

# *GreenChill & Farm Fresh*



Presented by: Jon Perry  
Director of Maintenance  
and Energy

# Welcome,



# *What is GreenChill?*

*Partners must pledge to go above and beyond regulatory requirements by establishing an inventory of current refrigerant emissions that may affect climate change and the stratospheric ozone layer, and then setting reduction targets for these emissions. Partners will also participate in an industry/government research initiative to assess the performance of cutting edge "green" technologies in terms of energy efficiency, reduction of ozone-depleting refrigerant charges, and minimization of refrigerant leaks.*





## *Why is Farm Fresh Joining?*

- *We want to be good environmental Stewards*
- *We know by joining and sharing we will reach our goals more effectively*
- *We have a duty to our customers*
- *We also are hoping to help guide an industry in the correct direction by being active contributors*



## *Farm Fresh Engineering Background*

- We are a Class A General Contractor*
- We have been the General Contractor on all projects since Mike took over the department (approximately 24 Years ago)*
- We have very quick supermarket construction schedule, some have been built from the ground up in 3 months*



## *Continued*

- *We design our own stores including electrical, hvac, refrigeration, and equipment*
- *We grew from a poor leveraged buyout company background where we had limited resources*
- *We have a lot of long term associates that work as a team*



## *Continued*

- We do our own maintenance*
- We manufacture our own cabinets and fixtures*
- We have our own paint shop*
- We get to see the entire life cycle for a grocery store*





# *Engineering Staffing*

*Approximately 91 associates*

- Construction accounts for 60*
- Maintenance accounts for 23*
- Equipment and Design  
account for the remaining 8*





# *Reasons for our Success*

- We see the entire picture*
- We value being flexible*
- We are open to new ideas*
- We are willing to make mistakes*
- We set challenging goals*
- We have a deep level of trust within our department*
- We deliver on our promises*



# *Maintenance and Energy Staff*

- *HVAC&R 9*
- *General 2*
- *Deli/Bakery 2*
- *Front end 2*
- *Electrical 1*
- *Office staff 7*



# *Central Monitoring*

- *Subdivision of Maintenance and Energy*
- *Currently we have 6 full time people involved in the day to day work with 10 people trained to assist as needed.*
- *7 computer terminals in the office to handle alarms*



# *Current hours of Coverage*

## *24 hours/365 days a year*

- Monday through Friday 7:00 AM to 5:30 PM we have 3 people on staff handling alarms, call booking and dispatch*
- Nights and Weekends we have one person on staff at all time*
- Weeknights depending on weather 1 or 2*





## *Current Monitored Store Count 150*

- *Bigg's*
- *Shop'n Save/St. Louis*
- *Shop'n Save/Pittsburgh*
- *Hornbachers*
- *Farm Fresh*
- *Cub Foods*



# *GreenChill points of this store*

- *Refrigerant Management*
- *Energy efficiency*
- *Reliability (Sustainability)*
- *Central Monitoring*



## *Refrigerant Management*

- *Non ODS (R-404A vs R-22)*
- *Reduced Charge*  
*4400 lbs to 2500 lbs*
- *Reduced Leak Potential*
- *Reduced oil waste*



## *Refrigerant Management*

- *Non ODS (R-404A vs R-22)*
- *Reduced Charge*  
*4400 lbs to 2500 lbs*
- *Reduced Leak Potential*
- *Reduced oil waste*





## *R-404A versus R-22*

- *Zero ODS*
  - *3400 GWP*
  - *Harder to detect leaks*
  - *Higher leak potential based on operating pressure/less safe*
  - *Lower grade waste heat for reclaim/good for oil temperature and desuperheating*
- *0.05 ODS*
  - *1700 GWP*
  - *Easier to detect leaks*
  - *Lower leak potential based on operating pressures*
  - *Higher grade waste heat/bad for oil temperatures and requiries desuperheating*

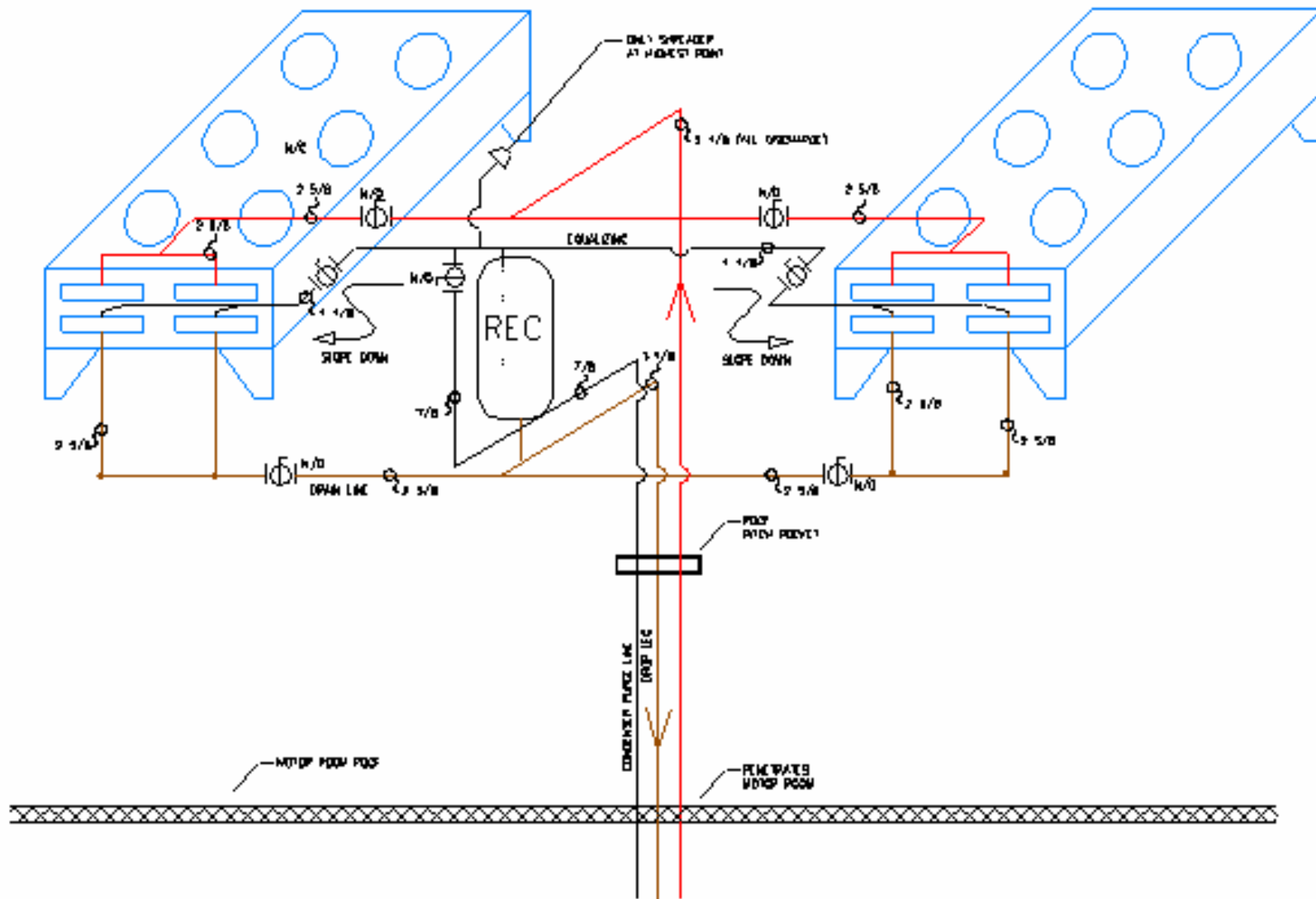


# *Reduced Charge*

- *One central system with loop piping*
- *One Surge receiver / Roof mounted*
- *Extreme Sub-cooling reduces liquid line sizes*
- *Hydronic heat reclaim with flat plate heat exchangers*



# *Surge Receiver Roof Mounted*

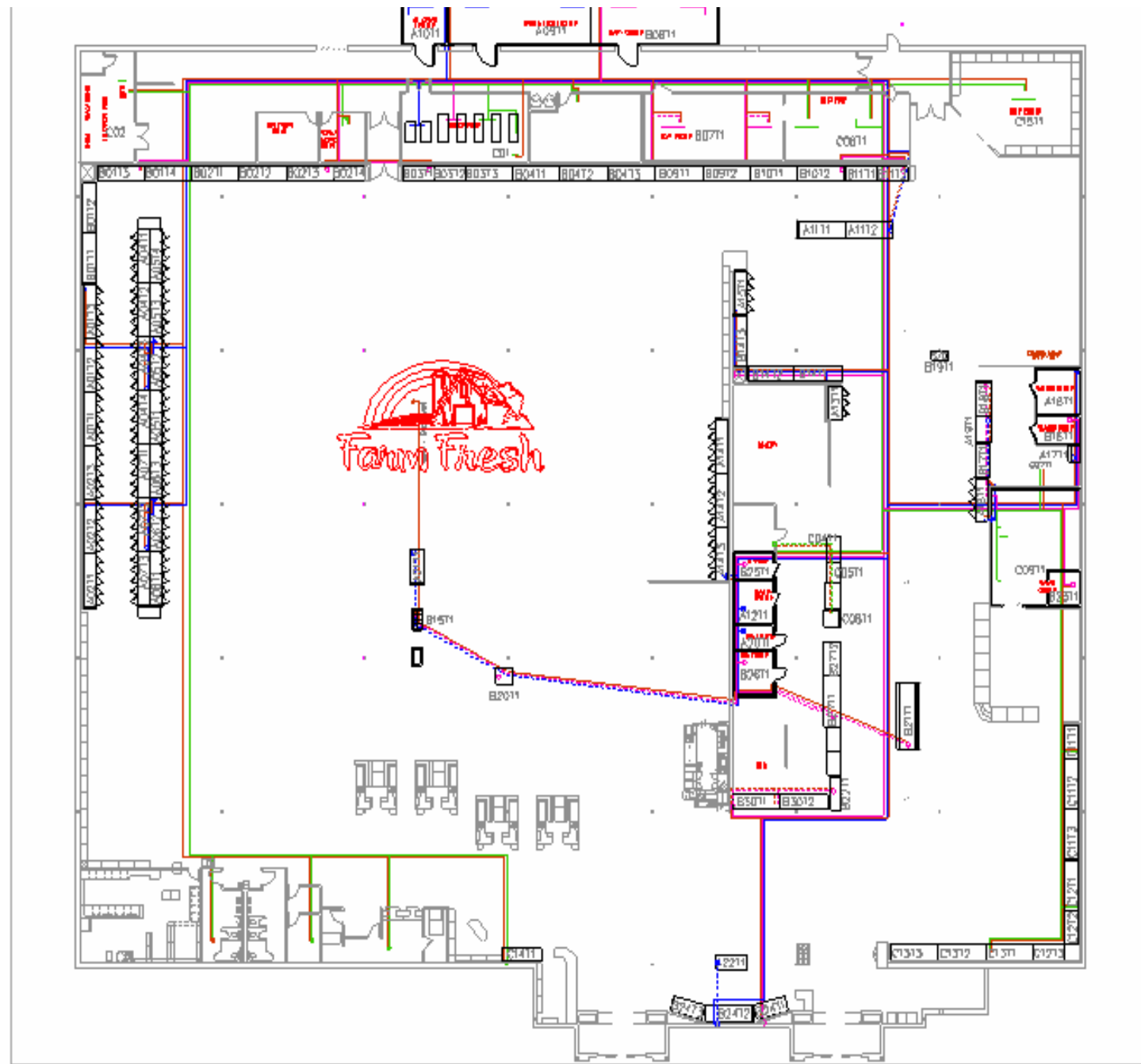


## *Reduced Leak Potential*

- *Less Pipe Surface area*
- *Less Pipe footage*
- *Less Solder Joints*
- *Less components*
- *Better piping supports*









# *Manifolded Piping*

				Outside Surface sq ft/ft	Outside Surface sq ft	Weight of tube lb/ft	Weight of tube lb
Pipe size	Feet	Cost/ft	Total				
158	1780	\$6.66	\$11,855	0.425	756.5	1.140	2029.2
138	4500	\$5.20	\$23,400	0.360	1620.0	0.882	3969.0
118	3980	\$3.88	\$15,442	0.295	1174.1	0.653	2598.9
78	3700	\$2.68	\$9,916	0.229	847.3	0.454	1679.8
58	2560	\$1.71	\$4,378	0.164	419.8	0.284	727.0
12	8180	\$1.41	\$11,534	0.131	1071.6	0.198	1619.6
	24700		\$76,525		5889.3		12623.6



# Central system loop piping

Loop system				Outside Surface sq ft/ft	Outside Surface sq ft	Weight of tube lb/ft	Weight of tube lb
Pipe size	Feet	Cost/ft	Total				
358	80	\$27.48	\$2,198	0.949	75.9	4.290	343.2
318	500	\$21.02	\$10,510	0.818	409.0	3.330	1665.0
258	760	\$15.63	\$11,879	0.687	522.1	2.480	1884.8
218	580	\$10.49	\$6,084	0.556	322.5	1.750	1015.0
158	960	\$6.66	\$6,394	0.425	408.0	1.140	1094.4
138	1020	\$5.20	\$5,304	0.360	367.2	0.882	899.6
118	1040	\$3.88	\$4,035	0.295	306.8	0.653	679.1
78	1380	\$2.68	\$3,698	0.229	316.0	0.454	626.5
58	1200	\$1.71	\$2,052	0.164	196.8	0.284	340.8
12	1460	\$1.41	\$2,059	0.131	191.3	0.198	289.1
	8980		\$54,213		3115.6		8837.6





# *Big View of Overhead piping*

## *Loop piping*

- *8,980 linear feet*
- *\$54,213*
- *3,115 sq ft of surface area*
- *8,837 lbs of copper*
- *779 feet of solder circumference*
- *2500 lbs refrigerant*

## *Manifolded*

- *24,800 linear feet*
- *\$76,500*
- *5,889 sq ft of surface area*
- *12,673 lbs of copper*
- *1472 feet of solder circumference*
- *4400 lbs refrigerant*



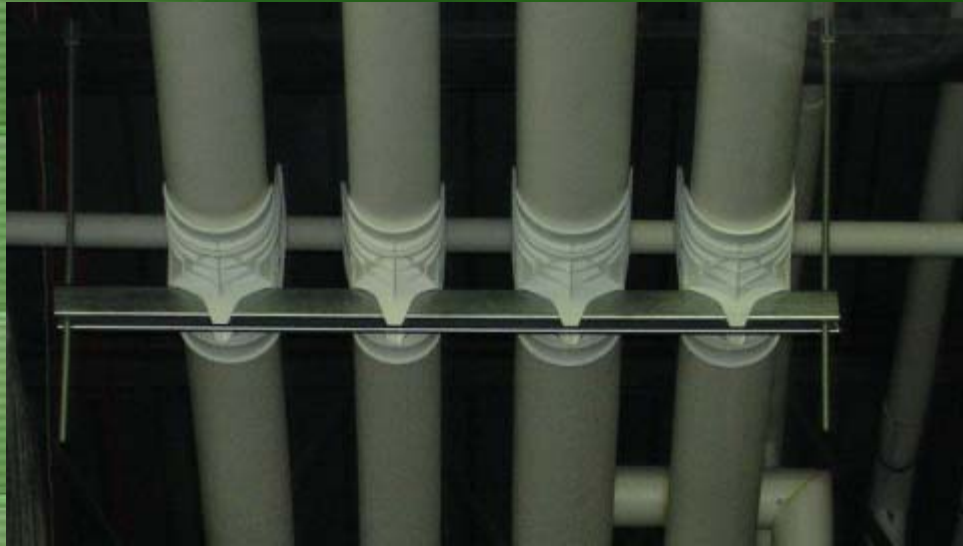
## *Less Components*

- *Only 6 compressors with, 6 dual pressure switches*
- *No oil seperator*
- *Only 1 receiver*
- *Only 2 oil floats*
- *Drastically reduced EPRs (8)*
- *No three way heat reclaim valves*
- *No hold back valves*
- *No desuperheating/No water-cooled heads*



# *Better Pipe Support*

- *Insugaurd*



## *Reduced Oil Waste*

- *The compressor motors are external to the system*
- *Open Drive Compressor burnouts cannot contaminate system / Less environmental damage*
- *Often systems have high levels of acid and are not cleaned up leading to early compressor failure*







## *Refrigeration Energy Efficiency*

- *Premium efficiency Toshiba motors approximately 10% more efficient and low rpms*
- *Two stage compression 7% savings*
- *Open Drive Direct Connected Carlyle compressors are still the most efficient compressor 50 years later*
- *Access to entire store THR for heat reclaim*
- *Loop piping reduces heat gain by reducing surface area by 50% on suction and liquid lines*



## *Refrigeration Energy Efficiency*



- *Variable speed condenser fan control*
- *Condenser heat rejection capacity available to all systems at all times*
- *Receiver is roof mounted (additional heat of rejection/free sub-cooling/ no hold back valves)*
- *Soft starters for low inrush currents*
- *Solenoid control at the case for full load operation of TXV (good oil flow)*
- *Superior Insulation install with 1" wall on all lines*



# How often are the front doors open?

- \$300,000 per week
- \$25 bag of groceries per customer
- Door opens twice per customer
- 168 hours per week
- $= 300,000 * 2 / (25 * 168 * 60)$
- **2.4 door openings per minute**
- *Add employees, cart gathering, vendors, and broken automatic doors and the average is higher*





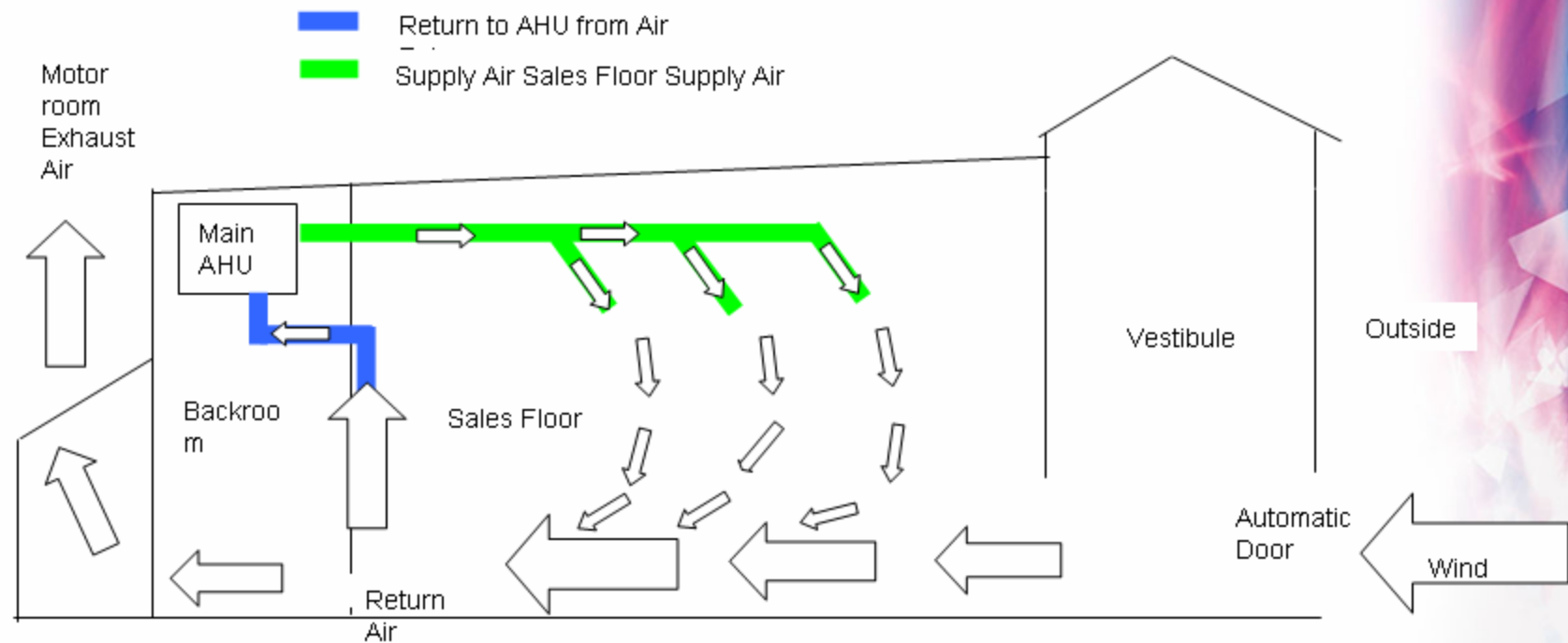
# CFM of air entering a door

- Assume 10 miles per hour (mph)
- $(10 \text{ mph}) * (5280 \text{ ft/mile}) / (60 \text{ min/Hour}) = 880 \text{ ft/min}$
- The door opening is  $5 \text{ ft} \times 7.5 \text{ ft} = 37.5 \text{ sq ft}$
- This means  $(880 \text{ ft/min}) * (37.5 \text{ sq ft}) = 33,000 \text{ cfm}$  come through a standard bi-parting automatic door





# Previous Pattern of Air Flow with Motor room

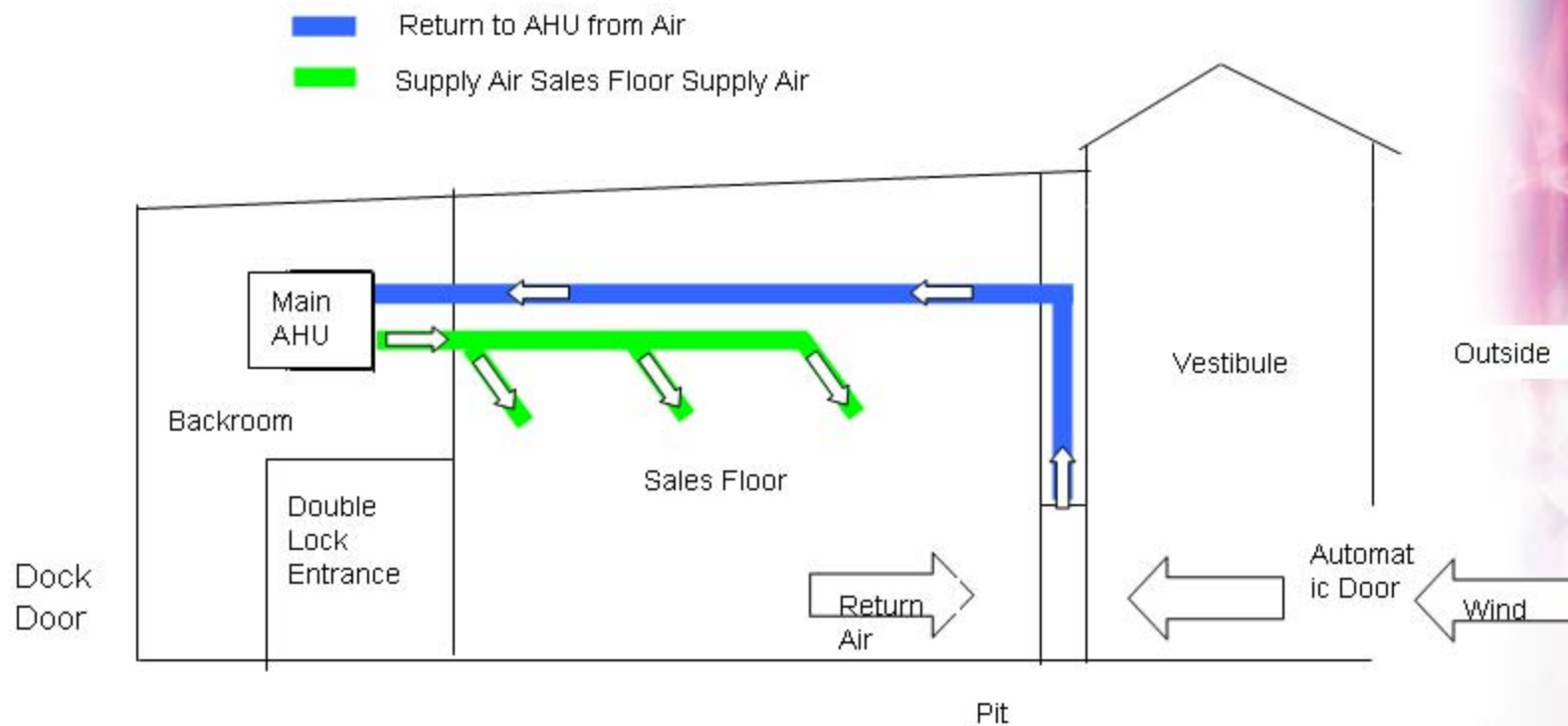


# Explanation of Reverse Return Air

- In comparing most stores the return air actually sets up an air pattern that assists in pulling outdoor air through the store when the front doors are open
- By reversing this pattern the mass of the store air is colliding with the in coming air at a concentrated point effectively cancelling an infiltrating wind proportionate to each streams kinetic energy



# Basic Layout in Profile



# Why One Main AHU?

I believe multiple units operate in heating mode and cooling mode at the same time frequently

I believe larger motors can be applied and balanced for a more efficient system than package units.

I believe circulating air and mixing wide ranges of air is more effective than heating and cooling that same air in small local zones

Less roof top travel / more technician friendly

Less static pressure than roof top mounted units

Less concerns on unit insulation

Not effected by weather

Standby capacity

No cranes necessary for compressor replacement





# Down Blast Fans

- These deliver a targeted cone of air of about 1100 cfm to the floor in about an 18" diameter
- They de-stratify the store and keep the store temp uniform
- They can add heat to your cold isles
- Low static pressure compared to using main duct work



# Reasons for using Fabric Duct

- Comes essentially balanced as designed
- No dampers to get confused
- More difficult for a technician to tinker with
- Looks cleaner over time in open ceiling
- Takes up less space during construction
- Environmentally friendly
- Installs quickly



## *Reliability (Sustainability)*

- *Carlyle Open Drive Compressors installed correctly have 25 + years average life*
- *Superior oil management*
  - *Compressors have oil overflow*
  - *Compressor oil pumps move the oil*
- *Reduce materials*
  - *Less copper, solder, nitrogen, insulation, unistrut, saddles, glue , acetylene, etc*
  - *Less refrigerant*
  - *Fabric Duct*



# *Central Monitoring*

- *Advanced notification of refrigerant leaks MLRDS sensors*
- *Contained Motor room*
- *Rapid response with technicians*
- *Electronic As-builts of stores*
- *Innovation in leak detection and refrigerant management*





# *Refrigerant Leak Monitor*





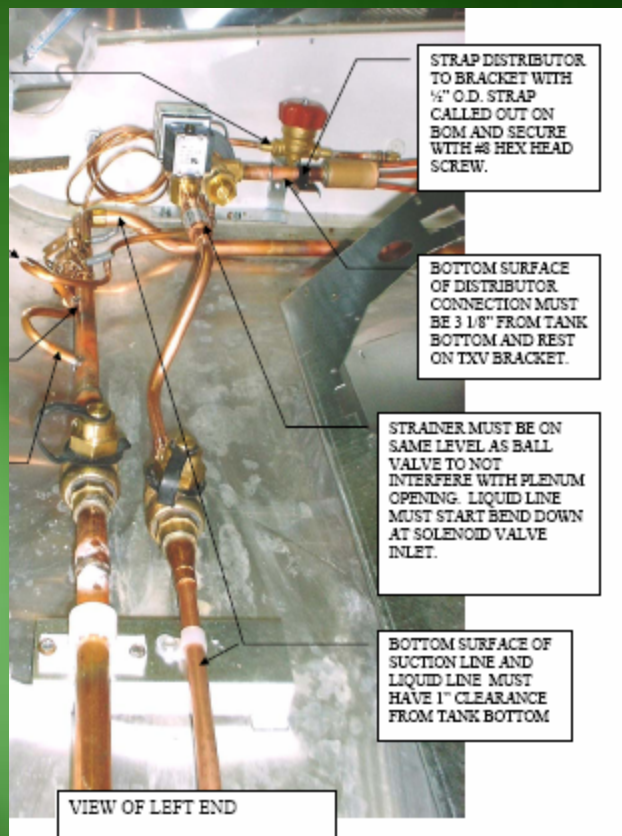
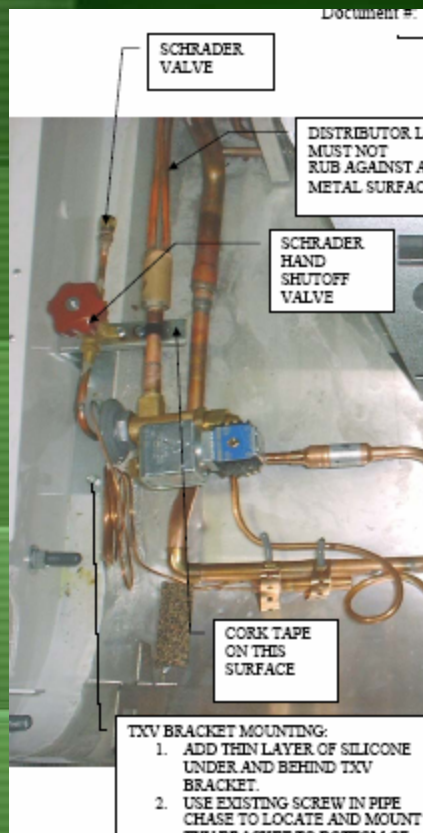
## *Where are we headed?*

- *We are studying secondary systems and CO2*
- *Removal of all Schraders outside of motor room*
- *Better partnerships with suppliers focused on reducing leaks creating improved equipment (Case piping)*
- *Improved installation techniques*
  - *Higher pressure testing for longer periods*
  - *Lower vacuums for longer periods*
  - *Hydrogen leak testing*





# Superior line supports





- *Thank you*

