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AHRI Standard 1230

AHRI Standard 1230

AHRI = Air Conditioning Heating and Refrigeration Institute

- AHRI Standard 1230 was launched in 2011
- Established certification standard for Variable Refrigerant Flow (VRF) equipment
- Before 2011, no certification standard was available for VRF equipment (DOE waiver required)
 - Since VRF is relatively new to US market, AHRI had to create a new standard to rate this equipment



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AHRI Standard 1230

- Covers air source and water source VRF equipment
- 65,000 Btu/h thru 300,000 Btu/h
 - VRF equipment larger than 300,000 Btu/h currently not covered by any AHRI
 - VRF equipment smaller than 65,000 Btu/h currently covered by AHRI Standard 210/240
- www.ahridirectory.org



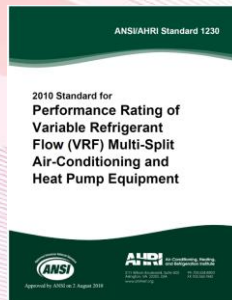
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Performance data reported includes

- EER (Energy Efficiency Rating) at 95°F
- COP (Coefficient of Performance) at 47°F
- COP (Coefficient of Performance) at 17°F
- IEER (Integrated Energy Efficiency Ratio)



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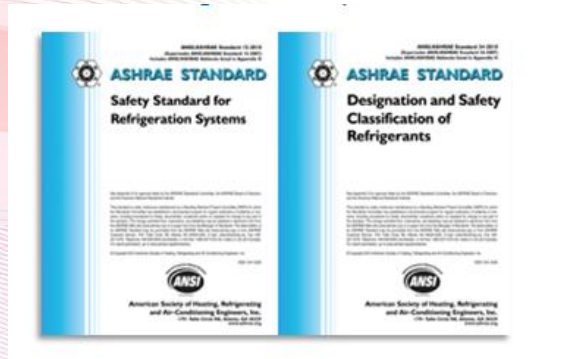
What is IEER?

- Measures VRF equipment's ability to react to changing building loads
- $IEER = (0.020 * A) + (0.617 * B) + (0.238 * C) + (0.125 * D)$
- Where
 - A = EER @ 100% net capacity
 - B = EER @ 75% net capacity
 - C = EER @ 50% net capacity
 - D = EER at 25% net capacity

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ASHRAE Standard 15 for VRF



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ASHRAE Standard 15 for VRF

- When designing a refrigerant pipe system for VRF, refrigerant safety must be considered
- The **occupied** spaces where the refrigerant piping and indoor units are installed may experience a discharge of refrigerant if a leak occurs in the system.
- Local codes and ASHRAE Standard 15 (in conjunction with ASHRAE Standard 34) provide guidelines to assist in designing safe VRF refrigerant systems

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Determine smallest occupied space volume

- Spaces connected by permanent openings may be considered in volume calculations
- Permanent openings may include
 - Ducts
 - Transfer grills

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ASHRAE 15/34

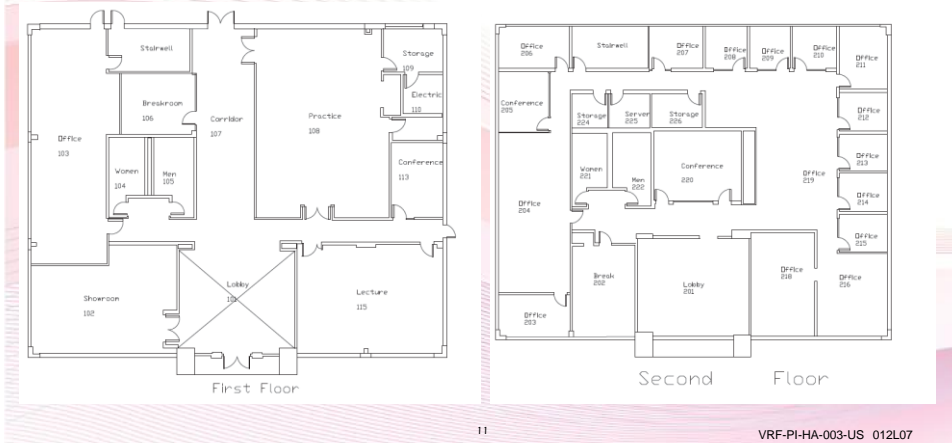
- Establishes maximum allowable volume of R410A refrigerant concentration level (RCL) in an occupied space
 - **26 lbs per 1000 cubic feet** for commercial and residential occupancies
 - **13 lbs per 1000 cubic feet** for institutional occupancies

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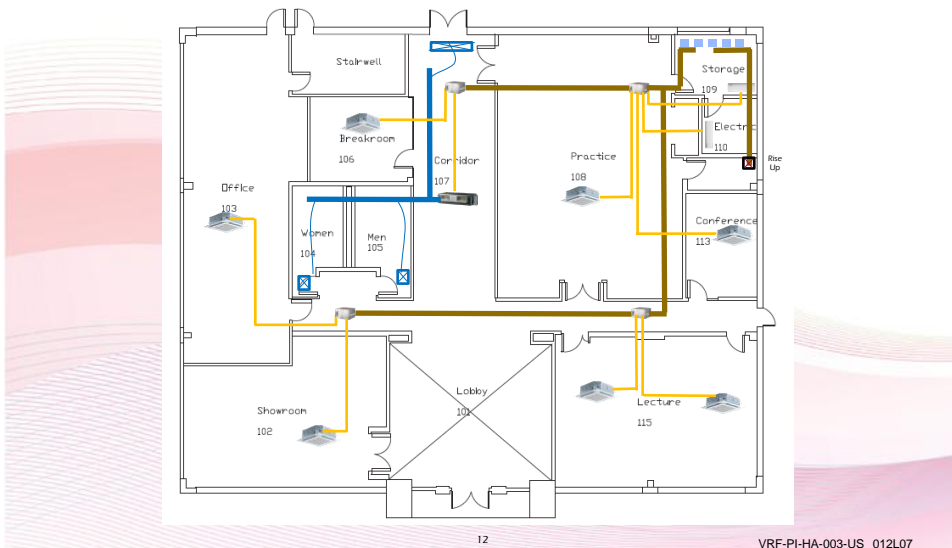
ASHRAE Standard 15 for VRF

- Below is an example of design process for a VRF system for a 2 story office building
- Need to layout VRF system in order to calculate total system refrigerant



ASHRAE Standard 15 for VRF

- VRF layout for first floor system
- 18 ton water source VRF system, total system charge 63.32 lbs



ASHRAE Standard 15 for VRF

ASHRAE 15 refrigerant concentration levels for offices

- 26 lbs/1000 ft³ allowed for occupied areas
- First floor system has total of 63.32 lbs of refrigerant
 - Smallest volume of office allowed = $(63.32 * 1000 \text{ ft}^3) / 26 = 2435 \text{ ft}^3$
 - With 9' ceiling height, smallest office area allowed is $2435/9 = 270 \text{ ft}^2$
 - After reviewing office areas on first floor, Conference Room 113 area of $247 \text{ ft}^2 < 270 \text{ ft}^2$

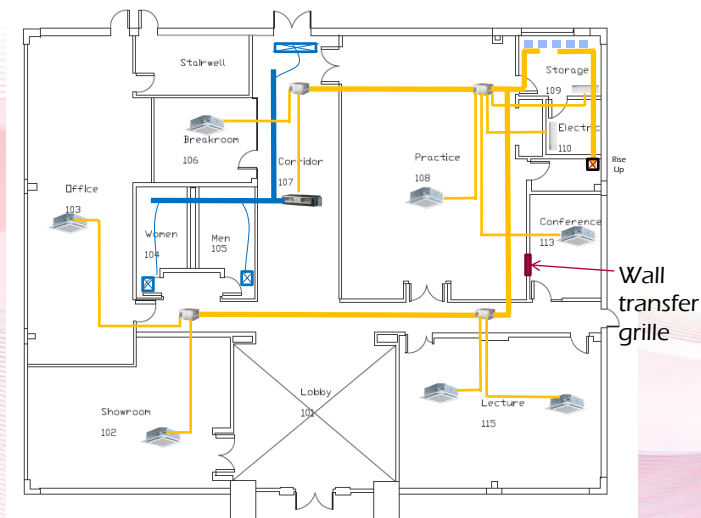
Rm Number	Room Name	Area(sq. ft)	Comment
102	Showroom	820	
103	Office	1102	
104	Women Restroom	146	Combined w/107
105	Men Restroom	165	Combined w/107
106	Breakroom	270	
107	Corridor	728	
108	Practice	1400	
109	Storage	160	Unoccupied
110	Elec.	100	Unoccupied
113	Conference	247	
115A	Lecture	432	
115B	Lecture	432	

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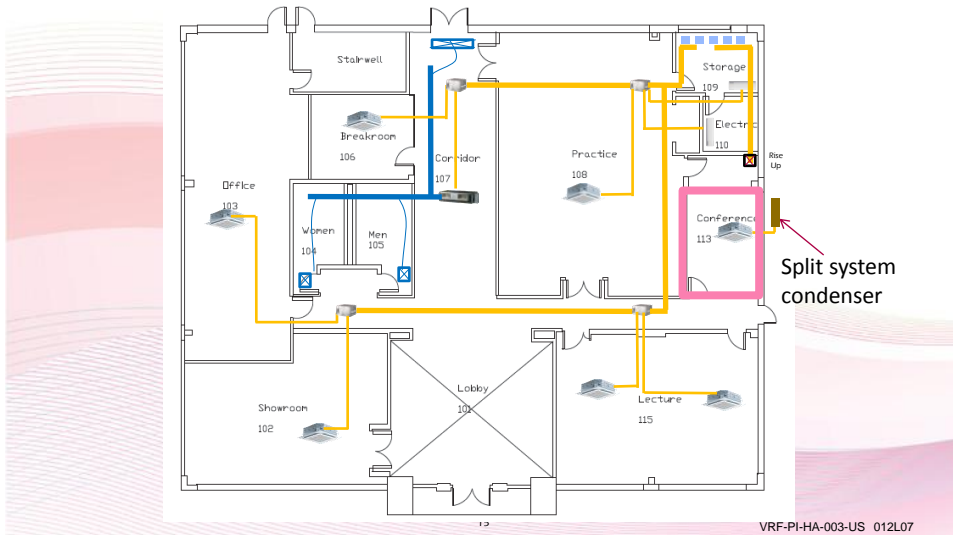
To comply with ASHRAE 15, a transfer opening could be added to Conference 113 (check with local codes)



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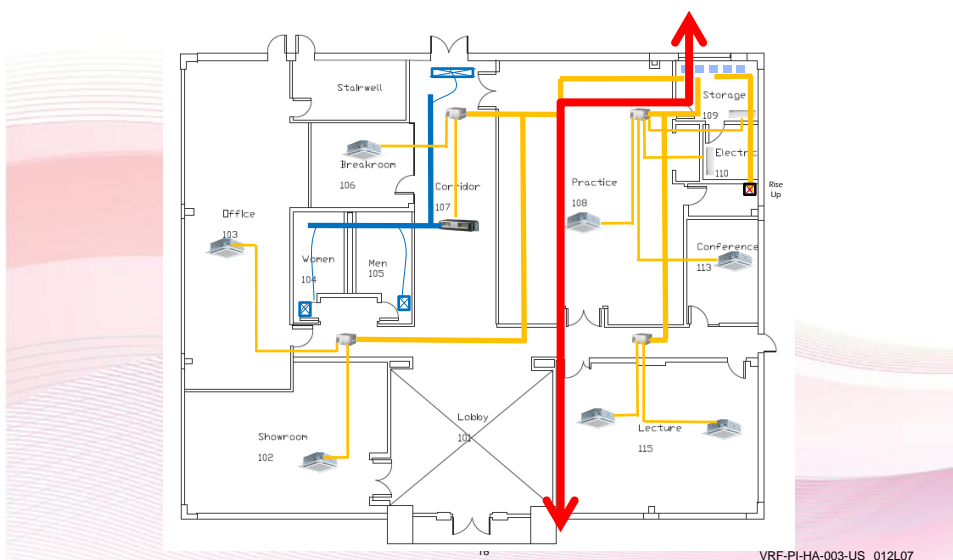
ASHRAE Standard 15 for VRF

To comply with ASHRAE 15, Conference 113 could be removed from VRF system and served by single split system.



ASHRAE Standard 15 for VRF

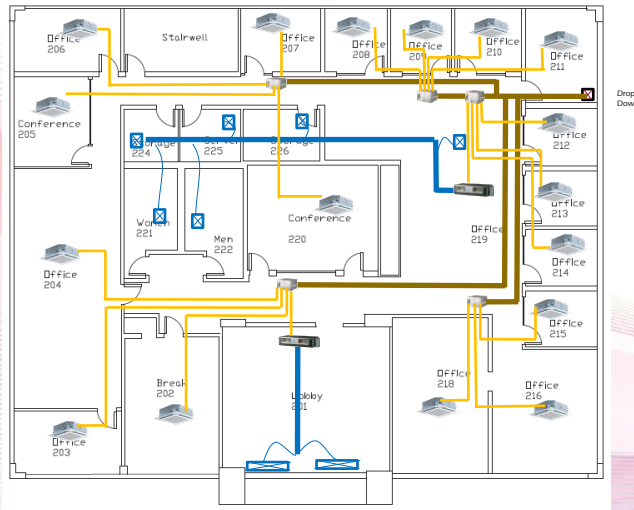
Another solution, split 18 ton system into (2) smaller 6 ton and 12 ton systems, lowering system charge



ASHRAE Standard 15 for VRF

•VRF layout for second floor system

•36 ton water source VRF system, total system charge 114.71 lbs



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ASHRAE Standard 15 for VRF

ASHRAE 15 refrigerant concentration levels for offices

- Second floor system has total of 114.71 lbs of refrigerant
- Smallest volume of office allowed = $(114.71 * 1000 \text{ ft}^3) / 26 = 4442 \text{ ft}^3$
 - With 10' ceiling height, smallest office area allowed is $4442/10 = 444 \text{ ft}^2$
 - After reviewing office areas on second floor, the following are too small
 - 202, 203, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 218, 220

Rm Number	Room Name	Area(sq. ft)	Comment
201	Lobby	672	
202	Break Room	352	
203	Office	180	
204	Office	720	
205	Conference	208	
206	Office	198	
207	Conference	143	
208	Office	121	
209	Office	121	
210	Office	121	
211	Office	192	
212	Office	120	

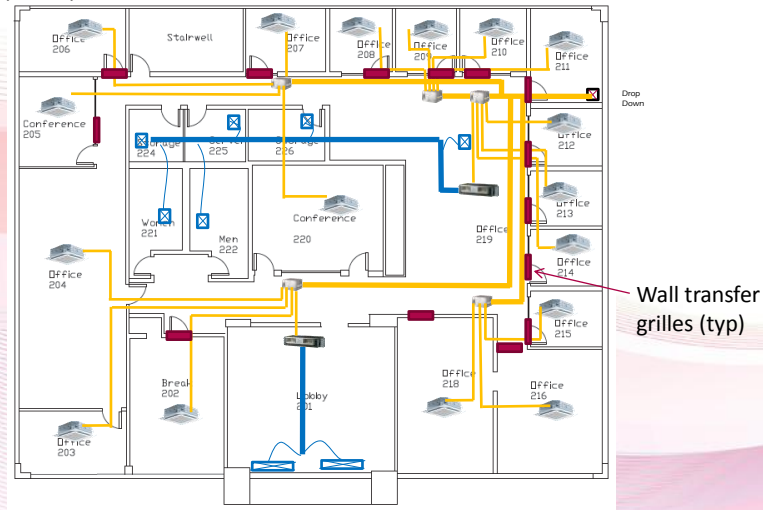
Rm Number	Room Name	Area(sq. ft)	Comment
213	Office	120	
214	Office	120	
215	Office	120	
216	Office	378	
218	Office	400	
219	Office	930	
220	Conference	396	
221	Restroom	142	Combined w/ 219
222	Restroom	164	Combined w/ 219
224	Storage	90	Unoccupied
225	Storage	90	Unoccupied
226	Storage	117	Unoccupied

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ASHRAE Standard 15 for VRF

To comply with ASHRAE 15, transfer openings could be added to 202, 203, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 218, 220

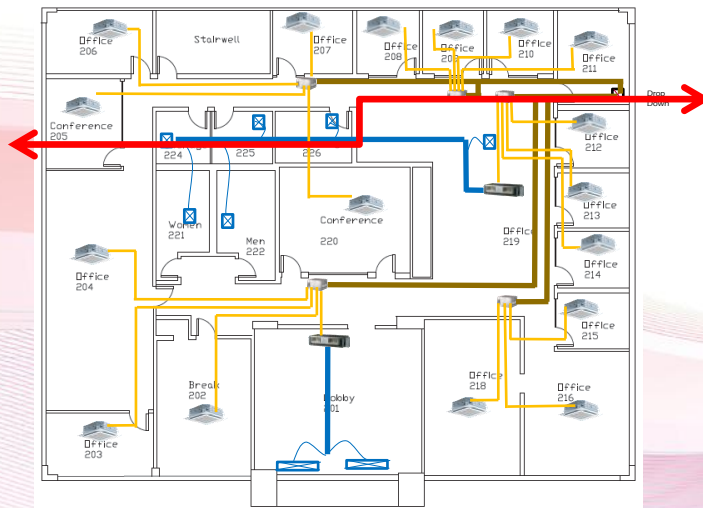


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ASHRAE Standard 15 for VRF

Another solution, divide the 36 ton water source VRF system into (2) systems 24 and 12 ton with smaller refrigerant charges



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ASHRAE Standard 15 for VRF

ASHRAE 15 refrigerant concentration levels for offices

- Second floor 24 ton system has total of 81.03 lbs of refrigerant
- Smallest volume of office allowed = $(81.03 * 1000 \text{ ft}^3) / 26 = 3116 \text{ ft}^3$
 - With 10' ceiling height, smallest office area allowed is $3116 / 10 = 312 \text{ ft}^2$
 - After reviewing office areas on second floor 24 ton system, the following are too small
 - 203, 212, 213, 214, 215

Rm Number	Room Name	Area(sq. ft)	Comment	Rm Number	Room Name	Area(sq. ft)	Comment
201	Lobby	672		216	Office	378	
202	Break Room	352		218	Office	400	
203	Office	180		219	Office	930	
204	Office	720		221	Restroom	142	Combined w/ 219
212	Office	120		222	Restroom	164	Combined w/ 219
213	Office	120		224	Storage	90	Unoccupied
214	Office	120		225	Storage	90	Unoccupied
215	Office	120		226	Storage	117	Unoccupied

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ASHRAE Standard 15 for VRF

ASHRAE 15 refrigerant concentration levels for offices

- Second floor 12 ton system has total of 43.8 lbs of refrigerant
- Smallest volume of office allowed = $(43.8 * 1000 \text{ ft}^3) / 26 = 1684 \text{ ft}^3$
 - With 10' ceiling height, smallest office area allowed is $1684 / 10 = 168 \text{ ft}^2$
 - After reviewing office areas on second floor 12 ton system, the following are too small
 - 207, 208, 209, 210

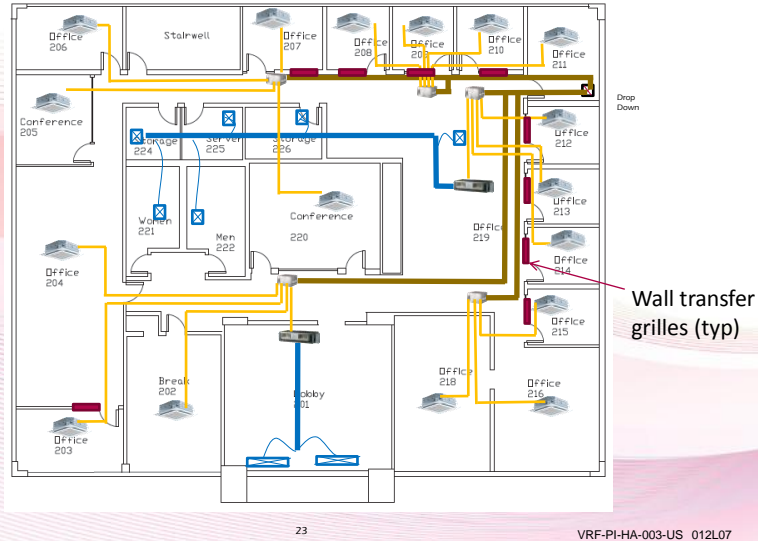
Rm Number	Room Name	Area(sq. ft)	Comment
205	Conference	208	
206	Office	198	
207	Conference	143	
208	Office	121	
209	Office	121	
210	Office	121	
211	Office	192	
220	Conference	396	

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ASHRAE Standard 15 for VRF

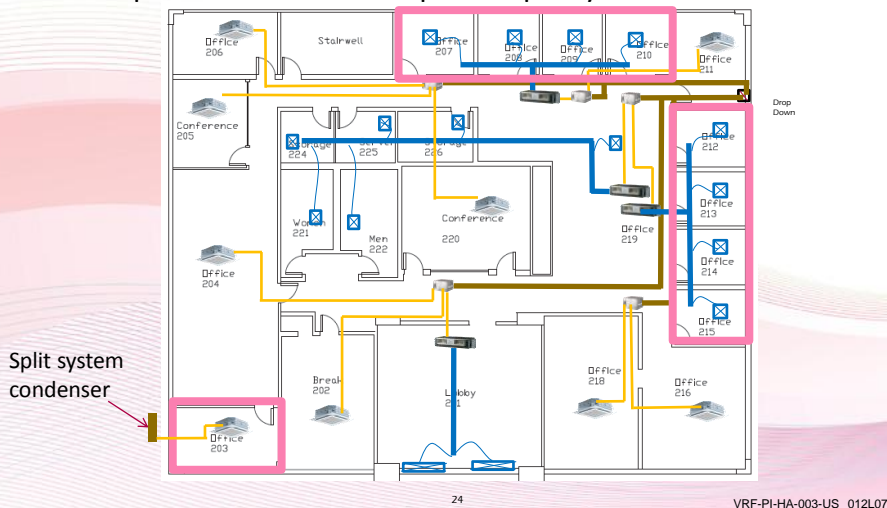
To comply with ASHRAE 15, transfer openings could be added to 203, 207, 208, 209, 210, 212, 213, 214, 215 (check with local codes)



ASHRAE Standard 15 for VRF

Another solution to comply with ASHRAE 15

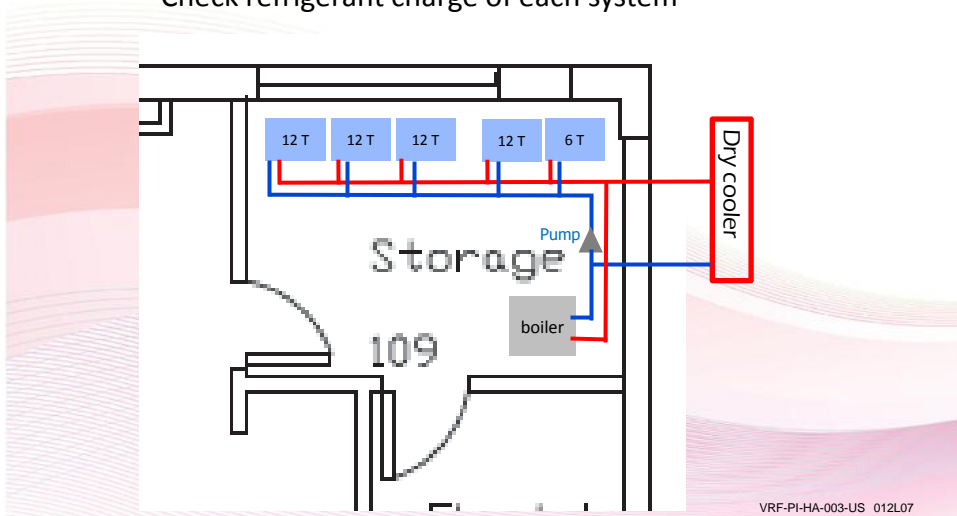
- Combine rooms 207, 208, 209, 210 into single ducted unit
- Combine rooms 212, 213, 214, 215 into single ducted unit
- Separate room 203 to separate split system



ASHRAE Standard 15 for VRF

ASHRAE Standard 15 requires that system with over 110 lbs of refrigerant charge have the fusible plugs vented to outdoors

- Check refrigerant charge of each system



ASHRAE Standard 15 for VRF

Check refrigerant charge of each system

- First Floor 18 ton water source VRF
 - 35.49 lbs (equipment charge)
 - 27.83 lbs (pipe system charge)
 - Total of 63.32 lbs < 110 lbs (venting **not** required)

ASHRAE Standard 15 for VRF

Check refrigerant charge of each system

- Second Floor water source system
 - 24 ton system total charge 81.03 lbs
 - 12 ton system total charge 43.8 lbs
 - < 110 lbs (venting **not** required)

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Questions?

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