



# **FASTENER**

## **BOLTS & NUTS**

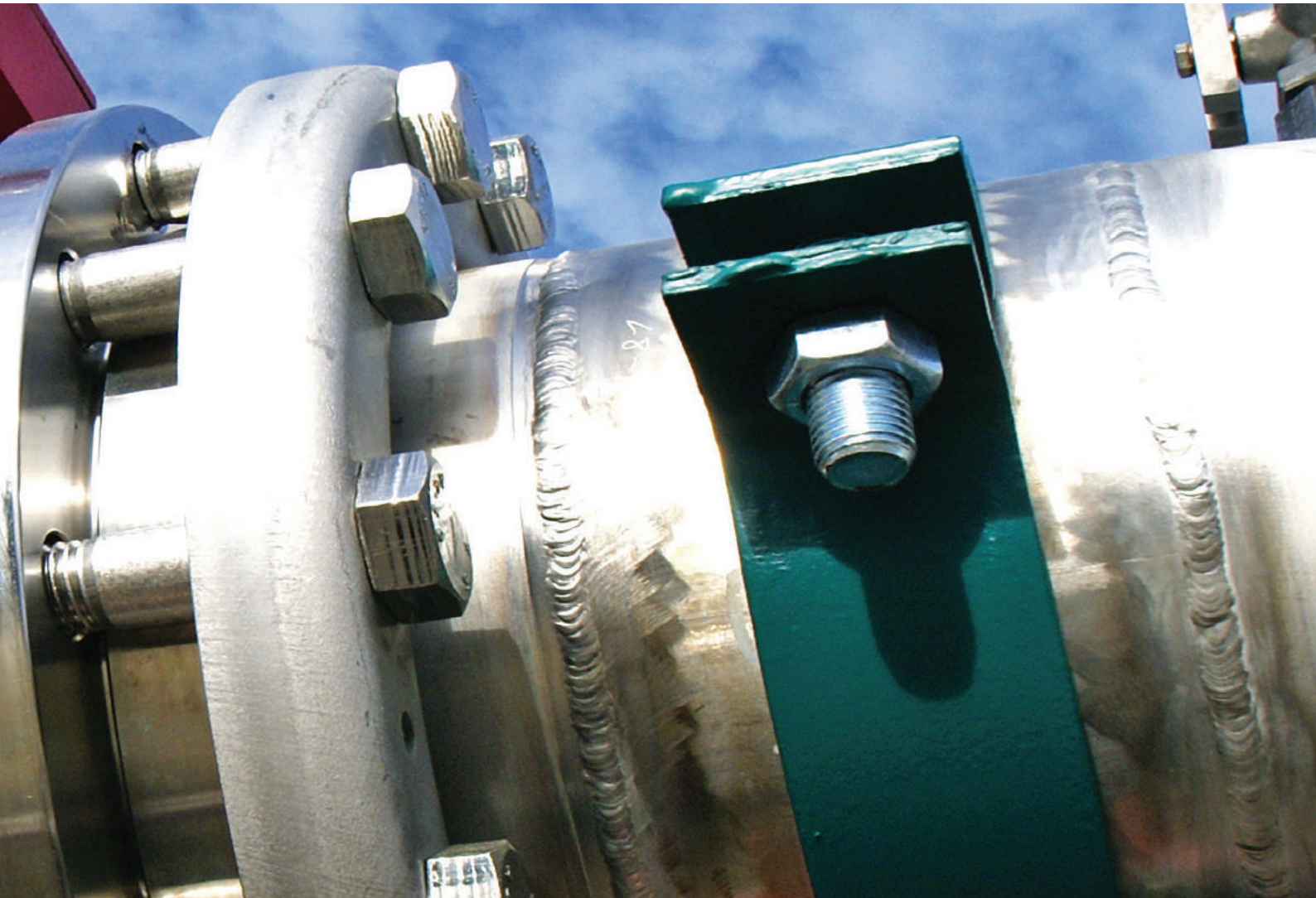
**ALLOY STEELS**

**CARBON STEELS**

**STAINLESS STEELS**

**DUPLEX STAINLESS STEELS**

**SUPER DUPLEX STAINLESS STEELS**



OPI is a stockiest and partner of leading manufacturer and distributor of Bolts and Nuts worldwide. We offer a wide-range of regular and custom-made fasteners made to internationally-upheld safety and quality standards for various project worldwide.

Our partners remains at the forefront in implementing new safety standards and technology by continually upgrading themselves and investing heavily in state-of-the-art machinery that deliver fasteners of the highest quality.

We also take pride in delivering excellent customer service through prompt response and willingness to our clients, operations and challenges. Our experiences are able to assist our client for cost- efficient, on-time delivery through anywhere in the world.

# Supplied Fastener material list

## Carbon Steel

Fastner type	Material Class										Standard Dimension					Coating									
Fastner type	A325	A193 B7/A193 B7M	A320 L7/A320 L7M	A307	Gr. 4.6/Gr. 4.8	Gr. 8.8/Grade 5	A490/Gr. 10.9	Gr. 12.9	Steel			B18.2.3.6M	B18.2.1	DIN931/DIN933	JIS B1180	JIS B1186	DIN975/DIN939		White/Yellow Zinc Galvanized	Hot-Dip Galvanized	Cadmium Plated	Zn+Ni Plating & Xylan (PTFE)	Xylan (PTFE)	Geomet/Dacromet	
<b>Bolt</b>																									
Heavy Hex Bolt	●	●	●	●			●					●				●					●	●	●	●	●
Hex Bolt		●		●	●	●	●	●	●	●		●	●	●	●					●	●	●	●	●	●
Stud Bolt	●	●	●														●			●	●	●	●	●	
J Bolt / L Bolt	●									●									●	●					

Fastner type	Material Class										Standard Dimension					Coating									
Fastner type	A325	A193 B7/A193 B7M	A320 L7/A320 L7M	A307	Gr. 4.6/Gr. 4.8		A490/Gr. 10.9	Gr. 12.9	Steel	SWRCH6R	DIN7991	B18.3/DIN912	B18.3/DIN914	DIN 580	DIN963	JIS B1111			White/Yellow Zinc Galvanized	Hot-Dip Galvanized	Cadmium Plated	Zn+Ni Plating & Xylan (PTFE)	Xylan (PTFE)	Geomet/Dacromet	
<b>Screw</b>																									
Hex Socket Head Countersunk Screw							●	●	●	●	●	●								●	●	●	●	●	●
Hex Socket Head Cap Screw												●								●	●	●	●	●	●
Hex Socket Head Set Screw													●							●	●	●	●	●	●
Shoulder Screw	●	●	●	●															●	●	●	●	●	●	●
U Bolt		●																	●	●	●	●	●	●	●
Eye bolt																			●	●					
<b>Machine Screw</b>																									
Pan/Round Head Screw																			●	●	●	●	●	●	●
Flat Head Screw																			●	●	●	●	●	●	●
Truss Head Screw																			●	●	●	●	●	●	●

Fastner type	Material Class										Standard Dimension					Coating										
Fastner type	A563	A194 2H/A194 2HM	A194 7/A194 7M		BS1083	Cl. 8	Cl. 10	F10T	Steel		B18.2.4.6M	B18.2.2	DIN934	JIS B1181	JIS B1190	DIN985	JIS B1183	DIN582		White/Yellow Zinc Galvanized	Hot-Dip Galvanized	Cadmium Plated	Zn+Ni Plating & Xylan (PTFE)	Xylan (PTFE)	Chrome Plated	
<b>Nut</b>																										
Heavy Hex Nut	●	●	●								●	●	●	●							●	●	●	●	●	●
Hex Nut	●	●			●	●	●				●	●	●	●							●	●	●	●	●	●
Flange Nut																●					●	●	●	●	●	●
Lock Nut/Nylon Lock Nut																●					●	●	●	●	●	●
Domed Cap Nut																	●				●	●	●	●	●	●
Eye Nut																				●	●	●	●	●	●	●

Fastner type	Material Class										Standard Dimension					Coating										
Fastner type	F436	HW200		Gr. 4.6/Gr. 4.8	Gr. 8.8/Grade 5	A490/Gr. 10.9	Gr. 12.9				F436	DIN125	DIN127	BS1083	DIN434					White/Yellow Zinc Galvanized	Hot-Dip Galvanized	Cadmium Plated	Zn+Ni Plating & Xylan (PTFE)	Xylan (PTFE)	Zin Flake	
<b>Washer</b>																										
Taper Washer	●	●	●	●							●	●		●							●	●	●	●	●	●
Flat Washer	●													●	●						●	●	●	●	●	●
Nord Lock											●										●	●	●	●	●	●
Spring Washer																					●	●	●	●	●	●

### NUT OPTION

#### NYLON LOCK NUT



Lock nuts have a unique design that includes an inner face or features that interact with the threads of the bolt or stud. When tightened, the lock nut creates friction or mechanical resistance to rotation, making it harder for the threaded connection to come loose. This is particularly useful in application where there are constant vibrations or when it is crucial to maintain the integrity and stability of the connection.

#### WEDGE-LOCK WASHERS





# Stainless Steel, Duplex Stainless, Super Duplex Stainless

## Supplied Fastener material list

Fastner type	Material Class					Standard Dimension					Coating			
	A193 B8/ A193 B8M	SS304 (A2)	SS316/ SS316L (A4)	1.4462 Duplex Stainless Steel	Inconel Alloy 625 (NO6625)	B18.2.3.6M	B18.2.1	DIN931/ DIN933	JIS B180	DIN975/ DIN939			No coating	Xylan (PTFE)
<b>Bolt</b>														
Heavy Hex Bolt	●				●	●	●						●	●
Hex Bolt		●	●	●	●		●	●					●	
Stud Bolt	●	●	●							●			●	●

Fastner type	Material Class					Standard Dimension					Coating				
		SS304 (A2)	SS316/ SS316L (A4)	1.4462 Duplex Stainless Steel		DIN7991/ ISO 10642	B18.3/ DIN912	DIN916/ ISO 4029	DIN 580	DIN7985H	DIN965H/ ISO 7046-2			No coating	Xylan (PTFE)
<b>Screw</b>															
Hex Socket Head Countersunk Screw		●	●			●								●	●
Hex Socket Head Cap Screw		●	●	●										●	●
Hex Socket Head Set Screw		●	●				●							●	●
Shouder Screw		●	●											●	●
U Bolt		●	●											●	●
Eye bolt		●	●						●					●	●
<b>Machine Screw</b>															
Pan/ Round Head Screw		●	●											●	
Flat Head Screw		●	●							●				●	
Truss Head Screw		●	●							●				●	

Fastner type	Material Class					Standard Dimension					Coating				
	A194 B8/ A194 B8M	SS304 (A2)	SS316/ SS316L (A4)	1.4462 Duplex Stainless Steel	Inconel Alloy 625 (NO6625)	B18.2.4.6M	B18.2.2	DIN934	JIS B1181	DIN6923/ JIS B1190	DIN985	DIN1587/ JIS B1183	DIN582	No coating	Xylan (PTFE)
<b>Nut</b>															
Heavy Hex Nut	●				●	●	●							●	●
Hex Nut	●	●	●	●	●			●						●	
Flange Nut		●	●							●				●	
Lock Nut/Nylon Lock Nut		●	●								●			●	
Domed Cap Nut		●	●								●	●		●	
Eye Nut		●	●										●	●	●

Fastner type	Material Class					Standard Dimension			Coating				
		SS304 (A2)	SS316/ SS316L (A4)	1.4462 Duplex Stainless Steel	Inconel Alloy 625 (NO6625)	DIN125/ ISO 7089	DIN127	DIN434			No coating	Xylan (PTFE)	
<b>Washer</b>													
Flat Washer		●	●	●	●	●						●	●
Spring Washer		●	●	●	●		●					●	●
Taper Washer		●	●					●				●	●
Nord Lock			●									●	

## NUT OPTION

A pair of washers for maximum safety Nord-Lock® bolt securing solutions consist of a pair of washers with cams facing each other and serrations gripping the mating surfaces. They use cam-geometry to effectively prevent the bolt from vibrating loose.

## WELD NUTS



Available in a variety of styles, including round base, slab base, slab base-long flange, pallet nuts, and square base. If you cannot find the precise weld nut suitable for your application among our extensive options.

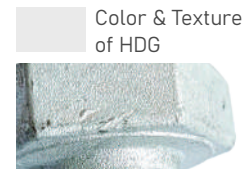
# FASTENER COATING

## HOT-DIP GALVANIZED (HDG)



is a process that involves immersing bolts and nuts that have undergone surface preparation into molten zinc. This results in the formation of a zinc coating layer, characterized by a grayish appearance, with a thickness ranging from approximately 40 to 65 microns.

This thickness is considerably greater than the zinc plating thickness of 3-5 times, making HDG-coated bolts and nuts more resistant to corrosion and erosion caused by acids and alkaline solutions.



### Corrosion Resistance

HDG acts as a protective barrier, shielding the bolts from corrosive elements in the environment, particularly in harsh conditions or outdoor applications.

### Durability

Hot-dip galvanized bolts have a longer lifespan due to their resistance to corrosion and abrasion.

### Cost-Effectiveness :

They often require less maintenance and replacement, reducing long-term costs.

## CADMIUM PLATED



Cadmium plated bolts find applications in industries like aerospace, marine and electrical due to their exceptional corrosion resistance and ability to withstand high-stress environments.

They are preferred in scenarios where corrosion protection is crucial.



### Corrosion Resistance

Cadmium offers excellent corrosion protection, particularly in harsh environments such as marine or aerospace applications.

### Durability

The cadmium layer provides good wear resistance, contributing to the bolt's longevity and performance.

### Sacrificial Coating :

In case of damage, cadmium can act as a sacrificial coating, corroding in place of the base metal, thus protecting it.

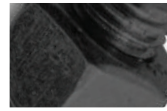
# ZINC PLATED

Zinc-plated bolts are commonly used in a wide range of industries, including construction, automotive, manufacturing, and electronics. They are suitable for applications where moderate corrosion resistance and cost-effectiveness are essential.

Color & Texture of White Zinc



Color & Texture of Black Zinc



Color & Texture of Yellow Zinc



## Corrosion Resistance

The zinc layer acts as a barrier, protecting the underlying metal from corrosion caused by exposure to moisture, air, and other environmental elements.

## Cost-Effectiveness

Zinc plating is relatively cost-effective compared to some other coating methods, making it a popular choice for various applications.

## Enhanced Appearance

Zinc plating can provide an appealing finish and can be further treated for improved aesthetics or additional protection.

## Comparison Summary :

### Corrosion Resistance :

- Highest Level
- 1 HDG
  - 2 Cadmium Plated
  - 3 Zinc Plated

### Environment and Application :

- 1 HDG bolts is excellent in harsh environments and outdoor use.
- 2 Cadmium plated well-suited for marine and aerospace industries.
- 3 Zinc plated is suitable for indoor or mildly corrosive environments.

### Toxicity and Handling :

Cadmium, used in Cadmium Plating, is toxic, requiring strict handling and disposal measures. Zinc and Hot-Dip Galvanizing are less toxic.

Each coating method offers different levels of protection and is suitable for specific environments and applications. The choice between them depends on factors like the intended use, environmental conditions, durability requirements, and safety considerations.

# FASTENER COATING

**DACROMET®**

**4 WAYS CORROSION  
PROTECTION SYSTEM**

**SUPERIOR ALTERNATIVE  
TO HOT DIP GALVANIZING**

**GEOMET®**

**AT LEAST 1000 HOURS  
OF SALT SPRAY TEST**

**SOLUTION TO AVOID  
HYDROGEN EMBRITTLEMENT**

“HYDROGEN EMBRITTLEMENT MAY CAUSE PREMATURE FAILURE OF PARTS WHICH ARE HEAT TREATED OR COLD WORKED TO A SURFACE HARDNESS OF 320HV AND ABOVE OR PROPERTY CLASS 8.8 OR ABOVE.” BS 7371-6

## AT LEAST 1000 HOURS OF SALT SPRAY TEST

One layer of DACROMET® and GEOMET® has demonstrated 0% red rust after 1000 hours of Salt Spray Test hours (tested against ASTM B117). This performance exceeds that of Electro - Galvanizing, Hot Dip Galvanizing and Mechanical Galvanizing.

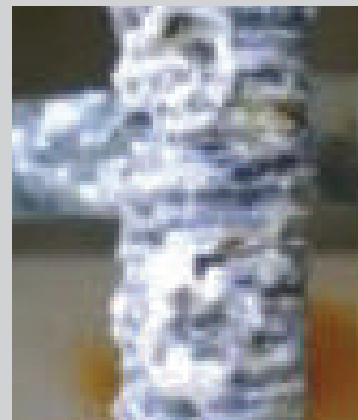
The corrosion resistance capability can be further enhanced by applying multiple layers of coating. Alternatively, DACROMET® and GEOMET® can be trusted as a base coat to be applied with other top coats. The inorganic base coat protects the substrate from any chemical reactions and the overall corrosion resistance will be increased exponentially.



0 Hrs SST  
0% Rust



48 Hrs SST  
10% White Rust



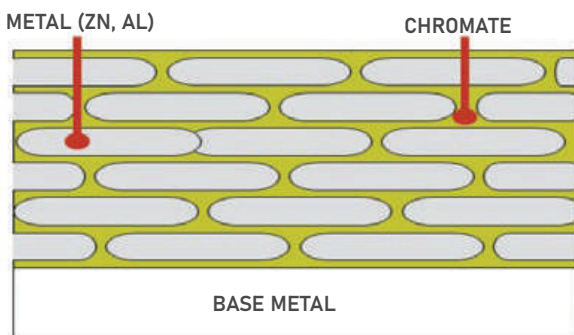
346 Hrs SST  
100% White Rust

**Using Hot-Dip Galvanizing**

## DACROMET®

### COATING

is a coating solution made up of Zinc and Aluminum flakes in chromic acid. This coating system exists uncured as a zinc and aluminium flake suspended in aqueous chromic acid. In the uncured form, it is a water based suspension, but when cured, the chromic acid forms an inorganic chromate binder that enhances corrosion resistance.

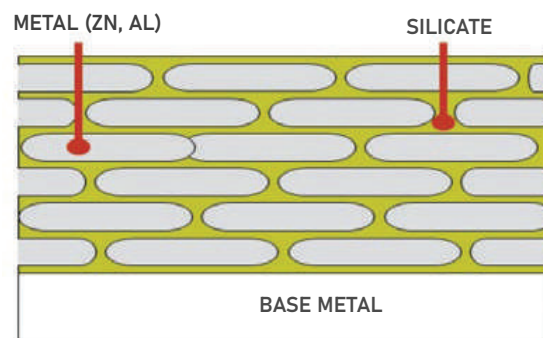


Film Structure of DACROMET

## GEOMET®

### COATING

is also a Zinc and Aluminum flake coating system but is designed to meet environmental requirements imposed by many countries by creating an aqueous replacement for the chromic acid used in DACROMET. As GEOMET is a water based coating, it does not cause any damages to the environment and is ELV and RoHS compliant.



Film Structure of GEOMET

SUPERIOR ALTERNATIVE TO HDG, DACROMET® and GEOMET® coated fasteners have demonstrated superior corrosion resistance performance compared to HDG ones. When we performed salt spray test as per ASTM B117 on both types of bolts, HDG bolts began to have 10% white rust at approximately 48 hours whereas DACROMET® and GEOMET® coated bolts are still exhibiting 0% white rust and red rust after 1000 hours of salt spray test.

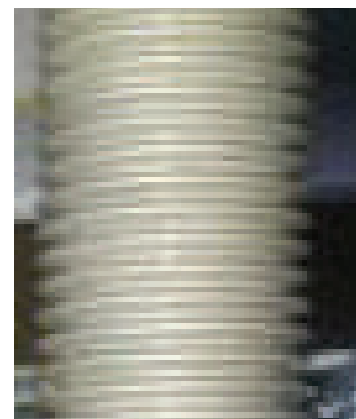
In addition, hot dipped galvanizing requires a minimum coating thickness of 36 microns. To compensate for the fit between bolts and nuts, ASTM A153 allows the nuts or tapped holes to be tapped to meet over-tapping allowances. DACROMET® and GEOMET® do not require any reworks as the average coating is only 8-10 microns.



0 Hrs SST  
0% Rust



48 Hrs SST  
10% White Rust



346 Hrs SST  
100% White Rust

Using GEOMET®



# XYLAN COATING

## Fluorocarbon coating

## Superior Corrosion Resistance

**Xylan coating** provides outstanding protection against corrosion in various environments. This fluoropolymer-based coating shields bolts and nuts from moisture, chemicals, and corrosive elements, ensuring prolonged durability even in harsh conditions.

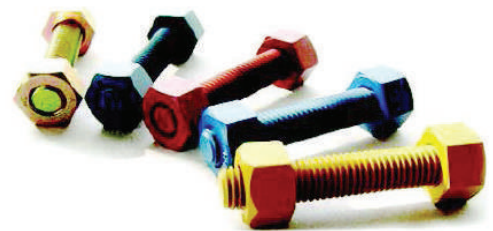
### Ways to Reach 15% Red Rust as per ASTM B117

Xylan	Xylan 1014	Xylan 1424	Xylan 1424	Xylan 1424	Xylan 1424
Primer	P-92	-	-	-	-
Aurface Treatment	Zinc Phosphate	Zinc Phosphate	Zinc Plating	Zinc Nickel Plating	Cadmium Plating
Substrates	Steel	Steel	Steel	Steel	Steel
Salt Spray Hours	500 Hours	1,500 Hours	2,500 Hours	4,000 Hours	4,000 Hours

Materials that coated with Xylan coating are often considered suitable for use in petrochemical applications. The Xylan coating offers several advantageous properties that are beneficial in such environments:

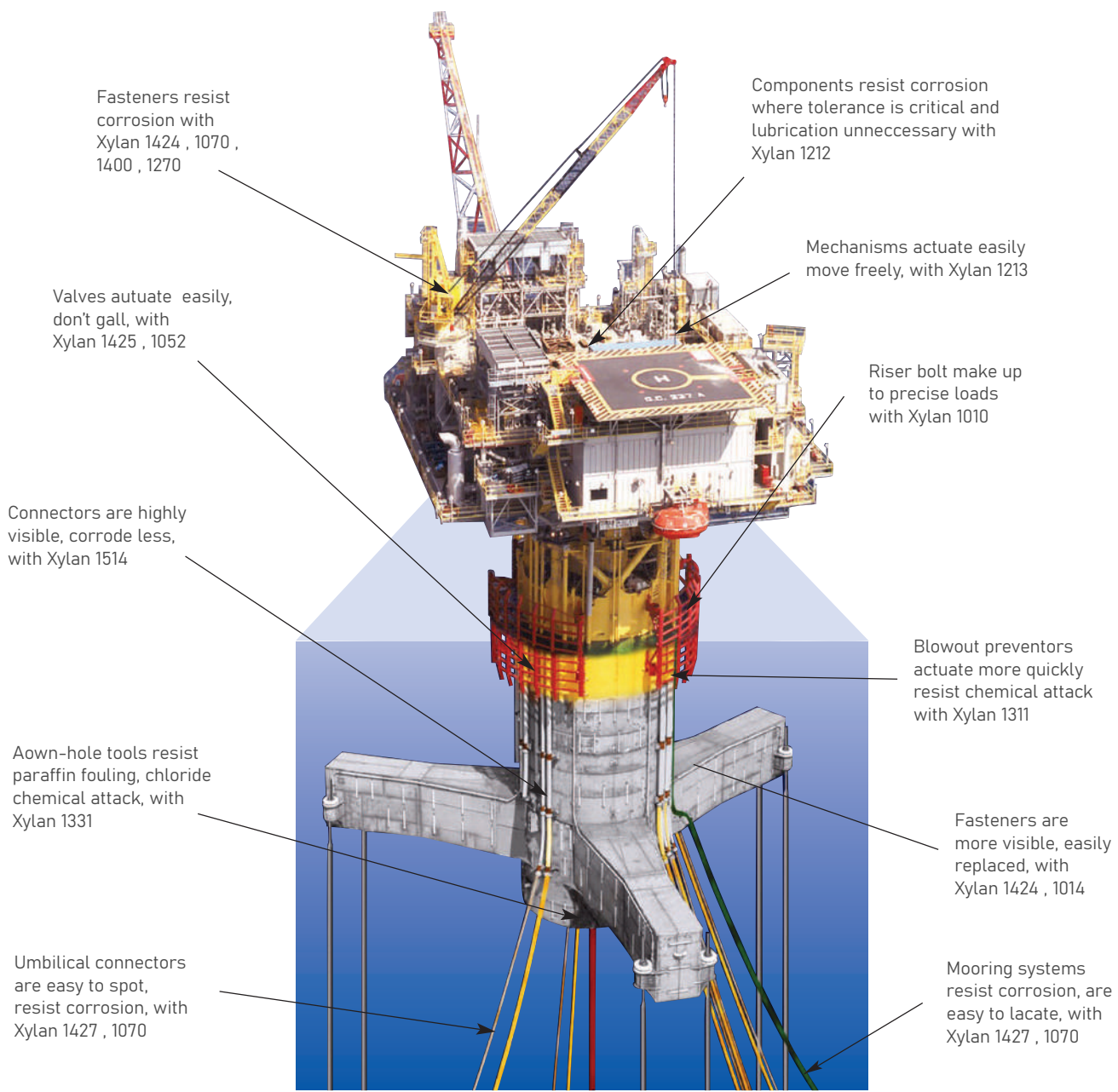
### Xylan Coating Statistics

Tensile Strength (ASTM D1708)	4000 - 5000 psi
Elongation (ASTM D1457)	50%
Impact Strength (ASTN D256)	13 ft - lb/in
Hardness (ASTM D2240)	60 -90 HB (Shore D)
Abrasion Resistance (Tabor)	>15 mg
Coefficient of Friction (ASTM D1894)	0.15 - 0.35 Static
Dielectric Strength (ASTM D149 )	1400 Volts per mill
Use Temperature	-100 °F to 500 °F max
Melting Point	n/a
Thermal Conductivity	n/a
Chemical Resistance (ASTM F543)	good
Salt Spray Resistance ASTM (B117)	exellent
Water Absorption (ASTM D570)	< .03%
Thickness	0.008" - 0.002"



# Coating Guide

Bolt and Nut PTFE-coated, fluoropolymer-coated and Xylan-coatings. Xylan-coated bolt and nuts are also renowned as one of the most reputable types of fluoropolymer coatings.



**Whitford**

Where good ideas come to the surface



illustration courtesy of  
**ATLANTIA OFFSHORE LIMITED**  
MEMBER OF THE IHC CALAND GROUP



# TUNNEL SYSTEM

TUNNEL SEGMENT ACCESSORIES &  
RAILS / TRACK FASTENING SYSTEM








“Since the construction of the first MRT line in Singapore in the 1980s, we have manufactured and supplied accessories for the tunnel & rail projects. Our rail fastening systems, tunnel segment lifting systems and tunnel segment linking systems are used in various tunnel & rail projects throughout Southeast Asia”

-from Chin Yuan Metal (CYM : ARC partner).



**CHIN YUAN METAL**  
your bolting solution

20 Nov 2018  
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ARC: To whom it may concern  
**RE: LECTOR DE SUFORS**


On behalf of Chin Yuan Metal Pte Ltd, we are pleased to confirm that ARC CIO CIO has been working with us for our range of steel products for their projects.

We will continue to support them for their future projects and have no hesitation to serve them with the highest quality and products as follows:

- Anchor bolts
- High strength fasteners
- Structural steel fasteners
- Piping accessories such as U-bolt and Pipe clamp

If you require more information about Chin Yuan Metal Pte Ltd, please kindly contact our capacity representative.

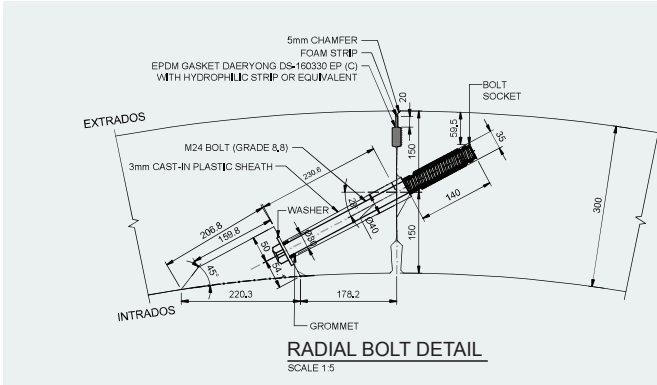
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Yours Sincerely  
  
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# TUNNEL SEGMENT ACCESSORIES

## SHEAR BOLT SYSTEMS



### Some of the advantages by using Shear Bolt System are

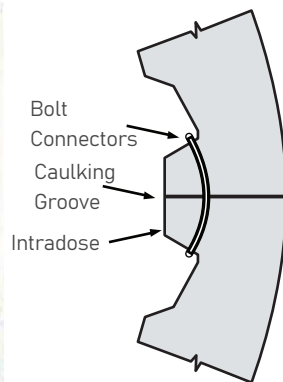
- Removable and can be re-used as the bolting connection only to provide temporary support until the grout annulus hardens.
  - Secondary service for hanging of cables ; reduces drilling time and prevent concrete damage.
  - Has better shear and pull out resistances on the radial connection joints.
- Photo demonstrates how the system being applied during tunnel ring building

Shear bolt systems also known as linking system are used to assemble the concrete segments by bolt tightening. The bolts are often required as a radial and / or circumferential connection system between segments of the tunnel lining.

The design may vary depending on the project requirements. There are various steel grade bolt options available for selection (ASTM, BS standards), finishing to be Hot-dipped Galvanized (HDG) to ASTM, BS standards.

The common grade of Bolt being actively used in the market is Gr 8.8 with HDG finishing. Bolt socket and grommet washer made from polyethylene.

The Bolt sockets are installed onto the concrete segments at the Precast Yard. The shear bolts are screwed immediately after the segment installation the tunnel face.



**Curved bolts** are used to permanently fix tunnel segments together through a radius hole. They can be used in both radial and circumferential joints. Curved bolts are available from the smallest diameter of M16 to M30 diameter, depending on design and force resistance calculation. Bolt length and radius can be customized as per design requirements. The force will determine material grade to be used for the project. Multiple steel grades available for bolt selection such as (ASTM, BS standards), finishing to be Hot-dipped Galvanizing (HDG) to ASTM, BS standards.

The common grade of Curved Bolt is Grade 8.8 and Grade 10.9 with HDG finishing (Geomet or Dacromet coating are an optional). Curved Bolt tightening will be done using Hex Nut at the threaded end of the Bolt.

## CYM Steel Division Works

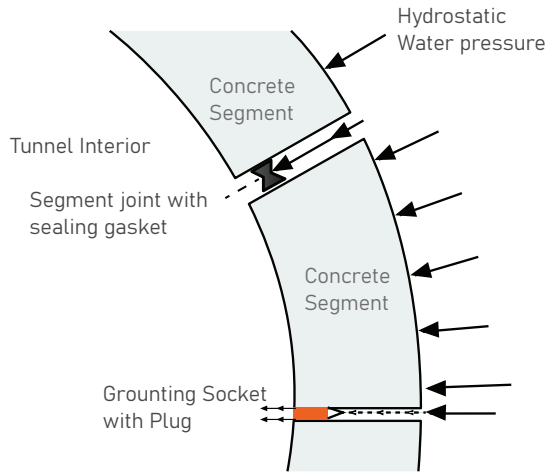
### Kingpost & Struts



- Kingpost
- Tubular Struts
- Shear Keys
- Cradle
- Tunnel Eye
- Thrust Frame
- BHS Thrust
- Frame







## LIFTING SYSTEMS

Lifting system can be steel or thermoplastic material, depending on the applications, project budget, and safety requirements. Also known as Grout / Lifting sockets, it can be used for variety precast applications for tunnelling industry. Designed to be bi-functional, these sockets can be used in conjunction with the TBM's segment erection system to lift segments during ring building or for primary or secondary grouting through the segments. Lifting system is critical for tunnelling work due to the safety risks involved. As such, supplier track record, type of material, test reports, and design requirements required to be considered prior to ordering the goods. As the rest of the accessories, lifting sockets are also available in vary sizes and length to fit the individual design requirements. The sockets can be produced in either closed or open ends.

### The sockets do come with supporting components as follows :

- Grout plugs which will be used to cover the socket internal thread, typically accompanied by a Hydrophilic "O" ring.
- Non-return valve which will be installed during grouting to prevent back-flow of grout prior to screw-in the grout plugs.
- Hydrophilic "O" ring can be applied to the outer body of the socket to prevent water penetration between the socket body and concrete segment, especially for HDPE sockets.
- End caps, normally produced from PVC material if it's Steel socket, designed to prevent ingress during casting and prevent debris stagnant into the sockets while placed in storage area. This PVC also designed for easy drilling during grouting. Whereas for HDPE sockets, the closed end design or extension tube produced for same purpose.

### CYM Steel Division Works

#### Noise Enclosures & Barriers

- Noise Enclosure
- Noise Barrier

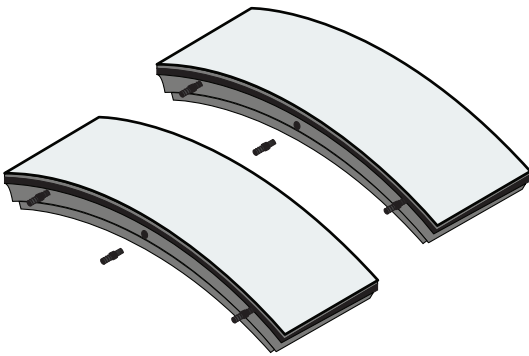


#### Gantry Beam & Muck Pit

- Gantry Beam
- Gantry Platform
- Muck Pit Beam
- Muck Pit

# TUNNEL SEGMENT ACCESSORIES

## DOWELS



**Dowel** component is a method of connecting two concrete segmental tunnel rings together in the circumferential joint. It is designed to be used with Hydrophilic gaskets.

The most common design that made available has 2 sockets + 1 pin + 1 centring ring.

The pin and centring ring are co-moulded as a single part for better resistance. The shear capacity is guaranteed by the centring ring and pin.

### Dowel system has several advantages :

- Cost saving per mould / ring compared to Bolting systems
- Fasten segment installation work onsite.
- Least supervision / manpower needed at the tunnel face
- Improved segment alignment

## RAIL FASTENER SYSTEMS



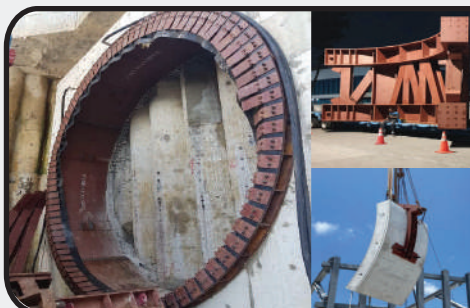
The function of rail fastening system is to fix rails to railway sleeper or railway ties. Generally, a rail fastening system is consisted of rail anchors, rail tie plates, fasteners, spikes, screws, bolts and etc.

There are strict criteria on producing rail fastening system; this is because the safety of rail track can't be compromised. We should consider the features of rail fastening system and then produce the most reliable finished products.

CYM branded rail fastening system available for various types of track lines. It supplies safe, reliable and cost-saving fastening system with high tensioning force and creep resistance to effectively protect the rail against tilting.

Building on over 20 years' experience and solution for global end users, our fasteners are well used to ensure the track condition. There is few range of fastening system available, depending on the design requirements.

*CYM Steel Division Works*



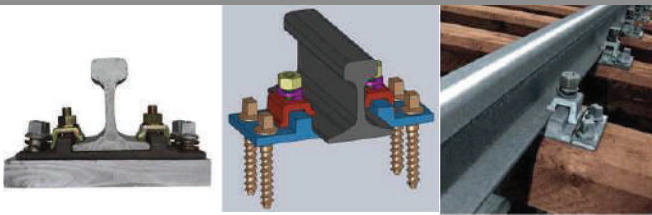
### Trust Frame, Cradles & Tunnel Eyes

- Cradle
- Tunnel Eye
- Thrust Frame
- BHS Thrust
- Frame

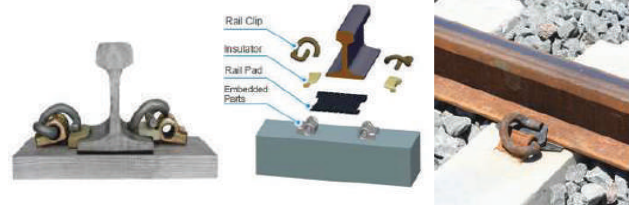


Other accessories such as rails, fish plates, and steel sleepers among the products that made available in CYM factory.

Rail fastening system assembly :



E-Clip Fastening system assembly :



Tension clip fastening system assembly :



There is few range of fastening system is available, depending on the design requirement. Rail fastening system assembly:

Fish plate / Rail joint plates



Rail



Rail clamp system



Type of spike screws



Single / double coil washer



Note: We also capable of producing customized fastening system based on client design drawing.

*CYM Steel Division Works*

**Cross Passages, Lintels & Sleepers**

- Cross Passage
- Lintel
- Sleepers
- Y-Switch



**Factory, Pipe Racks, Staircases & Others**

- Y-Switch
- Drain Box
- Tanks
- Canopy
- Load Test Structure
- Silo
- Pipe Rack
- Utility Box
- Lifting Device