

Factory-Built Grease Duct

Architects and engineers have two options for specifying the design and construction of kitchen hood (Type 1) exhaust duct, more commonly known as grease duct, per mechanical code requirements: field fabricated and listed (3rd party safety certified) factory-built, modular duct. The field fabricated grease duct is typically rectangular and made of 16 gauge, welded, carbon steel. The factory-built design is cylindrical and made of 20 gauge stainless steel.

Selkirk was the first to develop factory-built grease duct back in the early 1980's and remains a leading provider of the factory-built design today. They use the same robust design that is used on their commercial boiler flue pipe (aka pressure stack) and generator / engine exhaust systems. Traditional models are as follows;

G (single wall)

PS (double wall air insulated)

IPS-C1, C2, or C4 (double wall, blanket insulated (1", 2", or 4" thick options))



Benefits

The round, stainless steel, factory-built design offers many benefits over traditional field fabricated methods;

1. Modular / no welding required (very advantageous for *renovation*¹ projects and new construction)
2. Far superior structural integrity, especially during grease fires (survives the most severe grease fires, providing great advantage of minimizing business interruption²)
3. No or minimal slope required³
4. Lower airflow resistance
5. Easier to clean
6. Superior corrosion resistance
7. Lighter weight
8. Aesthetic protective metal outer wall
9. Lifetime warranty
10. Factory design / layout assistance
11. Single inspection (field fabricated options usually require multiple)

Notes:

- 1) The modularity feature and no welding benefit make renovation projects much easier versus a field fabricated system where welding equipment must be brought to and used at the jobsite. These modular / no weld systems can be installed in less time and with far less preparation (compared to a site welded system) during time intervals when the business is not operating. For example, major restaurant chains have used the Selkirk grease duct system for renovation projects and installed it in portions, strictly during non-operating hours (overnight) permitting the business to open again for normal business each day during the process. Welded, field fabricated / site built systems of any size would require far more preparation and business interruption.
- 2) Business interruption costs can be extreme; virtually catastrophic in the event of a fire in a grease duct system. With any type of field fabricated system, even if the fire is relatively small and extinguished fairly quickly, the rectangular duct is very likely to distort (sag) locally and require replacement. The business will need to be and remain closed while cutting torches and other equipment are brought in to remove the old system, then welding equipment is brought in to install the new system. In the event fire rated wraps were also in place around the existing duct they require complete replacement with specialized installers. The overall timeframe for rehabilitation can easily be weeks or months.

By contrast when a fire is experienced within a listed, factory-built system it is extremely likely that the grease duct and any integral insulation will, indeed, survive the fire and be entirely suitable for further use. In such case, the only business interruption related to rehabilitating the grease duct would be associated with inspection and replacement of some silicone sealant in any joints where it may have deteriorated. This can all be accomplished in a matter of days as opposed to weeks or months.

- 3) Selkirk grease duct's UL Listing – including installation instructions – confirm that these systems may be installed at less than the typical, code prescribed ¼" per foot slope. UL condoned these statements based upon a variety of technical rationale Selkirk presented including the fact that cylindrical systems permit flow at far lesser slope than rectangular systems. As such, with minimal or no slope a cylindrical system provides "equivalent" draining capability for grease to a similar sized rectangular system at ¼" per foot slope (such is easy to demonstrate using standard hydraulic flow calculation methods). At present (June 2012), the codes do not yet acknowledge this fact and formally permit lesser slopes for listed, round grease ducts. As such, it is recommended to check with the local code authority, who may insist upon more slope as required (and necessary) for rectangular ducts.

Safety Certifications

The factory-built, modular option is safety certified to the rigors of the UL 1978 "Grease Duct" test standard. Thermal and mechanical tests specified in UL1978 include;

1. Temperature Test - 500^oF flue gases: a thermal test that evaluates the system's ability to handle the assumed, worst case, steady state normal operating conditions [500^oF] for which the system is designed, without deteriorating or overheating surrounding combustibles placed at specified minimum airspace clearance to combustibles.
2. Abnormal Fire Test: a continuation of the 500^o Temperature Test whereby, after equilibrium is reached, the flue gases are increased from 500^oF to 2000^oF and held there for 30 minutes, simulating a very long and severe internal grease fire.
 - a. The system must sustain this extreme exposure without rupturing or deforming in any manner by which it would be judged not suitable for further use. The test also confirms safe, reduced clearances to combustibles.
3. Joint Leakage Test: assesses the modular joints of the grease duct and their ability to sustain normal and abnormal conditions without leaking grease by subjecting a representative sample of a modular duct system to a test whereby all internal surfaces are first smeared with a thick layer of grease then directly exposed to a fire while the grease either burns or melts and drains away. As a condition of compliance no leakage of grease, grease vapor or flame may occur through the various joints on the outside of the duct.
4. Various other thermal or mechanical tests including:
 - a. Vertical support – all supports are tested at 4 times the maximum load they will sustain when installed per the instructions.
 - b. Side impact test – heavy (50 lb) sandbag on pendulum (dropping through 18" difference in elevation) impacts system at various locations including joints. System must sustain all impacts without any damage that would cause it to be judged inappropriate for further use.
 - c. Longitudinal force test – 100 lb "Pull" test on various system parts to confirm joints remain secured.
 - d. Load test for grease duct elbows - inclined lengths (between elbows) are tested at 4 times the maximum load they will sustain when installed per the instructions.
 - e. Joint torsion test – simulating cleaning of system to insure joints don't separate.
 - f. Fire and leakage test of grease duct access doors and fittings – representative samples are coated with grease then subjected to fire and heat. Door/fitting must resist effects without allowing propagation of grease or flame through assembly.

In addition to being Listed per the UL1978 Grease Duct standard, Selkirk's Model PS and IPS are also listed to a number of other chimney and venting standards including UL103 (Factory-Built Chimneys), UL2561 (1400^oF Chimneys). Model IPS is listed as a Building Heating Appliance "Type HT" chimney per UL103 making it particularly well suited for commercial cooking operations involving solid fuel applications (like wood fired pizza ovens, smokers and barbeques) where manufacturer's instructions and / or code may require a system that is listed both as a Type HT chimney (with proven capability of withstanding very severe creosote fires) and as a factory-built grease duct for its air and moisture tight joints and (again) ability to withstand a very long and severe grease fire.

Fire Ratings

Although the traditional factory-built grease duct options comply with various severe fire and other tests, they are not fire-rated in terms of being granted an hourly rating. As such when passing through a fire rated floor or wall, they are required by code to be installed within a fire-rated shaft at their respective specified clearances, based upon model and diameter.

In more recent years, in order to eliminate the need for a separate fire-rated shaft and based upon a desire for even further reduced clearances, Selkirk developed model **IPS-Z3** (aka Zero Clear™), with zero clearance to combustibles and

a 2 hour F&T rating (using Selkirk's certified TPF fire stop). This was all accomplished per the stringent UL 2221 (the test standard by which fire ratings for factory-built grease ducts are determined) and UL 1978 standards.

UL2221 "Tests of Fire Resistive Grease Duct Enclosure Assemblies" incorporates a variety of tests.

These include:

1. Internal Fire tests - similar 500°F and Abnormal Temperature [2000⁰] tests (from UL1978) – with the exception that outer wall temperatures are monitored by placing the thermocouples (temperature sensing devices) directly on the outer wall of the duct and beneath an insulating pad – simulating direct / zero clearance to combustibles.
2. External (Fire Engulfment) Test – whereby a worst case, representative system is suspended within a UL263 / ASTM E119 type "Floor Furnace" and subjected to full fire engulfment as the furnace is controlled to operate following a standardized time – temperature curve for the entire duration of the test. The test assembly also incorporates a simulated floor / ceiling penetration through which the grease duct system's "Through Penetration Firestop" assembly is evaluated in accordance with the UL1479 / ASTM E814 standard for evaluating fire stop penetration systems.

At the completion of the fire exposure, a standardized UL263 / ASTM E119 "Hose Stream" test is conducted on the grease duct and the through penetration fire stop system to insure adequate structural integrity of the system has been maintained.

During and after the respective exposures, the grease duct and through penetration fire stop must remain intact in that it cannot fall from the supporting construction nor may it collapse or deteriorate in any manner that would permit heat or flames to escape from the assemble. The fire stop assembly must also prevent flames from penetrating to the outside (unexposed side of the test assembly) and prevent any excessive heat from being conducted through the system to the unexposed side of the test assembly.

Based upon successful testing per UL2221, the Selkirk ZeroClear™ (ZC) grease duct's combination of 3" high density ceramic insulation and a 24 gauge metal outer wall around the inner duct are certified to provide an "integral", fire rated shaft. No separate field constructed, fire-rated, space consuming shaft or field applied, fire-rated wrap is required. This provides the architect with the option to show the cylindrical industrial look of the duct or create an aesthetic wall to their liking.

An additional advantage to note is that all Selkirk factory-built grease duct models are interchangeable, so if a building doesn't need the fire rated duct in certain areas, one of Selkirk's more economical models may be selected, all the while reaping the numerous benefits of the factory-built design.

Code Compliance

Selkirk Models G, PS, IPS and ZC grease ducts comply with all major mechanical codes including the International Mechanical Code (IMC), the Uniform Mechanical Code (UMC), the California Mechanical Code (CMC) and NFPA96 (Standard for Ventilation Control and Fire Protection of Commercial Cooking Operations). Additional approvals have been gained in many urban areas and municipalities who have their own mechanical codes.

UL1978 Listed grease ducts have been acknowledged as acceptable alternatives to field fabricated grease ducts since the mid 1990's in the various codes.

UL2221 Classified, fire resistance rated grease ducts are acknowledged as acceptable alternatives to field fabricated grease ducts with separate fire rated enclosures or field applied enclosures systems (like wraps) in the 2006 [and all more recent editions of the] IMC and UMC, the 2007 [and all more recent editions of the] CMC and the 2004 [and all more recent editions of] NFPA96.

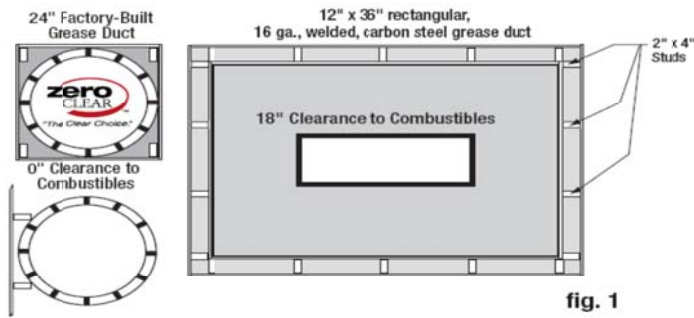
Summary

Including a listed, factory-built grease duct system with your kitchen hood exhaust system is the safest and most cost effective option for many reasons. The kitchen hood and exhaust fan are 3rd party safety certified (typically UL listed), so why not use a UL listed exhaust duct and reap the safety benefits that UL listed products have offered for 100 years?

Factory-built grease ducts are the next generation of grease duct design and construction. There are now multiple manufacturers that have followed Selkirk's lead into the modular grease duct market. While awareness and specification of the superior, factory-built option was slow initially, engineering specifications are now making the transition to modular factory-built grease ducts. Among the thousands of facilities where factory-built grease ducts have been included are: university campuses, hotels, casinos, small and large restaurants, airports, military bases, and food processing factories.

So, which should you choose to provide the short and long term benefits to a building owner and their occupants?

Grease Duct "Footprint" – 24" I.D. ZeroClear™ vs. 12"x36" Fabricated Welded Steel



Comparison of wrapped, welded steel and ZeroClear™ after 2000°F (simulated grease fire) for 30 minutes.



ZeroClear™ after 2000°F (simulated grease fire) for 30 minutes.

12" x 36" rectangular, 16 Ga., welded, carbon steel duct with generic "wrap" insulation – after 2000°F (simulated grease fire) for 30 minutes.

