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TECHNICAL REPORT

colour inside

Wearable electronic devices and technologies – Part 250-1: Electronic textile – Snap fastener connectors between e-textiles and detachable electronic devices

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WEARABLE ELECTRONIC DEVICES AND TECHNOLOGIES –

Part 250-1: Electronic textile – Snap fastener connectors between e-textiles and detachable electronic devices

FOREWORD

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IEC TR 63203-250-1 has been prepared by IEC technical committee 124: Wearable electronic devices and technologies. It is a Technical Report.

The text of this Technical Report is based on the following documents:

Draft	Report on voting
124/119/DTR	124/143/RVDTR

Full information on the voting for its approval can be found in the report on voting indicated in the above table.

The language used for the development of this Technical Report is English.

This document was drafted in accordance with ISO/IEC Directives, Part 2, and developed in accordance with ISO/IEC Directives, Part 1 and ISO/IEC Directives, IEC Supplement, available at www.iec.ch/members_experts/refdocs. The main document types developed by IEC are described in greater detail at www.iec.ch/standardsdev/publications.

A list of all parts in the IEC 63203 series, published under the general title *Wearable electronic devices and technologies*, can be found on the IEC website.

The committee has decided that the contents of this document will remain unchanged until the stability date indicated on the IEC website under webstore.iec.ch in the data related to the specific document. At this date, the document will be

- reconfirmed,
- withdrawn,
- replaced by a revised edition, or
- amended.

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INTRODUCTION

E-textiles are suitable for measuring biological signals such as electrocardiograms, electromyograms and respiratory rates in everyday life without discomfort. The e-textile is interwoven or coated with an electric material for sensing the body surface potential in order to measure biological signals. To measure these biological signals, a detachable electronic device is connected to measure the body surface potential from the e-textile.

However, there is no established standard on the method for connecting the detachable electronic device to the e-textile. In view of the above circumstances and in order to standardize connection interface issues, it is necessary to investigate the connector types between e-textile and the detachable electronic device.

To date, conductive snap fasteners have been the most commonly applied as connectors for e-textiles.

This document reviews conductive snap fastener connectors and gives some guidance for future standardization work as regards connectors for e-textiles.

WEARABLE ELECTRONIC DEVICES AND TECHNOLOGIES –

Part 250-1: Electronic textile – Snap fastener connectors between e-textiles and detachable electronic devices

1 Scope

This document reviews the use cases of conductive snap fasteners applied as electrical connectors for e-textile products available on the market and provides guidance on future standardization works.

2 Normative references

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

There are no normative references in this document.

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

- ISO Online browsing platform: available at http://www.iso.org/obp
- IEC Electropedia: available at http://www.electropedia.org/

3.1
snap fastener
device for attaching one material to another consisting of matching male (stud) and female (socket) parts, each of which is attached to a separate material so that the parts can be joined by an appropriate force and separated by a sufficient perpendicular tensile force

3.2
stud
male functional part of a snap fastener which engages with, or snaps into, the mouth of the socket to form a closure of two parts of the item, or garment on which the fastener is used

3.3
socket
female functional part of the fastener which engages with the stud part of the fastener to form the closure of two parts of the item on which the fastener is used

4 Classification of devices by connector type

4.1 General

Snap fasteners may be used for connecting detachable electronic devices to e-textile products.

Snap fasteners are already accepted in the e-textile industry.

The snap fastener consists of a socket and a stud. Snap fastener connectors are used taking into account whether the device to be connected has a socket or a stud part of a snap fastener already mounted on it. Snap fastener connectors are classified into two types depending on whether the connected device has a socket or a stud.

Most disposable medical electrodes adopt studs, so medical devices that use these disposable medical electrodes have sockets. In wearable healthcare applications, there are many configurations similar to those for medical use.

In sports applications, stud designs are common due to waterproof abilities because the studs can be constructed seamlessly, which is advantageous for waterproofing; in contrast, the socket may have moving parts for spring function.

To obtain an electrocardiogram or heart rate from a difference of the body surface potential, at least two electrodes are required. In order to obtain a stable electrocardiogram, a common electrode is required in addition to the two electrodes, and three or more electrodes are necessary to measure electrocardiogram of two or more channels.

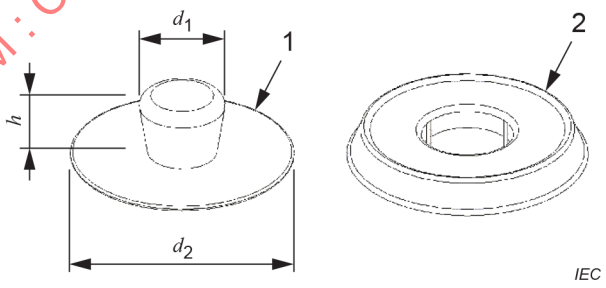
An EMS (electronic muscle stimulation) device that electrically stimulates the muscles also needs two or more electrodes.

Though outside of the scope of this document, medical devices and related standards may be cited in order to enumerate as many cases of electronic device connections using snap fasteners as possible.

4.2 Devices having two electrodes and using sockets of snap fasteners to connect with the e-textile

4.2.1 Size of the stud on the e-textile

Figure 1 shows a pair of typical snap fastener stud and socket. Many studs have diameters less than 4 mm. However, there are no standards as regards the diameter, height, and overall diameter of studs, including as regards studs mounted on disposable medical electrodes.



Key

d_1	diameter	1	stud
d_2	overall diameter	2	socket
h	height		

Figure 1 – A pair of typical snap fastener stud and socket

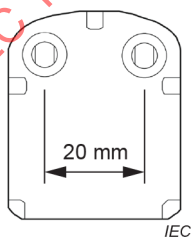
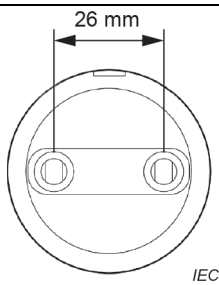
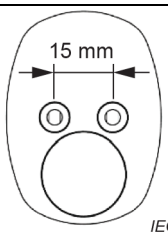
4.2.2 Distance between electrodes on the e-textile

There are devices that have the same distance between electrodes, even though there is no standard on this subject.

The above-mentioned device is the Nihon Kohden Corporation[1]'s telemetry electrocardiograph ZZ-100P™ [2], which has two electrodes with a distance of 20 mm between electrodes. Following the example of this device, see devices in "ECG and heart rate sensor" rows of Table 1.

In the EMS device, as shown in "EMS" rows of Table 1, the distance between electrodes is not constant.

Table 1 – Examples of devices using sockets as connector

<table>
<tr><th></th><th>Device name</th><th>Electrode appearance and distance</th></tr>
<tr><td rowspan="4">ECG and heart rate sensor</td><td>Union Tool Co.
Heart rate sensor WHS-3™</td><td> 
</td></tr>
<tr><td>Nihon Kohden Corporation
Telemetry electrocardiograph
ZZ - 100P™</td><td rowspan="3"> 
</td></tr>
<tr><td>GM3 Co., Ltd.
Telemetry electrocardiograph
RF-ECG2™</td></tr>
<tr><td>Medi link Co., Ltd.
Holter monitor
CarPod™</td></tr>
<tr><td rowspan="2">EMS</td><td>ELECOM Co., Ltd.
ECLEAR lean HCT-P01BU1™</td><td> 
</td></tr>
<tr><td>Atex Co., Ltd.
Atex Lourdes AX-KXL5200™</td><td> 
</td></tr>
<tr><td colspan="3">WHS-3™ are the trade names of products supplied by Union Tool Co.. ZZ-100P is the trade name of a product supplied by the Nihon Kohden Corporation. RF-ECG2™ is the trade name of a product supplied by GM3 Co., Ltd. CarPod™ is the trade name of a product supplied by Medi Link Co., Ltd. ECLEAR lean HCT-P01BU1™ is the trade name of a product supplied by ELECOM Co., Ltd. AX-KXL5200 is the trade name of product supplied by Atex Co., Ltd.[3]</td></tr>
</table>

1 This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of the companies named.

2 ZZ-100P is an example of a suitable product available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this product.

3 These trade names or trademarks are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this these products.

4.3 Devices with two electrodes using snap fastener studs to connect

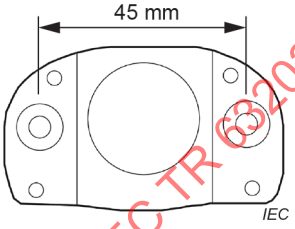
4.3.1 Size of the stud on the device

Stud diameter is typically larger than 4 mm. However, there is no standard for stud diameter, height, and overall diameter.

4.3.2 Distance between the electrodes on the device

The de facto standard is to have two electrodes, a distance of 45 mm apart. More products from other suppliers are shown in Table 2.

Table 2 – Examples of devices using two studs as connectors

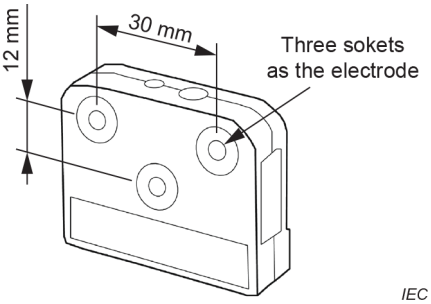
Device Name	Electrode appearance and distance
Polar Electro Oy V800™	
Adidas AG miCoach™	
CATEYE Co., Ltd. HR11™	
V800™ is the trade name of a product supplied by Polar Electro Oy. miCoach™ is the trade name of a product supplied by Adidas AG. HR11™ is the trade name of a product supplied by CATEYE Co., Ltd.[4]	

4.4 Devices using snap fasteners to connect the e-textile, but having more than two electrodes

The electrocardiogram can be obtained by measuring difference between two body surface potentials. However, as Table 3 shows, there is a device with three electrodes for grounding. The device for healthcare purposes uses sockets and, for sports, uses studs as electrodes. There is no standard for stud size.

4 These trade names or trademarks are examples of suitable products available commercially. This information is given for the convenience of users of this document and does not constitute an endorsement by IEC of this these products.

Table 3 – Examples of devices having many electrodes

Device Name	Appearance
Pacific Medico Co., Ltd. Holter monitor PMP-400™	
NTT docomo, Inc. Toray Industries, Inc. Hitoe™ transmitter	
Mitsufuji Co. hamon™ transmitter	
PMP-400™ is the trade name of a product supplied by Pacific Medeco Co., Ltd. Hitoe™ is the trade name of a product supplied by Toray Industries, Inc. hamon™ is the trade name of a product supplied by Mitsufuji Co.[5]	

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