
**Tractors and machinery for
agriculture and forestry — Electrical
high-power interface 700 V DC / 480 V
AC —**

Part 7:
Mechanical integration

iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 23316-7:2023

<https://standards.iteh.ai/catalog/standards/sist/d910b16f-9ae2-4672-9c71-993a0f2bc0da/iso-23316-7-2023>



iTeh STANDARD PREVIEW
(standards.iteh.ai)

ISO 23316-7:2023

<https://standards.iteh.ai/catalog/standards/sist/d910b16f-9ae2-4672-9c71-993a0f2bc0da/iso-23316-7-2023>



COPYRIGHT PROTECTED DOCUMENT

© ISO 2023

All rights reserved. Unless otherwise specified, or required in the context of its implementation, no part of this publication may be reproduced or utilized otherwise in any form or by any means, electronic or mechanical, including photocopying, or posting on the internet or an intranet, without prior written permission. Permission can be requested from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office
CP 401 • Ch. de Blandonnet 8
CH-1214 Vernier, Geneva
Phone: +41 22 749 01 11
Email: copyright@iso.org
Website: www.iso.org

Published in Switzerland

Contents

	Page
Foreword	iv
Introduction	v
1 Scope	1
2 Normative references	1
3 Terms and definitions	1
4 Mounting positions at tractor and implement	1
4.1 Rear mounted implements.....	1
4.2 Front mounted implements.....	2
5 Cabling	3
5.1 Cabling on tractor side.....	3
5.2 Cabling on implement side.....	3
5.2.1 Implement cable length.....	3
5.2.2 Maximum length of free hanging cable.....	3
5.2.3 Maximum pull force of cable.....	3
5.2.4 Environmental conditions.....	4
5.2.5 Cable support and clamp location.....	4
5.2.6 Strain relief.....	4
6 Park box for connector	4
Bibliography	5

(standards.iteh.ai)

[ISO 23316-7:2023](https://standards.iteh.ai/catalog/standards/sist/d910b16f-9ae2-4672-9c71-993a0f2bc0da/iso-23316-7-2023)

<https://standards.iteh.ai/catalog/standards/sist/d910b16f-9ae2-4672-9c71-993a0f2bc0da/iso-23316-7-2023>

Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO document should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

ISO draws attention to the possibility that the implementation of this document may involve the use of (a) patent(s). ISO takes no position concerning the evidence, validity or applicability of any claimed patent rights in respect thereof. As of the date of publication of this document, ISO had received notice of (a) patent(s) which may be required to implement this document. However, implementers are cautioned that this may not represent the latest information, which may be obtained from the patent database available at www.iso.org/patents. ISO shall not be held responsible for identifying any or all such patent rights.

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 19, *Agricultural electronics*.

A list of all parts in the ISO 23316 series can be found on the ISO website.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Introduction

The purpose of the ISO 23316 series is to provide design and application standards covering implementation of electrical high power interface with a nominal voltage of 700 VDC/480 VAC for agricultural and forestry machinery.

Conformance to the ISO 23316 series is determined when applicable requirements from all parts of the ISO 23316 series are met.

It is permitted for partial systems or components to be compliant to the ISO 23316 series by applying all applicable requirements, e.g. for the plug, receptacle or inverters, on a tractor or implement.

NOTE For example, if a DC-mode only HPI is provided, it is not necessary to comply with ISO 23316-4 describing AC-mode, as it is not applicable. If an AC-mode only HPI is provided, it is not necessary to comply with ISO 23316-5 describing DC-mode, as it is not applicable.

The ISO 23316 series specifies physical and logical interface requirements that provide interoperability and cross compatibility for systems and equipment operating at nominal voltages of 700 VDC/480 VAC.

The following are not within the scope of the ISO 23316 series:

- service, maintenance, and related diagnostics;
- functional safety;
- control strategies for high power sources and loads;
- application-specific strategies and operational modes;
- component design;
- energy storage systems, e.g. supercapacitors or batteries;
- multiple electrical power sources supplying a common DC link.

ISO 23316-1 describes the general purpose and structure of standards in the ISO 23316 series.

Tractors and machinery for agriculture and forestry — Electrical high-power interface 700 V DC / 480 V AC —

Part 7: Mechanical integration

1 Scope

This document instructs the manufacturers of tractors and implements how to integrate mechanically and use the HPI.

NOTE The terms "tractor" and "implement" are used instead of "supply system" and "consumer system" for better understanding in this part.

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.

ISO 16230-1:2015, *Agricultural machinery and tractors — Safety of higher voltage electrical and electronic components and systems — Part 1: General requirements*

ISO 23316-1, *Tractors and machinery for agriculture and forestry — Electrical high-power interface 700 V DC/480 V AC — Part 1: General*

ISO 23316-2, *Tractors and machinery for agriculture and forestry — Electrical high-power interface 700 V DC/480 V AC — Part 2: Physical interface*

3 Terms and definitions

For the purposes of this document, the terms and definitions given in ISO 23316-1 and the following apply.

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

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

3.1

park box

equipment on implement side to protect the connector from dust or humidity ingress while not used

[SOURCE: IEC 60050-442]

4 Mounting positions at tractor and implement

4.1 Rear mounted implements

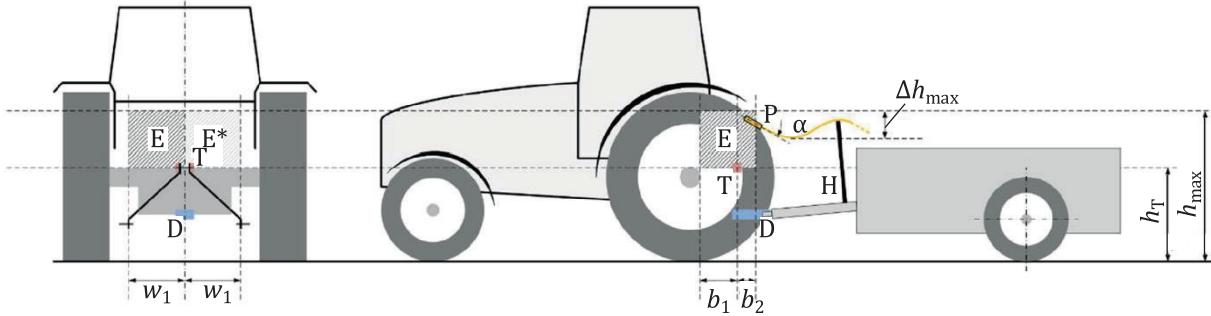
The HPI is preferable to be mounted at the left side of the tractor. In case of space restrictions at the left side, the HPI may be mounted at the right side.

The receptacle shall be positioned above the hydraulic connectors.

The geometries shall follow [Figures 1](#) and [2](#) and the corresponding values given in the tables.

If the drawbar is too low, a cable holder should be installed as shown in [Figure 1](#).

Depending on the tractor size, a footstep may be required to access to the HPI. Where a step is fitted, the dimensions recommended below are from the step height.



Key					
D	Drawbar	Space claim length forward from hitch top link position	b_1	=	300 mm
E(E*)	HPI envelope	Space claim backward from hitch top-link position	b_2	=	200 mm
H	Cable holder	Support cable to prevent from too much sag			
T	Hitch top-link position	Maximum Hitch top-link height from ground CAT1,2,3 and represents the lower limit of the HPI envelope on the tractor	h_T	=	1 500 mm
P	Plug (HPI)	Maximum height for HPI mounting from ground or from step	h_{max}	=	2 000 mm
		Maximum cable slack/ sag	Δh_{max}	=	500 mm
		Space claim width from hitch top-link position (vert. centerline)	w_1	=	450 mm
		HPI downward angle (horizontal downwards) The angle shall be downwards only. Upward angles with reference to horizontal position are not allowed.	α	=	0 to 30 deg

Figure 1 — HPI envelope at tractor rear

Due to the widespread variety of implements, it is not possible to define a detailed envelope on implement side. The implement manufacturer shall consider the HPI connection envelope within the design.

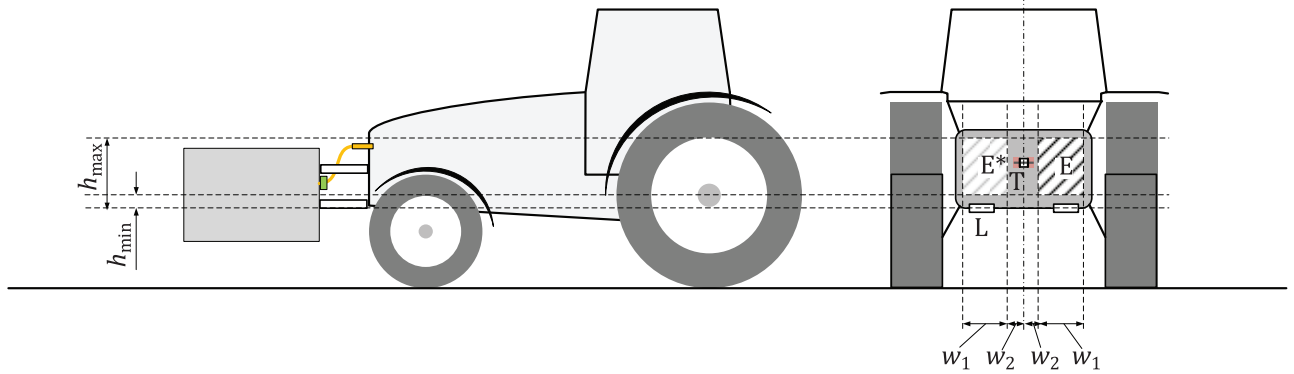
4.2 Front mounted implements

The HPI is preferable to be mounted at the left side of the tractor. In case of space restrictions at the left side, the HPI may be mounted at the right side.

The receptacle shall be positioned above the hitch lower link.

The geometries shall follow [Figure 2](#) and the corresponding values given in the table.

The direction of the HPI shall be horizontal plus 0° minus 15°.



Key						
E(E*)	HPI envelope	Space claim width	w_1	=	200	mm
E(E*)	HPI envelope	Reserved hitch top-link space width	W_2	=	100	mm
E(E*)	HPI envelope	Space claim minimum height from hitch lower link position	h_{\min}	=	100	mm
E(E*)	HPI envelope	Space claim minimum height from hitch lower link position	h_{\max}	=	500	mm
L	Hitch lower link	Position of Hitch lower link attached to the tractor front				
T	Hitch top link	Position of Hitch top link attached to the tractor front				

Figure 2 — HPI envelope at tractor front

5 Cabling

ISO 23316-7:2023

<https://standards.iteh.ai/catalog/standards/sist/d910b16f-9ae2-4672-9c71-993a0f2bc0da/iso-23316-7-2023>

5.1 Cabling on tractor side

The cabling on the tractor side shall be in accordance with the requirements given in ISO 16230-1, 2015, Clauses 7 and 8.

5.2 Cabling on implement side

5.2.1 Implement cable length

The implement manufacturer shall define the cable length considering the maximum allowed pull force and the other requirements from paragraphs below as well as additional implement restrictions (e.g. geometry).

5.2.2 Maximum length of free hanging cable

To avoid unintended disconnection of the connector while in operation, the weight of the cable free length shall be 250 N maximum.

5.2.3 Maximum pull force of cable

The maximum pull force caused by the free length weight of the cable including plug shall not exceed 250 N (including dynamics) to avoid unintended disconnection of the connector while in operation.

5.2.4 Environmental conditions

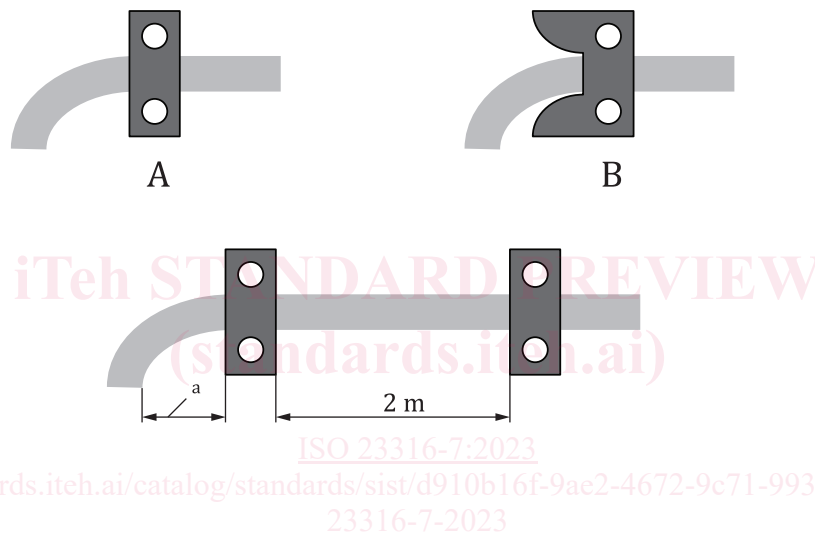
For implementation of plug and receptacle, the environmental conditions shall be according to ISO 23316-2.

5.2.5 Cable support and clamp location

First cable fixing point on the implement shall be clamped. The clamp shall be designed to limit the bending radius of the cable all the time (at free hanging and breakaway) as shown in Figure 3 B. The clamp location should be designed and located to ensure that the minimum bend radius of the cable is not compromised, typically this is six times the cables overall diameter.

NOTE See cable manufacturers data for specific requirements.

The cable free length, measured from the HPI connector face to the first clamp at the implement, shall be 2 m maximum.



a 6 x diameter.

Figure 3 — Cable clamping variants

Figure 3 shows alternatives for clamping.

Clamp style “A” shall only be used on straight cable runs.

Clamp style “B” is recommended where the cable is subject to bending post clamping.

5.2.6 Strain relief

The HPI connector and cable shall be provided with a cable anchorage such that the conductors are relieved from strain, including twisting, where they are connected to the terminals or terminations, and that their covering is protected from abrasion. Cable anchorages shall be designed, that the cable cannot touch accessible metal parts.

6 Park box for connector

A park-box shall be provided by the implement.

Connector shall be placed either in the HPI or in the park box.

Park box shall avoid, for example, water and dust ingress, particle impact in accordance with ISO 23316-2.

NOTE Consider movement of the implement while not plugged.