

C A P E MODERN JV

URESTRUCT™

High Density PU Foam Technical Information

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URESTRUCT™

High Density PU Foam

Introduction

URESTRUCT™ is a high density CFC free closed cell polyurethane foam manufactured in Western Australia to engineering standards.

It is manufactured in a range of densities ranging from 160 Kg/m³ to 500 Kg/m³ and its strength gives it many uses in the structural field of engineering.

A major application for URESTRUCT™ is for insulated pipe supports where strength and insulation value is a prerequisite.

The service temperatures for URESTRUCT™ is from +120°C to -196°C making it especially suitable for use in industrial Cryogenic applications.

URESTRUCT™ can be manufactured in various block sizes and can also be supplied in moulded or cut shapes as required.

Please contact Cape Modern JV for further information.

**URESTRUCT™ HIGH DENSITY
POLYURETHANE FOAM PRODUCT
INFORMATION
(160 kg/m³ nom. density)**

PROPERTY	TEST METHOD	RESULT
Core Density :	ASTM D1622	160 Kg/m ³ (nom.)
Compressive Strength : (at 20°C)	ASTM D1621 perpendicular parallel	2.035 MPa 1.999 MPa
Compressive Strength : (at -196°C)	ASTM D1621 perpendicular parallel	3.300 MPa 3.494 MPa
Thermal Conductivity : (at 20° C)	ASTM C518	0.0292 W/mK
Thermal Conductivity : (at -160° C)	ASTM C177	0.0253 W/mK
Closed Cell Content :	ASTM D2856	95%
Leachable Halides :	ASTM D871	Less than 20 ppm
Flammability :	ASTM D1692	10/10 S.E. Extent of burn: 10.5 mm Extinguishing time: 0 sec Burn rate: 0 mm/sec
Tensile Strength : (at 22° C)	ASTM D1623	2.412 MPa
Tensile Strength : (at -196° C)	ASTM D1623	3.204 MPa
Tensile Modulus : (at -196° C)	ASTM D1623	11.8 MPa
Water Absorption :	ASTM D2842	0.17% Vol.

**URESTRUCT™ HIGH DENSITY
POLYURETHANE FOAM PRODUCT
INFORMATION
(224 kg/m³ nom. density)**

PROPERTY	TEST METHOD	RESULT
Core Density :	ASTM D1622	224 Kg/m ³ (nom.)
Compressive Strength : (at 20° C)	ASTM D1621 perpendicular parallel	4.563 MPa 3.819 MPa
Compressive Strength : (at -196° C)	ASTM D1621 perpendicular parallel	7.485 MPa 7.540 MPa
Thermal Conductivity : (at 20° C)	ASTM C518	0.0345 W/mK
Thermal Conductivity : (at -160° C)	ASTM C177	0.0316 W/mK
Closed Cell Content :	ASTM D2856	95%
Leachable Halides :	ASTM D871	Less than 20 ppm
Flammability :	ASTM D1692	10/10 S.E. Extent of burn: 9.5 mm Extinguishing time: 0 sec Burn rate: 0 mm/sec
Tensile Strength : (at 22° C)	ASTM D1623	3.517 MPa
Tensile Strength : (at -196° C)	ASTM D1623	4.854 MPa
Tensile Modulus : (at -196° C)	ASTM D1623	19.4 MPa
Water Absorption :	ASTM D2842	0.15% Vol.

**URESTRUCT™ HIGH DENSITY
POLYURETHANE FOAM PRODUCT
INFORMATION
(320 kg/m³ nom. density)**

PROPERTY	TEST METHOD	RESULT
Core Density :	ASTM D1622	320 Kg/m ³ (nom.)
Compressive Strength : (at 20° C)	ASTM D 1621 perpendicular parallel	8.144 MPa 9.114 MPa
Compressive Strength : (at -196° C)	ASTM D1621 perpendicular parallel	15.829 MPa 17.107 MPa
Thermal Conductivity : (at 20° C)	ASTM C518	0.0407 W/mK
Thermal Conductivity : (at -160° C)	ASTM C177	0.0346 W/mK
Closed Cell Content	ASTM D2856	95%
Leachable Halides	ASTM D871	Less than 20 ppm
Flammability	ASTM D 1692	10/10 S. E. Extent of burn: 8.0 mm Extinguishing time: 0 sec Burn rate: 0 mm/sec
Tensile Strength : (at 22° C)	ASTM D1623	6.649 MPa
Tensile Strength : (at -196° C)	ASTM D1623	8.305 MPa
Tensile Modulus : (at -196° C)	ASTM D1623	24.0 MPa
Water Absorption :	ASTM D2842	0.12% Vol.

URESTRUCT™
HIGH DENSITY POLYURETHANE FOAM
PRODUCT INFORMATION
(500 kg/m³ nom. density)

PROPERTY	TEST METHOD	RESULT
Core Density :	ASTM D1622	500 Kg/m ³ (nom.)
Compressive Strength : (at 20° C)	ASTM D1621 perpendicular parallel	22.998 MPa 21.217 MPa
Compressive Strength : (at -196° C)	ASTM D1621 perpendicular parallel	48.394 MPa 47.408 MPa
Thermal Conductivity : (at 20° C)	ASTM C518	0.0425 W/mK
Thermal Conductivity : (at -160° C)	ASTM C 177	0.039 W/mK
Closed Cell Content :	ASTM D2856	96%
Leachable Halides :	ASTM D871	Less than 20 ppm
Flammability :	ASTM D1692	10/10 S.E. Extent of burn: 7.0 mm Extinguishing time: 0 sec Burn rate: 0 mm/sec
Tensile Strength : (at 22° C)	ASTM D1623	12.582 MPa
Tensile Strength : (at -196° C)	ASTM D1623	15.055 MPa
Tensile Modulus : (at -196° C)	ASTM D1623	29.5 MPa
Water Absorption :	ASTM D2842	0.1 % Vol.

**TENSILE TESTING OF HIGH DENSITY POLYURETHANE FOAM
SAMPLES - ROOM TEMPERATURE TESTS****INTRODUCTION**

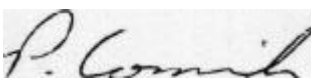
Four (4) samples of high density polyurethane foam, identified as below, were received for tensile testing at room temperature, based on the requirements of ASTM D1623-1973. The test samples were not subjected to any conditioning with storage being in an air conditioned laboratory prior to testing. The laboratory temperature during testing was 23 °C with a relative humidity of approximately 45%.

Sample Identification: Density 160 kg/m³
 Density 224 kg/m³
 Density 320 kg/m³
 Density 500 kg/m³

TEST RESULTS**1.0 Tensile Test**

Five (5) specimens were removed from each foam sample perpendicular to the direction of rise marked by arrow on the samples. Following diameter measurement the specimens were individually placed in a suitable test jig within a Shimadzu UH30A universal testing machine and an increasing tensile load applied until failure. The failure load was recorded and the tensile strength for each specimen was calculated with the results obtained as follows:

Sample	Tensile Strength (KPa)					
	1	2	3	4	5	Average
160 kg/m ³	2226.665	2429.989	2340.188	2571.236	2490.032	2411.622
224 kg/m ³	3390.722	3635.921	3388.492	3728.123	3443.145	3517.281
320 kg/m ³	6585.534	7092.328	6506.395	6570.258	6493.211	6649.545
500 kg/m ³	9428.810	15135.143	11929.460	12889.183	13528.800	12582.279



P. CORNISH
SENIOR METALLURGIST

**TENSILE TESTING OF HIGH DENSITY POLYURETHANE FOAM SAMPLES
 - CRYOGENIC TESTS**

INTRODUCTION

Four (4) samples of high density polyurethane foam, identified as below, were received for tensile testing at cryogenic temperature, based on the requirements of ASTM D1623-1973. The test samples were immersed in liquid nitrogen for a minimum period of 4 hours prior to testing. The laboratory temperature during testing was 23°C with a relative humidity of approximately 45%.

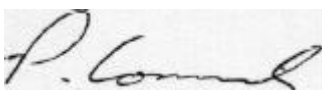
Sample Identification: Density 160 kg/m³
 Density 224 kg/m³
 Density 320 kg/m³
 Density 500 kg/m³

TEST RESULTS

1.0 Tensile Test

Five (5) specimens were removed from each foam sample perpendicular to the direction of rise marked by arrow on the samples. Following diameter measurement the specimens were immersed in a bath of liquid nitrogen for a minimum period of 4 hours. The specimens were individually removed from the bath and placed in a suitable test jig within a Shimadzu UH30A universal testing machine and an increasing tensile load applied until failure. The failure load was recorded and the tensile strength for each specimen was calculated with the results obtained as follows:

Sample	Tensile Strength (KPa)					
	1	2	3	4	5	Average
160 kg/m ³	3118.677	3452.188	3097.098	2980.342	3373.900	3204.441
224 kg/m ³	4566.335	5345.171	4120.996	5192.124	5049.011	4854.727
320 kg/m ³	8363.608	8069.776	8752.391	7679.620	8659.997	8305.078
500 kg/m ³	15392.269	14700.933	15999.631	15611.136	13573.339	15055.461



P. CORNISH
SENIOR METALLURGIST

**COMPRESSIVE LOAD TESTING OF HIGH DENSITY POLYURETHANE
 FOAM SAMPLES - CRYOGENIC TESTS**

INTRODUCTION

Four (4) samples of high density polyurethane foam, identified as below, were received for compressive load testing at cryogenic temperature, based on the requirements of ASTM D1621-1973. The test samples were immersed in liquid nitrogen for a minimum period of 4 hours prior to testing. The laboratory temperature during testing was 23°C with a relative humidity of approximately 45%.

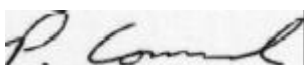
Sample Identification: Density 160 kg/m³
 Density 224 kg/m³
 Density 320 kg/m³
 Density 500 kg/m³

TEST RESULTS

1.0 Compressive Load Test

Five (5) specimens were removed, from each foam sample, perpendicular to the direction of rise marked by arrow on the foam samples and five (5) specimens were removed parallel to the direction of rise. Following suitable measurement the specimens were immersed in a bath of liquid nitrogen for a minimum period of 4 hours. The specimens were individually removed from the bath and placed between the compressive test platens of a Shimadzu UH30A universal testing machine and an increasing load applied. At 0.2mm increments of crosshead movement corresponding loads were read and recorded enabling construction of a load-deflection curve with the load at 10% deformation able to be determined. In cases where the specimen showed a definite yield the load at this point was recorded and construction of a load-deflection curve was not required. Using the yield load or load at 10% deformation data the following compressive strength values were calculated:

Sample	Compressive Strength (MPa)					Average
	1	2	3	4	5	
160 kg/m ³ - Perpendicular	3.044	3.486	3.418	3.397	3.155	3.300
160 kg/m ³ - Parallel	3.314	3.149	4.282	3.505	3.219	3.494
224 kg/m ³ - Perpendicular	6.924	8.063	6.473	7.171	8.792	7.485
224 kg/m ³ - Parallel	7.452	7.056	6.637	8.118	8.438	7.540
320 kg/m ³ - Perpendicular	16.186	15.842	16.080	15.149	15.887	15.829
320 kg/m ³ - Parallel	16.961	14.448	17.446	18.131	18.547	17.107
500 kg/m ³ - Perpendicular	46.746	48.755	49.341	48.975	48.154	48.394
500 kg/m ³ - Parallel	45.415	46.027	47.932	49.949	47.718	47.408



P. CORNISH
SENIOR METALLURGIST

**COMPRESSIVE LOAD TESTING OF HIGH DENSITY POLYURETHANE
 FOAM SAMPLES - ROOM TEMPERATURE TESTS**

INTRODUCTION

Four (4) samples of high density polyurethane foam, identified as below, were received for compressive load testing at room temperature, based on the requirements of ASTM D1621-1973. The test samples were not subjected to any conditioning with storage being in an air conditioned laboratory prior to testing. The laboratory temperature during testing was 23°C with a relative humidity of approximately 45%.

Sample Identification: Density 160 kg/m³
 Density 224 kg/m³
 Density 320 kg/m³
 Density 500 kg/m³

TEST RESULTS

1.0 Compressive Load Test

Five (5) specimens were removed, from each foam sample, perpendicular to the direction of rise marked by arrow on the foam samples and five (5) specimens were removed parallel to the direction of rise. Following suitable measurement the specimens were placed between the compressive test platens of a Shimadzu UH30A universal testing machine and an increasing load applied. At 0.2mm increments of crosshead movement corresponding loads were read and recorded enabling construction of a load-deflection curve with the load at 10% deformation able to be determined. In cases where the specimen showed a definite yield the load at this point was recorded and construction of a load-deflection curve was not required. Using the yield load or load at 10% deformation data the following compressive strength values were calculated:

Sample	Compressive Strength (MPa)					
	1	2	3	4	5	Average
160 kg/m ³ - Perpendicular	1.899	1.986	1.983	2.256	2.053	2.035
160 kg/m ³ - Parallel	1.922	2.288	1.959	1.925	1.901	1.999
224 kg/m ³ - Perpendicular	4.566	4.368	4.570	4.643	4.668	4.563
224 kg/m ³ - Parallel	3.676	3.654	3.501	4.395	3.867	3.819
320 kg/m ³ - Perpendicular	8.361	7.729	8.486	7.969	8.174	8.144
320 kg/m ³ - Parallel	9.329	8.998	9.287	8.719	9.236	9.114
500 kg/m ³ - Perpendicular	23.420	22.819	22.727	22.866	23.159	22.998
500 kg/m ³ - Parallel	21.726	21.348	21.023	20.939	21.049	21.217



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SENIOR METALLURGIST

**TENSILE TESTING OF HIGH DENSITY POLYURETHANE FOAM SAMPLES
CRYOGENIC TESTS -DETERMINATION OF ELASTIC MODULUS**

INTRODUCTION

Four (4) samples of high density polyurethane foam, identified as below, were received for tensile testing at cryogenic temperature in order to determine the elastic modulus. The test samples were immersed in liquid nitrogen for a minimum period of 4 hours prior to testing. The laboratory temperature during testing was 23 C with a relative humidity of approximately 45%.

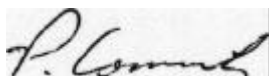
Sample Identification: Density 160 kg/m³
 Density 224 kg/m³
 Density 320 kg/m³
 Density 500 kg/m³

TEST RESULTS

1.0 Tensile Test

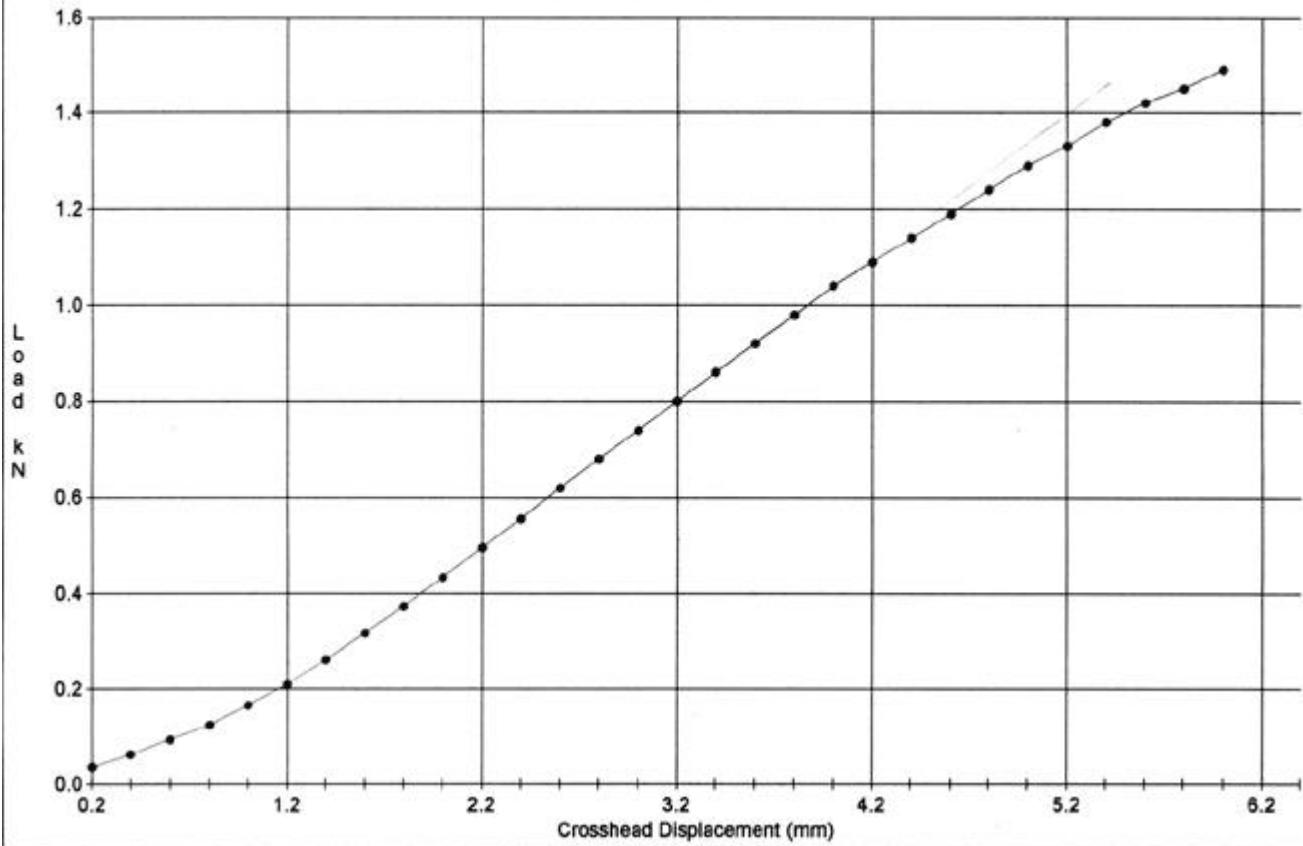
One (1) specimen was removed from each foam sample perpendicular to the direction of rise marked by arrow on the samples. Following diameter and parallel length measurement the specimens were immersed in a bath of liquid nitrogen for a minimum period of 4 hours. The specimens were individually removed from the bath and placed in a suitable test jig within a Shimadzu UH30A universal testing machine and an increasing tensile load applied. At 0.2mm increments of crosshead movement corresponding loads were read and recorded enabling construction of a load-deflection graph (refer attached). From a straight line produced on each graph the elastic modulus was calculated by dividing the change in stress by the corresponding change in strain. The results obtained were as follows:

Sample	Elastic Modulus (E) (MPa)
160 kg/m ³	11.8
224 kg/m ³	19.4
320 kg/m ³	24.0
500 kg/m ³	29.5

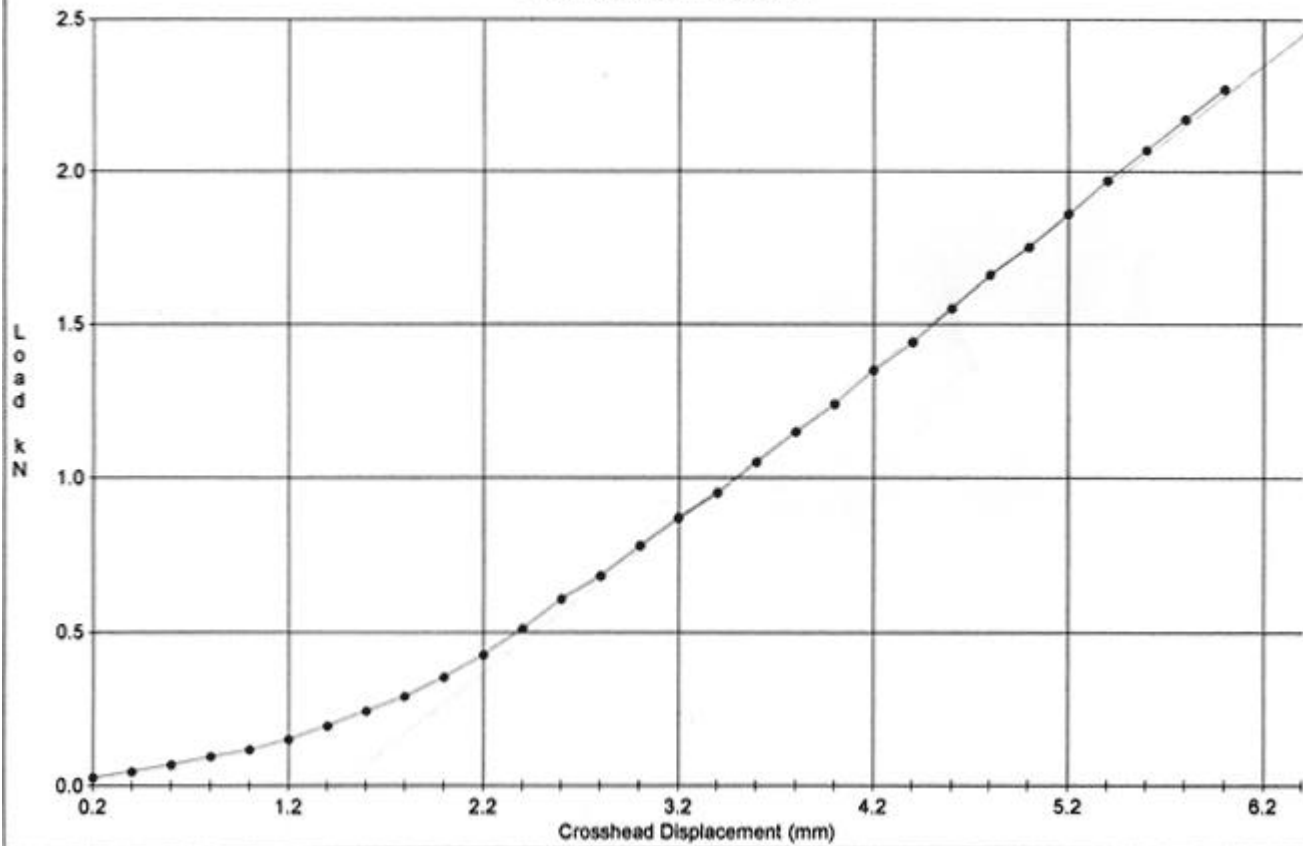


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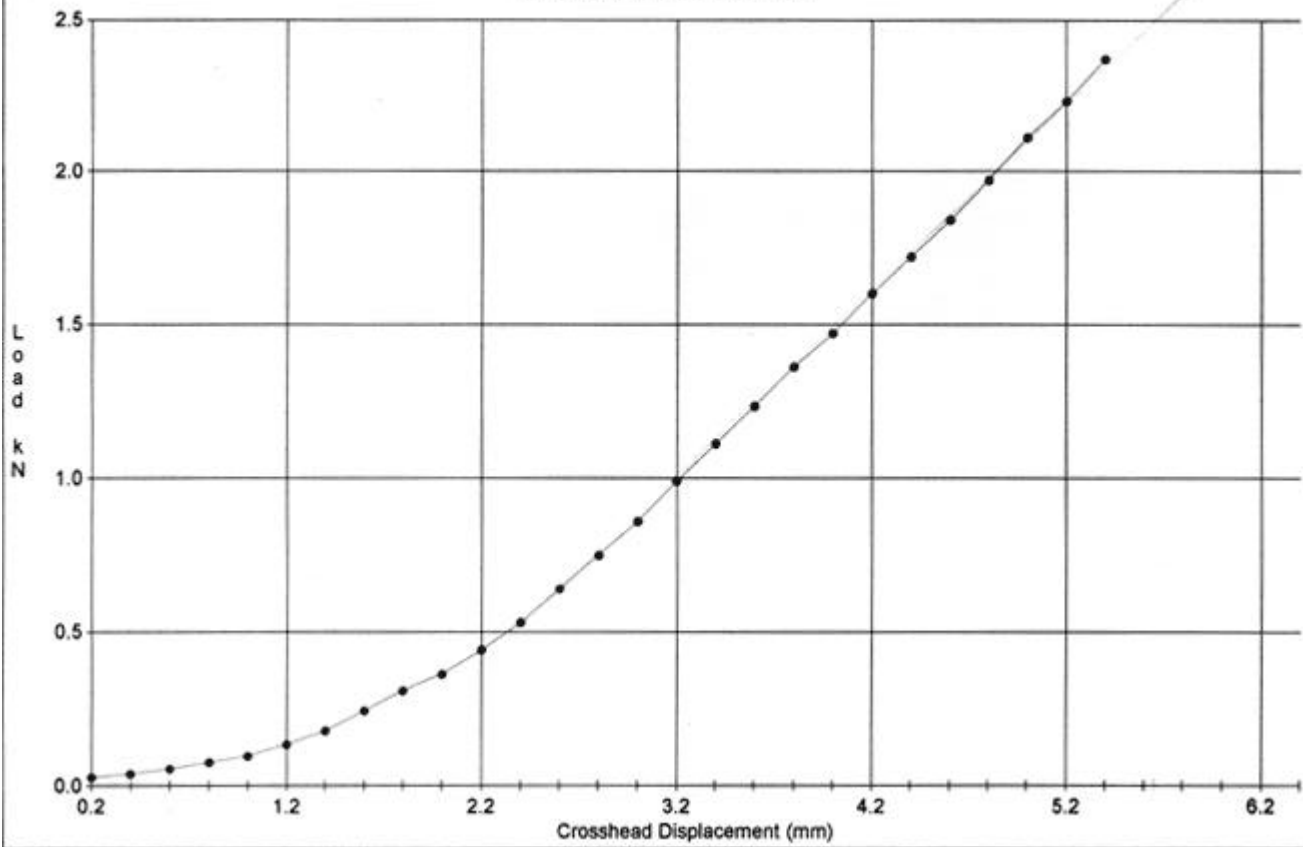
TENSILE TEST
160kg/m³-CRYOGENIC-SPEC. 1



TENSILE TEST
224kg/m³-CRYOGENIC-SPEC. 1



TENSILE TEST
320kg/m³-CRYOGENIC-SPEC. 1



TENSILE TEST
500kg/m³-CRYOGENIC-SPEC. 1

