Gazpromneft F Synth EP

TURBINE OILS · ISO VG 32 AND 46



Industrial turbine rotor — illustration

Turbine Oil F Synth EP-32 and EP-46 — for steam and gas turbines, turbine gearboxes and compressors

Siemens Energy approval · track record at CHP plants, refineries and steel works · supply and technical support by FEOTECH in Indonesia

MANUFACTURER

GAZPROM NEFT LUBRICANTS

Gazpromneft-Lubricants Ltd.

GAZPROM NEFT LUBRICANTS · GAZPROM GROUP — WORLD'S LARGEST GAS COMPANY



HYDP complex · Omsk Lubricants Plant · since 2023

590K t
OILS, GREASES AND TECHNICAL FLUIDS PER YEAR

>3,700
SKU · >800 PRODUCTS

70+ YEARS
LUBRICANT PRODUCTION EXPERIENCE · OMSK REFINERY

>55
COUNTRIES OF SUPPLY · >150 DISTRIBUTORS

No. 1
IN RUSSIA · PACKAGED LUBRICANTS AND MARINE OILS

I · II · III · V
OWN API BASE OIL GROUPS · HYDP OMSK +220K T/YR

PRODUCTION SITES

- Omsk (OZSM) — the largest site: base oils, blending, packaging, greases, additives
- Moscow — Gazpromneft MLP (Fryazino) — blending and packaging; SUCOFINDO audit for SNI, 2024
- Yaroslavl (YANOS) — base-oil JV · Rospolikhim — esters · 4 processing sites abroad: Turkey, UAE, China

R&D AND TECHNOLOGY

- 4 R&D centres: Moscow (HQ), Fryazino (flagship), Omsk, Nizhny Novgorod
- >3,000 laboratory and bench tests per year
- Alchemist AI formulation platform: >500 formulations developed per year

MARKET POSITIONS

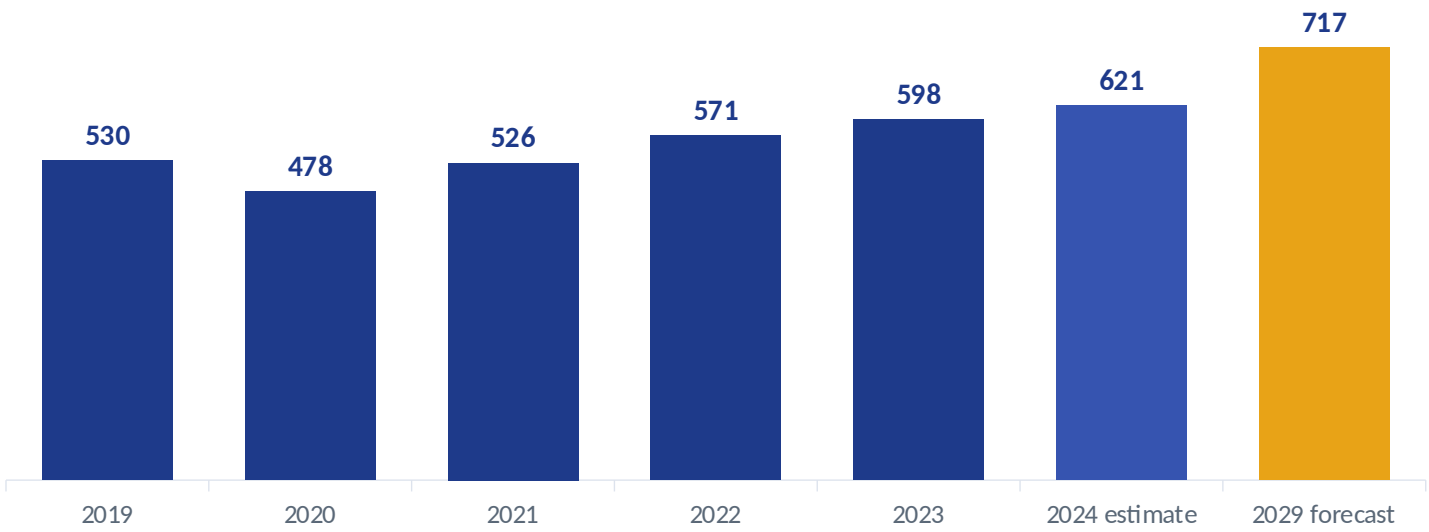
- No. 1 in Russia: packaged lubricants (31% share) and marine oils (36%)
- Dual-brand strategy: G-Energy (premium) · Gazpromneft (mass segment)
- Key regions: Russia & CIS, Central Asia, Middle East, Africa, SE Asia, South Asia

Source: Gazpromneft-Lubricants Ltd. corporate presentation, January 2025

Indonesia's industrial lubricants: 621 million litres a year

INDUSTRIAL SEGMENT · 2019–2029 · MORDOR INTELLIGENCE ESTIMATE

INDUSTRIAL LUBRICANTS, MILLION LITRES PER YEAR



621 million L
ESTIMATE FOR 2024

717 million L
FORECAST FOR 2029

54.5%
INDUSTRY SHARE OF THE MARKET, 2024

+2.9%
AVERAGE ANNUAL GROWTH 2024–2029

Indonesia's total lubricants market in 2024 — 1,139 million L; industry accounts for more than half.

WHERE TURBINE OILS WORK

- Power plants
- Industrial park power plants
- Refining and petrochemicals
- Metallurgy
- Cement plants
- Pulp and paper

Source: Mordor Intelligence, Indonesia Lubricants Market, 2024 edition (2024 — estimate, 2029 — forecast).

Indonesia's turbine fleet: 85 GW of generation

STEAM, GAS AND GEOTHERMAL TURBINES · ESDM, 2025 · EQUIPMENT EXAMPLES

60.5 GW
STEAM TURBINES
THERMAL PLANTS, ALL OWNERSHIP TYPES

22.0 GW
GAS TURBINES
AND COMBINED CYCLE

2.8 GW
GEOTHERMAL
POWER PLANTS

+7.6 GW
HYDROPOWER PLANTS
IN ADDITION

Site · region	Manufacturer and equipment	Capacity	Status
Jawa 1 · West Java	GE: 2 × 9HA.02, combined cycle	1,760 MW	COD 2024
Tambak Lorok 3 · Central Java	GE 9HA.02 + STF-D650 steam turbine	780 MW	COD 2024
Cirebon 2 · West Java	Toshiba, steam turbine	1,000 MW	COD 2023
Jawa 9 & 10 · Banten	Steam turbines, 2 units	2 × 1,000 MW	COD 2025
Darajat 3 · West Java	Mitsubishi Power, geothermal	129 MW	upgraded in 2026
Balikpapan RDMP · Kalimantan	Siemens: 4 × SGT-800 + 5 × SST-600	Refinery	phased start-up
Lygend Obi · North Maluku	Harbin Electric, steam · nickel	4 × 150 MW	unit 2 — since 2022
Tangguh LNG · Papua	Baker Hughes: turbines and compressors	LNG	operating fleet

OIL SYSTEM EXAMPLE · BATAM

7,000 L

of oil in a single oil system

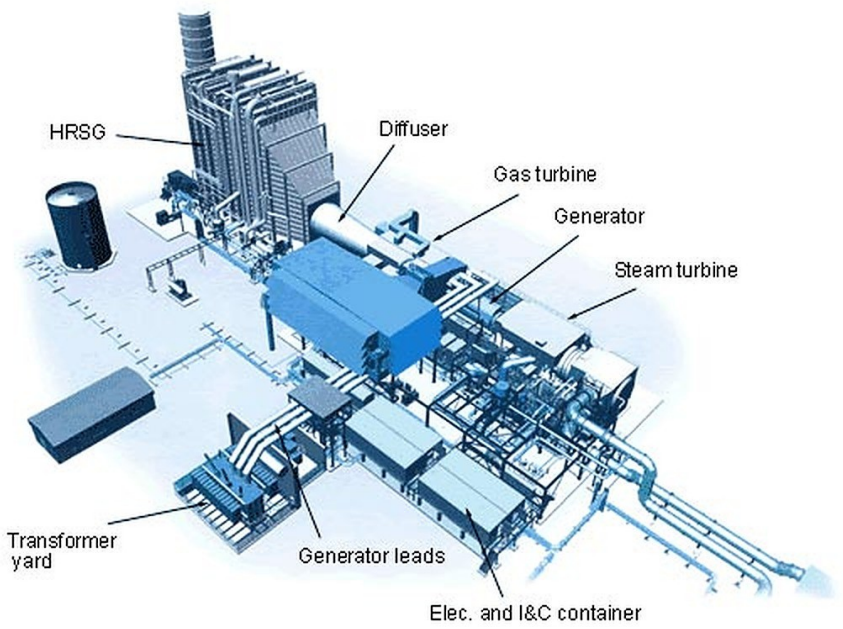
- GE Frame 6B gas turbine, Flender Graffenstaden gearbox, Brush generator
- Currently — ISO VG 32 EP-class turbine oil
- Selection and compatibility test — slide 20

**Geared turbine units —
the niche for F Synth EP-32 and EP-46**

ESDM, Handbook of Energy & Economic Statistics of Indonesia 2025, table 6.4.9; equipment manufacturer and operator announcements as of 23.10.2026.

Where turbine oil works

STEAM AND GAS TURBINES · COMBINED CYCLE · TURBINE GEARBOXES · COMPRESSORS



Combined-cycle plant: gas and steam turbines, generator — illustration

Steam turbines
Thermal power plants, industrial CHP plants and captive power plants

Gas turbines and combined cycle
Bearings, lubrication and control systems of turbine units

Geared turbine units
Highly loaded gears — scuffing protection (EP) is required

Turbocompressors
Centrifugal and screw compressors for air and gas

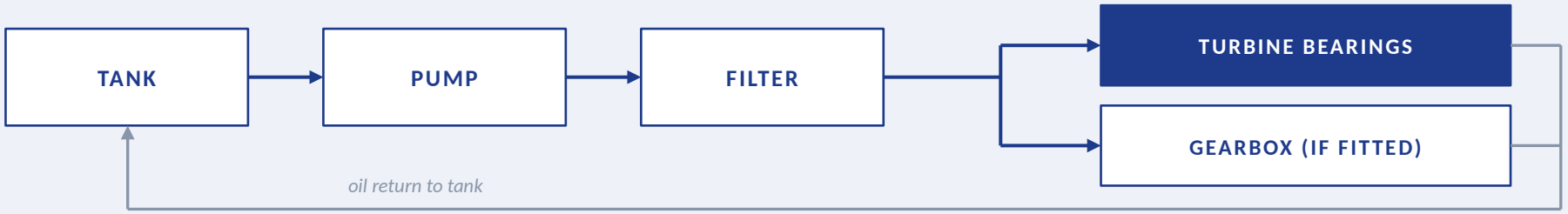
CUSTOMER'S GOALS

- Continuous operation of the unit
- Protection of bearings and gears
- Predictable maintenance

TDS Gazpromneft Turbine Oil F Synth EP-32/46, 05/2026; plant reports. Combined-cycle illustration — Gazpromneft-Lubricants Ltd. presentation, 2016.

Four oil properties — four risks for the turbine

CIRCULATING SYSTEM · WHAT THE OIL DOES · WHAT HAPPENS IF A PROPERTY FALLS SHORT



The oil lubricates and cools bearings and gear teeth, and carries away air, water and particles

01

Oxidation stability

The oil keeps its properties longer under heat and contact with air

IF THE PROPERTY FALLS SHORT

Sludge and varnish deposits, sticking control valves

EP-32: RPVOT 3,249 min → slide 09

02

Air release

Entrained air leaves the oil in the tank quickly

IF THE PROPERTY FALLS SHORT

Foam, pump cavitation, unstable pressure in the control system

EP-32: 1.6 min → slide 10

03

Water separation

Water from steam and condensate settles out quickly and is drained

IF THE PROPERTY FALLS SHORT

Emulsion, corrosion, oil film breakdown in bearings

EP-32: 10 min → slide 10

04

Scuffing protection (EP)

Additives protect gearbox teeth under high load

IF THE PROPERTY FALLS SHORT

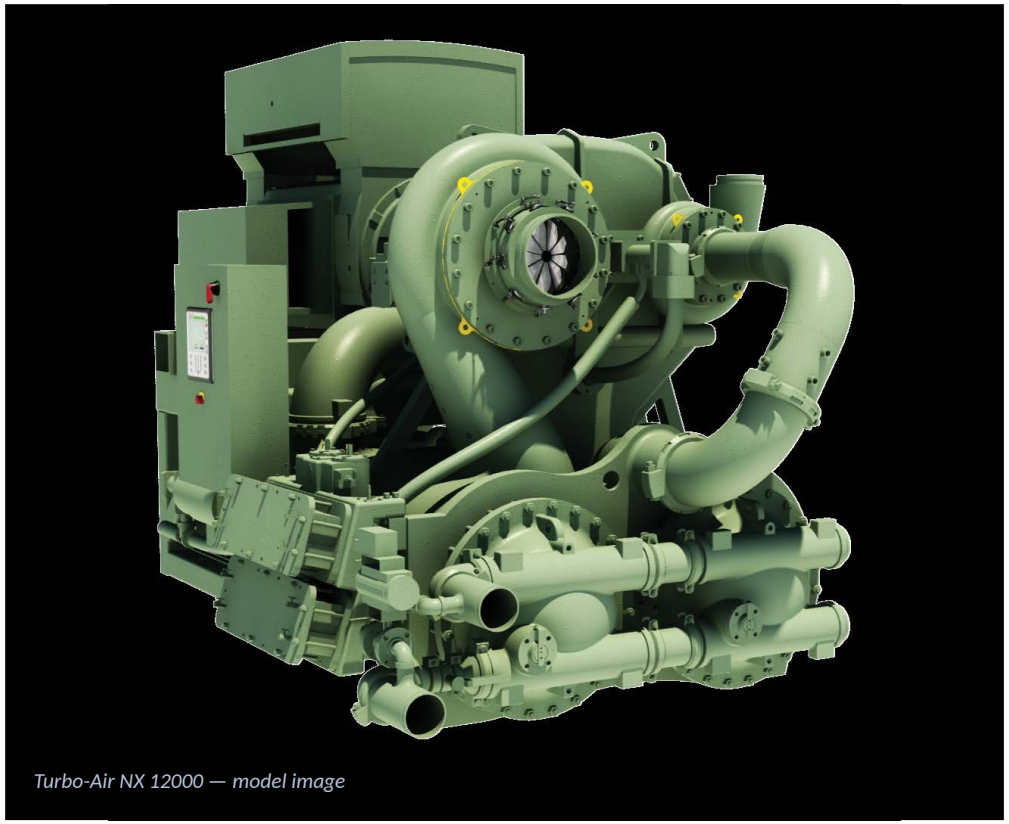
Scuffing and accelerated wear of turbine gearbox teeth

EP-46: FZG 12 → slide 11

FEOTECH schematic based on the TDS application scope and VTI materials; the oil system configuration depends on the unit.

An "oil-free" compressor also runs on turbine oil

INGERSOLL RAND TURBO-AIR NX 12000 CENTRIFUGAL COMPRESSOR · EXAMPLE



Turbo-Air NX 12000 — model image

Compressed air — oil-free

01

In the Turbo-Air series, air is compressed without contact with oil — clean air for production

Bearings and gears — on oil

02

Mechanical assemblies need a constant oil supply and heat removal

Own oil system

03

Oil filters, coolers and the distribution manifold are part of the compressor design

TAKEAWAY

Clean compressed air and bearing lubrication are different tasks. Example of EP-46 in Turbo-Air NX 12000 compressors — Omsk Refinery, slide 15

Ingersoll Rand, MSG TURBO-AIR NX 12000 brochure: model image (p. 1) and description of the lubrication system.

Gazpromneft turbine oil range

ISO VG 32 AND 46 · WITH AND WITHOUT EXTREME-PRESSURE ADDITIVES · HYDROTREATED BASE OILS

GAZPROMNEFT TURBINE OIL

F Synth EP-32

ISO VG 32 — IN DEMAND IN INDONESIA

APPLICATION

Gas turbines and combined cycle, turbine units with and without gearbox

CONFIRMATIONS

- Siemens Energy approval
- Properties confirmed by Lubrizol, 2021
- Omsk Refinery: MAN gas compressor

GAZPROMNEFT TURBINE OIL

F Synth EP-46

ISO VG 46 — IN DEMAND IN INDONESIA

APPLICATION

Turbine units with and without gearbox, turbocompressors

CONFIRMATIONS

- Siemens Energy approval
- FZG: failure load stage 12
- Indonesian NPT — valid until 2030
- Izhevsk CHP-1, Omsk Refinery

GAZPROMNEFT

Turbine Oil 32

ISO VG 32

APPLICATION

Steam turbines with a conventional oil system — no enhanced gearbox protection requirements

CONFIRMATIONS

- Alstom recommendation (HTGD 90117)
- Manufacturer's TDS, 04/2020

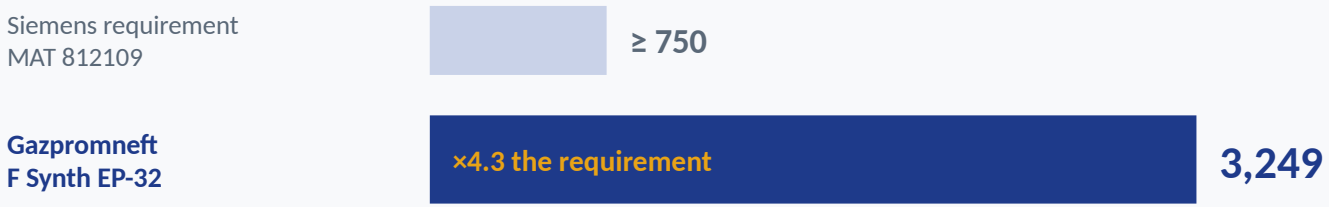
Special application: for the nuclear icebreaker Ural, Gazpromneft-Lubricants produced a dedicated high-viscosity turbine oil — slide 18

TDS Turbine Oil 32, 04/2020; TDS F Synth EP-32/46, 05/2026; Siemens Energy, 08.07.2021; Alstom, 06.08.2012; Gazprom Neft, 31.10.2022.

EP-32: oxidation stability with a 4-fold margin

LUBRIZOL LABORATORY DATA, 2021 · RPVOT AND TOST TESTS

RPVOT, MINUTES · ASTM D2272 · HIGHER IS BETTER



RPVOT is an accelerated test: how many minutes the oil resists oxidation in a pressurised oxygen vessel. The EP-32 result is more than 4 times the requirement.

TOST · ASTM D943

> 10,000 h

Long-term ageing test: time to an acid number of 2 mg KOH/g in the presence of water and a metal catalyst

WHAT IT MEANS FOR THE PLANT

- **The oil ages more slowly under heat**
- **Less sludge and varnish**
- **Stable operation of control systems**

Lubrizol Performance letter, 21.10.2021, EP-32 appendix, pp. 5–8. Siemens MAT 812109 requirement — per table 2 of the VTI article, 2025.

EP-32: air and water leave the oil faster than required

LUBRIZOL LABORATORY DATA, 2021 · SHORTER TIME IS BETTER

AIR RELEASE · 50 °C · ASTM D3427

1.6 min

2.5 times faster

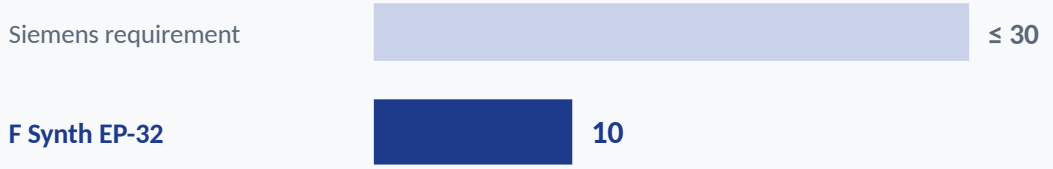


Air leaves the oil quickly — lower risk of foam, pump cavitation and pressure surges in the control system

WATER SEPARATION · 54 °C · ASTM D1401

10 min

3 times faster



Water settles out in the tank quickly — the oil keeps its lubricating film in the bearings

FOR INDONESIA

The humid tropical climate and turbine steam seals are constant sources of water in the oil. Fast water separation keeps the oil film in the bearings and protects against corrosion.

Lubrizol Performance letter, 21.10.2021, EP-32 appendix. Siemens MAT 812109 requirements — per table 2 of the VTI article, 2025.

EP-46: gear protection — FZG stage 12

LUBRIZOL TEST, 2020 · ISO 14635-1 · A/8.3/90 PROCEDURE

12

FAILURE LOAD STAGE

Failure Load Stage · top stage of the 12-stage test scale

1	2	3	4	5	6	7	8	9	10	11	12

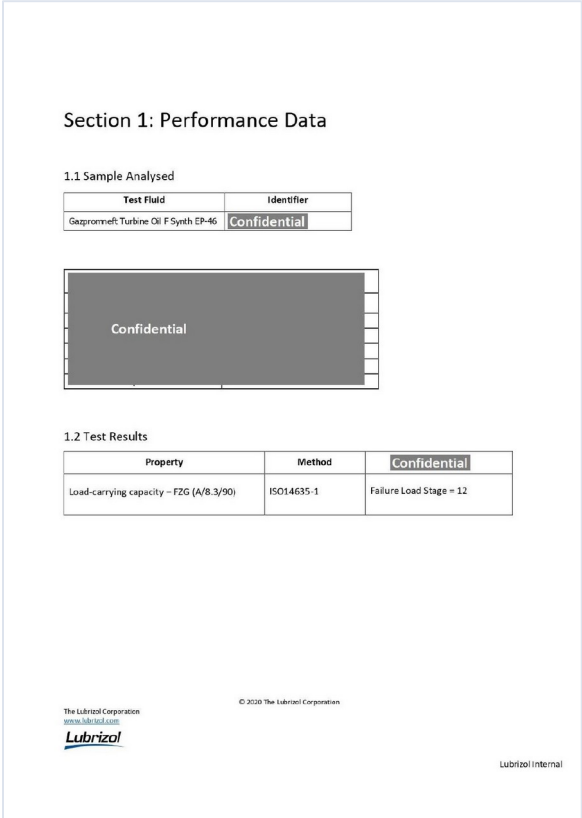
load stages 1–11 — no tooth damage

scuffing

FZG is a gear rig test of the oil: the load is raised stage by stage until scuffing appears on the teeth. The higher the stage, the more reliable the gearbox protection.

WHAT IT GIVES

Reliable protection of turbine gearbox teeth under peak loads — which is why EP grades are used in geared turbine units



Section 1: Performance Data

1.1 Sample Analysed

Test Fluid	Identifier
Gazpromneft Turbine Oil F Synth EP-46	Confidential

Confidential

1.2 Test Results

Property	Method	Confidential
Load-carrying capacity – FZG (A/8.3/90)	ISO14635-1	Failure Load Stage = 12

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www.lubrizol.com

Lubrizol

Lubrizol Internal

Lubrizol, Technical Data, 28.05.2020, p. 2: FZG A/8.3/90, ISO 14635-1, Failure Load Stage = 12.

EP-32 and EP-46: typical properties

PER THE MANUFACTURER'S TECHNICAL DATA SHEET (TDS), MAY 2026

Property	EP-32	EP-46
Viscosity at 40 °C, mm²/s	32.6	46.1
Viscosity at 100 °C, mm²/s	5.8	7.3
Viscosity index	122	121
Flash point, °C	242	253
Pour point, °C	−40	−36
Acid number, mg KOH/g	0.06	0.06
Density at 20 °C, kg/m³	842	847

121–122
VISCOSITY INDEX
VISCOSITY STAYS STABLE UNDER HEAT

242 / 253 °C
FLASH POINT
EP-32 / EP-46

−40 / −36 °C
POUR POINT
EP-32 / EP-46

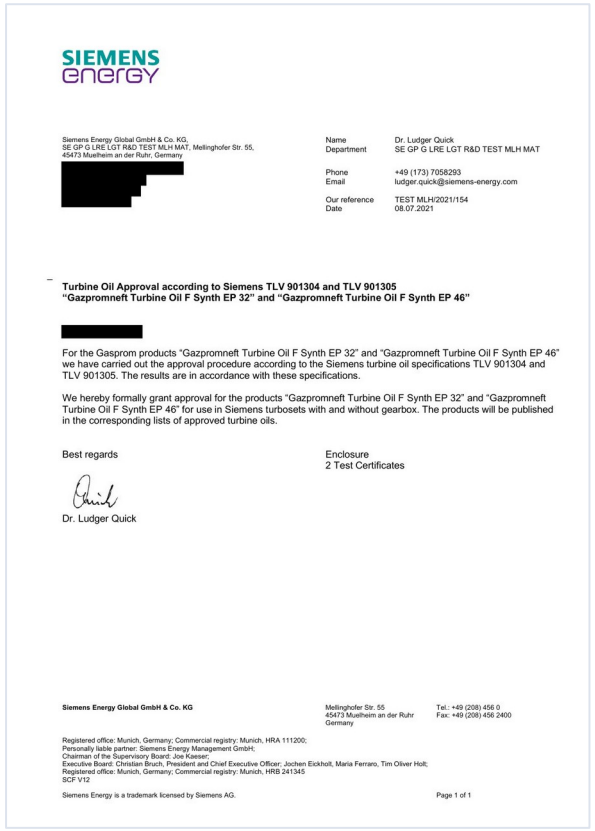
BASE AND ADDITIVES

Hydrotreated mineral base oils; anti-oxidation, anti-corrosion and extreme-pressure additives

TDS Gazpromneft Turbine Oil F Synth EP 32/46, 05/2026, p. 2. Typical values; each delivery comes with a batch certificate of analysis.

Siemens Energy officially approved EP-32 and EP-46

LETTER TEST MLH/2021/154 OF 08.07.2021 · TLV 901304 / TLV 901305



SIEMENS energy

Siemens Energy Global GmbH & Co. KG,
SE GP G LRE LGT R&D TEST MLH MAT, Mellinghofer Str. 55,
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[redacted]

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Department SE GP G LRE LGT R&D TEST MLH MAT

Phone +49 (173) 7058293
Email ludger.quick@siemens-energy.com

Our reference TEST MLH/2021/154
Date 08.07.2021

Turbine Oil Approval according to Siemens TLV 901304 and TLV 901305
"Gazpromneft Turbine Oil F Synth EP 32" and "Gazpromneft Turbine Oil F Synth EP 46"

[redacted]

For the Gasprom products "Gazpromneft Turbine Oil F Synth EP 32" and "Gazpromneft Turbine Oil F Synth EP 46" we have carried out the approval procedure according to the Siemens turbine oil specifications TLV 901304 and TLV 901305. The results are in accordance with these specifications.

We hereby formally grant approval for the products "Gazpromneft Turbine Oil F Synth EP 32" and "Gazpromneft Turbine Oil F Synth EP 46" for use in Siemens turbosets with and without gearbox. The products will be published in the corresponding lists of approved turbine oils.

Best regards

Enclosure
2 Test Certificates

Dr. Ludger Quick

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Chairman of the Supervisory Board: Joe Kaeser;
Executive Board: Christian Bruch, President and Chief Executive Officer; Jochen Eickholt, Maria Ferraro, Tim Oliver Holt;
Registered office: Munich, Germany; Commercial registry: Munich, HRB 241345
SCF V12

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Page 1 of 1

OFFICIAL APPROVAL BY THE TURBINE MANUFACTURER

TLV 901304 · TLV 901305

Siemens Energy turbine oil specifications

BOTH GRADES

Gazpromneft Turbine Oil F Synth EP-32 and EP-46

WITH AND WITHOUT GEARBOX

Scope of approval — Siemens turbine units with and without gearbox

COPY OF THE LETTER IS PUBLICLY AVAILABLE

news.feotech-id.com/documents/approvals/siemens-f-synth-ep-32-46-2021.pdf

Siemens Energy Global GmbH & Co. KG, letter TEST MLH/2021/154 of 08.07.2021; TDS F Synth EP, 05/2026.

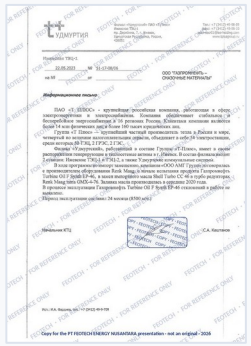
Izhevsk CHP-1: EP-46 in Renk-Maag turbine gearboxes

CHP PLANT, IZHEVSK · RENK-MAAG GMX-4-76 TURBINE GEARBOXES · REPLACING SH · TRB CC 46

GEARBOX OIL SYSTEM



EP-46 — in the oil system of each turbine gearbox, 3,500 L per system



PLANT'S LETTER

No. 51-17-08/06 of 22.05.2023 — feedback from the boiler and turbine shop on EP-46 in the turbine gearboxes

Copy of the letter: news.feotech-id.com/documents/references/izhevsk-chp-1-f-synth-ep-46-2023.pdf

8,500 h
OPERATING HOURS PER THE PLANT'S LETTER

24 months
OPERATING PERIOD

3,500 L
OF OIL IN EACH SYSTEM

PLANT'S ASSESSMENT

No deviations found in turbine gearbox operation

OIL ANALYSIS AFTER 8,500 H

Viscosity 46.6–46.8 mm²/s, water 12–13 ppm — laboratory rating “Normal” (A4)

CHANGEOVER

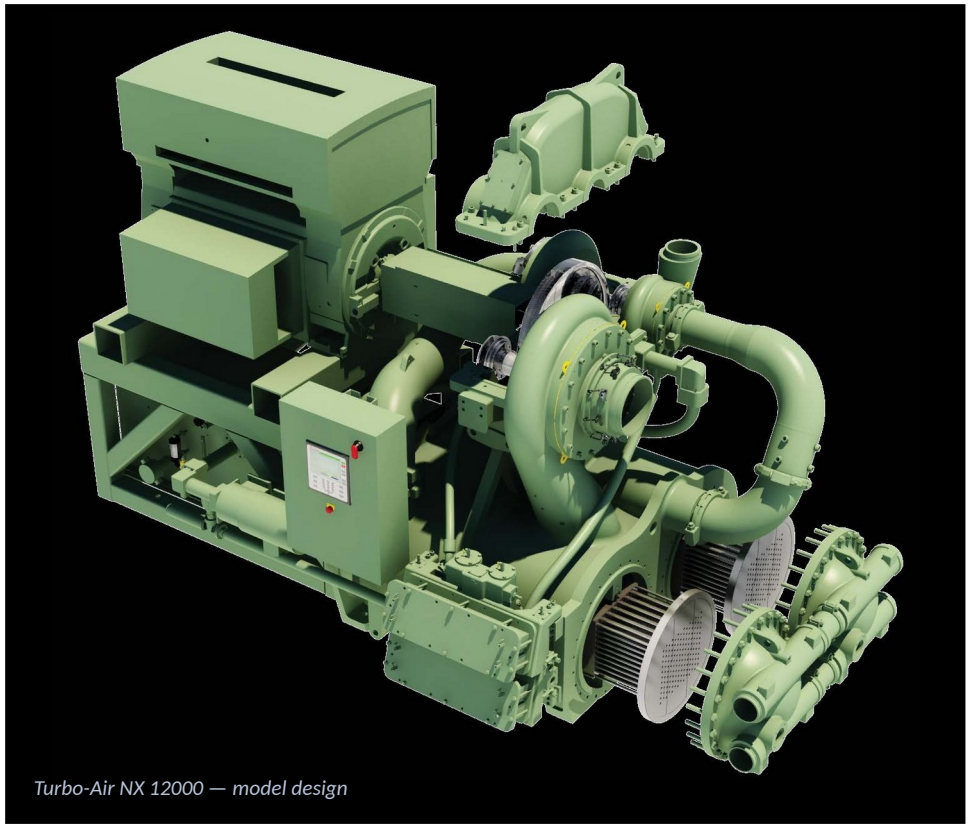
EP-46 instead of SH · TRB CC 46, filled in mid-2020

Two years in turbine gearboxes — without deviations

Izhevsk CHP-1 letter No. 51-17-08/06 of 22.05.2023; oil analysis reports No. 371973 / 371974 of 05.10.2021.

Omsk Refinery: EP-46 in a Turbo-Air NX 12000 compressor

AIR COMPRESSORS VK-1 / VK-2 · UNIT 19/3 · REPLACING IR · TBL 46



Turbo-Air NX 12000 — model design

30,000
RPM
ROTOR SPEED

1,271
KW
POWER INPUT

8,123
OPERATING HOURS

870
LITRES OF OIL IN THE SYSTEM

OPERATING CONDITIONS

CAPACITY
16,000 Nm³/h of air

PRESSURE IN → OUT
0.098 → 0.76 MPa

AIR TEMPERATURE
40 → 95 °C

BEARINGS
50–70 °C

RESULT

- EP-46 replaced IR · TBL 46
- Field trial programme completed successfully
- High-speed machine: 30,000 rpm, 1,271 kW

Omsk Refinery report on EP-46 of 02.03.2022, table 3.2 and conclusions, p. 11. Model design image — Ingersoll Rand brochure, p. 4.

Omsk Refinery: EP-32 in a MAN screw gas compressor

MAN CP-100 · UNIT AT-9 · REPLACING MB · DT 832

up to 12,200
RPM
RANGE 6,300–12,200

132 kW
POWER INPUT

8,556 h
OPERATING HOURS IN THE REPORT

200 L
OF OIL IN THE SYSTEM

COMPRESSOR OPERATING CONDITIONS

Medium	**gas**
Capacity	**759 m³/h**
Pressure in → out	**0.138 → 0.562 MPa**
Gas temperature	**40 → 118 °C**
Bearings	**50–70 °C**

PROGRAMME RESULT

- EP-32 replaced MB · DT 832
- A separate field trial programme was completed successfully
- Equipment operating parameters — normal
- Gas, heating up to 118 °C, speed up to 12,200 rpm

Omsk Refinery report on EP-32 of 02.03.2022, table 3.2 and conclusions, p. 11 — parameters of the tested equipment.

VMZ: F Synth 32 in a CENTAC compressor — 6,000 hours and more

STEEL WORKS · CENTAC C155MX3 CENTRIFUGAL COMPRESSOR · REPLACING TT · GLD III

≥ 6,000 h
OIL CHANGE INTERVAL PER THE REPORT CONCLUSIONS

165 m³/min
INTAKE AIR FLOW

7.7 bar
DISCHARGE PRESSURE

3
COMPRESSION STAGES

THREE AIR COMPRESSION STAGES



Principle of sequential compression — explains the equipment type



MONITORING PROGRAMME REPORT

30 pages, conclusions on p. 7. Oil in the report — Gazpromneft Turbine Oil F Synth 32; compressor CENTAC C155MX3 V7968 No. 2

REPORT CONCLUSIONS

- F Synth 32 recommended to replace TT · GLD III
- Oil change interval — at least 6,000 h for the tested compressor
- Oil properties — within acceptable limits

VMZ report on Gazpromneft Turbine Oil F Synth 32: table 2.1, p. 3; conclusions, p. 7. Oil name — as in the report.

Ural: turbine oil for a nuclear icebreaker

GAZPROM NEFT, 31.10.2022 · FIRST DELIVERY TO ROSATOMFLOT · DEDICATED MARINE FORMULATION



Main turbine generator for the Ural — shipment from the plant

36 MW

OUTPUT OF ONE MAIN TURBINE GENERATOR

245 t

UNIT WEIGHT

DELIVERY · 2022

First delivery of a special high-viscosity turbine oil to Rosatomflot for the Ural

INSTALLATION

Main turbine generator: two-cylinder steam turbine and generator (Kirovsky Zavod)

WHAT IT MEANS

Gazpromneft-Lubricants develops turbine oils for the most critical installations — up to the nuclear fleet

Gazprom Neft, 31.10.2022; Kirovsky Zavod, 21.05.2020 and 11.11.2020. Photo: Kirovsky Zavod PJSC.

EP-46 is registered in Indonesia: NPT valid until 2030

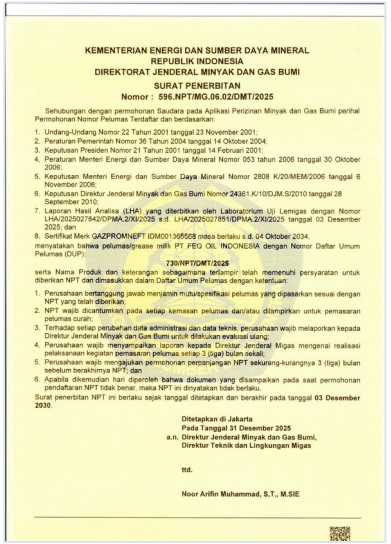
NOMOR PELUMAS TERDAFTAR · DITJEN MIGAS, ESDM · SNI 7069.14:2019

Item	Per the NPT document
Product	Gazpromneft Turbine Oil F Synth EP-46
NPT number	SSC061T4004631230
Category	Minyak Lumas Turbin — turbine oil
Viscosity grade	ISO VG 46
Standard	SNI 7069.14:2019
Issued	31.12.2025, Ditjen Migas (ESDM)
Valid until	03.12.2030

Documents with each delivery: NPT, TDS, SDS and batch certificate of analysis

NOMOR PELUMAS TERDAFTAR

Mandatory registration of lubricants in Indonesia



KEMENTERIAN ENERGI DAN SUMBER DAYA MINERAL
REPUBLIK INDONESIA
DIREKTORAT JENDERAL MINYAK DAN GAS BUMI
SURAT PENERBITAN
Nomor : 596.NPT/MG.06.02/DMT/2025

Sehubungan dengan permohonan Saudara pada Aplikasi Perizinan Minyak dan Gas Bumi perihal Permohonan Nomor Pelumas Terdaftar dan berdasarkan:

1. Undang-Undang Nomor 22 Tahun 2001 tanggal 23 November 2001;
2. Peraturan Pemerintah Nomor 36 Tahun 2004 tanggal 14 Oktober 2004;
3. Keputusan Presiden Nomor 21 Tahun 2001 tanggal 14 Februari 2001;
4. Peraturan Menteri Energi dan Sumber Daya Mineral Nomor 053 tahun 2006 tanggal 30 Oktober 2006;
5. Keputusan Menteri Energi dan Sumber Daya Mineral Nomor 2808 K/20/MEM/2006 tanggal 6 November 2006;
6. Keputusan Direktur Jenderal Minyak dan Gas Bumi Nomor 24361.K/10/DJM.S/2010 tanggal 28 September 2010;
7. Laporan Hasil Analisa (LHA) yang diterbitkan oleh Laboratorium Uji Lemigas dengan Nomor LHA/20250278/2/DPMA.2/XI/2025 s.d. LHA/20250278510/DPMA.2/XI/2025 tanggal 03 Desember 2025; dan
8. Sertifikat Merk GAZPROMNEFT IDM001365568 masa berlaku s.d. 04 Oktober 2034;

menyatakan bahwa pelumas/grease milik PT FEO OIL INDONESIA dengan Nomor Daftar Umum Pelumas (DUP):

730/NPT/DMT/2025

serta Nama Produk dan keterangan sebagaimana terlampir telah memenuhi persyaratan untuk diberikan NPT dan dimasukkan dalam Daftar Umum Pelumas dengan ketentuan:

1. Perusahaan bertanggung jawab menjamin mutu/spesifikasi pelumas yang dipasarkan sesuai dengan NPT yang telah diberikan;
2. NPT wajib dicantumkan pada setiap kemasan pelumas dan/atau dilampirkan untuk pemasaran pelumas curah;
3. Terhadap setiap perubahan data administrasi dan data teknis, perusahaan wajib melaporkan kepada Direktur Jenderal Minyak dan Gas Bumi untuk dilakukan evaluasi ulang;
4. Perusahaan wajib menyampaikan laporan kepada Direktur Jenderal Migas mengenai realisasi pelaksanaan kegiatan pemasaran pelumas setiap 3 (tiga) bulan sekali;
5. Perusahaan wajib mengajukan permohonan perpanjangan NPT sekurang-kurangnya 3 (tiga) bulan sebelum berakhirnya NPT; dan
6. Apabila dikemudian hari diperoleh bahwa dokumen yang disampaikan pada saat permohonan pendaftaran NPT tidak benar, maka NPT ini dinyatakan tidak berlaku.

Surat penerbitan NPT ini berlaku sejak tanggal ditetapkan dan berakhir pada tanggal 03 Desember 2030.

Ditetapkan di Jakarta
Pada Tanggal 31 Desember 2025
a.n. Direktur Jenderal Minyak dan Gas Bumi,
Direktur Teknik dan Lingkungan Migas

ttd.

Noor Arifin Muhammad, S.T., M.SIE

Surat Penerbitan 596.NPT/MG.06.02/DMT/2025

DUP 730/NPT/DMT/2025

Attachment, line 9

Ditjen Migas, Surat Penerbitan 596.NPT/MG.06.02/DMT/2025, DUP 730/NPT/DMT/2025 of 31.12.2025, attachment, line 9.

Compatibility test first: our oil + your oil

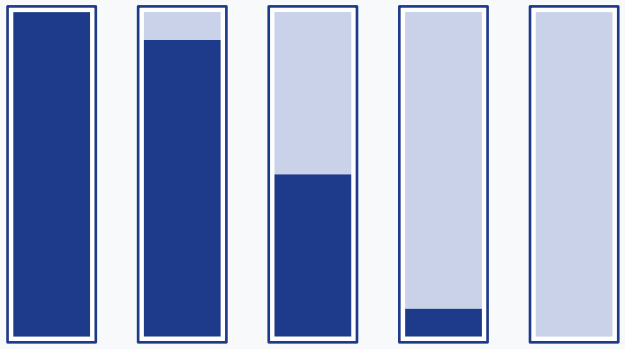
BLEND TEST BEFORE CHANGEOVER · ASTM D7155 PRACTICE · PERFORMED BY FEOTECH

WHY IT MATTERS

- At a changeover, part of the previous oil always remains in the system — in the pipelines, coolers and on the tank walls
- If the two oils' additives are incompatible, the blend forms sediment, foam and varnish — filters, bearings and control valves suffer
- A test before the changeover removes this risk and shows whether flushing is needed

VTI (2025) recommends checking oil compatibility at changeover

TEST BLENDS



F Synth EP share / share of oil from the system, %

F Synth EP

oil in the system

The blends are held under heating and cooling, then inspected for haze, sediment, flocculation and separation

WHAT WE CHECK

- Appearance and sediment after holding
- Foaming — ASTM D892
- Water separation — ASTM D1401
- Oxidation stability — RPVOT
- If needed — varnish tendency (MPC)

FEOTECH CONCLUSION

- Compatible — standard changeover
- Limitations — flush before filling
- Incompatible — full system cleaning

ASTM D7155 — practice for evaluating the compatibility of turbine oil mixtures; VTI, 2025 — recommends checking compatibility at changeover.

Changeover and oil monitoring: five steps

SEQUENCE — BASED ON THE COMPATIBILITY TEST · DECISIONS — BASED ON SAMPLE ANALYSIS

01

Compatibility test

Blends with oil from the system — slide 20

02

Cleaning

Drain and flush scope — based on the test

03

Filling

Filtration of fresh oil, cleanliness before start-up

04

Baseline sample

Reference point for all further analyses

05

Scheduled samples

Trend and manufacturer's limits → decision

WHAT IN-SERVICE OIL ANALYSIS SHOWS

- **Viscosity and acid number** — oil ageing, oxidation products
- **Water and cleanliness (ISO 4406)** — ingress of water and particles, filter performance
- **RULER and MPC** — remaining antioxidants, varnish risk

EXAMPLE · IZHEVSK CHP-1

8,500 h

after the changeover to EP-46, all oil parameters are normal per the laboratory assessment (Appendix A4)

VTI, 2025; TDS F Synth EP, 05/2026; analysis reports No. 371973 / 371974 of 05.10.2021.

We count the cost of ownership, not the price per litre

TOTAL OIL SYSTEM COST OVER ONE PERIOD · BASED ON THE CUSTOMER'S UNIT DATA

(Purchase and top-ups + Oil change and preparation + Condition monitoring + Equipment downtime + Disposal) = Cost for the period

All components are costs for the same period for one unit, under the same delivery terms

01

Same basis

One unit, one period, same delivery terms and prices in IDR

02

Technical result

Oil properties within OEM requirements, analysis trend, no deposits

03

Commercial result

Total cost for the period based on the unit's actual data — the basis for the changeover decision

FEOTECH calculation structure; prices, intervals and volumes — from the customer's unit data.

How to start: from an oil sample to the changeover

THREE STAGES · THE COMPATIBILITY TEST IS PART OF THE TECHNICAL REVIEW

01

Data and oil sample

Unit model and nameplate, OEM requirements, current oil, oil sample from the system

02

Test and proposal

Compatibility test, selected grade, changeover procedure and documents

03

Changeover and support

Filling, scheduled analyses, report and decision on use

WHAT THE PLANT GETS

- Selected oil grade
- Compatibility conclusion
- Changeover plan
- Analysis report

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FEOTECH procedure; timing, services and commercial terms are agreed per project.

A1. Properties and test methods

EACH PROPERTY IS MEASURED BY ITS OWN METHOD AND UNDER ITS OWN CONDITIONS

Property	Method	What it evaluates	Slide
Kinematic viscosity	ASTM D445	Lubricating film thickness and ISO VG grade	12
RPVOT	ASTM D2272	Oxidation stability — accelerated test	09
TOST	ASTM D943	Oxidation stability — long-term test	09
Acid number (TAN)	ASTM D974	Build-up of acidic ageing products	A3, A4
Air release	ASTM D3427	Release time of entrained air	10
Water separation	ASTM D1401	Demulsibility	10
FZG failure load stage	ISO 14635-1, A/8.3/90	Gear protection against scuffing	11

Lubrizol Performance letter, 21.10.2021; FZG EP-46 report, 28.05.2020; TDS F Synth EP, 05/2026.

A2. EP-46: batch certificate — all values in spec with a margin

CERTIFICATE OF ANALYSIS NO. 904 · BATCH 2015011401 · ISSUED 25.02.2020

Property	Result	Certificate limit	Margin
Viscosity at 40 °C, mm²/s	46.96	41.40–50.60	mid-range
Viscosity index	122	≥ 110	+12
Acid number, mg KOH/g	0.10	≤ 0.20	2 times lower
RPVOT, min	4,091	≥ 1,000	× 4.1
Air release at 50 °C, min	3	≤ 5	1.7 times faster
Water separation, min	10	≤ 30	3 times faster
Cleanliness ISO 4406	17/15/11	≤ 19/15/13	cleaner than the limit



Watermarked sample. Signature and stamp hidden; the original comes with every delivery

Certificate of analysis No. 904, batch 2015011401, issued 25.02.2020. Every delivery comes with its own certificate.

A3. EP-46: independent study by VTI

FRESH SAMPLE · COMPARISON WITH SIEMENS MAT 812109 REQUIREMENTS · VTI, 2025

Property	VTI	Requirement	Assessment
RPVOT, min	854	≥ 750	+14% above the requirement
Air release at 50 °C, min	2.5	≤ 4	1.6 times faster
Water separation at 54 °C, min	4.5	≤ 30	6 times faster
Acid number, mg KOH/g	0.063	≤ 0.3	5 times lower

2,215 min

RPVOT PER THE MANUFACTURER'S DATA IN THE VTI ARTICLE

AUTHORS' CONCLUSION

At changeover — check compatibility; after changeover — monitor the oil

VTI — All-Russian Thermal Engineering Institute. The fresh EP-46 sample met all four requirements of the table.

VTI, 2025, table 2, printed p. 119 (PDF p. 120). The manufacturer's data are given separately in the article.

A4. Izhevsk CHP-1: EP-46 analysis after 8,500 hours

TWO UNITS · SAMPLES 24.09.2021 · REPORTS NO. 371973 / 371974

Property	Unit A	Unit B
Viscosity at 40 °C, mm²/s	46.57	46.83
Acid number, mg KOH/g	0.27	0.28
Water, ppm	13	12
Cleanliness ISO 4406	18/15/13	18/16/12
MPC, ΔE	3.4	5.1
Laboratory rating	Normal	Normal

46.6–46.8

VISCOSITY AFTER 8,500 H · ISO VG 46 GRADE RETAINED

“Normal”

OVERALL LABORATORY RATING FOR BOTH UNITS

Reports No. 371973 and 371974 of 05.10.2021; sampling 24.09.2021. Overall laboratory rating — “Normal”.

A5. Approvals and technical confirmations

EACH DOCUMENT HAS ITS OWN PRODUCT, PERIOD AND STATUS

Document	Product	Status and scope
Siemens Energy, 2021	EP-32 / EP-46	Official approval to TLV 901304 / 901305, turbine units with and without gearbox
Alstom, 2012	Turbine Oil 32	Tested and recommended per HTGD 90117 (oil without EP)
Lubrizol, 2021	EP-32 / EP-46	Confirmation of the performance level for the named formulation
Manufacturer's TDS, 05/2026	EP-32	Meets GEK requirements (performance level)
VTI, 2025	EP-46	Independent study, comparison with Siemens MAT 812109 requirements
Migas (ESDM), 2025	EP-46	NPT registration in Indonesia until 03.12.2030

TDS 05/2026; Siemens Energy 2021; Alstom 2012; Lubrizol 2021; VTI 2025.

A6. Sources

PRIMARY DOCUMENTS · FULL REFERENCES — IN THE SLIDE NOTES

MANUFACTURER AND PRODUCTS

Gazpromneft-Lubricants Ltd. corporate presentation, January 2025
TDS F Synth EP-32 / EP-46, 05/2026 · TDS Turbine Oil 32, 04/2020
SDS F Synth EP-32 / EP-46, 04.07.2025

APPROVALS AND REGISTRATION

Siemens Energy, 08.07.2021, TEST MLH/2021/154
Alstom, 06.08.2012, Turbine Oil 32
Migas: NPT 596.NPT/MG.06.02/DMT/2025, DUP 730/NPT/DMT/2025, line 9

LABORATORIES

Lubrizol Performance letter, 21.10.2021
Lubrizol, FZG EP-46, 28.05.2020
VTI, 2025, table 2 · certificate of analysis No. 904, 25.02.2020

FIELD OPERATION

Izhevsk CHP-1: letter 22.05.2023; reports 371973 / 371974
Omsk Refinery: reports on EP-46 and EP-32, 02.03.2022
VMZ: report on F Synth 32, conclusions on p. 7

MARKET AND SPECIAL APPLICATIONS

Mordor Intelligence, Indonesia Lubricants, 2024
Gazprom Neft, 31.10.2022 · Kirovsky Zavod, 21.05 and 11.11.2020

IMAGES

FEOTECH brochure (rotor visualisation) · Kirovsky Zavod PJSC
Ingersoll Rand, Turbo-Air NX 12000 brochure · Gazpromneft-Lubricants presentation for RGT, 2016