



WIRE & WIRE ROPE DIVISION

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WELL MEASURING LINE – CORROSION RESISTANCE, MECHANICAL PROPERTIES

1) Corrosion resistance --Pitting and Crevice.

Performance of various alloys is often measured using Critical Pitting Temperatures [CPT], Critical Crevice Temperatures [CCT] and **Pitting Resistance equivalent Numbers [PREN]** The corrosion resistance of stainless steel is basically dependent on their chemical compositions.

The PREN is determined by a calculation based on the chromium, molybdenum, and nitrogen contents.

$$PREN = \%CR + (3.3 \times \%Mo) + (30 \times \%N)$$

As a general rule, the higher the PREN, the better the resistance to pitting. However, alloys having similar values may differ considerably in actual service. Those with values greater than 38 on the PREN scale offer more corrosion resistance than austenitic stainless steels.

The **Critical Pitting Temperature [CPT]** test involves exposing sample to a solution of ferric chloride solution. The **Critical Crevice Temperature [CCT]** involves exposing samples to the same test solution as above except accelerated by devices. i.e. TFE-fluorocarbon washer.



Table 1- Pitting Resistance Equivalent Numbers
 (%CR+(3.3 x %Mo) + (30 x %N))

ALLOY	Cr %	Mo %	N %	PREN
304	19	--	--	19
316	17	2.5	--	25
2205	22	3.0	0.15	31
25-6Mo	20	6.5	0.20	36
Inconel 625	21	9.0	.15	55
Hastelloy C-276	15	16	.15	72
Nitronic 50	22	2.25	.30	38

Table 2- Critical Crevice Temperatures [CCT]
 Critical Pitting Temperature [CPT]
 6% Ferric Chloride Solution

ALLOY	CCT		CPT	
	°C	°F	°C	°F
Hastelloy C-276				
Inconel 625	30-35	86-95	>85	>185
25-6 Mo	30-35	86-95	70	158
2205				
316	<0	<32	20	68
304	<0	<32	15	59



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2) Mechanical Properties

		304	316	2205	25-6Mo	Inconel 625	Hastelloy C-276	Nitronic 50
Density,	lb/in ³	0.29	0.287	0.289	0.29	0.305	0.319	0.28
	g/cm ³	7.90	7.95	8.00	8.03	8.44	8.82	7.95
Melting range,	°F			2525-2625	2410-2550	2350-2460	2415-2500	2415-2500
	°C			1385-1440	1320-1400	1290-1350	1325-1370	1325-1370
Specific Heat	Btu/lb•°F			0.12	0.12	0.098	0.102	0.102
	J/kg•°C			500	500	412	427	427
Permeability at 200 oersted	[15.9kA/m				1.005	1.0006	1.0002	1.0002
Modulus of Elasticity [E]	Ksi [X 10 ³]	28.0	28.0	29.0	27.3	29.7	29.8	29.0
	MPa [X 10 ³]	193	193	200		204.8	205	200

References:

Special Metals –Alloy Data

Carpenter Steel –Alloy Data

Wire Line Materials for Sour service –Glen A. Vaughn, Hung-ERH Chuang, Exxon Mobil.

Sandvik - Wirelines

Specialists in: stainless steel, hi-carbon and alloy wire/galvanized & stainless steel cables/plastic coated cable and chain/cable assemblies/cable hardware/fittings, terminals and tools/fiberoptic light guides/wire for the wire brush industry