LaMotte Water Management

CORROSION TEST COUPONS

Corrosion coupons are an inexpensive, effective method for monitoring corrosion rates. The relative corrosivity of water in cooling systems, closed systems, condensate return systems, or any aqueous system, can be evaluated by measuring the weight loss of metal coupons installed in the systems. The evaluation does not give precise corrosion rates of system's metal, but the results are very useful for comparative purposes.

Obtaining meaningful results requires not only the analysis of weight loss, but of several other factors as well. Metallurgy, surface finish, coupon installation and exposure time significantly affect the accuracy of the results.

METALLURGY

Selecting the correct metal to use as your corrosion coupon is by far the most important step in this process. To determine the general corrosion rate of a system or structure, designate a material that is identical (or as close as possible) to the material of construction. For example, select mild steel coupons for most cooling towers and copper coupons for most copper heat exchangers.

LaMotte Water Management generally employs mild steel, 304 stainless steel, 316 stainless steel, copper, and galvanized steel. Other metals can be acquired, such as admiralty brass, aluminum, black iron and copper/nickel.

SURFACE FINISH

The corrosion coupons are carefully prepared with oil-removing solvents before they are sent out to the field. It is imperative that the test coupons be handled carefully (we recommend latex gloves) to avoid coating them with natural oils from the skin, pipe thread compounds or any contaminant that imparts a film to the coupon surface and leads to increased corrosion rates. The coupons should be wiped with a clean, soft cloth prior to installation. Save the special envelope containing the coupon for use when the coupons are removes for evaluation.

COUPON INSTALLATION

Meaningful and representative corrosion rates can only be achieved using a coupon rack bypass assembly. The coupon rack ensures a constant flow rate with minimal amount of water turbulence, which is critical in achieving valid corrosion rates. All coupons and pipe plug assemblies are sized to fit ¾" pipe. LaMotte Water Management offers a coupon rack constructed of either schedule 80 PVC for low temperature systems, less than 140°F (60°C), or black iron for higher temperature systems. These bypass assemblies generally incorporate a flow control system to reduce flow to avoid erosion (generally 5 GPM or 3.0 feet per second is recommend).

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See Figure 1

1. Note the flow direction relative to coupon placement. Use the rack positions that allow the coupons to point in the direction of the flow.

2. The 5 GPM flow controller is at the outlet of the bypass rack. This is crucial to guarantee that the pipe remains full of system water.

3. When installing copper or brass coupons with steel coupons, all copper or brass coupons should be installed downstream from the steel coupons. This will minimize the potential for copper metal migrating from the (more noble) test coupon to "plate-out" on the steel coupon within the short distance of the bypass assembly.

Galvanic Series of Typical Coupon Metals:

Active (-) or less noble metal

⇓

(Upstream)	Galvanized
	Aluminum
	Mild Steel
	Stainless Steel
	Admiralty Brass
	Copper
(Downstream)	Cupro Nickel

⇓

Passive (+) or more noble metal

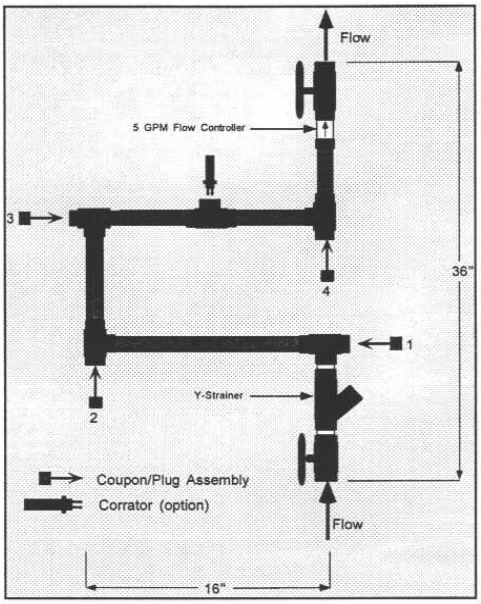

Figure 1 - Schedule 80, dark grey PVC, low temp <140°F (<60°C), corrosion coupon rack.

EXPOSURE TIME

Short or long exposure periods can yield unrepresentative corrosion rates, especially for alloys that form passive films (i.e. Aluminum). Corrosion coupon optimum exposure is 60 days; only exposures of more than 30 days but less than 90 days are acceptable.

CORROSION RATES

Corrosion control ratings are in mils/year.

Coupon	Mild Steel	Copper
Excellent	< 2.0	< 0.1
Good	2.0 to 5.0	0.1 to 0.5
Fair	5.0 to 8.0	0.5 to 1.0
Poor	> 8.0	> 1.0

INTERPRETATION OF RESULTS

The formula for calculating corrosion rate in mils per years is:

$$\text{Corrosion rate in mils per year} = 534\,(\mathbf{W}) \div (\mathbf{D})(\mathbf{A})(\mathbf{T})$$

where **W** is the weight loss in milligrams, **D** is the density of the coupon in grams/cm^3, **A** is the exposure area in square inches, and **T** is the exposure time in hours.