



# Technical Process Bulletin

This Revision: 02/12/2010

## RODINE 213 & 214

### 1. Introduction:

RODINE 213 is an organic, liquid, cationic corrosion inhibitor especially designed to inhibit the attack of hydrochloric acid on iron and steel during industrial cleaning operations. It also inhibits acid attack on copper and brass. It does not contain arsenic, chlorinated hydrocarbons, or lead compounds. RODINE 214 inhibitor has the same formula as RODINE 213 inhibitor with the exception that approved defoamer and red dye have been added so that the presence of the RODINE inhibitor in an acid cleaning bath is readily apparent. RODINE DEFOAMER 16 is available for use with RODINE 213 where red dye is not required. Please refer to the Technical Process Bulletin for RODINE 16 DEFOAMER.

The addition of RODINE 213 or 214 inhibitors to hydrochloric acid solution provides maximum protection for equipment during:

- a. The removal of lime deposits or water scale from power plant boilers and piping systems and from evaporating equipment.
- b. The removal of scale and deposits from equipment in refineries, utility companies, paper mills, chemical plants and other industries.

RODINE 213 and 214 inhibitors meet the requirements of Military Specification Nos. MIL-I-17433 and MIL-C-17434.

### 2. Materials:

RODINE 213,  
RODINE DEFOAMER 16 (optional)  
or  
RODINE 214

### 3. Buildup:

For each 1000 gallons of either 5% or 10% by weight\* hydrochloric acid solution, not less than the following amount of RODINE 213 or RODINE 214 inhibitor should be used:

- 1 gallon for a cleaning temperature of 150° Fahrenheit.
- 2 gallons for a cleaning temperature of 175° Fahrenheit.
- 3 gallons for a cleaning temperature of 200° Fahrenheit.

\* A 5% by weight hydrochloric acid solution contains 14.1% by volume of 20° Bé hydrochloric acid.

### 4. Operation:

The exceptional strength and heat stability of RODINE 213 and 214 acid inhibitors give the user a considerable safety factor in relation to temperature, acid strength, and time.

RODINE 213 or RODINE 214 inhibitor may be added to either the diluted or concentrated hydrochloric acid. In either case, the RODINE inhibitor should be thoroughly mixed with the acid by stirring or agitation.

The hydrochloric acid solution inhibited with RODINE 213 or 214 inhibitor is best circulated through the equipment to be cleaned. When circulation cannot be accomplished, the equipment should be filled with the inhibited acid and allowed to react for sufficient time to remove the objectionable deposits. To estimate the proper acid concentration and cleaning time, samples of the deposits to be removed can be tested in the laboratory prior to cleaning. If heating of the equipment to be cleaned or acid solution is desired to speed the cleaning action, it should be done prior to the start of the cleaning operation.

#### 5. Storage Requirements:

RODINE 213 and RODINE 214 inhibitors will not freeze at temperature as low as -20° Fahrenheit. Below 0° Fahrenheit, RODINE 213 and RODINE 214 become very viscous and may be difficult to pump. It is recommended that RODINE 213 and RODINE 214 inhibitors be stored in a dry area where the temperature will not go lower than 0° Fahrenheit.

#### 6. Water Disposal Information:

Applicable regulations concerning disposal and discharge of chemicals should be consulted and followed.

Disposal information for RODINE 213 and RODINE 214 is given on the Material Safety Data Sheet for each product.

The industrial cleaning bath is acidic and contains hydrochloric acid and organic RODINE inhibitor components. Waste treatment and neutralization is required.

The industrial cleaning bath and sludge can contain ingredients other than those in the chemical as supplied and analysis of the solution and/or sludge is required before waste treatment and disposal.

#### 7. Precautionary Information:

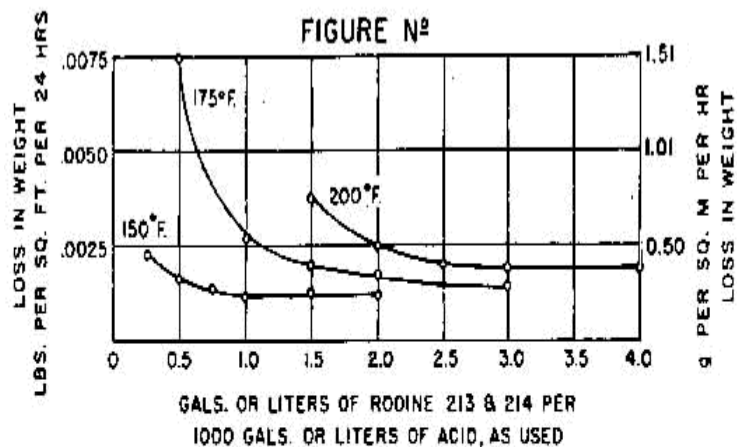
Before handling the chemical products used in this process, the first aid and handling recommendations on the Material Safety Data Sheet for each product should be read, understood and followed.

The industrial cleaning bath is strongly acid and can burn skin and eyes. Refer to the Material Safety Data Sheet for hydrochloric acid for recommendations for protective action.

8. Corrosion Rate Data:

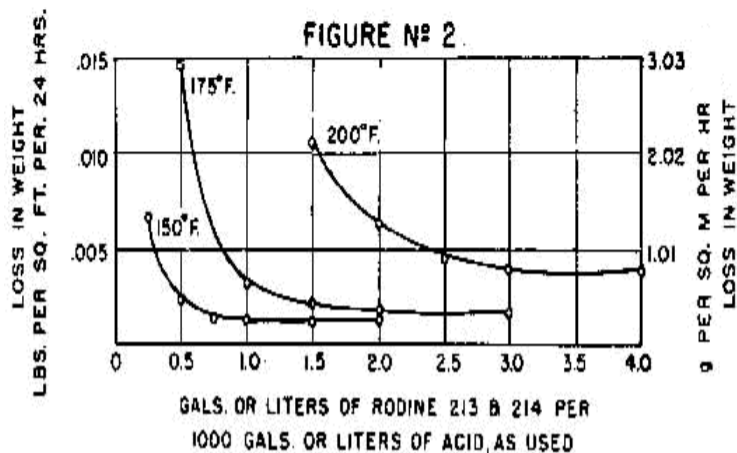
Figure 1 and Figure 2 show the metal loss data at various levels of Rodine 213 and Rodine 214 in both 5 and 10% by weight hydrochloric acid.

Figure 1 and Figure 2 show the metal loss data at various levels of Rodine 213 and Rodine 214 in both 5 and 10% by weight hydrochloric acid.



TEST CONDITIONS

ACID CONCENTRATION - HCL 5% BY WEIGHT  
 TEST METAL - 1010 HOT-ROLLED STEEL  
 DURATION OF TEST - 16 HOURS  
 TEMPERATURE - AS SHOWN ON CURVES



TEST CONDITIONS

ACID CONCENTRATION - HCL 10% BY WEIGHT  
 TEST METAL - 1010 HOT-ROLLED STEEL  
 DURATION OF TEST - 16 HOURS  
 TEMPERATURE - AS SHOWN ON CURVES

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Form Revised 04 June 2001