Department of Industry
Resources Regulator
Mine Safety

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Flexible Ducting
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26th of July, 2016

M.S.T.C. TEST REPORT T16-00304/0001

Company:	Flexible Ducting
Sample Description:	*Flex Duct Layflat* – approx. 800 gsm, black, flexible ducting
Intended Use:	Non-Metallic Flexible Ventilation Ducting [Refer *MDG3608*, Section 4.3]
Sample No.:	T16-00304/0001

SUMMARY

The material **complied** with the requirements of *MDG3608*, 4.3.1 for Fire Resistance.

The material **complied** with the requirements of *MDG3608*, 4.3.2.1 for 'external surface' Electrical Resistance.
The 'internal surface' Electrical Resistance of a single pair of joined duct sections was assessed against the requirements of *MDG3608*, 4.3.2.2.

The Oxygen Index of the material was determined as specified by *MDG3608*, 4.3.2.

Analysed by: A.Thompson
C.Teasdale

Checked by:

Authorised by:

G. Slater
Manager, Mine Safety Technology Centre

NATA
WORLD RECOGNISED ACCREDITATION
Accredited for compliance with ISO/IEC 17025
Accreditation No. 2325

Endorsed tests indicated by logo on test page

Clause 4.1.2 of *MDG3608* states that all ventilation products and accessories must be re-tested at least every 5 years and whenever a change in the formulation, raw-material supply or manufacturing process occurs, and if aware that supplied product is not compliant to *MDG3608*.

FIRE RESISTANCE
1kW Burner Flame Test

Sample:
Flex Duct Layflat - approx. 800 gsm, black, flexible ducting

Test Date:
12th of July, 2016

Results:

Test	Persistence of Flame (s)	Persistence of After Glow (s)	Extent of Shrivel (mm)
1	0	0	170
2	0	0	155
3	0	0	160
4	0	1	140
5	0	1	160
6	3	0	175
Mean:	**< 1 s**	**< 1 s**	**160 mm**

Note:
- Sample sizes: 360 mm x 50 mm.
- 20 s flame duration.

Method of Analysis:
MDG3608, Appendix C2.1 – *One Kilowatt Burner Flame Test*
(– adapted from *NCB Specification 245:1985, Appendix 2 – Spirit Burner Flame Test* procedure)

Any variation from Standard/Test Method:
None. A 1kW burner conforming to the requirements of *IEC 60695-11-2* was used.

Requirements:
The material shall fail the test if any of the following occur:
a) If at any time:
(i) a flame on two or more test pieces extends above the marker, or
(ii) a glow on two or more test pieces extends above the marker.

b) If after the burner flame has been removed:
(i) the mean persistence time of the flame of the six test pieces exceeds 3 seconds, or the persistence time of the flame on any test piece exceeds 10 seconds, or
(ii) the mean persistence time of the glow of the six test pieces exceeds 10 seconds, or if the persistence time of the glow on any test piece exceeds 30 seconds.

Sample Status:
The material complied with the Fire Resistance requirements of *MDG3608*, 4.3.1.1.

FIRE RESISTANCE
Spirit Lamp Test

Sample:
Flex Duct Layflat – approx. 800 gsm, black, flexible ducting

Test Date:
12th of July, 2016

Results:

Test No.	Persistence of Flame (s)	Persistence of After Glow (s)	Extent of Shrivel (mm)
1	1*	4	60
2	1*	0	55
3	0*	5	50
4	1*	2	65
5	0*	3	60
6	0*	0	60
Mean	**< 1* s**	**< 3 s**	**58 mm**

* Indicates that the material shrivelled sufficiently to remove itself from the visible burner flame during application.

Note:
- Sample sizes: 360 mm x 75 mm.
- 10 s flame duration.

Method of Analysis:
MDG3608, Clause C3.1.
(– *adapted from NCB Specification 245:1985, Appendix 3 - Spirit Lamp Test* procedure)

Any variation from Standard/Test Method:
None.

Requirements:
The material shall fail the test where any of the following occur:
(1) the mean persistence time of the flame of the six test pieces exceeds 6 seconds, or the persistence time of the flame on any single test piece exceeds 12 seconds; or
(2) the mean persistence time of the glow of the six test pieces exceeds 10 seconds, or if the persistence time of the glow on any single test piece exceeds 30 seconds.

Should the material shrivel away such that the flame does not make contact with the material for the entire application time, the test shall be deemed invalid and the Follow-Up Flame Test shall be performed.

Sample Status:
Due to the shrivelling of each test piece away from the burner flame, no definite statement can be made in respect to the compliance of the material against the Fire Resistance requirements of *MDG3608*, 4.3.1.2.

The 'Follow-Up' fire resistance flame test was therefore applied to the material.

Clause 4.1.2 of *MDG3608* states that all ventilation products and accessories must be re-tested at least every 5 years and whenever a change in the formulation, raw-material supply or manufacturing process occurs, and if aware that supplied product is not compliant to *MDG3608*.

FIRE RESISTANCE
'Follow-Up' Flame Test

Sample:
Flex Duct Layflat – approx. 800 gsm, black, flexible ducting

Test Date:
12th of July, 2016

Results:

Test No.	Persistence of Flame (s)	Persistence of After Glow (s)	Extent of Shrivel (mm)
1	0	0	85
2	0	10	80
3	0	2	75
4	0	7	80
5	20	0	90
6	2	0	85
Mean	**< 4 s**	**< 4 s**	**83 mm**

Notes:
- Spirit lamp raised steadily so that it remained in contact with the test piece - i.e. the material was not allowed to shrivel away from the flame.
- Duration of flame application: 15 s.
- Sample sizes: 350 mm x 75 mm.

Method of Analysis:
MDG3608, Clause C4.1 [– adapted from *NCB Specification 245:1985, Appendix 4 - 'Follow Up' Flame Test* (Revised Method)].

Any variation from Standard/Test Method:
Sample lengths less than 360 mm.

Requirements:
The material shall fail the test where any of the following occur:
(1) the mean persistence time of the flame of the six test pieces exceeds 60 seconds or the persistence time of the flame on any one test piece exceeds 80 seconds;
(2) the mean persistence time of the glow of the six test pieces exceeds 60 seconds, or if the persistence time of the glow on any single test piece exceeds 80 seconds; or
(3) the material is completely consumed.

Sample Status:
The material complied with the Fire Resistance requirements of *MDG3608*, 4.3.1.2.

The material **complied** with the Fire Resistance requirements of *MDG3608*, 4.3.1.

Clause 4.1.2 of *MDG3608* states that all ventilation products and accessories must be re-tested at least every 5 years and whenever a change in the formulation, raw-material supply or manufacturing process occurs, and if aware that supplied product is not compliant to *MDG3608*.

ELECTRICAL RESISTANCE
External Surface

Sample:
Flex Duct Layflat – approx. 800 gsm, black, flexible ducting

Test Date:
12th of July, 2016

Results:

Test Piece	Electrical Resistance (MΩ)	
	Upper Surface	Lower Surface
1	< 0.1*	< 0.1*
2	< 0.1*	< 0.1*
Mean	**< 0.1 MΩ**	**< 0.1 MΩ**

* Indicates resistance measurement was below lower limit of measurement device.

Notes:
a) Samples conditioned at 23°C with 50% relative humidity for > 2 hours in an unrestrained state.
b) Samples tested at ambient temperature of 23°C with 55% relative humidity.
c) No conductivity solution was applied between the electrodes and the sample material.
d) Sample sizes: 300 mm x 300 mm.

Method of Analysis:
MDG3608, Clause C5 – *Electrical Resistance of Flat Surfaces Test* [– adapted from *NCB Specification 245:1985, Appendix 5 - Electrical Resistance of Flat Surfaces Test.*

Any variation from Standard/Test Method:
Conditioning and testing in an atmosphere with less than (65 ± 5)% relative humidity.

Requirements:
The average value of the electrical resistance on both the upper and lower surfaces of the sheeting shall not be greater than 300 MΩ (300 x 10^6 ohms), and shall remain so in use.

Sample Status:
The material **complied** with the 'External Surface' Electrical Resistance requirements of *MDG3608*, 4.3.2.1.

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Clause 4.1.2 of *MDG3608* states that all ventilation products and accessories must be re-tested at least every 5 years and whenever a change in the formulation, raw-material supply or manufacturing process occurs, and if aware that supplied product is not compliant to *MDG3608*.

ELECTRICAL RESISTANCE – Joined Ducting
Internal surface

Sample:
Flex Duct Layflat – 1.86 m long, approx. 40 cm ø, joined flexible duct sections
(- joined using approx. 70 mm wide joining band supplied by Flexible Ducting.)

Test Date:
19th of July, 2016

Results:

Joined Test Pieces	'Inner Surface' Electrical Resistance (MΩ)
# 1 and # 2	0.21
# 2 and # 3	Test Piece #3 not supplied
# 1 and # 3	Test Piece #3 not supplied
Mean	0.21 MΩ
Mean – per metre length	**< 0.13 MΩ.m^{-1}**

Notes:
a) Electrical contact between ring electrodes and inner surfaces of joined duct sections.
b) Test specimens placed on insulating polyethylene plate block during testing.
c) Sample size: joined duct sections approx. 1860 mm long; electrode separation approx. 1620 mm.

Method of Analysis:
AS 1180.13A-1983: Determination of Electrical Resistance of hose and hose components

Any variation from Standard/Test Method:
Electrode separation on joined samples > 1 metre.
Only two sample pieces supplied for joining.

Requirements:
When the joined duct material is tested in accordance with *AS 1180.13A – 1983*, using flexible ring electrodes connected to the internal duct surfaces, the internal surface resistivity shall not be greater than 1 Megohm per metre length (1 MΩ.m^{-1}).

Sample Status:
The 'internal surface' Electrical Resistance of a single pair of joined duct sections was assessed against the requirements of *MDG3608*, 4.3.2.2 by testing in accordance with *AS 1180.13A – 1983*.

Clause 4.1.2 of *MDG3608* states that all ventilation products and accessories must be re-tested at least every 5 years and whenever a change in the formulation, raw-material supply or manufacturing process occurs, and if aware that supplied product is not compliant to *MDG3608*.

OXYGEN INDEX

Sample:
Flex Duct Layflat – approx. 800 gsm, black, flexible ducting

Test Date:
26th of July, 2016

Results:

	% O_2
Oxygen Index	25.4

Notes:
a) Oxygen concentrations are percentage by volume.
b) Propagating ignition [*ISO4589-2:1996* ignition 'Procedure B']
c) Sample size: 140 mm x 50 mm [*ISO4589-2:1996* test specimen form: V (– flexible sheet)]

d) The estimated standard deviation of the Oxygen Index concentration measurements is 0.16.
e) The material exhibited flaming and glowing combustion. The Oxygen Index of the material was determined by the duration of flaming combustion and the extent of flame propagation along the sample piece length.
f) The result relate only to the behaviour of the test specimens under the conditions of the test and these results shall not be used to infer the fire hazards of the materials in other forms or under other fire conditions.
g) Samples conditioned at 23°C and 50% relative humidity for >88hrs.

Method of Analysis:
ISO 4589-2:1996(E) Determination of Burning Behaviour by Oxygen Index – Part 2 Ambient-temperature test.

Any variation from Standard/Test Method:
No.

Sample Status:
The Oxygen Index of the sample was determined as specified by *MDG3608*, 4.3.3.

Clause 4.1.2 of *MDG3608* states that all ventilation products and accessories must be re-tested at least every 5 years and whenever a change in the formulation, raw-material supply or manufacturing process occurs, and if aware that supplied product is not compliant to *MDG3608*.