# White Paper

## Feather Keys:

## The forgotten and ignored

## drive component



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## Feather Keys: The Forgotten and Ignored Drive Component

With all of the unique components and unique materials coming at engineers these days, some of the simple but very effective ways of the past have been pushed aside. Some of these approaches, such as the Feather Key, must be re-examined to show why they should be considered again.

Shaft Keys, sometimes called Sunk Keys are used in power transmission to transmit torque between a shaft and a shaft mounted component such as a gear or pulley. Both the shaft and the component must be machined with a keyway of the appropriate size and style for the key to be used. Shaft keys are available in a variety of types and include Parallel Keys, Square Keys, Flat Keys, Rectangular Keys, Woodruff Keys, Plain Taper Keys, Gib-Head Taper Keys, Perpendicular Pins and the Feather Key.

### Parallel Keys

Parallel Keys are sometimes called Straight Keys. These include Square Keys, Rectangular Keys. They are the most common keys used in industry. When Parallel keys are used the shaft is usually key slotted for the full length of the shaft or slotted from the end of the shaft and along the length of the shaft for a distance greater than the length of the key to be used. Parallel keys can be installed by lining up the keyslots in the shaft and the component and then pressing the parallel key between the slots.

### Square Keys

Square Keys as their name suggest, have a square cross section. They are normally specified for shafts from 1/4” diameter to 1” diameter but larger square keys are available for shafts up to 6-1/2” diameter. They would be used where it is desirable to have greater key depth than is provided by a rectangular key.

### Rectangular Keys

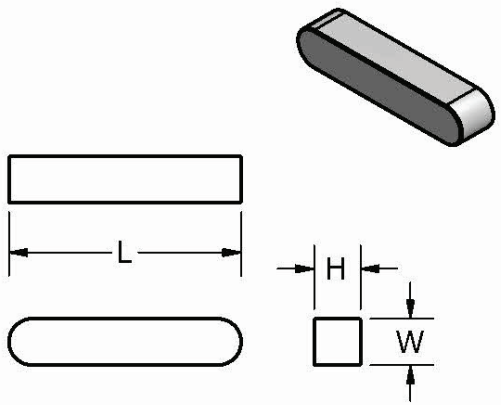
Rectangular Keys sometimes called Flat Keys
are the general purpose key for shafts greater than 1” diameter and up to 20” Diameter. The rectangular key is larger in width than it is in height. The added width of the key transmits greater torque without adding slot depth to the shaft or keyway depth to the component. When a rectangular key is used on shafts larger than 11” diameter it is often mated with a shaft that has a milled flat along the shaft length instead of a Keyslot. A standard broached keyway is used in the mounted component.

Parallel keys are inexpensive, readily available and easy to install. The keyslot in the shaft can be milled with an end mill or circular saw. Once installed, the parallel key must be held in place with a set screw in the mounted component or other retaining
method. Vibration or direction reversal of the drive system often allows the screw to loosen and when that occurs, the parallel key may walk itself out of the assembly.

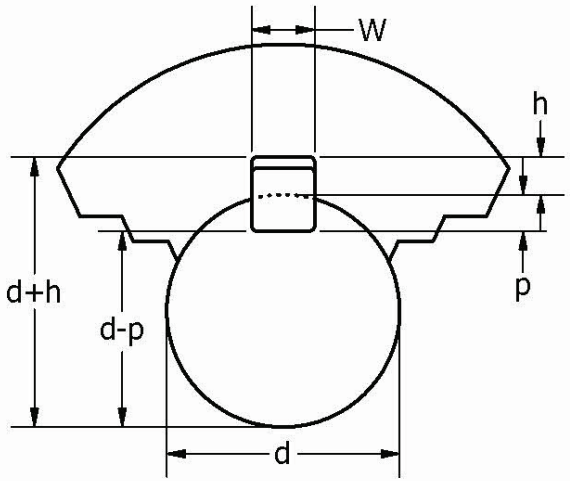
It is a frequent frustration to have a drive component to suddenly spin free and the key to be lost in the bowels of a machine, sometimes causing catastrophic damage by falling into adjacent machinery. Parallel keys can be purchased in a variety of widths and lengths or they can be cut to length from key stock.

Parallel keys are generally fitted snugly to the bottom and sides of the keyslot in the shaft member with clearance at the top of the keyway in the hub member. These keys are used for transmitting unidirectional torques in transmissions not subject to heavy starting loads and where periodic withdrawal or sliding of the hub member may be required. Parallel keys can be purchased in a variety of widths and lengths or they can be cut to length from key stock.

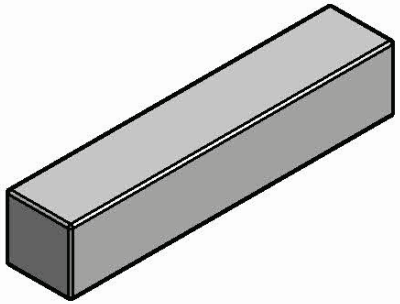
In many instances particularly with couplings, a Gib-head key (a special tapered key -see drawing below) cannot be accommodated, and there is insufficient room to drift out the key from behind. In these cases it is necessary to withdraw the component over the key and a parallel key is essential. Parallel square and rectangular keys are normally side fitting with top clearance and are usually retained in the shaft rather, more securely than in the hub.



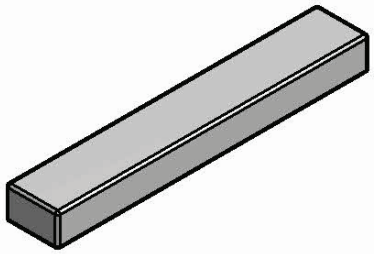

**Feather Key**



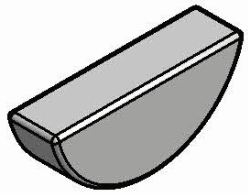

**Machining Details**



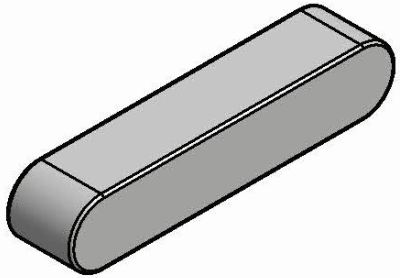
Square Key



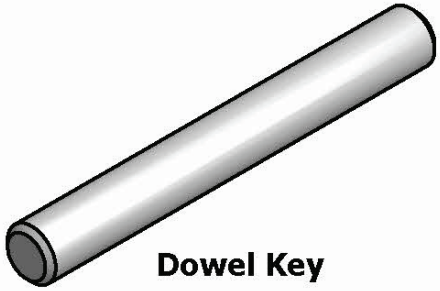
Flat Key



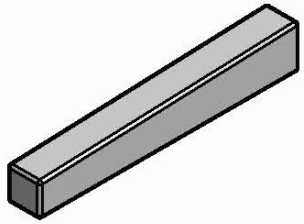
Woodruff Key



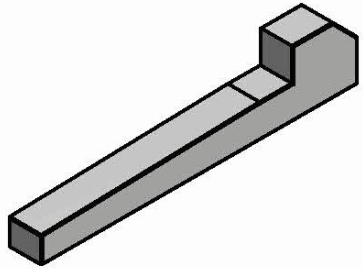
Feather Key



Dowel Key



Taper Key



Gib-Head Key

## Woodruff Keys

A Woodruff Key is a half moon shaped key that is inserted into a curved slot in the shaft. The advantage of a Woodruff Key is that once the key is properly installed, it is captive and cannot walk itself out of the shaft. Woodruff keys are used on shafts from ¼" diameter to 2-1/2" diameter.

Woodruff Keys have a disadvantage in that they are difficult to install. The Woodruff key is first pressed into a curved slot which has been milled in the shaft and must be aligned so that the flat on the top of the key is parallel with the shaft. As the shaft with the Woodruff Key is pressed into the component, the key has a tendency to slip out of position. Keys installed out of parallel will cause problems in installation.

Woodruff keys are relatively short and cannot carry the same load as longer keys. When heavy torque is to be transmitted such as with a wide faced gear or a multi groove V belt pulley, Woodruff keys are inappropriate. Placing two or more Woodruff keys in line is expensive and difficult to install.

Woodruff keys are available in a variety of sizes and require special key cutting tools. These keys are used for light applications or mounting taper bored components onto tapered shaft ends.

## Taper Keys /Gib Head Keys

These keys are used for transmitting heavy unidirectional, reversing, or vibrating torques and in applications where periodic withdrawal of the key may be necessary. Taper keys are available as Plain, Saddle or Gib-Head Type. Each functions similarly. A long keyslot is required in the shaft. When the component is positioned on the shaft and the keyslot and keyway are aligned, the taper key is inserted and pressed or hammered tightly into place.

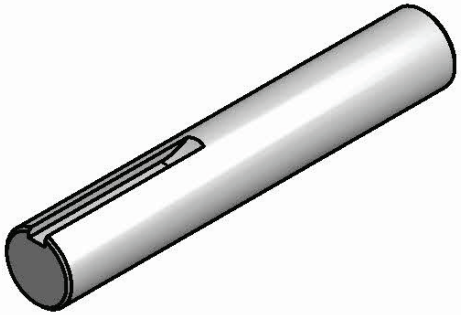
The taper is 1/8" per foot . It wedges the key against the Keyslot and keyway and helps prevent the key from walking out of the assembled shaft and component. This method is not foolproof and the keys can come free especially when vibration, face wobble, stop/start or reversals of drive direction act upon the components. The taper for tapered keys is put in the hub member. A well-fitted taper key has no clearance on the top, bottom, or sides; hence closer tolerances on taper keyway depths than parallel keyway depths may be desired. The tapered sunk key not only acts as a driver for the key part, but holds it against axial or endwise movement, and should have a bearing on all sides.

The Gib-Head type has a raised head on the larger end of the taper. This head allows for easy removal of the key by prying a tool between the Gib and the face of the mounted component. Some Plain Taper keys are supplied with a cross drilled hole in the larger end to function as a removal device. The axial position of Taper keys is controlled by the depth of the slots in both the shaft and the component and cannot be pre determined. The deeper either of these slots is made then the further the taper key will enter axially.

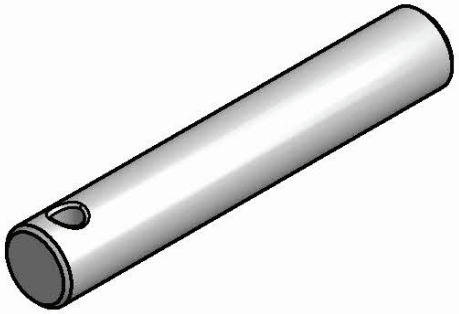
If the keyslot or keyway depth is excessive, a gib-head taper key might enter the slot enough that the gib-head contacts the face of the component. If this occurs, the taper key cannot be trusted to wedge itself strongly. It would have a high percentage of failure.

The Saddle Key is simply concaved on one side to fit the shaft and is tapered on the top. As the drive with this type of key is not positive, it is only used when there is little power to transmit.

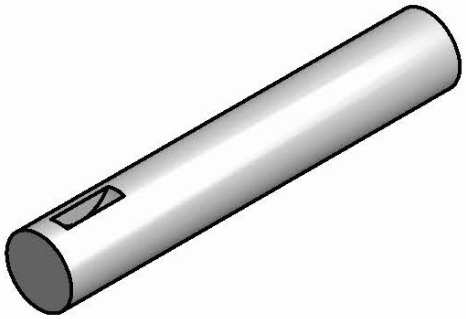
Taper keys are usually top fitting, but may be top and side fitting where required. Rectangular section Taper keys are used for general purpose. Like the parallel rectangular key, the height is less than the width. Taper keys are used for shafts ½” to 6” in diameter.



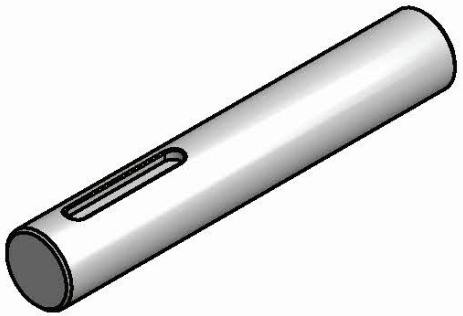
**Keyslot for Parallel Key**



**Cross Drilled Hole for Pinned Shaft**



**Keyslot for Woodruff Key**



**Keyslot for Feather Key**

## Perpendicular Pin

When a small diameter shaft of 1/4” diameter or smaller requires a shaft key, a traditional shaft key may not be suitable. Drilling a through hole in a shaft and inserting a dowel pin or spring pin may solve the problem. A vertical slot cut into the end of the component is used to engage the two protruding ends of the pin and transmit the torque. The vertical slot must be at least as deep as the pin diameter but can be much deeper. A properly toleranced slot in the component and the use of a spring pin rather than a dowel pin will result in near zero backlash between the shaft and the component.

## Feather Keys

Now we come to the almost ignored Feather Key. Feather Keys are well known in Europe and elsewhere in the world but not in the USA. They are used for shafts from 1/4” diameter up to 2-1/2” diameter. And have the same torque capacity as square and rectangular parallel keys.

The Feather key is a parallel key and very similar to square and rectangular keys except that it has a radius on both ends and machined to tight length tolerances. The mating keyslot in the shaft is machined with an end mill cutting tool and machined to the same length as the Feather Key. This oval shape contains the key accurately in the shaft and does not allow any axial movement of the key in the shaft. The broached keyway in the mounted component is identical to conventional keyways used for parallel keys, so no changes to the mounted components are necessary.

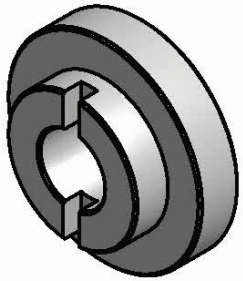
Feather keys have unique advantages over all of the traditional keys:

1. The radius end of the key funnels the key into the keyway of the component simplifying the assembly. Feather keys are easy to insert in the shaft. The radius helps the alignment of the key in the shaft key slot.
2. Feather Keys are totally contained. It is not necessary to have a set screwhold the key in position. Feather keys cannot walk out of an assembly.
3. When a Feather key is installed it cannot move axially. This permits the mounted component to be laterally adjusted along the shaft to the desired position.
4. The contained Feather Key cannot cause damage to adjacent machinery caused by a key falling out of a shaft. Loose keys in working machinery are a major cause of damage and possible injury.
5. There is no possibility for a lost key and the related down time due to this type of failure.
6. Disassembly and reassembly with a Feather key is hassle free.
7. Feather Keys are pre-cut to exact lengths. There is no need for cutting, measuring, filing or fitting.

The only down side to feather keys are that they are not readily available in the USA.

The feather key, though it is a simple mechanical part, can assist in lowering costs in your products manufacture, possibly giving lower warranty callbacks and lower customer downtime for maintenance. For such a mundane low cost part, it has large benefits. The phrase that people say when they give gifts, “use it well” definitely applies to the Feather Key.

**Standard Keyway in Component**



**Vertical Key slot for Cross Pinned Shaft**