



SLOVENSKI STANDARD

SIST EN 12965:2020

01-februar-2020

Nadomešča:

SIST EN 12965:2004+A2:2009

Traktorji ter kmetijski in gozdarski stroji - Priključne gredi in njihova zaščita - Varnost

Tractors and machinery for agriculture and forestry - Power take-off (PTO) drive shafts and their guards - Safety

Traktoren und Maschinen für die Land- und Forstwirtschaft - Gelenkwellen und ihre Schutzeinrichtungen - Sicherheit

Tracteurs et matériels agricoles et forestiers - Arbres de transmission à cardans de prise de force et leurs protecteurs - Sécurité

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Ta slovenski standard je istoveten z: EN 12965:2019

ICS:

65.060.01	Kmetijski stroji in oprema na splošno	Agricultural machines and equipment in general
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EUROPEAN STANDARD
NORME EUROPÉENNE
EUROPÄISCHE NORM

EN 12965

December 2019

ICS 65.060.01

Supersedes EN 12965:2003+A2:2009

English Version

**Tractors and machinery for agriculture and forestry -
Power take-off (PTO) drive shafts and their guards - Safety**

Tracteurs et matériels agricoles et forestiers - Arbres
de transmission à cardans de prise de force et leurs
protecteurs - Sécurité

Traktoren und Maschinen für die Land- und
Forstwirtschaft - Gelenkwellen und ihre
Schutzeinrichtungen - Sicherheit

This European Standard was approved by CEN on 16 September 2019.

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COMITÉ EUROPÉEN DE NORMALISATION
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European foreword

This document (EN 12965:2019) has been prepared by Technical Committee CEN/TC 144 “Tractors and machinery for agriculture and forestry”, the secretariat of which is held by AFNOR.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by June 2020, and conflicting national standards shall be withdrawn at the latest by December 2020.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN shall not be held responsible for identifying any or all such patent rights.

This document supersedes EN 12965:2003+A2:2009.

The main changes compared to the previous edition are as follows:

- precision of the general requirements;
- addition of PTO type 4;
- precision of the requirements for the restraining system;
- addition and precision of the requirements for service and maintenance;
- addition of requirements for the locking system;
- addition of an entanglement test; [SIST EN 12965:2020](https://standards.iteh.ai/catalog/standards/sist/07161da4-8a90-4258-9e2c-fc03bd7f3c9f/sist-en-12965-2020)
- addition of new pictogram required to highlight compatibility of guarding systems of PTO drive shaft with tractor and machinery.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EU Directive(s).

For relationship with EU Directive(s), see informative Annex ZA, which is an integral part of this document.

According to the CEN-CENELEC Internal Regulations, the national standards organisations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Croatia, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Republic of North Macedonia, Romania, Serbia, Slovakia, Slovenia, Spain, Sweden, Switzerland, Turkey and the United Kingdom.

Introduction

This document is a type C standard as defined in EN ISO 12100:2010.

The machinery concerned and the extent to which hazards, hazardous situations and events are covered are indicated in the scope of this document.

When provisions of this type C standard are different from those which are stated in type A or B standards, the provisions of this type C standard take precedence over the provisions of the other standards, for machines that have been designed and built according to the provisions of this type C standard.

Hazards that are common to agricultural machines (self-propelled, mounted, semi-mounted and trailed) are dealt with in EN ISO 4254-1:2015. EN 12965 provides requirements for power take-off (PTO) drive shafts in addition to those of EN ISO 4254-1.

This document is of relevance, in particular, for the following stakeholder groups representing the market players with regard to machinery safety:

- machine manufacturers (small, medium and large enterprises);
- health and safety bodies (regulators, accident prevention organizations, market surveillance, etc.).

Others can be affected by the level of machinery safety achieved with the means of the document by the above-mentioned stakeholder groups:

- machine users/employers (small, medium and large enterprises);
- machine users/employees (e.g. trade unions, organizations for people with special needs);
- service providers, e.g. for maintenance (small, medium and large enterprises);
- consumers (in case of machinery intended for use by consumers).

The above-mentioned stakeholder groups have been given the possibility to participate at the drafting process of this document.

1 Scope

This document specifies safety requirements and their verification for the design and construction of power take-off (PTO) drive shafts and their guards linking a tractor or self-propelled machinery to the first fixed bearing of recipient machinery. It describes methods for the elimination or reduction of risks that need specific requirements including such risks arising from misuse, reasonably foreseeable by the manufacturer. It is applicable only to those PTO drive shafts and guards mechanically linked to the shaft by at least two bearings. When used with compatible guards for power take-off (PTO) of the tractor (master shield) or self-propelled machine and the power input connection (PIC) of the power receiving machine, the requirements for power take-off drive shafts are complete.

NOTE 1 Fully enclosing PIC guard cones alone provide full protection.

NOTE 2 ISO 500-1 and ISO 500-2 give requirements for the guarding of tractor power take-offs (PTO) and ISO 4254-1 gives requirements for power input connections (PIC) of power receiving machinery that are compatible with the guarding required by this document.

In addition, it specifies the type of information on safe working practices to be provided by the manufacturer.

This document does not deal with:

- the guards totally covering, but not mechanically linked to, the PTO drive shaft;
- the mechanical characteristics of PTO drive shafts, overrun devices and torque limiters;
- general hazards which are dealt with in EN ISO 4254-1:2015 (see introduction).

Environmental aspects have not been considered in this document.

This document is not applicable to PTO drive shafts and their guards that are manufactured before the date of publication of this document by CEN.

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.

EN 15811:2014, *Agricultural machinery — Fixed guards and interlocked guards with or without guard locking for moving transmission parts (ISO/TS 28923:2012 modified)*

EN ISO 4254-1:2015, *Agricultural machinery — Safety — Part 1: General requirements (ISO 4254-1:2013)*

EN ISO 5674:2009, *Tractors and machinery for agriculture and forestry — Guards for power take-off (PTO) drive-shafts — Strength and wear tests and acceptance criteria (ISO 5674:2004, corrected version 2005-07-01)*

EN ISO 12100:2010, *Safety of machinery — General principles for design — Risk assessment and risk reduction (ISO 12100:2010)*

EN ISO 13857:2008, *Safety of machinery — Safety distances to prevent hazard zones being reached by upper and lower limbs (ISO 13857:2008)*

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ISO 11684:1995, *Tractors, machinery for agriculture and forestry, powered lawn and garden equipment — Safety signs and hazard pictorials — General principles*

ISO 1140:2012, *Fibre ropes — Polyamide — 3-, 4-, 8- and 12-strand ropes*

ISO 500-3:2014, *Agricultural tractors — Rear-mounted power take-off types 1, 2, 3 and 4 — Part 3: Main PTO dimensions and spline dimensions, location of PTO*

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:

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

3.1
power take-off (PTO) drive shaft
assembly consisting of two joints, telescopic members and a guard which is mechanically linked to the shaft by at least two bearings used to transmit rotational power from the PTO of a tractor or self-propelled machine to the PIC of an implement

Note 1 to entry: See Figure 1 - only shown as an example.

3.2
restraining system
part of the PTO drive shaft guard which prevents rotation of the guard when the PTO drive shaft rotates

Note 1 to entry: See Figure 1, key 28 - only shown as an example.

3.3
universal joint
mechanical device which can transmit torque and/or rotational motion

Note 1 to entry: See Figure 1, key 12 - only shown as an example.

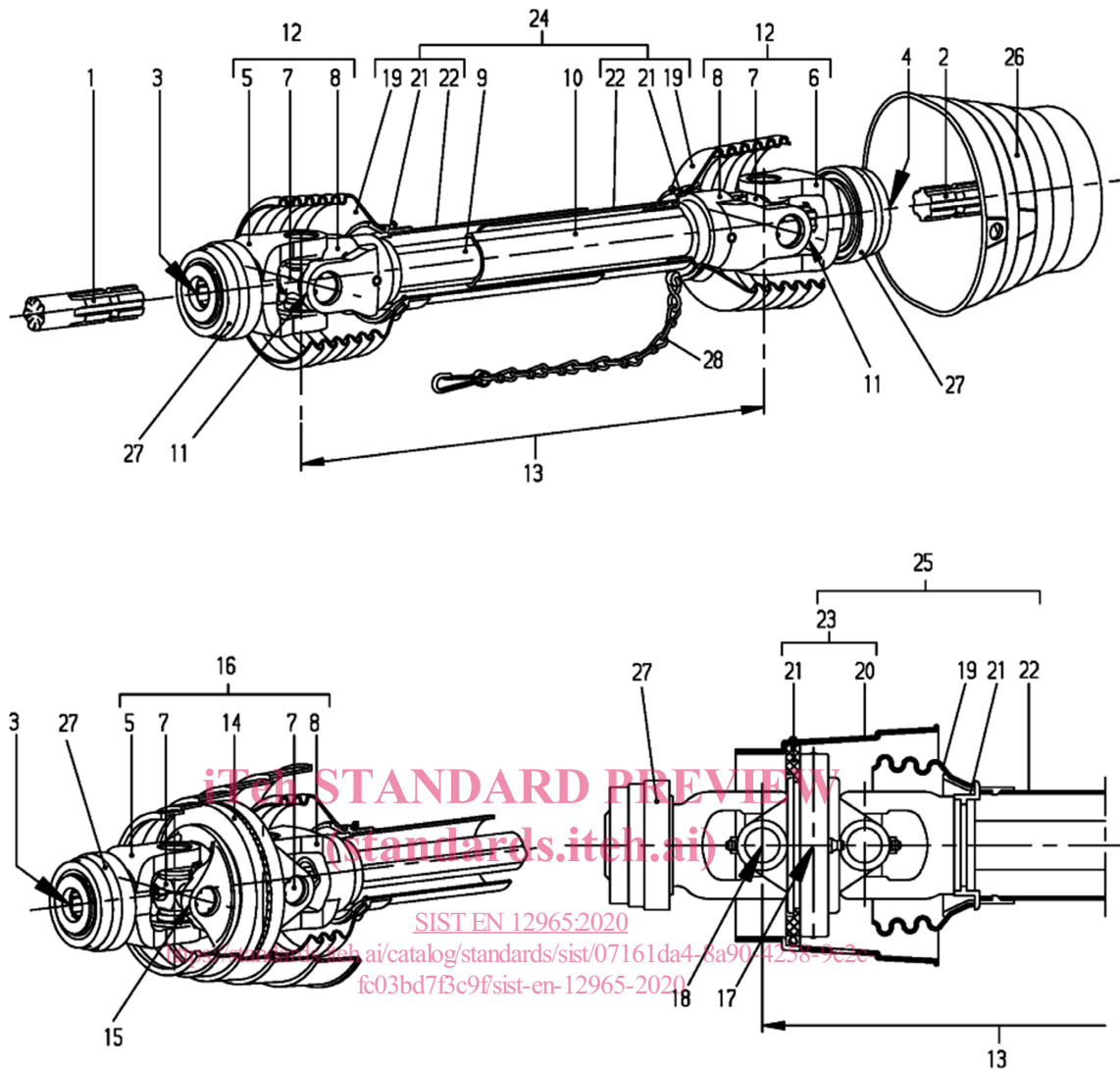
3.4
wide-angle universal joint
mechanical device which can transmit torque and/or rotational motion at a constant velocity at fixed or varying angles, generally equal or higher than 50°

Note 1 to entry: See Figure 1, key 16 - only shown as an example.

3.5
overrun device
device that permits the transmission of motion only in one direction (from the tractor towards the recipient machinery)

Note 1 to entry: It is normally used with recipient machine having high value inertia.

3.6
torque limiter
device that cuts or limits the transmission of motion between tractor and recipient machinery, when the torque reaches a prefixed value



Key

- | | |
|--|--|
| 1 power take off shaft (PTO) | 15 end of double yoke of outer joint |
| 2 power-input connection (PIC) | 16 wide-angle universal joint |
| 3 PTO yoke bore | 17 centre of articulation of wide-angle universal joint |
| 4 PIC yoke bore | 18 centre of outer joint |
| 5 PTO yoke | 19 guard cone |
| 6 PIC yoke | 20 wide angle guard cone |
| 7 journal cross-assembly | 21 guard bearing |
| 8 inner yoke | 22 guard tube |
| 9 inner telescopic member | 23 separate guard of wide angle universal joint |
| 10 outer telescopic member | 24 PTO drive shaft guard |
| 11 end of inner yoke of universal joint | 25 PTO drive shaft guard (in case of wide-angle PTO drive shaft) |
| 12 universal joint | 26 PIC guard |
| 13 PTO drive shaft, closed and extended length | 27 locking system |
| 14 double yoke | 28 restraining system (as an example) |

Figure 1 — Example of PTO drive shaft and guard

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3.7

locking system

device on the PTO yoke and PIC yoke which allows locking of the PTO drive shaft mechanically to the tractor's PTO and to the PIC of the recipient machinery

Note 1 to entry: See Figure 1, key 27 - only shown as an example.

3.8

guard cone

guard of the inner yokes of the PTO drive shaft, integrally fixed to the guard tubes of the inner and outer telescopic members of the PTO drive shaft

Note 1 to entry: See Figure 1, key 19 - only shown as an example.

3.9

wide-angle guard cone

guard of the wide-angle universal joint of the PTO drive shaft

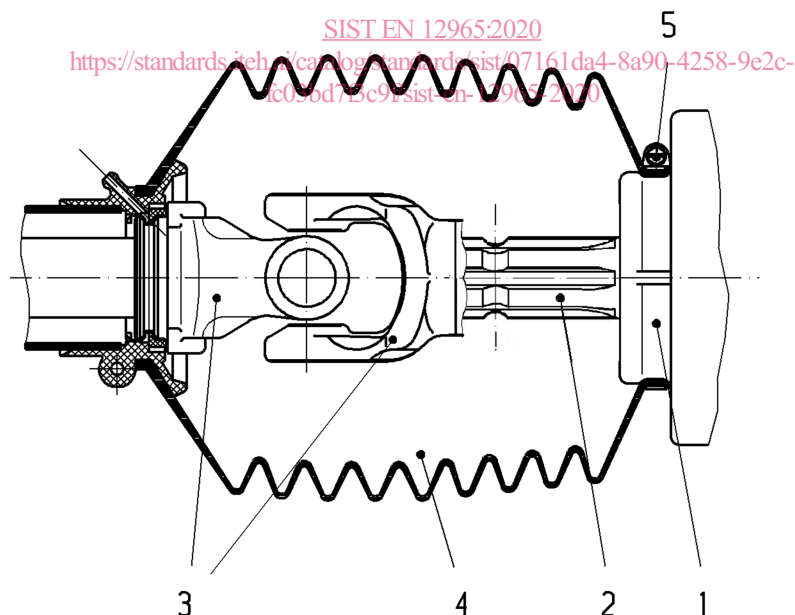
Note 1 to entry: See Figure 1, key 20 - only shown as an example.

3.10

fully enclosed guard cone

guard on PIC side of the PTO drive shaft covering the universal or wide-angle universal joint, including its locking system and the PIC of the recipient machinery, and which also includes other devices, if any (e.g. torque limiter, overrun device)

Note 1 to entry: See Figure 2, key 4 - only shown as an example.

**Key**

- | | | | |
|---|-----------------|---|------------------------------|
| 1 | implement | 4 | fully enclosed guard cone |
| 2 | PIC | 5 | clamping device on implement |
| 3 | universal joint | | |

Figure 2 — Example of fully enclosed guard cone

3.11

PTO drive shaft guard

guard attached to the PTO drive shaft by bearings, designed to be able to be held stationary by a restraining system while the shaft is rotating

Note 1 to entry: See Figure 1, keys 24 and 25 – only shown as an example.

4 Safety requirements and/or measures

4.1 General requirements

The PTO drive shafts and their guards shall comply with the safety requirements and/or protective measures of this clause. In addition, the PTO drive shafts and their guards shall be designed according to the principles of EN ISO 12100:2010 for hazards relevant but not significant, which are not dealt with by this standard (e.g. thermal hazards).

Concerning the guards between the outer ends of the guard cones, unless otherwise specified in this standard, all the apertures and safety distances shall comply with the requirements given in EN ISO 13857:2008, Table 4.

The list of significant hazards dealt with in this standard is given in Annex A.

PTO drive shaft guards, together with PTO master shield (referred in ISO 500-1) and PIC guard, shall be designed to prevent contact with the moving components of the PTO drive shaft when the PTO drive shaft is operated in accordance with the operator's manual and the PTO drive shaft is connected in the appropriate way between a tractor or self-propelled machine and a recipient machine.

The outside parts of the guard shall not turn with the PTO drive shaft.

If there is

- a torque limiter and/or an overrun device
- or
- the use of a tool is required to lock the PIC yoke (e.g. flange yoke, clamp yoke)

on the PTO drive shaft it shall be positioned only on the PIC side of the PTO drive shaft. Relevant marking shall be provided (see 6.2.2).

If PTO drive shaft guards have movable parts, they shall have a system to lock the parts of the PTO drive shaft guard which can only be released by using a tool (in order to make opening an intentional action) and which lock automatically without the use of a tool.

In the operator's manual (see 6.1), the manufacturer shall provide recommendations for proper application and any information limiting the use of the PTO drive shaft and its guards (see 6.1, d), including operating data and warnings against misuse. Information about requirements of the support (e.g. form, type, position etc.) for the PTO drive shaft (see 6.1, g) and the restraining system (see 6.1, k), shall also be provided. A safety sign illustrating the need to read the operator's manual shall be provided on the PTO drive shaft guard (see 6.2.3).

Information on how to modify the PTO drive shaft length shall be included in the operator's manual (see 6.1 b).

4.2 Overlap on PTO side

NOTE For overlap of the PTO drive shaft guard with the power input connection (PIC) guard see EN ISO 4254-1:2015, 6.4.1.

4.2.1 Universal joint

The PTO drive shaft guard cone shall cover the PTO drive shaft at least up to the end of the inner yoke of the universal joint in order to ensure sufficient overlap between tractor master shield and PTO drive shaft guard (Figure 1). For this purpose, the values for dimension c , distance between axis of locking system and end of guard cone as shown in Figure 3, shall be as given in Table 1.

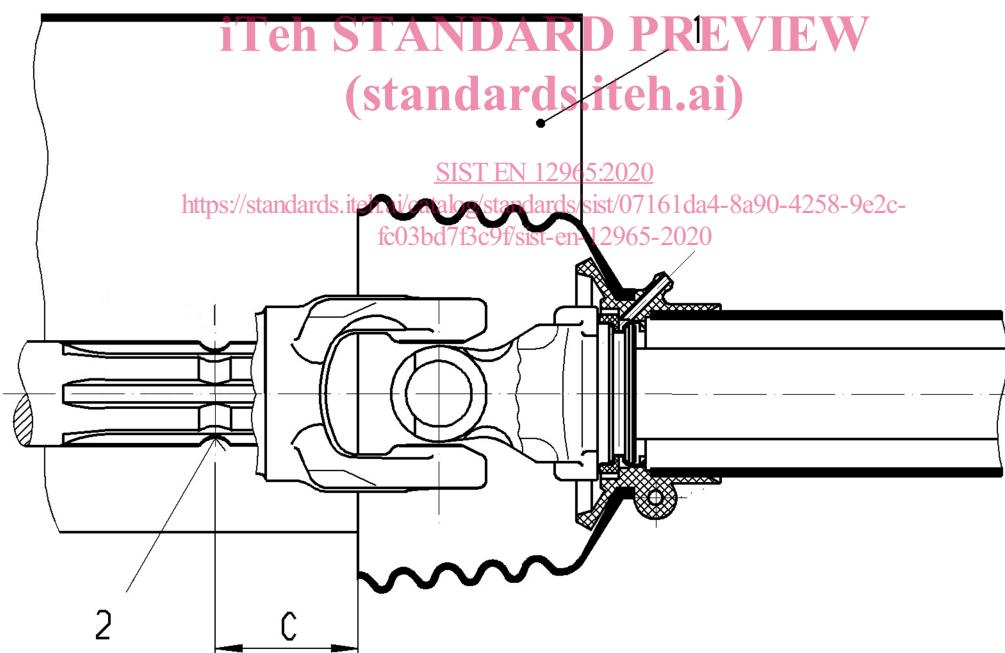
The dimension, c , shall be measured in straight line position of the PTO drive shaft.

Table 1 — Dimension c for PTO drive shaft

Dimensions in millimetres

PTO type according to ISO 500-3	c max.
1	80
2	80
3	90
4	110

NOTE The overlap of minimum 50 mm of the PTO drive shaft guard with the PTO master shield results from ISO 500-1 and ISO 500-3.



Key

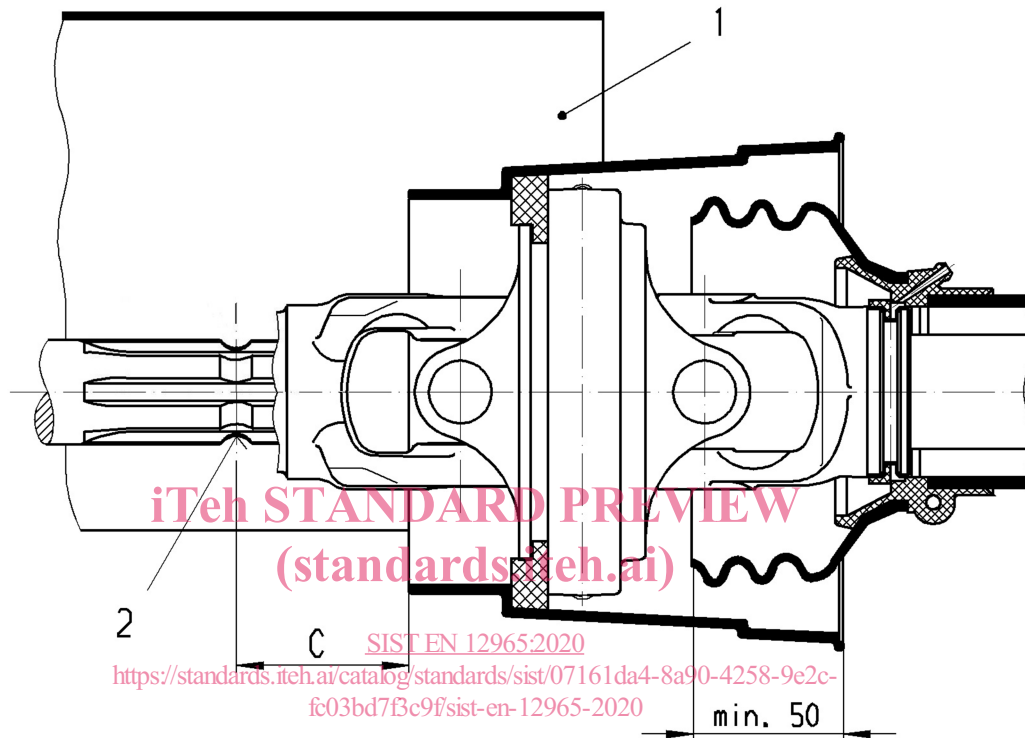
- 1 master shield of tractor power take-off (PTO)
- 2 axis of locking system shield of tractor PTO

Figure 3 — Example of guarding of universal joints on PTO drive shafts on tractor side

4.2.2 Wide-angle universal joint

The PTO drive shaft shall be guarded in the straight-line position at least up to the end of the outer joint of the double yoke in order to ensure sufficient overlap between tractor master shield and PTO drive shaft guard (Figure 1). For this purpose the values for dimension c , distance between axis of locking system and end of wide angle guard cone as shown in Figure 4, as given in Table 1 shall be met.

Dimensions in millimetres



Key

- 1 master shield of tractor power take-off (PTO)
- 2 axis of the locking system of tractor PTO

Figure 4 — Example of guarding of wide-angle universal joints on PTO drive shafts on tractor side

4.3 Wide-angle guard cone requirements

When a wide-angle universal joint is guarded by means of a separate guard independent of the guard of the other parts of the PTO drive shaft (Figure 1), the guarding of this wide-angle joint shall be ensured by taking all of the following measures.

- At the maximum angular position of the rotating PTO drive shaft, as specified by the manufacturer in the operator's manual, the opening resulting from the angular movement shall not be more than 30 mm (see Figure 5). This requirement shall be verified by the use of a rod: if the rod can be inserted into the opening without being in contact with the guards on both sides then the opening is too large to be acceptable.