

# The crucial role of piston rod coatings

**CHOOSING THE RIGHT PISTON ROD AND COATING COMBINATION IS ESSENTIAL TO SECURE LONG-LASTING PRODUCTIVITY. FIND OUT WHICH WILL WORK BEST FOR YOU.**



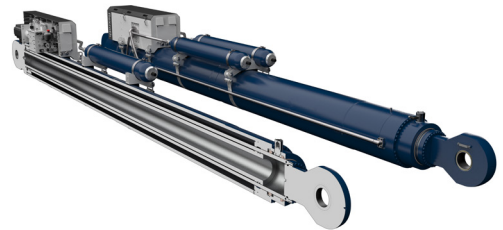
# Introduction

**A vast majority of industrial processes all over the world value one thing above all else – reliability. With any piece of equipment it’s essential for the operators to be able to rely on it day in, day out, no matter how tough the conditions may become.**

Some pieces of equipment are more exposed to wear than others, such as large hydraulic cylinders, electro-mechanical actuators, and electro-hydraulic actuators. This is because the cylinders are, in some cases, operating in challenging applications under high demand. Alternatively, in other applications the piston rod can be exposed to the elements for days, weeks, or even months at a time. This means degeneration can be caused by a variety of factors, whether that’s through the regular piston movement, or through the rod consistently being exposed to corrosive environments.

However, it’s always essential that these rods remain operational, and the rod coating is integral to this. The coating is what ensures continued smooth operation and rod durability, regardless of how tough the operating environment is.

In this whitepaper we will look at the challenges you need to consider when looking at piston rod coatings, what the different materials can offer, and how you can be sure you’re making the right choice for the future of your business.



# Coating challenges

Cylinders and actuators are essential components of a wide range of large machines, many of which operate in the harshest environments. Machines like excavation equipment used in mines, or parts of oil rigs and water dams rely heavily on the continued operability of large hydraulic cylinders, and these cylinders are often the ones exposed for longer periods.

This means that the piston rod coatings needs to be able to withstand the most challenging environments, from industrial to dredging and offshore. Here are the challenges that you need to take into consideration when investing in piston rods and their associated coatings:

## **Choosing the right rod/coating combination for your specific needs**

As with any major procurement, the first step is to identify what you actually need. However, it's not as simple as selecting the equipment that will work in the present – you also need to think about how this equipment could potentially handle any changes in the future.

The piston rod is an essential part of the overall structure, so it's not possible to simply change this if you need a piston rod coating with better wear resistance at a later date. On the other hand, it makes no sense to over-invest, and spend on the absolute best in class when you don't actually need all of the benefits provided. The best solution looks different for every individual project.





### **Identifying priorities**

In some projects, the piston rods will have to be able to withstand severe corrosive attack, so resistance to this will naturally be the highest priority, followed by the equipment being relatively easy to repair. Other projects will take place in less corrosive environments, but will place different demands on the rods over a longer period of time.

The coatings are a crucial piece of the puzzle, so one needs to make sure the one you choose has the specifications which match your priorities.

### **Knowing your project's parameters**

Every piece of equipment is acquired for a specific purpose, and every purpose will have a different time frame and budget attached to it. These two parameters alone will heavily influence your purchasing decision, so it's important to recognise what impact they have on the equipment itself, and the features you should look for.

If you need something built to last, and you have more flexibility with regards to what you can spend, rods with a durable, reliable coating will be the most suitable option, but less expensive, less robust solutions are also available. It all comes down to your requirements.

### **Finding the right features**

Overall functionality of piston rods and cylinders is key, and by functionality we mean durability, predictability, and reliability. The coating is an integral part of this, and any failure can have a serious impact on the rest of the system.

However, coatings can offer more than this, and some offer real innovation that can help make your business run in a more efficient way. These features are worth looking for if you want your equipment to be smarter and, in some cases, future proof.

## **HARDNESS VS WEAR RESISTANCE**

One aspect of cylinder rod coatings that's often misunderstood is that higher coating hardness does not make the cylinder more resistant to wear. In fact, with some of the hardest coating materials, wear resistance is actually much lower.

Likewise, rods with 'softer' coatings actually exhibit higher wear resistance, so it's important to remember these are not interchangeable properties.

# Surface application technologies and materials



All cylinder rods are engineered and designed with different purposes in mind, which means there are a number of different rod coating technologies in use today. Each has its pros and cons, so the best solution for you will be decided by your specific needs. Here are some of the more common technologies:

### **Electrodeposited nickel/hard chromium**

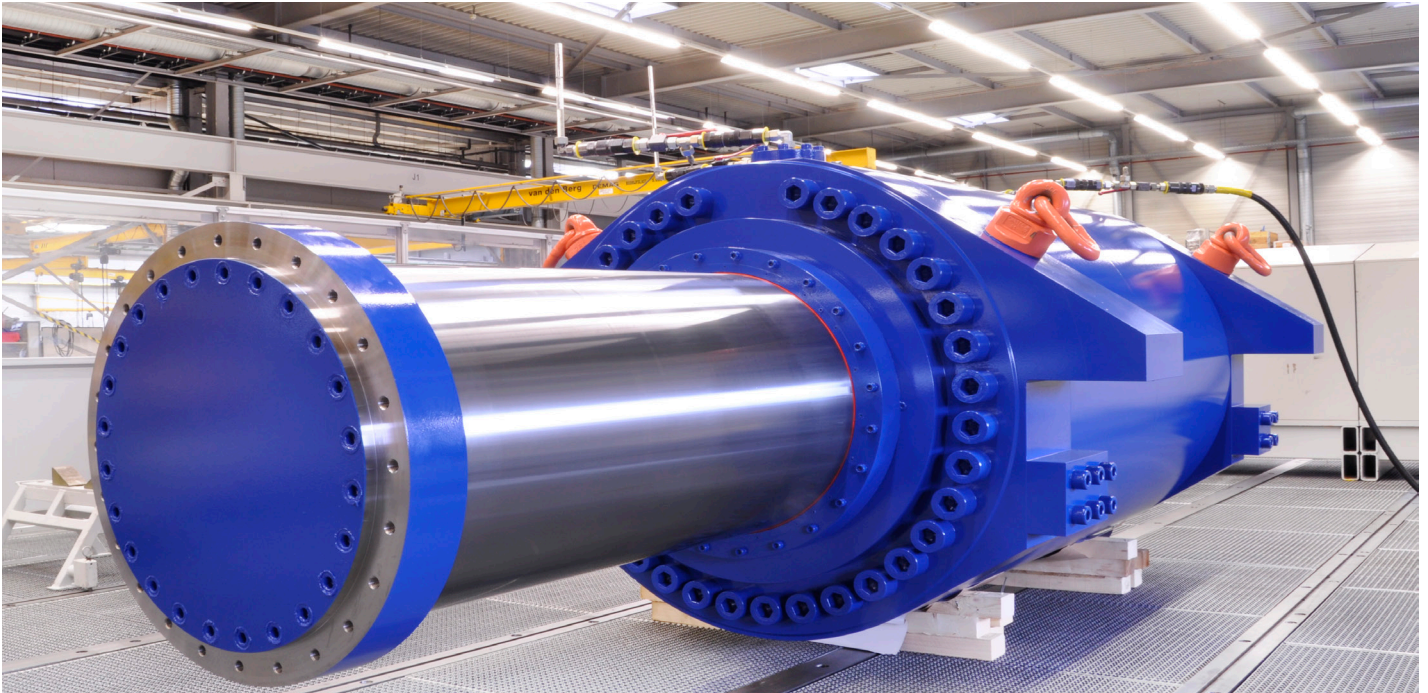
This kind of coating has been the standard for a long time, thanks to its availability and relatively low price level. It offers good corrosion resistance in salt-free environments and is resistant to wear in general. It's also very hard, and can be adapted to different uses.

The main drawback is that where increased wear and corrosion resistance is necessary, the coating needs to be much thicker, which tends to amplify defects in this material. Then, preventing these defects and making the coating more suitable to the environment becomes significantly more costly.

### **Plasma sprayed ceramic**

Ceramic coatings are not as common, but are very effective in more dynamic applications. They also protect the rods against mechanical wear, but not as effectively as some other coatings.

This coating is also brittle, with a low impact resistance, and corrosion resistance depends entirely on how these coated rods are used – it can be good in some circumstances, but poor in others.



### **HVOF sprayed metallic**

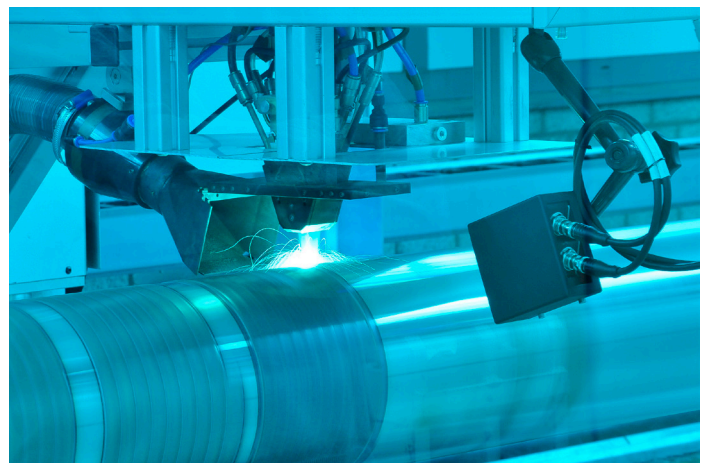
High Velocity Oxygen Fuel, or HVOF, is a process which allows rods to be efficiently coated with metals or metal matrix composites. It can offer unique coating properties, along with high bond strength and high to very high resistance to corrosion.

It is a complex and sensitive process which requires experienced, qualified personnel, but it's an effective coating material.

### **Laser cladding**

This method of applying coating is becoming more and more popular, and there have been major advances in its efficacy in recent years. The method can be used to apply a number of different coating materials, but the reasons why it's increasingly popular are that laser power is becoming more and more affordable, and there are high levels of inline process control. This opens up new and exciting opportunities for applying laser clad coatings within various applications and markets that previously couldn't have hoped for this type of high-tech coating.

Lasers can also be used for other unique coating materials, which could mean improving wear and corrosion resistance even more. This new generation of coatings will likely lead to piston rods lasting longer than ever, and maintaining the required efficiency far beyond anything seen previously.



# The future of coating technology



Bosch Rexroth are experts when it comes to offering piston rods with the best possible coating solutions for the toughest applications. Enduroq 3 is our coating solution specifically designed for applications in extremely corrosive environments, or applications where the risk of impact or bending is greater. More specifically, Enduroq 3 is ideal for offshore applications, particularly where the piston rods are exposed to saltwater for longer periods. Additionally, this coating can be considered for typical civil engineering applications where the piston rod is exposed to a corrosive environment for prolonged periods of time.



Enduroq 3 is applied using laser cladding techniques, and because of the advances in this field the dilution of the base material can be very low whilst maintaining the best possible metallurgical bonding. The low dilution means the iron concentration in the coating is more dependent on the additive powder composition than it is on the laser cladding process, as the cladding process will only add a few percentiles to the iron content in total.

This means that the resistance to corrosion is extremely high, and because of the process used to apply it to the piston rods, there's zero permeability and no porosity.

This unique coating allows large cylinders and piston rods to last longer without showing any signs of corrosion, regardless of application. It's a robust material, and forms a very important part of the tribological system which makes pistons and the associated mechanisms work, and it contributes towards maximum uptime and makes the road easier to repair for the end user if there are any issues.

This single layer cylinder technology was designed for long-lasting surface protection, and Bosch Rexroth will continue to innovate and improve the concept. The latest iteration, Enduroq 3i, does everything Enduroq 3 can do, but adds an integrated technological twist...

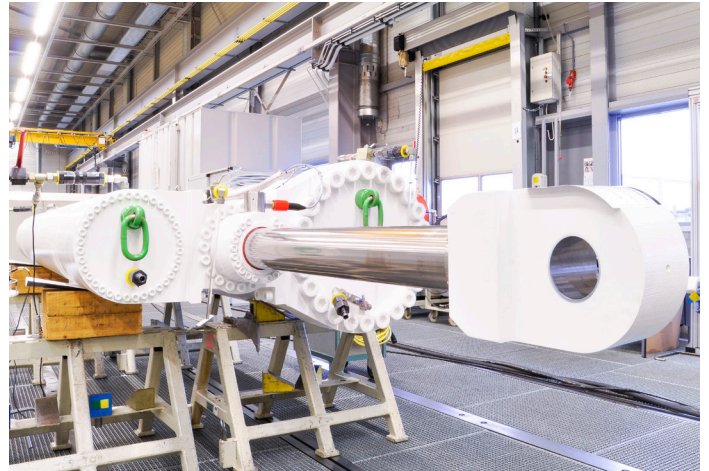
### **Enduroq 3i**

There's more to Enduroq 3i than meets the eye. Underneath this coating, there's a Bosch Rexroth patented Cylinder Integrated Measuring System, or CIMS, which is a pattern that's machined into the rod's base material. The purpose of this is for a specifically designed sensor to be able to register where the pattern is, and then tell the user where the piston rod is, and how much it's extended. CIMS also logs usage information, which makes preventive maintenance easier and more reliable. There's even more potential for innovation around the integration of CIMS capabilities for different applications in the future.



When it comes to heavy machinery that have any kind of piston rods or large cylinders, selecting the right rod with the right coating is key. Choosing the incorrect coating can cause issues, and lead to downtime and reduced productivity. Choosing the correct solution can ensure optimal productivity for years, even decades, provided everything is maintained as necessary.

From the options available today, Bosch Rexroth's Enduroq 3 coating is optimal when it comes to the toughest applications. It's long-lasting, durable, resistant to corrosion and truly innovative. If you want to learn more, please contact our team.



#### Contact details

#### Roy Orbon, Development engineer service technology

Bosch Rexroth BV, Kruisbroeksestraat 1, 5281 RV Boxtel  
+31 (0) 411 651 951, [large.cylinders@boschrexroth.com](mailto:large.cylinders@boschrexroth.com)  
[www.boschrexroth.com/largecylinders](http://www.boschrexroth.com/largecylinders)

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