PAKSITAN STANDARD SPECIFICATIONS FOR SUB-SOILER

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 sub-soiler 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 1808/86: Agricultural wheeled tractors – Three-point linkage – Linchpins.

iv) PS 877/72: The provision of safety on farm implements.

v) ASAE S318.9/SAE J208d: Safety for Agricultural equipment.

3 DEFINITIONS

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

3.1 **Sub-soiler: A t**ractor rear mounted primary tillage implement which is used for deep tillage to break hardpan which in turn facilitate root development and conservation of rain water. It shatters the soil to facilitate soil aeration and deep percolation of excessive moisture from the root zone. It usually has only one tine. A wooden or metallic mole can be attached at the lower end of the tine to make mole drain which helps drain/remove excessive water. Depth of penetration is more than 300 mm, but may vary according to tractor power and soil compaction.

3.2 **Linkage Categories:** Linkage categories have been standardized through PS 1650/I/1984 and and ISO 530-1:1994(E) as per tractor drawbar power which helps in selecting matching size of implements with tractor drawbar power. Recommended size of implement 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 depth of penetration
	kW	HP	
1	15-35	20-45	600 mm (2ft)
2	30-75	40-100	760 mm (2.5ft)
3	60-168	80-225	900 mm (3ft)

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

3.12 **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.

3.13 **Mild Steel (MS):** Steel with low carbon contents in the range of 0.05%-0.25% carbon. It is commonly used for implement frame, mast and other non-wearing and structural components of the implements.

3.14 **Medium Carbon Steel (MCS):** Steel with medium carbon contents in the range of 0.29-0.54 percent. It is commonly used for soil working and wearing components of the implements.

3.15 **Frame:** Rigid structure to which different components of the implement are attached.

3.16 **Tine:** A rigid formed member, hinged to the frame to which soil working tool like shovel is attached.

3.17 **Shovel:** A curved reversible soil working tool with both ends pointed, which is attached to the lower end of the tine and is used primarily for land preparation.

3.18 **Contact Angle:** The forward angle between the horizontal ground and the tangent line joining the shovel tip, when shovel is fitted with tine and placed on its working position.

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 sub-soiler is shown in Figure 1(a).

4.1.1 Frame assembly

4.1.1.1 Frame assembly shall consist of main frame structure, tine mounting bracket and parking stand bracket.

4.1.1.2 The rear member of the main frame structure shall be made of MS box section measuring 120 x 120 x 9 mm

4.1.1.3 The front member of the main frame structure shall be made from MS box 120 x 65 x 9 mm.

4.1.1.4 Tine mounting bracket shall be made from MS plate 250 x 10 mm with opening measuring 180 x 30 mm with sufficient clearance to accommodate easy insertion of tine.

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 preferably be made from formed MS plate 9 mm which shall be welded to mast mounting bracket made from MS plate (9)--- mm thick using M12 bolts.

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 pin 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 Lower hitch attachment mounting plate shall be made from MS plate 22 mm thick which shall be welded with the front member of the frame.

4.1.2.5 Diameter of lower hitch attachment mounting plate holes (D_2) shall be made at a place to ensure that mast height (H) and lower hitch attachment span (S) shall be as specified as in Table 1.

4.1.3 **Upper hitch attachment, lower hitch attachment and linchpin (Figure 2)**

4.1.3.1 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.

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

4.1.4 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	Cat 1		Cat 2		Cat 3	
	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 yoke 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 attachments						
Diameter of lower hitch attachment hole (D_2)	22.40	22.73	28.70	29.03	37.40	37.75
Lower hitch attachments span (S)	683.± 1. 5		825±1.5		965±1.5	

Table 2 (a): Upper hitch attachment pin 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 pin 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

Table 3: Linchpin dimensions (mm)

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

4.2 **Tine assembly (Figure 3)**

4.2.1 Tine assembly shall consist of tine and shovel sub-assembly.

4.2.2 Tine shall be made from MS plate 850 x 180 x 28 mm with lower end shaped as a heel. Tine shall have 03 holes of 25 mm dia. for depth adjustment.

4.2.3 Tine shall have dimensions as shown in Figure 3 (a).

4.2.4 The shovel sub-assembly shall consist of shovel and boot.

4.2.4.1 Shovel shall be made from forged MCS plate measuring 280 x 12 x 12 mm.

4.2.4.2 Boot shall be made from 02 Nos. triangular MS plates 5 mm thick. Both plates shall be welded to shovel plate in a manner to ensure that the space in between shall be enough so that these can easily be bolted to the lower heel shaped end of the tine. Boot dimensions are shown in Figure 3 (b).

4.2.4.3 Hardness of the shovel plate shall be 45-50 HRC.

4.2.4.4 Contact Angle of the shovel attached with the tine shall be 150 degrees as shown in Figure 3 (c).

4.3 **Parking stand assembly (Figure 4)**

4.3.1 Parking stand assembly shall consist of stand and heel.

4.3.2 Stand shall be two legged and made from MS box measuring (25x25x4) mm and shall have couple of holes for level adjustment.

4.3.3 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 tines, shovels, nuts and bolts shall be brand new.

5.3 Nuts and bolts shall be zinc coated.

5.4 Overall size and weight of the sub-soiler 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 Shovel shall be bolted to tine using bolts of size M 12.

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 and ASAE S318.9/SAE J208d.

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.

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6 FINISH AND WORKMANSHIP

6.1 All components of the sub-soiler 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 sub-soiler 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 and batch or code number.

7.2 The particulars listed under 7.1.1 and 7.1.2 shall be stamped embossed or engraved on metallic plate and rigidly fitted on a non-wearing part of the sub-soiler.

7.3 Each sub-soiler may also carry the PSQCA Certification Mark subject to verification by the competent authority.

7.4 The sub-soiler 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 sub-soiler is shown in Figure 5. The design can be modified as agreed between the purchaser and the manufacturer subject to compliance of these standard specifications.*

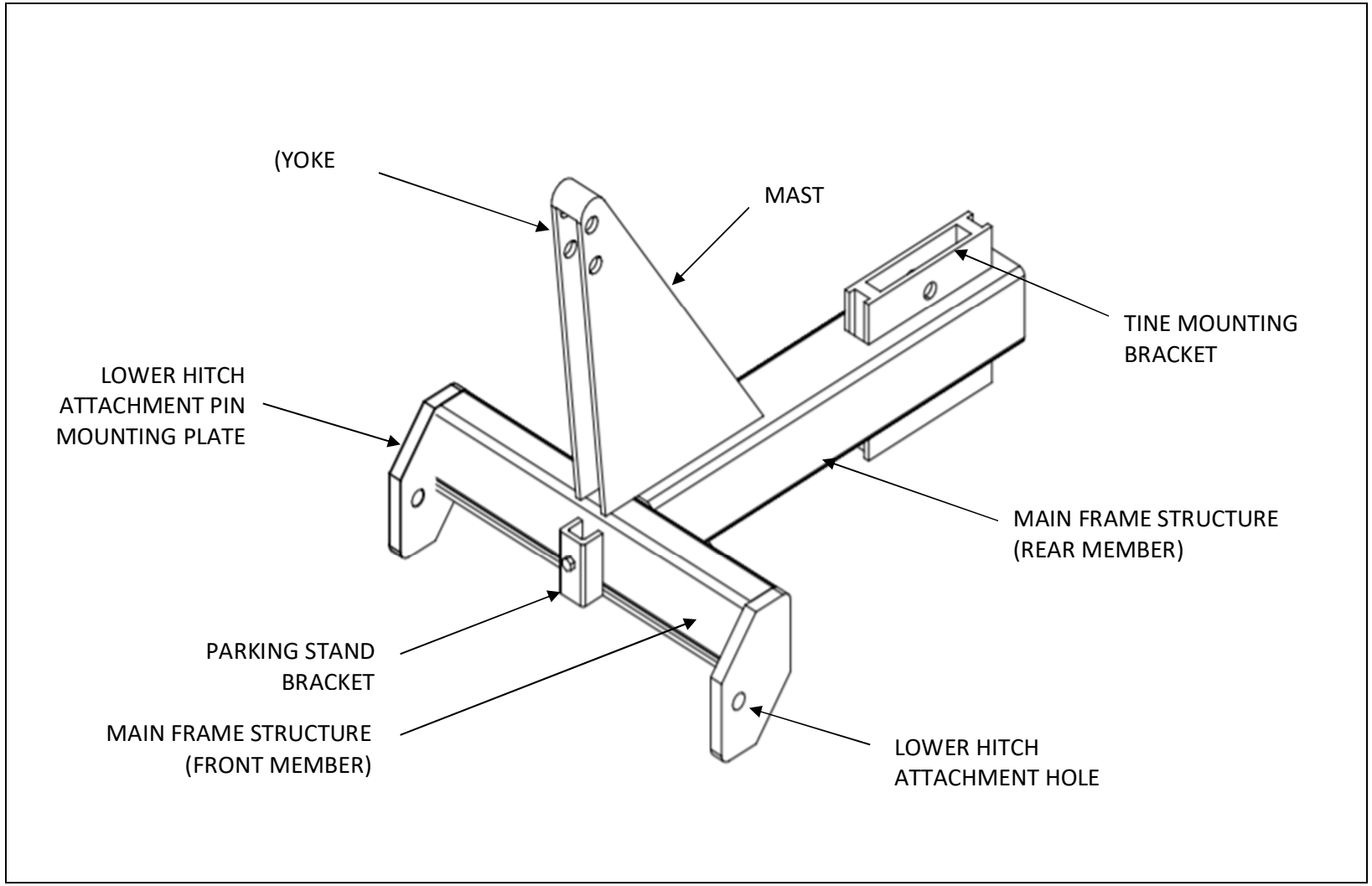

Figure 1(a): Frame and hitch assembly

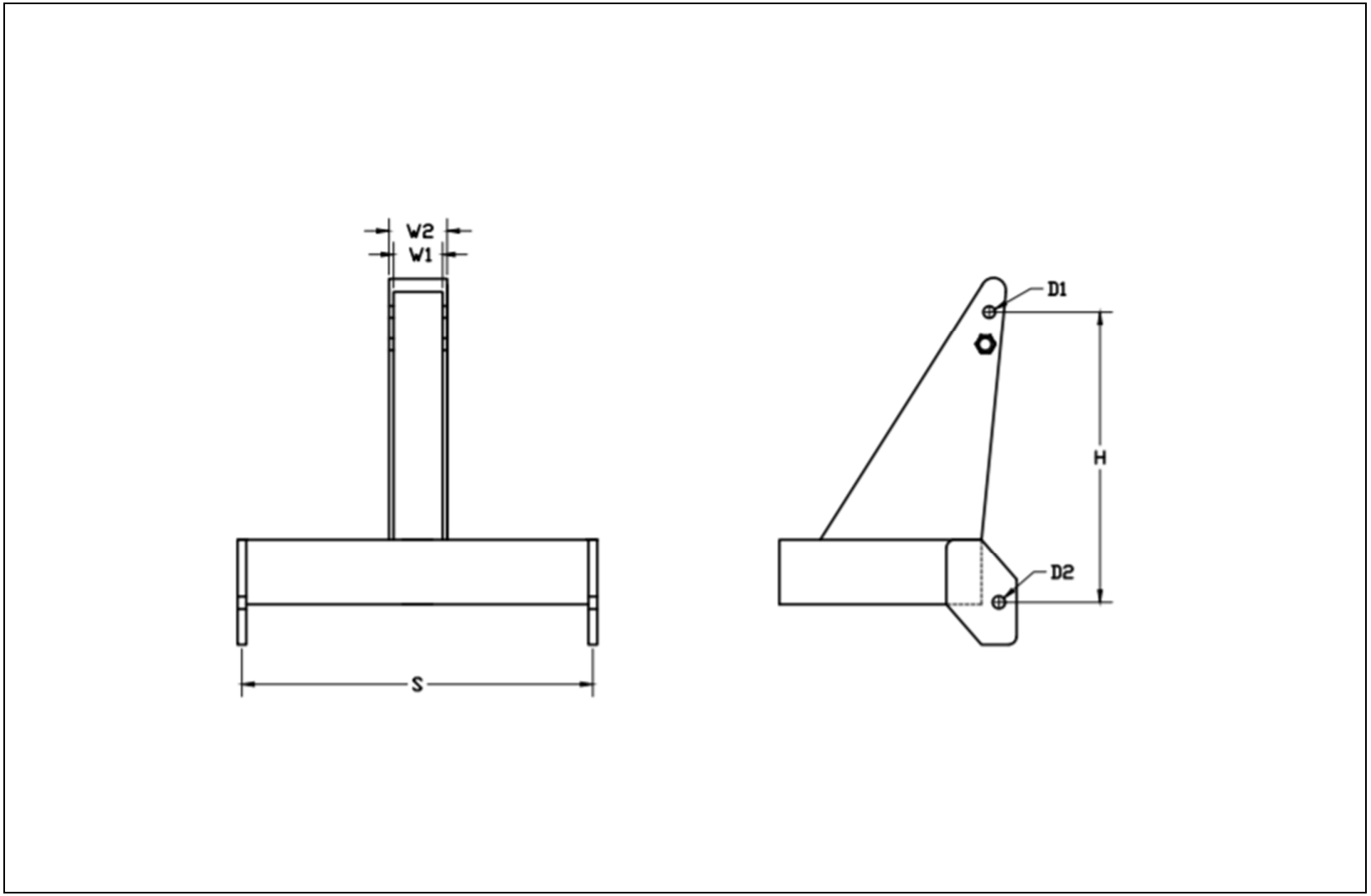

Figure 1(b): Three point hitch dimensions

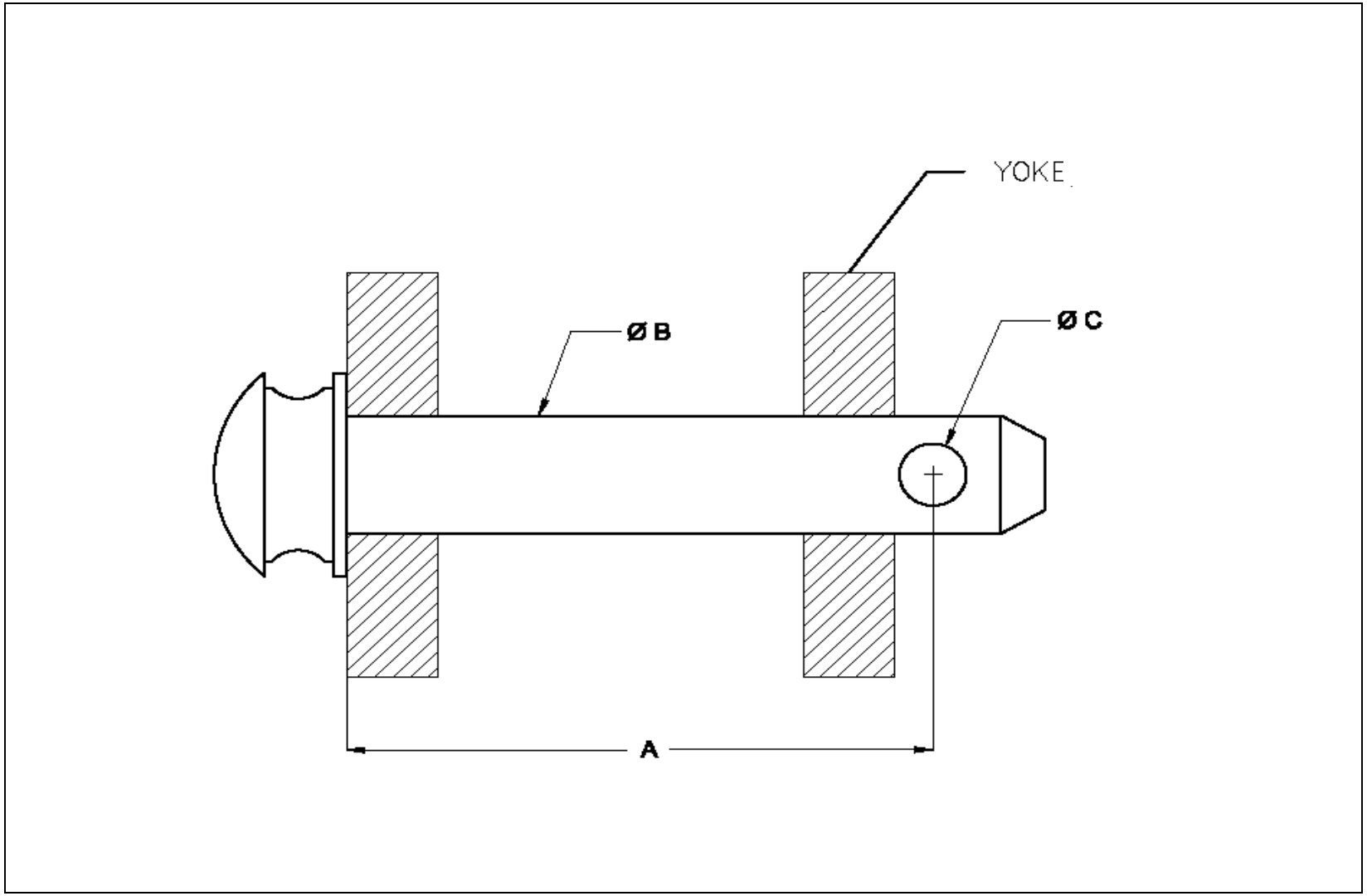

Figure 2 (a): Upper hitch attachment dimensions

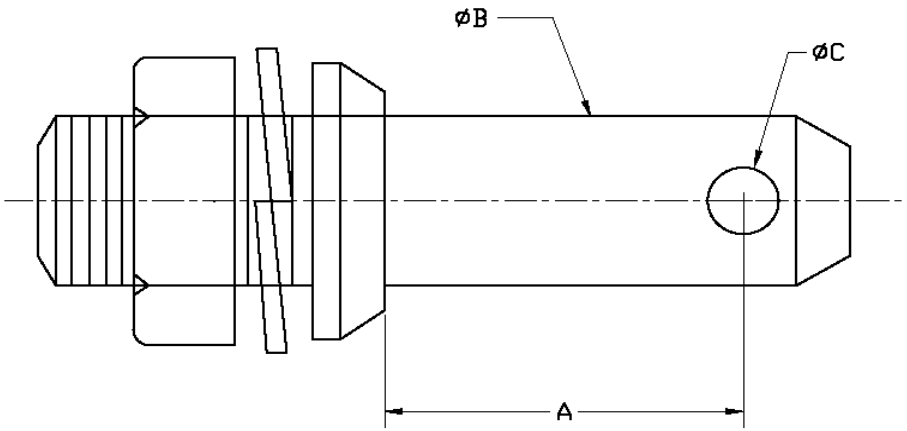

Figure 2 (b): Lower hitch attachment dimensions

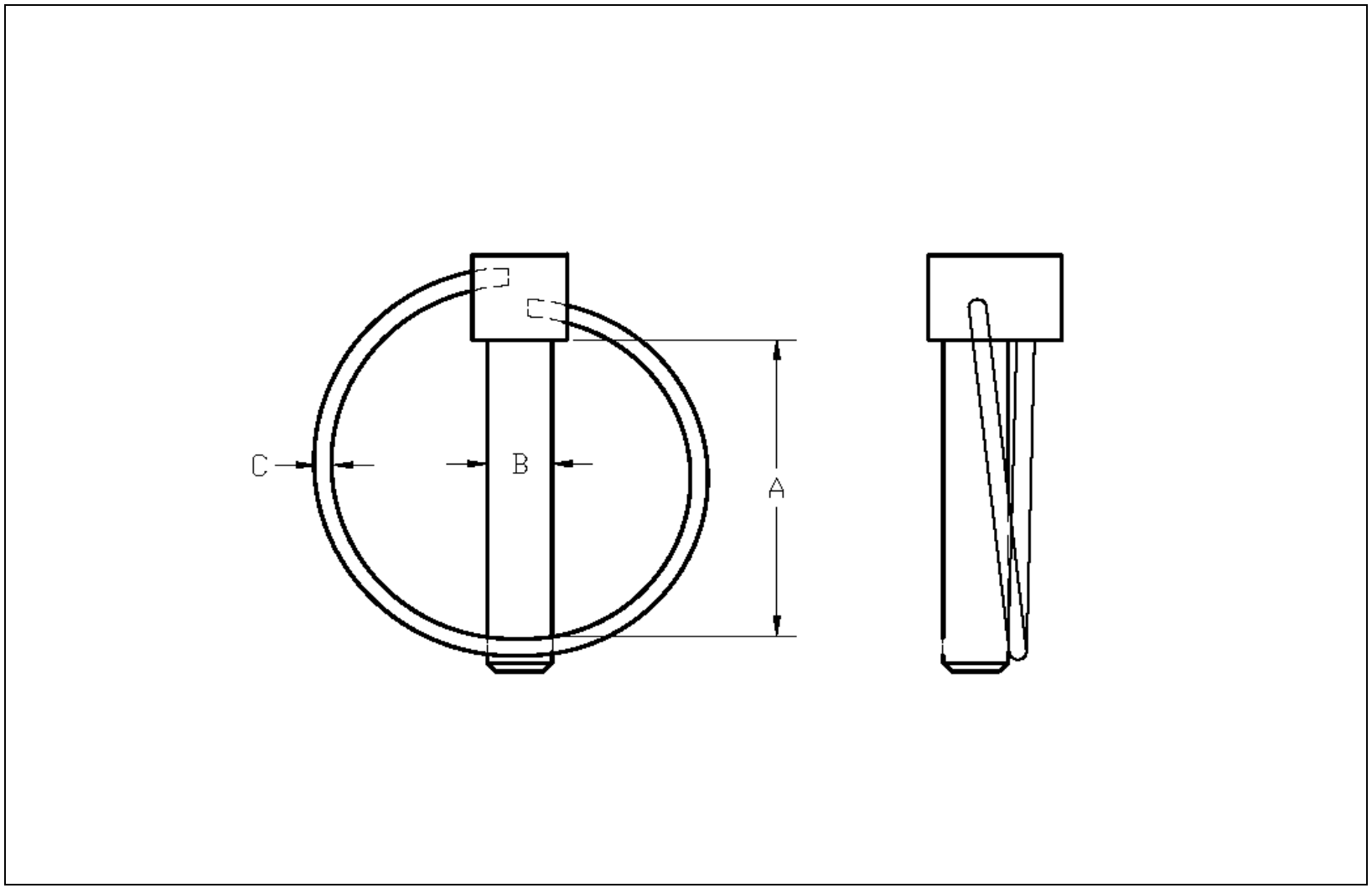

Figure 2 (c): Lynchpin dimensions

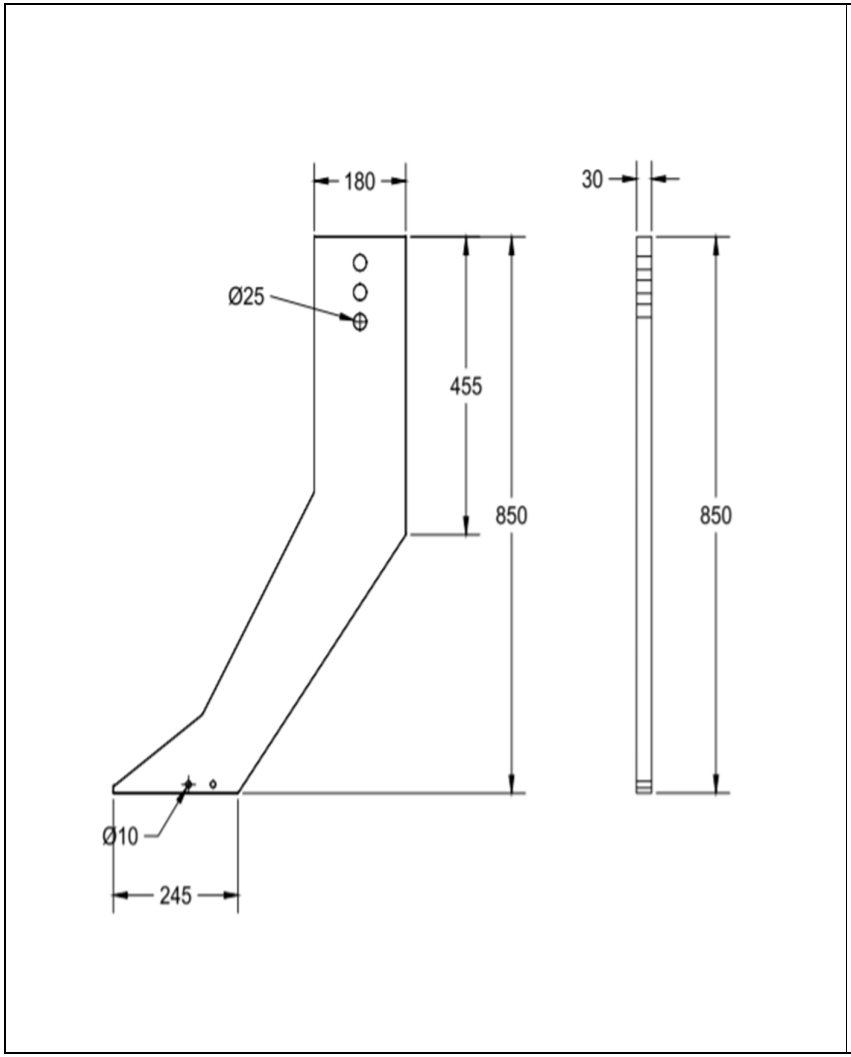

Figure 3 (a): Tine dimensions

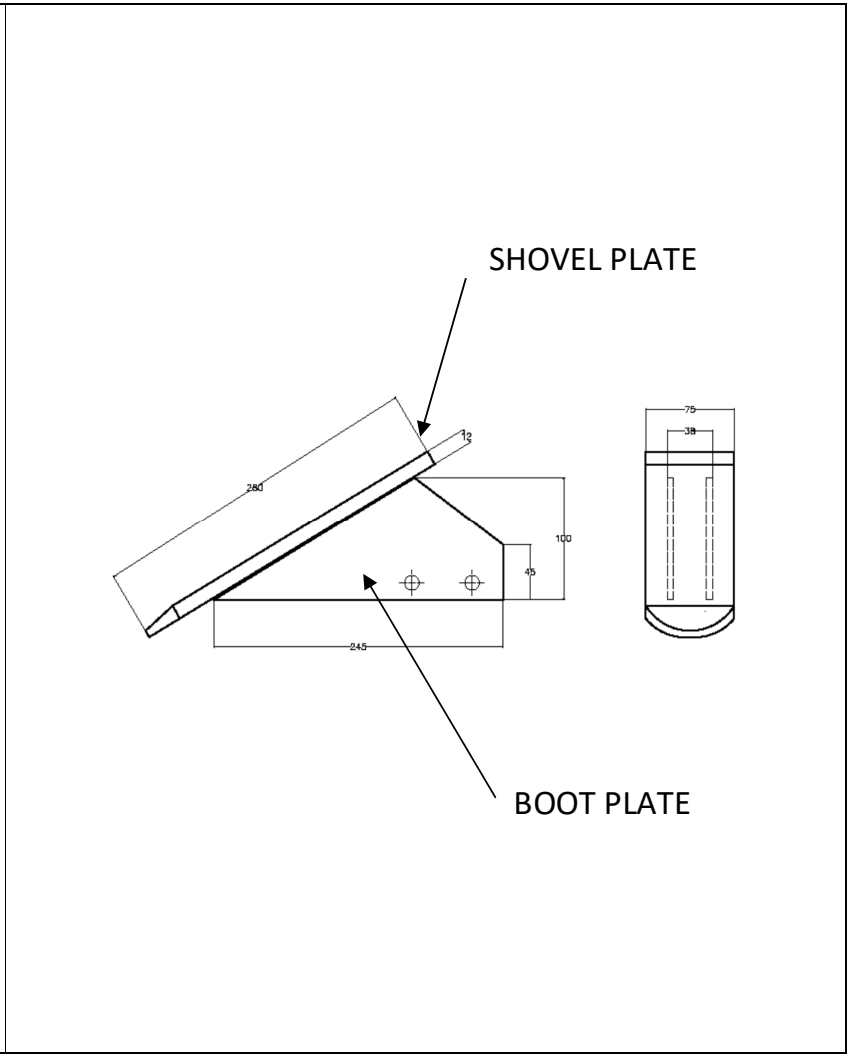

Figure 3 (b): Shovel sub-assembly dimensions

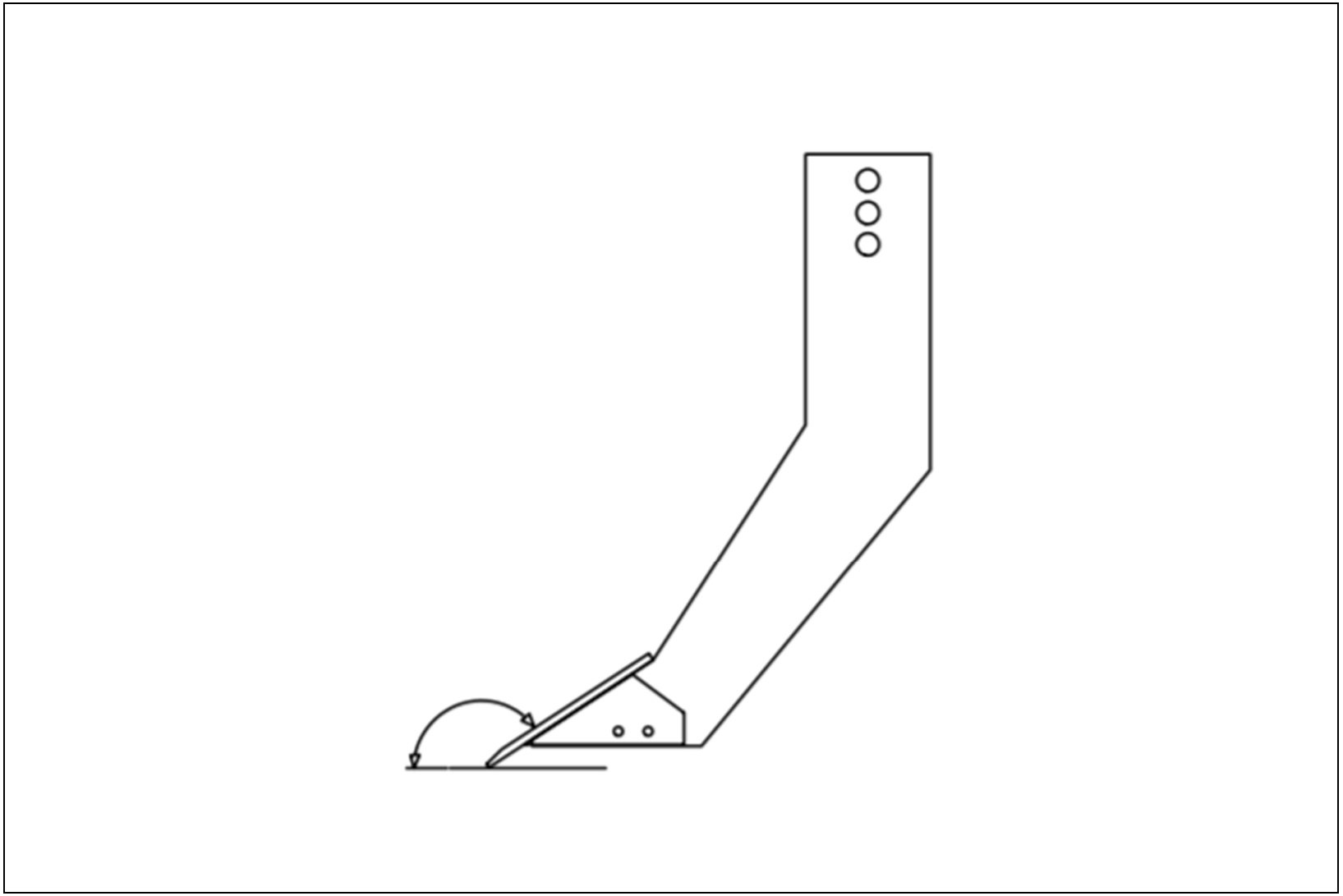

Figure 3 (c): Contact angle

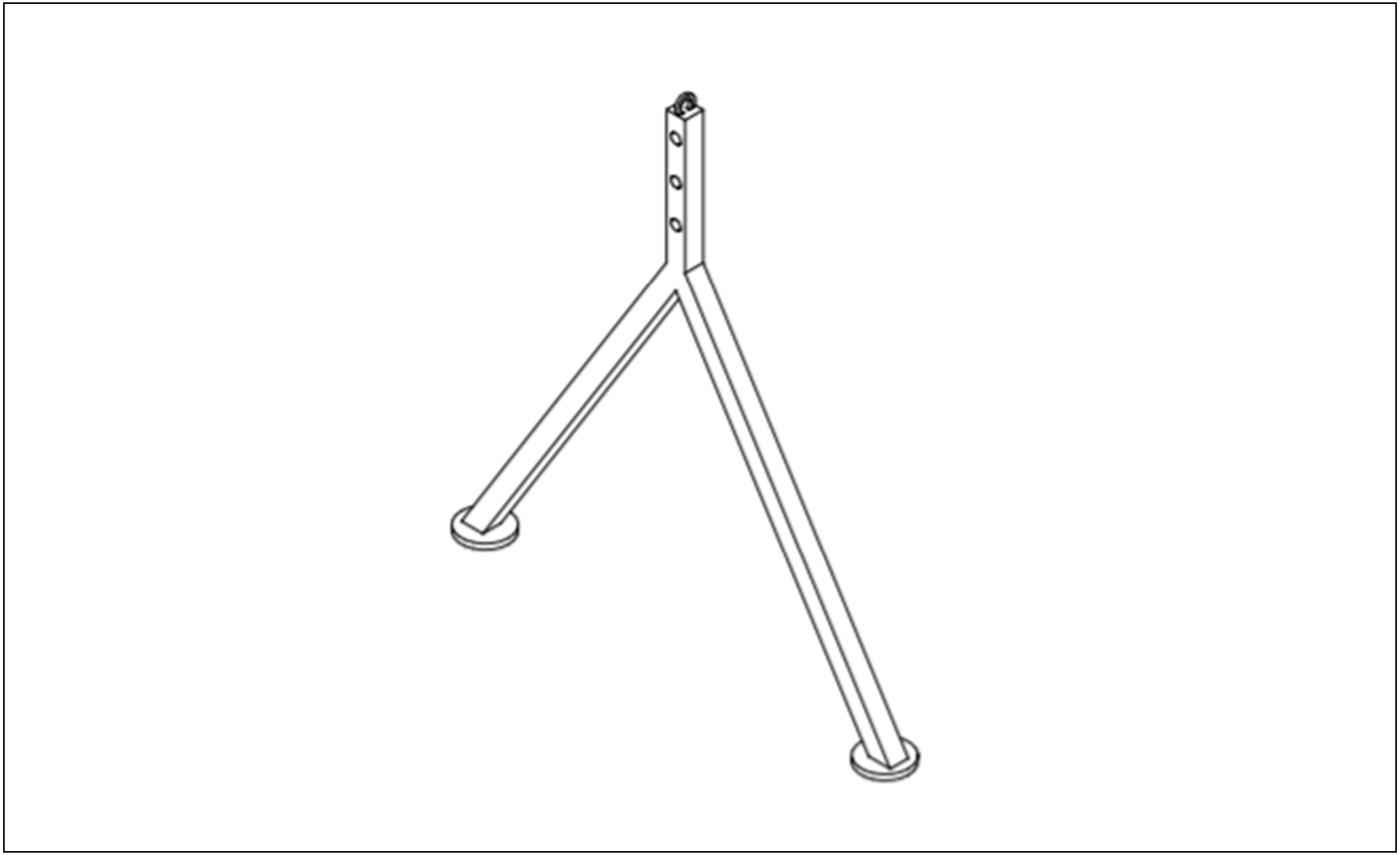

Figure 4: Parking stand assembly

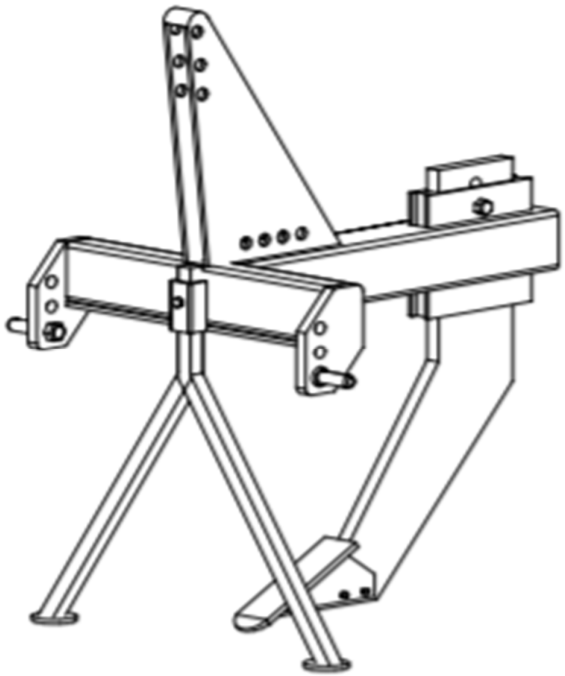

Figure 5: Typical sub-soiler