

UNIVERSITAS BRAWIJAYA

LAMPIRAN



LAMPIRAN 1



The Learning University

LABORATORIUM STRUKTUR
JURUSAN TEKNIK SIPIL
FAKULTAS TEKNIK UNIVERSITAS NEGERI MALANG
Gedung D9 Lt 1 Kampus UM Jl. Semarang No. 5 Malang Telp/Fax: (0341) 587 082

SURAT KETERANGAN

No. 07b.11.2016

Yang bertandatangan di bawah ini Laboran / Teknisi Laboratorium Jurusan Teknik Sipil
Fakultas Teknik Universitas Negeri Malang, menerangkan bahwa,

Nama : Dimas Bayu Samudro
NIM : 125060207111053-62
Instansi : S1 Jurusan Teknik Mesin - Fakultas Teknik – Universitas Brawijaya

Telah melakukan pengujian kuat tarik terhadap material Las Gesek A6061- ST41 sebanyak 36
benda uji pada tanggal 03 November 2016 di Laboratorium Struktur - TeknikSipil – FT - UM.

Demikian keterangan ini dibuat untuk dipergunakan sebagaimana mestinya.

Mengetahui,
Kepala Laboratorium
Teknik Sipil - FT - UM



Dr. Karyadi, M.P., M.T
NIP. 19610312 198703 1 001

Malang, 07 November 2016
Koordinator Uji
Laboratorium Struktur - FT - UM

Lusti Mustikasari, Amd
NIP. -



LAMPIRAN 2



LABORATORIUM STRUKTUR
JURUSAN TEKNIK SIPIL
FAKULTAS TEKNIK UNIVERSITAS NEGERI MALANG

The Learning University; Gedung D9 Lt 2 Kampus UM Jl. Semarang No. 5 Malang Telp/Fax: (0341) 587 082 Ext. 2051

Data Hasil Pengujian Tarik

Variasi Burn-off Length	Variasi Tinggi Kerucut	Penulangan	diameter (mm)	Peak Load (kN)	Jari-Jari (mm)	Calibrated Load (N)	Luas Area (mm ²)	kekuatan Tarik (Mpa)	Kekuatan Tarik Rata-rata (Mpa)	Standar Deviasi	standar deviasi (%)	
3 mm	0 mm	A	13.07	38.3	6.535	25.2	25200	134.0975	187.9229	187.4315	12.37057	6.60005
		B	13.08	39.9	6.54	26.8	26800	134.3028	199.549			
		C	13.03	36.4	6.515	23.3	23300	133.278	174.8225			
	1 mm	A	13.28	38.5	6.64	25.4	25400	138.4413	183.4712	184.01739	2.020962	1.098245
		B	13.05	38	6.525	24.9	24900	133.6875	186.2553			
		C	13.03	37.4	6.515	24.3	24300	133.278	182.3257			
	2 mm	A	12.92	37.5	6.46	24.4	24400	131.0372	186.2066	189.9248	4.27853	2.252749
		B	12.92	38.6	6.46	25.5	25500	131.0372	194.6012			
		C	12.93	37.9	6.465	24.8	24800	131.2401	188.9666			
	3 mm	A	12.94	41.1	6.47	28	28000	131.4432	213.0197	208.06224	7.575898	3.641169
		B	12.89	39.1	6.445	26	26000	130.4294	199.3416			
		C	12.93	40.9	6.465	27.8	27800	131.2401	211.8254			
5 mm	0 mm	A	12.93	34.2	6.465	21.1	21100	131.2401	160.774	167.41942	5.807045	3.468561
		B	13.07	36.1	6.535	23	23000	134.0975	171.5169			
		C	12.87	35.2	6.435	22.1	22100	130.025	169.9674			
	1 mm	A	12.96	37.4	6.48	24.3	24300	131.8499	184.3005	180.09071	3.841564	2.133127
		B	12.93	36.3	6.465	23.2	23200	131.2401	176.7752			
		C	12.98	36.8	6.49	23.7	23700	132.2571	179.1964			
	2 mm	A	13.05	37.9	6.525	24.8	24800	133.6875	185.5073	184.11002	3.624127	1.968457
		B	13.06	37.2	6.53	24.1	24100	133.8924	179.9952			
		C	13.03	38	6.515	24.9	24900	133.278	186.8275			
	3 mm	A	13.07	39.6	6.535	26.5	26500	134.0975	197.6173	193.89408	3.269514	1.686237
		B	13.19	39.4	6.595	26.3	26300	136.5712	192.5735			
		C	13.05	38.7	6.525	25.6	25600	133.6875	191.4914			
7 mm	0 mm	A	12.86	33.5	6.43	20.4	20400	129.823	157.137	154.39004	2.610251	1.690686
		B	13.05	33.7	6.525	20.6	20600	133.6875	154.0907			
		C	13.11	33.6	6.555	20.5	20500	134.9196	151.9423			
	1 mm	A	12.94	35.6	6.47	22.5	22500	131.4432	171.1766	177.96658	6.448223	3.623277
		B	12.97	36.7	6.485	23.6	23600	132.0534	178.7156			
		C	12.89	37.1	6.445	24	24000	130.4294	184.0076			
	2 mm	A	12.99	38.3	6.495	25.2	25200	132.461	190.2447	183.73485	7.263021	3.952991
		B	12.96	37.5	6.48	24.4	24400	131.8499	185.059			
		C	12.99	36.4	6.495	23.3	23300	132.461	175.9009			
	3 mm	A	12.93	38.5	6.465	25.4	25400	131.2401	193.5383	188.93212	7.952038	4.208939
		B	12.88	38.3	6.44	25.2	25200	130.2271	193.5081			
		C	12.96	36.8	6.48	23.7	23700	131.8499	179.7499			



LAMPIRAN 3

CALIBRATION LABORATORIES
PT. GLOBAL QUALITY INDONESIA
 CALIBRATION, INSTRUMENTATION, TRAINING, QUALITY CONSULTANT, MAINTENANCE & REPAIR



CALIBRATION CERTIFICATE

Certificate Number : 7722/GQI-Sert/07/16
 Page : 1 of 1

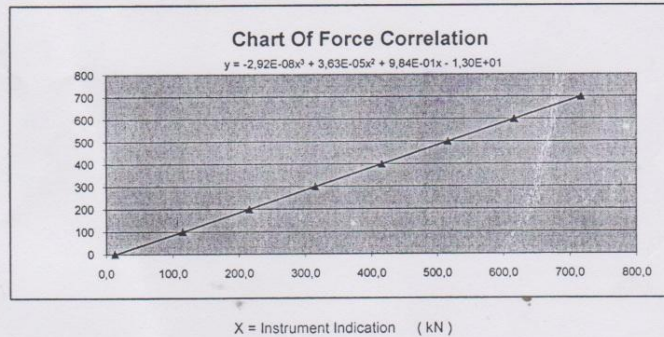
Order Number : 031.0716.153-1
 Received Date : 14 July 2016
 Equipment Name : Universal Testing Machine
 Manufacturer : Kai-Wei
 Model/Type : -
 Serial Number : 068
 Capacity/Graduation : 1000 kN / 0,1 kN
 Technician ID : AMNE
 Typewriter ID : ED

Owner : Laboratorium Struktur Jurusan Teknik Sipil Universitas Negeri Malang
 Address : Jl. Semarang No.5 - Malang
 Calibration Location : Laboratorium Struktur Jurusan Teknik Sipil Universitas Negeri Malang
 Calibration Date : 14 July 2016
 Calibration Method : IK-G-01 ref. JIS B 7721 - 2009
 Environmental Condition : T = 26.7°C RH = 74 %

Calibration Report :

Standard Indication (kN)	Instrument Indication (kN)		Correction (kN)	Error of Force (%)
	Before Setting	After Setting		
0	13,1	-	-13,1	-
100	114,5	-	-14,5	14,5
200	215,2	-	-15,2	7,6
300	315,3	-	-15,3	-5,1
400	415,6	-	-15,6	3,9
500	515,8	-	-15,8	3,2
600	616,3	-	-16,3	2,7
700	716,8	-	-16,8	2,4

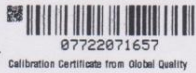
Uncertainty $U_{95\%} = \pm 0,5 \%$



The Uncertainty is taken at a Confidence Level 95 % and Coverage Factor (k) = 2

Standard used :

Name : Merk/Type : Serial Number : Traceable to SI through
 Loadcell : MATEST : 15784 : LK-013-IDN



Issuance Date : 16 July 2016

(Signature)
GLOBAL QUALITY INDONESIA
 Didi Rudy Hamid
 Director

— End of Certificate —

Address :
 Komplek Kopo Mas Regency Blok N No.7C Bandung 40227 Indonesia Telp.+62-22-5436533 Fax. +62-22-5436637
 Website : www.globalquality.co.id - Webblog : www.globalquality.info - E-mail : calibration@globalquality.co.id

FR.23.01

Attention : 1. This calibration result is valid only for the equipment calibrated
 2. It is not permitted to reproduce this certificate without permission from PT. Global Quality Indonesia
 3. The Original Calibration Certificate of PT. Global Quality Indonesia uses a Barcode Mark.

Certificate



LAMPIRAN 4



**LABORATORIUM PENGECORAN LOGAM
FAKULTAS TEKNIK JURUSAN MESIN
UNIVERSITAS BRAWIJAYA**

Jl. MT Haryono 167 Malang Telp. (0341) 551611 – 551430 Pes.157 Malang 65145



HASIL PENGUJIAN POROSITAS

No	Tinggi Kerucut (mm)	Burn-Off Length (mm)	Berat Udara	Berat air	ps	%p
1	0	3 mm	31.86	25.46	4.963191	0.0423
		5 mm	33.28	26.41	4.829718	0.0681
		7 mm	33.18	26.07	4.652667	0.1023
2	1	3 mm	34.09	27.26	4.976242	0.0459
		5 mm	33.74	26.91	4.925151	0.0557
		7 mm	33.49	26.39	4.702751	0.0984
3	2	3 mm	33.41	26.81	5.046935	0.0385
		5 mm	33.38	26.76	5.027169	0.0422
		7 mm	31.58	25.02	4.799582	0.0856
4	3	3 mm	34.95	28.28	5.22416	0.0100
		5 mm	34.19	27.64	5.204188	0.0138
		7 mm	34.98	27.86	4.898183	0.0718

Malang, 4 November 2016
Kepala Laboratorium Pengecoran Logam

Rudianto Raharjo, ST., MT
NIP. 19820225 201212 1 002



LAMPIRAN 5

TABLE 1 Density of Air-Free Water^A

Temperature (°C)	Density (g/cm ³)
18.0	0.9986
18.5	0.9985
19.0	0.9984
19.5	0.9983
20.0	0.9982
20.5	0.9981
21.0	0.9980
21.5	0.9979
22.0	0.9978
22.5	0.9976
23.0	0.9975
23.5	0.9974
24.0	0.9973
24.5	0.9972
25.0	0.9970
25.5	0.9969
26.0	0.9968
26.5	0.9966
27.0	0.9965
27.5	0.9964
28.0	0.9962
28.5	0.9961
29.0	0.9959
29.5	0.9958
30.0	0.9956

^A*Metrological Handbook 145,* "Quality Assurance for Measurements," National Institute of Standards and Technology, 1990, p. 9.10.

where:

D = density of test specimen, g/cm³,

LAMPIRAN 6

ANALYTICAL MODE
 FE01 TEST 16/S1001 14-Sep-16
 Sum:99.81,IT: 5,VC:.6148 SFI

	Fe2	C	Si	Mn1	P	S	Cr1	Mo	Ni1	Al	B	Co
ST 1*	98.69	.159	.185	.447	.008	.011	.055	.024	.000<	.016	.0000<	.000<
ST 2*	98.69	.163	.184	.448	.008	.011	.054	.025	.000<	.016	.0000<	.000<
ST 3*	98.64	.165	.185	.450	.008	.011	.054	.025	.000<	.016	.0000<	.000<
AVG	98.68	.162	.185	.448	.008	.011	.055	.025	.000	.016	.0000	.000

	Cu	Nb	Pb	Sn	Ti	V	W
ST 1*	.071	.043	.0036	.006	.000<	.004	.078
ST 2*	.071	.043	.0037	.006	.000<	.014	.088
ST 3*	.071	.044	.0036	.005	.000<	.039	.092
AVG	.071	.043	.0036	.006	.000	.019	.086

ACN>

F1=HLP F2=RECALL F3=ABO F4=SID F5=HST F6=STO F7=STD F8=AVG F9=SDV F10=SRT

ANALYTICAL MODE
 FE01 TEST 16/S1001 14-Sep-16
 Sum:99.81,IT: 5,VC:.6148 SFI

	Fe2	C	Si	Mn1	P	S	Cr1	Mo	Ni1	Al	B	Co
SDV	.0297	.0028	.0007	.0012	.0001	.0001	.0006	.0001	.0000	.0002	.0000	.0000
CDV	0.03	1.73	0.40	0.27	1.76	0.70	1.04	0.38	0.00	1.06	0.00	0.00
MIN	98.64	.1593	.1839	.4473	.0081	.0109	.0541	.0245	.0000	.0156	.0000	.0000
AVG	98.68	.162	.185	.448	.008	.011	.055	.025	.000	.016	.0000	.000

	Cu	Nb	Pb	Sn	Ti	V	W
SDV	.0000	.0003	.0000	.0001	.0000	.0177	.0075
CDV	0.00	0.75	0.96	1.40	0.00	94.16	8.74
MIN	.0714	.0431	.0036	.0055	.0000	.0043	.0777
AVG	.071	.043	.0036	.006	.000	.019	.086



 (Luh-yatme)

*** Strike any key ***

F1=HLP F2=RECALL F3=ABO F4=SID F5=HST F6=STO F7=STD F8=AVG F9=SDV F10=SRT



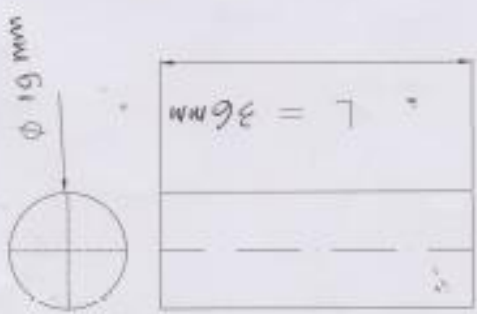
LAMPIRAN 7



PT. HP. METALS INDONESIA

Ngare Industri Persada
Negeri - Mojowarto
East Java - Indonesia
Tel: +62 321 6818569
Fax: +62 321 6818500
Email: info@hpmindonesia.com
Web: www.hpmindonesia.com

INSPECTED BY: *[Signature]* CHECKED BY: *[Signature]* DATE: 15/2016



$\phi 19 \text{ mm}$

$L = 36 \text{ mm}$

ELEMENTS	SAMPLE		ELEMENTS	SAMPLE	
	REQU	RESU		REQU	RESU
A	Si	0.580	P	Sb	<0.001
B	Mn	0.3127	Q	Sr	<0.0002
C	Cu	0.1620	R	Zr	0.0155
D	Mn	0.0289	S	Al	98.01
E	Mg	0.747	T		
F	Zn	0.0395	U		
G	Ni	0.0053	V		
H	Cr	0.0765	W		
I	Pb	0.0031	X		
J	Sn	<0.001	Y		
K	Ti	0.0193	Z		
L	Bi	<0.001	a		
M	Ca	0.0023	b		
N	Na	0.0024	c		
O	P	<0.001	d		

EXPLAIN

ITEM REQUEST ACTUAL CHARGE RESULT

REMARKS

LAMPIRAN 8

Program: AL-01
 Comment: Al-alloy global
 Single scan(s)
 09/15/2016 11:36:05 PM
 Elements: Concentration

11863700

Sample No: A
 Sample Id:

No	Si	P	Cu	Mn	Mg	Zn	Ni	Cr	Pb
1	0.506	0.3127	0.1620	0.0269	0.747	0.0396	0.0055	0.0765	0.0031
2	0.570	0.3132	0.1605	0.0279	0.738	0.0403	0.0050	0.0761	0.0031

No	Sr	Ti	Ba	Ca	Na	F	Sb	Se	As
1	<0.0010	0.0198	<0.0010	0.0027	0.0024	<0.0010	<0.0010	<0.0002	0.0186
2	<0.0010	0.0193	<0.0010	0.0023	0.0024	<0.0010	<0.0010	<0.0002	0.0189

No	Al
1	<37.00
2	<38.03

Program: AL-01
 Comment: Al-alloy global
 Average (n=2)
 09/15/2016 11:37:26 PM
 Elements: Concentration

11863700

Sample No: A
 Sample Id:

x	Si	P	Cu	Mn	Mg	Zn	Ni	Cr	Pb
x	0.579	0.3129	0.1613	0.0284	0.742	0.0399	0.0023	0.0763	0.0031

x	Sr	Ti	Ba	Ca	Na	F	Sb	Se	As
x	<0.0010	0.0196	<0.0010	0.0025	0.0029	<0.0010	<0.0010	<0.0002	0.0186

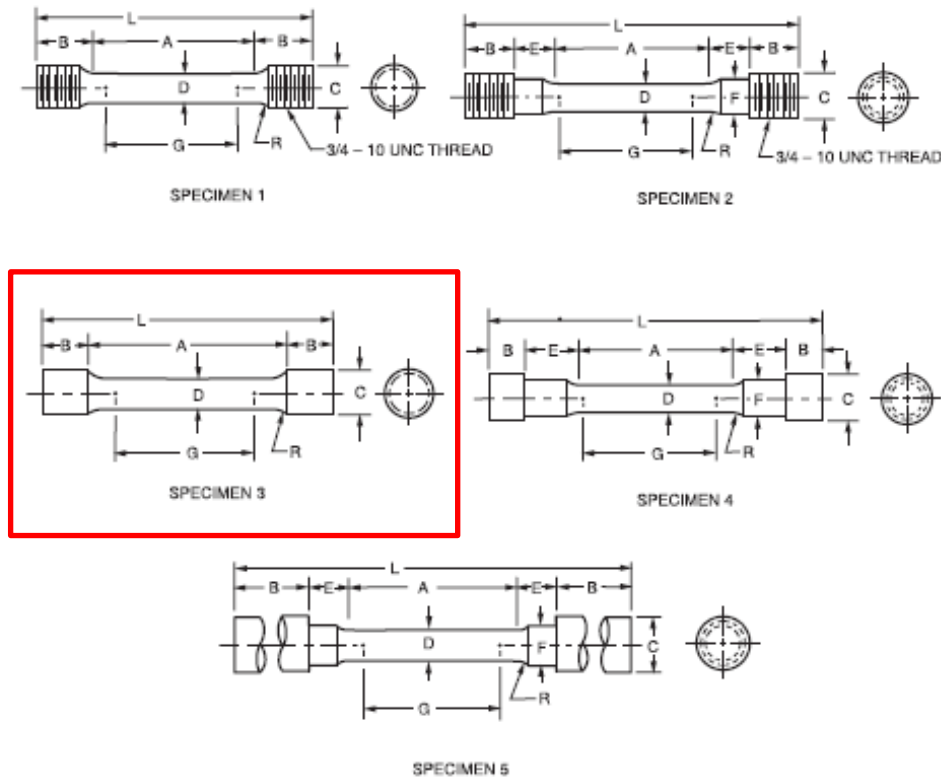
x	Al
x	<38.01

15/09/2016 Laborat
 Jeffrey
 M. Jeffrey

LAMPIRAN 9

CLAUSE 4. TENSION TESTS

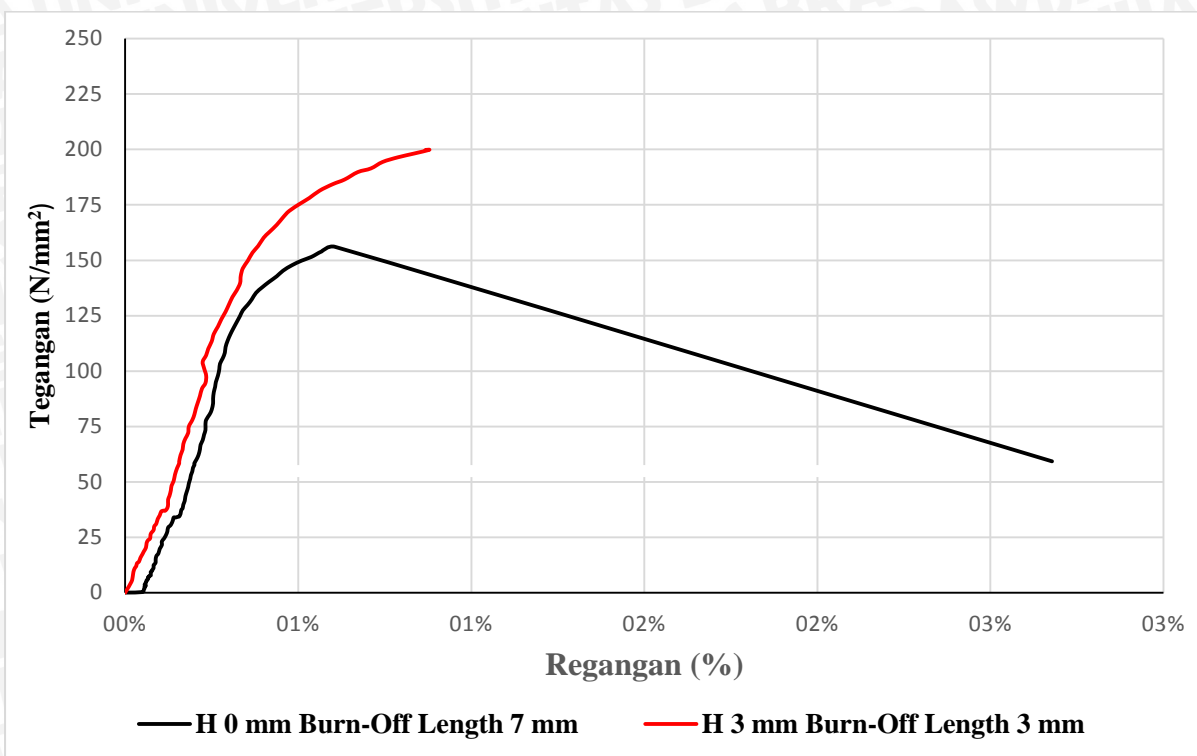
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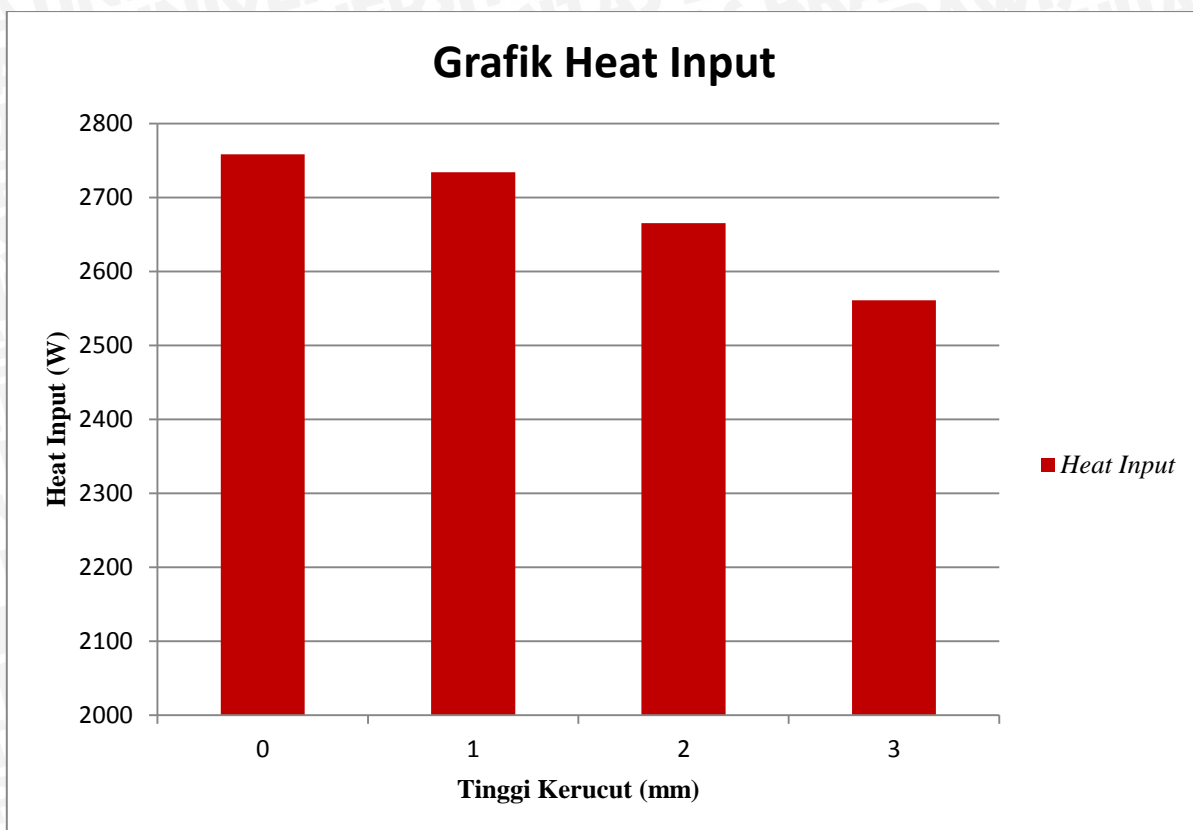
	Dimensions				
	Specimen 1 In (mm)	Specimen 2 In (mm)	Specimen 3 In (mm)	Specimen 4 In (mm)	Specimen 5 In (mm)
G — gage length	2.000 ± 0.005 (50 ± 0.127)	2.000 ± 0.005 (50 ± 0.127)	2.000 ± 0.005 (50 ± 0.127)	2.000 ± 0.005 (50 ± 0.127)	2.000 ± 0.005 (50 ± 0.127)
D — diameter (Note 1)	0.500 ± 0.010 (13 ± 0.254)	0.500 ± 0.010 (13 ± 0.254)	0.500 ± 0.010 (13 ± 0.254)	0.500 ± 0.010 (13 ± 0.254)	0.500 ± 0.010 (13 ± 0.254)
R — radius of fillet, min.	3/8 (10)	3/8 (10)	1/16 (1.6)	3/8 (10)	3/8 (10)
A — length of reduced section (Note 2)	2-1/4 (56) min.	2-1/4 (56) min.	4 (101) approx.	2-1/4 (56) min.	2-1/4 (56) min.
L — over-all length approx.	5 (126)	5-1/2 (139)	5-1/2 (139)	4-3/4 (120)	9-1/2 (241)
B — length of end section	1-3/8 (35) approx.	1 (25) approx.	3/4 (19) approx.	1/2 (13) approx.	3 (76) min.
C — diameter of end section	3/4 (19)	3/4 (19)	23/32 (18)	7/8 (22)	3/4 (19)
E — length of shoulder and fillet section, approx.	—	5/8 (16)	—	3/4 (19)	5/8 (16)
F — diameter of shoulder	—	5/8 (16)	—	5/8 (16)	19/32 (15)

Figure 4.1 (Continued)—Round Tensile Specimens

LAMPIRAN 10



LAMPIRAN 11



LAMPIRAN 12

