



BÖHLER

HIGH PERFORMANCE STEELS
FOR PUNCHING AND BLANKING

沖壓和下料所需之
高性能鋼材

voestalpine BÖHLER Edelstahl GmbH & Co KG
www.voestalpine.com/boehler-edelstahl

voestalpine



ONE STEP AHEAD.
梧濟工業股份有限公司
WU JII INDUSTRY CO., LTD.

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為您量身打造的 頂尖產品

MADE-TO-MEASURE DIVERSITY FOR THE WORLD'S BEST

現今對成型·切斷加工·沖壓以及下料之模具要求越來越高。基於成本考量·業者所需之模具壽命與前幾年相比要長許多。因此業界對模具鋼材之要求不斷提高。

BÖHLER提供量身定制的產品·以及應用領域之建議和塗層技術之專業技術知識。*

根據客戶的需求·我們提供以下多種不同製程之優異鋼種。

The requirements on **forming, cutting, punching and blanking tools** are constantly rising. Significantly longer service life is expected for tools today compared with just a few years ago, primarily due to continuously rising cost pressure. Consequently the requirements on tool steels are increasing.

BÖHLER offers a broad spectrum of made-to-measure products, along with essential expertise for application advice and coating technology.*

Depending on customer wishes and requirements profiles, we offer various options for the production of BÖHLER top grades with the following designations:

ISODUR®

Cold work tool steels – ESR/PESR
冷作鋼種-ESR/PESR製程

ISOBLOC®

Hot work tool steels – ESR/PESR
熱作鋼種- ESR/PESR製程

MICROCLEAN®

Powder metallurgical steels
粉末冶金製程

* Fa. Eifeler



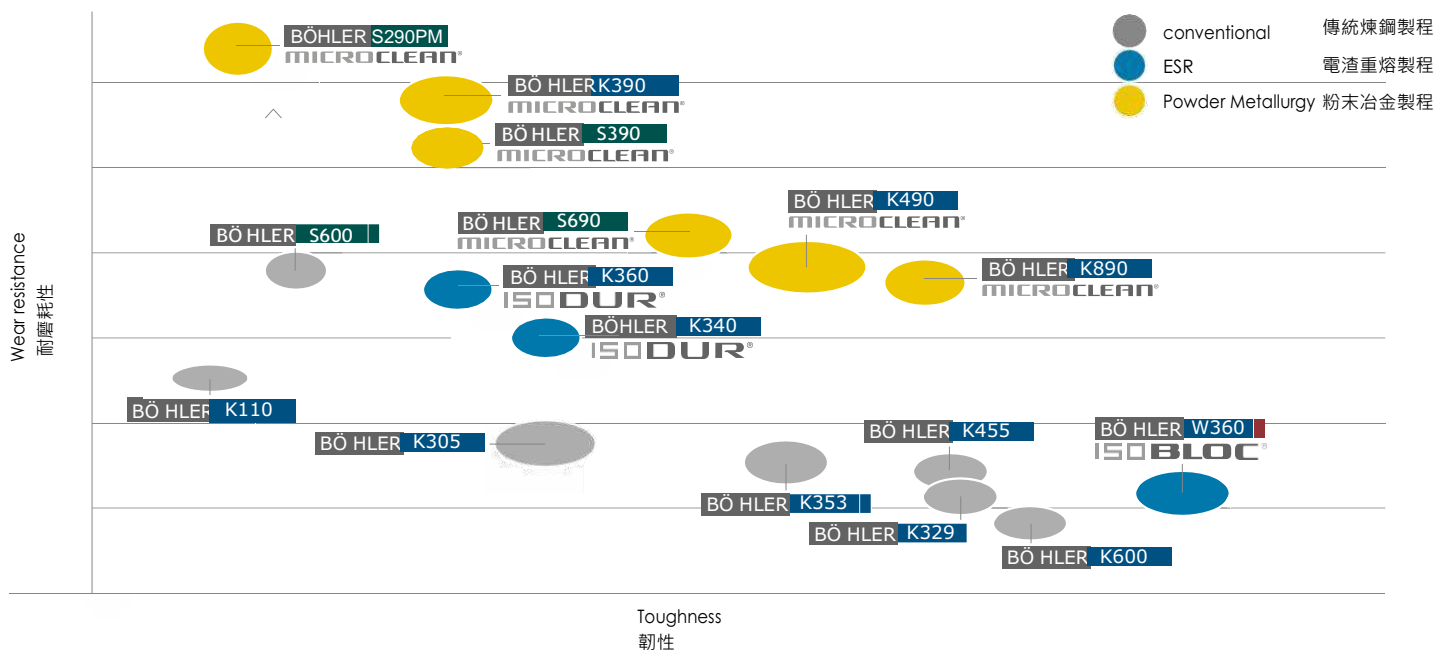
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BÖHLER頂級鋼種特性概觀

COMPARATIVE OVERVIEW OF BÖHLER TOP GRADES

BÖHLER不同製程之冷作鋼種特性比較示意圖

Property profiles of BÖHLER cold work tool steels with various manufacturing technologies



3 種品質等級

3 種煉鋼技術

3 QUALITY LEVELS

3 TECHNOLOGIES

BASIC 基礎級



Conventional production

Products made using the electric arc process are designated as conventionally melted materials and are the "basic materials" for ordinary loading, with the following primary properties:

- » Banded carbide distribution
- » Sufficient cleanliness

常規煉鋼方式

常規煉鋼材質為使用電弧工藝生產的產品，是一般用途通常使用的“基本材質”(EAF)，有以下幾種主要特性：

- » 帶狀碳化物分布
- » 可接受之清淨度



含鉻12%之常規
鋼種微金相組織

Micro structure of
conventional 12%
chromium steel

PREMIUM 優良級



ESR / PESR Manufacture

Products with improved properties can be produced using the ESR or PESR method. Using remelted materials leads to longer tool life due to:

- » High level of cleanliness
- » Low segregation
- » Larger bar dimensions can be produced with the same carbide distribution
- » Uniform dimensional changes
- » Improved toughness

ESR/PESR 或VAR煉鋼

使用ESR/ PESR以及VAR的方式可以生產擁有更佳性能的鋼材。使用重熔鋼能延長模具壽命的原因:

- » 高等級的清淨度
- » 低偏析
- » 即使是產出較大的尺寸也可以有同等級的碳化物分布
- » 尺寸變化均勻 » 韌性較好



含鉻8%之ESR鋼種
微金相組織

Microstructure of
8% chromium steel
in ESR grade

SUPERIOR 特優級



Powder metallurgical production

Materials produced using powder metallurgy are increasingly being used to meet the most stringent requirements with various processing methods. These materials offer properties that meet demanding requirements:

- » No segregation
- » Extremely fine carbide distribution
- » Homogeneous properties
- » High wear resistance » Very good dimensional stability
- » High compressive strength » High toughness with high hardness

粉末冶金煉鋼

使用粉末冶金所製造的鋼材越來越常用在最嚴苛的條件，因為它能滿足以下最嚴格的要求:

- » 無偏析
- » 碳化物分布極細緻 » 高尺寸穩定性
- » 均質化之組織 » 高抗壓強度
- » 高耐磨耗性 » 高韌性及高硬度



粉末冶金鋼種
微金相組織

Microstructure of
PM materials

切斷加工和沖壓- 對材料的要求

CUTTING AND STAMPING – MATERIAL REQUIREMENTS

為了挑選最適用的模具鋼材，需要先了解在製造過程中產生應力的原因。另外也需考慮其他破壞模具的機制。

在很多情況中，常規熔煉製程製造的模具鋼材無法負荷偶爾出現之極高應力，依此無法達到需要的模具壽命。

為了提供較節省成本的選項，BÖHLER提供了多種最新一代的材料，這些材料的特性精準的滿足應用所需的要求。維持穩定的品質使切斷加工與沖壓之製程能達到業界所需之提高生產率。

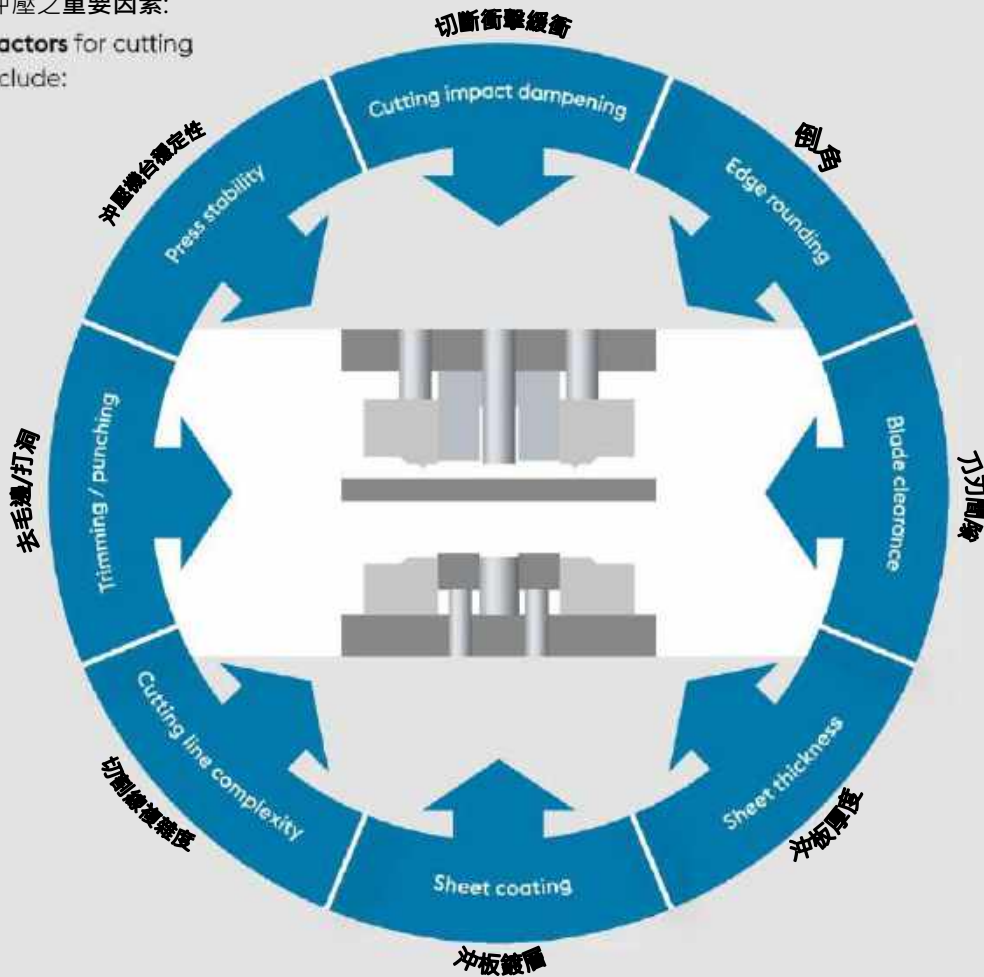
Detailed knowledge of the stress factors in the manufacturing process is needed for selecting a tool material with optimal properties for the process concerned. On the other hand, various damage mechanisms should also be taken into account.

In many cases, conventional tool materials are not able to cope with the extremely high stresses sometimes encountered and are therefore not able to achieve the desired lifetimes.

As a cost-effective alternative, BÖHLER offers a variety of latest-generation materials with performance features precisely aligned to the desired application. Consistently high cutting and stamping performance yield the desired productivity gains.

影響切斷加工和沖壓之重要因素:

The significant factors for cutting and stamping include:



REQUIREMENTS PROFILE

Tool life for cold forming is limited by wear and fatigue, which can lead to considerable downtime costs. By selecting a specific combination of matrix and carbides and a suitable cleanliness grade, BÖHLER offers top grades with properties that achieve optimal results in the relevant application and/or under the relevant stress conditions.

In cold forming operations, 80% of all tool failures in the production of simple high-volume parts are caused by wear.

應用需求概況

冷成型之模具壽命會受限於磨耗及疲勞，會導致可觀的停機成本。透過選擇特定比例組合之基體組織和碳化物，以及適當的清淨度之鋼種，BÖHLER提供了能夠在相關應用以及相關應力條件下達到最佳結果之性能的鋼種。

在冷成型之簡單大批量零件生產的製程中，所有模具失效的原因有80%是由磨損引起的。

損耗機制以及 避免其發生之方法

DAMAGE MECHANISMS AND THEIR AVOIDANCE

ABRASIVE WEAR

Abrasion means material removal by gouging, cutting or chipping where two materials are in contact. In the case of cold forming tools, this primarily takes the form of erosion of the matrix of the tool material. Carbides retard this process.

磨粒磨耗

磨粒磨耗是指在兩個材質之接觸下，材料表面被刨除、切割以及崩角。在冷成型模具的案例中，這樣的問題通常會以模具材料基地沖蝕之方式表現。而碳化物可以減緩該過程。

可能的解決方法

使用碳化物含量高且基地組織強度高的材料，例如 BÖHLER K390 MICROCLEAN

ADHESIVE WEAR

Adhesion refers to the tendency to cold welding. Steels with high hardness and strength must be used to counter or prevent this tendency. The carbides embedded in the steel matrix reduce the tendency to adhesion, with a higher carbide content and more uniform carbide distribution both increasing the resistance to adhesive wear.

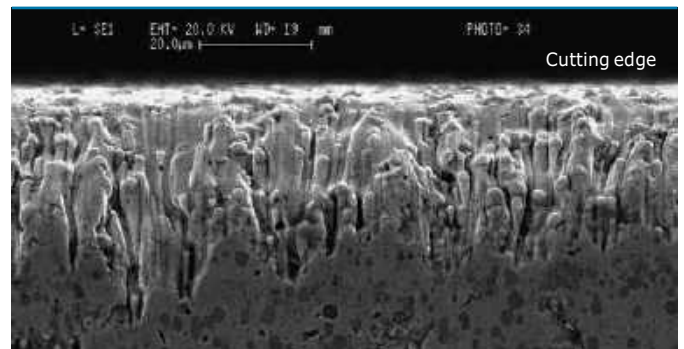
黏著磨耗

黏著磨耗是指在在製程中出現冷鐸之過程。須使用高硬度和高強度的鋼材來抵消或防止這種趨勢。嵌入基地中的碳化物降低了材料黏著的趨勢，更高的碳化物含量且更均勻分布的碳化物，得以增加了對黏著磨耗的抵抗力。

可能的解決方法

使用具有精細碳化物，均勻分佈和高強度基地的材料，例如 BÖHLER K340 ISODUR或在模具表面鍍層

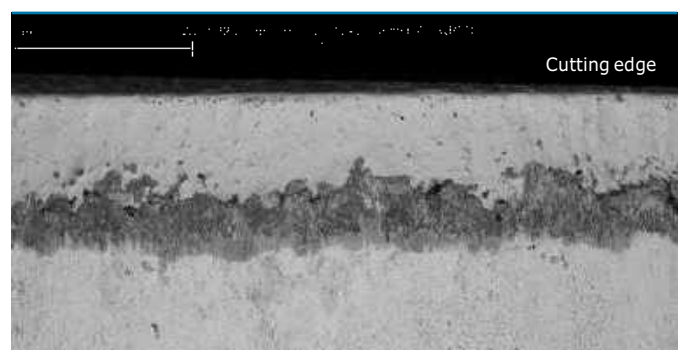
Abrasive wear – 磨粒磨耗- matrix erosion 基地沖蝕



Potential solution:

Use a material with high carbide content and a high-strength matrix, such as BÖHLER K390 MICROCLEAN

Adhesive wear – 黏著磨耗- cold welding, material transfer 冷鐸，材料轉移



Potential solution:

Use a material with fine carbides, uniform distribution and a high-strength matrix, such as BÖHLER K340 ISODUR or use of coated tools



FATIGUE

Material fatigue means crack initiation and crack growth as a result of cyclic stress. Although tools for cold forming are usually pre-stressed under compression, fatigue fractures may occur under certain conditions, such as pressing operations.

疲勞

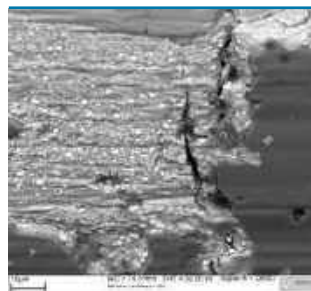
材料疲勞是指循環應力導致的裂紋產生和裂紋擴展。儘管在壓縮狀況下冷成型模具會預先受到應力影響，在某些條件下（例如沖壓製程）可能會發生疲勞斷裂。

可能的解決方法

使用碳化物細、分佈均勻、抗壓强度高和清淨度高的材料，例如BÖHLER S390 MICROCLEAN

疲勞-剝落以及塑性變型

Fatigue – spalling & plastic deformation



Tangential cracks
切向破裂



Edge chipping due to cyclic plastic deformation
由於循環塑性變型造成的邊緣崩角

Potential solution:

Use a material with fine, uniformly distributed carbides, high compressive strength and high purity, such as BÖHLER S390 MICROCLEAN

選對模具材料 能為您帶來的益處

GOOD TO KNOW

對模具材料的要求越來越苛刻，也越來越複雜。

憑藉專業的產品建議和全面的產品範圍，BÖHLER能夠提供針對您特定需求和問題量身定制之解決方案。改為使用高性能材料進行加工，通常會很快得到回報，因為高性能模具的材料成分通常僅佔總價值的5%，但能帶給您以下益處。

成本效益來自：

- » 更好的加工性
- » 更長的模具壽命
- » 減少維護成本
- » 減少開模數量
- » 減少停機時間

總結：

通過使用可靠的工具材料，您可以節省時間和金錢，並提高您的競爭力。

Requirements for tool materials are becoming more demanding and more complex.

With expert product advice and a comprehensive product spectrum, BÖHLER is able to offer solutions individually tailored to your specific requirements and problems. The decision to use high-quality materials for your tooling often pays off quickly, since the material component of high-performance tooling often represents only 5% of the total value.

Cost-effectiveness result from:

- » Better machining characteristics
- » Longer life
- » Lower maintenance costs
- » Fewer tools
- » Less downtime

In short:

BY USING RELIABLE TOOL MATERIALS, YOU SAVE TIME AND MONEY AND IMPROVE YOUR COMPETITIVENESS.



多樣化之鋼種 供您選擇最符合之材料

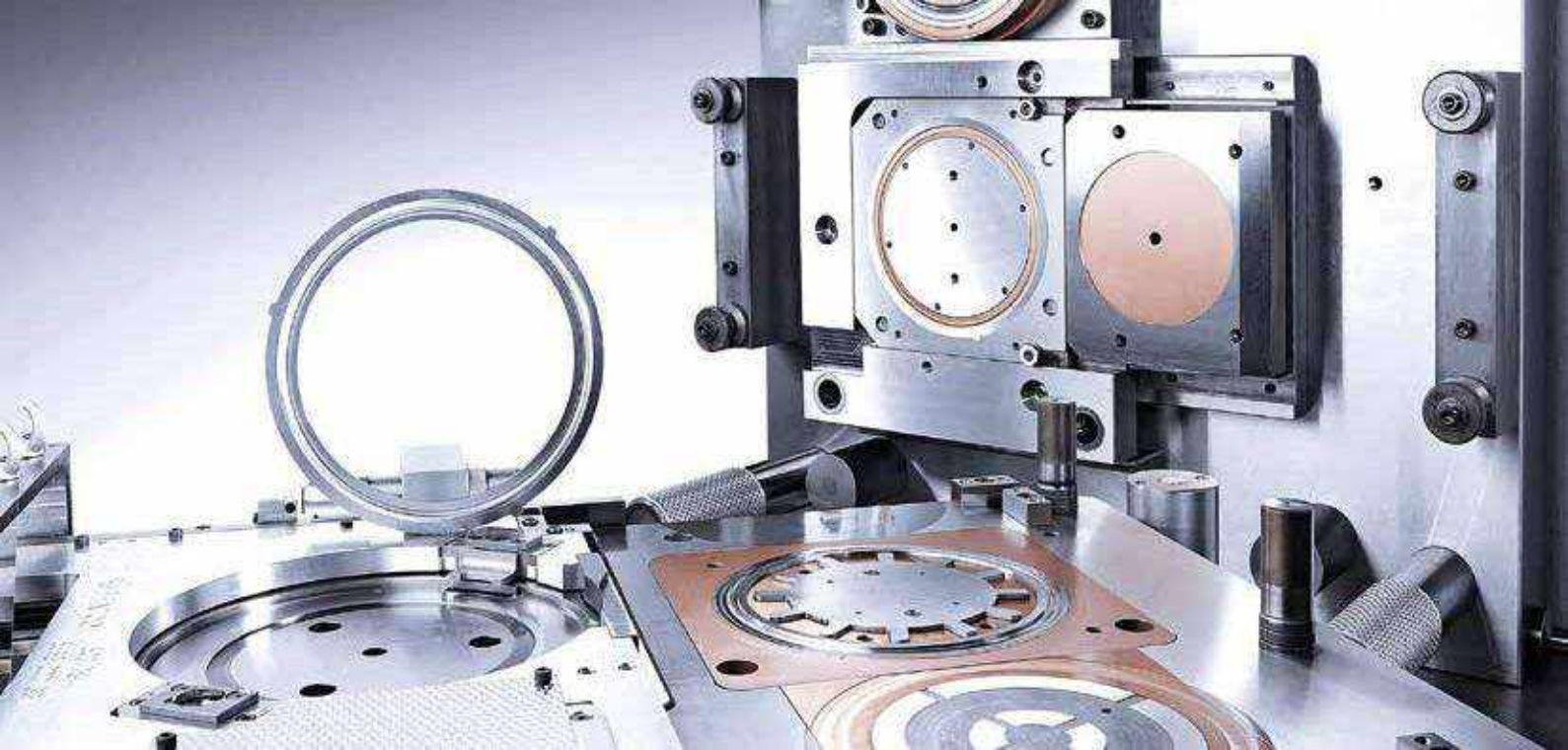
THE FULL DIVERSITY AT A GLANCE

CORE PRODUCTS 主要產品

| 百樂牌號 BÖHLER grade | 合金成分 (百分比%) Chemical composition (nominal in wt.%) | | | | | | 標準牌號 Standards | |
|----------------------|---|-------|------|------|------|-----------|-------------------------|---------------|
| | C | Cr | Mo | V | W | Others | DIN / EN | AISI |
| BÖHLER K100 | 2.00 | 11.50 | - | - | - | - | 1.2080 X210Cr12 | ~ D3 |
| BÖHLER K110 | 1.55 | 11.50 | 0.75 | 0.75 | - | - | 1.2379 X155CrVMo12-1 | D2 |
| BÖHLER K305 | 1.00 | 5.20 | 1.10 | 0.25 | - | - | 1.2363 X100CrMoV5-1 | A2 |
| BÖHLER K353 | 0.82 | 8.00 | 1.60 | 0.60 | - | + Al | Patented | - |
| BÖHLER K455 | 0.63 | 1.10 | - | 0.18 | 2.00 | - | 1.2550 60WCrV7 | ~ S1 |
| BÖHLER K600 | 0.45 | 1.30 | 0.25 | - | - | Ni = 4.00 | 1.2767 45NiCrMo16 | - |
| BÖHLER S600 | 0.90 | 4.10 | 5.00 | 1.80 | 6.40 | - | 1.3343 HS6-5-2 | ~ M2 reg.C |
| BÖHLER S630 | 0.95 | 4.00 | 4.00 | 2.00 | 4.00 | + Al | 1.3330 HS4-4-2 | - |

| 百樂牌號 BÖHLER grade | 合金成分 (百分比%) Chemical composition (nominal in wt.%) | | | | | | 標準牌號 Standards | |
|---------------------------------------|---|------|------|------|---|--------------|-------------------|------|
| | C | Cr | Mo | V | W | Others | DIN / EN | AISI |
| BÖHLER K340 ISODUR® | 1.10 | 8.30 | 2.10 | 0.50 | - | + Al + Nb | Patented | - |
| BÖHLER K360 ISODUR® | 1.25 | 8.75 | 2.70 | 1.18 | - | + Al + Nb | Patented | - |
| BÖHLER W360 ISOBLOC® | 0.50 | 4.50 | 3.00 | 0.55 | - | - | Patented | - |

| 百樂牌號 BÖHLER grade | 合金成分 (百分比%) Chemical composition (nominal in wt.%) | | | | | | 標準牌號 Standards | |
|--|---|------|------|------|-------|------------|-------------------|------|
| | C | Cr | Mo | V | W | Others | DIN / EN | AISI |
| BÖHLER K390 MICROCLEAN® | 2.45 | 4.15 | 3.75 | 9.00 | 1.00 | Co = 2.00 | Patented | - |
| BÖHLER K490 MICROCLEAN® | 1.40 | 6.40 | 1.50 | 3.70 | 3.50 | + Nb | Patented | - |
| BÖHLER K890 MICROCLEAN® | 0.85 | 4.35 | 2.80 | 2.10 | 2.55 | Co = 4.50 | Patented | - |
| BÖHLER S290 MICROCLEAN® | 2.00 | 3.75 | 2.50 | 5.00 | 14.30 | Co = 11.00 | Patented | - |
| BÖHLER S390 MICROCLEAN® | 1.60 | 4.80 | 2.00 | 5.00 | 10.50 | Co = 8.00 | - | - |
| BÖHLER S690 MICROCLEAN® | 1.33 | 4.30 | 4.90 | 4.10 | 5.90 | - | - | ~ M4 |




























| 百樂牌號 BÖHLER grade | 抗磨耗性 Wear resistance | | 韌性 Toughness | 抗壓強度 Compressive strength | 熱處理時的尺寸穩定性 Dimensional stability during heat treatment |
|---|-------------------------|---------------|-----------------|------------------------------|---|
| | abrasive 磨粒磨耗 | adhesive 黏著磨耗 | | | |
| BÖHLER K100 | ★★★ | ★ | ★ | ★ | ★★ |
| BÖHLER K110 | ★★★ | ★ | ★ | ★★ | ★★ |
| BÖHLER K305 | ★ | ★ | ★★★★★ | ★ | ★ |
| BÖHLER K340 ISODUR® | ★★★ | ★★★★★ | ★★★ | ★★★ | ★★★ |
| BÖHLER K353 | ★★ | ★★★ | ★★★★★ | ★★ | ★★ |
| BÖHLER K360 ISODUR® | ★★★★★ | ★★★★★ | ★★ | ★★★ | ★★★ |
| BÖHLER K390 MICROCLEAN | ★★★★★ | ★★★★★ | ★★★★★ | ★★★★★ | ★★★★ |
| BÖHLER K490 MICROCLEAN | ★★★★★ | ★★★★★ | ★★★★★ | ★★★ | ★★★★ |
| BÖHLER K890 MICROCLEAN | ★★★ | ★★★ | ★★★★★ | ★★★ | ★★★★ |
| BÖHLER K455 | ★ | ★ | ★★★★★ | ★ | ★ |
| BÖHLER K600 | ★ | ★ | ★★★★★ | ★ | ★ |
| BÖHLER S600 | ★★ | ★★ | ★ | ★★★ | ★★ |
| BÖHLER S630 | ★★ | ★★★ | ★★ | ★★★ | ★★ |
| BÖHLER S290 MICROCLEAN | ★★★★★ | ★★★★★ | ★★ | ★★★★★ | ★★★★ |
| BÖHLER S390 MICROCLEAN | ★★★★★ | ★★★★★ | ★★★ | ★★★★ | ★★★★ |
| BÖHLER S690 MICROCLEAN | ★★★★★ | ★★★ | ★★★★★ | ★★★ | ★★★★ |
| BÖHLER W360 ISOBLOC® | ★ | ★ | ★★★★★ | ★ | ★★ |

Note:
The rating of the properties is based solely on stamping and cutting applications and the steels listed here. Comparative ratings are strongly dependent on specific heat treatment. For detailed advice on material selection, please consult your voestalpine BÖHLER dealer.

PROFITABLE MATERIAL RECOMMENDATIONS

經濟實惠的 推薦鋼種















| 可加工之材料 Material to be cut | 被加工材料之厚 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRC) Standard hardness of punches and dies in HRC | |
|--|-------------------------------|---------------------------|--|---|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 |
| Steel sheet, plate & strip, aluminium and aluminium alloys, copper and copper alloys with tensile strength up to 600 MPa 鋼板、鋼帶、鋁及鋁合金、銅 及銅合金，抗拉強度不高於 600 MPa | up to 3 mm 3 mm 以下厚度 | BÖHLERK110 | 60 | 62 |
| | | BÖHLERK340 ISODUR® | 60 | 63 |
| | | BÖHLERK360 ISODUR® | 61 | 63 |
| | 3 – 6 mm | BÖHLERK390 MICROCLEAN® | 62 | 64 |
| | | BÖHLER S600 | 60 | 63 |
| | | BÖHLERK110 | 58 | 62 |
| | | BÖHLERK305 | 58 | 62 |
| | | BÖHLERK340 ISODUR® | 60 | 62 |
| | | BÖHLERK353 | 60 | 62 |
| | | BÖHLERK360 ISODUR® | 60 | 62 |
| | | BÖHLERK390 MICROCLEAN® | 61 | 63 |
| | | BÖHLERW360 ISOBLOC® | 55 | 57 |
| BÖHLERK490 MICROCLEAN® | | 62 | 64 | |
| 6 – 12 mm | BÖHLERK890 MICROCLEAN® | 61 | 63 | |
| | BÖHLER S600 | 59 | 62 | |
| | BÖHLER S630 | 59 | 62 | |
| | BÖHLERK340 ISODUR® | 58 | 60 | |
| | BÖHLERK353 | 60 | 62 | |
| | BÖHLERK390 MICROCLEAN® | 60 | 62 | |
| | BÖHLERW360 ISOBLOC® | 54 | 56 | |
| | BÖHLERK455 | 52 | 56 | |
| | BÖHLERK490 MICROCLEAN® | 61 | 63 | |
| | BÖHLERK890 MICROCLEAN® | 60 | 62 | |
| over 12 mm 12 mm 以上厚度 | BÖHLERK353 | 58 | 60 | |
| | BÖHLERW360 ISOBLOC® | 50 | 54 | |
| | BÖHLERK490 MICROCLEAN® | 58 | 60 | |
| | BÖHLERK600 | 52 | 54 | |
| | BÖHLERK890 MICROCLEAN® | 58 | 60 | |

| 可加工之材料 Material to be cut | 被加工材料之厚 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRC) Standard hardness of punches and dies in HRc | |
|--|---|---|--|---|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 |
| Steel sheet/plate & strip and metal alloys with tensile strength of 600 to 1000 MPa 鋼板、鋼帶、金屬合金·抗 拉強度界於600至1000 MPa之間 | up to 3 mm 3 mm 以下厚度 |  | 58 | 62 |
| | |  | 60 | 62 |
| | |  | 60 | 62 |
| | |  | 61 | 63 |
| | |  | 59 | 62 |
| | |  | 59 | 62 |
| | 3 - 6 mm |  | 56 | 60 |
| | |  | 58 | 60 |
| | |  | 58 | 60 |
| | |  | 60 | 62 |
| | |  | 60 | 62 |
| | |  | 60 | 62 |
| | 6 - 12 mm |  | 54 | 56 |
| | |  | 58 | 60 |
| | |  | 58 | 60 |
| | |  | 52 | 54 |
| | |  | 50 | 54 |
| | |  | 58 | 60 |
| | |  | 58 | 60 |
| | |  | 57 | 59 |
| over 12 mm 12 mm 以上厚度 |  | 52 | 54 | |
| |  | 48 | 52 | |
| |  | 58 | 60 | |
| |  | 48 | 52 | |
| |  | 58 | 60 | |

PROFITABLE MATERIAL RECOMMENDATIONS

經濟實惠的 推薦鋼種




















| 可加工之材料 Material to be cut | 被加工材料之厚 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRC) Standard hardness of punches and dies in HRC | | |
|--|--|--|--|---|----|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 | |
| | | | | | |
| Precision blanking tools for metallic sheets and strips 加工金屬板或金屬帶之精密 下料模具 | up to 4 mm 4 mm 以下厚度 | BÖHLER K110 | 60 | 62 | |
| | | BÖHLER K305 | 60 | 61 | |
| | | BÖHLER K340 ISODUR® | 61 | 63 | |
| | | BÖHLER K353 | 60 | 62 | |
| | | BÖHLER K360 ISODUR® | 61 | 63 | |
| | | BÖHLER K390 MICROCLEAN® | 62 | 64 | |
| | | BÖHLER K490 MICROCLEAN® | 62 | 64 | |
| | | BÖHLER S290 MICROCLEAN® | 63 | 67 | |
| | | BÖHLER S390 MICROCLEAN® | 62 | 64 | |
| | | BÖHLER S600 | 60 | 62 | |
| | | BÖHLER S630 | 60 | 62 | |
| | | BÖHLER S690 MICROCLEAN® | 60 | 62 | |
| | | 4 - 8 mm | BÖHLER K110 | 58 | 60 |
| | | | BÖHLER K305 | 58 | 60 |
| | | | BÖHLER K340 ISODUR® | 60 | 62 |
| | BÖHLER K353 | | 60 | 62 | |
| | BÖHLER K360 ISODUR® | | 60 | 62 | |
| | BÖHLER K390 MICROCLEAN® | | 61 | 63 | |
| | BÖHLER K490 MICROCLEAN® | | 61 | 63 | |
| | BÖHLER K890 MICROCLEAN® | | 60 | 63 | |
| | BÖHLER S390 MICROCLEAN® | | 61 | 64 | |
| | BÖHLER S600 | | 59 | 62 | |
| | BÖHLER S630 | | 59 | 62 | |
| | BÖHLER S690 MICROCLEAN® | | 60 | 62 | |

| 可加工之材料 Material to be cut | 被加工材料之厚 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRC) Standard hardness of punches and dies in HRC | | |
|--|-------------------------------|---|---|---|----|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 | |
| Precision blanking tools for metallic sheets and strips 加工金屬板或金屬帶之精密 下料模具 | 8 - 12 mm |  | 58 | 60 | |
| | |  | 58 | 60 | |
| | |  | 60 | 62 | |
| | |  | 60 | 62 | |
| | |  | 59 | 62 | |
| | |  | 54 | 56 | |
| | |  | 60 | 63 | |
| | |  | 58 | 62 | |
| | |  | 58 | 62 | |
| | |  | 58 | 62 | |
| | | over 12 mm 12 mm 以上厚度 |  | 50 | 54 |
| | | |  | 58 | 62 |
| | | |  | 58 | 62 |
| | | |  | 58 | 62 |

PROFITABLE MATERIAL RECOMMENDATIONS

經濟實惠的 推薦鋼種

| 可加工之材料 Material to be cut | 被加工材料之厚 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRc) Standard hardness of punches and dies in HRc | | |
|---|--|--|--|---|----|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 | |
| Sheets and strips for dynamos and transformers (highly abrasive) 用於發電機及變壓器之金屬 板或金屬帶 (高磨粒磨耗) | up to 1 mm 1 mm 以下厚度 | BÖHLER K100 | 63 | 65 | |
| | | BÖHLER K110 | 60 | 62 | |
| | | BÖHLER K360 ISODUR® | 61 | 63 | |
| | | BÖHLER K390 MICROCLEAN® | 62 | 64 | |
| | | BÖHLER K490 MICROCLEAN® | 62 | 64 | |
| | | BÖHLER S290 MICROCLEAN® | 63 | 68 | |
| | | BÖHLER S390 MICROCLEAN® | 62 | 66 | |
| | | BÖHLER S690 MICROCLEAN® | 62 | 64 | |
| | | 1 - 3 mm | BÖHLER K360 ISODUR® | 59 | 62 |
| | BÖHLER K390 MICROCLEAN® | | 61 | 63 | |
| | BÖHLER K490 MICROCLEAN® | | 60 | 63 | |
| | BÖHLER S390 MICROCLEAN® | | 61 | 63 | |
| | 3 - 6 mm | BÖHLER K340 ISODUR® | 58 | 60 | |
| | | BÖHLER K390 MICROCLEAN® | 60 | 62 | |
| | | BÖHLER K490 MICROCLEAN® | 60 | 63 | |
| | | BÖHLER K890 MICROCLEAN® | 60 | 63 | |
| | | BÖHLER S390 MICROCLEAN® | 60 | 62 | |
| | Austenitic steels 沃斯田鐵鋼材 | up to 3 mm 3 mm 以下厚度 | BÖHLER K340 ISODUR® | 60 | 62 |
| | | | BÖHLER K353 | 60 | 62 |
| | | | BÖHLER K360 ISODUR® | 60 | 63 |
| | | | BÖHLER K390 MICROCLEAN® | 62 | 64 |
| BÖHLER K490 MICROCLEAN® | | | 62 | 64 | |
| BÖHLER S390 MICROCLEAN® | | | 63 | 65 | |
| BÖHLER S600 | | | 61 | 63 | |
| BÖHLER S690 MICROCLEAN® | | | 61 | 63 | |

| 可加工之材料 Material to be cut | 被加工材料之厚 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRC) Standard hardness of punches and dies in HRC | |
|------------------------------|-------------------------------|---|--|---|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 |
| | | | Austenitic steels 沃斯田鐵鋼材 | 3 - 6 mm |
| | |  | 59 | 61 |
| | |  | 61 | 63 |
| | |  | 61 | 63 |
| | |  | 60 | 63 |
| | |  | 60 | 64 |
| | |  | 60 | 62 |
| | 6 - 12 mm |  | 56 | 58 |
| | |  | 58 | 60 |
| | |  | 54 | 56 |
| | |  | 58 | 60 |
| | |  | 59 | 61 |
| | |  | 60 | 62 |
| | |  | 58 | 60 |
| | |  | 58 | 60 |
| | over 12 mm 12 mm 以下厚度 |  | 57 | 59 |
| | |  | 54 | 56 |
| | |  | 58 | 60 |
| | |  | 58 | 60 |
| | |  | 58 | 60 |

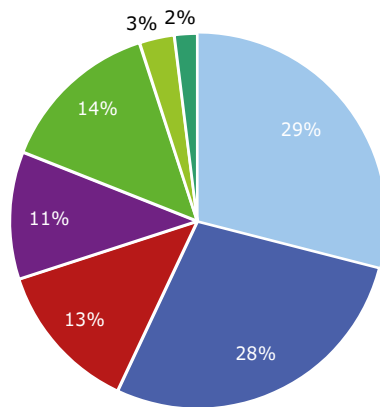
加工高強度及 超高強度鋼板

MACHINING OF HIGH-STRENGTH AND ULTRA HIGH-STRENGTH SHEETS

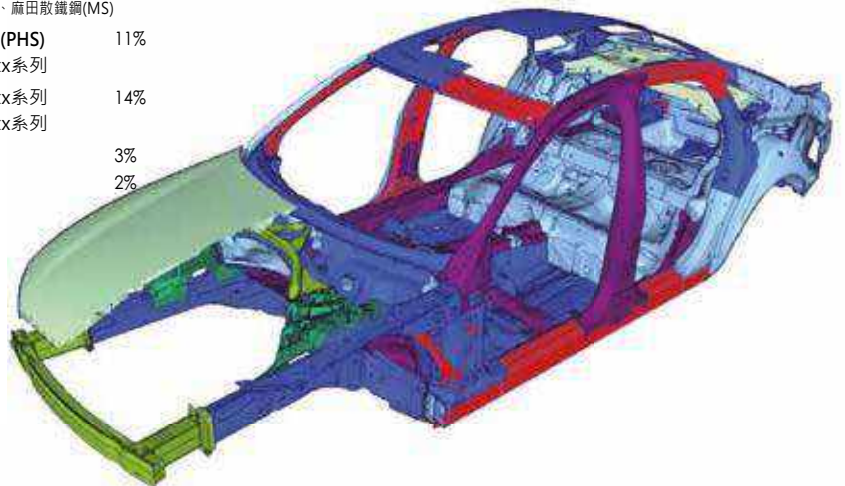
APPLICATION 應用

The share of high-strength and ultra high-strength sheet metal in vehicle construction is strongly rising. BÖHLER offers a broad spectrum of grades to provide the optimum solution for demanding machining tasks

高強度和超高強度鈹金在汽車構造中的應用比例正在急速上升。BÖHLER提供多種等級的產品，為苛刻的加工製程提供最佳解決方案



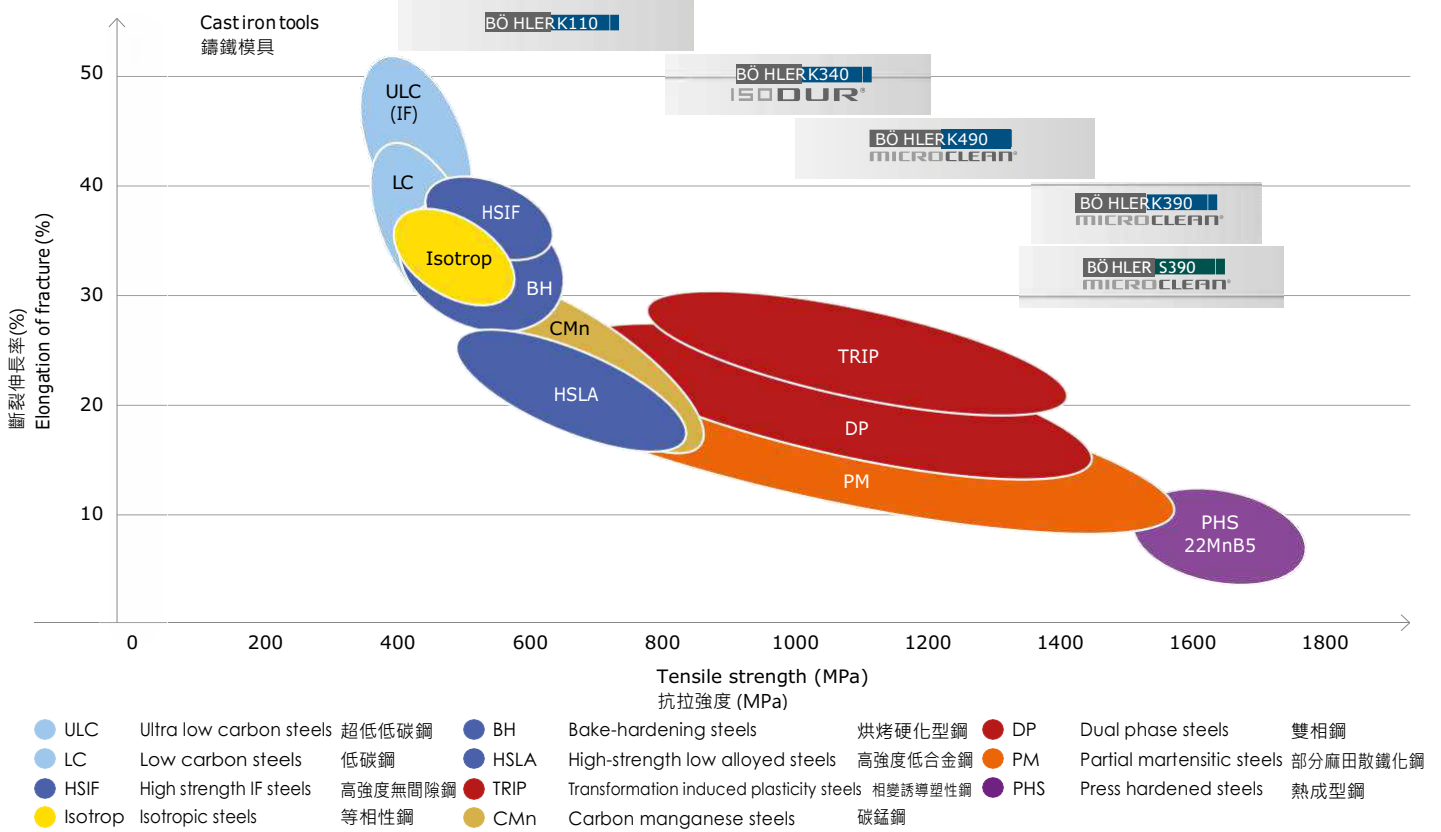
| | | |
|---|--|-----|
| ■ Low-strength steels: Mild steels | 低強度鋼: 低碳鋼 | 29% |
| ■ High-strength steels (HSS): High-strength interstitial-free steels (HSIF), Bake hardening steels (BH), High-strength low alloy steels (HSLA) | 高強度鋼(HSS): 高強度無間隙鋼(HSIF) 烘烤硬化型鋼(BH) 高強度低合金鋼(HSLA) | 28% |
| ■ Advanced high-strength steels (AHSS): Dual phase steels (DP), Transformation induced plasticity steels (TRIP) | 先進高強度鋼(AHSS) 13% 雙相鋼(DP)、 相變誘導塑性鋼(TRIP) | |
| ■ Stainless steels: Austenitic stainless steels | 不銹鋼: 沃斯田鐵系不銹鋼 | |
| ■ Ultra high-strength steels (UHSS): Complex phase steels (CP), Martensitic steels (MS) | 超高強度鋼(UHSS) 複相鋼(CP)、麻田散鐵鋼(MS) | |
| ■ Press hardened steels (PHS) | 熱成型鋼(PHS) | 11% |
| ■ Aluminium sheets: 7xxx series | 鋁板: 7xxx系列 | |
| ■ Aluminium sheets: 6xxx series | 鋁板: 6xxx系列 | 14% |
| ■ Aluminium sheets: 5xxx series | 鋁板: 5xxx系列 | |
| ■ Aluminium extrusion profiles | 鋁擠材 | 3% |
| ■ Cast aluminium | 鑄鋁 | 2% |





MATERIALS FOR CUTTING, PUNCHING AND BLANKING 用於切斷加工、沖孔及下料高強度和超高強度板材之鋼材
HIGH-STRENGTH AND ULTRA-HIGH STRENGTH SHEETS

Tool steels – sheet materials 模具鋼 – 板材



PROFITABLE MATERIAL RECOMMENDATIONS 經濟實惠的推薦鋼種

| 可加工之材料 Material to be cut | 加工材料之厚度 Material thickness | 推薦之百樂牌號 BÖHLER grade | 沖頭與模具的標準硬度 (HRC) Standard hardness of punches and dies in HRC | |
|--|-------------------------------|--|--|--|
| | | | Complex shapes and/or thick sheets 複雜型狀及/或厚板 | Simple shapes and/or thin sheets 簡單型狀及/或薄板 |
| Steel sheet/plate and strip and metal alloys with tensile strengths over 1000 MPa 鋼板、鋼帶、抗拉強度大於 1000 MPa 之間的金屬合金 | up to 2 mm 2 mm 以下厚度 | BÖHLER K340 ISODUR® | 60 | 62 |
| | | BÖHLER K360 ISODUR® | 60 | 62 |
| | | BÖHLER K390 MICROCLEAN® | 62 | 64 |
| | | BÖHLER K490 MICROCLEAN® | 62 | 64 |
| | | BÖHLER K890 MICROCLEAN® | 60 | 64 |
| | | BÖHLER S390 MICROCLEAN® | 62 | 64 |
| | | BÖHLER S600 | 60 | 62 |
| | over 2 mm 2 mm 以上厚度 | BÖHLER K340 ISODUR® | 58 | 60 |
| | | BÖHLER W360 ISOBLOC® | 55 | 57 |
| | | BÖHLER K490 MICROCLEAN® | 60 | 62 |
| | | BÖHLER K890 MICROCLEAN® | 60 | 64 |
| | | BÖHLER S390 MICROCLEAN® | 60 | 62 |
| | | BÖHLER S600 | 60 | 62 |
| | | BÖHLER S690 MICROCLEAN® | 60 | 64 |

The formability and ductility of all of the materials mentioned above decrease with increasing hardening phases.
上面提到的所有材料的可成形性和延展性隨著硬化程度的增加而降低。



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