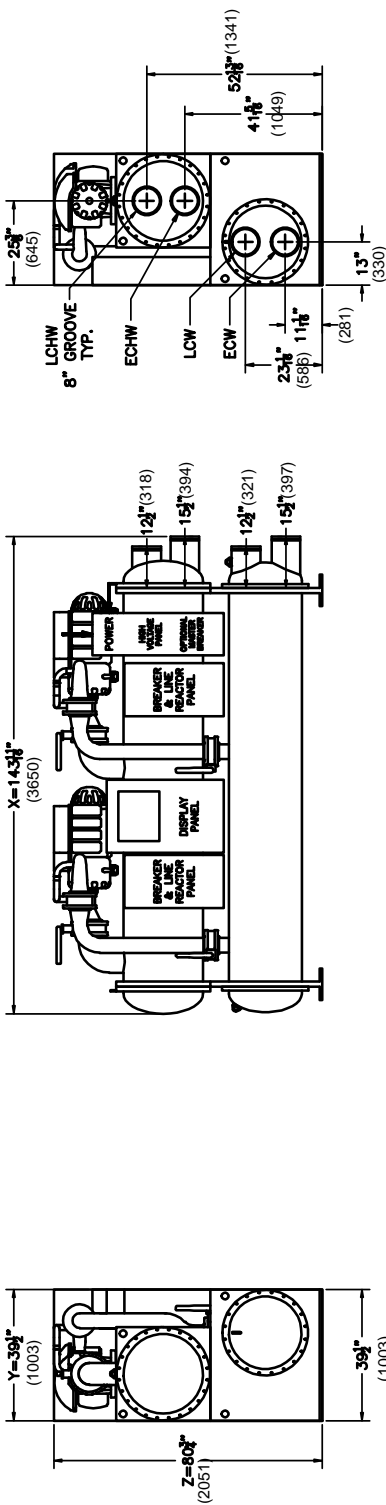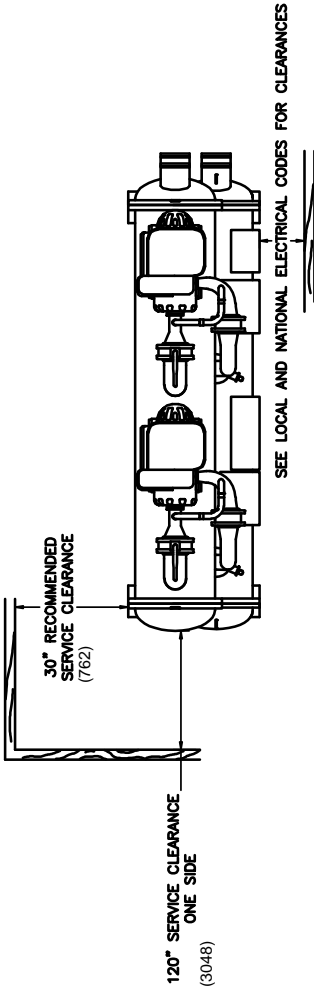
52⅞" (1341)

41⅛" (1049)

25⅜" (645)

13" (330)

11⅜" (281)

2⅜" (58B)

LCHW

8" GROOVE TYP.

ECHW

LCW

ECW

12" (318)

15½" (394)

12" (321)

15⅝" (397)

POWER

BREAKER & LINE REACTOR PANEL

DISPLAY PANEL

BREAKER & LINE REACTOR PANEL

X = 143¾" (3650)

30" RECOMMENDED SERVICE CLEARANCE (762)

120° SERVICE CLEARANCE ONE SIDE (3048)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES
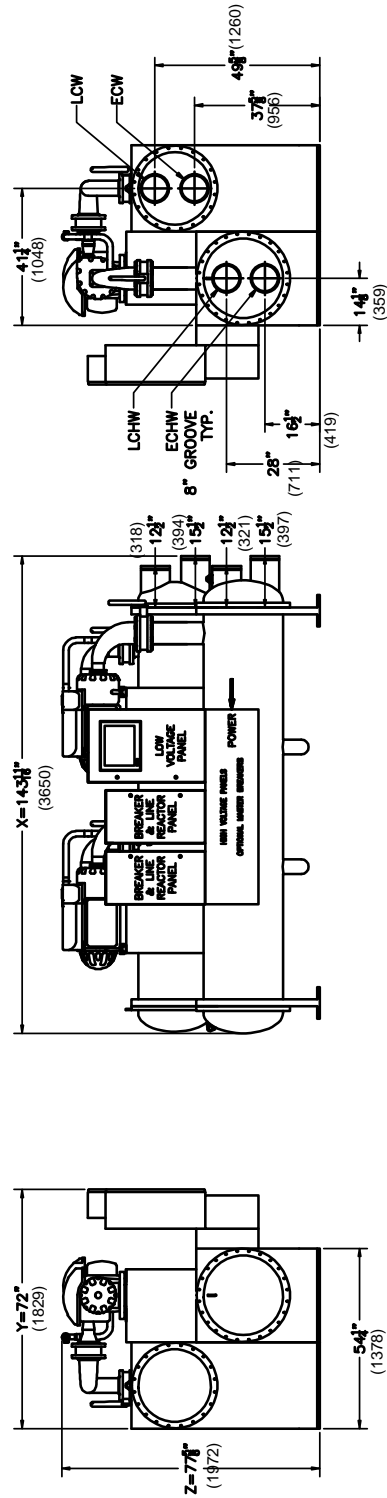
Y = 39½" (1003)

39½" (1003)

Z = 80¾" (2051)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

MS0392 Side-by-Side

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
10800	11510	12530
(4898kg)	(5221kg)	(5684kg)

LCW
ECW
49⅝" (1260)
37⅝" (956)
41⅜" (1048)
14⅛" (359)
LCHW
ECHW
8" GROOVE TYP.
16⅜" (419)
28" (711)

(318)
12⅞" (394)
15⅝" (321)
12⅝" (321)
15⅝" (397)

X=143¾" (3650)

LOW VOLTAGE PANEL
POWER
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
HIGH VOLTAGE PANEL OPTIONAL WHEN REQUIRED

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

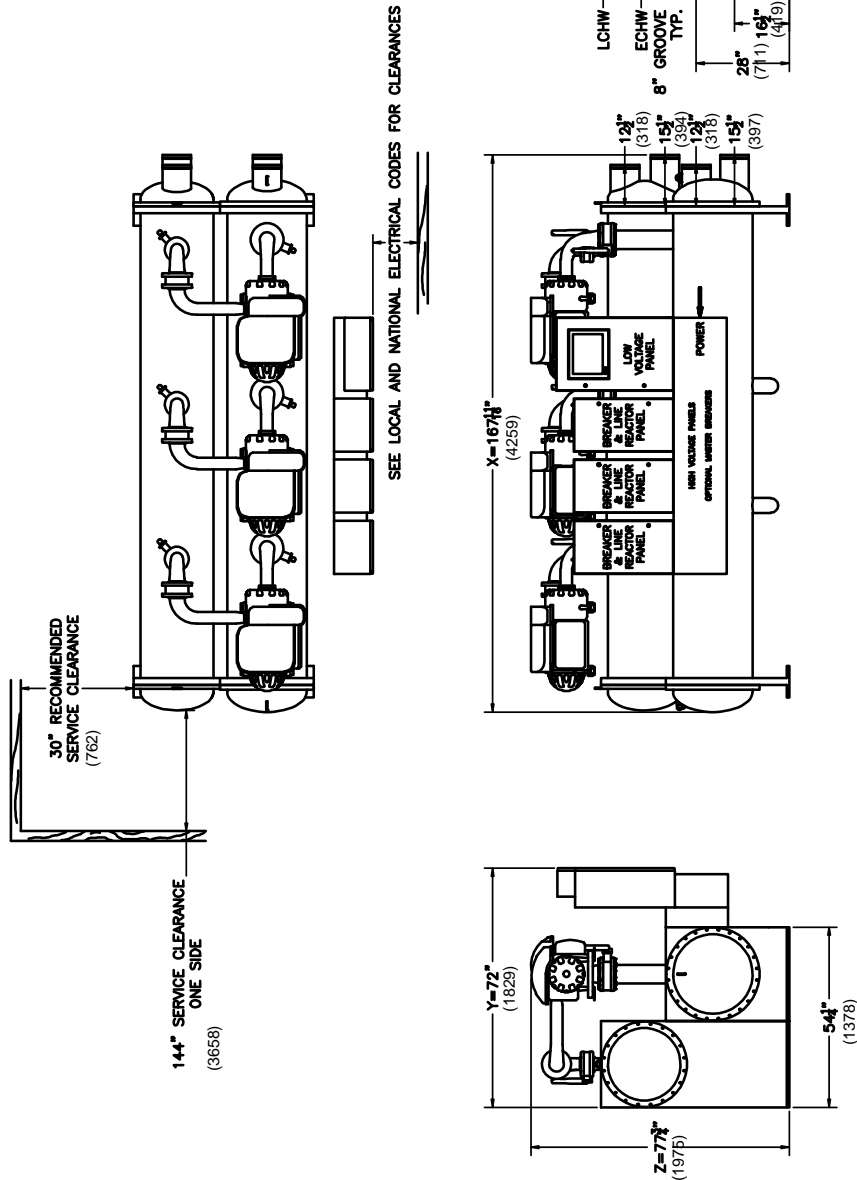30" RECOMMENDED SERVICE CLEARANCE (762)

120" SERVICE CLEARANCE ONE SIDE (3048)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

Y=72" (1829)
54¼" (1378)
Z=77⅝" (1972)

MS0412

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
11030	11860	13050
(5003kg)	(5380kg)	(5919kg)
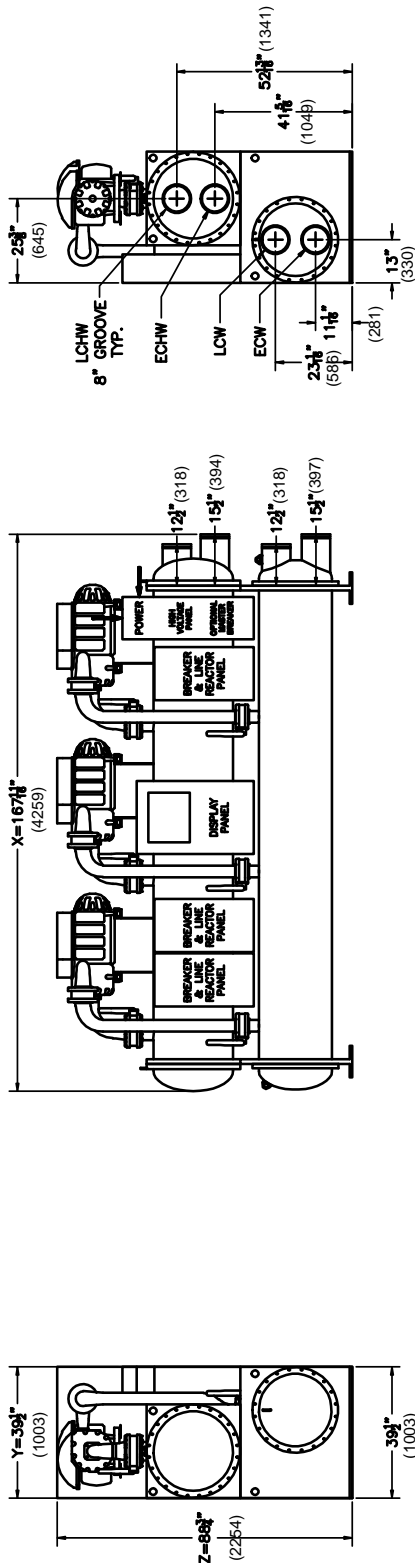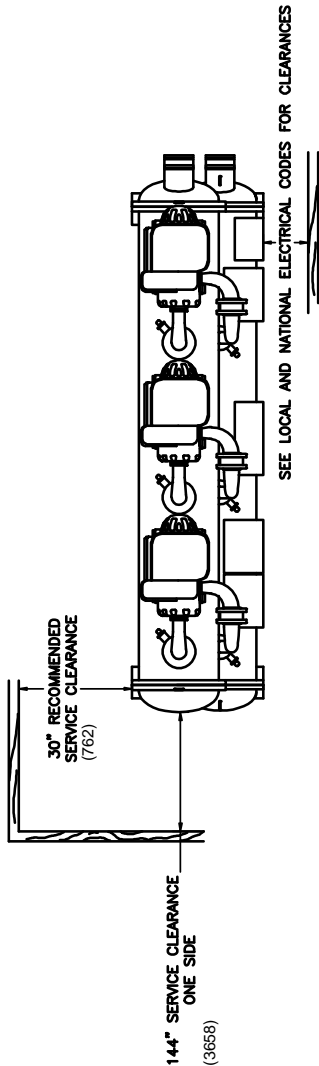
52⅞" (1341)
41⅛" (1044)
25⅜" (645)
13" (330)
11⅛" (281)
2⅜" (58)

LCHW
8" GROOVE TYP.
ECHW
LCW
ECW

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

X=167¾" (4259)

12½" (318)
15½" (394)
12½" (318)
15⅝" (397)

POWER
HIGH VOLTAGE PANEL
OPTIONAL WATER ECONOMIZER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL

Y=39½" (1003)
Z=88¾" (2254)
39½" (1003)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

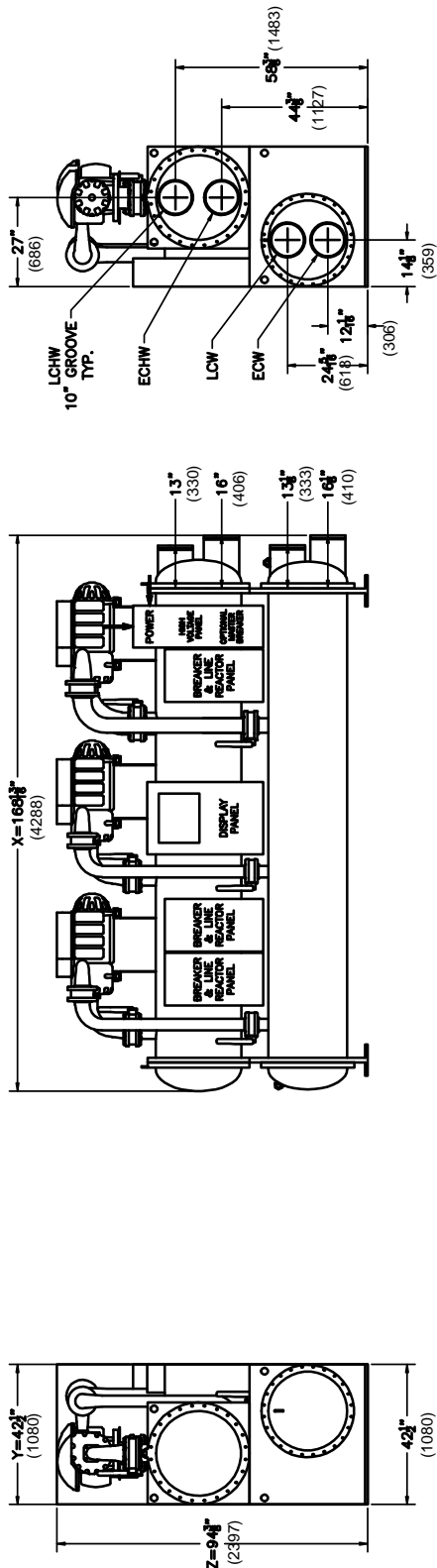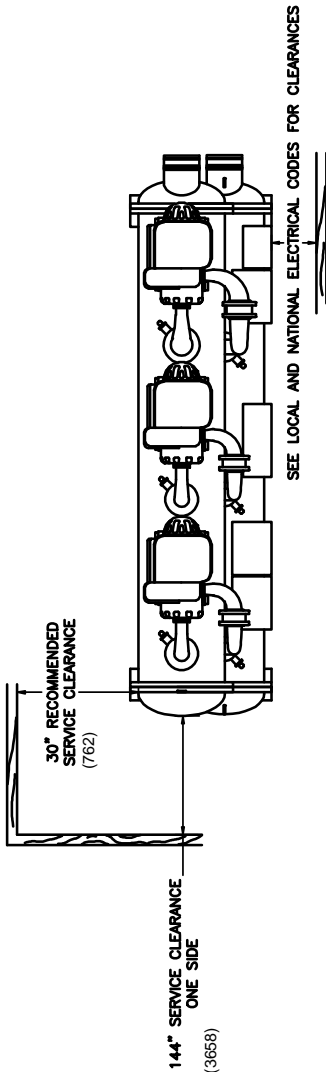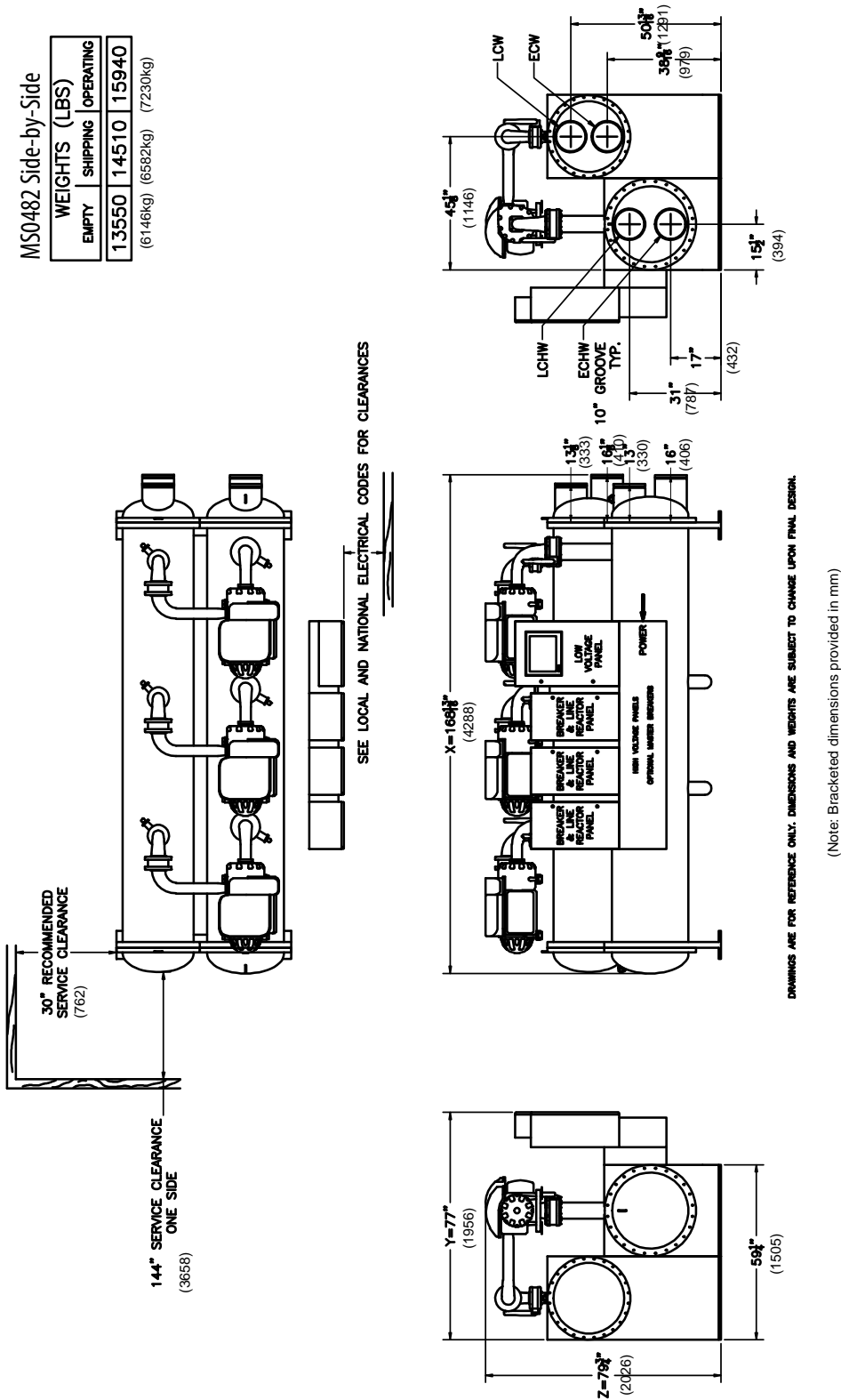(Note: Bracketed dimensions provided in mm)

MS0412 Side-by-Side

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
12070	12900	14090
(5475 kg)	(5851 kg)	(6391 kg)

LCW
ECW

49" (1260)
37⅝" (956)
41⅛" (1048)
14⅛" (359)
LCHW
ECHW
8" GROOVE TYP.
28" (711)
16½" (419)

12½" (318)
15½" (394)
12½" (318)
15⅝" (397)

X = 167¾" (4259)

LOW VOLTAGE PANEL
POWER
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
HIGH VOLTAGE PANEL
OPTIONAL WAFER BREAKERS

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

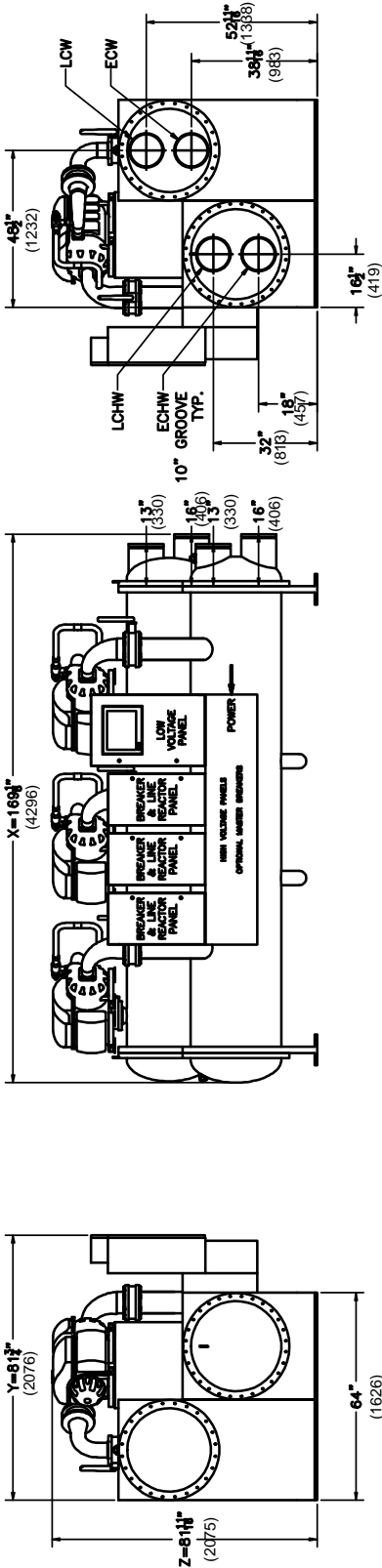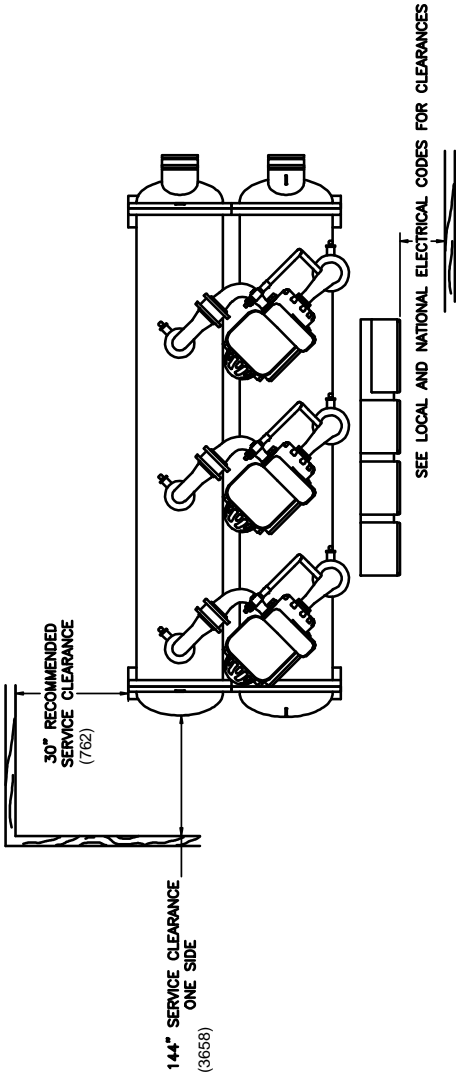30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

Y = 72" (1829)
54" (1378)
Z = 77¾" (1975)

25

MS0482

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
12320	13280	14710
(5588kg)	(6024kg)	(6672kg)

58⅜" (1483)
44⅜" (1127)
27" (686)
14⅛" (359)
24⅜" (618)
12⅛" (306)

LCHW
10" GROOVE TYP.
ECHW
LCW
ECW

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

X=168⅞" (4288)

13" (330)
16" (406)
13⅛" (333)
16⅛" (410)

POWER
HIGH VOLTAGE PANEL
OPTIONAL MAIN BREAKER
BREAKER & LINE REACTOR PANEL
DISPLAY PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL

Y=42½" (1080)
42½" (1080)
Z=94⅜" (2397)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
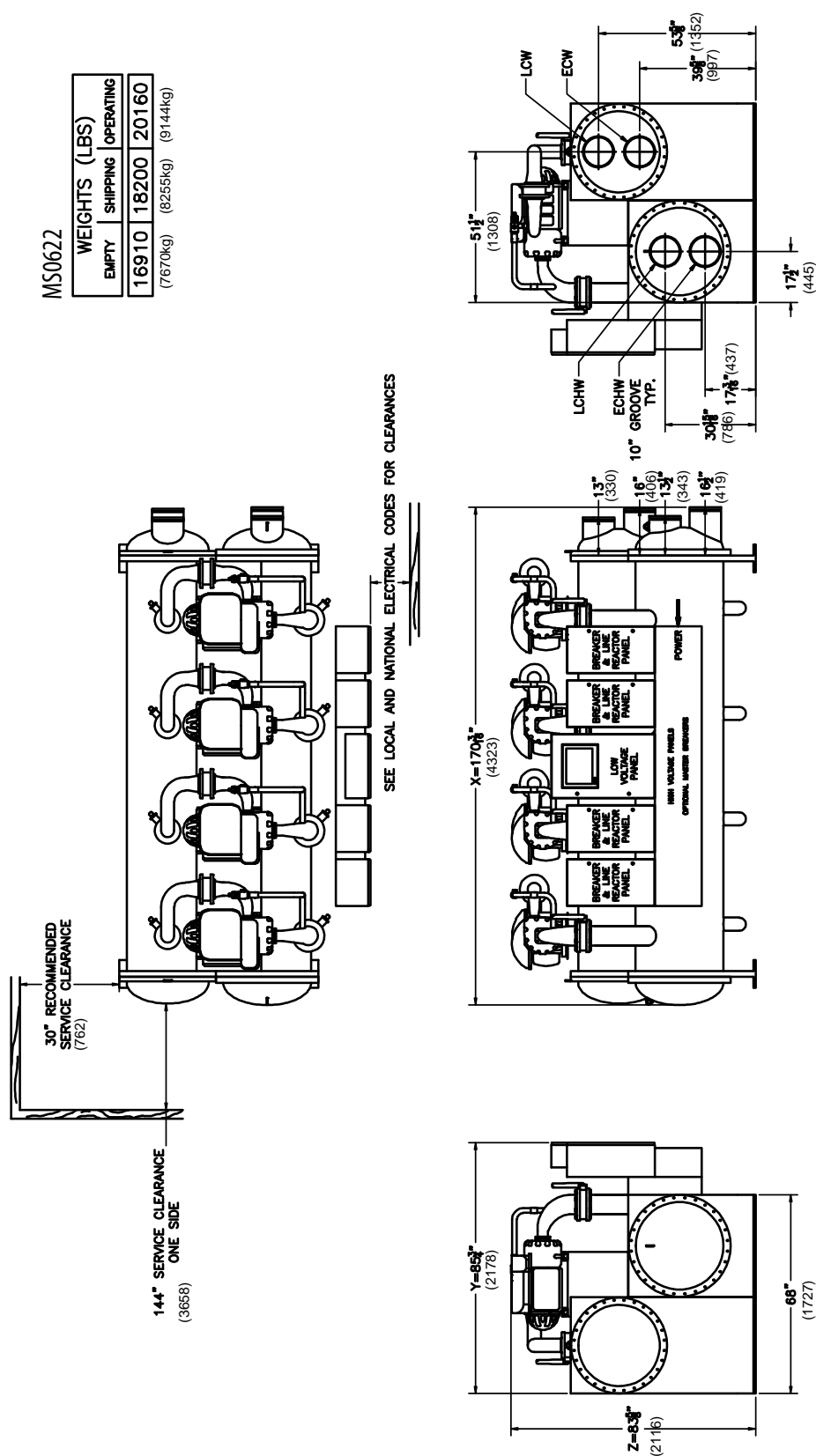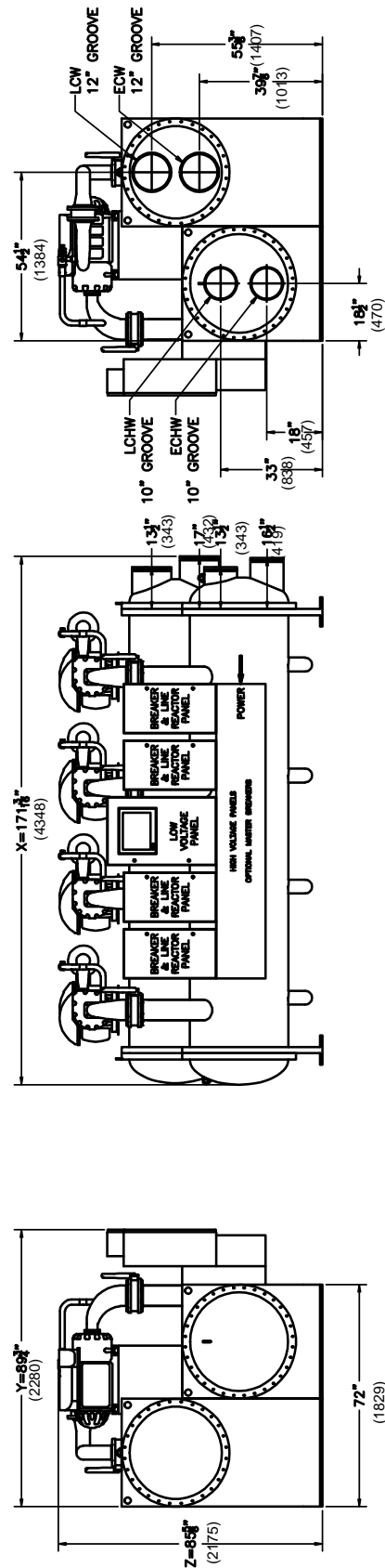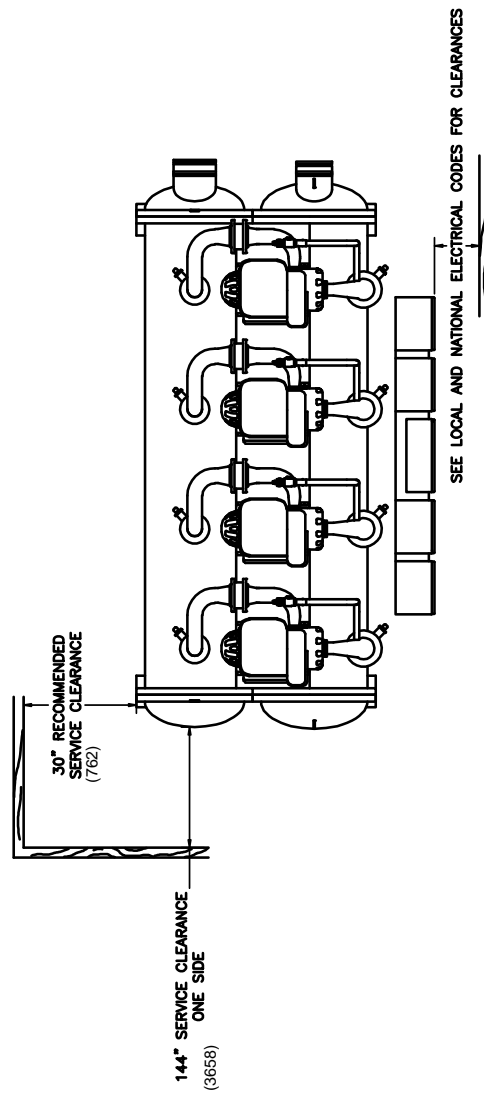(Note: Bracketed dimensions provided in mm)

MS0482 Side-by-Side

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
13550	14510	15940
(6146kg)	(6582kg)	(7230kg)

LCW
ECW
45" (1146)
LCHW
ECHW
10" GROOVE TYP.
50⅞" (1291)
38⅝" (979)
15½" (394)
31⅛" (787)
17" (432)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

13⅛" (333)
16½" (420)
13" (330)
16" (406)

X=168⅞" (4288)

LOW VOLTAGE PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
POWER
HIGH VOLTAGE PANELS OPTIONAL WHERE SHOWN

Y=77" (1956)
Z=79¾" (2026)
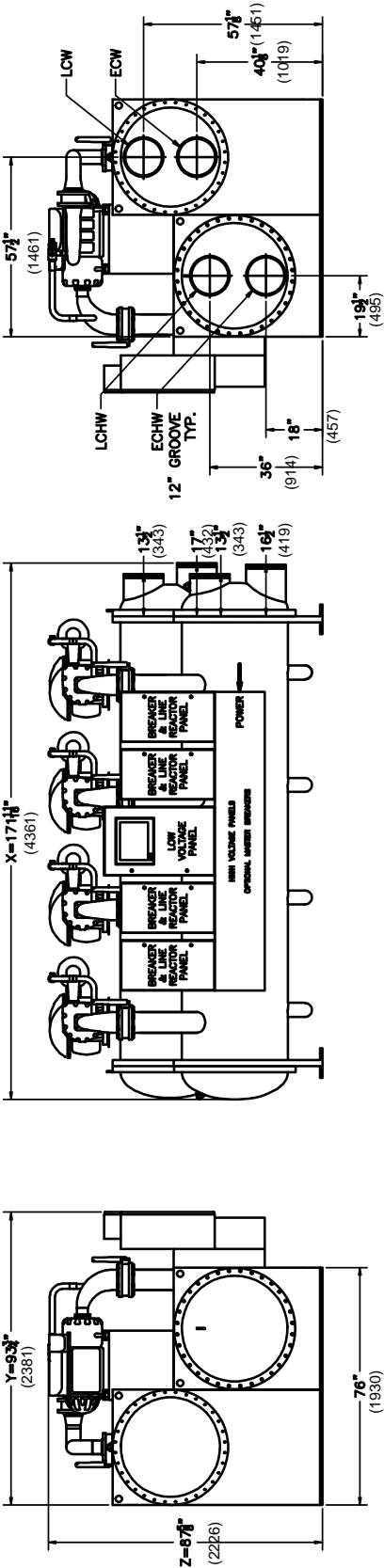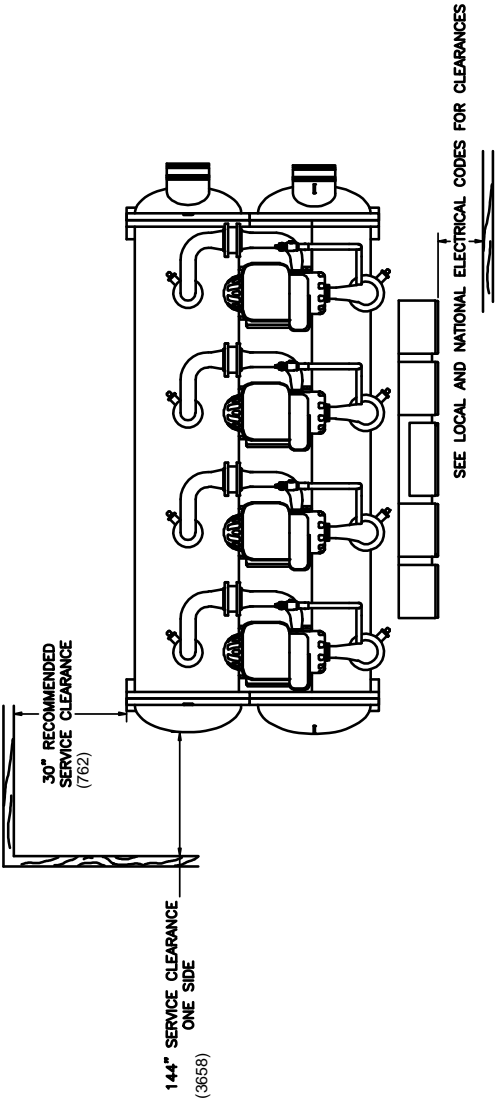59¼" (1505)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

MS0542

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
14820	15940	17660
(6722kg)	(7230kg)	(8010kg)

LCW
ECW
LCHW
ECHW
10" GROOVE TYP.

52¼" (1338)
38⅝" (983)
48" (1232)
16½" (419)
18" (457)
32" (813)

13" (330)
16" (406)
13" (330)
16" (406)

X=169⅛" (4296)

LOW VOLTAGE PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
POWER
HIGH VOLTAGE PANELS
OPTIONAL MARINE BREAKER

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

Y=81¾" (2076)
Z=81¾" (2075)
64" (1626)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
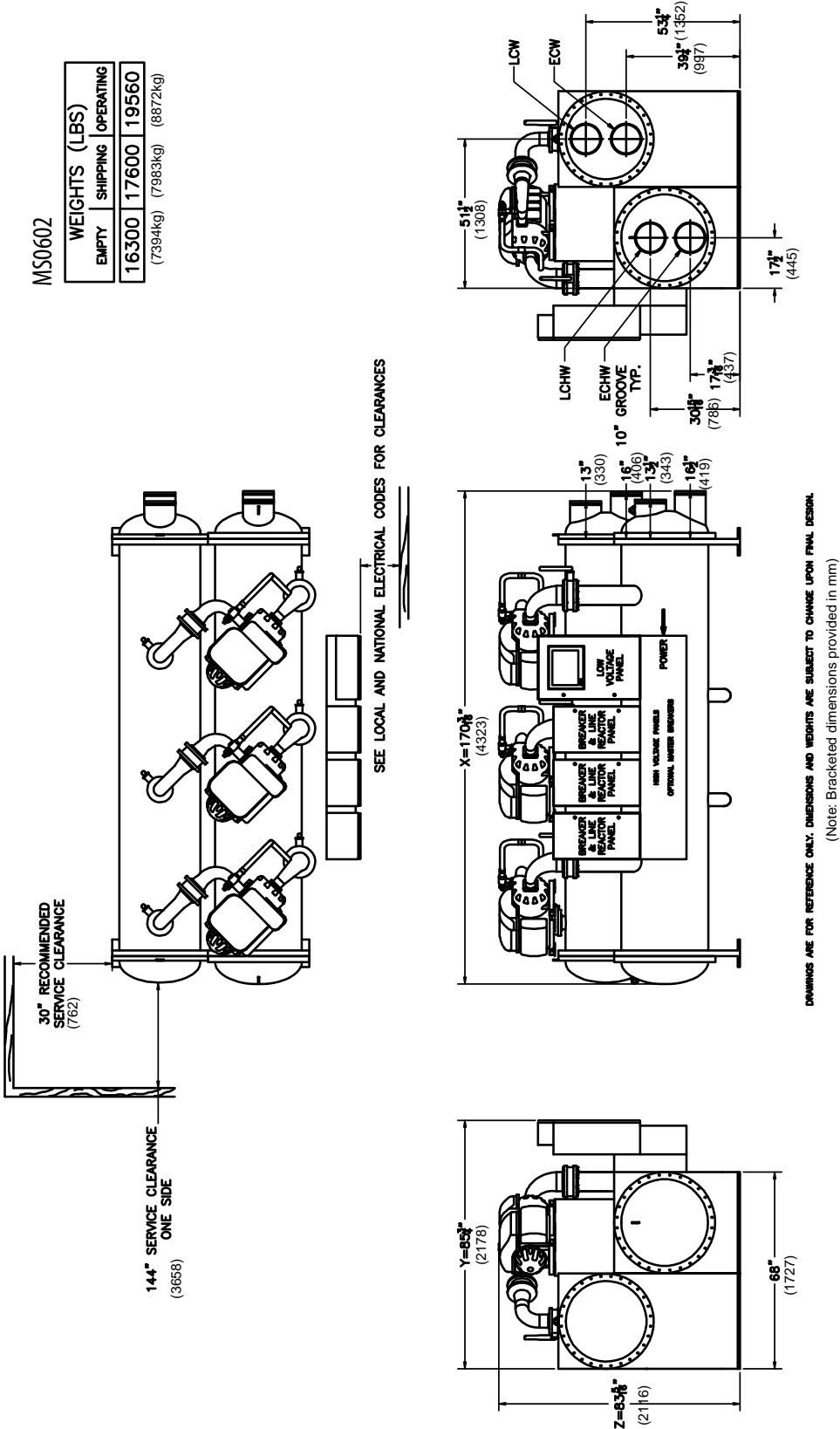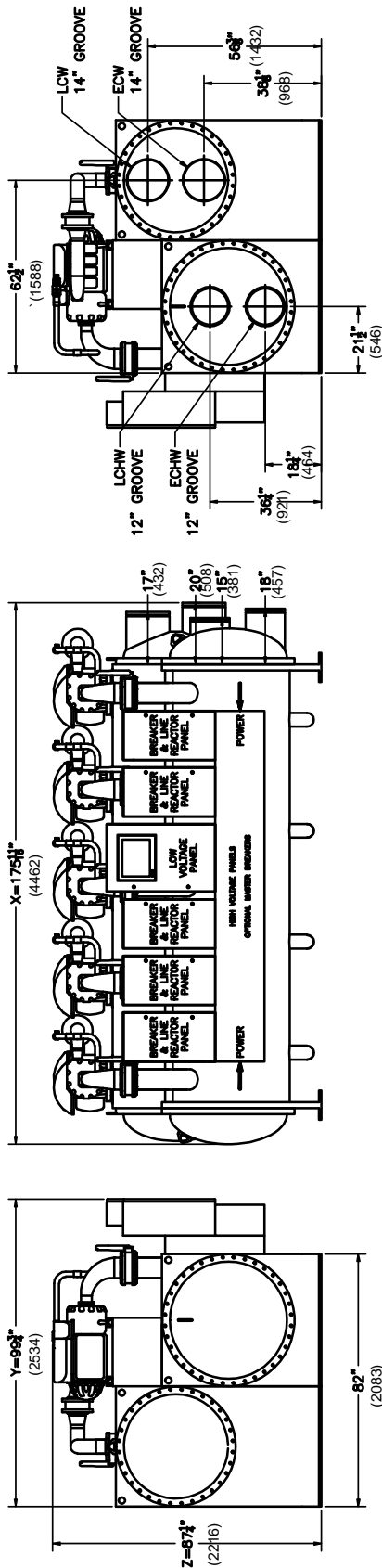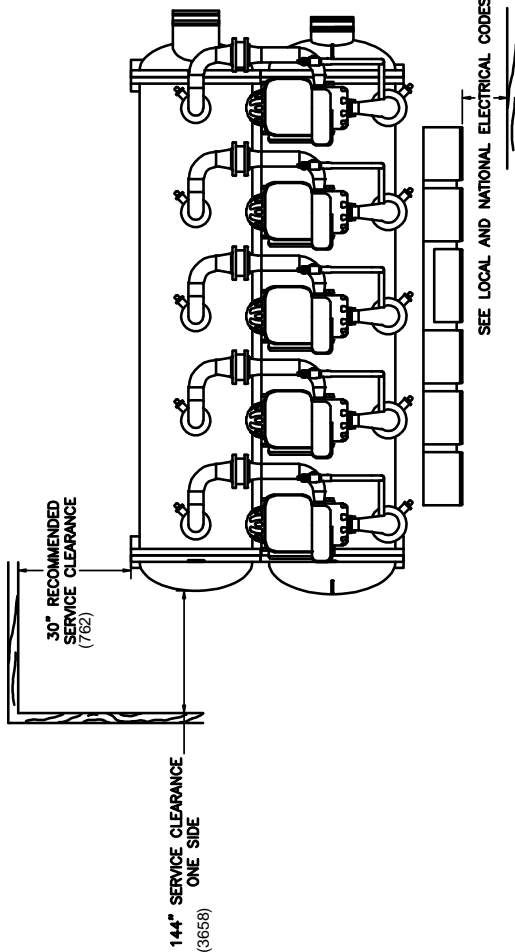
(Note: Bracketed dimensions provided in mm)

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
16300	17600	19560
(7394kg)	(7983kg)	(8872kg)

MS0602

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
(Note: Bracketed dimensions provided in mm)

MS0622

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
16910	18200	20160
(7670kg)	(8255kg)	(9144kg)

LCW
ECW

53⅜" (1152)
39⅜" (997)

51½" (1308)

17½" (445)

LCHW
ECHW
10" GROOVE TYP.

30⅞" (786) 17⅛"(437)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

13" (330)
16" (406)
13½" (343)
16½" (419)

BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL
BREAKER & LINE REACTOR PANEL

LOW VOLTAGE PANEL

POWER

HIGH VOLTAGE PANEL
OPTIONAL MAIN BREAKER

X=170⅛" (4323)

Y=85¾" (2178)

68" (1727)

Z=83⅜" (2116)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.

(Note: Bracketed dimensions provided in mm)

MS0702

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
18750	20240	22590
(8504kg)	(9181kg)	(10247kg)

LCW 12" GROOVE
ECW 12" GROOVE

LCHW 10" GROOVE
ECHW 10" GROOVE

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

BREAKER & LINE REACTOR PANEL
LOW VOLTAGE PANEL
HIGH VOLTAGE PANEL
OPTIONAL WATER SENSOR
POWER

X=171⅛" (4348)

Y=89¾" (2280)

72" (1829)

Z=85⅝" (2175)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
(Note: Bracketed dimensions provided in mm)

MS0802

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
20350	22070	24770
(9231kg)	(10011kg)	(11235kg)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
(Note: Bracketed dimensions provided in mm)

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

30" RECOMMENDED SERVICE CLEARANCE (762)

144" SERVICE CLEARANCE ONE SIDE (3658)

X=171 1/8" (4361)

Y=93 3/4" (2381)

Z=87 5/8" (2226)

76" (1930)

BREAKER & LINE REACTOR PANEL

LOW VOLTAGE PANEL

POWER

HIGH VOLTAGE PANEL OPTIONAL UNDER BREAKERS

13 1/2" (343)
17" (432)
13 1/2" (343)
16 1/2" (419)

57 1/8" (1451)
40 1/8" (1019)
57 1/2" (1461)
19 1/2" (495)
18" (457)
36" (914)
12" GROOVE TYP.

LCW
ECW
LCHW
ECHW

MS1002

WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
24060	26140	29460
(10913kg)	(11857kg)	(13363kg)

LCW 14" GROOVE
ECW 14" GROOVE
56⅜" (1432)
38⅛" (968)
62" (1588)
21½" (546)
LCHW 12" GROOVE
ECHW 12" GROOVE
36¼" (921)
18¼" (464)

17" (432)
20" (508)
15" (381)
18" (457)

X=175½" (4462)

BREAKER & LINE REACTOR PANEL
LOW VOLTAGE PANEL
HIGH VOLTAGE PANEL
OPTIONAL WATER BOXES
POWER

SEE LOCAL AND NATIONAL ELECTRICAL CODES FOR CLEARANCES

144" SERVICE CLEARANCE ONE SIDE (3658)

30" RECOMMENDED SERVICE CLEARANCE (762)

Y=99¾" (2534)

82" (2083)

Z=87¼" (2216)

DRAWINGS ARE FOR REFERENCE ONLY. DIMENSIONS AND WEIGHTS ARE SUBJECT TO CHANGE UPON FINAL DESIGN.
(Note: Bracketed dimensions provided in mm)

SECTION 15400 MECHANICAL WATER CHILLER WATER COOLED Multistack® MagLev™ CENTRIFUGAL CHILLER

PART 1- GENERAL

1.01 SUMMARY

Section includes design, performance criteria, refrigerants, controls, and installation requirements for Multistack water cooled centrifugal chillers.

1.02 REFERENCES

Comply with the following codes and standards:

ARI 550/590-2003

ANSI/ASHRAE 15

ASME Section VIII

NEC

ETL Listed

CSA Approved

1.03 SUBMITTALS

Submittals shall include the following:

A. Chiller dimensional drawings with elevation overview. Drawings to include required service clearances, location of all field installed piping and electrical connections.

B. A summary of all auxiliary utility requirements for normal system operation required. Auxiliary utility requirements include: electrical, water, and air. Summary of auxiliary equipment shall include quantity and quality of each specific auxiliary utility required.

C. Chiller Control documentation to include: Chiller control hardware layout, wiring diagrams depicting factory installed wiring, field installed wiring with points of connection, and points of connection for BAS control/interface points.

D. Sequence of operation depicting overview of control logic used

E. Installation and Operating Manuals.

F. Manufacturer certified performance data at full load in addition to either IPLV or NPLV.

1.04 QUALITY ASSURANCE

A. Regulatory Requirements: Comply with the codes and standards as defined in Section 1.02 titled REFERENCES

B. Chiller is required to be run tested at manufacturer's facility on an AHRI Certified test stand prior to shipment. Report available upon request.

1.05 DELIVERY and HANDLING

A1. Chillers shall be delivered to the job site completely assembled and charged with complete refrigerant charge.

<div align="center">OR</div>

A2. OPTIONAL: Chiller shall be delivered "knocked down". When "knocked down", chiller to arrive from factory with compressors, control panels, and necessary refrigerant components on skids for reassembly by installing contractor. Knockdown chiller will be delivered with nitrogen charge.

B. Installing contractor to comply with the manufacturer's instructions for transporting, rigging, and assembly of chiller.

1.06 WARRANTY

A. The manufacturer's parts only warranty shall be for a period of:
    (1) One year from date of equipment start up or 18 months from the date of shipment, whichever occurs first.

B. Extended warranty on parts and labor available by request.

1.07 MAINTENANCE

A. Maintenance of the chiller shall be the sole responsibility of the owner.

PART 2 - PRODUCTS

2.01 ACCEPTABLE MANUFACTURERS

A. Multistack LLC

2.02 PRODUCT DESCRIPTION

A. Provide and install as shown on the plans a factory assembled, charged, and run tested, water-cooled chiller.

B. Each unit shall include: One or more MagLev®, oil-free, magnetic bearing, variable speed two stage centrifugal compressor equipped with inlet guide vanes. Each compressor to utilize its own, stepper controlled load balance valve. Solenoids for load balancing will not be accepted. Each compressor to utilize its integrated variable speed drive in conjunction with the compressors inlet guide vanes and load balance valve, to optimize the chillers part load efficiency.

C. The chillers evaporator, condenser, and electronic expansion valves shall be common to all compressors. The chiller shall operate with (1) one refrigerant circuit.

D. Chiller shall utilize R-134A refrigerant only.

2.03 DESIGN REQUIREMENTS

A. Provide a complete factory assembled or knocked down water cooled, oil free centrifugal chiller equipped with MagLev® compressors as specified herein. Chiller to be built in accordance to the standards defined in Section 1.02 of this specification.

B. Chillers to utilize one of the following compressor arrangements for the specified nominal tonnages:
    •   Combination of TT300, TT350, TT400, and TT500 compressors
    •   Mismatching of compressor models is permitted to optimize full load efficiency and total chiller turn down

C. Each chiller shall be equipped with the following: One (1) flooded evaporator heat exchanger, one (1) water cooled condenser heat exchanger, one (1) or more MagLev® Compressors (refer to section 2.03 B) with integrated variable speed drive, soft start, magnetic bearings, and inlet guide vanes, one (1) or more electronic expansion valves, one (1) liquid level refrigerant sensor monitoring condenser level, one (1) load balance valve per compressor, one (1) master chiller control with necessary operating controls and system safeties.

D. Chiller Performance: Refer to performance schedule on the job specific drawings.

E. Unloading: When utilizing MagLev® model TT-300 compressor, the chiller shall be capable of unloading to 15 tons. When using a MagLev® TT-350 compressor, chiller shall be capable of unloading to 25 tons. When using a MagLev® TT-400 compressor, chiller shall be capable of unloading to 35 tons. When using a MagLev® TT-500 compressor, chiller shall be capable of unloading to 50 tons. All unloaded capacity values are without the use of traditional hot gas bypass or load balance valves.

F. Loading: Chiller shall be able to stage compressor(s) without drastically unloading compressors on-line or creating check valve chatter on staged compressors. Total pressure ratio shall not be decreased below 2.4 pressure ratio as observed at the suction and discharge flanges of each individual compressor when staging lag compressors.

G. Acoustics: Sound data shall be measured in accordance with ARI 575-87 Standard. Unit sound performance data shall be measured at the highest level recorded at all load points. Unit sound performance shall not exceed a level of 70 DBA measured at a distance of five (5) feet.

H. Electrical: Chiller shall feature single-point power connection not utilizing adjoining power cabinets as pull boxes. If over 800 amps, two points of power is required. The10K SECR Rating is standard, however, higher is available.

I. Minimum Operating Conditions: Lowest evaporator saturated suction temperature shall not be below 34F. Lowest leaving chilled water temperature shall not be below 36F. Lowest entering condenser water temperature shall not drop below 55F. A differential of 12F between the leaving chilled water temperature and entering condenser water temperature is required to ensure chiller can maintain minimum lift requirements.

2.04 CHILLER COMPONENTS

A. Compressors:

1. Chiller to have one or more MagLev®, magnetic bearing, oil-free, two-stage, centrifugal compressor(s). Each compressor to contain integrated variable speed drive with soft start, movable inlet guide vane assembly, and weigh no more than 300 lbs.

2. Each compressor to be microprocessor controlled. Each compressor to be networked to master controller to control the variable speed drive and inlet guide vanes on each compressor to maximize unit efficiency.

3. Each compressor shall be capable of coming to a controlled safe stop in the event of a power outage. Unit shall be capable of auto restart in the event of a power outage, once power has been restored.

4. All compressors are required to be mechanically and electrically isolated to facilitate proper maintenance, service, and or removal

5. Each compressor shall be equipped with a minimum anti-recycle time of 5 minutes if power electronics are too warm before being allowed to restart.

6. Minimum restart time of a compressor, without a UPS, from power down till drive line is rotating shall not exceed 3 minutes.

Mechanical Specification, Cont'd

B. Refrigerant, Evaporator and Condenser:

1. All heat exchangers to be built in accordance to Section VIII of the ASME code and carry a manufacturer's name plate certifying ASME compliance.

2. The evaporator to be of shell and tube construction. Evaporator to be constructed of a single shell. Evaporator to be of flooded type with refrigerant surrounding the tubes and water passing through the tubes. Tubes to be enhanced and rifled. Minimum tube velocity of two (2) feet per second required. Design to not exceed a maximum tube velocity of nine (9) feet per second. Internal intermediate tube supports, liquid eliminator baffle plate, pressure relief vent, water drains and vents required. Pressure relief to be spring loaded self seating type in accordance to ASHRAE 15 standard. Evaporator to be pressure tested at a test pressure of 1.1 times the operating pressure however no less than 100 Psig. Evaporator, water boxes, suction piping, and any other component subject to condensate shall be insulated with a UL recognized ¾ inch or 1 ½" closed cell insulation. All joints and seams to be sealed so a vapor barrier is created. Factory mounted & wired thermal dispersion switch required for flow safety. Evaporator shall be able to hold entire unit charge as required for machine service. Evaporator capable of forty-five (45) percent rate of change per minute on water side and maintain stable operation without dropping compressors offline.

3. The condenser to be of shell and tube construction. Condenser to be constructed of a single shell. Condenser to be water cooled type with refrigerant surrounding the tubes and water passing through the tubes. Tubes to be enhanced and rifled. Minimum tube velocity of two (2) feet per second required. Design to not exceed a maximum tube velocity of nine (9) feet per second. Internal intermediate tube supports, pressure relief tree with isolation valves, water drain and vents required. Pressure relief tree to be equipped with isolation/transfer valve to prevent the loss of refrigerant when relief is removed for testing and or replacement. Rupture disks are not acceptable. Condenser to be pressure tested at a test pressure of 1.1 times the operating pressure however no less than 100 Psig. Factory mounted & wired thermal dispersion switch required for flow safety. Condenser shall be able to hold entire unit charge as required for machine service. Condenser capable of forty-five (45) percent rate of change per minute on water side and maintain stable operation without dropping compressors offline.

4. Heat Exchangers to feature enhanced and rifled individual tubes. Tubes shall be individually replaceable. Tubes shall be mechanically rolled into steel tube sheets and sealed with Loctite® or equivalent sealant. Tubes shall be supported by intermediate tube supports at a maximum spacing of 18" apart. Waterside to be designed to a minimum of 150 Psig, 300 Psig, or 450 Psig whichever is specified. Heat exchangers to be equipped with either dished heads or marine water boxes with drain and vent reports, whichever is specified. Piping connections are mechanical grooved connections.

5. Refrigerant Control: Chiller to feature a minimum of one (1) electronic expansion valves with a minimum step count of 480 to full open and a fully closed transit time of less than ten (10) seconds to prevent refrigerant migration. Additional valves to be added as chiller capacity dictates. Fixed orifices and float controls are not acceptable. The electronic expansion valve to operate from minimum chiller capacity to the full load of the chiller's capacity. A high side refrigerant level sensor, is to be used to provide feedback to the expansion valves for proper control. This ensures that a proper liquid seal is always present on the compressors power electronics. A refrigerant sight glass is required on the main liquid line feeding the electronic expansion valves. Isolation valves required to isolate charge in either the condenser or evaporator.

C. Prime Mover:

1. The prime mover shall be of sufficient size to effectively meet the compressor horsepower requirements. Prime mover shall be a one or more liquid refrigerant cooled, sealed, permanent magnet synchronous motor. Motor shall be controlled by variable speed drive. Motor shall utilize soft start capabilities with an inrush current no greater than two (2) amps. Motor shall have internal thermal overload protection devices embedded in the winding of each phase of the motor.

D. Variable Speed Drive:

1. Each compressor shall be equipped with an integral, variable speed drive. Please refer to section 2.03 B for compressor requirements. The variable speed drive to utilize Insulated Gate Bi-Polar Transistors. Variable speed drive to create it's own simulated AC voltage for the motor connected to it. Acceptable applied voltages are: 400 Volt 50 hertz, 460 Volt 60 hertz, and 575 volt 60 hertz. 575 volt applicable to TT-300 and TT-400 only.

2. Variable Speed drive in conjunction with the compressors inlet guide vanes will be controlled via compressor microprocessor to optimally match the lift and load requirements.

3. Each compressor circuit is required to have a line reactor and circuit breaker.

E. Chiller Controls

The unit shall have an industrial grade cpu with an Intel-based processor. All chiller and compressor I/O to be controlled via Etherbus with an update rate of 50 microseconds. Controller to have 15 inch TFT touch screen interface that can be disconnected and chillers still runs properly. Controller to use natural progression control algorithms which properly define the compressors operating range to optimize loading, unloading, and control of multiple MagLev compressors. User shall operate chiller via HMI located on touch screen or remote web connection. All system parameters, compressor status, alarms, and faults, trend graphing, fault logging, bas communication window, manuals, wiring diagrams, log book, and control set points shall be viewable. Shall be able to fully commission and adjust all components on the chiller, including the compressors without an auxiliary computer or software.

The chiller controller shall include the necessary I/O for proper chiller operation including:

Hardware

- Dedicated EXV Output for each liquid level EXV of Economizer Valve
- Chiller LP Safety input
- Chiller HP Safety input
- Chilled Water Safety input
- Condenser Water Safety input
- Emergency Stop input
- Chilled Water Reset input
- Load Limit input
- Tower Setpoint output
- Chiller kW output
- Chiller Amps output
- Condenser Water Bypass Valve output
- Chiller Run Contact output
- Chiller Fault output
- Compressor Lockout Fault Status output
- Dedicated Compressor Enable output (no relay or paralleled signal)
- Dedicated Economizer Enable output (no relay or paralleled signal)
- Chilled Water In and Out Temperatures
- Condenser Water In and Out Temperatures
- Liquid Line Temperature
- Dedicated RS-485 communication to each compressor (no daisy chaining)
- Dedicated RS-232 communication to each compressor
- Windows-based industrial PC featuring Intel Processor for maximum reliability and performance.
- Solid State hard drive for maximum reliability and redundancy. Hard drive features no moving parts to ensure nothing mechanically fails. With dual-hard drives there is no need to partition a single drive. One drive handles the operating system while the other handles all data acquisition to ensure no data is corrupted.
- DC Powered to ensure maximum resistance to EMI and RFI noise
- Built in 2-port Ethernet Switch for easy integration to BAS interface and web control feature.
- Integrated 5 second UPS to allow data to write to drives before power shut off
- On board USB drives to support external peripheral devices including, keyboard, mouse, and printer
- 15 "TFT Touchscreen Display featuring 1024 X 768 Resolution.
- All hardware, including I/O is CE and UL Certified
- I/O features modular design to simplify troubleshooting and or replacement if required.
- I/O has LED Indicators for all inputs and outputs to ease the troubleshooting process.
- All wiring utilizes spring capture technology to prevent loose connections or wires from falling out.
- Optional auxiliary device expansion hub for control of pumps, towers, etc
- BAS Interfaces include:
    - Modbus RTU standard
    - Modbus TCP/IP standard
    - BAC Net IP (optional)
    - BAC Net TCP/IP (optional)
    - BACNET MSTP (optional)
    - Lonworks (optional)

Mechanical Specification, Cont'd

Software

- Can control one (1) to five (5) compressors on single or multiple refrigerant circuits
- Control System can control up to six (6) exv's with proper hardware and network all exv's to the control system
- Only control system on the market with the capability of controlling different size compressors for maximum efficiency and turn down
- HMI interface allows the user the following options: definable points list, tag names, and functions without special software. With this feature, end user can scale an all inputs and outputs, change what controls it, change the functionality, the name of it etc.
- Control system can trend graph up to two (2) years of data, without overwriting or decreasing data acquisition time
- Chiller controller has the Danfoss Turbocor Compressor Software on board. This allows for the service tech to troubleshoot remotely.
- Control System features easy to use web interface. This allows the user to do anything remotely that could be done in front of the chiller.
- Most advanced trend graphing available on the market. Over 200 data points are recorded in five (5) second intervals. Data can be analyzed with zoom feature. Data stored on separate 32 GB drive. Trend graph images can be exported.
- Advanced Fault Logging featuring calendar capability for ease of use. Data can be recalled up to two (2) years. Data can be sorted by alarm type, time stamp, or compressor
- Color coded data. Green data means good, yellow means alarm, red means fault or off
- Controller logs when user makes any type of change
- Controller is loaded with all manuals, wiring diagrams, and supporting data which can be recalled via touch screen
- Controller has onboard maintenance log to store system information
- Controller offers real time capacity and efficiency data
- BAS interface dashboard shown on HMI. This allows the user to view what data is being written to the BAS system. Also shows if there is an error, last com, and how many times the data was sent or received.
- Control system uses proprietary natural progression control algorithms to perform accurate energy balance on all systems for maximum system performance.
- Control System features an optimum start function to ensure initial lift is always made. This prevents nuisance check valve flutter and compressor faults.

2.05 OPTIONS

The following items are deemed optional and available upon request:

Heat Exchangers-

- Heat exchanger designed for 300 PSI
- Marine water boxes, hinged marine water boxes or flanged
- Epoxy Coating available on tube sheets and/or heads
- Insulation, 1 ½ Closed Cell Foam
- PVC, Metal Jacket to cover insulation
- Multiple pass configurations to meet water side design criteria
- Heat exchanger lengths

Electrical-

- Chiller Disconnect
- EMI noise filtration to meet IEE 519 standards

Warranties-

- Compressor warranties available by request.
- Chiller extended and parts, labor and refrigeration warranties available by request.

Other

- Lifting Frame
- Vibration Isolation

PART 3- EXECUTION

3.01 INSTALLATION

A. Chiller must be installed per all of the manufacturer's documentation. This includes: IOM Manual, Submittal documentation, CAD Drawings, other.

B. All local structural codes must be observed.

C. All local plumbing codes must be observed. Piping must be run in such a way that the proper required clearances for head removal for tube cleaning are observed.

D. All National and Local Electrical codes must be observed. Installation of the electrical on the chiller must follow the associated documentation from the chiller manufacturer. Electrical installation shall be coordinated with electrical contractor.

E. All National and Local Electrical codes must be observed. Controls installation shall be coordinated with the controls contractor.

F. Provide all material required for a fully operational and functional chiller.

3.02 START-UP

A. Units shall be factory charged with R-134a refrigerant unless unit is knocked down.

B. Factory Start-Up Services: An authorized factory start agent is required. At minimum, (2) two days shall be spent on-site to ensure proper unit operation.

C. During the start up period, the factory authorized agent will instruct the owner's representative on proper care and operation of the chiller.

Originators. Innovators. Never the Imitators._{SM}

Originators…

Multistack invented the modular water chiller. It started with a radically simple idea: chiller modules that could be brought into the equipment room one at a time, through standard doorways and down elevators, to form a fully integrated chiller system. The idea launched a revolution and transformed Multistack into a leader in the commercial water-chiller industry.

Innovators…

Multistack perfected the modular chiller and leads the industry in innovative and environmentally friendly modular solutions. Since founding in the late 1980s, Multistack has engineered, manufactured, and distributed an impressive array of modular air conditioning firsts: the first on-board strainer, the first modular automatic blow-down device, the first modular chiller for variable flow, the first modular chiller-heater (heat pump), the first modular heat-recovery chiller, the first modular air-to-water heat pump, the first modular chiller to utilize MagLev™ compressor technology, and the first modular chiller to utilize R-410A.

Never the Imitators…

Multistack sets the standard in the industry for superior customer service, fast and on time shipment, superior product quality, and new product development. Our pioneering leadership in environmental issues is well documented. If you want the best, be sure to specify the original – Multistack®.

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