

## Case Study 36: Tungum® vs. 316/316L Stainless Steel

### Why Tungum® alloy tube was chosen instead of 316/316L stainless steel in offshore applications

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The manufacturers of Tungum and stainless steel make their own claims in terms of the relative strength and corrosion resistance of their alloys. Indeed, both have other attractions and specific applications unique to themselves. For example, colour (in the case of decorative applications), high thermal conductivity (Tungum), and wider range of chemical process applications (stainless steel).

However, in the common interests of hydraulics and pneumatics in harsh marine environments, for example, on ships or oil platforms, the industry awareness of Tungum's superiority over stainless steel is increasingly evident.

Historically, shipowners and operators have utilised copper-based alloys (Tungum is a copper-based alloy with 81 to 84% copper) for several hundred years. Typically, canons and anchors retrieved from sunken galleons, and propellers from Victorian-era steamships all bear witness to excellent condition and longevity when examined in modern times.

Tungum alloy was created in the early 1930s originally for decorative purposes because when it is polished it looks like gold! Later, it was found to be an excellent engineering alloy and was established as a favoured material for marine applications (naval vessels, ferries, dredgers, linkspans and swing bridges) where absence of corrosion and long-term freedom from maintenance of exposed lines were paramount to the operator.

In the late 1960s/early 1970s, the oil and gas industry came to the North Sea. It brought with it American technology from offshore operations which, combined with British process industry knowledge, formed the UK's design base for rigs and platforms. Originally both believed in stainless steel tubing. The Americans because it was traditional in their industry, and the British because stainless steel was the generally accepted material in the process industry, of which many chemicals are hostile to copper alloys. Although there is no industry standard marine grade stainless steel, 316/316L are the most common grades used for this application due to the inclusion of chromium and molybdenum in their composition.

Tungum tube was already being preferentially used by major crane manufacturers, for example, Priestman, Clarke Chapman, and Stothert & Pitt for pedestal frame hydraulics and other specialised hydraulically actuated auxiliaries on platforms.

The acceptance of Tungum alloy on platforms and other offshore vessels (FPSOs, DSVs, and survey vessels) increased as operators discovered the long-term benefits compared to stainless steel. Trouble and maintenance-free performance of these Tungum tube installations were, after a few years of user-experience, being noticed by operators who were, by now, being faced with costly replacements of 316 stainless steel tubing. In some cases, this has been reported to be within as little as 4 years of an intended 30+ years of platform life!



Tungum tube remains unscathed despite more than 10 years marine exposure on a semi-submersible support vessel. The stainless-steel section on the left from a southern North Sea platform, shows both crevice corrosion and chloride pitting after barely 5 years in the same environment.

In salt-laden marine atmospheres, 316 stainless steel is susceptible to pitting and crevice corrosion. After several years of salt spray exposure, 316 stainless steel tubing may still look bright from a distance, but closer inspection reveals tell-tale signs of imminent failure to hold pressure.

Tungum alloy, however, possesses a natural protection mechanism whereby, on exposure to salt spray, a very thin oxide coating is generated over the exposed surface, no more than two thousandths of an inch thick when complete. The tube becomes discoloured, and may even have a verdigris coating, but under the oxide layer the tube material is perfect with the wall thickness unaffected. Operators realised they had a tube material which, when used on appropriate circuits, was capable of lasting the life of the platform without being disturbed.

For more information on using Tungum tube on your offshore project or any other application, please go to our website at [www.t2alloys.com](http://www.t2alloys.com).