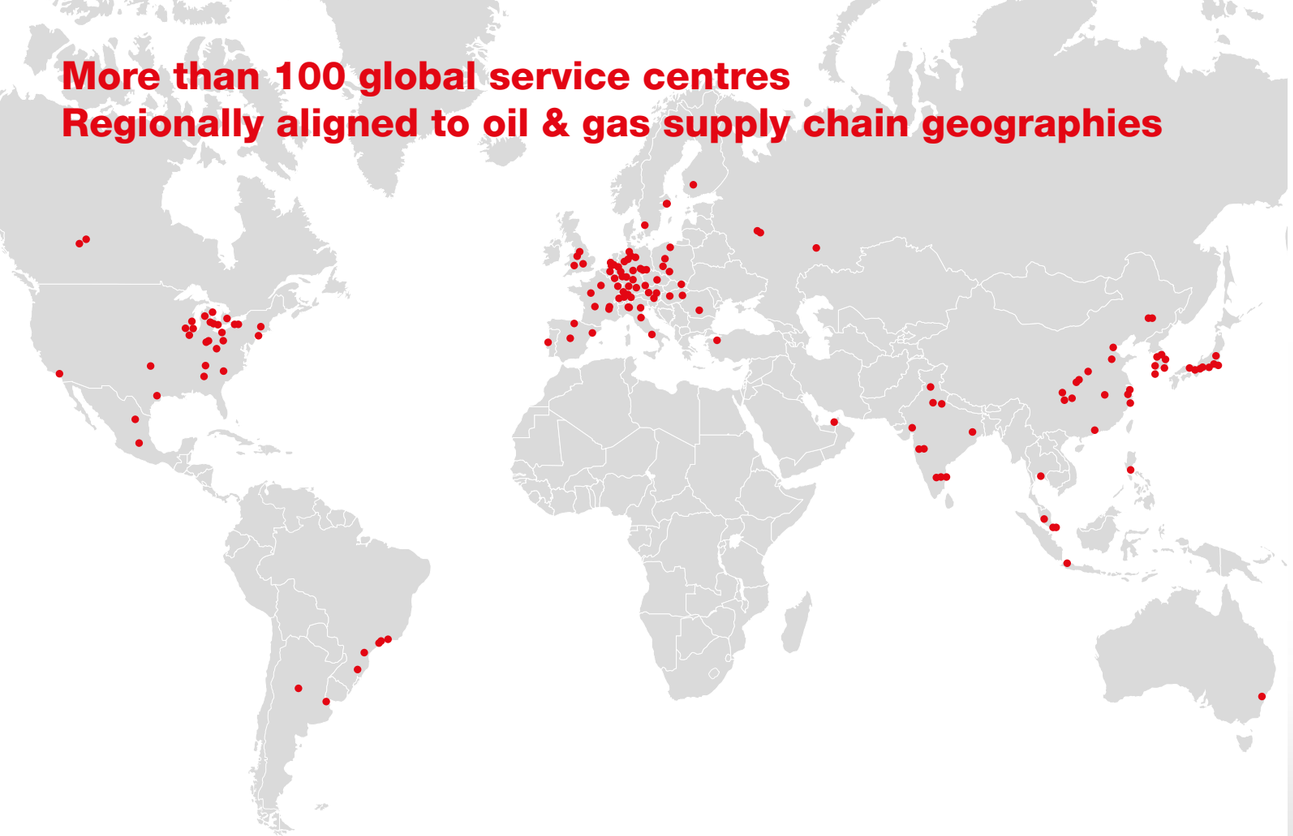

Contact Oerlikon today and tap into our production – boosting expertise in surface coatings tailored explicitly to oil & gas applications

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You can find a full listing of our locations at:
www.oerlikon.com/balzers
www.oerlikon.com/metco

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Higher level productivity

With innovative coatings engineered for exploration and production components, downtime can be significantly reduced

Drilling down to hard facts

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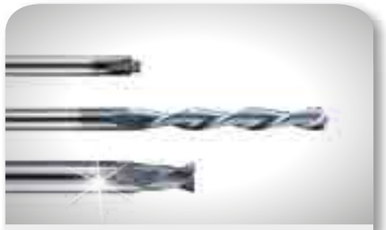
Oerlikon Balzers and Oerlikon Metco are the surface solutions providers embedded in the Oerlikon Group. Their combined capabilities cover virtually all wear-reducing, anti-corrosion and productivity-enhancing coating applications in the oil and gas industry.

In oil and gas exploration, components are exposed to some of the harshest strains and stresses encountered anywhere: abrasive wear, erosion, corrosion, fatigue, high fluid pressure, vibrations, jar impact loads, extreme torque, and many more. Our coating solutions have been engineered to mitigate these metallurgical challenges that the industry encounters.

Oerlikon Balzers and Oerlikon Metco proprietary coatings extend the service lives of critical components by improving their resistance to wear and corrosion. Coating matrices can be tailored to specific types of corrosion to reduce the incidence of drill string trips and to assure sacrificial corrosion control for pipelines for both on and offshore applications.

In addition to exposure-specific coatings for heavily stressed components, Oerlikon Balzers is also a provider of coatings for the tools used to manufacture and machine components.



Coated precision tools

- Improved milling and drilling for a wide range of difficult-to-cut materials.
- Maintains the hardness of tools at high operational temperatures.
- Reduces cutting stress due to low frictional co-efficient.
- Enhances performance and reliability.

Centralisers & Augers

- Exploration and production cost savings can be achieved using our coatings that reduces friction and protection against wear.
- Coating on centralisers for drill strings decreases friction and wear preventing drilling downtime.

Couplings

- Component service life is increased by using our coatings that reduces friction and protection against wear.
- Increased service life reduces planned OPEX costs and ensures continued production.

Pumps

- At high loads and tight tolerances even hardened or nitride steel components suffer damage due to high friction or too high wear.
- Our coatings are designed to protect against seizure due to low friction delivering resistance against abrasive particles due to its extreme hardness.

Refinery & rotating equipment

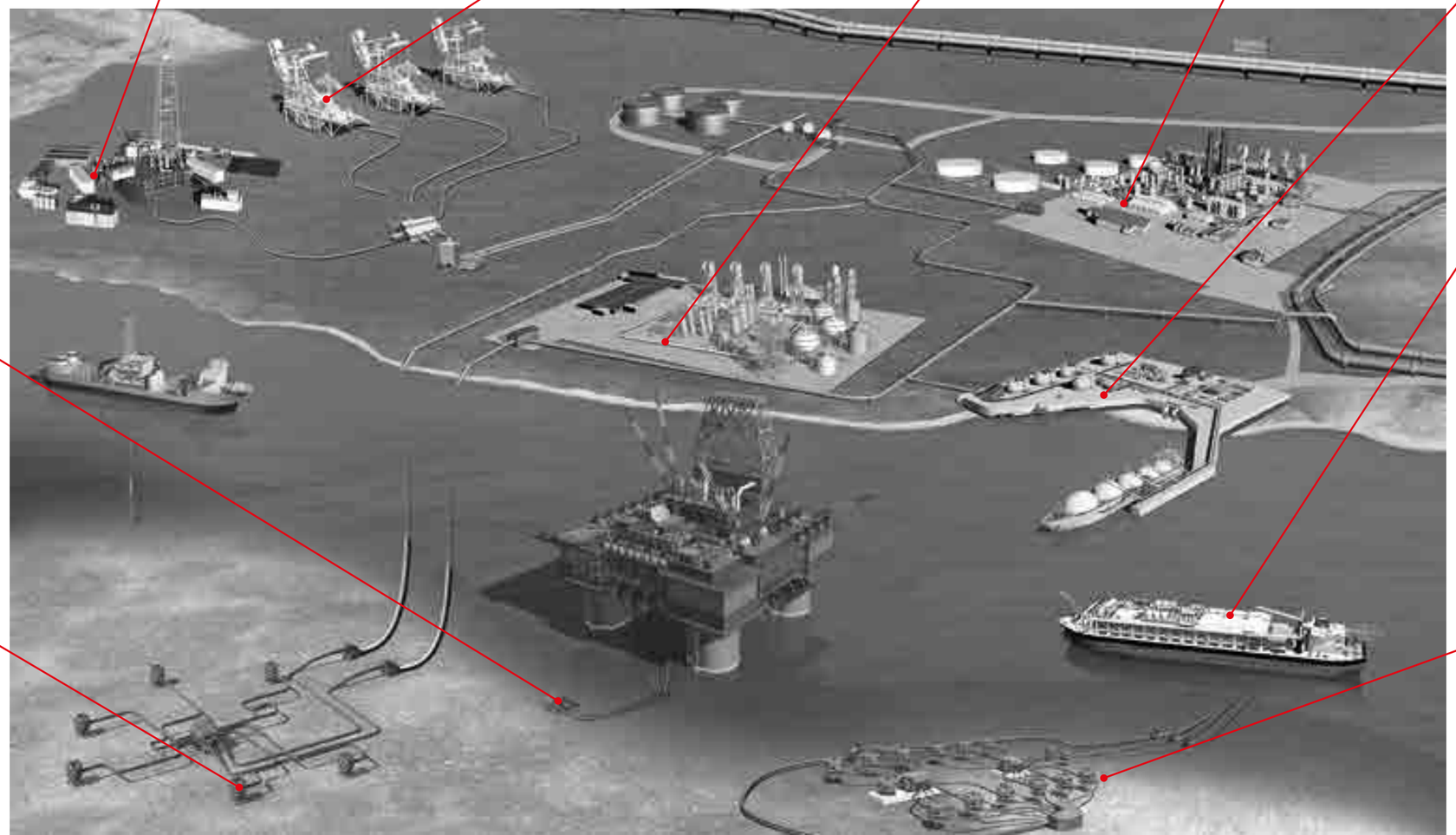
Providing coatings for gas turbines, steam turbines, boilers, steam vessels, external pipework, pipe clamping protection for erosion, corrosion and both high and low temperature environments, Oerlikon Metco has a solution.

Liquefied natural gas

Coating the internal surfaces of pressure vessels, external connectors and pipes, Oerlikon Metco coatings are designed to withstand high pressure and temperature fluctuations.

Connectors

Hardface coatings deliver durable resistance against fretting, sliding, general surface wear, abrasion and corrosion. They provide an excellent alternative to hard chromium plating.

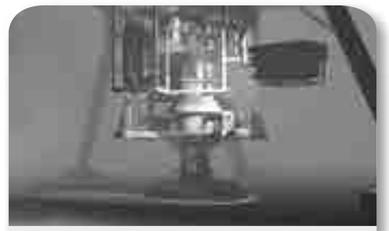


Mechanical seals

Coating of seals prevents downtime and OPEX related costs. Our coatings deliver low friction properties that reduces seal damage caused by start up and / or coast down operations, significantly reducing the danger of leakage thus protecting the entire system and the environment.

Floating production storage & offloading

Oerlikon Metco have a coating for all applications: coating of power generation components on gas & steam turbines, compressors, drill pipes, ship hulls, propellers, drive shafts and risers.



Subsea pumps and valves

- Erosion & corrosion resistant coatings on pump, compressor and e-motor casings.
- Bearing journal HVOF applications for extended running durations within pressurised environments.

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Tribological wear, friction and mechanical impacts take their toll. During service, components must withstand wear, corrosion and great loads while maintaining their light-weight and low-friction properties.

Oil and gas components have to meet very strict code of standards regarding environmental and safety requirements. With surface technologies such as physical vapor deposition (PVD), chemical vapor deposition (CVD), and Nitriding, Oerlikon Balzers boosts the longevity of vital components. Our thinfilms and coatings cost-effectively enhance their durability and ruggedness. The result: physical properties that deliver a value proposition more out reaching than just the sum of the substrate and coating whilst adhering to oil and gas standards.

High-end coating solutions and outstanding services provide reliability and long life for the oil & gas industry

Protected with Oerlikon Balzers BALINIT® coatings, surface properties are optimised to realise important advantages for oil and gas components. The service life of practically all components involved in drilling for oil and gas can be dramatically extended by applying high-end surface solutions that improve their resistance to abrasion, wear, corrosion, galling, and most other tribological phenomena.

Cutting tools have to resist wear under serious conditions, from high cutting temperatures to heavy loads causing friction and difficulties in removing chips. Oerlikon Balzers supplies state-of-the-art BALINIT® coatings which fulfil those requirements – and are based on the environmentally friendly and future-oriented PVD and Plasma Assisted Chemical Vapor Deposition (PACVD) coating technologies.

Your benefits

- **Bespoke engineered coating solutions**
- **More than 100 global service centres**
- **Supporting R&D capabilities**
- **Economies of scale reducing manufacturing and installation CAPEX costs**
- **Extend service life due to component reliability reducing OPEX cost**
- **Low coefficient of friction (~0.15), greater load tolerance, superior anti wear, corrosion and abrasive properties**

Oerlikon Balzers' coating applications for oil & gas components

	COMPONENTS				
	BALINIT® C	**BALINIT® DLC**	**BALINIT® DLC STAR**	**BALINIT® DYLYN**	**BALINIT® DYLYN PLUS**
Coating material	WC7C	a-C:H	CrN / a-C:H	a-C:H:Si	a-C:H:Si
Process technology	Sputter	PACVD	PACVD	PACVD	PACVD
Coating hardness H_{IT} [GPa]	8 - 12 / 12 - 15	~15 - 25	~15 - 25	~20 - 25	~17 - 23
Typical coating thickness [µm]	1 - 4	1 - 3	2 - 5	1 - 3	1 - 3
Friction against steel, dry running	0.1 - 0.2	0.1 - 0.3	0.1 - 0.2	0.1 - 0.2	0.05 - 0.1
Coating temperature [°C]	< 250	< 250	< 250	180 - 220	180 - 220
Max. service temp. [°C]	300	300	300	300	350
Max. treatable dimensions (mm) D x L	250 x 1,000	250 x 1,000	250 x 1,000	330 x 900	330 x 900
Applications	The standard coating for sliding and rolling elements under poor lubrication conditions, counteracts seizure and galling	Harder than BALINIT® C and therefore used to withstand higher levels of abrasive wear and high sliding speeds	Tribological performance like DLC, but enhanced with a very ductile CrN base layer for additional loads	Silicon-enriched DLC coatings for lower friction, higher corrosion resistance and good release properties	Improved corrosion resistance, protects against abrasive wear and high stress resistance under dry running conditions

All given data are approximate values, they depend on application, environment and test conditions.

Oerlikon Balzers' coating applications for precision tools machining oil & gas components

	TOOLS				
	BALINIT® ALNOVA	**BALINIT® DIAMOND MICRO**	**BALINIT® DIAMOND NANO**	**BALINIT® HARD CARBON**	**BALINIT® PERTURA**
Coating material	AlCrN-based	C (sp3) micro-crystalline	C (sp3) nano-crystalline	ta-C	AlTiN-based
Coating structure	multi layer	mono layer	mono layer	mono layer	nano layers
Coating colour	light-grey	grey	grey	black-rainbow	aubergine-grey
Coating hardness H_{IT} [GPa]	38 +/-3	80 – 100	80 – 100	40-50	35 +/- 3
Max. service temp. [°C]	> 1,100	600	600	500	1,000
Coating temperature [°C]		800 - 850	800 - 820	< 150	
Typical coating thickness [µm]		6, 8	6, 8, 12	1 – 2	
Applications	Milling of Ti and Al alloys	Drilling and milling of graphite	Drilling and milling of CFRP and sandwich materials	Drilling and milling of Al < 12 Si content and non-ferrous metals	Drilling of challenging material

All given data are approximate values, they depend on application, environment and test conditions.

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metco

Oerlikon Metco has over 80 years of market experience and more than 45 years of partnership with the oil and gas industry. Oerlikon Metco's materials, coating equipment and services, specialised machining services and components for rotating and fixed components significantly increase efficient and longevity of the components to meet the next planned outage.
Specifically designed materials and coatings protect the base material of critical parts from oxidation, erosion and corrosion.

Oerlikon Metco's surface solutions include thermal spraying, plasma-transferred arc welding, high-velocity oxy-fuel spray, laser cladding materials, and tungsten carbides.

These technologies multiply component service lives, typically by several orders of magnitude. Our customers in the oil and gas industry rely on us for coating materials, services, and equipment for a broad spectrum of applications.

Market leader in many industries

SURFACE MECHANISM	AVIATION	POWER	AUTOMOTIVE	OIL & GAS	INDUSTRIAL & SPECIALITY*
Wear	X	X	X	X	X
Friction	X	X	X	X	X
Corrosion	X	X	X	X	X
Thermal Protection	X	X			
Clearance Control	X	X			
Oxidation	X	X	X	X	X
Electronical conductivity			X		X
Anti-Skid				X	X
Dimensional Restriction	X	X	X	X	X

*Agriculture, PPP, Metals Processing, Heavy Machinery, Construction, Tooling, Mining, New Energies, Medical, Electronics

- **Oil Production**
  Our services and coatings ensure reliable compressor, turbine and pump operations. Coatings designed to prevent Corrosion Under Insulation (CUI) protect pipeworks in oil refineries and ensure safe operation.

- **Subsea**
  To help protect surfaces in subsea environments, we have developed long-lasting coatings that excel at wear prevention on critical components while resisting the corrosive effects of saltwater environments.

- **Liquefied Natural Gas**
  Our sacrificial coatings offer long-lasting protection to storage tanks, transfer pipelines and tanker hulls and equipment, increasing their service life, reliability and safety.

- **FPSO**
  Floating production, storage, and offloading (FPSO) is very demanding. Our coatings provide reliable protection in applications like riser tensioners, hulls, pumps, drill platforms and drill strings. We can also provide anti-skid coatings for decks and stairways.

- **Exploration & Drilling**
  Oil and gas equipment is exposed to extreme demands. Our surface solutions like plasma transferred arc welding, high-velocity oxy-fuel spray, laser cladding materials, and tungsten carbides multiply component service life. In demanding environments, you can rely on our products and services.

- **Shale/Coal Seam Gas**
  Our thermal spray, weld hardface and cladding coating solutions provide wear protection for drilling and extraction equipment, and can be adapted for use in various media such as rock, sand or gravel, and for a variety of corrosive conditions.

- **Pipeline**
  The transport of oil and gas over long distances with differing loads is very demanding. Our thermal spray coating solutions provide long-lasting corrosion protection for pipelines, pump and valves. Our coating solutions for turbines ensure continuous operation.

- **Carbon Capture and Storage**
  Pumps, valves and piping are protected with surface technology to maintain the operating efficiency of carbon capture and storage systems.

Coating Systems

Thermal Spray

Single- and multi-process systems with standard and customised handling designed for every budget and need.

- Atmospheric Plasma Spray: APS
- Controlled Atmosphere Plasma Spray: VPS, LPPS, LVPS, LPPS-Hybrid
- High-Velocity Oxygen Fuel Spray: HVOF-GF, HVOF-LF
- Electric Arc Wire Spray
- Combustion Wire and Powder Spray

Laser Cladding (LC)

LC Systems with customised robotic handling for process head and work piece movement.

Customer Services

- Thermal spray and laser cladding coating services
- Coating Solutions Centres for Coating Development
- Additive Manufacturing printing for materials testing and test article production
- Technical and Field Services
- Customer training
- Spare parts

Build-to-print services

- 1-stop-shop for your hot and cold section turbine engine components
- Production cell concepts delivering a high level of delivery performance
- Automation in place to maximise efficiency
- Cross-functional work approach with customers for new parts introduction