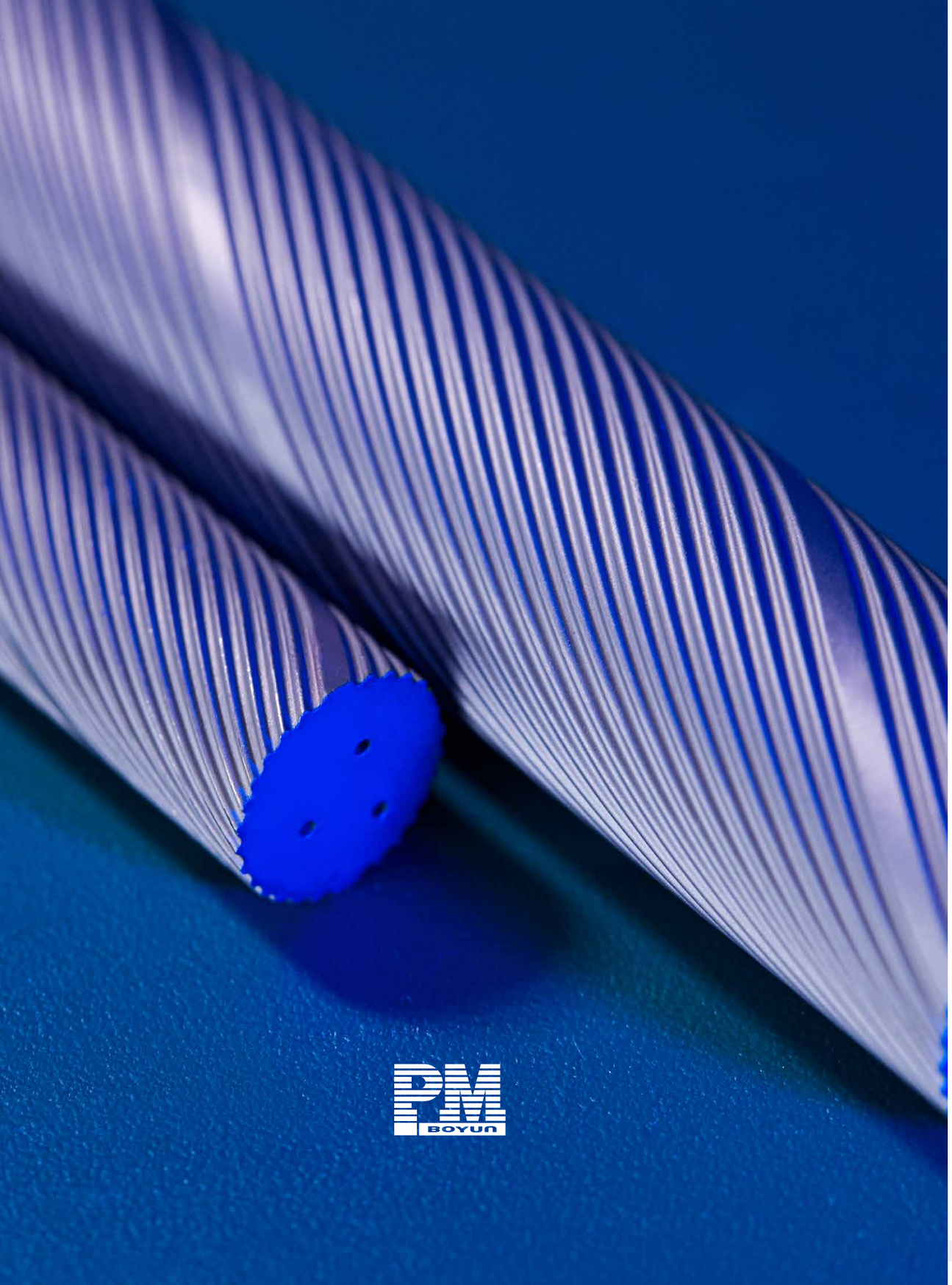
PM BOYUN

CARBIDE
CUTTING TOOLS MATERIAL

BOYUN

#1 CARBIDE - CUTTING TOOLS MATERIAL

INNOVATION MAKES DREAMS COME TRUE



CONTENTS

Our Company

Hunan Boyun Dongfang Powder Metallurgy Co., Ltd. was founded in 1994 by the Institute of powder metallurgy of Central South University of Technology (now the research center of powder metallurgy engineering of Central South University) and Hunan Yinzhou Co., Ltd. (now the wholly-owned member company of China Dongfang asset management company, Bangxin Asset Management Co., Ltd.),now it is the holding subsidiary of Hunan Boyun New Material Co., Ltd. (Stock Code: 002297), with a registered capital of 307 million yuan. The company is a national high-tech enterprise with Academician Huang Boyun, the top material scientist in China, as the chief scientist and honorary chairman of the board, integrating domestic and foreign talents and technological advantages, integrating production, learning, research and application, engaged in the research, development, production and sales of high-performance cemented carbide. Company is medium-sized enterprises to become state-level technologically advanced 'little giant' enterprises. The member of China Tungsten Industry Association, China mold industry association, China machinery industry metal cutting tool technology association.

With strong support from Central South University, State Key Laboratory of Powder Metallurgy, National Engineering Research Center of Powder Metallurgy, national key laboratory of light and high strength structural materials, Quality Supervision and Inspection Center of Powder Metallurgy Products of Chinese Nonferrous Material Industry , the Company has played leading role in three projects of "National High Technology Research and Development Program (863 plan)".

Chief Scientist

Academician of Chinese Academy of Engineering
Winner(1st) of China National Technological Invention Award (2005)
Former president of Central South University
Member of Twelfth National People's Congress Standing Committee
Vice-Chairman, Chinese Association for Science

ACADEMICIAN HUANG BOYUN

Honorary Chairman, Chief Scientist

COMPANY INTRODUCTION

Specialty One: Owned complete discipline system on non-ferrous materials while established top classes of non-ferrous metallurgy in the world.
Specialty Two: Conducted over 60 years of high education and R&D in rail transit system and made vital contributions to major projects including Qinghai-Tibet railway, high-speed railway, urban rail and helped to increase speed of all Chinese trains (six times).

1 GEOLOGY

4 METALLURGY

2 MINING

5 MATERIAL

3 ORE DRESSING

6 MECHANICAL

FEATURE SUBJECTS OF CENTRAL SOUTH UNIVERSITY

The University participated in the "Qinghai-Tibet Railway Project"
The series of railway aerodynamics are widely used in the speeding of western railways and the construction of high-speed railways.

INSTITUTE OF POWDER METALLURGY

Among 31 colleges of CSU, the Institute of Powder Metallurgy is a comprehensive base of high education, R&D and industrialization of new materialsvv in China.

P / M Research Institute has established four national level P / M material and technology research and development bases:
State Key Laboratory of Powder Metallurgy
Supervision and Testing Center of Products of Powder Metallurgy of Chinese Nonferrous Metals Industry
National Engineering Research Center of Powder Metallurgy

Company Introduction

GLORIOUS HISTORY OF POWDER METALLURGY RESEARCH INSTITUTE

Established at 1958,

First Powder Metallurgy discipline in China.

In 1989,
Expansion, Solidification of fundamental theory and technology and frontier of PM.

In 1995,
Open up, civil-military integration and innovation-driven strategies to meet major national needs.

In 2003,

EXCELLENT State Key Laboratory

In 2004,

First Prize of National Technology Invention Award.

In 2008,
EXCELLENT State Key Laboratory.

In 2011,

First Prize of National Science and Technology Progress.

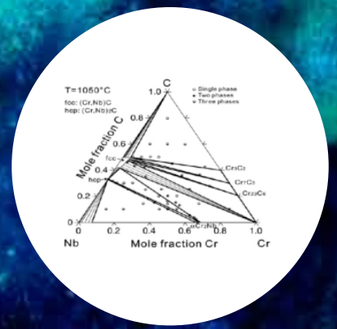
In 2017,
C919 took her maiden flight.

In 2018,
project 2011" Nonferrous Metals Advanced Structural Materials and Manufacturing Cooperative Innovation Center" was passed the acceptance.

2019

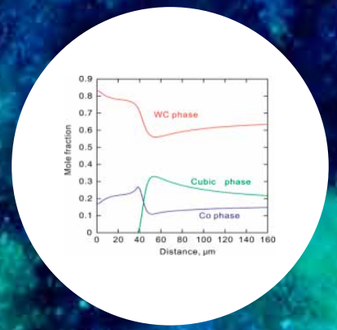
INSTITUTE OF POWDER METALLURGY

Basic research on Application of special PM materials



Thermodynamics database

$$V_{Co} = \frac{u_{Co}^{S} \cdot V_{Co}^{m}}{\left(1-u_{Co}^{S}\right) \cdot V_{WC}^{m} + u_{Co}^{S} \cdot V_{Co}^{m}}$$



Dynamics database

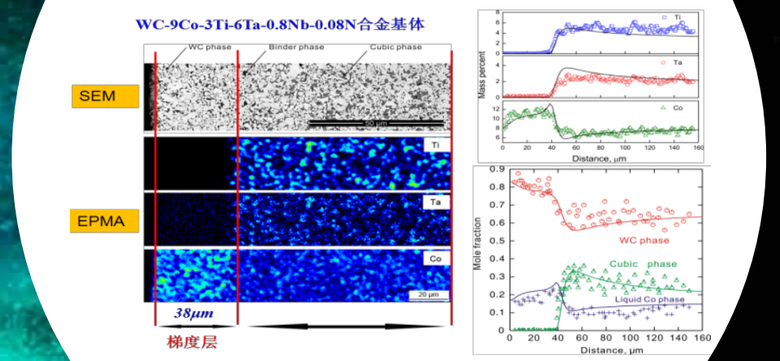
The Institute of powder metallurgy has built the most complete database of thermodynamics and dynamics of muti-component cemented carbide in the world, which can accurately predict the distribution of phases and elements in the gradient layer of cemented carbide. Base on this database, a series of new gradient cemented carbide have been developed by integrated calculation.

Propose the Symplectic Du formula to achieve efficient prediction of liquid phase diffusion coefficient 16-component cemented carbide thermodynamic and dynamics database.

Using the database, quantitative description of Phase and Element Distribution in Cemented Carbide Gradient.

Gradient cemented carbide composition

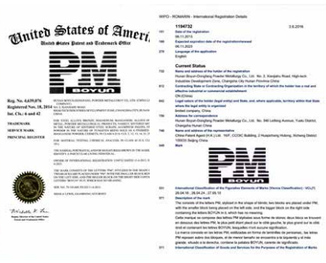
Comparison of predictions and experimental results



Structure Characterization and Quantitative Description of Element Distribution of Gradient Cemented Carbide

Company Introduction

COMPANY BRAND AND MARKET



Protection of Intellectual Property RightsProfessional

Besides registered in China, "PM" trademark has also been registered in the United States and the European Union.

Business Area

The company's business has expanded to many countries and regions around the world.

Company Introduction

CEMENTED CARBIDE

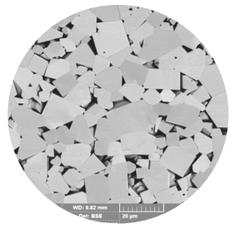
Cemented carbide is a kind of composite material which is made of refractory metal hard compounds (WC, TiC, etc.) and bonding metals (CO, Ni, Fe, etc.) by powder metallurgy. Cemented carbide have high hardness, high wear resistance, high strength, high modulus of elasticity, low coefficient of thermal expansion, high red hardness and stable chemical properties.

Classification of Grain Size of Cemented Carbide (ISO4499-2-2008)

Category	Grain size of WC(μm)
Nano	＜0.2
Ultrafine	0.2～0.5
Submicron	0.5～0.8
Fine	0.8～1.3
Medium	1.3～2.5
Coarse	2.5～6.0
Extra coarse	＞6.0

Nano cemented carbide which means the WC grain size is less than 0.2 μm cemented carbide, nano cemented carbide has higher hardness and strength than normal cemented carbide, at the same time ,effectively solves the problem of ultra-high speed cutting of hard to machine materials such as superalloy, titanium alloy, composite material, hardened steel, etc., greatly improves the machining efficiency, and is the preferred tools material in the aerospace field and high-end equipment manufacturing industry.

Extra coarse-grained cemented carbide is a kind of cemented carbide with WC grain size larger than 6μm, compared with coarse grained cemented carbide, it has better toughness, thermal fatigue resistance and higher wear resistance. It is widely used in shield, mining, stamping die, cold heading die, roll and other industries under extreme working conditions, and the product reliability is greatly improved.



SEM micrograph of extra coarse grained cemented carbide (2000X)

Company Introduction

TECHNICAL ADVANTAGES

R & D Team

Academician Huang Boyun is the chief scientist, relying on the Central South University, and in combination with the premium customer WOLF group in Germany, the largest shield equipment manufacturer in China, China railway construction heavy industry group, and the first industrial Internet in China Brand Foxconn industrial Internet Co., Ltd. consists of a strong interdisciplinary R & D team.

Company Introduction

TECHNICAL ADVANTAGES

Ultrafine / Nano Cemented Carbide

Since 2002, Boyun-Dongfang has been cooperating with Central South University to continuously carry out the research and development and preparation of ultra-fine / nano cemented carbide with the support of the National Innovation Fund for small and medium-sized science and technology enterprises and the national high-tech research and development plan-(863 Program).

Extra Coarse-Grained Cemented Carbide

The company developed the extra coarse-grained cemented carbide with WC grain size greater than 9μm has better toughness, better thermal fatigue resistance and higher wear resistance than the traditional extra coarse-grained cemented carbide. It is widely used in shield, mining, stamping die, cold upsetting die, roll and other industries under extreme working conditions, and the product reliability is greatly improved.

Have independent intellectual property rights and advanced self-activation high temperature reduction high temperature carbonization extra coarse-grained tungsten carbide powder preparation technology.

Company Introduction

DEVELOPMENT HISTORY

Established in 1994

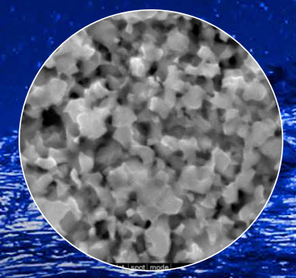
IN 2003
0.4μm

IN 2008
0.3μm

IN 2016
The company developed the grain size less than 0.2μm.

IN 2018

IN 2019



SEM Image of Nano Size Carbide(30000X)

Ultrafine / Nano Cemented Carbide development history

TECHNICAL ADVANTAGES

Coating

Coating technology reaches the international leading level

- Unique droplet suppression
- Unique decorating process
- High Adhesion
- Precise Control of Thickness, With Guaranteed Accuracy
- High Wear Resistance

We are the strategic partner of eifeler and wolf in China

We are eifeler's demonstration plant in China

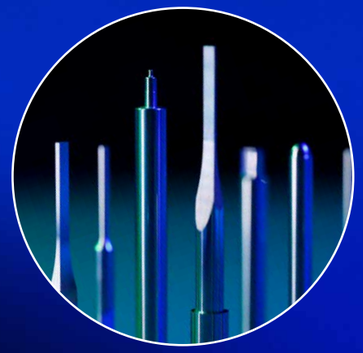
Our coating products have the same performance level as Germany

Company Introduction

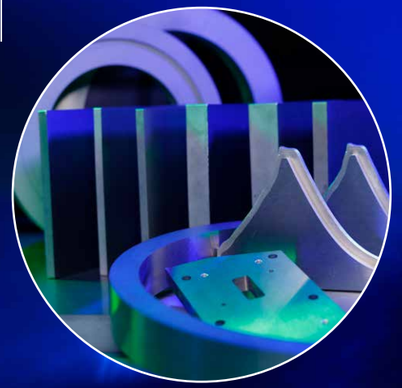
MAIN BUSINESS

The main business is the R & D, producing and sales of high-performance cemented carbide products. The main products are high-performance ultra-fine / nano cemented carbide rods, high-performance cemented carbide mold materials, high-performance extra coarse grain size cemented carbide in engineering and mining, refined and deep processed cemented carbide products (parts / components), etc. Our products are widely used in aerospace, automobile, metallurgy, engineering & mining, microelectronics and other industrial fields, and have been well known by our customers.

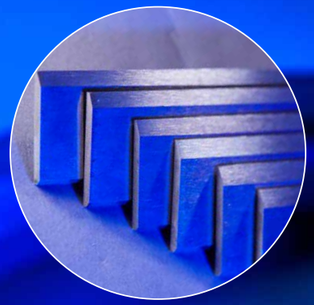
Coating



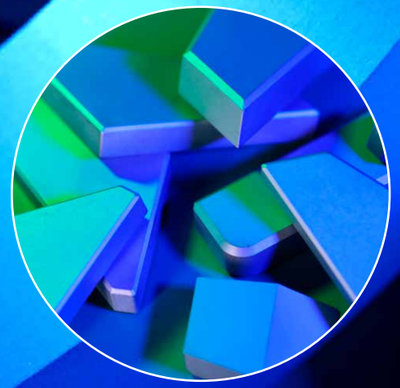
Finished Products



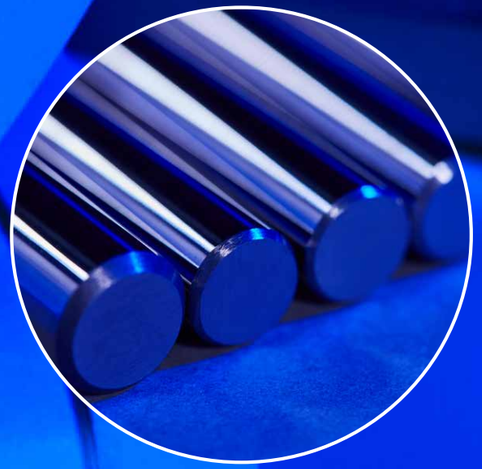
Molds



Special Tools



Shield Cutter



Rods

MAIN GRADE INTRODUCTION OF RODS

Main Grade Introduction of Rods

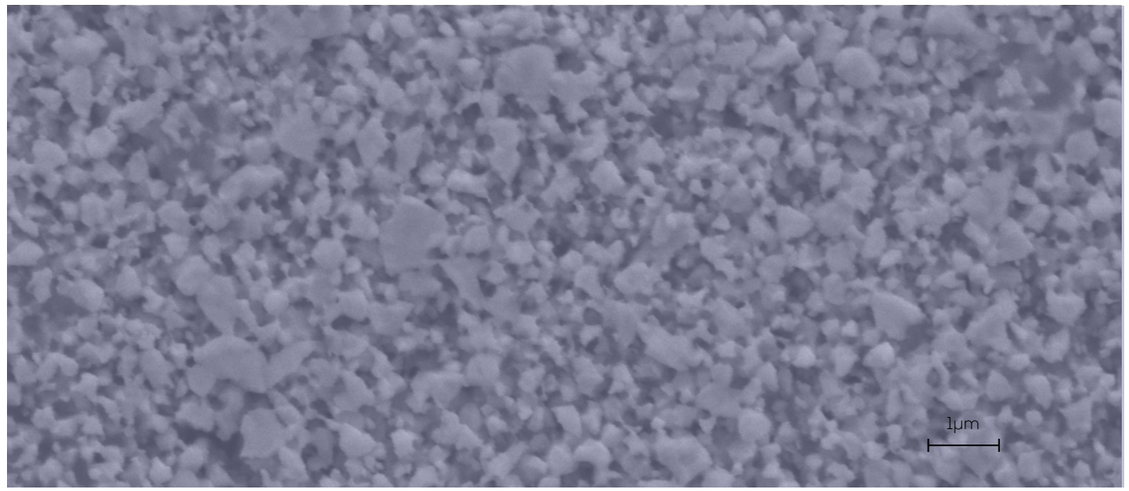
Grade Introduction of Rods

Grade	Co	Grain Size of WC	Hardness		Density	Flexural Strength	Fracture Toughness	Elastic Modulus	Coefficient of Thermal Expansion
	Co%		HRA	HV_{30}	g/cm³	MPa	$MNm^{-3/2}$	GPa	10^{-6}/℃
ST10F	6	Sub-Micron	92.9	1840	14.8	3800	10	530	4.9
ST10UF	6	Ultra-fine	93.8	2040	14.7	3200	9	530	4.9
ST10NF	6	Nano	94.5	2180	14.6	4000	9	530	4.9
ST10C	7	Fine	90.7	1480	14.7	3800	12	520	5.0
ST11F	8	Sub-Micron	92.3	1720	14.6	4100	10	510	5.1
ST11UF	8	Ultra-fine	93.5	1960	14.5	3000	9	510	5.1
ST12F	9	Ultra-fine	93.5	1960	14.4	4500	10	500	5.3
ST12NF	9	Nano	94.2	2100	14.3	4800	9	500	5.3
ST15D	9	Sub-Micron	91.2	1520	14.4	4000	13	500	5.3
ST15F	10	Sub-Micron	92.0	1670	14.3	4000	11	490	5.4
ST20F	10	Sub-Micron	91.7	1620	14.4	4300	11	490	5.4
ST20D	10	Sub-Micron	92.0	1670	14.3	4500	11	490	5.4
ST25F	12	Ultra-fine	92.4	1740	14.1	5100	10	470	5.7
ST25EF	12	Ultra-fine	92.2	1700	14.1	4800	10	470	5.7
ST25D	12	Ultra-fine	91.5	1570	14.2	4200	13	470	5.7
ST37NF	15	Nano	92.0	1670	13.8	4800	10	430	6.3

Date reported in the table are averaged

Values which maybe under change without notice.

Grade ST12F SEM Of Nano Size Carbide



Cemented Carbide Selection Guide

Cemented Carbide Selection Guide

Material	Processing method	Grade
Steel,Alloy Ateel,Cast Steel	Rough Milling	ST20F/ST11F
Steel,Alloy Ateel,Cast Steel	Finish milling	ST20F/ST25EF
Steel,Alloy Ateel,Cast Steel	Drilling	ST15F/ST15D
Steel,Alloy Ateel,Cast Steel	Reaming	ST11F/ST12F/ST25F
Cast Iron	Rough Milling	ST11F/ST20F
Cast Iron	Finish milling	ST10F
Cast Iron	Drilling	ST20F/ST15F
Cast Iron	Reaming	ST11F
High Hardness Steel	Rough Milling	ST12F/ST25F
High Hardness Steel	Finish milling	ST12F/ST12NF
High Hardness Steel	Drilling	ST12F
Stainless Steel	Rough Milling	ST15D/ST25EF/ST25D
Stainless Steel	Finish milling	ST25F/ST12F/ST15D/ST25D
Stainless Steel	Drilling	ST15F
Stainless Steel	Reaming	ST15F/ST11F
Titanium alloy High temperature alloy	Rough Milling	ST25EF/ST25F
Titanium alloy High temperature alloy	Finish milling	ST25F/ST12F
Titanium alloy High temperature alloy	Drilling	ST15F
Titanium alloy High temperature alloy	Reaming	ST15F/ST25F/ST11F
Aluminum Alloy, Copper Alloy	Rough Milling	ST11F/ST10F
Aluminum Alloy, Copper Alloy	Finish milling	ST10UF
Aluminum Alloy, Copper Alloy	Drilling	ST11F/ST15F
Aluminum Alloy, Copper Alloy	Reaming	ST11F
Plastic Composite	Rough Milling	ST10UF/ST10NF
Plastic Composite	Finish milling	ST10UF/ST10NF/ST12NF
Plastic Composite	Drilling	ST11F/ST15F/ST12NF
Diamond coating		ST10C

Note:

The above is our recommended reference grade for different materials,

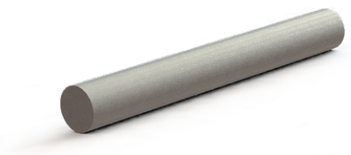
Grade application recommendation data is for reference only.

OUR PRODUCT

C A R B I D E

SOLID RODS

Unground Carbide Rods

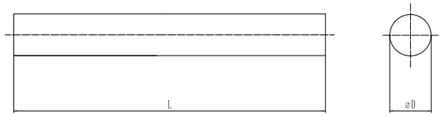


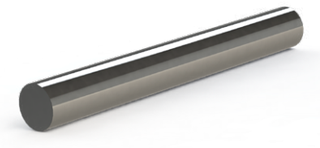
Unground Carbide Rods -310/330mm

Diameter		Leng		Grade						
D(mm)	Tolerance	L(mm)	Tolerance	ST20F	ST25F	ST15F	ST15D	ST11F	ST12F	ST12NF
1.5	+0.2～+0.4	310/330	+2.0～+6.0	○	○	○	○	○	○	○
2.0	+0.2～+0.4	310/330	+2.0～+6.0	○	○	○	○	○	○	○
2.5	+0.2～+0.4	310/330	+2.0～+6.0	○	○	○	○	○	○	○
3.0	+0.2～+0.4	310/330	+2.0～+6.0	●	●	●	●	●	●	●
3.5	+0.2～+0.4	310/330	+2.0～+6.0	○	○	○	○	○	○	○
4.0	+0.2～+0.4	310/330	+2.0～+6.0	●	●	●	●	●	●	●
4.5	+0.2～+0.4	310/330	+2.0～+6.0	○	○	○	○	○	○	○
5.0	+0.2～+0.4	310/330	+2.0～+6.0	●	●	●	●	●	●	●
5.5	+0.2～+0.4	310/330	+2.0～+6.0	○	○	○	○	○	○	○
6.0	+0.2～+0.4	310/330	+2.0～+6.0	●	●	●	●	●	●	●
6.5	+0.3～+0.55	310/330	+2.0～+6.0	○	○	○	○	○	○	○
7.0	+0.3～+0.55	310/330	+2.0～+6.0	●	●	●	●	●	●	●
7.5	+0.3～+0.55	310/330	+2.0～+6.0	○	○	○	○	○	○	○
8.0	+0.3～+0.55	310/330	+2.0～+6.0	●	●	●	●	●	●	●
8.5	+0.3～+0.55	310/330	+2.0～+6.0	○	○	○	○	○	○	○
9.0	+0.3～+0.55	310/330	+2.0～+6.0	●	●	●	●	●	●	●
9.5	+0.3～+0.55	310/330	+2.0～+6.0	○	○	○	○	○	○	○
10.0	+0.3～+0.55	310/330	+2.0～+6.0	●	●	●	●	●	●	●
10.5	+0.3～+0.55	310/330	+2.0～+6.0	○	○	○	○	○	○	○
11.0	+0.3～+0.55	310/330	+2.0～+6.0	●	●	●	●	●	●	●
12.0	+0.3～+0.55	310/330	+2.0～+6.0	●	●	●	●	●	●	●
13.0	+0.3～+0.65	310/330	+2.0～+6.0	●	●	●	●	●	●	●
14.0	+0.3～+0.65	310/330	+2.0～+6.0	●	●	●	●	●	●	●
15.0	+0.3～+0.65	310/330	+2.0～+6.0	●	●	●	●	●	●	●
16.0	+0.3～+0.65	310/330	+2.0～+6.0	●	●	●	●	●	●	●
17.0	+0.4～+0.8	310/330	+2.0～+6.0	●	●	●	●	●	●	●
18.0	+0.4～+0.8	310/330	+2.0～+6.0	●	●	●	●	●	●	●
19.0	+0.4～+0.8	310/330	+2.0～+6.0	●	●	●	●	●	●	●
20.0	+0.4～+0.8	310/330	+2.0～+6.0	●	●	●	●	●	●	●
21.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
22.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
23.0	+0.5～+0.9	310/330	+2.0～+6.0	○	○	○	○	○	○	○
24.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
25.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
26.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
27.0	+0.5～+0.9	310/330	+2.0～+6.0	○	○	○	○	○	○	○
28.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
29.0	+0.5～+0.9	310/330	+2.0～+6.0	○	○	○	○	○	○	○
30.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●
32.0	+0.5～+0.9	310/330	+2.0～+6.0	●	●	●	●	●	●	●

●Stock ○Limited stork ◇Other grades and dimensions on request

Ground Carbide Rods



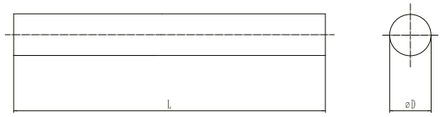


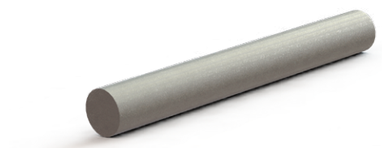
Ground Carbide Rods -310/330mm

Diameter		Leng		Grade						
D(mm)	Tolerance	L(mm)	Tolerance	ST20F	ST25F	ST15F	ST15D	ST11F	ST12F	ST12NF
1.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
2.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
2.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
3.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
3.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
4.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
4.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
5.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
5.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
6.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
6.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
7.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
7.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
8.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
8.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
9.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
9.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
10.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
10.5	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
11.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
12.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
13.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
14.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
15.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
16.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
17.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
18.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
19.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
20.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
21.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
22.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
23.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
24.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
25.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
26.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
27.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
28.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
29.0	h5	310/330	+2.0～+6.0	○	○	○	○	○	○	○
30.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●
32.0	h5	310/330	+2.0～+6.0	●	●	●	●	●	●	●

●Stock ○Limited stork ◇Other grades and dimensions on request

Unground Fixed Length Carbide Rods



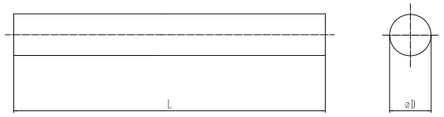


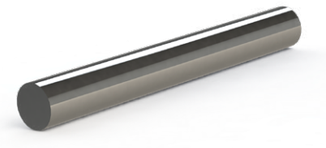
Unground Fixed Length Carbide Rods

Diameter		Length		Grade		
D(mm)	Tolerance	L(mm)	Tolerance	ST20F	ST25F	ST12F
3.0	+0.2～+0.4	40	+0.5～+1.0	○	○	○
3.0	+0.2～+0.4	50	+0.5～+1.0	●	●	●
3.0	+0.2～+0.4	75	+0.5～+1.0	●	●	●
3.0	+0.2～+0.4	100	+0.5～+1.0	●	●	●
4.0	+0.2～+0.4	50	+0.5～+1.0	●	●	●
4.0	+0.2～+0.4	60	+0.5～+1.0	●	●	●
4.0	+0.2～+0.4	75	+0.5～+1.0	●	●	●
4.0	+0.2～+0.4	100	+0.5～+1.0	●	●	●
5.0	+0.2～+0.4	50	+0.5～+1.0	●	●	●
5.0	+0.2～+0.4	60	+0.5～+1.0	●	●	●
5.0	+0.2～+0.4	75	+0.5～+1.0	●	●	●
5.0	+0.2～+0.4	100	+0.5～+1.0	●	●	●
6.0	+0.2～+0.4	50	+0.5～+1.0	●	●	●
6.0	+0.2～+0.4	60	+0.5～+1.0	●	●	●
6.0	+0.2～+0.4	75	+0.5～+1.0	●	●	●
6.0	+0.2～+0.4	80	+0.5～+1.0	●	●	●
6.0	+0.2～+0.4	100	+0.5～+1.0	●	●	●
6.0	+0.2～+0.4	150	+0.5～+1.0	●	●	●
8.0	+0.3～+0.55	60	+0.5～+1.0	●	●	●
8.0	+0.3～+0.55	75	+0.5～+1.0	●	●	●
8.0	+0.3～+0.55	80	+0.5～+1.0	●	●	●
8.0	+0.3～+0.55	100	+0.5～+1.0	●	●	●
8.0	+0.3～+0.55	150	+0.5～+1.0	●	●	●
10.0	+0.3～+0.55	75	+0.5～+1.0	●	●	●
10.0	+0.3～+0.55	100	+0.5～+1.0	●	●	●
10.0	+0.3～+0.55	150	+0.5～+1.0	●	●	●
12.0	+0.3～+0.55	75	+0.5～+1.0	●	●	●
12.0	+0.3～+0.55	100	+0.5～+1.0	●	●	●
12.0	+0.3～+0.55	150	+0.5～+1.0	●	●	●
14.0	+0.3～+0.65	100	+0.5～+1.0	●	●	●
14.0	+0.3～+0.65	150	+0.5～+1.0	●	●	●
16.0	+0.3～+0.65	92	+0.5～+1.0	○	○	○
16.0	+0.3～+0.65	100	+0.5～+1.0	●	●	●
16.0	+0.3～+0.65	150	+0.5～+1.0	●	●	●
18.0	+0.4～+0.8	100	+0.5～+1.0	●	●	●
18.0	+0.4～+0.8	150	+0.5～+1.0	●	●	●
20.0	+0.4～+0.8	100	+0.5～+1.0	●	●	●
20.0	+0.4～+0.8	150	+0.5～+1.0	●	●	●

●Stock ○Limited stork ◇Other grades and dimensions on request

Ground Fixed Length Carbide Rods



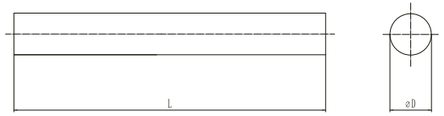


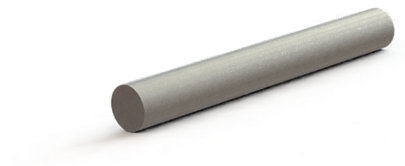
Ground Fixed Length Carbide Rods

Diameter		Length	Grade		
D(mm)	Tolerance	L(mm)	ST20F	ST25F	ST12F
3.0	h5/h4	40	○	○	○
3.0	h5/h4	50	●	●	●
3.0	h5/h4	52	○	○	○
3.0	h5/h4	75	●	●	●
3.0	h5/h4	100	●	●	●
4.0	h5/h4	50	●	●	●
4.0	h5/h4	60	●	●	●
4.0	h5/h4	75	●	●	●
4.0	h5/h4	100	●	●	●
5.0	h5/h4	50	●	●	●
5.0	h5/h4	51	○	○	○
5.0	h5/h4	60	○	○	○
5.0	h5/h4	75	●	●	●
5.0	h5/h4	100	●	●	●
6.0	h5/h4	50	●	●	●
6.0	h5/h4	51	○	○	○
6.0	h5/h4	55	○	○	○
6.0	h5/h4	60	●	●	●
6.0	h5/h4	63	○	○	○
6.0	h5/h4	75	●	●	●
6.0	h5/h4	80	○	○	○
6.0	h5/h4	100	●	●	●
6.0	h5/h4	150	●	●	●
8.0	h5/h4	60	○	○	○
8.0	h5/h4	64	●	●	●
8.0	h5/h4	75	●	●	●
8.0	h5/h4	80	●	●	●
8.0	h5/h4	100	●	●	●
8.0	h5/h4	150	●	●	●
10.0	h5/h4	67	○	○	○
10.0	h5/h4	73	○	○	○
10.0	h5/h4	75	●	●	●
10.0	h5/h4	100	●	●	●
10.0	h5/h4	150	●	●	●
12.0	h5/h4	74	○	○	○
12.0	h5/h4	75	●	●	●
12.0	h5/h4	84	○	○	○
12.0	h5/h4	100	●	●	●
12.0	h5/h4	150	○	○	○
14.0	h5/h4	84	○	○	○
14.0	h5/h4	100	●	●	●
14.0	h5/h4	101	○	○	○
14.0	h5/h4	150	●	●	●
16.0	h5/h4	83	○	○	○
16.0	h5/h4	92.3	○	○	○
16.0	h5/h4	100	●	●	●
16.0	h5/h4	150	○	○	○
16.0	h5/h4	93.3	○	○	○
18.0	h5/h4	100	●	●	●
18.0	h5/h4	150	●	●	●
20.0	h5/h4	93.3	○	○	○
20.0	h5/h4	100	○	○	○
20.0	h5/h4	105.3	○	○	○
20.0	h5/h4	150	●	●	●

●Stock ○Limited stork ◇Other grades and dimensions on request

Unground Fixed Length Carbide Rods - Inch





Unground Carbide Rods - Inch

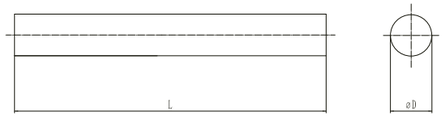
Diameter		Length		Grade		
D(inch)	Tolerance	L(inch)	Tolerance	ST20F	ST25F	ST12F
1/8	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
3/16	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
1/4	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
5/16	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
3/8	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
7/16	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
1/2	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
9/16	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
5/8	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
11/16	+0.015～+0.030	13-1/14	+0.08～+0.24	○	○	○
3/4	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
7/8	+0.01～+0.02	13-1/14	+0.08～+0.24	○	○	○
15/16	+0.015～+0.030	13-1/14	+0.08～+0.24	○	○	○
1	+0.015～+0.030	13-1/14	+0.08～+0.24	○	○	○

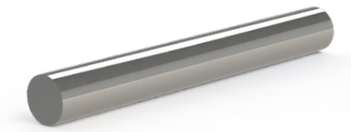
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Fixed Length Carbide Rods - Inch





Ground Carbide Rods - Inch

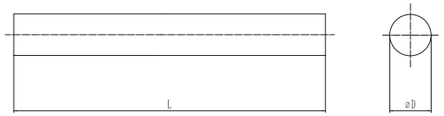
Diameter		Length		Grade		
D(inch)	Tolerance	L(inch)	Tolerance	ST20F	ST25F	ST12F
1/8	h5	13-1/14	+0.08～+0.24	○	○	○
3/16	h5	13-1/14	+0.08～+0.24	○	○	○
1/4	h5	13-1/14	+0.08～+0.24	○	○	○
5/16	h5	13-1/14	+0.08～+0.24	○	○	○
3/8	h5	13-1/14	+0.08～+0.24	○	○	○
7/16	h5	13-1/14	+0.08～+0.24	○	○	○
1/2	h5	13-1/14	+0.08～+0.24	○	○	○
9/16	h5	13-1/14	+0.08～+0.24	○	○	○
5/8	h5	13-1/14	+0.08～+0.24	○	○	○
11/16	h5	13-1/14	+0.08～+0.24	○	○	○
3/4	h5	13-1/14	+0.08～+0.24	○	○	○
7/8	h5	13-1/14	+0.08～+0.24	○	○	○
15/16	h5	13-1/14	+0.08～+0.24	○	○	○
1	h5	13-1/14	+0.08～+0.24	○	○	○

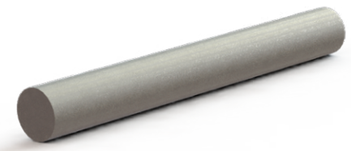
●Stock

○Limited stork

◇Other grades and dimensions on request

Unground Fixed Length Carbide Rods - Inch





Unground Fixed Length Carbide Rods - Inch

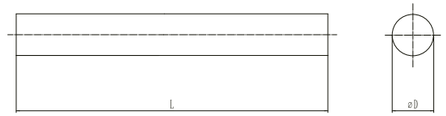
Diameter		Length		Grade		
D(inch)	Tolerance	L(inch)	Tolerance	ST20F	ST25F	ST12F
1/8	+0.005～+0.01	1-1/2	+0.02～+0.04	○	○	○
1/8	+0.005～+0.01	2	+0.02～+0.04	○	○	○
1/8	+0.005～+0.01	2-1/2	+0.02～+0.04	○	○	○
1/8	+0.005～+0.01	3	+0.02～+0.04	○	○	○
3/16	+0.005～+0.01	2	+0.02～+0.04	○	○	○
3/16	+0.005～+0.01	3	+0.02～+0.04	○	○	○
1/4	+0.005～+0.01	2	+0.02～+0.04	○	○	○
1/4	+0.005～+0.01	2-1/2	+0.02～+0.04	○	○	○
1/4	+0.005～+0.01	3	+0.02～+0.04	○	○	○
1/4	+0.01～+0.02	4	+0.02～+0.04	○	○	○
5/16	+0.005～+0.01	2-1/2	+0.02～+0.04	○	○	○
3/8	+0.005～+0.01	2-1/2	+0.02～+0.04	○	○	○
3/8	+0.005～+0.01	3	+0.02～+0.04	○	○	○
1/2	+0.005～+0.01	2-1/2	+0.02～+0.04	○	○	○
1/2	+0.005～+0.01	3	+0.02～+0.04	○	○	○
1/2	+0.01～+0.02	4	+0.02～+0.04	○	○	○
5/8	+0.005～+0.01	3-1/2	+0.02～+0.04	○	○	○
3/4	+0.01～+0.02	4	+0.02～+0.04	○	○	○
3/4	+0.01～+0.02	5	+0.02～+0.04	○	○	○
1	+0.01～+0.02	4	+0.02～+0.04	○	○	○

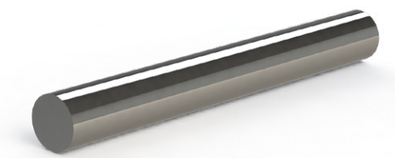
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Fixed Length Carbide Rods - Inch





Ground Fixed Length Carbide Rods - Inch

Diameter		Length	Grade		
D(inch)	Tolerance	L(inch)	ST20F	ST25F	ST12F
1/8	h5/h4	1-1/2	○	○	○
1/8	h5/h4	2	○	○	○
1/8	h5/h4	2-1/2	○	○	○
1/8	h5/h4	3	○	○	○
3/16	h5/h4	2	○	○	○
3/16	h5/h4	3	○	○	○
1/4	h5/h4	2	○	○	○
1/4	h5/h4	2-1/2	○	○	○
1/4	h5/h4	3	○	○	○
1/4	h5/h4	4	○	○	○
5/16	h5/h4	2-1/2	○	○	○
3/8	h5/h4	2-1/2	○	○	○
3/8	h5/h4	3	○	○	○
1/2	h5/h4	2-1/2	○	○	○
1/2	h5/h4	3	○	○	○
1/2	h5/h4	4	○	○	○
5/8	h5/h4	3-1/2	○	○	○
3/4	h5/h4	4	○	○	○
3/4	h5/h4	5	○	○	○
1	h5/h4	4	○	○	○

●Stock

○Limited stork

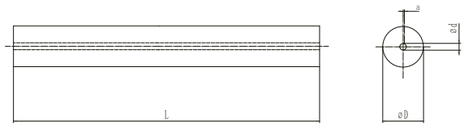
◇Other grades and dimensions on request

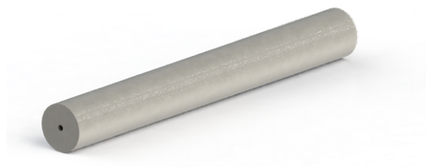
OUR PRODUCT

C A R B I D E

RODS WITH COOLANT HOLES

Unground Rods with 1 Straight Coolant Hole





Unground Rods with 1 Straight Coolant Hole

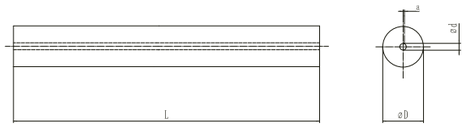
Diameter		Length		Hole Spac		amax(mm)	Grade	
D(mm)	Tolerance	L(mm)	Tolerance	d(mm)	Tolerance		ST20F	ST15D
4.0	+0.20～+0.40	330	+2.0～+6.0	0.60	±0.10	0.10	●	●
6.0	+0.20～+0.40	330	+2.0～+6.0	1.00	±0.15	0.15	●	●
8.0	+0.30～+0.55	330	+2.0～+6.0	1.30	±0.15	0.15	●	●
10.0	+0.30～+0.55	330	+2.0～+6.0	2.00	±0.15	0.20	●	●
12.0	+0.30～+0.55	330	+2.0～+6.0	2.00	±0.15	0.30	●	●
12.0	+0.30～+0.55	330	+2.0～+6.0	3.00	±0.15	0.30	●	●
13.0	+0.30～+0.65	330	+2.0～+6.0	2.00	±0.15	0.34	●	●
14.0	+0.30～+0.65	330	+2.0～+6.0	2.00	±0.15	0.37	●	●
14.0	+0.30～+0.65	330	+2.0～+6.0	3.00	±0.15	0.37	●	●
16.0	+0.30～+0.65	330	+2.0～+6.0	2.00	±0.2	0.40	●	●
16.0	+0.30～+0.65	330	+2.0～+6.0	3.00	±0.2	0.40	●	●
18.0	+0.40～+0.80	330	+2.0～+6.0	3.00	±0.2	0.50	●	●
20.0	+0.40～+0.80	330	+2.0～+6.0	2.00	±0.25	0.50	●	●
20.0	+0.40～+0.80	330	+2.0～+6.0	3.00	±0.25	0.50	●	●
22.0	+0.50～+0.90	330	+2.0～+6.0	3.00	±0.25	0.50	●	●
24.0	+0.50～+0.90	330	+2.0～+6.0	4.00	±0.25	0.50	○	○
25.0	+0.50～+0.90	330	+2.0～+6.0	4.00	±0.25	0.50	○	○
28.0	+0.50～+0.90	330	+2.0～+6.0	4.00	±0.25	0.50	○	○
30.0	+0.50～+0.90	330	+2.0～+6.0	5.00	±0.25	0.50	○	○
32.0	+0.50～+0.90	330	+2.0～+6.0	5.00	±0.25	0.50	○	○

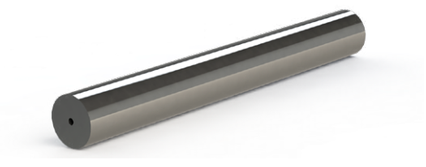
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Rods with 1 Straight Coolant Hole





Ground Rods with 1 Straight Coolant Hole

Diameter		Length		Hole Spac		amax(mm)	Grade	
D(mm)	Tolerance	L(mm)	Tolerance	d(mm)	Tolerance		ST20F	ST15D
4.0	h5	330	+2.0～+6.0	0.60	±0.10	0.10	●	○
6.0	h5	330	+2.0～+6.0	1.00	±0.15	0.15	●	○
8.0	h5	330	+2.0～+6.0	1.30	±0.15	0.15	●	○
10.0	h5	330	+2.0～+6.0	2.00	±0.15	0.20	●	○
12.0	h5	330	+2.0～+6.0	2.00	±0.15	0.30	●	○
12.0	h5	330	+2.0～+6.0	3.00	±0.15	0.30	●	○
13.0	h5	330	+2.0～+6.0	2.00	±0.15	0.34	●	○
14.0	h5	330	+2.0～+6.0	2.00	±0.15	0.37	●	○
14.0	h5	330	+2.0～+6.0	3.00	±0.15	0.37	●	○
16.0	h5	330	+2.0～+6.0	2.00	±0.2	0.40	●	○
16.0	h5	330	+2.0～+6.0	3.00	±0.2	0.40	●	○
18.0	h5	330	+2.0～+6.0	3.00	±0.2	0.50	●	○
20.0	h5	330	+2.0～+6.0	2.00	±0.25	0.50	●	○
20.0	h5	330	+2.0～+6.0	3.00	±0.25	0.50	●	○
22.0	h5	330	+2.0～+6.0	3.00	±0.25	0.50	●	○
24.0	h5	330	+2.0～+6.0	4.00	±0.25	0.50	○	○
25.0	h5	330	+2.0～+6.0	4.00	±0.25	0.50	○	○
28.0	h5	330	+2.0～+6.0	4.00	±0.25	0.50	○	○
30.0	h5	330	+2.0～+6.0	5.00	±0.25	0.50	○	○
32.0	h5	330	+2.0～+6.0	5.00	±0.25	0.50	○	○

●Stock

○Limited stork

◇Other grades and dimensions on request

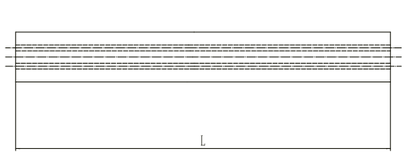
OUR PRODUCT

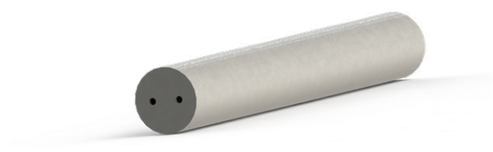
C A R B I D E

RODS WITH TWO STRAIGHT
COOLANT HOLES

RODS WITH TWO SPRIAL
COOLANT HOLES

Unground Rods with 2 Straight Coolant Holes



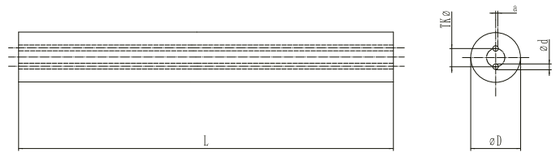


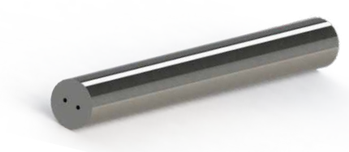
Unground Rods with 2 Straight Coolant Holes

Diameter		Length		Hole Spacing		Hole sizeH		amax(mm)	Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Toler-ance		ST20F	ST15D
4.0	+0.2～+0.4	330	+2.0～+6.0	1.80	+0/-0.15	0.80	±0.10	0.10	○	○
5.0	+0.2～+0.4	330	+2.0～+6.0	2.00	+0/-0.15	0.80	±0.10	0.13	○	○
6.0	+0.2～+0.4	330	+2.0～+6.0	1.50	+0/-0.20	0.90	±0.10	0.15	○	○
6.0	+0.2～+0.4	330	+2.0～+6.0	3.00	+0/-0.20	1.00	±0.10	0.15	○	○
7.0	+0.3～+0.55	330	+2.0～+6.0	3.50	+0/-0.20	1.00	±0.15	0.15	○	○
8.0	+0.3～+0.55	330	+2.0～+6.0	2.60	+0/-0.30	1.00	±0.10	0.15	○	○
8.0	+0.3～+0.55	330	+2.0～+6.0	4.00	+0/-0.30	1.00	±0.15	0.15	○	○
9.0	+0.3～+0.55	330	+2.0～+6.0	4.00	+0/-0.30	1.40	±0.10	0.20	○	○
10.0	+0.3～+0.55	330	+2.0～+6.0	3.50	+0/-0.30	1.20	±0.10	0.20	○	○
10.0	+0.3～+0.55	330	+2.0～+6.0	5.00	+0/-0.30	1.40	±0.15	0.20	○	○
11.0	+0.3～+0.55	330	+2.0～+6.0	5.00	+0/-0.30	1.40	±0.15	0.28	○	○
12.0	+0.3～+0.55	330	+2.0～+6.0	3.50	+0/-0.30	1.20	±0.15	0.30	○	○
12.0	+0.3～+0.55	330	+2.0～+6.0	6.00	+0/-0.30	1.75	±0.15	0.30	○	○
13.0	+0.3～+0.65	330	+2.0～+6.0	6.00	+0/-0.30	1.75	±0.15	0.34	○	○
14.0	+0.3～+0.65	330	+2.0～+6.0	5.00	+0/-0.30	1.50	±0.15	0.37	○	○
14.0	+0.3～+0.65	330	+2.0～+6.0	7.00	+0/-0.30	1.75	±0.15	0.37	○	○
15.0	+0.3～+0.65	330	+2.0～+6.0	7.00	+0/-0.30	2.00	±0.15	0.40	○	○
16.0	+0.3～+0.65	330	+2.0～+6.0	5.00	+0/-0.30	1.50	±0.15	0.40	○	○
16.0	+0.3～+0.65	330	+2.0～+6.0	8.00	+0/-0.30	2.00	±0.20	0.40	○	○
17.0	+0.4～+0.80	330	+2.0～+6.0	8.00	+0/-0.30	2.00	±0.20	0.47	○	○
18.0	+0.4～+0.80	330	+2.0～+6.0	9.00	+0/-0.30	2.00	±0.20	0.50	○	○
19.0	+0.4～+0.80	330	+2.0～+6.0	9.00	+0/-0.30	2.00	±0.20	0.50	○	○
20.0	+0.4～+0.80	330	+2.0～+6.0	10.00	+0/-0.40	2.50	±0.25	0.50	○	○
21.0	+0.5～+0.90	330	+2.0～+6.0	10.00	+0/-0.40	2.50	±0.25	0.50	○	○
22.0	+0.5～+0.90	330	+2.0～+6.0	11.00	+0/-0.40	2.50	±0.25	0.50	○	○
23.0	+0.5～+0.90	330	+2.0～+6.0	11.00	+0/-0.40	2.50	±0.25	0.50	○	○
24.0	+0.5～+0.90	330	+2.0～+6.0	12.00	+0/-0.50	3.00	±0.25	0.50	○	○
25.0	+0.5～+0.90	330	+2.0～+6.0	12.00	+0/-0.50	3.00	±0.25	0.50	○	○
28.0	+0.5～+0.90	330	+2.0～+6.0	14.00	+0/-0.50	3.00	±0.25	0.50	○	○
30.0	+0.5～+0.90	330	+2.0～+6.0	14.00	+0/-0.50	3.00	±0.25	0.50	○	○
32.0	+0.5～+0.90	330	+2.0～+6.0	14.00	+0/-0.50	3.00	±0.25	0.50	○	○

●Stock ○Limited stork ◇Other grades and dimensions on request

Ground Rods with 2 Straight Coolant Holes



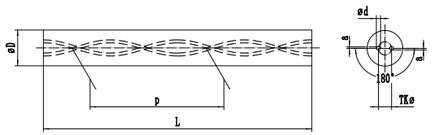


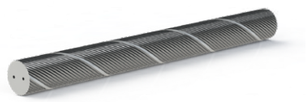
Ground Rods with 2 Straight Coolant Holes

Diameter		Length		Hole Spacing		Hole sizeH		amax(mm)	Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Tolerance		ST20F	ST15D
4.0	h5	330	+2.0～+6.0	1.80	+0/-0.15	0.80	±0.10	0.10	○	○
5.0	h5	330	+2.0～+6.0	2.00	+0/-0.15	0.80	±0.10	0.13	○	○
6.0	h5	330	+2.0～+6.0	1.50	+0/-0.20	0.90	±0.10	0.15	○	○
6.0	h5	330	+2.0～+6.0	3.00	+0/-0.20	1.00	±0.10	0.15	○	○
7.0	h5	330	+2.0～+6.0	3.50	+0/-0.20	1.00	±0.15	0.15	○	○
8.0	h5	330	+2.0～+6.0	2.60	+0/-0.30	1.00	±0.10	0.15	○	○
8.0	h5	330	+2.0～+6.0	4.00	+0/-0.30	1.00	±0.15	0.15	○	○
9.0	h5	330	+2.0～+6.0	4.00	+0/-0.30	1.40	±0.10	0.20	○	○
10.0	h5	330	+2.0～+6.0	3.50	+0/-0.30	1.20	±0.10	0.20	○	○
10.0	h5	330	+2.0～+6.0	5.00	+0/-0.30	1.40	±0.15	0.20	○	○
11.0	h5	330	+2.0～+6.0	5.00	+0/-0.30	1.40	±0.15	0.28	○	○
12.0	h5	330	+2.0～+6.0	3.50	+0/-0.30	1.20	±0.15	0.30	○	○
12.0	h5	330	+2.0～+6.0	6.00	+0/-0.30	1.75	±0.15	0.30	○	○
13.0	h5	330	+2.0～+6.0	6.00	+0/-0.30	1.75	±0.15	0.34	○	○
14.0	h5	330	+2.0～+6.0	5.00	+0/-0.30	1.50	±0.15	0.37	○	○
14.0	h5	330	+2.0～+6.0	7.00	+0/-0.30	1.75	±0.15	0.37	○	○
15.0	h5	330	+2.0～+6.0	7.00	+0/-0.30	2.00	±0.15	0.40	○	○
16.0	h5	330	+2.0～+6.0	5.00	+0/-0.30	1.50	±0.15	0.40	○	○
16.0	h5	330	+2.0～+6.0	8.00	+0/-0.30	2.00	±0.20	0.40	○	○
17.0	h5	330	+2.0～+6.0	8.00	+0/-0.30	2.00	±0.20	0.47	○	○
18.0	h5	330	+2.0～+6.0	9.00	+0/-0.30	2.00	±0.20	0.50	○	○
19.0	h5	330	+2.0～+6.0	9.00	+0/-0.30	2.00	±0.20	0.50	○	○
20.0	h5	330	+2.0～+6.0	10.00	+0/-0.40	2.50	±0.25	0.50	○	○
21.0	h5	330	+2.0～+6.0	10.00	+0/-0.40	2.50	±0.25	0.50	○	○
22.0	h5	330	+2.0～+6.0	11.00	+0/-0.40	2.50	±0.25	0.50	○	○
23.0	h5	330	+2.0～+6.0	11.00	+0/-0.40	2.50	±0.25	0.50	○	○
24.0	h5	330	+2.0～+6.0	12.00	+0/-0.50	3.00	±0.25	0.50	○	○
25.0	h5	330	+2.0～+6.0	12.00	+0/-0.50	3.00	±0.25	0.50	○	○
28.0	h5	330	+2.0～+6.0	14.00	+0/-0.50	3.00	±0.25	0.50	○	○
30.0	h5	330	+2.0～+6.0	14.00	+0/-0.50	3.00	±0.25	0.50	○	○
32.0	h5	330	+2.0～+6.0	14.00	+0/-0.50	3.00	±0.25	0.50	○	○

●Stock ○Limited stork ◇Other grades and dimensions on request

Unground Rods with 2 Helix Coolant Holes 30°





Unground Rods with 2 Helix Coolant Holes 30°

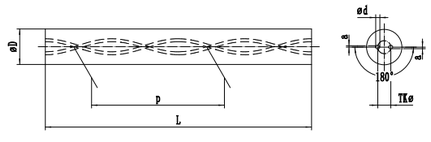
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Tolerance	"P (±0.5°)"	αmax(mm)	ST20F	ST15D
4.3	+0.7/+1.1	330	+2.0～+6.0	2.20	+0/-0.20	0.60	±0.10	21.77 -0.43/+0.45	0.10	●	●
5.3	+0.7/+1.1	330	+0.0～+5.0	2.60	+0/-0.40	0.70	±0.10	27.21 -0.54/+0.56	0.13	○	○
6.3	+0.9/+1.3	330	+2.0～+6.0	1.90	+0/-0.20	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.3	+0.9/+1.3	330	+2.0～+6.0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	●	●
7.3	+0.9/+1.3	330	+2.0～+6.0	3.70	+0/-0.40	1.00	±0.15	38.09 -0.76/+0.78	0.15	○	○
8.3	+0.9/+1.3	330	+2.0～+6.0	3.30	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	○	○
8.3	+0.9/+1.3	330	+2.0～+6.0	4.00	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	●	●
9.3	+0.9/+1.3	330	+2.0～+6.0	4.80	+0/-0.60	1.40	±0.15	48.97 -0.97/+1.00	0.20	○	○
10.3	+0.9/+1.3	330	+2.0～+6.0	2.70	+0/-0.40	0.80	±0.10	54.41 -1.08/+1.11	0.20	○	○
10.3	+0.9/+1.3	330	+2.0～+6.0	4.80	+0/-0.60	1.40	±0.15	54.41 -1.08/+1.11	0.20	●	●
11.3	+0.9/+1.3	330	+2.0～+6.0	5.30	+0/-0.80	1.40	±0.15	59.86 -1.19/+1.22	0.28	●	●
12.3	+1.1/+1.5	330	+2.0～+6.0	3.70	+0/-0.40	1.00	±0.15	65.30 -1.30/+1.34	0.30	○	○
12.3	+1.1/+1.5	330	+2.0～+6.0	5.40	+0/-0.60	1.50	±0.15	65.30 -1.30/+1.34	0.30	○	○
12.3	+1.1/+1.5	330	+2.0～+6.0	6.25	+0/-0.80	1.40	±0.15	65.30 -1.30/+1.34	0.30	●	●
13.3	+1.1/+1.5	330	+2.0～+6.0	6.50	+0/-0.80	1.75	±0.20	70.74 -1.40/+1.45	0.34	●	●
14.3	+1.1/+1.5	330	+2.0～+6.0	4.80	+0/-0.60	1.30	±0.15	76.18 -1.51/+1.56	0.37	○	○
14.3	+1.1/+1.5	330	+2.0～+6.0	6.00	+0/-0.60	1.60	±0.20	76.18 -1.51/+1.56	0.37	○	○
14.3	+1.1/+1.5	330	+2.0～+6.0	7.10	+0/-0.80	1.75	±0.20	76.18 -1.51/+1.56	0.37	●	●
15.3	+1.1/+1.5	330	+2.0～+6.0	7.70	+0/-0.80	1.75	±0.20	81.62 -1.62/+1.67	0.40	●	●
16.3	+1.1/+1.5	330	+2.0～+6.0	4.90	+0/-0.60	1.40	±0.15	87.06 -1.73/+1.78	0.40	○	○
16.3	+1.1/+1.5	330	+2.0～+6.0	5.70	+0/-0.60	1.50	±0.15	87.06 -1.73/+1.78	0.40	○	○
16.3	+1.1/+1.5	330	+2.0～+6.0	8.30	+0/-0.80	1.75	±0.20	87.06 -1.73/+1.78	0.40	●	●
17.3	+1.1/+1.5	330	+2.0～+6.0	8.90	+0/-0.80	1.75	±0.20	92.50 -1.84/+1.89	0.47	●	●
18.3	+1.1/+1.5	330	+2.0～+6.0	6.30	+0/-0.80	1.70	±0.20	97.95 -1.94/+2.00	0.50	○	○
18.3	+1.1/+1.5	330	+2.0～+6.0	9.55	+0/-0.80	2.00	±0.25	97.95 -1.94/+2.00	0.50	●	●
19.3	+1.1/+1.5	330	+2.0～+6.0	10.10	+0/-0.80	2.00	±0.25	103.39 -2.05/+2.12	0.50	●	●
20.3	+1.1/+1.5	330	+2.0～+6.0	6.00	+0/-0.60	1.00	±0.15	108.83 -2.16/+2.23	0.50	○	○
20.3	+1.1/+1.5	330	+2.0～+6.0	10.40	+0/-1.00	2.00	±0.25	108.83 -2.16/+2.23	0.50	●	●

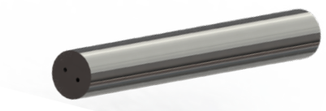
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Rods with 2 Helix Coolant Holes 30°





Ground Rods with 2 Helix Coolant Holes 30°

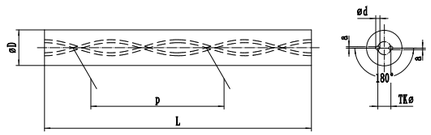
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Tolerance	"P (±0.5°)"	αmax(mm)	ST20F	ST15D
4.0	h5	330	+2.0～+6.0	2.20	+0/-0.20	0.60	±0.10	21.77 -0.43/+0.45	0.10	●	●
5.0	h5	330	+0.0～+5.0	2.60	+0/-0.40	0.70	±0.10	27.21 -0.54/+0.56	0.13	●	●
6.0	h5	330	+2.0～+6.0	1.90	+0/-0.20	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.0	h5	330	+2.0～+6.0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	●	●
7.0	h5	330	+2.0～+6.0	3.70	+0/-0.40	1.00	±0.15	38.09 -0.76/+0.78	0.15	●	●
8.0	h5	330	+2.0～+6.0	3.30	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	○	○
8.0	h5	330	+2.0～+6.0	4.00	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	●	●
9.0	h5	330	+2.0～+6.0	4.80	+0/-0.60	1.40	±0.15	48.97 -0.97/+1.00	0.20	●	●
10.0	h5	330	+2.0～+6.0	2.70	+0/-0.40	0.80	±0.10	54.41 -1.08/+1.11	0.20	○	○
10.0	h5	330	+2.0～+6.0	4.80	+0/-0.60	1.40	±0.15	54.41 -1.08/+1.11	0.20	●	●
11.0	h5	330	+2.0～+6.0	5.30	+0/-0.80	1.40	±0.15	59.86 -1.19/+1.22	0.28	●	●
12.0	h5	330	+2.0～+6.0	3.70	+0/-0.40	1.00	±0.15	65.30 -1.30/+1.34	0.30	○	○
12.0	h5	330	+2.0～+6.0	5.40	+0/-0.60	1.50	±0.15	65.30 -1.30/+1.34	0.30	○	○
12.0	h5	330	+2.0～+6.0	6.25	+0/-0.80	1.40	±0.15	65.30 -1.30/+1.34	0.30	●	●
13.0	h5	330	+2.0～+6.0	6.50	+0/-0.80	1.75	±0.20	70.74 -1.40/+1.45	0.34	●	●
14.0	h5	330	+2.0～+6.0	4.80	+0/-0.60	1.30	±0.15	76.18 -1.51/+1.56	0.37	○	○
14.0	h5	330	+2.0～+6.0	6.00	+0/-0.60	1.60	±0.20	76.18 -1.51/+1.56	0.37	○	○
14.0	h5	330	+2.0～+6.0	7.10	+0/-0.80	1.75	±0.20	76.18 -1.51/+1.56	0.37	●	●
15.0	h5	330	+2.0～+6.0	7.70	+0/-0.80	1.75	±0.20	81.62 -1.62/+1.67	0.40	●	●
16.0	h5	330	+2.0～+6.0	4.90	+0/-0.60	1.40	±0.15	87.06 -1.73/+1.78	0.40	○	○
16.0	h5	330	+2.0～+6.0	5.70	+0/-0.60	1.50	±0.15	87.06 -1.73/+1.78	0.40	○	○
16.0	h5	330	+2.0～+6.0	8.30	+0/-0.80	1.75	±0.20	87.06 -1.73/+1.78	0.40	●	●
17.0	h5	330	+2.0～+6.0	8.90	+0/-0.80	1.75	±0.20	92.50 -1.84/+1.89	0.47	●	●
18.0	h5	330	+2.0～+6.0	6.30	+0/-0.80	1.70	±0.20	97.95 -1.94/+2.00	0.50	○	○
18.0	h5	330	+2.0～+6.0	9.55	+0/-0.80	2.00	±0.25	97.95 -1.94/+2.00	0.50	●	●
19.0	h5	330	+2.0～+6.0	10.10	+0/-0.80	2.00	±0.25	103.39 -2.05/+2.12	0.50	●	●
20.0	h5	330	+2.0～+6.0	6.00	+0/-0.60	1.00	±0.15	108.83 -2.16/+2.23	0.50	○	○
20.0	h5	330	+2.0～+6.0	10.40	+0/-1.00	2.00	±0.25	108.83 -2.16/+2.23	0.50	●	●

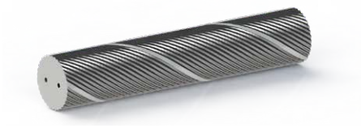
●Stock

○Limited stork

◇Other grades and dimensions on request

Unground Fixed Length Rods with 2 Helix Coolant Holes 30°





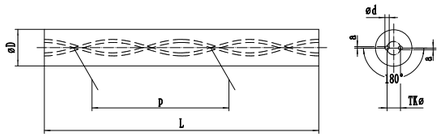
Unground Fixed Length Rods with 2 Helix Coolant Holes 30°											
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Tolerance	"P (±0.5°)"	αmax(mm)	ST20F	ST15D
6.3	+0.9/+1.3	63	+0.5/+1.0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.3	+0.9/+1.3	67	+0.5/+1.0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.3	+0.9/+1.3	75	+0.5/+1.0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.3	+0.9/+1.3	83	+0.5/+1.0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
8.3	+0.9/+1.3	80	+0.5/+1.0	4.00	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	○	○
8.3	+0.9/+1.3	92	+0.5/+1.0	4.00	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	○	○
10.3	+0.9/+1.3	90	+0.5/+1.0	4.80	+0/-0.60	1.40	±0.15	54.41 -1.08/+1.11	0.20	○	○
10.3	+0.9/+1.3	103	+0.5/+1.0	4.80	+0/-0.60	1.40	±0.15	54.41 -1.08/+1.11	0.20	○	○
12.3	+1.1/+1.5	103	+0.5/+1.0	6.25	+0/-0.80	1.40	±0.15	65.30 -1.30/+1.34	0.30	○	○
12.3	+1.1/+1.5	119	+0.5/+1.0	6.25	+0/-0.80	1.40	±0.15	65.30 -1.30/+1.34	0.30	○	○
14.3	+1.1/+1.5	108	+0.5/+1.0	7.10	+0/-0.80	1.75	±0.20	76.18 -1.51/+1.56	0.37	○	○
14.3	+1.1/+1.5	125	+0.5/+1.0	7.10	+0/-0.80	1.75	±0.20	76.18 -1.51/+1.56	0.37	○	○
16.3	+1.1/+1.5	116	+0.5/+1.0	8.30	+0/-0.80	1.75	±0.20	87.06 -1.73/+1.78	0.40	○	○
16.3	+1.1/+1.5	134	+0.5/+1.0	8.30	+0/-0.80	1.75	±0.20	87.06 -1.73/+1.78	0.40	○	○
18.3	+1.1/+1.5	124	+0.5/+1.0	9.55	+0/-0.80	2.00	±0.25	97.95 -1.94/+2.00	0.50	○	○
18.3	+1.1/+1.5	144	+0.5/+1.0	9.55	+0/-0.80	2.00	±0.25	97.95 -1.94/+2.00	0.50	○	○
20.3	+1.1/+1.5	132	+0.5/+1.0	10.40	+0/-1.00	2.00	±0.25	108.83 -2.16/+2.23	0.50	○	○
20.3	+1.1/+1.5	154	+0.5/+1.0	10.40	+0/-1.00	2.00	±0.25	108.83 -2.16/+2.23	0.50	○	○

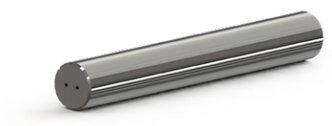
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Fixed Length Rods with 2 Helix Coolant Holes 30°





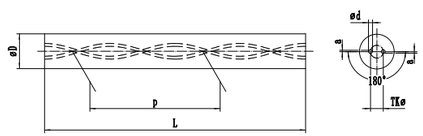
Ground Fixed Length Rods with 2 Helix Coolant Holes 30°											
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Tolerance	"P (±0.5°)"	αmax(mm)	ST20F	ST15D
6.0	h5/h4	63	+1/0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.0	h5/h4	67	+1/0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.0	h5/h4	75	+1/0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
6.0	h5/h4	83	+1/0	2.60	+0/-0.40	0.70	±0.10	32.65 -0.65/+0.67	0.15	○	○
8.0	h5/h4	80	+1/0	4.00	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	○	○
8.0	h5/h4	92	+1/0	4.00	+0/-0.40	1.00	±0.15	43.53 -0.86/+0.89	0.15	○	○
10.0	h5/h4	90	+1/0	4.80	+0/-0.60	1.40	±0.15	54.41 -1.08/+1.11	0.20	○	○
10.0	h5/h4	103	+1/0	4.80	+0/-0.60	1.40	±0.15	54.41 -1.08/+1.11	0.20	○	○
12.0	h5/h4	103	+1/0	6.25	+0/-0.80	1.40	±0.15	65.30 -1.30/+1.34	0.30	○	○
12.0	h5/h4	119	+1/0	6.25	+0/-0.80	1.40	±0.15	65.30 -1.30/+1.34	0.30	○	○
14.0	h5/h4	108	+1/0	7.10	+0/-0.80	1.75	±0.20	76.18 -1.51/+1.56	0.37	○	○
14.0	h5/h4	125	+1/0	7.10	+0/-0.80	1.75	±0.20	76.18 -1.51/+1.56	0.37	○	○
16.0	h5/h4	116	+1/0	8.30	+0/-0.80	1.75	±0.20	87.06 -1.73/+1.78	0.40	○	○
16.0	h5/h4	134	+1/0	8.30	+0/-0.80	1.75	±0.20	87.06 -1.73/+1.78	0.40	○	○
18.0	h5/h4	124	+1/0	9.55	+0/-0.80	2.00	±0.25	97.95 -1.94/+2.00	0.50	○	○
18.0	h5/h4	144	+1/0	9.55	+0/-0.80	2.00	±0.25	97.95 -1.94/+2.00	0.50	○	○
20.0	h5/h4	132	+1/0	10.40	+0/-1.00	2.00	±0.25	108.83 -2.16/+2.23	0.50	○	○
20.0	h5/h4	154	+1/0	10.40	+0/-1.00	2.00	±0.25	108.83 -2.16/+2.23	0.50	○	○

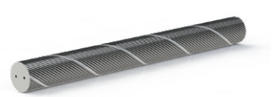
●Stock

○Limited stork

◇Other grades and dimensions on request

Unground Rods with 2 Helix Coolant Holes 40°





Unground Rods with 2 Helix Coolant Holes 40°

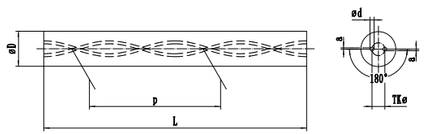
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Toler-ance	"P (±0.5°)"	αmax(mm)	ST20F	ST15D
6.3	+0.9/+1.3	330	+2.0～+6.0	1.40	+0/-0.40	0.40	±0.15	22.46 -0.39/+0.40	0.15	○	○
6.3	+0.9/+1.3	330	+2.0～+6.0	2.20	+0/-0.40	0.50	±0.15	22.46 -0.39/+0.40	0.15	●	●
7.3	+0.9/+1.3	330	+2.0～+6.0	2.40	+0/-0.40	0.70	±0.15	26.21 -0.46/+0.47	0.15	○	○
8.3	+0.9/+1.3	330	+2.0～+6.0	1.70	+0/-0.20	0.40	±0.10	29.95 -0.53/+0.54	0.15	○	○
8.3	+0.9/+1.3	330	+2.0～+6.0	2.70	+0/-0.60	0.65	±0.15	29.95 -0.53/+0.54	0.15	●	●
9.3	+0.9/+1.3	330	+2.0～+6.0	3.20	+0/-0.60	0.75	±0.15	33.70 -0.59/+0.60	0.20	○	○
10.3	+0.9/+1.3	330	+2.0～+6.0	2.10	+0/-0.20	0.50	±0.10	37.44 -0.66/+0.67	0.20	○	○
10.3	+0.9/+1.3	330	+2.0～+6.0	3.50	+0/-0.80	0.80	±0.15	37.44 -0.66/+0.67	0.20	●	●
11.3	+0.9/+1.3	330	+2.0～+6.0	3.70	+0/-0.80	0.80	±0.15	41.18 -0.72/+0.74	0.28	○	○
12.3	+1.1/+1.5	330	+2.0～+6.0	2.50	+0/-0.40	0.60	±0.10	44.93 -0.79/+0.80	0.30	○	○
12.3	+1.1/+1.5	330	+2.0～+6.0	4.20	+0/-0.80	0.90	±0.20	44.93 -0.79/+0.80	0.30	●	●
13.3	+1.1/+1.5	330	+2.0～+6.0	4.40	+0/-0.80	0.90	±0.15	48.67 -0.85/+0.87	0.34	○	○
14.3	+1.1/+1.5	330	+2.0～+6.0	2.90	+0/-0.40	0.70	±0.10	52.42 -0.92/+0.94	0.37	○	○
14.3	+1.1/+1.5	330	+2.0～+6.0	4.70	+0/-0.80	1.00	±0.20	52.42 -0.92/+0.94	0.37	○	○
15.3	+1.1/+1.5	330	+2.0～+6.0	5.10	+0/-0.80	1.10	±0.20	56.16 -0.99/+1.01	0.40	○	○
16.3	+1.1/+1.5	330	+2.0～+6.0	3.30	+0/-0.40	0.80	±0.10	59.90 -1.05/+1.07	0.40	○	○
16.3	+1.1/+1.5	330	+2.0～+6.0	5.50	+0/-0.80	1.20	±0.20	59.90 -1.05/+1.07	0.40	○	○
18.3	+1.1/+1.5	330	+2.0～+6.0	3.70	+0/-0.40	0.90	±0.15	67.39 -1.18/+1.21	0.50	○	○
18.3	+1.1/+1.5	330	+2.0～+6.0	6.30	+0/-0.80	1.40	±0.25	67.39 -1.18/+1.21	0.50	○	○
20.3	+1.1/+1.5	330	+2.0～+6.0	4.10	+0/-0.40	1.00	±0.15	74.88 -1.31/+1.34	0.50	○	○
20.3	+1.1/+1.5	330	+2.0～+6.0	7.10	+0/-1.00	1.50	±0.25	74.88 -1.31/+1.34	0.50	○	○

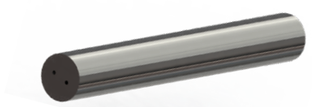
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Rods with 2 Helix Coolant Holes 40°





Ground Rods with 2 Helix Coolant Holes 40°

Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Toler-ance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Toler-ance	"P (±0.5°)"	αmax(mm)	ST20F	ST15D
6.0	h5	330	+2.0～+6.0	1.40	+0/-0.40	0.40	±0.15	22.46 -0.39/+0.40	0.15	○	○
6.0	h5	330	+2.0～+6.0	2.20	+0/-0.40	0.50	±0.15	22.46 -0.39/+0.40	0.15	●	●
7.0	h5	330	+2.0～+6.0	2.40	+0/-0.40	0.70	±0.15	26.21 -0.46/+0.47	0.15	○	○
8.0	h5	330	+2.0～+6.0	1.70	+0/-0.20	0.40	±0.10	29.95 -0.53/+0.54	0.15	○	○
8.0	h5	330	+2.0～+6.0	2.70	+0/-0.60	0.65	±0.15	29.95 -0.53/+0.54	0.15	●	●
9.0	h5	330	+2.0～+6.0	3.20	+0/-0.60	0.75	±0.15	33.70 -0.59/+0.60	0.20	○	○
10.0	h5	330	+2.0～+6.0	2.10	+0/-0.20	0.50	±0.10	37.44 -0.66/+0.67	0.20	○	○
10.0	h5	330	+2.0～+6.0	3.50	+0/-0.80	0.80	±0.15	37.44 -0.66/+0.67	0.20	●	●
11.0	h5	330	+2.0～+6.0	3.70	+0/-0.80	0.80	±0.15	41.18 -0.72/+0.74	0.28	○	○
12.0	h5	330	+2.0～+6.0	2.50	+0/-0.40	0.60	±0.10	44.93 -0.79/+0.80	0.30	○	○
12.0	h5	330	+2.0～+6.0	4.20	+0/-0.80	0.90	±0.20	44.93 -0.79/+0.80	0.30	●	●
13.0	h5	330	+2.0～+6.0	4.40	+0/-0.80	0.90	±0.15	48.67 -0.85/+0.87	0.34	○	○
14.0	h5	330	+2.0～+6.0	2.90	+0/-0.40	0.70	±0.10	52.42 -0.92/+0.94	0.37	○	○
14.0	h5	330	+2.0～+6.0	4.70	+0/-0.80	1.00	±0.20	52.42 -0.92/+0.94	0.37	○	○
15.0	h5	330	+2.0～+6.0	5.10	+0/-0.80	1.10	±0.20	56.16 -0.99/+1.01	0.40	○	○
16.0	h5	330	+2.0～+6.0	3.30	+0/-0.40	0.80	±0.10	59.90 -1.05/+1.07	0.40	○	○
16.0	h5	330	+2.0～+6.0	5.50	+0/-0.80	1.20	±0.20	59.90 -1.05/+1.07	0.40	○	○
18.0	h5	330	+2.0～+6.0	3.70	+0/-0.40	0.90	±0.15	67.39 -1.18/+1.21	0.50	○	○
18.0	h5	330	+2.0～+6.0	6.30	+0/-0.80	1.40	±0.25	67.39 -1.18/+1.21	0.50	○	○
20.0	h5	330	+2.0～+6.0	4.10	+0/-0.40	1.00	±0.15	74.88 -1.31/+1.34	0.50	○	○
20.0	h5	330	+2.0～+6.0	7.10	+0/-1.00	1.50	±0.25	74.88 -1.31/+1.34	0.50	○	○

●Stock

○Limited stork

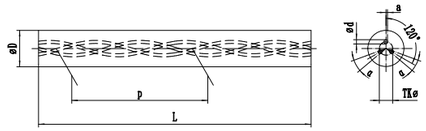
◇Other grades and dimensions on request

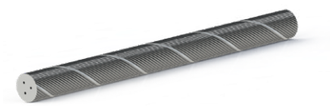
OUR PRODUCT

C A R B I D E

RODS WITH THREE
SPRIAL COOLANT HOLES

Unground Rods with 3 Helix Coolant Holes 30°





Unground Rods with 3 Helix Coolant Holes 30°

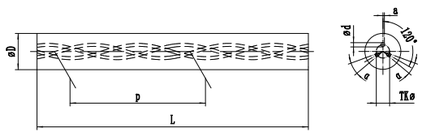
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Toler-ance	"Thread (±0.5°)"	αmax-(mm)	ST20F	ST15D
6.3	+0.9/+1.3	330	+2.0～+6.0	2.90	+0/-0.30	0.50	±0.10	32.65 -0.65/+0.67	±4°	○	○
8.3	+0.9/+1.3	330	+2.0～+6.0	4.00	+0/-0.30	0.70	±0.10	43.53 -0.86/+0.89	±4°	●	●
10.3	+0.9/+1.3	330	+2.0～+6.0	5.10	+0/-0.30	0.85	±0.15	54.41 -1.08/+1.11	±4°	●	●
12.3	+0.9/+1.3	330	+2.0～+6.0	6.30	+0/-0.50	1.10	±0.15	65.30 -1.30/+1.34	±4°	●	●
14.3	+1.1/+1.5	330	+2.0～+6.0	7.30	+0/-0.50	1.40	±0.15	76.18 -1.51/+1.56	±4°	○	○
16.3	+1.1/+1.5	330	+2.0～+6.0	8.30	+0/-0.50	1.60	±0.20	87.06 -1.73/+1.78	±4°	○	○
18.3	+1.1/+1.5	330	+2.0～+6.0	9.50	+0/-0.50	1.70	±0.20	97.95 -1.94/+2.00	±4°	○	○
20.3	+1.1/+1.5	330	+2.0～+6.0	10.20	+0/-0.50	1.90	±0.25	108.83-2.16/+2.23	±4°	○	○

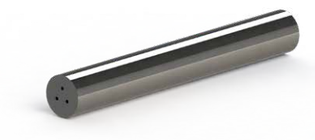
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Rods with 3 Helix Coolant Holes 30°





Ground Rods with 3 Helix Coolant Holes 30°

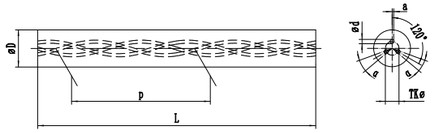
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Toler-ance	L(mm)	Tolerance	TK(mm)	Toler-ance	d(mm)	Toler-ance	"Thread (±0.5°)"	αmax-(mm)	ST20F	ST15D
6.0	h5	330	+2.0～+6.0	2.90	+0/0.30	0.50	±0.10	32.65 -0.65/+0.67	±4°	○	○
8.0	h5	330	+2.0～+6.0	4.00	+0/0.30	0.70	±0.10	43.53 -0.86/+0.89	±4°	●	●
10.0	h5	330	+2.0～+6.0	5.10	+0/0.30	0.85	±0.15	54.41 -1.08/+1.11	±4°	●	●
12.0	h5	330	+2.0～+6.0	6.30	+0/0.50	1.10	±0.15	65.30 -1.30/+1.34	±4°	●	●
14.0	h5	330	+2.0～+6.0	7.30	+0/0.50	1.40	±0.15	76.18 -1.51/+1.56	±4°	○	○
16.0	h5	330	+2.0～+6.0	8.30	+0/0.50	1.60	±0.20	87.06 -1.73/+1.78	±4°	○	○
18.0	h5	330	+2.0～+6.0	9.50	+0/0.50	1.70	±0.20	97.95 -1.94/+2.00	±4°	○	○
20.0	h5	330	+2.0～+6.0	10.20	+0/0.50	1.90	±0.25	108.83 -2.16/+2.23	±4°	○	○

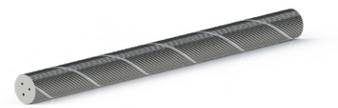
●Stock

○Limited stork

◇Other grades and dimensions on request

Unground Rods with 3 Helix Coolant Holes 40°





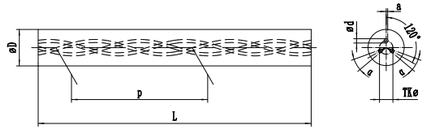
Unground Rods with 3 Helix Coolant Holes 40°											
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Toler-ance	"Thread (±0.5°)"	αmax-(mm)	ST20F	ST15D
6.3	+0.9/+1.3	330	+2.0～+6.0	2.20	+0/-0.30	0.50	±0.15	22.46 -0.39/+0.40	±4°	○	○
8.3	+0.9/+1.3	330	+2.0～+6.0	2.70	+0/-0.30	0.65	±0.15	29.95 -0.53/+0.54	±4°	●	●
10.3	+0.9/+1.3	330	+2.0～+6.0	3.50	+0/-0.30	0.80	±0.15	37.44 -0.66/+0.67	±4°	●	●
12.3	+0.9/+1.3	330	+2.0～+6.0	4.20	+0/-0.50	0.90	±0.20	44.93 -0.79/+0.80	±4°	●	●
14.3	+1.1/+1.5	330	+2.0～+6.0	4.70	+0/-0.50	1.00	±0.20	52.42 -0.92/+0.94	±4°	○	○
16.3	+1.1/+1.5	330	+2.0～+6.0	5.50	+0/-0.50	1.20	±0.20	59.90 -1.05/+1.07	±4°	○	○
18.3	+1.1/+1.5	330	+2.0～+6.0	6.30	+0/-0.50	1.40	±0.25	67.39 -1.18/+1.21	±4°	○	○
20.3	+1.1/+1.5	330	+2.0～+6.0	7.10	+0/-0.70	1.50	±0.25	74.88 -1.31/+1.34	±4°	○	○

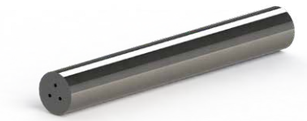
●Stock

○Limited stork

◇Other grades and dimensions on request

Ground Rods with 3 Helix Coolant Holes 40°





Ground Rods with 3 Helix Coolant Holes 40°											
Diameter		Length		Hole Spacing		Hole size				Grade	
D(mm)	Tolerance	L(mm)	Tolerance	TK(mm)	Tolerance	d(mm)	Toler-ance	"Thread (±0.5°)"	αmax-(mm)	ST20F	ST15D
6.0	h5	330	+2.0～+6.0	2.20	+0/-0.30	0.50	±0.15	22.46 -0.39/+0.40	±4°	○	○
8.0	h5	330	+2.0～+6.0	2.70	+0/-0.30	0.65	±0.15	29.95 -0.53/+0.54	±4°	●	●
10.0	h5	330	+2.0～+6.0	3.50	+0/-0.30	0.80	±0.15	37.44 -0.66/+0.67	±4°	●	●
12.0	h5	330	+2.0～+6.0	4.20	+0/-0.50	0.90	±0.20	44.93 -0.79/+0.80	±4°	●	●
14.0	h5	330	+2.0～+6.0	4.70	+0/-0.50	1.00	±0.20	52.42 -0.92/+0.94	±4°	○	○
16.0	h5	330	+2.0～+6.0	5.50	+0/-0.50	1.20	±0.20	59.90 -1.05/+1.07	±4°	○	○
18.0	h5	330	+2.0～+6.0	6.30	+0/-0.50	1.40	±0.25	67.39 -1.18/+1.21	±4°	○	○
20.0	h5	330	+2.0～+6.0	7.10	+0/-0.70	1.50	±0.25	74.88 -1.31/+1.34	±4°	○	○

●Stock

○Limited stork

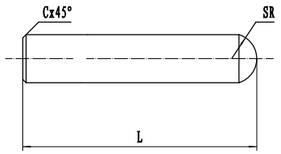
◇Other grades and dimensions on request

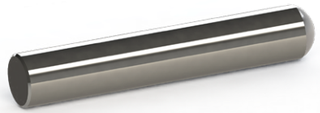
OUR PRODUCT

C A R B I D E

PREFORMS

Endmill Blanks with Ballnose Rods





Endmill Blanks with Ballnose Rods

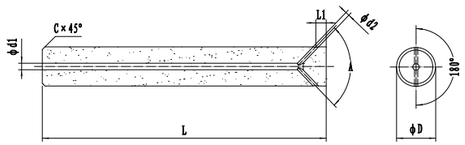
D(mm)		L(mm)		C(mm)		SR	
6	h5	57	+1/0	0.5	±0.1	3.15	+0.38/0
8	h5	63	+1/0	0.6	±0.1	4.19	+0.38/0
10	h5	72	+1/0	0.6	±0.1	5.24	+0.38/0
12	h5	83	+1/0	0.8	±0.1	6.29	+0.38/0
12	h5	97	+1/0	0.8	±0.1	6.29	+0.38/0
14	h5	83	+1/0	0.8	±0.1	7.34	+0.38/0
14	h5	90	+1/0	0.8	±0.1	7.34	+0.38/0
14	h5	100	+1/0	0.8	±0.1	7.34	+0.38/0
16	h5	92	+1/0	0.8	±0.1	8.39	+0.38/0
16	h5	108	+1/0	0.8	±0.1	8.39	+0.38/0
16	h5	110	+1/0	0.8	±0.1	8.39	+0.38/0
18	h5	92	+1/0	0.8	±0.1	9.44	+0.38/0
18	h5	100	+1/0	0.8	±0.1	9.44	+0.38/0
18	h5	120	+1/0	0.8	±0.1	9.44	+0.38/0
20	h5	100	+1/0	1.0	±0.1	10.49	+0.38/0
20	h5	104	+1/0	1.0	±0.1	10.49	+0.38/0
20	h5	110	+1/0	1.0	±0.1	10.49	+0.38/0
20	h5	120	+1/0	1.0	±0.1	10.49	+0.38/0

●Stock

○Limited stork

◇Other grades and dimensions on request

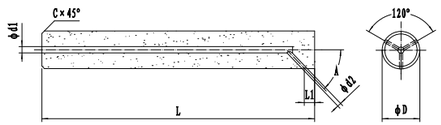
Endmill Blanks with Axial Coolant Hole and 2 Lateral Exits



Endmill Blanks with Axial Coolant Hole and 2 Lateral Exits											
D(mm)		L(mm)		L1(mm)		C(mm)		d1		d2	
6	h5	57	+1/0	3	±0.3	0.4	±0.1	1.20	±0.15	0.80	±0.15
8	h5	63	+1/0	4	±0.3	0.6	±0.1	1.60	±0.15	1.10	±0.15
10	h5	72	+1/0	5	±0.3	0.8	±0.1	2.00	±0.15	1.40	±0.15
12	h5	83	+1/0	6	±0.3	0.8	±0.1	2.20	±0.15	1.60	±0.15
14	h5	83	+1/0	7	±0.3	0.8	±0.1	2.40	±0.15	1.70	±0.15
16	h5	92	+1/0	8	±0.3	0.8	±0.1	2.60	±0.15	1.90	±0.15
18	h5	92	+1/0	9	±0.3	1.0	±0.1	2.80	±0.15	2.00	±0.15
20	h5	104	+1/0	10	±0.3	1.0	±0.1	3.00	±0.15	2.10	±0.15

●Stock ○Limited stork ◇Other grades and dimensions on request

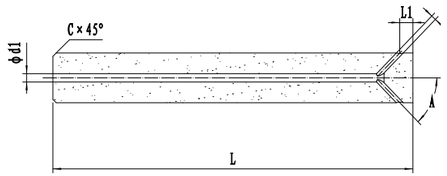
Endmill Blanks with Axial Coolant Hole and 3 Lateral Exits

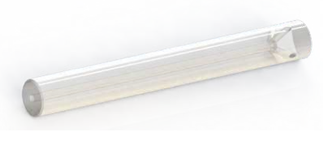


Endmill Blanks with Axial Coolant Hole and 3 Lateral Exits											
D(mm)		L(mm)		L1(mm)		C(mm)		d1		d2	
6	h5	57	+1/0	3	±0.3	0.4	±0.1	1.20	±0.15	0.70	±0.15
8	h5	63	+1/0	4	±0.3	0.6	±0.1	1.60	±0.15	0.90	±0.15
10	h5	72	+1/0	5	±0.3	0.8	±0.1	2.00	±0.15	1.20	±0.15
12	h5	83	+1/0	6	±0.3	0.8	±0.1	2.20	±0.15	1.30	±0.15
14	h5	83	+1/0	7	±0.3	0.8	±0.1	2.40	±0.15	1.40	±0.15
16	h5	92	+1/0	8	±0.3	0.8	±0.1	2.60	±0.15	1.50	±0.15
18	h5	92	+1/0	9	±0.3	1.0	±0.1	2.80	±0.15	1.60	±0.15
20	h5	104	+1/0	10	±0.3	1.0	±0.1	3.00	±0.15	1.70	±0.15

●Stock ○Limited stork ◇Other grades and dimensions on request

Endmill Blanks with Axial Coolant Hole and 4 Lateral Exits

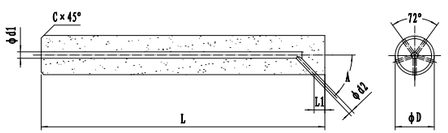


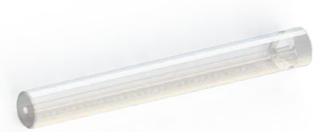


Endmill Blanks with Axial Coolant Hole and 4 Lateral Exits											
D(mm)		L(mm)		L1(mm)		C(mm)		d1		d2	
6	h5	57	+1/0	3	±0.3	0.4	±0.1	1.20	±0.15	0.60	±0.15
8	h5	63	+1/0	4	±0.3	0.6	±0.1	1.60	±0.15	0.80	±0.15
10	h5	72	+1/0	5	±0.3	0.8	±0.1	2.00	±0.15	1.00	±0.15
12	h5	83	+1/0	6	±0.3	0.8	±0.1	2.20	±0.15	1.10	±0.15
14	h5	83	+1/0	7	±0.3	0.8	±0.1	2.40	±0.15	1.20	±0.15
16	h5	92	+1/0	8	±0.3	0.8	±0.1	2.60	±0.15	1.30	±0.15
18	h5	92	+1/0	9	±0.3	1.0	±0.1	2.80	±0.15	1.40	±0.15
20	h5	104	+1/0	10	±0.3	1.0	±0.1	3.00	±0.15	1.50	±0.15

●Stock ○Limited stork ◇Other grades and dimensions on request

Endmill Blanks with Axial Coolant Hole and 5 Lateral Exits

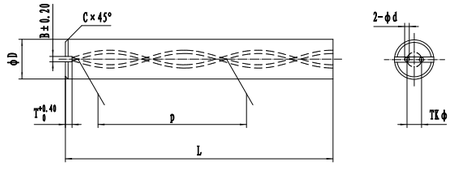




Endmill Blanks with Axial Coolant Hole and 5 Lateral Exits											
D(mm)		L(mm)		L1(mm)		C(mm)		d1		d2	
6	h5	57	+1/0	3	±0.3	0.4	±0.1	1.20	±0.15	0.50	±0.15
8	h5	63	+1/0	4	±0.3	0.6	±0.1	1.60	±0.15	0.70	±0.15
10	h5	72	+1/0	5	±0.3	0.8	±0.1	2.00	±0.15	0.90	±0.15
12	h5	83	+1/0	6	±0.3	0.8	±0.1	2.20	±0.15	1.00	±0.15
14	h5	83	+1/0	7	±0.3	0.8	±0.1	2.40	±0.15	1.10	±0.15
16	h5	92	+1/0	8	±0.3	0.8	±0.1	2.60	±0.15	1.20	±0.15
18	h5	92	+1/0	9	±0.3	1.0	±0.1	2.80	±0.15	1.30	±0.15
20	h5	104	+1/0	10	±0.3	1.0	±0.1	3.00	±0.15	1.40	±0.15

●Stock ○Limited stork ◇Other grades and dimensions on request

Drill Blanks With Slot - 30°



Drill Blanks with Slot - 30°

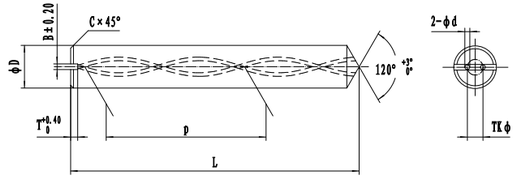
D(mm)		L(mm)		C(mm)		TK(mm)		d(mm)		"P(mm)"		αmax-(mm)	B(mm)	T(mm)
6	h5	63	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
6	h5	67	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
6	h5	75	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
6	h5	92	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
8	h5	80	+1/0	0.60	±0.10	4.00	+0/-0.40	1.00	±0.15	43.53	+0.89/-0.86	0.15	2.00	1.40
8	h5	92	+1/0	0.60	±0.10	4.00	+0/-0.40	1.00	±0.15	43.53	+0.89/-0.86	0.15	2.00	1.40
10	h5	90	+1/0	0.60	±0.10	4.80	+0/-0.60	1.40	±0.15	54.41	+1.11/-1.08	0.20	2.50	1.65
10	h5	104	+1/0	0.60	±0.10	4.80	+0/-0.60	1.40	±0.15	54.41	+1.11/-1.08	0.20	2.50	1.65
12	h5	103	+1/0	0.80	±0.10	6.25	+0/-0.80	1.40	±0.15	65.30	+1.34/-1.30	0.30	2.50	1.75
12	h5	119	+1/0	0.80	±0.10	6.25	+0/-0.80	1.40	±0.15	65.30	+1.34/-1.30	0.30	2.50	1.75
14	h5	108	+1/0	0.80	±0.10	7.10	+0/-0.80	1.75	±0.20	76.18	+1.56/-1.51	0.40	3.00	2.15
14	h5	125	+1/0	0.80	±0.10	7.10	+0/-0.80	1.75	±0.20	76.18	+1.56/-1.51	0.40	3.00	2.15
16	h5	116	+1/0	0.80	±0.10	8.30	+0/-0.80	1.75	±0.20	87.06	+1.78/-1.73	0.40	3.00	2.30
16	h5	134	+1/0	0.80	±0.10	8.30	+0/-0.80	1.75	±0.20	87.06	+1.78/-1.73	0.40	3.00	2.30
18	h5	124	+1/0	0.80	±0.10	9.55	+0/-0.80	2.00	±0.25	97.95	+2.00/-1.94	0.50	3.50	2.50
18	h5	144	+1/0	0.80	±0.10	9.55	+0/-0.80	2.00	±0.25	97.95	+2.00/-1.94	0.50	3.50	2.50
20	h5	132	+1/0	1.00	±0.10	10.40	+0/-1.00	2.00	±0.25	108.83	+2.23/-2.16	0.50	3.50	2.70
20	h5	154	+1/0	1.00	±0.10	10.40	+0/-1.00	2.00	±0.25	108.83	+2.23/-2.16	0.50	3.50	2.70

●Stock

○Limited stork

◇Other grades and dimensions on request

Drill Blanks With Slot And Pointed Cone - 30°



Drill Blanks with Slot And Pointed Cone - 30°

D(mm)		L(mm)		C(mm)		TK(mm)		d(mm)		"P(mm)"		αmax-(mm)	B(mm)	T(mm)
6	h5	63	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
6	h5	67	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
6	h5	75	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
6	h5	92	+1/0	0.50	±0.10	2.60	+0/-0.40	0.70	±0.10	32.65	+0.67/-0.65	0.15	1.50	0.90
8	h5	80	+1/0	0.60	±0.10	4.00	+0/-0.40	1.00	±0.15	43.53	+0.89/-0.86	0.15	2.00	1.40
8	h5	92	+1/0	0.60	±0.10	4.00	+0/-0.40	1.00	±0.15	43.53	+0.89/-0.86	0.15	2.00	1.40
10	h5	90	+1/0	0.60	±0.10	4.80	+0/-0.60	1.40	±0.15	54.41	+1.11/-1.08	0.20	2.50	1.65
10	h5	104	+1/0	0.60	±0.10	4.80	+0/-0.60	1.40	±0.15	54.41	+1.11/-1.08	0.20	2.50	1.65
12	h5	103	+1/0	0.80	±0.10	6.25	+0/-0.80	1.40	±0.15	65.30	+1.34/-1.30	0.30	2.50	1.75
12	h5	119	+1/0	0.80	±0.10	6.25	+0/-0.80	1.40	±0.15	65.30	+1.34/-1.30	0.30	2.50	1.75
14	h5	108	+1/0	0.80	±0.10	7.10	+0/-0.80	1.75	±0.20	76.18	+1.56/-1.51	0.40	3.00	2.15
14	h5	125	+1/0	0.80	±0.10	7.10	+0/-0.80	1.75	±0.20	76.18	+1.56/-1.51	0.40	3.00	2.15
16	h5	116	+1/0	0.80	±0.10	8.30	+0/-0.80	1.75	±0.20	87.06	+1.78/-1.73	0.40	3.00	2.30
16	h5	134	+1/0	0.80	±0.10	8.30	+0/-0.80	1.75	±0.20	87.06	+1.78/-1.73	0.40	3.00	2.30
18	h5	124	+1/0	0.80	±0.10	9.55	+0/-0.80	2.00	±0.25	97.95	+2.00/-1.94	0.50	3.50	2.50
18	h5	144	+1/0	0.80	±0.10	9.55	+0/-0.80	2.00	±0.25	97.95	+2.00/-1.94	0.50	3.50	2.50
20	h5	132	+1/0	1.00	±0.10	10.40	+0/-1.00	2.00	±0.25	108.83	+2.23/-2.16	0.50	3.50	2.70
20	h5	154	+1/0	1.00	±0.10	10.40	+0/-1.00	2.00	±0.25	108.83	+2.23/-2.16	0.50	3.50	2.70

●Stock

○Limited stork

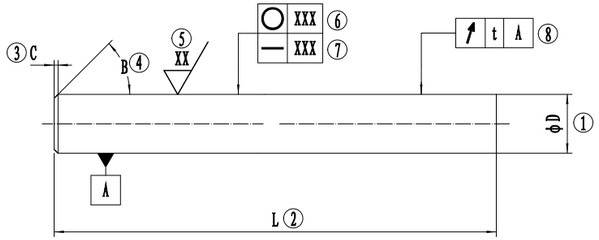
◇Other grades and dimensions on request

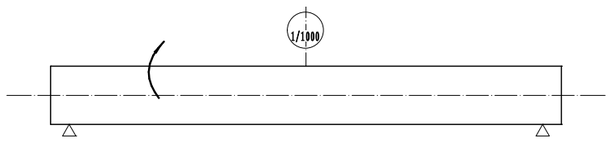
OUR PRODUCT

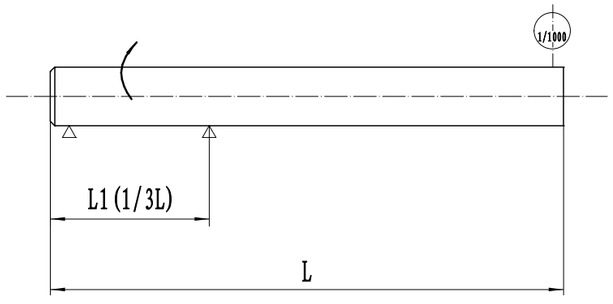
C A R B I D E

TECHNICAL PARAMATER

Technical Paramater







Precision Ground Rod		
D (mm)	L (mm)	Schlag/Straightness (mm)
3≤D<6	300≤L≤350	0.15 max.
6≤D<8	300≤L≤350	0.12 max.
8≤D<12	300≤L≤350	0.08 max.
D≥12	300≤L≤350	0.05 max.

Unground Rod		
D (mm)	L (mm)	Schlag/Straightness(mm)
2≤D≤42	300≤L≤350	0.40 max.

Run-out(mm)							
L / D	0<L≤60	60<L≤80	80<L≤100	100<L≤120	120<L≤150	150<L≤200	200<L≤300
3≤D<4	0.005	0.008	0.012	0.020			
4≤D<6	0.005	0.005	0.008	0.012	0.020		
6≤D<8	0.005	0.005	0.005	0.008	0.012	0.020	
8≤D<10	0.005	0.005	0.005	0.005	0.008	0.015	
10≤D<16	0.005	0.005	0.005	0.005	0.008	0.008	0.015
16≤D<20	0.005	0.005	0.005	0.005	0.005	0.008	0.015
20≤D≤32	0.005	0.005	0.005	0.005	0.005	0.005	0.008

OUR PRODUCT

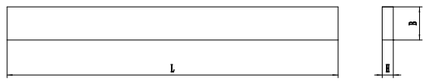
C A R B I D E

STRIP GRADES AND SPECIFICATIONS

Strip Grades and Specifications

Grade	Co	Grain Size of WC	Hardness		Density	Flexural Strength	Fracture Toughness	Elastic Modulus	Coefficient of Thermal Expansion
	Co%		HRA	HV_{30}	g/cm^3	MPa	$MNm^{-3/2}$	GPa	$10^{-6}/℃$
ST01F	4	Sub-Micron	94.0	2060	15.1	2800	9	550	4.6
ST03F	5	Sub-Micron	93.4	1930	14.9	3000	10	540	4.8
ST10F	6	Sub-Micron	92.9	1840	14.8	3500	10	530	4.9
ST10UF	6	Ultra-fine	93.8	2040	14.7	2900	9	530	4.9
ST05F	6	Sub-Micron	92.9	1840	14.8	3400	10	530	4.9
ST03B	6	Sub-Micron	91.6	1600	14.9	2800	11	530	4.9
ST05B	6.5	Fine	91.4	1550	14.8	3000	12	525	4.9
ST10C	7	Fine	90.7	1480	14.7	3200	12	520	5.0
ST11F	8	Sub-Micron	92.3	1720	14.6	3800	10	510	5.1
ST11UF	8	Ultra-fine	93.5	1960	14.5	3000	9	510	5.1
ST10B	8	Sub-Micron	90.5	1460	14.6	3200	11	510	5.1
ST12F	9	Ultra-fine	93.5	1960	14.4	4500	10	500	5.3
ST12NF	9	Nano	94.2	2100	14.3	4800	9	500	5.3
ST15F	10	Sub-Micron	92.0	1670	14.3	3600	11	490	5.4
ST20F	10	Sub-Micron	91.7	1620	14.4	4300	11	490	5.4
ST37F	15	Sub-Micron	89.6	1350	13.8	4100	16	430	6.3
ST37NF	15	Nano	92.0	1670	13.8	4800	10	430	6.3
ST37UF	15	Ultra-fine	91.5	1570	13.8	4000	11	430	6.3

Strip Specifications



Cemented Carbide Strips

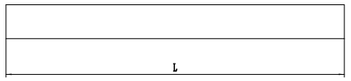
H	Tolerance	B	Tolerance	L	Tolerance	Grade		
						ST10C	ST05B	ST11F
1.5	+0～+0.3	8.0	-0.1～+0.6	310	+0～+6.5	○	○	○
1.5	+0～+0.3	10.0	-0.1～+0.6	310	+0～+6.5	○	●	●
1.5	+0～+0.3	12.0	-0.1～+0.6	310	+0～+6.5	○	●	●
1.5	+0～+0.3	14.0	-0.1～+0.6	310	+0～+6.5	○	●	●
1.5	+0～+0.3	15.0	-0.3～+0.7	310	+0～+6.5	○	●	●
1.5	+0～+0.3	18.0	-0.3～+0.7	310	+0～+6.5	○	●	●
1.5	+0～+0.3	20.0	-0.3～+0.7	310	+0～+6.5	○	●	●
2	+0～+0.3	8.0	-0.1～+0.6	310	+0～+6.5	●	●	●
2	+0～+0.3	10.0	-0.1～+0.6	310	+0～+6.5	●	●	●
2	+0～+0.3	12.0	-0.1～+0.6	310	+0～+6.5	●	●	●
2	+0～+0.3	14.0	-0.1～+0.6	310	+0～+6.5	●	●	●
2	+0～+0.3	15.0	-0.3～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	18.0	-0.3～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	20.0	-0.3～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	22.0	-0.3～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	25.0	-0.5～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	28.0	-0.5～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	30.0	-0.5～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	32.0	-0.5～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	35.0	-0.5～+0.7	310	+0～+6.5	●	●	●
2	+0～+0.3	40.0	-0.5～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	8.0	-0.1～+0.6	310	+0～+6.5	●	●	●
3	+0～+0.3	10.0	-0.1～+0.6	310	+0～+6.5	●	●	●
3	+0～+0.3	12.0	-0.1～+0.6	310	+0～+6.5	●	●	●
3	+0～+0.3	14.0	-0.1～+0.6	310	+0～+6.5	●	●	●
3	+0～+0.3	15.0	-0.3～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	16.0	-0.3～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	18.0	-0.3～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	20.0	-0.3～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	22.0	-0.3～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	25.0	-0.5～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	28.0	-0.5～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	30.0	-0.5～+0.7	310	+0～+6.5	●	●	●
3	+0～+0.3	32.0	-0.5～+0.7	310	+0～+6.5	●	●	●

Cemented Carbide Strips

H	Tolerance	B	Tolerance	L	Grade		
					ST10C	ST05B	ST11F
3	+0～+0.3	35.0	-0.5～+0.7	310	●	●	●
3	+0～+0.3	40.0	-0.8～+0.9	310	●	●	●
3.5	+0～+0.3	10.0	-0.1～+0.6	310	●	●	○
3.5	+0～+0.3	12.0	-0.1～+0.6	310	●	●	○
3.5	+0～+0.3	15.0	-0.3～+0.7	310	●	●	○
3.5	+0～+0.3	18.0	-0.3～+0.7	310	●	●	○
3.5	+0～+0.3	20.0	-0.3～+0.7	310	●	●	○
3.5	+0～+0.3	22.0	-0.3～+0.7	310	●	●	○
3.5	+0～+0.3	25.0	-0.5～+0.7	310	●	●	○
3.5	+0～+0.3	28.0	-0.5～+0.7	310	●	●	○
3.5	+0～+0.3	30.0	-0.5～+0.7	310	●	●	○
3.5	+0～+0.3	32.0	-0.5～+0.7	310	●	●	○
3.5	+0～+0.3	35.0	-0.8～+0.9	310	●	●	○
3.5	+0～+0.3	38.0	-0.8～+0.9	310	●	●	○
3.5	+0～+0.3	40.0	-0.8～+0.9	310	●	●	○
4	+0～+0.3	10.0	-0.1～+0.6	310	○	●	○
4	+0～+0.3	12.0	-0.1～+0.6	310	○	●	○
4	+0～+0.3	14.0	-0.1～+0.6	310	○	●	○
4	+0～+0.3	15.0	-0.3～+0.7	310	○	●	○
4	+0～+0.3	16.0	-0.3～+0.7	310	○	●	○
4	+0～+0.3	18.0	-0.3～+0.7	310	○	●	○
4	+0～+0.3	20.0	-0.3～+0.7	310	○	●	○
4	+0～+0.3	22.0	-0.3～+0.7	310	○	●	○
4	+0～+0.3	25.0	-0.5～+0.7	310	○	●	○
4	+0～+0.3	28.0	-0.5～+0.7	310	○	●	○
4	+0～+0.3	30.0	-0.5～+0.7	310	○	●	○
2	+0～+0.3	80.0	-1.2～+1.4	170	○	●	●
2.5	+0～+0.3	80.0	-1.2～+1.4	170	○	●	●
3	+0～+0.3	80.0	-1.2～+1.4	170	●	●	●
3.5	+0～+0.3	80.0	-1.2～+1.4	170	●	●	●
4	+0～+0.3	80.0	-1.2～+1.4	170	●	●	●

●Stock ○Limited stork ◇Other grades and dimensions on request

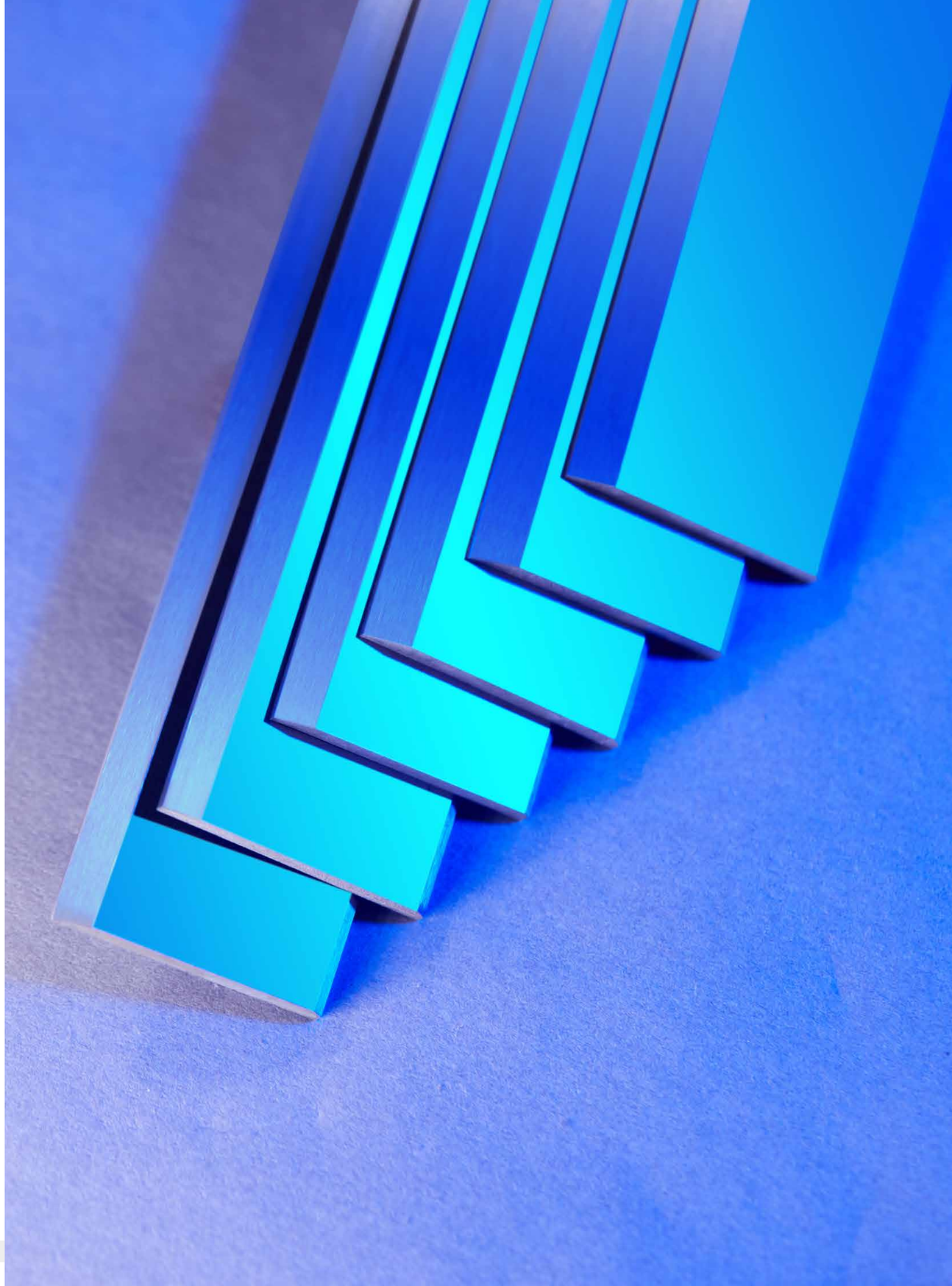
Strips Specifications



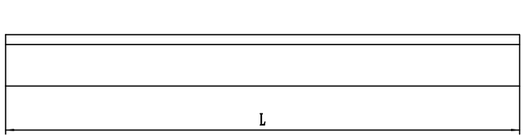
Cemented Carbide Strips Rectangle Types

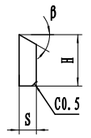
H	Tolerance	B	Tolerance	L	Tolerance	Grade		
						ST10C	ST05B	ST11F
2	+0～+0.3	3.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	4.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	5.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	6.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	8.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	10.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	12.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	15.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	18.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	20.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	22.0	+0～+0.5	330	+0～+6.5	●	●	◇
2	+0～+0.3	25.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	4.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	5.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	6.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	8.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	10.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	12.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	15.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	18.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	20.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	22.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	25.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	28.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	30.0	+0～+0.5	330	+0～+6.5	●	●	◇
3	+0～+0.3	32.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	8.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	10.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	12.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	15.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	18.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	20.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	22.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	25.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	28.0	+0～+0.5	330	+0～+6.5	●	●	◇
4	+0～+0.3	30.0	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	8	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	10	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	12	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	15	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	18	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	20	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	22	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	25	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	28	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	30	+0～+0.5	330	+0～+6.5	●	●	◇
5	+0～+0.3	35	+0～+0.5	330	+0～+6.5	●	●	◇
6	+0～+0.3	16	+0～+0.5	330	+0～+6.5	●	●	◇
6	+0～+0.3	20	+0～+0.5	330	+0～+6.5	●	●	◇
6	+0～+0.3	25	+0～+0.5	330	+0～+6.5	●	●	◇
6	+0～+0.3	30	+0～+0.5	330	+0～+6.5	●	●	◇
6	+0～+0.3	35	+0～+0.5	330	+0～+6.5	●	●	◇

●Stock ○Limited stork ◇Other grades and dimensions on request



Strips with Bevel Angles 1





Strips with Bevel Angles 1

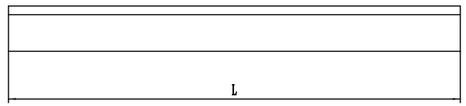
H	Tolerance	S	Tolerance	β	L	Tolerance	Grade ST05B
10	+0～+0.3	3.0	+0～+0.3	30°	310	+1～+2.0	○
15	+0～+0.3	3.0	+0～+0.3	30°	310	+1～+2.0	○
20	+0～+0.3	3.0	+0～+0.3	30°	310	+1～+2.0	○
25	+0～+0.3	3.0	+0～+0.3	30°	310	+1～+2.0	○
30	+0～+0.3	3.0	+0～+0.3	30°	310	+1～+2.0	○
10	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
12	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
15	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
18	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
20	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
22	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
25	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
27	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
30	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
35	+0～+0.3	4.0	+0～+0.3	30°	310	+1～+2.0	○
12	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
15	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
16	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
18	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
20	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
22	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
25	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
27	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
30	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
32	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
35	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
40	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
45	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
50	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○
60	+0～+0.3	5.0	+0～+0.3	30°	310	+1～+2.0	○

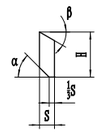
●Stock

○Limited stork

◇Other grades and dimensions on request

Strips with Bevel Angles 2





Strips with Bevel Angles 2

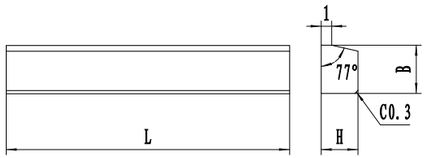
H	Tolerance	S	Tolerance	α	β	L	Tolerance	Grade ST05B
10	+0～+0.3	3.0	+0～+0.3	0°	30°	310	+1～+2.0	○
15	+0～+0.3	3.0	+0～+0.3	0°	30°	310	+1～+2.0	○
20	+0～+0.3	3.0	+0～+0.3	0°	30°	310	+1～+2.0	○
25	+0～+0.3	3.0	+0～+0.3	0°	30°	310	+1～+2.0	○
30	+0～+0.3	3.0	+0～+0.3	0°	30°	310	+1～+2.0	○
10	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
12	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
15	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
18	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
20	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
22	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
25	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
27	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
30	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
35	+0～+0.3	4.0	+0～+0.3	35°	30°	310	+1～+2.0	○
12	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
15	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
16	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
18	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
20	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
22	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
25	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
27	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
30	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
32	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
35	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
40	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
45	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
50	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○
60	+0～+0.3	5.0	+0～+0.3	35°	30°	310	+1～+2.0	○

●Stock

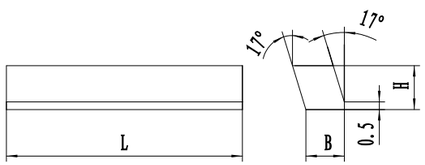
○Limited stork

◇Other grades and dimensions on request

Cemented Carbide Tools for Bamboo



Cemented Carbide Tools for Bamboo							
H	Tolerance	B	Tolerance	L	Tolerance	Grade	
						ST05F	ST03F
3.5	±0.1	4.2	±0.1	27	0～+0.4	○	●
3.5	±0.1	4.6	±0.1	27	0～+0.4	○	●
3.5	±0.1	4.8	±0.1	27	0～+0.4	○	●
3.5	±0.1	5.2	±0.1	27	0～+0.4	○	●
3.5	±0.1	4.2	±0.1	28.5	0～+0.4	○	●
3.5	±0.1	5.2	±0.1	25.7	0～+0.4	○	●
3.5	±0.1	5.5	±0.1	25.7	0～+0.4	○	●
3.5	±0.1	6.0	±0.1	26.8	0～+0.4	○	●
3.8	±0.1	4.0	±0.1	26.8	0～+0.4	○	●
3.8	±0.1	4.5	±0.1	26.8	0～+0.4	○	●
3.8	±0.1	4.5	±0.1	32	0～+0.4	○	●
3.8	±0.1	4.8	±0.1	26.8	0～+0.4	○	●
3.8	±0.1	4.8	±0.1	32	0～+0.4	○	●
3.8	±0.1	5.0	±0.1	25.7	0～+0.4	●	●
3.8	±0.1	5.2	±0.1	25.7	0～+0.4	●	●
3.8	±0.1	6.0	±0.1	25.7	0～+0.4	●	○
3.8	±0.1	8.0	±0.1	25.7	0～+0.4	●	○
3.8	±0.1	5.5	±0.1	26	0～+0.4	●	○
3.8	±0.1	5.5	±0.1	36	0～+0.4	●	○



Cemented Carbide Tools for Bamboo							
H	Tolerance	B	Tolerance	L	Tolerance	Grade	
						ST05F	ST03F
	±0.1		±0.1		0～+0.4	○	○
4	±0.1	3.5	±0.1	36	0～+0.4	●	○
4	±0.1	3.5	±0.1	26	0～+0.4	●	○
4	±0.1	4.1	±0.1	26.5	0～+0.4	●	○
4	±0.1	4.1	±0.1	36.5	0～+0.4	●	●
3.5	±0.1	4.0	±0.1	31	0～+0.4	●	○
3.5	±0.1	4.0	±0.1	32	0～+0.4	○	●
	±0.1		±0.1		0～+0.4	○	○
	±0.1		±0.1		0～+0.4	○	○

●Stock ○Limited stork ◇Other grades and dimensions on request

Hardness Conversion

Hardness Conversion			
HV_{30}	HRA	HV_{30}	HRA
2310	95.0	1620	91.8
2280	94.9	1600	91.7
2260	94.8	1590	91.6
2230	94.7	1570	91.5
2200	94.6	1560	91.4
2180	94.5	1540	91.3
2150	94.4	1530	91.2
2130	94.3	1520	91.1
2100	94.2	1500	91.0
2080	94.1	1450	90.5
2050	94.0	1400	90.0
2030	93.9	1350	89.5
2030	93.8	1300	89.0
2010	93.7	1250	88.5
1980	93.6	1200	88.0
1960	93.5	1150	87.5
1940	93.4	1100	87.0
1920	93.3	1060	86.5
1870	93.2	990	86.0
1850	93.1	940	85.6
1830	93.0	900	85.0
1810	92.9	865	84.5
1790	92.8	832	83.9
1770	92.7	800	83.4
1750	92.6	772	82.8
1740	92.5	746	82.3
1720	92.4	720	81.8
1700	92.3	697	81.2
1680	92.2	674	80.7
1670	92.1	653	80.1
1650	92.0	613	79.0
1630	91.9	577	78.0

INTEGRITY
COOPERATION
INNOVATION

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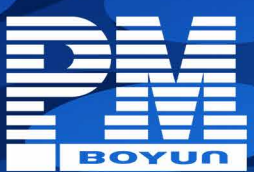
POWDER METALLURGY CO., LTD.



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