# LAMPIRAN

## 1. Perhitungan Teoritis Uji Tarik

Diketahui : PC Murni = 61,6 MPa

ABS Data Sheet = 54 MPa

Ditanya : a. Tegangan tarik...?

b. Nilai regangan...?

c. Nilai modulus elastisitas...?

Jawab : a. Tegangan tarik

Nilai tegangan tarik campuran PC/ABS variasi 80/20 = (61,6 x 0,8) + (54 x 0,2) = 60,08 MPa

Nilai tegangan tarik campuran PC/ABS variasi 70/30 = (61,6 x 0,7) + (54 x 0,3) = 59,32 MPa

Nilai tegangan tarik campuran PC/ABS variasi 60/40 = (61,6 x 0,6) + (54 x 0,4) = 58,56 MPa

b. Nilai regangan

Nilai regangan tarik campuran PC/ABS variasi 80/20 = (6,3 x 0,8) + (10 x 0,2) = 7,04 %

Nilai regangan tarik campuran PC/ABS variasi 70/30 = (6,3 x 0,7) + (10 x 0,3) = 7,41 %

Nilai regangan tarik campuran PC/ABS variasi 60/40 = (6,3 x 0,6) + (10 x 0,4) = 7,78 %

c. Nilai modulus elastisitas

Nilai modulus elastisitas campuran PC/ABS variasi 80/20 = (2330 x 0,8) + (2700 x 0,2) = 2404 MPa

Nilai modulus elastisitas campuran PC/ABS variasi 70/30 = (2330 x 0,7) + (2700 x 0,3) = 2441 MPa

Nilai modulus elastisitas campuran PC/ABS variasi 60/40 = (2330 x 0,6) + (2700 x 0,4) = 2478 MPa

**2. Perhitungan Teoritis Uji Impak**

Diketahui : PC Murni = 39,90 kJ/$m^2$
ABS Data Sheet = 17 kJ/$m^2$
Ditanya : Nilai energi impak...?
Jawab : Nilai energi impak
Nilai energi impak campuran PC/ABS variasi 80/20 =
(39,90 x 0,8) + (17 x 0,2) = 35,32 kJ/$m^2$
Nilai energi impak campuran PC/ABS variasi 70/30 =
(39,90 x 0,7) + (17 x 0,3) = 33,03 kJ/$m^2$
Nilai energi impak campuran PC/ABS variasi 60/40 =
(39,90 x 0,6) + (17 x 0,4) = 30,74 kJ/$m^2$

**3. Perhitungan Teoritis Uji MFI**

Diketahui : PC Murni = 5,84 gr/10 min
ABS Data Sheet = 23 gr/10 min
Ditanya : Nilai melt flow index (MFI)...?
Jawab : Nilai MFI
Nilai MFI campuran PC/ABS variasi 80/20 =
(5,84 x 0,8) + (23 x 0,2) = 9,27 gr/10 min
Nilai MFI campuran PC/ABS variasi 70/30 =
(5,84 x 0,7) + (23 x 0,3) = 10,98 gr/10 min
Nilai MFI campuran PC/ABS variasi 60/40 =
(5,84 x 0,6) + (23 x 0,4) = 12,70 gr/10 min

# LAMPIRAN 1. UJI TARIK

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Zwick / Roell

## Test report

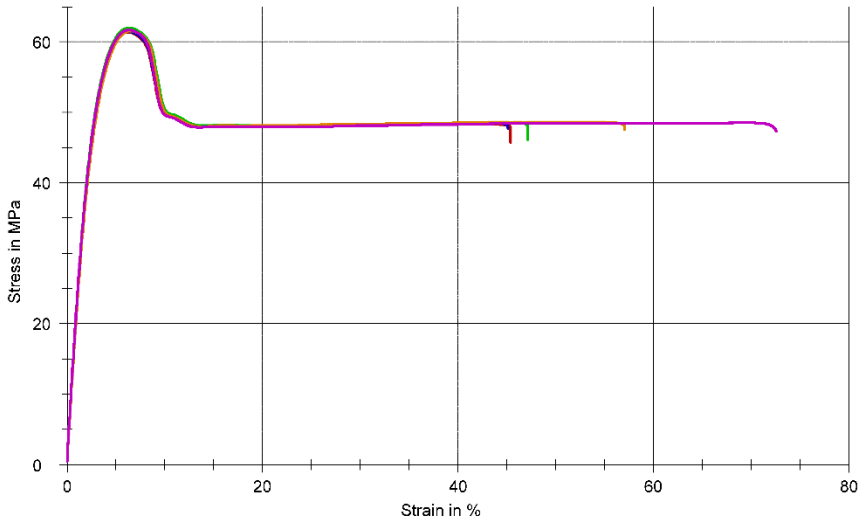
| | | | | | |
|---|---|---|---|---|---|
| Customer | : | Ariza Umam | Notes | : | PC Murni |
| Test standard | : | DIN EN ISO 527-1 | Machine data | : | Zwick Z020 |
| Material | : | Polycarbonate | | | |

| | | | |
|---|---|---|---|
| Pre-load | : | 0,6 | MPa |
| Speed, tensile modulus | : | 1 | mm/min |
| Test speed | : | 50 | mm/min |
| Grip to grip separation at the start position | : | 115,00 | mm |
| Gage length, standard travel | : | 50 | mm |

### Test results:

| Legend | No. | $E_t$ MPa | $\sigma_m$ MPa | $\varepsilon_m$ % | $\sigma_b$ MPa | $\varepsilon_b$ % | b mm | h mm |
|---|---|---|---|---|---|---|---|---|
| | 1 | 2360 | 61,4 | 6,2 | 61,4 | 6,2 | 9,98 | 3,99 |
| | 2 | 2340 | 62,0 | 6,3 | 62,0 | 6,3 | 9,96 | 4,02 |
| | 3 | 2350 | 61,5 | 6,3 | 61,5 | 6,3 | 9,98 | 3,99 |
| | 4 | 2250 | 61,6 | 6,5 | 61,6 | 6,5 | 9,95 | 3,99 |
| | 5 | 2350 | 61,7 | 6,4 | 61,7 | 6,4 | 9,99 | 4 |

### Series graph:




### Statistics:

| Series n = 5 | $E_t$ MPa | $\sigma_m$ MPa | $\varepsilon_m$ % | $\sigma_b$ MPa | $\varepsilon_b$ % | b mm | h mm |
|---|---|---|---|---|---|---|---|
| $\bar{x}$ | 2330 | 61,6 | 6,4 | 61,6 | 6,4 | 9,972 | 3,998 |
| s | 46,2 | 0,238 | 0,11 | 0,238 | 0,11 | 0,01643 | 0,01304 |
| ν [%] | 1,98 | 0,39 | 1,70 | 0,39 | 1,70 | 0,16 | 0,33 |

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Zwick / Roell

# Test report

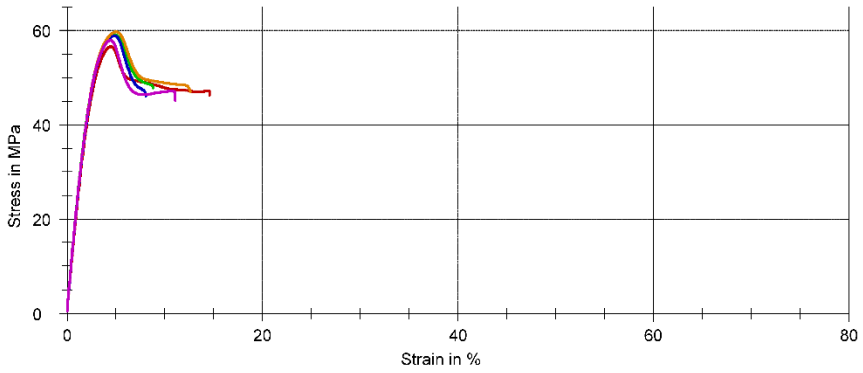
| | | | | | |
|---|---|---|---|---|---|
| Customer | : | Ariza Umam | Notes | : | PC 80% - ABS 20% |
| Test standard | : | DIN EN ISO 527-1 | Machine data | : | Zwick Z020 |
| Material | : | PC-ABS | | | |

| | | | |
|---|---|---|---|
| Pre-load | : | 0,57 | MPa |
| Speed, tensile modulus | : | 1 | mm/min |
| Test speed | : | 50 | mm/min |
| Grip to grip separation at the start position | : | 115,00 | mm |
| Gage length, standard travel | : | 50 | mm |

## Test results:

| Legend | No. | $E_t$ | $\sigma_m$ | $\varepsilon_m$ | $\sigma_b$ | $\varepsilon_b$ | b | h |
|---|---|---|---|---|---|---|---|---|
| | | MPa | MPa | % | MPa | % | mm | mm |
| | 1 | 2320 | 56,6 | 4,4 | 56,6 | 4,4 | 9,96 | 4,04 |
| | 2 | 2370 | 59,0 | 4,9 | 59,0 | 4,9 | 9,98 | 4,02 |
| | 3 | 2340 | 58,9 | 4,8 | 58,9 | 4,8 | 10,01 | 4,03 |
| | 4 | 2370 | 59,7 | 5,0 | 59,7 | 5,0 | 9,97 | 4,01 |
| | 5 | 2390 | 57,9 | 4,4 | 57,9 | 4,4 | 9,99 | 4,06 |

## Series graph:




## Statistics:

| Series | $E_t$ | $\sigma_m$ | $\varepsilon_m$ | $\sigma_b$ | $\varepsilon_b$ | b | h |
|---|---|---|---|---|---|---|---|
| n = 5 | MPa | MPa | % | MPa | % | mm | mm |
| $\bar{x}$ | 2360 | 58,4 | 4,7 | 58,4 | 4,7 | 9,982 | 4,032 |
| s | 28,2 | 1,21 | 0,26 | 1,21 | 0,26 | 0,01924 | 0,01924 |
| v [%] | 1,20 | 2,08 | 5,60 | 2,08 | 5,60 | 0,19 | 0,48 |

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Zwick / Roell

# Test report

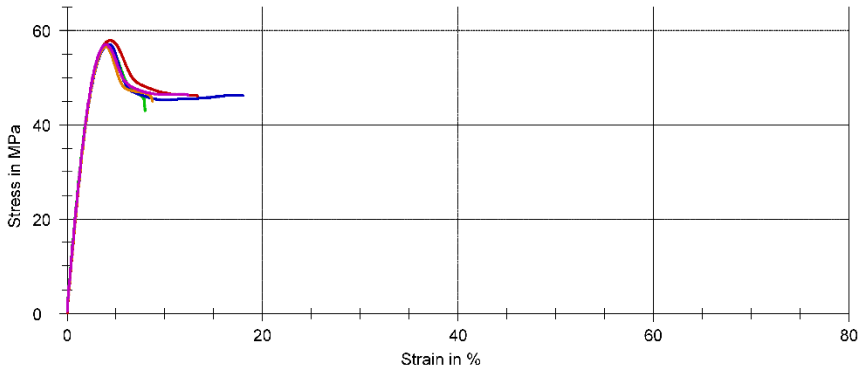
| | | | | | |
|---|---|---|---|---|---|
| Customer | : | Ariza Umam | Notes | : | PC 70% - ABS 30% |
| Test standard | : | DIN EN ISO 527-1 | Machine data | : | Zwick Z020 |
| Material | : | PC-ABS | | | |

| | | | |
|---|---|---|---|
| Pre-load | : | 0,57 | MPa |
| Speed, tensile modulus | : | 1 | mm/min |
| Test speed | : | 50 | mm/min |
| Grip to grip separation at the start position | : | 115,00 | mm |
| Gage length, standard travel | : | 50 | mm |

## Test results:

| Legend | No. | $E_t$ | $\sigma_m$ | $\varepsilon_m$ | $\sigma_b$ | $\varepsilon_b$ | b | h |
|---|---|---|---|---|---|---|---|---|
| | | MPa | MPa | % | MPa | % | mm | mm |
| | 1 | 2400 | 57,9 | 4,4 | 57,9 | 4,4 | 10 | 4,01 |
| | 2 | 2490 | 56,9 | 4,2 | 56,9 | 4,2 | 10,04 | 4,05 |
| | 3 | 2410 | 57,0 | 4,3 | 57,0 | 4,3 | 9,96 | 4,05 |
| | 4 | 2390 | 56,6 | 4,0 | 56,6 | 4,0 | 9,98 | 4,03 |
| | 5 | 2470 | 57,0 | 4,0 | 57,0 | 4,0 | 9,98 | 4,02 |

## Series graph:




## Statistics:

| Series | $E_t$ | $\sigma_m$ | $\varepsilon_m$ | $\sigma_b$ | $\varepsilon_b$ | b | h |
|---|---|---|---|---|---|---|---|
| n = 5 | MPa | MPa | % | MPa | % | mm | mm |
| $\bar{x}$ | 2430 | 57,1 | 4,2 | 57,1 | 4,2 | 9,992 | 4,032 |
| s | 45,0 | 0,485 | 0,21 | 0,485 | 0,21 | 0,03033 | 0,01789 |
| ν [%] | 1,85 | 0,85 | 4,91 | 0,85 | 4,91 | 0,30 | 0,44 |

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Zwick / Roell

# Test report

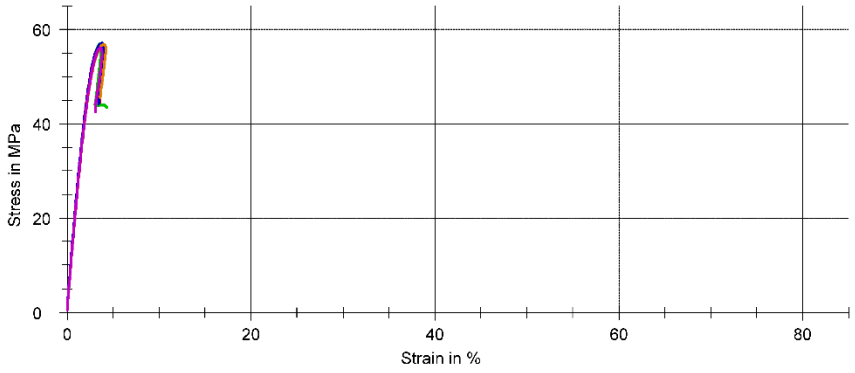
| | | | |
|---|---|---|---|
| Customer | : Ariza Umam | Notes | : PC 60% - ABS 40% |
| Test standard | : DIN EN ISO 527-1 | Machine data | : Zwick Z020 |
| Material | : PC-ABS | | |

| | | | |
|---|---|---|---|
| Pre-load | : | 0,55 | MPa |
| Speed, tensile modulus | : | 1 | mm/min |
| Test speed | : | 50 | mm/min |
| Grip to grip separation at the start position | : | 115,00 | mm |
| Gage length, standard travel | : | 50 | mm |

## Test results:

| Legend | No. | $E_t$ | $\sigma_m$ | $\varepsilon_m$ | $\sigma_b$ | $\varepsilon_b$ | b | h |
|---|---|---|---|---|---|---|---|---|
| | | MPa | MPa | % | MPa | % | mm | mm |
| | 1 | 2470 | 57,0 | 3,7 | 57,0 | 3,7 | 9,99 | 4,01 |
| | 2 | 2360 | 57,0 | 3,6 | 57,0 | 3,6 | 9,98 | 4,02 |
| | 3 | 2530 | 57,1 | 3,8 | 57,1 | 3,8 | 10 | 4,02 |
| | 4 | 2370 | 56,8 | 4,0 | 56,8 | 4,0 | 9,98 | 4,04 |
| | 5 | 2340 | 56,1 | 3,6 | 56,1 | 3,6 | 10 | 4 |

## Series graph:




## Statistics:

| Series | $E_t$ | $\sigma_m$ | $\varepsilon_m$ | $\sigma_b$ | $\varepsilon_b$ | b | h |
|---|---|---|---|---|---|---|---|
| n = 5 | MPa | MPa | % | MPa | % | mm | mm |
| $\bar{x}$ | 2410 | 56,8 | 3,8 | 56,8 | 3,8 | 9,99 | 4,018 |
| s | 79,3 | 0,398 | 0,17 | 0,398 | 0,17 | 0,01 | 0,01483 |
| v [%] | 3,29 | 0,70 | 4,43 | 0,70 | 4,43 | 0,10 | 0,37 |

# LAMPIRAN 2. UJI IMPAK

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Zwick / Roell

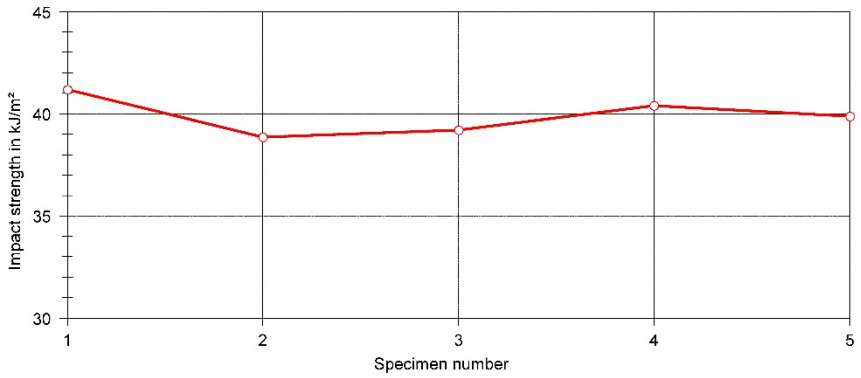
## Test report

| | | |
|---|---|---|
| Customer | : | Ariza Umam |
| Tester | : | Yotam S |
| Test standard | : | ISO 179-1 |
| Applied methods | : | Charpy impact strength test ISO 179-1/1 e A |
| Material | : | Polycarbonate Murni |
| Machine data | : | HIT 5,5P |
| Nominal work capacity | : | 2 J |
| Theoretical impact velocity | : | 2,901 m/s |

## Results:

| No. | b mm | h mm | $b_N$ mm | W J | ak kJ/m² | Type of failure |
|---|---|---|---|---|---|---|
| 1 | 10,02 | 4,06 | 8,03 | 1,34231 | 41,17 | H |
| 2 | 10,05 | 4,03 | 7,99 | 1,25101 | 38,85 | H |
| 3 | 9,97 | 4,07 | 8,93 | 1,42524 | 39,21 | H |
| 4 | 10,04 | 4,04 | 8,04 | 1,31228 | 40,40 | H |
| 5 | 10,04 | 4,03 | 8,03 | 1,29003 | 39,86 | H |

## Series graph:




## Statistics:

| Total/Hinge break n = 5 | $b_N$ mm | b mm | h mm | W J | ak kJ/m² |
|---|---|---|---|---|---|
| $\bar{x}$ | 8,204 | 10,02 | 4,046 | 1,32417 | 39,90 |
| s | 0,4063 | 0,03209 | 0,01817 | 0,06558 | 0,93 |
| ν [%] | 4,95 | 0,32 | 0,45 | 4,95 | 2,32 |

PC Murni.zs2

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Zwick / Roell

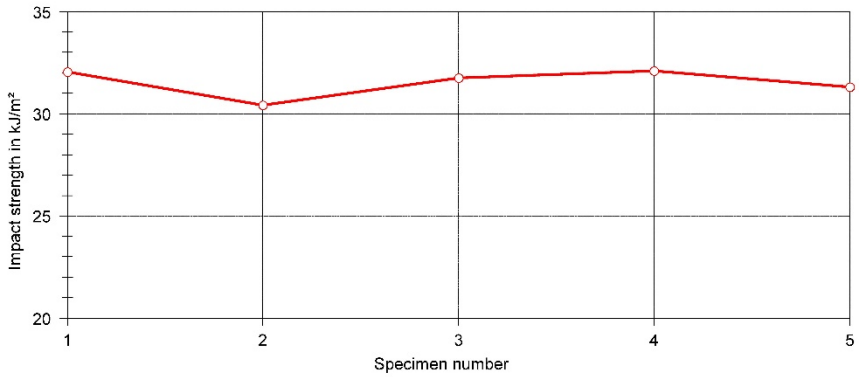
## Test report

| | | |
|---|---|---|
| Customer | : | Ariza Umam |
| Tester | : | Yotam S |
| Test standard | : | ISO 179-1 |
| Applied methods | : | Charpy impact strength test ISO 179-1/1 e A |
| Material | : | PC & ABS 80:20 |
| Machine data | : | HIT 5,5P |
| Nominal work capacity | : | 2 J |
| Theoretical impact velocity | : | 2,901 m/s |

## Results:

| No. | b mm | h mm | $b_N$ mm | W J | ak kJ/m² | Type of failure |
|---|---|---|---|---|---|---|
| 1 | 9,99 | 4,01 | 8,02 | 1,03046 | 32,04 | H |
| 2 | 10 | 4,02 | 8 | 0,97847 | 30,42 | H |
| 3 | 10 | 4,02 | 8,02 | 1,02372 | 31,75 | H |
| 4 | 10,1 | 4,1 | 8 | 1,05284 | 32,10 | H |
| 5 | 10,08 | 4,08 | 7,96 | 1,01697 | 31,31 | H |

## Series graph:




## Statistics:

| Total/Hinge break n = 5 | $b_N$ mm | b mm | h mm | W J | ak kJ/m² |
|---|---|---|---|---|---|
| $\bar{x}$ | 8 | 10,03 | 4,046 | 1,02049 | 31,53 |
| s | 0,02449 | 0,05177 | 0,04099 | 0,02709 | 0,69 |
| ν [%] | 0,31 | 0,52 | 1,01 | 2,65 | 2,19 |

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Zwick / Roell

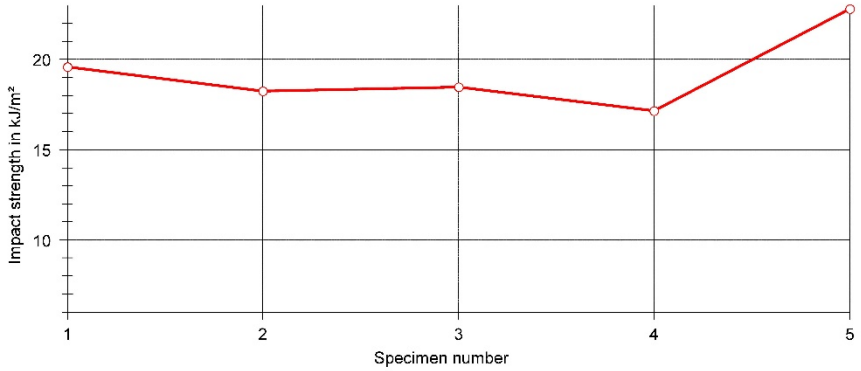
## Test report

| | | |
|---|---|---|
| Customer | : | Ariza Umam |
| Tester | : | Yotam S |
| Test standard | : | ISO 179-1 |
| Applied methods | : | Charpy impact strength test ISO 179-1/1 e A |
| Material | : | PC & ABS 70:30 |
| Machine data | : | HIT 5,5P |
| Nominal work capacity | : | 2 J |
| Theoretical impact velocity | : | 2,901 m/s |

## Results:

| No. | b mm | h mm | $b_N$ mm | W J | ak kJ/m² | Type of failure |
|---|---|---|---|---|---|---|
| 1 | 9,99 | 4,03 | 7,99 | 0,63065 | 19,59 | C |
| 2 | 9,99 | 4,05 | 8,02 | 0,59215 | 18,23 | C |
| 3 | 10 | 4,02 | 7,95 | 0,58974 | 18,45 | C |
| 4 | 9,98 | 4 | 8 | 0,54873 | 17,15 | C |
| 5 | 10 | 4,08 | 8,06 | 0,75015 | 22,81 | C |

## Series graph:




## Statistics:

| Total/Hinge break n = 5 | $b_N$ mm | b mm | h mm | W J | ak kJ/m² |
|---|---|---|---|---|---|
| $\bar{x}$ | 8,004 | 9,992 | 4,036 | 0,62228 | 19,25 |
| s | 0,04037 | 0,008367 | 0,0305 | 0,07713 | 2,17 |
| ν [%] | 0,50 | 0,08 | 0,76 | 12,40 | 11,29 |

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Zwick / Roell

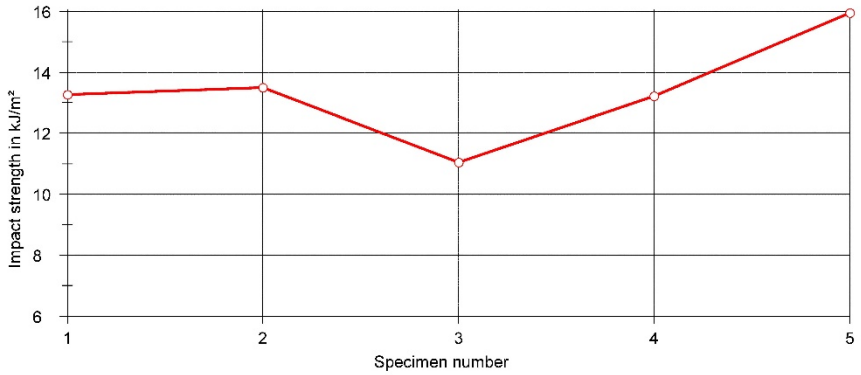
## Test report

| | | |
|---|---|---|
| Customer | : | Ariza Umam |
| Tester | : | Yotam S |
| Test standard | : | ISO 179-1 |
| Applied methods | : | Charpy impact strength test ISO 179-1/1 e A |
| Material | : | PC & ABS 60:40 |
| Machine data | : | HIT 5,5P |
| Nominal work capacity | : | 2 J |
| Theoretical impact velocity | : | 2,901 m/s |

## Results:

| No. | b mm | h mm | $b_N$ mm | W J | ak kJ/m² | Type of failure |
|---|---|---|---|---|---|---|
| 1 | 9,99 | 4 | 8,02 | 0,42543 | 13,26 | C |
| 2 | 9,99 | 4,02 | 7,98 | 0,43269 | 13,49 | C |
| 3 | 10,09 | 4 | 8,04 | 0,35536 | 11,05 | C |
| 4 | 10,01 | 4,02 | 8,01 | 0,42543 | 13,21 | C |
| 5 | 9,99 | 4,01 | 8,01 | 0,51249 | 15,96 | C |

## Series graph:




## Statistics:

| Total/Hinge break n = 5 | $b_N$ mm | b mm | h mm | W J | ak kJ/m² |
|---|---|---|---|---|---|
| $\bar{x}$ | 8,012 | 10,01 | 4,01 | 0,43028 | 13,39 |
| s | 0,02168 | 0,04336 | 0,01 | 0,05573 | 1,74 |
| ν [%] | 0,27 | 0,43 | 0,25 | 12,95 | 12,99 |

## LAMPIRAN 3. UJI MFI

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Zwick / Roell

# Test report

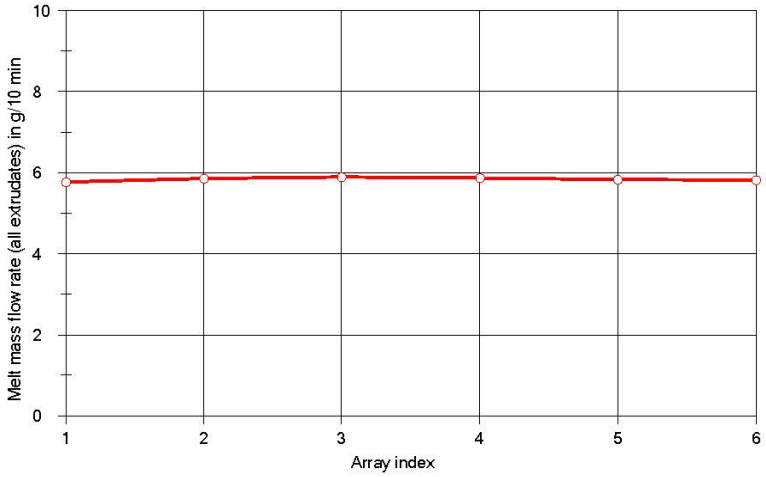
Customer : Ariza Umam
Tester : Yotam S
Material : Polycarbonate

Test definition of extrusion test (Automatic) : ISO 1133 Accurate
Test conditions : A (250 °C; 2.16 kg)
Set temperature : 250,0 °C
Test load : 2.16 kg

## Test results:

| No. | Index | Weight gram | Times second | $MFR_n$ g/10 min | $\overline{MFR}$ g/10 min | $MVR_n$ $cm^3$/10 min | $\overline{MVR}$ $cm^3$/10 min |
|---|---|---|---|---|---|---|---|
| 1 | 1 | 0,3879 | 40,34 | 5,77 | 5,84 | 5,29 | 5,35 |
| | 2 | 0,3881 | 39,8 | 5,85 | | 5,37 | |
| | 3 | 0,3880 | 39,52 | 5,89 | | 5,40 | |
| | 4 | 0,3880 | 39,66 | 5,87 | | 5,38 | |
| | 5 | 0,3877 | 39,9 | 5,83 | | 5,35 | |
| | 6 | 0,3875 | 40,02 | 5,81 | | 5,33 | |

## Series graph:




## Statistics:

| Series n = 1 | $\overline{MFR}$ g/10 min | $\overline{MVR}$ $cm^3$/10 min |
|---|---|---|
| $\bar{x}$ | 5,84 | 5,35 |
| s | - | - |
| v [%] | - | - |

**POLITEKNIK ATMI SURAKARTA**
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Zwick / Roell

# Test report

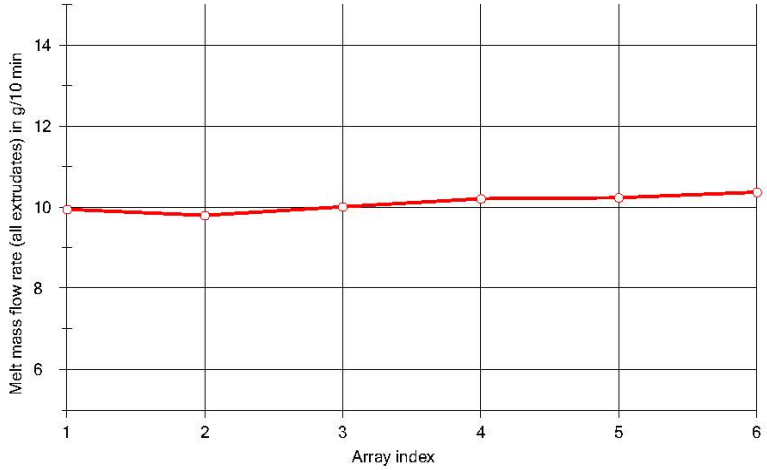
Customer : Ariza Umam
Tester : Yotam S
Material : PC & ABS 80:20

Test definition of extrusion test (Automatic) : ISO 1133 Accurate
Test conditions : A (250 °C; 2.16 kg)
Set temperature : 250,0 °C
Test load : 2.16 kg

## Test results:

| No. | Index | Extrudate | $MFR_n$ g/10 min | $\overline{MFR}$ g/10 min | $MVR_n$ cm³/10 min | $\overline{MVR}$ cm³/10 min | $t(Start)_n$ s | $t(End)_n$ s |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 9,94 | 10,09 | 9,12 | 9,26 | 410,70 | 434,10 |
| | 2 | 2 | 9,80 | | 8,99 | | 434,10 | 457,87 |
| | 3 | 3 | 10,01 | | 9,18 | | 457,87 | 481,11 |
| | 4 | 4 | 10,20 | | 9,36 | | 481,11 | 503,93 |
| | 5 | 5 | 10,23 | | 9,38 | | 503,94 | 526,68 |
| | 6 | 6 | 10,37 | | 9,51 | | 526,68 | 549,13 |

## Series graph:




## Statistics:

| Series n = 1 | $\overline{MFR}$ g/10 min | $\overline{MVR}$ cm³/10 min |
|---|---|---|
| x | 10,09 | 9,26 |
| s | - | - |
| ν [%] | - | - |

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Zwick / Roell

# Test report

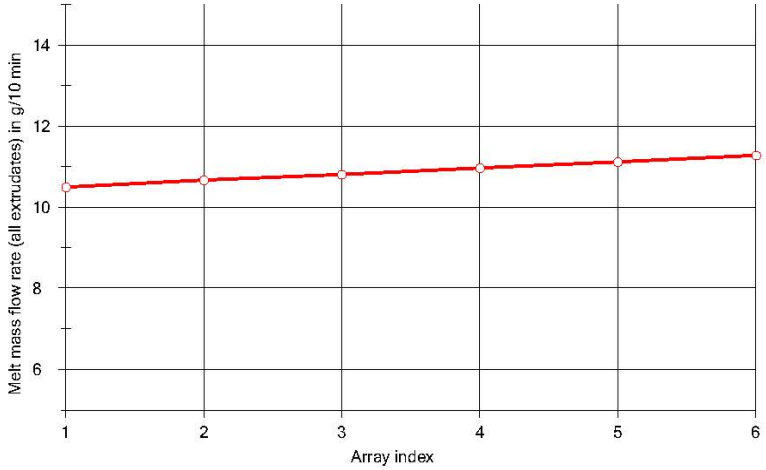
Customer : Ariza Umam
Tester : Yotam S
Material : PC & ABS 70:30

Test definition of extrusion test (Automatic) : ISO 1133 Accurate
Test conditions : A (250 °C; 2.16 kg)
Set temperature : 250,0 °C
Test load : 2.16 kg

## Test results:

| No. | Index | Extrudate | $MFR_n$ g/10 min | $\overline{MFR}$ g/10 min | $MVR_n$ cm³/10 min | $\overline{MVR}$ cm³/10 min | $t(Start)_n$ s | $t(End)_n$ s |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 10,50 | 10,89 | 10,00 | 10,37 | 422,83 | 444,19 |
| | 2 | 2 | 10,66 | | 10,15 | | 444,19 | 465,22 |
| | 3 | 3 | 10,80 | | 10,29 | | 465,22 | 485,97 |
| | 4 | 4 | 10,97 | | 10,45 | | 485,97 | 506,42 |
| | 5 | 5 | 11,11 | | 10,58 | | 506,42 | 526,59 |
| | 6 | 6 | 11,28 | | 10,74 | | 526,59 | 546,47 |

## Series graph:




## Statistics:

| Series n = 1 | $\overline{MFR}$ g/10 min | $\overline{MVR}$ cm³/10 min |
|---|---|---|
| x | 10,89 | 10,37 |
| s | - | - |
| ν [%] | - | - |

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Zwick / Roell

# Test report

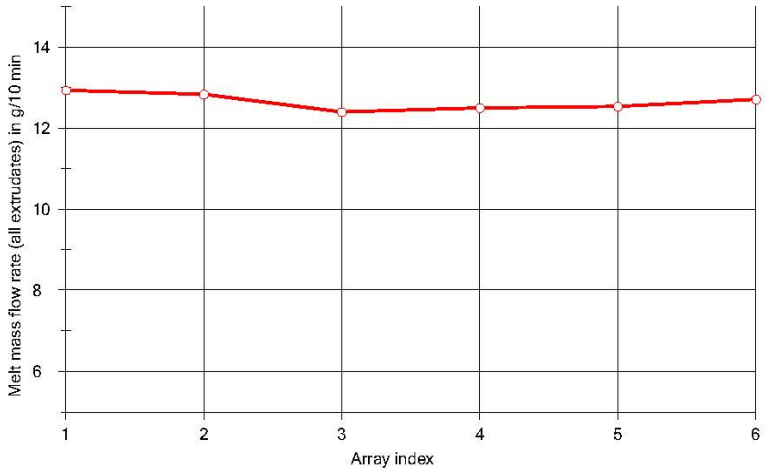
Customer : Ariza Umam
Tester : Yotam S
Material : PC & ABS 60:40

Test definition of extrusion test (Automatic) : ISO 1133 Accurate
Test conditions : A (250 °C; 2.16 kg)
Set temperature : 250,0 °C
Test load : 2.16 kg

## Test results:

| No. | Index | Extrudate | $MFR_n$ g/10 min | $\overline{MFR}$ g/10 min | $MVR_n$ cm³/10 min | $\overline{MVR}$ cm³/10 min | $t(Start)_n$ s | $t(End)_n$ s |
|---|---|---|---|---|---|---|---|---|
| 1 | 1 | 1 | 12,93 | 12,65 | 11,87 | 11,60 | 399,89 | 417,88 |
| | 2 | 2 | 12,83 | | 11,77 | | 417,89 | 436,02 |
| | 3 | 3 | 12,40 | | 11,37 | | 436,03 | 454,79 |
| | 4 | 4 | 12,49 | | 11,46 | | 454,79 | 473,43 |
| | 5 | 5 | 12,53 | | 11,50 | | 473,43 | 492,00 |
| | 6 | 6 | 12,70 | | 11,65 | | 492,00 | 510,32 |

## Series graph:




## Statistics:

| Series n = 1 | $\overline{MFR}$ g/10 min | $\overline{MVR}$ cm³/10 min |
|---|---|---|
| x | 12,65 | 11,60 |
| s | - | - |
| ν [%] | - | - |