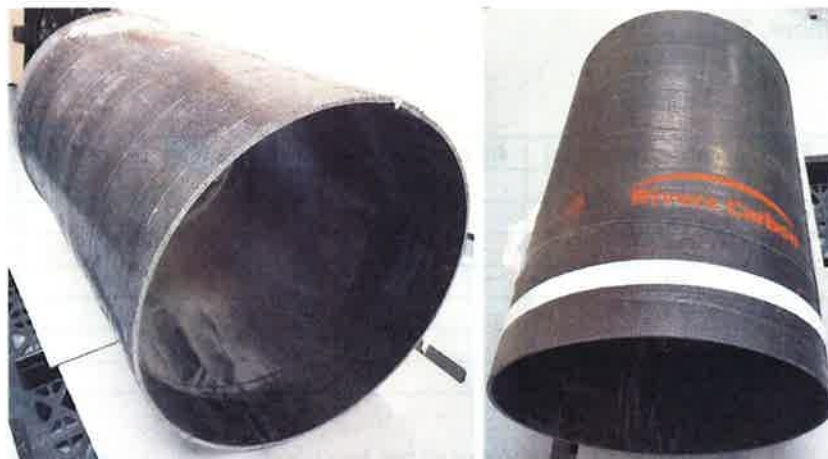


Rivers Carbon Technologies Ltd.
49 B William Pickering Drive
Rosedale, Auckland 0632
NEW ZEALAND

21st of February, 2018

M.S.T.C. TEST REPORT T17-00756/0001

Company:	Rivers Carbon Technologies Ltd.	
Sample Description:	HighVac - approx. 720 mm OD rigid, black, carbon-fibre/honeycomb composite duct ; silicone composite duct joining seals	
Intended Use:	Non-Metallic Rigid Ventilation Ducting	[Refer to MDG3608, Section 4.4] *
Sample No.:	T17-00756/0001	



SUMMARY

The material **complied** with the Fire Resistance requirements of MDG3608, 4.4.1.

The material **complied** with the Electrical Resistance requirements of MDG3608, 4.4.2.1 and 4.4.2.2.

The Oxygen Index of the material was determined as specified by MDG3608, 4.4.3.

Analysed by: A. Thompson
C. Teasdale

Checked by:



Authorised by:



G. Slater
Manager, Mine Safety Technology Centre



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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

Sample:

HighVac - approx. 720 mm OD rigid, black, carbon-fibre/honeycomb composite duct



Test Date:

12th of December, 2017

Results:

TABLE 1

Test No.	Flame Persistence (s)	After Glow Persistence (s)	Extent of Charring (mm)
1	0	0	156
2	24	0	160
3	26	0	169
4	29	0	152
5	22	0	167
6	12	0	150
Mean	19 s	0 s	159 mm

Notes:

- The test results relate only to the behaviour of the test pieces under the particular conditions of the test; they shall not be used as a means of assessing the potential fire hazard of the product in use.
- Mean flame temperature: approx. 953°C.
- Approx. 600 mm x 300 mm arched rectangular pieces - cut from curved surface of tubular duct.

Method of Analysis:

AS 1180.10B:1982 - Determination of combustion propagation characteristics of a horizontally oriented specimen of hose using surface ignition (- as referenced in Clause 2.1 of *AS2660:1991*).

Any variation from Standard/Test Method:

The Analite No T203 burner replaced with a Bunsen type burner in accordance with the annex to *ISO340*.

Due to large diameter of sample duct, curved sections of duct were cut from the supplied ducting and used for testing.

Requirements:

When tested in accordance with *AS1180.10B:1982*, the average duration of flaming and glowing shall not exceed 30 seconds.

Sample Status

The material **complied** with the Fire Resistance requirements of *MDG3608*, 4.4.2.1.

ELECTRICAL RESISTANCE – Ducting material (single duct sections)

Sample:

HighVac - approx. 720 mm OD rigid, black, carbon-fibre/honeycomb composite duct



Test Date:

5th of December, 2017

Results:

TABLE 2

Test Piece	Electrical Resistance (MΩ)		
	Outer Surface	Inner Surface	Through
1	< 0.1*	< 0.1*	< 0.1*
2	< 0.1*	< 0.1*	< 0.1*
3	< 0.1*	< 0.1*	< 0.1*
Mean	< 0.1* MΩ	< 0.1* MΩ	< 0.1* MΩ
Mean per metre	< 0.1 MΩ.m⁻¹	< 0.1 MΩ.m⁻¹	< 0.1 MΩ.m⁻¹

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

Notes:

- Electrical contact between ring electrodes and outer surface/cover of duct as described.
- Test specimens placed on insulating polyethylene plate block during testing.
- Mean laboratory ambient conditions during testing: 23°C, 55% relative humidity.
- Sample lengths: #1 & #2 - approx. 1.18 m; #3 – approx. 1.03 m ; electrode separation: approx. 1 m.

Method of Analysis:

AS 1180.13A-1983: *Determination of Electrical Resistance of hose and hose components.*

Any variation from Standard/Test Method:

None.

Requirements:

When the material is tested accordance with AS 1180.13A–1983 the electrical resistance measured when electrodes contact the duct covers, or duct lining, or both, shall not be greater than 1 Megohm per metre of length (1 MΩ.m⁻¹).

Sample Status

The material **complied** with the Fire Resistance requirements of MDG3608, 4.4.2.1.

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 – Joined Ducting

'Inner' surface

Sample:

HighVac - approx. 720 mm OD rigid, carbon-fibre/honeycomb composite duct with silicone composite joining seals



- joined duct pieces

Test Date:

5th of December, 2017

Results:

TABLE 3

Joined Test Pieces	'Inner Surface' Electrical Resistance (MΩ)
1 & 2	< 0.1*
2 & 3	< 0.1*
1 & 3	< 0.1*
Mean	< 0.1* MΩ
Mean – per metre length	< 0.1 MΩ.m⁻¹

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

Notes:

- Electrical contact between ring electrodes and inner surfaces of joined ducts.
- Test specimens placed on insulating polyethylene plate block during testing.
- Ambient laboratory conditions during testing: approx. 23°C, 55% relative humidity.
- Electrode separation: > 2 m.

Method of Analysis:

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

Any variation from Standard/Test Method:

None.

Requirements:

When the joined duct material is tested 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 material **complied** with the Fire Resistance requirements of MDG3608, 4.4.2.2.

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:

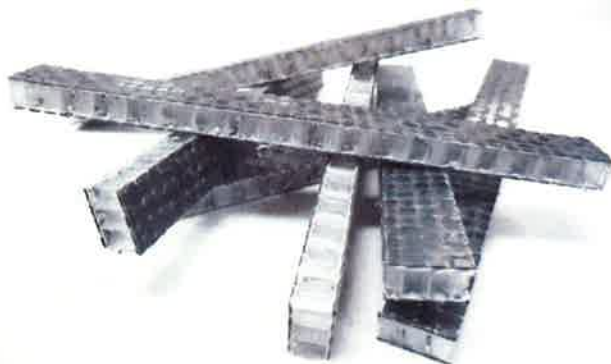
HighVac - black, carbon-fibre/honeycomb composite duct

Test Date:

13th of December, 2017

Results:

	% O ₂
Oxygen Index	23.2



Samples as supplied



Samples after testing

Notes:

- Oxygen concentrations are percentage by volume.
- Top surface ignition [ISO4589-2:1996 ignition 'Procedure A'].
- Sample size: 8 mm x 15 mm x 150 mm.
- The estimated standard deviation of the Oxygen Index concentration measurements is 0.15.
- The material exhibited flaming combustion, with the Oxygen Index being determined by the duration of flaming combustion and the extent of flame propagation along the sample length.
- 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.
- Tested in ambient 23°C, 54% relative humidity.
- Samples conditioned at 23°C and 50% relative humidity for > 88 hours.

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:

Sample sizes as received.

Requirements:

- The oxygen index of non-metallic rigid ventilating ducting must be determined in accordance with ISO 4589-2:1996 for characterisation of the material.
- Subsequent testing of the oxygen Index of any sample of the product must be within ± 3 points of that originally obtained.



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Sample Status:

The Oxygen Index of the material was determined as specified by MDG3608, 4.4.3.

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.