



Ultra-Hard Tungsten Carbide Based Coatings



WESTERN PROCESS CONTROLS PTY

Case Study

► Profile

Based in Western Australia, Western Process Controls Pty Ltd is a leading provider of control valve and valve automation service and solutions to the oil and gas, metals and mining industries.

► Challenge

WPC supply Fisher 'AA' 80mm angle body control valves for Reduction Feed Liquor (RFL) level control to BHP's NKW Kwinana nickel refinery. This is a severe service application due to the high pressures and temperatures and the inherently erosive nature of the operating environment.

The valves operate in primarily ammonium sulphate with dissolved nickel metal and ammonia in water. This includes smaller amounts of cobalt and nickel hydroxide particulates with trace elements such as copper and sulphur. Operating pressure is between 200 and 4,300 kPa and operating temperature ranges from a minimum of 0°C to a normal 230°C and a maximum of 300°C.

Between 1993 and 2010, WPC re-designed the plug stem four times in efforts to extend its lifespan. The original design was a two piece 316SST stem with ceramic tip. This had a life of one to two weeks with failure caused by the cracking of the ceramics at the threaded connection, likely due to thermal shock.

A redesign led to a two piece construction comprising a 316SST/COCRA plug with pinned 316SST stem. This extended the lifespan to three to four weeks with failure caused by plug wear and separation of the plug and stem, likely due to vibration.

A third design saw a 316SST stem with retained ceramic tip designed to alleviate plug tip wear and ensure positive connection of the stem to plug tip. However, the ceramic tip snapped off due to thermal shock and lifespan was measured in hours and days.

The fourth design was a one piece 316SST/COCRA (Alloy 6) plug stem. This lasted between six and eight weeks before erosion caused total failure of the AA control valve. The average repair cost after a plug failure was US\$12,000.



New plug



Short term wear



Complete failure

► Further information

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► Solution

In 2010, Hardide Coatings worked with WPC to engineer a coating solution on the one piece 316SST/COCRA (Alloy 6) plug stem which has extended the life of the part up to three fold. The plug stem now has a life cycle of approximately four months in service with minimal wear to the plug. The Hardide coating is now standard on all overhauls, saving considerable downtime and repair costs.



Original plug stem, 2 piece design, 316SST stem with Ceramic tip. Life span of approx 1 – 2 weeks with failure mode being cracking of the ceramics at the threaded connection, likely due to thermal shock.



Second design, 2 piece construction 316SST/ COCRA plug with pinned 316SST stem. Failure occurred with wear of plug and separation of plug/ stem likely due to vibration. Lifespan 3-4 weeks.



Third design, 316SST stem with retained ceramic tip. This design was to alleviate plug tip wear and ensure positive connection of stem to plug tip. Ceramic tips snapped off due to thermal shock. Lifespan of hours/ days.



Fourth design, 1 piece 316SST/ COCRA (Alloy 6) plug stem. Four month lifespan with Hardide coating. Now standard fit on all AA valves.