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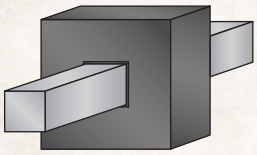
KEY STOCK FEATURES

Key stock is a general term for a stock of square or rectangular cold drawn steel that is 1' (305 mm) or greater in length from which machine keys are produced (for lengths less than 12", see *Machine Keys* on page 48). Hex, round, and step profiles are available to mate with a variety of gears, key ways, sprockets, or other assembly components. Depending on their use, hex and round profiles are sometimes called shafting, just as cut-to-size key stock is commonly referred to as machine keys.

DESIGN CONSIDERATIONS

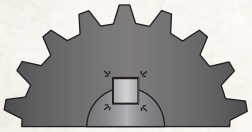
PRODUCTION QUALITY

Key stock, or "bright steel," refers to square and rectangle bars that are drawn to exacting tolerances with sharp corners, perpendicular and parallel sides, and smooth, bright surface finishes.



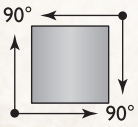
COLD DRAWN STEEL

Manufacturing true key stock to tight tolerances is challenging as tolerances for square and rectangle key stock tend to be more precise than for rounds or other forms because of the desired interference fit into the key way.



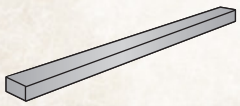
SHARP CORNERS

During production, as material passes through a die, stresses from cold working are introduced that may cause twisting. To produce superior finished results, G.L. Huyett has supported the development of cold drawing technologies while working in concert with U.S. and international steel mills.



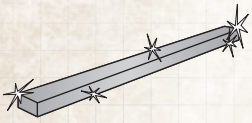
PERPENDICULAR PLANES

Though harder to draw and more difficult to install, key stock with sharp corners is desired so that the interference fit of the key into the corners of the key way is optimized to reduce bearing stresses.



STRAIGHT

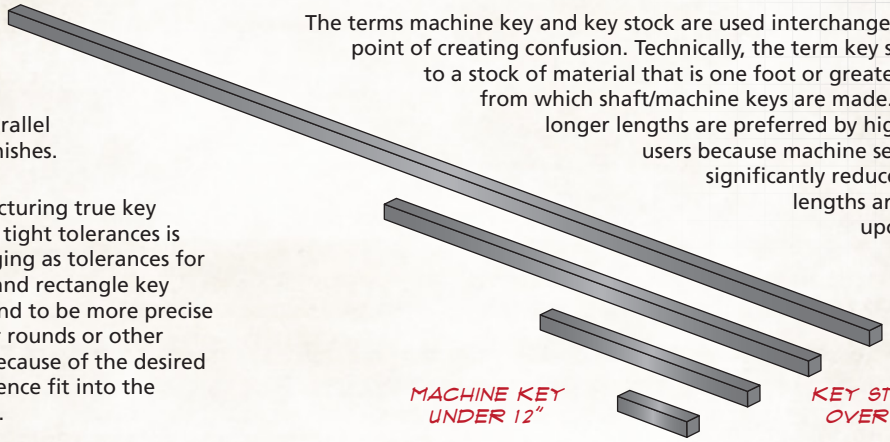
Key stock is more costly and difficult to produce, but it is near-finished when drawn compared to conventional steel bars. To produce a bright finish, key stock can be treated to produce a surface finish that is more uniform and precise compared to rounds and other forms.



BRIGHT

KEY STOCK VS. MACHINE KEYS

The terms machine key and key stock are used interchangeably to the point of creating confusion. Technically, the term key stock refers to a stock of material that is one foot or greater in length from which shaft/machine keys are made. Generally, longer lengths are preferred by high quantity users because machine setup time is significantly reduced. Custom lengths are available upon request.

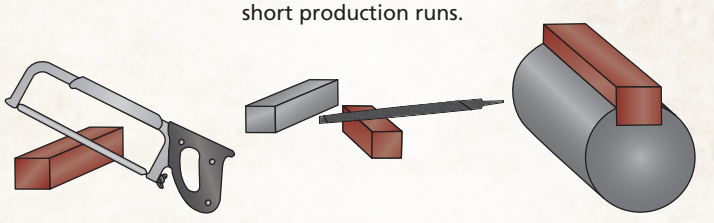


MACHINE KEY UNDER 12" | KEY STOCK OVER 12"

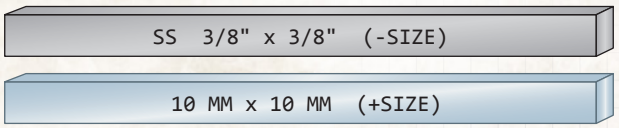
KEY STOCK IS AVAILABLE IN ANY LENGTH FROM 1' TO 12'

CUT TO FIT

A key may be cut from stock in the field and fit into a key way for aftermarket repairs, or in contract shops that use short production runs.



CUT TO LENGTH | FILE | FIT INTO KEY WAY

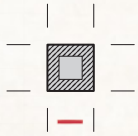


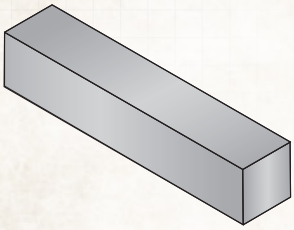
1', 3', 6', 305 MM, AND 1,000 MM STAINLESS STEEL AND PLATED KEY STOCK ARE MARKED FOR EASY IDENTIFICATION

KEY STOCK TYPES

UNDERSIZE

The actual size of undersize material will be at least the specified size and may be slightly smaller than the specified size within the acceptable tolerance range.

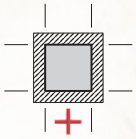


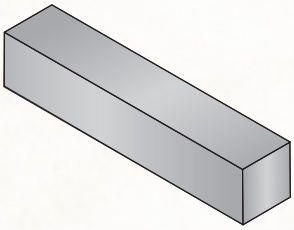


PAGES 28 & 36

OVERSIZE

The actual size of oversize material will be at least the specified size and may be slightly larger than the specified size within the acceptable tolerance range.





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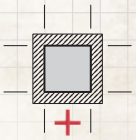
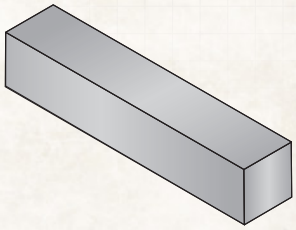
MOLTRUP

Moltrup key stock is tightly toleranced oversize material designed to provide a tight, interference fit when a Class 2 fit is desired.





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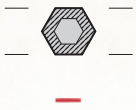
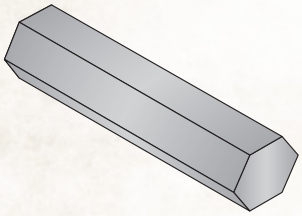
HEX

Hex key stock is frequently used for tool shafts, tool steel, drill bits, transmission shafts, axles, machine mounts, and gearbox output shafts.





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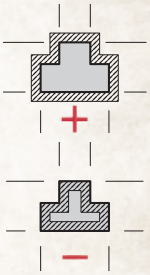
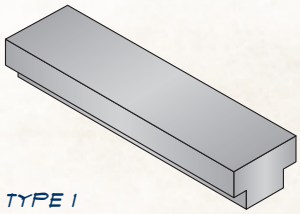
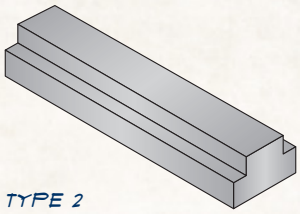
STEP KEY STOCK

Step key stock is used when worn or damaged key ways have been repaired. Type 1 is designed for use in key ways of repaired gears, sprockets, pulleys, and other hub assembly components. Type 2 is designed for use in repaired shaft key ways.





TYPE 1



TYPE 2

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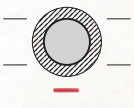
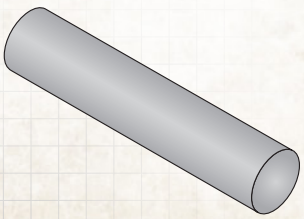
ROUND

Round key stock may be used as a rotating device or to connect or align components. It can be easily welded, machined, or fabricated.





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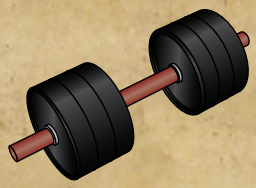
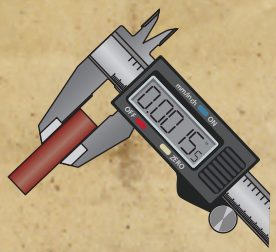
COLD DRAWN BRIGHT STEEL

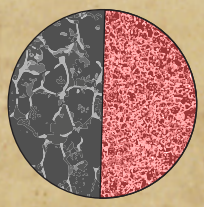
All of G.L. Huyett's key stock, shafting, and machine keys are produced using cold drawn bright steel. While higher in cost than traditional cold drawn steel, bright steel is stronger, made to tighter tolerances, and has a finer surface finish.



STRONGER



TIGHTER TOLERANCES



FINER SURFACE FINISH

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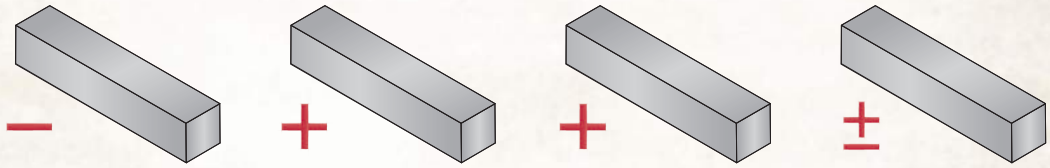
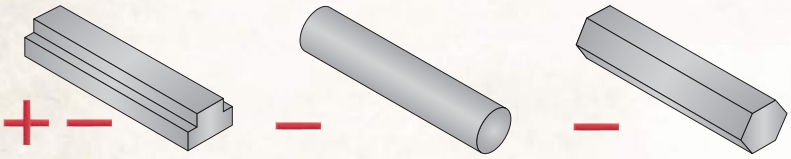
QUICK REFERENCE GUIDE

Understanding the standards and tolerances (permitted variance) of key stock can be complicated. Key stock is called out by nominal or named size. Among squares and flats, tolerances are referred to as "oversize" (over nominal) or "undersize" (under nominal).



	UNDERSIZE	MOLTRUP	OVERSIZE	SPECIALTY GRADES
DESCRIPTION	Actual size is nominal to less than nominal.	Actual size is very slightly over nominal.	Actual size is nominal to greater than nominal.	Actual size can be above or below nominal.
COMMON NAMES	Bar Stock; Redi-Key; Key Bar Stock; Machine Key Bar Stock; Broad Key Stock; Negative Key Stock	Moltrup Steel; True Key Stock; Bright Steel; Close Key Stock	Bar Stock; Redi-Key; Key Bar Stock; Machine Key Bar Stock; Mak-A-Key™; Close Key Stock; Plus Key Stock	Bar Stock; Mak-A-Key
APPLICABLE STANDARDS	ANSI B17.1, Class 1 fit; Metric DIN 6880 for key stock; DIN 6885 for machine keys	ANSI B17.1, Class 2 fit	None known, though popularized as Mak-A-Key.	Depends on material grade. ASTM 829; ASTM 484; ASTM 582; ASTM B16; ASTM A276
FABRICATION	Typically cold drawn. DIN may be polished to make bright.	Typically cold drawn. May be polished to make bright.	Cold drawn steel.	Cold drawn material. Some nonferrous may be extruded.
COMMON GRADES (AISI AND DIN REFERENCES)	1018; 1045; 1060; 4140; SS303; SS314; SS316; DIN 6880; A2; A4; DIN 178; DIN 179	1045; 8630; 4140	1018; 1045; SS303; SS304	1095; 6061; CDA 360; some grades of stainless steel.
COMMON USES	Used in field applications for repair, with no filing normally needed.	Most popular in original equipment manufacturing due to precision finish and tight fit in key way.	Based on Mak-A-Key specifications, which require filing in the field for repair applications.	Typically used in field applications for repair.
COMMENTS	Some commercial tolerances deviate from the ANSI spec. Plated parts are marked with the size. Plating normally adds .0005" to the height and width. Relatively free fitting bar stock keys. Only applies to parallel keys.	This is true +.0010" Class 2 ANSI spec key stock with tight tolerances. Material is difficult to draw and is not always easy to find in the U.S.	Used when a custom fit is required or desired for an oversize key way, for field repairs, or in worn key ways.	Does not match ANSI spec, and is a frequent source of confusion. Most desirable grade in maintenance repair operations, and has wide acceptance, but limited commercial availability.

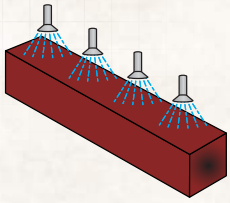
QUICK REFERENCE GUIDE



STEP KEY STOCK	ROUND	HEX
T-form, offered in both oversize and undersize tolerances.	Round form, with undersize tolerances.	Hex form, with undersize tolerances.
Offset Key Stock; Repair Key Stock	Round Linear Shaft; Round Bar; Round Stock; Rod; Round Axle; Mak-A-Pin	Hex Bar Stock; Hexagon Shaft; Hex Shaft Stock; Hex Stock; Hex Rod; Hex Axle
Sizing aligns to ANSI B17.1 Class 1 fit, bar stock.	Depends on material grade. ASTM A108; ASTM A681; ASTM A686	ASTM A108
Cold drawn steel. Milled for step and to size; usually plated and marked with size.	Cold drawn steel. Sometimes turned and polished.	Cold drawn steel.
1018; 1045; SS304; SS316	1018; 1045; O-1; W-1; 1095; SS303; SS304; 6061; CDA 360	1018; 1045; 8630; 4140
Used in repair of damaged key ways in shafts, sprockets, and pulleys.	Versatile material used as shafting, straight pins, rails, or for locating in a wide range of applications and industries.	Machinery, gears, machine parts, structural components, automobile parts, axles, and drive shafts.
Step key stock is often erroneously called "offset key stock," which generally refers to "Z" shaped rectangle key stock machined with inverse steps on opposing faces.	Round key stock is not drill rod. Drill rod is precision ground to size and surface finished.	The primary benefit of hex key stock is that there is no key needed and no key way to cut which saves machining time.

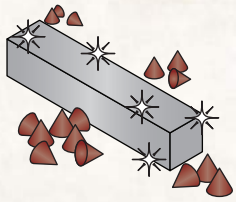
SECONDARY PROCESSES

Depending on your application, a secondary processes may be necessary.



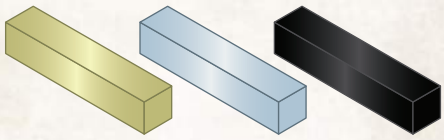
HEAT TREATING

Heat treating is used to increase strength by raising the temperature of the steel and then cooling it in a controlled manner to change the grain structure of the steel.



TUMBLING

Parts are tumbled to remove burrs prior to shipment or plating. Using friction, the tumbling media is engineered to polish the parts in a controlled manner.



PLATING

The primary purpose of plating is to protect steel from oxidation and corrosion. Zinc electroplating is one of the most common types of electroplating.

G.L. Huyett's *Engineering Handbook* gives an in-depth explanation of heat treating and other finishing processes.

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MATERIAL CODES

G.L. Huyett stocks over 1,000,000 lbs. of key stock in a wide variety of material. Material/finish combinations may not be available in all sizes. Unless specifically stated, our standard key stock (30 series) is any one of the following grades, subject to market availability: 1018, 1035, 1045, 1095, 1215, or 8630. For precise grade call 785-392-3017.

ZINC PLATING AND OTHER FINISHES AVAILABLE FOR ALL PARTS
SEE PAGE 16

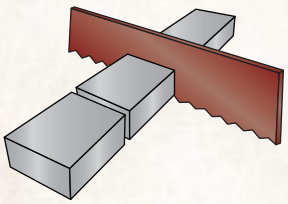
MATERIAL		TOLERANCE
(Prefix)	*(Material/Finish)*	
04	Aluminum, Plain◆◆	(+/-)
06	Brass, Plain◆◆	(+/-)
12	Nylon, Plain◆◆	(+/-)
30	Cold Finished Steel, Plain*	Undersize (-)
31	Cold Finished Steel, Zinc Clear Trivalent	Undersize (-)
35	Cold Finished Steel, Plain*	Oversize (+)
36	Cold Finished Steel, Zinc Clear Trivalent	Oversize (+)
45	Cold Finished Steel, Plain* (1045)	Undersize (-)

MATERIAL		TOLERANCE
(Prefix)	*(Material/Finish)*	
46	Cold Finished Steel, Zinc Clear Trivalent (1045)	Undersize (-)
60	Moltrup Quality Steel, Plain* (8630)	Oversize (+)
65	Cold Finished Alloy Steel, Plain (4140)	Undersize (-)
66	Cold Finished Alloy Steel, Zinc Clear Trivalent (4140)	Undersize (-)
70	300 Series Stainless Steel, Plain	Undersize (-)
75	300 Series Stainless Steel, Plain	Oversize (+)
80	316 Stainless Steel, Plain	Undersize (-)
85	416 Stainless Steel, Plain	Undersize (-)

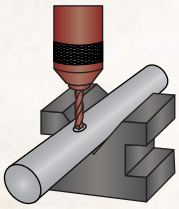
◆◆Size can vary over or under from nominal size.

CUSTOMIZATION

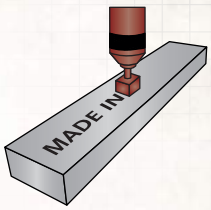
Our state-of-the-art manufacturing facility is capable of producing custom key stock and machine keys. With experience in the automotive, power transmission, and agricultural industries, your special is our specialty.



SAWING
Lengths can be cut up to 144" with profiles from 1/8" to 6".

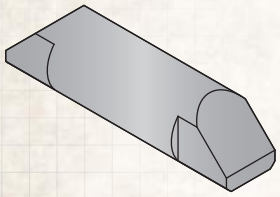


DRILLING
Usually performed with turning or milling operations.

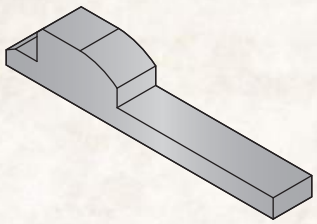


MARKING
Inkjet printing capabilities to mark information directly on parts. RoHS compliant ink.

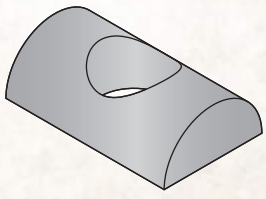
EXAMPLES OF WHAT WE CAN DO FOR YOU



HALF-ROUND KEY WITH MILLED ENDS
This machine key was saw cut and milled to create its shape.



FLYWHEEL KEY
This flywheel key was saw cut and milled. Then it was heat treated.



HALF ROUND KEY WITH HOLE
This half round key was saw cut and milled. Then drilled to create the hole.

KEY STOCK STANDARDS

The world of key stock is confusing and non-standardized. For the user, it is important to note:

- Key stock is produced to a very high level of precision.
- Imperial product tends to be close tolerance oversize if called "key stock" and wider tolerance undersize if called "bar stock."
- Metric parts are nearly always close tolerance undersize.
- The tighter the tolerance, the more the product costs to manufacture.

The addition of other features and attributes such as heat treatment can further complicate production of machine keys. Heat treatment can relieve material stresses, and parts can swell and shrink. In close tolerance key stock applications, the addition of heat treatment can result in additional processing costs for stress relieving, grinding, or milling.

G.L. Huyett's Sales Team can assist in finding the right balance of specification and cost, so the part yields desirable mechanical benefits at the desired cost.

ANSI B17.1

ANSI B17.1 is the prevailing standard for key stock, but even this standard causes confusion. Within the standard are call outs for "Class 1, a clearance or metal-to-metal side fit using bar stock and key way tolerances… This is known as a relatively free fit and applies only to parallel keys." and "Class 2, a side fit, with possible interference or clearance, obtained by using key stock and key way tolerances… This is a relatively tight fit." While the terms "bar stock," "key stock," and "parallel keys" are used in the standard, the definitions are somewhat ambiguous. The standard defines that there are two classes of stock for parallel keys: Class 1; broad, negative tolerance bar stock, and Class 2; close, plus tolerance key stock. There is a Class 3 noted, but no standards are given and it is suggested to use Class 2 for Class 3 applications.

The variance in standards is to account for the availability of material at economic costs in the marketplace. Some refer to the Class 1 standard as "bar stock" and the Class 2 as "key stock" or "true key stock."

Class 2 aligns to the conventional and historical definition of key stock. This specification denotes oversize, close tolerance standards of +.001/-0" from nominal on sizes up to 1-1/4". The idea is that such tolerance will insure a tight fit with minimum rocking of the key in the key way.

Class 1 widens the permitted standards to the standards of ASTM A108 used by the commercial steel industry. It is thought that this second standard was created to ensure a commercially viable alternative to so-called "true key stock."

ANSI KEY STOCK TOLERANCE SPECIFICATIONS

ANSI B17.1	KEY WIDTH		TOLERANCE
	OVER	TO (INCL)	
Class 1: "A clearance or metal-to-metal side fit obtained by using bar stock keys and key way tolerances."	–	3/4"	+0/-0.002"
	3/4"	1-1/2"	+0/-0.003"
	1-1/2"	2-1/2"	+0/-0.004"
	2-1/2"	3-1/2"	+0/-0.006"
Class 2: "A side fit, with possible interference or clearance, obtained by using key stock and key way tolerances."	–	1-1/4"	+0.001/-0"
	1-1/4"	3"	+0.002/-0"
	3"	3-1/2"	+0.003/-0"

DIN AND ISO

Historically, metric key stock was specified under DIN 6880 and parallel and tapered keys in DIN 6885, ISO R773, and ISO 2491. These standards have been withdrawn without replacement standards. Because there was no replacement standard issued, these standards are still in use today with DIN 6885 predominating.

Contrarily, ANSI standards contemplate close tolerance oversize material for Class 2, and wider tolerance undersize for Class 1; ISO contemplates **only undersize** and only one tolerance specification that is roughly equal to Class 2 ANSI, except the tolerances are under the nominal.

BRANDING AND TRADE NAMES

The traditional branding and trade names for key stock add additional complexity and confusion. Class 2 and ISO key stock are difficult to make, and only specialized mills using specialized equipment can maintain such close tolerances.

Moltrup Steel of Beaver Falls, PA, is one of the more famous brand names for key stock. Moltrup was bought out as the steel industry consolidated in the 1980s. The plant closed and is no longer in operation. Moltrup is still listed on many prints and when listed, the general inference is that the user wants ANSI B17.1 Class 2 fit.

Mak-A-Key™, originally trademarked by Devan-Johnson Co., was the first branded key stock intended as an aftermarket product. Technically, a machine key is a cut-to-length part for an application, while key stock is a "stock" of material 12" or longer that is cut in the field. Mak-A-Key's moniker is "cut, file, fit."

Mak-A-Key was historically advertised as "key stock." The material was actually oversize drawn bar stock. In this regard, Mak-A-Key is unique. Oversize bar stock is quite rare and rarely specified in applications, however Mak-A-Key and Moltrup are still commonly referenced by design engineers.