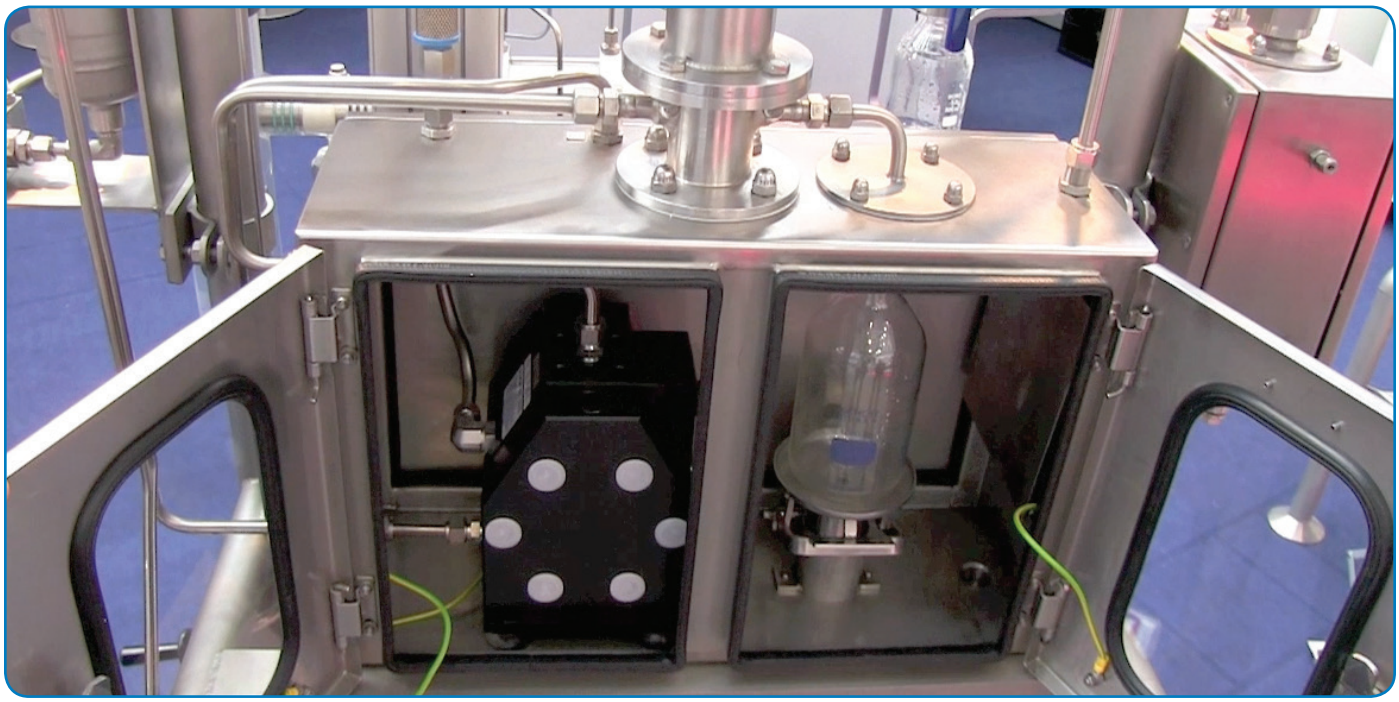
ATEX: The Symbol of Safety in Dangerous-Chemicals Handling

Safety-conscious chemical companies are making ATEX-certified equipment, such as Almatec® E-Series pumps, mandatory in their day-to-day operations

By Edison Brito



Solid-body air-operated double-diaphragm pumps from Almatec® provide operators with peace of mind when handling dangerous chemicals.

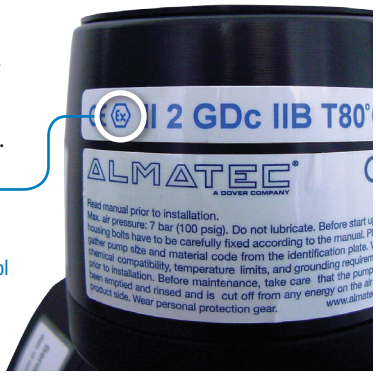
Introduction

A variety of legislation and regulations have been implemented in the chemical industry as a direct result of accidents—accidents that could have been avoided if companies had followed necessary safety precautions. This includes the classification, labeling and packaging of chemicals that could potentially pose a threat. For example, in 1967, the Dangerous Substances Directive (67/548/EEC) was passed, and its orange-and-black hazardous substance symbols became instantly recognizable to anyone in the world who was handling a variety of hazardous chemicals; anything from basic cleaning products to acids. But this applied to Europe only and, as a result, the United Nations Globally Harmonized System of Classification and Labeling of Chemicals (GHS) was created in 1992 and standardized by 2000.

In Europe, the most important legislation introduced in recent years has been Registration, Evaluation, Authorisation and Restriction of Chemicals—better known as REACH. Implemented in June 2007 by the European Union, REACH replaced 40 existing directives. There are 73 substances on the Substance of Very High Concern (SVHC) candidate list. The regulation puts greater responsibility on industry to manage the risks of chemicals and provide safety information on the substances. But REACH remains a work in progress.

One other way that the chemical industry is working to create a safer environment is through certifications. Equipment must meet certain standards in order to gain certification and be considered safe to handle known dangerous chemicals like acids, solvents and caustics. In the past, the CE symbol was the recognized symbol for safety. Since 1993, the CE mark has been a mandatory conformity marking for products sold in the European Economic Area. The CE mark indicates that a product conforms with essential health and safety requirements set out in European Directives.

But in recent years, one symbol has joined CE as the trusted symbols of safety: "Ex," better known as ATEX.



The "Ex" symbol, better known as ATEX, has been the recognized symbol for safety since the European Union made it mandatory in 2003.

Pumps with conductive materials help chemical plants avoid electrostatic discharge, one of the greatest hazards when handling dangerous chemicals.

ATEX

The ATEX directive is meant to protect employees as well as the surrounding communities from the risk of explosions. Deriving its title from the French *Appareils destinés à être utilisés en ATmosphères EXplosives*, ATEX consists of two European Union directives: one for the manufacturer (ATEX 95 equipment directive 94/9/EC) and one for the end-user (ATEX 137 workplace directive 99/92/EC).

In July 2003, the EU made it mandatory that organizations within the EU follow the ATEX directives. Equipment in use before July 2003 can still be used, although a risk assessment showing the equipment is safe is required. Equipment that falls under this mandate includes any machine, apparatus, fixed or mobile device, control component and instrumentation intended for the generation, transfer, storage, measurement and conversion of energy and/or processing of material that is capable of causing an explosion through the equipment's own potential sources of ignition.

Hazardous area atmospheres are classified into zones based on size, location and the likelihood of an explosion. Zones 0, 1 and 2 specify gas-vapor-mist, while zones 20, 21 and 22 specify dust. These classifications dictate that those properties be protected from sources of ignition. Zone 0 and 20 require Category 1 designation—the highest risk of an explosive atmosphere being present. Other categories are Zone 1 and 21, which fall into Category 2; and Zone 2 and 22, which require Category 3.

ATEX 95 directive 94/9/EC is designed to allow the free trade of ATEX-conformed equipment and protective systems within the EU by removing the need for separate testing and documentation for each member state. The regulation applies to all equipment intended for use in explosive environments, including electrical and mechanical. Equipment affixed with the "CE" marking and the "Ex" marking certify that piece of equipment can be sold anywhere within the EU without any further requirements being needed.

The most common areas where a potentially explosive atmosphere could exist include offshore oil platforms, petrochemical plants and mines, to name a few. There are three preconditions for the ATEX directive to apply. First, the equipment should be intended for use in a potentially explosive environment. It should be under normal atmospheric conditions and, finally, the equipment must have its own effective source of ignition.

Ignition Sources

The ATEX directive defines an effective ignition source as an event that—in combination with sufficient oxygen and fuel in gas, mist, vapor or dust form—can cause an explosion. There are various ignition sources that companies must take into account, including:

- Lightning strikes
- Open flames and hot gases
- Arcs and flashes
- Electrostatic discharges
- Electromagnetic waves
- Ionizing radiation
- Hot surfaces
- Mechanically generated sparks
- Optical radiation
- Chemical flame irritation

Electrostatic discharge, for example, is considered one of the greatest hazards when handling dangerous chemicals. In this process, static electricity is generated by surface friction when chemicals come in contact with other materials. Typically, this involves the product being moved or transferred through pipes, filters, mixers and/or pumps. Static electricity may accumulate in the liquid involving liquid hydrocarbons, in particular. This can lead to sparking in a flammable vapor-air mixture. Ignitable discharges can occur between an insulated or earthed conductive object, and a charged, insulated conductive or non-conductive object. Avoiding electrostatic discharge starts with selecting the right equipment to transfer those chemicals—equipment that meets the criteria of the ATEX directive.

A Pump's Role in Safe Chemical Transfer

Dr. Georg Baum is the owner of CTB-Chemical Technologies, a German-based company that supplies systems and solutions for the safe transfer of hazardous materials in chemical plants. As an authority on the subject of safe, ATEX-compliant chemical-transfer applications, Dr. Baum always stresses three important factors when selecting a pump for dangerous-chemical transfer.

"One important point is the compatibility of the material with the chemical," Dr. Baum said. "The second factor is, if we use solvents, for example, we must use the appropriate pump that won't cause an ignition. This means using pumps with electric conductive material. The third factor is suction capability."

One pump technology that meets that above criteria is ATEX-certified, solid-body air-operated double-diaphragm (AODD) pumps, which can be built using conductive plastic materials, and offers the material compatibility and strong suction that other pump technologies cannot. When selecting an AODD pump for a dangerous-chemicals application, consider the following:

Material Compatibility

Matching the proper pump to the materials being transferred starts with the housing. Pumps made of polyethylene (PE) have a better wear resistance than pumps made of polypropylene (PP), enabling the units to transfer highly abrasive chemicals. Polytetrafluoroethylene (PTFE) construction, on the other hand, provides the superior chemical resistance necessary in dangerous-chemical transfer. Operators should also focus on the materials of construction for a pump's internal components. Diaphragms made of EPDM, PTFE/EPDM-composite or NBR feature large diameters and short strokes with low flexural loads, which ensure uniform material delivery regardless of chemical properties.

Conductive Materials

Pumps with non-conductive housing materials are susceptible to electrostatic discharge. Static can accumulate in liquid being moved or transferred through a non-conductive pump, leading to sparking in a flammable vapor-air mixture. Pumps with conductive PE or PTFE housings are preferred in explosion-proof areas where there is the presence of flammable liquids. These conductive PE and PTFE housings enable pumps to meet ATEX requirements.

Strong Suction (Self-priming)

Totes or barrels of chemicals are often placed at ground level in protective cabinets with pumps situated on the top or to the side of these containers. Strong suction is imperative. AODD pumps, by their nature and design, provide suction sufficient to draw fluids from tanks regardless of location. Other technologies such as centrifugal pumps require fluid pressure into the impeller to create suction and flow.

Operators should also consider that AODD pumps also offer superior containment, shear-sensitivity and dry-run capabilities over other pump technologies:

Solid-body construction

Solid-plastic-block machining increases the pump's strength and life cycle while eliminating maintenance concerns. A CNC-machined solid block of PTFE or PE allows the pump to deal with the harshest environments. Plastic injection-molded construction, by comparison, deforms in harsh environments, creating a potential leak path whenever there is a temperature variation—regardless of how tight the bolts are. But with solid-plastic-block machining, there are no crevices where there can be a potential leak path. It is also more robust and the integrity of the material is stronger. CNC technology also enables tight tolerances, along with reduced vibration and greater stability and durability.

Containment

Another important consideration when selecting a pump that will effectively handle and transfer dangerous chemicals is containment. Mechanicals seals found in centrifugal pumps, progressive cavity pumps and gear pumps can be prone to failure. Seal failure can lead to bearing failure, which means costly downtime and unscheduled maintenance. The safest way to avoid seal failure and avoid product contamination is by simply taking the seal out of the equation. AODD pumps are free of mechanical seals and are designed so the diaphragm actually acts like a seal. When matched with materials that are appropriate to the type of chemical being pumped, the seal area acts as a gasket, which is not subject to wear from shaft friction.

Dry-run

Friction can lead to static discharge, which, in turn, creates a dangerous environment. When handling chemicals, operators will continue to operate the pump even after the chemical has been depleted in order to more fully clear the lines. This is known as running dry. When certain pump technologies run dry, their components can burn and seize, creating a very dangerous situation when hazardous chemicals are involved. AODD pumps are designed to run dry. When the fluid is depleted, they pump air with no damage to the pump internals.

Shear-sensitivity

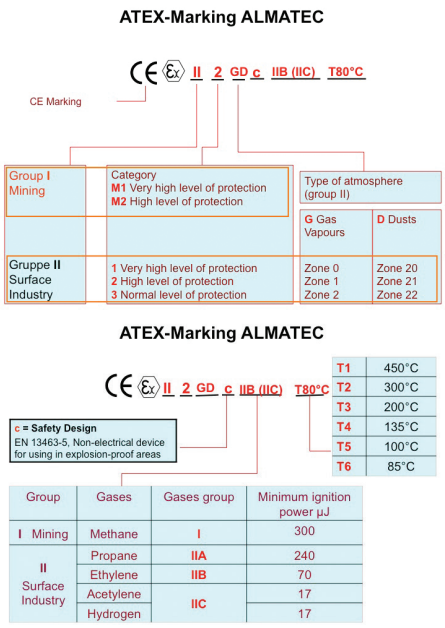
Pumps that have a propensity for shearing or damaging the product typically have meshing teeth or introduce the fluid to multiple moving parts. When transferring dangerous chemicals, it's critical to provide gentle handling in order to eliminate any change to the chemical properties. AODD pumps are considered one of the gentlest pumping technologies available because the fluid is simply drawn into a chamber and then pushed out with no contact to moving parts.

Deadheading

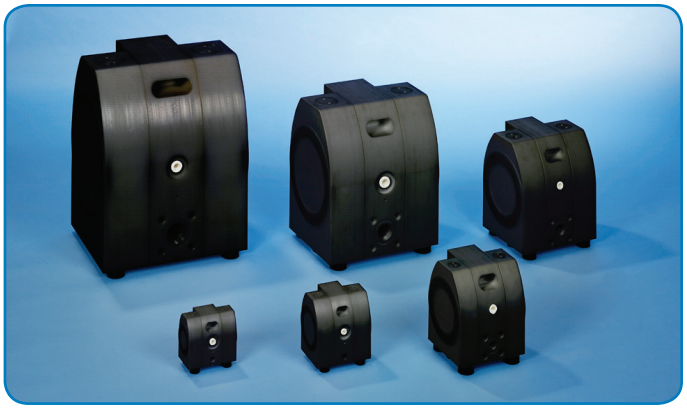
Many chemical applications require accurate flow rates to maintain the consistency and quality of the product. To maintain this consistency, valves on the discharge side of the pump are used to close swiftly, thereby interrupting the product flow. This creates a jolt to the pump, also known as deadheading. AODD pumps are designed to handle such start-and-stop deadhead conditions without any adverse effects to either the product or the pump.

Almatec® E-Series AODD Pump

One pump that meets all of the above criteria is the E-Series AODD Pump from Almatec®, Kamp Lintfort, Germany, part of Pump Solutions Group (PSG®). The E-Series features housing constructed of PE, PTFE, PE conductive and PTFE conductive. The PE conductive and PTFE conductive E-Series pumps meet the requirements of the ATEX 94/9/EG directive (see right).



For use in device group IIC without additional protection measures, E-Series Plastic AODD Pumps also feature electrically conductive PTFE diaphragms to provide safer transfer of chemicals while avoiding dangerous electrostatic discharge. E-Series pumps continue pumping even after the chemical has been depleted. By comparison, other pumps require operators to insert nitrogen, water or carbon dioxide once the fluid transfer has been completed to avoid potentially dangerous electrostatic discharge. E-Series AODD Pumps simply pump air with no damage to the pump internals. Almatec's diaphragms have a large diameter and short stroke with low flexural load, ensuring uniform product delivery regardless of the material used for the diaphragm's construction. The EPDM diaphragms are conductive as standard.



Almatec® E-Series AODD Pumps provide the material compatibility, strong suction and conductive materials that ATEX-compliant chemical-transfer expert Dr. Georg Baum stresses as being critical in the safe movement of dangerous chemicals.

The E-Series is available in seven sizes from 6 to 76 mm (1/4- to 3-inch) with maximum temperatures to 120°C (248°F). The pump features maximum flows to 800 L/min (210 gpm); suction lift to 5 m (16.4 ft) dry, 9.5 m (31.2 ft) wet; and maximum solids size to 15 mm (9/16-inch).

Conclusion

Chemical plants have a strong responsibility to take every necessary precaution to protect their employees, as well as the surrounding communities. Over the past half-century, legislation has been put in place due to a number of preventable chemical accidents. While adhering to these rules remains mandatory, chemical companies need to consider installing ATEX-conformed equipment as standard, despite it only being required in the EU. ATEX is widely considered the accepted symbol of safety, and utilizing ATEX-rated pumping equipment, such as the E-Series AODD Pump from Almatec, can provide operators with the peace of mind they need when working in potentially dangerous environments.

About the Author:

Edison Brito is the Director, Global Segment Marketing - Chemical with Pump Solutions Group (PSG®). He can be reached at edison.brito@psgdover.com. Almatec®, Kamp-Lintfort, Germany, is one of the world's leading manufacturers of air-operated double-diaphragm (AODD) pumps and is an operating company within Dover Corporation's Pump Solutions Group (PSG®), Oakbrook Terrace, IL, USA. PSG is comprised of several of the world's leading pump brands including Abaque®, Almatec®, Blackmer®, Griswold™, Neptune™, Maag, Mouvex®, Quattroflow™ and Wilden®. You can find more information on Almatec at www.almatec.de and PSG at www.psgdover.com.