

EagleBurgmann supplies high-pressure seals for Russia's ESPO pipeline project

EagleBurgmann Germany GmbH & Co Kg is playing a major role in the East Siberia Pacific Ocean pipeline project by supplying high-pressure seals for pumps that are used to move oil. Ellen Klier and Franz Schäfer, who are responsible for group marketing and Eastern Europe sales, respectively, at the company, briefly describe the company's involvement in this project and look at the sealing technology that is being used.

The state-owned Russian company Transneft Jsc is building the East Siberia Pacific Ocean (ESPO) pipeline in two phases (see box copy). With a total length of 5000 km, the pipeline – which is scheduled to be completed and operating at full capacity in 2014 – will supply Siberian oil to China, Japan and Korea.

The first phase (ESPO-1) of the pipeline – which takes oil from the city of Taishet in the Eastern Siberian region of Irkutsk to the city of Skovorodino in Russia's eastern Amur region – has been operating since the end of 2009. The

planned second phase (ESPO-2) will extend the pipeline from the station based at Skovorodino to the port of Kozmino on the Pacific Ocean.

EagleBurgmann Germany GmbH & Co Kg, which has technical expertise in the oil and gas industry and experience in transporting oil over long distances, under a range of different operating conditions, is playing a major role in this project by supplying high-pressure seals for the pumps housed at various points along the pipeline.

machinery and component suppliers such as EagleBurgmann.

The seals, which are at the very "heart" of the pumps, have to keep running without "personal" care. In addition, the pump stations are located in rough terrain and are difficult to access. This means that the pump components have to meet stringent quality, durability, availability and service-life standards.

The seals have to adapt precisely to the different operating conditions, for example, pressure and temperature fluctuations and speed variations, to ensure optimal leakage protection and service life. Also, given the logistics involved, service, maintenance and repair outlay must be kept to a minimum.

The company's international footprint, its Russian subsidiary and local presence (through a Ukrainian pump manufacturer) played a crucial role in the contract acquisition, alongside its technical expertise. These factors guaranteed fast cooperation and component availability.

No leakage

The pipeline runs through earthquake hazard zones and overcomes large geographic differences in altitude.

Once the entire pipeline is complete the average distance between pump stations will be roughly 150 km. Currently, there are only seven pump stations on the ESPO-1 pipeline, which means that the average spacing is around 400 km.

The distances between stations, the overall length of the pipeline (which has a diameter of 1.22 m), the extreme and varied climatic conditions, the transportation capacities and oil delivery commitments of the operator present substantial technical and business challenges for

Engineered seals

Standardised mechanical seals do not meet stringent pipeline requirements and are unable to withstand the loads placed on the pumps. This means that engineered seals are used almost exclusively in pipelines. These seals are designed in close collaboration with the pipeline planners, pump manufacturers and users for this specific application.

In 2006 EagleBurgmann received initial queries for the ESPO-1 project from several

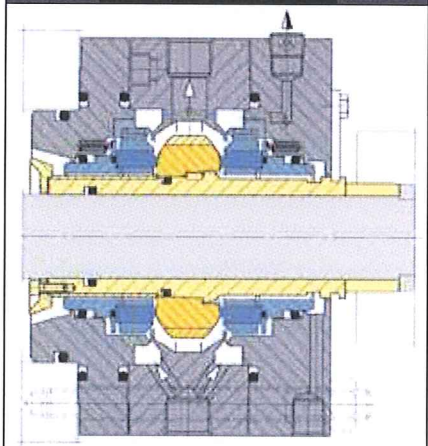
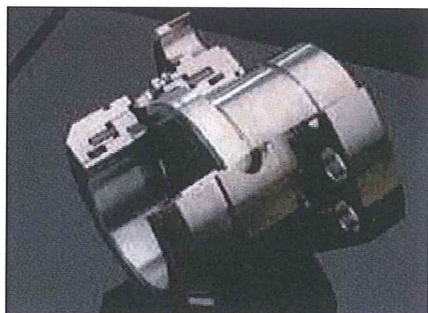


Figure 1. EagleBurgmann's SHPV-D double mechanical seals – shown here as a section model (top) and in cross-section – have a proven track record in applications that involve corrosive and abrasive media.



Figure 2. The seat and seal face of the SHPV-D double mechanical seal.

international pump manufacturers. A lot was expected from the high-pressure seals and their design. Engineering analysis and test runs were needed to optimise the seals for this application.

For cost and availability reasons, oil rather than water is used as the buffer fluid in this particular project. Specific operating conditions include:

- pressure to be sealed of 10–78 bar (which varies because four pumps/stations are connected in series);
- a buffer pressure on all pumps, set to 90 bar;
- product temperature of -15°C to +60°C; and
- a speed of 1500 rpm or 3000 rpm, depending on the pump manufacturer.

The EagleBurgmann SH double mechanical seal (**Figure 1**) was selected for this application and was set up for the operating conditions listed.

This seal has a solid track record in pumping applications involving corrosive and abrasive media. During operation, the effects of pressure and temperature deform the sliding faces. The type and extent of mechanical and thermal deformation, and the degree of overlap, depend on the design and the face materials.

Finite element analysis (FEA) was used to determine the optimal geometry for the seal face and seat under the given operating pressure, temperature and speed conditions. To further improve seal running characteristics, lubrication grooves were placed on the face of the rotating seat (**Figure 2**). By fine-tuning the design, the engineers were able to minimise leakage, friction loss and seal face wear.

Dynamic and static testing

The seals were then subjected to extensive dynamic and static testing.

During the test phase further modifications were made to optimise seal-running characteristics under fluctuating operating conditions. Friction losses and leakage volumes were considerably below the minimum specified by the customer.

Franz Schäfer, Sales Manager, EagleBurgmann, commented: 'During the test runs our customers had the opportunity to get a first-hand impression of our expertise and the quality of our products. They were convinced by what they saw.'

During 2007 24 single high-pressure seals for booster pumps, 60 double high-pressure seals for main pipeline pumps and 24 API-Plan 53B buffer systems, with heat exchangers, were delivered for the project. The seals have demonstrated the quality and durability needed for the harsh operating conditions of this application.

East Siberia Pacific Ocean pipeline route

Construction of the first phase of the East Siberia Pacific Ocean (ESPO) pipeline (ESPO-1) got under way over five years ago. Around 30 million tonnes of oil are transported each year over a distance of 2757 km through five pump stations, with 20 pumps, from the city of Taishet in the Eastern Siberian region of Irkutsk to the city of Skovorodino in Russia's eastern Amur region.

The planned second phase (ESPO-2) will extend the pipeline for another 2100 km from the Skovorodino station to the port of Kozmino on the Pacific Ocean.

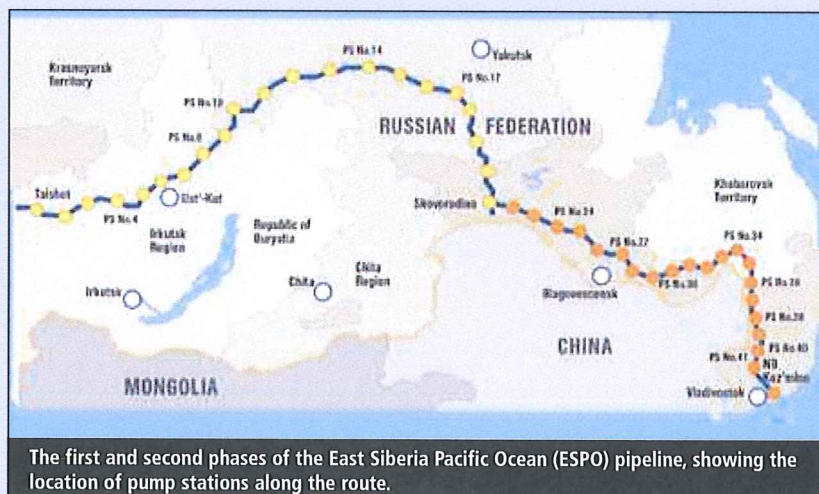
Including the planned extension to phases ESPO-1 and ESPO-2 roughly 80 million tonnes of oil will be transported annually by 2013/2014 over a distance of 4857 km through 43 pump stations, each containing four pipeline pumps.

The ESPO-1 section to Skovorodino and the \$2-billion oil terminal at Kozmino near Nakhkoka on the Pacific Ocean were opened in 2009. Until ESPO-2 is completed oil is being taken by rail from the station at Skovorodino to Kozmino.

Transneft

Transneft Jsc was established during 1992 to coordinate the transportation of oil and petroleum products through pipelines in Russia and other countries.

The company has 50 000 km of pipelines, more than 300 pump stations and 900 oil tanks with a capacity of more than 16 million m³, and transports 93% of the oil produced in Russia.



They have been running for over two years without a problem.

Follow-on contract

Following the success of the first ESPO-1 project, EagleBurgmann has become a qualified supplier for the user and for TransNeft's major equipment supplier, the HMS Group (a Russian machinery holding company and one of the country's largest pump manufacturers) including its production firm JSC Nasosenergomash based in Ukraine.

The HMS Group and the plant in Ukraine were selected to supply the pumps for six additional stations on the ESPO-2 project and five pump stations for an extension of ESPO-1. Based on the good performance of the products,

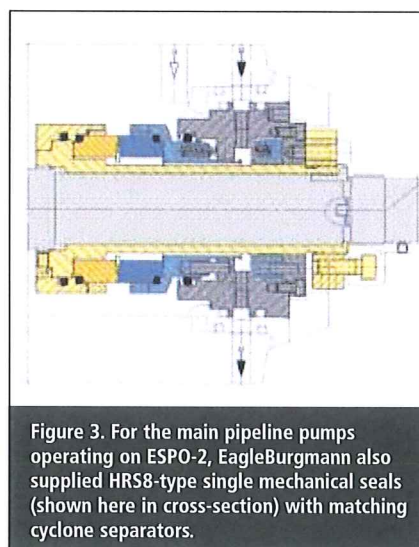




Figure 4. Seal test runs were carried out at EagleBurgmann's facility in Wolftratshausen, Germany. Shown here (from left to right) assessing the test results are: Oleg Isaev, Deputy ESPO Project Manager, HMS Group; Vladimir Jamburenko, Executive Board Chairman/President of the pump OEM Nasosenergomash (Ukraine); Franz Schäfer, Sales Manager, EagleBurgmann; and Igor Tverdochleb, Director of New Pump Trials & Development, HMS Group.

the HMS Group signed a delivery contract for SH double seals and supply systems for the first ESPO-1 extension and HR single seals (Figure 3) and cyclone separators for use in ESPO-2.

Test runs

Various personnel from the HMS Group and Nasosenergomash have visited EagleBurgmann in Wolftratshausen, Germany, to take part in seal test runs which were ordered under the contract.

Following the test runs at a customer acceptance meeting (Figure 4) Vladimir Jamburenko, Executive Board Chairman/President, Nasosenergomash and Igor Tverdochleb, Director of New Pump Trials & Development, HMS Group, commented: 'Before this contract we already had many years of experience with EagleBurgmann on other projects.'

'The expert advice and the engineering design, quality and durability of the mechani-

cal seals and systems have always been the reasons why we selected EagleBurgmann as our seal supplier.'

The ESPO-1 and ESPO-2 extensions are scheduled to start up in 2013/2014. The next extensions after that will include 22 stations and 88 pumps.

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PATENTS

Multi-layer gasket with labyrinth stopper

Applicant: Federal-Mogul Corp, USA

This invention relates to a multi-layer gasket, but in particular to one that includes a stopper for limiting compression height (of the gasket) when it is installed between two mating surfaces. A shortcoming of many prior art multi-layer gasket designs is attributed to combustion-gas leak paths which can easily form at the exposed edges of the stacked functional layers as they terminate around the opening of the combustion chamber or another flow passage shared between the mating surfaces. The multi-layer metal gasket (40) described has a first (28) and second (30) functional layer. Each layer includes an opening (34 & 38) for sealing a fluid passage or the combustion chamber. Each layer (28 & 30) includes

a folded lip, or rim (50 & 52), bent in opposite directions and overlapping one another in a nested configuration to form a labyrinth which also serves as the "compression stopper feature" for the gasket assembly. Sealing beads (42 & 44) are formed in each layer and, preferably, are arranged to contact each other in a crest-to-crest orientation to create a seal.

Patent number: WO/2011/103373

Inventor: B. Tripathy

Publication date: 25 August 2011

Method for manufacturing a metallic gasket for a cylinder head

Applicant: Nippon Leakless

Industry Co Ltd, Japan

A method of positively locating the intermediate layer of a multi-layer steel (MLS) head-gasket is described. A hole is punched in the layer at the position of a hole at a matching location in the functional layer. This is done in such a way that the two can be subsequently crimped together.

Patent number: WO/2011/102148

Inventor: Y. Matsushita

Publication date: 25 August 2011

Manhole cover with a sealing gasket

Applicant: Norinco, France

The gasket described is designed to provide a reliable seal for a manhole cover in the road. A U-section seal fits over the ID and OD of the axial section of the manhole which is seated in the drain-hole. The centre of the U-section contains serrations that fit into a groove in the cover and help to retain the gasket.

Patent number: WO/2011/101582

Inventor: B. Tourte

Publication date: 25 August 2011

Method for producing piston rings

Applicant: Federal-Mogul Burscheid GmbH, Germany

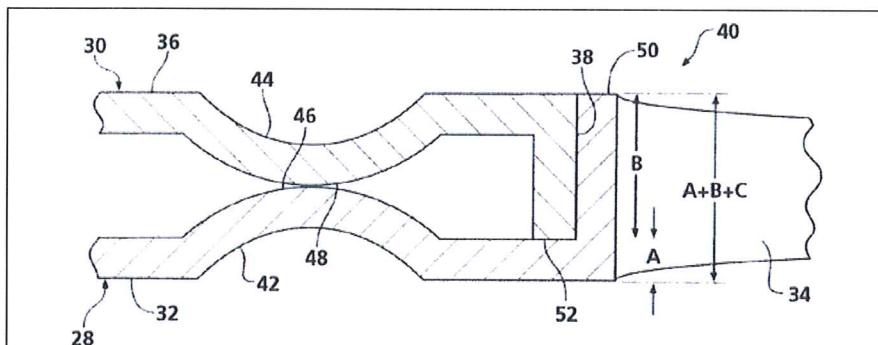
This patent details a method for producing piston rings – in particular compression piston rings. A number of piston rings that form an assembly are machined as one unit. A wear-resistant electro-deposited layer of chrome is applied to the finished, machined cylindrical circumferential surface, so that it (the layer) has a constant thickness within the assembly as a whole. The layer is subsequently machined to produce a running surface with a tapered chrome thickness for each ring.

Patent number: WO/2011/103853

Inventors: D. Bärenreuter

and M. Kellner

Publication date: 1 September 2011



This multi-layer gasket has layers folded (50 & 52) to form a labyrinth seal adjacent to the cylinder bore. Patent WO/2011/103373 has further details.