



AMTEC
Agricultural Machinery Testing and Evaluation Center
1977

ACR 014:2023 CHECKLIST AND REMINDERS FOR THE AMTEC TEST CONDITIONS AND REQUIREMENTS FOR KNAPSACK SPRAYER

■ Application for AMTEC Test

The test applicant shall submit AMTEC-OP-F01 (Agricultural Machinery Test Application Form) together with the following requirements:

- AMTEC-OP-F16 (Waiver for Machine Specifications)
- AMTEC-OP-F18 (Data Privacy Consent Form)

■ Technical Specifications of the Machine

The test applicant shall submit any document/s indicating the specifications and other relevant information of the machine upon application for testing.

- Operator's manual with complete specifications as indicated in Annex B of PNS/BAFS 332:2022
- Brochure
- Machine specifications sheet (shall be filled out upon request and receipt of copy from AMTEC in case the manual or brochure is not available)

■ Preparation and Operation of the Machine

The representative of the test applicant and testing agency shall check the knapsack sprayer to ensure that it has been operated in accordance with the instruction of the manufacturer. The official testing agency shall test the knapsack sprayer in accordance with the rated operating pressure. If there is no indicated rated operating pressure, 275 kPa shall be used. The knapsack sprayer shall be tested for normal operation, as stated in the operators' manual.

■ Running-in of the Machine

A test run shall be conducted prior to the official test to check its condition and make necessary adjustments to the machine. No other adjustments shall be permitted while the official test is on-going.

■ Other Test Necessities

The following shall also be supplied for the conduct of the performance test:

- 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
- At least two nozzles that can deliver two different spray qualities (e.g., fine, medium or coarse) depending on the intended use, shall be provided.

■ Requirements

AMTEC shall conduct various tests and verification on different parameters of the machine including the following requirements as per PAES 331:2022:

■ Fabrication Requirements

Item	Requirement as per PAES 331:2022
General	<ul style="list-style-type: none"> <input type="checkbox"/> All permanent joints shall not show any sign of failure, when tested for durability, as specified in the PNS/BAFS 332:2022 (Knapsack sprayers – Methods of test). <input type="checkbox"/> Pressurized parts of the sprayer shall withstand twice the rated operating pressure.
Spray Tank	<ul style="list-style-type: none"> <input type="checkbox"/> For engine-driven knapsack sprayer, the tank nominal volume should not be more than 40 kg. For other sprayers (i.e., lever-operated, compression, electric motor-driven, and dual), the tank nominal volume shall not be more than 25 kg. <input type="checkbox"/> For compression knapsack sprayer, the spray tank volume shall exceed the nominal volume by at least 25%. For other sprayers (i.e., lever-operated, engine-driven, electric motor-driven, and dual), the spray tank volume shall exceed the nominal volume by at least 5%.



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1977

	<ul style="list-style-type: none"> <input type="checkbox"/> 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. <input type="checkbox"/> Shall have a minimum capacity of 10 L. <input type="checkbox"/> The nominal volume shall be specified in whole liter (L). 																											
Filter Assembly	<ul style="list-style-type: none"> <input type="checkbox"/> Shall contain a minimum of two filters, which are made of corrosion resistant material that allows for easy cleaning, maintenance, and/or replacement. <input type="checkbox"/> The design of the spray tank inlet strainer shall be such that it allows rapid filling of the tank without splashing. <input type="checkbox"/> The spray tank inlet strainer shall have at least 16 holes per square centimeter (mesh 16/cm²). 																											
Spray tank inlet	<ul style="list-style-type: none"> <input type="checkbox"/> The sprayer shall be filled through the spray tank inlet without spillage. <input type="checkbox"/> The lid shall allow easy and secure fitting by the gloved hand of an operator and shall provide an effective seal. <input type="checkbox"/> There should be a provision for chain, string or any form of attachment of the lid to the sprayer tank to avoid misplacement of the lid. <input type="checkbox"/> 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 five minutes. 																											
Hose and Lance	<ul style="list-style-type: none"> <input type="checkbox"/> The hose should be made of either rubber or synthetic material. If made of rubber, it shall have one or more plies of fiber reinforcement. <input type="checkbox"/> 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 that the strength and size permit liquid tight joints to be made by thumb pressure at the highest operating pressure of the sprayer. <input type="checkbox"/> The length of the hose from the hose nipple of the spray tank to that of the spray lance hand grip shall be at least 1200 mm. <input type="checkbox"/> The spray lance shall provide a sufficient distance from the operator to the spray. <input type="checkbox"/> The length of the lance shall be at least 500 mm. 																											
Cut-off Valve Assembly	<ul style="list-style-type: none"> <input type="checkbox"/> Shall have a lock on and lock off feature. <input type="checkbox"/> Shall not leak or break when subjected to leak test. 																											
Nozzle Assembly	<ul style="list-style-type: none"> <input type="checkbox"/> At least two nozzles that can deliver two different spray qualities (e.g., fine, medium or coarse) depending on the intended use, as characterized in table below, shall be provided. <table border="1" style="width: 100%; border-collapse: collapse; text-align: center;"> <thead> <tr> <th>VMD, μm</th> <th>Spray Quality</th> <th>Use</th> </tr> </thead> <tbody> <tr> <td><60</td> <td>Extremely Fine</td> <td>-</td> </tr> <tr> <td>61-105</td> <td>Very Fine</td> <td>-</td> </tr> <tr> <td>106-235</td> <td>Fine</td> <td>Good Cover</td> </tr> <tr> <td>236-340</td> <td>Medium</td> <td>Most Products</td> </tr> <tr> <td>341-403</td> <td>Coarse</td> <td>Systemic Herbicides</td> </tr> <tr> <td>404-502</td> <td>Very Coarse</td> <td>Soil Herbicides</td> </tr> <tr> <td>503-665</td> <td>Extremely Coarse</td> <td>Liquid fertilizer</td> </tr> <tr> <td>>665</td> <td>Ultra Coarse</td> <td>Liquid fertilizer</td> </tr> </tbody> </table> <p style="font-size: small; margin-top: 5px;">Based on American Society of Agricultural and Biological Engineers (ASABE). (2020). Droplet size classification (ASABE S-572.1).</p> <ul style="list-style-type: none"> <input type="checkbox"/> The nozzle body should contain a filter, which can be cleaned, maintained, or replaced. <input type="checkbox"/> Shall be provided with a standard thread to fit the lance. 	VMD, μm	Spray Quality	Use	<60	Extremely Fine	-	61-105	Very Fine	-	106-235	Fine	Good Cover	236-340	Medium	Most Products	341-403	Coarse	Systemic Herbicides	404-502	Very Coarse	Soil Herbicides	503-665	Extremely Coarse	Liquid fertilizer	>665	Ultra Coarse	Liquid fertilizer
VMD, μm	Spray Quality	Use																										
<60	Extremely Fine	-																										
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AMTEC

Agricultural Machinery Testing and Evaluation Center 1977

Strap	<input type="checkbox"/> Adjustable strap/s shall be provided to carry the sprayer. <input type="checkbox"/> Shall be durable. <input type="checkbox"/> The length of strap shall be minimum of 425 mm. <input type="checkbox"/> Shall be provided with quick release mechanism for emergency purposes <input type="checkbox"/> The sprayer strap, straphangers or strap clip shall not fail or get damaged during operation when subjected to strap test. <input type="checkbox"/> The increase in mass of straps after defined immersion in water shall not exceed 30% of the dry mass.
Connectors and Fasteners	<input type="checkbox"/> All hose connections shall have the same diameter, be interchangeable and be provided with reusable clamps <input type="checkbox"/> All other external connectors shall be of standard thread size and designed so as not to provide a potential source of leakage <input type="checkbox"/> Fasteners shall not penetrate the pressure chamber
Fluid Level Indicator	<input type="checkbox"/> Should be provided <input type="checkbox"/> Should be clearly marked and visible, at 1- liter graduation with maximum error of +10%.

■ Specific Requirements

For Lever-operated knapsack sprayer

General	<input type="checkbox"/> The sprayer shall remain functional after a defined drop. <input type="checkbox"/> After the pressure test is conducted and after a duration of 30 s, as defined by PNS/BAFS 332:2022, the total volume of leakage shall: <ul style="list-style-type: none"> a) Have no leak when in upright position; b) Not exceed 0.5 mL when in 45° position; and c) Not exceed 5 mL when in horizontal position. <input type="checkbox"/> The lever should be accessible to enable right- or left-hand operation. Its length and position shall be such that it is comfortable to operate. <input type="checkbox"/> Shall have 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. <input type="checkbox"/> Vertical movement at the end of the lever shall not exceed 400 mm. <input type="checkbox"/> The grip should be comfortable to hold and securely fastened to the lever. It should have a minimum diameter of 25 mm and a minimum length of 100 mm.
Straps	<input type="checkbox"/> The load bearing part of the strap shall be at least 50 mm wide. <input type="checkbox"/> Shall have a length of at least 200 mm and a thickness of at least 4 mm.

For Knapsack compression sprayer

General	<input type="checkbox"/> Shall not suffer any performance deterioration after the specified drop test. <input type="checkbox"/> Shall not leak in any position.
Strap	<input type="checkbox"/> A double shoulder strap shall be provided for all sprayers exceeding a weight of 15 kg. Sprayers having a weight of 15 kg or less shall be provided with at least a single shoulder strap. <input type="checkbox"/> The load bearing part of the strap shall be at least 50 mm wide. <input type="checkbox"/> Shall have a length of at least 200 mm and a thickness of at least 4 mm.



AMTEC

Agricultural Machinery Testing and Evaluation Center 1977

Spray tank	<input type="checkbox"/> Sprayers should have an inlet opening of at least 100 mm diameter. If the diameter is less than 100 mm, a separate funnel of at least 100 mm diameter shall be provided. <input type="checkbox"/> Shall be equipped with a pressure-relief device that prevents pressurization of the spray tank beyond the maximum working pressure prescribed by the manufacturer plus 20%. The device shall reseal automatically to allow normal operation of the sprayer without leakage.
For Engine-driven knapsack sprayer	
General	<input type="checkbox"/> After the pressure test is conducted and after a duration of 30 s, as defined by PNS/BAFS 332:2022, the total volume of leakage shall: <ul style="list-style-type: none"> a) Have no leak when in upright position; b) Not exceed 0.5 mL when in 45° position; and c) Not exceed 5 mL when in horizontal position.
Spray tank	<input type="checkbox"/> The amount of liquid remaining in the tank shall not exceed 50 mL after operation. <input type="checkbox"/> Engine starting device shall be provided to allow starting of the engine without the need for separate and independent auxiliary assistance (e.g., belts or cables). If the engine is fitted with an electric starting device, two or more independent and dissimilar motions shall be required to engage the device. The sprayer shall be fitted with an engine-stopping device through which the engine can be brought to a full stop and that does not depend on sustained manual effort for its operation.
Straps	<input type="checkbox"/> The load bearing part of the strap shall be at least 65 mm wide <input type="checkbox"/> Shall have a length of at least 200 mm and a thickness of at least 10 mm.
Fuel tank	<input type="checkbox"/> Fuel inlet shall have a strainer. <input type="checkbox"/> Shall have an air vent. <input type="checkbox"/> Openings shall be at least 20 mm in diameter and the oil-tank opening (if any) shall be at least 15 mm in diameter. <input type="checkbox"/> The design of the fuel-tank assembly shall be such that no leakage occurs in any operating and transport position at normal operating temperature.
Pressure regulation	<input type="checkbox"/> Pressure control (e.g., relief valve) shall prevent excessive pressure build up on the sprayer and its components. <input type="checkbox"/> It should be positioned external to the tank. If positioned internally, there shall be means of adjustment from the outside of the tank.
Hot parts	<input type="checkbox"/> Insulation and protection devices shall be provided to minimize the possibility of inadvertent contact with any exposed element which may cause burns during mounting, dismounting or operating the machinery. <input type="checkbox"/> Legible and nonremovable warning notices or signs made of heat resistant materials for hot parts shall be provided.
Exhaust system	<input type="checkbox"/> Shall be located to direct exhaust emissions away from the operator in the normal operating position.
Parts under high voltage	<input type="checkbox"/> All parts of the engine which are under high voltage shall be insulated to avoid hazards or accidents.
Noise	<input type="checkbox"/> There shall be a provision of earmuffs or other ear protection device for the operator to use when 92 dB(A) is exceeded during operation.
Vibration	<input type="checkbox"/> Vibration reduction shall be an integral part of the design process, specifically taking into account measures at source. Technical measures such as isolators and resonating masses shall be used to isolate the vibration from the handle, when appropriate.



AMTEC

Agricultural Machinery Testing and Evaluation Center 1977

For Electric motor-driven knapsack sprayer

General	<input type="checkbox"/> The provision for the electric motor-driven knapsack sprayer shall conform to engine-driven knapsack sprayer provisions mentioned above except for fuel tank, pressure regulation and exhaust system. <input type="checkbox"/> For strap, the load bearing part of the strap shall be at least 50 mm wide and shall have a length of at least 200 mm and a thickness of at least 4 mm. <input type="checkbox"/> The sprayer shall be able to continuously operate at rated operating pressure for at least two hours.
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For Dual knapsack sprayer

General	<input type="checkbox"/> The provision for specific requirements for electric motor-driven and lever-operated knapsack sprayer applies.
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■ Performance Requirements

Criteria	Requirement as per PNS/PAES 331:2022
Volumetric efficiency, %, minimum	80
Pressure Drop During Leakage Test	Shall not drop by more than 50% of the applied pressure
Continuous Running Test	Shall not have any abnormality or trouble
Flow Rate, L/min (at the rated operating pressure)	
a. Nozzle 1	0.3-1.40
b. Nozzle 2	0.3-1.40
Spray Quality, VMD, μm	Medium (236-340)

■ Safety, Workmanship, and Finish

General	<input type="checkbox"/> Shall include among others at least one set of protective nose and mouth mask and a pair of eye goggles to protect the operator against inhalation and eye irritation, respectively due to spray chemicals. <input type="checkbox"/> Shall conform to the operator's body, shall have a weight distributed evenly and shall have operating controls in reasonable locations and configuration. <input type="checkbox"/> No part of the outer surface shall entrap spilled liquid and there shall be no sharp edges or protrusions. <input type="checkbox"/> Engine or electric motor-driven sprayers shall be constructed in such manner that access to power-driven components such as pulleys, shafts, gears, and flywheels, and to drive belts and chains is prevented. For openings (e.g., covers and guards) the safety distances shall be in accordance with PAES 101:2000 (Agricultural machinery — Technical means for ensuring safety — General).
Valve parts	<input type="checkbox"/> Shall be readily accessible for servicing and replacement
Lance	<input type="checkbox"/> Should be provided with a convenient clip or any holder when not in use.
Cut-off valve	<input type="checkbox"/> Shall be easy to use and comfortable to operate <input type="checkbox"/> Shall be comfortable to hold and easy to use.



AMTEC

Agricultural Machinery Testing and Evaluation Center 1977

■ Suspension and Termination of Test

If the machine stops due to breakdown or malfunction during the test run affecting the machine's performance, the test may be suspended. If the machine cannot continue the operation, the test shall be consequently terminated.

Should the test applicant request the conduct of the test despite the non-conformity to the test requirements identified by AMTEC, the applicant shall sign the AMTEC Waiver for Nonconformity to Test Requirements.

- AMTEC-OP-F24 (Waiver for Nonconformity to Test Requirements)

■ Testing Fee

1. The testing fee for each classification of knapsack sprayer with a minimum of two nozzles is Php 13,000.
2. To proceed through AMTEC test, the test applicant shall settle at least 50 % of the testing fee which is non-refundable but transferrable.
3. In cases of additional testing during the field, the test applicant shall immediately submit the required documents and settle at least 50% of the testing fee within 5 working days after the testing proper.
 Additional testing, number of machines: _____
4. Payment/s shall be directed to the following:
 Through UPLB Cashier's Office (8AM to 12PM): AMTEC Trust Fund Code No. 8271632-40A2040101000
 Through Landbank (8:30AM to 3PM): UPLB Trust Fund Account No. 1892100507 or UPLB FI Account No. 1892-1003-29

■ Other Reminders

1. All manufacturers, fabricators, assemblers, and importers (MFAI) shall secure a Certificate of Conformity (CC) from the Bureau of Agricultural and Fisheries Engineering (BAFE) which guarantees that their agricultural and fisheries machinery conforms with PNS/BAFS PABES or other relevant standards identified by BAFE. More information about the application for CC can be found at <http://bafe.da.gov.ph/index.php/certificate-of-conformity-of-manufacturers-fabricators-assemblers-distributors-dealers-importers-and-exporters/>.
2. All MFAI shall employ an Agricultural and Biosystems Engineer (ABE), as mandated by RA 10915 (ABE Law), who shall facilitate all activities and concerns pertinent to AMTEC testing and BAFE requirements. Do you currently have an ABE in your roster of employees? Yes No