LAMPIRAN

Lampiran 1. Gambar Alat dan Bahan

(Alat)

			
1. Mesin Las *Gas Tungsten Arc Welding* (GTAW)	2. Tungku Pemanas	3. Gunting Logam	4. Alat Uji *Stress Corrosion Cracking* (SCC)
			
5. *Masker*	6. Sarung Tangan Laboratorium	7. Gelas Ukur	8. Sarung Tangan Lapangan

			
9. Lem	10. Kunci Pas	11. Jam	12. *Mousture Analyzer*
			
13. Vernier Caliper	14. Laptop		

(Bahan)

	
1. Spesimen Uji Dasar: Aluminium, yang akan dibagi menjadi tiga, yakni spesimen dasar tanpa pengelasan (spesimen A), spesimen dengan pengelasan (spesimen WA), dan spesimen dengan pengelasan dan perlakuan *stress relieving* (spesimen SR)	2. Larutan Korosif: HCl 1M

Lampiran 2. Sertifikat Uji Komposisi

124-2 Albertus Rahesta.xlsx

LEMBAGA ILMU PENGETAHUAN INDONESIA
(INDONESIAN INSTITUTE OF SCIENCES)
PUSAT PENELITIAN METALURGI DAN MATERIAL
Kawasan PUSPIPTEK - Tangerang Selatan 15314
Telp: 021 - 7560911, 7563205 Fax: 021 - 7560553
website: http:www.metalurgi.lipi.go.id email : p2m@metalurgi.lipi.go.id

QM Certification
Cert No. : SM-0017-16
SNI ISO 9001

LAPORAN PENGUJIAN MATERIAL

Report of Material Testing

Laporan No / *Report Nr* : B-1322 /IPK.5/AP.04/VII/2017

Kendali No / *Control Nr* : 124-2/KS/PNBP/VI/2017

Dibuat Untuk / *Executed for* : ALBERTUS RAHESTA - UNIV. BRAWIJAYA - MALANG

Metode Uji / *Test Method* : SPARK OES

Komoditi / *Material* : **Aluminium A 6061**

Tanggal Terima Specimen / *Date of Specimen Receiving* : 15 Juni 2017

Hasil Pengujian / *Test Result* :

Unsur / *Element*	Kadar/% / *Content/%*
Si	0,652
Fe	0,272
Cu	0,171
Mn	0,020
Mg	0,808
Zn	0,024
Ti	0,024
Cr	0,065
Ni	0,010
V	0,006
Cd	0,002
Al	97,95

Tangerang Selatan, 04 Juli 2017
A.n.Kepala Pusat Penelitian Metalurgi dan Material - LIPI
Kepala Bidang Pengelolaan dan Diseminasi
Hasil Penelitian

Dr.Ika Kartika
NIP. 19720125 199803 2 001

* Laporan ini hanya berlaku untuk sampel yang diuji
This report refers to the tested sample only

Lampiran 3. Surat Data Uji Kekerasan

KEMENTERIAN RISET,TEKNOLOGI DAN PENDIDIKAN TINGGI
UNIVERSITAS BRAWIJAYA FAKULTAS TEKNIK JURUSAN MESIN

LABORATORIUM PENGUJIAN BAHAN

Jl. Mayjen Haryono 167 Telp. 553286 Pes. 1214 Malang 65145

DATA HASIL PENGUJIAN

Jenis Pengujian : Pengujian Kekerasan Mikrovikers.
Beban : 0.98 N
Penguji : Sudarsono
Nim. : 135060200111065
Program Studi : Teknik Mesin
Instansi : Universitas Brawijaya Malang
Tanggal Pengujian : 14 Desember 2017

Spesimen Uji	Nilai Kekerasan Vikers (HV)				
	0	5	10	15	20
Spesimen A.	60.9	60.9	60.9	60.9	60.9
Spesimen SR.	36.09	39.74	55.24	60.89	60.9

Malang, 30 Januari 2018
Ka. Lab. Pengujian Bahan

Ir. Erwin Sulistyo, MT.
NIP. 19661215 199802 1 007

Lampiran 4. Perhitungan Nilai Tegangan pada Setiap Variasi Pembebanan

(Spesimen A)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

(Tidak patah)

Pembebanan 30 kg

$$\sigma = \frac{1218.169805\ N}{0.00004\ m^2}$$

$$\sigma = 30454245.117\ Pa$$

$$\sigma = 30.454\ MPa$$

Pembebanan 35 kg

$$\sigma = \frac{1414.302805\ N}{0.00004\ m^2}$$

$$\sigma = 35357570.117\ Pa$$

$$\sigma = 35.358\ MPa$$

Pembebanan 40 kg

$$\sigma = \frac{1610.435805\ N}{0.00004\ m^2}$$

$$\sigma = 40260895.117\ Pa$$

$$\sigma = 40.261\ MPa$$

Pembebanan 45 kg

$$\sigma = \frac{1806.568805\ N}{0.00004\ m^2}$$

$$\sigma = 45164220.117\ Pa$$

$$\sigma = 45.164\ MPa$$

Pembebanan 50 kg

$$\sigma = \frac{2002.701805\ N}{0.00004\ m^2}$$

$$\sigma = 50067545.125\ Pa$$

$$\sigma = 50.068\ MPa$$

(Spesimen WA)

Pembebanan 20 kg

$$\sigma = \frac{825.9038047\ N}{0.00004\ m^2}$$

$$\sigma = 20647595.117\ Pa$$

$$\sigma = 20.648\ MPa$$

Pembebanan 25 kg

$$\sigma = \frac{1022.036805\ N}{0.00004\ m^2}$$

$$\sigma = 25550920.117\ Pa$$

$$\sigma = 25.551\ MPa$$

Pembebanan 30 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 30 kg)

Pembebanan 35 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 35 kg)

Pembebanan 40 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 40 kg)

Pembebanan 45 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 45 kg)

Pembebanan 50 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 50 kg)

(Spesimen SR)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen WA pembebanan 25 kg)

Pembebanan 30 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 30 kg)

Pembebanan 35 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 35 kg)

Pembebanan 40 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 40 kg)

Pembebanan 45 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 45 kg)

Pembebanan 50 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 50 kg)

Lampiran 5. Perhitungan Faktor Intensitas Tegangan pada Setiap Variasi Pembebanan (Spesimen A)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

(Tidak patah)

Pembebanan 30 kg

$$K = \frac{1218.169805\ N}{0.00165\ m\sqrt{0.019/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.009}\ \boldsymbol{m}}}{\sqrt{1-\frac{0.009\ m}{0.0095\ m}}}\left[1{,}122-0{,}561\frac{0.009\ m}{0.0095\ m}-0{,}205\left(\frac{0.009\ m}{0.0095\ m}\right)^2+0{,}471\left(\frac{0.009\ m}{0.0095\ m}\right)^3+0{,}19\left(\frac{0.009\ m}{0.0095\ m}\right)^4\right]\right\}$$

$$K = \frac{1218.169805\ N}{0.00165\sqrt{0.019/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.009}}}{\sqrt{1-\frac{0.009}{0.0095}}}\left[1{,}122-0{,}561\frac{0.009}{0.0095}-0{,}205\left(\frac{0.009}{0.0095}\right)^2+0{,}471\left(\frac{0.009}{0.0095}\right)^3+0{,}19\left(\frac{0.009}{0.0095}\right)^4\right]\right\}$$

$$K = 18512424.83\ \frac{N}{\sqrt[3]{m}}$$

$$K = 18.51242483\ MPa\sqrt{m}$$

Pembebanan 35 kg

$$K = \frac{1414.302805\ N}{0.0017\ m\sqrt{0.0185/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008}\ \boldsymbol{m}}}{\sqrt{1-\frac{0.008\ m}{0.00925\ m}}}\left[1{,}122-0{,}561\frac{0.008\ m}{0.00925\ m}-0{,}205\left(\frac{0.008\ m}{0.00925\ m}\right)^2+0{,}471\left(\frac{0.008\ m}{0.00925\ m}\right)^3+0{,}19\left(\frac{0.008\ m}{0.00925\ m}\right)^4\right]\right\}$$

$$K = \frac{1414.302805\ N}{0.0017\sqrt{0.0185/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008}}}{\sqrt{1-\frac{0.008}{0.00925}}}\left[1{,}122-0{,}561\frac{0.008}{0.00925}-0{,}205\left(\frac{0.008}{0.00925}\right)^2+0{,}471\left(\frac{0.008}{0.00925}\right)^3+0{,}19\left(\frac{0.008}{0.00925}\right)^4\right]\right\}$$

$$K = 21140917.89\ \frac{N}{\sqrt[3]{m}}$$

$$K = 21.14091789\ MPa\sqrt{m}$$

Pembebanan 40 kg

$$K = \frac{1610.435805\ N}{0.00175\ m\sqrt{0.018/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008}\ \boldsymbol{m}}}{\sqrt{1-\frac{0.008\ m}{0.009\ m}}}\left[1{,}122-0{,}561\frac{0.008\ m}{0.009\ m}-0{,}205\left(\frac{0.008\ m}{0.009\ m}\right)^2+0{,}471\left(\frac{0.008\ m}{0.009\ m}\right)^3+0{,}19\left(\frac{0.008\ m}{0.009\ m}\right)^4\right]\right\}$$

$$K = \frac{1610.435805\ N}{0.00175\sqrt{0.018/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008}}}{\sqrt{1-\frac{0.008}{0.009}}}\left[1{,}122-0{,}561\frac{0.008}{0.009}-0{,}205\left(\frac{0.008}{0.009}\right)^2+0{,}471\left(\frac{0.008}{0.009}\right)^3+0{,}19\left(\frac{0.008}{0.009}\right)^4\right]\right\}$$

$$K = 23707477.05\ \frac{N}{\sqrt[3]{m}}$$

$$K = 23.70747705\ MPa\sqrt{m}$$

Pembebanan 45 kg

$$K = \frac{1806.568805\ N}{0.00175\ m\sqrt{0.017/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008}\ \boldsymbol{m}}}{\sqrt{1-\frac{0.008\ m}{0.0085\ m}}}\left[1{,}122-0{,}561\frac{0.008\ m}{0.0085\ m}-0{,}205\left(\frac{0.008\ m}{0.0085\ m}\right)^2+0{,}471\left(\frac{0.008\ m}{0.0085\ m}\right)^3+0{,}19\left(\frac{0.008\ m}{0.0085\ m}\right)^4\right]\right\}$$

$$K = \frac{1806.568805\ N}{0.00175\sqrt{0.017/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.008}}{0.017}}}{\sqrt{1-\frac{0.008}{0.0085}}}\left[1{,}122-0{,}561\frac{0.008}{0.0085}-0{,}205\left(\frac{0.008}{0.0085}\right)^2+0{,}471\left(\frac{0.008}{0.0085}\right)^3+0{,}19\left(\frac{0.008}{0.0085}\right)^4\right]\right\}$$

$$K = 27365804.48\ \frac{N}{\sqrt[3]{m}}$$

$$K = 27.36580448\ MPa\sqrt{m}$$

Pembebanan 50 kg

$$K = \frac{2002.70185\ N}{0.0018\ m\sqrt{0.017\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.008}\ \boldsymbol{m}}{0.017\ m}}}{\sqrt{1-\frac{0.008\ m}{0.0085\ m}}}\left[1{,}122-0{,}561\frac{0.008\ m}{0.0085\ m}-0{,}205\left(\frac{0.008\ m}{0.0085\ m}\right)^2+0{,}471\left(\frac{0.008\ m}{0.0085\ m}\right)^3+0{,}19\left(\frac{0.008\ m}{0.0085\ m}\right)^4\right]\right\}$$

$$K = \frac{2002.70185\ N}{0.0018\sqrt{0.017/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.008}}{0.017}}}{\sqrt{1-\frac{0.008}{0.0085}}}\left[1{,}122-0{,}561\frac{0.008}{0.0085}-0{,}205\left(\frac{0.008}{0.0085}\right)^2+0{,}471\left(\frac{0.008}{0.0085}\right)^3+0{,}19\left(\frac{0.008}{0.0085}\right)^4\right]\right\}$$

$$K = 29494126.99\ \frac{N}{\sqrt[3]{m}}$$

$$K = 29.49412699\ MPa\sqrt{m}$$

(Spesimen WA)

Pembebanan 20 kg

$$K = \frac{825.9038047\ N}{0.0016\ m\sqrt{0.0165/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}\ \boldsymbol{m}}{0.0165\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00825\ m}}}\left[1{,}122-0{,}561\frac{0.007\ m}{0.00825\ m}-0{,}205\left(\frac{0.007\ m}{0.00825\ m}\right)^2+0{,}471\left(\frac{0.007\ m}{0.00825\ m}\right)^3+0{,}19\left(\frac{0.007\ m}{0.00825\ m}\right)^4\right]\right\}$$

$$K = \frac{825.9038047\ N}{0.0016\sqrt{0.0165/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.0165}}}{\sqrt{1-\frac{0.007}{0.00825}}}\left[1{,}122-0{,}561\frac{0.007}{0.00825}-0{,}205\left(\frac{0.007}{0.00825}\right)^2+0{,}471\left(\frac{0.007}{0.00825}\right)^3+0{,}19\left(\frac{0.007}{0.00825}\right)^4\right]\right\}$$

$$K = 13889407.97\ \frac{N}{\sqrt[3]{m}}$$

$$K = 13.88940797\ MPa\sqrt{m}$$

Pembebanan 25 kg

$$K = \frac{1022.036805\ N}{0.0016\ m\sqrt{0.0165/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}\ \boldsymbol{m}}{0.0165\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00825\ m}}}\left[1{,}122-0{,}561\frac{0.007\ m}{0.00825\ m}-0{,}205\left(\frac{0.007\ m}{0.00825\ m}\right)^2+0{,}471\left(\frac{0.007\ m}{0.00825\ m}\right)^3+0{,}19\left(\frac{0.007\ m}{0.00825\ m}\right)^4\right]\right\}$$

$$K = \frac{1022.036805\ N}{0.0016\sqrt{0.0165/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.0165}}}{\sqrt{1-\frac{0.007}{0.00825}}}\left[1{,}122-0{,}561\frac{0.007}{0.00825}-0{,}205\left(\frac{0.007}{0.00825}\right)^2+0{,}471\left(\frac{0.007}{0.00825}\right)^3+0{,}19\left(\frac{0.007}{0.00825}\right)^4\right]\right\}$$

$$K = 17187820.25\ \frac{N}{\sqrt[3]{m}}$$

$$K = 17.18782025\ MPa\sqrt{m}$$

Pembebanan 30 kg

$$K = \frac{1218.169805\ N}{0.0016\ m\sqrt{0.0155/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007\ m}}{0.0155\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00775\ m}}}\left[1{,}122-0{,}561\frac{0.007\ m}{0.00775\ m}-0{,}205\left(\frac{0.007\ m}{0.00775\ m}\right)^2+0{,}471\left(\frac{0.007\ m}{0.00775\ m}\right)^3+0{,}19\left(\frac{0.007\ m}{0.00775\ m}\right)^4\right]\right\}$$

$$K = \frac{1218.169805\ N}{0.0016\sqrt{0.0155/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.0155}}}{\sqrt{1-\frac{0.007}{0.00775}}}\left[1{,}122-0{,}561\frac{0.007}{0.00775}-0{,}205\left(\frac{0.007}{0.00775}\right)^2+0{,}471\left(\frac{0.007}{0.00775}\right)^3+0{,}19\left(\frac{0.007}{0.00775}\right)^4\right]\right\}$$

$$K = 2113675.05\ \frac{N}{\sqrt[3]{m}}$$

$$K = 21.1367505\ MPa\sqrt{m}$$

Pembebanan 35 kg

$$K = \frac{1414.302805\ N}{0.0016\ m\sqrt{0.015/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007\ m}}{0.015\ m}}}{\sqrt{1-\frac{0.007\ m}{0.0075\ m}}}\left[1{,}122-0{,}561\frac{0.007\ m}{0.0075\ m}-0{,}205\left(\frac{0.007\ m}{0.0075\ m}\right)^2+0{,}471\left(\frac{0.007\ m}{0.0075\ m}\right)^3+0{,}19\left(\frac{0.007\ m}{0.0075\ m}\right)^4\right]\right\}$$

$$K = \frac{1414.302805\ N}{0.0016\sqrt{0.015/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.015}}}{\sqrt{1-\frac{0.007}{0.0075}}}\left[1{,}122-0{,}561\frac{0.007}{0.0075}-0{,}205\left(\frac{0.007}{0.0075}\right)^2+0{,}471\left(\frac{0.007}{0.0075}\right)^3+0{,}19\left(\frac{0.007}{0.0075}\right)^4\right]\right\}$$

$$K = 24945545.93\ \frac{N}{\sqrt[3]{m}}$$

$$K = 24.94554593\ MPa\sqrt{m}$$

Pembebanan 40 kg

$$K = \frac{1610.435805\ N}{0.0017\ m\sqrt{0.014/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.006\ m}}{0.014\ m}}}{\sqrt{1-\frac{0.006\ m}{0.007\ m}}}\left[1{,}122-0{,}561\frac{0.006\ m}{0.007\ m}-0{,}205\left(\frac{0.006\ m}{0.007\ m}\right)^2+0{,}471\left(\frac{0.006\ m}{0.007\ m}\right)^3+0{,}19\left(\frac{0.006\ m}{0.007\ m}\right)^4\right]\right\}$$

$$K = \frac{1610.435805\ N}{0.0017\sqrt{0.014/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.006}}{0.014}}}{\sqrt{1-\frac{0.006}{0.007}}}\left[1{,}122-0{,}561\frac{0.006}{0.007}-0{,}205\left(\frac{0.006}{0.007}\right)^2+0{,}471\left(\frac{0.006}{0.007}\right)^3+0{,}19\left(\frac{0.006}{0.007}\right)^4\right]\right\}$$

$$K = 27672391.98\ \frac{N}{\sqrt[3]{m}}$$

$$K = 27.67239198\ MPa\sqrt{m}$$

Pembebanan 45 kg

$$K = \frac{1806.568805\ N}{0.0017\ m\sqrt{0.014/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.006\ m}}{0.014\ m}}}{\sqrt{1-\frac{0.006\ m}{0.007\ m}}}\left[1{,}122-0{,}561\frac{0.006\ m}{0.007\ m}-0{,}205\left(\frac{0.006\ m}{0.007\ m}\right)^2+0{,}471\left(\frac{0.006\ m}{0.007\ m}\right)^3+0{,}19\left(\frac{0.006\ m}{0.007\ m}\right)^4\right]\right\}$$

$$K = \frac{1806.568805\ N}{0.0017\sqrt{0.014/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.006}}{0.014}}}{\sqrt{1-\frac{0.006}{0.007}}}\left[1{,}122-0{,}561\frac{0.006}{0.007}-0{,}205\left(\frac{0.006}{0.007}\right)^2+0{,}471\left(\frac{0.006}{0.007}\right)^3+0{,}19\left(\frac{0.006}{0.007}\right)^4\right]\right\}$$

$$K = 31042578.63\ \frac{N}{\sqrt[3]{m}}$$

$$K = 31.04257863\ MPa\sqrt{m}$$

Pembebanan 50 kg

$$K = \frac{2002.70185\ N}{0.0017\ m\sqrt{0.0135/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.006\ m}}}{\sqrt{1-\frac{0.006\ m}{0.00675\ m}}}\left[1{,}122 - 0{,}561\frac{0.006\ m}{0.00675\ m} - 0{,}205\left(\frac{0.006\ m}{0.00675\ m}\right)^2 + 0{,}471\left(\frac{0.006\ m}{0.00675\ m}\right)^3 + 0{,}19\left(\frac{0.006\ m}{0.00675\ m}\right)^4\right]\right\}$$

$$K = \frac{2002.70185\ N}{0.0017\sqrt{0.0135/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.006}}}{\sqrt{1-\frac{0.006}{0.00675}}}\left[1{,}122 - 0{,}561\frac{0.006}{0.00675} - 0{,}205\left(\frac{0.006}{0.00675}\right)^2 + 0{,}471\left(\frac{0.006}{0.00675}\right)^3 + 0{,}19\left(\frac{0.006}{0.00675}\right)^4\right]\right\}$$

$$K = 35044244.85\ \frac{N}{\sqrt[3]{m}}$$

$$K = 35044244.85\ MPa\sqrt{m}$$

(Spesimen SR)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

$$K = \frac{1022.036805\ N}{0.0016\ m\sqrt{0.017/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008\ m}}}{\sqrt{1-\frac{0.008\ m}{0.0085\ m}}}\left[1{,}122 - 0{,}561\frac{0.008\ m}{0.0085\ m} - 0{,}205\left(\frac{0.008\ m}{0.0085\ m}\right)^2 + 0{,}471\left(\frac{0.008\ m}{0.0085\ m}\right)^3 + 0{,}19\left(\frac{0.008\ m}{0.0085\ m}\right)^4\right]\right\}$$

$$K = \frac{1022.036805\ N}{0.0016\sqrt{0.017/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.008}}}{\sqrt{1-\frac{0.008}{0.0085}}}\left[1{,}122 - 0{,}561\frac{0.008}{0.0085} - 0{,}205\left(\frac{0.008}{0.0085}\right)^2 + 0{,}471\left(\frac{0.008}{0.0085}\right)^3 + 0{,}19\left(\frac{0.008}{0.0085}\right)^4\right]\right\}$$

$$K = 1693317.18\ \frac{N}{\sqrt[3]{m}}$$

$$K = 16.9331718\ MPa\sqrt{m}$$

Pembebanan 30 kg

$$K = \frac{1218.169805\ N}{0.00165\ m\sqrt{0.0155/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.007\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00775\ m}}}\left[1{,}122 - 0{,}561\frac{0.007\ m}{0.00775\ m} - 0{,}205\left(\frac{0.007\ m}{0.00775\ m}\right)^2 + 0{,}471\left(\frac{0.007\ m}{0.00775\ m}\right)^3 + 0{,}19\left(\frac{0.007\ m}{0.00775\ m}\right)^4\right]\right\}$$

$$K = \frac{1218.169805\ N}{0.00165\sqrt{0.0155/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.007}}}{\sqrt{1-\frac{0.007}{0.00775}}}\left[1{,}122 - 0{,}561\frac{0.007}{0.00775} - 0{,}205\left(\frac{0.007}{0.00775}\right)^2 + 0{,}471\left(\frac{0.007}{0.00775}\right)^3 + 0{,}19\left(\frac{0.007}{0.00775}\right)^4\right]\right\}$$

$$K = 20496242.91\ \frac{N}{\sqrt[3]{m}}$$

$$K = 20.49624291\ MPa\sqrt{m}$$

Pembebanan 35 kg

$$K = \frac{1414.302805\ N}{0.00165\ m\sqrt{0.0155/2\ m}}\left\{\frac{\sqrt{\left(\frac{22}{7}\right)\mathbf{0.007\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00775\ m}}}\left[1{,}122 - 0{,}561\frac{0.007\ m}{0.00775\ m} - 0{,}205\left(\frac{0.007\ m}{0.00775\ m}\right)^2 + 0{,}471\left(\frac{0.007\ m}{0.00775\ m}\right)^3 + 0{,}19\left(\frac{0.007\ m}{0.00775\ m}\right)^4\right]\right\}$$

$$K = \frac{1414.302805\ N}{0.00165\sqrt{0.0155/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.0155}}}{\sqrt{1-\frac{0.007}{0.00775}}}\left[1{,}122-0{,}561\frac{0.007}{0.00775}-0{,}205\left(\frac{0.007}{0.00775}\right)^2+0{,}471\left(\frac{0.007}{0.00775}\right)^3+0{,}19\left(\frac{0.007}{0.00775}\right)^4\right]\right\}$$

$$K = 23796266.92\ \frac{N}{\sqrt[3]{m}}$$

$$K = 23.79626692\ MPa\sqrt{m}$$

Pembebanan 40 kg

$$K = \frac{1610.435805\ N}{0.001725\ m\sqrt{0.0145/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}\ \boldsymbol{m}}{0.0145\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00725\ m}}}\left[1{,}122-0{,}561\frac{0.007\ m}{0.00725\ m}-0{,}205\left(\frac{0.007\ m}{0.00725\ m}\right)^2+0{,}471\left(\frac{0.007\ m}{0.00725\ m}\right)^3+0{,}19\left(\frac{0.007\ m}{0.00725\ m}\right)^4\right]\right\}$$

$$K = \frac{1610.435805\ N}{0.001725\sqrt{0.0145/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.0145}}}{\sqrt{1-\frac{0.007}{0.00725}}}\left[1{,}122-0{,}561\frac{0.007}{0.00725}-0{,}205\left(\frac{0.007}{0.00725}\right)^2+0{,}471\left(\frac{0.007}{0.00725}\right)^3+0{,}19\left(\frac{0.007}{0.00725}\right)^4\right]\right\}$$

$$K = 26797022.42\ \frac{N}{\sqrt[3]{m}}$$

$$K = 26.79702242\ MPa\sqrt{m}$$

Pembebanan 45 kg

$$K = \frac{1806.568805\ N}{0.00175\ m\sqrt{0.0145/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}\ \boldsymbol{m}}{0.0145\ m}}}{\sqrt{1-\frac{0.007\ m}{0.00725\ m}}}\left[1{,}122-0{,}561\frac{0.007\ m}{0.00725\ m}-0{,}205\left(\frac{0.007\ m}{0.00725\ m}\right)^2+0{,}471\left(\frac{0.007\ m}{0.00725\ m}\right)^3+0{,}19\left(\frac{0.007\ m}{0.00725\ m}\right)^4\right]\right\}$$

$$K = \frac{1806.568805\ N}{0.00175\sqrt{0.0145/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.007}}{0.0145}}}{\sqrt{1-\frac{0.007}{0.00725}}}\left[1{,}122-0{,}561\frac{0.007}{0.00725}-0{,}205\left(\frac{0.007}{0.00725}\right)^2+0{,}471\left(\frac{0.007}{0.00725}\right)^3+0{,}19\left(\frac{0.007}{0.00725}\right)^4\right]\right\}$$

$$K = 29631161.76\ \frac{N}{\sqrt[3]{m}}$$

$$K = 29.63116176\ MPa\sqrt{m}$$

Pembebanan 50 kg

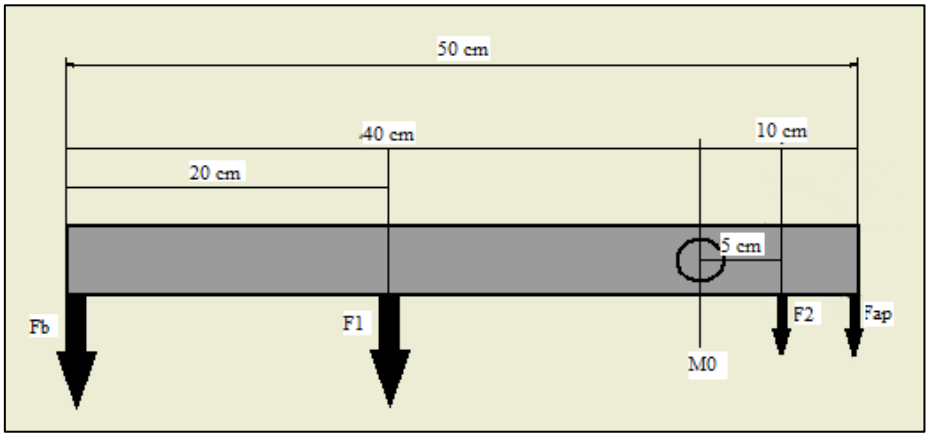
$$K = \frac{2002.70185\ N}{0.00175\ m\sqrt{0.014/2\ m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.006}\ \boldsymbol{m}}{0.014\ m}}}{\sqrt{1-\frac{0.006\ m}{0.007\ m}}}\left[1{,}122-0{,}561\frac{0.006\ m}{0.007\ m}-0{,}205\left(\frac{0.006\ m}{0.007\ m}\right)^2+0{,}471\left(\frac{0.006\ m}{0.007\ m}\right)^3+0{,}19\left(\frac{0.006\ m}{0.007\ m}\right)^4\right]\right\}$$

$$K = \frac{2002.70185\ N}{0.00175\sqrt{0.014/2}\ \sqrt[3]{m}}\left\{\frac{\sqrt{\frac{\left(\frac{22}{7}\right)\mathbf{0.006}}{0.014}}}{\sqrt{1-\frac{0.006}{0.007}}}\left[1{,}122-0{,}561\frac{0.006}{0.007}-0{,}205\left(\frac{0.006}{0.007}\right)^2+0{,}471\left(\frac{0.006}{0.007}\right)^3+0{,}19\left(\frac{0.006}{0.007}\right)^4\right]\right\}$$

$$K = 33429543.42\ \frac{N}{\sqrt[3]{m}}$$

$$K = 33.42954342\ MPa\sqrt{m}$$

Lampiran 6. Perhitungan Nilai Gaya pada Setiap Variasi Pembebanan



(Spesimen A)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

(Tidak patah)

Pembebanan 30 kg

$$(294.1995\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$$

$$(F_{ap})(0.1\ m) = (294.1995\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$$

$$F_{ap} = \frac{(294.1995\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$$F_{ap} = 1218.169805\ N$$

Pembebanan 35 kg

$$(343.23275\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$$

$$(F_{ap})(0.1\ m) = (343.23275\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$$

$$F_{ap} = \frac{(343.23275\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$$F_{ap} = 1414.302805\ N$$

Pembebanan 40 kg

$$(392.266\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$$

$$(F_{ap})(0.1\ m) = (392.266\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$$

$$F_{ap} = \frac{(392.266\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$$F_{ap} = 1610.435805\ N$$

Pembebanan 45 kg

$$(441.29925\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$$

$$(F_{ap})(0.1\ m) = (441.29925\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$$

$$F_{ap} = \frac{(441.29925\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$F_{ap} = 1806.568805\ N$

Pembebanan 50 kg

$(490.3325\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$

$(F_{ap})(0.1\ m) = (490.3325\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$

$$F_{ap} = \frac{(490.3325\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$F_{ap} = 2002.701805\ N$

(Spesimen WA)

Pembebanan 20 kg

$(196.133\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$

$(F_{ap})(0.1\ m) = (196.133\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$

$$F_{ap} = \frac{(196.133\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$F_{ap} = 825.9038047\ N$

Pembebanan 25 kg

$(245.16625\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m) - (F_{ap})(0.1\ m) = 0$

$(F_{ap})(0.1\ m) = (245.16625\ N)(0.4\ m) + (22.0649625)(0.2\ m) - (5.516240625)(0.05\ m)$

$$F_{ap} = \frac{(245.16625\ N)(0.4\ m) + (22.0649625\ N)(0.2\ m) - (5.516240625\ N)(0.05\ m)}{0.1\ m}$$

$F_{ap} = 1022.036805\ N$

Pembebanan 30 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 30 kg)

Pembebanan 35 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 35 kg)

Pembebanan 40 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 40 kg)

Pembebanan 45 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 45 kg)

Pembebanan 50 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 50 kg)

(Spesimen SR)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen WA pembebanan 25 kg)

Pembebanan 30 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 30 kg)

Pembebanan 35 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 35 kg)

Pembebanan 40 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 40 kg)

Pembebanan 45 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 45 kg)

Pembebanan 50 kg

(Perhitungan sama dengan perhitungan nilai tegangan spesimen A pembebanan 50 kg)

Lampiran 7. Perhitungan Laju Korosi pada Setiap Variasi Pembebanan

(Spesimen A)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

(Tidak patah)

Pembebanan 30 kg

$$CR = \frac{(0.45)(8.76)\ (10^4)}{(2700)(0.8)(188)}\ mm/_{year}$$

$$CR = \frac{39420}{406080}\ mm/_{year}$$

$$CR = 0.097\ mmpy$$

Pembebanan 35 kg

$$CR = \frac{(0.15)(8.76)\ (10^4)}{(2700)(0.8)(59)}\ mm/_{year}$$

$$CR = \frac{13140}{127440}\ mm/_{year}$$

$$CR = 0.1\ mmpy$$

Pembebanan 40 kg

$$CR = \frac{(0.06)(8.76)\ (10^4)}{(2700)(0.8)(25.7)}\ mm/_{year}$$

$$CR = \frac{5256}{55620}\ mm/_{year}$$

$$CR = 0.101\ mmpy$$

Pembebanan 45 kg

$$CR = \frac{(0.03)(8.76)\ (10^4)}{(2700)(0.8)(12.8)}\ mm/_{year}$$

$$CR = \frac{2628}{27648}\ mm/_{year}$$

$$CR = 0.105\ mmpy$$

Pembebanan 50 kg

$$CR = \frac{(0.02)(8.76)\ (10^4)}{(2700)(0.8)(7)}\ mm/_{year}$$

$$CR = \frac{1752}{15120}\ mm/_{year}$$

$$CR = 0.11\ mmpy$$

(Spesimen WA)

Pembebanan 20 kg

$$CR = \frac{(0.55)(8.76)\ (10^4)}{(2700)(0.8)(250)}\ mm/_{year}$$

$$CR = \frac{48180}{540000}\ mm/_{year}$$

$$CR = 0.089\ mmpy$$

Pembebanan 25 kg

$$CR = \frac{(0.14)(8.76)\ (10^4)}{(2700)(0.8)(57)}\ mm/_{year}$$

$$CR = \frac{12264}{123120}\ mm/_{year}$$

$$CR = 0.1\ mmpy$$

Pembebanan 30 kg

$$CR = \frac{(0.04)(8.76)\ (10^4)}{(2700)(0.8)(15.9)}\ mm/_{year}$$

$$CR = \frac{3504}{34344}\ mm/_{year}$$

$$CR = 0.102\ mmpy$$

Pembebanan 35 kg

$$CR = \frac{(0.011)(8.76)\ (10^4)}{(2700)(0.8)(3.92)}\ mm/_{year}$$

$$CR = \frac{963.6}{8467.2}\ mm/_{year}$$

$$CR = 0.114\ mmpy$$

Pembebanan 40 kg

$$CR = \frac{(0.24)(8.76)\ (10^6)}{(2700)(0.8)(0.8)}\ mm/_{year}$$

$$CR = \frac{210.24}{1728}\ mm/_{year}$$

$$CR = 0.122\ mmpy$$

Pembebanan 45 kg

(Terjadi patah spontan)

Pembebanan 50 kg

(Terjadi patah spontan)

(Spesimen SR)

Pembebanan 20 kg

(Tidak patah)

Pembebanan 25 kg

$$CR = \frac{(0.57)(8.76)\ (10^4)}{(2700)(0.8)(250)}\ mm/_{year}$$

$$CR = \frac{49932}{540000}\ mm/_{year}$$

$$CR = 0.092\ mmpy$$

Pembebanan 30 kg

$$CR = \frac{(0.12)(8.76)\ (10^4)}{(2700)(0.8)(49.6)}\ mm/_{year}$$

$$CR = \frac{10687.2}{107136}\ mm/_{year}$$

$$CR = 0.1\ mmpy$$

Pembebanan 35 kg

$$CR = \frac{(0.04)(8.76)\ (10^4)}{(2700)(0.8)(13.4)}\ mm/_{year}$$

$$CR = \frac{3127.32}{28944}\ mm/_{year}$$

$$CR = 0.108\ mmpy$$

Pembebanan 40 kg

$$CR = \frac{(0.01)(8.76)\ (10^4)}{(2700)(0.8)(3.5)}\ mm/_{year}$$

$$CR = \frac{840.96}{7560}\ mm/_{year}$$

$$CR = 0.111\ mmpy$$

Pembebanan 45 kg

$$CR = \frac{(0.24)(8.76)\ (10^6)}{(2700)(0.8)(0.7)}\ mm/_{year}$$

$$CR = \frac{175.2}{1512}\ mm/_{year}$$

$$CR = 0.116\ mmpy$$

Pembebanan 50 kg

(Terjadi patah spontan)

Lampiran 8. Surat Keterangan Perancangan dan Konstruksi Alat Uji SCC

PPPPTK VEDC MALANG

Jl. Teluk Mandar, Arjosari, Tromol Pos 5 Malang
Telp. (0341) 491239 – 495849, Fax (0341) 491342
e-mail: vedcmalang@vedcmlg.itgo.com

SURAT KETERANGAN PENGUJIAN

Yang bertanda tangan dibawah ini :

Nama	: Suyono, ST
NIP	: 196709191988031002
Jabatan	: Ketua Laboratorium Pengujian Logam
Alamat	: PPPPTK / VEDC Malang Jl. Teluk Mandar Tromol Pos 5 Arjosari – Malang

menerangkan bahwa :

Nama	: Sudarsono
Mahasiswa	: Universitas Brawijaya
NIM	: 135060200111065
Jurusan	: Teknik Mesin
Fakultas	: Teknik
Judul Skripsi	: ***Analisis Stress Corrosion Cracking Sambungan Las Aluminium: Sebelum dan Sesudah Stress Relieving.***

Benar benar telah melaksanakan kegiatan pengelasan pada bahan aluminium dan pembuatan alat uji di Departemen TPL PPPPTK/VEDC Malang

Demikian Surat Keterangan ini kami buat untuk dapat dipergunakan sebagaimana mestinya.

Malang, 29 September 2017
Ketua Laboratorium Pengujian Logam

PROJAS DEPARTEMEN TEKNOLOGI PENGERJAAN LOGAM 40

Suyono,ST
NIP.196709191988031002

Lampiran 9. Dokumentasi Beberapa Kegiatan Selama Penelitian Berlangsung