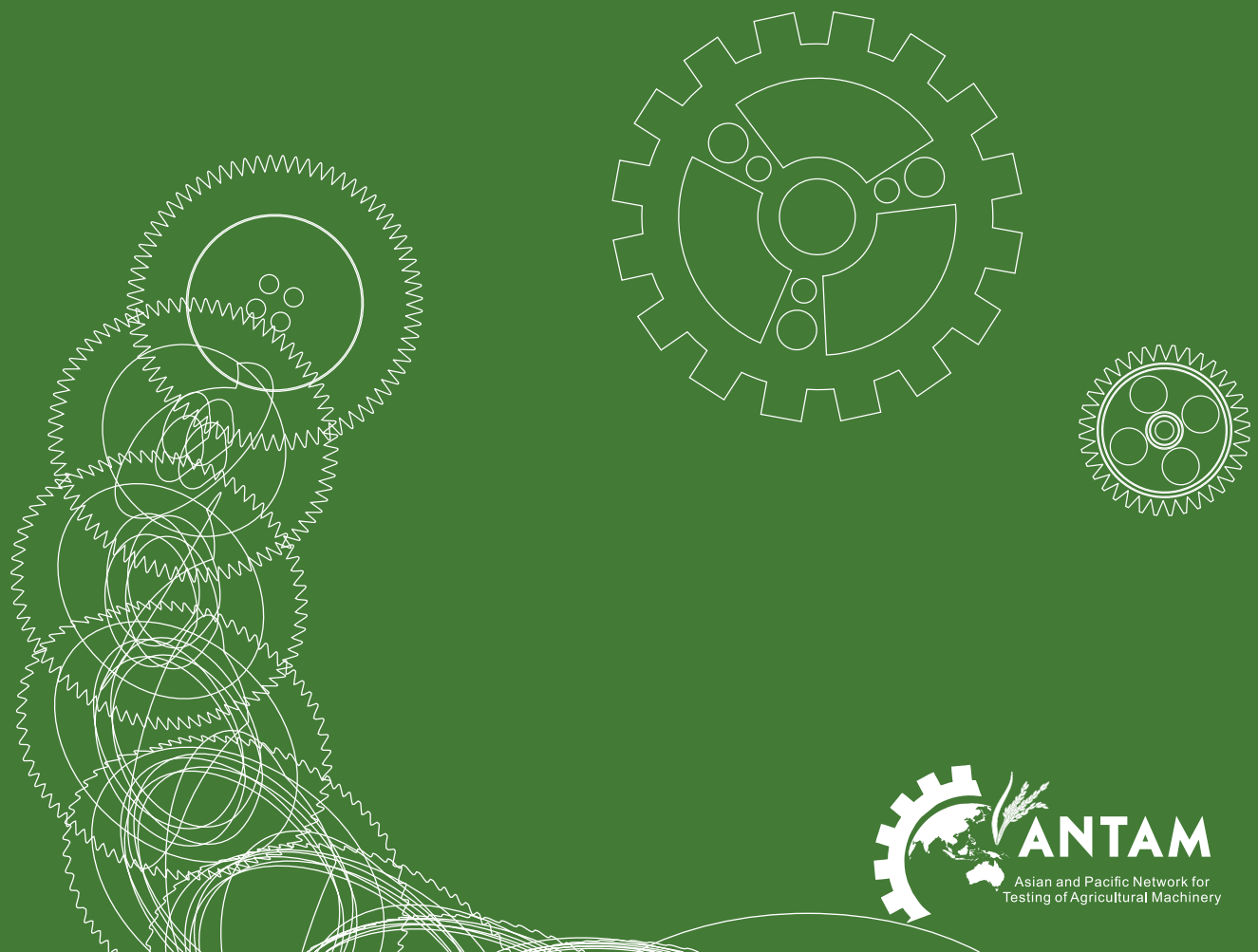
UNITED NATIONS ESCAP
Economic and Social Commission for Asia and the Pacific

CSAM

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

002-2018

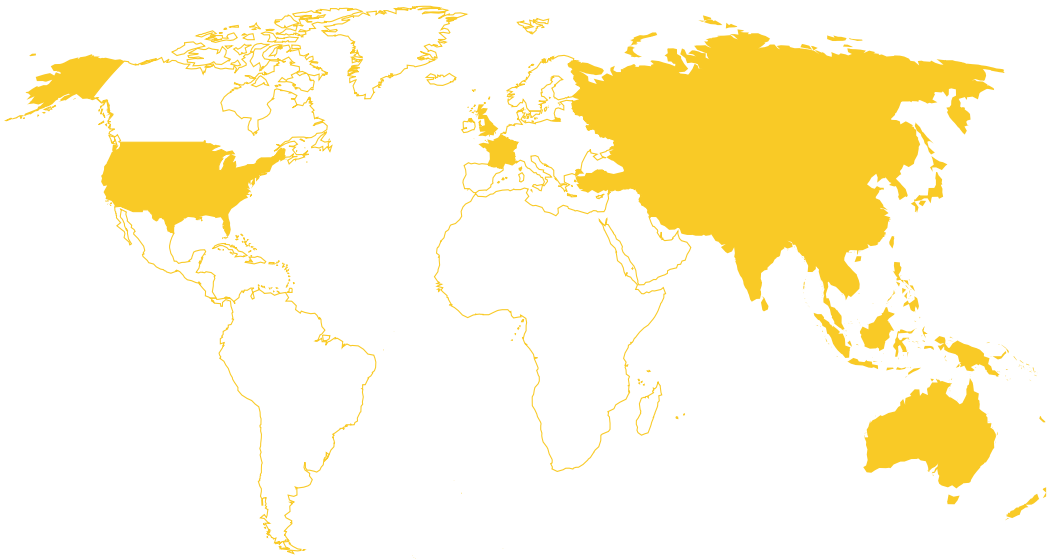


ANTAM
Asian and Pacific Network for Testing of Agricultural Machinery

The Centre for Sustainable Agricultural Mechanization (CSAM), is a regional institution of the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), 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 ESCAP.

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

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

002-2018*

September 2018

* Subject to adoption by the 5th Annual Meeting of ANTAM to be held in November 2018

Acknowledgments

The Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) Standard Code for Testing of Powered Knapsack-Misters- Cum- Dusters 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 and modified based on technical negotiations conducted with designated national counterparts from 2015 to 2018.

The consultation process in 2018 started in March and was concluded at the 4th Meeting of the Technical Working Groups (TWGs) of the Asian and Pacific Network for Testing of Agricultural Machinery (ANTAM) held on June 25-28, 2018 in Georgetown, Penang, Malaysia. The Code has been developed with contributions from: Duc Sam On; Ma Lingjuan; Douzals Jean-Paul; Panna Lal Singh; Azmy Ulya; Kawase Yoshiyuki; Mohd Fazly Bin Mail; Hafiz Sultan Mahmood; Pavel Ishkin; Ayesha Herath; Khanit Wannaronk; Barıs Ozgur Kocturk; and Nguyen Tuan Anh. The ANTAM Test Code on Powered Knapsack Misters-cum-Dusters. was formulated by referring to standards developed by the International Electrotechnical Commission (IEC), International Organization for Standardization (ISO), and Organisation for Economic Co-operation and Development (OECD), and by merging relevant national standards from China, and India to reflect unique regional conditions.

Special thanks go to the ANTAM Focal Points in the Philippines, Malaysia and China, namely Dr. Aurelio Delos Reyes Jr., Mr. Mohd Taufik Bin Ahmad and Ms. 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, OECD, 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. Dr. Singh Surendra provided final reviews and editing of the Code and Mr. Wei Zhen contributed to the layout and design of the publication.

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). In support of the 2030 Agenda for Sustainable Development, the ANTAM network develops regional standards to promote the use of safe, efficient and environmentally sound agricultural machinery in the Asia-Pacific region.

The 2030 Agenda for Sustainable Development recognizes eradicating poverty in all its forms as the greatest human challenge. The 17 Sustainable Development Goals (SDGs) advocate for multisectoral, coordinated action to integrate the three dimensions of sustainable development: the economic, social and environmental. Eradicating poverty (SDG 1) and hunger (SDG 2) occupy central stage in the work of ESCAP-CSAM. The important contribution of mechanization to agricultural productivity has long been recognized by experts[1]. Nevertheless, the factors that influence the diffusion of mechanization, in particular for developing and least developed countries, involve multiple sub-sectors such as farmers' access to capital, infrastructure development, manufacturing capacity and import regulations. To tackle this complex and interconnected set of issues the public sector can play a crucial role by implementing regulations that, in a time and cost-effective manner, assist stakeholders in overcoming economic and other practical impediments to the diffusion of mechanized agriculture. Testing and certification of agricultural machinery is recognized as one of the most effective public interventions in support of the diffusion of mechanization[2].

The certification released after testing is a written assurance for farmers, retailers, importers and manufacturers that testifies to the stated specifications of a given machine. This aspect is particularly important because according to several experts[3], the constraints in the introduction, use and export of agricultural machinery can be attributed to lack of quality, design, and production techniques. Since the quality of the same type of machine manufactured by different firms can vary greatly, farmers are reluctant to invest in unknown technology without assurance of quality or efficiency. The variations in quality amongst the same type of machinery can be minimized by following standard design and production techniques. In addition, the presence of a recognized certification, issued after testing, can help farmers in determining the comparative performance of machines available in the market and the public sector as well as financial institutions in allocating financial support for the purchase of reliable equipment.

Agricultural machinery testing Codes are among the key elements of a well-functioning certification system. The ANTAM Codes for testing of agricultural machinery draw upon national standards of ESCAP member States and major international requirements for agricultural machinery testing. They aim to help our stakeholders in identifying sustainable, affordable and environmentally sound machinery. The fourth version of the ANTAM Codes that we are presenting in 2018, builds upon the work conducted since 2015 and incorporates important feedback received from our member States to integrate their needs into one standard able to serve the unique agricultural characteristics of countries in the Asia-Pacific region.

Li Yutong
Head
Centre for Sustainable Agricultural Mechanization

[1] FAO (2013) *Mechanization for Rural Development: A review of patterns and progress from around the world- Integrated Crop Management Vol. 20-2013;* Plant Production and Protection Division of the Food and Agriculture Organization of the United Nations; Rome, Italy.
[2] World Bank (2017) *Enabling the Business of Agriculture 2017*; Washington, DC, World Bank.
[3] Mehta M L; Verma S R; Misra S K; Sharma V K. 2016. Testing and Evaluation of Agricultural Machinery. Vedams eBooks [P] Ltd. New Delhi

Method of Operation[4]

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 American National Standard Institute (ANSI) and the International Organization for Standardization (ISO) 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 as necessary.

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 tests[5] among testing stations 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.

[4] 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.

[5] 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 5th Annual Meeting of ANTAM to be held in Indonesia in November 2018.

TESTING OF MISTERS-CUM-DUSTERS

1. 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 of 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 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 ANTAM Test Code on Powered Knapsack Misters-Cum-Dusters (2017).

2. 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 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 8178-4:2017 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. TERMINOLOGY

3.1 Powered 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 or volume of active ingredient or formulated product applied per unit of time (ISO 5681:1992).

3.7 Rated speed

Speed at which, according to the statement of the engine manufacturer, the rated power is delivered (*ISO 8178-4:2017*).

3.8 Net 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 the ability to perform the required functions in the specified modes and conditions of application, maintenance, storage and transportation (GOST 27.002-2015).

4. Measuring Tolerances

The measuring apparatus shall be such that the following items shall have the tolerances within the limits shown against each measurement (Table 1). (Clause 3.4 of JB/T 7723-2014 also referred).

Table 1: Accuracy Requirements of Measurement

Parameters (unit/scale)	Accuracy	Notes
Rotational speed (rpm)	$\pm$ 0.5	Tachometer may be used
Time variation (s)	$\pm$1	Digital stopwatch
Noise variation (dB(A))	$\pm$0.5	Sound level meter
Vibration (percent FS)	$\pm$ 10	3-axis accelerometer
Mass variation (kg)	$\pm$0.05	Weighing balance of sufficient accuracy

Mass variation (g)	±0.05	Weighing balance of sufficient accuracy
Pressure (percent FS)	± 1 (< 10 kPa) ±2.5 (≥ 10 kPa)	Pressure gauge (analogue/digital)
Wind speed (percent FS)	± 5	Anemometer (hot wire or vane type) capable of measuring air velocity at 1 Hz during 15 s.
Temperature (degrees Celsius)	± 1	Thermometer
Relative Humidity (percent FS)	± 1	Hygrometer
Paint layer thickness (µm)	± 3	Digital coating thickness gauge

5. CHECKING OF SPECIFICATION

5.1 Technical Details

Manufacturer/applicant shall complete the specification sheet given in **Annex B-1** for the powered 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.

5.1.1 Material

The material for construction of different components of powered knapsack mister-cum-duster except gasoline engine is given in **Annex B-2.** 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/T7723-2014 and IS 7593 (Part 1)-1986 has been referred.

5.1.2 Manual

Manufacturer can prepare operator's 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, liquid 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.

5.2 Submission of Test Samples

Three powered knapsack misters-cum-dusters, under production, should be randomly selected by the manufacturer/applicant from the production line, complete with its standard accessories and in a condition as generally offered for sale. The powered knapsack misters-cum-dusters shall be new and should not be given any special treatment or preparation to pass the test. An additional unit of a similar machine with the engine removed is to be supplied. If the manufacturer provides more than one nozzle, separate test should be carried out for the minimum and maximum flow nozzles. Optional tests can be performed on providing additional nozzles.

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

5.3 Marking and Packing

5.3.1 Marking

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

a) Manufacturer's name and registered trade-mark

b) Liquid tank capacity

c) Unloaded mass of machine with empty liquid tank and empty fuel tank

d) Production Code and serial number

e) Engine certification label

f) Type of fuel used

g) Maximum blower speed (rpm)

h) 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 and 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.

i) 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.

j) 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.

5.3.2 Packing

The machine shall be properly packaged with material having sufficient strength to avoid from damage during transportation.

Required number of spare parts for each mister-cum-duster should be separately packed and provided.

5.4 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: (JB/T 5673-2015)

5.4.1 Appearance quality

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

5.4.1.1 The total thickness of the paint coating shall not be less than 40µm.

5.4.1.2 If the surface touches chemicals, i.e.: steel tank, the total thickness shall not be less than 75µm, and the paint coating shall pass the pesticide resistance to corrosion test.

5.4.2 Test procedure is as follows:

- Selection and concentration of the chemical is determined by the testing station
- 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 at an angle of 5 degrees front to back and side to side for duration of 7 days
- Empty the tank
- Inspect the paint finishing
- Continue the test for another 6 cycles each of 7 days
- For each test cycle, renew the chosen chemical as reuse of chemical is not allowed
- Stop the test if there is leakage due to corrosion

5.4.3 Quality criteria: (good/pass/fail):

- Good: the surface gloss maintained without change or colour. No bubbles, flaking or pits. No powdery appearance, cracks or rust
- Pass: change of colour, loss of gloss, minor bubbles (less than 30 percent of the covering surface) rough paint work surface appear in less than 30 percent 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

5.5 Running-In

5.5.1 The manufacturer/applicant shall run-in all three powered knapsack misters-cum-dusters 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.

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

5.5.2 Servicing and Preliminary Setting after Running-In

5.5.2.1 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.

5.5.2.2 Preliminary Setting

The manufacturer/applicant may adjust 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.

5.5.3 Repairs and Adjustments during Tests

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

5.5.4 Fuel and Lubricants

Fuel and lubricants for the tests shall conform to the manufacturer's specifications.

5.5.5 Stability Test

The stability test shall be conducted as follows:

- Position the empty machine filled with fuel on a flat and hard surface with an inclination of (8.5 ± 0.2) degrees (Figure 1).
- Check the stability of the machine by rotating it at 90 degrees intervals along its vertical axis.
- Repeat the test with the liquid tank filled to its maximum marked volume.

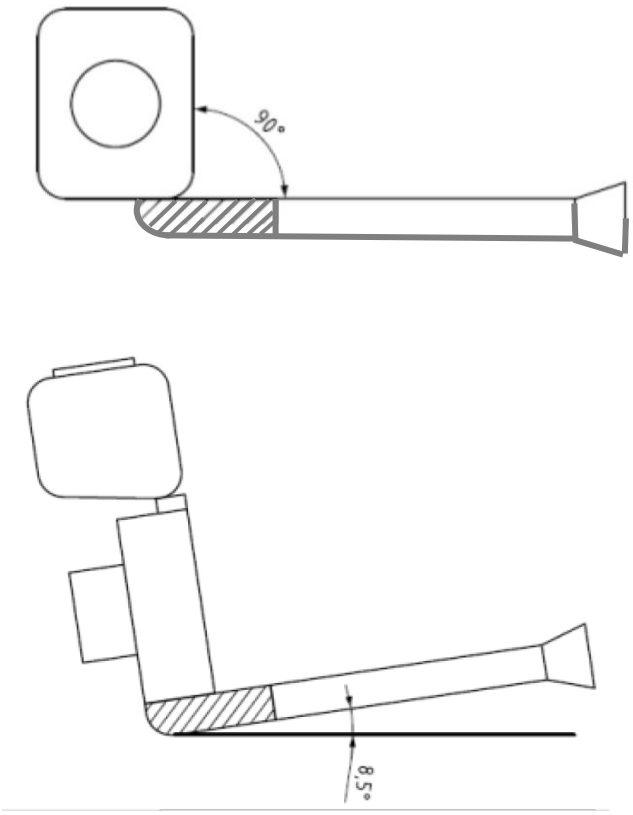


Figure 1. Stability test

5.6 Specifications

5.6.1 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.

5.6.2 Total Mass with liquid/dust

The mass of the machine (mister/duster) including liquid/dust in the tank up to full capacity should be less or equal to 30 kg.

5.6.3 Liquid 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 m^3 (20 liter). The tank shall be accurately marked (±1 liter) so the operator can visualize the volume of the liquid/dust in the tank. The tank capacity shall be declared by the

manufacturer. The full tank capacity shall not differ by more than 7.5 percent of the declared value (ISO: 9357: 1990). The actual overall volume of the tank shall exceed the nominal volume by at least 5 percent. 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.

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).

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.

5.6.4 Impeller

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

5.6.5 Blower Housing

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

5.6.6 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.

5.6.7 Flow Regulator

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

5.6.8 Air Hose

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

5.6.9 Straps

A strap shall be provided to carry the mister-cum-duster. The strap should be comfortable enough to carry the machine during operation. 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 off in any direction.

5.6.9.1 Two straps of not less than 800 mm length after its maximum adjustment and 38 mm width shall be provided 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.

5.6.9.2 All double shoulder straps shall be equipped with a durable 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. 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.

5.6.9.3 Each shoulder strap shall have a load-bearing part of a length of at least 190 mm and of a minimum comfort width of 50 mm. The load shall be distributed over the whole width. Compliance shall be checked by measurement and inspection.

5.6.9.4 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.

5.6.10 Gasoline Engine

5.6.10.1 The gasoline engine used should comply with JB/T 5135.1-2013, IS:7347-1974 or ISO 8178-4:2017 (without governor).

5.6.10.2 All engine control components shall be normal without restriction, easy to control with the maximum rated engine power achieved at the highest setting. A separate hand-operated button/switch for stopping the engine shall be provided. The fuel and chemical discharge controls shall be in easy access of the operator.

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

5.6.11 Safety Requirements

Dangerous parts of the gasoline engine, such as 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 8178-4:2017). If dimensions are not available because of structure, warning signs shall be set up, and noted it in the manual. The sprayer engine shall be equipped with a spark arrestor in the exhaust system.

5.6.12 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.

5.6.13 Nozzle

If the machine equipped with nozzles, all types of nozzle should be listed.

6. ENGINE

6.1 Gasoline Engine

6.1.1 Speed

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

6.1.2 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).

6.1.3 Rated Power

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

6.1.4 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 (i.e. kg/h or l/h).

6.1.5 Specific Fuel Consumption

Fuel consumption per unit of energy produced expressed in grams per kilowatt hour (g/kWh).

6.1.6 Full Throttle

Throttle opening corresponding to maximum speed.

6.1.7 The general tests requirements, rated power, rated speed, specific fuel consumption and lubricating oil consumption shall comply with ISO 8178-4:2017 or IS:7347-1974 (with amendment No. 3 September 2011) or JB/T 5135.1-2013.

7. JOINTS, TANK, STRAPS, HOSE AND CONTROLS

7.1 Joints

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

7.2 Hose Accelerated Ageing Test

After ageing at 70±1 ºC for a period of 72 hours, the rubber used for lining of all types of hoses shall not vary by more than ±25 percent for tensile strength and for elongation at breakage point.

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

7.3 Chemical Tank Assembly

7.3.1 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.

7.3.2 Residue

7.3.2.1 Liquid Tank

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

7.3.2.2 Idling

During idling speed of powered knapsack mister-cum-duster with flow regulator fully closed, collect the dust at the outlet. Dust flow rate shall not exceed 40 g/min. Conduct the test for a duration of 30 min.

7.4 Straps

7.4.1 Strap Drop Test

7.4.1.1 Checking the Straps for Damage

Make sure that there is no damage in straps before test. The straps and their assembly shall withstand the test as follows:

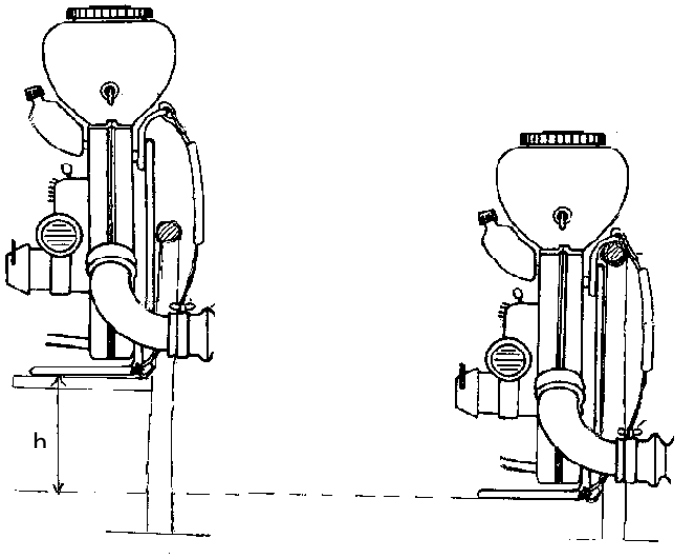
- The tank shall be filled with clean water to its full capacity.
- The mister-cum-duster (without discharge line) shall be hung from a solid support by its strap(s) simulating its carriage or to the shoulder of an operator.
- Raise the tank vertically to a height of 300 mm and allow to drop freely while 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.

7.4.1.2 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 2.



a) Raised position **b) Impact position**

Figure 2. Straps Drop Test Setup

7.4.2 Straps Chemical Absorption Test

Remove the carrying straps, 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 and hang freely to drain for 10 min before re-weighing.

Calculate the mass 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 (g)

m_a is the mass after the test (g)

The increase in mass of straps after defined immersion in water shall not exceed 30 percent of

the dry mass.
Note: ISO 19932-2: 2013 is referred.

7.4.3 Controls

7.4.3.1 Control Device

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

7.4.3.2 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.

7.4.3.3 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.

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

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

Place the mister-cum-duster in an operating position. Lock the machine as per Figure 3. Position air duct pipe in a horizontal position such as the height of the mister-cum-duster outlet center 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 center of the air duct pipe outlet.

Measure the air velocity at the centre of the air duct.

distances of 3000 ± 20 mm and 6000 ± 20 mm (Figure 4) from the air duct pipe outlet based on sampling grid of 100 x 100 mm ± 5 mm and along the four sampling lines AA, BB, CC and DD as per Figure 5. Calculate the average velocity for 15s at each sampling point.

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

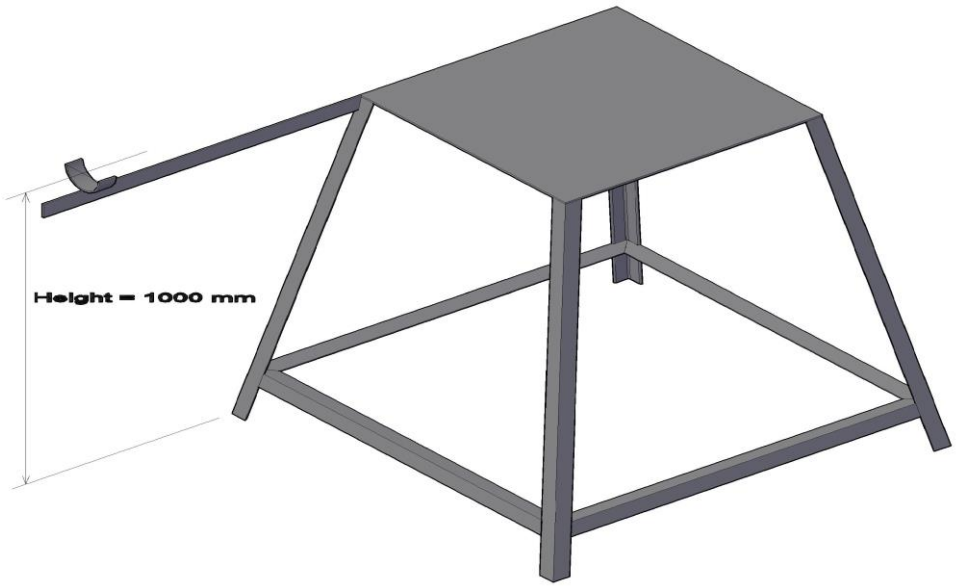


Figure 3. Supporting Test Bench for Mounting Mister-Cum-Duster

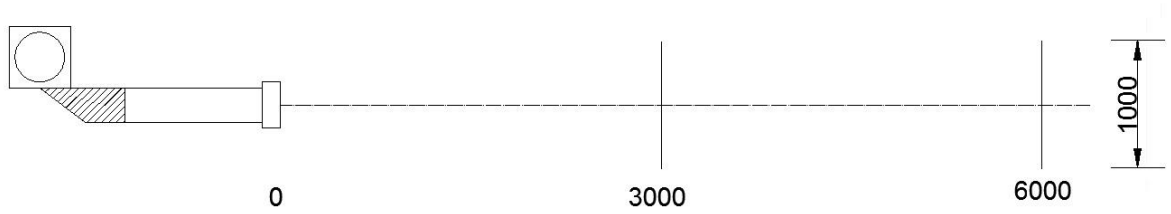


Figure 4. Top View with Sampling Planes

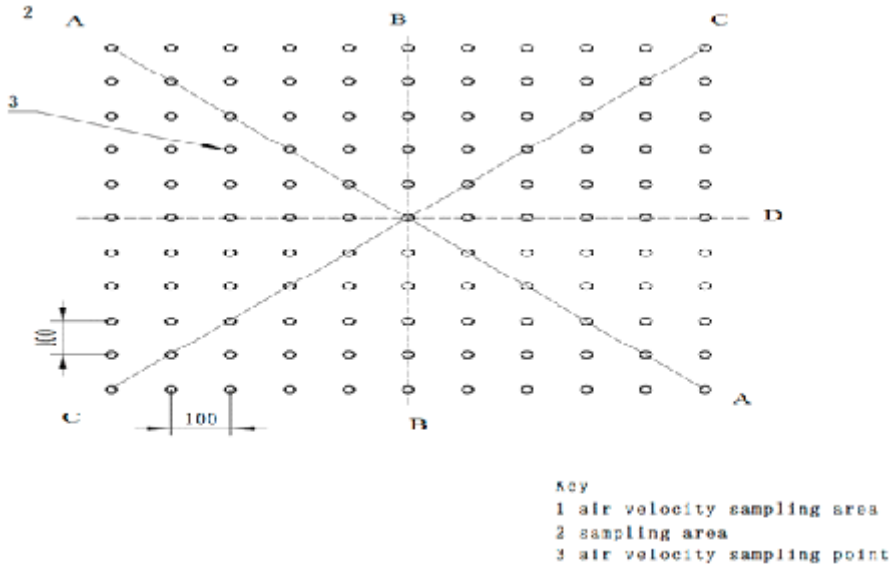


Figure 5. Front View of The Sampling Grid

8.2 Fan Impeller Over-Speed Inspection

Mount the test sample (without the engine) onto a test rig (Figure 6) with a variable speed controlled electric motor. The impeller shall be tested at 1.3 times the rated speed for 5 minutes on the occasion of full load. Replicate three times for each fan impeller. After all of these, the phenomena shall not occur to the impeller, such as get injured, get loose or be out of shape, etc.

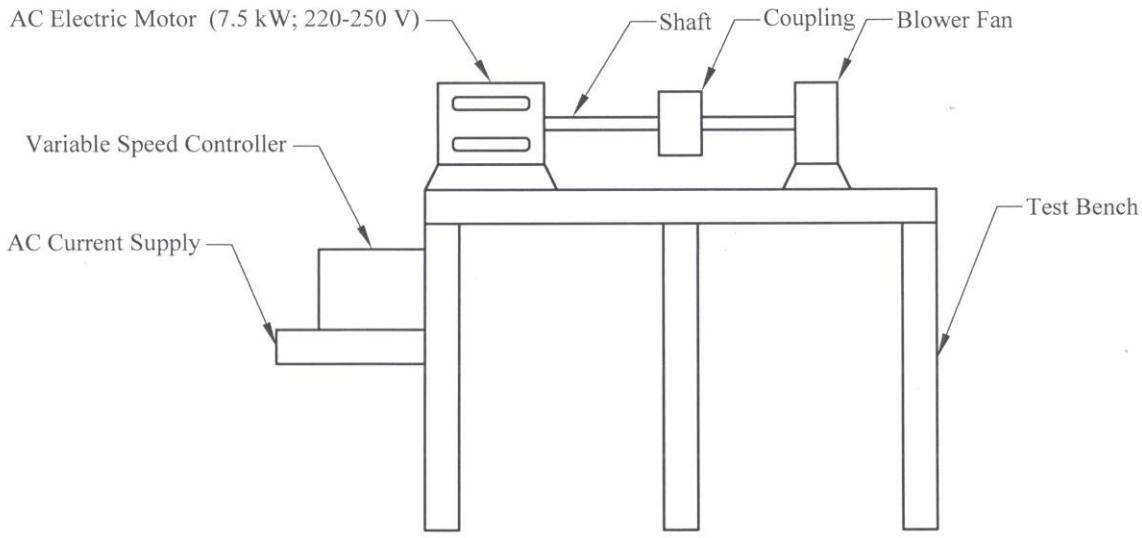


Figure 6. Test Rig for Over-Speed Impeller Inspection.

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

9. DISCHARGE RATE TESTS

9.1 Misting Performance

9.1.1 Misting Discharge Rate (Full Tank)

Fill the liquid tank of the mister with pre-determined quantity of clean water up to its full marked capacity. Firmly place the knapsack mister on a weighing scale, set the flow regulator at full throttle setting and, divide the starting and stopping of misting into 7 segments of full marked capacity (stopping is defined as irregular continuous misting). Measure the time and weight for each segment and calculate misting discharge rate. Conduct the horizontal and vertical misting.

Repeat these tests three times and record data into Table 2 (Source: Chinese JB/T 7723- 2014 Clause 5.5.5). Use the following equations to find the average misting discharge rate.

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

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 (percent). A maximum value of 6 percent 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 2: 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 :			
Inspecter					

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 (percent)								
	Residue (kg) test 1								
	Residue (kg) test 2								
	Residue (kg) test 3								
	Residue (kg) - average								

9.1.2 Misting Discharge Variation

Obtain the tank filling variation discharge with data from section 9.1.1. The variation in discharge due to tank filling at the various segments shall not exceed 15 percent of the discharge at full capacity of the tank.

9.1.3 Residue

Weigh or measure the residual clean water remained in the liquid tank after the test and record it in Table 2.

9.2 Dusting Performance

9.2.1 Dusting 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 pesticides/talcum powder or micro granules used for chemical formulations up to its full marked capacity. The talcum powder should pass through the 75-micron sieve (Clause 12.2 of IS: 6940-1982).

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 percent.

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 3.

i. Repeat the test for 1/4, 1/2 and 3/4 and full tank (4/4) capacity of dust/micro granules.

Table 3: 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		1/4	2/4	3/4	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					
	Coefficient of variation (percent)					
	Residue (kg) 1					
	Residue (kg) 2					
	Residue (kg) 3					
	Residue (kg) Average					

Note: Consider only 1 column (4/4)

9.2.2 Residue

Weigh or measure the residual dust remained in the chemical tank and hose after the test and record it in Table 3.

10. MISTING/ DUSTING RANGE AND WIDTH

10.1 Measurement of Ground Deposition

10.1.1 Conduct this test in an enclosed space without interferences due to wind. The humidity and temperature will be noted during the test. Place the mister-cum-duster in an upright position and lock the machine as per Figure 7 position. Position air duct pipe of the mister-cum-duster in horizontal direction in such a way that the outlet center is 1000±20 mm from the ground to ensure mist flow in horizontal direction. 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.

10.1.2 Initial Trial

Fill the liquid tank with clean water and set the 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).

10.1.3 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 (Figure 7).

Position the center row of Petri dishes corresponding with the symmetric axis of the mist flow direction. 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.

Dimensions in meter

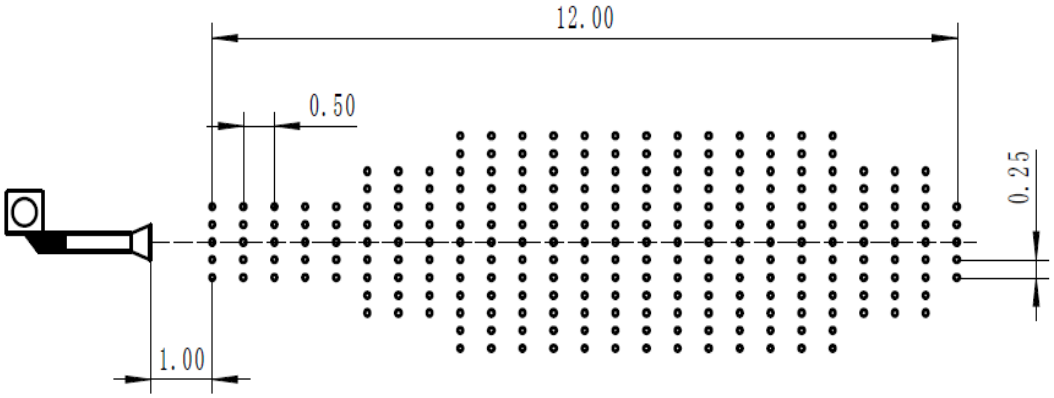


Figure 7. Mister and Petri Dishes Layout

10.1.4 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 up to full marked capacity. 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 of water or the tank is empty.

10.1.5 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.

10.1.6 Repeat similar procedure 10.1.1 to 10.1.5 for dusters considering water is replaced by dust.

10.2 Measurement of Vertical Deposition (Mister Only)

10.2.1 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 8 position. Position air duct pipe in a vertical direction, such as the height of the mister-cum-duster outlet center is 1000 ±20 mm from the ground.

10.2.2 Test Preparation

Use rows of sponges to sample water droplets. Position the center 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 (Figure 8). In order to get more accurate results especially in the central deposition area, the sampling density may be increased.

10.2.3 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.

10.2.4 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.

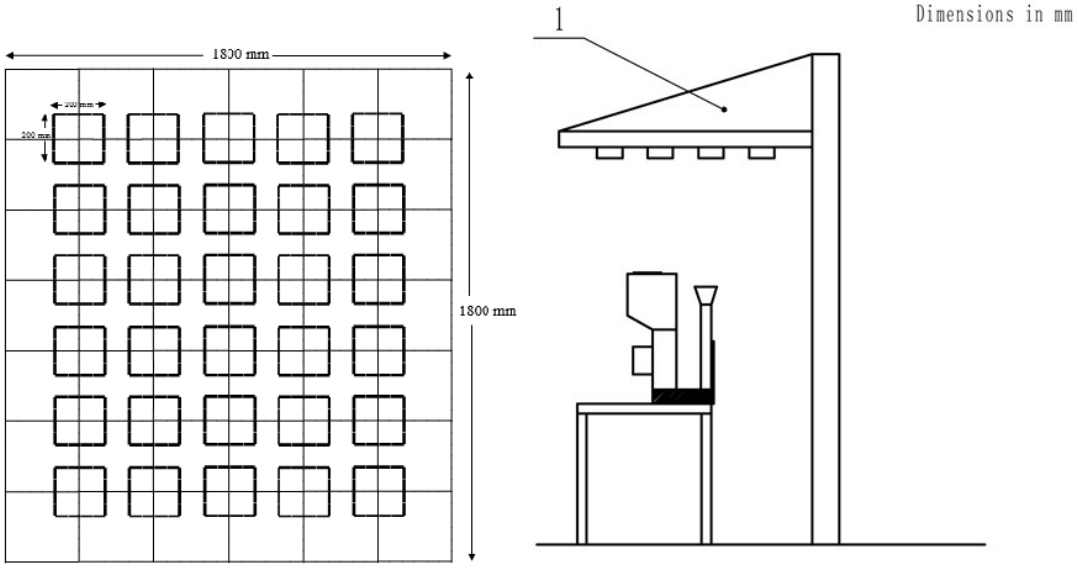


Figure 8. Vertical Deposition Test Set-up.

10.3 Measurement of Dusting and Misting Width

Record the maximum width of the misting/dusting as measured in 10.2.2 and 10.2.4.

11. MEASUREMENT OF DROPLET SIZE AND DROPLET DENSITY (OPTIONAL)

Set the mister as described in Clause 10.1.1 to 10.1.5. 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.

Set the machine at manufacturer's recommended pressure and nozzle type before the test. During a short misting time (of about 10s), the duct is moved laterally to avoid collector saturation. All collectors described in Figure 7 are analyzed. 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. The droplet analyzing system consists of a microscope, CCD camera, PC and a monitor with Software used to analyze the droplets available locally can also be used to determine the number of spots, maximum diameter, minimum diameter, equivalent diameter, area, average diameter of each spot, etc.

12. NOISE TEST

12.1 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 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.

12.1.2 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 (Figure 9). The platform shall not resonate or reverberate with the mister-cum-duster.

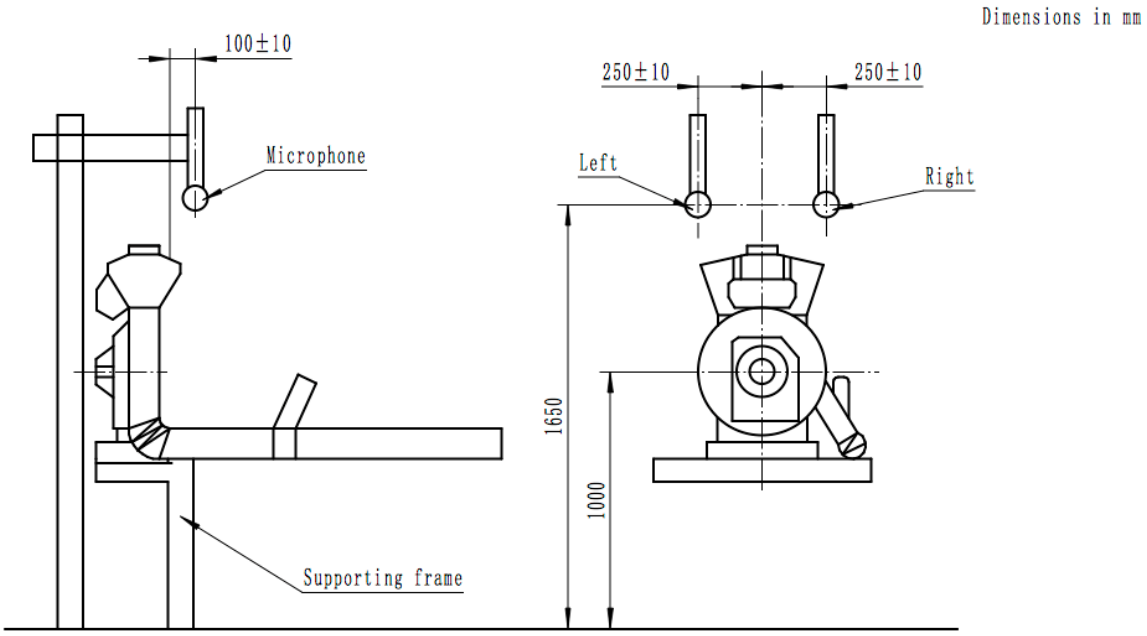


Figure 9. Setup for Noise Measurement

12.1.3 Operator Ear Level Noise Measurement

During measurement, the microphone is placed as explained in Figure 9. Measure the noise level. Repeat 3 times at each point. Compute the average, record readings in Table 4.

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

The noise level of the machine should be the lowest possible to safeguard the operators and because it is a limitation for export to some countries. Manufacturer should supply appropriate ear protectors along with the mister-cum-duster in respect to the country's limitations

according to noise exposure level[6].

Table 4: 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		

13. VIBRATION TEST

13.1 Test Conditions

Fill the liquid tank with ½ tank of clean water. Vibrations shall be measured using a vibration accelerometer fitted at 6 to 9 spots uniformly distributed on the backpack. The sensors shall be placed at the top, middle and the bottom of the backpack. Operate the machine at normal misting conditions and repeat the test three times.

Compute the average of measured results in the Table 5. Average vibration acceleration at the back rest shall not exceed 15 m/s^2.

Table 5: Vibration Test

Machine model		Maximum rpm		Rated power (kW)	
Instrument type and model		Environment Temperature/ Humidity		Test date	
Test site			Note:		
Inspector					

[6] List of country regulations on noise exposure level: For Japan the limit is 100 dB(A), for India, Sri Lanka and China the limit is 95 dB(A), for Turkey the limit is 85 dB(A), for Russia the limit is 90 dB (A) and for Vietnam the limit is 89 dB(A).

Test No.	Vibration acceleration (m/s^2)								
	1	2	3	4	5	6	7	8	9
1									
2									
3									
Average									

14. ENDURANCE TEST

14.1 Reliability and Endurance

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

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

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

where: Mean Time to First Failure (MTTFF) = Average operating time before 1st failure (h)
n = number of machine
r = number of machine having 1st failure
t_i = Cumulative operating hour of the i^{th} unit of machine first failure
t_j = Cumulative operating hour of the j^{th} machine (not having failure) at the end of 100 h cumulative operation.

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

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

15. GENERAL SAFETY REQUIREMENTS

The applicant shall submit operation, maintenance and service manuals. The operational manual shall include schematic diagrams of levers, switches and other parts with functional description and instruction on all adjustments necessary for operation of the powered knapsack misters-cum-dusters, assembly and disassembly for cleaning and routine inspection, replacements of parts, safety precautions to be taken during operation and handling and spare parts list with part number in the manual. Manuals shall comply with ISO 3600:2015, IS 8132:1999 standards and contain information on main technical details of the engine including its accessories.

ANNEX A: LIST OF STANDARD CITED

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 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 (with amendment No. 3 September 2011)	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: 2015
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 8178-4:2017	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 mistblowers - 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 Organization for Standardization
GOST= Russian Federation National Standards
TCVN= Vietnam National Standards

ANNEX 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	
1.6	Overall packing dimensions (Width x height x length) (mm)	
1.7	Net mass (kg)	
2.0	ENGINE	
2.1	Make/Type/Model/Country	
2.2	Serial number	
2.3	Engine (manufacturer's recommended settings) *Testing center should verify the following engine parameters, either from manufacturer data or by testing of the engine in the testing center.* *Note: For China, it is mandatory to follow the standards JB/T 5135.1 -2013.* - Type - Make/brand - Model - Country of Manufacture - Serial number - Rated speed (rpm) - Power at rated speed (kW) - Specific fuel consumption (g/kWh) - Maximum torque (Nm)	
2.4	Type of fuel used (octane number)	

2.5	Capacity of fuel tank(liter)	
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	
3.0	TYPE OF PUMP	
4.0	FRAME	
4.1	Material of Construction	
4.2	Size (Width x height x length) (mm)	
5.0	LIQUID TANK	
5.1	Shape (Trapezoidal/Cylindrical/Any other)	
5.2	Size (In case of Trapezoidal: Width x height x depth, In case of cylindrical: Diameter x length) (mm)	
5.3	Capacity (liter)	
5.4	Material of construction	
5.5	Size of Liquid filling hole (mm)	
5.6	Strainer or filter Mesh (< 2 mm)	
5.7	Marking on the tank (if any)	
6.0	BACK REST	
6.1	Size (Width x height x thickness) (mm)	
6.2	Material	
7.0	STRAP	
7.1	Material of strap	
7.2	Material of strap buckle	

7.3	Width and thickness of strap (mm)	
7.4	Minimum and Maximum strap length can be used (mm)	
8.0	MISTING DUCT	
8.1	Type of misting duct	
8.2	Misting duct internal diameter and length (mm)	
8.3	Misting duct discharge at recommended pressure (ml/min)	
8.4	Misting range (m)	
9.0	BLOWER	
9.1	Fan type: Fully enclosed/partially enclosed	
9.2	Fan blade type: Forward bent/radial/backward bent	
10.0	DUSTING	
10.1	Dusting width (m)	
10.2	Dusting discharge rate (horizontal) (kg/min)	
11.0	TOTAL MASS (with liquid/dust and fuel) (kg)	
12.0	DETAILS OF AGITATING DEVICE PROVIDED (if any)	
13.0	LIST OF STANDARD ACCESSORIES/PARTS PROVIDED WITH EQUIPMENT (provide as annex)	
14.0	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.	Liquid Tank	Fiber glass reinforced plastics HDPE Other	
2.	Lid or cap	Fibre glass reinforced plastics Plastics HDPE Other	
3.	Frame		
4.	Impeller	Mild steel Galvanized plain steel Aluminum alloy Other	
5.	Casing	Mild steel Galvanized plain steel Aluminum alloy Other	
6.	Air bent outlet	Galvanized plain steel Plastics Other	
7.	Air hose	Rubber, fabric braided Rubber. synthetic Plastics Other	
8.	Strap	Leather, vegetable tanned Woven web cotton Yarn, synthetic Other	
9.	Strap buckle	Mild steel Galvanized plain steel Aluminum Engineering Plastic Other	
10.	Cushion	Foam rubber Foam plastics Other	
11.	Gasket	Rubber, synthetic PVC Leather Fiber Other	
12.	Air pressure regulating device	Brass Plastics Other	
13.	Air pressure pipe	Plastics Other	
14.	Liquid or dust regulating device	Brass Plastics Other	
15.	Hose clip	Mild steel Galvanized plain steel Other	
16.	Air duct (misting or dusting)	Stainless steel Plastic Other	

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

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. Year of manufacturing:

6. Place of running-in:

7. Duration and schedule of running-in (6 h 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, 2 and 3):

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 h):
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
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Appendix II: ANTAM Technical Working Groups Members 2018

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Dr. Champat Raj Mehta	India
Mr. Muhamad Iqbal	Indonesia
Dr. Takahashi Hiroyuki	Japan
Mr. Mohd Khusairy Khadzir	Malaysia
Mr. Liaqat Ali Shahid	Pakistan
Mr. Darwin Aranguren	Philippines
Dr. Vadim Pronin	Russia
Mr. Janaka Hemachandra	Sri Lanka
Dr. Anuchit Chamsing	Thailand
Mr. Le Huy Phuong	Vietnam

Technical Working Group on Powered Knapsack Misters-Cum-Dusters

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Ms. Ma Lingjuan	China
Dr. Douzals Jean-Paul	France
Dr. Panna Lal Singh	India
Mr. Azmy Ulya	Indonesia
Mr. Kawase Yoshiyuki	Japan
Mr. Mohd Fazly Bin Mail	Malaysia
Dr. Hafiz Sultan Mahmood	Pakistan
Mr. Pavel Ishkin	Russia

Ms. Ayesha Herath	Sri Lanka
Ms. Khanit Wannaronk	Thailand
Mr. Barıs Ozgur Kocturk	Turkey
Mr. Nguyen Tuan Anh	Vietnam

Technical Working Group on Paddy Transplanters

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Mr. Takashi Fujimori	Japan
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ANTAM
Asian and Pacific Network for Testing of Agricultural Machinery

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