



**Report No. TC.20.03.000601**

**Date of Issue 06/09/2020**

**Applicant: Caledonian Cables Limited**

**Applicant address: 1/F., CMA Building, 64-66 Connaught Road Central, Hong Kong**

**Description of the test subject:**

Sample	Description	Photo
001	<p>Sample Description: Rolling stock Cables</p> <p>Style No.: FRL-MW-1SU 1C*1 mm<sup>2</sup></p> <p>Manufacturer: Caledonian Cables Limited</p>	 

**Receipt Date of Sample: 03/10/2020**

**Date of Testing: From 03/10/2020 to 06/09/2020**

**Sample submitted: The sample(s) was (were) submitted by applicant and identified.**

**Conclusion:**

Test Items			Result
No.	Items	Standard	
1	Single wire or cable burn testing	EN 50264-3-1:2008 EN 60332-1-2:2004+A1:2015	Pass
2	Vertically-mounted bunched wires or cables burn testing	EN 50264-3-1:2008 EN 50305:2002	Pass
3	Smoke density testing	EN 50264-3-1:2008 EN 61034-2:2005	Pass
4	Smoke toxicity testing	EN 50264-3-1:2008 EN 50305: 2002	Pass
5	Constructional and dimensional characteristics	EN 50264-3-1:2008	Pass

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6	Electrical properties of cables	EN 50264-3-1:2008	Pass
7	Mechanical Properties	EN 50264-3-1:2008	Pass
8	Cable marking and identification	EN 50264-3-1:2008	Pass
9	Assessment of halogens	EN 50264-3-1:2008	Pass

Test Results

EN 50264-3-1:2008 Railway applications - Railway rolling stock power and control cables having special fire performance - Part 3-1: Cables with crosslinked elastomeric insulation with reduced dimensions - Single core cables

1.EN 60332-1-2:2004+A1:2015 Tests on electric and optical fiber cables under fire conditions —Part 1-2: Test for vertical flame propagation for a single insulated wire or cable —Procedure for 1 kW pre-mixed flame

1.1 Sample details

Diameter	2.5mm
Specimen size	600mm

Precondition	Temperature (°C)	Humidity (%)	Duration(h)
	23±5	50±20	16

1.2 Test results

Measurements/ observation	1 <sup>st</sup> Test
The distance between the lower edge of the top support and the onset of charring (mm)	390
The distance between the lower edge of the top support and the charring downwards (mm)	485

Note: If a failure is recorded, two more tests shall be carried out. If both tests result in passes, the single insulated conductor or cable shall be deemed to have passed the test.

1.3 Requirement and conclusion

- 1) The single insulated conductor or cable shall pass the test if the distance between the lower edge of the top support and the onset of charring is greater than 50 mm.
- 2) In addition, a failure shall be recorded if charring extends downwards to a point greater than 540 mm from the lower edge of the top support.

Conclusion: Pass

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**2. EN 50305:2002 Railway applications — Railway rolling stock cables having special fire performance — Test methods**

**2.1 Sample details**

Specimen size	2.5m
Cable diameter	2.5mm
Conductor diameter	1.2mm
Number of bundles	3
Number of strands in the bundle	37
The method of mounting	Spaced

Precondition	Temperature (°C)	Humidity (%)	Duration(h)
	20±10	50±20	16

**2.2 Test results**

Measurements/ observation	Result
The extent of damage	0.91m

**2.3 Requirement and conclusion**

Test Item	Requirement	Result	Conclusion
Vertically-mounted bunched wires or cables burn testing (m)	≤1.5	0.91	Pass

**3. EN 61034-2:2005 Measurement of smoke density of cables burning under defined conditions Part 2: Test procedure and requirements**

**3.1 Sample details**

Diameter	1.0mm
Cable diameter	2.5mm
Number of bundles	6
Number of strands in the bundle	7

Pre-conditioning	Indoor		Duration(h)
	Temp: 23±2°C	Humidity: 50±5%	16

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Ignition Source	Fire source 1
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**3.2 Test Result**

The minimum light transmittance within 40 minutes; (%)	88.49
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**3.3 Requirement and conclusion**

Test Item	Requirement	Result	Conclusion
Smoke density (%)	≥70	88.49	Pass

**4. EN 50305:2002 Railway applications — Railway rolling stock cables having special fire performance — Test methods**

**4.1 Sample details**

Weight (g)	S1: 1.0067 g; S2: 1.0031 g; S3: 1.0070 g		
Conditioning	Temperature (°C)	Humidity (%)	Duration (h)
	23±2	50±5	At least 48

**4.2 Test results**

Gas	MDL	1	2	3	Average
Carbon Monoxide (CO)	5	36.6	32.1	32.1	33.6
Carbon Dioxide (CO <sub>2</sub> )	40	216.0	230.4	208.8	218.4
Sulphur Dioxide (SO <sub>2</sub> )	0.1	ND	ND	ND	ND
Nitrogen Dioxide (NO <sub>2</sub> )	0.5	ND	ND	ND	ND
Hydrogen Cyanide (HCN)	0.3	0.4	0.4	0.5	0.4

**Remark:** MDL=Method Detection Limited  
ND= Not Detected

Gas	CCz; mg/m <sup>3</sup>	Mz; mg	$\frac{Mz}{CCz}$
Carbon Monoxide (CO)	1750	33.6	0.019
Carbon Dioxide (CO <sub>2</sub> )	90000	218.4	0.002

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Sulphur Dioxide (SO <sub>2</sub> )	260	0	0
Nitrogen Dioxide (NO <sub>2</sub> )	90	0	0
Hydrogen Cyanide (HCN)	55	0.4	0.008
ITC			2.90

The toxicity index (ITC) shall be calculated using the following formula:

$$ITC = \frac{100}{m} \sum \frac{M_z}{CC_z}$$

Where,

M = weight of the sample, g;

M<sub>z</sub> = weight of gas Z produced by the sample combustion, mg;

CC<sub>z</sub> = critical concentration for a 30 min exposure for gas z, mg/m<sup>3</sup>.

The ITC Value determined was 2.90.

**4.3 Requirement and conclusion**

Test Item	Requirement	Result	Conclusion
Toxicity index (ITC)	≤3	2.90	Pass

**5. Constructional and dimensional characteristics**

No.	Test Item	Unit	Requirement	Result	Conclusion
	Insulation core color and mark			Black	
	Constructional and dimensional characteristics				
5.1	Conductor material and construction	/	Tinned copper	Tinned copper	Pass
	Conductor number		/	30	--
	Wires diameter	mm	Maximum 0.21	0.20	Pass
	Average elongation of wires	%	Minimum 15	24.7	Pass

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	Minimum elongation of individual wire	%	Minimum 10	24.4	Pass
5.2	Insulation thickness				
	Average thickness	mm	Minimum 0.6	0.60	Pass
	Minimum thickness	mm	Minimum 0.44	0.52	Pass
5.3	Cable overall diameter	mm	2.4-2.8	2.50	Pass

**6. Electrical properties of cables**

No.	Test Item	Unit	Requirement	Result	Conclusion
	Electrical properties of cables				
6.1	Conductor resistance	Ω/km	Maximum 20	17.0	Pass
6.2	Voltage test on cable	/	(3.5kV 5min) No breakdown	No breakdown	Pass
6.3	Dielectric strength	kV	Minimum 6	15.6	Pass
6.4	Insulation resistance (20°C)	MΩ/km	Minimum 11.4	364	Pass
6.5	Insulation resistance (90°C)	MΩ/km	Minimum 0.114	0.245	Pass
6.6	D.C stability			(85°C 240h 3%NaCl Water solution)	
	Voltage test (d.c.)	/	(±1.5kV) No breakdown	No breakdown	Pass
	Voltage test (a.c.)	/	(1.0kV 5min) No breakdown	No breakdown	Pass

**7. Mechanical Properties**

No.	Test Item	Unit	Requirement	Result	Conclusion
	Mechanical Properties				
7.1	Properties in the state as delivered				
	Tensile strength	MPa	Minimum 10	14.9	Pass
	Elongation at break	%	Minimum 150	172.0	Pass

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7.2	Properties after ageing in air oven		(135°C 168h)		
	Tensile strength: Variation	%	Maximum ±30	+22.1	Pass
	Elongation at break: Variation	%	Maximum ±30	-5.5	Pass
7.3	Hot set test		(200°C 15min 20N/cm <sup>2</sup> )		
	Elongation under load	%	Maximum 100	20	Pass
	Elongation after unloading	%	Maximum 25	0	Pass
7.4	Mineral oil resistance		(100°C 72h)		
	Tensile strength: Variation	%	Maximum ±30	-29.5	Pass
	Elongation at break Variation	%	Maximum ±40	-5.1	Pass
7.5	Fuel resistance		(70°C 168h)		
	Tensile strength: Variation	%	Maximum ±30	-20.1	Pass
	Elongation at break Variation	%	Maximum ±40	+6.5	Pass
7.6	Acid resistance test		(23°C 168h)		
	Tensile strength: Variation	%	Maximum ±30	-6.0	Pass
	Elongation at break	%	Minimum100	149.4	Pass
7.7	Alkali resistance test		(23°C 168h)		
	Tensile strength: Variation	%	Maximum ±30	-4.7	Pass
	Elongation at break	%	Minimum100	146.4	Pass
7.8	Compatibility		(100°C 168h)		
	Tensile strength: Variation	%	Maximum ±30	+16.1	Pass
	Elongation at break Variation	%	Maximum ±40	-4.9	Pass
7.9	Ozone resistance	/	(25°C 24h 250ppm) No cracks	No cracks	Pass
7.10	Bending test at low temperature	/	(-40°C) No cracks	No cracks	Pass
7.11	Impact test at low temperature	/	(-25°C) No cracks	No cracks	Pass

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**8. Cable marking and identification**

No.	Test Item	Unit	Requirement	Result	Conclusion
	Cable marking and identification				
8.1	Marking of Cable	/	There shall be marked with manufacturer's name; EN reference; rated voltage (U <sub>0</sub> ); conductor size and code designation	CALEDONIAN CABLE FRL-MW-1SU EN 50264-3-1 0.6/1kV 1x1 2019 M	Pass
8.2	Cable surface appearance	/	It shall be smooth, round, without spots, scratches, color difference, etc.	Meet the requirements	Pass
8.3	Continuity of marking	mm	The distance between the end of the mark and the starting point of the next similar mark shall not exceed 275mm	160	Pass
8.4	Durability of marking	/	Use cotton fabric or absorbent cloth to rub the mark or color for 10 times, and the mark or color will not be wiped off	Meet the requirements	Pass

**9. Assessment of halogens**

No.	Test Item	Unit	Requirement	Result	Conclusion
9.1	Amount of halogen acid gas				
	HCl and HBr	%	Maximum 0.5	0.2	Pass
	HF	%	Maximum 0.1	<0.1	Pass
9.2	PH	/	Minimum 4.3	4.7	Pass
9.3	Conductivity	µs/mm	Maximum 10	0.91	Pass

**Statement:** The test results relate to the behaviour of the test specimens of a product under the particular conditions of the test; they are not intended to be the sole criterion for assessing the potential fire hazard of the product in use

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Test results are just for client internal reference.

Changzhou Jinbiao Railway Transportation Technical Service Co., Ltd.

Drafted by:

Lynn liu

Approved by:

Shen hui

-End of Report-

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