

COAL SEAM GAS DRILLING AND WELL INTEGRITY

This factsheet contains information on Origin’s Coal Seam Gas drilling and well integrity activities. It includes information on cement and casing design, well design, completion, integrity and abandonment.

Drilling

A well is created by drilling a hole in the earth with a drilling rig. The rig rotates a drill string with a bit on the end of it. After the hole is drilled to the required depth, steel casing of a slightly smaller diameter than the hole is installed. Cement is then placed in the annular space between the casing and the borehole wall. The casing and cement provide structural integrity for the well and isolate formations in the earth from each other and from the surface. If the well must be drilled deeper it can be done safely by using smaller bits and casing that fit inside the casing previously installed. Additional barriers, valves and seals, called a wellhead, are also added at the surface to maintain control of the well.

In the case of Coal Seam Gas wells there are typically two cemented strings (surface casing, and production casing). The surface casing is always cemented back to the surface and the production casing is cemented from the total depth to inside the surface casing as a minimum. See Figure 1.

Cementing of casing

The cement used in drilling and completions is very much like the cement used in typical construction activities. The biggest difference is the grade of the cement is more closely controlled to ensure the set-up time is consistent. Cement has very low permeability, not allowing fluids to move through it, so it forms an effective barrier in the well. Cement is pumped down the inside of the casing to the bottom of the well where it exits and then travels up the annular space between the formation and the casing. Once the cement has been pumped in place it hardens, isolating formations from each other and from the surface. Centralizers are devices placed on the outside of the casing while it is run into the hole. They keep the casing in the centre of the well, ensuring that a uniform volume of cement surrounds the casing. Cement also prevents exterior casing corrosion that could occur over time if the casing were exposed to formation fluids.

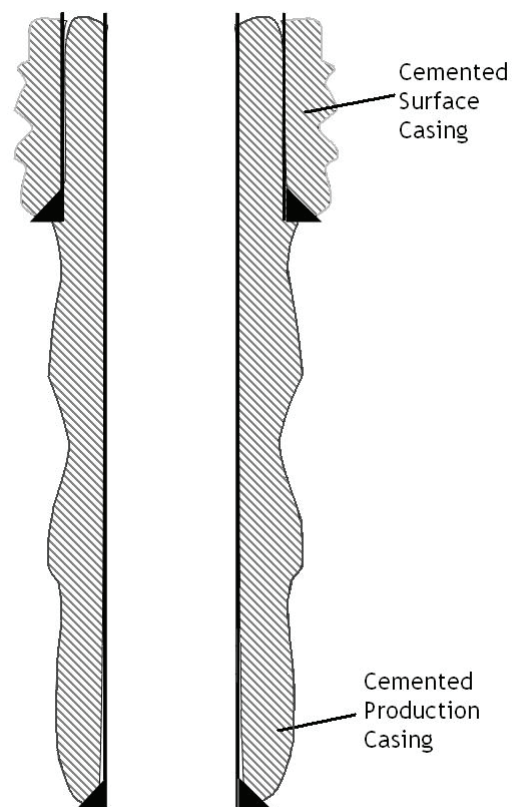


Figure 1

Casing Quality

All casing and tubing used in Origin’s oil and gas operations are manufactured to American Petroleum Institute (API) 5CT requirements. This sets minimum standards for manufacture and testing. It also sets minimum performance properties for API grade casing and tubing (burst, collapse and tension). Using these casing specifications allows each well to be designed so that the well can be operated safely for its entire producing life.

Well Completion

The completion process connects the well to gas and water in the formation, allowing formation fluids to be brought to the surface in a safe and controlled manner. The first step in the completion process is to ensure the well has integrity by conducting a casing pressure test. If a well is to be hydraulically fractured, a cement bond log is also run to confirm isolation between any zones that would be fractured and formations above or below that zone. Once the well is confirmed to have integrity, completion operations can begin. For Coal Seam Gas fields there are two main completion types: pre-perforated and hydraulically fractured. For both completion types the well is tested for water and gas rates and then a tubing string is installed and hung off in the wellhead. Finally, additional valves are placed on the wellhead depending on the well characteristics, whether free flowing or pumping. This additional equipment will eventually be connected into surface equipment and pipelines.

Tubing is very different from casing (which is permanently installed in a well). Tubing is designed to be replaceable. During the life of the well various workovers may be required to reconfigure the well so that it will continue to produce reservoir fluids. During production of water and gas, reservoir pressures decline. This means it may be necessary to change production equipment later in the life of a well to ensure it is capable of producing fluids to surface. See Figure 2.

Well design

During the drilling process, two barriers are maintained at all times to prevent the release of formation fluids from the wellbore. The primary barrier is the drilling fluid. This fluid exerts a pressure which is higher than that of the formation in which reservoir fluids lie, thus keeping the fluid within the formation. The second barrier is the blow out preventer (BOP). The BOP is located at the surface and consists of a series of large valves which can be closed to control the well in the event formation fluids enter the wellbore.

During the completion process, BOPs are also used to ensure formation fluids are controlled. When a well is completed, formation fluids are allowed to enter the wellbore in a controlled manner so that the final completion design can be selected based on water and gas rates. Mechanical barriers including floats and BOPs are always maintained to ensure the produced fluids can be controlled. Once the well is completed the well design provides multiple barriers that prevent fluids from moving between formations or coming to the surface. The primary barriers are the casing and cement. The cement isolates formation fluids from moving behind the casing or from coming to the surface. The casing design is engineered using safety factors and provides a pressure-tested steel conduit that will allow the gas and water to be produced safely. The wellhead provides additional barriers at the surface. See Figure 3.

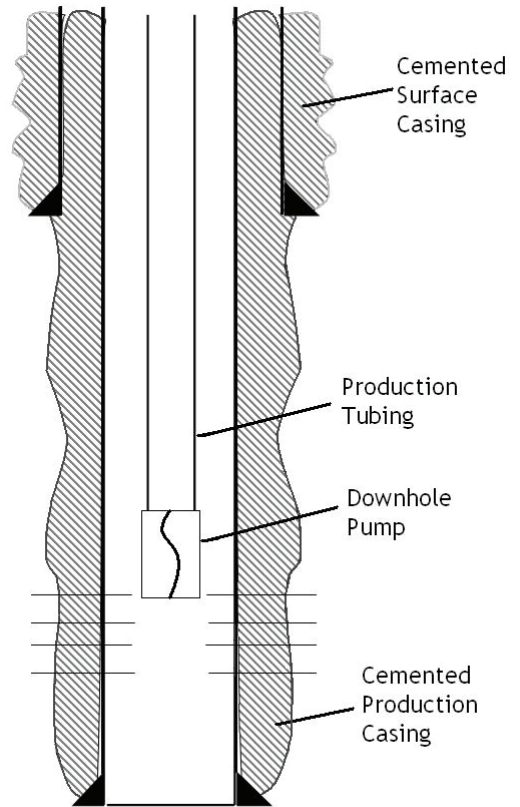


Figure 2

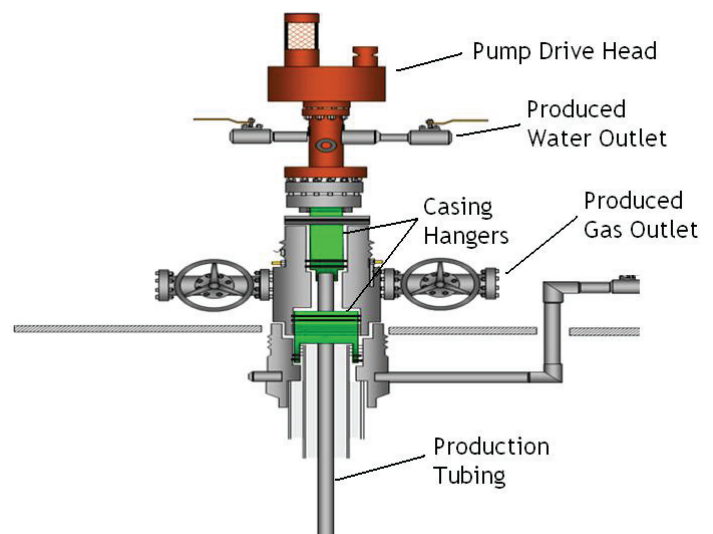


Figure 3

Components in wells are designed, manufactured, and/or tested according to published standards or recommended practices. These include:

Component	Standard
Casing and tubing	International Organisation for Standardisation (ISO) 11960:2004 / API Spec 5CT
Wellheads	Design, manufacture, testing - API Spec 6A
Blow out preventer	Compliance - ISO 13533:2001 / API Spec 16A
Cement	Design - ISO 10426-1:2000 / API Spec 10A Testing - ISO 10426-2:2003 / API RP 10B-2
Well construction	API RP 65 and API Guidance Document HF-1

Ensuring the well's integrity

In coal seam gas wells, all casing strings are cemented to provide formation isolation. If for any reason cement does not return to the surface during pumping operation, other means of evaluation must then be used to ensure formations are properly isolated prior to moving on to the next operation. Casing strings and all wellhead seals are also tested to ensure there are no leaks prior to completing an operation. During a well's life the operations team does regular checks on the well to ensure integrity is maintained.

Well abandonment

Well abandonment occurs when the well is no longer productive. The life of a well is generally around 20 to 30 years. At abandonment the well is plugged with cement to ensure all formations are isolated from each other. The cement ensures the well's integrity and maintains isolation from other zones. The plug and abandonment procedure complies with all Australian regulations.