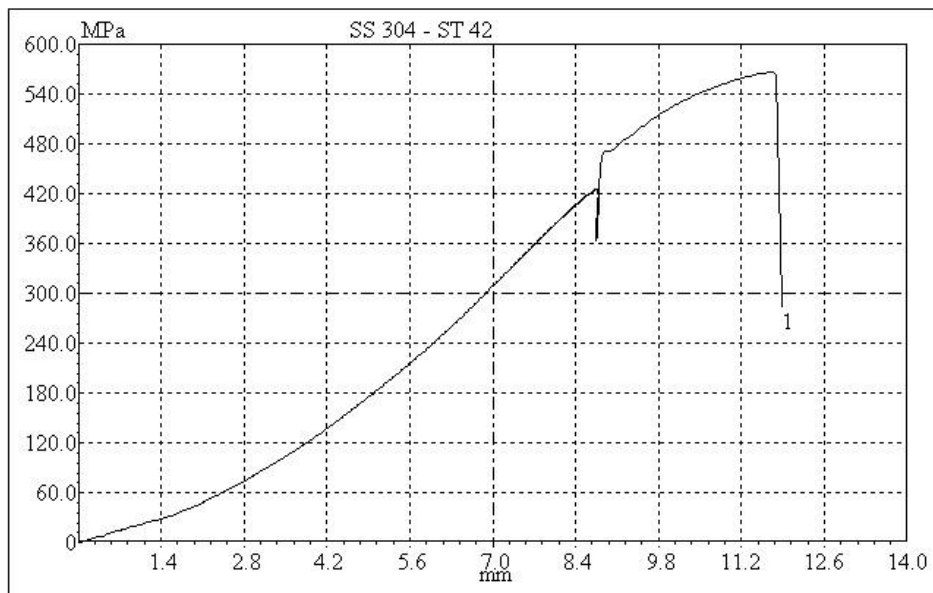


# LAMPIRAN

## LABORATORIUM JURUSAN TEKNIK MESIN UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
1.3  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	109.359	399.480	566.235	282.897



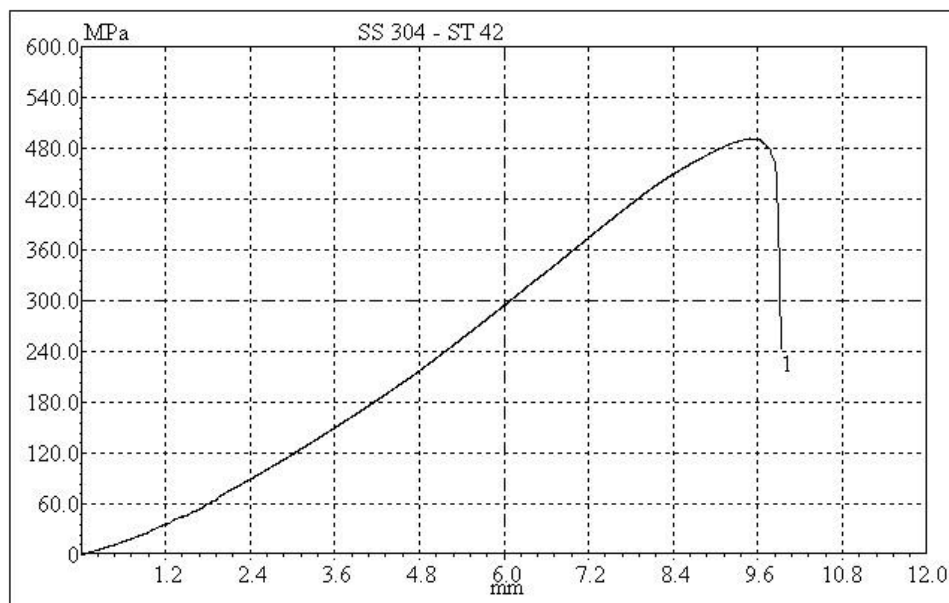
Yogyakarta, 08 Juni 2018  
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
2.3  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	107.513	491.727	491.839	242.958



Yogyakarta, 08 Juni 2018

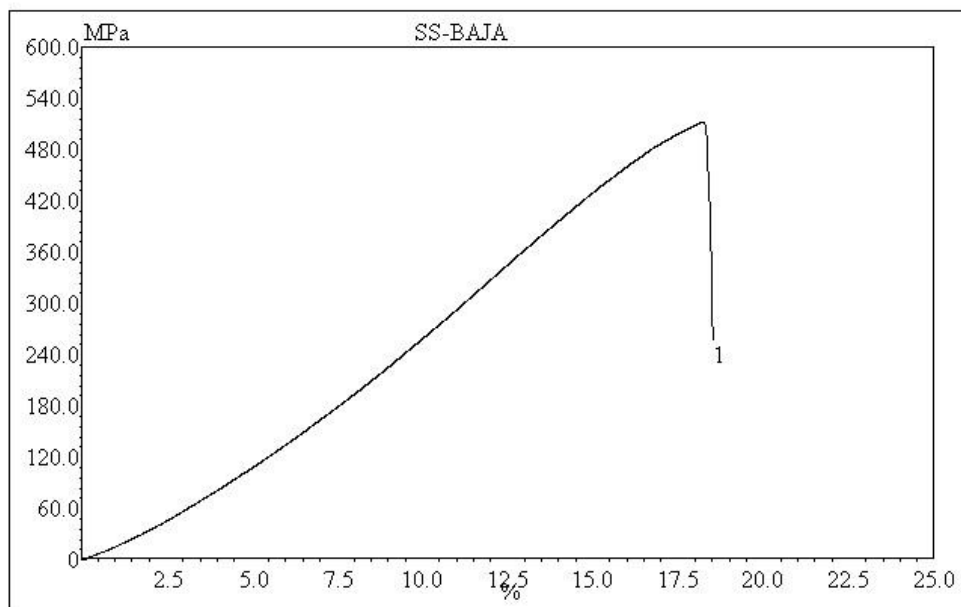
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

SS-BAJA  
3 DETIK

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	103.869	512.319	512.372	256.132



Yogyakarta, 31 Mei 2018

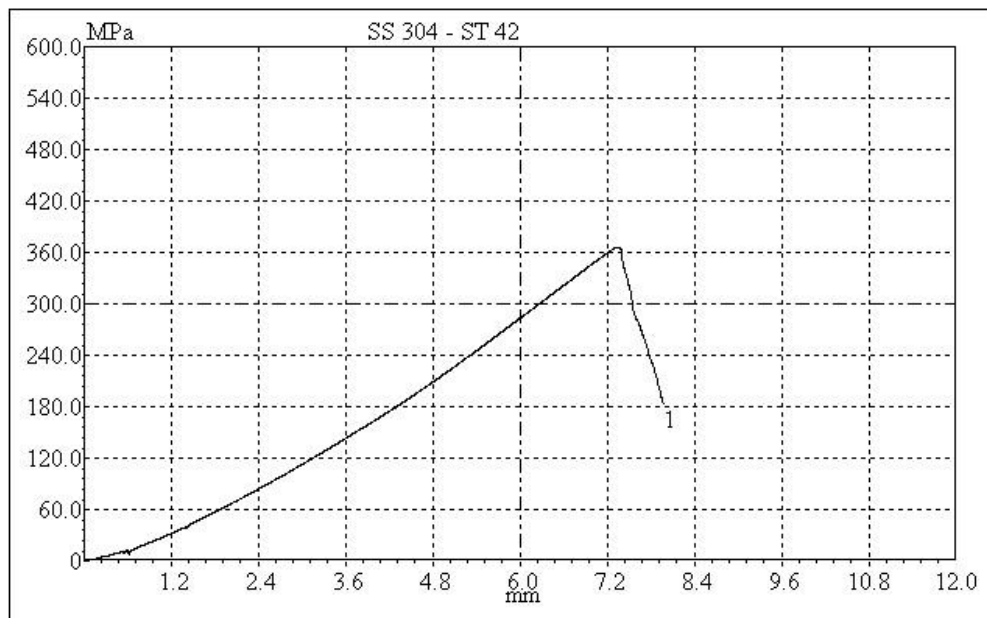
Material Teknik

WAHYU JATMIKO

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
1.6  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	107.513	366.222	366.242	183.090



Yogyakarta, 08 Juni 2018

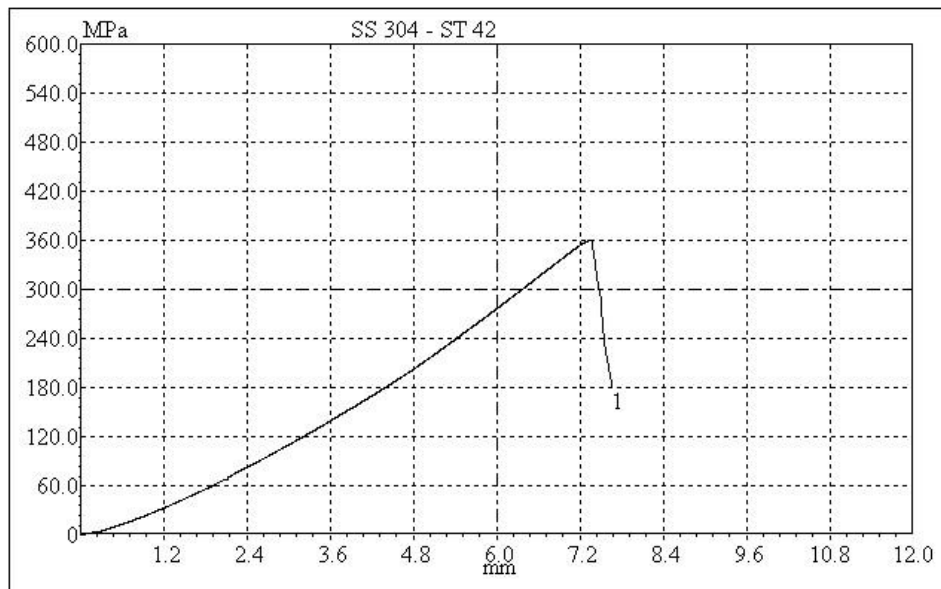
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
2.6  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01-	105.683	360.152	360.176	180.009



Yogyakarta, 08 Juni 2018

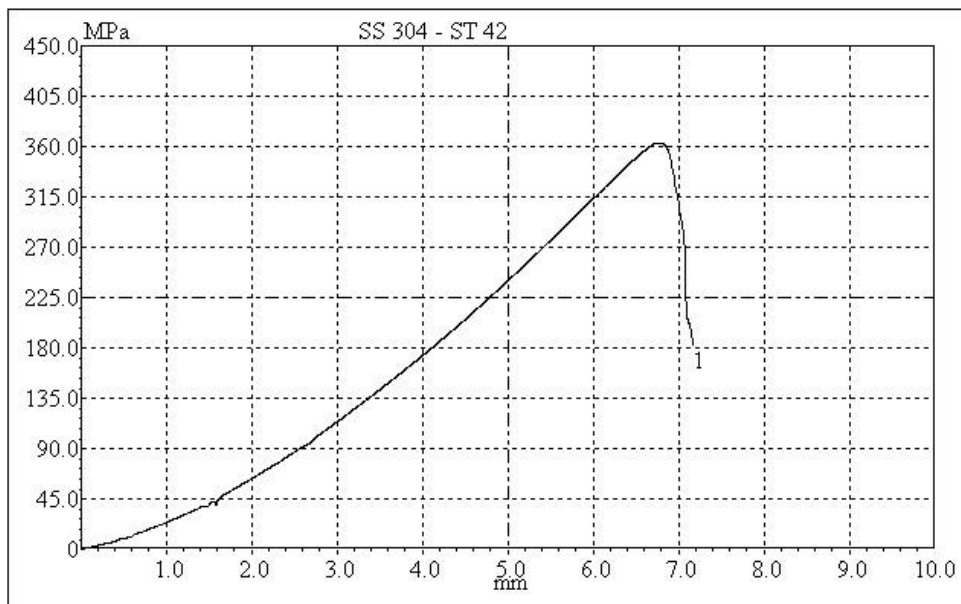
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
3.6  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	100.287	363.324	363.432	181.642



Yogyakarta, 08 Juni 2018

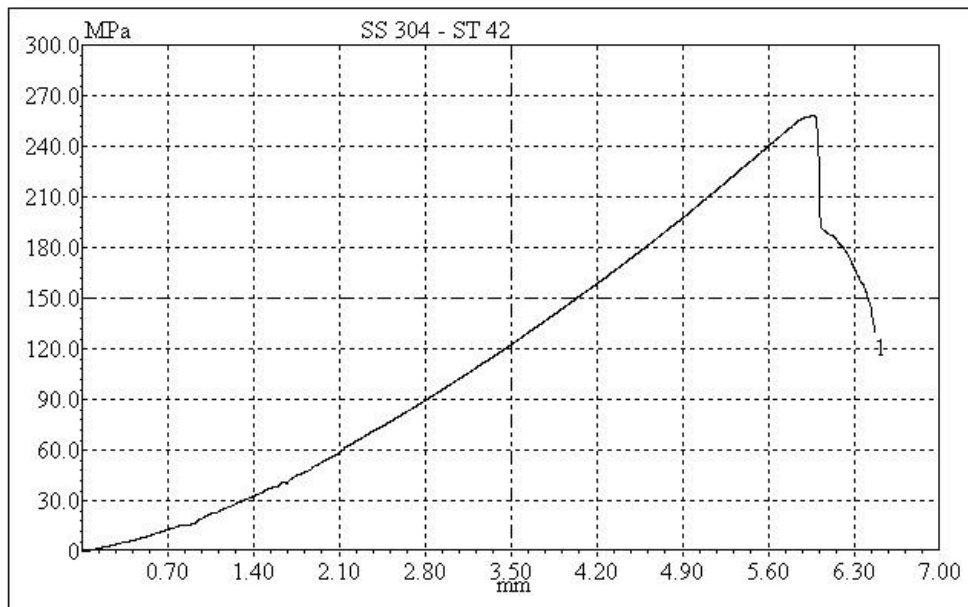
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
1.9  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01-	107.513	258.332	258.438	129.057



Yogyakarta, 08 Juni 2018

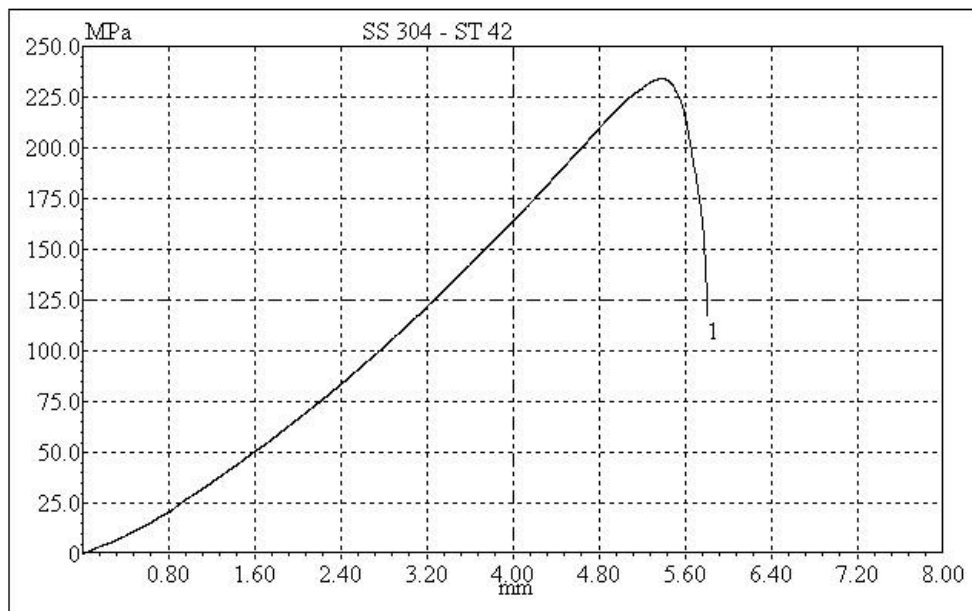
Kepala Laboratorium  
Material Teknik

Sударisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
2.9  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01-	103.869	234.201	234.253	117.099



Yogyakarta, 08 Juni 2018

Kepala Laboratorium  
Material Teknik

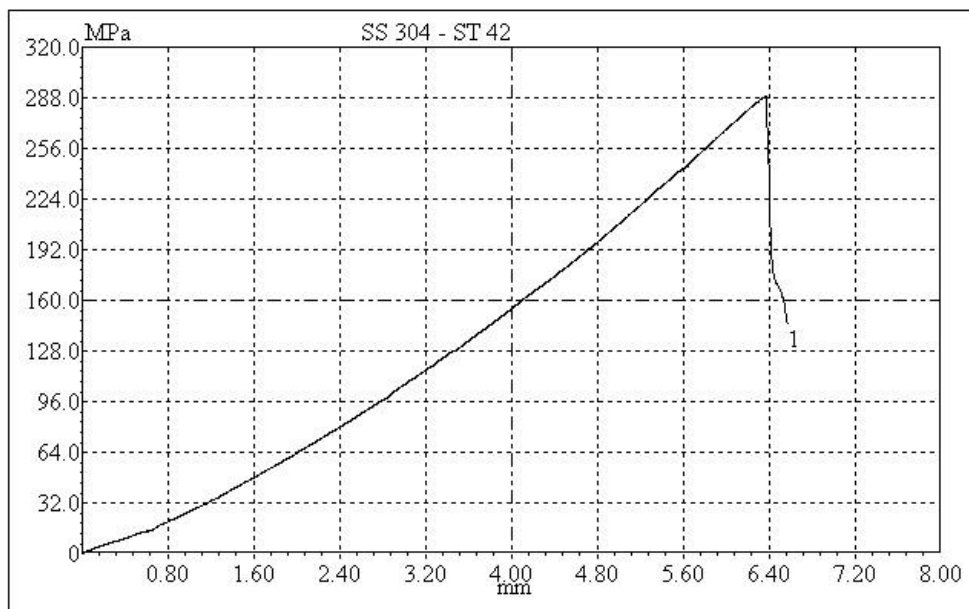
Sudarisman Ph.D



LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
3.9  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01-	103.869	244.944	289.394	144.673



Yogyakarta, 08 Juni 2018

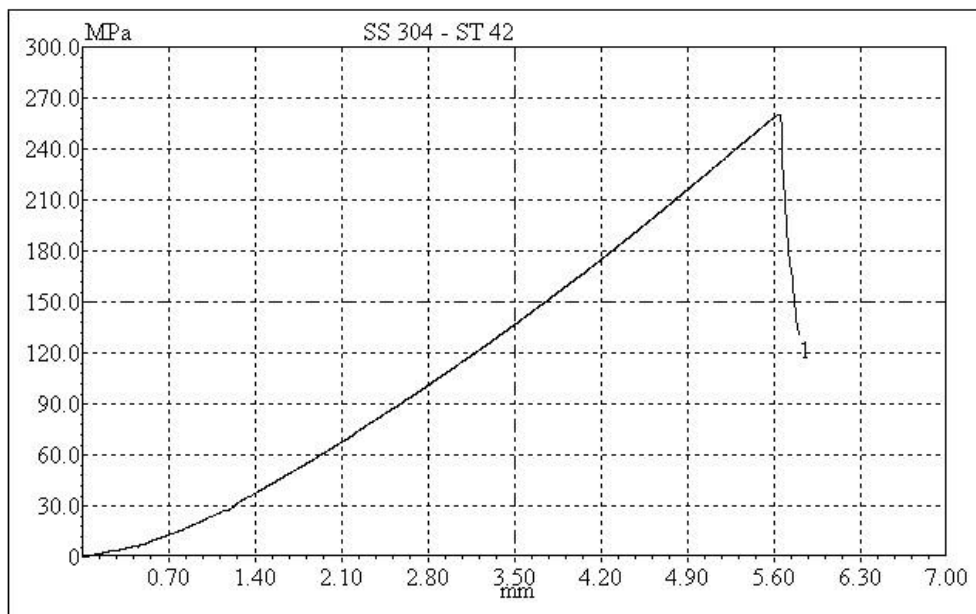
Kepala Laboratorium  
Material Teknik

Sударisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
1.12  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	103.869	260.353	260.408	130.155



Yogyakarta, 08 Juni 2018

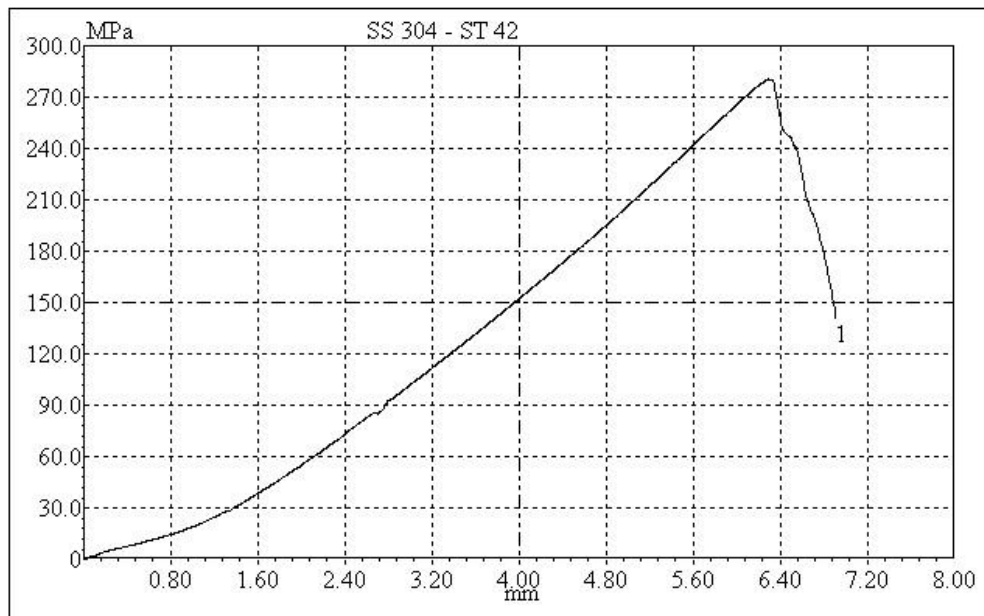
Kepala Laboratorium  
Material Teknik

Sударisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
2.12  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	105.683	280.622	280.764	140.319



Yogyakarta, 08 Juni 2018

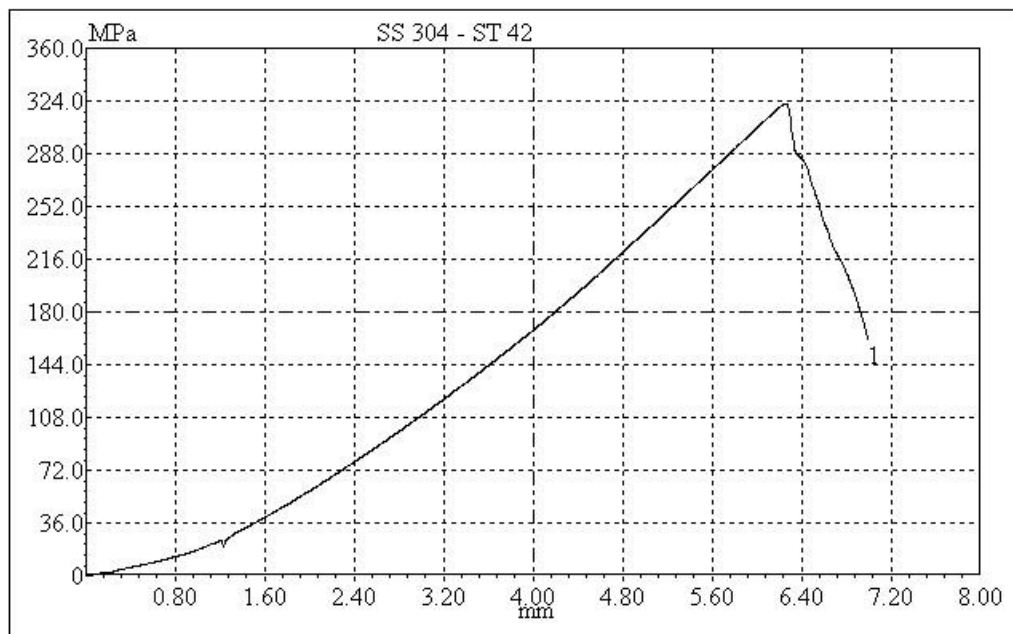
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
3.12  
SS 304 - ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	103.869	322.182	322.270	161.060



Yogyakarta, 08 Juni 2018

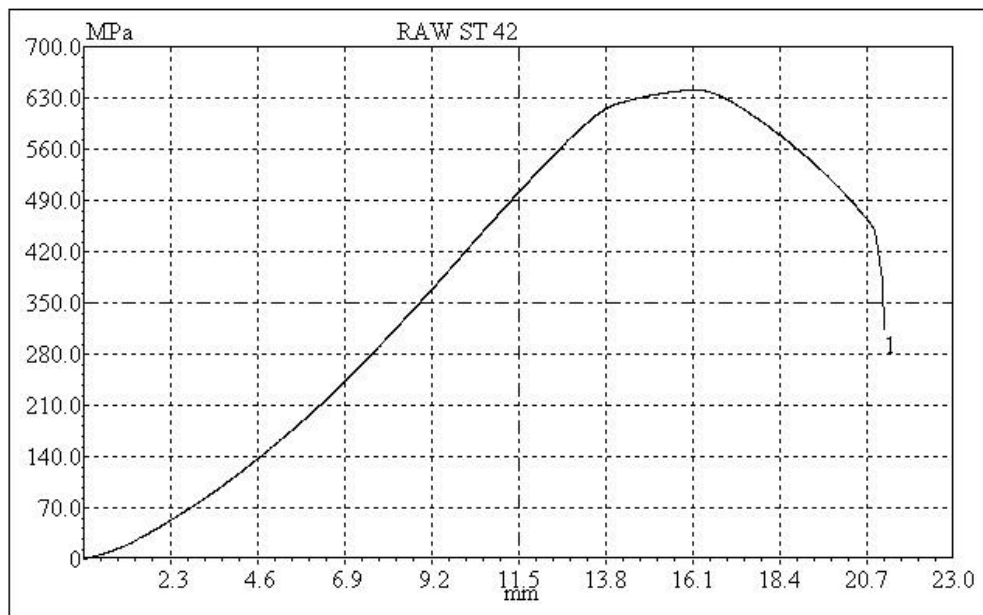
Kepala Laboratorium  
Material Teknik

Sudarisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
RAW ST 42

Test date	Area mm <sup>2</sup>	Yield point MPa	Max. Load MPa	Break MPa
2007-01	122.718	628.126	641.113	311.796



Yogyakarta, 08 Juni 2018

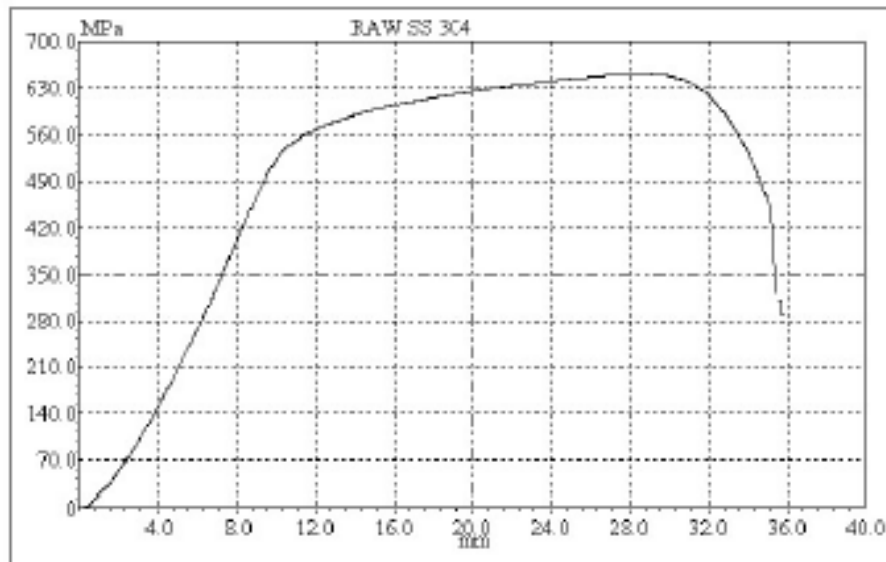
Kepala Laboratorium  
Material Teknik

Sударisman Ph.D

LABORATORIUM JURUSAN TEKNIK MESIN  
UNIVERSITAS MUHAMMADIYAH YOGYAKARTA

Friction Welding  
RAW SS 304

Test date	Area mm <sup>2</sup>	Yield point MPa	Max Load MPa	Break MPa
2007-07	122.718	601.729	650.864	321.088



Yogyakarta, 10 Juli 2018  
Kepala Laboratorium  
Material Teknik

Sudrisman Ph.D



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

**HASIL PENGUJIAN KEKERASAN**

No. 114 / P.Kkr / BT.DTM / 2018

**Spesimen Friction Welding Baja - Stainless Steel, Variasi Waktu.**

No	Kode	Jarak dr sambungan	d <sub>1</sub> (μm)	d <sub>2</sub> (μm)	d <sub>rata-rata</sub> (μm)	Kekerasan (VHN)	
1	3 dtk	Stainless Steel	12.0 mm	40.0	40.0	40.00	231.8
			8.0 mm	40.0	40.0	40.00	231.8
			3.5 mm	40.0	40.0	40.00	231.8
			1.5 mm	47.0	48.0	47.50	164.4
			0.5 mm	47.0	48.0	47.50	164.4
		Baja	0.0 mm	46.0	48.0	47.00	167.9
			0.5 mm	45.0	46.0	45.50	179.1
			1.5 mm	46.0	47.0	46.50	171.5
			3.5 mm	41.0	40.0	40.50	226.1
			8.0 mm	40.0	40.0	40.00	231.8
			12.0 mm	40.0	40.0	40.00	231.8

No	Kode	Jarak dr sambungan	d <sub>1</sub> (μm)	d <sub>2</sub> (μm)	d <sub>rata-rata</sub> (μm)	Kekerasan (VHN)	
2	6 dtk	Stainless Steel	12.0 mm	40.0	40.0	40.00	231.8
			8.0 mm	40.0	40.0	40.00	231.8
			3.5 mm	40.0	40.0	40.00	231.8
			1.5 mm	40.0	40.0	40.00	231.8
			0.5 mm	42.0	41.0	41.50	215.3
		Baja	0.0 mm	45.0	43.0	44.00	191.6
			0.5 mm	47.0	46.0	46.50	171.5
			1.5 mm	46.5	46.0	46.25	173.4
			3.5 mm	43.0	43.0	43.00	200.6
			8.0 mm	40.0	40.0	40.00	231.8
			12.0 mm	39.0	40.0	39.50	237.7

**Keterangan :**

1. Menggunakan metode uji Vikers dengan pembebanan 200 gf, 5 detik
2. Satuan pengukuran diagonal jejak indentor dalam μm
3. Pengujian dilakukan pada tanggal 09 Juli 2018

Lembar 1 dari 2



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

**HASIL PENGUJIAN KEKERASAN**

No. 114 / P.Kkr / BT.DTM / 2018

**Spesimen Friction Welding Baja - Stainless Steel, Variasi Waktu.**

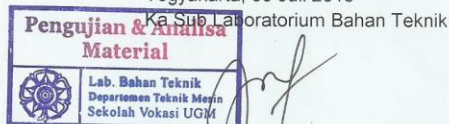
No	Kode	Jarak dr sambungan	d <sub>1</sub> ( $\mu\text{m}$ )	d <sub>2</sub> ( $\mu\text{m}$ )	d <sub>rata-rata</sub> ( $\mu\text{m}$ )	Kekerasan (VHN)	
3	9 dtk	Stainless Steel	12.0 mm	42.0	40.0	41.00	220.6
			8.0 mm	42.0	40.0	41.00	220.6
			3.5 mm	42.0	41.0	41.50	215.3
			1.5 mm	42.0	42.0	42.00	210.2
			0.5 mm	40.0	42.0	41.00	220.6
			0.0 mm	40.0	40.0	40.00	231.8
		Baja	0.5 mm	46.0	45.0	45.50	179.1
			1.5 mm	46.0	46.0	46.00	175.3
			3.5 mm	47.0	47.0	47.00	167.9
			8.0 mm	42.0	40.0	41.00	220.6
			12.0 mm	40.0	40.0	40.00	231.8
			4	12 dtk	Stainless Steel	12.0 mm	40.0
8.0 mm	40.0	40.0				40.00	231.8
3.5 mm	42.0	42.0				42.00	210.2
1.5 mm	42.0	41.0				41.50	215.3
0.5 mm	38.0	38.0				38.00	256.8
0.0 mm	35.0	35.0				35.00	302.8
Baja	0.5 mm	47.0			48.0	47.50	164.4
	1.5 mm	47.0			48.0	47.50	164.4
	3.5 mm	48.0			47.0	47.50	164.4
	8.0 mm	40.0			40.0	40.00	231.8
	12.0 mm	40.0			40.0	40.00	231.8

Lembar asli, tidak untuk digandakan

**Keterangan :**

1. Menggunakan metode uji Vickers dengan pembebanan 200 gf, 5 detik
2. Satuan pengukuran diagonal jejak indenter dalam  $\mu\text{m}$
3. Pengujian dilakukan pada tanggal 09 Juli 2018

Yogyakarta, 09 Juli 2018



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

Lembar 2 dari 2