PHILIPPINE NATIONAL STANDARD

PNS/BAFS 393:2024
ICS 65.060.40

Agricultural and Fishery Pumpset — Methods of Test

BUREAU OF AGRICULTURE AND FISHERIES STANDARDS
BPI Compound, Visayas Avenue, Vasra, Quezon City 1128 Philippines
Trunkline: **(632) 928-8741 to 64 loc. 3301-3319**
E-mail: **bafs@da.gov.ph**
Website: **www.bafs.da.gov.ph**

Agricultural and Fishery Pumpset — Methods of Test
PNS/BAFS 393:2024
ICS 65.060.40

Published by:

Bureau of Agriculture and Fisheries Standards
BAFS Building, BPI Compound, Visayas Avenue, Vasra, Quezon City
info.dabafs@gmail.com | bafs@da.gov.ph
(+632) 8928 8756 to 65 local 3301 – 3325

ISBN 978-621-455-560-4 (PDF)

www.bafs.da.gov.ph

Foreword

In 2023, the University of the Philippines Los Baños (UPLB)-Agricultural Machinery Testing and Evaluation Center (AMTEC) proposed the development of Philippine National Standards (PNS) on Agricultural and Fishery Pumpset — Specifications and Methods of Test. The proposal was submitted to and reviewed by the Philippine Council for Agricultural and Fisheries (PCAF)-National Sectoral Committee on Agricultural and Fisheries Mechanization (CAFMech).

In the same year, the Committee issued Resolution No. 19, series of 2023 (Recommending to the Bureau of Agriculture and Fisheries Standards [BAFS] the Prioritization of the Review and/or Amendment of the Standards for Small Engines and Agricultural Pumpsets) for the development of this Standard to the Department of Agriculture (DA)-BAFS. The development aims to cover different types of pumpset used for agricultural and fishery purposes. Further, it also aims to ensure and improve the quality of the machine by setting various performance parameters to be included as a requirement for the manufacturing of the pumpset.

In response, the DA-BAFS officially created a Technical Working Group (TWG) to develop the PNS under the following Special Orders (SO):

1. SO No. 305, series of 2024 (Creation of TWG and Project Management Team [PMT] for the Development of PNS for Agricultural and Fishery Products and Machinery);
2. SO No. 905, series of 2024 (Addendum to SO No. 305, series of 2024 entitled, “Creation of TWG and Project Management Team [PMT] for the Development of PNS for Agricultural and Fishery Products and Machinery”); and
3. SO No. 29, series of 2024 (Authority to Conduct and Attend the DA-BAFS Standards Development Division [SDD] Activities for the 2nd Semester CY 2024).

The TWG was composed of relevant stakeholders from the government sector, academe/research institutions, private sector organizations, and Civil Society Organizations (CSO). The draft PNS underwent an extensive series of TWG meetings and stakeholder consultations, facilitated through physical and online platforms, from January to October 2024 prior to its endorsement to the DA Secretary for approval. Through these activities, the TWG reached a consensus to retain the existing Philippine Agricultural Engineering Standard (PAES) 115:2000 (Agricultural machinery — Centrifugal, mixed flow and axial flow water pumps — Methods of test), which is applicable to bare pumps.

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 pumpset used for agricultural and fishery purposes. Specifically, it shall be used to:

a) Verify the mechanism, main dimensions, materials, accessories of pumpset, and the list of specifications submitted by the test applicant;
b) Determine the performance of the machine;
c) Describe the handling and safety features; and
d) Prepare the test report.

2 Normative References

The following documents are referred to in the text in such a way that some or all their contents constitute 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). (2017). Conveyance systems — Performance evaluation of open channels — Determination of conveyance loss by inflow-outflow method (PNS/BAFS/PAES 220:2017).

BAFS-DA. (2024). Agricultural and fishery pumpset — Specifications (PNS/BAFS 392:2024).

3 Terms and Definitions

For the purpose of this Standard, the definitions given in PNS/BAFS 392:2024 (Agricultural and fishery pumpset — Specifications) and the following shall apply:

3.1
discharge
volume of liquid discharged from the outlet area of the pump in a given time (International Organization for Standardization [ISO], 2012a)
admitted term: volume rate of flow

3.2
head
energy of mass of liquid divided by gravitation acceleration (ISO, 2012a)

3.2.1
friction head
loss of pressure due to flow of liquid in pipe and fittings (ISO, 2012b, *modified*)
admitted term: friction losses

3.2.2
static discharge head
difference in elevation between the datum and the highest point of delivery (Bureau of Indian Standards [BIS], 2011)

3.2.3
static suction head
difference in elevation between the pump datum and the liquid level in the suction vessel when the pump is operating (BIS, 2011)

NOTE It exists when the source of water supply is below the center line of the pump

3.2.4
total dynamic head
measure of energy increase imparted to the liquid by the pump and the algebraic difference between the total discharge head and total suction head (BIS, 2011, *modified*)

NOTE Total dynamic head, as determined on test where suction head exists, is the sum of the total discharge head and total suction head. When positive suction head exists, the total dynamic head is the total discharge head minus the total suction head

3.2.5
total discharge head
this is the sum total of the static delivery head and the friction and exist losses in the delivery pipe line. The total delivery head, as determined on the test bed, is the reading of the pressure gauge at the discharge of the pump corrected to pump datum plus the velocity head at the point of measurement (BIS, 2011, *modified*)

3.2.6
total suction head
this is equal to the static suction head minus the friction and entrance losses in suction pipe line. The total suction head, as determined on test bed, is the reading of a suction gauge at the suction nozzle of the pump corrected to pump datum plus velocity head at the point of measurement (BIS, 2011, *modified*)

3.2.7
velocity head
the kinetic energy per unit weight of liquid handled at a given section (BIS, 2011)

3.3
input power
the power input to the prime mover of the pumpset (BIS, 2011, *modified*)

3.4
overall height
distance between the horizontal supporting plane surface and the horizontal plane touching the uppermost part of the machine (Agricultural Machinery Testing and Evaluation Center [AMTEC]-University of the Philippines Los Baños [UPLB], 2021)

3.5
overall length
distance between the vertical planes perpendicular to the median plane of the machine, each plane touching the front and rear extremities of the machine (AMTEC-UPLB, 2021)

3.6
overall width
distance between the vertical planes parallel to the median plane of the machine, each plane touching the outermost point of the machine on its left and right sides (AMTEC-UPLB, 2021)

3.7
pump datum
for horizontal units, it is the pump horizontal center line; for vertical single suction pumps, it is the entrance eye to the first stage impeller; for vertical double suction pumps, it is the impeller discharge horizontal centerline (BIS, 2011)
admitted term: base plane

3.8
system efficiency
proportion of the input power delivered as output power of the pumpset at a given operating conditions (ISO, 2012a)

3.9
output power
the power delivered by the pumpset to the liquid (BIS, 2011, *modified*)

4 Principles of Test

The test shall be carried out to verify the actual specifications of the pumpset. Its specifications shall be validated with PNS/BAFS 392:2024 (Agricultural and fishery pumpset — Specifications).

5 Test Equipment and Materials

The suggested minimum list of test equipment and materials needed to carry out the test is shown in Annex A (Minimum list of test equipment and materials).

5.1 Test equipment and instruments

The test equipment and instruments to be used shall be calibrated regularly, physically checked for operation, and shall be cleaned before and after each test.

5.2 Test materials

The pumpset shall be tested using a clean and solids-free water (liquid) with a temperature range of 20-40 ºC.

6 General Considerations

6.1 Test site conditions

6.1.1 The pumpset shall be tested using a laboratory water pumping test rig. The test site should be in a conducive environment with ample space and suitable to safe working conditions. Adequate ventilation and lighting should be provided in the area.

6.1.2 In cases that the pumpset will be tested on the field, the test site should have a sump with sufficient volume to maintain a relatively constant water depth during testing.

6.1.3 The actual measurements of the following shall be obtained:

a) suction head;
b) discharge head;
c) diameter, length, and materials of the pipes; and
d) number, types, and materials of fittings.

6.2 Role of the test applicant

The test applicant or a technical representative should be present during the conduct of test to immediately attend to any concerns regarding the testing of the machine.

6.3 Pre-test activities

6.3.1 Running-in and preliminary adjustments

The pumpset shall have undergone a running-in period and various adjustments shall be made by the test applicant according to the manufacturer's recommendation prior to the conduct of testing to ensure the readiness of the machine.

6.3.2 Verification of specifications

The specifications claimed by the manufacturer and other physical details given in Annex B (Specifications of pumpset) shall be verified. A stable and level surface shall be used as a reference plane for verification of dimensional machine specifications when fully assembled and ready for testing.

6.3.3 Preparation of the pumpset for testing

The pumpset shall be mounted on to the test rig and checked to ensure that the machine has been properly assembled and installed in conformance with the instructions of the manufacturer. It shall undergo a running-in according to the protocol of the testing agency.

6.4 Suspension/termination of test

6.4.1 During the test run, if the pumpset stops (due to minor breakdown or malfunction), the test shall be suspended. The test applicant shall be given an opportunity to make minor repairs or adjustments within a reasonable time.

6.4.2 The test shall be terminated if the machine is unable to continue operation after three attempts and all efforts have been exerted without replacing any major parts that can affect the performance of the machine. The test applicant has the option to terminate the test voluntarily at any stage of the testing process. In cases of terminated test, a test report shall be prepared.

7 Performance Test and Procedures

7.1 Operation of the machine

7.1.1 For engine-driven pumpset, it shall be set at full throttle for the whole duration of the test.

7.1.2 For electric motor driven pumpset, it shall be set based on any of the following settings:

7.1.2.1 For AC motor driven pumpset, the supplied voltage shall be set to a voltage of 220 V ±2. In case that the voltage is higher than the recommended setting,

it shall be based on the manufacturer's requirements. The controller shall be provided by the test applicant.

7.1.2.2 For DC motor driven pumpset, the supplied voltage shall be based on the manufacturer's requirements. The controller and rectifier/battery shall be provided by the test applicant.

7.1.3 The discharge shall be varied by regulating the gate valve on the discharge side. The suction head shall be kept constant throughout the test.

7.1.4 The measurements shall be taken in at least ten different discharge values, ranging from zero flow to the maximum possible discharge. At least one of these measurements shall be taken at a head lower than the head specified on the nameplate.

7.1.5 The gauges to be used for head measurements shall be water columns or manometers. For a relatively high pressure, mercury manometer, Bourdon gauges, electrical pressure transducers or dead weight gauge testers shall be used. Pressure gauges shall be attached as shown in Figure 1 of Annex C (Illustrations for pressure gauge attachment, total head measurement, and test rig setup sample).

7.2 Test trial

The following test for the data collection shall be measured for a minimum of two trials.

7.3 Data collection

7.3.1 Discharge capacity

The discharge capacity of the pumpset shall be obtained using the applicable formula for the discharge measurement as shown in Annex D (Formulas for calculations of test parameters). For measuring discharge, either weir, venturi, nozzle, orifice plate, Pitot tube, ultrasonic flow meter, or pressure transducer should be used. For relatively small flow rates, gravimetric or volumetric may be applied with the use of a container.

7.3.2 Energy consumption

The energy consumption of engine or motor of the pumpset may be obtained using any of the following methods:

a) Refilling the fuel tank

The fuel consumption of the engine shall be obtained by measuring the volume of fuel refilled after the test. The tank shall be filled to full capacity before and after each trial. The total operating time of the engine shall be

recorded. The fuel consumption shall be computed using the formula specified in Annex D (Formulas for calculations of test parameters).

b) Using fuel consumption meter

The fuel consumption shall be obtained by connecting the engine fuel line to a fuel consumption meter. The total time to consume a given volume of fuel (e.g., 10 mL) shall be recorded. The fuel consumption shall be computed using the formula specified in Annex D (Formulas for calculations of test parameters).

c) Using power meter

The power consumption shall be obtained using a power meter to measure the voltage, current, and the total electric power requirement of the pumpset.

7.3.3 System efficiency

The input power, output power, and system efficiency of the pumpset shall be computed using the formula specified in Annex D (Formulas for calculations of test parameters).

7.3.4 Noise level

The noise level, expressed in decibel [dB(A)], shall be measured 0.5 m away from the machine (from the main source of noise) at a height of 167 cm ±15 by using a sound level meter. For each data on the location to be taken, there shall be a minimum of five (5) observations. Before collecting data, it should be ensured that the operations and other functional characteristics of the machine have stabilized. The time of recording shall be properly spaced during the whole duration of the test trial.

7.4 Data recording and observations

The record sheet for all data and information during the test is given in Annex E (Performance test data sheet). Necessary observations and other parameters to be taken during the field performance test should be recorded on this sheet.

8 Formula

The formulas to be used during calculations and testing are given in Annex D (Formulas for calculations of test parameters).

9 Test Report

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

a) Name of testing agency;
b) Test report number;
c) Title;
d) Summary of results;
e) Purpose and scope of test;
f) Methods of test;
g) Description of the machine;
h) Specifications;
i) Results (include pumpset performance curve);
j) Observations (include pictures); and
k) Names, signatures, and designation of test engineers and assisting technicians.

Annex A
(Informative)

Minimum list of test equipment and materials

	Test equipment and materials	Quantity
A.1	**Test equipment and instruments**	
A.1.1	Sound level meter Range: 30 dB(A) to 130 dB(A) Resolution: 0.1 dB(A)	1
A.1.2	Digital stopwatch Resolution: 0.1 sec	1
A.1.3	Measuring tape Minimum length: 10 m	1
A.1.4	Camera	1
A.1.5	Vernier caliper	1
A.1.6	Weighing scale	1
A.1.7	Graduated cylinder	1
A.1.8	Tachometer	1
A.1.9	Pressure gauge (Discharge and suction side)	2
A.1.10	Computer	1
A.1.11	Fuel consumption meter	1
A.1.12	Power meter	1
A.1.13	Water collecting device (Container)	1
A.1.14	Thermocouple	1
A.1.15	Thermometer	1
A.1.16	Hygrometer	1
A.1.17	Barometer	1
A.1.18	Spirit or bubble level	1
A.2	**Test materials**	
A.2.1	Water (20-40 ºC)	

Annex B
(Normative)

Specifications of pumpset

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

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

GENERAL INFORMATION

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

For electric-driven pumpset:
Voltage Requirement : _____ Ampere Requirement : _____
Frequency Requirement : _____ Power Requirement : _____

No.	Item[a]	Manufacturer's specification	Verification by the testing agency
1	**Type of pump**		
1.1	**For variable displacement**		
1.1.1	Class		
1.1.2	No. of Stage		
1.1.3	**Impeller**		
1.1.3.1	Type		
1.1.3.2	Diameter, mm		
1.1.3.3	Width, mm		
1.1.3.4	No. of vanes		
1.1.3.5	Material		
1.1.4	For centrifugal, Method of priming		
1.1.5	For centrifugal, Type of casing by hydraulic design		
1.2	**For positive displacement**		
1.2.1	Class/Subclass		

No.	Item[a]	Manufacturer's specification	Verification by the testing agency
1.2.2	For reciprocating, Number of pistons and rod assemblies		
1.2.3	For piston or plunger, Type of action		
1.2.4	For rotary, Number of rotors		
1.2.5	Rated RPM		
2	**Casing by mechanical construction**		
2.1	Type		
2.2	Material		
3	**Prime Mover**		
3.1	Type		
3.2	Rated Power		
3.3	Rated RPM		
4	**Power Source**		
5	**Power Transmission**		
5.1	Type		
5.2	**For belt-driven pumpset**		
5.2.1	Size of Engine Pulley, mm		
5.2.2	Size of Pump Pulley, mm		
5.2.3	**Belt**		
5.2.3.1	Type		
5.2.3.2	Number		
6	**Installation**		
7	**Suction side**		
7.1	Type		
7.2	Diameter, mm		
7.3	Material		
8	**Discharge side**		
8.1	Type		
8.2	Diameter, mm		
8.3	Material		
9	**Overall dimensions and weight**		
9.1	Length, mm		
9.2	Width, mm		
9.3	Height, mm		
9.4	Weight, kg		

No.	Item[a]	Manufacturer's specification	Verification by the testing agency
10	**Pumpset information**		
10.1	Discharge capacity at maximum efficiency, L/s		
10.2	Total dynamic head at maximum efficiency, m		
10.3	Operating shaft speed, rpm		
[a] The parameter will be checked upon availability			

Annex C
(Normative)

Illustrations for pressure gauge attachment, measurement of different heads, and test rig setup sample

C.1 Pressure gauges attachment

The pressure gauge tappings are specified as follows:

C.1.1 The suction and discharge side of the pump shall be connected to a straight pipe with a minimum length of 4 times the diameter of each bore and one pressure gauge tapping shall be provided at a distance twice the diameter from each flange surface of the pump. Its position shall be at right angle to the plane of the bend or of the curve of the spiral of the pump as shown in Figure 1.

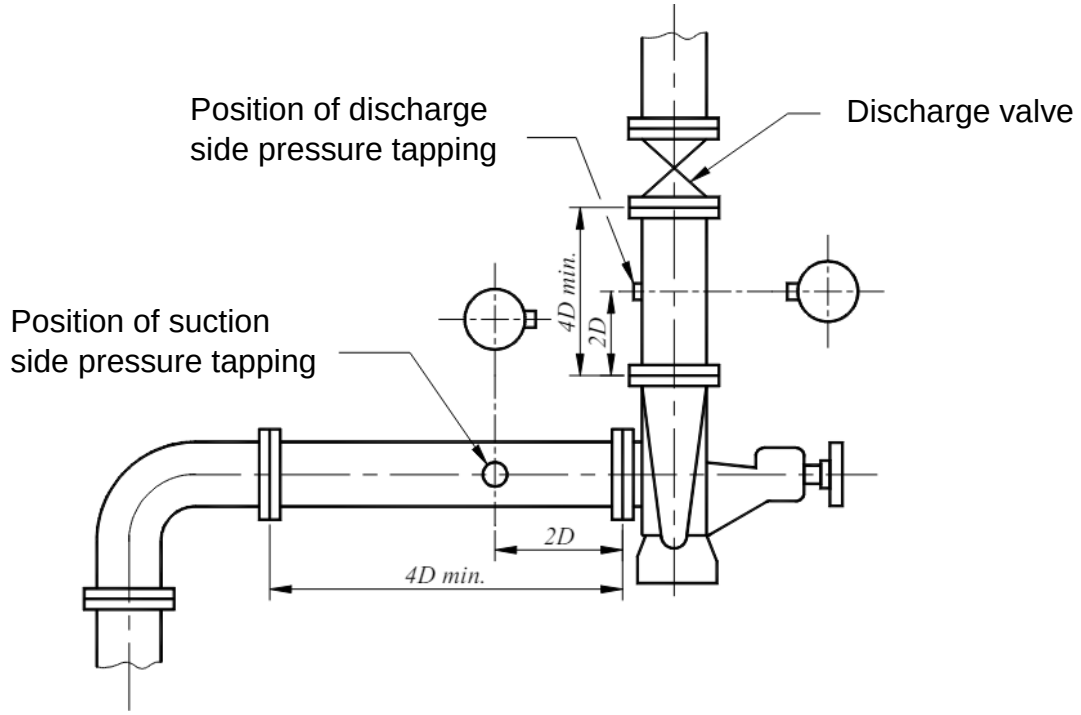
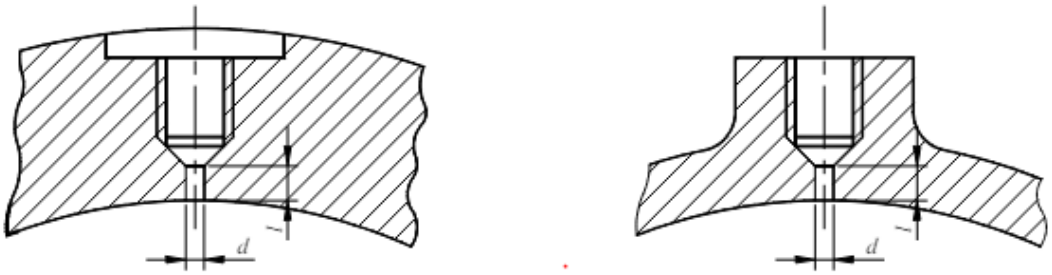


Figure 1. Location of pressure tappings (adapted from AMTEC-UPLB, 2000)

C.1.2 The diameter of pressure tapping shall be 2 to 6 mm or 1/10 of pipe inner diameter, whichever has the less value, and the bore shall be normal (perpendicular) to the inner wall of the pipe and shall have length of not less than twice of its diameter as shown in Figure 2. Inner wall of the pipe at this part shall be sufficiently smooth and the inner rim of the bore shall be made free from any burrs.



a) Thick wall b) Thin wall

Figure 2. Illustration for dimension of a) thick and b) thin wall inner pipe (adapted from AMTEC-UPLB, 2000)

C.2 Measurement of different heads

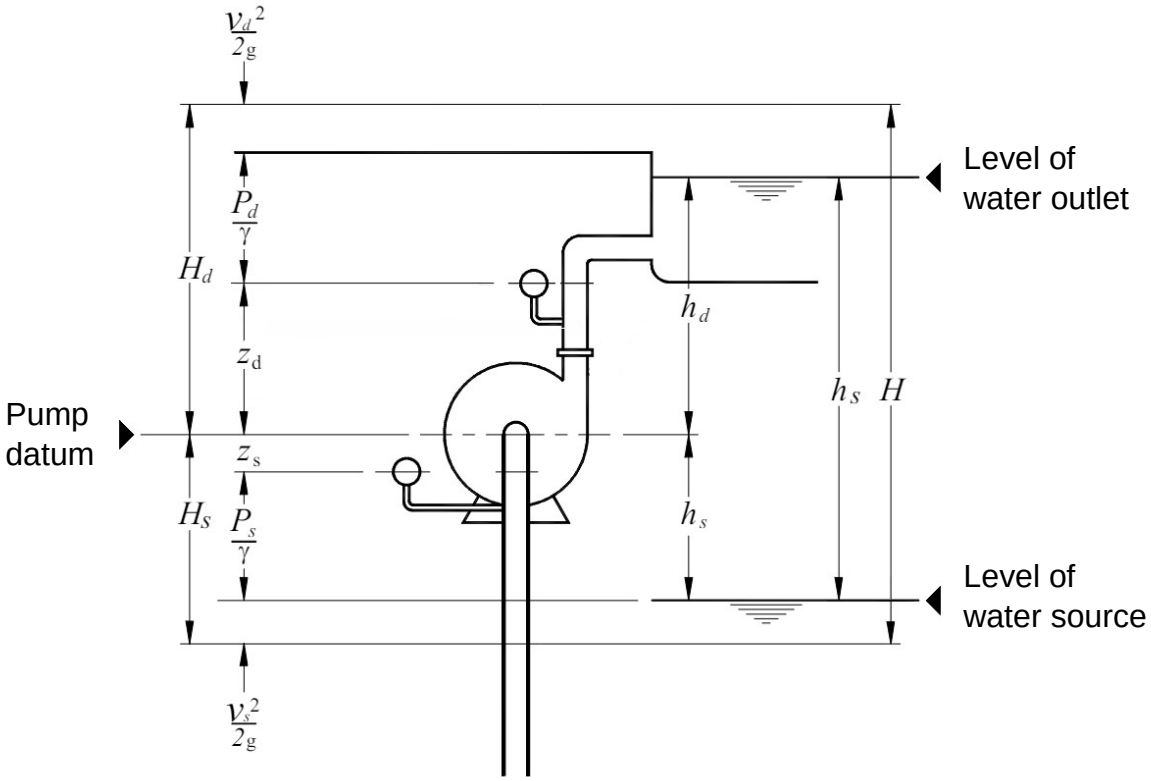
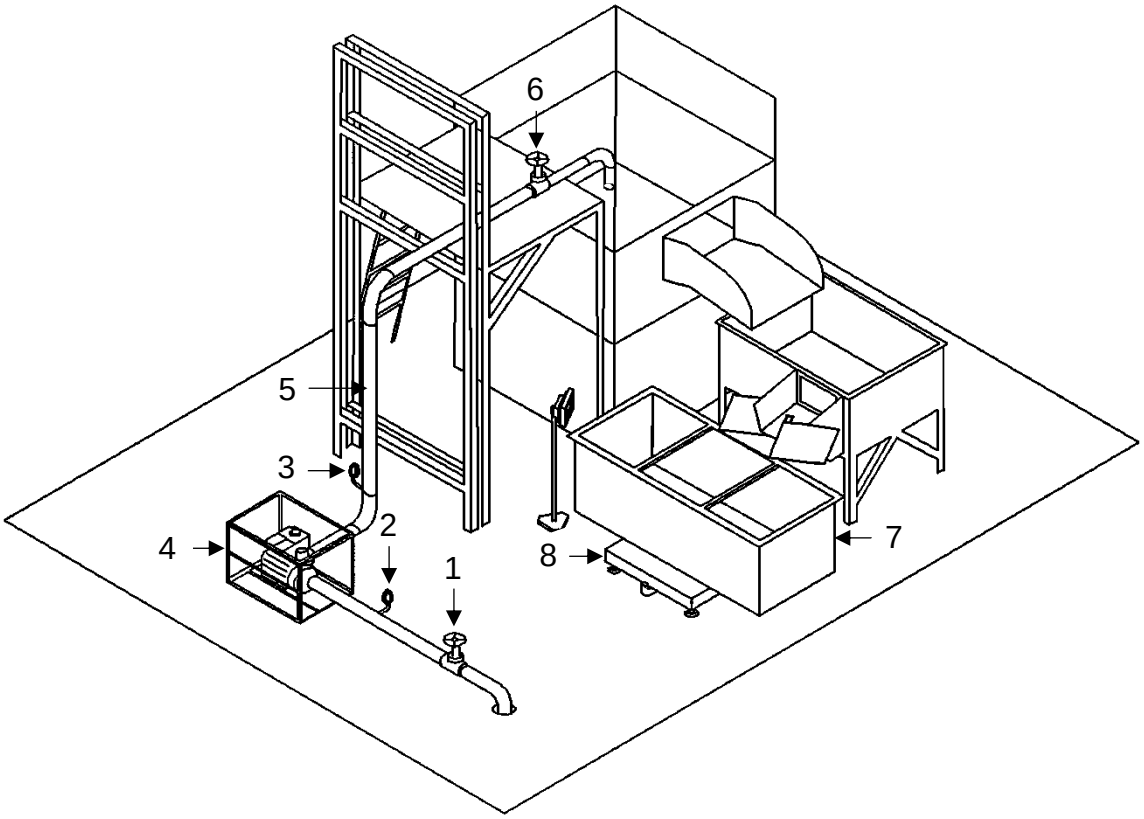


Figure 3. Measurement of different heads (adapted from AMTEC-UPLB, 2000)

C.3 Test rig setup sample



Key:

1	Suction valve	5	Pipe
2	Pressure gauge (suction)	6	Discharge valve
3	Pressure gauge (discharge)	7	Container
4	Pumpset	8	Weighing scale

Figure 4. Sample illustration of test rig setup (adapted from AMTEC-UPLB, 2024)

Annex D
(Normative)

Formulas for calculations of test parameters

D.1 Total dynamic head

Measure of energy increase imparted to the water by the pump and the algebraic difference between the total discharge head and total suction head.

NOTE If the liquid level in the suction vessel is below the pump datum, H_s, is to be taken as negative.

$$H = H_d - H_s$$

where:

$$H_d = \frac{P_d}{\gamma} + \frac{{v_d}^2}{2g} + z_d + h_{fd}$$

$$H_s = \frac{P_s}{\gamma} + \frac{{v_s}^2}{2g} + z_s + h_{fs}$$

where:

H is the total head, m
H_d is the total discharge head, m
H_s is the total suction head, m
$\frac{P_d}{\gamma}$ is the pressure gauge reading on the discharge pipe at gauge connection, in m of H_2O
$\frac{P_s}{\gamma}$ is the pressure gauge reading on the suction pipe at gauge connection, in m of H_2O
$\frac{{v_d}^2}{2g}$ is the velocity head at the point of gauge attachment on the discharge side, m
$\frac{{v_s}^2}{2g}$ is the velocity head at the point of gauge attachment on the suction side, m
Z_d is the elevation of the pressure gauge from the datum line, m
Z_s is the elevation of the vacuum gauge from the datum line, m
h_{fd} is the friction head at the discharge side, m
h_{fs} is the friction head at the suction side, m

NOTE 1 The friction heads, h_{fd} and $h_{fs,}$ is to be computed using Darcy-Weisbach or any appropriate equation

NOTE 2 Water temperature correction shall be considered in the computation

D.2 Discharge capacity

D.2.1 Container method

Measurement of discharge by container method is primarily suitable for the measurement of relatively small flow rate. The two ways of discharge measurement by means of a container are the gravimetric and volume methods.

a) Gravimetric method

This method is preferably used when a liquid's bubbles are hard to break. The container shall have a sufficient capacity to prevent the liquid from overflowing during measurement. The weight of the liquid in the container shall be obtained using a suitable scale at a definite time usually one minute. The discharge shall be computed using the formula:

$$Q = \frac{W}{\rho \times t}$$

where:

Q is the discharge rate of the pumpset, L/s
W is the mass of liquid introduced into container in t seconds, kg
t is the time required to introduce the liquid of W, s
ρ is the mass per unit volume of liquid at the measured temperature, kg/L

b) Volumetric method

The container shall have sufficient capacity to prevent the liquid from overflowing during measurement, and it shall be sufficiently rigid to prevent deformation when it is filled with liquid. The liquid shall be obtained in a container of known volume and the time required to fill that volume is recorded. The discharge shall be computed using the formula:

$$Q = \frac{V}{t}$$

where:

Q is the discharge rate of the pumpset, L/s
V is the volume of liquid introduced into container, L
t is the time required to introduce liquid of V, s

D.2.2 Using weir

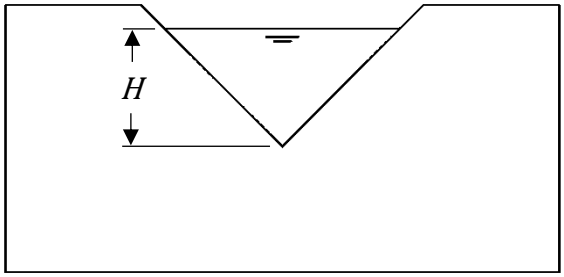
For the measurement of flow by means of a weir, sharp crested triangular or rectangular weir shall preferably be used. The flow shall be calculated according to the following equation:

a) for 90º triangular weir

$$Q = 0.0138\, H^{\frac{5}{2}}$$

where:

Q is the discharge rate of the pumpset, L/s
H is the head, cm

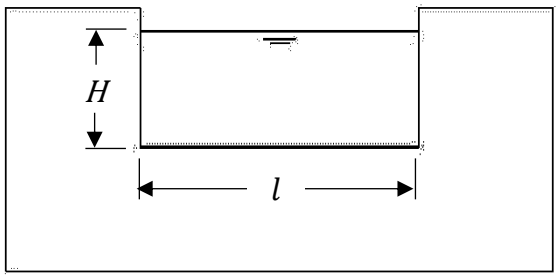


b) for rectangular weir

$$Q = 0.0184\, l \times H^{\frac{3}{2}}$$

where:

Q is the discharge rate of the pumpset, L/s
H is the head over the crest, cm
l is the length of the crest, cm



NOTE For a more detailed formulas, Table 1 (Types of weir, description and discharge evaluation) of PNS/BAFS/PAES 220:2017 may be referred for the computation

D.3 Fuel consumption

$$F_C = \frac{V}{t_e}$$

where:

F_C is the fuel consumption rate, L/h
V is the total volume of fuel consumed, L
t_e is the total operating time of the engine, h

D.4 System efficiency

$$SE = \frac{P_o}{P_i} \times 100$$

where:

$$P_o = \frac{Q \times p}{60000}$$

for engine driven pumpset:

$$P_i = HV_f \times \rho_f \times F_C$$

for electric motor driven pumpset (single-phase):

$$P_i = \frac{V \times I \times PF}{1000}$$

for electric motor driven pumpset (three-phase):

$$P_i = \frac{V \times I \times \sqrt{3} \times PF}{1000}$$

where:

SE is the system efficiency, %
P_o is the output power, kW
P_i is the input power, kW
Q is the discharge rate, L/min
p is the pressure, kPa
HV_f is the heating value of fuel, MJ/kg
ρ_f is the density of fuel, kg/m^3
F_c is the fuel consumption rate, L/h
V is the voltage, V
I is the current, A
PF is the power factor

Annex E
(Normative)

Performance test data sheet

Test Trial No. : _____ Date : _____
Test Engineer/s : _____ Location : _____
Assistants : _____ Machine : _____
Test Applicant : _____ Manufacturer : _____
Serial No. of Pump : _____ Serial No. of Engine : _____

E.1 Test Condition

E.1.1 Test Rig Specifications

Item	Data
Suction head, m	
Discharge head, m	
Diameter of pipes, mm	
Length of pipes, m	
Materials of pipes	
No. of fittings	
Type of fittings	
Materials of fittings	

E.1.2 Ambient Condition and Test Material

Item	Trials			Average
	1	2	3	
Temperature, ºC (Dry bulb)				
Temperature, ºC (Wet bulb)				
Relative humidity, %				
Atmospheric pressure, kPa				
Water temperature, ºC				

E.2 Data Collection

Trials	Pressure, kPa	Discharge Capacity, L/s	Total Head, m	Operating Shaft Speed, rpm	Energy Consumption		Input Power, kW	Output Power, kW	System Efficiency, %	Noise Level, dB(A)
					Engine, L/h	Motor, kW-h				
1										
2										
3										
4										
5										
6										
7										
8										
9										
10										

E.3 Observations

Include applicable clauses from Specifications

E.3.1 Special features

_____
_____
_____

E.3.2 Other observations (e.g., handling and safety features)

_____
_____
_____

Bibliography

Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2000). Agricultural machinery — Centrifugal, Mixed Flow and Axial Flow Water Pumps — Methods of Test (PAES 115:2000). https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2019/07/PAES-115-2000.pdf

Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2021). Agricultural and fisheries machinery — General methods of test (AS 001:2021). https://amtec.ceat.uplb.edu.ph/wp-content/uploads/2023/04/AS-001-2021-Agricultural-and-Fisheries-Machinery-General-Methods-of-Test.pdf

Agricultural Machinery Testing and Evaluation Center (AMTEC)-University of the Philippines Los Baños (UPLB). (2024). Illustration of test rig setup for the pumpset testing.

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2017). Conveyance systems — Performance evaluation of open channels — Determination of conveyance loss by inflow-outflow method (PNS/BAFS/PAES 220:2017).

Bureau of Agriculture and Fisheries Standards (BAFS)-Department of Agriculture (DA). (2024). Agricultural and fishery pumpset — Specifications (PNS/BAFS 392:2024).

Bureau of Indian Standards (BIS)-Department of Consumer affairs, Ministry of Consumer Affairs, Food & Public Distribution, Government of India. (2011). Technical requirements for rotodynamic special purpose pumps.

International Organization for Standardization (ISO). (2012a). Liquid pumps and installation — General terms, definitions, quantities, letter symbols and units — Part 1: Liquid pumps.

International Organization for Standardization (ISO). (2012b). Liquid pumps and installation — General terms, definitions, quantities, letter symbols and units — Part 1: Pumping system.

Department of Agriculture (DA)
Bureau of Agriculture and Fisheries Standards (BAFS)

Technical Working Group (TWG) for the Philippine National Standard (PNS) on Agricultural and Fishery Pumpset — Methods of Test

Chairperson
Luyun, Roger Jr., PhD
Raches, Mark Angelo, ABE
Institute of Agricultural and Biosystems Engineering (IABE)-University of the Philippines Los Baños (UPLB)

Vice Chairperson
Eusebio, Marck Ferdie, ABE
Pangan, Ronel, PhD
Center for Agri-Fisheries and Biosystems Mechanization (BIOMECH)-UPLB

Members

1 Pandiño, Jessa Rica, ABE
2 Sabasaje, Arjay, ABE
Bureau of Agricultural and Fisheries Engineering (BAFE)-DA

3 De Guzman, Evander, ABE
4 Melendez, Peachie, ABE
Philippine Council for Agriculture and Fisheries (PCAF)-DA

5 Martin, Rachelle Marie, ABE
6 Tallada, Jasper, PhD
Philippine Rice Research Institute (PhilRice)-DA

7 Avila, Richard, ABE
8 Macaranas, Raymund Joseph, MSc
Philippine Center for Postharvest Development and Mechanization (PHilMech)-DA

9 Jardin-Millare, Triniza, ABE
10 Perey, Ronnel, ABE
DA-Regional Field Office (RFO) CALABARZON

11 Cubita, Bryan, ABE
12 Salva, Jon James, ABE
DA-RFO Northern Mindanao

13 Collada, Kaye, ABE
14 Mora, Peter Paul, ABE
DA-RFO Bicol

15 Payod, Renato, ABE
16 Rebayno, Jay, ABE
DA-RFO Eastern Visayas

17 Balao, Katherine, ABE
18 Ribad, Gregorio Jr., ABE
DA-RFO Cagayan Valley

19 Brazas, Jane, ABE
20 Tayson, Raffy, ABE
DA-RFO Western Visayas

21 Luces, Joein, ABE
22 Marquez, Adonis, IE-MSEM
Metal Industry Research and Development Center (MIRDC)-Department of Science Technology (DOST)

23 Eusebio, Romulo, ABE
24 Menguito, Jerson Jose, ABE
25 Reyes, Marie Jehosa, MSc
Agricultural Machinery Testing and Evaluation Center (AMTEC)-UPLB

Members

26 Beltran, Christian Jake
27 Raza, Nhesreen, ABE
Central Isabela Agri Manufacturing Corporation (CIAMC)

28 Amoroso, Apolinario
29 Galit, Samson, ABE
30 Tayong, Neptaly, ABE
Agricultural Machinery Manufacturers and Distributors Association (AMMDA), Inc.

31 Agliam, Jovita, PhD
32 Tamondong, Alexis, ABE
Philippine Society of Agricultural and Biosystems Engineers (PSABE) Inc.

BAFS Management Team
Lanuza, Alpha, DVM/
Aquino, John Gregory, PFT
Hernandez, Gari Pellinor, DVM
Anareta, El John Paul, ABE
Tumagan, Eula, ABE

Adviser
Mandigma, Mary Grace, PFT/
Roscom, Karen Kristine, PFT, PhD

BUREAU OF AGRICULTURE AND FISHERIES STANDARDS

BPI Compound, Visayas Avenue, Vasra, Quezon City 1128 Philippines
T/ (632) 928-8741 to 64 loc. 3301-3319
E-mail: bafs@da.gov.ph
Website: www.bafs.da.gov.ph