

SAFETY DATA SHEET

ENERGY SPRING NS Gear Series — Industrial EP Gear 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 Gear 68, NS Gear 100, NS Gear 150, NS Gear 220, NS Gear 320, NS Gear 460, NS Gear 680
Product family	Lead-free sulphur-phosphorus extreme-pressure (EP) industrial gear oils of type CLP to DIN 51517-3, meeting ISO 12925-1 category CKD and AGMA 9005-F16 EP. All seven viscosity grades share the same base oil and additive chemistry, carry the same GHS classification and are therefore covered by a single safety data sheet. The grades differ only in the physical properties tabulated in Section 9.
Grade(s)	ISO VG 68, 100, 150, 220, 320, 460 and 680. 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	Extreme-pressure lubricant for enclosed industrial gear drives - spur, helical, bevel, spiral bevel, herringbone and planetary - lubricated by splash, bath or circulation, and operating under heavy, high peak or intermittent shock loading. Applications include marine machinery, mining, steel, cement, paper and general plant service. Also suitable for heavily loaded plain and rolling element bearings. Select the viscosity grade according to the gear or bearing manufacturer's requirement and the expected operating temperature and speed. Industrial / professional use only.
Uses advised against	Worm gears and any gear set or bearing containing bronze, brass or other yellow-metal components. The sulphur-phosphorus EP additive system is chemically active towards yellow metals, particularly at elevated temperature, and can cause staining and corrosive attack. Where a yellow-metal-safe oil is required, an ISO 12925-1 CKC or compounded worm gear oil is the correct product. Not for use as an engine oil, hydraulic fluid, turbine oil, automotive gear or axle 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). Any use other than that stated above is advised against.
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	AGMA 9005-F16 EP grade	Kin. viscosity at 40 °C, mm ² /s (ISO 3448)
NS Gear 68	68	2 EP	61.2 - 74.8
NS Gear 100	100	3 EP	90.0 - 110.0
NS Gear 150	150	4 EP	135 - 165
NS Gear 220	220	5 EP	198 - 242
NS Gear 320	320	6 EP	288 - 352
NS Gear 460	460	7 EP	414 - 506
NS Gear 680	680	8 EP	612 - 748

SECTION 2 - Hazards identification

2.1 Classification of the substance or mixture	GHS classification (SS 586-2 / SS 586-3), all grades: Skin sensitisation, Category 1 - H317 Hazardous to the aquatic environment, long-term (chronic), Category 3 - H412 Physical hazards: not classified. The classification has been determined from the composition in Section 3 by the summation and generic cut-off methods. See the concentration limits below.
Basis of the classification	H317 - skin sensitisation. The sulphurised olefin (olefin polysulphide) declared in Section 3 is classified Skin Sens. 1B; H317 and is specified at up to 3 % w/w, above the 1.0 % generic concentration limit for a Category 1 or 1B skin sensitizer in a mixture. H412 - chronic aquatic hazard. Derived by the summation method of SS 586-2. Taking the long chain alkyl amine as Aquatic Chronic 1 (M = 1) at up to 0.99 % w/w and the sulphurised olefin as Aquatic Chronic 2 at up to 3 % w/w: - Chronic 1: sum of (M x Chronic 1) = 0.99 %, against a 25 % threshold. Not met. - Chronic 2: (10 x 0.99) + 3 = 12.9 %, against a 25 % threshold. Not met. - Chronic 3: (100 x 0.99) + (10 x 3) = 129 %, against a 25 % threshold. Met. The mixture is therefore Aquatic Chronic 3; H412. No ecotoxicity testing has been carried out on the finished mixture; where such data is obtained it takes precedence over the summation method and this classification is to be reviewed. Hazard classes considered and not met: - Aspiration toxicity. The base oil streams are themselves classified Asp. Tox. 1; H304 and are present above 10 % w/w, but the kinematic viscosity of every grade in this series is at least 61.2 mm²/s at 40 °C, far above the 20.5 mm²/s cut-off. No grade is classified for aspiration. - Skin and eye irritation. The long chain alkyl amine carries Skin Irrit. 2; H315 and Eye Dam. 1; H318, but is present below 1.0 % w/w, against generic limits of 10 % for Skin Irrit. 2 and 1 % for Eye Irrit. 2. Not met - but by a narrow margin; see the concentration limits below. - Carcinogenicity. The mineral base oils contain less than 3 % DMSO extract by IP 346. Not classified. - Acute toxicity, germ cell mutagenicity, reproductive toxicity, STOT (single or repeated exposure), and all physical hazard classes: criteria not met.

2.2 Label elements



GHS07
Exclamation mark

Applies to	All grades: ISO VG 68, 100, 150, 220, 320, 460 and 680.
Signal word	WARNING
Hazard statements	H317: May cause an allergic skin reaction. H412: Harmful to aquatic life with long lasting effects.
Supplemental information	Contains sulphurised olefin (olefin polysulphide) and long chain alkyl amine. Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin, resulting in disorders such as oil acne or folliculitis. Used oil may contain harmful impurities. Not classified as flammable, but will burn.
Precautionary statements	Prevention: P261: Avoid breathing mist, vapours or spray. P272: Contaminated work clothing should not be allowed out of the workplace. P273: Avoid release to the environment. P280: Wear protective gloves, protective clothing and eye / face protection. Response: P302 + P352: IF ON SKIN: Wash with plenty of water and soap. P321: Specific treatment - see the first aid instructions in Section 4. P333 + P313: If skin irritation or rash occurs: Get medical advice / attention. P362 + P364: Take off contaminated clothing and wash it before reuse. Disposal: P501: Dispose of contents and container to an approved waste disposal plant, in accordance with local regulations.

Concentration limits on which this classification depends	Skin sensitisation. H317 derives from the sulphurised olefin, specified at up to 3 % w/w against a 1.0 % generic concentration limit. The classification and label above apply to product in which that component is present at 1.0 % w/w or more. Product supplied to a specification holding it below 1.0 % w/w is not classified as a skin sensitiser and carries H412 alone, with no pictogram and no signal word. Eye irritation. The long chain alkyl amine carries Eye Dam. 1; H318 and is specified below 1.0 % w/w, beneath the 1 % generic limit at which Eye Irrit. 2; H319 would be added and the 3 % limit at which Eye Dam. 1; H318 would apply with the GHS05 pictogram and the signal word DANGER.
Effect on transport classification	An Aquatic Chronic 3 (H412) classification does not meet the criteria for UN 3082, environmentally hazardous substance, liquid, n.o.s., which requires Aquatic Acute 1 or Aquatic Chronic 1 or 2. The product is therefore not a marine pollutant. Were the alkyl amine content to rise to 2.5 % w/w, or the sulphurised olefin to 25 %, the mixture would become Aquatic Chronic 2; H411 and would have to be shipped as UN 3082. Neither is a realistic outcome within this specification, but Section 14 is to be reviewed if the formulation changes.
2.3 Other hazards - yellow metal attack	Not a GHS hazard class, but the principal misapplication risk for this product. The sulphur-phosphorus EP system is chemically active towards bronze, brass and other yellow metals at elevated temperature and can cause staining and corrosive attack. Do not use in worm gears or in any gear set or bearing containing yellow-metal components. See 'Uses advised against' in Section 1.

Hydrogen sulphide from overheated product	The sulphurised additive system can release hydrogen sulphide (H₂S) if the product is overheated, and H₂S may accumulate in the headspace of heated bulk storage tanks. Hydrogen sulphide is acutely toxic, heavier than air, and rapidly deadens the sense of smell, so odour is not a reliable warning. Do not heat above 65 °C in storage, and avoid contact between the product and water in heated storage. Treat the headspace of any heated tank containing this product as a potential confined space with a toxic atmosphere: test the atmosphere and apply a confined space entry permit before entry. In service, maintain bulk oil temperature within the gear unit maker's limits, normally not above 90 - 100 °C.
Hot material	Circulating gear oil is hot in service. Reservoirs, coolers, filter housings, sight glasses and return lines may be hot enough to cause thermal burns. Depressurise, isolate and allow the oil to cool before breaking any connection on a circulation system.
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 leaking pressurised circulation line 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 circulation lines away from hot surfaces and ignition sources.
Skin effects	The mixture is a skin sensitiser: repeated contact may cause an allergic skin reaction in susceptible individuals, which may be delayed by 24 to 72 hours after exposure. Prolonged or repeated contact with the fresh product may also cause defatting of the skin, leading to dryness, redness or dermatitis.
Used oil	During service the oil 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 leaking pressurised lines and by return lines discharging above the oil level in the reservoir.
Odour	The product has a distinctive sulphurous odour derived from the EP additive system. The odour is characteristic of the product and is not in itself an indication of decomposition, but a marked increase in sulphurous odour from a heated system should be investigated - see the hydrogen sulphide note above.
Slip hazard	Spillages produce slippery surfaces; clean up immediately.
PBT / vPvB	This mixture contains no substance considered to be persistent, bioaccumulative and toxic (PBT) at >= 0.1 %, nor very persistent and very bioaccumulative (vPvB) at >= 0.1 %.

SECTION 3 - Composition / information on ingredients

Component	CAS number	Approx. % w/w	GHS classification
Highly refined mineral base stocks*	See note *	90 - 97	Asp. Tox. 1; H304 (does not carry over to the mixture - see note below)
Olefin polysulphide (sulphurised olefin)	Proprietary	0 - 3	Skin Sens. 1B; H317 Aquatic Chronic 2; H411
Long chain alkyl amine	Proprietary	0 - < 1.0	Skin Irrit. 2; H315 Eye Dam. 1; H318 Aquatic Acute 1; H400 Aquatic Chronic 1; H410

• Substance / mixture: Mixture. Chemical nature: highly refined mineral oils with a lead-free sulphur-phosphorus extreme-pressure additive system, together with antioxidant, anti-rust, demulsifier and anti-foam components.

• * The base stock component may consist of one or more of the following CAS numbers: 64742-65-0, 68649-12-7, 68037-01-4, 64742-55-8, 64742-54-7.

• The highly refined mineral oil contains less than 3 % (w/w) DMSO extract when tested by IP 346. On that basis, and in accordance with Regulation (EC) 1272/2008 Annex VI Part 3 Note L, no carcinogen classification applies. The aspiration toxicity classification of the individual base oil streams does not carry over to the finished mixture, whose kinematic viscosity is at least 61.2 mm²/s at 40 °C in every grade, well above the 20.5 mm²/s cut-off.

- The classifications shown for the olefin polysulphide and the long chain alkyl amine are those assigned to additive components of these types by their suppliers, and the classification of the mixture in Section 2 is derived from them.
- The olefin polysulphide content is specified at up to 3 % w/w, a range which straddles the 1.0 % generic concentration limit for a skin sensitiser. Whether the product carries H317 with the GHS07 pictogram, as classified here, or H412 alone with no pictogram, depends on this figure. See the concentration limits in Section 2.
- The long chain alkyl amine content is specified below 1.0 % w/w, immediately beneath the 1 % generic concentration limit at which an Eye Irrit. 2 classification would be triggered. See the concentration limits in Section 2.
- Concentrations shown as a range beginning at zero indicate that the component may be absent from a given blend; ranges are given to protect confidentiality or reflect batch-to-batch variation. Where a range straddles a classification cut-off, the classification in Section 2 has been assigned on the basis of the worst case.
- 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	Remove clothing soiled by the product without delay. Move affected persons into fresh air. 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.
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. If exposure to hydrogen sulphide is suspected - for example following work on a heated bulk tank - treat as a medical emergency and do not enter the space to effect a rescue without self-contained breathing apparatus.
Skin contact	Remove contaminated clothing and shoes. Wash the affected area immediately with plenty of soap and water and rinse thoroughly. Do not use solvents or thinners. If skin irritation or a rash occurs, obtain medical advice: the product is a skin sensitiser and further exposure should be prevented. 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. High-pressure injection injury: fluid escaping from a pressurised circulation line can penetrate the skin. Obtain medical attention immediately. Injuries may appear trivial at first but require urgent surgical treatment.
Eye contact	Remove contact lenses if worn and easy to do. Rinse the eyes immediately with plenty of clean water for at least 15 minutes, alternately lifting the upper and lower eyelids. Avoid a strong water jet, because of the risk of corneal damage. Obtain medical advice if irritation persists.
Ingestion	Do not induce vomiting. If the person is conscious, rinse the mouth with water and then give plenty of water to drink. Never give anything by mouth to an unconscious person. Take the casualty to hospital as soon as possible and show this safety data sheet.
4.2 Most important symptoms and effects, both acute and delayed	Skin: allergic skin reaction (redness, itching, rash, eczema), which may be delayed by 24 to 72 hours after contact; dryness or dermatitis after prolonged contact; thermal burns from hot product. Eyes: discomfort or 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. Hydrogen sulphide exposure: headache, dizziness, nausea, loss of consciousness, respiratory arrest.

4.3 Indication of any immediate medical attention and special treatment needed	Treat symptomatically. An allergic skin reaction may require dermatological assessment and permanent removal of the worker from exposure. Aspiration of liquid into the lungs, although not a classified hazard for these viscosity grades, may cause chemical pneumonitis and should be managed accordingly if it occurs. No specific antidote is required. Note to physician - high-pressure injection: injection of oil through the skin causes rapid swelling, ischaemia and tissue necrosis, and is a surgical emergency requiring prompt decompression, debridement and irrigation regardless of how minor the entry wound appears.
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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 the fire.
5.2 Special hazards arising from the substance or mixture	This product is a combustible liquid with a high flash point (see Section 9); it does not readily ignite but will burn once heated above its flash point. A fine mist or spray released under pressure can ignite well below the flash point. Combustion or thermal decomposition produces a complex mixture of airborne solids, liquids and gases, highly dependent on combustion conditions, including carbon monoxide, carbon dioxide, sulphur dioxide, hydrogen sulphide, oxides of phosphorus and nitrogen, and unidentified organic compounds. Sulphur dioxide and hydrogen sulphide are both acutely toxic; positive-pressure breathing apparatus is essential. 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. Collect contaminated fire-fighting water separately; it must not enter the sewage system or any watercourse. See Section 7 for proper handling and storage.

SECTION 6 - Accidental release measures

6.1 Personal precautions, protective equipment and emergency procedures	Ensure adequate ventilation. Avoid contact with skin and eyes and avoid breathing any mist. Wear gloves, goggles and protective clothing (see Section 8); the product is a skin sensitiser and contact is to be prevented rather than merely limited. Keep unprotected and non-essential persons away. Remove all sources of ignition. Beware of hot product and of slippery surfaces and floors. Emergency responders: protective clothing, chemical-resistant gloves, goggles and a respiratory device with a type A filter, or self-contained breathing apparatus where hydrogen sulphide may be present following a release of hot product.
6.2 Environmental precautions	Prevent the product from entering drains, sewers, soil, surface water or groundwater; the mixture is classified as harmful to aquatic life with long lasting effects. Prevent spreading by damming in or with oil barriers. 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, diatomite, sawdust, silica gel 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. Marine spillage: apply the vessel's Shipboard Oil Pollution Emergency Plan (SOPEP) and report in accordance with MARPOL Annex I requirements.
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	Avoid all personal contact with the product: the mixture is a skin sensitiser, and once a worker is sensitised even very low exposures may provoke a reaction. Do not get in eyes, on skin or on clothing. Do not breathe mist or vapour. Do not eat, drink or smoke in areas where the product is handled. Wash hands thoroughly after handling. Wash contaminated clothing before reuse and do not allow it out of the workplace. Ensure adequate ventilation where there is any risk of vapours, mists or aerosols forming. Handle in closed systems where practicable. Do not heat above 65 °C in storage, in order to minimise possible release of toxic hydrogen sulphide from the sulphurised additive system. Avoid contact between the product and water in heated storage. Treat the headspace of a heated bulk tank as a potential confined space with a toxic atmosphere. Avoid the accumulation of static electricity; provide earthing and bonding. Review all operations which have the potential to generate and accumulate an electrostatic charge and/or a flammable atmosphere - including tank and container filling, splash filling, tank cleaning, sampling, gauging, switch loading, filtering, mixing, agitation and vacuum truck operations - and apply appropriate mitigating procedures. Take care when sampling from gearbox drain points and circulation systems, where the product may be hot and under pressure.
7.2 Conditions for safe storage, including any incompatibilities	Store in a cool, dry, well-ventilated area in well-sealed containers, away from sources of heat, ignition and direct sunlight, and away from oxidising agents and strong acids (see Section 10). Store away from foodstuffs. Keep out of the reach of children. Keep containers tightly closed and correctly labelled with the full GHS label. Prevent any seepage into the ground. Use only receptacles, joints, pipes and fittings which are resistant to hydrocarbons. Do not use copper, brass, bronze or galvanised pipework, fittings or storage vessels; the EP additive system attacks yellow metals and zinc coatings. Carbon steel and stainless steel are suitable. Recommended storage temperature: 0 °C to 45 °C. Water contamination is to be avoided, both because it degrades EP and demulsibility performance and because water in heated storage promotes hydrogen sulphide release. 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.
7.3 Specific end use(s)	Lubrication of enclosed industrial gear drives and heavily loaded bearings requiring an EP oil of type DIN 51517-3 CLP or ISO 12925-1 CKD. Select the viscosity grade according to the gear unit maker's requirement. Refer to the product technical data sheet. Do not use in worm gears or yellow-metal gear sets - see Section 1.

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)
Hydrogen sulphide (H ₂ S)*	Singapore PEL (WSH Regulations)	10 ppm	15 ppm (STEL)
Hydrogen sulphide (H ₂ S)*	ACGIH TLV	1 ppm	5 ppm (STEL)

8.1 Control parameters - note	* Hydrogen sulphide is not a component of the product. The limits are given because H₂S may be released from the sulphurised additive system if the product is overheated and may accumulate in the headspace of heated bulk storage (see Sections 2, 7 and 10). They apply to the tank atmosphere, not to the liquid product. Note that the Singapore permissible exposure level for hydrogen sulphide is ten times the ACGIH threshold limit value; where a company standard is applied across sites, the lower figure is the prudent basis for alarm set points. Limits and standards are shown for guidance only. Follow applicable national regulations. No occupational exposure limit has been established for the sulphurised olefin or the alkyl amine; exposure should be minimised as far as reasonably practicable, as is appropriate for a skin sensitiser. 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. Because the mixture is a skin sensitiser, the control strategy should be elimination or minimisation of contact rather than reliance on personal protective equipment alone: use closed transfer systems, fixed pipework and quick-release couplings where practicable. A worker who has become sensitised may react at exposures well below those tolerated by others and will normally have to be removed from exposure altogether. For circulation 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, 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. Insulate or guard hot surfaces and hot oil lines. Provide fixed or portable H₂S monitoring where heated bulk storage is used.
Respiratory protection	Not normally required where ventilation is adequate. Where the oil mist concentration may exceed the exposure limit, wear an approved respirator fitted with an organic vapour / particulate filter (type A-P2). Use air-supplied or self-contained breathing apparatus where hydrogen sulphide may be present, or for entry into tanks and confined spaces. A filtering respirator is not adequate protection against H₂S.
Hand protection	Impermeable hydrocarbon-resistant gloves conforming to EN ISO 374. Suitable materials include nitrile rubber, 4H (PE/EVAL), Viton and Silver Shield. Breakthrough time to be confirmed with the glove supplier; determined penetration times under EN 16523-1 are not measured under practical conditions, so a maximum wearing time of 50 % of the penetration time is recommended. Use heat-resistant gloves when handling hot product. Replace gloves immediately if damaged or contaminated internally - this is critical for a sensitising product. Do not reuse single-use gloves.
Eye protection	Safety glasses with side shields to EN 166 as a minimum. Wear chemical goggles or a face shield where splashing of hot product, emission of mist, or release from a pressurised circuit is possible.
Skin and body protection	Oil-resistant protective clothing which prevents skin contact, and safety footwear. Wear an apron and sleeve protection for sampling, draining and filter changes. Store protective clothing separately from personal clothing. Avoid keeping oil-soaked rags or clothing in pockets.

Hygiene measures	Avoid prolonged and repeated contact with skin, particularly with used oil. Remove soiled and contaminated clothing immediately. Wash hands with soap and water before breaks, before eating, drinking or smoking, and at the end of work. Use a suitable skin cream after washing. Do not use solvents, petrol or abrasive cleaners to remove oil from the skin. Keep the product away from foodstuffs, beverages and feed.
Environmental exposure controls	Avoid release to the environment. Prevent discharge to drains, surface water, groundwater and soil. Bund bulk storage. 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 (ISO 3448)	Kin. viscosity at 100 °C, mm ² /s (typ.)	Viscosity index (typ.)	Density at 15 °C, g/cm ³ (typ.)	Flash point, COC (typ.)	Pour point (typ.)
68	61.2 - 74.8	8.7	100	0.882	230 °C	-24 °C
100	90.0 - 110.0	11.0	98	0.886	228 °C	-21 °C
150	135 - 165	14.6	96	0.888	240 °C	-24 °C
220	198 - 242	18.9	96	0.889	245 °C	-21 °C
320	288 - 352	23.9	96	0.896	242 °C	-15 °C
460	414 - 506	30.4	95	0.895	260 °C	-14 °C
680	612 - 748	38.5	93	0.904	285 °C	-9 °C

Viscosity at 40 °C is the ISO 3448 specification band and is the figure on which the aspiration assessment 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. Test methods: ASTM D445 (viscosity), ASTM D2270 (viscosity index), ASTM D4052 (density), ASTM D92 (flash point, Cleveland open cup), ASTM D97 (pour point).

Figures for ISO VG 100 and ISO VG 320 are indicative. None of the figures in this table affects the classification in Section 2, which turns on the kinematic viscosity at 40 °C only.

9.2 Properties of the series

Physical state at 20 °C	Liquid
Appearance / colour	Clear and bright; amber, darkening with increasing grade
Odour	Distinctive sulphurous hydrocarbon odour
Odour threshold	No data available
pH	Not applicable
Melting / freezing point	Not applicable
Pour point	-24 °C to -9 °C, grade dependent (see the grade table above; ASTM D97)
Initial boiling point / range	> 300 °C (estimated)
Flash point	>= 220 °C (Cleveland open cup, ASTM D92) across the series. Typical values run from 230 °C (ISO VG 68) to 285 °C (ISO VG 680); see the grade table above. The lowest grade governs where a single figure is required for the series.
Evaporation rate	No data available
Flammability (solid, gas)	Not applicable - liquid
Flammability (liquids)	Not classified as flammable, but will burn
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	0.882 - 0.904 g/cm ³ , grade dependent (ASTM D4052)
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	61.2 - 748 mm ² /s across the series; see the grade table above. This is the property which decides the aspiration assessment (cut-off 20.5 mm ² /s); every grade is well above it.
Kinematic viscosity at 100 °C	8.7 - 38.5 mm ² /s (typical), grade dependent
Viscosity index	93 - 100 (typical), grade dependent
Explosive properties	Not explosive
Oxidising properties	Not oxidising
Conductivity	Not expected to be a static accumulator
Other information - DMSO extract (mineral oil only), IP 346	< 3 % w/w
Other information - FZG gear test, A/8.3/90, DIN 51354-2	Failure load stage ≥ 12 (all grades)
Other information - rust prevention, ASTM D665 A	Pass
Other information - copper corrosion, ASTM D130	1b
Other information - product classification	DIN 51517-3 (CLP); ISO 12925-1 category CKD; AGMA 9005-F16 EP; ISO 6743-6 CKC / CKD

SECTION 10 - Stability and reactivity

10.1 Reactivity	No dangerous reaction known under conditions of normal use. The sulphur-phosphorus additive system is by design chemically reactive at the loaded contact, and is reactive towards yellow metals more generally - see 10.5.
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 oil temperature within the gear unit maker's limits, normally not above 90 - 100 °C.
10.3 Possibility of hazardous reactions	Hazardous polymerisation will not occur. No hazardous reactions expected under normal conditions of storage and use. Overheating of the sulphurised additive system can release hydrogen sulphide; see 10.6.
10.4 Conditions to avoid	Heat, sparks, naked flame and other sources of ignition. Do not heat above 65 °C in storage. Heating in the presence of water, which promotes release of hydrogen sulphide. Prolonged exposure to high temperatures, which promotes oxidation and thermal decomposition. Release of the product as a fine spray or mist near a hot surface or ignition source.
10.5 Incompatible materials	Strong oxidising agents and strong acids. Copper, brass, bronze and other yellow metals, and zinc or galvanised surfaces: the EP additive system is chemically active towards these materials, particularly at elevated temperature, and can cause staining and corrosive attack. Use carbon or stainless steel pipework, fittings and vessels. Do not use in worm gears or yellow-metal gear sets - see Section 1.
10.6 Hazardous decomposition products	Hydrogen sulphide, which may accumulate in the headspace of heated bulk storage. Thermal decomposition also produces sulphur dioxide, oxides of phosphorus and nitrogen, carbon monoxide, carbon dioxide and other unidentified organic compounds. If decomposition is suspected, or if the product has been overheated, do not open the 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.

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. No toxicological testing has been carried out on the finished mixture.
Exposure routes	Skin and eye contact are the primary routes of exposure, although exposure may occur by inhalation of oil mist or following accidental ingestion.
Acute oral toxicity	LD50 rat / rabbit > 5,000 mg/kg. Low toxicity. Based on available data, the classification criteria are not met. Ingestion may result in nausea, vomiting or diarrhoea and irritation of the gastrointestinal tract.
Acute dermal toxicity	LD50 rabbit > 5,000 mg/kg. Low toxicity. Based on available data, the classification criteria are not met.
Acute inhalation toxicity	Based on available data, the classification criteria are not met. Inhalation of oil mist above the exposure limit in Section 8 may cause respiratory irritation; symptoms may include coughing and difficulty breathing. Hydrogen sulphide, which may be released from overheated product, is acutely toxic by inhalation and is assessed separately in Sections 2, 7, 8 and 10. The figures in this section relate to the liquid product.
Skin corrosion / irritation	Slightly irritating to skin. Prolonged or repeated contact may cause defatting, leading to dryness, redness, cracking or dermatitis. Prolonged or repeated skin contact without proper cleaning can clog the pores of the skin, resulting in disorders such as oil acne or folliculitis. Based on available data, the classification criteria for the mixture are not met: the long chain alkyl amine (Skin Irrit. 2) is present below 1 % w/w against a 10 % generic limit.
Serious eye damage / eye irritation	Slightly irritating to the eye. Based on available data, the classification criteria are not met - by a narrow margin. The long chain alkyl amine carries Eye Dam. 1; H318 and is specified below 1.0 % w/w, immediately beneath the 1 % generic limit at which Eye Irrit. 2; H319 would apply. See the concentration limits in Section 2.
Respiratory or skin sensitisation	CLASSIFIED: Skin sensitisation Category 1 - H317, may cause an allergic skin reaction. The classification derives from the olefin polysulphide (sulphurised olefin, Skin Sens. 1B) declared in Section 3, present above the 1.0 % generic concentration limit. Signs and symptoms may include itching, redness, rash and eczema, and may be delayed by 24 to 72 hours after exposure. Once a worker is sensitised, subsequent reactions may be provoked by very low exposures. Respiratory sensitisation: based on available data, the classification criteria are not met.
Germ cell mutagenicity	Non-mutagenic. Based on available data, the classification criteria are not met.
Carcinogenicity	Not a carcinogen. Based on available data, the classification criteria are not met. The mineral base oils are highly refined and contain less than 3 % DMSO extract by IP 346; on that basis no carcinogen classification applies (Note L). The base oils have not been listed in the National Toxicology Program (NTP) Annual Report, nor classified by IARC as Group 1, 2A or 2B, nor by ACGIH as A1, A2 or A3. See the note on used oil below, which addresses a different question.
Reproductive toxicity	Based on available data, the classification criteria are not met. No component is classified as a reproductive toxicant at a concentration above its generic concentration limit.
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. 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 concentrations of mineral oil mist well above applicable workplace exposure levels include lung inflammatory reaction, lipoid granuloma formation and lipoid pneumonia. Exposures at or near current workplace exposure levels produced no significant toxicological effects, and long-term studies of up to two years reported no carcinogenic effects in any animal species tested.

Aspiration hazard	Not classified. The kinematic viscosity of every grade in this series is at least 61.2 mm ² /s at 40 °C, well above the 20.5 mm ² /s cut-off, so the aspiration classification of the base oil streams does not carry over to the mixture. Ingestion of a large quantity followed by vomiting could nonetheless result in aspiration and chemical pneumonitis; do not induce vomiting.
Other information	The product is not expected to present a significant hazard under anticipated conditions of normal use provided that skin contact is prevented, and additional personal protective equipment may be required as the situation demands - for example when handling hot product, working on a pressurised circulation system, or entering a heated bulk tank.
Notes to physician	Treat symptomatically. An allergic skin reaction may require dermatological assessment and permanent removal of the worker from exposure. Suspected hydrogen sulphide exposure or high-pressure injection injury is a medical emergency.
Additional information - used oil	Used oils may contain harmful impurities that have accumulated during use, including wear metals and oxidation and thermal degradation products. The concentration of such impurities depends on the service, and they may present risks to health and to the environment on disposal. All used oil should be handled with caution and skin contact avoided as far as possible. 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.

SECTION 12 - Ecological information

12.1 Toxicity - basis for assessment	CLASSIFIED: Aquatic Chronic 3 - H412, harmful to aquatic life with long lasting effects. The classification is derived by the summation method from the component data in Section 3; the arithmetic is set out in Section 2. Ecotoxicological data have not been determined for this product. Information given is based on a knowledge of the components and the ecotoxicology of similar products. Base oil component: Toxicity to fish (acute): LL/EL/IL50 > 100 mg/l; practically non-toxic. Toxicity to crustacea (acute): LL/EL/IL50 > 100 mg/l; practically non-toxic. Toxicity to algae / aquatic plants (acute): LL/EL/IL50 > 100 mg/l; practically non-toxic. Additive components: Long chain alkyl amine - Aquatic Acute 1; H400 and Aquatic Chronic 1; H410. The M-factor is taken as 1 in the summation in Section 2. An M-factor of 10 would drive the mixture to Aquatic Chronic 2; H411 at an alkyl amine content of 0.25 % w/w or above, which would in turn make the product a marine pollutant shipped as UN 3082. Olefin polysulphide - Aquatic Chronic 2; H411. Where measured data is obtained for the finished mixture it takes precedence over the summation method and this section, together with Sections 2 and 14, is to be reviewed.
12.2 Persistence and degradability	Not readily biodegradable. The major constituents are inherently biodegradable, but the product contains components which may persist in the environment. No specific data is available for this mixture.
12.3 Bioaccumulative potential	Contains components with the potential to bioaccumulate. Bioconcentration factor: no data available. Partition coefficient n-octanol/water: no data available for the mixture.
12.4 Mobility in soil	Liquid under most environmental conditions. Floats on water. If it enters soil it will adsorb to soil particles and will not be mobile.
12.5 Results of PBT and vPvB assessment	No ingredient is considered to meet the PBT or vPvB criteria at 0.1 % or higher.
12.6 Other adverse effects	The product has no ozone depletion potential, photochemical ozone creation potential or global warming potential, and is a mixture of non-volatile components which will not be released to air in significant quantities under normal conditions of use. It is a poorly soluble mixture which causes physical fouling of aquatic organisms. Uncontrolled release to the environment must be prevented; keep the product out of drains, watercourses and the sea.

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. Contact the manufacturer for recycling information. Used gear oil should be treated as hazardous waste unless the waste holder's own assessment shows otherwise. On board ship, retain in the waste oil tank and discharge only to an approved reception facility, in accordance with MARPOL Annex I. For supply into the EU: European waste catalogue code 13 02 05* - non-chlorinated engine, gearbox and mineral-based lubricating oils.
Contaminated packaging	Empty containers retain product residue and their GHS labelling must remain legible until the container is cleaned. 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).

SECTION 14 - Transport information

General	Not classified as a dangerous good for transport. An Aquatic Chronic 3 (H412) classification does not meet the criteria for UN 3082, environmentally hazardous substance, liquid, n.o.s., which requires Aquatic Acute 1 or Aquatic Chronic 1 or 2, and the product is therefore not a marine pollutant under the IMDG Code. See the concentration limits in Section 2 and the M-factor note in Section 12: an increase in alkyl amine content, or confirmation of an M-factor above 1 for that component, would change this section. The description shown may not apply to all shipping situations. Consult the applicable dangerous goods regulations for additional description requirements and for mode-specific or quantity-specific shipping requirements.
14.1 UN number	Not applicable
14.2 UN proper shipping name	Lubricating oil
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): lubricating oil; not regulated as dangerous goods under the IMDG Code. Air (ICAO / IATA): lubricating oil; not regulated as dangerous goods under the ICAO Technical Instructions or the IATA DGR. Road / rail (ADR / RID): not regulated. United States (DOT): lubricating 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: - Classification and labelling in accordance with SS 586-2 and SS 586-3. The product is classified hazardous (Skin Sens. 1, H317; Aquatic Chronic 3, H412) and must be supplied with a full GHS label bearing the GHS07 pictogram, the signal word WARNING, the hazard statements and the precautionary statements listed in Section 2. - Workplace Safety and Health Act and subsidiary regulations - permissible exposure levels for mineral oil mist apply (Section 8). Employers should include the skin sensitisation hazard, the yellow-metal misapplication risk and the potential for hydrogen sulphide accumulation in heated storage in their risk assessment. - Fire Safety Act and Fire Safety (Petroleum and Flammable Materials) Regulations: not applicable. - Environmental Protection and Management Act and Environmental Protection and Management (Hazardous Substances) Regulations: not applicable. International: - MARPOL 73/78 Annex I (oil) applies to discharge and to disposal of used oil. - IMO IBC Code: not applicable.
Notes for supply into the EU / EEA	Where EU legislation applies, the following are relevant and should be reviewed before export: - REACH Regulation 1907/2006 and Regulation (EU) 2020/878 (SDS format). - CLP Regulation 1272/2008, including Note L for the base oils (DMSO extract < 3 %, IP 346). - A Unique Formula Identifier (UFI) and a poison centre notification under CLP Article 45 / Annex VIII are required for a classified mixture placed on the EU market. - Directive 98/24/EC (chemical agents at work) is relevant given the skin sensitisation classification. - Directive 2012/18/EU (Seveso III), Annex I: no named substances contained.
Chemical inventory status	The base oil components of this product are listed on, or exempt from, the inventories of the United States (TSCA) and Australia (AIC). The inventory status of the proprietary additive components is to be confirmed with the additive supplier for each territory of supply, including Canada (DSL/NDL), China (IECSC), Japan (ENCS), Republic of Korea (KECL), New Zealand (NZIoC), the Philippines (PICCS) and Taiwan (TCSCA).
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 hazardous under the OSHA Hazard Communication Standard, 29 CFR 1910.1200, on two independent grounds: it is a skin sensitizer, and it carries the occupational exposure limit for mineral oil mist. United States - SARA 302/304, SARA 311/312, SARA 313 and CERCLA: no component identified above de minimis or reportable levels, subject to confirmation of the proprietary additive identities. 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

Performance level	The NS Gear Series meets or exceeds: DIN 51517-3 CLP; ISO 12925-1 CKD; AGMA 9005-F16 EP; ISO 6743-6 CKC / CKD; US Steel 224; David Brown S1.53.101; Chinese GB 5903 L-CKC / L-CKD. Fives Cincinnati: P-63 (ISO VG 68), P-77 (150), P-74 (220), P-35 (460), P-34 (680). Performance claims are commercial statements and form no part of the hazard classification. Refer to the product technical data sheet for the full specification.
Revision date	12 September 2026

Revision number	Rev. 0
Reason(s) for revision	First issue by Energy Spring Pte Ltd.
Reference(s)	Singapore Standard SS 586-2:2022 and SS 586-3:2022 (classification, labelling and safety data sheets for hazardous chemicals and dangerous goods). ISO 3448 (viscosity classification), ISO 6743-6 and ISO 12925-1 (gear oil classification and specification), DIN 51517-3 (CLP gear oils), AGMA 9005-F16 (industrial gear lubrication), DIN 51354-2 (FZG gear test), IP 346 (DMSO extract). Physical data from the NS Gear Series technical data sheet, Version 1.0, September 2026. Composition and component classification data derive from the base oil and additive suppliers' data. Classification of the mixture carried out by the calculation (summation) and generic cut-off methods using substance data; no testing on the finished mixture.
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. H317: May cause an allergic skin reaction. H318: Causes serious eye damage. H319: Causes serious eye irritation. H400: Very toxic to aquatic life. H410: Very toxic to aquatic life with long lasting effects. H411: Toxic to aquatic life with long lasting effects. H412: Harmful to aquatic life with long lasting effects.
Training	Suitable training on the safe handling and storage of this product should be given to employees on the basis of all the information in this safety data sheet, with particular attention to the prevention of skin contact, to the hydrogen sulphide risk in heated bulk storage, and to the high-pressure injection risk on circulation systems.
Abbreviations and acronyms	ACGIH - American Conference of Governmental Industrial Hygienists; ADR - European Agreement concerning the International Carriage of Dangerous Goods by Road; AGMA - American Gear Manufacturers Association; Asp. Tox. - aspiration hazard; ASTM - American Society for Testing and Materials; CAS - Chemical Abstracts Service; CKC / CKD - ISO 12925-1 gear oil categories; CLP - Classification, Labelling and Packaging Regulation, or (DIN 51517) a gear oil with anti-oxidant, anti-corrosion and anti-scuffing additives; COC - Cleveland open cup; DMSO - dimethyl sulphoxide; DNEL - derived no-effect level; EC50 / EL50 - effect concentration / loading 50 %; EP - extreme pressure; Eye Dam. / Eye Irrit. - serious eye damage / eye irritation; FZG - Forschungsstelle fuer Zahnraeder und Getriebebau (gear test rig); GHS - Globally Harmonized System; H2S - hydrogen sulphide; IARC - International Agency for Research on Cancer; IBC - International Bulk Chemical Code; IMDG - International Maritime Dangerous Goods; ISO VG - ISO viscosity grade; LC50 / LD50 / LL50 - lethal concentration / dose / loading 50 %; M-factor - multiplying factor for aquatic classification; NOAEL - no observed adverse effect level; NOEC - no observed effect concentration; NTP - National Toxicology Program; OECD TG - Organisation for Economic Co-operation and Development Test Guideline; PBT - persistent, bioaccumulative and toxic; PEL - permissible exposure level; PNEC - predicted no-effect concentration; Skin Corr. / Skin Irrit. / Skin Sens. - skin corrosion / irritation / sensitisation; STEL - short-term exposure limit; STOT RE / SE - specific target organ toxicity, repeated / single exposure; TWA - time-weighted average; UFI - unique formula identifier; 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 68, 100, 150, 220, 320, 460 and 680 only. It must not be used for any other viscosity grade of this product. Any grade below ISO VG 32 would require the aspiration assessment in Section 2 to be redone against the 20.5 mm ² /s cut-off.

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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