

S290



BÖHLER S290
MICROCLEAN®

粉末冶金高速钢
HIGH SPEED STEEL

BÖHLER S290 MICROCLEAN®

钢材主要性能比较表

Qualitative comparison of the major steel properties

牌号 / Grade BÖHLER	红硬性 Red hardness	耐磨性 Wear resistance	韧性 Toughness	可磨削性 Grindability	抗压强度 Compressive strength
S200	Medium	Medium	Medium	Medium	Medium
S400	Medium	Medium	Medium	Medium	Medium
S401	Medium	Medium	Medium	Medium	Medium
S404	Medium	Medium	Medium	Medium	Medium
S500	Medium	Medium	Medium	Medium	Medium
S600	Medium	Medium	Medium	Medium	Medium
S607	Medium	Medium	Medium	Medium	Medium
S700	Medium	Medium	Medium	Medium	Medium
S705	Medium	Medium	Medium	Medium	Medium
S290 MICROCLEAN	High	High	High	High	High
S390 MICROCLEAN	Medium	Medium	Medium	Medium	Medium
S590 MICROCLEAN	Medium	Medium	Medium	Medium	Medium
S690 MICROCLEAN	Medium	Medium	Medium	Medium	Medium
S790 MICROCLEAN	Medium	Medium	Medium	Medium	Medium

本表旨在助于钢材的选用，而未说明不同用途下所遭受的各种应力状态。我方技术人员将乐于回答你在钢材使用和加工过程中的有关问题。

This table is intended to facilitate the steel choice. It does not, however, take into account the various stress conditions imposed by the different types of application. Our technical consultancy staff will be glad to assist you in any questions concerning the use and processing of steels.

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是粉末冶金高速钢。高纯度的无偏析，各向同性的金属粉末和适当大小的颗粒在高温高压下被加工成无偏析，各向同性的高速钢。

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is produced by powder-metallurgy methods. Segregation-free and homogeneous metal powders of highest purity and adequate granulation are processed to homogeneous and segregation-free high speed steels of virtually isotropic properties in a diffusion process taking place at high pressures and temperatures.

碳化物分布和碳化物大小的比较

Comparison of carbide distribution and carbide size

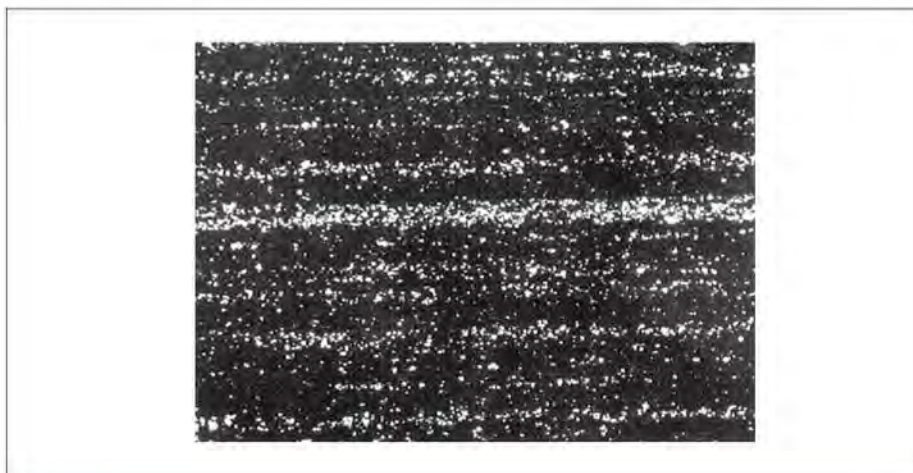
粉末冶金材料

Powder-metallurgy material



普通铸造材料

Conventionally cast material



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性能

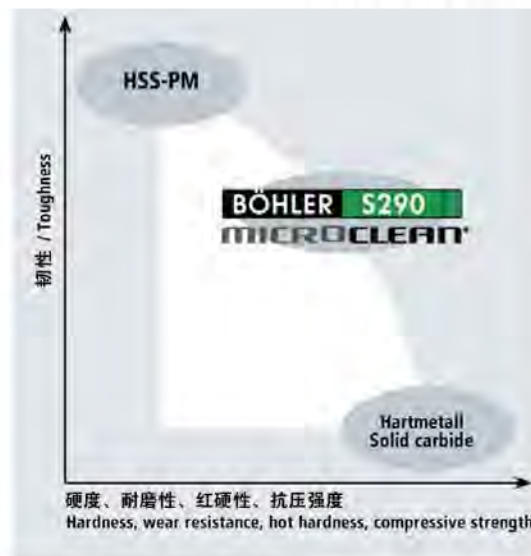
粉末冶金高速钢具有极高的红硬性，抗压强度和耐磨性，粉末冶金技术还赋予钢材极佳的韧性和机加性能，例如十分满意的可磨削性。

Properties

High speed steel produced by powder- metallurgy methods with highest red hardness, compressive strength and wear resistance. The PM technology imparts to the material also excellent toughness and machinability properties, e.g. highly satisfactory grindability.

用途范围

Field of application



用途

重型加工工具

不但可以加工钢材，而且可以加工有色金属，如镍基合金，钛合金。

Applications

Heavy-duty machining tools

Not only for the machining of steels but also for nonferrous metals such as nickel-base and titanium alloys

工具

在极大压力下使用的工具

如：精密冲切工具

- 冲头
- 冲模

Tools

used under extreme compressive stresses

e.g. precision blanking tools for high-strength materials

- shaping punches
- dies

化学成份 (平均值 %) / Chemical composition (average %)

C	Si	Mn	Cr	Mo	V	W	Co
2,0	0,5	0,3	3,8	2,5	5,1	14,3	11,0

交货状态

退火：最大硬度350HB

应力消除

600–650°C

随炉慢冷。用于消除经广泛机械加工和形状复杂工件的内应力。完全加热后，在保护气体中保持1–2小时。

淬火

1180–1210°C /盐浴

1170–1190°C /真空

形状简单的工件采用较高的温度，复杂的工件采用较低的温度。对冷作工具也取较低的淬火温度，这样有助于提高韧性。工件烧透后，整体均热时间不少于80秒，以满足碳化物充分溶解的需要。最长的均热时间为150秒，以避免过热的损害。实践中通常用工件从预热后进入盐槽至往上拿开的时间来代替均热时间（包括表面和心部透烧的过程）。见“浸入时间曲线图”。也可进行真空淬火，在真空炉内的时间取决于相应的工件尺寸和炉子参数。

Delivery condition:

Annealed: max. 350 Brinell.

Stress relieving:

600 to 650°C (1112 to 1202°F)

Slow cooling in furnace.

To relieve stresses set up by extensive machining or in tools of intricate shape.

After through heating, hold in neutral atmosphere for 1 to 2 hours.

Hardening:

1150 to 1210°C (2102 to 2210°F) / salt bath

1150 to 1190°C (2102 to 2174°F) / gas

Upper temperature range for parts of simple shape, lower for parts of complex shape. For coldworking tools also lower temperatures are of importance for higher toughness. Soaking time after heating up the whole section of a workpiece 80 seconds minimum is required for dissolving sufficient carbides. Maximum soaking time 150 seconds to avoid detriments by oversoaking.

In practice instead of soaking time the time of exposure from placing the workpiece into the salt bath after preheating until removing (including the stages of heating to the specified surface temperature and of heating to the temperature throughout the whole section) is used. "see immersion time diagrams".

The time in the vacuum furnace depends on the relevant workpiece size and furnace parameters.

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浸入时间曲线 (盐浴)

奥氏体化时间
(淬火温度)

—— 80 秒
----- 150 秒

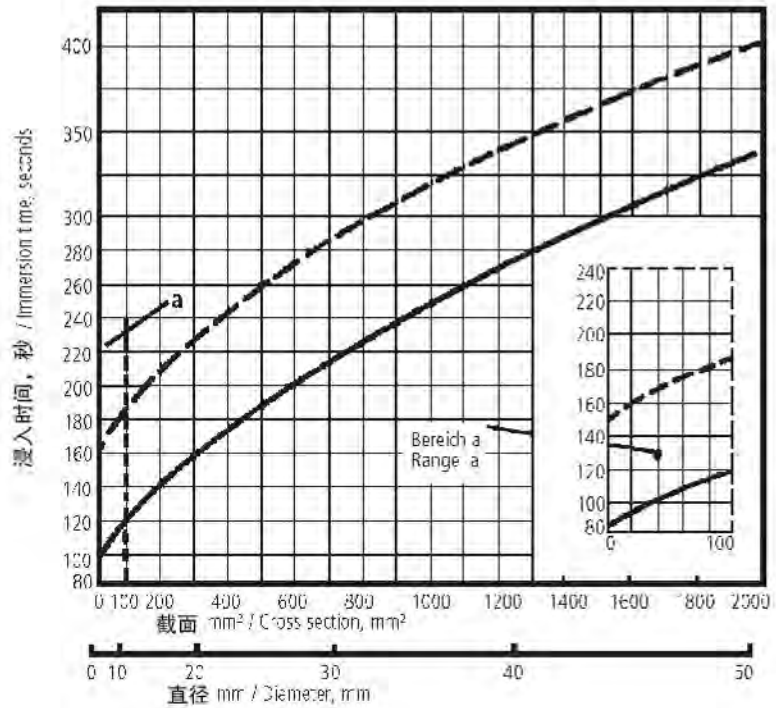
550°C, 850°C, 1050°C 预热

Immersion time chart (salt bath)

Austenitising time
(hardening temperature)

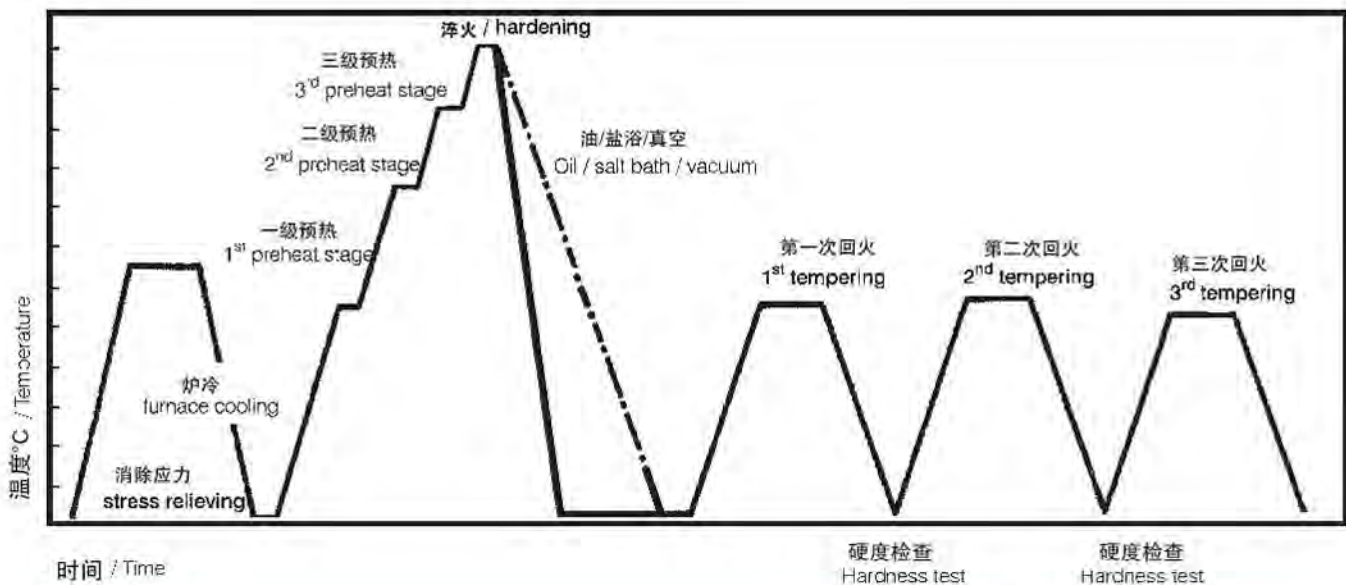
—— 80 seconds
----- 150 seconds

Preheating at 550°C (1022°F), 850°C (1562°F) and 1050°C (1922°F).



热处理程序

Heat treatment sequence



回火:

淬火后及时回火，缓慢加热至回火温度/炉内时间：工件厚度每20mm一小时，但不少于2小时/空冷（最少保持时间：1小时）。

第一次回火和第二次回火至所需工作硬度。

平均硬度值见回火曲线图。

第三次回火用于消除应力，温度比最高回火温度低30-50°C。

回火后可得硬度：66-70HRC。

Tempering:

Slow heating to tempering temperature immediately after hardening/time in furnace: 1 hour for every 20 mm of workpiece thickness, but not less than 2 hours/ air cooling (minimum holding time: 1 hour).

1st tempering and 2nd tempering to desired working hardness.

Average obtainable hardness values are shown in the tempering chart.

3rd tempering for stress relieving,

30 - 50°C (86-122°F) below highest tempering temperature.

Obtainable hardness after tempering:

66 - 70 HRC.

回火曲线图

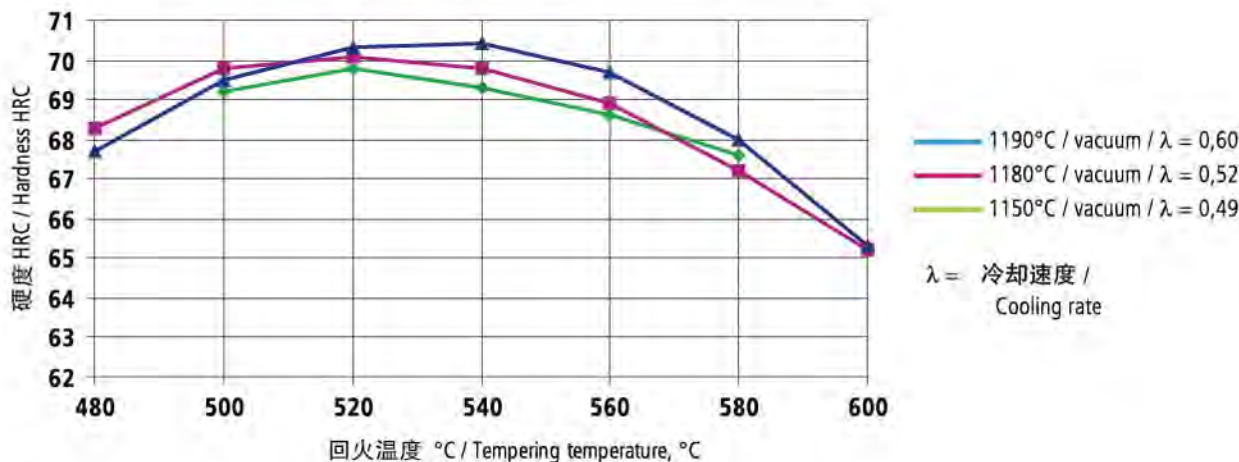
保持时间：3x2小时

工件尺寸：方形25x25mm

Tempering chart

Holding time 3 x 2 hours

Specimen size: square 25 mm



表面处理

氮化:

该钢制件可液体氮化、离子氮化和气体氮化。

Surface treatment

Nitriding:

Parts made from this steel can be bath, plasma and gas nitriding.

涂层:

某些用途可以PVD涂层。

Coating

PVD coating is recommended for certain applications.

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连续冷却CCT曲线图 /
Continuous cooling
CCT curves

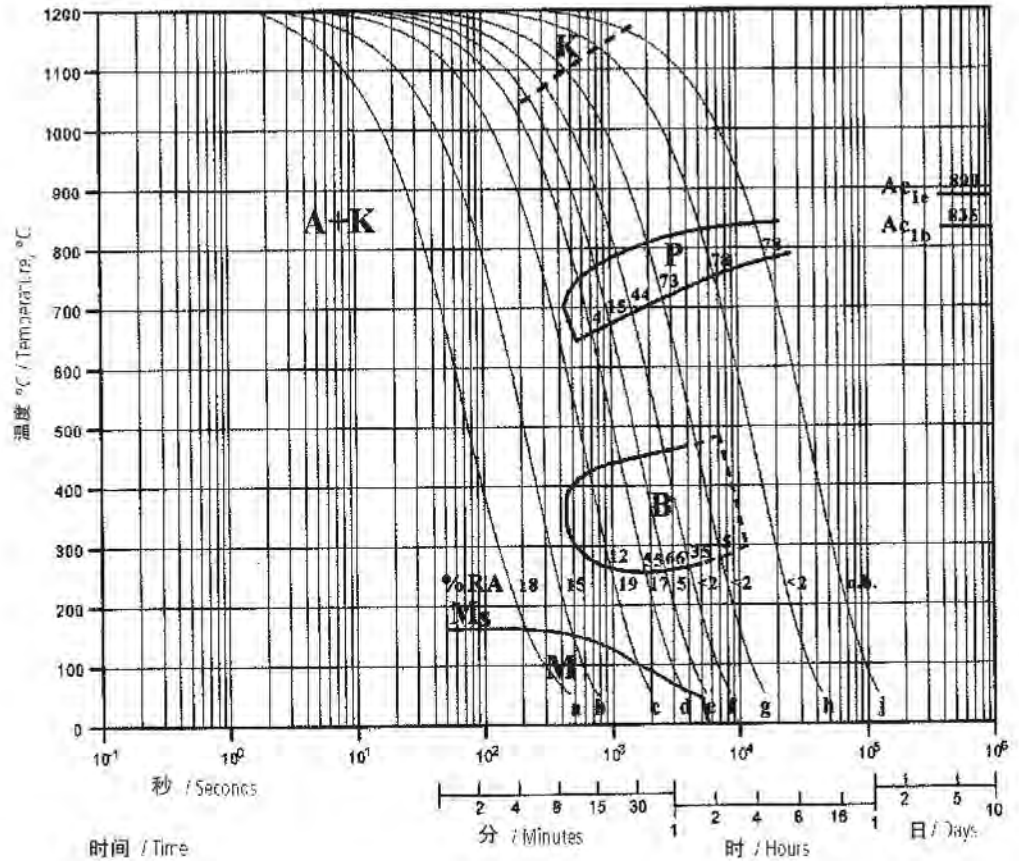
化学成份 (平均值 %) / Chemical composition (average %)

C	Si	Mn	P	S	Cr	Mo	V	W	Co
2,00	0,43	0,30	0,021	0,018	3,77	2,49	4,83	14,27	11,00

奥氏体化温度: 1210°C
保持时间: 3分钟

Austenitising temperature: 1210°C (2210°F)
Holding time: 3 minute

A .. 奥氏体 / Austenite
B .. 贝氏体 / Bainite
K .. 碳化物 / Carbide
P .. 珠光体 / Pearlite
M .. 马氏体 / Martensite
RA .. 残留奥氏体 / Retained austenite



样品 Sample	λ	HV ₁₀
a	0,4	842
b	1,1	864
c	3,0	737
d	5,5	678
e	8,0	626
f	12,5	562
g	23,0	476
h	65,0	444
j	180,0	418

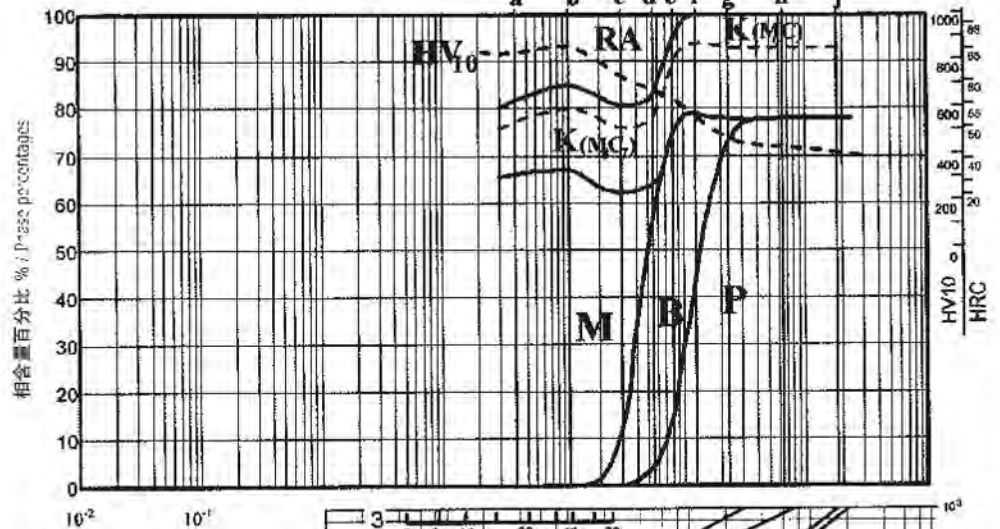
定量相图 /
Quantitative phase diagram

化学成分 (平均值%) / Chemical composition (average %)

C	Si	Mn	P	S	Cr	Mo	V	W	Co
2,00	0,43	0,30	0,021	0,018	3,77	2,49	4,83	14,27	11,00

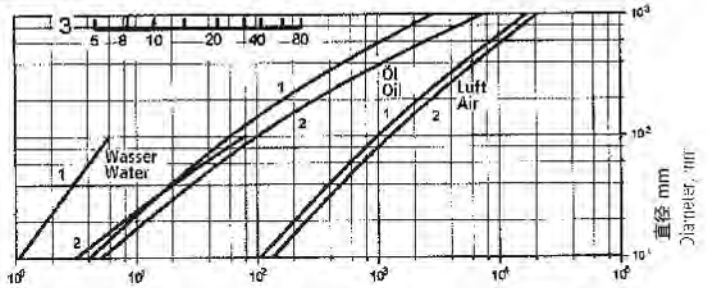
冷却参数 / Cooling parameter

$\lambda = 10^{-4}$ 10^{-3} 10^{-2} 10^{-1} 10^0 10^1 10^2 10^3



- A ... 奥氏体 / Austenite
- B ... 贝氏体 / Bainite
- K ... 碳化物 / Carbide
- P ... 珠光体 / Pearlite
- M ... 马氏体 / Martensite
- RA ... 残留奥氏体 / Retained austenite

- 1 ... 边缘或表面 / Edge or face
- 2 ... 心部 / Core
- 3 ... 顶端淬火试验:
到末端距离
Jominy test:
distance from the quenched end



从800°C冷却到500°C所需时间 单位为秒 / Cooling time in sec. From 800°C to 500°C

物理性能

Physical properties

密度 /
Density at20°C (68°F).....8,30kg/dm³

导热率 /
Thermal conductivity at20°C (68°F).....19,0W/(m.K)

比热 /
Specific heat at20°C (68°F).....410J/(kg.K)

电阻率 /
Electrical resistivity at20°C (68°F).....0,56Ohm.mm²/m

弹性模量 /
Modulus of elasticity at20°C (68°F).....242 x 10³N/mm²

热膨胀系数 20°C 与 ...°C, 10 ⁻⁶ m/(m.K)						
Thermal expansion between 20°C (68°F) and ...°C (°F), 10 ⁻⁶ m/(m.K) at						
100°C 212°F	200°C 392°F	300°C 572°F	400°C 752°F	500°C 932°F	600°C 1112°F	700°C 1292°F
9,6	10,0	10,3	10,6	10,9	11,2	11,6

本产品说明书没有专门提及有关用途和加工手段的数据表，用户可在个别咨询时提出要求。

As regards applications and processing steps that are not expressly mentioned in this product description/data sheet, the customer shall in each individual case be required to consult us.

您的伙伴:

Your partner:

博乐特殊钢(上海)有限公司
中国上海市莘庄工业园区春东路288号3号厂房101区
邮政编码: 201108
电话:(86 21)5442 8989 传真:(86 21)5442 8278
邮箱:shanghai@bohler.com.cn

博乐特殊钢(上海)有限公司深圳分公司
中国广东省深圳市宝安区沙井街道锦程路
和—北方永发科技园第30栋A部分
邮政编码: 518104 电话:(86 755) 2917 5221
传真:(86 755) 2917 5997 邮箱:shenzhen@bohler.com.cn

博乐特殊钢(上海)有限公司—北京办事处
北京经济技术开发区荣京东街甲10号
邮政编码: 100176
电话:(86 21)5442 8989 传真:(86 21)5442 8278
邮箱:beijing@bohler.com.cn



博乐特殊钢(上海)有限公司—大连办事处
中国辽宁省大连市中山区祝贺街35号锦联大厦1403室
邮政编码: 116001
电话:(86 411) 8252 8416 传真:(86 411)8252 8415
邮箱:dalian@bohler.com.cn

博乐特殊钢(上海)有限公司—成都办事处
中国四川省成都市上东大街段246号新良大厦2410室
邮政编码: 610016
电话:(86 28) 8666 7880 传真:(86 28) 8666 7880
邮箱:chengdu@bohler.com.cn

博乐特殊钢(上海)有限公司—厦门办事处
中国福建省厦门市湖里区嘉禾路398号628室
邮政编码: 361009
电话:(86 592)5530 070 传真:(86 592)5530 070
邮箱:xiamen@bohler.com.cn

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