



Shell Diala S2 ZU-I Dried non-gasoil tariff

- Reliable Performance
- Meets IEC 60296

Uninhibited Electrical Insulating Oil

Shell Diala S2 ZU-I Dried non-gasoil tariff is an uninhibited electrical insulating oil manufactured from highly refined mineral oils. It offers good dielectric properties, good oxidation stability and provides efficient heat transfer. It has excellent low temperature properties and is dried to achieve a higher breakdown voltage than required by standard industry norms.

Shell Diala S2 ZU-I Dried non-gasoil tariff meets both the established and the new industry copper corrosion tests.

DESIGNED TO MEET CHALLENGES

Performance, Features & Benefits

- **Extended oil life**
Shell Diala S2 ZU-I Dried non-gasoil tariff offers inherent natural resistance to oil degradation through oxidation.
- **System efficiency**
The good low temperature properties of the oil ensure proper heat transfer inside the transformer, even from lowest starting temperatures. Shell Diala S2 ZU-I Dried non-gasoil tariff 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.
- **Transformer protection**
Shell Diala S2 ZU-I Dried non-gasoil tariff is non-corrosive towards copper, with no need for passivation. Shell Diala S2 ZU-I Dried non-gasoil tariff meets all relevant tests on copper corrosion, namely the established DIN 51353 (Silver Strip Test) and ASTM D1275, and also the latest more severe tests: ft IEC 62535 and ASTM D1275B.

Main Applications



- **Transformers**
Electrical insulating oil for grid and industrial transformers.
- **Electrical equipment**
Components such as rectifiers, circuit breakers and switchgears.

Specifications, Approvals & Recommendations

- IEC 60296 (Edition 4.0 2012-02), Table 2 Transformer Oil (U), uninhibited
- For a full listing of equipment approvals and recommendations, please consult your local Shell Technical Helpdesk.

Typical Physical Characteristics

Properties	Method	IEC 60296 Requirement	Shell Diala S2 ZU-I Dried Non-Gasoil
Appearance	IEC 60296	Clear, free from sediment and suspended matters	Complies
Density @15°C kg/m³	ISO 3675	-	882
Density @20°C kg/m³	ISO 3675	Max 895	879
Kinematic Viscosity @40°C mm²/s	ISO 3104	Max 12	11.0
Kinematic Viscosity @-30°C mm²/s	ISO 3104	Max 1 800	1700
Flash Point (PM) °C	ISO 2719 / ASTM D93	Min 135	146
Pour Point °C	ISO 3016	Max -40	-57

Properties		Method	IEC 60296 Requirement	Shell Diala S2 ZU-I Dried Non-Gasoil
Neutralisation Value	mg KOH/g	IEC 62021-1	Max 0.01	<0.01
Corrosive Sulphur		DIN 51353	Not corrosive	Not corrosive
Corrosive Sulphur		IEC 62535	Not corrosive	Not corrosive
Corrosive Sulphur		ASTM D1275B	-	Not corrosive
Breakdown Voltage As Delivered	kV	IEC 60156	Min 30	>60
Breakdown Voltage After Treatment	kV	IEC 60156	Min 70	>70
Dielectric dissipation factor (DDF)	@90°C	IEC 60247	Max 0.005	0.002
Oxidation Stability (164 hrs) - Total Acidity	@120°C mg KOH/g	IEC 61125 C	Max 1.2	0.9
Oxidation Stability (164 hrs) - Sludge	@120°C %m	IEC 61125 C	Max 0.8	0.3
Oxidation Stability (164 hrs) - DDF at 90°C	@90°C	IEC 60247	Max 0.5	0.1

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 S2 ZU-I Dried non-gasoil tariff 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.

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 <http://www.epc.shell.com>

Protect the Environment

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

Polychlorinated Biphenyls

Shell Diala S2 ZU-I Dried non-gasoil tariff is free from polychlorinated biphenyls (PCB).

Additional Information

Storage Precautions

The critical electrical properties of Shell Diala S2 ZU-I Dried non-gasoil tariff 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 airtight seals. It is further recommended that electrical insulating oils be stored indoors in climate-controlled environments.

Advice

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



Previous Name: **Shell Diala DX**

Shell **Diala S3 ZX-I** *Premium Inhibited Electrical Insulating Oil*

- **EXTRA PERFORMANCE**
- **MEETS IEC 60296 - HIGH**

Shell Diala S3 ZX-I is a premium, inhibited electrical insulating oil manufactured from specially refined mineral oils with an ultra-low sulphur content. It offers very high oxidation stability and excellent dielectric and low temperature properties.

Shell Diala S3 ZX-I meets both the established and new industry copper corrosion tests.

Applications

- **Transformers**
All Power transformer types and applications (e.g. generator transformers, shunt reactors, distribution transformers)
- **Electrical equipment**
Components such as rectifiers, circuit breakers and switchgear.

Advice on applications not covered in this leaflet may be obtained from your Shell Representative.

Performance Features and Benefits

- **Extended oil life**
Shell Diala S3 ZX-I is a fully inhibited oil giving outstanding oxidation performance and an extended oil life. Shell Diala S3 ZX-I is also suitable for use in highly loaded applications.
- **Transformer protection**
Shell Diala S3 ZX-I is manufactured from an ultra low sulphur base oil, making it intrinsically non-corrosive towards copper, without the need for passivation.
Shell Diala S3 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 D1275B.
- **System efficiency**
The good low temperature properties of the oil ensures proper heat transfer inside the transformer, even from very low starting temperatures. With exceptional viscometrics at -30°C Shell Diala S3 ZX I can be classed as "Arctic grade".

Specifications and Approvals

IEC 60296 (2003): Table 2 Transformer Oil (I) (Inhibited oil) Section 7.1 ("Higher oxidation stability")

Baader oxidation test of (obsolete) DIN 57370-1 (1978)

Storage precautions

The critical electrical properties of Shell Diala S3 ZX-I 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.

Health & Safety

Guidance on Health and Safety is available on the appropriate Material Safety Data Sheet, which can be obtained from your Shell representative.

Shell Diala S3 ZX-I is free from polychlorinated biphenyls (PCB).

Protect the environment

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



Typical Physical Characteristics

Property	Units	Method	IEC 60296 Table 2 + section 7.1	Shell Diala S3 ZX-I
Appearance		IEC 60296	Clear, free from sediment and suspended matters	Complies
Density at 15 °C	kg/m ³	ISO 3675	-	881
Density at 20 °C	kg/m ³	ISO 3675	Max. 895	878
Kinematic viscosity at 40 °C	mm ² /s	ISO 3104	Max. 12	8,0
Kinematic viscosity at -30 °C	mm ² /s	ISO 3104	Guaranteed max. 800 (IEC 60296=Max. 1.800)	720
Flashpoint P.M.	°C	ISO 2719	Min. 135	140
Pourpoint	°C	ISO 3016	Guaranteed max. -45 (IEC 60296=Max. -40)	-60
Neutralisation value	mg KOH/g	IEC 62021-1	Max. 0,01	< 0,01
Corrosive Sulphur		DIN 51353	Not corrosive	Not corrosive
Corrosive Sulphur		IEC 62535	Not corrosive	Not corrosive
Corrosive Sulphur		ASTM D 1275 B	-	Not corrosive
Breakdown voltage Untreated After treatment	kV	IEC 60156	Min. 30 Min. 70	>30 >70
Dielectric dissipation factor (DDF) at 90 °C		IEC 60247	Max. 0,005	0,001
Oxidation Stability (500 h / 120 °C)		IEC 61125 C		
Total acidity	mg KOH/g		Max. 0,3	0,02
Sludge	%m		Max. 0,05	0,01
Dielectric dissipation factor (DDF) at 90 °C			Max 0,05	0,005
Oxidation Stability Baader (28 d /110 °C)		DIN 51554		
Neutralisation value	mg KOH/g		-	<0,03
Sludge content	% m		-	<0,006
Dielectric dissipation factor (DDF) at 90 °C			-	0,005

These characteristics are typical of current production.

Whilst future production will conform to Shell's specification, variations in these characteristics may occur.



Shell Diala S4 ZX-I

Premium Inhibited Electrical Insulating Oil

Shell Diala S4 ZX-I is the new 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 zero sulphur 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 D1275B.

*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.

Main Applications



Specifications, Approvals & Recommendations

- IEC 60296 (2012): Table 2 Transformer Oil (I) (Inhibited Oil) Section 7.1 ("Higher oxidation stability and low sulphur content").

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

Typical physical characteristics

Properties			Method	IEC 60296 Table 2 + section 7.1	Shell Diala S4 ZX-I Typical
Appearance			IEC 60296	Clear, free from sediment and suspended matter	Complies
Density	@20°C	kg/m ³	ISO 3675	Max. 895	805
Kinematic Viscosity	@40°C	mm ² /s	ISO 3104	Max. 12	9.6
Kinematic Viscosity	@-30°C	mm ² /s	ISO 3104	Max. 1 800	382
Flashpoint P.M.		°C	ISO 2719	Min. 135	191
Pour Point		°C	ISO 3016	Max. -40	-42
Neutralisation value	mg KOH/g		IEC 62021-1	Max. 0.01	<0.01
Total Sulphur Content	mg/kg		ASTM D5185	Max. 500	<1

Properties			Method	IEC 60296 Table 2 + section 7.1	Shell Diala S4 ZX-I Typical
Corrosive Sulphur			DIN 51353	Not corrosive	Not corrosive
Potentially Corrosive Sulphur			IEC 62535	Not corrosive	Not corrosive
Corrosive Sulphur			ASTM D1275 B		Not corrosive
Breakdown Voltage Untreated	kV		IEC 60156	Min. 30	60
Breakdown Voltage After Treatment	kV		IEC 60156	Min. 70	75
Dielectric Dissipation Factor	@90°C	DDF	IEC 60247	Max 0.005	<0.001
Oxidation Stability	500h / 120°C		IEC 61125 C	Section 7.1 Limits	
Total Acidity	mg KOH/g		IEC 61125 C	Max 0.3	0.02
Sludge		%m	IEC 61125 C	Max 0.05	<0.01
Dielectric Dissipation Factor (DDF @90°C)			IEC 61125 C	Max 0.05	0.001
Water content (drums and IBC)	mg/kg		IEC 60814	Max 40	6
Water content (Bulk)	mg/kg		IEC 60814	Max 30	6
2-Furfural and related compounds content	mg/kg		IEC 61198	Not detectable	Complies
Metal passivator additives	mg/kg		IEC 60666	Not detectable	Complies
Oxidation inhibitor content (DBPC)		% mass			0.2
PCA Content		% mass	IP346	Max 3	Complies
PCB content	mg/kg		IEC 61619	Not detectable	Complies

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 Material Safety Data Sheet, which can be obtained from your Shell representative.

Protect the Environment

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

Additional Information

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.