

## Did You Know? Motion Control Solutions For Hazardous Environments

by Roy Park, Site Manager, Australia

The evolution of safety standards for explosive environments was initially driven by coal mining disasters in the early part of the 20<sup>th</sup> century. Since that time a range of solutions and standards has evolved to minimize the chance of an explosion in the presence of gases, vapors, flammable liquids, combustible dust, or easily ignitable fibers. Moog has had extensive experience with the design and testing of intrinsically-safe products since the early 1960's for coal mining radios and hydraulic valves for mining and turbine actuation.

Methods for protection are based on three levels:

1. Primary protection limits the quantity of a potentially explosive mixture
2. Secondary explosion protection prevents ignition sources
3. Tertiary limits the effects of an explosion if the other two cannot be implemented.

Explosion protection is based on the use of approved control devices and their interconnectivity into the total system.

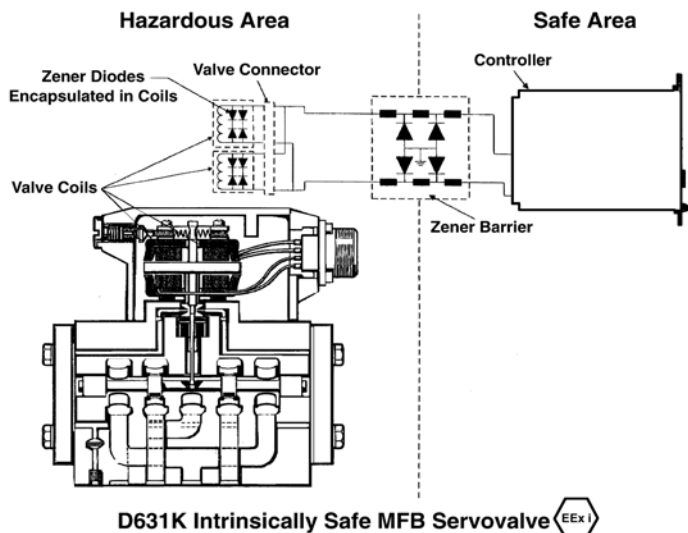
For motion control solutions, users employ a mixture of methods that typically focus on combinations of intrinsic-safety and explosion/flameproof measures.

## Products

### 1. Intrinsically-Safe [IS]

These devices operate at levels of electrical power [V, I] below 'explosion limit' curves for the particular hazardous gas or dust environment. They provide the highest level of protection for the most demanding environments defined by the various global standards. The relatively low power allowance means that the device should have inherently low electrical operating power. The Moog 2-stage Servovalve employing a nozzle-flapper hydraulic amplifier has been used for many years on applications such as gas turbines due their low power.

Moog offers a broad range of intrinsically-safe valves based on standard industrial designs but with special coils and cable connections. They are identified by the "K" in the model code and include: 631K, 72K, 770K, 78K & 760K series Servovalves and Servo-Proportional valves with flows to 200 l/min [53 gpm].



IS devices are compact and use small diameter cabling. Connections to Ex enclosures via IS barriers will complete the installation. Moog's IS servovalves are found in power generation, chemical processing, oil exploration and wood products industries.

## 2. Explosion-Proof /Flameproof

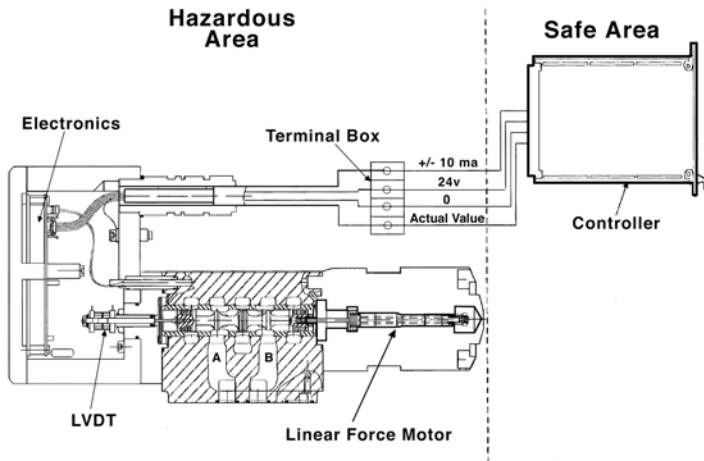
Tertiary explosion protection is provided by enclosing conventional devices in a special housing. The explosion proof housing will allow hazardous gas mixtures to enter the housing and to be ignited, however the energy of the resulting flame is dissipated through a controlled gap to prevent ignition of the general hazardous area outside the enclosure.

The major advantage of the explosion-proof approach is that standard industrial products can be used and only the enclosure is customized.



Moog motion control devices include:

- Servo-Proportional Valves D660K up to 2000l/min [ 530 gpm]
- Direct Drive Servovalves D633K and D634K for flow rates to 100 l/min [26 gpm]
- Brushless Servomotors G490 series
- Power Generation Electro-Mechanical Actuators



**D63XK Flameproof Direct Drive Valves** 

Applications include electro-mechanical actuation for turbines and higher flow handling and automation for offshore oil and gas production.

### 3. Additional Product Requirements

Apart from the basic electrical considerations there may be additional factors to be applied to the product to suit specific installation approvals.

Some examples include:

- Local variations to approvals – can be related to State, regional, or industry specific issues.
- Cable and cable gland requirements.
- External materials to resist sparking due to striking (aluminium content) or build up of static charge (conductivity of plastic housings)

### 4. Control System Electronics

Proprietary approved enclosures are available for safe housing of standard motion control system hardware such as PLC's, servo amplifiers and related electrical and electronics to complete the system. Fieldbus interfaces (Sercos, CANopen, Ethernet) are possible as part of an overall control strategy.

For IS products the electronics I/O will be connected to the enclosure via approved IS barriers. These barriers limit short circuit current and open circuit voltage to below prescribed operating limits for the particular hazardous environment.

Explosion proof products are connected with approved cables and cable glands at the enclosure.

### Applications

Globally our hydraulic and electric controls are applied in a broad range of applications from grain handling conveyor with dust ignition proof Servo-Proportional valves in Australia to IS solenoid valves for ballast regulation on oil & gas tanker ships in Singapore to underground coal mining in Europe, USA, Australia and China.



Component handling fixture with 4-axis for spray-painting line. Application called for a Moog Brushless Servomotor G492K206



Drive electronics DACS2000 in remote explosion-proof enclosure



Steam turbine in oil refinery meant that although the fuel is inert, the installation at a refinery required protection to Class 1 Zone IIB H2.



These upgrade servo actuators run on 5 bar lube oil and feature Moog's Ex direct drive servo valve for position control on both inlet and outlet turbine regulation valves.

Moog developed a new explosion-proof actuator for gas turbine fuel control and inlet guide vane (IGV) actuation use. This utilizes Moog's 760N/78N explosion-proof servovalves with explosion-proof junction box, LVDT, and conduits. The explosion-proof design removes the requirement for zener barriers. The junction box simplifies the wiring process. Moog started series production in Japan in 2004 and to date has supplied more than 300 units. These are used in projects in China and Europe, which has adopted the ATEX Directive.



### **Conclusion**

Clearly the selection of products with existing certification will save time and money for a project. Moog has a strong history for support of such solutions with a comprehensive range of hydraulic and electric motion controls certified globally to requirements such as CE, FM, ATEX and UL.

### **Author**

**Roy Park** has 32 years experience in engineering, marketing and management in the hydraulics industry, including the past 21 years as Managing Director and Site Manager for Moog Australia. He has a B.E. honors degree in mechanical engineering from Monash University.