High Pressure Gas Pipelines: Construction Methods & Infrastructure

Survey and Fencing

The pipeline route is surveyed and any existing fencing is modified to facilitate access during construction. The initial survey collects information which will be used to refine the design of the pipeline.

Setting Up Work Areas

Prior to construction, crews are required to prepare work areas for machinery such as dedicated pipe lay down yards along the pipeline route, construction material stockpiles, and areas for trenchless construction and horizontal directional drilling.

Clear and Grade

This stage involves preparing the pipeline easement to allow construction activities to commence. Graders, bulldozers and excavators are generally used to clear vegetation and prepare the easement ready for construction to commence. This includes any additional temporary work areas that the pipeline company wants to use as well.

The combined easement and additional work area is commonly referred to as the construction right-of-way (ROW). Any vegetation and topsoil is removed from the construction ROW and stockpiled separately.

Stringing

Pipe is transported to the easement and laid end to end next to where the trench will be dug.

Bending

Where required, specialized machinery is used to bend the pipe to conform with the contours of the land and the pipeline route.

Welding and Non-destructive Testing

Pipe sections are welded together. All welding is tested to ensure quality.

Trenching

Specialised trenching machines and excavators, rock saws and blasting are then used to dig the trench.

Lowering In and Padding

Specialist equipment (side booms) are used to lower the pipe into the trench. The pipe is then covered by fine grain material (padding) to protect the pipeline coating from stones or other sharp objects.

Backfilling

The trench is backfilled with the previously excavated subsoil material. In rocky terrain, further sand padding is used to protect the pipeline.

Hydrostatic Testing

Using water, the pipe is pressure tested (hydrotested) to ensure it is fit for operational service. Hydrotesting involves filling the pipeline with water and pressurising and sustaining pressure for a period of time, testing it for strength and leak tightness. The exact sequence of the pipeline hydro testing is dependent on the construction sequence. Once the installed pipelines have successfully passed the hydrostatic pressure test, a process of dewatering and drying are conducted prior to the final tie-ins of the completed system. Following a sequence of engineering and safety checks, gas will be introduced to pressurise the system.

Installation of Above Ground Infrastructure

With all gas pipelines there are a number of associated above ground facilities, including pigging stations, valve stations and connection points (to other pipelines and facilities); perimeter security fences, security and service lighting, and signage; installation of communication and telemetry towers; installation of cathodic protection devices; and construction of pipeline corridor access tracks.

CATHODIC PROTECTION SYSTEM

To protect pipelines from corrosion an impressed current cathodic protection system would be installed at a typical spacing of 60 km along the pipeline. Each cathodic protection station comprises an array of anodes buried in the ground and connected to an above ground solar powered transformer rectifier, located in a cabinet. The transformer rectifier is connected to the pipeline using buried cabling. The choice of ground bed type and size depends on the location and soil resistivity. Test points for potential corrosion measurement are usually installed every 5 km along the length of the pipeline.

MAIN LINE VALVES

Main line valves are installed as a means to isolate the pipeline into segments for maintenance, operation, repair and for the minimisation of gas loss in the event that pipeline integrity is lost. Once isolated, the gas from the relevant section may be vented prior to incident investigation and/or maintenance taking place.

Each main line valve site would comprise the following components located within a fenced compound; above ground pipework and automated mainline isolation valve with gas over oil actuator, pipeline blowdown vent, remote terminal unit, self-contained solar power supply and satellite communications, cathodic protection unit, ground bed and test points

COMPRESSOR STATIONS

Gas pipelines typically have a compressor station at the origin and where they enter other pipelines. They comprise gas compression infrastructure, various filtration and separation equipment used to remove liquids and impurities to ensure gas meets the specifications for delivery into the receiving pipeline. Infrastructure would be of varying heights with flare stacks up to 50m. Flare systems operate with a permanent pilot flame. The flare and pipeline vent systems would be designed for release of gas during commissioning, periodic testing, variations in incoming gas and in emergency situations. Compressor stations occupy about 10 hectares of land.

SCRAPER, RECEIVER AND LAUNCHER STATIONS

These are used to launch and retrieve devices, typically called ‘pigs’, that perform a range of maintenance functions, including but not limited to inspection and cleaning.

FLARES

Flaring is the process of intentionally burning the product within a natural gas pipeline, a valve is opened on a stack attached to the pipeline and lit with a pilot flame. Gas pipelines typically have flare points at 50 km intervals and are used during maintenance procedures

Restoration & Signage

Disturbed areas are reinstated to match existing contouring and installation of permanent erosion control structures. Topsoil conserved during the construction process is re-spread over areas used for construction.

PIPELINE MARKING

Pipeline marker signs would be installed along the length of the pipeline to indicate the location of the pipeline, its description and the name and contact details of the operator.

Additional signs will be installed at: either side of public roads and watercourse crossings; one side of vehicle tracks and minor watercourse crossings; all fence lines; all direction change points; utility crossings; facility points; property boundaries. Aerial marker signs are typically installed at 1 to 10km km intervals to allow identification from aerial patrol.

Additional infrastructure

Other infrastructure will include pipeline corridor access tracks, security and service lighting and communication and telemetry towers.