PHILIPPINE NATIONAL STANDARDS FOR RICE AND CORN COMBINE HARVESTER

PNS/PAES 224:2015 - Agricultural Machinery - Rice Combine Harvester - Specifications

PNS/PAES 225:2015 - Agricultural Machinery - Rice Combine Harvester - Methods of Test

PNS/PAES 241:2018 - Agricultural Machinery - Corn Combine Harvester - Specifications

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PHILIPPINE AGRICULTURAL ENGINEERING STANDARD PNS/PAES 225:2015
Agricultural Machinery – Rice Combine Harvester – Methods of Test

1 Scope

This standard specifies the methods of test and inspection for rice combine harvester. Specifically, it shall be used to:

1.1 verify the mechanism, main dimensions, weight, materials and accessories of the rice combine harvester, and the list of specifications submitted by the manufacturer/supplier/dealer;

1.2 determine the performance of the machine;

1.3 evaluate the ease of handling and safety features;

1.4 determine the effect of harvesting on grain quality through laboratory analysis and;

1.5 prepare a report on the results of the tests.

2 Reference

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

PNS/PAES 102:2000 Agricultural Machinery – Operator's Manual – Content and Presentation

PNS/PAES 103:2000 Agricultural Machinery – Method of Sampling

PNS/PAES 205:2015 Agricultural Machinery – Mechanical Rice Thresher – Methods of Test

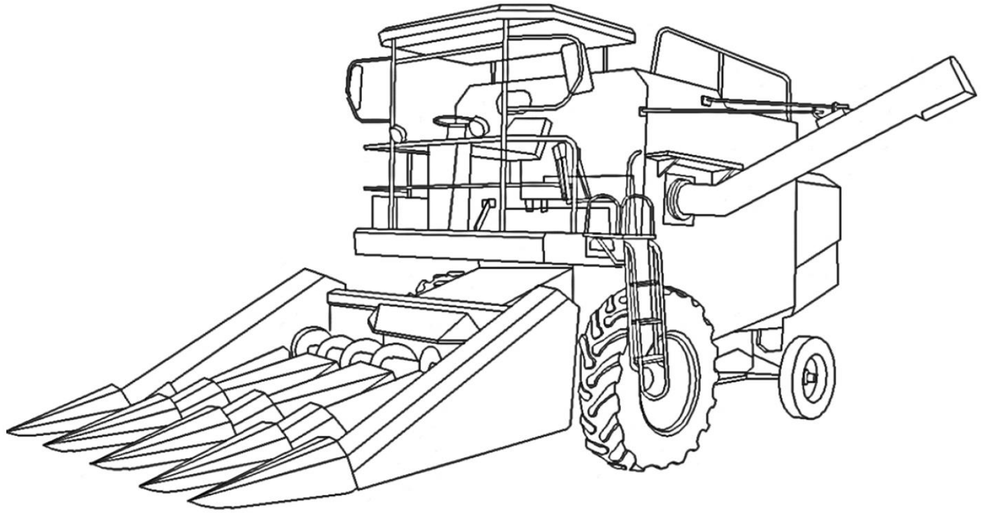
PNS/PAES 213:2015 Agricultural Machinery – Rice Reaper – Methods of Test

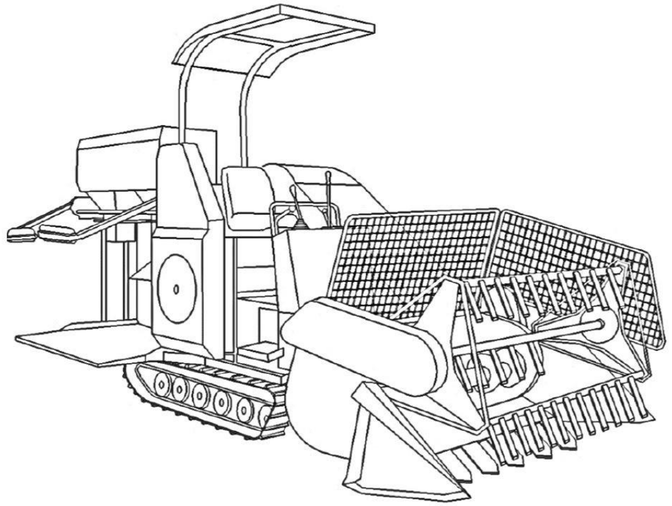
PNS/PAES 224:2015 Agricultural Machinery – Rice Combine Harvester – Specifications

Specifications

Definition:

Corn Combine Harvester - machine which performs a combination of harvesting, dehusking, shelling, separating, cleaning, and conveying kernels into a holding bin





Specifications

Classifications:

Types of Traction

1. Wheel Type

2. Track Type
   (Crawler)

3. Half-Track Type

Specifications

Classifications:

Types of Unloading

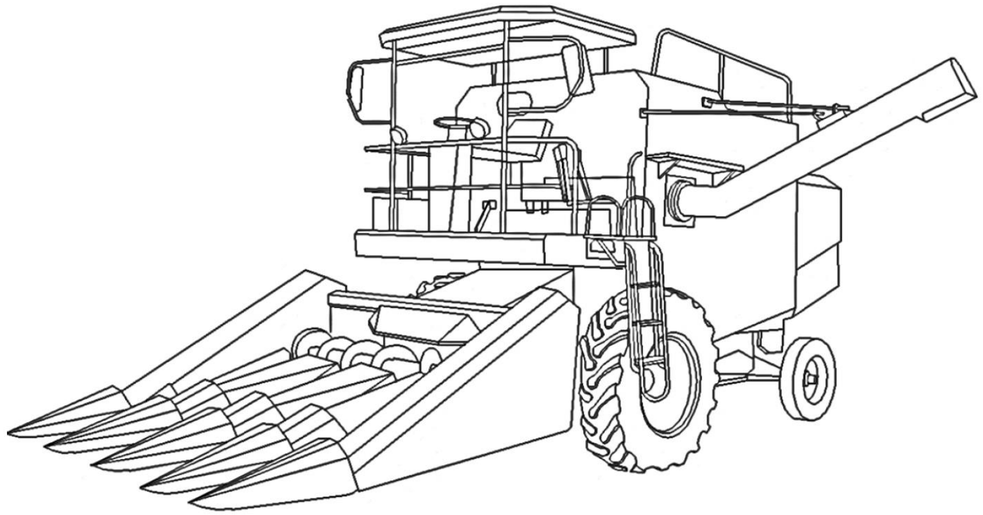
1. Bulk Unloading

2. Manual Unloading

Specifications

Classifications:

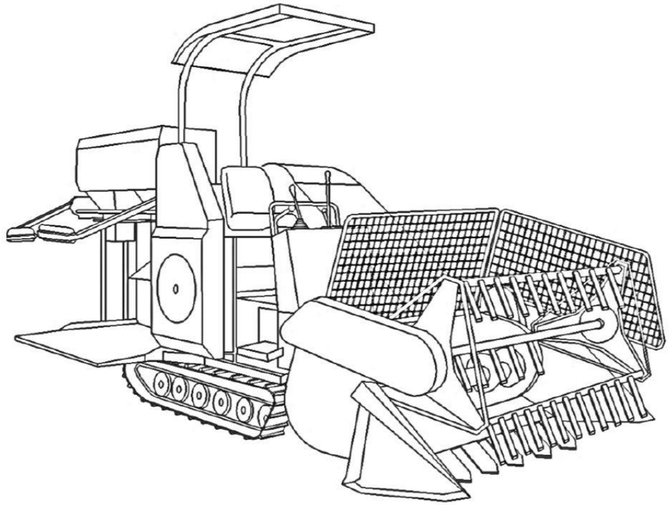
Typical Corn Combine Harvester



Specifications

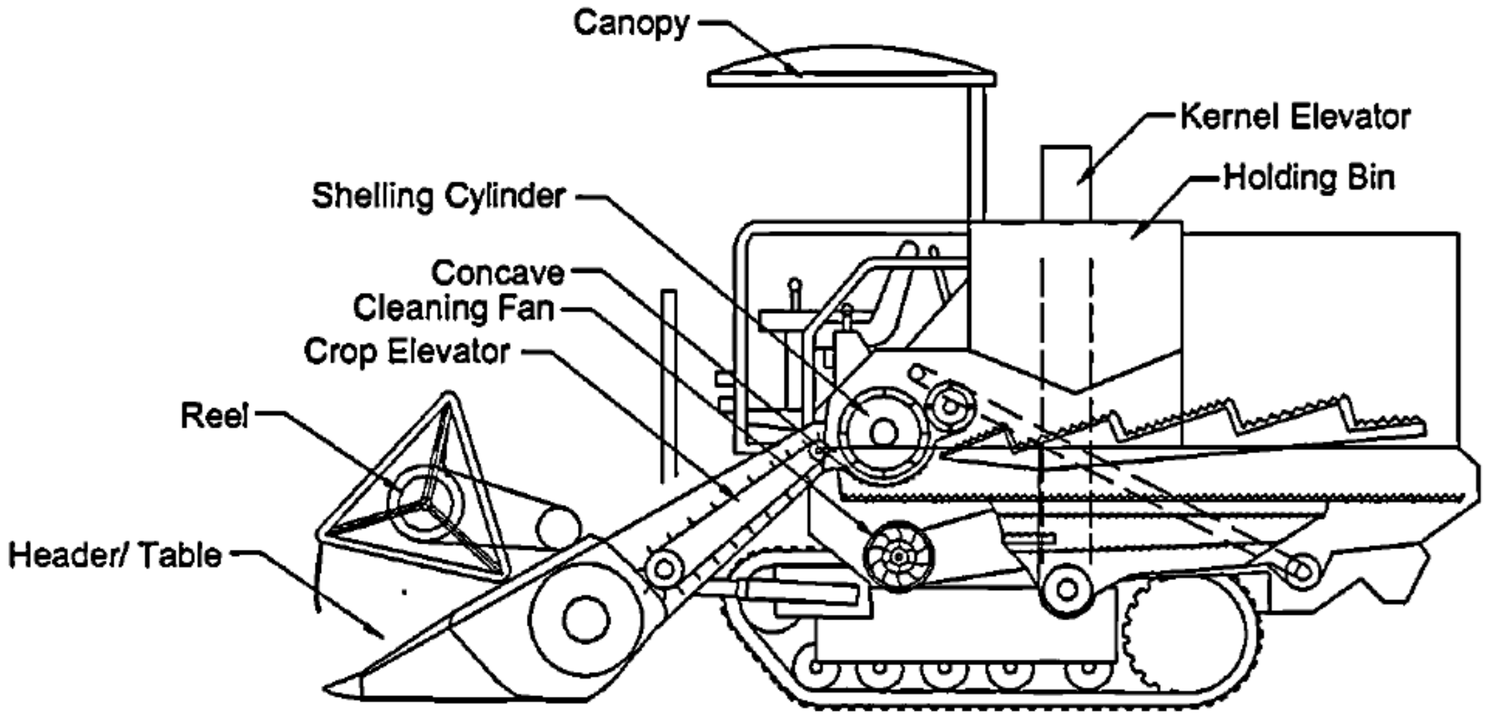
Classifications:

Modified Corn Combine Harvester



Specifications

Common Parts and Components:



Specifications

General Fabrication Requirements:

1. Steel bars and metal sheets shall be generally used for the fabrication of corn combine harvester.

2. Reel assembly, and pick-up tines shall be made of either stainless steel, steel alloys, or any abrasion-resistant coated materials

Specifications

General Fabrication Requirements:

3. 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.

4. The non-hardened portion of the cutting knife shall have hardness within RC 25 to RC 27.

Specifications

General Fabrication Requirements:

5. Bolts and nuts, screws, bearings, bushing and seals shall conform to the food safety requirements, PAES or otner international standards.

Specifications

Header or Feed Table Requirements:

1. The header should be composed of reel assembly, fluted rollers, and cutter bar.

2. The reel shall be adjustable vertically to suit different corn stalk height.

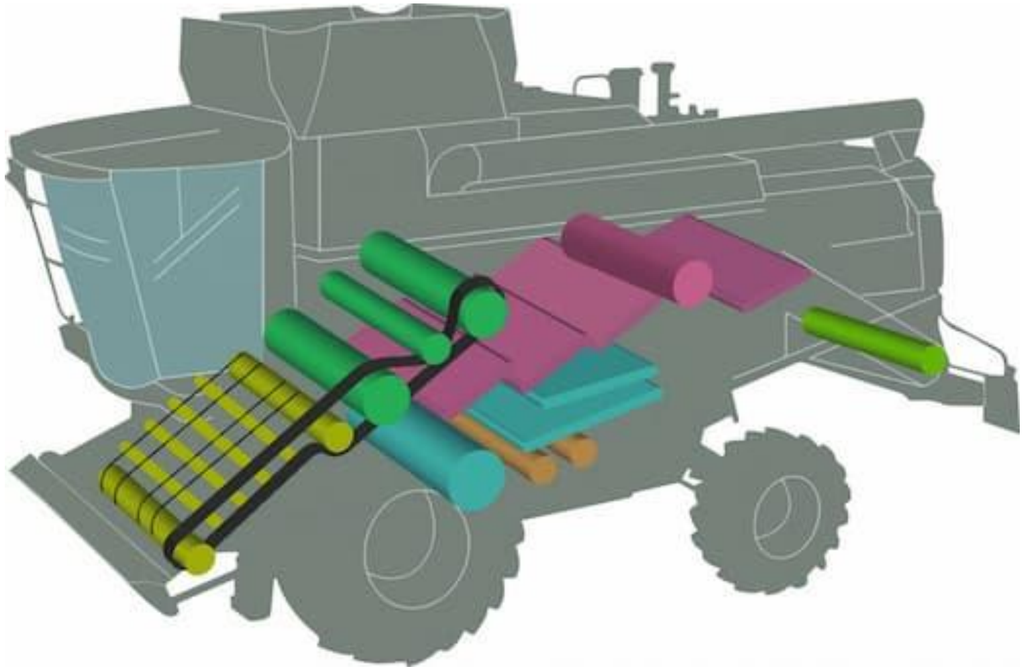
3. The header shall be adjustable vertically to fit various height of cut.

Specifications

Feeding Unit Requirements:

1. The feeding unit should be composed of feeder or conveyor and front beater or corn ear elevator.

2. There should be a reverse mechanism.

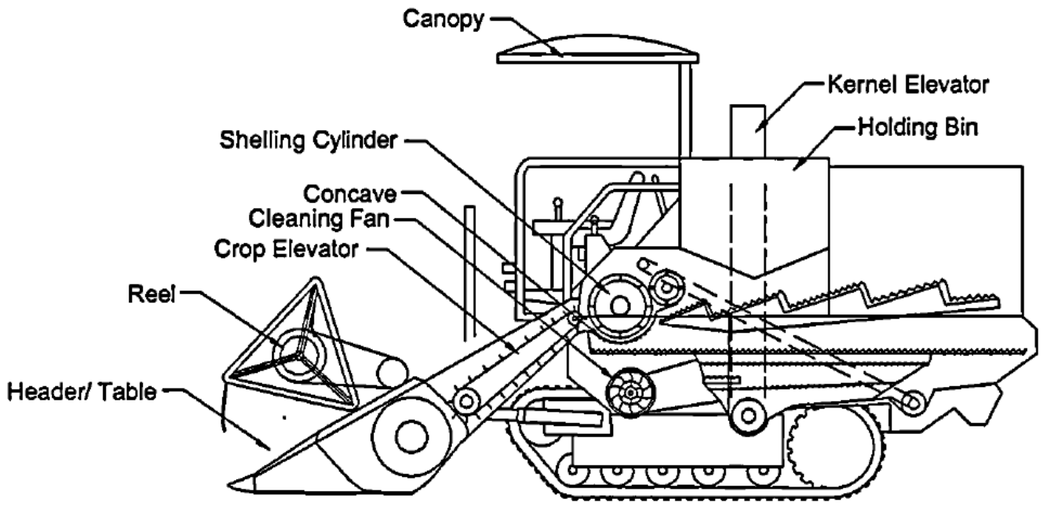


Specifications

Shelling Unit Requirements:

1. The shelling unit should be composed of shelling drum, concaves, open grates, and beaters or stripper drums.

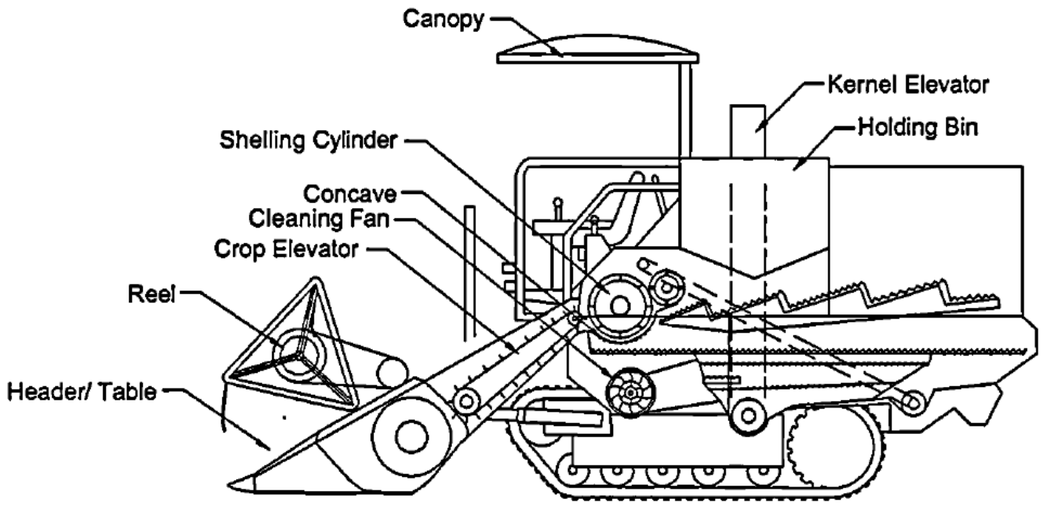
2. Concaves should be adjustable to change the clearance between the concave and the cylinder.



Specifications

Separating Unit Requirements:

1. The separating unit shall be provided with deflectors, rotary beaters to regulate the movement of the cob and to deflect flying kernels.

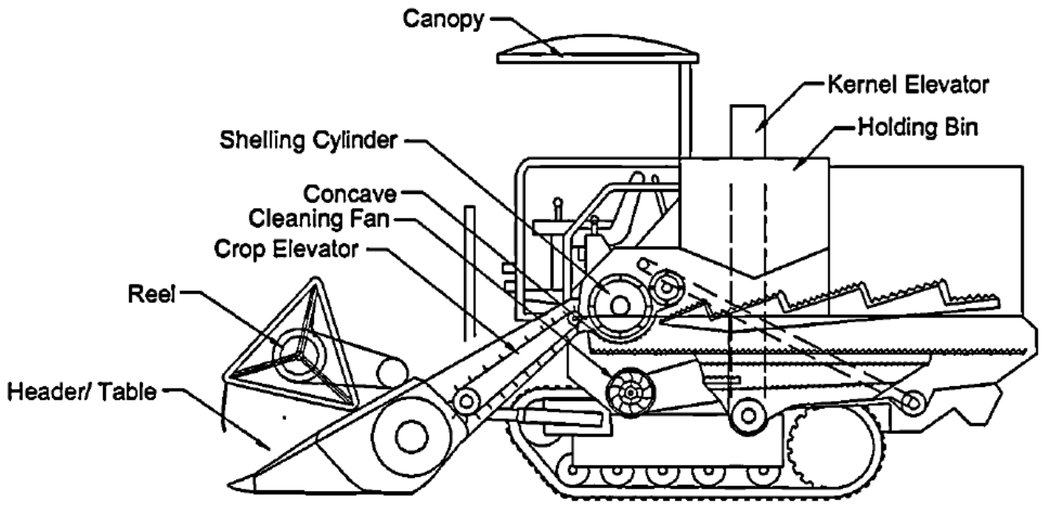


Specifications

Cleaning Unit Requirements:

1. The cleaning operation shall be mechanical using screens and blowers.

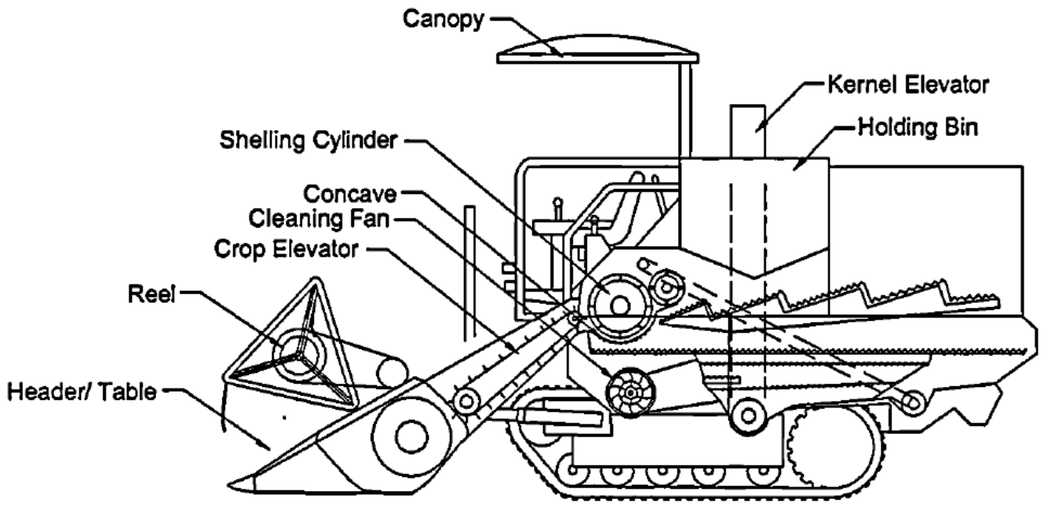
2. The cleaning unit should consist of kernel pan, chaffer with adjustable openings, tailings auger, sieves with adjustable position and inclination, and adjustable blower.



Specifications

Cob/Stalk Handling Unit Requirements:

1. The cob/stalk handling unit should be composed of stalk spreader, chaffs spreader, and plain cob ejector or beater.



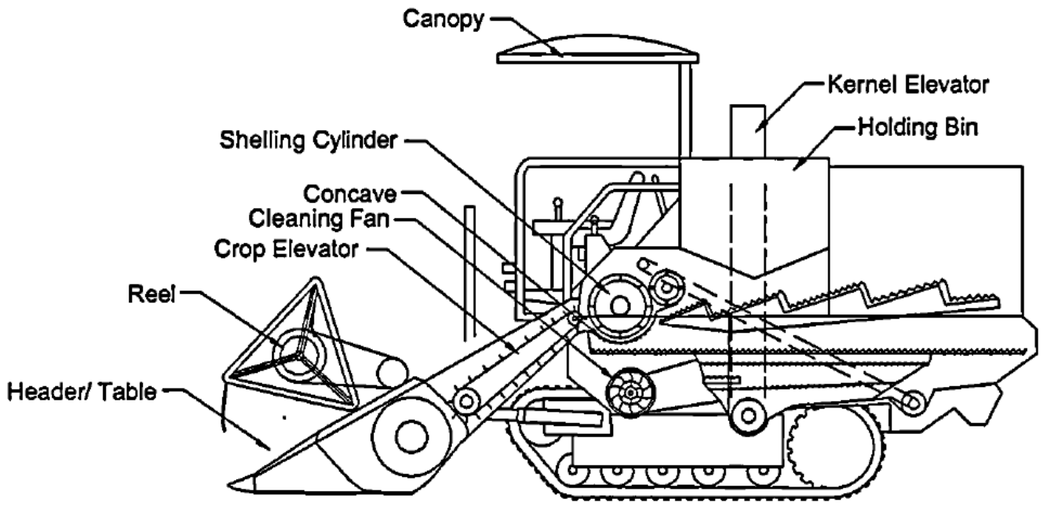
Specifications

Kernel Handling Unit Requirements:

1. The kernel handling unit should be composed of auger, kernel conveyor, and collector or tank.

2. The tank shall minimize the bridging of kernels.

3. Steps and handrails for the collector tank shall be provided.



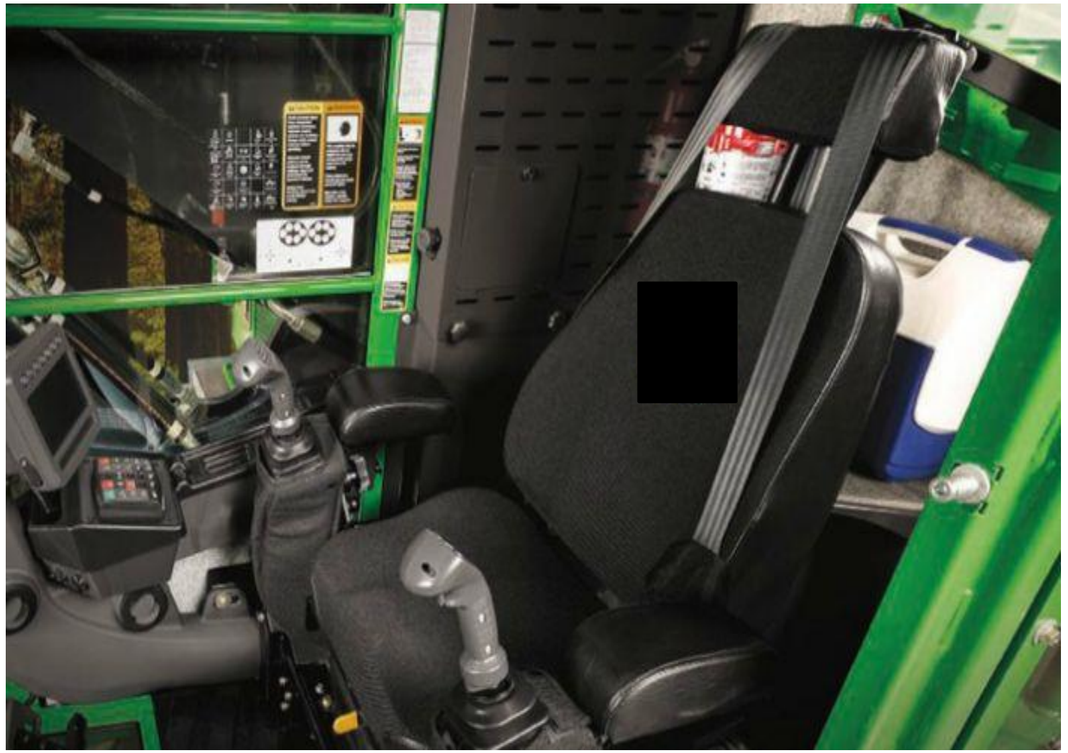
Specifications

Operator’s Seat Requirements:

1. The operator’s seat and control locations relative to the Seat Index Point (SIP) shall conform to PAES 139:2004.

2. The seat cover should be heat insulated.

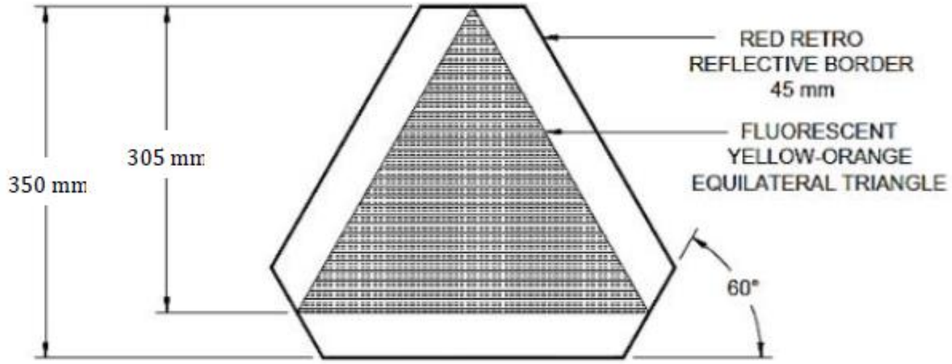
3. Protective guards/screens located at the front of the operator and side of the header shall be provided.



Specifications

Safety, Workmanship, and Finish:

1. Safety requirements shall conform to ISO 4254-7. Warning notices shall be provided in accordance with PAES 101:2000.
2. Corn combine harvester shall be fitted with slow-moving vehicle (SMV) emblem at the rear.
3. Head and tail lights shall be provided.
4. The noise level should conform with the Occupational Safety and Health Standard (Rule 1074.01 - 1074.03).
5. Ear protective device shall be provided if 95 dB(A) is exceeded during operation.



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

Specifications

Safety, Workmanship, and Finish:

6. The machine shall be free from manufacturing defects.
7. Any metallic surfaces shall be free from rust.
8. Picking section shall be coated with anti-corrosive paint.
9. The machine shall be free from sharp edges and surfaces that may injure the operator (except cutting blades)
10. Rotating parts shall be dynamically balanced.
11. All moving parts shall be provided with safety features in accordance with PAES 101:2000.

Specifications

Performance Requirements

Criteria	Performance Data	Definition
Harvesting Loss (%), maximum	3.0	Kernels left in the test area after harvesting over input kernels
Separation Loss (%), maximum	1.5	Shelled kernels from the cob and husk output over input kernels
Unshelled Loss (%), maximum	0.5	Unshelled kernels from the kernel, husk, and cob output over input kernels
Purity (%), minimum	97	Weight of cleaned kernels over weight of uncleaned kernels
Mechanically Damaged Kernel (%), maximum	3.0	Ouput kernels that were broken and/or scratched due to the corn combine harvester mechanisms
Net Cracked Kernels (%), maximum	5.0	Cracked kernels due to the corn combine harvester mechanisms
Total Grain Loss (%), maximum	2.0	Summation of losses (harvesting, separation, and unshelled)

Methods of Test

Definitions:

Effective Field Capacity - actual area covered over total operating time (ha/h)

Theoretical Field Capacity - computed rate of harvesting based on effective width and actual travelling speed (ha/h)

Field Efficiency - effective field capacity over theoretical field capacity (%)

Potential Yield - estimated yield per unit area (tons/ha)

Fuel Consumption - fuel consumption per unit time of operation (L/h)

Methods of Test

Fomulas:

Effective Field Capacity

$$efc = \frac{A_T}{T}$$

where:

efc	is the actual field capacity (ha/h)
A_T	is the area covered during test (ha)
T	is the total operating time (h)

Theoretical Field Capacity

$$tfc = \frac{WS_A}{10}$$

where:

tfc	is the theoretical field capacity (ha/h)
W_C	is the working width (m)
S_A	is the average Operating speed (km/h)

Field Efficiency

$$\varepsilon_f = \frac{efc}{tfc} \times 100$$

where:

Eff	is the field efficiency (%)
EFC	is the effective field capacity (ha/h)
TFC	is the theoretical field capacity (ha/h)

Fuel consumption

$$FC = \frac{F}{T}$$

where:

FC	is the fuel consumption (L/h)
F	is the amount of fuel consumed (L)
T	is the total operating time (h)

Methods of Test

Fomulas:

Total Kernel Input

$$TKI = W_{CS} + L_T$$

where:

TKI	is the total kernel input (kg)
W_{CS}	is the weight of cleaned shelled kernels (kg)
L_T	is the summation of all losses (kg)

Unshelled loss

Amount

$$US_W = \frac{W_{Us}}{D_C} \times T$$

where:

US_W	is the unshelled loss (kg)
W_{Us}	is the weight of unshelled clean kernel (kg)
D_C	is the duration of collection (h)
T	is the total operating time (h)

Percentage

$$US_P = \frac{US_W}{TKI} \times 100$$

where:

US_P	is the unshelled loss (%)
US_W	is the unshelled loss (kg)
TKI	is the total kernel input (kg)

Methods of Test

Fomulas:

Total Grain Loss

$$TGL = \frac{L_T}{TKI} \times 100\%$$

where:

L_T is the summation of all losses (kg)
TKI is the total kernel input (kg)

Purity

$$P = \frac{W_C}{W_U} \times 100$$

where:

P is the purity (%)
W_U is the weight of uncleaned kernel (g)
W_C is the weight of cleaned kernel (g)

Mechanically Damaged or Broken kernels

$$B_K = \frac{W_{BK}}{T_W} \times 100$$

where:

B_K is the mechanically damaged or Broken kernels (%)
W_{BK} is the weight of broken kernels (kg)
T_W is the total weight of the sample (kg)

Harvesting Recovery

$$HR = \frac{SK}{P_Y} \times P \times 100\%$$

where:

HR is the harvesting recovery (%)
SK is the total cleaned shelled kernel (kg)
P_Y is the potential yield (kg)
P is the purity

Cracked kernels

$$NC_K = \frac{C_{ME} - C_{MA}}{100\ kernel\ sample} \times 100$$

where:

NC_K is the net cracked kernels (%)
C_{ME} is the number of cracked kernels due to mechanical
ng
C_{MA} is the number of cracked kernels due to manual shelling

Methods of Test

General Conditions of Test and Inspection:

Selection of corn combine harvester to be tested

The machine to be tested should be in accordance with PAES 103:2000 or any suitable method of selection.

Role of test applicant

The test applicant shall submit a complete machine specifications and operator's manual of the machine.

Role of the test applicant's representative

The representative shall only be allowed to operate, demonstrate, adjust, and repair the machine and decide on matters related to the operation of the machine.

Methods of Test

General Conditions of Test and Inspection:

Suspension/Termination of test

1. If the machine stops due to breakdown or malfunction that can affect the machine's performance, the test may be suspended

2. If the test area does not conform to the standards and requirements of testing agency.

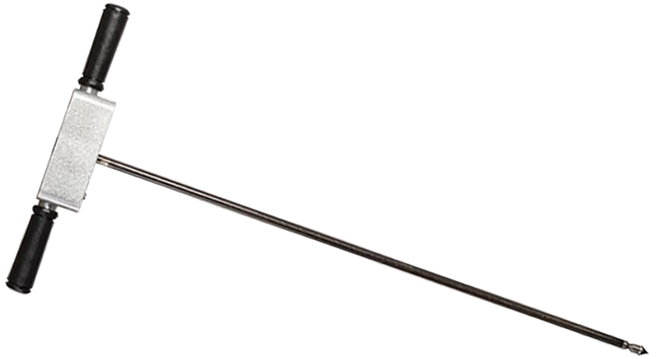
Test Area Requirements:

a. Completely dried
b. Enough for 3 test trials
c. Each trial area is rectangular, 1000 m^2, side ratio of 2:1
d. Corn plant shall be locally grown
e. Corn ear shall be ready for harvesting and at 28% moisture content at maximum

Methods of Test

Test Instruments:

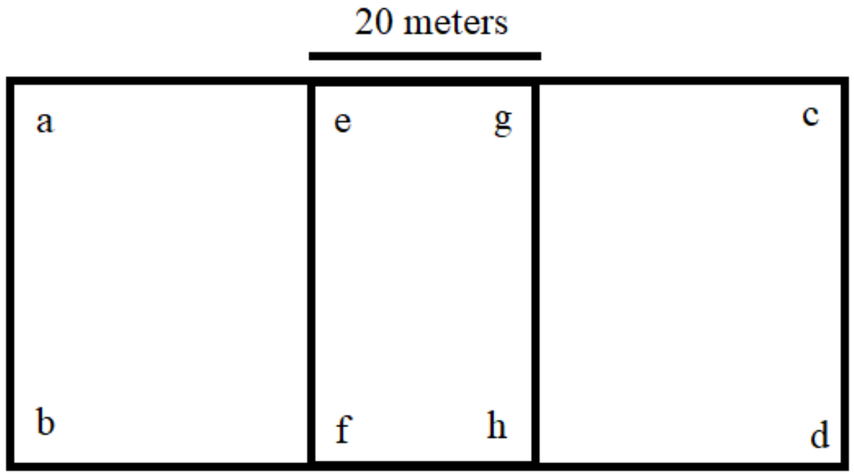
1. Stopwatch
2. Steel Tape and Caliper
3. Long Tape
4. Graduated Cylinder
5. Marking Pegs
6. Upland Penetrometer
7. Sound Level Meter



Methods of Test

Before Performance Test:

1. Running-in and preliminary adjustments of the corn combine harvester
2. Measure the specifications of the machine
3. Take pictures of the machine, area, and corn samples
4. Obtain the machine settings, plant variety, plant population per m^2, row spacing, and plant maturity
5. Setup the area for each test trial



Methods of Test

Before Performance Test:

Specifications of the Corn Combine Harvester

Name of Applicant : _____
Address : _____
Tel. No. : _____

Name of Manufacturer : _____
Address : _____
Tel. No. : _____

GENERAL INFORMATION

Make : _____ Type : _____
Serial No. : _____ Brand/Model : _____
Year of Manufacture : _____
Testing Agency : _____ Test Engineer : _____
Location of Test : _____ Date of Test : _____

ITEM	Manufacturer's Specifications	Verification by the Testing Agency
B.1 Overall dimensions		
B.1.1 Length, mm		
B.1.2 Width, mm		
B.1.3 Height, mm		
B.3 Machine condition		
B.3.1 No. of rows		
B.3.2 Harvesting method		
B.3.3 Working width, mm		
B.3.4 Harvesting speed, kph		
B.4 Traction Type		
B.5 Field capacity, ha/h		
B.6 Engine		
B.6.1 Brand		
B.6.2 Model		
B.6.3 Serial Number		
B.6.4 Type (stroke/ignition)		
B.7 Safety Features (enumerate)		

Methods of Test

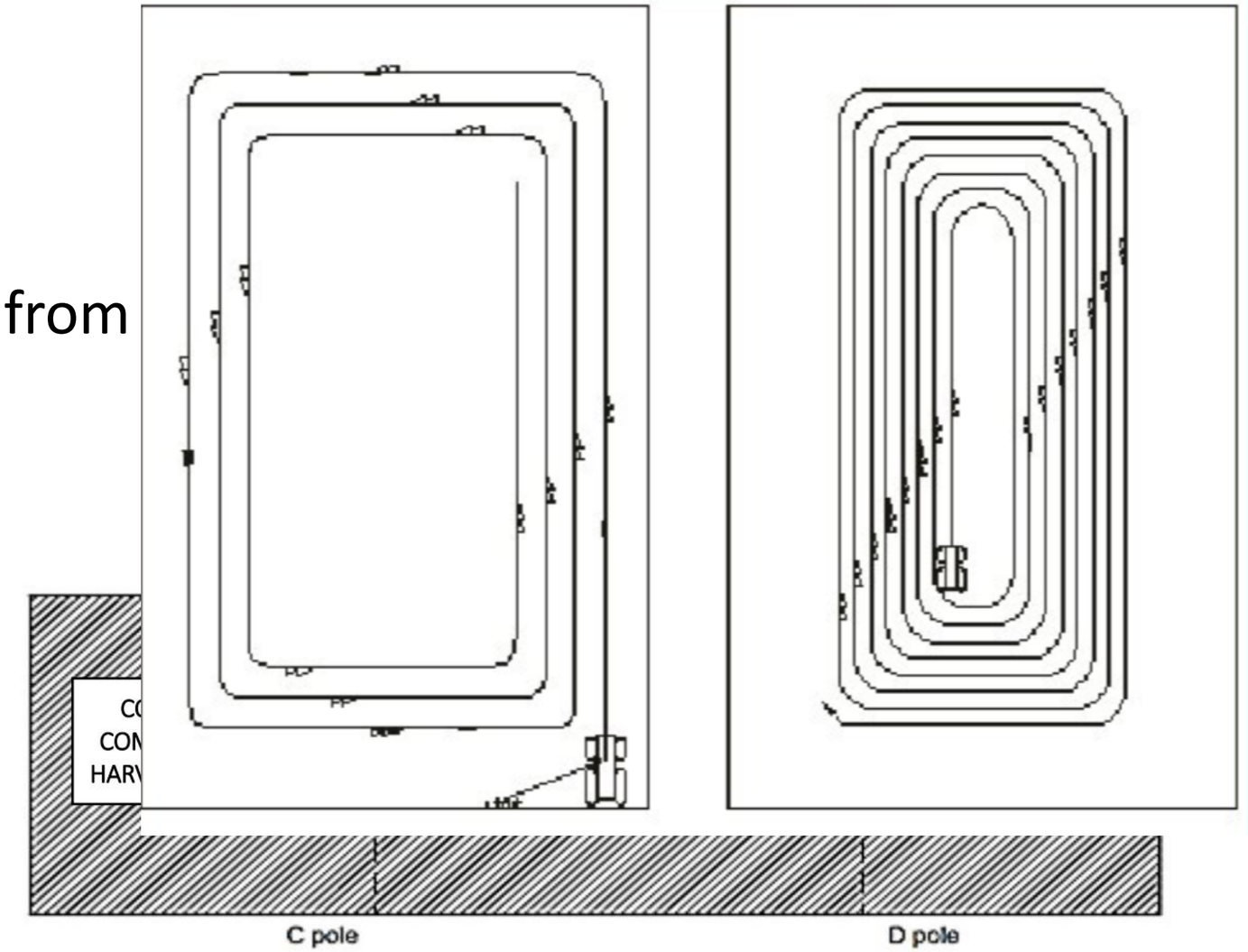
Before Performance Test:

5. Measure soil hardness
6. Measure crop height
7. Randomly select three 3 meter columns with the harvesters effective width
8. Count the number of corn ears within the selected areas
9. Collect test samples from the selected areas by manual harvesting

Methods of Test

During Performance Test:

1. Measure time to travel 20 meters
2. Measure working width
3. Measure noise level 50 mm away from operator and baggers' ear level
4. Collect samples from the husk and cob outlet three times for 5 seconds each
5. Observe harvesting pattern
6. Determine total operating time



Methods of Test

After Performance Test:

1. Measure fuel consumed
2. Measure height of cut
3. Randomly select three 3 meter column with the harvesters effective width and collect shelled and unshelled kernels

Methods of Test

Laboratory Test:

1. Measure kernel moisture content
2. Determine purity of the output kernels
3. Measure separation and unshelled losses from the husk and cob outlet samples
4. Measure harvesting loss

Methods of Test

Laboratory Test:

5. Determine net cracked kernels from 300 sample kernels

6. Determine mechanically damaged kernels from 300 grams sample kernels

7. Determine potential yield from the pre-performance test samples

Test Report

Contents:

1. Title
2. Summary (Performance Requirements)
3. Purpose and Scope of Test
4. Methods of Test
5. Description of the Machine (Specifications)
6. Results
7. Observations
8. Name(s), Signature(s) of Test Engineer(s)


AMTEC
AGRICULTURAL MACHINERY TESTING AND EVALUATION CENTER

Test Report No. [redacted]

Agricultural Machinery –
Corn Combine Harvester

[redacted]

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