



Unveiling the revolutionary coating technology – Pioneering a sustainable future in hydraulic cylinder manufacturing with Hydroline & Savroc



BUILDING A MORE SUSTAINABLE FUTURE WITH CAREFULLY SELECTED PARTNERS

We warmly welcome you to join us to the forefront of innovation and responsibility in the manufacturing industry.

As the world places an ever-growing emphasis on environmental stewardship, sustainability, safety, and financial prudence, we, who operate at the heart of the manufacturing industry, find ourselves at a pivotal crossroads.

A notable concern revolves around the use of hexavalent chromium (Cr6), a key component in creating hard chromium layers but notorious for its adverse environmental and health effects. In response to this global challenge, Savroc has introduced TripleHard® coating—a groundbreaking alternative that not only outperforms Cr6 in terms of performance but also offers substantial financial benefits.

At Hydroline, our commitment to environmentally-friendly practices led us to partner with Savroc from the beginning. We place our trust in the transformative capabilities of TripleHard®, and we suggest you and your company do the same.

To show you why, this document presents two case studies where TripleHard® was compared with the traditional Cr6 coating in extremely acid and extreme environments. Want to guess which one stood out as the winner?

THREE LEVELS OF TRIPLEHARD® COATING

TripleHard® Basic

- Good resistance
- Hardness up to Hv 1100 without heat treatment
- Safe: no chromic acid
- Chromium 3 solution – same results as Cr6

TripleHard® Wear

- Good resistance
- Hardness up to Hv 1500 without heat treatment
- Safe: no chromic acid
- Chromium 3 solution – better performance than Cr6

TripleHard® Superior Corrosion

This coating demonstrates exceptional resistance to both wear and corrosion, showcasing outstanding durability against acidic environments and achieving an impressive hardness of up to 1800 HV. Operating effectively in harsh conditions, TripleHard® Corrosion presents a viable alternative to considerably pricier coating methods such as laser cladding.

- Hardness up to Hv 1800
- Excellent wear and acid resistance
- Used in harsh environment like offshore and mining
- Plating rate up to 5µm/ minute
- Requires post heat treatment at 400 °C



CASE STUDY: TRIPLEHARD® MINING

The first case study presents a comparison of Cr6 and TripleHard in mining conditions. For the test, same kind of hydraulic cylinder rods were coated with different coating options: for Cr6, the used base materials were AISI 329 and 20MnV6 (if you are not familiar with these, read more from the info box on the right), and for TripleHard®, the used base material was normal steel.

The environment where the field test was executed, took place in an Australian mine, where the high temperature and saltiness cause even more difficulties in extreme conditions. Salt environments especially are known for their corrosive nature. Equipment and infrastructure used in mining operations, such as metal structures and machinery, may be susceptible to corrosion.

The complete duration of the field test was 34 months, during which the hydraulic cylinder rods were regularly monitored.

AISI 329 is a duplex stainless steel with a two-phase microstructure consisting of both austenitic and ferritic phases. Stainless steels are known for their high corrosion resistance, strength, and toughness. They are often used in applications where a combination of these properties is required, such as in chemical processing, oil and gas, and marine environments.

20MnV6 is a low carbon-manganese steel and is known for its high strength and good machinability. It is often used in applications where high strength and wear resistance are essential, such as in the manufacturing of hydraulic cylinders, pistons, and other components in machinery.



CASE STUDY RESULTS

Cr6 + 20MnV6: After only two months of operating, a lot of rust had been formed onto the cylinder rod, and the rod needed to be replaced. The price after one year for cylinder rod with this coating option was a total of 290€, and for the end user 6 300€. After 34 months, the price tag for the end user was 18 900 €.

Cr6 + AISI 329: After four months rust had been formed. Even the AISI 329, stainless steel, was rusty. After one year of usage, the price for the cylinder rod was 290€, and for the end user 4 050€ After three years of usage, the price for end user was 12 150 €.

TripleHard®: After 34 months of continuous usage in the mine, there was no evidence of rust anywhere in the cylinder rod. During the three years of operating there were no additional costs.

Sample	CR6 + 20MnV6	Cr6 + AISI 329	TripleHard
Life time	< 2 months	< 4 months	> 4 months
Base material price	22 €	110 €	22 €
Coating price	35 €	35 €	78 €
Total price	57 €	145 €	100 €
Cylinder rod price after 1 year	342 €	290 €	100 €
Cylinder price after 1 year for end customer	6 300 €	4 050 €	0 €
Price after 3 years for end customer	18 900 €	12 150 €	0 €

Based on the field test conducted in the mining environment, it is apparent that TripleHard is the superior choice. TripleHard® coating demonstrates superior performance compared to the Cr6 coatings (both with 20MnV6 and AISI 329 rods).

While both Cr6-coated rods experienced rust formation within a few months, resulting in replacement costs and escalating expenses for the end user, TripleHard® exhibited exceptional durability with no evidence of rust even after 34 months of continuous usage in the mining conditions.

Additionally, TripleHard® incurred no additional costs during the three-year operating period, highlighting its longevity and cost-effectiveness in comparison to the Cr6 alternatives.



CASE STUDY: KITZ BALL VALVE



Second case study was executed with KITZ ball valves. Like the first case study, this one had three samples to compare. The balls were coated with different materials: Cr6, electroless nickel and TripleHard®. In ball valves, the coating material matters a great deal, as the 'seat,' typically made of a hard ceramic material, plays a crucial role forming a seal against the ball to control the flow of fluids. The performance of the coated balls in conjunction with the seat material is crucial for the overall effectiveness and durability of the valve in challenging environments.

The tested balls were installed to applications in an electronic recycling factory. The testing environment had very strong nitric acid levels and the temperature rose up to 70-80 degrees Celsius.

CASE STUDY RESULTS

The Cr6 Coated Ball Valve had a series of challenges during the test. One notable issue arose from the crystallization that occurred between the ball and the seat during the process. The seat material, a highly durable ceramic (PIC), undergoes crystallization that adversely affects the integrity of the hard chrome coating. This phenomenon, where the crystallization gradually erodes the coating, results in the valve developing leakage problems over time. The wear problem further exacerbated the performance issues and made it evident that the Cr6 coating is susceptible to degradation in this specific application.

The electroless nickel coated ball valve encountered a significant challenge in the form of nitric acid exposure, leading to the corrosion of the electroless nickel coating. In an effort to mitigate this issue, a Nedox coat was applied on top of the electroless nickel. However, despite this additional protective layer, a corrosion problem persisted. This scenario emphasized the need for a more robust and corrosion-resistant solution.

The TripleHard coated ball valve stood out as the optimal choice in the application, as affirmed by the customer who deemed it the best coating for this specific use. Remarkably, the valve demonstrated exceptional performance, and operated in a real-world environment for over 1.5 years.

The feedback from the field highlights the impressive corrosion resistance and wear resistance exhibited by the TripleHard® coating. This underscores the reliability and durability of TripleHard®, reinforcing its position as a superior coating solution that not only meets but exceeds the expectations of customers in challenging operational conditions.



TRIPLEHARD® – THE SUPERIOR CHOICE

As the case studies clearly show, Savroc's TripleHard® technology represents a groundbreaking shift in manufacturing practices. And as a hydraulic cylinder manufacturer, we at Hydroline always want to help our customers find the best solutions for their specific needs.

Do you want to stand out as the forerunner of the industry and improve the quality, performance and reliability of your machinery? In that case, TripleHard® is the right coating solution for you.

Get in touch with us and let's discuss more!

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