Fact Sheet

Steamate* FM1007

Steam Condensate Corrosion Inhibitor

Features

- Unique non-amine, solid (powder), non-GMO corrosion inhibitor for steam condensate corrosion control
- Acceptable for use in boilers where steam contacts food per FDA 21 CFR 173.310
- Kosher certified Steamate FM1007 is designed for use in food and beverage applications where steam contacts the food product which are under an organic food certification program per USDA 7 CFR 205.605 and 205.606
- Protects steam condensate system surfaces against corrosion by carbonic acid, dissolved oxygen corrosion, and other forms of corrosion without the need for volatile organic amines to elevate condensate pH
- Contains no nitrogen, and eliminates gunking and fouling characteristic of conventional filming amines
- Safe for workers – no hazardous ingredients; no SARA 302/313 warnings; no California Proposition 65 chemicals; no carcinogenicity warnings
- Environmental exposure: Should lecithin be released into the environment, it is considered readily biodegradable. Such degradability is expected to occur regardless of the environmental media in which the chemical resides. Lecithin is not persistent in the environment

Description and Use

Steamate FM1007 contains a proprietary (patent-pending) non-amine, non-GMO, corrosion inhibitor. This unique chemistry is designed to prevent the corrosion of metal surfaces in steam condensate systems without the requirement for pH elevation by volatile amines. Corrosion control is achieved through the formation of an adherent film on the metal surface. This film serves as a barrier between the metal and the corrosive species present in the steam condensate.

Because it contains no volatile amines, Steamate FM1007 is a viable treatment option for systems which cannot feed these materials due to regulatory, process, environmental or steam purity restrictions, as well as organic food certification requirements per the USDA National Organic Program. It is very well-suited for food processing applications where amine-based, volatile corrosion inhibitors are not permitted or desired.

Condensate Corrosion

Corrosion in steam condensate systems is frequently a serious problem. Carbon dioxide (CO_2) is the most common cause of this corrosion. CO_2 is produced in the boiler as a result of thermal breakdown of the natural alkalinity, principally bicarbonate ions, which enter with the feedwater. The reactions are as follows:

$$2\ NaHCO_3 + HEAT \rightarrow Na_2CO_3 + CO_2 + H_2O \quad (1)$$

$$Na_2CO_3 + H_2O + HEAT \rightarrow 2\ NaOH + CO_2 \quad (2)$$

The conversion of bicarbonate alkalinity to carbon dioxide is a function of boiler temperature, pressure and residence time. Because it is extremely volatile, the carbon dioxide exits the boiler with the steam produced. At points of condensation, some fraction of the carbon dioxide present in the steam enters in the condensate, forming carbonic acid:

$$CO_2 + H_2O\ H_2CO_3 \rightarrow H_+ + HCO_3 \quad (3)$$

The carbonic acid hydrolyzes to produce hydrogen ions which cause acidic corrosion of both iron and

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copper alloy surfaces in the steam condensate system. The corrosion reaction for iron is shown below:

$$2\ H_2CO_3 + Fe \rightarrow Fe(HCO_3)_2 + H_2 \qquad (4)$$

Excessive corrosion of the condensate system can lead to costly equipment failure and increased maintenance costs, and can also cause deposition of metal oxide corrosion products on boiler heat transfer surfaces if the condensate is recovered as feedwater. Metal oxide deposition on boiler heat transfer surfaces will result in lower efficiency and higher fuel costs and can lead to tube failure due to long-term overheating.

Dissolved oxygen is another major cause of condensate system corrosion. Oxygen contamination of steam condensate can occur due to inefficient or improper feedwater deaeration, air leakage at pump seals, receivers and flanges, leaking heat exchangers, and systems which are under vacuum. Pitting corrosion caused by dissolved oxygen can cause rapid failure of critical equipment in the steam distribution system. In addition, traces of oxygen in the condensate can significantly accelerate the rate of acidic corrosion. Erosion-corrosion will aggravate metal loss of both copper and steel.

Typical Applications

For use in boilers where steam contacts food per FDA 21 CFR 173.310 and USDA-inspected systems per USDA G6, as well those requiring organic food certification per the USDA National Organic Program.

Treatment and Feeding Requirements

Proper treatment levels for Steamate FM1007 depend on many factors specific to a particular application. The product is to be applied in accordance with the control procedures that GE establishes for a particular application. These include carbon dioxide and dissolved oxygen levels in the steam, system design and operating conditions. Typical feed rates are between 1 and 2 ppm as product to the steam, and the maximum feed rate permitted by the FDA where steam contacts food is 2 ppm as product.

- **Feed Point:** Steamate FM1007 must be fed directly to the steam line or steam header. It is not effective if fed to the boiler feedwater or directly to the boiler.
- **Dilution:** Steamate FM1007 must be diluted to the prescribed strength (0.5 to 2%o product in water by weight), and mixed with condensate or demineralized quality water. Due to the requirement for steam phase injection, the dilution water must not contain appreciable levels of dissolved solids. Detailed feed instructions are available from your GE service representative.

General Properties

Physical properties of FM1007 are shown on the Material Safety Data Sheet, a copy of which is available on request.

Packaging Information

Steamate FM1007 is available in 5-gallon (19-liter) pails and 44-gallon (167-liter) drums.

Storage and Handling

Steamate FM1007 is a high-purity, powdered product supplied in pail and drum containers with a plastic insert liner and twist tie. It is important to store the container indoors with the lid tightly closed when not in use, and to maintain the integrity of the plastic liner. The supplied twist tie closure should always be used when re-sealing the plastic liner after use. This is positive protection against moisture ingress and product spoilage.

Safety Precautions

A Material Safety Data Sheet containing detailed information about this product is available on request.