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Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2, 3N, 3, 4N and 4

Tracteurs agricoles à roues — Attelage trois points monté à l'arrière — Catégories 1N, 1, 2, 3N, 3, 4N et 4

[Revision of ISO 730-1:1994, ISO 730-1:1994/Cor.1:1995 and ISO 730-2:1976]

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Foreword

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ISO 730 was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 4, *Tractors*.

ISO 730 cancels and replaces the third edition (1994) of ISO 730-1 (including its Technical Corrigendum 1 (1995)) and the first edition (1979) of ISO 730-2, of which have been technically revised.

Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2, 3N, 3, 4N and 4

1 Scope

This International Standard specifies the dimensions and requirements of the three-point linkage for the attachment of implements or equipment to the rear of agricultural wheeled tractors.

It specifies different categories to be used on different ranges of agricultural tractors as shown in Table 1.

Table 1 – Categories

Category	PTO power at rated rotational frequency of engine[1)] kW
1N	up to 35
1	up to 48
2	30 to 92
3N / 3	60 to 185
4N / 4	110 to 350
1) Determined in accordance with ISO 789-1.	

Category 1N applies to narrow agricultural wheeled tractors.

Certain specialized implements or farming operations that require dual rear wheels and narrow spacing require special consideration for the three-point linkage. Category 3N and 4N hitch categories have been established to handle these requirements.

Dimensions and requirements for the three-point linkage for the attachment of implements or equipment to the front of agricultural tractors are given in ISO 8759-1 [5].

2 Normative references

The following referenced documents are indispensable for the application 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 789-1:1990, *Agricultural tractors – Test procedures – Part 1: Power test for power take-off*

ISO 2332:1993[1)], *Agricultural tractors and machinery – Connection of implements via three-point linkage – Clearance zone around implement*

3 Definitions

For the purpose of this document, the following definitions apply. General definitions are given in 3.1, and definitions for components and dimensions in 3.2. The last element of the definition number in 3.2 is also the key number for the element or dimension in Figures 1, 2 and A.1.

3.1 General

3.1.1
linkage
combination of one upper link and two lower links, each articulated to the tractor and the implement at opposite ends, in order to connect the implement to the tractor.

3.1.2
hitch point
articulated connections between link and implement.

NOTE 1 For geometrical purposes the hitch point is the centre of the articulated connection between link and implement.

3.1.3
link point
articulated connection between link and tractor.

NOTE 2 For geometrical purposes the link point is the centre of the articulated connection between link and tractor.

3.1.4
three-point hitch coupler
device which facilitates the connection of the tractor three-point linkage to the implement.[2)]

3.2 Linkage components and dimensions

3.2.1
upper link
upper linkage element, fitted with articulated connection at both ends.

3.2.2
lower link
lower linkage element, fitted with articulated connection at both ends.

3.2.3
upper hitch point
articulated connection between the upper link and the implement.

3.2.4
lower hitch point
articulated connection between a lower link and the implement.

[1)] under revision

[2)] For examples, see annex B, [6] to [9].

3.2.5
upper link point
articulated connection between the upper link and the tractor.

3.2.6
lower link point
articulated connection between a lower link and the tractor.

3.2.7
upper hitch attachment
pin, usually detachable and forming part of the upper link assembly, by which an upper link is secured.

3.2.8
lower hitch attachment
pin, or clevis and pin, usually attached to the implement, by which a lower link is secured.

3.2.9
upper link attachment
pin by which the upper link is connected to the tractor.

3.2.10
linch pin
pin, usually fitted with a spring-retaining device, by which an articulated connection is retained in position. [3)]

3.2.11
lift rods
connections that transmit force to the lower links for raising and lowering.

3.2.12
mast
component that provides location of the upper hitch point on the implement.

3.2.13
mast height
vertical distance between the upper hitch point and the common axis of the lower hitch points.

3.2.14
lower hitch point height
height of the centre of the lower hitch points above the ground level when they are fully lowered using the full extent of manual adjustment provided in the lift rods in conjunction with the movement range with the lower hitch point axis maintained horizontal to the ground in a transverse plane.

3.2.15
levelling adjustment
movement, measured vertically, of either lower hitch point higher or lower than the other, to allow inclination of the implement, measured with one lower link horizontal.

3.2.16
lower hitch point span
distance between the shoulders of the lower hitch pins against which the sides of the lower link ball joints abut.

3.2.17
linch pin hole distance
distance from the centreline of the linch pin hole to the shoulder of the hitch pin.

[3)] See annex B, [4].

3.2.18
movement range
vertical movement of the lower hitch points corresponding to the power travel of the lift, excluding any adjustment in the lift rod linkage.

3.2.19
transport height
total height of the lower hitch points above the ground using the full extent of manual adjustment provided in the lift rods in conjunction with the movement range, with the lower hitch point axis maintained horizontal to the ground in a transverse plane.

3.2.20
lower hitch point clearance
clearance expressed as a radial dimension from the lower hitch point axis to the outside diameter of the tyre, mudguard or other part of the tractor, measured in a longitudinal vertical plane with the implement raised to transport height and all side-sway prevented.

3.2.21
pitch
angle of the mast to the vertical, considered positive when anticlockwise viewed from the left-hand side of the tractor.

3.2.22
mast adjustment
usable range of pitch of the mast from a vertical plane. It is measured at the maximum and minimum height of the lower hitch points above the ground between which the mast (3.2.12), when using the specified mast height, can be adjusted to any inclination between + 5° and – 5° from the vertical for categories 1, 2, 3N, 3, 4N and 4 and between the vertical and 10° to the vertical towards the rear for category 1N.

Note 3 Mast adjustment is not shown in Figure 1

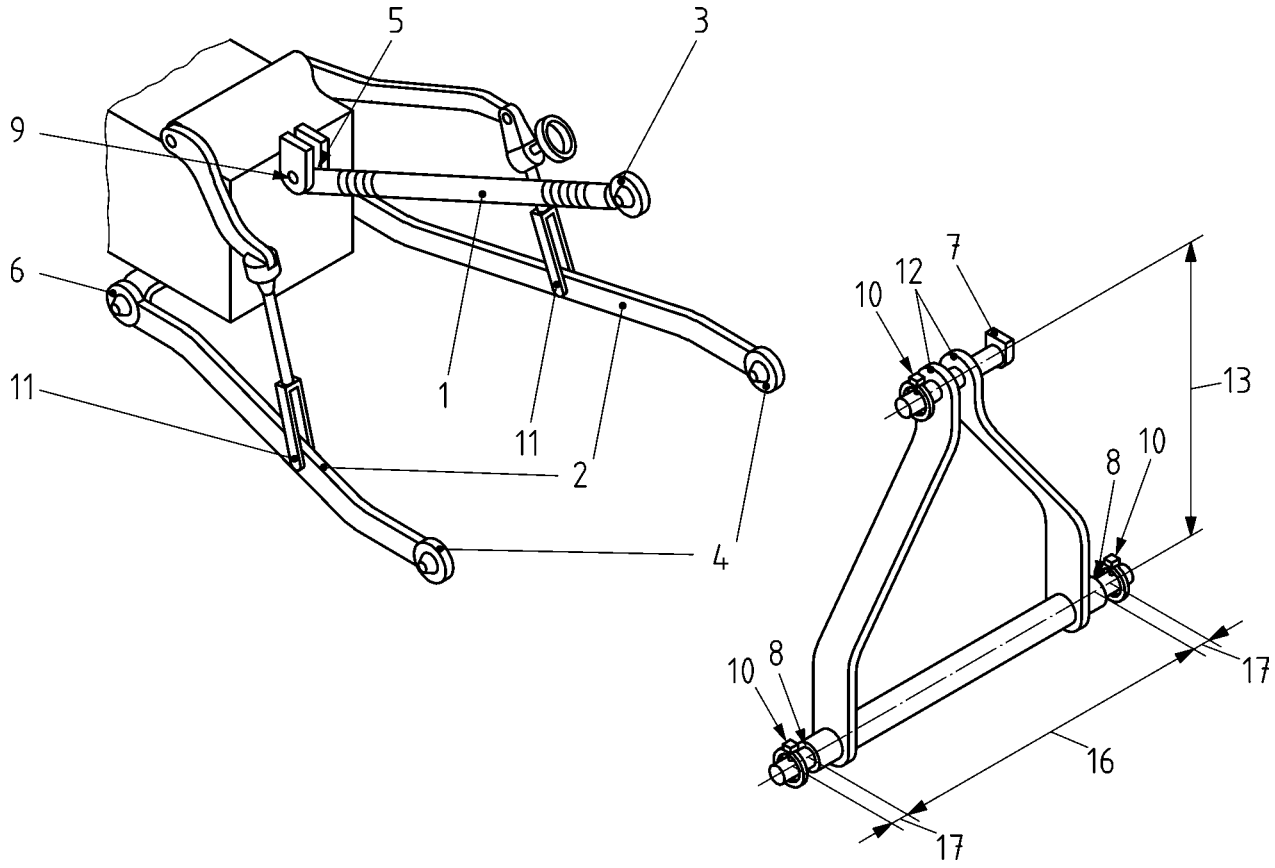
Note 4 Adjustment of the mast controls the pitch of the implement. Specifying the mast adjustment to be provided enables the tractor designer to determine the minimum acceptable adjustment of the length of the top link in relation to the points of attachment of the linkage. It also permits the implement designer to determine the range of operating depths of the implement over which pitch adjustment can be obtained.

3.2.23
torsional free float distances
vertical distance that either of the lower hitch points can move free relative to the other to allow the implement to roll, with lower links initially horizontal.

3.2.24
transport pitch
pitch reached by the mast when lifted to standard transport height from a position with horizontal lower links and vertical mast.

3.2.25
horizontal convergence distance
horizontal distance from the lower hitch points to the point of convergence of the lower links when the lower links are horizontal and laterally symmetrical, seen in a plan view (see Figure A.1).

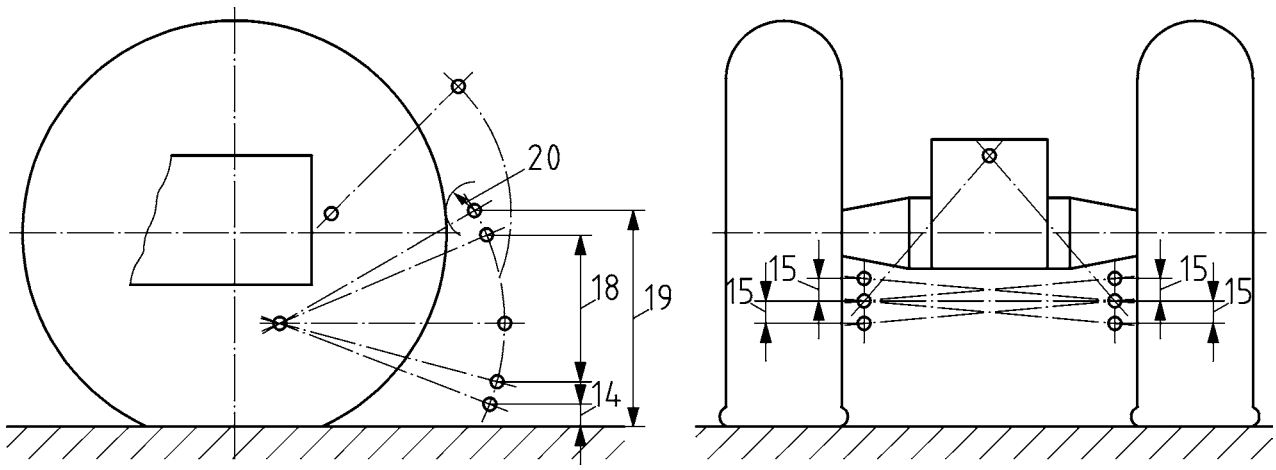
3.2.26
vertical convergence distance
horizontal distance from the lower hitch points to the point of convergence formed in the vertical longitudinal plane by the top link and the lower links (see Figure A.1).



Key

1	Upper link	9	Upper link attachment
2	Lower link	10	Linch pin
3	Upper hitch point	11	Lift rods
4	Lower hitch point	12	Mast
5	Upper link point	13	Mast height
6	Lower link point	16	Lower hitch point span
7	Upper hitch attachment	17	Linch pin hole distance
8	Lower hitch attachment		

Figure 1 – Components of three-point linkage



Key
14 Lower hitch point height
15 Levelling adjustment
18 Movement range
19 Transport height
20 Lower hitch point clearance

Note Some dimensions are shown in Figures 1 and A.1.

Figure 2 – Dimensions of three-point hitch

4 Tractor requirements

4.1 Dimensions

Dimensions apply to the tractor equipped with the normal range of tyre sizes as recommended by the tractor manufacturer.

4.1.1 Hitch points

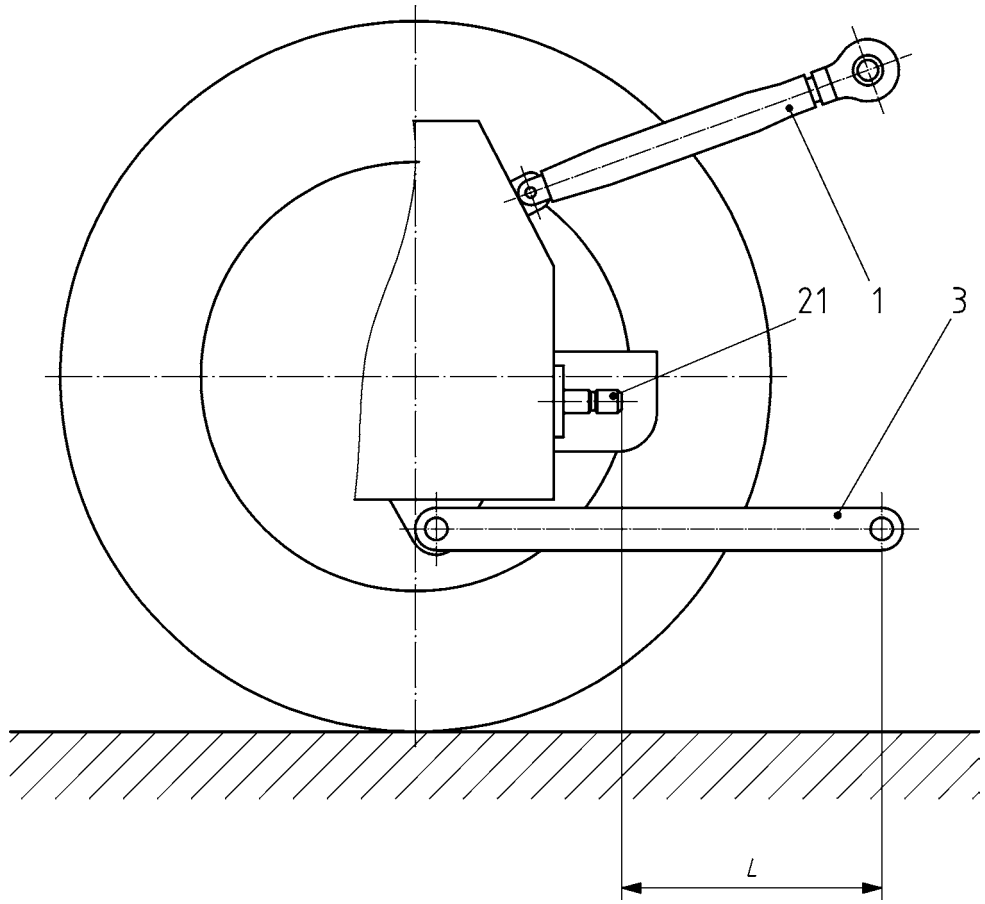
The dimensions concerning the hitch points shall be as given in Figures 3 and 4, and Table 2.

4.1.2 Upper link point

Upper link point arrangements shall be provided so that the transport pitches of – 3° to + 3° and + 10° to + 15° can be achieved with the standard mast height.

4.1.3 Torsional free float

Torsional free float shall be provided at a distance as given in Table 3. It shall be possible to block the torsional free float.



Key
1 upper link
3 horizontal lower links
21 PTO

Note Dimension L is given in Table 2.

Figure 3 – Distance from PTO to lower link points

4.1.4 Lift, movement range and levelling adjustments

The ranges of lift, movement range and levelling adjustment shall be as specified in Table 3.

4.1.5 Convergence distances

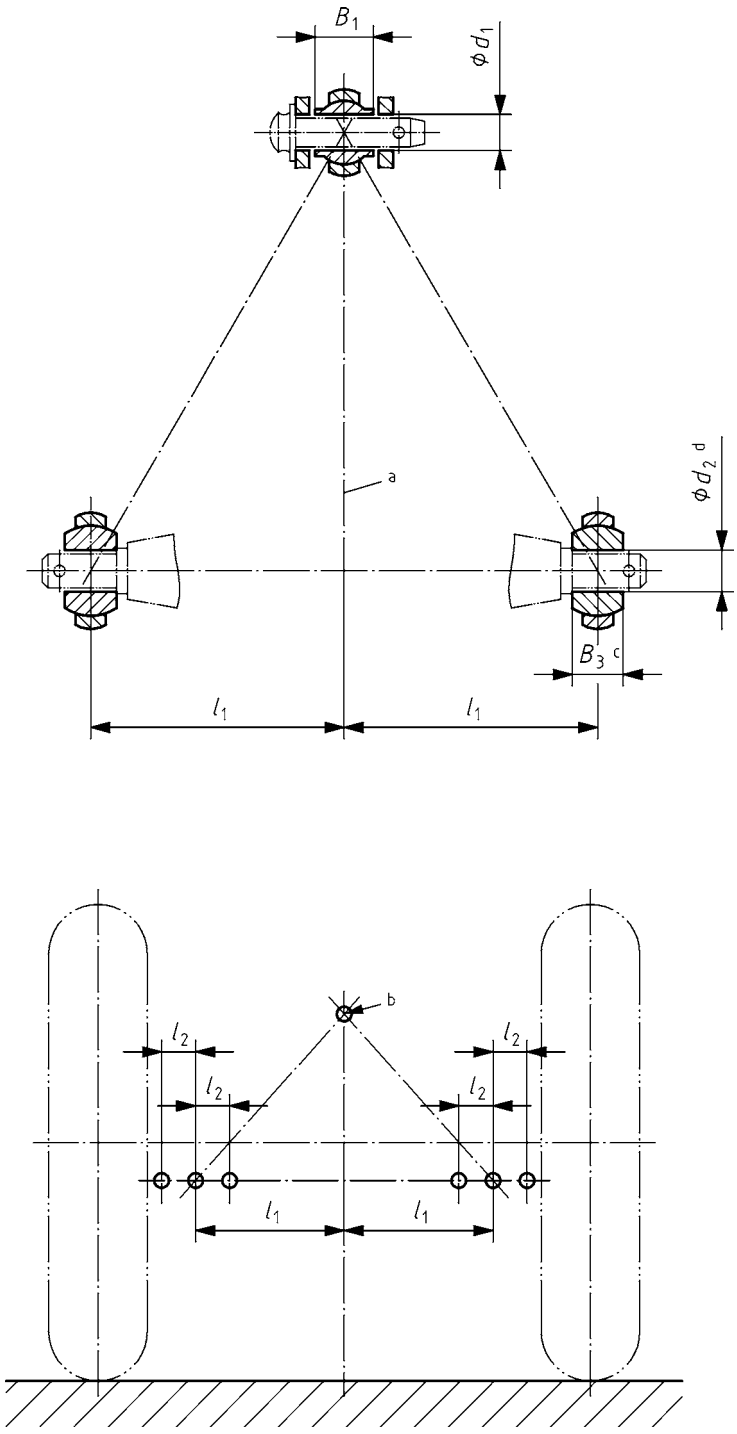
See annex A.

4.2 Restriction of transport height

Tractors shall have means by which the operator can easily restrict the transport height by, for example an adjustable stop, particularly to avoid damage to the PTO-shafts of the machine.

4.3 Interchangeability

Provisions shall be made in the design of the lower links, or by the use of double-ended hitch attachments, to enable implements based on the dimensions of category 1 to be fitted to linkages made in accordance with category 2 or vice versa. The same applies in case of categories 2 and 3, as well as of categories 3 and 4.



Key
1 axis of tractor

[a] axis of the tractor

[b] both sides

Note Dimensions are given in Table 2.

Figure 4 – Dimensions concerning tractor hitch points

Table 2 – Dimensions concerning tractor hitch points

Dimension	Description	See Figure	Category 1N	1	2	3N	3	4N	4
Upper hitch points									
d_1	Diameter of hitch pin hole	4	$19{,}3\ ^{+0{,}2}_{0}$	$19{,}3\ ^{+0{,}2}_{0}$	$25{,}7\ ^{+0{,}2}_{0}$	$32\ ^{+0{,}25}_{0}$	$32\ ^{+0{,}25}_{0}$	$45{,}2\ ^{+0{,}3}_{0}$	$45{,}2\ ^{+0{,}3}_{0}$
B_1	Width of ball	4	$44\ ^{0}_{-0{,}5}$	$44\ ^{0}_{-0{,}5}$	$51\ ^{0}_{-0{,}5}$	$51\ ^{0}_{-0{,}5}$	$51\ ^{0}_{-0{,}5}$	$64\ ^{0}_{-0{,}5}$	$64\ ^{0}_{-0{,}5}$
Lower hitch points									
d_2	Diameter of hitch pin hole	4	$22{,}4\ ^{+0{,}25}_{0}$	$22{,}4\ ^{+0{,}25}_{0}$	$28{,}7\ ^{+0{,}3}_{0}$	$37{,}4\ ^{+0{,}35}_{0}$	$37{,}4\ ^{+0{,}35}_{0}$	$51\ ^{+0{,}5}_{0}$	$51\ ^{+0{,}5}_{0}$
B_3	Width of ball	4	$35\ ^{0}_{-0{,}5}$	$35\ ^{0}_{-0{,}5}$	$45\ ^{0}_{-0{,}5}$	$45\ ^{0}_{-0{,}5}$	$45\ ^{0}_{-0{,}5}$	$57{,}5\ ^{0}_{-0{,}5}$	$57{,}5\ ^{0}_{-0{,}5}$
l_1	Lateral distance from lower hitch point to centreline of tractor[1)]	4	218	359	435	435	505	505[5)]	612
l_2	Lateral movement of lower hitch point[4)]	4	50 min.	100 min.[6)]	125 min.	125 min.	125 min.	125 min.	125 min.
L	Distance from end of power take-off to centre of lower hitch point, with the lower link horizontal[2) 3)]	3	300 to 375	500 to 575	550 to 625	575 to 675	575 to 675	575 to 675	575 to 675

1) It may be necessary to vary these dimensions in case of specalized implements.

Where a shorter distance between the lower hitch points appears necessary, the following values are preferred:

218 mm for category 1;
364 mm for category 2.

2) If a three-point hitch coupler is used, dimension L may be shortened accordingly, so that the distance between PTO and power input connection (PIC) remains the same.

3) Dimensions apply only to nominal diameter [1] 35 mm PTO-shaft and shall be increased by 100 mm if a nominal diameter [1] 45 mm PTO-shaft is used.

4) Reduced values of 30 mm are permissible for example for wagon hitches (e.g. ISO 6489-2).

5) If U-frame couplers according to ISO 11001-1 are used, dimension l_1 should be 489 mm.

6) If the tractor has a track width ≤ 1150 mm this value may be reduced to 50 mm min.

Table 3 – Lift, movement range and levelling adjustments

Definition	Subclause	Category						
		1N	1	2	3N	3	4N	4
Lower hitch point height	3.2.14	200 max.	200 max.	230 max.	230 max.	230 max.	230 max.	230 max.
Levelling adjustment	3.2.15	75 min.	100 min.	100 min.	125 min.	125 min.	150 min.	150 min.
Movement range	3.2.18	610 min.	610 min.	650 min.[1)]	735 min.	735 min.	760 min.	760 min.
Transport height point (lower point axis to be horizontal throughout)	3.2.19	600 min.	820 min.	950 min.	1065 min.	1065 min.	1200 min.	1200 min.
Lower hitch point clearance	3.2.20	90 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.
Main adjustment height	3.2.22							
Highest position		420 min.	508 min.	610 min.	660 min.	660 min.	710 min.	710 min.
Lowest position		200 max.	200 max.	200 max.	230 max.	230 max.	255 max.	255 max.
Torsional free float	3.2.23	60 min.	60 min.	60 min.	75 min.	75 min.	75 min.	75 min.
1) For tractors with PTO power above 65 kW, this dimension shall be 700 mm minimum.								

5 Implement requirements

5.1 Dimensions

The hitch attachments dimensions shall be as given in Figure 5 and Table 4.

5.2 Clearance zone

The clearance for the implement shall be as given in ISO 2332 which also shows the clearance needed around hitch points.

Dimensions in millimetres

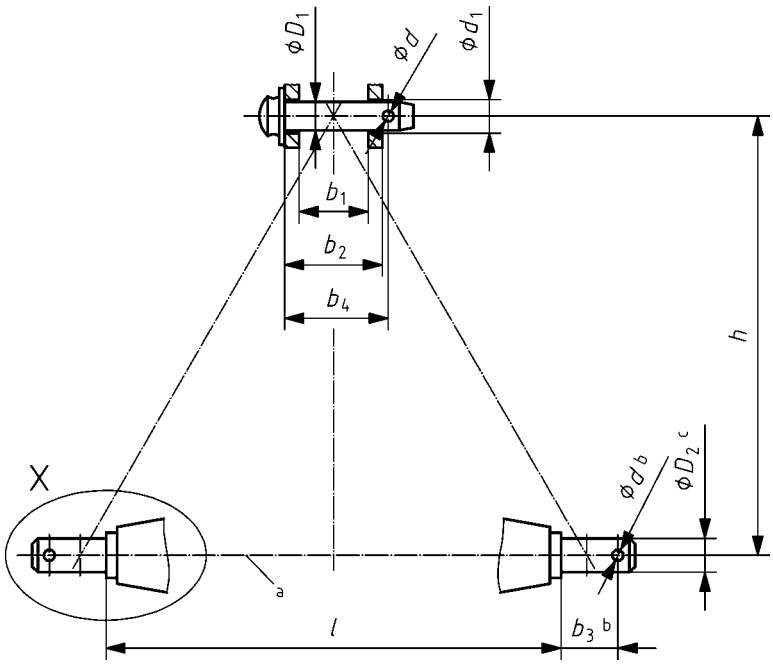


Figure 5a – Pin type

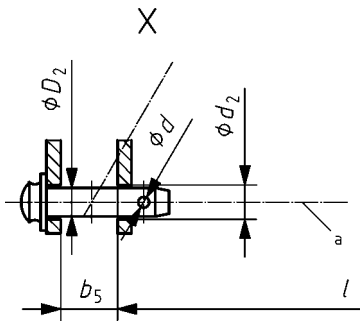


Figure 5b – Clevis type

[a] axis of implement

[b] both sides

[c] both sides

Note Dimensions given in Table 2 and Table 4

Figure 5 – Dimensions concerning implement hitch attachments

Table 4 – Dimensions concerning implement hitch points

Dimension	Description	Category						
See figure 5		1N	1	2	3N	3	4N	4
Upper hitch attachments								
D_1	Diameter of hitch pin	$19\ ^{0}_{-0,08}$	$19\ ^{0}_{-0,08}$	$25,5\ ^{0}_{-0,13}$	$31,75\ ^{0}_{-0,2}$	$31,75\ ^{0}_{-0,2}$	$45\ ^{0}_{-0,8}$	$45\ ^{0}_{-0,8}$
b_1	Width between inner faces of yoke	52 min.	52 min.	52 min.	52 min.	52 min.	65 min.	65 min.
Lower hitch attachments								
D_2	Diameter of hitch pin	$22\ ^{0}_{-0,2}$	$22\ ^{0}_{-0,2}$	$28\ ^{0}_{-0,2}$	$36,6\ ^{0}_{-0,2}$	$36,6\ ^{0}_{-0,2}$	$50,8\ ^{0}_{-1,1}$	$50,8\ ^{0}_{-1,1}$
b_3	Linch pin hole distance	49 min.	49 min.	49 min.	52 min.	52 min.	68 min.	68 min.
b_5	Clevis width[3]	$65\ ^{+2}_{0}$	$65\ ^{+2}_{0}$	$65\ ^{+2}_{0}$	$72,5\ ^{+2}_{0}$	$72,5\ ^{+2}_{0}$	$96,5\ ^{+2}_{0}$	$96,5\ ^{+2}_{0}$
l	Lower hitch point span[1]	400 ± 1,5	683 ± 1,5	825 ± 1,5	825 ± 1,5	965 ± 1,5	952[4] ± 1,5	1166,5 ± 1,5
Other dimensions								
d	Diameter for linch pin hole							
	For upper hitch pin	12 min.	12 min.	12 min.	12 min.	12 min.	17 min.	17 min.
	For lower hitch pin	12 min.	12 min.	12 min.	17 min.	17 min.	17 min.	17 min.
h	Mast height[2]	360 ± 1,5	460 ± 1,5	610 ± 1,5	685 ± 1,5	685 ± 1,5	685 ± 1,5	1100 ± 1,5

1) It may be necessary to vary these dimensions in case of specialized implements. Where a shorter distance between the lower hitch points appears necessary, the following values are preferred:

400 mm for category 1;
683 mm for category 2.

2) If U-frame couplers according to ISO 11001-1 are used, dimension h should be in line with upper hook vertical spacing as specified in ISO 11001-1.

3) Dimensions can be enlarged to 72,5 mm for categories 1N, 1 and 2 on implements which are connected to a coupler frame according to ISO 11001-1

4) If U-frame couplers according to ISO 11001-1 are used, dimension l should be 920,5 ± 1,5.

Annex A
(informative)

Convergence distances

This annex gives recommendations for choosing the vertical and the horizontal convergence distances for the three-point linkage to achieve good working conditions for implements, in particular soil-working implements such as ploughs.

The aim with these recommendations is to make it possible to achieve an effective tractor-implement combination under all conditions.

A.1 Horizontal convergence distances

The horizontal convergence distance (see figure A.1) is of great importance for the horizontal stability of implements (see annex B [9] to [8].)

If the horizontal convergence distance is too large, the lateral stability of directional implements is decreased. For ploughs this means an uneven and crooked first furrow.

If the horizontal convergence distance is too short, non-directional implements, such as harrows, easily find equilibrium positions somewhat asymmetric to the tractor. For many implements, especially long multirow ones, this leads to decreased quality of work.

Experience shows that most implements will function well with the following horizontal convergence distance:

Category 1N / 1: 1700 mm to 2400 mm

Category 2: 1800 mm to 2400 mm

Category 3N: 1800 mm to 2400 mm

Category 3: 1900 mm to 2700 mm

Category 4N: 1900 mm to 2700 mm

Category 4: 1900 mm to 2800 mm

A.2 Vertical convergence distances

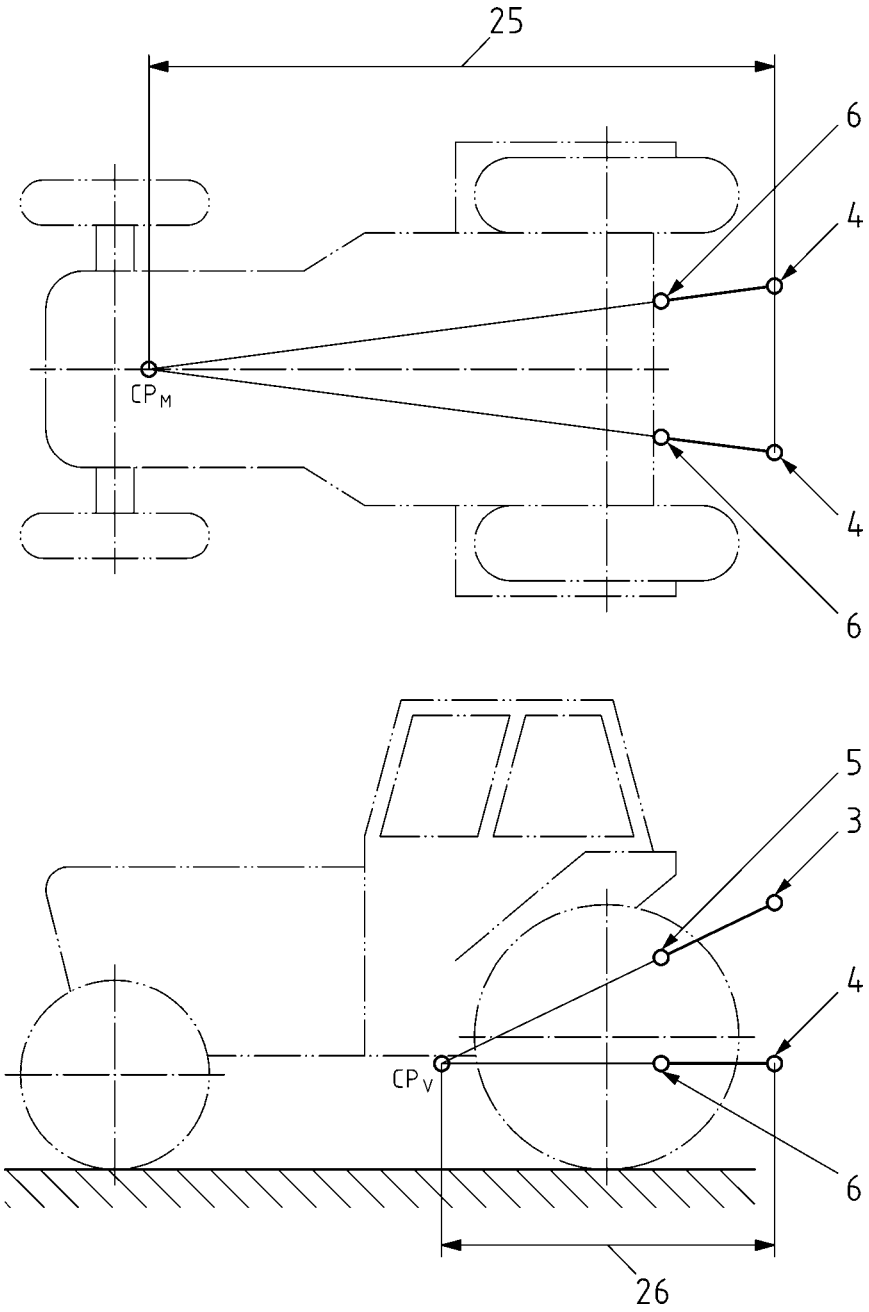
The vertical convergence distance (see Figure A.1) is important for stable working conditions and makes it possible

— to reduce the influence of tractor movements (pitching, rolling, turning) on connected implements;

— for designers of implements to apply the optimal technical decisions and design criteria for working bodies of an implement and to use the mass of the implement properly;

— to provide for wide interchangeability of tractors and implements designed by different producers.

To achieve these properties for a linkage, it is recommended that the vertical convergence distance is not less than 0,9 times the tractor wheelbase.



Key
3 Upper hitch point
4 Lower hitch point
5 Upper link point
6 Lower link point
25 Horizontal convergence distance
26 Vertical convergence distance

CP_V Vertical virtual hitch point
CP_M Horizontal virtual hitch point

Figure A.1 – Convergence distances

Annex B
(informative)

Bibliography

B.1 Literature concerning main body of standard

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[3] ISO 500-3:2004, *Agricultural tractors – Rear-mounted power take-off types 1, 2 and 3 – Part 3: Main PTO dimensions and spline dimensions, location of PTO*

[4] ISO 7072:1993, *Tractors and machinery for agriculture and forestry – Linch pins and spring pins – Dimensions and requirements.*

[5] ISO 8759-1:1998, *Agricultural wheeled tractors – Front-mounted equipment – Part 1: Power take-off and three-point linkage*

[6] ISO 11001-1:1993, *Agricultural wheeled tractors and implements – Three-point hitch couplers – Part 1: U-frame coupler*

[7] ISO 11001-2:1993, *Agricultural wheeled tractors and implements – Three-point hitch couplers – Part 2: A-frame coupler*

[8] ISO 11001-3:1993, *Agricultural wheeled tractors and implements – Three-point hitch couplers – Part 3: Link coupler*

[9] ISO 11001-4:1994, *Agricultural wheeled tractors and implements – Three-point hitch couplers – Part 4: Bar coupler*

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B.2 Literature concerning annex A

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