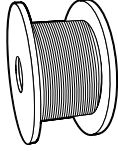


WIRELINES | SLICKLINES

ZAPP 2205 (UNS S32205)



ZAPP QUALITY SYSTEM CERTIFIED TO ISO 9001:2015



Alloy ZAPP 2205 (UNS S32205) Wire for

- Wirelines for down hole service applications
- Shaping/shaped wire for down hole well screens

Characteristics

ZAPP 2205 (UNS S32205) is a duplex (austenitic/ferritic) stainless steel that provides a good combination of corrosion resistance and tensile strength. It contains about 5% nickel, 22% chromium, and 3% molybdenum. See Table 1 for chemical composition limits. Nickel and molybdenum provide resistance to reducing media while the high chromium content offers resistance to oxidizing media.

The ZAPP 2205 alloy offers better resistance to chloride ion stress corrosion cracking than lower alloyed materials such as AISI 316 stainless steel. The alloy ZAPP 2205 produces comparable mechanical properties to AISI 316.

See Table 2 for minimum break loads and table 3 for PREN and CPT values.

Table 1 - Limiting Chemical composition of Alloy Zapp 2205, Weight %

Ni	Cr	Mo	N	C	Si	Mn	P	S
4.50 – 6.50	21.00 – 23.00	2.50 – 3.50	0.10 – 0.22	0.030 max.	1.00 max.	2.00 max	0.030 max.	0.015 max.

Chemistry Standards

- UNS S32205
- W.Nr.1.4462
- ASTM A276

Table 2 - Minimum Break Loads for a 0.108” Diameter Wireline Product

Alloy	Min. Break Load	Recommended Safe Working Load
ZAPP 316	2000#	1200#
ZAPP 2205	2240#	1344#
ZAPP XM19	2200#	1320#
ZAPP 2507	2240#	1344#
ZAPP 25-6MO	2150#	1290#
ZAPP 27-7MO	2250#	1350#
ZAPP MP35N	2300#	1380#
ZAPP C276	2210#	1326#

Table 3 - Pitting Resistance Equivalency Numbers (PREN)

Alloy	PREN*	CPT(°F)	CPT(°C)
ZAPP 316	26	72	22
ZAPP 2205	36	108	42
ZAPP XM19	38	106	41
ZAPP 2507	41	143	61
ZAPP 25-6MO	47	149	65
ZAPP 27-7MO	56	176	80
ZAPP MP35N	53	183	84
ZAPP C276	73	>302	>150

*PREN = Cr + 3.3Mo + 30N

*ZAPP 2205 PREN = Cr + 3.3Mo + 16N

*CPT (°C) = 2.5Cr + 7.6Mo + 31.9N - 41

Weight per Foot (lbs.) for Wirelines

Alloy	.082"	.092"	.108"	.125"	.140"	.150"	.160"
ZAPP 316	0.018	0.023	0.031	0.042	0.053	0.060	0.069
ZAPP 2205	0.018	0.022	0.031	0.041	0.051	0.059	0.067
ZAPP XM19	0.018	0.023	0.031	0.042	0.053	0.060	0.069
ZAPP 2507	0.018	0.022	0.031	0.041	0.052	0.059	0.068
ZAPP 25-6MO	0.018	0.023	0.032	0.043	0.054	0.062	0.070
ZAPP 27-7MO	0.018	0.023	0.032	0.043	0.054	0.062	0.070
ZAPP MP35N	0.020	0.025	0.034	0.046	0.057	0.066	0.075
ZAPP C276	0.018	0.022	0.031	0.041	0.052	0.059	0.068

Zapp Technical Data

Alloy Chemistry

Alloy	UNS	C	Mn	Cr	Ni	Mo	Cu	N	Co	Ti	Fe
ZAPP 316	S31600	.08	2.0	16.0 - 18.0	10.0 - 14.0	2.0 - 3.0	-	-	-	-	bal.
ZAPP 2205	S32205	.03	2.0	21.0 - 23.0	4.5 - 6.5	2.5 - 3.5	-	.10 - .22	-	-	bal.
ZAPP XM19	S20910	.06	4.0 - 6.0	20.5 - 23.5	11.5 - 13.5	1.5 - 3.0	-	.20 - .40	-	-	bal.
ZAPP 2507	S32750	.03	1.2	25.0	7.0	4.0	-	.30	-	-	bal.
ZAPP 25-6MO	NO8926	.02	2.0	19.0 - 21.0	24.0 - 26.0	6.0 - 7.0	.5 - 1.5	.15 - .25	-	-	bal.
ZAPP 27-7 MO	S31277	.02	3.0	20.5 - 23.0	26.0 - 28.0	6.6 - 8.0	.5 - 1.5	.30 - .40	-	-	bal.
ZAPP MP35N	R30035	.02	0.1	19.0 - 21.0	33.0 - 37.0	9.0 - 10.5	-	-	bal.	1.0	1.0
ZAPP C276	N10276	.01	1.0	14.5 - 16.5	-	15.0 - 17.0	-	-	2.5	-	4.0 - 7.0

(Maximum values unless range specified)

Wireline Minimum Break Strength**

Size	ZAPP 316	ZAPP 2205	ZAPP XM19	ZAPP 2507	ZAPP 25-6MO	ZAPP 27-7MO	ZAPP MP35N	ZAPP C276
.082"	1150#	1345#	1215#	1345#	1175#	1300#	1300#	1280#
.092"	1500#	1690#	1540#	1690#	1500#	1650#	1690#	1615#
.108"	2000#	2240#	2200#	2240#	2150#	2250#	2300#	2210#
.125"	2700#	2945#	3000#	2975#	2800#	3000#	3100#	2935#
.140"	3300#	3540#	3540#	3694#	3480#	3670#	3725#	3680#
.150"	3750#	3975#	4065#	4150#	3950#	4155#	4240#	4205#
.160"	4225#	4425#	4625#	4665#	4350#	4650#	4825#	4785#

(** The recommended **safe working load** is 60% of minimum break strength)

Density/Corrosion

Alloy	Density (lb/in ³)	Corrosion (PREN)*	CPT (°F)	CPT (°C)**
ZAPP 316	.287	26	72	22
ZAPP 2205	.278	36	108	42
ZAPP XM19	.285	38	106	41
ZAPP 2507	.281	41	144	62
ZAPP 25-6MO	.290	47	149	65
ZAPP 27-7MO	.289	56	176	80
ZAPP MP35N	.309	53	183	84
ZAPP C276	.321	68	>302	>150

* PREN = Cr + 3.3 Mo + 30N

** CPT (°C) = 2.5 Cr + 7.6 Mo + 31.9 N - 41

Examples of Theoretical Acceptable Well Environments for ZAPP 2205 Wire*

Chlorides	Temp °F	H ₂ S	CO ₂	Pressure (PSI)	Reg. Minimum Pitting Index (PI)	ZAPP 2205 (PI)	ZAPP 2205 (PREN)
20,000 ppm	325	0 %	6 %	12,000	16.50	31.57	36
100,000 ppm	275	0 %	10 %	10,000	30.00	31.57	36
20,000 ppm	200	0 %	80 %	5,000	13.00	31.57	36
90,000 ppm	326	0 %	30 %	5,000	16.50	31.57	36

** Marginally acceptable

PI= Cr + 3.3Mo + 11N + 1.5(W+Nb)

PREN = Cr + 3.3Mo + 30N

* The theoretical acceptable well environments are based on the SOCRATES software. SOCRATES is a comprehensive material selection tool for oil and gas applications that selects corrosion resistant alloys (CRA) through material evaluation based on mechanical strength parameters, heat treatment/cold work and hardness limitations. The program also evaluates the characterization of the environment in terms of operating pressure, temperature, pH, H₂S, chlorides, elemental sulfur, aeration, gas to oil ratio and water to gas ratio water cut. Stress corrosion cracking, hydrogen embrittlement cracking, sulfide stress cracking and resistance to pitting corrosion are also evaluated. The examples above are based on the environment listed and do not take into consideration the actual values of elemental sulfur, aeration, gas to oil ratio and water to gas ratio water cut.

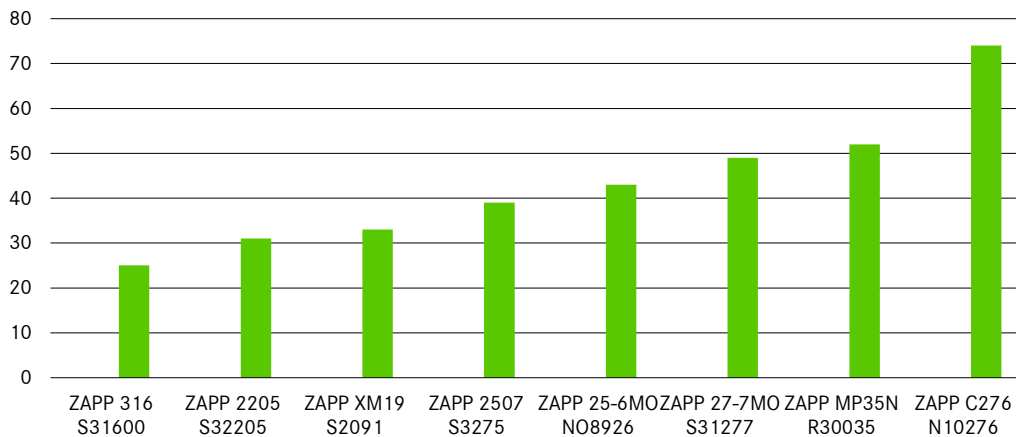
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Nominal Chemical Composition Comparison

Chemical Element	ZAPP 316	ZAPP 2205	ZAPP XM19	ZAPP 2507	ZAPP 25-6MO	ZAPP 27-7MO	ZAPP MP35N	ZAPP C276
Fe	65.40	67.71	56.40	62.43	46.30	39.65	1.00	5.50
Mn	2.00	2.00	5.00	0.60	2.00	3.00	0.15	0.50
Ni	12.00	5.50	12.50	7.00	25.00	27.00	35.00	55.00 bal.
Co	*	*	*	*	*	*	*	*
Cr	17.00	22.00	22.00	25.00	20.00	27.75	20.00	15.50
Mo	2.50	2.50	2.25	4.00	6.50	7.25	9.75	16.00
W	*	*	*	*	*	*	*	*
Nb	*	*	0.20	*	*	*	*	*
N	*	0.12	0.30	*	0.20	0.35	*	*
* Trace								
PI	25.25	31.57	33.03	39.85	43.65	49.53	52.18	74.43

Material Selection Overview

Pitting Index



The ZAPP 2205 alloy wire produces a tensile strength of 200/230,000 psi through cold drawing. At this strength level, the wire is ductile and able to successfully pass the wrap test in the as drawn condition as well as the as drawn plus exposed to temperatures as high as 540°F conditions. This wrap or bend test shows no surface cracking or failure.

Material produced to the UNS S32205 chemistry ranges and manufactured into wirelines by Zapp Precision Wire will provide an excellent quality product. Zapp Precision Wire technology, quality, and superior wire drawing capabilities will make the difference for these critical applications.

The Zapp Precision Wire quality system is registered to ISO 9001:2015. For additional information on this or any other Zapp Precision Wire, Inc. product, please contact the Customer Service Department at 843-851-0700 or fax your inquiry to 843-851-0100, or e-mail the inquiry to sales@zapp.com.

Zapp Precision Wire Standards

1. All wirelines must pass an eddy current test as part of our NDT quality assurance program.
2. All wirelines and armor wires must pass an aged wrap test as part of our ductility quality assurance program.
3. All wirelines and armor wires have full traceability.

Zapp Precision Wire Quality

The Zapp Precision Wire technology, quality, and superior wire drawing capabilities will make the difference for critical armor wire and wireline applications. The Zapp Precision Wire quality system is registered to ISO 9001:2015.

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