



**ADVANTICA**

## Utility Distribution

*R 4782*

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### **ESTIMATION OF LEAKAGE FROM AUSTRALIAN DISTRIBUTION ASSET**

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*Confidential*

*Restricted to GTL & Advantica*

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## **Executive Summary**

GTL Business International approached Advantica to assist with the provision of lost gas estimates relating to an Australian distribution asset. The customer requested that the estimates should be consistent with the estimating methodologies currently utilised for estimating lost gas within the UK gas industry.

In order that this work could be undertaken, it was necessary to obtain asset material, diameter, and average system operating pressures for the various pressure tiers within the asset. This data was obtained from GTL Business International by the completion of a questionnaire supplied by Advantica which enabled the data to be presented in the most appropriate format. This data has been modelled and the leakage outputs produced utilising the same methodologies which are applied to leakage estimations for the networks within the UK gas industry.

For the pressure tiers  $\leq 75$  mbar and  $>75$  mbar – 2 bar, estimates of lost gas have been provided. For the pressure tiers 2 bar – 28 bar there are no leakage rates which have been established as a result of statistically robust leakage measurement surveys, and the customer has therefore been provided with an estimating methodology which would be applicable for estimates of this type.

**Project Code** :

**Distribution**

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## Contents

<b>1</b>	<b>INTRODUCTION</b> .....	<b>1</b>
1.1	MODELLING ASSUMPTIONS.....	1
<b>2</b>	<b>Leakage Estimates</b> .....	<b>1</b>
2.1	PRESSURE TIER $\leq$ 75 MBAR .....	1
2.1.1	<i>Assumptions for pressure tier <math>\leq</math> 75 mbar</i> .....	2
2.2	PRESSURE TIER $>$ 75 MBAR - 2 BAR.....	3
2.2.1	<i>Assumptions for pressure tier <math>&gt;</math>75 mbar – 2 bar</i> .....	3
2.3	PRESSURE TIERS 2 BAR – 28 BAR .....	4
2.4	TYPICAL LEAKAGE RATES FOR LOW PRESSURE SYSTEMS.....	4

## 1 INTRODUCTION

Following discussions with GTL Business International regarding the estimation of leakage for various pressure tiers within an Australian gas distribution network, an estimate has been produced which is based upon information supplied regarding the mains populations and operating pressures within the various pressure tiers. This data has been modelled and the leakage outputs produced utilising the same methodologies which are applied to leakage estimations for the networks within the UK gas industry.

### 1.1 Modelling Assumptions

In order to undertake the modelling exercise, it has been necessary to make a number of assumptions relating to the data and the estimating process. These have been highlighted in relation to the specific estimates being considered.

The outputs have been calculated in cubic metres per annum, and a calorific value of 39.469 megajoules per cubic metre utilised for conversion.

## 2 LEAKAGE ESTIMATES

### 2.1 Pressure Tier $\leq 75$ mbar

#### Mains Populations in kilometres

Material	$\leq 3''$	4 – 5''	6 – 7''	8 – 11''	$\geq 12''$
PE	4.36	3.51	0.42	4.82	0.00
Steel	235.94	298.32	105.99	41.10	20.42
Ductile	0.00	0.73	0.00	0.31	0.00
Pit Cast	12.08	1254.88	365.48	71.16	105.35
Other – Specify PVC	30.27	550.64	213.69	0.00	0.00

cast 27% mechanical joint, 73% lead yarn  
steel is 34% welded, 66% screwed  
All PE is fused.  
Ductile includes wrought and other

Total mains population 3,319.5 kilometres

### Service Population by connection type

Service Material	Mains Material	Number
Metal	Metal	145,509
Metal	PE	0
PE	Metal	26,735
PE	PE	55,416
Other - specify		
Total		227,660

Annual average system pressure 18.5 mbar

Annual average MEG % saturation level. 0%

Percentage of distribution system treated with MEG 0%

**Estimated leakage :**

<b>Mains</b>	<b>282.9 TJ</b>
<b>Services</b>	<b>28.1 TJ</b>

**1 terajoule [TJ] = 10<sup>12</sup> joules**

#### 2.1.1 Assumptions for pressure tier <= 75 mbar

A] Leakage rates are those derived from the British Gas National Leakage Tests undertaken in 1992 on a statistically robust sample of 574 low pressure mains within the UK. The relationship between pressure and leakage rates which was established by the tests has been applied to the estimation process.

B] The steel leakage rates used in the calculation represent a joint type split of welded 24.6%, screwed 42.6%, lead yarn 32.8%, as contained within the National Leakage Test sample. There are no individual rates available for steel mains with specific joint types.

C] Leakage rates for the pit cast iron mains have been adjusted to reflect the presence of 73% lead yarn joints.

D] As requested, a separate estimate for the PVC mains within the system has been undertaken utilising a leakage rate of 0.1m<sup>3</sup>/hr/km.

E] The estimate associated with the total leakage from low pressure mains and services following completion of the British Gas National Leakage Tests undertaken in 1992 had an accuracy of +/- 17%. The confidence interval for this result was 90%.

## 2.2 Pressure Tier >75 mbar - 2 bar

### Mains Populations in kilometres

Material	<=3"	4 – 5"	6 – 7"	8 – 11"	>=12"
PE	343.40	3.40	1.08	0.00	0.00
Steel	418.96	139.94	101.70	31.90	30.80
Ductile	0.15	0.00	0.00	0.00	0.00
Pit Cast	0.00	20.39	14.49	9.31	29.98
Other Specify PVC	0.00	0.15	0.00	0.00	0.00
All PE is fused Steel – 86% welded, 14% screwed Cast – 61% mechanical, 39% lead yarn Ductile includes wrought					

Total mains population 1,145.65 kilometres

### Service Population by connection type

Service Material	Mains Material	Number
Metal	Metal	21,780
Metal	PE	0
PE	Metal	17,932
PE	PE	17,352
Other -Specify		
Total		57,064

Annual average system pressure 550 mbar

Annual average MEG % saturation level. 0%

Percentage of distribution system treated with MEG 0%

**Estimated leakage: Mains 73.4 TJ**  
**Services 8.5 TJ**

### 2.2.1 Assumptions for pressure tier >75 mbar – 2 bar

A] There are no leakage rates which have been established as a result of statistically robust leakage measurement surveys. Leakage rates for mains within this pressure tier are assumed to be equivalent to the average leakage



rates of the material types established from the British Gas National Leakage Tests undertaken in 1992. The use of these rates follows correlation with field trial decay test evidence established following a measurement programme.

B] PVC mains within this pressure tier are assumed to have leakage rates equivalent to PE.

C] Cast mains are considered to be spun cast iron, with the appropriate average leakage rate applied.

### **2.3 Pressure Tiers 2 bar – 28 bar**

For pressure tiers above 2 bar, there are no leakage rates which have been established as a result of statistically robust leakage measurement surveys. Where estimates have been undertaken for these pressure tiers, the estimated loss has been based upon an assumption that the entire length of the system being considered is leaking at a rate equivalent to the maximum allowable loss which would be permissible when undertaking a pre-commissioning pressure test to current standards.

### **2.4 Typical Leakage Rates for Low Pressure Systems**

The following leakage rates represent typical values at 30 mbar:

<b>Material</b>	<b>Leakage Rate [m<sup>3</sup>/hr/km]</b>
Steel <=3"	0.05 – 0.10
Steel >=4"	0.4 – 0.6
Spun Cast <=5"	0.1 – 0.2
Spun Cast 6 – 7"	0.05 – 0.15
Spun Cast >=8"	0.15 – 0.30
Pit Cast <=3"	0.4 – 0.7
Pit Cast 4 – 5"	0.25 – 0.5
Pit Cast 6 – 7"	0.15 – 0.3
Pit Cast 8 – 11"	0.6 – 1.0
Pit Cast >=12"	1.5 – 2.0

<b>Material</b>	<b>Leakage Rate [m3/hr/km]</b>
Ductile Iron <=5"	0.1 – 0.3
Ductile Iron >=6"	0.05 – 0.2
All PE	0.01 – 0.03

These are typical leakage rates for low pressure mains and services which were identified from the British Gas 1992 National Leakage Tests. These rates are for guidance only and do not imply a mean or standard deviation.