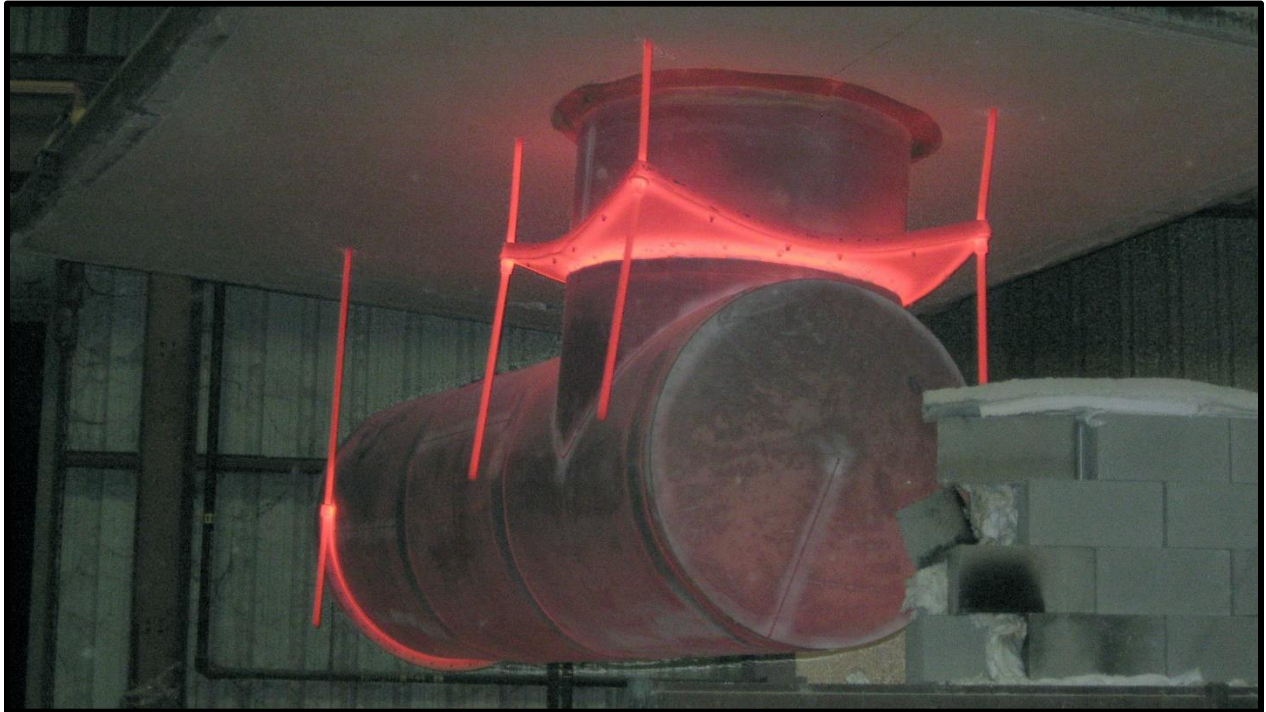


Grease Duct Systems

Important Questions on Fire Safety



Grease duct testing for UL Listing

Why are unlisted, untested, grease duct systems still being installed in multi-story buildings with high occupancy?

Pre-engineered, UL listed and labeled products have been exclusively utilized as chimney systems for decades. These products are utilized to vent exhaust from gas or oil burning boilers, hot water heaters and engine powered generators. Manufacturers of hydronic heating equipment require the use of UL listed products to retain the product warranty and to ensure safe operation.

These products provide cost effective systems that ensure consistent quality, ease of installation and maximum safety due to the extensive testing required to obtain the appropriate UL listing. Site inspection with documentation from the manufacturer, can also allow quick verification of proper application and installation of the venting system.

For grease duct systems, similar factory designed and built products that have a UL 1978 listing and a UL 2221 Classification are code compliant when applied properly. These products are accepted by virtually all local Authority Having Jurisdiction (AHJ). Please note the following video for details on design for code compliancy of prefabricated grease duct systems. (<https://www.youtube.com/watch?v=8AIXBbWZwVA>)

Why are contractors still field fabricating carbon steel ductwork for use as a grease duct system?

The Risk:

Type 1 hoods used in commercial cooking operations produce grease laden vapors. As a result, they must utilize an exhaust duct system that can withstand a potential fire and guarantee the grease vapors have the ability to properly flow through the venting system. Despite improved hoods, filters and variable frequency drive fans, grease vapors still collect in the ductwork creating a potential fire hazard.

Grease is an excellent accelerant to start and fuel a fire. A small spark can initiate a fire inside the duct, with the grease also providing a source to facilitate the growth of the fire, generating extremely high temperatures. Anyone who has cooked on an outdoor grill is able to comprehend how well grease from animal fat or frying oil fuels a fire.

The high temperature generated by a grease fire forces extensive expansion of the exhaust duct system. This expansion places significant stress on the entire system causing any weak points in the system to leak OR even worse, cause a complete system failure. The grease that has accumulated in the duct turns back into a liquid which can leak out through the smallest openings, likely causing an expansion of the fire.

The Vulnerabilities of Grease Ducts:

Duct profile, joints holding sections together, welded seams, supports and hangers can all be potential points of system vulnerability.

Field-fabricated grease ducts are typically constructed of 16-gauge carbon steel, often in a rectangular profile. They are prefabricated in short sections and welded together at the construction site. A rectangular shaped duct has straight sides with sharp corners, and code does not necessarily limit the aspect ratio of a grease duct or limit the overall size. As a result, the duct may have considerably large, flat surfaces that can distort from the heat experienced during a grease duct fire. This distortion may force the duct to collapse and/or drastically stress the supports holding the ductwork in place.

Welding together the sections, whether rectangular or round, at the construction site must later be inspected to ensure there are no defects or pinholes prohibiting a leak-free weldment. A light test, which is accepted by IMC and NFPA, is typically performed on all welds in an attempt to confirm a leak-free duct system. In this process, a light is placed inside the duct while a visual examination of the outside occurs to inspect for light shining through a joint, indicating a hole or gap is present. This simple test is often the only one done to verify weld quality that could be subject to significant stress during a grease duct fire. Other, more stringent testing processes such as dye penetration, x-ray or sample

destructive testing are not feasible to be conducted on a construction site. Field-welded ducts can also be troublesome to test because the weldments can be virtually impossible to inspect based on where they are located and where the duct is mounted in a building.

The support structure of the duct system is also critical for fire safety. If a fire starts inside the duct, the forces generated from thermal expansion must be properly handled by the duct supports and hangers. Since there are no notable codes that provide details on the proper installation of grease duct supports, the system should be designed by a qualified engineer. In most cases, field-fabricated grease duct systems are supported with Unistrut and all-thread rod largely located wherever it is easiest to hang. This is not typically an issue for many venting systems where the temperature of the exhaust is operating at lower temperatures compared to a duct with an active fire containing molten grease as the accelerant. During a fire, this condition could be a catastrophic vulnerability.

Insulation of field-fabricated duct systems is conducted after the carbon steel ductwork is completely installed. Manufacturers of this insulation have gone to great lengths to obtain certifications and listings to allow these wraps to be considered code compliant and fire safe. While the integrity of the insulation to provide a level of fire safety is not in question, the vulnerability is whether the installation of the insulation is done in a manner to maintain the compliance.

Published detailed installation methods and processes are provided by the insulation manufacturers. Tests have been conducted in labs to confirm that if applied properly, the insulation will perform as specified. Since the duct is already assembled and installed, access to critical areas (example - above ceilings, unrated shafts) make it difficult, if not impossible to properly apply the insulation. Inadequate application of the insulation is not an issue during normal cooking operation because the air temperature inside the duct is relatively low, most likely under 400° Fahrenheit. During a grease duct fire, the extremely high temperatures expose any poorly or improperly insulated areas, creating hot spots in the duct and increasing the clearance to combustibles that could start material in close proximity to the duct on fire.

UL tested and listed products have actually been subjected to testing to simulate actual grease duct fires as reflected in the photo on the first page. Leakage tests are also performed by simulating a grease fire inside the duct to ensure the construction and design of the product can maintain integrity at high temperatures. This testing is conducted to not only ensure the ducts structural integrity, but also to guarantee the supports and hangers are able to withstand the thermal expansion. The testing ensures the duct system stays in place and intact during a fire.

Multistory buildings, per code, require grease ducts to have a fire rating which is covered by UL 2221 Classification. The fire rating is very important to ensure the grease duct system does not allow a fire to spread from the kitchen area to the rest of the occupied building. Since the duct must be considered fire-rated, the structural integrity of the duct and proper insulation must be verified to ensure an adequate level of safety for the building occupants. As noted earlier, with no more than simple guidelines from IMC/NFPA and the installation instructions from the insulation manufacturer, the AHJ must inspect and determine that a field constructed duct system is truly fire-rated. This type of inspection is not required on systems comprised of prefabricated UL listed products.



What is the cost implication of utilizing a safe UL listed and labeled product versus a field fabricated duct?

Contractors who deal with both types of systems provide various answers depending on the specific installation. How the system is specified will impact a cost comparison.

Two types of contractors are usually involved in a field-fabricated grease duct system. The duct is typically fabricated and installed by a sheet metal contractor. The insulation for the duct is then provided and installed by an insulating contractor, which is often a significant portion of the total system cost.

When specified as field-fabricated grease duct systems, the sheet metal contractor will quote it as such. The cost for insulating the grease duct typically ends up being combined with the total insulation cost for the entire project, distorting the actual cost of the duct system, especially when asked to back this number out after the original quote.

To fairly evaluate the comparison, a system must be specified and quoted as UL listed and labeled duct. The specification needs to be clear on product design, UL listings, and classification for code compliance. Code compliance can be based on the buildings number of floors, access doors for cleaning locations/spacing and all components that are required to complete the system. This will ensure the quote from the insulator does not include the grease duct on bid day, allowing a second number to be generated later for insulation, thus ensuring a more accurate comparison.

Working with many sheet metal contractors across the country, most would prefer to utilize UL listed grease duct products versus fabricating the ductwork on site. The UL listed product, when specified accurately, allows them to control material cost and reduce installation labor expense along with eliminate fire watch cost that is required on most jobsites for field welding and inspection time. This in turn reduces the total system cost of UL listed products in comparison to field fabricated systems.

Conclusion: Field-fabricated duct systems are accepted by code but are not UL listed. While insulation has been tested and listed with some construction criteria per ASTM standards, what is actually installed is not listed. There is no way to ensure a field-fabricated duct system will be able to contain or stay securely mounted to the building if a grease duct fire occurs. Prefabricated grease duct systems not only ensure the safety and integrity of the installation, it provides a cost-effective alternative with a beneficial return on investment.