

Next-Generation Manufactured Grease Ducts

by Jayendra S. Parikh, P.E.

Conventional commercial grease ducts are typically constructed of carbon steel, fabricated and welded into a rectangular shape. Section 506.3.6 of the 2006 *International Mechanical Code* (IMC) requires an 18-inch clearance separating such ducts from combustibles, and Section 506.3.10 requires the provision of either a ventilated, fire-rated enclosure or a fire-rated insulation wrap system.

This approach may be deemed less than optimal for several reasons. Grease can “hide” in the pores of carbon steel and accumulate in the corners of a rectangular duct despite the most rigorous cleaning regimen. If the duct is to be protected with a ventilated, fire-rated enclosure, the required clearance for the ventilated shaft consumes valuable space and does not lend itself to architectural designs that intentionally leave infrastructure exposed. If a fire-resistant insulation wrap system is to be used instead, a skilled subcontractor must be hired to install the wrap and inspections are often required, adding to labor costs and time for approval process. Further, poor welds can be more difficult to detect, leading to the possibility of grease and duct cleaning liquid leaking unnoticed into the insulation.

Building a Better Mousetrap

Seeing an opportunity to “build a better mousetrap,” duct manufacturers have devised a solution that offers a competitive alternative to conventional welded grease ducts. Gone is the rectangular shape: the new pre-fabricated ducts are cylindrical. Gone is carbon steel construction, replaced by high-density insulation between an inner layer of stainless steel and an outer layer of aluminized or stainless steel, resulting in a smooth duct wall several inches thick. Instead of welds, these modular ducts connect together by means of simple, air-tight coupling systems that do not demand the skills of an experienced tradesperson.

Also worthy of note is that supports and guiding for factory-built ducts can be spaced farther apart than those of conventional grease ducts because the inner duct and joints are the structural load bearing members of the assembly and—unlike conventional ducts—manufactured ducts incorporate expansion joints. Finally, all factory-built grease ducts are certified for conformance with industry safety standards, and thus do not require the detailed inspections necessary for conventional site-welded systems.



Next-generation factory-built commercial grease ducts connect together by means of simple, air-tight coupling systems that do not demand the skills of an experienced tradesperson, and incorporate expansion joints.

Trial by Fire

When the first factory-built commercial grease ducts were introduced in 1982, they were listed by Underwriters Laboratories Inc. (UL) based on a safety certification program that included various structural and thermal performance tests. In 1995, these requirements evolved into UL 1978, *Standard for Grease Ducts*, which evaluates modular grease ducts for safe use at clearances to combustibles less than that required (18 inches) for conventional single-wall, carbon steel grease ducts. UL 1978 does not, however, address evaluation of the fire resistance required for grease ducts in certain applications. Consequently, even though many earlier factory-built systems incorporated significant amounts of insulation, the standard could not be used to evaluate their fire resistance.

Duct manufacturers and fire safety advocates then asked UL to develop a standard for evaluating the ability of factory-built grease duct systems to meet model code requirements for fire-resistance-rated enclosures, including zero clearance to combustibles. The result was UL 2221, *Tests of Fire Resistive Grease Duct Enclosure Assemblies*, first published in 2001. UL 2221 includes tests to evaluate a system’s ability to provide the intended level of fire resistance both under internal fire and external fire conditions. The internal fire test is similar to the abnormal temperature test included in UL 1978, which consists of a severe exposure whereby the system is subjected to an internal flue gas temperature of 2,000°F for 30 minutes, simulating a grease fire in the duct. The external fire tests are intended to simulate

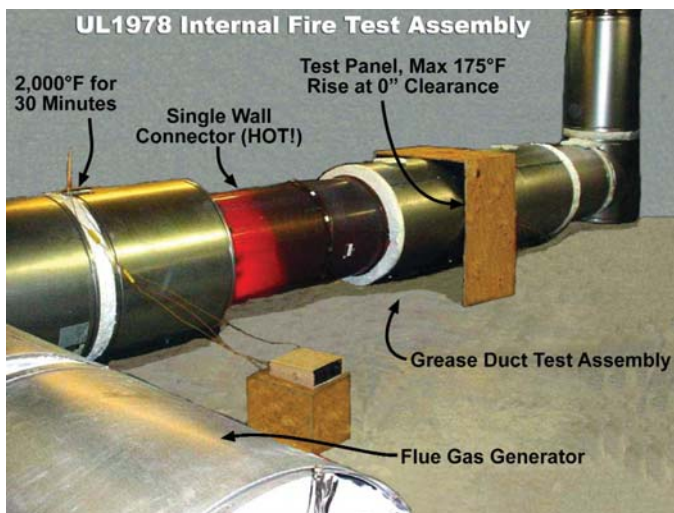
system installation in areas of a building fully engulfed by fire.

Among the main differences between the internal fire test in UL 1978 and UL 2221 are how temperatures on simulated combustibles are measured and the maximum temperature-rise limits. Under UL 1978, a three-sided (top and two sides) plywood framework is installed at intended clearances over and straddling the duct and temperatures are measured on the plywood, with the maximum rise limited to 175°F above ambient temperature. Under UL 2221, the test is conducted with the thermocouples placed on the external surface of the grease duct system and covered with a square pad of insulating material, and the maximum limits are a 250°F average rise and a 325°F maximum rise (single point) above the initial starting temperature. Note that these criteria are the same as those used in ASTM International E119, *Standard Test Methods for Fire Tests of Building Construction and Materials*; International Organization for Standardization (ISO) 834, *Fire-Resistance Tests—Elements of Building Construction*; and other recognized standards associated with fire-resistance testing.

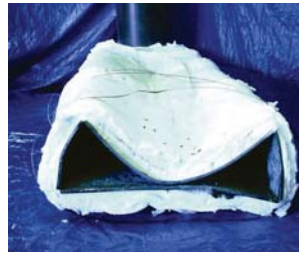
The hourly rating for the fire resistance of a factory-built grease duct system is evaluated and established by fire engulfment and firestop tests, following which the exposed surfaces of the duct and through-penetration system are subjected to a standardized hose stream test in order to evaluate structural integrity and ability to prevent fire spread.

Code Compliance

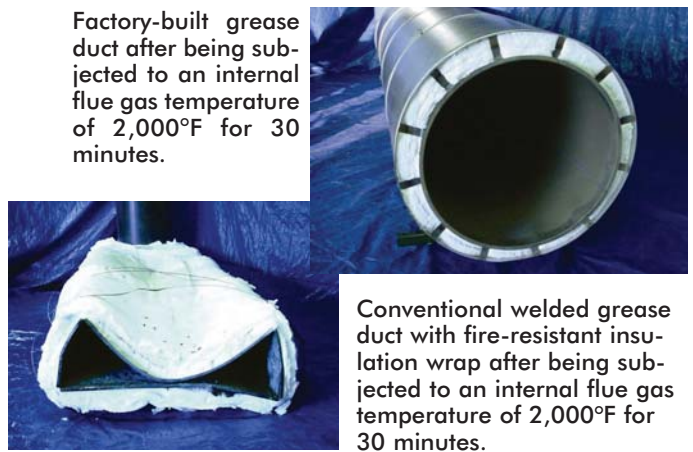
The 2007 *Supplement to the International Codes* includes an exception to IMC Section 506.3.6 that allows the installation of factory-built commercial kitchen grease ducts listed and labeled in accordance with UL 1978 with clearances to combustible materials less than the 18-inch minimum required for welded carbon steel ducts. An exception to Section 506.3.10 of the 2006 IMC allows factory-built grease ducts incorporating an integral fire-resistance enclosure which are listed under UL 2221 to be installed with zero clearance to combustibles.



Factory-built grease duct after being subjected to an internal flue gas temperature of 2,000°F for 30 minutes.



Conventional welded grease duct with fire-resistant insulation wrap after being subjected to an internal flue gas temperature of 2,000°F for 30 minutes.



These code provisions are significant because the latest generation of factory-built grease ducts incorporate higher density insulation, enabling one manufacturer to obtain listing per UL 1978 and classification for 2-hour rating per UL 2221 of a commercial grease duct with 3-inch-thick wall. Several other manufacturers have obtained listings for ducts with 4-inch-thick walls.

Innovation Yields Advantages

The use of less porous stainless steel on inner surfaces and the cylindrical shape make the latest factory-built commercial grease duct systems much easier to clean. Some can even incorporate automatic cleaning with built-in spray nozzles.

When all factors are considered, the new ducts are also more competitive with conventional welded and wrapped duct systems in terms of cost. Although stainless steel remains approximately twice as expensive as carbon steel, this is offset by the elimination of the need for skilled welders and insulation contractors during installation and the likelihood of less extensive safety inspections. It is also worth considering that if a fire occurs involving a conventional insulated carbon steel duct system, the insulation and duct may well need to be removed and replaced. In contrast, factory-built ducts can sustain severe internal fire without damage to the duct or its insulation.

Along with these advantages and better performance due to reduced airflow resistance, the latest zero-clearance fire-rated grease ducts open new possibilities for architects and designers. Their cylindrical shape is inherently more visually appealing and their zero-clearance means that there is more free space to work with, making it easier to employ them as design elements.

Further Considerations

There may still be situations in which conventional welded grease ducts are more appropriate than factory-built ducts. For example, high-performance factory-built grease ducts might be deemed unnecessary for relatively simple low-rise

Manufactured Grease Ducts (continued)

buildings, or a business owner about to break ground on a new building who plans to sell the structure within a few years might be more interested in initial costs than long-term savings. Labor issues could come into play if welders in a jurisdiction become concerned about a possible reduction of work. Also, it will be interesting to see how the insurance industry responds as the track record of factory-built grease ducts grows with respect to performance and experience validates the replacement cost savings, putting building owners in a position to demand lower premiums.

Whatever the interim developments, fire-rated, zero-clearance, manufactured grease ducts are an idea whose time has come—dovetailing with the growing trend toward factory-built components in commercial construction and offering a cost-competitive alternative to conventional welded and wrapped duct systems. ♦

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