

PHILIPPINE NATIONAL STANDARD

PNS/BAFS 416:2025
ICS 65.060.20

Subsoiler — Specifications



BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

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Foreword

The Department of Agriculture (DA)-Bureau of Agriculture and Fisheries Standards (BAFS) was mandated under Section 21 (Standards Development and Enforcement) particularly Rule 21.2 of the Implementing Rules and Regulations (IRR) for Republic Act (RA) No. 10601 (Agricultural and Fisheries Mechanization [AFMech] Law) to update existing standards under the Philippine Agricultural Engineering Standards (PAES) in collaboration with concerned agencies.

In 2022, the DA-Bureau of Agricultural and Fisheries Engineering (BAFE) formally endorsed a list of aged PNS/PAES/PABES with concerns to the DA-BAFS to be considered for revision/amendment. The list was subjected to a prioritization assessment by the DA-Philippine Council for Agriculture and Fisheries (PCAF)-National Sectoral Committee on Agriculture and Fishery Mechanization (CAFMech) and was subsequently endorsed to the DA-BAFS. Further assessment was conducted by the DA-BAFS to identify the priority list for CY 2025, which was then presented during the PCAF-CAFMech Regular Meeting held on October 30, 2024. Accordingly, PAES 149:2010 (Agricultural Machinery — Subsoiler — Specifications) was included in the 2025 priority list for standardization to update its provisions in line with evolving industry practices and enhance clarity, consistency, and usability for stakeholders.

To expedite the review of these aged standards, the Bureau conducted a Table Review Assessment and Writeshop. This initiative aimed to reevaluate and validate whether the provisions of these existing standards remain relevant and reflective of current regulatory and industry practices, as well as harmonized with related regional and international standards. Moreover, this enables the Bureau to check and, if applicable, revise or amend the standards, especially those that pose a risk to end-users' safety and are potential trade barriers.

The revision was guided by the Technical Working Group (TWG) officially created under Special Order (SO) No. 745, series of 2025 (Composition of TWG and Project Management Team (PMT) for the Development of the Philippine National Standards (PNS) for the Agricultural and Fishery Products and Machinery). The TWG was composed of representatives from relevant government agencies, academe/research institutions, private sector organizations, and civil society organizations (CSO). The draft PNS underwent a series of TWG writeshops and a stakeholder consultation conducted via online platforms or a hybrid setup before its endorsement to the DA Secretary for approval.

This Standard includes the following significant changes compared to the previous version:

- a) Omission of the provision for "Principle of Operation";
- b) Removal of the design dimensional requirements from the Manufacturing Requirements;
- c) Deletion of the specific provisions for the welded parts;
- d) Replacement of the clause "Warranty of Construction" with "After-sales Service Requirements";

- e) Removal of the multiple provisions on the performance requirements; and
- f) Addition of a clause for sampling.

This document cancels and replaces PAES 149:2010 (Agricultural Machinery — Subsoiler — Specifications), which has been technically revised. This document was written in accordance with the formatting and editorial rules of the Standardization Guide (SG) No. 1 (Writing the PNS) and SG No. 5 (Writing the PNS for Agricultural and Fishery Machinery and Infrastructures) developed by the Standards Development Division (SDD) of the DA-BAFS.

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1 Scope

This Standard specifies the manufacturing and performance requirements for a subsoiler.

2 Normative References

The following documents are referred to in the text in such a way that some or all their contents constitute the requirement of this document. The latest edition of the referenced documents (including any amendments) applies:

Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2010). Agricultural machinery — Subsoiler — Specification (PAES 149: 2010). <https://amtec.uplb.edu.ph/wp-content/uploads/2019/07/pns-paes-149-2010.pdf>

American Welding Society (AWS). (2000). Structural welding code – Steel (AWS D1.1:2000) <https://law.resource.org/pub/us/cfr/ibr/003/aws.d1.1.2000.pdf>

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2020). Production machinery — Four-wheel tractors — Methods of test (PNS/BAFS 302:2020) https://drive.google.com/file/d/1NiUlxCa5qbbAFWSYj_XHJ6TpTuYGp_KCW/view?usp=sharing

BAFS-DA. (2024). Operator’s manual for agricultural and biosystems power and machinery — Guidelines (PNS/BAFS 390:2024) <https://drive.google.com/file/d/1V0j10815Yy-o9qvcGLiiBOWMDHYgitb/view>

BAFS-DA. (2025). Soil tillage machinery — Terminologies (PNS/BAFS 411:2025)

BAFS-DA. (2025). Subsoiler — Methods of Test (PNS/BAFS 417:2025)

3 Terms and Definitions

For the purpose of this Standard, the following definitions shall apply:

3.1

gauge wheel

auxiliary component of the subsoiler that helps maintain uniform depth of cultivation and eliminate the need to set the tension with the three-point hitch each time subsoiler is down (AMTEC-UPLB, 2010)

3.2**intermittent tillage**

one-time deep tillage, and conventional tillage through smash-ridging modified technology that could promote agricultural production through optimizing soil quality without high disturbance (Gu et al., 2022)

3.3**main frame**

part of the subsoiler that holds the transverse toolbars together (AMTEC-UPLB, 2010)

NOTE See Figure 1.

3.4**primary tillage**

tillage operation, that which displaces and shatters soil to reduce soil strength and to bury or mix plant materials, pesticides, and fertilizers in the tillage layer (ASABE, 2006)

3.5**ripper point**

tool attached to the shank of the subsoiler to cut through the soil (AMTEC-UPLB, 2010)

NOTE See Figure 1.

3.6**shank**

structural member primarily used for attaching a tillage tool to a transverse toolbar (AMTEC-UPLB, 2010)

NOTE See Figure 1.

3.7**soil abrasion**

scratching, cutting, or abrading of materials caused by the action of soil (AMTEC-UPLB, 2010)

3.8**subsoiler**

implement for intermittent tillage at depths sufficient to shatter compacted subsurface layers, equipped with widely spaced shanks either in-line or staggered on a V-shaped frame (AMTEC-UPLB, 2010, modified)

NOTE See Figure 1 and 2.

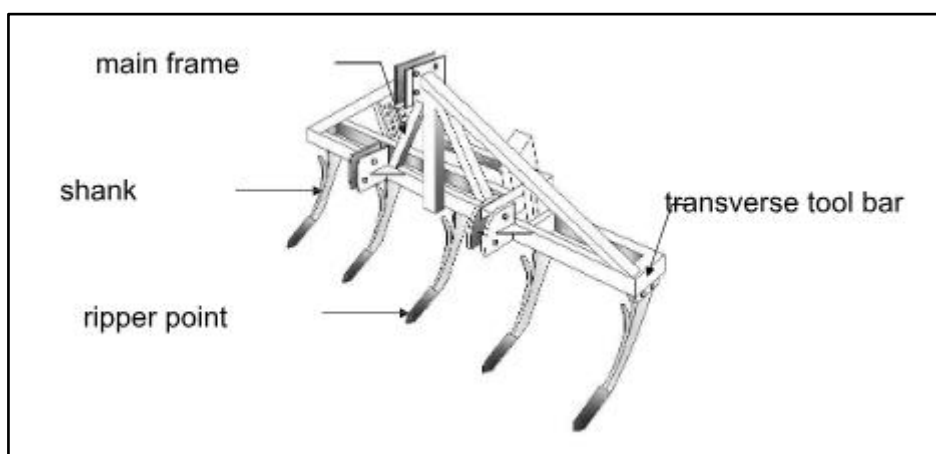


Figure 1. Subsoiler (AMTEC-UPLB, 2010)

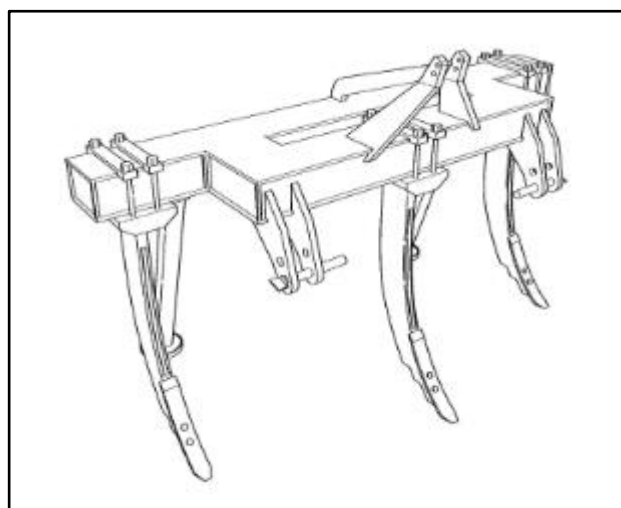


Figure 2. Heavy-duty Subsoiler

3.9 subsoiling

primary tillage operation, deep tillage, for the purpose of loosening soil for root growth and/or water movement (AMTEC-UPLB, 2000, *modified*)

NOTE The depth of specific tillage operations may reach a depth of at least 300 mm, depending on the specific site conditions.

3.10 transverse toolbar

part of the main frame to which shank assemblies are attached (AMTEC-UPLB, 2010)

NOTE See Figure 1.

3.11**wear shin**

metal plate attached to the shank to reduce abrasion and enhance durability of the shank (AMTEC-UPLB, 2010)

NOTE See Figure 6.

4 Classifications**4.1 According to type of mounting****4.1.1 Drawn type subsoiler**

Type of subsoiler wherein main frame is hitched to the tractor. Guide wheels are necessary for transport as shown in Figure 3.

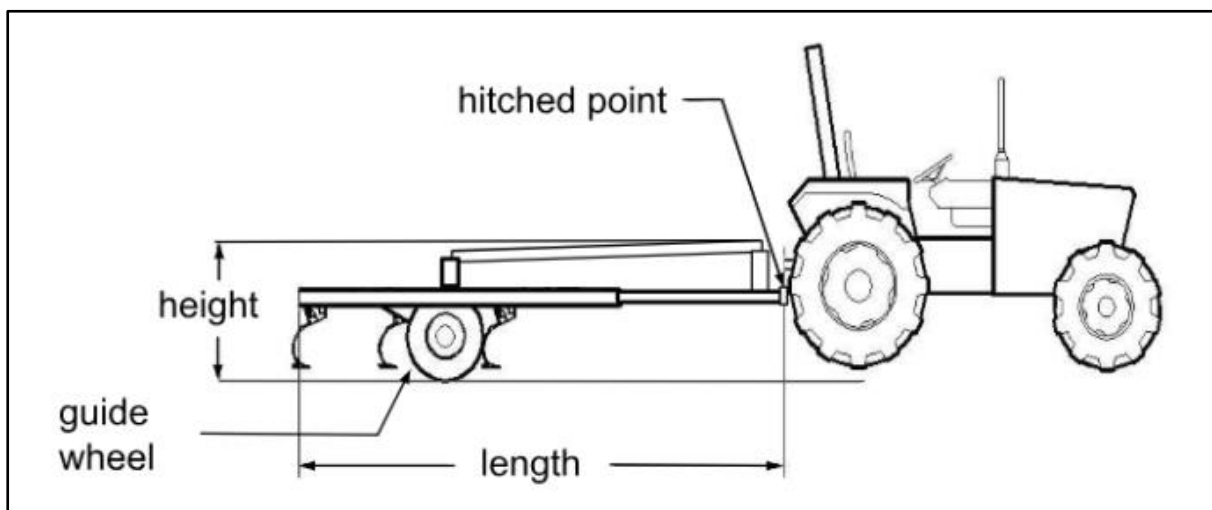


Figure 3. Drawn type subsoiler (AMTEC-UPLB, 2010)

4.1.2 Three-point hitch

Type of subsoiler wherein main frame is connected to the rear of the tractor using the 3-point hitch linkages as shown in Figure 4.

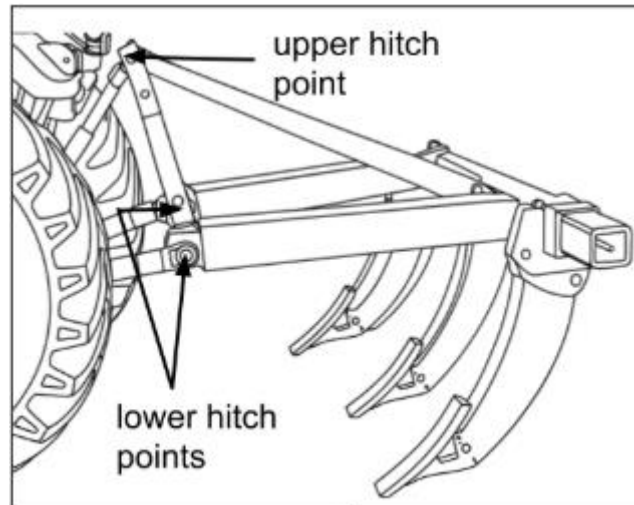


Figure 4. Three-point hitch type subsoiler

4.2 According to type of shank

4.2.1 Straight shank

Straight shank as shown in Figure 5.

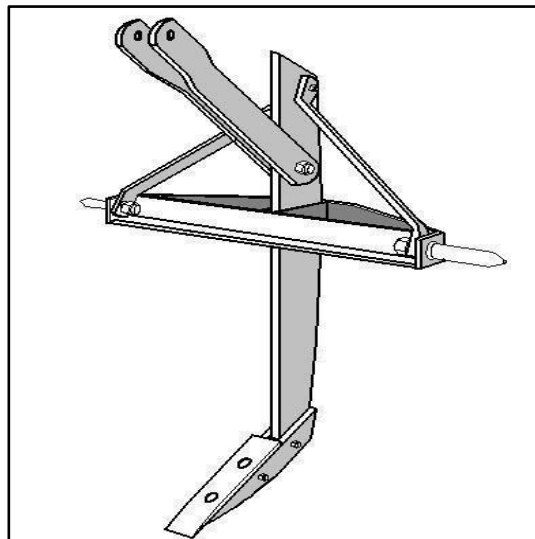


Figure 5. Straight shank subsoiler (AMTEC-UPLB, 2010)

4.2.2 Curved or parabolic shank

Curved or parabolic shank as shown in Figure 6.

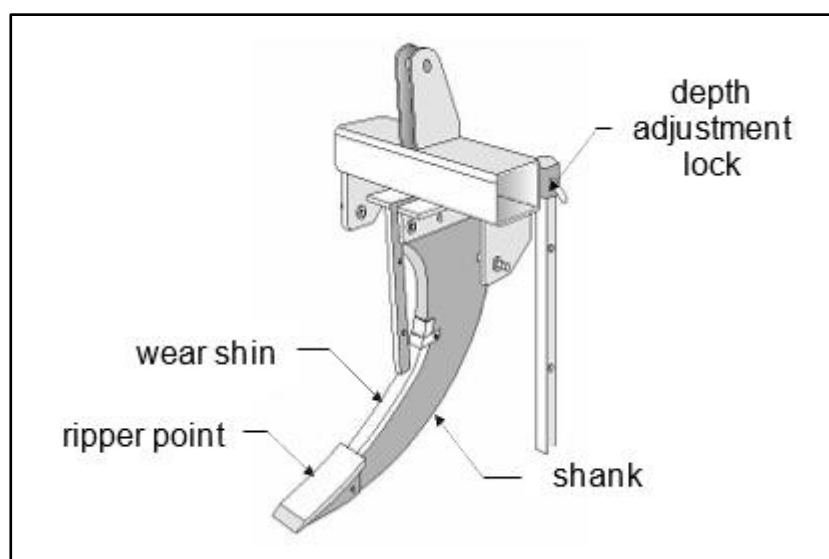


Figure 6. Curved shank subsoiler (AMTEC-UPLB, 2010)

5 Manufacturing Requirements

- 5.1** The main frame shall be made of mild steel (i.e. AISI 1020). It shall have a provision for attaching to the tractor as specified in PNS/BAFS 301:2020 Production Machinery — Four-Wheel Tractors — Specifications.
- 5.2** The transverse toolbars shall be made of mild steel (i.e. AISI 1020).
- 5.3** The shank assembly should consist of a shank, wear shin, and ripper point.
- 5.3.1** Shanks shall be made of alloy steel (i.e. AISI 5160). It should be attached to the frame by bolt or shall be fully welded.
- 5.3.2** Holes should be punched at the ends of the shanks where the ripper points shall be attached.
- 5.3.3** The ripper points shall be made of heat-treated carbon steel (i.e. AISI 1080). It shall be bolted on the end of the shanks to allow replacement.
- 5.3.4** Wear shin should be installed in the shank assembly to provide protection for the shank during tillage. It shall be made of alloy steel (i.e. AISI 5160).
- 5.4** Gauge wheels should have an adjustable axle to allow modification of operating depth.
- 5.5** The subsoiler should be equipped with a parking stand to provide support when it is not in operation.

- 5.6** All welded parts shall be in accordance with the criteria set in AWS D1.1:2000.

6 Performance Requirements

- 6.1** The subsoiler shall have an operating depth of at least 300 mm in accordance with PNS/BAFS 411:2025 (Soil tillage machinery — Terminologies).
- 6.2** The subsoiler shall have no major breakdowns or malfunctions (i.e., failure of components, etc.) during operation.

7 Safety, Workmanship, and Finish

- 7.1** The machine shall be free from defects that may be detrimental to its use and shall be free from sharp edges and surfaces that may harm the operator. All metal parts should be machine bent, pressed and cut, and all rough surfaces should be machine finished and smoothed.
- 7.2** Warning notices shall be provided in conformance with PNS/BAFS 330:2022 (Technical means for ensuring safety — Guidelines).
- 7.3** The use of subsoilers in terms of operator's exposure on permissible noise level shall conform to Annex A (Occupational safety and health standards - [Rule 1074.01– 1074.03]).
- 7.4** If the machine exceeds the noise level of 92 dB(A), an ear protective device shall be provided by the manufacturer.

8 After-sales Service Requirements

Requirements for after-sales services shall be in conformance with PNS/BAFS 192:2024 (After-sales service — Guidelines).

9 Maintenance and Operation

- 9.1** Each unit of the subsoiler shall be provided with a set of standard tools for operation and basic maintenance as prescribed by the manufacturer.
- 9.2** An operator's manual for the subsoiler shall be provided in conformance with PNS/BAFS 390:2024 (Operator's manual for agricultural and biosystems power and machinery — Guidelines). The operator's manual shall include emphasis on the safety and health hazards especially the use of basic personal protective equipment.

10 Sampling

The subsoiler shall be sampled for testing in conformance with PNS/BAFS 391:2024 (Methods of sampling for agricultural and biosystems power and machinery — Guidelines) or other suitable method of selection validated by the testing authority.

11 Testing

The sampled subsoiler shall be tested in conformance with PNS/BAFS 417:2025 (Subsoiler — Methods of test).

12 Markings and Labeling

12.1 Each unit of subsoiler shall be engraved or embossed with the following information, either on the body or on a metal nameplate/s permanently attached at the most conspicuous place:

- a) Registered trademark of the manufacturer;
- b) Brand;
- c) Model;
- d) Serial number;
- e) Date of manufacture; and
- f) Country of manufacture/origin (if imported) / “Made in the Philippines” (if manufactured in the country).

12.2 Reflectors shall be attached at the rear of the subsoiler for safety during transport.

12.3 Other markings and labeling shall comply with the applicable regulations set by the competent authority.

Annex A
(Informative)

Occupational safety and health standards (Rule 1074.01–1074.03)

A.1 Threshold limit values for noise

- A.1.1** The threshold limit values refer to sound pressure that represents conditions under which it is believed that nearly all workers may be repeatedly exposed without adverse effect on their ability to hear and understand normal speech.
- A.1.2** Feasible administrative or engineering controls shall be utilized when workers are exposed to sound levels exceeding those specified in Table A.1 hereof when measured on a scale of a standard sound level meter at slow response. If such controls fail to reduce sound within the specified levels, ear protective devices capable of bringing the sound level to permissible noise exposure shall be provided by the employer and used by the worker.

Table A.1. Permissible noise exposure (OSHC-DOLE, 2020)

Duration per day, h	Sound levels (slow response), dB(A)
8	90
6	92
4	95
3	97
2	100
1½	102
1	105
½	110
¼	115

A.2 Permissible noise exposure

- A.2.1** The values specified in Table A.1 apply to total time of exposure per working day, regardless of whether this is one continuous exposure or a number of short-term exposures but does not apply to impact or impulsive type of noise.
- A.2.2** If the variation in noise level involves maximum intervals of one second or less, it shall be considered as continuous. If the interval is over one second, it becomes impulse or impact noise.
- A.2.3** When the daily noise exposure is composed of two or more periods of noise exposure of different levels, their combined effect should be considered rather than the effect of each.

A.2.4 If the sum of the fractions in Equation 1 exceeds one, then the mixed exposure should be considered to exceed the threshold limit value. *C* indicates the total time exposure at a specified noise level, and *T* indicates the total time of exposure permitted at the level. However, the permissible levels indicated in Table A.1 shall not be exceeded for the corresponding number of hours per day allowed. Noise exposures of less than 90 dB(A) are not covered by Equation 1.

$$X = \frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} + \dots + \frac{C_n}{T_n} \quad (1)$$

where:

- X* is the sum of the ratios of *C* and *T*
- C* is the total time of exposure at a specified noise level
- T* is the total time of exposure permitted at the level

A.2.5 Exposures to impulsive or impact noise shall not exceed 140 dB(A) peak sound pressure level (ceiling value).

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