ATOMET 4901

ATOMET 4901 is a highly compressible, water-atomized alloy steel containing 1.5% molybdenum designed for use in high strength, high performance powder metallurgy and sinter hardening applications.

- **Compressibility** - **ATOMET 4901** extends the benefits of prealloyed powders to high density applications above 7.0 g/cm^3 giving strength, higher density PM parts and enhancing compaction capability.
- **Hardenability** - molybdenum enhances heat-treated properties without sacrificing compressibility, thus improving hardness and tensile strength.
- **Consistency** - a stable ore base and ultra modern processing capability, including SPC, assure lot-to-lot consistency and reduced part-to-part variation.
- **Purity and cleanliness** - state-of-the-art clean steel practices and a proprietary powder manufacturing process produce a powder with exceptionally low levels of residuals and inclusions, resulting in improved mechanical and dynamic properties and improved machinability in PM and P/F parts.

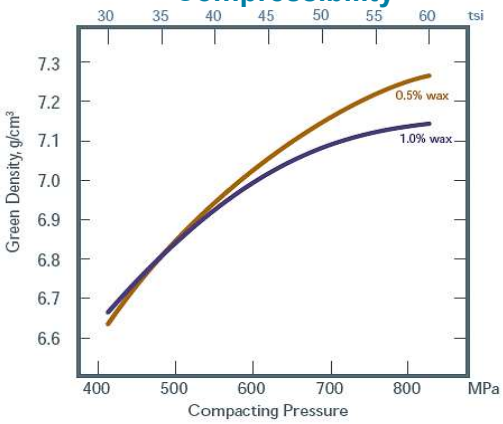
PHYSICAL AND CHEMICAL PROPERTIES

Chemistry, wt%						Particle Size Analysis, wt%				A.D.	Flow	Density*
C	O	S	Mn	Mo	U.S. mesh	+60	+100	+325	-325	g/cm^3	s/50g	g/cm^3
0.01	0.15	0.009	0.15	1.5	µm	+250	+150	+45	-45	3.00	25	7.05
						Trace	10	62	28			*@43.5 tsi @600 MPa

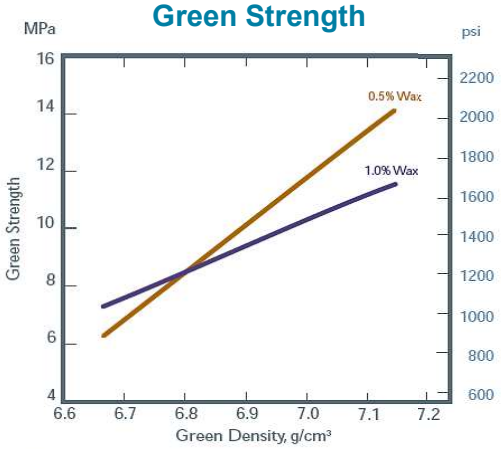
COMPACTING PROPERTIES

ATOMET 4901 + Wax

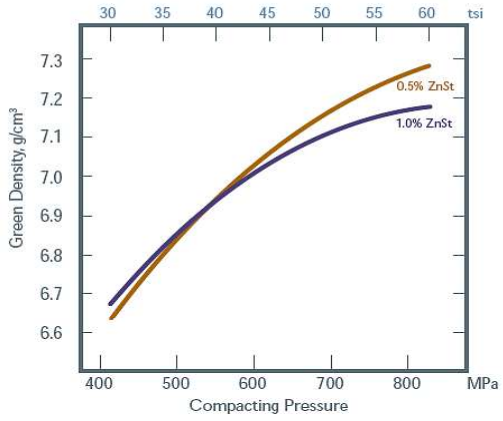
Compressibility

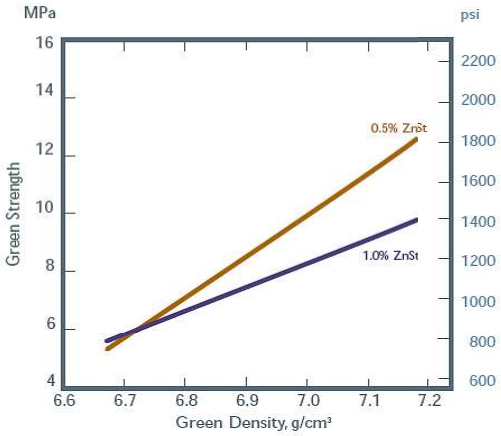


Green Strength



ATOMET 4901 + ZnSt





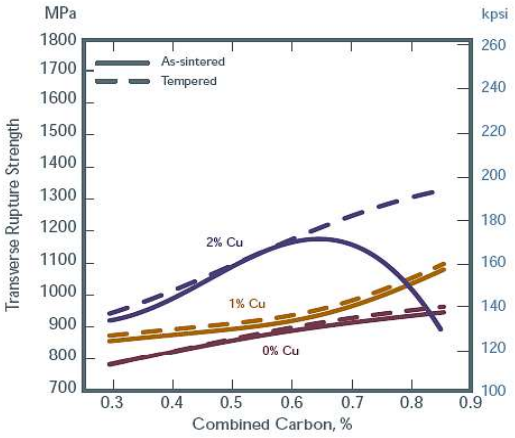
SINTERED PROPERTIES - Copper Steels, Slow Cooled

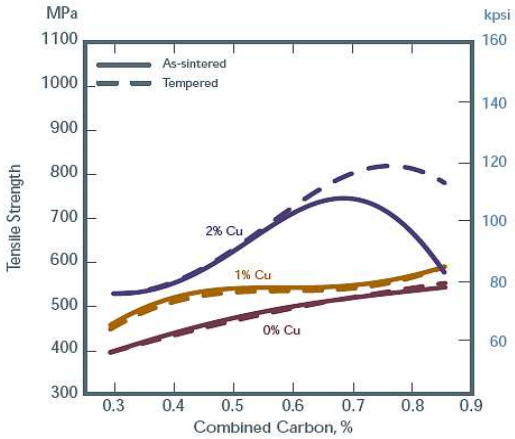
Composition: **ATOMET 4901** + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1160ºC (2120ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Transverse Rupture Strength

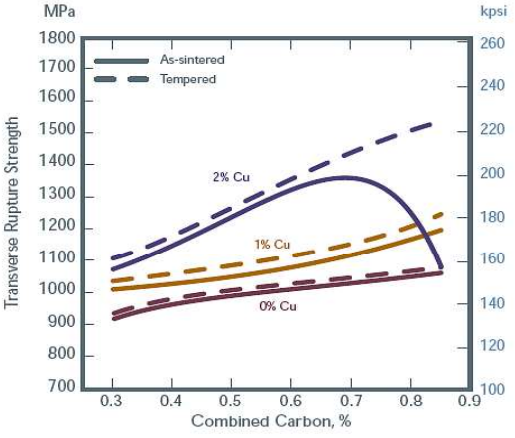
Tensile Strength

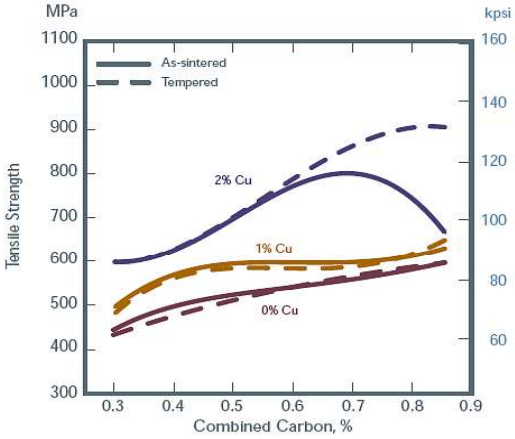
Sintered Density 6.7 g/cm³



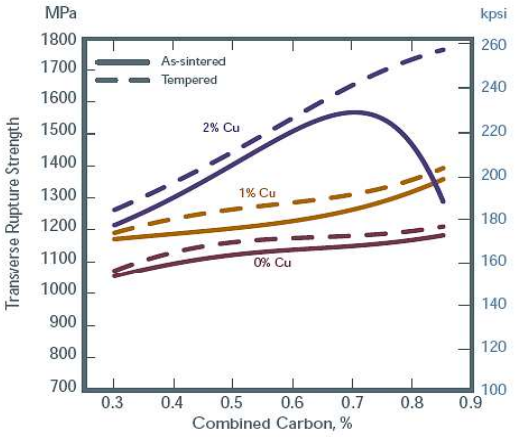


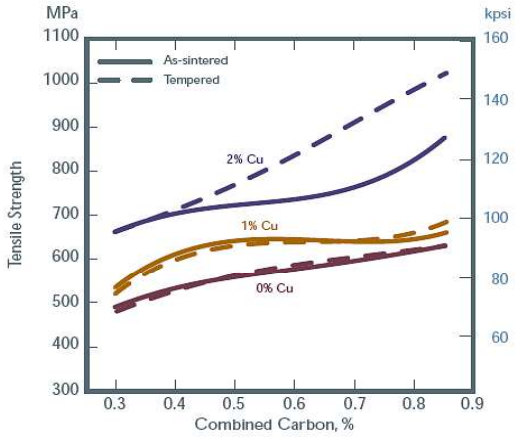
Sintered Density 6.9 g/cm³





Sintered Density 7.1 g/cm³





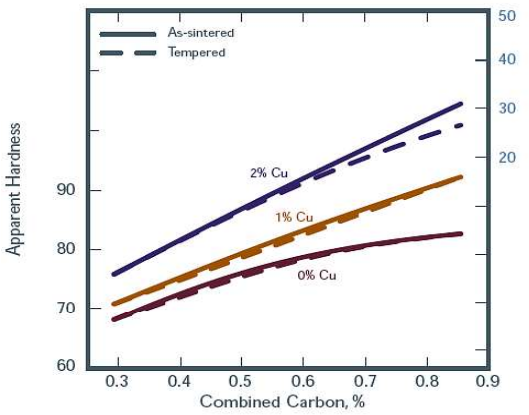
SINTERED PROPERTIES (continued)- Copper Steels, Slow Cooled

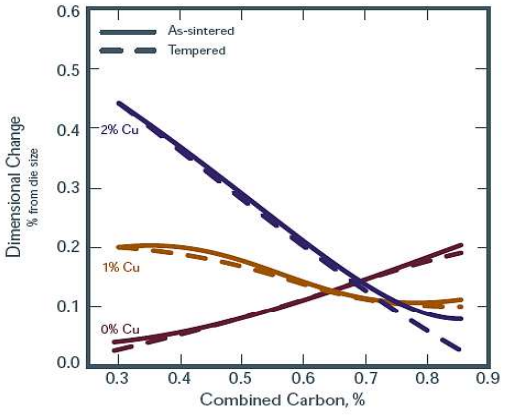
Composition: **ATOMET 4901** + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1160ºC (2120ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Apparent Hardness

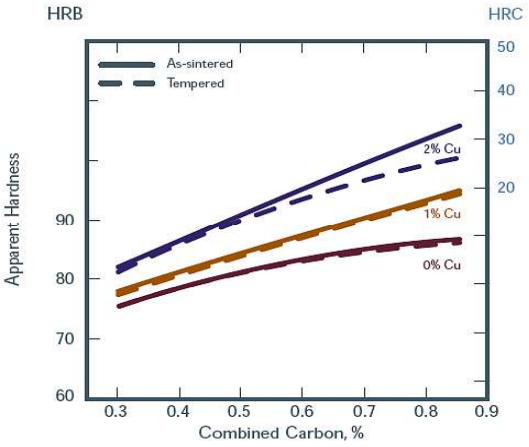
Dimensional Change

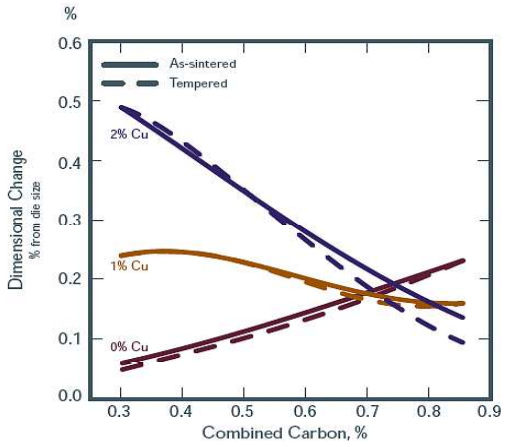
Sintered Density 6.7 g/cm^3



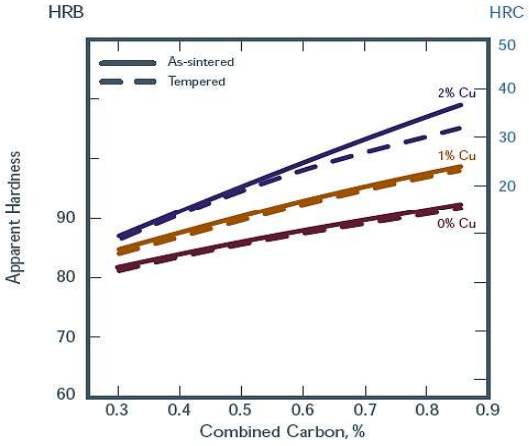


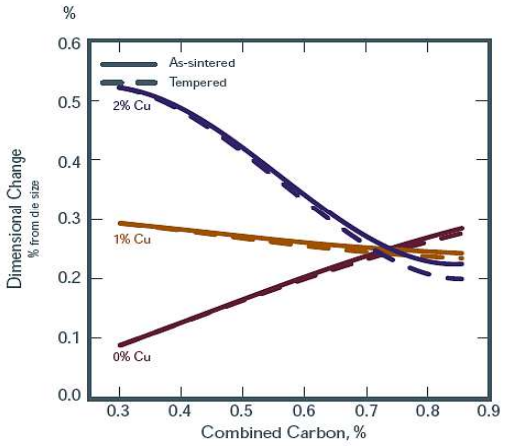
Sintered Density 6.9 g/cm^3





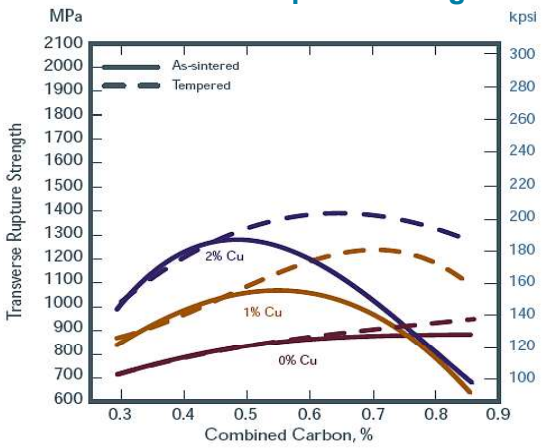
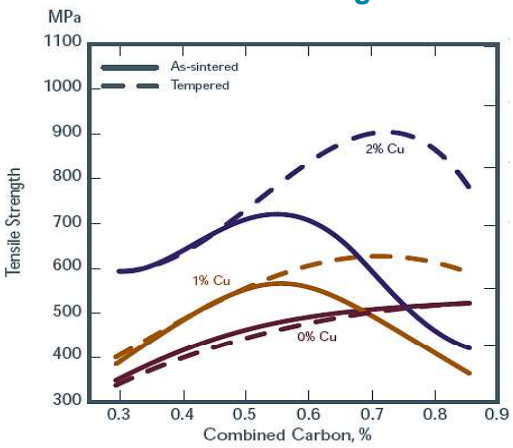
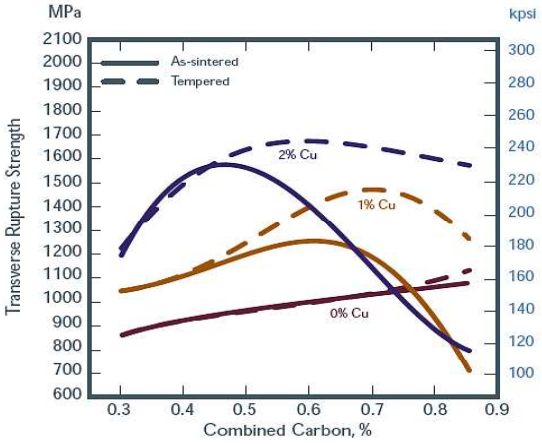
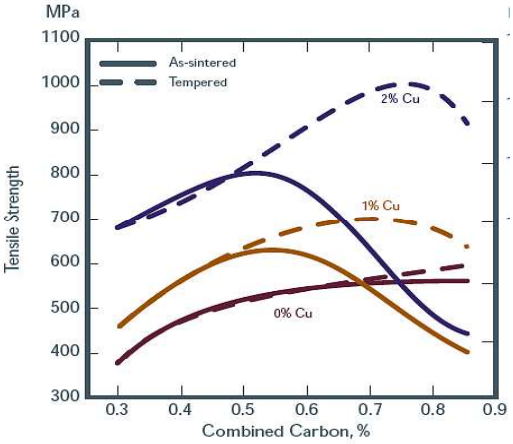
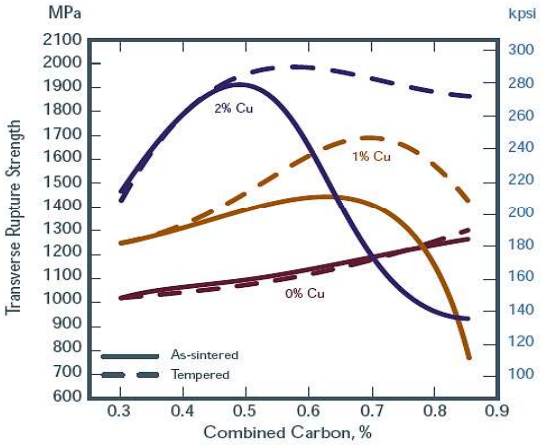
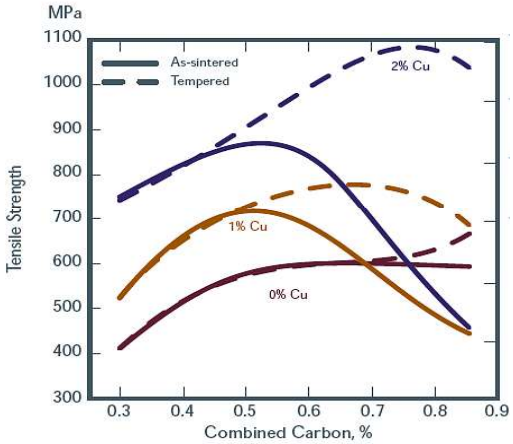
Sintered Density 7.1 g/cm^3





SINTERED PROPERTIES - Copper Steels, Fast Cooled

Composition: **ATOMET 4901** + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1135ºC (2075ºF) for 25 minutes.
Cooling rate of 1.85ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

	Transverse Rupture Strength	Tensile Strength
Sintered Density 6.7 g/cm^3		
Sintered Density 6.9 g/cm^3		
Sintered Density 7.1 g/cm^3		

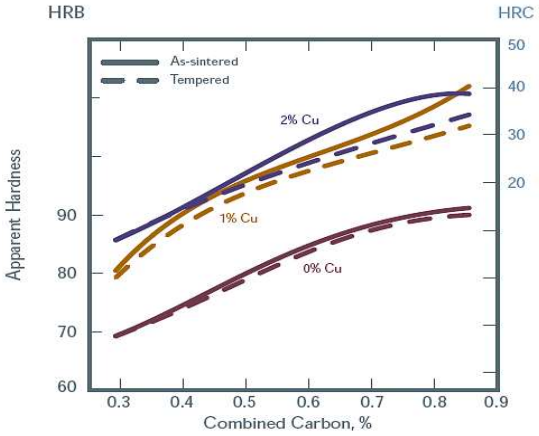
SINTERED PROPERTIES (continued) – Copper Steels, Fast Cooled

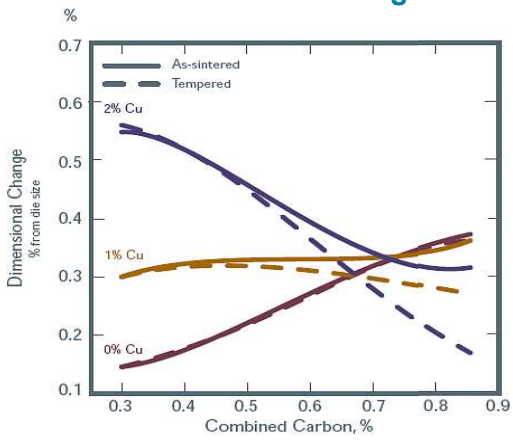
Composition: **ATOMET 4901** + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1135ºC (2075ºF) for 25 minutes.
Cooling rate of 1.85ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Apparent Hardness

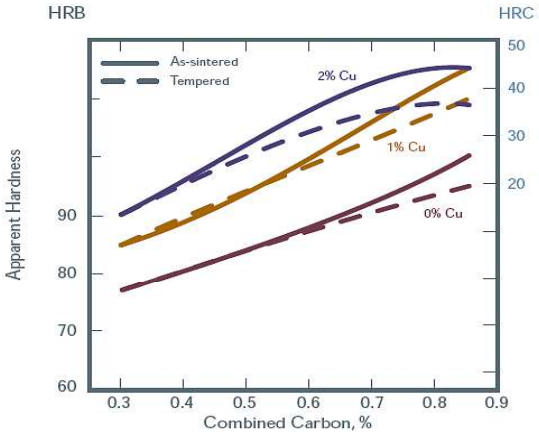
Dimensional Change

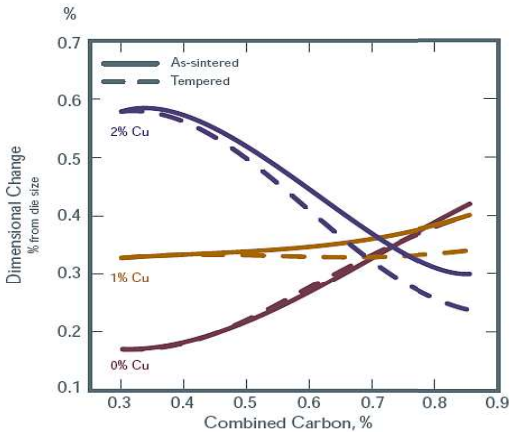
Sintered Density 6.7 g/cm³



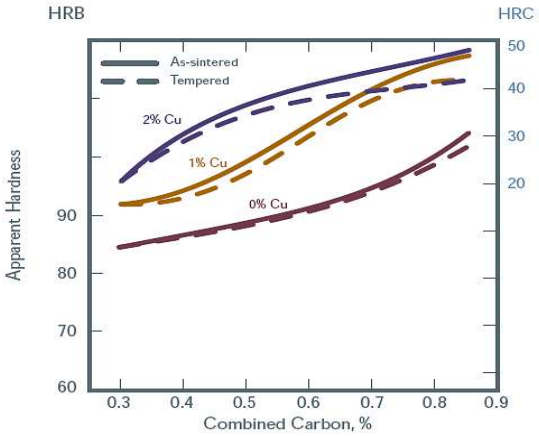


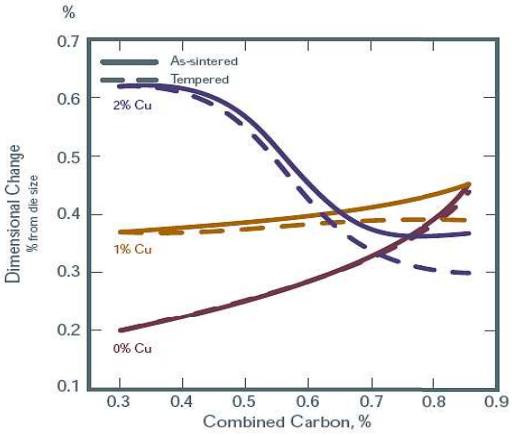
Sintered Density 6.9 g/cm³





Sintered Density 7.1 g/cm³





AS-SINTERED PROPERTIES - Copper Steels, Slow Cooled

Sintered Density	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.71	0	0.30	795	115	380	55	340	49	1.0	(68)	0.03
6.91	0	0.30	915	133	435	63	385	56	1.3	(76)	0.05
7.13	0	0.30	1090	158	480	70	415	60	1.7	(83)	0.10
6.69	0	0.48	855	124	450	65	365	53	1.0	(75)	0.09
6.90	0	0.48	1005	146	505	73	395	57	1.2	(84)	0.10
7.13	0	0.48	1145	166	550	80	435	63	1.3	(86)	0.17
6.69	0	0.67	895	130	490	71	385	56	<1	(79)	0.14
6.89	0	0.67	1080	157	550	80	455	66	<1	(84)	0.16
7.12	0	0.67	1150	167	570	83	470	68	<1	(86)	0.22
6.68	0	0.85	950	138	515	75	415	60	<1	(83)	0.19
6.89	0	0.85	1060	154	600	87	480	70	<1	(87)	0.23
7.12	0	0.85	1235	179	615	89	510	74	<1	(92)	0.28
6.67	1	0.31	830	120	440	64	360	52	<1	(70)	0.19
6.86	1	0.31	980	142	460	67	370	54	1.0	(77)	0.23
7.08	1	0.31	1165	169	530	77	420	61	1.1	(84)	0.28
6.67	1	0.49	850	123	515	75	400	58	<1	(78)	0.16
6.86	1	0.49	1075	156	580	84	425	62	1.0	(83)	0.21
7.08	1	0.49	1185	172	635	92	480	70	1.0	(89)	0.26
6.67	1	0.67	917	133	525	76	450	65	<1	(85)	0.12
6.88	1	0.67	1140	165	595	86	480	70	<1	(91)	0.17
7.10	1	0.67	1255	182	615	89	560	81	<1	(95)	0.24
6.69	1	0.87	1030	149	580	84	490	71	<1	(91)	0.10
6.88	1	0.87	1250	181	620	90	540	78	<1	(95)	0.15
7.11	1	0.87	1405	204	650	94	570	83	<1	(98)	0.24
6.62	2	0.32	808	117	490	71	360	52	1.4	(75)	0.41
6.81	2	0.32	1050	152	560	81	395	57	1.5	(80)	0.47
7.02	2	0.32	1090	158	620	90	460	67	1.6	(84)	0.51
6.64	2	0.50	1035	150	580	84	415	60	1.0	(87)	0.28
6.84	2	0.50	1195	173	670	97	455	66	1.2	(91)	0.34
7.05	2	0.50	1365	198	705	102	515	75	1.3	(94)	0.41
6.68	2	0.69	1185	172	710	103	470	68	<1	20	0.14
6.86	2	0.69	1350	196	800	116	525	76	<1	23	0.21
7.08	2	0.69	1560	226	855	124	605	88	<1	27	0.27
6.70	2	0.86	870	126	545	79	495	72	<1	30	0.08
6.88	2	0.86	1090	158	670	97	515	75	<1	33	0.13
7.10	2	0.86	1280	186	615	104	540	78	<1	36	0.22

TEMPERED PROPERTIES - Copper Steels, Slow cooled

Sintered Density	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.71	0	0.30	795	115	370	54	345	50	1.0	(69)	0.04
6.91	0	0.30	945	137	435	63	385	56	1.2	(76)	0.06
7.14	0	0.30	1090	158	460	67	400	58	1.6	(83)	0.10
6.70	0	0.48	850	123	450	65	365	53	1.0	(75)	0.08
6.90	0	0.48	1000	145	490	71	395	57	1.0	(84)	0.11
7.14	0	0.48	1195	173	540	78	440	64	1.1	(86)	0.16
6.69	0	0.67	850	123	490	71	385	56	<1	(78)	0.14
6.89	0	0.67	1070	155	545	79	435	63	<1	(85)	0.17
7.10	0	0.67	1180	171	595	86	475	69	<1	(90)	0.22
6.68	0	0.85	960	139	525	76	415	60	<1	(82)	0.20
6.91	0	0.85	1035	150	600	87	490	71	<1	(88)	0.23
7.11	0	0.85	1220	177	615	89	510	74	<1	(92)	0.29
6.66	1	0.31	850	123	435	63	360	52	1.0	(70)	0.19
6.87	1	0.31	1005	146	460	67	380	55	1.2	(77)	0.23
7.08	1	0.31	1180	171	505	73	400	58	1.3	(84)	0.28
6.67	1	0.49	905	131	510	74	395	57	1.3	(78)	0.17
6.85	1	0.49	1040	151	580	84	440	64	1.4	(83)	0.22
7.08	1	0.49	1290	187	620	90	480	70	1.5	(89)	0.27
6.69	1	0.67	930	135	510	74	440	64	<1	(85)	0.12
6.89	1	0.67	1130	164	585	85	490	71	<1	(89)	0.16
7.10	1	0.67	1240	180	615	89	550	80	<1	(96)	0.24
6.68	1	0.87	1095	159	560	81	400	58	<1	(92)	0.11
6.88	1	0.87	1185	172	660	96	540	78	<1	(94)	0.16
7.11	1	0.87	1385	201	685	99	595	86	<1	(98)	0.24
6.62	2	0.32	860	125	495	72	380	55	1.2	(73)	0.41
6.81	2	0.32	1055	153	560	81	420	61	1.5	(80)	0.47
7.02	2	0.32	1200	174	635	92	475	69	1.6	(84)	0.51
6.64	2	0.50	1005	146	570	83	455	66	<1	(85)	0.27
6.84	2	0.50	1170	170	675	98	480	70	1.0	(90)	0.34
7.05	2	0.50	1400	203	730	106	545	79	1.0	(94)	0.40
6.68	2	0.69	1205	175	760	110	515	75	<1	18	0.13
6.86	2	0.69	1415	205	860	125	580	84	<1	20	0.19
7.08	2	0.69	1605	233	910	132	640	93	<1	23	0.25
6.70	2	0.86	1330	193	730	106	620	90	<1	27	0.03
6.89	2	0.86	1545	224	930	135	595	86	<1	27	0.09
7.10	2	0.86	1780	258	970	141	640	93	<1	32	0.20

AS-SINTERED PROPERTIES - Copper Steels, Fast cooled

Sintered Density	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.67	0	0.32	675	98	330	48	310	45	<1	(69)	0.15
6.88	0	0.32	875	127	360	52	350	51	<1	(76)	0.17
7.10	0	0.32	1000	145	405	59	400	58	<1	(84)	0.20
6.66	0	0.49	815	118	440	64	365	53	<1	(79)	0.22
6.84	0	0.49	895	130	490	71	435	63	1.0	(82)	0.22
7.13	0	0.49	1130	164	560	81	515	75	1.1	(88)	0.25
6.65	0	0.67	805	117	475	69	450	65	<1	(85)	0.31
6.86	0	0.67	1025	149	510	74	455	66	<1	(89)	0.32
7.09	0	0.67	1170	170	570	83	510	74	<1	(92)	0.32
6.65	0	0.88	855	124	490	71	455	66	<1	(91)	0.35
6.85	0	0.88	995	144	560	81	505	73	<1	26	0.42
7.09	0	0.88	1270	184	585	85	545	79	<1	30	0.44
6.64	1	0.33	820	119	370	54	345	50	<1	(80)	0.30
6.85	1	0.33	995	144	415	60	400	58	<1	(83)	0.32
7.06	1	0.33	1220	177	505	73	440	64	1.0	(90)	0.35
6.63	1	0.50	1025	149	515	75	440	64	<1	(95)	0.34
6.83	1	0.50	1145	166	620	90	510	74	<1	19	0.34
7.06	1	0.50	1380	199	705	102	595	86	<1	21	0.38
6.63	1	0.68	905	131	485	70	415	60	<1	29	0.33
6.84	1	0.68	1185	172	550	80	470	68	<1	31	0.35
7.06	1	0.68	1380	200	570	83	530	77	<1	39	0.40
6.63	1	0.87	620	90	330	48	-	-	<1	40	0.34
6.84	1	0.87	715	104	380	55	-	-	<1	45	0.39
7.07	1	0.87	770	112	405	59	-	-	<1	48	0.44
6.59	2	0.31	915	133	510	74	435	63	<1	(84)	0.54
6.78	2	0.31	1110	161	660	96	470	68	1.0	(85)	0.56
7.00	2	0.31	1365	198	685	99	545	79	1.1	(94)	0.60
6.61	2	0.50	1125	163	685	99	495	72	<1	19	0.43
6.80	2	0.50	1525	221	750	109	560	81	<1	28	0.49
7.02	2	0.50	1805	262	855	124	635	92	<1	35	0.55
6.64	2	0.70	1020	148	605	88	510	74	<1	33	0.31
6.82	2	0.70	1090	158	635	92	570	83	<1	41	0.37
7.05	2	0.70	1285	186	730	106	655	95	<1	40	0.38
6.65	2	0.88	660	96	420	61	-	-	<1	39	0.34
6.86	2	0.88	765	111	400	58	-	-	<1	44	0.30
7.06	2	0.88	915	133	455	66	-	-	<1	49	0.36

TEMPERED PROPERTIES - Copper Steels, Fast Cooled

Sintered Density	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.67	0	0.32	695	101	325	47	310	45	<1	(69)	0.15
6.88	0	0.32	870	126	370	54	365	53	<1	(76)	0.17
7.11	0	0.32	1020	148	415	60	395	57	<1	(84)	0.19
6.67	0	0.49	835	121	425	62	380	55	<1	(80)	0.22
6.88	0	0.49	895	130	475	69	420	61	1.0	(81)	0.22
7.11	0	0.49	1095	159	550	80	510	74	1.2	(88)	0.24
6.65	0	0.67	850	123	475	69	450	65	<1	(84)	0.30
6.86	0	0.67	1025	149	510	74	455	66	<1	(91)	0.32
7.09	0	0.67	1150	167	565	82	515	75	<1	(92)	0.32
6.65	0	0.88	880	128	505	73	460	67	<1	(84)	0.35
6.86	0	0.88	1130	164	545	79	525	76	<1	20	0.39
7.08	0	0.88	1275	185	640	93	670	97	<1	32	0.45
6.64	1	0.33	840	122	400	58	395	57	<1	(79)	0.29
6.85	1	0.33	945	137	420	61	400	58	1.0	(84)	0.32
7.06	1	0.33	1170	170	525	76	490	71	1.1	(90)	0.36
6.63	1	0.50	960	139	540	78	490	71	<1	(93)	0.32
6.83	1	0.50	1250	181	580	84	795	72	<1	20	0.33
7.06	1	0.50	1305	189	695	101	585	85	<1	19	0.38
6.63	1	0.68	1150	167	585	85	565	82	<1	26	0.30
6.85	1	0.68	1435	208	655	95	600	87	<1	28	0.32
7.07	1	0.68	1675	243	745	108	670	97	<1	37	0.36
6.65	1	0.87	1040	151	580	84	545	79	<1	32	0.25
6.86	1	0.87	1235	179	625	91	600	87	<1	37	0.32
7.08	1	0.87	1400	203	670	97	635	92	<1	41	0.38
6.59	2	0.31	895	130	525	76	450	65	1.0	(84)	0.55
6.78	2	0.31	1115	162	660	96	505	73	1.1	(87)	0.57
7.00	2	0.31	1305	189	695	101	595	86	1.2	(93)	0.60
6.60	2	0.50	1115	162	670	97	550	80	<1	19	0.44
6.81	2	0.50	1545	224	760	110	615	89	<1	26	0.47
7.02	2	0.50	1800	261	835	121	680	99	<1	32	0.53
6.64	2	0.70	1315	191	850	123	605	88	<1	28	0.27
6.82	2	0.70	1585	230	980	142	675	98	<1	34	0.33
7.06	2	0.70	1890	274	1040	151	710	103	<1	35	0.35
6.67	2	0.88	1235	179	730	106	600	87	<1	31	0.16
6.87	2	0.88	1475	214	905	131	635	92	<1	38	0.22
7.08	2	0.88	1840	267	985	143	690	100	<1	42	0.29

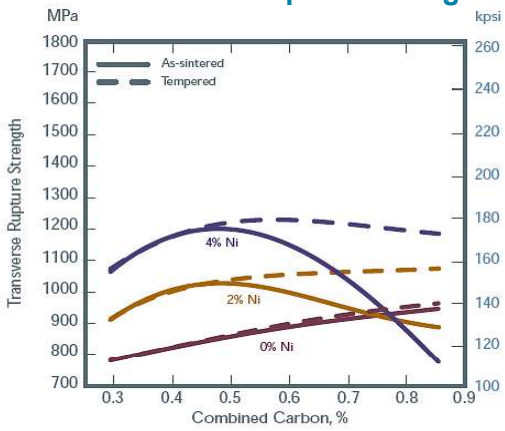
SINTERED PROPERTIES - Nickel Steels, Slow Cooled

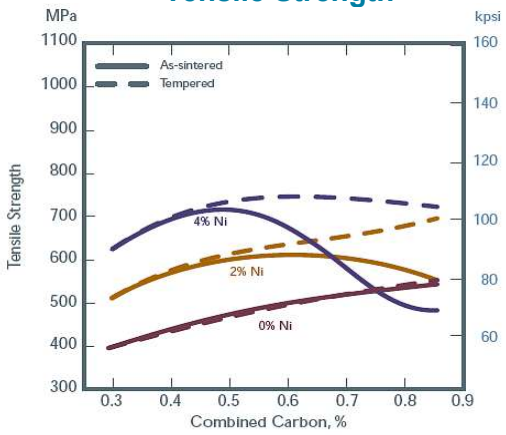
Composition: **ATOMET 4901** + nickel + graphite + 0.75% ZnSt .
Sintered in a 90% nitrogen-based atmosphere at 1160ºC (2120ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Transverse Rupture Strength

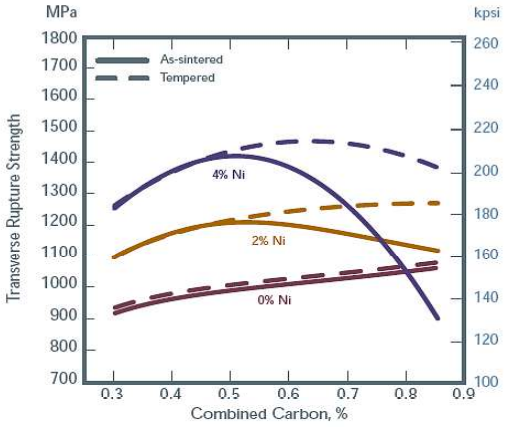
Tensile Strength

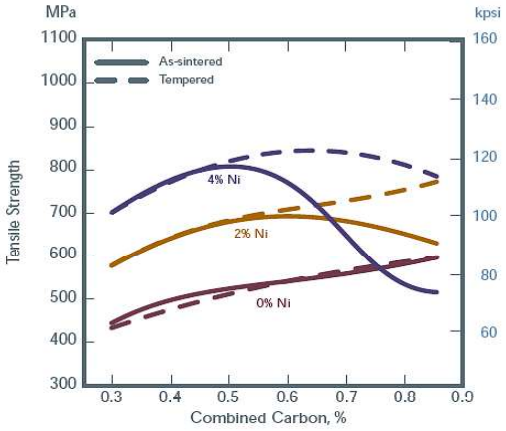
Sintered Density 6.7 g/cm^3



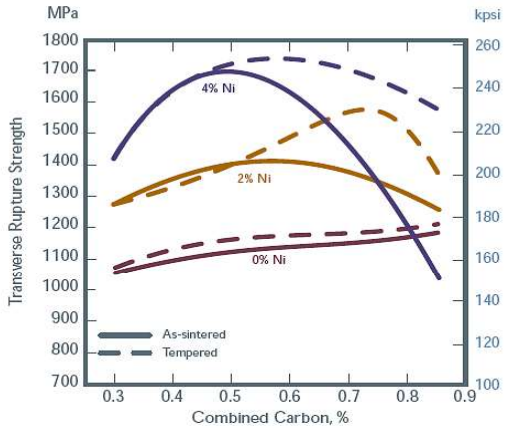


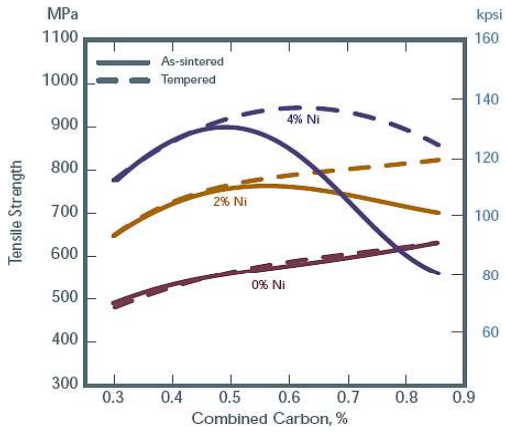
Sintered Density 6.9 g/cm^3





Sintered Density 7.1 g/cm^3





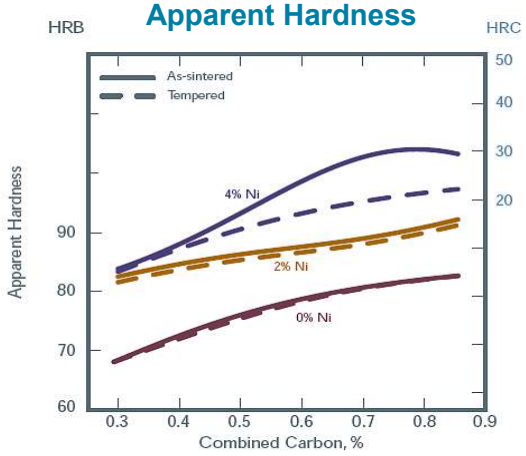
SINTERED PROPERTIES (continued) - Nickel Steels, Slow Cooled

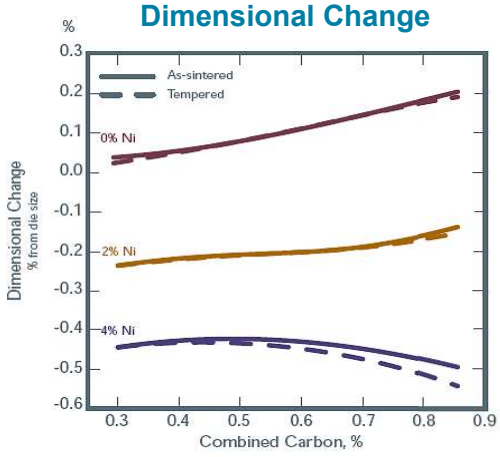
Composition: **ATOMET 4901** + nickel + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1160ºC (2120ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Apparent Hardness

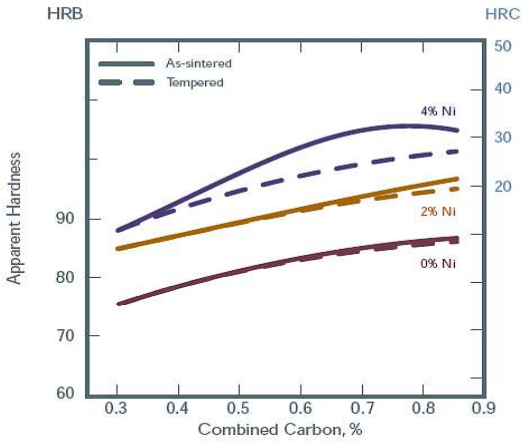
Dimensional Change

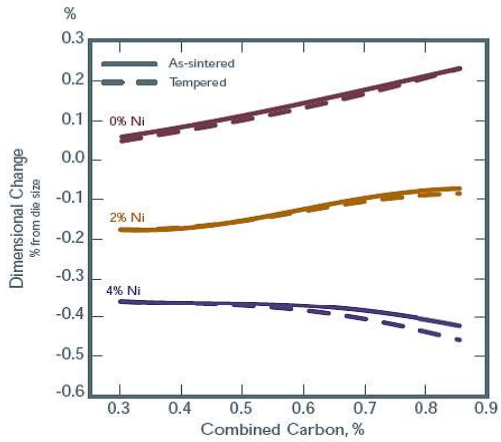
Sintered Density 6.7 g/cm^3



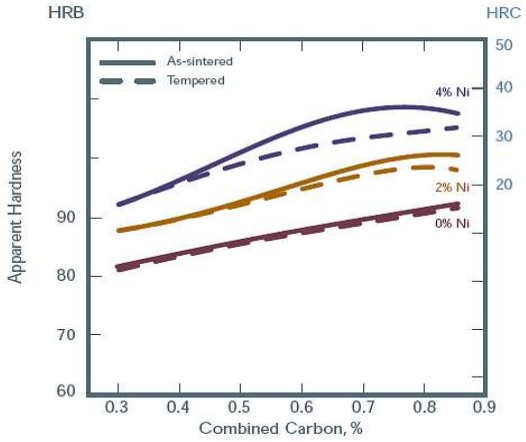


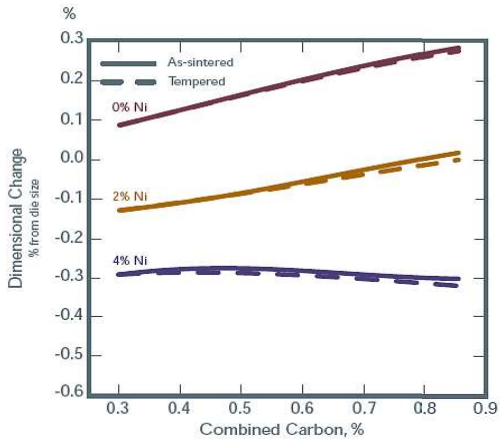
Sintered Density 6.9 g/cm^3





Sintered Density 7.1 g/cm^3





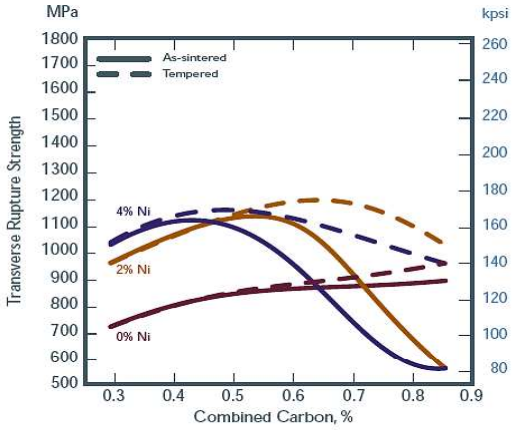
SINTERED PROPERTIES - Nickel Steels, Fast Cooled

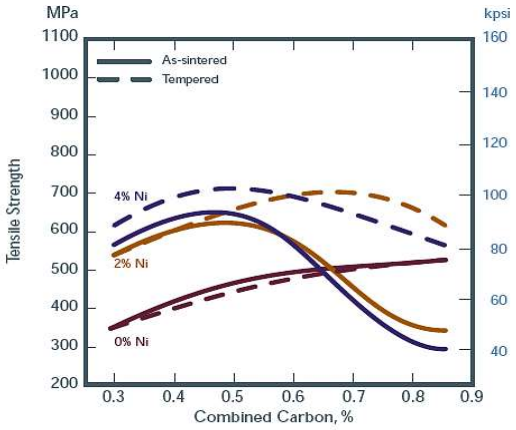
Composition: **ATOMET 4901** + nickel + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1135ºC (2075ºF) for 25 minutes.
Cooling rate of 1.85ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Transverse Rupture Strength

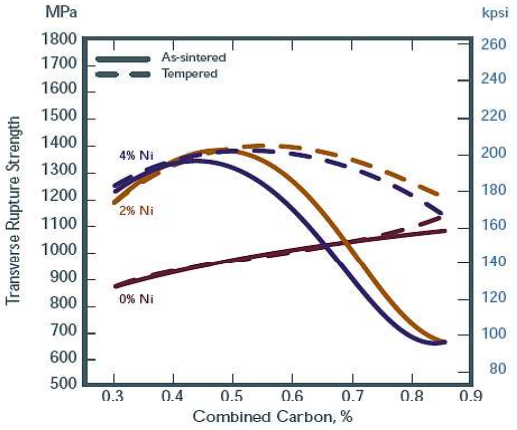
Tensile Strength

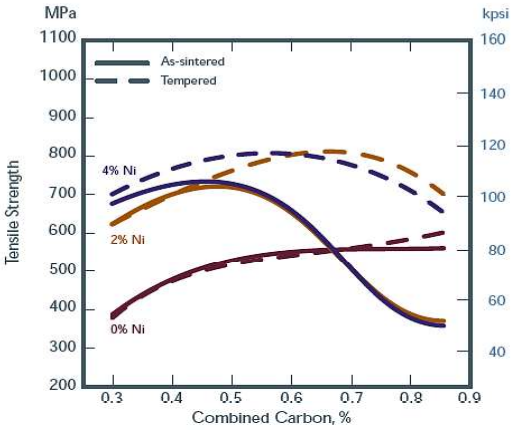
Sintered Density 6.7 g/cm³



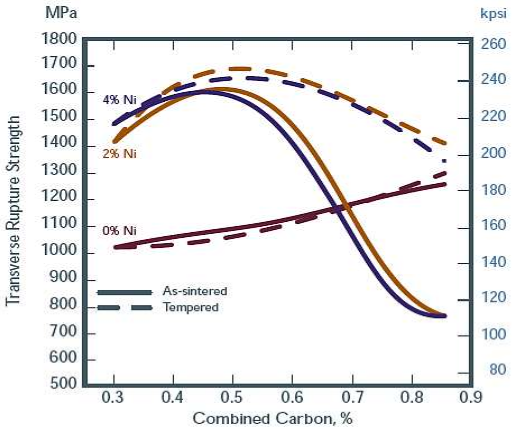


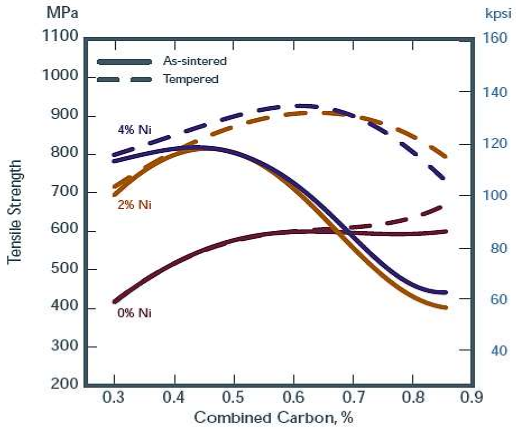
Sintered Density 6.9 g/cm³





Sintered Density 7.1 g/cm³





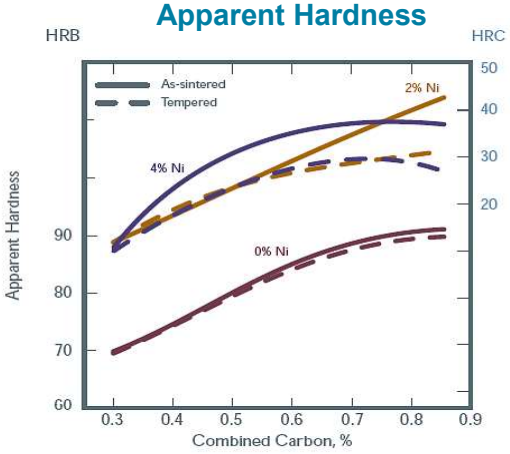
SINTERED PROPERTIES (continued) - Nickel Steels, Fast Cooled

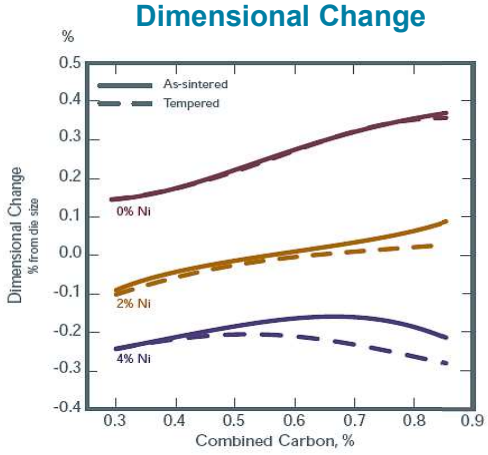
Composition: **ATOMET 4901** + nickel + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1135ºC (2075ºF) for 25 minutes.
Cooling rate of 1.85ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Apparent Hardness

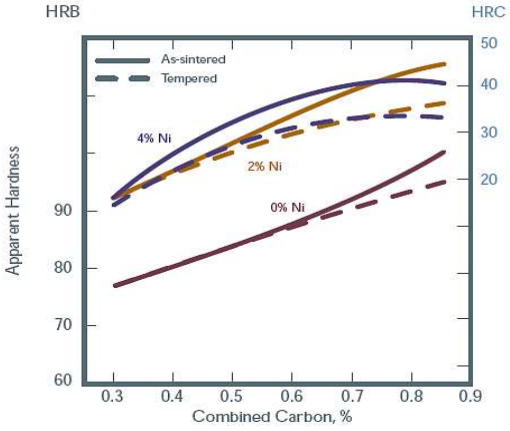
Dimensional Change

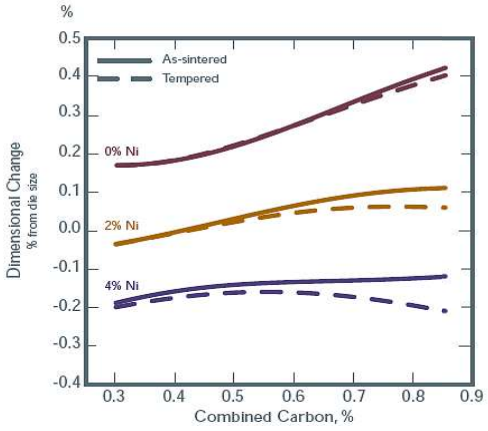
Sintered Density 6,7 g/cm^3



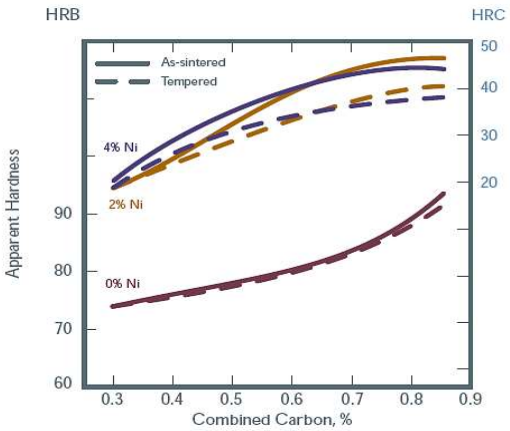


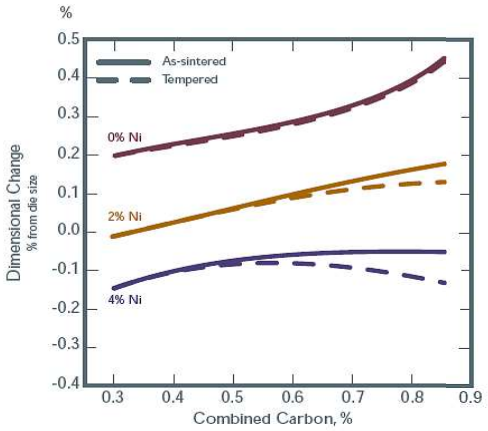
Sintered Density 6,9 g/cm^3





Sintered Density 7.1 g/cm^3





AS-SINTERED PROPERTIES - Nickel Steels, Slow Cooled

Sintered Density	Added Nickel	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.71	0	0.30	795	115	380	55	340	49	1.0	(68)	0.03
6.91	0	0.30	915	133	435	63	385	56	1.3	(76)	0.05
7.13	0	0.30	1090	158	480	70	415	60	1.7	(83)	0.10
6.69	0	0.48	855	124	450	65	365	53	1.0	(75)	0.09
6.90	0	0.48	1005	146	505	73	395	57	1.2	(84)	0.10
7.13	0	0.48	1145	166	550	80	435	63	1.3	(86)	0.17
6.69	0	0.67	895	130	490	71	385	56	<1	(79)	0.14
6.89	0	0.67	1080	157	550	80	455	66	<1	(84)	0.16
7.12	0	0.67	1150	167	570	83	470	68	<1	(89)	0.22
6.68	0	0.85	950	138	515	75	415	60	<1	(83)	0.19
6.89	0	0.85	1060	154	600	87	480	70	<1	(87)	0.23
7.12	0	0.85	1235	179	615	89	510	74	<1	(92)	0.28
6.75	1	0.33	965	140	525	76	400	58	<1	(81)	-0.22
6.94	1	0.33	1130	164	600	87	455	66	1.1	(86)	-0.17
7.16	1	0.33	1345	195	660	96	475	69	1.1	(90)	-0.11
6.75	1	0.51	1050	152	605	88	460	67	<1	(87)	-0.19
6.94	1	0.51	1310	190	695	101	495	72	1.1	(92)	-0.14
7.16	1	0.51	1455	211	785	114	515	75	1.1	17	-0.05
6.74	1	0.68	995	144	615	89	480	70	<1	(92)	-0.17
6.93	1	0.68	1225	178	710	103	530	77	<1	17	-0.08
7.19	1	0.68	1450	210	770	112	565	82	<1	23	-0.02
6.73	1	0.87	985	143	550	80	495	72	<1	14	-0.13
6.95	1	0.87	1195	173	660	96	530	77	<1	22	-0.06
7.13	1	0.87	1275	185	695	101	585	85	<1	26	0.04
6.76	2	0.29	1395	173	640	93	455	66	<1	(88)	-0.41
7.00	2	0.29	1370	199	745	108	510	74	1.1	(92)	-0.33
7.21	2	0.29	1550	225	825	120	545	79	1.2	16	-0.26
6.78	2	0.51	1340	194	760	110	480	70	<1	19	-0.40
6.99	2	0.51	1635	237	875	127	540	78	1	24	-0.33
7.21	2	0.51	1875	272	960	139	600	87	1.2	28	-0.23
6.77	2	0.67	1165	169	600	87	470	68	<1	28	-0.42
6.98	2	0.67	1360	197	725	105	545	79	<1	32	-0.34
7.19	2	0.67	1585	230	765	111	600	87	<1	35	-0.24
6.79	2	0.88	850	123	490	71	415	60	<1	30	-0.46
6.99	2	0.88	970	141	515	75	455	66	<1	33	-0.38
7.17	2	0.88	1090	158	580	84	480	70	<1	34	-0.23

TEMPERED PROPERTIES - Nickel Steels, Slow Cooled

Sintered Density	Added Nickel	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.71	0	0.3	795	115	370	54	345	50	1.0	(69)	0.04
6.91	0	0.3	945	137	435	63	385	56	1.2	(76)	0.06
7.14	0	0.3	1090	158	460	67	400	58	1.6	(83)	0.10
6.70	0	0.48	850	123	450	65	365	53	1.0	(75)	0.08
6.90	0	0.48	1000	145	490	71	395	57	1.0	(84)	0.11
7.14	0	0.48	1195	173	540	78	440	64	1.1	(86)	0.16
6.69	0	0.67	850	123	490	71	385	56	<1	(78)	0.14
6.89	0	0.67	1070	155	545	79	435	63	<1	(85)	0.17
7.10	0	0.67	1180	171	595	86	475	69	<1	(90)	0.22
6.68	0	0.85	960	139	525	76	415	60	<1	(82)	0.20
6.91	0	0.85	1035	150	600	87	490	71	<1	(88)	0.23
7.11	0	0.85	1220	177	615	89	510	74	<1	(92)	0.29
6.76	1	0.33	970	141	525	76	405	59	<1	(80)	-0.22
6.94	1	0.33	1145	166	620	90	460	67	<1	(85)	-0.17
7.16	1	0.33	1340	194	670	97	495	72	1.1	(89)	-0.12
6.75	1	0.51	1110	161	620	90	495	72	<1	(87)	-0.20
6.95	1	0.51	1240	180	710	103	530	77	1.0	(91)	-0.14
7.17	1	0.51	1435	208	765	111	570	83	1.0	17	-0.06
6.74	1	0.68	1055	153	650	94	515	75	<1	(91)	-0.17
6.95	1	0.68	1275	185	750	109	570	83	<1	16	-0.10
7.19	1	0.68	1670	242	825	120	615	89	<1	21	-0.02
6.74	1	0.87	1125	163	715	104	510	74	<1	13	-0.14
6.95	1	0.87	1330	193	770	112	580	84	<1	19	-0.07
7.13	1	0.87	1420	206	825	120	615	89	<1	23	0.02
6.78	2	0.29	1130	164	635	92	490	71	<1	(88)	-0.40
7.00	2	0.29	1340	194	740	107	750	78	1.1	(91)	-0.33
7.21	2	0.29	1505	218	805	117	585	85	1.2	17	-0.26
6.79	2	0.51	1305	189	760	110	540	78	1.0	15	-0.42
7.00	2	0.51	1565	227	875	127	605	88	1.1	20	-0.35
7.21	2	0.51	1765	256	940	136	650	94	1.3	25	-0.24
6.78	2	0.67	1340	194	760	110	525	76	1.1	20	-0.44
6.99	2	0.67	1585	230	925	134	570	83	1.1	25	-0.37
7.20	2	0.67	1805	262	970	141	615	89	1.2	29	-0.26
6.81	2	0.88	1260	183	760	110	455	66	<1	23	-0.50
7.00	2	0.88	1510	219	805	117	475	69	<1	28	-0.40
7.19	2	0.88	1650	239	890	129	515	75	1.2	13	-0.25

AS-SINTERED PROPERTIES - Nickel Steels, Fast Cooled

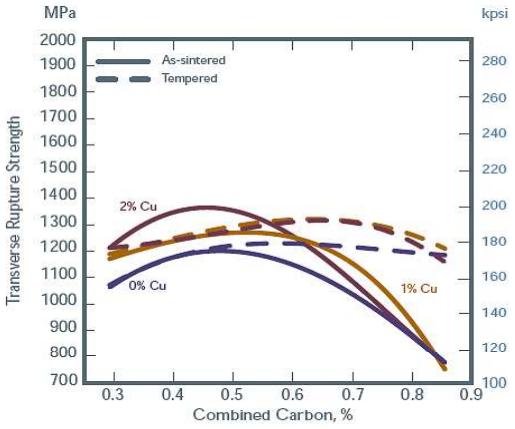
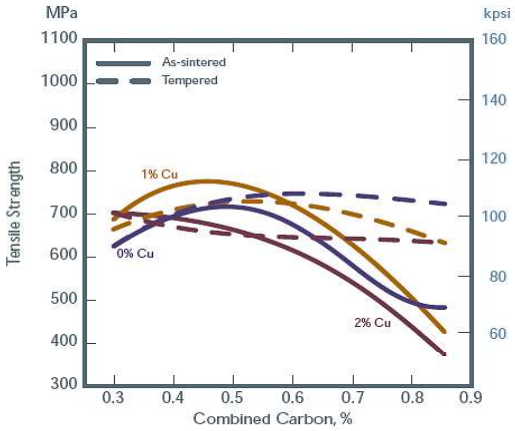
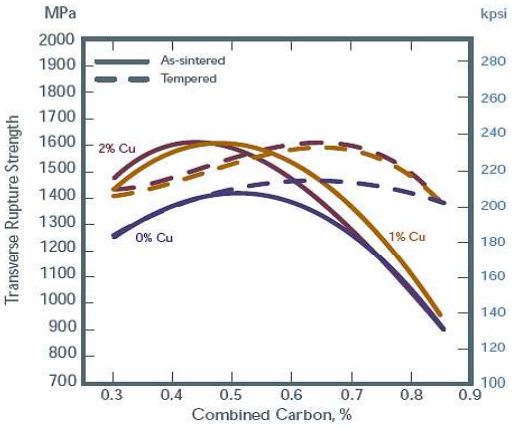
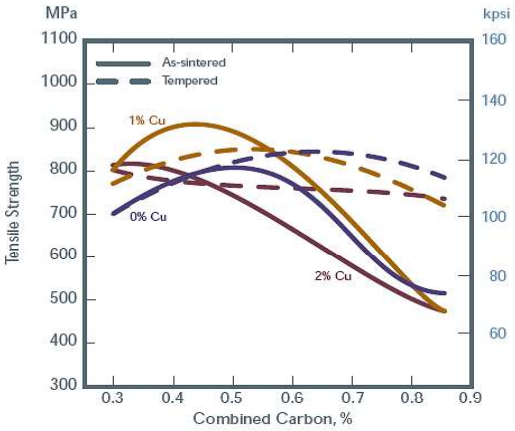
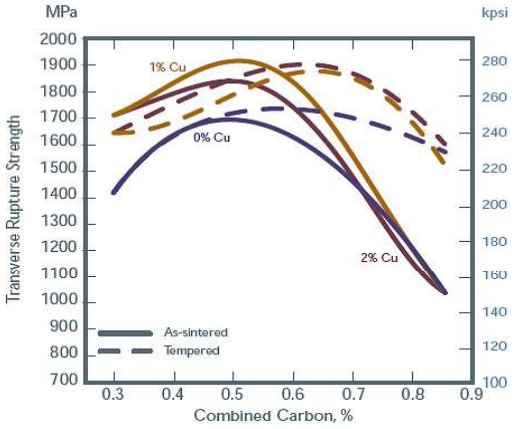
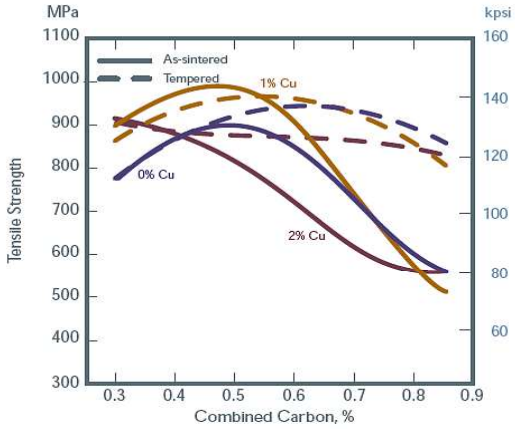
Sintered Density	Added Nickel	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.67	0	0.32	675	98	330	48	310	45	<1	(69)	0.15
6.88	0	0.32	875	127	360	52	350	51	<1	(76)	0.17
7.10	0	0.32	1000	145	405	59	400	58	<1	(84)	0.20
6.66	0	0.49	815	118	440	64	365	53	<1	(79)	0.22
6.84	0	0.49	895	130	490	71	435	63	1.0	(82)	0.22
7.13	0	0.49	1130	164	560	81	515	75	1.1	(88)	0.22
6.65	0	0.67	805	117	475	69	450	65	<1	(85)	0.31
6.86	0	0.67	1025	149	510	74	455	66	<1	(89)	0.32
7.09	0	0.67	1170	170	570	83	510	74	<1	(92)	0.32
6.65	0	0.88	855	124	490	71	455	66	<1	(91)	0.35
6.85	0	0.88	995	144	560	81	505	73	<1	26	0.42
7.09	0	0.88	1270	184	585	85	545	79	<1	30	0.44
6.73	1	0.34	980	142	550	80	725	62	<1	(85)	-0.09
6.93	1	0.34	1240	180	635	92	455	66	<1	(93)	-0.04
7.15	1	0.34	1425	207	705	102	495	72	1.0	15	-0.01
6.71	1	0.52	1150	167	625	91	475	69	<1	19	-0.01
6.89	1	0.52	1455	211	710	103	545	79	<1	27	0.03
7.11	1	0.52	1640	238	815	118	565	82	<1	30	0.07
6.70	1	0.68	925	134	440	64	-	-	<1	31	0.03
6.89	1	0.68	1115	162	470	68	-	-	<1	41	0.09
7.14	1	0.68	1165	169	570	83	-	-	<1	42	0.14
6.69	1	0.86	570	83	325	47	-	-	<1	42	0.09
6.88	1	0.86	655	95	360	52	-	-	<1	44	0.11
7.07	1	0.86	780	113	395	57	-	-	<1	45	0.18
6.73	2	0.29	1140	165	570	83	435	63	<1	(90)	-0.23
6.96	2	0.29	1325	192	725	105	515	75	1.0	14	-0.18
7.17	2	0.29	1595	231	815	118	600	87	1.0	20	-0.12
6.73	2	0.53	1170	170	635	92	495	72	<1	31	-0.17
6.94	2	0.53	1370	199	807	117	530	77	<1	31	-0.13
7.15	2	0.53	1650	239	825	120	570	83	<1	36	-0.05
6.73	2	0.68	800	116	420	61	415	60	<1	36	-0.06
6.91	2	0.68	905	131	495	72	460	67	<1	41	-0.12
7.13	2	0.68	1165	169	585	85	510	74	<1	41	-0.04
6.72	2	0.87	605	88	275	40	-	-	<1	36	-0.19
6.92	2	0.87	670	97	380	55	370	54	<1	41	-0.11
7.12	2	0.87	815	118	450	65	405	59	<1	44	-0.04

TEMPERED PROPERTIES - Nickel Steels, Fast Cooled

Sintered Density	Added Nickel	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.67	0	0.32	695	101	325	47	310	45	<1	(69)	0.15
6.88	0	0.32	870	126	370	54	365	53	1.0	(76)	0.17
7.11	0	0.32	1020	148	415	60	395	57	1.2	(84)	0.19
6.67	0	0.49	835	121	425	62	380	55	<1	(80)	0.22
6.88	0	0.49	895	130	475	69	420	61	<1	(81)	0.22
7.11	0	0.49	1095	159	550	80	510	74	<1	(88)	0.24
6.65	0	0.67	850	123	475	69	450	65	<1	(84)	0.3
6.86	0	0.67	1025	149	510	74	455	66	<1	(91)	0.32
7.09	0	0.67	1150	167	565	82	515	75	<1	(92)	0.32
6.65	0	0.88	880	128	505	73	460	67	<1	(84)	0.35
6.86	0	0.88	1130	164	545	79	525	76	<1	20	0.39
7.08	0	0.88	1275	185	640	93	670	97	<1	32	0.45
6.73	1	0.34	970	141	525	76	460	67	<1	(86)	-0.09
6.93	1	0.34	1225	178	650	94	505	73	<1	(92)	-0.03
7.14	1	0.34	1440	209	715	104	560	81	1.3	15	-0.01
6.71	1	0.52	1110	161	655	95	505	73	<1	(95)	-0.02
6.9	1	0.52	1475	214	760	110	580	84	<1	25	0.03
7.11	1	0.52	1710	248	860	125	595	86	<1	29	0.07
6.71	1	0.68	1170	170	695	101	550	80	<1	24	0.01
6.9	1	0.68	1405	204	805	117	625	91	<1	35	0.06
7.13	1	0.68	1545	224	930	135	655	95	<1	35	0.11
6.7	1	0.86	1000	145	585	85	505	73	<1	31	0.03
6.91	1	0.86	1275	185	725	105	550	80	<1	35	0.06
7.07	1	0.86	1395	202	750	109	650	94	<1	40	0.13
6.74	2	0.29	1060	154	615	89	490	71	<1	(88)	-0.23
6.96	2	0.29	1280	186	745	108	580	84	<1	14	-0.19
7.18	2	0.29	1510	219	820	119	655	95	<1	18	-0.12
6.74	2	0.53	1220	177	710	103	540	78	<1	23	-0.19
6.94	2	0.53	1420	206	850	123	580	84	<1	27	-0.15
7.16	2	0.53	1705	247	910	132	615	89	<1	31	-0.07
6.74	2	0.68	1110	161	640	93	505	73	<1	28	-0.22
6.92	2	0.68	1360	197	825	120	550	80	<1	32	-0.16
7.13	2	0.68	1605	233	910	132	570	83	<1	36	-0.08
6.74	2	0.87	960	139	565	82	400	58	<1	28	-0.27
6.94	2	0.87	1255	182	675	98	440	64	<1	32	-0.2
7.12	2	0.87	1350	196	750	109	475	69	<1	39	-0.11

SINTERED PROPERTIES - Nickel-Copper Steels, Slow Cooled

Composition: **ATOMET 4901** + 4% nickel + copper + graphite + 0.75% ZnSt
Sintered in a 90% nitrogen-based atmosphere at 1160ºC (2120ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

	Transverse Rupture Strength	Tensile Strength
Sintered Density 6,7 g/cm³		
Sintered Density 6,9 g/cm³		
Sintered Density 7,1 g/cm³		

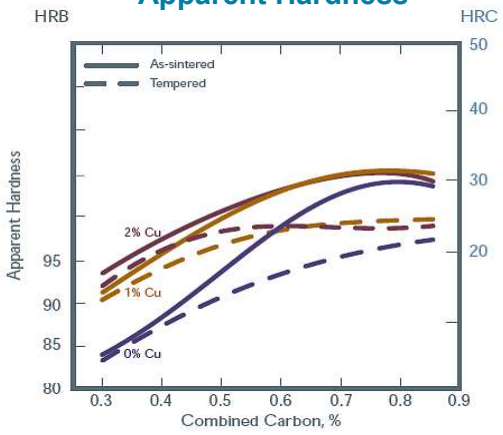
SINTERED PROPERTIES (continued) - Nickel-Copper Steels, Slow Cooled

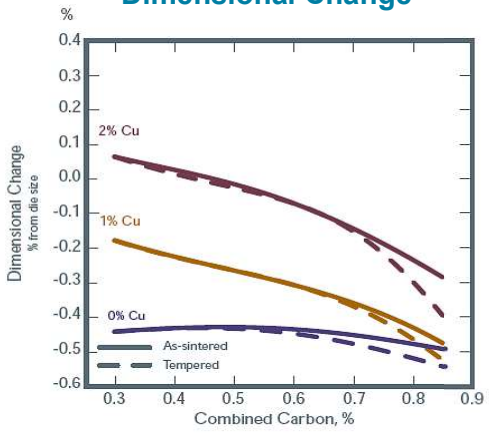
Composition: **ATOMET 4901** + 4% nickel + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1160ºC (2120ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

Apparent Hardness

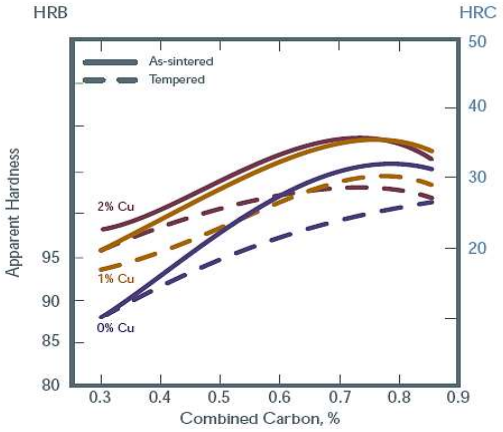
Dimensional Change

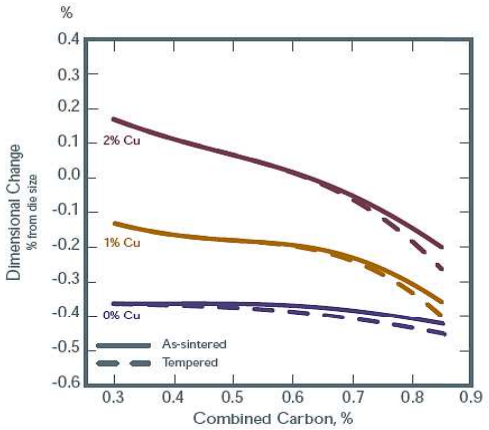
Sintered Density 6.7 g/cm^3



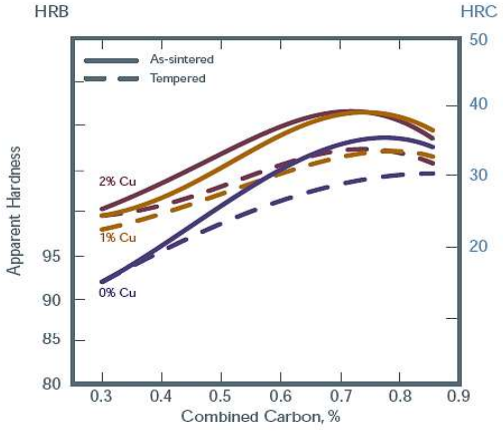


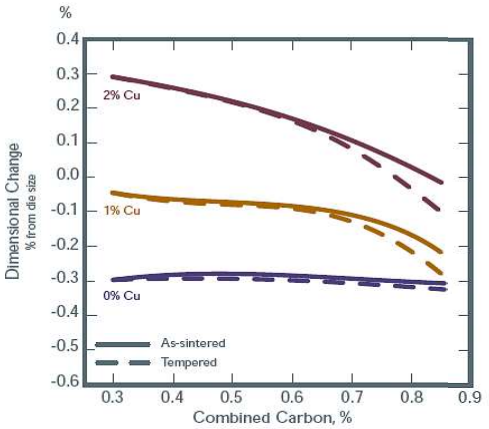
Sintered Density 6.9 g/cm^3





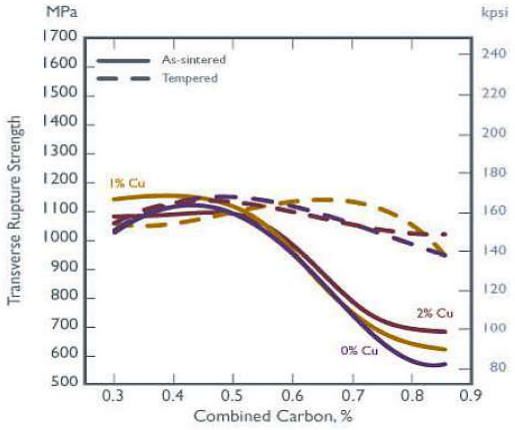
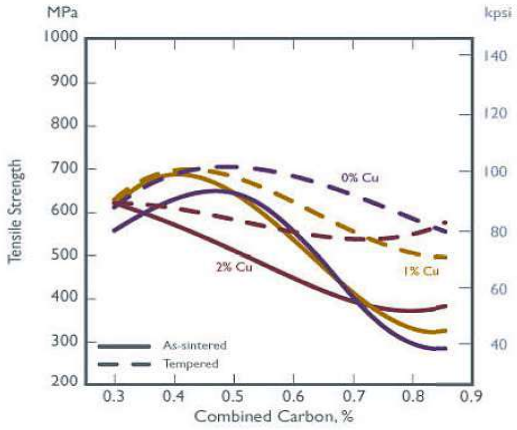
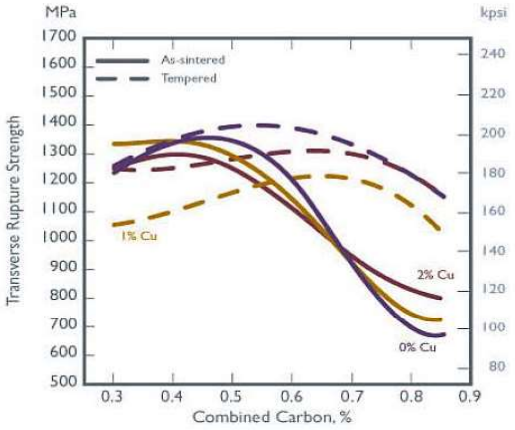
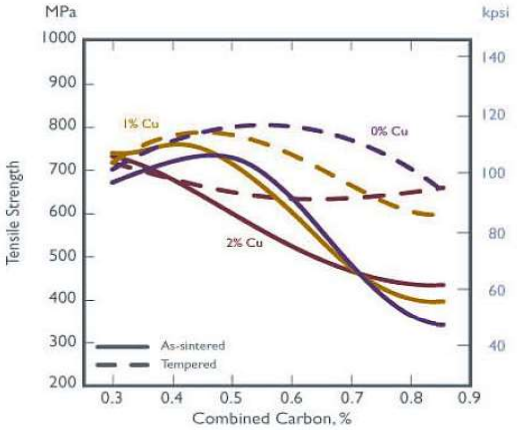
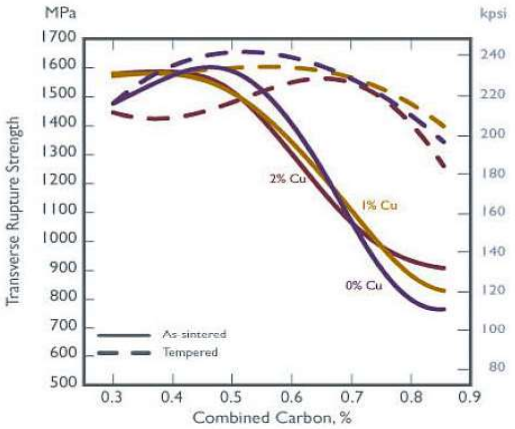
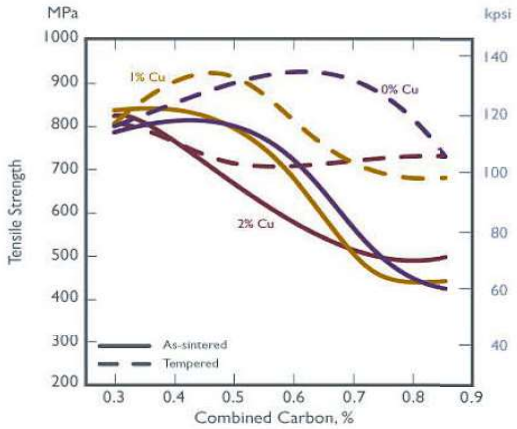
Sintered Density 7,1 g/cm^3





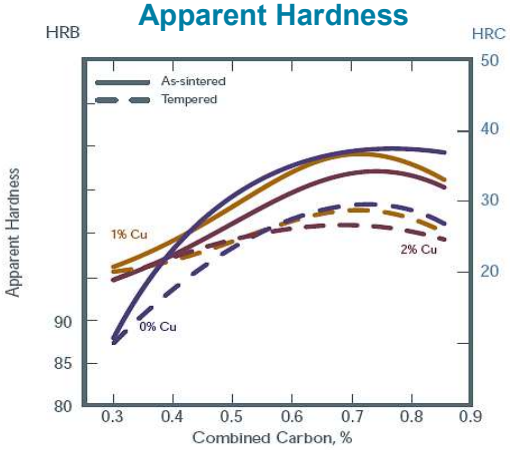
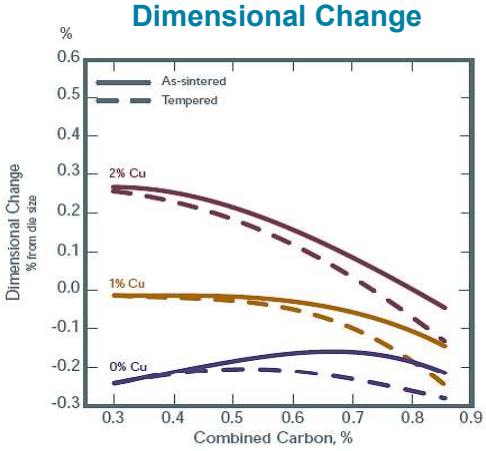
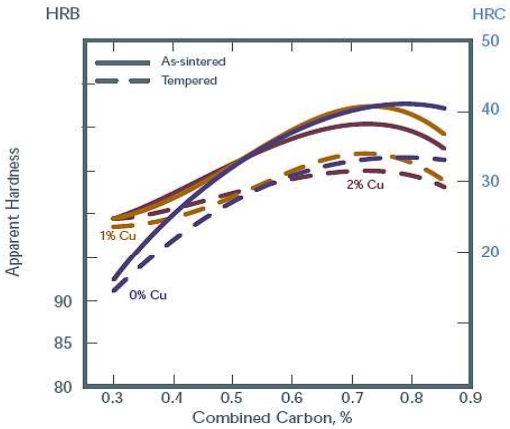
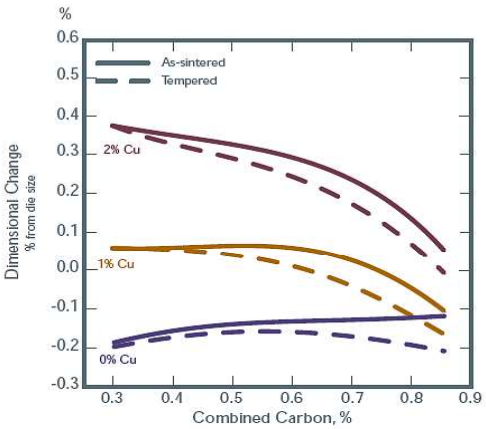
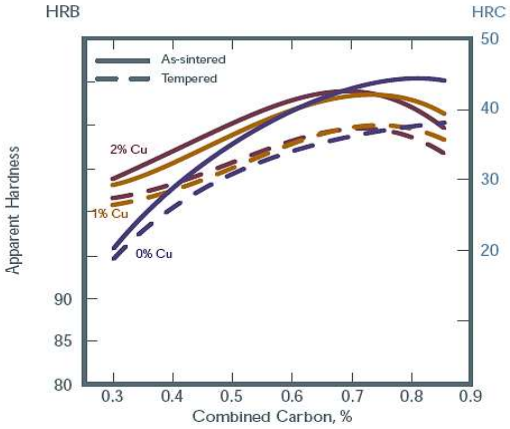
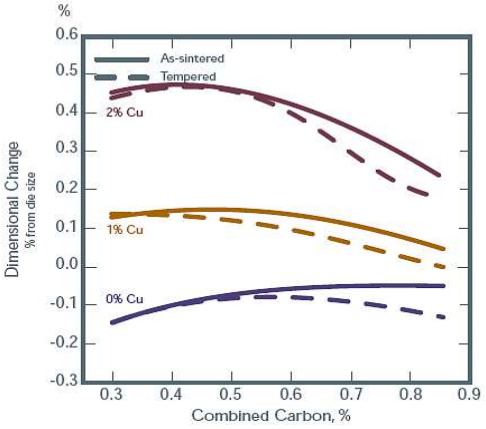
SINTERED PROPERTIES - Nickel-Copper Steels, Fast Cooled

Composition: **ATOMET 4901** + 4% nickel + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1135ºC (2075ºF) for 25 minutes.
Cooling rate of 0.65ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

	Transverse Rupture Strength	Tensile Strength
Sintered Density 6.7 g/cm^3		
Sintered Density 6.9 g/cm^3		
Sintered Density 7,1 g/cm^3		

SINTERED PROPERTIES (continued) - Nickel-Copper Steels, Fast Cooled

Composition: **ATOMET 4901** + 4% nickel + copper + graphite + 0.75% ZnSt.
Sintered in a 90% nitrogen-based atmosphere at 1135ºC (2075ºF) for 25 minutes.
Cooling rate of 1.85ºC/s from 650ºC (1200ºF) to 400ºC (750ºF).
Tempered 60 minutes at 200ºC (390ºF).

	Apparent Hardness	Dimensional Change
Sintered Density 6.7 g/cm^3		
Sintered Density 6.9 g/cm^3		
Sintered Density 7.1 g/cm^3		

SINTERED PROPERTIES - Copper-Nickel Steels, Slow Cooled

Sintered Density	Added Nickel	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.76	4	0	0.29	1395	173	640	93	455	66	<1	(88)	-0.41
7.00	4	0	0.29	1370	199	745	108	510	74	1.1	(92)	-0.33
7.21	4	0	0.29	1550	225	825	120	545	79	1.2	16	-0.26
6.78	4	0	0.51	1340	194	760	110	480	70	<1	19	-0.40
6.99	4	0	0.51	1635	237	875	127	540	78	1.0	24	-0.33
7.21	4	0	0.51	1875	272	960	139	600	87	1.2	28	-0.23
6.77	4	0	0.67	1165	169	600	87	470	68	<1	28	-0.42
6.98	4	0	0.67	1360	197	725	105	545	79	<1	32	-0.34
7.19	4	0	0.67	1585	230	765	111	600	87	<1	35	-0.24
6.79	4	0	0.88	850	123	490	71	415	60	<1	30	-0.46
6.99	4	0	0.88	970	141	515	75	455	66	<1	33	-0.38
7.17	4	0	0.88	1090	158	580	84	480	70	<1	34	-0.23
6.72	4	1	0.32	1195	174	700	101	445	65	1.2	(91)	-0.17
6.93	4	1	0.32	1485	215	805	117	495	72	1.3	17	-0.12
7.11	4	1	0.32	1730	251	895	130	545	79	1.4	23	-0.03
6.74	4	1	0.49	1350	196	770	111	585	85	<1	24	-0.26
6.92	4	1	0.49	1630	236	900	130	530	77	<1	26	-0.16
7.12	4	1	0.49	1965	285	990	143	590	86	1.0	31	-0.06
6.75	4	1	0.65	1235	179	650	94	450	66	<1	30	-0.27
6.93	4	1	0.65	1425	207	760	110	505	73	<1	33	-0.20
7.12	4	1	0.65	1660	241	795	115	545	79	<1	37	-0.08
6.77	4	1	0.85	805	116	435	63	370	53	<1	31	-0.44
6.95	4	1	0.85	975	142	490	71	415	60	<1	33	-0.32
7.14	4	1	0.85	1090	158	510	74	460	67	<1	37	-0.17
6.68	4	2	0.31	1175	170	710	103	470	68	1.2	(93)	0.05
6.86	4	2	0.31	1450	210	800	116	510	74	1.4	19	0.14
7.05	4	2	0.31	1650	239	915	133	530	77	1.7	23	0.26
6.69	4	2	0.49	1355	197	670	97	440	64	<1	23	-0.01
6.88	4	2	0.49	1530	222	710	103	485	70	<1	28	0.06
7.05	4	2	0.49	1810	262	805	117	535	78	1.1	31	0.18
6.70	4	2	0.65	1115	162	550	80	425	62	<1	29	-0.10
6.89	4	2	0.65	1345	195	620	90	440	64	<1	34	-0.03
7.06	4	2	0.65	1495	217	630	91	445	65	<1	37	0.11
6.74	4	2	0.82	805	117	415	60	335	49	<1	29	-0.27
6.92	4	2	0.82	930	135	515	75	365	53	<1	33	-0.19
7.09	4	2	0.82	1040	151	570	83	410	60	<1	34	-0.02

TEMPERED PROPERTIES - Copper-Nickel Steels, Slow Cooled

Sintered Density	Added Nickel	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.78	4	0	0.29	1130	164	635	92	490	71	<1	17	-0.40
7.00	4	0	0.29	1340	194	740	107	750	78	1.1	(91)	-0.33
7.21	4	0	0.29	1505	218	805	117	585	85	1.2	17	-0.26
6.79	4	0	0.51	1305	189	760	110	540	78	1.0	15	-0.42
7.00	4	0	0.51	1565	227	875	127	605	88	1.1	20	-0.35
7.21	4	0	0.51	1765	256	940	136	650	94	1.3	25	-0.24
6.78	4	0	0.67	1340	194	760	110	525	76	1.1	20	-0.44
6.99	4	0	0.67	1585	230	925	134	570	83	1.1	25	-0.37
7.20	4	0	0.67	1805	262	970	141	615	89	1.2	29	-0.26
6.81	4	0	0.88	1260	183	760	110	455	66	<1	23	-0.50
7.00	4	0	0.88	1510	219	805	117	475	69	<1	28	-0.40
7.19	4	0	0.88	1650	239	890	129	515	75	1.2	31	-0.25
6.73	4	1	0.32	1230	178	680	98	480	69	1.1	(91)	-0.18
6.93	4	1	0.32	1420	206	775	113	560	82	1.2	(95)	-0.12
7.12	4	1	0.32	1665	241	865	125	640	93	1.7	22	-0.03
6.74	4	1	0.49	1365	198	715	104	525	76	<1	21	-0.26
6.93	4	1	0.49	1545	224	885	128	560	82	<1	22	-0.18
7.12	4	1	0.49	1805	262	940	136	715	103	1.0	27	-0.08
6.75	4	1	0.65	1365	198	725	105	495	72	1.0	23	-0.32
6.93	4	1	0.65	1695	246	850	123	560	82	1.0	27	-0.22
7.13	4	1	0.65	1875	272	950	138	575	84	1.1	32	-0.12
6.79	4	1	0.85	1280	186	650	94	420	61	<1	25	-0.48
6.97	4	1	0.85	1440	209	770	112	480	70	<1	28	-0.37
7.16	4	1	0.85	1575	228	805	117	590	85	<1	33	-0.24
6.68	4	2	0.31	1180	171	705	102	485	70	1.0	(92)	0.04
6.87	4	2	0.31	1410	205	790	114	530	77	1.2	17	0.15
7.05	4	2	0.31	1590	230	905	131	600	87	1.6	22	0.24
6.70	4	2	0.49	1260	182	670	97	540	78	<1	19	-0.05
6.88	4	2	0.49	1540	223	720	105	595	86	1.0	23	0.03
7.05	4	2	0.49	1790	259	870	126	615	89	1.0	27	0.18
6.72	4	2	0.65	1320	191	720	105	480	70	1.0	22	-0.16
6.91	4	2	0.65	1635	237	760	110	495	72	1.1	27	-0.08
7.07	4	2	0.65	1805	262	860	125	520	75	1.2	31	0.08
6.76	4	2	0.82	1215	177	700	101	360	52	1.1	23	-0.37
6.93	4	2	0.82	1420	206	720	104	370	54	1.1	27	-0.24
7.10	4	2	0.82	1595	232	870	126	415	60	1.5	31	-0.11

SINTERED PROPERTIES - Copper-Nickel Steels, Fast Cooled

Sintered Density	Added Nickel	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.73	4	0	0.29	1140	165	570	83	435	63	<1	(90)	-0.23
6.96	4	0	0.29	1325	192	725	105	515	75	1.0	14	-0.18
7.17	4	0	0.29	1595	231	815	118	600	87	1.0	20	-0.12
6.73	4	0	0.53	1170	170	635	92	495	72	<1	31	-0.17
6.94	4	0	0.53	1370	199	807	117	530	77	<1	31	-0.13
7.15	4	0	0.53	1650	239	825	120	570	83	<1	36	-0.05
6.73	4	0	0.68	800	116	420	61	415	60	<1	36	-0.16
6.91	4	0	0.68	905	131	495	72	460	67	<1	41	-0.12
7.13	4	0	0.68	1165	169	585	85	510	74	<1	41	-0.04
6.72	4	0	0.87	605	88	275	40	-	-	<1	36	-0.19
6.92	4	0	0.87	670	97	380	55	370	54	<1	41	-0.11
7.12	4	0	0.87	815	118	450	65	405	59	<1	44	-0.04
6.69	4	1	0.32	1145	166	615	89	485	70	<1	(95)	-0.01
6.88	4	1	0.32	1290	187	700	101	520	75	<1	17	0.05
7.08	4	1	0.32	1560	226	820	119	650	94	1.0	27	0.12
6.69	4	1	0.51	1145	166	620	90	460	67	<1	25	-0.01
6.88	4	1	0.51	1300	188	715	104	495	72	<1	33	0.05
7.07	4	1	0.51	1505	218	780	113	510	74	<1	35	0.14
6.70	4	1	0.66	795	115	420	61	345	50	<1	35	-0.02
6.89	4	1	0.66	970	140	480	70	375	55	<1	40	0.04
7.08	4	1	0.66	1200	174	560	81	460	67	<1	40	0.12
6.71	4	1	0.86	635	92	305	44	270	39	<1	33	-0.14
6.90	4	1	0.86	725	105	385	56	365	53	<1	34	-0.10
7.09	4	1	0.86	820	119	425	61	370	54	<1	40	0.04
6.63	4	2	0.32	1030	149	590	86	435	63	<1	(91)	0.23
6.82	4	2	0.32	1180	171	690	100	475	69	<1	21	0.34
7.00	4	2	0.32	1355	197	785	114	535	77	<1	25	0.41
6.62	4	2	0.51	1035	150	465	67	425	62	<1	23	0.20
6.82	4	2	0.51	1185	172	570	83	475	69	<1	31	0.27
7.00	4	2	0.51	1390	201	620	90	525	76	<1	35	0.42
6.66	4	2	0.66	830	121	390	57	370	54	<1	31	0.09
6.82	4	2	0.66	950	138	415	60	395	58	<1	37	0.22
7.02	4	2	0.66	1080	156	455	66	415	60	<1	39	0.34
6.70	4	2	0.84	690	100	375	54	305	44	<1	31	-0.04
6.86	4	2	0.84	775	112	415	60	315	46	<1	34	0.04
7.02	4	2	0.84	865	126	480	69	365	53	<1	36	0.18

TEMPERED PROPERTIES - Copper-Nickel Steels, Fast Cooled

Sintered Density	Added Nickel	Added Copper	Combined Carbon	Transverse Rupture Strength		Tensile Strength		Yield Strength		Elongation	Apparent Hardness	Dimensional Change
g/cm^3	%	%	%	MPa	kpsi	MPa	kpsi	MPa	kpsi	%	HRC (HRB)	%
6.74	4	0	0.29	1060	154	615	89	490	71	<1	(88)	-0.23
6.96	4	0	0.29	1280	186	745	108	580	84	<1	14	-0.19
7.18	4	0	0.29	1510	219	820	119	655	95	<1	18	-0.12
6.74	4	0	0.53	1220	177	710	103	540	78	<1	23	-0.19
6.94	4	0	0.53	1420	206	850	123	580	84	<1	27	-0.15
7.16	4	0	0.53	1705	247	910	132	615	89	<1	31	-0.07
6.74	4	0	0.68	1110	161	640	93	505	73	<1	28	-0.22
6.92	4	0	0.68	1360	197	825	120	550	80	<1	32	-0.16
7.13	4	0	0.68	1605	233	910	132	570	83	<1	36	-0.08
6.74	4	0	0.87	960	139	565	82	400	58	<1	28	-0.27
6.94	4	0	0.87	1255	182	675	98	440	64	<1	32	-0.20
7.12	4	0	0.87	1350	196	750	109	475	69	<1	39	-0.11
6.69	4	1	0.32	1075	156	625	91	505	74	<1	(93)	-0.01
6.87	4	1	0.32	1235	179	690	100	620	90	<1	(94)	0.05
7.08	4	1	0.32	1505	218	785	114	705	102	1.0	24	0.12
6.70	4	1	0.51	1060	153	650	94	495	72	<1	22	-0.03
6.89	4	1	0.51	1330	193	790	115	520	75	<1	27	0.03
7.08	4	1	0.51	1560	226	875	127	660	95	<1	30	0.12
6.70	4	1	0.66	1135	165	550	80	425	62	<1	27	-0.07
6.90	4	1	0.66	1390	202	640	92	540	78	<1	31	-0.02
7.08	4	1	0.66	1555	225	715	104	565	82	<1	35	0.07
6.73	4	1	0.86	985	143	485	70	385	56	<1	25	-0.24
6.92	4	1	0.86	1180	171	585	85	390	57	<1	28	-0.16
7.10	4	1	0.86	1390	201	685	99	575	83	<1	35	-0.01
6.63	4	2	0.32	1000	145	600	87	40	66	<1	(91)	0.20
6.83	4	2	0.32	1169	170	665	97	510	74	<1	17	0.35
7.01	4	2	0.32	1345	195	780	113	580	84	<1	22	0.41
6.64	4	2	0.51	1075	156	535	78	475	69	<1	17	0.19
6.83	4	2	0.51	1220	177	600	87	520	76	<1	26	0.23
7.00	4	2	0.51	1390	202	680	99	585	85	<1	29	0.39
6.65	4	2	0.66	1010	147	525	76	410	59	<1	23	0.05
6.84	4	2	0.66	1250	181	595	86	405	66	<1	29	0.16
7.02	4	2	0.66	1460	212	685	99	465	68	<1	33	0.28
6.68	4	2	0.84	1005	146	580	84	330	48	<1	22	-0.12
6.88	4	2	0.84	1150	167	640	93	345	50	1.3	28	-0.03
7.04	4	2	0.84	1225	178	710	103	375	54	1.1	30	0.10

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