PHILIPPINE NATIONAL STANDARD

PNS/BAFS 401:2024
ICS 65.060.01

Coffee Pulper — Methods of Test

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Foreword

In 2011, the University of the Philippines Los Baños (UPLB)-Agricultural Machinery Testing and Evaluation Center (AMTEC), through the project "Development of Standards for Agricultural and Postharvest Machinery," funded by the Department of Science and Technology (DOST)-Philippine Council for Agriculture, Aquatic, and Natural Resources Research and Development (PCAARRD), initiated the development of the Philippine National Standard (PNS)/Philippine Agricultural and Engineering Standards (PAES) 253:2011 (Coffee pulper — Specifications) and PNS/PAES 252:2011 (Coffee pulper — Methods of test). These standards were established to define the quality parameters of coffee pulpers, aiming to improve the quality of parchment coffee produced by the machine.

In 2019, issues were raised on some major provisions of the PNS. Based on the data obtained from the tests conducted by the UPLB-AMTEC and on the morphology of the coffee cherry, the minimum pulping recovery of 93.5% cannot be met. These concerns on the PNS led UPLB-AMTEC to propose their review and amendment. As part of the standards development process, the proposal for revision of the PNS on Coffee Pulper was presented to the Philippine Council for Agriculture and Fisheries (PCAF)-Committee on Agricultural and Fisheries Mechanization (CAFMech) Regular Meeting held last August 17, 2021. During the deliberation of the PCAF-CAFMech, the committee agreed to endorse to the Department of Agriculture (DA)-Bureau of Agriculture and Fisheries Standards (BAFS) the prioritization of the revision of PNS/PAES 252:2011 and PNS/PAES 253:2011 through the issuance of CAFMech Resolution No. 6, series of 2021 (Recommending to the BAFS The Prioritization of the Development or Revision of the Philippines National Standards for Various PCAARRD-Funded Machinery Projects).

In response, the DA-BAFS in collaboration with the UPLB-AMTEC embarked on a project entitled “Amendment of PNS on Coffee Pulper — Specifications and Methods of Test”. The amendment of the said standards intends to provide minimum requirements for coffee pulper, thereby ensuring its safety, durability, and market equity.

A Technical Working Group (TWG) was created to amend the PNS under Special Order No. 305, series of 2024 (Creation of Technical Working Group (TWG) and Project Management Team (PMT) for the Development of the PNS for Agricultural and Fishery Products and Machinery). The TWG was composed of representatives from relevant government agencies, academe/research institutions, Civil Society Organization (CSO), and private sector. The draft PNS underwent an extensive series of TWG meetings and stakeholder consultations, facilitated through physical and online platforms, from May 2023 to October 2024 before their finalization and endorsement to the DA Secretary for approval.

This Standard includes the following significant changes compared to the PNS/PAES 253:2011:

1. Modifications on the terms and definitions;

2. Inclusion of the Principle of the Test;
3. Modifications on the test materials;
4. Inclusion of other losses from the total losses;
5. Modification on the formula of Pulping Recovery into Pulping Recovery Index;
6. Inclusion of the energy consumption (engine/electric motor) formula;
7. Inclusion of the conditions for suspension and termination of test; and
8. Inclusion of the assessment of workload based on heart rate.

This Standard cancels and replaces PNS/PAES 253:2011 which has been technically revised. This document was written in accordance with the formatting and editorial rules of the Standardization Guide No. 1 (Writing the PNS) developed by the Standards Development Division (SDD) of the DA-BAFS.

Table of Contents

1 Scope

This Standard specifies the methods of test and inspection for coffee pulper. Specifically, it shall be used to:

a) Verify the mechanism, main dimensions of parts/components, materials, accessories of the coffee pulper and the list of specifications submitted by the test applicant;
b) Determine the performance of the machine;
c) Describe/observe the handling, operation, maintenance, and safety features; and
d) Prepare the report for test results.

2 Normative References

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

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2024). Coffee pulper — Specifications (PNS/BAFS 400:2024).

BAFS-DA. (2024). Methods of sampling for agricultural and biosystems power and machinery — Guidelines (PNS/BAFS 391:2024).

3 Terms and Definitions

For the purpose of this Standard, the terms and definitions given in PNS/BAFS 400:2024 (Coffee pulper — Specifications) and the following shall apply:

3.1
defect
imperfections and irregularities on coffee cherries related to maturity, size, shape and texture (BAFS-DA, 2015, modified)

3.1.1
immature coffee cherries
not fully developed or unripe coffee cherries of greenish color (BAFS-DA, 2012, *modified*)

3.1.2
insect damaged coffee cherries
coffee cherries with one or more hole(s) caused by insects (BAFS-DA, 2012, *modified*)

3.1.3
dried coffee cherries
dried husk coffee cherries that shrink and has rough surface (BAFS-DA, 2012, *modified*)

3.1.4
deformed coffee cherries
coffee cherry with irregular shape or shriveled (BAFS-DA, 2012, *modified*)

3.2
overall height
distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the coffee pulper (BAFS-DA, 2023, *modified*)

3.3
overall length
distance between the vertical planes perpendicular to the median plane of the coffee pulper, each plane touching the front and rear extremities of the machine (BAFS-DA, 2023, *modified*)

3.4
overall width
distance between the vertical planes parallel to the median plane of the coffee pulper, each plane touching the outermost point of the machine on its left and right sides (BAFS-DA, 2023, *modified*)

3.5
running-in period
preliminary operation conducted to make various adjustments before the actual testing of the machine (BAFS-DA, 2023, *modified*)

3.6
test applicant
manufacturer, fabricator, assemblers, distributors, dealers, importer, exporters (MFADDIE), inventor, owner, or end-user of the machine (BAFS-DA, 2020, *modified*)

4 Principle of the Test

The test shall be carried out to verify the actual specification of the coffee pulper. Its specification shall be validated with PNS/BAFS 400:2024 (Coffee pulper — Specifications).

5 Test Instruments, Equipment and Materials

5.1 Test instruments and equipment

The suggested list of minimum field and laboratory test instrument, equipment and materials needed to carry out the coffee pulper test is shown in Annex A (Minimum list of field and laboratory test equipment and materials). These equipment/instruments shall be calibrated regularly. It shall be physically checked and cleaned for operation before and after each test. A checklist of instruments and materials shall be prepared to be used before departure to and from the testing area.

5.2 Test materials

5.2.1 Coffee cherries to be used shall be commonly or locally grown. It shall undergo floatation and separation in water to be able to identify and remove the floaters (e.g. immature coffee cherries, insect damaged cherries) and foreign matters. The coffee cherries that did not float shall be used as test materials and will be placed on a strainer/net to drain the excess liquid and air dried for at least 10 mins before weighing of inputs.

5.2.2 The amount of test material to be supplied shall be sufficient for the required test trials, running-in, and laboratory analyses.

5.2.3 Equal quantity of test material shall be used for all test trials. The test materials should be prepared in such a way that they should have homogenous characteristics in terms of species, size, and other characteristics. If the test materials are not conforming to the recommended quality parameter and characteristics, the test engineer shall not pursue the test.

6 General

6.1 Conditions for the test

6.1.1 Test site conditions

The coffee pulper shall be tested and installed for normal operation. The site should have ample provisions for material handling, temporary storage, workspace and suitable for normal working condition. Adequate supply of water, ventilation and lighting shall be provided in the area.

6.1.2 Selection of coffee pulper to be tested

Coffee pulper submitted for testing shall be sampled in accordance with PNS/BAFS 391:2024 (Methods of sampling for agricultural and biosystems power and machinery — Guidelines) or any suitable/available method of selection.

6.1.3 Suspension/termination of test

During the test run, if the coffee pulper stops due to breakdown or malfunction affecting its performance, the test shall be suspended. If the coffee pulper will not be able to continue the operation, the test shall be terminated. See Annex B (Conditions of suspension and termination and heart rate as indication of workload) for the specific conditions of suspension and termination

6.2 Pre-test activities

6.2.1 Running-in and preliminary adjustments

The coffee pulper shall have undergone a running-in period before starting the test. It shall be operated for sufficient duration with and without load at the test site by the official representative of the test applicant. During the running-in period, the various adjustments of the machine shall be made according to the recommendation of the manufacturer.

6.2.2 Verification of specifications

The specifications claimed by the manufacturer and the physical details given in Annex C (Specifications of Coffee pulper) shall be verified by the testing agency. A stable and level surface shall be used as reference plane for verification of dimensional machine specifications when fully assembled/installed and ready for use.

6.2.3 Preparation of the coffee pulper for testing

The representative of the test applicant and testing agency shall check the coffee pulper so as to ensure that the machine has been assembled and installed in accordance with the instruction of the manufacturer. The official testing agency will test the coffee pulper according to the manufacturer’s specifications

6.2.4 Sampling of test materials

Random representative test samples shall be collected from the test material for the determination of dimensions, moisture content, bulk density, defects, and purity. Sampling procedure is shown in Annex D (Sampling procedures and measurements).

7 Performance Test and Procedures

7.1 Performance test

7.1.1 Operation of the Coffee pulper

The coffee pulper shall be operated with and without load by the official representative of the applicant using the manufacturer's recommended setting of its components. The same recommended setting shall be maintained during the test run. The testing agency shall record all measurements, which form part of the test and take the prescribed samples. After the test run, the area shall be cleaned and then prepared for the next test trial. This procedure shall be repeated for the succeeding test trials. No other adjustments shall be permitted during the test.

NOTE The parchment coffee will be placed on a strainer/net to drain excess liquid and air dried for at least 10 minutes before weighing of output.

7.1.2 Test trial

A minimum of two (2) trials, each with a minimum duration of 15 minutes, shall be carried out of the similar operational setting. The input capacity of the coffee pulper according to manufacturer's specification will be the basis of 15 minutes duration.

7.1.3 Sampling

Samples shall be collected at different outlets (i.e. parchment and pulp outlet) during each test trial. Sampling procedure is shown in Annex D (Sampling procedures and measurements).

7.1.4 Data collection

7.1.4.1 Duration of test

a) The input time shall start at the feeding of coffee cherries to the input/intake hopper/pit and ends when there are no more coffee cherries in the input/intake hopper/pit.

b) The output time shall start from the first discharge of the parchment coffee at the parchment coffee outlet and shall end after the last discharge of parchment coffee.

7.1.4.2 Noise level

a) The noise emitted by the coffee pulper, with and without load, shall be measured using a sound level meter at the location of the operator/s. The noise level, expressed in decibel [dB(A)], shall be measured 50 mm away

from the ear level of the operator/s standing near the edge of the feeding hopper and the bagger/s.

b) There shall be a minimum of five observations for each data to be taken. It should be ensured that the feed rate, speed, and other functional characteristics have stabilized before taking data. The time of recording shall be properly spaced during the whole duration of the test trial.

7.1.4.3 Power requirement/fuel consumption and manually operated

a) Using electric motor as prime mover

Use a power meter to measure the voltage, current, and the total electric power requirement of the coffee pulper. Requirements for each data to be taken shall conform to 7.1.4.2b.

b) Using engine as prime mover

To get the amount of fuel consumed, the fuel tank shall be filled to full capacity before the test. After the test trial, the fuel tank shall be filled back to full capacity and the fuel used shall be measured. When filling up the tank, careful attention shall be paid to keep the tank horizontal and not to leave empty space in the tank.

c) For manually operated coffee pulper

The coffee pulper shall be manually operated by one or more operator for the entire duration of testing while maintaining the recommended pulping mechanism speed. The pulse rate and blood pressure of the operator/s shall be measured before and after the test operation. The pulse rate and blood pressure shall be measured using sphygmomanometer. Data obtained shall be recorded in Annex E (Performance test data sheet). The work load assessment will base on Annex B (Conditions of suspension and termination and heart rate as indication of workload).

7.1.4.4 Speed of components

The speed of the rotating shafts of the major components of the coffee pulper expressed in rpm, with and without load, shall be measured using a tachometer. Requirements for each data to be taken shall conform to 7.1.4.2b.

7.1.5 Data recording and observation

Record sheet for all data and information during the test is given in Annex E (Performance test data sheet). Observations to be taken during the performance test shall be recorded in this sheet.

7.2 Laboratory analysis

Laboratory analysis shall be made to determine the pulping recovery index, pulping efficiency, purity (parchment coffee), losses (separation, unpulped, scattering and other losses) and mechanically damage parchment coffee. The laboratory procedure to be followed in the analysis is given in Annex F (Laboratory analysis), while data sheets are given in Annex G (Laboratory analysis data sheet).

8 Formula

The formulas to be used are given in Annex H (Formulas used during calculations and testing).

9 Test Report

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

a) Name of accredited testing agency;
b) Test report number;
c) Title;
d) Name of the Manufacturer;
e) Summary of results;
f) Purpose and scope of test;
g) Methods of test;
h) Description of the coffee pulper;
i) Specifications;
j) Results;
k) Observations (include pictures); and
l) Names, signatures, and designation of test engineers.

Annex A
(Informative)

Minimum list of field and laboratory test equipment, instrument, and materials

No.	Equipment/Instrument/material	Quantity
A.1	**Field test**	
A.1.1	Hand-held tachometer	1
A.1.2	Stopwatch (Resolution: 0.1sec)	2
A.1.3	Measure tape (at least 5m)	1
A.1.4	Sound level meter Range: 30 dB(A) to 130 dB(A)	1
A.1.5	Weighing scale (capacity: 100kg) Scale division: 0.1 kg	1
A.1.6	Graduated cylinder Capacity: at least 500 mL	1
A.1.7	Clamp-on type power meter /Multimeter (True RMS)	1
A.1.8	Caliper (Resolution 0.05 g)	1
A.1.9	Psychrometer	1
A.1.10	Sphygmomanometer	1
A.1.11	Protractor	1
A.1.12	Digital camera	1
A.1.13	Nylon-catch bag	1
A.1.14	Sampling bags with labeling tags	30
A.2	**Laboratory test**	
A.2.1	Digital weighing scale Resolution: 0.01 g	1
A.2.2	Bulk density meter	
A.2.3	Air oven	1
A.2.4	Desiccator	1
A.2.5	Magnifying lens	
A.2.6	Vernier caliper (0.01 mm accuracy, 200 mm length)	1
A.2.7	Foot ruler	1
A.2.8	Aluminum moisture cans	1
A.2.9	Labeling tags which include: Date of test Pulper on Test Sample source Species Trial number	20

Annex B
(Normative)

Conditions of suspension and termination and heart rate as indication of workload

B.1. Conditions for suspension

Item No.	Conditions
B.1.1	Minor breakdown or malfunction
B.1.2	Insufficient amount of test material
B.1.3	Nonconformity of the test material to the recommended characteristics and quality
B.1.4	Insufficient area of test plot
B.1.5	Nonconformity of the test plot to the recommended characteristics and conditions
B.1.6	Unmatched prime mover or tractor used
B.1.7	Clogged or choked part/s of the machine
B.1.8	Absence of power source for the machine due to power outage or brownout
B.1.9	Accident and injury of the personnel/representatives of test applicant or testing agency
B.1.10	Poor and severe weather conditions that may affect the test

B.2. Conditions for termination

Item No.	Conditions
B.2.1	Three minor breakdowns during the whole duration of all test trials
B.2.2	Three clogging or choking during the whole duration of all test trials
B.2.3	Major malfunction, breakdown, or damage affecting performance of the machine

B.3. Heart rate as indication of work load

Assessment of work load	Heart rate, Pulses/min
Very low	60-70
Low	75-100
Moderate	100-125
High	125-150
Very high	150-175
Extremely high	over 175

NOTE Based on Table 5.3 of FAO Agricultural Services Bulletin 110: Testing and Evaluation of Agricultural Machinery and Equipment (1994)

Annex C
(Informative)

Specifications of coffee pulper

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

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

GENERAL INFORMATION
Brand and Model : _____ Make : _____
Classification:_____ Serial No. _____
Date of Manufacture: : _____ Test Engineer : _____
Location of Test : _____Date of Test : _____

No.	Items[a]	Manufacturer's specification	Verification by the testing agency
1	**Main structure**		
1.1	Overall dimensions, mm		
1.1.1	Length		
1.1.2	Width		
1.1.3	Height		
1.2	Overall weight without prime mover, kg		
2	**Pulping Chamber**		
2.1	**Drum-type**		
2.1.1	**Drum**		
2.1.1.1	Material of construction		
2.1.1.2	Dimensions, mm		
2.1.1.2.1	Length		
2.1.1.2.2	Diameter		
2.1.2	Flute		
2.1.2.1	Material of construction		
2.1.2.2	Dimensions, mm		
2.1.2.2.1	Length		
2.1.2.2.2	Diameter		
2.2	**Fluted cylinder**		
2.2.1	Material of construction		
2.2.2	Dimensions, mm		

No.	Items[a]	Manufacturer's specification	Verification by the testing agency
2.2.2.1	Length		
2.2.2.2	Diameter		
2.2.2.3	Flute thickness		
2.2.3	Flute inclination		
2.3	**Disc-type**		
2.3.1	Material of construction		
2.3.2	Dimensions, mm		
2.3.2.1	Diameter		
2.3.2.2	Thickness		
2.3.3	Chop rails		
2.3.3.1	Material of construction		
2.3.3.2	Dimensions, mm		
2.3.3.2.1	Length		
2.3.3.2.2	Width		
2.3.4	Clearance of disc and chop rails, mm		
2.3.5	Disc bulbs		
2.3.5.1	Material of construction		
2.3.5.2	Dimensions, mm		
2.3.5.2.1	Thickness		
2.3.5.2.2	Diameter		
2.4	**Slotted plate type**		
2.4.1	Material of construction		
2.4.2	Dimensions, mm		
2.4.2.1	Length		
2.4.2.2	Diameter		
2.4.2.3	Thickness		
2.4.2.4	Size of slots, mm		
2.4.2.4.1	Height		
2.4.2.4.2	Width		
3	**Input hopper**		
3.1	Dimensions of bottom opening of the feeding hopper, L × W × H, mm		
3.2	Height from the ground, mm		
3.3	Hopper inclination		
3.4	Material of construction		
3.5	Other special features		
4	**Discharge outlet**		
4.1	**Parchment coffee outlet**		
4.1.1	Material of construction		
4.1.2	Location		
4.1.3	Dimensions, mm		
4.1.3.1	Length		

No.	Items[a]	Manufacturer's specification	Verification by the testing agency
4.1.3.2	Width		
4.1.3.3	Height from ground		
4.2	**Pulp outlet**		
4.2.1	Material of construction		
4.2.2	Dimensions, mm		
4.2.2.1	Length		
4.2.2.2	Width		
4.2.2.3	Height from ground		
5	**Water-pulp-parchment conveyor (if available)**		
5.1	Material of construction		
5.2	Dimensions, mm		
5.2.1	Length		
5.2.2	Width		
5.2.3	Height from ground		
6	**Prime mover**		
6.1	Electric motor		
6.1.1	Brand		
6.1.2	Model		
6.1.3	Make or Manufacturer		
6.1.4	Serial number		
6.1.5	Rated power, kW		
6.1.6	Rated speed, rpm		
6.1.7	Electric service required		
6.1.8	Voltage, V		
6.1.9	Current, A		
6.1.10	Frequency, Hz		
6.2	Engine		
6.2.1	Brand		
6.2.2	Model		
6.2.3	Make		
6.2.4	Serial number		
6.2.5	Type		
6.2.6	Rated power, kW		
6.2.7	Rated speed, rpm		
6.2.8	Piston displacement, cm^3		
6.2.9	Cooling system		
6.2.10	Starting system		
7	**Safety device(s)**		
8	**Special feature(s)**		
[a] The parameter will be checked upon availability			

9 Illustration of transmission system

Annex D
(Normative)

Sampling procedures and measurements

D.1 Sampling procedures for input coffee cherries

Representative samples of at least six sets of 500g of coffee cherries shall be taken before the start of each test trial. The conditions of the input coffee cherries to be used such as bulk density, purity, dimensions, moisture content, and defects shall be taken using three “representative samples”, which represent the different conditions of the input coffee cherries in the bulk. This shall be done by randomly taking samples at the top, middle, and bottom portions of the bulk. Half of the sample shall be used for laboratory analysis and the other half shall be used for reference purposes or for an eventual second check in case of review. Samples representing the materials for each test trial shall be placed in appropriate containers for laboratory analysis

D.2 Sampling from different outlets

D.2.1 During each test trial, samples shall be collected from the different outlets to be analyzed in the laboratory for pulping recovery index, pulping efficiency, purity (parchment coffee), losses (separation and unpulped) and mechanically damage parchment coffee. The minimum amount of sample to be taken shall be twice as much as what is needed for a particular analysis. The excess sample shall be used for reference purposes or for an eventual second check in case of review.

D.2.2 In the collection of the sample in the outlets, use a rectangular box-shaped nylon catch open at one end of the small side. Three sample shall be collected randomly from the outlets with ten-second duration per collection.

D.3 Collection of scattered parchment coffee

Parchment coffee scattered beyond 1.0 m from the base of the machine shall be collected. Spread canvas sheets around the sorting floor area to catch the scattered beans after each test trial. The collected material shall be placed in appropriate containers and labelled as scattered parchment coffee. Care should be taken to prevent alterations of the conditions of the test samples.

D.4 Collection of other losses

Parchment coffee losses other than separation loss, unpulped loss, and scattering loss shall be collected, weighed, and labeled as other losses.

D.5 Handling of samples

All samples to be taken to the laboratory shall be placed in appropriate containers and properly labeled. If the sample is to be used for determining moisture content, it shall be kept in dry and airtight containers. Care should be taken to prevent alterations of the conditions of the test samples.

Annex E
(Informative)

Performance test data sheet

Test Trial No.:_____ Date:_____
Test Engineers:_____ Location:_____
Assistants:_____ Machine:_____
Test Requested By: _____ Manufacturer:_____

No.	Items	Trial 1	Trial 2	Trial 3	Average
1	Crop condition				
1.1	Material				
1.2	Species				
1.3	Source				
1.4	Moisture content, $\%_{wb}$				
1.5	Purity (coffee cherries), %				
1.5	Bulk density, kg/m^3				
1.7	Coffee cherries dimensions, mean + standard dev, mm				
1.7.1	Length				
1.7.2	Width				
1.7.3	Thickness				
1.8	Defects, %				
1.8.1	Immature				
1.8.2	Insect damage				
1.8.3	Dried				
1.8.4	Deformed				
2	Performance Test				
2.1	Weight of input, kg				
2.2	Weight of output, kg				
2.3	Input capacity, kg/h				
2.4	Output capacity, kg/h				
2.5	Pulping recovery index				
2.5.1	Pulping recovery (actual)				
2.5.2	Pulping recovery(laboratory)				
2.6	Pulping efficiency, %				
2.7	Purity (parchment coffee), %				
2.8	Losses, %				
2.8.1	Separation loss				
2.8.2	Unpulped loss				
2.8.3	Scatttering loss				
2.8.4	Other loss				
2.9	Mechanically damaged parchment coffee, %				

No.	Items	Trial 1	Trial 2	Trial 3	Average
2.10	Speed of components, rpm				
2.10.1	Prime mover				
2.10.1.1	without load				
2.10.1.2	with load				
2.10.2	Pulping shaft				
2.10.2.1	without load				
2.10.2.2	with load				
2.11	Noise level, dB(A)				
2.11.1	without load				
2.11.2	with load				
2.12	Power consumption				
2.12.1	For mechanically operated coffee pulper				
2.12.1.1	Small engine				
2.12.1.1.1	Engine time of operation, min				
2.12.1.1.2	Fuel consumed, L				
2.12.1.1.3	Fuel consumption rate, L/h				
2.12.1.2	Electric Motor				
2.12.1.2.1	Power, kW				
2.12.1.2.1.1	without load				
2.12.1.2.1.2	with load				
2.12.1.2.2	Current, A				
2.12.1.2.2.1	without load				
2.12.1.2.2.2	with load				
2.12.1.2.3	Voltage, V				
2.12.1.2.3.1	without load				
2.12.1.2.3.2	with load				
2.12.1.2.4	Power factor (For 3-phase)				
2.12.1.2.4.1	without load				
2.12.1.2.4.2	with load				
2.12.2	For manually operated coffee pulper				
2.12.2.1	Pulse rate, bpm				
2.12.2.1.1	Before operation				
2.12.2.1.2	After operation				
2.12.2.2	Blood pressure, mmHg (systolic over diastolic)				
2.12.2.2.1	Before operation				
2.12.2.2.2	After operation				
2.12.2.3	Assessment of workload				

4 Other observations

4.1 Transporting the machine

_____
_____
_____
_____

4.2 Adjusting, replacing, repairing, assembly and disassembly of parts.

_____
_____
_____
_____

4.3 Safety features

_____
_____
_____
_____

4.4 Cleaning the coffee pulper components

_____
_____
_____
_____

4.5 Labor requirement

_____
_____
_____
_____

4.6 Failure or abnormalities observed on the coffee pulper or its component parts during and after the pulping operation.

_____
_____
_____
_____

4.7 Others

_____
_____
_____
_____

Annex F
(Normative)

Laboratory analysis

F.1 Analysis of input coffee cherries

F.1.1 Measurement of coffee cherries dimensions

F.1.1 Randomly take at least 30 pieces of coffee cherries from the representative samples collected from the test material.

F.1.2 For each sample, measure the length, width, and thickness using a caliper. Record the measurement to the nearest 0.01 mm.

F.1.2 Determination of bulk density of coffee cherries

F.1.2.1 At least five representative samples shall be randomly obtained from the input coffee cherries samples. The bulk density of each coffee cherries samples shall be measured using a bulk density tester/meter.

F.1.2.2 Fill the bulk density meter's measuring cup with samples at a standard height. Level the heap above the cup using a blunt ruler. Weigh the samples inside the cup and record the bulk density. Replicate these steps three times.

F.1.3 Measurement of moisture content

F.1.3.1 Using air oven method

F.1.3.1.1 Randomly obtain three 100 g from the input coffee cherries samples.

F.1.3.1.2 Place each sample in separate moisture can. The moisture can shall be sealed to ensure that no moisture is lost or gained by the sample between the time it was collected and when it is weighed. Record the initial weight.

F.1.3.1.3 Dry the samples in the oven with a temperature of 105 °C for 16 ± 0.5 h.

F.1.3.1.4 After removing the samples from the oven, moisture can with samples should be placed in a desiccator and be allowed to cool to the ambient temperature.

F.1.3.1.5 Weigh the moisture can with the dried sample and record the final weight. Calculate moisture content (wet-basis) of coffee cherries using the formula in Annex H (Formulas used during calculations and testing).

F.1.3.2 Using moisture meter

At least five representative samples shall be randomly obtained from the input coffee cherries samples. The moisture content of each sample shall be measured using a calibrated moisture meter specific for different species of coffee cherries.

F.1.4 Determination of defects

Three sets of 100 pieces of coffee cherries samples will be analyzed for defects. Each coffee cherries shall be identified for immature, insect damaged, dried and broken. The different defects will be counted, and the percentage defects will be computed.

F.1.5 Determination of purity of coffee cherries

Take three 500 g samples of coffee cherries input. Clean the coffee cherries to remove the impurities. The cleaned coffee cherries shall be weighed and recorded. Calculate the purity using the formula in Annex H (Formulas used during calculations and testing).

F.2 Analysis of parchment coffee

F.2.1 Determination of purity of parchment coffee

Take three 500 g samples from the main parchment coffee outlet. Clean the parchment coffee to remove the impurities. The cleaned parchment coffee shall be weighed and recorded. Calculate the purity using the formula in Annex H (Formulas used during calculations and testing).

F.2.2 Determination of net percent mechanically damaged parchment coffee

Three samples shall be taken for analysis from the parchment coffee. Each sample shall consist of 100 g. Separate and weigh the parchment coffee that were broken or partially dehulled. Compute for the percentage of mechanically damaged parchment coffee using the formula in Annex H (Formulas used during calculations and testing).

F.2.3 Determination of Losses

F.2.3.1 Scattering loss

Parchment coffee scattered beyond 1.0 m from the base of the machine shall be collected after each trial, cleaned, and weighed for the determination of scattering loss using the formula in Annex H (Formulas used during calculations and testing).

F.2.3.2 Separation loss

Parchment coffee obtained from the pulped outlet shall be separated, cleaned, and weighed after each trial for the determination of separation loss using the formula in Annex H (Formulas used during calculations and testing).

F.2.3.3 Unpulped loss

Unpulped coffee cherries obtained from all outlets shall be separated. Manually pulped the unpulped coffee cherries and separate the pulp and parchment coffee. Weigh the parchment coffee after each trial for the determination of unpulped loss using the formula in Annex H (Formulas used during calculations and testing).

F.3 Determination of pulping recovery index

F.3.1 Manual pulping recovery

Take three (3) 100 g samples from the coffee cherries input on each trial. Manually pulp and record the weight of clean parchment coffee. Compute the manual pulping recovery R_m using the formula in Annex H (Formulas used during calculations and testing).

F.3.2 Actual pulping recovery

For each trials, weigh the cleaned parchment coffee at main parchment coffee outlet and weight of input coffee cherries. Compute the actual pulping recovery R_a using the formula in Annex H (Formulas used during calculations and testing).

F.3.2 Pulping recovery index

Compute the pulping recovery index PR_i using the formula in Annex H (Formulas used during calculations and testing).

Annex G
(Informative)

Laboratory analysis data sheet

Machine Tested : _____ Date Tested : _____
Analyzed by : _____ Date Analyzed : _____

G.1 Crop Condition

G.1.1 Measurement of Coffee Cherries Dimensions

Sample no.	Length, mm	Width, mm	Thickness, mm
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			
Average, mm			
Standard deviation, mm			

G.1.2 Bulk density

Sample no.	Bulk density, kg/m^3
1	
2	
3	
Average	

G.1.3 Moisture content (wet-basis)

G.1.3.1 Using air oven method

Test trial no.	Sample no.	Initial weight, g	Final weight, g	Moisture content, $\%_{wb}$
I	1			
	2			
	3			
	Ave.			
II	1			
	2			
	3			
	Ave.			
III	1			
	2			
	3			
	Ave.			

G.1.3.2 Using moisture meter

Item	Test trial I					Test trial II					Test trial III				
Sample no.	1	2	3	4	5	1	2	3	4	5	1	2	3	4	5
Moisture content, $\%_{wb}$															
Average, $\%_{wb}$															

G.1.4 Determination of defects

Initial number of coffee cherries samples (cleaned) = 100 pieces

Item	Test Trial I				Test Trial II				Test Trial II				Gen. Ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Immature, %													
Insect damage, %													
Dried, %													
Deformed, %													

G.1.5 Purity Determination

Initial weight of coffee cherries samples (uncleaned) = 500 g

Item	Test trial I				Test trial II				Test trial III				Gen. ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Cleaned, g													
Purity, %													

G.2 Analysis of Parchment coffee

G.2.1 Purity Determination

Initial weight of parchment coffee samples (uncleaned) = 500 g

Item	Test trial I				Test trial II				Test trial III				Gen. ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Cleaned, g													
Purity, %													

G.2.2 Loss determination

Test trial no.	Sample no.	Separation loss		Unpulped Loss		Scattering loss		Other losses	
		Duration, s:		Duration, s:					
		Total wt., kg	%	Total wt., kg	%	Total wt., kg	%	Total wt., kg	%
I	1								
	2								
	3								
	Ave.								
II	1								
	2								
	3								
	Ave.								
III	1								
	2								
	3								
	Ave.								
Gen Ave.									

G.2.3 Determination of Pulping Efficiency

Test trial no.	Separation loss		Unpulped loss		Scattering loss		Other loss		Total losses	Total Total Wt of clean parch-ment coffee, kg	Pulping efficiency
	Wt.	%	Wt.	%	Wt.	%	Wt.	%	%		
I											
II											
III											
Average											

G.2.4 Determination of Mechanically Damaged Parchment Coffee

Initial Weight of Samples (cleaned) = 100 g

Item	Test Trial I				Test Trial II				Test Trial II				Gen. Ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Mechanically damaged parchment coffee (g)													
Percent Mechanically damaged (%)													

G.3 Determination of Pulping Recovery Index

Initial weight of coffee cherries samples = 100 g

Item	Test trial I				Test trial II				Test trial III				Gen. ave.
	1	2	3	Ave.	1	2	3	Ave.	1	2	3	Ave.	
Wt. of clean parchment coffee													
Manual pulping recovery, %													
Actual pulping recovery, %													
Pulping recovery index													

Annex H
(Normative)

Formulas used during calculations and testing

H.1 Moisture content (wet-basis)

$$MC = \frac{M_i - M_f}{M_i} \times 100$$

where:

MC is the moisture content, %wb
M_i is the initial weight of coffee cherries sample, g
M_f is the final weight of coffee cherries sample, g

H.2 Input Capacity

$$C_i = \frac{W_i}{T_i} \times 100$$

where:

C_i is the input capacity, kg/h
W_i is the weight of coffee cherries input, kg
T_i is the input time, h

H.3 Output Capacity

$$C_o = \frac{W_c}{T_o} \times 100$$

where:

$$W_c = W_0 \times \frac{P}{100}$$

where:

C_o is the output capacity, kg/h
W_c is the weight of clean parchment coffee, kg
T_o is the output time, h
W_0 is the weight of total parchment coffee from the parchment coffee outlet, kg
P is the purity of output, %

H.4 Purity

$$P = \frac{W_c}{W_u} \times 100$$

where:

P is the purity, %
W_c is the weight of cleaned coffee cherries/parchment coffee sample, g
W_u is the weight of uncleaned coffee cherries/parchment coffee sample, g

H.5 Losses

H.5.1 Total losses

$$L_T = L_{un} + L_{se} + L_{sc} + L_o$$

where:

L_T is the weight of summation of all losses, kg
L_{un} is the weight of unpulped loss, kg
L_{se} is the weight of separated loss, kg
L_{sc} is the weight of scattering loss, kg
L_o is the weight of other losses, kg

H.5.2 Unpulped loss

H.5.2.1 Amount

$$L_{un} = \frac{W_{un}}{T_c} \times T_o$$

where:

L_{un} is the weight of unpulped loss, kg
W_{un} is the weight of the collected patchment coffee from unpulped coffee cherries at all outlet, kg
T_c is the duration of collection, h
T_o is the duration of operation trial, h

H.5.2.2 Percentage

$$\%L_{un} = \frac{L_{un}}{W_c + L_T} \times 100$$

where:

$\%L_{un}$ is the percentage of unpulped loss, %
L_{un} is the weight of unpulped loss, kg
W_c is the weight of clean parchment coffee from parchment coffee outlet, kg
L_T is the weight of summation of all losses, kg

H.5.3 Separation loss

H.5.3.1 Amount

$$L_{se} = \frac{W_{se}}{T_c} \times T_o$$

where:

L_{se} is the weight of separation loss, kg
W_{se} is the weight of the clean parchment coffee collected at the pulp outlet, kg
T_c is the duration of collection, h
T_o is the duration of operation trial, h

H.5.3.2 Percentage

$$\%L_{se} = \frac{L_{se}}{W_c + L_T} \times 100$$

where:

$\%L_{se}$ is the percentage of separation loss, %
L_{se} is the weight of separation loss, kg
W_c is the weight of clean parchment coffee from parchment coffee outlet, kg
L_T is the weight of summation of all losses, kg

H.5.4 Scattering loss

$$\%L_{sc} = \frac{L_s}{W_c + L_T} \times 100$$

where:

$\%L_{sc}$ is the percentage of scattering loss, %
L_s is the weight of scattered clean parchment coffee, kg
W_c is the weight of clean parchment coffee from parchment coffee outlet, kg
L_T is the weight of summation of all losses, kg

H.5.5 Other losses

$$\%L_o = \frac{L_o}{W_c + L_T} \times 100$$

where:

$\%L_o$ is the percentage of other losses, %
L_o is the weight of other losses, kg
W_c is the weight of clean parchment coffee from parchment coffee outlet, kg
L_T is the weight of summation of all losses, kg

H.6 Pulping Efficiency

$$Eff_p = \frac{W_c + L_{se} + L_{sc} + L_o}{W_c + L_T} \times 100$$

or

$$Eff_p = 100\% - \%L_{un}$$

where:

Eff_p is the pulping efficiency, %
W_c is the weight of clean parchment coffee, kg
L_{se} is the weight of separation losses, kg
L_{sc} is the weight of scattered losses, kg
L_o is the weight of other losses, kg
L_T is the weight of the total losses, kg
$\%L_{un}$ is the percentage of unpulped losses, %

H.7 Pulping Recovery Index

$$PR_i = \frac{R_a}{R_m}$$

where:

$$R_a = \frac{W_c}{W_i} \times 100;\ W_c = W_o \times \frac{P}{100}$$

$$R_m = \frac{W_m}{W_{im}} \times 100$$

where:

PR_i is the pulping recovery index
R_a is the actual pulping recovery based on total weight of coffee cherries input, %
R_m is the pulping recovery from laboratory manual pulping, %
W_c is the total weight of clean parchment coffee on the main parchment coffee outlet, kg
W_i is the total weight of coffee cherries input, kg
W_o is the weight of total parchment coffee from the parchment coffee outlet, kg
P is the purity of output, %
W_m is the weight of clean parchment coffee after manual pulping, g
W_{im} is the weight of coffee cherries before manual pulping, g

H.8 Mechanically damaged parchment coffee

$$MD_{cb} = \frac{W_{dpc}}{100g} \times 100$$

where:

MD_{cb} is the mechanically damaged parchment coffee, %
W_{dpc} is the weight of mechanically damaged parchment coffee, kg

H.9 Fuel and electric energy consumption

H.9.1 Fuel Consumption

$$F_{cr} = \frac{F_v}{T_f}$$

where:

F_{cr} is the fuel consumption rate, L/h
F_v is the volume of fuel consumed, L
T_f is the total fuel consuming time, h

H.9.2 Electric energy consumption

H.9.2.1 For single-phase (if not true rms)

$$P_r = \frac{V\ x\ I\ x\ PF}{1000}$$

where:

P_r is the electric power requirement, kW
V is the voltage, V
I is the current, A
PF is the power factor equals to 1

H.9.2.2 For three-phase (if not true rms)

$$P_r = \frac{V\ x\ I\ x\ \sqrt{3}\ x\ PF}{1000}$$

where:

P_r is the electric power requirement, kW
V is the voltage, V
I is the current, A
PF is the power factor

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