POWDER METALLURGY

THINK > Materials and Processes

GKN Sinter Metals Material Lists

GKN Sinter Metals offers the broadest material selection in the industry to meet a wide range of needs.

GKN´s powder metal (PM) material capabilities not even match with traditional material types, it rather excels them due to the fact that PM allows for unique material combinations that cannot be produced with the traditional iron melting furnace process.

That is why the GKN PM technology offers unique product solutions and benefits for diverse markets from Automotive, Medical, Aerospace, Industrial to Consumer product applications!

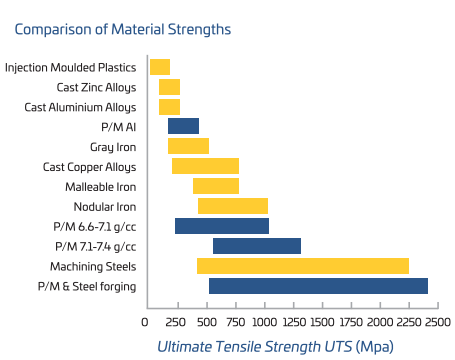
The following graph shows the comparison of ultimate tensile strengths of PM grades compared to traditional materials types.

As full metal shape solution provider we find the best technology fit to get the optimum value for your product solution. Below graphic shows available material structure types.

MATERIAL		POWDER METALLURGY (PM) PROCESS TECHNOLOGY				
Classification	Description	Conventional	Forged	MIM *	Filters	Bearings
Iron & Steel	Iron	■	■			■
	Plain Carbon Steel	■	■	■		
	Structural Alloy Steel (Cu, Ni, Mo, Mn, Cr) **	■	■	■		
	Specialized Alloy Steel **	■		■		
Stainless Steel	Austenitic	■		■	■	
	Ferritic	■		■	■	
	Martensitic	■		■	■	
	Precipitation Hardening			■	■	
Ferrous Soft Magnetic	Iron	■		■		
	Alloyed Iron	■		■		
	(P, Si, and Ni) **	■				
Copper-Based	Copper	■				
	Brass	■			■	
	Bronze	■			■	■
	Diluted Bronze					■
Aluminum Alloys ***	Standard Series (PM2014, 6061, 7075; PM-AL-145I	■				
	Thermal Series (TC-2000)	■				
	Mechanical Strength Series (MMC-1)	■				

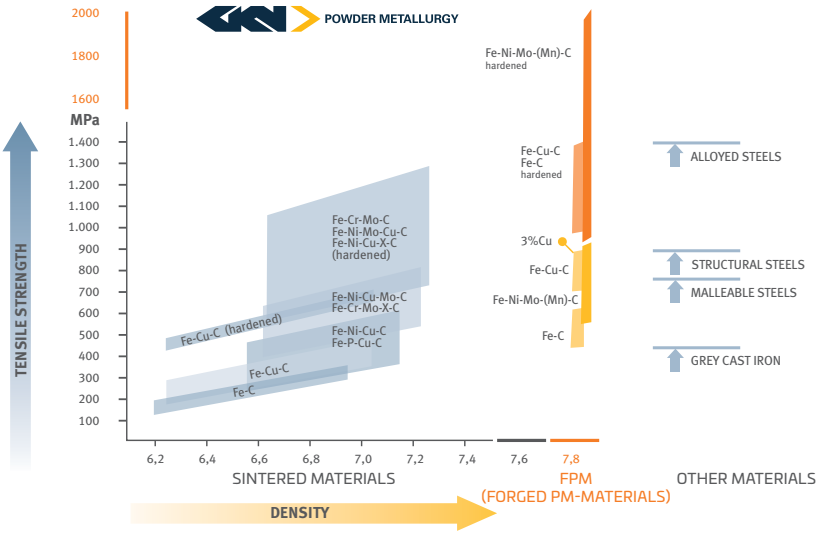
* Metal Injection Molding)
** Several PM alloying methods are utilized: elemental blends, diffusion bonded, fully alloyed, or combinations of these.
*** Various alloys are available including 2024 (Al-Cu-Mg-Si), 6061 (Al-Mg-Si-Cu)and 7075 (Al-Zn-Cu-Mg) plus Metal Matrix Composite (MMC) variants.

PM Material strengths



GKN supports customers with the best material selction in order to achieve maximum product performances.

Find an overview of the wide performance range of our PM grades and densities values.



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Part I: Material Lists

Part II: Sintered Metal Capabilities

Sintered Steels

Standard References I		Typical Properties (References)									
GKN SM Material Code	Density [g/cm³]	Typical composition[1]	Typical density [g/cm³]	UTS [MPa]	YS 0,2 [MPa]	FEL[3] [MPa]	A[2] El[2] [%]	Hard-ness HB	Hard-ness HRB	E [GPa]	Remark
PMET 103P56-SP	6.5 - 6.9	Fe3Cu0.55P-0.55C	6.70	485	415	180	3	-	75	120	
PMET 104P56-SP	6.6 - 7.1	Fe4Cu0.55P-0.55C	7.00	590	465	215	3.5	-	85	140	
PMET 1000C	6.4 - 6.8	Fe	6.60	130	75	35	4	40	58 HRF	100	
PMET 1005C	6.4 - 6.8	Fe-0.5C	6.60	250	160	80	1.5	75	40	100	
PMET 1020C	6.4 - 6.8	Fe2Cu	6.60	230	185	90	2	65	25	100	
PMET 1000D	6.8 - 7.2	Fe	7.00	150	90	45	10	50	75 HRF	140	
PMET 1002D	6.8 - 7.2	Fe-0.2C	7.00	230	150	70	5	75	-	140	
PMET 1005D	6.8 - 7.2	Fe-0.5C	7.00	300	180	95	3	90	58	140	
PMET 1007D	6.8 - 7.2	Fe-0.7C	7.00	380	230	120	2	120	68	140	
PMET 1020D	6.8 - 7.2	Fe2Cu	7.00	270	230	75	4	85	-	140	
PMET 1025D	6.8 - 7.2	Fe2Cu-0.5C	7.00	500	330	160	2.5	140	70	140	
PMET 1025D-H1	6.8 - 7.2	Fe2Cu-0.5C	7.00	690	660	240	< 1	380	36 HRC	140	quench + temper[4]
PMET 1027D	6.8 - 7.2	Fe2Cu-0.7C	7.00	560	410	180	1.5	170	74	140	
PMET 1205D	6.8 - 7.2	Fe2Ni0.5C	6.9	340	210	120	2	-	69	135	
PMET 1205D-H	6.8 - 7.2	Fe2Ni0.5C	7.1	1,000	980	290	< 1	-	33 HRC	150	quench + temper[4]
PMET 1208D	6.8 - 7.2	Fe2Ni0.8C	6.9	380	280	140	1	-	71	135	
PMET 1208D-H	6.8 - 7.2	Fe2Ni0.8C	7.0	1,000	990	320	< 1	-	35 HRC	140	quench + temper[4]
PMET 4602D	6.8 - 7.2	Fe1.5Cu1.75Ni0.5Mo-0.2C	7.00	470	360	150	3.5	140	60	140	
PMET 4602E	> 7.2	Fe1.5Cu1.75Ni0.5Mo-0.2C	7.25	500	390	160	4	160	68	160	
PMET 4605D	6.8 - 7.2	Fe1.5Cu1.75Ni0.5Mo-0.5C	7.00	540	420	185	2.5	180	78	140	
PMET 4605D-H1	6.8 - 7.2	Fe1.5Cu1.75Ni0.5Mo-0.5C	7.00	1,020	900	270	< 1	400	35 HRC	140	quench + temper[4]
PMET 4605E	> 7.2	Fe1.5Cu1.75Ni0.5Mo-0.5C	7.25	570	340	175	5	190	82	160	
PMET 4607D	6.8 - 7.2	Fe1.5Cu1.75Ni0.5Mo-0.7C	7.00	580	380	180	1.5	210	85	140	
PMET 4802D	6.8 - 7.2	Fe1.5Cu4Ni0.5Mo-0.2C	7.00	520	330	170	3.5	150	58	140	
PMET 4802E	> 7.2	Fe1.5Cu4Ni0.5Mo-0.2C	7.25	570	350	180	4	170	66	160	
PMET 4805D	6.8 - 7.2	Fe1.5Cu4Ni0.5Mo-0.5C	7.00	620	340	200	2	180	84	140	
PMET 4805D-H1	6.8 - 7.2	Fe1.5Cu4Ni0.5Mo-0.5C	7.00	1,050	820	300	< 1	380	34 HRC	140	quench + temper[4]
PMET 4805E	> 7.2	Fe1.5Cu4Ni0.5Mo-0.5C	7.25	700	370	200	2.5	200	89	160	
PMET 4807D	6.8 - 7.2	Fe1.5Cu4Ni0.5Mo-0.7C	7.00	610	380	190	1.5	230	89	140	
PMET 49N2D	6.8 - 7.2	Fe2Cu4Ni1.5Mo-0.2C	7.00	620	450	170	2	160	-	140	
PMET 49N2E	> 7.2	Fe2Cu4Ni1.5Mo-0.2C	7.25	710	470	190	2.5	190	-	160	
PMET 49N6D	6.8 - 7.2	Fe2Cu4Ni1.5Mo-0.6C	7.00	900	650	220	1	300	-	140	sinter hardened[5]
PMET 49N6E	> 7.2	Fe2Cu4Ni1.5Mo-0.6C	7.25	1,050	670	240	1.5	330	-	160	sinter hardened[5]
PMET 49C2D	6.8 - 7.2	Fe2Cu1.5Mo-0.2C	7.00	550	400	170	1.5	150	-	140	
PMET 49C2E	> 7.2	Fe2Cu1.5Mo-0.2C	7.25	600	450	180	2	180	-	160	
PMET 49C6D	6.8 - 7.2	Fe2Cu1.5Mo-0.6C	7.00	850	800	200	0.5	320	-	140	sinter hardened[5]
PMET 49C6E	> 7.2	Fe2Cu1.5Mo-0.6C	7.25	1,000	930	220	1	400	-	160	sinter hardened[5]
PMET 10P0D	6.8 - 7.2	Fe0.45P	7.00	380	230	120	10	100	-	140	
PMET L44N6D	6.8 - 7.2	Fe2Ni0.85Mo0.5C	7.05	550	440	220	1	-	85	145	
PMET L44N6D-H	6.8 - 7.2	Fe2Ni0.85Mo0.5C	7.05	1,170	1000	340	< 1	-	38 HRC	145	quench + temper [4]
PMET L4206D	6.8 - 7.2	Fe0.45Ni0.6Mo0.25Mn0.5C	6.95	400	320	190	1	-	66	140	
PMET L4206D-H	6.8 - 7.2	Fe0.45Ni0.6Mo0.25Mn0.5C	7.0	900	890	300	< 1	-	36 HRC	140	quench + temper [4])
PMET L44NC8D	6.8 - 7.2	Fe2Ni2Cu0.85Mo0.8C	7.0	790	780	230	< 1	-	25 HRC	140	sinter hardened + temper[5]
PMET L4628D	6.8 - 7.2	Fe2Cu1.8Ni0.5Mo0.2Mn0.8C	7.0	720	710	230	< 1	-	36 HRC	140	sinter hard.+ temper[5]
PMET L4618D	6.8 - 7.2	Fe1Cu2.8Ni0.5Mo0.2Mn0.8C	7.15	1,000	980	290	< 1	-	36 HRC	150	sinter hard.+ temper[5]
PMET 10P52	6.8 - 7.2	Fe0.55P0.2C	7.1	350	280	[7]	7	-	58	150	
PMET 4306D	6.8 - 7.2	Fe1Cr1Ni0.85Mo0,6Si-0.6C	7.00	950	900	220	1	350	34 HRC	140	sinter hardened[5]
PMET 4306D-HT	6.8 - 7.2	Fe1Cr1Ni0,85Mo0,6Si-0.6C	7.15	1,150	1,000	250	1	380	39 HRC	150	sinter hardened[5], HT sintered[6]

[1] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.
[2] Sizing will reduce the elongation.
[3] Bending load. 2 x 10^6 cycles, notch factor α_k = 1.0 (ref. 30912 Part 6); R= -1.
[4] Austenitized at 900 °C, 60 minutes – oil quenched; tempered at 180 - 220 °C, 60 minutes, air.
[5] Sinterhardening is performed in the sinter furnace by gas quenching subsequently to the sintering process. Materials can be tempered as well at 160 °C – 240 °C for 30 min – 120 min due to requirements.
[6] High temperature sintering (HT) is performed at 1,200 °C – 1,300 °C depending on furnace type.
[7] FEL available for 3 point bending stress

Chemical Compositions (Standard)[1]									Standard References II		
C [wt.-%]	Cu [wt.-%]	Ni [wt.-%]	Mo [wt.-%]	Cr [wt.-%]	Si [wt.-%]	P [wt.-%]	Fe [wt.-%]	Others [wt.-%]	DIN 30910 Sint-	ISO 5755	MPIF 35
0.45 - 0.65	2.0 - 4.0	-	-	-	-	0.45 - 0.65	bal.	<2	n/a	n/a	n/a
0.45 - 0.65	2.0 - 4.0	-	-	-	-	0.45 - 0.65	bal.	<2	n/a	n/a	n/a
<0.3	-	-	-	-	-	-	bal.	<2	C 00	-F-00-100	F-0000-15
0.3 - 0.7	<1	-	-	-	-	-	bal.	<2	C 01	-F-05-140	F-0005-20
<0.3	1.5 - 2.5	-	-	-	-	-	bal.	<2	C 10	-F-00C2-140	FC-0200-21
<0.3	-	-	-	-	-	-	bal.	<2	D 00	-F-00-120	F-0000-20
0.1 - 0.5	-	-	-	-	-	-	bal.	<2	D 00	-F-00-120	F-0000-20
0.3 - 0.7	<1	-	-	-	-	-	bal.	<2	D 01	-F-05-170	F-0005-25
0.5 - 0.9	-	-	-	-	-	-	bal.	<2	n/a	-F-08-240	F-0008-35
<0.3	1.5 - 2.5	-	-	-	-	-	bal.	<2	D 10	-F-00C2-175	FC-0200-24
0.3 - 0.7	1.5 - 2.5	-	-	-	-	-	bal.	<2	D 11	-F-05C2-300	FC-0205-45
0.3 - 0.7	1.5 - 2.5	-	-	-	-	-	bal.	<2	D 11	-F-05C2-620H	FC-0205-90HT
0.5 - 0.9	1.5 - 2.5	-	-	-	-	-	bal.	<2	D 11	-F-08C2-390	FC-0208-60
0.3 - 0.6	0.0 - 2.5	1.0 - 3.0	-	-	-	-	bal.	<2	n/a	-F-05N2-180	FN-0205
0.3 - 0.6	0.0 - 2.5	1.0 - 3.0	-	-	-	-	bal.	<2	n/a	-F-05N2-800H	n/a
0.6 - 0.9	0.0 - 2.5	1.0 - 3.0	-	-	-	-	bal.	<2	n/a	-F-08N2--260	FN-0208
0.6 - 0.9	0.0 - 2.5	1.0 - 3.0	-	-	-	-	bal.	<2	n/a	-F-08N2-900H	n/a
0.1 - 0.5	1.0 - 2.0	1.5 - 2.0	0.3 - 0.7	-	-	-	bal.	<2	D 30	n/a	n/a
0.1 - 0.5	1.0 - 2.0	1.5 - 2.0	0.3 - 0.7	-	-	-	bal.	<2	E 30	n/a	n/a
0.3 - 0.7	1.0 - 2.0	1.5 - 2.0	0.3 - 0.7	-	-	-	bal.	<2	D 39	-FD-05N2C-400	FD-0205-55
0.3 - 0.7	1.0 - 2.0	1.5 - 2.0	0.3 - 0.7	-	-	-	bal.	<2	D 39	-FD-05N2C-950H	FD-0205-120HT
0.3 - 0.7	1.0 - 2.0	1.5 - 2.0	0.3 - 0.7	-	-	-	bal.	<2	E 39	-FD-05N2C-440	FD-0205-65
0.5 - 0.9	1.0 - 2.0	1.5 - 2.0	0.3 - 0.7	-	-	-	bal.	<2	D 39	n/a	FD-0208-60
0.1 - 0.5	1.0 - 2.0	3.5 - 4.5	0.3 - 0.7	-	-	-	bal.	<2	D 30	n/a	n/a
0.1 - 0.5	1.0 - 2.0	3.5 - 4.5	0.3 - 0.7	-	-	-	bal.	<2	E 30	n/a	n/a
0.3 - 0.7	1.0 - 2.0	3.5 - 4.5	0.3 - 0.7	-	-	-	bal.	<2	D 39	-FD-05N4C-420	FD-0405-60
0.3 - 0.7	1.0 - 2.0	3.5 - 4.5	0.3 - 0.7	-	-	-	bal.	<2	D 39	-FD-05N4C-930H	FD-0405-130HT
0.3 - 0.7	1.0 - 2.0	3.5 - 4.5	0.3 - 0.7	-	-	-	bal.	<2	E 39	-FD-05N4C-450	FD-0405-65
0.5 - 0.9	1.0 - 2.0	3.5 - 4.5	0.3 - 0.7	-	-	-	bal.	<2	D 39	n/a	FD-0408-60
0.1 - 0.5	1.5 - 2.5	3.5 - 4.5	1.3 - 1.7	-	-	-	bal.	<2	D 31	n/a	n/a
0.1 - 0.5	1.5 - 2.5	3.5 - 4.5	1.3 - 1.7	-	-	-	bal.	<2	E 31	n/a	n/a
0.4 - 0.8	1.5 - 2.5	3.5 - 4.5	1.3 - 1.7	-	-	-	bal.	<2	D 32	n/a	FLDN4C2-4908
0.4 - 0.8	1.5 - 2.5	3.5 - 4.5	1.3 - 1.7	-	-	-	bal.	<2	E 32	n/a	FLDN4C2-4908
0.1 - 0.5	1.5 - 2.5	-	1.3 - 1.7	-	-	-	bal.	<2	D 31	n/a	n/a
0.1 - 0.5	1.5 - 2.5	-	1.3 - 1.7	-	-	-	bal.	<2	E 31	n/a	n/a
0.4 - 0.8	1.5 - 2.5	-	1.3 - 1.7	-	-	-	bal.	<2	D 32	n/a	FLDC2-4908
0.4 - 0.8	1.5 - 2.5	-	1.3 - 1.7	-	-	-	bal.	<2	E 32	n/a	FLDC2-4908
<0.3	-	-	-	-	-	0.3 - 0.6	bal.	<2	D 35	-F-00P05-210	FY-4500-20W
0.4 - 0.7	-	1.0 - 3.0	0.65 - 0.95	-	-	-	bal.	<2	n/a	n/a	FLN2-4405
0.4 - 0.7	-	1.0 - 3.0	0.65 - 0.95	-	-	-	bal.	<2	n/a	n/a	n/a
0.4 - 0.7	-	0.35 - 0.55	0.50 - 0.85	-	-	-	bal.	<2	n/a	n/a	FL-4205
0.4 - 0.7	-	0.35 - 0.55	0.50 - 0.85	-	-	-	bal.	<2	n/a	n/a	n/a
0.6 - 0.9	1.0 - 3.0	1.0 - 3.0	0.65 - 0.95	-	-	-	bal.	<2	n/a	n/a	FLNC-4408
0.6 - 0.9	1.0 - 3.0	1.6 - 2.0	0.43 - 0.60	-	-	-	bal.	<2	n/a	n/a	FLC-4608
0.6 - 0.9	0.5 - 2.0	2.4 - 3.2	0.43 - 0.60	-	-	-	bal.	<2	n/a	n/a	n/a
< 0.3	-	-	-	-	-	0.45 - 0.65	bal.	<2	D 35	n/a	n/a
0.4 - 0.8	-	0.5 - 2.5	0.6 - 1.1	0.8 - 1.2	0.4 - 0.8	-	bal.	<2	n/a	n/a	n/a
0.2 - 0.8	-	0.5 - 2.5	0.6 - 1.1	0.8 - 1.2	0.4 - 0.8	-	bal.	<2	n/a	n/a	n/a

UTS: Ultimate Tensile Strength FEL: Fatigue Endurance Limit YS: Yield Strength

A, El: Fracture Elongation E: Youngs Modulus

Surface Densified Sintered Steels

Standard References I			Typical Properties (References)							
GKN SM Material Code	Core density [g/cm³]	Surface density[3] [g/cm³]	Typical composition[1]	Typical core density [g/cm³]	UTS [MPa]	$YS_{0,2}$ [MPa]	A[2] El[2] [%]	Surface hard-ness[4] HV0,1	Core hardness HB	E [GPa]
PMET 1002D/F	6.8 - 7.2	> 7.6	Fe-0.2C	7.00	230	150	5	180	75	140
PMET 1005D/F	6.8 - 7.2	> 7.6	Fe-0.5C	7.00	300	180	3	250	90	140
PMET 1025D/F	6.8 - 7.2	> 7.6	Fe2Cu-0.5C	7.00	500	330	2.5	300	140	140
PMET 1025E/F	> 7.2	> 7.6	Fe2Cu-0.5C	7.25	570	360	3	300	180	160
PMET 4402D/F	6.8 - 7.2	> 7.6	Fe0.85Mo-0.2C	7.00	280	180	4	260	120	140
PMET 4402E/F	> 7.2	> 7.6	Fe0.85Mo-0.2C	7.25	340	220	5	260	130	160

[1] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.
[2] Case hardening or carbo-nitriding is perfomed depending on the required case depth and is in general followed by a stress relief operation as well.
[3] The surface density can be exactly determined by metallographic investigations combined with quantitative image analysis.
[4] The indicated surface hardness is determined after the surface densification but prior to a potential heat treatment. The increased hardness at the surface can be explained by work hardening due to the deformation of the material during the densification step.

PM Aluminium Materials

Standard References I		Typical Properties (References)							
GKN SM Material Code	Density [g/cm³]	Typical composition[1]	Typical density [g/cm³]	UTS [MPa]	$YS_{0,2}$ [MPa]	FEL[3] [MPa]	A[5] El[5] [%]	Hard-ness HB	E [GPa]
PMET Al2014	2.45 - 2.60	Al4.5Cu0.5Mg0.7Si	2.60	160	130	60	1.5	60	50
PMET Al2014-T6	2.45 - 2.60	Al4.5Cu0.5Mg0.7Si	2.60	300	280	80	1	80	57
PMET Al6061	2.50 - 2.60	Al1.0Mg0.5Si0.2Cu	2.55	160	100	-	2	40	-
PMET Al6061-T6	2.50 - 2.60	Al1.0Mg0.5Si0.2Cu	2.55	240	210	-	1	70	-
PMET Al14Si	2,55 - 2,65	Al2.5Cu0.5Mg14Si	2.62	200	150	100	1	80	79
PMET Al14Si-T6	2.55 - 2.65	Al2.5Cu0.5Mg14Si	2.62	320	300	80	<1	115	79
PMET Al7075	2.74 - 2.78	Al5.5Zn1.6Cu2.5Mg	2.76	315	270	80	1.2	100	65
PMET Al7075-T6	2.74 - 2.78	Al5.5Zn1.6Cu2.5Mg	2.76	420	410	120	1	135	65
Aluminum Metal Matrix Composite Materials (Al MMC)[2]									
PMET AlMMC1	2.69 - 2.74	AlXCuXMgXCeram	2.70	260	230	[4]	3	110	65
PMET AlMMC1-T6	2.69 - 2.74	AlXCuXMgXCeram	2.70	340	310	[4]	1.5	115	66
Thermal Management Materials									
PMET Al6021-SP	2.69 - 2.71	AlXMgXSn	2.70	100	40	-	12	-	-

[1] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.
[2] Other MMC materials are currently under development
[3] FEL - Based on 10,000,000 cycles of completely reversed stress (R = -1) using an R. R. Moore type of instrument. Specimens prepared and polished in accordance with ASTM standard E111-04
[4] Being evaluated
[5] Sizing will reduce the elongation

	Chemical Compositions (Standard)[1]										Standard References II		
Remark	C [wt.-%]	Cu [wt.-%]	Ni [wt.-%]	Mo [wt.-%]	Cr [wt.-%]	Si [wt.-%]	P [wt.-%]	Mn [wt.-%]	Fe [wt.-%]	Oth-ers [wt.-%]	DIN 30910 Sint-	ISO 5755	MPIF 35
case hardening steel[2]	0.1 - 0.5	-	-	-	-	-	-	-	bal	<2	D 00	-F-00-120	n/a
	0.3 - 0.7	-	-	-	-	-	-	-	bal.	<2	D 01	-F-05-170	F-0005-25
hardenable	0.3 - 0.7	1.5 - 2.5	-	-	-	-	-	-	bal.	<2	D 11	-F-05C2-300	FC-0205-45
hardenable	0.3 - 0.7	1.5 - 2.5	-	-	-	-	-	-	bal.	<2	E 11	n/a	n/a
case hardening steel[2]	0.1 - 0.5	-	-	0.6 - 1.1	-	-	-	-	bal.	<2	n/a	n/a	n/a
case hardening steel[2]	0.1 - 0.5	-	-	0.6 - 1.1	-	-	-	-	bal.	<2	n/a	n/a	n/a

UTS: Ultimate Tensile Strength FEL: Fatigue Endurance Limit YS: Yield Strength
A, El: Fracture Elongation E: Youngs Modulus

	Chemical Compositions (Standard)[1]						Standard References II			
Remark	Al [wt.-%]	Cu [wt.-%]	Zn [wt.-%]	Si [wt.-%]	Mg [wt.-%]	Others [wt.-%]	DIN 30903 Sint-	ISO 5755	MPIF	ASTM B595-95
	bal.	4.0 - 5.0	-	0.7	0,5	<0.5	D73/E73	n/a	n/a	ACT1-2014 type II
T6 heat treated	bal.	4.0 - 5.0	-	0.7	0,5	<0.5	F73	n/a	n/a	ACT6-2014 type II
	bal.	0.2	-	0.5	1	<0.5	E73	n/a	n/a	AT1-6061 type II
T6 heat treated	bal.	0.2	-	0.5	1	<0.5	E73	n/a	n/a	AT6-6061 type II
	bal.	2.0 - 3.0	-	13 - 15	0.5	<0.5	n/a	n/a	n/a	n/a
T6 heat treated	bal.	2.0 - 3.0	-	13 - 15	0.5	<0.5	n/a	n/a	n/a	n/a
	bal.	1.6	5.0 - 6.0	-	2.5	<1	n/a	n/a	n/a	n/a
T6 heat treated	bal.	1.6	5.0 - 6.0	-	2.5	<1	n/a	n/a	n/a	n/a
	bal.	X	-	-	X	<10	n/a	n/a	n/a	n/a
T6 heat treated	bal.	X	-	-	X	<10	n/a	n/a	n/a	n/a
Thermal Con-ductivity: 230 - 240 W/(m·K)	bal.	-	-	-	X	<15	n/a	n/a	n/a	n/a

UTS: Ultimate Tensile Strength FEL: Fatigue Endurance Limit YS: Yield Strength
A, El: Fracture Elongation E: Youngs Modulus

Stainless Steels[4)]

Standard References I		Typical Properties (References)									
GKN SM Material Code	Density [g/cm³]	Typical composition[1)]	Typical density [g/cm³]	UTS [MPa]	$YS_{0,2}$ [MPa]	FEL[3)] [MPa]	A[2)] El[2)] [%]	Hard-ness HB	Hard-ness HRB	E [GPa]	Remark
PMET SS303C-N1	6.4 - 6.8	Fe18Cr9Ni	6.40	270	220	90	<1	-	62	105	Nitrogen cont. sint. atmosphere
PMET SS303C-N2	6.4 - 6.8	Fe18Cr9Ni	6.50	380	290	110	5	-	63	115	Nitrogen cont. sint. atmosphere
PMET SS303D-N2	6.8 - 7.2	Fe18Cr9Ni	6.90	470	310	145	10	-	70	140	Nitrogen cont. sint. atmosphere
PMET SS303C-H	6.4 - 6.8	Fe18Cr9Ni	6.60	270	120	105	17	-	21	115	Hydrogen atmosphere
PMET SS303D-H	6.8 - 7.2	Fe18Cr9Ni	6.90	330	170	130	20	-	35	140	Hydrogen atmosphere
PMET SS304C-N	6.4 - 6.8	Fe18Cr10Ni	6.60	370	280	105	5	125	-	115	Nitrogen cont. sint. atmosphere
PMET SS304C-N1	6.4 - 6.8	Fe19Cr10Ni	6.40	300	260	105	<1	-	61	105	Nitrogen cont. sint. atmosphere
PMET SS304C-N2	6.4 - 6.8	Fe19Cr10Ni	6.50	390	280	125	10	-	62	115	Nitrogen cont. sint. atmosphere
PMET SS304D-N2	6.8 - 7.2	Fe19Cr10Ni	6.90	480	310	160	13	-	68	140	Nitrogen cont. sint. atmosphere
PMET SS304C-HL	6.4 - 6.8	Fe19Cr10Ni	6.60	280	170	110	10	-	35	115	Hydrogen atmosphere
PMET SS304C-H	6.4 - 6.8	Fe19Cr10Ni	6.60	300	120	115	23	-	30	115	Hydrogen atmosphere
PMET SS304D-H	6.8 - 7.2	Fe19Cr10Ni	6.90	390	180	145	26	-	45	140	Hydrogen atmosphere
PMET SS304E-N	> 7.2	Fe18Cr10Ni	7.25	520	420	140	2.5	130	-	160	sintered with shrinkage at HT
PMET SS316C-N	6.4 - 6.8	Fe16Cr12Ni2,5Mo	6.60	410	270	120	2	115	-	115	Nitrogen cont. sint. atmosphere
PMET SS316C-N1	6.4 - 6.8	Fe17Cr12Ni2.5Mo	6.4	280	230	75	<1	-	59	105	Nitrogen cont. sint. atmosphere
PMET SS316C-N2	6.4 - 6.8	Fe17Cr12Ni2.5Mo	6.5	410	270	95	10	-	62	115	Nitrogen cont. sint. atmosphere
PMET SS316C-HL	6.4 - 6.8	Fe17Cr12Ni2.5Mo	6.6	240	170	105	7	-	33	115	Hydrogen atmosphere
PMET SS316C-H	6.4 - 6.8	Fe17Cr12Ni2.5Mo	6.6	280	140	90	18	-	20	115	Hydrogen atmosphere
PMET SS316D-N	6.8 - 7.2	Fe16Cr12Ni2,5Mo	6.90	480	310	130	3	130	-	135	Nitrogen cont. sint. atmosphere
PMET SS316D-H	6.8 - 7.2	Fe16Cr12Ni2,5Mo	6.90	280	200	90	8	80	-	135	Hydrogen atmosphere
PMET SS409CbE-H	> 7.2	Fe12Cr0,5Nb	7.25	380	200	130	12	100	-	160	sintered with shrinkage at HT
PMET SS409D-H	6.8 - 7.2	Fe11Cr0.5Cb	7.0	320	180	-	14	-	45	165	Hydrogen atmosphere
PMET SS410C	6.4 - 6.8	Fe12Cr-0.2C	6.5	720	710	240	<1	-	23 HRC	125	Tempered at 180°C
PMET SS410C-N	6.4 - 6.8	Fe12Cr	6.60	420	320	120	<1	220	-	115	Nitrogen containing sintering atmosphere
PMET SS410D-H	6.8 - 7.2	Fe12Cr	6.9	330	180	125	16	-	45	165	Hydrogen atmosphere
PMET SS430C-N	6.4 - 6.8	Fe16Cr	6.60	450	330	125	1	240	-	115	Nitrogen cont. sint. atmosphere
PMET SS430C-H	6.4 - 6.8	Fe16Cr	6.60	270	190	90	6	90	-	115	Hydrogen atmosphere
PMET SS430D-N2	6.8 - 7.2	Fe16Cr	7.1	410	240	170	5	-	70	170	Nitrogen cont. sint. atmosphere
PMET SS430D-H	6.8 - 7.2	Fe16Cr	7.1	340	210	170	20	-	45	170	Hydrogen atmosphere
PMET SS434D-N2	6.8 - 7.2	Fe16Cr1Mo	7.0	410	240	150	8	-	65	165	Nitrogen cont. sint. atmosphere
PMET SS434D-H	6.8 - 7.2	Fe16Cr1Mo	7.0	340	210	150	15	-	50	165	Hydrogen atmosphere
PMET SS434C-N	6.4 - 6.8	Fe16Cr1Mo	6.60	460	340	130	1	250	-	115	Nitrogen cont. sint. atmosphere

[1)] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.
[2)] Sizing will reduce the elongation.
[3)] Bending load. 2 x 10^6 cycles, notch factor α_k = 1.0 (ref. 30912 Part 6); R = -1.
[4)] Corrosion resistance depending on sintering temperature and medium.

Chemical Compositions (Standard)[1]									Standard References II		
C [wt.-%]	Ni [wt.-%]	Mo [wt.-%]	Cr [wt.-%]	Si [wt.-%]	P [wt.-%]	Mn [wt.-%]	Fe [wt.-%]	Others [wt.-%]	DIN 30910 Sint-	ISO 5755	MPIF 35
< 0.15	8.0 - 13.0	-	17.0 - 19.0	<1	< 0.20	< 2.0	bal.	<2	n/a	-FL303-170N	SS-303N1-25
< 0.15	8.0 - 13.0	-	17.0 - 19.0	<1	< 0.20	< 2.0	bal.	<2	n/a	n/a	SS-303N2-35
< 0.15	8.0 - 13.0	-	17.0 - 19.0	<1	< 0.20	< 2.0	bal.	<2	n/a	-FL303-260N	SS-303N2-38
< 0.03	8.0 - 13.0	-	17.0 - 19.0	<1	< 0.20	< 2.0	bal.	<2	n/a	n/a	SS-303L-12
< 0.03	8.0 - 13.0	-	17.0 - 19.0	<1	< 0.20	< 2.0	bal.	<2	n/a	n/a	SS-303L-15
<0.1	8.0 - 12.0	-	18.0 - 20.0	<1	<0.04	<2	bal.	<2	n/a	-FL304-210N	SS 304N2-33
< 0.08	8.0 - 12.0	-	18.0 - 20.0	<1	< 0.04	< 2.0	bal.	<2	n/a	-FL304-210N	SS-304N1-30
< 0.08	8.0 - 12.0	-	18.0 - 20.0	<1	< 0.04	< 2.0	bal.	<2	n/a	n/a	SS-304N2-33
< 0.08	8.0 - 12.0	-	18.0 - 20.0	<1	< 0.04	< 2.0	bal.	<2	n/a	-FL304-260N	SS-304N2-38
< 0.03	8.0 - 12.0	-	18.0 - 20.0	<1	< 0.04	< 2.0	bal.	<2	n/a	n/a	SS-304H-20
< 0.03	8.0 - 12.0	-	18.0 - 20.0	<1	< 0.04	< 2.0	bal.	<2	n/a	n/a	SS-304L-13
< 0.03	8.0 - 12.0	-	18.0 - 20.0	<1	< 0.04	< 2.0	bal.	<2	n/a	n/a	SS-304L-18
<0.1	8.0 - 12.0	-	18.0 - 20.0	<1	<0.04	<2	bal.	<2	n/a	-FL304-210N	SS 304N2-33
<0.1	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	<1	<0.04	<2	bal.	<2	C 40	-FL316-170N	SS 316N2-33
< 0.08	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	< 1.0	< 0.04	< 2.0	bal.	<2	C 40	-FL316-170N	SS-316N1-25
< 0.08	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	< 1.0	< 0.04	< 2.0	bal.	<2	C 40	n/a	SS-316N2-33
< 0.03	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	< 1.0	< 0.04	< 2.0	bal.	<2	C 40	n/a	SS-316H-20
< 0.03	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	< 1.0	< 0.04	< 2.0	bal.	<2	C 40	n/a	SS-316L-15
<0.1	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	<1	<0.04	<2	bal.	<2	D 40	-FL316-260N	SS 316N2-38
<0.1	10.0 - 14.0	2.0 - 3.0	16.0 - 18.0	<1	<0.04	<2	bal.	<2	D 40	-FL316-150	SS 316L-22
<0.1	0 - 0.5	-	11.5 - 13.5	<1	<0.04	<1	bal.	Nb / Cb 0.3 - 1	n/a	n/a	SS 409LE
< 0.03	-	-	10.50 - 11.75	< 1.0	< 0.04	< 1	bal.	<2	n/a	n/a	SS-409L
< 0.25	-	-	11.50 - 13.50	< 1.0	< 0.04	< 1	bal.	<2	n/a	-FL410-620H	SS-410-90HT
<0.1	-	-	11.5 - 13.5	<1	<0.04	<1	bal.	<2	C 43	-FL410-140	SS 410
< 0.03	-	-	11.50 - 13.50	< 1.0	< 0.04	< 1	bal.	<2	C 43	-FL410-140	SS-410L-20
<0.1	-	-	16.0 - 18.0	<1	<0.04	<1	bal.	<2	C 42	-FL430-170	SS 430
<0.1	-	-	16.0 - 18.0	<1	<0.04	<1	bal.	<2	C 42	-FL430-170	SS 430L
< 0.08	-	-	16.00 - 18.00	< 1.0	< 0.04	< 1	bal.	<2	n/a	n/a	SS-430N2-28
< 0.03	-	-	16.00 - 18.00	< 1.0	< 0.04	< 1	bal.	<2	n/a	-FL430-170	SS-430L-24
< 0.08	-	0.75 - 1.25	16.00 - 18.00	< 1.0	< 0.04	< 1	bal.	<2	n/a	n/a	SS-434N2-28
< 0.03	-	0.75 - 1.25	16.00 - 18.00	< 1.0	< 0.04	< 1	bal.	<2	n/a	-FL434-170	SS-434L-24
<0.1	-	0.75 - 1.25	16.0 - 18.0	<1	<0.04	<1	bal.	<2	n/a	-FL434-170	SS 434

UTS: Ultimate Tensile Strength FEL: Fatigue Endurance Limit YS: Yield Strength
A, El: Fracture Elongation E: Youngs Modulus

Powder Forged Steels

Standard References I		Typical Properties (References)										
GKN SM Material Code	Density [g/cm³]	Typical composition[1]	Typical density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	FEL[3] [MPa]	A[2] El[2] [%]	Hard-ness HB	E [GPa]	Remark	C [wt.-%]	Cu [wt.-%]
PMET 1022F-H2	>7.6	Fe2Cu-0,2C	7.65	380	250	150	24	125	200	case hardening steel[4]	< 0.3	1.5 - 2.5
PMET 1026F	>7.6	Fe2Cu-0,6C	7.65	810	530	270	12	250	200		0.4 - 0.8	1.5 - 2.5
PMET 1026FA	>7.81.	Fe2Cu-0.6C	7.83	950	610	440[6]	8	27 HRC	210		[5]	1.8 - 2.2
PMET 1036FA	>7.81	Fe3Cu-0.6C	7.83	1,045	745	[7]	12	32 HRC	210		[5]	2.8 - 3.2
PMET 4202FA	>7.82	Fe0.45Ni0.6Mo0.25Mn-0.2C	7.84	520	380	[7]	25	84 HRB	210		[5]	< 0.15
PMET 4202FA	>7.82.	Fe0.45Ni0.6Mo0.25Mn-0.2C	7.84	830	690	[7]	23	26 HRC	210	quench + temper	[5]	< 0.15
PMET 4202FA	>7.82	Fe0.45Ni0.6Mo0.25Mn-0.2C	7.84	1,210	970	[7]	9	38 HRC	210	quench + temper	[5]	< 0.15
PMET 4202FA	>7.81	Fe0.45Ni0.6Mo0.25Mn-0.4C	7.83	900	690	[7]	15	28 HRC	210	quench + temper	[5]	< 0.15
PMET 4202FA	>7.81	Fe0.45Ni0.6Mo0.25Mn-0.4C	7.83	1,320	830	[7]	9	38 HRC	210	quench + temper	[5]	< 0.15
PMET 4202F-H2	>7.6	Fe0,45Ni0,6Mo0,25Mn-0,2C	7.65	520	380	180	20	150	200	case hardening steel[4]	< 0.3	-
PMET 4206F	>7.6	Fe0,45Ni0,6Mo0,25Mn-0,6C	7.65	760	520	250	12	230	200		0.4 - 0.8	-
PMET 4206FA	>7.8	Fe0.45Ni0.6Mo0.25Mn-0.6C	7.82	870	1,170	[7]	12	26 HRC	210		[5]	< 0.15
PMET 4206FA	>7.8	Fe0.45Ni0.6Mo0.25Mn-0.6C	7.82	1,250	1,160	[7]	8	40 HRC	210	quench + temper	[5]	< 0.15
PMET 4206FA	>7.8	Fe0.45Ni0.6Mo0.25Mn-0.6C	7.82	1,860	1,650	[7]	2	50 HRC	210	quench + temper	[5]	< 0.15
PMET 4206F-H1	>7.6	Fe0,45Ni0,6Mo0,25Mn-0,6C	7.65	1,310	1,170	420	5	38 HRC	200	quench + temper	0.4 - 0.8	-
PMET 4602FA	>7.82	Fe1.75Ni0.55Mo0.15Mn-0.2C	7.84	550	410	[7]	20	96 HRB	210		[5]	< 0.15
PMET 4602FA	>7.82	Fe1.75Ni0.55Mo0.15Mn-0.2C	7.84	970	900	[7]	24	28 HRC	210	quench + temper	[5]	< 0.15
PMET 4602FA	>7.82	Fe1.75Ni0.55Mo0.15Mn-0.2C	7.84	1,310	1,070	[7]	9	38 HRC	210	quench + temper	[5]	< 0.15
PMET 4602FA	>7.81	Fe1.75Ni0.55Mo0.15Mn-0.4C	7.83	900	830	[7]	15	28 HRC	210	quench + temper	[5]	< 0.15
PMET 4602FA	>7.81	Fe1.75Ni0.55Mo0.15Mn-0.4C	7.83	1,310	1,070	[7]	13	38 HRC	210	quench + temper	[5]	< 0.15
PMET 4602F-H2	>7.6	Fe1.8Ni0.55Mo-0.2C	7.65	550	410	200	20	180	200	case hardening steel[4]	< 0.3	-
PMET 4606FA	>7.81	Fe1.75Ni0.55Mo0.15Mn-0.6C	7.83	960	660	[7]	13	29 HRC	210	quench + temper	[5]	< 0.15
PMET 4606FA	>7.81	Fe1.75Ni0.55Mo0.15Mn-0.6C	7.83	970	900	[7]	13	28 HRC	210	quench + temper	[5]	< 0.15
PMET 4606FA	>7.81	Fe1.75Ni0.55Mo0.15Mn-0.6C	7.83	1,310	1,070	[7]	12	38 HRC	210	quench + temper	[5]	< 0.15
PMET 4606FA	>7.81	Fe1.75Ni0.55Mo0.15Mn-0.6C	7.83	1,650	1,380	[7]	6	48 HRC	210	quench + temper	[5]	< 0.15

[1] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.
[2] Sizing will reduce the elongation.
[3] Bending load. 2 x 10^6 cycles, notch factor α_k = 1.0 (ref. 30912 Part 6); R = -1.
[4] Case hardening or carbo-nitriding is perfomed depending on the required case depth and is in general followed by a stress relief operation as well.
[5] Carbon content shall be as specified by the purchaser. Unless agreed upon between the purchaser and manufacturer, the forged product carbon content s be within +/- 0.1% of the specified carbon content.
[6] For FEL, polished specimen and R = 0.1. Runout 1 x 107 cycles. Other fatigue information available on request.
[7] Details on request.

Chemical Compositions (Standard)1)								Standard References II			
Ni [wt.-%]	Mo [wt.-%]	Cr [wt.-%]	Si [wt.-%]	P [wt.-%]	Mn [wt.-%]	Fe [wt.-%]	Others [wt.-%]	DIN 30910 Sint-	ISO 5755	MPIF 35	ASTM B 848
-	-	-	-	-	-	bal.	<2	F 10	n/a	P/F-11C20	n/a
-	-	-	-	-	-	bal.	<2	F 11	n/a	P/F-11C60	n/a
< 0.1	< 0.05	< 0.1	< 0.03	< 0.03	0.30 - 0.60	bal.	<2	n/a	n/a	P/F-11C60	P/F-11C60 Grade A
< 0.1	< 0.05	< 0.1	< 0.03	< 0.03	0.30 - 0.60	bal.	<2	n/a	n/a	n/a	n/a
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4220	P/F-4220 Grade A
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4220	P/F-4220 Grade A
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4220	P/F-4220 Grade A
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4240	P/F-4240 Grade A
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4240	P/F-4240 Grade A
0.3 - 0.6	0.3 - 0.7	-	-	-	0.1 - 0.4	bal.	<2	n/a	n/a	P/F-4220	n/a
0.3 - 0.6	0.3 - 0.7	-	-	-	0.1 - 0.4	bal.	<2	n/a	n/a	P/F-4260	n/a
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4260	P/F-4260 Grade A
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4260	P/F-4260 Grade A
0.40 - 0.50	0.55 - 0.65	< 0.1	< 0.03	< 0.03	0.25 - 0.35	bal.	<2	n/a	n/a	P/F-4260	P/F-4260 Grade A
0.3 - 0.6	0.3 - 0.7	-	-	-	0.1 - 0.4	bal.	<2	n/a	n/a	P/F-4260	n/a
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4620	P/F-4620 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4620	P/F-4620 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4620	P/F-4620 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4640	P/F-4640 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4640	P/F-4640 Grade A
1.4 - 2.2	0.3 - 0.7	-	-	-	0.1 - 0.4	bal.	<2	F 30	n/a	P/F-4620	n/a
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4660	P/F-4660 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4660	P/F-4660 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4660	P/F-4660 Grade A
1.75 - 2.00	0.50 - 0.60	< 0.1	< 0.03	< 0.03	0.10 - 0.25	bal.	<2	n/a	n/a	P/F-4660	P/F-4660 Grade A

UTS: Ultimate Tensile Strength
FEL: Fatigue Endurance Limit
YS: Yield Strengt
A, El: Fracture Elongation
E: Youngs Modulus

hall

Bearing Materials (DIN-/ISO-Standard Info)

Standard References I		Typical Properties (References)						
GKN SM Material Code	Density [g/cm³]	Typical composition[1]	Typical density [g/cm³]	Porosity[2] [%]	K-Factor[3] [N/mm²]	Hardness HB	Remark	C [wt.-%]
PMET B-ILD	5.6 - 6.0	Fe	5.8	26	170	30	Fe-base	-
PMET B-IMD	6.0 - 6.4	Fe	6.2	21	220	40	Fe-base	-
PMET B-T1LD	5.6 - 6.0	Fe2Cu	5.8	26	200	40	Fe-base	-
PMET B-T1MD	6.0 - 6.4	Fe2Cu	6.2	21	250	50	Fe-base	-
PMET B-FLD[4]	5.6 - 6.0	Fe36Cu4Sn1C	5.8	27	90	40	Fe-base	0.8 - 1.2
PMET B-FMD[4]	6.0 - 6.4	Fe36Cu4Sn1C	6.2	22	120	50	Fe-base	0.8 - 1.2
PMET B-M211LD[4]	5.4 - 5.8	Fe1.5Cu3C	5.6	24	70	45	Fe-base	2.5 - 3.5
PMET B-M211MD[4]	5.8 - 6.2	Fe1.5Cu3C	6.0	18	80	55	Fe-base	2.5 - 3.5
PMET B-M36MD[4]	6.0 - 6.4	Fe3Cu1.5C	6.2	18	170	60	Fe-base	1.0 - 2.0
PMET B-M21MD[4]	6.0 - 6.4	Fe2Cu0.4C	6.2	20	270	70	Fe-base	0.2 - 0.6
PMET B-MP208LD[4]	5.6 - 6.0	Fe20Cu1.8C	5.8	25	120	40	Fe-base	1.2 - 2.4
PMET B-MP208MD[4]	6.0 - 6.4	Fe20Cu1.8C	6.2	20	140	50	Fe-base	1.2 - 2.4
PMET B-QLD	6.4 - 6.8	Cu9Sn	6.6	25	140	30	Bronze	-
PMET B-QMD	6.8 - 7.2	Cu9Sn	7.0	20	180	35	Bronze	-
PMET B-H4LD[4]	6.2 - 6.6	Cu9Sn1.5C	6.4	24	120	30	Bronze	1.0 - 2.0
PMET B-H4MD[4]	6.6 - 7.0	Cu9Sn1.5C	6.8	19	160	35	Bronze	1.0 - 2.0

[1] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.
[2] The oil content is at least 90 % of the open porosity.
[3] Values determined after sizing.
[4] Carbon mainly in the form of free graphite.

Chemical Compositions (Standard)[1]				Standard References II		
Cu [wt.-%]	Sn [wt.-%]	Fe [wt.-%]	Others [wt.-%]	DIN 30910 Sint-	ISO 5755	MPIF 35
-	-	bal.	<2	A 00	-F-00-K170	n/a
-	-	bal.	<2	B 00	-F-00-K220	n/a
1.5 - 2.5	-	bal.	<2	A 10	-F-00C2-K200	F-0000-K15
1.5 - 2.5	-	bal.	<2	B 10	-F-00C2-K250	F-0000-K23
32.0 - 40.0	3.5 - 4.5	bal.	<2	n/a	-F-03C36T-K90	n/a
32.0 - 40.0	3.5 - 4.5	bal.	<2	n/a	-F-03C36T-K120	n/a
1.0 - 2.0	-	bal.	<2	n/a	-F-03G3-K70	FG-0303-K10
1.0 - 2.0	-	bal.	<2	n/a	-F-03G3-K80	FG-0303-K12
2.5 - 3.5	-	bal.	<2	B 11	n/a	n/a
1.5 - 2.5	-	bal.	<2	B 11	n/a	n/a
18.0 - 22.0	-	bal.	<2	A 22	n/a	n/a
18.0 - 22.0	-	bal.	<2	B 22	n/a	n/a
bal.	7.0 - 11.0	-	<2	A 50	-C-T10K-140	CT-1000-K26
bal.	7.0 - 11.0	-	<2	B 50	-C-T10K-180	CT-1000-K37
bal.	7.0 - 11.0	-	<2	A 51	-C-T10GK-120	CTG-1001-K17
bal.	7.0 - 11.0	-	<2	B 51	-C-T10GK-160	CTG-1001-K23

See special GKN catalogue for bearing materials

Bearing Materials (US-Standard Info)

Standard References I		Typical Properties (References)				
GKN SM Material Code	Wet Density [g/cm³]	Typical Composition[1)]	Typical Wet Density [g/cm³]	Mln. K-Factor [N/mm²]	Minimum Oil Content [%]	Remark
PMET B-B0000	6.0 - 6.4	Cu10Sn	6.2	130	24	Low graphite bronze
PMET B-B0000-A	6.4 - 6.8	Cu10Sn	6.6	180	19	Low graphite bronze
PMET B-B0000-B	6.8 - 7.2	Cu10Sn	7.0	260	12	Low graphite bronze
PMET B-B00012	6.0 - 6.4	Cu10Sn1C	6.2	120	22	Medium graphite bronze
PMET B-B00012-A	6.4 - 6.8	Cu10Sn1C	6.6	160	17	Medium graphite bronze
PMET B-B00012-A	6.8 - 7.2	Cu10Sn1C	7.0	210	17	Medium graphite bronze
PMET B-B00025-A	5.8 - 6.2	Cu10Sn3C	6.0	70	11	High graphite bronze
PMET B-B00025-B	6.2 - 6.6	Cu10Sn3C	6.4	100	5	High graphite bronze
PMET B-DB10365-A	5.6 - 6.0	Fe36Cu4Sn1C	5.8	110	22	Diluted bronze
PMET B-DB10365-B	6.0 - 6.4	Fe36Cu4Sn1C	6.2	150	17	Diluted bronze
PMET B-DB005410-A	5.6 - 6.0	Cu38Fe6Sn1C	5.8	100	22	Diluted bronze
PMET B-DB005410-B	6.0 - 6.4	Cu38Fe6Sn1C	6.2	150	17	Diluted bronze
PMET B-1000-A	5.6 - 6.0	Fe	5.8	100	21	Iron
PMET B-1000-B	6.0 - 6.4	Fe	6.2	160	17	Iron
PMET B-1005-A	5.6 - 6.0	Fe0.5C	5.8	140	21	Iron-Carbon
PMET B-1005-B	6.0 - 6.4	Fe0.5C	6.2	190	17	Iron-Carbon
PMET B-1008-A	5.6 - 6.0	Fe0.8C	5.8	140	21	Iron-Carbon
PMET B-1008-B	6.0 - 6.4	Fe0.8C	6.2	220	17	Iron-Carbon
PMET B-1020-A	5.6 - 6.0	Fe2Cu	5.8	140	22	Iron-Copper
PMET B-1020-A	6.0 - 6.4	Fe2Cu	6.2	230	17	Iron-Copper
PMET B-10100-A	5.6 - 6.0	Fe10Cu	5.8	140	22	Iron-Copper
PMET B-10100-B	6.0 - 6.4	Fe10Cu	6.2	210	19	Iron-Copper
PMET B-1025-A	5.6 - 6.0	Fe2Cu0.5C	5.8	140	22	Iron-Copper-Carbon
PMET B-1025-B	6.0 - 6.4	Fe2Cu0.5C	6.2	240	17	Iron-Copper-Carbon
PMET B-1028-A	5.6 - 6.0	Fe2Cu0.8C	5.8	170	22	Iron-Copper-Carbon
PMET B-1028-B	6.0 - 6.4	Fe2Cu0.8C	6.2	280	17	Iron-Copper-Carbon
PMET B-1058-A	5.6 - 6.0	Fe5Cu0.8C	5.8	240	22	Iron-Copper-Carbon
PMET B-1058-B	6.0 - 6.4	Fe5Cu0.8C	6.2	320	17	Iron-Copper-Carbon
PMET B-10208-A	5.6 - 6.0	Fe20Cu0.8C	5.8	300	22	Iron-Copper-Carbon
PMET B-10208-B	6.0 - 6.4	Fe20Cu0.8C	6.2	320	17	Iron-Copper-Carbon
PMET B-10023G-A	5.6 - 6.0	Fe0.3C2.5Gr	5.8	170	18	Iron-Graphite
PMET B-10023G-B	6.0 - 6.4	Fe0.3C2.5Gr	6.2	240	12	Iron-Graphite

[1)] In addition to the elements mentioned, further alloying elements up to 2 % are admitted.

Chemical Compositions (Standard)[1]						Standard References II		
C [wt.-%]	Cu [wt.-%]	Sn [wt.-%]	Fe [wt.-%]	Graphite [wt.-%]	Others [wt.-%]	DIN 30910 Sint-	ISO-5755	MPIF
0.0 - 0.3	87.2 - 90.5	9.5 - 10.5	-	-	<2	-	-C-T10K-110	CT-1000-K19
0.0 - 0.3	87.2 - 90.5	9.5 - 10.5	-	-	<2	A 50	-C-T10K-140	CT-1000-K26
0.0 - 0.3	87.2 - 90.5	9.5 - 10.5	-	-	<2	B 50	-C-T10K-180	CT-1000-K37
0.5 - 1.8	85.7 - 90.0	9.5 - 10.5	-	-	<2	-	-C-T10GK-90	CTG-1001-K17
0.5 - 1.8	85.7 - 90.0	9.5 - 10.5	-	-	<2	A 51	-C-T10GK-120	CTG-1001-K23
0.5 - 1.8	85.7 - 90.0	9.5 - 10.5	-	-	<2	B 51	-C-T10GK-160	CTG-1001-K30
2.5 - 5.0	82.8 - 88.3	9.5 - 10.5	-	-	<2	n/a	n/a	CTG-1004-K10
2.5 - 5.0	82.8 - 88.3	9.5 - 10.5	-	-	<2	n/a	n/a	CTG-1004-K15
0.5 - 1.3	34.0 - 38.0	3.5 - 4.5	54.2 - 62.0	-	<2	n/a	-F-03C36T-K90	FCTG-3604-K16
0.5 - 1.3	34.0 - 38.0	3.5 - 4.5	54.2 - 62.0	-	<2	n/a	-F-03C36T-K120	FCTG-3604-K22
0.5 - 1.3	50.2 - 58.0	5.5 - 6.5	50.2 - 58.0	-	<2	n/a	-F-03C45T-K70	CFTG-3806-K14
0.5 - 1.3	50.2 - 58.0	5.5 - 6.5	50.2 - 58.0	-	<2	n/a	-F-03C45T-K100	CFTG-3806-K22
0.0 - 0.3	0.0 - 1.5	-	96.2 - 100.0	-	<2	A 00	-F-00-K170	F-0000-K15
0.0 - 0.3	0.0 - 1.5	-	96.2 - 100.0	-	<2	B 00	-F-00-K220	F-0000-K23
0.3 - 0.6	0.0 - 1.5	-	95.9 - 99.7	-	<2	A 01	n/a	F-0005-K20
0.3 - 0.6	0.0 - 1.5	-	95.9 - 99.7	-	<2	B 01	n/a	F-0005-K28
0.6 - 0.9	0.0 - 1.5	-	95.6 - 99.4	-	<2	A 01	n/a	F-0008-K20
0.6 - 0.9	0.0 - 1.5	-	95.6 - 99.4	-	<2	B 01	n/a	F-0008-K32
0.0 - 0.3	1.5 - 3.9	-	93.8 - 98.5	-	<2	A 10	F-00C2-K200	FC-0200-K20
0.0 - 0.3	1.5 - 3.9	-	93.8 - 98.5	-	<2	B 10	F-00C2-K200	FC-0200-K34
0.0 - 0.3	9.0 - 11.0	-	86.7 - 91.0	-	<2	n/a	n/a	FC-1000-K20
0.0 - 0.3	9.0 - 11.0	-	86.7 - 91.0	-	<2	n/a	n/a	FC-1000-K30
0.3 - 0.6	1.5 - 3.9	-	93.5 - 98.2	-	<2	n/a	n/a	FC-0205-K20
0.3 - 0.6	1.5 - 3.9	-	93.5 - 98.2	-	<2	B 11	n/a	FC-0205-K35
0.6 - 0.9	1.5 - 3.9	-	93.2 - 97.9	-	<2	n/a	n/a	FC-0208-K25
0.6 - 0.9	1.5 - 3.9	-	93.2 - 97.9	-	<2	B 11	n/a	FC-0208-K45
0.6 - 0.9	4.0 - 6.0	-	91.1 - 95.4	-	<2	n/a	n/a	FC-0508-K35
0.6 - 0.9	4.0 - 6.0	-	91.1 - 95.4	-	<2	B 11	n/a	FC-0508-K46
0.6 - 0.9	18.0 - 22.0	-	75.1 - 81.4	-	<2	A 22	n/a	FC-2008-K44
0.6 - 0.9	18.0 - 22.0	-	75.1 - 81.4	-	<2	B 22	n/a	FC-2008-K46
0.0 - 0.5	-	-	-	2.0 - 3.0	<2	n/a	-F-03G3-K70	FG-0303-K10
0.0 - 0.5	-	-	-	2.0 - 3.0	<2	n/a	-F-03G3-K80	FG-0303-K12

Sintered Soft Magnetic Materials

Standard References I	Typical Properties [1]										
GKN SM Material Code	Typical Density [g/cm³]	Coercivity Hc [A/m]	Bmax @ 1200 A/m [T]	Permeability	Hardness	Hardness	UTS [MPa]	$YS_{0,2}$ [MPa]	A El [%]	E [GPa]	Composition
PM4EM 1000D	7.0	170	1.05	2,300	50 HRF	50 HB	195	115	12	140	Fe
PM4EM 1000E	7.25	165	1.20	2,900	55 HRF	55 HB	255	155	17	155	Fe
PM4EM 10P40D	7.15	150	1.25	3,200	55 HRB	95 HB	380	270	12	155	Fe0.45P
PM4EM 10P40E	7.4	130	1.35	3,600	65 HRB	115 HB	415	280	15	170	Fe0.45P
PM4EM 10S30D	7.2	85	1.30	5,000	75 HRB	135 HB	380	275	15	155	Fe3Si
PM4EM 50NiE	7.5	20	1.20	10,000	40 HRB	80 HB	275	170	15	110	Fe50Ni
PM4EM SS410C	6.7	390	1.15	340	85 HRB	165 HB	280	150	10	125	Fe12Cr
PM4EM SS410D	7.0	330	1.23	410	95 HRB	210 HB	320	190	14	140	Fe12Cr
PM4EM SS430C	6.7	320	1.06	320	70 HRB	120 HB	300	170	12	125	Fe16Cr
PM4EM SS430D	7.0	280	1.17	370	90 HRB	185 HB	340	200	16	140	Fe16Cr

[1] Properties can be influenced and optimized by the proper selection of processing conditions. Consult an GKN Sinter Metals expert on the specifics of the application for the best solution.
[2] C <0.1 wt-%; Co < 0.1 wt-%

Soft Magnetic Composites (SMC)

GKN SM Material Code	Typical Properties*					
	B @ 10 kA/m [T]	Permeability	Coercivity Hc [A/m]	Iron losses at 1T		
				P @ 50Hz [W/kg]	P @ 400Hz [W/kg]	P @ 1000Hz [W/kg]
PM4EM 10	1.56	502	249	6	59	168
PM4EM 10-HS	1.55	550	272	6	69	229
PM4EM 11	1.56	472	249	6	59	164
PM4EM 11-HS	1.59	557	260	6	59	176
PM4EM 35	1,3	337	327	6	51	134
PM4EM 35-HS	1,26	332	392	8	72	201
PM4EM 110	1,55	454	210	5	45	128
PM4EM 110 HS	1,55	602	234	6	58	152

* Tested with standard rings

Chemical Composition[2)]						Standard References II			Applications
Fe [wt-%]	P [wt-%]	Ni [wt-%]	Si [wt-%]	Cr [wt-%]	Other [wt-%]	DIN EN 10331	DIN 30910 Sint-	MPIF	
bal.	-	-	-	-	< 0.5	S-Fe-170	D 00	FF-0000-20W	applications at DC & low frequency current or permant magnetic systems
bal.	-	-	-	-	< 0.5	S-Fe-165	E 00	FF-0000-20X	
bal.	0.45	-	-	-	< 0.5	S-FeP-150	D 35	FY-4500-17X	
bal.	0.45	-	-	-	< 0.5	S-FeP-130	E 35	FY-4500-17Y	
bal.	-	-	3	-	< 0.5	S-FeSi-80	n/a	FS-0300-12X	
bal.	-	50	-	-	< 0.5	S-FeNi-20	n/a	FN-5000-5Z	
bal.	-	-	-	13	< 1	n/a	C 43	SS-410L	applications at DC & low frequency current or permant magnetic systems with high corrosion resistance
bal.	-	-	-	13	< 1	n/a	D 43	SS-410L	
bal.	-	-	-	18	< 1	n/a	C 42	SS-430L	
bal.	-	-	-	18	< 1	n/a	D 42	SS-430L	

UTS: Ultimate Tensile Strength YS: Yield Strength A, El: Elongation

E: Youngs Modulus

			Applications
P @ 2000Hz [W/kg]	Transverse Rupture Strength TRS [MPa]	Density [g/cm³]	
384	39	up to 7.4	BLDC electric motors; transverse and axial flux machines; transformers; high frequency softmagnetic application
617	121	up to 7.4	
377	42	up to 7.5	
426	136	up to 7.5	
296	62	bis zu 7,3	
498	149	bis zu 7,3	
298	44	bis zu 7,4	
344	112	bis zu 7,4	

MIM - Case Hardened Steels

Material	Sintered					Heat Treated				Chemical Compositions[1]				
	Density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardn. [HV10]	UTS [MPa]	$YS_{0.2}$ [MPa]	A El [%]	Hardn. [HV10]	C [%]	Ni [%]	Cr [%]	Mo [%]	Mn [%]
IMET Ni 2	> 7.40	280	140	25	90	by agreement				< 0.1	1.90-2.20	-	-	-
IMET Ni 8	> 7.40	350	200	15	90	by agreement				< 0.1	7.50-8.50	-	-	-
IMET 8620	> 7.40	400	220	15	90	by agreement				0.12-0.23	0.40-0.70	0.40-0.60	0.15-0.25	-

MIM - Corrosion Resistant Steels

Material	Sintered					Heat Treated				Chemical Composition[1]					
	Density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardn. [HV10]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardn. [HV10]	C [%]	Ni [%]	Cr [%]	Mo [%]	Mn [%]	Si [%]
IMET 316 L	> 7.60	450	160	40	105	n/a				<0.03	10.00-14.00	16.00-18.00	2.00-3.00	<2	<1
IMET 430	> 7.40	350	200	20	190	n/a				<0.08	-	15.50-17.50	-	<1	< 1
IMET 17-4 PH	> 7.50	800	700	3	250	1,000	950	2	350	<0.07	3.00-5.00	15.00-17.50	-	<1	<1

MIM - Heat Treatable Steels

Material	Sintered					Heat Treated				Chemical Composition[1]					
	Density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	A [%]	Hard-ness [HV10]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardness [HV10]	C [%]	Ni [%]	Cr [%]	Mo [%]	Mn [%]	Si [%]
IMET Ni 2C	> 7.40	450	250	5	170	1,000	800	2	600	0.40-0.70	1.90-2.20	-	-	-	-
IMET Ni 8C	> 7.40	700	350	3	320	1,200	1000	2	600	0.40-0.70	7.50-8.50	-	-	-	-
IMET Cr Mo 4	> 7.40	600	350	4	110	1,350	1150	2	450	0.35-0.45	-	0.90-1.20	0.15-0.30	-	-
IMET 8740	> 7.40	600	350	5	180	1,600	1100	1	450	0.45-0.55	0.50-0.80	0.40-0.60	0.25-0.40	-	0.30-0.55
IMET Cr 6	> 7.40	950	630	5	250	1,500 1,400	1,250 1,100	1 0.5	450 650	0.80-1.05	-	1.35-1.65	-	-	-

[1] Percent by weight

			Other Designation			Properties	Applications
Si [%]	Cu [%]	Fe [%]	Mat no: DIN	AISI/SAE/ MPIF	Others		
-	-	bal.	n/a	MPIF MIM - 2200	carbonyl iron with 2% nickel	high strength, fatigue strength, high surface hardness	mechanical engineering
-	-	bal.	n/a	MPIF MIM - 2700	carbonyl iron with 8% nickel		
-	-	bal.	1.6523	AISI/SAE 8620	21 NiCrMo 2	for parts with the highest mechanical loading, high surface hardness	gear segments, crown wheels, camshafts, tools, mechanical engineering

			Other Designation			Properties	Applications
Cu [%]	Nb [%]	Fe [%]	Mat no: DIN	AISI/SAE	Others		
-	-	bal.	1.4404	AISI 316 L	X 2 Cr-NiMo 17 13 2	excellent corrosion resistance, austenitic, non-magnetic, moderate hardness, high ductility, excellent polished surface and shape reproduction	apparatus engineering, chemical industry, watchmaking and jewellery, medical technology
-	-	bal.	1.4016	AISI 430	X 6 Cr 17	high strength and corrosion resistance, ferritic	automotive industry
3.00-5.00	0.15-0.45	bal.	1.4542	SAE J 467 (17-4PH)	X 5 CrNi-CuNb 17 4	high corrosion resistance, martensitic, ferromagnetic, precipitation hardening	pump components, medical engineering, automotive industry, mechanical engineering, aircraft and shipbuilding industries

	Other Designation			Properties	Applications
Fe [%]	Mat no: DIN	AISI/SAE	Others		
bal.	n/a	n/a	carbonyl iron with 2% nickel	excellent surface finish, high strength	miscellaneous applications (e. g. mechanical engineering, firearm components)
bal.	n/a	n/a	carbonyl iron with 8% nickel		
bal.	1.7225	AISI/SAE 4140	42 CrMo 4	high strength and ductility, large heat treated diameter	mechanical engineering, firearms, gearbox components
bal.	1.6546	AISI/SAE 8740	40NiCrMo2 2		wear resistant, highly loaded components in mechanical engineering and automotive industry
bal.	1.3505	AISI/SAE 52100	100 Cr 6	cold working tool steel, high wear resistance, high hardness	mechanical engineering

UTS: ultimate tensile strength YS: yield strength A, El: elongation to fracture

MIM - Soft Magnetic Steels

Material	Sintered					Heat Treated				Chemical Com				
	Density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardness [HV10]	UTS [MPa]	$YS_{0.2}$ [MPa]	A El [%]	Hardn. [HV10]	C [%]	Ni [%]	Cr [%]	Mo [%]	Mn [%]
IMET Si 3	> 7.40	450	300	20	160	n/a				< 0.1	-	-	-	-
IMET FN 50	> 7.40	400	150	25	110	n/a				< 0.1	49.50-50.50	-	-	-
IMET F S	> 7.40	220	100	40	60	n/a				< 0.1	-	-	-	-

MIM - Alloys for High Temperature Applications

Material	Sintered					Heat Treated				Chemical Com					
	Density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardn. [HV10]	UTS [MPa]	$YS_{0.2}$ [MPa]	A El [%]	Hardn. [HV10]	C [%]	Ni [%]	Cr [%]	Mo [%]	Co [%]	Al [%]
IMET GHS-4 *)	> 7.70	700	550	1	310	n/a				2.0-2.4	38.0-42.0	11.0-13.0	5.0-7.0	-	-
IMET 310N **)	> 7.55	650	380	7	220	n/a				0.20-0.50	19.0-22.0	24.0-26.0	-	-	-
IMET N 90 ***)	> 7.8	1,000	620	10	280	1,100	650	10	300	≤ 0.13	bal.	18.0-21.0	-	15.0-21.0	1.0-2.0

*) Heat and wear resistant alloy

**) Heat resistant alloy

***) Superalloy

MIM - Tool Steels

Material	Sintered					Heat Treated				Chemical		
	Density [g/cm³]	UTS [MPa]	$YS_{0.2}$ [MPa]	A EL [%]	Hardn. [HV10]	UTS [MPa]	$YS_{0.2}$ [MPa]	A El [%]	Hardness [HV10]	C [%]	Cr [%]	W [%]
IMET M2	> 7.70	1,100	700	1	480	-	-	-	800	0.95-1.05	3.80-4.50	5.50-6.75

1) Percent by weight

position[4]			Other Designation			Properties	Applications
Si [%]	Cu [%]	Fe [%]	Mat no: DIN	AISI/SAE/MPIF	Others		
2.50-3.00	-	bal.	1.0884	MPIF MIM-Fe-3%Si	carbonyl iron w. 3% silicium	relatively high permeability	for pole shoes and relay components (where fast magnetic reversal is required)
-	-	bal.	1.3926	MPIF MIM-Fe-50%Ni	carbonyl iron w. 50% nickel		pole shoes, relay parts, rotors, stators, etc.
-	-	bal.	n/a	n/a	carbonyl iron	high polarisation	

position[4]						Other Designation			Properties	Applications
Ti [%]	Si [%]	Mn [%]	V [%]	Nb [%]	Fe [%]	Mat no: DIN	AISI/SAE	Others		
-	1.5-1.9	0.8-1.3	0.8-1.0	-	bal.	n/a	n/a	PI Ni 40 Cr 12 Mo 6	high application temperature, wear resistant	turbocharger
-	0.75-1.30	<1.5	-	1.2-1.5	bal.	1.4848	ACI HK 30	G- X40 CrNiSi 25 20	application temperature up to 850 °C	turbocharger
3.0-4.0	≤ 1.0	≤ 1.0	-	-	≤ 1.5	2.4632	SAE J775 (HEV-6)	NiCr 20 Co 18 Ti	nickel base alloy for highest temperature applications	turbocharger

Composition[4]			Other Designation			Properties	Applications
Mo [%]	V [%]	Fe [%]	Mat no: DIN	AISI/SAE	Others		
4.50-5.50	1.75-2.20	bal.	1.3342	AISI M2	SC 6-5-2	wear resistant high-speed steel	cutting knives, nozzles

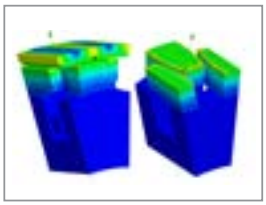
UTS: ultimate tensile strength YS: yield strength A, El: elongation to fracture

Engineering & PM Metal Shaping Capabilities

GKN offers unique engineering support and a wide range of PM Metal shaping processes which enables to find the best product solution in value and performance for our customers. Our product solutions benefit all kind of markets from automotive, medical, aerospace, industrial to consumer products.

ENGINEERING

- GKN's competence in engineering and design for best possible customer satisfaction
- ~ 550 highly qualified engineers and designers



SIMULATION

- Structural mechanic simulation and system design
- Thermal simulation
- Electromagnetic simulation

DESIGN FOR PM

- Benefit from reduced total-cost-of-ownership (TCO) through GKN's development experience and support
- Technology-oriented design for cost efficient production
- Reduced development periods
- Added value due to integrated functionality

METROLOGY

- B-H field meter
- Coercimeter
- Resistance test

MATERIALS & ENGINE TEST BENCHES

- In-house materials test center for tensile testing, service life tests, elevated temperature testing, tribological testing
- In-house variable engine test bench for performance tests, long-run performance, thermal performance

CONVENTIONAL PM

Improvements in materials and processes has resulted in a new class of high performance, consistent, competitive and creative products.

ALUMINIUM PM

Providing engineers with a new tool for weight reduction and improved product performance, GKN is taking PM Aluminium to a new level by leveraging unique materials capabilities not possible with competing technologies.

SOFT MAGNETIC PM

Enables engineers to develop smaller products with improved performance for electric motors and electromechanical systems.

SURFACE DENSIFIED PM

This technology enables GKN to deliver gears that combine the net shape advantages of PM technology with the performance of wrought steel.

POROUS METAL FILTERS

These filters and compnents are based on GKN´s controlled porosity materials for demanding applications where traditional filters are unable to deliver.

METAL INJECTION MOLDING (MIM)

MIM is 3D shape capability of plastic injection molding combined with the performance of alloy steels, stainless steels and high temperature alloys.

STAINLESS STEEL PM

Excellent choice for optimum corrosion resistance in high demand applications.

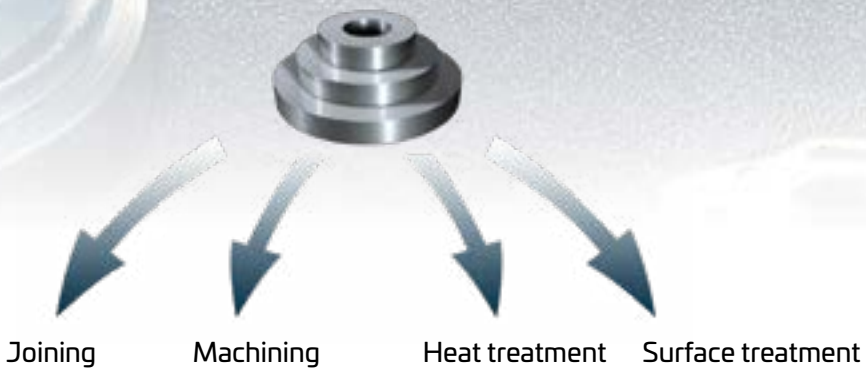
FORGED PM

This process step creates a nearly full dense part with high dynamic loads by utilizing a closed die which creates high axial precision.

ADDITIVE MANUFACTURING

In a competitive environment, speed is a crucial enabler and getting your solution to market first is a clear advantage. GKN's additive manufacturing capabilities are allowing us and our partners to develop products more rapidly without need for product specific molding tools.

Auxilliary Processing Operations



Optional Auxiliary Operations - Examples

Turned inner cone

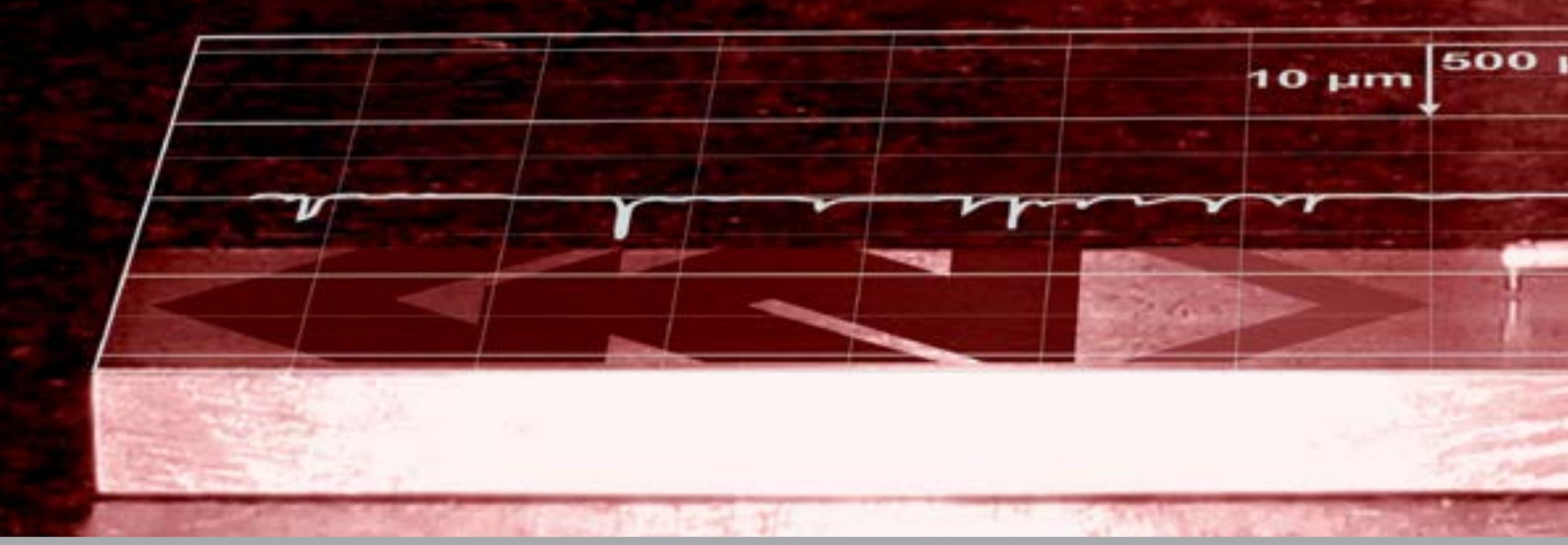
Turned outer diam-
eter

Surface densification
by rolling process

Ground surface

Induction hardened
teeth

Organic coated sur-
face



Surface Roughness Quality of PM Components

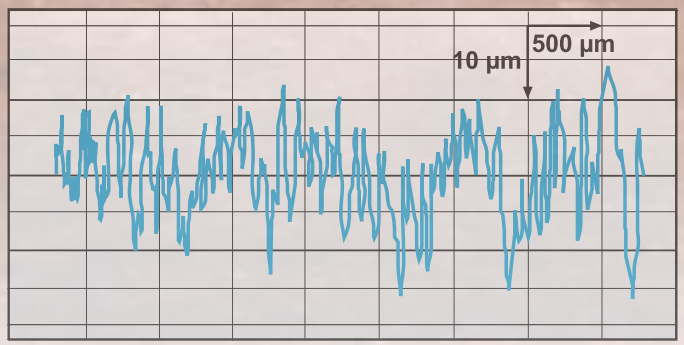
It is important to know that the surface structure of sintered components depends on the density but offers an enhanced contact aera compared to machined surfaces. Especially when sintered parts surfaces have been sized they are superior even to grinded surfaces offering best performance in form and function.

Today surface qualities on sintered parts are often still defined by R_t, R_a or R_z using values that seem to be based on experiences with machined surface qualities on non porous materials.

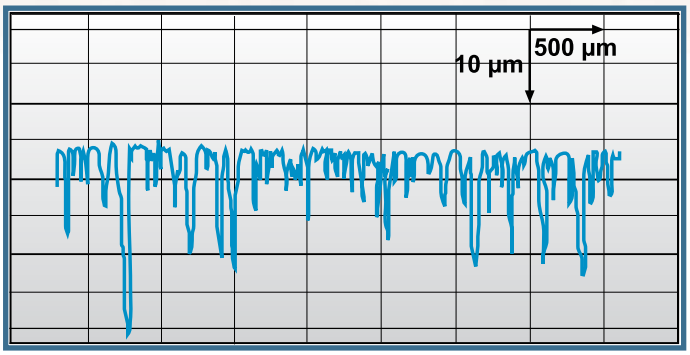
Due to the special (porous) structure of PM components the surface measurement with current measuring devices according to DIN EN ISO 4287 und 4288 is misleading and does not reflect the high quality of sintered surfaces. Hence deep pores may create extremely high R_t values even though the surface is plateau like and thus contains extraordinary well gliding properties.

By comparing profiles of surfaces from machined parts with porous PM components it becomes obvious that PM materials offer without doubt an improved surface smoothness although the P_t values from the compared St 50 vs. PM measurement plots are almost identical.

Due to the special surface properties of sintered parts it is therefore recommended to define roughness in R_{pk} and R_k (see DIN ISO 23519). The adjoining pictures and table 1 serve to illustrate this.



a) St 50 fine turned (P_t ~ 30)

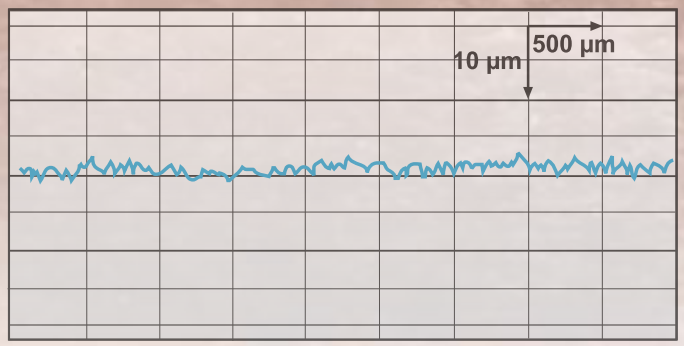


b) Sint-C 00 as sintered (P_t ~ 30)

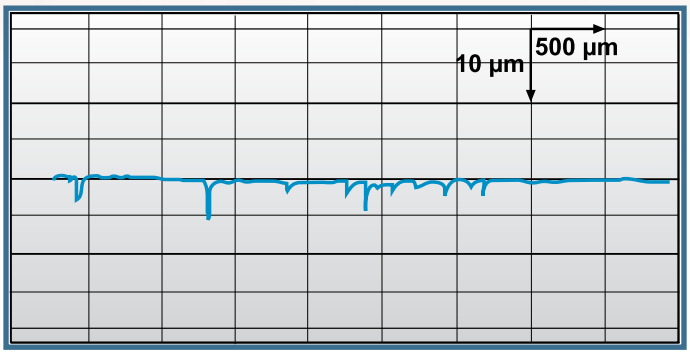
Figures a - d) Surface profiles of materials according to table 1

Figure	Processing Condition	Rough (repres	
		R_t	R_a
a)	St 50 fine turned	10.7	1.28
b)	Sintered (see graph b)	28	1.9
c)	St 50 grinded	4.2	0.6
d)	Sized (see graph d)	10.6	1.22

Table 1
Surface roughness measured on different processing conditions of steel and PM parts (examples)



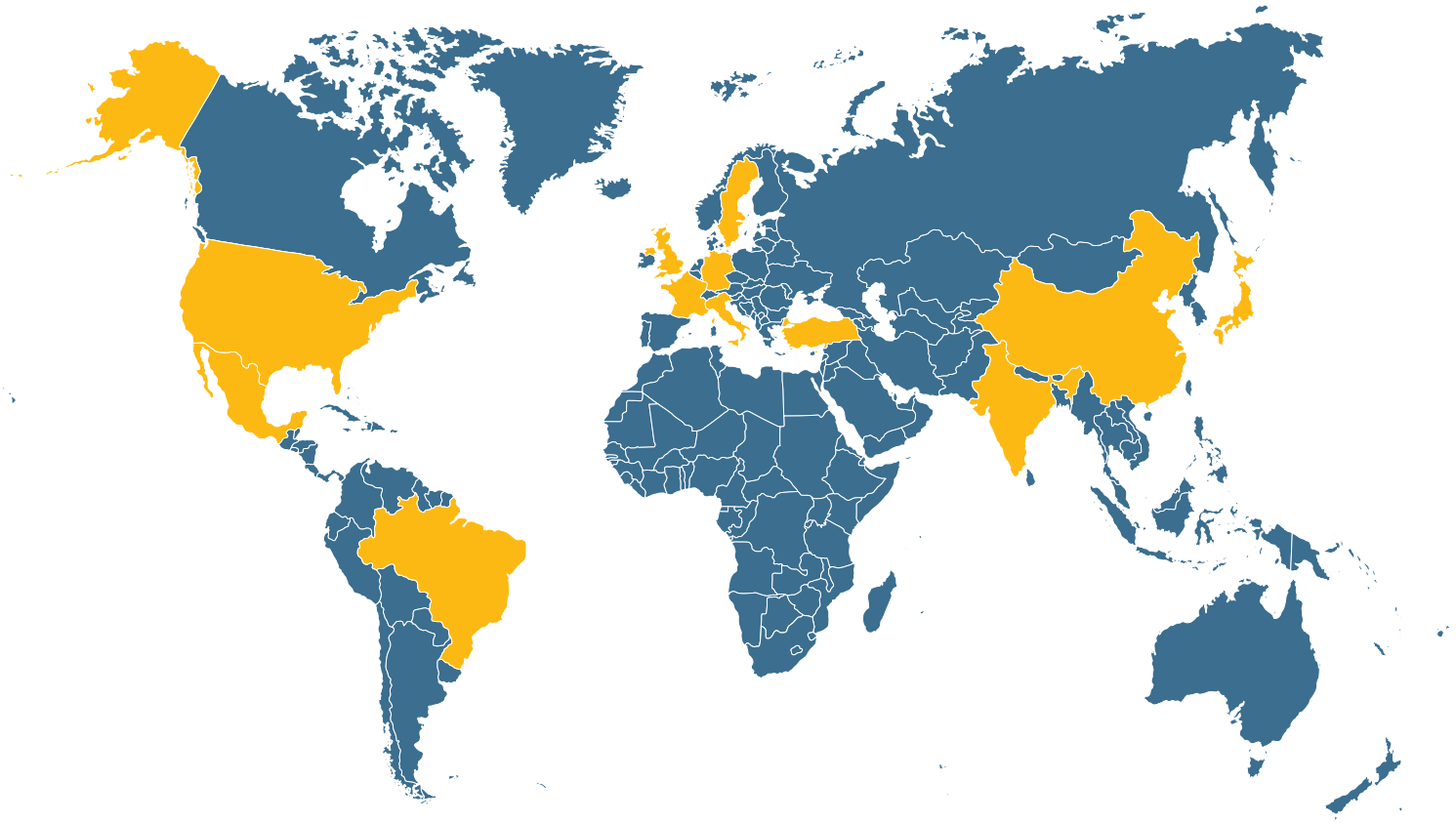
c) St 50 grinded (P_t ~ 6)



d) Sint-C 00 sintered and sized (P_t ~ 6)

ness Values in µm entative examples)			Contact Area in % at Cutting Depth c		
R_z	R_{pk}	R_k	1 µm	2 µm	4 µm
8.2	4.5	5.4	< 1	6	12
18	1.4	1.4	< 1	56	72
3.6	1.3	1.4	< 1	71	100
7.8	0.8	0.6	96	98	100

Notes



GKN Locations

Over 30 locations
in 12 countries
on 4 continents

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