FORMS OF CORROSION

There are many forms of corrosion. The form of corrosion depends on the metal involved, its size and shape, its specific function, atmospheric conditions, and the corrosion producing agents present. Those described in this section are the more common forms found on airframe structures.

Surface Corrosion

Surface corrosion appears as a general **roughening, etching, or pitting* of the surface of a metal, frequently accompanied by a **powdery* deposit of corrosion products. Surface corrosion may be caused by either direct chemical or electrochemical attack. Sometimes corrosion will spread under the surface coating and cannot be recognized by either the roughening of the surface or the powdery deposit. Instead, closer inspection will reveal the paint or plating is lifted off the surface in small **blisters* which result from the pressure of the underlying accumulation of corrosion products.

Filiform corrosion gives the appearance of a series of small worms under the paint surface. It is often seen on surfaces that have been improperly chemically treated prior to painting.

Dissimilar metal corrosion

Extensive pitting damage may result from contact between dissimilar metal parts in the presence of a conductor. While surface corrosion may or may not be taking place, a galvanic action, not unlike electroplating, occurs at the points or areas of contact where the insulation between the surfaces has broken down or been omitted. This electrochemical attack can be very serious because in many instances the action is taking place out of sight, and the only way to detect it prior to structural failure is by disassembly and inspection.

The contamination of a metal’s surface by mechanical means can also induce dissimilar metal corrosion. The improper use of steel cleaning products, such as **steel wool or a steel wire brush* on aluminium or magnesium, can force small pieces of steel into the metal being cleaned, which will then further corrode and ruin the adjoining surface. Carefully monitor the use of **nonwoven abrasive pads*, so that pads used on one type of metal are not used again on a different metal surface.

Intergranular Corrosion

This type of corrosion is an attack along the **grain boundaries* of an alloy and commonly results from a lack of uniformity in the alloy structure. Aluminium alloys and some stainless steels are particularly susceptible to this form of electrochemical attack. The lack of uniformity is caused by changes that occur in the alloy during heating and cooling during the material’s manufacturing process. Intergranular corrosion may exist without visible surface evidence. Very severe intergranular corrosion may sometimes cause the surface of a metal to “exfoliate”. This is a lifting or flaking of the metal at the surface due to delamination of the grain boundaries caused by the pressure of corrosion residual product build-up. This type of corrosion is difficult to detect in its initial stage. **Extruded* components such as spars can be subject to this type of corrosion. Ultrasonic and eddy current inspection methods are being used with a great deal of success.

Stress Corrosion

Stress corrosion occurs as the result of the combined effect of **sustained* tensile stresses and a corrosive environment. Stress corrosion cracking is found in most metal systems; however, it is particularly characteristic of aluminium, copper, certain stainless steels, and high strength alloy steels (over 240,00 psi). It usually occurs along lines of cold working and may be transgranular or intergranular in nature. Aluminium alloy **bellcranks* with pressed in **bushings, landing gear shock struts* with pipe thread type grease fittings, **clevis pin* joints, **shrink fits*, and overstressed tubing B-nuts are examples or parts which are susceptible to stress corrosion cracking.

Fretting Corrosion

Fretting corrosion is a particularly damaging form of corrosive attack that occurs when two mating surfaces, normally at rest with respect to one another, are subject to slight relative motion. It is characterized by pitting of the surfaces and the generation of considerable quantities of finely divided debris. Since restricted movements of the two surfaces prevent the **debris* from escaping very easily, an extremely localized abrasion occurs. The presence of water vapor greatly increased this type of deterioration. If the contact areas are small and sharp, deep **grooves* resembling brinell markings or pressure indentations may be worn in the rubbing surface. As a result, this type of corrosion (on bearing surfaces) has also been called **false brinelling*.

VOCABULARY

*roughening = raspado, aspereza; *etching = grabado; *pitting = picadura

*powdery = en polvo, polvoriento

*blisters = ampollas

*steel wool brush = cepillo de lana de acero

*steel wire brush = cepillo de alambre de acero

*nonwoven abrasive pads = estropajos abrasivos (no tejidos, sin tejer)

*grain boundaries = los bordes de grano

*extruded = extruido, extrudido

*sustained = constante, sostenido

*bellcrank = palanca acodada

*bushings = bujes

*landing gear shock struts = puntales amortiguadores del tren de aterrizaje

*clevis pin = pasador de horquilla

*shrink fit = ajuste por contracción

*debris = escombros, deshechos

*grooves = ranuras, surcos

*false brinelling = formación de estrías

Read the text and answer the following questions:

1. What are the main forms of corrosion found on airframe structures?

2. Where is filiform corrosion often found?

3. When does dissimilar metal corrosion occur?

4. What is the consequence of using improper steel cleaning products?

5. Which metals are mainly affected by intergranular corrosion?

6 Which inspection methods are used to detect intergranular corrosion?

7. Which metals may be affected by stress corrosion?

8. How can be fretting corrosion identified?

Have a look at the following pictures. Can you identify the form of corrosion that appears in each picture?