

Foreword

The formulation of this Standard was initiated by the Agricultural Machinery Testing and Evaluation Center (AMTEC) under the project entitled "Enhancing the Implementation of AFMA Through Improved Agricultural Engineering Standards" which was funded by the Bureau of Agricultural Research (BAR) of the Department of Agriculture (DA).

This revised standard was reviewed by the Technical Committee for Study 1- Development of Standards for Agricultural Production Machinery and was circulated to various private and government agencies/organizations concerned for their comments and reactions. This standard was presented to the Philippine Society of Agricultural Engineers (PSAE) and subjected to a public hearing organized by the National Agriculture and Fisheries Council (NAFC). The comments and reactions received during the presentation and public hearing were taken into consideration in the finalization of this standard.

This standard has been formulated in accordance with PNS 01:Part 4:1998 - Rules for the Structure and Drafting of Philippine National Standards.

In the preparation of this standard, the following documents/publications were considered:

Draft International Standard/International Organization for Standardization (DIS/ISO) 9905 – Technical Specification for centrifugal pumps

KUBOTA Pump Handbook Vol. 1 Technical Manual

Basic Hydraulics by Andrew Simon (1981)

Water Supply 2nd edition by A. C. Twort, R.C. Hoather and F.M. Law (1974)

McPherson's Pump Handbook

Water-pumping Devices – A handbook for Users and choosers by Peter Fraenkel (1986)

Republic Act No. 7394 otherwise known as "The Consumer Act of the Philippines" enacted on July 22, 1991.

Agricultural Machinery – Centrifugal Pump – Specifications

1 Scope

This standard specifies the requirements for construction and performance of centrifugal pump which is used in agriculture.

2 References

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

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

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

PAES 115:2000, Centrifugal, Mixed-Flow and Axial Flow Water Pumps – Methods of Test.

3 Definitions

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

3.1**capacity**

discharge at maximum efficiency

3.2**centrifugal pump**

type of pump with impellers rotating inside a closed casing which draws water into the pump through a central inlet opening and forces water out through a discharge outlet at the periphery of the housing by means of centrifugal force (Figure 1)

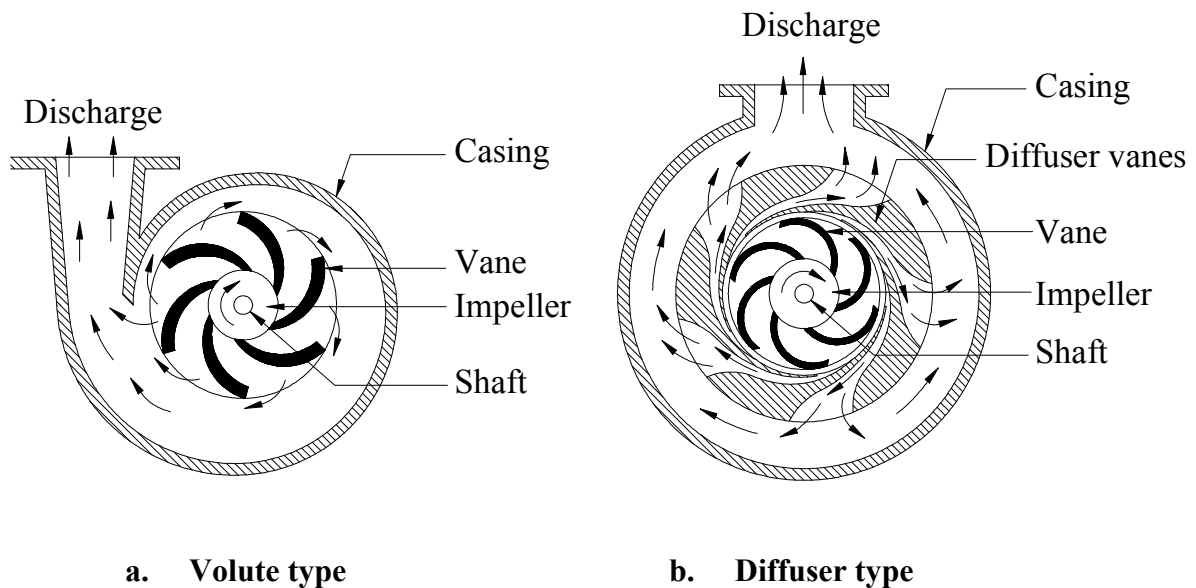


Figure 1 – Centrifugal pumps

3.2.1

diffuser pump

turbine pump

type of centrifugal pump wherein the impeller is surrounded by diffuser vanes

NOTE The diffuser vanes have small openings near the impeller and enlarge gradually to their outer diameter where the water flows into the chamber and around to the pump discharge.

3.2.2

volute pump

type of centrifugal pump with a casing made in the form of a spiral or volute curve

NOTE The casing is proportioned to reduce gradually the velocity of water as it flows from the impeller to the discharge, thus changing velocity head to pressure head.

3.3

head

quantity used to express a form (or combination of forms) of the energy content of the liquid per unit weight of the liquid referred to any arbitrary datum

3.4

net positive suction head required (NPSHR)

performance characteristic required of the pump and is the NPSH at the pump inlet

NOTE It is the statement of the minimum suction conditions required to prevent cavitation.

3.5**pump**

device used to lift or transfer water from one source to another

3.6**pump efficiency (η_p)**

ratio of the power output to the power input of the pump

3.7**priming**

filling up the pump with water to displace or evacuate the entrapped air through a vent and create a liquid seal inside the casing

3.8**shaft power**

power required to drive the pump shaft

NOTE It is the input power to the pump.

3.9**water power**

theoretical power required for pumping

NOTE It is the head and capacity of the pump expressed in kilowatt.

4 Classification

The classification of centrifugal pumps shall be based on the following:

4.1 Type of energy conversion**4.1.1** Volute**4.1.2** Diffuser or turbine**4.2** Type of Impellers (Figure 2)**4.2.1** Open

It is used to pump water with considerable amount of small solids.

4.2.2 Semi-open or semi-enclosed

It is used to pump water having some amount of suspended sediments.

4.2.3 Enclosed

It is designed to pump clear water.

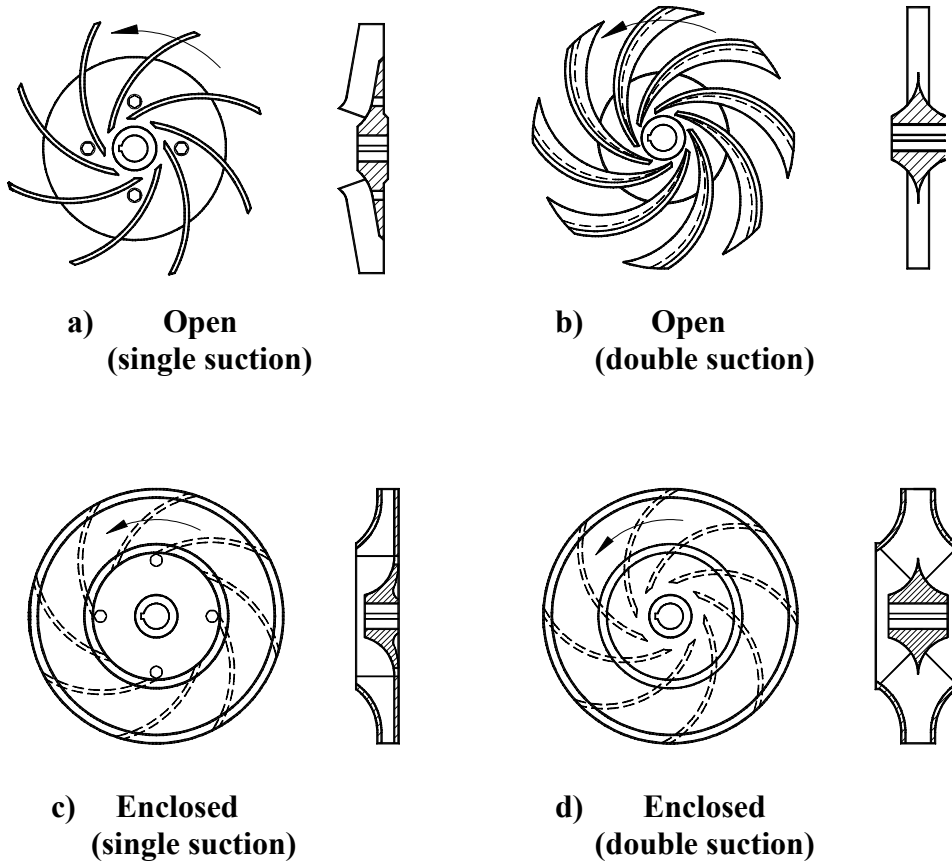


Figure 2 – Different types of impeller

4.3 Type of suction inlets (Figure 3)

4.3.1 Single suction

A single suction type of pump has an impeller which has suction cavity on one side.

4.3.2 Double suction

A double suction type of pump has an impeller which has suction cavity on both sides.

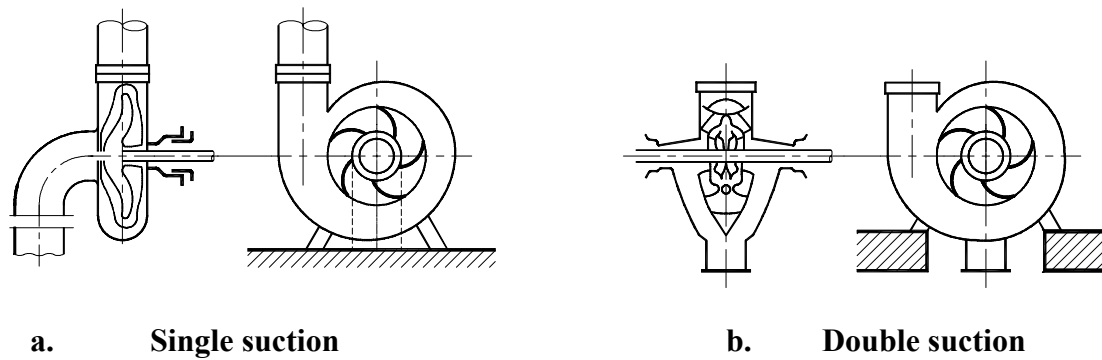


Figure 3 – Types of suction inlets

4.4 Axis of rotation

4.4.1 Horizontal

A horizontal centrifugal pump has a vertical impeller mounted on a horizontal shaft.

4.4.2 Vertical

A vertical centrifugal pump has a horizontal impeller mounted on a vertical shaft.

4.5 Method of priming

4.5.1 Non-self-priming

Non-self-priming pump is one that needs to be manually primed. The system has to be filled initially by pouring water into the pipes from a bucket and thereafter the footvalve will keep water in the system even after the pump is not used for some time.

4.5.2 Self-priming

Self-priming pump is one that develops a vacuum sufficiently enough for atmospheric pressure to force the liquid to flow through the suction pipe into the pump casing without priming the pump.

5 Performance Requirements

The centrifugal pump when tested in accordance with PAES 115 shall conform to the following requirements:

- 5.1** Performance curve, which shows the head, efficiency, NPSHR, and the power, plotted against discharge at specified shaft speed, shall be provided.
- 5.2** The capacity and total head at maximum efficiency and rated shaft speed, as claimed by the manufacturer shall be attained.

6 Other Requirements

- 6.1** The centrifugal pump shall be designed for easy maintenance. Major parts such as casing components and bearing housings (shouldered or doweled) shall have accurate alignment on reassembly.
- 6.2** The rotating components shall be dynamically balanced.
- 6.3** The pump shall be designed to permit removal of the impeller, shaft seal and bearing assembly without disturbing the inlet and outlet flange connection.
- 6.4** Radial bearings shall be of standard available design (ball, roller, sleeve or pivoted shoe).
- 6.5** Sealed type bearing shall be used or the bearing housing shall be sealed, to prevent the entry of contaminants and the escape of lubricant under the normal operating conditions.
- 6.6** Bearing housing shall preferably be arranged so that bearings and seal can be easily replaced without disturbing pump drive and mounting.
- 6.6** Shafts shall be of ample size and of appropriate stiffness to:
 - 6.6.1** Transmit the primemover rated power.
 - 6.6.2** Ensure satisfactory packing or seal performance.
 - 6.6.3** Minimize wear and the risk of seizure.
 - 6.6.4** Take due consideration of static and dynamic radial thrust.

7 Workmanship and Finish

7.1 Castings shall be free of shrink holes, blowholes, cracks, scale, blisters and other similar injurious defects. The surface of castings shall be cleaned by sandblasting, shot blasting, pickling or any other standard method. All mold-parting fins and remains of gates and risers shall be chipped, filed, or ground flush.

7.2 Shaft shall be machined and properly finished throughout their length.

8 Warranty for Construction and Durability

8.1 Warranty against defective materials and workmanship shall be provided for parts and services except on consumable maintenance parts such as seals, within six (6) months from the purchase of the pump.

8.2 The construction shall be rigid and durable without breakdown of its major components (i.e. casing, impeller, shaft, etc) within six (6) months from purchase by the first buyer.

9 Maintenance and Operation

9.1 Each centrifugal pump unit shall be provided with the following basic hand tools such as two (2) pieces open wrenches of appropriate sizes and one (1) piece adjustable wrench for repair and maintenance.

9.2 An operator's manual, which conforms to PAES 102, shall be provided.

10 Sampling

Centrifugal pumps shall be sampled for testing in accordance with PAES 103.

11 Test Method

The sampled centrifugal pumps shall be tested for performance in accordance with PAES 115.

12 Marking and Labeling

Each pump shall be marked with the following information using a plate, stencil or by directly punching it at the most conspicuous place:

12.2.1 Registered trademark of the manufacturer

12.2.2 Brand

12.2.3 Model

12.2.4 Type and size

12.2.5 Serial number

12.2.6 Production date (optional)

12.2.7 Name and address of manufacturer

12.2.8 Name and address of the importer, if imported (optional)

12.2.9 Country of manufacture (if imported) / “Made in the Philippines” (if manufactured in the Philippines)

12.2.10 Maximum efficiency

12.2.11 Discharge at maximum efficiency (Capacity)

12.2.12 Total head at maximum efficiency

12.2.13 Rated shaft speed

12.2.14 Input/Shaft power

12.2.15 Safety/precautionary markings