

Metrology, standardization and certification

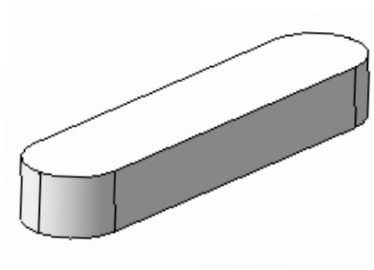
Theme 9: Accuracy rationing of keyed and splined joints

Lecture plan:

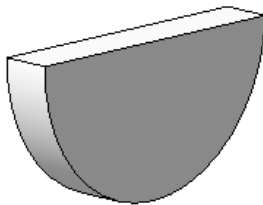
1. Accuracy rationing of keyed joints.
2. Accuracy rationing of splined joints.
3. Designation of splined joints in the drawings.

Accuracy rationing of keyed joints

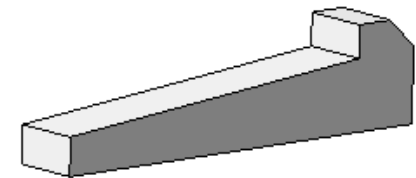
Keyed joint is called connection the shaft with sleeve by means of a key, i.e. part, which is a prismatic, wedge-shaped or segment bar.



Prismatic key

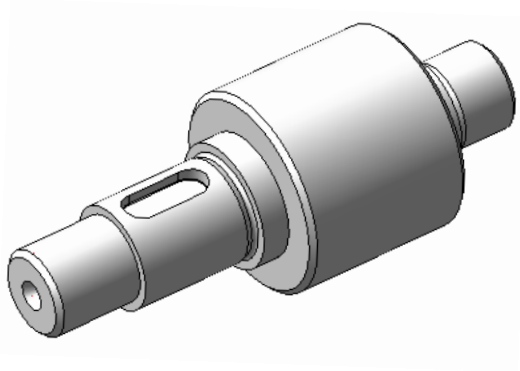


Segment key

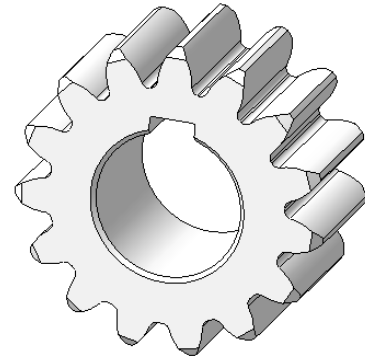


Wedge key

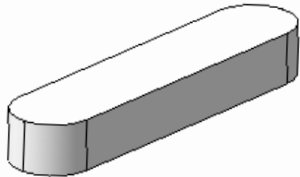
Keyed joint



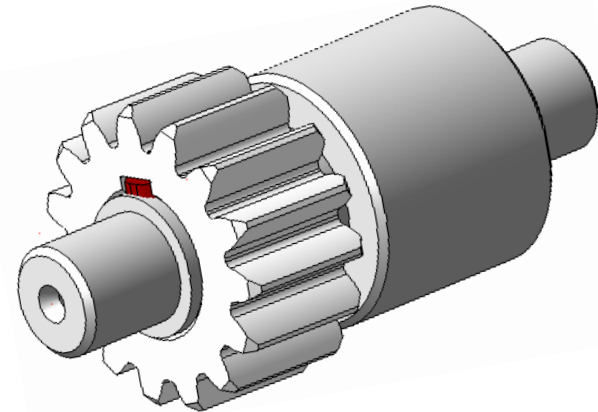
Shaft with keyway



Pinion with keyway



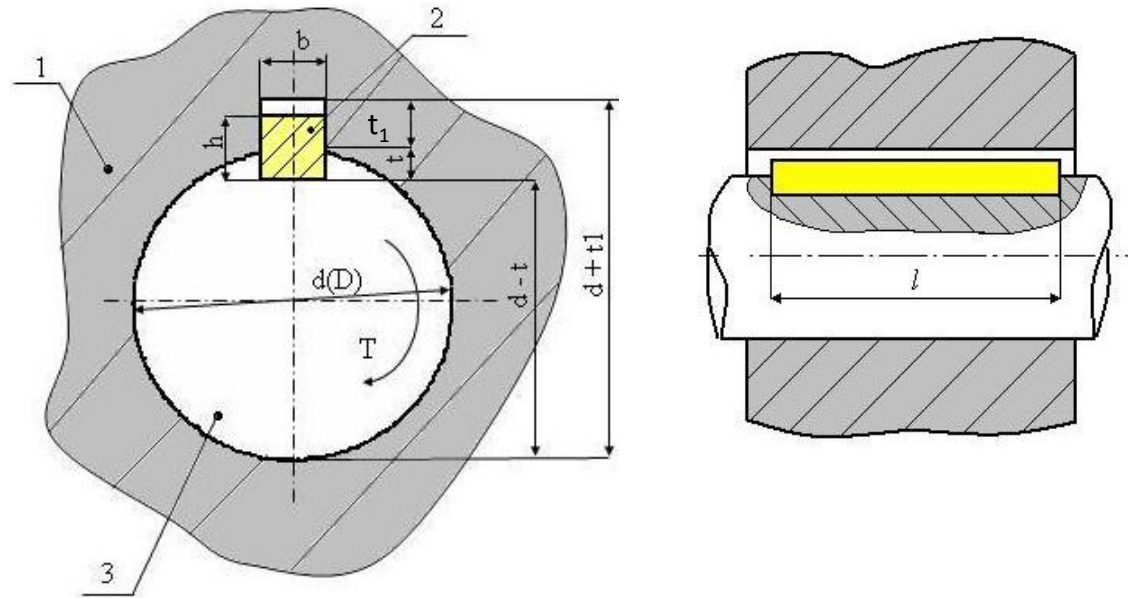
Feather key



The shaft and pinion connected by a key

Accuracy rationing of keyed joints

Rationing precision keys is made depending on their dimensions. For the **width** of the key (b) standardized one field **h9** tolerance. For **height** (h) - usually a tolerance **h11** and **h9** (for height of keys 2 ... 6mm tolerance zone **h9**) and for **length** (l) - tolerance field **h14**.



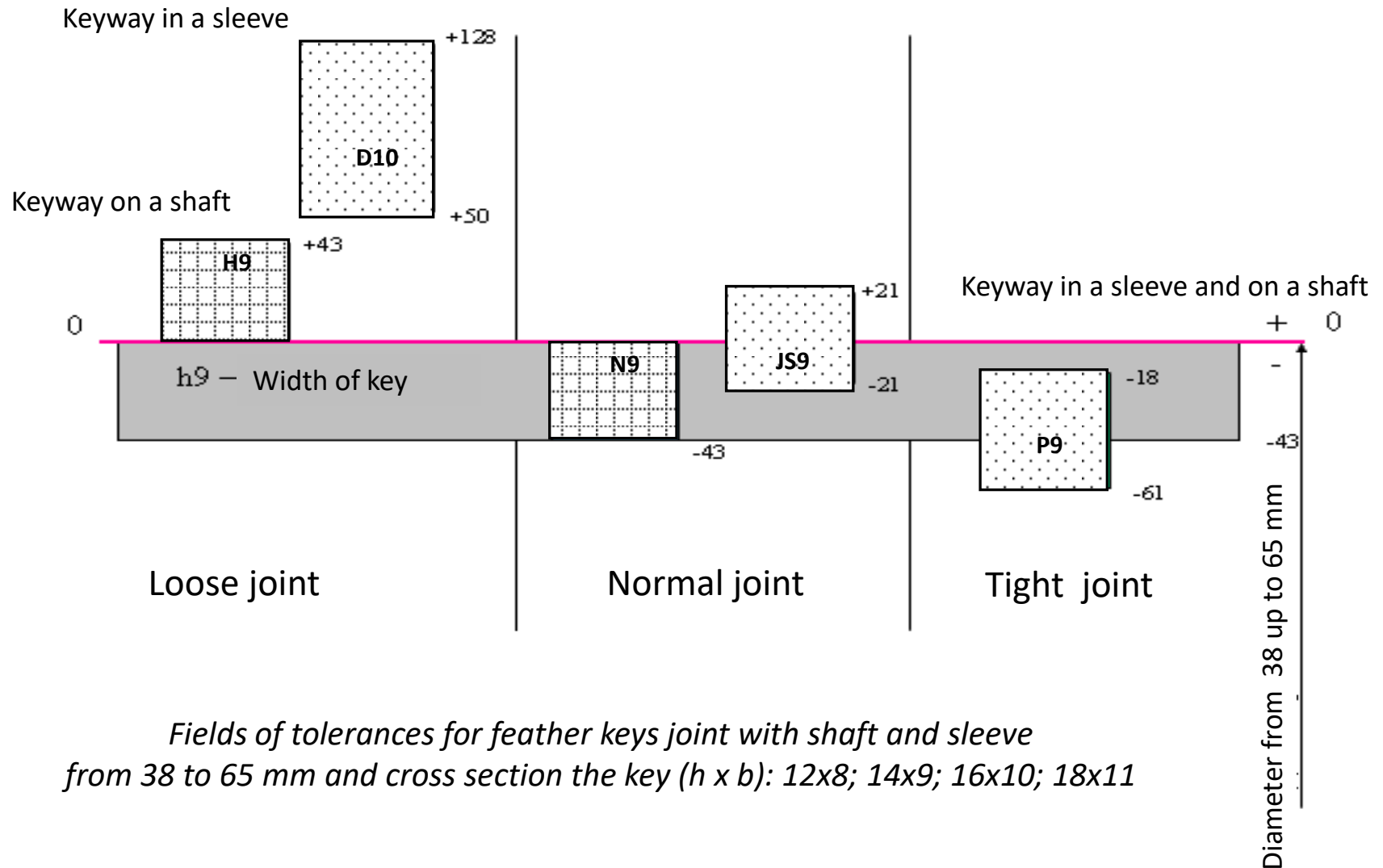
Connection by a prismatic key:

1- sleeve; 2- key; 3- shaft;

t - depth of a keyway on a shaft; t_1 - depth of a keyway in a sleeve;

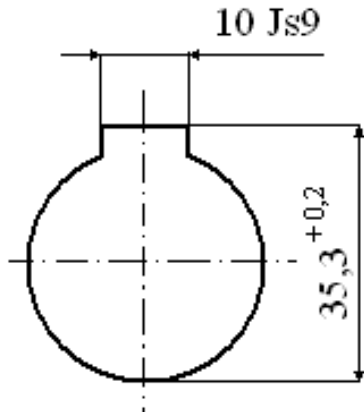
l - length of key; T - torque; d - shaft diameter; D - internal sleeve diameter

Accuracy rationing of keyed joints

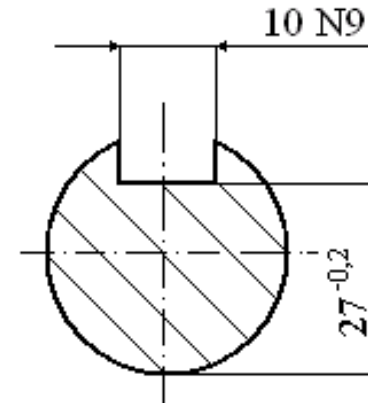


Fields of tolerances for feather keys joint with shaft and sleeve from 38 to 65 mm and cross section the key (h x b): 12x8; 14x9; 16x10; 18x11

Accuracy rationing of keyed joints



Rationing accuracy keyway in the sleeve



Rationing of accuracy keyway in the shaft

The requirements for precision in the depth of the grooves are set to range from 0.1 - 0,3mm in the shaft and from +0.1 to + 0.3 mm in the sleeve, depending on the nominal size. On the length of the groove is set one field **H15** tolerance.

Designation the key: **b x h x l**;

b - width of the key; **h** - height of the key; **l** - the key length.

For example: 18x11x100 GOST 23360-78

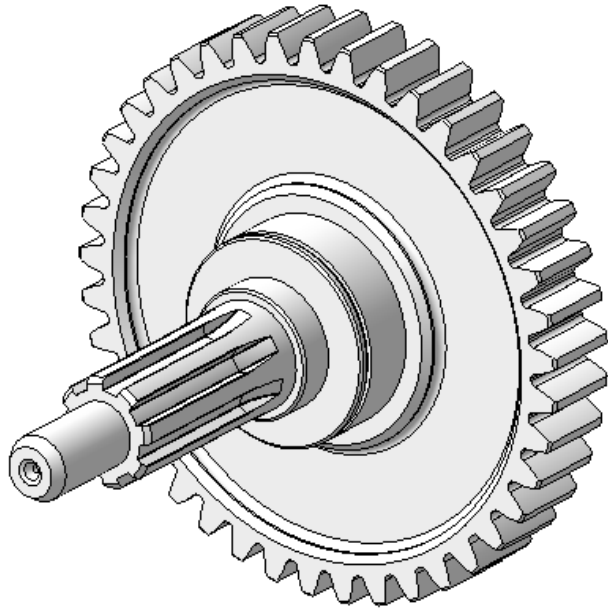
Accuracy rationing of splined joints

Spline connection (SC) is a plug-in connection the sleeve with the shaft when the shaft has teeth (projections), and the sleeve has the corresponding cavities (slots).

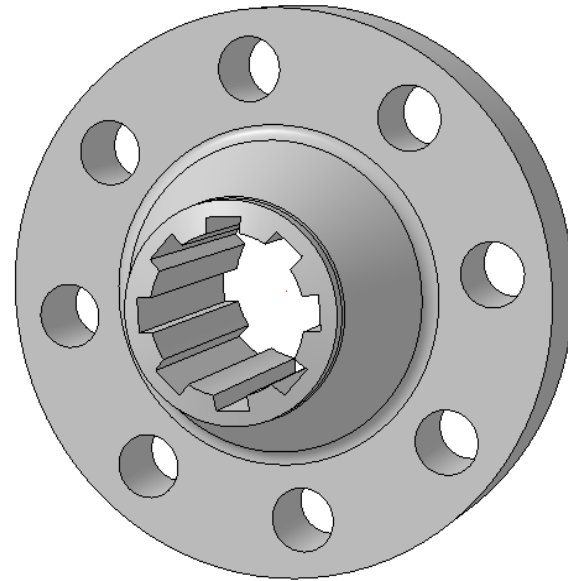
SC used when necessary to provide high torque transmission and, moreover, in cases when it is necessary to provide a relatively high demands on the coaxiality (centering) of the shaft and sleeve. There are straight-sided, evolvent and triangular spline connections. Triangular SC used mainly for small parts and clamp connections.

Rectangular spline connections are used in mobile (with a gap) and motionless (with a tightness) connections. For coupling of details to outer diameter from 14 to 125 mm.

Accuracy rationing of splined joints

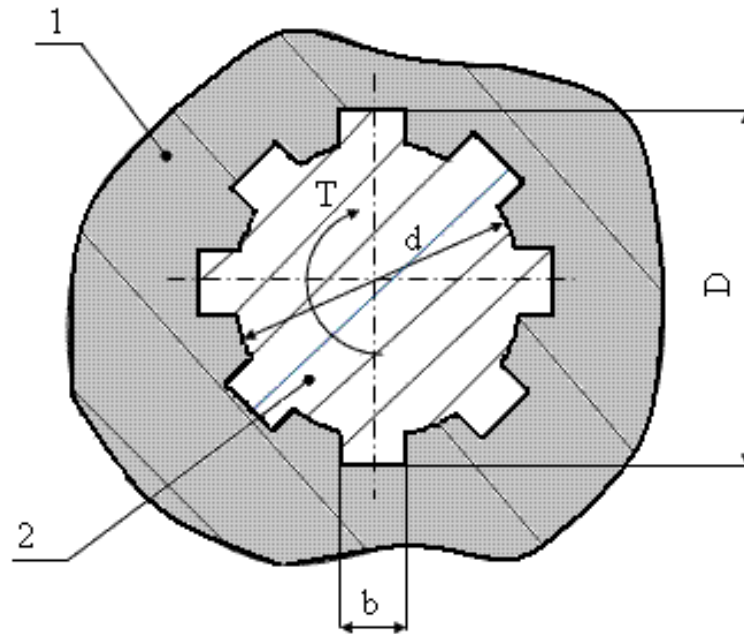


Shaft-gear with splines



Semi-coupling with splines

Accuracy rationing of splined joints



Straight-sided splined joint

1 – sleeve; 2 – shaft;

D – outer diameter; d – inner diameter; b – width of splines;

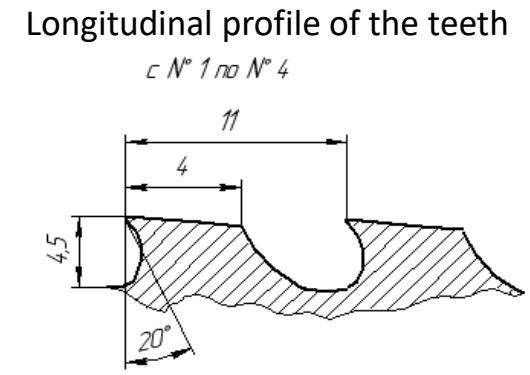
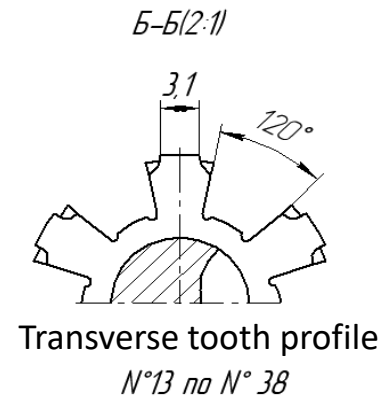
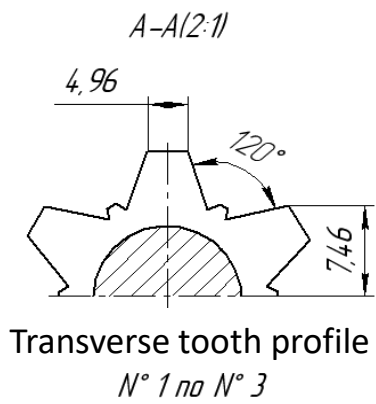
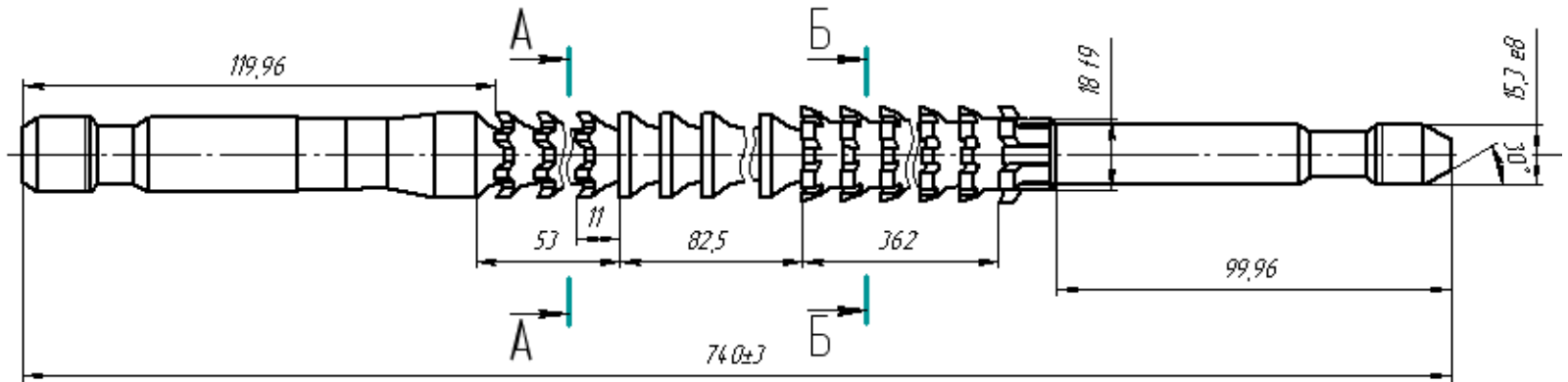
T – torque

Accuracy rationing of splined joints

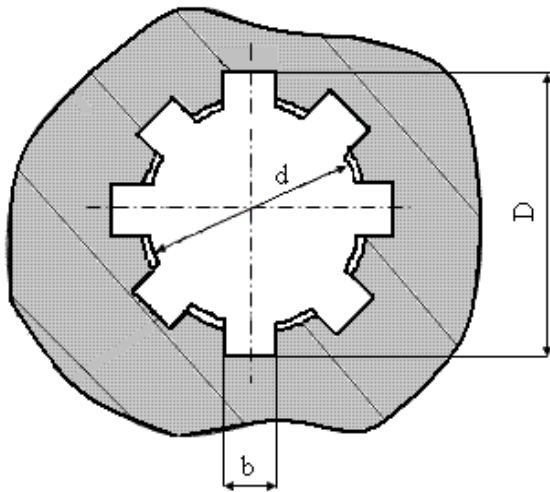
The standard defines a combinations of $z \times d \times D$, which can be used. There is necessity to rationing of combinations for diameters and number of teeth because the spline sleeve obtained mainly broaching method. The tool for this process - broach - made under a certain size of the sleeve and to a certain number of slots. It is therefore very important to make limited sizes of the sleeves as well as a tool for broaching a very complicated and expensive. We can not allow any combination of diameters and number of teeth.

A feature of SC is that the fit components is carried out simultaneously on three surfaces: on the outer surface, on the inner diameter of the slots and on lateral faces. Therefore, it is necessary to normalize the three landings (fits). The landing must be different in terms of accuracy, since if all surface make with high precision, it is impossible to provide a splined connection assembly.

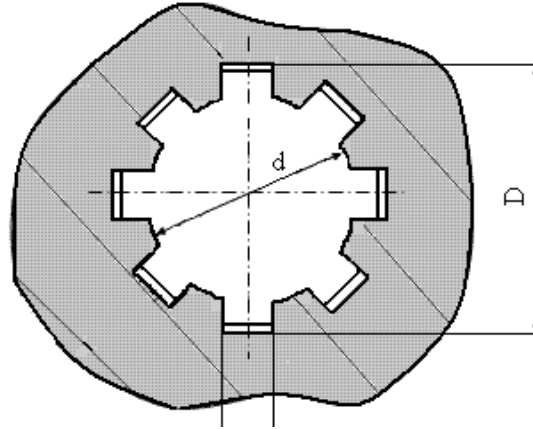
Spline broach



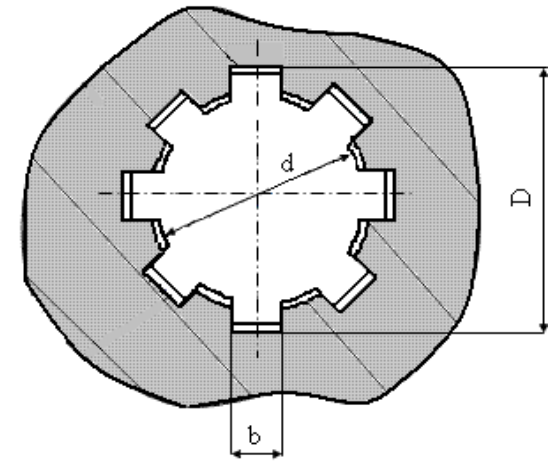
Accuracy rationing of splined joints



Centering by outer diameter



Centering by inner diameter



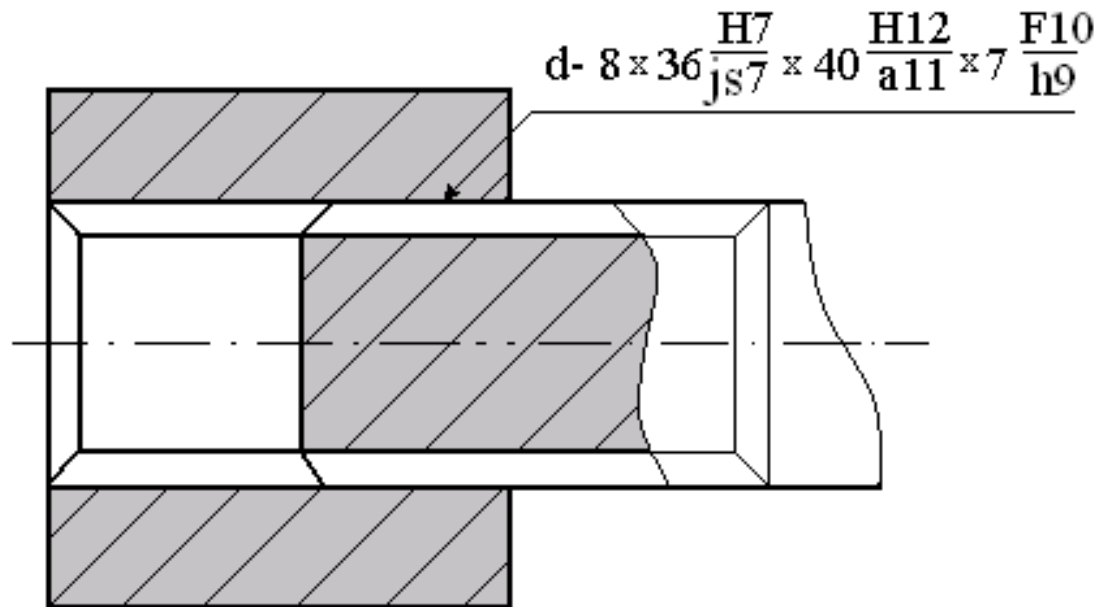
Centering by sides of the splines

Centering by (D) is used for moving and fixed joints, with small transmission torque and in other connections, which are subjected to low wear. To achieve this type of coupling, the sleeve must be manufactured with a small hardness to ensure processing by broach.

Centering by (d) is used to obtain a high precision alignment sleeve and shaft axes.

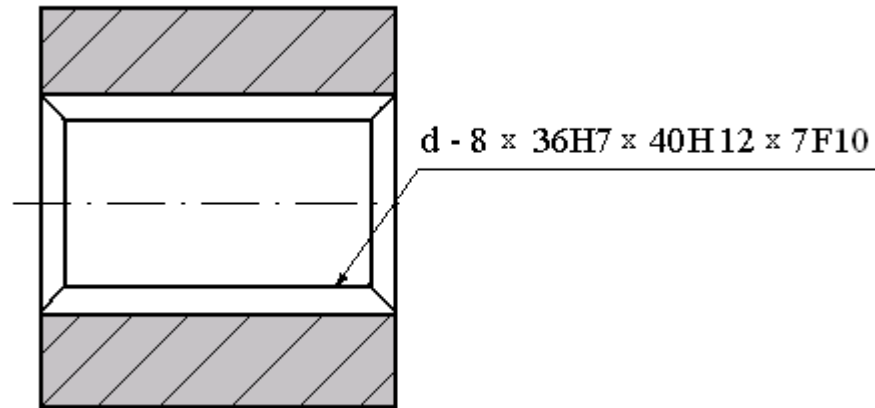
Centering by (b) is used when you need to transfer high torques, especially at alternating load, especially with reversing. This method does not ensure the highest accuracy of coincidence of the axes of the shaft and the sleeve, and therefore it is used much less frequently than the other two.

Designation of splined joints in the assemble drawings

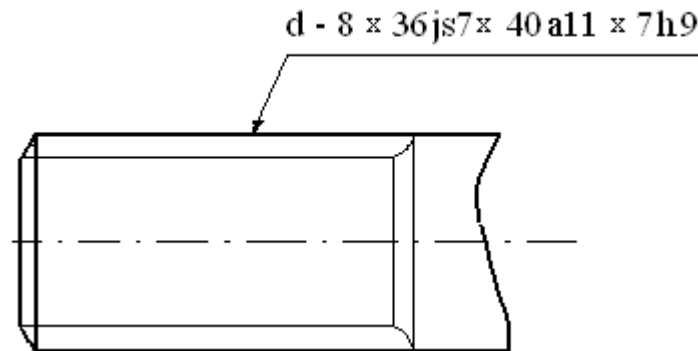


Designation of straight-sided splined joints in the assemble drawings

Designation of splined joints in the work drawings



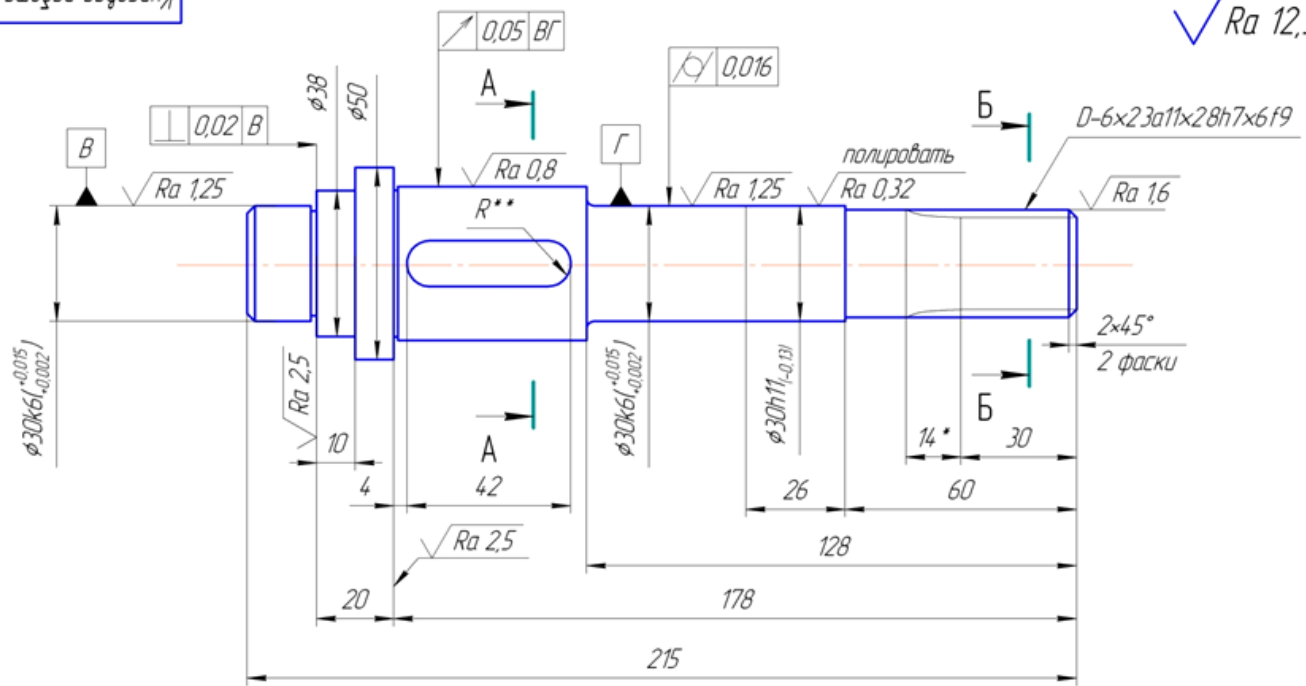
Designation of straight-sided spline in the sleeve



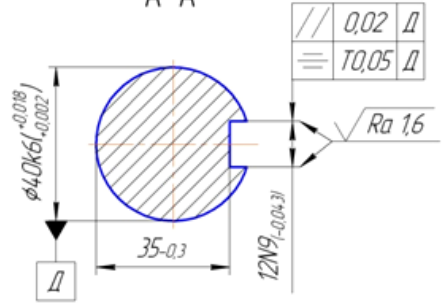
Designation of straight-sided spline in the shaft

Курсовая работа по МсиС

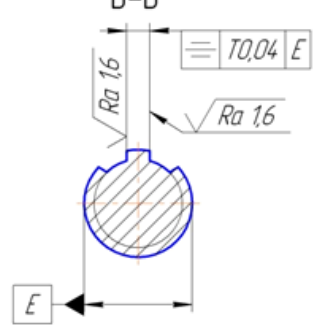
$\sqrt{Ra\ 12,5}$ (\checkmark)



A-A



Б-Б



1. H14, h14, ±T14/2
2. *Размер для справок
3. **Размер обеспечивается инструментом

Курсовая работа по МсиС				Лист	Масса	Масштаб
Вал						1:1
				Лист	Листов	1
Сталь 40Х ГОСТ 4543-71						
Копировал				Формат А3		

Лист №...
Спецификация №...
Лист №...
Лист №...
Лист №...
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Thank you for attention