Marine Hardware

James Standard & James Premium

Marine Ready Products

Key Features:

- High quality fastener material: 316-SS and CP-GR.2 Ti
- Passivated to further improve its natural corrosion resistance
- Fluoropolymer coating to prevent thread galling, seizing, and enhance corrosion resistance
- Application of Tef-Gel for additional corrosion resistance

Applications:

- Marine audio
- Outdoor audio

In a marine environment, speakers will be exposed to several factors which place them at high risk including: harsh winds, high humidity, atmospheric salinity, and direct contact with seawater. Whether you're looking for an outdoor system, a sound system for your boat, a complete distributed audio system for your oceanside getaway or even a super-yacht, James Loudspeaker offers the necessary hardware to withstand harsh environmental conditions and provide long-lasting marine speaker products.

Selecting the proper hardware material is essential for long-term corrosion control. As our James Standard, we provide 316 Stainless Steel fasteners which have been widely used in marine environments. Considered the marine grade stainless, 316 Stainless Steel is the preferred steel for service because of its greater resistance to corrosion than other grades of steel. Referring to the chemical composition in Table 1, the material incorporates about 2 to 3 percent

Table 1: Chemical composition of 316 Stainless Steel

Carbon (Maximum)	0.08	%	Manganese (Maximum)	2.00	%
Phosphorus (Maximum)	0.045	%	Sulfur (Maximum)	0.030	%
Silicon (Maximum)	1.00	%	Chromium	16.00 to 18.00	%
Nickel	10.00 to 14.00	%	Molybdenum	2.00 to 3.00	%
Iron	Balance				

molybdenum, which increases corrosion resistance particularly against pitting and crevice corrosion in chlorides and other industrial solvents. Furthermore, our 316-SS hardware is passivated in nitric acid after its production to facilitate the natural formation of a thin, transparent oxide film that protects the stainless steel from corrosion.

In addition, we provide optional CP-GR.2 Titanium fasteners as our James Premium. Commercially Pure (CP) Grade 2 Titanium is used primarily for its superior corrosion resistance. It resists pitting, crevice, and stress corrosion cracking in seawater, marine atmospheres, and a broad range of acids, alkalis, and industrial chemicals. The corrosion resistance results from a very thin (~10nm), stable, continuous oxide layer that regenerates instantaneously if any oxygen is present. Table 2 presents the chemical composition of CP-GR.2

Table 2: Chemical composition of CP-GR.2 Titanium

Carbon (Maximum)	0.10	%	Titanium	Balance	
Nitrogen (Maximum)	0.03	%	Iron (Maximum)	0.30	%
Oxygen (Maximum)	0.250	%	Hydrogen (Maximum)	0.015	%
Other, Total (Maximum)	0.40	%			

titanium. Similarly to the 316-SS hardware, our CP-GR.2 Ti hardware is passivated in citric acid after its production to further assist its natural corrosion resistance and extend product life.

All of our marine grade products undergo a process which protects them against the elements even under the harshest conditions. To further protect our hardware from corrosive surroundings, both our CP-GR.2 Ti and 316-SS fasteners are applied with FluoroKote#1 coating. A proprietary fluoropolymer coating that provides exceptional corrosion resistance, a low coefficient of friction, consistent tensioning and subsequent ease of installation and removal. A metallic base coat, as shown in Figure 1, is applied first followed by an adhesion

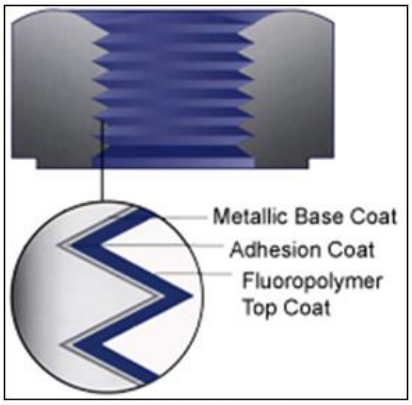

Figure 1: Section view of FluoroKote#1

coat. The adhesion coat creates a chemical bond between the base coat and the top coat. The top coat, a heat cured fluoropolymer coating containing PTFE, is used to seal the two under coatings facilitating the installation of hardware on to marine speaker products. The result is thin, continuous, protective film barriers which resist chipping, spalling, abrasion, galling, seizing, and a wide range of corrosive environments. Previously, hot dip galvanized, cadmium or zinc plated fasteners were considered the standard. However, these coatings could not withstand the corrosive surroundings common in many industries. After 2,000 hours of salt spray testing (ASTM B117), fasteners coated with these conventional methods showed severe corrosion illustrated in Figure 2. The fastener

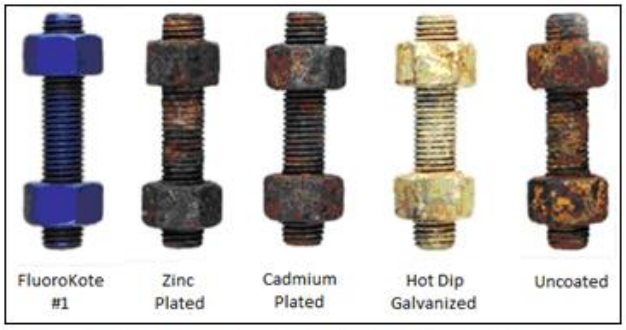

Figure 2: B-7 Stud Bolts after 2,000 Hours of Salt Spray Testing

coated with FluoroKote#1 withstood these conditions with no noticeable deterioration. The fluoropolymer coating was additionally tested in various acidic-based solutions, where the test duration and results are represented in Table 3. After 24 hours, the coating showed no effects of corrosion. Indicating the coating

Table 3: Corrosion resistance test data

ASTM	TEST	DURATION	RESULTS
D1308	Muriatic Acid 31% HCL	24 Hours	No Effect
D1308	Sulfuric Acid 93% H2SO4	24 Hours	No Effect
D1308	Caustic Soda 50% NaOH	24 Hours	No Effect
D1308	Methyl Ethyl Ketone MEK	24 Hours	No Effect
B117	Salt Fog	2,000 Hours	No Effect

specifications in Figure 3, one of the benefits of this coating presents a low coefficient of friction of 0.06–0.08, which ultimately decreases torque requirements and significantly reduces thread galling and seizing problems during installation and assembly. Additionally, our fasteners receive the highest quality control where they are checked for cure, thickness, adhesion, and overall coverage. In recognition of these efforts, our coating applicator earned the ISO 9001 certification for the application of industrial coatings. Combined with advanced computer controlled, automated equipment keeps the coating thickness precise and extremely uniform.

Upon application of marine hardware onto our marine speaker products, we additionally utilize Tef-

Use Temperatures: -100° to 500°F
Corrosion Resistance: Salt Spray (ASTM B117) ...up to 4,000 hrs (Nuts not frozen)
Pencil Hardness: 5H-6H (ASTM D3363-92A)
Kinetic Friction Coefficient: 0.06-0.08
Thickness: nominal 0.001" (1 mil)
Impact: 160 in. lb. (ASTM D2794-93)
Adhesion: 5B (ASTM D3359-95)

Dielectric Strength: 500 volts per mil
Elongation: 35%-50%
Tensile Strength: 4,000 psi
Operating Pressure: Up to 100,000 psi
Kesternich Test: Nuts not frozen after 30+ cycles (DIN 50018)
Thread Fit: Over tapping of nuts 0.010" (Recommended)

Figure 3: Fluoropolymer coating specifications

Gel. Tef-Gel is specifically designed for the marine environment and serves as a lubricant and essentially eliminates electrolytes, e.g. seawater, from entering the interface of metallic surfaces as in Figure 4. The lubricant contains 40% PTFE powder and 0% volatile solvents. No silicones or petroleum solvents are used

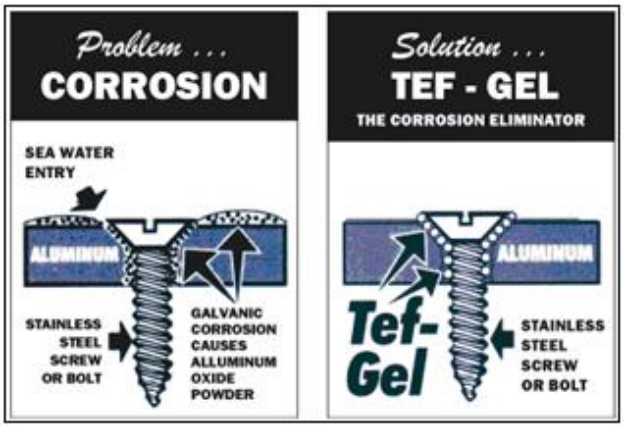

Figure 4: Tef-Gel application

which can evaporate and would leave voids for electrolytes to be drawn into creating a galvanic cell. Although our fasteners are fluoropolymer coated, additional application of Tef-Gel ensures prevention of dissimilar metal corrosion if bare metal to metal contact exists.

To prevent contamination by steel particles on to fasteners via tool bit contact, our marine products are assembled utilizing Titanium Nitride tool bits. Our titanium nitride tools provide high surface hardness to help penetrate tough materials, significantly reduces friction between bit and work-piece, and most importantly ensures no contamination of steel particles when installing our fasteners.

By understanding the causes and types of corrosion experienced in marine environments, we have been able to design and select hardware to endure harsh conditions throughout its service life.