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**Agricultural machinery – Soil Auger –
Methods of Test**



BUREAU OF PRODUCT STANDARDS

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National Foreword

This Philippine Agricultural Engineering Standards PAES 162:2011, Agricultural machinery – Soil Auger – Methods of Test was approved for adoption as Philippine National Standard by the Bureau of Product Standards upon the recommendation of the Agricultural Machinery Testing and Evaluation Center (AMTEC) and the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development of the Department of Science and Technology (PCARRD-DOST).

Foreword

The formulation of this national standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled “Development of Standards for Agricultural Production and Postharvest Machinery” funded by the Philippine Council for Agriculture, Forestry and Natural Resources Research and Development - Department of Science and Technology (PCARRD-DOST).

This standard has been technically prepared in accordance with BPS Directives Part 3:2003 – Rules for the Structure and Drafting of International Standards.

The word “shall” is used to indicate mandatory requirements to conform to the standard.

The word “should” is used to indicate that among several possibilities one is recommended as particularly suitable without mentioning or excluding others.

In the preparation of this standard, the following documents/publications were considered:

European Patent Office EP0334934B1.

Slatter, J.W., J.P. Seidel and W. Kingwell. A proposed model for soil auger interaction during installation of screw piling augers.

United States Patent US3760893. Cylinder Type Soil-sampling Auger.

United States Patent US4653336. Combination Soil Auger and Soil Core Sampler with Sample Retaining Capacity.

United States Patent US4779689. Soil Auger.

United States Patent US5133269. Plant Hole Digger with Cylindrical Cutter.

United States Patent US572249. Soil Displacement Auger Head for Installing Piles in the Soil.

<http://www.accurate.net.nz/soil/auger.html>

<http://www.eijkelkamp.com>

<http://www.johnsonsoilauger.co.za/types.aspx>

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Agricultural Machinery – Soil Auger – Methods of Test

1 Scope

This standard specifies the methods of test and inspection for a soil auger. Specifically, it shall be used to:

1.1 verify the mechanism, dimensions, materials, accessories of the soil auger and the list of specifications submitted by the manufacturer;

1.2 determine the performance of the equipment;

1.3 report the results of the tests.

2 References

The following normative documents contain provisions, which through reference in this text constitute provisions of these standards:

PAES 161:2011 Agricultural Machinery – Soil Auger – Specifications

3 Definitions

For the purpose of this standard, the definitions given in PAES 161:2011 and the following shall apply:

3.1**boring depth**

maximum depth that the soil auger can reach

3.2**boring efficiency**

ratio between the actual boring time and the theoretical boring time expressed in percent

3.3**minor diameter, d**

for a straight thread, this diameter is the imaginary cylinder bounding the root of an external thread (Fig.1)

3.4

overall length

measurement from the tip of the auger head of the soil auger to its opposite end along its longitudinal side

3.5

overall width

measurement between the outermost dimensions of the soil auger along its lateral side

3.6

pitch, P

distance (in millimeters), measured parallel to the thread axis, between corresponding points on adjacent thread forms in the same axial plane on the same side of the axis (Fig.1)

3.7

pitch diameter, D

for a straight thread, this is the diameter of the imaginary cylinder whose surface passes through the thread profiles in such a way to make the widths of the thread ridge and the thread groove equal (Fig.1)

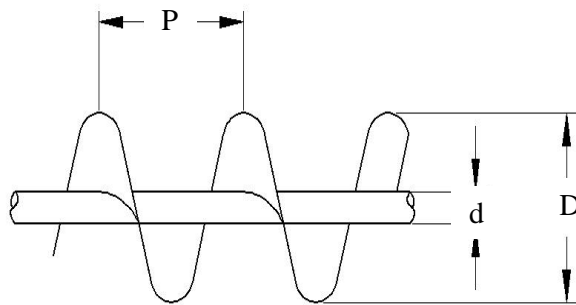


Figure 1. Dimensions of an auger

3.8

sampling efficiency

ratio between the actual volume contained in the auger head and the theoretical volume that can be contained in the auger head expressed in percent

4 General Conditions for Test and Inspection

4.1 Role of manufacturer or dealer

The manufacturer shall submit the operator's manual of the soil auger and shall abide by the terms and conditions set forth by an official testing agency.

4.2 Role of the operator

An officially designated operator shall be skilled and shall be able to demonstrate, operate, adjust and repair matters related to the operation of the tool.

4.3 Test site conditions

The soil auger shall be tested through actual operation in an area free from loose stones, vegetations and other obstructions. It shall be tested under three (3) different soil conditions.

4.4 Test equipment

The suggested list of minimum test materials needed to carry out the soil auger test is shown in Annex A.

4.5 Termination of test for soil auger

If during the test, the soil auger encounters major component breakdown, the test engineer shall terminate the test.

4 Test and Inspection

5.1 Verification of the manufacturer's technical data and information

This inspection is carried out to verify the mechanism, dimensions, materials and accessories of the soil auger in comparison with the list of manufacturer's technical data and information. All data shall be recorded in Annex B.

5.2 Performance test

5.2.1 This is carried out to obtain actual data on overall performance of the equipment.

5.2.2 Measurement of initial data

Initial data, such as field area, soil type and soil moisture content, shall be obtained before the test operation.

5.2.3 Field performance test

5.2.3.1 The time to complete the drilling operation shall be obtained and recorded.

5.2.3.2 The speed of boring shall be computed by obtaining the time required for the soil auger to drill a depth of 300 mm.

5.2.3.3 For power-operated type, the energy consumption shall be obtained (formula in Annex D) as described in Annex E.

5.2.3.4 Fuel consumed shall be obtained as described in Annex E.

5.2.3.5 The size of the auger head before and after the test shall be compared to determine the percentage of wear (formula in Annex D).

5.2.3.6 Welded parts shall be inspected to determine cracks on welded joints.

5.2.4 All data shall be recorded in Annex C.

5.3 Test trial

There shall be at least three (3) trials to conduct the test.

6 Test Report

The test report shall include the following information in the order given:

6.1 Title

6.2 Summary

6.3 Purpose and Scope of Test

6.4 Methods of Test

6.5 Description of the Machine

Table 1 – Machine Specifications

6.6 Results and Discussions

6.7 Observations (include pictures)

Table 2 –Performance test data

6.8 Name(s), signature(s) and designation(s) of test engineer(s)

Annex A

Suggested Minimum List of Test Equipment

Items	Quantity
A.1. timer accuracy: 0.10 s	1
A. 2 steel tape length: 5m	1
A.3 weighing scale capacity, 500 kg	1
A.4 soil analysis	
soil test kit	1
oven	1
A.5 noise level meter	1
A.6 Vernier caliper	1
A.7 fuel consumption	
graduated cylinder capacity, 1000 mL	1
A.8 power meter	1

Annex B
(informative)

Specifications of Soil Auger

Name of Applicant/ Distributor: _____

Address: _____

Tel No: _____

GENERAL INFORMATION

Name of Manufacturer: _____

Make: _____

Classification: _____

Serial No: _____ Brand/Model: _____

Production date of soil auger to be tested: _____

Testing Agency: _____ Test Engineer: _____

Date of Test: _____ Location of Test: _____

Items to be inspected

ITEMS	Manufacturer's Specification	Verification by the Testing Agency
B.1 overall dimensions		
B.1.1 length, mm		
B.1.2 width, mm		
B.2 weight, kg		
B.3 handle		
B.3.1 material		
B.3.2 diameter, mm		
B.3.3 length, mm		
B.4 auger head/drill bit		
B.4.1 material		
B.4.2 diameter, mm		
B.4.3 type		
B.4.4 pitch, mm		
B.4.5 pitch diameter, mm		
B.4.6 minor diameter, mm		
B.5 extension rod (for hand-operated)		
B.5.1 material		
B.5.2 length		
B.5.3 diameter, mm		
B.6 prime mover (for power-operated type)		
B.6.1 power rating, kW		
B.6.2 type		
B.7 boring depth, mm		

ANNEX C

Performance Test Data Sheet

Items to be measured and Inspected

C.1 Test field conditions	Remarks
C.1.1 soil type (clay, clay loam, sandy, etc.)	
C.1.2 soil texture (fine, medium, coarse)	
C.1.3 soil moisture content (% d.b.)	

C.2 Field performance				
Items	Trials			average
	I	II	III	
C.2.1 total operating time, h				
C.2.2 boring speed, mm/s				
C.2.3 noise level, db(A)				
C.2.4 wear, %				
C.2.5 energy consumption				
C.2.5.1 electrical energy consumption, kW-h				
C.2.5.2 fuel consumption, Lps				
C.2.6 efficiency, %				
C.2.6.1 boring efficiency, %				
C.2.6.2 sampling efficiency, %				

C.3 Other observations	Remarks
C.3.1 detached welded parts	
C.3.2 ease of maintenance/repair	
C.3.3 ease of operation	
C.3.4 ease of handling (transporting, assembly, cleaning)	
C.3.5 miscellaneous:	

ANNEX D

Formula Used During Calculation and Testing

D.1 Boring efficiency

$$Eff_B = \frac{T_a - T_t}{T_t} \times 100$$

where:

Eff_B boring efficiency, %

T_a actual boring time, h

T_t theoretical boring time, h

$$T_t = \frac{d}{s}$$

where:

d displacement, mm

s boring speed, mm/s

D.2 Sampling efficiency

$$Eff_S = \frac{V_t - V_a}{V_t} \times 100$$

where:

Eff_S sampling efficiency, %

V_a actual volume, mm³

V_t theoretical volume, mm³

D.3 Electrical energy consumption

$$E_c = P_c T_o$$

where:

E_c electrical energy consumption, kW-h

P_c power consumed, kW

T_o operating time, h

D.4 Fuel consumption

$$E_f = \frac{V_i - V_f}{t}$$

where:

E_f fuel consumption, Lps

V_i initial volume of fuel in tank

V_f final volume of fuel in tank

t time of operation

D.5 Wear

$$W = 1 - \frac{D_f}{D_i} \times 100$$

where:

W wear, %

D_i auger head diameter before test, mm

D_f auger head diameter after test, mm

ANNEX E

Measurement of Energy Consumption

E.1 Electrical energy consumption

This shall be done by measuring the power consumed by the equipment. The total operating time shall be noted. The product of the power consumed and the operating time shall determine the electrical energy consumed by the equipment.

E.2 Fuel consumption

This shall be done by filling the tank with a known volume of fuel. After the test, the tank shall be emptied by draining the fuel through the carburetor. The drained fuel shall be measured using a graduated cylinder. The difference between the initial volume of fuel and the final volume shall be divided by the time of operation to determine the fuel consumption of the equipment.

Fuel consumption can also be measured by filling the tank to full capacity before and after the each test trial. The amount of fuel refilled shall be measured using a graduated cylinder. The difference in the volume of the fuel shall be divided by the time of operation to yield the fuel consumption of the equipment.

Philippine Agricultural Engineering Standards

AMTEC-UPLB – PCARRD Project: “Development of Standards for Agricultural Production and Postharvest Machinery”

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