INDEX

C3	Added note and explanation	C. CORDOLA	GTURCO	Apr. 2009
C	Revised per ECN ET00-0033-04	C. CORDOLA	GTURCO	MAR.2004
B2	Revised wire requirements et00-0031-03	C. CORDOLA	GTURCO	May2003
A2	Revised data and pages layout ET00-0112-02	C. CORDOLA	G. TURCO	JULY 02
A1	REVISED PER EC ET00-0004-02	C. CORDOLA	G. TURCO	06-MAY02

1. SCOPE:

1.1 This specification covers the requirement for applications of Mono-Shape Mark II - 5mm Pitch I.D.C Connectors. These requirements are applicable to Tyco-Electronics connectors when terminated by Tyco-Electronics Application tools and machines. The point 5 of this document defines in detail which are the control parameters to be verified on the IDC harness. Harnesses manufactured with these connectors family are used on appliance equipment.

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2.0 APPLICABLE DOCUMENTS

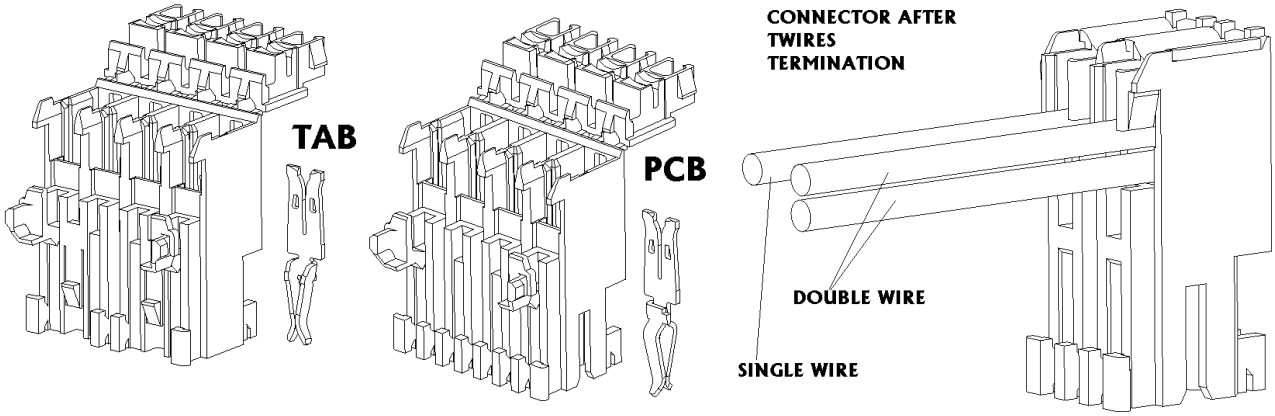
2.1 The following documents have to be considered as integral part of this specification:
AMP Product Drawings (284471 and 284482)
Product Spec. 108-20213 and 108-20214
M.H.A.R.A. Machine technical specification.
N.B. for multiple Wire Termination please refer to #114-20111

3.0 COMPONENTS

The list below is referred to IDC connectors assembly used to manufacture the IDC harness

description	PN's
From 1 to 10 pos. IDC connector 5.00 mm pitch for TAB RAST 5 applications	From 284471 to 284480
From 2 to 12 pos. IDC connector 5.00 mm pitch for PCB	From 284482 to 284492

Wires for these components have to be applied also in accordance with the limits defined on product spec. 108-20213 and 108-20214.



this Image is showing a typical
product configurations (for reference only).

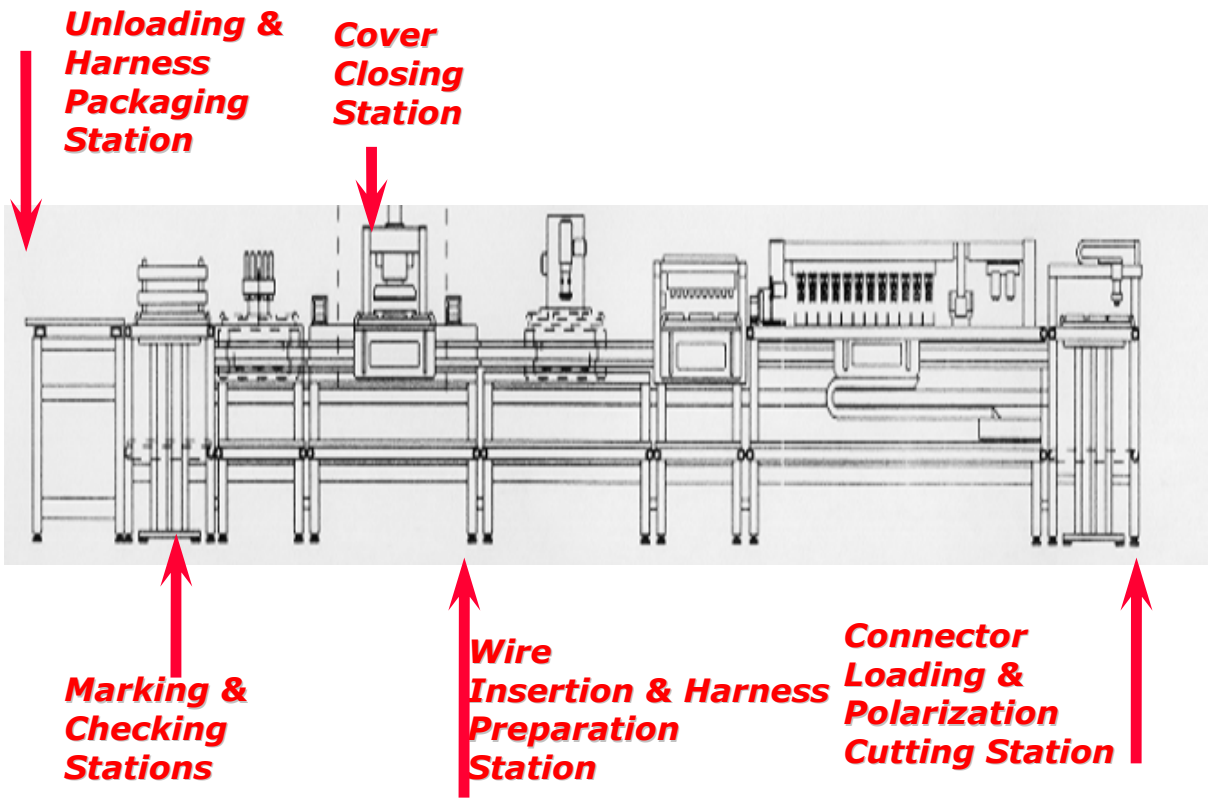
4.0 APPLICATION TOOLS

The following application spec. describe the operating method for tools like MHARA Machine that shall be used to apply the IDC connectors on proper wires to make the harness, providing a termination of a single way/wire at the time (no multiple termination, see Fig. 1 for MHARA Scheme).

The below scheme represent a fully automated machine capable to manufacture the complete and crossing harness, double wire performance included. Harness could be different for connectors numbers position and also different for wires length.

Those operations are included in the production cycle:

- to load and feed connectors in the right configuration needed to produce the relevant harness
- to load the wire with the right section (in a range from 0.5 to 1.5 mm² - for special application wire sect. of 0.35 is allowed previous Tyco Engineering Approval),
- to make the single or double wire termination on the IDC
- to fix the cover on to the housing,
- to cut the polarization, product could be specialized using a polarization keys system according to RAST 5 rules,
- to make a complete electrical continuity check,
- marking of the connector with a color code and packaging of the finished harness (optional).



For a reliable IDC termination, the insertion of the wires must be done using pliers or similar features to contrast the contact during the wire termination, the pliers must act on the two contact adjacent to the one that is being terminated. Attached Sketch (Fig. 1A).

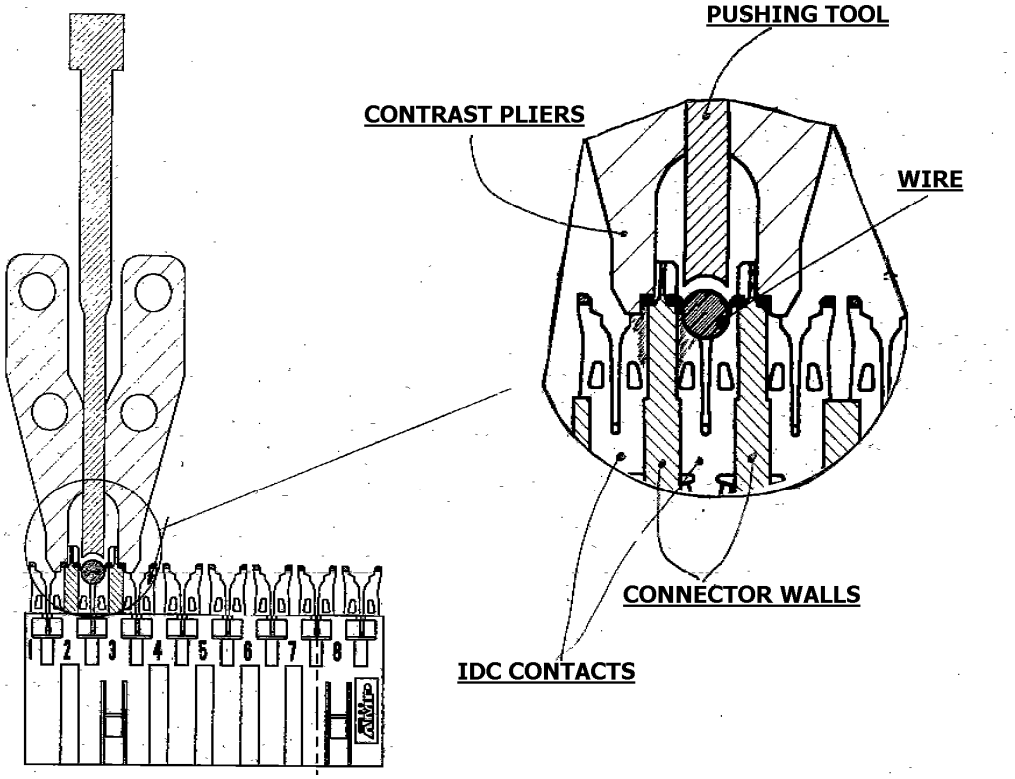


Fig.1A

The tool head as shown in above mentioned figure is for reference only but is very similar to the tool head designed for the MHARA machine.

The tool is moving up and down for the termination process. While the wire is inserted in the contact slot, a synchronized cam system provides to close the contrast pliers on the two contacts adjacent to the one subjected to the termination. Pliers must be completely closed before the wire touches the slot so at the beginning of wire insertion.

This operating methods will control contact deformation/stress on slot geometry, caused by the wire during the insertion, using this system a considerable portion of this stress is absorbed by the wire.

Pliers works on the two adjacent contacts because, due to limits in available space, (connector is for application having Pitch of 5mm) this is a good compromise between the needs of having a contrast as much as possible near to the slot, a and a fast and reliable operation.

4.2 WIRE INSERTION OPERATION – DETAIL FOR CONTRAST PLIERS

The pliers act at a specified dimension as shown on attached Fig.1B, when closed the pliers have a contrast dimension of 6.5 mm on housing walls and 7.5 mm on the two adjacent contacts.

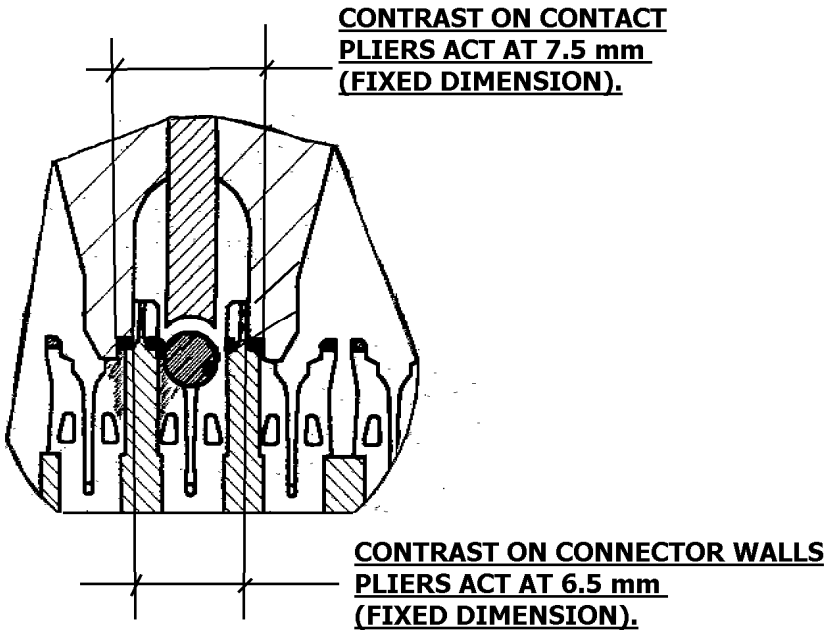


Fig. 1B

4.3 WIRE INSERTION OPERATION – DETAIL WHEN TOOL OPERATE ON EXTERNAL WAYS OF STACKED CONNECTORS

For a correct wire insertion, on the external ways of connectors, blades to support the connector on the side are used as shown an attached Fig. 1C, (blades on the first and the last way of the connectors loaded on the pallet station for the cabling process).

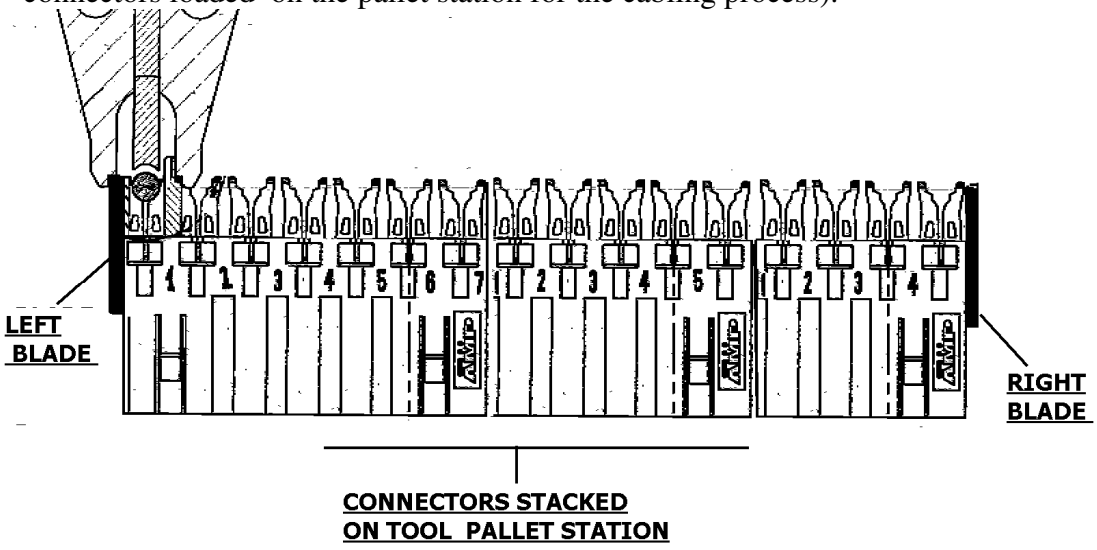


Fig.1C

5.0 CONTROL PARAMETERS

5.1 VISUAL EXAMINATION

Shipped connectors, supplied on strip on tray (Fig.2) must be positioned in the connector loading station plate in the right position looking at the number of position and configuration. A color code stripe, located on the cover as shown on Fig.3, provide to help the operator to verify if the connector strip is a PCB or a TAB or a BRIDGE version. See relevant product drawing, document number 284482 and 284471 for color coding.

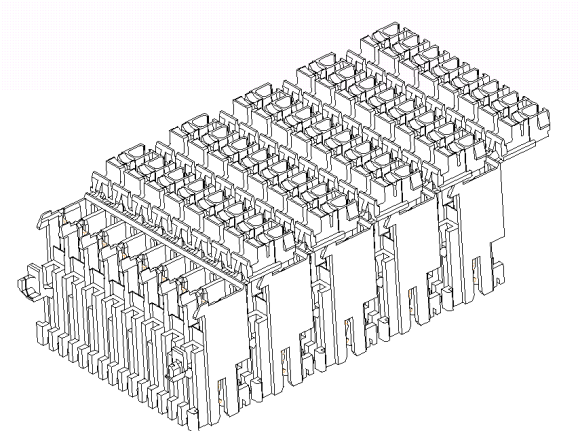


Fig.2 Connectors strip as shipped

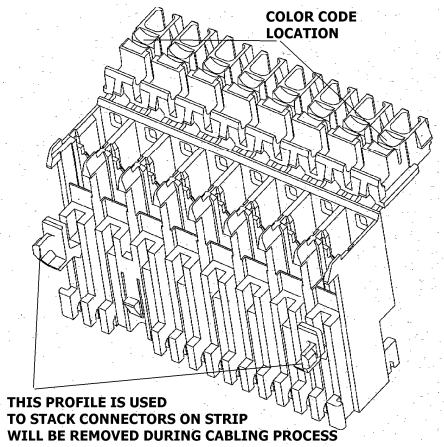


Fig.3

5.2 CONTROL DIMENSIONS

A Computer station with a proper software provide to acquire data to manage the cable specialization, like connector components, electrical layout of the connection, wire length of each connection point and polarization cut-off. When start a new production lot of a harness, at least the first one produced must be measured and checked, in order to verify the correct wire length from one termination point to the other and the correct polarization cut-off.

5.3 WIRE TERMINATION INTO THE IDC SLOT

A "V" shaped slot in the contact (item 1 on attached sketch) creates the electrical connection throughout the displacement of the wire insulation material (IDC technique see Fig. 4 Pag. 7).

The termination made by the tooling is 100% checked FOR electrical continuity during the cabling process.

In any case a periodical visual examination of the product shall be done to verify:

1- Wire in the correct position. (Dimension of the wire referred to the Connector as per Fig. 5 Pag. 7)
2- Cover closed in the correct position (see Fig.6 and Fig.7)
3- No physical damage (Connector cracks, peeled wire and so on)
4- Wire cut-off
5- Marking (optional feature on the cabling machine), correct color code identification see Fig. 5 to facilitate the connector placing on the counterpart, this mark shall be applied during the cabling process on the top of the closed cover; codification is programmable by software and is defined by the customer according to the final application.
6- Contact position in the Housing, after termination. Wire termination is conform when the requirements shown in Fig. 5A are meet.

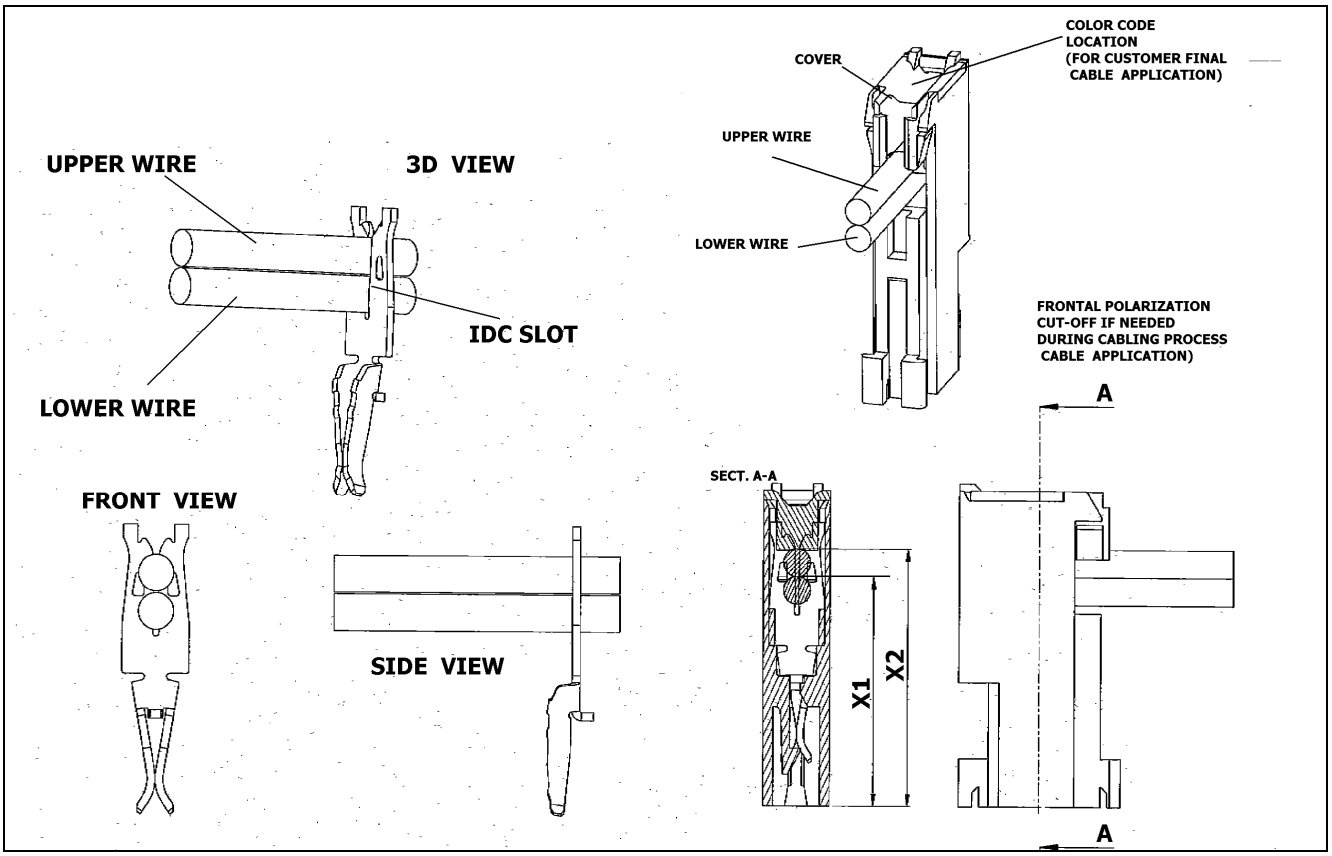
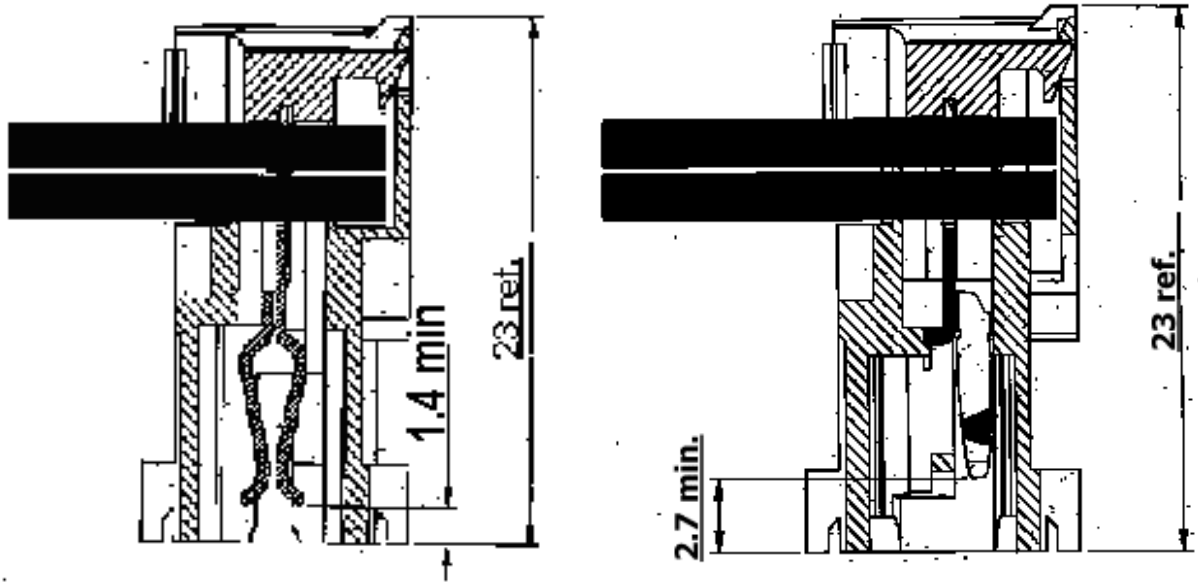


Fig.4 Fig.5



PCB VERSION TAB VERSION

Fig. 5A

5.4 ACCEPTANCE CRITERIA OF THE WIRE INTO THE IDC SLOT

The IDC slot shall accept one or two wires respecting following requirements:

5.4.1 Single wire in a range from 0.5 to 1.5 mm². The wire position (dim. X1 in Fig.5) to be checked. Measurement check shall be done before cover closing operation.
For all wire section used, wire position to be according to the following table:

wire section (mm²)	X1 Min (mm)	X1 Max (mm)
From 0.5 to 1.5	18.2	18.6

5.4.2 Double wire, the following mix. of wire size are related to the termination with MHARA machine (other termination equipment do not allow double wire insertion):

Wire Sec.(mm²) Lower wire	Wire Sec.(mm²) Upper wire
0.5	0.5
0.5	0.75
0.75	0.75
0.75	1.0
1.0	1.0

N.B. as shown on the table, using two different wire size, the minor must be the first inserted (lower wire) and the major the second one.

Following table is relevant to X1 and X2 dim. (see Fig. 5 for ref.), dim X2 should be checked as inspection after termination and before cover closing operation. lower wire nominal Dimension X1 is calculated using a math formula which is considering the wire outside diameter:

X1= X2- (wire DIA. Upper wire) + κ, where k is a corrective factor in a range from 0.1 to 0.4 due to wire deformation and relevant sections combination.

wire section (mm²) lower-upper	X1 dim. (mm) LOWER WIRE (For ref. Only)	X2 dim. (mm) UPPER WIRE
0.5-0.5	16.7	18.6
0.5-0.75	16.6	18.6
0.75-0.75	16.5	18.6
0.75-1.0	16.4	18.6
1.0-1.0	16.3	18.6

Dimension tolerances of +0 /-0.3 mm shall be applied when upper wire dim. X2 is checked.

a) For product performances and/or limitation related to wire size see product spec #108-20213 and #108-20214.

5.5 ACCEPTANCE CRITERIA FOR COVER CLOSING OPERATION.

This operation is done by a station on the machine during cabling process to check the correct operation a periodical visual inspection shall be done to verify that:

a) The cover in operating position must be securely hooked up to the connector housing, the retention teeth on the back (Fig.6) must be released in their seat as shown.

b) The frontal retention teeth must be released in the proper seats as shown on Fig.7

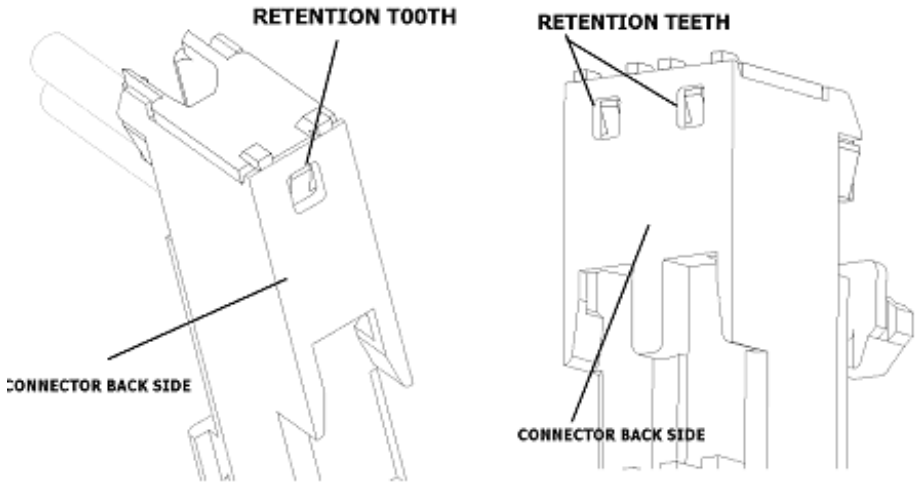


Fig.6

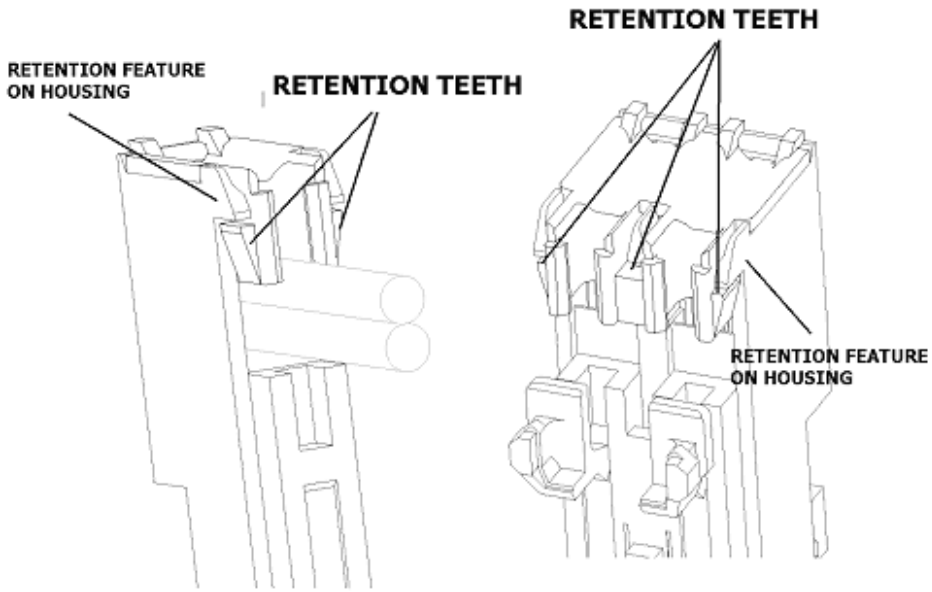


Fig.7

c) The wire insertion stop is provided by a thin plastic wall in the front of the connector (see Fig. 8). Especially in double wire on the same IDC slot application, a deformation of the wire insulation is acceptable and should be more evident using a big wires size. (see also attached photo 1).
For the same reason, similar deformation will be visible on the opposite side of the wire due to Cover geometry and relevant interference with the wire PVC. (see attached photos 2,2a,2b,2c)..
Those visual deformation are acceptable because they do not affect the mechanical and electrical performances of the connections.

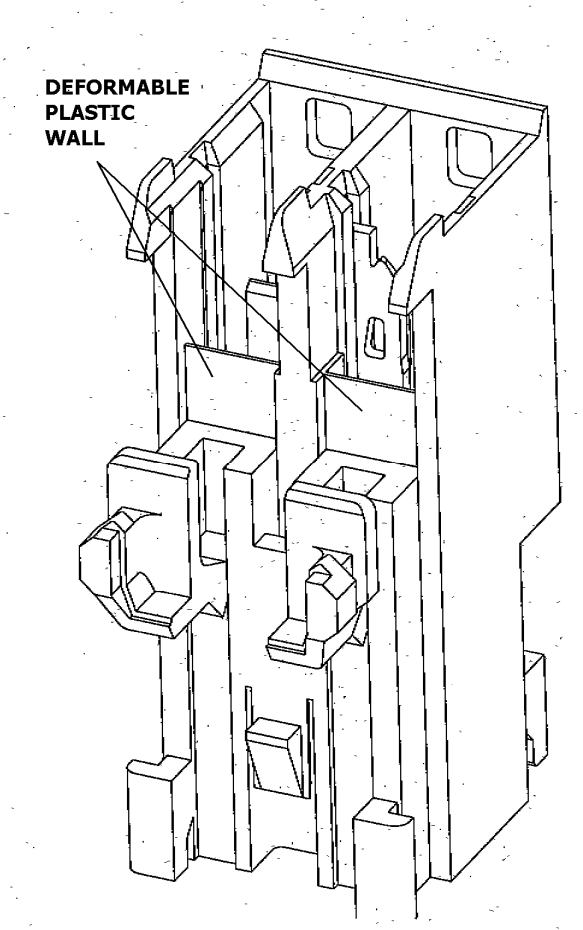


Fig.8

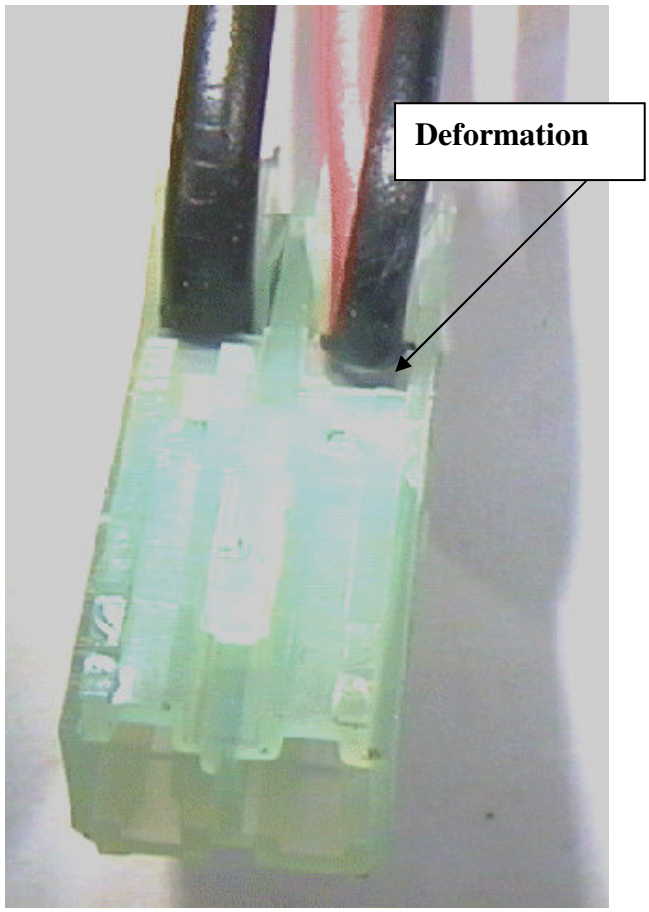
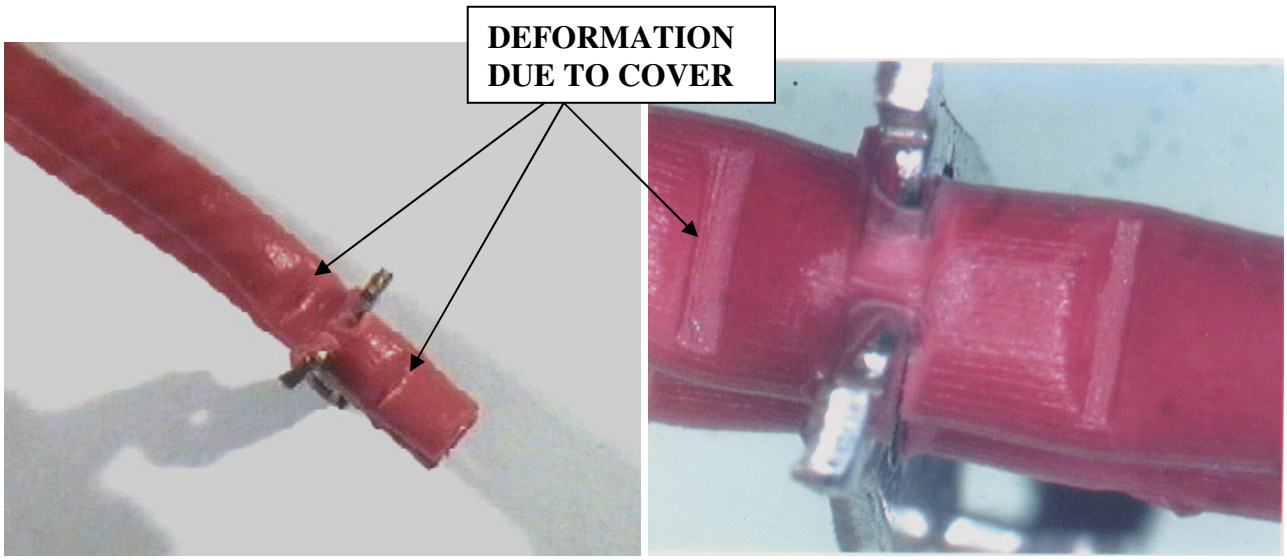
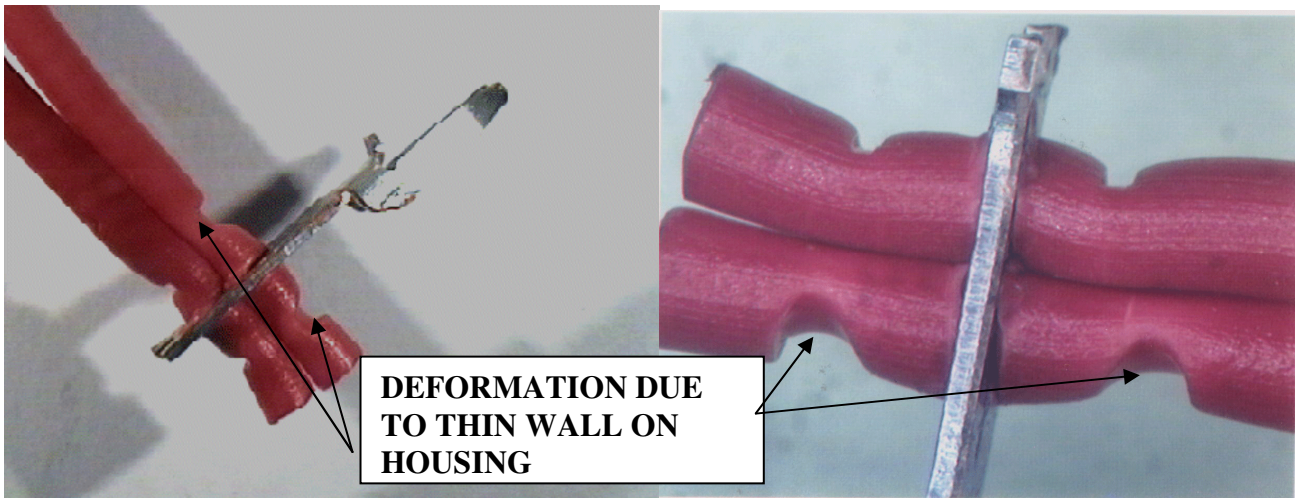


Photo 1



Photos 2 & 2a (Incision on PVC wire due do Cover Interference).



Photos 2c,2d (Incision on PVC wire due do Thin Plastic Wall and Cover Interference).

5.6 ACCEPTANCE CRITERIA FOR WIRES CUT-OFF

A cutting tool provide to cut the surplus of wire before the termination.
Below Photos, shown an example of a good cut-off, clear cut and perpendicular to the wire axe.

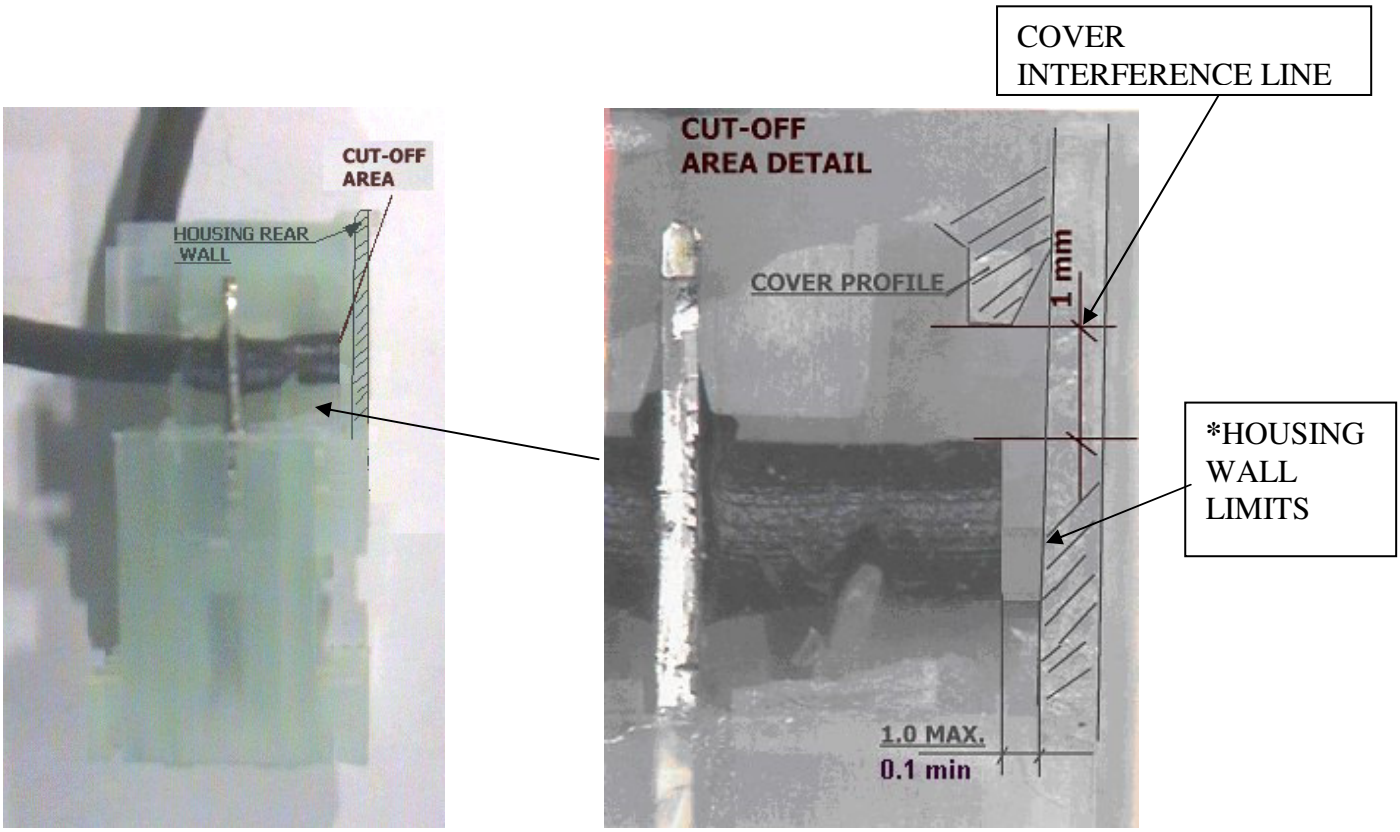


Photo 9

A non clear cut-off could cause an excess of wire that protrude more than 1 mm in the rear side of the connector where the cover is hooked to the connector housing, or could interfere with the housing wall limits. If those limits are not respected the wire could interfere with the cover or with the rear wall of the housing, avoiding a correct cover fastening and a good IDC connection. (see Photo 9 for ref.).

*As already shown on Photo 9 a 1,0 mm max. of clearance between wire cut-off and housing wall shall be respected and at the same time, the wire must not touch the housing wall.

5.7 ACCEPTANCE CRITERIA FOR OVERALL DIMENSION AFTER WIRE TERMINATION

During the wire termination the Machine Design provide to contrast and support the contact. Especially for the first and last way if contacts are not properly supported during termination (see Par. 4.2 for detail), it's possible to have a poor insulation displacement on the terminated wire and consequently, an unstable electrical connection.

A visual/dimensional check on the connectors areas as shown on attached photo can give an indication of correct/incorrect contrast during termination.
Figure 10 shown the area to be inspected, the max. dimension allowed cannot exceed the dim. "L" reported on the TABLE A (see also Photo 10 and 10A) of an amount of 0.15 mm when lower wire size is used (0.5 mm^2) and 0.4 mm for the maximum wire size(1.5 mm^2) .
Especially when 0.5 wire size is used, a dimension exceeding this value is a symptom of poor contrast during termination causing abnormal contact displacement and consequent a bad wire insulation displacement. Dimensional check shall be done after cover insertion, on finished cable.

Table A nominal Dim.

No. OF POS	DIM. "L"
1	5.0
2	10.0
3	15.0
4	20.0
5	25.0
6	30.0
7	35.0
8	40.0
9	45.0
10	50.0
11	55.0
12	60.0

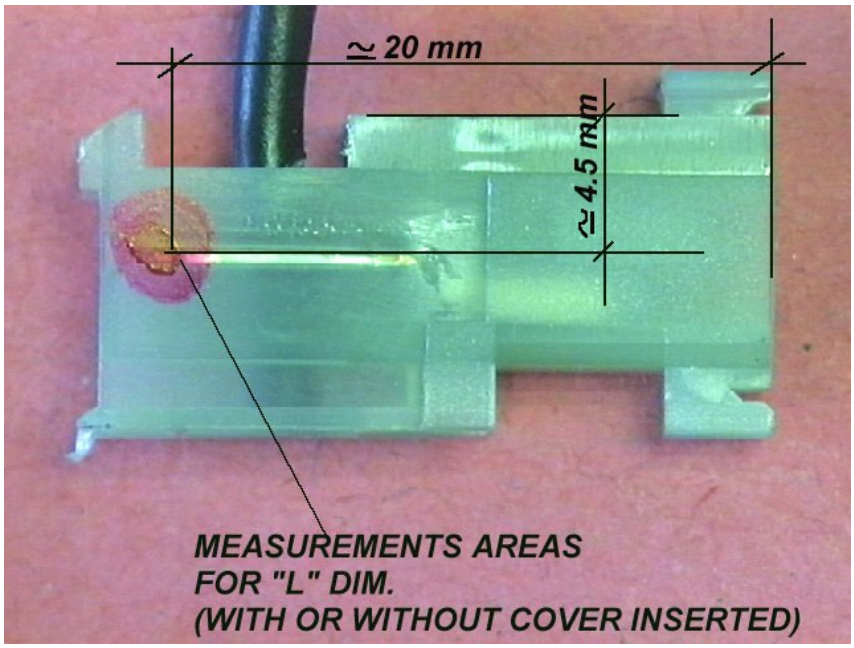


Photo 10

A visual check on this area must not evidence plastic cracks or perforation due to excess of contact stress during the termination ,that may be caused by the use of incorrect wire size/type or incorrect termination of the wire.

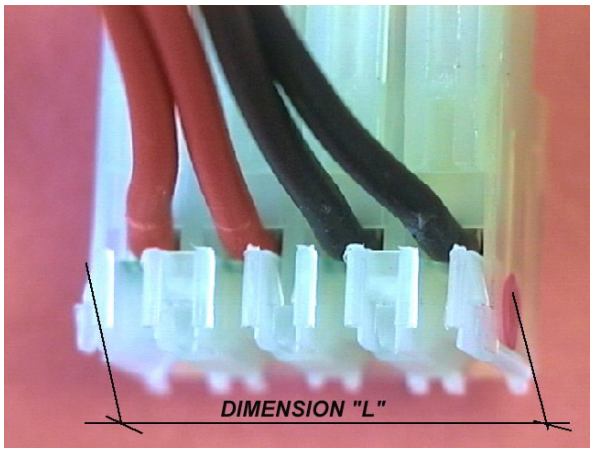


Photo 10A

5.8 ACCEPTANCE CRITERIA FOR POLARIZATION CUT-OFF

The polarization cut-off is used to specialize the connector according to RAST 5 Norm. The Fig. 11 shows a detail of a typical polarization geometry. After the polarization cut-off the dim "C" must be 9 $^{+0.5}_{-0.2}$ mm. Sink, burrs or flash on relevant surfaces due to cut-off operation, can be accepted if not affecting the tolerance limits of "C" dimension.

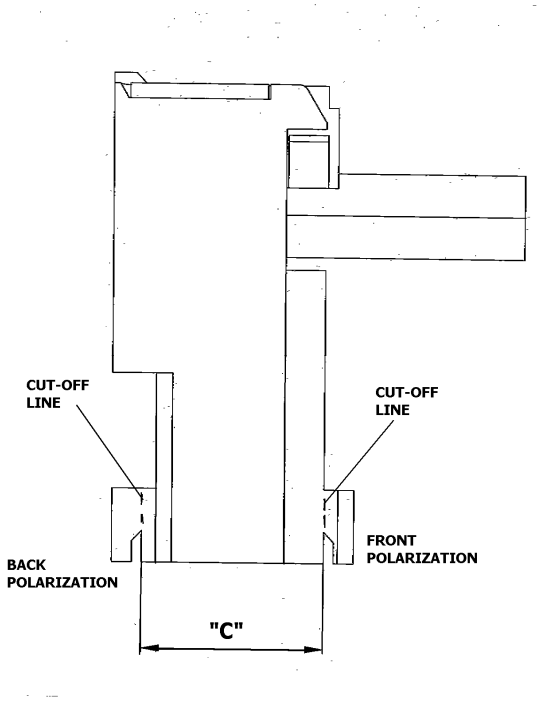


Fig. 11

5.9 INSPECTION OF THE WIRE STRANDS INTO IDC SLOTS

Inspection of the wire strands into the IDC slots, is a means to be confident that production we are manufacturing will fully meet the requirements of a good connections in terms of electro-mechanical performances.
This control should be made each time that "external factors" occur on the product or on the application tools or on the IDC harness process.
For external factors we mean those variables not mentioned in the specifications, but that could be added by the operators such us bad use of the application tools , environment , dust etc.

How to inspect wire strands

The method we suggest for examining the strands into their own IDC slots, is well known as *Cross section. method*

The method is destructive of the samples used for the exam and consists in preparing a test connector sample straining cold resin in a special plastic shell (in which the connector sample has been properly fixed) using a resin added with a hardening component (max temp. increasing during hardening process 40°C)
(e.g. . resin type CYBA- GEIGY " ARALDIT D + HY 956) . When the resin is completely hardened (it takes about six hours) it's possible make cross section and polishing the surface to be examined.
An example of cross section realized using an IDC connector with this technique is shown on attached photo 12.

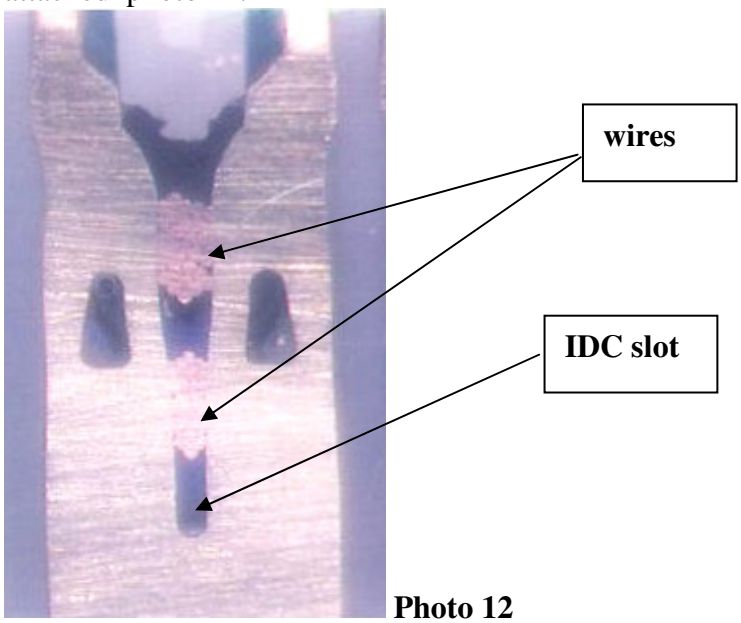


Photo 12

ACCEPTANCE CRITERA of the WIRE STRANDS into the IDC SLOT (*Cross section. Exams)*

Single wire.

The attached photo "A" shows a typical cross section of a correct termination. As we can see the wire strands are compressed in to the V slot of the IDC contact and more or less the 40% of the strands are in touch with the slot blade and the PVC is separate from the copper wire in the slot.
This situation reflect a good and stable electrical connection. The photo "B" is the opposite situation; the wire stand are not enough compressed and not well in touch with the slot blade. The wire is not completely inserted in to the slot an the PVC separation is incomplete. This situation reflect a non stable and a poor electrical connection.

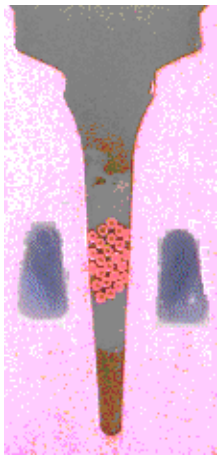


Photo A

Photo B

Double wire.
Similar approach for the double wire termination, looking at photos "C" and "D" as reference.

Photo C (good termination)

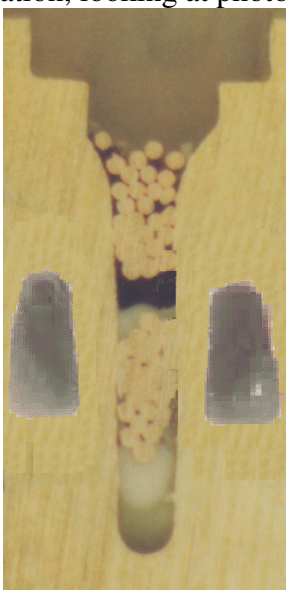


Photo D (bad termination)

6.0 APPLICABLE WIRES

Following listed are Tyco-Electronics-Amp Italy single-pole wire types normally available on the market and suitable for Mono Shape Products termination.

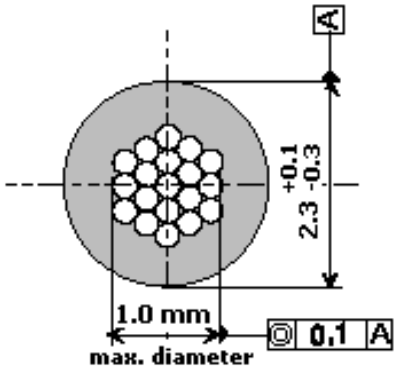
6.1 Wire Insulation material

Shore hardness for Insulation Material is requested to be A92 tolerance +/-5

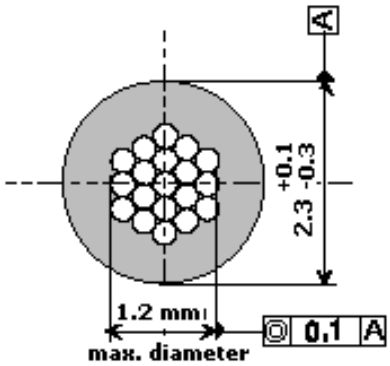
6.2 Conductor requirements from 0.5 to 1.5 mm²
(0.35 wire sect. For special application see also par. 4.0)

Wire type (according to CEI 20-20/3 – 20/7):
H 05V-K / H 05V2-K for section 1.0 - 0.75 and 0.5 mm²
H 07V-K / H 07V2 -K tinned, for section of 1.5 mm²

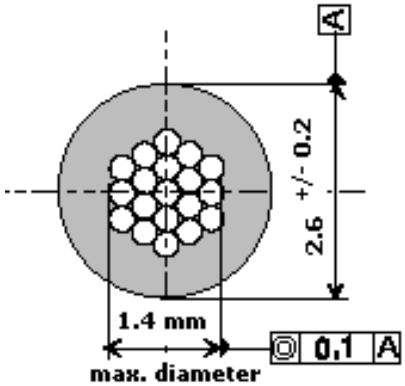
Stranded conductor of the wire suitable for a proper termination must be according to the following drawing requirements



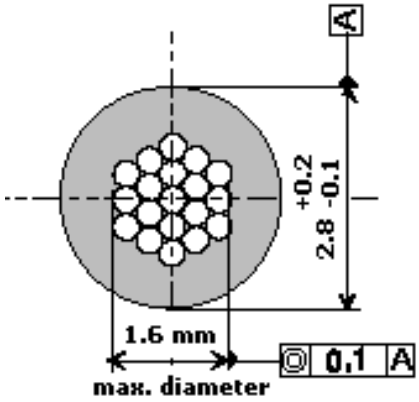
Multiple Strands (16x0.20 mm DIA.)
Wire range 0.5 mm²
Turning Length 20-30 mm



Multiple Strands (24x0.20mm DIA).
Wire range 0.75 mm²
Turning Length 20-30 mm



Multiple Strands. (32x0.20mm DIA).
Wire range 1.0 mm²
Turning Length 20-30 mm



Multiple Strands. (30x0.25mm DIA).
Wire range 1.5 mm²
Turning Length 20-30 mm

UL Cable 20-16 AWG Style 1015/CSA TEW (can also be used on V0 connectors for special application.
Other type of wire shall not be used without the Tyco Electronics, Amp Italy Engineering Department approval.