

WL1+ Example

2 Stage Spur Gearbox calculation

On **EDiT** menu, we recommend the following calculation procedure:

1. **Shaft** define shaft geometry
2. **Material** shaft material selection. (default MDB setting be done at '**Calculation**'))
3. **Bedding** Bearing support type and location
4. **Calculation** calculation default setting
5. **Radial Force ~ Torque, Mass** ... input of forces introduced on the shaft

- Radial force, Path load, Bending moment, Axial force, Torque

- In Gear connection, you can input gear spec. directly or use ZAR1+ EDI import function:

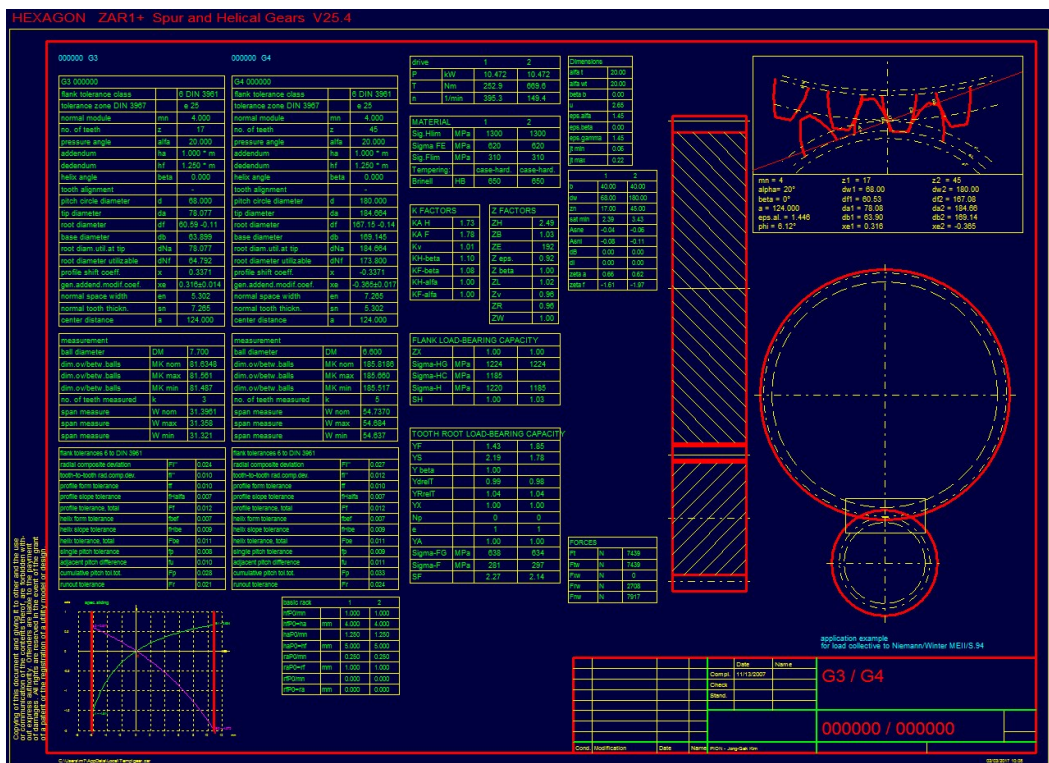
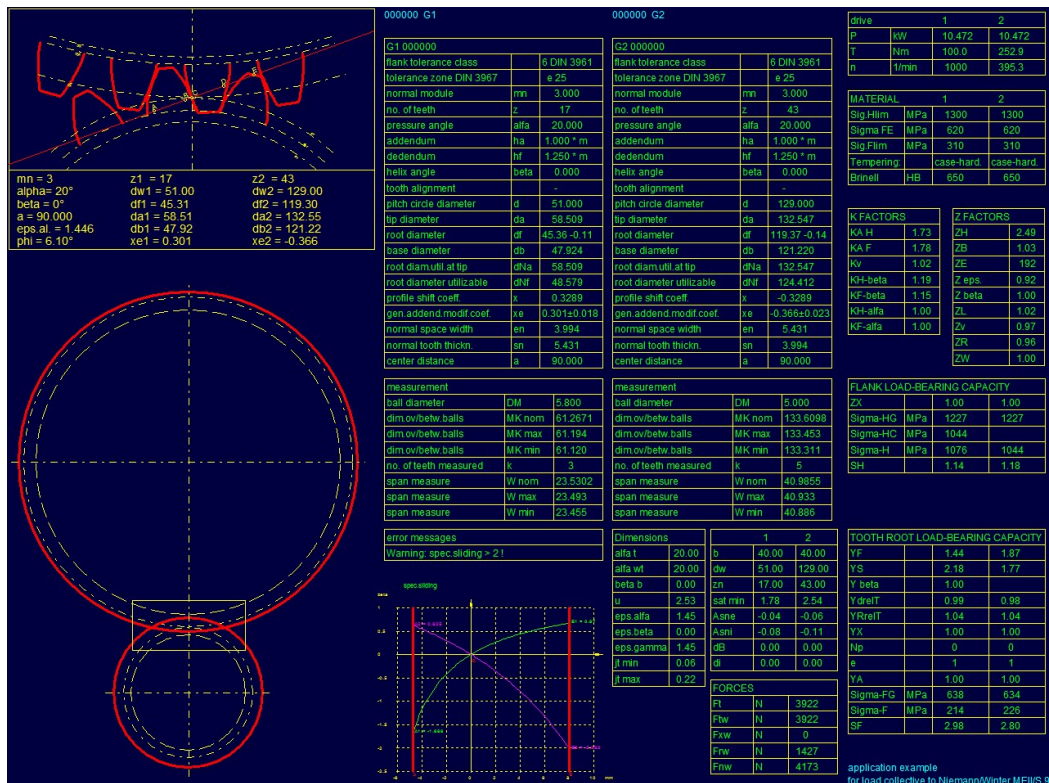
'**Complex Load**'(;1~2 gears) or '**Gear ZAR1+**' can be used for gear connection.

On ZAR1+, save as EDI file(;File → Export EDI) and import it by use of '**Import Edi file of ZAR1+**'.

6. **Stress Concentration zone** ... define factors and location for press fit, keys, inv./serration spline joint ..
7. **Roller Bearing** ... Rolling bearing spec. and selection on Bearing DB.

1. Two Gear pair calculation

Firstly, two spur gear pairs should be calculated on ZAR1+ and saved it as 'G1-G2.edi' and 'G3-G4.edi'.
(File → Export EDI)



2. Shaft Calculation on WL1+

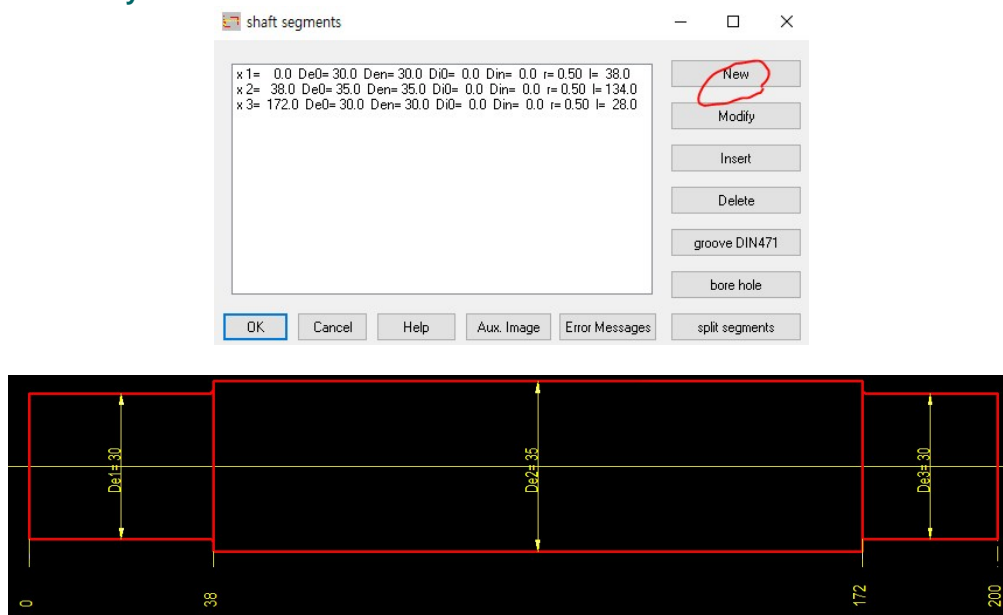
Shaft calculation for input shaft, intermediate shaft, and output shaft will be done here.

Please note:

- If 2 helical gears on a shaft, set for one gear flank direction right and left for the other one to compensate axial load by helix.
- Input shaft and output shaft: position of 2nd torque position is at the end of shaft with load introduction.

2.1 Input Shaft calculation

Input Shaft Geometry: **Shaft** → Standard → New



Select Shaft Material: **Material** → DIN743: 1C45

TAB_A	NAME	STANDARD	TYPE	CONDITION	INFO1	INFO2	SIGMA_B	SIGMA_S	SIGMA_ZDV	SIGMA_BW	TAU_TW	E_MODUL	G_MODUL	DENSITY	ISO	JIS	USA	CHINA
3	C10E	DIN 17210	case-hardening	case-hardened	1.1121	Cr 10	750	430	300	375	225	206000	79000	7.8	C10E	S10C	Grade 1010	10
3	17C3	DIN 17210	case-hardening	case-hardened	1.7016		1050	750	420	525	315	206000	79000	7.8		(SC415)	5115	15C
3	16MnCr5	DIN 17210	case-hardening	case-hardened	1.7131		900	630	360	450	270	206000	79000	7.8	16MnCr5		20CrMn	
3	20MnCr5	DIN 17210	case-hardening	case-hardened	1.7147		1100	730	440	550	330	206000	79000	7.8	20MnCr5	SMnCr420H	5120	20CrMn
3	20MnCr54	DIN 17210	case-hardening	case-hardened	1.7323		900	630	360	450	270	206000	79000	7.8			Grade 4121	
3	17CrNiMo6	DIN 17210	case-hardening	case-hardened	1.6587		1150	830	460	575	345	206000	79000	7.8			A709Gr.100	
3	18CrNiMo7-6	DIN 17210	case-hardening	case-hardened	1.6597		1150	830	460	575	345	206000	79000	7.8			A709Gr.100	
4	1 C 22	EN 10083	heat-treatable	heat-treated	1.0402		500	340	200	250	150	206000	79000	7.8	C20	S20C	Grade 1020	20
4	2 C 22	EN 10083	heat-treatable	heat-treated	1.0402		500	340	200	250	150	206000	79000	7.8	C20	S20C	Grade 1020	20
4	1 C 25	EN 10083	heat-treatable	heat-treated	1.0406		550	370	220	275	165	206000	79000	7.8	C25	S25C	Grade 1025	25
4	1 C 30	EN 10083	heat-treatable	heat-treated	1.0528		550	370	220	275	165	206000	79000	7.8	C30	S30CM	Grade 1030	30
4	1 C 35	EN 10083	heat-treatable	heat-treated	1.0501		630	430	250	315	190	206000	79000	7.8	C35	S35C	Grade 1035	35
4	1 C 40	EN 10083	heat-treatable	heat-treated	1.0511		650	460	260	325	200	206000	79000	7.8	C40	S40C	Grade 1040	40
4	1 C 45	EN 10083	heat-treatable	heat-treated	1.0503		700	490	280	350	210	206000	79000	7.8	C45	S45C	Grade 1045	45
4	2 C 45	EN 10083	heat-treatable	heat-treated	1.0503		700	490	280	350	210	206000	79000	7.8	C45	S45C	Grade 1045	45
4	1 C 50	EN 10083	heat-treatable	heat-treated	1.0540		750	520	300	375	220	206000	79000	7.8	C50	S50C	Grade 1050	50
4	1 C 50i	EN 10083	heat-treatable	heat-treated	1.0501		850	580	340	425	250	206000	79000	7.8	C50	S58C	Grade 1060	60
4	40C2	EN 10083	heat-treatable	heat-treated	1.7006		900	650	360	450	270	206000	79000	7.8	40C2E		5045	
4	41Cr4	EN 10083	heat-treatable	heat-treated	1.7035		1000	800	400	500	300	206000	79000	7.8	41Cr4	SC440(H)	5140	40C
4	34CrMo4	EN 10083	heat-treatable	heat-treated	1.7220		1000	800	400	500	300	206000	79000	7.8	34CrMo4	SCM435	4135	35CrMo

Input

surface roughness Rz [µm]

10

OK Cancel Help Text Aux. Image

Input

coeff. surface strain hardening Kv

1

OK Cancel Help Text Aux. Image

Set Bearing type and support location: **Bedding** → 2 bearing (fixed-floating) ... bearing B1, B2

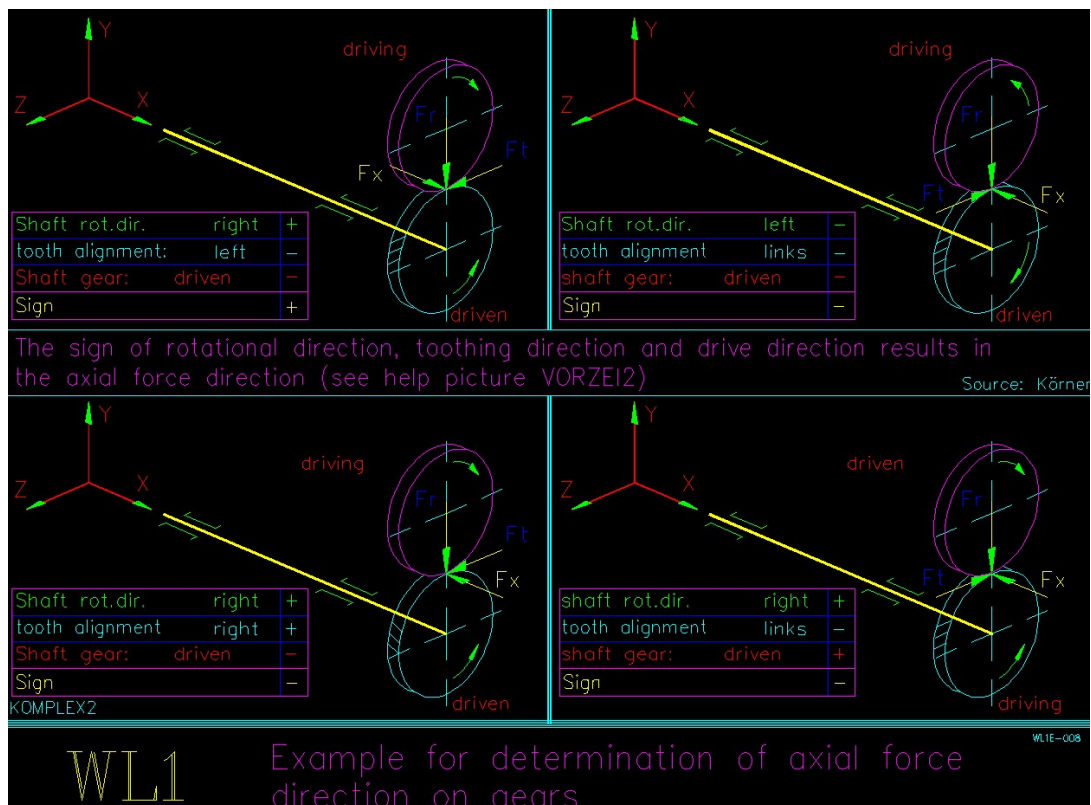
Please note:

- If more than 2 bearings exists, the 1st is A and the last is B. (Ex.: if 5 bearings, order will be A-C-D-E-B)
- For 2 taper roller bearings or angular contact ball bearings, select "radial thrust bearing(O/X-config.)" in WL1+. These bearings are normally adjusted by a nut at assembly until clearance is as desired

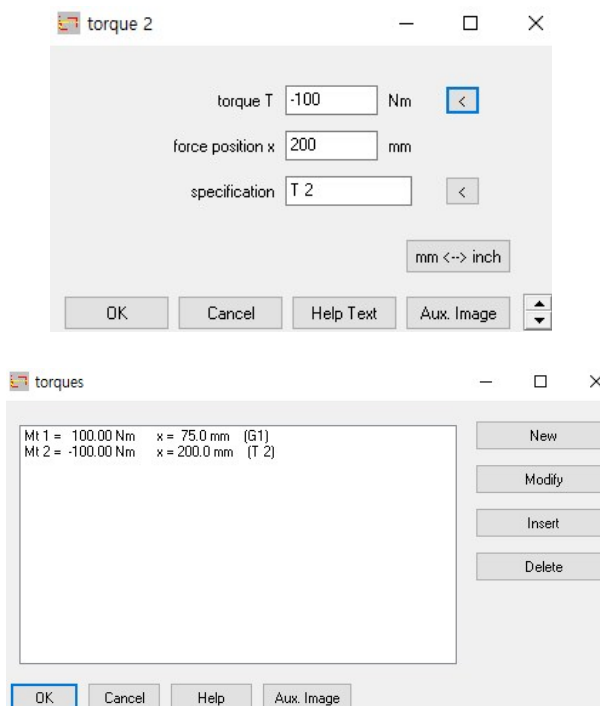
Define Gear spec. on the Shaft: Gear ZAR1+ → import edi file of ZAR1+ → ...

Please note:

- Flank direction and driving/driven has large influence on axial load if gear with big helix angle. Maybe it is easier to directly input axial loads with sign + and -.
- If you import loads from ZAR1+, rotation direction, driving/driven and helix direction defines direction of forces. (see aux. image below)



Torque → New → “<” button click! → $Mt2 = -100\text{Nm}$.



Define Bearing spec. and selection: Roller Bearing → ... bearing spec →

For Bearing B1:

Select

please select...

☒ enter bearing specifications
☐ selection of bearings from database
☐ reset selection
☐ return

OK Cancel Help Text Aux. Image

Select

choose bearing..

☒ locating bearing A
☐ non-locating bearing B

OK Cancel Help Text Aux. Image

OPERATION DATA

minimum radial load Fr min 100000 N
average speed n 1000 1/min
operating temperature theta 50 °C
nominal viscosity lubricant at 40°C 220 mm²/s

reliability 90% L10m a1 = 1

lubricant and material coefficient
☒ a23 to SKF calculation
☐ a23 manual entry 1
☐ a50 calc. to ISO 281
☐ a50 manual entry 1

OK Cancel Help Text Aux. Image mm <-> inch

Fr min is idle load, at least weight of the shaft.

Select

please select...

☐ enter bearing specifications
☒ selection of bearings from database
☐ reset selection
☐ return

Select

choose bearing..

☒ locating bearing A
☐ non-locating bearing B

Select

bearing type for locating bearing A

Groove ball bearing
Self-align.ball bear.
Needle bush
Needle bear. w/o in.rg.
Cylindr. roller bearing
Taper roller bearing
Self-align. roll. bear.
Ang. contact ball bear. [1]
Ang. contact ball bear. [2]
Needle cage

bearing load Fr = 2921 N Fa = 0 N WL1+ database Groove ball bearing

NAME	DI	DA	B	RS_MIN	C	CO	N_FETT	N_OEL	DI1	DA1	DIA_MIN	DAA_MAX	CU	PREIS	INF
61806 (SKF)	30	42	7	0.3	4490	2900	16000	20000	33.7	38.5	32	40	146	0	
61906 (SKF)	30	47	9	0.3	7280	4550	16000	19000	35.2	41.8	32	45	212	0	
16006 (SKF)	30	55	9	0.3	11900	7350	14000	17000	38	47.3	32	53	310	0	
6006 (SKF 1990)	30	55	13	1	13300	8300	12000	15000	38.2	47.1	35	50	355	0	
6206 (SKF 1990)	30	62	16	1	19500	11200	10000	13000	40.3	52.1	35	57	475	0	
6206 E (SKF 1990)	30	62	16	1	23400	12900	10000	13000	39.5	52.9	35	57	475	0	
6306 (SKF 1990)	30	72	19	1.1	28100	16000	9000	11000	44.6	59.9	36.5	65.5	670	0	
6306 ETN9 (SKF)	30	72	19	1.1	32500	17300	11000	14000	42.5	59.7	37	65	740	0	
6406 (SKF 1990)	30	90	23	1.5	43300	24000	8500	10000	50.3	70.7	38	82	1000	0	
6006 (SKF)	30	55	13	1	13800	8300	14000	17000	38.2	46.8	34.6	50.4	335	0	
6206 (SKF)	30	62	16	1	20300	11200	12000	15000	40.4	51.6	35.6	56.4	480	0	
98206 (SKF)	30	62	10	0.6	15900	10200	11000	14000	42.9	54.4	33.2	58.8	440	0	
6206 ETN9 (SKF)	30	62	16	1	23400	12900	12000	15000	39.5	52.9	35.6	56.4	540	0	

Select

radial and axial factor

☐ radial and axial factor
☒ clearance normal (RIKULA_N.HDF)
☐ clearance C3 (RIKUL_C3.HDF)
☐ clearance C4 (RIKUL_C4.HDF)
☐ factors from user file (RIKULA_U.HDF)

WL1+ shaft calculation

life expectation L10h = 4957 hours S dyn = 6.675 continue ?

예(Y) 아니요(N) 취소

For Bearing B2:

OPERATION DATA

minimum radial load Fr min 1000000 N

average speed n 1000 1/min

operating temperature theta 50 °C

nominal viscosity lubricant at 40°C 220 mm²/s

reliability 90% L10m a1 = 1

lubricant and material coefficient

☒ a23 to SKF calculation

☐ a23 manual entry 1 <

☐ aISO calc. to ISO 281

☐ aISO manual entry 1 <

OK Cancel Help Text Aux. Image mm <-> inch

Select

please select ...

☒ enter bearing specifications

☐ selection of bearings from database

☐ reset selection

☐ return

OK Cancel Help Text Aux. Image

Select

choose bearing..

☐ locating bearing A

☒ non-locating bearing B

bearing type for non-locating bearing B

Groove ball bearing

Self-align. ball bear.

Needle bush

Needle bear. w/o in.rg.

Cylindr. roller bearing

Taper roller bearing

Self-align. roll. bear.

Ang. contact ball bear. (1)

Ang. contact ball bear. (2)

Needle cage

bearing load Fr = 1252 N Fa = 0 N WL1+ database Groove ball bearing

File View Help

Search Search Next 70 /607 OK Cancel

NAME	DI	DA	B	RS_MIN	C	C0	N_FETT	N_OEL	DI1	DA1	DIA_MIN	DAA_MAX	CU
61806 (SKF)	30	42	7	0.3	4490	2900	16000	20000	33.7	38.5	32	40	146
61906 (SKF)	30	47	9	0.3	7280	4550	16000	19000	35.2	41.8	32	45	212
16006 (SKF)	30	55	9	0.3	11900	7350	14000	17000	38	47.3	32	53	310
6006 (SKF 1990)	30	55	13	1	13300	8300	12000	15000	38.2	47.1	35	50	355
6206 (SKF 1990)	30	62	16	1	19500	11200	10000	13000	40.3	52.1	35	57	475
6206 E (SKF 1990)	30	62	16	1	23400	12900	10000	13000	39.5	52.9	35	57	475
6306 (SKF 1990)	30	72	19	1.1	28100	16000	9000	11000	44.6	59.9	36.5	65.5	670
6306 ETN9 (SKF)	30	72	19	1.1	32500	17300	11000	14000	42.5	59.7	37	65	740
6406 (SKF 1990)	30	90	23	1.5	43300	24000	8500	10000	50.3	70.7	38	82	1000
6006 (SKF)	30	55	13	1	13800	8300	14000	17000	38.2	46.8	34.6	50.4	335
6206 (SKF)	30	62	16	1	20300	11200	12000	15000	40.4	51.6	35.6	56.4	490

Select

radial and axial factor

☐ radial and axial factor

☒ clearance normal (RIKULA_N.HDF)

☐ clearance C3 (RIKUL_C3.HDF)

☐ clearance C4 (RIKUL_C4.HDF)

☐ factors from user file (RIKULA_U.HDF)

life expectation L10h = 62974 hours S dyn = 15.58 continue ?

예(Y) 아니요(N) 취소

2.2 Intermediate Shaft calculation

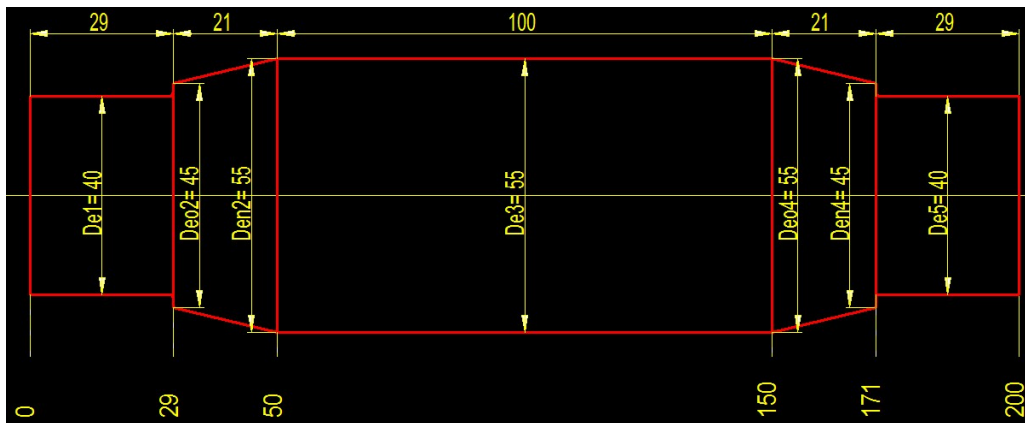
Intermediate Shaft Geometry: **Shaft** → Standard → New

shaft segments

x 1= 0.0 De0= 40.0 Den= 40.0 Di0= 0.0 Din= 0.0 r= 0.50 l= 29.0
 x 2= 29.0 De0= 45.0 Den= 55.0 Di0= 0.0 Din= 0.0 r= 0.50 l= 21.0
 x 3= 50.0 De0= 55.0 Den= 55.0 Di0= 0.0 Din= 0.0 r= 0.50 l= 100.0
 x 4= 150.0 De0= 55.0 Den= 45.0 Di0= 0.0 Din= 0.0 r= 0.50 l= 21.0
 x 5= 171.0 De0= 40.0 Den= 40.0 Di0= 0.0 Din= 0.0 r= 0.50 l= 29.0

New
 Modify
 Insert
 Delete
 groove DIN471
 bore hole
 split segments

OK Cancel Help Aux. Image



Select Shaft Material: Material → DIN743: 1C45

material choice

File View Help

Search Search Next 24 /40 OK Cancel

TAB_A	NAME	STANDARD	TYPE	CONDITION	INFO1	INFO2	SIGMA_B	SIGMA_S	SIGMA_ZDW	SIGMA_BW	TAU_TW	E_MODUL	G_MODUL	DENSITY	ISO	JIS	USA	CHINA
3	C10E	DIN 17210	case-hardening	case-hardened	1.1121	Ck 10	750	430	300	375	225	206000	79000	7.8	C10E	S10C	Grade 1010	10
3	17C3	DIN 17210	case-hardening	case-hardened	1.7016		1050	750	420	525	315	206000	79000	7.8		(SCr415)	5115	15Cr
3	16MnCr5	DIN 17210	case-hardening	case-hardened	1.7131		900	630	360	450	270	206000	79000	7.8	16MnCr5		5115	20CrMn
3	20MnCr5	DIN 17210	case-hardening	case-hardened	1.7147		1100	730	440	550	330	206000	79000	7.8	20MnCr5	SMnCr420H	5120	20CrMn
3	20MnCr5	DIN 17210	case-hardening	case-hardened	1.7323		900	630	360	450	270	206000	79000	7.8			Grade 4121	
3	17CrNiMo6	DIN 17210	case-hardening	case-hardened	1.6587		1150	830	460	575	345	206000	79000	7.8			A709Gr.100	
3	18CrNiMo7-6	DIN 17210	case-hardening	case-hardened	1.6587		1150	830	460	575	345	206000	79000	7.8			A709Gr.100	
4	1 C 22	EN 10083	heat-treatable	heat-treated	1.0402		500	340	200	250	150	206000	79000	7.8	C20	S20C	Grade 1020	20
4	2 C 22	EN 10083	heat-treatable	heat-treated	1.0402		500	340	200	250	150	206000	79000	7.8	C20	S20C	Grade 1020	20
4	1 C 25	EN 10083	heat-treatable	heat-treated	1.0406		550	370	220	275	165	206000	79000	7.8	C25	S25C	Grade 1025	25
4	1 C 30	EN 10083	heat-treatable	heat-treated	1.0528		550	370	220	275	165	206000	79000	7.8	C30	S30CM	Grade 1030	30
4	1 C 35	EN 10083	heat-treatable	heat-treated	1.0501		630	430	250	315	190	206000	79000	7.8	C35	S35C	Grade 1035	35
4	1 C 40	EN 10083	heat-treatable	heat-treated	1.0511		650	460	260	325	200	206000	79000	7.8	C40	S40C	Grade 1040	40
4	1 C 45	EN 10083	heat-treatable	heat-treated	1.0503		700	490	280	350	210	206000	79000	7.8	C45	S45C	Grade 1045	45
4	2 C 45	EN 10083	heat-treatable	heat-treated	1.0503		700	490	280	350	210	206000	79000	7.8	C45	S45C	Grade 1045	45
4	1 C 50	EN 10083	heat-treatable	heat-treated	1.0540		750	520	300	375	220	206000	79000	7.8	C50	S50C	Grade 1050	50
4	(1 C 60)	EN 10083	heat-treatable	heat-treated	1.0601		850	580	340	425	250	206000	79000	7.8	C60	S58C	Grade 1060	60
4	46Cr2	EN 10083	heat-treatable	heat-treated	1.7006		900	650	360	450	270	206000	79000	7.8	46Cr2E		5045	
4	41Cr4	EN 10083	heat-treatable	heat-treated	1.7035		1000	800	400	500	300	206000	79000	7.8	41Cr4	SCr440(H)	5140	40Cr
4	34CrMo4	EN 10083	heat-treatable	heat-treated	1.7220		1000	800	400	500	300	206000	79000	7.8	34CrMo4	SCM435	4135	35CrMo

Input

surface roughness Rz [µm]

10

OK Cancel Help Text Aux. Image

Input

coeff. surface strain hardening Kv

1

OK Cancel Help Text Aux. Image

Set Bearing type and support location: Bedding → 2 bearing (fixed-floating) ... bearing B3, B4

WL1+ shaft calculation

bearing type

bearing position
☐ consider stiffness of bearing and housing

spring rate
 bearing force angle
 average rolling bearing diameter

A. locating bearing
 x 20 mm
 R N/mm
 w °
 dw mm

B. floating bearing
 x 180 mm
 R N/mm
 w °
 dw mm

Define 2 Gears on the Shaft: Complex Load → 2 spur or helical gears → import edi file of ZAR1+ → ...

Select type of complex load
☐ 1 spur or helical gear
☒ 2 spur or helical gears
☐ no gears

Select entry mode
☐ calculation from P, n, alpha, beta, d, u
☐ calculation from Fr, Fx, Ft, Mt
☒ import edi file of ZAR1+

Select shaft rotation direction
☐ right
☒ left

열기
 찾는 위치(O): EDI
 이름: G1-G2.edi, G3-G4.edi, STAGE1.edi, STAGE2.edi, STAGE3.edi
 수정한 날짜: 2017-02-03 오전 9..., 2017-02-03 오전 9..., 2017-02-02 오전 11..., 2017-02-02 오전 11..., 2017-02-02 오전 11...
 유형: EDI 파일, EDI 파일, EDI 파일, EDI 파일, EDI 파일
 파일 이름(N): G1-G2
 파일 형식(T): *.EDI
 열기(O), 취소

Select which gear should be entered?
☐ wheel1
☒ wheel2

Select 1.gear: drive type of gear shaft
☒ driven
☐ driving

Input 1.gear: x-position on the shaft [mm]
 75

Input 1.gear: bearing angle relative to y axis [°]
 0

WL1+ shaft calculation
 torque Mt= 252.9 Nm adopt ?
 예(Y), 아니요(N), 취소

열기
 찾는 위치(O): EDI
 이름: G1-G2.edi, G3-G4.edi, STAGE1.edi, STAGE2.edi, STAGE3.edi
 수정한 날짜: 2017-02-03 오전 9..., 2017-02-03 오전 9..., 2017-02-02 오전 11..., 2017-02-02 오전 11..., 2017-02-02 오전 11...
 유형: EDI 파일, EDI 파일, EDI 파일, EDI 파일, EDI 파일
 파일 이름(N): G3-G4
 파일 형식(T): *.EDI
 열기(O), 취소

Select which gear should be entered?
☒ wheel1
☐ wheel2

Select 2.gear: drive type of gear shaft
☒ driven
☐ driving

Input 2.gear: x-position on the shaft [mm]
 125

Input 2.gear: bearing angle relative to y axis [°]
 0

WL1+ shaft calculation
 torque Mt= 252.9 Nm adopt ?
 예(Y), 아니요(N), 취소

Input set gears as additional mass?
 Select
☒ Yes
☐ No

Torque

torques

Mt 1 = 252.94 Nm x = 75.0 mm ()
 Mt 2 = -252.94 Nm x = 125.0 mm ()

Define Bearing spec. and selection: Roller Bearing → ... bearing spec → ...

For Bearing B3:

Select

please select ...

☒ enter bearing specifications

☐ selection of bearings from database

☐ reset selection

☐ return

OK Cancel Help Text Aux. Image

Select

choose bearing..

☒ locating bearing A

☐ non-locating bearing B

OK Cancel Help Text Aux. Image

OPERATION DATA

minimum radial load Fr min N

average speed n 1/min

operating temperature theta °C

nominal viscosity lubricant at 40°C mm²/s

reliability L10m a1 = 1

lubricant and material coefficient

☒ a23 to SKF calculation

☐ a23 manual entry

☐ aISO calc. to ISO 281

☐ aISO manual entry

OK Cancel Help Text Aux. Image

Select

please select ...

☐ enter bearing specifications

☒ selection of bearings from database

☐ reset selection

☐ return

Select

choose bearing..

☒ locating bearing A

☐ non-locating bearing B

Select

bearing type for locating bearing A

Groove ball bearing

Self-align. ball bear.

Needle bush

Needle bear. w/o in. rg.

Cylindr. roller bearing

Taper roller bearing

Self-align. roll. bear.

Ang. contact ball bear. (1)

Ang. contact ball bear. (2)

Needle cage

bearing load Fr = 5460 N Fa = 0 N WL1+ database Groove ball bearing

File View Help

Search Search Next 90 /607 OK Cancel

NAME	DI	DA	B	RS_MIN	C	C0	N_FET	N_OEL	DI1	DA1	DIA_MIN	DAA_MAX	CU
6008 (SKF)	40	68	15	1	17800	11600	11000	14000	49.3	58.8	44.6	63.4	490
5208 (SKF 1990)	40	80	18	1.1	30700	19000	8500	10000	52.6	67.9	46.5	73.5	800
6208 ETN9 (SKF)	40	80	18	1.1	35800	20800	9000	11000	52	68.8	47	73	880
6208 (SKF)	40	80	18	1.1	32500	19000	9000	11000	52.6	57.4	47	73	800
6308 (SKF 1990)	40	90	23	1.5	41000	24000	7500	9000	56.1	74.7	48	82	1020
6308 (SKF)	40	90	23	1.5	42300	24000	9000	11000	56.1	73.8	49	81	1020
6408 (SKF 1990)	40	110	27	2	63700	36500	6700	8000	62.8	88	49	101	1530
6408 (SKF)	40	110	27	2	63700	36500	7500	9000	62.8	87	53	97	1530
NB 709 (NSK)	45	55	6	0.3	3800	4050	11000	14000	48	52	47	53	0
61809 (SKF 1990)	45	58	7	0.3	6050	4300	9500	12000	48.7	54.5	47	56	228
61809 (SKF)	45	58	7	0.3	6630	6100	11000	14000	49.1	53.9	47	56	260

Select

radial and axial factor

☐ radial and axial factor

☒ clearance normal (RIKULA_N.HDF)

☐ clearance C3 (RIKUL_C3.HDF)

☐ clearance C4 (RIKUL_C4.HDF)

☐ factors from user file (RIKULA_U.HDF)

WL1+ shaft calculation

? life expectation L10h = 7492 hours S dyn = 5.623 continue ?

예(Y) 아니요(N) 취소

For Bearing B4:

OPERATION DATA

minimum radial load Fr min 1000000 N

average speed n 395.4 1/min

operating temperature theta 50 °C

nominal viscosity lubricant at 40°C 220 mm²/s

reliability 90% L10m a1 = 1

lubricant and material coefficient

☒ a23 to SKF calculation

☐ a23 manual entry 0.89

☐ aISO calc. to ISO 281

☐ aISO manual entry 1

OK Cancel Help Text Aux. Image mm <-> inch

Select

please select ...

☒ enter bearing specifications

☐ selection of bearings from database

☐ reset selection

☐ return

Select

choose bearing..

☐ locating bearing A

☒ non-locating bearing B

Select

bearing type for non-locating bearing B

☒ Groove ball bearing

☐ Self-align. ball bear.

☐ Needle bush

☐ Needle bear. w/o in. rg.

☐ Cylindr. roller bearing

☐ Taper roller bearing

☐ Self-align. roll. bear.

☐ Ang. contact ball bear. (1)

☐ Ang. contact ball bear. (2)

☐ Needle cage

bearing load Fr = 6630 N Fa = 0 N WL1+ database Groove ball bearing

File View Help

Search Search Next 90 /607 OK Cancel

NAME	DI	DA	B	RS_MIN	C	C0	N_FETT	N_OEL	DI1	DA1	DIA_MIN	DAA_MAX
6208 (SKF 1990)	40	80	18	1.1	30700	19000	8500	10000	52.6	67.9	46.5	73.5
6208 ETN9 (SKF)	40	80	18	1.1	35800	20800	9000	11000	52	68.8	47	73
6208 (SKF)	40	80	18	1.1	32500	19000	9000	11000	52.6	57.4	47	73
6308 (SKF 1990)	40	90	23	1.5	41000	24000	7500	9000	56.1	74.7	48	82
6308 ISKF1	40	90	23	1.5	42300	24000	9000	11000	56.1	73.8	49	81

Select

radial and axial factor

☐ radial and axial factor

☒ clearance normal (RIKULA_N.HDF)

☐ clearance C3 (RIKUL_C3.HDF)

☐ clearance C4 (RIKUL_C4.HDF)

☐ factors from user file (RIKULA_U.HDF)

WL1+ shaft calculation

? life expectation L10h = 4185 hours S dyn = 4.63 continue ?

예(Y) 아니요(N) 취소

2.3 Output Shaft calculation

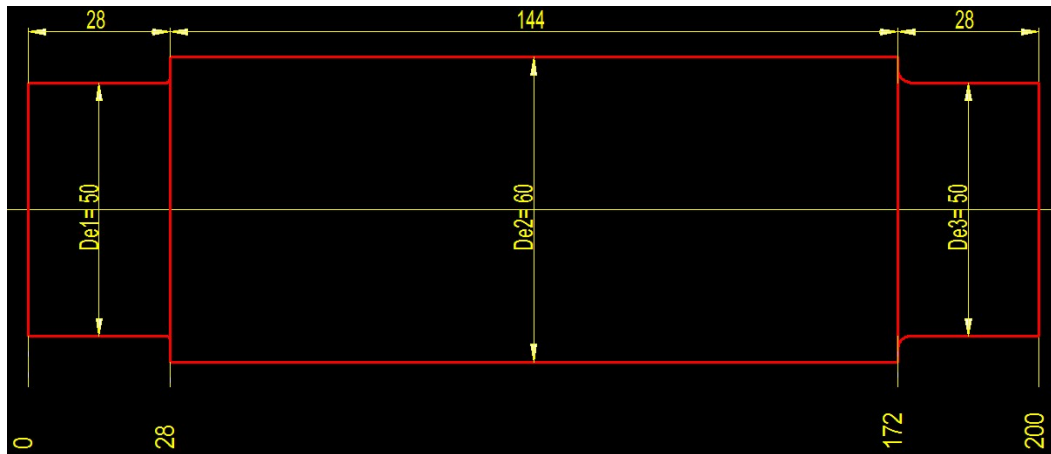
Output Shaft Geometry: Shaft → Standard → New

shaft segments

x 1= 0.0 De0= 50.0 Den= 50.0 Di0= 0.0 Din= 0.0 r= 0.50 l= 28.0
 x 2= 28.0 De0= 60.0 Den= 60.0 Di0= 0.0 Din= 0.0 r= 2.50 l= 144.0
 x 3= 172.0 De0= 50.0 Den= 50.0 Di0= 0.0 Din= 0.0 r= 2.50 l= 28.0

New
 Modify
 Insert
 Delete
 groove DIN471
 bore hole
 split segments

OK Cancel Help Aux. Image



Select Shaft Material: **Material** → DIN743: 1C45

material choice

File View Help

Search Search Next 24 / 40 OK Cancel

TAB_A	NAME	STANDARD	TYPE	CONDITION	INFO1	INFO2	SIGMA_B	SIGMA_S	SIGMA_ZDW	SIGMA_BW	TAU_TW	E_MODUL	G_MODUL	DENSITY	ISO	JIS	USA	CHINA
3	C10E	DIN 17210	case-hardening	case-hardened	1.1121	Cl. 10	750	430	300	375	225	206000	79000	7.8	C10E	S10C	Grade 1010	10
3	17C3	DIN 17210	case-hardening	case-hardened	1.7016		1050	750	420	525	315	206000	79000	7.8		(SC415)	5115	15Cr
3	18MnCr5	DIN 17210	case-hardening	case-hardened	1.7131		900	630	360	450	270	206000	79000	7.8	18MnCr5		5115	20CrMn
3	20MnCr5	DIN 17210	case-hardening	case-hardened	1.7147		1100	730	440	550	330	206000	79000	7.8	20MnCr5	SMnCr420H	5120	20CrMn
3	20MnCr54	DIN 17210	case-hardening	case-hardened	1.7323		900	630	360	450	270	206000	79000	7.8				Grade 4121
3	17CrNiMo6	DIN 17210	case-hardening	case-hardened	1.6587		1150	830	460	575	345	206000	79000	7.8				A709Gr. 100
3	18CrNiMo7-6	DIN 17210	case-hardening	case-hardened	1.6587		1150	830	460	575	345	206000	79000	7.8				A709Gr. 100
4	1 C 22	EN 10083	heat-treatable	heat-treated	1.0402		500	340	200	250	150	206000	79000	7.8	C20	S20C	Grade 1020	20
4	2 C 22	EN 10083	heat-treatable	heat-treated	1.0402		500	340	200	250	150	206000	79000	7.8	C20	S20C	Grade 1020	20
4	1 C 25	EN 10083	heat-treatable	heat-treated	1.0406		550	370	220	275	165	206000	79000	7.8	C25	S25C	Grade 1025	25
4	1 C 30	EN 10083	heat-treatable	heat-treated	1.0528		550	370	220	275	165	206000	79000	7.8	C30	S30CM	Grade 1030	30
4	1 C 35	EN 10083	heat-treatable	heat-treated	1.0501		630	430	250	315	190	206000	79000	7.8	C35	S35C	Grade 1035	35
4	1 C 40	EN 10083	heat-treatable	heat-treated	1.0511		650	460	260	325	200	206000	79000	7.8	C40	S40C	Grade 1040	40
4	1 C 45	EN 10083	heat-treatable	heat-treated	1.0503		700	490	280	350	210	206000	79000	7.8	C45	S45C	Grade 1045	45
4	2 C 45	EN 10083	heat-treatable	heat-treated	1.0503		700	490	280	350	210	206000	79000	7.8	C45	S45C	Grade 1045	45
4	1 C 50	EN 10083	heat-treatable	heat-treated	1.0540		750	520	300	375	220	206000	79000	7.8	C50	S50C	Grade 1050	50
4	1 C 60	EN 10083	heat-treatable	heat-treated	1.0601		850	580	340	425	250	206000	79000	7.8	C60	S58C	Grade 1060	60
4	45C2	EN 10083	heat-treatable	heat-treated	1.7006		900	650	360	450	270	206000	79000	7.8	45C2E		5045	
4	41Cr4	EN 10083	heat-treatable	heat-treated	1.7035		1000	800	400	500	300	206000	79000	7.8	41Cr4	SC440(H)	5140	40Cr
4	34CrMo4	EN 10083	heat-treatable	heat-treated	1.7220		1000	800	400	500	300	206000	79000	7.8	34CrMo4	SCM435	4135	35CrMo

Input

surface roughness Rz [µm]

10

OK Cancel Help Text Aux. Image

Input

coeff. surface strain hardening Kv

1

OK Cancel Help Text Aux. Image

Set Bearing type and support location: **Bedding** → 2 bearing (fixed-floating) ... bearing B5, B6

WL1+ shaft calculation

bearing type
2 bearing (fixed-floating bearing) ▼

☐ consider stiffness of bearing and housing

bearing position
x 20 mm

spring rate
R N/mm

bearing force angle
w °

average rolling bearing diameter
dw mm

A. locating bearing
x 180 mm
R N/mm
w °
dw mm

B. floating bearing
x 180 mm
R N/mm
w °
dw mm

Define Gear spec. on the Shaft: Gear ZAR1+ → import edi file of ZAR1+ → ...

Select

entry mode

☐ calculation from P, n, alpha, B, d, u

☐ calculation from Fr, Ft, Ft, Mt

☒ import edi file of ZAR1+

OK Cancel Help Text Aux. Image

Input

specification

G4

Select

shaft rotation direction

☐ right

☒ left

열기

찾는 위치(): EDI

이름

G1-G2.edi 2017-02-03

G3-G4.edi 2017-02-03

Select

which gear should be entered?

☐ wheel1

☒ wheel2

Select

1. gear: drive type of gear shaft

☐ driven

☒ driving

Input

1. gear: x-position on the shaft [mm]

125

Input

1. gear: bearing angle relative to y axis [°]

0

WL1+ shaft calculation

? torque Mt= 669.6 Nm adopt ?

예(Y) 아니오(N) 취소

WL1+ shaft calculation

? submit 2xfq, fx, mb ?

예(Y) 아니오(N) 취소

Input

set gears as additional mass?

Select

☒ Yes

☐ No

OK Cancel Help Text Aux. Image

Torque → New → “<” button click! → Mt2=-669.6Nm.

torque 2

torque T -669.6 Nm

force position x 200 mm

specification T 2

mm <-> inch

OK Cancel Help Text Aux. Image

torques

Mt 1 = 669.60 Nm x = 125.0 mm [G4]

Mt 2 = -669.60 Nm x = 200.0 mm [T 2]

New

Modify

Insert

Delete

Define Bearing spec. and selection: Roller Bearing → ... bearing spec → ...

For Bearing B5:

Select

please select ...

☒ enter bearing specifications

☐ selection of bearings from database

☐ reset selection

☐ return

OK Cancel Help Text Aux Image

Select

choose bearing..

☒ locating bearing A

☐ non-locating bearing B

OK Cancel Help Text Aux Image

OPERATION DATA

minimum radial load Fr min 1000000 N

average speed n 1500 1/min

operating temperature theta 50 °C

nominal viscosity lubricant at 40°C 220 mm²/s

reliability 90% L10m a1 = 1

lubricant and material coefficient

☒ a23 to SKF calculation

☐ a23 manual entry 2.053

☐ aISO calc. to ISO 281

☐ aISO manual entry 1

OK Cancel Help Text Aux Image mm <-> inch

Select

please select ...

☐ enter bearing specifications

☒ selection of bearings from database

☐ reset selection

☐ return

Select

choose bearing..

☒ locating bearing A

☐ non-locating bearing B

Select

bearing type for locating bearing A

Groove ball bearing

Self-align. ball bear.

Needle bush

Needle bear. w/o in. rg.

Cylindr. roller bearing

Taper roller bearing

Self-align. roll. bear.

Ang. contact ball bear. (1)

Ang. contact ball bear. (2)

Needle cage

bearing load Fr = 2721 N Fa = 0 N WL1+ database Groove ball bearing

File View Help

Search Search Next 104 / 607 OK Cancel

NAME	DI	DA	B	RS_MIN	C	C0	N_FET	N_OEL	DI1	DA1
16010 (SKF 1990)	50	80	10	0.6	16300	11400	8500	10000	60	
16010 (SKF)	50	80	10	0.6	16800	11400	10000	11000	60	
6010 (SKF 1990)	50	80	16	1	21600	16000	8500	10000	59.7	
6010 (INA)	50	80	16	1	20800	15600	8500	20000	59.7	

Select

radial and axial factor

☐ radial and axial factor

☒ clearance normal (RIKULA_N.HDF)

☐ clearance C3 (RIKUL_C3.HDF)

☐ clearance C4 (RIKUL_C4.HDF)

☐ factors from user file (RIKULA_U.HDF)

WL1+ shaft calculation

life expectation L10h = 55778 hours S dyn = 7.937 continue ?

예(Y) 아니오(N) 취소

For Bearing B6:

Figure 10 shows the 'Select' window with the 'bearing type for non-locating bearing B' dropdown menu open. The menu lists the following options: Groove ball bearing (selected), Self-align. ball bear., Needle bush, Needle bear. w/o in. r.g., Cylindr. roller bearing, Taper roller bearing, Self-align. roll. bear., Ang. contact ball bear. (1), Ang. contact ball bear. (2), and Needle cage.

bearing load $F_r = 5195 \text{ N}$ $F_a = 0 \text{ N}$ WL1+ database Groove ball bearing

File View Help

◀ ◀ ▶ ▶ Search Search Next 104 /607 OK Cancel

	NAME	DI	DA	B	RS_MIN	C	CO	N_FETT	N_OEL
▶	6010 (SKF 1990)	50	80	16	1	21600	16000	8500	10000
	6010 (INA)	50	80	16	1	20800	15600	8500	20000
	6010 (SKF)	50	80	16	1	22900	16000	9000	11000