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Subject: Oil Mist Lubrication of Explosion Proof Motors

Introduction

A question has been raised whether Explosion Proof (XP) electric motors are viable candidates for oil mist lubrication. This technical bulletin discusses issues and provides guidelines for addressing this question with customers.

The installation and use of any machinery or the machinery control in a hydrocarbon processing plant is governed by accepted industrial standards, governmental regulations and applicable codes. Customer's standards, specifications and best practices are also used as design input to a project. When any project is undertaken all applicable inputs must be considered and addressed.

LubriMist® Pure Oil Mist is often the preferred method of lubrication for antifriction bearings and specified for inclusion in a project. The antifriction bearings of electric motors are candidates' for pure oil mist. However, the acceptability of oil mist on Explosion Proof Motors relates to the third party approval and original equipment manufacturers certification of the motor. Insuring electrical safety once an Explosion Proof Motor has been altered from its original approved design is the issue at stake.

Background

In the hydrocarbon processing industry, the hazardous areas that we most commonly deal with are designated as Class 1 Division 2 Groups B, C and D. A Class 1 area designation means that a flammable liquid or vapor is present. A Class 2 designation involves an area where combustible metal, carbonaceous or other combustible dusts such as grain flour or plastic are present. In the Hydrocarbon Processing Industry we seldom deal with Class 2 areas.

The Division designation further defines the probability of the flammable gas or vapor being present in a Class 1 or Class 2 location. Division 1 is defined as a location where ignitable concentrations of flammable gases or vapors can exist under normal operating conditions or be present due to frequent equipment repair or maintenance. Division 2 defines the area as a location where the flammable liquid or vapor is 1) normally confined within closed containers or closed systems and are present only in case of accidental rupture or breakdown of such containers, or in case of abnormal operation of equipment, or 2) where ignitable concentrations are normally prevented by positive ventilation, or 3) an area adjacent to a Class 1 Division 1 location.

The Group designation has four designations, or gas groups. These are Group A, B, C and D. Determining the proper group classification for flammable gases and vapors involves a



determination of explosion pressures and maximum safe clearance between parts of a clamped joint under several conditions when a test gas is mixed with air and ignited. The test values obtained for the test gas are compared with presently classified materials which were tested under the same test conditions. Gases having similar explosion pressures are grouped together. Groups C and D contain the vast majority of flammable gases and vapors. Group A only contains Acetylene. Group B generally contains hydrogen and other hydrogen enriched gasses, and a few other flammable gases.

A final comment regarding equipment used in Division 2 areas. Remember the distinction between a Division 1 and a Division 2 hazardous area. In a Division 1 area, flammable gases may be present under normal operation conditions. In a Division 2 area, flammable gases are normally not present. Because flammable concentrations of flammable gasses are not normally present in Division 2 areas, the National Electrical Code (NEC) allows the use of certain types of devices and materials which may not be "listed", provided they meet certain criteria. These allowances are referred to as exceptions to the requirements in the NEC. General-purpose enclosures are permitted if electrical current interrupting contacts are;


1. Immersed in oil; or
2. Enclosed within a chamber that is hermetically sealed against the entrance of gases or vapors; or
3. In non-incendive circuits; or
4. Part of a listed non-incendive component; or
5. Are without make-and-break or sliding contacts.

Discussion

The National Electrical Code - NFPA 70 (NEC) requires that all electrical apparatus installed in classified (hazardous) areas must be approved for use in the specified Class and Group where it is to be used. When we describe an electrical apparatus as "Explosion Proof", what we mean is that the device has been evaluated and approved for use in a particular Class and Group. A third party such as Underwriters Laboratories (UL), Factory Mutual (FM) or CSA generally provides approvals for equipment used in the US. These are referred to as a "listed" components or devices.

In most Class 1 Division 2 hazardous areas, the electric motors are not "Explosion Proof". They are typically motors that are non-arching induction type that meet the requirements of the applicable allowed exceptions. These non-Explosion Proof Motors can readily be adapted for oil mist lubrication by connecting oil mist supplies and vents to the existing connections on the bearing brackets. Because these motors are non-arching, and an explosion proof housing is not needed for Division 2 service, the case drain fitting can be removed and a drain can be installed without jeopardizing the safety of the motor for Division 2 service.

However, the situation is different when a motor is listed for Class 1 Division 1 service. The application of oil mist to the motor changes the device and renders it different from what was approved by the third party. By removing plugs and drain fittings to adapt for oil mist

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application, venting and draining, the safe clearance requirements between clamped components used in the original design requirement may have been changed. Therefore the approval listing is void and the motor is no longer suitable for use in Class 1 Division 1 service. For this reason, field adaptation by LSC to connect an Explosion Proof Motor to oil mist service should never be performed.

We contacted several motor manufactures regarding the suitability of oil mist as a lubrication method when applied to Explosion Proof Motors. Below are summaries of their responses.

1. From Reliance Electric
 Reliance only provides oil mist Explosion Proof Motors for Class 1 Groups C & D. In their design, the bearing is located outside of the Class 1 shaft opening of the motor and also outside of the Class 1 joint of the inner bearing cap-end shield. The Reliance design provides lip seals outside the bearing and optionally between inner bearing cap and bearing. Reliance has a third party listing for oil mist lubricated motors in Class 1 Groups C & D. A Reliance Sales Office should be contacted regarding specific applications.
 Modifications to an existing Class 1 motor to accept oil mist lubrication would either need to be done as part of the initial order for the motor, or as a modification by a Reliance service shop. When this was discussed with a local Reliance repair facility, LSC was advised that they had never reapplied a third party approval to any such modified motor.
2. From General Electric
 Presently, GE does not have a design for oil mist lube systems on any Explosion Proof Motors. Accordingly, they do not have instructions for care or use of such a lube system for UL listed products. General Electric UL files do not allow for any modifications to Explosion Proof Motors once they leave their manufacturing facility.
3. From Siemens (verbal)
 Siemens does not have any third party approved oil mist lubricated electric motors for any Class 1 application.
4. From Continental:
 No response.

Conclusion

The responses above tell us that some motor manufacturers have made investments in addressing customer request for oil mist lubrication, while others have not. We understand why; the third party approval process is often quite difficult and always very expensive.

In summary, the following guidelines should be adhered to when dealing with oil mist lubrication of Explosion Proof Motors



1. When working with customers who are specifying and purchasing new Explosion Proof Motors, oil mist lubrication must be specified prior to purchase.
2. If a customer wants to apply oil mist to an existing Explosion Proof Motor, the customer must remove the motor from service and send it to an authorized motor repair facility to make the necessary modifications. The repair facility should be recognized by the original motor manufacturer, and have the capability of re-listing the modified motor with the required third party hazardous listing.
3. LSC personnel should never make field modifications to Explosion Proof Motors to adapt them to oil mist.
4. LSC personnel should connect oil mist only to Explosion Proof Motors that have been setup for oil mist lubrication by the motor manufacturer or modified and re-listed by a motor manufacturers authorized repair facility.

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