

<u>Torsional vibration calculation</u>		Date:		03.11.2025	
<u>Input data combustion engine</u>					
Manufacturer engine :	KHD				
Engine typ:	BV9M628				
Power at full load:	1.735	kW			
Engine speed:	900	1/min			
Engine concept::	Inline engine				
Amount of cylinder:	9				
Middle effective pressure pe	25,55	bar			
Combustion process:	Diesel				
Working methode:	four stoke engine				
Compression ratio:	18,50				
Piston diameter:	220,00	mm			
Piston stroke:	280,00	mm			
Push rod-ratio:	0,26				
Crank radius:	140,00	mm			
connection rod lenght:	532,32	mm			
Total displacement engine:	0,01	m ³	VH	0,0957934	m ³ 10.643,72 cm ³
Stroke volume:	0,001	m ³			
Average piston speed:	8,40	m/s			
Internal friction pressure in the engin	1,40	bar			
Average torque	19.476,14	Nm			
Lightweight connecting rods and pist	47,80	kg			
 <u>Key to the spring-mass system</u>					
i = location of the component's moment of inertia					
Component = component of the vibrating system					
Teta = moment of inertia of the component in kgm ²					
cT = torsional stiffness of the connecting element between two components, in Nm/rad					
D wave = damping in the shaft assembly between two components, in Nms/rad					
D-i = Damping within the component itself in N·m/rad					

Torsional vibration calculation

Date: 03.11.2025

Input: Spring-mass system

i	Modelname	Parameter	Teta kgm ²	Torsionssteife	Relative Dämpfung		Absolute Dämpfung		D Welle mm
				Nm/rad	Nms/rad	L in m	Nms/rad	V Vergröß	
1	Dämpfer	Massenträghei	11,40				0,0		
	Dämpfer	Drehsteifigkeit		3.030.303	2.343,7	330,00			0
2	Dämpfer	Massenträghei	2,19				0,0		
	Dämpfer	Drehsteifigkeit		3.030.303	0,0	330,00			0
3	Dämpfer	Massenträghei	2,24				0,0		
	Dämpfer	Drehsteifigkeit		27.777.778	0,0	36,00			0
4	ohne	Massenträghei	0,41				0,0		
	ohne	Drehsteifigkeit		46.948.357	0,0	21,30			0
5	Mot K'w Zapfen 1	Massenträghei	4,50				2,0		
	Mot K'w Zapfen 1	Drehsteifigkeit		26.881.720	26,1	37,20			187
6	Mot K'w Zapfen 2	Massenträghei	3,60				2,0		
	Mot K'w Zapfen 2	Drehsteifigkeit		26.881.720	26,1	37,20			187
7	Mot K'w Zapfen 3	Massenträghei	2,71				2,0		
	Mot K'w Zapfen 3	Drehsteifigkeit		26.881.720	26,1	37,20			187
8	Mot K'w Zapfen 4	Massenträghei	4,47				2,0		
	Mot K'w Zapfen 4	Drehsteifigkeit		26.881.720	26,1	37,20			187
9	Mot K'w Zapfen 5	Massenträghei	4,47				2,0		
	Mot K'w Zapfen 5	Drehsteifigkeit		26.881.720	26,1	37,20			187
10	Mot K'w Zapfen 6	Massenträghei	4,47				2,0		
	Mot K'w Zapfen 6	Drehsteifigkeit		26.881.720	26,1	37,20			187
11	Mot K'w Zapfen 7	Massenträghei	2,71				2,0		
	Mot K'w Zapfen 7	Drehsteifigkeit		26.881.720	26,1	37,20			187
12	Mot K'w Zapfen 8	Massenträghei	3,60				2,0		
	Mot K'w Zapfen 8	Drehsteifigkeit		26.881.720	26,1	37,20			187
13	Mot K'w Zapfen 9	Massenträghei	4,50				2,0		
	Mot K'w Zapfen 9	Drehsteifigkeit		46.948.357	26,1	21,30			187
14	Schwungrad	Massenträghei	70,30				0,0		
	Schwungrad	Drehsteifigkeit		100.000.000	0,0	10,00			0
15	Kupplung	Massenträghei	17,37				0,0		
	Kupplung	Drehsteifigkeit		1.649.997	2.371,8	606,06			0
16	Generator	Massenträghei	38,40				0,0		
	Generator	Drehsteifigkeit		16.129.032	8,0	62,00			180
17	Generator	Massenträghei	275,00				0,0		
	Generator	Drehsteifigkeit		0	8,0	0,00			0

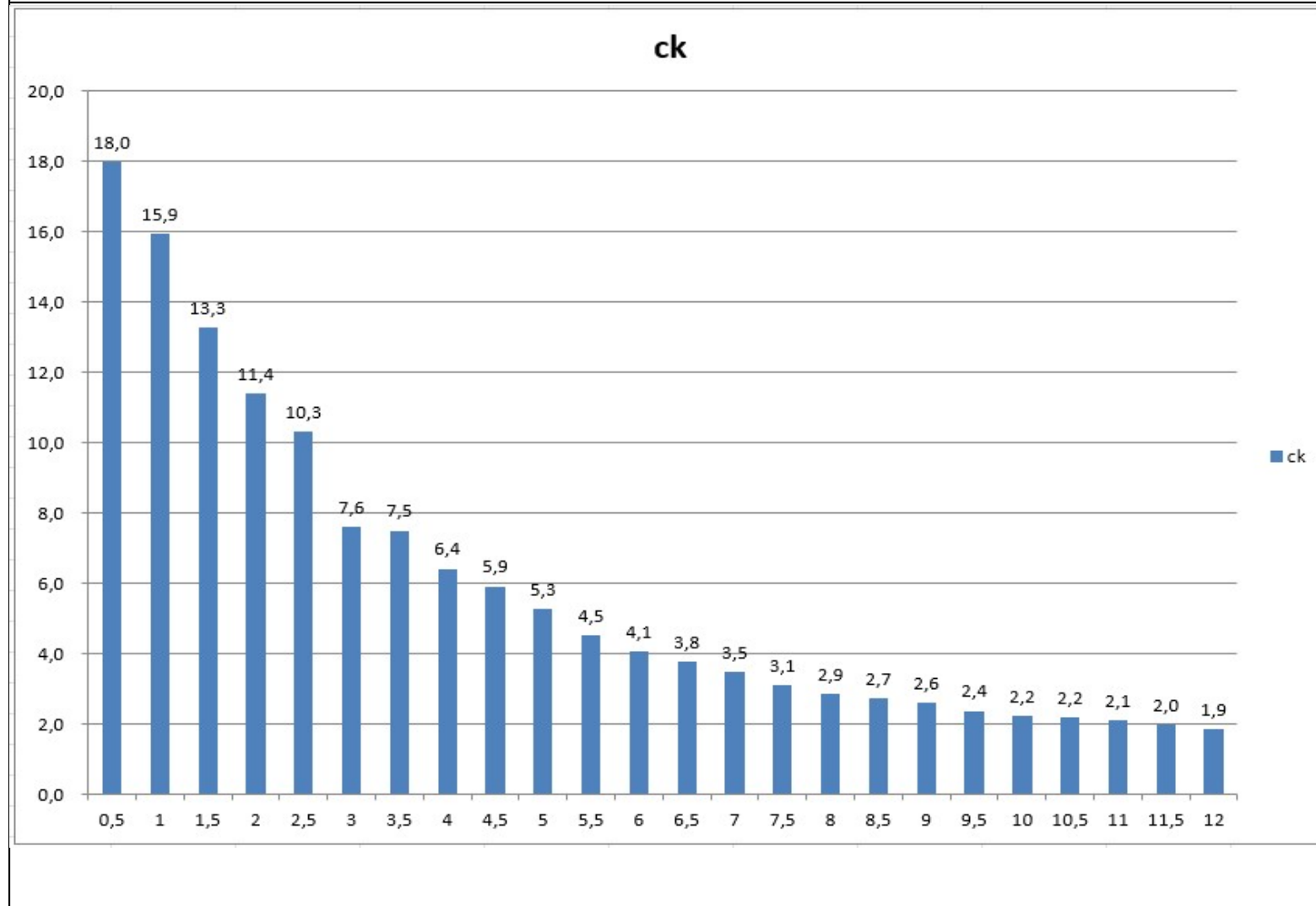


Torsional vibration calculation

Date: 03.11.2025

Harmonic Analysis: Gas Power Diagram for a Single Cylinder

(cK-Werte berechnet Mittels Fourier Analyse)

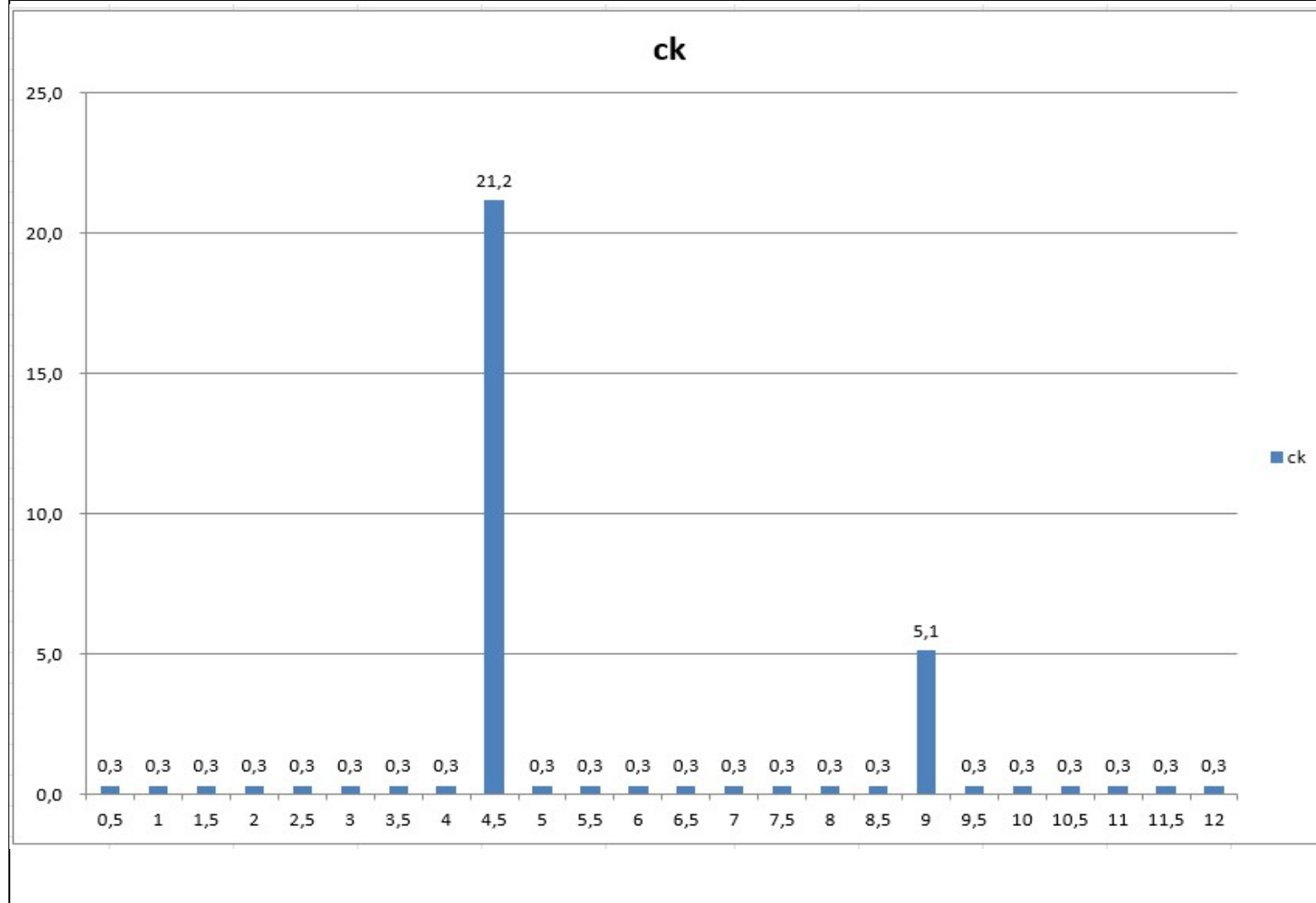


Torsional vibration calculation

Datum: 03.11.2025

Harmonic Analysis: Gas Power Diagram for all Cylinder

(cK-Werte berechnet Mittels Fourier Analyse)



Legende:

Dämpfer	torsional vibration damper
Motor KW Zapfen n	crankshaft cylinder no. N
Schwungrad	flywheel
Kupplung	elastically coupling
Generator	alternator shaft
Massenträgheit	mass inertia
Drehsteifigkeit	torsional stiffness
rel. Dämpfung	rel. damping
abs. Dämpfung	abs. damping

Torsional vibration calculation:					Date:	03.11.2025
Clutch engagement as the engine speed increases:		263	1/min	500	kW	
Typ of coupling:	MMG16000	Element	NN	65	°Shore	
Calculation result for coupling selection:					Data for coupling	
Engine power red.		444	Nm	Rated torque of the coupling		
Operating torque of the motor/system		16.137	Nm	160.000 Nm		
Engine speed		263	rpm			
Capacity utilisation (%)		10,09%				
for calculation selected li in m		608	m			
Torsional stiffness		1.645.548	Nm/rad			
Operating mode		Engine normal operation				
Operating torque of the clutch is sufficient		temperature factors permissible				
Rated torque under operating conditions, including impact and t		23.076	Nm			
Coupling engagement	%	14,42%				
max. speed	910	1/min	permissible			
Maximum torque of the coupling		permissible			Maximum torque of the coupling	
Maximum torque calculated		72.982	Nm	436.364 Nm		
Permissible alternating torque	+/-	65.909	Nm	maximum alternating torque		
Continuous alternating torque during operation	+/-	56.844,85	Nm	48.000 Nm		
Coupling engagement		86,25%			at n L	
		permissible				

Torsional vibration calculation:					Date:	03.11.2025
Clutch engagement as the engine speed increases:		900	1/min	1.735	kW	
Typ of coupling:	MMG16000	Element	NN	65	°Shore	
Calculation result for coupling selection:					Data for coupling	
Engine power red.		1.735	Nm	Rated torque of the coupling		
Operating torque of the motor/system		18.409	Nm	160.000 Nm		
Engine speed		900	rpm			
Capacity utilisation (%)		11,51%				
for calculation selected li in m		591	m			
Torsional stiffness		1.691.361	Nm/rad			
Operating mode		Engine normal operation				
Operating torque of the clutch is sufficient		temperature factors permissible				
Rated torque under operating conditions, including impact and t		26.325	Nm			
Coupling engagement		%	16,45%			
max. speed	910	1/min	permissible			
Maximum torque of the coupling		permissible		Maximum torque of the coupling		
Maximum torque calculated		19.622	Nm	436.364 Nm		
Permissible alternating torque	+/-	35.629	Nm	maximum alternating torque		
Continuous alternating torque during operation	+/-	1.213,36	Nm	48.000 Nm		
Coupling engagement		3,41%		at n L 600 rpm		
		permissible				

Torsional vibration calculation:				Date:	03.11.2025
Clutch engagement as the engine speed increases:		900	1/min	1.735	kW
Typ of coupling:	MMG16000	Element	NN	65	°Shore
Calculation result for coupling selection:				Data for coupling	
Engine power red.	1.542	Nm	Rated torque of the coupling		
Operating torque of the motor/system	16.363	Nm	160.000 Nm		
Engine speed	900	rpm			
Capacity utilisation (%)	10,23%				
for calculation selected li in m	606	m			
Torsional stiffness	1.649.997	Nm/rad			
Operating mode	engine intermitted operation				
Operating torque of the clutch is sufficient	temperature factors permissible				
Rated torque under operating conditions, including impact and t	23.400	Nm			
Coupling engagement	%	14,62%			
max. speed	910	1/min	permissible		
Maximum torque of the coupling	permissible		Maximum torque of the coupling		
Maximum torque calculated	25.068	Nm	436.364 Nm		
Permissible alternating torque	+/-	35.629	Nm	maximum alternating torque	
Continuous alternating torque during operation	+/-	8.704,70	Nm	436.364 Nm	
Coupling engagement		24,43%	at n L		
		permissible	600 rpm		

