Shell Diala *S4 ZX-I*

Technical Data Sheet

- Extra Performance
- Meets IEC 60296 - Higher Oxidation Stability & Low Sulphur Content

Premium Inhibited, Electrical Insulating Oil

Shell Diala S4 ZX-I is a electrical insulating oil from Shell designed to meet the challenges presented by the latest power transformers. It offers an extended oil life with the peace of mind of zero sulphur content.
Shell Diala S4 ZX-I is manufactured from virtually sulphur-free base oils produced using Shell's GTL (gas-to-liquid) technology. These base oils offer a high degree of compositional consistency and have an excellent response to anti-oxidant. In addition, they are globally available and free from PCBs, DBDS and passivators.
Shell Diala S4 ZX-I meets both the established and new industry copper corrosion tests.

DESIGNED TO MEET CHALLENGES

Performance, Features & Benefits

- **Extended oil life**

  Shell Diala S4 ZX-I is a fully inhibited oil giving outstanding oxidation performance and an extended oil life. Shell Diala S4 ZX-I is also suitable for use in highly loaded applications.

- **Transformer protection**

  Shell Diala S4 ZX-I is manufactured from a zero sulphur* base oil, making it intrinsically non-corrosive towards copper, without the need for passivation or other additives.

  Shell Diala S4 ZX-I meets all relevant tests for copper corrosion, namely the established DIN 51353 (Silver Strip Test), ASTM D1275, and also the latest more severe tests: IEC 62535 and ASTM D1275.

  *Sulphur content below 1ppm detection limit of ASTM D5185

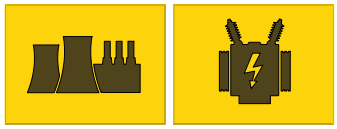
- **System efficiency**

  The good low temperature viscometric properties of the oil ensure proper heat transfer inside the transformer, even from very low starting temperatures.

  Shell Diala S4 ZX-I is specially dried and handled to achieve a low water content and retain a high breakdown voltage at point of delivery. This enables it to be used in many applications without further treatment. The need for further drying and treatment should be evaluated per application and OEM specification.

- **The base oil used in the formulation of Shell Diala S4 ZX-I is readily biodegradable according to OECD 301 test criteria.**

Main Applications



Specifications, Approvals & Recommendations

- IEC 60296 (Edition 5 year 2020); Type A, fully inhibited high grade oils
- IEC 60296 Ed4 (2012): Table 2 Transformer Oil (I) (Inhibited oil) Section 7.1 ("Higher oxidation stability & low Sulphur content")
- Meets GB 2536-2025
- Siemens Energy (including HVDC application)
- Hitachi Energy
- ENGIE Laborelec (LPS 05/2020) Specification
- DOBLE TOPS (inhibited) performance
- GE Grid Solutions
- TBEA, TWBB, SPECO, Huapeng Transformers, Xian XD
- ASTOR, BEST
- MR (Maschinenfabrik Reinhausen)
- SGB-SMIT
- HYOSUNG

  For a full listing of equipment approvals and recommendations, please consult your local Shell Technical Helpdesk

Typical Physical Characteristics

Properties			Method	IEC 60296, Type A minimum	IEC 60296, Type A maximum	Shell Diala S4 ZX-I Typical
Appearance			IEC 60296	Clear, free from sediment and suspended matter	Clear, free from sediment and suspended matter	Clear, free from sediment and suspended matter
Density	@20°C	kg/m³	ISO 3675		895	805
Kinematic Viscosity	@40°C	mm²/s	ISO 3104		12.00	9.8
Kinematic Viscosity	@-30°C	mm²/s	ISO 3104		1 800.00	438
Flash Point (PMCC)		°C	ISO 2719	135		191
Pour Point		°C	ISO 3016		-40	-45
Neutralisation value		mg KOH/g	IEC 62021-1		0.01	<0.01
Interfacial Tension		mN/m	IEC 62961	43		51
Colour			ISO 2049		L0.5	L0.5
Total Sulphur Content		m%	ISO 14596		0.05	< 0.001
Corrosive Sulphur			DIN 51353		Not corrosive	Not corrosive
Potentially Corrosive Sulphur			IEC 62535		Not corrosive	Not corrosive
Corrosive Sulphur			ASTM D1275			Not corrosive
Breakdown Voltage Untreated		kV	IEC 60156	30		50 - 60
Breakdown Voltage After Treatment		kV	IEC 60156	70		78
Dielectric Dissipation Factor	DDF @ 90°C		IEC 60247		0.005	0.001
Oxidation Stability 500h@120°C	500h / 120°C		IEC 61125		High grade oil Type A	High grade oil, Type A
Total Acidity (after oxidation)		mg KOH/g	IEC 62021-1		0.3	0.02
Sludge (after oxidation)		%m	IEC 61125		0.05	0.01
Dielectric Dissipation Factor (after oxidation)	DDF @90°C	DDF	IEC 60247		0.05	0.001
Water content (Drums/IBC)		mg/kg	IEC 60814		40	14
Water content (Bulk)		mg/kg	IEC 60814		30	10
2-Furfural and related compounds content		mg/kg	IEC 61198		Not detectable (< 0,05 mg/kg) for each individual compound	Not detectable (< 0,05 mg/kg) for each individual compound
DBDS content		mg/kg	IEC 62697-1		Not detectable (< 5 mg/kg)	Not detectable (< 5 mg/kg)
Metal passivator additives		mg/kg	IEC 60666		Not detectable (< 5 mg/kg)	Not detectable (< 5 mg/kg)
Oxidation inhibitor content (DBPC)		%m	IEC 60666	0.08	0.40	0.2
PCA Content		%m	IP 346		3	< 3
PCB content		mg/kg	IEC 61619		Not detectable (< 2 mg/kg)	Not detectable (< 2 mg/kg)

These characteristics are typical of current production. Whilst future production will conform to Shell's specification, variations in these characteristics may occur.

Health, Safety & Environment

- **Health and Safety**

  Shell Diala S4 ZX-I is unlikely to present any significant health or safety hazard when properly used in the recommended application and good standards of personal hygiene are maintained.

  Shell Diala S4 ZX-I is free from polychlorinated biphenyls (PCB). Avoid contact with skin. Use impervious gloves with used oil. After skin contact, wash immediately with soap and water.

  Guidance on Health and Safety is available on the appropriate Safety Data Sheet, which can be obtained from https://www.epc.shell.com

- **Protect the Environment**

  Take used oil to an authorised collection point. Do not discharge into drains, soil or water.

Additional Information

- **Stray Gassing, test data, part of requirements High Grade oil, type A, table 1 in IEC 60296 Ed5 (2023)**

  Typical test data from Stray Gassing test IEC60296, procedure in Clause A.4: Oil saturated with Air, in presence of copper (48 hours, at 105^{0}C)

DGA after stray gassing test (DGA test according to IEC 60567)	Requirements per IEC 60296 Ed5 (Table 3, Type A oil)	Shell Diala S4 ZX-I Typical value
Hydrogen (H2)	≤ 50 µl/l	≤ 5 µl/l
Methane (CH4)	≤ 50 µl/l	≤ 5 µl/l
Ethane (C2H6)	≤ 50 µl/l	≤ 5 µl/l

- Evaluation results per IEC 60296: Shell Diala S4 ZX-I is classified as non-stray gassing oil.
- **Storage precautions**

  The critical electrical properties of Shell Diala are easily compromised by trace contamination with foreign material. Typically encountered contaminants include moisture, particles, fibres and surfactants. Therefore, it is imperative that electrical insulating oils be kept clean and dry. It is strongly recommended that storage containers be dedicated for electrical service and include air-tight seals. It is further recommended that electrical insulating oils are stored indoors in climate-controlled environments.

- **Advice**

  Advice on applications not covered here may be obtained from your Shell representative.