

CARBIDE GRADE SELECTION AND PREFORM BLANK DESIGN GUIDE

Successful Results Start From the Grade



H.B. Carbide

hbcarbide.com

OUR PASSION IS
PROVIDING
OPTIMIZED
SOLUTIONS
FOR YOUR MOST
CHALLENGING
APPLICATIONS.

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GRADE SELECTION INTRO

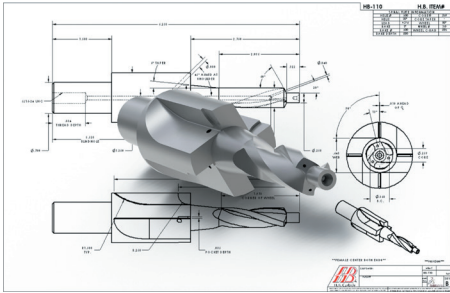
Successful Results Start From the Grade

AMERICAN MADE. AMERICAN PRIDE.

H.B. Carbide Company delivers custom and altered standard carbide blanks that provide consistency, reliability and advanced capabilities for your most demanding applications



- **Manufactured in the USA** from raw material to finished ground blank
- Providing consistent quality and reliable service for nearly 40 years
- Comprehensive grade/capability offering specialized to provide solutions to all your business and application challenges



SHAPING TANGIBLE SOLUTIONS

H.B. Carbide delivers tangible solutions through operational and manufacturing process efficiencies, reduced lead times, and overall productivity improvements.

- Straight flutes
- Spiral flutes
- Coolant holes (in any locations)
- Stepped diameters
- Centers (male or female)
- Keyways
- Flats
- Chamfers
- PCD pockets
- Preformed sharpening angles
- Threads

CUSTOM, STANDARD AND ALTERED DESIGN

H.B. Carbide's experienced specialists are prepared and committed to support and assist you in your decision-making process to achieve optimized solutions, from grade selection to preform blank design.

- Advanced near net shape preform solutions
- Solid and coolant-through capabilities
- Pre-fluted blanks
- Large diameter and extended overall length
- Die and bushing blanks
- Centerless and between centers OD grinding
- Flow control products
- Program file sharing



VALUE ADDED FINISH GRINDING CAPABILITIES

- h5 and h6 diameter tolerances
- Multi-diameter grinding
- Lapped centers
- Centerless and between center OD grinding

Carbide Die & Bushing Blanks

Wire drawing dies, cold heading dies, stamping dies, wear parts, seal rings and bushings

Round Rod

Altered standard and standard offering

Drill & Reamer Blanks

Comprehensive offering of custom configurations

Deep Hole and Drill Blanks

Full-length or cut-to-length gundrill blanks with preformed pre-sharpened angles; Diverse coolant hole configurations offered; round, single hole, two hole and kidney holes

GRADE SELECTION INTRO

Successful Results Start From the Grade

- Grade selection is crucial to meeting today's strict quality requirements and technical challenges, while maximizing productivity
- H.B. Carbide has a comprehensive grade offering specialized to provide solutions for all your business and application challenges
- We provide the optimum combination of high quality, consistency and performance reliability with industry-leading product/feature capabilities
- Committed service and focused support



NOT ALL MATERIALS ARE PRODUCED THE SAME

- H.B. Carbide is a fully-integrated manufacturer, from raw materials to finished ground blanks
- We partner with high-quality suppliers, ensuring quality/consistency from the start
- Integrated quality systems ensure product performance and traceability
- Process control from raw materials to shipping ensure product quality, consistency and performance.

THE GRADE SELECTION PROCESS

Cutting/Wear and Impact/Toughness represent opposite ends of the carbide spectrum and are important in tool design. This chart provides a perspective for guiding the grade selection process in meeting those tool design challenges for a manufacturing applications.



GRADE SELECTION

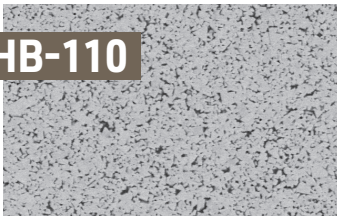
All Grades



Ultrafine Submicron **Medium** Coarse Bimodal



HB-110



Co	10%
WC	90%
Density	14.5 g/cm ³
Hardness	91.7 HRA
Grain Structure	Submicron
TRS	550,000psi

Cutting & Wear Resistance

Impact & Toughness

- Heat-resistant steels
- Corrosion-resistant steels
- Stainless steels
- Non-ferrous metal alloys
- Titanium



HB-2



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	92.2 HRA
Grain Structure	Medium
TRS	530,000psi

Cutting & Wear Resistance

Impact & Toughness

- Diamond coating
- Machining of graphite
- Cast iron
- Non-ferrous metal alloys
- Nozzles and wear applications



HB-3



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	93 HRA
Grain Structure	Submicron
TRS	520,000psi

Cutting & Wear Resistance

Impact & Toughness

- Stainless steels
- Plastics
- Diamond coating
- Non-ferrous metal alloys
- Wear applications, flow control



HB-512



Co	12%
WC	88%
Density	14.11 g/cm ³
Hardness	92.5 HRA
Grain Structure	Ultrafine
TRS	640,000psi

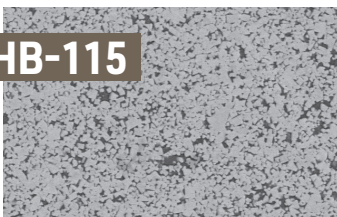
Cutting & Wear Resistance

Impact & Toughness

- Stainless steels
- Titanium alloys
- Heat-resistant steels
- Interrupted cutting



HB-115



Co	15%
WC	85%
Density	14.0 g/cm ³
Hardness	90 HRA
Grain Structure	Submicron
TRS	610,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Diverse wear applications
- Shock-resistance applications
- Impact punches
- Punches and ejector pins
- Roughing, shearing applications

GRADE SELECTION

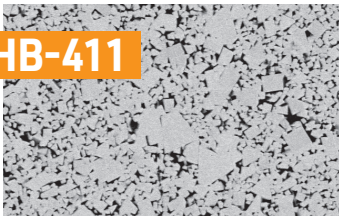
All Grades



Ultrafine Submicron **Medium** Coarse Bimodal



HB-411



Co	11.5%
WC	88.5%
Density	14.39 g/cm ³
Hardness	90 HRA
Grain Structure	Bimodal
TRS	530,000psi

Cutting & Wear Resistance

Impact & Toughness



- Exceptional performance in punch applications
- Heat-resistant steels
- Stainless steels
- Non-ferrous metal alloys



HB-320



Co	20%
WC	80%
Density	13.56 g/cm ³
Hardness	85.4 HRA
Grain Structure	Coarse
TRS	455,000 psi

Cutting & Wear Resistance

Impact & Toughness



- Med-/High-impact forming applications
- Header dies, draw dies, stamping die details
- Fastener forming dies
- Ammunition dies



HB-325



Co	25%
WC	75%
Density	13.18 g/cm ³
Hardness	83.3 HRA
Grain Structure	Coarse
TRS	430,000 psi

Cutting & Wear Resistance

Impact & Toughness



- High Impact forming applications
- Header dies, draw dies, stamping die details
- Thread rolling
- Ammunition dies



HB-312



Co	12%
WC	88%
Density	14.33 g/cm ³
Hardness	88.7 HRA
Grain Structure	Coarse
TRS	490,000 psi

Cutting & Wear Resistance

Impact & Toughness



- Low impact/light shock resistance
- Capability for wide variety of forming applications
- Ammunition dies
- Light stamping



HB-315



Co	15%
WC	85%
Density	14.03 g/cm ³
Hardness	87.4 HRA
Grain Structure	Coarse
TRS	470,000 psi

Cutting & Wear Resistance

Impact & Toughness



- Steels, SS, non-ferrous varieties forming applications
- Light stamping carbide die and nib deep draw
- Fine blanking stamping dies
- Ammunition dies

GRADE SELECTION

All Grades



METAL CUTTING



WEAR & DIE



ENERGY



DEFENSE

Ultrafine

Submicron

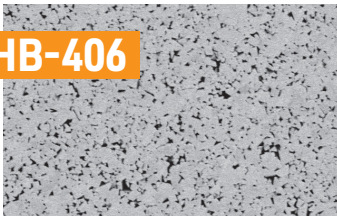
Medium

Coarse

Bimodal



HB-406



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	92.3 HRA
Grain Structure	Bimodal
TRS	334,000psi

Cutting & Wear Resistance

Impact & Toughness

- Ideal for deep hole drilling
- Bimodal grain structure offering excellent wear properties
- Gundrill



HB-212



Co	12%
WC	88%
Density	14.28 g/cm ³
Hardness	90.2 HRA
Grain Structure	Medium
TRS	377,000psi

Cutting & Wear Resistance

Impact & Toughness

- Excellent thermal cycling properties
- Optimal braze adhesion
- Non-cutting grade
- Good toughness characteristics



HB-410



Co	10%
WC	90.0%
Density	14.5 g/cm ³
Hardness	91 HRA
Grain Structure	Bimodal
TRS	553,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Ideal for deep hole drilling
- Exceptional toughness/wear properties
- Gundrill



GRADE SELECTION

Metal Cutting

H.B. Carbide prides itself in solving unique challenges for tool manufacturers by delivering a combination of superior service, industry-leading capabilities and material reliability.

Consistency is essential when working with critical metal cutting applications including aerospace (engine & frame) and medical, as well as high performance segments such as die and mold, oil and gas, wind power and automotive.

As a fully-integrated manufacturer, H.B. Carbide provides optimized cemented carbide grade selection, achieving the perfect balance of hardness and toughness for fracture resistance. Our company also provides improved edge wear reliability in cutting applications and superior adhesion in diamond coating applications and grades – for shank or carrier – on non-cutting application areas.

As your partner, we can quickly and reliably provide you with custom, altered and standard designs in solid and various coolant-hole configurations. Our extensive process knowledge and technical support help customers increase their cost effectiveness. This includes maximizing operational efficiency and productivity improvement, especially in work piece materials like aluminum, composites, heat resistant super alloys, stainless or high alloy steels and titanium.

WE PROVIDE A VARIETY OF CARBIDE DRILL AND REAMER BLANKS INCLUDING, BUT NOT LIMITED TO:

- Straight flutes
- Spiral flutes
- Coolant holes (in any location)
- Stepped diameters
- Centers (male or female)
- Flats
- Chamfers
- Keyways
- PCD pockets
- Carbide threads
- Deep hole drilling



HB-110



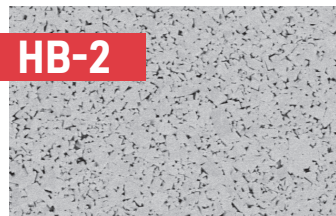
Co	10%
WC	90%
Density	14.5 g/cm ³
Hardness	91.7 HRA
Grain Structure	Submicron
TRS	550,000psi

Cutting & Wear Resistance

Impact & Toughness

- Heat-resistant steels
- Corrosion-resistant steels
- Stainless steels
- Non-ferrous metal alloys
- Titanium

HB-2



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	92.2 HRA
Grain Structure	Medium
TRS	530,000psi

Cutting & Wear Resistance

Impact & Toughness

- Diamond coating
- Machining of graphite
- Cast iron
- Non-ferrous metal alloys
- Nozzles and wear applications



GRADE SELECTION

Metal Cutting

Ultrafine

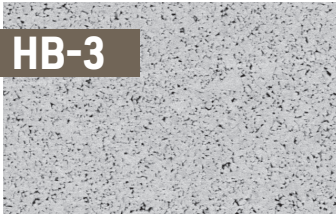
Submicron

Medium

Coarse

Bimodal

HB-3



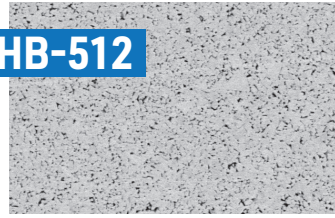
Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	93 HRA
Grain Structure	Submicron
TRS	520,000psi

Cutting & Wear Resistance

Impact & Toughness

- Stainless steels
- Plastics
- Diamond coating
- Non-ferrous metal alloys
- Wear applications, flow control

HB-512



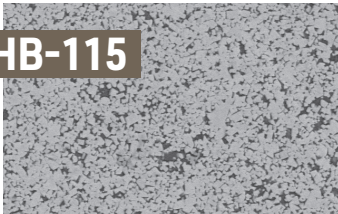
Co	12%
WC	88%
Density	14.11 g/cm ³
Hardness	92.5 HRA
Grain Structure	Ultrafine
TRS	640,000psi

Cutting & Wear Resistance

Impact & Toughness

- Stainless steels
- Titanium alloys
- Heat-resistant steels
- Interrupted cutting

HB-115



Co	15%
WC	85%
Density	14.0 g/cm ³
Hardness	90 HRA
Grain Structure	Submicron
TRS	610,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Diverse wear applications
- Shock-resistance applications
- Impact punches
- Punches and ejector pins
- Roughing, shearing applications

HB-212



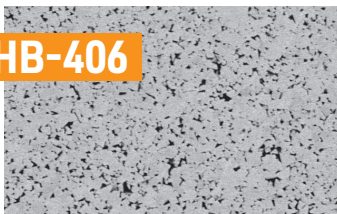
Co	12%
WC	88%
Density	14.28 g/cm ³
Hardness	90.2 HRA
Grain Structure	Medium
TRS	377,000psi

Cutting & Wear Resistance

Impact & Toughness

- Excellent thermal cycling properties
- Optimal braze adhesion
- Non-cutting grade
- Good toughness characteristics

HB-406



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	92.3 HRA
Grain Structure	Bimodal
TRS	334,000psi

Cutting & Wear Resistance

Impact & Toughness

- Ideal for deep hole drilling
- Bimodal grain structure offering excellent wear properties
- Gundrill

HB-410



Co	10%
WC	90.0%
Density	14.5 g/cm ³
Hardness	91 HRA
Grain Structure	Bimodal
TRS	553,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Ideal for deep hole drilling
- Exceptional toughness/wear properties
- Gundrill



GRADE SELECTION

Defense

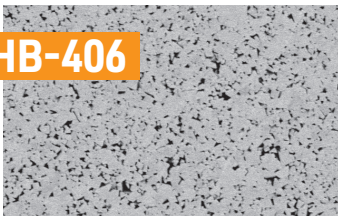
H.B. Carbide provides superior service, industry-leading capabilities and performance reliability, which are crucial factors in successfully supporting the defense industry's vast work piece material and application requirements. Whether it's military aircraft, ground defense, space exploration, shipbuilding, gun manufacturing or various defense systems designed to operate on land, sea or in the air, we are prepared to support you. Our fully-integrated capabilities, extensive process knowledge and experienced specialists are committed to helping you in your decision-making to achieve optimized solutions – from grade to customized blank specification.

CAPABILITIES EXAMPLES INCLUDE, BUT ARE NOT LIMITED TO:

- Gundrills
- Ammunition die blanks
- Casing & bullet die blanks
- Deep hole drills
- Draw dies
- Punches
- Cartridge drawing die
- Preform round tool blanks
- Extensive wear part blank configurations



HB-406



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	92.3 HRA
Grain Structure	Bimodal
TRS	334,000psi

Cutting & Wear Resistance

Impact & Toughness

- Ideal for deep hole drilling
- Bimodal grain structure offering excellent wear properties
- Gundrill

HB-410



Co	10%
WC	90.0%
Density	14.5 g/cm ³
Hardness	91 HRA
Grain Structure	Bimodal
TRS	553,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Ideal for deep hole drilling
- Exceptional toughness/wear properties
- Gundrill



GRADE SELECTION

Defense

Ultrafine

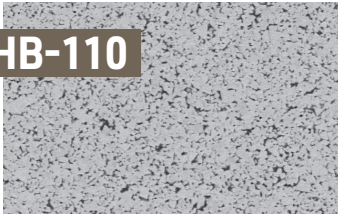
Submicron

Medium

Coarse

Bimodal

HB-110



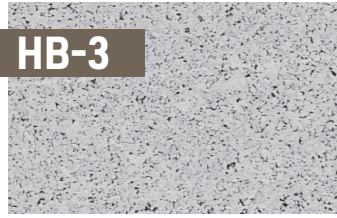
Co	10%
WC	90%
Density	14.5 g/cm ³
Hardness	91.7 HRA
Grain Structure	Submicron
TRS	550,000psi

Cutting & Wear Resistance

Impact & Toughness

- Chamber reamers
- Heat-resistant steels
- Non-ferrous metal alloys
- Titanium

HB-3



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	93 HRA
Grain Structure	Submicron
TRS	520,000psi

Cutting & Wear Resistance

Impact & Toughness

- Chamber reamers
- Wear applications
- Diamond coating
- Non-ferrous metal alloys

HB-312



Co	12%
WC	88%
Density	14.33 g/cm ³
Hardness	88.7 HRA
Grain Structure	Coarse
TRS	490,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Low impact/light shock resistance
- Capability for wide variety of forming applications
- Ammunition dies
- Light stamping

HB-315



Co	15%
WC	85%
Density	14.03 g/cm ³
Hardness	87.4 HRA
Grain Structure	Coarse
TRS	470,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Steels, SS, non-ferrous varieties forming applications
- Light stamping carbide die and nib deep draw
- Fine blanking stamping dies
- Ammunition dies

HB-320



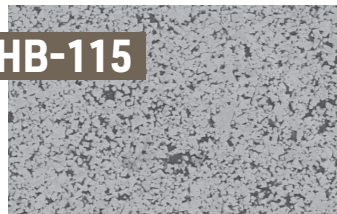
Co	20%
WC	80%
Density	13.56 g/cm ³
Hardness	85.4 HRA
Grain Structure	Coarse
TRS	455,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Med-/High-impact forming applications
- Header dies, draw dies, stamping die details
- Fastener forming dies
- Ammunition dies

HB-115



Co	15%
WC	85%
Density	14.0 g/cm ³
Hardness	90 HRA
Grain Structure	Submicron
TRS	610,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Diverse wear applications
- Shock-resistance applications
- Impact punches
- Punches and ejector pins
- Roughing, shearing applications



GRADE SELECTION

Energy

The energy industry plays a crucial role in our global infrastructure, the maintenance of our society, and our everyday life. H.B. Carbide is committed to supporting this global industry by providing superior service and material quality and reliability for these demanding applications and conditions. Whether you're in fossil fuel extraction, electrical, nuclear generation or renewable energy including hydroelectric, wind or solar power generation, we have a solution for your carbide blank component requirements.

OUR APPLICATION SPECIFIC GRADE OFFERING AND INDUSTRY LEADING CAPABILITIES ALLOW RELIABILITY IN MANY PRODUCT COMPONENTS INCLUDING:

- Flow control
- Nozzles
- Trim
- Valve parts
- Bushings
- Bearings
- Rods
- Rings
- Tubes square
- Flat bars





GRADE SELECTION

Energy

Ultrafine

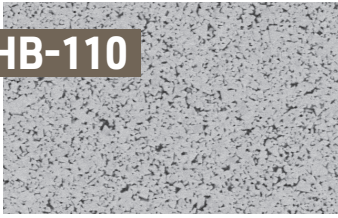
Submicron

Medium

Coarse

Bimodal

HB-110



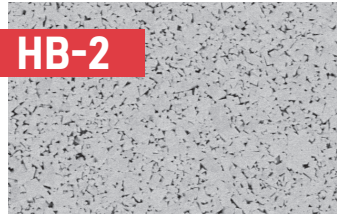
Co	10%
WC	90%
Density	14.5 g/cm ³
Hardness	91.7 HRA
Grain Structure	Submicron
TRS	550,000psi

Cutting & Wear Resistance

Impact & Toughness

- Heat-resistant steels
- Corrosion-resistant steels
- Stainless steels
- Non-ferrous metal alloys
- Titanium

HB-2



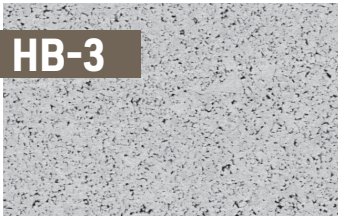
Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	92.2 HRA
Grain Structure	Medium
TRS	530,000psi

Cutting & Wear Resistance

Impact & Toughness

- Diamond coating
- Machining of graphite
- Cast iron
- Non-ferrous metal alloys
- Nozzles and wear applications

HB-3



Co	6%
WC	94%
Density	14.9 g/cm ³
Hardness	93 HRA
Grain Structure	Submicron
TRS	520,000psi

Cutting & Wear Resistance

Impact & Toughness

- Stainless steels
- Plastics
- Diamond coating
- Non-ferrous metal alloys
- Wear applications, flow control

HB-320



Co	20%
WC	80%
Density	13.56 g/cm ³
Hardness	85.4 HRA
Grain Structure	Coarse
TRS	455,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Med-/High-impact forming applications
- Header dies, draw dies, stamping die details
- Fastener forming dies
- Ammunition dies



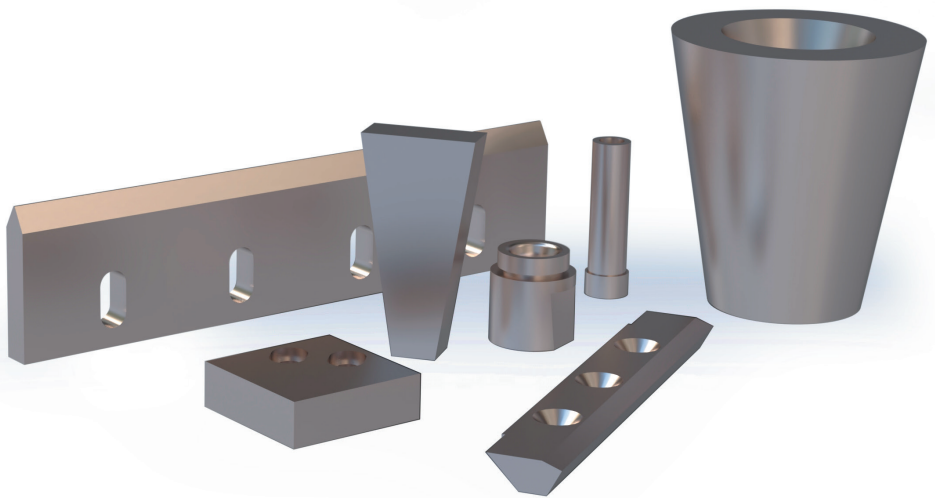
GRADE SELECTION

Wear & Die

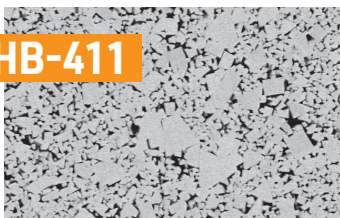
The need for maximum resistance to impact, wear, deformation and fracture is crucial to achieve success in many industries and production processes. H.B. Carbide is committed to improving productivity by providing effective carbide blank solutions that address component deterioration and failure issues in wear and die application areas. As a fully-integrated manufacturer, we have the ability to manage the complete part cycle from powder to ground blank. This allows us to ensure optimum grade selection, part-to-part reliability, and the flexibility needed to achieve unique geometric designs. We accomplish all this while delivering exceptional technical support for an overall superior customer experience.

CAPABILITIES EXAMPLES INCLUDE, BUT ARE NOT LIMITED TO:

- Forming dies
- Compacting dies
- Stamping dies
- Punches and ejector pins
- Nozzles
- Drawing dies
- Rolls
- Slitter knives
- EDM blanks



HB-411



Co	11.5%
WC	88.5%
Density	14.39 g/cm ³
Hardness	90 HRA
Grain Structure	Bimodal
TRS	530,000psi

Cutting & Wear Resistance

Impact & Toughness

- Exceptional performance in punch applications
- Heat-resistant steels
- Stainless steels
- Non-ferrous metal alloys

HB-312



Co	12%
WC	88%
Density	14.33 g/cm ³
Hardness	88.7 HRA
Grain Structure	Coarse
TRS	490,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Low impact/light shock resistance
- Capability for wide variety of forming applications
- Ammunition dies
- Light stamping



GRADE SELECTION

Wear & Die

Ultrafine

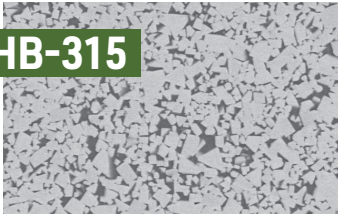
Submicron

Medium

Coarse

Bimodal

HB-315



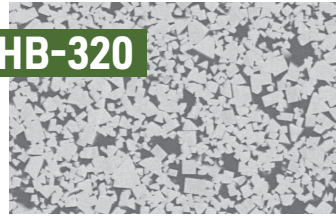
Co	15%
WC	85%
Density	14.03 g/cm ³
Hardness	87.4 HRA
Grain Structure	Coarse
TRS	470,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Steels, SS, non-ferrous varieties forming applications
- Light stamping carbide die and nib deep draw
- Fine blanking stamping dies
- Ammunition dies

HB-320



Co	20%
WC	80%
Density	13.56 g/cm ³
Hardness	85.4 HRA
Grain Structure	Coarse
TRS	455,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Med-/High-impact forming applications
- Header dies, draw dies, stamping die details
- Fastener forming dies
- Ammunition dies

HB-325



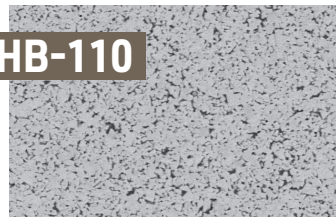
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Hardness	83.3 HRA
Grain Structure	Coarse
TRS	430,000 psi

Cutting & Wear Resistance

Impact & Toughness

- High Impact forming applications
- Header dies, draw dies, stamping die details
- Thread rolling
- Ammunition dies

HB-110



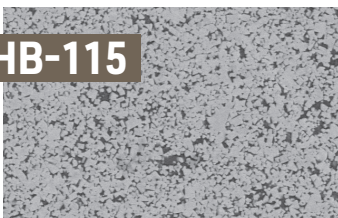
Co	10%
WC	90%
Density	14.5 g/cm ³
Hardness	91.7 HRA
Grain Structure	Submicron
TRS	550,000psi

Cutting & Wear Resistance

Impact & Toughness

- Calibration Dies
- Cold Forming Punches (high wear resistance)
- Drawing Dies
- Mandrels (ferrous & non-ferrous)

HB-115



Co	15%
WC	85%
Density	14.0 g/cm ³
Hardness	90 HRA
Grain Structure	Submicron
TRS	610,000 psi

Cutting & Wear Resistance

Impact & Toughness

- Diverse wear applications
- Shock-resistance applications
- Impact punches
- Punches and ejector pins
- Roughing, shearing applications

NOTES

A large grid of graph paper for taking notes, consisting of 20 columns and 30 rows of small squares.

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DISCOVER WHAT THE
H.B. CARBIDE ADVANTAGE
CAN DO FOR YOU

- **Responsible corporate citizen** - social, cultural and environmental responsibilities
- **Reliable partner** for global supply & support
- **Sustainability** - Environmentally focused, including recycling of carbide scraps
- **Focus on customer experience** - Service Supply & Technical Support
- **Material innovation** - Optimized application specific grade selection
- **Advanced production controls** and techniques ensuring quality and consistency



H.B. Carbide

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