A connection is a mechanical assembly that joins two or more pipes together to form a string. The connections are mainly related to “threads” and all the connections in OCTG pipes have a pin and a box.

If we had one single and continuous pipe long enough to reach the required depth of the well from the surface, there would be no need for connections. However, due to practical restrictions and manufacturing limitations the pipes must be produced within a specific length range. And those pipes must be made up together through connections.

**Thread profile:** this is the shape of the thread itself.

**Metal seal:** this is the area of high-pressure contact between the pin and the box that provides sealability, and prevents gas leakages.

**Shoulder:** this is the area inside the box where the nose of the pin touches and is in full contact with it.

**Outside diameter:** this is the external diameter of the connection. This diameter is usually different from the external diameter of the pipe body.

**Efficiency:** this is the relationship between the performance of the connection and the performance of the pipe body multiplied by 100 and expressed as a percentage. The connections, together with the pipes, behave like the links in a chain.

The performance of the connection is related to its tension, compression, internal pressure (burst), external pressure (collapse) and torque. When we say that a connection is more than 100% efficient in tension, we are stating that the connection has a tension performance that is higher than the pipe body performance. If we pull out the string, the pipe body will break but the connection will remain intact. On the other hand when a connection is less than 100% efficient in tension, then the pipe body is more resistant than the connection. Therefore, the connection is the weakest point of the string and if we pull out the string, the connection will break.

The thread profile has different characteristics such as the load flank, which is the one that supports the weight of the string inside the well; the stabbing flank, which is required to allow the pin to enter the box in a smooth way; and the crest and root which are the peaks and valleys of the threads.
Sealability is assured through the seal interference. The connections are manufactured in such a way that the OD of the pin is a little bit bigger than the Internal Diameter of the box. When both parts are made up together, they deform elastically until an balance is reached; the pin is shrunk and the box is expanded. These deformations are always within the elastic limits, this means, when the connection is broken out, both pin and box recover their original shape. Such deformations never reach plasticity.

Another characteristic of the threads is the taper. This represents the change of the thread diameter over a given length and is calculated by:

$$Taper = \frac{D_2 - D_1}{L} \times 100\%$$

Where D1 is the smallest diameter, D2 is the biggest diameter and L is the length of the threads.

Continuing with the thread characteristics, another parameter is the stand-off, but to better understand this concept, we need to explain first what the hand tight and the power tight positions are.

When we make up the connection by hand until the external surface of the pin comes into contact with the internal surface of the box, we have what is known as a hand tight position. Let’s identify the distance from the nose of the pin to the center of the box with the letter ‘A’. If we continue making up the same connection until the required torque is achieved, we will reach what is known as a power tight position. And following the same nomenclature, we can identify this new distance from the nose of the pin to the center of the box with the letter ‘B’. The stand-off is defined as the difference between ‘A’ and ‘B’.
The first connections used in the oil and gas industry followed the API standards, particularly API Spec 5B titled ‘Specification for Threading, Gauging and Thread Inspection of Casing, Tubing and Line Pipe Threads’. These connections are known as API connections and according to the profile of their threads, they may be ‘Round Thread’ or ‘Buttress’.

Manufacturers began to design new connections that exceeded the API requirements. Those new designs belong to each manufacturer and they are known as Premium Connections.

Premium Connections are proprietary, meaning that each manufacturer has its own designs, intellectual property rights and product exclusivity. From 2002, the most used standard to qualify premium connection is ISO 13679 ‘Petroleum and Gas Industries – Procedures for Testing Casing and Tubing Connections’.

Finally, there is another type of connection for some specific applications known as Connectors.