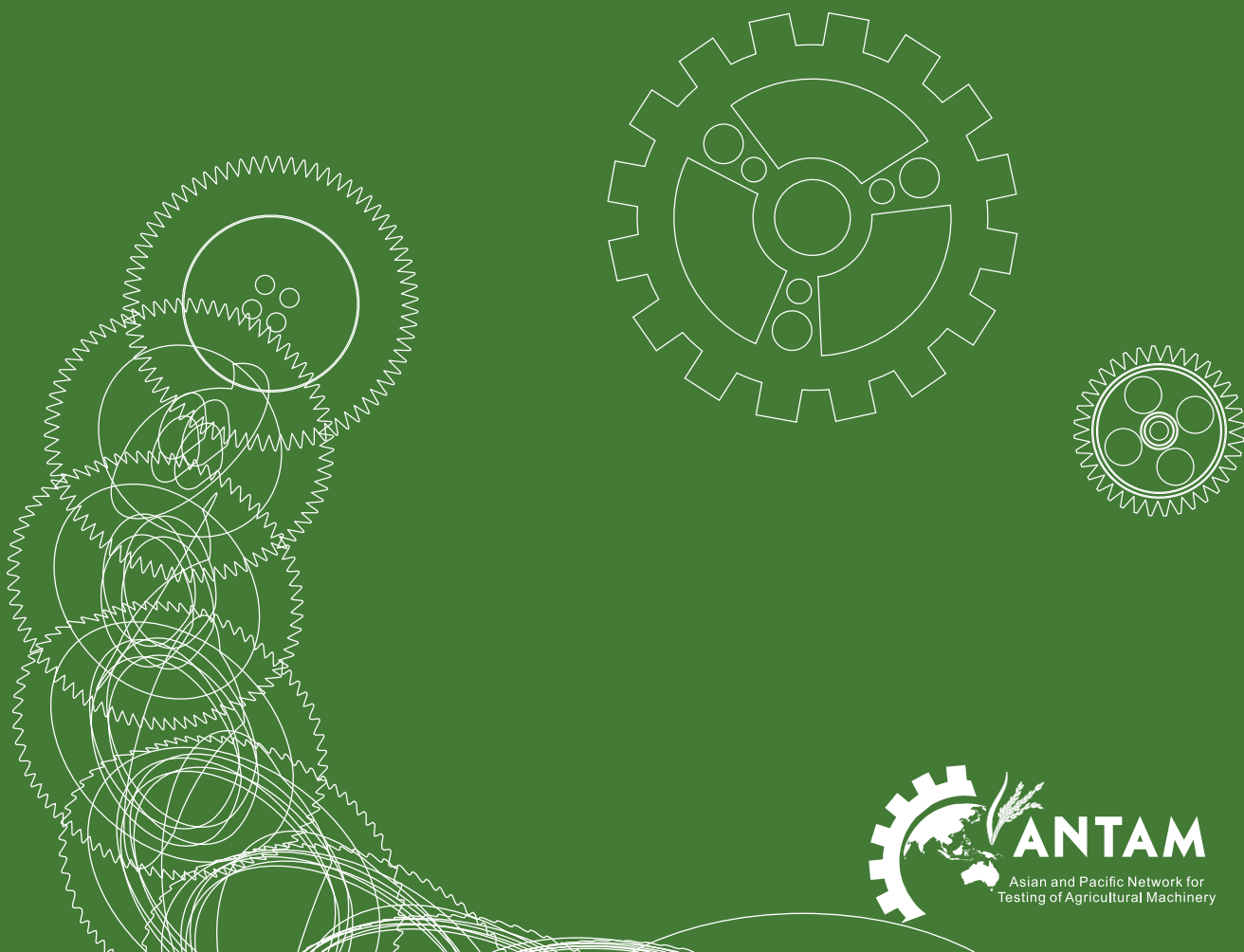


ANTAM STANDARD CODE FOR TESTING OF POWERED KNAPSACK MISTERS-CUM-DUSTERS

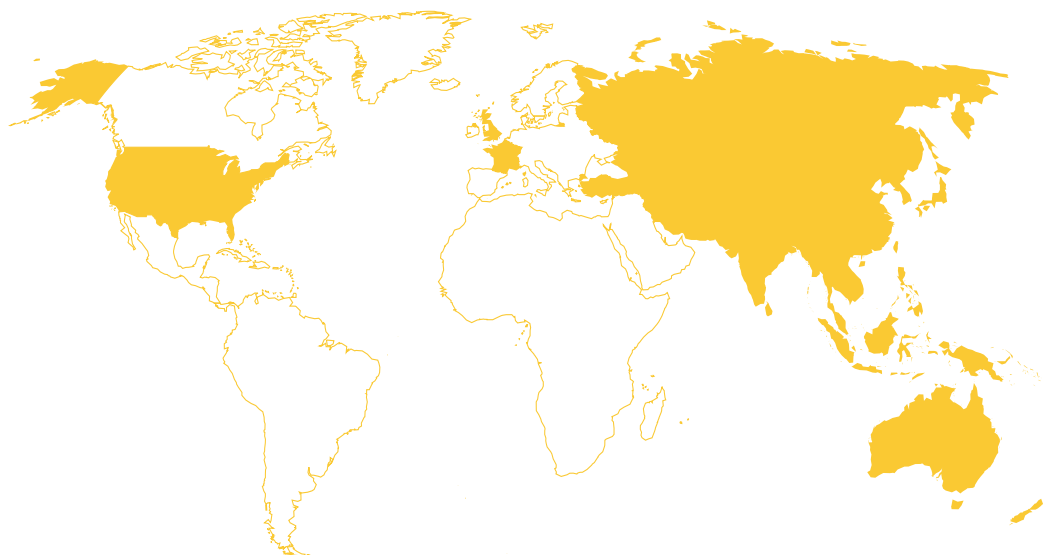
002-2017



The Centre for Sustainable Agricultural Mechanization (CSAM), is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (UNESCAP), based in Beijing, China. CSAM started operations in 2004, building on the achievements of the Regional Network for Agricultural Machinery (RNAM) and the United Nations Asian and Pacific Centre for Agricultural Engineering and Machinery (UNAPCAEM). CSAM serves the 62 members and associate members of UNESCAP.

The vision of CSAM is to achieve production gains, improved rural livelihood and poverty alleviation through sustainable agricultural mechanization for a more resilient, inclusive and sustainable Asia and the Pacific.

The Secretariat of the Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) is based at CSAM. CSAM is the executing agency of ANTAM. The ANTAM Secretariat assists and coordinates the operation of the network, and provides necessary logistical and administrative support.



The shaded areas of the map indicate ESCAP members and associate members

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**ANTAM STANDARD CODE FOR
TESTING OF POWERED KNAPSACK
MISTERS-CUM-DUSTERS**

**Centre for Sustainable Agricultural Mechanization
United Nations Economic and Social Commission for Asia and the Pacific**

002-2017*

August 2017

* The current Code is subject to revision and adoption by the 4th Annual Meeting of ANTAM to be held in Manila, the Philippines, on November 22-24, 2017.

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Acknowledgments

The Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) Standard Code for Testing of Power Tillers was prepared under the supervision of the Centre for Sustainable Agricultural Mechanization of the United Nations Economic and Social Commission for Asia and the Pacific (CSAM-ESCAP). The current version of the Code is based on the first edition published in August 2015, initially drafted by Dr. Chan Chee Wan and modified based on technical negotiations conducted with designated national counterparts in 2015, 2016 and 2017.

The consultation process in 2017 started in March and was concluded at the 3rd Meeting of ANTAM Technical Working Groups held on May 24-27, 2017 in Dhaka, Bangladesh. The Code was developed with contribution from: Duc Sam On; Zhang Xiaochen; Jean-Paul Douzals; Panna Lal Singh; Mohd Fazly Bin Mail; Muhammad Mohsin Ali; Ayesha Herath and Nguyen Tuan Anh. The ANTAM Test Code on Powered Knapsack Misters-Cum-Dusters was formulated by referring to standards developed by the International Standard Organization (ISO), the American National Standard Institute (ANSI) and by merging relevant national standards from China, India, Russia and Vietnam to reflect unique regional conditions.

Special thanks go to the ANTAM Focal Points in Sri Lanka, Bangladesh and China, namely Chintaka Balasooriya, Sheikh Md. Nazimuddin and Han Xue, for the important support provided during the organization of ANTAM meetings in their respective countries.

The contribution of the Italian Agency for Agricultural Mechanization (ENAMA), the Technical Reference Unit of ANTAM, which has provided technical peer review and guidance to the overall development of ANTAM, is gratefully acknowledged. A note of appreciation is also due to other collaborating partners of ANTAM, including the Food and Agriculture Organization of the United Nations, the Organisation for Economic Co-operation and Development, the United Nations Industrial Development Organization and all ANTAM Focal Points (Appendix 1) in member countries for their continuous support to and active involvement in ANTAM.

At CSAM, the process of development of the Code was coordinated by Camilla Stelitano under the supervision of Anshuman Varma, Programme Officer and the overall guidance of Li Yutong, Head of CSAM. Chan Chee Wan provided final reviews and editing of the Code and Wei Zhen contributed to the layout and design of the publication.

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I. Foreword

The Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) is an initiative led by the Centre for Sustainable Agricultural Mechanization (CSAM) of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP). The network develops regional standards to promote the use of safe, efficient and environmentally sound agricultural machinery in the Asia-Pacific region. In support of the 2030 Agenda for Sustainable Development, the ANTAM project aims to tackle cross-sectoral issues to impact economic, social and environmental aspects that affect the agricultural output of ESCAP member countries.

Over the past few decades the Asia-Pacific region has been an important engine for growth and poverty reduction. Between 2010 and 2013 the poverty rate fell to 10.3 percent of the total population in the region and the total number of people who are poor fell to 400 million¹. In this context, the increase in productivity of the agricultural work force has played a crucial role and it has been estimated that greater labour productivity in agriculture has the potential to lift an additional 110 million people from poverty between 2016 and 2030².

In the coming years, modernization of production systems that can empower the agricultural workforce is expected to play a central role in enabling the required increases in productivity in the agricultural sector. However, substantive progress in the modernization of agricultural production in the Asia-Pacific region, of which sustainable agricultural mechanization is undoubtedly an important component, continues to be restrained by uneven manufacturing capacity and the lack of regional integration mechanisms. The adoption of mutually recognized testing Codes for agricultural machinery can significantly reduce the need to conduct national testing when importing foreign machinery, and set minimum regional standards on the requirements pertinent to safety and efficiency. The integration of the agricultural machinery market through mutually recognized testing Codes can also unleash the full potential of the agricultural mechanization sub-sector by facilitating technology and knowledge exchange while at the same time helping protect end users from the use of unsafe and inefficient inputs.

Furthermore, a shared commitment to combat climate change and support the sustainable intensification of agricultural production calls for simultaneously addressing production gains and environmental protection. In this context, it is crucial to support the adoption of mechanization technologies and products that can increase yields, reduce the excessive use of chemical fertilizers and pesticides, and minimize the related environmental footprint. The regional standards being developed through ANTAM can guide manufacturers and end users towards this objective.

The ANTAM Codes for testing of agricultural machinery are developed by appointed members of the Technical Working Groups (Appendix 2) and are based on national standards of ESCAP member countries and major international requirements for agricultural machinery testing. The third version of the ANTAM Code for Testing of Powered Knapsack Misters-Cum-Dusters that we are presenting in 2017, builds upon the work conducted in 2016 and is enriched with the inclusion of a chapter on terminology to promote a common understanding among participating countries, modification of testing methodologies to enable increased accuracy of test results and new requirements on maximum weight to facilitate the provision of efficient, durable and safe equipment for end users.

Li Yutong
Head

Centre for Sustainable Agricultural Mechanization

¹ United Nations, Asian Development Bank, United Nations Development Programme (March 2017) Asia-Pacific Sustainable Development Goals Outlook. Bangkok, Thailand. Available at: <http://www.unescap.org/publications/asia-pacific-sustainable-development-goals-outlook>

² United Nations (2016) Economic and Social Survey of Asia and The Pacific 2016- Nurturing productivity for inclusive growth and sustainable development. Bangkok, Thailand. Available at: http://www.unescap.org/sites/default/files/publications/Economic%20and%20Social%20Survey%20of%20Asia%20and%20the%20Pacific%202016_0.pdf

II. Method of Operation³

The Annual Meeting shall adopt the Test Codes by consensus amongst ANTAM participating countries.

The Technical Working Groups (TWGs) of ANTAM develop, review and revise ANTAM Codes based on the decisions adopted at the Annual Meeting of ANTAM.

The ANTAM Test Codes are updated by the TWGs through technical negotiations led by CSAM. The content of the Codes is finalized and agreed upon by consensus amongst all TWGs members at the annual meetings of the TWGs.

The ANTAM Test Code on Powered Knapsack Misters-Cum-Dusters was formulated by referring to standards developed by the International Standard Organization (ISO) the American National Standard Institute (ANSI) and by merging relevant national standards from China, India, Russia and Vietnam to reflect unique regional conditions. As specified in the Terms of Reference of the TWGs, members are responsible for selecting and providing relevant references to national and international standards. All selected standards are subject to revision and considered the most updated edition as per documents provided by TWGs members. All documents provided by national standards agencies are copyrighted.

Implementation of ANTAM Test Codes is voluntary. Member countries can use ANTAM Test Codes in their entirety or refer to parts of the Code to integrate them with procedures applied in national testing stations. ANTAM Test Codes apply only to the equipment described in the Codes. Thus, any testing station from an ANTAM member country is welcome to use the test Codes assuming it has adapted testing equipment, facilities and skilled personnel.

Participating national testing stations are responsible for using the Codes to carry out the tests and complete the test report. Each testing station shall certify that ANTAM Codes are followed and that the test report complies with ANTAM Test Codes and procedures. ANTAM strongly encourages the implementation of round robin tests⁴ among testing stations in order to ensure that test reports are supported by a quality assurance process.

The test report shall be verified by the ANTAM Secretariat prior to its release. The ANTAM Secretariat shall work with the Technical Reference Unit (TRU), an independent third party elected by member countries at the Annual Meeting, to check the technical contents of the report to ensure strict compliance with ANTAM testing methodologies.

Upon approval and validation of the test report by the ANTAM Secretariat, the ANTAM logo may be used on the tested machinery. The ANTAM Secretariat will then release the test report on its website.

The ANTAM Test Codes are designed to guide member countries in the application of standards for testing of agricultural machinery. The Codes provide information only and do not constitute formal legal advice. The ANTAM Secretariat assumes no liability for actions undertaken in reliance on the information contained in the Codes.

³ In reference to the Terms of Reference of ANTAM and the Terms of Reference of ANTAM Technical Working Groups adopted by the Annual Meeting on December 9, 2016.

⁴ Measurement system analysis technique, where independent technicians perform the tests in different stations. Such interlaboratory activity is encouraged to compare discrepancies in results, if any, and determine the reproducibility of test methods.

*The current Code is subject to revision and adoption by the 4th Annual Meeting of ANTAM to be held in Manila, the Philippines, on November 22-24, 2017.

III. General Text

1.0 SCOPE

This Test Code covers the terminology, general guidelines and tests to be conducted on powered knapsack mister cum duster fitted with a small ≤ 4.5 kW gasoline engine coupled with a centrifugal fan. The Code covers methodology for checking on machine specifications, materials, noise, vibration, safety and inspection of components and applications, labels, packing, transportation and storage. This Code also prescribes the performance and other requirements of powered knapsack type pneumatic mister cum duster for spraying chemicals in liquid form and convertible into duster for dusting the chemicals in powder/micro granules form.

This publication supersedes the previous The ANTAM Test Code on Powered Knapsack Misters-Cum-Dusters (2015).

2.0 REFERENCES

The Standards listed in **Annex A** contain provisions which through reference in this text, constitute provision of this draft standard incorporating existing international standards (ISO) and national standards practiced by China, India and Vietnam. The selection of publications, the editions indicated were provided by the various national representatives on test standards. Typical engine power for powered knapsack mister cum duster is 3 kW, current relevant standards for 3 kW and below small gasoline engines in the Chinese JB/T 5135.1.2.3-2013 (for engine less than 30 kW) and the Indian IS: 7347-1974 (for engine less than 20 kW) are referred. The ISO 8178-4: 2007 standard is also referred. Specific references selected are the Chinese JB/T 7723-2014 and the Indian IS: 7593.1-1986. All selected standards are considered recent as per documents provided. All documents provided from the various national standards agency are copyrighted.

3.0 TERMINOLOGY

3.1 Knapsack Misters-cum-Dusters

Machine with a backpack power unit designed for applying chemicals to crops by means of a hand-held spraying device with the liquid and powder chemical being contacted, nebulized and transported by a high-speed air flow generated by a fan (*ISO 28139:2009*).

3.2 Duster

Machine for applying formulated products in the form of dust (*ISO 5681:1992*).

3.3 Dusting

Operation of applying formulated product in the form of dust (*ISO 5681:1992*).

3.4 Mister

Machine for applying formulated products in the form of liquid.

3.5 Misting

Operation of applying formulated product in the form of liquid.

3.6 Discharge Rate

Mass of active ingredient or of formulated product applied per unit of length, area or volume to be treated (ISO 5681:1992).

3.7 Rated speed

Speed at which, according to the statement of the engine manufacturer, the rated power is delivered (*ISO 8178-4:2007*).

3.8 Total Mass

The mass of the whole unit without liquid or dusting powder as ready for operation including discharge line for spraying or dusting whichever is heavier and prime mover without fuel and starter (IS: 7593.1-1986).

3.9 Fuel Tank

The container holding the fuel for operating the engine.

3.10 Endurance

The total operating time of the object from the beginning of its operation until the moment of reaching the limit state (GOST 27.002-2015).

3.11 Reliability

Property of the object to preserve during time the ability to perform the required functions in the specified modes and conditions of application, maintenance, storage and transportation (GOST 27.002-2015).

IV. Code

1.0 CHECKING OF SPECIFICATION

1.1 Technical Details

Manufacturer/applicant shall complete the specification sheet given in **Annex B-1** for the power operated knapsack mister cum duster along with schematic drawing of the equipment and any other information required by the testing authority to carry out the tests. The manufacturer/applicant should also supply technical literature such as operation and maintenance manual, service manual and parts catalogue.

1.1.1 Material

The material for construction of different components of powered knapsack mister cum duster except gasoline engine is given in B-2 **Annex B**. All components come in contact with the chemicals shall be of good quality chemical resistant materials.

Note: The specification data sheet for tests of powered knapsack mister cum duster for JB/T 7723-2014, and IS 7593 (Part 1)-1986 has been referred.

1.1.2 Manual

Manufacturer can prepare operators and service manual separately or as a single document. Operational and maintenance manual should contain complete list of regular and optional parts, method of converting the mister into duster, instruction on adjustments, assembly and disassembly for cleaning and routine inspection and replacement of parts and safety precautions to be taken during operation and handling. Manuals shall comply with the ISO 3600: 1998 or IS 8132: 1999 standards and contain information on: main technical details of engine, rated speed, tank capacity, misting/dusting rate at recommended pressure, recommended pressure range, horizontal spray range, starting and stopping instructions, safety, common faults and repairs, safe chemical handling, cleaning, maintenance, storage, forbidden chemical/liquid to be used, manufacturer and supplier contact details.

1.2 Submission of Test Samples

The powered knapsack mister cum duster, under production, should be selected by the manufacturer from the production line, complete with its standard accessories and in a condition as generally offered for sale. The power operated knapsack mister cum duster shall be new and should not be given any special treatment or preparation for test. At least 3 units of current year production, new and unused qualified machine are to be submitted. An additional unit of a similar machine with the engine removed is to be supplied.

The submission of test samples should be reported in the pro-forma given in **Annex C-1**.

1.3 Measuring Instrument Accuracy

1.3.1 Accuracy- The measuring apparatus shall be such that the following items shall have the tolerances within the limits shown against each measurement (Table 1a). (Clause 3.4 of JB/T 7723.2-2005 also referred).

Table 1a: Accuracy Requirements of Measurement

Parameters, unit/scale	Accuracy	Notes
Rotational speed, rev min ⁻¹	± 0.5	Tachometer may be used
Time variation, s	± 1	Digital stopwatch
Noise variation, dB (A)	± 0.5	Sound level meter
Vibration, % FS	± 10	Accelerometer
Weight variation, kg	± 0.05	Weighing balance of sufficient accuracy
Weight variation, g	± 0.05	Weighing balance of sufficient accuracy
Pressure, % FS	± 1 (< 10 kPa) ± 2.5 (≥ 10 kPa)	Pressure gauge (analogue/digital)
Wind speed, % FS	± 5	Anemometer (hot wire or vane type) capable of measuring air velocity at 1 Hz during 15 s.
Temperature, °C	± 1 °C	Thermometer
Relative Humidity, % FS	$\pm 1\%$	Hygrometer
Paint layer thickness, μm	$2 \pm 3\%$	Digital coating thickness gauge

1.4 Marking and Packing

1.4.1 Marking

Each mister-cum-duster shall be marked with the following particulars:

- a) Manufacturer's name or registered trade-mark
- b) Tank capacity
- c) Production Code and serial number

- d) Engine certification label
- e) Type of fuel used
- f) Maximum blower speed rev min^{-1}
- g) Safety labels: The mister-cum-duster shall have safety label which reminds the operator to pay attention to safety while operating. There shall be warning sign near the entrance of fan, high-temperature components of muffler. The pattern and content of the safety label shall comply with the terms of ISO 11684: 1995. The safety label shall be pasted firmly.
- h) Control device labels: In the control device or nearby location, there shall have clear labels, its contents should reflect the basic characteristics of the control device.
- i) Any other ANTAM approved Asia Pacific member countries national certification label.

Note: The use of the certification label is governed by the approval of the ANTAM Secretariat.

1.4.2 Packing

Each unit shall be first packed in a polyethylene bag and then in a wooden case or carton package of sufficient strength to avoid damage in transit.

Spare parts separately packed for each mister-cum duster according to the number required shall be provided.

1.4.3 Workmanship and Finishing

All the components of the unit shall be free from burrs, pits and other visual defects which may be detrimental for their use. Coating or proper surface treatment should be applied for the erodible materials. The paint quality shall comply with the following: (Source: Chinese JB/T 5673-2015)

1.4.3.1 Appearance quality

The paint coating surface shall be flat, smooth, uniform, without pinhole, pitting, there shall not have any painting defects.

1.4.3.2 The total thickness of the paint coating shall not be less than $40\mu\text{m}$.

1.4.3.3 If the surface touches chemicals, i.e.: steel tank, the total thickness shall not be less than $75\mu\text{m}$, and the paint coating shall pass the pesticide resistance to corrosion test.

Test procedure is as follows.

- Fill in chemical up to the maximum tank level after conducting tank leakage test.
- Securely tighten the lid
- Place the mister/duster securely on a support structure
- Shake the mister/duster vigorously for every 15 minutes and stop for another 15 minutes at a frequency of 0.5 Hz and a 5° angle for duration of 7 days

- Empty the tank
- Inspect the paint finishing
- Change the chemical
- Continue the test for another 6 cycles each of 7 days
- Stop the test if there is leakage due to corrosion

Quality criteria: (good/pass/fail):

- Good: the surface gloss maintained without change or color. No bubbles, flaking or pits. No powdery appearance, cracks or rust
- Pass: change of color, loss of gloss, minor bubbles (less than 30% of the covering surface) rough paint work surface appear in less than 30% of total surface area, minor powdery appearance without cracks, few rust spots (diameter less than 0.5 mm)
- Fail: greater deterioration than previous for criteria

1.5 Running-In

1.5.1 The manufacturer/applicant shall run-in the powered knapsack mister cum duster before the test, under his responsibility and in accordance with his usual instructions. The running-in shall be carried out in collaboration with the testing authority. If this procedure is impracticable due to the powered knapsack mister cum duster being an imported model, the testing authority may itself run-in the powered knapsack mister cum duster in accordance with the procedure prescribed or agreed to with the manufacturer/applicant.

1.5.2 The place and duration of the running-in shall be reported in the pro-forma given in **Annex C-2**.

1.6 Servicing and Preliminary Setting after Running-In

1.6.1 Servicing

After completion of running-in, servicing and preliminary settings should be done according to the printed literature supplied by the manufacturer/applicant. The following may be carried out, wherever applicable:

- a) Change of the engine oil;
- b) Change of oil and fuel filters (if required);
- c) Greasing/oiling of all the lubricating points;
- d) Tightening the nuts and bolts;
- e) Checking and adjustment of safety devices, if any;
- f) Any other checking or adjustment recommended by the manufacturer after the running-in period, and included in the printed literature of the powered knapsack mister cum duster.

1.6.2 Preliminary Setting

The manufacturer/applicant may make adjustments in any other adjustments during the

period the powered knapsack mister cum duster is prepared for tests.

These adjustments should conform to the values specified by the manufacturer/applicant for agricultural use in the printed literature/specification sheet. No adjustment shall be made, unless it is recommended in the literature. All the parts replaced shall be reported in the test report.

1.7 Repairs and Adjustments during Tests

All repairs made during the tests shall be reported, together with comments on any practical defects or shortcomings in **Annex C-2**. This shall not include those maintenance jobs and adjustments which are performed in conformity with the manufacturer's recommendations.

1.8 Fuel and Lubricants

Fuel and lubricants for the tests shall conform to those as indicated in the manufacturer's specifications.

1.9 Stability Test

The stability test shall be conducted as follows:

- Position the empty sprayer on a flat, and hard surface with an inclination of $(8.5 \pm 0.2)^\circ$ Figure 1a.
- Check the stability of the sprayer by rotating it at 90° intervals along its vertical axis.
- Repeat the test with the spray tank filled to its nominal volume.

Annex C
(normative)
Stability test

The sprayer shall be positioned in accordance with Figure C.1.

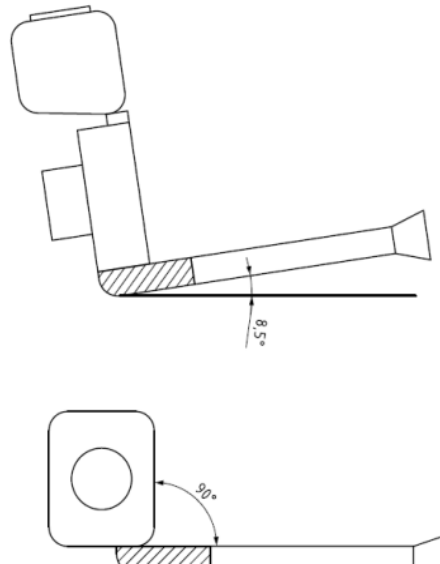


Figure 1a Stability test

1.10 Specifications for Performance

1.10.1 Checking of Specification

The information given by the manufacturer/applicant in the specification sheet as per **Annex B-1** shall be verified by the testing authority and any deviation may be reported. Details of the components and assemblies which do not conform to the standards shall also be reported. The material of construction should be verified.

1.10.2 Net Weight (without liquid/dust)

The weight of the machine (mister/duster) including empty tank should be less or equal to 11 kg.

1.10.2 Tank

A tank for holding the liquid shall be provided with the provision of easy conversion into a dust/micro granules tank. A filling hole of 90 mm minimum diameter if circular or in minor axis if oval, shall be provided on the top of the tank. The hole shall be covered with a cap or lid so that no leakage of the liquid or dusting powder takes place during the mounting of the mister cum duster and during its operation. The tank capacity (nominal value) shall not exceed 0.02 m³ (20 l). The tank capacity shall be declared by the manufacturer. The full tank capacity shall not differ by more than 7.5% of the declared value (ISO: 9357: 1990). The

actual overall volume of the tank shall exceed the nominal volume by at least 5%. When the liquid or dusting powder is filled in tank up to its total capacity, the tank shall not show any sign of leakage and shall not buckle.

1.10.2.1 A strainer shall be fitted at the filling hole using a mesh size in the range of 0.5 to 2 mm; the strainer should be deep enough to allow free flow of chemicals without spilling (liquid).

1.10.2.2 When the liquid or dusting powder is filled in tank up to its full capacity, the tank, connected hoses and air pressure hose shall not show any sign of leakage and shall not buckle.

1.10.3 Impeller

The impeller of the fan shall be dynamically balanced at its rated speed. The impeller shall not touch casing at any point.

1.10.4 Blower Housing

The internal and external blower housing surface shall be smooth, without dents or depressions, cracks and defects. Testing is by observation and manual hand feeling method.

1.10.5 Air Bent (or Vent) Outlet

An air bent outlet may be provided. If provided, shall be connected with fan casing outlet, air hose and air pressure regulating device.

1.10.6 Flow Regulator

A device to regulate the flow of the liquid or dusting powder shall be provided.

1.10.7 Air Hose

An air hose of minimum 45 mm inside diameter and not less than 500 mm in length shall be provided.

1.10.8 Straps

A strap shall be provided to carry the mister cum duster. It shall be adjustable to the size of the operator so that one person shall be able to pick up, to carry and to put down the mister cum duster. A double shoulder strap shall be designed so that pressure is evenly distributed on both shoulders of the operator. The design of the double shoulder strap shall prevent slipping in any direction.

1.10.8.1 Two straps of not less than 800 mm length after its maximum adjustment and 38 mm width shall be provided in order to help carriage of the unit. Provision for adjustment of each strap shall be made. A cushion of minimum 40 mm width and 20 mm thickness with each strap at least on the portion that rests on the operator's shoulder and a back rest shall be provided at the option of the purchaser. The back rest may be fitted with a cushion of minimum size of 200 x 200 x 20 mm. The cushions, when provided, shall be covered with

suitable materials, such as cotton, canvas, resin, and PVC or plastic coated fabrics.

1.10.8.2 All double shoulder straps shall be equipped with a quick-release mechanism positioned either at the connection between the mister cum duster and strap or between the strap and operator. Either the strap or the use of the quick-release mechanism shall ensure that the mister cum duster can be released quickly from the operator in the event of emergency. If a quick-release mechanism is provided, it shall be possible to open it under load and release the machine using only one hand. Compliance shall be checked by inspection and function test.

1.10.8.3 Each shoulder strap shall have a load-bearing part of a length of at least 200 mm \pm 10 mm and of a minimum comfort width 50 mm. The load shall be distributed over the whole width. Compliance shall be checked by measurement and inspection.

1.10.8.4 If the load-bearing area is formed by a pad, this shall not slip from its position unintentionally. Compliance shall be checked by inspection and function test.

1.10.9 Gasoline Engine

1.10.9.1 The gasoline engine used should comply with JB/T 5135.1-2013, IS:7347-1974 or ISO 8178-4: 2007 (without governor).

1.10.9.2 All engine control components shall be normal without restriction, easy to control with the maximum rated engine achieved at the highest setting. A separate manual button/switch for stopping the engine shall be provided for hand lever operated idle speed set at the lowest level position. The fuel and chemical discharge controls shall be in easy access of the operator.

1.10.9.3 The exhaust outlet of the engine shall be so positioned that the smoke and heat does not directly affect the operator.

1.10.10 Spare Parts

Spare parts separately packed for each mister-cum-duster according to the number required by the purchaser shall be provided. Even if no demand for spare parts has been made, a set of gaskets, one funnel with a strainer having aperture size of 300 to 425 micron, a measuring cylinder for lubricating oil and a set of necessary tools shall be provided.

1.10.11 Safety Requirements

Dangerous parts of the gasoline engine: recoil rope starter, exhaust (silencer), inlet of blower shall be fitted with protective cover. The rotating parts such as the entrance of fan, starting wheel, etc. shall be equipped with protective cover with proper strength. The muffler and other high-temperature components shall be equipped with protective device to avoid emprises (ISO 8178-4: 2007). If dimensions are not available because of structure, warning signs shall be set up, and note it in the manual.

1.11 Checking Material of Construction

The recommended material for construction of different components of mister cum-duster except gasoline engine is given in **Annex B-2**.

All the metallic parts come in contact with the pesticides/ chemical dust should preferably be of the same material to minimize electrolytic potential deterioration.

1.12 Checking for Adequacy of Literature

Manufacturer can prepare operators and service manual separately or as a single document as per Clause 1.1.2.

2.0 ENGINE

2.1 Gasoline Engine

2.1.1 Speed

The speed of an engine is the mean speed of its crank shaft in revolution per minute (rpm).

2.1.2 Power

For the engines delivering power by shaft or shafts, it is a quantity proportional to the mean torque calculated or measured, and to the mean speed of the shaft or shafts transmitting this torque. Defined in kilowatts (kW).

2.1.3 Rated Power

The power available at the crankshaft or its equivalent at the rated speed specified by the manufacturer under standard reference conditions.

2.1.4 Indicated Horse Power

Total power developed in the engine cylinder.

2.1.5 Fuel Consumption

The quantity of fuel consumed by engine per unit of time at a stated power and under stated operating conditions expressed in mass units (kg) and/or liters per hour.

2.1.6 Specific Fuel Consumption

Fuel consumption per unit of energy produced expressed in grams per kilowatt hour.

2.1.7 Full Throttle

Throttle opening corresponding to rated power.

2.1.8 The gasoline engine used should comply with Clause 2.10.9.1

2.1.9 The general tests requirements, rated power, rated speed, specific fuel consumption and lubricating oil consumption shall comply with ISO 8178-4:2007 or IS:7347-1974 or JB/T 5135.1-2013.

3.0 JOINTS, TANK, STRAPS, HOSE AND CONTROLS

3.1 Joints

All joints for components of the powered knapsack mister cum duster must be reliable and sealed without disconnection or leaking during operation.

3.2 Hose Accelerated Ageing Test

After ageing at 70 ± 1 °C for a period of 72 hours, the rubber used for lining of all types of hoses shall not vary by more than ± 25 % for tensile strength and +10, -30 % for elongation at breakage of the corresponding values obtained before ageing.

Note: Clause 6 of IS: 443-1975 and IS: 3400 (Part 4)-2012 are referred.

3.3 Chemical Tank Assembly

3.3.1 Conceal the end of pressure hose, seal the tank lid and apply an air pressure of 10 kPa at the liquid discharge hose into the chemical tank for 1 minute. The tank, connected hoses and air pressure hose shall not show any sign of leakage and shall not buckle.

3.3.2 Residue

3.3.2.1 Tank

The amount of chemical residue (liquid or dust) remain in the tank shall not exceed 0.1 kg for dust or 0.1 liter for liquid.

3.3.2.2 Idling

During idling speed of powered knapsack mister cum duster with the shutter outlet fully closed, collect the dust in a bag tied to the dust pipe outlet. Dust flow rate shall not exceed 40 g/min. Conduct the test for a duration of 30 min.

3.4 Straps

3.4.1. Strap Drop Test

The straps and their assembly shall withstand the test as follows:

- The tank shall be filled with clean water to its full capacity.
- The mister cum duster (without discharge line) shall be hung from a solid support by its strap(s) simulating its carriage or to the shoulder of an operator.
- Raise the tank vertically to a height (h) of 300 mm and allow to drop freely while hang by the strap (s). Repeat the operation 24 times.
- The assembly shall be deemed to have passed this test if none of its parts (straps, brackets, etc.) break.

3.4.2 There shall be no damage on load bearing straps and their fixation points that reduces their functionality as a consequence of the specified strap drop test.

WARNING: This test has an element of risk. All personnel shall either be kept out of the test area or otherwise protected from hazards such as parts displaced from the mister cum duster on test.

A strap test device is a device capable of applying a controlled and reproducible force to the load carrying straps as shown in Figure 3a.

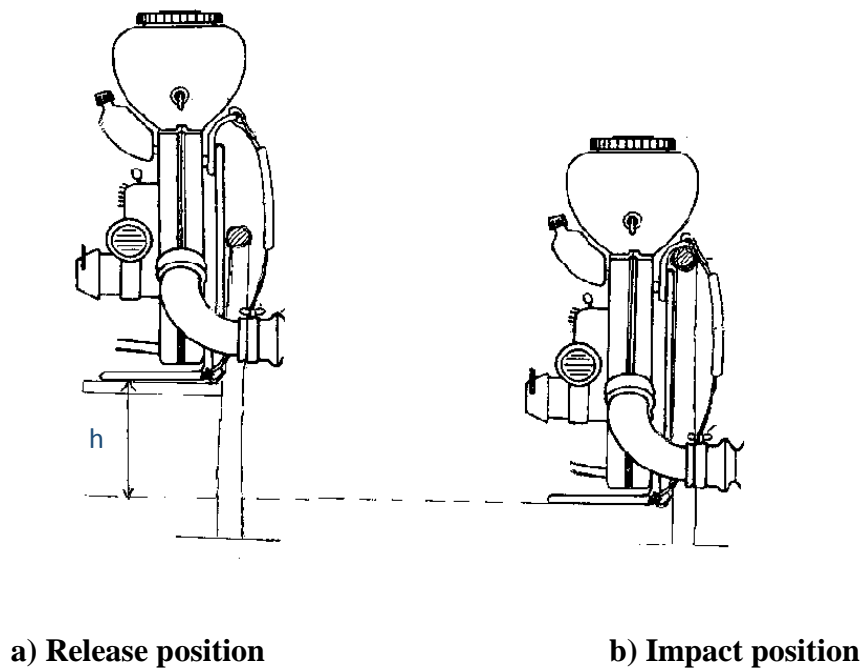


Figure 3a. Straps Drop Test Setup

3.4.3 Straps Chemical Absorption Test

Straps shall be made of non-absorbent material. Remove the carrying straps, and any padding and any metal or plastic parts attached to them before immersion (to minimize, as far as possible, the dry mass of the straps) and weigh them dry using a weighing device. Completely immerse the straps in water for 2 min. Remove the straps from the water, shake off surplus liquid and hang freely to drain for 10 min, before re-weighing.

Calculate the weight increase Δm in percentage using the following equation:

$$\Delta m = \frac{m_a - m_b}{m_b} \times 100$$

Where

m_b is the mass before the test

m_a is the mass after the test

The increase in mass of straps after defined immersion in water shall not exceed 30 % of the dry mass.

Note: ISO 19932-2: 2013 is referred.

3.5 Controls

3.5.1 Control Device

Control device should be equipped in a range that is easy to reach, and it shall be easy to operate. It shall control the machine swiftly and accurately.

3.5.2 Sign of Control Device

In the control device or nearby location, there shall have clear signs or marks, its contents should reflect the basic characteristics of the control device.

3.5.3 It shall be possible to operate all controls by an operator wearing appropriate protective gloves.

Note: Vietnamese National Standards TCVN 8745: 2011 (ISO 28139: 2009) is referred.

4.0 BLOWER TEST (ISO 10988: 2011 §5.8; Annex D)

4.1 Air Velocity and Air Volume Measurement (ANSI /OPEI B175.2-2012 Annex C)

Place the mister cum duster in an operate position. Lock the machine as per figure 5a position. Position air duct pipe in a horizontal position such as the height of the mister cum duster outlet centre is 1000 ± 20 mm from the ground.

Set the engine speed according to the rated engine speed defined by the manufacturer. Place an anemometer at the centre of the air duct pipe.

Measure the air velocity at distances of 3000 ± 20 mm and 6000 ± 20 mm from the air duct pipe outlet based on sampling grid of 100×100 mm ± 5 mm and along the four sampling lines AA, BB, CC and DD as per figure 5b2. Calculate the average velocity from 15s at each sampling point.

Stop measuring when an air velocity lower than 2 m/s is detected.



Figure 4a. Supporting Test Bench for Mounting Mister-Cum-Duster

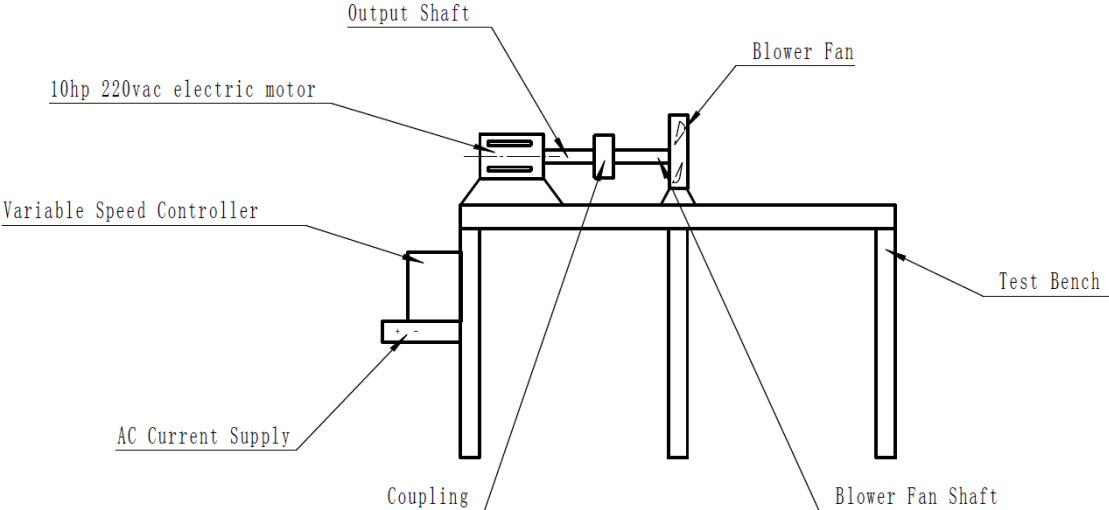


Figure Test rig for over-speed mister-cum-duster test

Figure 4c. Test Rig for Over-Speed Inspection

Note : Source JB/T 7723-2014, Clause 5.6

5.0 DISCHARGE RATE TESTS

5.1 Misting Discharge Rate (Full Tank)

Fill the tank of the mister with pre-determined quantity of clean water up to its full capacity. Firmly place the knapsack mister on a weighing scale (or hang it), set the flow regulator at a desired setting, divide the starting and stopping of misting into 5 to 7 segments of full tank capacity (stopping is defined as irregular continuous misting). Measure the time and respective misting rate. Conduct the horizontal and vertical misting.

Repeat three times, used the following equations the average misting rate, record data onto Table 6a, 6b. (Source: Chinese JB/T 7723- 2014 Clause 5.5.5).

The data shall be recorded in Annex Table 6a.

$$Q_i = \frac{\Delta g_i}{\Delta t_i}$$

Where Q_i = Average discharge rate at measure segment, kg / min

Δg_i = Discharged at measure segment, kg

Δt_i = Average time for discharge at measure segment, min

$$Q = \frac{1}{n} \sum_{i=1}^n Q_i$$

Where Q = Average discharge rate, kg / min

n = Number of segment

$$S = \sqrt{\left[\frac{1}{n-1} \sum_{i=1}^n (Q_i - Q)^2 \right]}$$

Where S = Standard deviation

$$CV = \frac{S}{Q} \times 100$$

Where CV = Coefficient of variation, %. A maximum value of 6% is recommended for misting.

Note: The mister should be run idle for some time before commencing the test to avoid initial variation in discharge.

Table 5a: Misting Volume, Evenness and Residue Test

Machine model		Maximum RPM		Rated power, kW	
Instrument type and model		Environment Temperature/ Humidity		Test date	
Test site	Misting pipe condition:				
Inspector					

Test No.	Discharge segment	1	2	3	4	5	6	7	
		Reduction in test materials (kg)							
Record	spray time (s)	1							
		2							
		3							
Computation	spray time (s)	1							
		2							
		3							
		Average							
	Sprayed rate, kg/min								
	Average sprayed rate, kg/min								
	Standard deviation								
	Coefficient of variation (%)								
	Residue (kg) test 1								
	Residue (kg) test 2								
	Residue (kg) test 3								
	Residue (kg) - average								

5.2 Test for Tank Filling Variation Discharge - Liquid

Obtain the tank filling variation discharge with data from section 6.1. The variation in discharge due to tank filling at the various segments defined in section 6.1 shall not exceed 15% of the discharge at full capacity of the tank as obtained in 6.1.

5.3 Residue

Weigh or measure the residual clean water remained in the chemical tank after the test and record it in table 6a.

5.4 Test for Dust Discharge Rate

- a. Operate the duster unit idle for some time to avoid initial variation in discharge.
- b. Measure the initial mass of the duster unit.
- c. Fill the tank with pre-determined quantity of talc powder or micro granules or the likes used for chemical formulations up to its full capacity. The minimum of 90% by mass of the talc powder shall pass through the 75 micron sieve 985. The bulk density after compacting, when tested in accordance with 12.2 of IS: 6940-1982, shall not exceed by more than 60% of the value obtained before compacting.

Note: BS sieve 200, ASTM test sieve 200, Tyler test sieve 200 have their apertures within the limit specified (or 75-micron IS test sieve).

- d. Operate the duster at its rated speed and set the dust outlet for full discharge. The variation in speed, if any, shall be not more than 5%.
- e. Allow the dust to come out through the outlet. Run the engine till the quantity of dust in the tank is empty.
- f. Take the mass of the unit. Obtain the quantity of the dust discharged giving due allowances to the fuel consumed during the test.
- g. Calculate the discharge rate per minute.
- h. Repeat the above test for a minimum of three times and obtain the average discharge per minute. The data shall be recorded in Table 6b.
- i. Repeat the test for 1/4, 1/2 and 3/4 full tank capacity of dust/micro granules.

Table 5b: Dusting Volume, Evenness and Residue Test

Machine model			Maximum RPM			Rated power, kW		
Instrument type and model			Environment Temperature/ Humidity			Test date		
Test site					Dusting pipe condition:			
Inspector								
Test No.	Tank level						4/4	
	Reduction in test materials (kg)							
Record	Continuous dusting time (s)	1						
		2						
		3						
Computation	Continuous dusting time (s)	1						
		2						
		3						
		Average						
	Dusting rate, kg/min							
	Average dusting rate, kg/min							
	standard deviation deviation							
	Residue (kg) 1							
	Residue (kg) 2							
	Residue (kg) 3							
Residue (kg) Average								

Note: Consider only 1 column (4/4)

5.5 Residue

Weigh or measure the residual dust remained in the chemical tank and hose after the test and record it in Table 6b.

6.0 MISTING/ DUSTING RANGE AND WIDTH

6.1 Measurement of Ground Deposition

6.1.1 Conduct this test in an enclosed space without interferences due to wind. Place the mister cum duster in an upright position. Lock the machine as per Figure 5a position. Position air duct pipe in a horizontal position such as the height of the mister cum duster outlet centre is 1000 ± 20 mm from the ground. Because of health and safety issues, dusting material may preferably be used in outdoor conditions. In this case, the natural wind speed shall be lower than 0.5 m/s otherwise a wind breaker is to be used.

6.1.2 Initial Trial

Fill the chemical tank with clean water and set engine at rated speed. Operate the misting at full throttle for 3 min.

Visually observe the coverage of misting that will define the sampling zone and the misting range (along the deposition main axis) and misting width (perpendicular to the deposition main axis).

6.1.3 Test Preparation

Use rows of Petri dishes to sample water droplets according to the previously defined misting range and misting width. Each sidewall of the indoor enclosure shall have a minimum distance of 500 ± 20 mm from the outermost Petri dishes (Fig. 7a).

Position the centre row of Petri dishes corresponding with the symmetric axis of the air duct pipe. The first Petri dish is placed at 1000 ± 20 mm from the air duct pipe outlet. The following Petri dishes shall be placed at 500 ± 20 mm from one to another. In order to get more accurate results especially in the central deposition area, the sampling density may be increased.

Additional number of Petri dishes is placed as according to the dimension and shape of the zone defined in 7.1.2.

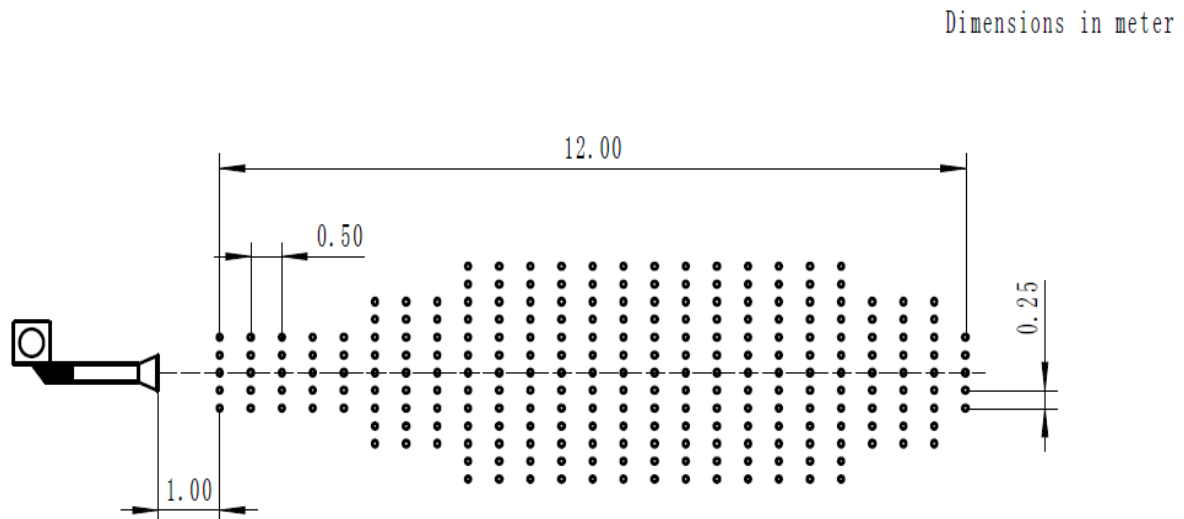


Figure 6a. Sprayer and Petri Dishes Layout

6.1.4 Set the engine speed according to the rated engine speed defined by the manufacturer. This test is conducted with the shutter outlet set at the minimum and the maximum misting flow rate. Fill the mister tank to the full tank level. Conduct the test while observing the water level of each of the Petri dishes. Stop the test when one of the Petri dishes is almost full with water or the tank is empty.

6.1.5 Number and collect all Petri dishes and weigh the mass of water taking into consideration the initial mass of each Petri dish.

Draw the deposition profile according to the sampling grid.

6.1.6 Repeat similar procedure 7.1.1 to 7.1.5 for dusters considering water is replaced by dust as referred in Clause 6.4 c.

6.2. Measurement of Vertical Deposition (Mister Only)

6.2.1 Conduct this test in an enclosed space without interferences due to wind. Place the mister cum duster in an upright position. Lock the machine as per figure 7b position. Position air duct pipe in a vertical position such as the height of the mister cum duster outlet centre is 1000 ± 20 mm from the ground.

6.2.2 Test Preparation

Use rows of sponges to sample water droplets.

Position the centre row of sponges corresponding with the symmetric axis of the air duct pipe. The sponges sampling grid is placed at a height of 3000 ± 20 mm from the air duct pipe outlet. See figure 7b. In order to get more accurate results especially in the central deposition area, the sampling density may be increased.

6.2.3 Set the engine speed according to the rated engine speed defined by the manufacturer.

This test is conducted with the shutter outlet set at the minimum and the maximum misting flow rate. Fill the mister tank to the full tank level. Conduct the test until the sponges almost get saturated.

6.2.4 Number and collect all sponges and weigh the mass of water taking into consideration the initial mass of each sponge. Draw the deposition profile according to the sampling grid.

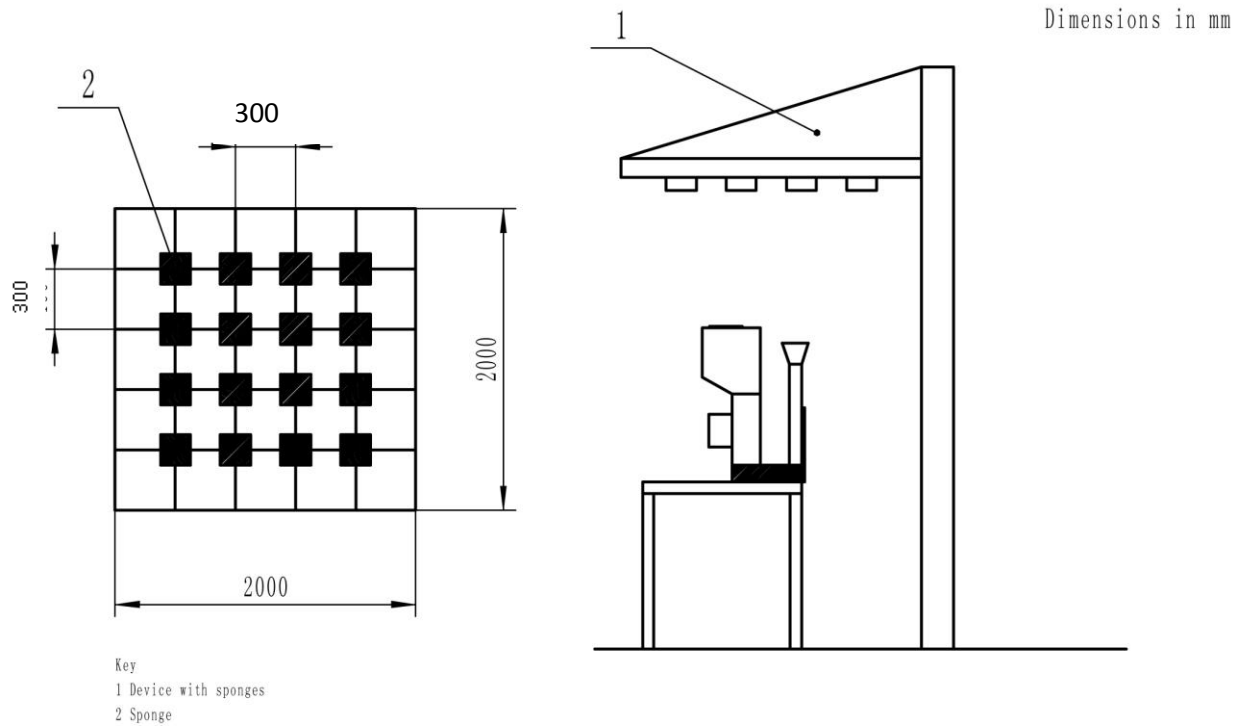


Figure 6b. Vertical Deposition Test Set-up

6.3 Measurement of Dusting and Misting Width

Record the maximum width of the misting/dusting as measured in 7.1.2 and 7.1.6.

7.0 MEASUREMENT OF DROPLET SIZE AND DROPLET DENSITY

Set the mister as described in Clause 7.1.1 to 7.1.5. Fill the tank either with clean water (in case Water Sensitive Papers are used) or coloured when a dye is used to contrast with artificial collectors such as filter papers, papers cards, etc placed in each Petri dish.

During a short misting time (of about 10s) the duct is moved laterally to avoid collector saturation. All collectors described in figure 6a are analysed. After digitalization, droplet sizes are directly calculated from the impact distribution. At least 3 repetitions of the test are to be achieved.

Alternatively, a droplet analyser based on light diffraction can be used to sample droplet size directly in the spray. Currently, no further information on the measurement of droplet size and droplet density can be provided.

8.0 NOISE TEST

8.1 Test Conditions

The test of the noise of powered knapsack mister-cum-duster shall be conducted in a flat open field of radius greater than 20 m. There shall not be any obstacles or reflective surfaces. The level of the background noise and the sound pressure level of the wind shall be at least 10 dB (A) below the sound level measured during the test. The natural wind speed shall be less than 5 m/s otherwise a windbreaker shall be used.

Note: Source IS: 12180 (part1) 2000 and JB/T 7723-2014.

8.1.2 Test Procedure

The mister-cum-duster shall be misting normally at its rated speed, at the highest misting rate, and it shall be standing on a stationary platform with the shaft of the engine 1000 mm height above the ground (see figure 8a). The platform shall not resonate or reverberate with the mister-cum-duster.

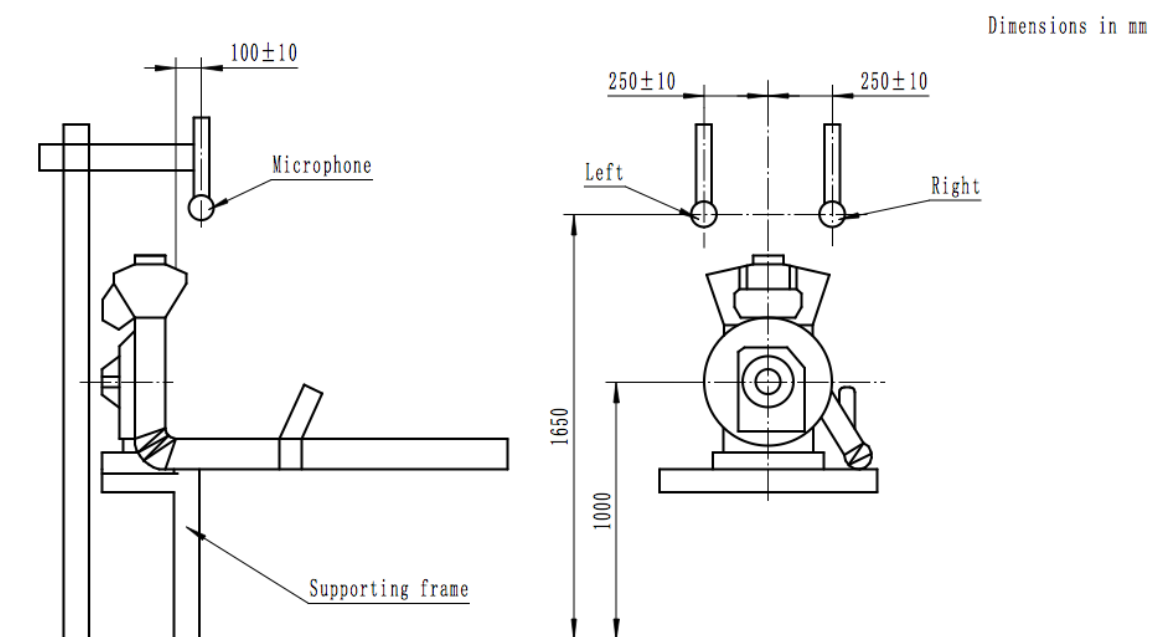


Figure 8a. Setup for Noise Measurement

8.1.3 Operator Ear Level Noise Measurement

During measurement, the microphone is placed vertically left and right at a distance of 250 ± 10 mm, horizontally in front of the operator backpack cushion 100 ± 10 mm and 1650 mm above the ground level. Measure the noise level. Repeat 3 times at each point. Compute the average, record readings in Table 8a.

Variations between two successive measurements shall not exceed 3 dB(A). Record the max

value.

The noise level measured at the ear side may not exceed 95 dB(A) for safety purpose. Manufacturer should supply ear protectors along with the mister cum duster.

Table 8a: Noise Test

Machine model		Maximum RPM		Rated power, kW	
Instrument type and model		Environment Temperature/ Humidity		Test date	
Test site			Note:		
Inspector					

Test No.	Noise level at ear, dB (A)	
	Left	Right
1		
2		
3		
Average		

9.0 VIBRATION TEST

Test Conditions: Fill the chemical tank with ½ tank of clean water. Vibrations shall be measured using a vibration accelerometer fitted at 6 to 9 spots on the backpack. The sensors shall be placed at the top in the middle and at the bottom of the backpack. Operate at normal misting conditions. Repeat the test three times.

Compute the average record results in the table 9a. Average vibration acceleration at the back rest shall not exceed 15 ms^{-2} .

Table 9a: Vibration Test

Machine model		Maximum RPM		Rated power, kW	
Instrument type and model		Environment Temperature/ Humidity		Test date	
Test site			Note:		
Inspector					

Test No.	Vibration acceleration, ms^{-2}								
	1	2	3	4	5	6	7	8	9
1									
2									
3									
Average									

10.0 ENDURANCE TEST

10.1 Reliability and Endurance

Sample selection: Three new units of knapsack powered misters-cum-dusters are used for the endurance test.

10.1.1 Time to first failure test – Average operation time to the first failure (exclude minor failure) shall not be less than 90 hrs.

$$MTTFF = \frac{1}{n} \left(\sum_{i=1}^r t_i + \sum_{j=1}^{n-r} t_j \right)$$

where: Mean Time To First Failure (MTTFF) = Average operating time before 1st failure, h

n = number of machine

r = no. of machine having 1st failure (when r=0 hr, r=1)

t_i = Cumulative operating hour of the ith unit of machine first failure

t_j = Cumulative operating hour of the jth machine (not having failure) at the end of 100 hr cumulative operation.

Note: Minor failure refers to failure which can be easily repaired by farmer such as loose parts, loose wire and unimportant parts.

10.1.2 There shall not be any leakages during misting and dusting operation.

V. Annexes

ANNEX A

LIST OF CITED AMERICAN STANDARDS

Standards No.	Title	
ANSI /OPEI B175.2-2012	American National Standard for Outdoor Power Equipment: Internal Combustion Engine-powered Handheld and Backpack Blowers and Blower-vacuums: Safety Requirements and Performance Testing Procedures	

LIST OF CITED CHINESE STANDARDS

Standards No.	Title	Referred ISO standards
JB/T 5135.1-2013	General utility small gasoline engine -- Technical specification	
JB/T 5135.2-2013	General utility small gasoline engine -- Performance test method	
JB/T 5135.3-2013	General utility small gasoline engine -- Test and evaluate method of reliability and durability	
JB/T 7723-2014	Power-operated knapsack air-blast sprayer-duster	ISO 10988: 2011
JB/T 7723.2-2005	Power-operated knapsack air-blast sprayer-duster, Part 2 - Test method	
JB/T 5673-2015	Agricultural and forestry tractor and machinery paint work -- General technical requirements	

LIST OF CITED INDIAN STANDARDS

Standards No.	Title	Referred ISO standards
IS: 7347-1974	Specification for performance of small size spark ignition engines	
IS: 7593.1-1986	Specification for power-operated pneumatic sprayer-cum duster. Part 1 knapsack type	
IS: 8132-1999	Tractors and machinery for agriculture and forestry: power lawn and garden equipment - operator's manual: content and presentation.	ISO 3600: 1998
IS: 443-1975	Methods of sampling and tests for rubber hoses	
IS: 3400 (Part 4)-2012	Methods of Test for Vulcanized Rubbers,	

	Part 4: Accelerated Ageing and Heat Resistance	
IS: 460 (Part 1) -1985	Test Sieves: Part-I Wire Cloth Test Sieves	

LIST OF CITED ISO STANDARDS

Standards No.	Title	
ISO 8178-4: 2007	Reciprocating internal combustion engines -- Exhaust emission measurement - Part 4: Steady-state test cycles for different engine applications	
ISO 11684: 1995	Tractors, machinery for agriculture and forestry, powered lawn and garden equipment -- Safety signs and hazard pictorials -- General principles	
ISO 9357: 1990	Equipment for crop protection -- Agricultural sprayers -- Tank nominal volume and filling hole diameter	
ISO 5681:1992	Equipment for crop protection- Vocabulary	

LIST OF CITED RUSSIAN STANDARDS

Standards No.	Title	
GOST 27.002-2015	Dependability in Technics-terms and definitions-in the area of reliability	

LIST OF CITED VIETNAMESE STANDARDS

Standards No.	Title	Referred ISO standards
TCVN 8745: 2011	Agricultural and forestry machinery -- Knapsack combustion-engine-driven mist blowers - Safety requirements	ISO 28139: 2009

ANSI /OPEI= American National Standard for Outdoor Power Equipment

JB/T= Chinese National Standards

IS= Indian National Standards

ISO= International Standard Organization

GOST= Russian Federation National Standards

TCVN= Vietnam National Standards

ANNEX B

**B-1 DETAILED TECHNICAL SPECIFICATION OF POWERED KNAPSACK
MISTERS-CUM-DUSTERS**

1.0	GENERAL	PLEASE INDICATE
1.1	Name & address of manufacturer (If more than one give details of manufactures. Separate sheets may be used)	
1.2	Name and address of the applicant for test	
1.3	Make/Type/Model	
1.4	Serial number	
1.5	Year of manufacture	
	Overall packing dimensions (Width x height x length)	
	Net Weight (kg)	
2.0	ENGINE	
2.1	Make/Type/Model/Country	
2.2	Serial number	
2.3	<p>Engine (manufacturer's recommended settings)</p> <p><i>No test necessary if a certified test report is provided by the manufacturer (according to either one of the following standard: IS 7374-1974, JB/T 5135.1 -2013 or ISO 8178-4: 2007)</i></p> <p><i>If no engine test certification provided the equipment might be rejected</i></p> <ul style="list-style-type: none"> - Rated power, kW - Maximum torque, Nm - Speed at the rated power at no load, rpm - Speed at max. torque, rpm - Specific fuels consumption, g/ kWh - Specific oil consumption, g/ kWh 	
2.4	Type of fuel used (octane number)	

2.5	Capacity of fuel tank (litre)	
2.6	Presence of strainer at engine tank inlet, yes/no	
2.7	Type of fuel filter	
2.8	Starting system: - Type - Aids for cold starting, if any - Any other device provided for easy starting	
2.9	Noise level at maximum speed, dB(A)	
3.0	FRAME	
	Material of Construction	
	Size (Width x height x length)	
4.0	TANK	
	Shape (Trapezoidal/Cylindrical/ Any other)	
	Size (In case of Trapezoidal : Width x height x depth, In case of cylindrical: Diameter x length), mm	
	Capacity, litre	
	Material of construction	
	Size of Liquid filling hole, mm	
	Strainer or filter Mesh (< 2 mm)	
	Marking on the tank, if any	
5.0	BACK REST	
	Size (Width x height x thickness)	
	Material	
6.0	STRAP	
	Material of strap	
	Material of strap buckle	
	Width and thickness of strap	

	Minimum and Maximum strap length can be used	
7.0	MISTING DUCT	
	Type of misting duct	
	Misting duct internal diameter and length	
	Misting duct discharge at recommended pressure, ml/min	
	Misting range (m)	
8.0	BLOWER	
	Fan type : Fully enclosed / partially enclosed	
	Fan blade type : Forward bent / radial / backward bent	
9.0	DUSTING	
	Dusting width, m	
	Dusting discharge rate (horizontal), kg/min	
10.0	TOTAL MASS (without liquid/dust), kg	
11.0	DETAILS OF AGITATING DEVICE PROVIDED (if any)	
12.0	LIST OF STANDARD ACCESSORIES/PARTS PROVIDED WITH EQUIPMENT (provide as annex)	
13.0	PUBLICATIONS Operator's manual Service Manual Parts catalogue Safety Precautions	

ANNEX B-2**MATERIAL OF CONSTRUCTION OF VARIOUS COMPONENTS**

No.	Component	Material	Please Indicate
1.	Tank	Fiber glass reinforced plastics Plastics HDPE	
2.	Lid or cap	Fibre glass reinforced plastics Plastics HDPE	
3.	Frame	Mild steel Engineering Plastics	
4.	Impeller	Mild steel Galvanized plain steel Aluminum alloy Fibre glass reinforced plastics Plastics	
5.	Casing	Mild steel Galvanized plain steel Aluminum alloy Fibre glass reinforced plastics Plastics	
6.	Air bent outlet	Galvanized plain steel Plastics	
7.	Air hose	Rubber, fabric braided Rubber. synthetic Plastics	
8.	Strap	Leather, vegetable tanned Woven web cotton Yarn, synthetic	
9.	Strap buckle	Mild steel Galvanized plain steel Aluminum Engineering Plastic	
10.	Cushion	Foam rubber Foam plastics	
11.	Gasket	Rubber, synthetic PVC Leather Fiber	
12.	Air pressure regulating device	Brass Plastics	
13.	Air pressure pipe	Plastics	
14.	Liquid or dust regulating device	Brass Plastics	
15.	Hose clip	Mild steel Galvanized plain steel	
16.	Air duct (misting or dusting)	Stainless steel Plastic	

17.	Valve assembly	Brass Stainless steel Plastics	
18.	Pipe for agitator	Galvanized iron Brass Polyvinyl chloride (PVC)	

ANNEX C-1

PRO-FORMA FOR SUBMISSION, RUNNING-IN AND REPAIRS

1. Name of the manufacturer:
2. Address:
3. Submitted for test by:
4. Sample model and serial number:
Sample 1:
Sample 2:
Sample 3:
Sample 4 (additional unit without engine):
5. Date of manufacture:
6. Place of running-in:
7. Duration and schedule of running in (6 hrs each for 4 times):
8. Repairs and adjustments made during running-In:
9. Received by: _____ when: _____
10. Signatures (manufacturer)
11. Signature (test centre):

ANNEX C-2
RUNNING-IN

Pro-forma For Running-In (samples 1 and 2):

1. Name of the manufacturer:
2. Address:
3. Sample model and serial numbers:
4. Place of running-in:
5. Duration and schedule of running in (at rated speed for a total of 24 hr):
6. Repairs and adjustments made during running-in:
7. Signatures (manufacturer):
8. Signature (test centre):

Appendix 1

ANTAM Focal Points (As of August 2017)

1. Armenia

Mr. Armen Harutyunyan
Adviser
Minister of Agriculture of the Republic of Armenia

E-mail: armenharut@gmail.com

2. Bangladesh

Mr. Sheikh Md Nazimuddin
Project Director
Farm Mechanization Project
Department of Agricultural Extension

E-mail: nazimdae@gmail.com

3. Cambodia

Dr. Chan Saruth
Director
Department of Agricultural Engineering
Ministry of Agriculture, Forestry and Fisheries

E-mail: saruthchan@hotmail.com

4. China

Ms. Han Xue
Deputy Division Director
Division of Technology & Foreign Affairs
China Agricultural Machinery Testing Center (CAMTC)
Ministry of Agriculture of the People's Republic of China

E-mail: hanxue100@foxmail.com

5. France

Dr. Jean-Paul Douzals
Researcher
National Institute of Science and Technology for
the Environment and Agriculture (IRSTEA)

E-mail: jean-paul.douzals@irstea.fr

6. Hong Kong, China

Ms. Mandy Au
Regional Cooperation Division Trade and Industry Department

E-mail: mandyau@tid.gov.hk

7. India

Dr. Karuppiyah Alagusundaram
Deputy Director General (Engineering)
Indian Council of Agricultural Research (ICAR)

E-mail: ddgengg@icar.org.in

8. Indonesia

Dr. Astu Unadi
Senior Researcher
Indonesian Centre for Agricultural Engineering Research and Development (ICAERD)
Indonesian Agency for Agricultural Research and Development (IAARD)
Ministry of Agriculture

E-mail: unadiastu@yahoo.com

9. Japan

Mr. Hiroshi Fujimura
Director General
Institute of Agricultural Machinery (IAM)
National Agriculture and Food Research Organization (NARO)

E-mail: hfjmr@affrc.go.jp

10. Malaysia

Mr. Mohd Taufik Bin Ahmad
Senior Research Officer
Engineering Research Centre
Malaysian Agricultural Research and Development Institute (MARDI)

E-mail: taufik@mardi.gov.my

11. Nepal

Mr. Ishwori Prasad Upadhyay
Division Chief
Agricultural Engineering Division
Nepal Agricultural Research Council

E-mail: ishwaripu@yahoo.com

12. Pakistan

Dr. Tanveer Ahmad
Director and Principal Engineer
Agricultural and Biological Engineering Institute National Agricultural Research Centre
(NARC)

E-mail: tanveerz_isd@yahoo.com

13. Philippines

Dr. Aurelio A. Delos Reyes

Director

Agricultural Machinery Testing and Evaluation Center (AMTEC)

College of Engineering and Agro-Industrial Technology

E-mail: aadelosreyes2@up.edu.ph

14. Russia

Mr. Vadim Pronin

Chairman

Executive Board

Association of Testing of Agriculture Machinery and Technology

E-mail: vadim_pronin@mail.ru

15. Republic of Korea

Dr. Young-lim Kim

Action Officer

Agro-material Industry Division,

Rural Development Administration

Ministry of Agriculture, Food and Rural Affairs

E-mail: tree70@korea.kr

16. Sri Lanka

Mr. B. M. Chintaka P. Balasooriya

Deputy Director

Farm Mechanization Research Centre

Department of Agriculture

E-mail: chinthaka.balasooriya@gmail.com

17. Thailand

Mr. Viboon Thepent

Senior Agricultural Engineering Specialist

Agricultural Engineering Research Institute

Department of Agriculture

Ministry of Agriculture and Cooperatives

E-mail: v_thepent@hotmail.com

18. Turkey

Mrs. Banu Sener

Test Engineer

Directorate of Testing Center of Agricultural Equipment and Machine

Ministry of Food Agriculture and Livestock

Directorate of Testing Center of Agricultural Equipment and Machinery
Ministry of Food Agriculture and Livestock

Email: banuneva@yahoo.com

19. Vietnam

Mr. Tran Duc Tuan

Deputy Director

Research Centre for Agricultural Machinery and Aero-Hydraulic

Vietnam Institute of Agricultural Engineering and Post-Harvest Technology

E-mail: Ductuanvcd@gmail.com

Appendix 2

ANTAM Technical Working Groups Members (As of August 2017)

Technical Working Group on Power Tillers

Name	Country
Dr. Israil Hossain	Bangladesh
Mr. Sinh Chao	Cambodia
Mr. Chang Xiongbo	China
Dr. Champat Raj Mehta	India
Mr. Angit Sasmito	Indonesia
Mr. Takashi Fujimori	Japan
Mr. Mohd Khusairy Khadzir	Malaysia
Dr. Shabbir Ahmed Kalwar	Pakistan
Mr. Darwin Aranguren	Philippines
Dr. Vadim Pronin	Russia
Mr. Pavel Ishkin	Russia
Dr. Anuchit Chamsing	Thailand
Mr. Erol Akdemir	Turkey

Technical Working Group on Powered Knapsack Misters-Cum-Dusters

Name	Country
Mr. Duc Sam On	Cambodia
Mr. Zhang Xiaochen	China
Dr. Douzals Jean-Paul	France
Dr. Panna Lal Singh	India
Mr. Mohd Fazly Bin Mail	Malaysia
Mr. Muhammad Mohsin Ali	Pakistan
Ms. Ayesha Herath	Sri Lanka
Mr. Nguyen Tuan Anh	Vietnam

Technical Working Group on Paddy Transplanters

Name	Country
Dr. Md. Anwar Hossen	Bangladesh
Mr. Zhang Xiaochen	China
Dr. Allimuthu Surendrakumar	India
Dr. Joko Pitoyo	Indonesia
Mr. Takashi Fujimori	Japan
Mr. Mohd Shahril Shah bin Mohamad Ghazali	Malaysia
Mr. Romulo Esteban Eusebio	Philippines
Mr. Anuradha Wijethunga	Sri Lanka
Dr. Isara Chaorakam	Thailand
Mr. Erol Akdemir	Turkey
Mr. Ngo Van Phuong	Vietnam



United Nations
Centre for Sustainable Agricultural Mechanization

A-7/F, China International Science and
Technology Convention Centre
No.12, Yumin Road, Chaoyang District
Beijing 100029, P.R.China

Tel: (86-10) 8225 3581
Fax: (86-10) 8225 3584
info@un-csam.org
www.un-csam.org

