

## DAFTAR PUSTAKA

- A Naufal, Jokosisworo dan Samuel (2016) “*pengaruh arus listrik dan sudut kampuh V terhadap kekuatan tarik dan tekuk alumunium 5083 pengelasan GTAW*”, jurnal teknik perkapalan UNDIP
- Afwandia, A dan Mochammad Arif Irfa’I, 2016. *Pengaruh Kuat Arus Las MIG(Metal Inert Gas) Terhadap Kekuatan Tarik Sambungan V BajaTahan Karat AISI 30*. JTM Volume 04 Nomor 02 07-12
- Aljufri., 2008., “*Pengaruh variasi sudut kampuh V tunggal dan kuat arus pada sambungan logam aluminium – Mg 5083 terhadap kekuatan tarik hasil pengelasan TIG*”. Universitas Sumatra utara., Medan
- American Society For Testing And Materials, 1997. “*Standard Test Method For Vickers Hardness Of Metallic Materials*”, ASTM, E92-82.
- ASME IX 2001, “*Welding and Brazing Qualifications. American Society Mechanical Engineering, Three Park Avenue*”, New York, 10016 USA.
- ASTM E8/E8-M.”*Standart Uji Tarik Amerika*”
- Ausaid. 2001. “*Dasar Las MIG/MAG (GMAW)*”. Batam Institutional Development Project.
- Chohey, N.P. 2004, “*Handbook chemical Engineering Calculations*”, Third Edition, McGraw-Hill, New York.
- Daryanto. 2012. “*Teknik Las*”. Bandung: Alfabeta
- Dieter, 1933:330. *Teori dan Rumus Perhitungan Pengujian Kekerasan Brinell, Vickers, Rockwheel.*
- Hartono Anton J; Tomojiro Kaneko, 1992, “*Mengenal Pelapisan Logam (elektroplating)*”, Andi offset, Yogyakarta
- James K. Wessel, 2004, “*Handbook of Advanced Materials, John Wiley & Sons, Inc*”. New Jersey
- JIS Handbook Ferrous Material and Metallurgy* : JIS Z2241, Japan : JIS Publisher, 1993
- jokosisworo, S., 2009. ” *Pengaruh Besar Arus Listrik dengan Menggunakan Elektroda SMAW Terhadap kekuata Sambungan Las Butt Joint pada Plat Mild Steel*”. Jurnal Teknik Perkapalan Fakultas UNDIP

- Laksono, Solichin dan Yoto (2017) tentang ”*Analisa Kekuatan Tarik Alumunium 5083 Hasil Pengelasan GMAW Posisi 1G dengan Variasi Kuat Arus dan Debit Aliran Gas Pelindung*”, Jurnal Teknologi
- Mandal. 2005. “*Aluminum Welding*”. 2nd ed. Narosa Publishing House. New Delhi.
- Mutombo dkk (2010), “*sifat mekanik dari aluminium AA 5083 H116 setelah pengelasan manual dan otomatis las GMAW dengan elektroda ER5356*”.
- R Rusnoto, S Soebyakto 2019.” *Analisa Hasil Pengelasan Baja St37 dengan Arus Terhadap Sifat Mekanis*”. 1st Mechanical Engineering Conference
- Rusnoto, Agung Prasetyo N, dkk, 2022 “*VARIASI TEMPERATUR PEMANASAN MULA PADA SIFAT MEKANIK PENGELASAN BAJA SS400*” jurnal ilmiah Teknik Mesin Surya Teknika volume 6 nomor 2
- Sindo Kou. (2003).” *Metallurgy Second Edition Welding Metallurgy*”. Wiley & Sons
- Suharto, (1991). “*Manajemen Perawatan Mesin*”, Penerbit PT. Rineka Cipta. Jakarta.
- Surdia, T., Shinroku, S., 2005, “*Pengetahuan Bahan Teknik*”, PT. Pradnya Paramita, Jakarta
- Surdia, T.; Saito, S., 1999, “*Pengetahuan Bahan Teknik, Cetakan ke4*”, PT. Pradnya Paramita, Jakarta
- Surdia, Tata dan Chijiwa, Kenji., 2006, “*Teknik Pengecoran Logam Cetakan Kedua*”, PT Pradnya Paramita, Jakarta.
- Tata Surdia & Shinroku Saito. 2005. “*Pengetahuan Bahan*”. Pradnya Paramita.
- Wirjosumarto, H., Okumura, S., 1996,”*Teknologi Pengelasan Logam*”, PT. Pradnya Paramita, Jakarta.

## LAMPIRAN

### 1. Perhitungan uji kekerasan Vickers

$$\text{VHN} = \frac{1,854P}{d^2}$$

Keterangan :

VHN = *Vickers Hardnes Number* (VHN)

P = Beban penekan (kg) = 588 N (59,96 kg)

d = Diameter injakan penetrator (mm)

#### A. Raw Alumunium 5083

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$37,11 = \frac{1,854 \times 59,96}{d^2}$$

$$37,11 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{37,11}$$

$$d^2 = 2,99558 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{2,99558}$$

$$= \frac{111,16584}{2,99558}$$

$$= 37,11 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$37,38 = \frac{1,854 \times 59,96}{d^2}$$

$$37,38 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{37,38}$$

$$d^2 = 2,9739 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{2,9739}$$

$$= \frac{111,16584}{2,9739}$$

$$= 37,38 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$36,60 = \frac{1,854 \times 59,96}{d^2}$$

$$36,60 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{36,60}$$

$$d^2 = 3,0373 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,0373}$$

$$= \frac{111,16584}{3,0373}$$

$$= 36,60 \text{ HV}$$

$$\text{Rata-rata} = \frac{37,11 + 37,38 + 36,60}{3} = 37,03 \text{ HV}$$

## **B. Aluminium pengelasan variasi 80A**

### **1. Pada titik las**

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$29,03 = \frac{1,854 \times 59,96}{d^2}$$

$$29,03 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{29,03}$$

$$d^2 = 3,8293 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,8293}$$

$$= \frac{111,16584}{3,8293}$$

$$= 29,03 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$24,47 = \frac{1,854 \times 59,96}{d^2}$$

$$24,47 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{24,47} = 4,5429 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,5429}$$

$$= \frac{111,16584}{4,5429}$$

$$= 24,47 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$25,86 = \frac{1,854 \times 59,96}{d^2}$$

$$25,86 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{25,86}$$

$$d^2 = 4,2987 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,2987}$$

$$= \frac{111,16584}{4,2987}$$

$$= 25,86 \text{ HV}$$

$$\text{Rata-rata} \frac{29,03 + 24,47 + 25,86}{3} = 26,46 \text{ HV}$$

## 2. Pada titik HAZ

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$26,72 = \frac{1,854 \times 59,96}{d^2}$$

$$26,72 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{26,72}$$

$$d^2 = 4,1603 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,1603}$$

$$= \frac{111,16584}{4,1603}$$

$$= 26,72 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$25,05 = \frac{1,854 \times 59,96}{d^2}$$

$$25,05 = \frac{111,16584}{d^2}$$



$$d^2 = \frac{111,16584}{25,05}$$

$$d^2 = 4,4377 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,4377}$$

$$= \frac{111,16584}{4,4377}$$

$$= 25,05 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$26,97 = \frac{1,854 \times 59,96}{d^2}$$

$$26,97 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{26,97}$$

$$d^2 = 4,1218 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,1218}$$

$$= \frac{111,16584}{4,1218}$$

$$= 26,97 \text{ HV}$$

$$\text{Rata-rata } \frac{26,72 + 25,05 + 26,97}{3} = 26,25 \text{ HV}$$

### 3. Pada titik logam induk

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$30,63 = \frac{1,854 \times 59,96}{d^2}$$

$$30,63 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{30,63}$$

$$d^2 = 3,6293 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,6293}$$

$$= \frac{111,16584}{3,6293}$$

$$= 30,63 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$33,36 = \frac{1,854 \times 59,96}{d^2}$$

$$33,36 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{33,36}$$

$$d^2 = 3,3323 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,3323}$$

$$= \frac{111,16584}{3,3323}$$

$$= 33,36 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$30,63 = \frac{1,854 \times 59,96}{d^2}$$

$$30,63 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{30,63}$$

$$d^2 = 3,6293 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,6293}$$

$$= \frac{111,16584}{3,6293}$$

$$= 30,63 \text{ HV}$$

$$\text{Rata-rata} \frac{30,63 + 33,36 + 30,63}{3} = 31,54 \text{ HV}$$

### C. Aluminium pengelasan variasi 90A

#### 1. Pada titik las

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$24,20 = \frac{1,854 \times 59,96}{d^2}$$

$$24,20 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{24,20}$$

$$d^2 = 4,5636 \text{ mm}$$

$$\begin{aligned} \text{HV} &= \frac{1,854P}{d^2} \\ &= \frac{1,854 \times 59,96}{4,5636} \\ &= \frac{111,16584}{4,5636} \\ &= 24,20 \text{ HV} \end{aligned}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$29,21 = \frac{1,854 \times 59,96}{d^2}$$

$$29,21 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{29,21}$$

$$d^2 = 3,8057 \text{ mm}$$

$$\begin{aligned} \text{VHN} &= \frac{1,854P}{d^2} \\ &= \frac{1,854 \times 59,96}{3,8057} \\ &= \frac{111,16584}{3,8057} \end{aligned}$$

$$= 29,21 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$30,53 = \frac{1,854 \times 59,96}{d^2}$$

$$30,53 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{30,53}$$

$$d^2 = 3,6412 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,6412}$$

$$= \frac{111,16584}{3,6412}$$

$$= 30,53 \text{ HV}$$

$$\text{Rata-rata} \frac{24,20 + 29,21 + 30,53}{3} = 27,98 \text{ HV}$$

## 2. Pada titik HAZ

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$26,89 = \frac{1,854 \times 59,96}{d^2}$$

$$26,89 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{26,89}$$

$$d^2 = 4,1340 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,1340}$$

$$= \frac{111,16584}{4,1340}$$

$$= 26,89 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$26,25 = \frac{1,854 \times 59,96}{d^2}$$

$$26,25 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{26,25}$$

$$d^2 = 4,2348 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,2348}$$

$$= \frac{111,16584}{4,2348}$$

$$= 26,25 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$25,86 = \frac{1,854 \times 59,96}{d^2}$$

$$25,86 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{25,86}$$

$$d^2 = 4,2987 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,2987}$$



$$= \frac{111,16584}{4,2987}$$

$$= 25,86 \text{ HV}$$

$$\text{Rata-rata } \frac{26,89+26,25+25,86}{3} = 26,33 \text{ HV}$$

### 3. Pada titik logam induk

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$34,04 = \frac{1,854 \times 59,96}{d^2}$$

$$34,04 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{34,04}$$

$$d^2 = 3,2657 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,2657}$$

$$= \frac{111,16584}{3,2657}$$

$$= 34,04 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$31,74 = \frac{1,854 \times 59,96}{d^2}$$

$$31,74 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{31,74}$$

$$d^2 = 3,5023 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,5023}$$

$$= \frac{111,16584}{3,5023}$$

$$= 31,74 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$31,74 = \frac{1,854 \times 59,96}{d^2}$$

$$31,74 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{31,74}$$

$$d^2 = 3,5023 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,5023}$$

$$= \frac{111,16584}{3,5023}$$

$$= 31,74 \text{ HV}$$

$$\text{Rata-rata} \frac{34,04 + 31,74 + 31,74}{3} = 32,51 \text{ HV}$$

#### **D. Aluminium pengelasan variasi 100A**

##### **1. Pada titik las**

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$29,77 = \frac{1,854 \times 59,96}{d^2}$$

$$29,77 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{29,77}$$

$$d^2 = 3,7341 \text{ mm}$$

$$\begin{aligned}
 \text{HV} &= \frac{1,854P}{d^2} \\
 &= \frac{1,854 \times 59,96}{3,7341} \\
 &= \frac{111,16584}{3,7341} \\
 &= 29,77 \text{ HV}
 \end{aligned}$$

$$\begin{aligned}
 \text{Titik 2. VHN} &= \frac{1,854P}{d^2} \\
 26,02 &= \frac{1,854 \times 59,96}{d^2} \\
 26,02 &= \frac{111,16584}{d^2} \\
 d^2 &= \frac{111,16584}{26,02}
 \end{aligned}$$

$$d^2 = 4,2723 \text{ mm}$$

$$\begin{aligned}
 \text{VHN} &= \frac{1,854P}{d^2} \\
 &= \frac{1,854 \times 59,96}{4,2723} \\
 &= \frac{111,16584}{4,2723} \\
 &= 26,02 \text{ HV}
 \end{aligned}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$26,17 = \frac{1,854 \times 59,96}{d^2}$$

$$26,17 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{26,17}$$

$$d^2 = 4,2478 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,2478}$$

$$= \frac{111,16584}{4,2478}$$

$$= 26,17 \text{ HV}$$

$$\text{Rata-rata} \frac{29,77+26,02+26,17}{3} = 27,32 \text{ HV}$$

## 2. Pada titik HAZ

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$27,46 = \frac{1,854 \times 59,96}{d^2}$$

$$27,46 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{27,46}$$

$$d^2 = 4,0482 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,0482}$$

$$= \frac{111,16584}{4,0482}$$

$$= 27,46 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$25,49 = \frac{1,854 \times 59,96}{d^2}$$

$$25,49 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{25,49}$$

$$d^2 = 4,3611 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,3611}$$

$$= \frac{111,16584}{4,3611}$$

$$= 25,49 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$24,97 = \frac{1,854 \times 59,96}{d^2}$$

$$24,97 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{24,97}$$

$$d^2 = 4,4519 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,4519}$$

$$= \frac{111,16584}{4,4519}$$

$$= 24,97 \text{ HV}$$

$$\text{Rata-rata} \frac{27,46 + 25,49 + 24,97}{3} = 25,97 \text{ HV}$$

### 3. Pada titik logam induk

$$\text{Titik 1. VHN} = \frac{1,854P}{d^2}$$

$$25,41 = \frac{1,854 \times 59,96}{d^2}$$

$$25,41 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{25,41}$$

$$d^2 = 4,3748 \text{ mm}$$

$$\text{HV} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{4,3748}$$

$$= \frac{111,16584}{4,3748}$$

$$= 25,41 \text{ HV}$$

$$\text{Titik 2. VHN} = \frac{1,854P}{d^2}$$

$$29,39 = \frac{1,854 \times 59,96}{d^2}$$

$$29,39 = \frac{111,16584}{d^2}$$



$$d^2 = \frac{111,16584}{29,39}$$

$$d^2 = 3,7824 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,7824}$$

$$= \frac{111,16584}{3,7824}$$

$$= 29,39 \text{ HV}$$

$$\text{Titik 3. VHN} = \frac{1,854P}{d^2}$$

$$30,34 = \frac{1,854 \times 59,96}{d^2}$$

$$30,34 = \frac{111,16584}{d^2}$$

$$d^2 = \frac{111,16584}{30,34}$$

$$d^2 = 3,6640 \text{ mm}$$

$$\text{VHN} = \frac{1,854P}{d^2}$$

$$= \frac{1,854 \times 59,96}{3,6640}$$

$$= \frac{111,16584}{3,6640}$$

$$= 30,34 \text{ HV}$$

$$\text{Rata-rata } \frac{25,41+29,39+30,34}{3} = 28,38 \text{ HV}$$

## 2. Perhitungan Uji Tarik

Rumus tegangan tarik :

$$\sigma = \frac{F}{A_0}$$

Rumus regangan tarik :

$$\varepsilon = \frac{l_i - l_0}{l_0} \times 100$$

$$= \frac{\Delta l}{l_0} \times 100$$

Keterangan :

$\sigma$  = Tegangan tarik (N/mm<sup>2</sup>)

F = Beban (N)

$A_0$  = Luas penampang (mm<sup>2</sup>)

$\varepsilon$  = Regangan

$l_i$  = Panjang akhir (mm)

$l_0$  = Panjang awal (mm)

$\Delta l$  = Pertambahan panjang (mm)

**a) Raw Material**

1) Diketahui :

$$F = 16,13 \text{ KN} = (16130 \text{ N})$$

$$A_o = 5,00 \times 14,66 = (73,3 \text{ mm}^2)$$

$$l_i = (56,17 \text{ mm})$$

$$l_o = (50 \text{ mm})$$

$$\Delta l = (6,17 \text{ mm})$$

Ditanya :  $\sigma$  = Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon$  = Regangan

$$\sigma = \frac{F}{A_o}$$

$$= \frac{16130}{73,3}$$

$$= 220,05 \text{ N/mm}^2$$

$$\varepsilon = \frac{l_i - l_o}{l_o} \times 100$$

$$= \frac{\Delta l}{l_o} \times 100$$

$$\varepsilon = \frac{56,17 - 50}{50} \times 100$$

$$= \frac{6,17}{50} \times 100$$

$$= 12,34 \%$$

**b) Variasi arus 80A**

1) Diketahui :

$$F = 3,21 \text{ KN} = (3210 \text{ N})$$

$$A_o = 5,32 \times 13,12 = (69,7984 \text{ mm}^2)$$

$$l_i = (50,54 \text{ mm})$$

$$l_o = (50 \text{ mm})$$

$$\Delta l = (0,54 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\sigma = \frac{F}{A_o}$$

$$= \frac{3210}{69,7984}$$

$$= 45,99 \text{ N/mm}^2$$

$$\varepsilon = \frac{l_i - l_o}{l_o} \times 100$$

$$= \frac{\Delta l}{l_o} \times 100$$

$$\varepsilon = \frac{50,54 - 50}{50} \times 100$$

$$= \frac{0,54}{50} \times 100$$

$$= 1,08 \%$$

2) Diketahui :

$$F = 4,15 \text{ KN} = (4150 \text{ N})$$

$$A_0 = 5,46 \times 13,32 = (72,7272 \text{ mm}^2)$$

$$l_i = (50,84 \text{ mm})$$

$$l_0 = (50 \text{ mm})$$

$$\Delta l = (0,84 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\sigma = \frac{F}{A_0}$$

$$= \frac{4150}{72,7272}$$

$$= 57,06 \text{ N/mm}^2$$

$$\varepsilon = \frac{l_i - l_0}{l_0} \times 100$$

$$= \frac{\Delta l}{l_0} \times 100$$

$$\varepsilon = \frac{50,84 - 50}{50} \times 100$$

$$= \frac{0,84}{50} \times 100$$

$$= 1,68 \%$$

3) Diketahui :

$$F = 4,29 \text{ KN} = (4290 \text{ N})$$

$$A_0 = 6,00 \times 13,70 = (82,2 \text{ mm}^2)$$

$$l_i = (51,50 \text{ mm})$$

$$l_o = (50 \text{ mm})$$

$$\Delta l = (1,50 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\sigma = \frac{F}{A_0}$$

$$= \frac{4290}{82,2}$$

$$= 52,19 \text{ N/mm}^2$$

$$\varepsilon = \frac{l_i - l_o}{l_o} \times 100$$

$$= \frac{\Delta l}{l_o} \times 100$$

$$\varepsilon = \frac{51,50 - 50}{50} \times 100$$

$$= \frac{1,50}{50} \times 100$$

$$= 3,00 \%$$

**c) Variasi arus 90A**

1) Diketahui :

$$F = 3,74 \text{ KN} = (3740 \text{ N})$$

$$A_0 = 6,42 \times 14,52 = (93,2184 \text{ mm}^2)$$

$$l_i = (51,48 \text{ mm})$$

$$l_o = (50 \text{ mm})$$

$$\Delta l = (1,48 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\sigma = \frac{F}{A_0}$$

$$= \frac{3740}{93,2184}$$

$$= 40,12 \text{ N/mm}^2$$

$$\varepsilon = \frac{l_i - l_0}{l_0} \times 100$$

$$= \frac{\Delta l}{l_0} \times 100$$

$$\varepsilon = \frac{51,48 - 50}{50} \times 100$$

$$= \frac{1,48}{50} \times 100$$

$$= 2,96 \%$$

2) Diketahui :

$$F = 5,25 \text{ KN} = (5250 \text{ N})$$

$$A_0 = 5,92 \times 13,96 = (82,6432 \text{ mm}^2)$$

$$l_i = (51,52 \text{ mm})$$

$$l_0 = (50 \text{ mm})$$

$$\Delta l = (1,52 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\begin{aligned}\sigma &= \frac{F}{A_0} \\ &= \frac{5250}{82,6432} \\ &= 63,53 \text{ N/mm}^2\end{aligned}$$

$$\begin{aligned}\varepsilon &= \frac{l_i - l_0}{l_0} \times 100 \\ &= \frac{\Delta l}{l_0} \times 100 \\ \varepsilon &= \frac{51,52 - 50}{50} \times 100 \\ &= \frac{1,52}{50} \times 100 \\ &= 3,04 \%\end{aligned}$$

3) Diketahui :

$$F = 3,35 \text{ KN} = (3350 \text{ N})$$

$$A_0 = 5,90 \times 13,06 = (77,054 \text{ mm}^2)$$

$$l_i = (51,54 \text{ mm})$$

$$l_0 = (50 \text{ mm})$$

$$\Delta l = (1,54 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan



$$\begin{aligned}\sigma &= \frac{F}{A_0} \\ &= \frac{3350}{77,054} \\ &= 77,63 \text{ N/mm}^2\end{aligned}$$

$$\begin{aligned}\varepsilon &= \frac{l_i - l_0}{l_0} \times 100 \\ &= \frac{\Delta l}{l_0} \times 100 \\ \varepsilon &= \frac{51,54 - 50}{50} \times 100 \\ &= \frac{1,54}{50} \times 100 \\ &= 3,08 \%\end{aligned}$$

**d) Variasi arus 100A**

1) Diketahui :

$$F = 6,80 \text{ KN} = (6800 \text{ N})$$

$$A_0 = 6,86 \times 13,98 = (95,9028 \text{ mm}^2)$$

$$l_i = (51,40 \text{ mm})$$

$$l_0 = (50 \text{ mm})$$

$$\Delta l = (1,40 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\begin{aligned}\sigma &= \frac{F}{A_0} \\ &= \frac{6800}{95,9028} \\ &= 70,91 \text{ N/mm}^2\end{aligned}$$

$$\begin{aligned}\varepsilon &= \frac{l_i - l_0}{l_0} \times 100 \\ &= \frac{\Delta l}{l_0} \times 100 \\ \varepsilon &= \frac{51,40 - 50}{50} \times 100 \\ &= \frac{1,40}{50} \times 100 \\ &= 2,80 \%\end{aligned}$$

2) Diketahui :

$$F = 4,26 \text{ KN} = (4260 \text{ N})$$

$$A_0 = 6,40 \times 14,32 = (91,648 \text{ mm}^2)$$

$$l_i = (51,42 \text{ mm})$$

$$l_0 = (50 \text{ mm})$$

$$\Delta l = (1,42 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\begin{aligned}\sigma &= \frac{F}{A_0} \\ &= \frac{4260}{91,648} \\ &= 46,48 \text{ N/mm}^2\end{aligned}$$

$$\begin{aligned}\varepsilon &= \frac{l_i - l_0}{l_0} \times 100 \\ &= \frac{\Delta l}{l_0} \times 100 \\ \varepsilon &= \frac{51,42 - 50}{50} \times 100 \\ &= \frac{1,42}{50} \times 100 \\ &= 2,84 \%\end{aligned}$$

3) Diketahui :

$$F = 3,81 \text{ KN} = (3810 \text{ N})$$

$$A_0 = 6,16 \times 12,66 = (77,9856 \text{ mm}^2)$$

$$l_i = (51,72 \text{ mm})$$

$$l_0 = (50 \text{ mm})$$

$$\Delta l = (1,72 \text{ mm})$$

Ditanya :  $\sigma =$  Tegangan Tarik ( $\text{N/mm}^2$ )

$\varepsilon =$  Regangan

$$\sigma = \frac{F}{A_0}$$

$$= \frac{3810}{77,9856}$$

$$= 48,86 \text{ N/mm}^2$$

$$\varepsilon = \frac{l_i - l_0}{l_0} \times 100$$

$$= \frac{\Delta l}{l_0} \times 100$$

$$\varepsilon = \frac{51,72 - 50}{50} \times 100$$

$$= \frac{1,72}{50} \times 100$$

$$= 3,44 \%$$

### 3. Perhitungan uji *impact charpy*

$$HI = \frac{E}{A}$$

$$E = G \times R (\cos \beta - \cos \alpha)$$

Keterangan :

E = Energi yang diserap untuk mematahkan *specimen* (J)

G = Berat *hammer* (N)

R = Panjang pendulum (m)

HI = Harga *impact* per satuan luas ( $\text{J/mm}^2$ )

A = Luas penampang *specimen* ( $\text{mm}^2$ )

$\alpha$  = Besarnya sudut awal jatuh pendulum ( $^\circ$ )

$\beta$  = Besar sudut pantul pendulum setelah menabrak *specimen* ( $^\circ$ )

**a) Raw Material**

**1) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (130^\circ)$$

Ditanya : Nilai *impact*  $\text{J/mm}^2$

$$E = KV = G.R (\cos \beta - \cos \alpha)$$

$$= 390,63 \times 0,72 (\cos (130) - \cos (140))$$

$$= 281,25 \times 0,12325$$

$$= 34,67 \text{ J}$$

$$\text{Nilai } *impact* \text{ I} = \frac{E}{A}$$

$$= \frac{34,67}{40,15}$$

$$= 0,863 \text{ J/mm}^2$$

Jadi nilai *impact* adalah  $0,863 \text{ J/mm}^2$

**2) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (131^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned} E &= KV = G.R (\cos \beta - \cos \alpha) \\ &= 390,63 \times 0,72 (\cos (131) - \cos (140)) \\ &= 281,25 \times 0,10998 \\ &= 30,93 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Nilai } \textit{impact} \text{ I} &= \frac{E}{A} \\ &= \frac{30,93}{40,10} \\ &= 0,771 \text{ J/mm}^2 \end{aligned}$$

Jadi nilai *impact* adalah 0,771 J/mm<sup>2</sup>

### 3) Energi *impact*

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (130^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned} E &= KV = G.R (\cos \beta - \cos \alpha) \\ &= 390,63 \times 0,72 (\cos (130) - \cos (140)) \\ &= 281,25 \times 0,12325 \\ &= 34,67 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Nilai } \textit{impact} \text{ I} &= \frac{E}{A} \\ &= \frac{34,67}{40,15} \end{aligned}$$

$$= 0,863 \text{ J/mm}^2$$

Jadi nilai *impact* adalah 0,863 J/mm<sup>2</sup>

**b) Variasi arus 80A**

**1) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (139^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$E = KV = G.R (\cos \beta - \cos \alpha)$$

$$= 390,63 \times 0,72 (\cos (139) - \cos (140))$$

$$= 281,25 \times 0,01133$$

$$= 3,19 \text{ J}$$

$$\text{Nilai } \textit{impact} \text{ I} = \frac{E}{A}$$

$$= \frac{3,19}{39,85}$$

$$= 0,080 \text{ J/mm}^2$$

Jadi nilai *impact* adalah 0,080 J/mm<sup>2</sup>

**2) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (138^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned} E &= KV = G.R (\cos \beta - \cos \alpha) \\ &= 390,63 \times 0,72 (\cos (138) - \cos (140)) \\ &= 281,25 \times 0,02289 \\ &= 6,44 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Nilai } \textit{impact} \text{ I} &= \frac{E}{A} \\ &= \frac{6,44}{40,10} \\ &= 0,160 \text{ J/mm}^2 \end{aligned}$$

Jadi nilai *impact* adalah 0,160 J/mm<sup>2</sup>

### 3) Energi *impact*

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (137^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned} E &= KV = G.R (\cos \beta - \cos \alpha) \\ &= 390,63 \times 0,72 (\cos (137) - \cos (140)) \\ &= 281,25 \times 0,0346 \\ &= 9,76 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Nilai } \textit{impact} \text{ I} &= \frac{E}{A} \\ &= \frac{9,76}{40,15} \end{aligned}$$



$$= 0,243 \text{ J/mm}^2$$

Jadi nilai *impact* adalah 0,243 J/mm<sup>2</sup>

**c) Variasi arus 90A**

**1) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (138^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$E = KV = G.R (\cos \beta - \cos \alpha)$$

$$= 390,63 \times 0,72 (\cos (138) - \cos (140))$$

$$= 281,25 \times 0,02289$$

$$= 6,44 \text{ J}$$

$$\text{Nilai } \textit{impact} \text{ I} = \frac{E}{A}$$

$$= \frac{6,44}{40,10}$$

$$= 0,160 \text{ J/mm}^2$$

Jadi nilai *impact* adalah 0,160 J/mm<sup>2</sup>

**2) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (138^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned} E &= KV = G.R (\cos \beta - \cos \alpha) \\ &= 390,63 \times 0,72 (\cos (138) - \cos (140)) \\ &= 281,25 \times 0,02289 \\ &= 6,44 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Nilai } \textit{impact} \text{ I} &= \frac{E}{A} \\ &= \frac{6,44}{40,10} \\ &= 0,160 \text{ J/mm}^2 \end{aligned}$$

Jadi nilai *impact* adalah 0,160 J/mm<sup>2</sup>

### 3) Energi *impact*

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (139^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned} E &= KV = G.R (\cos \beta - \cos \alpha) \\ &= 390,63 \times 0,72 (\cos (139) - \cos (140)) \\ &= 281,25 \times 0,01133 \\ &= 3,19 \text{ J} \end{aligned}$$

$$\begin{aligned} \text{Nilai } \textit{impact} \text{ I} &= \frac{E}{A} \\ &= \frac{3,19}{40,15} \end{aligned}$$

$$= 0,079 \text{ J/mm}^2$$

Jadi nilai *impact* adalah 0,079 J/mm<sup>2</sup>

**d) Variasi arus 100A**

**1) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (138^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$E = KV = G.R (\cos \beta - \cos \alpha)$$

$$= 390,63 \times 0,72 (\cos (138) - \cos (140))$$

$$= 281,25 \times 0,02289$$

$$= 6,44 \text{ J}$$

$$\text{Nilai } impact \text{ I} = \frac{E}{A}$$

$$= \frac{6,44}{40,15}$$

$$= 0,160 \text{ J/mm}^2$$

Jadi nilai *impact* adalah 0,160 J/mm<sup>2</sup>

**2) Energi *impact***

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (138^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned}
E &= KV = G.R (\cos \beta - \cos \alpha) \\
&= 390,63 \times 0,72 (\cos (138) - \cos (140)) \\
&= 281,25 \times 0,02289 \\
&= 6,44 \text{ J}
\end{aligned}$$

$$\begin{aligned}
\text{Nilai } impact \text{ I} &= \frac{E}{A} \\
&= \frac{6,44}{49,90} \\
&= 0,160 \text{ J/mm}^2
\end{aligned}$$

Jadi nilai *impact* adalah 0,160 J/mm<sup>2</sup>

### 3) Energi *impact*

$$G = 390,63 \text{ N}$$

$$R = (0,72 \text{ m})$$

$$\alpha = (140^\circ)$$

$$\beta = (139^\circ)$$

Ditanya : Nilai *impact* J/mm<sup>2</sup>

$$\begin{aligned}
E &= KV = G.R (\cos \beta - \cos \alpha) \\
&= 390,63 \times 0,72 (\cos (139) - \cos (140)) \\
&= 281,25 \times 0,01133 \\
&= 3,19 \text{ J}
\end{aligned}$$

$$\begin{aligned}
\text{Nilai } impact \text{ I} &= \frac{E}{A} \\
&= \frac{3,19}{40,10} \\
&= 0,079 \text{ J/mm}^2
\end{aligned}$$

Jadi nilai *impact* adalah 0,079 J/mm<sup>2</sup>

## 1. Dokumentasi penelitian



Gambar 1. Proses pengelasan



Gambar 2. Spesimen setelah di las



Gambar 3. Spesimen siap uji



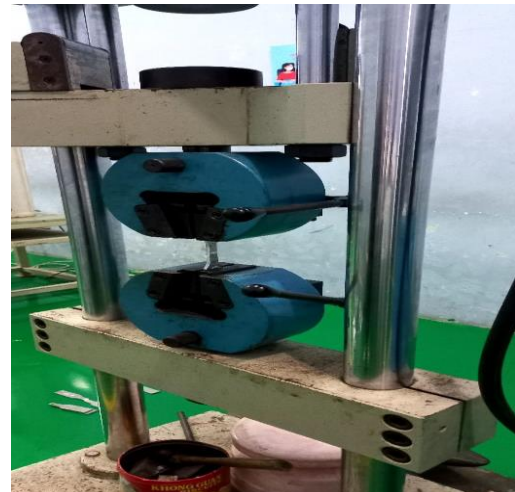
Gambar 4 proses pengujian *Vickers*



Gambar 5 proses pengujian *impact*



Gambar 6. Spesimen uji tarik



Gambar 7 proses pengujian tarik



Gambar 8. Spesimen uji *impact* setelah dilakukan pengujian



Gambar 9. Spesimen uji tarik setelah dilakukan pengujian









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**LAPORAN UJI KEKERASAN**

Laporan No. : 02/2023.28/H/07 Benda Uji : Sesuai JIS Z 2244 : 2003  
Pemakai Jasa : MUHAMMAD RIZQUL Objek uji : Aluminium Pengelasan Variasi  
AKBAR 80 A  
Alamat : Universitas Pancasakti Kota Metode Uji : JIS Z 2244 : 2003  
Tegal  
Suhu : 26 °C Mesin Uji : Affri 206 RT  
Tgl. Terima : 13 Februari 2023 Jml. Specimen : 1 Pc  
Tgl. Pengujian : 13 Februari 2023 Halaman : 1 dari 1

**HASIL UJI :**

No.	Kode Sampel uji	Parameter uji	Hasil uji		Satuan	Keterangan
			Daerah Uji	Nilai Kekerasan		
1.	07.2 <sup>1)</sup>	Kekerasan Vickers	Titik 1	29,03	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - Las
			Titik 2	24,47		
			Titik 3	25,86		
			Rata-rata	26,46		
2.	07.3 <sup>2)</sup>	Kekerasan Vickers	Titik 1	26,72	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - HAZ
			Titik 2	25,05		
			Titik 3	26,97		
			Rata-rata	26,25		
3.	07.4 <sup>3)</sup>	Kekerasan Vickers	Titik 1	30,63	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - Logam Induk
			Titik 2	33,36		
			Titik 3	30,63		
			Rata-rata	31,54		

**Keterangan :**

1)  $U_{95} = 26,46 \pm 2,92$

2)  $U_{95} = 26,25 \pm 1,65$

3)  $U_{95} = 31,54 \pm 2,14$

$U_{95}$  / Ketidakpastian pengukuran tersebut diukur pada tingkat kepercayaan 95% dengan faktor cakupan (k) = 2

Tegal, 14 Februari 2023  
Manajer Teknis  
  
EKO SUPRIYANTO, S.T.  
NIP. 19741231 200604 1 093

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Email : labperintgl@gmail.com website : lab.disperinnaker.tegalkab.go.id

**LAPORAN UJI KEKERASAN**

Laporan No. : 02/2023.28/H/07 Benda Uji : Sesuai JIS Z 2244 : 2003  
Pemakai Jasa : MUHAMMAD RIZQUL Objek uji : Aluminium Pengelasan Variasi  
AKBAR 90 A  
Alamat : Universitas Pancasakti Kota Metode Uji : JIS Z 2244 : 2003  
Tegal  
Suhu : 26 °C Mesin Uji : Affri 206 RT  
Tgl. Terima : 13 Februari 2023 Jml. Specimen : 1 Pc  
Tgl. Pengujian : 13 Februari 2023 Halaman : 1 dari 1

**HASIL UJI :**

No.	Kode Sampel uji	Parameter uji	Hasil uji		Satuan	Keterangan
			Daerah Uji	Nilai Kekerasan		
1.	07.5 <sup>1)</sup>	Kekerasan Vickers	Titik 1	24,20	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - Las
			Titik 2	29,21		
			Titik 3	30,53		
			Rata-rata	27,98		
2.	07.6 <sup>2)</sup>	Kekerasan Vickers	Titik 1	26,89	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - HAZ
			Titik 2	26,25		
			Titik 3	25,86		
			Rata-rata	26,33		
3.	07.7 <sup>3)</sup>	Kekerasan Vickers	Titik 1	34,04	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - Logam Induk
			Titik 2	31,74		
			Titik 3	31,74		
			Rata-rata	32,51		

**Keterangan :**

1)  $U_{95} = 27,98 \pm 4,02$

2)  $U_{95} = 26,33 \pm 1,28$

3)  $U_{95} = 32,51 \pm 1,91$

$U_{95}$  / Ketidakpastian pengukuran tersebut diukur pada tingkat kepercayaan 95% dengan faktor cakupan (k) = 2

Tegal, 14 Februari 2023

Manajer Teknis



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Email : labperintgl@gmail.com website : lab.disperinnaker.tegalkab.go.id

LAPORAN UJI KEKERASAN

Laporan No. : 02/2023.28/H/07 Benda Uji : Sesuai JIS Z 2244 : 2003  
Pemakai Jasa : MUHAMMAD RIZQUL Objek uji : Aluminium Pengelasan Variasi  
AKBAR 100 A  
Alamat : Universitas Pancasakti Kota Tegal Metode Uji : JIS Z 2244 : 2003  
Suhu : 26 °C Mesin Uji : Affri 206 RT  
Tgl. Terima : 13 Februari 2023 Jml. Specimen : 1 Pc  
Tgl. Pengujian : 13 Februari 2023 Halaman : 1 dari 1

HASIL UJI :

No.	Kode Sampel uji	Parameter uji	Hasil uji		Satuan	Keterangan
			Daerah Uji	Nilai Kekerasan		
1.	07.8 <sup>1)</sup>	Kekerasan Vickers	Titik 1	29,77	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - Las
			Titik 2	26,02		
			Titik 3	26,17		
			Rata-rata	27,32		
2.	07.9 <sup>2)</sup>	Kekerasan Vickers	Titik 1	27,46	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - HAZ
			Titik 2	25,49		
			Titik 3	24,97		
			Rata-rata	25,97		
3.	07.10 <sup>3)</sup>	Kekerasan Vickers	Titik 1	25,41	HV	- Beban penekanan F = 588 N - Waktu penekanan 15 detik - Indentor intan berbentuk piramida dengan sudut 136° - Logam Induk
			Titik 2	29,39		
			Titik 3	30,34		
			Rata-rata	28,38		

Keterangan :

1)  $U_{95} = 27,32 \pm 2,70$

2)  $U_{95} = 25,97 \pm 1,89$

3)  $U_{95} = 28,38 \pm 3,23$

$U_{95}$  / Ketidakpastian pengukuran tersebut diukur pada tingkat kepercayaan 95% dengan faktor cakupan (k) = 2

Tegal, 14 Februari 2023  
Manajer Teknis  
  
EKO SUPRIYANTO, ST.  
NIP. 19741231 200604 1 093

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**LABORATORIUM BAHAN TEKNIK**  
**DEPARTEMEN TEKNIK MESIN SEKOLAH VOKASI**  
**UNIVERSITAS GADJAH MADA**

**HASIL PENGUJIAN TARIK**

No.	Variasi Spesimen	Tebal (mm)	Lebar (mm)	Pmax (KN)	$\Delta L$ (mm)	Tegangan (MPa)	Regangan (%)
1	RAW	5.00	14.66	16.13	6.17	220.05	12.34
2	80A_1	5.32	13.12	3.21	0.54	45.99	1.08
3	80A_2	5.46	13.32	4.15	0.84	57.06	1.68
4	80A_3	6.00	13.70	4.29	1.50	52.19	3.00
5	90A_1	6.42	14.52	3.74	1.48	40.12	2.96
6	90A_2	5.92	13.96	5.25	1.52	63.53	3.04
7	90A_3	5.90	13.06	3.35	1.54	43.48	3.08
8	100A_1	6.86	13.98	6.80	1.40	70.91	2.80
9	100A_2	6.40	14.32	4.26	1.42	46.48	2.84
10	100A_3	6.16	12.66	3.81	1.72	48.86	3.44

*Keterangan:*

1. Pengujian dilakukan tanggal 1 April 2023
2. Pengujian menggunakan Universal Testing Machine
3. Standar spesimen menggunakan ASTM D638

*Identitas Penguji :*

Nama : Muhammad Rizqul Akbar  
NPM : 6418500055  
Institusi : Teknik Mesin Universitas Pancasakti Tegal

Yogyakarta, 1 April 2023

Staf Laboratorium Bahan Teknik



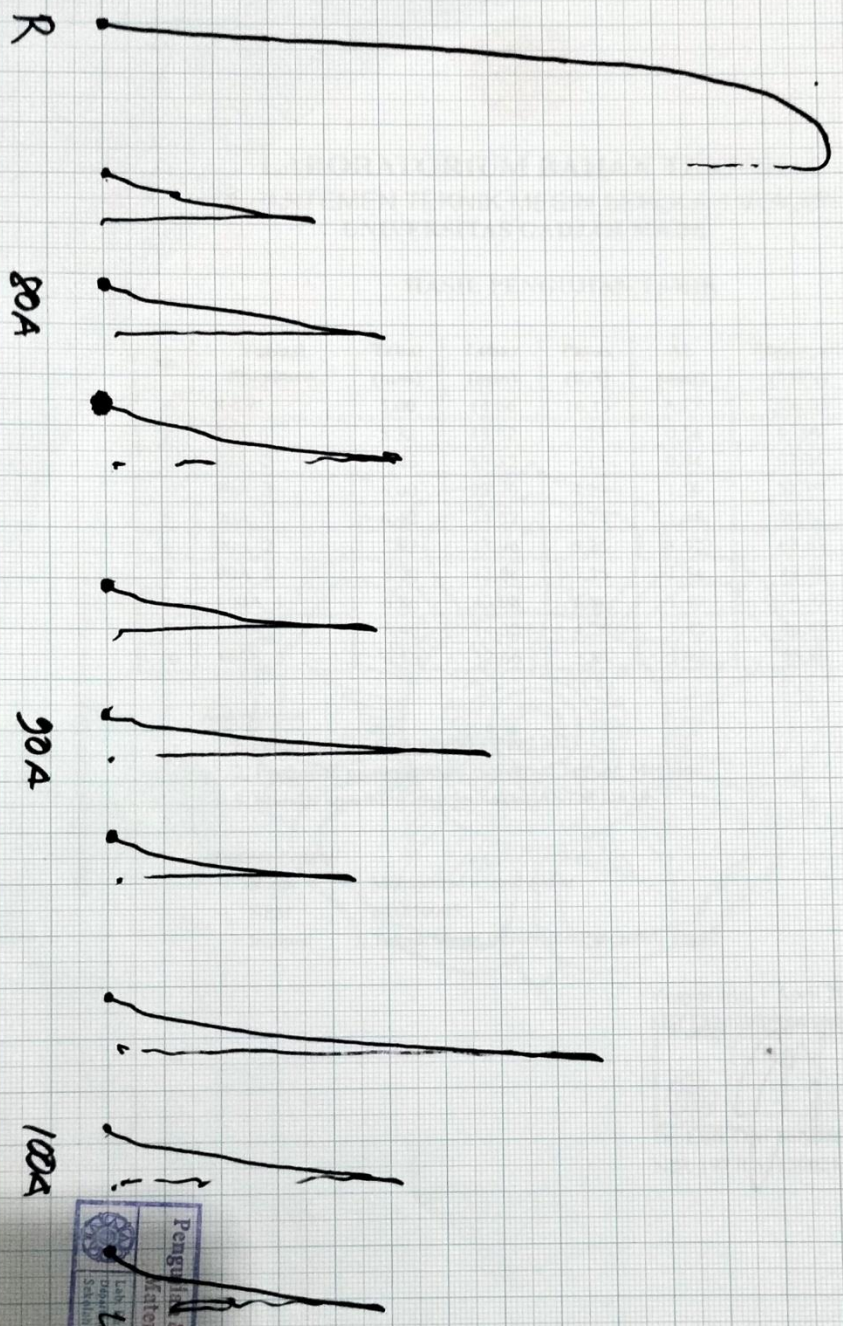
Dr. Lilik Dwi Setyana, S.T., M.T

NIP. 197703312002121002

Lembar asli, tidak untuk digandakan



Titik  
M. Rizguli. A.









DINAS PERINDUSTRIAN, TRANSMIGRASI DAN TENAGA KERJA  
KABUPATEN TEGAL

**UPTD LABORATORIUM PERINDUSTRIAN**

Komplek LIK Takaru Jl. Raya Dampyak KM 4 Tegal Telp/Fax : (0283) 357437  
Email : labperintgl@gmail.com website : lab.disperinnaker.tegalkab.go.id



**KAN**  
Komite Akreditasi Nasional  
LABORATORIUM

**LAPORAN UJI IMPACT CHARPY**

Laporan No. : 02/2023.28/I/05 Benda Uji : Sesuai Standar JIS Z 2242 : 2018  
Pemakai Jasa : MUHAMMAD RIZQUL Objek uji : Aluminium Pengelasan Variasi 80 A  
AKBAR  
Alamat : Universitas Pancasakti Kota Metode Uji : JIS Z 2242 : 2018  
Tegal  
Suhu : 25 °C Mesin Uji : Hung Ta, HT-8041  
Tgl. Terima : 13 Februari 2023 Jml. Specimen : 3 Pcs  
Tgl. Pengujian : 13 Februari 2023 Halaman : 1 dari 1

**HASIL UJI :**

No.	Kode Sampel	Energi Impact <sup>1)</sup> (Joule)	$\alpha$ (derajat)	$\beta$ (derajat)	Keterangan
1.	05.4	3,19	140	139	-
2.	05.5	6,44	140	138	
3.	05.6	9,76	140	137	

<sup>1)</sup> Energi Impact =  $GR (\cos \beta - \cos \alpha)$

G : Berat Pendulum (390,63 N)

R : Panjang Pendulum (0,72 m)

$\alpha$  : Sudut Awal Sebelum Pengujian

$\beta$  : Sudut Akhir Setelah Peengujian

$U_{95} = 6,46 \pm 4,74$

Ketidakpastian pengukuran tersebut diukur pada tingkat kepercayaan 95% dengan faktor cakupan (k) = 2

Tegal, 14 Februari 2023  
Manajer Teknis  
  
**EKO SUPRIYANTO, S.T.**  
NIP. 197412312006041093

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