

# Finishes & Coatings



## Lubricants and Coatings

It is important that correct selection of the most suitable fastening lubricant or coating is made at the design stage for long term security within the bolted joint.

The ideal finish or coating for the insert is dependent upon the optimum coefficient of friction (governed by the bolt material and surface finish) and the required service conditions of the assembled parts, e.g. temperature, chemical influences, humidity, and dust.

The coefficient of friction ( $\mu$ ) of most threaded components will generally vary between  $\mu = 0.15$  and  $\mu = 0.35$ .

For example differences occur between bolts made of Grade 8.8 steel (Werkstoff 1.0503), compared with the same size of bolt produced from an austenitic stainless steel X5 CrNi 18-9, (Werkstoff 1.4301).

Differences also occur between bolts having different surface coatings, such as electro-galvanizing, hot galvanizing, cadmium plating, or chromium plating.

## Typical Recoil wire thread insert finishes and coatings

PLATING / FINISH	PART NUMBER SUFFIX	APPLICABLE PROCESS SPECIFICATION
Silver Plating	AG	DTD 939
Cadmium Plating	C	QQP-416 or DEF STD 03-19
Dry Film Lubricant	D	MIL-L-8937 or MIL-L-46010
Red Dye	Not Applicable	Applied to all Recoil locking inserts for identification where called for by specification*

\* Recoil inserts may also be dyed in other colors such as Green and Blue for identification purposes.

MATERIAL TYPE	MAX. TEMPERATURE		TYPICAL APPLICATIONS	COATINGS (SEE SECTION ON LUBRICANTS)
	PEAK	CONTINUOUS		
Stainless 304	425°C (800°F)	315°C (600°F)	Most general applications in all materials	Non-finished Dry film lubricant Silver Cadmium
Stainless 316	425°C (800°F)	315°C (600°F)	Improved corrosion resistance Salt water applications	Non-finished Dry film Lubricant Silver Cadmium
Nitronic 60 Phosphor Bronze	425°C (800°F)	315°C (600°F)	Anti-galling Copper parts Non magnetic / Low permeability applications	Dry film lubricant Cadmium
	300°C (572°F)	235°C (455°F)		
Inconel x 750	650°C (1200°F)	550°C (1020°F)	Aerospace / Turbines / Corrosive atmospheres / High temperature use	Silver Copper
Nimonic alloy 90	650°C (1200°F)	550°C (1020°F)	Aerospace / Turbine applications	Silver

## Silver Plating

Primarily used to reduce the effects of galling (seizure) of screw threads in high temperature service applications.

Silver plating is the most commonly used coating for aero-engine fasteners providing an even degree of lubrication up to a maximum service temperature of about 650°C (1200°F).

The plated silver is electrolytically deposited in typical thicknesses up to 6.3µm (0.00025").

Silver plated wire thread inserts may be installed into various housing materials including magnesium alloys, aluminum alloys, corrosion and heat resistant materials, etc.

**Caution must be emphasized where inserts are to be installed into titanium alloy components which may exceed a service temperature of 300°C (570°F). Silver plated inserts are not recommended with titanium housings as stress corrosion, resulting from the combination of silver with titanium may occur in the housing material.**

## Cadmium Plating

In mildly corrosive or marine environments, cadmium plating is the preferred treatment for providing protection against pitting of the insert/bolt materials and to minimize the risk of thread seizure.

Plating thickness may vary depending on particular applications, between 2µm - 5µm (0.0001" - 0.0002"). Following cadmium plating, either a bronze or olive drab chromate finish will be used to provide uniformity in the overall finish.

It should be noted that cadmium plated parts must not:

- Be subjected to temperatures exceeding 235°C (455°F)
- Come into contact with fuel or hot oil
- Come into contact with food or drinking water
- Be used with titanium components either directly or indirectly as, at elevated temperatures, embrittlement and subsequent component failure may occur

**Warning: Cadmium is a highly toxic compound. Because of its poisonous nature extreme care must be taken when handling.**

## Dry Film Lubricants

Used for mildly corrosive or high temperature applications, dry film lubricants comprise suspensions of small particles of solid lubricants such as molybdenum disulphide (MoS<sub>2</sub>) or PTFE, in organic or inorganic binders. They are applied as a thin film (5µm - 20µm) to grease-free metal surfaces.

Through careful selection of appropriate additives and solvents, specific lubricants may be formulated to suit most industrial applications to service temperatures around 315°C (600°F).

Special high temperature lubricant coatings are available for use up to 425°C (800°F).

Recoil inserts may be coated with dry film lubricant in either the non-finished (passivated) condition or after cadmium plating treatment for maximum corrosion protection.

## Red Dye Coating

Recoil screw-locking inserts are, generally color coded with a red dye coating for identification purposes only. This organic resin based dye does not affect the installation or function of the inserts and normally does not need to be removed.

However, if in extreme conditions of cleanliness (such as precision instrument assembly in clean room conditions) removal of the dye may be desired. The red dye may be removed by soaking the inserts in a denatured alcohol solution prior to use.

To prevent galling or seizing when using an unplated or corrosion resistant screw/bolt in a screw-locking insert, we recommend the use of an anti-seize compound on the bolt threads.

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## Corrosion Protection

Under some service conditions, Recoil inserts and their mating parts may be subjected to a degree of corrosion, the severity of which is dependent upon the particular application.

Factors such as differing material types, atmospheric conditions, chemical attack, and even frequency of use will have an appreciable effect on the longevity of the bolted joint.

The following are recommendations to minimize corrosion within the bolted Recoil insert assemblies.

**Normal Service:** Natural atmospheric environment with the screw/bolt permanently installed into the insert not adjacent to salt water.

**Severe Service:** Mildly contaminated atmospheric environments involving moisture, occasional exposure to a chloride air or sea spray, and where the screw/bolt may be removed from the insert for extended periods of time.

**Extreme Severe Service:** Assembly is exposed to salt water, corrosive atmosphere, high temperature, or the screw/bolt is frequently removed from the assembly, allowing the ingress of water into a blind hole.

In addition to methods 1, 2 and 3 below, further corrosion protection can be achieved by:

- Using blind holes wherever possible
- Using a sealing, insulating, or step-down type washer under the head of the bolt
- Using bolts that extend completely through the entire length of the insert
- In critical applications, the use of a non-hardening seal or compound over the joint and protecting bolt thread is recommended

**Note - For extremely severe service conditions involving temperatures in excess of 425°C (800°F) or contact with acids, alkalis or sea water, stainless steel inserts are not recommended.**

SERVICE CONDITIONS			
PARENT MATERIAL	NORMAL	SEVERE	EXTREME SEVERE
Aluminum	None	Methods 2 or 3	Methods 1, 2 & 3
Magnesium	Methods 2 or 3	Methods 2 and 3	Methods 1, 2 & 3

## Typical Corrosion Recommendations

METHOD 1	METHOD 2	METHOD 3
Parent Material Protection Aluminum: For oxide coating use Alodine, Anodize, Iridite, or similar. Iridite 14 or 14-2 (MIL-C-554) is recommended for critical parts rather than anodizing (MIL-S-5002)	Coat the insert with one of the following: Cadmium per QQ-P-416, Type II 0.0001" thick; or Dry Film Lubricant per MIL- L- 893 (must be free of graphite)	Separate the parent material from the insert by using liquid zinc chromate primer, Federal Specification TT-P-1757. Apply the primer to the hole sparingly and install while the primer is still wet.

## Gas and Water Applications

Where gas or water threads are being manufactured or repaired it is important that an AFS sales office be consulted regarding the type of seal that will be provided in this situation. A wire insert may not provide a satisfactory thread seal.

ALCOA Fastening Systems products are available from MARYLAND METRICS P.O. Box 261 Owings Mills, MD 21117 USA  
ph: (410)358-3130 (800)638-1830 fx: (410)358-3142 (800)872-9329 email: sales@mdmetric.com web: http://mdmetric.com