ADDINOL®
THE ART OF OIL • SINCE 1936

ADDINOL EcoShield HF-FR 46 and HF-FR 68 for the operation of heavy-duty hydraulics in fire-hazard plants

GERMAN QUALITY

ADDINOL EcoShield HF-FR 46 and HF-FR 68 are water-free, flame-resistant pressure fluids based on PAG for hydraulic systems at risk of fire and explosion. In practical use, they achieve significantly better results than conventional fluids thanks to their excellent flame resistance. Based on specifically selected, high-quality base oils, they have the highest thermal-oxidative stability and very good sealing compatibility. Their innovative additive technology ensures reliable protection of the components against corrosion and wear. ADDINOL EcoShield HF-FR fluids are characterized by best environmental compatibility and remain stable even under the influence of water.

These are your practical benefits:

- ✓ High operational safety thanks to flame resistance
- ✓ Very long service life compared to ester and mineral oils
- ✓ Can be used in a wide temperature range (-50° C to 150°C)
- ✓ High stability even when exposed to moisture
- ✓ Reliable water separation
- ✓ Excellent corrosion and wear protection
- ✓ Safe application even in ecologically sensitive areas
- ✓ Problem-free conversion of mineral and ester-based products thanks to high compatibility with elastomers, seals, pipes, non-ferrous metals and plastics
- ✓ Non-toxic, very environmentally friendly, rapidly biodegradable

Fields of application:

- ✓ Steelworks
- ✓ Metal manufacturing
- ✓ Tunnel boring machines
- ✓ Blast furnaces
- ✓ Foundries
- ✓ Refineries
- ✓ Automobile industry
- ✓ Machine tools
- ✓ Robotics

Maximum safety with ADDINOL EcoShield HF-FR 46 and 68

Many applications in the most diverse branches of industry take place under demanding ambient conditions. Plants and equipment in steel production and foundries, for example, operate at extremely high temperatures. High temperatures are also not uncommon in special machine and vehicle construction or in robotics. Here there is an increased risk of fire in the event of leaks or pipe breaks. Contact of the hydraulic fluid with hot machine surfaces or sparking from an ignition source can lead to a fire. Other areas at risk are, for example, tunnel construction or track and rail construction.

This fire risk and the associated dangers must be kept to a minimum. The use of our flame-resistant hydraulic fluids significantly reduces the fire load and increases safety. The additional time saved in the event of an accident for rescue and extinguishing measures is extremely important.

Flame resistance of hydraulic fluids

Following the devastating mine accident in Marcinelle, Belgium, in 1956, the Safety and Health Commission for Mining and Other Excavative Industries formulated requirements and test methods for flame-resistant hydraulic fluids for the first time in the 7th Luxembourg Report. On this basis, international standards were developed that apply to the industries concerned.

Today, the updated requirements are summarized according to DIN EN ISO 12922 and the fluids are basically subjected to three different tests:

1. **Spray flame persistance (DIN EN ISO 15029/1-2)**

   In this test, the pressurized spray jet is exposed to a flame and the afterburning time until the flame extinguishes is determined. This property is particularly important in the event of a leak, for example, as it describes the time to self-extinguishing (see Chart 1a).

2. **Wick flame persistance (DIN EN ISO 14935)**

   Here a piece of aluminium silicate strip is soaked with the PAG liquid to be tested and then flamed with a gas burner for 2 seconds and 5 seconds respectively. After removal of the pilot flame, the afterburning time of the wick is measured and an average value is determined. This must not exceed 60 seconds (see Chart 1b).

3. **Flammability of fluids in contact with hot surfaces (DIN EN ISO 20823)**

   The tendency of a fluid to spontaneously ignite on hot surfaces is tested by applying the fluid to a hot surface and evaluating the reaction. The temperature of the surface differs depending on the type of fluid: flame-retardant PAG fluids must not ignite on a surface at 400 °C. The actual ignition temperature is also determined in this test (see Chart 2).

Fire resistance of ADDINOL EcoShield HF-FR compared to competitive products

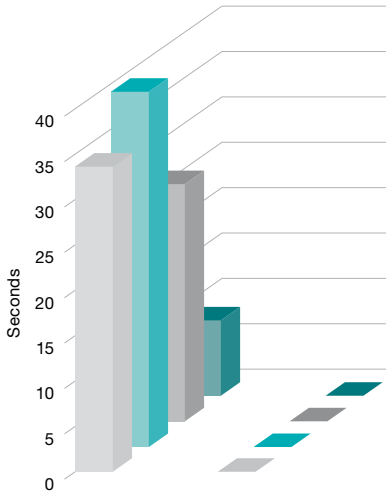


Chart 1a) Ignition properties of spray jets
Chart 1b) Afterburning time at the wick

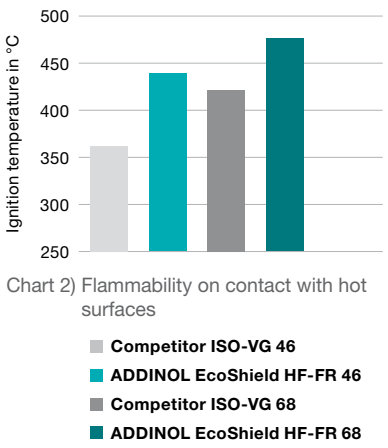


Chart 2) Flammability on contact with hot surfaces

Maximum safety with ADDINOL EcoShield HF-FR 46 and 68

ADDINOL EcoShield HF-FR scores best in all three tests and can prove a reduced fire risk. The fire load is reduced and additional time is gained in the event of a fire which is highly important.

In addition, the excellent properties of ADDINOL EcoShield HF-FR hydraulic fluids are maintained even in an extremely wide temperature range thanks to the high quality of the base oils used: the viscosity remains almost unchanged, the above-average flash point provides the decisive plus in terms of safety and even at outside temperatures as low as -50 °C, ADDINOL EcoShield HF-FR remains flowable.

High biological degradability

Rapid biodegradability plays a major role, especially in ecologically sensitive applications where fluids can be released into the environment in the event of an accident, e.g. in tunnel boring work.

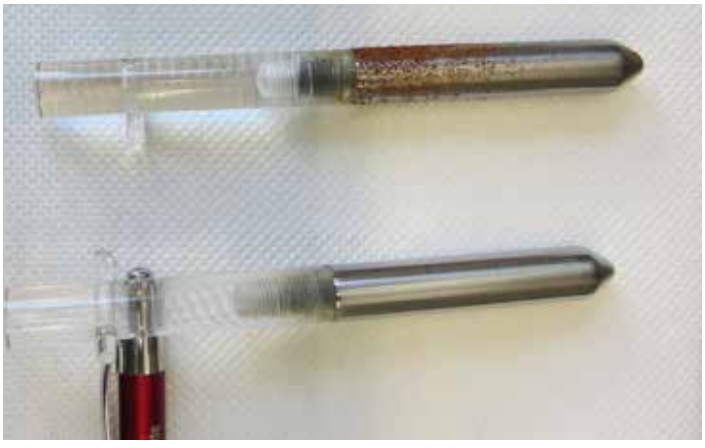
The biodegradability of poorly water-soluble chemicals is determined according to OECD 301 B in the carbon dioxide development test: The carbon dioxide resulting from the biodegradation of the test substance is regularly analysed over 28 days and is an indicator of the biodegradability. ADDINOL EcoShield HR-FR meets the criteria of easy biodegradability in ISO-VG 46 and also ISO-VG 68 is basically biodegradable.

These excellent results are achieved while maintaining high chemical stability. The PAG-based fluids of the EcoShield series are of extreme hydrolytic stability, i.e. not susceptible to a reaction with water. No chemically aggressive degradation products such as alcohols or acids are formed, as for example with ester fluids. In addition to long service lives and effective protection against varnish and sludge formation, a stable lubricating film over long operating intervals and thus a consistently high performance of your hydraulic system is achieved.

The ADDINOL EcoShield HF-FR fluids are zinc-free and non-toxic. This is a great advantage over liquids based on phosphoric acid esters (HFD R).

Reliable protection against corrosion and wear

A specifically matched additive package ensures reliable protection of the components against corrosion and wear. In combination with good water separation properties, ADDINOL EcoShield HF-FR contributes to safe operation and a significant reduction of maintenance costs.



Corrosion protection properties against steel according to DIN ISO 7120: ADDINOL EcoShield HF-FR (below) also achieves best values in procedure B.

Characteristic values	Test conditions	Unit	Competitor ISO-VG 46	ADDINOL EcoShield HF-FR 46	Competitor ISO-VG 68	ADDINOL EcoShield HF-FR 68
Chemical and physical values						
Density @ 20°C	DIN 51575	kg/m³	990	993	993	996
Viscosity @ 40°C	ASTM D445	cSt	50	50	68	70
Viscosity @ 100°C	ASTM D445	cSt	9.5	9.4	12.3	12.7
Viscosity index	ASTM D2270		176	176	181	184
Pour point	ASTM D97	°C	-42	-51	-39	-51
Flash point	ASTM D92	°C	279	282	281	298
Air release @ 50°C	ASTM D3427	min	< 5 min	< 5 min	< 6 min	< 6 min
Water release @ 54°C	ASTM D1401	min	> 60	10	> 60	20
Foaming characteristics	ASTM D892		60/0	30/0	30/0	20/0
			20/0	0/0	20/0	10/0
			20/0	30/0	40/0	20/0
TOST. Δ AN(1000 h)	ASTM D943		2.3	0.6	1.0	0.5
Material compatibility						
Corrosion category on copper	ASTM D130		1A - 125/3	1 - 125/3	1A - 125/3	1 - 125/3
Corrosion category on steel	ASTM D665		3-B (fail)	0-B (pass)	2-B (fail)	0-B (pass)
NBR 1-Compatibility	ISO 6072		ΔV = +11.3% ΔHrdn. = -7	ΔV = +8.7% ΔHrdn. =-5	ΔV = +10.8% ΔHrdn. = -5	ΔV = +6.7% ΔHrdn. = -5
FKM 2-Compatibility			ΔV = +1.5% ΔHrdn. = -3	ΔV = +0.7% ΔHrdn. = -1	ΔV = +1.5% ΔHrdn. = -3	ΔV = +0.4% ΔHrdn. = -1
Mechanical performance						
Brugger Test	DIN 51347	N/mm²	44	45	38	40
Four-Ball Wear	ASTM D4172	mm²	0.45	0.42	0.35	0.40
Environmental compatibility						
Biodegradability	OECD 301B		readily biodegradable	readily biodegradable	readily biodegradable	in principle biodegradable
Fire resistance						
Spray flame persistance	DIN EN ISO 15029-1	s	max. 34	max. 39	max. 27	max. 8
			Ø: 4.8	Ø: 4.6	Ø: 4.7	Ø: 1.4
Wick flame persistance	DIN EN ISO 14935	s	$MP_2 = 0$ $MP_5 = 0$	$MP_2 = 0$ $MP_5 = 0$	$MP_2 = 0$ $MP_5 = 0$	$MP_2 = 0$ $MP_5 = 0$
Ignition temperature	DIN EN ISO 20823	°C	342 – 373	440	425	475

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