1. SCOPE

1.1 Content

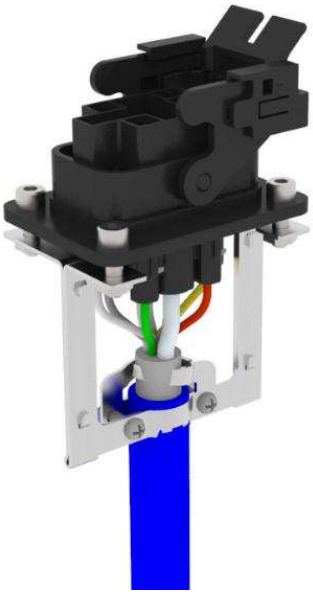
This specification covers the performance, tests and quality requirements for Motorman Hybrid Connector and Motorman Shroud (fig. A1).

Motorman Hybrid Connector
Plastic Version

Motorman Hybrid Connector
Metal Version

Fig. A1

Motorman Shroud
Metal Version



Motorman Shroud
Plastic Version

1.2 Qualification

When tests are performed the following specifications and standards shall be used. All inspections shall be performed by using the applicable inspection plan and product drawings.

2. APPLICABLE DOCUMENTS

The following documents are part of this specification, if they are referenced. In case of conflicts between this specification and the product drawing or of conflicts between this specification and the referenced documents, this specification shall take precedence.

2.1 Tyco Electronics Documents

A *Test Specifications*

109-1: General requirements for test specification

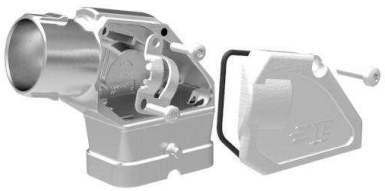
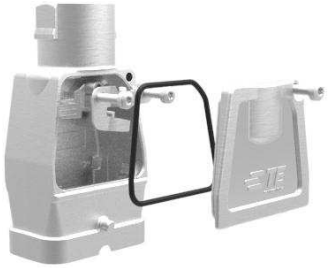
108-94002: MCON 2.8 contact

108-18782: MCON 1.2LL contact / Tab contact 1.2

108-1268: Contact series 22DF

108-18063: Tab Contact 2.8mm

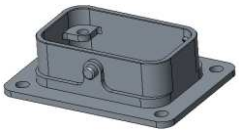
B Drawings (Motorman Hybrid Connector)

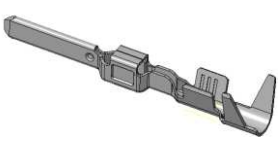
Sample	Description	Drawing/PN
	Male Insert	2120325 (C-2120325)
	Receptacle Housing (Female Insert)	2120319 (C-2120319)
	Rec. Housing + PE (Female Insert)	2120320 (C-2120320)
	Signal Housing	2120321 (C-2120321)
	Metal Hood Kit 90°	2120330 (C-2120330)
	Plastic Hood Kit 90	2120340 (C-2120340)
	Metal Hood Kit 180°	2120457 (C-2120457)

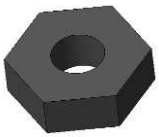
	Plastic Hood Kit 90	2120451 (C-2120451)
	Assy Female Insert Series HC26, 4Pos	1103427
	Protection Cover	2120336 (C-2120336)
	Cable Sealing	2120337 (C2120337-2)
	Side Clip Metal	2120339 (C-2120339)
	Side Clip Plastic	1245276
	Screw Metal	2120204-2
	Screw Plastic	1110916-8
	Mcon 2.8	1719840

	Mcon 1.2LL	1452653
	Contact Series 22DF	1658686
	Ferrules Large and Small	2120432

C Drawings (Motorman Shroud)

Sample	Description	Drawing/PN
	Male Insert Housing	2295893 (C-2295893)
	Signal Housing	2295894 (C-2295894)
	Shroud, Metal	2295889 (C-2295889)
	Shroud, Plastic	2295892 (C-2295892)

	Side Clip, Metal	2295890 (C-2295890)
	Side Clip, Plastic	2295895 (C-2295895)
	Locking Slider, Metal version	2295896 (C-2295896)
	Locking Slider, Plastic version	2297012 (C-2297012)
	Flange Sealing	2295897 (C-2297897)
	Screen Clamp, Motorman Shroud	2295891 (C-2295891)
	Gland Plate	2120338 (C-2120338)
	Male Insert Ass´y Series HC26, 4 POS	1103426-2
	Pin Contact	1658670-2
	Tab Contact 1.2 x 0.6	1418758-3 (Plastic version) 1418760-3 (Metal version)
	Tab Contact 2.8 x 0.8	2-2141598-2

	M4 x12 Metric screw, Hex, head height 2.7mm	DIN 7984
	M3x12 Metric Screws, Cross	1-519089-7 (DIN 7985)
	M4 Nut	519021-8 (DIN 934)
	M3 Nut	519021-7 (DIN 934)

2.2 Other Documents

2.3 IEC 60068-1 Environmental testing. Part 1: General and guidance

IEC60068-2-2 Environmental testing - Part 2-2: Tests - Tests B: Dry heat

IEC 60068-2-14 1984 Environmental testing - Part 2: Tests. Test N: Change of temperature

IEC 60068-2-30 2005 Environmental testing - Part 2-30: Tests - Test Db: Damp heat, cyclic (12 h + 12 h cycle)

IEC 60068-2-60 Environmental testing - Part 2: Tests - Test Ke: Flowing mixed gas corrosion

IEC 60512-1	2001 Connectors for electronic equipment - Tests and measurements - Part 1: General
IEC 60512-2-1	Connectors for electronic equipment - Tests and measurements - Part 2-1: Electrical continuity and contact resistance tests – Test 2a: Contact resistance - Mill volt level method
IEC 60512-2-5	2003 Connectors for electronic equipment - Tests and measurements - Part 2-5: Electrical continuity and contact resistance tests - Test 2e: Contact disturbance
IEC 60512-2-6	Connectors for electronic equipment - Tests and measurements - Part 2-6: Electrical continuity and contact resistance tests – Test 2f: Housing (shell) electrical continuity
IEC 60512-4-1	Connectors for electronic equipment - Tests and measurements - Part 4-1: Voltage stress tests - Test 4a: Voltage proof
IEC 60512-6-3	2002 Connectors for electronic equipment - Tests and measurements - Part 6-3: Dynamic stress tests - Test 6c: Shock
IEC 60512-6-4	2002 Connectors for electronic equipment - Tests and measurements - Part 6-4: Dynamic stress tests - Test 6d: Vibration
IEC 60512-9	1992 Electromechanical components for electronic equipment; basic testing procedures and measuring methods - Part 9: Miscellaneous tests
IEC 60512-9-1	Connectors for electronic equipment - Tests and measurements - Part 9-1: Endurance tests - Test 9a - Mechanical operation

IEC 60512-13-1	2006 Connectors for electronic equipment - Tests and measurements - Part 13-1: Mechanical operation tests - Test 13a: Engaging and separating forces
IEC 60512-15-6	2006 Connectors for electronic equipment - Tests and measurements - Part 15-6: Connector tests (mechanical) - Test 15f: Effectiveness of connector coupling devices
IEC 60512-17-3	Connectors for electronic equipment - Tests and measurements - Part 17-3: Cable clamping tests - Test 17c: Cable clamp resistance to cable pull (tensile)
IEC 60529	1999 Degrees of protection provided by enclosures (IP Code)
EN 61373	Railway applications - Rolling stock Equipment - Shock and vibration tests

3. REQUIREMENTS

3.1 Design and construction

The product shall be specified on the applicable product drawing in the aspects of design, construction and physical dimensions.

3.2 Materials

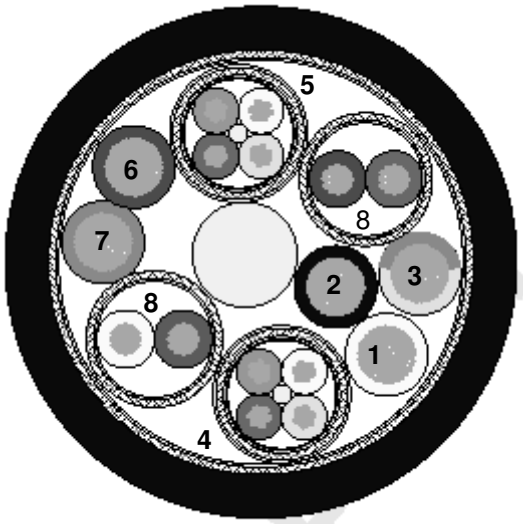
The materials used for the product are free of Silicone or Silicone contained release agents and free of unbound Teflon. See drawings for further information and details.

3.3 Ratings

A	Operating temperature:	- 40°C till + 85°C
B	Degree of protection:	IP 65
C	Current Rating for MCON 2.8 Receptacle:	max. 20A at 40°C
D	Maximal voltage:	900V DC
E	UL Recognized / UL File No.	E 28476 tested with 900V AC

For other electrical properties see mentioned test specifications above.

3.4 Proposed Cable Configuration



1 PE	5 Ethernet Core
2 DC-	6 24V
3 DC+	7 0V
4 Ethernet Core	8 Signal Wires

Contact TE Connectivity for your individual configuration

3.5 Performance and Test Description

The product is designed to establish the electrical, mechanical and environmental performance requirements specified in paragraph 3.5. All tests are performed at ambient environmental conditions per IEC 60512-2, unless specified otherwise.

No.	Test Description	Requirements	Test Procedure
		General Inspections	
1.1	Visual and dimensional examination	Meets the requirements of product drawing. There shall be no defect that would impair normal operation.	According to IEC 60512-1, Test 1a and 1b
		Electrical Inspections	
1.2	Transfer resistance DC	Transfer resistance < 200mΩ	According to IEC 60512-2-1, Test 2a
1.3	Shield resistance (DC)	Transfer resistance between cable and connector <120mΩ	According to ICE 60512-2-6, Test 2f
1.4	[4] Voltage proof between shield and wiring	Value and nature of test voltage: 1500V_{AC}	According to IEC 60512-4-1, Test 4a Time of testing 60s. Test voltage between shield and signal paths (connected together)
1.5			
1.6	Current- temperature capability (Derating diagram)	Temp. rise ↑ 40K	According to IEC 60512-5-2

Mechanical Inspections			
1.7	Separation and engagement forces (Motorman Hybrid Connector)	Insertion and withdrawal force: 100N max. <u>Female /Male :</u> • 5 x MCON 2.8 LL and TAB • 2 x MCON 1.2 LL and TAB • 2 x Female Ethernet and Male Ethernet	According to IEC 60512-13-1, Test 13a
	Separation and engagement forces (Motorman Shroud)	Insertion and withdrawal force: 100N max. Insertion forces has to be measured with locking device	
1.8	Handling of Coupling Device (Motorman Hybrid Connector)	Fasten of Locking Device (Side Clip) 5 times	Manual Handling
	Handling of Coupling Device (Motorman Shroud)	*Fasten of Locking Device (Side Clip) 10 times for metal version, 5 times for plastic version *Measure closing force of side clip before/after rapid change of temperature, each one time measurement *Locking / Unlocking operation of Locking slider 10 times before/after Rapid change of temperature. Check if Locking slider breaks	*Manual Handling *Locking with Manual, Unlocking with Screw driver
1.9	Effectiveness of coupling device	Rate of load: max. 25mm/min 80N for 60s ± 5s	According to IEC 60512-15-6, Test 15f
2.0	[5] Tensile strength of cable	Pull force: F≥ 156N / 1min End of the cable must not slip from isolation cable clamp	According to IEC 60512-17-3, Test 17c

2.1	Mechanical Operation	Max. speed 10mm/s; rest 5s No physical damage, maximum transfer resistance must not be exceeded	According to IEC 60512-9 PL1 (N/2) = 20 cycles
2.2	Vibration	f= 10-500Hz, Amplitude= 0,35 mm, Acceleration = 50m/s² 10 sweeps /axis	According to 60512-6-4, Test 6d contact disturbance max.1µs / 7Ω According to IEC 60512-2-5, Test 2e
2.3	Shock	50g, 11ms duration of impact, 500m/s² half sine 3 shocks /axis	According to IEC 60512-6-3, Test 6c contact disturbance max.1µs / 7Ω According to IEC 60512-2-5, Test 2e
2.4	Noise	No physical damage, no discontinuities > 1µs transfer resistance within limits, no opening of connector locking device	EN 50155 (Railways application) According to EN61373 5Hz →0,01034g² Hz 20Hz →0,01034g² Hz 150Hz →0,000183g² Hz
2.5	Contact retention force (between contact and housing)	1.2 x 0.6 Tab contact: F≥ 50N 2.8 x 0.8 Tab contact: F≥ 50N Male Insert Ass´y Series HC26: F≥ 50N	According to IEC 60512-8 Test 16d
2.6	Push out force (Insert housing from Shroud)	F≥ 60N	According to IEC 60512-8 Test 16d, Vertical disengaging force of insert housing from shroud

Environmental Inspections			
3.1	Rapid change of temperature	No physical damage -40° to +85°C mated connector 100 cycles, ta:30 min, tb:30min transfer time: > 20 sec	According to IEC 60068-2-14, Na
3.2	Dry heat	No physical damage	According to IEC 60068-2-2, Bb Motorman HC - Plastic Temperature: 85°C Duration 168h Motorman HC - Metal Temperature: 85°C Duration 168h
3.3	Climatic damp heat (cycles)	10 days low temperature: -25°C high temperature: +55°C humidity: 93% rH In mated state	According to IEC 60068-2-30, Db
3.4	Industrial atmosphere	No physical damage. max. transfer resistances must not be exceeded	According to IEC 60068-2-60 Rel. Humidity: 75% Temperature: 25°C Duration: 21 days 0,20 ppm SO_2 0,01 ppm H_2S 0,20 ppm NO_2 0,01 ppm Cl_2
3.5	Foreign substance – and protection against ingress of water	category IPx5 than IP6x	According to IEC 60529
3.6	[3] Chemical stress	No physical damage	According to ISO 61750-5, applied by a brush, test is performed at room temperature ♠ “bio” diesel fuel ♠ hydraulic fuel ♠ engine oil ♠ coolant additive

3.6 Qualification and Requalification Test Sequences (Motorman Hybrid Connector)

Nr.	Test	[1]Test Group									
		A	B	C	D	E	F	G	H	J	K
		[2] Test Sequence									
1.1	Visual and dimensional examination	1/ 5/ 9/ 13/17	1/6/ 10	1/ 5/ 9/13/ 17	1/ 3	1/ 3	1/ 3	1/ 3/ 7	1/3		1/ 3
1.2	Transfer resistance	2/ 6/ 10/14/ 18	2/7	2/ 6/ 10/14 /18							
1.3	Shield resistance	3/ 7/ 11/15/ 19	3/8	3/ 7/ 11/15 /19							
1.4	Voltage test		4/9								
1.5											
1.6	Derating										2
1.7	Separation and engagement forces						2				
1.8	Handling of Coupling Device							4			
1.9	Effectiveness of coupling device				2						
2.0	Tensile strength of cable					2					
2.1	Mechanical operation			4/ 16							
2.2	Vibration	8									
2.3	Shock	12									
2.4	Noise	16									
3.1	Rapid change of Temperature		5					5			
3.2	Dry heat	4									
3.3	Climatic damp heat			12							
3.4	Industrial atmosphere			8							
3.5	Foreign substance – and protection against ingress of water (IP)							2/ 6			
3.6	[3] Chemical stress								2		

3.7 Qualification and Requalification Test Sequences (Motorman Shroud)

Nr.	Test	[1]Test Group					
		M	N	O	P	Q	R
		[2] Test Sequence					
1.1	Visual and dimensional examination	1/ 5/ 9/ 13/17	1/6/10	1/ 3	1/ 3	1/ 3	1/ 3/ 8
1.2	Transfer resistance	2/ 6/ 10/14/18	2/7				
1.3	Shield resistance	3/ 7/ 11/15/19	3/8				
1.4	Voltage test		4/9				
1.6	Derating						
1.7	Separation and engagement forces					2	
1.8	Handling of Coupling Device						4/ 6
1.9	Effectiveness of coupling device			2			
2.1	Mechanical operation						
2.2	Vibration	8					
2.3	Shock	12					
2.4	Noise	16					
2.5	Contact retention force				2		
2.6	Push out force						
3.1	Rapid change of Temperature		5				5
3.2	Dry heat	4					
3.3	Climatic damp heat						
3.4	Industrial atmosphere						
3.5	Foreign substance – and protection against ingress of water (IP)						2/7
3.6	[3] Chemical stress						

(1) See paragraph 4.1 A

(2) Numbers indicate sequence in which tests are performed.

(3) Requirements pH>2 (this regulation does apply to sulphuric or hydrochloric acid)

(4) The test for high voltage will be performed only with one special cable type and stands for documentation of the basic design features only concerning clearance and creepage distances or grounding (cover). Test performed by UL-Laboratory. Any of ESD immunity according to EN 61000-4-2 itself has to be proven in context of application to customer (type test of apparatus)

(5) Hybrid cable should be fixed as of length of 700mm to avoid over-load on side clip locking device especially when unspecified tumescent load on cable is expected.

4. QUALITY ASSURANCE PROVISIONS

4.1 Qualification Testing

A Sample selection

The samples shall be prepared in accordance with product drawings. They shall be selected at random from the production.

Test groups consist of:

Test group A	5 assemblies
Test group B	4 assemblies
Test group C	5 assemblies
Test group D	2 assemblies
Test group E	5 assemblies
Test group F	3 assemblies
Test group G	5 assemblies
Test group H	1 component each
Test group J	
Test group K	3 assemblies

Test group M	3 assemblies
Test group N	3 assemblies
Test group O	2 assemblies
Test group P	3 assemblies
Test group Q	3 assemblies
Test group R	3 assemblies

B Test sequence

Qualification inspection shall be verified by testing samples as specified in paragraph 3.6.

4.2 Requalification Testing

If changes affecting significantly the form, fit or function of the product or the manufacturing process, product assurance shall coordinate requalification testing, consisting of all or of a part of the original testing sequence as determined by development/product, quality and reliability engineering.

4.3 Acceptance

The acceptance is based on verification that the product establishes the requirements of paragraph 3.5. Failures attributed to the equipment, test setup or operator deficiencies shall not disqualify the product.
When product failure occurs, corrective action shall be taken and samples are resubmitted for qualification. Testing to confirm corrective action is required before resubmitted.

4.4 Quality and Conformance Inspection

The applicable Tyco Electronics quality inspection plan will specify the sampling acceptable quality level to be used. Dimensional and functional requirements shall be in accordance with the applicable product drawing and this specification.

A APPENDIX

A.1 Test Setup for Mechanical Vibration Test (1.8) and Mechanical Shock Test (1.9)

For the mechanical and the vibration test, it is important to fix the Specimens on a fixing plate. Fix the cable according to fig. A2

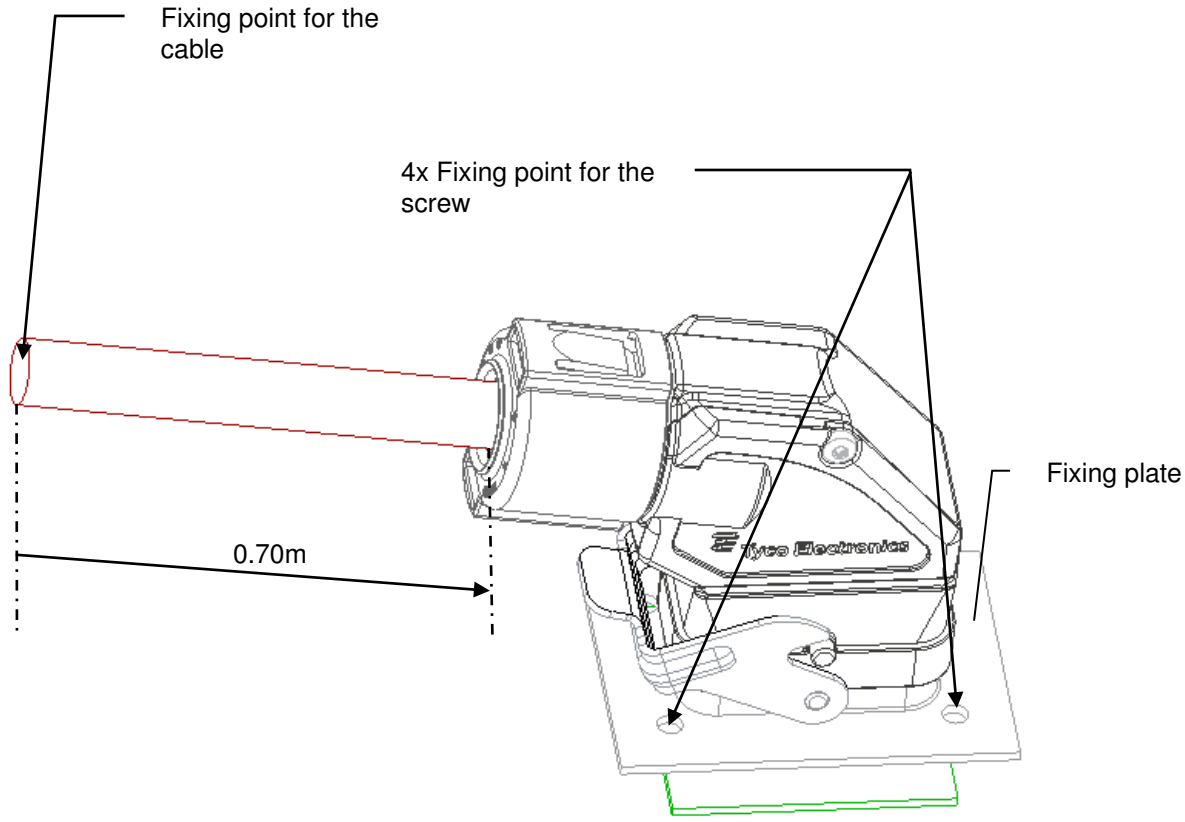


Fig. A2

A.2 Configuration of Test groups

Test Group	Cable assy, DB-MOT LL(plastic 90)	Cable assy, ACPm65, Hybrid cable (metal 90)	Motorman Shroud, Plastic version	Motorman Shroud, Metal version
M	3	3	3	3
N	3	3	3	3
O	2	2	2	2
P *1)			3	
Q	3		3	
R	3	3	3	3
Total Sum	14	11	17	11

*1) Group P consists of insert housing, signal housing and separated crimped contacts

Revision Record

Revision	Remarks	Name	Date
J	Motorman Shroud components are added	I. Kang	27July2016
K	Specification updated	E. Reiss	23June2017