



TREM Engineering

an efficient base

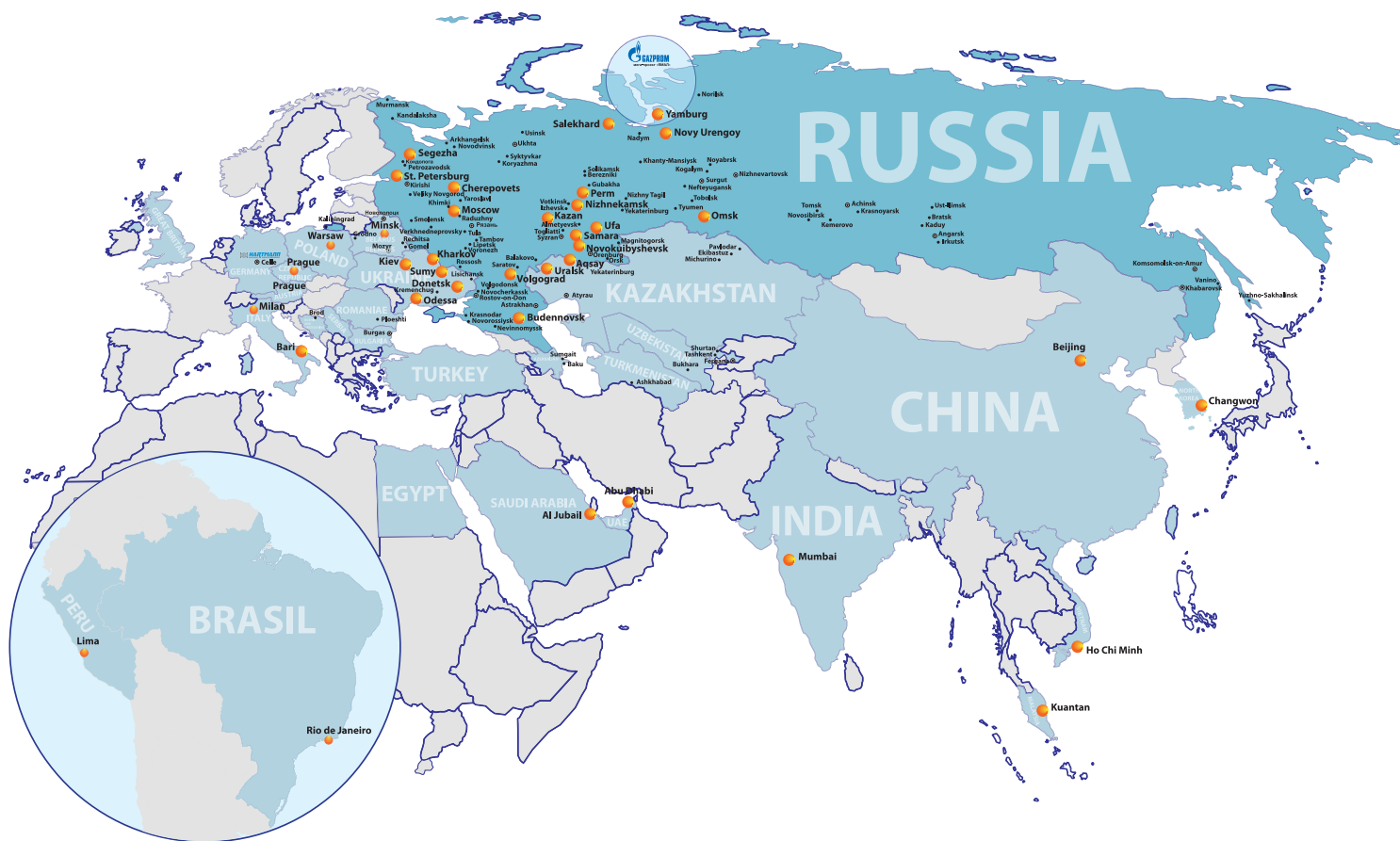
www.tremseals.com



TREM Engineering:

**MECHANICAL SEALS AND DRYGAS SEALS
FOR OIL AND GAS**

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The technology is determined by our mission:

To provide the Customer with products and services of such a high quality that the Customer will rely on us as the main partner in mechanical seals and gas seals.

Where does quality come from?

- A lot of effort has been invested into mechanical seal design. Design starts with FEA calculations of critical components, for example, seal faces or welded metal bellows. As a result, TREM Engineering can boast outstanding performance of mechanical seals, be it lower heat generation in high pressure applications or long life of metal bellows assemblies (no fatigue cracking for at least 5-7 years).
- A lot of effort has been invested into the compact design so that the standard high performance seals fit most seal chambers. For example, our stationary metal bellows seal or dry gas seal are compact but sturdy. Also, being standard, they are not expensive.

Products

Proven sealing solutions for industrial use

- mechanical seals and seal systems
- dry gas seals and control panels for compressors

Our customers

- oil and gas producing companies
- oil and gas refineries
- oil and gas pipelines
- petrochemical plants
- chemical industry
- power generation industry

Manufacturing

- Our Manufacturing and Service facilities are located in Russia and occupies an area of over 7,000 square meters. manufacturing and service.
- For manufacturing mechanical seals, API 682 – specified materials and seal designs are used.
- CNC machining makes production efficient.
- Several test rigs have been installed to test mechanical seals and dry gas seals.
- Quality is assured by an ISO9001-2001 certified quality system.
- Customers enjoy product support of TREM Engineering, be it application engineering, product-specific training, mechanical seal installation, or repair.

Engineering

Our engineers support our customers starting from choosing proper seal design and up to installation, commissioning, performance monitoring, maintenance, and repair.



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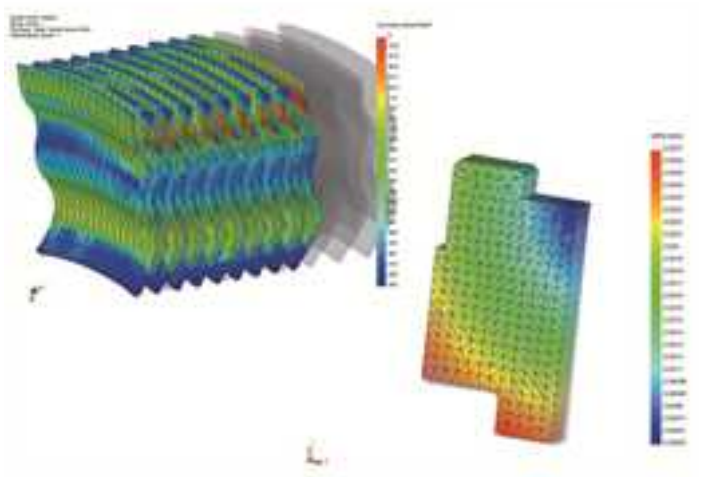


WE GAIN EXPERIENCE



Seals performance at more than 25 major refineries and petrochemical plants with overall refining capacity 390.000 cubic meters a day has been analyzed.

WE DESIGN



Design is based on FEA calculations and is backed up by more 80 year history of Russian mechanical seal industry.

WE MANUFACTURE AND TEST



Best western and domestic equipment are used for seal manufacturing and testing.

**WE PUT INTO OPERATION
AND TRACK OPERATION HISTORY**



TREM Engineering and Customer engineers work together starting from seals installation and commissioning and up to "plant through" seal MTBR optimization program.

* based on the reports at the 2008 Annual Meeting of Senior Mechanical Engineers (of Russian oil refineries)

FEATURES

BENEFITS

Proven seal range for almost any pump at oil/gas exploration, transportation, refining and petrochemical industries. Deep knowledge of equipment operational conditions specifics.

Very good seal durability and standardization through all customer process units. Customer may implement "company through seal/pumps maintenance costs optimization program" with just one supplier.

Competitive pricing both for complete seals and spare parts kits.

Lower running costs of pumps

Comprehensive SD and RDT dual seal families for both hot and cooler applications for oil refinery units starting from atmospheric and vacuum distillation to hydrocracker and ethylene units.

The SD and RDT seals have won the trust of refinery engineers in Russia and nowadays about 70% of Russian major refinery critical process pumps are equipped with our seals.

Highly professional seal application engineers "trained" by pumps of more than 25 Russian and CIS refineries and petrochemical plants attend to customers' needs.

Most of our customers have chosen TREM Engineering engineers as main consultants and trouble shooters for ALL seals, including seals of famous western manufacturers.

The compact design of our high performance seals and flexible manufacturing allows us to fit proven standard designs to almost any seal chamber of almost any pump.

The majority of oil refineries in Russia and CIS have switched most of their Flowserve, Sulzer, Borg Warner, KSB and other western pumps to Trem Engineering seals.



APITERM SD

Cartridge dual welded metal bellows “o rings free” mechanical seal (API 682, Type C)

Description

The APITERM (R) mechanical seal is the new addition to the SD family of welded metal bellows mechanical seals. These seals are mainly designed for sealing hot hydrocarbons at oil refineries and petrochemical plants. SD family seals correspond to API682, type C seal. The APITERM SD mechanical seal can be used both in tandem (API682 Arrangement 2) and double (API682 Arrangement 3) modes. Also, contacting wet and dry running outboard seal versions are available.

Advantages

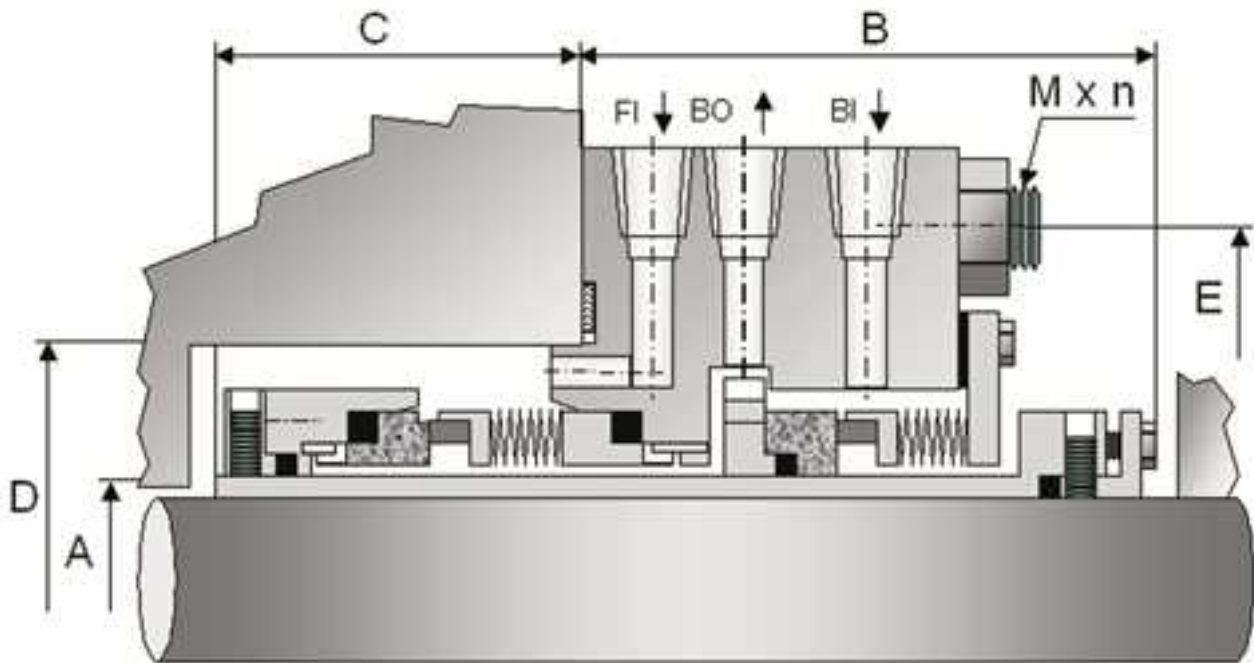
- Almost the only stationary bellows tandem seal on the market fitting API 610 standard seal chambers (a stationary bellows seal offers many advantages to the end user);
- Double layer tilted edge inner bellows as standard;
- Same design for API Plans 52, 53, and 54
- This seal shares many parts with APILITE RDT seal which makes production cheaper.

Technical data	
Temperature	From 70 up to +425°C
Dynamic Pressure	Up to 65 bar
Static pressure	Up to 90 bar
Linear speed	Up to 50 m/sec

Materials	
Metal bellows	Inconel 718 Alloy 276 AM350
Seal faces	Tungsten carbide, Silicon carbide, Carbon, Trembide 85, Trembide 50
Secondary seals	Flexible graphite
Metal parts	SS304 SS316 SS321H Special alloys

Recommended API Plans for APITERM SD seals			
API 682 Flush Plan	Description	Application guidelines	Seal systems
52	Non pressurized external fluid reservoir with forced circulation	Most of light and heavy hydrocarbons, alcohols, solvents, etc	Barrier fluid tank with heat exchanger SO 1 (high temperature applications) or SO 3, SO 12, SO 20 with ball valves and instrumentation
53	Pressurized external fluid reservoir with forced circulation	Fluids with high content of mechanical impurities, hazardous fluids, crystallizing fluids	
54	Circulation of clean fluid from external system	Fluids with solids, crystallizing fluids	
11, 13	Recirculation from/to pump case through orifice to/from seal	VOCs	
62	Steam or nitrogen quench supplied after the inboard seal	Coking and solidifying fluids (mostly hydrocarbons)	Supply system for the dry running outboard seal

APITERM SD mechanical seal diagram



APITERM SD seal for Russian hot oil pump NK560/335 180.



APITERM SD seals were successfully designed for the pumps of many famous manufacturers:

- Sulzer
- Flowserve
- Worthington
- KSB
- Byron Jackson
- RuhrPumpen
- EBARA
- Nigata
- Ingersoll Dresser Pumps



All of the above systems can be supplied with:

- level sensors/indicators
- pressure switch, temperature sensor
- safety valve
- ball valves
- and other C&I devices and valves



SO SINGLE BELLOWS SEALS FOR HIGH TEMPERATURE APPLICATIONS (API 682, TYPE C)

Description

SO series welded metal bellows cartridge single mechanical seals are designed for sealing many fluids including chemically aggressive with temperature from 70 to +425 °C.

Materials	
Bellows	Alloy AM 350, Hastelloy® C, Inconel 718
Seal rings	Tungsten carbide, silicon carbide, carbon graphite, Trembide 85, Trembide 50
Secondary seals	Flexible graphite with or without stainless steel reinforcement
Metal items	Stainless steel SS304, SS316, SS321H

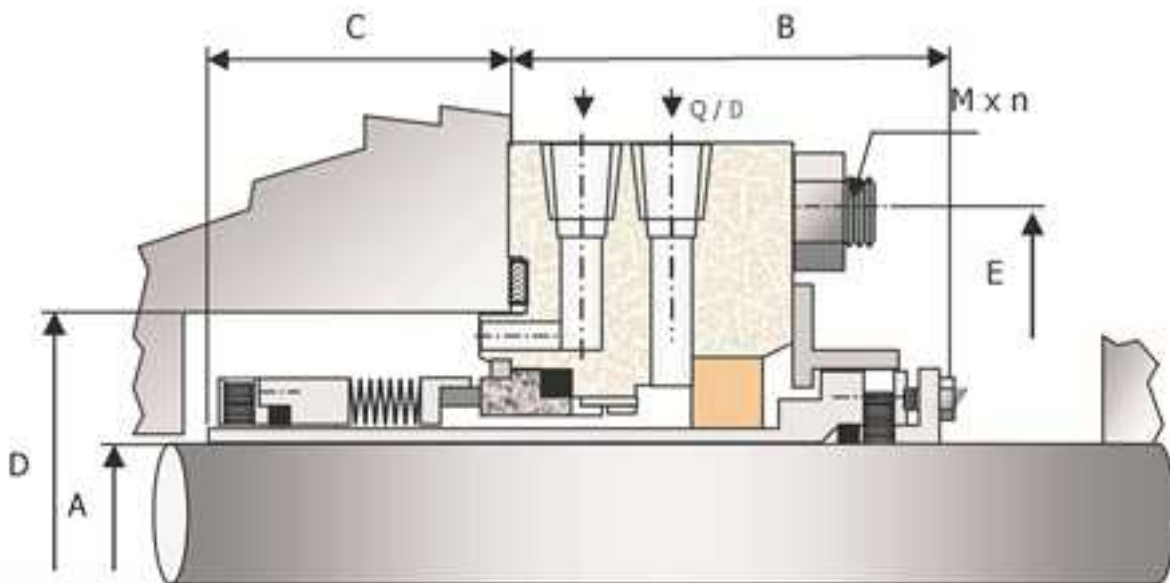
Advantages

- Welded metal bellows mechanical seals feature no rubber secondary seals; all seal components are made of advanced thermally and chemically resistant materials to substantially expand the range of application temperatures and fluids.
- The SO series mechanical seals are fitted with a throttle bushing as a secondary seal; it can be used to seal inflammable fluids in compliance with OST 26 06 2028 96.
- Being a single seal, the SO mechanical seal's support system is by far less complicated than that of a double mechanical seal (but before use please check if you are allowed to use a single seal for the specific application).
- Compared to spring loaded mechanical seals metal bellows seals are more resistant to clogging and hang up.
- Shaft sleeve is sealed by a gland tightened graphite gasket. This provides for higher sealing safety especially with worn out or scratched/galled shafts.
- Metal bellows mechanical seals are balanced, so they have lower heat generation.

Technical data	
Temperature	From 70 to +425°C
Pressure	Up to 65 bar (with reinforced bellows), 90 bar static
Linear speed	Up to 50 m/sec (with stationary bellows)

Recommended API Plans for SO seals			
API 682 Flush Plan	Description	Application guidelines	Seal systems
11, 13	Recirculation from/to pump case through orifice to/from seal chamber before the seal	VOCs, crystallizing fluids, fluids with solids	
62	Steam or nitrogen quench, applied between main seal and throttle bushing	Coking and hardening fluids (mainly hydrocarbons)	

SO seal general layout (rotary bellows version shown)



The seal is designed to every pump individually

Due to compactness of SO seals in radial direction they can be installed into sealing chamber of most pumps, mixers, reactors and other equipment, including imported one.

To receive an offer for SO mechanical seals for specific applications, it is advisable to fill in the seal selection form.



SO seals were successfully designed for the pumps of many famous manufacturers:

- Sulzer
- Flowserve
- Worthington
- KSB
- Byron Jackson
- RuhrPumpen
- EBARA
- Nigata
- Ingersoll Dresser Pumps



“TREM Engineering SO seals not requiring an additional heat exchanger proved to be reliable solution for hot pump with coke particles in fluid”

SIBUR



APILITE RDT

TANDEM PUSHER SEAL (API 682, TYPE A)

Description

The APILITE (R) mechanical seal is a new addition to the RDT cartridge seal family. It is designed for sealing heavy and light hydrocarbons, including VOCs, and other hazardous fluids at oil refineries and petrochemical plants, gas plants, and chemical plants. APILITE RDT seal is an o ring dual seal to be used with API Plan 52, 53, or 54.

Advantages

- Minimized bending of seal rings allows for stable operation under higher pressures and for longer MTBR (mean time between repair) because of less wear;
- Same seal can be used in tandem and double applications;
- Interchangeability of many parts and design solutions with the SD APITERM seal reduces inventory of spare parts, lets the seal survive under pump dry running, and decreases prices by encreasing parts production volume;
- Tolerates pump dry running even in tandem mode;
- Containment outboard seal version available for API 682 flush plans 71 and 72;
- Connections for API 682 flush plans 11/13, 21, 22, 31, 32, and 52/53/54 are provided as standard.



All of the above systems can be supplied with:

- level sensors/indicators
- pressure switch
- temperature sensor
- safety valve
- ball valves
- and other C&I devices and valves

Technical data	
Temperature	From -50 up to +260°C
Dynamic Pressure	Up to 50 bar
Static pressure	Up to 90 bar
Linear speed	Up to 50 m/sec

Materials	
Seal faces	Tungsten carbide, Silicon carbide, Carbon, Trembide 85, Trembide 50
Secondary seals	Viton®, ethylene propylene, Kalrez®, etc.
Metal parts	SS304 SS316 SS321H Special alloys
Springs	Hastelloy® C

Recommended API plans for APILITE RDT seal

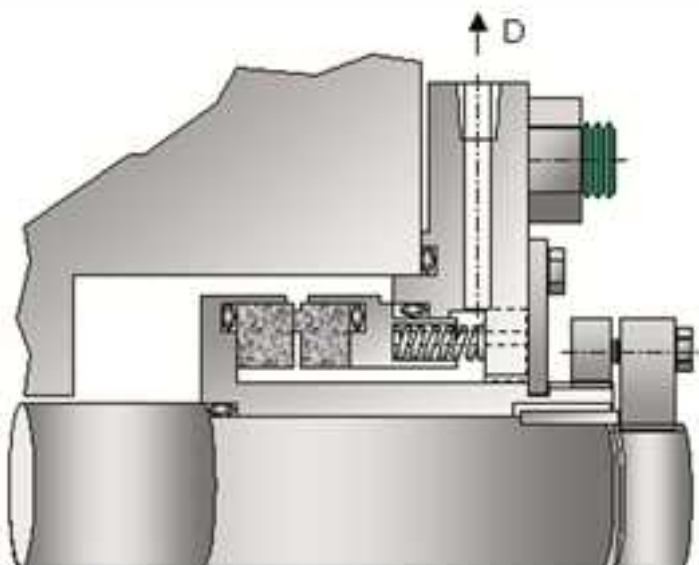
API 682 Flush Plan	Description	Application guidelines	Seal systems
52	Non pressurized external fluid reservoir with forced circulation	Most of combustible liquids, volatile flammable liquids (light and heavy hydrocarbons), alcohols, solvents, ethanolamine, etc	Barrier fluid tank with heat exchanger SO 1, SO 3, SO 12 or SO 20 with auxiliary valves
53	Pressurized external fluid reservoir with forced circulation	Fluids with high content of mechanical impurities, hazardous fluids, crystallizing fluids	Barrier fluid tank with heat exchanger SO 1 (high temperature applications) or SO 3, SO 12, SO 20 with ball valves and instrumentation
54	Circulation of clean fluid from external system	Fluids with solids, crystallizing fluids	
11, 13	Recirculation via throttling orifice to/out of chamber before the seal	VOCs, crystallizing fluids, fluids with solids	

RO SINGLE SEAL FOR OIL & GAS APPLICATIONS

Description

RO family seals are mainly designed for sealing crude oil, water and petroleum products in the oil & gas industry. There are several specially engineered seals to cover the needs of the industry:

- Seal for water injection pumps. This seal has special design to protect the dynamic o ring from hang up and to allow for shaft axial movement of 10 mm to compensate for thrust bearing wear. This new seal has had huge success and is widely used now at TNK BP's biggest oil producing division in Russia.
- Special seal for pumps pumping crude oil to main crude oil transportation pumps. This seal also features 10 mm axial movement capability.
- Seal for main crude oil transportation pumps.
- New: 50 – series high pressure mechanical seal. The new seal operates with less friction, less wear and 10 times less leakage compared to older generation seals. Although new, this seal has already proved its high pressure capability at crude oil pumps and boiler feed water pumps.



Oil exploration

Water injection multistage pumps



Pipeline high pressure applications. Refinery high pressure applications.



Advantages (depending on seal model)

- Ability to compensate for huge shaft travel
- No O ring hang up
- High pressure capability

Technical data

Temperature	From 70 to +260 °C
Static Pressure	Up to 100 bar (200 bar with special design)
Dynamic Pressure	Up to 100 bar (50 series seal)
Linear speed	Up to 50 m/sec



SGDU

GAS SEAL FAMILY

Description

Use of dry gas seals in centrifugal compressors has increased dramatically during the last 20 years because these seals provide many benefits for the end user. In gas seals lubricating oil is not used, thus it can no longer contaminate the process.

All manufactured gas seals are run on test rigs at working parameters as well as beyond them (speed). Customers are welcome to visit our facility for a witnessed test. The procedure is as per API 617 Standard.

For compressors at GAZPROM's natural gas pipeline transportation and distribution network, TREM Engineering has designed two series of dry gas seals:

- 1 SGDU 210 Gas Seal – for compressors NC 16 series (16 MW) – a compact gas seal with traditional carbon vs tungsten carbide faces.
- 2 SGDU 220 Gas Seal – for compressors PCL 804 series – a gas seal with diamond coated silicon carbide faces with varying depth of grooves.

For compressors at oil refineries and petrochemical plants, SGDU 210 Gas Seal is recommended.

TREM Engineering offers to its customers not only new gas seals and control systems. A complete package to upgrade a compressor from oil seals to dry gas seals is available. In this very popular package, besides seals, engineering, control panels and necessary new parts are included.

The following compressor sealing products are manufactured:

- Tandem seal, with additional labyrinth seal or without it
- Double seal, with additional labyrinth seal or without it
- Triple seal for extra clean processes (combination of tandem and double seals so that nitrogen does not get into the process, but the process gas does not get into the bearing / shop atmosphere as well)
- Single seal
- Rigid radial and thrust bearings (useful when upgrading from oil mechanical seals)
- Control panels, Emerson (Fisher/Rosemount) based (useful when upgrading from oil mechanical seals or for supply to OEM).

In addition, nitrogen generation, air supply systems and temperature & vibration monitoring systems can be offered.



The following jobs have been successfully done by 2010:

New complete compressor sealing systems at

- Syzran Oil Refinery, Russia
- Omsk Oil Refinery, Russia
- Mozyr Oil Refinery, Byelorussia.

New dry gas seals to replace original seals at

- Omsk Oil Refinery, Russia
- Nizhnekamsk Oil Refinery, Russia
- Gazprom's Zavolzhskaya natural gas transfer station.

A number of other manufacturer's dry gas seals have been repaired (the list available upon request).

Technical data	
Shaft size, mm	50 200
Speed, RPM	100 14000
Temperature, °C	50/+200
Pressure, bar (dynamic)	100
Pressure, bar (static)	150



Photos of dry gas seals in the field

Major compressor upgrade job replacing wet seals with dry gas seals. Project: Oil refinery at Angarsk Petrochemicals (Rosneft), Angarsk, Russia, 2009. The transferred gas is petroleum gas with high content of solids and heavier fractions condensate!



This is the old wet seal. The compressor is horizontally split. The wet seal was part of the lubricating system so with the wet seal removed the lubrication system had to be modified.



New dry gas seal on compressor rotor, ready for installation.



Compressor being closed.



Job almost done. The complete job included wet seal removal, modification of the lubricating system, dry gas seal installation, rotor balancing, installation of the control panel, nitrogen supply connection, cables connection.

50-series TANDEM SEAL FOR HIGH PRESSURES AND SPEEDS (API 682, TYPE A)

Description

The new generation high pressure 50 series mechanical seal is designed for high pressure applications, such as crude oil, hot water, light hydrocarbons, including VOCs, at oil producing, oil transportation, oil refineries and petrochemical plants, power plants. Depending on the application, it is made single, tandem or double.

Typical applications include

- Main crude oil transportation pumps single and tandem
- Boiler feed water pumps single
- Multi phase pumps double
- Flashing hydrocarbons under high pressure tandem or double.



Materials	
Seal faces	Tungsten carbide, Silicon carbide, Carbon, Special materials, Trembide 85, Trembide 50
Secondary seals	Viton®, ethylene propylene, Kalrez®, etc
Metal parts	SS304 SS316 SS321H Special alloys
Springs	Hastelloy® C

Technical data	
Temperature	From -50 up to +260°C
Dynamic Pressure	Up to 100 bar
Static pressure	Up to 100 bar (200 bar with special design)
Linear speed	Up to 50 m/sec

High pressure capability

Tests show that a traditional seal has leakage rate of 150-250 ml/hour at 50 bar, 3000 rpm, oil 35°C. Why? Because of high pressure, seals faces bend, and the small gap between the faces goes out of parallel. The gap becomes conical. Because of this, the fluid film in the gap does not act as in a sliding bearing anymore. Friction and wear increase. It is clearly seen during testing: when the test rig is switched off, the shaft stops immediately because of high friction. And when the seal is disassembled after an 8 hour run, initial wear is already seen on the faces.

In the 50 series seal, faces have been carefully designed using FEA (finite element analysis). The good results are immediately seen during testing: when the test rig is switched off, the shaft rotates for 8-10 seconds because of inertia (it points to low friction). And when the seal is disassembled after an 8 hour run, NO initial wear can be seen on the faces. Leakage rate is as little as 15-30 ml/hour at the same 50 bar, 3000 rpm, oil 35°C. The leakage rate is 10 times less!

Recommended API plans for 50 series seal

API 682 Flush Plan	Description	Application guidelines	Seal systems
52	Non-pressurized external fluid reservoir with forced circulation	Most of combustible liquids, volatile flammable liquids (light and heavy hydrocarbons), alcohols, solvents, ethanolamine, etc	Barrier fluid tank with heat exchanger SO 1, SO 3, SO 12 or SO 20 with auxiliary valves
11, 13	Recirculation via throttling orifice to/out of chamber before the seal	VOCs, crystallizing fluids, fluids with solids	

Seal advantages

- Excellent for high pressure applications
- Stationary springs allow for high speed
- Special wear resistant, non-sticking materials are available for seal faces (see below).

Special hard faces available

- Further resist deformation
- Anti-stick, low wear properties
- Can operate in non-lubricating fluids such as hot boiler feed water.

SO-12/20 BARRIER FLUID RESERVOIRS FOR DUAL MECHANICAL SEALS

Description

SO 3 reservoir (see below) is available in API 682 3rd edition 12 and 20 liter versions. The reservoirs can be used with flush plans API 52 or 53A as per API682. To operate under the API 53A Plan, the barrier fluid tank may be equipped with a manual fluid make up pump. A 12 or 20 liter reservoir is chosen depending on pump shaft diameter as required by the API 682 standard.

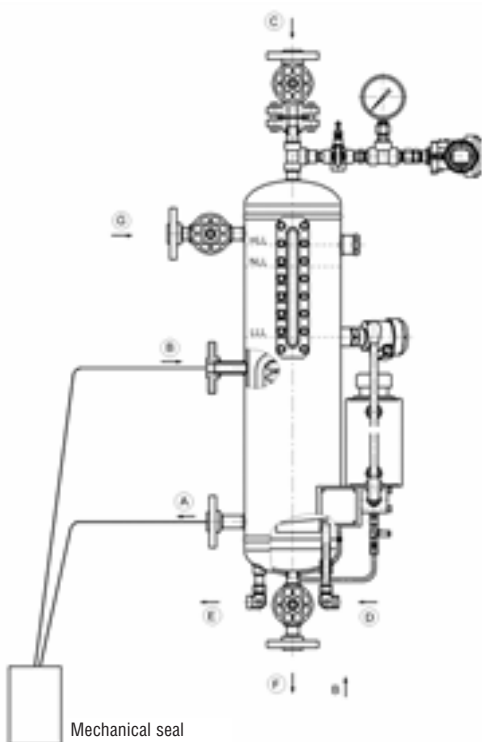
The reservoirs are fitted with:

socket welded ANSI B16.11 #800 block valves;

ASME B16.5 flanges for barrier fluid IN/OUT lines, drain, fluid make up and vent connections. Connections may be threaded if specified.

The reservoirs can be fitted with instrumentation and control for automatic checking of mechanical seal performance and pump shut down in case of mechanical seal failure. The instrumentation and control may include a level sensor, a pressure switch, and a temperature sensor. Sensors and switches are either intrinsically safe or explosion proof depending on customer's order.

Example of use: SO 20 Liter Reservoir in API 682 Plan 53A



Brief Specifications

Heat exchanger type	Coil, vertical
Design Pressure	63 bar
Design Temperature	200°C

Connections

A	Supply to seal	Flange 3/4" #600 RF
B	Return from seal	Flange 3/4" #600 RF
C	Nitrogen source	Flange 3/4" #600 RF
D	Cooling water inlet	G 1/2, female
E	Cooling water outlet	G 1/2, female
F	Drain	Flange 3/4" #600 RF
G	Fluid fill in	Flange 3/4" #600 RF

SO-1

BARRIER FLUID TANK FOR DUAL MECHANICAL SEALS

The SO 1 barrier fluid tank (reservoir) is designed to contain barrier fluid for a tandem or double mechanical seal, to provide its cooling and to control mechanical seal performance. The SO 1 barrier fluid tank can be used with API Plans 52 or 53 as per API682.

TECHNICAL DATA	
Heat exchanger type	Shell and tube, floating head, four way, vertical
Cooling power	Up to 3.8 kW
Barrier fluid volume	7.8 liters
Maximum barrier fluid pressure in reservoir	35 bar
Maximum barrier fluid temperature after mechanical seal entering reservoir	150°C
Triggering pressure of the installed safety valve	6 8 bar
Heat exchanger cooling area	0,55 m ²
Heat exchanger effective volume	1,2 liters
Heat exchanger tube pack length	0,58 m
Heat exchanger tube cross section	16x2 mm
Heat exchanger tubes quantity	5x4=20 pcs
Heat exchanger cooling fluid	Water 15 30°C
Cooling water flow rate	0.6 1.2 m ³ /hour
Minimum service life	10 years
Weight	54 kg

Design Features

The SO 1 barrier fluid tank can be easily disassembled, so the heat exchanger can be mechanically cleaned.

Materials of parts:

metal parts SS321H

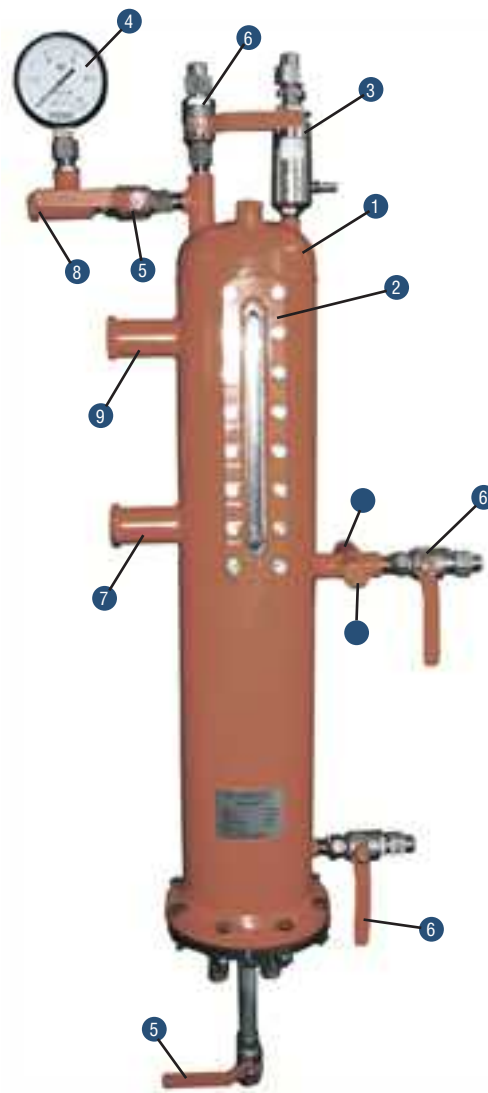
gaskets reinforced flexible graphite MG140 1 or PTFE

Barrier fluid tank is supplied with ball valves with fittings for welded connections to fit barrier fluid tubes.

The basic version of the SO 1 heat exchanger includes a 1/2" safety valve, a pressure indicator, and a level gauge.

The system can be fitted with instrumentation and control for automatic checking of mechanical seal performance and pump shut down in case of mechanical seal failure. The instrumentation and control version of SO 1 can additionally include a level sensor, a pressure switch, and a temperature sensor. Sensors and switches are either intrinsically safe or explosion proof depending on customer's order.

SO 1 Barrier fluid tank. Basic version system shown



- 1 Reservoir
- 2 Level indicator
- 3 Safety valve
- 4 Pressure indicator
- 5 Ball valve
- 6 Ball valve
- 7 Low level switch connection
- 8 Pressure switch connection
- 9 High level switch connection
- 18 Temperature indicator connection
- 19 Temperature sensor connection

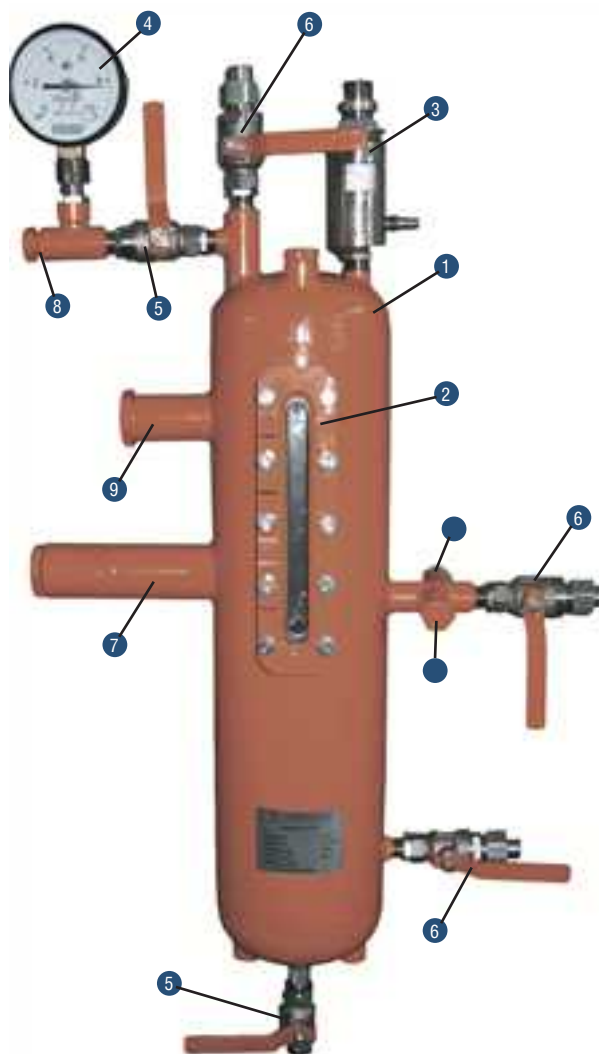
SO-3 BARRIER FLUID TANK FOR DUAL MECHANICAL SEALS

The SO 3 barrier fluid tank (reservoir) is designed to contain barrier fluid for a tandem or double mechanical seal, to provide its cooling and to control mechanical seal performance. The SO 3 barrier fluid tank can be used with API Plans 52 or 53 as per API682.

TECHNICAL DATA	
Heat exchanger type	Water 15 30°C
Cooling power	Up to 2.0 kW
Metal parts material	ss304 or ss321H
Gaskets	Flexible graphite
Barrier fluid volume	6.5 liters
Maximum barrier fluid pressure in reservoir	35 bar
Maximum barrier fluid temperature after mechanical seal entering reservoir	150°C
Heat exchanger cooling fluid	Water, diesel, glycol 5 30°C
Cooling water flow rate	0.6 – 1.2 m³/hour
Weight	32 kg

Design features

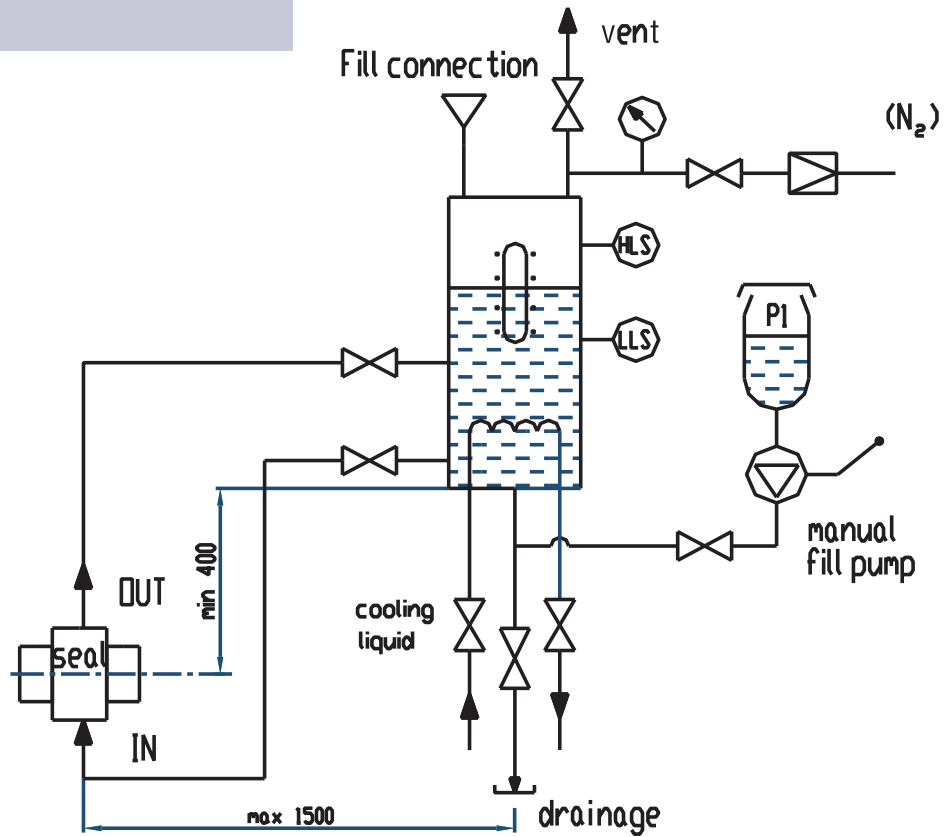
The system can be fitted with instrumentation and control for automatic checking of mechanical seal performance and pump shut down in case of mechanical seal failure. The instrumentation and control version of SO 3 can additionally include a level sensor, a pressure switch, and a temperature sensor. Sensors and switches are either intrinsically safe or explosion proof depending on customer's order



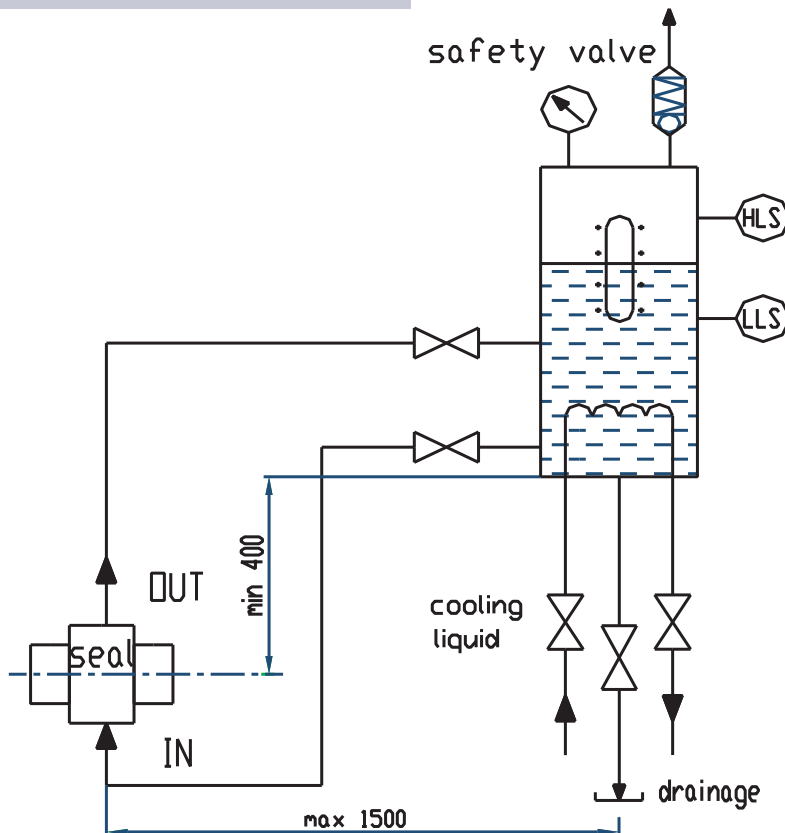
- 1 Reservoir
- 2 Level indicator
- 3 Safety valve
- 4 Pressure indicator
- 5 Ball valve
- 6 Ball valve
- 7 Low level switch connection
- 8 Pressure switch connection
- 9 High level switch connection
- 18 Temperature indicator connection
- 19 Temperature sensor connection

General double seal piping system

Plan 53 (API 682)



Plan 52 (API 682)



Designations:

- MS mechanical seal
- IN barrier fluid IN
- OUT barrier fluid OUT
- LS level switch
- PS pressure switch
- P1 filling vessel
- V thermo siphon vessel

Also readily available: 53B, 23, 65 and 75 seal systems.

SEAL SYSTEM PLAN **API 53B**

Description

In flush Plan 53B barrier fluid circulates to and from a double mechanical seal (Arrangement 3 seal). Pre pressurized bladder accumulator provides pressure to the circulation system. Flow is maintained by the seal impeller. Heat is removed by the heat exchanger. A centralized or local auto top up unit is recommended for higher pressures.

Plan 53B advantages:

Plan 53B is recommended when barrier fluid pressure is above 10 bar to avoid the problem of nitrogen dissolving into the barrier fluid. In Plan 53B barrier fluid and nitrogen are physically separated by the elastomer bladder.

A Plan 53B system does not require a nitrogen line near the installed pump unit. Nitrogen is injected into the system only once with the required pressure. Only fluid make up is required during operation (automated top up is recommended for higher pressures).



SEAL SYSTEM PLAN **API 65**

Description

Flush Plan 65 is used to detect excess leakage from a single mechanical seal. Since mechanical seals at high pressure applications will leak, it is important to differentiate between normal leakage from a healthy seal and high leakage from a failed seal. This system does it and sends an alarm when the seal fails.



Mixer solutions

Description

Implementing standard technology of SD/RDT/SGDU seals for mixers enables TREM to design mixer seals with features:

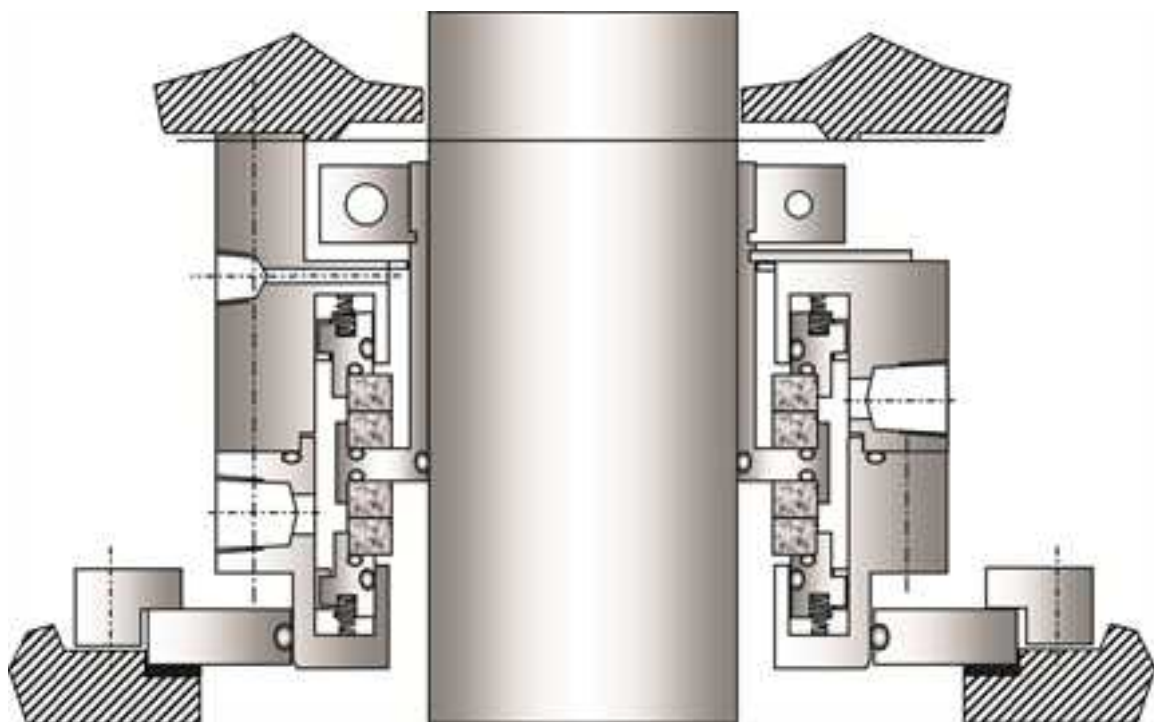
- Bellows mixer seals for applications where elastomers can not be used
- High pressure mixer seals for pressures up to 200bar
- Seals for sticky, abrasive, polymerizing fluids
- Seals for top, side, bottom vessel entry

Advantages

- Various designs to meet most demanding applications.
- Finite element analysis optimized seal rings to minimize deformation and emissions longer seal life.

Materials	
Seal faces	Silicon carbide, carbon, tungsten carbide, Trembide 85
Secondary seals	EPDM, fluoroelastomer, perfluoroelastomer, fluorosilicone, and others
Springs	Hastelloy® C
Metal parts	SS316, SS304, SS321H, Titan, and others

Technical data	
Temperature	From -196 up to +425 °C
Dynamic Pressure	Up to 200 bar
Static pressure	up to 200 bar
Speed	Up to 10 m/sec



DLS

Diamond-Like Carbon (DLC) coatings - Longer, Farther, Faster!
Coating technology developed in Russia.



Due to our innovative equipment of applying DLC-coatings, seals show high terms of reserve maintenance periods, resistance to work in extreme conditions withstand extremely adverse and over difficult operating conditions.

Properties of offered DLC-coatings:

Hardness - 1200-4500HV depending on type of coating:

- Dry friction against steel – 0.05-0.12
- Coating thickness – 5-40 μm . As coating is the final process no machining is made after the coating.
- Wear resistance is 13-20 higher than of steel and 3-5 higher than of tungsten carbide.
- Porosity – less than 0.5%, so it's good for corrosion protection.
- High chemical resistance to most acids and alkalis.
- One grade of coatings can be used to coat deep and blind holes.

Currently size of parts accepted for coating is limited to 390 mm (15") in diameter and 900 mm (35") in length.



"... In 2003 the SD TREM Engineering "o ring free" seals were installed (API plan 52) at hot heavy hydrocarbon and residue pumps of tar cracking unit. The seals were installed without any additional heat exchangers or injection of cooled fluids into stuffing box. After 20months of operation all seals are still running well without any problems."

Sibneft Omsk refinery



"...Tandem SD seals work well (API plan 62) at hot residue pumps without barrier fluid and additional cooling and show the same durability as previously installed seals by Sealol(UK)"

LUKOIL Volgograd refinery



"Tandem SD seals have been operating since 2000 at the following applications without problems:

- 1. Vacuum distillation and visbreaking Russian VNM pumps (hot hydrocarbons, t up to 380 C)*
- 2. Vacuum distillation and visbreaking USA Flowserve pumps (hot hydrocarbons, t up to 380 C)"*

Nizhnekamsk refinery



"...SD seal high quality and good reliability make it first choice for hot pumps service..."

GAZPROM, Sosnogorsk gas plant



"...High quality TREM mechanical seals and sealing materials are up to the most demanding standards and application conditions..."

YUKOS, Syzran refinery



"...TREM SD tandem seals were installed at new Flowserve hot oil pumps at visbreaking and FCC units. TREM seals durability is at least as long as original Flowserve seals or even better"

Slavneft Mozyr refinery



"TREM seals successfully used at MPC286 76 (Borneman)pumps for multiphase fluid gas pumping at oil fields"

Rosneft



"TREM Engineering SO seals not requiring an additional heat exchanger proved to be reliable solution for hot pump with coke particles in fluid"

SIBUR



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