



PIG TRACKING
A REVIEW OF EXISTING TECHNOLOGY

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‘Pig Tracking’ is used as a generic term to cover any requirement to monitor the movement or locate the position of pigs during the pigging operation.

This generic term can in some cases cause confusion, and the PPSA (Pipeline Pigging and Services Association) has endeavoured to be more correct and specific.

DEFINITIONS

The Pigging Products and Services Association has published the following definitions.

- **PIG SIGNALLING** is a method of indicating when the pig has reached a certain point in the pipeline. This is usually achieved by attaching a triggering device or ‘signaller’. This may be activated by the pig physically moving a lever or a plunger, which protrudes, into the line (referred to as intrusive), or by remotely sensing the pig’s presence from outside the pipe wall by, for example, a change in the magnetic field. This is usually referred to as a non-intrusive signaller.
- **PIG LOCATING** is a method of determining the position of a pig, normally when it is stationary, and usually due to it being either held up (due, perhaps, to low flow conditions), or stuck (due to damage or obstruction). This normally requires the pig to carry a transmitter device of some kind and a receiver to be carried along the line to locate it.
- **PIG TRACKING** is a method of literally following the path of a pig either continuously or, more likely, by locating it at a series of predetermined points. This can be achieved by various methods including transmitter/receiver systems, mass balance via computer calculations, and by acoustics.

PIG SIGNALLING

Pig signallers are required at the very least at the exit and entrance to the pig traps.

Traditionally these have been mechanical devices, which flip up a flag when the pig actuates a pressure or mechanical sensor during its passage. They have the disadvantage that they need to be well maintained and need reset prior to the passage of the next pig.

Non intrusive signallers – i.e. those which do not require any interference with the pipe integrity are now the preferred method and indeed are the only feasible method for subsea use.

SUBSEA SIGNALLING

Detectors based on radiation and magnetism are now in common use. A magnet or radioisotope ‘bomb’ is placed in the pig and the receivers mounted at the relevant subsea locations. With magnetic systems e.g. Nautronix Model 6390 Magnetic Signaller the detector is normally strapped to the pipe thus allowing an operator on a platform or vessel to ‘listen’ for the pig passage.

A diver held receiver normally detects radioisotopes.

Notes:-

1. Radioisotopes are often given bad press. The level of radiation required for detection is very small but HSE and operator safety requirements generally mean trained operators, which may increase operational costs, must use such systems.
2. It is very important when sourcing a non-intrusive signaller to provide the supplier with as much information as possible on the pig and pipeline e.g. material, thickness, weight coat, space for magnets etc.
3. Magnetic detectors subsea can be combined with pingers to provide remote sub sea signalling
4. Eexd versions can be provided.

This will ensure the correct amount and grade of magnets or source can be recommended to ensure correct detection.

PIG LOCATION

To locate a pig – normally when it gets stuck, it is necessary to mount a transmitter of some sort in the pig. There are four possible types of transmitter each with advantages and limitations.

ACOUSTIC PINGERS

Pingers are the most common and cost effective method of pig location in subsea lines. Units are generally activated by a through water contact and can be provided with battery life up to 90 days. Different frequencies are available e.g. Nautronix Model 2475, 248X and 2434. Detection is by a pinger receiver (6120B) with vessel transducer or ROV antenna (6555) diver held units are also available (6280).

Advantages

- Cheap
- Large detection range – up to 2km
- Can listen from vessel
- Accurate location using diver or ROV units 5-10m
- Different frequencies available (e.g. for pig trains)
- Long battery life (up to 90 days)
- Can use 'call pingers' if wet lay down required

Disadvantages

- Not suitable for gas lines
- Will not work in multi-layer or dual pipe, and in burial

Note: Call pingers lie in dormant mode until activated, thus preserving the battery life.

ELECTROMAGNETIC

Generally used for land pipelines and increasingly for gas, coflexip and buried lines. The transmitter creates and collapses an electromagnetic field.

Advantages

Cheap
Can be detected through earth (burial) 5 - 6m
Highly accurate – position to 2cm possible
Very small units being developed – down to 5cm dia

Disadvantages

Short range 5 – 6m
Shorter battery life 400hrs (specials to 1600hrs)
Transmitter must protrude from pig (space in receiver)
Only one frequency
Slow detection – need to walk/along line, or use an ROV on subsea lines

Note 1: Nautronix 6385/6751 combination is the only one in the market suitable for subsea use.

Note 2: The Model 6385 receiver can also be used as a pig signaller.

Note 3:- Subsea signaler and Exd variants are available

RADIOISOTOPES

Can be used in gas or fluid, land or sea. The transmitter is a radioisotope and the detector a 'guiger counter'.

Advantages

Accurate – 2cm
Can be detected through some burial
No electronics in pig
Very small size

Disadvantages

Can cause logistic problems
Generally expensive as need operator
Can not generally separate frequencies
Short range 10m or so therefore need diver or ROV

PIG TRACKING

Pig Tracking can either be achieved by continuously following the pig or 'tracking' its progress passed fixed points. This methodology can considerably reduce search times on long lines and is particularly common on landlines.

All the available technologies can be utilised.

ACOUSTIC PINGERS

The same advantages and disadvantages as location.

ACOUSTIC EARS

These units listen for the passage of the pig and generally graph the passage

Advantages

Simple units

Claim to give information about debris in front of pig

ELECTROMAGNETIC

The same advantages and disadvantages as location.

RADIOISOTOPES

The same advantages and disadvantages as location.

MAGNETIC

The transmitter in this case is a magnet

Advantages

Cheap

Accurate 5 – 10 cm

Disadvantages

Short range

Can not be used dynamically

ACOUSTIC TRANSPONDERS

Generally only used with pig trains on long lines. The only system, which can continuously follow pigs in subsea lines. The transmitter replies to an interrogation command from a surface unit. Replies on different frequencies or with different codes to distinguished different units.

Advantages

Large detection range – up to 2km

Can be interrogated from vessel

Very accurate 1 – 2m possible

Range measured can monitor pig separations

Different frequencies available

Interrogation is from boat not diver but same accuracy

Disadvantages

More expensive than pingers

Interrogator expensive and may need operator

Requires vessel to 'follow' pigs

Battery life generally less than pingers

GENERAL POINTS

a) Acoustic Tracking

Do you need a pinger or a transponder?

Transponders = continuous tracking

Pingers = location once stuck

See previous advantages and disadvantages

- b) Mounting of the pinger/transponder in the pig is very important as the transducer (the cap) needs to be in the fluid and ideally not covered.
- c) The type of the pipeline is also important. Acoustic power is reduced each time it crosses an interface. Coflexip and dual pipes are therefore not a good medium for acoustics. Electromagnetic systems should be used in these circumstances.
- d) Electromagnetic transmitters need to be mounted with the transmitter protruding from the body, as the steel body will shield the signal. There are therefore implications for pig trains and traps.
- e) Pingers are generally activated by a through water contact i.e. they are off until there is fluid in the line.
- f) Transponders have to be manually activated and are then in a listening mode. They are therefore less suitable where there is a delay between laydown and commissioning.
- g) In wet laydown situations it is possible to utilise call pingers. These units lie dormant in a listening mode until they receive an acoustic command, which activates them to start pinging.
- h) If the transmitter is to be in a crude, chemical or sour gas environment, special compounds may need to be used in the manufacture. Prices and delivery will therefore be affected.

**PIG TRACKING ENQUIRIES
CUSTOMER SPECIFICATION CHECK LIST**

CUSTOMER..... CONTACT.....
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PROJECT DETAILS.....
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Pipe Diameter

Wall Thickness

Coating Type

Subsea/Surface

Buried Yes/No

Burial Depth

Water Depth

Wet/Dry Laydown

Medium Water/Oil/Gas

Pig Type

Uni/Bi Directional

Time in Trap

Ping Time Required – Battery Life

Number of pigs in Trap

Range of Frequencies