Foreword

This standard is a revision of the Philippine National Standard (PNS) 1134:1993 - Lever-Operated Manual Knapsack Sprayer – Specifications". The revision 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 technically revised in accordance with PNS 01:Part 4:1998 - Rules for the Structure and Drafting of Philippine National Standards. The main changes are listed below:

- title of the standard has been modified in conformity to the format of International Standard;
- the scope was delineated thereby indicating the aspects covered and the limits of applicability;
- definition of lever-operated knapsack sprayer (LOKS);
- inclusion of performance criteria based on the result of actual test conducted by Agricultural Machinery Testing and Evaluation Center; and
- modification on general requirements and specific requirements for the different components of LOKS.

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

Workshop on Small Sprayer Standards, Safety and Future Directions held in Bombay, India

Procedures for the Comparative Evaluation of Knapsack Sprayer by J.A. Sutherland

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

Agricultural Machinery – Lever-Operated Knapsack Sprayer – Specifications

1 Scope

This standard specifies the requirements for construction and performance of lever-operated knapsack sprayer (LOKS) in which hydraulic nozzles are used for the application of liquid chemicals 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 113 : 2000, Lever-Operated Knapsack Sprayers – Methods of Test.

3 Definitions

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

3.1
lever-operated knapsack sprayer (LOKS)
backpack sprayer
sprayer which is operated manually with a lever and can be carried on the back of an operator for spraying

3.2
pressure chamber
component of the sprayer that evens out the fluctuations of the fluid pressure and induces more uniform flow of the sprayed liquid

3.3
tank capacity
maximum allowable volume of the liquid to fill the sprayer tank, when equipped with all its internal mounting

4 Physical Description and Construction

A lever-operated knapsack sprayer (Fig. 1) consists of reservoir or tank to carry liquid chemical on the operators back. A lever operating either below or above the shoulder with the left or right hand is used to operate a piston or diaphragm type pump, mounted inside, but in some cases, outside the sprayer tank, which forces the liquid chemical into a pressure chamber. Air trapped in this chamber is pressurized and forces the liquid chemical, via a cut-off valve, to the nozzle fitted on a hand lance. The sprayer tank is not pressurized and the operator must continue pumping while spraying. Such equipment is hereafter referred to as the sprayer. The sprayer and related accessories shall be built in such a way to minimize operator hazards and provide reliable operation over the expected life of the equipment (life expectancy in hours shall be specified by the manufacturer). All parts of the sprayer shall be made of materials, which shall not be affected by the use of a liquid chemical for a minimum of 48 hours use. The respective grades and standards of materials used in pressure areas shall be specified by the manufacturer in the sprayer manual.

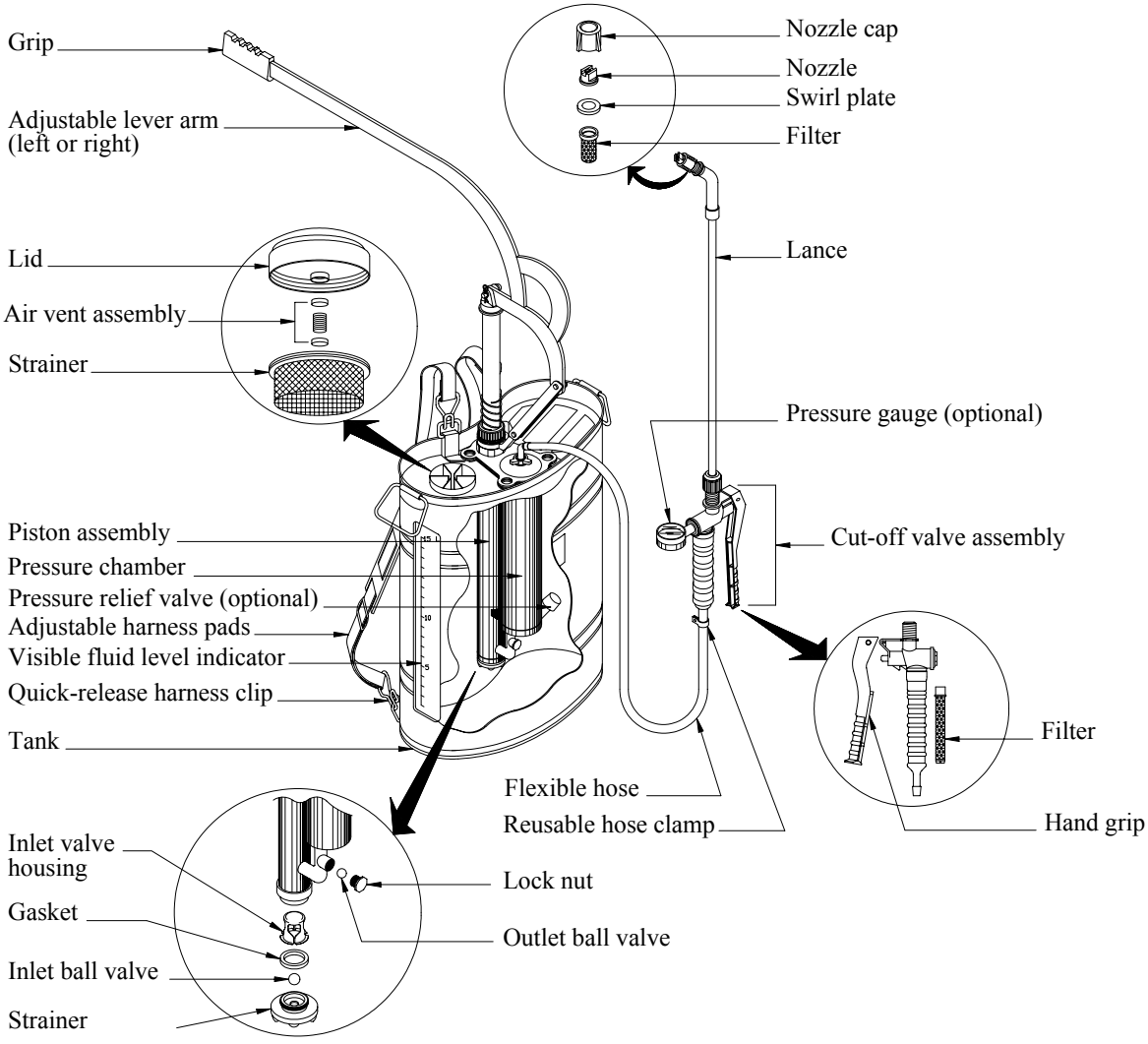

Figure 1 – A Typical Lever-Operated Knapsack Sprayer (Piston type) with its Components

5 Requirements

5.1 General

5.1.1 LOKS shall include among others at least one set of protective nose and mouth mask and a pair of eye goggles to protect operator against inhalation and eye irritation respectively due to spray chemicals.

5.1.2 LOKS shall conform to the operator's body, distributing weight evenly, presenting operating controls in a reasonable location and configuration, in such a way that the operator is not exhausted after sustained usage.

5.1.3 LOKS shall provide the required output with a minimum of energy expended, and shall be capable of driving a boom with up to four nozzles.

5.1.4 LOKS shall offer a well-engineered design of high quality construction and components which are readily accessible, serviceable and considered durable over the expected life of the sprayer.

5.1.5 No part of the outer surface shall entrap spilled liquid, and there shall be no sharp edges or protrusions.

5.1.6 The weight of the sprayer, empty but otherwise ready for operation, shall not exceed 6.0 kg.

5.1.7 All valve parts shall be readily accessible for servicing and replacement.

5.1.8 The LOKS when tested in accordance with PAES 113 shall attain the following:

5.1.8.1 The sprayer shall have a minimum volumetric efficiency of 80%.

5.1.8.2 The sprayer shall not leak from the body or any of its component parts and the pressure shall not drop by more than 35 kPa when subjected to leak test.

5.1.8.3 The sprayer shall not have any abnormality or trouble when subjected to continuous running test.

5.1.8.4 All permanent joints shall not show any sign of fatigue or failure, when tested for durability.

5.2 Tank

5.2.1 The tank shall have a minimum capacity of 10 liters.

5.2.2 The overall weight of the sprayer with its component parts, when fully loaded with water shall not exceed 22 kgs.

5.2.3 The sprayer shall remain upright and stable when placed on a level surface. It shall be easy for the user to lift the sprayer at full tank and its components onto the back.

5.2.4 It should be possible to empty the tank completely during spraying, and in no case shall there be more than 50 ml of residue after system pump out.

5.2.5 The sprayer shall withstand standard drop test when tested in accordance with PAES 113.

5.3 Pump and Lever

5.3.1 The pump shall be easily detachable from the sprayer without the use of specialized tools, unless these are provided with, or are part of the sprayer.

5.3.2 The lever shall be adjustable to enable right or left hand operation.

5.3.3 The length and position of the lever shall be such that it is comfortable to operate for up to 4 hours of field usage.

5.3.4 The grip shall be comfortable to hold and securely fastened to the lever. It shall have a minimum diameter of 25 mm and a minimum length of 100 mm.

5.3.5 The LOKS when tested in accordance with PAES 113 shall attain the following:

5.3.5.1 The flow rate from the nozzle using water and the nozzles provided, shall lie in the range of 0.3 to 1.4 L/min. at a mean pressure of 300 kPa.

5.3.5.2 The pumping rate shall not exceed 40 strokes/min. and the vertical movement at the end of the lever shall not exceed 400 mm.

5.3.5.3 For nozzles designed for the application of herbicides, the operating pressure shall be 100 kPa.

5.4 Filter Assembly

5.4.1 The sprayer shall contain a minimum of two filters, which are made of corrosion resistant material, with each allowing easy cleaning, maintenance and/or replacement.

5.4.2 The design of the filter basket shall be such that it allows rapid filling of the tank, without splashing and an air vent shall be provided. It shall have a mesh of $100/cm^2$.

5.4.3 The filter basket shall be such that it can be easily removed by users for cleaning even when wearing gloves.

5.5 Filling Hole

5.5.1 The sprayer shall be capable of filling through the tank opening, provided with a filter, without spillage.

5.5.2 The filler hole shall be circular with minimum diameter of 100 mm.

5.5.3 The lid shall allow easy and secure fitting by the gloved hand of an operator and shall provide an effective seal.

5.5.4 Any air vent in the lid or tank shall limit the escape of spray liquid to 5 ml if the sprayer is completely inverted for 5 minutes.

5.6 Hose and Lance

5.6.1 The material of the hose may be either rubber or synthetic material. If rubber, it shall have one or more plies of fiber reinforcement.

5.6.2 Hoses shall be retained on connectors and couplings preferably by clamps or clips of the worm drive type. Threaded connections may be of any design provided the strength and size permit liquid tight joints to be made by thumb pressure at the highest operating pressure of the sprayer.

5.6.3 The lance shall be of length not less than 100 cm.

5.6.4 The lance shall allow for convenient storage when not in use.

5.7 Cut-off Valve Assembly

5.7.1 The cut-off grip shall be comfortable to hold and easy to use.

5.7.2 The cut-off valve shall be easy and comfortable to operate without undue fatigue in the hand and lower arm.

5.7.3 The cut-off valve shall have a LOCK ON and LOCK OFF feature.

5.7.4 The cut-off valve assembly may contain an adequate filter, which can be cleaned, maintained and replaced.

5.7.5 The cut-off valve must not leak or break when subjected to leak test and shall withstand the durability test.

5.8 Nozzle Assembly

5.8.1 At least two nozzle tips shall be provided one each for fine and coarse spray application.

5.8.2 The nozzle body may contain a filter, which can be cleaned, maintained and replaced, and be provided with a standard thread to fit the lance.

5.8.3 Variable cone type nozzles shall not be used.

5.9 Strap

5.9.1 The load bearing part of the strap shall be at least 50 mm wide. A load bearing waist strap is desirable.

5.9.2 All materials shall be durable and non-absorbent.

5.9.3 There shall be provision for adjustment of the strap.

5.9.4 A quick release mechanism shall be provided for emergency purposes.

5.9.5 The sprayer strap, straphangers or strap clip shall not fail or damage when subjected to strap test.

5.10 Connectors and Fasteners

5.10.1 All hose connections shall have the same diameter, be interchangeable and be provided with reusable clamps.

5.10.2 All other external connectors shall be of standard thread size and designed so as not to provide a potential source of leakage.

5.10.3 Fasteners shall not penetrate the pressure chamber.

5.11 Pressure Regulation (optional)

5.11.1 Some form of pressure limiting valve may be present to prevent excessive pressure of the sprayer and its components and cause external leak.

5.11.2 The device should be positioned external to the tank, or if internal, shall provide means of adjustment from the outside of the tank.

5.12 Pressure gauge (Optional)

5.12.1 A pressure gauge, if provided, shall have an accuracy of $\pm$ 5% of maximum pressure.

5.12.2 The gauge shall be in a position where it is clearly visible when spraying, and shall be upstream of the cut-off valve.

5.13 Fluid Level Indicator

5.13.1 A fluid level indicator shall be provided. The liquid capacity of the tank shall be clearly marked and visible, at 1-liter intervals, within 5% accuracy.

6 Warranty for Construction and Durability

6.1 Warranty against defective materials and workmanship shall be provided for parts and services except on consumable maintenance parts (i.e. strainer or filter) within six (6) months from the purchase of the sprayer.

6.2 The construction shall be rigid and durable without breakdown of its major components within six (6) months from purchase by the first buyer.

7 Maintenance and Operation

7.1 Each LOKS unit shall be provided with one (1) spare piece of gasket and nozzle.

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

8 Sampling

LOKS shall be sampled for testing in accordance with PAES 103.

9 Test Method

The sampled LOKS shall be tested for performance and durability in accordance with PAES 113.

10 Packaging , Marking and Labeling

10.1 Each unit shall be properly packaged and shall be provided with all necessary information relating to sprayer maintenance and safe use and an illustrated parts list in a sprayer manual written in appropriate language.

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

10.2.1 Registered trademark of the manufacturer

10.2.2 Brand

10.2.3 Production date (optional)

10.2.4 Name and address of manufacturer

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

10.2.6 Country of manufacture (if imported) / "Made in the Philippines" (if manufactured in the Philippines)

10.2.7 Tank capacity (L)

10.2.8 Safety/precautionary markings

10.2.9 Disclaimer clause for the misuse of the equipment