Bevel and hypoid gearing - geometry [ISO 23509]

		Pinion	Gear	
i	Calculation without errors.			
ii	☐ Project information			
?	Input section			

1.0 ☑ Options of basic input parameters

			Pinion	Gear	
1.1	Calculation units		SI Units (N, mm, kW…)		
1.2	Transferred power	Pw	10.0000		[kW]
1.3	Speed (Pinion / Gear)	n [/min]	1500.00	500.00	[/min]
1.4	Torsional moment (Pinion / Gear)	T [Nm]	63.67	191.00	[Nm]
	Gear type, material, load				
1.5	Gearing type		5. Hypoid spiral bevel gears (Gleason) - Methode 1		
1.6	Straight and Zerol bevel factor	SZF	1.00	1.00 ☑	[~]
1.7	Material of the pinion / gear		Case-hardened steel 55HRC / Case-hardened steel 55HRC (KM=1)		
1.8	Material factor	KM	1.00	1.00 ☑	[~]
1.9	Precision-finished gears	PFG	1.00	No	[~]
1.10	Load type		Dynamic load (LTF=1.00)		
1.11	Load type factor	LTF	1.00	1.00 ☑	[~]
1.12	Accuracy grade - ISO1328		8 - 12		
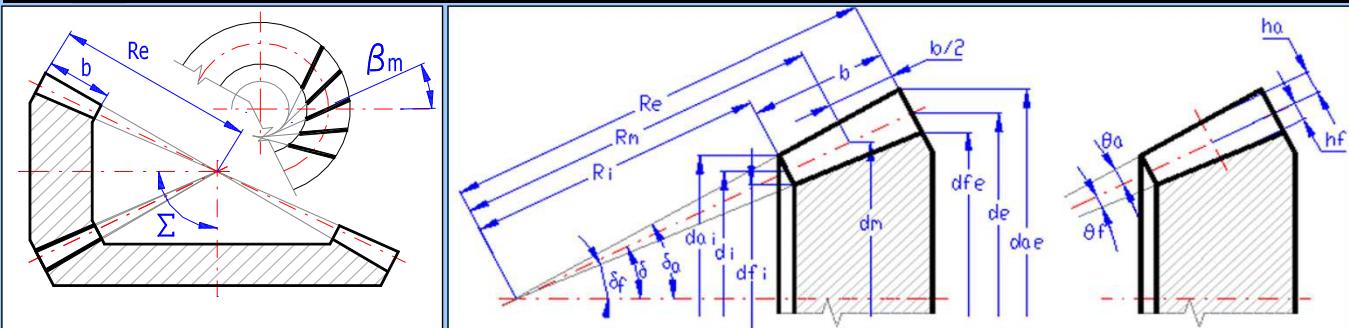
2.0 ☑ Preliminary / Approximate design of geometrical parameters
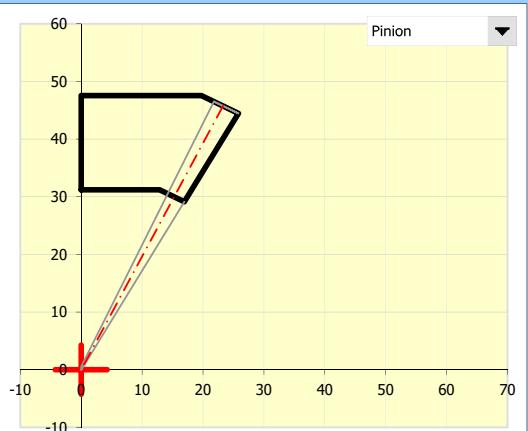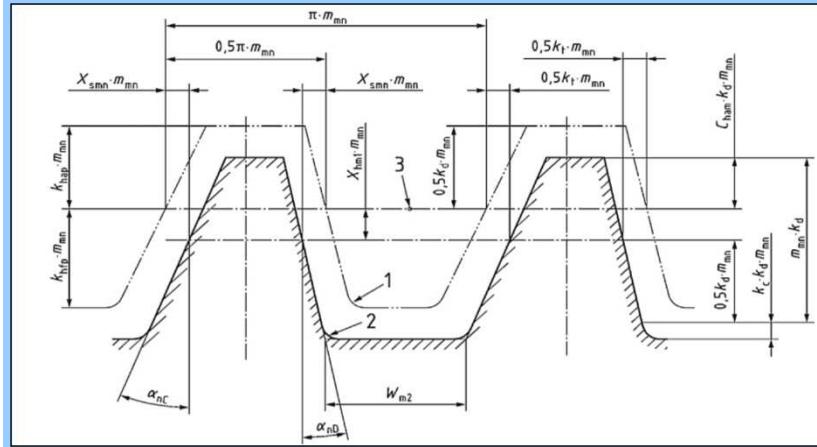
|			Pinion	Gear	
2.1	Transmission ratio / from table	u	3.0000	2.50	[~]
2.2	Recommended (minimum) number of teeth pinion / wheel	z1 / z2	14 (>9)	42	[~]
2.3	Number of teeth pinion / wheel	z1 / z2	15	45 ☑	[~]
2.4	Actual transmission ratio / deviation	u	3.0000	0.00%	[~]
2.5	Angle of shaft axes	Sigma	90.00		[°]
2.6	Hypoid offset / max. value (25% of de2)	a	20.000	< 24.5	[mm]
2.7	Outer pitch diameter	de1,2	32.7219	98.1657	[mm]
2.8	Outer transverse module / Outer transverse DP	met, DP	2.1815	11.6436	[mm], [~]
2.9	Pitch cone angle	delta1,2	18.435	71.565	[°]
2.10	Outer cone distance	Re1,2	51.7379	51.7379	[mm]
2.11	Face width / max. recommendet value	b1	15.5200	< 15.52 ☑	[mm]
2.12	Mean spiral angle	betam	49.60	= 49.6 ☑	[°]
2.13	Face contact ratio	epsilonbeta	3.050	3.047	[~]

3.0 ☑ Initial data for tooth profile parameters (used in all calculation methodes)

3.1	Nominal design pressure angle drive side / coast side	alfadD, alfadC	20.0000	20.0000	[°]	
3.2	Influence factor of limit pressure angle	falfalim	1.0000	= 1.0000	☑ [°]	
3.3	Mean normal pressure angle	alfan	20.0000		[°]	
3.4	**Data type selection (I or II)**		Data type I (European Standards)	▼	<<	
3.5	Profile shift coefficient	xhm1	0.4000	0.4000	[~]	= 0.4000
3.6	Basic crown gear addendum factor	khap	1.0000	1.0000	[~]	= 1.0000
3.7	Basic crown gear deddendum factor	khfp	1.2500	1.2500	[~]	= 1.2500
3.8	Thickness modification coefficient (theoretical)	xsmn	0.0490	0.0490	[~]	= 0.0490
3.9	Mean addendum factor of wheel	cham	0.2646	0.3000	[~]	= 0.2641
3.10	Depth factor	kd	2.0000	2.0000	[~]	= 2.0000
3.11	Clearence factor	kc	0.1250	0.1250	[~]	= 0.1250
3.12	Circular thickness factor	kt	0.1264	0.0980	[~]	= 0.1040

	Results section					
?				**Methode 0**		
4.0	☑ **For all nonhypoid gears (a=0)**					
4.1	Outer pitch diameter (wheel)	de2	99.000	> 98.17	[mm]	<
4.2	Face width (gear)	b1	15.300	< 15.7	[mm]	
4.3	Mean spiral angle	betam2	49.000	<0...61> (>37)	[°]	
4.4	Outer normal backlash	jen2	0.0800	> 0.08 (0.08)	[mm]	
4.5	Cutter radius	rc0	42.0000	<28.1...181.5>	[mm]	
4.6	Depthwise taper, (adendum and dedendum angles)		1. Standard, (SumThetafs=3.96 ,Thetaa2=1.347, Thetaf2=2.613)			▼
4.7	Addendum angle	Thetaa2	1.3469	= 1.3469	[°]	☑
4.8	Dedendum angle	Thetaf2	2.6133	= 2.6133	[°]	
	Determination of pitch cone parameters					
4.9	Pitch cone angle	delta1,2	18.4349	71.5651	[°]	
4.10	Outer cone distance	Re1,2	52.1776	52.1776	[mm]	
4.11	Mean cone distance	Rm1,2	44.5276	44.5276	[mm]	
4.12	Inner pitch cone distance	Ri1,2	36.8776	36.8776	[mm]	
4.13	Mean spiral angle	betam1,2	49.0000	49.0000	[°]	
4.14	Face width	b1,2	15.3000	15.3000	[mm]	
4.15	Face width factor	cbe2	0.5000		[~]	
	Determination of basic data					
4.16	Outer pitch diameter	de1,2	33.0000	99.0000	[mm]	
4.17	Mean pitch diameter	dm1,2	28.1617	84.4851	[mm]	
4.18	Inner pitch diameter	di1,2	23.3234	69.9703	[mm]	
4.19	Shaft angle departure from 90°	DeltaSigma	0.0000		[°]	
4.20	Offset angle in the pinion axial plane	zetam	0.0000		[°]	
4.21	Offset angle in the pitch plane	zetamp	0.0000		[°]	
4.22	Offset in pitch plane	ap	0.0000		[mm]	
4.23	Mean normal module	mmn	1.2317	1.6300	[mm]	<
4.24	Outer transverse module	met2	2.2000	1.6300	[mm]	<
4.25	Limit pressure angle	alfa_lim	0.0000		[°]	
4.26	Generated normal pressure angle drive side / coast side	alfanD, alfanC	20.0000	20.0000	[°]	
4.27	Efective presure angle drive side / coast side	alfaeD, alfaeC	20.0000	20.0000	[°]	
4.28	Pinion / wheel face width from calculation point to outside	be1,2	7.6500	7.6500	[mm]	
4.29	Pinion / wheel face width from calculation point to inside	bi1,2	7.6500	7.6500	[mm]	
4.30	Crossing point to calculation point along pinion / wheel axis	tzm1,2	42.2426	14.0809	[mm]	
4.31	Pitch apex beyond crossing point along axis	tz1,2	0.0000	0.0000	[mm]	
4.32	Mean working depth	hmw	2.4634		[mm]	
4.33	Mean addendum pinion / wheel	ham1,2	1.7244	0.7390	[mm]	
4.34	Mean dedendum pinion / wheel	hfm1,2	1.0469	2.0323	[mm]	
4.35	Clearence	c	0.3079	0.2500	[mm]/[mmn]	
4.36	Mean whole depth	hm	2.7713		[mm]	
4.37	Face angle pinion / wheel	deltaa1,2	21.0482	72.9120	[°]	
4.38	Root angle pinion / wheel	deltaf1,2	17.0880	68.9518	[°]	
4.39	Auxiliary angle for calculating pinion offset angle in root / face plane	fiR, fio	0.0000	0.0000	[°]	
4.40	Pinion ofset angle in root / face plane	zetaR, zetao	0.0000	0.0000	[°]	
4.41	Addendum angle	Thetaa1,2	2.6133	1.3469	[°]	
4.42	Dedendum angle	Thetaf1,2	1.3469	2.6133	[°]	
4.43	Pinion / wheel root apex beyond crossing point along pinion / wheel axis	tzR1,2	-0.0003	0.0000	[mm]	
4.44	Pinion / wheel face apex beyond crossing point along pinion / wheel axis	tzF1,2	-0.8574	-0.3221	[mm]	
4.45	Pinion face width in pitch plane	bp1	15.3000		[mm]	
4.46	Pinion face width from calculation point to front crown	b1A	7.6500		[mm]	
4.47	Wheel cone distance of outer pinion boundary point (>Re2)	Re21	52.1776		[mm]	
4.48	Wheel cone distance of inner pinion boundary point (<Ri2)	Ri21	36.8776		[mm]	

	Face milling:				
4.49	Wheel spiral angle at outer / inner boundary point	betae21,betai21	54.3752	45.2539	[°]
4.50	Wheel spiral angle outer / inner	betae2, betai2	54.3752	45.2539	[°]
	Face hobbing and face milling:				
4.51	Pinion offset angle in pitch plane at outer / inner boundary point	zetaep21, zetaip21	0.0000	0.0000	[°]
4.52	Pinion spiral angle outer / inner	betae1, betai1	54.3752	45.2539	[°]
	Determination of tooth depth				
4.53	Outer addendum	hae1,2	2.0735	0.9189	[mm]
4.54	Outer denendum	hfe1,2	1.2268	2.3815	[mm]
4.55	Outer whole depth	he1,2	3.3004	3.3004	[mm]
4.56	Inner addendum	hai1,2	1.3752	0.5592	[mm]
4.57	Inner dedendum	hfi1,2	0.8671	1.6831	[mm]
4.58	Inner whole depth	hi1,2	2.2423	2.2423	[mm]
	Determination of tooth thickness				
4.59	Mean normal pressure angle	alfan	20		[°]
4.60	Thickness modification coefficient	xsm1,2	0.0324	-0.0656	[~]
4.61	Mean normal circular tooth thickness	smn1,2	2.3732	1.4145	[mm]
4.62	Mean transverse circular thickness	smt1,2	3.6173	2.1560	[mm]
4.63	Mean normal diameter	dmn1,2	59.7234	537.5104	[mm]
4.64	Mean normal chordal tooth thickness	smnc1,2	2.3726	1.4145	[mm]
4.65	Mean chordal addendum	hamc1,2	1.7467	0.7393	[mm]
	Determination of remaining gear dimensions				
4.66	Tip diameter (outer)	dae1,2	36.9343	99.5812	[mm]
4.67	Root diameter (outer)	dfe1,2	30.6723	97.4938	[mm]
4.68	Tip diameter (inner)	dai1,2	25.9327	70.3239	[mm]
4.69	Root diameter (inner)	dfi1,2	21.6783	68.9058	[mm]
4.70	Crossing point to crown along axis	txo1,2	48.8443	15.6283	[mm]
4.71	Crossing point to front crown along axis	txi1,2	34.5503	11.1313	[mm]
4.72	Pinion whole depth, perpendicular to the root cone	ht1	3.2992		[mm]

5.0	☑ **Hypoid gear set (Gleason)**		**Methode 1**		<====	
5.1	Outer pitch diameter (wheel)	de2	99.000	> 98.17	[mm]	<
5.2	Face width (gear)	b2	15.300	< 16.9	[mm]	
5.3	Mean spiral angle	betam1	49.000	<0...65> (>49.6)	[°]	
5.4	Hypoid offset / max. value (25% of de2)	a	17.000	< -6.9...17.3>	[mm]	
5.5	Outer transverse backlash	jet2	0.5270	> 0.122 (0.475)	[mm]	
5.6	Cutter radius	rc0	35.0000	<28.1...37.1>	[mm]	
5.7	Number of blade groups	z0	0	<0...19>	[~]	
5.8	Depthwise taper, (adendum and dedendum angles)		1. Standard, (SumThetafs=4.941 ,Thetaa2=1.681, Thetaf2=3.26)			▼
5.9	Addendum angle	Thetaa2	1.6810	= 1.681	[°]	
5.10	Dedendum angle	Thetaf2	3.2605	= 3.2605	[°]	
5.11	Desired pinion spiral angle	betaDelta1	49.0000		[°]	
5.12	Shaft angle departure from 90°	DeltaSigma	0.0000		[°]	
5.13	Approximate wheel pitch angle	deltaint2	68.1986		[°]	
5.14	Wheel mean pitch radius	rmpt2	42.3972		[mm]	
5.15	Approximate pinion offset angle in pitch plane	epsiloni'	21.8570		[°]	
5.16	Approximate hypoid dimension factor	K1	1.3564		[~]	
5.17	Approximate pinion mean radius	rmn1	19.1690		[mm]	
	Start of itteration					
5.18	Wheel ofset angle in axial plane	eta	9.9999029	<-Changed value	[°]	
5.19	Intermediate pinion offset angle in axial plane	epsilon2	18.8117		[°]	
5.20	Intermediate pinion pitch angle	deltaint1	27.0098		[°]	
5.21	Intermediate pinion offset angle in pitch plane	epsilon2'	21.2192		[°]	
5.22	Intermediate pinion mean spiral angle	betamint1	49.5275		[°]	
5.23	Increment in hypoid dimension factor	DeltaK	-7.8253E-03		[~]	
5.24	Pinion mean radius increment	Deltarmpt1	-1.1059E-01		[mm]	
5.25	Pinion offset angle in axial plane	epsilon1	18.8392		[°]	
5.26	Pitch cone angle	delta1,2	26.9735	61.3634	[°]	
5.27	Pinion offset angle in pitch plane	epsilon1'	21.2432		[°]	
5.28	Mean spiral angle	betam1,2	48.9797	27.7365	[°]	
5.29	Mean cone distance	Rm1,2	42.0179	48.3061	[mm]	
5.30	Mean pinion radius	rmpt1	19.0584		[mm]	
5.31	Limit presure angle	alfalim	-4.7976		[°]	
5.32	Limit radius of curvature	rolim	35.0000		[mm]	
	A. For face hobbed gears					
5.33	Number of crown gear teeth	zp	51.2717		[~]	
5.34	Lead angle of cutter	ny	0.0000		[°]	
5.35	First auxiliary angle	lambda	62.2635		[°]	
5.36	Crown gear to cutter centre distance	roP0	44.5505		[mm]	
5.37	Second auxiliary angle	eta1	16.3191		[°]	
5.38	Lengthwise tooth mean radius of curvature	rombetaA	35.0000		[mm]	
5.39	Condition A	|rombetaA/rolim-1| < 0.01	0.00000001	Iterat	[~]	
	B. For face milling gears					
5.40	Lengthwise tooth mean radius of curvature	rombetaB	35.0000		[mm]	
5.41	Condition B	|rombetaB/rolim-1| < 0.01	0.00000001	Iterat	[~]	

	End of itteration					
5.42	Face width factor	cbe2	0.5289			[~]
	Determination of basic data					
5.43	Mean pitch diameter	dm1,2	38.1168	84.7943		[mm]
5.44	Shaft angle departure from 90°	DeltaSigma	0.0000			[°]
5.45	Offset angle in the pinion axial plane	zetam	18.8392			[°]
5.46	Offset angle in the pitch plane	zetamp	21.2432			[°]
5.47	Offset in pitch plane	ap	17.5026			[mm]
5.48	Mean normal module	mmn	1.6678	3.0000	<	[mm]
5.49	Outer transverse module	met2	2.2000	4.0000	<	[mm]
5.50	Limit pressure angle	alfalim'	-4.7976			[°]
5.51	Generated normal pressure angle drive side / coast side	alfanD, alfanC	15.2024	24.7976		[°]
5.52	Efective presure angle drive side / coast side	alfaeD, alfaeC	20.0000	20.0000		[°]
5.53	Outer cone distance	Re1,2	51.3237	56.3989		[mm]
5.54	Inner pitch cone distance	Ri1,2	33.6421	41.0989		[mm]
5.55	Outer pitch diameter	de1,2	46.5586	99.0000		[mm]
5.56	Inner pitch diameter	di1,2	30.5187	72.1431		[mm]
5.57	Pinion / wheel face width from calculation point to outside	be1,2	9.3058	8.0928		[mm]
5.58	Pinion / wheel face width from calculation point to inside	bi1,2	8.3758	7.2072		[mm]
5.59	Face width	b1,2	17.6815	15.3000		[mm]
5.60	Crossing point to calculation point along pinion / wheel axis	tzm1,2	40.1259	18.7689		[mm]
5.61	Pitch apex beyond crossing point along axis	tz1,2	-2.6788	4.3819		[mm]
	Determination of tooth depth at calculation point					
5.62	Mean working depth	hmw	3.3356			[mm]
5.63	Mean addendum pinion / wheel	ham1,2	2.3349	1.0007		[mm]
5.64	Mean dedendum pinion / wheel	hfm1,2	1.4176	2.7519		[mm]
5.65	Clearence	c	0.4170	0.25		[mm]/[mmn]
5.66	Mean whole depth	hm	3.7526			[mm]
	Determination of root angles and face angles					
5.67	Face angle pinion / wheel	deltaa1,2	30.1064	63.0444		[°]
5.68	Root angle pinion / wheel	deltaf1,2	25.3619	58.1029		[°]
5.69	Auxiliary angle for calculating pinion offset angle in root / face plane	fiR, fio	0.0000	0.0000		[°]
5.71	Pinion ofset angle in root / face plane	zetaR, zetao	18.3221	19.1042		[°]
5.73	Addendum angle	Thetaa1,2	3.1329	1.6810		[°]
5.74	Dedendum angle	Thetaf1,2	1.6116	3.2605		[°]
5.75	Pinion / wheel root apex beyond crossing point along pinion / wheel axis	tzR1,2	-3.2310	4.3819		[mm]
5.76	Pinion / wheel face apex beyond crossing point along pinion / wheel axis	tzF1,2	-2.6184	3.9144		[mm]
	Determination of pinion face widt					
5.77	Pinion face width in pitch plane	bp1	16.4286			[mm]
5.78	Pinion face width from calculation point to front crown	b1A	7.8380			[mm]
5.79	Auxiliary angle	lambda'	3.1852			[°]
5.80	Pinion face width	breri1	16.0678			[mm]
5.81	Pinion face width increment along pinion axis	Deltabx1	0.6991			[°]
5.82	Increment along pinion axis from calculation point to outside	Deltagxe	7.0033			[°]
5.83	Increment along pinion axis from calculation point to inside	Deltagxi	8.3158			[°]

Determination of inner and outer spiral angles

Pinion

5.84	Wheel cone distance of outer pinion boundary point (>Re2)	Re21	57.0792		[mm]
5.85	Wheel cone distance of inner pinion boundary point (<Ri2)	Ri21	40.6130		[mm]

Face milling:

5.86	Wheel spiral angle at outer / inner boundary point	betae21, betai21	38.7020	18.2367	[°]

Face hobbing and face milling:

5.87	Pinion offset angle in pitch plane at outer / inner boundary point	zetaep21, zetaip21	17.8567	25.5286	[°]
5.88	Pinion spiral angle outer / inner	betae1, betai1	56.5587	43.7653	[°]

Gear

Face milling:

5.89	Wheel spiral angle outer / inner	betae2, betai2	37.8253	18.8471	[°]

Determination of tooth depth

5.90	Outer addendum	hae1,2	2.8443	1.2382	[mm]
5.91	Outer denendum	hfe1,2	1.6795	3.2129	[mm]
5.92	Outer whole depth	he1,2	4.5237	4.4511	[mm]
5.93	Inner addendum	hai1,2	1.8765	0.7892	[mm]
5.94	Inner dedendum	hfi1,2	1.1820	2.3413	[mm]
5.95	Inner whole depth	hi1,2	3.0585	3.1305	[mm]

Determination of tooth thickness

5.96	Mean normal pressure angle	alfan	20.0000		[°]
5.97	Thickness modification coefficient	xsm1,2	-0.0109	-0.1089	[~]
5.98	Mean normal circular tooth thickness	smn1,2	3.0691	1.7710	[mm]
5.99	Mean transverse circular thickness	smt1,2	4.6762	2.0009	[mm]
5.100	Mean normal diameter	dmn1,2	85.9942	218.7741	[mm]
5.101	Mean normal chordal tooth thickness	smnc1,2	3.0684	1.7709	[mm]
5.102	Mean chordal addendum	hamc1,2	2.3593	1.0024	[mm]

Determination of remaining gear dimensions

5.103	Tip diameter (outer)	dae1,2	51.6283	100.1868	[mm]
5.104	Root diameter (outer)	dfe1,2	43.5651	95.9204	[mm]
5.105	Tip diameter (inner)	dai1,2	33.8634	72.8995	[mm]
5.106	Root diameter (inner)	dfi1,2	28.4119	69.8989	[mm]
5.107	Crossing point to crown along axis	txo1,2	47.1292	21.5606	[mm]
5.108	Crossing point to front crown along axis	txi1,2	31.8101	14.6222	[mm]
5.109	Pinion whole depth, perpendicular to the root cone	ht1	4.5181		[mm]

			Methode 2		
6.0 ☑ **Hypoid gear set - Face hobbing (Oerlikon)**					<
6.1 Mean pitch diameter (wheel)	dm2	84.0000	> 83.44	[mm]	
6.2 Face width (gear)	b2	15.3000	< 17.7	[mm]	
6.3 Mean spiral angle	betam2	49.000	<0...75> (>49.6)	[°]	
6.4 Hypoid offset / max. value (25% of de2)	a	17.0000	< -24.5...19.2>	[mm]	
6.5 Outer transverse backlash	jet2	0.7320	> 0.122 (0.732)	[mm]	
6.6 Cutter radius	rc0	48.0000	<38.3...54.6>	[mm]	
6.7 Number of blade groups	z0	5	1 - 19	[~]	
6.8 Depthwise taper, (adendum and dedendum angles)		1. Standard, (SumThetafs=3.405 ,Thetaa2=1.158, Thetaf2=2.247)			▼
6.9 Addendum angle	Thetaa2	1.1581	= 1.1581 ☑	[°]	
6.10 Dedendum angle	Thetaf2	2.2471	= 2.2471	[°]	
6.11 Lead angle of cutter	ny	3.6570		[°]	
6.12 First auxiliary angle	lambda	44.6570		[°]	
6.13 First approximation pitch angle	delta1,2'	18.4349	71.5651	[°]	
6.14 First approximate pinion offset angle in axial plane	zetamapp	21.3636		[°]	
6.15 Approximate hypoid dimension factor	Fapp	1.9523		[~]	
6.16 Approximate pinion mean pitch diameter	dm1app	54.6635		[mm]	
6.17 Intermediate angle	fi2	55.0553		[°]	
6.18 Approximate mean radius of crown gear	Rmapp	51.2379		[mm]	
6.19 Second auxiliary angle	eta1	14.1293		[°]	
6.20 Intermediate angle	fi3	67.4453		[°]	
6.21 Second approximate pitch angle	delta1,2"	35.1893	54.8107	[°]	
Start of itteration					
6.22 Improved wheel pitch angle	delta2imp	54.1661	<-Changed value	[°]	
6.23 Auxiliary angle	etap	14.7382		[°]	
6.24 Approximate wheel offset angle	etaapp	11.0261		[°]	
6.25 Improved pinion offset angle in axial plane	zetamimp	16.3875		[°]	
6.26 Improved pinion offset angle in pitch plane	zetampimp	19.9377		[°]	
6.27 Hypoid dimension factor	F	1.8255		[~]	
6.28 Mean pitch diameter	dm1'	51.1144		[mm]	
6.29 Intermediate angle	fi4	67.0022		[°]	
6.30 Improved pinion / wheel pitch angle	delta1,2imp"	33.6984	56.3016	[°]	
6.31 Wheel pitch angle	delta2		54.6483	[°]	
6.32 Intermediate angle	fi5	55.7617		[°]	
6.33 Improved auxiliary angle	etapimp	11.0261		[°]	
6.34 Wheel offset angle in axial plane	eta	11.4026		[°]	
6.35 Pinion offset angle in axial plane	zetam'	16.5172		[°]	
6.36 Pinion offset angle in pitch plane	zetamp'	19.9801		[°]	
6.37 Mean spiral angle	betam1	68.9801		[°]	
6.38 Mean pitch diameter	dm1	51.2129		[mm]	
6.39 Auxiliary angle	ksi	35.3517		[°]	
6.40 Pinion pitch angle	delta1	33.6913		[°]	
6.41 Mean cone distance	Rm1,2	46.1612	51.4948	[mm]	
6.42 Crown gear to cutter centre distance	roP0'	37.9377		[mm]	
6.43 Intermediate angle	fi6	62.7832		[°]	
6.44 Complementary angle	ficomp	97.2367		[°]	
6.45 Checking variable	Rmcheck	46.1612		[mm]	
6.46 Condition	|Rm1/Rmcheck-1| < 0.01	0.00000000	Iteration	[~]	

6.47	Face width factor	cbe2	0.5000			[~]
	Determination of basic data					
6.48	Mean pitch diameter	dm1,2	51.2129	84.0000		[mm]
6.49	Shaft angle departure from 90°	DeltaSigma	0.0000			[°]
6.50	Offset angle in the pinion axial plane	zetam	16.5140			[°]
6.51	Offset angle in the pitch plane	zetamp	19.9763			[°]
6.52	Offset in pitch plane	ap	17.5922			[mm]
6.53	Mean normal module	mmn	1.2246	3.2923	<	[mm]
6.54	Outer transverse module	met2	2.1440	4.0000	<	[mm]
6.55	Limit pressure angle	alfalim	-2.3410			[°]
6.56	Generated normal pressure angle drive side / coast side	alfanD, alfanC	17.6590	22.3410		[°]
6.57	Efective presure angle drive side / coast side	alfaeD, alfaeC	20.0000	20.0000		[°]
6.58	Outer cone distance	Re1,2	54.8220	59.1448		[mm]
6.59	Inner pitch cone distance	Ri1,2	37.5003	43.8448		[mm]
6.60	Outer pitch diameter	de1,2	60.8215	96.4789		[mm]
6.61	Inner pitch diameter	di1,2	41.6042	71.5211		[mm]
6.62	Pinion / wheel face width from calculation point to outside	be1,2	8.6608	7.6500		[mm]
6.63	Pinion / wheel face width from calculation point to inside	bi1,2	8.6608	7.6500		[mm]
6.64	Crossing point to calculation point along pinion / wheel axis	tzm1,2	40.2675	25.1010		[mm]
6.65	Pitch apex beyond crossing point along axis	tz1,2	-1.8597	4.6936		[mm]
	Determination of tooth depth at calculation point					
6.66	Mean working depth	hmw	2.4493			[mm]
6.67	Mean addendum pinion / wheel	ham1,2	1.7145	0.7348		[mm]
6.68	Mean dedendum pinion / wheel	hfm1,2	1.0409	2.0207		[mm]
6.69	Clearence	c	0.3062	0.2500		[mm]/[mmn]
6.70	Mean whole depth	hm	2.7554			[mm]
	Determination of root angles and face angles					
6.71	Face angle pinion / wheel	deltaa1,2	35.8893	55.8063		[°]
6.72	Root angle pinion / wheel	deltaf1,2	32.5614	52.4011		[°]
6.73	Auxiliary angle for calculating pinion offset angle in root / face plane	fiR, fio	0.0000	0.0000		[°]
6.75	Pinion ofset angle in root / face plane	zetaR, zetao	16.0926	16.7304		[°]
6.77	Addendum angle	Thetaa1,2	2.1980	1.1581		[°]
6.78	Dedendum angle	Thetaf1,2	1.1299	2.2471		[°]
6.79	Pinion / wheel root apex beyond crossing point along pinion / wheel axis	tzR1,2	-2.1034	4.6936		[mm]
6.80	Pinion / wheel face apex beyond crossing point along pinion / wheel axis	tzF1,2	-1.9614	4.3235		[mm]

	Determination of pinion face widt				
6.81	Pinion face width in pitch plane	bp1	16.3072		[mm]
6.82	Pinion face width from calculation point to front crown	b1A	8.2359		[mm]
6.83	Face width	b1,2	17.3216	15.3000	[mm]
	Determination of inner and outer spiral angles				
6.84	Wheel cone distance of outer pinion boundary point (>Re2)	Re21	59.7079		[mm]
6.85	Wheel cone distance of inner pinion boundary point (<Ri2)	Ri21	43.4560		[mm]
	Face hobbing:				
6.86	Lead angle of cutter	ny	3.6570		[mm]
6.87	Crown gear to cutter centre distance	roP0	37.9377		[mm]
6.88	Epicycloid base circle radius	rob, rz0	34.7853	3.1524	[mm]
6.89	Auxiliary angle	fie21,fii21	53.4127	71.9125	[°]
6.90	Wheel spiral angle at outer / inner boundary point	betae21, betai21	54.3727	44.6424	[°]
	Face hobbing and face milling:				
6.91	Pinion offset angle in pitch plane at outer / inner boundary point	zetaep21, zetaip21	17.1358	23.8804	[°]
6.92	Pinion spiral angle outer / inner	betae1, betai1	71.5086	68.5228	[°]
	Wheel face hobbing:				
6.93	Auxiliary angle	fie2,fii2	54.0692	71.4628	[°]
6.94	Wheel spiral angle outer / inner	betae2, betai2	53.9751	44.8304	[°]
	Determination of tooth depth				
6.95	Outer addendum	hae1,2	2.0469	0.8894	[mm]
6.96	Outer denendum	hfe1,2	1.2118	2.3208	[mm]
6.97	Outer whole depth	he1,2	3.2587	3.2103	[mm]
6.98	Inner addendum	hai1,2	1.3821	0.5801	[mm]
6.99	Inner dedendum	hfi1,2	0.8701	1.7205	[mm]
6.100	Inner whole depth	hi1,2	2.2522	2.3006	[mm]
	Determination of tooth thickness				
6.101	Mean normal pressure angle	alfan	20.0000		[°]
6.102	Thickness modification coefficient	xsm1,2	-0.0364	-0.1344	[~]
6.103	Mean normal circular tooth thickness	smn1,2	2.1912	1.2380	[mm]
6.104	Mean transverse circular thickness	smt1,2	6.1089	1.8870	[mm]
6.105	Mean normal diameter	dmn1,2	266.9317	292.0867	[mm]
6.106	Mean normal chordal tooth thickness	smnc1,2	2.1912	1.2380	[mm]
6.107	Mean chordal addendum	hamc1,2	1.7182	0.7355	[mm]
	Determination of remaining gear dimensions				
6.108	Tip diameter (outer)	dae1,2	64.2277	97.5082	[mm]
6.109	Root diameter (outer)	dfe1,2	58.8050	93.7933	[mm]
6.110	Tip diameter (inner)	dai1,2	43.9041	72.1924	[mm]
6.111	Root diameter (inner)	dfi1,2	40.1563	69.5302	[mm]
6.112	Crossing point to crown along axis	txo1,2	46.3382	28.8018	[mm]
6.113	Crossing point to front crown along axis	txi1,2	32.2947	20.2016	[mm]
6.114	Pinion whole depth, perpendicular to the root cone	ht1	3.2562		[mm]

7.0	☑ Hypoid gear set - Face hobbing (Klingelnberg)		Methode 3		
7.1	Outer pitch diameter (wheel)	de2	99.0000	> 98.17	[mm]	<
7.2	Face width (gear)	b2	15.3000	< 16.59	[mm]
7.3	Mean spiral angle	betam2	49.000	<0...75> (>49.6)	[°]
7.4	Hypoid offset / max. value (25% of de2)	a	15.0000	< -24.8...15.5>	[mm]
7.5	Outer transverse backlash	jet2	0.6100	> 0.122 (0.554)	[mm]
7.6	Cutter radius	rc0	46.0000	<37.1...57.7>	[mm]
7.7	Number of blade groups	z0	7	<1...19>	[~]
7.8	Depthwise taper, (adendum and dedendum angles)		1. Standard, (SumThetafs=3.737 ,Thetaa2=1.271, Thetaf2=2.466)		▼
7.9	Addendum angle	Thetaa2	1.2709	= 1.2709 ☑	[°]
7.10	Dedendum angle	Thetaf2	2.4660	= 2.466	[°]
	Start of itteration				
7.11	Hypoid dimension factor	F'	1.6648128	<-Changed value	[~]
7.12	Pitch cone angle	delta1,2'	25.3706	63.5255	[°]
7.13	Mean pitch diameter (wheel)	dm2'		85.3045	[mm]
7.14	Pinion offset angle in axial plane	zetam'	16.0269		[°]
7.15	Pinion pitch angle	delta1"	25.3706		[°]
7.16	Offset angle in the pitch plane	zetamp'	17.7918		[°]
7.17	Mean normal module	mmn'	1.2437		[mm]
7.18	Mean spiral angle	betam1	66.7918		[°]
7.19	Hypoid dimension factor	F	1.6648		[~]
7.20	Mean pitch diameter	dm1'	47.3386		[mm]
7.21	Mean cone distance	Rm1,2	55.2413	47.6490	[mm]
7.22	Lead angle of cutter	ny'	5.4298		[°]
7.23	Auxiliary angle	thetam	14.4201		[°]
7.24	Intermediate variable	A3	24.1475		[mm]
7.25	Intermediate variable	A4	13.9874		[mm]
7.26	Intermediate variable	A5	0.2946		[~]
7.27	Intermediate variable	A6	35.6134		[mm]
7.28	Intermediate variable	A7	-0.1813		[~]
7.29	Intermediate variable	Rmint	55.2412		[mm]
7.30	Condition	|Rmint - Rm1| < 0.005524	3.52278E-05	I	[mm]

7.31	Face width factor	cbe2	0.5000			[~]
	Determination of basic data					
7.32	Pitch cone angle	delta1,2	25.3706	63.5255		[°]
7.33	Mean pitch diameter	dm1,2	47.3387	85.3045		[mm]
7.34	Shaft angle departure from 90°	DeltaSigma	0.0000			[°]
7.35	Offset angle in the pinion axial plane	zetam	16.0269			[°]
7.36	Offset angle in the pitch plane	zetamp	17.7918			[°]
7.37	Offset in pitch plane	ap	14.5596			[mm]
7.38	Mean normal module	mmn	1.2437	3.0000	<	[mm]
7.39	Outer transverse module	met2	2.2000	4.4585	<	[mm]
7.40	Limit pressure angle	alfalim	-6.9286			[°]
7.41	Generated normal pressure angle drive side / coast side	alfanD, alfanC	13.0714	26.9286		[°]
7.42	Efective presure angle drive side / coast side	alfaeD, alfaeC	20.0000	20.0000		[°]
7.43	Outer cone distance	Re1,2	64.1727	55.2990		[mm]
7.44	Inner pitch cone distance	Ri1,2	46.1727	39.9990		[mm]
7.45	Outer pitch diameter	de1,2	54.9924	99.0000		[mm]
7.46	Inner pitch diameter	di1,2	39.5674	71.6089		[mm]
7.47	Pinion / wheel face width from calculation point to outside	be1,2	8.9314	7.6500		[mm]
7.48	Pinion / wheel face width from calculation point to inside	bi1,2	9.0686	7.6500		[mm]
7.49	Crossing point to calculation point along pinion / wheel axis	tzm1,2	40.9944	23.4487		[mm]
7.50	Pitch apex beyond crossing point along axis	tz1,2	8.9191	-2.2068		[mm]
	Determination of tooth depth at calculation point					
7.51	Mean working depth	hmw	2.4873			[mm]
7.52	Mean addendum pinion / wheel	ham1,2	1.7411	0.7462		[mm]
7.53	Mean dedendum pinion / wheel	hfm1,2	1.0571	2.0520		[mm]
7.54	Clearence	c	0.3109	0.2500		[mm]/[mmn]
7.55	Mean whole depth	hm	2.7982			[mm]
	Determination of root angles and face angles					
7.56	Face angle pinion / wheel	deltaa1,2	27.7730	64.7964		[°]
7.57	Root angle pinion / wheel	deltaf1,2	24.1344	61.0596		[°]
7.58	Auxiliary angle for calculating pinion offset angle in root / face plane	fiR, fio	0.0000	0.0000		[°]
7.60	Pinion ofset angle in root / face plane	zetaR, zetao	15.6462	16.2239		[°]
7.62	Addendum angle	Thetaa1,2	2.4024	1.2709		[°]
7.63	Dedendum angle	Thetaf1,2	1.2363	2.4660		[°]
7.64	Pinion / wheel root apex beyond crossing point along pinion / wheel axis	tzR1,2	9.2479	-2.2068		[mm]
7.65	Pinion / wheel face apex beyond crossing point along pinion / wheel axis	tzF1,2	7.6784	-2.5504		[mm]
	Determination of pinion face widt					
7.66	Pinion face width in pitch plane	bp1	16.0928			[mm]
7.67	Pinion face width from calculation point to front crown	b1A	8.1150			[mm]
7.68	Face width	b1	18.0000			[mm]
7.69	Additional pinion face width	bx	0.9536			[mm]

Determination of inner and outer spiral angles

7.72	Wheel cone distance of outer pinion boundary point (>Re2)	Re21	56.2195		[mm]
7.73	Wheel cone distance of inner pinion boundary point (<Ri2)	Ri21	39.1124		[mm]
	Face hobbing:				
7.74	Lead angle of cutter	ny	5.4298		[mm]
7.75	Crown gear to cutter centre distance	roP0	36.9458		[mm]
7.76	Epicycloid base circle radius	rob, rz0	32.4301	4.5157	[mm]
7.77	Auxiliary angle	fie21,fii21	54.5457	74.3676	[°]
7.78	Wheel spiral angle at outer / inner boundary point	betae21, betai21	54.7712	44.2031	[°]
	Face hobbing and face milling:				
7.79	Pinion offset angle in pitch plane at outer / inner boundary point	zetaep21, zetaip21	15.0094	21.8544	[°]
7.80	Pinion spiral angle outer / inner	betae1, betai1	69.7806	66.0575	[°]
	Wheel face hobbing:				
7.81	Auxiliary angle	fie2,fii2	55.6264	73.3082	[°]
7.82	Wheel spiral angle outer / inner	betae2, betai2	54.1091	44.6481	[°]
	Determination of tooth depth				
7.83	Outer addendum	hae1,2	2.1158	0.9159	[mm]
7.84	Outer denendum	hfe1,2	1.2499	2.3815	[mm]
7.85	Outer whole depth	he1,2	3.3657	3.2974	[mm]
7.86	Inner addendum	hai1,2	1.3607	0.5765	[mm]
7.87	Inner dedendum	hfi1,2	0.8614	1.7226	[mm]
7.88	Inner whole depth	hi1,2	2.2221	2.2991	[mm]
	Determination of tooth thickness				
7.89	Mean normal pressure angle	alfan	20.0000		[°]
7.90	Thickness modification coefficient	xsm1,2	-0.0203	-0.1183	[~]
7.91	Mean normal circular tooth thickness	smn1,2	2.2651	1.2971	[mm]
7.92	Mean transverse circular thickness	smt1,2	5.7480	1.9771	[mm]
7.93	Mean normal diameter	dmn1,2	206.1800	384.9807	[mm]
7.94	Mean normal chordal tooth thickness	smnc1,2	2.2651	1.2971	[mm]
7.95	Mean chordal addendum	hamc1,2	1.7467	0.7467	[mm]
	Determination of remaining gear dimensions				
7.96	Tip diameter (outer)	dae1,2	58.8159	99.8166	[mm]
7.97	Root diameter (outer)	dfe1,2	52.7337	96.8767	[mm]
7.98	Tip diameter (inner)	dai1,2	42.0262	72.1229	[mm]
7.99	Root diameter (inner)	dfi1,2	38.0107	70.0731	[mm]
7.100	Crossing point to crown along axis	txo1,2	48.1578	26.0392	[mm]
7.101	Crossing point to front crown along axis	txi1,2	32.2174	19.5223	[mm]
7.102	Pinion whole depth, perpendicular to the root cone	ht1	3.3632		[mm]
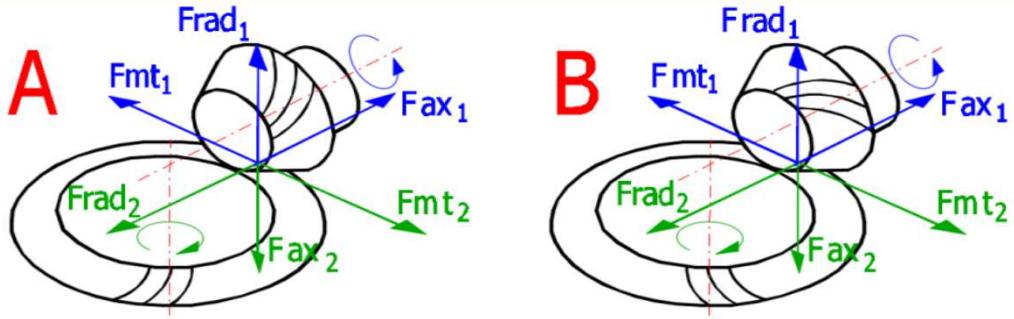
**8.0** ☑ **Analysis of forces (forces acting on the toothing)**

8.1	Selection of source for forces calculation		Methode 1	▼	
8.2	Direction of the teeth pitch (pinion)		A. Left-Hand	▼	
8.3	Tangential force on the pinion / wheel	Fmt1,2	3340.6	4505.0	[N]
8.4	Axial force (A) - drive side flank loading	FaxD1,2	4049.8	78.7	[N]
8.6	Radial force (A) - drive side flank loading	FradD1,2	-509.2	2741.9	[N]
8.5	Axial force (B) - coast side flank loading	FaxC1,2	-2355.8	3199.2	[N]
8.7	Radial force (B) - coast side flank loading	FradC1,2	3837.6	-952.1	[N]

9.1	2D drawing output to:		DXF File	▼
9.2	2D Drawing scale		Automatic	▼
9.3	Detail:		Pinion	▼
9.4	**Definition of the gear wheel dimensions**		**Pinion**	**Gear**			
9.5	Amount of the inner offset	a	1.5000	1.5000	[mm]	☑
9.6	Amount of the outer offset	b	2.3000	3.6000	[mm]
9.7	Mounting distance (inner)	mdi1,2	33.8778	18.6862	40.0000	[mm]
9.8	Mounting distance (external)	mde1,2	50.2243	28.6269	60.0000	[mm]
9.9	Circle on mounting distance (inner)	dmdi1,2	25.7382	68.4612	22.0000	[mm]
9.10	Circle on mounting distance (external)	dmde1,2	39.4655	92.4698	32.0000	[mm]
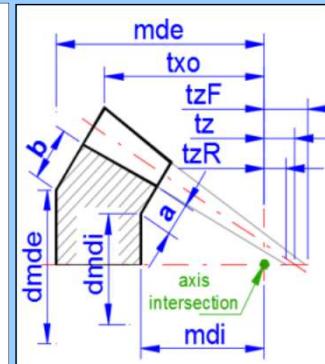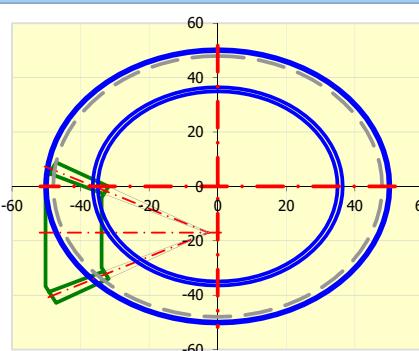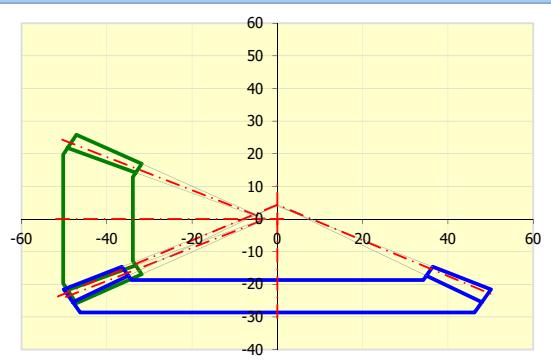
9.11	**Text description (Information for BOM)**
9.12	Row 1 (BOM attribute 1)	**Pinion**	Pignon conique - pignon	☑
9.13	Row 2 (BOM attribute 2)		z1=15, mmn=1.668, betam1=48.9797
9.14	Row 3 (BOM attribute 3)		Matériel: Acier de cémentation (55HRC)
9.15	Row 1 (BOM attribute 1)	**Gear**	Pignon conique - roue	☑
9.16	Row 2 (BOM attribute 2)		z2=45, mmn=1.668, betam2=27.7365
9.17	Row 3 (BOM attribute 3)		Matériel: Acier de cémentation (55HRC)
9.18	Table of parameters		Table of pinion parameters	▼
9.19	**Generation of the basis for the 3D models**
9.20	Generation / Direction of the teeth pitch (pinion)		Pinion ▼	A. Left-Hand ▼
9.21	Pre-fixes of the names of saved files / Saving remarks		05 ▼	No (Notes.out) ▼
9.22	Rotation / mirroring of the gear wheel profile in the coordinate system.		270 [°] ▼	No (Mirror) ▼
9.23	Root fillet radius of tooth rf (pinion / wheel) [modul	A.	0.2500	0.2500
9.24	Coefficient of extension of the profile path	B.	1.10 ▼
9.25	Number of points of tooth flank	C.	20
9.26	Add a profile superstructure	D.	Yes ▼
9.27	The number of curvature angle points of the supers	E.	5
9.28	Close the generated profile	F.	Yes ▼
9.29	Output of curves generated to the format		XLSX (XLS) ▼
9.30	Marking of the points on the tooth curve (only dxf)		No ▼
9.31	Generating the number of cross sections		All in one ▼
9.32	Generate number profile path		1	=< 66 max.
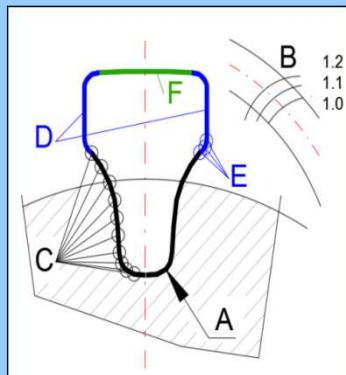
Gearing type-5 (LH, SI units), Depthwise taper-1, u=3, z=15 / 45, sigma=90, alfadD=20, alfadC=20, alflim=1, beta=49, a=17, rc0=35, z0=0, Tha2=1.681, Thf2=3.26, x=0.4, ha=1, hf=1.25, xs=0.049, dm2=84.794, de2=99, b1=17.682, b2=15.3, j=0.527, rf1=0.25, rf2=0.25, mmn=1.668, met=2.2, B:=1.1, C:=20, mde1=50.224, mde2=28.627, mdi1=33.878, mdi2=18.686

9.34 **Graphs and figures**