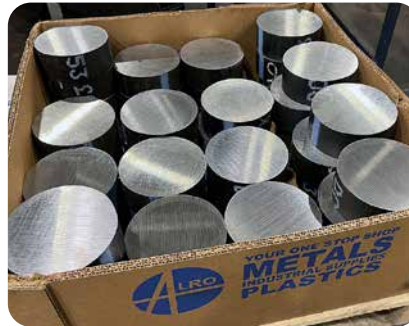
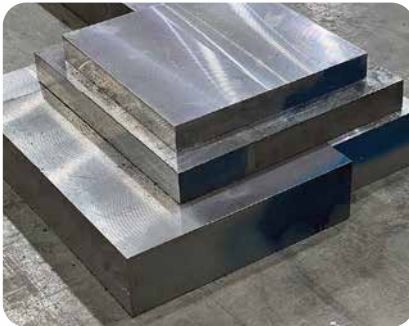




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DC53 Medium Chrome Tool Steel



Features:

- Uniform distribution of fine carbides
- Excellent galling and wear resistance
- Exceptional toughness and fatigue resistance
- High temper resistance to support PVD and Nitride surface treatments
- Machining and grinding characteristics superior to most other tool steels
- Rounds from 1/4" diameter up to 20" diameter
- Flats from 1/2" to 12" thick & widths up to 24" wide

The High Performance Alternative for:

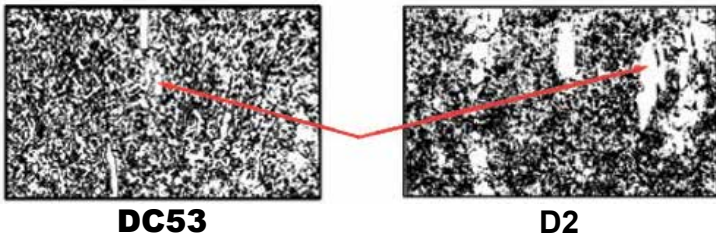
- Punches
- Dies
- Draw & Form Dies
- Shear Blades
- Shredder Knives
- Thread & Form Rolls
- Cold Heading Dies
- Mill Rolls & Slitters

DC53 INTRODUCTION

DC53 is a general purpose cold work tool steel with exceptional Toughness, Wear Resistance, Compressive Strength and Temper Resistance. These properties are obtained through its chemistry as well as its unique manufacturing process of ladle refinement, vacuum degassing and forging methods. **DC53** also has excellent machining characteristics and is well suited as a substrate for PVD surface treatments. **DC53** can also be hot process CVD and TD (Thermal Diffusion) coated, however post heat treat is generally recommended.

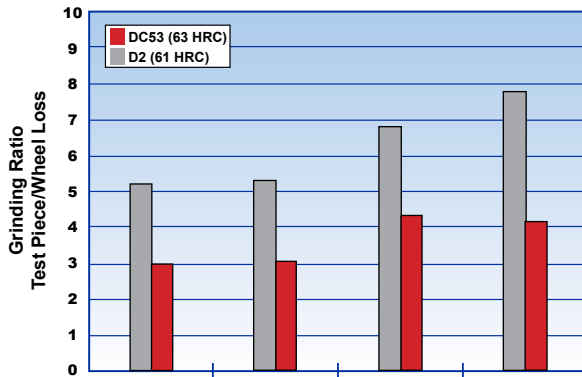
Primary Carbides

Primary Carbides in **DC53** are relatively small with highly uniform distribution as compared to other tool steel grades such as D2. This helps to provide **DC53** with it's superior toughness and fatigue resistances.



Grinding

DC53 can typically be machined 20% to 40% faster than D2 while experiencing as much as 50% less tool wear and breakdown. Faster feeds and speeds reduce machining cost and yield an improved surface finish.

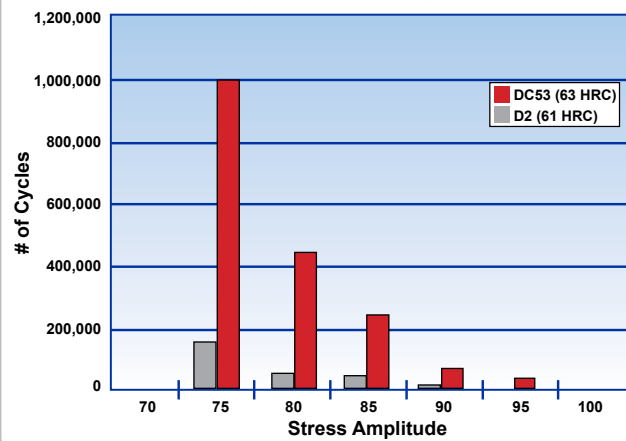


| | | | | |
|---------------------------|-------|-------|-------|-------|
| Grinding Frequency (Time) | 20 | 10 | 35 | 40 |
| Cut Depth (u/Time) | 5 | 5 | 10 | 10 |
| Circum. Velocity (m/min) | 6.9 | 10.4 | 6.9 | 10.4 |
| Table Feed (mm/min) | 1,300 | 1,300 | 2,600 | 2,600 |

Chemical Composition %

| C | Si | Mn | Cr | Mo | V |
|---------------------------------------|------------|------------|------------|------------|------------|
| .95 | 1.0 | 0.4 | 8.0 | 2.0 | 0.3 |
| Annealed Hardness (BHN) | | | | 210 - 225 | |
| Specific Gravity (g/cm ³) | | | | 7.76 | |
| Density (lb./Inch ³) | | | | .2793 | |
| Young's Modulus (E) | | | | 21,700 | |
| Modulus of Rigidity (G) | | | | 8,480 | |
| Poisson's Ratio | | | | 28 | |

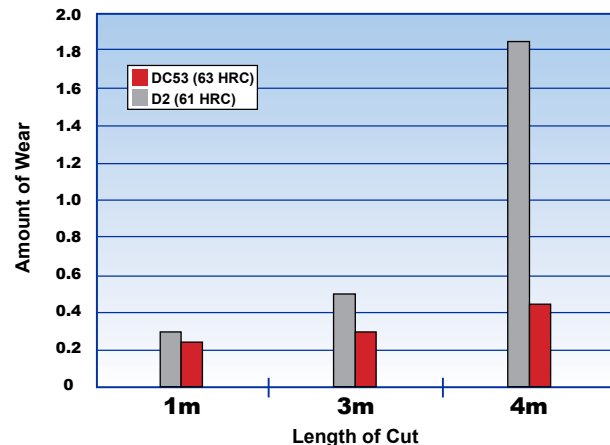
Fatigue Strength



Machining

Cutting Speeds for DC53 in Surface Feet per Minute

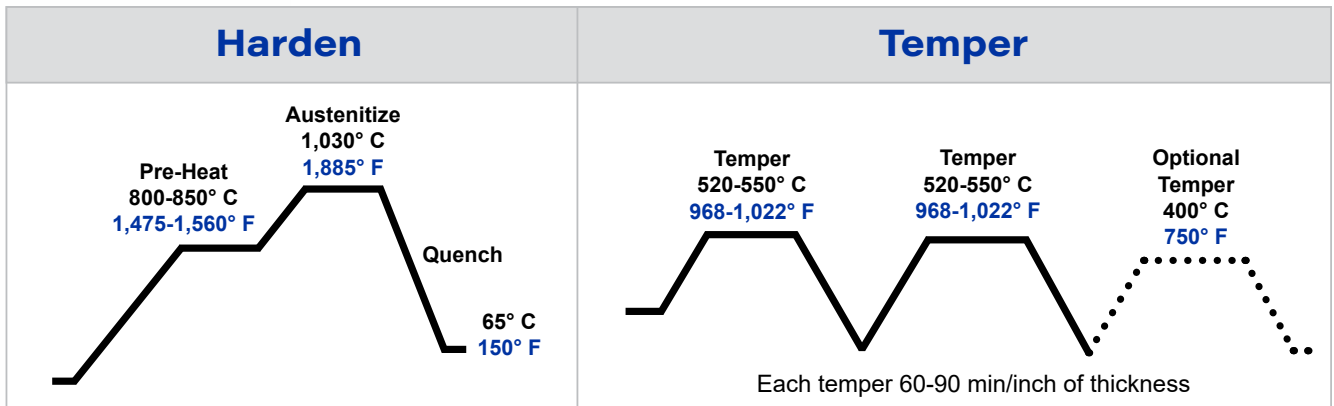
| Operation | HSS Tools | Carbide Tools |
|-----------|-----------|---------------|
| Turning | 70 SFM | 235 SFM |
| Drilling | 50 SFM | 150 SFM |
| Milling | 55 SFM | 195 SFM |



HEAT TREATMENT

| Austenitize | Double High Temperature Draw* | |
|------------------------------------|----------------------------------|------------------|
| 1,030° C 1,885° F | 520° C 968° F | HRC 62/64 |
| | 540° C 1,004° F | HRC 60/62 |
| | 550° C 1,022° F | HRC 58/60 |

* Material growth .10% to .15% (.0010" to .0015" per inch). An optional third temper recommended for intricate high precision components requiring EDM work or PVD coatings.



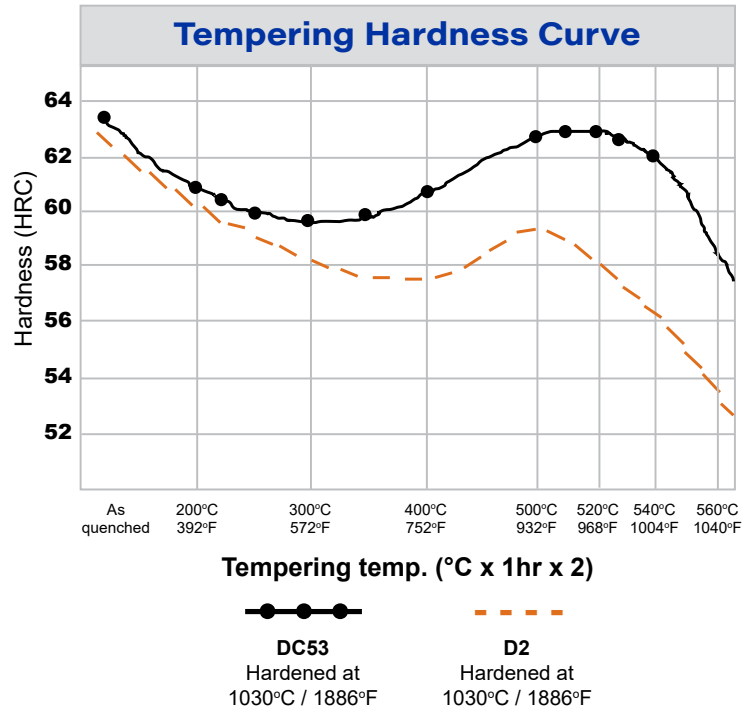
Vacuum Austenitize

| Dia./Thickness | Heating Time (min.) |
|--------------------|------------------------------|
| 4" (100mm) & Under | 20-30 min./inch of thickness |
| over 4" (100mm) | 10-20 min./inch of thickness |

2 bar quench pressure recommended

Salt Bath Austenitize

| Dia./Thickness | Immersing Time (min.) |
|----------------|-----------------------|
| 1/4" (6 mm) | 5 - 8 minutes |
| 1/2" (12 mm) | 8 - 10 minutes |
| 3/4" (18 mm) | 10 - 15 minutes |
| 1-1/2" (36 mm) | 15 - 20 minutes |
| 2" (48 mm) | 20 - 25 minutes |
| 4" (96 mm) | 30 - 40 minutes |



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TOOL STEEL APPLICATIONS

| Application | | | | |
|--|----------------------------|-----------------------------------|------------------------------|-----------------------|
| Blanking dies for Ni based alloy materials used for medium scale production of television components. | | | | |
| Results | | | | |
| Working | Material Worked | Conventional Die Steel | DC53 | Aprox. Dimensions |
| Cold Pressing | Ni-based Alloy 0.2mm Thick | D2 (HRC 58/59) Tempered at 510° C | HRC 62/63 Tempered at 520° C | 35 mm x 100 mm 250 mm |
| Evaluation | --- | 5,000 Hits | 25,000 Hits | 400% Increase |
| Conclusions | | | | |
| Durability: The worked material is tough and the chipping and seizing of die edge were problematic. | | | | |
| Effect of DC53: High temperature tempering and high hardness are important in preventing seizing and extending the life of die edges. | | | | |

| Application | | | | |
|---|------------------------|---|--|-------------------------|
| This type of die is commonly used; surface hardness treatment is applied depending upon the material worked and finishing preciseness required. | | | | |
| Results | | | | |
| Working | Material Worked | Conventional Die Steel | DC53 | Aprox. Dimensions |
| Trimming | 5140 HRC 23 16 mm Dia. | M2 High Speed Steel; HRC 60 CVD-Treated | HRC 62/63 Tempered at 520° C CVD-Treated | 48 mm Dia. x 35 mm Long |
| Evaluation | --- | 11,000 Hits | 42,000 Hits | 281% Increase |
| Conclusions | | | | |
| Durability: Chipping of the cutting-edge and insufficient base hardness of the die led to termination of life. | | | | |
| Effect of DC53: In order to increase the effectiveness of surface treatment, higher base hardness of the die should be considered; the high hardness of DC53 proved effective. | | | | |

| Application | | | | |
|--|---|-----------------------------------|------------------------------|--------------------------------|
| Blanking and forming of cold-worked bearing races. | | | | |
| Results | | | | |
| Working | Material Worked | Conventional Die Steel | DC53 | Aprox. Dimensions |
| Cold Pressing | Cold Rolled Steel 1.2 mm Thick Not Coated | D2 (HRC 58/60) Tempered at 510° C | HRC 62/63 Tempered at 520° C | 80 mm Dia x 100 mm Long 250 mm |
| Evaluation | --- | 220,000 Hits | 380,000 Hits | 72% Increase |
| Conclusions | | | | |
| Durability: Wear (Galling) of inner die surface and edge chipping affected durability. | | | | |
| Effect of DC53: High hardness and high toughness of DC53 when tempered at high temperature greatly improved durability. | | | | |

| Application | | | | |
|--|-----------------------------|--------------------------------|---------------------------|-------------------------|
| FB punches hook-shaped electric appliance components; its long, thin shape provides severe conditions. | | | | |
| Results | | | | |
| Working | Material Worked | Conventional Die Steel | DC53 | Aprox. Dimensions |
| Fine Blanking | HR 1045 HRB 80 1.5 mm Thick | D2 (HRC 56) Tempered at 530° C | HRC 60 Tempered at 550° C | 70 mm Dia. x 110 mm Lg. |
| Evaluation | --- | 1,600 Hits | 3,900 Hits | 143% Increase |
| Conclusions | | | | |
| Durability: Cracking and fracturing occurred at the tip of the long, thin shape resulting in a shortened life. | | | | |
| Effect of DC53: Because of DC53's excellent toughness, hardness could be increased, resulting in more than double the life. | | | | |

Here is what our customer's are saying:

"The key to the project was selecting the right tool steel to get a successful draw. Given the rigors of the stainless steel Class A surface application, a stronger material was required. We chose DC53 and have experienced an increase in tool life by a factor of three compared to traditional draw tooling."

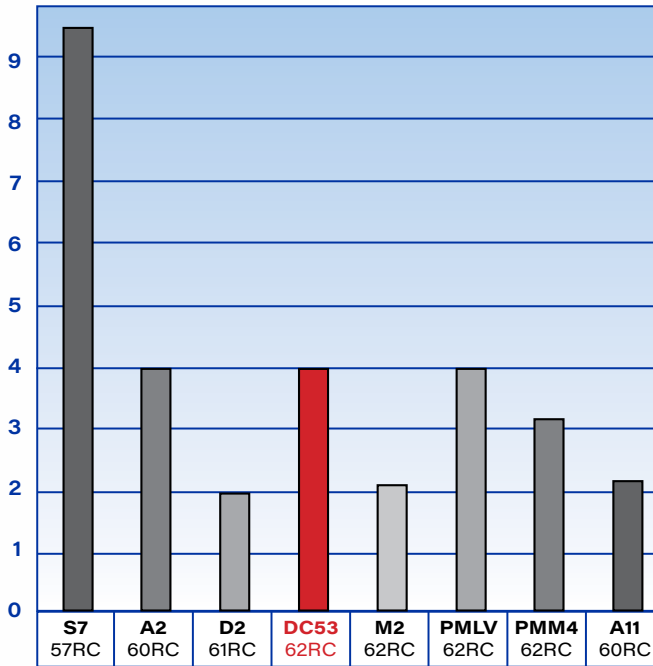
"With DC53 we are able to offer our customer's a better performing steel while decreasing our production costs, definitely a win-win situation."

Alro Steel is the authorized distributor of DC53 for  Daido Steel Co. Ltd.

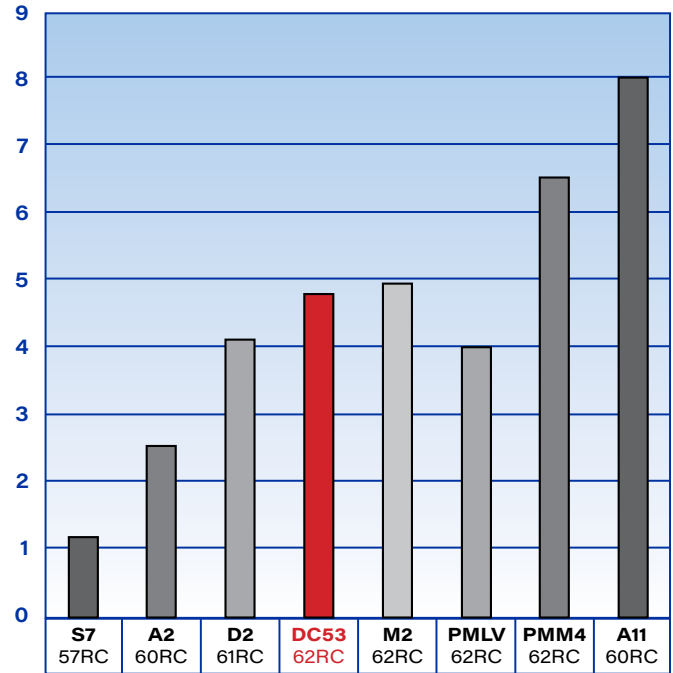
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CHARACTERISTICS

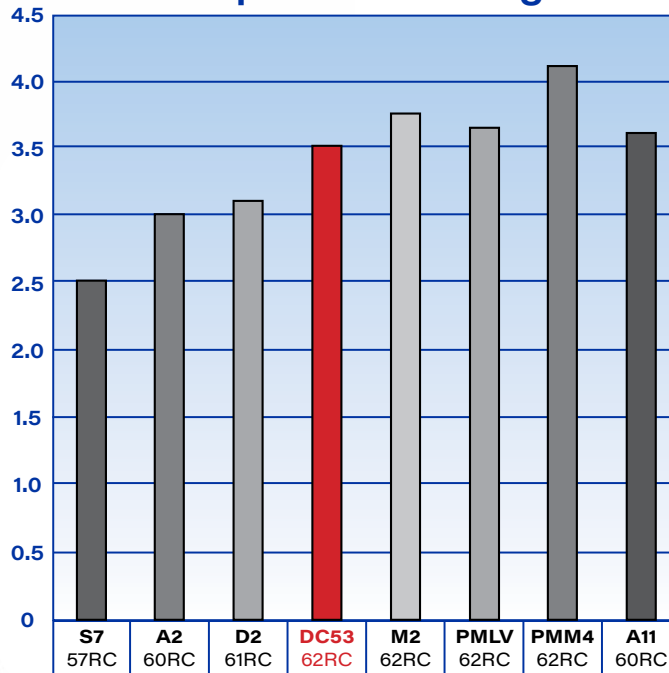
Toughness



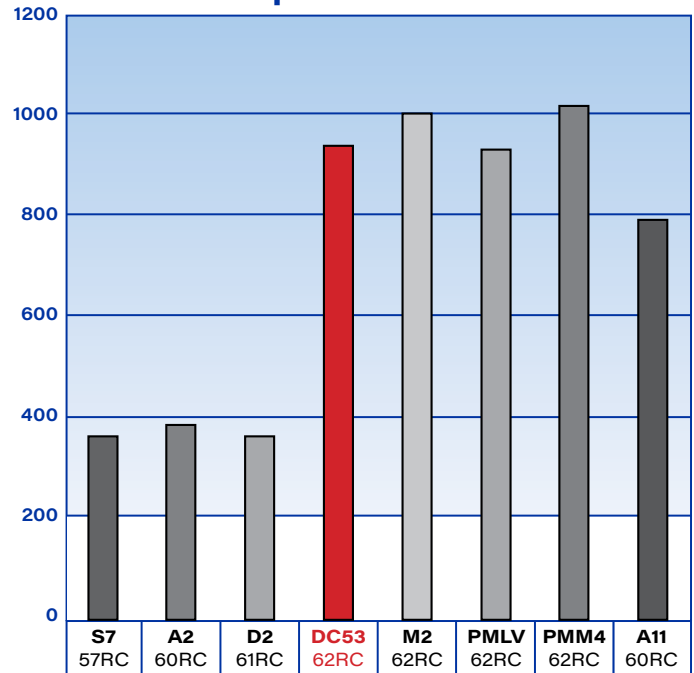
Wear Resistance



Compressive Strength



Temper Resistance



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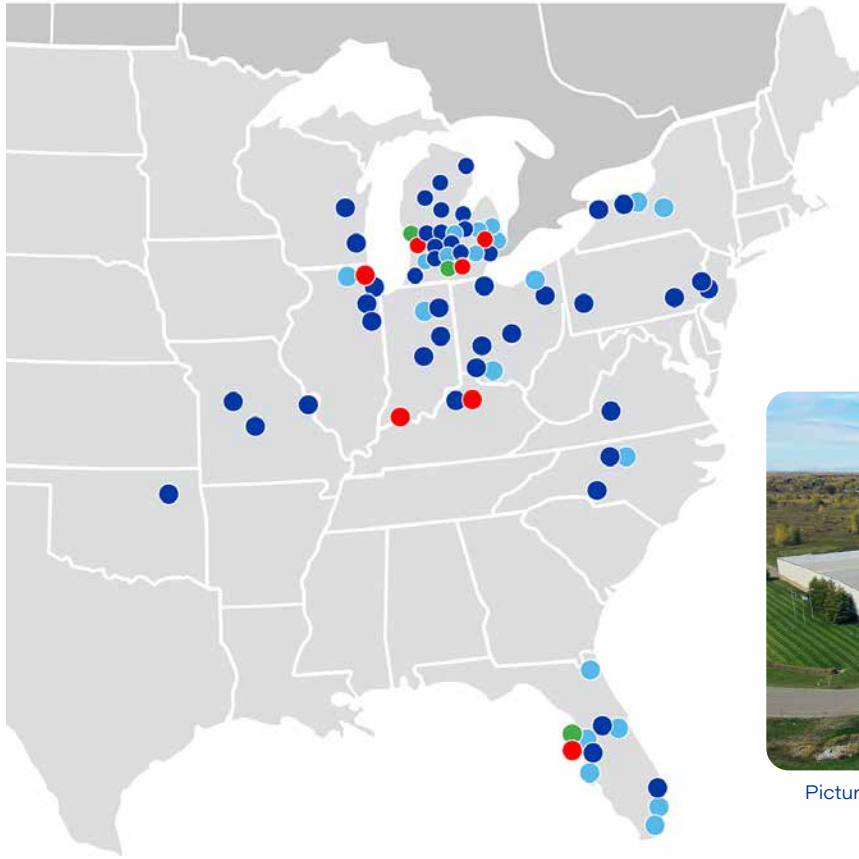
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Pictured above, the Alro Steel facility in Potterville, Michigan

Integrity. Loyalty. Honesty. These principles have guided Alro Steel since our founding in 1948 by brothers, Al and Robert Glick. From a small garage in Jackson, Michigan, Alro Steel has grown to over 70 locations in 13 states. Alro distributes metals, industrial supplies and plastics. A wide variety of processing services are available including cut-to-size metals and plastics with next day delivery to over 50,000 customers in North America. Focused on exceeding our customers' expectations, we build relationships with all our customers, large and small. [To learn more, visit alro.com.](http://alro.com)

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| Brass | ● | | ● | | |
| Bronze | ● | ● | | | |
| Carbon Steel | ● | ● | ● | ● | ● |
| Cast Iron | ● | ● | | | |
| Copper | ● | ● | ● | | |
| Stainless Steel | ● | ● | ● | ● | ● |
| Tool Steel | ● | | ● | | |



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