

Improving Refrigeration Safety

Art Sutherland





Plantroom Safety Systems



Test Refrigerant Detectors Monthly



Install Intuitive Warning Lights



300ppm

25ppm

All
Clear

Improve Plantroom Ventilation



Test fans Monthly



Ammonia Air Scrubber

Install Alarms on Emergency Showers





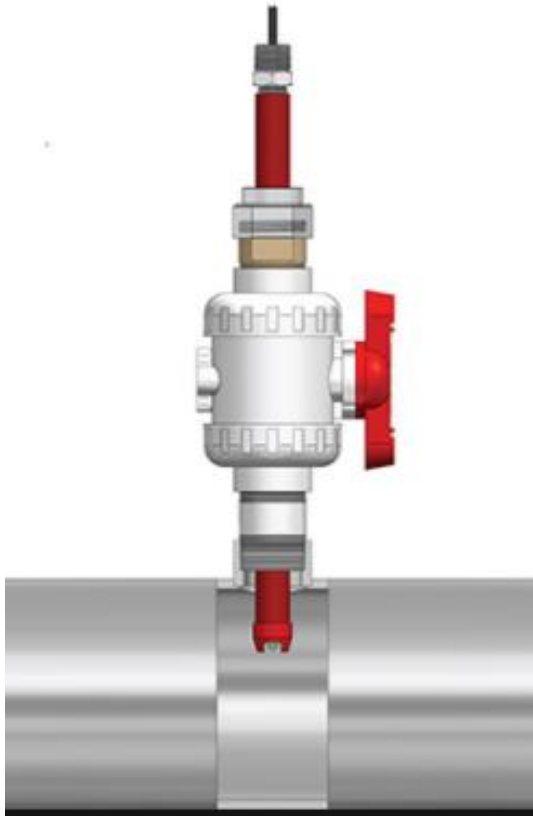
Secondary Coolant Safety



Maintain your Brine



pH Sensors in Secondary Loops



Install Pressure Reliefs on Secondary Side



Install Level Sensors on Secondary Side



Aqua Ammonia Secondary Coolant

Secondary Coolant Pumping Horsepower

Coolant	Piping	Capacity	Pump Horsepower
Calcium Chloride	1" HDPE	100 Tons	23 HP
Propylene Glycol	1" HDPE	100 Tons	44 HP
Ethlene Glycol	1" HDPE	100 Tons	31 HP
SR-17	1" HDPE	100 Tons	8.5 HP

Benefits of Aqua Ammonia

Significant Reduction in Pumping Horsepower

Not Corrosive like Calcium Chloride

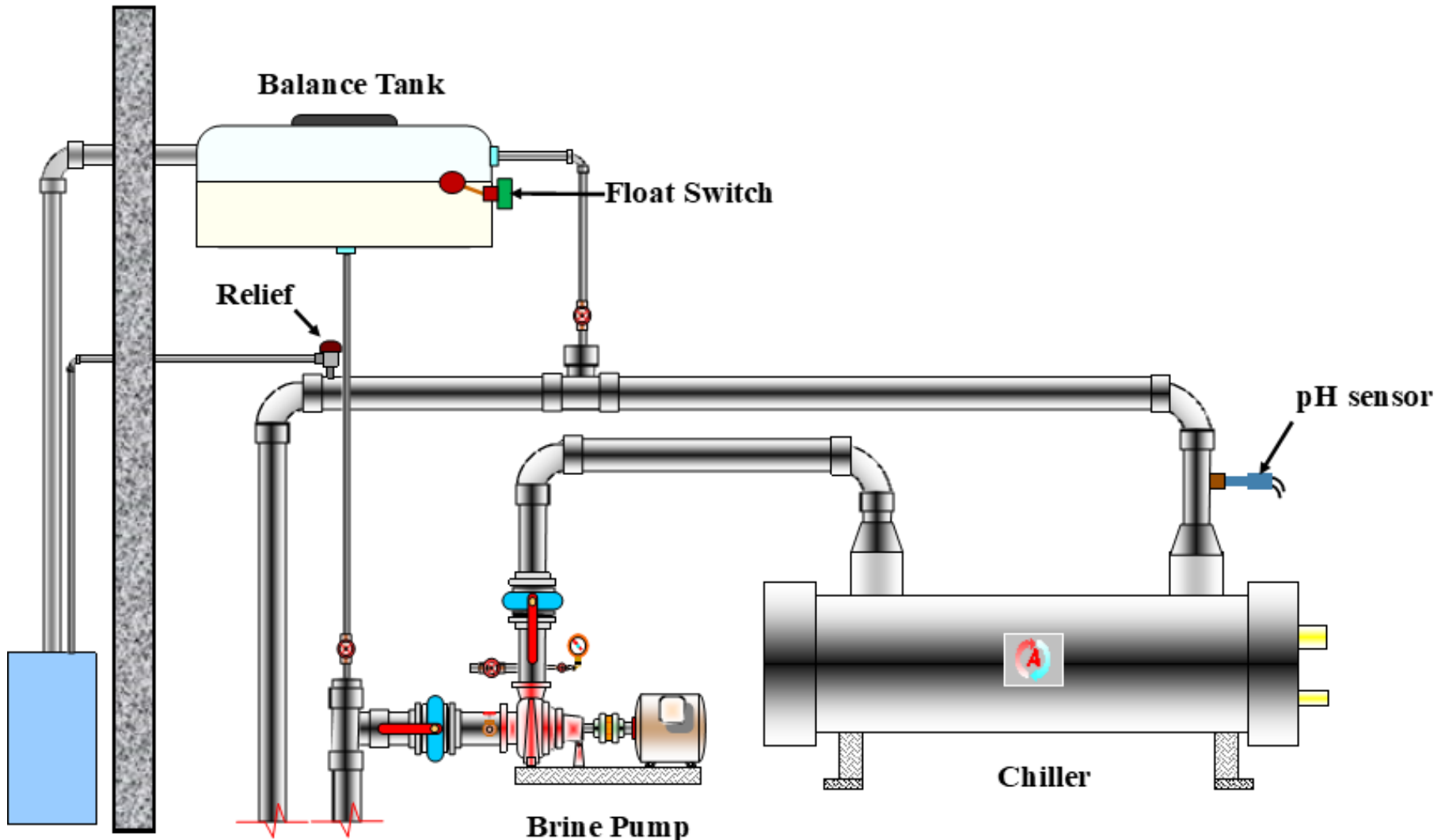
No Need for Inhibitors

Chiller Leaks Do Not Require Expensive Remediation

Does Not Require Expensive Titanium Chillers

Very Short Environmental Life

Vent your Balance Tank to the Outside

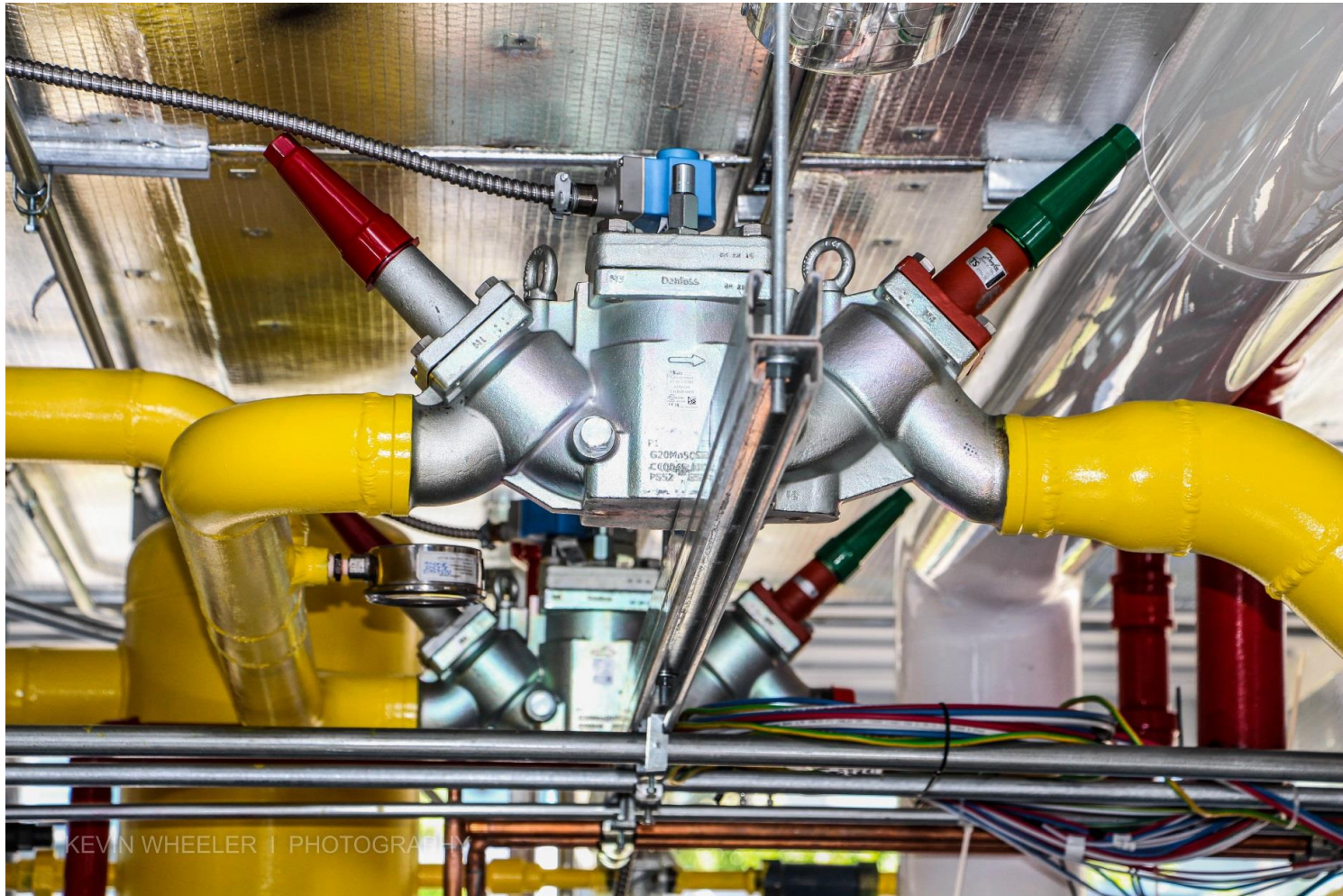




System Construction



All Welded Construction



KEVIN WHEELER | PHOTOGRAPHY

Refrigerant Characteristics

Refrigerant	Class	Ozone Depletion	Global Warming	Atmospheric Life	COP 10sst / 90sct
Ammonia	B2	0	0	72 Hours	4.03
R-22	A1	.055	1780	11.9 Years	3.69
R-134A	A1	0	1430	14 Years	3.10
R-404A	A1	0	3843	40.4 Years	3.23
R-410A	A1	0	2088	28 Years	3.41
R-448A	A1	0	1273	14 Years	3.73
R-513	A1	0	573	9.6 Years	3.29
R-1234YF	A2L	0	4	11 Days	
CO2	A1	0	1	30,000 Years	2.78



The Chiller



Traditional Flooded Chiller



8 Pounds of Ammonia Per Ton

Flooded Plate and Frame Chiller



2 Pounds of Ammonia Per Ton

DX Plate and Frame Chiller



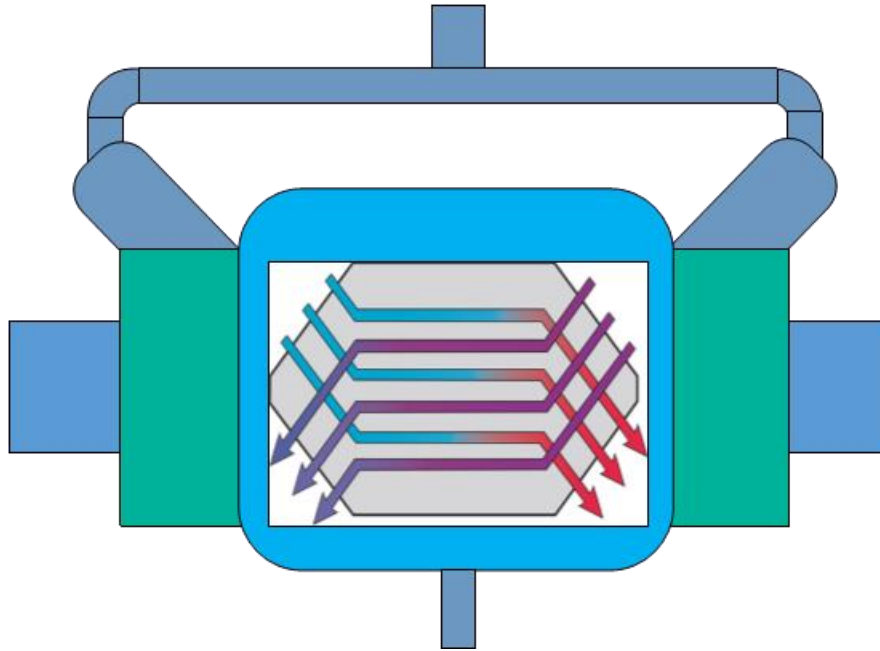
0.7 Pounds of Ammonia Per Ton

Plate and Shell Chiller



1 Pound of Ammonia Per Ton

Next Generation Chiller



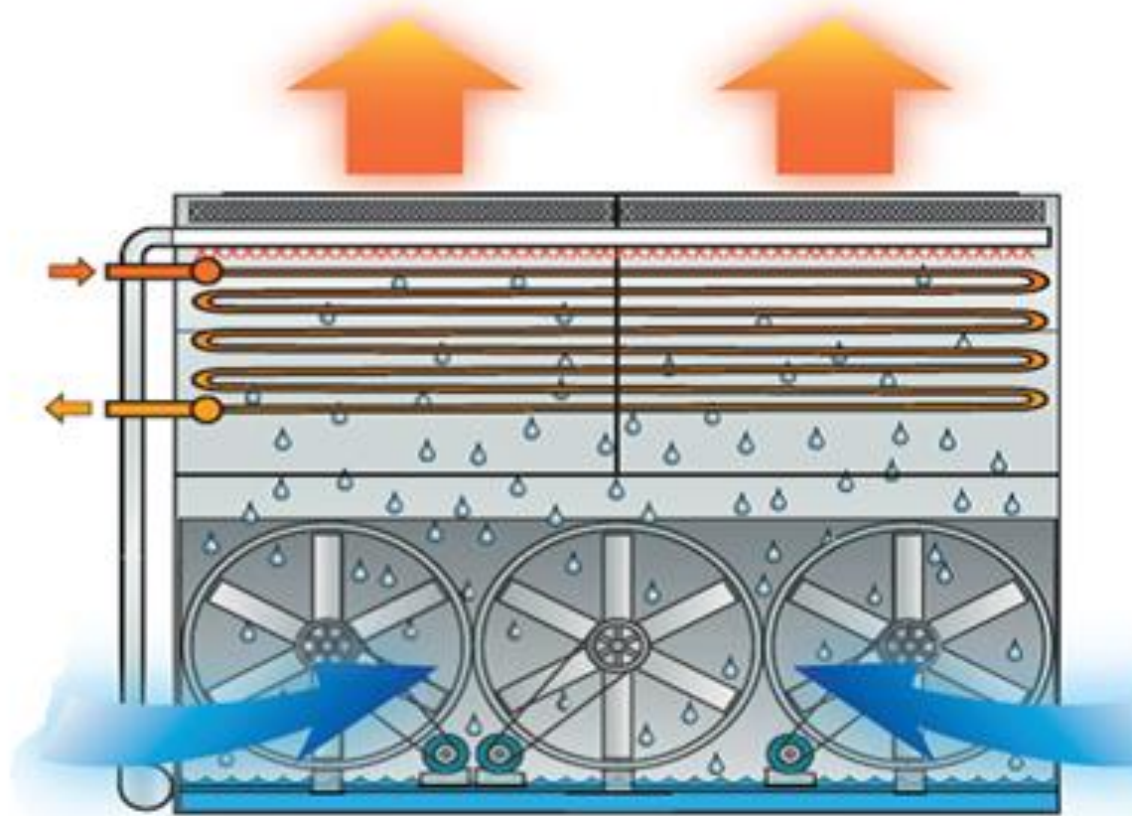
No Liquid Ammonia in Chiller
0.4 Pounds per ton in Suspension



The Condenser

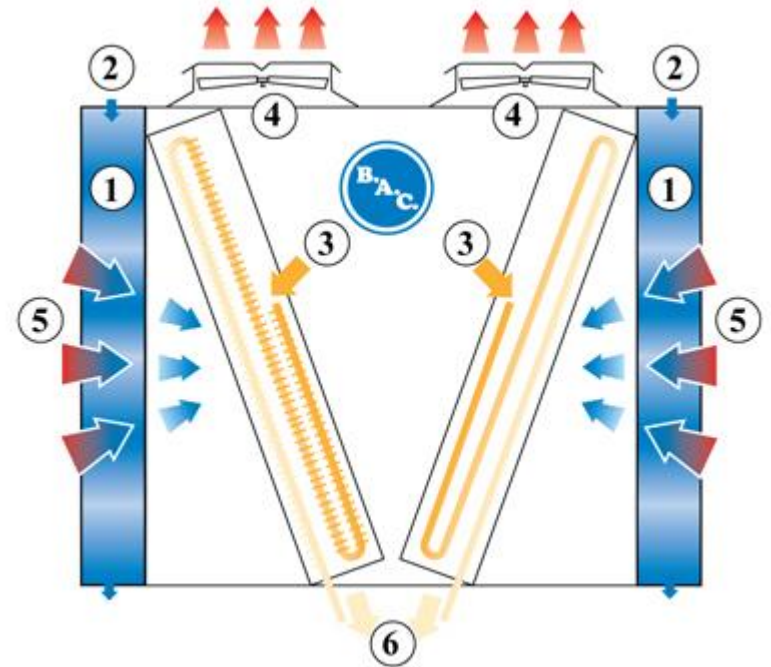


Evaporative Condenser



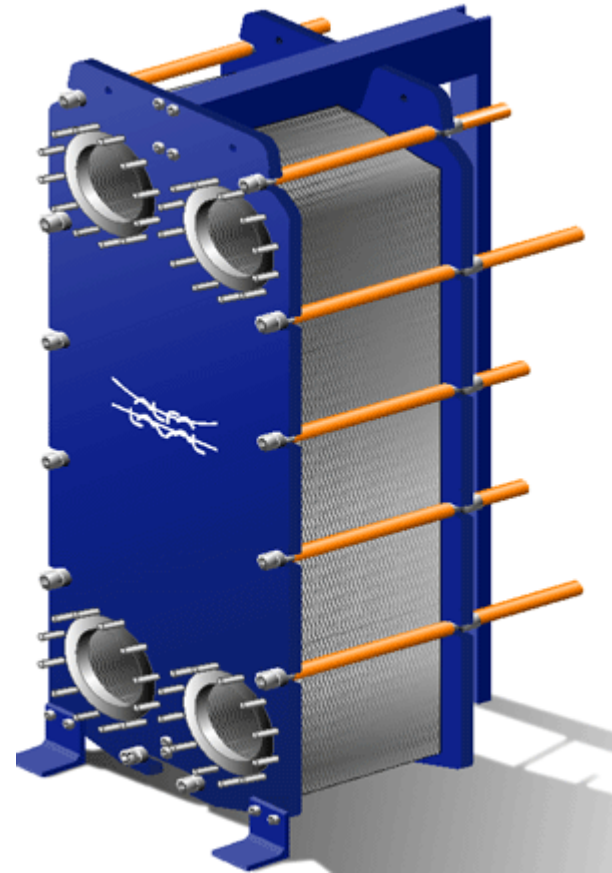
*130 to 150 Pounds of Ammonia
(100 ton plant)*

Limited Charge Hybrid Condenser



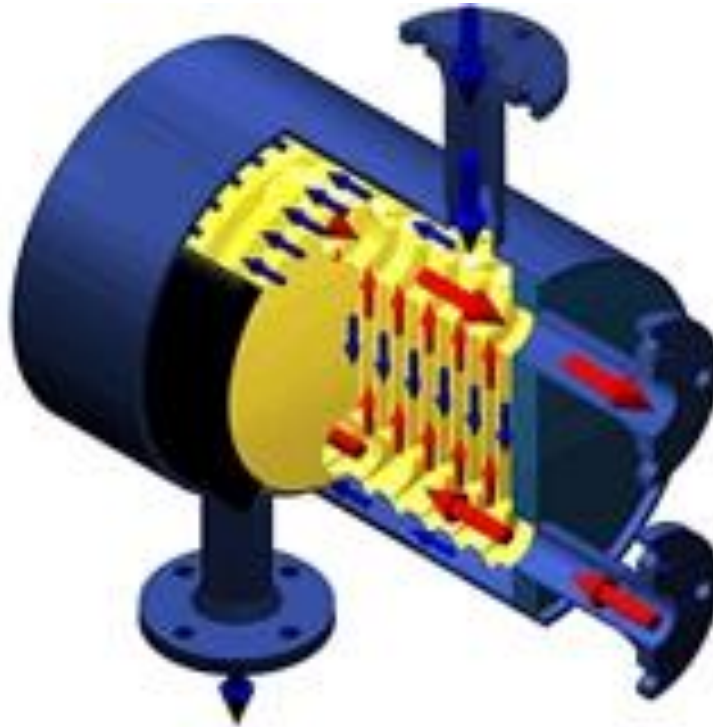
20 to 25 Pounds of Ammonia
(100 Ton Plant)

Plate Style Condensers



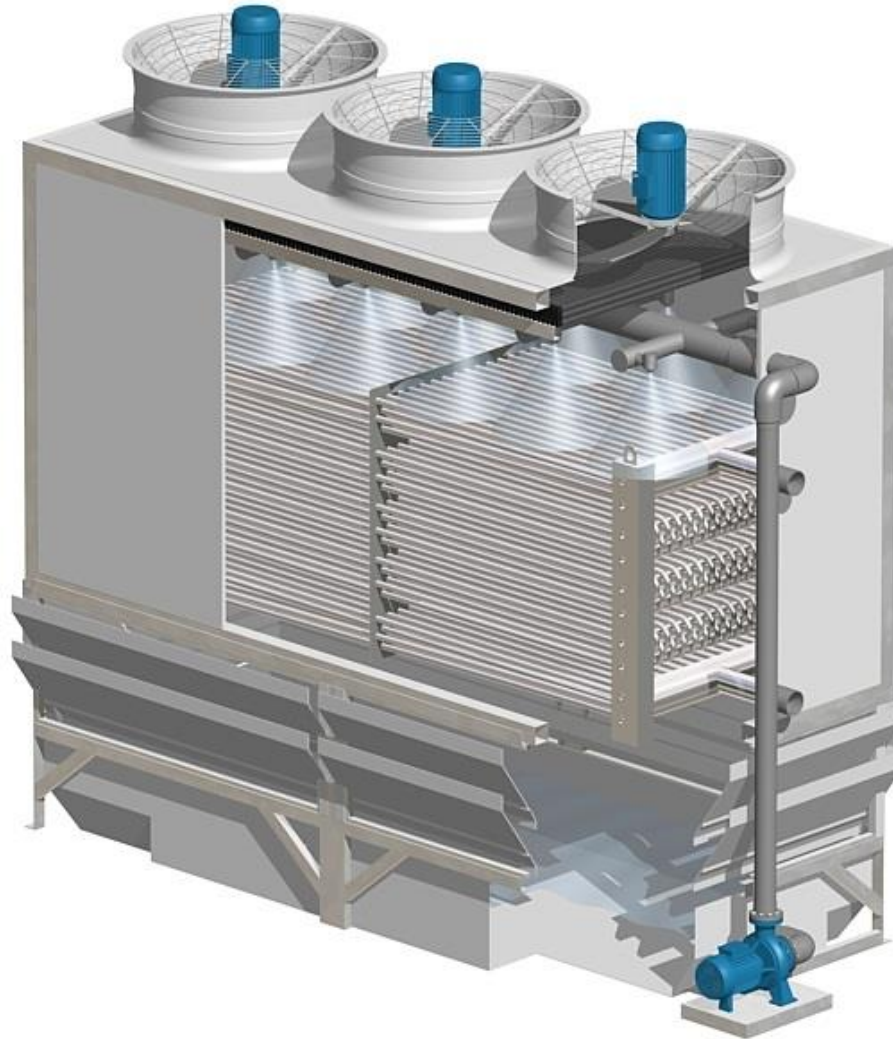
Less than 3 pounds of Ammonia

Plate and Shell Condenser

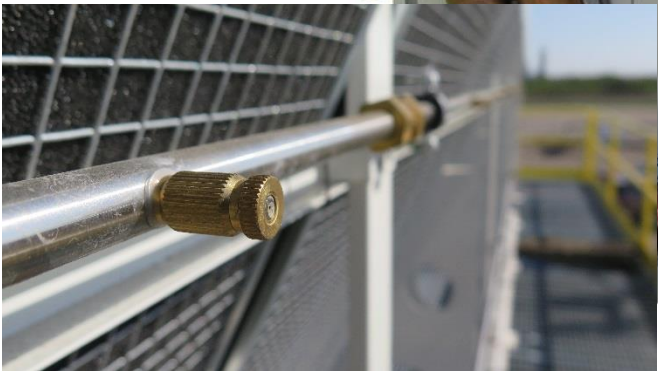


Less than 3 pounds of Ammonia

Evaporative Fluid Coolers



Adiabatic Fluid Cooler





Refrigeration System Styles

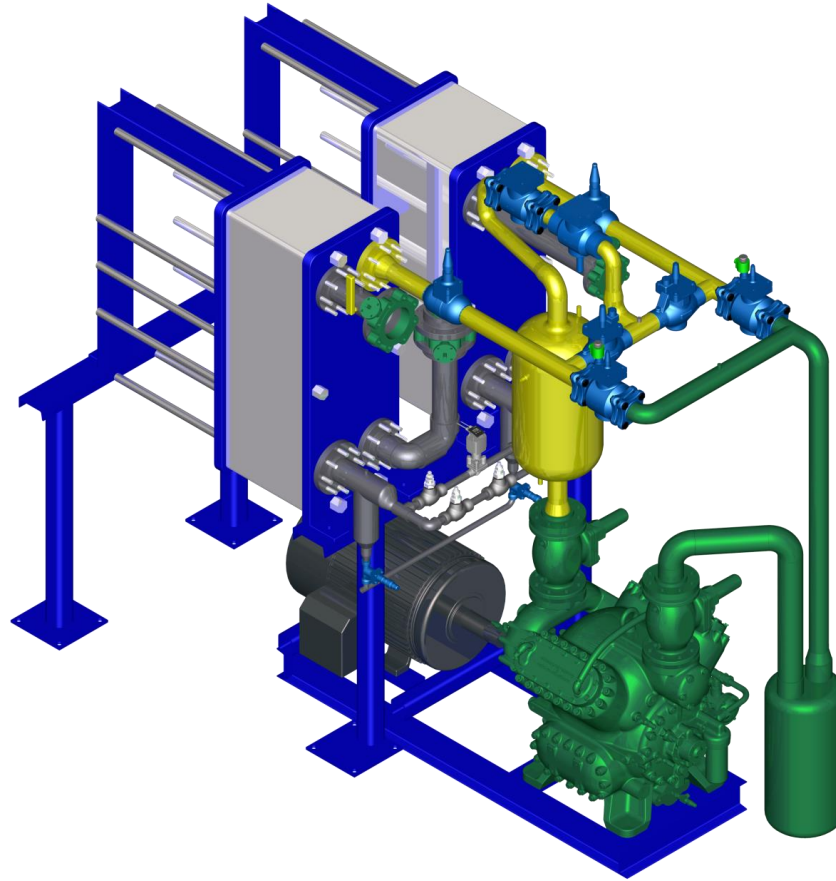


Traditional Flooded Ammonia System



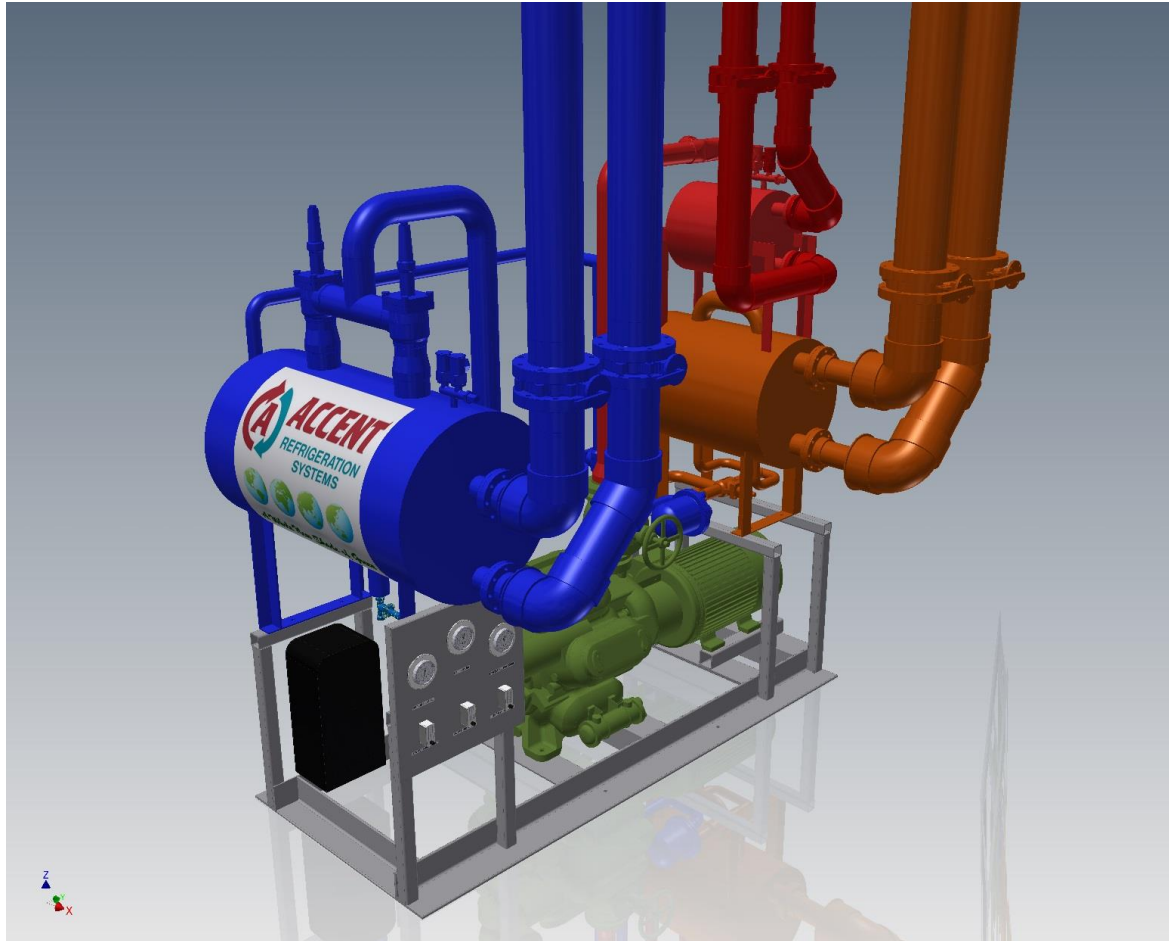
600 to 900 pounds of Ammonia

Limited Charge Ammonia System



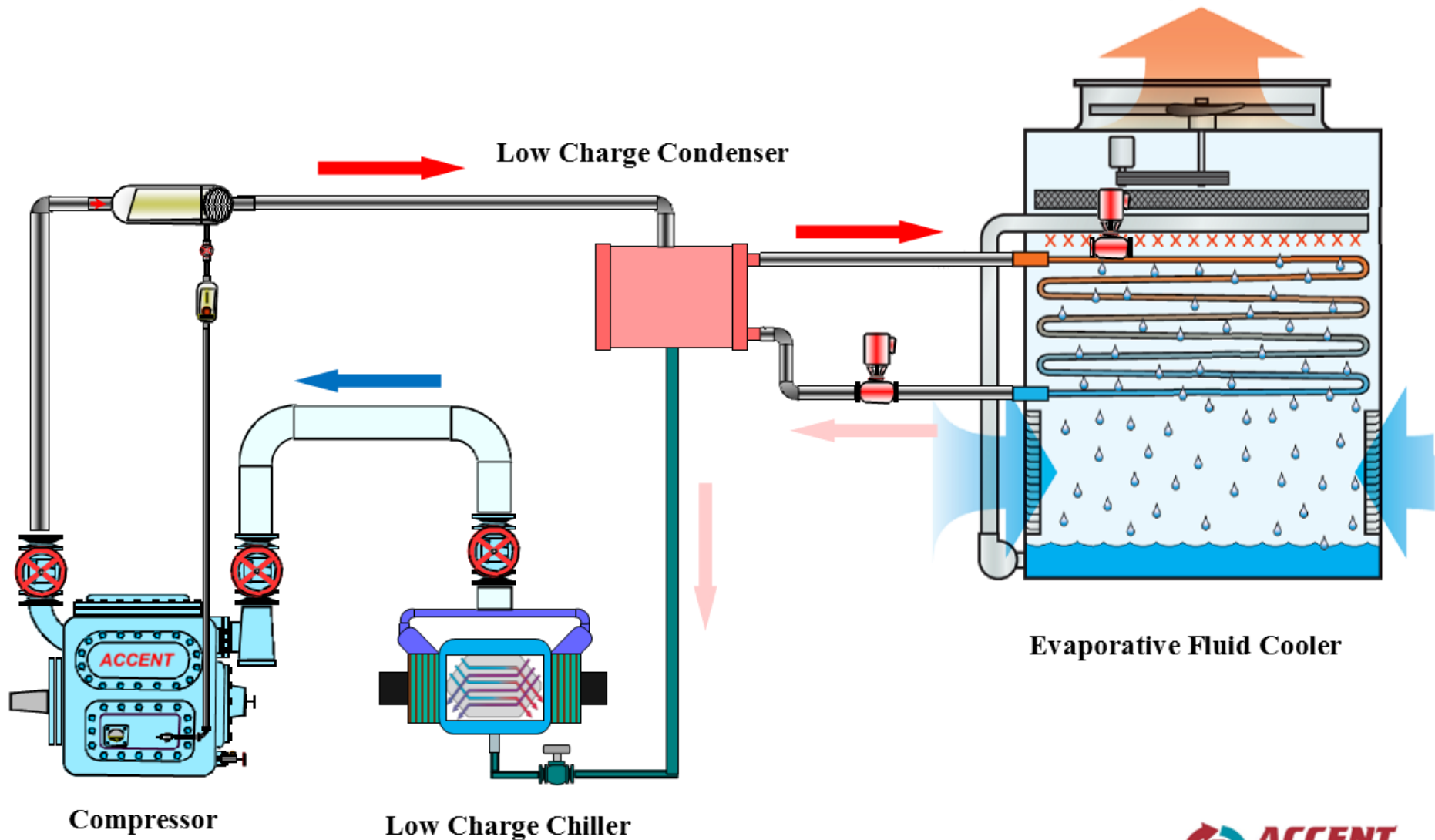
30 to 50 pounds of Ammonia

Low Charge with 100% Energy Recovery

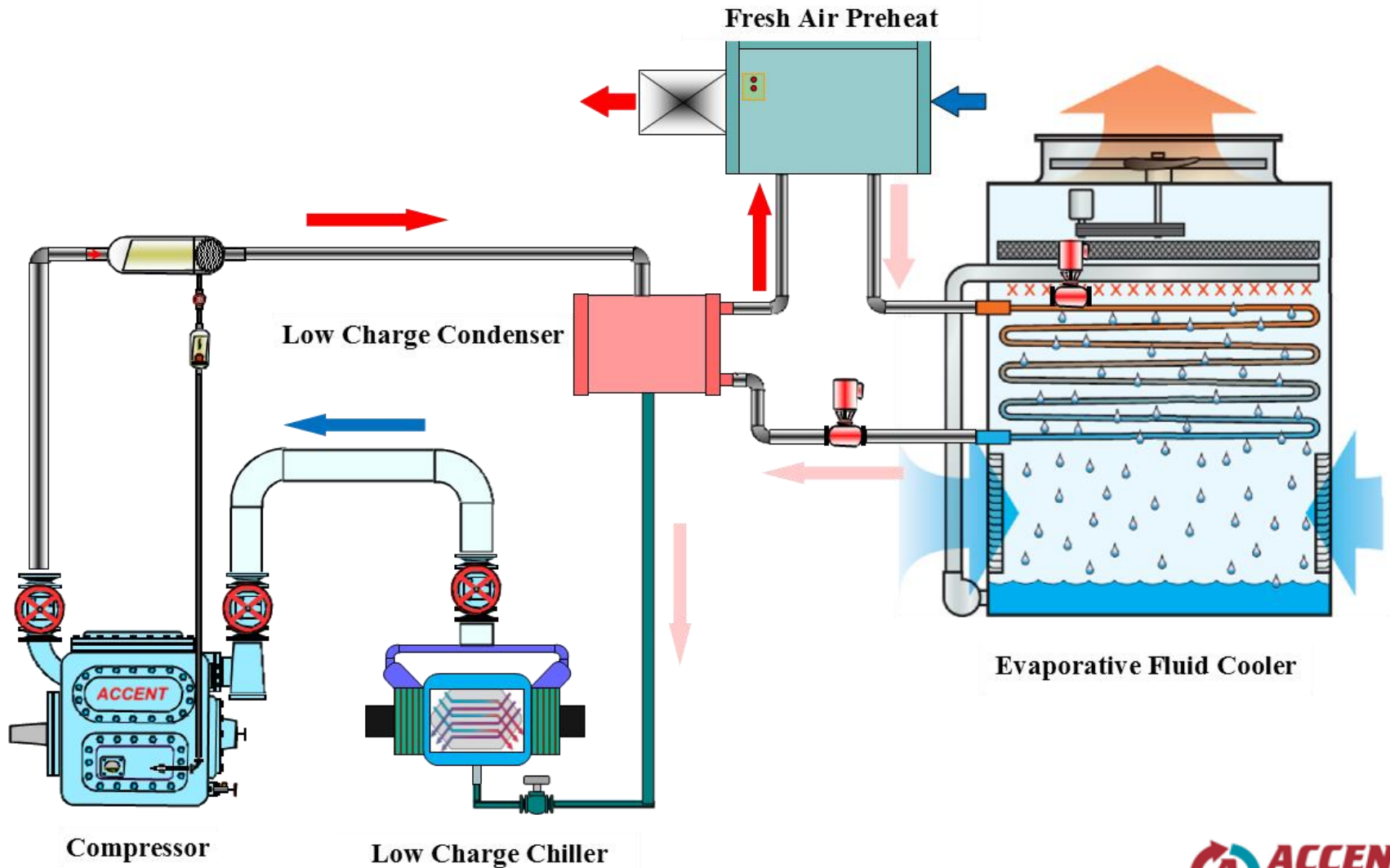


30 to 50 pounds of Ammonia

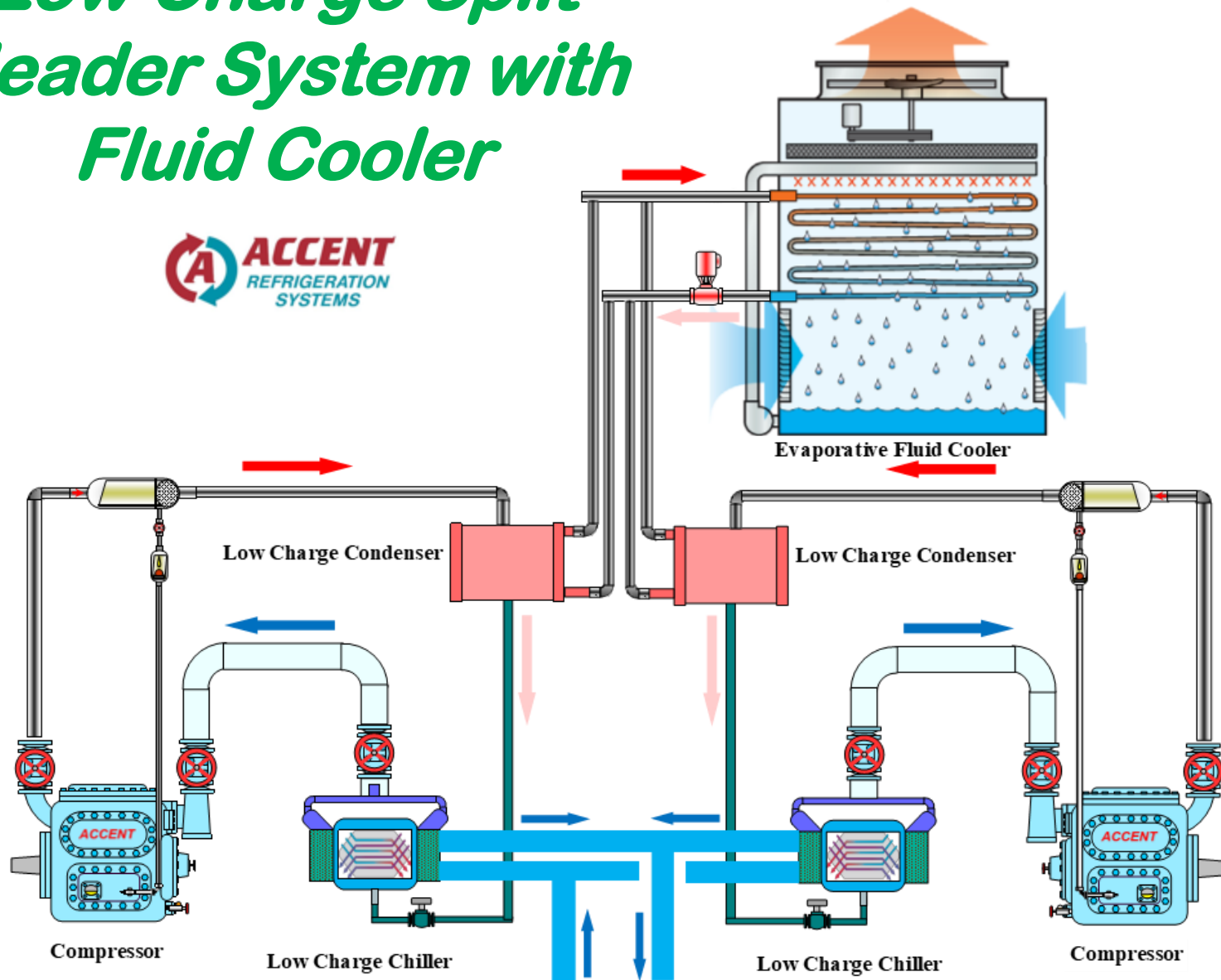
Low Charge System with Fluid Cooler



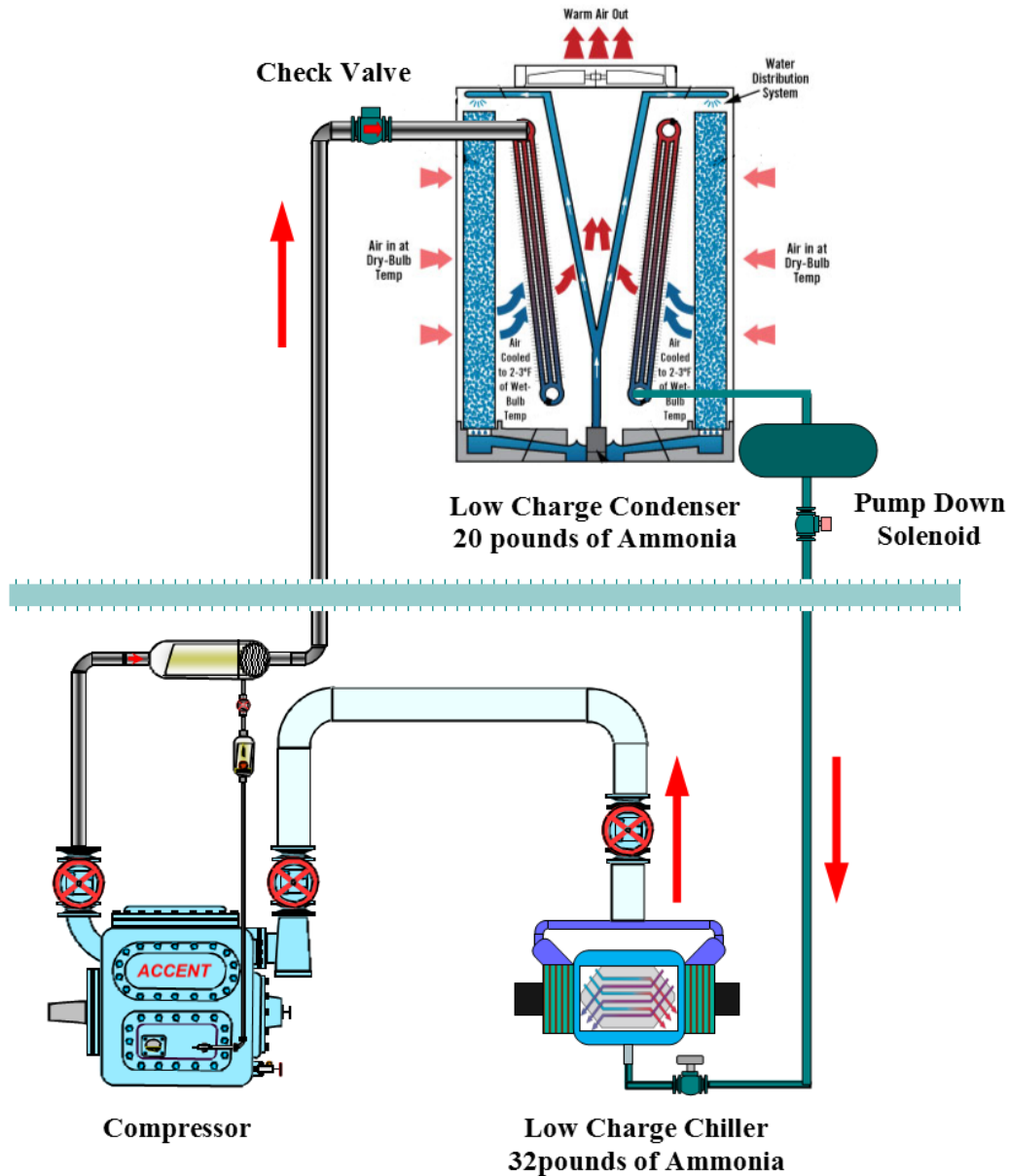
Low Charge System with Heat Reclaim



Low Charge Split Header System with Fluid Cooler



Emergency Pump Down System



Ammonia Leak-25 PPM

High Speed Exhaust Fan
Alarm Initiated

Ammonia Leak 300 PPM

Solenoid Closes
Pumped down in 50 seconds

**Less than 3 pounds of Low Pressure Ammonia Vapour
Remaining in Plant Room in the Event of a Leak**

Containerized Machine Room



Low Charge Chiller Advantages

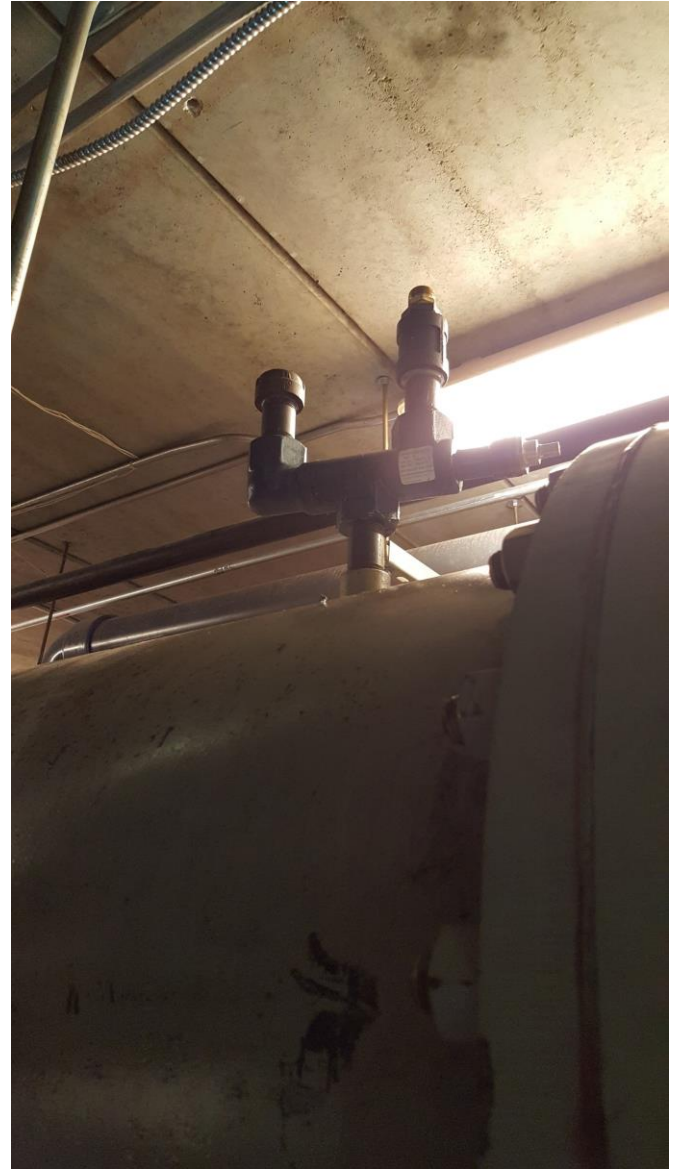
- Zero Ozone Depletion and Global Warming
- Very low ammonia charge
- Split systems add redundancy
- Split systems reduce ammonia charge exposure
- All work is done in factory improving quality
- Might not required mandatory operation
- Fluid Cooled Condenser facilitates heat reclaim
- Substantially higher level of community safety



Relief Valve Installation



Inspect Your Relief Valves

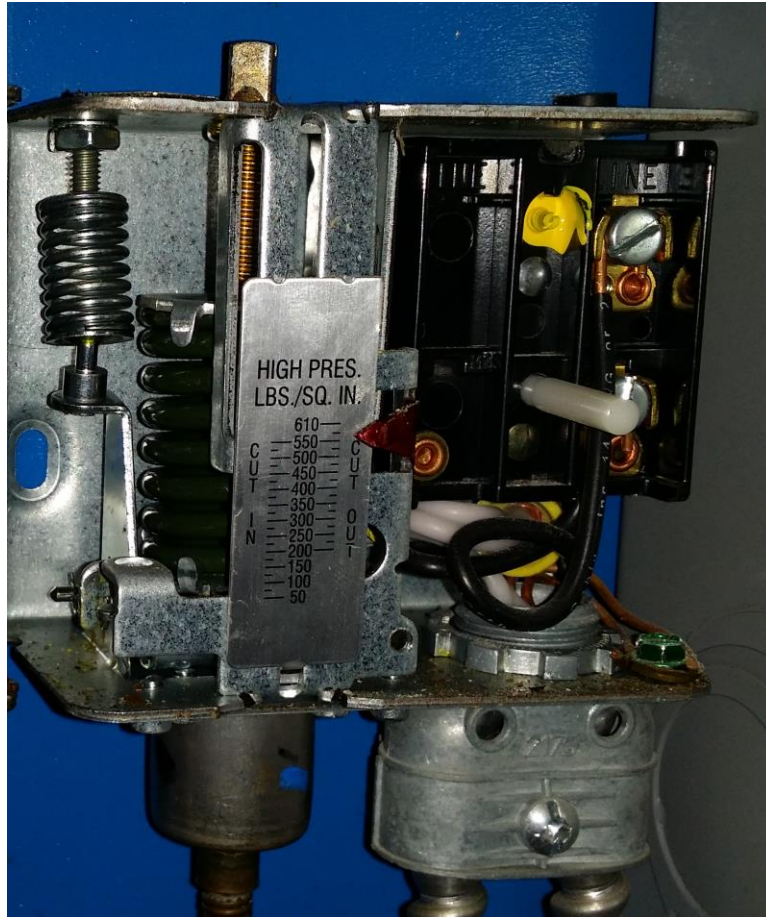


Make Sure Relief Valve Settings Don't Exceed Chiller Ratings



CERTIFIED BY							
DOCAL							
MONTREAL, QUEBEC (CANADA)							
W	SHELL MAWP	250	PSI	AT	250	°F	
RES	SHELL MDMT	-20	°F	AT	250	PSI	
	TUBE MAWP		PSI	AT		°F	
	TUBE MDMT		°F	AT		PSI	
	DO 'AL S/N	14607	YEAR BUILT		2011		
	CRN	404081					
	DLRA-209						BB182
	REFRIGERATION SERVICE ONE						

Make Sure Pressure Control Settings Don't Exceed Relief Valve Settings



Install Rupture Discs

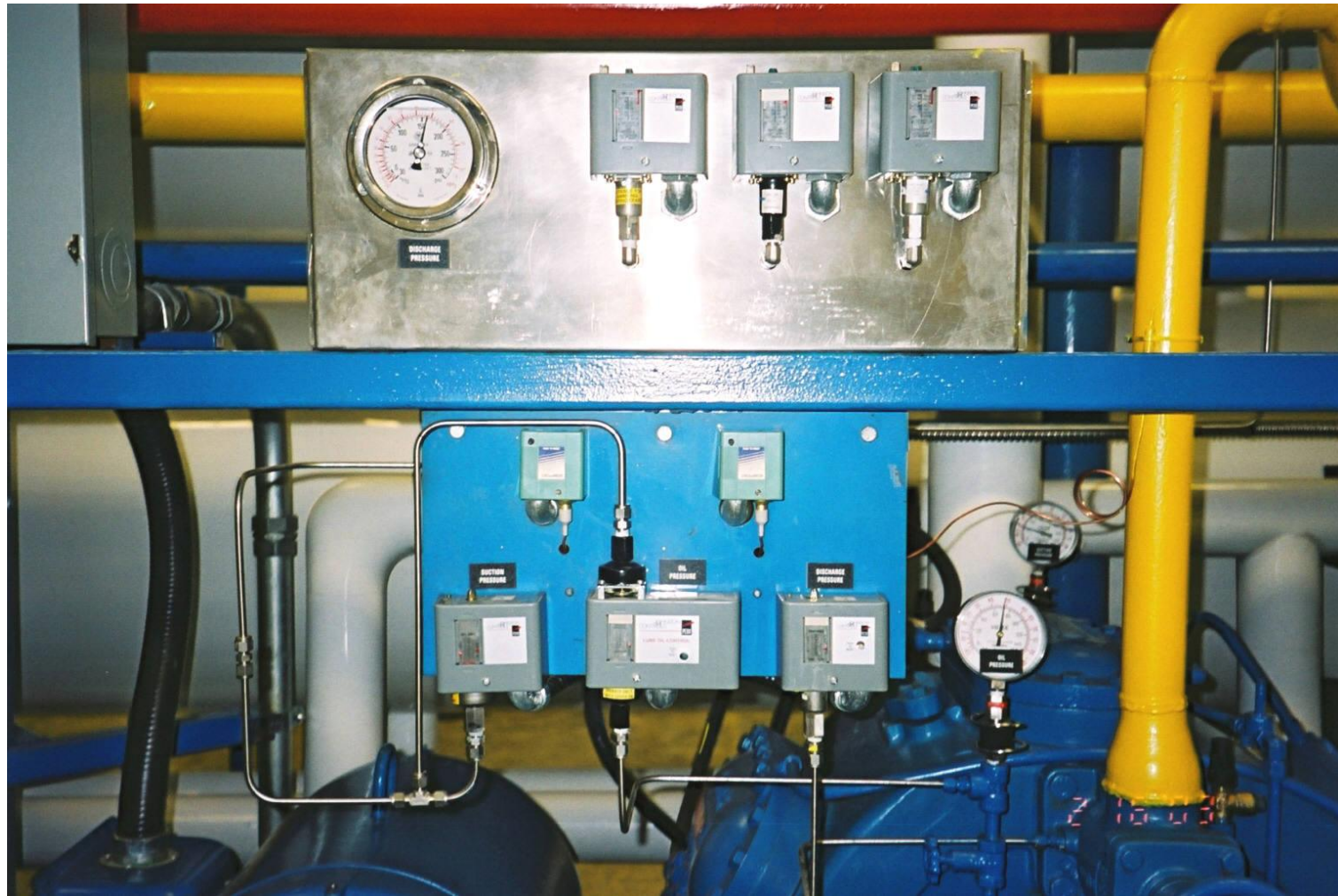




Reducing Relief Valve Incidents



Test Your Safety Controls





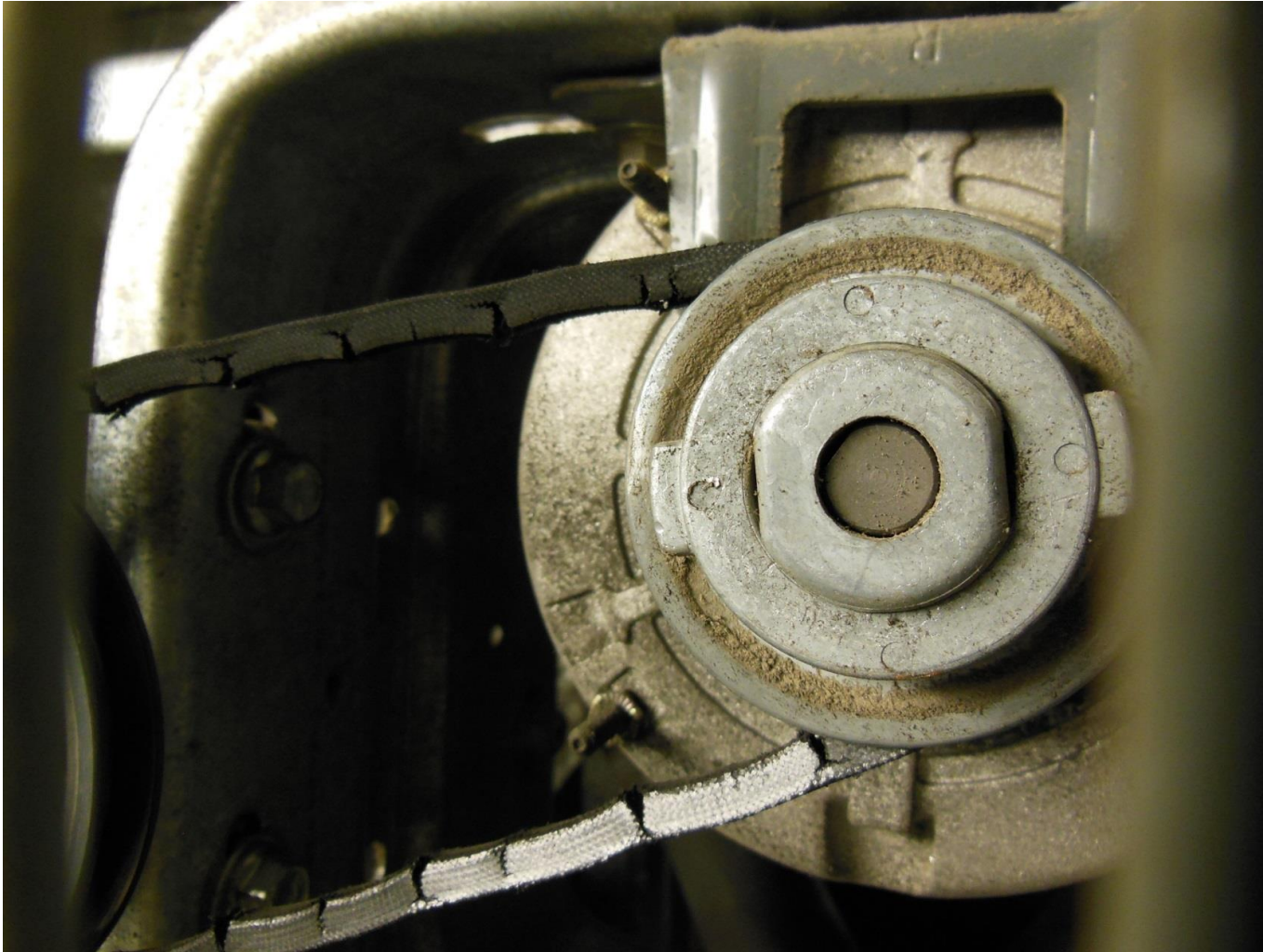
Keep Condenser Coils Clean



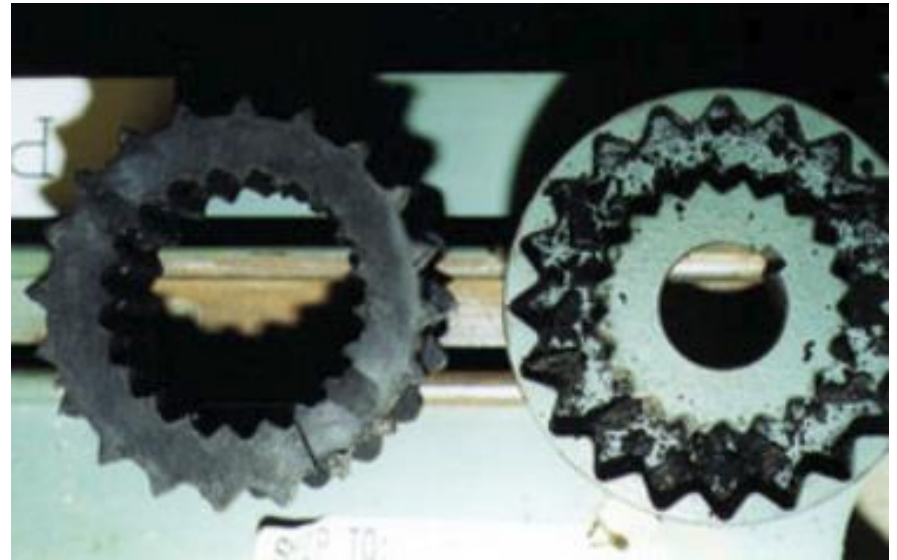
Check Condenser Fans for Debris



Time to Change the Belts?



Check your Water Pump Couplings



Check Your Compressor Belts



Check Condenser Water Filter









VFD's Improve System Operation



Make sure they are set up correctly and are programmed to auto-restart after a fault

Condenser Water Line Stolen





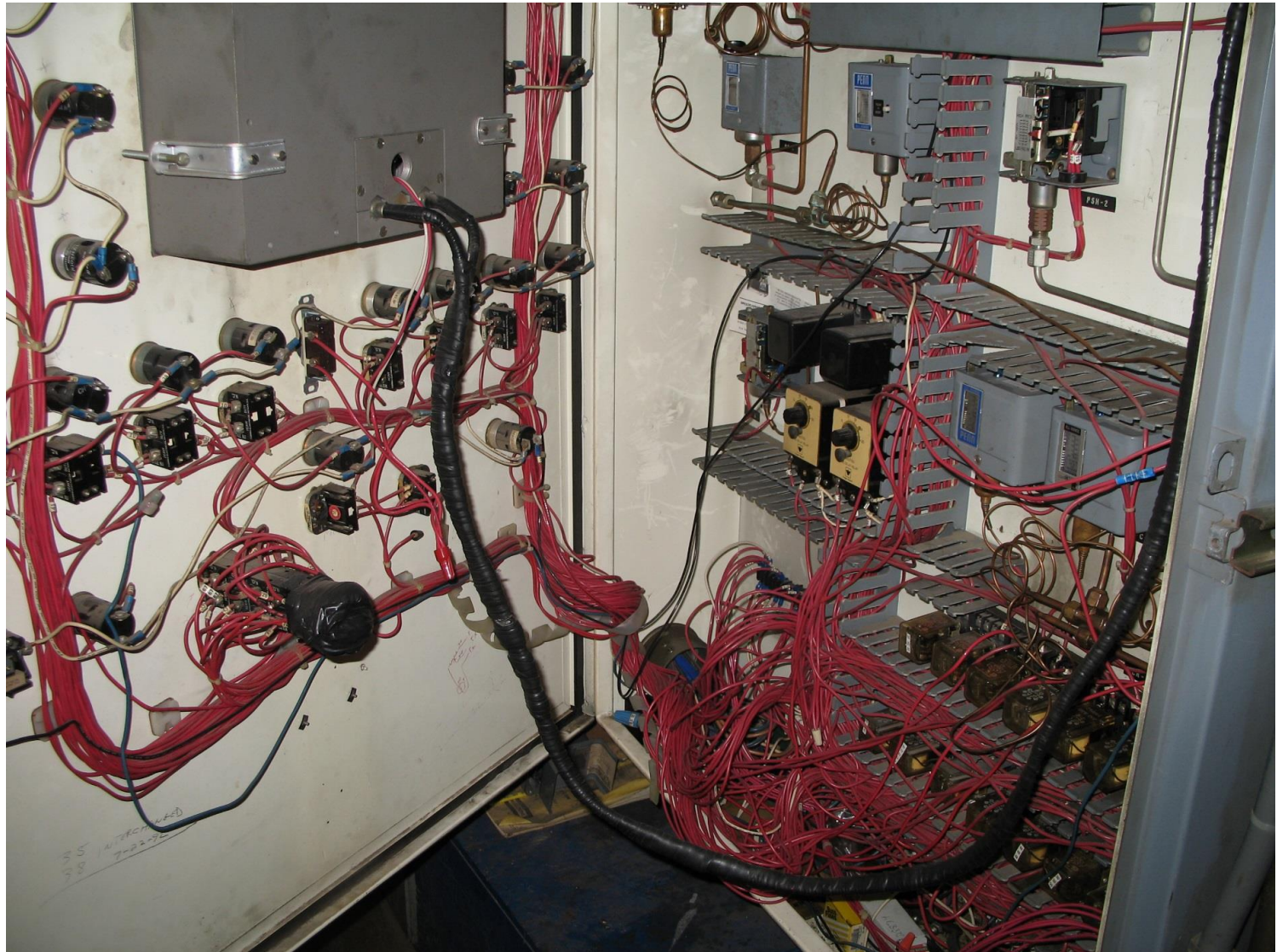


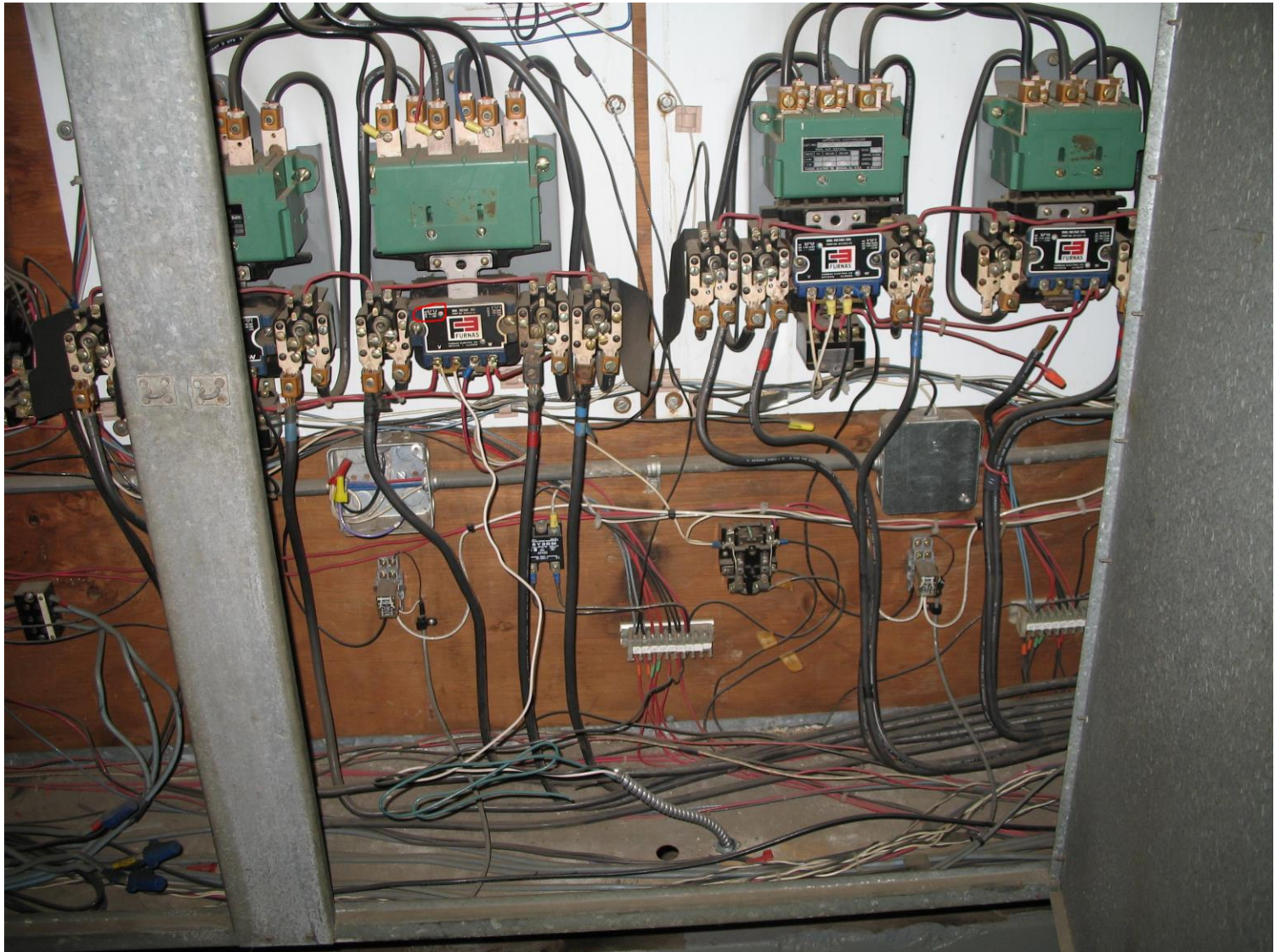


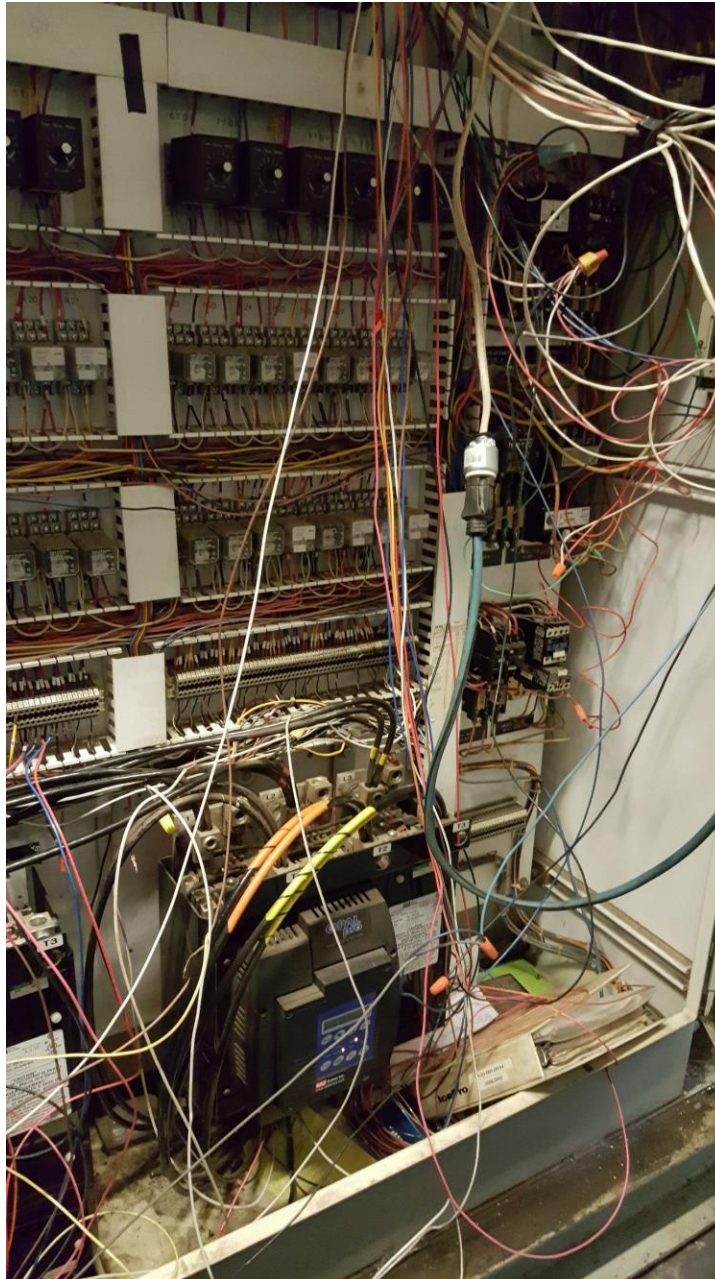
Electrical Safety







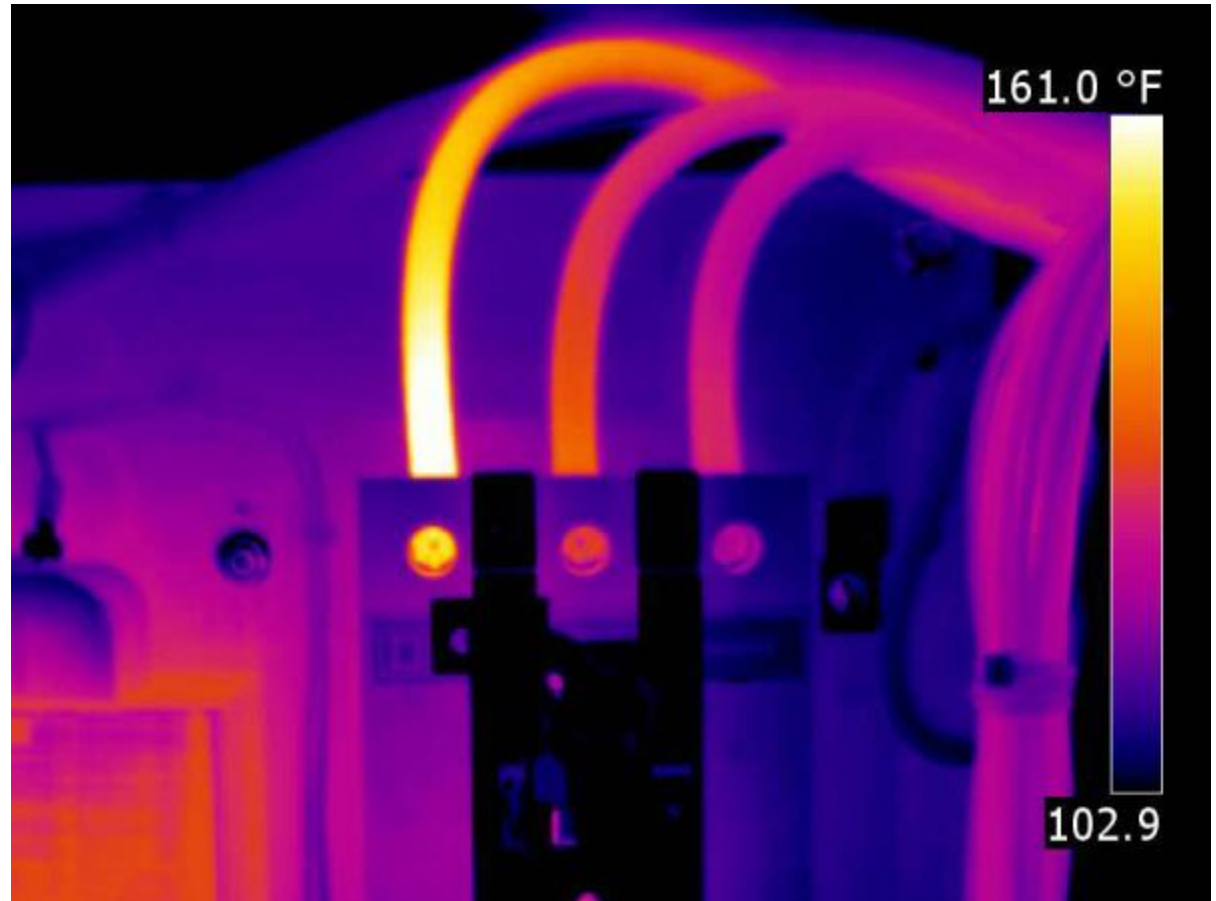




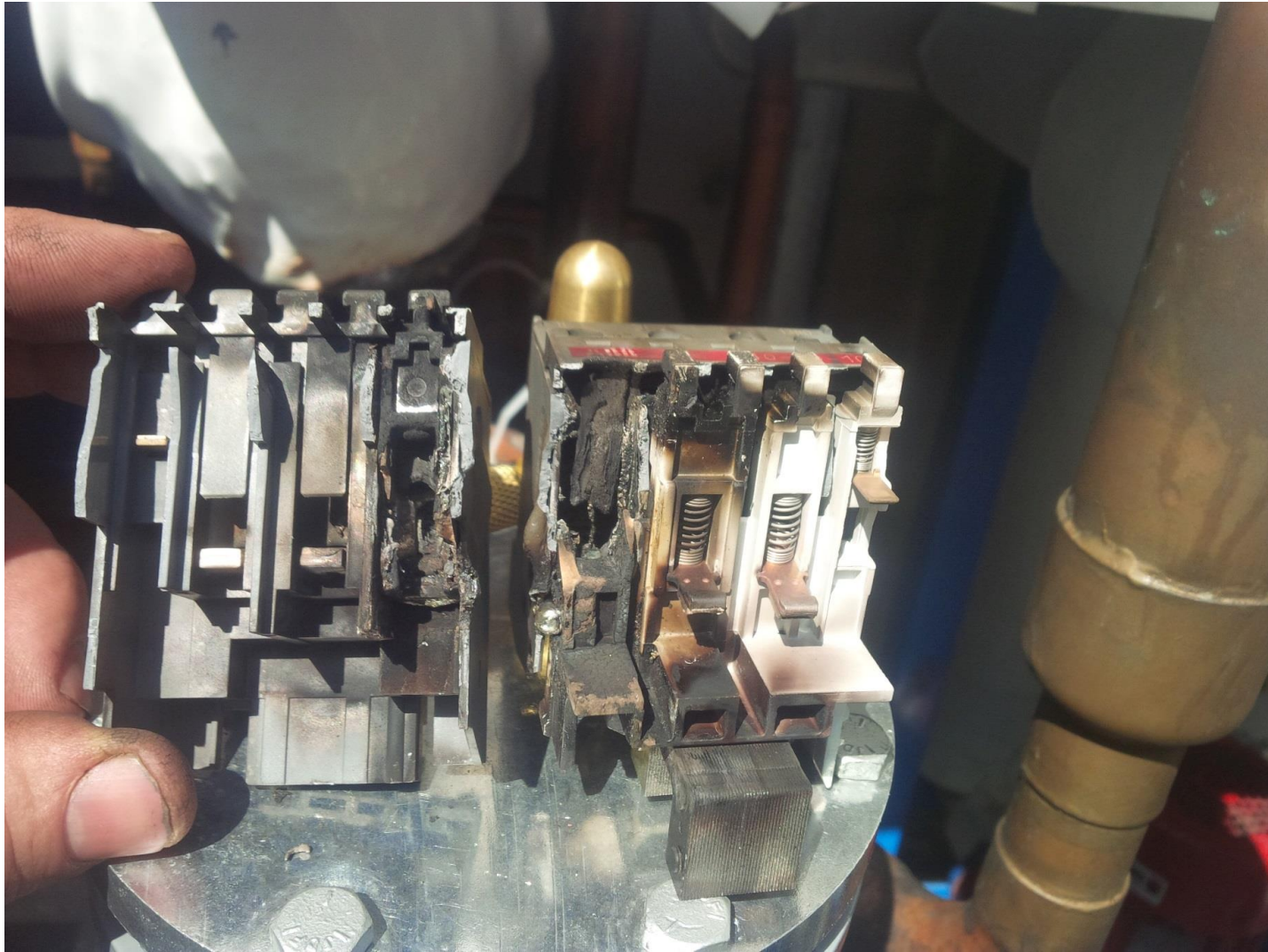
No Chance These Fuses will Blow



Thermal Imaging of Electrical



Welded Electrical Contacts



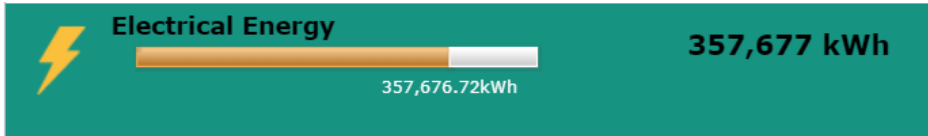


Computer Control Sytems



Your Computer is Your Best Friend





« 2017-01-29 »

D W M **Y**

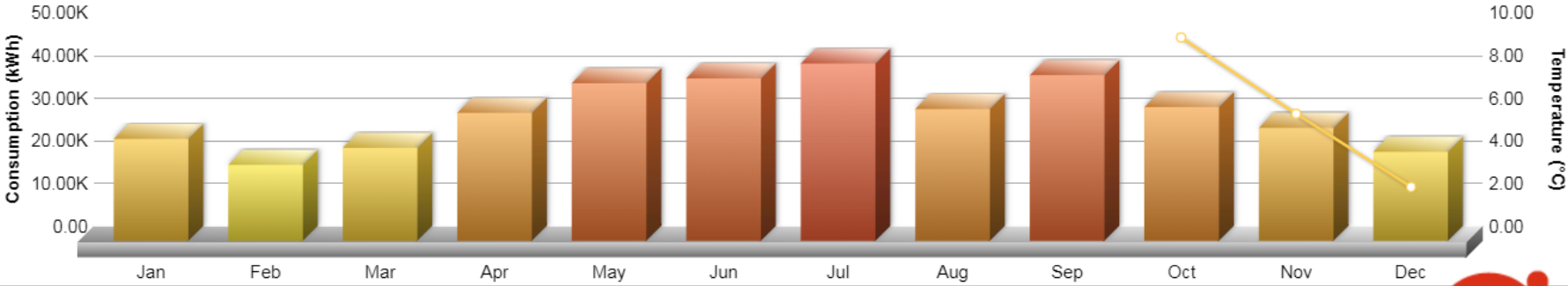
Jan	Feb	Mar	Apr
May	Jun	Jul	Aug
Sep	Oct	Nov	Dec

3 Low Usage 22,495.63 kWh or lower

5 Average Usage 29,611.43 kWh

4 High Usage 36,727.24 kWh or higher

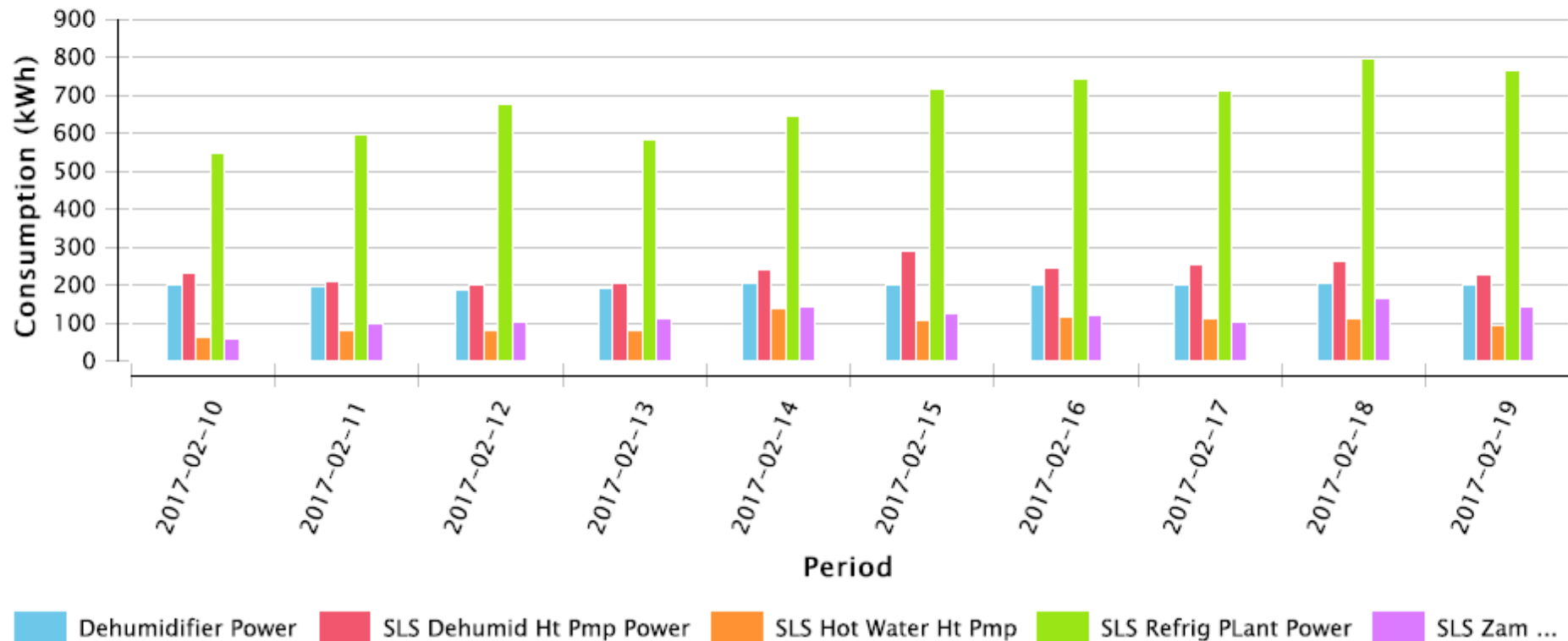
Consumption for 2017



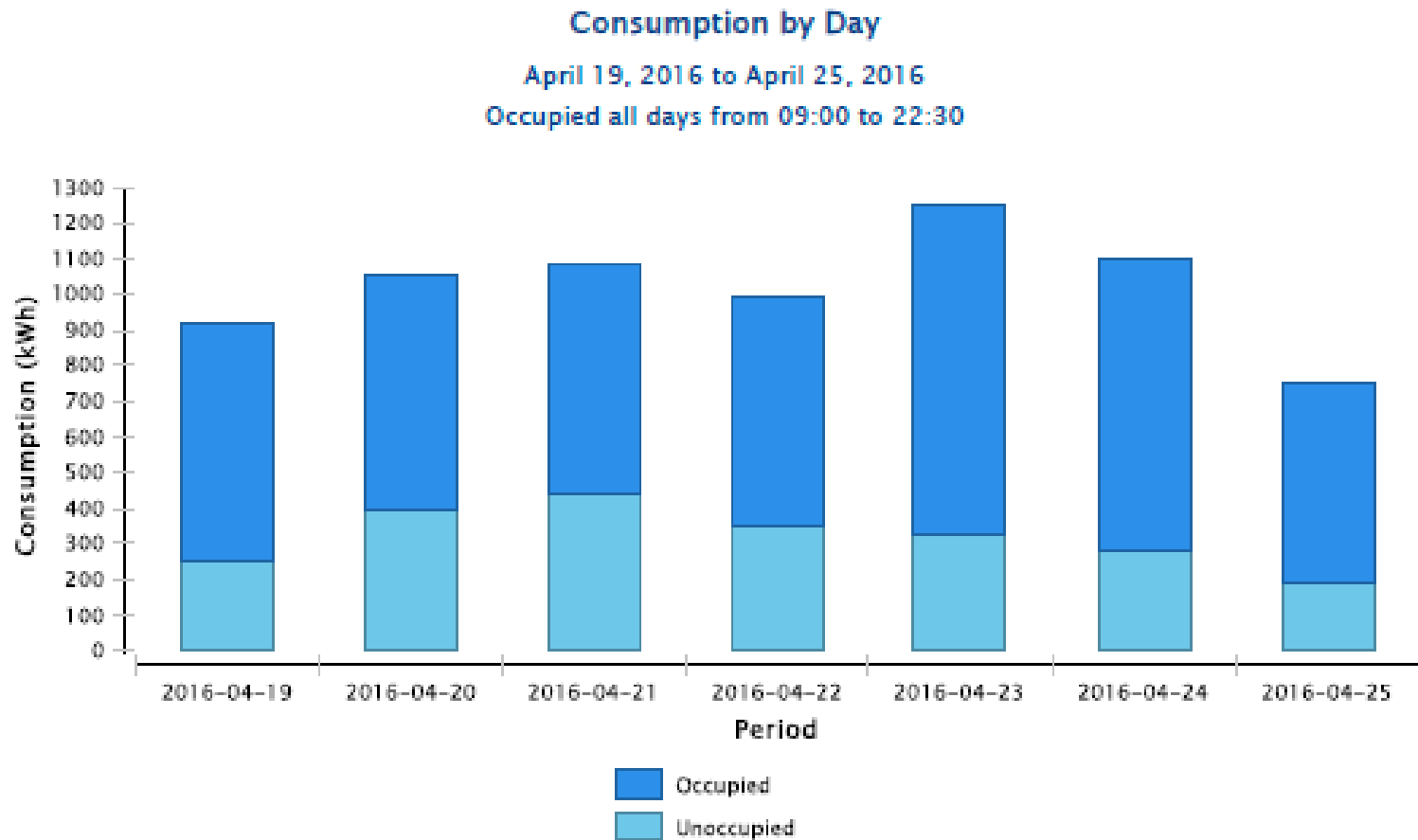
Individual Component Energy Monitoring

Meter Comparison

February 10, 2017 to February 19, 2017 (by Day)



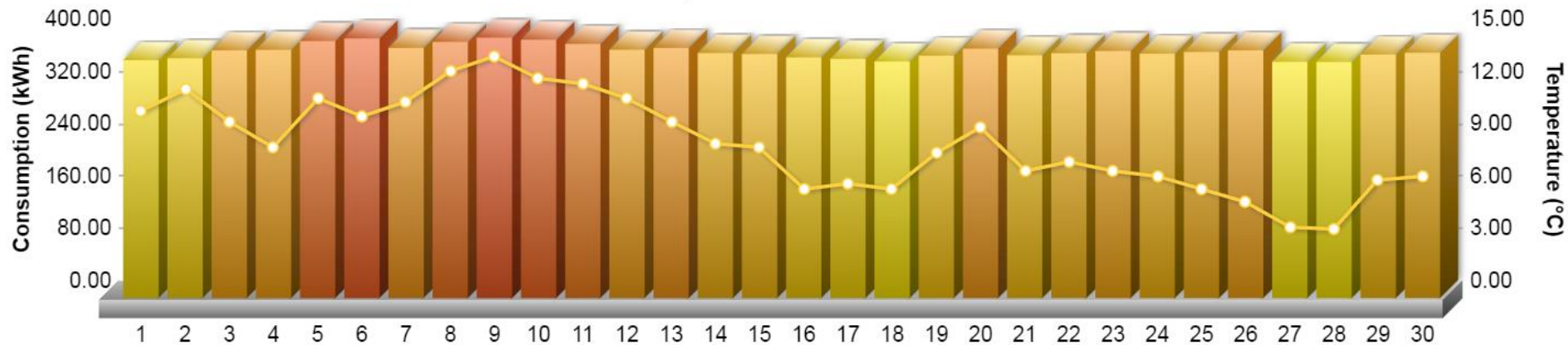
Time of Day Energy Monitoring



Trouble Shooting Problems



Consumption for November 2016



Problem Identified and Repaired

12

Low Usage
115.19 kWh or
lower

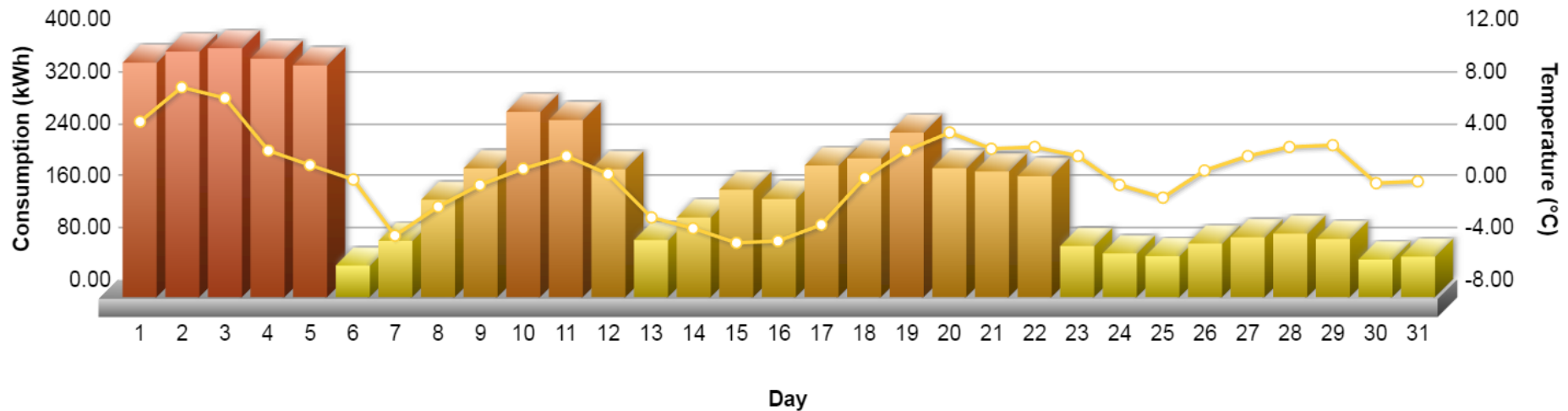
14

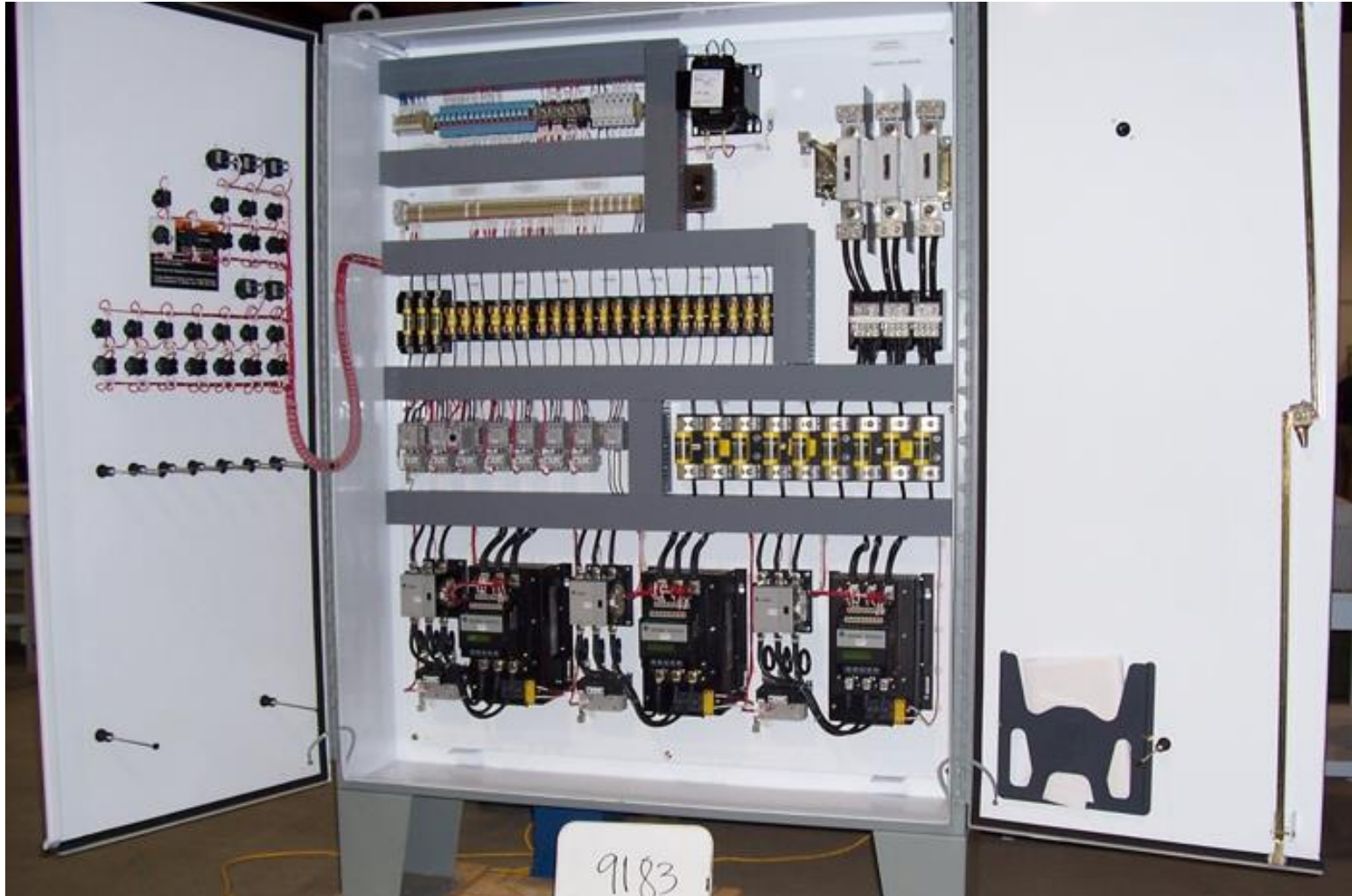
Average Usage
215.26 kWh

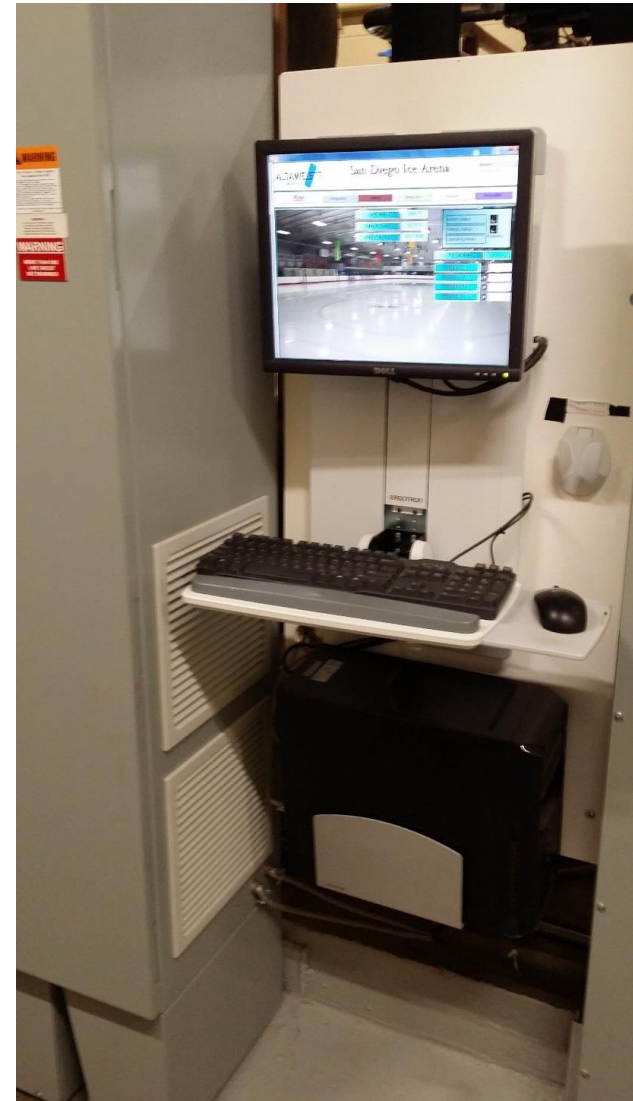
5

High Usage
315.33 kWh or
higher

Consumption for December 2016









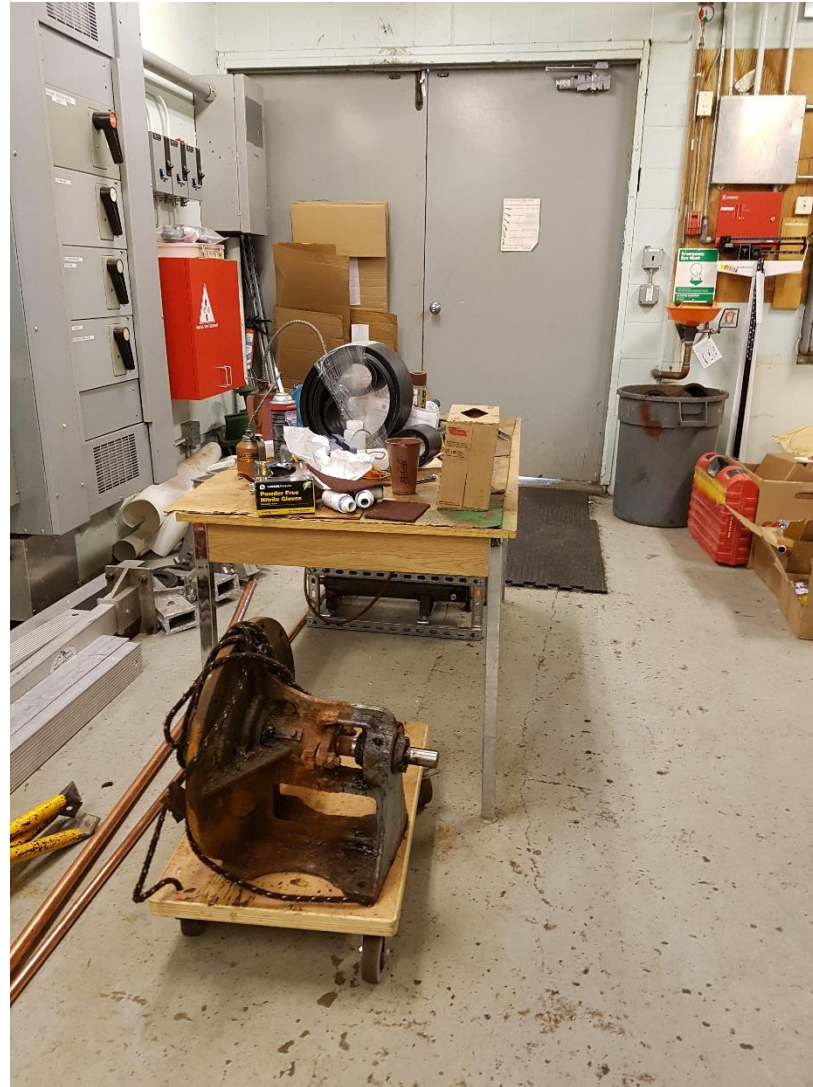
Practice Good Housekeeping








Keep A Clear Path to Your Doorways



WARNING

**IF YOU DON'T SCHEDULE
TIME FOR MAINTENANCE,
YOUR EQUIPMENT WILL
SCHEDULE IT FOR YOU.**

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I Will Stop Now 😊



Thank You For Your Time

