



UL Rated Ceiling Radiation Dampers: A Closer Look

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- Joined AMCA in February 2019
- Responsible for development of AMCA's education programs; staff liaison for the Education & Training Committee
- Projects include webinars, online education modules, presentations at trade shows, AMCA Speakers Network and many other items.



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Michael Bulzomi

Product Manager – Commercial Dampers Greenheck

- Over 16 years experience in the HVAC industry
- Has held positions in sales, marketing and application engineering across the U.S. for HVAC product manufacturers and Sales Reps
- Holds an MBA, and a Bachelors in Earth Science and Atmospheric Science
- Active member of ASHRAE, NFPA & AMCA, serving on multiple committees; Current Chair of the AMCA Fire & Smoke Damper Subcommittee



UL Rated Ceiling Radiation Dampers: A Closer Look

Purpose and Learning Objectives

The purpose of this presentation is to provide an overview of Ceiling Radiation Damper types and their ratings.

At the end of this presentation, you will be able to:

1. Identify the difference between a UL555C rated Ceiling Radiation Damper and a UL263 rated assembly that includes a Ceiling Radiation Damper.
2. Explain how to identify and read a UL Floor-Ceiling or Roof-Ceiling design.
3. Describe the difference between a Fire Damper and a Ceiling Radiation Damper.
4. Outline what Dynamic Rating is for Ceiling Radiation Dampers and what limitations exist in the market today.

Agenda

- What is a Ceiling Radiation Damper
- Different Types of Ceiling Radiation Dampers
- Differences from other Life Safety Dampers
- UL Floor/Ceiling & Roof/Ceiling Design Review
- How to Identify Ceiling Radiation Dampers
- How to Select the Appropriate Ceiling Radiation Damper



What...


is a Ceiling Radiation Damper?

What is a Ceiling Radiation Damper?

- **Definition of a Ceiling Damper per NFPA Standard 90A**

“A device installed to limit radiant heat transfer through an air outlet or air inlet opening in the ceiling of a floor-or roof-ceiling assembly having not less than a 1 hour fire resistance rating.”

A rose by any other name...

- **Ceiling Radiation Damper**
- **Radiation Damper**
- **CRD**
- **Ceiling Radiation Fire Damper**
- **Wood Truss Ceiling Radiation Damper**
- **Fire Rated Wood Truss Damper**
- **Wood Joist Damper**
- **Fire Stop Flaps** 

Ceiling Radiation Dampers get installed in:

- Behind diffusers, grilles, and exhaust fans in ceilings
- Supply and return air ceiling membrane penetrations for above ceiling (or in attic) Furnaces/ERV/Fan Coils/Heat Pumps, etc...
- Supply and return air ceiling membrane penetrations for in closet Furnace/ERV/Fan Coil/Heat Pumps, etc...
- **NOTE: Single floor penetrations only**
Cannot use duct to create a “shaft” or multi-floor ducted penetration.



How...

does a Ceiling Radiation Damper
protect an assembly?

Limits radiant heat transfer above the ceiling

Designed to limit the transfer of radiant heat to protect structural integrity of floor/ceiling or roof/ceiling assembly above it.

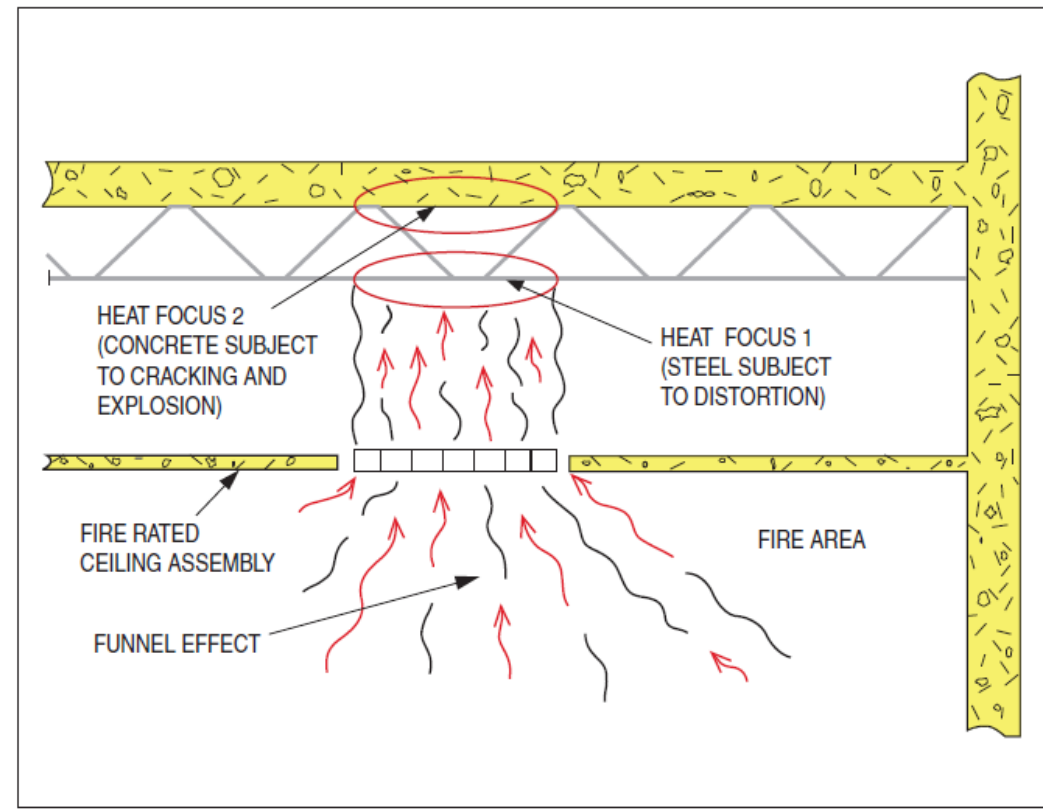
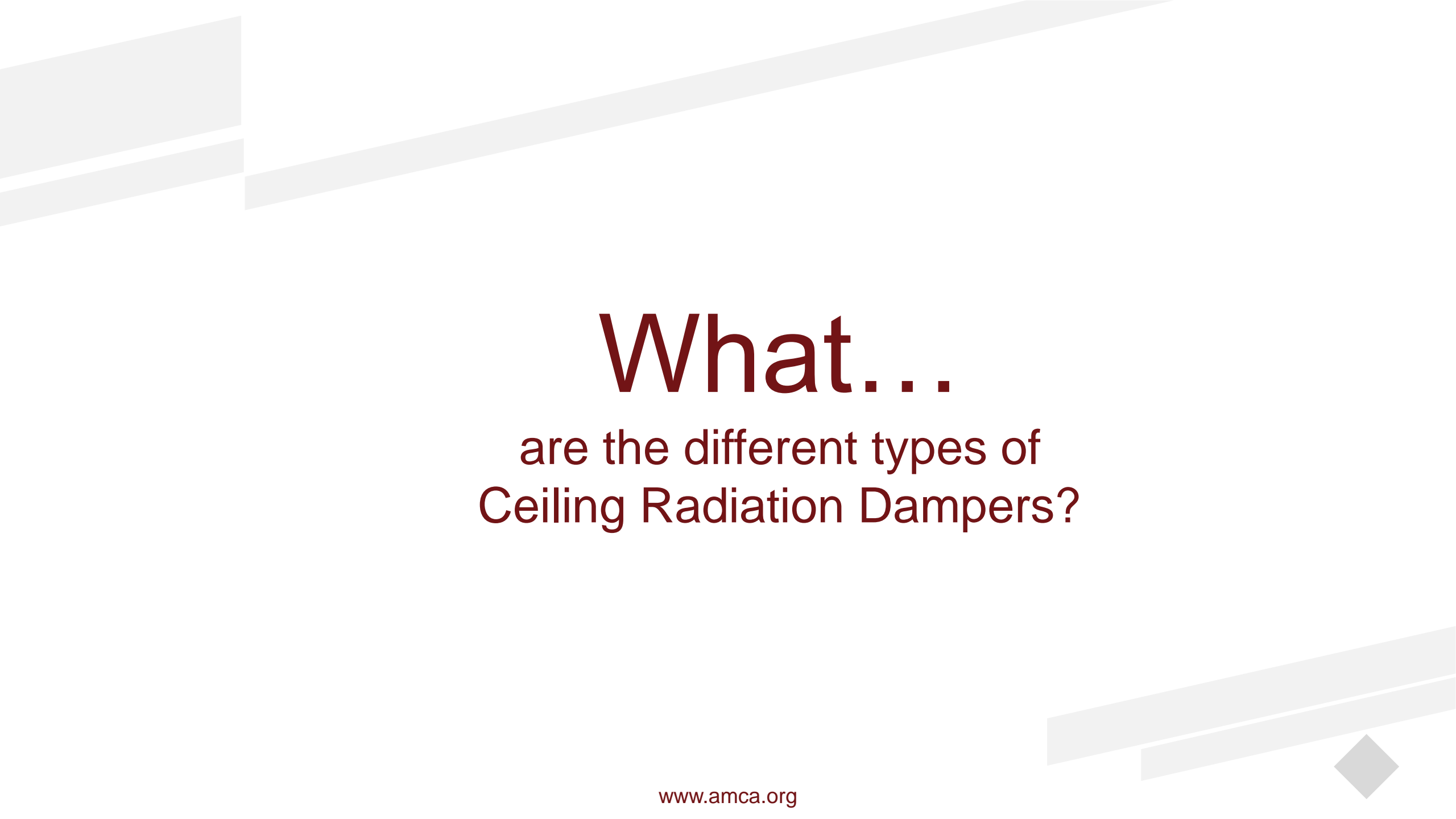


FIGURE 1



What...

are the different types of
Ceiling Radiation Dampers?

For Use in Lieu of Hinged Door Type Dampers

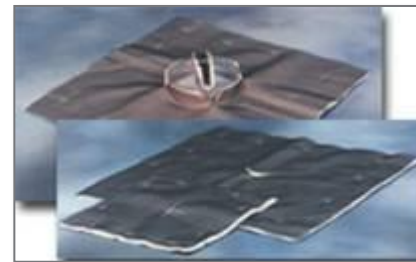
- Tested for use in those UL fire resistive designs that indicate the use of a **hinged door type damper**
- Tested and classified to **UL 555C**



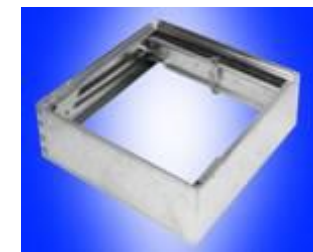
**Butterfly Type
Square or
Rectangular**



**Adjustable volume
control option**



Damper and Thermal Blanket



Curtain Type

For use in specific floor/ceiling or roof/ceiling designs

- Tested for use only in one or more specific UL fire-resistive floor/ceiling or roof/ceiling designs
- Commonly used in multi-family dwellings, nursing homes, smaller hotels and motels, etc.
- Tested and classified to **UL 263**



For use in specific UL floor/ceiling or roof/ceiling designs

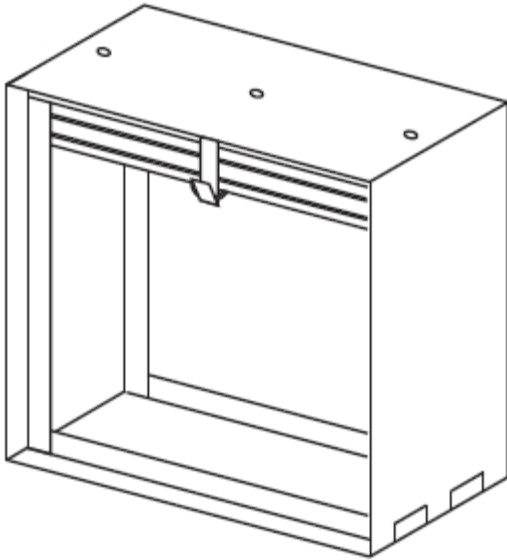
- These designs can be “**proprietary**”, meaning the listing is owned by a damper manufacturer and only their products have been tested and approved for use under that design number.
- Or they can be “**open**”, typically owned by a gypsum board manufacturer where multiple manufacturers of dampers have been tested and are approved for use under that design number.



What...
is the difference?

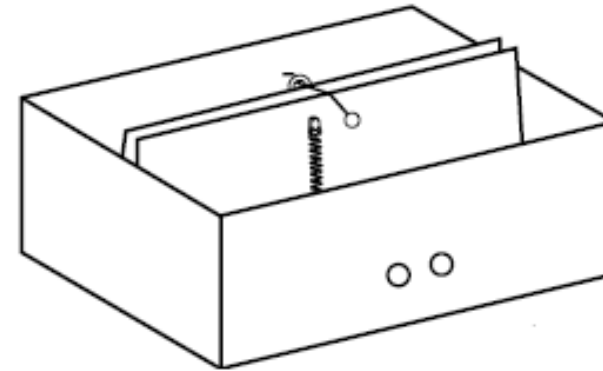
Between a Fire Damper & Ceiling Damper?

- **Limits Flame
(UL555)**



Fire Damper

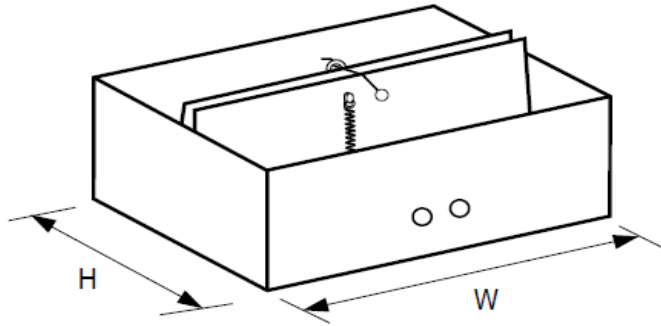
- **Limits Heat
(UL555C)**



**Ceiling Radiation
Damper**

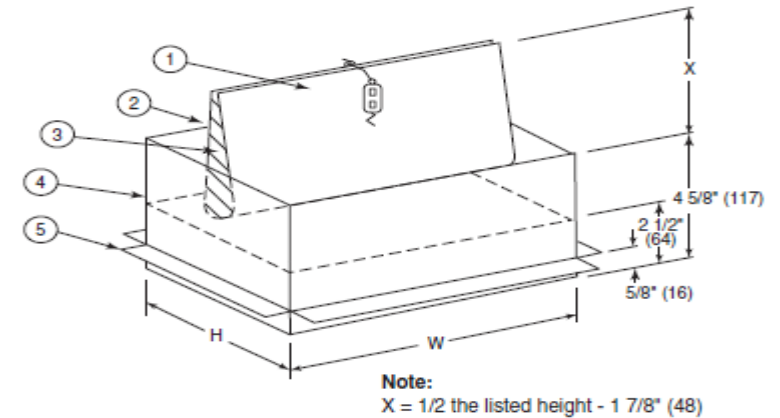
Between a CRD and Wood Truss CRD?

- For installation in ceiling penetration with an air outlet and thermal blanket (fire rated t-bar or gypsum board) (**UL555C**).



Ceiling Radiation Damper

- Part of a specific assembly usually in conjunction w/a factory or field supplied boot (by others) (**UL263**).



**Wood Truss
Ceiling Radiation Damper**

Differences continued...

The application of ceiling radiation dampers versus horizontal fire dampers, smoke dampers, combination fire-smoke dampers and corridor dampers are distinctly different.

- Dampers may be constructed differently
 - Different frame and/or blade gauges
 - May or may not require blade insulation
- Different installation methods/requirements
- Ceiling Dampers for Wood Truss are assemblies and usually require a Factory supplied or Field Supplied boot (by others) constructed per manufacturers IOM.
- And most importantly...the different UL classifications have different UL labels – they are tested and approved for different applications!



What...

do the UL designs look like?

Design that allows a UL 555C Rated Ceiling Damper

Design No. G526

July 28, 2017

Restrained Assembly Rating — 2 Hr.

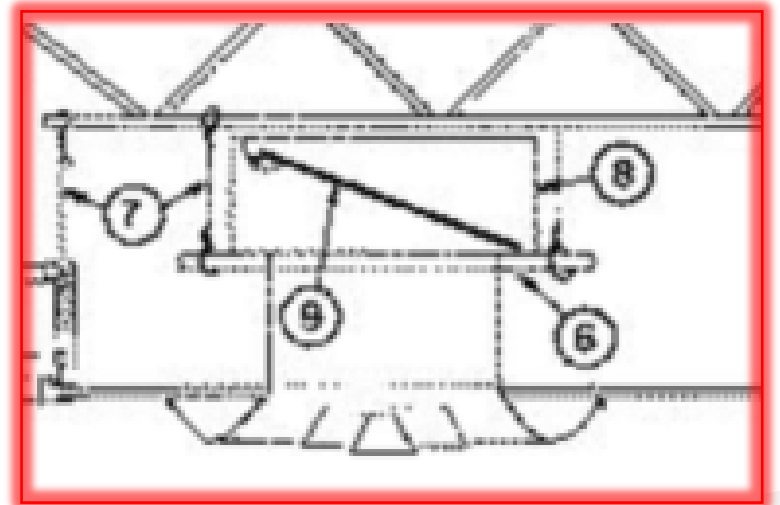
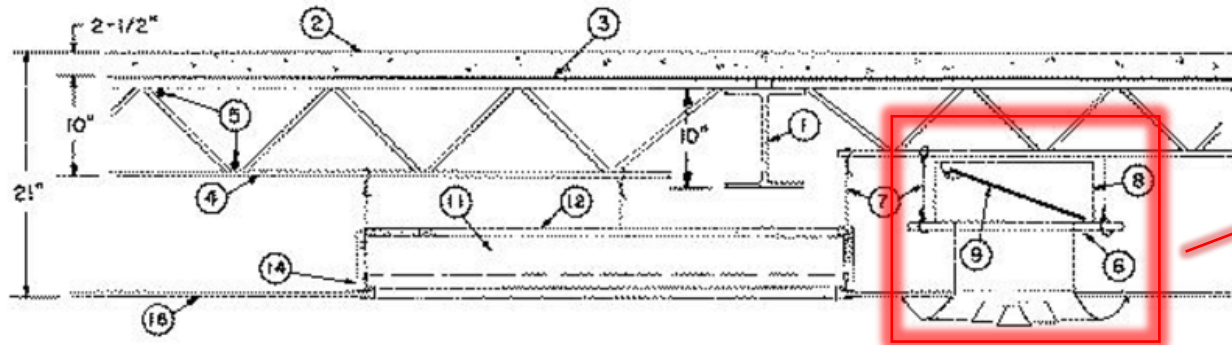
Unrestrained Assembly Ratings — 1-1/2 and 2 Hr.

(See Item 14B)

Unrestrained Beam Rating — 2 Hr.

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide [BXUV](#) or [BXUV7](#)

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



Listing that allows a UL 263 Ceiling Damper assembly for use in Wood Truss Ceiling

Design No. L550

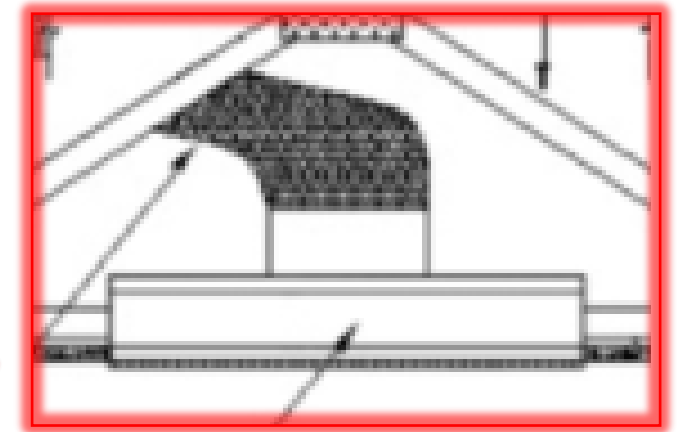
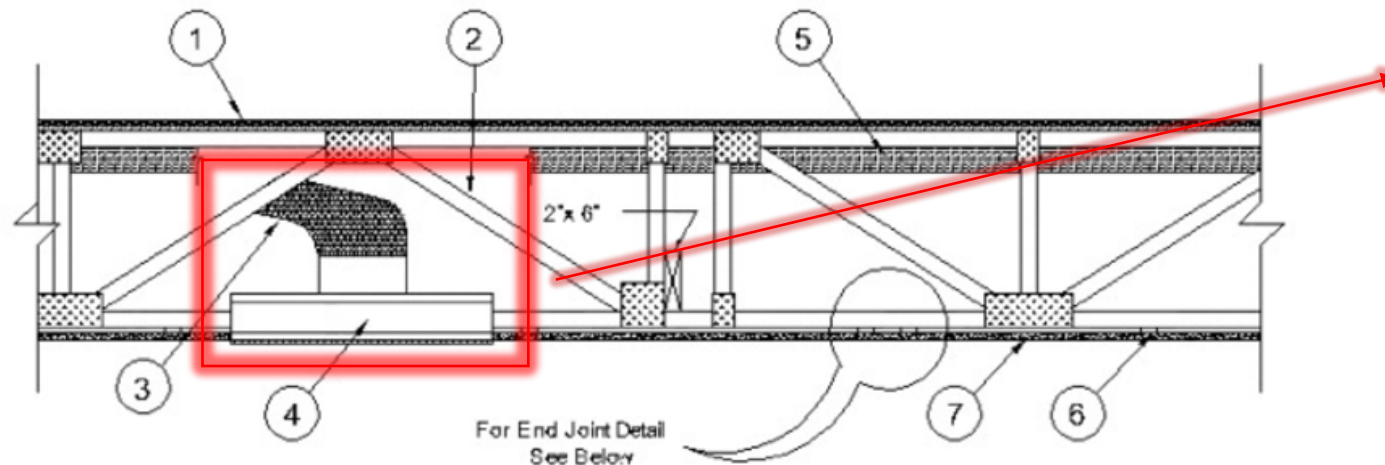
September 12, 2016

Unrestrained Assembly Rating — 1 Hr.

Finish Rating — 23 Min (See Items 5 or 5A)

This design was evaluated using a load design method other than the Limit States Design Method (e.g., Working Stress Design Method). For jurisdictions employing the Limit States Design Method, such as Canada, a load restriction factor shall be used — See Guide [BXUV](#) or [BXUV7](#)

* Indicates such products shall bear the UL or cUL Certification Mark for jurisdictions employing the UL or cUL Certification (such as Canada), respectively.



UL555C vs. UL263

There are several notable differences but always remember:

- **UL555C** Ceiling Dampers are intended for use in **sheet metal air duct outlets** which penetrate the ceilings of hourly-rated fire resistive assemblies (**in lieu of hinged plate dampers**).
- **UL263** Ceiling Radiation Dampers are part of an assembly intended for installation in **specific** fire resistive assemblies (**i.e. wood truss ceilings**).



What...

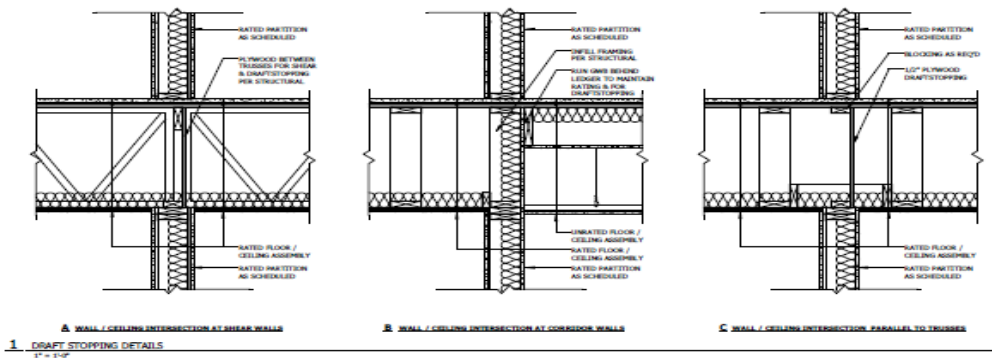
do I look for on Mechanical Plans?

Check the Architectural A set...

Look for the following:

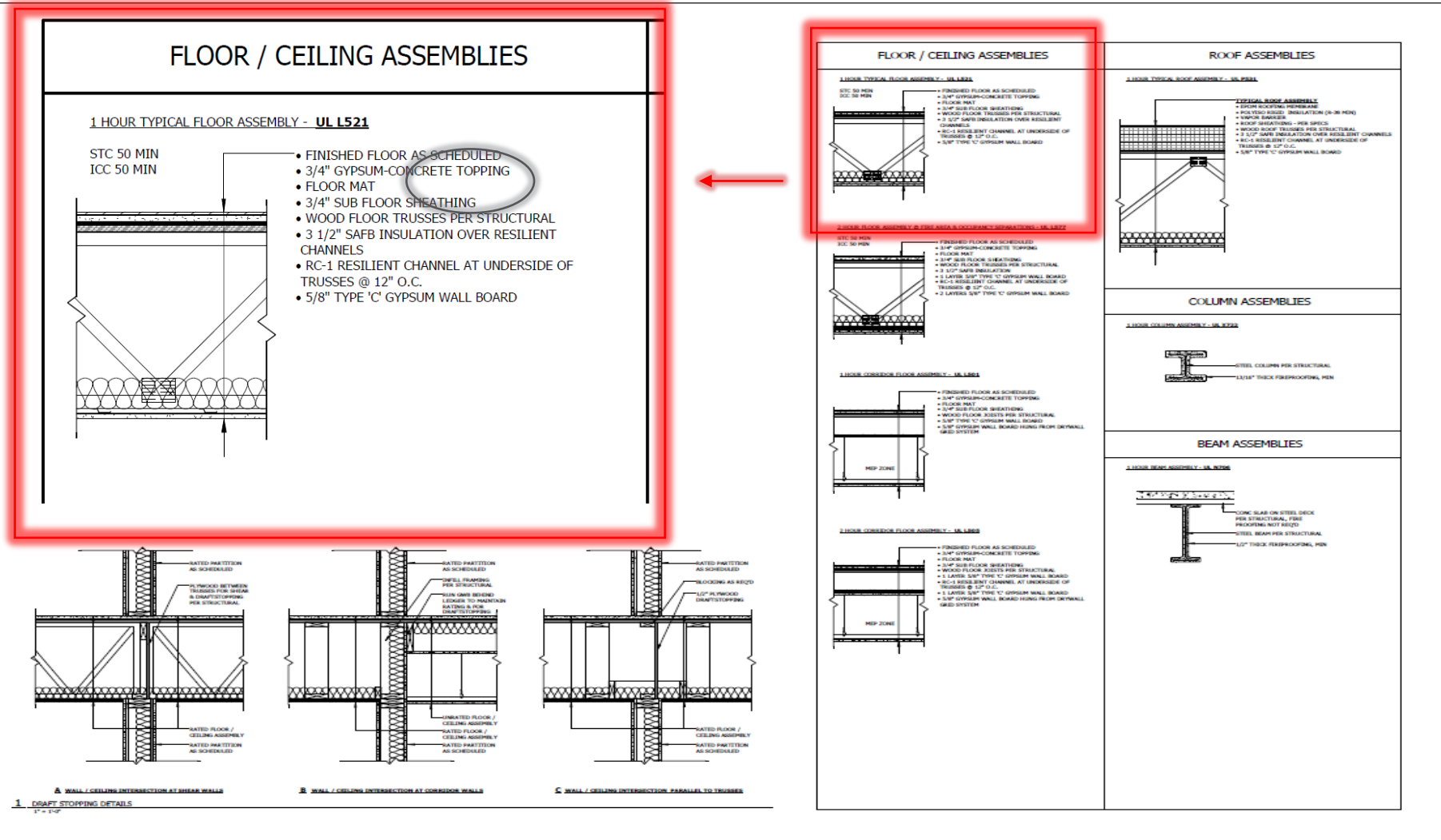
- Life Safety Plans
- Partition Plans
- Assembly Details
- Floor Elevations
- Building Section Details

Check the Architectural A set...

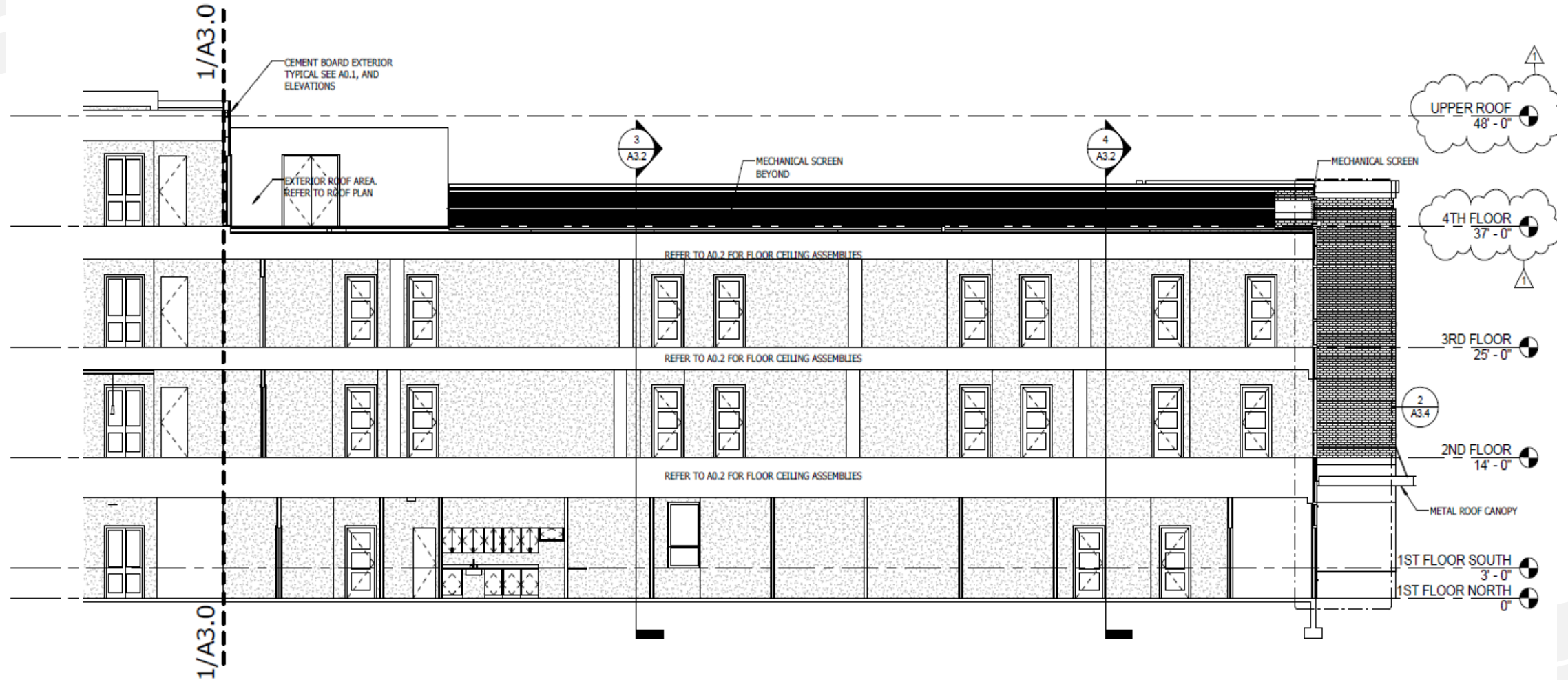


FLOOR / CEILING ASSEMBLIES	ROOF ASSEMBLIES
<p>1. USUAL TYPICAL FLOOR ASSEMBLY - IN AREA</p> <ul style="list-style-type: none"> FINISHED FLOOR AS SCHEDULED 3/4" GYPSUM-CONCRETE TOPPING FLOOR MAT 3/4" SUB FLOOR SHEATHING WOOD FLOOR TRUSSES PER STRUCTURAL 3 1/2" SAW INSULATION OVER RESIDENT CHANNLES AC-1 RESIDENT CHANNEL AT UNDERSIDE OF TRUSSES @ 12" O.C. 5/8" TYPE 12 GYPSUM WALL BOARD <p>2. FLOOR FLOOR ASSEMBLY & FLOOR AREA & CORRIDOR SEPARATIONS - IN AREA</p> <ul style="list-style-type: none"> FINISHED FLOOR AS SCHEDULED 3/4" GYPSUM-CONCRETE TOPPING FLOOR MAT 3/4" SUB FLOOR SHEATHING WOOD FLOOR TRUSSES PER STRUCTURAL 3 1/2" SAW INSULATION 1 LAYER 5/8" TYPE 12 GYPSUM WALL BOARD AC-1 RESIDENT CHANNEL AT UNDERSIDE OF TRUSSES @ 12" O.C. 2 LAYERS 5/8" TYPE 12 GYPSUM WALL BOARD <p>3. USUAL CORRIDOR FLOOR ASSEMBLY - IN AREA</p> <ul style="list-style-type: none"> FINISHED FLOOR AS SCHEDULED 3/4" GYPSUM-CONCRETE TOPPING FLOOR MAT 3/4" SUB FLOOR SHEATHING WOOD FLOOR JOISTS PER STRUCTURAL 5/8" TYPE 12 GYPSUM WALL BOARD 5/8" GYPSUM WALL BOARD FLOOR FROM OUTWALL GRID SYSTEM <p>4. USUAL CORRIDOR FLOOR ASSEMBLY - IN AREA</p> <ul style="list-style-type: none"> FINISHED FLOOR AS SCHEDULED 3/4" GYPSUM-CONCRETE TOPPING FLOOR MAT 3/4" SUB FLOOR SHEATHING WOOD FLOOR JOISTS PER STRUCTURAL 1 LAYER 5/8" TYPE 12 GYPSUM WALL BOARD AC-1 RESIDENT CHANNEL AT UNDERSIDE OF TRUSSES @ 12" O.C. 1 LAYER 5/8" TYPE 12 GYPSUM WALL BOARD 5/8" GYPSUM WALL BOARD FLOOR FROM OUTWALL GRID SYSTEM 	<p>1. USUAL TYPICAL ROOF ASSEMBLY - IN AREA</p> <ul style="list-style-type: none"> TYPICAL ROOF ASSEMBLY EPDM ROOFING MEMBRANE INSULATED INSULATION (R-30 MIN) WOOD TRUSSES ROOF SHEATHING - PER SPEC 3 1/2" SAW INSULATION OVER RESIDENT CHANNLES AC-1 RESIDENT CHANNEL AT UNDERSIDE OF TRUSSES @ 12" O.C. 5/8" TYPE 12 GYPSUM WALL BOARD
	<p>COLUMN ASSEMBLIES</p> <p>1. USUAL COLUMN ASSEMBLY - IN AREA</p> <ul style="list-style-type: none"> STEEL COLUMN PER STRUCTURAL 1/2" THICK FIREPROOFING, MIN
	<p>BEAM ASSEMBLIES</p> <p>1. USUAL BEAM ASSEMBLY - IN AREA</p> <ul style="list-style-type: none"> CONC SLAB ON STEEL DECK PER STRUCTURAL, FIRE PROOFING NOT REQD STEEL BEAM PER STRUCTURAL 1/2" THICK FIREPROOFING, MIN

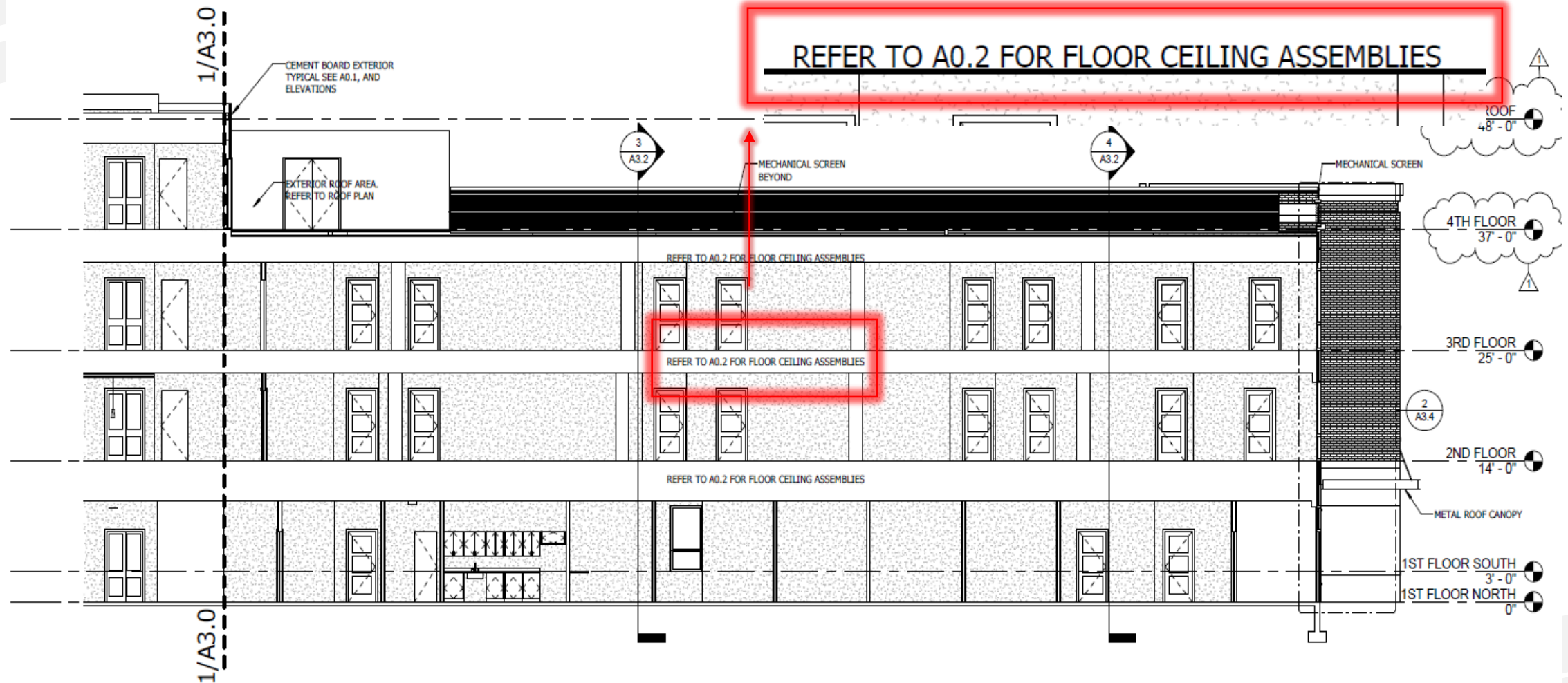
Check the Architectural A set...



Check the Architectural A set...



Check the Architectural A set...



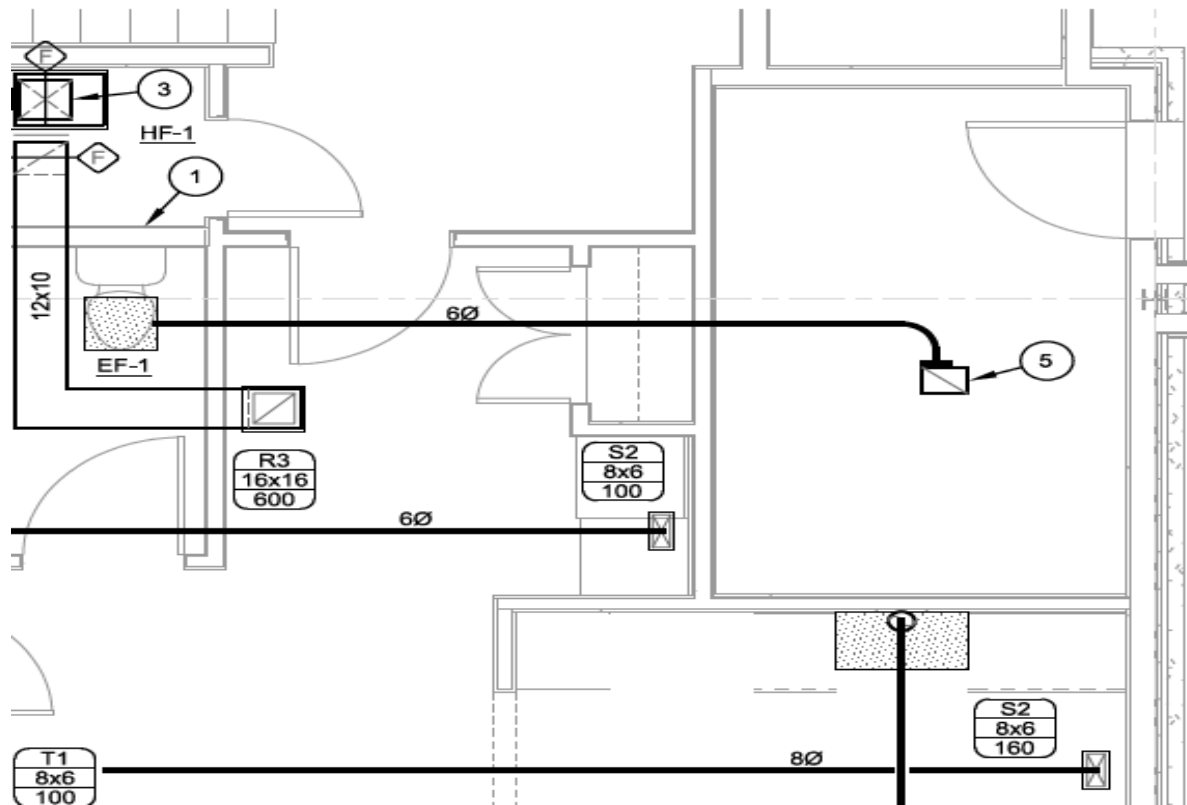
2 BUILDING SECTION-NORTH
1/8" = 1'-0"

Check the Mechanical M set...

Looking for:

- Key Notes
- Schedule Notes
- Product Detail Drawings

Check the Mechanical M set...

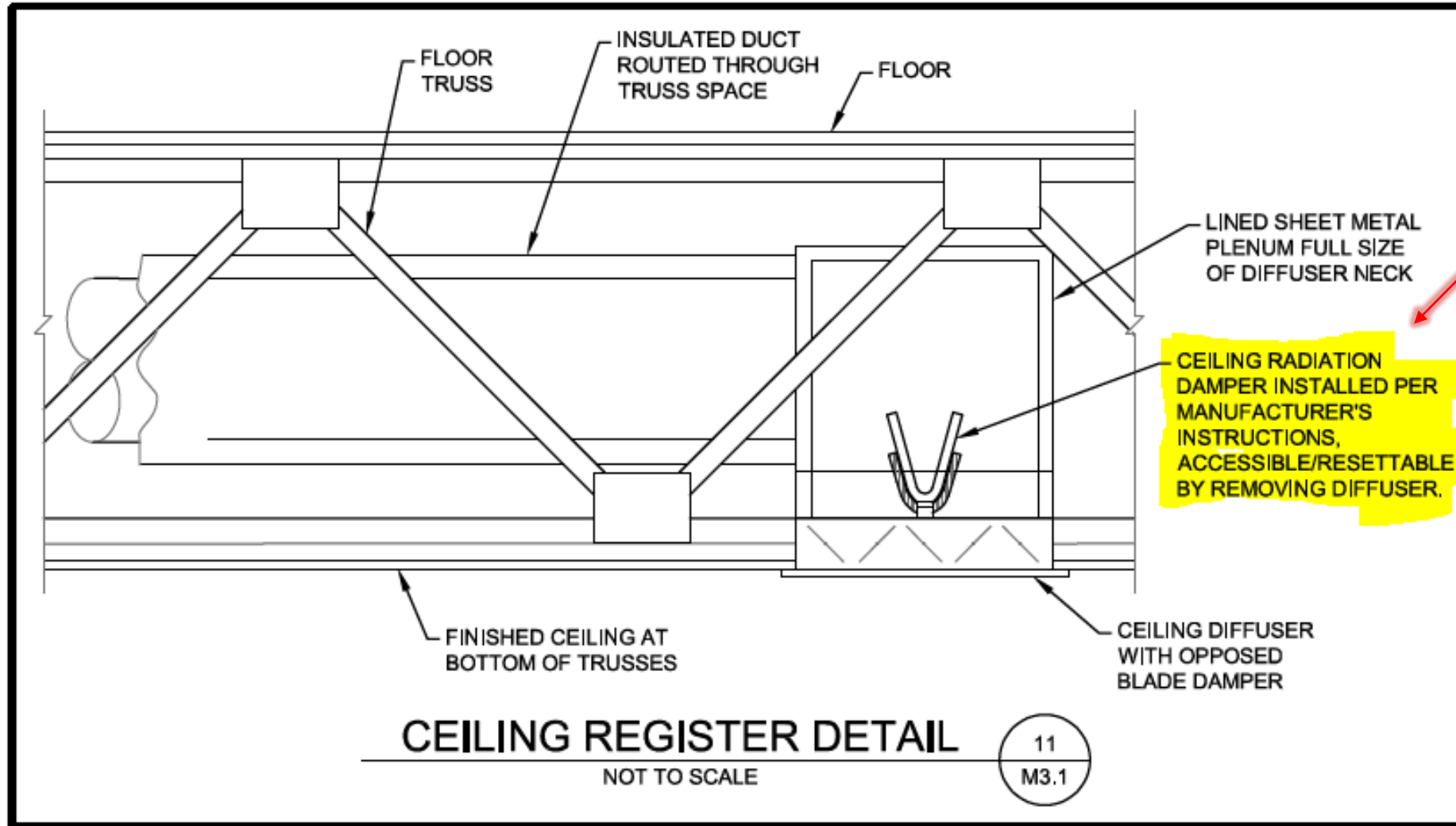


KEY NOTES

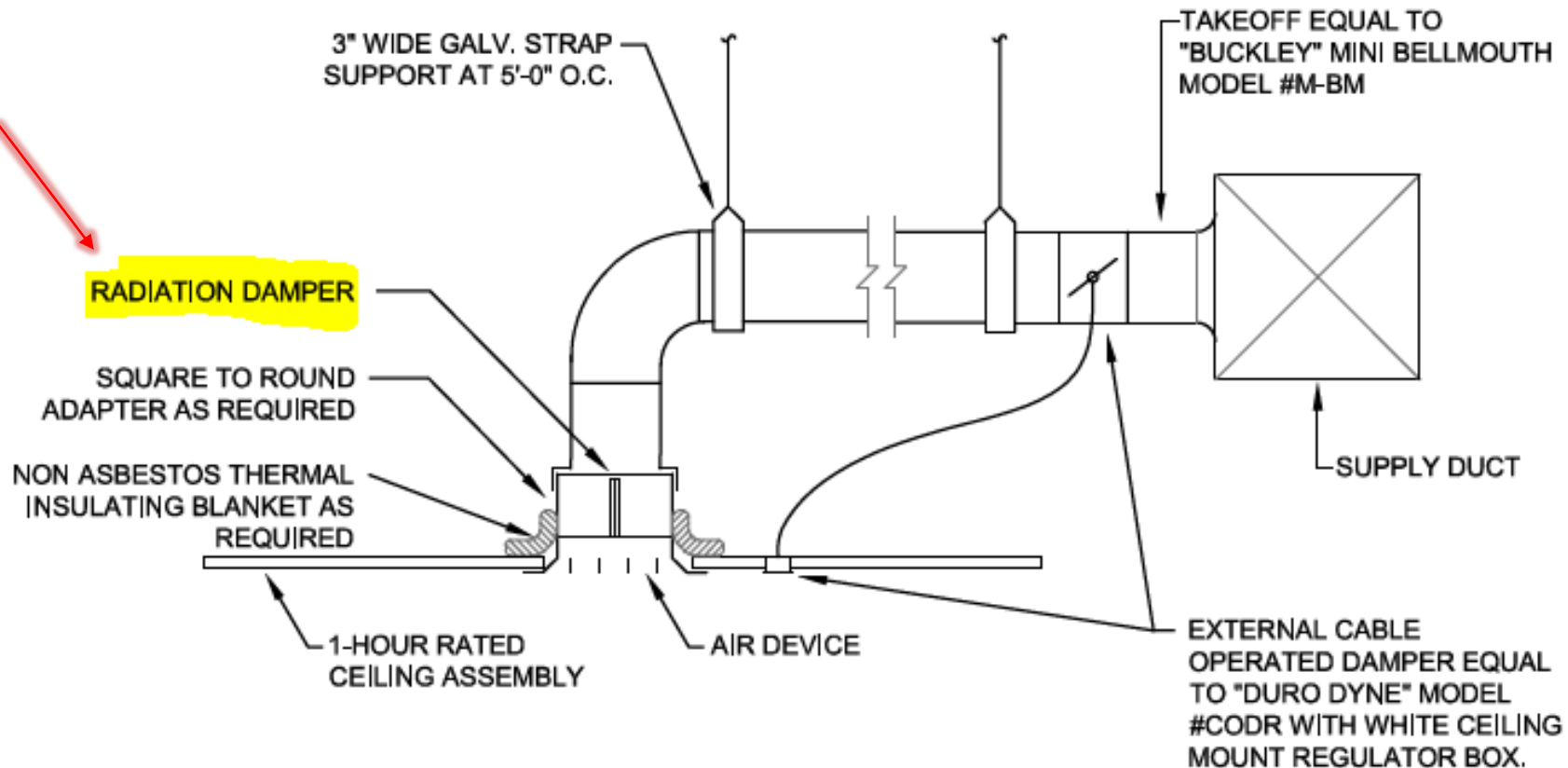
INDICATED BY SYMBOLS ①, ②, ETC.

1. COORDINATE DUCTWORK WITH WATER HEATER AND PIPING IN THIS AREA. SEE ENLARGED MECHANICAL CLOSET PLAN SHEET P2.4.
2. 8x6 EXHAUST AIR DUCT AT 1ST AND 2ND FLOOR, 8x10 AT 3RD AND UP TO UNIT F ON 4TH FLOOR OR TO ROOF TERMINATION.
3. 12x12 SUPPLY AIR DUCT FROM FURNACE UP BETWEEN JOISTS TO ROUND DUCT CONNECTION. COORDINATE WITH STRUCTURE.
4. CENTER 8x6 TRANSFER DUCT ABOVE DOOR WITH TRANSFER GRILLE ON EACH SIDE.
5. 6x8 EXHAUST AIR DUCT AT 1ST AND 2ND FLOOR, 10x8 AT 3RD AND 4TH FLOOR AND UP TO ROOF TERMINATION.
6. PROVIDE A RADIATION DAMPER AT EACH SUPPLY, RETURN, AND TRANSFER GRILLE THAT PENETRATES THE RATED CEILING ASSEMBLY. SEE DETAIL 4/M3.1.
7. 8x6 AT 2ND AND 3RD FLOOR, UP TO UNIT H ON 4TH FLOOR.
8. 10x5 EXHAUST AIR BETWEEN STUDS AT 2ND AND 3RD FLOOR, UP TO ROOF TERMINATION. PROVIDE FIRE DAMPER AT EACH RATED ASSEMBLY WITH ACCESS PANELS.
9. 6x6 TRANSFER DUCT ABOVE CEILING TO TRANSFER GRILLES IN CEILING, PROVIDE RADIATION DAMPERS AT FIRE RATED CEILING.

Check the Mechanical M set...



Check the Mechanical M set...



AIR DEVICE IN RATED ASSEMBLY DETAIL

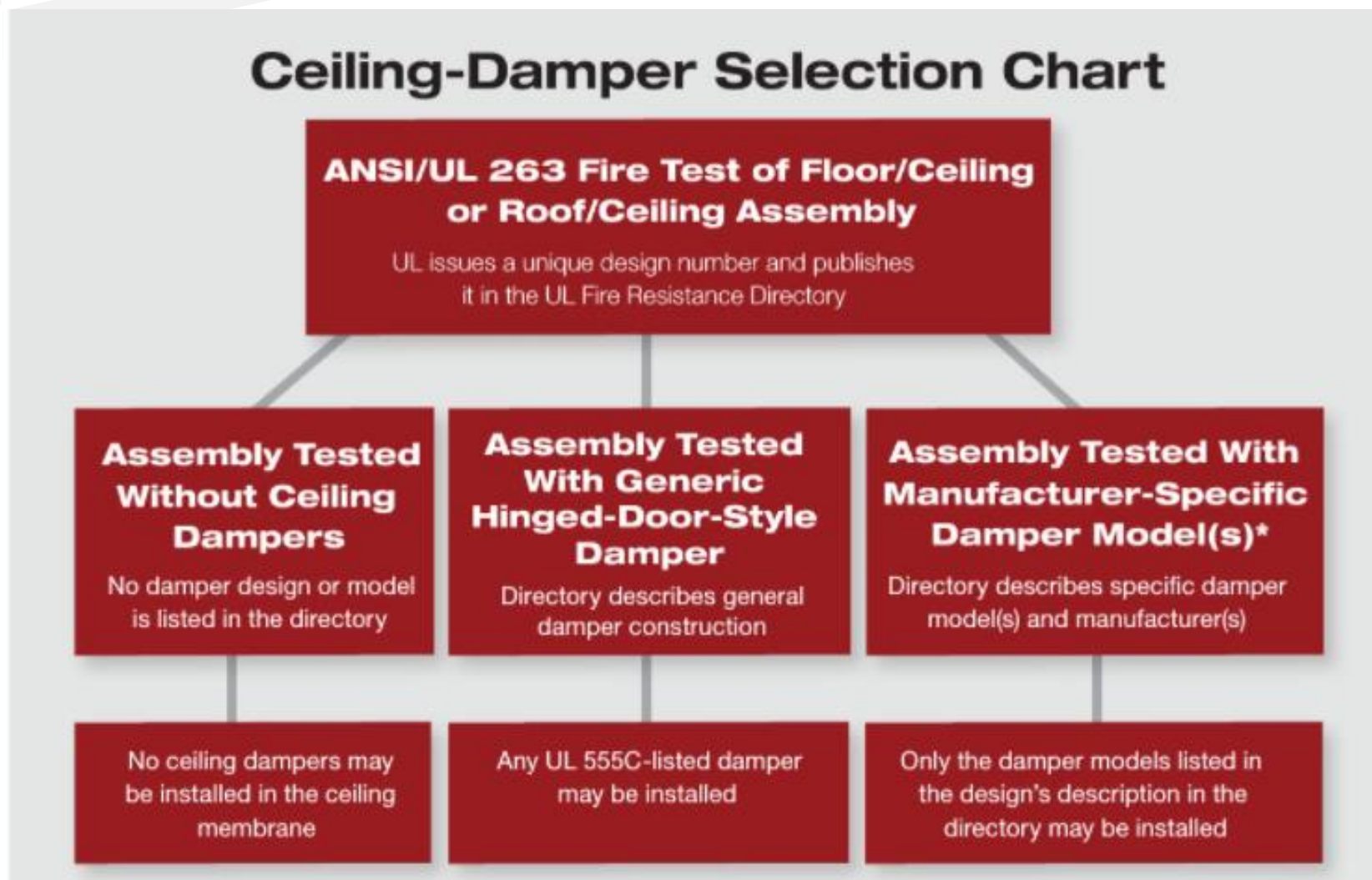
NOT TO SCALE





How...
to select the appropriate damper?

Ceiling Damper Selection



Gypsums Association's Fire Resistance Design Manual

- Design numbers found in the Gypsum Association's manual are commonly specified.
- However – the Gypsum Association is NOT a testing agency. The listings contained in the manual are based on test data from various accredited 3rd party labs, all of which test to UL263.
- Some of the listings are proprietary to the manufacturer of the gypsum board, they are not in respect to the damper.
- Ceiling dampers that are approved for use in specific Gypsum Associate designs can be determined by referring to the test reports and/or design numbers of the testing agency.



What...

is a Dynamic Ceiling Radiation Damper?

Static vs. Dynamic Systems

- Static systems can be defined as systems that are designed to shut fans off during a fire emergency.
- Dynamic systems can be defined as systems that are designed to have fans on during a fire emergency.
 - This can be either an engineered smoke control system where a series of fans, dampers, and other devices can be used to control the movement of smoke in a fire emergency,
 - But can also be a system where unitary heating & cooling devices are not equipped with a means to stop their fans from running in the event of a fire emergency.

Static vs. Dynamic Systems

- Until recently, all Ceiling Radiation Dampers available were Static rated and used in all applications.
- Underwriters Laboratory (UL) has devised a test method and begun a program to test and certify Dynamically rated Ceiling Radiation Dampers.
- Ceiling dampers now indicate on their published UL Certifications available if they are for use in static systems or for use in dynamic systems.

Dynamic Ceiling Radiation Dampers

- Rated for specific airflow and pressures as indicated by the table below.
- Also rated for airflow directionality - either upflow or downflow.

Re: UL 555C, Table 10.1
Test airflow and pressure conditions

Rated airflow and pressure		Minimum test airflow and pressure	
Airflow, fpm (m/s)	Pressure, inches of water (kPa)	Airflow, fpm (m/s)	Pressure, inches of water (kPa)
500 (2.54)	1 (.25)	600 (3.05)	1.125 (.280)
1000 (5.10)	1 (.25)	1200 (6.10)	1.125 (.280)
1500 (7.62)	1 (.25)	1800 (9.15)	1.125 (.280)
2000 (10.20)	1 (.25)	2400 (12.20)	1.125 (.280)

Dynamic Ceiling Radiation Dampers

- It should be noted that the current availability of Floor/Ceiling and Roof/Ceiling designs is limited to 1 manufacturer, and it is a “proprietary” listing.
 - Only one manufacturer’s damper may be used.
- If the specific assemblies are NOT specified, the available dynamically rated Ceiling Radiation Dampers cannot be substituted in another design unless it has been tested and approved by UL.
- The available design is limited in membrane penetration size (WxH) and rated velocity. Designers should be aware of limitations prior to specification.

Resources

- **AMCA International:** www.amca.org
- **AMCA Publication:** www.amca.org/store
 - > **503-08:** Fire, Ceiling (Radiation), Smoke and Fire/Smoke Dampers Application Manual (*Available for purchase*)
- **AMCA White Papers:**
<https://www.amca.org/educate/#articles-and-technical-papers>
 - > Ceiling Dampers Explained, April 2018
- **Underwriters Laboratory:** <https://www.ul.com/>

Q & A

Survey QR Code:



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*PDH credits and participation certificates will be issued electronically **within 30 days**, once all attendance records are checked and the completed online evaluations are received.*

Attendees will receive an email at the address provided on your 2023 AHR Expo registration, listing the total credit hours awarded and a link to a printable certificate of completion.

If you have any questions, please contact Lisa Cherney, Education Manager, at AMCA International (lcherney@amca.org).



NEXT SESSION @
10:30AM:

*How to Select the
Right Fan*