



WORLD CLASS TECHNOLOGY



DRILLING CATALOGUE

2014/2015

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DOF Tools develops, manufactures and sell cutting tools made from solid carbide. The company and our innovations are sprung from several years of research and practical experiences in machining and heat generation.

We want to be an active part of the environment we live in, that is why we have introduced management for quality and environment. Since October 12th 2012 we are certified according to ISO 9001 and ISO 14001.



QUALITY

For us it is a requirement that we in all situations supply high quality solutions. This is something we are well known for. As a step in our expansion there are always higher requirements for monitoring, availability and swift service. In the dialogue with our customers we find ways to constantly improve us and our subcontractors.

ENVIRONMENT

In the industrial sector we are working in, environment is a general matter. The environment is in focus in a natural way in every bussiness we do. To stay competitive in an industry where environment is an important aspect, we need to continuously find solutions for ineffective processes. In our business it is a direct link between effectivity and less environmental impact. The durability of our products is world class, which results in less use of raw materials.

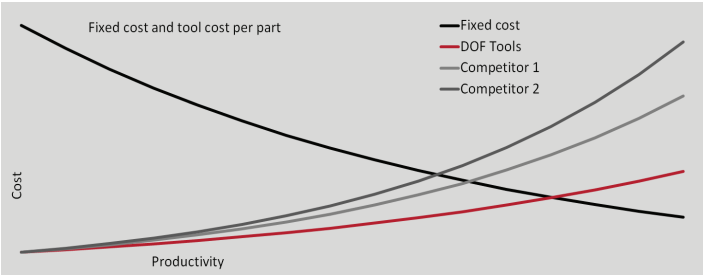
Our customers does not accept anything else than environmentally approved technology which follows the directives set up to follow. We continuously monitor and improve our environmental work by setting up goals which are all-embracing based on our customers requirements and the environmental aspects. The commitment to comply with laws and other requirements is a natural part of our everyday work.

DOF TOOLS AB

Mattias Svensson

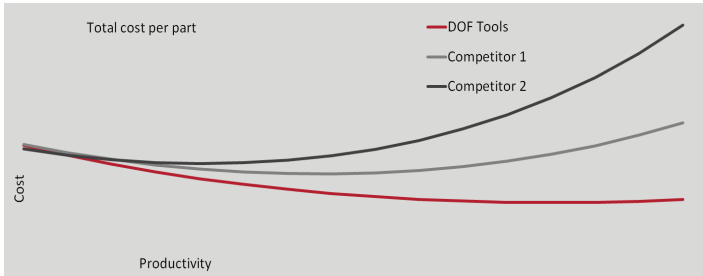
September 12th 2012

Demonstrated in the graph below are the fixed costs per part, and tool cost per part, as function. The fixed costs per part decreases and the tool cost per part increases as productivity increases. Different tools withstand high productivity in various degree. See the graph below:



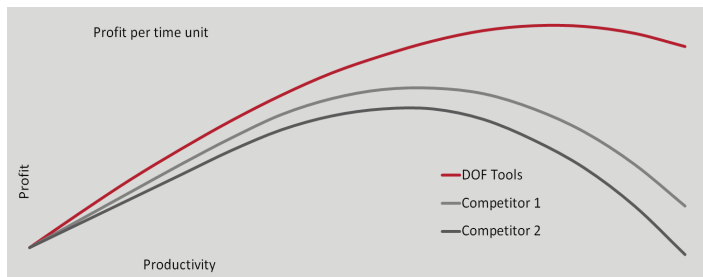
LOWER MANUFACTURING COSTS, HIGHER PRODUCTIVITY

Since our tools can withstand high productivity to a greater degree, the result is more parts produced at a lower cost. See the graph below:



GREATER PROFIT PER PART AND MORE PARTS

When the profit is calculated the effect is double, lower cost per part and higher productivity. See the chart below:



IMPLEMENTATION

On the following pages there are methodology, rule of thumb, formulas and arithmetical examples for adaption to specific cases. On page 39 there is a table with cutting parameters.

PROFITABILITY CALCULATIONS

In this case, profitability calculations describes how tool cost can be evaluated with regards to productivity and overall production economy.

When profitability is calculated, two bases for evaluation is possible.

First: Minimize the manufacturing cost per part.

Second: Maximize profit per unit of time.

FIRST BASIS

This approach is easier to calculate and is well-defined in literature.

The general idea is to find a maximum of the sum of fixed costs per part and tool cost per part. Included in the fixed costs are all the costs which are inflated by the number of parts produced per unit of time, (mantime cost, machine cost, overhead etc) but no costs specifcly tied to a specific part (raw material etc).

The fixed cost per part decrease and tool cost increase with higher productivity. This can be represented by one curve which increases, and another which decreases with higher productivity. It is possible to mathematically determine a minimum of the sum of the two curves. For an exact determination, use the formulas on page 9 and forward. The rules of thumb can also be used.

RULES OF THUMB

- » It is the cost per produced hole which is determining, not the fixed cost or the tools cost alone.
- » High machine cost requires high productivity and vice versa.
- » High overhead (rent, cost for development, quality control, programming etc) requires high productivity and vice versa.
- » Greater tool ability to withstand high productivity enables higher productivity.
- » Greater added value enables higher productivity.

SECOND BASIS

The general idea with this approach is that increased productivity enables less margin. This means focus on profit in euro instead of profit in percent. Otherwise it is the same basis for calculation and the same rules of thumb.

First example: 10 parts per hour are produced with a margin of 10 euro (100 euro profit/hour).

Second example: 15 of the same parts per hour are produced, but with a margin of 8 euro (120 euro profit/hour).

If the reduction in margin per part (A) and increased productivity (B) cancel each other out ($A+B=1$), it gives the same profit/hour.

It is harder to make calculations with this approach and it requires more testing, but gives a more accurate result if the goal is to maximize the profit per unit of time.

FORMULAS AND METHODOLOGY

On the next page (p. 10) there are formulas and methodology for comparing two known setups and see which gives the lowest total production cost per part and greatest profit per hour. Setup in this case could be either two different tools or the same tool brand but with different productivity and tool life.

The following parametres must be known for both setups:

K_{mc}	Machine cost per hour	(€)
K_{mt}	Man cost per hour	(€)
K_{oh}	Overhead cost per hour	(€)
L_d	Total hole depth per part	(mm)
$X_{\%}$	Drilling operations	(%)

Fixed cost per hour, is per effective production hour. Disturbance, quality problems etc in the production increase the fixed cost per hour.

The following parametres must be known but are different for both setups:

K_{v1}, K_{v2}	Tool cost per tool life	(€)
V_{f1}, V_{f2}	Feed	(mm/minute)
V_{t1}, V_{t2}	Tool life	(m)

First, the number of tool life per hour is calculated for both setups (N_{v1} resp. N_{v2}):

$$N_{v1} = \frac{V_{f1} \times 60}{V_{t1} \times 1000} \quad N_{v2} = \frac{V_{f2} \times 60}{V_{t2} \times 1000}$$

Then, the number of parts produced per hour is calculated for both setups (N_{a1} resp. N_{a2}):

$$N_{a1} = \frac{V_{f1} \times 60 \times X\%}{L_d \times 100} \quad N_{a2} = \frac{V_{f2} \times 60 \times X\%}{L_d \times 100}$$

It is now possible to calculate the total production cost per part for both setups (K_{tot1} resp. K_{tot2}).

$$K_{tot1} = \frac{K_{mc} + K_{mt} + K_{oh}}{N_{a1}} + \frac{K_{v1} \times N_{v2}}{N_{a1}}$$

$$K_{tot2} = \frac{K_{mc} + K_{mt} + K_{oh}}{N_{a2}} + \frac{K_{v1} \times N_{v2}}{N_{a2}}$$

The setup which gives the lowest K_{tot} is the best setup if the goal is to minimize the total production cost per part.

PROFIT CALCULATIONS

When the total production cost per part for both setups is known, there is a possibility to proceed and calculate profit per hour (P_{h1} and P_{h2}) and profit per tool (P_{v1} resp. P_{v2}).

The following parameter must be known:

P_{a1} value added per part produced 1 (€)

$P_{a2} = P_{a1} + K_{tot1} - K_{tot2}$ value added per part produced 2 (€)

Profit per hour (P_{h1} and P_{h2}) (€):

$$P_{h1} = P_{a1} \times N_{a1}$$

$$P_{h2} = P_{a2} \times N_{a2}$$

Profit per tool (P_{v1} and P_{v2}) (€):

$$P_{v1} = \frac{P_{h2}}{N_{v2}}$$

$$P_{v2} = \frac{P_{h2}}{N_{v2}}$$

DRILLING

DOF K+ Drill for specific material groups (see next page)

DOF P+ Drill for specific material groups (see next page)

DOF A+ Drill for specific material groups (see next page)

All geometries are designed for high productivity in the form of increased feed.

TOOLS FOR SPECIAL APPLICATIONS

SEMISTANDARD Adaption for specific diameter

DOF BRBS Drill with four land margins based on optional base geometry

STEP TOOLS Based on optional base geometry

MILLS End mills and ball nose mills tailored for specific cases

PROFILE TOOLS High accuracy profiles, concave radius or side milling cutters with gear teeth profile

This is an overview of which geometries that are suited for which materials. The chart should be interpreted as following:



Not recommended



Recommended in certain applications



Recommended

ISO	Geometry			Material group	
	p+	k+	a+		
P				1	Very soft <0.25% C
				2	Soft <= 0.25% C
				3	Normal >=0.25%C
				4	Low alloy steel
				5	Normal <5% alloyed
				6	Harder <5% alloyed
				7	High alloy steel
M				8	Annealed >5% alloyed
				9	Ferritic/martensitic
				10	Martensitic
K				11	Austenitic
				12	Nodular cast iron
				13	Difficult cast iron
N				14	Aluminium
				15	Brass/Copper Alloys
S				16	Super alloys (Ni-base)
				17	Annealed
				18	Cured
H				19	Super alloys (Ti-base)
				20	Hardened steel
					Hardness 48-55 HRc
					Hardness 55-65 HRc

Following charts displays our stock items. A web shop with current stocks will be introduced on our webpage (www.doftools.se) during 2013/2014.

DESIGN CRITERIAS

These geometries are designed to withstand high productivity. To achieve this, our whole manufacturing process have been customized.

GRINDING PROCESS

The most accurate grinding machines offered on the market are used. The grinding process is customized to maintain high repeatability even with tight tolerances. Each geometry is optimized the specific machining conditions in the recommended material groups.

PREPARATION AND COATING

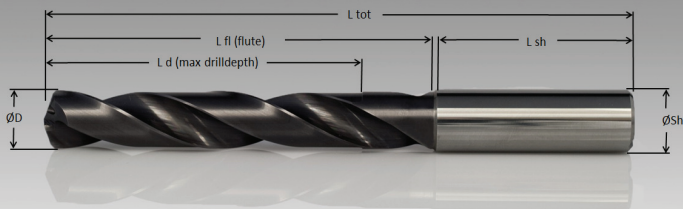
To increase the adhesion of the coating and to strengthen the cutting edges, all tools are subjected to a separate process.

SURFACE PREPARATION

The drills are prepared in a separate process, after coating, to reduce friction and to improve chip evacuation.

To increase heat transfer and thereby increase tool life, DOF k+ has a unique corner geometry. The centre is designed to reduce axial force.

To summarize, a great combination of productivity and tool life.



Art. n.	Description	internal coolant supply										
		length	no	yes	yes	yes	L _{fl}	L _d	L _{fl}	L _d	L _{tot}	
			2.5xd	3xd	5xd	7xd						10xd
12001	k+300-9-6c	3	x				6	36	15	9	58	
15069	k+300i-18-6c	3			x		6	36	23	18	62	
15070	k+310i-18-6c	3,1				x	6	36	23	18	62	
15065	k+320i-18-6c	3,2				x	6	36	23	18	62	
12004	k+330-9-6c	3,3	x				6	36	15	9	58	
15071	k+330i-18-6c	3,3			x		6	36	23	18	62	
17060	k+330i-25-6c	3,3				x	6	36	33	25	72	
15072	k+340i-18-6c	3,4				x	6	36	23	18	62	
17057	k+340i-26-6c	3,4				x	6	36	33	26	72	
12006	k+350-9-6c	3,5	x				6	36	15	9	58	
15061	k+350i-18-6c	3,5				x	6	36	23	18	62	
17061	k+350i-26-6c	3,5				x	6	36	33	26	72	
15073	k+360i-18-6c	3,6				x	6	36	23	18	62	
15074	k+370i-18-6c	3,7				x	6	36	23	18	62	
13001	k+380i-14-6c	3,8				x	6	36	21	14	58	
15001	k+380i-21-6c	3,8				x	6	36	33	21	70	
17001	k+380i-33-6c	3,8				x	6	36	40	33	77	
12011	k+400-11-6c	4	x				6	36	18	11	58	
13002	k+400i-14-6c	4				x	6	36	21	14	58	
15002	k+400i-21-6c	4				x	6	36	33	21	70	
17002	k+400i-33-6c	4				x	6	36	40	33	77	
12013	k+420-12-6c	4,2	x				6	36	18	12	58	
13003	k+420i-14-6c	4,2				x	6	36	21	14	58	
15003	k+420i-23-6c	4,2				x	6	36	33	23	70	
17003	k+420i-33-6c	4,2				x	6	36	40	33	77	
11033	k+420i-45-6c	4,2					x	6	36	53	45	90
12014	k+450-12-6c	4,5	x				6	36	18	12	58	
13004	k+450i-14-6c	4,5				x	6	36	21	14	58	
15004	k+450i-23-6c	4,5				x	6	36	33	23	70	
17004	k+450i-33-6c	4,5				x	6	36	40	33	77	
15075	k+460i-23-6c	4,6				x	6	36	38	23	70	
12015	k+480-15-6c	4,8	x				6	36	25	15	62	
15066	k+480i-25-6c	4,8				x	6	36	38	25	75	
13065	k+490i-15-6c	4,9				x	6	36	27	15	62	
12016	k+500-15-6c	5	x				6	36	25	15	62	
13005	k+500i-18-6c	5				x	6	36	27	18	64	
15005	k+500i-20-6c	5				x	6	36	29	20	76	
17005	k+500i-42-6c	5				x	6	36	51	42	88	

Art.	Denomination	internal coolant supply		no	yes	yes	yes	yes					
		length		2.5xd	3xd	5xd	7xd	10xd					
		ØD							ØSh	Lsh	Lfi	Ld	Ltot
11001	k+500i-60-6c	5						x	6	36	68	60	105
12017	k+510i-15-6c	5,1		x					6	36	25	15	62
13006	k+510i-18-6c	5,1			x				6	36	27	18	64
15006	k+510i-30-6c	5,1				x			6	36	38	30	75
17006	k+510i-42-6c	5,1					x		6	36	51	42	88
11002	k+510i-60-6c	5,1						x	6	36	68	60	105
12018	k+520i-15-6c	5,2		x					6	36	25	15	62
13007	k+520i-18-6c	5,2			x				6	36	27	18	64
15007	k+520i-30-6c	5,2				x			6	36	38	30	75
17007	k+520i-42-6c	5,2					x		6	36	51	42	88
11003	k+520i-60-6c	5,2						x	6	36	68	60	105
15068	k+540i-30-6c	5,4				x			6	36	38	30	75
12019	k+550i-15-6c	5,5		x					6	36	25	15	62
13008	k+550i-18-6c	5,5			x				6	36	27	18	64
15008	k+550i-30-6c	5,5				x			6	36	38	30	75
17008	k+550i-42-6c	5,5					x		6	36	51	42	88
11004	k+550i-60-6c	5,5						x	6	36	68	60	105
15081	k+560i-30-6c	5,6				x			6	36	38	30	75
17059	k+560i-42-6c	5,6					x		6	36	51	42	88
12020	k+580i-15-6c	5,8		x					6	36	25	15	62
13009	k+580i-18-6c	5,8			x				6	36	27	18	64
15009	k+580i-30-6c	5,8				x			6	36	38	30	75
17009	k+580i-42-6c	5,8					x		6	36	51	42	88
11005	k+580i-60-6c	5,8						x	6	36	68	60	105
13088	k+590i-18-6c	5,9			x				6	36	27	18	64
12021	k+600i-15-6c	6		x					6	36	25	15	62
13010	k+600i-18-6c	6			x				6	36	27	18	64
15010	k+600i-30-6c	6				x			6	36	38	30	75
17010	k+600i-42-6c	6					x		6	36	51	42	88
11006	k+600i-60-6c	6						x	6	36	68	60	105
13041	k+610i-24-8c	6,1			x				8	36	36	24	73
12065	k+620i-20-8c	6,2		x					8	36	33	20	70
15063	k+620i-40-8c	6,2				x			8	36	52	40	89
17062	k+620i-56-8c	6,2					x		8	36	68	56	105
11035	k+620i-80-8c	6,2						x	8	36	91	80	128
15077	k+630i-40-8c	6,3				x			8	36	52	40	89
12056	k+635i-20-8c	6,35		x					8	36	33	20	70
15082	k+640i-40-8c	6,4				x			8	36	52	40	89
12022	k+650i-20-8c	6,5		x					8	36	33	20	70
13011	k+650i-24-8c	6,5			x				8	36	36	24	73
15011	k+650i-40-8c	6,5				x			8	36	52	40	89
17011	k+650i-56-8c	6,5					x		8	36	68	56	105
11007	k+650i-80-8c	6,5						x	8	36	91	80	128
12023	k+680i-20-8c	6,8		x					8	36	33	20	70

	internal coolant supply		no	yes	yes	yes	yes					
	length		2.5xd	3xd	5xd	7xd	10xd					
Art.	Denomination	ØD						øSh	Lsh	Lfl	Ld	Ltot
13012	k+680l-24-8c	6,8		x				8	36	36	24	73
15012	k+680l-40-8c	6,8			x			8	36	52	40	89
17012	k+680l-56-8c	6,8				x		8	36	68	56	105
11008	k+680l-80-8c	6,8					x	8	36	91	80	128
12024	k+690-20-8c	6,9	x					8	36	33	20	70
13013	k+690l-24-8c	6,9		x				8	36	36	24	73
15013	k+690l-40-8c	6,9			x			8	36	52	40	89
17013	k+690l-56-8c	6,9				x		8	36	68	56	105
12025	k+700-20-8c	7	x					8	36	33	20	70
13014	k+700l-24-8c	7		x				8	36	36	24	73
15014	k+700l-40-8c	7			x			8	36	52	40	89
17014	k+700l-56-8c	7				x		8	36	68	56	105
11010	k+700l-80-8c	7					x	8	36	91	80	128
15092	k+720l-40-8c	7,2			x			8	36	52	40	89
12055	k+740-20-8c	7,4	x					8	36	33	20	70
13093	k+740l-24-8c	7,4		x				8	36	36	24	73
15051	k+740l-40-8c	7,4			x			8	36	52	40	89
17049	k+740l-56-8c	7,4				x		8	36	68	56	105
12026	k+750-20-8c	7,5	x					8	36	33	20	70
13015	k+750l-24-8c	7,5		x				8	36	36	24	73
15015	k+750l-40-8c	7,5			x			8	36	52	40	89
17015	k+750l-56-8c	7,5				x		8	36	68	56	105
11011	k+750l-80-8c	7,5					x	8	36	91	80	128
15090	k+760l-40-8c	7,6			x			8	36	52	40	89
17040	k+770l-56-8c	7,7				x		8	36	68	56	105
12027	k+780-20-8c	7,8	x					8	36	33	20	70
13016	k+780l-24-8c	7,8		x				8	36	36	24	73
15016	k+780l-40-8c	7,8			x			8	36	52	40	89
17016	k+780l-56-8c	7,8				x		8	36	68	56	105
12028	k+800-20-8c	8	x					8	36	33	20	70
13017	k+800l-24-8c	8		x				8	36	36	24	73
15017	k+800l-40-8c	8			x			8	36	52	40	89
17017	k+800l-56-8c	8				x		8	36	68	56	105
11013	k+800l-80-8c	8					x	8	36	91	80	128
15067	k+810l-50-10c	8,1			x			10	40	62	50	103
13043	k+820l-30-10c	8,2		x				10	40	45	30	86
17063	k+820l-70-10c	8,2				x		10	40	85	70	126
13052	k+830l-30-10c	8,3		x				10	40	45	30	86
15089	k+830l-50-10c	8,3			x			10	40	62	50	103
17039	k+830l-70-10c	8,3				x		10	40	85	70	126
15078	k+840l-50-10c	8,4			x			10	40	62	50	103
12029	k+850-25-10c	8,5	x					10	40	41	25	82
13018	k+850l-30-10c	8,5		x				10	40	45	30	86
15018	k+850l-50-10c	8,5			x			10	40	62	50	103

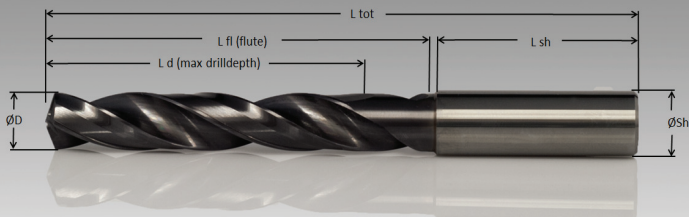
	internal coolant supply		no	yes	yes	yes	yes										
	length		2.5xd	3xd	5xd	7xd	10xd										
Art.	Denomination	g/D							gSh	Lsh	Lfl	Ld	Ltot				
17018	k+850i-70-10c	8,5					x		10	40	85	70	126				
11014	k+850i-100-10c	8,5						x	10	40	113	100	154				
13094	k+860i-30-10c	8,6		x					10	40	45	30	86				
15045	k+860i-50-10c	8,6							10	40	62	50	103				
13063	k+870i-30-10c	8,7		x					10	40	45	30	86				
15046	k+870i-50-10c	8,7				x			10	40	62	50	103				
17045	k+870i-70-10c	8,7					x		10	40	85	70	126				
12030	k+880-25-10c	8,8	x						10	40	41	25	82				
13019	k+880i-30-10c	8,8		x					10	40	45	30	86				
15019	k+880i-50-10c	8,8				x			10	40	62	50	103				
17019	k+880i-70-10c	8,8					x		10	40	85	70	126				
11015	k+880i-100-10c	8,8						x	10	40	113	100	154				
12031	k+900-25-10c	9	x						10	40	41	25	82				
13020	k+900i-30-10c	9			x				10	40	45	30	86				
15020	k+900i-50-10c	9				x			10	40	62	50	103				
17020	k+900i-70-10c	9					x		10	40	85	70	126				
11016	k+900i-100-10c	9						x	10	40	114	100	155				
15093	k+920i-50-10c	9,2				x			10	40	62	50	103				
15049	k+930i-50-10c	9,3				x			10	40	62	50	103				
17042	k+930i-70-10c	9,3					x		10	40	85	70	126				
15052	k+940i-50-10c	9,4				x			10	40	62	50	103				
12032	k+950-25-10c	9,5	x						10	40	41	25	82				
13021	k+950i-30-10c	9,5			x				10	40	45	30	86				
15021	k+950i-50-10c	9,5				x			10	40	62	50	103				
17021	k+950i-70-10c	9,5					x		10	40	85	70	126				
11017	k+950i-100-10c	9,5						x	10	40	115	100	156				
15043	k+960i-50-10c	9,6				x			10	40	62	50	103				
12033	k+980-25-10c	9,8	x						10	40	41	25	82				
13022	k+980i-30-10c	9,8			x				10	40	45	30	86				
15022	k+980i-50-10c	9,8				x			10	40	62	50	103				
17022	k+980i-70-10c	9,8					x		10	40	85	70	126				
11018	k+980i-100-10c	9,8						x	10	40	115	100	156				
13046	k+990i-30-10c	9,9			x				10	40	45	30	86				
12034	k+1000-25-10c	10	x						10	40	41	25	82				
13023	k+1000i-30-10c	10			x				10	40	45	30	86				
15023	k+1000i-50-10c	10				x			10	40	62	50	103				
17023	k+1000i-70-10c	10					x		10	40	85	70	126				
11019	k+1000i-100-10c	10						x	10	40	115	100	156				
12035	k+1020-30-12c	10,2	x						12	45	49	30	95				
13024	k+1020i-36-12c	10,2			x				12	45	52	36	98				
15024	k+1020i-60-12c	10,2				x			12	45	78	60	124				
17024	k+1020i-84-12c	10,2					x		12	45	102	84	148				
11020	k+1020i-120-12c	10,2						x	12	45	135	120	181				
12061	k+1030-30-12c	10,3	x						12	45	49	30	95				

Art.	internal coolant supply		no	yes	yes	yes	ye:					
	Denomination	length	2.5xd	3xd	5xd	7xd	10xd	øSh	Lsh	Lfi	Ld	Ltot
13055	k+1030i-36-12c	10,3		x				12	45	52	36	98
15056	k+1030i-60-12c	10,3			x			12	45	78	60	124
13067	k+1040i-36-12c	10,4		x				12	45	52	36	98
15079	k+1040i-60-12c	10,4			x			12	45	78	60	124
17055	k+1040i-84-12c	10,4				x		12	45	101	84	148
12036	k+1050i-30-12c	10,5	x					12	45	49	30	95
13025	k+1050i-36-12c	10,5		x				12	45	52	36	98
15025	k+1050i-60-12c	10,5			x			12	45	78	60	124
17025	k+1050i-84-12c	10,5				x		12	45	101	84	148
12037	k+1080i-30-12c	10,8	x					12	45	49	30	95
13039	k+1080i-36-12c	10,8		x				12	45	52	36	98
12038	k+1100i-30-12c	11	x					12	45	49	30	95
13026	k+1100i-36-12c	11		x				12	45	52	36	98
15026	k+1100i-60-12c	11			x			12	45	78	60	124
17026	k+1100i-84-12c	11				x		12	45	101	84	148
11022	k+1100i-120-12c	11					x	12	45	131	120	183
13069	k+1120i-36-12c	11,2					x	12	45	52	36	98
15040	k+1120i-60-12c	11,2				x		12	45	78	60	124
11034	k+1120i-120-12c	11,2				x		12	45	131	120	183
12039	k+1150i-30-12c	11,5	x					12	45	49	30	95
13027	k+1150i-36-12c	11,5		x				12	45	52	36	98
15027	k+1150i-60-12c	11,5			x			12	45	78	60	124
17027	k+1150i-84-12c	11,5				x		12	45	101	84	148
11023	k+1150i-120-12c	11,5					x	12	45	131	120	183
17058	k+1160i-84-12c	11,6					x	12	45	101	84	148
12040	k+1180i-30-12c	11,8	x					12	45	49	30	95
13040	k+1180i-36-12c	11,8		x				12	45	52	36	98
15028	k+1180i-60-12c	11,8			x			12	45	78	60	124
17041	k+1180i-84-12c	11,8				x		12	45	101	84	148
11030	k+1180i-120-12c	11,8					x	12	45	131	120	184
12041	k+1200i-30-12c	12	x					12	45	49	30	95
13028	k+1200i-36-12c	12		x				12	45	52	36	98
15029	k+1200i-60-12c	12			x			12	45	78	60	124
17028	k+1200i-84-12c	12				x		12	45	101	84	148
11024	k+1200i-120-12c	12					x	12	45	131	120	184
12060	k+1220i-35-14c	12,2	x					14	45	56	35	102
13049	k+1220i-42-14c	12,2		x				14	45	61	42	107
11032	k+1230i-140-14c	12,3					x	14	45	151	140	203
12042	k+1250i-35-14c	12,5	x					14	45	56	35	102
13029	k+1250i-42-14c	12,5		x				14	45	61	42	107
15030	k+1250i-70-14c	12,5			x			14	45	91	70	137
17129	k+1250i-98-14c	12,5				x		14	45	111	98	165
11125	k+1250i-140-14c	12,5					x	14	45	151	140	203
12143	k+1270i-35-14c	12,7	x					14	45	56	35	102

Art.	Denomination	length	internal coolant supply					ϕSh	Lsh	Lfl	Ld	$Ltot$
			no	yes	yes	yes	yes					
		ϕD	2.5xd	3xd	5xd	7xd	10xd					
15031	k+1270i-70-14c	12,7			x			14	45	91	70	137
13047	k+1280i-4i-14c	12,8		x				14	45	61	42	107
12044	k+1300-35-14c	13	x					14	45	56	35	102
13030	k+1300i-42-14c	13		x				14	45	61	42	107
15032	k+1300i-70-14c	13			x			14	45	91	70	137
17030	k+1300i-98-14c	13				x		14	45	119	98	165
11026	k+1300i-140-14c	13					x	14	45	157	140	203
15044	k+1320i-70-14c	13,2			x			14	45	91	70	137
12045	k+1350-35-14c	13,5	x					14	45	56	35	102
13031	k+1350i-42-14c	13,5		x				14	45	61	42	107
15033	k+1350i-70-14c	13,5			x			14	45	91	70	137
17031	k+1350i-98-14c	13,5				x		14	45	119	98	165
11027	k+1350i-140-14c	13,5					x	14	45	157	140	203
12046	k+1400-35-14c	14	x					14	45	56	35	102
13032	k+1400i-42-14c	14		x				14	45	61	42	107
15034	k+1400i-70-14c	14		x				14	45	91	70	137
17032	k+1400i-98-14c	14				x		14	45	119	98	165
11028	k+1400i-140-14c	14					x	14	45	157	140	203
15050p	k+1400i-80-16c	14,1			x			16	48	104	80	153
12047	k+1450-40-16c	14,5	x					16	48	61	40	110
13033	k+1450i-48-16c	14,5		x				16	48	69	48	118
15035	k+1450i-80-16c	14,5			x			16	48	104	80	153
17033	k+1450i-112-16c	14,5				x		16	48	136	112	185
12048	k+1500-40-16c	15	x					16	48	61	40	110
13034	k+1500i-48-16c	15		x				16	48	69	48	118
15036	k+1500i-80-16c	15			x			16	48	104	80	153
17034	k+1500i-112-16c	15				x		16	48	136	112	185
13072	k+1520i-48-16c	15,2		x				16	48	69	48	118
15076	k+1530i-80-16c	15,3			x			16	48	104	80	153
12049	k+1550-40-16c	15,5	x					16	48	61	40	110
13035	k+1550i-48-16c	15,5		x				16	48	69	48	118
15037	k+1550i-80-16c	15,5			x			16	48	104	80	153
17035	k+1550i-112-16c	15,5				x		16	48	136	112	185
13048	k+1580i-48-16c	15,8		x				16	48	69	48	118
12050	k+1600-40-16c	16	x					16	48	61	40	110
13036	k+1600i-48-16c	16		x				16	48	69	48	118
15038	k+1600i-80-16c	16			x			16	48	104	80	153
17036	k+1600i-112-16c	16				x		16	48	136	112	185
12051	k+1650-45-18c	16,5	x					18	48	71	45	120
13051	k+1650i-54-18c	16,5		x				18	48	79	54	128
15039	k+1650i-90-18c	16,5			x			18	48	116	90	165
17069	k+1650i-125-18c	16,5				x		18	48	151	126	207
12052	k+1700-45-18c	17	x					18	48	71	45	120
13037	k+1700i-54-18c	17		x				18	48	79	54	128

Art.	Denomination	internal coolant supply									
		length	no	yes	yes	yes	yes				
			2.5xd	3xd	5xd	7xd	10xd	$\varnothing Sh$	Lsh	Lfl	Ld
15040	k+1700i-90-18c	17	x		x		18	48	116	90	165
17037	k+1700i-126-18c	17				x	18	48	151	126	200
12053	k+1750-45-18c	17,5					18	48	71	45	120
13050	k+1750i-54-18c	17,5	x	x			18	48	79	54	128
15041	k+1750i-90-18c	17,5			x		18	48	116	90	165
12054	k+1800-45-18c	18					18	48	71	45	120
13038	k+1800i-54-18c	18	x	x			18	48	79	54	128
15042	k+1800i-90-18c	18			x		18	48	116	90	165
17038	k+1800i-126-18c	18				x	18	48	151	126	200

DOF p+ geometry has been optimized for chip breaking and chip formation in ductile materials. Four land margins ensures high hole quality even in these materials.



Art.	Denomination	ØD	internal coolant supply				ØSh	Lsh	Lfi	Ld	Ltot
			no	yes	yes	yes					
			length	2.5xd	3xd	5xd					
182001p	p+300-9-6c	3	x				6	36	15	9	58
183001p	p+300-11-6c	3		x			6	36	18	11	58
185001p	p+300-18-6c	3			x		6	36	23	18	62
182002p	p+310-9-6c	3,1	x				6	36	15	9	58
183002p	p+310-11-6c	3,1		x			6	36	18	11	58
185002p	p+310-18-6c	3,1			x		6	36	23	18	62
182003p	p+320-9-6c	3,2	x				6	36	15	9	58
185003p	p+320-18-6c	3,2			x		6	36	23	18	62
182004p	p+330-9-6c	3,3	x				6	36	15	9	58
183004p	p+330-11-6c	3,3		x			6	36	18	11	58
185004p	p+330-18-6c	3,3			x		6	36	23	18	62
182005p	p+340-9-6c	3,4	x				6	36	15	9	58
183005p	p+340-11-6c	3,4		x			6	36	18	11	58
185005p	p+340-18-6c	3,4			x		6	36	23	18	62
182006p	p+350-9-6c	3,5	x				6	36	15	9	58
183006p	p+350-11-6c	3,5		x			6	36	18	11	58
185006p	p+350-18-6c	3,5			x		6	36	23	18	62
187039p	p+350-26-6c	3,5				x	6	36	33	26	72
182007p	p+360-9-6c	3,6	x				6	36	15	9	58
183007p	p+360-11-6c	3,6		x			6	36	18	11	58
185007p	p+360-18-6c	3,6			x		6	36	23	18	62
182008p	p+370-9-6c	3,7	x				6	36	15	9	58
183008p	p+370-11-6c	3,7		x			6	36	18	11	58
185008p	p+370-18-6c	3,7			x		6	36	23	18	62
182009p	p+380-11-6c	3,8	x				6	36	18	11	58
183009p	p+380-14-6c	3,8		x			6	36	21	14	58
185009p	p+380-21-6c	3,8			x		6	36	33	21	70
187001p	p+380-33-6c	3,8				x	6	36	40	33	77
182010p	p+390-11-6c	3,9	x				6	36	18	11	58
182011p	p+400-11-6c	4	x				6	36	18	11	58
183010p	p+400-14-6c	4		x			6	36	21	14	58
185010p	p+400-21-6c	4			x		6	36	33	21	70
187002p	p+400-33-6c	4				x	6	36	40	33	77
182012p	p+410-11-6c	4,1	x				6	36	18	11	58
183058p	p+410-14-6c	4,1		x			6	36	21	14	58
187042	p+410-33-6c	4,1				x	6	36	40	33	77
182013p	p+420-11-6c	4,2					6	36	18	11	58
183011p	p+420-14-6c	4,2		x			6	36	21	14	58

Art.	Denomination	length	internal coolant supply				ØSh	Lsh	Lfl	Ld	Ltot
			no	yes	yes	yes					
			2.5xd	3xd	5xd	7xd					
185011p	p+420i-23-6c	4,2			x		6	36	33	23	70
187003p	p+420i-33-6c	4,2				x	6	36	40	33	77
183085	p+430i-14-6c	4,3		x			6	36	21	14	58
185089	p+430i-23-6c	4,3			x		6	36	33	23	70
182014p	p+450i-12-6c	4,5	x				6	36	18	12	58
183012p	p+450i-14-6c	4,5		x			6	36	21	14	58
185012p	p+450i-23-6c	4,5			x		6	36	33	23	70
187004p	p+450i-33-6c	4,5				x	6	36	40	33	77
182061	p+470i-15-6c	4,7	x				6	36	25	15	62
182015p	p+480i-15-6c	4,8	x				6	36	25	15	62
183013p	p+480i-18-6c	4,8		x			6	36	27	18	64
185013p	p+480i-25-6c	4,8			x		6	36	38	25	75
182016p	p+500i-15-6c	5	x				6	36	25	15	62
183014p	p+500i-18-6c	5		x			6	36	27	18	64
185014p	p+500i-30-6c	5			x		6	36	38	30	75
187005p	p+500i-42-6c	5				x	6	36	51	42	88
182017p	p+510i-15-6c	5,1	x				6	36	25	15	62
183015p	p+510i-18-6c	5,1		x			6	36	27	18	64
185015p	p+510i-30-6c	5,1			x		6	36	38	30	75
187006p	p+510i-42-6c	5,1				x	6	36	51	42	88
182018p	p+520i-15-6c	5,2	x				6	36	25	15	62
183016p	p+520i-18-6c	5,2		x			6	36	27	18	64
185016p	p+520i-30-6c	5,2			x		6	36	38	30	75
187007p	p+520i-42-6c	5,2				x	6	36	51	42	88
182019p	p+550i-15-6c	5,5	x				6	36	25	15	62
183017p	p+550i-18-6c	5,5		x			6	36	27	18	64
185017p	p+550i-30-6c	5,5			x		6	36	38	30	75
187008p	p+550i-42-6c	5,5				x	6	36	51	42	88
182020p	p+580i-15-6c	5,8	x				6	36	25	15	62
183018p	p+580i-18-6c	5,8		x			6	36	27	18	64
185018p	p+580i-30-6c	5,8			x		6	36	38	30	75
187009p	p+580i-42-6c	5,8				x	6	36	51	42	88
185070	p+590i-30-6c	5,9			x		6	36	38	30	75
182021p	p+600i-15-6c	6	x				6	36	25	15	62
183019p	p+600i-18-6c	6		x			6	36	27	18	64
185019p	p+600i-30-6c	6			x		6	36	38	30	75
187010p	p+600i-42-6c	6				x	6	36	51	42	88
182060	p+620i-20-8c	6,2	x				8	36	33	20	70
182022p	p+650i-20-8c	6,5	x				8	36	33	20	70
183020p	p+650i-24-8c	6,5		x			8	36	36	24	73
185020p	p+650i-40-8c	6,5			x		8	36	52	40	89

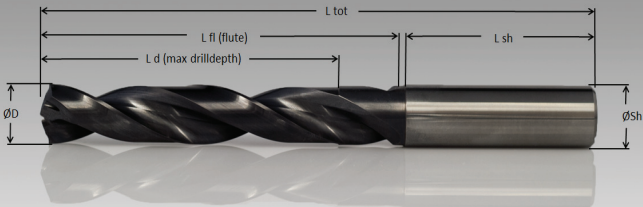
	internal coolant supply		no	yes	yes	yes					
	length		2.5xd	3xd	5xd	7xd					
Art.	Denomination	ØD					øSh	Lsh	Lfi	Ld	Ltot
187011p	p+650i-56-8c	6,5	x	x	x	x	8	36	68	56	105
182023p	p+680-20-8c	6,8					8	36	33	20	70
183021p	p+680i-24-8c	6,8					8	36	36	24	73
185053p	p+680i-40-8c	6,8					8	36	52	40	89
187012p	p+680i-56-8c	6,8	x	x	x	x	8	36	68	56	105
182024p	p+690-20-8c	6,9					8	36	33	20	70
183022p	p+690i-24-8c	6,9					8	36	36	24	73
185022p	p+690i-40-8c	6,9					8	36	52	40	89
187013p	p+690i-56-8c	6,9	x	x	x	x	8	36	68	56	105
182025p	p+700-20-8c	7					8	36	33	20	70
183023p	p+700i-24-8c	7					8	36	36	24	73
185023p	p+700i-40-8c	7					8	36	52	40	89
187014p	p+700i-56-8c	7	x	x	x	x	8	36	68	56	105
183072	p+720i-24-8c	7,2					8	36	36	24	73
187045	p+720i-56-8c	7,2					8	36	68	56	105
182026p	p+750-20-8c	7,5					8	36	33	20	70
183024p	p+750i-24-8c	7,5	x	x	x	x	8	36	36	24	73
185024p	p+750i-40-8c	7,5					8	36	52	40	89
187015p	p+750i-56-8c	7,5					8	36	68	56	105
183067	p+760i-24-8c	7,6					8	36	36	24	73
185069	p+760i-40-8c	7,6	x	x	x	x	8	36	52	40	89
187044	p+760i-56-8c	7,6					8	36	68	56	105
183087	p+770i-24-8c	7,7					8	36	36	24	73
182027p	p+780-20-8c	7,8					8	36	33	20	70
183025p	p+780i-24-8c	7,8	x	x	x	x	8	36	36	24	73
185025p	p+780i-40-8c	7,8					8	36	52	40	89
187016p	p+780i-56-8c	7,8					8	36	68	56	105
182028p	p+800-20-8c	8					8	36	33	20	70
183026p	p+800i-24-8c	8	x	x	x	x	8	36	36	24	73
185026p	p+800i-40-8c	8					8	36	52	40	89
187017p	p+800i-56-8c	8					8	36	68	56	105
183062	p+810i-30-10c	8,1					10	40	45	30	86
183066	p+840i-30-10c	8,4	x	x	x	x	10	40	45	30	86
185080	p+840i-50-10c	8,4					10	40	62	50	103
182029p	p+850-25-10c	8,5					10	40	41	25	82
183027p	p+850i-30-10c	8,5					10	40	45	30	86
185027p	p+850i-50-10c	8,5	x	x	x	x	10	40	62	50	103
187018p	p+850i-70-10c	8,5					10	40	85	70	126
182056p	p+860-25-10c	8,6					10	40	41	25	82
183088	p+860i-30-10c	8,6					10	40	45	30	86
182059	p+870-25-10c	8,7	x	x	x	x	10	40	41	25	82
185066	p+870i-50-10c	8,7					10	40	62	50	103
182030p	p+880-25-10c	8,8					10	40	41	25	82

		internal coolant supply		no	yes	yes	yes					
		length	2.5xd	3xd	5xd	7xd						
Art.	Denomination	ØD					ØSh	Lsh	Lfl	Ld	Ltot	
183056p	p+880i-30-10c	8,8	x	x			10	40	45	30	86	
185028p	p+880i-50-10c	8,8			x		10	40	62	50	103	
187019p	p+880i-70-10c	8,8				x	10	40	85	70	126	
182031p	p+900-25-10c	9					10	40	41	25	82	
183029p	p+900i-30-10c	9	x	x			10	40	45	30	86	
185029p	p+900i-50-10c	9			x		10	40	62	50	103	
187020p	p+900i-70-10c	9				x	10	40	85	70	126	
185076	p+940i-50-10c	9,4			x		10	40	62	50	103	
182032p	p+950-25-10c	9,5	x				10	40	41	25	82	
183030p	p+950i-30-10c	9,5		x			10	40	45	30	86	
185021p	p+950i-50-10c	9,5			x		10	40	62	50	103	
187021p	p+950i-70-10c	9,5				x	10	40	85	70	126	
182033p	p+980-25-10c	9,8	x				10	40	41	25	82	
183031p	p+980i-30-10c	9,8		x			10	40	45	30	86	
185031p	p+980i-50-10c	9,8			x		10	40	62	50	103	
187022p	p+980i-70-10c	9,8				x	10	40	85	70	126	
182034p	p+1000-25-10c	10	x				10	40	41	25	82	
183032p	p+1000i-30-10c	10		x			10	40	45	30	86	
185032p	p+1000i-50-10c	10			x		10	40	62	50	103	
187023p	p+1000i-70-10c	10				x	10	40	85	70	126	
183063	p+1010i-36-12c	10,1	x	x			12	45	52	36	98	
185059	p+1010i-60-12c	10,1			x		12	45	78	60	124	
182035p	p+1020-30-12c	10,2					12	45	49	30	95	
183033p	p+1020i-36-12c	10,2		x			12	45	52	36	98	
185033p	p+1020i-60-12c	10,2	x		x		12	45	78	60	124	
187024p	p+1020i-84-12c	10,2				x	12	45	102	84	148	
183060p	p+1030i-36-12c	10,3		x			12	45	52	36	98	
185082	p+1030i-60-12c	10,3			x		12	45	78	60	124	
183086	p+1040i-36-12c	10,4	x	x			12	45	52	36	98	
185058	p+1040i-60-12c	10,4			x		12	45	78	60	124	
182036p	p+1050-30-12c	10,5					12	45	49	30	95	
183034p	p+1050i-36-12c	10,5		x			12	45	52	36	98	
185034p	p+1050i-60-12c	10,5	x		x		12	45	78	60	124	
187025p	p+1050i-84-12c	10,5				x	12	45	102	84	148	
183080	p+1060i-36-12c	10,6		x			12	45	52	36	98	
182037p	p+1080-30-12c	10,8		x			12	45	49	30	95	
183035p	p+1080i-36-12c	10,8	x	x			12	45	52	36	98	
185035p	p+1080i-60-12c	10,8			x		12	45	78	60	124	
182038p	p+1100-30-12c	11					12	45	49	30	95	
183036p	p+1100i-36-12c	11		x			12	45	52	36	98	
185036p	p+1100i-60-12c	11	x		x		12	45	78	60	124	
187026p	p+1100i-84-12c	11				x	12	45	102	84	148	
185084	p+1120i-60-12c	11,2				x	12	45	78	60	124	
182039p	p+1150-30-12c	11,5		x			12	45	49	30	95	

Art.	Denomination	length	internal coolant supply				ØSh	Lsh	Lfl	Ld	Ltot
			no	yes	yes	yes					
			2.5xd	3xd	5xd	7xd					
183037p	p+1150i-36-12c	11,5		x			12	45	52	36	98
185037p	p+1150i-60-12c	11,5			x		12	45	78	60	124
187027p	p+1150i-84-12c	11,5				x	12	45	102	84	148
182040p	p+1180-30-12c	11,8	x				12	45	49	30	95
183038p	p+1180i-36-12c	11,8		x			12	45	52	36	98
185038p	p+1180i-60-12c	11,8			x		12	45	78	60	124
182041p	p+1200-30-12c	12	x				12	45	49	30	95
183039p	p+1200i-36-12c	12		x			12	45	52	36	98
185039p	p+1200i-60-12c	12			x		12	45	78	60	124
187028p	p+1200i-84-12c	12				x	12	45	102	84	148
185060	p+1210i-70-14c	12,1			x		14	45	91	70	137
182042p	p+1250-35-14c	12,5	x				14	45	56	35	102
183040p	p+1250i-42-14c	12,5		x			14	45	61	42	107
185040p	p+1250i-70-14c	12,5			x		14	45	91	70	137
187029p	p+1250i-98-14c	12,5				x	14	45	119	98	165
182043p	p+1270-35-14c	12,7	x				14	45	56	35	102
183041p	p+1270i-42-14c	12,7		x			14	45	61	42	107
185041p	p+1270i-70-14c	12,7			x		14	45	91	70	137
182044p	p+1300-35-14c	13	x				14	45	56	35	102
183042p	p+1300i-42-14c	13		x			14	45	61	42	107
185044p	p+1300i-70-14c	13			x		14	45	91	70	137
187030p	p+1300i-98-14c	13				x	14	45	119	98	165
183078	p+1340i-42-14c	13,4		x			14	45	61	42	107
182045p	p+1350-35-14c	13,5	x				14	45	56	35	102
183057p	p+1350i-42-14c	13,5		x			14	45	61	42	107
185043p	p+1350i-70-14c	13,5			x		14	45	91	70	137
187031p	p+1350i-98-14c	13,5				x	14	45	119	98	165
182046p	p+1400-35-14c	14	x				14	45	56	35	102
183044p	p+1400i-42-14c	14		x			14	45	61	42	107
185044p	p+1400i-70-14c	14			x		14	45	91	70	137
187032p	p+1400i-98-14c	14				x	14	45	121	98	167
183081	p+1420i-48-16c	14,2		x			16	48	69	48	118
182047p	p+1450-40-16c	14,5	x				16	48	61	40	110
185045p	p+1450i-80-16c	14,5			x		16	48	104	80	153
187033p	p+1450i-112-16c	14,5				x	16	48	136	112	185
182048p	p+1500-40-16c	15	x				16	48	61	40	110
183046p	p+1500i-48-16c	15		x			16	48	69	48	118
185046p	p+1500i-80-16c	15			x		16	48	104	80	153
187034p	p+1500i-112-16c	15				x	16	48	136	112	185
185047p	p+1550i-80-16c	15,5			x		16	48	104	80	153
182058	p+1580-40-16c	15,8	x				16	48	61	40	110
182050p	p+1600-40-16c	16	x				16	48	61	40	110
183048p	p+1600i-48-16c	16		x			16	48	69	48	118

internal coolant supply			no	yes	yes	yes					
length			2.5xd	3xd	5xd	7xd					
Art.	Denomination	ØD					ØSh	Lsh	Lfl	Ld	Ltot
185048p	p+1600i-80-16c	16	x		x		16	48	104	80	153
187036p	p+1600i-112-16c	16				x	16	48	136	112	185
182052p	p+1700-45-18c	17					18	48	71	45	120
183052p	p+1700i-54-18c	17		x			18	48	79	54	128
185050p	p+1700i-90-18c	17	x		x		18	48	116	90	165
187037p	p+1700i-126-18c	17				x	18	48	151	126	200
182054p	p+1800-45-18c	18					18	48	71	45	120
183054p	p+1800i-54-18c	18		x			18	48	79	54	128
185042p	p+1800i-90-18c	18	x		x		18	48	116	90	165
187038p	p+1800i-126-18c	18				x	18	48	151	126	200

DOF a+ geometry has been optimized for chip breaking and chip formation in aluminium and enables exceptional feed. A concave corner geometry reduces exit burrs.



Art.	Denomination	$\varnothing D$	internal coolant supply				$\varnothing Sh$	L_{sh}	L_{fl}	L_d	L_{tot}
			no	yes	yes	yes					
			length	2.5xd	3xd	5xd	7xd				
165000	a+280i-15-6c	2,8						6	36	15	60
165060	a+280i-15-6c	2,8				x		6	36	20	60
162001p	a+300i-9-6c	3	x					6	36	15	58
163001p	a+300i-11-6c	3		x				6	36	18	58
165001p	a+300i-18-6c	3			x			6	36	23	62
163002p	a+310i-11-6c	3,1		x				6	36	18	58
165002p	a+310i-18-6c	3,1			x			6	36	23	62
162003p	a+320i-9-6c	3,2	x					6	36	15	58
163003p	a+320i-11-6c	3,2		x				6	36	18	58
165003p	a+320i-18-6c	3,2			x			6	36	23	62
167045	a+320i-25-6c	3,2				x		6	36	33	72
162004p	a+330i-9-6c	3,3	x					6	36	15	58
163004p	a+330i-11-6c	3,3		x				6	36	18	58
165004p	a+330i-18-6c	3,3			x			6	36	23	62
162005p	a+340i-9-6c	3,4	x					6	36	15	58
163005p	a+340i-11-6c	3,4		x				6	36	18	58
165005p	a+340i-18-6c	3,4			x			6	36	23	62
167048	a+340i-25-6c	3,4				x		6	36	33	72
162006p	a+350i-9-6c	3,5	x					6	36	15	58
163006p	a+350i-11-6c	3,5		x				6	36	18	58
165006p	a+350i-18-6c	3,5			x			6	36	23	62
162007p	a+360i-9-6c	3,6	x					6	36	15	58
163007p	a+360i-11-6c	3,6		x				6	36	18	58
165007p	a+360i-18-6c	3,6			x			6	36	23	62
162008p	a+370i-9-6c	3,7	x					6	36	15	58
163008p	a+370i-11-6c	3,7		x				6	36	18	58
165008p	a+370i-18-6c	3,7			x			6	36	23	62
162009p	a+380i-11-6c	3,8	x					6	36	18	58
163009p	a+380i-14-6c	3,8		x				6	36	21	58
165009p	a+380i-21-6c	3,8			x			6	36	33	70
167001p	a+380i-33-6c	3,8				x		6	36	40	77
162010p	a+390i-11-6c	3,9	x					6	36	18	58
163060p	a+390i-14-6c	3,9		x				6	36	21	58
167041p	a+390i-33-6c	3,9				x		6	36	40	77
162011p	a+400i-11-6c	4	x					6	36	18	58
163010p	a+400i-14-6c	4		x				6	36	21	58
167002p	a+400i-33-6c	4				x		6	36	40	77

		internal coolant supply	no	yes	yes	yes					
		length	2.5xd	3xd	5xd	7xd					
Art.	Denomination	ØD					Øsh	Lsh	Lfl	Ld	Ltot
162013p	a+420-12-6c	4,2	x				6	36	18	12	58
163011p	a+420i-14-6c	4,2		x			6	36	21	14	58
165011p	a+420i-23-6c	4,2			x		6	36	33	23	70
167003p	a+420i-33-6c	4,2				x	6	36	40	33	77
163005p	a+430i-14-6c	4,3		x			6	36	21	14	58
165058p	a+430i-23-6c	4,3			x		6	36	33	23	70
162014p	a+450-12-6c	4,5	x				6	36	18	12	58
163012p	a+450i-14-6c	4,5		x			6	36	21	14	58
165012p	a+450i-23-6c	4,5			x		6	36	33	23	70
167004p	a+450i-33-6c	4,5				x	6	36	40	33	77
163063p	a+460i-14-6c	4,6		x			6	36	21	14	58
165061	a+460i-23-6c	4,6			x		6	36	38	23	70
162079	a+470-15-6c	4,7	x				6	36	25	15	62
163078	a+470i-18-6c	4,7		x			6	36	27	18	64
162015p	a+480-15-6c	4,8	x				6	36	25	15	62
163013p	a+480i-15-6c	4,8		x			6	36	27	18	64
165013p	a+480i-25-6c	4,8			x		6	36	38	25	75
165082	a+490i-25-6c	4,9			x		6	36	38	25	75
162016p	a+500-15-6c	5	x				6	36	25	15	62
163014p	a+500i-18-6c	5		x			6	36	27	18	64
165014p	a+500i-30-6c	5			x		6	36	38	30	75
167005p	a+500i-42-6c	5				x	6	36	51	42	88
162017p	a+510-15-6c	5,1	x				6	36	25	15	62
163015p	a+510i-18-6c	5,1		x			6	36	27	18	64
165015p	a+510i-30-6c	5,1			x		6	36	38	30	75
167006p	a+510i-42-6c	5,1				x	6	36	51	42	88
162018p	a+520-15-6c	5,2	x				6	36	25	15	62
163016p	a+520i-18-6c	5,2		x			6	36	27	18	64
165016p	a+520i-30-6c	5,2			x		6	36	38	30	75
167007p	a+520i-42-6c	5,2				x	6	36	51	42	88
162019p	a+550-15-6c	5,5	x				6	36	25	15	62
163017p	a+550i-18-6c	5,5		x			6	36	27	18	64
165017p	a+550i-30-6c	5,5			x		6	36	38	30	75
167008p	a+550i-42-6c	5,5				x	6	36	51	42	88
163070	a+560i-18-6c	5,6		x			6	36	27	18	64
162020p	a+580-15-6c	5,8	x				6	36	25	15	62
163018p	a+580i-18-6c	5,8		x			6	36	27	18	64
165018p	a+580i-30-6c	5,8			x		6	36	38	30	75
167009p	a+580i-42-6c	5,8				x	6	36	51	42	88
165083	a+590i-30-6c	5,9			x		6	36	38	30	75
162021p	a+600-15-6c	6	x				6	36	25	15	62
163019p	a+600i-18-6c	6		x			6	36	27	18	64
165019p	a+600i-30-6c	6			x		6	36	38	30	75

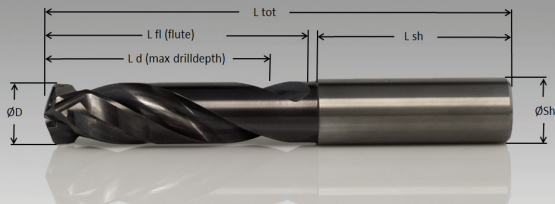
Art.	Designation	ØD	internal coolant supply				ØSh	Lsh	Lfl	Ld	Ltot
			no	yes	yes	yes					
		length	2.5xd	3xd	5xd	7xd					
167010p	a+60l-42-6c	6				x	6	36	51	42	88
162060	a+60l-20-9c	6,1	x				9	26	22	20	70
163069	a+60l-24-8c	6,1		x			8	36	36	24	73
167050	a+60l-56-8c	6,1				x	8	36	68	56	105
162022p	a+60l-20-3c	6,5	x				8	36	33	20	70
163020p	a+60l-24-8c	6,5		x			8	36	36	24	73
165020p	a+60l-40-8c	6,5			x		8	36	52	40	89
167011p	a+60l-56-8c	6,5				x	8	36	68	56	105
163057p	a+60l-24-8c	6,6		x			8	36	36	24	73
165079	a+60l-40-8c	6,7			x		8	36	52	40	89
162023p	a+60l-20-3c	6,8	x				8	36	33	20	70
163021p	a+60l-24-8c	6,8		x			8	36	36	24	73
165021p	a+60l-40-8c	6,8			x		8	36	52	40	89
167012p	a+60l-56-8c	6,8				x	8	36	68	56	105
162024p	a+60l-20-3c	6,9	x				8	36	33	20	70
163022p	a+60l-24-8c	6,9		x			8	36	36	24	73
165022p	a+60l-40-8c	6,9			x		8	36	52	40	89
167013p	a+60l-56-8c	6,9				x	8	36	68	56	105
162025p	a+70l-20-3c	7	x				8	36	33	20	70
163023p	a+70l-24-8c	7		x			8	36	36	24	73
165023p	a+70l-40-8c	7			x		8	36	52	40	89
167014p	a+70l-56-8c	7				x	8	36	68	56	105
162058p	a+70l-20-3c	7,1	x				8	36	33	20	70
163058p	a+70l-24-8c	7,1		x			8	36	36	24	73
165072	a+70l-40-8c	7,1			x		8	36	52	40	89
165062	a+70l-40-8c	7,4			x		8	36	52	40	89
162026p	a+75l-20-3c	7,5	x				8	36	33	20	70
163024p	a+75l-24-8c	7,5		x			8	36	36	24	73
165024p	a+75l-40-8c	7,5			x		8	36	52	40	89
167015p	a+75l-56-8c	7,5				x	8	36	68	56	105
162027p	a+78l-20-3c	7,8	x				8	36	33	20	70
163025p	a+78l-24-8c	7,8		x			8	36	36	24	73
165025p	a+78l-40-8c	7,8			x		8	36	52	40	89
167016p	a+78l-56-8c	7,8				x	8	36	68	56	105
165084	a+78l-40-8c	7,9			x		8	36	52	40	89
162028p	a+80l-20-3c	8	x				8	36	33	20	70
163026p	a+80l-24-8c	8		x			8	36	36	24	73
165026p	a+80l-40-8c	8			x		8	36	52	40	89
167017p	a+80l-56-8c	8				x	8	36	68	56	105
162062	a+80l-25-10c	8,2	x				10	40	41	25	82
167051	a+80l-70-10c	8,2				x	10	40	85	70	116
165053p	a+80l-50-10c	8,3			x		10	40	62	50	103
165056p	a+80l-50-10c	8,4			x		10	40	62	50	103

Art.	Denomination	ØD	internal coolant supply				ØSh	Lsh	Lfl	Ld	Ltot
			no	yes	yes	yes					
			length	2.5xd	3xd	5xd					
162029p	a+850-25-10c	8,5	x				10	40	41	25	82
163027p	a+850-30-10c	8,5		x			10	40	45	30	86
165027p	a+850-50-10c	8,5			x		10	40	62	50	103
167018p	a+850-70-10c	8,5				:	10	40	85	70	126
165063	a+860-50-10c	8,6			x		10	40	62	50	103
163061p	a+870-30-10c	8,7		x			10	40	45	30	86
162030p	a+880-25-10c	8,8	x				10	40	41	25	82
163028p	a+880-30-10c	8,8		x			10	40	45	30	86
165028p	a+880-50-10c	8,8			x		10	40	62	50	103
167019p	a+880-70-10c	8,8				:	10	40	85	70	126
162031p	a+900-25-10c	9	x				10	40	41	25	82
163029p	a+900-30-10c	9		x			10	40	45	30	86
165029p	a+900-50-10c	9			x		10	40	62	50	103
167020p	a+900-70-10c	9				:	10	40	85	70	126
165081	a+910-50-10c	9,1			x		10	40	62	50	103
165055p	a+920-50-10c	9,2			x		10	40	62	50	103
163071	a+930-30-10c	9,3		x			10	40	45	30	86
163064	a+930-50-10c	9,3			x		10	40	62	50	103
162032p	a+950-25-10c	9,5	x				10	40	41	25	82
163030p	a+950-30-10c	9,5		x			10	40	45	30	86
165030p	a+950-50-10c	9,5			x		10	40	62	50	103
167021p	a+950-70-10c	9,5				x	10	40	85	70	126
162033p	a+980-25-10c	9,8	v				10	40	41	25	82
163031p	a+980-30-10c	9,8		x			10	40	45	30	86
165031p	a+980-50-10c	9,8			x		10	40	62	50	103
167022p	a+980-70-10c	9,8				x	10	40	85	70	126
165057p	a+990-50-10c	9,9			x		10	40	62	50	103
163032p	a+1000-30-10c	10		x			10	40	45	30	86
165032p	a+1000-50-10c	10			x		10	40	62	50	103
167023p	a+1000-70-10c	10				x	10	40	85	70	126
163055p	a+1010-3612c	10,1		x			12	45	52	36	98
165067	a+1010-6012c	10,1			x		12	45	78	60	124
162035p	a+1020-3012c	10,2	t				12	45	49	30	95
163033p	a+1020-3612c	10,2		x			12	45	52	36	98
165033p	a+1020-6012c	10,2			x		12	45	78	60	124
167024p	a+1020-8412c	10,2				x	12	45	101	84	148
162034p	a+1030-6012c	10,3			x		12	45	78	60	124
162036p	a+1050-3012c	10,5	t				12	45	49	30	95
163034p	a+1050-3612c	10,5		x			12	45	52	36	98
165034p	a+1050-6012c	10,5			x		12	45	78	60	124
167025p	a+1050-8412c	10,5				x	12	45	101	84	148
163037p	a+1080-3012c	10,8	t				12	45	49	30	95
163035p	a+1080-3612c	10,8		x			12	45	52	36	98
163035p	a+1080-6012c	10,8			x		12	45	78	60	124

Art.	Denomination	internal coolant supply				ϕSh	Lsh	Lfl	Ld	$Ltot$
		length	no	yes	yes					
			2.5xd	3xd	5xd					
	ϕD									
162038p	a+1100-30-12c	11	x			12	45	49	30	95
163036p	a+1100i-36-12c	11		x		12	45	52	36	98
165036p	a+1100i-60-12c	11			x	12	45	78	60	124
167026p	a+1100i-84-12c	11				12	45	102	84	148
163072	a+1120i-36-12c	11,2			x	12	45	78	36	124
165076	a+1120i-60-12c	11,2		x		12	45	52	60	98
163073	a+1130i-36-12c	11,3		x		12	45	52	36	98
165078	a+1130i-60-12c	11,3			x	12	45	78	60	124
162039p	a+1150-30-12c	11,5	x			12	45	49	30	95
163037p	a+1150i-36-12c	11,5		x		12	45	52	36	98
165037p	a+1150i-60-12c	11,5			x	12	45	78	60	124
167027p	a+1150i-84-12c	11,5				12	45	102	84	148
162040p	a+1180-30-12c	11,8	x			12	45	49	30	95
163038p	a+1180i-36-12c	11,8		x		12	45	52	36	98
165038p	a+1180i-60-12c	11,8			x	12	45	78	60	124
162041p	a+1200-30-12c	12	x			12	45	49	30	95
163039p	a+1200i-36-12c	12		x		12	45	52	36	98
165039p	a+1200i-60-12c	12			x	12	45	78	60	124
167028p	a+1200i-84-12c	12				12	45	102	84	148
162042p	a+1250-35-14c	12,5	x			14	45	56	35	102
163040p	a+1250i-42-14c	12,5		x		14	45	61	42	107
165040p	a+1250i-70-14c	12,5			x	14	45	91	70	137
167029p	a+1250i-98-14c	12,5				14	45	119	98	165
162044p	a+1300-35-14c	13	x			14	45	56	35	102
163042p	a+1300i-42-14c	13		x		14	45	61	42	107
165042p	a+1300i-70-14c	13			x	14	45	91	70	137
167030p	a+1300i-98-14c	13				14	45	119	98	165
162045p	a+1350-35-14c	13,5	x			14	45	56	35	102
163043p	a+1350i-42-14c	13,5		x		14	45	61	42	107
165043p	a+1350i-70-14c	13,5			x	14	45	91	70	137
167031p	a+1350i-98-14c	13,5				14	45	119	98	165
162046p	a+1400-35-14c	14	x			14	45	56	35	102
163044p	a+1400i-42-14c	14		x		14	45	61	42	107
165044p	a+1400i-70-14c	14			x	14	45	91	70	137
167032p	a+1400i-98-14c	14				14	45	119	98	165
162047p	a+1450-40-16c	14,5	x			16	48	61	40	110
163045p	a+1450i-48-16c	14,5		x		16	48	69	48	118
165045p	a+1450i-80-16c	14,5			x	16	48	104	80	153
167033p	a+1450i-112-16c	14,5				16	48	136	112	185
163059p	a+1460i-48-16c	14,6		x		16	48	69	48	118
162048p	a+1500-40-16c	15	x			16	48	61	40	110
163046p	a+1500i-48-16c	15		x		16	48	69	48	118
165046p	a+1500i-80-16c	15			x	16	48	104	80	153
167034p	a+1500i-112-16c	15				16	48	136	112	185

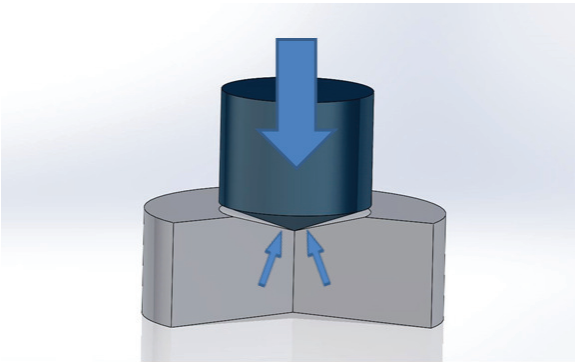
Art.	internal coolant supply		no	yes	yes	yes	ϕSh	Lsh	Lfl	Ld	$Ltot$
	Denomination	length ϕD	2.5xd	3xd	5xd	7xd					
163074	a+1530I-48-16c	15,3	x	x			16	48	69	48	118
165080	a+1530I-80-16c	15,3			x		16	48	104	80	153
162049p	a+1550-40-16c	15,5					16	48	61	40	110
163047p	a+1550I-48-16c	15,5		x			16	48	69	48	118
165047p	a+1550I-80-16c	15,5	x		x		16	48	104	80	153
167035p	a+1550I-112-16c	15,5				x	16	48	136	112	185
162050p	a+1600-40-16c	16					16	48	61	40	110
163048p	a+1600I-48-16c	16		x			16	48	69	48	118
165048p	a+1600I-80-16c	16	x		x		16	48	104	80	153
167036p	a+1600I-112-16c	16				x	16	48	136	112	185
162051p	a+1650-45-18c	16,5					18	48	71	45	120
163049p	a+1650I-54-18c	16,5		x			18	48	79	54	128
165049p	a+1650I-90-18c	16,5	x		x		18	48	116	90	165
162052p	a+1700-45-18c	17					18	48	71	45	120
163052p	a+1700I-54-18c	17		x			18	48	79	54	128
165050p	a+1700I-90-18c	17			x		18	48	116	90	165
167037p	a+1700I-126-18c	17	x			x	18	48	151	126	200
162053p	a+1750-45-18c	17,5					18	48	71	45	120
163053p	a+1750I-54-18c	17,5		x			18	48	79	54	128
165051p	a+1750I-90-18c	17,5			x		18	48	116	90	165
162054p	a+1800-45-18c	18	x				18	48	71	45	120
163054p	a+1800I-54-18c	18		x			18	48	79	54	128
165052p	a+1800I-90-18c	18			x		18	48	116	90	165
167038p	a+1800I-126-18c	18				x	18	48	151	126	200

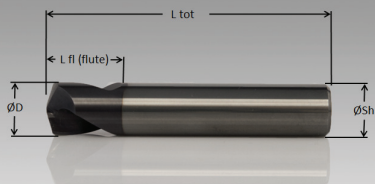
DOF brbs is a drill reamer with a negative helix ream cut. To ensure a robust process, extra support points and ground channels to guide the coolant flow are added. In most materials H7 tolerance is achieved.



internal coolant supply			yes	yes					
length			3xd	5xd					
Art.	Denomination	$\varnothing D$ k6			$\varnothing Sh$	L_{sh}	L_{fl}	L_d	L_{tot}
23101	brbs-6004i-18-8c	6,004	x		8	36	27	18	64
25101	brbs-6004i-30-8c	6,004		x	8	36	39	30	76
23102	brbs-7004i-24-8c	7,004	x		8	36	36	24	73
25102	brbs-7004i-40-8c	7,004		x	8	36	52	40	89
23103	brbs-8004i-24-10c	8,004	x		10	40	36	24	77
25103	brbs-8004i-40-10c	8,004		x	10	40	52	40	93
23104	brbs-9004i-30-10c	9,004	x		10	40	45	30	86
25104	brbs-9004i-50-10c	9,004		x	10	40	65	50	106
23105	brbs-10004i-30-12c	10,004	x		12	45	45	30	91
25105	brbs-10004i-50-12c	10,004		x	12	45	65	50	111
23106	brbs-11004i-36-12c	11,004	x		12	45	52	36	98
25106	brbs-11004i-60-12c	11,004		x	12	45	76	60	122
23107	brbs-12004i-36-14c	12,004	x		14	45	52	36	98
25107	brbs-12004i-60-14c	12,004		x	14	45	76	60	122
23108	brbs-13004i-42-14c	13,004	x		14	45	61	42	107
25108	brbs-13004i-70-14c	13,004		x	14	45	89	70	135
23109	brbs-14004i-42-16c	14,004	x		16	48	61	42	110
25109	brbs-14004i-70-16c	14,004		x	16	48	89	70	138
23110	brbs-15004i-48-16c	15,004	x		16	48	69	48	118
25110	brbs-15004i-80-16c	15,004		x	16	48	101	80	150
23111	brbs-16004i-48-18c	16,004	x		18	48	69	48	118
25111	brbs-16004i-80-18c	16,004		x	18	48	101	80	150
23112	brbs-17004i-54-18c	17,004	x		18	48	79	54	128
25112	brbs-17004i-90-18c	17,004		x	18	48	115	90	164
23113	brbs-18004i-54-20c	18,004	x		20	50	79	54	130
25113	brbs-18004i-90-20c	18,004		x	20	50	115	90	166

DOF cb is a centre drill with 145 degrees point angle and thereby guiding the next drilling operation by the point.





Art.	Denomination	ϕD k7	ϕSh	L_{sh}	L_{fl}	L_{tot}
90602	cb-500-0c-v145	5	6	30	13	50
90615	cb-600-6c-v145	6	6	36	13	50
90616	cb-800-8c-v145	8	8	36	14	51
90617	cb-1000-10c-v145	10	10	40	14	55
90618	cb-1200-12c-v145	12	12	45	16	62

Below there is a simplified description of material groups according to ISO.

ISO	Material group		
P	1	Low carbon steel	Very soft <0.25% C
	2		Soft <= 0.25% C
	3		Normal >=0.25%C
	4	Low alloy steel	Normal <5% alloyed
	5		Harder <5% alloyed
	6	High alloy steel	Annealed >5% alloyed
	7		Hardened >5% alloyed
M	8	Stainless steel	Ferritic/martensitic
	9		Martensitic
	10		Austenitic
K	11	Nodular cast iron	
	12		
	13	Difficult cast iron	
N	14	Aluminium	
	15	Brass/Copper Alloys	
S	16	Super alloys (Ni-base)	Annealed
	17		Cured
	18	Super alloys (Ti-base)	
H	19	Hardened steel	Hardness 48-55 HRC
	20		Hardness 55-65 HRC

The recommendations in the table below is to be considered as starting values in machines with good production parameters such as:

INTERNAL COOLANT

Cutting fluid good lubrication (conc. 5-10 %) approximately 20-40bar pressure. If the pressure is higher, both speed and feed can be increased. If the pressure is lower, both speed and feed should be decreased. If the concentration is lower, decrease the feed and maintain the speed.

EXTERNAL COOLANT

Cutting fluid for good lubrication (conc. 5-10 %) with accurate and rich flow. If the concentration is lower, decrease the feed and maintain the speed.

STABILITY

Work part firmly clamped. Tool holding with shrink fit or hydraulic attachment. If vibration occurs, a range of cutting values should be tested to find a minimum. If the breakout of the drill point causes noise, the feed should be reduced by 50 % during breakout. Of roundness or positioning of the hole is bad, pre-drill with 145-150 degrees drill point.

As clearly demonstrated in the chart below, DOF Tools can withstand high productivity in form of increased feed. For brbs (drill reaming), the feed should be reduced with 30-60 % to maintain high hole quality.

ISO	Material group	Cutting speed Vc [m/min]		Feed [mm/rev] (sorted by drilling diameter)				
		Internal coolant	External coolant	Ø3-5	Ø5.1-8	Ø8.1-12	Ø12.1-16	Ø16.1-20
P	1	200	130	0.25	0.35	0.4	0.45	0.48
	2	160	110	0.25	0.35	0.45	0.55	0.55
	3	130	100	0.25	0.35	0.45	0.6	0.6
	4	120	100	0.3	0.4	0.55	0.65	0.7
	5	110	100	0.3	0.4	0.55	0.65	0.7
	6	100	90	0.3	0.4	0.50	0.55	0.6
	7	85	70	0.25	0.35	0.4	0.45	0.48
M	8	70	60	0.12	0.18	0.24	0.3	0.33
	9	55	50	0.12	0.18	0.24	0.3	0.33
	10	45	40	0.09	0.14	0.19	0.24	0.25
K	11	120	90	0.35	0.5	0.7	0.8	0.85
	12	100	80	0.35	0.5	0.7	0.8	0.85
	13	90	70	0.35	0.5	0.7	0.8	0.85
N	14	350	200	0.4	0.6	1.0	1.0	1.0
	15	300	200	0.4	0.6	1.0	1.0	1.0
S	16	28	25	0.07	0.1	0.12	0.15	0.16
	17	18	15	0.05	0.07	0.08	0.1	0.12
	18	40	30	0.15	0.2	0.25	0.28	0.3
H	19	50	35	0.1	0.12	0.13	0.14	0.15
	20	30	20	0.05	0.07	0.08	0.09	0.1

group	AISI	W-stoff	DIN	BS	EN	AFNOR	SS	UNI
A 366 (1012) 1008		0.0030	C 10	040 A 10 045 M 10 1449 10 CS		AF 34 C 10 XC 10		C 10 C 10
		1.0028	Ust 34-2 (S250G1T)			A 34-2		Fe 330, Fe 330 B FU
		1.0034	RSt 34-2 (S250G2T)	1449 34/20 HR, HS, CR, CS		A 34-2 NE		Fe 330 B FN
		1.0035	St 185 (Fe 310-0)	Fe 310-0		A 33	1300	Fe 320
			St 33	1449 15 HR, HS				
	A 570 Gr. 33, 36	1.0036	S235JR (Fe 360 B)	Fe 360 B 4360-40 B			1311 1312	FE378FU
		1.0037	S235JR (Fe 360 B)	Fe 360 B 4360-40 B		E 24-2	1311	Fe 360 B 1449 37/23 HR
	1115	1.0038	GS 25K16	030404	1A		1325	
	A 570 Gr. 40	1.0044	S275JR (Fe 430 B)	Fe 430 B FN 1449 43/25 HR, HS			1412	Fe 430 B Fe 430 B FN
			St 44-2	4360-43 B		E 28-2		
		1.0045	S355JR	4360-50 B		E 36-2	2172	Fe 510 B
A 570 Gr. 50	1.0050	E295 (Fe 490-2)	Fe 490-2 FN				1550	Fe 490
A 572 Gr. 50			St 50-2	4360-50 B	A 50-2		2172	
A 572 Gr. 65	1.0060	E335 (Fe 590-2)	Fe 60-2 St 60-2	4360-55 E; 55 C	A 60-2		1650	Fe 60-2 Fe 590
	1.0060		St 60-2					Fe 60-2
	1.0070	E360 (Fe 690-2)	Fe 690-2 FN		A 70-2		1655	Fe 70-2 Fe 690
	1.0112	P235S	1501-164-360B LT20		A 37 AP			Fe 360 C
	1.0114	S235J2G3 (Fe 360 D 1)	Fe 360 D 1 FF		E 24-3		1312	Fe 360 D 1 FF
A 284 Gr. D	1.0116	S235J2G3 (Fe 360 D 1)	Fe 360 D 1 FF		E 24-4		1313	Fe 360 C FN Fe 360 D FF
A 573 Gr. 58			St 37-3	1449 37/23 CR				Fe 37-2
A 570 Gr. 36, C				4360-40 D				
A 611 Gr. C								
	1.0130	P265S	1501-164-400B LT 20		A 42 AP			
	1.0143	S275J0, St 44-3 U	4360-43C		E 28-3		1414-01	Fe 430 D
A 573 Gr. 70	1.0144	S275J2G3 (Fe 430 D 1)	Fe 430 D 1 FF		E 28-3		1411, 1412	Fe 430 B, Fe 430 C (FN)
A 611 Gr. D			St 44-3	4360-43 C; 43 D	E 28-4		1414	Fe 430 D (FF)
	1.0149	S275J0H, RoSt 44-2	4360-43 C				1412-04	Fe 430 C
	1.0226	DX51D; St 02 Z	Z2		GC		1151 10	FeP 02 G
M 1010	1.0301	C10	040 A 10 045 M 10 1449 10 CS		AF 34 C 10 XC 10			C 10 C 10
A 621 (1008)	1.0330	DC 01	1449 4 CR				1142	FeP 00
		St 2; St 12	1449 3 CS		TC			FeP 01
A 619 (1008)	1.0333	Ust 3 (DC03G1)	1449 2 CR; 3 CR		E			FeP 02
		Ust 13						
A 621 (1008)	1.0334	UstW 23 (DD12G1)			SC			FeP 12
A 622 (1008)	1.0335	DD13; StW 24	1449 1 HR		3 C			FeP 13
A 620 (1008)	1.0338	DC04	1449 1 CR; 2 CR		ES		1147	FeP 04
		SIE; St 14						
A 516 Gr. 65; 55	1.0345	P235GH	1501 Gr. 141-360		A 37 CP/AP		1331	FeE235, Fe 360 1 KW; KG
A 515 Gr. 65; 55		HI	1501 Gr. 161-360; 151-360				1330	Fe 360 2 KW; KG
A 414 Gr. C			1501 Gr. 161-400; 154-360					
A 442 Gr. 55			1501 Gr. 164-360; 161-360					
(M) 1020	1.0402	C22	055 M 15; 070 M 20	2C/2D	AF 42 C 20; XC 25; 1 C 22		1450	C 20 C 21, C 25
M 1023			1449 22 HS, CS					
1020	1.0402	C22	050A20	2C/2D	CC20		1450	C20C21
1020; 1023	1.0402	C22	055 M 15; 070 M 20	2C	AF 42 C 20; XC 25; 1 C 22		1450	C 20; C 21, C 25
	1.0425	P265GH	H11	1501 Gr. 161-400; 151-400 1501 Gr. 164-360; 161-400 1501 Gr. 164-400; 154-400	A 42 CP/AP		1431 1430 1432	Fe 410 1 KW; KG; KT Fe 410 2 KW; KG
A 27 65-35	1.0443	GS-45	A1		E 23-45 M		1305	
	1.0539	S355NH; SIE 335			TSE 355-4		2134-04	Fe 510 B
	1.0545	S355N; SIE 335	4360-50E		E 355 R		2334-01	Fe 355 KG
	1.0546	S355NL; TSE 355	4360-50E		E 355 FP		2135-01	Fe 355 KT
	1.0547	S355J0H	4360-50C		TSE355-3		2172-04	Fe 510 C
	1.0549	S355 NLH; TSE 355					2135	Fe 510 D
	1.0553	S355J0; St 52-3U	4360-50C		E 36-3			Fe 510 C
A 633 Gr. C	1.0562	P355N	1501 Gr. 225-490A LT 20		FeE 355 KG N		2106	FeE 355 KG; KW
A 588		SIE 355			E 355 R/FP; A 510 AP			
	1.0565	P355NH; WSIE 355	1501-225-490B LT 20		A 510 AP		2106	FeE 355-2
	1.0566	P355NL; TSE 355	1501-225-490A LT 50		A 510 FP		2107-01	FeE 355-3
	1.0570	S355J2G3	Fe 510 D1 FF		E 36-3		2132, 2133	17GS
		St 52-3	1449 50/35 HR-HS		E 36-4		2134	17GS1S
			4360-50 D				2174	
1213	1.0715	9 SMn 28 (1SMn 30)	230 M 07		S 250		1912	CF 9 SMn 28
1213	1.0715	9 SMn 28	230 M 07		S 250		1912	CF 9 SMn 28
12 L 13	1.0718	9 SMn Pb 28 (11SMn Pb 30)			S 250 Pb		1914	CF 9 SMn Pb 28
1108	1.0721	10 S 20	(210 M 15)		10S20			CF 10 S 20
1109					10F 2			
11 L 08	1.0722	10 SPb 20			10PbF 2			CF 10 SPb 20
11 L 08	1.0722	10 SPb 20			10PbF 2			CF 10 SPb 20

grupp	AISI	w-stoff	DIN	BS	EN	AFNOR	SS	UNI
1	1215	1.0736	9 SMn 36 (11SMn37)			S 300		CF 9 Mn 36
	12 L 14	1.0737	9 SMnPb 36 (11SMnPb37)			S 300Pb	1926	CF 9 SMnPb 36
		1.0972	S315MC, QSTE 300 TM	1501-40F30		E 315 D		
		1.0976	S355MC, QSTE 360 TM	1501-43F35		E 355 D	2642	FeE 355TM
		1.0982	S460MC, QSTE 460 TM	1501-50F45				
		1.0984	S500MC, QSTE 500 TM			E 490 D	2662	FeE 490 TM
		1.0986	S500MC, QSTE 500 TM	1501-60F55		E 490 D		FeE 500 TM
	1010	1.1121	CK 10 (C10E)	040 A 10		XC 10	1265	C 10, 2 C 10 2 C 15
		1.1121	Si 37-1	4360 40 A			1300	
	1015	1.1141	CK 15 (C15E)	040 A 15 080 M 15	32C	XC 12 XC 15 XC 18	1370	C 15
	1020	1.1151	C22E	055 M 15 (070M 20)		2 C 22 XC 18	1450	C 20
	1023		CK 22			XC 25		
	D 3	1.2080	X 210 Cr 12	BD 3		Z 200 C 12		
	A36		Si 44-2	4360 43 A		NFA 35-501 E 28	1411	
	A572-60	1.8900	SSE 320-32	1501 T60			1421	
2	(M) 1025	1.0406	SSE 380	4360 55 E			2145	FeE390KG
		1.0416	GS-38	070 M 26		1 C 25 20-400 M	1306	C 25
	A 537 CL1	1.0473	P355GH	19 Mn 6		A 52 CP	2101	FeE 355-2
	A 414 Gr. G						2102	
	A 612							
	1035	1.0501	C35	080 A 32, 080 A 35 080 M 36, 1449 40 CS		1 C 35 AF 55 C 35 XC 38	1572 1550	C 35 1 C 35
	1045	1.0503	CF 45 (C45G)	080 A 47 080 M 46		XC 42 H 1 TS	1672	C 43 C 46
	1040	1.0511	C40	080 M 40		1 C 40 AF 60 C 40		C 40
		1.0540	C 50				1674	C 50
	A27 70-36	1.0551	GS-52	A2		280-480 M	1505	
	A148 80-40	1.0553	GS-60	A3		320-560 M	1606	
	A738	1.0577	S355J2G4 (Fe 510 D 2)	Fe 510 D2 FF 1501 Gr. 224-460 1501 Gr. 224-490		A 52 FP	2107	
	1140	1.0726	35 S 20	212 M 36	8M	35 MF 6	1957	
	1146	1.0727	45 S 20 (46S20)			45 MF 4	1973	
	1035	1.1157	40Mn4	150 M 36	15	35 M 5 40 M 5		
3	1041					2 C 25 XC 25	C25	F.1120-C 25 K
	1025	1.1158	C25E CK 25	(070 M 25)				
	1036	1.1166	36Mn5					TO B
	1330	1.1170	28Mn6	(150 M 28) (150 M 18)		20 M 5, 28 Mn 6		C 28 Mn
	1330	1.1170	28Mn6	150 M 5		20 M 5		
	1330	1.1170	28Mn6		14A	20 M 5		C 28 Mn
		1.1178	C30E; CK 30	080M30		XC 32		C 30
	1035	1.1180	C35R Cm 35	080 A 35		3 C 35 XC 32	1572	
	1035	1.1181	C35E CK 35	080 A 35 (080 M 36)		2 C 35, XC 32 XC 38 H 1	1550 1572	C 35
	1035	1.1181	C35E CK 35	080 A 35 (080 M 36)		XC 38	1572	C 36
	1042	1.1191	GS-CK 45	080 A 46		XC 45	1660	C 45
	1049	1.1206	C50E	080 M 50		2 C 50 XC 48 H1; XC 50 H1	1674	C 50
	1050		CK 50					
	1050	1.1213	CF 53 (CS33)	070 M 55		XC 48 H TS	1674	C 53
	4520	1.5423	22Mo4	1503-245-420				16 Mo 5 KG; KW
3		1.0050	Si50-2					FE50
	A 516 Gr. 70	1.0481	P295GH	1501 Gr. 224		A 48 Cp; AP		Fe 510 KG; KT; KW
	A 515 Gr. 70		17 Mn 4					Fe 510-2 KG; KT; KW
	A 414 Gr.F; G							FeE 295
	1043	1.0503	C 35	060 A 47 080 M 46 1449 50 HS; CS		1 C 45 AF 65 C 45	1672 1650	C 45 1 C 45
	1074	1.0614	C 78 D; 75-2			XC 75		
	1086	1.0616	C 88 D; D 85-2			XC 80	C 85	
	1095	1.0618	C 92 D; D 95-2			XC 90		
	1036	1.1165	30Mn5	120 M 36 (150 M 28)		35 M 5		
	1330							
	1335	1.1167	36Mn5	150 M 36		40 M 5	2120	
	1040	1.1186	C40E	060 A 40, 080 A 40		2 C 40 XC 42 H 1		C 40
	1045	1.1191	C45E CK 45	080 M 46 080 A 47		2 C 45 XC 42 H 1 XC 45 XC 48 H 1	1672	C 45 C 46
	1049	1.1201	C45R Cm 45	080 M 46		3 C 45 XC 42 H 1 XC 48 H 1	1660	C 45

grupp	AISI	w-stoff	DIN	BS	EN	AFNOR	SS	UNI
3		1.7242	18 CrMo 4				18 CrMo 4	
	A 387 Gr. 12 Cl	1.7337	16 CrMo 4 4					A 18 CrMo 4 5 KW
		1.7362	12 CrMo 19 5	3606-625		Z 10 CD 5.05		16 CrMo 20 5
	A 572-60		17 MnV 6	436055 E		NFA 35-501 E 36	2142	
	1055	1.0535	C 55	070 M 55		1 C 55	1655	C 55
						AF 70 C 55		1 C 55
	1060	1.0601	C 60	060 A 62	43 D	1 C 60		C 60
				1449 HS; CS		AF 70 C 55		1 C 60
	107	1.0603	C 67	080 A 67				C 67
				1449 70 HS		XC 65		
	1074	1.0605	C 75	1449 80 HS				C 75
	1075							
	1055	1.1203	C50E	060 A 57		2 C 55		C 55
			CK 55	070 M 55		XC 55 H1		
	1055	1.1209	C55R	070 M 55		3 C 55		C 55
			Cm 55			XC 55 H 1		
	1060	1.1221	C60E	060 A 62	43D	2 C 60	1665	C 60
	1064		CK 60			XC 60 H 1	1678	
	1070	1.1231	CK 67	060 A 67		XC 68	1770	C 70
			(C67E)					
	1074	1.1248	CK 75				774	C 75
			(C75E)	060 A 78		XC 75		
4	1066	1.1269	CK 85 (C85E)			XC 90		C 90
	1095	1.1274	CK 101 (C101E)			XC 100	1870	C 100
	W 112	1.1663	C125W			Y2 120		
							2223	
		1.0070	Si70-2					FE70-2
		1.7238	49 CrMo 4					
		1.7701	51 CrMoV 4					51 CrMoV 4
	A573-81 65	1.0116	Si 37-3	4360 40 B		E 24-U	1312	Fe37-3
	A515 65	1.0345	H 1	1 501 161		A 37 CP	1330	
	5120	1.0841	Si 52-3	150 M 19		20 MC 5	2172	Fe 52
	9255	1.0904	55 Si 7	250 A 53	45	55 S 7	2085	55Si8
	9254	1.0904	55 Si 7	250 A 53		55 S 7	2090	
	9262	1.0961	60 SiCr 7			60 SC 6		100 Cr 6
	L3	1.2067	100 Cr 6	BL3		Y 100 C 6		100 Cr 6
	L1	1.2108	90 CrSi 5				2092	105 WCr 5
	L2	1.2210	115 CrV 3			100 C 3		107 CrV 3 KU
		1.2241	51 CrV 4					
		1.2311	40 CrMoMo 7					35 CrMo 8 KU
	4135	1.2330	35 CrMo 4	708 A 37		34 CD 4	2234	35 CrMo 4
		1.2419	105 WCr 6			105 WC 13	2140	10 WCr 6
	01	1.2510	100 MnCrW 4	BO 1		8 MO 8	2140	10 WCr 6
	S1	1.2542	45 WCrV 7	BS 1		55 WC 20	2710	45 WCrV 8 KU
	S1	1.255	60 WCrV 7			55 WC 20	2710	58 WCr 9 KU
	L6	1.2713	55 NiCrMoV 6			55 NCDV 7		55 NiCrMoV 6
	L6	1.2721	50 NiCr 13			55 NCV 6	2550	
	O2	1.2842	90 MnCrV 8	BO 2		90 MV 8		
5	E 50100	1.3501	100 Cr 2					
	52100	1.3505	100 CR 6	2 S 135	31	100 C 6	2258	100 Cr 6
				535 A 99				
		1.5024	46 Si 7			45 S 7; Y 46		
						7,46 Si 7		
	9255	1.5025	51 Si 7			51 S 7	2090	48 Si 7
						51 Si 7		50 Si 7
	9255	1.5026	55 Si 7	251 A 58		55 S 7	2085	55 Si 7
	9260	1.5027	60 Si 7	251 A 60		60 S 7		60 Si 7
				251 H 60				
	9260 H	1.5028	65 Si 7			60 S 7		
		1.5120	38 MnSi 4					
	A 204 Gr. A	1.5415	16 Mo 3	1503-243 B		15 D 3	2912	16 Mo 3 (KG:KW)
	4017		15 Mo 3					
	4419	1.5419	20 Mo 4	1503-243-430			-2512	G 20 Mo 5 G 22 Mo 5
	A 350-LF 5	1.5622	14 Ni 6			16 N 6		14 Ni 6 KG:KT
	3415	1.5732	1 NiCr 10			14 NC 11		16 NiCr 11
	3310; 3314	1.5752	14 NiCr 14	655 M 13	36 A	12 NC 15		
		1.6587	17CrNiMo 6	820 A 16		18 NCD 6		14 NiCrMo 13
		1.6657	14 NiCrMo 134					14 NiCrMo 131
	5015	1.7015	15 Cr 3	523 M 15		12 C 3		
	5132	1.7033	34 Cr 4	530 A 32	18 B	32 C 4		34 Cr 4 (KB)
	5140	1.7035	41 Cr 4	530 M 40	18	42 C 4		41 Cr 4
	5140	1.7045	42 Cr 41	530 A 40		42 C 4 TS	2245	41 Cr 4
	5115	1.7131	16 MnCr 5	527 M 17		16 MC 5	2511	16 MnCr 5
		1.7139	16 MnCr 5				2127	
	5155	1.7176	55 Cr 3	527 A 60	48	55 C 3	2263	
	4135; 4137	1.7220	34 CrMo 4	708 Aa 37		35 CD 4	2234	
	4142	1.7223	41 CrMo 4					41 CrMo 4
	4140	1.7225	42 CrMo 4	708 M 0		42 CD 4	2244	
		1.7228	55 NiCrMoV 6 G	823 M 30	33		2512	653 M 31
		1.7262	15 CrMo 5			12 CD 4	2216	
		1.7321	20 CrMo 4				2625	
	ASTM A182 F-12	1.7335	13 CrMo 4	1501-620 Gr 27				14 CrMo 4 5

grupp	AlSi	w-stoff	DIN	BS	EN	AFNOR	SS	UNI
4	A 182 F 11-12	1.7335	13 CrMo 4 4	1 501 620 Gr 27		15 CD 4.5	2216	
	ASTM A 182 F.22	1.7380	10 CrMo 9 10	1501-622 Gr 31; 6				
	A 182 F-22	1.7380	10 CrMo 9 10	1501-622		12 CD 9.10	2218	12 CrMo 9,10
	A 355 A	1.7715	14 MoV 6 3	1503-660-440				
	A 1859	1.8509	41 CrAlMo 7	905 M 39	41 B	40 CAD 6,12	2940	41 CrAlMo 9,10
	A 570.36	1.0038	S 235 JRG 2 (Fe 360 B)	Fe 360 B FU		E 24-2 NE	1312	Fe 360 B FN
			RSt 37-2	1449 27/23 CR				
				4360-40 B				
	3135	1.5710	36 NiCr 6	640 A 35		35 NC 6		
		1.5755	31 NiCr 14	653 M 31		18 NC 13		
5	3620	1.8553	2 NiCrMo 2	805 M 20	362	20 NCD 2	2506	20 NiCrMo 2
	8740	1.6546	40 NiCrMo 22	311-Ty 7				40 NiCrMo 2 (K8)
	4130	1.7218	25 CrMo 4	CDS 110		25 CD 4	2225	25 CrMo 4 (K8)
		1.7733	24 CrMoV 5 5	20 CDV 6		20 CDV 6		21 CrMoV 5 11
		1.7755	GS-45 CrMoV 10 4					
		1.8070	21 CrMoV 5 11					35 NiCr 9
	4142	1.2332	47 CrMo 4	708 M 40	19 A	42 CD 4	2244	42 CrMo 4
	A 128 (A)	1.3401	G-X120 Mn 12			Z 120 M 12	2183	GX 120 Mn 12
	3435	1.5736	36 NiCr 10			30 NC 11		
	9840	1.6511	36 CrNiMo 4	816 M 40	110	40 NCD 3		36 NiCrMo 4 (K8)
6	4340	1.6582	35 NiCrMo 6	817 M 40	24	35 NCD 8	2541	35 NiCrMo 6
		1.7361	32 CrMo 12	722 M 24	40 B	30 CD 12	2240	20 CrMo 12
	8150	1.8159	50 CrV 4	735 A 50	47	50 CrV 4	2230	50 CrV 4
		1.8161	58 CrV 4					
		1.8515	32 CrMo 12	722 M 24	40 B	30 CD 12	2240	32 CrMo 12
		1.8523	39 CrMoV 13 9	897 M 39	40 C			36 CrMoV 12
		1.4882	X 50 CrMnNiNbN 21 9			Z 50 CrMnNb		
						21 99		
	3135	1.5710	36 NiCr 6	640 A 35	111 A	35 NC 6		
		1.5864	35 NiCr 18					
7			31 NiCrMo 13 4	830 M 31			2534	
	A 573-B1	1.0144	ST 44-3	4360 43 C		E 28-3	1412	
	A 619	1.0347	DCO 3	1449 3 CR		E		Fep 02
			RStRRSt 13	1449 2 CR				
	M 1015	1.0401	C 15	080 M 15		AF 37 C 12	1350	C 15
	M 1016			080 M 15		XC 18		C 16
	M 1017			1449 17 CS				C 15
		1.0570	ST 52-3	4360 50 B		E 36-3	2132	Fe 52 BFN / Fe 52 CPN
	12 L 13	1.0718	9 SMnPb 28			S 250 Pb	1914	CF 9 SMnPb 28
	(12 L 13)	1.0718	9 SMnPb 28			S 250 Pb	1914	CF 9 SMnPb 28
8		1.0723	15 S 22	210 A 15			1922	
			15 S 20	210 M 15				
		1.2083					2314	
	H 11	1.2343	X 38 CrMoV 5 1	BH 11		Z 38 CDV 5		X 37 CrMoV 5 1 KU
	H 13	1.2344	X 40 CrMoV 5 1	BH 13		Z 40 CDV 5	2242	X 40 CrMoV 5 1 KU
	A 2	1.2363	X 100 CrMoV 5 1	BA 2		Z 100 CDV 5	2280	X 100 CrMoV 5 1 KU
	D 2	1.2379	X 155 CrMo 12 1	BD 2		Z 160 CDV 12	2370	X 165 CrMoV 12 KU
	HNW 3	1.2379	X 210 Cr 12 G	BD 2		Z 160 CDV 12	2370	
	D 4 (D6)	1.2436	X 210 CrW 12	BD 6		Z 200 CD 12	2312	X 215 CrW 12 1 KU
	H 21	1.2581	X 30 WCrV 9 3	BH 21		Z 30 WCrV 9		X 30 WCrV 9 3 KU
9		1.2601	X 165 CrMoV 12				2310	
	H 12	1.2606	X 37 CrMoV 5 1	BH 12		Z 35 CWDV 5		X 35 CrMoV 5 1 KU
	D 3	1.3343	S 6-5-2	BM 2		Z 200 C 12	2715	X 210 Cr 13 KU
	R 08028	1.4562				Z 1 NCDU 31-27-03	2584	
	ASTM A 353	1.5662	X 8 N 9	1501-509;510				14 Ni 6 KGKT
	ASME A 353	1.5662	X 8 N 9	502-600		9 Ni		X 10 Ni 9
	2517	1.5680	12 Ni 19	12 Ni 19		Z 18 N 5		
	2515	1.5680	12 Ni 19			Z 18 N 5		
		1.3202	S 12-1-4-5	BT 15				HS 12-1-5-5
		1.3207	S 10-4-3-10	BT 42		Z 130 WKCDV		
10	T 15	1.3243	S 6-5-2-5			KCV	2723	HS 6-5-2-5
						06-05-05-04-02		
		1.3246	S 7-4-2-6			Z 110 WKCDV	7-4-2-6	HS 7-4-2-6
						07-05-04		
		1.3247	S 2-10-1-8	BM 42		Z 110 DKCWW	2-10-1-8	HS 2-9-1-8
						09-08-04		2-9-2-8
	M 42	1.3249	S 2-9-2-8	BM 34				
	T 4	1.3255	S 18-1-2-5	BT 4		Z 80 WKCV		
						18-05-04-0		
	M 2	1.3343	S 6-5-2	BM 2		Z 85 WKCV	2722	HS 6-5-2
11	M 7	1.3348	S 2-9-2			Z 100 DCWW	2782	HS 2-9-2
						09-04-02		
	T 1	1.3355	S 18-0-1	BT 1		Z 80 WCV 18-401		
	530	1.4548				Z 7 CNV 17-04		
	HNW 3	1.4718	X 45 CrSi 9 3	401 S 45	52	Z 45 CS 9		
	422	1.4935	X 20 CrMoWV 12 1					
	403	1.4000	X 6 Cr 13	403 S 17		Z 6 C 13	2301	X 6 Cr 13
		1.4001	X 6 Cr 14					
	(410 S)	1.4001	X 7 Cr 13	(403 S 7)		Z 6 C 13	2301	
	405	1.4002	X 6 Cr 12	405 S 17		Z 6 CA 12		X 6 CrAl 12
12	405	1.4002	X 6 CrAl 12	405 S 17		Z 6 CA 13	2302	X 6 CrAl 13
	416	1.4005	X 12 Cr 13	416 S 21		Z 11 CF 13		X 12 Cr 13
	410-CA-15	1.4006	(G)-X 10 Cr 13	410 S 21	56 A	Z 10 C 13	2302	X 12 Cr 13
	430	1.4016	X 8 Cr 17	Z 8 C 17		430 S 15	2320	X 8 Cr 17

grupp	AISI	w-t-off	DIN	BS	EN	AFNOR	SS	UNI
8	430	1.4016	X 6 Cr 17	430 S 15	60	2 8 C 17	2320	X 8 Cr 17
		1.4027	G-X 20 CR 14	420 C 29		2 20 C 13 M		
		1.4027	G-X 20 CR 14	420 C 29		2 20 C 13 M		
	420	1.4028	X 30 Cr 13	420 S 45		2 30 C 13	2304	
		1.4086	G-X 120 Cr 29	452 C 11				
	430 F	1.4104	X 12 CrMoS 17	420 S 37		2 10 CF 17	2383	
	440 B	1.4112	X 80 CrMoV 18					
	434	1.4113	X 6 CrMo 17	434 S 17		2 8 CD 17	2325	X 8 CrMo 17
		1.4340	G-X 40 CrNi 27 4					
	S 31500	1.4417	X 2 CrNiM 0 Si 19 5				2376	
	S 31500	1.4417	X 2 CrNiMoSi 18 5 3				2376	
		1.4418	X 4 CrNiMo 16 5			2 6 CND 16-04-01	2387	
	XM 8	1.4510				2 4 CT 17		X 6 CrTi 17
	430 Ti							
	430 Ti	1.4510	X 6 CrTi 17			2 4 CT 17		
		1.4511	X 6 CrNb 17 (X 6 CrNb 17)			2 4 Cnb 17		X 6 CrNb 17
	409	1.4512	X 6 CrTi 12 (X 2 CrTi 12)	LW 19 409 S 19		2 3 CT 12		X 6 CrTi 12
		1.4720	X 20 CrMo 13					
	405	1.4724	X 10 CrAl 113	403 S 17		2 10 C 13		X 10 CrAl 112
	430	1.4742	X 10 CrAl 118	439 S 15	60	2 10 CAS 18		X 8 Cr 17
9	HNV 6	1.4747	X 80 CrNiSi 20	443 S 65	59	2 80 CSN 20.02		X 80 CrSiAl 20
	446	1.4749	X 18 CrNi 28					
	446	1.4762	X 10 CrAl 124			2 10 CAS 24	2322	X 16 Cr 26
	EV 8	1.4871	X 53 CrMnNiN 21 9	349 S 54		2 52 CMN 21.09		X 53 CrMnNiN 21 9
	302		X 12 CrNi 18 9	302 S 31		2 10 CN 18-09	2330	
	429		X 10 CrNi 16					
	420	1.4021	X 20 Cr 13	420 S 37		2 10 C 13	2303	14210
	420	1.4031	X 40 Cr 13			2 40 C 14	2304	
		1.4034	X 46 Cr 13	420 S 45		2 40 C 14		X 40 Cr 14
	431	1.4057	X 20 CrNi 172	431 S 29	57	2 15 CN 16.02	2321	X 16 CrNi 16
		1.4125	X 105 CrMo 17			2 100 CD 17		X 105 CrMo 17
	CAS-NiM	1.4313	G-X 4 CrNi 13 4	425 C 11		2 4 CND 13-04 M	2385	(GX) 6 CrNi 304
	630	1.4542	X 5 CrNiCuNb 17 4 (X 5 CrNiCuNb 16-4)					
		1.4544		S. 524 S. 526				X 6 CrNiTi 18 11
	348	1.4546	X 5 CrNiNb 18-10	347 S 31 2 S. 130 2 S. 143/144/145 S. 525/527				X 6 CrNiNb 18 11
		1.4922	X 20 CrMoV 12-1				2317	X 20 CrMoNi 12 01
		1.4923	X 22 CrMoV 12 1					
10	304	1.4301	X 5 CrNi 18 9	304 S 15		2 5 CN 18.09	2332-2333	
	303	1.4305	X 10 CrNiS 18 9	303 S 21	58 M	2 8 CNF 18-09	2346	
	304L	1.4306	X 2 CrNi 18 9	304 S 12		2 2 CN 18 10	2352	X 2 CrNi 18 11
	304 L	1.4306	X 2 CrNi 18 10	304 S 11		2 3 CN 19-11	2352	X 2 CrNi 18 11
	CF-8	1.4308	X 6 CrNi 18 9	304 C 15	58 E	2 6 CN 18-10 M	2333	
	31	1.4310	X 12 CrNi 17 7	301 S 21		2 12 CN 17.07	2331	X 2 CrNi 18 07
	304 LN	1.4311	X 2 CrNiN 18 10	304 S 62		2 2 CN 18 10	2371	X 2 CrNiN 18 10
		1.4312	G-X 10 CrNi 18 8	302 C 25		2 10 CN 18.9 M		
	305	1.4312	X 8 CrNi 18 12	305 S 19				
		1.4332	X 2 CrNi 18 9					
	304	1.4350	X 5 CrNi 18 9	304 S 15	58 E	2 6 CN 18.09	2332	X 5 CrNi 18 10
	S 32304	1.4362	X 2 CrNiN 23 4			2 2 CN 23-04 AZ	2327	
	202	1.4371	X 3 CrMnNiN 188 8 7	284 S 16		2 8 CMN 18-08-05		
	316	1.4401	X 2 CrNiMo 17 12 2 (X 4 CrNiMo 17-12-2)	316 S 13 316 S 17 316 S 19 316 S 31 316 S 33		2 3 CND 17-11-01 2 6 CND 17-11 2 6 CND 17-11-02 2 7 CND 17-11-02 2 7 CND 17-12-02	2347	X 5 CrNiMo 17 12
	316 L	1.4404	X 2 CrNiMo 17 13 2 (X 2 CrNiMo 18-15-4) GX 2 CrNiMoN 18-10	316 S 11, 316 S 13 316 S 14, 316 S 31 316 S 42, 316 S 37, 316 C 12, T. 75, S. 161		2 2 CND 17-12 2 2 CND 18-13 2 3 CND 17-11-02 2 3 CND 17-12-02 FF 2 3 CND 18-12-03 2 3 CND 18-10 M	2348	X 2 CrNiMo 17 12 G-X 2 CrNiMo 19 1
	316 LN	1.4406	X 2 CrNiMoN 17 12 2 (X 2 CrNiMoN 18-10)	316 S 61		2 2 CND 17-12 AZ		X 2 CrNiMoN 17 12
	CF-8M	1.4408	GX 5 CrNiMoN 17 12 2 GX 6 CrNiMo 18 10	316 S 63 316 C 16 (LT 198) ANG 4 B			2343	
		1.4410	GX 10 CrNiMo 18 9			2 5 CND 20.12 M	2328	
	316 LN	1.4429	X 2 CrNiMo 17-13-3	316 S 62		2 2 CND 17-13 AZ	2375	X 2 CrNiMoN 17 13
	316 L	1.4435	X 2 CrNiMo 18 14 3	316 S 11; 316 S 13 316 S 14; 316 S 31 LW 22 LWCF 22		2 3 CND 17-12-03 2 3 CND 18-14-03	2375	X 2 CrNiMoN 17 13
	316	1.4436	X 5 CrNiMo 17 13 3 (X 4 CrNiMo 17-13-3)	316 S 19; 316 S 31 316 S 33 LW 23 LWCF 23		2 6 CND 18-12-03 2 7 CND 18-12-03	2343	X 5 CrNiMo 17 13 X 8 CrNiMo 17 13
	317 L	1.4438	X 2 CrNiMo 18 16 4 (X 2 CrNiMo 18-15-4)	317 S 12		2 2 CND 19-15-04 2 3 CND 19-15-04	2367	X 2 CrNiMo 18 16
	(S 31726)	1.4439	X 2 CrNiMoN 17 13 5			2 3 CND 18-11-06 AZ		
		1.4440	X 2 CrNiMo 18 13					
	317	1.4449	X 5 CrNiMo 17 13 3	317 S 16				X 5 CrNiMo 18 15

grupp	AlSi	W-stoff	DIN	BS	EN	AFNOR	SS	UNI
10	329	1.4460	X 4 CrNiMo 27 5 2 (X3 CrNiMo 27-5-2)			Z 3 CND 25-07 AZ) Z 5 CND 27-05 AZ	2324	
	329	1.4460	X 8 CrNiMo 27 5				2324	
		1.4462	X 2 CrNiMoN 22 5 3	318 S 13		Z 3 CND 22-05 AZ (Z 2 CND 24-08 AZ) Z 3 CND 25-06-03 AZ)	2377	
		1.4500	GX 7 NiCrMoCuNb 25 20			23 NCDU 25.20 M		Z 8 CNA 17-07
	17-7 PH	1.4504		318 S 111				
	443	1.4521	X 2 CrNiMoTi 18-2				2326	
	444							
	UNS N 08904	1.4539	X 1 NiCrMoCuN 25-20-5			Z 2 NCDU 25-20	2562	
	CN-7M	1.4539	(G-JX 1 NiCrMoCu 25 20 5			Z 1 NCDU 25-02 M	2564	
	321	1.4541	Z 6 CrNiTi 18-10	321 S 31 321 S 51 (1010; 1105 LW 24 LWCF 24		Z 6 CNT 18-10	2337	X 6 CrNiTi 18 11
11	630	1.4542	X 5 CrNiCuNb 17 4 (X 5 CrNiCuNb 16-4)			Z 7 CNU 15-05 Z 7 CNU 17-04 Z 7 CNU 17-04		
	17-4 PH	1.4542						
	S 31254	1.4547	X 1 CrNiMoN 20 18 7				2378	
	17-4 PH	1.4548				Z 7 CNU 17-04		
	347	1.4550	X 6 CrNiNb 18 10	347 S 17	58 F	Z 6 CrNiNb 18-10 Z 4 NNB 19.10 M	2338	X 6 CrNiNb 18 11
		1.4552	GX 7 CrNiNb 18 9					
	17-7 PH	1.4568		316 S 111				Z 8 CNA 17-07
	316 Ti	1.4571	X 6 CrNiMoTi 17 12 2	320 S 31		Z 6 CNDT 17-12002	2350	
	316 Ti	1.4571	X 6 CrNiMoTi 17 12 2	320 S 31	58 J	Z 6 NDT 17.12	2350	X 6 CrNiMoTi 17 12
	316	1.4581	GX 5 CrNiMoNb	316 C 17		Z 4 CNDNB 18.12 M		
12		1.4583	X 10 CrNiCuNb 18 13	305 S 34		Z 4 CND 30.43		X 4 CrNiTi 18 11
		1.4585	GX 7 CrNiMoCuNb 18 18					X 6 CrNiMoTi 17 12
		1.4821	X 20 CrNiSi 25 4			Z 20 CNS 25.04		
		1.4823	GX 40 CrNiSi 27 4					
	309	1.4828	X 15 CrNiSi 20 12	309 S 24	58 C	Z 15 CNS 20.12		
	309 S	1.4833	X 6 CrNi 22 13	309 S 13		Z 15 CN 24-13		
	310 S	1.4845	X 12 CrNi 25 21	310 S 24		Z 12 CN 25-20	2361	X 6 CrNi 25 20
	321	1.4878	X 6 CrNiTi 18 9	321 S 20	58 B	Z 6 CNT 18-12 (B)	2377	X 6 CrNiTi 18 11
	S 30415	1.4891	X 5 CrNiNb 18 10				2372	
	S 30815	1.4893	X 8 CrNiNb 11				2368	
13	304 H	1.4948	X 6 CrNi 18 11	304 S 51		Z 5 CN 18-09	2333	
	660	1.498	X 5 NiCrTi 25 15			Z 8 NCTV 25-15 BF	2570	
			X 5 NiCrN 35 25					
	S 31753		X 2 CrNiMoN 18 13 4 X 2 CrNiMoN 25 22 7					
	CLASS 20	0.6010	GG 10			F1 10 D	110	G 10
	A 48-20 B	0.6010	GG 10			F1 10 D	0110-00	
	NO 25 B	0.6015	GG 15	Grade 150		F1 15 D	0115-00	G 15
	CLASS 25	0.6015	GG 15	Grade 150		F1 15 D	115	G 15
	A 48-25 B	0.6015	GG 15	Grade 150		F1 15 D	01 15-00	G 14
	A 48-30 B	0.6020	Gg 20	Grade 220		F1 20 D	0120-00	
14	NO 30 B	0.6020	GG 20	Grade 220		F1 20 D	120	G 20
	A 436 Type 2	0.6660	GGL-NiCr 202	L-NiCr 202		FGS 202	0623-00	
	60-40-18	0.7040	GGG 40	SNG 420/12		FCS 400-12	0717-02	GS 370-17
	NO 20 B		GG 10			F1 10 D	110	
	CLASS 30	0.6020	GG 20	Grade 220		F1 20 D	120	G 20
	CLASS 45	0.6030	GG 30	Grade 300		F1 30 D	130	G 30
	A 48-45 B	0.6030		Grade 300		F1 30 D	01 30-00	
	A 48-50	0.6035	GG 35	Grade 350		F1 35 D	135	G 35
	A 48-60 B	0.6040	GG 40	Grade 400		F1 40 D	140	
	100-70-03	0.7070	GGG 70	SNG 700/2		FGS 700-2	07 37-01	GGG 70
15		1.4829	X 12 CrNi 22 12					
		0.7033	GGG 35.3					07 17-15
		0.7033	GGG 35.3	350/22 L 40		FGS 370/17	0717-15	
	80-40-18	0.7040	GGG 40	SNG 420/12		FGS 400/12	0717-02	
	80-40-18	0.7043	GGG 40.3	370/7		FGS 370/17	0717-15	
	80-55-06	0.7050	GGG 50	SNG 500/7		FGS 500/7	0727-02	GGG 50
	65-45-12	0.7050	GGG 50	SNG 500/7		FGS 500/7		0727-02
		0.7652	GGG NiMn 13 7	S-Mn 137		S-Mn 137		
	A 43 D 2	0.7660	GGG NiCr 20 2	Grade S 6		S-NC 202	0772-00	
			GGG 40.3	SNG 370/17		FGS 370/17	0778-00	
16	A 48-40 B	0.6025	GG 25	Grade 260		F1 25 D	0717-12	
		0.7060	GGG 60	SNG 600/3		FGS 600/3	125	G 25
	80/55/06	0.7060	GGG 60	600/3		FGS 600/3	0732-03	GGG 60
	A 48-40 B						0727-03	
		0.8055	GTW 55					
	32510	0.8135	GTS 35-10	B 340/12		Mn 35-10		
	A 47-32510	0.8135	GTS 35-10	B 340/2		Mn 35-10	810	
	A 220-40010	0.8145	GTS 45-06	P 440/7		Mn 450-6	0815-00	
			GTS 35	B 340/12				0852-00
				8 290/6		Mn 32-8		
17	32510		GTS 35	B 340/12		Mn 35-10	0810-00	
		0.8035	GTM 35	W 340/3		Mb 35-7	814	
		0.8040	GTW 40	W 410/4		Mb 40-10	0815	
		0.8045					852	
		0.8065	GTW 65					GMB 40
	A 220-50005	0.8155	GTS 55-04	P 510/4		Mn 550-4		GMB 45
	50005	0.8155	GTS 55-04	P 510/4		Mp 50-5		
	70003	0.8166	GTS 65-03	P 570/3		Mn 560-3		
	90001	0.8170	GTS 70-02	P 690/2		Mn 700-2	0854-00	GMN 55

grupp	AISI	ISO	DIN	BS	EN	AFNOR	SS	UNI
13	A 220-90001	0.8170	GTS 70-02			Mn 700-2	3856-00	GHM 85
		0.817	GTS 7-02	IP 70-2			3852-00	GLN 70
	1022						3864-00	
	1518	1.1133	20 Mn 5	120 M 19		20 M 5		
14	1035	1.1183	Cr 35 (C 35 G)	080 A 35		XC 38 H 1 TS	2132	G 22 Mn 3
	400 10		GTS 45	P 440/7				20 Mn 7
	70003		GTS 65	P 570/3		MP 60-3	1572	C 36; C 38
	AI 99	3.0205	Al 99.5	L 31/34/36		A 59050 C	3852	
15	1000	3.0255	Al 99.5	L 31/34/36		A 59050 C	3852	
		3.3315	Al Mg 1					
		3.1325	AlCuMg 1					
		3.1655	AlCuSiPb					
16		3.2315	AlMgSi 1					
	7050	3.4345	AlZnMgCu 0.5	L 86		AZ 4 GU9051		
		3.2381	G-AlSi 10 Mg					
		3.2382	GD-AlSi 10 Mg				81104	
17		3.2581	G-AlSi 12					
		3.3561	G-AlMg 5					
	ZE 41	3.5101	G-MgZn 4 SE 1 Zr 1	MAG 5				
	EZ 33	3.5103	MgSE 3 Zn 27 r 1	MAG 6	G-TR 3 Z 2			
18	AZ 81	3.5812	G-MgAl 8 Zn 1	NMAG 1				
	AZ 91	3.5912	G-MgAl 9 Zn 1	MAG 7				
		2.1871	G-AlCu 4 TMg					
		3.1754	G-AlCu 5 Ni 1.5					
19		3.2163	G-AlSi 9 Cu 3					
	4218 B	3.2371	G-AlSi 7 Mg					
	SC 64 D	3.2373	G-AlSi 9 MgW			A-37 G	4251	
		3.2375	G-AlSi 9 Mg					
20	QE 22	3.5106	G-MgAl 3 SE 2 Zr 1	MAG 12				
	GD-AlSi 12		G-AlMg 5	LN 5		A-3J 12	4251	
	A 360.2	3.2383	G-AlSi 0 Mg(Cu)	LN 9			4251	
	A 356-72			2789.1973		NFA 32-20		
21	A 413.2		G-AlSi 12	LN 25			4241	
	A 413.1		G-AlSi 12 (Cu)	LN 20			4241	
	A 413.0		GD-AlSi 12				4241	
	A 380.1		GD-AlSi 8 Cu 3	LN 24			4251	
22	C 93200	2.1090	G-CuSn 7.5 Pb			U-47 Z 5 Pj 4		
	C 83600	2.1096	G-CuSn 5 Zn Pb	LC 2				
	C 83600	2.1098	G-CuSn 2 Zn Pb					
	C 23000	2.1182	G-CuPb 15 Sn	LB 2		U-Rb 15 E 1		
23	C 93800	2.1182	G-CuPb 15 Sn			UuPb 15 E 8		
		2.0240	CuZn 15					
	C 27200	2.0321	CuZn 37	Cu 108		CuZn 36, CuZr 37		C 2700
	C 27700	2.0321	CuZn 37	Cu 108		CuZn 36, CuZr 37		C 2720
24		2.0590	G-CuZn 40 Fe					
	C 86500	2.0592	G-CuZn 35 Al 1	U-Z 36 N 3	HTB 1			
	C 86200	2.0596	G-CuZn 34 Al 2	HTB 1	U-Z 36 N 3			
	C 18200	2.1293	CuCrZr	cC 132	U-Cr 08 Zr			
25	N 08800	1.4558	X 2 NiCrAlTi 32 20	NA 15				
	N 08031	1.4562	X 1 NiCrMoCu 32 28 7				2581	
	N 08028	1.4563	X 1 NiCrMoCuN 31 27 4					
	N 08330	1.4864	X 12 NiCrSi 36 16	NA 17		Z 11 NCS 36.16		
26	330	1.4865	X 17 NiCrSi 36 16	NA 17		Z 11 NCS 37.16		
		1.4865	G-X 40 NiCrSi 36 16	330 C 40				XG 50 NiCr 39 19
		1.4958	X 5 NiCrAlTi 3 20					
	AMS 5544	LW2.4668	NiCr 19 NbAl				NC20 K 14	
27	Monel 400	2.4360	NiCu 30 Fe	NA 13			NU30	
	5390A	2.4603					NC22 FeD	
	Hastelloy C-4	2.4610	NbMo 16Cr 16 Ti					
	Nimonic 75	2.4630	NiCr 20 1	HR 5.203-4			NC20 T	
28		2.4630	NiCr 20 1	HR 5.203-4			NC20 T	
	Inconel 690	2.4642	NiCr 29 Fe				Nb 30 Fe	
	Inconel 625	2.4656	NiCr 22 Mo 9 Nb	NA 21			NC22 FeNb	
	5666	2.4656	NiCr 22 Mo 9 Nb				Inconel 625	
29	Incoloy 825	2.4658	NiCr 21 Mo	NA 13			NC21 Fe Cu	
	5537 C	LW2.4964	60Cr 20V 15 Ni				KC20 WN	
	AMS 5772		60Cr 22W 14 Ni				KC22 WN	
	Inconel X-750	2.4689	NiCr 15 Fe 7 TiAl				NC15 TiNb	
30	Hastelloy B	2.4685	G-NiMo 8					
	Hastelloy C	2.4810	G-NiMo 8					
	AMS 5399	2.4973	NiCr 19 Co 11 MoTi				NC19 KDT	
		3.7115	AlSi 5 Sr 2					
31		1.4977	1.40 CoCrNi 20 20				Z 4r CNKDWNb	
	Monel k-500	2.4375	NiCu 30 Ni	NA 13			NU30 AT	
	4676	2.4375	NiCu 30 Ni	3072-76				
		2.4631	NiCr 20 Al	HR 4c.601			NC20 TA	
32	Inconel 18	2.4648	NiCr 19FeNbMo				NC19 Fe Nb	
	Inconel	2.4694	NiCr 16 Fe 7 TiAl					
		2.4955	NiFe 25 2 20 NbTi					
	1383	LM2.4668	NiCr 19FeNbMo	HR 8			NC19ENb	
33	1391	LW2.4670	S-NiCr 15 A 16 MoNb	3146-3			NC12 AD	
	1660	LW2.4662	NiFe 35 2 14 MoTi				ZS1CDT 4	
	1 50250	3.7025	T 1	2 TA 1				
	1 52250	3.7225	T 1 Pd	TP 1				
34	AMS 5397	LW2.4674	NiCo 15 2r 10 MoTi					
		3.7124	Co 2	2 TA 21-24				

grupp	AISI	W-stoff	DIN	BS	EN	AFNOR	SS	JNI
18	R 54620	3.7145	TiAl 6 Sn 2 Zr 4 Mo 2 Si					
		3.7165	TiAl 6 V 4	TA 10-13; TA 28		T-A 6 V		
		3.7185	TiAl 4 Mo 4 Sn 2	TA 45-51; TA 57				
		3.7198	TiAl 3 V 2.5					
			TiAl 4 Mo 4 Sn 4 Si 0.5					
	AMS R 54520		TiAl 5 Sn 2.5	TA 14/17		T-A 5 E		
	AMS R 56400		TiAl 6 V 4	TA 10-13/ TA 28		T-A 6 V		
19	AMS R 56401		TiAl 6 V 4 ELI	TA 11				
	W 1	1.1545	C 105 W 1	BW 1 A		Y 1 105	1880	≥ 100 KU
	W 210	1.1545	C 105 W 1	BW 2		Y 120	2900	≥ 120 KU
		1.2762	75 CrMoNiW 6.7					
	440 C	1.4125	X 105 CrMo 17			Z 100 CD 17		
		1.6746	32 NiCrMo 14.5	832 M 31		35 NCD 14		

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