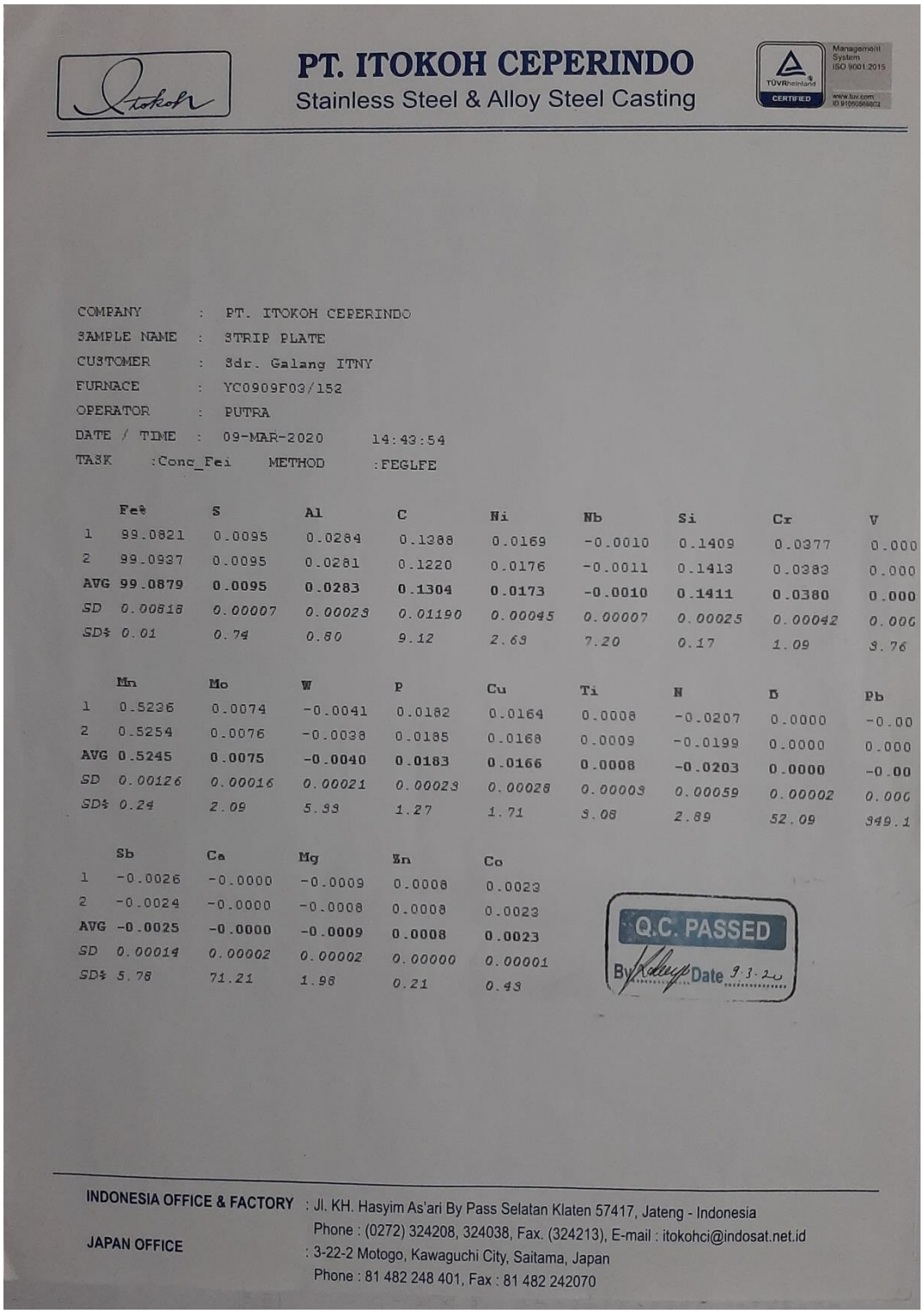
LAMPIRAN

Lampiran 1. Hasil uji komposisi kimia *raw material*



PT. ITOKOH CEPERINDO
Stainless Steel & Alloy Steel Casting

Management System ISO 9001:2015 — TÜVRheinland CERTIFIED — www.tuv.com ID 9105056872

COMPANY : PT. ITOKOH CEPERINDO
SAMPLE NAME : STRIP PLATE
CUSTOMER : Sdr. Galang ITNY
FURNACE : YC0909F03/152
OPERATOR : PUTRA
DATE / TIME : 09-MAR-2020 14:43:54
TASK :Conc_Fei METHOD :FEGLFE

	Fe%	S	Al	C	Ni	Nb	Si	Cr	V
1	99.0821	0.0095	0.0284	0.1388	0.0169	-0.0010	0.1409	0.0377	0.000
2	99.0937	0.0095	0.0281	0.1220	0.0176	-0.0011	0.1413	0.0383	0.000
AVG	**99.0879**	**0.0095**	**0.0283**	**0.1304**	**0.0173**	**-0.0010**	**0.1411**	**0.0380**	**0.000**
SD	*0.00818*	*0.00007*	*0.00023*	*0.01190*	*0.00045*	*0.00007*	*0.00025*	*0.00042*	*0.000*
SD%	*0.01*	*0.74*	*0.80*	*9.12*	*2.63*	*7.20*	*0.17*	*1.09*	*3.76*

	Mn	Mo	W	P	Cu	Ti	N	B	Pb
1	0.5236	0.0074	-0.0041	0.0182	0.0164	0.0008	-0.0207	0.0000	-0.00
2	0.5254	0.0076	-0.0038	0.0185	0.0168	0.0009	-0.0199	0.0000	0.000
AVG	**0.5245**	**0.0075**	**-0.0040**	**0.0183**	**0.0166**	**0.0008**	**-0.0203**	**0.0000**	**-0.00**
SD	*0.00126*	*0.00016*	*0.00021*	*0.00023*	*0.00028*	*0.00003*	*0.00059*	*0.00002*	*0.000*
SD%	*0.24*	*2.09*	*5.33*	*1.27*	*1.71*	*3.08*	*2.89*	*52.09*	*349.1*

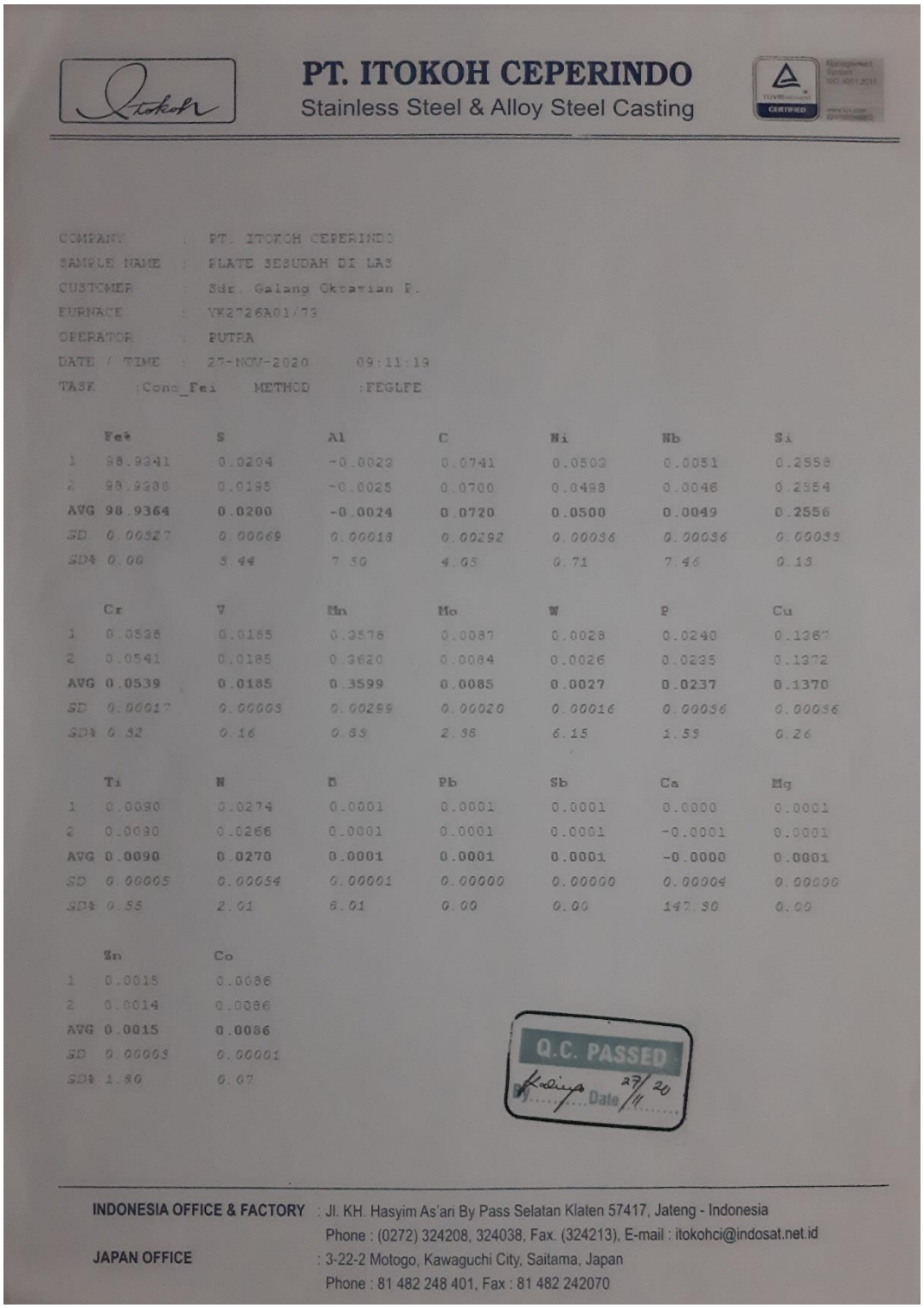
	Sb	Ca	Mg	Zn	Co
1	-0.0026	-0.0000	-0.0009	0.0008	0.0023
2	-0.0024	-0.0000	-0.0008	0.0008	0.0023
AVG	**-0.0025**	**-0.0000**	**-0.0009**	**0.0008**	**0.0023**
SD	*0.00014*	*0.00002*	*0.00002*	*0.00000*	*0.00001*
SD%	*5.78*	*71.21*	*1.98*	*0.21*	*0.43*

Q.C. PASSED
By Date 9-3-20

INDONESIA OFFICE & FACTORY : Jl. KH. Hasyim As'ari By Pass Selatan Klaten 57417, Jateng - Indonesia
Phone : (0272) 324208, 324038, Fax. (324213), E-mail : itokohci@indosat.net.id
JAPAN OFFICE : 3-22-2 Motogo, Kawaguchi City, Saitama, Japan
Phone : 81 482 248 401, Fax : 81 482 242070

Sumber: PT. ITOKOH CEPERINDO

Lampiran 2. Hasil uji komposisi kimia *weld metal*



PT. ITOKOH CEPERINDO
Stainless Steel & Alloy Steel Casting

COMPANY : PT. ITOKOH CEPERINDO
SAMPLE NAME : PLATE SESUDAH DI LAS
CUSTOMER : Sdr. Galang Oktavian P.
FURNACE : YK2726A01/73
OPERATOR : PUTRA
DATE / TIME : 27-NOV-2020 09:11:19
TASK :Cons_Fe1 METHOD :FEGLFE

	Fe*	S	Al	C	Ni	Nb	Si
1	98.9341	0.0204	-0.0023	0.0741	0.0503	0.0051	0.2558
2	98.9388	0.0195	-0.0025	0.0700	0.0498	0.0046	0.2554
AVG	**98.9364**	**0.0200**	**-0.0024**	**0.0720**	**0.0500**	**0.0049**	**0.2556**
SD	*0.00027*	*0.00069*	*0.00018*	*0.00292*	*0.00036*	*0.00036*	*0.00039*
SD%	*0.00*	*3.44*	*7.50*	*4.05*	*0.71*	*7.46*	*0.13*

	Cr	V	Mn	Mo	W	P	Cu
1	0.0538	0.0185	0.3578	0.0087	0.0028	0.0240	0.1367
2	0.0541	0.0185	0.3620	0.0084	0.0026	0.0235	0.1372
AVG	**0.0539**	**0.0185**	**0.3599**	**0.0085**	**0.0027**	**0.0237**	**0.1370**
SD	*0.00017*	*0.00003*	*0.00299*	*0.00020*	*0.00016*	*0.00036*	*0.00036*
SD%	*0.32*	*0.16*	*0.83*	*2.36*	*6.15*	*1.53*	*0.26*

	Ti	N	B	Pb	Sb	Ca	Mg
1	0.0090	0.0274	0.0001	0.0001	0.0001	0.0000	0.0001
2	0.0090	0.0266	0.0001	0.0001	0.0001	-0.0001	0.0001
AVG	**0.0090**	**0.0270**	**0.0001**	**0.0001**	**0.0001**	**-0.0000**	**0.0001**
SD	*0.00005*	*0.00054*	*0.00001*	*0.00000*	*0.00000*	*0.00004*	*0.00000*
SD%	*0.55*	*2.01*	*8.01*	*0.00*	*0.00*	*147.50*	*0.00*

	Sn	Co
1	0.0015	0.0086
2	0.0014	0.0086
AVG	**0.0015**	**0.0086**
SD	*0.00003*	*0.00001*
SD%	*1.80*	*0.07*

Q.C. PASSED
Date 27/11/20

INDONESIA OFFICE & FACTORY : Jl. KH. Hasyim As'ari By Pass Selatan Klaten 57417, Jateng - Indonesia
Phone : (0272) 324208, 324038, Fax. (324213), E-mail : itokohci@indosat.net.id
JAPAN OFFICE : 3-22-2 Motogo, Kawaguchi City, Saitama, Japan
Phone : 81 482 248 401, Fax : 81 482 242070

Sumber: PT. ITOKOH CEPERINDO

Lampiran 3. Hasil uji *bending*

LABORATORIUM BAHAN TEKNIK
DEPARTEMEN TEKNIK MESIN SEKOLAH VOKASI
UNIVERSITAS GADJAH MADA

HASIL PENGUJIAN BENDING
No. 015 / P.Bnd / BT.DTM.SV.UGM / 2021

Spesimen Baja Karbon Rendah, Las SMAW, Arus 80 Ampere, Variasi Elektroda.

No.	Kode	Lebar (mm)	Tebal (mm)	Gaya max. (Newton)	Tegangan Bending (MPa)	Pergerakan loading nose (mm)
1	E6013.1	23,62	5,88	12.020	1.732,69	45,95
2	E6013.2	23,76	5,88	9.160	1.312,64	45,45
3	E6013.3	25,32	5,88	9.720	1.307,07	45,38
4	E7016.1	23,75	6,60	12.950	1.554,68	45,73
5	E7016.2	23,10	6,60	12.990	1.603,36	45,53
6	E7016.3	24,06	6,60	14.440	1.711,22	45,88
7	E7018.1	23,99	6,60	14.700	1.747,11	45,76
8	E7018.2	27,22	6,60	14.350	1.503,13	45,30
9	E7018.3	23,06	6,60	12.620	1.560,39	45,87

Keterangan :

1. Menggunakan Standard ASTM E-190
2. Jarak tumpuan (L) 78,5 mm (E6013) dan 82,8 (E7016 & E7018).
3. Pengujian dilakukan pada tanggal 12 Januari 2021.

Yogyakarta, 12 Januari 2021.
Ka Sub Laboratorium Bahan Teknik

Pengujian & Analisa Material
Lab. Bahan Teknik
Departemen Teknik Mesin
Sekolah Vokasi UGM

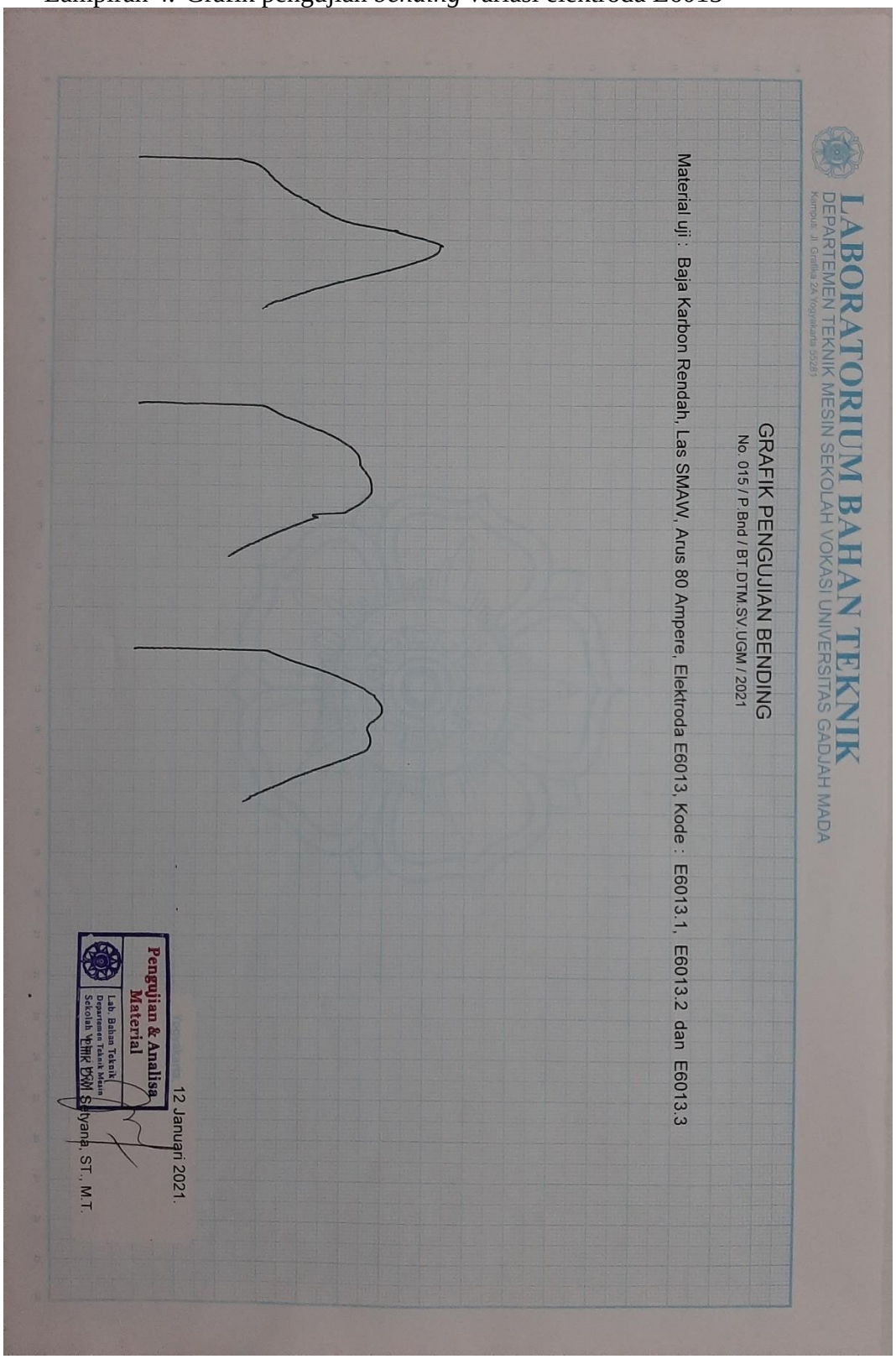
Lilik Dwi Setyana, ST., M.T.
NIP. 197703312002121002

Lembar asli, tidak untuk digandakan

Kampus : Jl. Grafika 2A Yogyakarta 55281

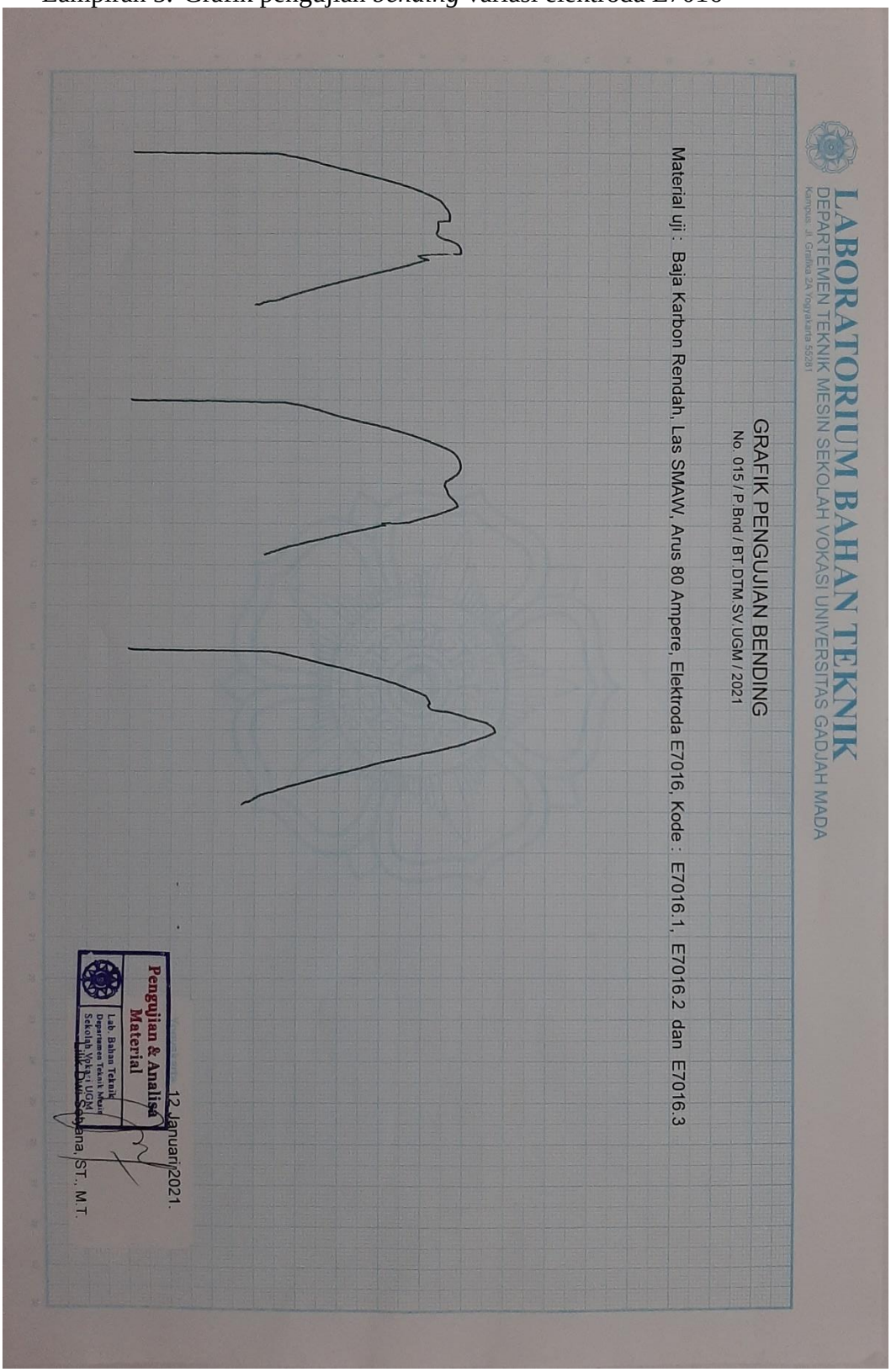
Sumber: Laboratorium Bahan Teknik Mesin Vokasi UGM

Lampiran 4. Grafik pengujian *bending* variasi elektroda E6013



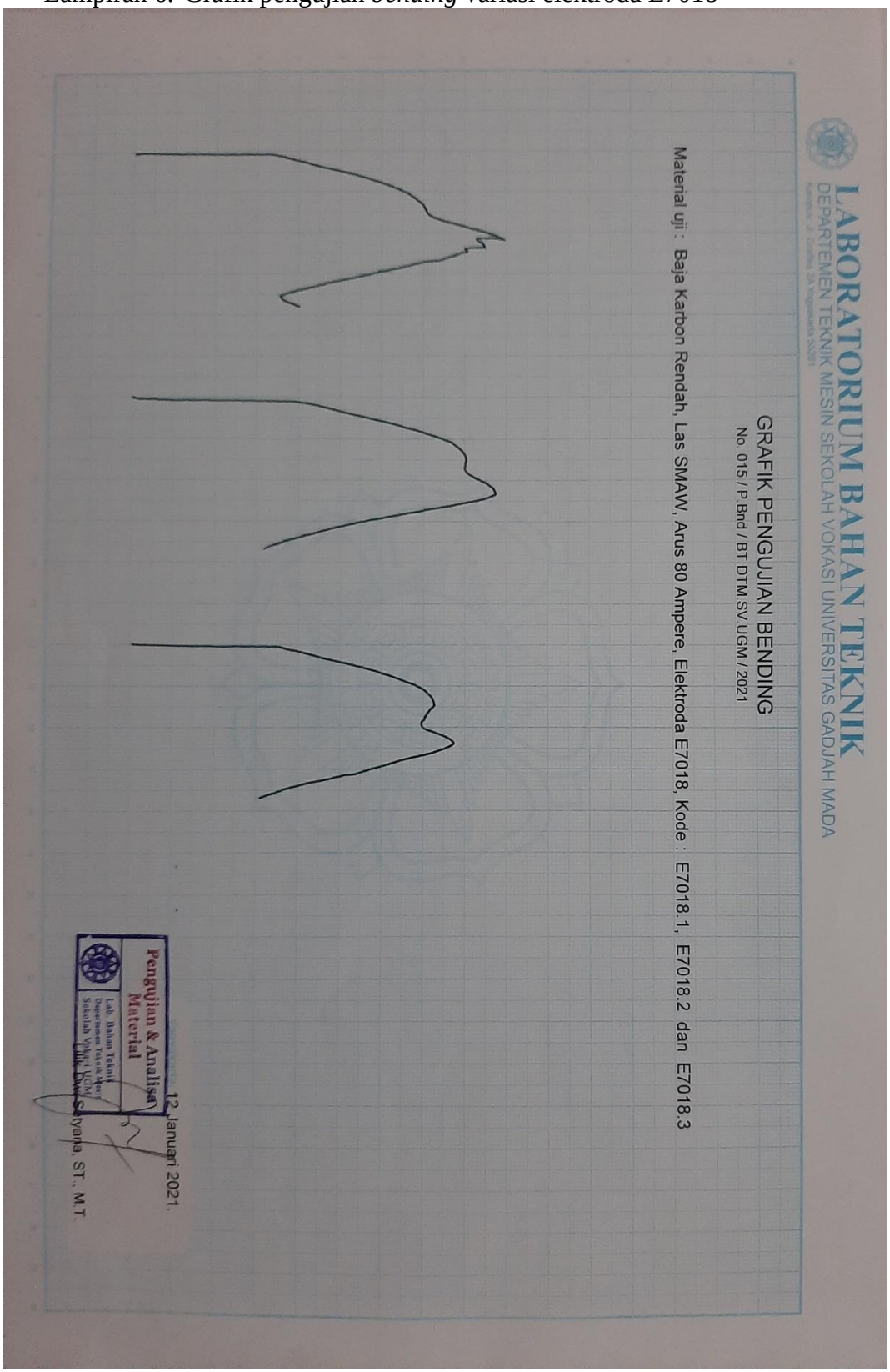
Sumber: Laboratorium Bahan Teknik Mesin Vokasi UGM.

Lampiran 5. Grafik pengujian *bending* variasi elektroda E7016



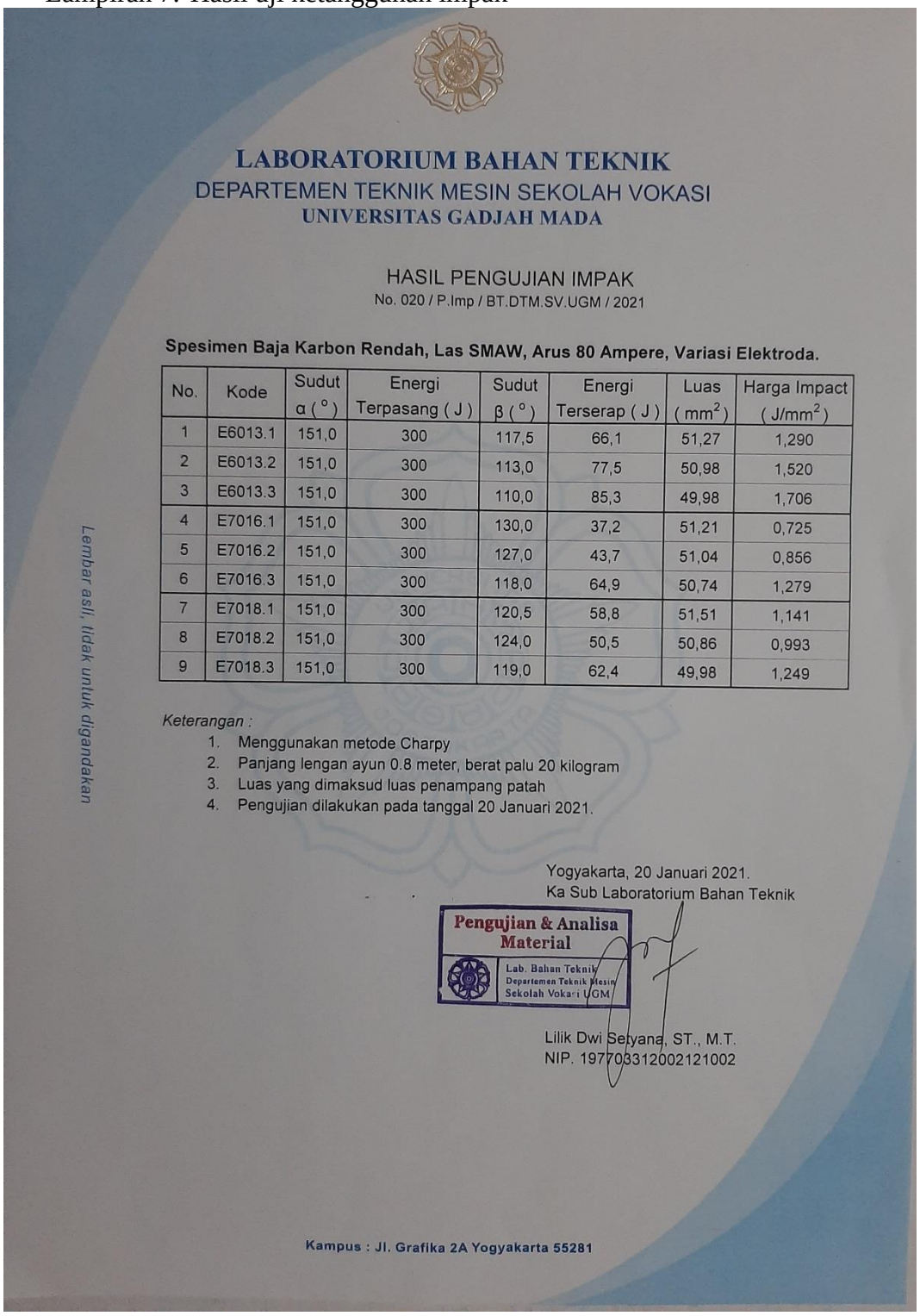
Sumber: Laboratorium Bahan Teknik Mesin Vokasi UGM.

Lampiran 6. Grafik pengujian *bending* variasi elektroda E7018



Sumber: Laboratorium Bahan Teknik Mesin Vokasi UGM.

Lampiran 7. Hasil uji ketangguhan impak



LABORATORIUM BAHAN TEKNIK
DEPARTEMEN TEKNIK MESIN SEKOLAH VOKASI
UNIVERSITAS GADJAH MADA

HASIL PENGUJIAN IMPAK
No. 020 / P.Imp / BT.DTM.SV.UGM / 2021

Spesimen Baja Karbon Rendah, Las SMAW, Arus 80 Ampere, Variasi Elektroda.

No.	Kode	Sudut α (°)	Energi Terpasang (J)	Sudut β (°)	Energi Terserap (J)	Luas (mm^2)	Harga Impact (J/mm^2)
1	E6013.1	151,0	300	117,5	66,1	51,27	1,290
2	E6013.2	151,0	300	113,0	77,5	50,98	1,520
3	E6013.3	151,0	300	110,0	85,3	49,98	1,706
4	E7016.1	151,0	300	130,0	37,2	51,21	0,725
5	E7016.2	151,0	300	127,0	43,7	51,04	0,856
6	E7016.3	151,0	300	118,0	64,9	50,74	1,279
7	E7018.1	151,0	300	120,5	58,8	51,51	1,141
8	E7018.2	151,0	300	124,0	50,5	50,86	0,993
9	E7018.3	151,0	300	119,0	62,4	49,98	1,249

Keterangan :

1. Menggunakan metode Charpy
2. Panjang lengan ayun 0.8 meter, berat palu 20 kilogram
3. Luas yang dimaksud luas penampang patah
4. Pengujian dilakukan pada tanggal 20 Januari 2021.

Yogyakarta, 20 Januari 2021.
Ka Sub Laboratorium Bahan Teknik

Pengujian & Analisa Material
Lab. Bahan Teknik
Departemen Teknik Mesin
Sekolah Vokasi UGM

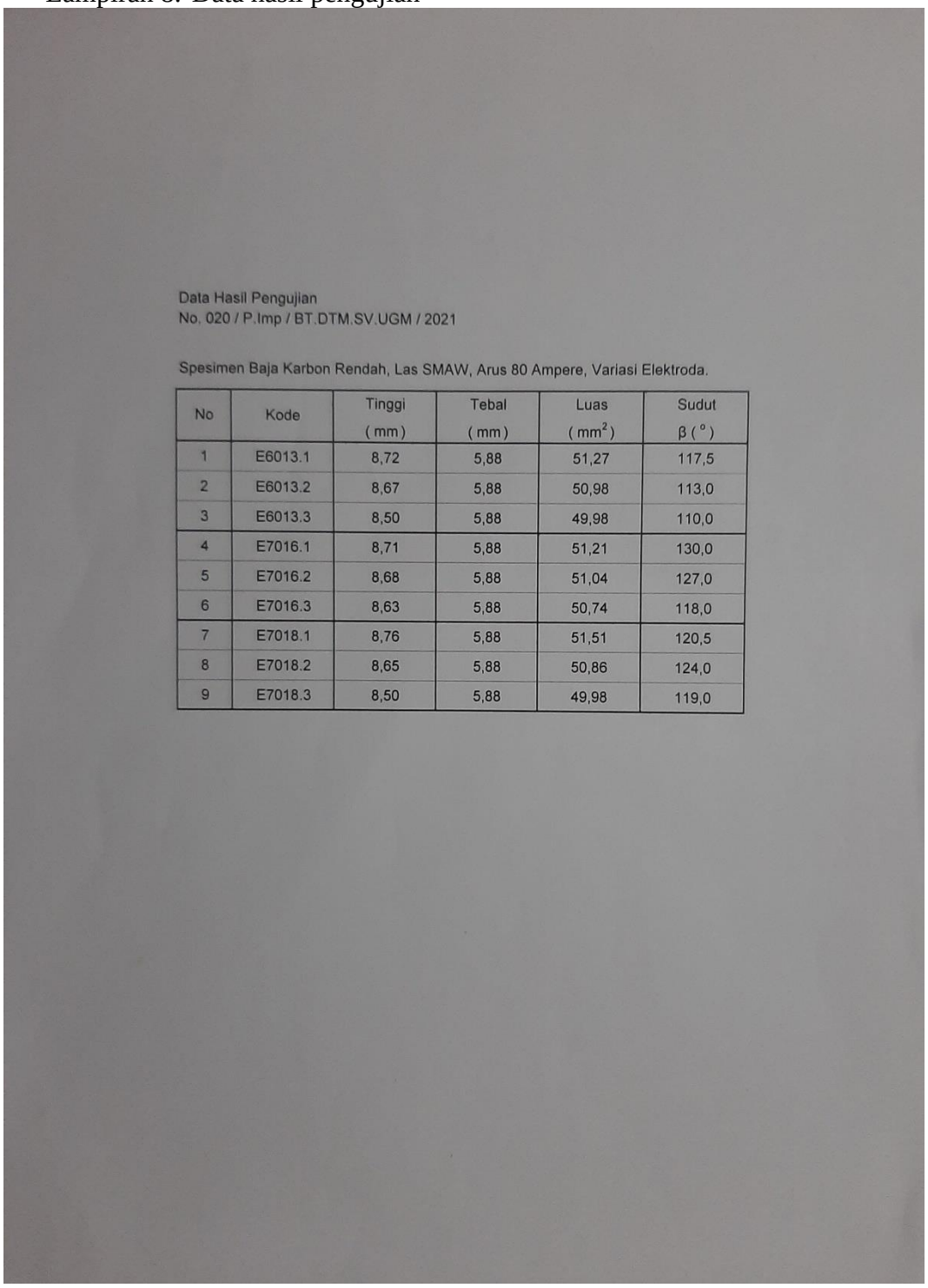
Lilik Dwi Setyana, ST., M.T.
NIP. 197703312002121002

Lembar asli, tidak untuk digandakan

Kampus : Jl. Grafika 2A Yogyakarta 55281

Sumber: Laboratorium Bahan Teknik Mesin Vokasi UGM.

Lampiran 8. Data hasil pengujian



Data Hasil Pengujian
No. 020 / P.Imp / BT.DTM.SV.UGM / 2021

Spesimen Baja Karbon Rendah, Las SMAW, Arus 80 Ampere, Variasi Elektroda.

No	Kode	Tinggi (mm)	Tebal (mm)	Luas (mm^2)	Sudut β (°)
1	E6013.1	8,72	5,88	51,27	117,5
2	E6013.2	8,67	5,88	50,98	113,0
3	E6013.3	8,50	5,88	49,98	110,0
4	E7016.1	8,71	5,88	51,21	130,0
5	E7016.2	8,68	5,88	51,04	127,0
6	E7016.3	8,63	5,88	50,74	118,0
7	E7018.1	8,76	5,88	51,51	120,5
8	E7018.2	8,65	5,88	50,86	124,0
9	E7018.3	8,50	5,88	49,98	119,0

Sumber: Laboratorium Bahan Teknik Mesin Vokasi UGM.

Lampiran 9. Laporan proses pengelasan spesimen variasi elektroda E6013

LAPORAN PROSES PENGELASAN SPESIMEN

BASE METAL
Specification type and grade : ST 37
Chem.Analysis Mech prop :
Thickness range : 6 mm
Base Metal : Groove: All size
Pipe dia.range :--
Other :--

TECNIQUE
String or Weave Bead : String and Weave
Welding position : 1G/PA (Down hand)
Initial and interpass cleaning : Brush and grinding
Method of back gouging : --
Oscilation : --
Electrode / Wolfram : --
Multi pass or Single pass(Per side) : Single Pass
Single or Multi Electrode : Single
Travel speed(Range) : --
Thickness of reinforcement : --
Trade Mark : DAIDEN MMA 400

Specimen	Proces	Filler metal		Current		Volt range	Travel Speed Range (mm/min)	Remaks
		Class	Dia.	Polarity	Amp.range			
Root	SMAW	E6013	2.6	DCSP	50	18 - 20	50 - 60	
Filler	SMAW	E6013	2.6	DCRP	80	18 -22	50 - 60	
Cap	SMAW	E6013	2.6	DCRP	80	18 -22	50 - 60	

Item Code	Norm	Typical Chemical Composition of Deposied Metal									
		C	Si	S	P	Mn					
	AWSA5.1 E6013	≤0.12	≤0.35	≤0.035	≤0.04	0.3 – 0.6					

Sumber: Las Inlastek

Lampiran 10. Laporan prosen pengelasan spesimen variasi elektroda E7016

LAPORAN PROSES PENGELASAN SPESIMEN

BASE METAL

Specification type and grade : ST 37
Chem.Analysis Mech prop :
Thickness range : 6 mm
Base Metal : Groove: All size
Pipe dia.range :--
Other :--

TECNIQUE

String or Weave Bead : String and Weave
Welding position : 1G/PA (Down hand)
Initial and interpass cleaning : Brush and grinding
Method of back gouging : --
Oscilation : --
Electrode / Wolfram : --
Multi pass or Single pass(Per side) : Single Pass
Single or Multi Electrode : Single
Travel speed(Range) : --

Thickness of reinforcement : --
Trade Mark : DAIDEN MMA 400

Specimen	Process	Filler metal		Current		Volt range	Travel Speed Range (mm/min)	Remaks
		Class	Dia.	Polarity	Amp.range			
Root	SMAW	E7016	2.6	DCSP	50	18 - 20	50 - 60	
Filler	SMAW	E7016	2.6	DCRP	80	18 -22	45 - 55	
Cap	SMAW	E7016	2.6	DCRP	80	18 -22	45 - 55	

Item Code	Norm	Typical Chemical Composition of Deposied Metal									
		C	Si	S	Ni	Cr	Mo	Mn	V		
	AWSA5.1 E7016	0.12	0.75	0.035	0.30	0.20	0,30	1.6	0.08		

Sumber: Las Inlastek

Lampiran 11. Laporan prosen pengelasan spesimen variasi elektroda E7018

LAPORAN PROSES PENGELASAN SPESIMEN

BASE METAL
Specification type and grade : ST 37
Chem.Analysis Mech prop :
Thickness range : 6 mm
Base Metal : Groove: All size
Pipe dia.range :--
Other :--

TECNIQUE
String or Weave Bead : String and Weave
Welding position : 1G/PA (Down hand)
Initial and interpass cleaning : Brush and grinding
Method of back gouging : --
Oscilation : --
Electrode / Wolfram : --
Multi pass or Single pass(Per side) : Single Pass
Single or Multi Electrode : Single
Travel speed(Range) : --
Thickness of reinforcement : --
Trade Mark : DAIDEN MMA 400

Specimen	Proces	Filler metal		Current		Volt range	Travel Speed Range (mm/min)	Remaks
		Class	Dia.	Polarity	Amp.range			
Root	SMAW	E7018	2.6	DCSP	50	18 - 20	50 - 60	
Filler	SMAW	E7018	2,6	DCRP	80	18 -22	40 - 50	
Cap	SMAW	E7018	2,6	DCRP	80	18 -22	40 - 50	

Item Code	Norm	**Typical Chemical Composition of Deposied Metal**									
		C	Si	S	P	Mn					
	AWSA5.1 E7018	≤ 0.12	≤ 0.75	≤0.035	≤0.04	≤1,6					

Sumber: Las Inlastek