

### Comparison of the properties of ZERON 100HS Slicklines with 2205 Duplex wires.

There are a number of duplex stainless steel (DSS) wires which have a composition that complies with UNS 31803 or UNS S32205 that are available in the market but these do not have comparable corrosion resistance to the ZERON 100HS slickline which is a Super duplex stainless steel (SDSS) wire.

ALLOY	Alloy Type	Nominal Composition (wt%)							PRENW*
		Fe	Cr	Ni	Mo	N	Cu	W	
UNS S31803	22% Cr DSS	Bal	22.5	5	2.5	0.12			33
UNS S32205	22% Cr DSS	Bal	22.5	5	2.5	0.15	-	-	35
ZERON 100HS	25% Cr SDSS	Bal	25	7	3.5	0.25	0.7	0.7	42

Bal = balance

$PRENW = \%Cr + 3.3 (\%Mo + 0.5 \times \%W) + 16 \times$

%N

The Pitting Resistance Equivalent Number or PRENW is an empirical relationship that has been shown to be related to the resistance to localised corrosion in chloride containing solutions. The higher the PRENW the greater is the resistance to localised corrosion attack. The UNS S32205 grade has a minimum Nitrogen content to ensure a minimum PRENW of 35 which gives improved corrosion resistance over UNS S31803. However ZERON 100HS has a minimum PRENW of 40, typically 42 and much higher giving better corrosion performance. It has been shown that a duplex alloy requires a minimum PRENW of 40 to be truly fully resistant in seawater.

### **BREAKING LOAD**

The duplex wires have a higher inherent strength over the austenitic grades as the structure is 50/50 austenite/ferrite, and therefore higher breaking loads for a given ductility can be achieved. ZERON 100HS has the highest breaking loads for a corrosion resistant wireline and this again makes it more attractive. See the table below of the breaking loads for the duplex and super duplex wirelines.

Alloy	Breaking Load lbf				
	0.092"	0.108"	0.125"	0.140"	0.160"
2205	1650	2400	3050	3800	4700
ZERON 100HS	1920	2500	3300	4050	5150

### **CORROSION**

ISO15165/NACEMR0175 is generally used as the controlling document for the limits of use of alloys downhole in sour applications. Duplex alloys are limited to 0.1Bar H<sub>2</sub>S with a maximum hardness of 36HRC. Duplex wires have significantly higher hardness as slickline wires than this and so cannot be used in anything other than low levels of H<sub>2</sub>S. ZERON 100HS has been tested as a slickline in 12 psi (0.8 Bar) H<sub>2</sub>S with low chloride (1000 ppm) and 7psi (0.5 Bar) H<sub>2</sub>S with 150,000ppm chloride at fully representative hardness levels.



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## **SERVICE PERFORMANCE**

One operator in the Far East who has been using ZERON 100HS for two years advises that he gets a much longer life from a ZERON 100HS wire as compared to the 6% Mo grade by a factor of 3. It is thought that this is because the wire is not cold worked to such a high level which in turn leaves a greater inherent ductility and so can withstand more abuse in the field.

## **SUMMARY**

Overall the advantages of ZERON 100HS when compared to the 22% Cr Duplex Grades are:

- ✓ Better corrosion performance
- ✓ Higher breaking loads
- ✓ Excellent service performance
- ✓ The overall cost of using ZERON 100HS is therefore very attractive.



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