

WQ1415 Issue 9

**Qualification report for ACW0219
to specification WSD1223 Issue 9**

November 2018



AUTOMOTIVE

Report Number: **WQ1415**

Issue Number: **Issue 9**

Qualification test data for ACW0219 tested to WSD1223 Issue 9

Author: Paul Francis
TE Connectivity Ltd.

Electronic sign off – No signature will appear

Approved by: Colin May
TE Connectivity Ltd.

Electronic sign off – No signature will appear

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Summary

This report details the qualification test data for ACW0219 wire test using the methods and requirements set out in WSD1223 Issue 9.

ACW0219 wire has met the requirements set out in WSD1223 Issue 9.

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1 INTRODUCTION

This report details the qualification test data for ACW0219 wire test using the methods and requirements set out in WSD1223 Issue 9.

2 CONCLUSION

Samples of ACW0219 wire met the requirements set out in WSD1223 Issue 9.

3 SAMPLES

Part number	Batch number
ACW0219-0.35-5	J1707NOV0211
ACW0219-0.50-87	J1707NOV0210
**ACW0219-0.50-36	1404091602
ACW0219-0.75-04	J1707NOV0212
**ACW0219-1.00-93	1415091623
ACW0219-1.00-40	J1707NOV0209
*ACW0219-1.50-25	J1421NOV0311
ACW0219-1.50-93	J1419SEP0321
ACW0219-2.50-96	J1419SEP0323
**ACW0219-2.50-05	1413091607
ACW0219-4.00-3	J1213NOV0207
ACW0219-6.00-54	J1223JAN0350
**ACW0219-6.00-2	1206011709
ACW0219-10.00-2	J1201DEC0002
*ACW0219-2.50-52	1406070636
*ACW0219-4.00-04	1217070608
*ACW0219-10.00-2	1226070611.

* Additional testing Ref to WQ1415 Issue 8

**Samples tested for qualification purposes.

4 EXPERIMENTAL

WQ1415 Clause	Test	WSD122 3 Clause	Method
5	Wall thickness	5.1.1	QC Test report
6	Wire diameter	5.1.2	QC Test report
7	Conductor diameter	5.1.3	QC Test report
7	Conductor resistance	5.1.4	ISO6722 clause 6.1
8	Spark testing	5.1.5	ISO6722 clause 6.3
9	30 Minute withstand voltage	5.1.6	ISO6722 clause 6.2
10	Insulation volume resistivity	5.1.7	ISO6722 clause 6.4
11	Pressure at high temperature	5.1.8	ISO6722 clause 7.1
12	Strip force $\leq 6\text{mm}^2$	5.1.9	ISO6722 clause 7.2
13	Low temperature winding (-40°C)	5.1.10	ISO6722 clause 8.1
14	Low temperature impact	5.1.11	ISO6722 clause 8.2
15	Abrasion resistance $\leq 6\text{mm}^2$	5.1.12	ISO6722 clause 9.3
16	Short term heat ageing	5.1.13	ISO6722 clause 10.2
17	Long term heat ageing	5.1.14	ISO6722 clause 10.1
18	Thermal overload	5.1.15	ISO6722 clause 10.3
19	Shrinkage by heat	5.1.16	ISO6722 clause 10.4
20	Fluid compatibility	5.1.17	ISO6722 clause 11.1
21	Resistance to ozone	5.1.18	ISO6722 clause 11.4
+22	Resistance to hot water	5.1.19	ISO6722 clause 11.5
23	Environmental cycling	5.1.20	ISO6722 clause 11.6
24	Resistance to flame propagation	5.1.21	ISO6722 clause 12
25	Flexibility $\leq 3.0\text{mm}^2$	5.1.22	WSK-1A348-A4 clause 3.11.10a
26	Flexibility $\geq 3.0\text{mm}^2$	5.1.23	WSK-1A348-A4 clause 3.11.10b
27	Dynamic cold bend	5.1.24	WSK-1A348-A4 clause 3.11.11
28	Notching resistance	5.1.25	WSK-1A348-A4 clause 3.11.12
29	Column strength 0.35mm^2 & 0.5mm^2	5.1.26	WSK-1A348-A4 clause 3.11.14
30	Compatibility tests	5.1.27	WSK-1A348-A4 clause 3.12
31	PVC compatibility test	5.1.28	WSK-1A348-A4 clause 3.13
32	Mycological	5.1.29	WSK-1A348-A4 clause 3.16
33	Bond Test	5.2.1	WSD1223 Issue 8
34	1X Mandrel wrap	5.2.2	WSD1223 Issue 8
35	Wicking test	5.2.3	WSD1223 Issue 8

5 WALL THICKNESS

Specification / Test method: WSD1223 Clause 5.1.1

Results taken from QC test report.

Requirements:

See Table below

Result:

Part number	Min requirement (mm)	Result (mm)
ACW0219-0.35-5	0.20	0.25
ACW0219-0.50-36	0.22	0.30
ACW0219-0.50-87	0.22	0.28
ACW0219-0.75-04	0.24	0.36
ACW0219-1.00-93	0.24	0.24
ACW0219-1.00-40	0.24	0.38
ACW0219-1.50-25	0.24	0.35
ACW0219-2.50-05	0.27	0.28
ACW0219-2.50-96	0.28	0.48
ACW0219-4.00-3	0.32	0.60
ACW0219-6.00-2	0.32	0.42
ACW0219-6.00-54	0.32	0.63
ACW0219-10.00-2	0.48	0.94

Ref: Tyco Electronics Laboratory Notebook: 5529/16

6 OUTSIDE DIAMETER

Specification / Test method: WSD1223 Clause 5.1.2

Results taken from QC test report.

Requirements:

See Table below

Result:

Part number	Requirement		Result (mm)
	Min. (mm)	Max. (mm)	
ACW0219-0.35-5	1.2	1.4	1.28, 1.28, 1.28
ACW0219-0.50-36	1.4	1.6	1.46, 1.46, 1.46
ACW0219-0.50-87	1.4	1.6	1.50, 1.50, 1.50
ACW0219-0.75-04	1.7	1.9	1.75, 1.74, 1.74
ACW0219-1.00-93	1.9	2.1	1.90, 1.96, 1.96
ACW0219-1.00-40	1.9	2.1	2.00, 2.00, 2.00
ACW0219-1.50-25	2.2	2.4	2.30, 2.30, 2.30
ACW0219-2.50-05	2.7	3.0	2.81, 2.81, 2.80
ACW0219-2.50-96	2.7	3.0	2.80, 2.80, 2.80
ACW0219-4.00-3	3.4	3.7	3.52, 3.50, 3.53
ACW0219-6.00-2	4.0	4.3	4.17, 4.16, 4.16
ACW0219-6.00-54	4.0	4.3	4.20, 4.20, 4.20
ACW0219-10.00-2	5.5	6.0	5.88, 5.98, 5.92

Ref: Tyco Electronics Laboratory Notebook: 5592/16

7 CONDUCTOR DIAMETER / RESISTANCE

Specification / Test method: WSD1223 Clause 5.1.3 & 5.1.4

Results taken from QC test report.

Requirements:

See Table below

Result:

Part number	Conductor diameter		Resistance		
	Max. (mm)	Result (mm)	Min. (Ω /km)	Max. (Ω /km)	Result (Ω /km)
ACW0219-0.35-5	0.80	0.76, 0.74, 0.74	47.80	52.00	51.80
ACW0219-0.50-36	1.00	0.86, 0.86, 0.87	34.10	37.10	36.29
ACW0219-0.50-87	1.00	0.88, 0.88, 0.89	34.10	37.10	36.00
ACW0219-0.75-04	1.20	1.14, 1.13, 1.13	22.70	24.70	23.20
ACW0219-1.00-93	1.35	1.21, 1.21, 1.21	17.00	18.50	18.00
ACW0219-1.00-40	1.35	1.28, 1.28, 1.28	17.00	18.50	18.00
ACW0219-1.50-25	1.70	1.52, 1.36, 1.50	11.70	12.70	12.45
ACW0219-2.50-05	2.15	1.91, 1.91, 1.91	7.00	7.60	7.24
ACW0219-2.50-96	2.15	2.03, 1.98, 2.00	7.00	7.60	7.30
ACW0219-4.00-3	2.50	2.35, 2.33, 2.31	4.42	4.70	4.53
ACW0219-6.00-2	2.95	2.95, 2.95, 2.95	2.91	3.10	3.00
ACW0219-6.00-54	2.95	2.86, 2.82, 2.85	2.91	3.10	3.10
ACW0219-10.00-2	4.50	3.93, 3.89, 4.00	1.70	1.82	1.79

Ref: Tyco Electronics Laboratory Notebook: 5529/16

8 SPARK TESTING

Specification / Test method: WSD1223 Clause 5.1.5

Results taken from QC test report.

Requirements:

See Table below

Result:

Part number	Requirement	Result
ACW0219-0.35-5	During the manufacturing process, a 5kV spark test is conducted along 100% of the wire, no breakdown shall occur.	No breakdown @ 5kV
ACW0219-0.50-36		No breakdown @ 5kV
ACW0219-0.50-87		No breakdown @ 5kV
ACW0219-0.75-04		No breakdown @ 5kV
ACW0219-1.00-93		No breakdown @ 5kV
ACW0219-1.00-40		No breakdown @ 5kV
ACW0219-1.50-25		No breakdown @ 5kV
ACW0219-2.50-05		No breakdown @ 5kV
ACW0219-2.50-96		No breakdown @ 5kV
ACW0219-4.00-3		No breakdown @ 5kV
ACW0219-6.00-2		No breakdown @ 5kV
ACW0219-6.00-54		No breakdown @ 5kV
ACW0219-10.00-2		No breakdown @ 5kV

Ref: Tyco Electronics Laboratory Notebook: 5592/16

9 30 MINUTES WITHSTAND VOLTAGE

Specification / Test method: WSD1223 Clause 5.1.6

Equipment	
Item	Serial Number
Voltage Cage	WCM 44
Test Parameters	
Sample Length (mm)	350
Test Solution (% NaCl in water)	3
Soak Time (hrs)	4
Test Voltage 1 (kV)	1
Voltage Application Time (minutes)	30
Voltage Increase Rate V/s	500
Test Voltage 2 (kV)	3 kV (r.m.s.) for cables < 0,5 mm ²
	5 kV (r.m.s.) for cables ≥ 0,5 mm ²

Requirements:

See Table below

Result:

Part number	Requirement	Result
ACW0219-0.35-5	During withstand voltage test, no breakdown shall occur.	No breakdown
ACW0219-0.50-36		No breakdown
ACW0219-0.50-87		No breakdown
ACW0219-0.75-04		No breakdown
ACW0219-1.00-93		No breakdown
ACW0219-1.00-40		No breakdown
ACW0219-1.50-25		No breakdown
ACW0219-2.50-05		No breakdown
ACW0219-2.50-96		No breakdown
ACW0219-4.00-3		No breakdown
ACW0219-6.00-2		No breakdown
ACW0219-6.00-54		No breakdown
ACW0219-10.00-2		No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5592/27

10 INSULATION VOLUME RESISTIVITY

Specification / Test method: WSD1223 Clause 5.1.7

Equipment	
Item	Serial Number
Ohm-meter	WCM 11
Iso Mantle	AD&M No2
Test Parameters	
Sample Soak Time (hrs)	2
Test Temperature (°C)	70
Test Solution	Tap Water
Sample Length (mm)	5000
Immersed Length (mm)	4500
Test Voltage Duration (minutes)	1
DC Test Voltage (V)	500

Requirements:

See Table below

Result:

Part number	Requirements	Insulation volume resistivity
ACW0219-0.35-5	The insulation volume resistivity shall be $10^9 \Omega \cdot \text{mm}$ minimum.	9.93×10^{14}
ACW0219-0.50-36		1.82×10^{15}
ACW0219-0.50-87		1.76×10^{15}
ACW0219-0.75-04		1.51×10^{15}
ACW0219-1.00-93		1.34×10^{15}
ACW0219-1.00-40		1.46×10^{15}
ACW0219-1.50-25		2.25×10^{15}
ACW0219-2.50-05		2.26×10^{15}
ACW0219-2.50-96		2.55×10^{15}
ACW0219-4.00-3		1.79×10^{14}
ACW0219-6.00-2		7.99×10^{14}
ACW0219-6.00-54		9.26×10^{13}
ACW0219-10.00-2		1.18×10^{12}

Ref: Tyco Electronics Laboratory Notebook: 5592/26

11 PRESSURE AT HIGH TEMPERATURE

Specification / Test method: WSD1223 Clause 5.1.8

Equipment	
Item	Serial Number
Oven	20
Voltage Cage	WCM 44
Scales	B15851
Test Parameters (Common to all Sizes)	
Hot Pressure Test	
Test Temperature (°C)	150
Test Duration (hrs)	4
Test Blade Thickness (mm)	0.70
Sample Length (mm)	600
Voltage Test	
Test Solution (% NaCl in water)	3
Soak Time (minutes)	10
Test Voltage (kV)	1
Test Voltage Time (minutes)	1

Requirements:

See Table below

Result:

Part number	Applied Force (g)	Requirement	Withstand voltage test
ACW0219-0.35-5	65.10	During the withstand voltage test, breakdown shall not occur	No breakdown
ACW0219-0.50-36	73.74		No breakdown
ACW0219-0.50-87	76.20		No breakdown
ACW0219-0.75-04	83.60		No breakdown
ACW0219-1.00-93	88.2		No breakdown
ACW0219-1.00-40	94.75		No breakdown
ACW0219-1.50-25	94.80		No breakdown
ACW0219-2.50-05	114.68		No breakdown
ACW0219-2.50-96	114.70		No breakdown
ACW0219-4.00-3	138.40		No breakdown
ACW0219-6.00-2	147.69		No breakdown
ACW0219-6.00-54	147.70		No breakdown
ACW0219-10.00-2	213.30		No breakdown

Ref: Tyco Electronics Laboratory Notebook:5529/17

12 STRIP FORCE

Specification / Test method: WSD1223 Clause 5.1.9

Equipment	
Item	Serial Number
Hounsfield H10KM	488
Test Parameters (Common to all sizes)	
Test Speed (mm/min)	250
Sample Length (mm)	100
Insulation Slug Length (mm)	50

Requirements:

See Table below

Result:

Part number	Requirements (N)	Strip force (N)
ACW0219-0.35-5	3 – 30	15.2, 12.8, 15.2
ACW0219-0.50-36	5 – 40	18.0, 15.0, 18.6
ACW0219-0.50-87	5 – 40	17.3, 12.9, 13.9
ACW0219-0.75-04	5 – 40	21.6, 27.0, 22.2
ACW0219-1.00-93	5 – 40	39.4, 35.2, 33.6
ACW0219-1.00-40	5 – 40	22.9, 20.8, 23.6
ACW0219-1.50-25	10 – 80	28.0, 26.5, 29.2
ACW0219-2.50-05	10 – 80	51.0, 50.0, 42.0
ACW0219-2.50-96	10 – 80	26.6, 25.3, 30.4
ACW0219-4.00-3	15 – 120	69.6, 71.6, 72.6
ACW0219-6.00-2	15 – 120	109.3, 116.9, 112.1
ACW0219-6.00-54	15 – 120	73.2, 73.0, 83.2
ACW0219-10.00-2	N/A	N/A

Ref: Tyco Electronics Laboratory Notebook: 5529/18

13 LOW TEMPERATURE WINDING**Specification / Test method: WSD1223 Clause 5.1.10**

Equipment	
Item	Serial Number
Voltage Cage	HV11
Scale	TS15
Freezer	No 1
Thermocouple	TR1743
Test Parameters (Common to all Sizes)	
Cold Wind	
Test Temperature (°C)	-40
Conditioning Time (hrs)	4
Voltage Test	
Test Solution (% NaCl in water)	3
Soak Time (minutes)	10
Test Voltage (kV)	1
Voltage Application Time (minutes)	1

Requirements:

See Table below

Result:

Part number	Test mass (kg)	Mandrel dia (mm)	Requirements	Withstand voltage test
ACW0219-0.35-5	0.5	6	After winding, no conductor shall be visible. During the 1kV /1 min withstand voltage test, breakdown shall not occur.	No breakdown
ACW0219-0.50-36	0.5	6		No breakdown
ACW0219-0.50-87	0.5	6		No breakdown
ACW0219-0.75-04	0.5	6		No breakdown
ACW0219-1.00-93	2.5	10		No breakdown
ACW0219-1.00-40	2.5	10		No breakdown
ACW0219-1.50-25	2.5	10		No breakdown
ACW0219-2.50-05	5.0	13		No breakdown
ACW0219-2.50-96	5.0	13		No breakdown
ACW0219-4.00-3	5.0	16.75		No breakdown
ACW0219-6.00-2	5.0	20		No breakdown
ACW0219-6.00-54	5.0	20		No breakdown
ACW0219-10.00-2	10.0	28		No breakdown

Ref: Tyco Electronics Laboratory Notebook:5592/23

14 LOW TEMPERATURE IMPACT

Specification / Test method: WSD1223 Clause 5.1.11

Three samples of each gauge size were prepared by removing 25mm of insulation from either end of a 1.2m length. The impact test as shown in Figure 5 of ISO6722:2006(E) was performed using the relevant weight as specified in Table 9 of ISO6722:2006(E) and a chamber temperature of -15°C .

After leaving the sample for 4 hours at -15°C , the hammer was dropped from a height of 100 mm. A visual examination was performed. The samples were then immersed in a saltwater bath for a minimum of 10 minutes and then subjected to a 1kV (r.m.s) voltage for 1 minute.

Requirements:

See Table below

Result:

Part number	Hammer mass (g)	Requirements	Withstand voltage test (1kV for 1 min)
ACW0219-0.35-5	N/A	After winding, no conductor shall be visible. During the 1kV /1 min withstand voltage test, breakdown shall not occur.	N/A
ACW0219-0.50-87	100		No breakdown
ACW0219-0.75-04	100		No breakdown
ACW0219-1.00-40	100		No breakdown
ACW0219-1.50-25	100		No breakdown
ACW0219-2.50-96	200		No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5276/68

15 ABRASION RESISTANCE**Specification / Test method: WSD1223 Clause 5.1.12**

Equipment	
Item	Serial Number
ISO Abrader No1	305206
ISO Abrader No2	302681
Test Parameters	
Blade Type	TVAB
Blade Dia (mm)	0.45
Scrape Length (mm)	15
Test Load (N)	7
Test Speed (cycles/minute)	55

Requirements:

See Table below

Result:

Part number	Requirement min. (cycles)	Result number of cycles to failure
ACW0219-0.35-5	200	>919, >593, >517, >372
ACW0219-0.50-37	300	>366, >600, >600, >546
ACW0219-0.50-87	300	>366, >600, >600, >546
ACW0219-0.75-04	350	>753, >1383, >1354, >1486
ACW0219-1.00-93	500	>1000, >1000, >1000, >1000
ACW0219-1.00-40	500	>1000, >1000, >1000, >1000
ACW0219-1.50-25	1500	>3500, >3500, >3000, 2787
ACW0219-2.50-05	1500	>3000, >3000, >3000, >3000
ACW0219-2.50-96	1500	>3000, >3000, >3000, >3000
ACW0219-4.00-3	1500	>4500, >3100, >3700, >5750
ACW0219-6.00-2	1500	>3000, >3000, >3000, >3000
ACW0219-6.00-54	1500	>6100, >3000, >3200, >4500

Results with the greater than symbol were stopped prematurely as they had exceeded the minimum requirements of TE Connectivity customers by a considerable margin. Therefore, actual values to failure would be higher.

Ref: Tyco Electronics Laboratory Notebook:5592/19

16 SHORT TERM AGEING

Specification / Test method: WSD1223 Clause 5.1.13

Two sample lengths of wire were suspended in an air circulating oven at 175°C for 240 hours. After removal from the oven the samples were fixed to a mandrel as specified in Table 7 of ISO6722:2006(E) and left for 4 hours at -25°C. They were then wound around the mandrel for three close turns. The wound samples without mandrels were then immersed in a saltwater bath for a minimum of 10 minutes and then subjected to a 1kV (rms) voltage for 1 minute.

Requirements:

See Table below

Result:

Part number	Test mass (kg)	Mandrel diameter (mm)	Requirements	Withstand voltage test
ACW0219-0.35-5	0.5	6	After winding, no conductor shall be visible. During the 1kV /1 min withstand voltage test, breakdown shall not occur.	No breakdown
ACW0219-0.50-87	0.5	6		No breakdown
ACW0219-0.75-04	0.5	6		No breakdown
ACW0219-1.00-40	2.5	10		No breakdown
ACW0219-1.50-25	2.5	10		No breakdown
ACW0219-2.50-96	5.0	13		No breakdown
ACW0219-4.00-3	5.0	16.75		No breakdown
ACW0219-6.00-54	5.0	20		No breakdown
ACW0219-10.00-2	10.0	28		No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5276/76, 5403/56

17 LONG TERM AGEING

Specification / Test method: WSD1223 Clause 5.1.14

Equipment				
Item	Serial Number			
Oven	17			
AC Voltage Cage serial number	HV11			
Test Parameters (Common to all Sizes)				
Ageing Test				
Test/Ageing Temperature (°C)	180			
Test Duration (hrs)	Up to 3500			
Sample Length (mm)	400			
Winding Test				
Test Temperature (°C)	RT			
Voltage Test				
Test Solution (% NaCl in water)	3			
Soak Time (minutes)	10			
Test Voltage (kV)	1			
Test Voltage Time (minutes)	1			
Test Parameters (Size Specific)				
Winding Test				
Part No	0.5	1.00	2.50	6.00
Cable O/d	1.50	2.00	2.85	4.15
Test Weight (kg)	0.5	0.5	1.5	5
Winding Speed (s ⁻¹)	1			
Mandrel Dia. 1.5 X wire OD (mm)	2.25	3.00	4.28	6.23
Mandrel Dia. Used (mm)	2.00	3.00	4.00	6.00

Long term heat ageing results continued over page.

Long term heat ageing results continued.**Requirements:**

See table below

Result:

Part number	Test mass (kg)	Mandrel dia (mm)	Visual examination	Withstand voltage test
ACW0219-0.35-5	0.5	6	After winding, no conductor shall be visible. During the 1kV /1 min withstand voltage test, breakdown shall not occur	No breakdown
ACW0219-0.50-36	0.5	6		No breakdown
ACW0219-0.50-87	0.5	6		No breakdown
ACW0219-0.75-04	0.5	6		No breakdown
ACW0219-1.00-93	2.5	10		No breakdown
ACW0219-1.00-40	2.5	10		No breakdown
ACW0219-1.50-25	2.5	10		No breakdown
ACW0219-2.50-05	5.0	13		No breakdown
ACW0219-2.50-96	5.0	13		No breakdown
ACW0219-4.00-3	5.0	16.75		No breakdown
ACW0219-6.00-2	5.0	20		No breakdown
ACW0219-6.00-54	5.0	20		No breakdown
ACW0219-10.00-2	10.0	28		No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5592/25

18 THERMAL OVERLOAD

Specification / Test method: WSD1223 Clause 5.1.15

Two sample lengths of wire were suspended in an air circulating oven at 200°C for 6 hours. After removing from the oven, the samples were maintained at room temperature for 16 hours & then wound around a mandrel as specified in Table 7 of ISO6722:2006(E). The wound samples without mandrels were then immersed in a saltwater bath for a minimum of 10 minutes and then subjected to a 1kV (rms) voltage for 1 minute.

Requirements:

See table below.

Result:

Part number	Test mass (kg)	Mandrel O/d (mm)	Req	Withstand voltage test (1kV for 1 min)
ACW0219-0.35-5	0.5	2	After winding, no conductor shall be visible. During the '1 min withstand voltage' test, breakdown shall not occur.	No breakdown
ACW0219-0.50-87	0.5	2		No breakdown
ACW0219-0.75-04	2.5	3		No breakdown
ACW0219-1.00-40	5.0	4		No breakdown
ACW0219-1.50-25	5.0	4		No breakdown
ACW0219-2.50-96	8.0	8		No breakdown

*See Sample List on Pg3'

Ref: Tyco Electronics Laboratory Notebook: 5276/69

19 SHRINKAGE BY HEAT**Specification / Test method: WSD1223 Clause 5.1.16**

Equipment	
Item	Serial Number
Oven	22

Test Parameters	
Test Temperature (°C)	150
Test Duration (min)	15
Sample Length (mm)	100

Requirements:

See table below.

Result:

Part number	Req	Total shrinkage (mm)
ACW0219-0.35-5	The maximum shrinkage shall not exceed 2 mm from either end.	0, 0.5, 0
ACW0219-0.50-36		0, 0, 0
ACW0219-0.50-87		0, 0, 0
ACW0219-0.75-04		0, 0, 0
ACW0219-1.00-93		0, 0.5, 0.5
ACW0219-1.00-40		0, 0, 0
ACW0219-1.50-25		0, 0, 0
ACW0219-2.50-05		0, 0, 0
ACW0219-2.50-96		0, 0, 0
ACW0219-4.00-3		0, 0.5, 0.5
ACW0219-6.00-2		0.5, 0, 0
ACW0219-6.00-54		0, 0, 0
ACW0219-10.00-2		0, 0, 0

Ref: Tyco Electronics Laboratory Notebook: 5592/22

20 FLUID COMPATIBILITY**Specification / Test method: WSD1223 Clause 5.1.17**

Equipment			
Item		Serial Number	
Auto Oven No		22	
Test Parameters (Common to all Sizes)			
Ageing Test			
Sample Length (mm)		600	
Temperature (°C)		See below	
Ageing Duration (hrs)		20	
Withstand Voltage Test			
Test Solution (% NaCl in water)		3	
Soak Time (minutes)		10	
Test Voltage (kV)		1	
Test Voltage Time (minutes)		1	
Fluid	Specification	Test temp (°C)	Test duration (hr)
Gasoline	ISO 1817, liquid C	23 ± 5	20
Diesel fuel	90% ISO 1817, Oil No. 3 + 10% p-xylene	23 ± 5	20
Engine oil	ISO 1817, Oil No. 2	50 ± 3	20
Ethanol	85% Ethanol + 15% ISO 1817 liquid C	23 ± 5	20
Power steering fluid	ISO 1817, Oil No. 3	50 ± 3	20
Auto transmission fluid	Dexron III	50 ± 3	20
Engine coolant	50% ethylene glycol + 50% distilled water	50 ± 3	20
Battery acid	H ₂ SO ₄ (specific gravity = 1,260 ± 0,005)	23 ± 5	20

Requirement:

See Table over page.

Fluid Compatibility Cont..

Results:

Wire O/d swell results after fluid immersion.										
Fluid	Req	Result								
	Max Swell (%)	ACW0219-0.35-5	ACW0219-0.50-87	ACW0219-0.75-04	ACW0219-1.00-40	ACW0219-1.50-93	ACW0219-2.50-96	ACW0219-4.00-3	ACW0219-6.00-54	ACW0219-10.00-2
Gasoline	15	0.96	-0.48	1.67	0.05	-0.15	0.24	0.44	0.34	0.22
Diesel fuel	15	0.41	-0.64	-0.19	-0.34	-0.29	-0.60	0.16	0.63	0.24
Engine oil	15	-0.49	-0.16	0.10	1.49	1.34	-1.20	0.64	-0.13	0.03
Ethanol	15	-0.52	-1.18	0.15	1.30	-0.30	0.12	0.22	-0.17	-0.07
Power steering fluid	30	0.28	-1.12	-1.27	1.09	-0.44	-0.48	0.07	-0.65	-0.14
Auto trans fluid	25	-0.31	-1.65	-0.69	-1.08	0.15	-0.12	-0.34	-0.62	-0.47
Engine coolant	15	0.18	-1.40	-0.02	0.41	-0.30	-0.24	-0.23	-0.24	-0.40
Battery acid	5	1.14	-0.78	-0.13	-0.56	-0.15	0.12	-0.34	-0.29	-0.11

Winding test after fluid immersion.										
Fluids	Part No									
Gasoline Diesel Fuel Engine oil Ethanol Power steering fluid Auto trans fluid Engine coolant Battery acid	ACW0219-0.35-5	ACW0219-0.50-87	ACW0219-0.75-04	ACW0219-1.00-40	ACW0219-1.50-93	ACW0219-2.50-96	ACW0219-4.00-3	ACW0219-6.00-54	ACW0219-10.00-2	
Requirement	Result									
After winding, no conductor shall be visible.	No conductor was visible.									
Status	Pass									

Fluid compatibility cont..

Winding test after fluid immersion.									
Fluids	Part No								
Gasoline Diesel Fuel Engine oil Ethanol Power steering fluid Auto trans fluid Engine coolant Battery acid	ACW0219-0.35-5	ACW0219-0.50-87	ACW0219-0.75-04	ACW0219-1.00-40	ACW0219-1.50-93	ACW0219-2.50-96	ACW0219-4.00-3	ACW0219-6.00-54	ACW0219-10.00-2
Requirement	Result								
During the withstand voltage test, breakdown shall not occur.	During the withstand voltage test, breakdown has not occurred.								
Status	Pass								

Ref: Tyco Electronics Laboratory Notebook: 5245/77 & 5276/34, 35, 40 & 41

21 FLUID COMPATIBILITY (Pt II)

Specification / Test method: WSD1223 Clause 5.1.17

Equipment	
Item	Serial Number
AD&M Fluids Oven Room	21
AD&M Oven Room	1

Test Parameters (Common to all Sizes)	
Ageing Test	
Sample Length (mm)	600
Temperature (°C)	See below
Ageing Duration (hrs)	20
Withstand Voltage Test	
Test Solution (% NaCl in water)	3
Soak Time (minutes)	10
Test Voltage (kV)	1
Test Voltage Time (minutes)	1

Requirements:

See table below

Results:

ACW0219-0.50 % of Swell						
Fluids	Sample	Measurement 1	Measurement 2	Measurement 3	Req (%) Max Swell	Status
Gasoline	A	0.7%	0.7%	0.7%	15	Pass
	B	0.0%	0.7%	0.7%		Pass
Diesel	A	0.7%	0.7%	0.7%		Pass
	B	0.7%	0.7%	0.7%		Pass
Oil Res (IRM902)	A	0.7%	0.7%	0.7%		Pass
	B	0.7%	0.7%	0.7%		Pass

Fluid compatibility continued:

<i>ACW0219-1.00 % of Swell</i>						
Fluids	Sample	Measurement 1	Measurement 2	Measurement 3	Req (%) Max Swell	Status
Gasoline	A	0.0%	0.0%	0.0%	15	Pass
	B	0.0%	0.0%	0.0%		Pass
Diesel	A	0.0%	0.0%	0.0%	15	Pass
	B	0.0%	0.0%	0.0%		Pass
Oil Res (IRM902)	A	0.0%	0.0%	0.0%	15	Pass
	B	0.0%	0.0%	0.0%		Pass

<i>ACW0219-1.50 % of Swell</i>						
Fluids	Sample	Measurement 1	Measurement 2	Measurement 3	Req (%) Max Swell	Status
Gasoline	A	0.4%	0.4%	0.0%	10	Pass
	B	0.0%	0.4%	0.0%		Pass
Diesel	A	0.4%	0.0%	0.4%	10	Pass
	B	0.4%	0.0%	0.0%		Pass
Oil Res (IRM902)	A	0.0%	0.4%	0.0%	10	Pass
	B	0.0%	0.0%	0.4%		Pass

<i>ACW0219-6.00 % of Swell</i>						
Fluids	Sample	Measurement 1	Measurement 2	Measurement 3	Req (%) Max Swell	Status
Gasoline	A	0.0%	0.0%	0.0%	15	Pass
	B	0.0%	0.0%	0.0%		Pass
Diesel	A	0.0%	0.0%	0.0%		Pass
	B	0.0%	0.0%	0.0%		Pass
Oil Res (IRM902)	A	0.0%	0.0%	0.0%		Pass
	B	0.0%	0.0%	0.0%		Pass

Ref: Tyco Electronics Laboratory Notebook: 5592/29/30/31/32



22 RESISTANCE TO OZONE

Specification / Test method: WSD1223 Clause 5.1.18

Test method: BS ISO6722-1 Clause 5.19, 2011, tested by Rapra.

The samples were wound around mandrels and conditioned in an ozone chamber with an atmosphere containing a mass fraction of 100 ± 5 pphm, at 65°C for 192 hours.

Requirement:

The visual examination of the insulation shall show no cracks.

Result:

Part number	Batch number	OD	Mandrel x1.5	Result
ACW0219-0.50	1404091602	1.50	2.25	No cracks
ACW0219-1.50	1712091609	2.30	3.45	No cracks

RAPRA Report No: 62073

Project No: GA0269

Ref to WT2765 iss1

Test report available in assignment folder 16-031

23 RESISTANCE TO HOT WATER

Specification / Test method: WSD1223 Clause 5.1.19

Equipment	
Item	Serial Number
Ohm-meter	WCM 11
Iso Mantle	Auto Lab
Voltage Cage	HV11

Test Parameters	
Hydrolysis Test	
Sample Strip Length (mm)	25.0
Test Solution (NaCl g/l in water)	10
Test Temperature (°C)	85
DC Test Voltage (V)	48
Immersed Length (m)	2.0
Insulation Resistance Test	
Test Voltage Duration (minutes)	1
DC Test Voltage (V)	500
Voltage Breakdown Test	
Test Voltage AC (kV)	1kV
Test Voltage Duration (minutes)	1

Requirement:

See Table over page.

Resistance to hot water Cont..**Result:**

Part number	Req	Min. volume resistivity (Ω .mm) Normal (+)	Min. volume resistivity (Ω .mm) Reverse (-)	Visual examination	Withstand voltage test (1kV for 1 min)
ACW0219-0.35-5	The 'insulation volume resistivity' shall not be less than $10^9 \Omega$ mm. A visual examination of the insulation shall show no cracks. During the 'withstand voltage' test, breakdown shall not occur.	4.68×10^{13}	3.64×10^{13}	No cracks	No breakdown
ACW0219-0.50-87		3.94×10^{13}	3.35×10^{13}	No cracks	No breakdown
ACW0219-0.50-36		5.51×10^{13}	4.79×10^{13}	No cracks	No breakdown
ACW0219-0.75-04		2.47×10^{13}	2.20×10^{13}	No cracks	No breakdown
ACW0219-1.00-40		2.88×10^{13}	2.82×10^{13}	No cracks	No breakdown
ACW0219-1.00-36		3.79×10^{13}	2.84×10^{13}	No cracks	No breakdown
ACW0219-1.50-93		5.87×10^{14}	8.23×10^{13}	No cracks	No breakdown
ACW0219-2.50-96		5.45×10^{14}	6.22×10^{13}	No cracks	No breakdown
ACW0219-2.50-05		3.96×10^{13}	5.28×10^{13}	No cracks	No breakdown
ACW0219-4.00-3		1.97×10^{13}	2.62×10^{13}	No cracks	No breakdown
ACW0219-6.00-54		2.22×10^{13}	3.43×10^{13}	No cracks	No breakdown
ACW0219-6.00-2		6.03×10^{13}	7.03×10^{13}	No cracks	No breakdown
ACW0219-10.00-2		1.23×10^{13}	1.46×10^{13}	No cracks	No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5592/24

24 ENVIRONMENTAL CYCLING

Test method:

Two 600mm lengths of each wire were wrapped around a mandrel as specified in Table 8 of ISO6722:2006(E), and the ends secured. The samples were then aged in a humidity chamber for 5.5 hours per cycle for 40 cycles.

After ageing the samples were removed and conditioned for 30 minutes at room temperature. The samples were then immersed in a saltwater bath for a minimum of 10 minutes and subjected to a 1kV (rms) voltage for 1 minute.

Requirement:

See Table below

Result:

Part number	Requirements	Insulation examination	Withstand voltage test (1kV for 1 min)
ACW0219-0.35-5	After winding, no conductor shall be visible. During the withstand voltage test, breakdown shall not occur.	No cracks	No breakdown
ACW0219-0.50-87		No cracks	No breakdown
ACW0219-0.75-04		No cracks	No breakdown
ACW0219-1.00-40		No cracks	No breakdown
ACW0219-1.50-93		No cracks	No breakdown
ACW0219-2.50-96		No cracks	No breakdown
ACW0219-4.00-3		No cracks	No breakdown
ACW0219-6.00-54		No cracks	No breakdown
ACW0219-10.00-2		No cracks	No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5276/80

25 RESISTANCE TO FLAME PROPAGATION**Specification / Test method: WSD1223 Clause 5.1.21**

Test Parameters		
Sample Orientation		45°
Burner Orientation		45°
Sample Length (mm)		600
Flame Application Time (secs)*	< 2.50 mm ²	15
	> 2.50 mm ²	30
Flame Height (mm)		100
Flame Inner Blue Cone Length (mm)		50
Combustion Tube ID (mm)		9

Requirement:

See Table below

Result:

Part number	Requirements	Afterburn time Ave (seconds)	Unburned length (mm)
ACW0219-0.35-5	Any combustion of insulating material shall extinguish within 70 seconds.	10	>200
ACW0219-0.50-87		9	>200
ACW0219-0.50-36		8	>200
ACW0219-0.75-04		4	>200
ACW0219-1.00-40		9	>200
ACW0219-1.00-93		9	>200
ACW0219-1.50-93	A minimum of 50 mm of insulation at the top of the test sample shall remain unburned.	12	>200
ACW0219-2.50-96		9	>200
ACW0219-2.50-05		2	>200
ACW0219-4.00-3		10	>200
ACW0219-6.00-54		9	>200
ACW0219-6.00-2		0	>200
ACW0219-10.00-2		12	>200

Ref: Tyco Electronics Laboratory Notebook: 5592/28

26 FLEXIBILITY \leq 3.0 MM²

Specification/Test method: WSD1223 Clause 5.1.22, WSK-1A348-A4 Clause 3.11.10a

Test Parameters	
Test Speed (mm/min)	50
Sample Length (mm)	600
Test Rig	Ford
Test Weight (N)	2.00
Scales	TS15
Scale Cal Date	May 2018

Requirement:
See Table below

Result:

Part number	Requirement max. (N)	Flexibility max. (N)
ACW0219-0.35-5	1.70	1.17
ACW0219-0.50-87	2.30	1.09
ACW0219-0.50-36	2.30	1.97
ACW0219-0.75-04	3.60	3.22
ACW0219-1.00-40	5.00	4.71
ACW0219-1.00-93	5.00	4.43
ACW0219-1.50-93	9.00	8.00
ACW0219-2.50-96	17.00	9.30
ACW0219-2.50-05	17.00	16.17

Ref: Tyco Electronics Laboratory Notebook: 5592/20

27 FLEXIBILITY > 3.0 MM²

Specification/Test method: WSD1223 Clause 5.1.22, WSK-1A348-A4 Clause 3.11.10b

Test Parameters	
Test Speed (mm/min)	100
Sample Length (mm)	250
Test Rig	3 Point

Requirement:

See Table below

Result:

Part number	Requirement (max.)		Results	
	Against reel set (N)	With reel set (N)	Against reel set (N)	With reel set (N)
ACW0219-4.00-3	6.00	4.00	4.12, 4.08	2.86, 3.12
ACW0219-6.00-54	8.00	6.00	6.40, 6.34	5.04, 5.30
ACW0219-6.00-2	8.00	6.00	4.80, 4.31	6.57, 5.88
ACW0219-10.00-2	20.00	18.00	17.80, 18.20	15.80, 16.20

Ref: Tyco Electronics Laboratory Notebook: 5592/21

28 DYNAMIC COLD BEND

Test method: WSD1223 Clause 5.1.22, WSK-1A348-A4 Clause 3.11.10b

As specified this test was conducted on 2.50mm² and 6mm² samples.

The conductor resistance of test samples approximately 300mm in length, was measured. The samples were then aged for 48 hours at 150°C. After ageing the samples were clamped in testing apparatus as illustrated in figure 7 of WSK-1A348-A4 and stored for at least 4 hours at -40°C.

Following this, the samples were subjected to 200 bending cycles at -40°C, at a cycle rate of one cycle every 3 seconds. After bending the conductor resistance was re-measured and then the samples were subjected to the 1-minute voltage withstand test (clause 3.10.3).

Requirement:

See Table below

Result:

Part number	Req max. (mΩ/m)	Res before bending (mΩ/m)	Res after bending (mΩ/m)	Voltage test
ACW0219-2.50-96	7.60	6.68	6.84, 6.95, 7.32	No breakdown
ACW0219-6.00-54	3.10	2.63	2.76, 2.97, 2.97	No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5276/63

29 NOTCHING RESISTANCE

Test method:

Wire samples were tested in a machine as specified in figure 8 of WSK-1A348-A4. The steel wire was pushed through the insulation at a constant speed of 10mm/min (max.), until an electrical contact between the steel wire and the conductor of the specimen shuts off the machine.

The force recorded at the time of contact was noted. After each reading the sample was move along by 10mm more and rotated a total of 4 times by 90° through its longitudinal axis. The average value of the 4 measurements is the notching force.

Requirement:

See table below.

Result:

Part number	Requirement min. (N)	Result min. (N)
ACW0219-0.35-5	30	39.6
ACW0219-0.50-87	40	50.7
ACW0219-0.75-04	50	58.2
ACW0219-1.00-40	50	57.1
ACW0219-1.50-93	60	74.5
ACW0219-2.50-96	70	84.9
ACW0219-4.00-3	100	156
ACW0219-6.00-54	120	182
ACW0219-10.00-2	No requirement	317

Ref: Tyco Electronics Laboratory Notebook: 5276/72

30 COLUMN STRENGTH

Test method:

As specified this test was conducted on 0.35mm² and 0.50mm² samples.

25 samples of 40mm were prepared and inserted into the appropriate cavities of a test fixture. A compressive force was applied at constant speed of 50mm/min and the maximum force measured.

Requirement:

See table below

Result:

Part number	Requirement min. (N)	Result min (N)
ACW0219-0.35-5	15	27.41
ACW0219-0.50-87	15	30.38

Ref: Tyco Electronics Laboratory Notebook:

Ref: 5245/85

31 COMPATIBILITY TESTS

Test Method:

400mm lengths of 0.75mm² and 4mm² samples were bent into 'U' shapes around mandrels as specified in clause 3.12 of WSK-1A348-A4.

Samples were separated into test groups:

Group 1 (without tape or tubing)

Group 2 (wrapped with tapes, 50% overlap)

- **PVC tapes:** Scapa 2726, natural rubber adhesive
TESA 4173 (equivalent to 4182), natural rubber adhesive
Coroplast 317, acrylic adhesive
- **Cloth tapes:** Coroplast 8550, synthetic rubber adhesive
Scapa 3366

Group 3 (convolute tubing)

Test samples were individually immersed for 2 minutes into each of the fluids specified in the table below. The samples were allowed to drain for 2 minutes (10 minutes for fuels). The samples were placed in their own test tube or beaker and stored at 150°C for the duration as specified in the table below. During the 1000-hour tests, the immersion process was repeated at 240, 480 and 720 hours.

After ageing the tape was removed from the samples (where applicable*) and the wires wound around a mandrel of 4 times the wire O.D. The samples were visually inspected and subjected to a 1-minute voltage withstand test (clause 3.10.3).

The samples were then tested to the notching resistance test as per section 3.11.12 (except the 4 notching resistance tests were taken approximately equidistant to each other on the untapped part of the wire).

* - After ageing, the PVC tapes could not be removed from the test samples, and so these samples were not mandrel wrapped. Small areas of tape were removed very carefully to show that the wire insulation underneath was not damaged.

Requirements

Insulation shall not exhibit cracks after mandrel wrap test.

No dielectric failure shall occur during withstand voltage test. The notching resistance force values of all heat aged samples, must be at least 20% of those values recorded against the comparable virgin samples.

Media type	Duration	
Multigrade motor oil	1000 hrs	<ul style="list-style-type: none"> • Mobil RL 128 / 2 • Mobil 1-5 W40 • Castrol SAE 0 W 30 • ESSO SAE 0 W 30 • Fuchs Titan 5 W 40 EM 540 • Shell Helix Ultra 5 W 40
CVT / ECVT automatic gearbox oil	1000 hrs	<ul style="list-style-type: none"> • ATF Type D Dextron II • Shell ATF 3403 M 115
Anti-freeze	1000 hrs	50% Ethylene glycol, 50 % H ₂ O <ul style="list-style-type: none"> • ELF XT 4030 • Glysantin G 05, Fa. BASF
Heavy duty cleaner	240 hrs	80 % Isopropanol, 20 % Polypropylenglycol
Cold cleaner, neat	240 hrs	<ul style="list-style-type: none"> • Auwa engine cleaner L • Haku 1025 / 400, • Chem. Werke Kluthe
Engine compartment sealant	240 hrs	<ul style="list-style-type: none"> • AKR 320 KD 604 • AF 1505 Pfinder Chemie
Grease	240 hrs	BP Energrease EP 2
Petrol	1000 hrs	FAM B DIN 51604 T 2
Diesel	1000 hrs	DIN EN 590
Saline de-icing solution	1000 hrs	5 % NaCl, 95 % H ₂ O
Battery acid	240 hrs	25% H ₂ SO ₄ , 75 % H ₂ O, density 1,28
Brake fluid	240 hrs	<ul style="list-style-type: none"> • Castrol DOT 4 • Teves/ATE DOT 4 • Teves/ATE Super DOT 4 • DB DOT 4 plus, DBL 7760.40 (MB.-Nr. 0009890807) • Hydraulan 400 NV/1, BASF
Automatic / steering gear oil	240 hrs	<ul style="list-style-type: none"> • Texaco Texamatic 9226 • DEA DES 5080 • DEA DES 5080 G 51 • DEA MB 5364 B • Pentosin CHF 11 s
Leak agent	240 hrs	• Super Caramba
PME (Biodiesel)	240 hrs	30% Biodiesel (DIN V 51606) mixed with road diesel (EN590)

Result:

Part number		Notch resistance			
ACW0219-0.75-04	100 %	72.7	59.1	47.4	53.7
	20 %	14.5	11.8	9.5	10.7
ACW0219-4.00-3	100%	139.7	142.3	149.4	191.3
	20 %	27.9	28.5	29.9	38.3

ACW0219-0.75-04: Control (No Tape)

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No Cracks	No Breakdown	167	271	237	300
CVT / ECVT automatic gearbox oil	No Cracks	No Breakdown	147	300	167	243
Anti-freeze	No Cracks	No Breakdown	245	159	263	174
Heavy duty cleaner	No Cracks	No Breakdown	64	95	120	120
Cold cleaner, neat	No Cracks	No Breakdown	62	181	60	73
Engine compartment sealant	No Cracks	No Breakdown	107	154	127	151
Grease	No Cracks	No Breakdown	71	141	71	73
Petrol	No Cracks	No Breakdown	300	106	129	210
Diesel	No Cracks	No Breakdown	102	319	245	169
Saline de-icing solution	No Cracks	No Breakdown	104	240	230	150
Battery acid	No Cracks	No Breakdown	66	65	60	71
Brake fluid	No Cracks	No Breakdown	114	90	73	101
Automatic / steering gear oil	No Cracks	No Breakdown	71	74	67	75
Leak agent	No Cracks	No Breakdown	99	63	121	90
PME (Biodiesel)	No Cracks	No Breakdown	92	129	89	104

ACW0219-0.75-04: Scapa 2726

Media type	Mandrel Wrap	Voltage test	Notch Resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	See * comment on page 39	See * comment on page 39	93	149	187	178
CVT / ECVT automatic gearbox oil	See * comment on page 39	See * comment on page 39	200	107	143	173
Anti-freeze	See * comment on page 39	See * comment on page 39	218	192	79	202
Heavy duty cleaner	See * comment on page 39	See * comment on page 39	73	82	76	70
Cold cleaner, neat	See * comment on page 39	See * comment on page 39	114	70	69	60
Engine compartment sealant	See * comment on page 39	See * comment on page 39	173	68	69	67
Grease	See * comment on page 39	See * comment on page 39	127	78	75	70
Petrol	See * comment on page 39	See * comment on page 39	149	231	309	315
Diesel	See * comment on page 39	See * comment on page 39	371	228	155	109
Saline de-icing solution	See * comment on page 39	See * comment on page 39	273	244	283	274
Battery acid	See * comment on page 39	See * comment on page 39	191	111	86	118
Brake fluid	See * comment on page 39	See * comment on page 39	95	191	63	119
Automatic / steering gear oil	See * comment on page 39	See * comment on page 39	95	178	67	145
Leak agent	See * comment on page 39	See * comment on page 39	174	65	60	60
PME (Biodiesel)	See * comment on page 39	See * comment on page 39	131	64	75	72

ACW0219-0.75-04: Coroplast 317

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	See * comment on page 39	See * comment on page 39	177	322	388	273
CVT / ECVT automatic gearbox oil	See * comment on page 39	See * comment on page 39	215	258	201	168
Anti-freeze	See * comment on page 39	See * comment on page 39	182	264	313	130
Heavy duty cleaner	See * comment on page 39	See * comment on page 39	53	56	74	61
Cold cleaner, neat	See * comment on page 39	See * comment on page 39	77	64	63	79
Engine compartment sealant	See * comment on page 39	See * comment on page 39	78	256	234	107
Grease	See * comment on page 39	See * comment on page 39	69	66	167	77
Petrol	See * comment on page 39	See * comment on page 39	358	342	297	394
Diesel	See * comment on page 39	See * comment on page 39	279	335	264	365
Saline de-icing solution	See * comment on page 39	See * comment on page 39	276	335	300	297
Battery acid	See * comment on page 39	See * comment on page 39	97	98	69	67
Brake fluid	See * comment on page 39	See * comment on page 39	85	154	65	79
Automatic / steering gear oil	See * comment on page 39	See * comment on page 39	105	111	112	63
Leak agent	See * comment on page 39	See * comment on page 39	72	69	73	105
PME (Biodiesel)	See * comment on page 39	See * comment on page 39	63	136	92	85

ACW0219-0.75-04: Coroplast 8550

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	201	229	215	184
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	227	218	168	167
Anti-freeze	No cracks	No breakdown	202	198	183	194
Heavy duty cleaner	No cracks	No breakdown	116	156	183	110
Cold cleaner, neat	No cracks	No breakdown	201	154	189	130
Engine compartment sealant	No cracks	No breakdown	86	134	106	167
Grease	No cracks	No breakdown	167	200	183	103
Petrol	No cracks	No breakdown	182	166	212	102
Diesel	No cracks	No breakdown	210	120	168	169
Saline de-icing solution	No cracks	No breakdown	183	260	158	168
Battery acid	No cracks	No breakdown	72	86	102	122
Brake fluid	No cracks	No breakdown	84	87	96	132
Automatic / steering gear oil	No cracks	No breakdown	106	90	89	64
Leak agent	No cracks	No breakdown	138	101	86	69
PME (Biodiesel)	No cracks	No breakdown	203	75	132	189

ACW0219-0.75-04: Tesaflex 4173

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	See * comment on page 39	See * comment on page 39	92	130	92	277
CVT / ECVT automatic gearbox oil	See * comment on page 39	See * comment on page 39	306	248	160	271
Anti-freeze	See * comment on page 39	See * comment on page 39	253	230	154	163
Heavy duty cleaner	See * comment on page 39	See * comment on page 39	83	85	78	66
Cold cleaner, neat	See * comment on page 39	See * comment on page 39	74	63	170	62
Engine compartment sealant	See * comment on page 39	See * comment on page 39	182	130	212	92
Grease	See * comment on page 39	See * comment on page 39	99	79	77	94
Petrol	See * comment on page 39	See * comment on page 39	365	385	159	247
Diesel	See * comment on page 39	See * comment on page 39	372	317	221	276
Saline de-icing solution	See * comment on page 39	See * comment on page 39	213	228	126	287
Battery acid	See * comment on page 39	See * comment on page 39	129	199	144	71
Brake fluid	See * comment on page 39	See * comment on page 39	146	75	90	198
Automatic / steering gear oil	See * comment on page 39	See * comment on page 39	81.5	170	69	82
Leak agent	See * comment on page 39	See * comment on page 39	90	120	161	105
PME (Biodiesel)	See * comment on page 39	See * comment on page 39	160	57	153	117

ACW0219-0.75-04: Scapa 3366

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	154	240	264	176
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	174	201	240	209
Anti-freeze	No cracks	No breakdown	222	228	351	209
Heavy duty cleaner	No cracks	No breakdown	89.6	87	175	197
Cold cleaner, neat	No cracks	No breakdown	182	251	120	129
Engine compartment sealant	No cracks	No breakdown	104	87	89	219
Grease	No cracks	No breakdown	137	67	226	161
Petrol	No cracks	No breakdown	278	364	281	273
Diesel	No cracks	No breakdown	255	131	314	275
Saline de-icing solution	No cracks	No breakdown	314	247	174	282
Battery acid	No cracks	No breakdown	66	86	75	120
Brake fluid	No cracks	No breakdown	109	92	86	90
Automatic / steering gear oil	No cracks	No breakdown	63	68	86	87
Leak agent	No cracks	No breakdown	125	223	109	168
PME (Biodiesel)	No cracks	No breakdown	98	212	286	129

ACW0219-0.75-04: Convolute tube

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	220	199	214	176
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	203	197	190	184
Anti-freeze	No cracks	No breakdown	254	98	154	166
Heavy duty cleaner	No cracks	No breakdown	63	70	132	178
Cold cleaner, neat	No cracks	No breakdown	75	54	58	66
Engine compartment sealant	No cracks	No breakdown	72	95	59	62
Grease	No cracks	No breakdown	60	77	64	104
Petrol	No cracks	No breakdown	167	186	100	132
Diesel	No cracks	No breakdown	154	133	97	166
Saline de-icing solution	No cracks	No breakdown	198	176	166	177
Battery acid	No cracks	No breakdown	91	90	93	136
Brake fluid	No cracks	No breakdown	121	189	186	187
Automatic / steering gear oil	No cracks	No breakdown	83	63	67	95
Leak agent	No cracks	No breakdown	85	62	70	71
PME (Biodiesel)	No cracks	No breakdown	138	100	162	140

ACW0219-4.00-3: Control (No Tape)

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	393	449	451	437
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	374	398	329	315
Anti-freeze	No cracks	No breakdown	224	272	231	215
Heavy duty cleaner	No cracks	No breakdown	182	231	177	256
Cold cleaner, neat	No cracks	No breakdown	243	182	220	265
Engine compartment sealant	No cracks	No breakdown	186	237	172	195
Grease	No cracks	No breakdown	177	196	183	227
Petrol	No cracks	No breakdown	371	443	348	323
Diesel	No cracks	No breakdown	349	320	302	321
Saline de-icing solution	No cracks	No breakdown	428	326	263	345
Battery acid	No cracks	No breakdown	236	253	147	193
Brake fluid	No cracks	No breakdown	174	163	167	215
Automatic / steering gear oil	No cracks	No breakdown	193	188	200	208
Leak agent	No cracks	No breakdown	216	227	212	206
PME (Biodiesel)	No cracks	No breakdown	251	269	150	153
No Ageing, No Fluid	No cracks	No breakdown	179	182	179	188

ACW0219-4.00-3: Scapa 2726

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	See * comment on page 39	See * comment on page 39	463	549	379	594
CVT / ECVT automatic gearbox oil	See * comment on page 39	See * comment on page 39	530	476	254	512
Anti-freeze	See * comment on page 39	See * comment on page 39	604	588	351	363
Heavy duty cleaner	See * comment on page 39	See * comment on page 39	259	164	150	169
Cold cleaner, neat	See * comment on page 39	See * comment on page 39	217	188	271	245
Engine compartment sealant	See * comment on page 39	See * comment on page 39	254	180	222	182
Grease	See * comment on page 39	See * comment on page 39	182	255	251	143
Petrol	See * comment on page 39	See * comment on page 39	243	369	320	347
Diesel	See * comment on page 39	See * comment on page 39	391	445	450	345
Saline de-icing solution	See * comment on page 39	See * comment on page 39	593	392	360	278
Battery acid	See * comment on page 39	See * comment on page 39	301	292	155	189
Brake fluid	See * comment on page 39	See * comment on page 39	201	258	306	200
Automatic / steering gear oil	See * comment on page 39	See * comment on page 39	193	203	119	201
Leak agent	See * comment on page 39	See * comment on page 39	186	128	196	203
PME (Biodiesel)	See * comment on page 39	See * comment on page 39	271	198	178	335

ACW0219-4.00-3: Coroplast 317

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	See * comment on page 39	See * comment on page 39	680	575	378	344
CVT / ECVT automatic gearbox oil	See * comment on page 39	See * comment on page 39	492	471	406	408
Anti-freeze	See * comment on page 39	See * comment on page 39	390	591	264	252
Heavy duty cleaner	See * comment on page 39	See * comment on page 39	177	188	258	306
Cold cleaner, neat	See * comment on page 39	See * comment on page 39	163	203	165	231
Engine compartment sealant	See * comment on page 39	See * comment on page 39	201	252	215	298
Grease	See * comment on page 39	See * comment on page 39	181	189	192	153
Petrol	See * comment on page 39	See * comment on page 39	432	321	483	390
Diesel	See * comment on page 39	See * comment on page 39	257	413	378	410
Saline de-icing solution	See * comment on page 39	See * comment on page 39	424	432	380	466
Battery acid	See * comment on page 39	See * comment on page 39	189	154	196	292
Brake fluid	See * comment on page 39	See * comment on page 39	172	172	143	153
Automatic / steering gear oil	See * comment on page 39	See * comment on page 39	222	218	155	256
Leak agent	See * comment on page 39	See * comment on page 39	172	155	171	169
PME (Biodiesel)	See * comment on page 39	See * comment on page 39	164	170	173	146

ACW0219-4.00-3: Coroplast 8550

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	402	425	351	426
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	311	323	315	326
Anti-freeze	No cracks	No breakdown	324	378	343	345
Heavy duty cleaner	No cracks	No breakdown	213	244	205	243
Cold cleaner, neat	No cracks	No breakdown	272	124	245	272
Engine compartment sealant	No cracks	No breakdown	225	196	140	187
Grease	No cracks	No breakdown	318	301	258	284
Petrol	No cracks	No breakdown	385	355	342	369
Diesel	No cracks	No breakdown	355	294	363	371
Saline de-icing solution	No cracks	No breakdown	393	368	400	366
Battery acid	No cracks	No breakdown	299	285	155	256
Brake fluid	No cracks	No breakdown	202	230	241	114
Automatic / steering gear oil	No cracks	No breakdown	243	191	252	253
Leak agent	No cracks	No breakdown	233	220	187	202
PME (Biodiesel)	No cracks	No breakdown	339	269	262	140

ACW0219-4.00-3: Tesaflex 4173

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	See * comment on page 39	See * comment on page 39	496	456	316	353
CVT / ECVT automatic gearbox oil	See * comment on page 39	See * comment on page 39	450	456	323	443
Anti-freeze	See * comment on page 39	See * comment on page 39	551	492	325	445
Heavy duty cleaner	See * comment on page 39	See * comment on page 39	189	182	164	170
Cold cleaner, neat	See * comment on page 39	See * comment on page 39	164	244	201	119
Engine compartment sealant	See * comment on page 39	See * comment on page 39	213	208	174	198
Grease	See * comment on page 39	See * comment on page 39	236	297	248	303
Petrol	See * comment on page 39	See * comment on page 39	445	491	460	409
Diesel	See * comment on page 39	See * comment on page 39	306	301	191	421
Saline de-icing solution	See * comment on page 39	See * comment on page 39	489	312	447	345
Battery acid	See * comment on page 39	See * comment on page 39	231	214	148	200
Brake fluid	See * comment on page 39	See * comment on page 39	186	152	154	178
Automatic / steering gear oil	See * comment on page 39	See * comment on page 39	378	165	232	296
Leak agent	See * comment on page 39	See * comment on page 39	178	329	276	224
PME (Biodiesel)	See * comment on page 39	See * comment on page 39	271	206	180	204

ACW0219-4.00-3: Scapa 3366

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	486	425	351	426
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	311	324	311	362
Anti-freeze	No cracks	No breakdown	372	386	339	309
Heavy duty cleaner	No cracks	No breakdown	172	185	196	180
Cold cleaner, neat	No cracks	No breakdown	208	314	149	204
Engine compartment sealant	No cracks	No breakdown	196	231	262	242
Grease	No cracks	No breakdown	271	368	311	336
Petrol	No cracks	No breakdown	385	355	343	343
Diesel	No cracks	No breakdown	297	294	363	371
Saline de-icing solution	No cracks	No breakdown	293	268	300	366
Battery acid	No cracks	No breakdown	229	262	184	153
Brake fluid	No cracks	No breakdown	231	231	243	284
Automatic / steering gear oil	No cracks	No breakdown	222	261	243	232
Leak agent	No cracks	No breakdown	234	281	177	191
PME (Biodiesel)	No cracks	No breakdown	324	181	237	301

ACW0219-4.00-3: Convolute tube

Media type	Mandrel wrap	Voltage test	Notch resistance (N)			
			90°	180°	270°	360°
Multigrade motor oil	No cracks	No breakdown	294	310	314	250
CVT / ECVT automatic gearbox oil	No cracks	No breakdown	384	387	269	389
Anti-freeze	No cracks	No breakdown	286	339	309	330
Heavy duty cleaner	No cracks	No breakdown	234	264	200	187
Cold cleaner, neat	No cracks	No breakdown	238	212	229	224
Engine compartment sealant	No cracks	No breakdown	249	224	219	273
Grease	No cracks	No breakdown	300	297	289	315
Petrol	No cracks	No breakdown	356	367	419	370
Diesel	No cracks	No breakdown	336	342	324	338
Saline de-icing solution	No cracks	No breakdown	389	352	363	381
Battery acid	No cracks	No breakdown	286	255	212	198
Brake fluid	No cracks	No breakdown	231	197	270	167
Automatic / steering gear oil	No cracks	No breakdown	234	199	183	206
Leak agent	No cracks	No breakdown	241	231	166	198
PME (Biodiesel)	No cracks	No breakdown	242	114	130	141

Ref: Tyco Electronics Laboratory Notebook: 5276/78

32 PVC COMPATIBILITY TEST

Test method:

A wire bundle consisting of two 0.75mm² sample wires and one 0.75mm² PVC wire, 400mm long, was spiral wrapped using tapes from section 6.9 in WSK-1A348-A4, leaving a 6mm gap between wraps. Three wire bundles were prepared and placed in an oven for 3000 hours at 150°C.

A further three wire bundles were placed in a test chamber at 85°C and 90% humidity using the cycle specified for 40 cycles.

Tapes: Scapa 2726, natural rubber adhesive
TESA 4173 (equivalent to 4182), natural rubber adhesive
Coroplast 317, acrylic adhesive

After ageing the tape was removed from the samples (where possible, see * comment on next page) and the centre of the wire bundle wrapped around a mandrel of diameter equal to four times the bundle O.D, at a uniform rate of one turn per 10 seconds, for a minimum of two full turns.

The samples were then subjected to the '1 min withstand voltage' test (clause 3.10.3)

Requirement:

After winding, no conductor shall be visible. During the '1 min withstand voltage' test, breakdown shall not occur.

Result:**3000 hours @ 150°C**

Part number	Tape description	Mandrel wrap	Voltage test (1 kV for 1 min)
ACW0219-0.75-04	Scapa 2726	* See below	* See below
	Coroplast 317	* See below	* See below
	Tesaflex 4173	* See below	* See below
ACW0219-4.00-3	Scapa 2726	* See below	* See below
	Coroplast 317	* See below	* See below
	Tesaflex 4173	* See below	* See below

* - After the 3000 hours @ 150°C heat ageing, the PVC tapes could not be removed from the test samples, and so these samples were not mandrel wrapped. Small areas of tape were removed very carefully to show that the wire insulation underneath was not damaged.

Humidity for 40 cycles

Part number	Tape description	Mandrel wrap	Voltage test (1 kV for 1 min)
ACW0219-0.75-04	Scapa 2726	No cracks	No breakdown
	Coroplast 317	No cracks	No breakdown
	Tesaflex 4173	No cracks	No breakdown
ACW0219-4.00-3	Scapa 2726	No cracks	No breakdown
	Coroplast 317	No cracks	No breakdown
	Tesaflex 4173	No cracks	No breakdown

Ref: Tyco Electronics Laboratory Notebook: 5276/38

33 MYCOLOGICAL

Test method: DIN IEC 60068-2-10

The test was performed in accordance with DIN IEC 60068-2-10. The specimens were tested for 28 days.

The organisms used were:

- *Aspergillus niger*
- *Aspergillus terreus*
- *Aureobasidium pullulans*
- *Paecilomyces varioti*
- *Penicillium funiculosum*
- *Penicillium ochro-chloron*
- *Scopulariopsis brevicaulis*
- *Trichoderma viride*

The test pieces must be checked every 24 hours for mould growth. The samples were then wrapped around a mandrel of 3 times the wire diameter and subjected to a 1-minute voltage test at 2.5 kV.

Requirements

No mould growth should occur. The insulation should not show cracks, fractures or other defects.

Results

Part number	Batch number	Result
ACW0219-1.00-9	J1315FEB9908	Mould rating 0 No sign of mould growth No cracks or breakdown

Ref: WT1359 issue 1

Test report available in assignment folder 16-031

34 BOND TEST

Test method:

A 25 mm strip of insulation was cut and checked for any delamination of the core and PJ layers by trying to peel the layers apart.

Requirement:

See table below

Result:

Part number	Requirement	Result
ACW0219-0.35-5	No delamination	No delamination
ACW0219-0.50-87	No delamination	No delamination
ACW0219-0.75-04	No delamination	No delamination
ACW0219-1.00-40	No delamination	No delamination
ACW0219-1.50-25	No delamination	No delamination
ACW0219-2.50-96	No delamination	No delamination
ACW0219-4.00-3	No delamination	No delamination
ACW0219-6.00-54	No delamination	No delamination
ACW0219-10.00-2	No delamination	No delamination

Ref: Tyco Electronics Laboratory Notebook: 5276/55, 5294/5

35 1 X MANDREL WRAP**Test method:**

A length of finished wire was wound around a mandrel having a diameter equal to the diameter of the wire for a minimum of 5 turns. The winding was performed at a rate of approximately 1 wrap per second and tension applied by hand sufficient to ensure contact with the mandrel.

Each successive wrap was touching the previous wrap. The sample was then be removed from the mandrel and placed in a dye indicator, then examined for cracks and pin holes in the PJ without the aid of magnification.

Requirement:

The core shall not be exposed through the PJ.

Result:

Part number	Requirement	Result
ACW0219-0.35-5	No exposure	No exposure
ACW0219-0.50-87	No exposure	No exposure
ACW0219-0.75-04	No exposure	No exposure
ACW0219-1.00-40	No exposure	No exposure
ACW0219-1.50-93	No exposure	No exposure
ACW0219-2.50-96	No exposure	No exposure
ACW0219-4.00-3	No exposure	No exposure
ACW0219-6.00-54	No exposure	No exposure
ACW0219-10.00-2	No exposure	No exposure

Ref: Tyco Electronics Laboratory Notebook: 5245/53, 72 & 5276/53, 5294/5

36 WICKING TEST

Test method:

The conductor was removed from a 50mm length of 1.5mm² wire. The sample was then dipped vertically into windscreen washer fluid to a depth of 5mm and left for 24 hours.

After this period the sample was removed from the fluid and inspect for wicking of the fluid between the insulation layers.

Requirement:

There shall be no signs of fluid wicking beyond 15mm from the dipped end of the insulation.

Result:

Part number	Result
ACW0219-1.50-93	No signs of wicking

Ref: Tyco Electronics Laboratory Notebook: 5294/5

37 QC TEST REPORTS



TEST REPORT FOR: ACW WIRE Page 1 of 1

To specification: SCD and WSD 1223 Issues in effect

Part Description: **ACW0219-0.50- 36 (ns)** Print Date
03 September 2016 05:22

Batch Number: **14 04 09 16 02** Quantity: **M**

M.O. Number: **K355484 (20K) K361153 (6K)**

Pass Date: **8-9-16** Passed By: **Away S** Final Stamp: **AB63227**

Cost Centre	Cost Centre Name	Quantity	Exit Number
	1st Core Extrusion	26500	P13 03 SEP 16 18
	2nd Primary Jacket Extrusion	26350	J14 04 SEP 16 02
	1st Small Beam	26300	R08 05 SEP 16 26

Core Extrusion Compound Batch: **1020058-01** CC batch: **26255**
 Stripe Batch: **26275 (6)** Conductor batch: **571003765**

	Conductor O.D		Extruded O.D		Core Wall	Concentricity	Stripe 1	Stripe 2	Stripe Total	Acceptance Stamp
	max	min	max	min						
	1.00 mm	1.30 mm	1.34 mm	.18 mm	min 70%	min 10%	min 10%	max 30%		
Start	0.869	1.312		-191	82%	10%	11%	2%	JB11144	
End	0.872	1.310		-190	82%	16%	11%	2%	JB11144	

Stripe Colour as Part Description {
 1 **JB11144**
 2 **JB11144**

Jacket Extrusion Compound Batch: **1020056-01**

	Extruded O.D		PJ Wall	Total Wall	Overall concentricity	Visual	Acceptance Stamp
	Min.	Max.	Min.	Min.	min 70%	Workmanship	
	1.40 mm	1.60 mm	.08 mm	0.26 mm		1st Class	
Start	1.525		0.089	0.200	84%	✓	OK205310
End	1.553		0.088	0.209	83%	✓	OK205310

Irradiation as beam manual R8 Beam Stamp Acceptance Stamp Verify R8 Beamed
AD12342 **AD12342** **AB63227**

Test	Requirement	Result
Conductor: Type and PCN	RHL-0.50MM-19X.19-BC PCN E26269-000	As per Conductor Batch No.
Conductor: DC Resistance @ 20.0°C	34.10 Ohms/ km Min. 37.10 Ohms/ km Max.	36.29 - 2 km AB63227
100% Spark Test Finished wire	5 kV HF rms 7kV impulse	In Process Check
Bond Test	Remove a minimum 25 mm strip of insulation from the sample, there should be no delamination of the core and jacket layers.	PASS AB63227
1 x OD Wrap Test (Sizes 0.35 mm² to 10 mm² Inclusive.)	Sample of 5 complete turns Mandrel size = 1 x OD of Wire Wind on to mandrel by hand 1 wrap per second ensuring contact with mandrel. Wraps must touch. Remove from mandrel and carry out dye Indicator test Extend the wrapped coil, visually inspect the wraps, there should be no cracks or pin holes in the PJ exposing core.	PASS AB63227

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TEST REPORT FOR: ACW WIRE Page 1 of 1

To specification: SCD and WSD 1223 Issues in effect

Part Description: **ACW0219-1.00-93 (nd)** Print Date: 15 September 2016 13:31
 Batch Number: **1215091623** Quantity: M

M.O. Number: **1355603 (12K) / 1417011 (6K)** Final Stamp: **AB63227**
 Pass Date: **16-9-16** Passed By: **Anay B**

Cost Centre	Cost Centre Name	Quantity	Exit Number
	1st Core Extrusion	18400	P13 15 SEP 16 09
	2nd Primary Jacket Extrusion	18200	J14 15 SEP 16 23
	1st Small Beam	18200	209 16 SEP 16 01

Core Extrusion Compound Batch: **1020220-01** CC batch: **← (9)**
 Stripe Batch: **21855 (2)** Conductor batch: **ST800878**

	Conductor O.D		Extruded O.D		Core Wall	Concentricity	Stripe 1	Stripe 2	Stripe Total	Acceptance Stamp
	max	min	min	max						
	1.35 mm	1.79 mm	1.79 mm	1.85 mm	.24 mm	min 70%	min 10%	min 10%	max 30%	
Start	1.211	1.790			244	83%	10%	10%	22%	CP152277
End	1.216	1.798			249	82%	11%	11%	22%	CP152277

Stripe Colour as Part Description {
 1 CP152277
 2 CP152277

Jacket Extrusion

Compound Batch: **1020215-02**

	Extruded O.D		PJ Wall	Total Wall	Overall concentricity	Visual	Acceptance Stamp
	Min.	Max.					
	1.90 mm	2.10 mm	.05 mm	0.29 mm	min 70%	Workmanship 1st Class	
Start	20	28	068	394	90%	/	HG196370
End	20	39	058	391	89%	/	HG196370

Irradiation as beam manual

Acceptance Stamp

Post Irradiation Checks

IM10598

Test	Requirement	Result
Conductor: Type and PCN	RHL-1.00-19X.26-BC PCN E16251-000	As per Conductor Batch No.
Conductor: DC Resistance @ 20.0°C	17.00 Ohms/ km Min. 18.50 Ohms/ km Max.	17.79 Ω/km AB63227
100% Spark Test Finished wire	5 kV HF rms 7kV impulse	In Process Check
Bond Test	Remove a minimum 25 mm strip of insulation from the sample, there should be no delamination of the core and jacket layers.	PASS AB63227
1 x OD Wrap Test (Sizes 0.35 mm ² to 10 mm ² inclusive.)	Sample of 5 complete turns Mandrel size = 1 x OD of Wire Wind on to mandrel by hand 1 wrap per second ensuring contact with mandrel. Wraps must touch. Remove from mandrel and carry out dye Indicator test Extend the wrapped coil, visually inspect the wraps, there should be no cracks or pin holes in the PJ exposing core.	PASS AB63227

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TEST REPORT FOR: ACW WIRE Page 1 of 1

T specification: SCD and WSD 1223 Issues in effect

Part Description: **ACW0219-2.50-05 (ws)** Print Date
12 September 2016 10:03

Batch Number: **1413091607** Quantity: **M**

M.O. Number: **k350932(9K)**

Pass Date: **14-9-16** Passed By: **AmayB** Final Stamp: **AB63227**

Cost Centre	Cost Centre Name	Quantity	Exit Number
	1st Core Extrusion	9300	P13 12 sep 16 23
	2nd Primary Jacket Extrusion	9100	J14 13 sep 16 07
	1st Small Beam	9100	108 14 sep 16 20

Core Extrusion Compound Batch: **1020220-01** CC batch: **25261**

Stripe Batch: **25252(5)** Conductor batch: **5786056663**

	Conductor O.D		Extruded O.D		Core Wall	Concentricity	Stripe 1	Stripe 2	Stripe Total	Acceptance Stamp
	max	min	min	max						
	2.15 mm	2.57 mm	2.63 mm	.27 mm	70%	min 10%	min 10%	max 30%		
Start	1.913	2.5	38	.287	85	10	11	21	DH14972	
End	1.915	2.5	36	.290	86	10	11	21	DH14972	

Stripe Colour as Part Description {
 1 **DH14972**
 2 **DH14972**

Jacket Extrusion Compound Batch: **1020056-01**

	Extruded O.D		PJ Wall	Total Wall	Overall concentricity	Visual	Acceptance Stamp
	Min.	Max.	Min.	Min.	min	Workmanship	
	2.70 mm	3.00 mm	.08 mm	0.35 mm	70%	1st Class	
Start	2.799	.090	.402	80%	✓	GB94371	
End	2.820	.082	.400	80%	✓	GB94371	

Irradiation as beam manual Acceptance Stamp **TEMP 02**

Post Irradiation Checks

Test	Requirement	Result
Conductor: Type and PCN	RHL-2.50MM-19X.41-BC PCN F75990-000	As per Conductor Batch No.
Conductor: DC Resistance @ 20.0°C	7.0Ω Ohms/ km Min. 7.60 Ohms/ km Max.	7.24 Ohm AB63227
100% Spark Test Finished wire	5 kV HF rms 7kV impulse	In Process Check
Bond Test	Remove a minimum 25 mm strip of insulation from the sample. there should be no delamination of the core and jacket layers.	PASS AB63227
1 x OD Wrap Test (Sizes 0.35 mm ² to 10 mm ² inclusive.)	Sample of 5 complete turns Mandrel size = 1 x OD of Wire Wind on to mandrel by hand 1 wrap per second ensuring contact with mandrel. Wraps must touch. Remove from mandrel and carry out dye Indicator test Extend the wrapped coil, visually inspect the wraps. there should be no cracks or pin holes in the PJ exposing core.	PASS AB63227

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TEST REPORT FOR ACW WIRE Page 1 of 1

To specification: SCD and WSD 1223 Issues in effect

Part Description: **ACW0219-6.0- 2 (Bp)** Print Date
04 January 2017 14:51

Batch Number: **1206011709** Quantity: M

M.O. Number: **K506342**

Pass Date: **9/1/17** Passed By: Final Stamp: **DB 14035**

Cost Centre	Cost Centre Name	Quantity	Exit Number
	1st Core Extrusion	1500	P12 05 JAN 17 09
	2nd Primary Jacket Extrusion	1350	J12 06 JAN 17 09
	1st Small Beam		R0507 JAN 16 05

Core Extrusion Compound Batch: **1021158-01** CC batch: **26897**

Stripe Batch: **N/A** Conductor batch: **5432002992**

	Conductor O.D		Extruded O.D		Core Wall		Concentricity	Stripe 1 min 10%	Stripe 2 min 10%	Stripe Total max 30%	Acceptance Stamp
	max	min	min	max	min	min					
	3.02 mm	3.82 mm	3.90 mm	.38 mm	min	70%					
Start	2.95	3.85	.42	84%							JR63130
End	2.95	3.85	.43	86%							JR63130

Stripe Colour as Part Description {
1
2

Jacket Extrusion Compound Batch: **1021783-01**

	Extruded O.D		PJ Wall	Total Wall	Overall concentricity	Visual	Acceptance Stamp
	Min.	Max.	Min.	Min.	min	Workmanship 1st Class	
	4.00 mm	4.30 mm	.10 mm	0.48 mm	min 70%		
Start	4.19	.12	60	72%	DB 14035	DB 14035	
End	4.20	.140	58	77%	JR63130	JR63130	

Irradiation as beam manual Acceptance Stamp **NC62679**

Post Irradiation Checks

Test	Requirement	Result
Conductor: Type and PCN	RHL-6.00MM-61X.36-BC PCN CQ3588-000	As per Conductor Batch No.
Conductor: DC Resistance @ 20.0°C	2.91 Ohms/ km Min. 3.10 Ohms/ km Max.	3.2 DB 14035
100% Spark Test Finished wire	5 kV HF rms 7kV impulse	In Process Check
Bond Test	Remove a minimum 25 mm strip of insulation from the sample, there should be no delamination of the core and jacket layers.	DB 14035
1 x OD Wrap Test (Sizes 0.35 mm² to 10 mm² inclusive.)	Sample of 5 complete turns Mandrel size = 1 x OD of Wire Wind on to mandrel by hand 1 wrap per second ensuring contact with mandrel. Wraps must touch. Remove from mandrel and carry out dye Indicator test Extend the wrapped coil, visually inspect the wraps, there should be no cracks or pin holes in the PJ exposing core.	DB 14035

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38 KEYWORDS

1	Automotive	4	T4
2	Qualification	5	WSD1223
3	ACW	6	

39 REFERENCES/RELATED DOCUMENTS

1	WSD1223 Issue 9
2	WSK-1A348-A4 (03/06/03)
3	ISO6722:2006(E) second edition 2006-08-01
4	Tyco Electronics QC Test Reports
5	Tyco Electronics Laboratory notebook: 5592
6	
7	
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