A "Quick" Commercial & Domestic Kitchen Hood Overview

Based on the 2015 IMC/SPS Chapter 364

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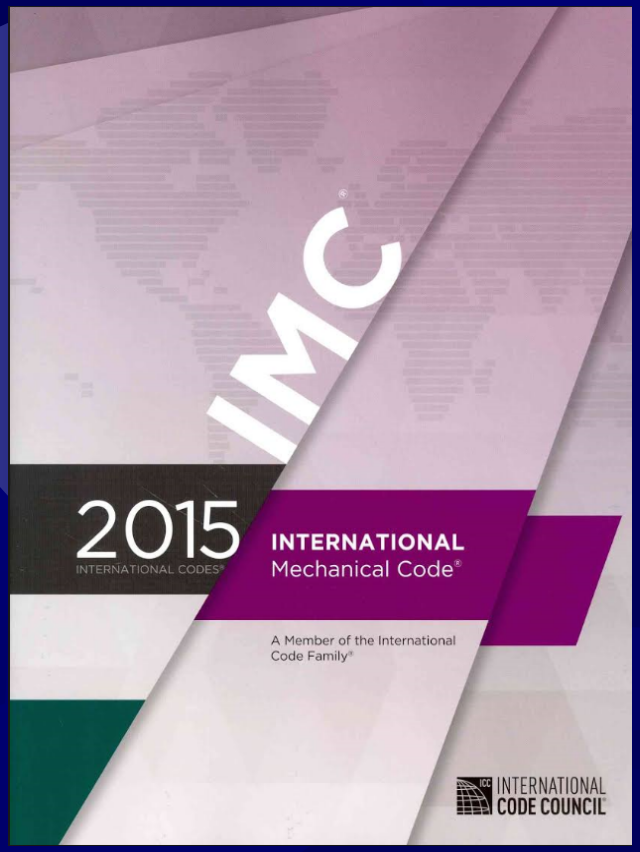
Department of Safety & Professional Services

Web Site:

https://dsps.wi.gov/Pages/Programs/CommercialBuildings/Default.aspx

SPS 364 WISCONSIN IMC-HVAC Code



A Partnership between Designers, Builders, Owners, and Code Officials

International Mechanical Code (IMC) Table of Contents

International Mechanical Code (IMC) Table of Contents (cont'd)

- Ch. 9 Specific Appliances/Fireplaces & Solid Fuel Burning Equipment
- Ch. 10 Boilers, Water Heaters & Pressure Vessels (NA-See SPS 341)
- Ch. 11 Refrigeration (NA-See SPS 345)
- Ch. 12 Hydronic Piping
- Ch. 13 Fuel Oil Piping & Storage
- Ch. 14 Solar Systems (See also SPS 371)

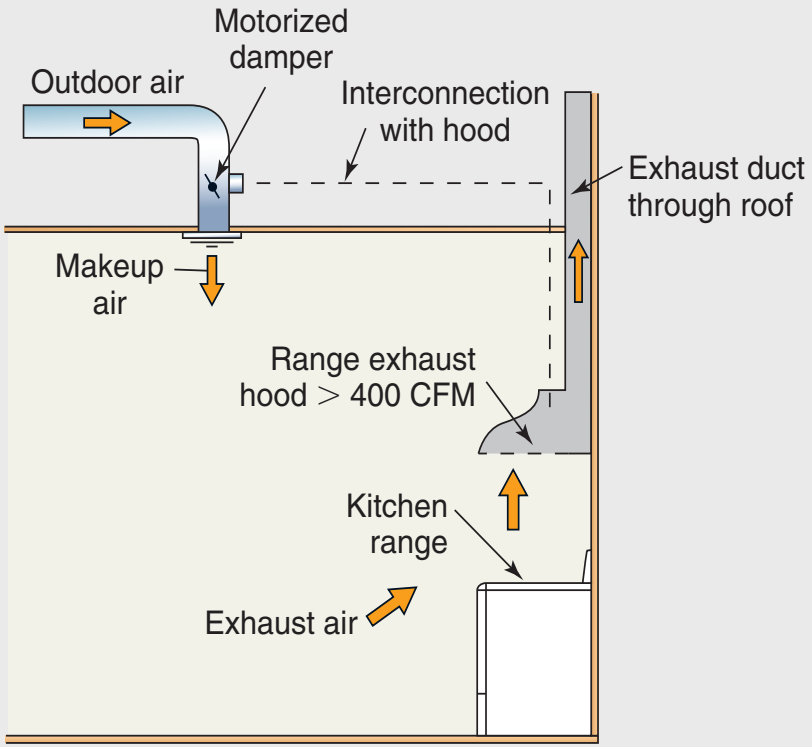
IMC Chapter 5
Exhaust Systems

- Governs design, construction and installation of mechanical exhaust systems…
  - Produce or throw off dust or particles sufficiently light to float in the air, OR which
  - Emit heat, odors, fumes, spray, gas or smoke, in such quantities so as to be injurious to health or safety.

Domestic Kitchen Exhaust Equipment IMC 505

- Where domestic range hoods & appliances equipped with downdraft exhaust are located within dwelling units, such hoods & appliances are to:
  - Discharge outdoors
  - Use sheet metal ducts
  - Shall have smooth inner walls,
  - Shall be air-tight
  - Shall be equipped w/backdraft damper
- Exceptions

Domestic Kitchen Exhaust Equipment IMC 505.2



Required Makeup Air for Kitchen Exhaust Hoods Exceeding 400 CFM

- Makeup air required if capable of exhausting > 400 cfm
- Shall be equipped with a means of closure
- Makeup air to be automatically controlled to start & operate simultaneously with the exhaust system

Domestic Kitchen Exhaust Equipment Group I-2 (Condition 1) IBC 904.13

- SPS 362.0904(3) eliminates application of IBC 904.13 and related subsections.

- *The Wisconsin amendment eliminates the need for domestic cooking hoods provided over the cooktop or range to be equipped with an automatic fire-extinguishing system per UL 300A.*

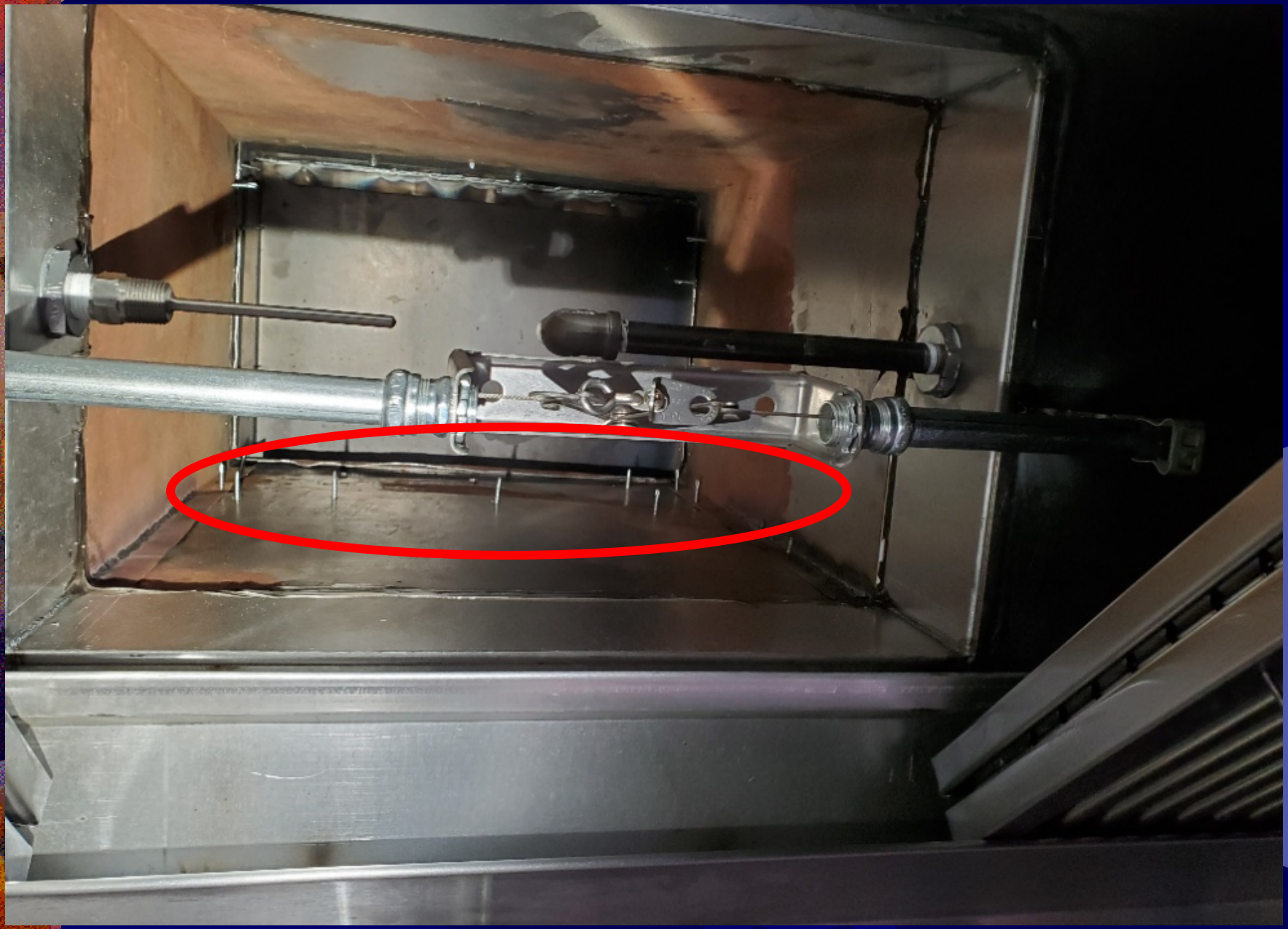
Type I Kitchen Hood Req'ts
IMC 506.3

Where a Type I hood is installed, the entire system must comply with the requirements for Type I hoods.

- Type I- Collects/Removes Grease Vapors & Smoke
  - Independent System Required Over Grease or Smoke Source

Type I Kitchen Hood Req'ts
IMC 506.3.1.1, 506.3.2, SPS 364.0506

- Grease ducts to be constructed of steel of min. 0.0575" (No. 16 gage) or stainless steel min. 0.0450 (No. 18 gage) thickness. Exception
- Joints/seams/penetrations to be liquid tight weld or braze made on the external surface–
  - Exception listed liquid tight seal good to 1,500°F
- *NOTE: If listed caulk is used, listed **"Grease Duct Enclosure"** wrap may not be used around the grease duct due to conflict with the wrap listing.*



2015 International Mechanical Code (IMC)/SPS Ch. 364

Picture by Brian Noe

Grease Duct Test

IMC 506.3.2.5/SPS 364.0506(2)(c)

- SPS 364.0506(2)(c) eliminates application of IMC 506.3.2.5.

- *The Wisconsin amendment eliminates the need to perform a leakage test to determine that all welded & brazed joints are liquid tight.*

Separation of Grease Duct Systems IMC 506.3.5

- A separate grease duct system shall be provided for each Type I hood. Exception if **ALL** of the following are met:
  - All interconnected hoods:
    - Are located within the same story
    - Are located within the same room or in adjoining rooms.
    - Do **NOT** penetrate assys req'd to be fire rated.
  - Grease duct system doesn't serve solid-fuel-fired appliance.

Grease Duct Clearances
IMC 506.3.6

- Grease duct system & exhaust equipment to have:
  - Minimum clearance from combustible construction of ≥18”
  - Minimum clearance to noncombustible construction and wallboard attached to noncombustible structures of ≥ 3”

Grease Duct Clearances
IMC 506.3.6

- Exceptions:
  - **Factory built commercial kitchen grease ducts per UL 1978.**
  - **Listed & labeled exhaust equipment installed per IMC 304.1**
  - **Commercial kitchen grease duct covered on all sides with grease duct enclosed material, system product or method of construction specifically evaluated for such purpose in accordance with ASTM E2336**

Prevention of Grease Accumulation in Grease Ducts

IMC 506.3.7

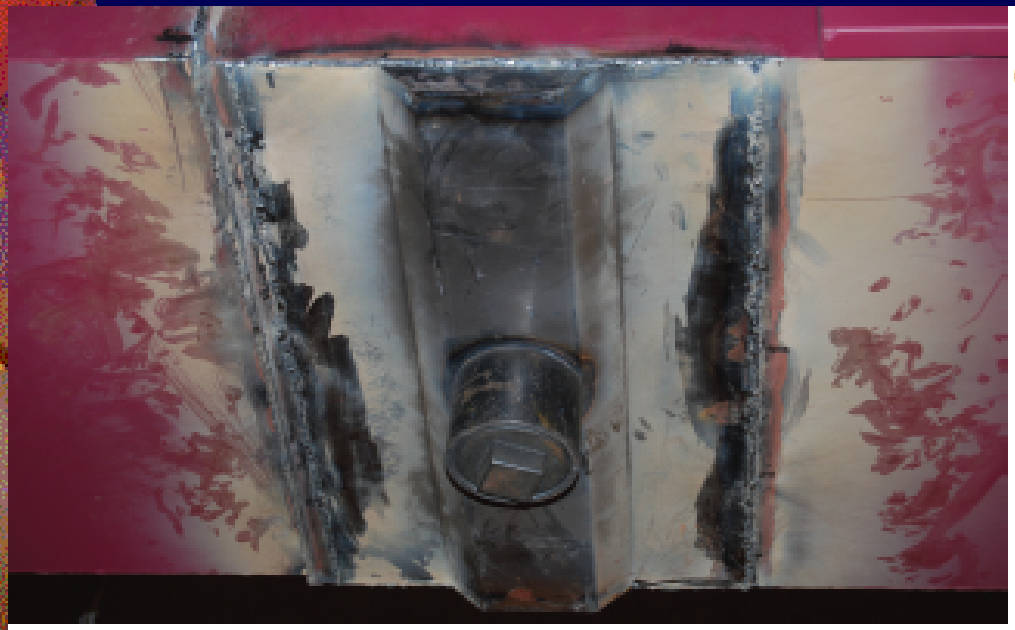
- Horizontal System < 75’ in length must be sloped ≥ 1/4:12 (2% slope) toward hood or approved grease reservoir
- Horizontal System > 75’ in length must be sloped ≥ 1:12 (8.3% slope) toward hood or approved grease reservoir

Grease Duct Reservoirs
IMC 506.7.1

- Constructed as req'd for duct serviced.
- Located on bottom of horizontal duct or bottommost section of duct riser.
- Extend across the full width of duct & have length ≥ 12".

Grease Duct Reservoirs
IMC 506.7.1 (continued)

- Have depth of ≥ 1”.
- Have bottom that slopes to drain.
- Has cleanout openings per IMC 506.3.8.
- Install per manufacturer’s instructions



International Code Council®

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- Grease duct reservoir with drain

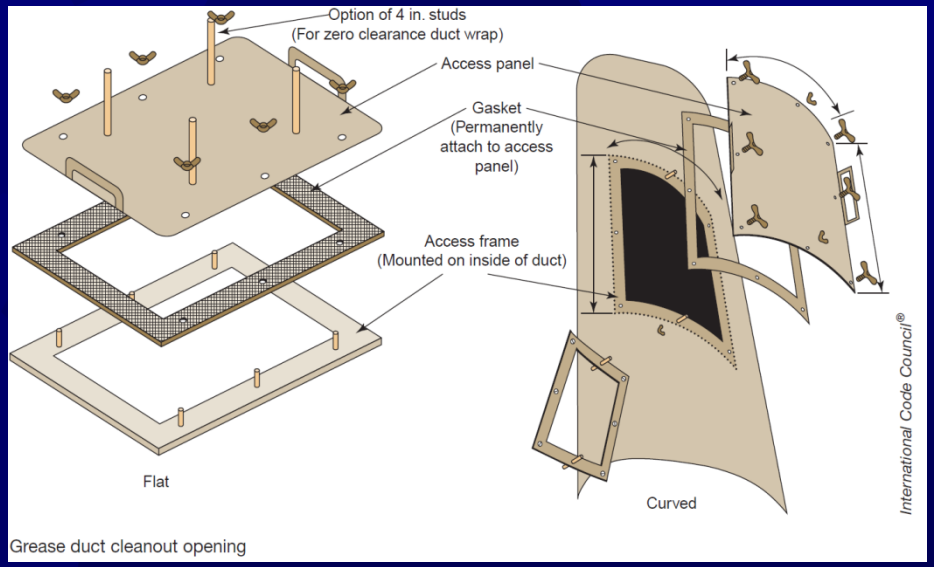
There's nothing like a coffee can for use in collecting grease….nothing…

Just think of how much grease could be collected before having to empty the 55 gallon drum…

This is why bird screen should not be allowed on kitchen exhaust fans. This was on top of a utility set fan discharge (in Florida).

Grease Duct Cleanouts & Openings IMC 506.3.8

- Sections of grease duct that are inaccessible from the hood or discharge openings shall be provided with cleanout openings ≤ 20 ft apart *& ≤ 10 ft from changes in direction greater than 45°*.



Grease duct cleanout opening

Type I Grease Duct Cleanouts and Openings IMC 506.3.8

- Cleanouts & openings to have tight-fitting doors
- Cleanout doors to be liquid tight
- Door assemblies to be approved for application with no fasters penetrating the duct

Type I Grease Duct Cleanouts and Openings IMC 506.3.8

- Gasket & sealing materials to be rated for ≥ 1,500°F
- Install door assemblies per manufacturer's instructions

Type I Kitchen Hood/ Exhaust Duct Requirements IMC 506.3.8.1 & 2

- Personnel entry requires 22” x 20” clearance provided in horizontal sections & top of vertical risers.
- A cleanout to be provided on inlet & outlet side of inline fan used with any commercial kitchen hood.
- Cleanouts to be located within 3 ft of the fan duct connections.

Type I Grease Duct Horizontal Cleanouts IMC 506.3.9

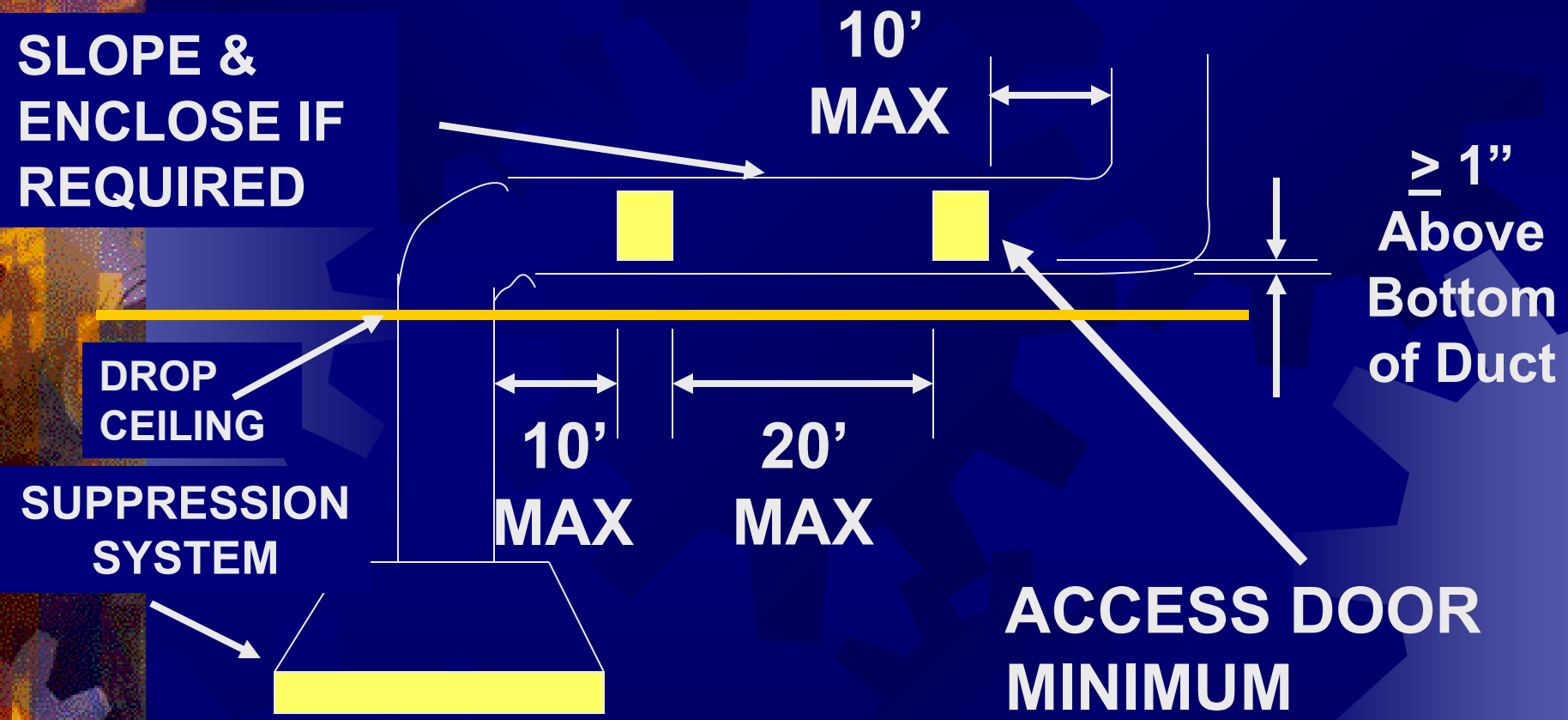
- Cleanouts are allowed to be located on bottom only where other locations are not available, with internal damming of the openings such that grease will not flow past the opening without pooling. Install liquid tight.

- Must be >1” from the edges of the duct.

Type I Grease Duct Horizontal Cleanouts IMC 506.3.9

- Must have openings dimensions of not less than 12” x 12”. If limited for clearance, at least one side must be 12” with other large enough for cleaning and maintenance access.

Type I Kitchen Hood/ Exhaust Duct Requirements IMC 506.3.7, 8 & 9



Underground Grease Duct Installation IMC 506.3.10

- Duct to be steel with min. 0.575” thickness (16 gage) or stainless steel with min. 0.0450” (18 gage)
- System exempted from being tested per IMC 506.3.2.5 per SPS 364.0506(2)(c) Must be completely encased in concrete with min. thickness of 4”.
- Slope toward reservoirs with cleanout

Field-Applied Grease Duct Enclosure IMC 506.3.11.2

- 2 layers of wrap material required to attain a listing criteria --Refer to Material Listing
- **Wraps MUST meet ASTM E 2336—Major Issue**
- Many wraps are listed as allowing "zero" clearance to combustibles. The listing MUST be followed before this clearance reduction is recognized as acceptable.
  - Example: Some wraps can only be used with welded or brazed seams – not seams with sealants

TYPE I COMMERCIAL KITCHEN HOOD EXHAUST DUCTS ABOVE A SUSPENDED CEILING--GREASE DUCT ENCLOSURE WRAP NON-CONTINUOUS--FAILS TO MEET CODE

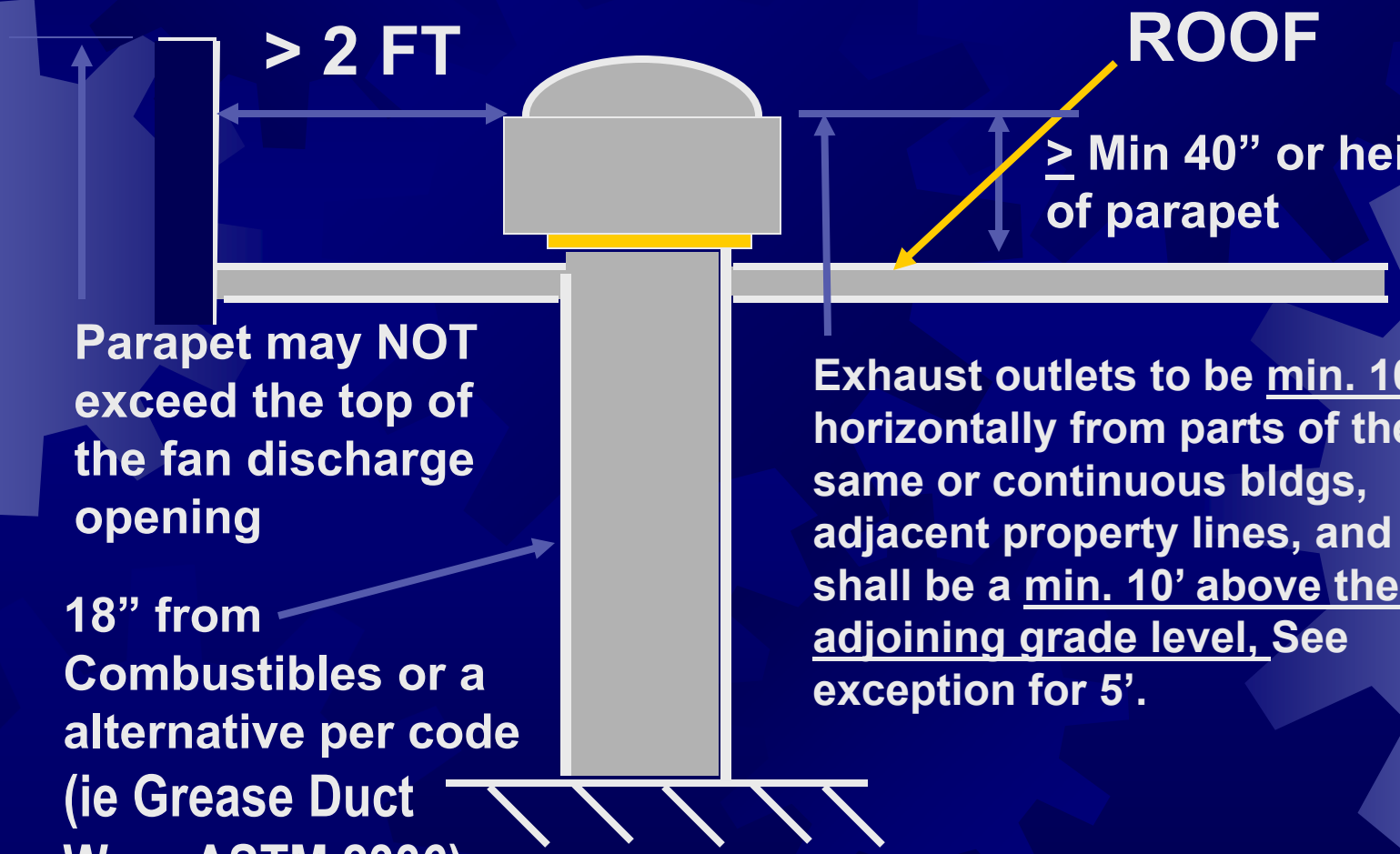
Field-Applied Grease Duct Enclosure IMC 506.3.11.2

- Partial application of a field applied grease duct enclosure shall not be installed for the sole purpose of reducing clearances to combustibles at isolated sections of grease duct.

Partial Application Not Allowed.. This is a Non-Grease Duct Enclosure

If the listing for installation requires “pins” can a band be used?---No

Type I Kitchen Hood/ Exhaust Duct Req'ts IMC 506.3.11.2, 506.3.13.1 506.3.13.3 & 506.5.5

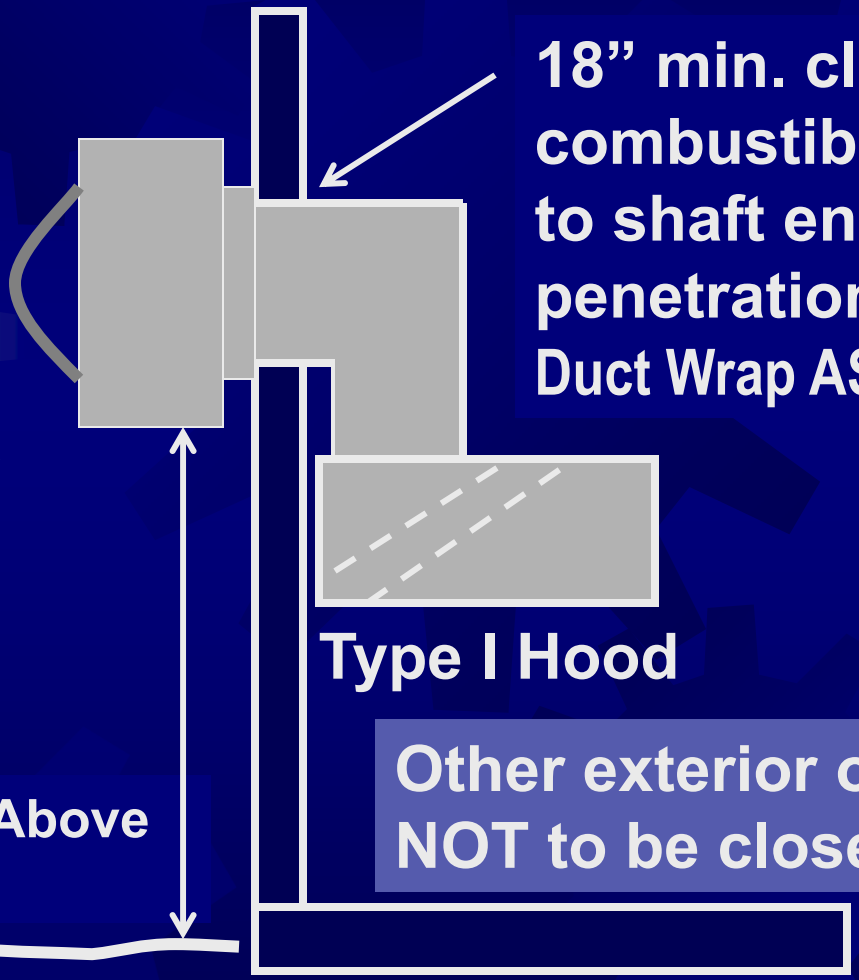


The minimum horizontal distance between vertical discharge fans and parapet-type building structures shall be 2 ft provided that such structures are not higher than the top of the fan discharge openings—

Anyone see a problem??

Type I Kitchen Hood/ Exhaust Duct Req'ts IMC 506.3.11.2 & 506.3.13.3

10' min. from lot line, contiguous building, air intakes or any other building openings. (See Exceptions)



18" min. clearance to combustibles OR alternative to shaft enclosure penetration system (ie Grease Duct Wrap ASTM 2336)

Other exterior openings NOT to be closer than 3 ft

IMC 506.3.13.3 10 ft above adjoining grade? Min. 10 ft from openable window? **IMC 506.3.13.2** Nuisance/fire hazard to wood stairway?

Grease Duct Fire-Resistive Access Opening IMC 506.3.12

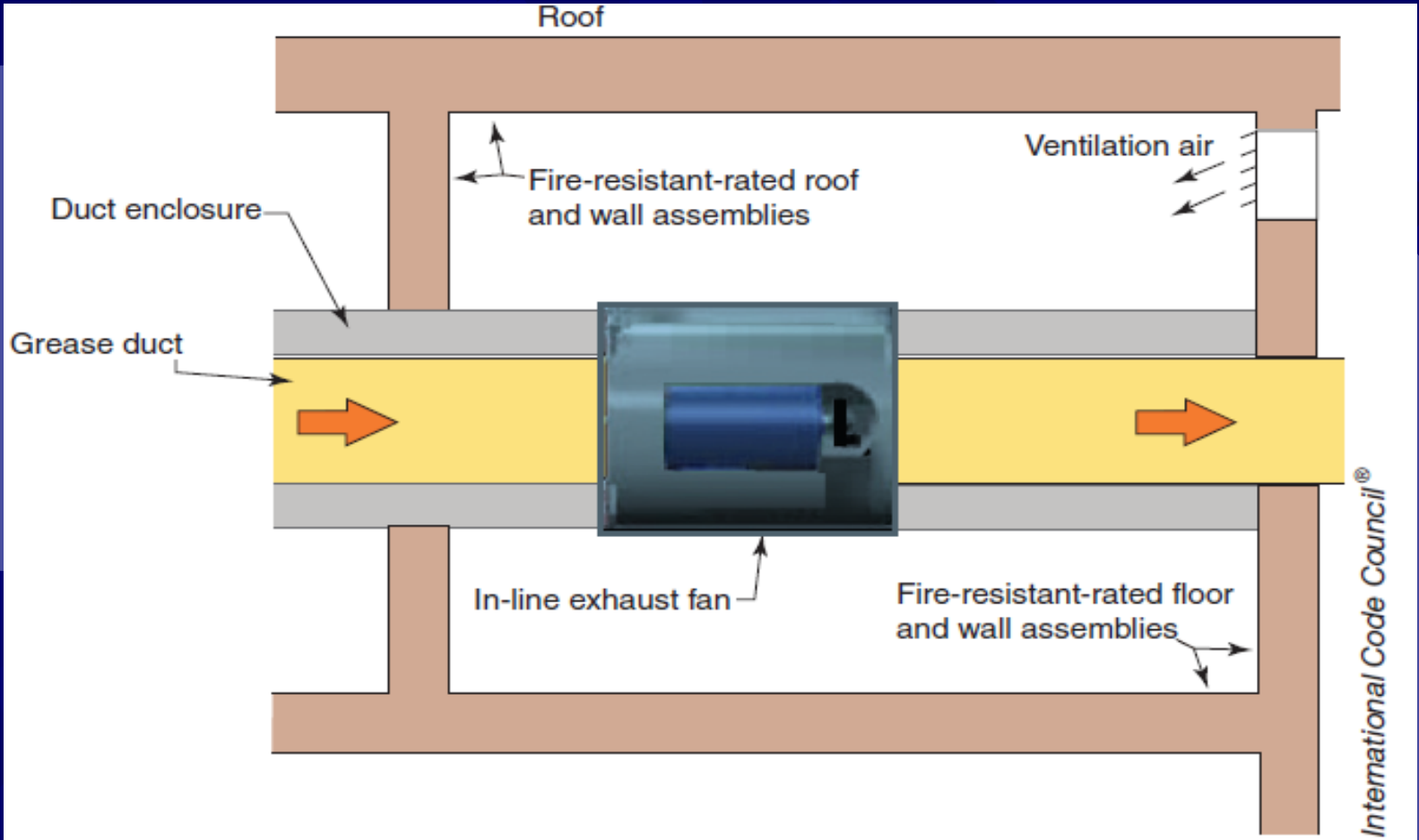
Access opening panels to have approved signage which states, *"ACCESS PANEL. DO NOT OBSTRUCT"*

In-line Fan Location
IMC 506.5.1.2

- Where enclosed duct systems are connected to in-line fans not located outdoors, the fan shall be located in a room or space having the same fire resistance rating as the duct enclosure.

In-Line Fan Location in Exhaust Ducts Serving Commercial Kitchen Hoods

IMC 506.5.1.2



An in-line fan must be located in a room or space having the same fire-resistance rating as the grease-duct enclosure.


NOTICE / AVIS

Really??

In-line Fan Location
IMC 506.5.1.2

- Access shall be provided for servicing and cleaning of fan components.

- Such rooms or spaces shall be ventilated in accordance with the fan manufacturer's installation instructions.

Exhaust Fan Discharge

IMC 506.5.2

- Exhaust fans shall be positioned so that the discharge will not impinge on the roof, other equipment or appliances, or parts of the structure…

Note the grease outline on the wall….

Exhaust Fan Discharge
IMC 506.5.2

- A vertical discharge fan shall be manufactured with an approved drain outlet at the lowest point of the housing to permit drainage of grease to an approved grease reservoir

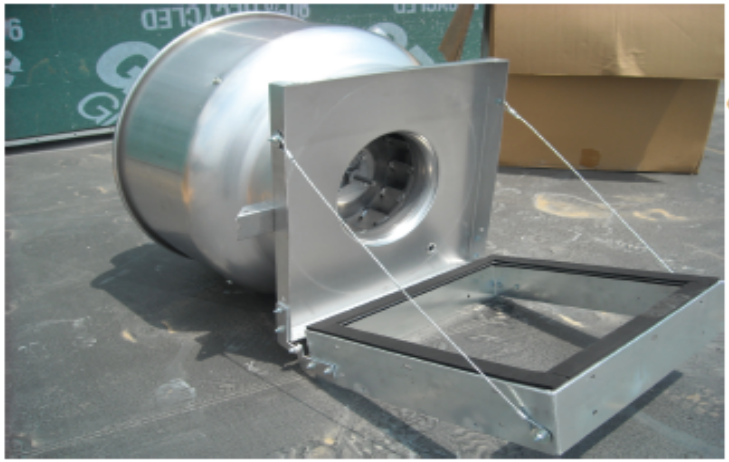
Exhaust Fan Mounting (Type I Hoods) IMC 506.5.3

- Up-blast fans installed in vertical or horizontal position shall be ***hinged*** and supplied with a flexible weatherproof electrical cable to permit inspection and cleaning.


Electrical Installed as Code Compliant??

Hinged Up-Blast Fans
IMC 506.5.3

Hinged up-blast fan for Type I hood exhaust



Restraint cable for hinged exhaust fan

- The code now requires that *vertical & horizontal hinged exhaust fans* be provided with a means to limit the travel of the fan assembly on its hinges to prevent injury to personnel & damage to the building & fan.

Exhaust Fan Mounting (Type I Hoods) IMC 506.5.3

- Upblast fans shall be equipped with means of restraint to limit the swing of the fan on its hinge.

- The ***ductwork shall extend a minimum of 18 inches (457 mm) above the roof surface.***

Someone forgot the hinge & the 18” duct extension above the roof…

Type I Hood Installations
IMC 507.1 Exceptions

- Factory built commercial cooking recirculating (ventless) systems that are listed and labeled per UL 710B are allowed. (Still req'rs Suppression System)

- Additional kitchen ventilation per SPS Table 364.0403 is required, or ventilation per the installation instructions, if the latter is more restrictive shall also apply.

Example of a Ventless Hood System

Wells WVU-26 Ventless Hood System

Type I Hood Installations
IMC 507.1 Exceptions

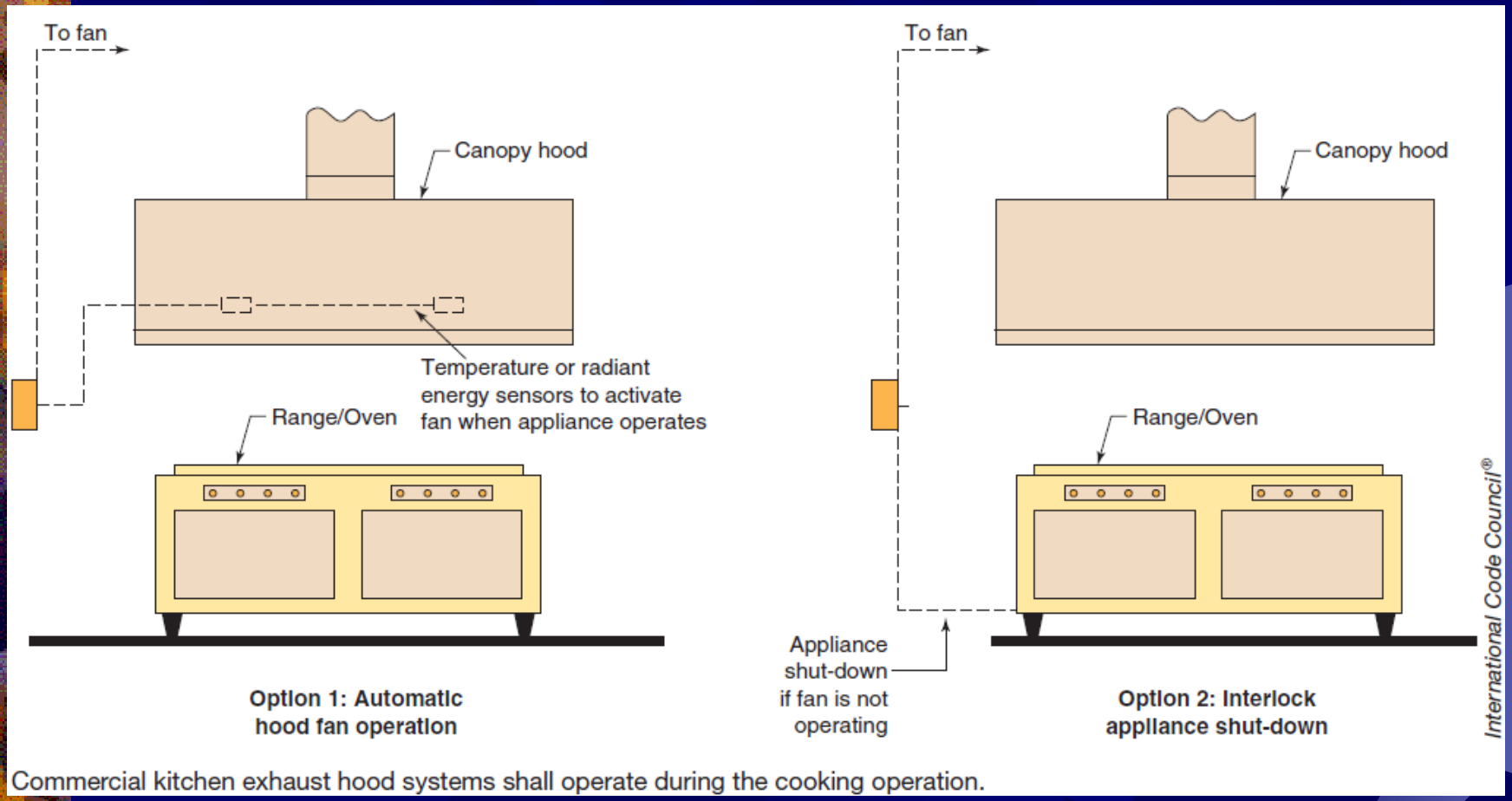
- Where cooking appliances are equipped with integral down-draft exhaust systems and such appliances and exhaust systems are listed and labeled for the application in accordance with NFPA 96, a hood is not required at or above them. (Still req’rs Suppression System)

Example of an integral down-draft exhaust system

Type I Hood Installation
IMC 507.1

- Interlock required on Type I hoods to prevent operation when the exhaust fan is NOT turned on
- Where >1 sensor are installed, the fan is to activate for ≤ 15 minutes after the first appliance served by the hood, has been turned on.

Type I Hood Installation
IMC 507.1



Commercial kitchen exhaust hood systems shall operate during the cooking operation.

Type I Hood Installation
IMC 507.1

- Type I or II hood to be installed above commercial cooking appliances.
- Where any cooking appliance located under a single hood req'rs a type I hood, a type I hood shall be used.
- Where a type II hood is req'd, type I or II to be installed
- Where type I hood is installed, the installation of entire systems shall comply with Type I hood.

Type I Kitchen Hood Operating Requirements

IMC 507.1.1

- Type I hoods to be installed to **AUTOMATICALLY** activate the exhaust fan whenever cooking operations occur
  - Activation may occur through:
    - interlock with the cooking appliance,
    - by means of heat/radiant sensors, or
    - by other approved methods

Type I Hood Operation
IMC 507.1.1

- Net exhaust volumes permitted to be reduced during part-load cooking conditions, where engineered or listed multi-speed or variable speed controls automatically operate the exhaust system.

Heat Sensors Installed Inside Type I Commercial Kitchen Hood

Type I Kitchen Hood Materials
IMC 507.2.3

- To be constructed of steel having a min. 0.0466” (No. 18 gage) or stainless steel min 0.0335” (No. 20 MSG) in thickness.

Clearances for Type I Hood
IMC 507.2.6

- A Type I hood shall be installed with a clearance to combustibles of not less than 18”.

Clearances for Type I Hood
IMC 507.2.6

- Grease hoods shall be installed a minimum of 18” from combustible construction *(Including structure behind finish material)*.
  - Gypsum board is considered combustible in the IMC
  - May be installed closer than 18” to gypsum board if, per IMC 308.4,:
    - **A listed or recognized assembly used**
    - **A listed/tested product is used**

Clearances for Type I Hood
IMC 507.2.6

- Exception:
  - Clearance shall not be required from gypsum wallboard or ½ inch or thicker cementitious wallboard attached to noncombustible structures, provided that a smooth, cleanable, nonabsorbent and noncombustible material is installed between the hood and the gypsum or cementitious wallboard over an area extending not less than 18” in all directions from the hood.

Ceiling Clearance?

Type I Kitchen Hood Req'ts
IMC 507.5 & SPS 364.0507(1)

- **Capacity**
  - Min. prescribed by code OR defined by engineering analysis
- **Types of Hoods**
  - Extra-heavy duty; Heavy-duty, Medium-duty, Light-duty—See definitions IMC 202

Dishwashing Appliances
IMC 507.5.5

- A Wisconsin amendment was removed
- The minimum net airflow for Type II hoods used for dishwashing appliances shall be 100 cfm/linear ft of hood length
  - Exception: Dishwashing appliances and equipment installed in accordance with IMC 507.3 which allows for local ventilation design

Performance Test
IMC 507.6

- Performance test required upon completion & before final approval must verify:
  - Exhaust air-flow rate,
  - Makeup air flow,
  - Operation/Sequencing
- The permit holder shall furnish the necessary test equipment and devices.

Capture & Containment Test
IMC 507.6.1

- Capture & containment shall be verified visually by observing smoke or steam produced by actual or simulated cooking, such as with smoke candles, smoke puffers, and similar means.

Commercial Kitchen Make-up Air IMC 508

- **Makeup Air**
  - Shall be controlled to start & operate simultaneously with the exhaust system
  - The temperature differential between makeup air and the air in the conditioned space shall not exceed 10°F except where the added heating and cooling loads of the makeup air do not exceed the capacity of the HVAC system

Air Balance for Commercial Kitchen Ventilation Systems IMC 508.1.2

- The design outdoor air balance shall indicate all exhaust & replacement air for the facility, plus the net exfiltration if applicable.

- Total replacement air airflow =
  Total exhaust airflow rate + net exfiltration

It is requested that designer's address on all Kitchen Hood Plans

Air Balance for Commercial Kitchen Ventilation Systems

IMC 508.1.2

- 1,400 cfm hood A
- 1,225 cfm hood B
- 300 cfm toilet exhausts
- 75 cfm janitor room
- Total Exhaust
  - 3,000 cfm

- 2,200 cfm makeup air
- 800 cfm O.A. for ventilation
- Total Outside Air
  - 3,000 cfm

Type I Kitchen Hood-- Fire Suppression Required IMC 509/ IBC 904.12 & 906, IFC 904.12.5

Follow IBC for location of Fire Suppression Activation system

Commercial Cooking Systems

IBC 904.12 & 904.12.1

- Fire-extinguishing system to be tested in accordance with UL 300
- Manual System Operation defined
  - Location to be a min. of 10 ft, max. of 20 ft from kitchen exhaust system on way out…
  - Activation device @ height ≥ 42” and ≤ 48”
  - To require a max. force of 40 lbs & max. movement of 14 inches to actuate
- Special provisions for automatic sprinkler systems defined.

Commercial Cooking Systems
IBC 904.12.2, SPS 362.0904(2)

- The actuation of the fire suppression system shall automatically shut down ***ALL*** sources of fuel and power to all equipment located beneath the exhaust hood and protected by the suppression system.
- The fuel and power reset shall be manual.

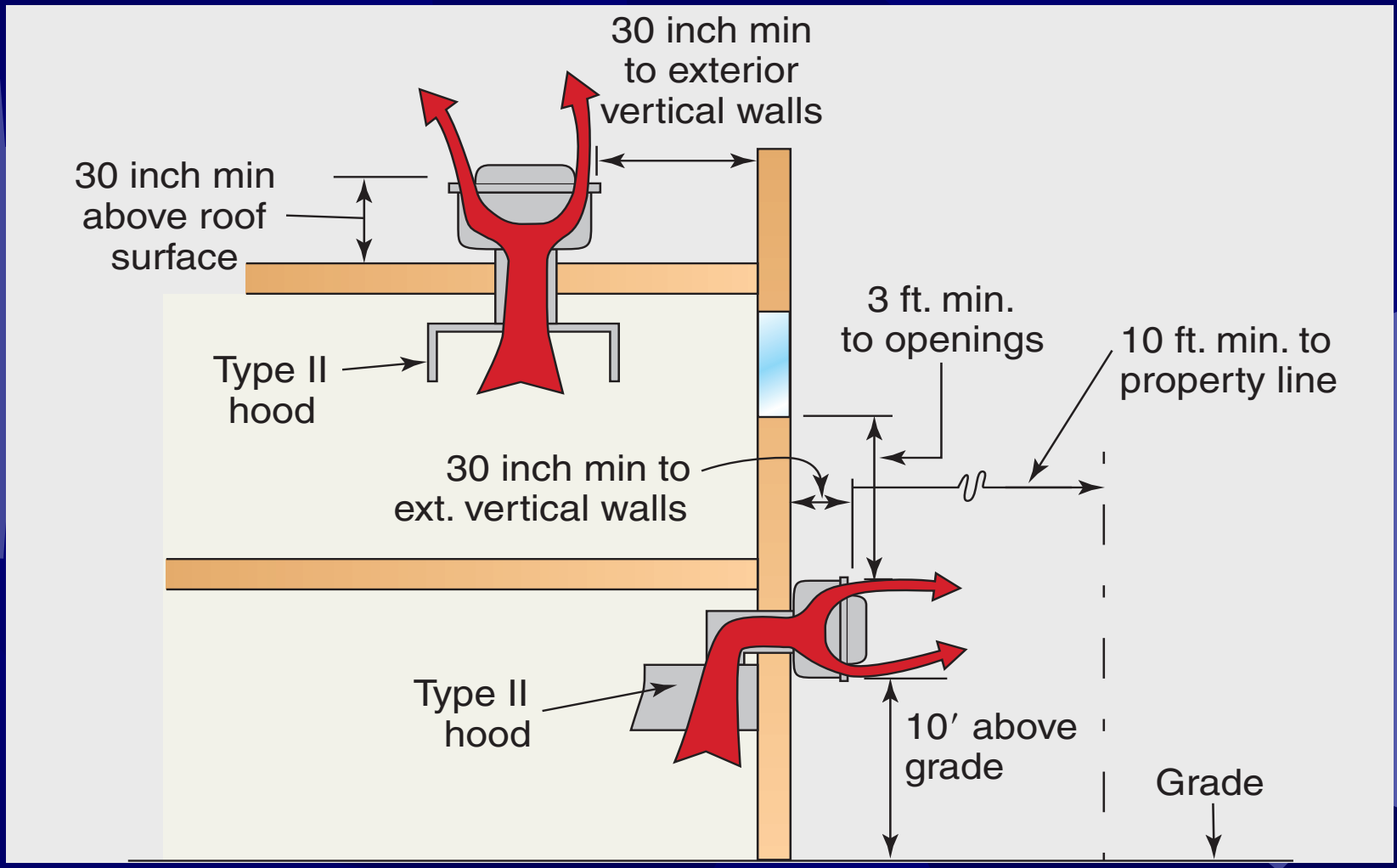
Type II Kitchen Hood/ Exhaust Duct Requirements IMC 506.4 & 507.3

- Type II - Installed above dishwashers and appliances that produce heat or moisture unless exception met.
  - Light duty appliances that produce products of combustion & do not produce grease or smoke
  - Examples: steamers, kettles, pasta cookers, etc
- Hood requires min. 22 gage Steel, 24 gage Stainless Steel, or as approved

Type II Kitchen Exhaust Terminations IMC 506.4.2

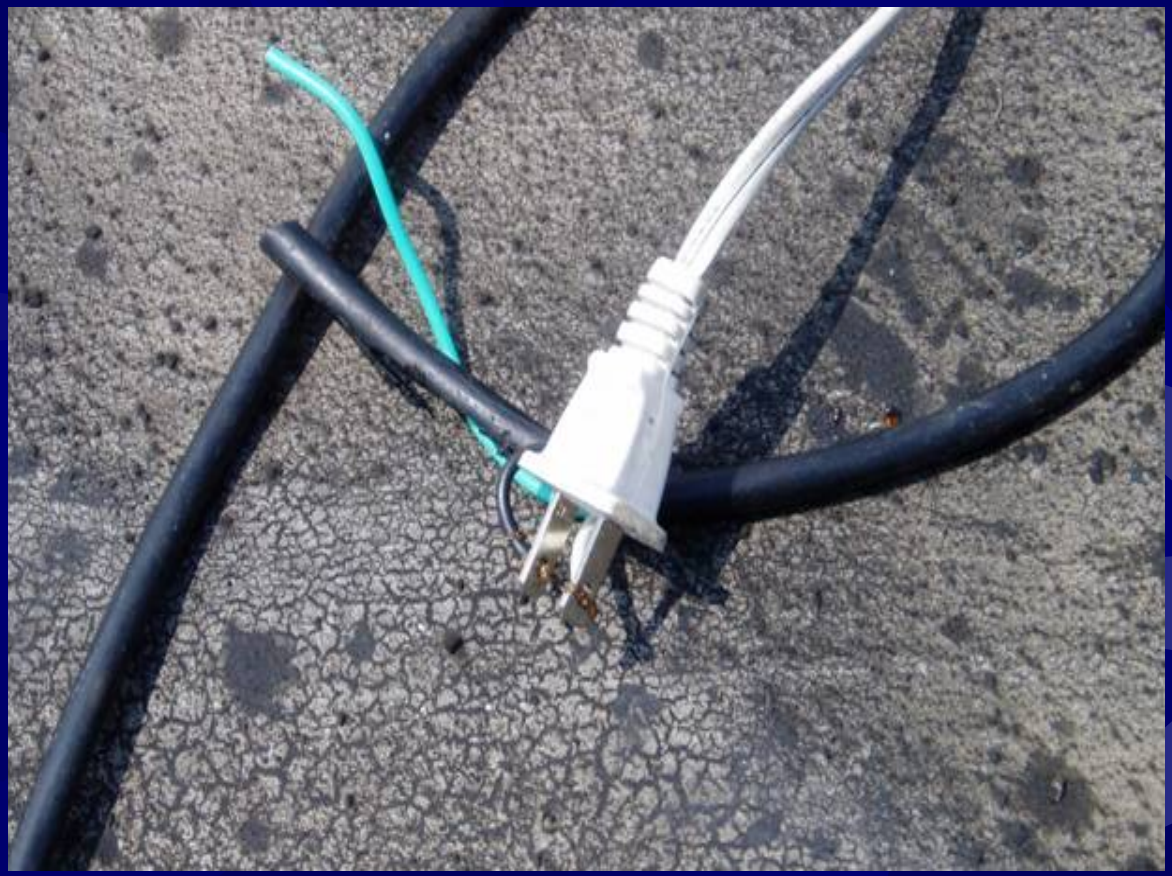
- Exhaust outlets to terminate ≥ 3 ft in any direction from openings into the bldg
- Outlets to terminate ≥ 10 ft from property lines or bldgs on same lot
- Outlets to terminate ≥ 10 ft above grade
- Outlets to terminate ≥ 30 inches above the roof surface
- Outlets to be protected against weather conditions
- Outlets shall not be directed onto walkways
- Outlets to meet the provisions for exterior wall opening protectives in accordance with the IBC

Type II Kitchen Exhaust Terminations IMC 506.4.2



This is a new idea in building makeup air. The white framework is the base to a pedestal floor fan.

Plus you can save the need for an electrician ……



Looks like a pretty typical kitchen hood aye??

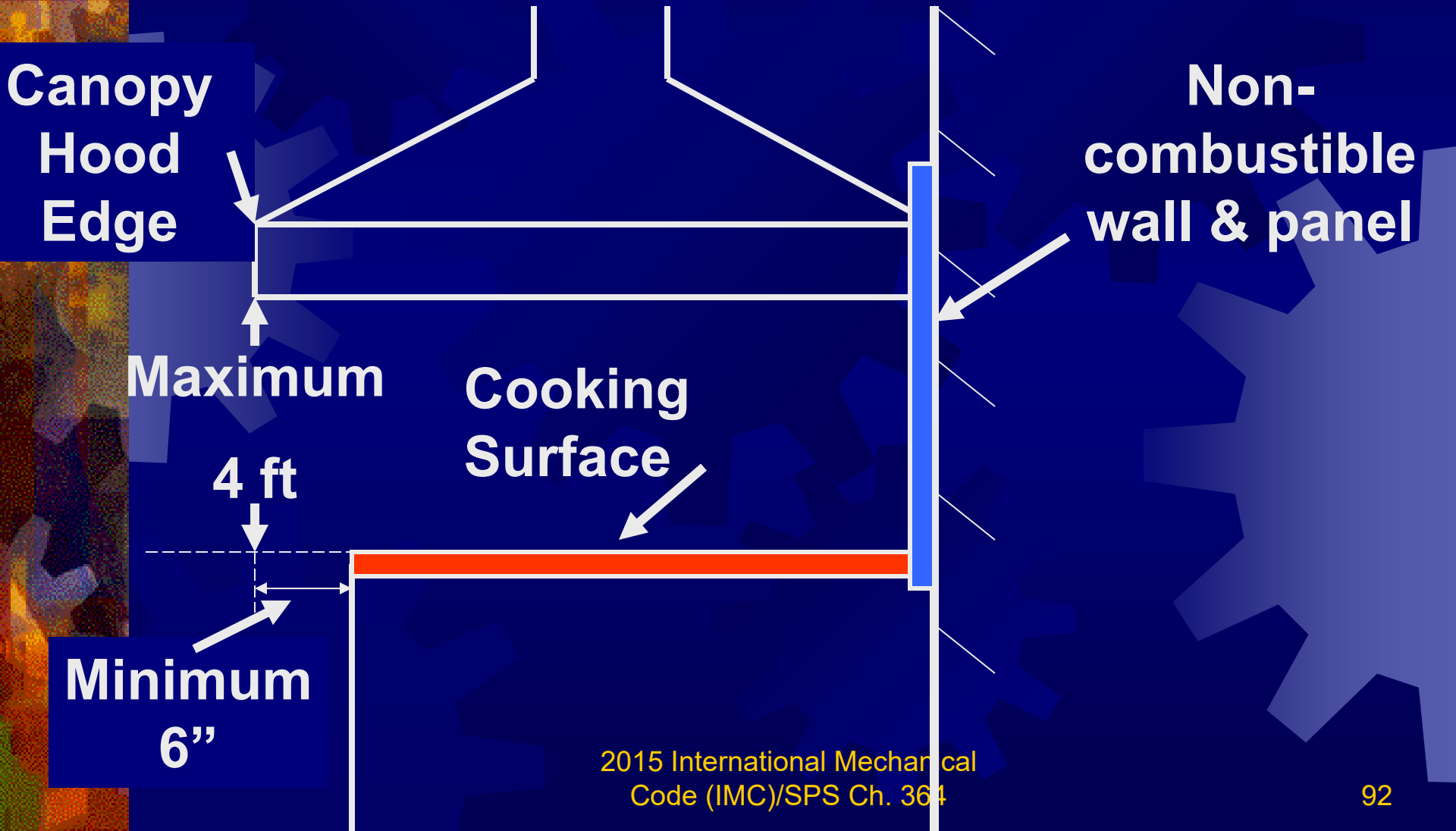
Type I & II Kitchen Hood Canopy Size and Location

IMC 507.4.1

- Inside lower edge of canopy type commercial cooking hoods shall overhang or extend a horizontal distance of not less than 6” beyond the edge of the cooking surface, on all open sides.
- Vertical distance between the front lower lip of the hood & the cooking surface to be ≤ 4 ft.

Type I & II Kitchen Hood Canopy Size and Location

IMC 507.4.1



Attached is a “what’s wrong with this picture” quiz….sideways filters, wood on the right, backshelf hood hung too high, no min. 6” side overhang)

Kitchen Exhaust Systems

IECC C403.2.8

- Replacement air introduced directly into the exhaust hood cavity shall not be greater than 10% of the hood exhaust airflow rate.

Kitchen Exhaust Systems

IECC C403.2.8

- Where the total kitchen hood exhaust airflow rate is > 5,000 cfm, each hood shall be a factory built commercial exhaust hood listed by a nationally recognized testing laboratory in compliance with UL 710.
- Additional criteria required to be met.

Duct Sealing –For Duct other than those Connected to Type I Grease Hood IECC C403.2.9.1/IMC 603.9

Cut out from SMACNA Duct Construction

Duct Seal Class	Sealing Requirements[a]
A Ok	All transverse joints, longitudinal seams, and duct wall penetrations. Pressure sensitive tape shall not be used as the primary sealant.
B Ok	All transverse joints and longitudinal seams. Pressure sensitive tape shall not be used as the primary sealant.
C No !	Transverse joints only.

[a] Longitudinal seams are joints oriented in the direction of airflow. Transverse joints are connections of two-duct sections and are oriented perpendicular to airflow. Duct wall penetrations are openings made by any screw fastener, pipe, rod or wire. Spiral lock seams in round and flat oval duct need not be sealed. All other connections are considered transverse joints, including but not limited to spin-ins, taps and other branch connections, access door frames and jambs, and duct connections to equipment.

HVAC Equipment Replacement
SPS 361.30(3)

- If **New** HVAC equipment Btu & air flow output is ≥ **Old** HVAC equipment Btu & air flow output, no submittal is required
  - Must be like for like replacement (ie. boiler for boiler, furnace for furnace)
  - The use of the same fuel is not required

HVAC Equipment Replacement

SPS 361.30(3)

- If **New** Equipment Btu output is < **Old** Equipment, or
- If New equipment installation varies significantly from existing, then a submittal is required

HVAC Equipment Replacement

SPS 361.30(3)

- If submittal is required, include info on both new/old manufacturer, model, btu input/output, efficiency, and heat loss calculations (to verify size decrease).

  - Submit Plans (If installation changes to system are made) and a completed application / fees

IMC – Chapter 3
General Requirements

IMC – Chapter 3
General Requirements

- All appliances shall be listed & labeled as specified in IMC 301.7, unless approved by the department in accordance with SPS 364.0301(3)(b) or the product approval criteria in SPS 361.60.
- Heat producing equipment to be installed per listing & manufacturer's instructions

It Meets Code ???
Installed Per Listing ??????

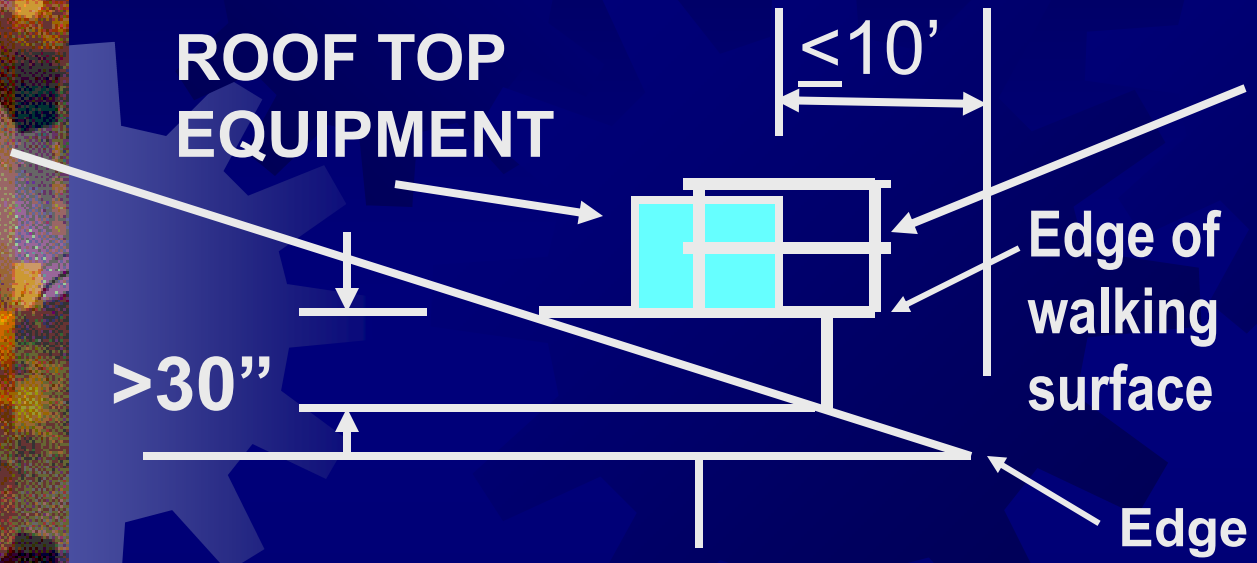
HVAC Equipment Clearance to Grade

IMC 304.10

- Equipment at grade level to be supported on a level concrete slab or other approved material ≥3” above grade OR shall be suspended not less than ≥ 6” above adjoining grade.

HVAC Equipment & Roof Hatch Guards

IMC 304.11, 306.5, IBC 1009.11, 1011.13, 1015.7, 1607.8.1, IFGC 306.6



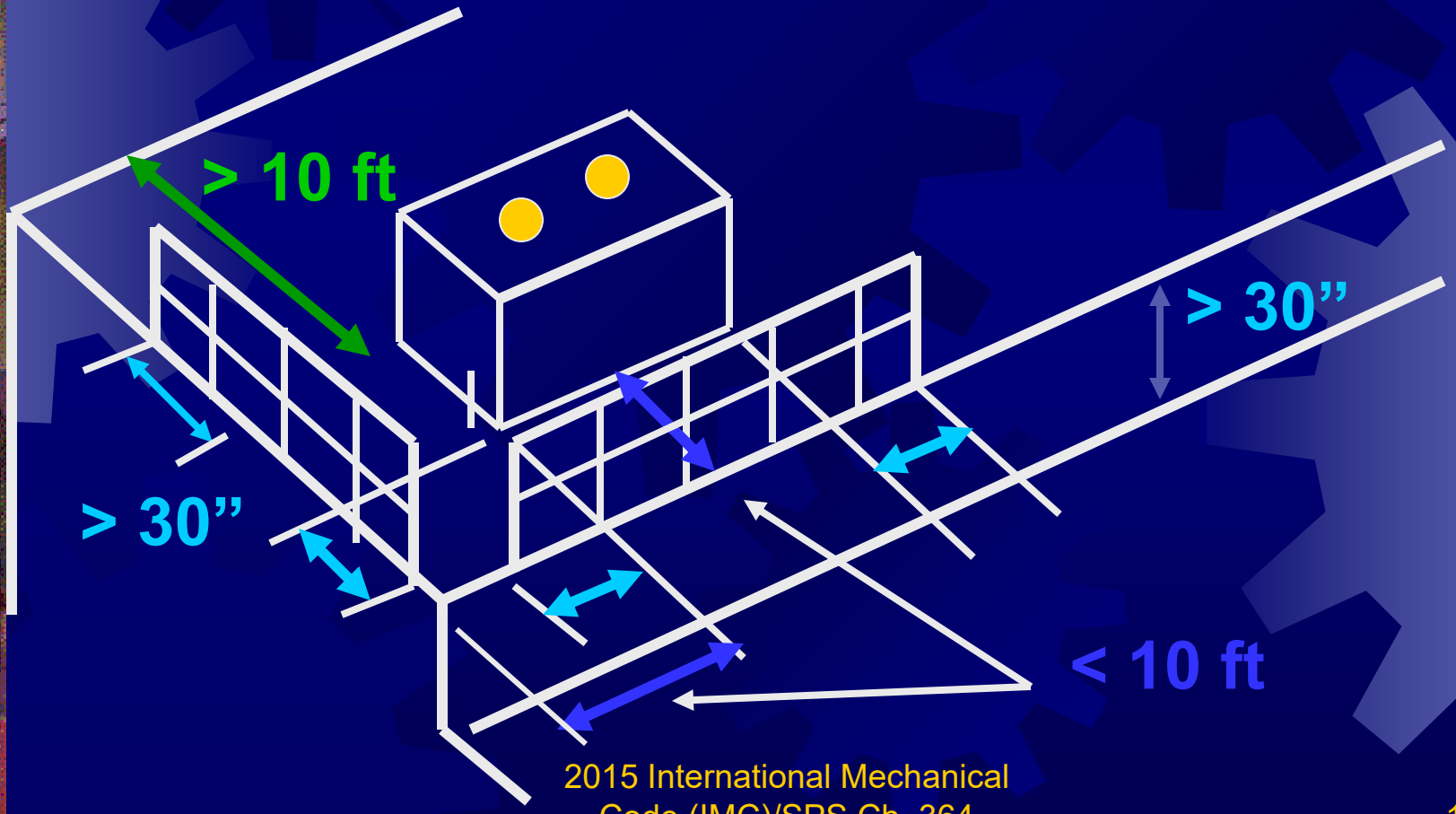
GUARD MUST BE ≥30” BEYOND EACH END OF THE APPLIANCE

GUARD REQUIRED IF ≤10’ FROM EDGE AND THERE IS AN OPEN SIDE >30” ABOVE THE FLOOR, ROOF, OR GRADE BELOW

HVAC Equipment & Roof Hatch Guards

IMC 304.11, 306.5, IBC 1009.11, 1011.13, 1015.7, 1607.8.1, IFGC 306.6

EXAMPLE:



HVAC Equipment & Roof Hatch

Guards IMC 304.11

HVAC Equipment Guards
IMC 304.11


Hmmmm……..


BANANZA

Fall-Arresting Restraint System
IMC 304.11

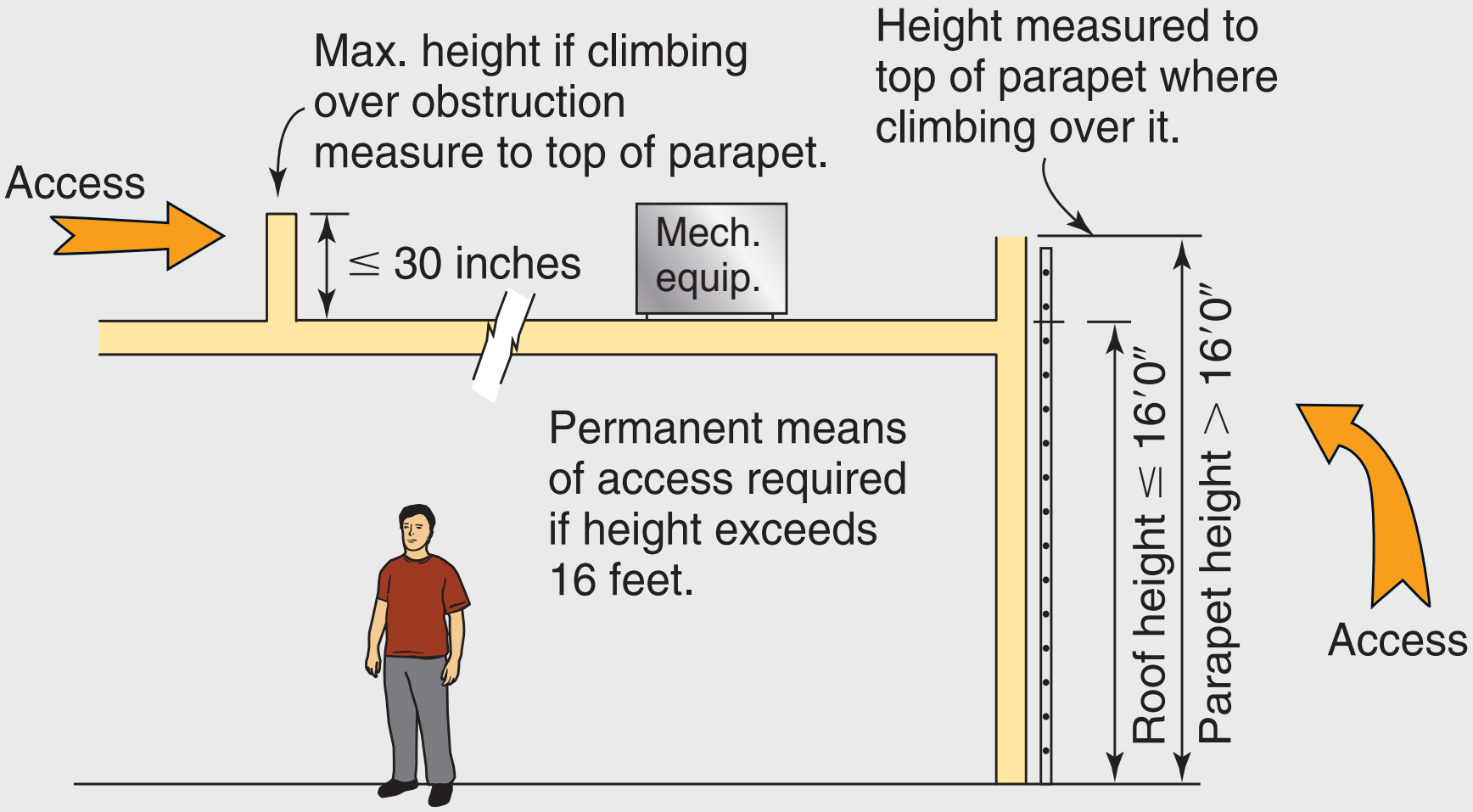
- Guards not req'd where permanent fall arrest/restraint anchorage connector devices are affixed for use during the entire roof conveying lifetime.
- Devices to be placed ≤10 ft on center along hip & ridge lines; as well ≤ 10 ft from roof edge or open side of walking surface.

Fall-Arresting Restraint System
IMC 304.11

HVAC on Roofs & Elevated Structures IMC 306.5

- Permanent approved means of access required for equipment & appliances on roofs or elevated structures at heights >16 ft
- Access may not involve:
  - Climbing over obstructions > 30" high
  - Walking on roofs w/> 4/12 pitch

HVAC on Roofs & Elevated Structures IMC 306.5



HVAC on Roofs & Elevated Structures IMC 306.5.1

- **Permanent platform req'd** where equipment, appliances, fans, etc. requiring access are installed on roofs or elevated structures
- Platform not required if roof pitch is < 3/12

Sloped Roof-Equipment Req't
Amendment Removal from IMC 306.5.1

- Removal of amendment now requires installation of guards & platforms when installations consist of fans only.
  - If the roof is ≥ 3/12
    - Install guards if > 30" at each edge
    - Install platform with not less than 30" clearance in any dimension
  - *This is an important issue when addressing upblast fans associated with kitchen exhaust systems*

Equipment Clearances
Combustible Construction
Installations per Listing
IMC Table 308.4.2, SPS 364.0301(2)

- Clearances may be reduced per IMC 308

TABLE 308.4.2
CLEARANCE REDUCTION METHODS[b]

TYPE OF PROTECTIVE ASSEMBLY[a]	REDUCED CLEARANCE WITH PROTECTION (inches)[a]							
	Horizontal combustible assemblies located above the heat source				Horizontal combustible assemblies located beneath the heat source and all vertical combustible assemblies			
	Required clearance to combustibles without protection (inches)[a]				Required clearance to combustibles without protection (inches)			
	36	18	9	6	36	18	9	6
Galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), mounted on 1-inch glass fiber or mineral wool batt reinforced with wire on the back, 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	2
Two layers of galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), having a 1-inch airspace between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
Two layers of galvanized sheet steel, having a minimum thickness of 0.0236 inch (No. 24 gage), having 1 inch of fiberglass insulation between layers, spaced 1 inch off the combustible assembly	18	9	5	3	12	6	3	3
0.5-inch inorganic insulating board, over 1 inch of fiberglass or mineral wool batt, against the combustible assembly	24	12	6	4	18	9	5	3
$3^1/_2$-inch brick wall, spaced 1 inch off the combustible wall	—	—	—	—	12	6	6	6
$3^1/_2$-inch brick wall, against the combustible wall	—	—	—	—	24	12	6	5

For SI: 1 inch = 25.4 mm, °C = [(°F)-32]/1.8, 1 pound per cubic foot = 16.02 kg/m^3, 1.0 Btu • in/(ft^2 • h • °F) = 0.144 W/m^2 • K.

a. Mineral wool and glass fiber batts (blanket or board) shall have a minimum density of 8 pounds per cubic foot and a minimum melting point of 1,500°F. Insulation material utilized as part of a clearance reduction system shall have a thermal conductivity of 1.0 Btu • in/(ft^2 • h • °F) or less. Insulation board shall be formed of noncombustible material.

b. For limitations on clearance reduction for solid fuel-burning appliances, masonry chimneys, connector pass-throughs, masonry fire places and kitchen ducts, see Sections 308.4.2.1 through 308.4.2.5.

Balancing, Operation & Maintenance SPS 364.0313

- Balancing **MUST** be performed on every HVAC installation
- Balancing report **MUST** be provided to owner & made available to Dept. Representative
- Air systems & hydronic systems **SHALL** be balanced as outlined in the code
- Operation & maintenance information **SHALL** also be provided

Amount of Supply Air shall Approx. = Amount of Return and Exhaust Air IMC 403.1

Portable Fire Extinguisher

IBC 906.4, IFC 904.12.5

Provide portable fire extinguishers within a 30 ft travel distance of commercial Type I cooking equipment.

Cooking equipment involving vegetable or animal oils and fats shall be protected by a “Class K” rated portable extinguisher.

Maintenance shall be per NFPA 10.

Questions -----

- ??????????