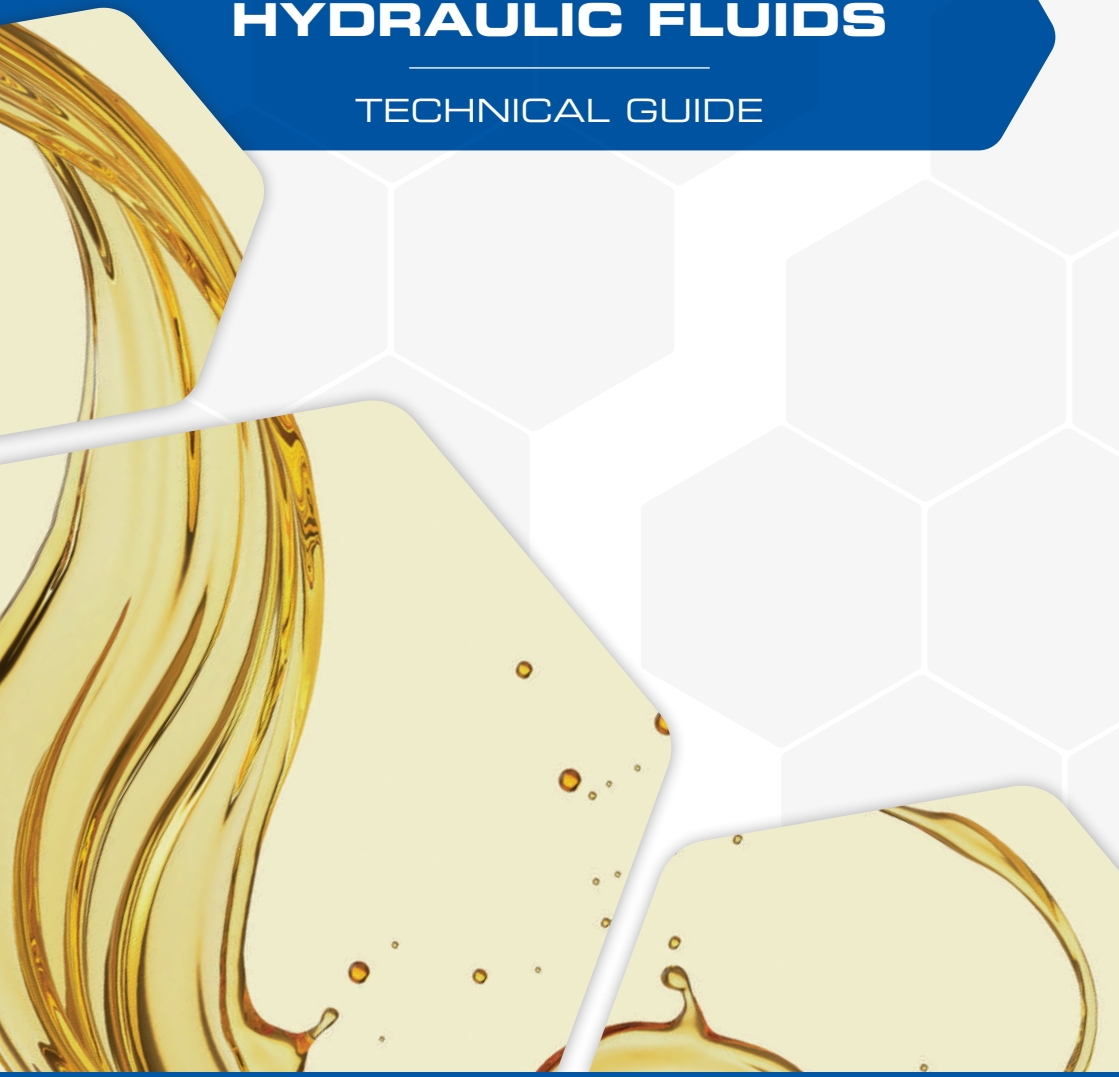
CONDAT

FIRE RESISTANT HYDRAULIC FLUIDS

TECHNICAL GUIDE



Thank you for downloading our Fire Resistant Hydraulic Fluid technical guide.

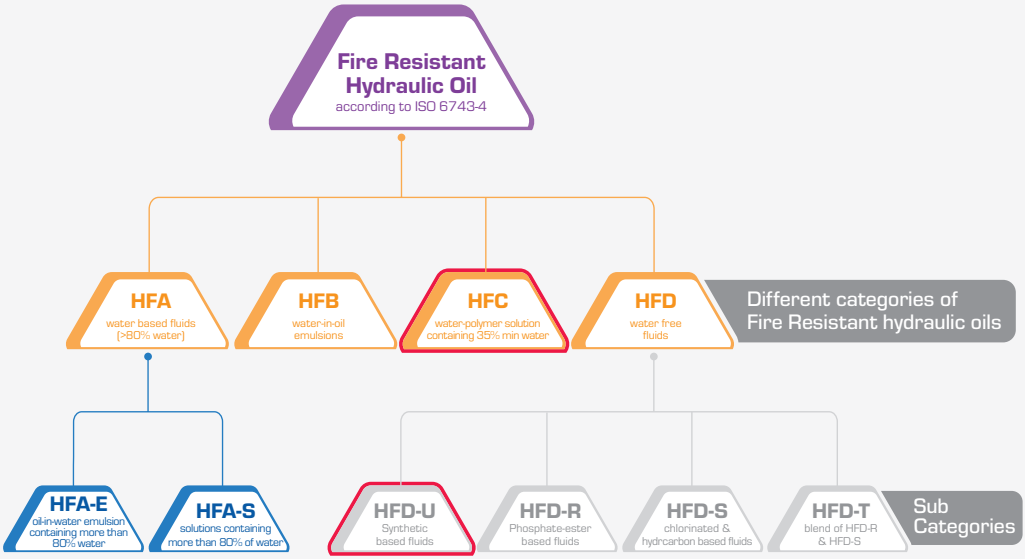
This guide will detail each type of fire-resistant fluids. A description of the formulation, the characteristics and the technical performances of the fluid will be presented. Some advice will be given on the best practices when converting from a competitor fluid to a CONDAT one.
For HFDU fluid, this technical document will give you some guidelines on the monitoring of the product in use and the parameters to control on a regular basis.
At the end of this technical guide, you will find some general information about the safety, the storage of the products and the disposal of the used fluids.
You will also find a quick presentation of Condat, its background and philosophy.

The purpose of this document is to give you some general information about fire resistant fluids, mainly about CONDAT range of products. Should you have any question or need any technical support for an analysis interpretation, for a product conversion or for another topic, please do not hesitate to contact your CONDAT sales representative.

Summary

TECHNICAL GUIDE

On this technical guide, you will find information on HFC and HFDU fluids, which are the two main technologies of fire-resistant hydraulic oils used within this family:

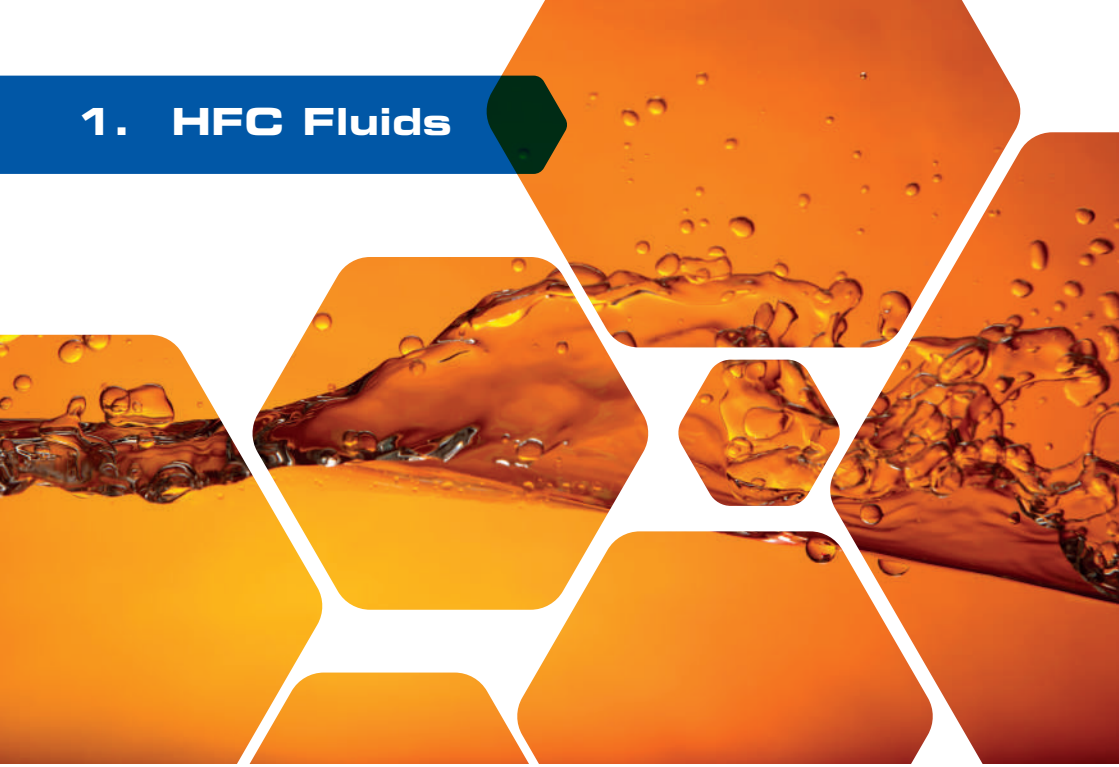


Fluids based on phosphoric ester or chlorinated hydrocarbons (HFD-R or HFD-S), or from a mixture of these two products (HFD-T) present risks for the health of your employees or for the environment.

CONDAT has been committed to a CSR approach for many years and has chosen to work only with fluids without major impact on health and the environment such as HFC and HFDU.

HFA products are also available in the range but are not part of this study because of their specificities of use, manufacturing and follow-up.

1. HFC Fluids



1.1. Definition and properties

According to ISO 6743 Part 4, HFC-grade low-flammability oils are aqueous solutions of polymers (mostly glycol and polyglycol diluted in water).
Excellent fire resistance properties are guaranteed by their highwater content: to be qualified as HFC according to ISO 12922, these hydraulic fluids must contain a minimum of 35% water (by weight).
Because of this water content, all fire-resistant water-containing hydraulic fluids do not have a flash point or fire point.

HFCs are therefore highly resistant to ignition and are designed for all installations where there is a high risk of fire: coke oven die casting machines, mines, iron and steel industries, foundries...

CONDAT has developed and optimized over the years a HFC formulation: **CONDAT GUARD C46**, which complies with ISO 6743-4 and ISO 12922 standards.

1.2. Physical and chemical properties

The density of HFCs is generally slightly higher than 1. As the product is often clear or colorless, a colorant is added to the formula to easily identify the fluid which is useful in case of leakages or spillages.

► **CONDAT GUARD C46** is formulated with a fluorescent green pigment.

Advantages:

- High viscosity index, meaning that the viscosity of the fluid does not change much with temperature variations
- Excellent behavior at low temperature and low pressure
- Good heat transfer properties
- Very good filterability
- No flash point or fire point if the water content is in conformity, meaning no risk of fire
- Non-toxic in a normal use
- Biodegradable

Disadvantages vs HFDU technology:

- Medium lubricity
  (this characteristic can be improved by using additives)
- Medium thermal stability due to the presence of water, meaning that product is ageing quickly
- Dissolving action on paints and coatings
- Corrosive action on metals (additives)
- Conversion from a mineral oil to an HFC more delicate than to an HFDU
- More sensitive to particles pollution
- Specific equipment & maintenance due to the corrosion risk
- Poor air release, requiring the use of very large tank with separation devices

Specific additives may be proposed by the fluid supplier to minimize these disadvantages. This will need to be checked with your oil supplier. However, the use of these additives can significantly increase the total cost of the fluid.
Those additives are used to improve the following characteristics: anti-wear, anti-rust, de-aeration and anti-foam properties, filterability and fire resistance.

► **CONDAT GUARD C46** is specifically formulated to ensure an excellent fire protection, to extend your hydraulic component service life, to protect the operators and the environment (biodegradable product).

Use of HFCs:

When HFC is the selected option, the addition or blend with different type of products is strongly discouraged, as this can rapidly altered the overall characteristics of the fluid.
The temperature of use of the HFC are normally in the range from -20 to +60°C (-4 to 140°F) for this type of product.
The optimum use temperature is around 40 to 55 °C (104 to 131°F) in the tank.
For a use temperature higher than 55°C (131°F), we do recommend the use of HFDU fluids.

Caution:

- Due to the significant water content, it is not recommended to use this type of product in applications where tank temperatures are high: this would promote water evaporation, leading to high consumption.
- In case of hose breakage, the fluid may splash the molten metal creating dangerous projections.
- In high pressure circuits, working at higher temperatures is possible. However, in case of break or leakage, the water will vaporize almost instantaneously and the product will lose its fire resistance property even if the created mist of vapor is favorable to the extinction of the flames.

1.3. Hydraulic system compatibility

1.3.1. Restriction of Use and Compatibility with Hydraulic Systems

HFCs are generally not recommended in systems with:

- components under heavy loads (bearings, valves, distributors...)
- axial piston pumps

Because of the low lubricity properties of the water containing fluids in case of high loads and shocks.

Nor in systems:

- with pump which are only partially filled with fluid
- If the pressure exceeds 1000 psi (68.9 bar) with bearings.

Because this will create a loss of water and pump cavitation (pitting corrosion).

1.3.2. Compatibility with seals

HFCs are generally compatible with the following elastomers:

- NBR: NITRILE seals
- FPM: VITON or TEFLON seals
- EPDM: Ethylene Propylene Diene

However, it should be ensured that the proposed product has no effect on the installation gaskets by contacting CONDAT or the seals supplier.

HFCs are incompatible with:

- polyurethane (AU/EU) materials which can, according to their qualities, be sensitive to humidity or water
- FKM elastomers
- seals or elements made of paper, cardboard, leather or any other material which dissolves in water

1.3.3. Compatibility with coatings and paints on the inside of the tank

Glycols are aggressive towards paints or coatings like single component lacquer (for example zinc dust paint). In this case, you will need to either remove the paint (blasting), change the tank or use another compatible fluid (HFDU).
Therefore, the use of stainless-steel tanks is highly recommended.

If the paint type is not known, it will be necessary to contact:

- the manufacturer to check the quality and type of the coating
- CONDAT to perform some tests to check **CONDAT GUARD C46** compatibility with this specific coating.

1.3.4. Compatibility with other materials

Water-containing fluids are generally aggressive to metallic materials due to corrosion phenomena. It is therefore necessary to check with CONDAT the anti-corrosion properties of the fluid based on the standards ISO 7120 and ISO 4404:

- Cadmium and magnesium alloys are not compatible.
- Tin, zinc and zinc coatings (eg Zn die-cast housings for filters, or galvanized pipes, etc.) should be avoided. When in contact with glycols, they may produce tin & zinc soaps which can block filters, solenoids etc.
- Aluminum alloys are unstable in all cases. In the presence of steel, galvanic corrosion occurs (electrochemical reaction) capable of causing significant aluminum removal.
- Aluminum forging alloys provide improved stability.
- Residual amounts of HLP mineral oils containing zinc and oils used for corrosion protection must be avoided.

1.4. Maintenance and monitoring of HFCs in service

The main characteristic to be monitored is the ignition resistance. This characteristic is the purpose of these fluids and must guide your decisions for the maintenance of the fluid in service.

Furthermore, the water content of the fluid should be monitored regularly because the high temperature conditions can cause some evaporation: the ignition resistance is directly related to this characteristic.

An annual analysis may be appropriate in normal use to monitor the following characteristics:

- viscosity at 40°C
- reserve of alkalinity
- pH
- water content in %
- optical filter examination
- gravimetry (pollution control) in mg / L
- aqueous spectrometry
  (wear control by measuring the wear elements or wear particles) in ppm

For each product, there is a critical threshold for the water content below which you should not operate. In case of excessive evaporation, the product viscosity significantly increases and causes cavitation phenomena in the pumps.

Water should not be added alone: if a top-up is needed, CONDAT advise to add fresh CONDAT GUARD C46 to refill the system with additives and fresh product. Using only water will lead to the hydraulic system dilution and performance losses.

Finally, the other characteristics (anti-wear, anti-corrosion, filterability ...) should be checked so that they have not been altered: in some cases, new product or a drain can be recommended.

1.5. Conversion of HFC fluids

Important:

The implementation of a conversion is a specific step: we strongly advise to consult CONDAT sales representative to avoid any inconvenience.

Indeed, with years of fluids & installations experience, CONDAT will provide you with guidance on the most suitable method to get the best results from the first operation based on your installation.

A «preliminary study» is recommended for equipment difficult to lubricate (pallet pumps, needle bearings, etc.).

1.5.1. Conversion from mineral oil or HFDU to HFC fluid

When converting mineral oil or HFDU to an HFC fluid, the design of each circuit element must be checked so that it is compatible with the use and characteristics of a HFC aqueous fluid.
It will be necessary to check the characteristics of the various components of the system with the manufacturer to confirm their suitability with aqueous fluids, especially regarding pumps, filters, reservoir, coatings, elastomers and seals, piping...
If not compatible, these items must be replaced.
Then a complete drain and one or several rinses must be carried out according to the best practices guidance to eliminate any residual trace of oil and any deposit. The residual oil limit value allowed in an HFC product is 0.1%. When this value is too high, there is a risk of filter clogging.
At the end of this step, the filters must be changed. A final oil analysis should confirm the characteristics of the new product.

Note: HFC oils have a strong detergent power that can act on previously formed deposits. Clogging of filters should be monitored for several days.

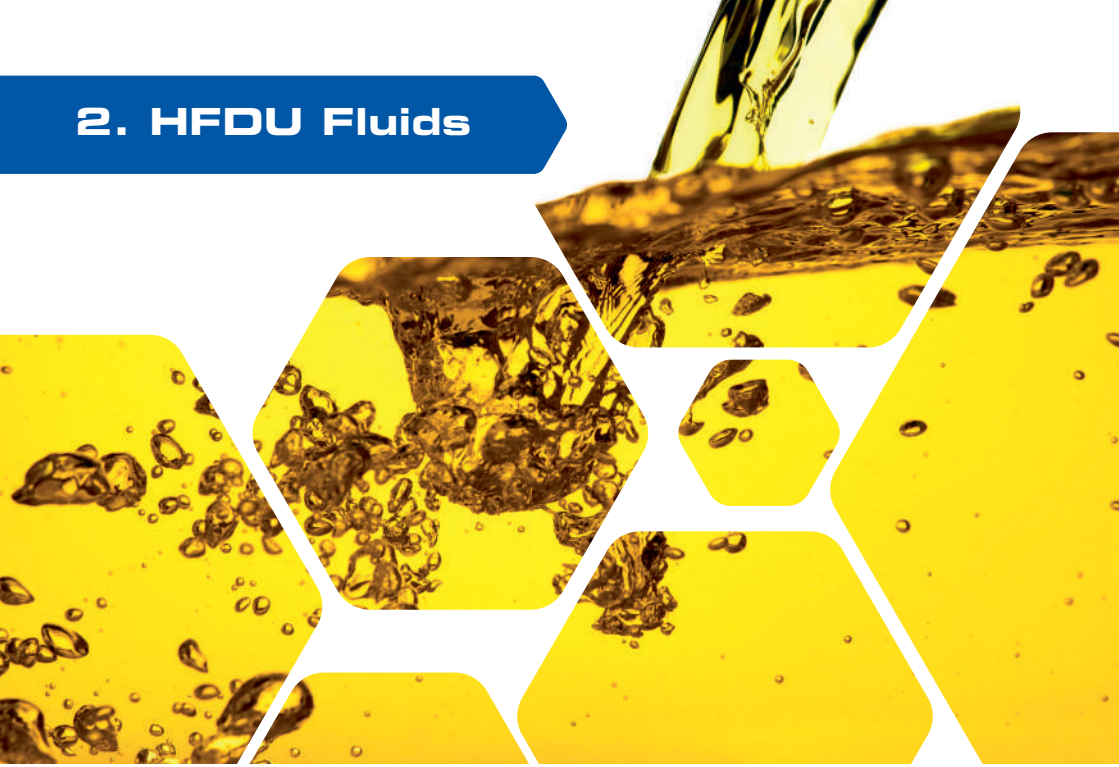
1.5.2. Conversion from HFC fluid to another HFC fluid

In the case of conversion of an HFC fluid to another HFC fluid, the installation design is already ok.
It will only be necessary to check the compatibility of the two fluids which can be done by CONDAT laboratory.
Analysis before conversion will enable to check all the characteristics of the fluid in place and its compatibility with the new product. In case of a perfect compatibility, you can proceed by successive top-ups during a period.
Otherwise, you can adjust the cleaning or rinsing of the hydraulic system according to the situation.
The filters must be changed before final filling and in case of rinsing.

A post-conversion analysis will:

- check that the characteristics of the product in place comply with the reference product.
- correct the characteristics by partial oil top-up.

2. HFDU Fluids



2.1. Definition and properties

According to ISO 6743 Part 4, HFDU-class fire resistant fluids are anhydrous synthesis fluids other than phosphate esters (HFDR type).

Their excellent fire resistance characteristics are due to their chemical composition and to a flash point value (Cleveland Open Cup test) much higher than mineral oils.

One of the main and interesting characteristic for the use of **CONDAT D** products (but not all the HFDUs) is their **self-extinguishing property**: the products do not maintain the flame when the heat source is removed.

The self-ignition temperature of HFDUs is generally above 400°C (750°F).

For this reason, HFDUs are widely used to replace mineral oils in all industries where there is a source of heat or ignition such as iron and steel industries, metallurgy, aluminum industry, die-casting machines, foundry, incineration plants, woodworking, paper and cardboard (compactors), etc.

These fluids are suitable for both old & new generation hydraulic systems.

CONDAT has developed a complete range of HFDU fluids to meet your technical requirements in terms of fire-resistant hydraulic fluids: **CONDAT D & CONDAT D600 series.**

2.2. Physical and chemical properties

HFDU has a density close to 0,9 and is not miscible with water. In case of introduction in the system, the water will lay at the bottom of the tank.

Due to the large number of synthetic esters available on the market, there can be a great disparity in the characteristics of HFDU fluids in terms of fire resistance, operating lifetime (oxidation resistance), lubricity performances, anti-wear properties, toxicity (especially in case of contact with the skin), etc....

Organic esters offer the best compatibility characteristics with a wide variety of materials and excellent biodegradability characteristics. Therefore, Condat has chosen these raw materials to formulate its **CONDAT D range**.

Advantages:

- Easy installation: same requirements than hydraulic systems using mineral oils
- Excellent lubricity and better protection of the material: pumps, bearings, ...
- Easy maintenance of facilities (identical to mineral hydraulic oil)
- Good thermal stability and resistance to high temperatures (compared to HFCs)
- Generally high viscosity index (may depend on the reference)
- Very good high-pressure behavior
- Foaming resistance and air release property
- High ignition resistance
- Biodegradable
- Non-toxic in normal use

Disadvantages:

- Sensitive to excessive water content
- Dissolving action on paints and coatings
- More rigorous fluid monitoring (a minimum of one or two analysis/year)

CONDAT D fire resistant fluid range is formulated to meet the most recent market expectations. **CONDAT D fluids prevent fire propagation and are self-extinguishing.** Compared to a standard mineral oil, they significantly reduce the fire risk & potential damages when a pipe breaks or when oil is sprayed out due to leaks near a flame.

Advantages of the CONDAT D range:

1 - Fire resistance and auto-extinguishing properties

► **For people and equipment safety.**

This property is independently evaluated by:

- "Factory Mutual Global", an US based Insurance company that sets standards and certifies products regarding fire resistance.
- "Mines, Safety and Health Administration", a U.S. governmental agency working to prevent death, illness and injury from mining and to promote safe and healthfull workplaces for U.S. miners. It also has its own set of tests and evaluates the fire resistance of hydraulic oils use in the mining industry.

2 - Lubrication properties

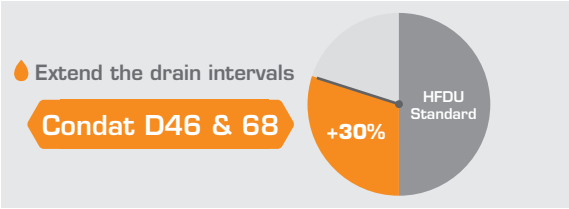
► To increase the longevity of your equipment.

The high level of additives and the choice of high-quality raw materials give our lubricants very high anti-wear and extreme pressure performances. These ensure long service life and equipment protection.

3 - Oxidation resistance

► To reduce your maintenance costs.

Keeping the product longer in the installation means that you reduce your consumption and maintenance downtime. *When using CONDAT D46 or D68, you can extend your drain intervals by 30%.*



4 - Biodegradability and non-toxicity

► To offer a safe workplace and protect the environment.

CONDAT D & D600 ranges are classified biodegradable according to OECD 301B standard and non-toxic according to OECD 201, 202 & 203 (algae, daphnia, fish)

2.3. Use of HDFU fluids

HFDU products can be mixed with mineral oils but it will reduce the fire resistance, the main characteristic for which you have chosen this type of product (you will also loose the Factory Mutual homologation).
The main altered property being the resistance to ignition, a partial or total drain must then be recommended to keep this characteristic to an acceptable value. Analysis should monitor this value after the top-up or addition.
The optimum range of working temperature for HFDUs is generally between 40 and 50°C (104-122°F) with short acceptable peaks at 100°C (212°F).
Additives are often use to maintain and reinforce the following characteristics: anti-wear, anti-rust, de-aeration and anti-foam, filterability and fire resistance.

2.4. Hydraulic system compatibility

2.4.1. Restriction of use and compatibility with hydraulic systems

HFDUs have the main advantage of being usable in all hydraulic systems using mineral oils of equal viscosity without requiring any modification of the mechanical system.
Conversion is thus facilitated from a mechanical point of view, as changes in pumps, filters or materials are not necessary.
There is no need to purchase new equipment or to set up and modify existing equipment.
The installation of the fluid is quick and easy.
Therefore, the switch from mineral to HFDU fluids can be done at minimal cost.

2.4.2. Compatibility with seals

HFDUs are compatible with the following elastomers:

- NBR1 and 2 and HNBR: NITRILE seals standard reference ISO 6072
- FPM: VITON or TEFLON seals

HFDUs are not fully compatible with EPDM seals: Ethylene Propylene Diene
HFDUs are incompatible with BUTYL seals.
However, it should be ensured that the proposed product has no effect on the seals of the installation by contacting CONDAT or the seals supplier.
CONDAT can perform some compatibility analysis in its laboratory to confirm the compatibility between **CONDAT D & D600** series with some normalized tests.

2.4.3. Compatibility with coatings and paints

Due to their high solvency power, HFDUs may have adverse effects on some paints or coatings : it will be necessary to contact:

- the manufacturer to check the quality and type of the coating
- CONDAT to check compatibility with this coating

HFDUs are not compatible with zinc-based paints but have no effect on multi-component paints (epoxy).

2.4.4. Compatibility with the other materials

HFDU fluids are perfectly compatible with steel and its alloys and most ferrous and non-ferrous metals and their alloys.
They are not compatible with lead, cadmium, zinc and alloys containing a high concentration of these metals.

2.5. Maintenance and monitoring of HFDUs in service

The monitoring of the installations and the fluid in use is the same as for mineral hydraulic oil except for the characteristics of ignition resistance. This parameter is the “raison d’être” of an HFDU product and this must guide your choices for the maintenance of the fluid in service. It will be necessary to carry out regular analysis and to follow the evolution of the characteristics to guide your maintenance operations.

One to two analysis per year are recommended in normal use to monitor the following points:

- Flash point (Cleveland Open Cup test)
- Viscosity at 40 and 100°C (104 & 122°F)
- Viscosity index
- Oxidation by the measurement of the acid number (TAN)
- Water content in ppm (Karl Fisher)
- Gravimetry (pollution control) in mg/l
- Spectrometry (wear control) in ppm

It is important to avoid water introduction into the circuit as this can alter the characteristics of the HFDU oil: water will react with the ester, start and accelerate oxidation mechanisms resulting in shortened service time. Drying filters can be used to correct this phenomenon.
Furthermore, the introduction of mineral oil is strongly discouraged because it lowers the characteristics of ignition resistance (and it is a breach in the Factory Mutual homologation)

The two main factors of alteration of the product are:

- Temperature, if excessive
- Pollution

CONDAT D & D600 series have an excellent service life and regular supplements (top-ups) keep the characteristics of the fluid at a good level without total draining. From a maintenance point of view, it will simply be necessary to ensure the change and the regular inspection of the filters and in particular the breather filters.
Tank temperature should ideally be kept at a temperature below 60°C (140°F): this is the best way to increase the life of all oils in general, particularly HFDUs and **CONDAT D & D600 series**.
If temperature is above 60°C (140°F), after feedback from fluid analysis and Condat support team, the installation of a cooling system may be recommended.

2.6. Conversion of HFDU fluid

Important:

The implementation of a conversion is a sensitive step: it is strongly advised to consult CONDAT to avoid any inconvenience.

CONDAT will offer its fluids and installations experience to guide you and to provide the most suitable method for your installation to obtain the best results from the first operation.

2.6.1. Conversion from mineral oil to HFDU fluid

As mentioned above, HFDU fluids have the main advantage of being usable in all hydraulic systems using mineral oils of equal viscosity without any modification of the system design. It will simply be necessary to check the compatibilities with the different materials in presence (coating, seals, ...)

In general, a small residual quantity of mineral oil does not modify the functioning performance of the circuit. On the other hand, **it lowers the flash point value and therefore the fire resistance characteristics.** In this case, the important thing is to remove as much mineral oil as possible to obtain, at the first shot, an ignition resistance value close to that of the new product.

Filters should be changed. A final oil analysis should confirm the characteristics of the new product.

Note: HFDU oils have a strong detergent power that can act on previously formed deposits. Clogging of filters should be monitored for several days. This is normal as the fluid cleans the system.

An analysis of the fluid in place before conversion will give the option to adapt the cleaning or the rinsing procedure of the hydraulic installation according to the situation.

The filters must be changed before final filling and in case of rinsing.
An analysis after conversion will:

- confirm that the characteristics of the product in place comply with the reference product
- correct the characteristics by partial drainage and back-up.

2.6.2. Conversion from HFC fluid to HFDU fluid

When converting an HFC fluid to an HFDU fluid, it will be necessary to check that the design of each element of the circuit is compatible with the characteristics of the HFDU fluid. It is necessary to get from the manufacturer the technical information of the various components of the system (pumps, filters, tank, coatings, elastomers and seals, piping ...) to confirm their use with waterless synthetic fluids. Otherwise, these items must be replaced.
Then a complete drain and one or more rinses, carried out according to the rules of the art, will be necessary to eliminate any residual trace of water and any deposit.
Filters should be changed. A final oil analysis should confirm the characteristics of the new product.

Note: HFDU oils have a strong detergent power that can act on previously formed deposits. Clogging of filters should be monitored for several days.

2.6.3. Conversion from HFDU fluid to another HFDU fluid

In the case of conversion of an HFDU fluid to another HFDU fluid, the design aspects are already verified. It will simply be necessary to contact CONDAT to ensure the good compatibility of the two fluids.

Analysis before conversion will allow to check all the characteristics of the fluid in place and its compatibility with the new product. In case of perfect compatibility, you can proceed by successive top-ups during a period of time.

Otherwise, you can adjust the cleaning or rinsing of the hydraulic system according to the results of the analysis.
The filters must be changed before final filling and in case of rinsing.

A post-conversion analysis will:

- check that the performance of the product in place comply with the reference product
- eventually correct the characteristics by partial drainage and additional top-ups.

For any conversion process, please contact your CONDAT sales representative to be sure to have the best practices and to keep the highest performances of the **CONDAT D/D600 series** in use.

3. Conditions monitoring & Troubleshooting

3.1. The effects of pollution

Contamination affects all types of hydraulic equipment without exception. The more precise the mechanical parts are (with tight tolerances), the more sensitive they are to these effects. **Dirty fluid causes wear which accelerates internal leakage and reduces the cooling effect. Increases in temperature may cause a drop in viscosity resulting in a lack of lubrication and significant wear.**

More than 70% of hydraulic system failures are due to solid or chemical pollution of the fluid.

- **Coarse pollution:**
  - Seizure of moving parts
- **Fine pollution:**
  - Components wear
  - Leakage increase
  - Rise in system temperature
- **Ultrafine pollution:**
  - Increase in friction forces
- **Chemical pollution:**
  - Destruction of the physicochemical properties of the fluid
  - Alteration of viscosity
  - Increase of acidity and oxidation
  - Impact on elastomers compatibility

3.2. Major sources of pollution

There are three major sources of pollution:

1 - Manufacturing or assembly pollution

When assembling components, welding, painting, and sometimes neglect, there is a risk to introduce solid particles.

2 - Internal pollution

The environment and the atmosphere of your hydraulic installation and its operating conditions may induce fluid pollution:

- Solid particles,
- Water,
- Air (Humidity, oxygen...)
- Temperature.

3 - Maintenance Pollution

This pollution is caused by human manipulation on machinery or equipment:

- Solid pollution: dust, fibers (rags)...
- Liquid pollution: water contained in compressed air ...
- Chemical pollution: fluid of a different nature during top-up, solvent, silicones, liquid seals

3.3. Analysis of used hydraulic fluids

3.3.1. Objectives of the analysis

Analysis are used to detect:

- **Contamination**
  - Particles, water, dirt, chemical pollution (mineral oil, glycol...)
- **Degradation of the fluid**
  - Oxidation, viscosity variations, alkalinity ...
- **Fatigue and wear of materials**
  - Metallic particles, etc ...

The results will help to diagnose of the state of the machine and lubricant.

3.3.2. The sampling

Analysis of the fluid in service is generally carried out by sampling from small to very small quantities: from a few tens to hundred milliliters.

These samples are used to evaluate the performance of oils in systems that contain several hundred or even thousands of liters.

The sample taken must therefore be **perfectly representative of the whole oil load inside the tank.**

For an in-service analysis, the sample should always be:

- At the same location of the circuit
- With the same methodology

The mode and the place of sampling include an infinity of possibilities according to the installations. Here is CONDAT method to perform the best sampling considering the most suited location to your situation:

- The sampling is to be done while operating or just after the system shutdown
- Ensure that the sample is protected from environmental pollution
- Always do it in the same place and in the same way
- Clean the oil outlet
- Allow the oil to flow a little before sampling
- Use an appropriate bottle (no recycled bottles as water bottles...), dry and clean
- Open the bottle at the last moment
- Correctly fill the label

The location of sampling on a circuit can be done on a pressure tap, during operation, in a vertical section and before filtering.

3.3.3. Frequency of analysis

In the case of preventive (predictive) and systematic analysis, the periodicity is fixed by the user according to:

- The severity of use of its equipment
- Experience
- Cost of equipment and cost of failure
- Maintenance methods

It may be considered that one or two analysis per year are sufficient to establish a diagnosis under normal operating conditions. The measured characteristics will always be the same to be able to compare their evolution. Please consult CONDAT for advice on the appropriate method for the product in use.

In the event of a malfunction or damage, an analysis can be carried out in a one-off or curative way, as soon as abnormal symptoms appear: noise, temperature increase, vibrations, smoke ...

In this case, you must inform your service provider for the analysis or contact your CONDAT representative who will help to define the analysis sequences adapted to your situation (which parameters to assess).

3.3.4. Sample information sheet

The information you need to know and communicate to the laboratory when transmitting a sample is very important for accurate diagnosis.

This information is:

- Date of collection
- Company Name
- Identification of the applicant for the analysis
- Type and name of lubricant
- Type or code of the desired analysis
- Circumstances of sampling (emptying, inter emptying, incident ...)
- The application: ► Identification of the machine
  ► Identification of the mechanical equipment
- Number of hours in function
- Amount of oil in service
- Top-ups
- Your observations of the situation

3.3.5. The analysis sequences

Below is a fire-resistant fluid analysis sequences:

- Flash point (Cleveland open cup) (ASTM D92a)
- Viscosity at 40 ° C and 100 ° C in mm^2/s (ASTM D445)
- Viscosity index (ASTM D2270)
- TAN (Total Acid Number) in mg KOH/g (ISO 6619)
- Gravimetry (pollution control) in mg/l (NF E 48-652)
- Spectrometry (wear control) in ppm
- Alkalinity reserve (ASTM D1121)
- pH (DIN 51369)
- Water content in ppm or % (ASTM D1744 -Karl Fischer)
- Gravimetry (pollution control) in mg/l (NF-E 48-652)
- Aqueous spectrometry (wear control) in ppm (NFT 60-106)

3.4. Interpretation of test results and oil change

For non-flammable fluids, the fire resistance property is the most important one to monitor, namely the flash point:

- If it is too low, a partial drain and a top-up may be enough to bring the situation back to acceptable
- If it is inferior to mineral oil based fluids or cannot be measured, a full drain will be necessary repetition.

All other analysis results must be studied together to finalize the diagnosis.

4. Health and Safety

Generally speaking, HFC and HFDU products currently on the market do not involve major health hazards in normal use.

When delivering chemical products, your supplier has the legal obligation to provide a Safety Data Sheet (SDS) and a Product Data Sheet (PDS). The two documents must be in correspondence and have the same commercial name which is the one on the packaging.

The SDS includes, among other things, all data on:

- Product identification
- Identification of the supplier: CONDAT
- Hazard identification with hazard pictograms related to the product (section 2)
- The details on the substances that lead to the product hazard classification (section 3)
- Protective measures for handling
- Description of first aid in case of contact with skin or eyes, ingestion or inhalation
- Main physical and chemical characteristics of the product
- Toxicological and ecological information

This Safety Data Sheet must be kept close to the installation in case of error of manipulation or accident.
The rules of the art for the handling of chemical substances should be observed and protective equipment and precautions should be adapted to the working situations: wearing glasses, gloves and protective clothing is recommended.
In case of prolonged contact with the skin, especially during hydraulic maintenance operations, operators should wear gloves. Hand cleaning should also be routine after each use to avoid contact with the eyes.
Samples should be clearly indentified and packed in non-food flasks to avoid accidental ingestion... AND MAINLY NOT TO CONTAMINATE THE FLUID.
Finally, when filling or cleaning tanks and in case of insufficient ventilation, respiratory protection is recommended.

When in doubt, please refer to the SDS, but you can also consult your CONDAT sales representative before a technical intervention who will advise on the best way to proceed.

5. Hydraulic fluids handling and storage

5.1. Marking containers

For the easy identification of our fire-resistant fluids, during delivery or storage, the following points are clearly and legibly indicated on CONDAT packaging:

- Manufacturer Name: CONDAT
- Commercial Product Name
- Batch number
- Main danger & precautions instructions

5.2. The duration of the conservation

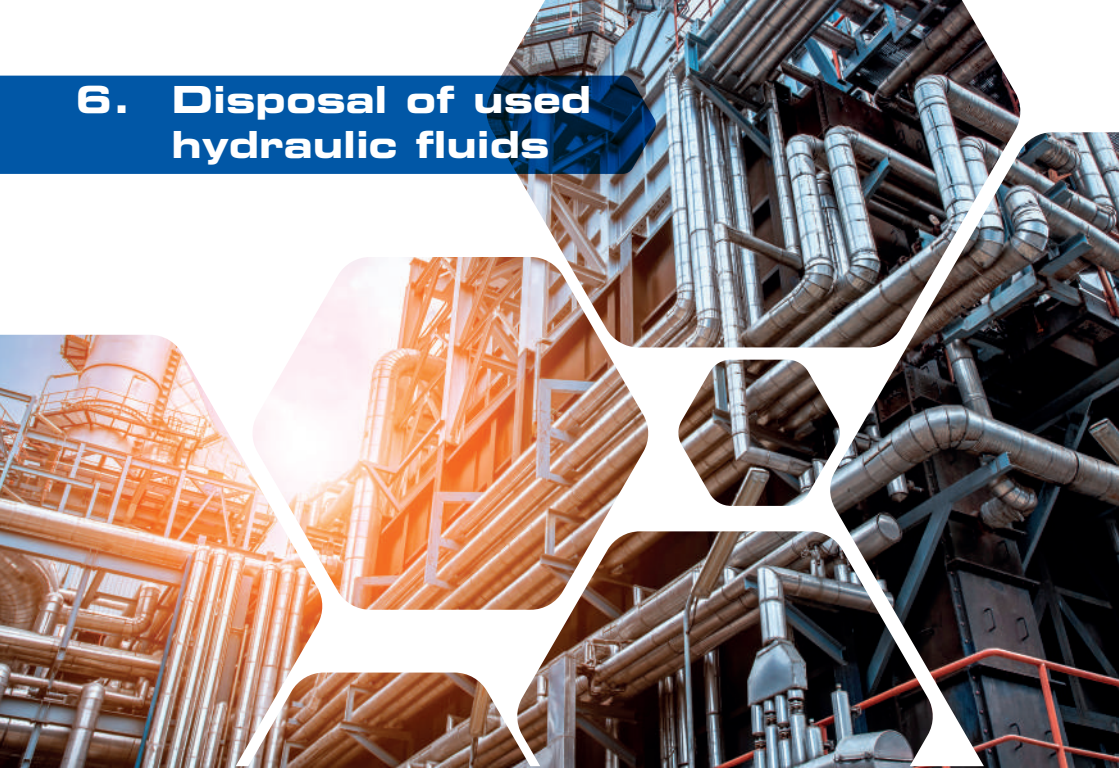
The shelf life is two years minimum from the manufacture date for HFCs and HFDUs provided that products are stored in their original packaging under the conditions recommended by CONDAT.

5.3. Storage

Special precautions for the storage of fluids are indicated on the Safety Data Sheet (SDS). Generally, products should be stored away from heat and ignition sources.
The products must be stored in the original packaging and kept closed until the time of use. The room must be dry, sheltered from the elements (water, wind, sun) and dust.

In case of prolonged storage, the drums may be «lying» with the two stoppers placed on the horizontal plane to avoid drums «breathing».

6. Disposal of used hydraulic fluids



According to the Good Practices and to protect the environment, the end-user should collect all liquids from leaks, flushes and rinses of all the appliances in which they are used. The products must be recovered in «clean» containers so as not to increase reprocessing costs.
It is recommended not to mix HFCs (which contain water) with other oils because of reprocessing costs.

The collection, transport, regeneration and disposal of used liquids must be carried out in accordance with the rules of the art and by authorized companies based on the law/ regulation of each country.

Even if the products are biodegradable (according to OECD 301B), it must be disposed of in a responsible way in accordance with local regulations. This usually includes disposal in sealed containers at licensed waste disposal sites. It should not be discharge in drains, water courses or onto the ground.

7. About CONDAT

Established in 1854, Condat SA is headquartered in Chasse-sur-Rhône, France.

Unique know-how

Since 1854, CONDAT formulates and produces a wide range of lubricants, metal-forming products, coatings and special products for the world of industry. Based on 165 years' expertise, CONDAT has focused on designing products with high added technical value for numerous applications and earned worldwide recognition in leading high-tech markets: tunneling, wire drawing, aeronautic, industrial maintenance...
Its international presence allows a privileged proximity with its customers, nurturing an approach based on permanent innovation and product development.

MORE THAN 165 YEARS EXPERTISE

700 employees worldwide

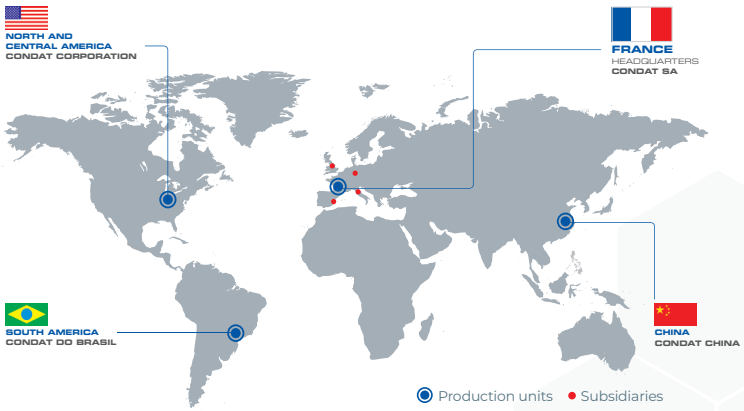
30 technologies mastered

74 agents and distributors

4 production sites ISO 9001 certified

42 markets application fields

2 000 products



Innovation

15%
turnover achieved with products less than 3 years old

Sustainable strategy

30%
of low carbon raw materials

100%
independent company

Our Commitment:
The Responsible Performance

Aware of environmental issues, Condat has been proposing for more than 20 years solutions that are more respectful of humankind and the planet. Our responsibility as a company is to preserve the Individual, the Nature and the 4 elements that compose it, Water, Fire, Earth and Air, by reducing the impact and risks of our activities and those of our customers on our ecosystem. Each of our markets is associated with 1 of the 4 elements to reflect our commitment to the society.

Water
for metal working

Fire
for steel, forging, glass and quenching

Earth
for maintenance and tunneling

Air
for wire drawing

Our corporate social responsibility aims to respect the environment and have a positive impact on society while remaining economically viable. This means building an offer that reduces the impact of our activities and those of our customers by limiting pollution, resource consumption and carbon footprint. Our priority is also to offer safe working conditions.

Our CSR policy, certified by ECOVADIS since 2018, embodies Condat's values, in particular «Build to last», a historical value of the group.

By optimizing the role of the lubricant, our ambition is not only to guarantee a high level of performance, it is also to accompany you towards a responsible performance.

Responsible performance for the steel & aluminum industries

Fire is naturally associated with the steel & aluminum industries as the art of mastering the fire is essential to turn the ore into metal.

However, fire can have dramatic consequences. Our products provide cost savings solutions by protecting your equipment, lengthening the drain intervals and reducing maintenance cost. They also offer safe working conditions for your operators and minimal environmental impacts.

The sales network

With production units based in France, North America, South America and Asia together with a solid distribution network, CONDAT supports all its customers around the world.
With a strong commercial network, the CONDAT Group has been growing steadily since the 1980s in all the industrialized countries. With 70% of its turnover outside France, the Group is experienced in international negotiations. On all registers, including commercially, we are committed to act responsibly, honestly, and respectfully.
For the steel and aluminum industries, CONDAT lubricants range answers your needs for commodity lubricants as well as for specific and technical applications.
Condat **fire-resistant fluids** and **innovative technical greases** have been recognized for decades by the steel industry.

CONDAT technical support

Along the years, CONDAT has gained expertise on the specifics of your application and offers you lubricants, oils and greases, specifically developed to satisfy your needs and technical requirements.
To increase the in-service performance of our lubricants, CONDAT makes its know-how & expertise available to its customers to increase their productivity. As part of a global offer concept, we develop numerous proposals for services and assistance.


Analysis


Technical assistance

Equipment

This technical guide of CONDAT introduces the family of fire resistant hydraulics fluids, their basic formulation, their properties, their advantages and disadvantages. For each technology (HFC/ HFDU), the reader will find information and best practices on how to use the product, how to monitor it, how to ensure the longest life in service.

This document reflects the general information about these technologies, but for any technical question, any support on site or any analyze interpretation, please contact CONDAT, a dedicated sales representative will help you to optimize the CONDAT product performances:

CONDAT

COMMITTED TO RESPONSIBLE PERFORMANCE

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