

**Extreme environments call for exceptional corrosion resistance –
Stainless steel universal joints for valve actuation in an oil pipeline system**

Broadview (Chicago), USA, May 2006. Harsh environments call for corrosion-resistant materials. Some environments, for example in marine or underwater applications, require machines and components with an exceptionally high resistance to corrosive elements.

For an undersea oil valve actuator, universal joint manufacturer Belden Inc. provided the actuator connection shafts. The installation is located on the sea floor, some 330 feet below sea level. Some of its valves are opened and closed by small submarines. To allow the submarines to operate the valves from a safe distance, the valves are fitted with articulated shafts. Articulated shafts also transfer the actuation movement and force to other parts of the system. The shafts are constructed like telescopes to allow change in length to adapt to small movements and relocation of the equipment's position. The complete shaft assemblies are easy to disassemble for transportation and reassemble for refitting.

Due to the extremely harsh underwater environment, all components must have an exceptional resistance to corrosion. Belden used a higher-grade stainless steel for the universal joints. The yokes of the universal joints are made of extremely corrosion-resistant 316L stainless steel. To prevent galling and to improve the joints' friction properties, the yokes' contact surfaces are PTFE-coated. The pins and blocks are also manufactured from 316L stainless steel and are protected with grease-packed boots.

To provide higher strength and improved wear resistance, Belden's standard stainless steel joints have AISI 303 stainless steel yokes and AISI 416 steel pins and blocks. Standard single joints can be modified with a variety of stainless steel grades, including 304, 316, 17-4 and 15-5, to meet specific applications' requirements. Diameters range from 13 mm (1/2 ") to 153 mm (6") with a standard operating angle of 35 degrees.

From underwater oil field equipment to drinking water conveying systems and food processing applications, Belden's universal joints and complete shaft assemblies are available in a variety of stainless steel grades and with various hub configurations, lubricants

and additional protective measures, such as boots, for use in a wide range of applications in even the most corrosive environments.

Company information:

Belden Inc., located in Broadview, Illinois, near Chicago, can be traced back to the year 1939, when three brothers opened a precision machine shop. Through the development of an extensive product line, the company rapidly expanded. In 1968, Belden Inc. was established and began manufacturing high quality, precision universal joints for a variety of applications, creating a primary focus for the company.

Today, Belden focuses on special-purpose universal joints and drive shaft assemblies made exclusively to customers' exact specifications. Unique manufacturing processes give Belden the flexibility to produce small batches economically and made-to-order custom parts just as cost-effectively as high volume standard universal joints. Belden supplies an extensive line of high quality, precision-engineered universal joints with complete shaft assemblies as well as couplings for a wide range of applications. These unique applications include steering and shift linkage assemblies for race cars as well as industrial and off-road vehicles, aerospace, packaging and conveying equipment, food processing equipment, steel roll forming and levelling equipment, machine tools and woodworking equipment for the furniture industry, and OEM machine tools.

Belden's continuing investment in state-of-the-art multiple axis CNC machinery and new engineering systems technology has given the company a worldwide manufacturing lead in the power transmission components market. Belden specialises in custom assemblies, such as customised hub configurations, lengths or the complete redesign of joints for specific applications. Materials include alloy, all grades of stainless steel, naval brass and extruded aluminium.

