

## **FORMIT SERVICES**

### **2000L LLDPE HOLDING TANK CERTIFICATION**

**31 October 2014**

**Rev No. 0**

Revision No.	Issue Date	Revision Details
0	31/10/2014	Issued for certification to Formit Services

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## 1. INTRODUCTION

In accordance with your request to provide a structural certification for the 2000L Linear Low Density Polyethylene (LLDPE) Holding Tank, we submit the following information.

## 2. ENGINEER

Zane Rendell B.E.(Civil)(Hons), Grad.I.E.Aust  
Graduate Structural / Civil Engineer

## 3. SUPERVISING ENGINEER

Nick Diemar B.E.(Civil)(Hons), M.I.E.Aust C.P.Eng.(NPER), RPEQ  
Lead Structural / Civil Engineer

## 4. GENERAL

This document should be read in conjunction with drawings provided by Formit Services, listed below in Table 1 and attached in Appendix A.

**Table 1: Engineering Drawings**

Drawing Number	Revision	Title
N/A	N/A	2000L Waste Tank

## 5. DESIGN BASIS

Our office was engaged to provide a design certification for a 2000L LLDPE Holding Tank. Two or three tanks can be utilised to create a 4000L or 6000L System. The waste tanks are housed with a steel support frame. This steel support frame also supports an ablution block above. The steel support frames are not covered in this certification, but have been previously certified by Izzat.

All design loads are as determined by SAA Loading Codes.

All design work was carried out in accordance with;

- AS1170.0 – 2002 Structural Design Actions Part 0: General Principles
- AS1170.1 – 2002 Structural Design Actions Part 1: Permanent, Imposed & Other Actions
- AS4100 – 1998 Steel Structures

And relevant sections of:

- AS1546.1 – 2008 On-site domestic wastewater treatment units - Septic tanks

Ultimate limit states design factors used in design are as follows:

- Liquid pressure factor of 1.2

## 6. DEFINED CRITERIA

Rational engineering judgement has been used to decide which components require checking with design certification calculations. The tank has been analysed by use of a finite element model incorporating the supporting steel frame.

## 7. DESIGN LOADINGS

The material thickness, and the internal pressure loads on the waste tank from the waste liquid, have been based on the following information provided by Formit Services:

- Specific gravity waste liquid = 1.05 (10.3 kN/m<sup>3</sup>)
- Average thickness (sides and top) = 5.8 mm
- Average thickness (base) = 6.36 mm

- Average thickness (base edges) = 8.33 mm

Design checks have been based on material properties provided by Price Plastics Pty Ltd, attached in Appendix A.

## 8. STATEMENTS

We certify that the LLDPE Waste Tank as detailed in the drawings noted in Table 1 (above), is structurally satisfactory for the Load Limits noted in section 7 above, provided the following are adhered to;

- The tank is to be fully emptied during lifting and transport.
- The above certificate is applicable only if the Tank is not affected by heat, adverse chemicals, excessive vibrations or other external factors unknown and not noted to the certifying engineer.
- The design certification is provided on the basis that materials used meet Australian Standards, and construction practices are in accordance with industry standards.
- No modifications shall be made from the drawings attached in Appendix A, and the frame is fully assembled.
- The Tank is to be supported by the Formit Services 4000L and 6000L steel support frames only.

## 9. DISCLAIMER

The design certification is provided on the basis that materials used meet Australian Standards, Construction practices are in accordance with industry standards and the structures exposure is not excessive with respect to vibration, corrosion or other external factors unknown and not notified to the certifying engineer. No modifications shall be made, which would significantly increase the mass, alter the stability or affect the design strength of the tank. An inspection of the tank at not more than 12 monthly intervals is recommended.

We trust the above information satisfies your requirements.

### Attachments

- Material Properties
- Drawings

## APPENDIX A

## Tensile Properties: 23°C



<b>Method</b>	ASTM D 638-02 Standard Test Method for Tensile Properties of Plastics		<i>Elastic modulus is defined as the slope of the initial linear portion of the stress versus strain curve.</i>
<b>Instrument</b>	Instron 5586 Materials Testing System		
<b>Specimen</b>	type conditioning other preparation specimen width specimen thickness specimen gage length	type I tensile bars 40 hrs 23°C 50% RH cut from plaques 12.77 mm 2.91 mm 50 mm	<i>True stress-true strain curves reflect the change in cross-sectional area as the specimen is deformed:</i>  <i>True stress = <math>\frac{\text{force} (1 + \text{strain})}{\text{initial specimen area}}</math></i>
<b>Parameters</b>	test temperature lab humidity crosshead speed # of replicates	23 °C 48 %RH 5 mm/min 5	<i>True strain = <math>\ln (1 + \text{strain})</math></i>
<b>Calculations</b>	strain range for E offset condition	0.05 - 0.25 % 0.2 %	
<b>Extensometry</b>	axial extensometer class	contact, 2" gage B-1	
<b>Uncertainty</b>	per standard		

### Properties

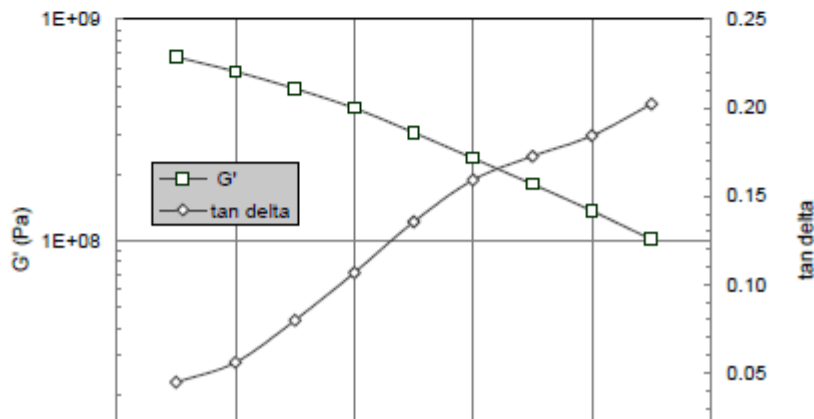
Replicate	Modulus E MPa	Offset Yield Stress MPa	Strain at Offset Yield %	Tensile Strength MPa	Strain at Ultimate %	Poisson's Ratio
1	792	5.9	0.92	16.7	13.01	0.429
2	820	5.6	0.85	16.5	13.63	0.463
3	851	5.8	0.85	16.8	13.47	0.467
4	815	5.7	0.87	16.7	13.87	0.433
5	829	5.8	0.87	17.0	13.39	0.451
Mean	821	5.7	0.87	16.7	13.47	0.449
Std Dev	21	0.1	0.03	0.2	0.32	0.017

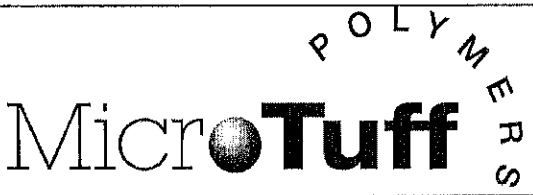
## Shear Modulus by DMA



<b>Method</b>	ASTM D 5279 - 01 Measuring the Dynamic Mechanical Properties of Plastics in Torsion	
<b>Instrument</b>	Rheometrics ARES DMA	
<b>Specimen</b>	type	ASTM flex bar
	conditioning	none
	other preparation	cut to size
	specimen width	12.89 mm
	specimen thickness	3.24 mm
<b>Parameters</b>	grip separation	32.09 mm
	temperature range	0-80 °C
	wait time	3 min
	frequency	1 Hz
	strain	0.1 %
	normal force	200 g
	sample atmosphere	N2
<b>Calibrations</b>	force (mass), strain, temperature (thermocouple)	
<b>Precision</b>	temperature	+/- 2 °C
<b>Uncertainty</b>	per standard	

**DMA Plot**



	Price Plastics Pty Ltd
Technical Data Sheet	

### **Microtuff® 6110 UV**

Microtuff® 6110 UV is a rotational moulding powder based on a hexene copolymer, linear low density polyethylene. Stabiliser packages and pigments in this grade were designed to cope with the demanding processing conditions experienced in rotational moulding.

Microtuff® 6110 UV is ideally suited for use in water tanks, chemical tanks, kayaks, materials handling and a wide range of other moulding applications.

Microtuff® 6110 UV provides excellent toughness and stiffness combined with a high ESCR and chemical resistance. It is UV stabilised for long term use in outdoor applications.

In a wide range of tank colours, Microtuff® 6110 UV has been issued with a Type Test certificate for compliance with AS4766:2006. In natural and tank colours, it meets the requirements of AS/NZS 4020 for use with potable water and AS 2070 for food contact. Volume, food type and end use restrictions may apply. For details on AS4766 compliance and on food and potable water status for other colours please contact your Price Plastics representative.

Physical Properties <sup>1</sup>			
Property	Test method	Value <sup>2</sup>	Unit
Melt Flow Index 190°C, 2.16 kg	ASTM D1238	3.0	g / 10 min
Density	ASTM D1505	0.938	g / cm <sup>3</sup>
ESCR (100% Igepal, condition A)	ASTM D1693	> 1000	hrs
Tensile Strength @ Yield <sup>3</sup>	ASTM D 638	19.5	MPa
Flexural Modulus (1% secant)	ASTM D790	800	MPa
Hydrostatic Design Base (23°C) <sup>4</sup>	ASTM D 2837	8.62	MPa
UV Rating	ASTM D2565	UV20	--

<sup>1</sup> Base resin properties as stated by the raw material manufacturer for virgin material

<sup>2</sup> typical values only – not to be construed as specifications

<sup>3</sup> At 50 mm/min crosshead speed

<sup>4</sup> Value must be derated for service temperatures above 23°C

This information is offered for your consideration and verification and should not be construed as a warranty or representation. Price Plastics Pty Ltd assumes no legal liability, except to the extent that such liability is imposed by legislation and cannot be excluded. The values are the results of testing on representative samples - the product supplied may not conform in all respects. The tests are based on natural resin, the addition of pigments and/or additives to the base resin may effect some properties.

When using this product you must establish for yourself the suitability of the product and the best production method and tests to ensure the uniformity and quality of your product in compliance with the law.

A Material Safety Data Sheet is available for this product.

Last revised: January 2014

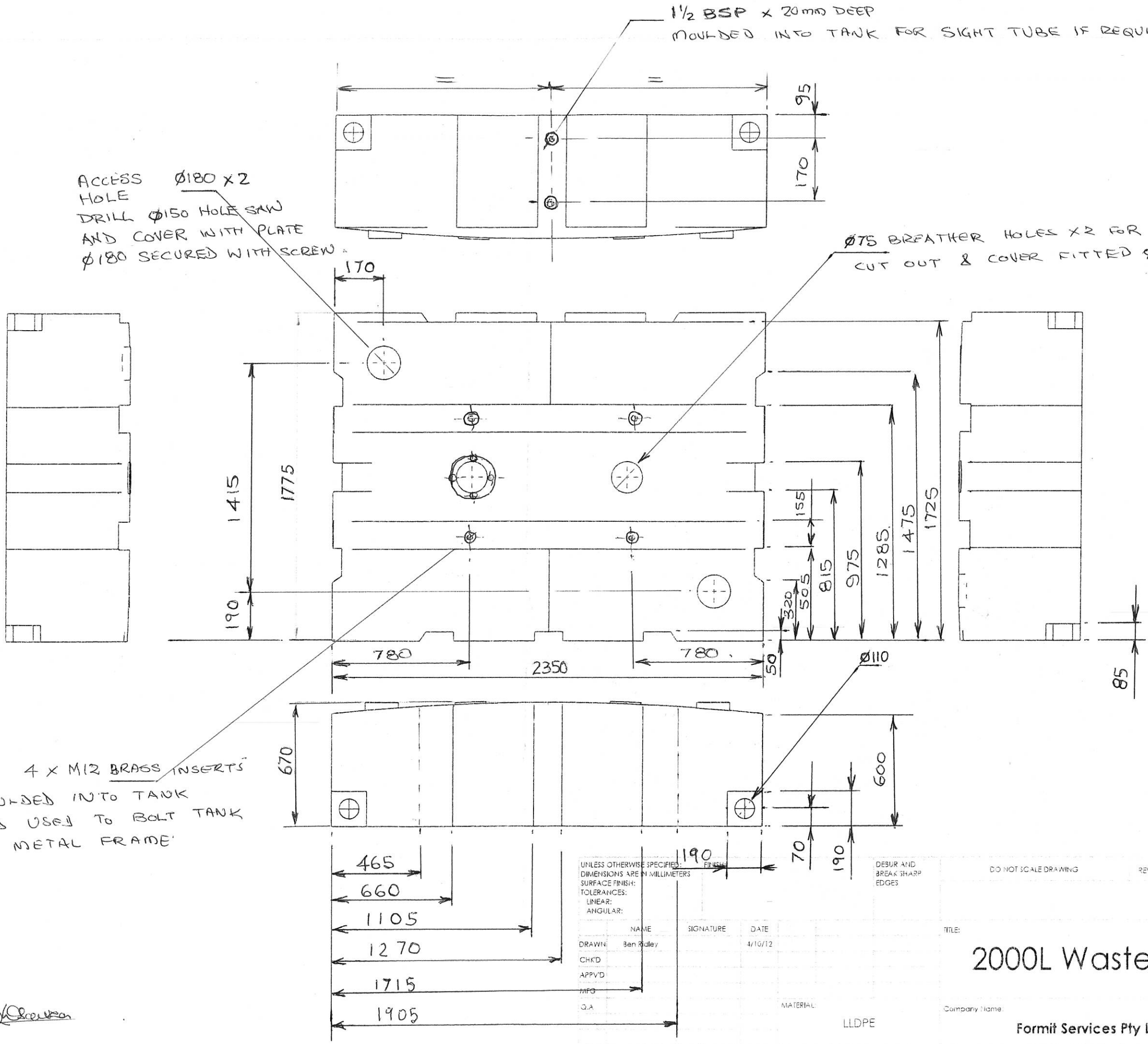
MICROTUFF

1/2 BSP x 20mm DEEP  
MOULDED INTO TANK FOR SIGHT TUBE IF REQUIRED

ACCESS HOLE  
HOLE  
DRILL Ø150 HOLE SAW  
AND COVER WITH PLATE  
Ø180 SECURED WITH SCREW

Ø75 BREATHER HOLES X2 FOR MOULDING  
CUT OUT & COVER FITTED Ø120 WITH 4 SCREWS

4 x M12 BRASS INSERTS  
MOULDED INTO TANK  
AND USED TO BOLT TANK  
TO METAL FRAME



UNLESS OTHERWISE SPECIFIED:  
DIMENSIONS ARE IN MILLIMETERS  
SURFACE FINISH:  
TOLERANCES:  
LINEAR:  
ANGULAR:

	NAME	SIGNATURE	DATE
DRAWN	Ben Riley		4/10/12
CHK'D			
APP'VD			
MFO			
Q.A			

DEBUR AND  
BREAK SHARP  
EDGES

DO NOT SCALE DRAWING

REVISION

TITLE:  
**2000L Waste Tank**

MATERIAL:  
LLDPE

Company Name:

**Formit Services Pty Ltd**

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SHEET 1 OF 1