

ANSI/ASABE AD730:2009 W/Amd. 1:2014 MAR2015

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



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ASABE, 2950 Niles Road, St. Joseph, MI 49085-9659, USA, phone 269-429-0300, fax 269-429-3852, hq@asabe.org

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History of ASAE S217, Three-Point Free-Link Attachment for Hitching Implements to Agricultural Wheel Tractors: Proposed by the Advisory Engineering Committee of the Farm and Industrial Equipment Institute; adopted by ASAE March 1959; revised 1961, 1962, 1963, June 1964, December 1966, March 1971, February 1972, April 1974, February 1975; revised editorially April 1977; reconfirmed December 1979, December 1984, December 1989; revised December 1991; reaffirmed December 1996, December 1997, December 1998; revised editorially March 1999; reaffirmed December 1999; January 2001; revised December 2001 to provide specific comparison to ISO 730-1:1994 E; reaffirmed January 2007.

S217 was used as the basis document for ISO 730, Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2N, 2, 3N, 3, 4N and 4. S217.12 replaced by an adoption with deviations of ISO 730:2009 December 2012; approved as an American National Standard January 2013; ISO 730:2009/Amd.1:2014 included to ISO 730:2009 adoption approved March 2015; approved by ANSI April 2015.

Keywords: Free-link, Hitch, Hitching implements, Three-point hitch

0 Foreword

0.1 ANSI/ASABE AD730:2009 W/Amd. 1:2014, Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2N, 2, 3N, 3, 4N and 4, is an adoption of the identically title ISO documents ISO 730:2009, Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2N, 2, 3N, 3, 4N and 4 and ISO 730:2009/Amd. 1:2014. Deviations noted in the following Foreword sections pertain to those provisions where harmonization could not be achieved between ASABE and the International Standard.

0.2 ANSI/ASABE AD730:2009 W/Amd. 1:2014 specifies the dimensions and requirements of the three-point linkage for the attachment of implements or equipment to the rear of agricultural wheeled tractors.

0.3 Three normative references are listed in ISO 730:2009 and ISO 730:2009/AMD. 1:2014. The responsible ASABE committee has reviewed these references and approved the following deviation:

0.3.1 Replace ISO 8759-1:1998, Agricultural wheeled tractors — Front-mounted equipment — Part 1: Power take-off and three-point linkage, with ANSI/ASABE AD8759-1:1998, Agricultural wheeled tractors — Front-mounted equipment — Part 1: Power take-off and three-point linkage. Any reference to ISO 8759-1:1998 in the printed portion of ISO 730:2009 shall be replaced by ANSI/ASABE AD8759-1:1998.

0.4 This standard has been approved as an American National standard by ANSI (American National Standard Institute). The original content of ISO 730 was based on ASAE S217.

0.5 This standard deviates from ISO 730:2009 and ISO 730:2009/AMD. 1:2014 as follows:

0.5.1 See Section 0.3 for Normative reference deviation.

0.5.2 In Table 3 change the value of the movement range for Category 1N from 610 mm to 420 mm.

0.5.3 In Table 2: L dimensions applied to 45 mm shaft also apply to 57.5 mm shaft.

Text of ISO 730:2009 and ISO 730:2009/AMD. 1:2014, Agricultural wheeled tractors — Rear-mounted three-point linkage — Categories 1N, 1, 2N, 2, 3N, 3, 4N and 4, follows.

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.

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 tests for power take-off

ISO 2332:2009, Agricultural tractors and machinery — Connection of implements via three-point linkage — Clearance zone around implement

ISO 8759-1:1998, Agricultural wheeled tractors — Front-mounted equipment — Part 1: Power take-off and three-point linkage

3 Terms and definitions

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

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 connection between link and implement

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

3.1.3

link point

articulated connection between link and tractor

NOTE 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

NOTE For examples, see References [5] to [8].

3.1.5

narrow-hitch

N

standard hitch in all dimensions except for the lower hitch point span, which is that of the next smallest category

EXAMPLE A category 3N hitch can also be a category 2 hitch in all dimensions excepting the upper and lower hitch point pin diameters, which are category 3.

3.2 Three-point linkage components and dimensions (see Figure 1)

3.2.1

upper link

upper linkage element, fitted with an articulated connection at both ends

3.2.2

lower link

lower linkage element, fitted with an 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

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

linchpin

pin, usually fitted with a spring-retaining device, by which an articulated connection is retained in position

NOTE See Reference [4].

3.2.11

lift rods

connections that transmit force to the lower links for raising and lowering

3.2.12

mast

component that provides the 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, and when the lower hitch point axis is maintained horizontal to the ground in a transverse plane

3.2.15

levelling adjustment

movement allowing inclination of the implement, measured vertically and with one lower link horizontal, so that either lower hitch point can be moved higher or lower than the other

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

linchpin hole distance

distance from the centreline of the linchpin hole to the shoulder of the hitch pin

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 viewed anticlockwise from the left-hand side of the tractor

3.2.22

mast adjustment

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

NOTE 1 Mast adjustment is not shown in Figure 1.

NOTE 2 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 distance

vertical distance over which either of the lower hitch points can move freely 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 lower links horizontal and mast vertical

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

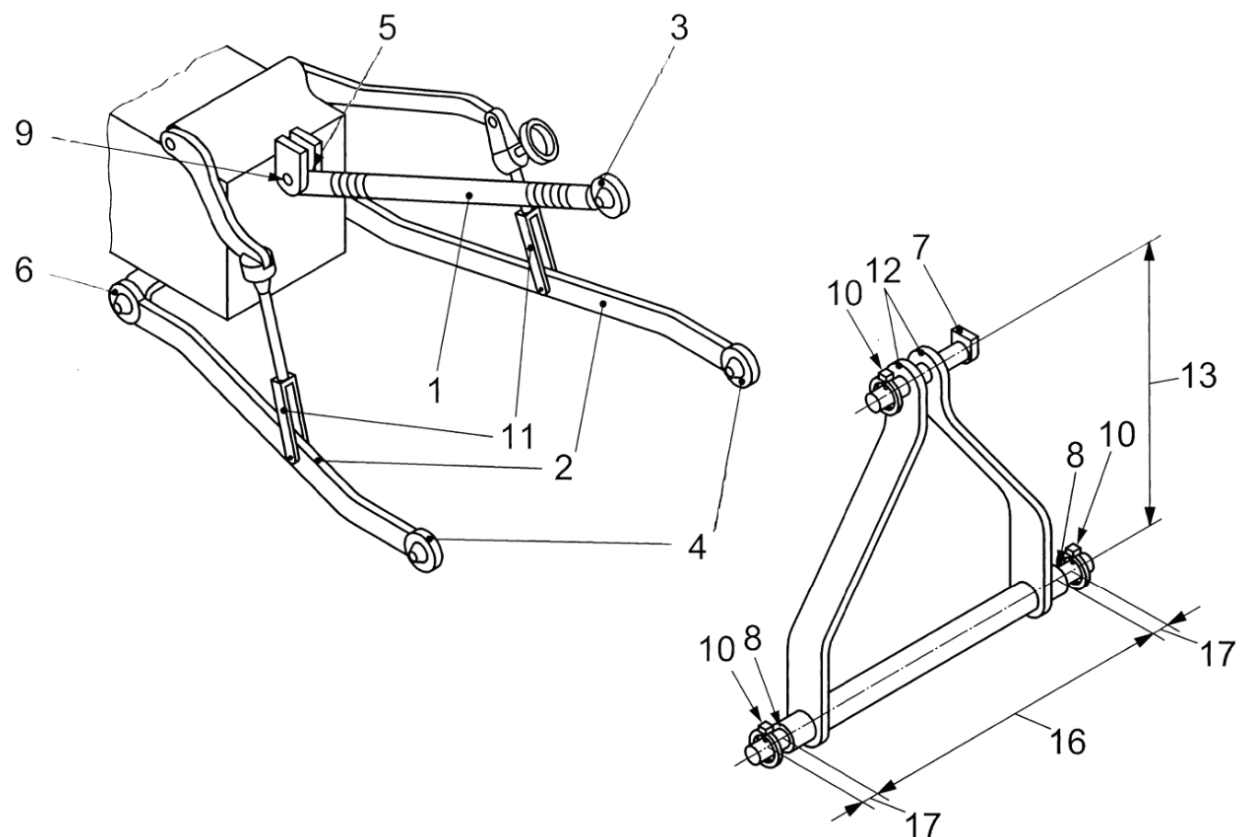
NOTE See Annex A.

3.2.26

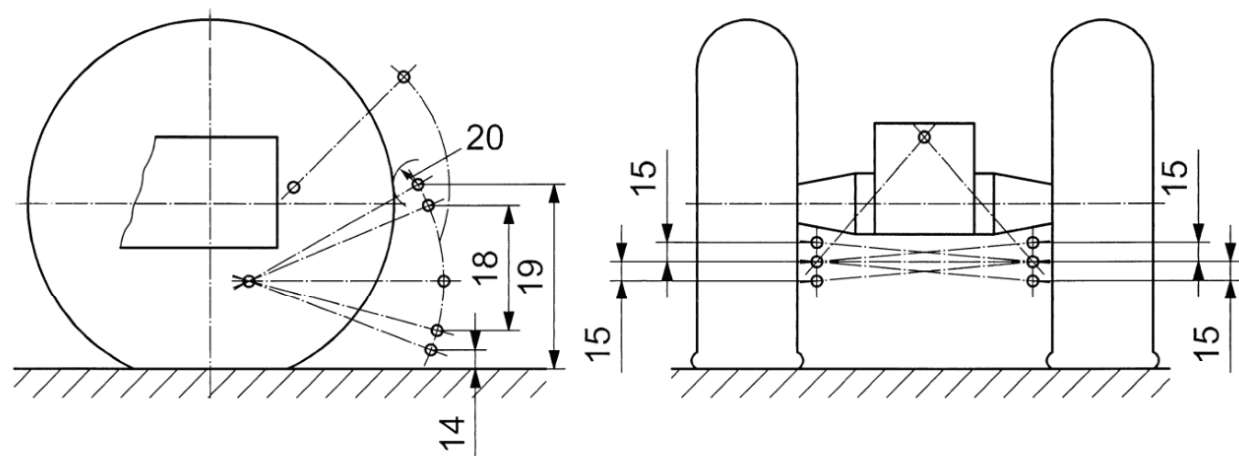
vertical convergence distance

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

NOTE See Annex A.



a) Components



b) Dimensions

Key

1 upper link	8 lower hitch attachment	15 levelling adjustment
2 lower link	9 upper link attachment	16 lower hitch point span
3 upper hitch point	10 linchpin	17 linchpin hole distance
4 lower hitch point	11 lift rods	18 movement range
5 upper link point	12 mast	19 transport height
6 lower link point	13 mast height	20 lower hitch point clearance
7 upper hitch attachment	14 lower hitch point height	

NOTE Each of the key items listed above is numbered so that it corresponds to the last element in the number of the term as defined in 3.2. For example, item 1, "upper link", is defined in 3.2.1, while item 20, "lower hitch point clearance", is defined in 3.2.20.

Figure 1 – Components and dimensions of three-point linkage

4 Tractor requirements

4.1 Categories

The categories of rear-mounted three-point linkages to be used on the various ranges of agricultural tractors are given in Table 1.

Table 1 – Categories of rear-mounted three-point linkages

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

Category 1N and 2N apply to narrow-track agricultural wheeled tractors.

Certain specialized implements or farming operations that require narrow spacing require special consideration for the three-point linkage. Categories 3N and 4N hitch categories have been established to respond to 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.

4.2 Dimensions

4.2.1 General

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

4.2.2 Hitch points

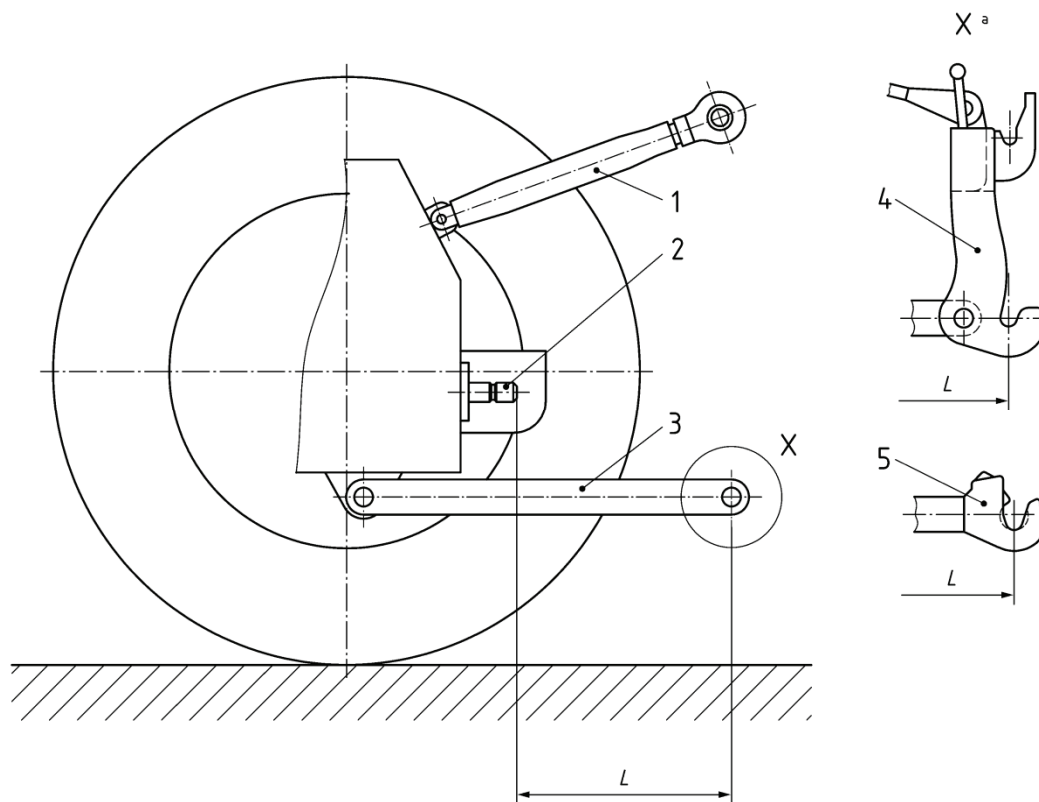
The dimensions related to the hitch points shall be in accordance with Figures 2 and 3, and Table 2.

4.2.3 Upper link point

Upper link point arrangements shall be provided so that the transport pitches of -3° to $+3^{\circ}$ and $+10^{\circ}$ to $+15^{\circ}$ can be achieved at the standard mast height.

4.2.4 Torsional free float

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



Key

- 1 upper link
- 2 PTO
- 3 lower links
- X
- 4 U frame coupler according to ISO 11001-1
- 5 Link coupler according to ISO 11001-3

NOTE Dimension L is given in Table 2.

Figure 2 – Distance from PTO to lower link points

4.2.5 Lift, movement range and levelling adjustments

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

4.2.6 Convergence distances

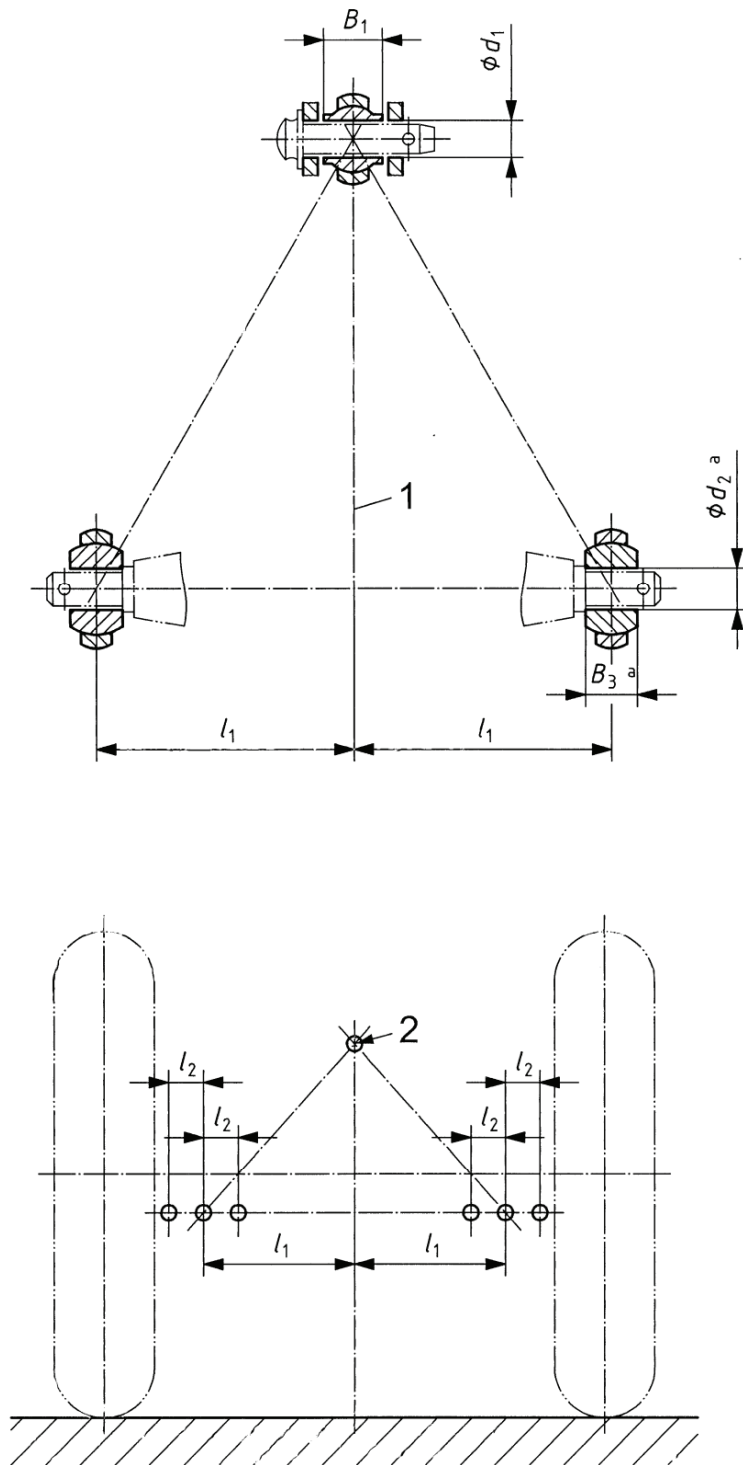
See Annex A.

4.3 Restriction of transport height

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

4.4 Interchangeability

In the event of connecting a tractor to an implement that does not have the same hitch category, smaller hitch pins may be adapted to the larger sizes with the use of bushings (or adapter balls in the case of ISO 11001-3 link couplers). The implement manufacturer should instruct the user to check for adequate PTO driveline telescoping and to potentially limit the hitch movement range.



Key

- 1 axis of the tractor
- 2 hitch point triangle

^a Both sides.

NOTE Dimensions are given in Table 2.

Figure 3 – Dimensions related to tractor hitch points

Table 2 – Dimensions concerning tractor linkage points

Dimension	Description	See Figure	Category							
			1N	1	2N	2	3N	3	4N	4
Upper hitch point										
d_1	Diameter of hitch pin hole	3	$19,3^{+0,2}_0$	$19,3^{+0,2}_0$	$25,7^{+0,2}_0$	$25,7^{+0,2}_0$	$32^{+0,25}_0$	$32^{+0,25}_0$	$45,2^{+0,3}_0$	$45,2^{+0,3}_0$
B_1	Width of ball	3	$44^0_{-0,5}$	$44^0_{-0,5}$	$51^0_{-0,5}$	$51^0_{-0,5}$	$51^0_{-0,5}$	$51^0_{-0,5}$	$64^0_{-0,5}$	$64^0_{-0,5}$
Lower hitch point										
d_2	Diameter of hitch pin hole	3	$22,4^{+0,25}_0$	$22,4^{+0,25}_0$	$28,7^{+0,3}_0$	$28,7^{+0,3}_0$	$37,4^{+0,35}_0$	$37,4^{+0,35}_0$	$51^{+0,5}_0$	$51^{+0,5}_0$
B_3	Width of ball	3	$35^0_{-0,5}$	$35^0_{-0,5}$	$45^0_{-0,5}$	$45^0_{-0,5}$	$45^0_{-0,5}$	$45^0_{-0,5}$	$57,5^0_{-0,5}$	$57,5^0_{-0,5}$
l_1	Lateral distance from lower hitch point to centreline of tractor ^a	3	218	359	364	435	435	505	505 ^b	612
l_2	Lateral movement of lower hitch point ^c	3	50 min.	100 min. ^d	100 min. ^d	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 for 35 mm PTO shafts ^{e,f}	2	350^{+25}_{-50}	550^{+25}_{-50}	600^{+75}_{-90}	600^{+75}_{-90}	650^{+75}_{-90}	650^{+75}_{-90}	Not recommended	Not recommended
	Distance from end of power take-off to centre of lower hitch point, with the lower link horizontal for 45 mm PTO shafts ^e	2	Not recommended	Not recommended	600^{+125}_{-10}	600^{+125}_{-10}	650^{+125}_{-10}	650^{+125}_{-10}	750^{+125}_{-100}	750^{+125}_{-100}

^a It could be necessary to vary these dimensions in case of specialized implements.

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

^c Values may be reduced by a maximum of 35 mm in certain applications [e.g. for wagon hitches (e.g. ISO 6489-2) or with wide tyre sizes].

^d If the tractor has a track width $\leq 1\,150$ mm, this value may be reduced to 50 mm min.

^e For tractors designed with U- frame couplers as defined by ISO 11001-1 as standard equipment the lower links should be shortened so that the distance to the lower U-frame coupler jaw falls within the range for dimension L specified in ISO 730. See Figure 2. For tractors that offer U-frame couplers as an option, the lower links should be designed to the minimum L dimension given in ISO 730 as far as possible to minimize the distance that the combined lower link and U-frame coupler length (Lower socket offset) is over the upper limit of the L dimension range given in Table 2.

Table 3 – Lift, movement range and levelling adjustments

Dimensions in millimetres

Term	No.	Category							
		1N	1	2N	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.	230 max.
Levelling adjustment	3.2.15	75 min.	100 min.	100 min.	100 min.	125 min.	125 min.	150 min.	150 min.
Movement range	3.2.18	610 min.	610 min.	650 min. ^a	650 min. ^a	735 min.	735 min.	760 min.	760 min.
Transport height (lower hitch point axis to be horizontal throughout)	3.2.19	600 min.	820 min.	950 min.	950 min.	1 065 min.	1 065 min.	1 200 min.	1 200 min.
Lower hitch point clearance	3.2.20	90 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.	100 min.
Mast adjustment height	3.2.22								
Highest position		420 min.	508 min.	610 min.	610 min.	660 min.	660 min.	710 min.	710 min.
Lowest position		200 max.	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.	60 min.	75 min.	75 min.	75 min.	75 min.
^a For tractors with PTO power above 65 kW, this dimension shall be 700 mm minimum.									

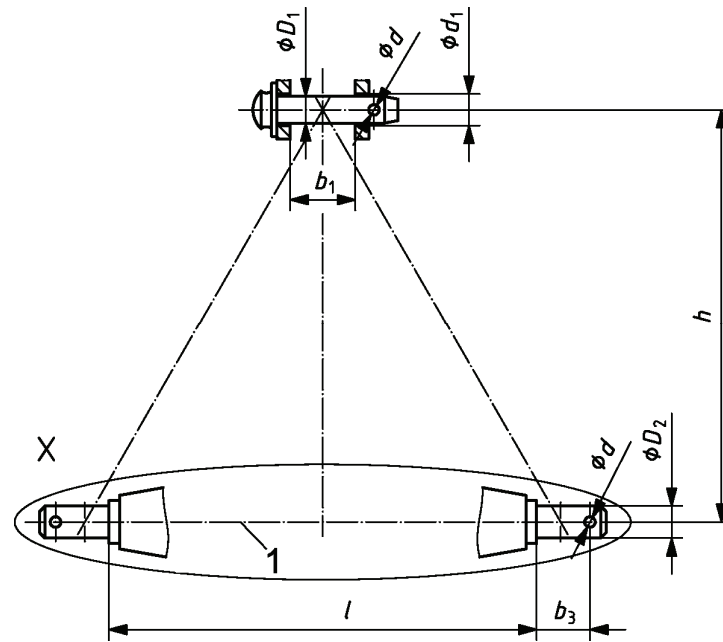
5 Implement requirements

5.1 Dimensions

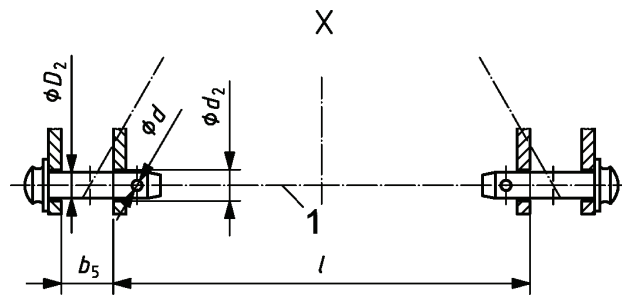
The hitch attachments dimensions shall be as given in Figure 4 and Table 4.

5.2 Clearance zone

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



a) Pin type



b) Clevis type

Key

1 axis of attachment

NOTE The dimensions are given in Table 2 and Table 4.

Figure 4 – Dimensions related to implement hitch attachments

Table 4 – Dimensions related to implement hitch points

Dimensions in millimetres

Dimension See Figure 4	Description	Category							
		1N	1	2N	2	3N	3	4N	4
Upper hitch attachment									
D_1	Diameter of hitch pin	$19_{-0,08}^0$	$19_{-0,08}^0$	$22,5_{-0,13}^0$	$22,5_{-0,13}^0$	$31,75_{-0,2}^0$	$31,75_{-0,2}^0$	$45_{-0,08}^0$	$45_{-0,08}^0$
b_1	Width between inner faces of yoke	52 min.	52 min.	52 min.	52 min.	52 min.	52 min.	65 min.	65 min.
Lower hitch attachment									
D_2	Diameter of hitch pin	$22_{-0,2}^0$	$22_{-0,2}^0$	$28_{-0,2}^0$	$28_{-0,2}^0$	$36,6_{-0,2}^0$	$36,6_{-0,2}^0$	$50,8_{-1,1}^0$	$50,8_{-1,1}^0$
b_3	Linchpin hole distance	49 min.	49 min.	49 min.	49 min.	52 min.	52 min.	68 min.	68 min.
b_5	Clevis width ^a	65_0^{+2}	65_0^{+2}	65_0^{+2}	65_0^{+2}	$72,5_0^{+2}$	$72,5_0^{+2}$	$96,5_0^{+2}$	$96,5_0^{+2}$
l	Lower hitch point span ^b	400 ± 1,5	683 ± 1,5	683 ± 1,5	825 ± 1,5	825 ± 1,5	965 ± 1,5	952 ^c ± 1,5	1 166,5 ± 1,5
Other dimensions									
d	Diameter for linchpin hole								
	For upper hitch pin	12 min.	12 min.	12 min.	12 min.	12 min.	12 min.	17 min.	17 min.
	For lower hitch pin	12 min.	12 min.	12 min.	12 min.	17 min.	17 min.	17 min.	17 min.
h	Mast height ^d	360 ± 1,5	460 ± 1,5	610 ± 1,5	610 ± 1,5	685 ± 1,5	685 ± 1,5	685 ± 1,5	1 100 ± 1,5
^a Dimensions may be enlarged to 72,5 mm for categories 1N, 1, 2N and 2 on implements connected to a coupler frame according to ISO 11001-1.									
^b It could be necessary to vary these dimensions in case of specialized implements.									
^c If U-frame couplers according to ISO 11001-1 are used, dimension l should be 920,5 mm ± 1,5 mm.									
^d If U-frame couplers according to ISO 11001-1 are used, dimension h should be in line with the upper hook vertical spacing as specified in ISO 11001-1.									

Annex A (informative) Convergence distances

A.1 General

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

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

A.2 Horizontal convergence distance

The horizontal convergence distance (see Figure A.1) is of great importance for the horizontal stability of implements.

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 multi-row ones, this leads to decreased quality of work.

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

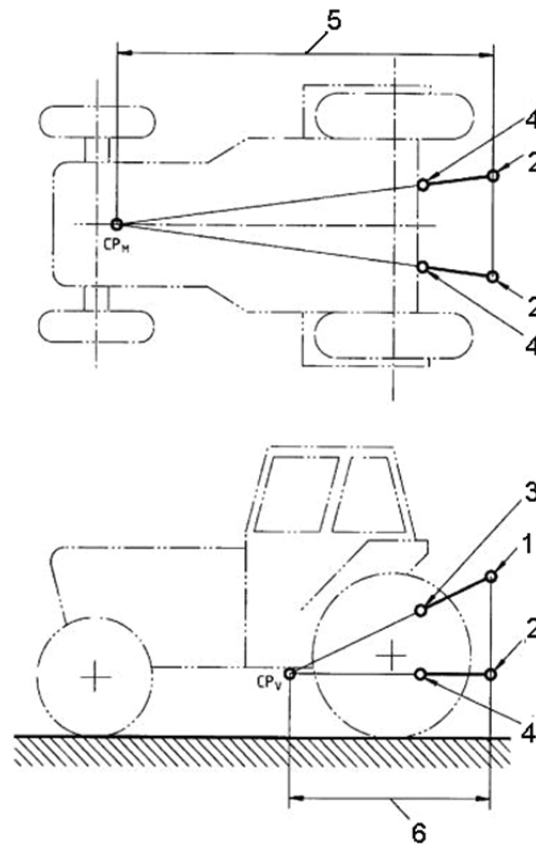
Category 1N/1:	1 700 mm to 2 400 mm
Category 2N/2:	1 800 mm to 2 400 mm
Category 3N:	1 800 mm to 2 400 mm
Category 3:	1 900 mm to 2 700 mm
Category 4N:	1 900 mm to 2 700 mm
Category 4:	1 900 mm to 2 800 mm

A.3 Vertical convergence distance

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

To achieve these properties for a linkage, the vertical convergence distance should be not less than 0,9 times the tractor wheelbase.



Key

- 1 upper hitch point (3.2.3)
- 2 lower hitch point (3.2.4)
- 3 upper link point (3.2.5)
- 4 lower link point (3.2.6)
- 5 horizontal convergence distance (3.2.25)
- 6 vertical convergence distance (3.2.26)
- CP_V vertical virtual hitch point
- CP_M horizontal virtual hitch point

Figure A.1 — Convergence distances

Bibliography

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