ALBERTA INFRASTRUCTURE

CORROSION RATE

MONITORING PROGRAM

Presented at

Alberta Infrastructure
Property Management

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by

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INTRODUCTION

The Alberta Infrastructure corrosion rate monitoring program is based on the International Standard entitled “ASTM D2688 – Standard Test Methods for Corrosivity of Water in the Absence of Heat Transfer (Weight Loss Methods)”.

The different components of this program consist of the Alberta Infrastructure Policy, specifications for the corrosion coupon rack, iron & copper corrosion coupons, and coupon holder, coupon installation procedure, calculation of corrosion rates, corrosion rate control limits, and trouble shooting high corrosion rates – all of which are contained herein.

ALBERTA INFRASTRUCTURE POLICY

The Alberta Infrastructure policy regarding monitoring of corrosion rates is as follows:

In-House Properties

- Corrosion rate monitoring is optional, but encouraged for closed hot water heating and closed chilled water systems;
- Corrosion rate monitoring is optional for closed glycol heating and closed glycol chilled water systems;
- Corrosion rate monitoring is optional for steam condensate systems;
- Corrosion rate monitoring is required for open condenser water (cooling tower) systems;
- Corrosion rate monitoring is not required for open air washer humidifier systems.

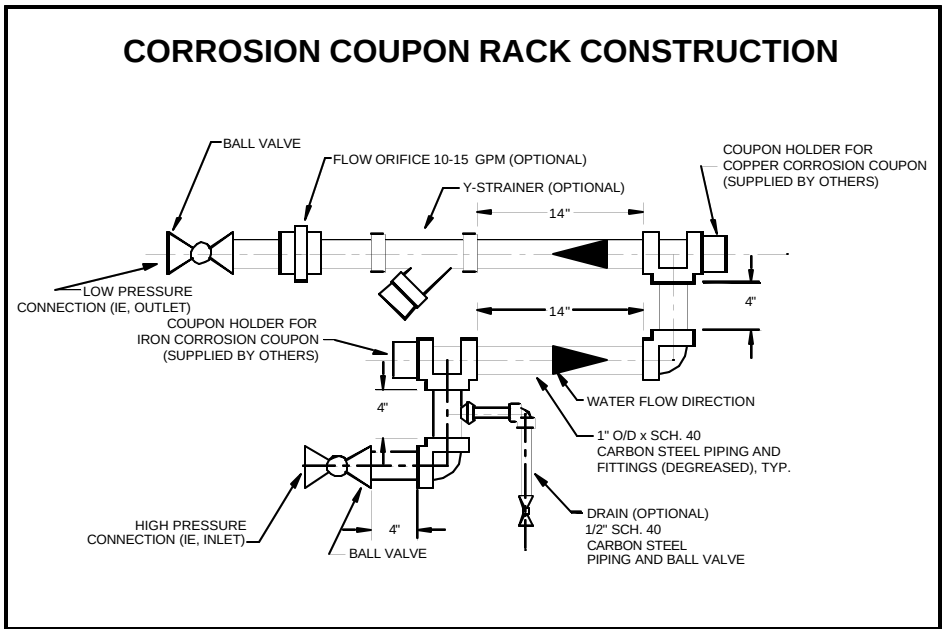
TPM Properties

- Corrosion rate monitoring is required for closed hot water heating and closed chilled water systems;
- Corrosion rate monitoring is optional for closed glycol heating and closed glycol chilled water systems;
- Corrosion rate monitoring is optional for steam condensate systems;
- Corrosion rate monitoring is required for open condenser water (cooling tower) systems;
- Corrosion rate monitoring is not required for open air washer humidifier systems.

SPECIFICATIONS

In order to obtain consistently accurate field measurements of iron & copper corrosion rates, the components (i.e., corrosion coupon rack, iron & copper corrosion coupons & corrosion coupon holder) must be manufactured to standard specifications.

Corrosion Coupon Rack



Corrosion Coupon Rack Installation Notes

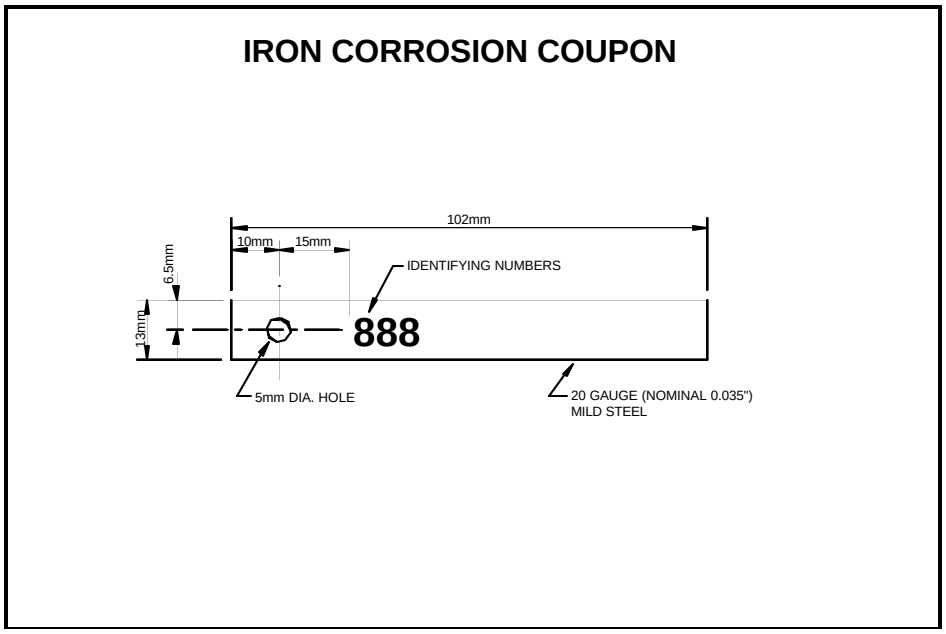
1. The corrosion coupon rack should be piped to valved connections (1/2" minimum) in the inlet & outlet piping of the system circulating pumps or to existing connections in parallel with the by-pass filter, with due regard to the water flow direction - see above drawing;

2. The corrosion coupon rack must be located at operating level, away from any electrical devises, and adequately supported;

3. Access must be provided so that the coupon holders and attached corrosion coupons may be easily removed from the corrosion coupon rack;

4. The piping to & from the corrosion coupon rack may be copper or iron (1/2" minimum), but the corrosion coupon rack itself must be fabricated in accordance with the above drawing.

Iron Corrosion Coupon



Iron Corrosion Coupon Preparation

1. Shear 20 gauge (nominal 0.035”) sheet iron to the dimensions of 13 mm X 102 mm (note: coupon dimensions must be identical from one coupon to the next);

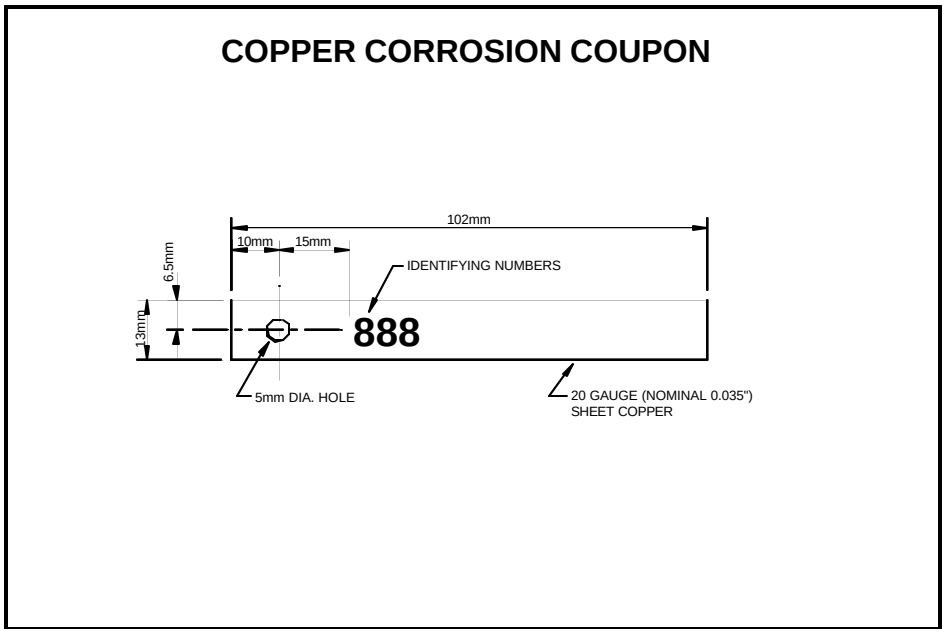
2. Drill a 5 mm mounting hole with its centre located in the centre of the coupon and 10 mm from one of its ends;

3. Stamp an identifying unique 3 digit 5 mm high number lengthways on the coupon starting 15 mm from the mounting hole centre (Note: numbers shall be in sequence from one coupon to the next);

4. Debur all sharp edges on the coupon, without scraping its flat surfaces;

5. The finished coupon shall be smooth on both sides, and free of grease, cutting oil, or any other material used in its manufacture.

Copper Corrosion Coupon



Copper Corrosion Coupon Preparation

1. Shear 20 gauge (nominal 0.035”) sheet copper to the dimensions of 13 mm X 102 mm (note: coupon dimensions must be identical from one coupon to the next);

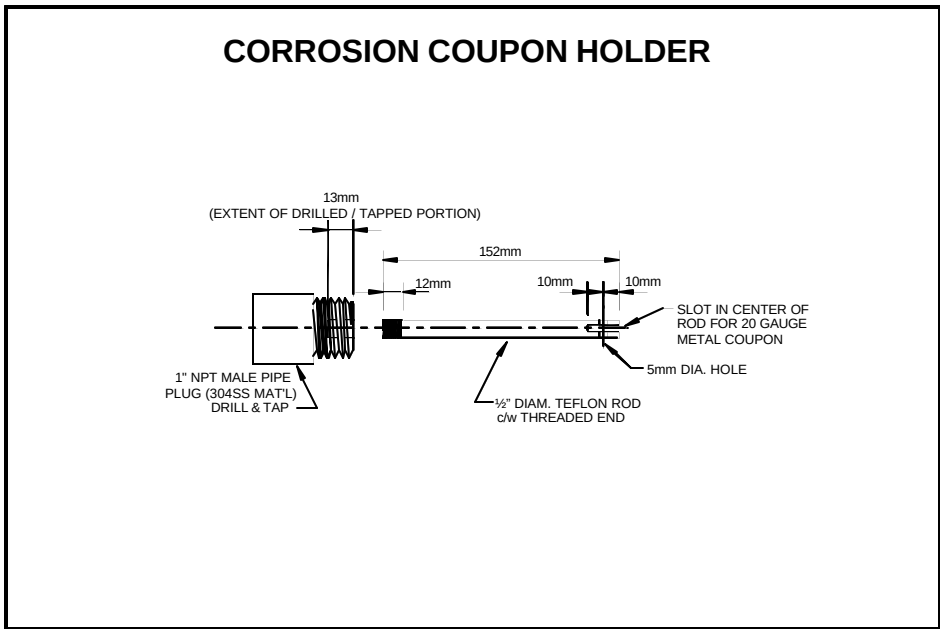
2. Drill a 5 mm mounting hole with its centre located in the centre of the coupon and 10 mm from one of its ends;

3. Stamp an identifying unique 3 digit 5 mm high number lengthways on the coupon starting 15 mm from the mounting hole centre (Note: numbers shall be in sequence from one coupon to the next);

4. Debur all sharp edges on the coupon, without scraping its flat surfaces;

5. The finished coupon shall be smooth on both sides, and free of grease, cutting oil, or any other material used in its manufacture.

Corrosion Coupon Holder



Corrosion Coupon Holder Preparation

1. Cut a solid ½" diameter teflon rod to a length of 152 mm;

2. At one end of the rod, cut a slot 20 mm in length into the centre, and drill a 5 mm hole 10 mm from the end of the rod (Note: the slot width must allow a snug fit for a 20 gauge metal coupon);

3. Cut a 12 mm long thread at the other end of the rod;

4. Drill & tap a matching 13 mm long thread into a 1" male 304 SS pip plug.

Note: The teflon rod must be perfectly in line when it is screwed into the pipe plug because this assembly will be installed inside a piping system, and the metal coupon which will be attached in the slot of the teflon rod must not touch the inside of the piping.

COUPON INSTALLATION PROCEDURE

1. Maintain the corrosion coupon in its zip locked bag until it is installed, and handle it carefully, since it is pre-weighed to the nearest 0.1 mg;

2. Attach the coupon onto the coupon holder with the nylon nut, bolt & washer provided (see drawing overleaf);

3. Wrap the threads of the coupon holder with teflon tape (see drawing overleaf);

4. Wipe the iron coupon with tissue, as it is coated with a protective oil film;

5. Install the coupon holder, with attached coupon, into the coupon rack (note 1: the iron coupon is installed first in the direction of water flow.

6. Tighten the coupon holder until the line marker on the face of the coupon holder is either parallel or perpendicular with the plane of the coupon rack;

7. Adjust the **inlet** valve on the coupon rack to the fully open position and the **outlet** valve to the 25-50% open position;

8. Record the installation date;

9. Replace the coupon with a fresh coupon after 30-90 days of continuous wetted service for closed systems, and 30-60 days for condenser water systems;

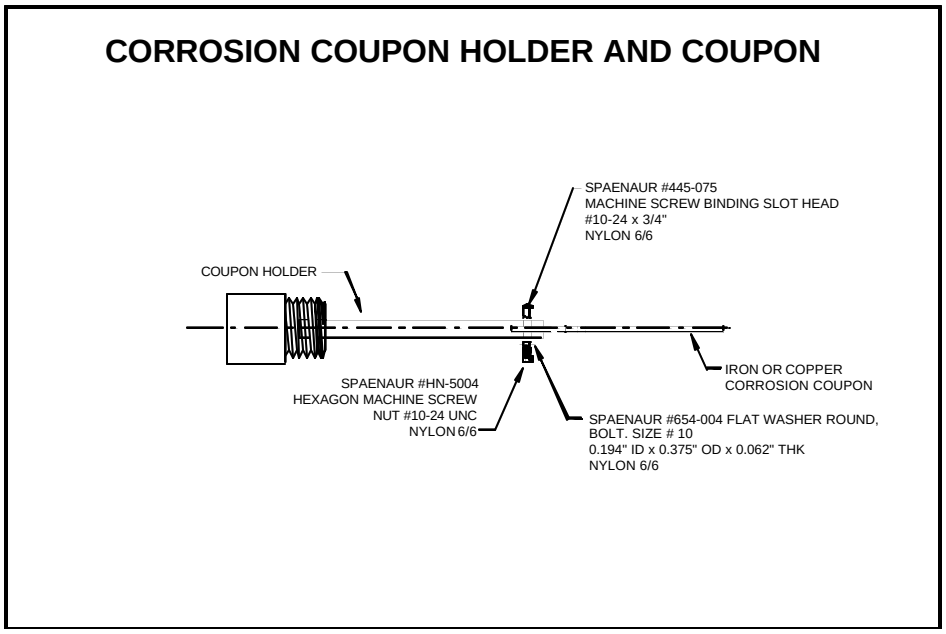
10. Record the removal date;

11. Air dry the used coupon, wrap it in tissue, and forward it to the Consultant, along with the information contained in the following Table.

Corrosion Coupon Information

Building Location		
Building Name		
Type of System		
Coupon Number	Iron:	Copper:
Coupon Installation Date	Iron:	Copper:
Coupon Removal Date	Iron:	Copper:

Corrosion Coupon Holder & Coupon Assembly



CALCULATION OF CORROSION RATES

Based on the dimensions of the iron & copper corrosion coupons indicated herein, the iron & copper corrosion rates are calculated as follows:

ICR = 0.689 X WL/T Equation (1)

CCR = 0.607 X WL/T Equation (2)

Where ICR: iron corrosion rate, mpy (mils per year)
CCR: copper corrosion rate, mpy (mils per year)
WL: weight loss, mg
T: immersion time, days

The two different factors indicated in Equations (1) & (2) are due to the different densities of iron & copper.

CORROSION RATE CONTROL LIMITS

The control limits for the iron & copper corrosion rates for closed hot water heating & closed chilled water systems are 0.50 mpy maximum & 0.20 mpy maximum respectively.

Similarly, the control limits for iron & copper corrosion rates for closed glycol heating & closed glycol cooling systems are 0.50 mpy maximum & 0.20 mpy maximum respectively.

The control limits for iron & copper corrosion rates for open condenser water (i.e., cooling tower) systems are 2.00 mpy maximum & 0.20 mpy maximum respectively.

TROUBLE SHOOTING HIGH CORROSION RATES

Generally speaking, high iron corrosion rates are to be expected under such conditions as low pH level, low inhibitor level, low system pressure, and air ingression. Similarly, high copper corrosion rates are to be expected under such conditions as high pH level, low inhibitor level, and high water velocity.

However, the iron & copper corrosion rates should be well within their respective control limits in most cases, provided that an effective water treatment program is maintained. This includes such activities as selection of an acceptable corrosion/scale inhibitor, routine water testing & documentation of all water test results, and inhibitor addition as required.

An exception to the rule occurs for free cooling systems (i.e., cooling water systems in which the chiller is by-passed and condenser water is allowed to flow into the normally closed chilled water system). Since these systems were not designed to operate in this manner, high iron & copper corrosion rates are to be expected.