

# **LAMPIRAN**

## **A**

### **“TABEL STANDAR PERHITUNGAN”**

### A.1. Tabel Trigonometri

Angle in Degrees						
	sin	cos	tan	sec	cosec	cot
0	0	1	0	1	Not Defined	Not Defined
30	$\frac{1}{2}$	$\frac{\sqrt{3}}{2}$	$\frac{1}{\sqrt{3}}$	$\frac{2}{\sqrt{3}}$	2	$\sqrt{3}$
45	$\frac{1}{\sqrt{2}}$	$\frac{1}{\sqrt{2}}$	1	$\sqrt{2}$	$\sqrt{2}$	1
60	$\frac{\sqrt{3}}{2}$	$\frac{1}{2}$	$\sqrt{3}$	2	$\frac{2}{\sqrt{3}}$	$\frac{1}{\sqrt{3}}$
90	1	0	Not Defined	Not Defined	1	0

( Sumber : Rumus Trigonometri )

## A.2. Tabel Berat Jenis dan Massa Jenis Material

Bahan	Berat jenis $\gamma$		Massa jenis $\rho$	
	lb/ft <sup>3</sup>	KN/m <sup>3</sup>	Slugs/ft <sup>3</sup>	Kg/m <sup>3</sup>
Paduan Aluminium 2014-T6, 7075-T6 6061-T6	160-180	26-28	5,2-5,4	2.600-2.800
	175	28	5,4	2.800
	170	26	5,2	2.700
Kuningan	520-540	82-85	16-17	8.400-8.600
Perunggu	510-550	80-86	16-17	8.200-8.800
Besi Tuang	435-460	68-72	13-14	7.000-7.400
Beton (tekan) Biasa Diperkuat Ringan	145	23	4,5	2.300
	150	24	4,7	2.400
	70-115	11-18	2,2-3,6	1.100-1.800
Tembaga dan paduannya	556	87	17	8.900
Gelas	150-180	24-28	4,7-5,4	2.400-2.800
Paduan Magnesium	110-114	17-18	3,4-3,5	1.760-1.830
Monel (67% Ni, 30% (Cu)	550	87	17	8.800
Nikel	550	87	17	8.800
Plastik Nilon Polietilen	55-70	8,6-11	1,7-2,2	880-1.100
	60-90	9,4-14	1,9-2,8	960-1.400
Batu (tekan) Granit, marmer, Kuarsa, sandstone	165-180	26-28	5,1-5,6	2.600-2.900
	125-180	9,4-14	3,9-5,6	2.000-2.900
Karet	60-80	9-13	1,9-2,5	960-1.300
Pasir, tanah, gravel	75-135	12-21	2,3-4,2	1.200-2.200
Baja	490	77,0	15,2	7.850
Paduan Titanium	280	44	8,7	4.500
Tungsten	1.200	190	37	1.900
Air laut	62,4	9,81	1,94	1.000
Air Segar	63,8	10,0	1,98	1.020
Kayu ( tekan ) Douglas fir Oak Southern pine	30-35	4,7-5,5	0,9-1,1	480-560
	40-45	6,3-7,1	1,2-1,4	640-720
	35-40	5,5-6,3	1,1-1,2	560-640

( Sumber : Ashby, 1998 )

<b>Nama Benda</b>	<b>Massa Jenis Kg/m<sup>3</sup></b>	<b>Nama Benda</b>	<b>Massa Jenis Kg/m<sup>3</sup></b>
Abu Batubara	641	Kapur padat	2611
Air	1000	Kapur rusak	1554
Aluminium	2712	Kapur ulverized	1394
Aluminium – meleleh	2560 – 2640	Karbon dioksida	1.98
Aluminium foil	2700 -2750	Karbon monoksida	1:25
Aluminium perunggu (3-10% Al)	7700-8700	Karbon padat	2146
Alumunium Oksida	1522	Kardus	689
Ammonium Nitrate	730	Karet caoutchouc	945
Ammonium Sulphate	1130	Karet diproduksi tahun	1522
Batubara bitumen rusak	833	Magnesium oksida	1940
Bauksit	1281	Magnesium sulfat kristal	1121
Benih Cengkeh	769	Malt	336
Beras dikuliti	753	Mangan padat	7609
berilium	1840	Mangan Bronze	8359
Besi cor	6800 – 7800	Mangan oksida	1922
Besi Sulfat	1290	Marmer padat	2563
Besi Tempa	7750	Marmer rusak	1570
Beton Aspal	2243	Mentega	865
Beton Kerikil	2403	Mercury	13593
Biji rami seluruh	753	Minyak biji rami	942
Bijih Besi	5046	Minyak cake	785

Bijih besi hancur	2100-2900	Minyak etroleum	881
Bijih Kobalt	6295	Molibdenum	1600
Bijih kromium	2162	Molibdenum	1600
Bijih Nikel	1600	Monel	8360 – 8840
Bijih Platinum	2600	Mortar basah	2403
Bijih Seng	4300	Nikel	8800
Bijih Tambaga	3750-3960	Nikel perak	8400 – 8900
Bismuth	9787	Nikel perak	8442
Boraks	849	Nitrogen	1:26
Brewers gandum	432	Oak merah	705
Brick chrome	2803	Oats	432
Brick magnesiumium	2563	Oksigen	1:43
Brick silika	2050	Pasir air diisi	1922
Brick umum merah	1922	Pasir basah	1922
Bronze (8-14% Sn)	7400-8900	Pasir basah acked	2082
Butir Gandum	780-800	Pasir dengan Kerikil basah	2020
Caliche	1442	Pasir dengan kerikil kering	1650
Gula pasir	849	Sendawa	1201
Gummite (bijih uranium)	3890-6400	Seng	7135
Gypsum padat	2787	Seng oksida	400
Iridium	22154	Serbuk gergaji	210
Jagung bubuk jagung	673	Sinter	1600-2180
Jagung dikupas	721	Soda	432
Jagung pada tongkol	721	Soda bikarbonat	689
Kaca rusak atau cullet	1290-1940	Sodium	977

Kaca jendela	2579	Stainless Steel	7480 – 8000
Kacang dikupas	641	Sulfur Padat	2002
Kacang kedelai	753	Takonit	2803
Kacang tanah tidak dikupas	272	Tar	1153
Kadmium	8650	Tebu	272
Kalium klorida	2002	tembaga	8930
Kalsium karbida	1201	Tembaga berilium	8100 – 8250
Kaolin	352	Tembaga bijih	1940-2590
Kapas daging	641	Tembaga sulfat tanah	3604
Kapas kering de linted	561	Tembakau	320
Kapas kering tidak de linted	320	Tepung gandum	593
Kapas kue kental	p673	Terpentin	865
Kapas makanan	593	titanium	4500
Kapas sekam	192	tungsten	19600
Kapur kental	1442	uranium	18900
Kapur baik	1121	vanadium	5494
Kapur padat	2499	Wol	1314

( Sumber : Ashby, 1998 )

### A.3. Tabel *Modulus Young Materials*

<b>Designations for Mild–Steel Coated Electrodes</b>	
The prefix “E” designates arc welding electrode.	
The first two digits of four-digit numbers and the first three digits of five-digit numbers indicate minimum tensile strength:	
E60XX	60,000 psi minimum tensile strength
E70XX	70,000 psi minimum tensile strength
E110XX	110,000 psi minimum tensile strength
The next-to-last digit indicates position:	
EXX1X	All positions
EXX2X	Flat position and horizontal fillets
The last two digits together indicate the type of covering and the current to be used.	
The suffix (Example: EXXXX-A1) indicates the approximate alloy in the weld deposit:	
–A1	0.5% Mo
–B1	0.5% Cr, 0.5% Mo
–B2	1.25% Cr, 0.5% Mo
–B3	2.25% Cr, 1% Mo
–B4	2% Cr, 0.5% Mo
–B5	0.5% Cr, 1% Mo
–C1	2.5% Ni
–C2	3.25% Ni
–C3	1% Ni, 0.35% Mo, 0.15% Cr
–D1 and D2	0.25–0.45% Mo, 1.75% Mn
–G	0.5% min. Ni, 0.3% min. Cr, 0.2% min. Mo, 0.1% min. V, 1% min. Mn (only one element required)

( sumber : Manufacturing, Engineering, and Technology, 2006 )

#### A.4. Tabel Jenis Elektroda Menurut AWS A5.1-69

<b>Jenis</b>	<b>AWS spesifikasi</b>	<b>Contoh</b>
<i>Baja karbon</i>	A5.1	<i>E60XX &amp; E70XX</i>
<i>Baja paduan rendah</i>	A5.5	<i>E7010-A1, E8016-C2</i>
<i>Baja tahan karat</i>	A5.4	<i>E310-15, E310-16</i>
<i>Besi Tuang (Cast iron)</i>	A5.15	<i>Nikel, Ni-Fe, Ni-Cu</i>
<i>Al dan paduannya</i>	A5.3	<i>1100 (Al murni), 4043</i>
<i>Cu dan paduannya</i>	A5.6	<i>ECuAl-A2</i>
<i>Ni dan paduannya</i>	A5.11	<i>ENiCrFe-1</i>
<i>Surfacing</i>	A5.13 dan A5.21	<i>EWC</i>

	Coating	DCRP	AC	DCSP	Iron Pwdr	Low H	All Pos
Exx10	Cellulose Sodium	v					v
Exx11	Cellulose Potasium	v	v				v
Exx12	Titania Sodium		v	v			v
Exx13	Titania Potasium		v	v			v
Exx14	Fe powder Titanium	v	v	v	v		v
Exx15	Low H Sodium	v				v	v
Exx16	Low H Potasium	v	v			v	v
Exx18	Fe powder Fe oxide	v	v		v	v	v
Exx20	Fe oxide Sodium	*	v	v			
Exx24	Fe powder Titanium	v	v	v	v		
Exx27	Fe powder	*	v	v	v		
Exx28	Fe powder Fe oxide	v		v	v	v	
Exx48	Low H Fe Powder K	v	v		v	v	

\*DCRP can be used if these electrodes are used in the flat position

(sumber : Winarto)



### A.5. Tabel Kekuatan Fatik untuk Konstruksi Lasan

Type and grade of joint		Fatigue strength grade ( $\Delta\sigma$ )	Remarks	
Transverse butt joint	1. Joint whose reinforcement is removed	B (155)		
	2. Joint with finished weld toes	C (125)		
	3. Joint with unfinished surfaces	(1) Double-sided weld		D (100)
		(2) One-sided weld with a sound penetration bead		D (100)
Longitudinal butt joint	1. Complete joint penetration welded joint	(1) Reinforcement is removed	B (155)	
		(2) With unfinished surfaces	C (125)	
	2. Incomplete joint penetration welded joint	D (100)		
	3. Fillet welded joint	D (100)		
	6. Welded joint with a scallop	G (50)		
Cruciform joint	Non-load-carrying type	1. Fillet joint with smooth weld toes	D (100)	
		2. Fillet joint with finished weld toes	D (100)	
		3. Fillet joint with unfinished weld toes	E (80)	
	Load-carrying type	6. Complete joint penetration weld	(1) Joint with smooth weld toes	D (100)
			(2) Joint with finished weld toes	D (100)
			(3) Joint with unfinished weld toes	E (80)
		7. Fillet weld and incomplete joint penetration weld (Fracture at weld toe)	(1) Joint with smooth weld toes	E (80)
			(2) Joint with finished weld toes	E (80)
			(3) Joint with unfinished weld toes	F (65)
			(4) Joint with weld end and start	F (65)

Type and grade of joint		Fatigue strength grade ( $\Delta\sigma$ )	Remarks
Gusset joint (out-of-plane)	1. Fillet joint or groove joint of gusset ( $\leq 100\text{mm}$ )	(1) Joint with finished weld toes	E (80)
		(2) Joint with unfinished surface	F (65)
	2. Groove joint of gusset with a fillet (Fillet weld is surface-finished)	E (80)	
	3. Fillet joint of gusset ( $> 100\text{mm}$ )	G (50)	
	4. Groove joint of gusset ( $> 100\text{mm}$ )	(1) Joint with finished weld toes	F (65)
(2) Joint with unfinished surface		G (50)	

( Sumber: Winarto, 2011 )

### A.6. Tabel Daftar Ukuran Baut – Mur Sesuai Standart (ISO)

Designation	Pitch mm	Major or nominal diameter Nut and Bolt ( $d = D$ ) mm	Effective or pitch diameter Nut and Bolt ( $d_p$ ) mm	Minor or core diameter ( $d_c$ ) mm		Depth of thread (bolt) mm	Stress area mm <sup>2</sup>
				Bolt	Nut		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
<b>Coarse series</b>							
M 0.4	0.1	0.400	0.335	0.277	0.292	0.061	0.074
M 0.6	0.15	0.600	0.503	0.416	0.438	0.092	0.166
M 0.8	0.2	0.800	0.670	0.555	0.584	0.123	0.295
M 1	0.25	1.000	0.838	0.693	0.729	0.153	0.460
M 1.2	0.25	1.200	1.038	0.893	0.929	0.158	0.732
M 1.4	0.3	1.400	1.205	1.032	1.075	0.184	0.983
M 1.6	0.35	1.600	1.373	1.171	1.221	0.215	1.27
M 1.8	0.35	1.800	1.573	1.371	1.421	0.215	1.70
M 2	0.4	2.000	1.740	1.509	1.567	0.245	2.07
M 2.2	0.45	2.200	1.908	1.648	1.713	0.276	2.48
M 2.5	0.45	2.500	2.208	1.948	2.013	0.276	3.39
M 3	0.5	3.000	2.675	2.387	2.459	0.307	5.03
M 3.5	0.6	3.500	3.110	2.764	2.850	0.368	6.78
M 4	0.7	4.000	3.545	3.141	3.242	0.429	8.78
M 4.5	0.75	4.500	4.013	3.580	3.688	0.460	11.3
M 5	0.8	5.000	4.480	4.019	4.134	0.491	14.2
M 6	1	6.000	5.350	4.773	4.918	0.613	20.1

(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
M 7	1	7.000	6.350	5.773	5.918	0.613	28.9
M 8	1.25	8.000	7.188	6.466	6.647	0.767	36.6
M 10	1.5	10.000	9.026	8.160	8.876	0.920	58.3
M 12	1.75	12.000	10.863	9.858	10.106	1.074	84.0
M 14	2	14.000	12.701	11.546	11.835	1.227	115
M 16	2	16.000	14.701	13.546	13.835	1.227	157
M 18	2.5	18.000	16.376	14.933	15.294	1.534	192
M 20	2.5	20.000	18.376	16.933	17.294	1.534	245
M 22	2.5	22.000	20.376	18.933	19.294	1.534	303
M 24	3	24.000	22.051	20.320	20.752	1.840	353
M 27	3	27.000	25.051	23.320	23.752	1.840	459
M 30	3.5	30.000	27.727	25.706	26.211	2.147	561
M 33	3.5	33.000	30.727	28.706	29.211	2.147	694
M 36	4	36.000	33.402	31.093	31.670	2.454	817
M 39	4	39.000	36.402	34.093	34.670	2.454	976
M 42	4.5	42.000	39.077	36.416	37.129	2.760	1104
M 45	4.5	45.000	42.077	39.416	40.129	2.760	1300
M 48	5	48.000	44.752	41.795	42.587	3.067	1465
M 52	5	52.000	48.752	45.795	46.587	3.067	1755
M 56	5.5	56.000	52.428	49.177	50.046	3.067	2022
M 60	5.5	60.000	56.428	53.177	54.046	3.374	2360
<b>Fine series</b>							
M 8 × 1	1	8.000	7.350	6.773	6.918	0.613	39.2
M 10 × 1.25	1.25	10.000	9.188	8.466	8.647	0.767	61.6
M 12 × 1.25	1.25	12.000	11.184	10.466	10.647	0.767	92.1
M 14 × 1.5	1.5	14.000	13.026	12.160	12.376	0.920	125
M 16 × 1.5	1.5	16.000	15.026	14.160	14.376	0.920	167
M 18 × 1.5	1.5	18.000	17.026	16.160	16.376	0.920	216
M 20 × 1.5	1.5	20.000	19.026	18.160	18.376	0.920	272
M 22 × 1.5	1.5	22.000	21.026	20.160	20.376	0.920	333
M 24 × 2	2	24.000	22.701	21.546	21.835	1.227	384
M 27 × 2	2	27.000	25.701	24.546	24.835	1.227	496
M 30 × 2	2	30.000	28.701	27.546	27.835	1.227	621
M 33 × 2	2	33.000	31.701	30.546	30.835	1.227	761
M 36 × 3	3	36.000	34.051	32.319	32.752	1.840	865
M 39 × 3	3	39.000	37.051	35.319	35.752	1.840	1028

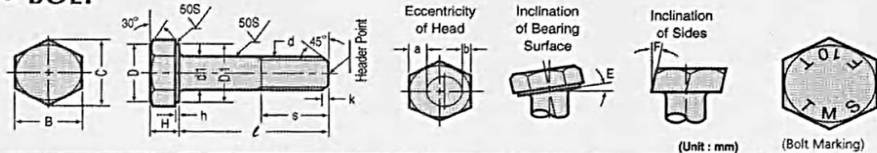
Note : In case the table is not available, then the core diameter ( $d_c$ ) may be taken as  $0.84 d$ , where  $d$  is the major diameter.

( Sumber : Reaffirmed, 1996 )

## A.7. Tabel Daftar Ukuran Baut – Mur Mutu Tinggi HTB

### 1. DIMENSION AND TOLERANCES

#### • BOLT

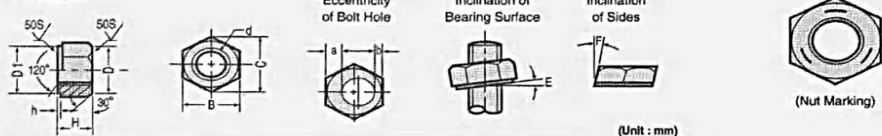


(Unit : mm)

Designation of Bolt (d)	d1		H		B		C	D	D1	k	n-b		E	F	S		
	Basic Dimension	Tolerance	Basic Dimension	Tolerance	Basic Dimension	Tolerance	Approx.	Approx.	Min.	r	Approx.	Max.	Max.	Max.	h	Basic Dimension	Tolerance
M 12	12	+ 0.7 - 0.2	8	± 0.8	22	+ 0 - 0.8	25.4	20	20	0.8 - 1.6	2	0.7				25	+ 5 - 0
M 16	16		10		27		31.2	25	25			0.8				30	
M 20	20		13		32		37	30	29	1.2 - 2.0	2.5	0.9				35	
M 22	22		14	± 0.9	36		41.6	34	33			1.1	1°	2°	0.4	40	
M 24	24	+ 0.8 - 0.4	15		41	- 1	47.3	39	38	1.6	3	1.2			- 0.8	45	+ 6 - 0
M 27	27		17		46		53.1	44	43	- 2.4		1.3				50	
M 30	30		19	± 1.0	50		57.7	48	47	2.0 - 2.8	3.5	1.5				55	

(Bolt Marking)

#### • NUT

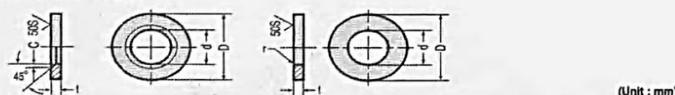


(Unit : mm)

Nominal Size of Thread (d)	Outside Diameter External Thread	H		B		C	D	D1	a-b		E	F	h
		Basic Dimension	Tolerance	Basic Dimension	Tolerance	Approx.	Approx.	Min.	Max.	Max.	Max.	Approx.	
M 12	12	12	± 0.35	22	0	25.4	20	20	0.7				
M 16	16	16		27	- 0.8	31.2	25	25	0.8				
M 20	20	20		32		37	30	29	0.9				
M 22	22	22		36		41.6	34	33	1.1	1°	2°	0.4 - 0.8	
M 24	24	24	± 0.4	41	+ 0 - 1	47.3	39	38	1.2				
M 27	27	27		46		53.1	44	43	1.3				
M 30	30	30		50		57.7	48	47	1.5				

(Nut Marking)

#### • WASHER



(Unit : mm)

Nominal Size of Washer	d		D		t		e or f
	Basic Dimension	Tolerance	Basic Dimension	Tolerance	Basic Dimension	Tolerance	Approx.
12	13	+ 0.7 0	26	+ 0 - 0.8	3.2		1.5
16	17		32		4.5	± 0.4	2
20	21		40	+ 0 - 1			
22	23	+ 0.8 0	44		6	± 0.7	2.4
24	25		48				
27	28	+ 1.0 0	56	+ 0 - 1.2	60		2.8
30	31		60				

( sumber : ASTM, 2012 )

## A.8. Tabel Daftar Ukuran Baut – Mur di Pasaran Indonesia



# MEGA BAIT INDONESIA

**M B I** \* Tool \* Bolt & Nut \* Industrial Supply

### BAUT MUR SS 304 MILI

DIAMETER	M 03		M 04		M 05		M 06		M 08		M 10		M 12	
	P 0.5		P 0.7		P 0.8		P 1.0		P 1.25		P 1.5		P 1.75	
LENGTH	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
10	-	-	-	-	-	-	1.520	(900)	-	-	-	-	-	-
12	-	-	-	-	-	-	1.590	(900)	-	-	-	-	-	-
16	-	-	-	-	-	-	1.620	(800)	3.310	(400)	6.490	(300)	-	-
20	-	-	-	-	-	-	1.940	(700)	3.570	(300)	6.720	(200)	9.790	(100)
25	-	-	-	-	-	-	2.050	(500)	3.740	(300)	7.260	(150)	10.250	(100)
30	-	-	-	-	-	-	2.220	(400)	4.100	(250)	7.510	(150)	10.930	(100)
35	-	-	-	-	-	-	2.360	(350)	4.500	(200)	8.080	(130)	11.770	(80)
40	-	-	-	-	-	-	2.420	(350)	4.670	(200)	8.660	(100)	13.150	(80)
45	-	-	-	-	-	-	-	-	5.120	(150)	9.220	(100)	13.780	(70)
50	-	-	-	-	-	-	2.960	(250)	5.350	(150)	9.680	(100)	14.810	-
55	-	-	-	-	-	-	-	-	-	-	-	-	15.360	(50)
60	-	-	-	-	-	-	3.310	(200)	6.030	(120)	10.630	(70)	15.940	-
65	-	-	-	-	-	-	-	-	-	-	-	-	16.440	(50)
70	-	-	-	-	-	-	3.640	(150)	6.610	(100)	11.560	(60)	16.928	-
75	-	-	-	-	-	-	3.740	(150)	7.050	(100)	12.340	(60)	18.120	(50)
80	-	-	-	-	-	-	4.010	(120)	7.400	(80)	12.530	(50)	18.450	(40)
90	-	-	-	-	-	-	4.380	(120)	8.310	(80)	13.670	(50)	20.500	(40)
100	-	-	-	-	-	-	4.475	(120)	9.720	(80)	15.000	(50)	21.410	(40)
110	-	-	-	-	-	-	-	-	9.990	(120)	15.710	(70)	22.810	(35)
120	-	-	-	-	-	-	-	-	10.420	(110)	17.380	(70)	26.190	(30)
130	-	-	-	-	-	-	-	-	12.130	(100)	19.560	(60)	26.600	(30)
140	-	-	-	-	-	-	-	-	12.800	(100)	20.980	(60)	28.995	(40)
150	-	-	-	-	-	-	-	-	13.530	(100)	22.570	(50)	33.020	(40)
MUR	255	(15.000)	575	(10.000)	315	(6.000)	575	(2.000)	1.150	(900)	2.650	(400)	3.910	(250)

### RING PLAT SS 304

DIAMETER	M 04		M 05		M 06		M 08		M 10		M 12	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
125	(12.500)		135	(10.000)	250	(7.000)	345	(3.000)	750	(2.000)	1.380	(1.000)

### RING PLAT SS 304

DIAMETER	M 04		M 05		M 06		M 08		M 10		M 12	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
125	(12.500)		135	(10.000)	230	(7.000)	355	(3.000)	600	(2.000)	1.265	(1.000)

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# MEGA BAUT INDONESIA

**MBI** \* Tool \* Bolt & Nut \* Industrial Supply

## BAUT MUR SS 304 MILI

DIAMETER	M 14		M 16		M 20		M 22		M 24	
	P 2.0		P 2.0		P 2.5		P 2.5		P 3.0	
LENGH	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
10	-	-	-	-	-	-	-	-	-	-
12	-	-	-	-	-	-	-	-	-	-
16	-	-	-	-	-	-	-	-	-	-
20	-	-	-	-	-	-	-	-	-	-
25	-	-	-	-	-	-	-	-	-	-
30	16.330	(80)	24.480	(50)	-	-	-	-	-	-
35	-	-	-	-	-	-	-	-	-	-
40	19.270	(85)	26.190	(40)	43.700	(25)	-	-	-	-
45	-	-	27.890	(40)	-	-	-	-	-	-
50	22.770	(50)	29.610	(40)	50.030	(20)	84.530	(30)	121.900	(25)
55	-	-	31.020	-	-	-	-	-	-	-
60	24.790	(40)	32.450	(35)	55.200	(15)	86.600	(25)	152.250	(20)
65	-	-	33.020	(30)	-	-	-	-	-	-
70	26.170	(30)	35.300	(30)	59.800	(25)	91.730	(25)	-	-
75	-	-	35.650	(30)	62.310	(15)	-	-	-	-
80	-	-	36.440	(25)	66.130	(20)	98.330	(20)	140.300	(15)
90	-	-	38.710	(20)	74.750	(20)	-	-	-	-
100	-	-	42.070	(20)	84.525	(15)	104.080	(20)	173.080	(12)
110	-	-	43.130	(30)	87.980	(20)	106.380	(15)	176.530	(12)
120	-	-	47.725	(25)	94.300	(15)	114.430	(15)	193.200	(12)
130	-	-	50.050	(30)	84.530	(15)	115.000	(12)	202.980	(10)
140	-	-	56.350	(20)	87.980	(15)	119.600	(12)	211.600	(9)
150	-	-	66.700	(20)	94.300	(15)	130.530	(12)	224.250	(9)
MUR	4.890	(180)	7.480	(120)	13.800	(70)	18.400	(75)	35.650	(40)

## RING PLAT SS 304

DIAMETER	M 14		M 16		M 20		M 22		M 24	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
	1.840	(600)	2.300	(500)	3.910	(250)	5.750	(200)	7.480	(150)

## RING PLAT SS 304

DIAMETER	M 14		M 16		M 20		M 22		M 24	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
	1.725	(600)	2.300	(500)	3.910	(250)	5.750	(200)	8.200	(150)

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# MEGA BOUT INDONESIA

**M B I** \* Tool \* Bolt & Nut \* Industrial Supply

## BAUT MUR SS 304 MILI

DIAMETER LENGH	1/4"		5/16"		3/8"		1/2"		1/2"	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
1/2"	1.820	(800)	-	-	-	-	-	-	-	-
3/4"	2.010	(600)	3.110	(400)	-	-	-	-	-	-
1"	2.280	(600)	3.640	(350)	5.120	(220)	10.810	(120)	10.810	(120)
1-1/4"	2.620	(400)	3.980	(300)	5.750	(200)	11.845	(100)	-	-
1-1/2"	3.080	(350)	4.560	(200)	6.610	(160)	13.210	(80)	13.210	(80)
2"	3.420	(250)	5.580	(150)	7.970	(100)	15.710	(60)	15.710	(60)
2-1/2"	4.250	(180)	5.660	(100)	8.220	(90)	17.990	(50)	-	-
3"	4.950	(150)	6.440	(100)	10.670	(80)	19.360	(40)	-	-
3 1/2"	5.870	(100)	6.900	(100)	11.730	(70)	23.120	(40)	-	-
4"	6.330	(120)	8.050	(90)	13.170	(70)	25.650	(40)	-	-
4-1/2"	-	-	-	-	-	-	27.030	(35)	-	-
5"	8.170	-	10.350	(100)	16.620	(75)	30.710	(50)	-	-
6"	-	-	11.730	(100)	19.380	(60)	31.010	(40)	-	-
7"	-	-	-	-	24.150	-	41.700	(30)	-	-
8"	-	-	-	-	29.900	-	49.800	(30)	-	-
9"	-	-	-	-	35.940	-	55.090	(30)	-	-
10"	-	-	-	-	40.250	-	60.030	(30)	-	-
11"	-	-	-	-	-	-	64.400	(30)	-	-
12"	-	-	-	-	-	-	68.890	(30)	-	-
MUR	790	(2.000)	1.150	(1200)	1.495	(600)	3.910	(75)	3.910	(250)

## RING PLAT SS 304

DIAMETER	1/4"		5/16"		3/8"		1/2"		1/2"	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
	1.840	(600)	2.300	(400)	3.910	(250)	5.750	(200)	7.480	(130)

## RING PLAT SS 304

DIAMETER	1/4"		5/16"		3/8"		1/2"		1/2"	
	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus	Harga	Qty/Dus
	1.725	(600)	2.300	(500)	3.910	(250)	5.750	(200)	9.200	(130)

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## **LAMPIRAN**

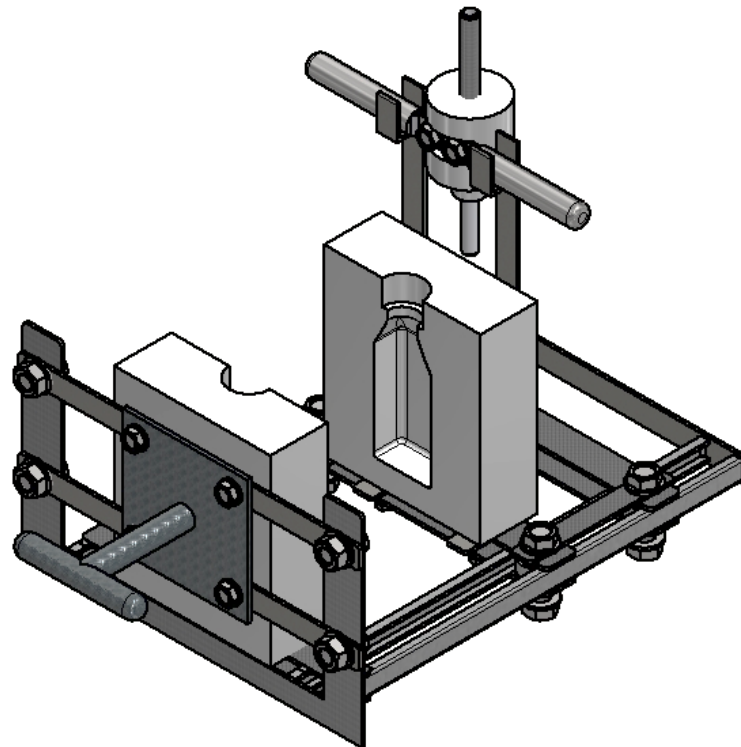
### **B**

#### **“TABEL HASIL PERHITUNGAN”**



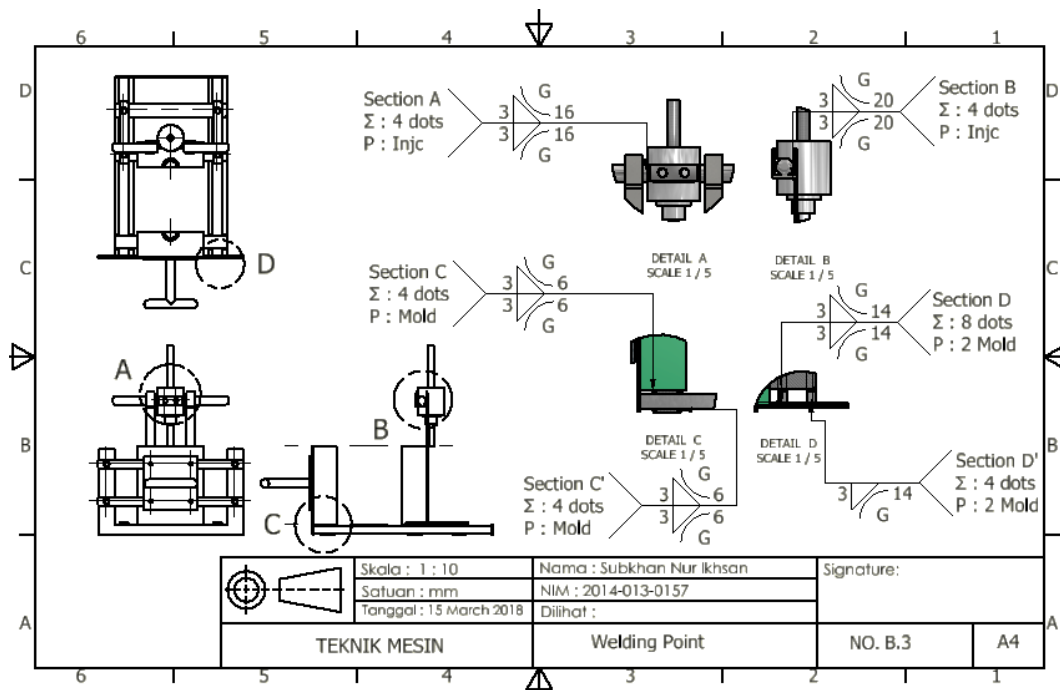
### B.1. Tabel Hasil Analisa dan Perhitungan Rancang Bangun Mesin

Hasil Analisa dan Perhitungan Rancang Bangun Mesin												
No	Bagian	Dimensi (mm)				Jumlah Komponen	Hasil Perhitungan				Kesimpulan ( $\gamma > \sigma_n$ )	
		P	L	T	- Bagian		Volume (mm <sup>3</sup> )	Berat (kg)	Gaya (N)	$\sigma_n$ (MPa)	Aman	Tidak
3.1	A	192,6	37	3	22	2	18936,6	0,30	62,41	$4,334 \times 10^{-3}$	√	-
	B	22	326	3	74	1	16632,0	0,13				
	C	20	327,6	3	0	2	19656,0	0,31				
3.2	Bagian	P	L	T	r							
	A'	100	-	-	10	2	31415,93	0,47	9,99	$11,352 \times 10^{-3}$	√	-
	B'	20	60	3	-	1	3600	0,03				
	C'	-	-	60	30	1	169646	0,44				
	C''	20	60	10	-		12000					
	C	C' - C''					157646					
	D'	-	-	5	19	1	5670,6	0,016				
	E'	-	-	16,1	12,5	1	7903,1	0,022				
	F'	-	-	200	6	1	22619,47	0,05				
F''	-	-	200	5	15707,96							
F	F' - F''					6911,50						
3.3	A	252	30	3	-	2	22680	0,35	62,2	$0,056 \times 10^{-3}$	√	-
	B'	400	18	3	-	2	21600	0,50				
	B''	400	9	3	-		10800					
	B	B' + B''					32400					



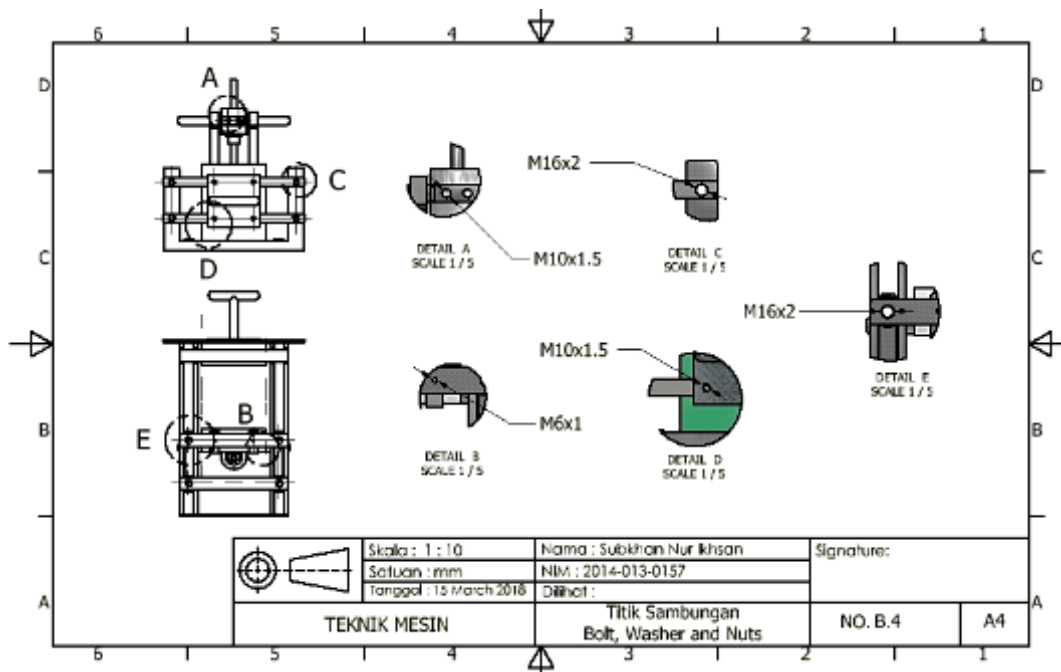
## B.2. Tabel Hasil Analisa dan Perhitungan Kekuatan Sambungan Las

Hasil Analisa dan Perhitungan									
Kekuatan Sambungan Las									
Bagian	Dimensi (mm)		Jumlah Titik	Hasil Perhitungan				Kesimpulan (E.maks < E.ijin)	
	s	L		$\sigma_{max}$ (MPa)	$\tau_{max}$ (MPa)	E. Maks	E.Ijin	Aman	Tidak
A	3	16	4	0,06	0,10	0,10	413,48	√	-
B	3	20	4	0,11	0,09	0,11	413,48	√	-
C	3	6	8	0,42	0,41	0,42	413,48	√	-
D	3	14	8	2,60	2,10	2,60	413,48	√	-



### B.3. Tabel Hasil Analisa dan Perhitungan Sambungan *Bolt, Washer, and Nuts*

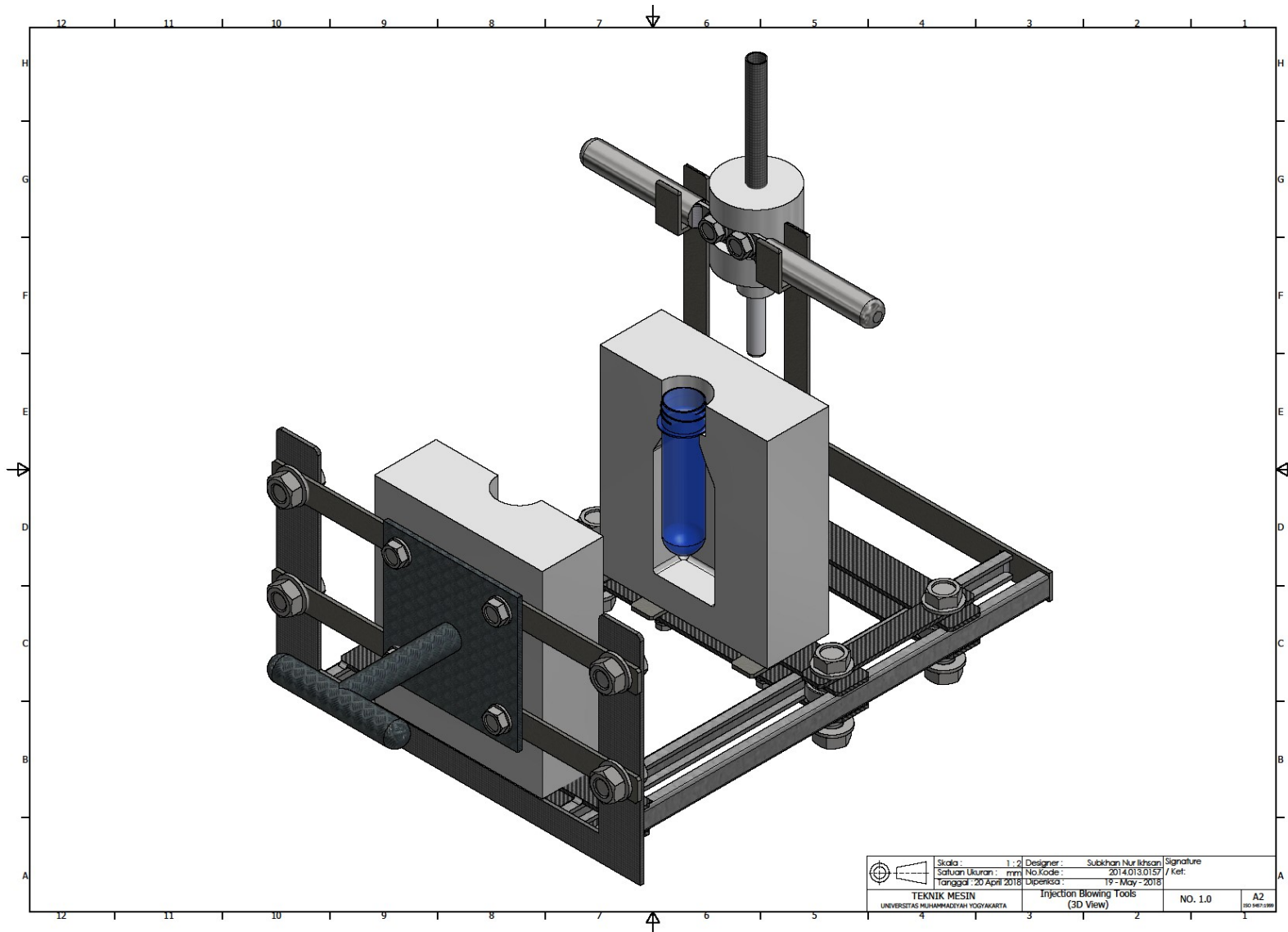
Hasil Analisa dan Perhitungan									
Sambungan <i>Bolt, Washer, and Nuts</i>									
Bagian	Jenis Sambungan	Jumlah Titik	Hasil Perhitungan					Kesimpulan	
			Besar Pembebanan (N)	Safety Factor	$\sigma_{max}$ (MPa)	$\sigma_{ijin}$ (MPa)	Diameter (mm)	Ukuran Pasti	Ukuran Alternatif
A	Tap	2	10,13	4,5	515	114,44	0,24	M 0,4	M 10
B	Jepit	2	3,00	2,0	515	257,50	0,09	M 0,4	M 6
C	Jepit	4	29,43	4,5	515	114,44	0,29	M 0,6	M 16
D	Tap	4	29,43	4,5	515	114,44	0,29	M 0,6	M 10
E	Jepit	4	3,00	4,5	515	114,44	0,09	M 0,4	M 16

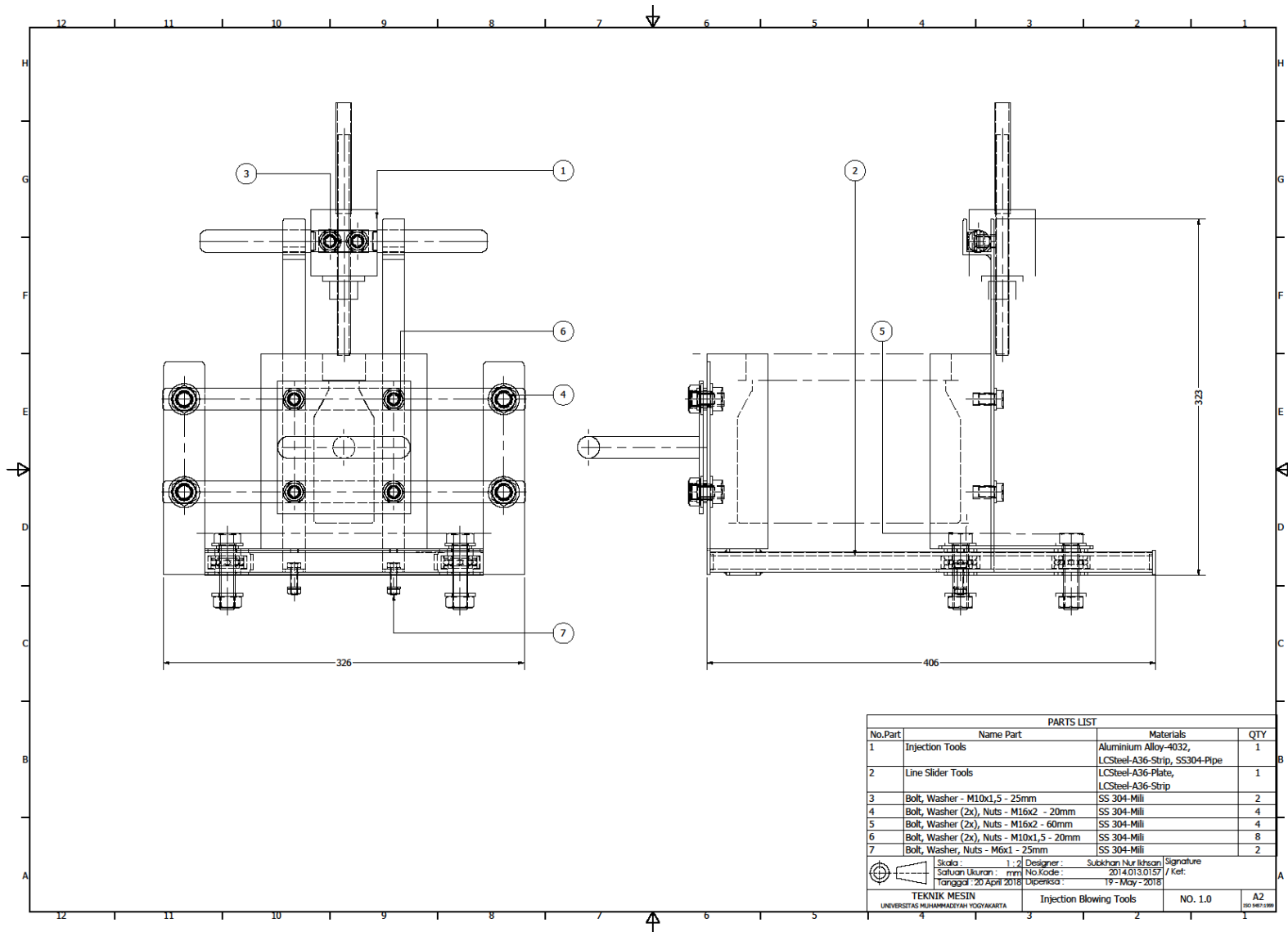


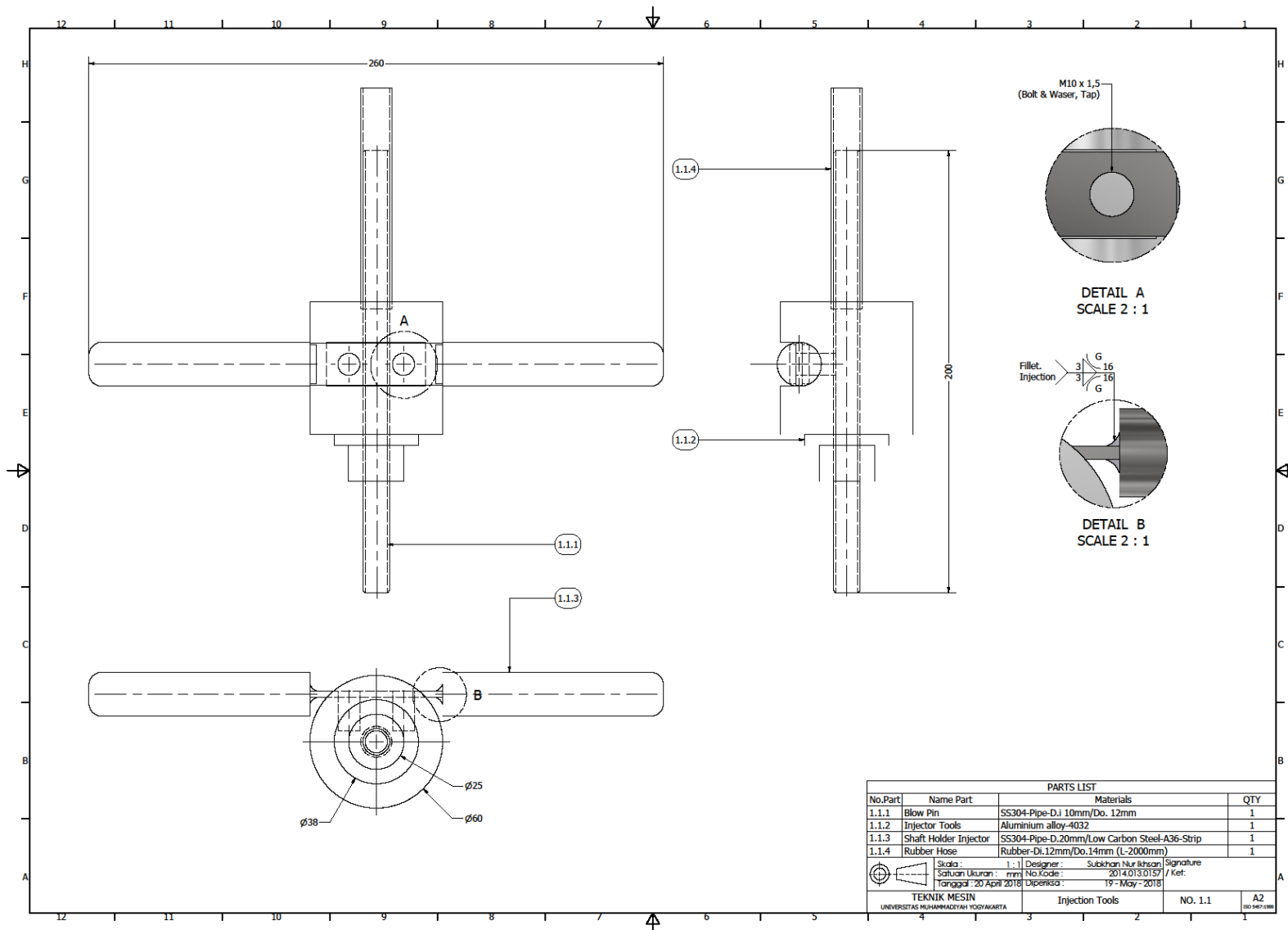
**LAMPIRAN**

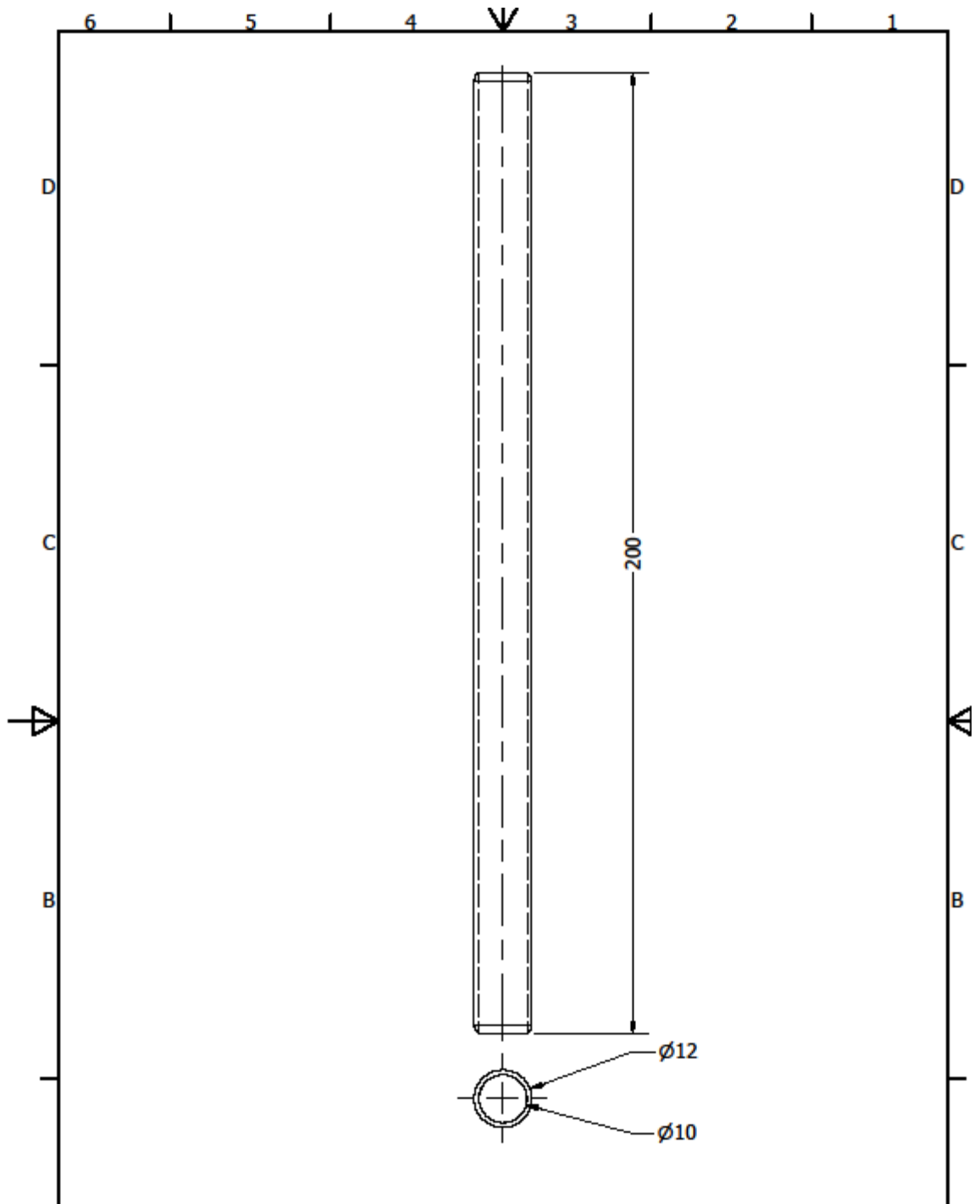
**C**

**“DESAIN HASIL PERANCANGAN”**

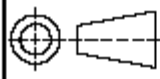




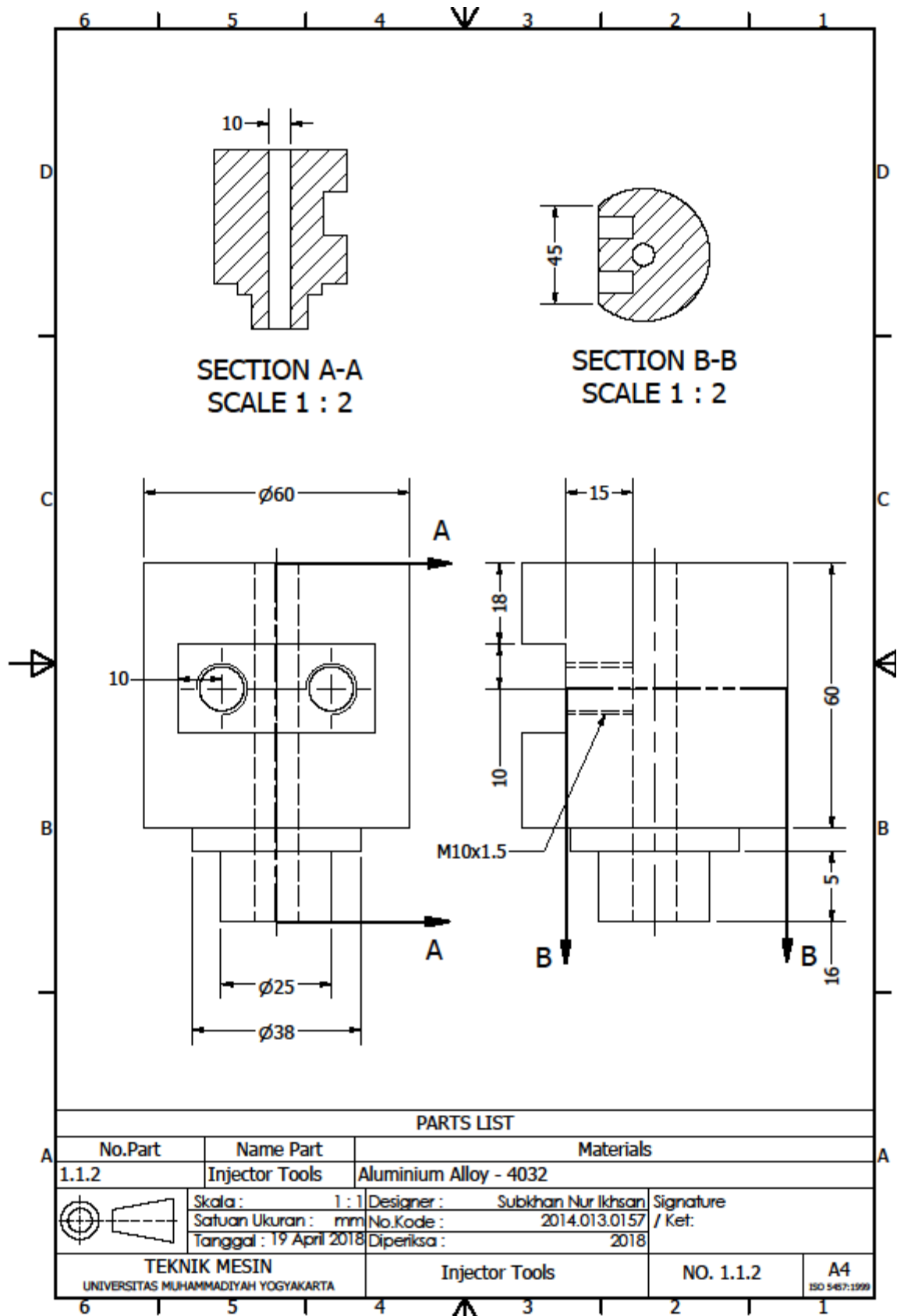




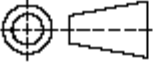
PARTS LIST

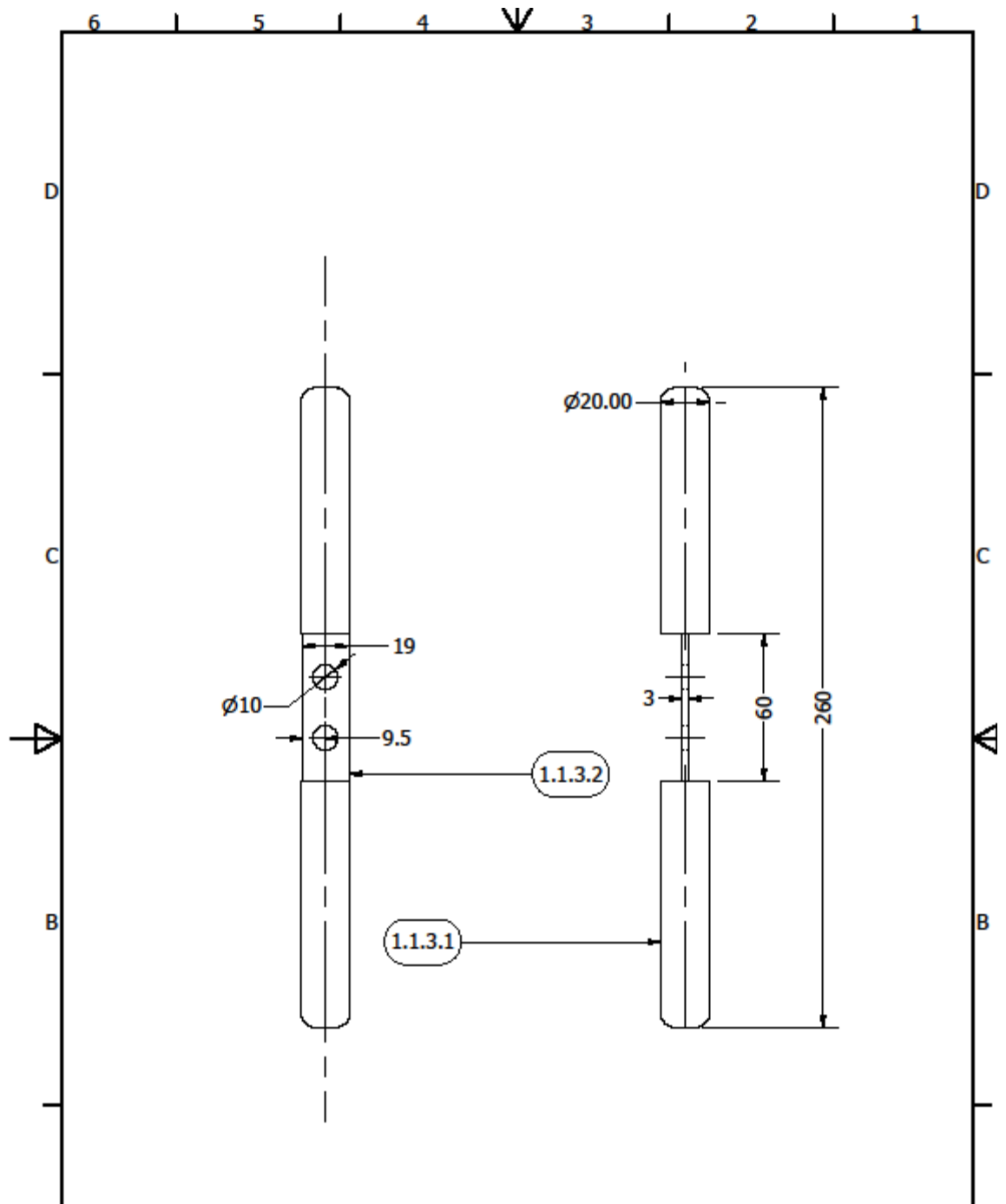
No.Part	Name Part	Materials	
1.1.1	Blow Pin	SS304-Pipe-Di.10/Do.12	
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan	Signature
	Satuan Ukuran : mm	No.Kode : 2014.013.0157	/ Ket:
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018	
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Blow Pin	NO. 1.1.1
			A4 ISO 5467:1999





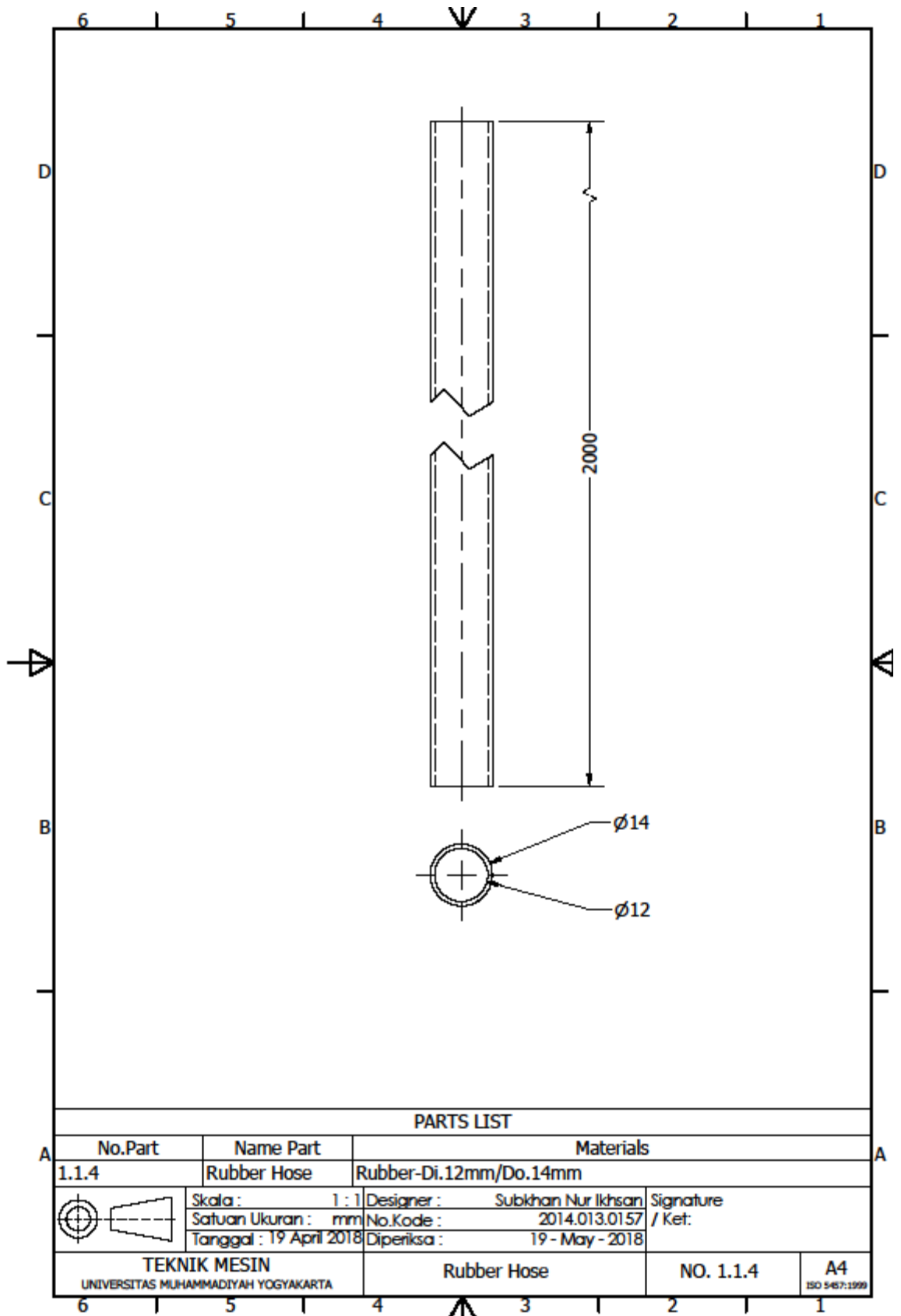
PARTS LIST

No.Part	Name Part	Materials
1.1.2	Injector Tools	Aluminium Alloy - 4032
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran : mm	No.Kode : 2014.013.0157
	Tanggal : 19 April 2018	Diperiksa : 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Injector Tools NO. 1.1.2 A4 <small>ISO 5467:1999</small>

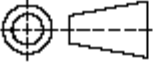


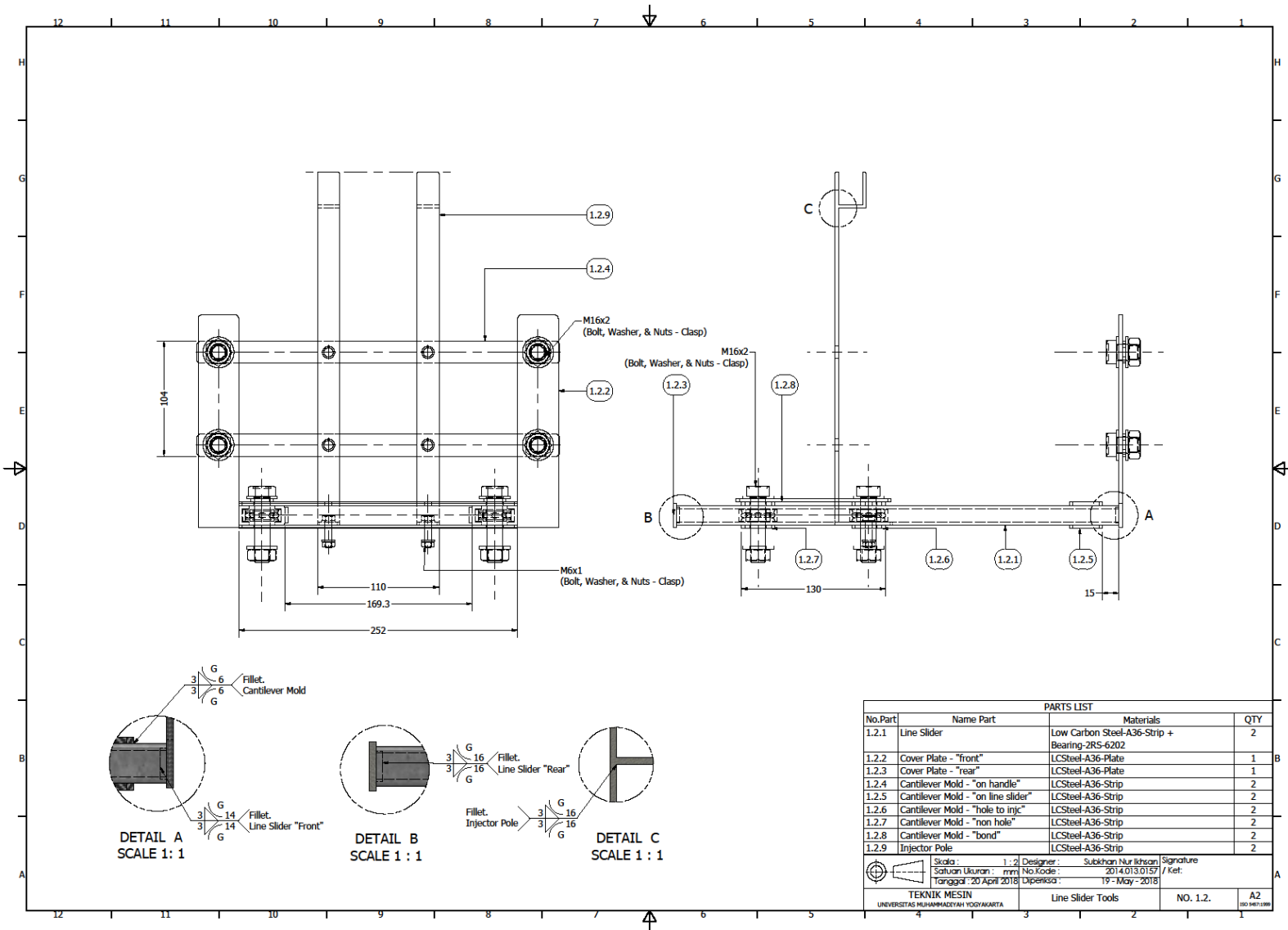
PARTS LIST

No.Part	Name Part	Materials	
1.1.3.1	Handle	SS304-Pipe-D.20mm	
1.1.3.2	Shaft	Low Carbon Steel-A36-Strip	
	Skala :	1 : 2	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran :	mm	No.Kode : 2014.013.0157
	Tanggal :	19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Shaft Holder Injector	NO. 1.1.3
			A4 ISO 5467:1999



PARTS LIST

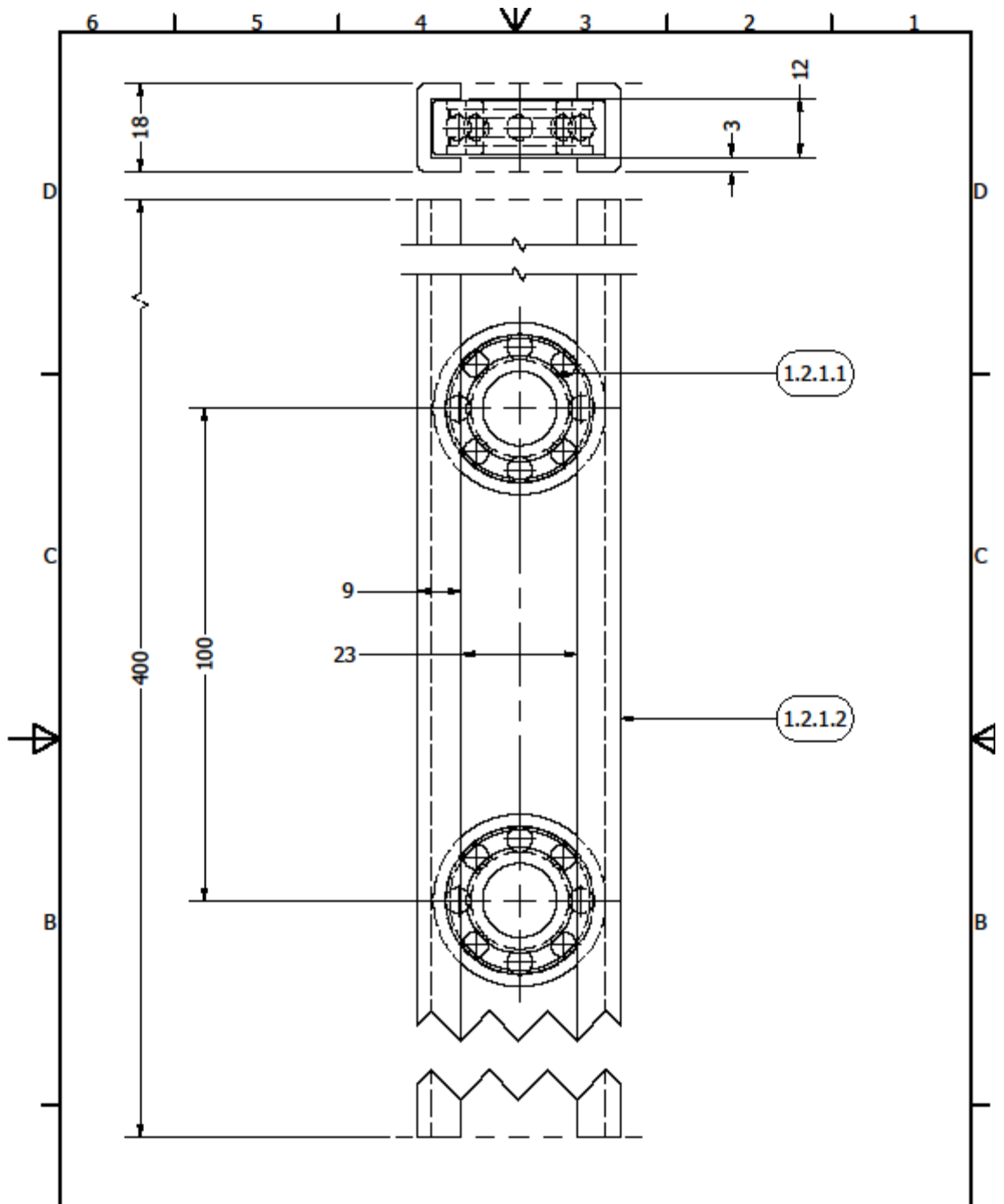
No.Part	Name Part	Materials	
1.1.4	Rubber Hose	Rubber-Di.12mm/Do.14mm	
	Skala :	1 : 1	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran :	mm	No.Kode : 2014.013.0157
	Tanggal :	19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Rubber Hose	NO. 1.1.4
			A4 ISO 5467:1999



PARTS LIST			
No.Part	Name Part	Materials	QTY
1.2.1	Line Slider	Low Carbon Steel-A36-Strip + Bearing-2RS-6202	2
1.2.2	Cover Plate - "front"	LCSteel-A36-Plate	1
1.2.3	Cover Plate - "rear"	LCSteel-A36-Plate	1
1.2.4	Cantilever Mold - "on handle"	LCSteel-A36-Strip	2
1.2.5	Cantilever Mold - "on line slider"	LCSteel-A36-Strip	2
1.2.6	Cantilever Mold - "hole to injc"	LCSteel-A36-Strip	2
1.2.7	Cantilever Mold - "non hole"	LCSteel-A36-Strip	2
1.2.8	Cantilever Mold - "bond"	LCSteel-A36-Strip	2
1.2.9	Injector Pole	LCSteel-A36-Strip	2

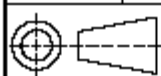
  

Skala : 1 : 2	Designer : Subhan Nur Ikhsan	Signature
Satuan Ukuran : mm	No.Kode : 2014.013.0157	/ Kiet.
Tanggal : 20 April 2018	Diperiksa : 19 - May - 2018	
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Line Slider Tools
NO. 1.2.		A2 100 9451199



**PARTS LIST**

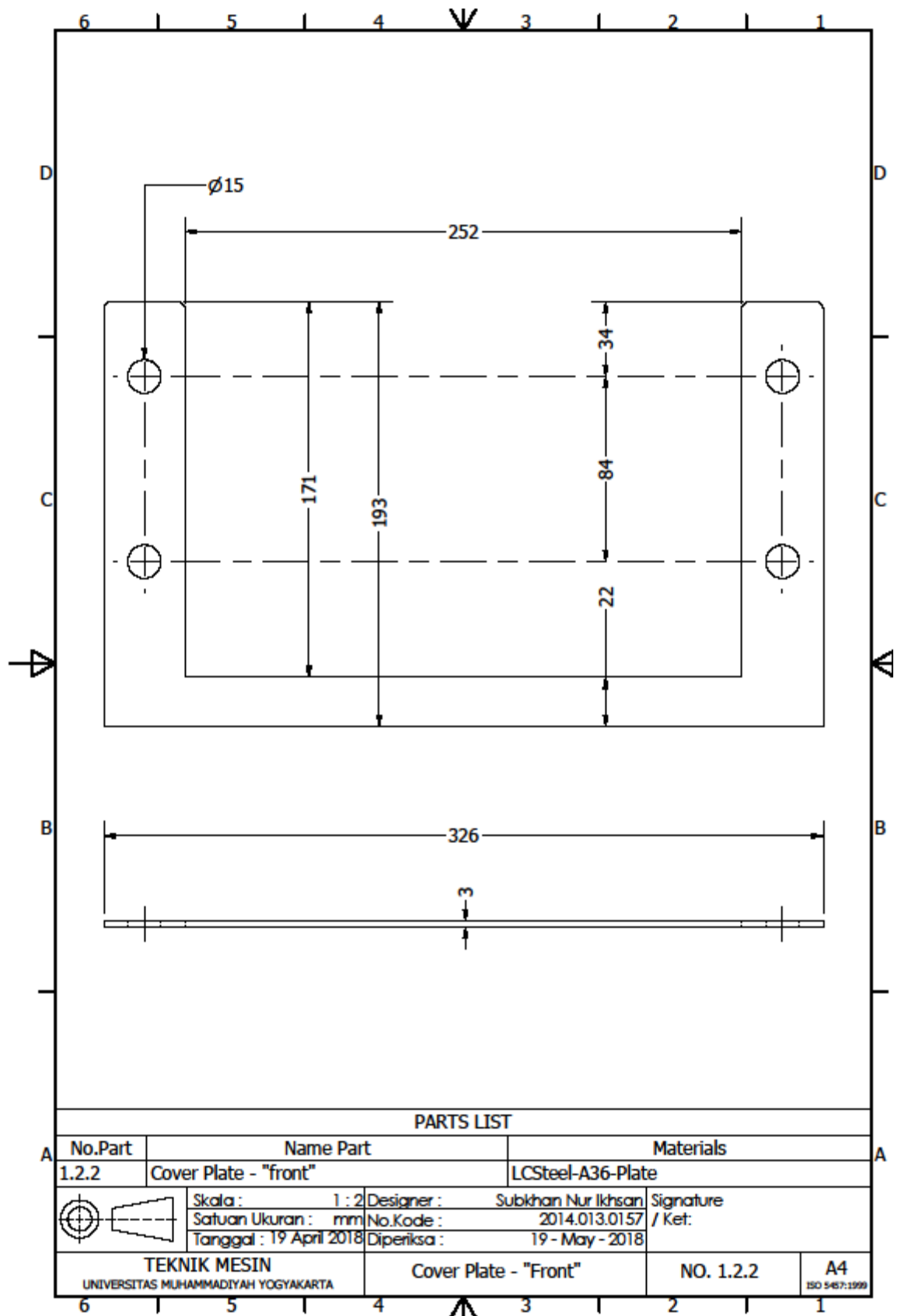
No.Part	Name Part	Materials	QTY
1.2.1.1	Bearing-2RS-6202	Steel	2
1.2.1.2	Steel Path	LCSteel-A36-Strip	2

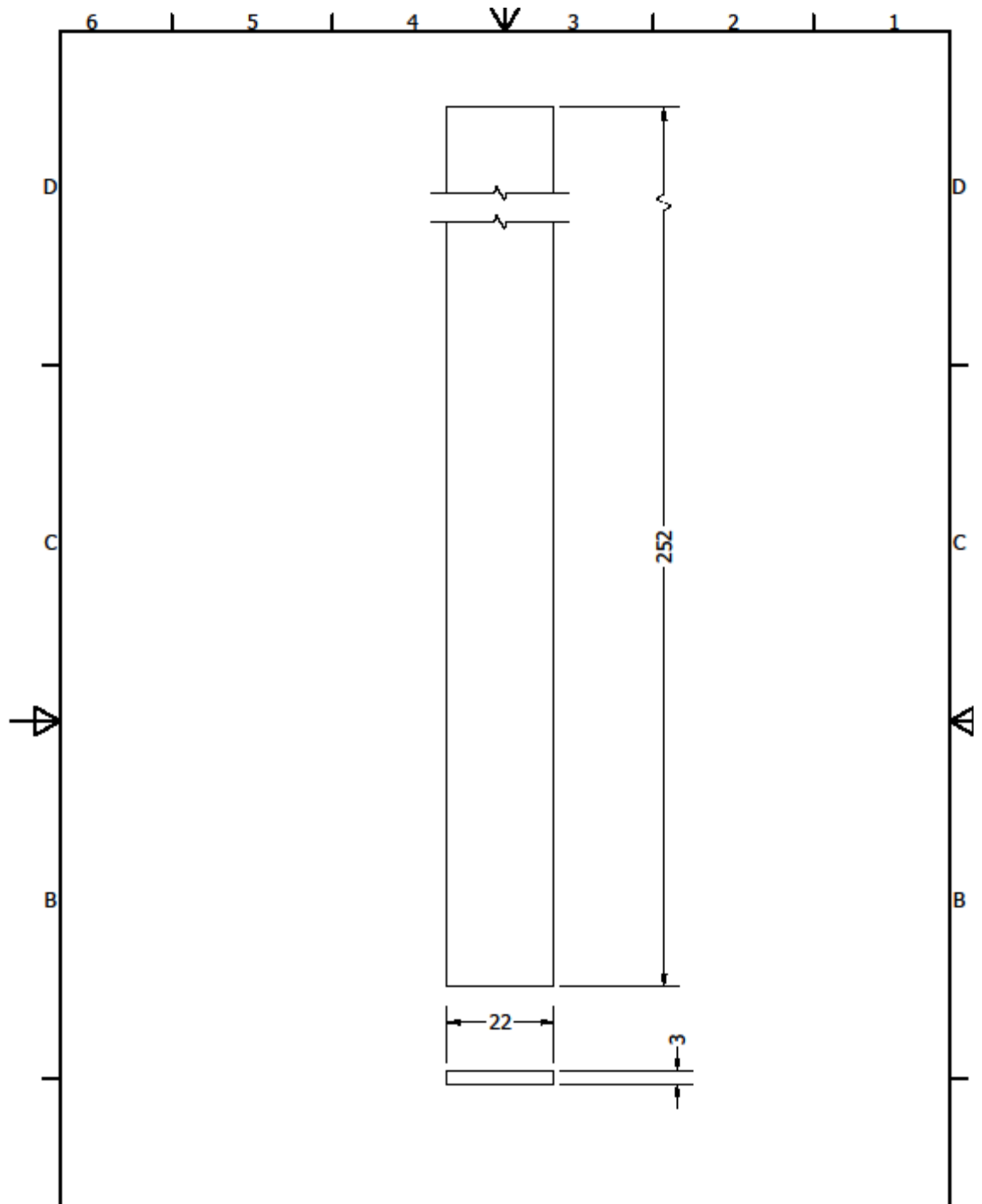


Skala : 1 : 1    Designer : Subkhan Nur Ikhsan  
 Satuan Ukuran : mm    No.Kode : 2014.013.0157  
 Tanggal : 19 April 2018    Diperiksa : 19 - May - 2018

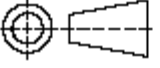
Signature / Ket:

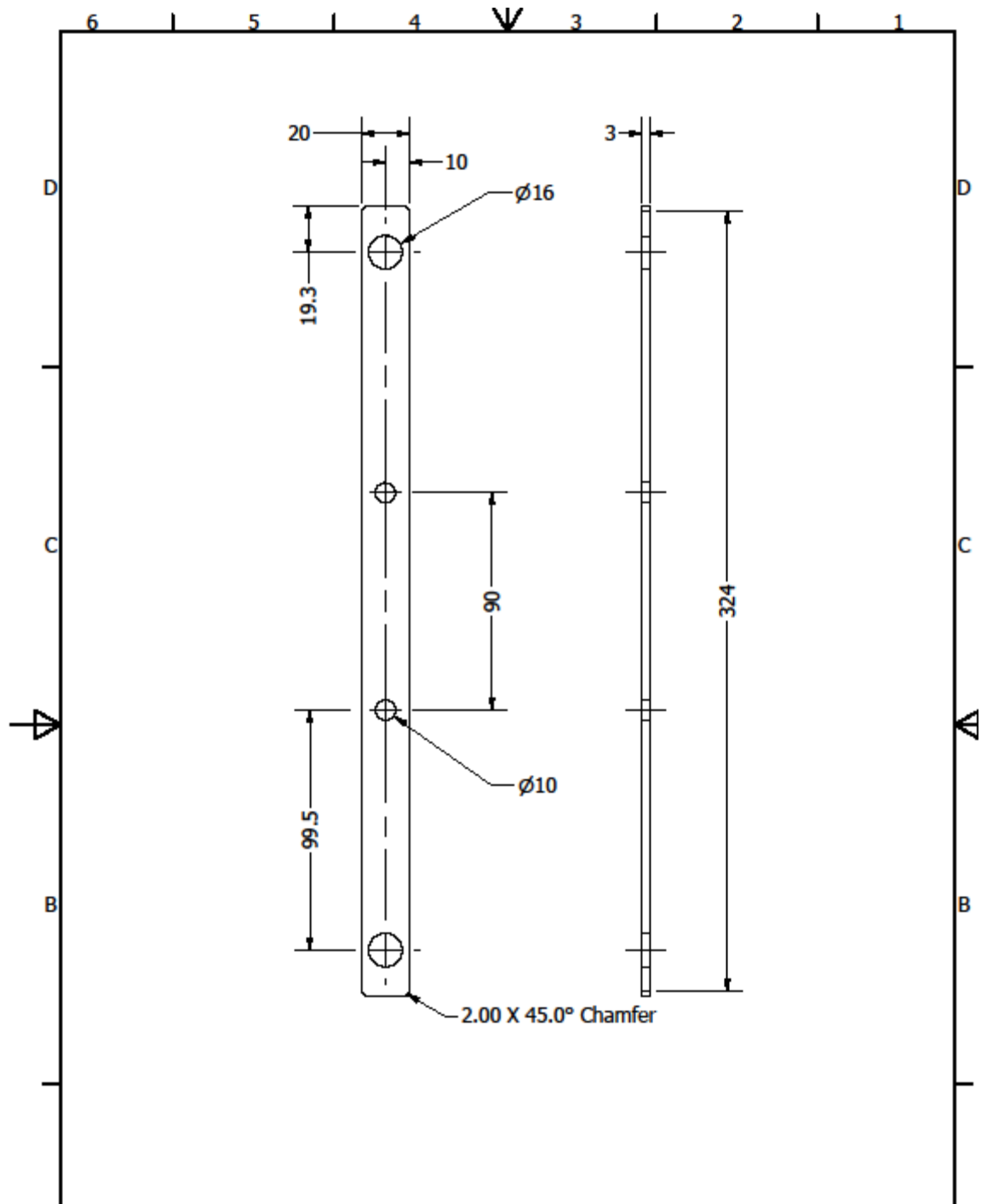
<b>TEKNIK MESIN</b> UNIVERSITAS MUHAMMADIYAH YOGYAKARTA	<b>Line Slider</b>	<b>NO. 1.2.1</b>	<b>A4</b> <small>ISO 5467:1999</small>
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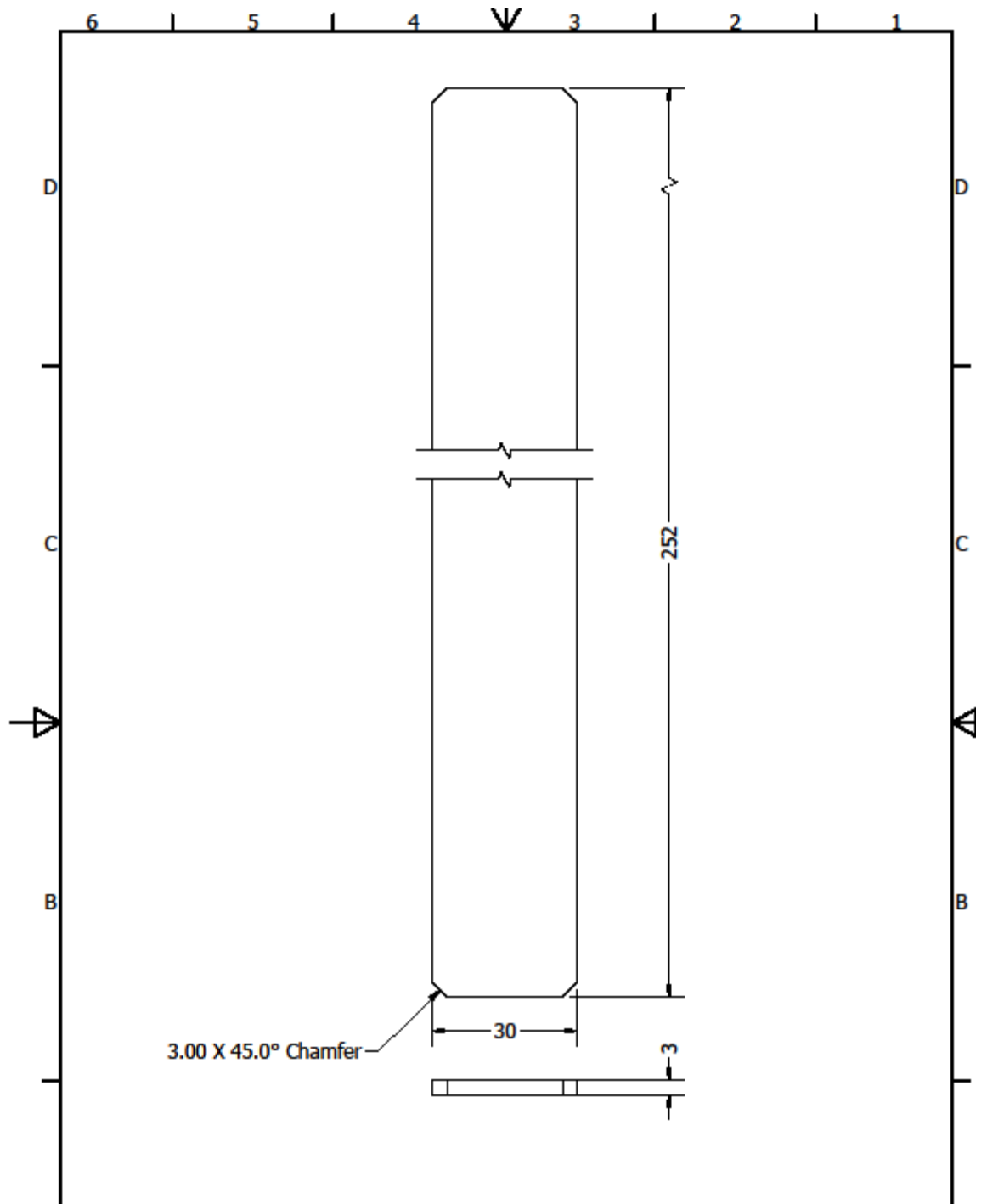
PARTS LIST

No.Part	Name Part	Materials
1.2.3	Cover Plate - "rear"	LCSteel-A36-Plate
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran : mm	No.Kode : 2014.013.0157
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Cover Plate - "Rear" NO. 1.2.3
		A4 ISO 5467:1999



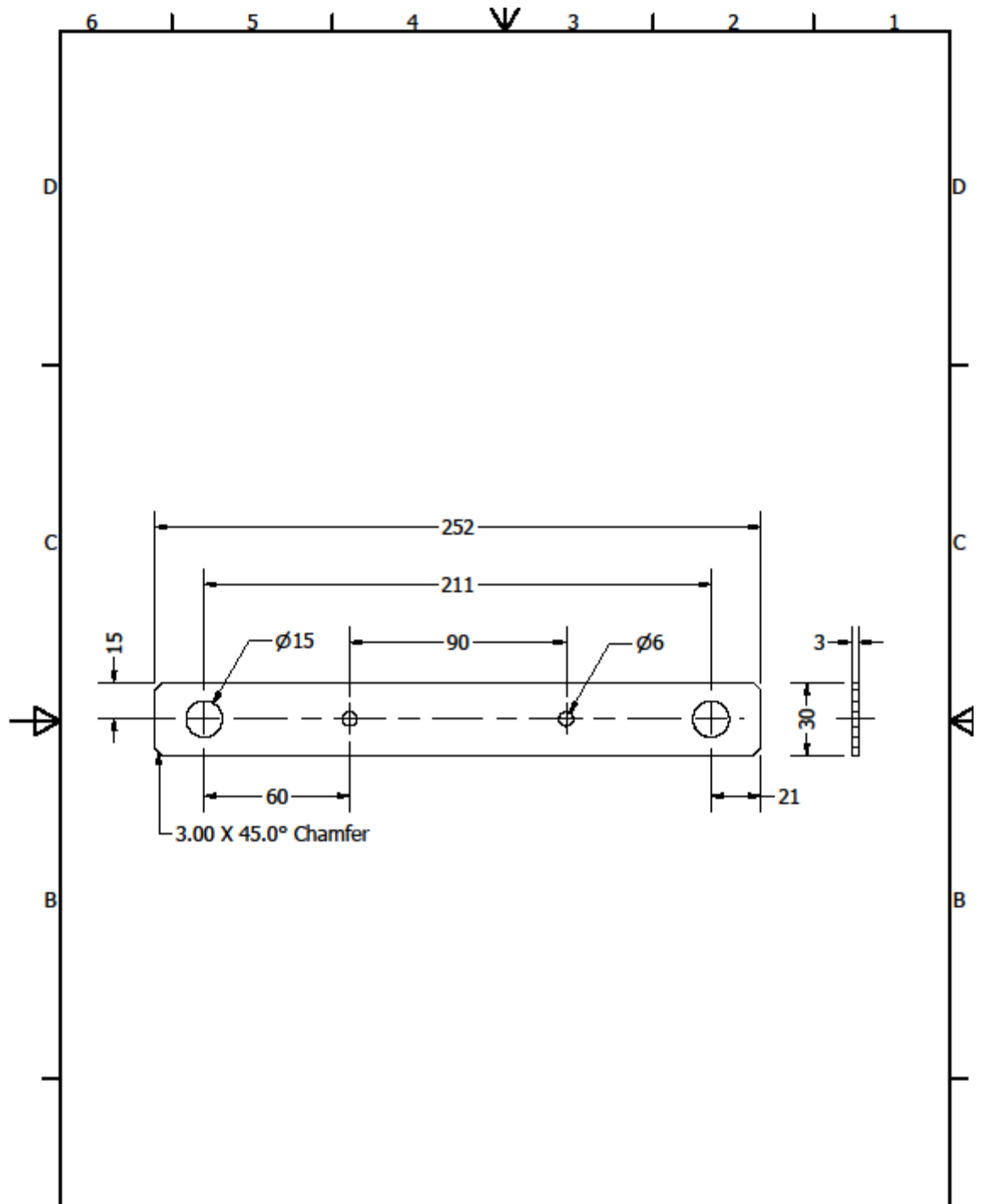
PARTS LIST			
No.Part	Name Part	Materials	
1.2.4	Cantilever Mold - "on handle"	LCSteel-A36-Strip	
	Skala : 1 : 2	Designer : Subkhan Nur Ikhsan	Signature / Ket:
	Satuan Ukuran : mm	No.Kode : 2014.013.0157	
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018	
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Cantiliver Mold - on handle	NO. 1.2.4
			A4 ISO 5467:1999





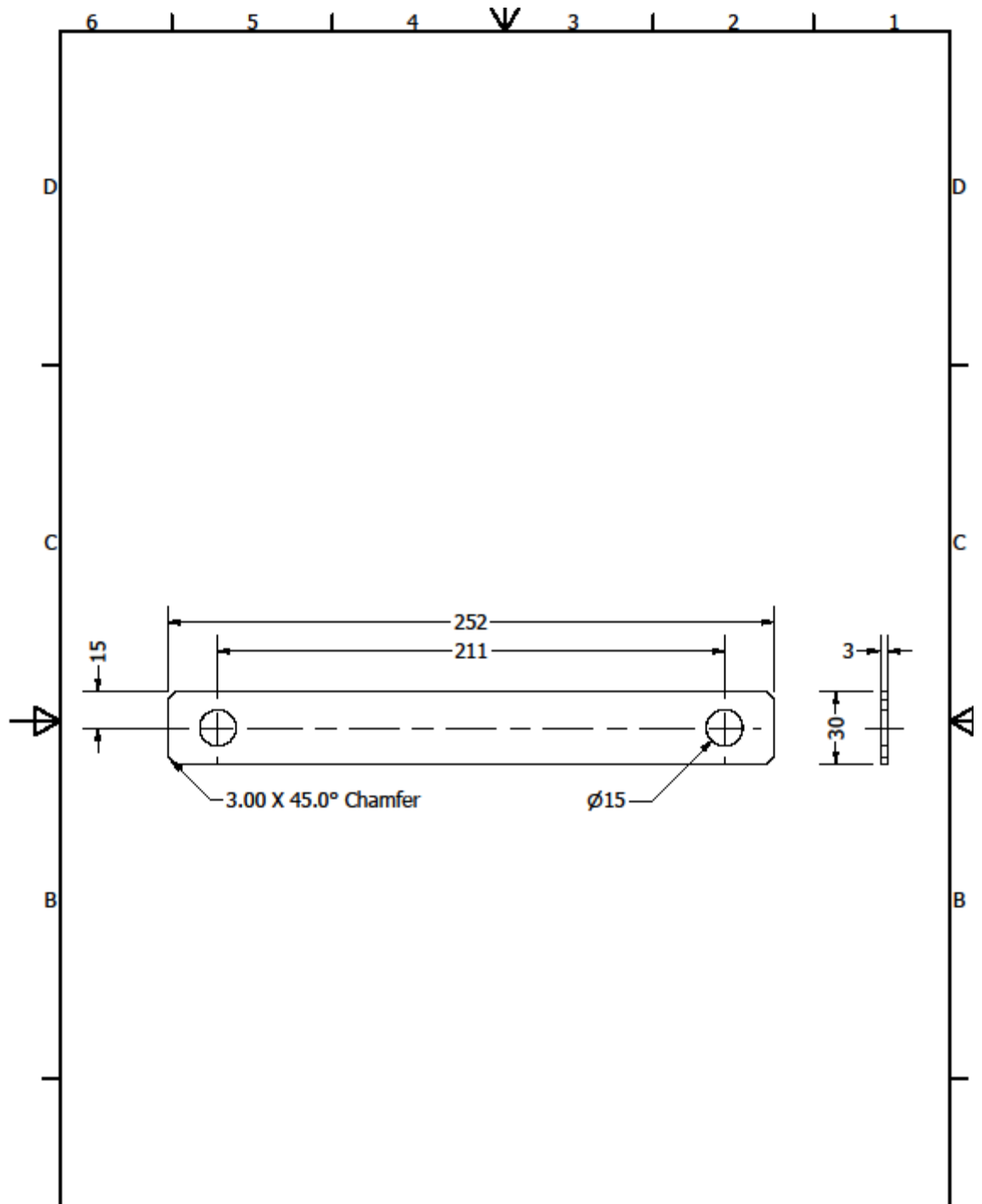
PARTS LIST

No.Part	Name Part	Materials
1.2.5	Cantilever Mold - "on line slider"	LCSteel-A36-Strip
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran : mm	No.Kode : 2014.013.0157
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Cantiliver Mold - on line slider NO. 1.2.5
		A4 ISO 5467:1999



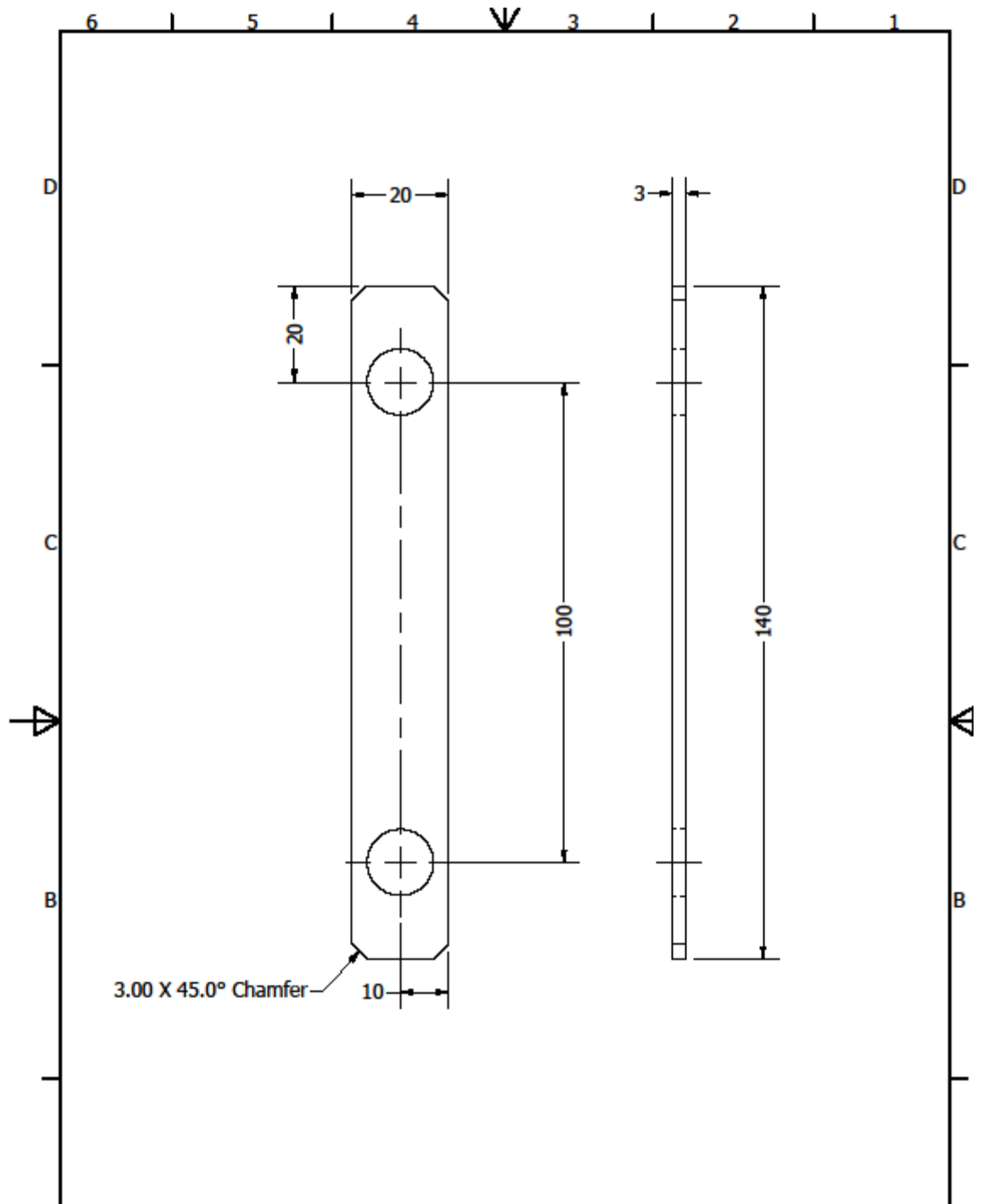
PARTS LIST

No.Part	Name Part	Materials
1.2.6	Cantilever Mold - "hole to injc"	LCSteel-A36-Strip
	Skala : 1 : 2	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran : mm	No.Kode : 2014.013.0157
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Cantiliver Mold - hole to injc NO. 1.2.6 A4 <small>ISO 5467:1999</small>

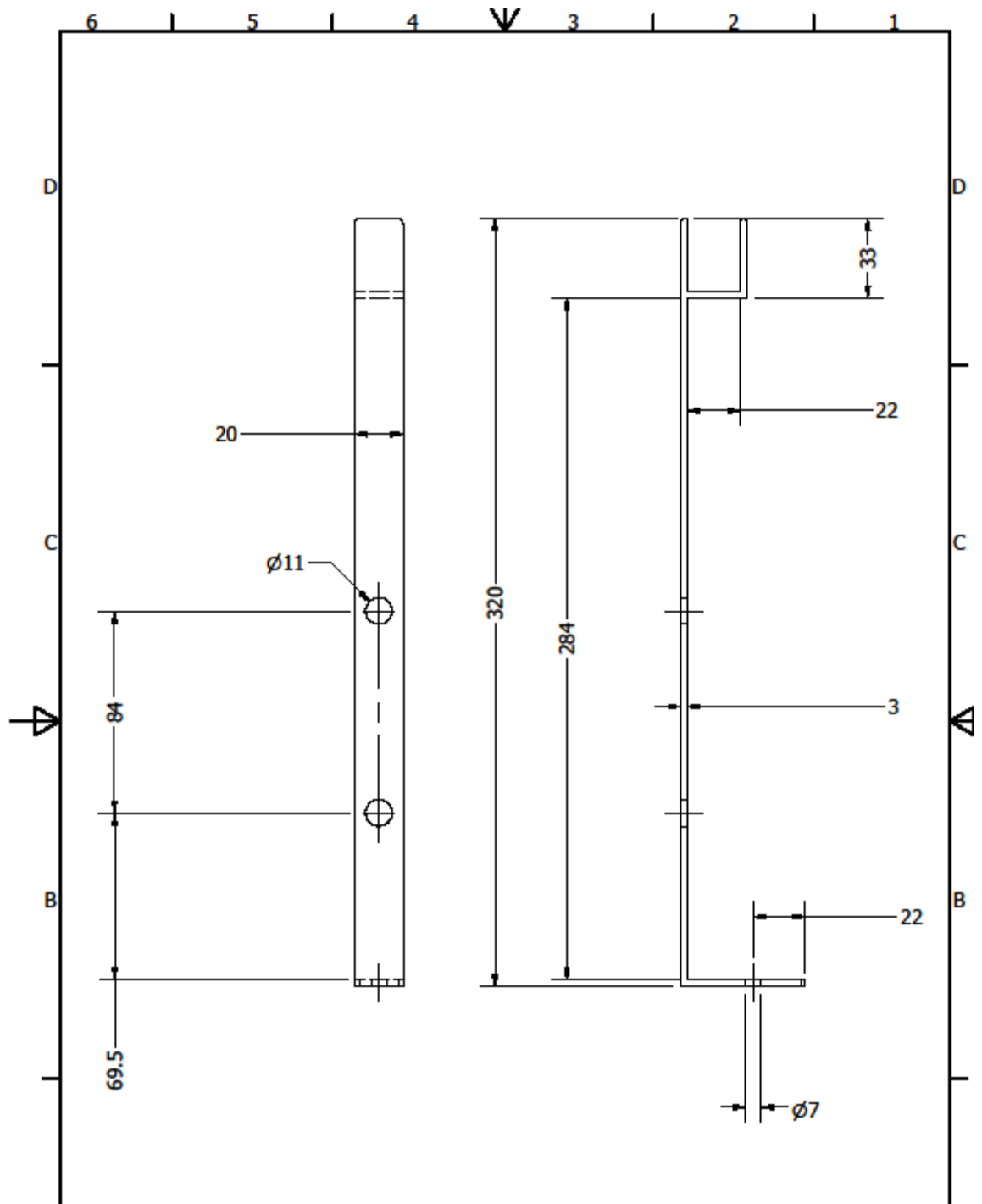


PARTS LIST

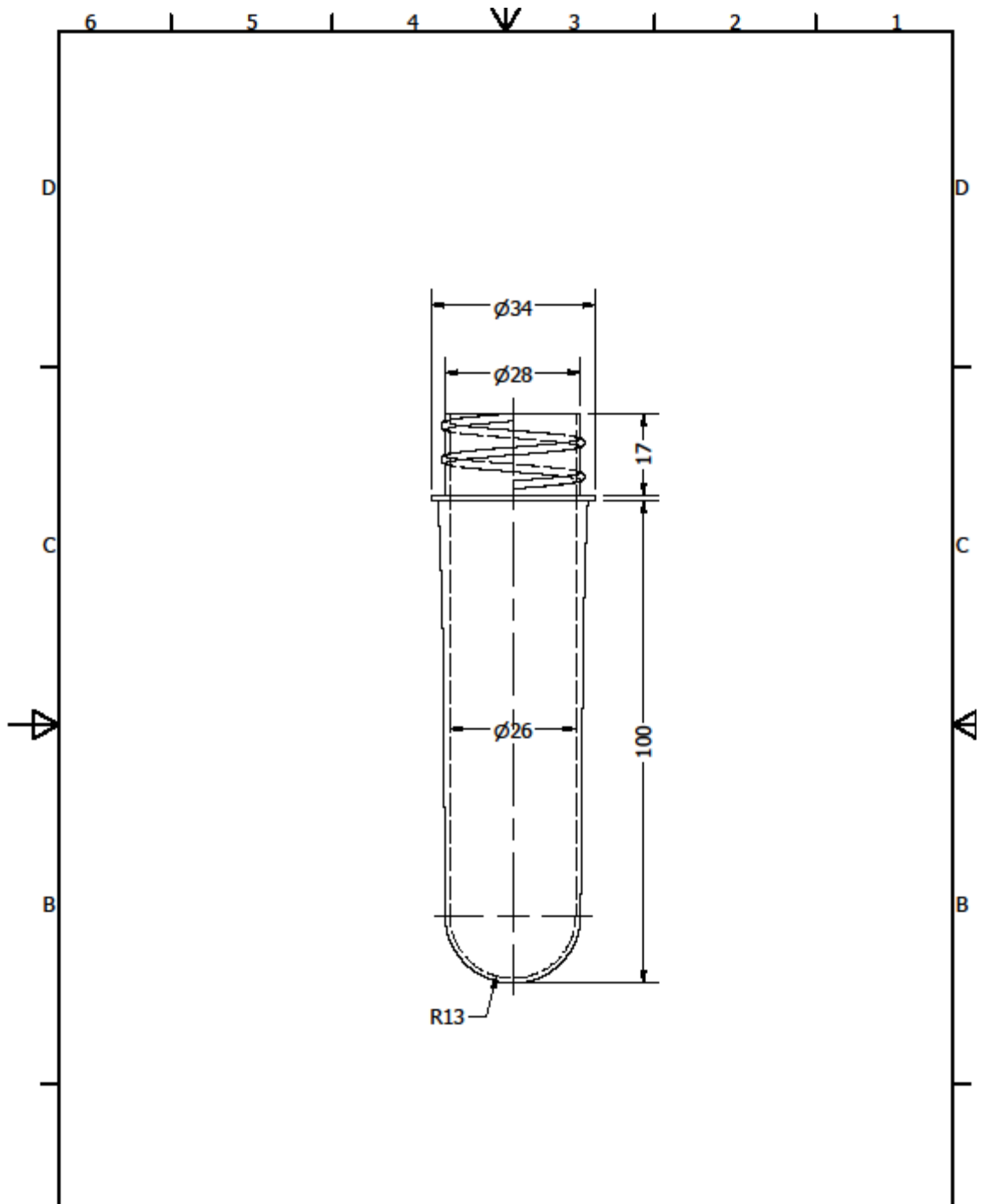
No.Part	Name Part	Materials
1.2.7	Cantilever Mold - "non hole"	LCSteel-A36-Strip
	Skala : 1 : 2	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran : mm	No.Kode : 2014.013.0157
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Cantiliver Mold - non hole NO. 1.2.7
		A4 ISO 5467:1999



PARTS LIST			
No.Part	Name Part	Materials	
1.2.8	Cantilever Mold - "bond"	LCSteel-A36-Strip	
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan	Signature
	Satuan Ukuran : mm	No.Kode : 2014.013.0157	/ Ket:
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018	
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Cantiliver Mold - bond	NO. 1.2.8
			A4 ISO 5467:1999

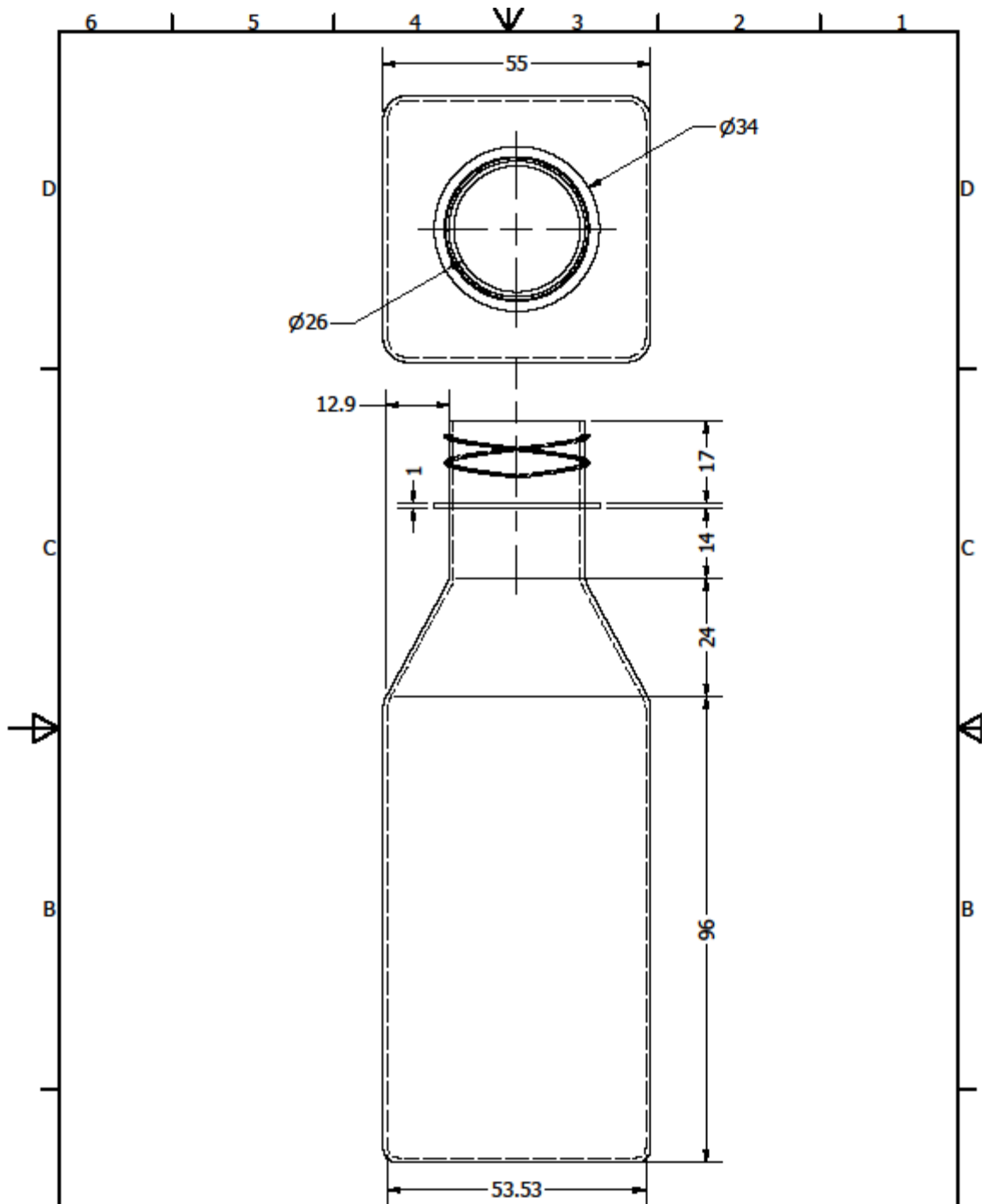


PARTS LIST			
No.Part	Name Part	Materials	
1.2.9	Injector Pole	LCSteel-A36-Strip	
	Skala :	1 : 2	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran :	mm	No.Kode : 2014.013.0157
	Tanggal :	19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Injector Pole	NO. 1.2.9
			A4 ISO 5467:1999



PARTS LIST

No.Part	Name Part	Materials		
2.0	Bottle Preform	PET		
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan		
	Satuan Ukuran : mm	No.Kode : 2014.013.0157		
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018		
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Dimension of Bottle Preform	NO. 2.0	A4 ISO 5467:1999



PARTS LIST

No.Part	Name Part	Materials
3.0	Product Bottle	PET
	Skala : 1 : 1	Designer : Subkhan Nur Ikhsan
	Satuan Ukuran : mm	No.Kode : 2014.013.0157
	Tanggal : 19 April 2018	Diperiksa : 19 - May - 2018
TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA		Dimension of Product Bottle NO. 3.0 A4 <small>ISO 5467:1999</small>

**LAMPIRAN**  
**“DATA SCAN”**