

CALIFORNIA MECHANICAL CODE OVERVIEW OF 2016 UPDATES CHANGES AND RAMIFICATIONS

Presented to:



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Introduction – Today’s Agenda

- Overview
 - Review changes in the California Mechanical Code (CMC) between 2013 and 2016 versions
 - Point out where there are discrepancies between the CMC and the California Energy Code (what is incorrectly called “Title 24” in our industry)
- What is not included in today’s presentation
 - Reviewing changes in other parts of Title 24 (California Plumbing, Electrical, Fire, Building, etc. Codes)
 - Comprehensive delineation of changes – only major changes and design ramifications will be presented

Introduction – Today's Agenda

- Natural ventilation
- Ventilation airflow requirements (full and part load)
- Air classifications and recirculation
- Exhaust termination locations
- Filter MERV ratings
- Product Conveying Duct and Fire Dampers
- Minimum exhaust duct design velocities
- Product Conveying Duct Supports
- Grease duct thicknesses and leakage testing
- Type II grease exhaust hood terminations

Introduction – Agenda (continued)

- Boilers and low-water cutoff alternative
- Regulations regarding relief valve discharge piping
- Refrigerant leak calculation and vapor alarms
- Outdoor refrigeration room constraints on intake air
- Refrigeration piping and shafts
- Automated controls for cycles of concentration
- Hydronic piping and flushing
- Scope of expansion tanks
- Hydronic pipe joining methods defined
- Hydronic system controls constraints
- Process piping materials

Introduction – Title 24 Background

- Title 24 is made up of 12 parts listed below and all parts are Title 24
 - 1. California Building Standards Administrative Code
 - 2. California Building Code (comes in two volumes)
 - 3. California Electrical Code
 - 4. California Mechanical Code
 - 5. California Plumbing Code
 - 6. California Energy Code (this is commonly called “Title 24” in our industry)
 - 7. California Elevator Safety Construction Code
 - 8. California Historical Building Code
 - 9. California Fire Code
 - 10. California Existing Building Code
 - 11. California Green Building Standards Code
 - 12. California Reference Standards Code
- Title 24 is the law in California
 - If you do not conform to an industry standard like ASHRAE, but follow Title 24, then you can be sued.
 - If you do not conform to Title 24 in favor of an industry standard or other practice, then you can go to jail and be sued.

Introduction – Slide Formatting

- When a code section is changed from 2013
 - The 2013 text that changes in 2016 will appear in ***bold, italic font like this***
 - The 2016 verbiage that modifies the language will then follow the 2013 text
 - In some cases, the ramifications of the change will be shown in a diagram or a sample situation on a job
- When a code section is new in 2016
 - A summary will be provided about the new section
 - In some cases, the ramifications of the change will be shown in a diagram or a sample situation on a job

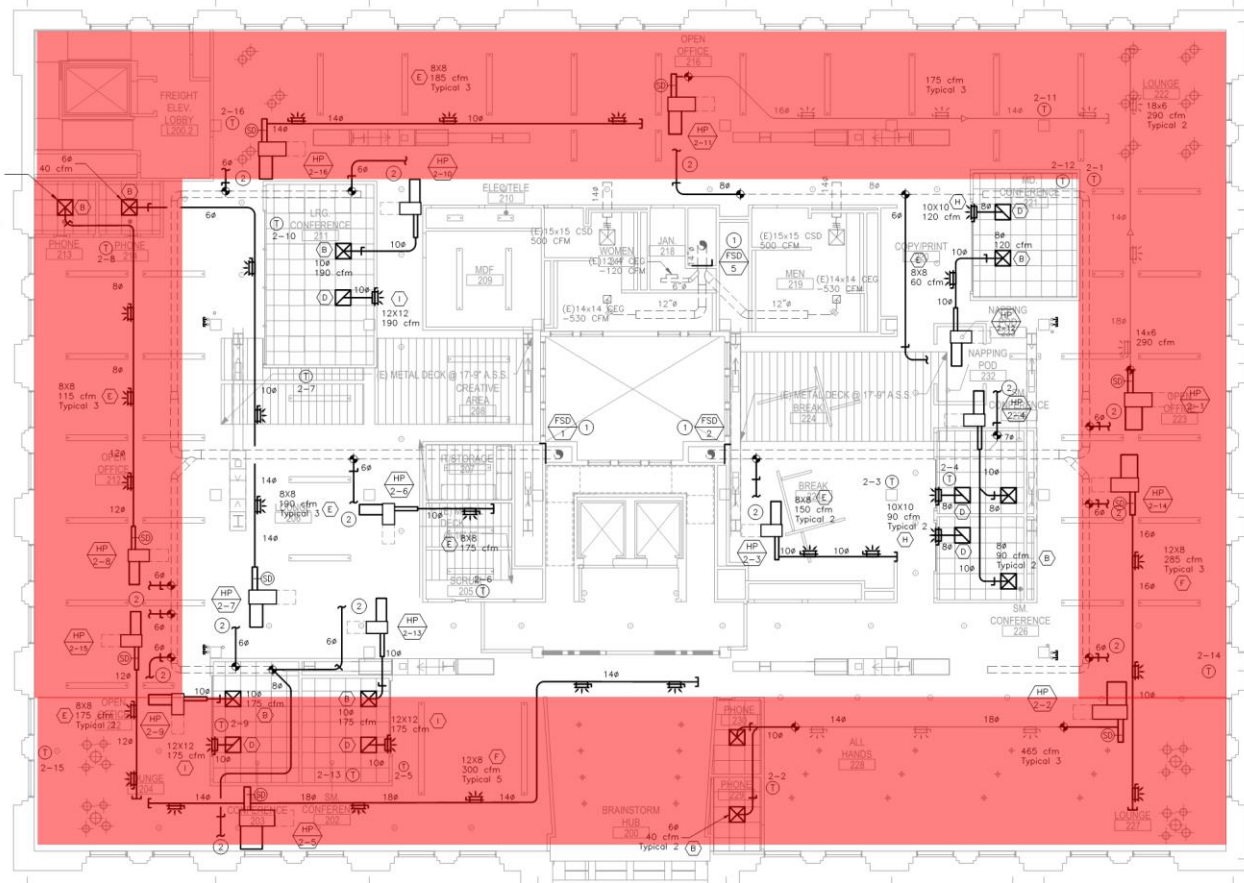
Natural Ventilation Constraints

- 2013 CMC
 - Sizes of openings follow ASHRAE 62.1
 - Openings must be permanently open unless ventilated space is also served by a mechanical ventilation system
 - ***Distance of space served to opening = 20-feet***
- 2016 CMC (402.2.1)
 - Distance of space served to opening is a function of ceiling height as well as if there are opposite or corner walls that contain openings
 - In general this relaxes the natural ventilation constraints allowing for more areas to be naturally ventilated

Natural Ventilation Example

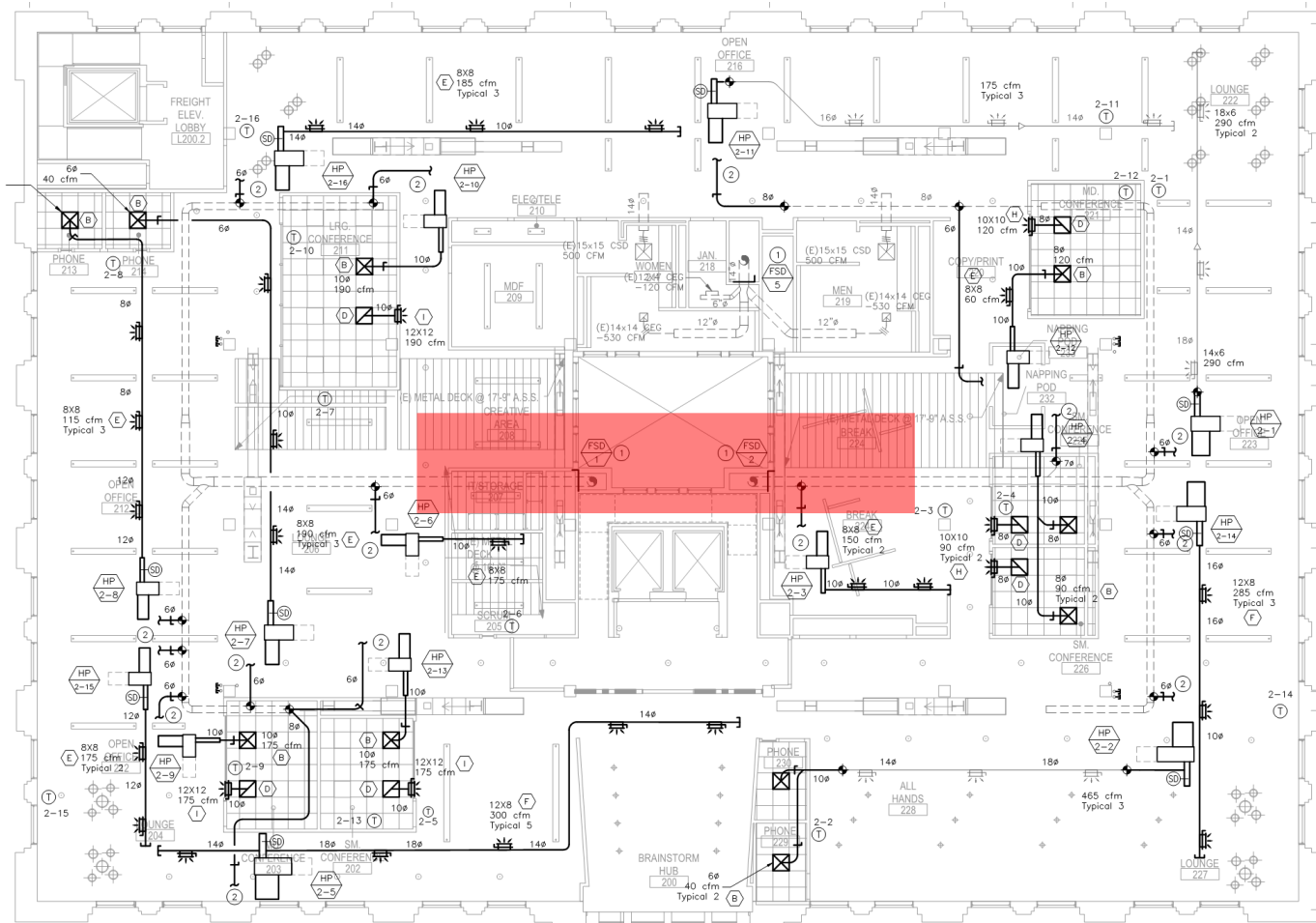
- A San Francisco office floor has a mechanical ventilation system, no ceilings (16-feet to deck) as well as operable windows
- The mechanical ventilation system is not conditioned and in winter mornings this results in cold complaints
- One solution is to shut down the mechanical ventilation system on cold mornings and let the occupants open operable windows for ventilation
- How much of the floor space can a natural ventilation option serve under the 2013 and 2016 distance-to-operable window constraints?

Natural Ventilation – 2013 criteria



- There are no dampers on the ventilation ducts; therefore, the mechanical ventilation system must operate for the areas that are not shaded

Natural Ventilation – 2016 criteria



- The NON-shaded areas are open to natural ventilation per the 2016 CMC - what is effectively the entire floor

Natural Ventilation – CMC Problem

- Recall that the CMC is part 4 of Title 24 and the California Energy Code is part 6 of Title 24
- It turns out that part 6 of Title 24 is more stringent than part 4
- If code is law and code has discrepancies, which part should be followed?
 - It could be argued that the more stringent code must be followed
 - It could also be argued that part 6 doesn't address multiple walls with openings, so part 4 can be used
 - The CMC *could* be used as a basis for engineering, but the project manager should approve the risk

Mechanical Ventilation Airflow

➤ 2013 CMC (403.2.1)

➤ Lists the equation from ASHRAE 62.1 as the criteria for outdoor airflow to a zone $V_{bz} = R_p P_z + R_a A_z$

➤ V_{bz} = outdoor airflow to zone

➤ R_p = outdoor airflow rate per person basis (cfm/person)

➤ P_z = ***largest number of people expected*** in zone during typical usage

➤ R_a = outdoor airflow rate per area basis (cfm/ft²)

➤ A_z = floor area of zone

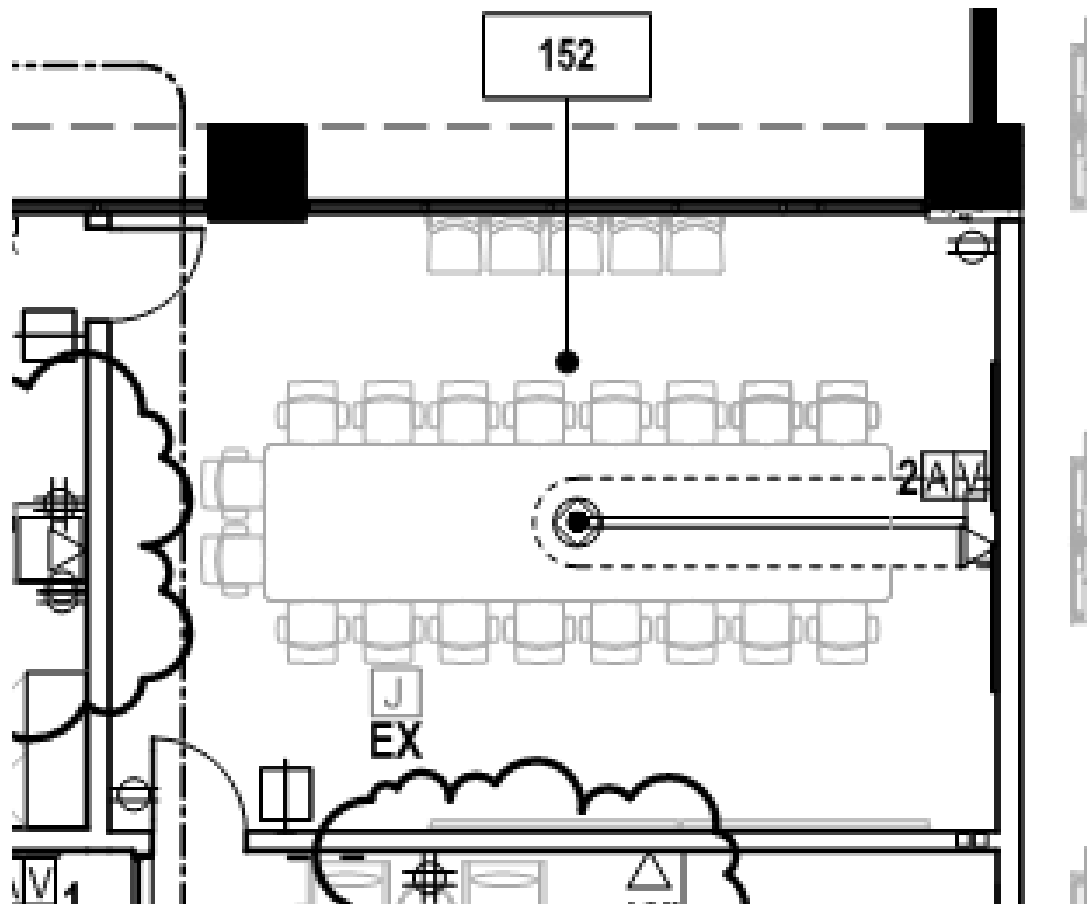
➤ 2016 CMC (403.2.1)

➤ P_z = number of people typically expected in zone

➤ In general, this decreases the required outdoor air rate

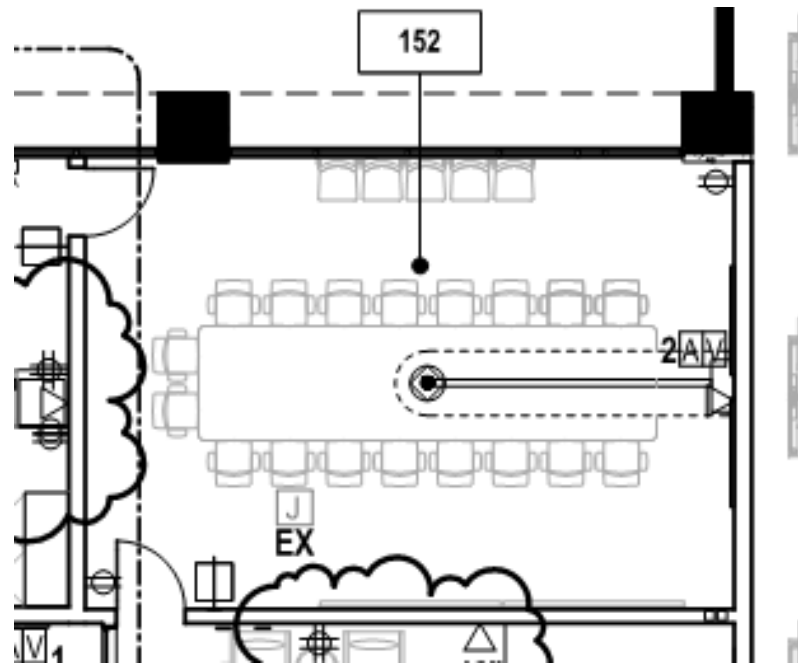
Mechanical Ventilation Airflow Sample

- A conference room on a floor has a table with chairs around it in addition to chairs placed along the wall in the architectural floor plans



Mechanical Ventilation Airflow Sample

- Based on the 2013 code, the ventilation rate would need to base the number of people in the zone on the number of chairs shown in the space (23)
- Following the 2016 code, the engineer would have flexibility to base the number of people in the zone on the quantity of chairs only around the table (18)



Mechanical Ventilation – CMC Problem

- Recall that the CMC is part 4 of Title 24 and the California Energy Code is part 6 of Title 24
- It turns out that part 6 of Title 24 is more stringent than part 4 (part 4 was updated, but not part 6)
- If code is law and code has discrepancies, which part should be followed?
 - Part 6, the California Energy Code, specifically shows the discrepancies with part 4 and stipulates that the more stringent code must be followed
 - The CMC could be used to argue a mistake, but it should not be used as a basis for engineering

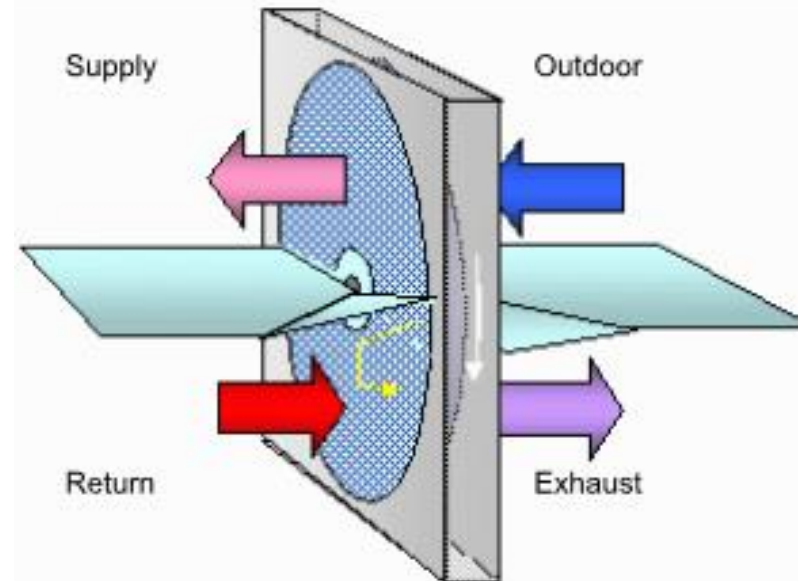
Air classifications and recirculation

- 2016 CMC (403.9) classified airstreams that now match 2013 ASHRAE 62.1
- Class 1 Air can be recirculated anywhere
- Class 2 Air can be recirculated to:
 - The same room
 - Other Class 2 or 3 rooms with similar pollutants
 - Any Class 4 room
 - Toilet rooms
 - To any space only through a heat recovery device as long as the recirculated air is less than 10% of the total outdoor air

Air classifications and recirculation

- Class 3 Air can be recirculated to:
 - The same room
 - To any space only through a heat recovery device as long as the recirculated air is less than 5% of the total outdoor air
- Class 4 air cannot be recirculated
- Energy recovery device:

Note how the heat wheel pockets will encapsulate some exhaust air as the wheel turns and redistribute it to the supply air.



Air classification – ramifications

- 2016 CMC (Table 402.1) airstream classifications have some conspicuous ramifications like:
 - Cafes, kitchens, and dining areas are Class 2, so in an office building they have to be once-through or isolated on a dedicated HVAC system
 - Art classrooms, wood/metal shops, and educational labs are all Class 2. Do they have similar pollutants?
- Engineering advice:
 - Stipulate the assumed air classes in a Basis of Design
 - Have the manufacturer of heat recovery equipment publish the recirculation rates in submittals

Exhaust Terminations

➤ 2013 CMC

➤ ***No mention of bird screens***

➤ 504.5 – Environmental Air Ducts

➤ 3-feet from property lines or building openings

➤ ***No mention of minimum distance to forced air inlets***

➤ 2016 CMC

➤ 502.1

➤ All exhaust openings except clothes dryer vents shall be covered with a corrosion resistant screen

➤ See code section for dimensional constraints of screens

➤ 502.2.1 – Environmental Air Ducts

➤ 3-feet from property lines or building openings

➤ 10-feet from forced air inlets

Filtration Constraints

➤ 2013 CMC

- ***No mention of mandated filtration in standard buildings***

- E 603.3

- Appendix E is for recommended sustainable practices

- Filtration value stipulated at MERV 13 in this section

➤ 2016 CMC

- 503.3

- All return airstreams must be filtered with a minimum of MERV 8 filters

- Note that MERV 13 is preferred because it captures most particle matter that is detrimental to human health with minimal pressure drop increase

Product Conveying Duct and Fire Dampers

➤ 2013 CMC

- ***No mention of restrictions on dampers in exhaust***
- Most building inspectors referred to an NFPA standard that prevents dampers in fume hood exhaust ducts

➤ 2016 CMC

- 505.2 now stipulates (via NFPA)
 - Fire dampers are not allowed when the toxic hazard is greater than the fire hazard
 - No product-conveying duct can pass through a fire wall

➤ Ramifications

- All product conveying ducts must be isolated in separate shafts or fire-wrapped
- The risk analysis about fire vs. toxic hazard is moot

Product Conveying Duct Velocities

➤ 2013 CMC

- ***No mention of welding exhaust***
- ***Fine light dust minimum velocity = 2,000-fpm***
- ***Dry dust minimum velocity = 2,500-fpm***

➤ 2016 CMC Table 505.4

- Added welding fume minimum velocity = 2,000-fpm
- Fine light dust minimum velocity increased to 2,500-fpm
- Dry dust minimum velocity increased to 3,000-fpm
- Provides more detailed examples of product conveyed material in the table

Product Conveying Garage Exhaust

- 2015 UMC Illustrated Training Manual 502.2.2
 - “Garage ventilation systems in parking garages ... should be regarded as ducts conveying flammable vapors.”
- 2016 CMC
 - As a variance, a calculation showing the concentration of flammables in the exhaust airstream is below 25% of the lower explosive limit (LEL) to avoid sprinklers and other constraints dealing with flammable exhaust
 - Even at below 25% of the LEL, the duct is still product-conveying which constrains its terminations as compared to environmental air duct terminations

Product Conveying Duct Supports

➤ 2013 CMC 506.5.1

- Duct supports designed for weight of duct half-filled with material
- ***Sprinklered duct supports' weight is duct half-filled with water***

➤ 2016 CMC Table 506.5.1

- Duct supports designed for weight of duct half-filled with material
- What would this mean for workshops with sawdust exhaust?
- Sprinklered duct supports' weight is duct with water expected (allows for less than half-filled weight if drains will remove enough water to prevent that)

Grease Duct Gage and Testing

- 2013 CMC 510.5

- Thickness

- **0.054-inches carbon steel or 0.043-inches stainless steel**

- States 16 MSG for carbon steel or 18 MSG for stainless

- **No mention of leakage testing**

- 2016 CMC Table 510.5

- Thickness

- **0.060-inches carbon steel or 0.048-inches stainless steel**

- States 16 MSG for carbon steel or 18 MSG for stainless

- 510.5.6 stipulates leakage testing on non-listed grease duct systems per ASHRAE 154 before concealing

- Ramification – use a listed grease duct system

Type II Grease Exhaust Terminations

- 2013 CMC
 - ***No mention of Type II grease exhaust terminations***
- 2016 CMC 510.10
 - Rooftop terminations
 - 10-feet from property lines
 - Directed away from the roof surface
 - Horizontal terminations
 - 10-feet from
 - Property lines
 - Operable openings
 - Grade level
 - No terminations permitted to be directed onto a public walkway

Boiler Low Water Cutoff Alternative

- 2013 CMC 904.5
 - Low water cutoff protection required on boilers
 - ***No mention of an alternative to low water cutoff***
- 2016 CMC 904.5
 - Low water cutoff protection required on boilers
 - As an alternative, flow sensing can be used to shut down boiler
- Check boiler submittal to confirm that either type of protection is factory-installed

Boiler Relief Discharge Piping Regulations

- 2013 CMC 1006.1
 - ***Piping to within 18-inches of receptacle***
 - ***Very little mention of other restrictions***
- 2016 CMC 1005.2
 - Piping discharge between 6-inches to 24-inches of receptacle
 - Many other restrictions added regarding pipe and sizing
- Ramification – change standard detail(s) to list all requirements of 1005.2 relief valve discharge piping

Refrigerant Calculations and Alarms

- 2013 CMC Chapter 11
 - *Very little mention of how to calculate concentration limits*
 - *1107.4 – only one alarm is required at lesser of 50% of IDLH and 25% of LFL*
- 2016 CMC
 - 1104.2 - Calculation methodology and exceptions are more clearly defined (many taken from ASHRAE 15)
 - 1106.4 requires two alarms for Group A1 or B1
 - First alarm at lesser of 50% of IDLH and 25% of LFL
 - Second alarm at lesser of vapor detector's upper limit and 25% of LFL

Refrigerant Room Natural Ventilation

➤ 2013 CMC

- ***No restrictions on outdoor refrigeration rooms***
- Many engineers, including me, used covered chiller pads with one or two exposed sides to obviate the need for refrigeration room alarms and exhaust

➤ 2016 CMC 1107.3

- Calculation methodology is now included to prove that natural ventilation of outdoor refrigeration rooms is adequate
- It's not enough to simply expose the chiller area to the outdoors

Refrigerant Piping and Shafts

➤ 2013 CMC

- **1110.0 – Materials for piping have general regulations**
- No mention of refrigerant pipe shafts

➤ 2016 CMC

- 1109.1 – More defined regulations on materials
- 1109.3 – There are several exceptions, but refrigerant piping shall not penetrate floors, ceilings, or roofs and this may require a refrigerant pipe shaft.
- Ramifications – VRV system piping in multi-story buildings may have to be run in vertical or horizontal shafts

Cycles of Concentration Controls

➤ 2016 CMC 1122.2

- Cycles of concentration have to be monitored and modulate the bleed rate of evaporative coolers
- In Part 6, California Energy Code, this is only required above 150-tons, but there is no size exception in Part 4
- This is going to lead to better water conservation

➤ Ramifications

- Most cooling tower vendors have dedicated control packages that can accomplish this and they should quote this, at least as an alternate, in any pricing
- Change standard equipment schedules to include this control strategy as part of the notes

Hydronic Piping and Flushing

➤ 2016 CMC 1205.3

- Hydronic piping systems have to be flushed prior to use with water or a cleaning solution

➤ Ramifications

- To avoid plan check comments, change standard piping material schedules to include this item on all plans with hydronic piping systems

Expansion Tanks Requirement

- 2013 CMC 1005.1
 - Hot-water heating systems require expansion tanks
 - ***No mention of expansion tanks required for process cooling or chilled water systems***
- 2016 CMC 1209.1
 - All hydronic piping systems must have expansion tanks
- Ramifications
 - Even a small, isolated process cooling water system would need an expansion tank which has material, installation, and startup costs
 - Engineers, remember that it is the project manager who should know about and accept the risk of ignoring this

Hydronic Piping Specifications

- 2013 CMC 1201.3.3
 - Joints and piping are loosely referred to
 - ***No mention of specific materials and joining methods***
- 2016 CMC 1211.2 and following sections
 - Similar to the 2013 Plumbing Code, most piping materials and joining methods have been added as part of code
- Ramifications
 - Generating specifications for a job becomes easier because code now includes means and methods for furnishing and installing hydronic piping

Hydronic System Control Specifications

➤ 2016 CMC 1213

- Many of these requirements are intuitive and common among engineering designs. 1213.1 is a good example:
- 1213.1 Water Temperature Controls. A heat source or system of commonly connected heat sources shall be protected by a water-temperature-activated operating control to stop heat output of the heat source where the system water reaches a pre-set operating temperature.
- 1214.1 makes balancing a requirement. Many heating systems do not need balancing, but it's required now.

➤ Ramifications

- Review the different control requirements and add applicable notes to general details
- If heating hot water systems were not balanced before, then it's time to start balancing them to comply with code

Process Piping Materials

- 2013 CMC 1406.1
 - ***Piping must be metallic unless there is a compatibility issue***
- 2016 CMC 1406.1
 - Piping material must be compatible and robust enough to handle pressure and temperature (no mention of metallic)
- Ramifications
 - If the city will allow it, run piping in the most economical material and joining method required for the system

Closing/Questions

- Questions
- Thank you for listening!

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