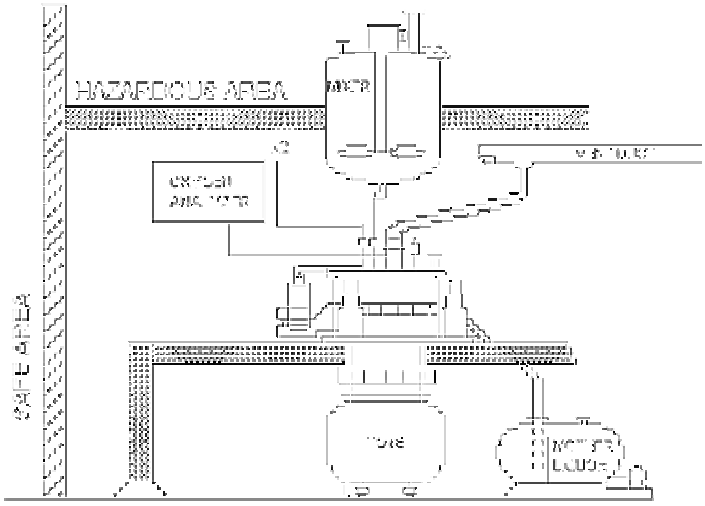
Application Note 1 :
Centrifuge - Inerting Control System



For Explosion Prevention on Centrifuges

The potential hazards involved in the use of centrifuges for the separation of solids from flammable liquids are gaining greater awareness and importance due to a number of serious incidents involving personal injury. Methods of monitoring and avoiding such hazards are important to all those involved, not just the production operator and safety manager.

The risk of explosion in a centrifuge is much greater than in most process equipment because the three ingredients necessary for combustion often occur within the centrifuge.

They are:

1. Fuel Supply
• Solvents may be used in the process.
• Solvents may be used in the wash cycle.

2. Oxygen Supply
• A centrifuge operates like a fan drawing ambient air inside from any point that is not gas tight.
• Before start up, the centrifuge contains ambient air.

3. Ignition Source
• High Spinning speeds of up to 1500 RPM can generate high static charges.
• Mechanical failure can occur within the centrifuge causing metal to metal contact and sparking.
• Hot spots due to mechanical wear, bearings, etc., can arise.

Application

There is an extensive range of centrifuge types and sizes. The most common type is the top or bottom discharge batch basket centrifuges. Other types include the continuous horizontal decanter centrifuge, the disc stack centrifuge, etc. The types of industries using centrifuges are similarly diverse. These include chemical, pharmaceutical, petrochemical, mining and food industries.

Every year a number of explosions involving centrifuges are reported. Each time the accident inquiry pinpoints human error, equipment failure or poor engineering design as the major

causes. A typical process cycle of a centrifuge operating with hazardous substances is:

1. Centrifuge sweeping/purging with Nitrogen.
2. Slurry feed into the inside of the rotating basket (separation).
3. Washing of cake.
4. Removal of liquid from the cake after final spinning.
5. Removal of the basket or ploughing out of the solids from the centrifuge.

During all of these operations, the centrifuge must be inerted by the introduction of inert gas into the atmosphere within. In most cases, Nitrogen is used as the inert gas however Carbon Dioxide may also be used. The principle behind the inerting process is as follows:

If one can keep the Oxygen level below the Minimum Oxygen level for Combustion (MOC), then there is zero probability for an explosion.

System Considerations

To carry out this inerting/purging function, a suitable control system must be implemented. The main operational criteria demanded of a control system are:

- **Reliable & Effective performance**
- **Fail Safe design**
- **Simple to operate**
- **Ease of installation and maintenance**
- **Economical to operate**
- **Flexible in design to suit different types and sizes of centrifuges**

When attempting to meet the above criteria, one must consider how to interface with the centrifuge itself in order to achieve optimum performance. The following questions must be asked:

- **Are there emergency interlocks & braking mechanisms?**
- **Is there speed control?**
- **Is the centrifuge gas tight?**
- **Is the bearing housing purged?**
- **What is the method of product discharge?**
- **Is there a lid locking mechanism?**
- **Is the centrifuge vented?**
- **What are the materials of construction of the centrifuge?**
- **What solvents and substances can be present in the centrifuge?**

The answers to these issues form the basis around which a complete solution can be implemented.