Calculation of shaped couplings of shafts with hubs

i Calculation: A = OK; B = OK; C = OK; D = OK

ii ☐ Project information

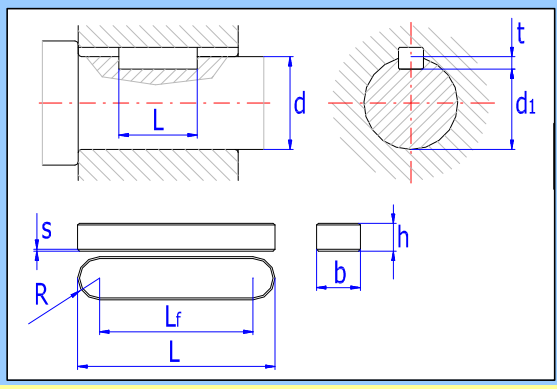
1.0 ☐ Common input data

A Parallel side keys

2.0 ☑ Coupling parameters, key material, dimensional design

2.1	**Coupling parameters**			2.6	**Key material (min. tensile strength) [hardness]**		
2.2	Key type		A ... ANSI B17.1	2.7	B...Carbon steel (72) [HB 220-270]		☑
2.3	Number of keys		1	2.8	Ultimate tensile strength	S_{Umin} 72	[ksi]
2.4	Load distribution factor	K_L	1,00	2.9	Permissible pressure	p_A 19	[ksi]
2.5	Total service factor	K_S	2,00 ☑	2.10	Permitted stress in shear	τ_A 30	[ksi]

2.11	**Design of coupling dimensions**				
2.12	Keys for diameters		0,3125 ~ 11		[in]
2.13	Min. shaft diameter	d_{1min}	0,714		[in]
2.14	Shaft diameter	d	1,375		[in]
2.15	Key		5/16 x 5/16 ☑		
2.16	Key width / height	b / h	0,3125	0,3125	[in]
2.17	Key radius / chamfer	R / s	0,15625	0,01	[in]
2.18	Parameters of the key groove	t / d_1	0,17	1,205	[in]
2.19	Min. functional key length	L_{fmin}	1,242		[in]
2.20	Minimum key length	L_{min}	1,555		[in]
2.21	Permitted range of key lengths		0,375 ~ 3		[in]
2.22	Chosen key length	L	1,750		[in] ☑



3.0 ☑ Strength checks of the coupling

3.1	**Check of shaft for torsion**			3.5	**Check of shaft key groove for deformation**		
3.2	Permitted stress in shear	τ_A	30 [ksi]	3.6	Permissible pressure	p_A 19	[ksi]
3.3	Comparative stress	τ	3,7 [ksi]	3.7	Comparative pressure	p 9,7	[ksi]
3.4	Safety		8,18	3.8	Safety	1,97	
3.9	**Check of key for deformation**			3.13	**Check of hub key groove for deformation**		
3.10	Permissible pressure	p_A	19 [ksi]	3.14	Permissible pressure	p_A 20	[ksi]
3.11	Comparative pressure	p	9,7 [ksi]	3.15	Comparative pressure	p 7,5	[ksi]
3.12	Safety		1,97	3.16	Safety	2,67	

B Woodruff's keys

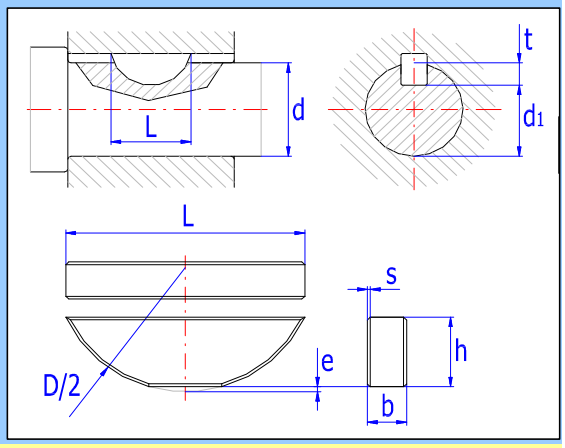
4.0 ☑ Coupling parameters, key material, dimensional design

4.1	**Coupling parameters**			4.6	**Key material (min. tensile strength) [hardness]**		
4.2	Key type		A ... ANSI B17.2 A - Full radius type	4.7	B...Carbon steel (72) [HB 220-270]		☑
4.3	Number of keys		1	4.8	Ultimate tensile strength	S_{Umin} 72	[ksi]
4.4	Load distribution factor	K_L	1,00	4.9	Permissible pressure	p_A 19	[ksi]
4.5	Total service factor	K_S	2,00 ☑	4.10	Permitted stress in shear	τ_A 30	[ksi]

4.11	**Automatic design of the coupling**				
4.12	Assort design results according to		Shaft diameter		
4.13	Start of design				

4.14	ID.	d	d_1	L	s_T	s_p	Key
	1.	1.06	0.72	1.72	1.77	2.03	1217 (3/8 x 2 1/8)

4.15	**Coupling dimensions**				
4.16	Keys for diameters		0,25 ~ 3,25		[in]
4.17	Min. shaft diameter	d_{1min}	0,714		[in]
4.18	Shaft diameter	d	1,063		[in]
4.19	Key		1217 (3/8 x 2 1/8)		
4.20	Key width / height	b / h	0,375	0,531	[in]
4.21	Key diameter / length	D / L	2,125	1,723	[in]
4.22	Parameters of the key groove	t / d_1	0,3385	0,724	[in]
4.23	Key chamfer	e / s	0	0,01	[in]



5.0 ☑ Strength checks of the coupling

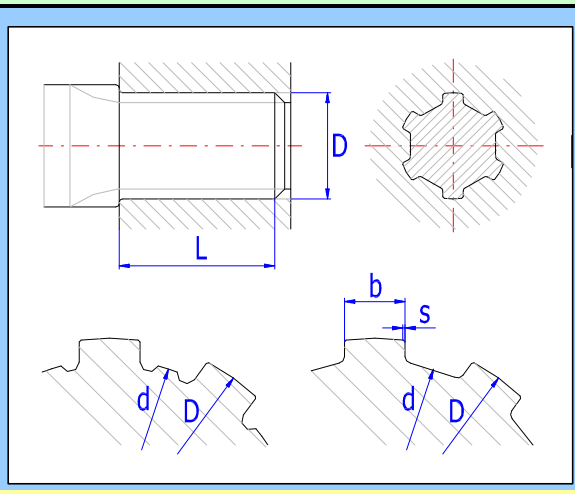
5.1	**Check of shaft for torsion**			5.5	**Check of shaft key groove for deformation**		
5.2	Permitted stress in shear	τ_A	30 [ksi]	5.6	Permissible pressure	p_A 19	[ksi]
5.3	Comparative stress	τ	16,9 [ksi]	5.7	Comparative pressure	p 9,4	[ksi]
5.4	Safety		1,77	5.8	Safety	2,03	

5.9	**Check of key for deformation**				5.13	**Check of hub key groove for deformation**			
5.10	Permissible pressure	p_A	19	[ksi]	5.14	Permissible pressure	p_A	20	[ksi]
5.11	Comparative pressure	p	9,4	[ksi]	5.15	Comparative pressure	p	5,4	[ksi]
5.12	Safety		2,03		5.16	Safety		3,74	

C Straight-sided splines

6.0 ☑ Coupling parameters, dimensional design

6.1	**Coupling parameters**			
6.2	Splines type		A ... SAE - Series A	
6.3	Load distribution factor	K_L	0,75	
6.4	Total service factor	K_S	2,00	☑
6.5	**Design of coupling dimensions**			
6.6	Splines for diameters		0,75 ~ 6	[in]
6.7	Min. shaft diameter	d_{min}	0,714	[in]
6.8	Spline		1.000 - 1 x 4	
6.9	Spline outer diameter	D	1	[in]
6.10	Spline inner diameter	d	0,85	[in]
6.11	Number of grooves	n	4	
6.12	Tooth width	b	0,241	[in]
6.13	Chamfer (radius)	s	0,005	[in]
6.14	Min. functional spline length	L_{min}	1,251	[in]
6.15	Chosen spline length	L	1,375	[in] ☑



7.0 ☑ Strength checks of the coupling

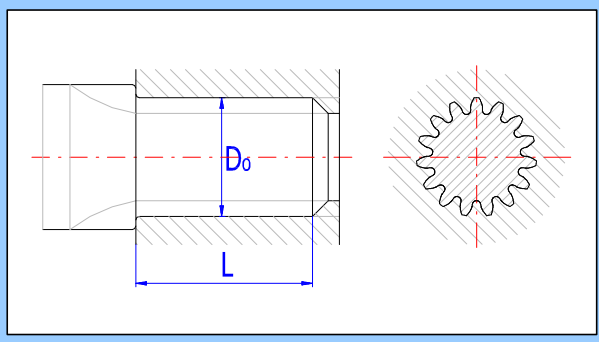
7.1	**Check of shaft for torsion**				7.5	**Check of deformation of grooving sides**			
7.2	Permitted stress in shear	τ_A	30	[ksi]	7.6	Permissible pressure	p_A	19	[ksi]
7.3	Comparative stress	τ	10,5	[ksi]	7.7	Comparative pressure	p	10,2	[ksi]
7.4	Safety		2,87		7.8	Safety		1,87	

D Involute splines

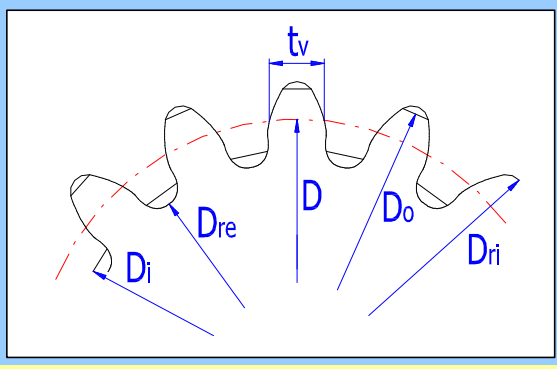
8.0 ☑ Coupling parameters, dimensional design

8.1	**Coupling parameters**			
8.2	Splines		C ... ANSI B92.1 - 30°, Fillet root, Side fit	
8.3	Load distribution factor	K_L	0,75	
8.4	Total service factor	K_S	2,00	☑
8.5	**Automatic design of the coupling**			
8.6	Filter for spline design		Complete series	
8.7	Assort design results according to		Outer diameter	
8.8	☐ Hub maximum length	L_{max}	1,181	[in]
8.9	Start of design			

8.10	ID.	m/P	n	D_o	D_{re}	L_{min}	L	s_T	s_p
	1.	48.0	37	0.79	0.73	0.51	0.56	1.81	1.89



8.11	**Coupling dimensions**				
8.12	Min. shaft diameter	D_{remin}	0,714		[in]
8.13	Spline		0.792 - 48 x 37		
8.14	Pitch / Number of teeth	P / n	48	37	[1/in]
8.15	Pitch / base diameter	D / D_b	0,771	0,668	[in]
8.16	Reference diameter / shift	Dd / xm			[in]
8.17	Diameters of external spline	D_o / D_{re}	0,792	0,729	[in]
8.18	Diameters of internal spline	D_i / D_{ri}	0,75	0,808	[in]
8.19	Tooth thickness / groove width	t_v / s_v	0,033	0,033	[in]
8.20	Circular pitch / form clearance	p / c_f	0,065	0,002	[in]
8.21	Min. functional spline length	L_{min}	0,507		[in]
8.22	Chosen spline length	L	0,563		[in] ☐



9.0 ☑ Strength checks of the coupling

9.1	**Check of shaft for torsion**				9.5	**Check of deformation of grooving sides**			
9.2	Permitted stress in shear	τ_A	30	[ksi]	9.6	Permissible pressure	p_A	19	[ksi]
9.3	Comparative stress	τ	16,6	[ksi]	9.7	Comparative pressure	p	10,1	[ksi]
9.4	Safety		1,81		9.8	Safety		1,89	

Additions section

10.0 ☑ Comparative table

10.1	**Parallel side keys**				10.6	**Woodruff's keys**			
10.2	5/16 x 5/16 ANSI B17.1				10.7	1217 (3/8 x 2 1/8) ANSI B17.2 A			
10.3	Shaft diameter	d	1,375	[in]	10.8	Shaft diameter	d	1,063	[in]
10.4	Key length	L	1,75	[in]	10.9	Key length	L	1,723	[in]
10.5	Safety		1,97		10.10	Safety		1,77	
10.11	**Straight-sided splines**				10.17	**Involute splines**			
10.12	1 x 4 SAE - Series A				10.18	48 x 37 ANSI B92.1 - 30°, Fillet root, Side fit			
10.13	Spline outer diameter	D	1	[in]	10.19	Spline outer diameter	D_o	0,792	[in]
10.14	Spline inner diameter	d	0,85	[in]	10.20	Spline inner diameter	D_{re}	0,729	[in]
10.15	Spline length	L	1,375	[in]	10.21	Spline length	L	0,5626	[in]
10.16	Safety		1,87		10.22	Safety		1,81	

11.0 ☑ **Graphical output, CAD systems**

11.1	2D drawing output to:	DXF File
12.2	2D Drawing scale	Automatic