

PAKSITAN STANDARD SPECIFICATIONS FOR BORDER DISC

1 SCOPE

- 1.1 This standard specifies the material, dimensions, manufacturing and other requirements of major/critical components/sub-assemblies and replacement parts of tractor rear mounted border disc to ensure proper quality control measures in the manufacture of these implements.
- 1.2 This standard is related to trade and manufacturing practices prevailing in the country and therefore, permits the purchaser to use his option for selecting the implement to suit his requirements.

2 NORMATIVE REFERENCES

The following standards contain provisions which, through reference in this text, constitute provisions of PS ---/2018. At the time of publication, the edition indicated was valid. All the normative references listed below are subject to revision, and parties to agreement, based on this part of PS ---/2018 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below;

- i) ISO 530-1:1994(E): Agricultural tractors – Rear-mounted three-point linkage – Part 1: Categories 1, 2, 3 and 4.
- ii) PS 1650/1/1984: Specification for Agricultural Wheeled Tractors – Three point linkage – Part 1: categories 1, 2 and 3.
- iii) PS 963-1983: Specification for Agricultural Discs
- iv) IS 4366-1972: Specification for Agricultural tillage discs – Part 1: Concave type (First revision).
- v) PS 877/72: The provision of safety on farm implements.
- vi) PS 1808/86: Agricultural wheeled tractors – Three-point linkage – Linchpins.
- vii) ASAE S318.9/SAE J208d: Safety for Agricultural equipment.
- viii) Richey, C. B. Editor in-charge (1961): Agricultural Engineers Handbook; McGraw-Hill Book Company Inc. New York.

3 DEFINITIONS

For the purpose of this Pakistan Standard, the following definitions shall apply.

- 3.1 **Border disc:** tractor rear mounted equipment primarily used to form borders, dikes or bunds for dividing large fields in to smaller strips for the purpose of improving irrigation efficiency.
- 3.2 **Linkage Categories:** Linkage categories have been standardized through PS 1650/I/1984 as per tractor drawbar power which helps in selecting matching size of implement.

Recommended size of border disc to be used with specified tractor drawbar power and associated category of three point linkage system of the tractor is shown below;

Linkage Category	Tractor drawbar power		Recommended diameter of disc blade
	kW	HP	
1	15-35	20-45	600 mm (24 inch) dia. disc blade
2	30-75	40-100	650 mm (26 inch) dia. disc blade
3	60-168	80-225	700 mm (28 inch) dia. disc blade

- 3.3 **Three point linkage assembly:** Combination of one upper link and two lower links, each articulated to the tractor and the implement at the opposite ends in order to connect the implement to the tractor.
- 3.4 **Three-point hitch assembly:** Combination of implement mast (providing yoke with hole for insertion of upper hitch attachment) and two lower hitch attachments on the implement, each used to connect tractor links with the implement rigidly.
- 3.5 **Upper hitch attachment:** Pin, usually detachable and forming part of the upper link assembly, by which an upper link is secured.
- 3.6 **Lower hitch attachment:** Pin, or clevis and pin, usually attached to the implement, by which a lower link is secured.
- 3.7 **Hitch point:** Articulated connection between link and implement.
- 3.8 **Mast:** Component of the implement that provides location of the upper hitch point on the implements.
- 3.9 **Linchpin:** Pin, usually fitted with a spring retaining device, by which an articulated connection is retained in position.
- 3.10 **Lower hitch attachment span:** Distance between the shoulders of the lower hitch pins or inner faces of the clevis prongs against which the sides of the lower link socket ball joints abut.
- 3.11 **Mast height:** Vertical distance between the center line of the upper hitch point and the common axis of the lower hitch points.
- 3.12 **Mild Steel (MS):** Steel with low carbon contents in the range of 0.05-0.25 percent. It is commonly used for implement frame, mast and other non-wearing and structural components of the implements.
- 3.13 **Alloy steel (AS):** Steel that is alloyed with a variety of elements in total amounts between 1.0-50 percent by weight to improve its mechanical properties like strength, hardness, toughness, wear resistance and corrosion resistance. Alloy steels are used in manufacture of agricultural discs and other soil working components of the implement.
- 3.14 **Spring steel (SS):** These steels are generally low-alloy manganese, medium-carbon steel or high-carbon steel with a very high yield strength.

- 3.15 **Mounted implement:** An implement which is directly attached with the tractor by connecting three point linkages and three-point hitch. During transportation, implement is lifted by the three point linkage with the help of tractor hydraulic system.
- 3.16 **Frame:** Rigid structure to which different components of the implement are attached.
- 3.17 **Agricultural disc:** A circular concave steel plate used for cutting and inverting the soil. It can be plain or notched.
- 3.18 **Nominal diameter:** is the size used for identification of a product. The nominal size may not match any dimension of the product, but within the domain of that product the nominal size may correspond to a large number of highly standardized dimensions and tolerances.
- 3.19 **Concavity:** It is the perpendicular distance from the plane of the inner surface of the disc at its center point to the plane of the cutting edge.
- 3.20 **Eccentricity:** The displacement of the center hole of the disc in relation to its true center.
- 3.21 **Wobble:** The total variation from true running of the cutting edge of a disc in a plane parallel to the axis.
- 3.22 **Pitch circle diameter (PCD):** The diameter of the circle which passes through the centre of all the holes used to bolt the disc blade with the disc mounting plate.
- 3.23 **Ground clearance:** The vertical distance between ground and the lower edge of the main frame when a border disc is placed on level surface.
- 3.24 **Standard:** A rigid component which is attached to frame at the upper end and to the disc gang shaft at the lower end.
- 3.25 **Working width:** The working width of the border disc is adjustable as per requirement.

4 DIMENSIONAL, MATERIAL AND MANUFACTURING REQUIREMENTS

Note: All dimensions are in mm and minimum, except where tolerances are specified.

4.1 Frame and three-point hitch assembly (Figure 1)

Frame and three-point hitch assembly of a typical border disc is shown in Figure 1(a).

4.1.1 Frame assembly

- 4.1.1.1 Frame assembly shall consist of main frame, mast mounting structure, reinforcement members, and parking stand mounting brackets.
- 4.1.1.2 Main frame shall be made of MS box section measuring 138 x116 x 6 mm. It shall have width of 1800 ± 20 mm.
- 4.1.1.3 Mast mounting structure shall be inverted L shaped made from MS box 98 x 56 x 4 mm.
- 4.1.1.4 Reinforcement members shall be made from MS angle 60 x 60 x 5 mm.
- 4.1.1.5 Parking stand mounting bracket shall be made from MS box 65 x 65 x 4 mm.

4.1.2 Three point hitch assembly

Three point hitch assembly shall conform to provisions of PS 1650/1/1984 and ISO 530-1:1994(E) and shall consist of a mast yoke to connect upper hitch point and two lower hitch attachments to connect lower hitch points with the implement.

Mast

4.1.2.1 Mast shall be made from MS plate 9 mm thick which shall be bolted to mast mounting structure using M16 bolts. The yoke area of the mast around pin shall be reinforced with MS plate 9 mm thick.

4.1.2.2 Width between inner faces of yoke (W_1), width between outer faces of yoke (W_2) and diameter of upper hitch attachment hole (D_1) shall have dimensions as specified in Table 1.

Lower hitch attachments

4.1.2.3 Lower hitch attachment may be pin type.

4.1.2.4 The pin shall be mounted on the lower end of mast mounting structure at a place to ensure that mast height (H) and span of lower hitches (S) shall be as specified in Table 1.

4.1.2.5 Diameter of lower hitch attachment hole (D_2) shall have dimensions as shown in Table 1.

Note: Vital dimensions of three point hitch assembly are shown in Table 1 and Figure 1(b).

4.2 Upper hitch attachment, lower hitch attachment and linchpin (Figure 2)

4.2.1 Upper hitch attachment, lower hitch attachment and linchpin shall be made from cold drawn MS which shall be zinc coated to make these corrosion resistant.

4.2.2 Upper hitch attachment and lower hitch attachment for different categories of three point linkage systems shall have dimensions as specified in Table 2.

4.2.3 Linchpin for different categories of three point linkage systems shall conform to provisions of PS 1808/86 and shall have dimensions as specified in Table 3.

Table 1: Vital dimensions of three-point hitch assembly

Dimension	Cat1		Cat2		Cat3	
	Min.	Max.	Min.	Max.	Min.	Max.
Mast						
Width between inner faces of yoke (W_1)	44.5	-	52.0	-	52.0	-
Width between outer faces of yoke (W_2)	-	69	-	86	-	95
Diameter of upper hitch attachment hole (D_1)	19.30	19.32	25.70	25.72	32.00	32.25
Mast height (H)	460 ± 1.5		610 ± 1.5		685 ± 1.5	
Lower hitch attachment						
Diameter of lower hitch attachment hole (D_2)	22.40	22.73	28.70	29.03	37.40	37.75
Span of lower hitch attachments (S)	683 ± 1.5		825 ± 1.5		965 ± 1.5	

Table 2 (a): Upper hitch attachment dimensions

Dimension	Cat 1	Cat 2	Cat 3
Diameter of upper hitch attachment (B)	18.97 - 19.00	25.27 - 25.40	31.50 - 31.75
Linchpin hole distance (A)	76 min	93 min	102 min
Diameter of linchpin hole (C)	12	12	12

Table 2 (b): Lower hitch attachment dimensions

Dimension	Cat 1	Cat 2	Cat 3
Diameter of lower hitch attachment (B)	21.79 - 22.00	27.79 - 28.00	36.40 - 36.50
Linchpin hole distance (A)	39 min	49 min	52 min
Diameter of linchpin hole (C)	12	12	17

Table3: Linchpin dimensions

Dimension	Cat 1	Cat 2	Cat 3
Linchpin length (A)	32	32	32
Diameter of Linchpin (B)	11	11	16
Diameter of Linchpin wire (C)	3	3	3

4.3 Disc blade mounting assembly (Figure 3)

- 4.3.1 The disc blade mounting assembly shall consist of clamp plates, standard, coupler arms, disc mounting brackets, disc angle adjusting sub-assembly and hub sub-assemblies.
- 4.3.2 The clamp plates shall be made from MS plates 12 mm thick. The rear clamp plate shall house a mechanism for disc angle adjustment.
- 4.3.3 The standard shall be made from MS plate 18 mm thick with holes of 16 mm diameter for attaching it to coupler arms.
- 4.3.4 The coupler arms shall be made from 02 Nos. MS angle 60 x 60 x 8 mm which shall be welded to the hub at the lower ends and bolted with the standard at the upper end.
- 4.3.5 Disc mounting bracket shall consist of a bracket with pin made from cast steel. The bracket shall have diameter 290 ± 5 mm and 12 mm thickness. It shall have same number of holes as on the disc blade. Diameter of holes of the disc mounting bracket shall be 13 mm. The pin dia. shall be 50 mm.
- 4.3.6 Disc angle adjusting sub-assembly shall consist of angle adjusting shaft and ratchets;
- 4.3.6.1 Angle adjusting shaft shall be made from MS round of 36 mm dia. Upper end of the shaft shall be threaded for fixing disc angle through turning of ratchets with bolt.
- 4.3.6.2 Upper ratchet shall be welded to the rear clamp plate while the lower ratchet shall be welded to the standard.

- 4.3.7 Hub sub-assembly shall consist of hub, hub cap and pin and bearings;
- 4.3.7.1 Hub shall be made from cast steel.
- 4.3.7.2 Hub cap shall be made from mild steel.
- 4.3.7.3 Hub pin shall be machined to accommodate 02 Nos. tapered roller bearings of 7509 or equivalent.

4.4 **Disc blade**

4.4.1 Disc blade shall conform to PS 963 – 1983 (first revision) in terms of parameters as described below;

4.4.1.1 *Type and variant:* the disc blade shall be of type B, variant 3.

4.4.1.2 *Material:* Disc shall be made from one of the following materials;

- (1) Plain carbon steel with a minimum carbon content of 0.7%;
- (2) Silicon – manganese steel;
- (3) Alloy/Boron steel
- (4) Nickel chrome molybdenum steel
- (5) Nickel chrome steel
- (6) AISI 1527

4.4.1.3 *Hardness:* The hardness of the disc shall HRC 35.7 – 46.7. The hardness values in the areas as defined in clause 4.4.1.4 shall not differ from the maximum hardness found on the same disc by more than 10%.

4.4.1.4 *Area of hardness:* Hardened area of the disc shall cover at least half the radius of the disc measured inwards from the disc edge, except where the diameter of the hub is greater than half the diameter of the disc, then all the area outside of the hub shall be hardened.

4.4.1.5 *Cutting edge beveling:* Disc blade shall be beveled along the outer periphery on one side only (concave or convex side). The thickness of the beveled edge shall not be more than 0.8 mm.

4.4.1.6 *Flatness:* Distortion of the disc blade shall not exceed 5 mm when placed on a flat surface.

4.4.2 **Disc blade dimensions (Figure 4)**

4.4.2.1 Disc blade dimensions such as nominal diameter, P.C.D, diameter of round and square central holes, number of fixing holes, radius of concavity, height of concavity, thickness, eccentricity and wobble of the disc blade to be used in the disc plow shall be as given in Table 4.

Table 4: Disc dimensions

Nominal dia. (D ₁ ± 10)	P.C.D. (D ₂)	Diameter of round bolt fixing holes (D ₃)	Size of square bolt fixing holes (D ₄)	Number of fixing holes	Radius of concavity (R) ± 5% of R	Height of concavity (T)	Thickness (S)	Eccentricity (max)	Wobble (max)
600	230	13	13	4, 5 or 6	600	80	5-7	4	8
650	230	13	13	4, 5 or 6	600	96	5-7	4	8
700	230	13	13	4, 5 or 6	700	94	6-8	6	8

4.5 Fixing bolts (Figure 5)

4.5.1 Fixing bolts shall be made from steel having minimum tensile strength of 400 N/mm².

4.5.2 Fixing bolts shall have overall length (A) of 50 mm, threaded portion length (B) of 30 mm and diameter (D) of 12 mm.

4.6 Parking stand (Figure 6)

4.6.1 Parking stand assembly shall consist of stand, heel and lifting/lowering hook.

4.6.2 Stand shall be made from MS box measuring 50 x 50 x 5 mm and shall have couple of holes for adjustment of implement level for stability.

4.6.3 Lifting and lowering hook shall be made from MS round of appropriate size to facilitate rod lifting and lowering to adjust height of parking stand for stability of the border disc.

4.6.4 Heel shall be made from an MS plate of appropriate size which shall be welded at the lower ends of the stand to prevent soil penetration.

5 OTHER REQUIREMENTS

5.1 All the structural components shall be manufactured by using new materials.

5.2 All the market items like pipes, nuts and bolts shall be brand new.

5.3 Nuts and bolts shall be zinc coated.

5.4 Overall size and weight of the border disc shall be declared by the manufacturer.

5.5 All the components/sub-assemblies shall be welded at right angle and parallel members of the frame shall be of equal length and size.

5.6 Provision for adjustability of border disc spacing shall be provided, if required.

5.7 All the nut bolt fastenings shall be tightened at appropriate torque using imported spring washers.

5.8 Operation and maintenance (O&M) manual shall be provided in English & Urdu with complete illustrations of assembling of replaceable components.

- 5.9 O&M manual shall also contain relevant safety instructions as provided in PS 877:1972: Specification for provision of safety on farm implements.
- 5.10 A set of pins with linchpins and two adjustable wrenches of 250 mm and 300 mm size should also be provided.
- 5.11 The implement shall be painted preferably using baking/stoving paint with primer.
- 5.12 The frame shall be rigid and strong. The frame members shall be welded perfectly at right angle. All the members of the frame shall be of equal length and size.

6 FINISH AND WORKMANSHIP

- 6.1 All components of the border disc should be free from pits, burrs and other visual defects.
- 6.2 The welding of various parts shall be satisfactory in all respects.
- 6.3 All the weld-ments shall be smoothened by grinding.
- 6.4 All the exposed parts shall have protective coating to prevent surface from rusting and to avoid deterioration in transit and during storage.

7 MARKING AND PACKING

- 7.1 Each border disc shall be marked with the following particular;
 - 7.1.1 Manufacturer's name, address, contact numbers and trade-mark, if any;
 - 7.1.2 Maximum size of disc and border; and
 - 7.1.3 Batch or code number.
- 7.2 The particulars listed under 7.1.1, 7.1.2 and 7.1.3 shall be stamped embossed or engraved on metallic plate and rigidly fitted on a non-wearing part of the border disc.
- 7.3 Each border disc may also carry the PSQCA Certification Mark subject to verification by the competent authority.
- 7.4 The border disc should be packed to ensure safety of the components in transportation as agreed to between the purchaser and the manufacturer/supplier.

Note: Design of a typical border disc is shown in Figure 6. The design can be modified as agreed between the purchaser and the manufacturer subject to compliance of these standard specifications.

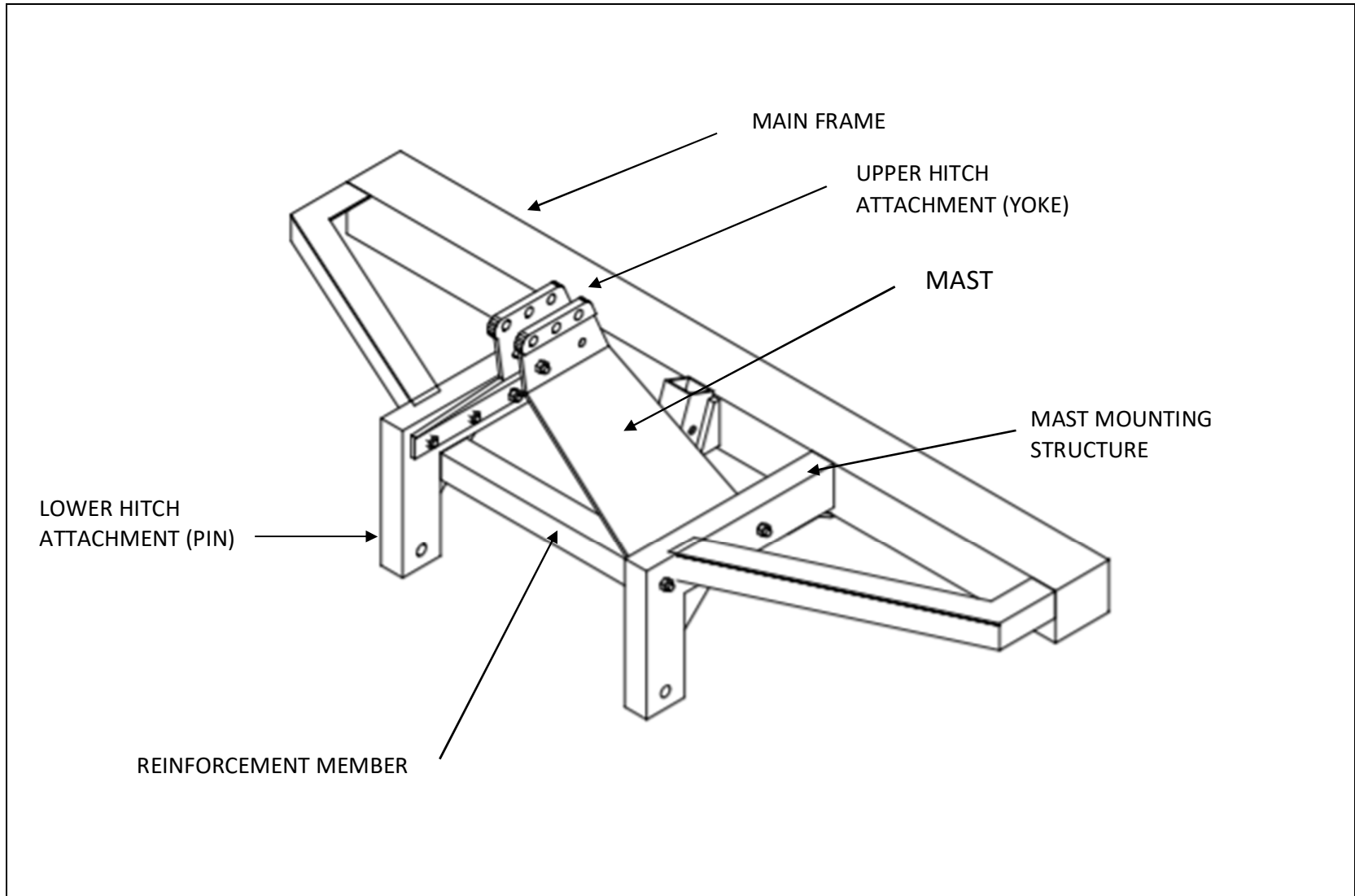


Figure 1 (a): Frame and three-point hitch assembly

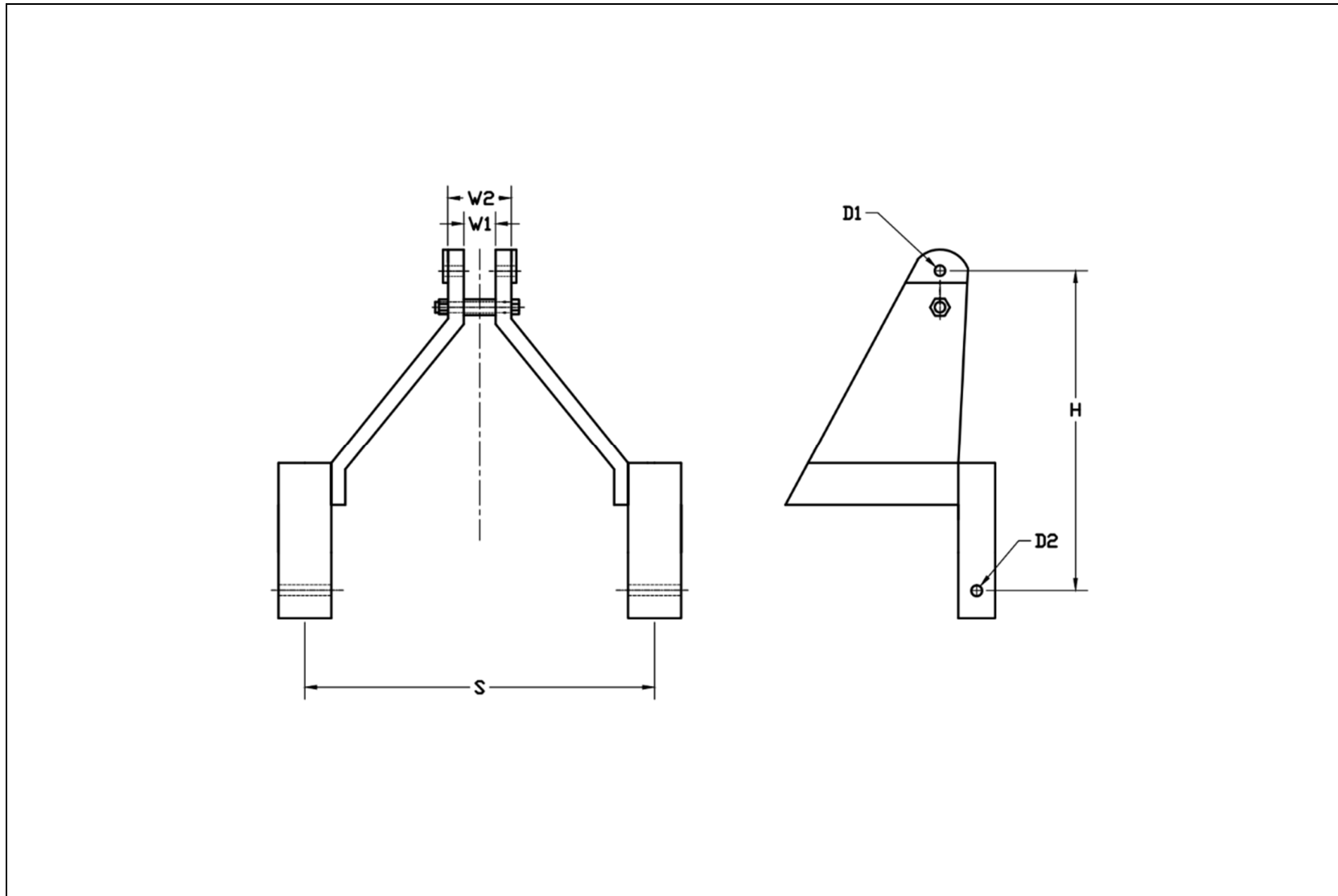


Figure 1(b): Three point hitch dimensions

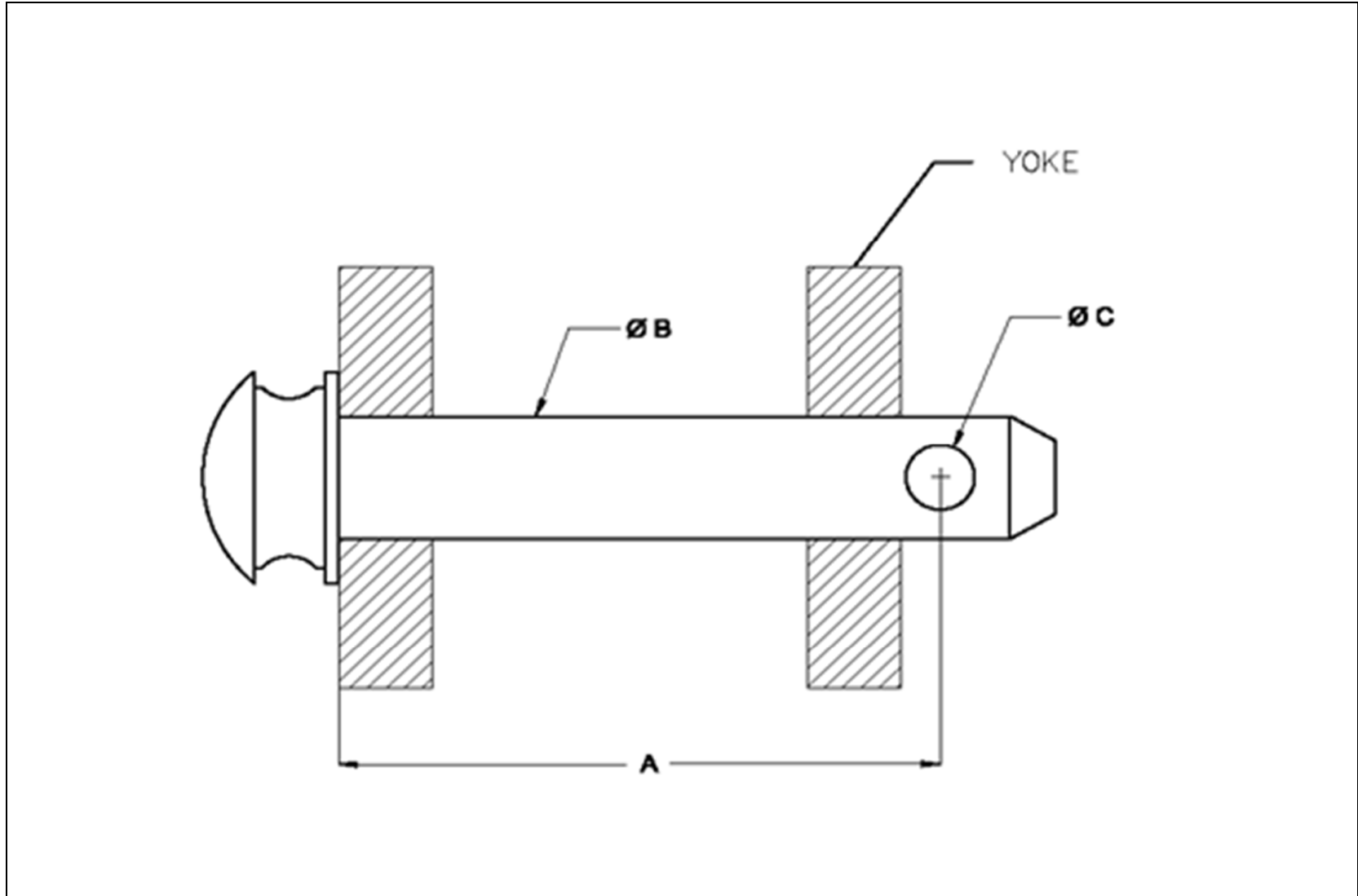


Figure 2(a): Upper hitch attachment dimensions

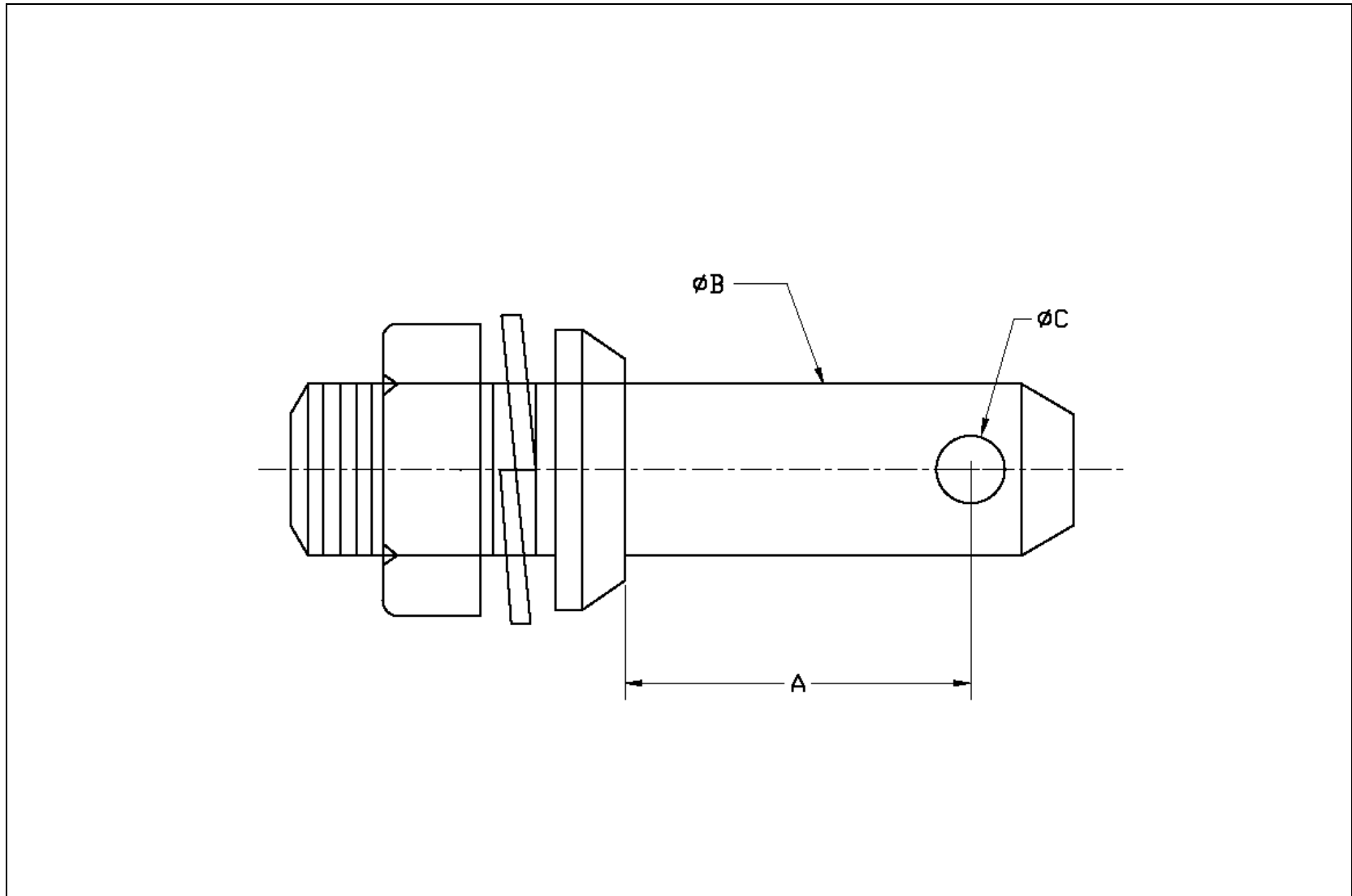


Figure 2 (b): Lower hitch attachment dimensions

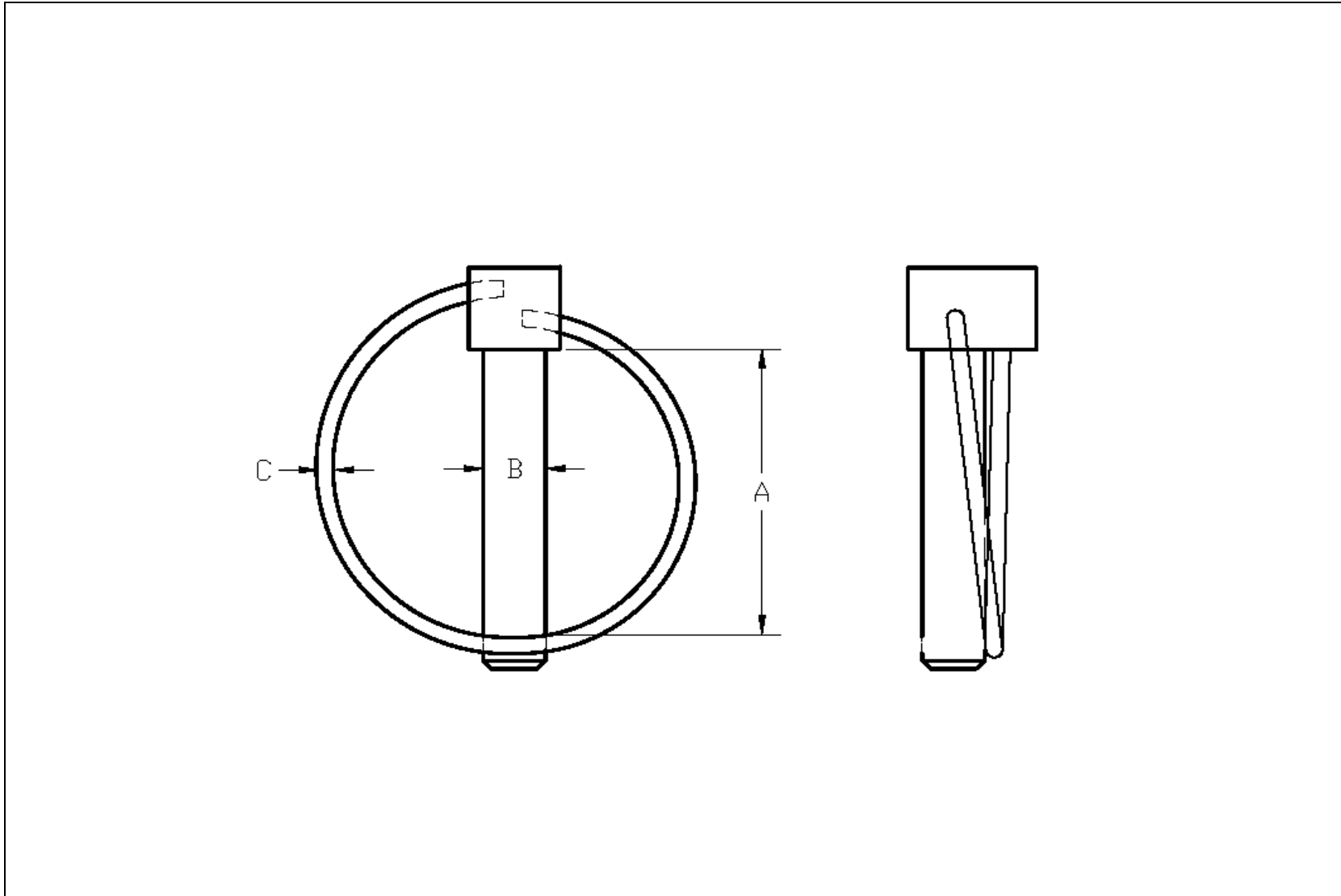


Figure 2 (c): Lynchpin dimensions

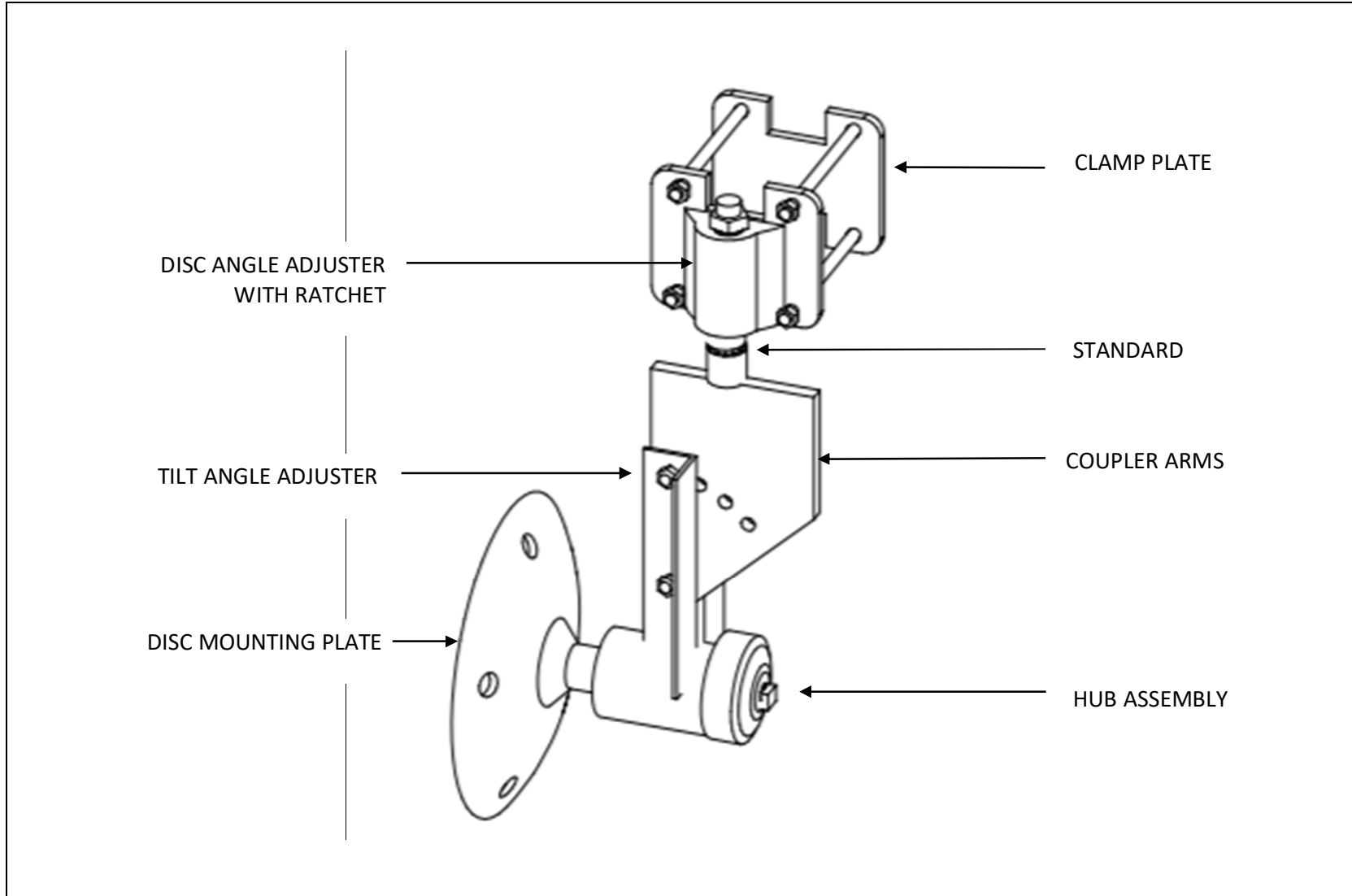


Figure 3: Disc blade mounting assembly

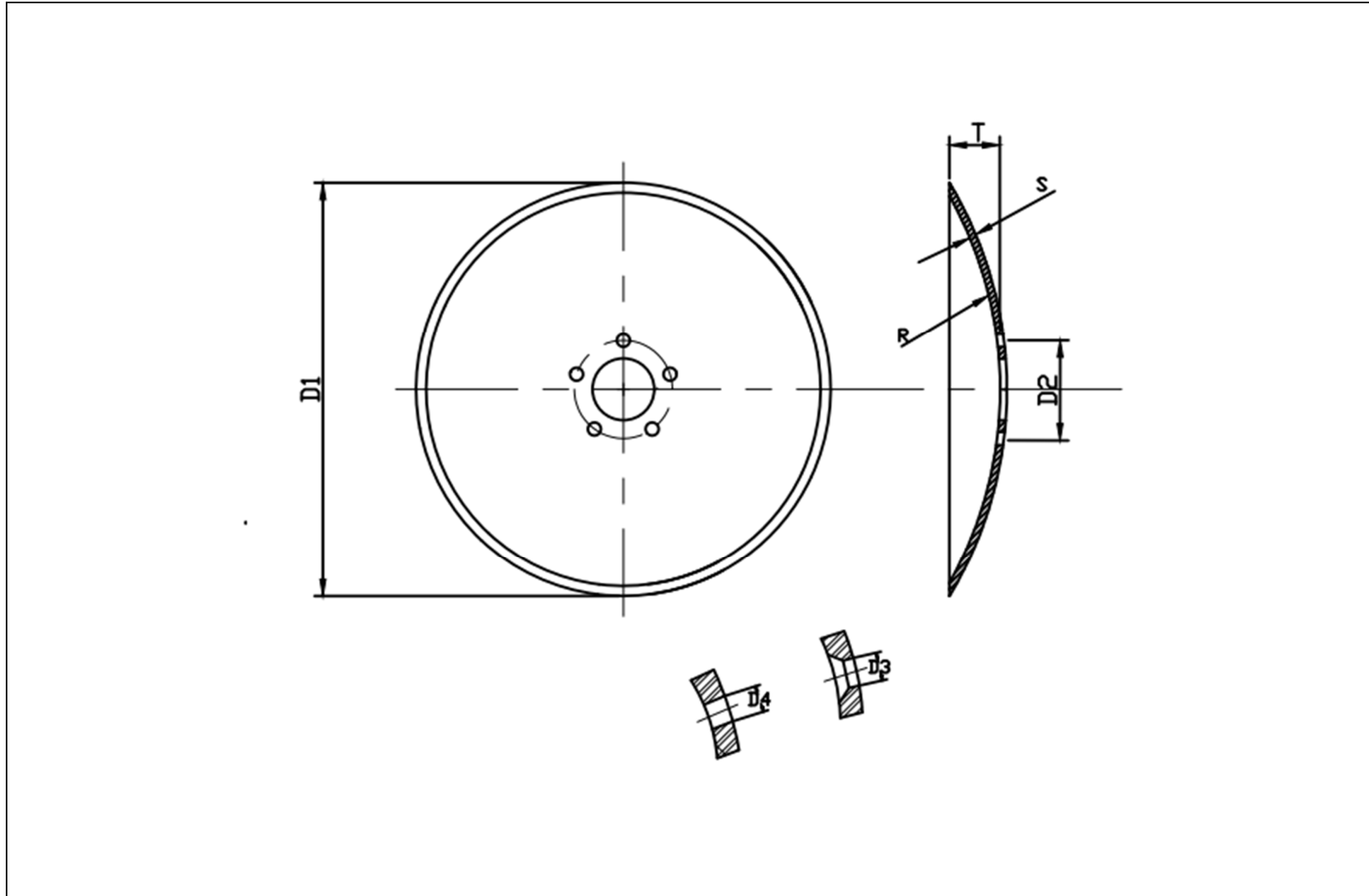


Figure 4: Disc blade dimensions

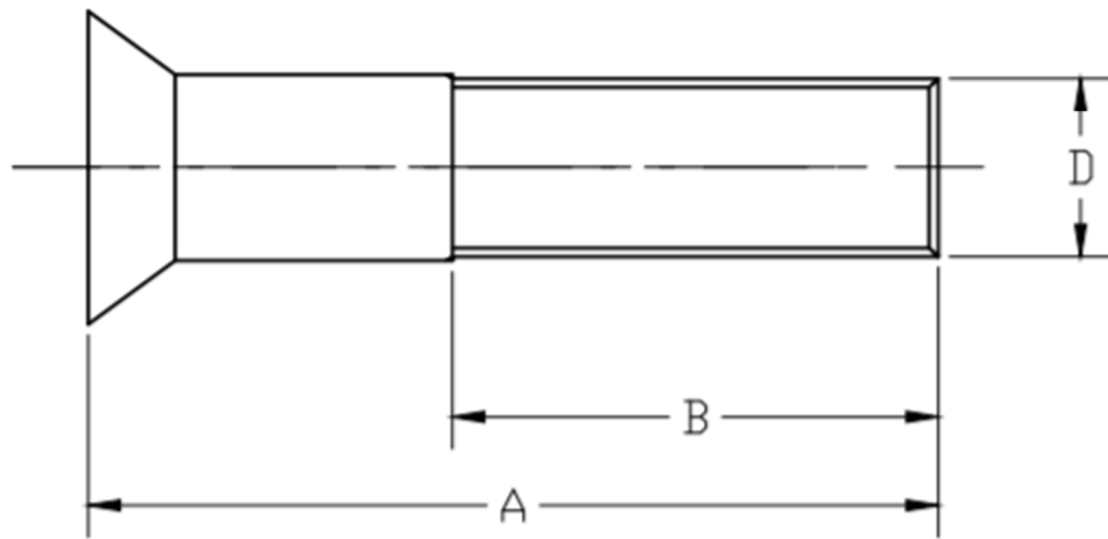


Figure 5: Countersunk type fixing bolt dimensions

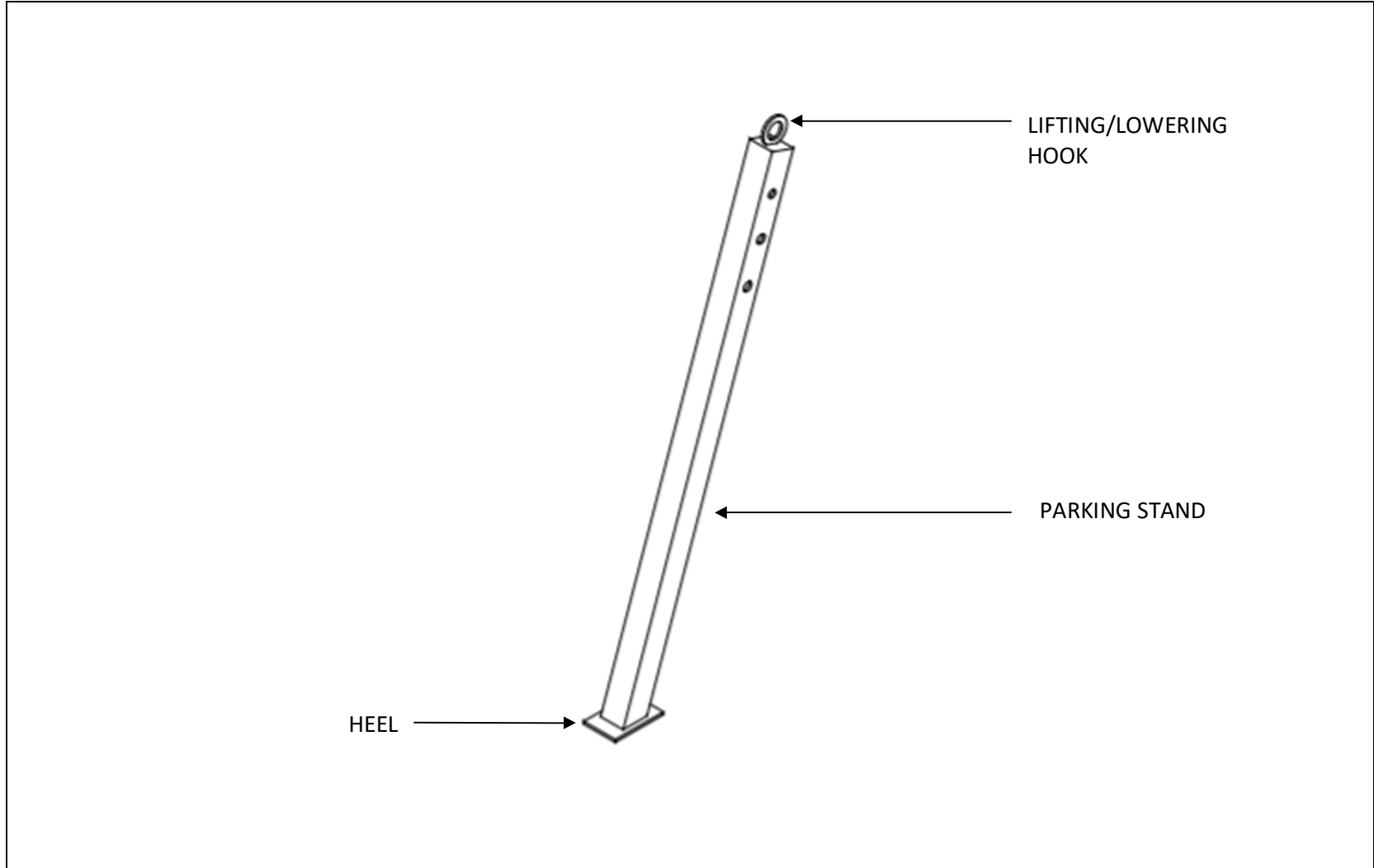


Figure 6: Parking stand assembly

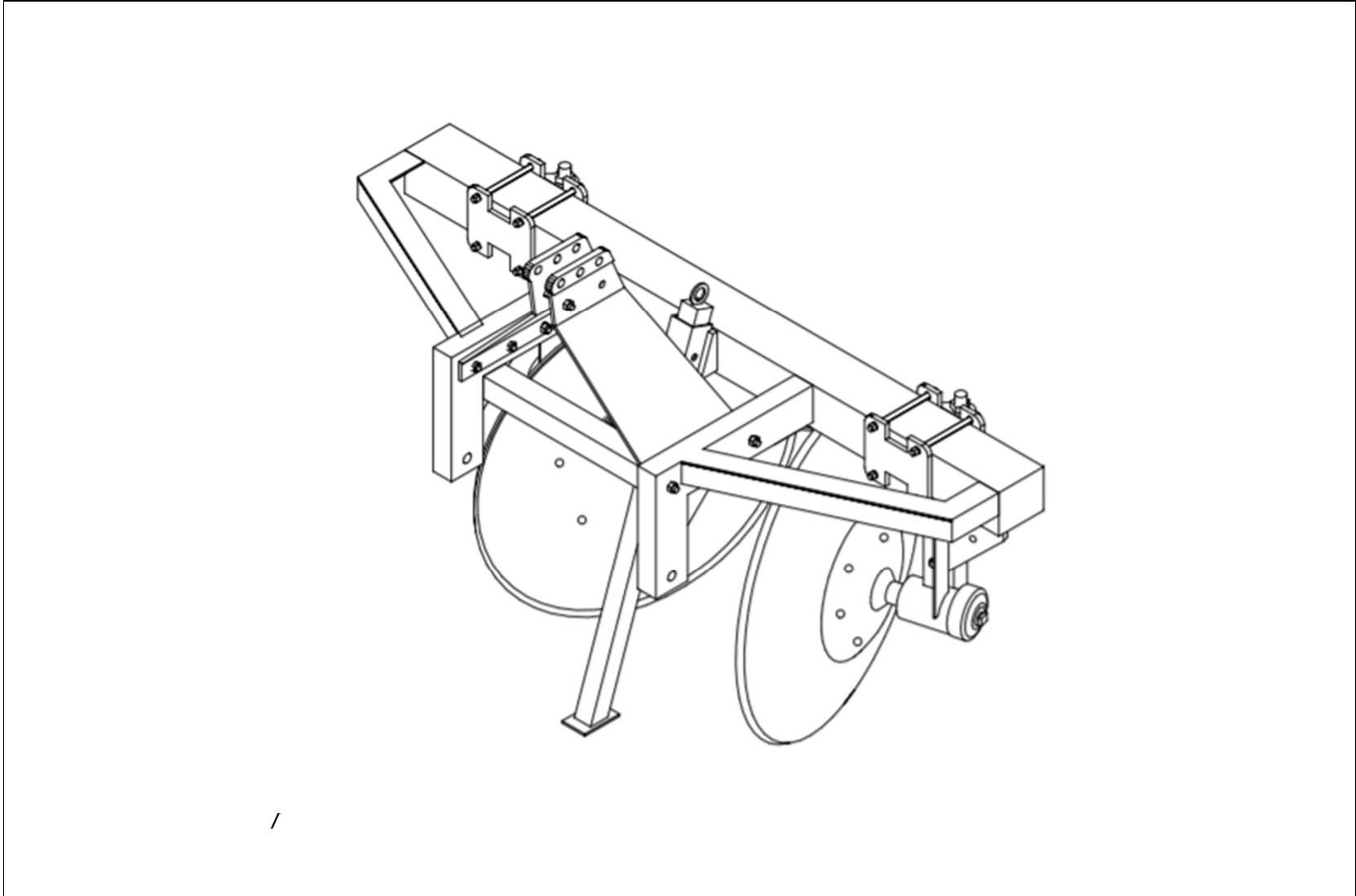


Figure 7: A typical border disc