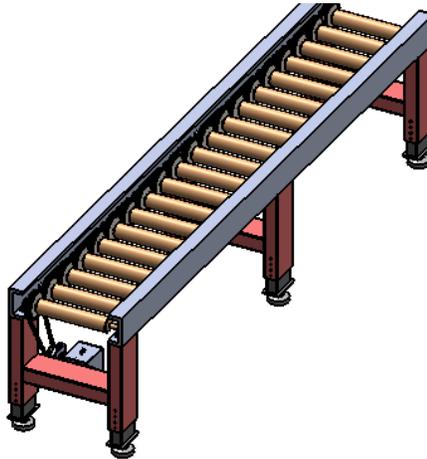


Chain-Roller Conveyor project

Spring 2022

EDPT602



Under supervision of:

Prof. Hesham Hegazy

Done by:

Names	ID number	Tutorial
Maryam Sherif	49-4013	T-32
Ayeshah Emad	49-19471	T-32
Salah Eldin Mohamed	49-18052	T-32
Yasmin Gabr	49-3334	T-32
Shehab Ibrahim	49-7639	T-32

Table of Contents

Introduction	3
Motor Selection	4
Gearbox Design	4
Bearings on Gearbox	7
Couplings calculations	9
Choosing the proper chain for rollers	11
Bearings Selection	13

Introduction

Nowadays, almost all industries require the transportation and handling of materials for the packaging, sorting, and distributing phases of production. Consequently, conveyors became a large necessity in any wide range industry. The main purpose of a conveyor system is to move materials from one position to another in a quick but efficient fashion. Conveyors are also used to: create buffers in the delivery of products in a specific sequence that fits the production line, transport products that are considerably dense for team members to carry, prevent workers from getting injured due to repetitive movement, avoid possible damage caused by movement of products, and create a flexible storage system, where the process flow is stabilized by raising or lowering the amount of products.

Based on their functionality and usage mode, there are many types and designs of industrial conveyors. Some types of conveyors that are mounted on the floor are conventional roller, motorized roller, and belt conveyors, while overhead conveyor types include electric track, inclined, and ramped conveyors. Although all types are very important in different industries, roller conveyor systems are the most employed type of conveyor systems. Since conveyors provide a significant service for industries, their applications are limitless: airports, distribution centers, food industry, packaging industries, and postal sectors.

In this project, we will be designing a roller conveyor that is driven by chains for the transportation of boxes. The design considerations of each component of the roller conveyor are clearly documented in this report.

Motor Selection

We first calculated the number of boxes to be held by the conveyor:

$$N_{boxes} = \frac{L_{total}}{L_{box}} = \frac{6000}{500} = 12 \text{ Box}$$

Then using the velocity required and the weight given of the boxes we got the power required:

$$H = W * V = (12 * 50 * 9.81) * 0.8 = 4.7 \text{ kW}$$

In addition, from the CHIARAVALLI catalog we chose the next higher motor in power.

6 POLI 1000 min⁻¹

P _N [kW]	Motore	Poli	n _N [min ⁻¹]	M _N [Nm]	I _N [A]	COS φ	η 100%	M _s /M _N	M _{max} /M _N	I _s /I _N	J ₀ [kg m ²]	W [kg]
5,5	CHT 132 MB	6	960	54,7	11,9	0,78	85,3	2,0	2,2	6,5	0,046	64
7,5	CHT 160 M	6	940	76,2	16,1	0,78	86,0	2,0	2,0	6,5	0,088	108
11	CHT 160 L	6	940	111,8	23,4	0,78	87,0	2,0	2,0	6,5	0,116	126

Figure 1. CHIARAVALLI Catalog selected motor

The roller diameter required to be within (100<D<150mm), we will choose 125mm

Specifications now goes as follow:

$$\omega = 960 \text{ RPM} v = 0.8 \text{ m/s} \phi_{roller} = 125 \text{ mm}$$

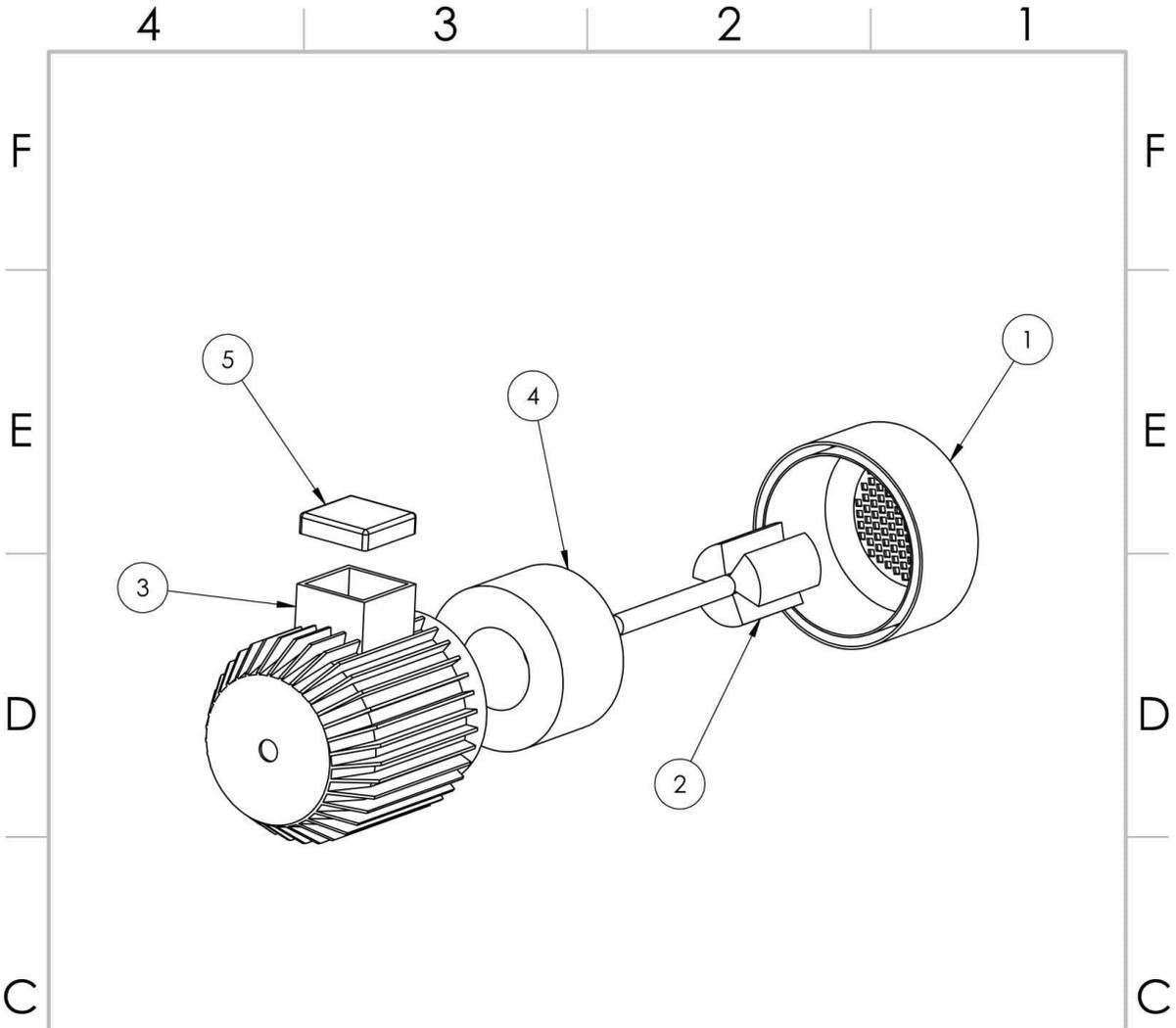
We can then find the required speed in RPM

$$w_{required} = \frac{v}{r} * \frac{60}{2\pi} = \frac{0.8}{0.125} * \frac{60}{\pi} = 122.23 \approx 120$$

Reduction ratio

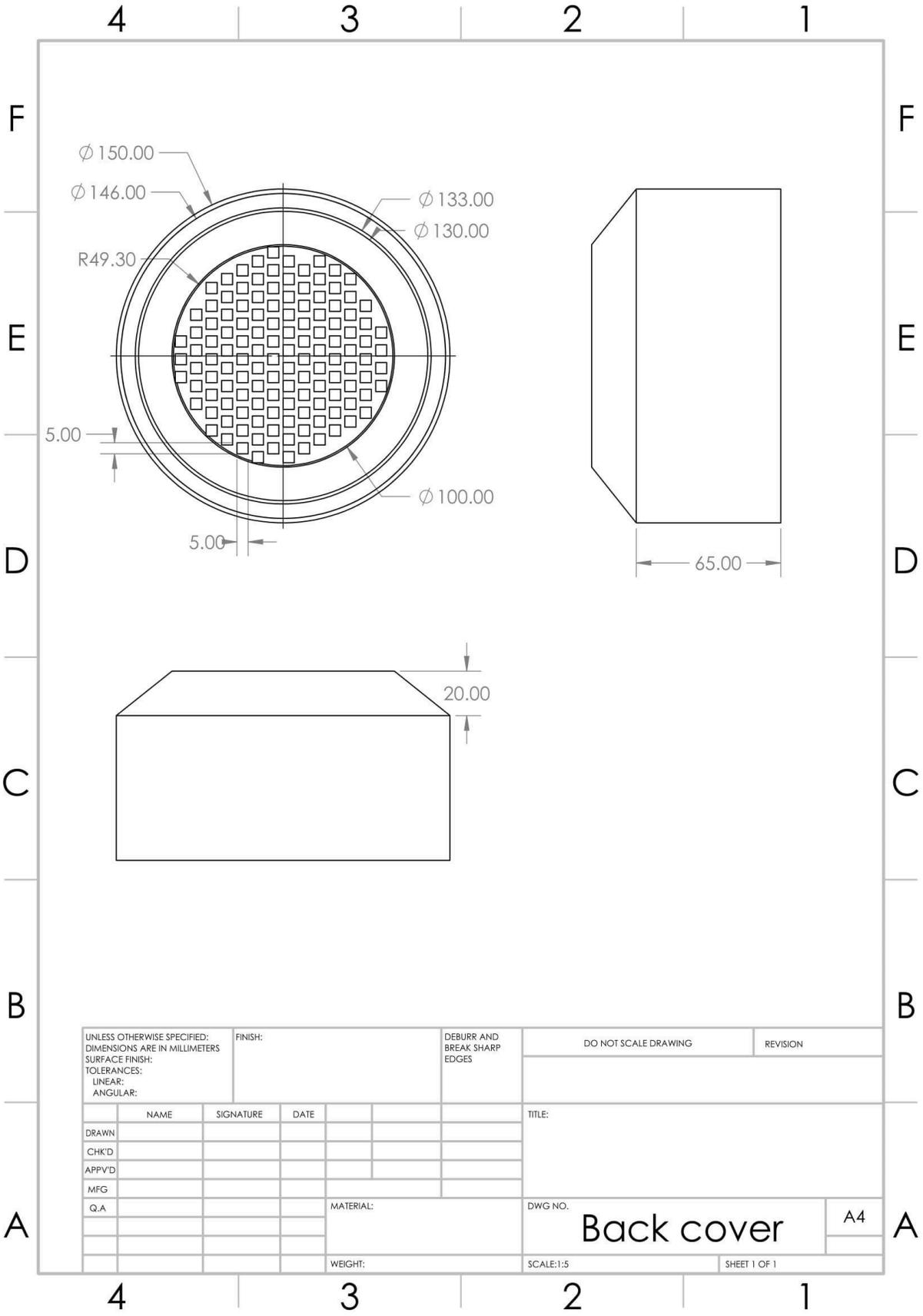
$$i = \frac{\omega_{driver}}{\omega_{driven}} = \frac{960}{120} = 8$$

In our design we will divide this reduction into two stages, one in the gearbox with $i = 4$ and another using the chain driver with $i = 2$ so that $i_{total} = 4 * 2 = 8$

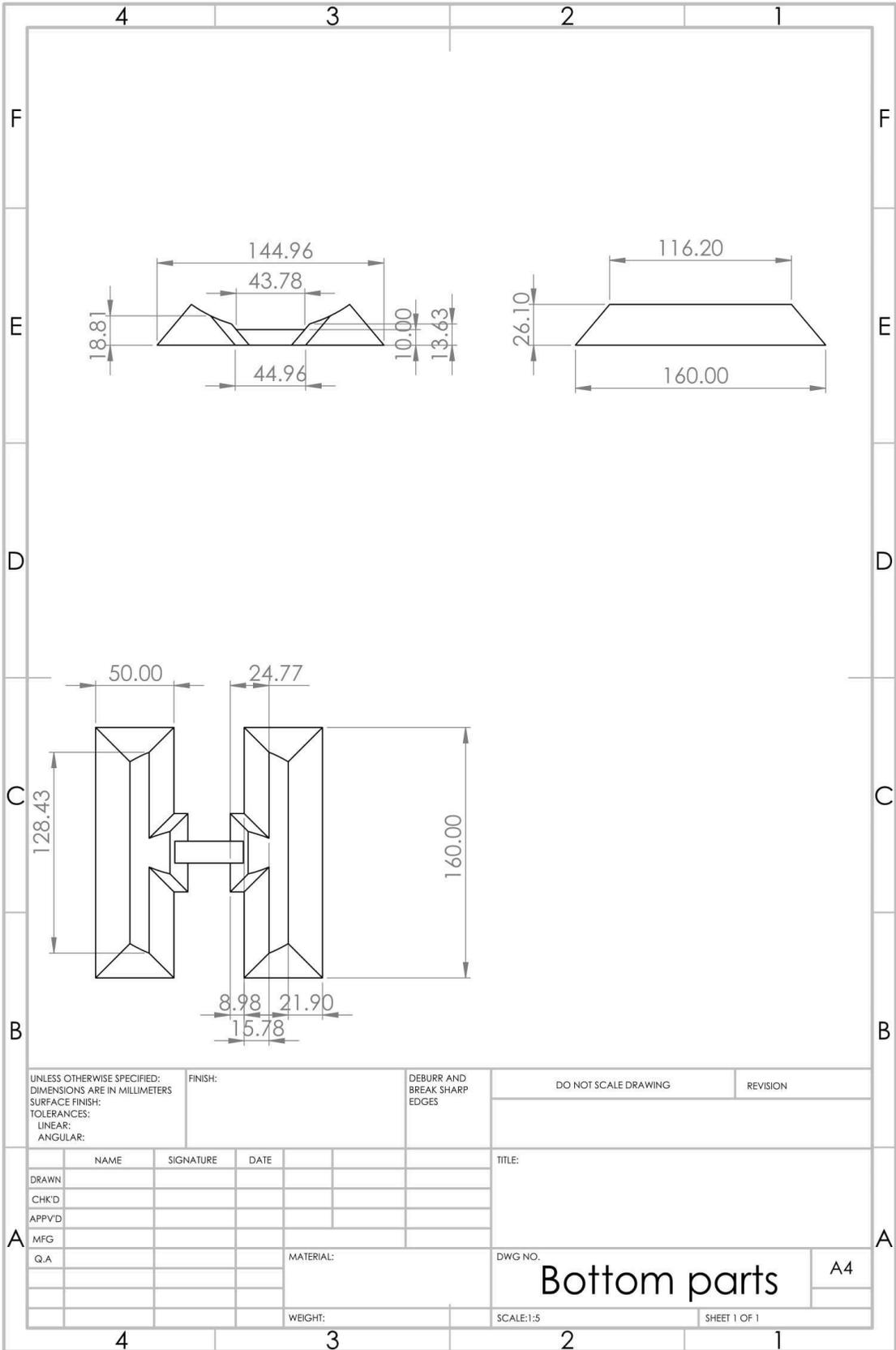


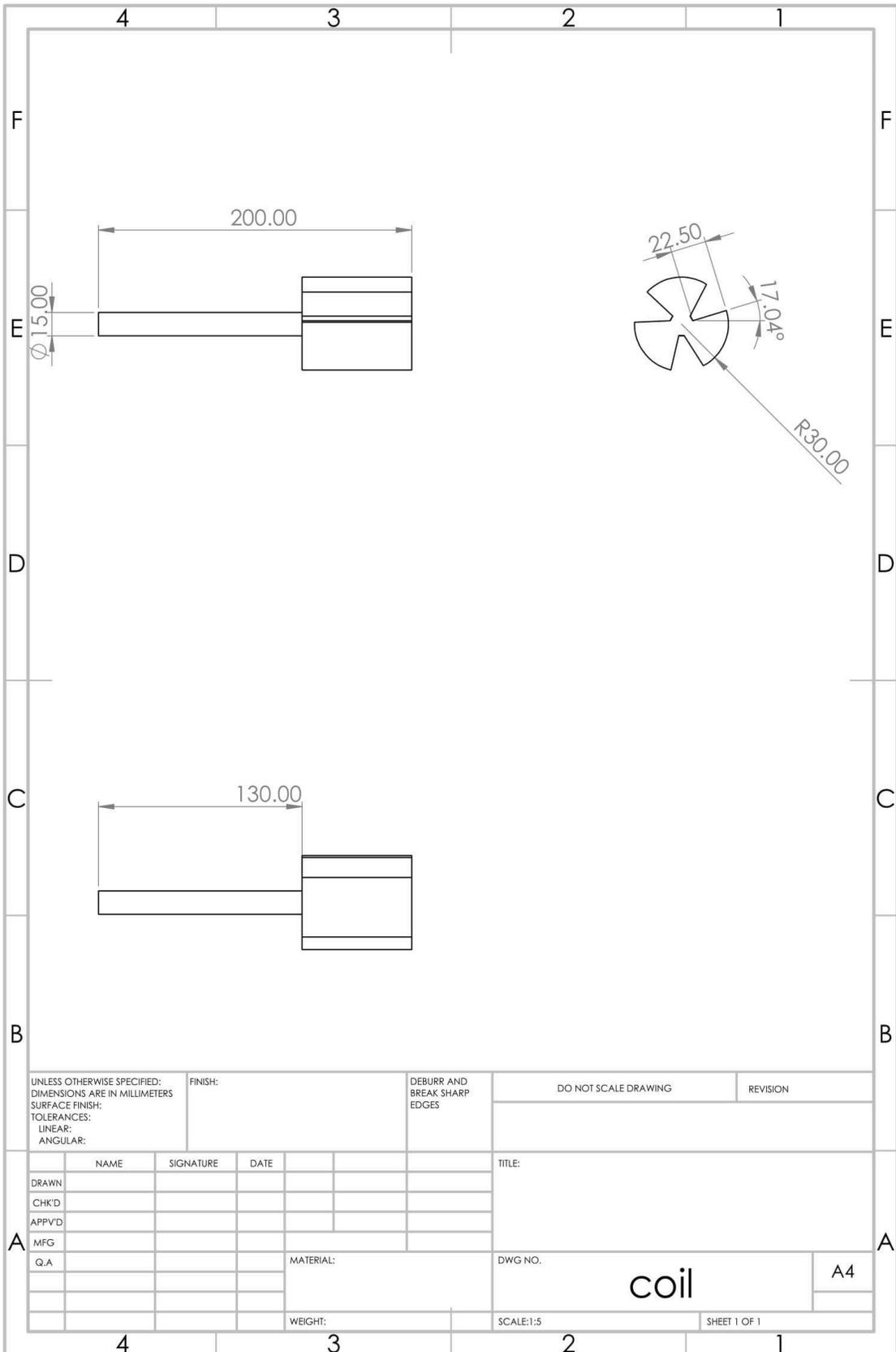
ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1		Back cover	1
2		coil	1
3		Cover	1
4		ring	1
5		Top	1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		NAME		SIGNATURE		DATE		TITLE:	
CHK'D									
APPV'D									
MFG									
Q.A								DWG NO.	
								Motor	
								A4	
								SCALE:1:10	
								SHEET 1 OF 1	

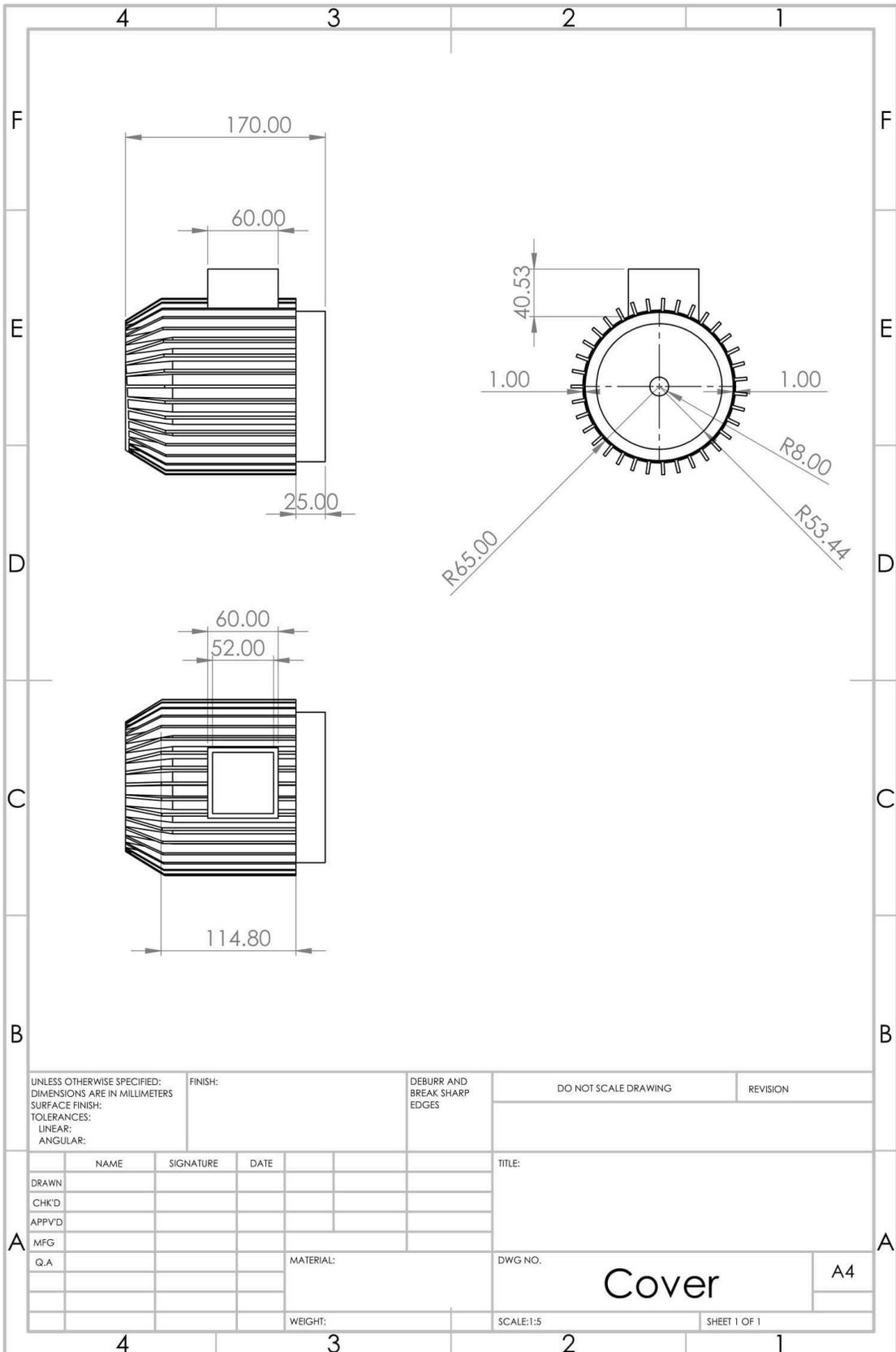


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:				TOLERANCES:		LINEAR:		ANGULAR:		TITLE:	
DRAWN		SIGNATURE		DATE							
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		A4	
								Back cover			
						WEIGHT:		SCALE:1:5		SHEET 1 OF 1	

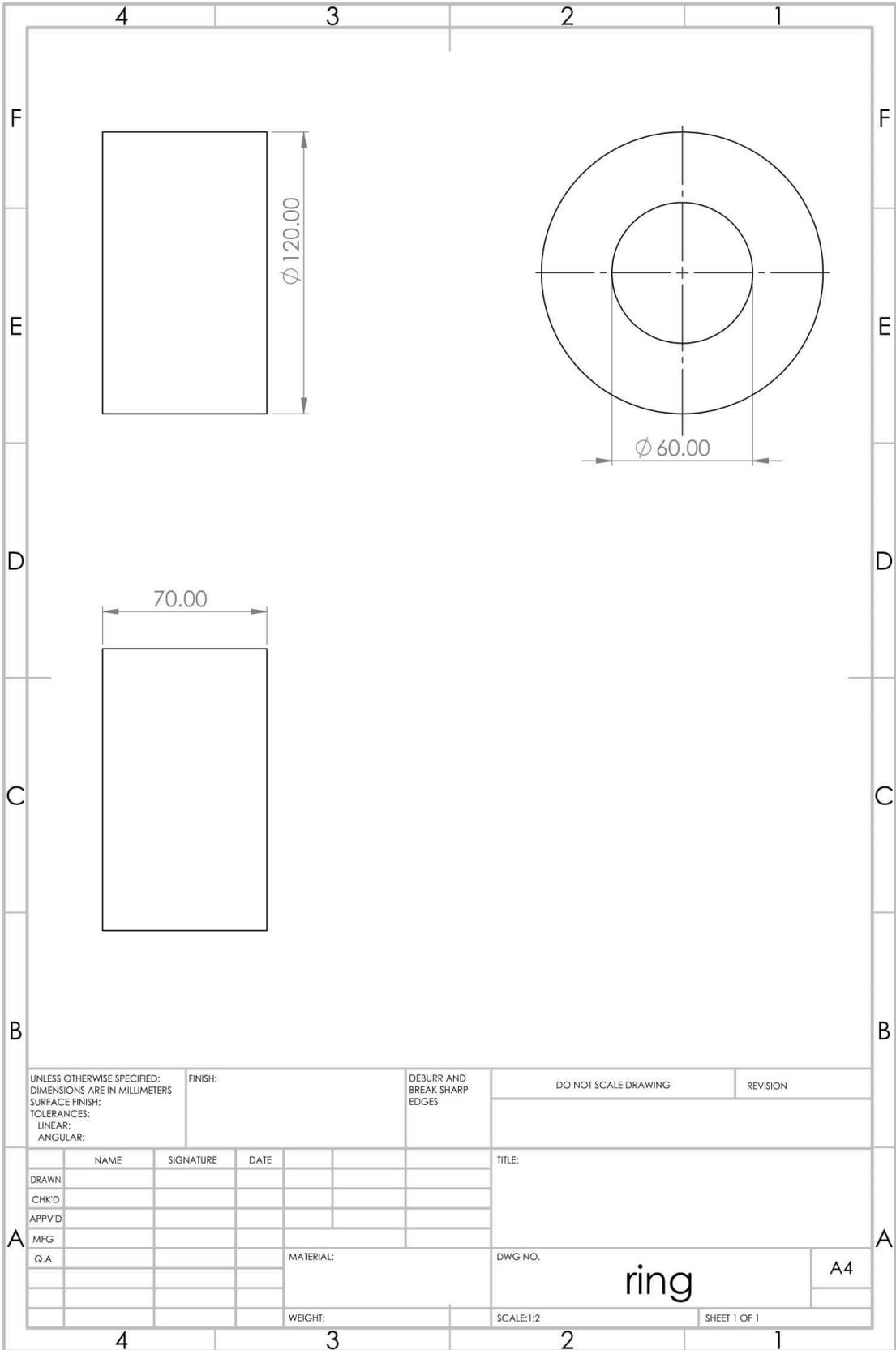


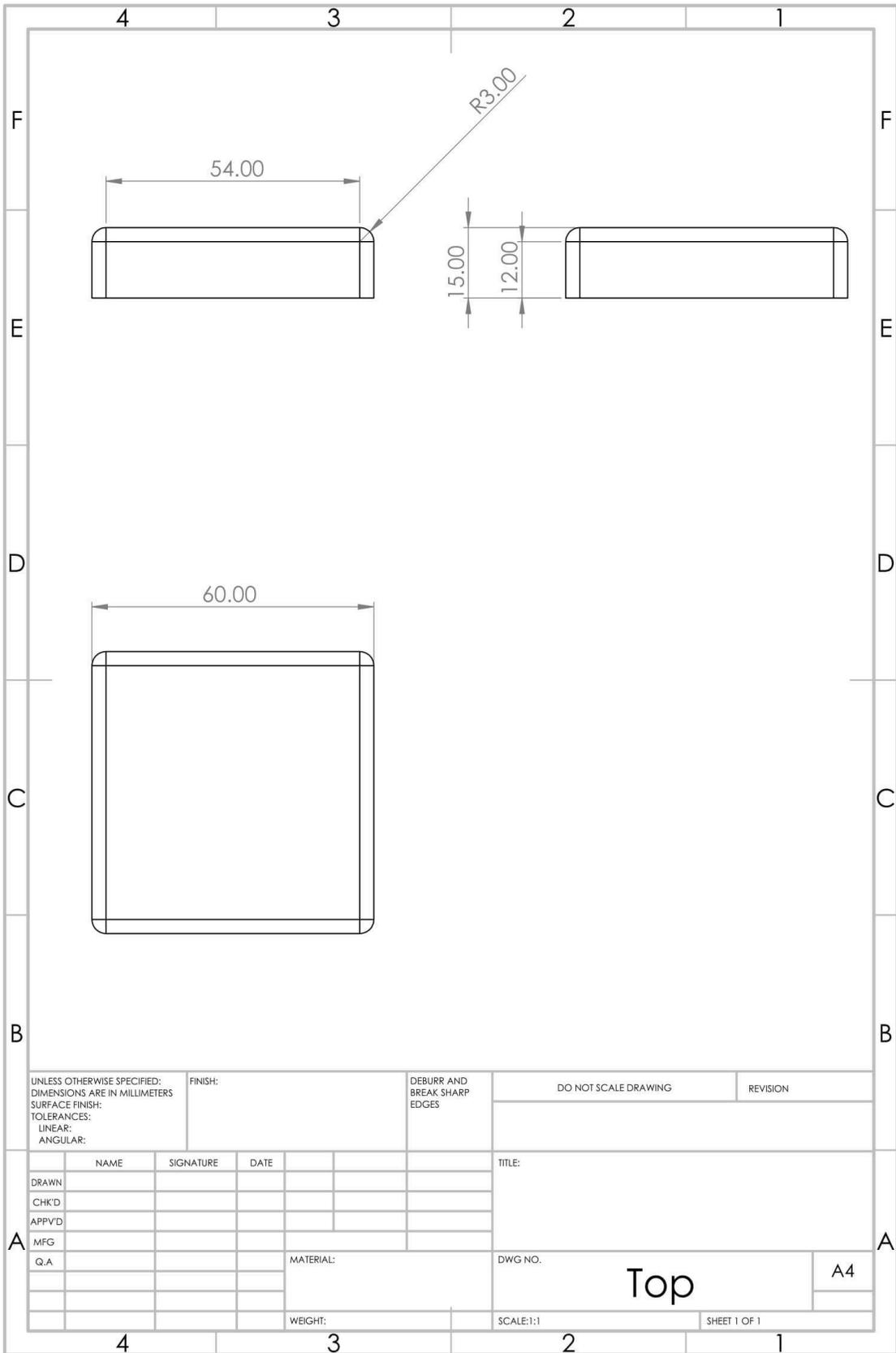


UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:											
TOLERANCES:											
LINEAR:											
ANGULAR:											
DRAWN		SIGNATURE		DATE				TITLE:			
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		coil	
										A4	
						WEIGHT:		SCALE:1:5		SHEET 1 OF 1	



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D									
APPV'D									
MFG						MATERIAL:		DWG NO.	
Q.A								Cover	
						WEIGHT:		SCALE: 1:5	
								SHEET 1 OF 1	





Gearbox Design

Given that:

$$H = 5.5 \text{ kW}$$

$$n_1 = 960 \text{ RPM}$$

$$i = 4$$

Assuming $N_1 = 18 \text{ teeth}$

Selecting the module $m \approx 2.3$ so standard $m = 2.5$

$$d_1 = mN_1 = 2.5 * 18 = 45 \text{ mm}$$

$$d_2 = mN_2 = miN_1 = 180 \text{ mm}$$

$$C = \frac{d_1 + d_2}{2} = \frac{45 + 180}{2} = 112.5 \text{ mm}$$

$$F = 4\pi m = 10\pi = 31.416 \text{ mm} \Rightarrow \text{take } F = 32 \text{ mm}$$

Bending Stress on Pinion:

$$\sigma = \frac{W_t}{FK_v m Y}$$

$$W_t = \frac{H}{V} = \frac{H}{w_1 r_1} = \frac{H * 60}{w_1 2\pi r_1} = 2.432 \text{ kN}$$

$$v = 2.262 \frac{\text{m}}{\text{s}}$$

$$K_v = \frac{6}{6+V} = 0.7262$$

$$Y = 0.29327 \text{ from table 2}$$

$$\sigma = 142.741 \text{ MPa}$$

$$\sigma_{design} = 4\sigma = 570.965 \text{ MPa}$$

Hence we will use **Carbon steel AISI 1040 OQT400** as $S_y = 600 > \sigma_{design}$

Bending Fatigue:

$$S_e' = 0.5S_{ult} = 0.5 * 779 = 389.5 \text{ MPa}$$

$$K_a = 0.71$$

$$K_b = 0.974$$

$$K_c = 0.814 \text{ (99\% reliability)}$$

$$K_d = K_e = K_f = 1$$

$$S_e = 219.255 \text{ MPa}$$

$$\sigma_a = \frac{W_t}{K_v F m J}$$

$$K_v = 0.82 \text{ as } Q = 7 \Rightarrow \text{For a mining conveyor}$$

$$J = 0.317$$

$$\sigma_a = 116.95 \text{ MPa}$$

$$n_G = \frac{S_y}{\sigma_a} = 1.87$$

$$K_o = 1.25$$

$$K_m = 1.3$$

$$n = \frac{n_G}{K_o K_m} = 1.15 > 1$$

Surface Durability

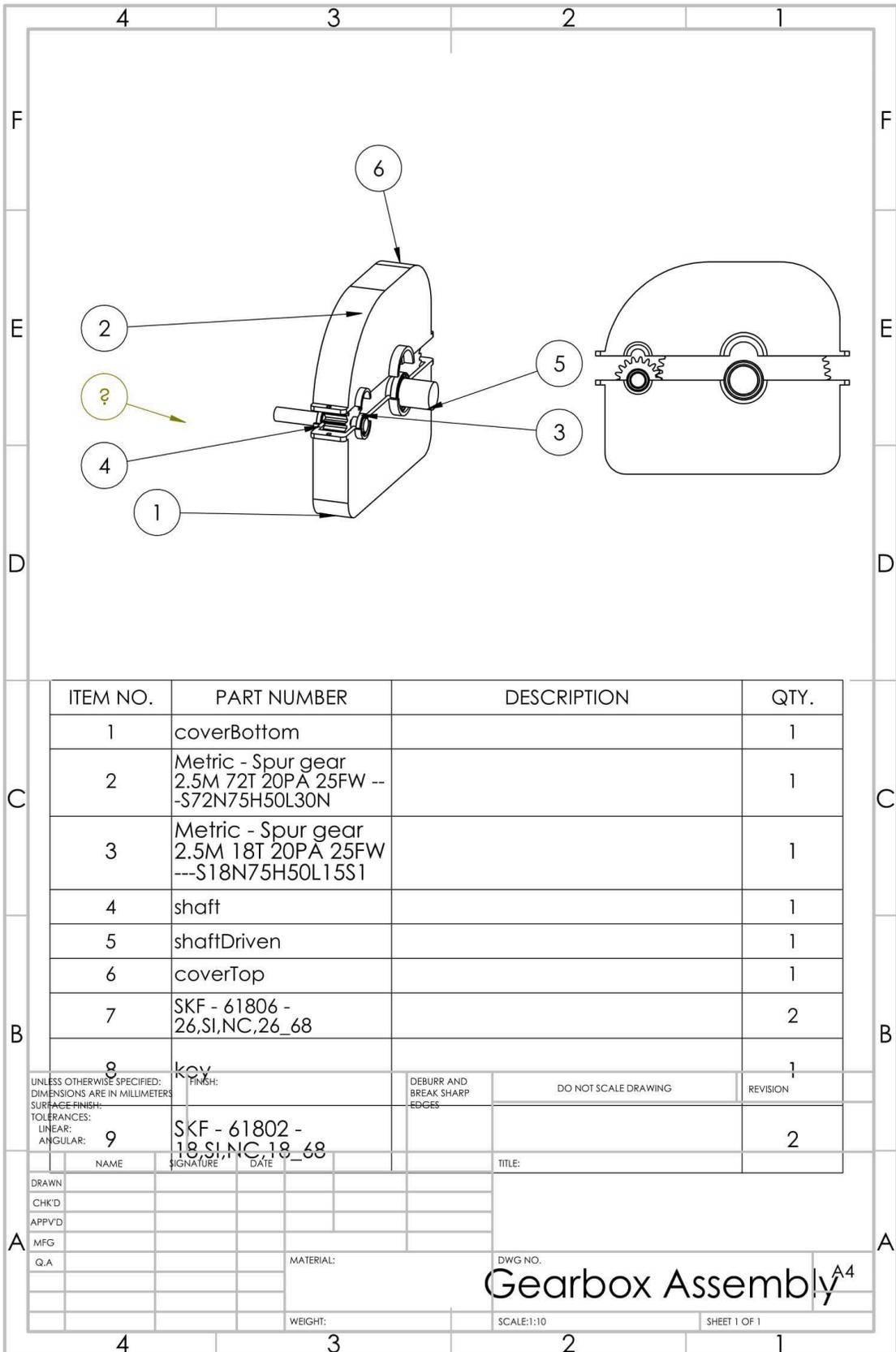
$$S_c = 2.76 \text{ HB} - 70 = 653.12$$

$$S_H = \frac{C_L C_H}{C_T C_R} S_c = \frac{1.1 * 1}{1 * 0.8} * 653.12 = 898.04$$

$$\sigma_H = C_P \sqrt{\frac{W_{t,p}}{C_v F d_1 I}} = 191 * \sqrt{\frac{2.432K}{0.82 * 32 * 45 * 0.9}} = 288.939$$

$$S_H = \sqrt{K_o K_m n} \sigma_H$$

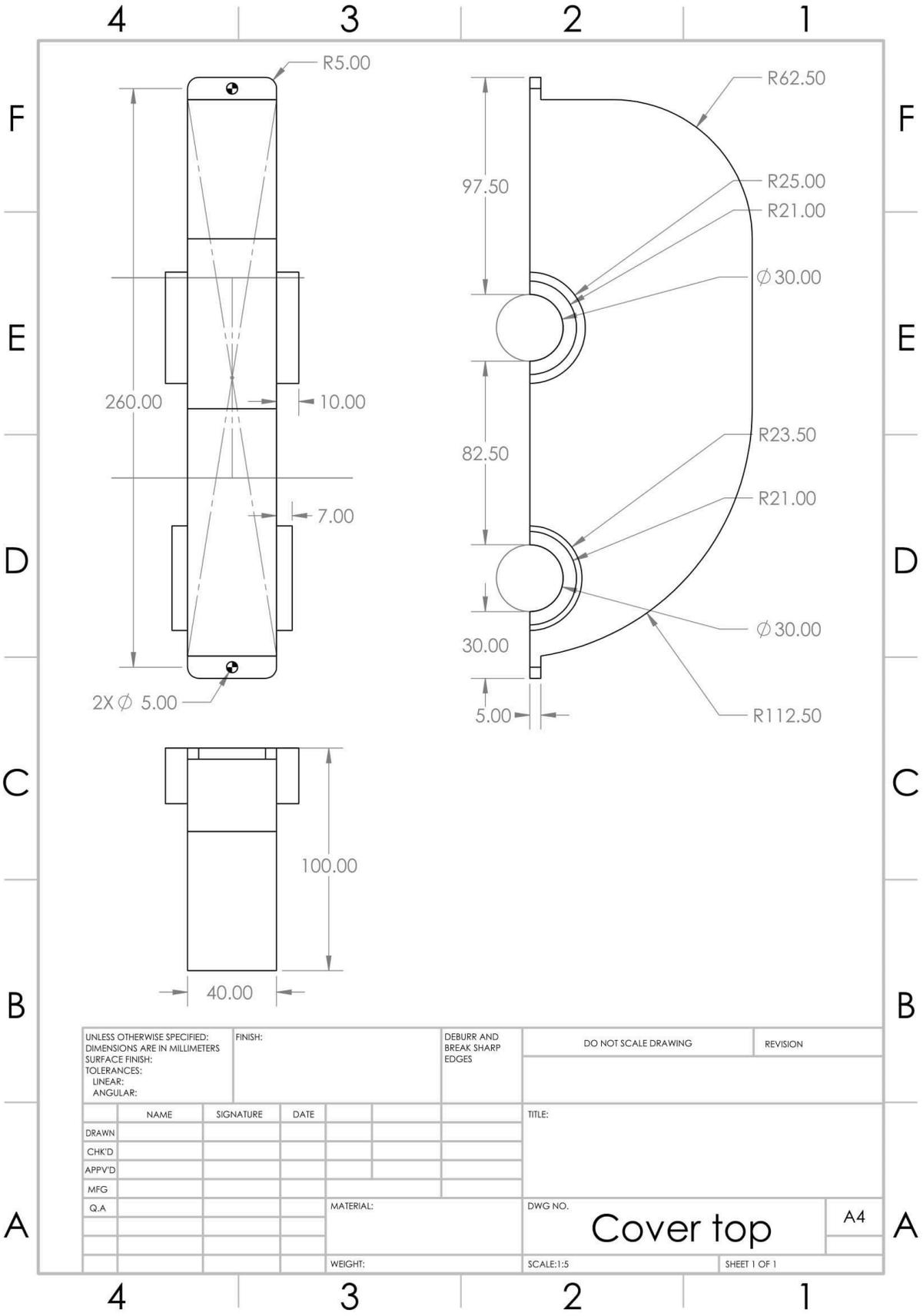
$$n = 5.944 > 1$$



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	coverBottom		1
2	Metric - Spur gear 2.5M 72T 20PA 25FW -- -S72N75H50L30N		1
3	Metric - Spur gear 2.5M 18T 20PA 25FW ---S18N75H50L15S1		1
4	shaft		1
5	shaftDriven		1
6	coverTop		1
7	SKF - 61806 - 26,SI,NC,26_68		2
8	key		1

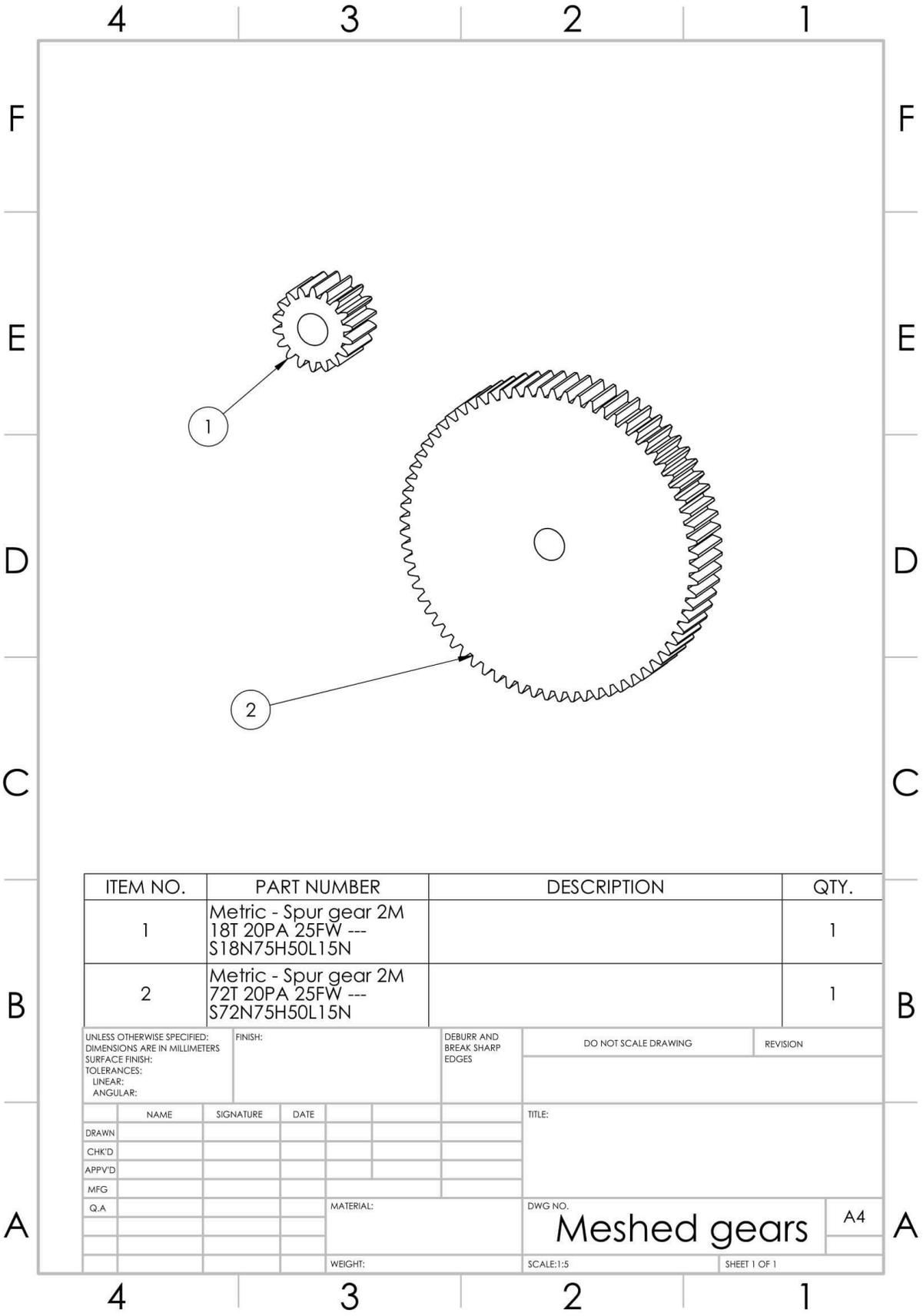
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:	FINISH:	DEBURR AND BREAK SHARP EDGES	DO NOT SCALE DRAWING	REVISION
	9 SKF - 61802 - 18,SI,NC,18_68			

DRAWN	NAME	SIGNATURE	DATE	TITLE:
CHK'D				
APPV'D				
MFG				
Q.A				
		MATERIAL:		DWG NO.
				Gearbox Assembly ^{A4}
		WEIGHT:		SCALE:1:10
				SHEET 1 OF 1



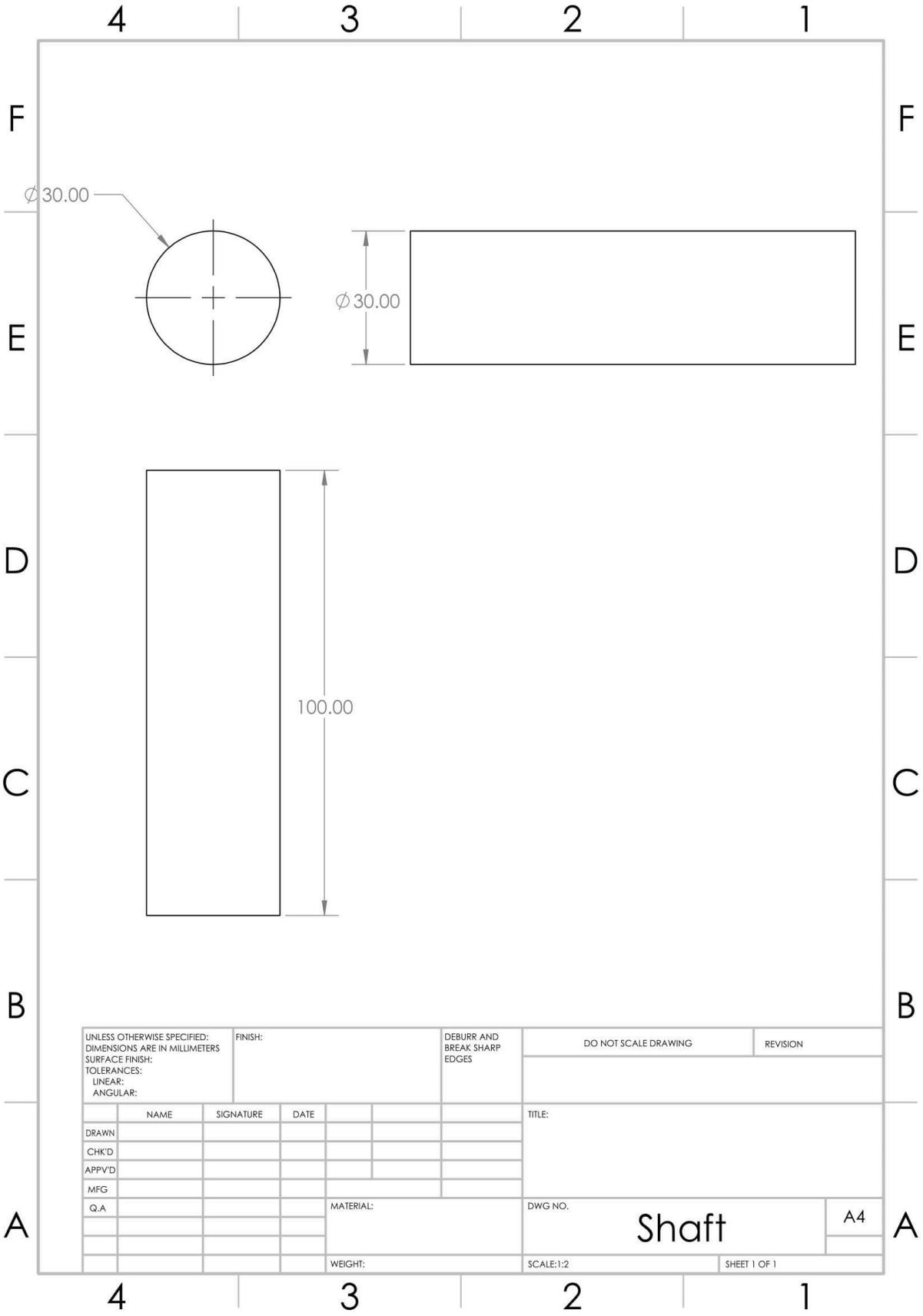
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:				TOLERANCES:		LINEAR:		ANGULAR:		TITLE:	
DRAWN		SIGNATURE		DATE							
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		A4	
						WEIGHT:		SCALE: 1:5		SHEET 1 OF 1	

Cover top



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Metric - Spur gear 2M 18T 20PA 25FW --- S18N75H50L15N		1
2	Metric - Spur gear 2M 72T 20PA 25FW --- S72N75H50L15N		1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D									
APPV'D									
MFG									
Q.A				MATERIAL:		DWG NO.		A4	
						Meshed gears			
				WEIGHT:		SCALE:1:5		SHEET 1 OF 1	



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:				TOLERANCES:		LINEAR:		ANGULAR:		TITLE:	
DRAWN		SIGNATURE		DATE							
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		Shaft	
										A4	
						WEIGHT:		SCALE: 1:2		SHEET 1 OF 1	

Bearings on Gearbox

For the bearings selection we need to calculate the actual loading capacity:

$$C = P' \left(\frac{60 \times L \times n}{10^6} \right)^{\frac{1}{3}}$$

The bearings are used with rollers having the following characteristics:

- Radial load (F_r) = $\frac{0.88517}{2} = 0.442585 \text{ kN}$
- Axial load (F_a) = $\frac{2.432}{2} = 1.216 \text{ kN}$
- Shaft diameter (d) = 30 mm

Using this, we selected a bearing **6406** from the SKF catalogue as follows:

30	42	7	4,49	2,9	0,146	32 000	20 000	0,025	61806
	47	9	7,28	4,55	0,212	30 000	19 000	0,049	61906
	55	9	11,9	7,35	0,31	28 000	17 000	0,089	* 16006
	55	13	13,8	8,3	0,355	28 000	17 000	0,12	* 6006
	62	16	20,3	11,2	0,475	24 000	15 000	0,2	* 6206
	62	16	23,4	12,9	0,54	24 000	15 000	0,18	6206 ETN9
	72	19	29,6	16	0,67	20 000	13 000	0,35	* 6306
	72	19	32,5	17,3	0,735	22 000	14 000	0,33	6306 ETN9
	90	23	43,6	23,6	1	18 000	11 000	0,75	6406

- Shaft rotational speed (n) = 960 rpm

Start of calculations:

1. $C = 43.6 \text{ kN}$ and $C_o = 23.6 \text{ kN}$

$$\frac{F_a}{C_o} = 0.0515$$

Using interpolation we find the values of e , x and y as follows

$$\frac{0.0515-0.04}{0.07-0.04} = \frac{e-0.24}{0.27-0.24}, e = 0.2515$$

$$x = 0.56$$

$$\frac{0.0515-0.04}{0.07-0.04} = \frac{y-1.8}{1.6-1.8}, y = 1.72$$

$$P = VXF_r + YF_a = 2.34 \text{ kN}$$

2. By selecting $K_{sf} = 1.5$ from the table, then :

$$P' = K_{sf} \times P = 1.5 \times 122.625 = 3.51 \text{ kN}$$

3. By choosing L= 20,000 hrs. for machines used 8 hours daily:

$$C = P' \left(\frac{60 \times L \times n}{10^6} \right)^{\frac{1}{3}} = 5.03 * 1000 \left(\frac{60 \times 20000 \times 960}{10^6} \right)^{\frac{1}{3}} = 36.79 \text{ kN}$$

Therefore, $C_{calculated} < C_{table}$.

4. Calculating the static loading:

$$P_o = 0.6 F_r + 0.5 F_a = 0.873551 \text{ kN.}$$

For normal and normal vibrations, $S_o = 1$. Then:

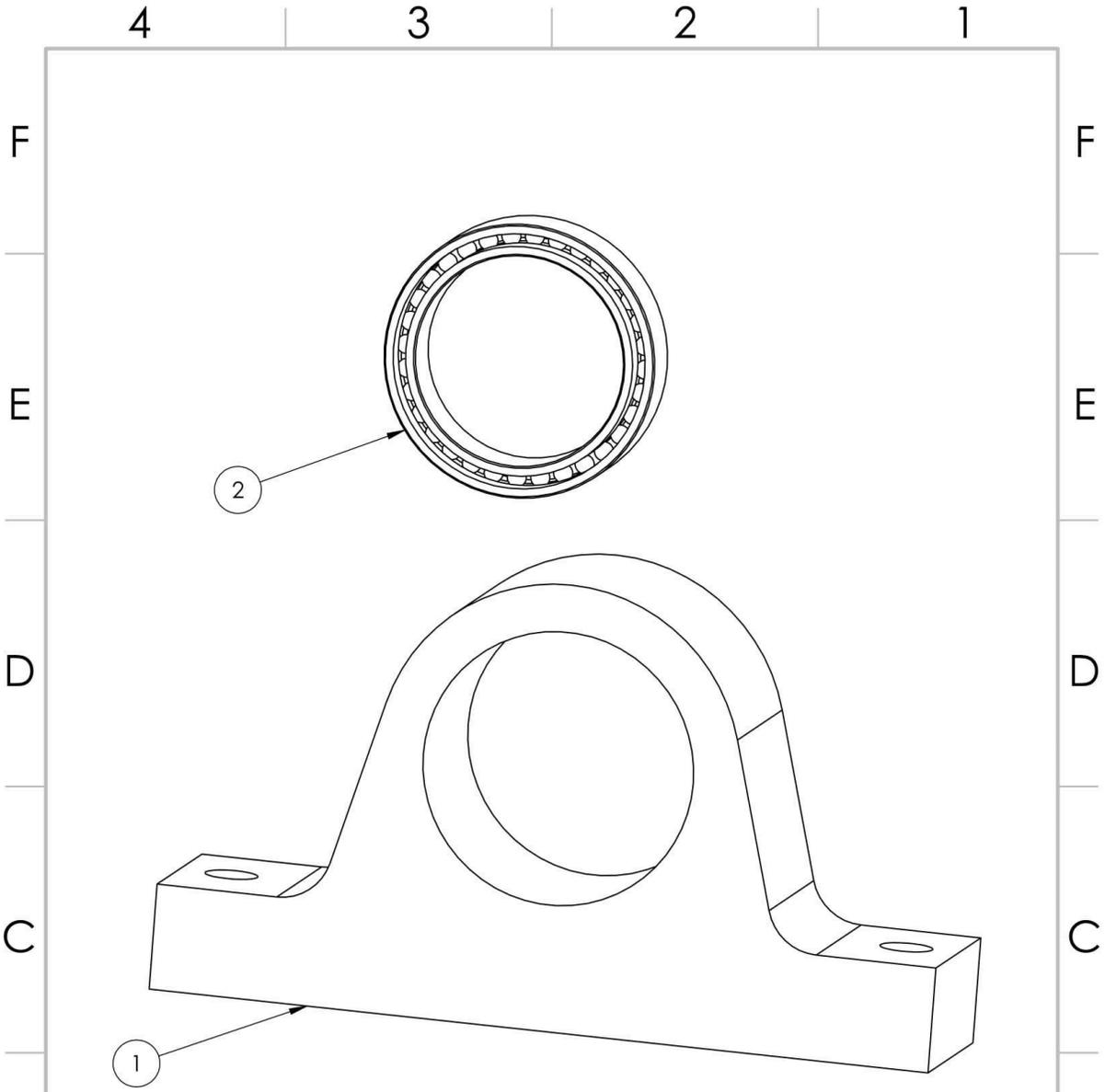
$$C_o = S_o \times P_o = 1 * P_o = 0.873551 \text{ kN}$$

Therefore, $C_o < C_{o\text{table}}$.

5. Checking for limiting speed: $n < n_{table}$

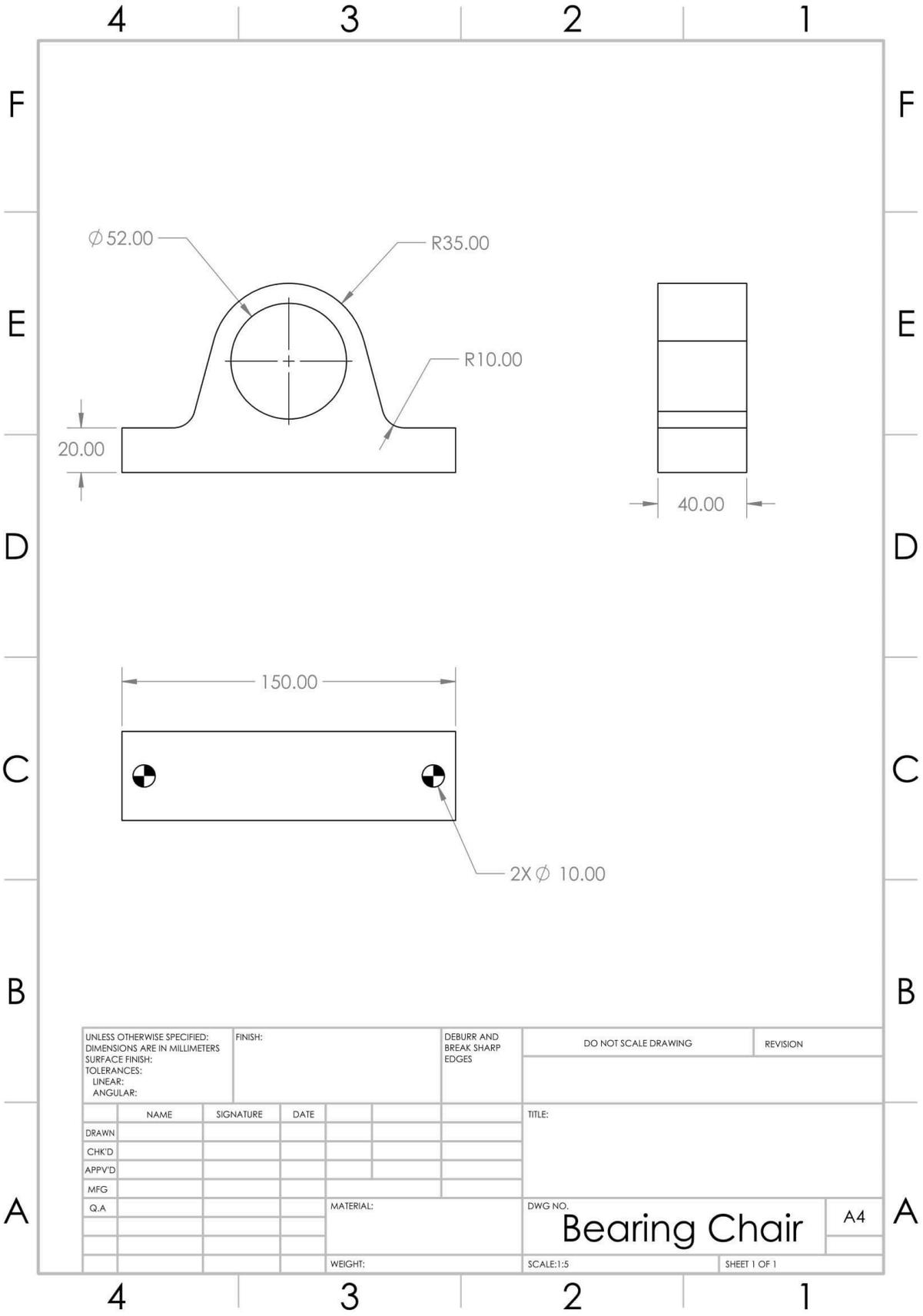
Now, after all these checks, we can consider the bearing designation **6406** as the right bearing selection for our rollers.

And since the bigger gear is affected by less force we will use the same bearing.

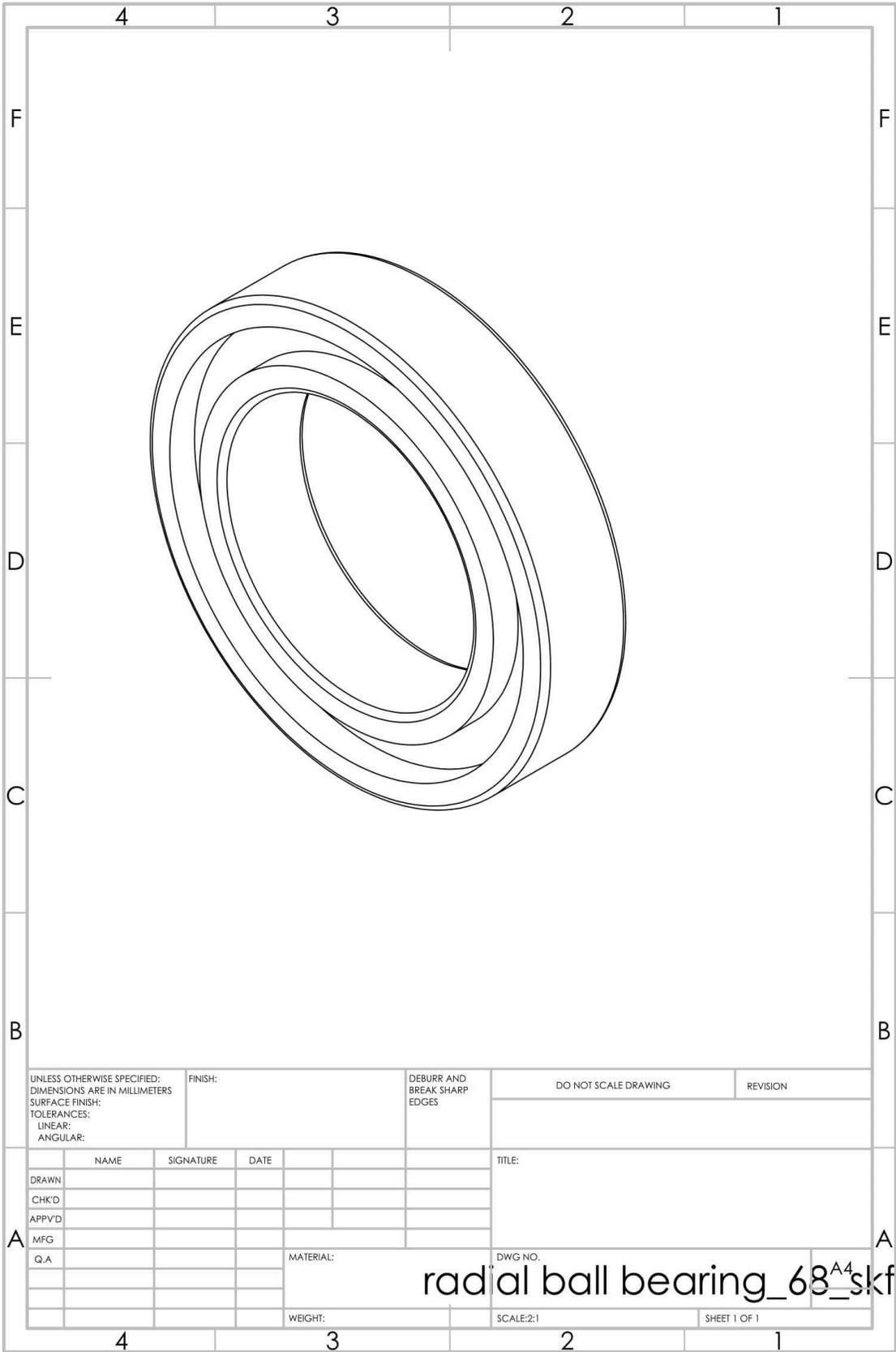


ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	Bearing Chair		1
2	bearingRoller		1

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:									
TOLERANCES:									
LINEAR:									
ANGULAR:									
DRAWN		NAME	SIGNATURE	DATE	TITLE:				
CHK'D									
APPV'D									
MFG									
Q.A					MATERIAL:		DWG NO.		
							Bearing assembly		A4
					WEIGHT:		SCALE:1:5		SHEET 1 OF 1



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:											
TOLERANCES:											
LINEAR:											
ANGULAR:											
DRAWN		SIGNATURE		DATE				TITLE:			
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		A4	
								Bearing Chair			
						WEIGHT:		SCALE:1:5		SHEET 1 OF 1	



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D									
APPV'D									
MFG									
Q.A						MATERIAL:		DWG NO.	
								radial ball bearing_68 ^{A4} _skf	
						WEIGHT:		SCALE:2:1	
								SHEET 1 OF 1	

Couplings calculations

- I. Power=5.5 kw, RPM=960 RPM, Number of bolts=4, Pitch diameter=30mm, Factor of safety=3

$$T = \frac{POWER}{W} = \frac{5.5*1000}{((2\pi*960))/60} = 54.70951169$$

$$\tau_y = 0.5 S_y = 0.5 * 380 = 190MPa$$

$$\tau_d = \frac{\tau_y}{F.S} = \frac{190}{3} = 63.3MPa$$

$$d^2 = \frac{8T}{\pi DN \tau_d} = \frac{8*54.70951169*(10^3)}{\pi*30*4*63.33} = 18.3311352$$

$$d = 4.281487499mm$$

$$d_o = \frac{4.281487499}{0.85} = 5.037044116mm$$

Outer diameter of hub: $D = 2d = 2(30) = 60mm$

Pitch circle diameter of the bolts: $D_1 = 3d = 3(30) = 90mm$

Outer diameter of flange: $D_2 = 4d = 4(30) = 120mm$

Length of the hub: $L = 1.5d = 1.5(30) = 45mm$

Thickness of flange: $t_f = 0.5d = 0.5(30) = 15mm$

Thickness of protective circumferential flange: $t_p = 0.25d = 0.25(30) = 7.5mm$

Then M6, 4 Bolts

- II. Power=5.5 kw, RPM=480 RPM, Number of bolts=4, Pitch diameter=30mm, Factor of safety=3

$$T = \frac{POWER}{W} = \frac{5.5*1000}{((2\pi*480))/60} = 109.4190234$$

$$\tau_y = 0.5 S_y = 0.5 * 380 = 190MPa$$

$$\tau_d = \frac{\tau_y}{F.S} = \frac{190}{3} = 63.3MPa$$

$$d^2 = \frac{8T}{\pi DN \tau_d} = \frac{8*109.4190234*(10^3)}{\pi*30*4*63.33} = 36.6622704$$

$$d = 6.05493768mm$$

$$d_o = \frac{6.05493768}{0.85} = 7.123456mm$$

Outer diameter of hub: $D = 2d = 2(30) = 60mm$

Pitch circle diameter of the bolts: $D_1 = 3d = 3(30) = 90mm$

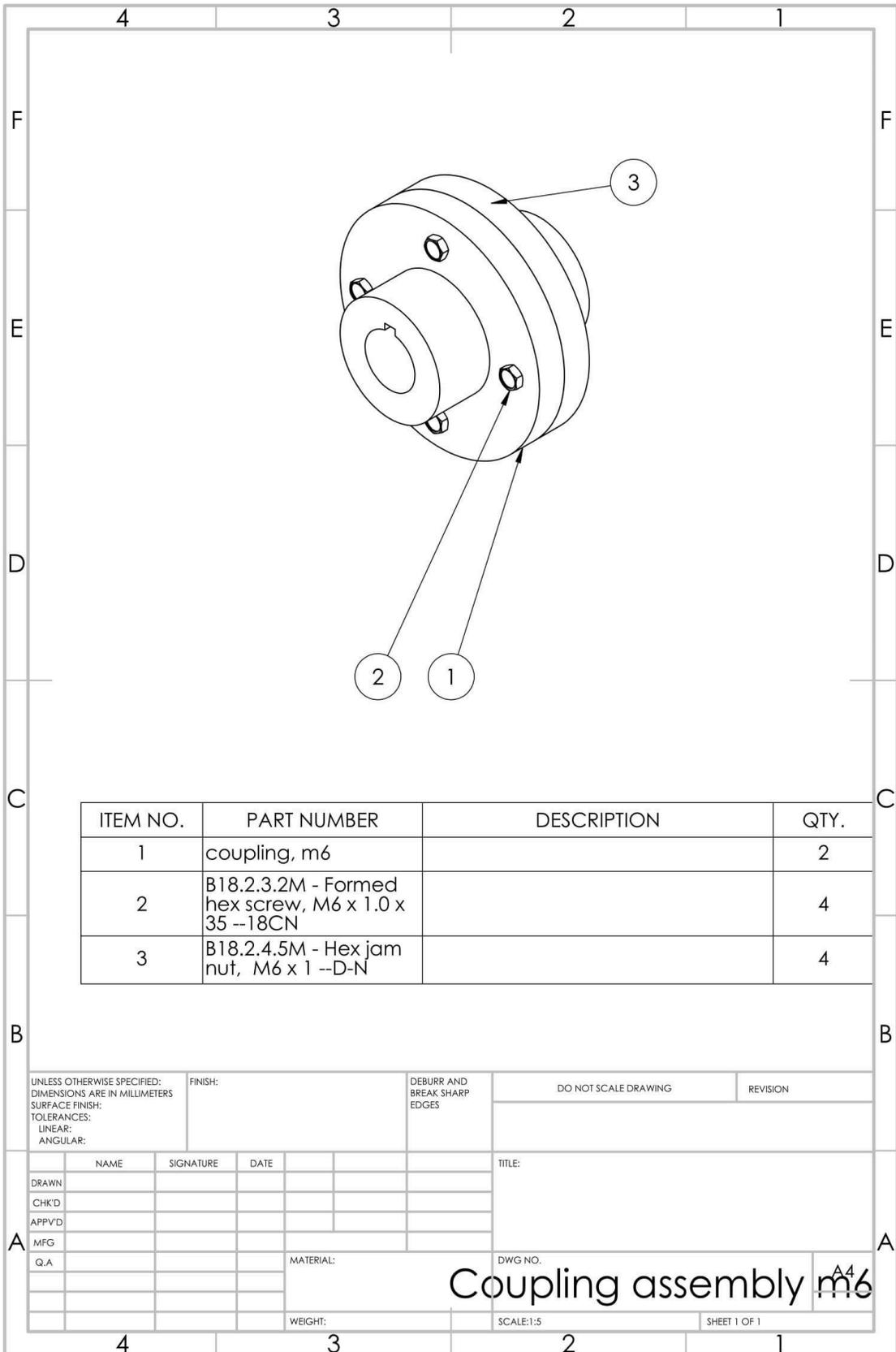
Outer diameter of flange: $D_2 = 4d = 4(30) = 120mm$

Length of the hub: $L = 1.5d = 1.5(30) = 45mm$

Thickness of flange: $t_f = 0.5d = 0.5(30) = 15mm$

Thickness of protective circumferential flange: $t_p = 0.25d = 0.25(30) = 7.5mm$

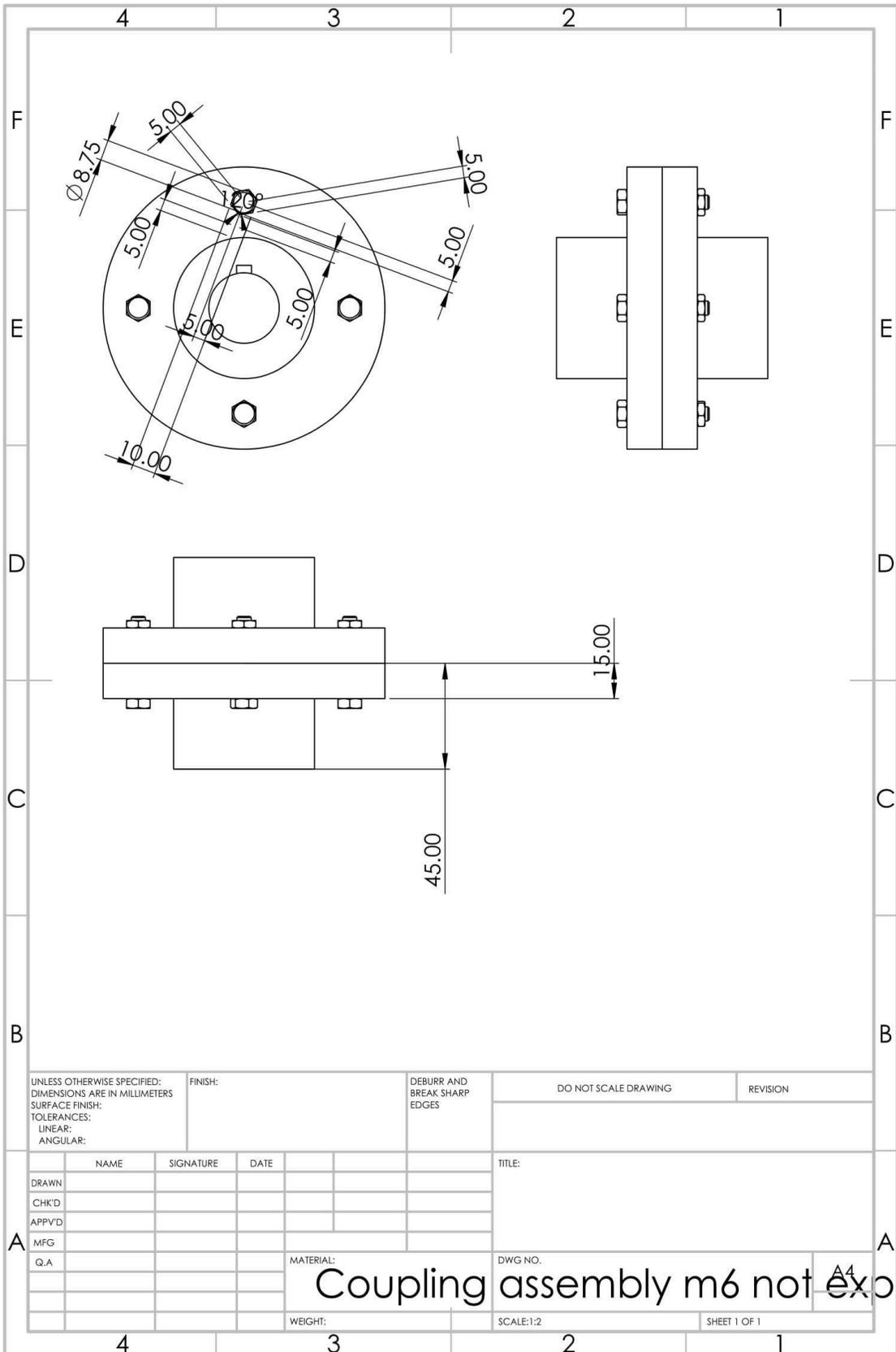
Then **M8 , 4 BOLTS**



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	coupling, m6		2
2	B18.2.3.2M - Formed hex screw, M6 x 1.0 x 35 --18CN		4
3	B18.2.4.5M - Hex jam nut, M6 x 1 --D-N		4

UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D									
APPV'D									
MFG						MATERIAL:		DWG NO.	
Q.A								SCALE:1:5	
						WEIGHT:		SHEET 1 OF 1	

Coupling assembly m6



UNLESS OTHERWISE SPECIFIED:
 DIMENSIONS ARE IN MILLIMETERS
 SURFACE FINISH:
 TOLERANCES:
 LINEAR:
 ANGULAR:

FINISH:
 DEBURR AND
 BREAK SHARP
 EDGES

DO NOT SCALE DRAWING

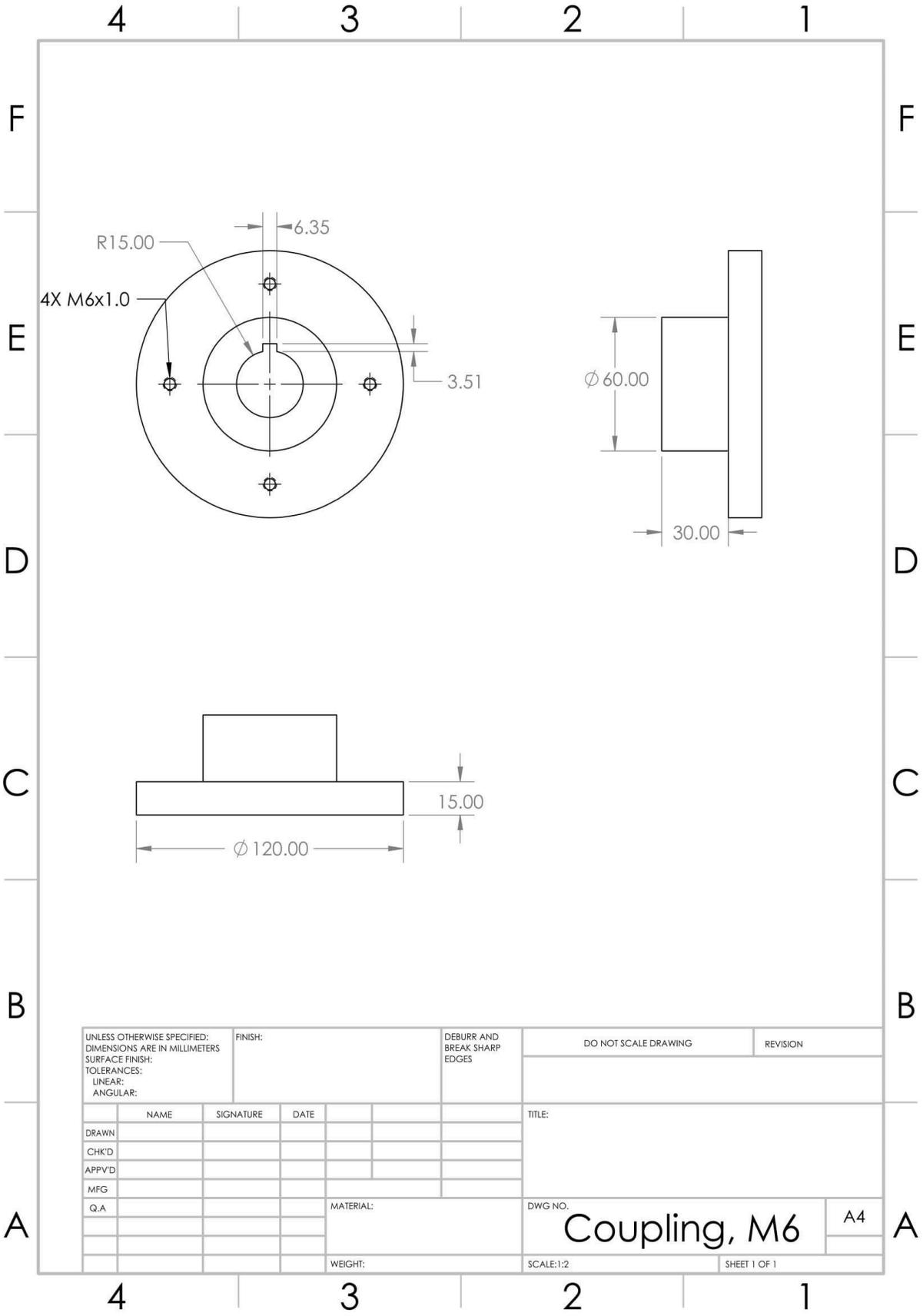
REVISION

	NAME	SIGNATURE	DATE
DRAWN			
CHK'D			
APPV'D			
MFG			
Q.A			

TITLE:

MATERIAL:
 DWG NO.
 SCALE: 1:2
 SHEET 1 OF 1

Coupling assembly m6 not exp c



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D									
APPV'D									
MFG									
Q.A						MATERIAL:		DWG NO.	
								Coupling, M6	
								A4	
						WEIGHT:		SCALE: 1:2	
								SHEET 1 OF 1	

Choosing the proper chain for rollers

1. Calculating the power rating:

$$\begin{aligned} \text{Power rating} &= (\text{kW to be transmitted}) * \frac{K_s}{K_1 * K_2} \\ &= 5.5 * \frac{1}{1.26 * 1} = 4.365 \text{ kW} \end{aligned}$$

Taking $K_s=1$ (smooth light conveyor)

In addition, $K_2=1.26$ (the number of teeth of the smaller Sprocket (pinion) to be 21).

And $K_1 = 1$ (only one strand)

2. Selection of chain:

Using 12B chain we will interpolate with pinion speed $n=240$ rpm:

$$\begin{aligned} \text{Power(kW)} &= \frac{200-240}{200-300} = \frac{3.75-x}{3.75-5.43} \\ \text{Power} &= 4.42 \text{ kW} \end{aligned}$$

Which is greater than the Power rating (4.365 kW), then this chain is suitable.

3. Pitch circle diameter of driving and driven pulleys:

From the tables:

Pitch $p = 19.05 \text{ mm}$

$$D_1 = \frac{p}{\sin \sin \left(\frac{180}{z_1} \right)} = \frac{19.05}{\sin \sin \left(\frac{180}{21} \right)} = 127.816 \text{ mm}$$

$$\frac{N_{(driven)}}{N_{(driver)}} = \frac{n_{(driver)}}{n_{(driven)}}$$

$$i = \frac{n_{(driver)}}{n_{(driven)}} = \frac{240}{n_{(driven)}} = 2$$

$$n_{driven} = 120 \text{ rpm}$$

$$z_2 (\text{No of teeth of the bigger Sprocket}) = 30 * \left(\frac{240}{120} \right) = 60 \text{ teeth}$$

$$D_2 = \frac{19.05}{\sin \sin \left(\frac{180}{42} \right)} = 254.9 \text{ mm}$$

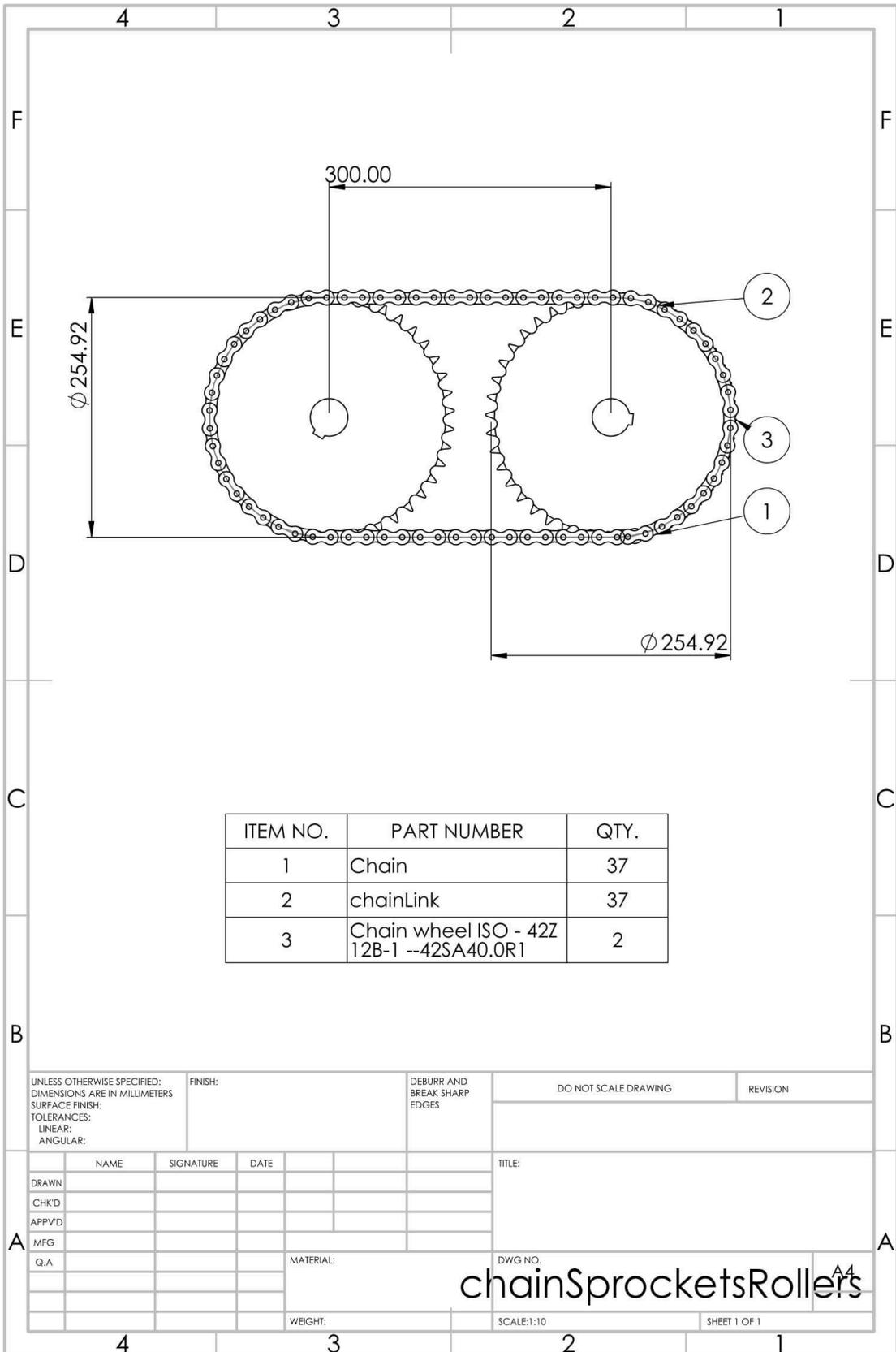
4. Number of chain links:

$$a = 40 * p = 762 \text{ mm}$$

$$Ln(\text{No of links}) = 2 * \left(\frac{a}{p}\right) + \frac{z1+z2}{2} + \left(\frac{z2-z1}{2*\pi}\right)^2 * \frac{p}{a} = 111.77 \text{ or } 112 \text{ links}$$

Last step we will substitute in the same equation to calculate the new center to center distance according to our approximation for Ln

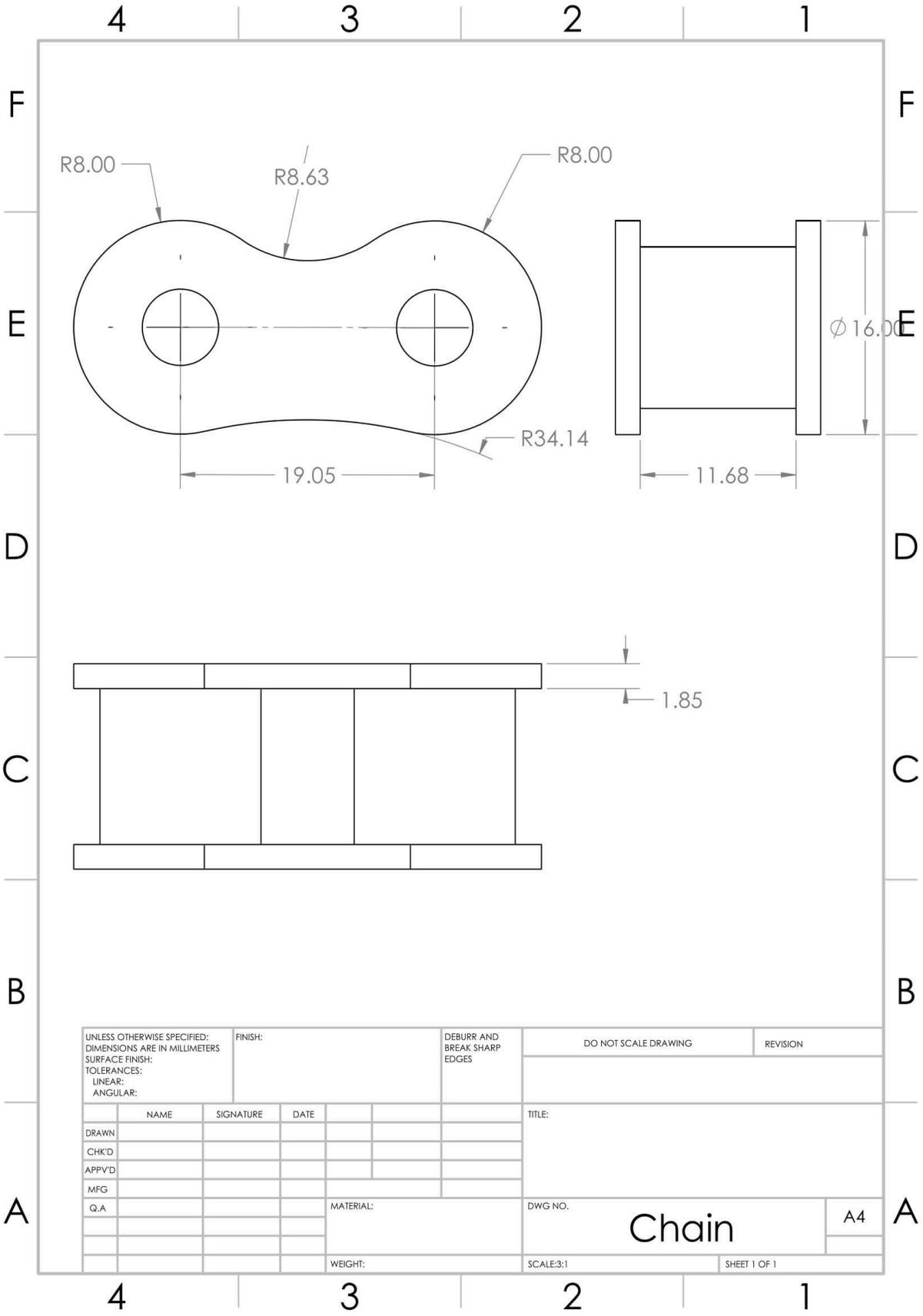
$$a = 764 \text{ mm}$$



ITEM NO.	PART NUMBER	QTY.
1	Chain	37
2	chainLink	37
3	Chain wheel ISO - 42Z 12B-1 --42SA40.0R1	2

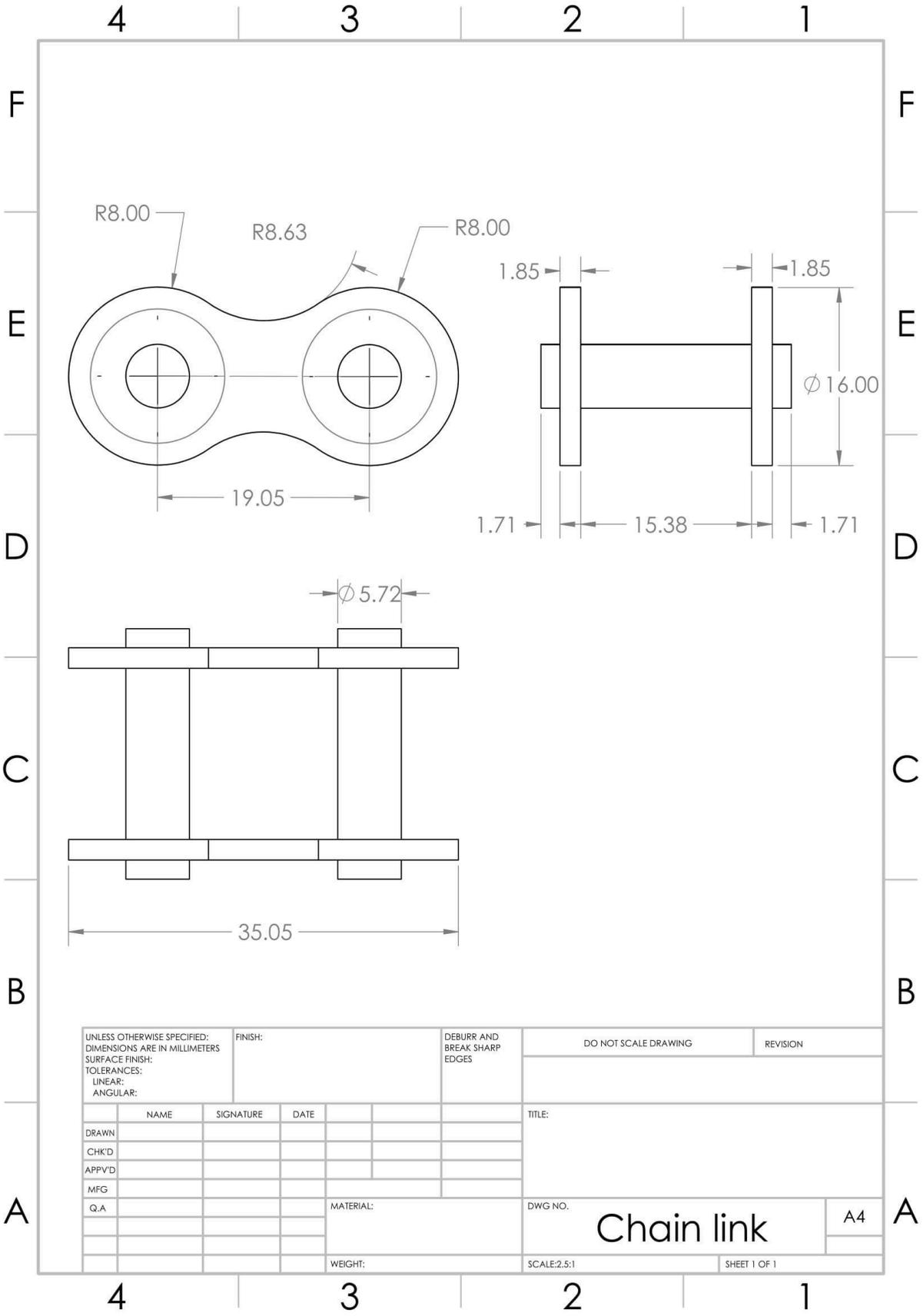
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS		FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:		TOLERANCES:		LINEAR:		ANGULAR:			
DRAWN		SIGNATURE		DATE		TITLE:			
CHK'D									
APPV'D									
MFG						MATERIAL:		DWG NO.	
Q.A								SCALE:1:10	
						WEIGHT:		SHEET 1 OF 1	

chainSprocketsRollers



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:				TOLERANCES:		LINEAR:		ANGULAR:		TITLE:	
DRAWN		SIGNATURE		DATE							
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		A4	
						WEIGHT:		SCALE:3:1		SHEET 1 OF 1	

Chain



UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS				FINISH:		DEBURR AND BREAK SHARP EDGES		DO NOT SCALE DRAWING		REVISION	
SURFACE FINISH:				TOLERANCES:		LINEAR:		ANGULAR:		TITLE:	
DRAWN		SIGNATURE		DATE							
CHK'D											
APPV'D											
MFG											
Q.A						MATERIAL:		DWG NO.		A4	
						WEIGHT:		SCALE:2.5:1		SHEET 1 OF 1	

Chain link

Bearings Selection

For the bearings selection we need to calculate the actual loading capacity:

$$C = P' \left(\frac{60 \times L \times n}{10^6} \right)^{\frac{1}{3}}$$

The bearings are used with rollers having the following characteristics:

- Radial load (F_r) = $\frac{\text{Box weight}}{4 \text{ bearings}} + \frac{\text{Shaft weight}}{2 \text{ bearings}} + \frac{\text{Roller weight}}{2 \text{ bearings}}$
 $= \left(\frac{50}{4} + \frac{10}{2} + \frac{15.232}{2} \right) \times 9.81 = 246.4 \text{ N}$
- Axial load = 0
- Shaft diameter (d) = 40 mm

Using this, we selected a bearing from the SKF catalogue as follows:

Principal dimensions			Basic load ratings		Fatigue load limit	Speed ratings		Mass	Designation
d	D	B	C	C ₀	P _u	Reference speed	Limiting speed		
mm			kN		kN	r/min		kg	-
40	52	7	4,49	3,75	0,16	26 000	16 000	0,032	61808
	62	12	13,8	10	0,425	24 000	14 000	0,12	61908
	68	9	13,8	10,2	0,44	22 000	14 000	0,13	* 16008
	68	15	17,8	11	0,49	22 000	14 000	0,19	* 6008
	80	18	32,5	19	0,8	18 000	11 000	0,37	* 6208
	80	18	35,8	20,8	0,88	18 000	11 000	0,34	6208 ETN9
	90	23	42,3	24	1,02	17 000	11 000	0,63	* 6308
	110	27	63,7	36,5	1,53	14 000	9 000	1,25	6408

- Shaft rotational speed (n) = 120 rpm

Start of calculations:

1. Since we have no axial load, then:

$$P = F_r = 246.4 \text{ N}$$

2. By selecting $K_{sf} = 1.5$ from the table, then :

$$P' = K_{sf} \times P = 1.5 \times 246.4 = 369.6 \text{ N}$$

3. By choosing L= 20,000 hrs. for machines used 8 hours daily:

$$C = P' \left(\frac{60 \times L \times n}{10^6} \right)^{\frac{1}{3}} = 369.6 \left(\frac{60 \times 20000 \times 120}{10^6} \right)^{\frac{1}{3}} = 1937.25 \text{ N}$$

Therefore, $C_{\text{calculated}} < C_{\text{table}}$.

4. Calculating the static loading:

$$P_o = 0.6 F_r + 0.5 F_a = 0.6 \times 246.4 + 0 = 147.84 \text{ N}$$

but since $P_o < F_r$ we take $P_o = F_r = 246.4 \text{ N}$.

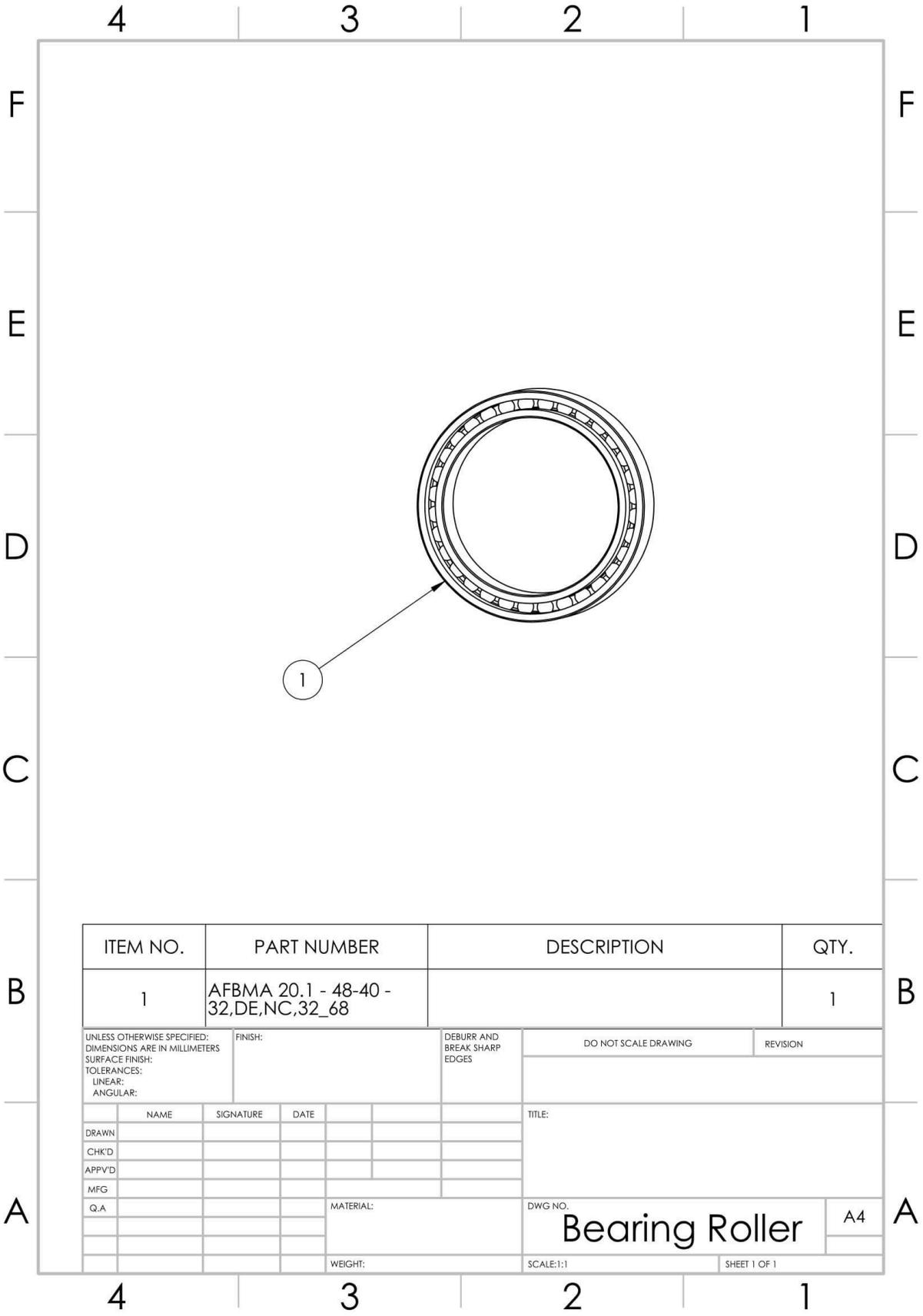
For normal and normal vibrations, $S_o = 1$. Then:

$$C_o = S_o \times P_o = 1 \times 246.4 = 246.4 \text{ N}$$

Therefore, $C_o < C_{\text{table}}$.

5. Checking for limiting speed: $n < n_{\text{table}}$

Now, after all these checks, we can consider the bearing designation **61808** as the right bearing selection for our rollers.



ITEM NO.	PART NUMBER	DESCRIPTION	QTY.
1	AFBMA 20.1 - 48-40 - 32,DE,NC,32_68		1
UNLESS OTHERWISE SPECIFIED: DIMENSIONS ARE IN MILLIMETERS SURFACE FINISH: TOLERANCES: LINEAR: ANGULAR:		FINISH:	DEBURR AND BREAK SHARP EDGES
		DO NOT SCALE DRAWING	REVISION
DRAWN		TITLE:	
CHK'D			
APPV'D			
MFG			
Q.A		MATERIAL:	DWG NO.
			Bearing Roller
		WEIGHT:	A4
			SCALE:1:1 SHEET 1 OF 1