PŘÍLOHA č. 1

Návrh klínového řemene – výstup z programu Desig Flex Pro

Návrh řemenového převodu - Detaily pohonu

Design Flex

Navrženo pro:

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Aplikace: **Konstrukce #1**

VSTUP

Známý řemen: **Predator PB**

Poměr otáček:	2,74 Do pomala
Výkon motoru:	1346 kW, Účinnost: 92,00 %
Provozní faktor:	1,2
Konstr. výkon:	1615,2 kW
Středová vzdálenost:	1215 až 1485 mm
Stand. motoru:	Elektrický motor

	Hnací	Hnaný
Známá velikost:	660 mm Vnější	1800 mm Vnější
Otáčky za minutu:	740,0	270,0
Maximální obvodová rychlost:	33 m / s	33 m / s

Kontrolovaná pouzdra: Taper-Lock, Bez provedení s min dírou
Kontrolované řemeny: Predator PB
Jednotlivé řemeny, Pásma,

ZVOLENÝ POHON

Typ řemene: **Predator PB - 8VP**

		Řemen	Hnací	Hnaný
	Počet drážek / žeber:	12		
Poměr otáček: **2,74 Do pomala**	Díl č.:	1-8VP2650/12	**660 mm Vnější**	**1800 mm Vnější**
Rychlost hnaná: **270,0**	Produkt č.:	9182-12265	Neskladová položka	Neskladová položka
Nominální výkon: **1493,81 kW**	Roztečný průměr:	--	654,9 mm	1794,9 mm
Na hřídel: **95023 N**	Otáčky za minutu:	226,2	740,0	270,0
Středová vzdálenost: **1307,0 mm**	Obv. rychl. m/s:	25,4 m / s	25,6 m / s	25,4 m / s
Instalační tolerance: 1217,0 mm až 1402,0 mm	Horní šířka:	--	--	--
	Pouzdro položka č.:	--	**--**	**--**
	Díra:	--	--	--
	Kroutící moment u Bushing	--	17369 Nm	47604 Nm
	Hmotnost:	50 kg	--	--

NAPĚTÍ

	Nový řemen	Použitý řemen
Statické napětí (na drážku/žebro):	5834 až 6251 N	5001 až 5417 N
Statický Belt Pull (Celková síla):	126004 až 135004 N	108003 až 117004 N
Průhyb na drážku/žebro:	18,00 mm	18,00 mm
Síla v průhybu na drážku/žebro:	40 až 43 kgf	35 až 38 kgf
Sonic - měřič napětí:	70010 až 75011 N	60009 až 65009 N
Frekvence řemene:	45 až 46 Hz	41 až 43 Hz

Nastavení Sonicu:
Hmota 527,85g / m,Šířka: 12 mm/#R, Rozpětí: 1176 mm

POZNÁMKY

- Osová vzdálenost je příliš malá. Řemenice mohou během instalace kolidovat.
- Vstupní zatížení přesahuje jmenovitou zátěžovou kapacitu pohonu a může mýt za následek kratší životnost pohonu.
- Hmotnost řemenu/ů překračuje 20 kg. Během instalace buďte opatrní.
- Výkonové možýnosti řemenů Predator mohou přesáhnout dovolené kroutící kapacitu kladky. Mohou být zapotřebí kladky, vyrobené na zakázku.
- Hnací řemenice je předmětem zvláštní objednávky. Průměr a pouzdro nejsou známy.
- Hnaná řemenice je předmětem zvláštní objednávky. Průměr řemenice a pouzdro nejsou známy.

PŘÍLOHA č. 2

Návrh ozubeného převodu – výstup z programu Kissoft

Calculation of a helical-toothed cylindrical gear pair

Drawing or article number:
Gear 1: 0.000.0
Gear 2: 0.000.0

Application factor, KA:
2.25
S-N curve (Woehler line) in the long life domain according: according to standard
Notice:
Calculation-method according to:
- ISO 6336-6 / DIN3990-6
During the calculation all the load factors (ISO 6336/DIN 3990: Kv, KHβ, KFβ; AGMA 2001: Kv, Km, ..) for each load spectrum bin are calculated separately.

Results

Calculation for load spectra:

Root safety	2.166	2.054
Flank safety	1.433	1.358
Safety against scuffing (integral temperature)	2.538	
Safety against scuffing (flash temperature)	1.701	

Only as information: Calculation with reference power

Calculation method: ISO 6336:2019

		Gear 1	Gear 2
Power (kW)	[P]	7517.000	
Speed (1/min)	[n]	750.0	275.7
Torque (Nm)	[T]	95709.4	260329.6
Application factor	[KA]	2.25	
Required service life (h)	[H]	10000000.00	
Gear driving (+) / driven (-)		+	-
Gear 1 direction of rotation:		Clockwise	

Tooth geometry and material

Center distance (mm)	[a]	1237.107	
Normal module (mm)	[mn]	25.0000	
Normal pressure angle (°)	[αn]	20.0000	
Helix angle at reference circle (°)	[β]	20.0000	
Number of teeth	[z]	25	68
Double helical gearing		left/right	right/left
Total facewidth of Gear (mm)	[B]	325.00	325.00
Surface hardness		HRC 61	HRC 61
Fatigue strength. tooth root stress (N/mm²)	[σFlim]	430.00	430.00
Fatigue strength for Hertzian pressure (N/mm²)	[σHlim]	1500.00	1500.00

Gear reference profile
1:

Reference profile	1.25 / 0.38 / 1.0 ISO 53:1998 Profil A	
Dedendum coefficient	[hfP*]	1.250
Root radius factor	[ρfP*]	0.380 (ρfPmax*=0.472)
Addendum coefficient	[haP*]	1.000

Tip radius factor	[ρaP*]	0.000
Protuberance height coefficient	[hprP*]	0.000
Protuberance angle	[αprP]	0.000
Tip form height coefficient	[hFaP*]	0.000
Ramp angle	[αKP]	0.000
	not topping	

Gear reference profile 2:

Reference profile	1.25 / 0.38 / 1.0 ISO 53:1998 Profil A	
Dedendum coefficient	[hfP*]	1.250
Root radius factor	[ρfP*]	0.380 (ρfPmax*=0.472)
Addendum coefficient	[haP*]	1.000
Tip radius factor	[ρaP*]	0.000
Protuberance height coefficient	[hprP*]	0.000
Protuberance angle	[αprP]	0.000
Tip form height coefficient	[hFaP*]	0.000
Ramp angle	[αKP]	0.000
	not topping	

Lubrication type	Grease lubrication	
Base oil nominal kinematic viscosity at 40°C (mm²/s)	[v40]	120.00
Overall transmission ratio	[itot]	-2.720
Transverse contact ratio	[εα]	1.563
Overlap ratio	[εβ]	0.708
Total contact ratio	[εγ]	2.270
Profile shift coefficient	[x]	0.0000
Tooth thickness, arc, in module	[sn*]	1.5708
Reference diameter (mm)	[d]	665.111
Base diameter (mm)	[db]	620.213
Tip diameter (mm)	[da]	715.111
Root diameter (mm)	[df]	602.611
Profile shift coefficient	[x]	0.0000
Tooth thickness, arc, in module	[sn*]	1.5708
Reference diameter (mm)	[d]	1809.102
Base diameter (mm)	[db]	1686.979
Tip diameter (mm)	[da]	1859.102
Root diameter (mm)	[df]	1746.602
Operating pitch diameter (mm)	[dw]	665.111
Specific sliding at the tip	[ζa]	0.445
Specific sliding at the root	[ζf]	-1.556
Operating pitch diameter (mm)	[dw]	1809.102
Specific sliding at the tip	[ζa]	0.609
Specific sliding at the root	[ζf]	-0.801

General influence factors

Nominal circum. force at pitch circle (N)	[Ft]	287799.8
Circumferential speed reference circle (m/s)	[v]	26.12
Meshing stiffness (N/mm/µm)	[cγα]	18.724
Load in accordance with Figure 13, ISO 6336-1:2006 0:a), 1:b), 2:c), 3:d), 4:e)	[-]	4
Without stiffening		
Tooth trace deviation (active) (µm)	[Fβy]	12.70
Tooth without tooth trace modification		
Position of contact pattern:	favorable	
Dynamic factor	[Kv]	1.500
Face load factor - flank	[KHβ]	1.034
- Tooth root	[KFβ]	1.023
- Scuffing	[KBβ]	1.034
Transverse load factor - flank	[KHα]	1.000
- Tooth root	[KFα]	1.000
- Scuffing	[KBα]	1.000

Tooth root load capacity

Calculation of Tooth form coefficients according method: B			
Tooth form factor	[YF]	1.11	1.01
Stress correction factor	[YS]	1.96	2.16
Helix angle factor	[Yβ]	1.063	
Tooth root stress (N/mm²)	[σF]	282.40	283.91
Notch sensitivity factor	[YdrelT]	0.994	0.998
Surface factor	[YRrelT]	0.957	0.957
Size factor, tooth root	[YX]	0.800	0.800
Finite life factor	[YNT]	0.850	0.850
Alternating bending factor, mean stress influence coefficient			
	[YM]	1.000	1.000
Limit strength tooth root (N/mm²)	[σFG]	555.89	558.41

Flank safety

Zone factor	[ZH]	2.371	
Elasticity factor (√N/mm²)	[ZE]	189.812	
Contact ratio factor	[Zε]	0.831	
Helix angle factor	[Zβ]	1.032	
Contact stress at operating pitch circle (N/mm²)	[σHw]	972.43	
Contact stress (N/mm²)	[σHB, σHD]	1056.16	1028.80
Lubrication factor for NL	[ZL]	0.977	0.977
Speed factor for NL	[ZV]	1.028	1.028
Roughness factor for NL	[ZR]	1.021	1.021
Material hardening factor for NL	[ZW]	1.000	1.000
Finite life factor	[ZNT]	0.850	0.850
Size factor (flank)	[ZX]	1.000	1.000
Pitting stress limit (N/mm²)	[σHG]	1307.45	1307.45

Micropitting according to **ISO/TS 6336-22:2018**

Calculation has not been carried out, lubricant: Load stage micropitting test not known

Scuffing load capacity

Calculation method according to	ISO/TS 6336-20/21:2017	
Helical load factor for scuffing	[KBγ]	1.172
Applicable circumferential force/facewidth (N/mm)	[wBt]	3089.767
Flash temperature-criteria		
Tooth mass temperature (°C)	[θMi]	96.44
Scuffing temperature (°C)	[θS]	301.13
Integral temperature-criteria		
Tooth mass temperature (°C)	[θMC]	89.01
Integral scuffing temperature (°C)	[θSint]	312.10
Integral tooth flank temperature (°C)	[θint]	122.97

Measurements for tooth thickness

Tooth thickness tolerance		DIN 3967 cd25	DIN 3967 cd25	
Tooth thickness allowance (normal section) (mm)	[As.e/i]	-0.175 /	-0.255-0.320 /	-0.450
Base tangent length (no backlash) (mm)	[Wk]	268.762	655.752	
Base tangent length with allowance (mm)	[Wk.e/i]	268.597 /	268.522655.452 /	655.330
(mm)	[ΔWk.e/i]	-0.164 /	-0.240 -0.301 /	-0.423
> Gear 2 base tangent length cannot be measured (gear too thin).				
Effective diameter of ball/pin (mm)	[DMeff]	45.000	45.000	
Diametral measurement over two balls without clearance (mm)	[MdK]	730.314	1876.862	
Diametral two ball measure (mm)	[MdK.e/i]	729.910 /	729.7251876.047 /	1875.715
Diametral measurement over pins without clearance (mm)	[MdR]	731.669	1876.862	
Measurement over pins according to DIN 3960 (mm)	[MdR.e/i]	731.264 /	731.0791876.047 /	1875.715
Measurement over 2 pins, free, according to AGMA 2002 (mm)	[dk2f.e/i]	729.689 /729.504	0.000 /	0.000
Measurement over 2 pins, transverse, according to AGMA 2002 (mm)				
	[dk2t.e/i]	732.587 /	732.401	0.000 / 0.000
Measurement over 3 pins, axial, according to AGMA 2002 (mm)				
	[dk3A.e/i]	731.264 /	731.0791876.047 /	1875.715
Circumferential backlash (transverse section) (mm)	[jtw.e/i]	0.791 /	0.486	
Normal backlash (mm)	[jn.e/i]	0.698 /	0.429	
Total torsional angle (°)	[j.tSys]	0.1363/	0.0837	

Service life, damage

Calculation with load spectrum			
Required safety for tooth flank	[SHmin]		1.00
System service life (h)	[Hatt]		> 1000000
Tooth root service life (h)	[HFatt]	1e+06	1e+06
Tooth flank service life (h)	[HHatt]	1e+06	1e+06

End of Report lines: 226

PŘÍLOHA č. 3

Návrh předlohové hřídele motoru – výstup z programu Kissoft

Analysis of shafts, axle and beams

Input data

Coordinate system shaft:	see picture W-002			
Label	Shaft 1			
Drawing				
Initial position (mm)		0.000		
Length (mm)		1300.000		
Speed (1/min)		750.00		
Direction of rotation:	clockwise			
Material	C45			
Young's modulus (N/mm²)		206000.000		
Poisson's ratio nu		0.300		
Density (kg/m³)		7830.000		
Coefficient of thermal expansion	(10^-6/K)	11.500		
Temperature (°C)		20.000		
Temperature for load spectrum				
No. Temperature (°C)				
1 20.000				
2 20.000				
Weight of shaft (kg)		798.150		
Note: the weight is only for the shaft. The gears are not considered.				
Weight of shaft, including additional masses (kg)		3128.042		
Mass moment of inertia (kg*m²)		399.538		
Momentum of mass GD2 (Nm²)		15677.890		
Weight towards		0.000		
Weight towards			0.000	
Weight towards				-1.000
Gears mounted with stiffness according to ISO				
Consider deformations due to shearing				
Shear correction factor		1.100		
Rolling bearing stiffness is calculated from inner bearing geometry				
Tolerance field:	Mean value			

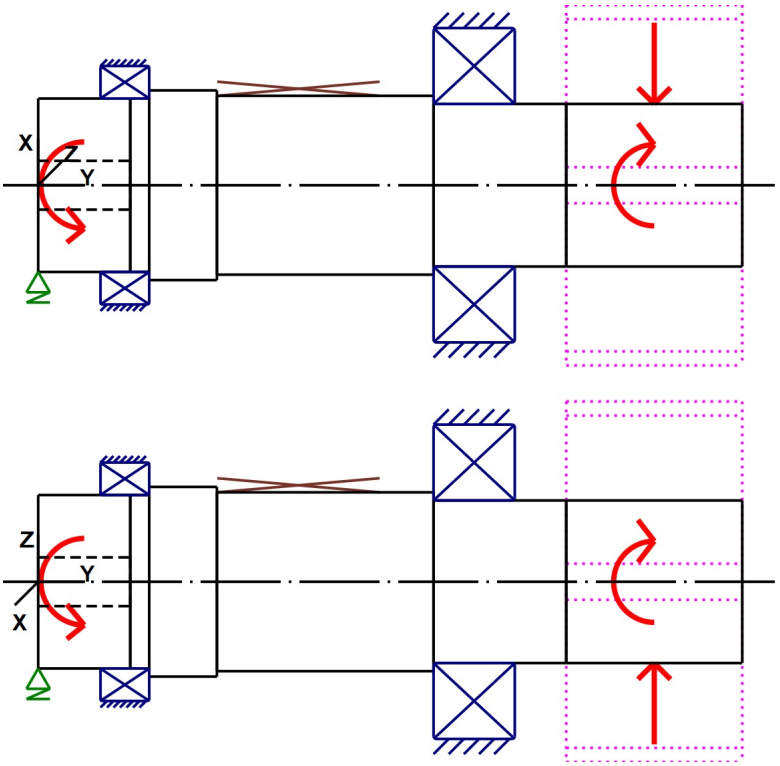


Figure: Load applications

Shaft definition **(Shaft 1)**

Outer contour

Cylinder (Cylinder)		**0.000 mm ... 205.000 mm**
Diameter (mm)	[d]	320.0000
Length (mm)	[l]	205.0000
Surface roughness (µm)	[Rz]	1.1000

Relief groove right (Relief groove right)
r=1.20 (mm), t=0.40 (mm), l=4.00 (mm), Rz=8.0, Machined (Ra=3.2µm/125µin)
Form F (DIN 509), Series 1, with the usual stressing

Cylinder (Cylinder)		**205.000 mm ... 330.000 mm**
Diameter (mm)	[d]	350.0000
Length (mm)	[l]	125.0000
Surface roughness (µm)	[Rz]	8.0000

Cylinder (Cylinder)		**330.000 mm ... 730.000 mm**
Diameter (mm)	[d]	330.0000
Length (mm)	[l]	400.0000
Surface roughness (µm)	[Rz]	1.1000

Relief groove left (Relief groove left)
r=1.20 (mm), t=0.40 (mm), l=4.00 (mm), Rz=8.0, Machined (Ra=3.2µm/125µin)
Form F (DIN 509), Series 1, with the usual stressing

Cylinder (Cylinder)		**730.000 mm ...1300.000 mm**
Diameter (mm)	[d]	300.0000
Length (mm)	[l]	570.0000
Surface roughness (µm)	[Rz]	1.1000

Relief groove left (Relief groove left)
r=1.20 (mm), t=0.40 (mm), l=4.00 (mm), Rz=8.0, Machined (Ra=3.2µm/125µin)
Form F (DIN 509), Series 1, with the usual stressing

Inner contour

Cylindrical bore (Cylindrical bore)		**0.000 mm ...**	**170.000 mm**
Diameter (mm)	[d]		90.0000
Length (mm)	[l]		170.0000
Surface roughness (µm)	[Rz]		8.0000

Forces

Type of force element		**Additional mass**
Label in the model		Additional mass
Position on shaft (mm)	[y_{local}]	480.5000
Length of load application (mm)		300.0000
Mass (kg)		1625.6250
Mass moment of inertia Jp (kg*m²)		377.7340
Mass moment of inertia Jxx (kg*m²)		0.0000
Mass moment of inertia Jzz (kg*m²)		0.0000
Eccentricity (mm)		0.0000

Type of force element		**Coupling**
Label in the model		Coupling
Position on shaft (mm)	[y_{local}]	85.0000
Effective diameter (mm)		90.0000
Radial force factor (-)		0.0000
Direction of the radial force (°)		0.0000
Axial force factor (-)		0.0000
Length of load application (mm)		170.0000
Power (kW)		7517.0000
Torque (Nm)		95709.4166
Axial force (load spectrum) (N)		0.0000 /0.0000
Shearing force X (load spectrum) (N)		0.0000 /0.0000
Shearing force Z (Load spectrum) (N)		0.0000 /0.0000
Mass (kg)		0.0000
Mass moment of inertia Jp (kg*m²)		0.0000
Mass moment of inertia Jxx (kg*m²)		0.0000
Mass moment of inertia Jzz (kg*m²)		0.0000
Eccentricity (mm)		0.0000

Load spectrum, driven (input)

No.	Frequency (%)	Speed (1/min)	Power (kW)	Torque (Nm)
1	0.7	750.000	7517.000	95709.417
2	99.3	750.000	160.112	2038.611

Type of force element		**Cylindrical gear**
Label in the model		Cylindrical gear
Position on shaft (mm)	[y_{local}]	1137.5000
Operating pitch diameter (mm)		665.1111
Helix angle (°)		20.0000 Double helical gearing, left-right
Working pressure angle at normal section (°)		20.0000
Position of contact (°)		0.0000
Length of load application (mm)		325.0000
Power (kW)		7517.0000
Torque (Nm)		-95709.4166
Axial force (load spectrum) (N)		0.0000 /0.0000
Shearing force X (load spectrum) (N)		-111473.2122 / -2372.7170
Shearing force Z (Load spectrum) (N)		287799.7839 /6125.8435
Bending moment X (Load spectrum) (Nm)		0.0000 /0.0000
Bending moment Z (Load spectrum) (Nm)		0.0000 /0.0000

Load spectrum, driving (output)

No.	Frequency (%)	Speed (1/min)	Power (kW)	Torque (Nm)
1	0.7	750.000	-7517.000	-95709.417
2	99.3	750.000	-160.000	-2037.183

Bearing

Label in the model Rolling bearing1

Bearing type		Spherical roller bearings SKF Explorer
Bearing position (mm)	[y_{lokal}]	160.000
Attachment of external ring		Fixed bearing
Number of rolling bodies	[Z]	36
Diameter, external race (mm)	[d_o]	412.655
Diameter, internal race (mm)	[d_i]	356.752
Radius of curvature, external race (mm)		[r_o] 207.629
Radius of curvature, internal race (mm)		[r_i] 207.629
Calculation with approximate bearings internal geometry (*)		
Bearing clearance		ISO 5753-1:2009 C0 (255.00 µm)
Basic static load rating (kN)	[C_0]	2700.000
Basic dynamic load rating (kN)	[C]	1480.000
Fatigue load limit (kN)	[C_u]	212.000

Label in the model		Plain journal bearings
Bearing type		Plain journal bearings
Bearing position (mm)	[y_{lokal}]	0.000

Label in the model		Rolling bearing2
Bearing type		Spherical roller bearings SKF Explorer
Bearing position (mm)	[y_{lokal}]	805.000
Attachment of external ring		Free bearing
Number of rolling bodies	[Z]	18
Diameter, external race (mm)	[d_o]	525.636
Diameter, internal race (mm)	[d_i]	387.451
Radius of curvature, external race (mm)		[r_o] 266.725
Radius of curvature, internal race (mm)		[r_i] 266.725
Calculation with approximate bearings internal geometry (*)		
Bearing clearance		ISO 5753-1:2009 C0 (235.00 µm)
Basic static load rating (kN)	[C_0]	4900.000
Basic dynamic load rating (kN)	[C]	3708.000
Fatigue load limit (kN)	[C_u]	375.000

Shaft 'Shaft 1': Cylindrical gear 'Cylindrical gear' (y= 1137.5000 (mm)) is taken into account as component of the shaft.
EI (y= 975.0000 (mm)): 81907210.9653 (Nm²), EI (y= 1300.0000 (mm)): 81907210.9653 (Nm²), m (yS= 1137.5000 (mm)):704.2670 (kg)
Jp: 11.5231 (kg*m²), Jxx: 8.2748 (kg*m²), Jzz: 8.2748 (kg*m²)

Results

Shaft

Maximum deflection (µm)	740.625
Position of the maximum (mm)	1300.000
Mass center of gravity (mm)	626.309
Total axial load (N)	0.000
Torsion under torque (°)	-0.061

Bearing

Probability of failure	[n]	10.00	%		
Axial clearance (ISO 281)	[u_A]			10.00	µm
Lubricant	Klübersynth GH 6-46 (API GL 5)				
Lubricant - service temperature	[T_B]			70.00	°C
Rolling bearing rating life according to ISO/TS 16281:2008					

Shaft 'Shaft 1' Rolling bearing 'Rolling bearing1'

Position (Y-coordinate)	[y]	160.00	mm
Dynamic equivalent load	[P]	167.29	kN

Static equivalent load	[P_0]			167.29	kN
Minimum EHL lubricant film thickness				[h_{min}]	0.210 µm

Results according to ISO 281:

Basic bearing rating life	[L_{nh}]			31825.58	h
Static safety factor	[S_0]			16.14	

Calculation with approximate bearings internal geometry

Operating bearing clearance	[Pd]			255.000	µm
Reference rating life	[L_{nrh}]			21623.43	h
Effective static safety factor	[S_{0w}]			7.05	
Static safety factor	[S_{0ref}]			11.34	
Static equivalent load	[P_{0ref}]			238.05	kN
Bearing reaction force	[Fx]	-57.465	kN		
Bearing reaction force	[Fy]	-0.000	kN		
Bearing reaction force	[Fz]	157.109	kN		
Bearing reaction force	[Fr]	167.288	kN (110.09°)		
Oil level	[H]	0.000	mm		
Rolling moment of friction	[M_{rr}]			27.215	Nm
Sliding moment of friction	[M_{sl}]			4.533	Nm
Moment of friction, seals	[M_{seal}]			0.000	Nm

Moment of friction for seals determined according to SKF main catalog 17000/1 EN:2018

Moment of friction flow losses	[M_{drag}]			0.000	Nm
Torque of friction	[M_{loss}]			31.748	Nm
Power loss	[P_{loss}]			2493.509	W

The moment of friction is calculated according to the details in SKF Catalog 2018.
The calculation is always performed with a coefficient for additives in the lubricant µbl=0.15.

Shaft 'Shaft 1' Bearing 'Plain journal bearings'

Position (Y-coordinate)	[y]	0.00	mm
Bearing reaction force	[Fx]	0.000	kN
Bearing reaction force	[Fy]	0.000	kN
Bearing reaction force	[Fz]	-0.000	kN
Bearing reaction force	[Fr]	0.000	kN

Shaft 'Shaft 1' Rolling bearing 'Rolling bearing2'

Position (Y-coordinate)	[y]	805.00	mm		
Dynamic equivalent load	[P]	451.16	kN		
Static equivalent load	[P_0]			451.16	kN
Minimum EHL lubricant film thickness				[h_{min}]	0.297 µm

Results according to ISO 281:

Basic bearing rating life	[L_{nh}]			24897.70	h
Static safety factor	[S_0]			10.86	

Calculation with approximate bearings internal geometry

Operating bearing clearance	[Pd]			235.000	µm
Reference rating life	[L_{nrh}]			41844.23	h
Effective static safety factor	[S_{0w}]			6.78	
Static safety factor	[S_{0ref}]			8.93	
Static equivalent load	[P_{0ref}]			548.94	kN
Bearing reaction force	[Fx]	168.938	kN		
Bearing reaction force	[Fy]	0.000	kN		
Bearing reaction force	[Fz]	-418.334	kN		
Bearing reaction force	[Fr]	451.158	kN (-68.01°)		
Oil level	[H]	0.000	mm		
Rolling moment of friction	[M_{rr}]			41.308	Nm
Sliding moment of friction	[M_{sl}]			11.936	Nm
Moment of friction, seals	[M_{seal}]			0.000	Nm

Moment of friction for seals determined according to SKF main catalog 17000/1 EN:2018

Moment of friction flow losses	[M_{drag}]			0.000	Nm
Torque of friction	[M_{loss}]			53.244	Nm
Power loss	[P_{loss}]			4181.755	W

The moment of friction is calculated according to the details in SKF Catalog 2018.
The calculation is always performed with a coefficient for additives in the lubricant µbl=0.15.
The factors used to calculate the torque loss have been assumed for this bearing.

(*) Note about roller bearings with an approximated bearing geometry:
The internal geometry of these bearings has not been input in the database.
The geometry is back-calculated as specified in ISO 281, from C and C0 (details in the manufacturer's catalog).

For this reason, the geometry may be different from the actual geometry.
This can lead to differences in the service life calculation and, more importantly, the roller bearing stiffness.

Damage (%) [Lreq] (20000.000)

Bin no	B1	B2
1	92.49	47.80
Σ	92.49	47.80

Utilization (%) [Lreq] (20000.000)

B1	B2
97.69	80.13

Note: Utilization = (Lreq/Lh)^(1/k)
Ball bearing: k = 3, roller bearing: k = 10/3

B1 : Rolling bearing1
B2 : Rolling bearing2

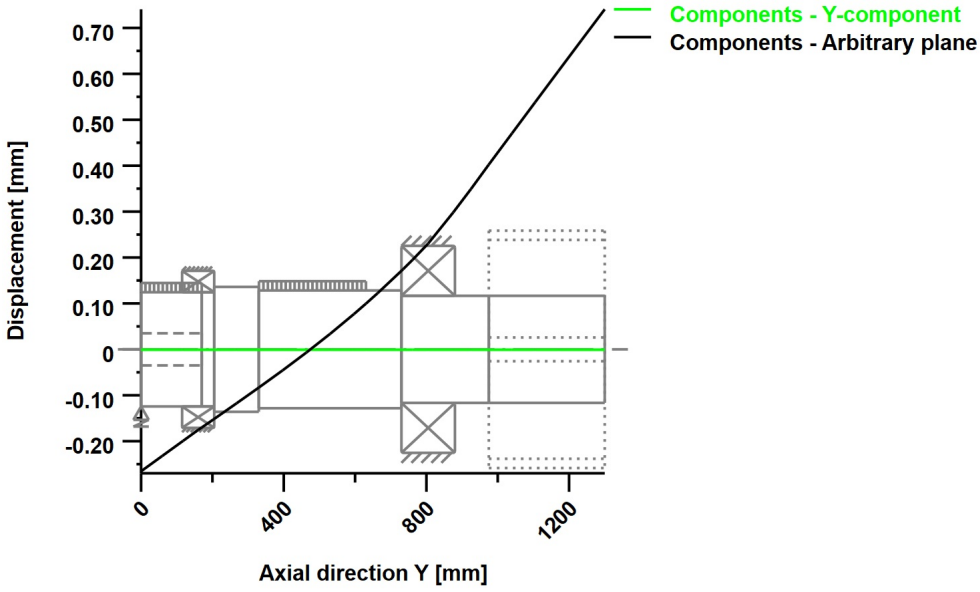
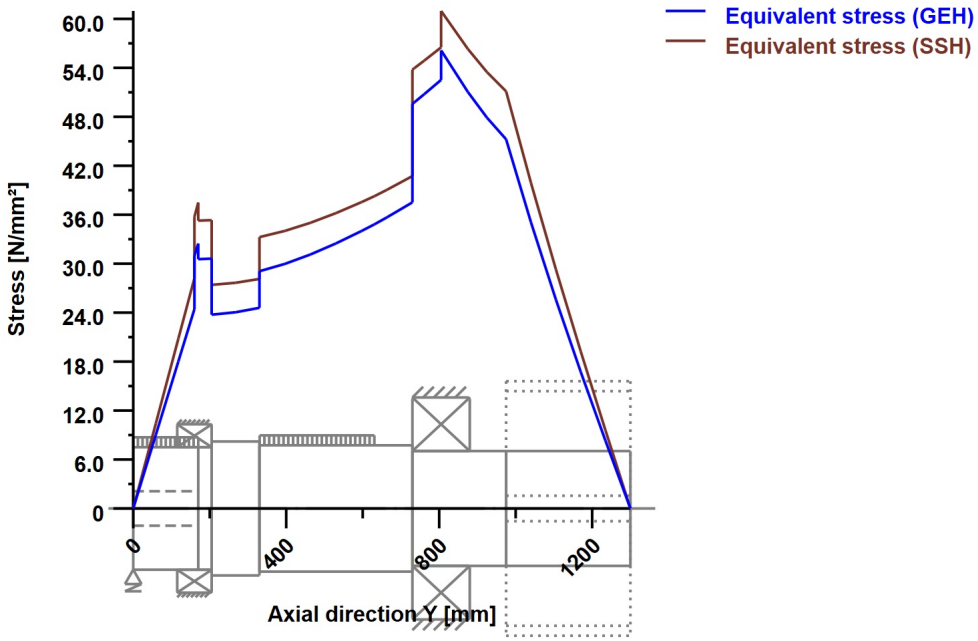


Figure: Deformation (bending etc.) (Arbitrary plane 111.3687183 124)



Nominal stresses, without taking into account stress concentrations
GEH(von Mises): sigV = ((sigB+sigZ,D)^2 + 3*(tauT+tauS)^2)^1/2
SSH(Tresca): sigV = ((sigB-sigZ,D)^2 + 4*(tauT+tauS)^2)^1/2

Figure: Equivalent stress

Strength calculation according to DIN 743:2012

Summary

Shaft 1

Material	C60
Material type	Through hardened steel
Material treatment	unalloyed, through hardened
Surface treatment	No

Calculation of endurance limit and the static strength
Stress analysis with load bins 1

The calculation has been performed with σbm > 0 and with σbm < 0. The less favorable case will be documented..

Calculation for load case 2 (σav/σmv = const)

Results:

Cross section	βσ	KFσ	K2d	SD	SS
A-A	3.44	0.91	0.80	3.03	5.38
B-B	3.49	0.91	0.80	7.34	8.96
C-C	3.21	0.91	0.80	7.55	9.46
D-D	1.00	0.91	0.80	6.45	4.73
Required safeties:				2.00	2.00

End of Report **lines: 363**

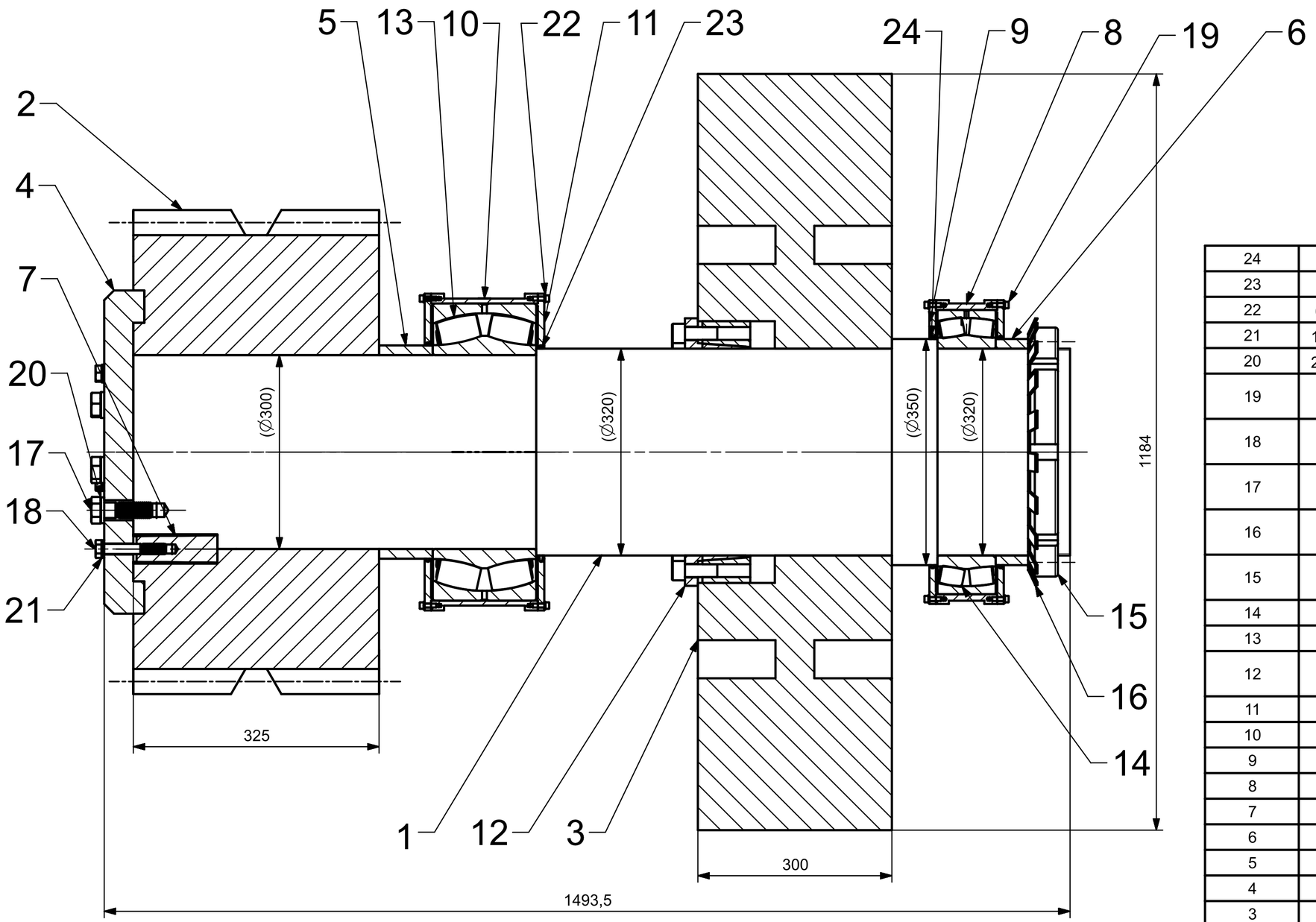
PŘÍLOHA č. 4

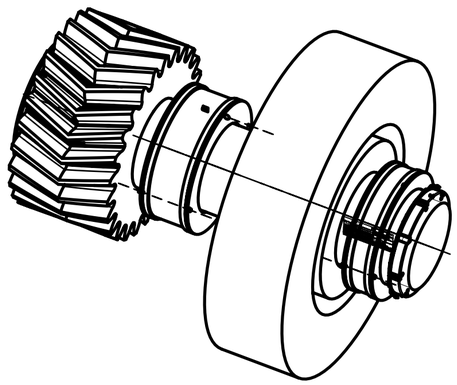
Výkresová dokumentace

Výrobní výkres předlohové hřídele motoru

Výkres sestavy předlohové hřídele motoru

(Volně vložené)





24	V_KKS_013	PRYŽ	2
23	V_KKS_012	PRYŽ	2
22	6 ČSN 02 1741.00	PRUŽNÁ PODLOŽKA M6	24
21	16 ČSN 02 1741.00	PRUŽNÁ PODLOŽKA M16	5
20	24 ČSN 02 1741.00	PRUŽNÁ PODLOŽKA M24	5
19	ČSN 02 1143.52	ŠROUB S VÁLCOVOU HLAVOU A VNITŘNÍM ŠESTIHRANEM M6x20	24
18	ČSN 02 1101.10	ŠROUB SE ŠESTIHRANOU HLAVOU M16x100	5
17	ČSN 02 1101.10	ŠROUB SE ŠESTIHRANOU HLAVOU M24x80	5
16		POJISTNÁ MB PODLOŽKA - SKF MB64	1
15		POJISTNÁ KM MATICE - SKF HM3164	1
14		LOŽISKO SKF 23964 CC/W33	1
13		LOŽISKO SKF 22264 CCK/W33	1
12		ROZPĚRNÝ KROUŽEK - RLK 133TC - 320x405	1
11	V_KKS_011	TĚSNĚNÍ VELKÉ KRAJNÍ	2
10	V_KKS_010	TĚSNĚNÍ VELKÉ STŘEDOVÉ	1
9	V_KKS_009	TĚSNĚNÍ MALÉ KRAJNÍ	2
8	V_KKS_008	TĚSNĚNÍ MALÉ STŘEDOVÉ	1
7	V_KKS_007	KOLÍK	5
6	V_KKS_006	DISTANČNÍ KROUŽEK	1
5	V_KKS_005	DISTANČNÍ KROUŽEK	1
4	V_KKS_004	PŘÍLOŽKA	1
3	V_KKS_003	SETRVAČNÍK	1
2	V_KKS_002	PASTOREK	1
1	V_KKS_001	PŘEDLOHOVÁ HŘÍDEL	1
POZICE	Číslo výkresu - normy	Název	Množství

CAD	Datum / Date	Jmeno / Name		FAKULTA STROJNI ZAPADOCESKE UNIVERZITY V PLZNI
Kreslil / Drawn by	20.05.2021	DAVID VYDRZEL		
Prekoukal / Checked by	---	---		
Schválil / Approved by	---	---		Vsechna prava vyhrazena / All rights reserved
Index zmeny	Popis zmeny / change description	Schval. / APP	Datum / Date	Podpis / Signature
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Poznamka / Note: ---

Tolerance / Tolerovani: ISO 128; ISO 8015; ISO 2768mK

Soubor-model / ASM-file: assembly_predlohova_hridel_motoru

Soubor-vykres / DRW-file: assembly_predlohova_hridel_motoru

Projekt / Project: ---

Cvestavy / Assembly No.: ---

C.hmot.sestavy: 0,00

Meritko / Scale: 1:10

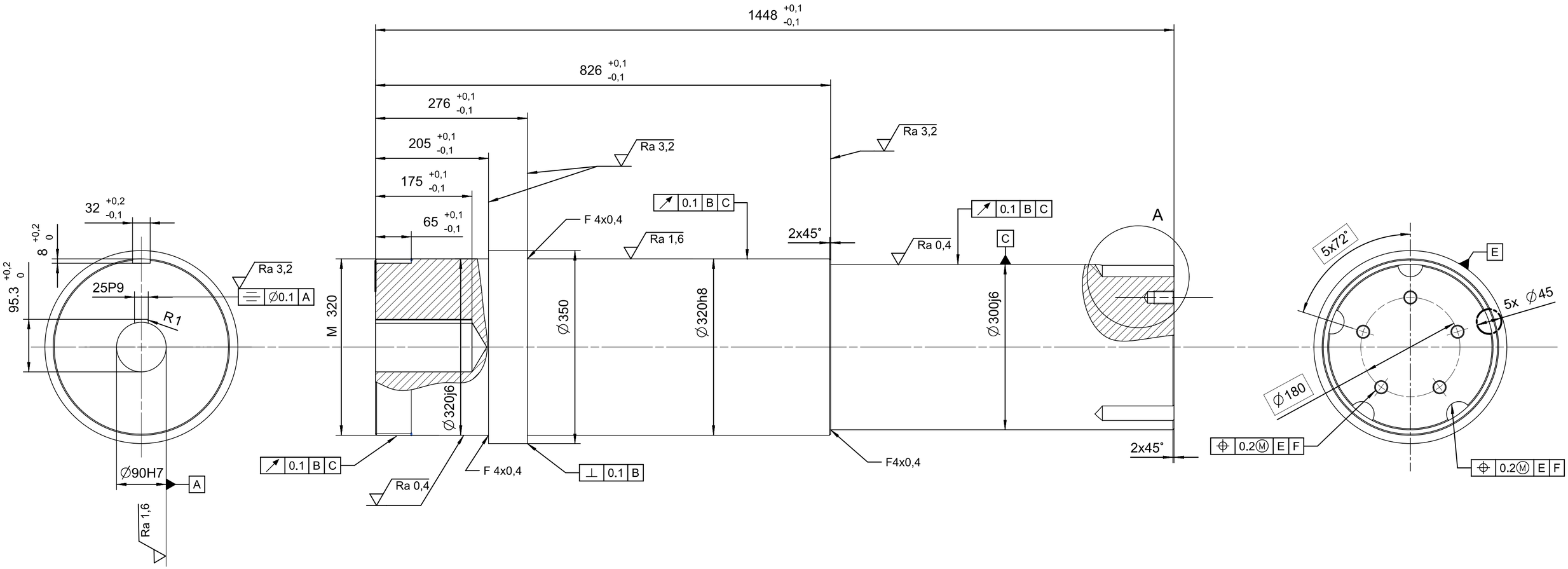
Nazev / Title: SESTAVA PH

Rev.: 0

Cislo vykresu / Drawing No.: A_KKS-001

Format: A2

List / sheet no. 1 Pocet listu / sheets 1



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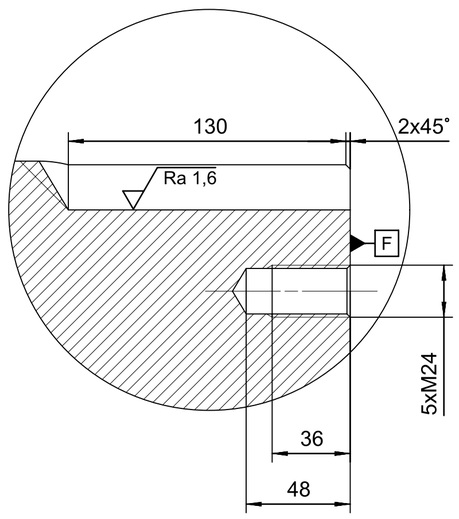

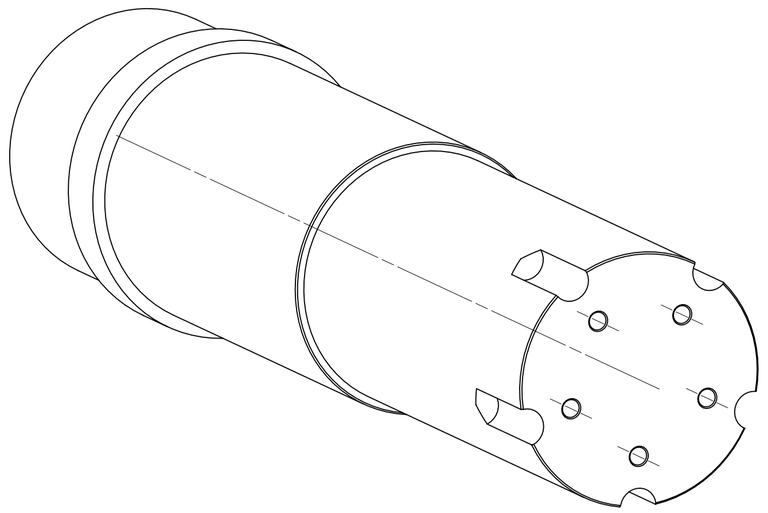

Ra 6,3 (√)

-OTVORY Ø 45 VRTAT S PROTIKUSEM

1	PREDLOHOVA HRIDEL	VYKOVEK	ocel C45		865,000		ASM-001	1
Poz.	Nazev - rozmer	Polotovar	Material konecny/vychozi	T.O.	C.hmot.	H.hmot	Cislo vykresu sestavy	Pocet ks.
Pos.	Title - size	Blank	End material/Start material	C.W.	Weight	R.weig.	Assembly drawing no.	Quant.

CAD	Datum / Date	Jmeno / Name
	26.4.2021	DAVID VYDRZEL
Schválil / Approved by		

FAKULTA STROJNI
ZAPADOCESKE
UNIVERZITY
V PLZNI

Index zmeny	Popis zmeny / change description	Schval. / APP	Datum / Date	Podpis / Signature

Poznamka / Note:

ISO E
ISO 128 ISO 8015 ISO 2768mK

Soubor-model / ASM-file: predlohova_hridel_2

Soubor-vykres / DRW-file: predlohova_hridel_2

Projekt / Project: A_KKS-001

Meritko / Scale

Nazev / Title: PREDLOHOVA HRIDEL

Rev.: 0

Cislo vykresu / Drawing No.: V_KKS-001

Format: A2