



CORROLON C-3000™



Product Code # SOL-TG080

Pioneered For Hostile Abrasive Environments:

Combining Non-Stick Performance With Nitride Hardening For Aggressive Wear Conditions

- ▶ Reduces severe wear and friction on metal substrates
- ▶ Thin coat application prevents undersize designs
- ▶ Continuous Operating Temperature 550°F (260°C)
- ▶ Nitride salt bath treatment “frac-hardens” substrates without significantly increasing part dimensions
- ▶ Excellent erosion and corrosion protection
- ▶ Non-stick characteristics reduce galling & seizing
- ▶ Allows engineers a variety of metal substrates
- ▶ Combines the advantages of a thin, non-stick fluoropolymer with the strength of nitride treatment

CORROLON C-3000™ is an engineered multi-step coating process that combines all of the superior non-stick properties of a fluoropolymer application with a case-hardened underlay of **MATRIX II™** nitride salt bath & oxidizing treatment. By designing a coating system that offers a cost-effective solution for downwell service, **CORROLON C-3000™** protects metal substrates against wear (sand & silica), pitting, corrosion and abrasive oilfield conditions.

Pioneered for abrasive petrochemical service environments, the **PUMPGUARD C-3000™** coating system enhances pump run-life by diffusing nitrogen & carbon into the parent metal and chemically “frac”-hardening the metal, without significantly increasing the original dimensions. The hardened surface is then impregnated with a fluoropolymer topcoat system to provide a low coefficient of friction and protect against asphaltine scale buildup and H₂S service.

Engineering Data & High Performance Characteristics:

Temperature Specifications

Designed for aggressive downwell service, **CORROLON C-3000™** operates very efficiently in high temperature environments. The thermosetting resins in this innovative coating enable it to perform in both a cryogenic and high temperature setting. Coated parts exhibit strength and non-stick properties, remaining highly flexible in demanding industrial use.

Continuous Operating Temp 500°F (260°C)
 Intermittent Temperature 555°F (290°C)



Solutions for Aggressive Wear & Chemical Applications



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Custom Global Coatings



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Wear Resistance

As a solution for reducing extreme wear to parts, **CORROLON C-3000™** prevents asperities (metal surface peaks) from making physical contact. The fluoropolymer coating acts as a cushion by spreading high point loads in bearings and reducing element fatigue. Another advantage of this coating is its ability to reduce “boundary lubrication failure”, caused when equipment is frequently started and stopped; thereby allowing oil films to become too thin to function as a lubricant.

CORROLON C-3000™ has been pioneered to work closely with Electric Submersible Pump (ESP) stages in hostile wear environments, deemed too aggressive for standard fluoropolymer coatings.



CORROLON C-3000™ is designed to provide wear resistance and corrosion protection for key system components and critical function units.

From ESP oilfield service in Yemen with Centrilift - Baker Hughes for CanOxy (Nexen) all the way to threaded bolts for drilling platforms in the North Sea, CORROLON C-3000™ provides a cost-efficient solution for high volumes of sand, silica, and fines.

Corrosion Resistance

Employing advanced fluoropolymer technology **CORROLON C-3000™** resists organic and inorganic compound attacks by means of a barrier (that can be applied in multiple coats) which impregnates the nitride metal-treated substrate.

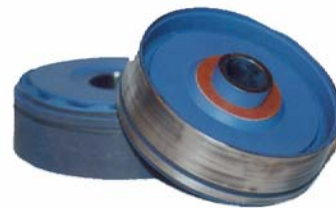
In environments where corrosion protection is important, process equipment and function-to-success parts are enhanced by reducing oxidization, fretting (vibration), galvanic corrosion, and increasing chemical resistance.

Hardness

As a result of its combination application, **CORROLON C-3000™** has a dual-hardness rating for the top and bottom layer of coating:

Base Coat - nitride salt bath treatment using sulphur as a catalyst, C-3000 has an ASTM 785 hardness rating of Rockwell Rc 50 - 52.

Top Coat - fluoropolymer PUMPGUARD™ has a hardness rating (ASTM D 785) of Rockwell 60 (+-2.0) and Pencil Hardness 3-4 H.



Thickness

CORROLON C-3000™ provides an even application that enables protective enhancement without affecting critical engineering tolerances in designs. This coating system is uniform in thickness and ranges from 0.0012” to 0.003” (+-0.0003”).

The nitride salt bath and oxidizing treatment does not significantly increase the dimensions of the part. This process provides a “frac”-hardened surface without requiring part re-engineering or pre-machining before fluoropolymer application.



High Performance Applications

- ▶ Downwell Packer Systems
- ▶ ESP Stages & Barstock
- ▶ “Frac” Hardened Parts
- ▶ Pipe & Tubing
- ▶ Latch Couplings
- ▶ Military Applications
- ▶ Mining & Water Pumps
- ▶ Pump Wash Zones
- ▶ Tanks & Valves
- ▶ Gears & Springs
- ▶ Completion Systems and Fishing Tools
- ▶ Part Re-tolerance and Reclamation
- ▶ Industrial Housings
- ▶ Offshore Platforms
- ▶ Fail-Safe Devices



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Scale & Asphaltine Resistance

Nuclei site formation is a common problem in both petrochemical and heavy industrial applications. **CORROLON C-3000™** provides a barrier between the hostile molecules and the protected substrate. An unprotected substrate is prone to scale and corrosion attack.

Resistance to Seizure & Fatigue

The unique structure of the surface layer of **CORROLON C-3000™** inhibits welding, avoids metal transfer and results in high residual compression stresses.



CORROLON C-3000™ applied to dump valve for erosion with Wellguard XP™ top-coat for high-build finish.

Chemical Corrosion Guideline Table:

Chemical	Concentration %	Hours	Effect on Coating Function
Water			
Deionized—Boiling	100	1000	none
Salt (immersed)	30	4000	none
Salt (Spray)	5	1000	none
Tap—250°F (120°C) @ 10,000 psi	100	24	none
Acids			
Hydrochloric	36	24	none
Hydrochloric	15	150	slight
Hydrochloric	2 pH	300	none
Hydrochloric 125°F (50°C)	2 pH	300	none
Sulfuric	25	1500	none
Nitric	35	24	none
Picric	saturated solution	120	none
Base			
Caustic	2	24	none
Caustic	100	336	slight
Caustic	12.5 pH	150	slight
Caustic	9.5 pH	300	none
Caustic 125°F (50°C)	9.5 pH	300	slight

Chemical	Concentration %	Hours	Effect on Coating Function
Solvents			
Acetone	100	1500	none
Benzene	100	1500	none
DMAC	100	1500	none
Ethanol	100	1500	none
Fluorocarbons (12, 22, 113)	100	1000	none
MEK	100	120	none
Methanol	100	1500	none
Methylene Chloride	100	1500	none
Perchloroethylene	100	1500	none
Phenol	5	120	none
Toluene	100	120	none
Xylene	100	1500	none
Other Fluids			
Skydrol (hydraulic fluid)	100	1500	none
JP-4 (jet fluid)	100	1500	none
Break Fluid (auto)	100	1500	none
H ₂ O + gas at 250°F (120°C), @ 2000 psi	79% CH ₄ , 6% CO ₂ , 15% H ₂ S	24	none

* All data reflected above was conducted in room temperature and assumes pinhole-free coating film.





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PUMPGUARD C-3000		
DEVELOPMENT ENGINEER:	M. MILLER	
TECHNICAL MANGER:	R. HUIZINGA	
APPROVAL BY:	M. FEARON	
REVISION 2.1.1	ISO DATA SHEET #710-B-1	

Factors Affecting Chemical Resistance

Chemical resistance and attack are very complex matters. The known factors which affect the chemical stability of **CORROLON C-3000™** fluoropolymer (PTFE) and **MATRIX II™** nitride salt bath and oxidizing treatment for chemical application, not listed in order of priority, are as follows:

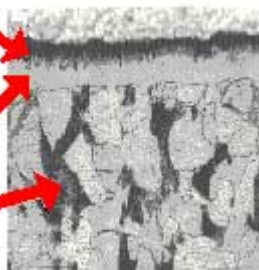
- ▶ Environment temperature and temperature variations.
- ▶ Specific chemical or mixture composition.
- ▶ Exotherm or heat of reaction or mixing.
- ▶ Pressure due to the effects of pressure on concentration of reactive gas.
- ▶ Concentration of the chemical which may be a complex different than the individual components.
- ▶ Velocity.
- ▶ Suspended solids.
- ▶ Thickness.
- ▶ EMF potential of the supporting metal compared to the ground potential.
- ▶ Time of exposure.
- ▶ Stress levels.

Other factors affecting chemical resistance probably exist but the aforementioned list is all of the known factors at this time.

Created by oxidization of the nitro-carburized part, this layer protects the hardened metal from corrosion.

This "White Layer" is composed of epsilon iron nitride and it functions to retain lubricants in the parent metal.

The nitrogen diffusion zone creates the increased wear resistance and is located approx. 10-25 microns below the surface.



Utilizing a unique application process, CORROLON C-3000™ is applied to pancake stages for thin and even coverage. This cross-section of a nitride diffused ni-cast stage demonstrates how MATRIX II™ nitride salt bath and oxidizing treatment frac-hardens the metal by dissipating nitrogen and carbon into the molecular core.



CORROLON C-3000™ is applied to oilfield packer seal nipple for Baker Oil Tools in order to "Frac" Harden parts for aggressive environments with severe abrasion and hostile temperatures.



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