



Xylan offers multiple benefits for oil rigs...



Provides controlled friction and corrosion resistance...



Xylan keeps wind farms running smoothly...



Solves many problems at chemical processing plants...

Where there's oil, where there's water, there's Xylan®

***How the versatile family of Xylan coatings can help
solve your friction and corrosion problems***

Whitford

Manufacturers of the world's largest, most complete line of fluoropolymer coatings

We all learned in school that “oil and water don’t mix”. But there is an important exception to the rule: today’s versatile Xylan coatings.

This vast array of coatings, each designed to meet a specific need (or needs) for fasteners, has been solving the same kinds of problems for the oil as well as the waterworks industries (not to mention the chemical, automotive, energy and other industries) for nearly 40 years.

Oil

The corrosive elements of the environment are responsible for today’s advanced coatings. Previously, fasteners were protected only by electroplating, cadmium or zinc. But the protection was insufficient for the demands of the industry. (In addition, zinc coatings by themselves cause uneven, unpredictable results.)

Water

The waterworks industry, like many others, faces a disturbing increase in raw-material costs. That’s why nobody in the industry wants to pay the steep (and still climbing) price of fasteners made of stainless steel. Further, stainless steel has less yield strength than alloy steel, so a fastener coated with Xylan not only offers greater strength but provides more accurate torque control than its stainless counterpart.

In spite of this, some do pay the higher cost, generally because nobody wants to put an uncoated steel fastener in wet, hot soil, only to encounter rapid corrosion and the problems that causes.

Enter Xylan coatings

Xylan coatings solve as many problems for the oil industry as they do for waterworks.



Xylan offers fasteners such as T-Bolts controlled torque, corrosion resistance and color-coding.

For example:

1. Controlled torque: Xylan coatings are engineered with PTFE for lubrication, which allows precise and uniform makeup torque. (Stainless-steel fasteners are prone to galling.)

2. Easy removal of nuts: The lubricity of Xylan coatings makes removal easy — even after many years. Coefficient of friction is as low as 0.055.

3. Resistance to rust/corrosion: Steel fasteners coated with Xylan over a zinc pretreatment provide corrosion resistance almost equal to that of stainless steel. (They last as long as 2,500 hours in ASTM B-117 salt-fog tests with less than 15% red rust.)

4. Resistance to galvanic corrosion: This occurs when two metals far from one another on the electromotive (galvanic) scale are joined by a conductor such as moisture. That frequently happens when stainless-steel fasteners are used with ductile iron, often employed in waterworks pipes and fittings. Xylan coatings reduce this corrosion. They also have a dielectric strength from 500-1,200 volts per mil (which inhibits galvanic corrosion).

5. Eliminates the need for toxic lubricating paste: In fact, Whitford recommends not using such pastes with Xylan-coated fasteners.

6. Tough: Excellent resistance to wear, abrasion, chipping.

7. Cost: Compared to stainless steel, Xylan coatings can save significant amounts (steel fasteners coated with Xylan cost an average of 50% less than stainless-steel fasteners).

8. Wide range of operating temperatures: Xylan coatings operate easily from -425°F/-255°C to +550°F/+290°C.

9. UV-stable: Some Xylan formulations have superb resistance to ultraviolet light.

10. Resistance to hot soil: Xylan helps protect fasteners from corrosion caused by hot soils and most common chemicals.

11. Easily applied: Xylan can be applied by conventional spray, HVLP, electrostatic and dip/spin, making Xylan cost-effective for any size item, from large fasteners to small O-rings.

12. Remarkable adhesion: It adheres to a variety of substrates, including steel, aluminum, copper, stainless steel, brass, titanium.

13. Color-coding: Xylan is easily color-coded for specific applications (to avoid confusion).

14. FDA-acceptable: Many Xylan coating formulations comply with Food & Drug Administra-



tion regulations for food contact.

Surface preparation

Xylan coatings (or any thin-film coating) cannot by themselves provide complete corrosion protection. For maximum performance, primers or pretreatments are required. The best are:

- Microcrystalline, heat-stable zinc or manganese phosphate conversion coating
- Xylan 4000 Series primers (ask Whitford)
- Commercial plating, zinc, cadmium and aluminum pretreatments
- Xylar 2 or P51 (ceramic metallics).

Types of corrosion-mitigating coatings

These fall into three common categories, all of which Whitford offers: barrier, inhibitive and sacrificial.

A barrier coating stands between the metal fastener and the environment. This is usually an organic coating with fillers that help stop moisture or vapor from permeating the film to the metal and becoming an electrolyte.

An inhibitive coating is usually an organic coating with corrosion inhibitors, such as zinc phosphates, chromates, and many more. In addition to acting as barriers, they help prevent corrosion by using pigments that provide an inhibitive effect, reacting with the absorbed moisture in the coating, then reacting with the steel to passivate it and decrease its corrosive characteristics.

A sacrificial coating is usually a metal or inorganic coating containing metal particles (often zinc). If the coating is damaged, they act as a sacrificial anode and corrode to protect the steel

substrate, sacrificing themselves by galvanic action. These can also be electroplated like zinc or cadmium.

The coating options

1000 series general-purpose coatings

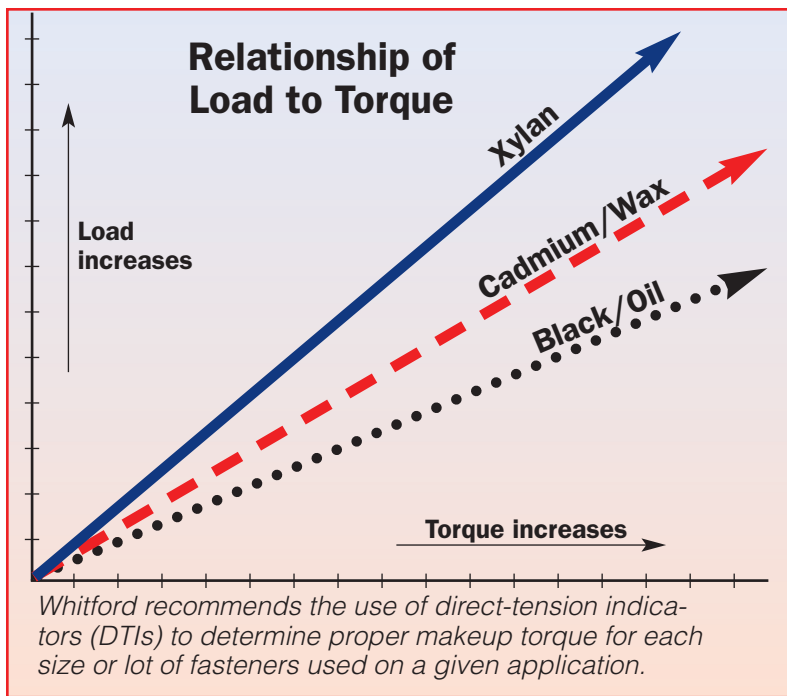
1014 and 1070 were the first Xylan fastener coatings, introduced in the mid-1970s and still going strong. They provide outstanding lubrication for predictable makeup and break-out torque, and they have outstanding chemical resistance. Another advantage: They tolerate temperatures from -425°F/-255°C to +550°F/+290°C continuously. Xylan 1070 has added corrosion inhibitors.

1400 series coatings

The 1400 series is the hand-spray version of the Xylan 5000 series dip/spin products (more on these later). The 1400 series does not have quite the wide temperature range of the 1000 series, although they have nearly three times the corrosion resistance applied over any given pretreatment. Xylan 1400 series coatings can be made in any color, including white. They also have better chemical resistance to bases than the 1000 series. Xylan 1400 series reaches complete cure at 400°F/205°C, ideal for most coating operations. Xylan 1400 series coatings work best for one-time installations, where the fastener will be coated, installed, and left alone.

142X series coatings

Xylan 1424 and 1427 are the environmentally friendlier combination of the 1000 and 1400 series coatings, combining the best of both. Xylan 142X coatings have all the chemical resistance of



the 1400 series with the lubricant levels of the 1000 series products. However, the 142X series products do not have the wide temperature range, performing best between -40°F/-40°C to +350°F/+175°C.

5000 series dip/spin coatings

These have all the attributes of their hand-spray cousins, except that they are formulated for application via dip/spin equipment. Xylan 5000 series products are specified for fasteners by the major automotive companies, building constructors and appliance manufacturers.

Achieving uniform torque

Fluoropolymer coatings have the lowest coefficient of friction of all known fastener coatings, which requires that “makeup torque” specification be adjusted to compensate.

Many factors affect the determination of the ideal torque value to achieve recommended clamping loads (K-factor). The coefficient of friction (CoF) is only one. The K (or nut) factor varies, since it is the net effect of many variables such as type of fastener, thread, thread angle, type of pretreatment, etc. It would be inappropriate for Whitford to offer K-factor information when Xylan is only one of the many variables involved. The same lot of Xylan 1424 applied to different types of fasteners can result in a reduction of makeup torque from 30 all the way to 70 percent, caused by the differences in fasteners. Note: Makeup torque will *not* vary on fasteners of the same size and make.

Every bolted joint is unique, and the optimum tightening torque should be determined for each by careful testing. A properly tightened bolt is stretched so that it acts like a rigid spring, pulling the mating surfaces together. Whitford recommends a direct-tension (load-cell) study for every size and type of fastener you are using, routine practice in the construction industry.

Another option is to use Fastorq’s Boltcalc software. Fastorq, of Houston, Texas, has performed this direct-tension study on many types of fasteners with many types of coatings, including Xylan. They have put this information in a program called Boltcalc (fastorq.com/products/boltcalc.cfm), which is available for purchase. We also recommend that you

use direct-tension-indicating washers (DTIs) on random connections to double-check the theoretical values.

Physical/chemical properties

Corrosion comes in many forms: atmospheric, galvanic, chemical, fretting, salt-fog, etc.

Stainless steel needs oxygen to provide an oxide layer that inhibits corrosion. So it would not be fair to compare Xylan to stainless steel in an ASTM B-117 salt-fog test when the end use is buried in hot soil. Of course stainless steel will outperform Xylan in the salt-fog test, although Xylan will outperform stainless steel when buried in hot soil.

In coastal environments, stainless steel is susceptible to chloride-induced stress-corrosion cracking (chemical corrosion). Xylan-coated carbon-steel bolts are not affected by chlorides.

Stainless-steel fasteners also gall and seize. It is common knowledge that stainless-steel fasteners need to be retorqued after 24 hours due to galling, losing up to 40% of their clamping force in 24 hours. But Xylan-coated carbon-steel fasteners reach the required clamp load on the first makeup.

When stainless steel is combined with dissimilar metals, galvanic corrosion results. Xylan-coated carbon steel in combination with any alloy does not lead to galvanic corrosion.

Perhaps the most striking difference of all is

that stainless-steel fasteners can cost twice as much as Xylan-coated carbon-steel fasteners.

A few suggestions

Whitford recommends the use of Whitford-approved fastener-class coating applicators, highly trained experts in the application of pre-treatments, Whitford primers and coatings.

Further, with today's emphasis on quality (such as ISO 9001-2000), Whitford urges that

all end users ask for and keep a record of the lot number of the Xylan coating used. This, with the fastener certification document, ensures traceability should there be a problem.

For more information, contact your Whitford representative (or sales@whitfordww.com) and ask for our "Guide to Industrial Products", "How to Reduce Friction with Xylan" and "9 Dangerous Misconceptions about Xylan 1000 series".

Examples of the Chemical Resistance of Xylan Coatings

Chemical	Xylan 1014	Xylan 1400	Xylan 1424
HCl (concentrated) at room temperature ⁽¹⁾	Severe blisters, rust	Severe blisters, rust	No effect
HCl (pH 2) at room temperature ⁽¹⁾	Slight marks	Slight marks	No effect
HCl (pH 2) at 125 °F ⁽¹⁾	Slight marks	Slight marks	No effect
NaOH (50%) at room temperature ⁽¹⁾	Severe failure, blisters	No effect	No effect
NaOH (pH 12.5) ⁽¹⁾	Severe failure, blisters	No effect	No effect
NaOH (pH 9.5) at room temperature ⁽¹⁾	Slight marks	No effect	No effect
NaOH (pH 9.5) at 125 °F ⁽¹⁾	Slight marks	Very slight marks	No effect
MEK at room temperature ⁽¹⁾	Slight marks	Slight marks	Slight marks
Toluene at room temperature ⁽¹⁾	Slight marks	Slight marks	Slight marks
Ethylene glycol at room temperature ⁽¹⁾	No effect	No effect	No effect
Salt spray for 1488 hours	20% red rust, adhesion loss	15% red rust, dense edge blistering	<15% red rust
Kesternich	4 cycles, 20+%, red rust, adhesion loss	30 cycles, 1% red rust, blistering	30 cycles, <15% red rust
Castrol Hydraulic Fluid at 200 °F ⁽²⁾	Not recommended	Gloss decrease, no loss in coating integrity	Gloss decrease, no loss in coating integrity
W. Canning Oceanic HK-540 at 200 °F ⁽²⁾	Not recommended	Gloss decrease, no loss in coating integrity, slight color lightening	Gloss decrease, no loss in coating integrity, slight color lightening

(1) = 24-hour chemical spot tests (ASTM D1308-79)
(2) = Immersion tests



**Whatever your coating problem,
Whitford probably has the right
product to solve it. If not, we will
work closely with you to
develop the coating that will.**

How to contact Whitford

Whitford manufactures and maintains sales offices in many countries of the world. For more information, please contact your Whitford representative or the nearest Whitford office (see our website: whitfordww.com) or sales@whitfordww.com.

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Manufacturers of the world's largest, most complete line of fluoropolymer coatings

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