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भारतीय मानक

पहियेदार कृषि ट्रैक्टर — पश्च-आरोपित तीन-पिन वाला जोड़

भाग 1 सर्ग 1, 2, 3 और 4

(चौथा पुनरीक्षण)

Indian Standard

**AGRICULTURAL WHEELED TRACTORS —
REAR-MOUNTED THREE-POINT LINKAGE**

PART 1 CATEGORIES 1, 2, 3 AND 4

(Fourth Revision)

ICS 65.060.10

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

FOREWORD

This Indian Standard (Fourth Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Agricultural Tractors and Power Tillers Sectional Committee had been approved by the Food and Agriculture Division Council.

This standard was first published in 1967 and subsequently revised in 1977 and 1986. At the time of third revision in 1993 the standard was splitted into three parts in line with ISO Standards adopting ISO 730 — Parts 1 to 3 in dual numbers. This fourth revision of Part 1 is being brought in order to align it with the revised ISO 730-1. This revision incorporates, among others, the following:

- a) Requirements of category 4 which was earlier covered in separate part;
- b) Definitions of few more terms and also modifying some of the terms already covered for clear interpretation;
- c) Requirements of upper link point arrangement to achieve a specified transport pitch; torsional free float and restriction of transport height;
- d) Diameter of hitch pin and hitch pin hole of category 1 modified;
- e) Requirements of clearance zone for the implements; and
- f) Recommended horizontal and vertical convergence distances for information and to achieve good working conditions for implements.

In preparation of this standard assistance has been derived from following ISO Standards:

ISO 730-1 : 1994 Agricultural wheeled tractors — Rear-mounted three-point linkage — Part 1: Categories 1, 2, 3 and 4

ISO 2332 : 1993 Agricultural tractors and machinery — Connection of implements via three point linkage — Clearance zone around implement

In order to cover the tractors of lower category (i.e. up to 25 hp) being manufactured in our country this Indian Standard deviates from ISO 730-1 with respect to dimension L (see Table 2) and movement range (see Table 3). Also the requirement of torsional free float is made optional.

The clearance zone (see 5.2) specified in this standard is based on ISO 2332 : 1993. Since this ISO Standard specifies the clearance zone for categories 1, 2 and 3 only, the same has been incorporated in this Indian Standard. As and when the clearance zone for category 4 is incorporated in ISO Standard the same will also be included in this Indian Standard.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AGRICULTURAL WHEELED TRACTORS — REAR-MOUNTED THREE-POINT LINKAGE

PART 1 CATEGORIES 1, 2, 3 AND 4

(Fourth Revision)

1 SCOPE

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

1.2 It specifies four 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
(1)	(2)
1	Up to 48
2	Up to 92
3	80 to 185
4	150 to 350

¹⁾Determined in accordance with IS 12036 : 1995.

Category 4 has been divided into two parts, 4 L and 4 H, depending on the location of the power take-off (PTO). Category 4L and 4H dimensions apply to tractors with the PTO, respectively, below and above the rear axle centreline.

2 REFERENCES

The following standards contain provisions which, through reference in this text constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision, and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
6483 : 1981	Linch pin assembly (<i>first revision</i>)
12036 : 1995	Agricultural tractors — Test procedures — Power tests for power take off (<i>first revision</i>)

3 DEFINITIONS

3.1 For the purpose of this standard, the following definitions shall apply. General definitions are given in 3.2 and definitions for components and dimensions in 3.3. The last element of the definition number in 3.3 is also the key number for the element or dimension in Fig. 1, 2 and 10.

3.2 General

3.2.1 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.

3.2.2 Hitch Point

Articulated connections between link and implement.

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

3.2.3 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.

3.2.4 Three Point Hitch Coupler

Device which facilitates the connection of the tractor three-point linkage to the implement.

3.3 Linkage Components and Dimensions

3.3.1 Upper Link

Upper linkage element, fitted with an articulated connection at both ends.

3.3.2 Lower Link

Lower linkage element, fitted with an articulated connection at both ends.

3.3.3 Upper Hitch Point

Articulated connection between the upper link and the implement.

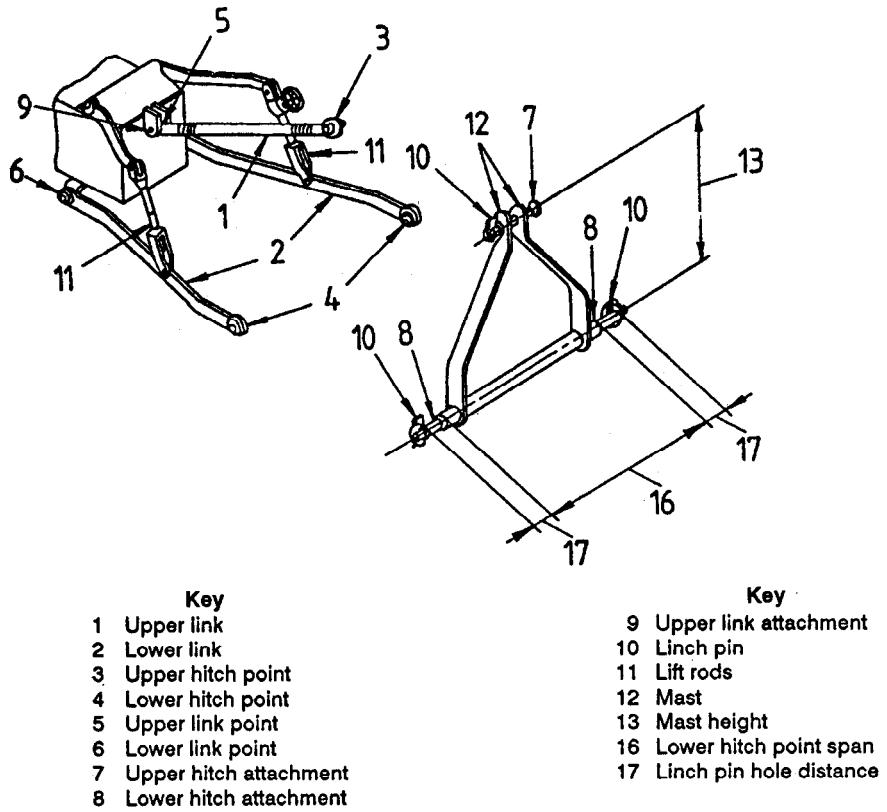
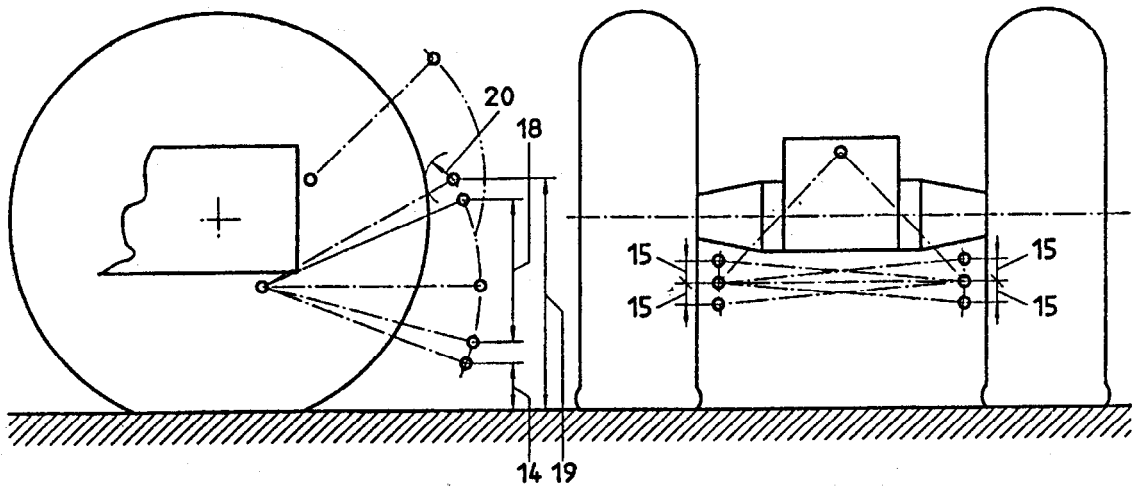


FIG. 1 COMPONENTS OF THREE-POINT HITCH



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

NOTE— Some dimensions are shown in Fig. 1 and 10.
 FIG. 2 DIMENSIONS OF THREE-POINT HITCH

3.3.4 Lower Hitch Point

Articulated connection between a lower link and the implement.

3.3.5 Upper Link Point

Articulated connection between a upper link and the tractor.

3.3.6 Lower Link Point

Articulated connection between a lower link and the tractor.

3.3.7 Upper Hitch Attachment

Pin, usually detachable and forming part of the upper link assembly, by which an upper link is secured.

3.3.8 Lower Hitch Attachment

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

3.3.9 Upper Link Attachment

Pin by which the upper link is connected to the tractor.

3.3.10 Linch Pin

Pin, usually fitted with a spring retaining device, by which an articulated connection is retained in position (see IS 6483 : 1981).

3.3.11 Lift Rods

Connections that transmit force to the lower links for raising and lowering.

3.3.12 Mast

Component that provides location of the upper hitch point on the implement.

3.3.13 Mast Height

Vertical distance between the upper hitch point and the common axis of the lower hitch points.

3.3.14 Lower Hitch Point Height

Height of the centre of the lower hitch points above ground level when they are fully lowered using the full extent 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.

3.3.15 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.

3.3.16 Lower Hitch Point Span

Distance between the shoulders of the lower hitch pins against which the sides of the lower link ball joints abut.

3.3.17 Linch Pin Hole Distance

Distance from the centreline of the linch pin hole to the shoulder of the hitch pin.

3.3.18 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.

3.3.19 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.

3.3.20 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.

3.3.21 Pitch

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

3.3.22 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 (see 3.3.12), when using the specified mast height, can be adjusted to any inclination between $+5^\circ$ and -5° from the vertical.

NOTES

1 Mast adjustment is not shown in Fig. 1.

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.

3.3.23 Torsional Free Float Distance

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.

3.3.24 Transport Pitch

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

3.3.25 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 Fig. 10).

3.3.26 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 Fig. 10).

4 TRACTOR

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 Fig. 3 and 4, and Table 2.

4.1.2 Upper Link Point

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

4.1.3 Torsional Free Float (Optional)

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

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 the case of categories 2 and 3.

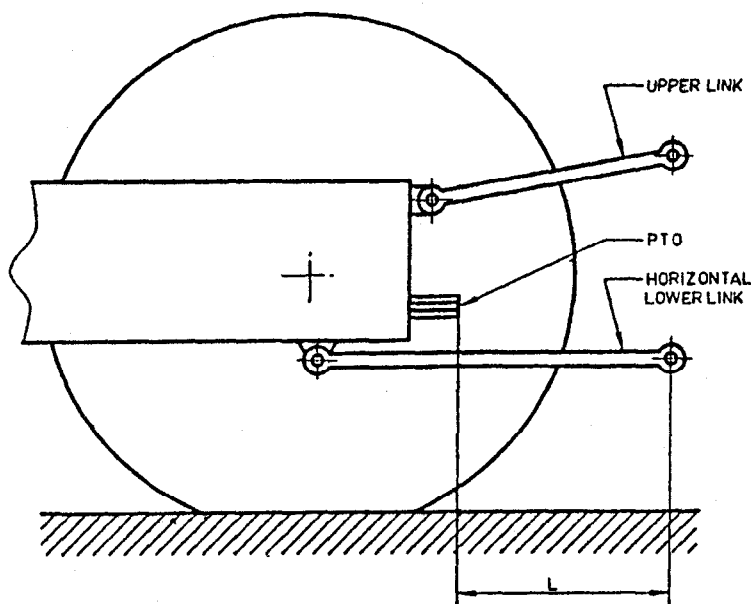
5 IMPLEMENT

5.1 Dimensions

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

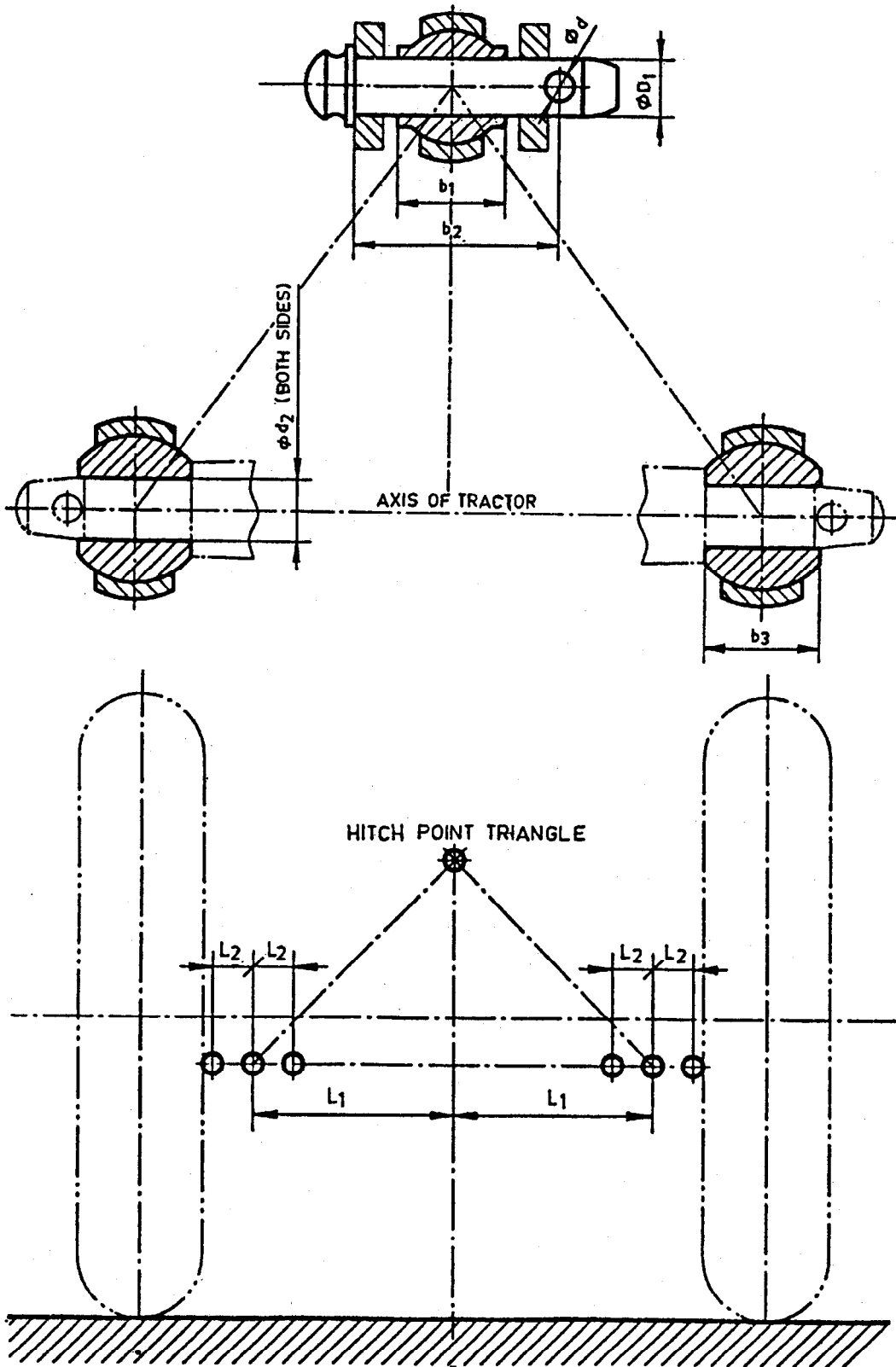
5.2 Clearance Zone

The shape and dimensions of the clearance zone on implements for attachment to a three-point linkage shall be as shown in Fig. 6 to 9 and in Table 5. Not included are adjustable levers and handles to operate the implement and specifications referring to the width of the implements.



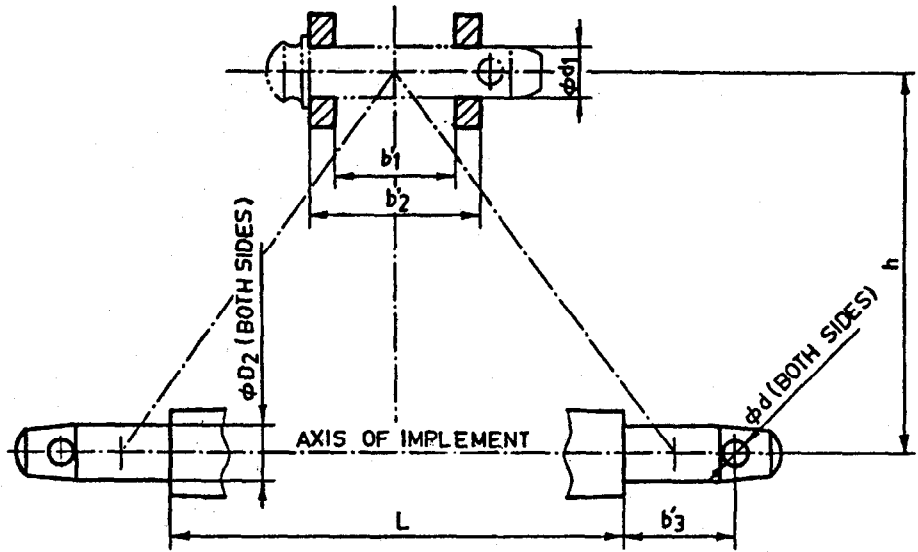
NOTE — Dimension L is given in Table 2.

FIG. 3 DISTANCE FROM PTO TO LOWER LINK POINTS

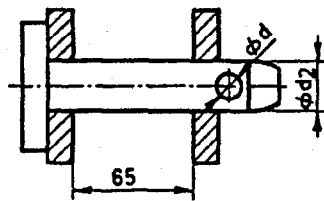


NOTE — Dimensions are given in Table 2, except d , in Table 4.

FIG. 4 DIMENSIONS CONCERNING TRACTOR HITCH POINTS



a) PIN TYPE



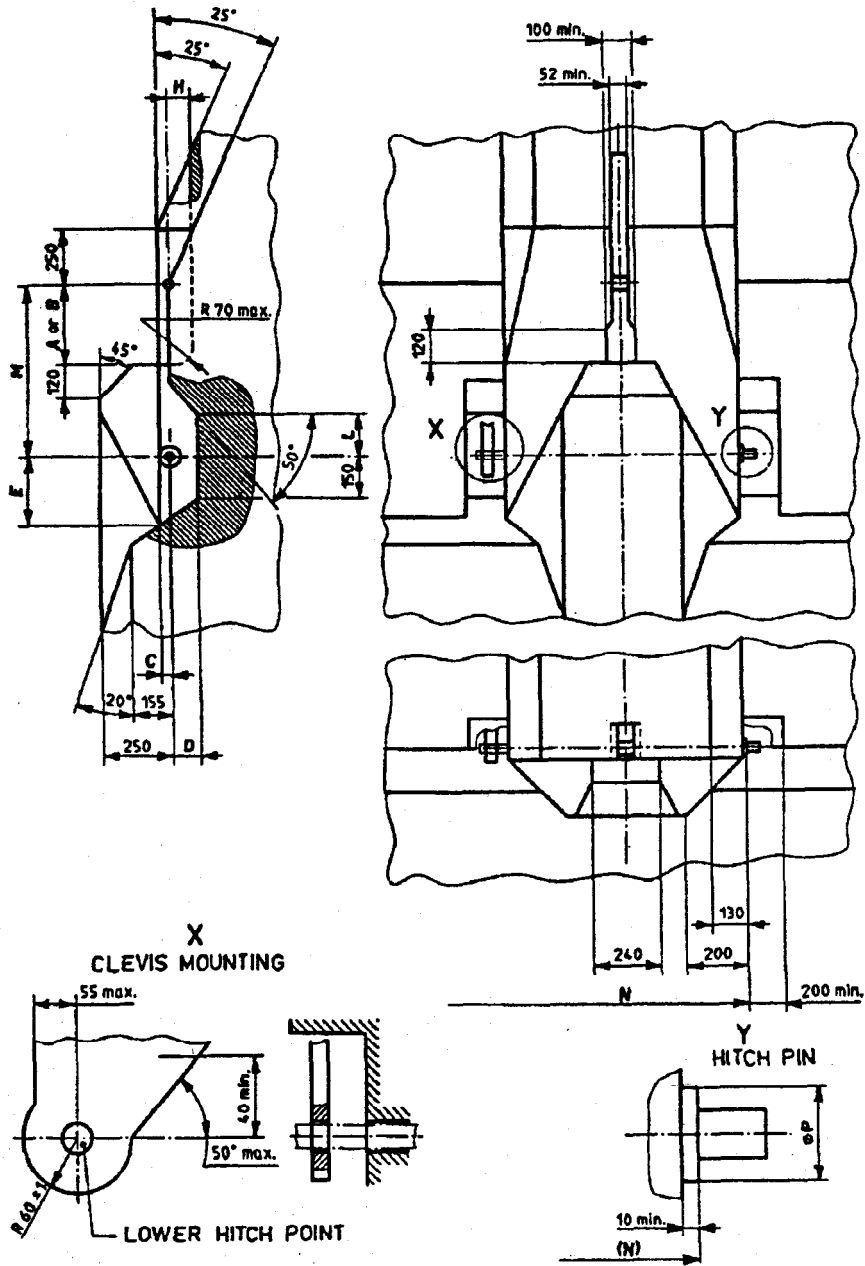
b) CLEVIS TYPE

NOTES

1 Dimensions are given in Table 4.

2 The clevis type mounting only applies to categories 2, 3 and 4. The dimension 65 mm shall be changed when accommodating the U-frame coupler.

FIG. 5 DIMENSIONS CONCERNING IMPLEMENT HITCH ATTACHMENTS



All dimensions in millimetres.

FIG. 6 CLEARANCE ZONE OF IMPLEMENTS WHERE TRANSPORT PITCH EXTENDS FORWARD OF VERTICAL IN RAISED POSITION (VIEW OF DETAILS)

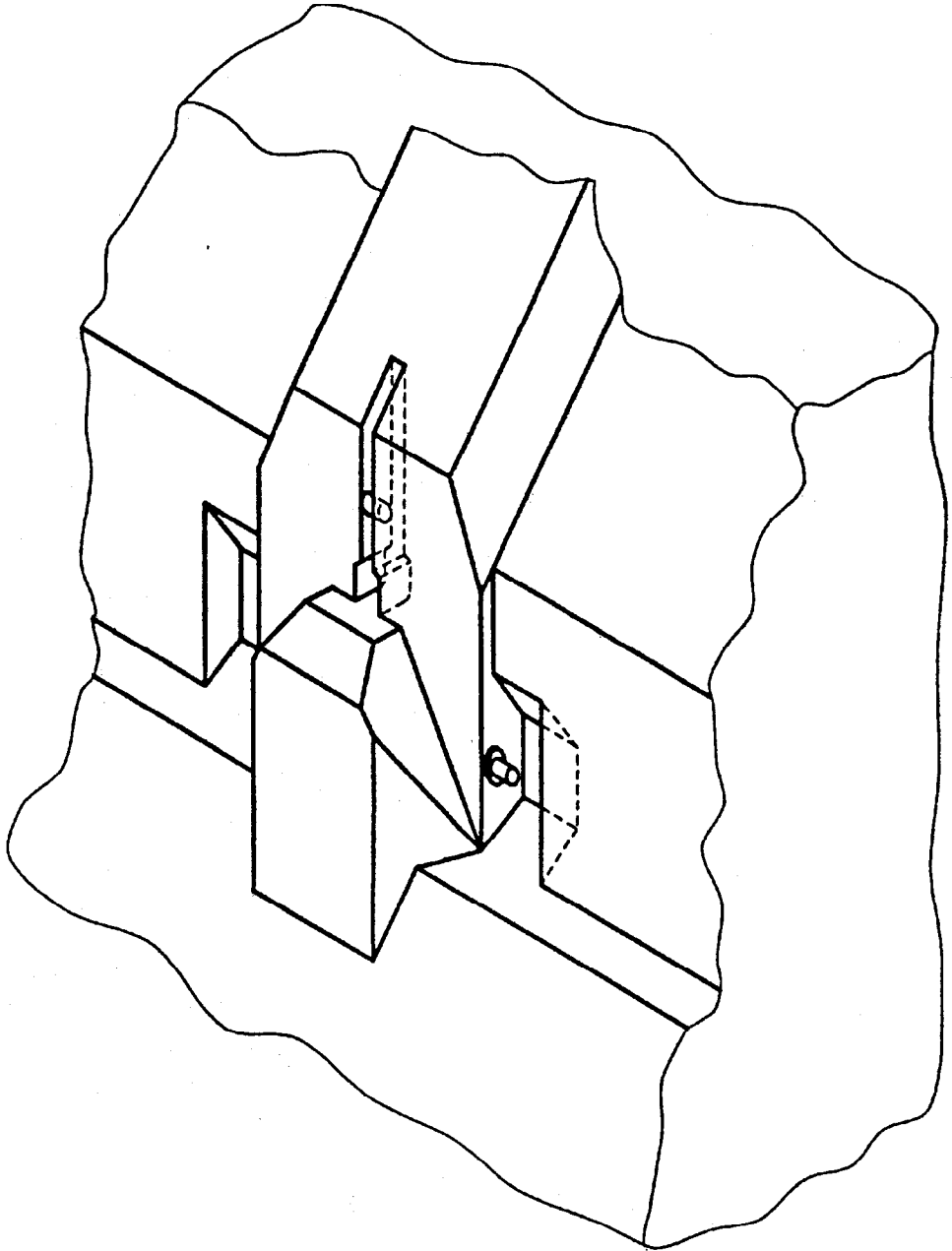
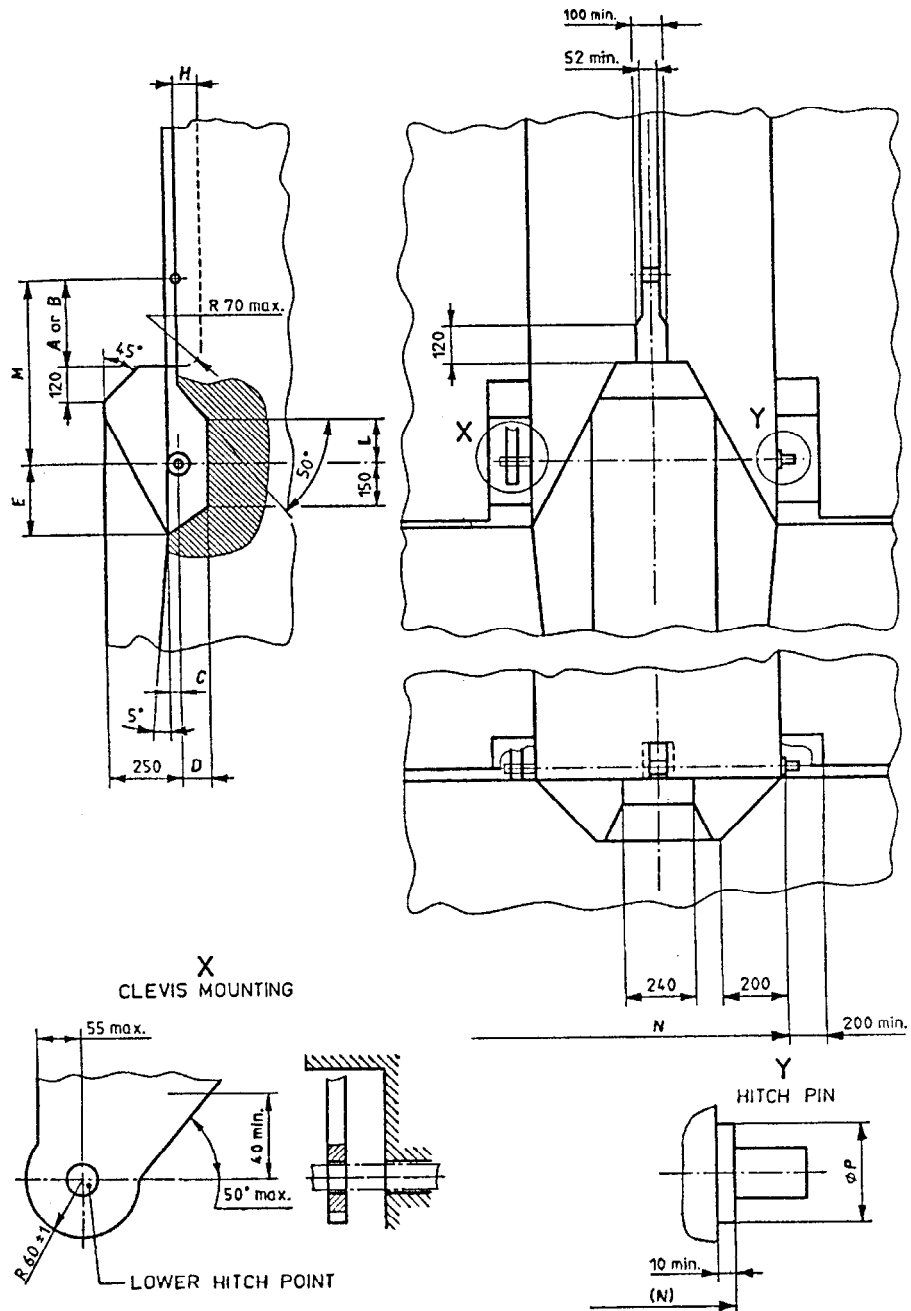


FIG. 7 CLEARANCE ZONE OF IMPLEMENTS WHERE TRANSPORT PITCH EXTENDS FORWARD OF VERTICAL IN RAISED POSITION (PERSPECTIVE VIEW)



All dimensions in millimetres.

FIG. 8 CLEARANCE ZONE OF IMPLEMENTS WHERE TRANSPORT PITCH SHALL NOT EXTEND FORWARD OF VERTICAL IN RAISED POSITION (VIEW OF DETAILS)

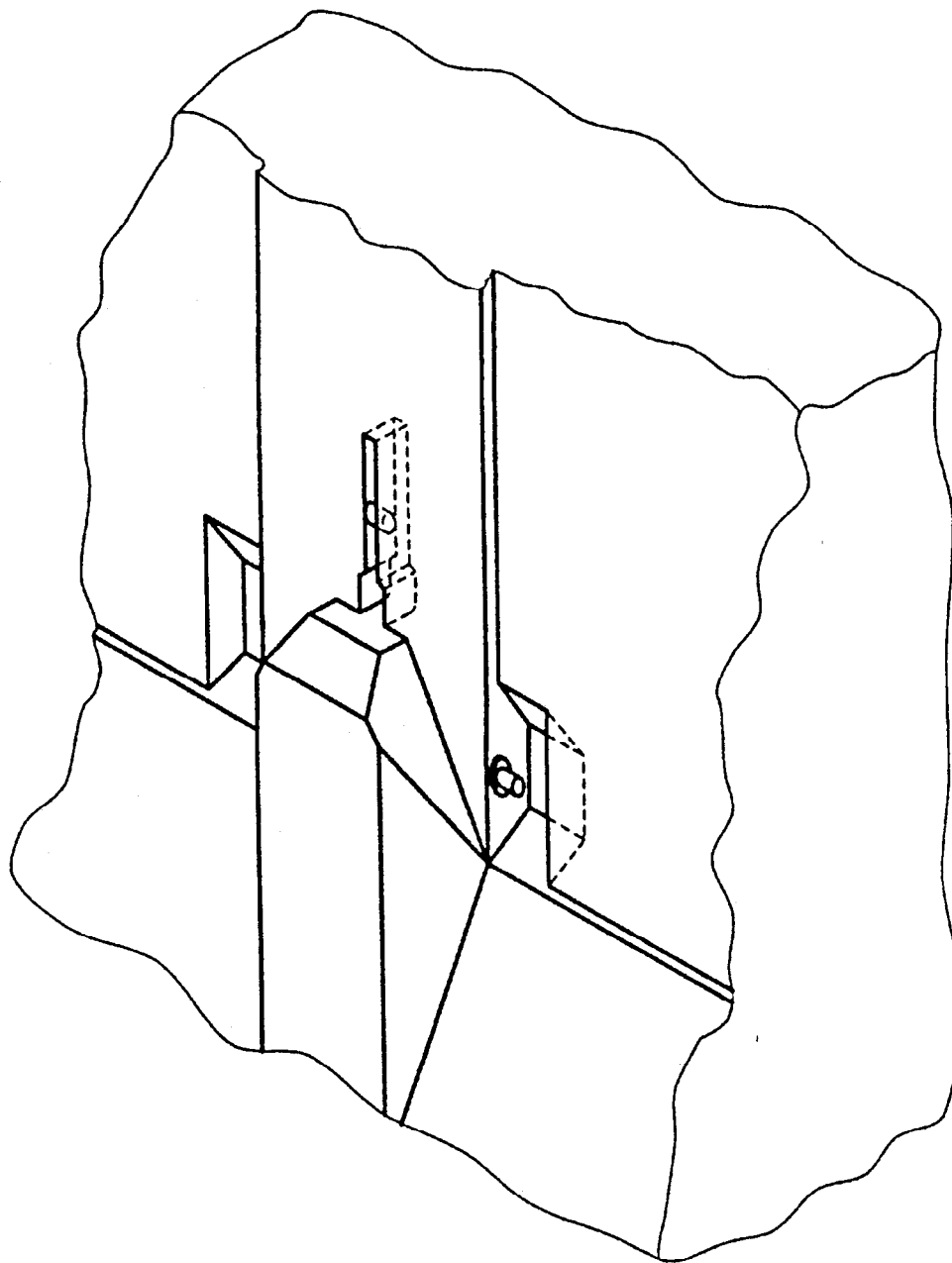


FIG. 9 CLEARANCE ZONE OF IMPLEMENTS WHERE TRANSPORT PITCH SHALL NOT EXTEND FORWARD OF VERTICAL IN RAISED POSITION (PERSPECTIVE VIEW)

Table 2 Dimensions Concerning Tractor Hitch Points
(Clause 4.1.1)

All dimensions in millimetres.

Dimension	Description	See Figure	Category				
			1	2	3	4L	4H
Upper hitch points							
D_1	Diameter of hitch pin	4	$19 \begin{smallmatrix} 0 \\ -0.08 \end{smallmatrix}$	$25.5 \begin{smallmatrix} 0 \\ -0.13 \end{smallmatrix}$	$31.75 \begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	$45 \begin{smallmatrix} 0 \\ -0.8 \end{smallmatrix}$	$45 \begin{smallmatrix} 0 \\ -0.8 \end{smallmatrix}$
b_1	Width of ball, <i>Max</i>	4	44	51	51	64	64
b_2	Linch pin hole distance, <i>Min</i>	4	76	93	102	140	140
Lower hitch points							
d_2	Diameter of hitch pin hole	4	$22.4 \begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	$28.7 \begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$	$37.4 \begin{smallmatrix} +0.35 \\ 0 \end{smallmatrix}$	$51 \begin{smallmatrix} +0.5 \\ 0 \end{smallmatrix}$	$51 \begin{smallmatrix} +0.5 \\ 0 \end{smallmatrix}$
b_3	Width of ball	4	$35 \begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	$45 \begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	$45 \begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	$57.5 \begin{smallmatrix} 0 \\ -0.5 \end{smallmatrix}$	$57.5 \begin{smallmatrix} 0 \\ -0.5 \end{smallmatrix}$
l_1	Lateral distance from lower hitch point to centreline of tractor ¹⁾	4	359	435	505	610/612	610/612
l_2	Lateral movement of lower hitch point, <i>Min</i>	4	100	125	125	130	130
L	Distance from end of power take-off to centre of lower hitch point, with the lower link horizontal ^{2,3)}	3	450 to 575	550 to 625	575 to 675	575 to 675	610 to 670

¹⁾ It may be necessary to vary these dimensions in the case of specialized 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
- 435 mm for Category 3
- 489 mm for Category 4

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 35 mm PTO-shafts and shall be increased by 100 mm if a nominal diameter 45 mm PTO-shaft is used.

Table 3 Lift, Movement Range and Levelling Adjustments
(Clauses 4.1.3 and 4.1.4)

All dimensions in millimetres.

Definition	Subclause	Category				
		1	2	3	4L	4H
Lower hitch point height, <i>Max</i>	3.2.14	200	200	230	230	230
Levelling adjustment, <i>Min</i>	3.2.15	100	100	125	150	150
Movement range, <i>Min</i>	3.2.18	560	650 ¹⁾	735	760	900
Transport height point, <i>Min</i> (lower point axis to be horizontal throughout)	3.2.19	820	950	1 065	1 200	1 200
Lower hitch point clearance, <i>Min</i>	3.2.20	100	100	100	100	100
Mast adjustment height highest position, <i>Min</i> lowest position, <i>Max</i>	3.2.22	508 200	610 200	660 230	710 255	710 255
Torsional free float, <i>Min</i>	3.2.23	60	60	75	75	75

¹⁾ For tractors with PTO power above 65 kW, this dimension shall be 700 mm, *Min*.

Table 4 Dimensions Concerning Implement Hitch Attachments
(Clause 5.1)

All dimensions in millimetres.

Dimension (see Fig.)	Description	Category				
		1	2	3	4L	4H
Upper hitch attachments						
d_1	Diameter of hitch pin hole	19.3 $\begin{smallmatrix} +0.2 \\ 0 \end{smallmatrix}$	25.7 $\begin{smallmatrix} +0.2 \\ 0 \end{smallmatrix}$	32 $\begin{smallmatrix} +0.25 \\ 0 \end{smallmatrix}$	45.2 $\begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$	45.2 $\begin{smallmatrix} +0.3 \\ 0 \end{smallmatrix}$
b'_1	Width between inner face of yoke, <i>Min</i>	44.5	52	52	65	65
b'_2	Width between outer face of yoke, <i>Max</i>	69	86	95	132	132
Lower hitch points						
D_2	Diameter of hitch pin	22 $\begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	28 $\begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	36.6 $\begin{smallmatrix} 0 \\ -0.2 \end{smallmatrix}$	50.8 $\begin{smallmatrix} 0 \\ -1.1 \end{smallmatrix}$	50.8 $\begin{smallmatrix} 0 \\ -1.1 \end{smallmatrix}$
b'_3	Linch pin hole distance, <i>Min</i>	39	49	52	68	68
l	Lower hitch point span ¹⁾	683±1.5	825±1.5	965±1.5	1 166.5±1.5	1 166.5±1.5
Other dimensions						
d	Diameter for linch pin for upper hitch pin, <i>Min</i>	12	12	12	17.5	17.5
	for lower hitch pins, <i>Min</i>	12	12	17	17.5	17.5
h	Mast height ²⁾	460±1.5	610 ± 1.5	685 ± 1.5	685 ± 1.5	1 100±1.5

¹⁾ It may be necessary to vary these dimensions in the 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
- 825 mm for Category 3
- 920 mm for Category 4

²⁾ Additional mast heights may be provided for specialized implements and frame-type three point hitch couplers. These additional mast heights shall be within a range of + 200 mm from the standard mast height given in the table.

Table 5 Clearance Zone
(Clause 5.2)

All dimensions in millimetres.

Symbol	Description	Category 1		Category 2		Category 3	
		<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>	<i>Min</i>	<i>Max</i>
A^1	Upper hitch pin, vertical clearance	310	—	460	—	460	—
B	Upper hitch pin, vertical clearance	160	—	280	—	280	—
C	Hitch pins, horizontal position	—	35	—	35	—	40
D	Lower hitch pin, horizontal clearance	95	—	95	—	105	—
E	Lower hitch pin, vertical position	230	—	230	—	245	—
H	Upper hitch pin, horizontal clearance	80	—	80	—	90	—
L	Lower hitch pin, vertical position	150	—	150	—	200	—
$M^2)$	Mast height	460±1.5		610±1.5		685±1.5	
$N^2)$	Lower hitch point span	681.5	684.5	823.5	826.5	963.5	966.5
P	Diameter of hitch pin shoulder	—	28	—	35	—	45

¹⁾ A applies where it is necessary to accommodate the upper hook to the U-frame coupler.

²⁾ It may be necessary to vary this dimension in the case of specialized implements. Dimensions M and N correspond to dimension h and l given in Table 4.

ANNEX A

(Clause 4.1.5)

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 DISTANCE

The horizontal convergence distance (see Fig. 10) 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 multirow ones, this leads to decreased quality of work.

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

Category 1	1 700 mm to 2 400 mm
Category 2	1 800 mm to 2 400 mm
Category 3	1 900 mm to 2 700 mm
Category 4	1 900 mm to 2 800 mm

A-2 VERTICAL CONVERGENCE DISTANCE

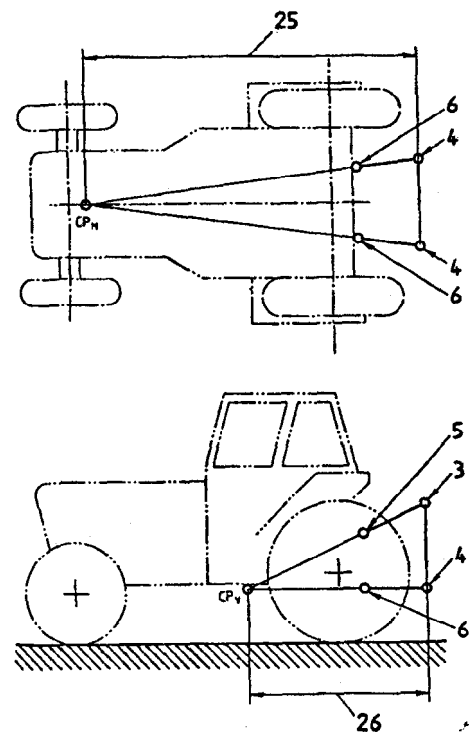
The vertical convergence distance (see Fig. 10) is important for stable working conditions and makes it possible:

- 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, it is recommended that the vertical convergence distance is not less than 0.9 times the tractor wheel-base.



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 hitch point
CP _M	Horizontal virtual hitch point

FIG. 10 CONVERGENCE DISTANCES

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards: Monthly Additions'.

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