

How to prevent leakage or environmental damage

IECEx-certified pigs essential in pipeline maintenance

By Claire Marchand

Pipelines are widely used throughout the world to transport oil, gas and other fluids over long distances and across continents. They are frequently subjected to extreme climatic conditions and huge temperature variations that can cause serious damage to the outer shell. This is why companies operating these lines use preventive methods to detect clogging or worse, cracks and flaws that can have disastrous consequences.

Pipeline pigging

One of these detection methods is called pipeline 'pigging'. It uses devices known as 'pigs' to perform maintenance operations on a pipeline without stopping the flow of fluid.

Why pigs? Interpretations differ on why these maintenance devices are named

pigs. Some allege that pig is an acronym for 'pipeline inspection gauge' or 'pipeline intervention gadget'; others affirm that the original pigs, made of straw wrapped in wire, and used for cleaning, made a noise similar to the squealing of a pig when traveling through the pipe.

Introducing smart pigs

There are several types of pigs, from the foam pig, driven through the line to measure its inner diameter, clean it or dry it, to the inline inspection pigs, including smart pigs, that can check various aspects of the pipeline.

The first intelligent pig, operated by Shell Development in 1961, could measure and record the thickness of the pipeline walls. It used electromagnetic fields (EMF) to sense wall integrity. In 1964, Tuboscope ran the first commercial instrument that used magnetic flux leakage (MFL) technology to inspect the bottom portion of the pipeline. The system used a black

box similar to those used on aircraft to record the information.

Modern smart pigs are highly sophisticated instruments that include electronics and sensors that collect various forms of data during their trip through the pipeline. They vary in technology and complexity depending on their intended use.

The electronics elements within the pig are sealed to prevent leakage of the pipeline fluid, which range from highly basic to highly acidic and can be of extremely high pressure and temperature. Power for the electronics is typically provided by on-board batteries which are also sealed.

Disaster prevention

The technology used varies according to the task required and the design of the pig. Surface pitting and corrosion, cracks and weld defects in steel or ferrous pipelines are often detected using MFL pigs. Other smart pigs use electromagnetic acoustic transducers to detect pipe defects. Caliper pigs can measure the roundness of the pipeline to determine areas of crushing or other deformations. Some smart pigs use a combination of technologies, such as providing MFL and caliper functions in a single tool. Pigs using acoustic resonance technology have been tested as well.

While in operation, the pig is unable to directly communicate with the outside world due to the distance underground or underwater and/or the materials that the pipe is made of. For instance,



A pig on display in a section of cutaway pipe, from the Alaska Pipeline (Photo: Harvey Barrison, Wikimedia)

CONFORMITY ASSESSMENT



Smart pigging is carried in gas pipelines to measure thickness faults and dents (Photo: Gaznat)

steel pipelines effectively prevent any significant radio communications outside the pipe. The pig records its own movement during the trip. This may be done by odometers, gyroscope-assisted tilt sensors and other technologies.

Surface instruments equipped with sensors, which often have GPS capability, record and transmit time and location of the pig by either audible, magnetic or radio-transmission means. The pig itself cannot use GPS as the metal pipe blocks satellite signals.

After completion of the pigging run, data from external sensors is combined with the pipeline evaluation data from the pig to provide a location-specific defect map and characterization. The data collected provides information on the location and severity of the defect, thus allowing repair crews to act quickly. Performing regular pigging runs within a pipeline helps identify and repair defects at an early stage, before any leakage or environmental damage occurs.

Protection requirements...

As many of these pigs are used in oil or gas pipelines, it is of the utmost importance that they are designed and built in compliance with the very strict requirements enunciated in standards and specifications, most notably in IEC International Standards developed by IEC Technical Committee (TC) 31: Equipment for explosive atmospheres.

As part of its IEC 60079 series of International Standards on explosive atmospheres, TC 31 has developed several International Standards that cover general and testing requirements for several types of pigs, including magnetic or ultrasonic pig signallers, pig tracking systems and pig intelligent systems.

They include:

- IEC 60079-0:2011, *Explosive atmospheres – Part 0: Equipment – General requirements*
- IEC 60079-1:2014, *Explosive atmospheres – Part 1: Equipment protection by flameproof enclosures “d”*
- IEC 60079-11:2011, *Explosive atmospheres – Part 11: Equipment protection by intrinsic safety “i”*
- IEC 60079-26:2014, *Explosive atmospheres – Part 26: Equipment with Equipment Protection Level (EPL) Ga*

...tested and certified by IECEx

As is the case for any product, designing and building pigs in compliance with IEC Standards is not enough. To prove that a pig meets all the requirements spelled out in Standards and can be used in explosive (Ex) areas, it has to go through testing and certification.

This is where IECEx, the IEC System for Certification to Standards Relating to Equipment for Use in Explosive Atmospheres, intervenes. An IECEx Certificate is like a passport for manufacturers of Ex equipment.

It provides clear proof of claimed compliance with International Standards. It certifies that the equipment in question has the right level of protection. It provides assurance that products bearing an IECEx Certificate conform to the International Standards listed on the same Certificate.

Highly-skilled staff

To assess and certify individuals working in potentially hazardous areas, IECEx has developed the IECEx Certification of Personnel Competence Scheme.

The IECEx CoPC (Certificate of Personnel Competence) provides companies with independent proof that the certificate holder has the required qualifications and experience necessary to work on electrical equipment located in hazardous areas and can implement IEC International Standards covering explosive atmospheres. This can be especially important for contracting staff.

Manufacturers who rely on IECEx for the testing and certifying of their equipment, who have their staff go through the steps necessary to obtain a Certificate of Personnel Competence, have that additional level of security that makes a real difference. They know that they operate in the best possible conditions and minimize the risks inherent to Ex sector.

All IECEx Certificates are issued via the IECEx On-Line certificate System. Full public view is available on the IECEx website at www.iecex.com



Different types of pigs (Photo: Fraser Engineering)