Report of Analysis

Issued Date	:	13 August 2009
Customers	:	Waterstop Product Co., Ltd.
		130/175 Moo 6, Soi Rama II 60/1, Rama II Rd.,
		Samaedam, Bangkhuntien, Bangkok 10150
		Tel : 08 6338 0602 Fax : 0 2450 1387
Serviced by	:	Mechanical Properties Testing Laboratory,
		Analytical and Testing Research Unit Division,
		National Metal and Materials Technology Center
Date received	:	28 July 2009
Date analyzed	:	5-6 and 13 August 2009
Sample	:	Bond PVC Waterstop
Identification no.	:	No data from the customer
Instruments used	:	- Universal Testing Machine (Instron 55R4502, S/N H3342)
		- XL Extensometer (Instron # 2603-070, S/N 656)
		- Vernier Caliper (Mitutoyo, S/N 05 37 7357)
Test method	:	Tensile (Based on ASTM D638)
Specimens conditioning	:	Temperature 23 ± 2 °C, Duration 48 hrs.
Test conditions	:	Gauge length = 25 mm.
		Grip distance = 65 mm.
		Crosshead speed = 500 mm./min.
		Temperature 22 °C, Humidity 52 % R.H.
Specimen preparation	:	The pellets were compression moulded into ~ 1.9 mm. thick sheet with conditions as following :

Press temperature	200	°C
Preheat time	10	minutes
Press time	3	minutes
Pressure	1900	psi

Sample sheet was cut into tensile shaped specimens
(Type IV ; Thickness ~ 1.9 mm.).
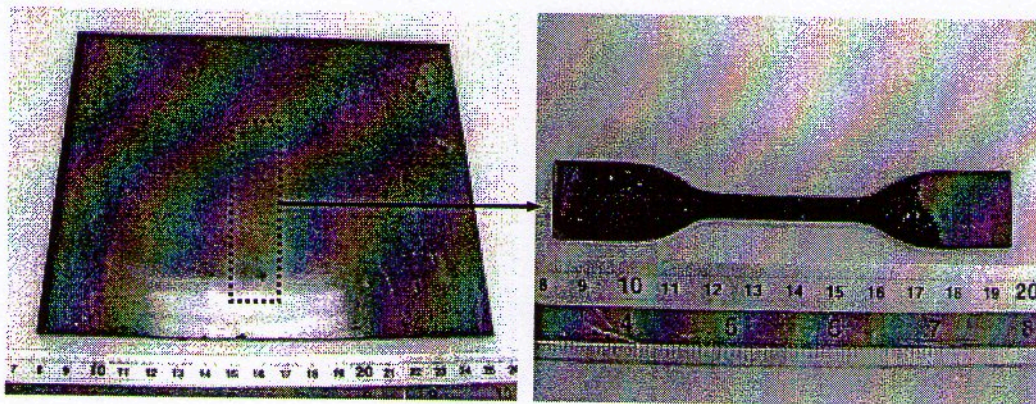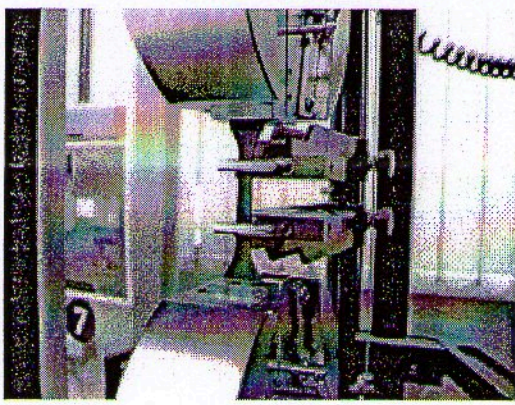

Figure 1 : Sample and specimen.

Figure 2 : Test configuration.

Results :

Sample	Specimen Number	Tensile Strength at Yield (MPa)	Elongation at Break (%)
Bond PVC Waterstop	1	16.46	375.65
	2	15.83	349.39
	3	16.93	382.68
	4	16.52	359.64
	5	15.70	347.19
Average		16.29	362.91
SD.		0.51	15.76
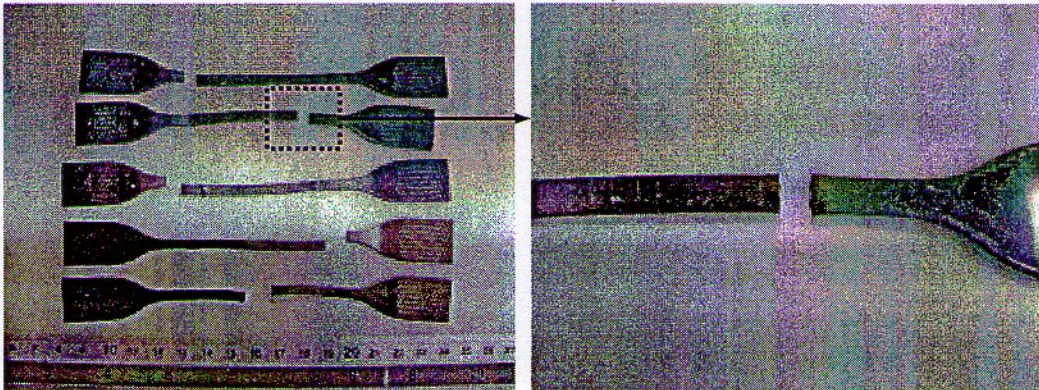
Figure 3 : Specimens after test.

|		
Instruments used	:	- Universal Testing Machine (Instron 55R4502, S/N H3342)
		- Vernier Caliper (Mitutoyo, S/N 05 37 7357)
Test method	:	Tear (Based on ASTM D624)
Specimens conditioning	:	Temperature 23 ± 2 °C, Duration 48 hrs.
Test conditions	:	Grip separation = 50 mm.
		Crosshead speed = 500 mm./min.
		Temperature 22 °C, Humidity 52 % R.H.
Specimen preparation	:	Compression moulded as above.
		Sample sheet was cut into tear shaped specimens
		(Die C ; Thickness ~ 1.9 mm.).

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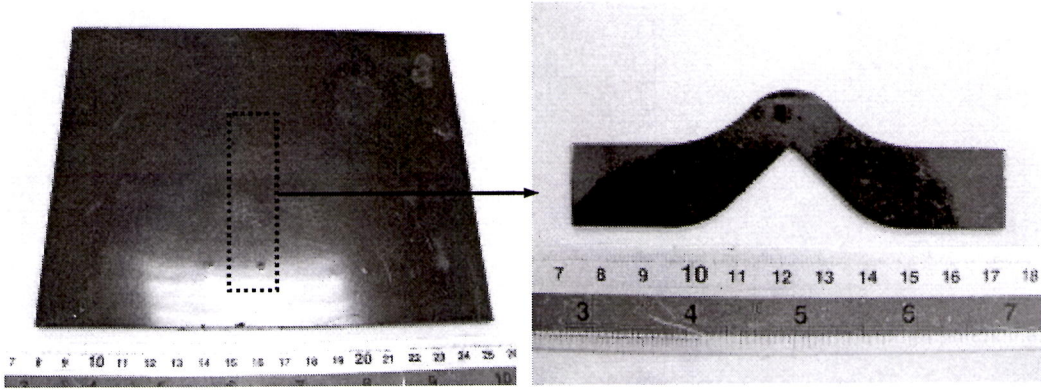
Figure 4 : Sample and specimen.
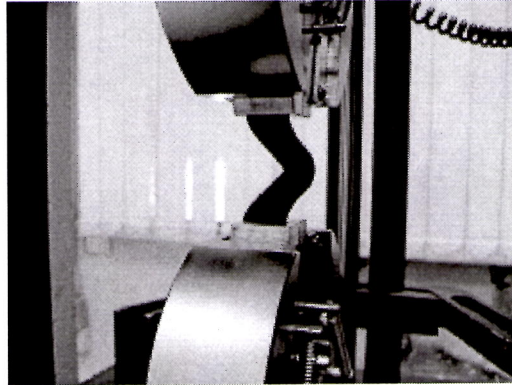
Figure 5 : Test configuration.

Results :

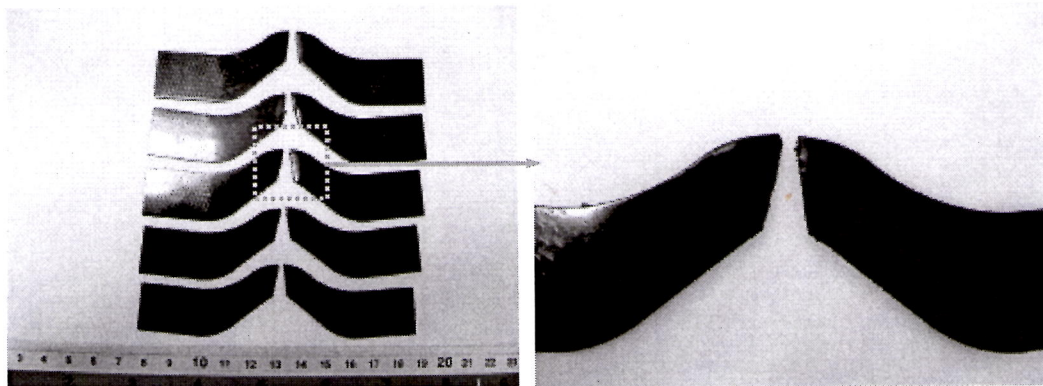| Sample	Specimen Number	Tear Strength (N/mm)
Bond PVC Waterstop	1	61.08
	2	65.35
	3	64.99
	4	61.79
	5	60.40
Average		62.72
SD.		2.29

Figure 6 : Specimens after test.

Instruments used	:	- Shore Hardness Tester
		(Shore Instruments-Instron, S/N 108816)
		- Vernier Caliper (Mitutoyo, S/N 05 37 7357)
Test method	:	Shore A (Based on ASTM D2240)
Specimens conditioning	:	Temperature 23 ± 2 °C, Duration 48 hrs.
Test conditions	:	Reading was taken within 1 second.
		Temperature 22 °C, Humidity 51 % R.H.
Specimen preparation	:	Supplied by client.
		Sample was cut into rectangular shaped specimen (~ 50x50x5.6 mm³).
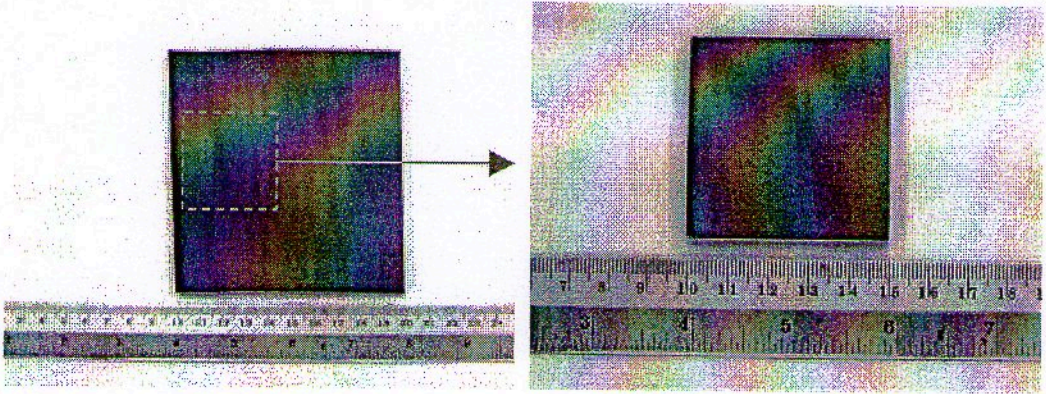
Figure 7 : Sample and specimen.

Figure 8 : Test configuration.

Results :

| Sample	Positions					Average	SD.
	1	2	3	4	5		
Bond PVC Waterstop	85	85	86	86	85	85.4	0.5

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Instruments used	:	- Balance (Precisa XT 220A, S/N 0006-45)
		- Vernier Caliper (Mitutoyo, S/N 05 37 7357)
Test method	:	Water absorption
Test conditions	:	Specimen was weighed and recorded. It was then submerged in clean water for 24 hours. When the time was reached, the specimen was removed from water, wiped with tissue paper. The weight was recorded again. Water absorption was calculated from the equation as following :

$$\text{Water absorption (\%) (ASTM D570)} = \left(\frac{\text{Wet weight - Dry weight}}{\text{Dry weight}} \, x100 \right)$$

| Specimen preparation | : | Supplied by client. |
| | | Sample was cut into rectangular shaped specimen ($\sim 25 \times 75 \times 5.6$ mm^3). |
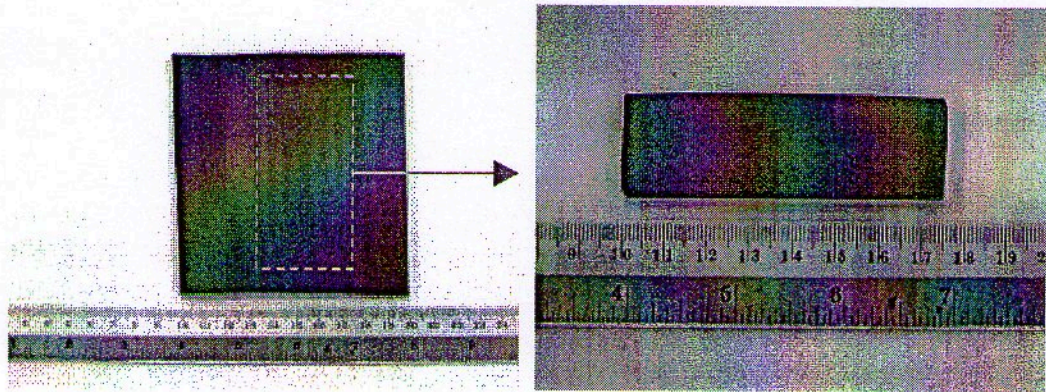
Figure 9 : Sample.

Results :

| Sample	Specimen Number	Water Absorption at 24 Hours Immersion (%)
Bond PVC Waterstop	1	0.026
	2	0.028
	3	0.027
	4	0.026
	5	0.025
Average		0.026
SD.		0.001

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Instruments used	:	- Balance with density kit
		(Mettler Toledo AG204, S/N M1-1 0509-38)
		- Vernier Caliper (Mitutoyo, S/N 05 37 7357)
Test method	:	Specific Gravity
Test conditions	:	Specimen was weighed in air and recorded. It was then submerged in water and the weight was recorded again. Specific gravity was calculated from the equation as following

$$\text{Specific Gravity (ASTM D792)} = \left(\frac{\text{Weight in air}}{\text{Weight in air - Weight in water}} \right)$$

| **Specimen preparation** | : | Supplied by client. |
| | | Sample was cut into rectangular shaped specimens (~11x11x5.6 mm³). |
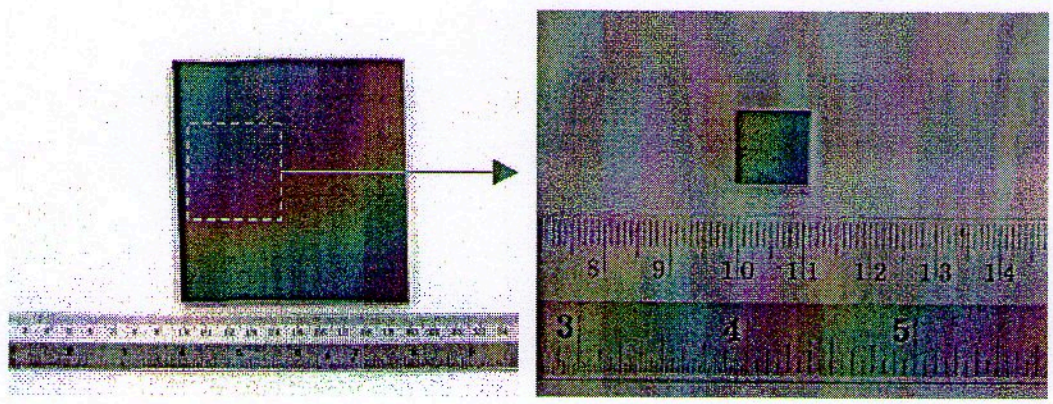
Figure 10 : Sample and specimen.

Results :

Sample	Specimen Number	Specific Gravity
	1	1.34
	2	1.34
Bond PVC Waterstop	3	1.34
	4	1.34
	5	1.34
Average		1.34
SD.		0.00

Interpretation/Opinions :
None

Attached pages :
Attached page 1 : Stress-strain curves of tensile tested sample (Bond PVC Waterstop).
Attached page 2 : Load-displacement curves of tear tested sample (Bond PVC Waterstop).

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Work performed by :

(Mr. Thawatchai Singsom)
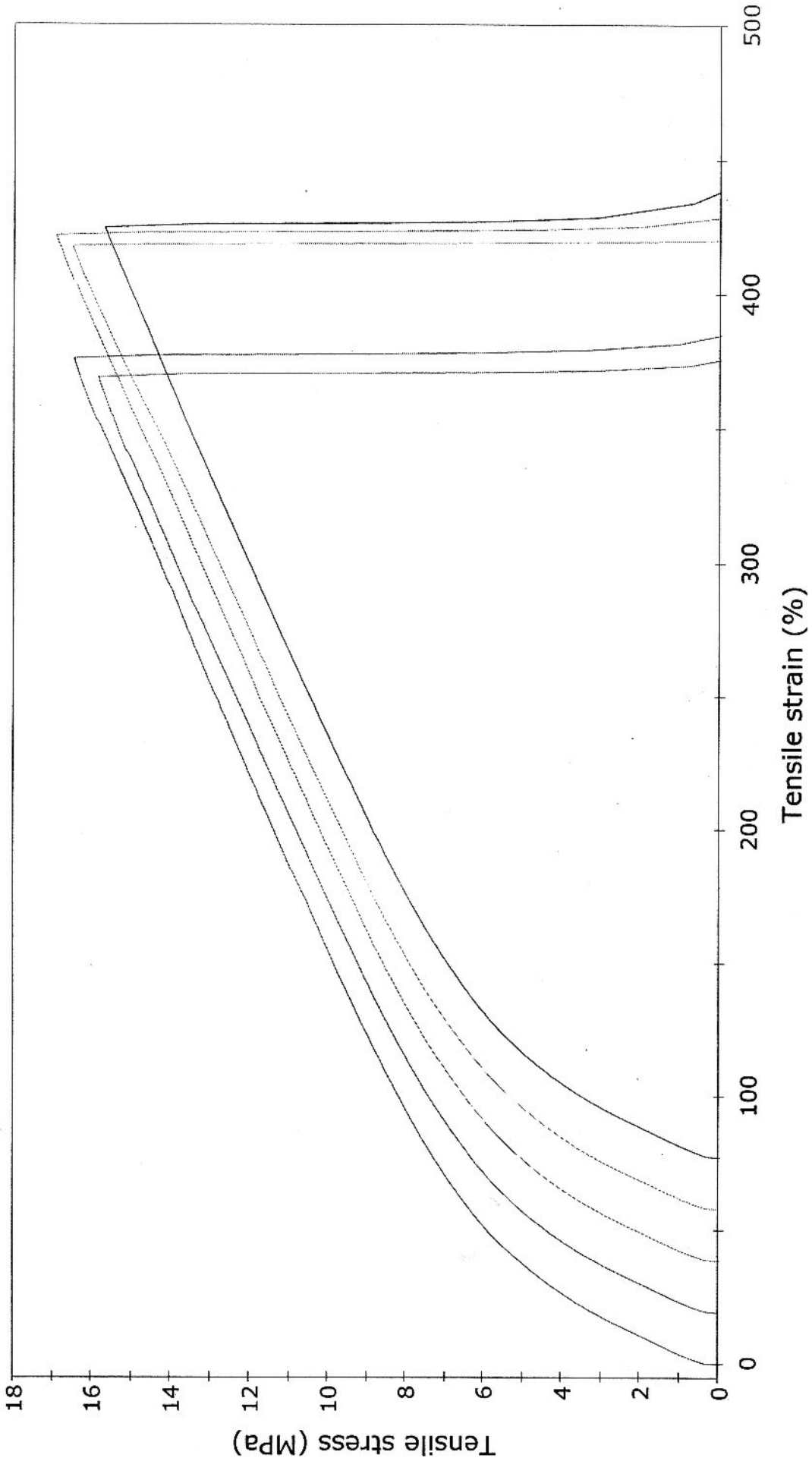Laboratory Officer 1

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Laboratory Officer 2

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(Dr. Jintamai Suwanprateeb)
Researcher 3

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Bond PVC Waterstop

Tensile strain (%)

Tensile stress (MPa)

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Bond PVC Waterstop

Load (N) vs Extension (mm)

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