

RB.LV.fe-8 and RB.LV.fe-12 - the LV cables for the barrel RPC's Front End

Introduction

This document describes the materials used to build the cables RB.LV.fe-# which supply the Low Voltage to the Front End electronics of the barrel RPC. There are 2 kinds of LV cables. They are made with the same materials. The only difference is the numbers of the electrical conductors, one has 8 wires, the other 12. All these cables are fully inside UXC55. Each one starts from a RPC detector and goes up to LV power supplies crates in the wheel's towers. For each sector there are 5-6 cables with 8 conductors (type RB.LV.fe-8) and always one with 12 conductors (RB.LV.fe-12). In a wheel we have 62 cables with 8 wires and 12 with 12 wires. So the grand total for all CMS is 310+60 LV RPC cables. The estimated medium length is around 15 [m].

The responsible person for technical aspects of these cables is:

Dott. Antonio Ranieri **INFN** Bari e-mail: antonio.ranieri@ba.infn.it

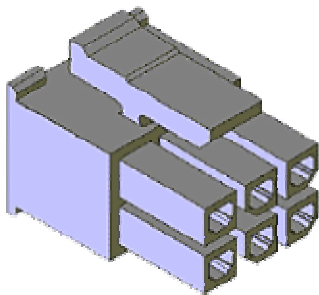
Cable

There are two types which differ in the number of internal conductors

- **Novacavi** "8x0.75 FMOH2M1-300V IEC 332-3-24 CERN IS23", ref. 8R3141
- **Novacavi** "12x0.75 FMOH2M1-300V IEC 332-3-24 CERN IS23", ref. 12R3117

Both are Blue colored and IS23 certified - excluding radiation resistance for sheath - by the firm and cern's TIS. See **Appendix 1** for the data-sheets and details.

Connector at the detector side



For both two types of cable, the connector at the detector side is the **MOLEX** p.n.43025-1200. It has 2 rows by 6 pins, **Fig.1** shows the 2 by 3 pins type. Concerning flammability this connector is *UL 94V-0* rated. Complete details are in **Appendix 2** and **3**.

Fig 1 The LV connector at the detector side.

Connector at the tower side

At the tower side this cable will be plugged in a CAEN EASY LV power supply. At present these are still under discussion.

Appendix 1 – Cable

1.1 RB.LV.fe-8 cable's datasheet (8 wires)

8X0,75 FMOH2M1-300 V IEC 332-3-24 CERN IS 23	Specification		8R3141
	Rev.	1	Page 1 of 1

CONSTRUCTION

8 X 0,75 mm²

Bare copper conductor 23x0,20 mm

Halogen free, flame retardant polyolefin insulation, colour black identified by white numbers, nominal thickness 0,40mm, nominal diameter 1,90 mm.

Conductors laid up in layers, diameter over the assembly 6,1 mm.

Polyester tape over the assembly.

Overall shield made of bare copper braid shield coverage >85%.

Halogen free, flame retardant polyolefin outer sheath, nominal thickness 0,90 mm colour blue Ral 5015.

Nominal overall diameter 8,4 mm

Test voltage: 1500 V among conductors

1000 V among conductors and shield

Insulation resistance > 100 Mohm*km


Electric resistance Max @ 20°C: 0,75 mm² 26 Ohm/km

Weight:134 kg/km

Bending radius static min. : 55 mm

REFERENCE STANDARD

IEC, CERN IS 23 excluding radiation resistance, IEC 60332-3-24, IEC 60332-1

 Electric cables for special purposes	Issued	Checked	Date
	T.D.	T.M.	13/01/04

1.2 RB.LV.fe-12 cable's datasheet (12 wires)

14/11/03 17:00 NOVACAVI SPA → 0805442431

NUMB57 005

12X0,75 FMOH2M1-300 V IEC 332-3-24 CERN IS 23	Specification		12R3117
	Rev.	1	Page 1 of 1

CONSTRUCTION

12 X 0,75 mm²

Bare copper conductor 23x0,20 mm

Halogen free, flame retardant polyolefin insulation, colour black identified by white numbers, nominal thickness 0,40mm, nominal diameter 1,90 mm.

Conductors laid up in layers, diameter over the assembly 7,9 mm.

Polyester tape over the assembly.

Overall shield made of bare copper braid shield coverage >85%.

Halogen free, flame retardant polyolefin outer sheath, nominal thickness 1,00 mm colour blue Ral 5015.

Nominal overall diameter 10,5 mm

Test voltage: 1500 V among conductors

1000 V among conductors and shield

Insulation resistance > 100 Mohm*km

Electric resistance Max @ 20°C: 0,75 mm² 26 Ohm/km

Weight: 198 kg/km

Bending radius static min. : 65 mm

REFERENCE STANDARD

IEC, CERN IS 23 excluding radiation resistance, IEC 60332-3/C, IEC 60332-1

novacavi Electric cables for special purposes	Issued	Checked	Date
	T.D.	T.M.	14/11/2003

Appendix 2 – Connector at the detector side

2.1 Connector's materials and electrical specifications

Crimp Housings (Series) - 43025

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English Español Français Italiano Deutsch Português 中文显示 日本語 한국어

Datasheet

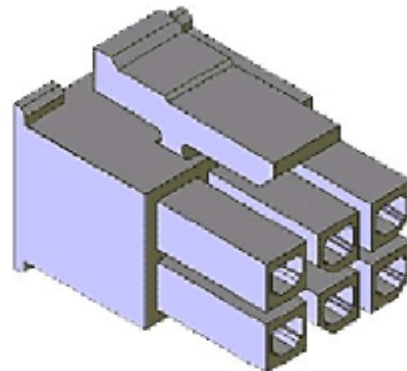
Crimp Housings (Series)

3.00mm (.118") Pitch Micro-Fit 3.0™ Receptacle, Dual Row 43025

[[Home](#) > [Products](#) > [Crimp Housings \(Series\)](#) > [Datasheet](#)]

[Help](#)

Status	Active
Gender	Female
Wire Entry Angle	Vertical
Circuits / Positions	2, 4, 6, 8, 10, 12, 14, 16, 18, 20, 22, 24
Pitch / Center Spacing	3.00mm (.118")
Rows	2
Mates With	43020, 43045, 43045dr, 43045dv, 43045r, 43045rfn, 43045rrc, 43045vfn, 43045vrc, 44242
Use With	43030
Designed In	Millimeters
Temperature Range	-40°C to +105°C
Contact Insertion Force-max. (per circuit)	14.7N (3.30 lb)
Contact Retention Force-min. (per circuit)	24.5N (5.51 lb)
Mating Force-max. (per circuit)	11.6N (2.61 lb)
Normal Force-min. (per circuit)	1.47N (0.33 lb)
Unmating Force-min. (per circuit)	3.7N (0.83 lb)
Panel Mount	No
Packaging	Bag
Housing Material	Polyester
Color	Black
Flammability	UL 94V-0
Stackable	No
Product Specification	PS-43650
UL File No.	E29179
CSA File No.	LR19980
TUV File No.	R95107
MX01 Catalog Page	F-125
Product Name	Micro-Fit, 3.0™
Molex Series	43025



Features and Benefits

- Receptacle for wire-to-wire or wire-to-board applications
- Positive latching housing for secure mating retention to plug or header
- Fully isolated terminals to protect contacts from damage
- Fully polarized to plug or header to prevent mismatching
- Integral pull tabs for ease in unmating

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PRODUCT SPECIFICATION

MICRO-FIT

1.0 SCOPE

This Product Specification covers the 3.00 mm (.118 inch) centerline (pitch) square pin headers when mated with either printed circuit board (PCB) connector or connectors terminated with 20 to 30 AWG wire using crimp technology.

2.0 PRODUCT DESCRIPTION

2.1 PRODUCT NAME AND SERIES NUMBERS

Receptacle: 43025 Terminal: 43030

Plug: 43020 Terminal: 43031

Headers: 43045, 44914

Test Plug: 44242 (recommended for continuity testing only)

Other products conforming to this specification are noted on the individual drawings.

2.2 DIMENSIONS, MATERIALS, PLATINGS AND MARKINGS

Housings: Polyester or LCP

Terminal: Phosphor Bronze

Pins: Brass, Modified Tin/Brass

2.3 SAFETY AGENCY APPROVALS

UL File Number: E29179

CSA: LR19980

TUV: R95107

3.0 APPLICABLE DOCUMENTS AND SPECIFICATIONS

4.0 RATINGS

4.1 VOLTAGE

UL: 250 Volts

TUV: 200 Volts

4.2 CURRENT AND APPLICABLE WIRES (Current is dependent on connector size, contact material, plating, ambient temperature, printed circuit board characteristics and related factors. Actual current rating is application dependent and should be evaluated for each application.)

AWG	Amps	Max. Outside Insulation Diameter
20	5	1.85 mm (.073 inch)
22	5	1.85 mm (.073 inch)
24	4	1.85 mm (.073 inch)
26	3	1.27 mm (.050 inch)
28	2	1.27 mm (.050 inch)
30	1	1.27 mm (.050 inch)

4.2.1 CURRENT FOR TEST PLUG 44242

2.5 Amps Maximum (Pogo pin current capacity)

4.3 TEMPERATURE

Operating: - 40°C to + 105°C (Including Terminal Temperature Rise)

Nonoperating: - 40°C to + 105°

REVISION:	ECR/ECN INFORMATION:	TITLE:	SHEET No.
H	EC No: UCP2003-2248 DATE: 2003 / 04 / 21	PRODUCT SPECIFICATION MICRO-FIT DUAL ROW CONNECTORS	1 of 5
DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
PS-43045	SAMIEC	MUELLER	MARGULIS

TEMPLATE FILENAME: PRODUCT_SPEC(SIZE_A)(V.1).DOC



PRODUCT SPECIFICATION

5.0 PERFORMANCE

5.1 ELECTRICAL REQUIREMENTS

DESCRIPTION	TEST CONDITION	REQUIREMENT
Contact Resistance (Low Level)	Mate connectors: apply a maximum voltage of 20 mV and a current of 100 mA. (Does not include wire resistance)	10 milliohms MAXIMUM [initial]
Contact Resistance @ Rated Current	Mate connectors: apply a maximum voltage of 20 mV at rated current.	30 milliohms MAXIMUM [initial]
Contact Resistance of Wire Termination (Low Level)	Terminate the applicable wire to the terminal and measure wire using a voltage of 20 mV and a current of 100 mA.	5 milliohms MAXIMUM [initial]
Insulation Resistance	Unmate & unmount connectors: apply a voltage of 500 VDC between adjacent terminals and between terminals to ground.	1000 Megohms MINIMUM
Dielectric Withstanding Voltage	Unmate connectors: apply a voltage of (two times the rated voltage plus 1000 volts) VAC for 1 minute between adjacent terminals and between terminals to ground.	No breakdown; current leakage < 5 mA
Capacitance	Measure between adjacent terminals at 1 MHz.	2 picofarads MAXIMUM
Temperature Rise (via Current Cycling)	Mate connectors: measure the temperature rise at the rated current after: 1) 96 hours (steady state) 2) 240 hours (45 minutes ON and 15 minutes OFF per hour) 3) 96 hours (steady state)	Temperature rise: +30°C MAXIMUM

5.2 MECHANICAL REQUIREMENTS

DESCRIPTION	TEST CONDITION	REQUIREMENT
Connector Mate and Unmate Forces	Mate and unmate connector (male to female) at a rate of 25 ± 6 mm ($1 \pm \frac{1}{4}$ inch) per minute. (Per circuit)	8.0 N (1.8 lbf) MAXIMUM insertion force & 3.7 N (0.8 lbf) MINIMUM withdrawal force
Terminal Retention Force (in Housing)	Axial pullout force on the terminal in the housing at a rate of 25 ± 6 mm ($1 \pm \frac{1}{4}$ inch) per minute.	24.5 N (5.5 lbf) MINIMUM retention force
Terminal Insertion Force (into Housing)	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm ($1 \pm \frac{1}{4}$ inch).	14.7 N (3.3 lbf) MAXIMUM insertion force

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DOCUMENT NUMBER:	CREATED / REVISED BY:	CHECKED BY:	APPROVED BY:
PS-43045	SAMIEC	MUELLER	MARGULIS

TEMPLATE FILENAME: PRODUCT_SPECSIZE_ARY1.DOC



PRODUCT SPECIFICATION

5.2 MECHANICAL REQUIREMENTS

Durability	Mate connectors up to 30 cycles at a maximum rate of 10 cycles per minute prior to Environmental Tests.	20 milliohms MAXIMUM (change from initial)
Vibration (Random)	Mate connectors and vibrate per EIA 364-28, test condition VII.	20 milliohms MAXIMUM (change from initial) & Discontinuity < 1 microsecond
Shock (Mechanical)	Mate connectors and shock at 50 g's with ½ sine wave (11 milliseconds) shocks in the ±X,±Y,±Z axes (18 shocks total).	20 milliohms MAXIMUM (change from initial) & Discontinuity < 1 microsecond
Wire Pullout Force (Axial) (Wire from Terminal)	Apply an axial pullout force on the wire at a rate of 25 ± 6 mm (1 ± ¼ inch).	MINIMUM pullout force 20 awg: 57.8 N (13.0 lbf) 22 awg: 35.6 N (8.0 lbf) 24 awg: 22.2 N (5.0 lbf) 26 awg: 13.3 N (3.0 lbf) 28 awg: 8.9 N (2.0 lbf) 30 awg: 6.6 N (1.5 lbf)
Normal Force	Apply a perpendicular force.	2.7 N (275 grams) MINIMUM
Pin to Header Retention	Apply axial push force to pin at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	13.7 N (3.1 lbf) MINIMUM pushout force
Thumb Latch to Ramp Yield Strength	Full mate and then Unmate the connectors at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	68.4 N (15.4 lbf) MINIMUM Yield Strength
Panel Mount Retention	Full mate and then Unmate the connectors at a rate of 25 ± 6 mm (1 ± ¼ inch) per minute.	155.7 N (35 lbf) MINIMUM pushout force
Compliant Pin Insertion Force into PCB Hole (44914 Series)	Apply an axial insertion force on the terminal at a rate of 25 ± 6 mm (1 ± ¼ inch).	106.7 N (24 lbf) MAXIMUM Insertion force (Per Terminal)
Compliant Pin Retention Force in PCB Hole (44914 Series)	Apply an axial extraction force on the terminal at a rate of 25 ± 6 mm (1 ± ¼ inch).	35.6 N (8 lbf) MINIMUM Retention force (Per Terminal)

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PRODUCT SPECIFICATION

5.3 ENVIRONMENTAL REQUIREMENTS

DESCRIPTION	TEST CONDITION	REQUIREMENT
Thermal Aging	Mate connectors; expose to: 240 hours at $105 \pm 2^\circ\text{C}$ OR 500 hours at $85 \pm 2^\circ\text{C}$	20 milliohms MAXIMUM (change from initial) & Visual: No Damage
Humidity (Steady State)	Mate connectors; expose to a temperature of $40 \pm 2^\circ\text{C}$ with a relative humidity of 90-95% for 96 hours. Note: Remove surface moisture and air dry for 1 hour prior to measurements.	20 milliohms MAXIMUM (change from initial) & Dielectric Withstanding Voltage: No Breakdown at 500 VAC & Insulation Resistance: 1000 Megohms MINIMUM & Visual: No Damage
Solderability	Per SMES-152	Solder coverage: 95% MINIMUM (per SMES- 152)
Solder Resistance	Dip connector terminal tails in solder; Solder Duration: 5 ± 0.5 seconds; Solder Temperature: $260 \pm 5^\circ\text{C}$	Visual: No Damage to insulator material
Salt Spray	Mate connectors: Duration: 48 hours exposure; Atmosphere: salt spray from a 5% solution; Temperature: $35 + 1/-2^\circ\text{C}$	20 milliohms MAXIMUM (change from initial) & Visual: No Damage
Cold Resistance	Mate connectors: Duration: 96 hours; Temperature: $-40 \pm 3^\circ\text{C}$	20 milliohms MAXIMUM (change from initial) & Visual: No Damage
Corrosive Atmosphere: Sulfur Dioxide Gas (SO₂)	Mate connectors: Duration: 24 hours exposure; Atmosphere: 50 parts per million (ppm) SO ₂ gas; Temperature: $40 \pm 3^\circ\text{C}$	20 milliohms MAXIMUM (change from initial) & Visual: No Damage
Corrosive Atmosphere: Ammonia Gas (NH₃)	Mate connectors: Duration: 40 minutes exposure; Atmosphere: NH ₃ gas evaporating from a 28% Ammonia solution	20 milliohms MAXIMUM (change from initial) & Visual: No Damage

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TEMPLATE FILENAME: PRODUCT_SPEC(SIZE: A) V.1.DOC



PRODUCT SPECIFICATION

6.0 PACKAGING

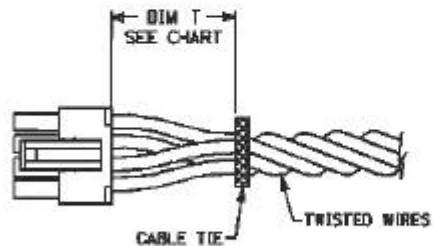
Parts shall be packaged to protect against damage during handling, transit and storage.

7.0 GAGES AND FIXTURES

8.0 OTHER INFORMATION

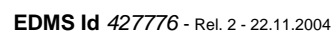
8.1 CABLE TIE AND OR WIRE TWIST LOCATION

CKT Sizes	Dim T Min.
2-8	.500 (12.70)
10-16	.750 (19.10)
18-24	1.000 (25.40)



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Appendix 3 – TIS evaluations

3.1 Connectors' IS41 compliance

Subject: RE: requests for IS41 evaluation for the cables "RB.LV.fe-8" and "RB.LV.fe-12"

Date: Fri, 12 Mar 2004 17:58:42 +0100

From: Jonathan Gulley <Jonathan.Gulley@cern.ch>

To: Fabio Montecassiano <Fabio.Montecassiano@cern.ch>

Hello Fabio,

Your cables are ok (re: IS23, radiation resistance unknown) - see in addition attached data sheet giving further details of smoke/corrosivity tests passed for sheathing material. Your connectors are ok (re: IS41).

Best Regards Jonathan

-----Original Message-----

From: Fabio Montecassiano

Sent: Wednesday, March 10, 2004 10:25 AM

To: Jonathan Gulley

Cc: Christoph Schaefer; Emilie Freret; antonio ranieri

Subject: requests for IS41 evaluation for the cables "RB.LV.fe-8" and "RB.LV.fe-12"

Dear Jonathan,

as requested by Christoph Schaefer, GLIMOS for CMS, I ask you to evaluate the IS41 compliance for the connectors MOLEX p.n. 43025-1200, as used in the cables "RB.LV.fe-8" and "RB.LV.fe-12" at the detectors side.

As summary, the connector is already UL 94V-0 rated. There will be 370 of them distributed on all 5 wheels, a grand total of very few kilos for all cms.

Please, see

<https://edms.cern.ch/document/427776>
for data-sheet and details.

Best regards

Fabio Montecassiano