

SAFETY DATA SHEET

ENERGY SPRING NS Hydraulic HVI Series — High Viscosity Index Anti-Wear Hydraulic Oils

Issued in accordance with Singapore Standard SS 586-3:2022 (16-section GHS format). This document supersedes all previous versions.

SECTION 1 - Identification of the substance / mixture and of the supplier	
1.1 Product identifier	NS Hydraulic HVI 15, NS Hydraulic HVI 32, NS Hydraulic HVI 46, NS Hydraulic HVI 68, NS Hydraulic HVI 100
Product family	High viscosity index (HVI) anti-wear hydraulic oils. Zinc-containing (ZDDP) anti-wear hydraulic fluids of type HV to ISO 6743-4, meeting the requirements of ISO 11158 category HV and DIN 51524 Part 3 (HVL).P). All five viscosity grades share the same base oil and additive chemistry and are therefore covered by a single safety data sheet. Note, however, that the ISO VG 15 grade carries a GHS classification which the higher grades do not - see Section 2.
Grade(s)	ISO VG 15, 32, 46, 68 and 100. See the product table below.
Chemical identity	Mixture of highly refined mineral base oils and additives
CAS number	Not applicable (mixture)
1.2 Relevant identified uses	Hydraulic fluid for industrial and mobile hydraulic systems - vane, gear and piston pumps - operating over a wide ambient or working temperature range, where a high viscosity index fluid of ISO 6743-4 type HV is specified. Also suitable for hydrostatic transmissions, machine tool hydraulics, deck machinery, steering gear and general circulating oil systems where an anti-wear oil of this specification is required. Select the viscosity grade according to the pump manufacturer's viscosity limits and the expected operating and start-up temperatures. Industrial / professional use only.
Uses advised against	Any use other than that stated above. Not for use where a fire-resistant hydraulic fluid (ISO 6743-4 types HFAE, HFAS, HFB, HFC or HFD) is required, nor where an ashless / zinc-free (HVL) or zinc-free (HLP) or environmentally acceptable (HEES, HEPG, HETG) fluid is specified. Not for use as a brake fluid, turbine oil where a zinc-free oil is called for, engine oil, fuel, solvent, cleaning agent or mould release agent, nor for any medicinal, food-contact or personal-care purpose. Not approved for incidental food contact (NSF H1).
1.3 Supplier of the safety data sheet	ENERGY SPRING PTE LTD 3 Temasek Avenue, #21-00 Centennial Tower Singapore 039190 Tel: +65 6993 9836 E-mail: info@energy-spring.sg Web: https://energy-spring.sg/
Manufactured / blended by	Product supplied under a manufacturing agreement. Manufacturer details available from ENERGY SPRING PTE LTD on request.
1.4 Emergency telephone number	ENERGY SPRING PTE LTD (office hours, Mon - Fri 09:00 - 18:00 SGT): +65 6993 9836 Singapore - emergency services (SCDF: ambulance and fire): 995 Singapore - Drug and Poison Information Centre (DPIC), Singapore General Hospital, 24-hour hotline: +65 6423 9119 Outside Singapore: contact the local emergency services or the national poison information centre for the country in which the incident occurs.

Product	ISO VG	Kinematic viscosity at 40 °C, mm ² /s	GHS classification
NS Hydraulic HVI 15	15	13.5 - 16.5	Asp. Tox. 1; H304 (see Section 2)

Product	ISO VG	Kinematic viscosity at 40 °C, mm ² /s	GHS classification
NS Hydraulic HVI 32	32	28.8 - 35.2	Not classified
NS Hydraulic HVI 46	46	41.4 - 50.6	Not classified
NS Hydraulic HVI 68	68	61.2 - 74.8	Not classified
NS Hydraulic HVI 100	100	90.0 - 110.0	Not classified

SECTION 2 - Hazards identification

2.1 Classification of the substance or mixture	GHS classification (SS 586-2 / SS 586-3) - grade dependent: NS Hydraulic HVI 15: Aspiration toxicity, Category 1 - H304 NS Hydraulic HVI 32, 46, 68 and 100: Not classified as hazardous Basis of the classification. The highly refined base oil streams declared in Section 3 are themselves classified Asp. Tox. 1; H304 and are present at well above 10 % w/w. Under the mixture criteria of SS 586-2, a mixture containing 10 % or more of a Category 1 aspiration toxicant is classified Asp. Tox. 1 only if its own kinematic viscosity does not exceed 20.5 mm²/s at 40 °C. For ISO VG 32 and above the kinematic viscosity of the finished blend is 28.8 mm²/s or greater, the viscosity cut-off is not met, and no aspiration classification applies. For ISO VG 15 the finished blend has a kinematic viscosity of 13.5 - 16.5 mm²/s at 40 °C, which is below the cut-off; that grade is therefore classified Asp. Tox. 1; H304 and must be labelled accordingly. No other health or environmental hazard class is triggered by any grade. The anti-wear and antioxidant components carrying Skin Irrit. 2, Eye Dam. 1 and Aquatic Chronic 2 are each present below their relevant generic concentration limits (see Sections 3 and 11), and the aquatic summation for the mixture does not reach the 25 % threshold for Aquatic Chronic 3.
Formulation control - the ISO VG 15 grade	The classification of the ISO VG 15 grade rests on two things only: the kinematic viscosity of the finished blend relative to the 20.5 mm²/s cut-off, and the aspiration classification of the base stocks used. Should the base stocks employed in this grade not be classified Asp. Tox. 1, or should the measured viscosity of the blend at 40 °C exceed 20.5 mm²/s, the grade is unclassified and Sections 2, 14, 15 and 16 change accordingly. Where a single label is required across the series, the ISO VG 15 grade must carry its own label; the classified and unclassified grades cannot share label artwork.

2.2 Label elements



GHS08
Health hazard
ISO VG 15 only

Applies to	NS Hydraulic HVI 15 only. NS Hydraulic HVI 32, 46, 68 and 100: no pictogram, no signal word and no hazard statement are required.
Signal word	DANGER (ISO VG 15)
Hazard statement	H304: May be fatal if swallowed and enters airways. (ISO VG 15)
Precautionary statements	General: P101: If medical advice is needed, have product container or label on hand. P102: Keep out of reach of children. P103: Read label before use. Response: P301 + P310: IF SWALLOWED: Immediately call a POISON CENTER or doctor. P331: Do NOT induce vomiting. Storage: P405: Store locked up, or under controlled access. Disposal: P501: Dispose of contents and container in accordance with local regulations.
Recommended handling precautions for the unclassified grades	Not label elements. Good occupational practice for all grades: P262: Do not get in eyes, on skin, or on clothing. P264: Wash skin thoroughly after handling. P280: Wear protective gloves and eye / face protection. P273: Avoid release to the environment. P501: Dispose of contents and container in accordance with local regulations.

2.3 Other hazards - high-pressure injection WARNING	This is the principal hazard of a hydraulic fluid in service and it applies to every grade, classified or not. Fluid escaping from a pinhole leak in a pressurised line, hose, fitting or seal forms an invisible or barely visible jet capable of penetrating intact skin and injecting oil deep into the tissue. The entry wound may be no more than a pinprick and may be almost painless at first, but the injected oil causes rapid swelling, ischaemia and tissue necrosis, and amputation may result if treatment is delayed. Never use the hand, or any part of the body, to search for a leak; use a piece of card or paper held at arm's length. Any suspected injection injury is a surgical emergency - see Section 4.
Stored energy and hot material	Hydraulic systems retain stored energy in accumulators, cylinders and suspended loads after the prime mover is stopped. Depressurise the system, isolate and lock out, support suspended loads and allow the fluid to cool before breaking any connection. Fluid in a working system is hot. Reservoirs, coolers, filter housings and return lines may be hot enough to cause thermal burns.
Spray and mist fire hazard	Although the bulk product has a high flash point (Section 9), a fine mist or atomised spray released from a pressurised leak can be ignited by a hot surface, flame, weld spatter or electrical arc at bulk temperatures well below the flash point, producing an intense spray fire. Route and shield hydraulic lines away from hot surfaces and ignition sources. Where this risk cannot be engineered out, a fire-resistant fluid is the correct product - see 'Uses advised against' in Section 1.
Skin effects	Prolonged or repeated skin contact with the fresh product may cause defatting of the skin, leading to dryness, redness or dermatitis.

Used oil	During service the fluid becomes contaminated with wear metals, water and oxidation and thermal degradation products. Used mineral oils have been shown to cause skin cancer in laboratory animals following prolonged, repeated exposure. Avoid skin contact with used oil and remove promptly with soap and water.
Oil mist	Generation of mist, vapour or aerosol above the applicable occupational exposure limit (Section 8) may cause respiratory irritation. Mist is readily produced by pressurised leaks and by return lines discharging above the fluid level in the reservoir.
Slip hazard	Spillages produce slippery surfaces.
PBT / vPvB	This mixture contains no substance considered to be persistent, bioaccumulative and toxic (PBT) at $\geq 0.1\%$, nor very persistent and very bioaccumulative (vPvB) at $\geq 0.1\%$.

SECTION 3 - Composition / information on ingredients

Component	CAS number	Approx. % w/w	GHS classification
Distillates (petroleum), hydrotreated light paraffinic	64742-55-8	0 - 90	Asp. Tox. 1; H304
Distillates (petroleum), hydrotreated heavy paraffinic	64742-54-7	0 - 95	Asp. Tox. 1; H304
Distillates (petroleum), solvent-dewaxed heavy paraffinic	64742-65-0	0 - 95	Asp. Tox. 1; H304
Poly(alkyl methacrylate) viscosity index improver	Polymer (trade secret)	1 - < 10	Not classified
Zinc dialkyldithiophosphate	68649-42-3	0.1 - < 1	Skin Irrit. 2; H315 Aquatic Acute 2; H401 Aquatic Chronic 2; H411
Phosphorodithioic acids, mixed O,O-bis(1,3-dimethylbutyl and iso-Pr) esters, zinc salts	84605-29-8	0 - < 0.5	Skin Irrit. 2; H315 Eye Dam. 1; H318 Aquatic Chronic 2; H411
Benzenamine, N-phenyl-, reaction products with 2,4,4-trimethylpentene (alkylated diphenylamine antioxidant)	68411-46-1	0 - < 0.5	Aquatic Chronic 2; H411

- Substance / mixture: Mixture. Total highly refined mineral base stock content: 88 - 98 % w/w. The individual base stock streams are interchangeable between blends and grades, which is why each is shown with a range starting at zero; the sum of the three streams always falls within the stated total.
- The base oils in this product are highly refined mineral oils containing less than 3 % (w/w) DMSO extract when tested by IP 346. On that basis no carcinogen classification applies to any grade.
- **ASPIRATION** - the one item on which this series is not uniform. The base stocks are classified Asp. Tox. 1; H304 and are present far above the 10 % trigger, so the classification of each grade turns entirely on the kinematic viscosity of the finished blend against the 20.5 mm²/s at 40 °C cut-off. ISO VG 32 (28.8 mm²/s minimum) and above clear the cut-off with margin and are unclassified. ISO VG 15 (13.5 - 16.5 mm²/s) does not clear it and is classified Asp. Tox. 1; H304. There is no grade in this series whose specification straddles the cut-off, so no batch-to-batch ambiguity arises; had an ISO VG 22 grade been included (19.8 - 24.2 mm²/s) it would have straddled it and would have required batch-by-batch assessment.
- **AQUATIC MARGIN** - the components classified Aquatic Chronic 2 (zinc dialkyldithiophosphate, zinc phosphorodithioate and alkylated diphenylamine) total no more than 2.0 % w/w. Applying the summation method with a multiplying factor of 1, the Chronic 2 contribution is 10 x 2.0 % = 20 %, below the 25 % threshold at which Aquatic Chronic 3; H412 would be assigned. The margin is therefore only 0.5 % w/w of combined Chronic 2 additive. Any increase in the additive treat rate, or any change of additive package, requires the aquatic summation to be recalculated before this data sheet is reissued.
- The zinc dithiophosphate is the only declared ingredient classified Eye Dam. 1 or Skin Corr. 1, and is present below 0.5 % w/w. The eye endpoint is assessed under SS 586-2 on the combined content of such ingredients against a generic concentration limit of 1 % w/w for Eye Irrit. 2 and 3 % w/w for Eye Dam. 1; neither is reached. Its Skin Irrit. 2 classification is assessed against a 10 % w/w additivity threshold, also not reached. No hazard class is therefore assigned to the mixture on either endpoint, and no substance-specific concentration limit has been relied on.
- This product contains no tetrapropenylphenol, no long chain alkyl phenol and no other declared reproductive toxicant or skin sensitiser at or above 0.1 % w/w. No supplemental label statement for allergic reaction is required.
- Any concentration shown as a range is given to protect confidentiality or is due to batch-to-batch variation.
- There are no additional ingredients present which, within the current knowledge of the supplier and in the concentrations applicable, are classified as hazardous to health or the environment and hence require reporting in this section.

SECTION 4 - First aid measures

4.1 Description of first aid measures - General	No hazards requiring special first aid measures are expected from ordinary skin or eye contact. In the event of serious problems, call a doctor or summon medical assistance urgently. Show this safety data sheet to the medical personnel in attendance.
High-pressure injection injury - SURGICAL EMERGENCY	If the product has been injected under the skin by a high-pressure system, however small the entry wound and however trivial the injury appears, obtain medical attention IMMEDIATELY and state clearly that a high-pressure hydraulic oil injection injury is suspected. The casualty is to be taken to an accident and emergency department, not to a first aid room. Do not delay while waiting for symptoms to develop. Do not attempt to squeeze the oil out or to probe or enlarge the wound. Immobilise and elevate the limb, cover the wound with a clean dry dressing, and do not apply heat. Urgent surgical exploration, debridement and decompression are usually required; delay of even a few hours increases the risk of permanent loss of function or amputation.
Inhalation	Move the person to fresh air. If breathing is difficult, give oxygen. If the person is not breathing, apply artificial respiration and obtain medical attention immediately.
Skin contact	Remove contaminated clothing and shoes. Wash the affected area with soap and water. Do not use solvents or thinners. If irritation or rash develops or persists, obtain medical advice. Launder contaminated clothing before reuse; discard contaminated leather articles. Hot product: cool the affected area immediately with cold running water for at least 15 minutes. Do not attempt to remove product adhering to the skin. Obtain medical attention for thermal burns. Injection under pressure: see above.
Eye contact	Remove contact lenses if worn and easy to do. Flush the eyes with clean water or sterile eye wash for at least 15 minutes, holding the eyelids apart. Obtain medical advice if discomfort or irritation persists. Where fluid has entered the eye under pressure, obtain medical attention immediately.
Ingestion	DO NOT induce vomiting: there is a risk of aspiration into the lungs, and for the ISO VG 15 grade this is a classified hazard (H304). If the person is conscious, rinse the mouth with water; small sips of water may be given. Never give anything by mouth to an unconscious person. Do not give milk, fats or alcoholic beverages. Place the casualty in the recovery position if drowsy and take to hospital immediately, with this safety data sheet.
4.2 Most important symptoms and effects, both acute and delayed	Injection injury: pinprick wound, blanching, rapidly increasing pain, swelling and numbness of the affected digit or limb; delayed necrosis and secondary infection. Skin: dryness, redness, cracking or dermatitis after prolonged or repeated contact; thermal burns from hot fluid. Eyes: transient discomfort or mild redness on direct contact. Inhalation of mist: coughing or difficulty breathing at concentrations above the exposure limit in Section 8. Ingestion: nausea and irritation of the gastrointestinal tract. Aspiration of the low-viscosity grade into the lungs may cause coughing, choking, wheezing, breathlessness and delayed onset of chemical pneumonitis, which may be fatal.
4.3 Indication of any immediate medical attention and special treatment needed	Note to physician - aspiration: the ISO VG 15 grade is a low-viscosity mineral oil classified for aspiration toxicity. Following ingestion, gastric lavage and emesis are contraindicated. Observe for signs of aspiration; chest radiography and monitoring for hydrocarbon pneumonitis are advised, and treatment is symptomatic and supportive. No specific antidote is required. Note to physician - injection injury: treat as a closed-space contamination injury. Early surgical decompression and thorough debridement of the oil-contaminated tract are the accepted management; antibiotic prophylaxis and tetanus cover as indicated. The extent of tissue involvement is routinely underestimated on initial presentation.

SECTION 5 - Fire-fighting measures

5.1 Extinguishing media	Suitable: foam, dry chemical powder, carbon dioxide, water fog or water spray. Use extinguishing methods suitable to the surrounding conditions. Unsuitable: direct water jet, which may spread burning oil. Where a hydraulic spray fire is involved, isolating the pump and depressurising the system to cut off the supply of atomised fluid is as important as the application of extinguishing media.
5.2 Special hazards arising from the substance or mixture	This product is a combustible liquid with a high flash point (see Section 9); the bulk liquid does not readily ignite but will burn once heated above its flash point. A pressurised leak producing a fine mist or spray can be ignited at bulk temperatures well below the flash point and burns with high intensity - this is the governing fire scenario for a hydraulic fluid. Combustion or thermal decomposition produces a complex mixture of airborne solids, liquids and gases, highly dependent on combustion conditions, including carbon monoxide, carbon dioxide, oxides of sulphur and phosphorus, zinc compounds, and unidentified organic compounds. Traces of hydrogen sulphide may be evolved from the thermal breakdown of the zinc dithiophosphate anti-wear additive. Containers exposed to fire may rupture. Cool exposed containers with water spray.
5.3 Advice for fire-fighters	Wear full protective clothing and self-contained positive-pressure breathing apparatus. Prevent fire-fighting water run-off from entering drains, sewers or watercourses. See Section 7 for proper handling and storage.

SECTION 6 - Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures	Depressurise and isolate the leaking system before approaching it. Do not attempt to stop a pressurised leak by hand and do not locate leaks by hand (see Section 2). Depending on the risk of exposure, wear gloves, goggles and protective clothing (see Section 8). Remove all sources of ignition. Ensure adequate ventilation. Beware of slippery surfaces and floors.
6.2 Environmental precautions	Prevent the product from entering drains, sewers, soil, surface water or groundwater. Design installations and take all measures necessary to avoid water and soil pollution: bunding, containment, drip trays, absorbent materials. Inform the relevant authorities if the product has entered the environment or a public sewer.
6.3 Methods and material for containment and cleaning up	Small spillages: absorb with sand, earth or a proprietary inert absorbent and transfer to a labelled, closable container for disposal. Large spillages: dam the spill and recover the free product by pumping or with suitable physical means. Send contaminated materials to an approved collection or disposal facility. Do not wash spillages away with water or detergent unless the effluent can be contained and treated.
6.4 Reference to other sections	See Section 8 for personal protective equipment and Section 13 for disposal.

SECTION 7 - Handling and storage

7.1 Precautions for safe handling - pressurised systems	Before breaking into any part of a hydraulic circuit: stop the prime mover, depressurise the system including accumulators, isolate and lock out the energy sources, lower or mechanically support any suspended load, and allow the fluid to cool. Do not exceed the system design pressure and do not defeat relief valve settings. Inspect hoses, fittings and seals on a planned basis and replace damaged hoses rather than repairing them. Never search for a leak by hand - use a piece of card. Do not tighten or slacken fittings on a live system.
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General handling	Avoid contaminating soil or releasing this material into sewage or drainage systems and bodies of water. Do not get in eyes, on skin or on clothing. Keep out of the reach of children. Wash thoroughly after handling. Do not eat, drink or smoke in areas where the product is handled. Ensure adequate ventilation where there is any risk of vapours, mists or aerosols forming. Return lines should discharge below the fluid level in the reservoir to limit aeration and mist formation. Avoid the accumulation of static electricity; provide earthing and bonding. Review all operations which have the potential to generate and accumulate an electrostatic charge - including tank and container filling, splash filling, tank cleaning, sampling, gauging, filtering, mixing, agitation and vacuum truck operations - and apply appropriate mitigating procedures.
7.2 Conditions for safe storage, including any incompatibilities	Store in a cool, dry, well-ventilated area, away from sources of heat, ignition and direct sunlight, and away from strong oxidising agents (see Section 10). Keep containers tightly closed and correctly labelled. Use only receptacles, joints, pipes and fittings which are resistant to hydrocarbons. Minimise periods of exposure to high temperature. Recommended storage temperature: 0 °C to 45 °C. Water contamination is to be avoided: it promotes additive hydrolysis, loss of anti-wear performance, corrosion and varnish formation. Store drums under cover and, where they must be kept outdoors, lie them horizontally with the bungs at the three and nine o'clock positions so that water is not drawn in past the closures as the drum breathes. Container warning: containers are not designed to contain pressure. Do not use pressure to empty a container or it may rupture with explosive force. Empty containers retain product residue (solid, liquid and/or vapour) and can be dangerous. Do not pressurise, cut, weld, braze, solder, drill, grind or expose such containers to heat, flame, sparks, static electricity or other sources of ignition; they may explode and cause injury or death. Empty containers should be completely drained, properly closed and promptly returned to a drum reconditioner or disposed of properly.
Incompatible fluids and materials of construction	Do not mix with fire-resistant fluids (HFC, HFD types), with phosphate esters, with polyglycols or with biodegradable ester fluids; mixing causes loss of performance and may produce sludge or seal failure. Do not mix with oils of a different additive chemistry without checking compatibility. This product is zinc-containing. It is not suitable where an ashless or zinc-free fluid is specified, and zinc dithiophosphates can attack silver-plated and some yellow-metal components; consult the equipment builder. Elastomer and coating compatibility: nitrile (NBR), hydrogenated nitrile (HNBR), fluorocarbon (FKM) and polyurethane seals are normally suitable. EPDM and SBR elastomers are not compatible with mineral oil and must not be used. Use oil-resistant paints and coatings for reservoir interiors.
7.3 Specific end use(s)	Hydraulic and circulating oil systems. Flush the system and filter the new charge to the target cleanliness code specified by the equipment builder before commissioning. Maintain fluid condition by planned filtration, water removal and oil analysis; refer to the product technical data sheet and to the equipment builder's instructions.

SECTION 8 - Exposure controls / personal protection

8.1 Control parameters & occupational exposure limits

Component / parameter	Source	TWA (8 h)	STEL / Ceiling
Oil mist, mineral	Singapore PEL (WSH Regulations)	5 mg/m ³	10 mg/m ³ (STEL)
Oil mist, mineral	ACGIH TLV	5 mg/m ³	10 mg/m ³ (STEL)

8.1 Control parameters - note	Limits and standards are shown for guidance only. Follow applicable national regulations. No biological limit values have been established for this product. DNEL / PNEC: not determined for this mixture.
8.2 Exposure controls - general considerations	Consider the potential hazards of this material (Section 2), the applicable exposure limits, the job activities and other substances in the workplace when designing engineering controls and selecting personal protective equipment. If engineering controls or work practices are not adequate to prevent exposure to harmful levels of this material, the personal protective equipment listed below is recommended. The user should read and understand all instructions and limitations supplied with the equipment, since protection is usually provided for a limited time or under certain circumstances only. For hydraulic systems the primary control is not personal protective equipment but the integrity of the pressurised circuit: guarding and shielding of hoses, routing away from hot surfaces and operator positions, planned hose replacement, and a documented depressurise-and-lock-out procedure before maintenance.
Engineering controls	Use the product in a well-ventilated area. Provide local exhaust ventilation where mist or vapour may be generated. Enclose or shield pressurised lines which pass near operator positions or hot surfaces. Provide eyewash facilities and safety showers close to the working area. Provide drip trays and bunding under reservoirs and filter stations.
Respiratory protection	Not normally required. Where the oil mist concentration may exceed the exposure limit, wear an approved respirator fitted with an organic vapour / particulate filter (e.g. type A-P2) or air-supplied breathing apparatus.
Hand protection	Impermeable hydrocarbon-resistant gloves. Suitable materials include nitrile rubber, 4H (PE/EVAL), Viton and Silver Shield. Breakthrough time to be confirmed with the glove supplier. Replace gloves immediately if damaged or contaminated internally. Gloves give no protection whatsoever against high-pressure fluid injection.
Eye protection	Safety glasses with side shields as a minimum. Wear chemical goggles or a face shield where splashing, pressurised release or emission of mist is possible.
Skin and body protection	Overalls or protective clothing which prevents skin contact. Safety footwear. Avoid keeping oil-soaked rags or clothing in pockets.
Hygiene measures	Avoid prolonged and repeated contact with skin, particularly with used oil. Wash hands with soap and water before eating, drinking, smoking and using toilet facilities. Use a suitable skin cream after washing. Do not use solvents, petrol or abrasive cleaners to remove oil from the skin.
Environmental exposure controls	Avoid release to the environment. Prevent discharge to drains and watercourses. See Sections 6, 12 and 13.

SECTION 9 - Physical and chemical properties

9.1 Grade-dependent properties

ISO VG	Kin. viscosity at 40 °C, mm ² /s	Kin. viscosity at 100 °C, mm ² /s (typ.)	Viscosity index (typ.)	Flash point, COC (min.)	Pour point (max.)
15	13.5 - 16.5	3.7	140	160 °C	-36 °C
32	28.8 - 35.2	6.1	150	200 °C	-36 °C
46	41.4 - 50.6	8.0	150	210 °C	-33 °C
68	61.2 - 74.8	10.8	150	215 °C	-30 °C
100	90.0 - 110.0	14.3	145	225 °C	-27 °C

Viscosity at 40 °C is the ISO 3448 specification band and is the figure on which the aspiration classification in Section 2 is decided. The remaining figures are typical values for guidance and are not a specification; refer to the product technical data sheet for the current guaranteed limits.

9.2 Properties of the series

Physical state at 20 °C	Liquid
Appearance / colour	Clear and bright; pale to light amber

Odour	Mild characteristic hydrocarbon odour
Odour threshold	No data available
pH	Not applicable
Melting / freezing point	Not applicable
Pour point	-36 °C to -27 °C, grade dependent (see grade table above)
Initial boiling point / range	> 280 °C (estimated)
Flash point	ISO VG 15: ≥ 160 °C. ISO VG 32 to 100: ≥ 200 °C. Method: Cleveland Open Cup, ASTM D92. The lowest grade governs where a single figure is required for the series.
Evaporation rate	No data available
Flammability (solid, gas)	Not applicable - liquid
Upper / lower flammability or explosive limits	No data available
Vapour pressure	< 0.01 mmHg at 37.8 °C (100 °F)
Vapour density (air = 1)	> 1
Relative density / density at 15 °C	0.845 - 0.880 kg/l, grade dependent
Solubility	Soluble in hydrocarbons; insoluble in water
Partition coefficient n-octanol/water	No data available for the mixture
Auto-ignition temperature	No data available; > 300 °C expected
Decomposition temperature	See Sections 5 and 10
Kinematic viscosity at 40 °C	13.5 - 110.0 mm ² /s across the series; see the grade table above. This is the property which decides the aspiration classification (cut-off 20.5 mm ² /s).
Kinematic viscosity at 100 °C	3.7 - 14.3 mm ² /s (typical), grade dependent
Viscosity index	≥ 140 (high viscosity index, ISO 6743-4 type HV)
Explosive properties	Not explosive
Oxidising properties	Not oxidising
Other information - DMSO extract (mineral oil only), IP 346	< 3 % w/w
Other information - product classification	ISO 6743-4 type HV; ISO 11158 category HV; DIN 51524 Part 3 (HVL P)

SECTION 10 - Stability and reactivity

10.1 Reactivity	No dangerous reaction known under conditions of normal use.
10.2 Chemical stability	Stable product at conventional temperatures for storage, handling and use. In service, oxidative and thermal degradation is accelerated by high bulk temperature, aeration, water contamination and catalytic wear metals; maintain bulk reservoir temperature within the equipment builder's limits, normally not above 80 - 90 °C for an industrial system.
10.3 Possibility of hazardous reactions	Hazardous polymerisation will not occur. No hazardous reactions expected under normal conditions of storage and use.
10.4 Conditions to avoid	Excessive heat and prolonged exposure to high temperature, which promote oxidation, additive depletion and varnish formation. Sources of ignition, particularly in combination with a pressurised leak (see Section 5). Water contamination and continuous aeration.
10.5 Incompatible materials	Strong oxidising agents. Powerful acids. See Section 7 for incompatible fluids, elastomers and coatings.

10.6 Hazardous decomposition products	Thermal decomposition produces oxides of carbon, sulphur and phosphorus, zinc compounds and other unidentified organic compounds. Traces of hydrogen sulphide may be evolved from the breakdown of the zinc dithiophosphate anti-wear additive at high temperature. If decomposition is suspected, or if the product has been overheated, do not open the reservoir or container; discontinue heating and secure the unit. Initiate emergency procedures, taking all necessary precautions to avoid exposure to noxious or flammable gases, such as evacuation of contaminated areas and use of suitable respiratory protection.
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SECTION 11 - Toxicological information

11.1 Basis for assessment	Information given is based on data on the components and on the toxicology of similar products. Unless indicated otherwise, the data presented is representative of the product as a whole rather than for individual components.
Highly refined petroleum lubricant base oils	Mineral oil mists derived from highly refined oils are reported to have low acute and sub-acute toxicity in animals. Effects from single and short-term repeated exposures to high concentrations of mineral oil mist, well above applicable workplace exposure levels, include lung inflammatory reaction, lipoid granuloma formation and lipoid pneumonia. Acute and sub-acute studies involving exposure to lower concentrations at or near current workplace exposure levels produced no significant toxicological effects. In long-term studies (up to two years) no carcinogenic effects have been reported in any animal species tested.
Acute oral toxicity	LD50 > 5.0 g/kg (rat / rabbit). Expected to be of low acute toxicity. May cause irritation of the gastrointestinal system; symptoms may include nausea. The hazard assessment is based on evaluation of data for similar materials or product components. Based on available data, the classification criteria are not met.
Acute dermal toxicity	LD50 > 5.0 g/kg (rabbit). The hazard assessment is based on evaluation of data for similar materials or product components. Based on available data, the classification criteria are not met.
Acute inhalation toxicity	Not expected to be harmful if inhaled under normal conditions of use. Contains a petroleum-based mineral oil; may cause respiratory irritation or other pulmonary effects following prolonged or repeated inhalation of oil mist at airborne levels above the recommended exposure limit. Symptoms of respiratory irritation may include coughing and difficulty breathing. Based on available data, the classification criteria are not met. Acute toxicity estimate: not determined.
Aspiration hazard - grade dependent	NS Hydraulic HVI 15: classified Aspiration toxicity Category 1; H304 - may be fatal if swallowed and enters airways. The mixture contains more than 10 % w/w of base oil streams classified Asp. Tox. 1 and has a kinematic viscosity of 13.5 - 16.5 mm²/s at 40 °C, which does not exceed the 20.5 mm²/s cut-off in the mixture criteria. Small quantities entering the airways during ingestion or subsequent vomiting may cause chemical pneumonitis, pulmonary oedema and haemorrhage, with a delayed onset of up to several hours. NS Hydraulic HVI 32, 46, 68 and 100: based on available data, the classification criteria are not met. The kinematic viscosity of each of these grades exceeds 20.5 mm²/s at 40 °C.
Skin corrosion / irritation	Not expected to cause irritation or injury during normal industrial use, based on toxicological evaluation of this product. Prolonged or repeated skin contact may cause skin irritation including redness, burning, drying, cracking, dermatitis, oil acne and folliculitis. Based on available data, the classification criteria are not met.
Serious eye damage / eye irritation	Not expected to cause prolonged or significant irritation or injury during normal industrial use, based on toxicological evaluation of this product. Based on available data, the classification criteria are not met.
Respiratory or skin sensitisation	Based on available data, the classification criteria are not met. The mixture contains no declared skin or respiratory sensitizer at or above 0.1 % w/w.
Germ cell mutagenicity	Based on available data, the classification criteria are not met.

Carcinogenicity	Based on available data, the classification criteria are not met. See 'Additional information' below regarding used oil.
Reproductive toxicity	Based on available data, the classification criteria are not met.
STOT - single exposure	Based on available data, the classification criteria are not met.
STOT - repeated exposure	Based on available data, the classification criteria are not met.
Mechanical injury - high-pressure injection	Injection of the product into the tissues by a high-pressure system causes severe mechanical and ischaemic injury which is not a classifiable toxicological hazard class under GHS but is the most serious foreseeable consequence of handling this product in service. See Sections 2, 4 and 7.
Additional information - base oils and used oil	This product contains petroleum base oils which may be refined by various processes, including severe solvent extraction, severe hydrocracking or severe hydrotreating. None of the oils requires a cancer warning under the OSHA Hazard Communication Standard (29 CFR 1910.1200). These oils have not been listed in the National Toxicology Program (NTP) Annual Report, nor have they been classified by the International Agency for Research on Cancer (IARC) as carcinogenic to humans (Group 1), probably carcinogenic to humans (Group 2A) or possibly carcinogenic to humans (Group 2B). These oils have not been classified by the American Conference of Governmental Industrial Hygienists (ACGIH) as confirmed human carcinogen (A1), suspected human carcinogen (A2) or confirmed animal carcinogen with unknown relevance to humans (A3). Used mineral oils have been shown to cause skin cancer in mice following repeated application and continuous exposure. Brief or intermittent skin contact with used oil is not expected to have serious effects in humans if the oil is thoroughly removed by washing with soap and water.
Component data - phosphorodithioic acid, mixed O,O-bis(1,3-dimethylbutyl and iso-Pr) esters, zinc salts	Acute oral toxicity: LD50 rat 3,150 mg/kg; OECD TG 401; GLP: no. May be harmful if swallowed. Acute inhalation toxicity: LC50 rat > 2.3 mg/l, 4 h; OECD TG 403; GLP: no. No adverse effect observed; classification criteria not met. Acute dermal toxicity: LD50 rat > 2,002 mg/kg; OECD TG 402; GLP: yes. Classification criteria not met. Skin corrosion / irritation: guinea pig, 4 h; OECD TG 404. Causes skin irritation. Specific concentration limits: Skin Irrit. 3, H316 at >= 1 - < 6.25 %; Skin Irrit. 2, H315 at >= 6.25 - 100 %. Serious eye damage / eye irritation: rabbit, 504 h; method 16 CFR 1500.42. Causes serious eye damage. Specific concentration limits: Eye Irrit. 2, H319 at >= 10 - < 12.5 %; Eye Dam. 1, H318 at >= 12.5 - 100 %. Skin sensitisation: Buehler test, guinea pig; OECD TG 406. Does not cause skin sensitisation; classification criteria not met. Genotoxicity in vitro: Ames test, Salmonella typhimurium with and without metabolic activation; OECD TG 471; GLP: yes. Result: negative. Genotoxicity in vivo: micronucleus test, mouse (male and female), intraperitoneal injection; OECD TG 474; GLP: yes. Result: negative. Carcinogenicity: no data available. Reproductive toxicity: rat, male and female, oral; NOAEL 160 mg/kg; OECD TG 422; GLP: yes; read-across (analogy). Classification criteria not met. STOT single and repeated exposure: classification criteria not met. Aspiration toxicity: classification criteria not met. Note: the specific concentration limits above are the basis on which this component, present at 0 - < 0.5 % w/w, does not classify the mixture for skin or eye effects.

SECTION 12 - Ecological information

12.1 Toxicity - product	Toxicity to fish: no data is available on the product itself. Toxicity to daphnia and other aquatic invertebrates: no data is available on the product itself. Toxicity to algae: no data is available on the product itself. The product is not expected to be readily biodegradable and floats on water. Spillages may form a film on the water surface, causing physical damage to organisms and impairing oxygen transfer. The mixture is not classified as hazardous to the aquatic environment; see the aquatic summation note in Section 3.
Toxicity - component: zinc dialkyldithiophosphate / phosphorodithioic acid, mixed O,O-bis(1,3-dimethylbutyl and iso-Pr) esters, zinc salts	Fish: LL50 (Oncorhynchus mykiss, rainbow trout) 4.5 mg/l, 96 h; semi-static test; OECD TG 203; GLP: yes. Toxic to aquatic life. Aquatic invertebrates: EL50 (Daphnia magna) 23 mg/l, 48 h; static test; OECD TG 202; GLP: yes. Harmful to aquatic life. Algae: EC50 (Desmodesmus subspicatus) 21 mg/l, 72 h; static test; OECD TG 201; GLP: yes. Harmful to aquatic life. Bacteria: IC50 10,000 mg/l, 3 h; respiration inhibition test. Chronic toxicity to aquatic invertebrates: NOEC 0.4 mg/l, 21 d (Daphnia magna); OECD TG 211; GLP: yes. Toxic to aquatic life with long lasting effects.
12.2 Persistence and degradability	No data is available on the product itself. Not readily biodegradable. Component - zinc dithiophosphate: biodegradability, aerobic activated sludge, concentration 10 mg/l; biodegradation 1.5 % in 28 d; OECD TG 301B; GLP: yes. Not readily biodegradable. Stability in water (hydrolysis, OECD TG 111): 6.6 % at 50 °C after 120 h at pH 7; 0 % at 50 °C after 120 h at pH 4; 0 % at 50 °C after 120 h at pH 9.
12.3 Bioaccumulative potential	Bioconcentration factor: no data available on the product itself. Octanol/water partition coefficient: no data available on the product itself. Component - zinc dithiophosphate: log Pow 0.56; read-across (analogy). Owing to the n-octanol/water distribution coefficient, accumulation in organisms is not expected.
12.4 Mobility in soil	No data is available on the product itself. Floats on water. Component - zinc dithiophosphate: after release, adsorbs onto soil.
12.5 Results of PBT and vPvB assessment	No data is available on the product itself. The mixture contains no component considered to be persistent, bioaccumulative and toxic (PBT) or very persistent and very bioaccumulative (vPvB) at or above 0.1 % w/w.
12.6 Other adverse effects	A release of hydraulic fluid to surface water forms a visible film and may be reportable irrespective of the GHS classification - see Section 15 (Clean Water Act). Used fluid may additionally contain wear metals and degradation products and is to be assessed as a waste, not as the virgin product.

SECTION 13 - Disposal considerations

13.1 Waste treatment methods - product	Do not discharge into the sewerage system, surface water or the natural environment. Waste product may be disposed of in a suitable incinerator or recovered for re-refining, provided that national and local legislation is complied with. Recovery should be carried out by a licensed specialist waste contractor. Used hydraulic oil is a controlled / toxic industrial waste in most jurisdictions, including Singapore, and must be collected by a licensed toxic industrial waste collector and tracked accordingly. Do not mix used oil with solvents, brake fluids, coolants, chlorinated materials or water, as this may render an otherwise recyclable oil unsuitable for re-refining and may reclassify the waste.
Contaminated packaging	Empty containers retain product residue. Drain thoroughly, close properly and return to a drum reconditioner or dispose of through an approved contractor. Do not cut, weld, drill or apply heat to empty containers (see Section 7).
Used filters and absorbents	Spent filter elements, absorbent pads and oily rags retain oil and are to be drained, bagged and disposed of as oil-contaminated waste through an approved contractor. Oily rags present a spontaneous heating risk if stored in a heap; keep in a closed metal container pending disposal.

SECTION 14 - Transport information

General	Not classified as a dangerous good for transport, for any grade in this series. The description shown may not apply to all shipping situations. Consult the applicable dangerous goods regulations for additional description requirements (e.g. technical name) and for mode-specific or quantity-specific shipping requirements.
Note on the ISO VG 15 grade	The Asp. Tox. 1; H304 classification assigned to NS Hydraulic HVI 15 in Section 2 is a supply and use classification only. Aspiration toxicity is not a transport hazard class under the UN Model Regulations, and the grade is not environmentally hazardous, so no UN number, class, packing group or marine pollutant marking arises. Supply labelling under SS 586-3 is nevertheless required for that grade.
14.1 UN number	Not applicable
14.2 UN proper shipping name	Hydraulic oil (not regulated)
14.3 Transport hazard class(es)	Not applicable
14.4 Packing group	Not applicable
14.5 Environmental hazards	Not classified as a marine pollutant under the IMDG Code. Not classified as environmentally hazardous for land transport.
14.6 Special precautions for user	Not dangerous cargo. Keep separate from foodstuffs. Handle in accordance with Sections 6, 7 and 8.
Modal information	Sea (IMO / IMDG): hydraulic oil; not regulated as dangerous goods under the IMDG Code. Air (ICAO / IATA): hydraulic oil; not regulated as dangerous goods under the ICAO Technical Instructions or the IATA DGR. Road / rail: not regulated. United States (DOT): hydraulic oil; not regulated as a hazardous material for transportation under 49 CFR.
14.7 Transport in bulk according to Annex II of MARPOL 73/78 and the IBC Code	Not applicable. Carriage of this product in bulk as cargo would fall under MARPOL Annex I (oil).

SECTION 15 - Regulatory information

15.1 Safety, health and environmental regulations specific to the product	Singapore: - Workplace Safety and Health Act and subsidiary regulations, including the Workplace Safety and Health (General Provisions) Regulations - permissible exposure levels for mineral oil mist apply (Section 8). - Classification and labelling in accordance with SS 586-2 and SS 586-3. NS Hydraulic HVI 15 requires a GHS supply label (GHS08, DANGER, H304); the remaining grades do not. - Fire Safety Act and Fire Safety (Petroleum and Flammable Materials) Regulations: not applicable; the product is not a petroleum or flammable material as defined. - Environmental Protection and Management Act and Environmental Protection and Management (Hazardous Substances) Regulations: not applicable to the product. Used oil is a toxic industrial waste under the Environmental Public Health (Toxic Industrial Waste) Regulations and must be consigned to a licensed collector. International: - MARPOL 73/78 Annex I (oil) applies to discharge and to disposal of used oil from shipboard systems. - IMO IBC Code: not applicable.
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Chemical inventory status	TSCA (United States): this product and/or its components are listed on the Toxic Substances Control Act inventory. Australia (AIC): all components are in compliance with chemical notification requirements in Australia. Canada (DSL/NDL): all substances contained in this product are in compliance with the Canadian Environmental Protection Act and are present on the Domestic Substances List or are exempted. China (IECSC): all components of this product are listed on the Inventory of Existing Chemical Substances in China. Japan (ENCS): all components are in compliance with the Chemical Substances Control Law of Japan. Republic of Korea (KECL): all components are in compliance in Korea. New Zealand (NZIoC): all components are in compliance with chemical notification requirements in New Zealand. Philippines (PICCS): all components are in compliance with the Philippines Toxic Substances and Hazardous and Nuclear Wastes Control Act of 1990 (R.A. 6969). Taiwan (TSCA): all components of this product are listed on the Taiwan inventory.
Other national provisions	United States - Clean Water Act (CWA): this material is classified as an oil under Section 311 of the CWA and the Oil Pollution Act of 1990 (OPA). Discharges or spills which produce a visible sheen on waters of the United States, their adjoining shorelines, or into conduits leading to surface waters, must be reported to the EPA National Response Center at (800) 424-8802. United States - OSHA: the product is regarded as hazardous under the OSHA Hazard Communication Standard, 29 CFR 1910.1200, because an occupational exposure limit exists for mineral oil mist. Under the US GHS-aligned HazCom criteria the ISO VG 15 grade is additionally classified for aspiration toxicity. Ozone-depleting substances (40 CFR 82, Clean Air Act): this material does not contain, nor was it directly manufactured with, any Class I or Class II ozone-depleting substances.
15.2 Chemical safety assessment	No chemical safety assessment has been carried out for this mixture.

SECTION 16 - Other information

Revision date	12 September 2026
Revision number	Rev. 0
Reason(s) for revision	First issue by Energy Spring Pte Ltd.
Performance level	ISO 6743-4 type HV; ISO 11158 category HV; DIN 51524 Part 3 (HVL). Performance claims are commercial statements and form no part of the hazard classification. Refer to the product technical data sheet for the full specification.
Reference(s)	Singapore Standard SS 586-2:2022 and SS 586-3:2022 (Hazard communication for hazardous chemicals and dangerous goods). ISO 3448 (viscosity classification), ISO 6743-4 and ISO 11158 (hydraulic fluid classification and specification), DIN 51524 Part 3. Data supplied by the manufacturer of the product.
Recommended uses and restrictions on use	See Section 1.
Full text of hazard statements referred to in Sections 2 and 3	H304: May be fatal if swallowed and enters airways. H315: Causes skin irritation. H316: Causes mild skin irritation. H318: Causes serious eye damage. H319: Causes serious eye irritation. H401: Toxic to aquatic life. H411: Toxic to aquatic life with long lasting effects. H412: Harmful to aquatic life with long lasting effects.

Abbreviations and acronyms	ACGIH - American Conference of Governmental Industrial Hygienists; Asp. Tox. - aspiration toxicity; CAS - Chemical Abstracts Service; COC - Cleveland Open Cup; DMSO - dimethyl sulphoxide; EC50 / EL50 - effect concentration / loading 50 %; EPDM - ethylene propylene diene monomer rubber; FKM - fluorocarbon elastomer; GHS - Globally Harmonized System; GLP - good laboratory practice; HFC / HFD - water-glycol and synthetic fire-resistant hydraulic fluids; HNBR - hydrogenated nitrile rubber; HV - high viscosity index anti-wear hydraulic oil (ISO 6743-4); HVLP - high viscosity index anti-wear hydraulic oil (DIN 51524-3); IARC - International Agency for Research on Cancer; IBC - International Bulk Chemical Code; IC50 - inhibitory concentration 50 %; IMDG - International Maritime Dangerous Goods; ISO VG - ISO viscosity grade; LC50 / LD50 / LL50 - lethal concentration / dose / loading 50 %; NBR - nitrile rubber; NOAEL - no observed adverse effect level; NOEC - no observed effect concentration; OECD TG - Organisation for Economic Co-operation and Development Test Guideline; PBT - persistent, bioaccumulative and toxic; PEL - permissible exposure level; SBR - styrene butadiene rubber; Skin Irrit. - skin irritation; STEL - short-term exposure limit; STOT RE - specific target organ toxicity, repeated exposure; TWA - time-weighted average; VI - viscosity index; vPvB - very persistent and very bioaccumulative; ZDDP - zinc dialkyldithiophosphate.
Note on the scope of this data sheet	This data sheet covers ISO VG 15, 32, 46, 68 and 100 only. It must not be used for any other viscosity grade of this product. An ISO VG 22 grade, if introduced, would fall across the 20.5 mm ² /s aspiration cut-off and would require a separate assessment; an ISO VG 10 grade would be classified Asp. Tox. 1; H304 in the same way as the ISO VG 15 grade.

This dossier supplements the technical notifications for use, but does not replace them. The information which it contains is based on our knowledge relating to the product in question on the date indicated.

The information is given in good faith. The user's attention is also drawn to the possible risks incurred if a product is employed for uses other than those for which it was designed.

This information dossier does not, under any circumstances, discharge the user from the obligation of being aware of, and of applying, all the texts which govern his sphere of activity. He shall be solely responsible for taking the precautions associated with the use which he makes of the product.

All the statutory provisions referred to are intended simply to assist the recipient in fulfilling the obligations incumbent upon him. This enumeration must not be considered to be exhaustive. The recipient must ensure that no other obligations are incumbent upon him, as a result of texts other than those cited, relating to the holding and handling of the product, for which he alone is responsible.

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