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Comparison of WILCO Zapp 2507 SDSS (UNS S32750) and ZERON 100 (UNS S32760) Super Duplex Stainless Steel Slickline

Introduction

Several years ago Wilco Oilfield Services changed from ZERON 100 (UNS S32760) slickline to Wilco Zapp 2507 (UNSS32750) Super Duplex Stainless steel (SDSS) slickline due to supply problems with the former grade. To maintain supply the UNS S32750 grade was chosen as an alternative and Wilco undertook an exhaustive manufacturing and testing programme to ensure the suitability of the alloy. The UNS S32750 alloy is a very similar grade to UNS S32760 with only slight differences in composition, and is therefore considered interchangeable and will give a similar performance in service. The properties of the UNS S32750 alloy slickline are compared to the UNS S32760 alloy below.

GRADE	C	Si	Mn	Ni	Cr	Mo	N	Cu	W	PRENW
UNS S32750	0.015	0.35	0.45	6.4	25.3	3.80	0.28	-	-	42.3
UNS S32760	0.015	0.35	0.60	6.9	25.4	3.65	0.23	0.7	0.7	42.3

PREN = Cr% + 3.3Mo% + 1.65W% + 16N%.

Composition

The composition of the two grades are shown above and UNS S32750 has a higher Molybdenum (Mo) and Nitrogen (N) content compared to the UNS S32760 which has Tungsten (W) and Copper (Cu) additions. Both alloys have similar levels of Nickel and Chrome. The Pitting Resistance equivalent number (PREN) is calculated for both grades and is the same value and gives similar corrosion resistance. This is discussed in more detail in the section below. resistance.

Corrosion Resistance

The Pitting Resistance Equivalent Number (PREN) is an empirical relationship developed initially by Kovach et al (1) that enables Stainless steels to be ranked in regard to pitting resistance in chloride containing environments. The PREN equation is shown below is the total content of those elements in the alloy that effect corrosion resistance and in general the higher the PREN then the better is the corrosion resistance. It can be seen above that both alloys have a similar PREN value and so will have similar corrosion resistance.

PREN = Cr% + 3.3Mo% + 1.65W% + 16N%

The basis of Sour service performance in the Oil & Gas industry is based around ISO 15156 (NACE MR01-75), “Materials for use in H2S containing environments in Oil & Gas production”. This standard uses the above PREN equation as a basis of categorizing performance of all duplex alloys. As the alloys have a similar PREN then they are in the same group in the standard and so both are suitable for use in the same environments and are interchangeable.

Breaking Loads

Revision 03: Jan 2025

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Grade/ Dia.	0.108”	0.125”	0.140”	0.160”
UNS S32750	2500	3300	4100	5135
UNS S32760	2350	3150	3950	5050

It can be seen in the table above that the UNS S32750 wire has significant advantages in breaking load over UNS S32760.
During the independent testing programme it was established that the UNS S32750 slickline had improved ductility during the tensile testing over the UNS S32760 slickline giving the wire an improved performance of a higher breaking load and more durability in service.

Other Properties

During the detailed independent testing programme, Torsion testing, wrap testing and ASTM G48 corrosion testing were all carried out all with excellent results.
Another important property is fatigue resistance and as with all Duplex and Super Duplex alloys they exhibit a fatigue limit that is related to the maximum tensile stress. Both alloys have high tensile stress values and are expected to behave in the same way and will give excellent service. In all cases Wilco 2507 SDSS was at the minimum equal to the ZERON 100 alloy and in tensile strength, ductility and the ASTM G48 corrosion test performed slightly better than the UNS S32760 alloy.

Advantages of Wilco Zapp 2507 UNS S32750 slickline.

1) Both alloys have a similar Pitting Resistance Equivalent number (PREN) value and will have similar corrosion resistance in Chloride containing environments and in sour service.
2) The UNS S32750 slickline has improved breaking loads over the UNS S32760 alloy across the range of sizes
3) The UNS S32750 slickline exhibited improved ductility during the independent tensile testing programme and this has proven to give a more resilient wire in service.
4) The wire has been used extensively by several operators in SE Asia and beyond since 2016 with excellent results on many different environments.
5) The UNS S32750 slickline is readily available from Wilco Oilfield Services stock.

The information included here is not exhaustive and further information is available on request from Wilco Oilfield Services to support the use of SDSS slicklines. If you require any more detail of the test results from the comparison programme then these can be also made available on request.

References

1) C. W. Kovach and J. D. Redmond, Paper 267, Corrosion ’93. New Orleans, LA, USA. March 1993, NACE International.

Revision 03: Jan 2025