



# Risk Alert – Hydraulic Fluids



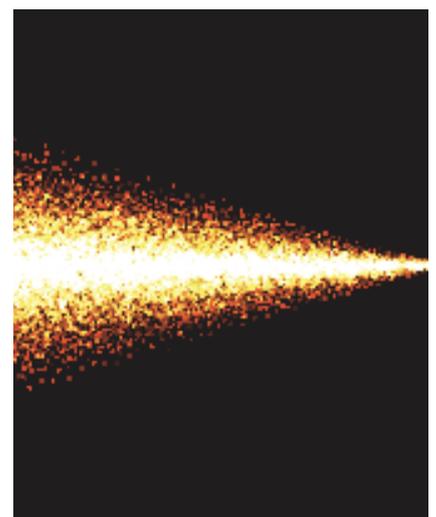
Hydraulic fluids are used to power and control equipment and machinery components such as injection molding machines, extruders, rolling mills, presses, shears, and tilting mechanisms, among others. The most commonly used hydraulic fluids are petroleum-based oils. These fluids are widely available and highly effective for mechanical power transmission, in addition to being non-corrosive and having good lubricating properties. Despite the relatively high flash point, usually above 300° F (150° C), petroleum based hydraulic fluids are susceptible to combustion, and have been the cause of many large fires resulting in significant damage to building and equipment, in addition to extended interruption of operations.

## Hazards associated with hydraulic fluids

Because it is under high pressure, the oil used in hydraulic systems, when released into the atmosphere, undergoes immediate atomization. The spray, or the mist of oil droplets, can be easily ignited when in contact with hot surfaces, open flames or welding arcs. The resulting torch-like fire has a high rate of heat release and, depending on the pressure and flow rate of the oil, it can reach distances of up to 50ft (15m) from the point of release. These types of fires can only be extinguished by shutting off the flow of hydraulic fluid.

## Passive and active protection

Hydraulic equipment should be properly designed and installed to minimize the possibility of having a release of combustible hydraulic fluid or, in the event of oil release, to allow for prompt equipment shutdown. Appropriate fire protection measures should also be considered, especially if there is combustible construction and/or combustible occupancy in areas adjacent to hydraulically operated equipment. If possible, the option of using less-flammable fluids should be considered (see discussion of less-flammable fluids below).



Although petroleum-based hydraulic fluids have a relatively high flash point, they atomize when released under pressure into the air. This means they easily ignite when in contact with a heat source. The illustration above depicts the typical flame profile of a hydraulic oil release that has been ignited.

In order to reduce the exposures associated with the use of petroleum-based hydraulic fluids, the following measures should be considered:

- Study the feasibility of using less flammable hydraulic fluids, such as emulsions of oil-in-water and water-in-oil, water-glycol solutions or synthetic fluids (see details below).
- Install hydraulically operated equipment in isolated areas to contain the release of hydraulic oil, which may ignite and cause a fire that is difficult to control. Storage areas are of particular concern. Compartmentation should be provided using fire doors, ceilings, and walls with a minimum fire rating of one hour.
- For equipment that uses centralized hydraulic oil pumping systems:
  - The pumping systems, the oil room or cellar should be segregated from other areas, including the area where hydraulically controlled equipment is installed. Separation should be provided by fire doors, ceilings, and walls with a minimum fire resistance of one hour.
  - In order to ensure/increase the tightness of hydraulic systems, the use of threaded parts and pipes should be avoided. If threaded parts are used, they should be sealed with welding. Only metal pipes should be used.
  - Where flexible parts are required, use reinforced rubber hoses or hoses covered in metal mesh.
- For systems containing 100 gal (380 liters) or more of hydraulic oil:
  - Provide interlocking mechanisms capable of shutting down hydraulically operated equipment whenever hydraulic oil level and/or pressure is reduced below the minimum limits required by the manufacturer for normal operation.
  - Automatic shutdown of hydraulically operated equipment can also be achieved by means of interlocks with the operation of sprinkler systems, or with the actuation of optical or heat detectors installed in the area.
  - Install pushbuttons for operators to manually shutdown hydraulic systems in an emergency involving the release of pressurized hydraulic oil. In order to allow for quick and safe operator access, pushbuttons should be remotely located from hydraulic equipment.
- Fire Protection:
  - Install automatic sprinkler protection above, and up to 50ft (15m) beyond, hydraulically actuated equipment. System design and installation should be done by a certified fire protection contractor in accordance with the requirements of NFPA 13 (Standard for the Installation of Sprinkler Systems).
  - Provide adequate manual fire protection through hose connections and fire extinguishers as required by the authority having jurisdiction.



Hydraulic systems should use metal piping, preferably without threaded connections. Flexible parts should be reinforced.

## Prevention and emergency response

- Good housekeeping conditions should be maintained in areas where hydraulic equipment is installed. Attention should be given to the accumulation of combustible material and/or storage around hydraulically operated machinery.
- Follow maintenance and testing guidelines as recommended by the original equipment manufacturer. This should include devices such as low oil level and low oil pressure sensors, auto shut-off interlock systems, manual shutdown pushbuttons.
- Implement a periodic routine of inspections to check the operating conditions of hydraulic systems. Special attention should be given to hoses and fittings. Any signs of wear or leakage should be corrected immediately.
- Maintain tight control over potential ignition sources. Any hot work must be authorized and monitored through an appropriate hot work permit procedure.
- The emergency response plan should include case-specific procedures for situations involving pressurized hydraulic fluid release. The procedures should, as a minimum, address the following points:
  - Immediate notification of the fire department
  - Activation of the facility's emergency procedures
  - Manual shutdown of hydraulically operated equipment involved in the emergency
  - Early identification of firefighting methods considering available equipment and building layout
  - Annual drills

## Less flammable hydraulic fluids

In addition to combustible petroleum-based hydraulic fluids, the industry has developed a series of fluids that are less flammable or fire-resistant. This category includes the following products (ISO 6743-4 classification standard):

- Oil-in-water emulsion (HF-A) – contains at least 90% water.
- Water-in-oil emulsion (HF-B) – contains 40% water and 60% mineral oil. This has superior lubricating and anti-corrosive properties than oil-in-water emulsions due to the higher content of oil in the mixture. It is also known as inverted emulsion.
- Water-glycol solutions (HF-C) – a mix of 60% glycol and 40% water.
- Synthetic fluids (HF-D) – made of phosphate esters, chlorinated hydrocarbons or a mix of both with a percentage of petroleum-based oil. Equipment that uses synthetic hydraulic fluid must have seals, joints and hoses made from special material, as these fluids are very corrosive. These fluids can also attack paint, coatings and electrical insulation.

If you would like to find out more about this or other technical issues associated with loss prevention and control, contact our **Risk Engineering Services** team.



Equipment containing combustible hydraulic fluids should be properly maintained to reduce the possibility of having a pressurized oil release. In addition, housekeeping conditions should be closely monitored to avoid the build-up of combustible materials near areas where hydraulically operated equipment is installed. This will help prevent conditions conducive to the rapid spread of fire if hydraulic fluid is released and ignited.

### Technical references:

1. NFPA Handbook, Chapter 11 – Fluid Power Systems
2. FM Data Sheet 7-98 – Hydraulic Fluids
3. NFPA 13 – Standard for the Installation of Sprinkler Systems
4. ISO 6743-4:2015 – Lubricants, industrial oils and related products – Classification – Part 4

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