Tapers on keys and cotters

Objectives : At the end of this lesson you shall be able to
- **define taper**
- **state the uses of tapers**
- **distinguish between features of self-holding and self-releasing tapers**
- **state the features of pin tapers & keyway tapers**
- **state why taper is provided on key and cotters.**

Taper

Taper is a gradually narrowing (or) increasing from one end to other end of the object either in thickness (or) cylinderical.

Tapers on key

When key is drive through the keyways fit, fight due to wedge action. This ensure tightness of joint in operation and prevent lossening of the parts. Due to taper it is lasy to remove the key and dismantle the joint. The normal value of taper of key is 1:100.

Taper on cotter

When cotter is driven through slots, it fit, tight due to wedge action. This ensures tightness of joint in operation and prevent loosening of the parts. Due to taper it is easy to remove the cotter and dismantle the joint. The normal value of taper varies from 1:48 to 1:24.

Taper pins

Taper pins like round keys are used for locking collars on shafts and also between shaft and hub for transmission of motion. Taper is 1:50, small end as ref nominal dia. Its ends are spherical and radius equal to dia. of the pin.

Tapers are used for:

- self-alignment/location of components in an assembly
- assembling and dismantling parts easily
- transmitting drive through assembly.

Tapers have a variety of applications in engineering assembly work.(Figs 1,2 & 3)

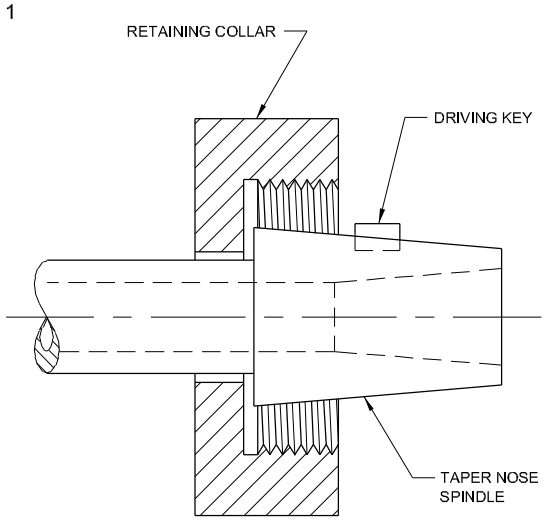
Tapers of components are expressed in two ways.

- Degree of arc (Fig 4)
- Gradient (Fig 5)

The method adopted for expressing tapers depends on:

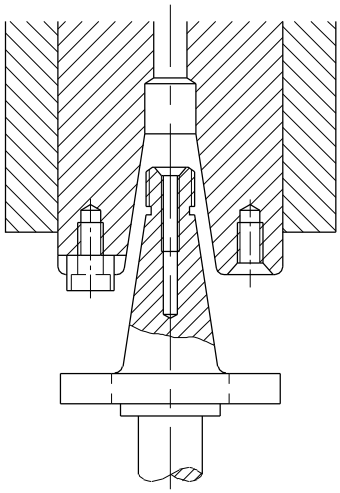
- the steepness of the tapers

Fig 1



LATHE-TAPER NOSE SPINDLE

Fig 2



MILLING MACHINE SPINDLE

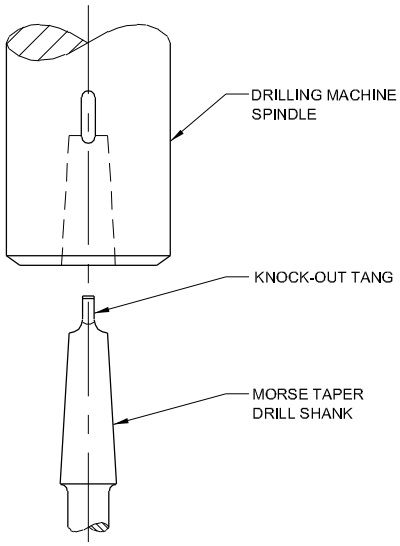
- the method adopted for measuring.

Specification of tapers

While specifying taper in drawings it should indicate the:

- angle of the taper
- size of the component. (Figs 6,7, 8 & 9)

Fig 3



DRILLING MACHINE SPINDLE AND DRILL WITH TAPER SHANK

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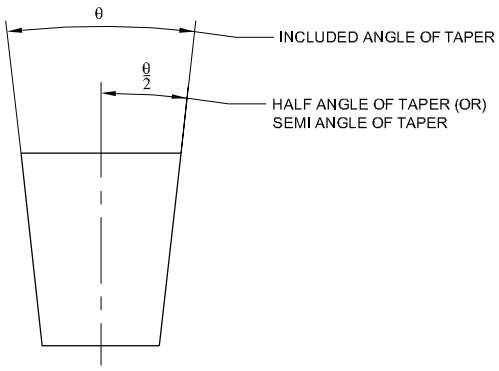
Fig 4



60 SECONDS (") = 1 MINUTE (')

60 MINUTES (') = 1 DEGREE OF ARC (°)

AN ANGLE EXPRESSED IN DEGREES OF ARC

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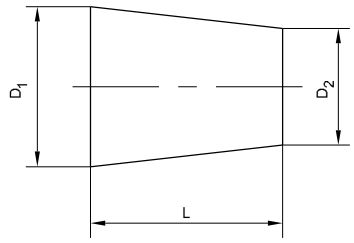
Fig 5



EXAMPLE: IS SELF RELEASE TAPER

(MILLING MACHINE SPINDLE NOSE) IS GIVEN AS: $\frac{7}{24}$

i.e.

$D_1 - D_2 = 7$

$L = 24$

NOTE: L IS MEASURED PARALLEL TO THE AXIS

$$\text{TAPER} = \frac{D_1 - D_2}{L}$$

AN ANGLE EXPRESSED AS A GRADIENT

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Fig 6

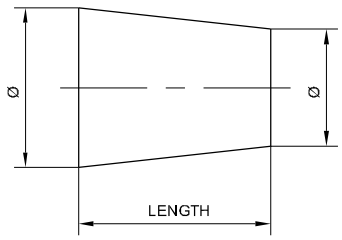

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Fig 7

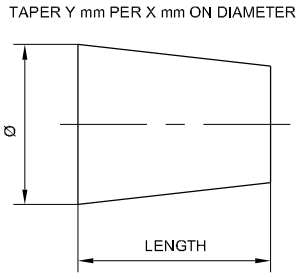

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Fig 8

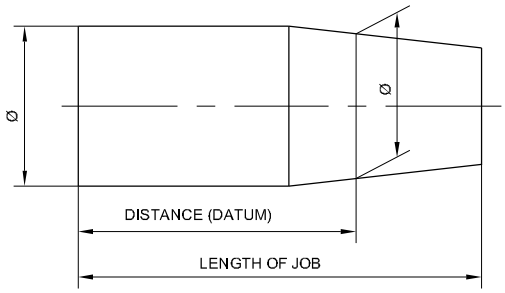

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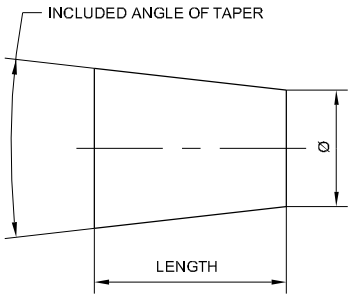
Fig 9



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Standard tapers

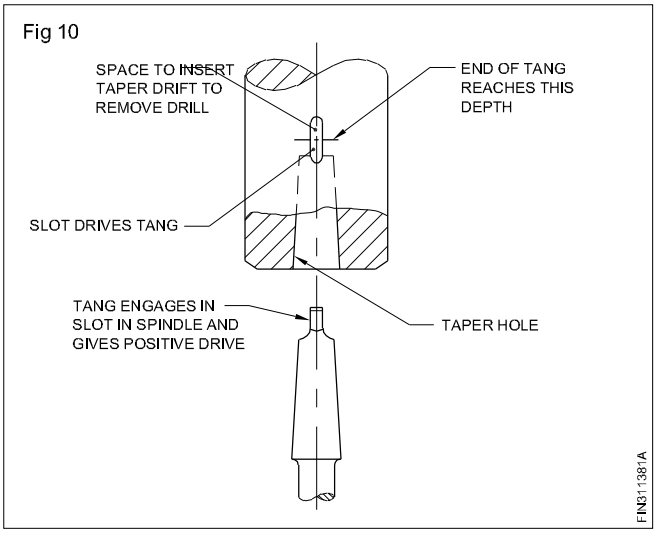
Tapers for tool-holding

Two types of tapers are used for tool-holding on machines.

- Self-holding tapers
- Self-releasing tapers

Self-holding tapers

Self-holding tapers have less taper angle. These are used for holding and driving cutting tools like drills, reamers etc. without any locking device. (Fig 10)



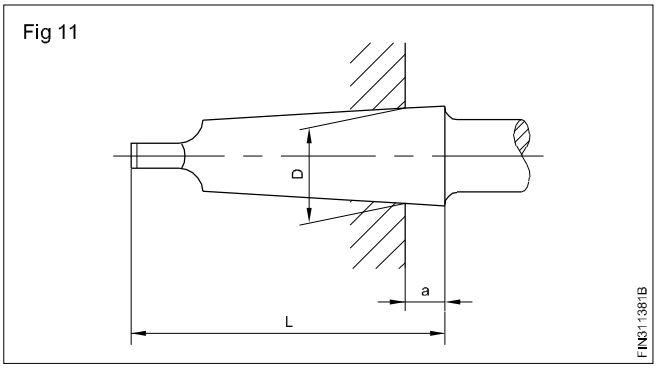
The standard tapers used for this are:

- the metric taper
- the Morse taper.

Metric taper

The taper on diameter is 1:20. The commonly used shank sizes in metric tapers are metric 4, 6, 80, 100, 120, 160 and 200.

The shank size indicating the metric taper is the diameter at D. (Fig 11)



Morse taper

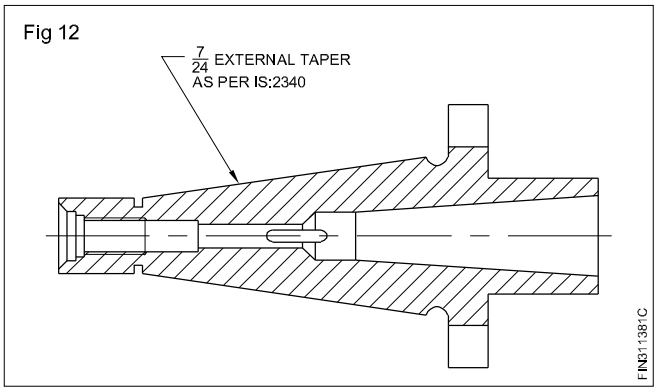
The commonly used taper shank sizes are:

0, 1, 2, 3, 4, 5 and 6.

The taper is varying according to the size of the Morse taper. It varies from 1:19.002 to 1:20.047.

Self-releasing 7/24 tape (Fig 12)

Spindle noses and arbors used on milling machines are usually provided with self-releasing tapers. The standard self-releasing taper is 7/24. This is a steep taper which helps in the correct location and release of the components in the assembly. This taper does not drive the mating component in the assembly. For the purpose of driving, additional features are provided.



The commonly used 7/24 taper sizes are: 30,40,45,50 and 60.

The taper of a 7/24 taper of No.30 will have a maximum diameter of (D) 31.75 mm and No.60, 107.950 mm. All other sizes fall within this range.

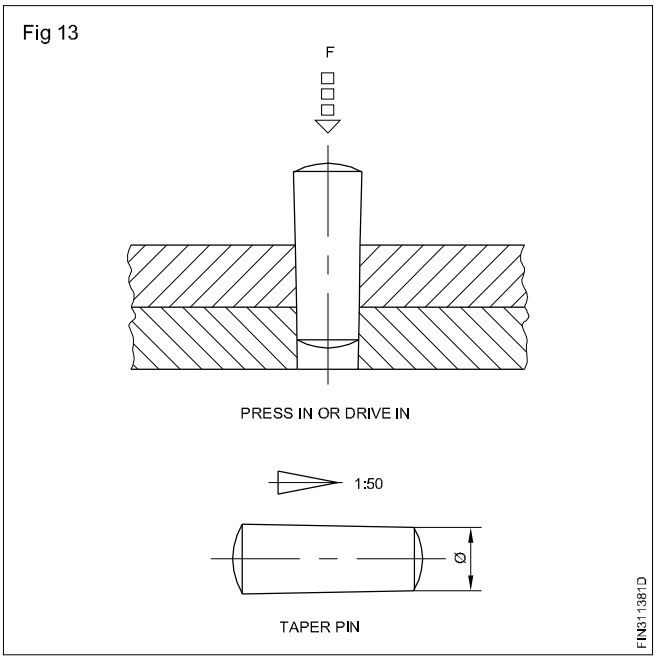
Tapers used in other assembly work

A variety of tapers are used in engineering assembly work. The most common ones are:

- pin taper
- key and keyway taper.

Pin taper

This is the taper used for taper pins used in assembly.(Fig 13)



The taper is 1:50.

The diameter of taper pins is specified by the small diameter.

Taper pins help in assembling and dismantling of components without disturbing the location.

Key and keyway tapers

This taper is 1:100. This taper is used on keys and keyways. (Figs 14 and 15)

Fig 14

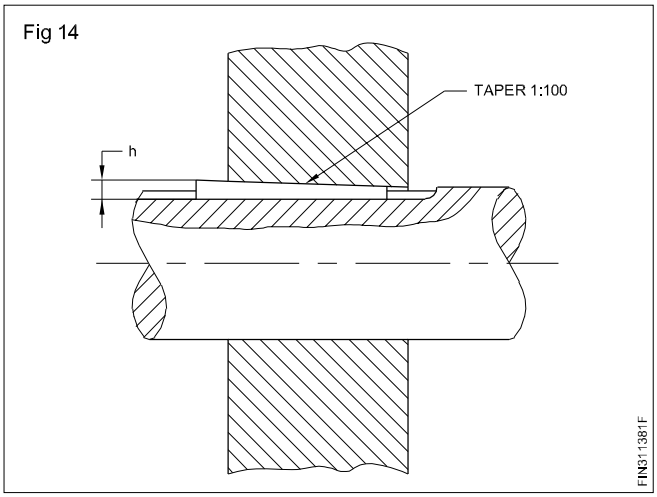
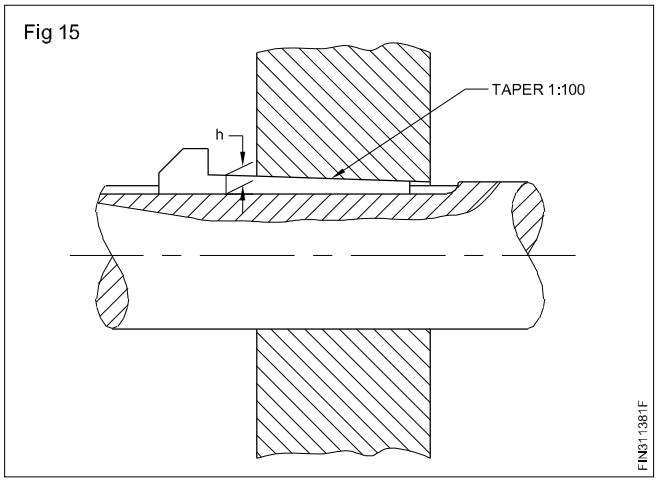


Fig 15



Note

For further information about the tapers used for special application refer to:

IS: 3458 - 1981.

Taper pins are three types:

Type A - pins ground with a surface finish N6

Type B - pins turned with a surface finish N7

Type C - split pins with a surface finish N7

The nominal dia range from 0.6 to 50 mm and of varying lengths 4 to 200 mm according to dia of pin.

Three types of taper pins

Designation: Taper pin shall be designated by name, type A.B or C, nominal dia, nominal length and BIS number.

Taper pin A 16 x 90 IS:6688

Taper pin B 20 x 60 IS:6688

Split taper pin C 5 x 40 IS:6688

General proportion: normal dia of pin = 1/6 (dia of shaft).

Cotter/cotter joint : Cotter is a rectangular wedge with taper on one side of the width, thickness being same. It is used to connect shafts, with reciprocating motion only. The ends of the shafts to be joined are formed into socket and spigot**.** A rectangular slot at right angle to the axis is made with taper on one side to suit the cotter. The socket and spigot are aligned and the cotter is driven in locking them together.

Two cotters are used to join shafts with a sleeve. The enlarged shaft ends with slots are placed facing each other in a sleeve with slots. On driving the cotters, with a bearing surface on the sleeve, the tapered or slope surface of the cotters pull the shafts closer. The clearance on the sleeve and shafts allow the variation of cotters width to certain extent.

Cotter joint: Is also used to connect square or rectangular members. A strap joint with a gib and cotter. One end of the member is made as fork end which takes the end of the other member to prevent the fork end getting bend while driving the cotter a gib is placed. The bending effect on the fork end and how the gibs are made use of. Single gib is used for cotter with slope on one side. Two gibs are used if the cotter has slope on both sides.

Use of pin in connecting shafts: Similar to the cotter, cylindrical pin is also used in connecting shafts. One end of the shaft is made as Fork (fork end) with holes and the end of the other shaft is formed as eye end. The eye end fits into the fork end, holes being in one line. A collared cylindrical pin with a small hole is inserted into the eye and fork. The pin is held in position using a coller and a small taper pin or split pin.