



Job Name VA Mare Island Option 1  
Location San Jose, CA  
Engineer \_\_\_\_\_  
Contractor \_\_\_\_\_

Job Number \_\_\_\_\_  
Quote Number QSGONDOLA10142014-1  
Representative Scott Gainer  
Rep Office San Jose

## Performance Data

Chiller Model Number	Frame Type	Rated Capacity
MS5082FC1F4W4H1AA88FF-R134A	Frame 1 1 TT-300	75.0

PERFORMANCE DATA										
				Evaporator			Condenser			
Load	Capacity	kW	kW/ton	Flow Rate (GPM)	Entering °F	ΔP (PSI)	Flow Rate (GPM)	Entering °F	Leaving °F	ΔP (PSI)
100%	75.0	42.9	0.571	113	60.0	1.9	209	80.0	90.0	4.9
90%	67.5	34.4	0.509	113	58.4	1.9	209	77.0	85.9	4.9
80%	60.0	27.3	0.456	113	56.8	1.9	209	74.0	81.8	4.9
75%	56.3	24.2	0.429	113	56.0	1.9	209	72.5	79.8	4.9
70%	52.5	20.9	0.399	113	55.2	1.9	209	71.0	77.7	4.9
60%	45.0	15.9	0.352	113	53.6	1.9	209	68.0	73.7	4.9
50%	37.5	11.7	0.313	113	52.0	1.9	209	65.0	69.7	4.9
40%	30.0	9.3	0.311	113	50.4	1.9	209	65.0	68.8	4.9
30%	22.5	7.1	0.316	113	48.8	1.9	209	65.0	67.8	4.9
25%	18.8	6.5	0.344	113	48.0	1.9	209	65.0	67.4	4.9
20%	15.0	5.4	0.358	113	47.2	1.9	209	65.0	66.9	4.9
10%										

With Tower Relief (per AHRI 550/590)

NPLV

0.359

The 20, 25 % points have incorporated a cycling penalty per 550/590.

EVAPORATOR DESIGN DATA (Based on Water)	
Entering Temperature	60
Leaving Temperature	44
Design Flow	112.5
Design Pressure Drop	1.870 PSI / 4.320 ft
Minimum Flow	70
Minimum Pressure Drop	0.720 PSI / 1.663 ft
Number of Passes	4
Tube Type	3/4 diameter 0.025" Copper Enhanced
Fouling Factor	0.0001
Connection Size	4"
Connection Type	Grooved Coupling
Head Style	Dish
Head Mounting	Inlet: Right Outlet: Right

CONDENSER DESIGN DATA (Based on Water)	
Entering Temperature	80
Leaving Temperature	90
Design Flow	208.8
Design Pressure Drop	4.910 PSI / 11.342 ft
Minimum Flow	90
Minimum Pressure Drop	0.920 PSI / 2.125 ft
Number of Passes	4
Tube Type	3/4 diameter 0.025" Copper Enhanced
Fouling Factor	0.00025
Connection Size	4"
Connection Type	Grooved Coupling
Head Style	Dish
Head Mounting	Inlet: Right Outlet: Right

PHYSICAL DATA	
* Length (Shell Only)	72"
Width	34"
Height	77.6875"
Estimated Shipping Weight	5130 lbs
Estimated Operating Weight	5430 lbs
Refrigerant Type	R-134A
Refrigerant Charge	197 lbs
Shell Configuration	Stacked

ELECTRICAL DATA	
Voltage	460-60-3
Power Input	42.86
Compressor(s) RLA	77
MCA	97
MOP	125

For MCA's of 380 or higher, parallel feeds required

Version #: 1.0.4435.38055

\* See Head drawing for additional length for the heads

Certified in accordance with the AHRI Water-Cooled Water Chilling Packages Using Vapor Compression Cycle Certification Program, which is based on AHRI Standard 550/590 (I-P). Certified units may be found in the AHRI Directory at [www.ahridirectory.org](http://www.ahridirectory.org)



**Product Overview:**

Chiller Quantity	Chiller Description	Multistack Model #
1	MagLev™ Water Cooled, Oil-Free Flooded Centrifugal	MS5082FC1F4W4H1AA88FF-R134A

The following items are included by Multistack:

**Compressors:**

- 1 TT-300 Oil-free Centrifugal Compressors featuring:
  - Integrated Refrigerant Cooled Variable Speed Drive w/Soft Start
  - Micro processor controlled magnetic Bearing System
  - Direct Drive Rotating Assembly
  - Environmentally friendly R-134A Refrigerant

**Electrical:**

- Phase Power Input 460-60-3
- Chillers listed with ETL per UL 1995
- High Voltage Electrical enclosures carry NEMA 1 rating
- Single Point of Connection for High Voltage Electrical, optional unit mounted disconnect
- 24 VDC control power supply built in. Optional UPS
- Each Compressor contains its own:
  - high voltage breaker
  - fast acting fuses
  - line reactor
  - line reactor cooling fan

**Heat Exchangers:**

- ASME certified horizontal shell & tube heat exchanger
- Maximum water side working pressure for evaporator: 145 PSI (optional higher rated shells available)
- Maximum refrigerant side working pressure for evaporator: 180 PSI (optional higher rated shells available)
- Water Side Connections featuring groove type mechanical connections
- 3/4" diameter, enhanced & rifled copper tubes with standard tube sheets.
- Tube sheets are supported & baffled to prevent tube damage.
- Evaporator insulated with 3/4" Closed Cell Foam Insulation
- Epoxy coated tube sheet on condenser standard, (option is available for evaporator)
- Factory installed temperature sensor wells
- Factory installed chilled water and condenser water flow safeties, (optional differential pressure sensors)
- Dual 3/4 @ 28.9 lbs/ChillerMaxMinCapacity Reliefs w/Isolation Tree (ASHRAE 15 Calculated Min=18.7 lbs/Min Evap, 16 lbs/Min Cond)

**Refrigerant Components:**

- Electronic Expansion Valve/s controlled by dedicated outputs via the FlexSys Control System
- Condenser mounted refrigerant level sensor with digital display
- Built in sight glass on evaporator and condenser shells to confirm refrigerant charge
- Load Balance Valves on all compressors to optimize compressor staging, unloading, and operating range of each compressor.
- Optional refrigerant side economizer for improved energy efficiency and an increase in chiller capacity
- Each compressor equipped with swing check to prevent anti-rotation
- Each Compressor can be isolated thru service valves for service while other compressors run
- Refrigerant service valves standard, which allow for refrigerant charge to be isolated in one shell while other is serviced
- Large, 3/8 port charging/recovery ports standard

**FlexSys Control System featuring:**

- 15" TFT touch screen featuring a resolution of 1024 x 768.
- Touch Screen can be disconnected & chiller will still operate as processor is completely separate from touch screen
- Real Time, Intel equipped CPU based control system featuring dual flash drives for maximum reliability.
- Windows Standard Embedded OS
- CPU is equipped with a battery backup & internal 5 second UPS
- Compressors controlled thru Multistack's proprietary natural progression control algorithms that define the proper operating range for the compressors to run in for maximum reliability while optimizing energy efficiency.
- FlexSys utilizes a one to one control concept for compressor control. What this means is the processor talks to each compressor individually versus relying on a daisy chain network. This speeds up the communication, improves reliability, and allows for each compressor to run with it's own unique demand signal. This allows each compressor to run in its own sweet spot to maximize energy efficiency. Studies have shown that this feature alone is able to save 3 to 5 kw, per compressor over the next leading chiller control.
- Industry leading trend graphing. Data captured in 5 second intervals. Data is saved daily to external thumb drive and can be broken down in intervals of: seconds, minutes, 10 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 12 hours, or full day. Trend graphing includes zoom feature. Trend graphing also includes all hardwired inputs and outputs so there is never again any guess work on what the chiller is doing.
- Advanced Fault capturing with calendar recall and color coding. Red for fault, Yellow for alarm, and green for good
- Chiller control features settings recall feature that allows you to tune the chiller to your own load requirements or default to factory settings.
- Chiller can respond to flow rate of change of X % per minute (needs to be confirmed during testing) and maintain stable operation.
- Danfoss Turbocor Monitoring Software on board (no need for a separate laptop)
- Web Control feature Standard on all FlexSys Control Systems. This allows the user to mirror the chiller control exactly as if they were standing in front of it. App support for iphone®, ipad®, android®, and desktop applications.
- Chiller Dashboard has 20 user configurable fields that allows the operator to customize the information they want to see
- Chiller controls a 3-way condenser water valve as a standard to help with inverted start conditions
- Chiller provides a tower output signal that provides a recommended setpoint for entering condenser water
- Standard I/O points include: external chilled water reset, external load limit, chiller kw, chiller amps, condenser 3-way valve control, tower setpoint, chilled & condenser water flow safeties, chilled water in & out and condenser water in & out temperatures, liquid line temp, chiller fault, chiller run, and a contact for any compressor in a fault condition.
- Built in modbus server for tcp/ip or rtu communication. Communication for BacNET or Lon is achieved thru an optional gateway.
- Optional I/O expansion hub available in two sizes: small or large. Customer can select one or the other which allows for up to 17 pre-configured control features such as: chilled water valve control, pump control, tower control, and more.

**Other Services & Special Features:**

- BAS Communication Module: BACNET IP
- Vibration Isolation (Neoprene waffle pads)
- Evaporator Standard Heat Exchanger (150 PSI)
- Condenser Standard Heat Exchanger (150 PSI)
- 4 Pass Evaporator
- 4 Pass Condenser
- Refrigerant (134-A)
- ¾" Insulation (Evaporator)
- 10kA SCCR
- Chiller to ship charged unless otherwise specified
- Factory Run Test Included
- Freight Included
- Factory Start Up Included
- Warranty: Compressor (5 Year)
- Warranty: All Parts (1 Year)

**Control Options:****Excluded By Multistack**

- Any Travel and Diagnosis for Warranties
- Refrigerant Monitoring Equipment as governed by ASHRAE 15 standard
- Rigging
- Sound Test
- Vibration Isolation
- Seismic Provisions including: Seismic Testing & Certification
- Couplings for Water Connections
- Pressure Relief Piping
- Multistack recommends a 2-3 minute minimum loop time. Contact Multistack if you have questions regarding system loop time design
- 1-1/2" Insulation (Evaporator)
- ¾" Insulation (Condenser)
- 1-1/2" Insulation (Condenser)
- Main Power Door Interlock Disconnect Switch

## **Component Specification- FLEXSYS Control System:**

MagLev Centrifugal Chillers are equipped with an industrial grade CPU based controls system called FlexSys. Flexsys features an Intel™ based processor. All chiller & compressor I/O is controlled via EtherCAT. With EtherCAT, FLEXSYS controls update at a rate of 50 microseconds.

The FlexSys Controller features a 15 TFT inch touch screen interface that can be disconnected & the chiller will still run. This is because the processor is not built into the screen like other control systems. The FlexSys Controller uses proprietary control logic to control the chiller thru the use of its natural progression control algorithms. These algorithms define the proper operating range for the compressors to run in for maximum reliability while optimizing energy efficiency

The end user is able to operate chiller via the HMI located on chiller's touch screen or via remote web connection. All system parameters including: compressor status, alarms, & faults, trend graphing, fault logging, BAS communication window, manuals, wiring diagrams, log book, & control set points are viewable. The FlexSys controller allows the user, the ability to fully commission & adjust all components on the chiller, including the compressors without an auxiliary computer or software.

The chiller controller includes the following features:

### **Hardware**

- Dedicated EXV Outputs
- Dry Contact style Digital Inputs
- 24 VDC Digital Outputs
- 4-20 mA Analog Inputs
- 0-10 VDC Analog Outputs
- 10k NTC style Temperature Inputs
- Dedicated RS-485 & 232 communication to each compressor

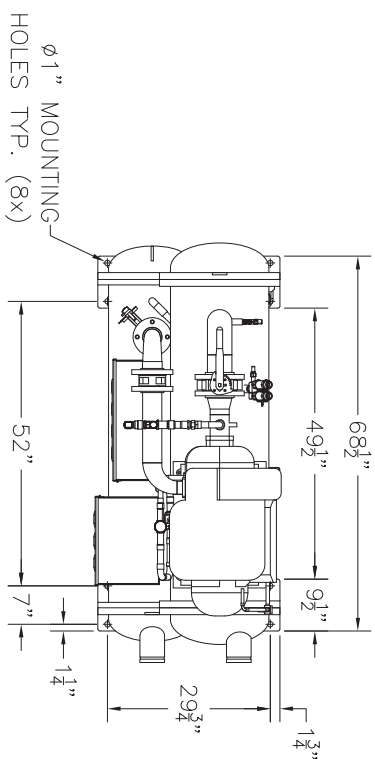


- Windows Based Industrial PC featuring Intel Processor for maximum reliability & performance.
- Industrial Grade Dual-Flash drives for maximum reliability & redundancy. Flash drives feature no moving parts to ensure nothing mechanically fails. One drive handles the operating system while the other handles all data acquisition to ensure no data is corrupted.
- DC Powered to ensure maximum resistance to EMI & RFI noise
- Built in 2 port Ethernet Switch for easy integration to BAS interface & Web Control feature.
- Features Industrial Style battery Back-Up in the event of a power outage
- Integrated UPS to eliminate temporary voltage fluctuations
- On board USB drives to support external peripheral devices including, keyboard, mouse, & printer
- 15 "TFT Display featuring 1024 X 768 Resolution.
- All Hardware, including I/O is CE & UL Certified
- I/O features modular design to simplify troubleshooting & or replacement if required.
- I/O has LED Indicators for ALL Inputs & Outputs to ease the troubleshooting process.
- I/O can be directly connected to without the use of Terminal Blocks.
- All wiring utilizes spring capture technology to prevent loose connections or wires from falling out.
- Dedicated Ethernet Communication at a communication rate of 50 microseconds to all compressors & I/O.

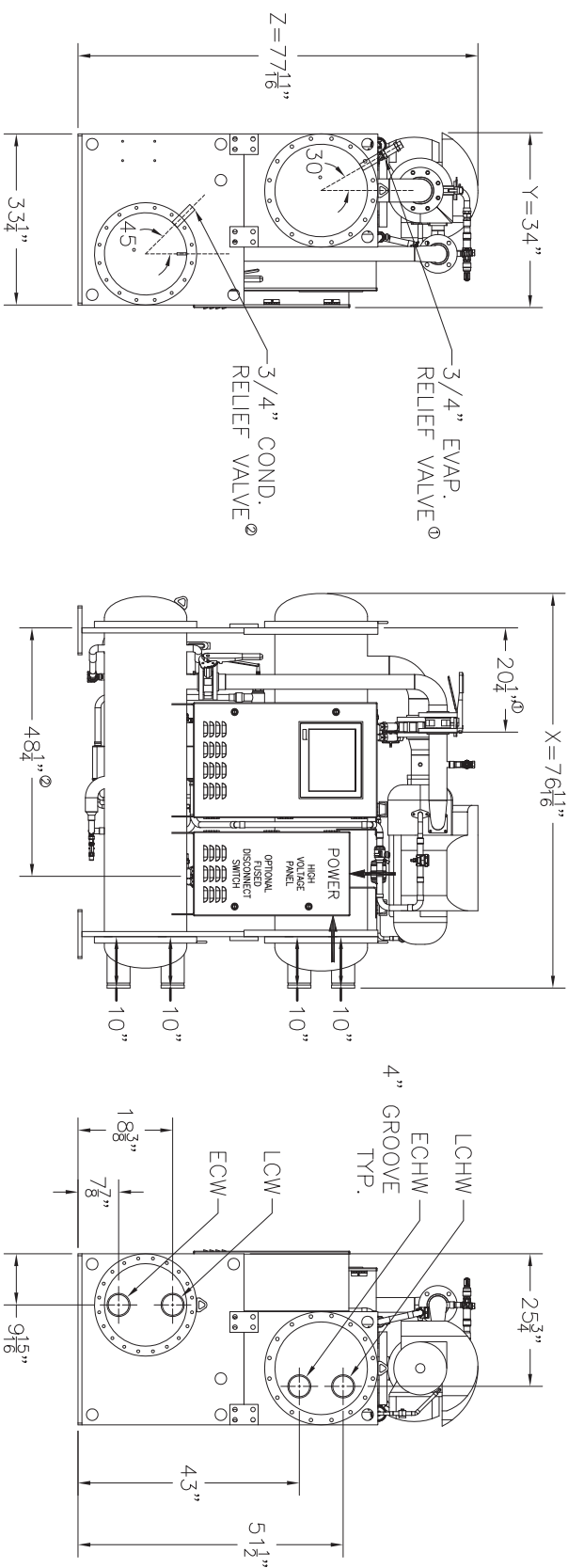
### **Software**

- Can control 1 to 5 compressors
- Able to control: TT-300, TT-310, TT-350, TT-400, & TT-500 compressors
- First and only control system in market place that can control mis-matched compressor sizes. This provides the best balance of energy efficiency with lowest turndown possible of all MagLev style machines.
- Software package is optimized for chillers equipped with flooded evaporator and either a water cooled or evaporative cooled condenser
- Controller can control up to 6 EXVS, including economizer valves

- HMI interface allows the user to define 20 text fields on the main dash board with whatever information they choose.
- Able to control auxiliary devices such as pumps, towers, valves, etc when coupled with optional I/O expansion hub. These control routines are pre defined and meet a wide variety of applications.
- Control system can be field reconfigured through HMI to remap the IO to change functionality on the fly. This allows for customized integration into the end users system.
- Industry leading trend graphing. Data captured in 5 second intervals. Data is saved daily to external thumb drive and can be broken down in intervals of: seconds, minutes, 10 minutes, 30 minutes, 1 hour, 2 hours, 4 hours, 12 hours, or full day. Trend graphing includes zoom feature. Trend graphing also includes all hardwired inputs and outputs so there is never again any guess work on what the chiller is doing. Data stored on separate 32 GB drive. Trend Graph images can be exported. Trend Graphs can be exported to csv files as well.
- Advanced Fault capturing with calendar recall and color coding. Red for fault, Yellow for alarm, and green for good
- Danfoss Turbocor Monitoring Software on board (no need for a separate laptop)
- Web Control feature Standard on all FlexSys Control Systems. This allows the user to mirror the chiller control exactly as if they were standing in front of it. App support for iphone®, ipad®, android®, and desktop applications.
- Input log feature logs every change made to the chiller from the HMI. No longer need to guess when a setpoint was adjusted.
- Controller has onboard maintenance log to store system information
- Controller offers real time capacity and efficiency data when coupled with optional flow meter input
- BAS Interfaces include:
  - Modbus RTU (standard)
  - Modbus TCP/IP (standard)
  - BAC Net IP (optional)
  - BACNET MSTP (optional)
  - Lonworks (optional)
- 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, & how many times the data was sent or received.
- Control System features an optimum start function to ensure initial lift is always made. This prevents nuisance check valve flutter & compressor faults.



WEIGHTS (LBS)		
EMPTY	SHIPPING	OPERATING
4940	5130	5430



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