

BUREAU OF INDIAN STANDARDS

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भारतीय मानक मसौदा

बीज कपास सिलेंडर क्लीनर — परीक्षण संहिता

Draft Indian Standard

SEED COTTON CYLINDER CLEANERS — TEST CODE

ICS 65.060

Agriculture and Food Processing Equipment Sectional Committee, FAD 20	Last date of comments: 26 May 2024
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FOREWORD

(Formal clause will be added later)

Seed cotton contains wide range of impurities gathered during post-harvest handling before these fibres are ginned. Cotton is sold in the market based on its grade. Trash content in cotton is the predominant parameter to decide the grade and value of cotton. In Indian ginning industry currently cylinder-type inclined pre-cleaner and cylinder type horizontal pre-cleaners are employed to remove trashes and contaminants.

Seed cotton cleaner removes dirt and trash. Inside this equipment, easily replaceable spikes on heavy duty cylinders and grid bars are used in various configurations for efficient cleaning with the least fiber damage. The cleaner machines clean the seed cotton using mechanical forces, and these forces could have a negative effect on the quality of the fiber and seeds.

Therefore, a need was felt to prepare a standard on seed cotton cylinder cleaners to evaluate the performance of these cleaners to ensure a quality output with minimum damaged product.

In reporting the result of a test made in accordance with this standard, if the final value, observed or calculated, is to be rounded off, it shall be done in accordance with IS 2: 2022 'Rules for rounding off numerical values (*second revision*)'.

1 SCOPE

This standard prescribes the methods for testing of seed cotton cylinder cleaners (*see* Fig. 1 & 2) to evaluate their performance.

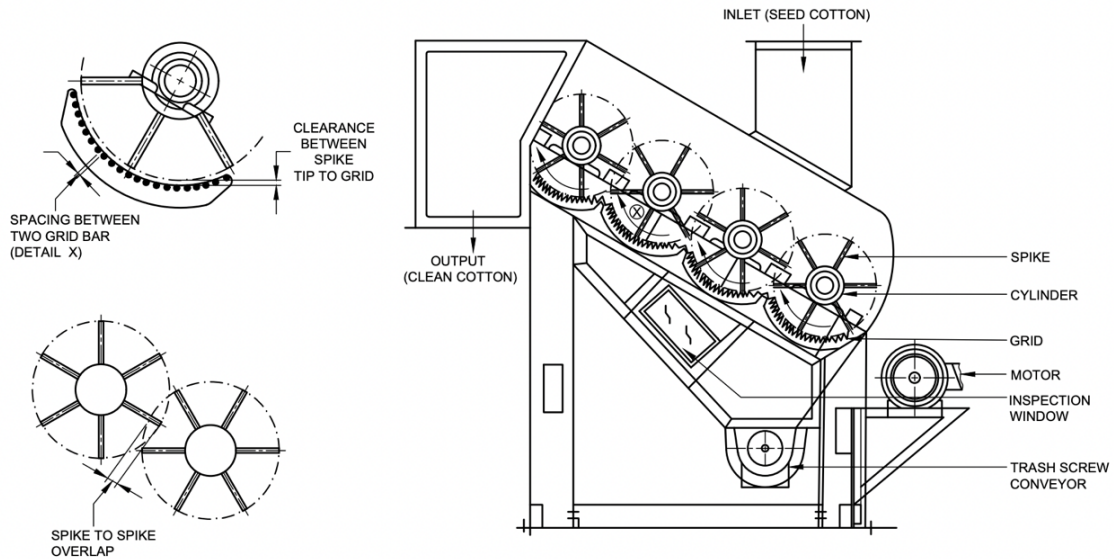


FIG. 1 SCHEMATIC DIAGRAM OF INCLINED CYLINDER CLEANER

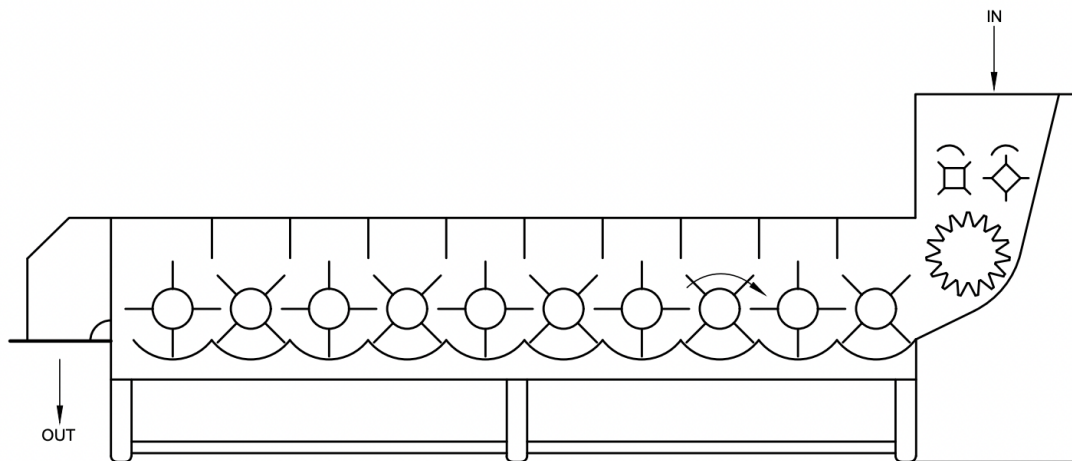


FIG. 2 SCHEMATIC DIAGRAM OF HORIZONTAL CYLINDER CLEANER

2 TERMINOLOGY

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

2.1 Cleaner — A machine for removing dirt and trash content from seed cotton.

2.2 Cylinder Cleaner — Cylinder cleaners that use spiked cylinders to scrub seed cotton over grid rods to remove foreign matter.

- 2.3 Feed Hopper** — Part of the machine through which uncleaned seed cotton is fed.
- 2.4 Foreign Matter** — Includes both inorganic and organic matter. The inorganic matter comprises sand, gravel, dirt, pebbles, stones, lumps of earth, mud and iron chips. The organic matter includes trash of leaves and bract accumulated during harvest.
- 2.5 Feed Mechanism** — The mechanism, which regulates the feed rate of uncleaned seed cotton.
- 2.6 Feed Rate** — The quantity of uncleaned seed cotton fed into the cleaner per unit time.
- 2.7 Feed Roller** — The component through which seed cotton is fed to spiked cylinders.
- 2.8 Fibre Strength (FS)** — Ratio of breaking load of a bunch of fibres to the weight per unit length of the fibres.
- 2.9 Green Boll** — A cotton boll that is neither dry nor open.
- 2.10 Grid Bar** — The component in the form of bars placed at a particular distance, which separates foreign matter from seed cotton.
- 2.11 Grid Bar Clearance** — The distance between tips of cylinder spikes and surface of grid bar.
- 2.12 Inlet Position** — The place from where the seed cotton is fed to the machine.
- 2.13 Micronaire value (MIC)** — A scale of measurement of fibre fineness calculated by measuring weight per unit length and is calibrated in microgram per inch.
- 2.14 Rated Input Capacity** — The feed rate at which the cleaning efficiency and purity of seed cotton are within the specified limit for a particular variety of seed cotton.
- 2.15 Seed Cotton** — Harvested cotton before the lint is removed from seed.
- 2.16 Short Fibre Index (SFI)** — The amount of fibers in percent that are less than 0.5 inch (12.7 mm) in length
- 2.17 Spiked Cylinder** — Part of the machine, which scrubs the seed cotton over grid rods to remove foreign matter.
- 2.18 Spiked Cylinder Slope** — The inclination, in degrees, of the spiked cylinder with the horizontal.
- 2.19 Uniformity Index (UI)** — The ratio of the mean length to the upper half-mean length. It is a measure of the uniformity of fiber lengths in the sample expressed as a percent.
- 2.20 Upper Half Mean Length (UHML)** — The average length of the longest one-half of the fibers.

3 SELECTION AND SPECIFICATION OF CYLINDER CLEANERS FOR TESTS

- 3.1 Selection** — Each and every machine manufactured has to be checked for conformity.

3.2 Specification — The manufacturer shall supply the specification sheet duly filled in as given in Annex A as well as any further information required to carry out the tests. The manufacturer shall also supply all the literature, the operational manual, and a schematic diagram of seed cotton flow in the cylinder cleaner. The manufacturer shall also indicate the rated input capacity.

4 PRE-TEST OBSERVATIONS

4.1 Determination of Foreign Matter — The foreign matter present in the seed cotton lot, to be cleaned, shall be determined by pneumatic fractionation method given in Annex B. In case of unavailability of pneumatic fractionation testing facility, the trash in lint may be determined by the method as given in Annex C. The data shall be recorded in the data sheet as given in Annex D.

4.2 Determination of Fibre Properties — The fibre properties of seed cotton viz. UHML, UI, MIC, FS and SFI of seed cotton lot shall be determined as per the method given in Annex E. The data shall be recorded in the data sheet as given in Annex D.

4.3 Determination of Moisture — The moisture content of seed cotton shall be determined by standard oven drying procedure as given in Annex F. The data shall be recorded in the data sheet as given in Annex E.

4.4 Running-in and Preliminary Adjustments

4.4.1 The seed cotton cylinder cleaner shall be installed on the level and preferably on a hard surface. All the adjustments shall be made in accordance with the manufacturer's recommendations.

4.4.2 The seed cotton cylinder cleaner shall be run-in without load before commencing the tests. The procedure for the running-in shall be in accordance with the manufacturer's recommendations.

5 TESTS

5.1 Type Tests

5.1.1 General

5.1.1.1 Checking of specifications — The specification given by manufacturer (*see 3.2*) shall be checked and reported in the proforma as given in Annex A.

5.1.1.2 Checking of material — The material of construction of all components of the seed cotton cylinder cleaner shall be reported in the data sheet as given in Annex G.

5.1.1.3 Visual observations and checking of provision for adjustments — The observations and adjustments given in the data sheet of Annex H shall be made and reported.

5.1.2 Test at No-Load

5.1.2.1 Power consumption

a) The seed cotton cleaner shall be installed on the level and preferably on a hard surface. All the

adjustments shall be made in accordance with the manufacturer's recommendations. The seed cotton cleaner shall be attached with a suitable prime mover preferably with an electric motor. An energy meter shall be fitted. The power delivered to seed cotton cylinder cleaner may be supplied in the following ways:

- i) Directly coupling the electric motor with the main shaft of the cleaner through a gearbox whenever necessary; or
- ii) Connecting the electric motor with the help of a flat or V-belt and a pulley with the main shaft of the cleaner.

In case of (i), the power delivered to the cleaner would be the power output of the electric motor; whereas in case of (ii), the allowance for a flat or V-belt drive may be taken as 6 and 3 percent respectively.

b) The seed cotton cylinder cleaner shall be run at no-load for 10 minutes at the specified speed and the readings of the energy meter shall be recorded. The power consumption at no-load shall be calculated.

c) The test shall be repeated at least six times to get average power consumption. The data shall be recorded in accordance with Annex J (J-1).

5.1.2.2 Visual observations — During and after completion of power consumption test (*see 5.1.2.1*), the observations given in Annex J (J-2) shall be made visually and recorded.

5.1.3 Test at Load

5.1.3.1 Short-run tests — Sufficient quantity of seed cotton of the same variety having moisture content (*see 5.3*) not exceeding 9 percent shall be taken and test shall be performed as following:

a) *Operation and collection of data* — The seed cotton cleaner as installed [*see 5.1.2.1(a)*] shall be operated at its specified speed for an hour at the rated input capacity specified by the manufacturer.

i) During the one hour run, three sets of samples at an interval of 20 minutes at following outlets for quantities indicated against each and speed of the spiked cylinder shafts and the readings of the energy meter shall be recorded.

- 1) *Cleaned seed cotton outlet* — 3.0 kg
- 2) *Foreign matter outlet* — 1.0 kg

ii) At the end of one-hour feeding, the cleaner shall be run idle for some time, so that practically no more material already fed comes out. At the end of the test, the material dropped through foreign matter outlet and the seed cotton received at cleaned seed cotton outlet shall be collected and weighed. The mass of the sample collected at the cleaned seed cotton outlet [*see 8.1.2.1 (a)*] shall be added to mass of seed cotton collected after one hour run.

iii) The test given at [*5.1.3.1(a)*] shall be repeated with 10 percent higher the rated input capacity in case the cleaner meets the requirements of cleaning efficiency, % fibre loss

and fibre properties of seed cotton [see 5.1.3.1(f)]. In case the cleaner does not meet the requirements of cleaning efficiency, % fibre loss and fibre properties of seed cotton, the test should be conducted at 10 percent below the rated input capacity specified by the manufacturer. The tests shall be conducted with minimum 3 different varieties for establishing the rated input capacity of different varieties of seed cotton.

iv) *Visual observations* — During and after the test runs, the cleaner shall be inspected visually and the observations shall be reported in the data sheet as given in Annex K.

b) *Preparation and analysis of samples* — The three sets of samples obtained at the cleaned seed cotton outlet and the foreign matter outlet [see 5.1.3.1 {a(i)}] for various feed rates shall be thoroughly mixed separately to form a composite sample. Out of these composite samples, 1.5 kg sample from cleaned seed cotton outlet and 0.5 kg sample from foreign matter outlet shall be taken and analysed for the following;

i) *Cleaned seed cotton outlet* — to be analysed for fraction of cleaned seed cotton, fraction of total foreign matter, fraction of individual foreign matters of seed cotton as per the method given in Annex B.

ii) *Foreign matter outlet* — to be analysed for fraction of cleaned seed cotton, fraction of total foreign matter, fraction of individual foreign matters of seed cotton as per pneumatic fractionation method and fibre properties of seed cotton using High Volume Instrument (HVI). The data shall be recorded in the data sheet as given in Annex D.

c) *Determination of cleaning efficiency* — Cleaning efficiency for various feed rates shall be calculated by the following formula and the data shall be recorded in the data sheet as given in Annex L:

$$\text{Cleaning Efficiency (\%)} = \frac{\text{Total foreign matter removed}}{\text{Total foreign matter present in the feed rate}} \times 100$$

d) *Determination of power consumption* — In case of prime mover fitted with an energy meter the difference between two consecutive readings [see 5.1.3.1 {a(i)}] shall be taken as the power consumption for 20 minutes. The power consumption per hour given due allowance to the type of the drive [see 5.1.2.1(a)] shall be calculated. The data shall be recorded in the data sheet as given in Annex L.

e) *Determination of rated input capacity* — The feed rate at which the cleaning efficiency shall not be less than 80 percent without any fibre damage shall be selected. The capacity in terms of energy consumed shall be calculated by dividing the capacity to power consumed [see 5.1.3.1(d)]. The data shall be recorded in the data sheet as given in Annex L.

f) *Determination of % fibre loss* — The % fibre loss for various feed rates shall be calculated by the following formula:

$$\% \text{ Fibre Loss} = \frac{\text{Seed cotton present in foreign matter outlet}}{\text{Total seed cotton in feed rates}} \times 100$$

5.1.3.2 Long-run test — The cleaner shall be operated at least 25 hours at the rated input capacity, which shall be covered by a continuous run of at least 5 hours. The major breakdowns, defects developed and repairs made, shall be recorded in the data sheet as given in Annex M.

5.2 Routine Tests

- a) Visual observations and checking of provision for adjustments (*see 5.1.1.3*)
- b) Test at no-load (*see 5.1.2*)

6 SUMMARY REPORT

For the guidance of the user, a summary report on the proforma as given in Annex N shall be compiled.

7. ACCEPTANCE CRITERIA

Criterion for acceptance of equipment shall be based on the conditions for all the parameters as given in Table 1.

Table 1 Acceptance Criteria
(Clause 7)

Sl. No.	Parameter	Conditions
(1)	(2)	(3)
i)	Specifications	Match with claimed by manufacturer
ii)	Material	Match with claimed by manufacturer
iii)	Adjustment	Matching with claimed by manufacturer
iv)	Capacity	Matching with claimed by manufacturer ($\pm 5\%$ %)
v)	Cleaning efficiency	Matching with claimed by manufacturer ($\pm 5\%$ %)
vi)	Power consumption	Matching with claimed by manufacturer ($\pm 5\%$ %)
vii)	Fibre Loss	Minimum as possible ($< 1\%$ by of seed cotton)
vii)	Fiber Properties	No adverse effect on fibre properties

ANNEX A
(Clauses 3.2 and 5.1.1.1)

SPECIFICATION SHEET

TO BE FILLED IN BY
Manufacturer Testing Station

A-1 General

- a) Make
- b) Model
- c) Type
- d) Year of manufacture

A-2 Power Unit

- a) Type of prime mover
- b) Recommended power, kW,
- c) Type of drive

A-3 Main Drive

- a) Type
- b) Size of belt
- c) Size of pulley
- d) Diameter of main shaft
- e) Sub-drive, if any

A-4 Grids

- a) Diameter of first bar, mm
- b) Diameter of remaining bars, mm
- c) Number of bars
- d) Linear space between each bars, mm
- e) Angular space between each bars
- f) Total angular and flat chord of grid bar
- g) Position of start of grid bar w.r.t. cylinder
- h) Position of end of grid bar w.r.t. cylinder
- j) Length of flat portion of grid bar at its start & end, mm
- k) Thickness of supporting plates, mm
- m) Size of bolts

A-5 Spiked Cylinder

- a) Number of cylinders
- b) Diameter of cylinders, mm

- c) Thickness of cylinder material, mm
- d) Speed of cylinder
- e) Diameter of spike rods, mm
- f) Length of spike rods
- g) Angular and linear spacing of spike rods over cylinder
- h) Angular and linear positions of cylinders w.r.t. first cylinder

A-6 Feeding Hooper

- a) Method of feeding
- b) Size of feeding hopper
- c) Height of feeding hopper
- d) Recommended maximum input capacity
- e) Method of feed adjustment
- f) Method of arrangement of even distribution of seed cotton in the hopper

A-7 Feeding Cylinder

- a) Diameter of cylinder
- b) Speed of cylinder
- c) Method of speed variation
- d) Thickness of cylinder material
- e) No. of projected plates fitted over the periphery of feeding cylinders
- f) Thickness and length of projected plates
- g) Relative position of projected plates on either cylinders
- h) Method of driving

A-8 Outlets

- a) Size and location of cleaned seed cotton outlet(s)
- b) Location of foreign matter outlet

A-9 Overall Dimensions

- a) Length
- b) Width
- c) Height
- d) Ground clearance
- e) Total mass

ANNEX B
[Clauses 4.1 and 5.1.3.1 {c(i)}]

**PNEUMATIC FRACTIONATOR METHOD FOR DETERMINATION OF
FOREIGN MATTER IN COTTON**

B-1 The pneumatic fractionator method is used to measure the amount of foreign matter in a sample or lot of seed cotton. The large particles of foreign matter are removed by hand, whereas the smaller particles are removed in a machine that uses compressed air to tumble the specimen. The foreign matter is collected on a series of three screens.

B-2 Test Specimen

Either allow fractionation samples to come to moisture equilibrium before testing, or be sure the moisture content of the sample is 7 percent or less. The specimen should weigh about 150 grams.

B-3 Equipment

- a) Balance, direct reading preferred, capacity 500 grams or more, sensitivity 0.1 gram.
- b) Fractionator, and three screens: 6, 50, and 200 mesh.
- c) Brush, soft bristle (2-inch paintbrush).
- d) Metal tray, 23 by 23 by 1 inch, one end open, 1 to 4 in number.
- e) Metal pan, 8 by 12 by 1 inch, 1 to 4 in number.
- f) Automatic timer.
- g) A compressed air supply capable of maintaining 70 psi when fractionator is in operation.

B-4 Procedure

Place the fractionation sample and the paper bag on a large scale pan, and record the weight to the nearest 0.1 gram. Empty the specimen on a large metal tray, taking care to avoid loss of foreign matter in removing the sample. Shake the paper bag mouth down over the removed lot to obtain all the foreign matter in the sample. Weigh the paper container to the nearest 0.1 gram, subtract the weight from the original sample and bag weight, and record on the laboratory fractionation sheet.

For seed cotton foreign matter samples weighing more than 150 grams, the following procedure is recommended:

- a) About one-half of the entire large sample is spread thinly over the balance pan about 12 inches in diameter. The remaining one-half is then carefully spread over the first half.
- b) Any sifted trash in the large sample container is spread uniformly over the entire sample area.
- c) A portion of the sample consisting of about 150 grams is removed from the center by pulling the protruding seed cotton away from the pan and lifting the pan carefully in a vertical direction.
- d) The small sample of approximately 150 grams is weighed and the weight recorded.
- e) Remove all large foreign matter from the test sample by hand before fractionation.
- f) If desired, separate the foreign matter as to kind, such as hulls, sticks and stems, and grass.
- g) Place the remaining sample in the fractionator.
- h) Set timer for 75 seconds, and start the agitation with the compressed air at 70 p.s.i.
- j) Collect and weigh the combined foreign matter on the three screens in the base of the machine,

and record to the nearest 0.1 gram.

k) Weigh and record the large trash removed by hand, and record to the nearest 0.1 gram.

m) When percentages of each kind of foreign matter are desired, refractionate the material on the coarse screen; then pick out the motes and seeds on the coarse screen, weigh each group, and record the weights. After picking out the motes and seeds, separate the material left on the coarse screen by fractionation. Weigh the material on each screen and each kind of large trash separately, and record on laboratory sheet. The material on the top or coarse screen is classified as lint; the middle screen, as leaf; and the fine or bottom screen, as pin trash. Carefully remove all foreign matter from each screen with a small brush.

m) Weigh the cleaned seed cotton, and record the weight.

ANNEX C
(Clause 4.1)

**SHIRLEY ANALYZER METHOD FOR DETERMINATION OF FOREIGN
MATTER IN COTTON**

C-1 Scope

The lint foreign matter test method is used to determine the foreign matter content in a sample of lint cotton or processing waste using the Shirley Analyzer. This method is designed to obtain accurate lint foreign matter test results in the shortest possible time. This is accomplished by using smaller test specimens, one pass through the machine.

C-2 Test Specimen

Take four portions, each about the same size, from four widely distributed locations throughout the laboratory sample, and weigh a 50-gram specimen to the nearest 0.01 gram. Do not blend or handle the laboratory sample in such a way as to cause loss of any foreign matter.

C-3 Conditioning

The samples should be conditioned to the atmosphere in the testing room (75o F. and 60% Relative Humidity) for at least 24 hours before testing.

C-4 Equipment

- a) Shirley Analyzer
- b) Balance, capacity of at least 100 grams, sensitivity of 0.01 gram.
- c) Set of weights.

C-5 Procedure

- a) Spread the test specimen as evenly as possible over the feed table. Large masses of fiber should be pulled apart to make an even batt.
- b) Set the exhaust valve to obtain the minimum amount of lint falling into the waste (foreign matter) compartment and a minimum amount of foreign matter (waste) collecting with the lint on the condenser cage.
- c) Clean the delivery box and waste compartment.
- d) Start the machine and process the test specimen through the machine.
- e) Collect the lint from the trash pan, shake lightly to remove the adhering trash, and process through the machine.
- f) Remove the cleaned lint from the compartment, weigh to the nearest 0.01 gram, then weigh the waste from the foreign matter compartment to the nearest 0.01 gram and record the weight.

NOTE — For total wastes ranging from 2.9 to 4.1 percent, 0.31 gram (0.16 gram exhaust lint and 0.15 gram moisture loss) should be added to the total clean lint weight to correct for moisture and lint loss during processing

ANNEX D
 [Clauses 4.1, 4.2 and 5.1.3.1{b(ii)}]

**DATA SHEET FOR ANALYSIS OF SAMPLE USING PNEUMATIC
 FRACTIONATION METHOD**

Sl No	Source	Feed rate	Sample variety	Sample mass	Fibre properties	Clear seed cotton	Total foreign matter	Burrs	Sticks	Leaf	San d	Mass of Motes	Plastics	Pin trash	Miscellaneous	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
i)	Seed cotton before pre-cleaning				UHML (mm) UI (%) MIC (µg/inch) FS (g/tex)											
ii)	From cleaned Seed Cotton Outlet				UHML (mm) UI (%) MIC (µg/inch) FS (g/tex) SFI (%)											

iii From
) foreign
n
matter
outlet

Data Sheet For Analysis Of Samples Using Shirley Method

Sl No.	Source	Feed rate	Sample variety	Sample mass	Fibre properties	Clean seed cotton	Mass of Lint	Total foreign matter	Trash	Invisible loss
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)
i)	Seed cotton before pre-cleaning				UHML (mm) UI (%) MIC (μ g/inch)FS (g/tex) SFI (%)					
ii)	From cleaned Seed Cotton Outlet				UHML (mm) UI (%) MIC (μ g/inch)FS (g/tex) SFI (%)					
iii)	From foreign matter outlet									

Test Data*

Sl No.	Date	Duration of operation	Speed (rev/min)	Feed rate (q/h)	Power required (kW)	Power consumption (kWh)	No. of Samples	Quantity (kg) of samples from		Total quantity of seed cotton at clean seed cotton outlet (kg)	Total quantity of foreign matter at clean seed cotton outlet (kg)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	Clean seed cotton outlet (9)	Foreign matter outlet (10)	(11)	(12)
i)							i)				
ii)							ii)				
iii)							iii)				

* The data should be collected for every test conducted at different feed rates.

Observations

- a) Presence of any marked vibration during operation
- b) Presence of undue knocking or rattling sound
- c) Frequent slippage of belts
- d) Smooth running of shafts in their respective bearings
- e) Smooth flowing of material through different component
- f) Any marked wear, deformation and breakdown
- g) Any marked rise in bearing temperature
- h) Presence of blocking of machine while in operation
- j) Presence of mixing of foreign matter with cleaned seed cotton
- k) Presence of damage to cottonseed
- m) Dropping out of seed cotton from the cleaner while in operation
- n) Other observations (if any)

ANNEX E
(Clauses 4.2 and 4.3)

**STANDARD TEST METHODS FOR MEASUREMENT OF PHYSICAL
PROPERTIES OF RAW COTTON BY COTTON
CLASSIFICATION INSTRUMENTS**

E-1 This test method covers the measurement of colour, trash content, micronaire, upper half mean length (UHML), uniformity index and breaking tenacity (strength) of raw cotton for cotton marketing using a cotton classification instrument. This test method is applicable to Upland and Extra Long Staple (ELS) raw cotton. This test method is applicable to roller and saw ginned raw cottons.

E-2 Sampling

Bale Sample: For a bale sample, take a 4 oz (100 g) sub sample of cotton from each of two opposite sides of the bale and combine the two subsamples into a single bale sample weighing 8 oz (200g).

E-3 Conditioning

Condition the cotton samples to the temperature and relative humidity levels of $21 \pm 1^\circ\text{C}$ ($70 \pm 2^\circ\text{F}$) and $65 \pm 2\%$ until moisture equilibrium is reached.

E-4 Calibration

Follow instrument manufactures' procedures for sample placement.

a) Calibration of Micronaire:

- 1) For calibration of micronaire, cotton calibration or orifice calibration methods are accepted practices within the industry.
- 2) For cotton calibration of micronaire, calibrate using Universal HVI Micronaire Calibration Cotton Standards in accordance with instrument manufacturers' recommendations.
- 3) For orifice calibration of micronaire, calibrate using USDA micronaire materials in accordance with instrument manufacturers' recommendations to establish a testing level consistent with the industry accepted Universal HVI Micronaire Calibration Cotton Standards.

b) Calibration of Upper Half Mean Length, Uniformity Index and Breaking Tenacity (Strength):

- 1) For Upland saw ginned and roller ginned raw cotton testing, calibrate the instrument with Universal HVI Calibration Cotton Standards (Short/Weak and Long/Strong).
- 2) For ELS saw ginned and roller ginned raw cotton testing, calibrate the instrument with Universal HVI Short/Weak Calibration Cotton Standard and Extra Long Staple HVI Long/Strong Calibration Cotton Standard.
- 3) The calibration materials can be obtained from the USDA, AMS, Cotton Division's Standardization and Engineering Branch.

E-5 Standard Test Method of Measurement Micronaire

a) Scope — This section described the measurement of the micronaire of raw cotton that is based upon standards established by USDA.

b) Summary of Test Method — A predetermined mass of raw cotton is placed in the measurement area and compressed. The resistance to air flow through the cotton using constant air pressure is measured.

c) Procedure:

- 1) Take one specimen from the bale sample and place the specimen into the instrument's micronaire measurement area for testing.
- 2) The specimen can be taken from either subsample or sample can be taken and combined from each subsample.
- 3) For the bale sample, report the micronaire reading to the nearest one hundredth of a unit.

E-6 Standard Test Method of Measurement of Upper Half mean Length (Length) and Uniformity Index

a) Scope — This section describes the measurement of the upper half mean length (length) and uniformity index of raw cotton that is based upon standards establishment by USDA.

b) Summary of Test Method — The measurements of length and uniformity index of cotton fibres in a tapered beard are derived from the measured length distribution of cotton fibres. Fibres are caught at random along their lengths to form a tapered beard. The tapered beard is scanned from base to tip to form the fibre length distribution.

c) Procedure:

- 1) Take one specimen from each subsample of the bale sample for Upland saw ginned raw cotton and place the specimen into the instrument's length measurement area.
- 2) Take two specimens from each subsample of the bale sample for ELS or roller ginned Upland raw cottons.
- 3) For the bale sample, report the average of the specimens for upper half mean length to the nearest one thousandth of an inch (one hundredth of a millimeter).
- 4) For the bale sample, report the average of the specimens for uniformity index to the nearest one tenth of a unit.

E-7 Standard Test Method of Measurement of Breaking Tenacity (Strength)

a) Scope — This section describes the measurement of the breaking tenacity (strength) of raw cotton that is based upon standards established by USDA.

b) Summary of Test Method — This test method describes the determination of the breaking tenacity at the breaking force of cotton fibres in a specimen in which fibres are distributed randomly in a specimen comb and broken using 1/8- inch (3.2 mm) clamp spacing.

c) Procedure:

- 1) Take one specimen from each subsample of the bale sample for Upland saw ginned raw cotton and place the specimen into the instrument's length measurement area.
- 2) Take two specimens from each subsample of the bale sample for ELS or roller ginned Upland raw cottons.
- 3) For the bale sample, report the average of the specimens for strength to the nearest one tenth of a gram per tex unit.

ANNEX F
(Clause 4.3)

**METHOD OF OVEN DRYING SEED COTTON FOR DETERMINATION OF
MOISTURE CONTENT**

O-1 Scope:

These methods cover the procedures for determining the amount of moisture in seed cotton by oven drying. When moisture is not the primary objective of the study, a 2-hour oven drying method with the formulas for calculating the moisture content may be used.

O-2 Equipment:

- a) Oven, thermostatically controlled in the temperature range of 220° F to 230° F., fan-forced ventilation, and, preferably, equipped with a balance that permits weighing the specimens without opening the ovens.
- b) Balance, of at least 100 grams capacity and a sensitivity of 0.01 gram, to weigh the specimens.
- c) Metal baskets, at least 3 inches in diameter by 6 inches high (75 mm. in diameter by 150 mm. high), for use in rectangular ovens equipped with revolving arms on which the baskets are hung. For specimens containing particles of foreign matter that are easily shaken out, use baskets made of wire screening fine enough to hold the trash, or line the lower part of the basket with metal foil, though this technique may prolong the drying period.
- d) Set of balance weights.

O-3 Five-Hour Procedure:

- a) Weigh a seed cotton specimen of about 50 grams from an airtight container, and record the weight to the nearest 0.01 gram.
- b) Place the specimen and the basket in the oven, and dry at 220° to 230° F. (105° to 110° C).
- c) Dry the seed cotton for at least 5 hours or until the change in weight between successive weighing at intervals of at least 1 hour is less than 0.1 percent of the specimen weight.
- d) Weigh to the nearest 0.01 gram and record the weight.

Calculate the moisture content as follows:

$$M = (W_o - W_d) / W_o \times 100$$

where ,

- M = Moisture content (%)
 W_o = the original weight of the specimen
 W_d = the specimen weight after oven drying

O-4 Two-Hour Procedure:

- a) Take a specimen of seed cotton from an airtight container, and weigh 50 grams to the nearest 0.01 gram on a balance in the glass case. (See previous note under "Five-hour Procedure.")
- b) Place the weighed specimen in the wire basket, and put in the hot oven without delay to avoid

an error due to change in moisture content before drying.

c) After 2 hours drying (while the basket is still in the oven), weigh to the nearest 0.01 gram and record.

Calculate the moisture content of seed cotton after 2 hours drying as follows:

$$Y = 0.66 + 2.25X$$

where,

Y = moisture percentage equivalent to 5 hours of oven drying

X = moisture loss in grams after 2 hours of oven drying

ANNEX G
(Clause 5.1.1.2)

DATA SHEET FOR MATERIAL OF CONSTRUCTION

G-1 Date of Test

G-2 Material of Construction

Sl. No. (1)	Components (2)	Material (3)	Size (4)	Mass (5)
i)	Feeding Hopper			
ii)	Feeding cylinders			
iii)	Spiked cylinders			
iv)	Spiked cylinder shafts			
v)	Spikes			
vi)	Grid bars			
vii)	Grid bar holders			
viii)	Transport wheel			
ix)	Pulleys			
x)	Gears			
xi)	Inspection windows			
xii)	Others			

NOTE

1. Delete the component, which is not applicable to a particular cleaner and add if any other component is provided.
2. Col 4 and 5 should be recorded, wherever feasible.

ANNEX H
(*Clause 5.1.1.3*)

**DATA SHEET FOR VISUAL OBSERVATION AND PROVISION
FOR ADJUSTMENTS**

H-1 Observations

- a) Adequacy of marking of inlets and outlets
- b) Adequacy of protection of bearings against the ingress of dust
- c) Adequacy of safety arrangements, specially at moving points and at inlet
- d) Provision for lubrication of moving parts
- e) Provision of belts tightening
- f) Provision of easy transportation
- g) Provision of easy changing of components requiring frequent replacement
- h) Provision of anti-corrosive coatings
- j) Provision of inspection windows/covers
- k) Tightness of bolts, nuts and other fasteners
- m) Welding of seams
- n) Other observations

H-2 Provisions For Adjustments of:

- a) Feed rate
- b) Grid bar spacing w.r.t. spiked cylinder
- c) Speed of spiked cylinders

ANNEX J
(Clauses 5.1.2.1 (c) and 5.1.1.2)

DATA SHEET FOR TEST AT NO-LOAD

J-1 Power Consumption

- a) Source of power
- b) Type of drive
- c) Total time of run
- d) Average power consumption for one hour

J-2 Observations

- a) Presence of any marked vibration during operation
- b) Presence of undue knocking or rattling sound
- c) Frequent slippage of belts
- d) Smooth running of shafts in their respective bearings
- e) Any marked unusual wear or slackness in any component
- f) Any marked rise in bearing temperature
- g) Accessibility of various controls and capability of being locked in a chosen position
- h) Other observations (if any)

ANNEX K
[Clause 5.1.3.1 {a(iv)}]

DATA SHEET FOR TEST AT LOAD

K-1 Source of Power

K-2 Power Rating

K-3 Type of Drive

K-4 Variety of Seed Cotton

K-5 Moisture Content

K-6 Grid Bar Spacing

K-7 Clearance Between Centre of Grid Bar and End of The Spikes

K-8 Speed of Spiked Cylinder

ANNEX L
[Clauses 8.1.3.1 9(c), 8.1.3.1(d), and 8.1.3.1(e)]

**DATA SHEET FOR EFFICIENCY, POWER REQUIREMENTS
AND CAPACITIES**

Sl. No.	Item	Test No's			
		1	2	3	etc.
i)	Spiked cylinders speed, rev/min				
ii)	Feed rate, q/h				
iii)	Power required, kW				
iv)	Total seed cotton received at clean seed cotton outlet, kg				
v)	Cleaning efficiency, percent				
vi)	% Fibre loss				
vii)	Rated input capacity, q/h				

ANNEX M
(Clause 5.1.3.2)

DATA SHEET FOR LONG-RUN TEST

M-1 Total Running Time

M-2 Continuous Running Time

M-3 Breakdown in Cleaning Unit

M-4 Breakdown in Body

M-5 Breakdown in Spikes

M-6 Major Wear And Tear

M-7 Any Major Repair Conducted

M-8 Any Other Observation, If Any

ANNEX N
(Clause 6)

SUMMERY REPORT

N-1 Name of Manufacturer

N-2 Type, Make And Model Number

N-3 Name of Testing Station

N-4 Brief Description of Cleaner

N-5 Variety of Seed Cotton Used

N-6 Percentage of Foreign Matter Before Feeding

N-7 Percentage of Foreign Matter After Feeding

N-8 Moisture Content Before Feeding

N-9 Moisture Content After Feeding

N-10 Provision of Adjustment:

- a) Feed Rate
- b) Speed of spiked cylinders

N-11 Power Requirement, Kw

- a) Recommended power, kW
- b) Observed power at no-load
- c) Observed power at load at rated input capacity

N-12 Cleaning Efficiency

N-13 % Fibre Loss

N-14 Deterioration of Fibre Properties

N-15 Rated Input Capacity

N-16 Any Marked Observation Affecting Performance

N-17 Any Marked Breakdown

N-18 Other Observation (If Any)