Foreword

This standard is a revision of the PNS 142:1988 "Specification for Corn Sheller" initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled "Standardization of Postharvest Machinery Testing and Evaluation" which was funded by the Bureau of Postharvest Research and Extension (BPRE) of the Department of Agriculture (DA).

This revised standard was reviewed by the Study Team for the Formulation of Standards for Corn Sheller and by the Technical Committee on Postharvest Machinery and was circulated to various private and government agencies/organizations concerned for their comments and reactions. This standard was presented to the Philippine Society of Agricultural Engineers (PSAE) and subjected to a public hearing organized by the National Agriculture and Fisheries Council (NAFC).

This second revision has been technically revised in accordance with PNS 01: Part 4:1998 – Rules for the Structure and Drafting of Philippine National Standards.

Revisions had been made to adopt various improvements in the design of the machine that may affect its performance. The main changes are listed below:

- definitions and classifications of corn and corn sheller;
- performance criteria were changed based on the result of actual test conducted by Agricultural Machinery Testing and Evaluation Center (AMTEC);
- performance parameter was included to meet the set performance criteria;
- materials of construction for shelling elements was specified; and
- warranty period provided for parts and services and basic tools were specified.

In the preparation of this standard, reference was made to AMTEC Test Reports on Corn Sheller, Volume 1.

PHILIPPINE AGRICULTURAL ENGINEERING STANDARD PAES 208:2000

Agricultural Machinery – Power-Operated Corn Sheller – Specifications

1 Scope

This standard specifies the requirements for power-operated corn sheller.

2 Reference

The following normative document contains provisions which through reference in this text constitute provisions of this National Standard:

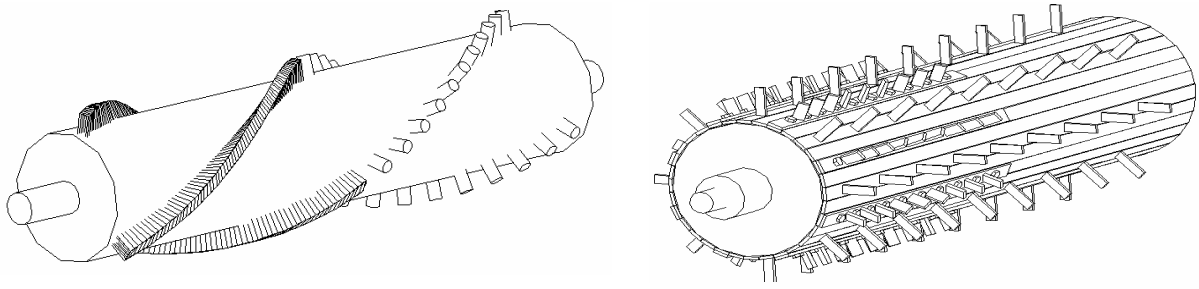
PAES 209:2000, Agricultural Machinery: Power – Operated Corn Sheller – Methods of Test.

3 Definitions

For the purpose of this standard the following definitions shall apply:

3.1
blower loss
ratio of the weight of corn kernels blown by the sheller fan, to the weight of the total corn kernel input of the sheller, expressed in percent

3.2
closed-frame cylinder
type of shelling cylinder formed by a rolled metal sheet/plate (Figure 1a) or formed by longitudinal bars adjacently arranged forming a continuous cylinder (Figure 1b)



(a) **(b)**

Figure 1. Closed-frame type cylinder

NOTE The shelling elements are either attached around the periphery of a cylinder or at the longitudinal bars.

3.3
concave component
iron grill frame partially or fully surrounding the cylinder on which the shelling elements rubs, shear and/or impact the corn ear with or without husk

3.4
corn cob
part of the ear corn where the kernels are attached

3.5
corn ear
pistillate inflorescence of the plant Zea mays L., enclosed with a leaf-like protective covering known as husk

3.6
corn husker-sheller
machine used to remove the husk of corn ear, detach, separate and clean the corn kernels from the cobs in one operation

3.7
corn sheller
machine used to detach, separate and clean the corn kernels from the cobs

3.8
cylinder-type
type of shelling unit consisting of a cylinder with shelling elements such as knife bar or pegtooth

NOTE The cylinder rotates inside a concave component.

3.9
cracked kernels
kernels which show signs of fissures or fractures or splinters

3.10
disc-type
type of shelling unit consisting of a vertical disc with spiked surface

NOTE The disc rotates along horizontal axis.

3.11
ear corn
dehusked corn
corn-in-cob
unshelled fruit of the corn plant where the husk has been removed mechanically or manually

3.12
hopper-fed type
type of corn sheller wherein the ear corn are fed into shelling chamber by gravity

3.13
kernel
dry and indehiscent seed developed from the ovary of the ear corn

3.14
kernel-ear corn ratio
ratio of the weight of the corn kernel present in the ear corn to the weight of the ear corn

3.15
mechanically damaged kernels
kernels that were broken and/or scratched as a result of shelling operation

3.16
moisture content
amount of moisture in the kernel expressed as percentage of the total weight of the sample, wet basis

NOTE calculated as:

$$\text{Moisture Content, \% w.b.} = \frac{Mo - M_1}{Mo} \times 100$$

Where:
M_o = initial mass in grams of the test portion
M_1 = mass in grams of the dry test portion

3.17
net cracked kernel
difference between the percent cracked sample taken before and after the shelling operation

3.18
open-frame cylinder
type of shelling cylinder where the shelling elements are attached to the equally spaced longitudinal bars arranged cylindrically (Figure 2)

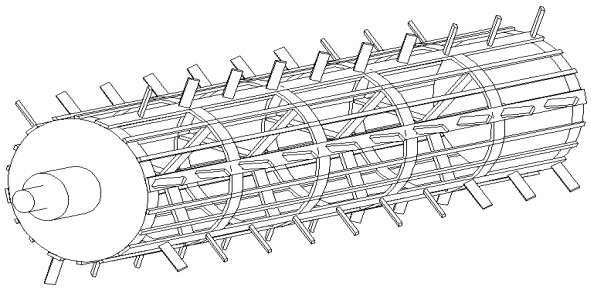


Figure 2. An open-frame type cylinder.

3.19
purity
ratio of the weight of clean corn kernels, to the total weight of unclean corn kernels sample, expressed in percent

3.20
scattering loss
ratio of the weight of corn kernels that fell out from the machine during shelling operation to the weight of the total corn kernel input of the sheller, expressed in percent

3.21
separation loss
ratio of the weight of corn kernels that come out of the shelling chamber with the cobs at the cob outlet, to the weight of the total corn kernel input of the sheller, expressed in percent

3.22
shelled kernels
whole and damaged corn kernels separated from the cob after shelling

3.23
shelling cylinder
shelling drum
part of the shelling unit that rotates about an axis and it is equipped with pegs on its periphery

3.24
shelling efficiency
ratio of the weight of the shelled corn kernels collected at all outlets, to the total corn kernel input of the sheller, expressed in percent

3.25
shelling recovery
ratio of the weight of the shelled corn kernels collected at the main outlet, to the total weight of the corn kernel input of the sheller, expressed in percent

3.26
shelling unit
shelling chamber
part of the sheller where the kernels are detached and separated from the corn cobs

3.27
table-fed type
type of corn sheller wherein the ear corn are fed into shelling chamber with the application of external force

3.28
unshelled kernels
kernels that remain in the cob after shelling

3.29
unshelled loss
ratio of the weight of corn kernels that remained in the cobs of the corn fed into the shelling chamber, to the weight of the total corn kernel input of the sheller, expressed in percent

3.30
whole kernels
unbroken kernels after shelling

4 Classification

The classification of corn sheller shall be based on the following:

4.1 Application

4.1.1 Corn Husker-Sheller

4.1.2 Corn Sheller

4.2 Method of feeding

4.2.1 Hopper-fed type

4.2.2 Table-fed type

4.3 Shelling unit

4.3.1 Cylinder –type

4.3.1.1 Number of cylinder

4.3.1.1.1 Single cylinder

4.3.1.1.2 Multi-cylinder

4.3.1.2 Type of cylinder

4.3.1.2.1 Closed-frame cylinder

4.3.1.2.2 Open-frame cylinder

4.3.2 Disc-type

5 Materials of Construction

5.1 Steel bars and metal sheet or plate shall be generally used in the manufacture of the different components of corn sheller.

5.2 Shelling elements shall be made of carbon steel (AISI 1040-1055 or its ISO equivalent).

6 Performance and Other Requirements

6.1 The performance criteria for corn sheller shall be as specified in Table 1.

6.2 Sealed type bearings shall be used as protection against dust. There shall be provision for lubrication of non-sealed type bearings and bushings.

Table 1 – Performance Criteria for Corn Sheller

Criteria	Performance Data
Shelling Recovery, percent, minimum	97.0
Shelling Efficiency, percent, minimum	99.5
Losses, percent, maximum a) Blower b) Separation c) Unshelled d) Scattering	 1.0 1.0 0.5 0.5
Purity, percent, minimum	98.0
Mechanically Damaged Kernel, percent, maximum	3.0
Net Cracked Kernel, percent, maximum	5.0
Noise Level [db(A)], maximum	100*

* Allowable noise level for two (2) hours of continuous exposure based on Occupational Safety and Health Standards, Ministry of Labor, Philippines. 1983.

6.3 Belt guard or cover and provisions for belt tightening and adjustments shall be provided.

7 Workmanship and Finish

7.1 Corn sheller shall be free from manufacturing defects that may be detrimental to its operation. The welding shall be satisfactory in all aspects and should not be brittle and porous.

7.2 All exposed metallic surfaces shall be free from rust and shall be painted properly.

7.3 Corn sheller shall be free from sharp edges and surfaces that may hurt the operator.

7.4 Rotating parts should be dynamically balanced.

8 Warranty for Construction and Durability

8.1 The construction shall be rigid and durable without major breakdown of the following components: fan, shelling mechanism and separating mechanism within six (6) months.

8.2 Warranty shall be provided for parts and services within six (6) months after the purchase of the sheller, except on fast moving and easy to wear parts such as belts.

9 Maintenance and Operation

9.1 Each corn sheller unit shall be provided with ear plugs or ear muffs, dust masks and the following basic tools: three (3) pieces open wrenches; one (1) piece each of Philips and flat screw driver; and one (1) piece adjustable wrench.

9.2 An instruction manual which conforms to PAES 102:2000 shall be provided.

10 Testing

The sampled corn sheller shall be tested in accordance with PAES 207:2000 – Agricultural Machinery: Power-Operated Corn Sheller – Methods of Test.

11 Marking and Labeling

Each corn sheller shall be marked at prominent place with the following information:

11.1 Registered trademark of the manufacturer

11.2 Brand

11.3 Model

11.4 Serial number

11.5 Name and address of the manufacturer

11.6 Country of manufacture/Made in the Philippines

11.7 Power requirement, kW

11.8 Recommended shelling cylinder speed, rpm

11.9 Date of testing and name of testing agency

11.10 Safety/Precautionary markings