

Hasil Uji Kekerasan

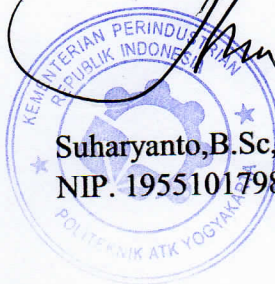

Nama : Isma Sulistianto

Material : Nylon 6 Friction Stir Welding

DATA HASIL PENGUJIAN KEKERASAN

| Kode Sampel | Pengulangan (HD) |
|-------------|-----------------------------|
| 10/3.5800.6 | 1. 75 2. 54,5 3. 61,5 |

Yogyakarta, 23 April 2019
Kepala Laboratorium Pengujian



Suharyanto, B.Sc, S.E, M.M
NIP. 19551017985031002

Hasil Uji Kekerasan


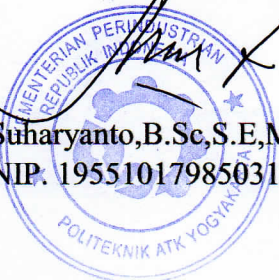
Nama : Isma Sulistianto

Material : Nylon 6 Friction Stir Welding

DATA HASIL PENGUJIAN KEKERASAN

| Kode Sampel | Pengulangan (HD) |
|-------------|-----------------------------|
| 20/3.5800.8 | 1. 72 2. 48,5 3. 61,5 |

Yogyakarta, 23 April 2019
Kepala Laboratorium Pengujian

Suharyanto, B.Sc, S.E, M.M
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Tensile Test report

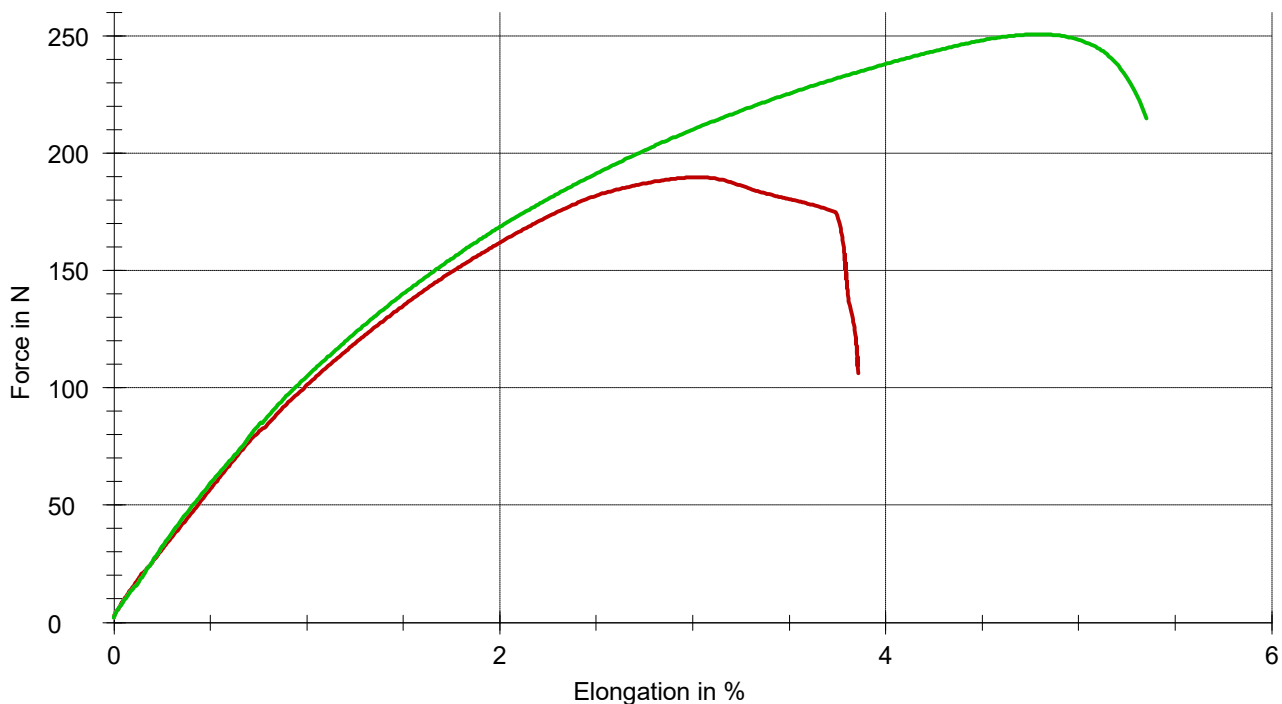
Customer : Isma Sulistianto Notes : 10/3 5800 rpm 4mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
Speed, tensile modulus : 5 mm/min
Test speed : 5 mm/min
Grip to grip separation at the start position : 65,00 mm
Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|--------|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| ■ | 1 | 189,68 | 421 | 7,54 | 3,0 | 4,23 | 3,9 | 4,38 | 5,74 |
| ■ | 2 | 250,51 | 454 | 9,77 | 4,8 | 8,37 | 5,4 | 4,58 | 5,6 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 220,10 | 438 | 8,66 | 3,9 | 6,30 | 4,6 | 4,48 | 5,67 |
| s | 43,02 | 23,2 | 1,57 | 1,2 | 2,93 | 1,1 | 0,1414 | 0,09899 |
| v [%] | 19,55 | 5,31 | 18,16 | 31,99 | 46,49 | 22,98 | 3,16 | 1,75 |



Tensile Test report

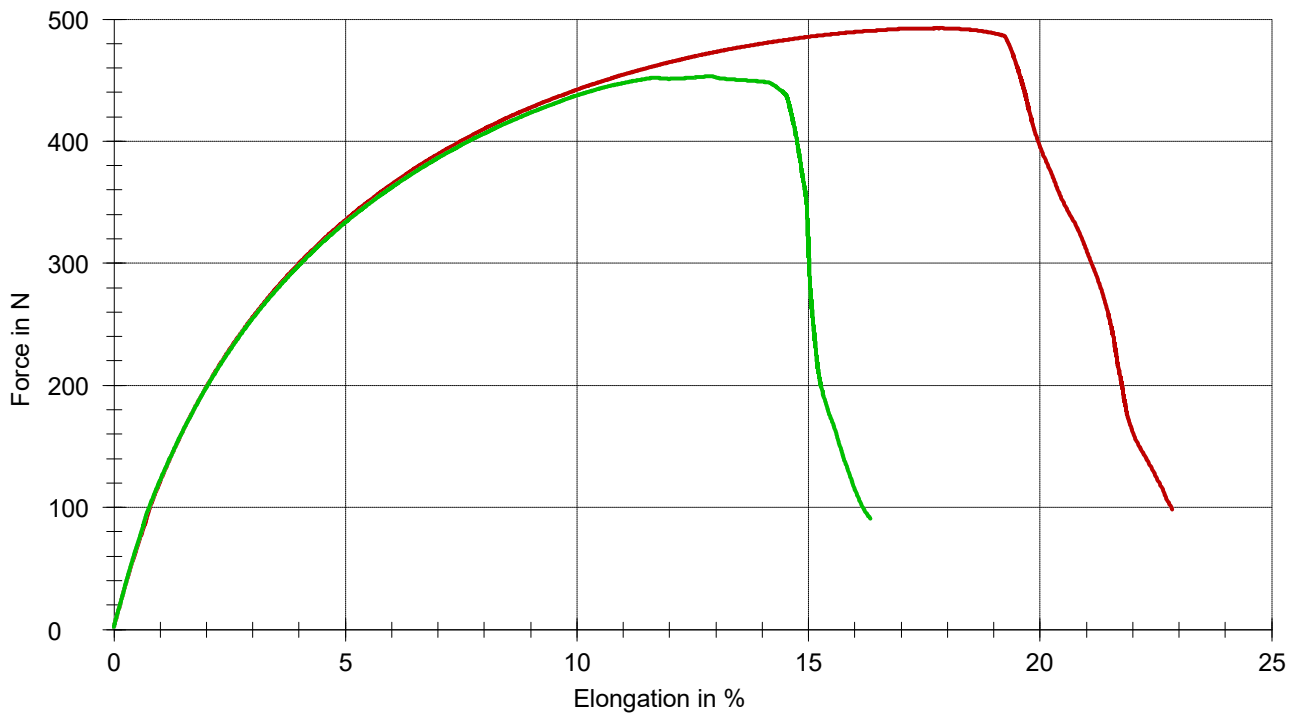
Customer : Isma Sulistianto Notes : 10/3 5800 rpm 6mm/min
 Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
 Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
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 Gage length, standard travel : 25 mm
 Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E _t MPa | σ _M MPa | ε _M % | σ _B MPa | ε _B % | h mm | b mm |
|---|-----|------------|-----------------------|-----------------------|---------------------|-----------------------|---------------------|---------|---------|
| | 1 | 492,59 | 557 | 20,1 | 18 | 4,03 | 23 | 4,32 | 5,66 |
| | 2 | 453,30 | 534 | 17,8 | 13 | 3,55 | 16 | 4,52 | 5,64 |

Series graph:



Statistics:

| Series | Force N | E _t MPa | σ _M MPa | ε _M % | σ _B MPa | ε _B % | h mm | b mm |
|-----------|------------|-----------------------|-----------------------|---------------------|-----------------------|---------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 472,95 | 545 | 19,0 | 15 | 3,79 | 20 | 4,42 | 5,65 |
| s | 27,78 | 16,3 | 1,67 | 3,5 | 0,334 | 4,6 | 0,1414 | 0,01414 |
| v [%] | 5,87 | 2,99 | 8,82 | 22,71 | 8,82 | 23,52 | 3,20 | 0,25 |



Tensile Test report

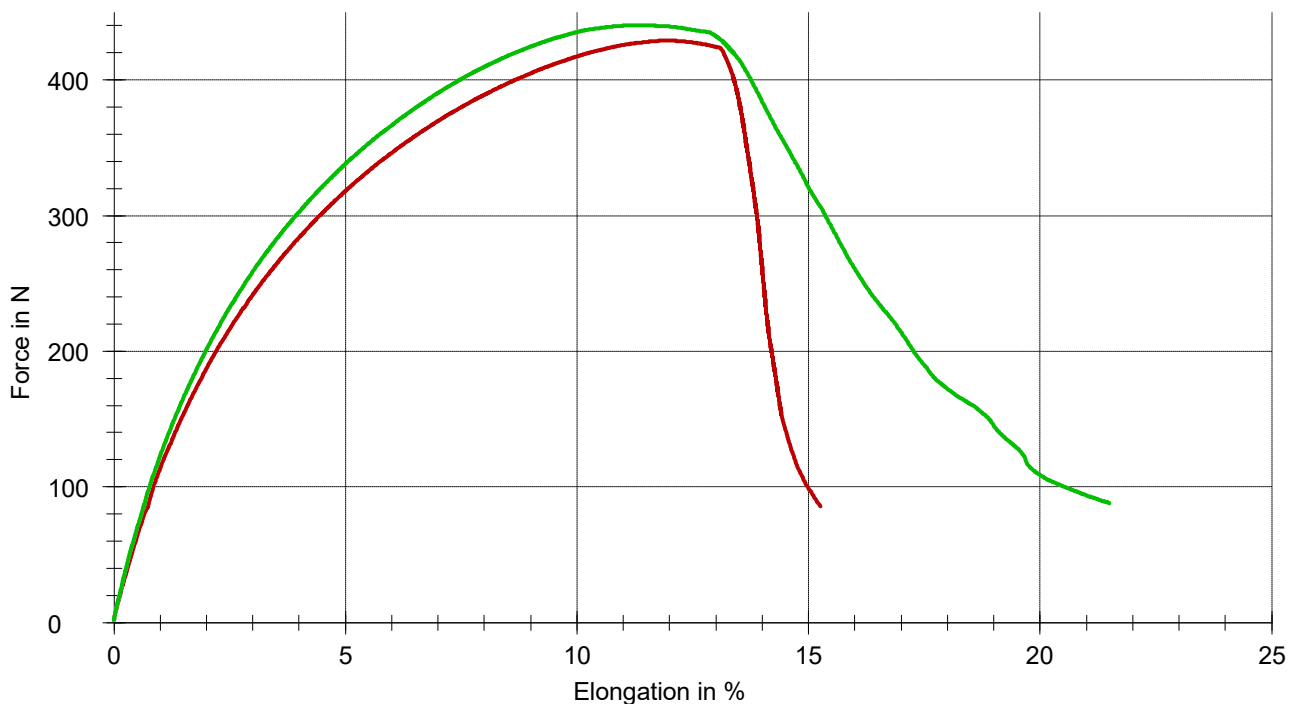
Customer : Isma Sulistianto Notes : 10/3 5800 rpm 8mm/min
 Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
 Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
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 Test speed : 5 mm/min
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 Gage length, standard travel : 25 mm
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Test results:

| Legend | No. | Force N | E _t MPa | σ _M MPa | ε _M % | σ _B MPa | ε _B % | h mm | b mm |
|--------------------------------------|-----|------------|-----------------------|-----------------------|---------------------|-----------------------|---------------------|---------|---------|
| █ | 1 | 428,98 | 507 | 17,2 | 12 | 3,44 | 15 | 4,38 | 5,7 |
| █ | 2 | 440,29 | 558 | 17,3 | 11 | 3,46 | 21 | 4,39 | 5,8 |

Series graph:



Statistics:

| Series | Force N | E _t MPa | σ _M MPa | ε _M % | σ _B MPa | ε _B % | h mm | b mm |
|-----------|------------|-----------------------|-----------------------|---------------------|-----------------------|---------------------|----------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 434,64 | 533 | 17,2 | 12 | 3,45 | 18 | 4,385 | 5,75 |
| s | 7,99 | 36,2 | 0,0772 | 0,49 | 0,0157 | 4,4 | 0,007071 | 0,07071 |
| v [%] | 1,84 | 6,79 | 0,45 | 4,26 | 0,45 | 24,01 | 0,16 | 1,23 |





Tensile Test report

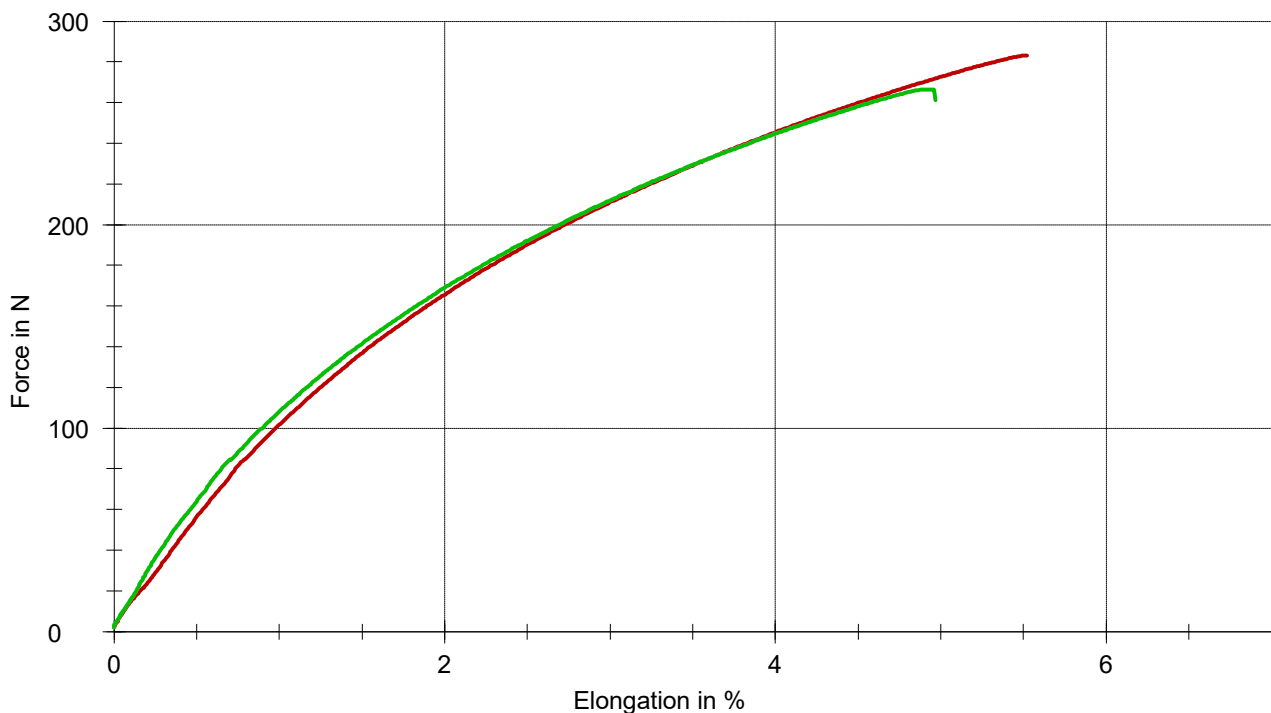
Customer : Isma Sulistianto Notes : 15/3 5800 rpm 4mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
Speed, tensile modulus : 5 mm/min
Test speed : 5 mm/min
Grip to grip separation at the start position : 65,00 mm
Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|---|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
|  | 1 | 283,20 | 363 | 10,6 | 5,5 | 10,6 | 5,5 | 4,74 | 5,62 |
|  | 2 | 266,51 | 501 | 9,77 | 4,9 | 9,77 | 4,9 | 4,75 | 5,74 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|----------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 274,86 | 432 | 10,2 | 5,2 | 10,2 | 5,2 | 4,745 | 5,68 |
| s | 11,80 | 97,6 | 0,606 | 0,42 | 0,606 | 0,42 | 0,007071 | 0,08485 |
| v [%] | 4,29 | 22,57 | 5,93 | 8,14 | 5,93 | 8,14 | 0,15 | 1,49 |



Tensile Test report

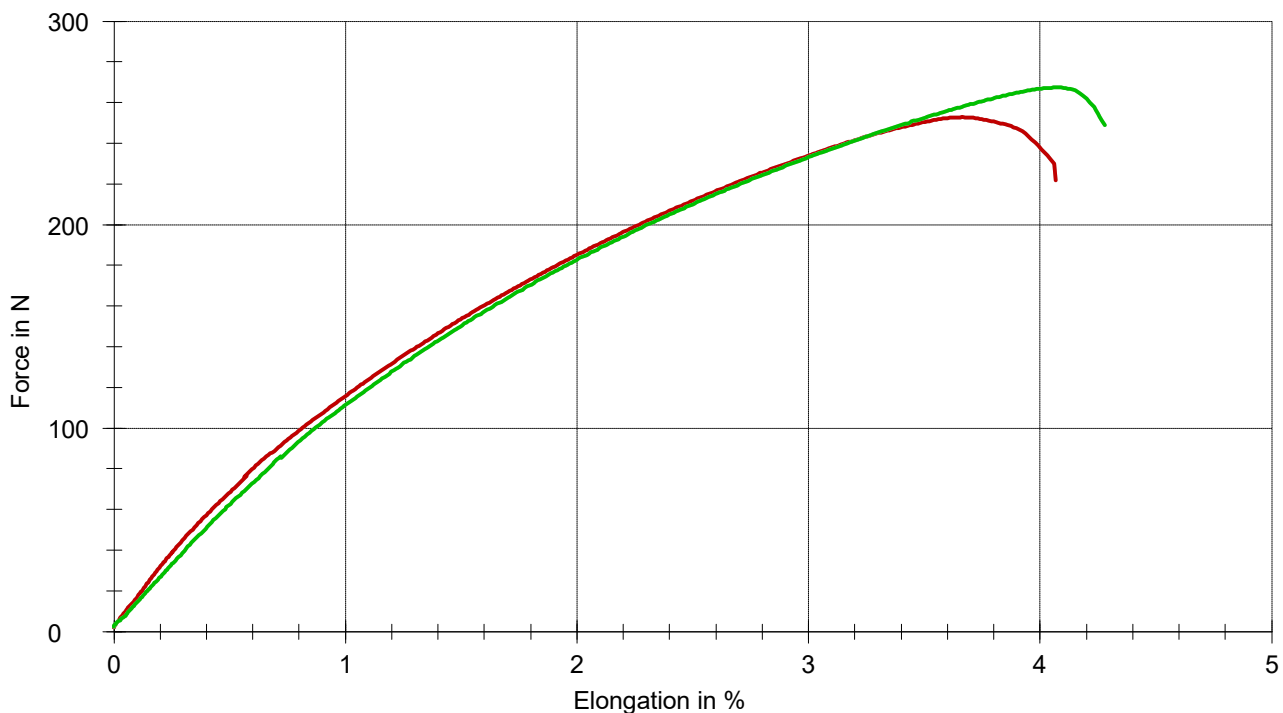
Customer : Isma Sulistianto Notes : 15/3 5800 rpm 6mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
Speed, tensile modulus : 5 mm/min
Test speed : 5 mm/min
Grip to grip separation at the start position : 65,00 mm
Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|--------|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| ■ | 1 | 252,81 | 562 | 9,69 | 3,7 | 9,69 | 3,7 | 4,56 | 5,72 |
| ■ | 2 | 267,36 | 466 | 9,96 | 4,1 | 9,96 | 4,1 | 4,66 | 5,76 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 260,09 | 514 | 9,83 | 3,9 | 9,83 | 3,9 | 4,61 | 5,74 |
| s | 10,29 | 68,4 | 0,190 | 0,29 | 0,190 | 0,29 | 0,07071 | 0,02828 |
| v [%] | 3,96 | 13,31 | 1,93 | 7,44 | 1,93 | 7,44 | 1,53 | 0,49 |



Tensile Test report

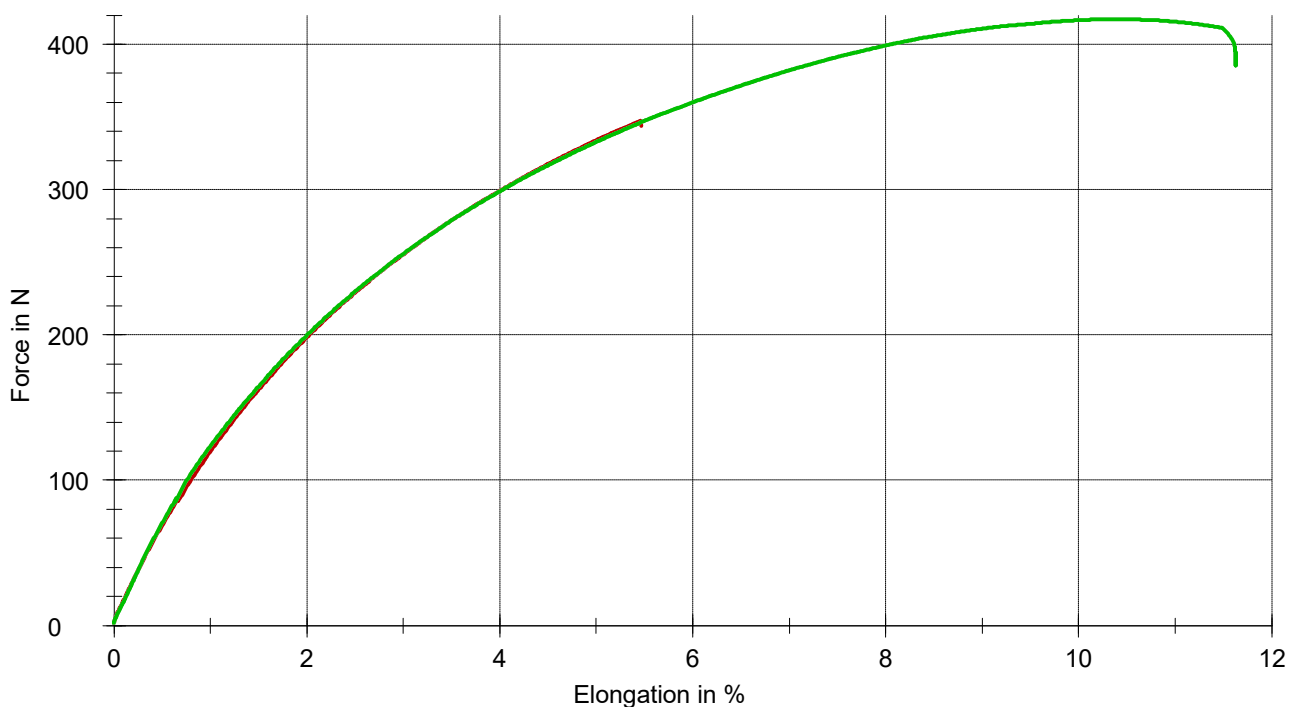
Customer : Isma Sulistianto Notes : 15/3 5800 rpm 8mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
Speed, tensile modulus : 5 mm/min
Test speed : 5 mm/min
Grip to grip separation at the start position : 65,00 mm
Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|--------|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| ■ | 1 | 347,25 | 532 | 13,4 | 5,5 | 13,4 | 5,5 | 4,59 | 5,66 |
| ■ | 2 | 417,20 | 576 | 17,0 | 10 | 15,7 | 12 | 4,32 | 5,68 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 382,23 | 554 | 15,2 | 7,9 | 14,5 | 8,5 | 4,455 | 5,67 |
| s | 49,46 | 31,0 | 2,57 | 3,5 | 1,65 | 4,4 | 0,1909 | 0,01414 |
| v [%] | 12,94 | 5,61 | 16,93 | 43,92 | 11,35 | 51,06 | 4,29 | 0,25 |



Tensile Test report

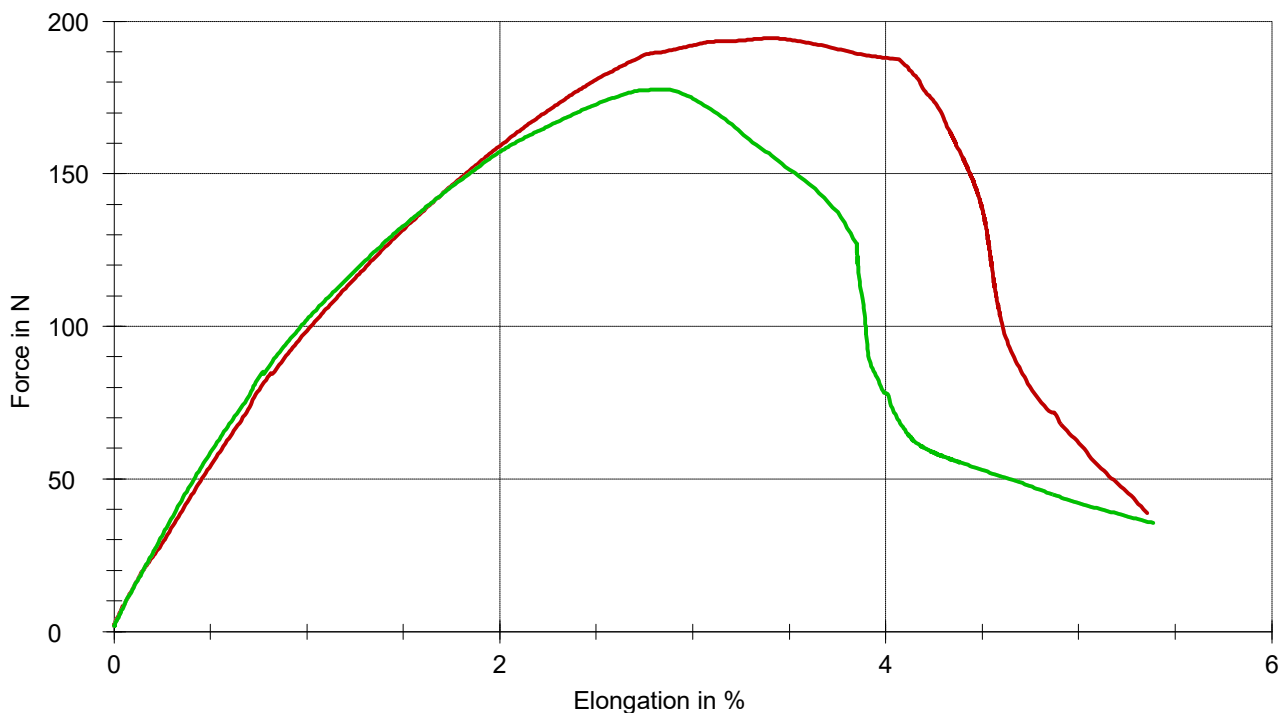
Customer : Isma Sulistianto Notes : 20/3 5800 rpm 4mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
Speed, tensile modulus : 5 mm/min
Test speed : 5 mm/min
Grip to grip separation at the start position : 65,00 mm
Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|---|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| | 1 | 194,40 | 420 | 8,06 | 3,4 | 1,61 | 5,4 | 4,29 | 5,62 |
| | 2 | 177,67 | 466 | 7,22 | 2,8 | 1,44 | 5,4 | 4,35 | 5,66 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 186,03 | 443 | 7,64 | 3,1 | 1,53 | 5,4 | 4,32 | 5,64 |
| s | 11,83 | 32,4 | 0,599 | 0,41 | 0,119 | 0,023 | 0,04243 | 0,02828 |
| v [%] | 6,36 | 7,32 | 7,84 | 13,04 | 7,78 | 0,42 | 0,98 | 0,50 |



Tensile Test report

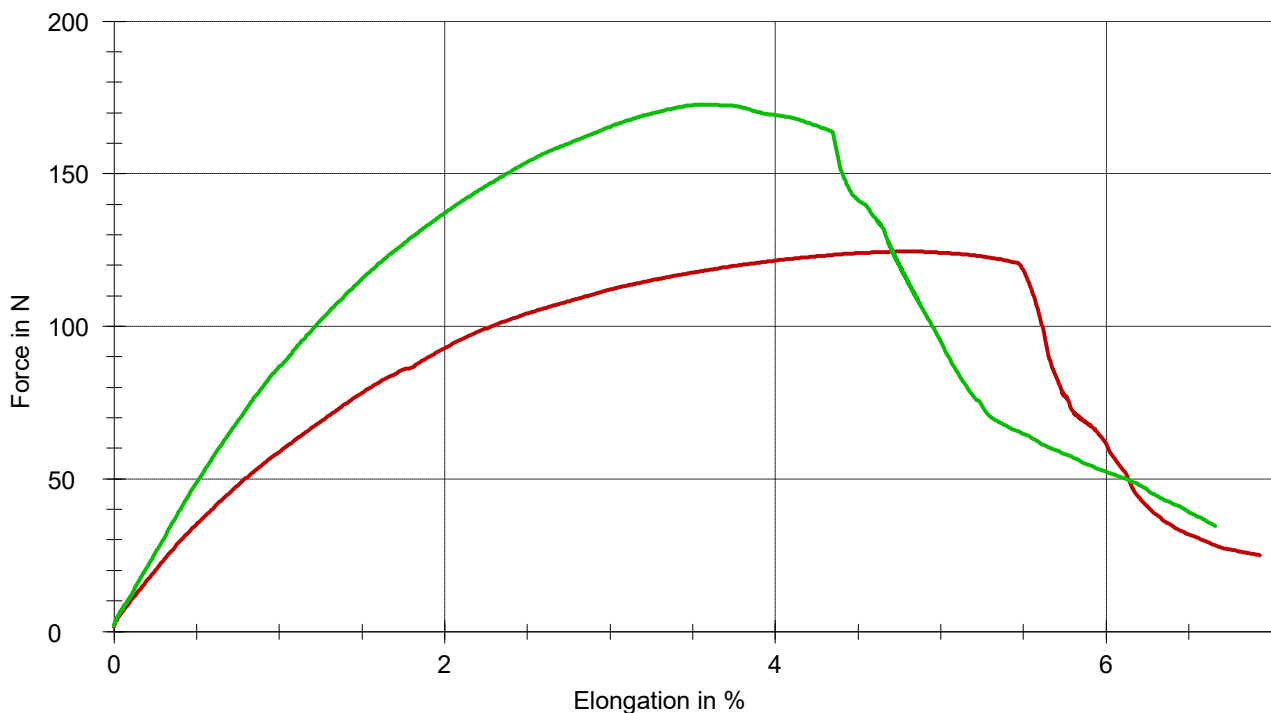
Customer : Isma Sulistianto Notes : 20/3 5800 rpm 6mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

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Speed, tensile modulus : 5 mm/min
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Grip to grip separation at the start position : 65,00 mm
Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|--------|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| ■ | 1 | 124,54 | 257 | 4,72 | 4,8 | 0,943 | 6,9 | 4,6 | 5,74 |
| ■ | 2 | 172,70 | 364 | 6,79 | 3,6 | 1,36 | 6,7 | 4,48 | 5,68 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 148,62 | 311 | 5,75 | 4,2 | 1,15 | 6,8 | 4,54 | 5,71 |
| s | 34,06 | 75,5 | 1,46 | 0,89 | 0,292 | 0,19 | 0,08485 | 0,04243 |
| v [%] | 22,91 | 24,32 | 25,45 | 21,22 | 25,41 | 2,80 | 1,87 | 0,74 |



Tensile Test report

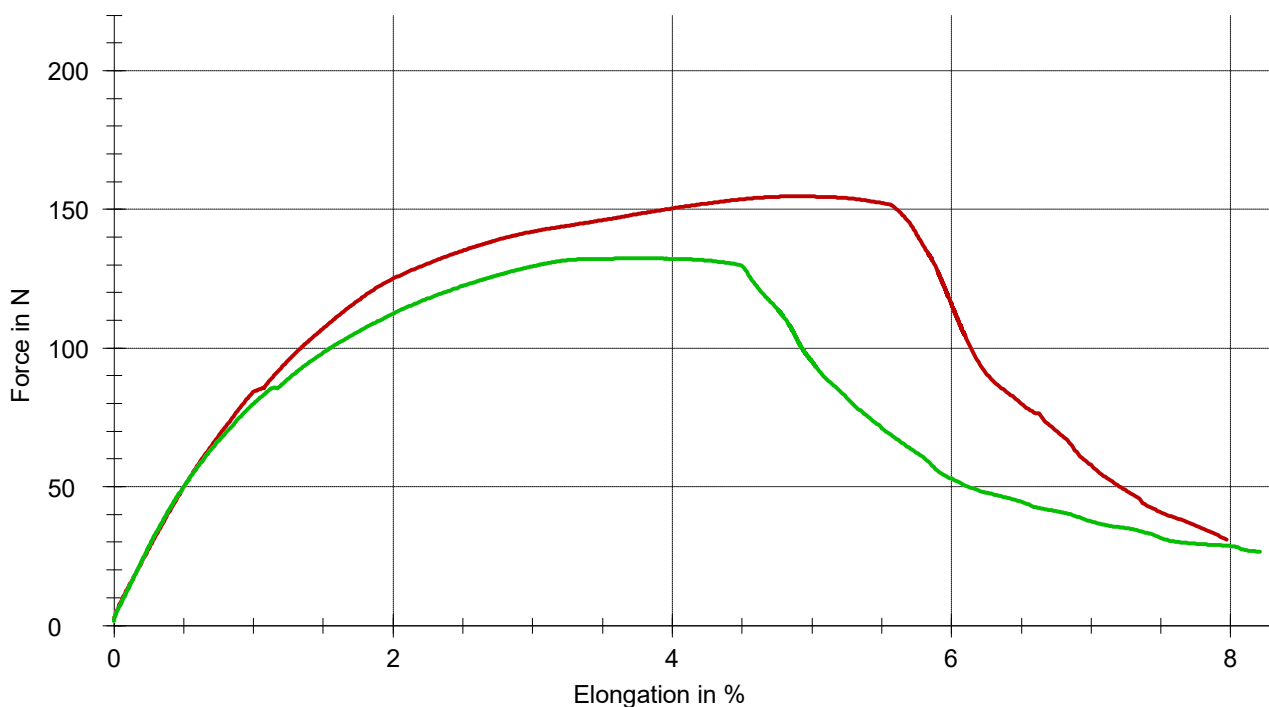
Customer : Isma Sulistianto Notes : 20/3 5800 rpm 8mm/min
Test standard : ASTM D 638 Tipe 4 Machine data : Zwick Z020
Material : Nylon Friction Stir Welding

Pre-load : 0,1 MPa
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Test speed : 5 mm/min
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Gage length, standard travel : 25 mm
Elongation preset, secant modulus : 1 %

Test results:

| Legend | No. | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|--|-----|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| | 1 | 154,69 | 362 | 5,91 | 4,9 | 1,18 | 8,0 | 4,59 | 5,7 |
| | 2 | 132,34 | 413 | 5,28 | 3,7 | 1,06 | 8,2 | 4,38 | 5,72 |

Series graph:



Statistics:

| Series | Force N | E_t MPa | σ_M MPa | ϵ_M % | σ_B MPa | ϵ_B % | h mm | b mm |
|-----------|------------|--------------|-------------------|-------------------|-------------------|-------------------|---------|---------|
| n = 2 | | | | | | | | |
| \bar{x} | 143,51 | 388 | 5,60 | 4,3 | 1,12 | 8,1 | 4,485 | 5,71 |
| s | 15,80 | 36,2 | 0,446 | 0,81 | 0,0883 | 0,17 | 0,1485 | 0,01414 |
| v [%] | 11,01 | 9,33 | 7,96 | 18,78 | 7,89 | 2,10 | 3,31 | 0,25 |