

Code Changes Impacting Grease Duct Selection

Not a lot has changed in the world of commercial grease ducts in the past few decades. Same goes in the industrial boiler realm. But recent code revisions and emerging attitudes toward energy efficiency are making an impact on specifications.

There are three major grease duct codes adopted by state, city and county officials and/or inspectors to regulate industrial and commercial installations:

- National Fire Protection Association (NFPA 96)
- International Mechanical Code (IMC 2009) developed by the International Code Council (ICC)
- Uniform Mechanical Code (UMC 2009) part of the International Association of Plumbers and Mechanical Officials (IAPMO) code set.

All of the code organizations have recognized UL1978 and UL2221 Underwriter Laboratory standards for safety. These codes recognize three duct designs:

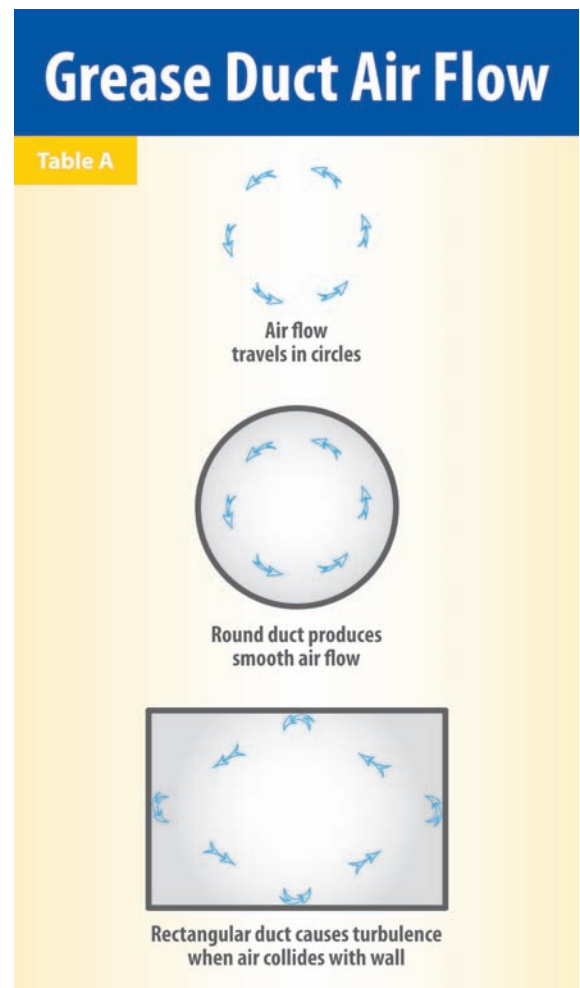
- Rectangular, on-site welded, carbon steel grease ducts wrapped with a single layer of insulation at the construction site
- Non-insulated, rectangular grease ducts contained in a fire-rated shaft
- Round, UL 1978 listed, prefabricated stainless steel grease ducts protected with a fire rated shaft if installed in a multiple story building.

UL 1978 covers factory-built grease ducts and grease duct assemblies that are intended to be installed at clearances less than 18 inches as specified in the Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations, NFPA 96 and the International Mechanical Code.

UL 2221 tests are intended to determine the fire resistance of grease duct enclosure assemblies. These requirements limit the combustibility, surface flammability and smoke generation potential of the coverings used to enclose the grease duct. In addition, these requirements evaluate the effectiveness of the combination of the grease duct and the enclosure as a fire-rated system and as a thorough penetration firestop system. It also measures the enclosure's effect on the grease duct.

Preferred design

The rectangular, on-site welded grease duct remains the most widely accepted of the three designs among building engineers. They are readily available in nearly every market as they can be manufactured in most sheet metal shops. And because they have been around for decades,



they are accepted in the majority of municipalities' building codes. They are without a doubt the current industry standard for grease ducts.

However, the rectangular design presents some safety concerns. First, it isn't UL rated. There is no verification that on-site welding is done properly. Substandard welds can increase the risk of a grease duct fire. Also, rectangular vents are constructed with porous carbon steel which can absorb grease as it passes through the duct.

Further, the rectangular shape impedes air flow. Gases being vented through the duct typically move in a circular motion as they pass to the outside. While a round duct acts as a natural conduit for this flow pattern, the rectangular shape causes turbulence when the air collides with the flat walls. This increases the likelihood of grease collecting in corners, creating a potential fire hazard. (See Table A)

In addition to these critical safety considerations, rectangular vents are more difficult to install than round stacks because of the on-site welding requirement. Field modifications are problematic as well since additional cuts may compromise the integrity of the duct and there is no guarantee that the modified pieces will be welded together accurately.

Finally, rectangular ducts have space and cost disadvantages. If the duct has to be protected with a separate, ventilated, fire-rated enclosure, the required 18" clearance for the ventilated shaft takes up valuable space. When a duct is wrapped with a fire-resistant material, a different sub-contractor is required for the insulation step, adding to the labor costs of the project.

New rules

Revisions to UL2221 that went into effect on 1/1/2009 contain two important changes that give a prefabricated grease duct several advantages over a conventional rectangular design for the building engineer. These changes include:

- On-site welded grease ducts must be wrapped in *two* layers of insulation, tested to UL 2221 standards at the construction site
- UL 2221 classified prefabricated stainless steel grease ducts no longer have to be contained in a fire rated shaft.

The primary impact the code changes may have on grease duct selection is cost differentiation. Table B compares the cost of a rectangular versus prefabricated grease duct. In this example, the prefabricated duct costs \$3,077 or 27% less. Even though upfront material costs are significantly higher for the prefab design, this is offset by the cost of the additional two layers of 1 ½" firewrap insulation. Additionally, this analysis doesn't include the savings associated with eliminating the fire-rated shaft that had been required prior to the code change.

The second advantage is space conservation. The new, double-wrap requirement adds considerable bulk to a rectangular configuration. Further, no additional clearance is required for the shaft around the prefabricated duct, affording significant space savings.

Cost Comparison		
Rectangular (on-site welded) vs. Prefab Grease Duct		
Table B	Rectangular Duct	Prefab Duct
Material Cost	\$386	\$6,713
Insulation	\$7,400	\$0
Shop Labor Cost	\$1,508	\$0
Install Labor Cost	\$1,984	\$1,488
Total Cost	\$11,278	\$8,201
Savings using Prefab Grease Duct = \$3,077 (27%)		

Finally, prefabricated ducts have been tested by UL to be fire rated, providing critical reassurance to the engineer and ultimately, the building owner. Bottom line, UL listings impact insurability. Any liability attributed to the ducts falls on Underwriters Laboratory because they tested the product. Most insurance companies prefer UL listed products and this reality is motivating an increasing number of project engineers to spec prefabricated grease ducts.

New trend

While code revisions are having an impact in the grease duct market, a trend toward installing more efficient boilers also is having an impact on the type of stack that's specified.

Boiler efficiency is the difference between the raw energy input, or fuel source, and energy output, or steam, generated by the boiler. For example, the typical commercial or industrial boiler runs at 80% or less, a statistic that is becoming unacceptable with today's green building practices.

High efficiency, condensing boilers were designed to eliminate wasted raw material, lower operating costs, and reduce raw energy usage. These new designs operate at 90% efficiency or more. This added efficiency reduces the number of boilers required which reduces the number of necessary stacks.

Fewer stacks can have a significant impact on project complexity and costs. Fewer roof penetrations afford a simpler building design. Less space is required in the boiler room for the heating system. Costs for materials and labor are reduced because there are fewer stacks to install.

New challenges

However, while these new boiler systems offer many advantages, the efficiency at which they operate poses a different challenge.

Chimney systems for traditional commercial boilers are typically double wall UL 103 with 304 or 316 stainless steel inner liners. The flue gas temperature from the boiler is typically 325°-450° because of the underutilized energy.

Since high efficiency boilers reduce the rate at which the raw energy source is utilized, the flue gas temperature is much lower, typically 130°- 230°, than traditional boilers. Consequently, condensation accumulates in the vent system because the flue gas temperature is lower than the water dew point. This condensate is highly corrosive and has a significant impact on the life of the entire boiler system.

To address this problem, chimney manufacturers designed UL-listed, prefabricated chimneys with inner liners constructed of AL 29-2C instead of traditional 300 series stainless steel for corrosion resistance and extension of the appliance's life.

To qualify for a UL 1738 listing, the two metals were subjected to rigorous testing. This nonstop procedure involved exposing the metals to 10,000 cycles of wetting with corrosive condensate solution and subsequent drying. Each cycle consisted of 5 minutes of wetting and 15 minutes of drying. After a 3+ month test period, the 300 series steel failed while the AL29-4C grade showed no signs of corrosion.



Durability is the primary reason an increasing number of building engineers are specifying, prefabricated, UL 1738 listed chimney systems for high efficiency boiler systems. This trend is likely to continue as green building practices become widely accepted.

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