

### Carbon Steel

Description	O&G Categories	Other Applications	Grades	Major Producers
Carbon steel is the most widely used type of steel. Typically carbon steel comprises of up to 2.1% carbon along with small quantities of manganese, and other metals such as phosphorus, sulfur and silicon. Carbon steels typically have good tensile and yield strength, are ductile and durable. As carbon content increases the steel get stronger and harder however becomes less ductile with lower weldability.	<p>Most widely used type of steel. Often used in large structures due to its strength and cost. Used also where corrosion is not a major concern. Common areas:</p> <ul style="list-style-type: none"> <li>• <a href="#">OCTG</a></li> <li>• <a href="#">Structural Components</a></li> <li>• <a href="#">Platforms &amp; Jackets</a></li> <li>• <a href="#">Valves</a></li> </ul>	<p>Most widely used category of steel across the globe. O&amp;G applications make up only a small fraction of the global demand. High demand areas include:</p> <ul style="list-style-type: none"> <li>• Construction</li> <li>• Infrastructure</li> <li>• Heavy Industry</li> <li>• Consumer Goods</li> <li>• Automotive</li> </ul>	<p>X65 L80 S355 S275</p>	<p>Arcelor Nippon Steel &amp; Sumitomo Metal Hebei Iron &amp; Steel Baosteel</p>

### Stainless Steel

Description	O&G Categories	Other Applications	Grades	Major Producers
The most common stainless steels contains at least 10.5% chromium as well as quantities of nickel. Known as austenitic stainless steel due to its microstructure, the addition of chromium creates a “passive layer” of chromium oxide giving the steel its stainless and corrosion resistive properties. Other metals molybdenum, may also be used to enhance the steel’s properties.	<p>Use when requiring high ductility, wide temperatures and corrosion resistance required. Common areas:</p> <ul style="list-style-type: none"> <li>• <a href="#">OCTG</a></li> <li>• <a href="#">Valves</a></li> <li>• <a href="#">Wellhead &amp; X-Mass Tree</a></li> <li>• <a href="#">Pressure Vessels</a></li> <li>• <a href="#">Pumps</a></li> </ul>	<p>O&amp;G demand represents on a small fraction of total demand. Major areas of demand include:</p> <ul style="list-style-type: none"> <li>• Catering</li> <li>• Medical</li> <li>• Infrastructure</li> <li>• Construction</li> <li>• Transport</li> </ul>	<p>302 304 316</p>	<p>Outokumpu POSCO Shanxi TISCO YUSCO Baosteel</p>

## Duplex Stainless Steel

Description	O&G Categories	Other Applications	Grades	Major Producers
<p>Duplex stainless steels are known as “duplex” due to their microstructure, roughly 50% austenite and 50% ferrite grains. This is created through lower levels of nickel than austenitic stainless steel.</p> <p>Duplex stainless steels are very strong, with high corrosion resistance and stress corrosion cracking properties.</p> <p>Duplex typically contains less nickel and molybdenum hence may be cheaper where alloy prices are high.</p>	<p>Use when requiring higher strength, lower weight, corrosion resistance and stress corrosion cracking resistance. Common areas:</p> <ul style="list-style-type: none"> <li>• <a href="#">OCTG</a></li> <li>• <a href="#">Pressure Vessels</a></li> <li>• <a href="#">Wellhead &amp; X-Mass Tree</a></li> <li>• <a href="#">Pumps</a></li> <li>• <a href="#">ESP</a></li> </ul>	<p>O&amp;G demand represents on a small fraction of total demand. Major areas of demand include:</p> <ul style="list-style-type: none"> <li>• Bridges</li> <li>• Swimming pools</li> <li>• Storage &amp; Transportation</li> <li>• Desalination plants</li> </ul>	<p>2205 2507</p>	<p>Outokumpu Sandvick JFE Steel</p>

## Engineered Steel

Description	O&G Categories	Other Applications	Major Producers
<p>Engineered steel or special bar quality steel (SBQ) is created for special application typically high stress and/or safety critical. The superior properties are achieved through the inclusion of varying quantities of nickel, chromium, molybdenum, cobalt, vanadium, manganese, silicon and tungsten. In addition, further heat treatment may be carried out improve properties. Used where strength and surface finish are important.</p>	<p>Used in special applications where standard steel cannot provide required properties. Common areas:</p> <ul style="list-style-type: none"> <li>• <a href="#">Completion Equipment</a></li> <li>• <a href="#">Drill Bits</a></li> <li>• <a href="#">Wellhead &amp; X-Mass Tree</a></li> </ul>	<ul style="list-style-type: none"> <li>• Automotive Parts</li> <li>• Hand Tools</li> <li>• Shafts &amp; Valves</li> <li>• Industrial Machinery</li> </ul>	<p>Citic NSSMC Timken Steel Gerdau Saarstahl JFE</p>

## Main Alloying Elements

Main Function	Chromium (Cr)	Nickel (Ni)	Molybdenum (Mo)	Manganese (Mg)
Increase hardenability	X		X	X
Increases toughness		X	X	
Increase strength		X	X	X
Increase corrosion resistance	X	X	X	
Improves heat resistance	X	X	X	
Wear resistance	X			X