

Most radial compression mechanisms and pleating mechanisms have stainless steel **dies that have low resistance to corrosion**. This article discusses the reasons for such materials, conditions that cause corrosion, and ways prevent corrosion. Damaging corrosion occurs more often on radial force testing machines, which are typically in a lab environment, and less on production machines, which are typically in a cleanroom.

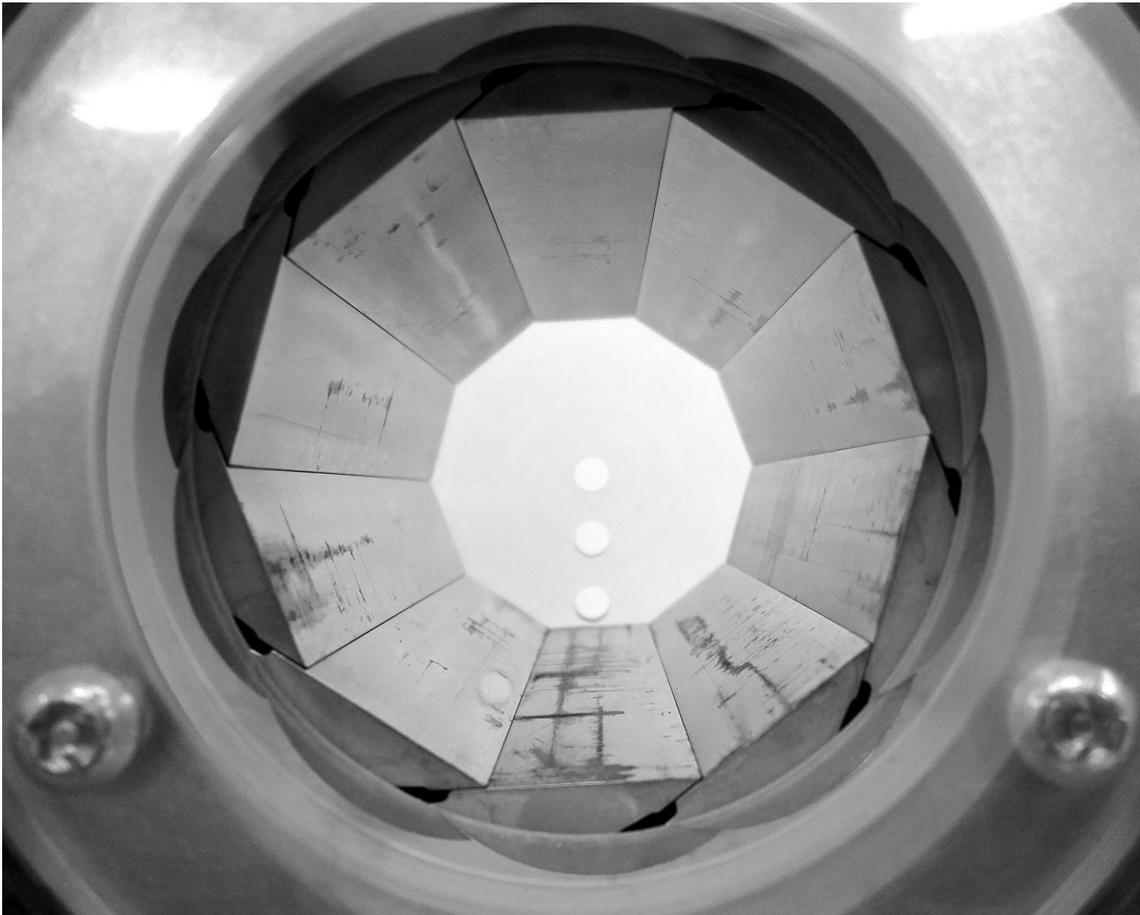
Why Dies Are Not Very Corrosion-Resistant

Blockwise compression and pleating mechanisms are designed using very corrosion-resistant materials wherever possible, such as austenitic stainless steels, plastics, and anodized aluminum. However, crimping and pleating dies are tools that need to have high hardness to be durable in use, just as pliers and screwdrivers do.

Most stainless steels are austenitic-type (referring to the crystal structure), also known as 300-series, or 18-8, stainless. But austenitic stainless steel is generally soft and not durable as a working tool surface. To gain material hardness, crimping and pleating dies are usually made from martensitic, or 400-series, stainless steels that can be hardened by heat-treating. But there is a tradeoff: the hardenable martensitic stainless steels are much less corrosion-resistant than austenitic ones (although still more corrosion-resistant than “normal” steels).

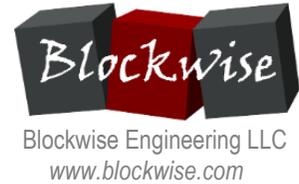
Another reason for using martensitic stainless is dimensional stability, which means that the dies, when made with certain manufacturing processes, can have very accurate dimensions.

What Conditions Can Cause Corrosion



1. This photo shows a compression station of a radial force testing machine with corroded dies. This machine was in a laboratory where the windows were sometimes opened.

Preventing Corrosion in Crimping Mechanisms



Here is an example scenario of a condensation event:

- The machine is in a room with refrigeration air-conditioning turned on for a while.
- The air-conditioner is turned off and a window is opened, allowing hot, humid air to come in.
- The machine's temperature is lower than the dew point of the hot, humid air. Then water condenses from the air on to the machine, just like droplets on the outside of a beer glass.

The station in the photo experienced two such events, in which water collected in the small gaps between the dies, causing matching pairs of lines of corrosion on many of the dies.

2. Touching the metal dies with bare fingers can cause corrosion.
3. Other conditions can corrode dies, such as crimping devices that are wet with water or saline, or exposing the metal to corrosive liquids during use.

How to Prevent Corrosion

Here are some ways to protect your expensive compression mechanism from corrosion.

1. Keep the machine in a climate-controlled room with **low humidity**. Most clean rooms are OK.
2. Don't **wipe the mechanism with water** or water-containing cleaner like 70% isopropyl alcohol. Stainless steels won't be corroded by wiping with microfiber cloth slightly dampened with 99% isopropyl alcohol or with acetone.
3. **Don't process** or test samples that contain **water or saline**.
4. Leave the compression station's **heating system turned on** at a low temperature (such as the 37C typical of radial force testing) 24 hours per day. 37C is higher than the dew point of any weather on Earth, and it costs only about 5W of power to maintain a compression station at 37C. With electric power price USD\$0.20 per kW-hr, the cost to maintain a typical compression station at 37C is less than USD\$10 per year.
5. **Don't touch** the dies with bare fingers. Use gloves. If you must touch the dies, wash your hands first.