

SUMMERMORE Pty Ltd ABN 42 108 898 433
PO Box 1671,
Browns Plains BC,
Queensland, 4118
Tel: 07 3800 0973 Fax: 07 3800 1860

Monday, 9 March 2015

Polyworld
14 – 20 Robson St
Clontarf
QLD 4019

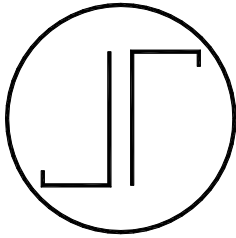
RE: Report on Spiral Wound Structure Wall HDPE Pipe Testing

We have pleasure in presenting the enclosed report and certification to you with respect to recent testing.

Should you have any queries with regard to the contents of the report, please do not hesitate to contact us.

Yours Faithfully

Ron Bell
Summermore Pty Ltd



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14 – 20 Robson St
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QLD 4019

RE: Testing of Spiral Wound Structure Wall HDPE Pipe

The purpose of this letter is to certify the results of testing of the Spiral Wound Structure Wall HDPE Pipe.

Observation:

The testing was completed at the Polyworld Test Facility and the University of Southern Queensland. Summermore was supplied with the test reports for analysis

Certification

We, Summermore Pty Ltd, being Registered Structural and Civil Engineers, hereby confirm that the Spiral Wound Structure Wall HDPE Pipe samples tested provide an alternative to other subterranean pipes as set out in the test report (15-7486) which provides data for design of the pipes to comply with the following Australian Standards.

AS/NZS 2566:1998 Buried flexible pipelines. Part 1: Structural design
AS/NZS 2033:2008 Installation of polyethylene pipe systems
AS/NZS 4130:2009 Polyethylene (PE) pipes for pressure applications
AS/NZS 4131:2003 Polyethylene (PE) compounds for pressure pipes and fittings
AS/NZS 5065:2005 Polyethylene and polypropylene pipes and fittings for drainage and sewerage applications

Summermore Pty Ltd accepts no responsibility for information that has not been expressly identified as part of this certification.

If we can be of any further assistance in this matter, please do not hesitate to contact this office.

Certified by

Ronald Bell

Grad Cert (Tech Mgt), BEng Civil (Hons), PEng, MIEAust (891940), MIPENZ(1027605), RPEQ (6715), RBP(Vic) EC27967, RBP(NT)(60596ES), MAIB (9225), JP(Qual).

Director

Summermore Pty Ltd

Polyworld
Spiral Wound Structure Wall HDPE Pipe
Testing Report

COMPILED FOR

Polyworld

BY SUMMMERMORE PTY LTD

March 2015

1.0 Introduction:

The aim of this report is to investigate the behaviour of the Spiral Wound Structure Wall HDPE Pipe and define the design properties for use as a structural member as outlined in the Building Code of Australia.

2.0 Sample Test Method:

The samples were tested as detailed in the attached reports from the University of Southern Queensland and Polyworld.

2.1 Selection of Materials

Summermore Pty Ltd had no input into the selection of materials used to manufacture the samples. Polyworld supplied the samples with no preference to sampling materials.

2.2 Material

The sample pipes were extruded from Qenos Alkadyne Polyethylene to form a box section that is wound spirally and welded inline to form a pipe.

The properties of the material are:

Density (ρ):	958kg/m ³
Stiffness $E_{\text{short term}}$:	1000MPa
Modulus G:	850MPa
Linear Expansion (α):	130x10 ⁻⁶ m/m.K
Thermal Conductivity (κ):	0.36 W/m°C
Poisson's Ratio (ν):	0.4

2.3 Weld Strength Test

Coupons of the welded section of the sample pipes were tested to determine the weld strength at USQ by placing the coupons in tension recording load versus elongation.

2.4 Stiffness Test

Sections of the sample pipes were tested to determine their stiffness at Polyworld by placing the samples in sectional compression recording load versus deflection.

3.0 Detailed Analysis:

3.1 Raw Data Weld Strength

The raw data is presented in the table below.

Specimen #	Avg Weld Thick mm	Avg Width mm (at weld)	Cross Sectional Area mm ²	Peak Load N	Load Per mm Width N/mm	Peak Stress MPa
1	11.69	10.93	127.77	1391	127.26	10.89
2	13.10	11.65	152.62	1474	126.54	9.66
3	12.42	12.35	153.39	1578	127.75	10.29
4	12.44	12.66	157.49	1959	154.71	12.44
5	9.76	17.12	167.09	2240	130.84	13.41
Mean	11.88	12.94	151.67	1728	133.42	11.33
Std Dev	1.29	2.43	14.55	359	12.01	1.55
COV	10.83	18.77	9.59	20.78	9.00	13.67

3.1.1 Test Load Analysis

The raw data produces a coefficient of variation for the peak stress of 13.67% over the five tested coupons. Using the table below (AS1170.0—Table B1), the factor k_t for testing variability is 1.41 for the samples. This results in limiting the weld stresses to 8.03MPa.

TABLE B1
VALUES OF k_t TO ALLOW FOR VARIABILITY
OF STRUCTURAL UNITS

Number of units to be tested	Coefficient of variation of structural characteristics (V_{sc}), percent						
	5	10	15	20	25	30	40
1	1.20	1.46	1.79	2.21	2.75	3.45	5.2
2	1.17	1.38	1.64	1.96	2.36	2.86	3.9
3	1.15	1.33	1.56	1.83	2.16	2.56	3.3
4	1.15	1.30	1.50	1.74	2.03	2.37	2.9
5	1.13	1.28	1.46	1.67	1.93	2.23	2.7
10	1.10	1.21	1.34	1.49	1.66	1.85	2.1

NOTE: For values between those listed in the Table, interpolation may be used. Extrapolation is not permitted.

3.2 Raw Data Stiffness

The raw data is presented in the tables below.

800ø x 12000mm

1000mm from entrance				3000mm from entrance			
Load (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)	Load (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)
0.0	880	0	0.0	0	880	0	0.0
2.3	865	15	1.7	1.8	865	15	1.7
3.9	845	35	4.0	3.6	845	35	4.0
5.1	815	65	7.4	5.2	825	55	6.3
5.9	810	70	8.0	6.9	795	85	9.7
7.3	775	105	11.9	7.6	775	105	11.9

1200ø x 12000mm

1000mm from entrance				3000mm from entrance			
Load in (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)	Load in (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate(%)
0.0	1335	0	0.0	0	1335	0	0.0
1.5	1325	10	0.7	2.5	1320	15	1.1
3.3	1310	25	1.9	4.3	1290	45	3.4
5.3	1285	50	3.7	5.6	1280	55	4.1
5.8	1275	60	4.5	7.4	1260	75	5.6
8.3	1245	90	6.7	9	1240	95	7.1
9.9	1205	130	9.7	10.1	1225	110	8.2
10.7	1175	160	12.0	11	1205	130	9.7
				12.4	1170	165	12.4

3000ø x 4100mm

Test direct at the edge			
Load in (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)
0.0	3325	0	0.0
3.0	3305	20	0.6
5.5	3290	35	1.1
7.5	3275	50	1.5
9.3	3255	70	2.1
12.1	3210	115	3.5

3.3 Ring Stiffness Calculation

$$\text{Ring Stiffness } R_s = E_o I / D_m^3$$

Where $E_o = 1000 \text{ MPa}$

I is calculated from the geometry of the true profiled wall

D_m = Mean diameter of pipe

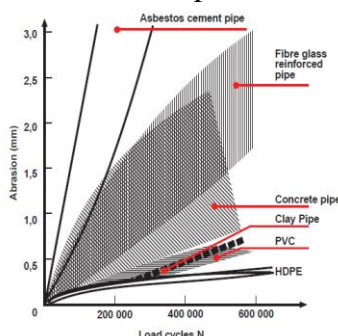
These results are included in the section properties table at the end of this report.

3.4 Pipe Corrosion

HDPE pipes are highly resistant to bacterial and chemical corrosion. An exception is that HDPE will corrode when in contact with hydrocarbons.

3.5 Pipe Abrasion

HDPE pipes have a very low rate of abrasion when compared to other pipe materials.



3.6 Hydraulic Design

Colebrook-White Formula

$$u = -2\sqrt{2gd} \cdot \log \left(-\frac{k}{3.7d} + \frac{2.51v}{d\sqrt{2gd}} \right)$$

v = kinematic viscosity (m^2/s)

d = internal diameter (m)

g = acceleration due to gravity (9.81m/s^2)

u = velocity (m/s)

l = hydraulic gradient (‰)

k = roughness coefficient (m),

COLEBROOK-WHITE $k_{\text{Polynex Pipe}} = 0.03\text{mm}$

MANNING $m = 0.01$

HAZEN WILLIAMS $C = 149$

3.7 Pipe Deflection Design Guide

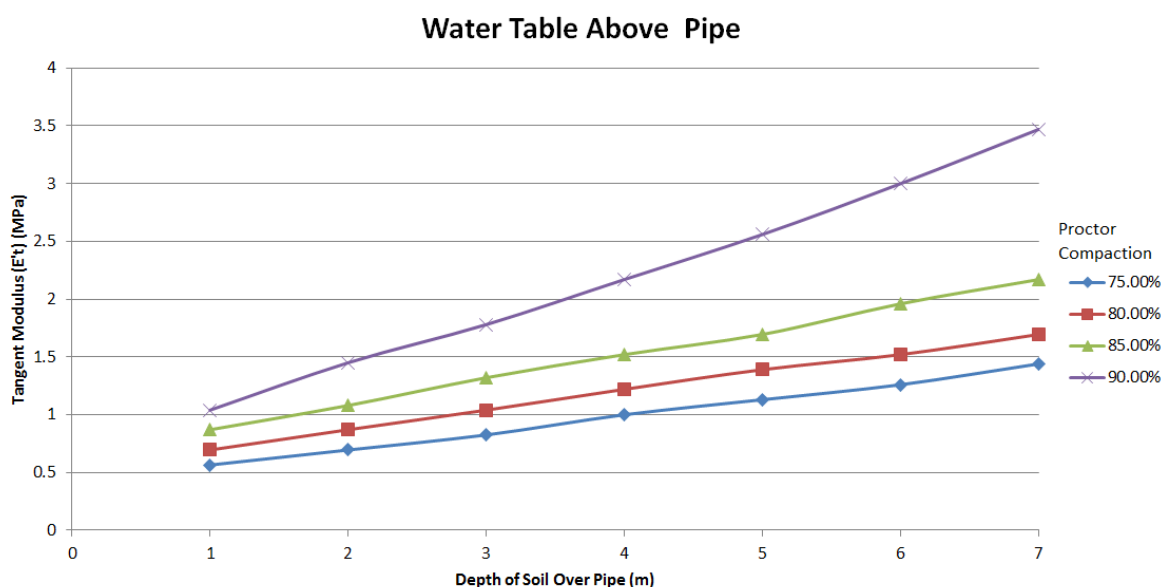
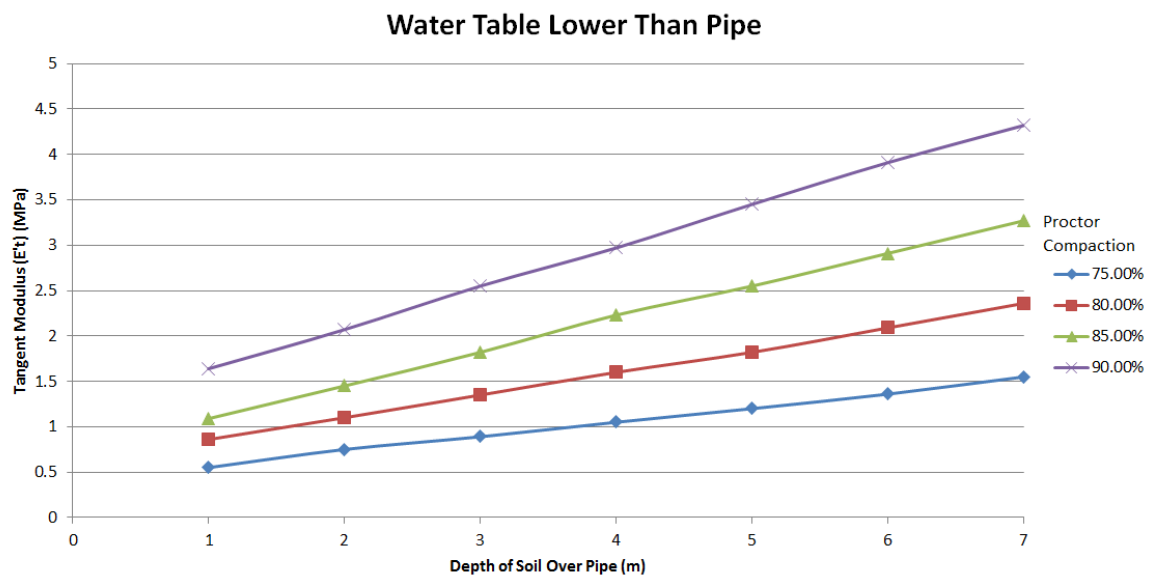
Pipe Deflection (%) for Good Compaction (>94% modified Proctor) for 6m soil depth

Soil Type	Light			Heavy		
	Short Term Average	Short Term Maximum	Maximum Long Term	Short Term Average	Short Term Maximum	Maximum Long Term
Poorly Graded Gravel	1.6	2.4	3.2	1.4	2.1	2.8
Well Graded Gravel / Sand	1.8	2.7	3.6	1.6	2.4	3.2
Mixed Granular Soils with low fines	2.2	3.3	4.4	1.9	2.9	3.8
Mixed Granular Soils with high fines	2.9	4.4	5.8	2.4	3.6	4.8
Fine Grained Cohesive Soils	3.2	4.8	6.4	2.6	3.9	5.2

3.8 Pipe Buckling Design

$$P_{bs} = 5.63 \sqrt{SN \cdot E'_t / n}$$

P_{bs} Buckling Pressure (MPa)
 SN Ring Stiffness (MPa)
 E'_t Tangent Modulus of Soil (MPa)
 N Factor of Safety



3.9 Pipe Section Properties

Polyworld Polynex Pipe Section Properties									
Light									
Nominal Diameter (mm)	w (mm)	d (mm)	t (mm)	A _{section} (mm ²)	I _{section} (mm ⁴)	A _{pipe} (mm ² /m)	I _{pipe} (mm ⁴ /m)	Ring Stiffness (N/mm ²)	SN
500	25	33	3.3	339	2.93E+04	6.94E+03	3.75E+08	2592	SN2
600	31	41	3.8	489	6.61E+04	9.28E+03	7.50E+08	2985	SN2
800	44	57	4.8	877	2.44E+05	1.49E+04	2.27E+09	3770	SN2
1000	50	67	6	1260	4.46E+05	2.24E+04	5.46E+09	4712	SN4
1200	62	67	6.8	1569	8.26E+05	2.99E+04	1.07E+10	5341	SN4
1400	71	81	7	1932	1.38E+06	3.58E+04	1.75E+10	5498	SN4
1600	85	92	8	2576	2.63E+06	4.59E+04	3.01E+10	6283	SN4
1800	95	104	8.5	3094	3.99E+06	5.45E+04	4.54E+10	6676	SN4
2000	105	118	10	4060	6.37E+06	7.01E+04	7.33E+10	7854	SN4
2200	115	130	11	4906	9.24E+06	8.40E+04	1.07E+11	8639	SN8
2400	125	142	13	6266	1.37E+07	1.07E+05	1.64E+11	10210	SN10
2600	135	154	15	7770	1.96E+07	1.32E+05	2.41E+11	11781	SN10
2800	145	165	17	9384	2.70E+07	1.60E+05	3.41E+11	13352	SN10
3000	165	185	18	11304	4.26E+07	1.81E+05	4.48E+11	14137	SN10

Heavy									
Nominal Diameter (mm)	w (mm)	d (mm)	t (mm)	A _{section} (mm ²)	I _{section} (mm ⁴)	A _{pipe} (mm ² /m)	I _{pipe} (mm ⁴ /m)	Ring Stiffness (N/mm ²)	SN
500	33	41	3.5	469	7.30E+04	7.30E+03	4.16E+08	2749	SN2
600	39	49	4	640	1.40E+05	9.71E+03	8.20E+08	3142	SN2
800	50	67	5.5	1166	4.21E+05	1.67E+04	2.65E+09	4320	SN4
1000	62	67	6.8	1569	8.26E+05	2.50E+04	6.40E+09	5341	SN4
1200	75	81	7.8	2190	1.71E+06	3.38E+04	1.27E+10	6126	SN4
1400	95	104	8.2	2995	3.89E+06	4.12E+04	2.15E+10	6440	SN4
1600	105	118	9.5	3876	6.14E+06	5.37E+04	3.70E+10	7461	SN4
1800	115	130	11	4906	9.24E+06	6.89E+04	6.07E+10	8639	SN8
2000	125	142	13	6266	1.37E+07	8.92E+04	9.80E+10	10210	SN10
2200	135	154	15	7770	1.96E+07	1.12E+05	1.50E+11	11781	SN10
2400	145	165	17	9384	2.70E+07	1.37E+05	2.20E+11	13352	SN10
2600	165	185	18	11304	4.26E+07	1.57E+05	2.99E+11	14137	SN10
2800	170	194	20	12960	5.12E+07	1.87E+05	4.12E+11	15708	SN10
3000	185	210	22	15444	7.20E+07	2.19E+05	5.58E+11	17279	SN10

3.10 Minimum Pipe Cover

The minimum cover requirements are shown in the table below to ensure adequate protection from external loads.

Type of External Loads		Minimum Cover (mm)
Open Country		300
Traffic Loads	Not Paved	500
	Sealed Pavement	600
	Unsealed Pavement	750
	Construction Equipment	800
	Embankment	800

3.11 Backfilling

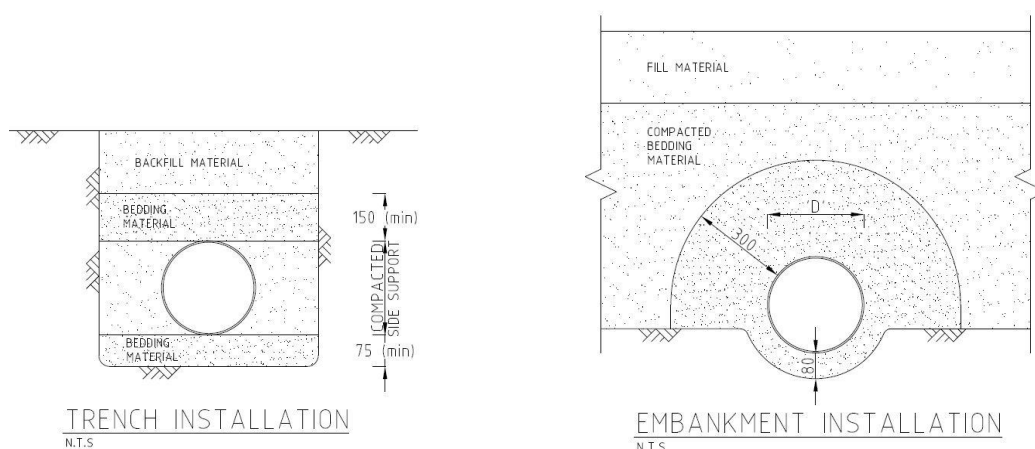
The excavated trench floors must be trimmed and be free from all rocks and hard objects. In poor soil conditions, an additional layer of imported bedding material may need to be introduced restrained by geofabric

The bedding materials used in both trenches and embankments should be a minimum of 75 millimetres depth of sand or soil free from rocks greater than 15 mm, and any hard clay lumps greater than 75 mm in size.

Sidefill materials should be built up equally on both sides of the pipes in layers of 150—200 mm and compacted evenly to the design level. The sidefill material shall be a mixture of sand/cement in the ratio of 14:1 and must be carefully placed around the haunches of the pipes to ensure that the pipes are evenly supported.

Vibrating plate compactors must not be used until there is a 300mm layer of overlay soil over the crown of the pipe.

The remainder of the trench, or embankment fill may be made with the previously excavated materials which must be free from large rocks, vegetable matter, and contaminated materials and all materials must have a maximum particle size less than 75 mm.



3.12 Service Life

The material used in the manufacture of these pipes is very durable and take many hundreds of years to break down. The service life of the pipe as a structure must be defined as a function of the method of use. The pipes can be expected suffer stress fatigue cracking over time and a realistic service life of 50 years is recommended.

4.0 Conclusion:

The test results show that the Spiral Wound Structure Wall HDPE Pipe samples tested provide an alternative to other subterranean pipes and this report provides data for design of the pipes.

Regulatory Data Sheet

GRADES:

- Alkadyne[®] - HDF145B, HDF193B, HDF193N and LL0228.

- Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

This product is not manufactured or formulated so as to intentionally include notifiable levels of any of the Substances of Very High Concern (SVHC) as per the candidate list that was current as of the effective date of this Regulatory Data Sheet. For further information regarding REACH please contact your primary Qenos representative.

- Adipates

Adipates, including those listed below, are not intentionally used, or added, in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Bis(2-ethylhexyl) adipate (DEHA)
- Dibutyl adipate
- Diethyl adipate
- Ethyl hydrogen adipate
- Dioctyl adipate (DOA)
- Di-n-alkyl adipate

- Allergens

The following substances are not intentionally used, or added, in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Cereals containing gluten (i.e. wheat, rye, barley, oats, spelt, kamut or their hybridised strains) and products thereof
- Crustaceans and products thereof
- Eggs and products thereof
- Fish and products thereof
- Peanuts and products thereof

- Soybeans and products thereof
- Milk and products thereof (including lactose)
- Tree nuts and products thereof
- Celery
- Mustard
- Sesame seeds and products thereof
- Sulphur dioxide and sulphites

- Bisphenol A (BPA) and Bisphenol S (BPS)

Bisphenol A, CAS number 80-05-7, and Bisphenol S, CAS number 80-09-1, are not intentionally used, or added, in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Butylated hydroxytoluene (BHT)

Butylated hydroxytoluene, CAS number 128-37-0, is not intentionally added in the formulation or manufacture of any Qenos polyethylene grades. However, we do not routinely test for this substance.

- Conflict minerals

Tin, tantalum, tungsten, gold, columbite-tantalite (coltan), cassiterite and wolframite are not intentionally added in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Heavy metals, polybrominated biphenyls, polybrominated diphenyl ethers and polychlorinated biphenyls

This product is not manufactured or formulated so as to intentionally include notifiable levels of lead, mercury, cadmium, hexavalent chromium, polybrominated biphenyls (PBB), polybrominated diphenyl ethers (PBDE) and polychlorinated biphenyls (PCB). Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Melamine

Melamine, CAS number 108-78-1, is not intentionally used, or added, in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for this substance.

- Natural Rubber or Latex

Natural rubber or latex are not intentionally used, or added, in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Phthalates

Phthalates, including those listed below, are not intentionally used, or added, in the formulation or manufacture of any Qenos polyethylene grades. Qenos also has in place quality assurance systems to ensure, as far as reasonably practical, that such substances are not inadvertently added. However, we do not routinely test for these substances.

- Di-2-ethylhexyl phthalate (DEHP)
- Di-n-octyl phthalate (DNOP)
- Benzyl butyl phthalate (BBP)
- Diisodecyl phthalate (DIDP)
- Diisobutyl phthalate (DIBP)
- Diisononyl phthalate (DINP)
- Diethyl phthalate (DEP)
- Dibutyl phthalate (DBP)
- Dimethylglycol phthalate (DMEP)
- Bis(2-ethoxyethyl) phthalate (BEEP)
- Bis(2-butoxyethyl) phthalate (BBEP)
- Bis(4-methylpentyl) phthalate (BMPP)
- Dipentyl phthalate
- Dihexyl phthalate (DHP)
- Dinonyl phthalate (DNP)
- Diphenyl phthalate
- Dimethyl phthalate (DMP)
- Dicyclohexyl phthalate (DCHP)
- Dipropyl phthalate

In using Qenos Pty Ltd's products; you must establish for yourself the most suitable formulation; production method and control tests; to ensure the uniformity and quality of your product in compliance with all laws. You should ensure that you have conducted your own investigations before making any representations as to your product's compliance with any regulatory standards. No warranty is given in relation to the information contained in this document.

Material Safety Data Sheet

infosafe
CS: 1.7.2

Page: 1 of 3

Infosafe No™ KP003 Issue Date : August 2014 APPROVED by QENOS

Product Name **BLACK PIGMENTED MDPE AND HDPE**

Not classified as hazardous

1. IDENTIFICATION OF THE SUBSTANCE/PREPARATION AND COMPANY/UNDERTAKING

Product Name	BLACK PIGMENTED MDPE AND HDPE																				
Product Use	Black pigmented extrusion applications (Medium and high density polyethylene).																				
Company Name	QENOS PTY LTD																				
Address	471 - 513 Kororoit Creek Road, ALTONA VIC 3018 Australia																				
Emergency Tel.	(03) 9258 7333																				
Telephone	Tel: (03) 9258 7333																				
Number/Fax	Fax: (03) 9360 9027																				
Other Names	<table><tr><td><u>Name</u></td><td><u>Product Code</u></td></tr><tr><td>HIGH DENSITY POLYETHYLENE (HDPE)</td><td></td></tr><tr><td>MEDIUM DENSITY POLYETHYLENE (MDPE)</td><td></td></tr><tr><td>ALKADYNE®</td><td></td></tr><tr><td colspan="2">-----</td></tr><tr><td>Alkadyne® grades:</td><td></td></tr><tr><td>GM5049B, HD700B, HDF145B,</td><td></td></tr><tr><td>HDF193B, HCR193BX, MD0898, MD0898-1.</td><td></td></tr><tr><td colspan="2">-----</td></tr><tr><td>BMSSBLK, MD600.</td><td></td></tr></table>	<u>Name</u>	<u>Product Code</u>	HIGH DENSITY POLYETHYLENE (HDPE)		MEDIUM DENSITY POLYETHYLENE (MDPE)		ALKADYNE®		-----		Alkadyne® grades:		GM5049B, HD700B, HDF145B,		HDF193B, HCR193BX, MD0898, MD0898-1.		-----		BMSSBLK, MD600.	
<u>Name</u>	<u>Product Code</u>																				
HIGH DENSITY POLYETHYLENE (HDPE)																					
MEDIUM DENSITY POLYETHYLENE (MDPE)																					
ALKADYNE®																					

Alkadyne® grades:																					
GM5049B, HD700B, HDF145B,																					
HDF193B, HCR193BX, MD0898, MD0898-1.																					

BMSSBLK, MD600.																					
Email	alan.findlay@qenos.com																				

2. COMPOSITION/INFORMATION ON INGREDIENTS

Chemical	Solid																				
Characterization																					
Ingredients	<table><tr><td><u>Name</u></td><td><u>CAS</u></td><td><u>Proportion</u></td><td><u>Hazard Symbol</u></td><td><u>Risk Phrase</u></td></tr><tr><td>POLYETHYLENE</td><td>9002-88-4</td><td>96-98 %</td><td></td><td></td></tr><tr><td>Carbon black</td><td>1333-86-4</td><td>2-3 %</td><td></td><td></td></tr><tr><td>PROPRIETARY ADDITIVES</td><td></td><td>0-1 %</td><td></td><td></td></tr></table>	<u>Name</u>	<u>CAS</u>	<u>Proportion</u>	<u>Hazard Symbol</u>	<u>Risk Phrase</u>	POLYETHYLENE	9002-88-4	96-98 %			Carbon black	1333-86-4	2-3 %			PROPRIETARY ADDITIVES		0-1 %		
<u>Name</u>	<u>CAS</u>	<u>Proportion</u>	<u>Hazard Symbol</u>	<u>Risk Phrase</u>																	
POLYETHYLENE	9002-88-4	96-98 %																			
Carbon black	1333-86-4	2-3 %																			
PROPRIETARY ADDITIVES		0-1 %																			

3. HAZARDS IDENTIFICATION

Chronic Effects	None known.
Inhalation	Inhalation of fines may cause irritation of nose and throat.
Ingestion	No known effects/minimal toxicity. May cause choking if swallowed.
Skin	Skin contact may result in mechanical injury or abrasion. This is a low risk hazard. Thermal burns may result from exposure to hot material.
Eye	Pellets and fines may scratch eye surfaces/cause mechanical irritation to eyes.

4. FIRST AID MEASURES

Inhalation	Remove victim to fresh air.
Ingestion	Not expected to be a problem. If uncomfortable seek medical assistance.
Skin	Wash contact area with soap and water. Molten material will adhere to skin and cause burns. Cool material as quickly as possible with water and see a physician for prompt removal of the adhering material and treatment of the burn. Do not remove material or clothing from skin. Removal may result in further damage to skin.
Eye	Flush with water in order to remove particulates.
Advice to Doctor	Advice as per above information.

5. FIRE FIGHTING MEASURES

Specific Hazards	EXTINGUISHING MEDIA: Carbon Dioxide, Foam, Dry Chemical, Water Fog or Fine Water Spray; SPECIAL FIRE FIGHTING PROCEDURES: Firefighters must use self contained breathing apparatus; Dust explosion hazard - High concentration of air-borne powders, fines or dust
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Material Safety Data Sheet

infosafe
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Infosafe No™ KP003 Issue Date : August 2014 APPROVED by QENOS

Product Name **BLACK PIGMENTED MDPE AND HDPE**

Not classified as hazardous

	may form explosive mixtures with air. Risk of dust explosion is increased if flammable vapour also present. Static electricity - May accumulate hazardous static charge when agitated in transfer handling systems. See section 7 for additional information.
Flash Point	None allocated
Flammable Limits	None allocated
LEL	
Flammability	Polymer may burn in presence of extreme heat and oxygen. Avoid extreme heat.

6. ACCIDENTAL RELEASE MEASURES

Spills & Disposal	1. Dampen down to prevent spread by wind. 2. Shovel or sweep up spilled material and dispose or recycle. 3. Disposal of recovered material should conform to local regulations. NOTE: Spilled pellets on surface/floors will create slip hazards and should be swept up promptly.
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7. HANDLING AND STORAGE

	Manage Dust explosion Hazard: Minimize production of fines/dust when handling PE polymer. Keep handling areas free of loose dust/powder and fines around handling systems and prevent build up and concentration of fines/dust on flat surfaces such as floors and other surfaces such as ducting, structure beams and ceilings. Manage Static Electricity hazard: Earth (ground) all material handling and transfer equipment to dissipate static electricity. Keep away from uncontrolled heat and other ignition sources. For additional information on control of static and potential dust and fire hazards, refer to NFPA -654 'Standard for the Prevention of Fire and Dust Explosions in the Chemical, Dye Pharmaceutical and Plastics Industries'.
Packaging	No special requirements.

8. EXPOSURE CONTROLS/PERSONAL PROTECTION

National Exposure Standards	Name	STEL		TWA		Footnote
		mg/m3	ppm	mg/m3	ppm	
	Carbon black			3		
Other Exposure Information	No exposure standard has been published by the National Occupational Health & Safety Commission (Worksafe Australia). Kemcor recommends a limit of 10 mg/m3 for nuisance dusts.					
Personal Protective Equipment	Thermal resistant gloves should be worn when handling hot materials. Use safety glasses. Under dusty conditions approved dust respirators should be worn to avoid exposure by inhalation.					
Eng. Controls	Good general ventilation is required under ordinary conditions of use.					

9. PHYSICAL AND CHEMICAL PROPERTIES

Appearance	Black pellets.
Melting Point	120 - 135°C
Boiling Point	None allocated
Specific Gravity (H2O=1)	None allocated
Vapour Pressure	None allocated
Flash Point	None allocated
Flammability	Polymer may burn in presence of extreme heat and oxygen. Avoid extreme heat.
Flammable Limits	None allocated
LEL	
Other Information	Density (Range): 0.930 - 0.970 g/cm3 Water Solubility: Negligible

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10. STABILITY AND REACTIVITY

Hazardous Reaction STABILITY (Thermal, Light, etc): Stable;
CONDITIONS TO AVOID: Extreme Heat;
INCOMPATIBILITY (Materials to Avoid): Strong oxidising agents;
HAZARDOUS DECOMPOSITION PRODUCTS: Carbon Monoxide, Aldehydes, Acetic Acid;
HAZARDOUS POLYMERISATION: Will not occur.

11. TOXICOLOGICAL INFORMATION

Inhalation Inhalation of fines may cause irritation of nose and throat.
Ingestion No known effects/minimal toxicity. May cause choking if swallowed.
Skin Skin contact may result in mechanical injury or abrasion. This is a low risk hazard. Thermal burns may result from exposure to hot material.
Eye Pellets and fines may scratch eye surfaces/cause mechanical irritation to eyes.
Chronic Effects None known.

12. ECOLOGICAL INFORMATION

Environ. Protection Pellets of resin considered environmentally inert.

13. DISPOSAL CONSIDERATIONS

14. TRANSPORT INFORMATION

Storage and Transport Not classified as Dangerous Goods, according to the Australian Code for the Transport of Dangerous Goods by Road and Rail.
The products listed in this MSDS are not classified as dangerous goods in the Australian Dangerous Goods Code.

15. REGULATORY INFORMATION

Poisons Schedule Not Scheduled
Packaging & Labelling No special requirements.

16. OTHER INFORMATION

Manufacturers Advice Conveying lines and equipment in material handling systems should be grounded to eliminate or reduce the build up of static electricity. Avoid sources of ignition in areas where fines may occur.
References Commonwealth of Australia, 'Australian Code for the Transport of Dangerous Goods by Road and Rail', Australian Government Publishing Service (1992).
Signature of Preparer/Data Service Updated 29/06/2005 - Updated 'Product Grades'
Poisons Schedule Not Scheduled
...End Of MSDS...

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Alkadyne™

Polyethylene



Grade	Major End Use
HDF193B	PIPE EXTRUSION

Description
Alkadyne HDF193B is a black high molecular weight bimodal PE100 High Density Polyethylene. It is a high performance resin for use in pressure pipes where service life to 100 years is required. Alkadyne HDF193B offers a balance of excellent processing characteristics along with outstanding toughness, chemical resistance and slow crack growth resistance. Alkadyne HDF193B will also provide excellent resistance to the effects of ultra-violet light exposure in outdoor applications due to well dispersed carbon black.

Application
Alkadyne HDF193B is suitable for extrusion into a full range of pipes, where High Density, PE 100 type resins are required. In particular, a broad processing window and good sag resistance enables the extrusion of larger bore, thick wall pipe. Alkadyne HDF193B is suitable for use in the transport of a wide range of fluids for industrial, rural and mining applications, including potable water. Suitability for use in any application should be determined by appropriate performance testing.

Compliance
HDF193B complies to AS/NZS 4131 2010 for PE100 type compounds. It is intended to be used in pipes conforming to AS/NZS 4130.

Safety
Material Safety Data Sheets are available for all Qenos polyethylene grades from Qenos.



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Telephone 61 3 9258 7333 Facsimile 61 3 9258 7451 Website www.qenos.com

Qenos Pty Ltd ACN 054 196 771

Grade
HDF193B

Physical Properties			
Property	Test Method	Value ¹	Units
<i>Base Polymer Properties</i>			
Melt Index @190°C, 5.0kg	ASTM D1238	0.3	g/10min
Melt Index @190°C, 21.6kg	ASTM D1238	8.9	g/10min
Density	Qenos method	0.956	g/cm ³
Tensile Strength at Break ²	ASTM D638	33	MPa
Tensile Strength at Yield ²	ASTM D638	26	MPa
Elongation at Break ²	ASTM D638	760	%
Elastic Modulus ²	ASTM D638	1300	MPa
Flexural Modulus ³ (1% secant)	ASTM D790	1150	MPa
Durometer Hardness	ASTM D2240	63	Shore D

1. Typical values - not to be construed as specifications.
2. At 50mm/min cross head speed, type 4 dumbbell and 1.9 mm thickness
3. At 12.7 mm/min cross head speed

For up to date information, refer to www.qenos.com

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Issue date: 25/1/2011 Refer to web site for latest version.	Version number: v 1.0
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WELD STRENGTH TESTING REPORT

Test Method: Client Specified

Test Date:
24/11/2014

Operator:
Wayne Crowell

Sample Information:

(A) Client Name:	Polyworld
(B) Mailing Address:	14 - 20 Robson Street
(C) Mailing Address:	Clontarf
(D) Mailing Address:	Qld 4019
(E) Attn:	Derwent Burisch
(F) Phone:	07 38895300
(G) Fax:	07 32846612
(H) Client Job ID:	Weld Strength Test – Trial Testing
(I) STS Job Number:	STS-14-208-WS
(J) Test Room Conditions:	23°C, 59% RH
(K) Conditioning Temp. & RH:	23°C, 50% RH Constant for 24 Hours
(L) Testing Speed (mm/min):	5

Test Equipment Details:

Test Machine:	MTS Insight
Location:	P9 110 Test Laboratory, CEEFC, USQ
Accuracy Grading:	Grade A

Testing Officer:

Digitally signed by Wayne Crowell
DN: cn=Wayne Crowell, o=CEEFC, ou=USQ,
email=crowellw@usq.edu.au, c=AU
Date: 2014.11.25 16:41:55 +10'00'

Disclaimer:

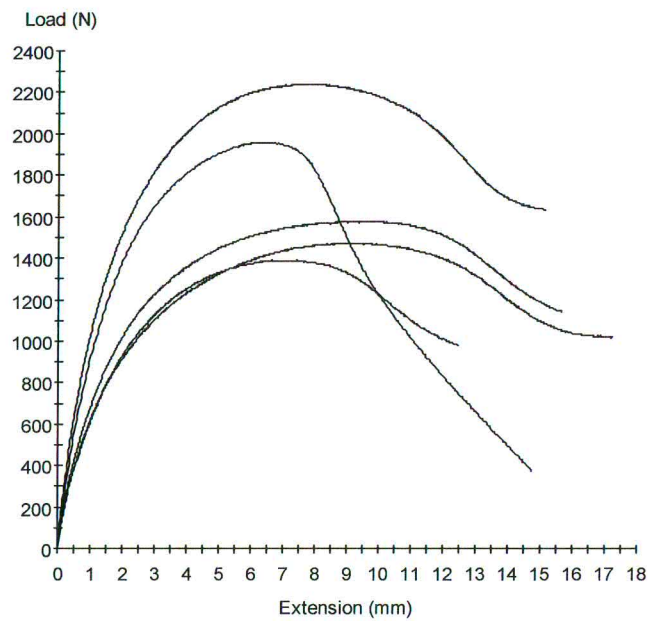
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Specimen Results:

Specimen #	Avg Weld Thick mm	Avg Width mm (at weld)	Cross Sectional Area mm ²	Peak Load N	Load Per mm Width N/mm	Peak Stress MPa
1	11.69	10.93	127.77	1391	127.26	10.89
2	13.10	11.65	152.62	1474	126.54	9.66
3	12.42	12.35	153.39	1578	127.75	10.29
4	12.44	12.66	157.49	1959	154.71	12.44
5	9.76	17.12	167.09	2240	130.84	13.41
Mean	11.88	12.94	151.67	1728	133.42	11.33
Std Dev	1.29	2.43	14.55	359	12.01	1.55
COV	10.83	18.77	9.59	20.78	9.00	13.67

Specimen Comments:

Specimen #	Failure Mode
1	Elongation of parent material
2	Elongation of parent material
3	Elongation of parent material
4	Elongation of parent material
5	Elongation of parent material



Load vs Extension Plot

Photographs:

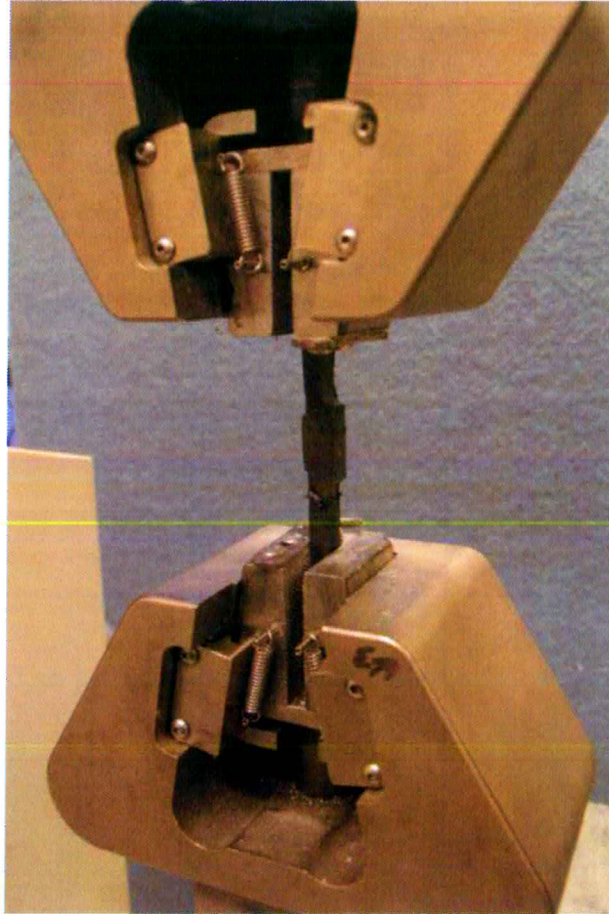


Photo 1: Typical test setup



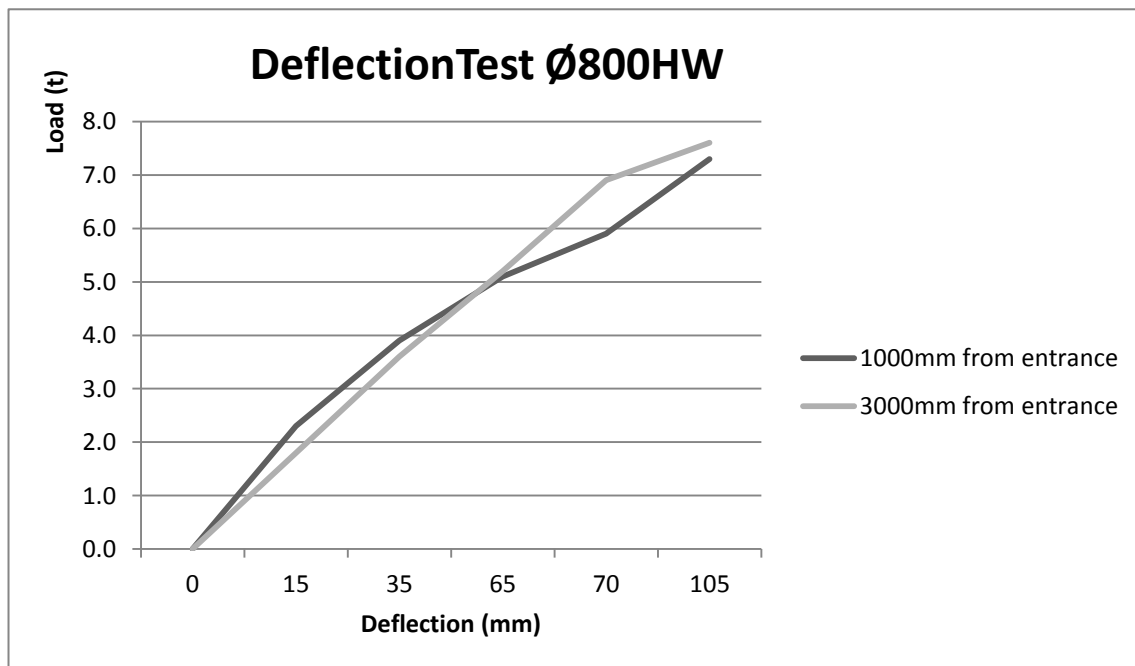
Photo 2: Test specimens after test showing failure mode

End of the Report

Date: 04.02.2014	Operator: Wieden	Test No.: 800HW
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Sample Size: Ø800*12000	Production Date:	Producer:
BatchNo.:		

Notes:							
1000mm from entrance				3000mm from entrance			
Load (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)	Load (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)
0.0	880	0	0.0	0	880	0	0.0
2.3	865	15	1.7	1.8	865	15	1.7
3.9	845	35	4.0	3.6	845	35	4.0
5.1	815	65	7.4	5.2	825	55	6.3
5.9	810	70	8.0	6.9	795	85	9.7
7.3	775	105	11.9	7.6	775	105	11.9

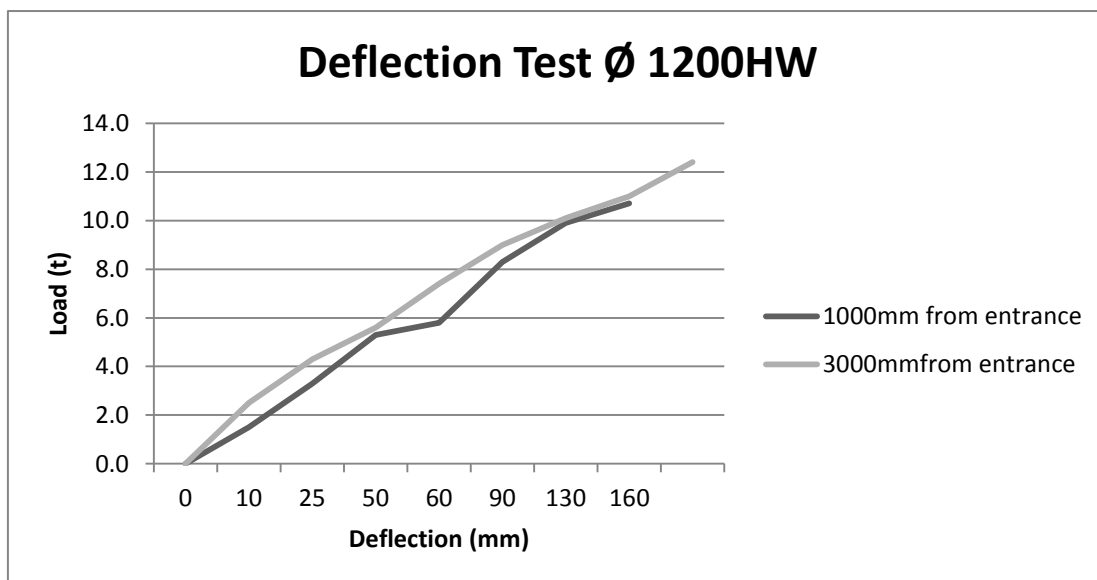


Date: 04.02.2014	Operator: Wieden	Test No.: 1200HW
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Sample Size: 1200*12000	Production Date:	Producer:
BatchNo.:		

Notes:

1000mm from entrance				3000mm from entrance			
Load in (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)	Load in (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate(%)
0.0	1335	0	0.0	0	1335	0	0.0
1.5	1325	10	0.7	2.5	1320	15	1.1
3.3	1310	25	1.9	4.3	1290	45	3.4
5.3	1285	50	3.7	5.6	1280	55	4.1
5.8	1275	60	4.5	7.4	1260	75	5.6
8.3	1245	90	6.7	9	1240	95	7.1
9.9	1205	130	9.7	10.1	1225	110	8.2
10.7	1175	160	12.0	11	1205	130	9.7
				12.4	1170	165	12.4



Date: 11.02.2014	Operator: Wieden	Test No.: 3000HW
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Sample Size: 3000*4100	Production Date:	Producer:
BatchNo.:		

Notes:

Test direct at the edge			
Load in (t)	Absolute Dimension (mm)	Deflection (mm)	Deflection Rate (%)
0.0	3325	0	0.0
3.0	3305	20	0.6
5.5	3290	35	1.1
7.5	3275	50	1.5
9.3	3255	70	2.1
12.1	3210	115	3.5

