CALIFORNIA MECHANICAL CODE
OVERVIEW OF 2016 UPDATES
CHANGES AND RAMIFICATIONS

Presented to: ASHRAE

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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)
  - 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.
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/ft\(^2\))
  - \( A_z \): 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 it’s 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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