Our technicians and engineers, study the lubrication processes in the customer facilities, the machinery operation and the work conditions by collecting the following information:

- Machinery, equipment and list of components.
- Points to localize and identify. Critical points.
- Ideal lubrication system.
- Environmental conditions, productive process, work conditions of the equipment and elements.
- Requirements of the Quality Normative (ISO), risk prevention and environmental protection.

After getting this information, it is analyzed and through the Engineering and Technical Office departments, a centralized lubrication project is developed according to the customer needs. The production area of Grupo Técnico RIVI starts the manufacturing of the equipment to install, only after the approval of the contract company.

According to the delivery times required by the customer, the Assembly Team completes the assembly, commissioning and start-up of the centralized lubrication system.
Lubrication systems in Oil & Gas industry


For the petrochemical sector, all the machines must operate continuously even under the most rigorous work conditions (dangerous / hazardous areas, offshore facilities, extreme temperatures...). Here is where RIVI’s equipment, systems and products, highlights for their quality and reliability, and it comes to represent an standard in production centers, as well as for OEMs of machinery for refineries, petrochemical plants, maritime platforms and others.

Grupo Técnico RIVI offers experience, quality and service, for any automatic lubrication project, giving an tangible and immediate productivity increase, cost reduction in maintenance, and reduction in energy consumption of the machinery.
A lack of lubricant might cause undesired breakdowns in the machines. The high cost of the mandatory maintenance and lubrication tasks, join to a big value of the machines, lead to the need of install centralized and automatic lubrication systems.

The accumulation of hostile agents like dirt, contamination, moisture as well as the high mechanic loads, are the reason of excessive wearing of the friction points. So, the lubrication is absolutely necessary to provide the right protection. RIVI lubrication systems are a reliable way to ensure a right lubrication. While the machine operates, the right volume of lubricant is distributed to every lube points connected to the automatic system, on the right time.

The lubrication ensures that the lubricant will be distributed optimally and evenly to every friction points, and it will avoid friction and premature wearing.

**Big Cost Reduction = Fast ROI**

*(return of investment)*

Installing a lubrication system reduces the cost of repairing and maintenance drastically. It also reduces the lubricant consumption and it extends the useful life of the machinery.
Lubrication systems in Oil & Gas industry

Upstream, Midstream and Downstream:

- The Upstream is referred to the prospection process of crude oil and gas extraction. Also is known as Exploration Sector and Production (SEP).

- The Midstream is referred to the handling and transporting of the products and raw materials extracted, as well as to the operations during its transportation. Midstream is usually included into the downstream process.

- The Downstream contains the refineries, petrochemicals plants, and the distribution and commercialization of oil, natural gas, and their derivatives. Also included the process relates to the fabrication and distribution of the products for the consume, lubricants, synthetic rubber, plastics, fertilizers, pesticides, natural gas, propane and pharmaceuticals products.
Lubrication systems in Oil & Gas industry

Upstream onshore:

Sequence for the extraction of fossil combustible & natural gas:

- Heart quakes study
- Government permissions
- Prospection
- Economic evaluation
- Environmental impact
- Social impact
- Machinery
- Infrastructure
- Extraction
- Disassembly of infrastructure.
Lubrication systems in Oil & Gas industry

Upstream offshore:

Offshore activities for the extraction of oil, are divided in underwater and on-platforms processes. Both involve an exhaustive control of expenses for every activity, including environmental and safety costs.
Lubrication systems in Oil & Gas industry

Upstream offshore:

Difficulties added to the extraction of fossil fuel & natural gas in offshore conditions:

- Cold climate environmental conditions (extremely low temperatures) that can breakdown production processes.
- High pressure at deep depths.
- Exponential cost increasing in safety
- Cost increment for environmental protection
- Needing to improve automatism & autonomy
- Highly qualified staff is essential
- Requirement of new materials and technologies
- FPSO Added costs (floating production, storage & offloading)

Midstream: the link

Throughout great pipelines, and huge ships and vessels – on ground or underwater – the raw materials extracted must be transported in a precise way, under control and safe, towards the process industries (Downstream)
Lubrication systems in Oil & Gas industry

Downstream: industrial processes

There are four main types of industries:

- Oil refinery
- Chemicals/petrochemicals plants
- Gas plant
- Synthetic oil industries (Coal, gas slate, hydrocarbons...)

Nowadays it is required a high workload in refineries and chemical plants, whose products consist of a technology based on heavy and expensive machinery. In order to achieve the reliability expected (until 4 years without maintenance), appropriate lubrication is absolutely essential.

The design and installation of automatic lubrication systems require of expertise personal, and not only concerning technical aspects, but also about environmental and safety requirements of each plant.

The proximity – in few cases – to seaport also implies equipment and systems suitable for marine environment. Also the consideration of hazardous areas leads to use of flameproof products (ATEX).
Lubrication systems in Oil & Gas industry

Centralized & Automatic Lubrication

Grupo Técnico RIVI offers the most appropriate lubrication solutions for every application, for each machine, and for every single phase, operation or process that exist in Upstream, Midstream & Downstream.

In fact, by giving a right lubrication, breakdowns and failures attributable to an inefficient greasing, are immediately reduced; moreover, an optimal performance of the machine is ensured.

More of the 50% of the failures in bearings come from inadequate lubrication. In 97% of them are manually lubricated.

Advantages

**Productivity:**
- Increase of availability of the machine
- Increase of production
- Improve of the ratio cost/production
- Increase in the competitiveness of the company

**Energy efficiency:**
- Less wearing
- Decrease of energy consumption due to friction is minimized
- Reduction of CO2 emissions

**Maintenance:**
- Decrease of number of no programming stops
- Improve on effectiveness
- Cost reduction for repairing
- Cost reduction for automatized activities
- Eliminate cost in tools of manual lubrication
- Extend the intervals for maintenance

**Security and occupational health:**
- Elimination of risks for access to dangerous areas for manual lubrication
- Less contamination and lubricant residues, and less risks of sliding lesions.

**Environmental protection:**
- Less acoustic contamination
- Reduction of residues (for use more efficient of the lubricants)
- Reduction of costs for manipulation and waste container of lubricants.
Lubrication systems in Oil & Gas industry

The professional team who compounds Grupo Técnico RIVI, work to provide you the technique solutions and the services which best optimize the lubrication of your industry, avoiding problems and ensuring the best continuous lubrication.

Few of our products have been specifically developed to be used in hazardous atmospheres, so they meet the standards more restrictive, like ATEX (directive for ATMosphere EXplosive) and API (normative of American Petroleum Institute).

It is possible to undertake centralized lubrication projects step-by-step, by gathering individual points or lubrication areas, centralizing them later on, and finally completing the automating process with different levels of monitoring and control.

1. Isolating lubrication points. Manual lubrication point to point
2. Lead/distribution. Manual lubrication gathering. It is reduced the number of points.
3. Centralization through lubrication equipment. First phase of the centralized system.
4. Integrated control. Centralize and automatic system.
5. Automation and control system from PLC/DCS in plant.
Lubrication systems in Oil & Gas industry

Technical systems: Single Line

RIVI’s single line systems are used when the lubrication needing’s are different among diverse lube points of machinery. The lube injectors – direct action – has a metal to metal adjustment, and pistons capable of deliver lubricants even at high pressures. Each injector is individually driven, and supply to only one lubrication point. It can be adjusted with high precision to supply the exact quantity of lubricant required. Whenever the pumpstation be powerful enough, and piping size be appropriate, the entire lube system can be expanded at anytime.

- Individual lubricant injection for each lubrication point.
- Visual and electric (optional) monitoring.
- Lubricant supply in high pressures.
- Simplicity – easy to understand and install.
- Extendable.
- Stainless steel injectors available.
Lubrication systems in Oil & Gas industry

Technical systems: Multiline

This system uses pumpstations of multiple outlets, radial pumps that have been successfully used since the earliest industrialization. With these pumps the lubrication – either with oil or grease – takes place by means of individual outlets from a central station in a metered way. Each outlet houses a pumping element in radial position which is driven by an eccentric, and supplies an adjustable volume of lubricant.

Features:

- All the points are connected directly with tubes to different outlets of the pumpstation, without distributors.

- The dosage to each single point is regulated in the pumpstation itself, by means of pumping elements.

- By means of progressive metering devices the possibility of points to lubricate is extended. The system continue working while the pump is switched on. When the pumpstation turns off, the progressive metering device stops, and it will continue from the same point when the system starts again.
Lubrication systems in Oil & Gas industry

Technical systems: Double Line

- DLS/C: Conventional double line system
- DLS/S: Smart double line system

In heavy duty conditions like extreme temperatures (very cold or very high), dirty or moisture environment, RIVI double line systems provides the most efficient way to lubricate friction points. Just one centralized equipment is able to supply lubricant to a huge number of lube points in the right way. RIVI double line systems can be also extended at anytime.

Features:

- Perfect for disperse lubrication points.
- A maximum pressure of 400 bar avoid the use of tubes with a diameter more small.
- Visual or electric monitoring for each couple of outsides (optional).
- Simple and individual dosage – each couple of outsides can be adapt individually.
Technical systems: Progressive

The progressive RIVI’s systems have been designed to satisfy the most restrictive lubrication requirements of machines and equipment. Its reliability is based on the principle of progressive function, where the lubricant is delivered to the lubrication points by pressure-driven pistons. The lubrication occurs in intervals regulated a maximum pressure of 350 bar. So that, the lubrication of the lube points is also feasible even against high backpressures.

Benefits of Quicklub system:
• There is not corrosion of the pump housing, make in fiber reinforced resin, especial for hard activities.
• Pump engine is protected for wear and wet.
• Few sizes of resevoir available.
• Safety valve, also equipped with visual indication and return line to reservoir.
• Integrated Control Plate (optional) and Touch Display and Data Logger to collect lube information.
• Monoblock design of Lincoln progressive Metering Devices prevents from leakages, and allow operation up to differential pressure of 100 bar (inlet vs outlet).
Lubrication systems in Oil & Gas industry

Technical systems: Spraying

By means of any centralized lubrication system (simple line, double line, multiline, etc.) either oil or grease is metered by nozzles that, throughout the inlet of compressed air, sprays the lubricant to the surfaces.

Depending on the products (pumps and nozzles) used, the operation and control of the installation takes place in different ways.

Spraying is mainly used to lubricate heavy open gears, where an insufficient or inadequate lubrication is unacceptable, due to consequences that it might cause.

So, it is essential to study and to define the system components, in order to avoid failures or breakdowns during the useful life of the machine.
Lubrication systems in Oil & Gas industry

Technical systems: Oil Circulation

This system is considered as an excellent solution for multiple applications. It mainly used to cool bearings down and to avoid pollution inside the bearings. The lubricants used are oils.

A pump suction oil from the tank and pump it through the filters, heat exchangers, etc... until it is continuously and evenly supplied to the different lubrication points. Later on oil returns to the tank by effect of gravity, where it is recirculated again.

Applications:
Hydrostatic and hydrodynamics applications, turbines, feed-water pumps, huge gears, reducers & gearboxes, industrial fans...

Features:

• Tanks, Containers & Reservoirs, up to 50,000 liters, with surface protection, RAL on request, indirect heating, visual and electric level monitoring, temperature & pressure control, etc...
• Screw & gear pumps, up to 2000 lt/min with safety valve
• Motor types on request
• Simple or change-over filters, clogging indication, etc...
• Adjustable valves, for temperature, flow and pressure
• Piping & Instrumentation.
Lubrication systems in Oil & Gas industry

Oil Circulation: API 610, API 614

- API 610: applicable normative for design of centrifuges pumps to petrochemical plants
- API 614: applicable normative for design and manufacturing lubrication systems for Downstream (petrochemical plants, refineries...)

G.T. RIVI designs and manufactures Oil Circulation stations & skids, according to API normative applicable.
Lubrication systems in Oil & Gas industry

Technical systems: Mechanical lubrication

This system is based on – extremely robust and efficient – mechanical lubricators that feed to each lube point the right, exact and precise volume of lubricant (oil). It is available in six different sizes, from 1 to 18 outlets, and reservoirs from 1 to 6,5 liters.

Due to it works in the same way as multiline systems, the number of lube points not only can be extended by connecting a few lubricators, but also by using progressive metering devices.

The lubricant quantity supplied is adjustable individually, and connected directly to the machine. The RIVI mechanical lubricator has notable technical advantages like zipper sealing (without ball valve and springs) and an absolutely exactness at the feeding of each out. The characteristics of the RIVI mechanical lubricators, make them the solution for a perfect lubrication of gas compressors.
Lubrication systems in Oil & Gas industry

Technical systems: API 682 (mechanical seals)

These API plans are specific lubrication & cooling systems for mechanical seals, mainly used in centrifugal or rotating pumps, which service to dangerous, flammable and/or toxic fluids for petrochemical and Oil & Gas industry. Each system and auxiliary accessories are connected to the sealing camera and/or to mechanical seal. Specific seals only can work in combination with the appropriate API plan 682. Usually, the combination of external control and supply unit constitutes the API plan and it is denominated “supply system”.

The normative API 682 merges from the target to regulate the standards for the applications developed in refineries, and industries of hydrocarbons processes. This normative, combined with the ISO 21049, specifies the differences between systems and plans of existing sealing, it defines the parameters which should be considered in developments. Its design also must maintain the highest level of quality, safety, manufacturing, installation and operation. One of the main points to consider in every API 682/ISO 21049, is the documentation attached to the project, by accomplishing the regulations & specifications of the manufacturer, clear indications about critical points of the equipment, and operation and maintenance instructions:

- Standard Documentation
  - General Arrangement (GA)
  - Process & Instrument Diagram (P&Id)
  - Quality dossier (Tests, calibration certificates, material certificates...)
  - Technical data sheets & Bill of Material (B.O.M)
  - Start-up & Maintenance User Manual
  - Spare parts & Operation instructions

- Optional Documentation
  - Sectional & specific drawings
  - Logic diagrams
  - Calculation of components
  - Special certificates
    - NDT (Not Destructive Test)
    - PMI (Destructive test) positive ID raw materials
  - Welding procedures
Grupo Técnico RIVI owns the experience and capability to develop complete sealing plans API 682, under the quality standards required, and also to prepare the documentation appropriate for each API plan.
Lubrication systems in Oil & Gas industry

Technical systems: Oil Mist

It is a centralized lubrication systems where the lubricant (oil), is atomized in a flow of compressed air at low pressure (5000 – 900 mm H2O), and distributed to the different equipment to be lubricated. The dispersion of the little oil particles in the air flow its called oil mist, being the proportion 200000 volumes of air per each of oil. The mist is produced by speeding up little volume of oil in contact with air. An oil mist generator is based in Venturi or Vortex principles.

During the transport, in laminar flow, the mist generated is a “dry mist”, without lubricant properties. Oil particles have a size between 1 and 3 μm. Before the injection of lubricant into the point, it is necessary to create “wet mist”, with lubricant properties, by means of recondensers which produce turbulent flow and therefore oil particles greater than 3 μm.

- Open system: oil excess is collected manually.
- Closed system:
  - With condensate collection. Used oil is collected into main tanks by using pressure equipment or distribution tubes.
  - With recirculation of oil condensate. Used oil is collected into tanks, and it is passed through a purifier which flows it out in optimal conditions for breathing.
Lubrication systems in Oil & Gas industry

Advantages of Oil Mist

✓ Optimal lubrication & cooling
  ▪ Continuous and automatic supply, dosing the right quantity of lubricant required
  ▪ Reduction of operation temperature in lube points, in comparison to conventional systems (oil bath or oil circulation), so the useful life is extended.

✓ Protection against external particles
  ▪ Prevent the oxidation and corrosion, because it covers all internal parts with a constant and even oil film.
  ▪ A light positive pressure is generated and therefore the entrance of moisture, contaminants and/or corrosives particles at inner of the bearing is avoided.

✓ Cost reduction
  ▪ Considerable decrease of oil consume against to other lubrication systems
  ▪ Saving energy consume thanks to the smaller friction during the performance of the machine.
  ▪ Elimination of storage activities, transport and oils raking (closed systems)
  ▪ Reduction of air compressed consume

✓ Sustainable environmentally
  ▪ Can apply through a closed system and one purifier

✓ Increase of machinery availability
  ▪ Pumps
  ▪ Electric engines
  ▪ Fans
  ▪ Reducers (refrigeration towers)
Lubrication systems in Oil & Gas industry

Pure Oil Mist vs Purge Oil Mist

There is two Oil Mist concepts, depending on the way to lubricate:

- Pure mist. The oil mist has a double target: lubricate the bearing elements and also purge the housing.
- Purge mist: the oil condensed remains inside the housing, and it creates an oil bath.

- In this application, the mist is used to preserve, not to lubricate, by maintaining a constant level of lubricant.
- Oil mist gets into and gets out the bearing from the top, where it is collected into ecological reservoirs.
- It creates a little pressure inside the bearing housing, and therefore the pollution entrance is prevented.
- It mitigates the temperature inside the bearing.
- The lubricants life is increased up to 5 times.
- Typical application for equipment with slipping bearings or gears (Turbines, balanced pumps, gear boxes, etc..)
- It is recommended for low speed bearings or mechanism.
Lubrication systems in Oil & Gas industry

Main components of a closed system, of Pure oil mist system, with recirculation of condensated.

1. Head generator (Venturi or Vortex technology)
2. Control panel: monitoring and handle system
3. Distribution lines: tubing and piping
4. Manifold: redistribution of mist until six lubrication points
5. Re-condenser: it produces the change of dry mist to wet mist.

There are four types:
   a) Spray
   b) Mist
   c) Condensate
   d) Directional

6. Condensate glass: checkout of the oil state.
8. Condensate deposit: oil storage of ecological storage and reply to purifier.
9. Purifier: equip that clean the oil for reuse it.
Lubrication systems in Oil & Gas industry

Application samples: API 610, electric engines, pillow blocks

RIVI’s oil mist application in electric engines optimizes the reliability of the bearings, increases the useful life and reduces the energy consumption in the Process Plant.

Pillow blocks:
Failures due to high loads and/or pollution are reduced up to 80% by using RIVI’s lubrication systems.
Lubrication systems in Oil & Gas industry

By using purge oil mist systems in steam turbines, the operation becomes easier, and maintenance activities are reduced. Also less steam gets into the box, and therefore the oil level monitoring becomes better. Consumption of oil is also significantly reduced.

Lubrication & cooling of gearboxes in Cooling Towers, Purge Mist system is applied to prevent the entrance of pollutants as well as oil protection. Failures in the gearboxes are reduced up to 75% in comparison to other systems for automatic lubrication.

Oil mist systems provide a little positive pressure inside the gearbox. It prevents from entrance of vapors and moisture – and therefore corrosion – when it is not working.

Purge mist system is excellent to avoid failures and breakdowns due to lubricant contamination.
# Lubrication systems in Oil & Gas industry

## Systems vs Applications

<table>
<thead>
<tr>
<th>Systems</th>
<th>Single Line</th>
<th>Multiline</th>
<th>Double Line</th>
<th>Progressive</th>
<th>Spraying</th>
<th>Oil Circulation</th>
<th>Mechanical Lubricators</th>
<th>Plan API 682</th>
<th>Oil Mist</th>
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<tbody>
<tr>
<td>Process Pumps</td>
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<td>Engines / Motors</td>
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<td>Actuators</td>
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<td>Centrifugal Fans</td>
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<td>Reducers &amp; Gearboxes</td>
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<td>Generators</td>
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<td>Cranes</td>
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<td>Mechanical Seals</td>
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Lubrication systems in Oil & Gas industry

**Process pumps:** Lube points require to be lubricated and cooled, in order to dissipate the heat power produced during operation. According to the speed and load of bearings, these pumps can be lubricated either with grease (low velocity, high loads) or oil (high speed, low loads).

Technical systems (grease):
- Single line
- Progressive
- Double line

Technical system (oil):
- Oil Circulation
- Oil Mist

**Engines:** Depending on the size, engines must be lubricated by grease (small or medium size) or by oil (big size).

Technical systems (grease):
- Single line
- Progressive
- Double line

Technical system (oil):
- Oil Circulation

**Actuators:** There are special applications which combine engines and gears (multipliers/reducers), which require to be lubricated and cooled to in order to dissipate the heat power produced during operation, by means of specific high viscosity lubricants.

Technical systems (oil):
- Circulation
Lubrication systems in Oil & Gas industry

**Compressors:** Piston compressors might require forced lubrication that ensures right operation performance even under high back-pressure and/or other limits of working conditions. Lubricant types depends on technical features of the machine, and its corresponding OEM recommendations.

<table>
<thead>
<tr>
<th>Technical systems (grease):</th>
<th>Technical system (oil):</th>
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<tr>
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<td>- Oil Circulation</td>
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<tr>
<td>- Progressive</td>
<td>- Oil Mist</td>
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<td>- Double line</td>
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**Fans:** Fans and key components in cooling systems. Any breakdown stops the production process. Industrial fans require permanent lubrication, and they are usually in difficult access areas. Depending on the size and the range of operation temperature, fans can be lubricated with grease or oil.

<table>
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<tr>
<th>Technical systems (grease):</th>
<th>Technical system (oil):</th>
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<tbody>
<tr>
<td>- Progressive /Multiline</td>
<td>- Circulation</td>
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<tr>
<td>- Double line</td>
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</table>

**Gearsboxes and reducers:** Most of gearboxes usually houses an oil bath, for permanent lubrication of the gears. Each application require different level of lubricant, cleanliness degree, and temperature value.

<table>
<thead>
<tr>
<th>Technical systems (oil):</th>
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<tr>
<td>- Circulation</td>
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</table>
**Generators:**

High temperature & speed, requires synthetic lubricants of high performance, as well as centralized lubrication system of outstanding quality and reliability. There are even environmental *Cold Climate Conditions*, and therefore an automatic system must be designed to work under this operation conditions.

Technical systems (grease):
- Simple line
- Progressive / Multiline
- Double line

---

**Cranes:**

Cranes houses lots of mechanical parts (bearings, pins, cylinders, eccentric, joints, open gears...) of big sizes. Cranes usually work at low speed but very high load, under heavy duty environmental conditions.

Technical systems (grease):
- Progressive / Multiline
- Double line

---

**Mechanical seals:**

There are special applications where seals must be sealed with clean lubricant (oil) at very low pressure, and – in many cases – must also be according regulations of hazardous areas.

Technical systems (oil):
- Circulation (API 682)
Others: Due to the huge variety and complexity of activities which compound Upstream, Midstream and Downstream, there are few other technologies which involve machinery and mechanisms with lubrication needs: Gate valves, wellheads, pump jacks, injection pumps, supply machinery, blowers, turbines, spin towers, axes, mechanical shakers, stirring paddles, etc...
The quality policy of Grupo Técnico RIVI promotes constant improvement and continued in the design, fabrication and old of equipment and installations. The certifications and homologations ISO, ASME, APII... as well as the security and environmental normative pertinent, making part of our company philosophy.

Guarantee of functionality, effectiveness, durability and reliability of installations under adverse conditions.

Strict compromise of fulfillment of delivery dates, ensure the start-up of production before deadlines requested.

After every project, is delivered complete documentation and personal training, for the correct operation, adjustment and maintenance of the installed automatic lubrication systems.
RIVI’s scope of supply in Oil & Gas industry:
Lubrication systems in Oil & Gas industry

Under the hardest operation conditions is where RIVI’s lubrication systems stands out for reliability, effectiveness, accuracy and durability. Each single system has been design specifically to satisfy the requirements of each application. Our customers are our best guarantee.