

PHILIPPINE NATIONAL STANDARD

**PNS/BAFS PAES 241:2018
ICS 65.060.50**

Agricultural Machinery – Corn Combine Harvester – Specifications



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Foreword

The Philippine National Standard (PNS) for Agricultural Machinery – Corn Combine Harvester - Specifications (PNS/BAFS PAES 241:2018) has been prepared by the Technical Working Group (TWG) for Various Agricultural Machinery as per approved Department of Agriculture Special Order No. 1045 series of 2016.

This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2.

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.

1 Scope

This standard specifies the fabrication and performance requirements for self-propelled corn combine harvester.

2 Normative References

The following documents are referred to in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 4254-7:2017, *Agricultural machinery -- Safety -- Part 7: Combine harvesters, forage harvesters, cotton harvesters and sugar cane harvesters*

PAES 101:2000, *Agricultural Machinery – Technical Means for Ensuring Safety – General*

PNS/PAES 102:2000, *Agricultural Machinery – Operator’s Manual – Content and Presentation*

PAES 103:2000, *Agricultural Machinery – Method of Sampling*

PNS/PAES 139:2004, *Agricultural Machinery – Roll – Over Protective Structure (ROPS) – Specifications*

PNS/PAES 311:2001, *Engineering Materials – Bolts and Nuts for Agricultural Machines – Specifications and Applications*

PNS/PAES 313:2001, *Engineering Materials – Screws for Agricultural Machines – Specifications and Applications*

PNS/BAFS/PAES 192:2016, *Agricultural Machinery – Guidelines on After-Sales Service*

PNS/BAFS PAES 242:2018 *Agricultural Machinery - Corn Combine Harvester – Methods of Test*

3 Terms and Definitions

For the purpose of this standard, the following terms and definitions shall apply.

3.1

canopy

protective roof covering mounted on the corn combine harvester frame

3.2

cleaning fan

blower/aspirator

rotary device which induces a flow of air across the shaker shoe to blow away or aspirate the materials or impurities lighter than kernels

3.3

concave

semi- cylindrical, stationary element partially or fully surrounding the shelling cylinder or shelling rotor, fitted primarily for shelling

3.4

corn combine harvester

machine which performs a combination of harvesting (cutting, picking, or snapping corn ear) and dehusking; shelling; separating; cleaning; and conveying kernels into a holding bin and discharging harvest residue onto the ground

3.5

corn ear

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

3.6

crop elevator

part of the corn combine harvester used to convey and feed the corn ear to the shelling cylinder

3.7

cracked kernels

kernels which show any signs of fissures, fractures and/or splinters

3.8

head

header

feed table

part of the corn combine harvester comprising the mechanism for gathering, and cutting, picking or stripping the corn ear

3.9

harvesting loss

corn ears that remain unharvested during the combine harvesting operation

3.10

holding bin

kernel tank

kernel hopper

used to hold the kernels during operation prior to manual (bagging) or bulk unloading

3.11

impurities

all foreign matters other than kernels such as leaves, weeds, stones, etc.

3.12

kernel

physiologically matured seed developed from the ovary of the corn ear

3.13

kernel elevator

part of the corn combine harvester used to carry the kernels to the kernel tank or kernel hopper

3.14

mechanically damaged kernels

output kernels that were broken and/or scratched due to the corn combine harvesting

3.15

net cracked kernel

difference between the percent cracked sample taken before and after the corn combine harvesting

3.16

purity

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

3.17

reel

revolving slats or arms with tines arranged parallel to the cutter bar to gather the corn stalk to the cutter bar

3.18

shelling cylinder

shelling drum

part of the shelling unit that rotates about an axis and it is equipped with shelling elements such as pegs or rasp bars on its periphery

3.19

shelling unit

shelling chamber

part of the sheller where the kernels are detached and separated from the corn cobs

3.20

total kernel input

summation of cleaned kernels and losses expressed in kilograms, kg

3.21

unshelled kernels

kernels that remain in the cob after shelling

3.22

unshelled loss

ratio of the weight of unshelled kernels to the weight of the total kernel input of the sheller, expressed in percent

4 Classification

The classification of corn combine harvester should be according to the following but not limited to the following.

4.1 Types of Traction

4.1.1 Wheel type

Corn Combine harvester with pneumatic wheels.

4.1.2 Track type (Crawler type)

Corn Combine harvester fitted with full tracks.

4.1.3 Half-Track type

Corn Combine harvester fitted with both half-track and pneumatic wheels at the rear for steering.

4.2 Unloading mechanism

4.2.1 For bulk unloading, there should be an unloading auger that will transfer the kernel out of the holding bin to a kernel trailer or truck.

4.2.2 For manual unloading, two or three spout bag attachment and a platform with bagger's seat should be provided.

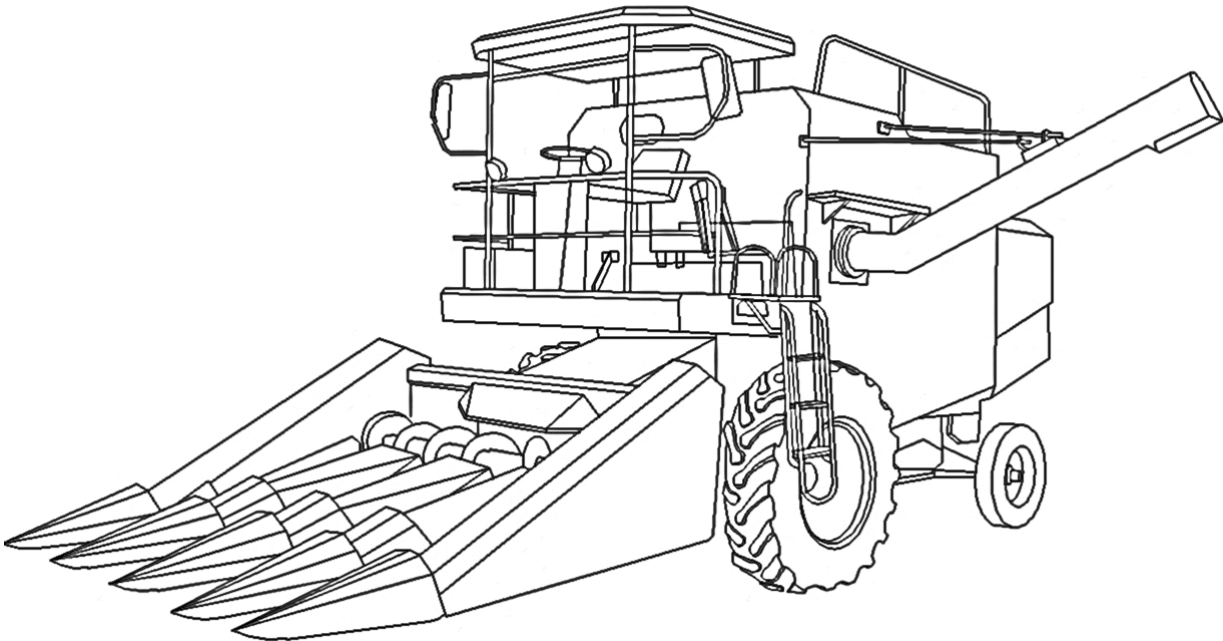


Figure 1 - Typical Corn Combine Harvester

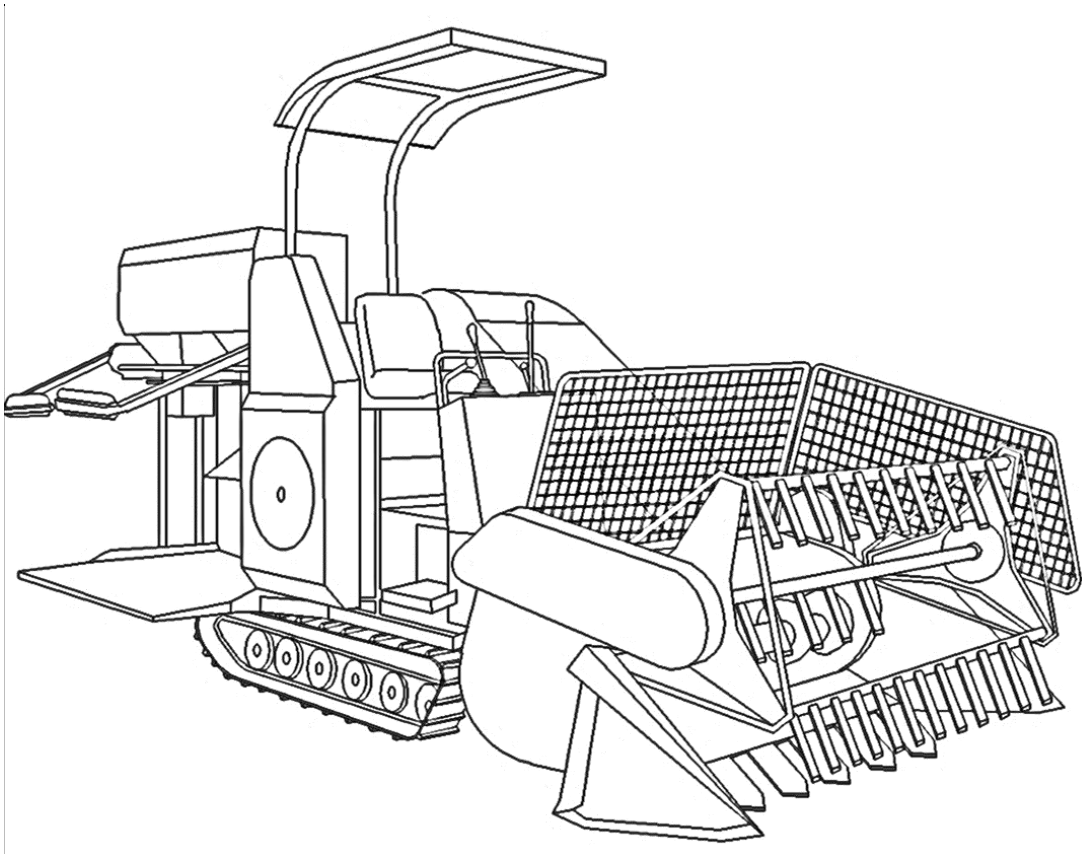


Figure 2 - Modified Combine Harvester

5 Fabrication Requirements

5.1 Steel bars, metal sheets, shall be generally used for the fabrication of the different components of corn combine harvester. Primary components such as reel assembly and pick-up tines shall be made of either stainless steel, steel alloys or any abrasion-resistant coated materials.

5.2 The serrated edge of the cutting knife shall be case hardened at Rockwell C Scale (RC) 46 to RC 52 for AISI 1080 to AISI 1085. The non-hardened portion of the cutting knife shall have hardness within the range of RC 25 to RC 27.

5.3 Shelling elements shall be made of alloy steel, or heat-treated carbon steel with carbon content of 0.40% - 0.45% (AISI 1040 to AISI 1045 or its equivalent).

5.4 Bolts and nuts, screws, bearings, bushing and seals to be used shall conform to the food safety requirements, PAES or other international standards.

5.5 The common components of the corn combine harvester are as seen in Figure 3. The following is the list of its major assemblies.

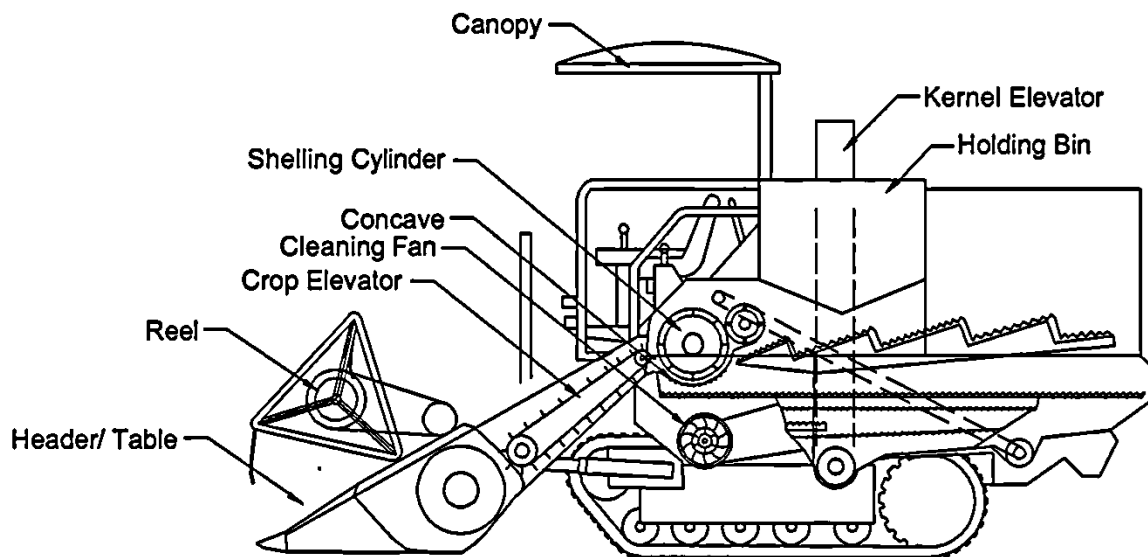


Figure 3 - Typical Design of Corn Combine Harvester

5.5.1 Corn Combine Harvester Header or Feed Table

5.5.1.1 Header or table should be composed of reel assembly, fluted rollers and cutter bar.

5.5.1.2 The reel shall be adjustable vertically to suit different corn stalks conditions such as height.

5.5.1.3 Header shall be adjustable to fit various height of cut.

5.5.2 Feeding unit

5.5.2.1 Feeding unit should be composed of feeder or conveyor and front beater or corn ear elevator.

5.5.2.2 There should be a reverse mechanism.

5.5.3 Shelling unit

5.5.3.1 Shelling unit should be composed of shelling drum, concaves, open grates, and beaters or stripper drum.

5.5.3.2 Concaves should be adjustable to change the clearance between the concave and the cylinder.

5.5.4 Separating unit

Separating unit shall be provided with deflectors, rotary beaters or retarders to regulate the movement of the cob and to deflect flying kernels.

5.5.5 Cleaning unit

5.5.5.1 Cleaning operation shall be mechanical (i.e. screening out larger impurities with the chaffer and sieves) and aerodynamics (i.e. blowing out the lighter impurities with an air blast).

5.5.5.2 Cleaning unit should consist of kernel pan, chaffer with adjustable openings, tailings auger, sieves with adjustable position and inclination, and blower. Cleaning fan speed should be adjustable.

5.5.6 Cob/Stalk handling unit

Cob/stalk handling unit should be composed of any of the following: stalk spreader; chaffs spreader; and plain cob ejector or beater.

5.5.7 Kernel handling unit

5.5.7.1 Kernel handling unit should be composed of auger, kernel conveyor and collector or tank. The tank shall be designed to minimize the bridging of kernels. Steps and handrails outside the collector tank shall be provided.

5.5.8 Operator’s Seat

5.5.8.1 Operator’s seat and the location of specific controls relative to the Seat Index Point (SIP) within the seating accommodation shall conform to PAES 139:2004.

5.5.8.2 For the operator’s safety, the operator’s seat cover should be heat insulated.

5.5.8.3 Protective guards/screens located at the front of the operator and side of the header shall be provided.

5.5.9 Traction

Traction should be made of either wheels, tracks or combination.

6 Performance Requirements

The performance criteria for corn combine harvester shall be as specified in Table 1.

Table 1 - Performance criteria for corn combine harvester

Criteria	Performance Data
Harvesting loss (%), maximum	3.0
Separation Loss (%), maximum	1.5
Unshelled loss (%), maximum	0.5
Purity (%), minimum	97
Mechanically Damaged Kernel (%), maximum	3.0
Net cracked kernels (%), maximum	5.0
Total Grain Loss (%), maximum	2.0

7 Safety, Workmanship, and Finish

7.1 Safety requirements shall conform to ISO 4254-7. Warning notices shall be provided in accordance with PAES 101:2000.

7.2 Corn combine harvester shall be fitted with slow-moving vehicle (SMV) emblem (Figure 4). The emblem shall be located at the rear of the corn combine harvester with dimensional requirement.

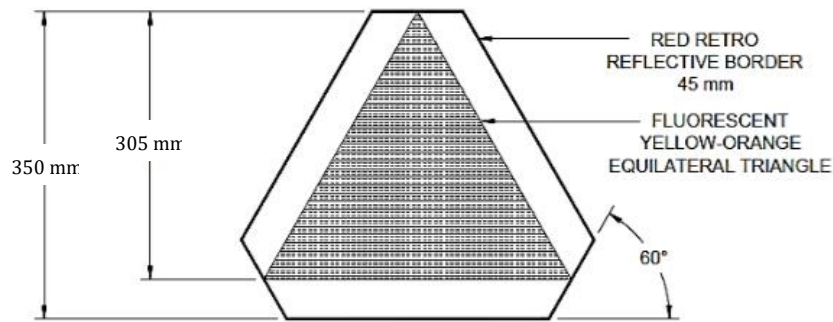


Figure 4 - Slow-moving vehicle emblem

- 7.3 Head and tail lights shall be provided.
- 7.4 The noise level should conform with the provisions given in Annex A.
- 7.5 There shall be ear muffs or other ear protective device provided for the operators to use when 95 db is exceeded during operation.
- 7.6 The corn combine harvester shall be free from manufacturing defects that may be detrimental to its operation.
- 7.7 Any metallic surfaces shall be free from rust.
- 7.8 Picking section shall be coated with anti-corrosive paint.
- 7.9 The corn combine harvester shall be free from sharp edges and surfaces that may injure the operator except for cutting blades.
- 7.10 Rotating parts shall be dynamically balanced.
- 7.11 All moving parts treated as dangerous to the operators shall be provided with safety features in accordance with PAES 101:2000.

8 Warranty for Fabrication and Services

Warranty shall be provided for parts and services except for normal wear and tear of expendable or consumable maintenance parts for at least one (1) year upon the acceptance of procuring entity of the machinery. General requirements of the warranty shall conform to PNS/BAFS/PAES 192:2016.

9 Maintenance and Operation

9.1 Each unit of corn combine harvester shall be provided with a set of manufacturer's standard tools required for maintenance.

9.2 Operator's manual based on PAES 102:2000, maintenance schedule, and list of non-warrantable parts of corn combine harvester shall be provided.

9.3 The corn combine harvester shall be easy to clean and operate.

10 Sampling

The corn combine harvester should be sampled for testing in accordance with PAES 103:2000 or any other suitable method.

11 Testing

Corn combine harvester shall be tested in accordance with PNS/BAFS PAES 242:2018.

12 Marking and Labeling

12.1 Each unit of corn combine harvester shall be provided with one (1) or several nameplates marked using a stencil or by directly punching it in the plate. This shall be positioned at the most visible place containing the following information:

12.1.1 Registered trademark of the manufacturer

12.1.2 Brand

12.1.3 Model

12.1.4 Year of Manufacture

12.1.5 Serial number

12.1.6 Name, address and contact number of the manufacture/ importer/ distributor

12.1.7 Country of manufacture/origin (if imported) / "Made in the Philippines" (if manufactured in the country)

12.1.8 Rated field capacity, ha/h

12.1.9 Power requirement, kW

12.2 Safety/precautionary markings shall be provided. It shall be stated in English and Filipino and printed in red color with white background.

12.3 The markings shall be durably bonded with the base surface material. It shall be all weather resistant and under normal cleaning procedures, it shall not fade, discolor, crack or blister and remain legible.

Annex A
(informative)

Occupational Safety and Health Standard (Rule 1074.01 – 1074.03)

A.1 Threshold Limit Values for Noise

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.

Feasible administrative or engineering controls shall be utilized when workers are exposed to sound levels exceeding those specified in Table 2 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.

A.2 Permissible Noise Exposure

A.2.1 The values specified in Table 2 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.

Table 2 - Permissible Noise Exposure

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

A.2.2 If the variation in noise level involves maximum intervals of one (1) second or less, it shall be considered as continuous. If the interval is over one (1) second, it becomes impulse or impact noise.

A.2.3 When the daily noise exposure is composed of two or more periods noise exposure of different levels, their combined effect should be considered rather than the effect of each.

If the sum of Equation A exceeds one (1), then the mixed exposure should be considered to exceed the threshold limit value. However, the permissible levels found

in the table shall not be exceeded for the corresponding number of hours per day allowed. Noise exposures of less than 90 dBA are not covered by Equation A.

$$X = \frac{C_1}{T_1} + \frac{C_2}{T_2} + \frac{C_3}{T_3} \quad (\text{Equation A})$$

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.2.4 Exposures to impulsive or impact noise shall not exceed 140 dB (A) peak sound pressures level (maximum value).

Bibliography

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- ISO 6508-1:2016 Metallic materials—Rockwell hardness test—Part 1: Test method (scales A, B, C, D, E, F, G, H, K, N, T)
- ISO 6689-1:1997 Equipment for harvesting – Combines and functional components – Part 1: Vocabulary
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- PNS/PAES 208:2000 – Agricultural Machinery – Power-Operated Corn Sheller
- PNS/PAES 224:2015 – Agricultural Machinery – Rice Combine Harvester – Specifications
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