

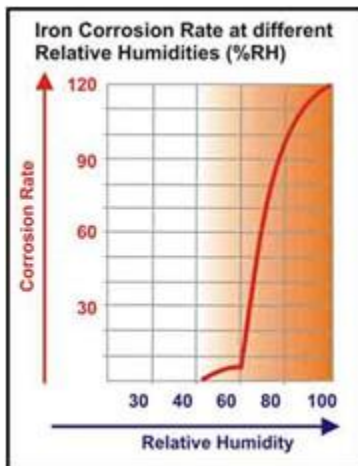


Technical Resource

FOUR WATER SOURCES IN PACKAGING APPLICATIONS AND HOW TO MINIMIZE THEIR IMPACT

Millions of dollars are lost due to corrosion of metal parts during transportation, with moisture attributed as the major cause. This moisture makes its way into the packaging by different means and negatively synergizes with the metal while in transit.

Common solutions to help with moisture problems include packaging barriers such as poly films. Typical packaging barriers (like poly films) are produced from low and high-density polyethylene resins, which are amorphous polymers, and create a partially closed net that allow gases (oxygen) and vapors (moisture) to get through. This is why poly films are not completely air-tight. If moisture finds its way into a poly bag, that presence of moisture can lead to a corrosion problem.



Corrosion rates are impacted by several factors:

- Type and severity of contamination
- Moisture on the surface
- Relative humidity at the surface

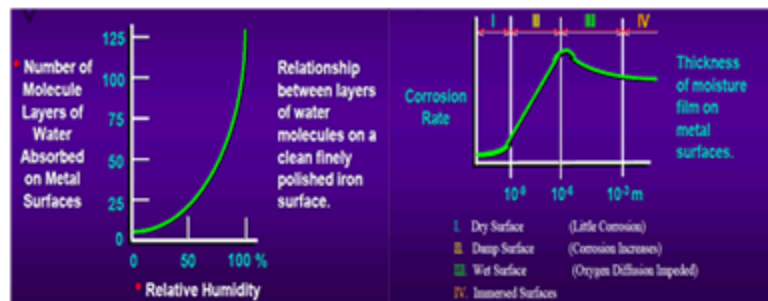
Relative humidity (RH) affects the amount of absorbed water on the metal surface and when relative humidity surpasses critical relative humidity, corrosion will occur. Another important role is played by salt deposition. When salt is deposited, it produces deliquescence and increased corrosion rate.

As shown on the Iron Corrosion Rate at Different Relative Humidities graph (shown above), corrosion is slowed significantly when RH is below 50%. In contrast, short-term corrosion reactions (flash rust) begin at 60% RH.

RH.

Corrosion problems arise when moisture is allowed to enter into the packaging (such as a poly bag) unimpeded by the film, such as through an incorrect closure or a significant hole in the bag. An unimpeded airflow into the bag is what must absolutely be avoided.

Properly inserting metal parts in the correct packaging is crucial. Even if no mistake has been made at the moment of closing the packaging, there are still four different ways by which water as vapor can come in contact with the metal parts. This added amount of water will combine and synergize to make things worse. Outlined below are the four sources of water and how to minimize their impact:





Technical Resource

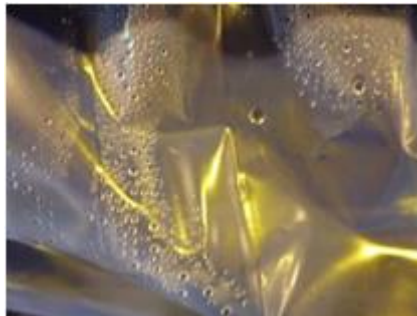
Water Source # 1: Air inside the package

Cause:

Packing metal parts in a hot and humid environment, sometimes referred to in the industry as “packaging rain.”



Notice the streams of water trapped inside the packaging due to humidity within the packaging.



Condensation and moisture grow when warm air is sealed and contained in the packaging.



Rust forms quickly when metal parts are not protected properly.

Solution:

- a) Make sure to pack metal parts in a clean and cool area. The cooler the air is, the less amount of moisture that it will hold.
- b) Use desiccant to lower the dew point and avoid condensation during transportation.



Technical Resource

Water Source # 2: Materials inside the package

Cause:

Packing wet and contaminated metal parts. Contaminants draw moisture to the surface and increase conductivity of that moisture. Furthermore, the use of moisture-absorbing materials such as wood and/or corrugated bring additional moisture into the pack.

Solution:

- Only pack clean and dry metal parts.
- If wood or corrugated are needed for structural support, wrap them in VCI materials to separate them from the metal. If possible, utilize plastic materials such as plastic corrugated or other inert packaging.

Water Source # 3: Walls of the package

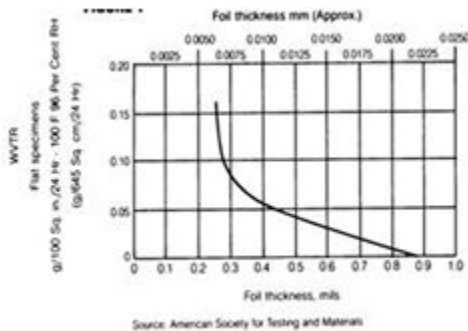
Cause:

Packaging material with high content of humidity.

Solution:

- Store packaging material in a cool, dry warehouse in the original packaging.

Water Source # 4: Permeation of water through the poly film



Cause:

The use of poor barrier film and/or barrier film with a deficient closure.

This chart above demonstrates that 4 MIL thickness is the breaking point on poly film. If a low thickness poly film is used on an international shipment, there is a greater chance that a significant amount of water will enter the interior of the bag through the film.

Solution:

- Use at least a 4 MIL LDPE film or a 3 MIL COEX film such as ARMOR's Defender™ film or use ARMOR's Crusader™ film (4.5 MIL COEX) for overseas and long-term protection.
- Tape it or heat seal the bag closure properly.

Barrier products such as ARMOR's Defender™ or Crusader™ film will help to isolate metal parts and protect from humidity exposure.