मानकः पथप्रदर्शकः

Bureau of Indian Standards

Session on

Agriculture Machinery : Post-Harvest Processing

Duration : 1.5 hours

By

Pradeep Sharma

Scientist-B/Assistant Director

Food & Agriculture

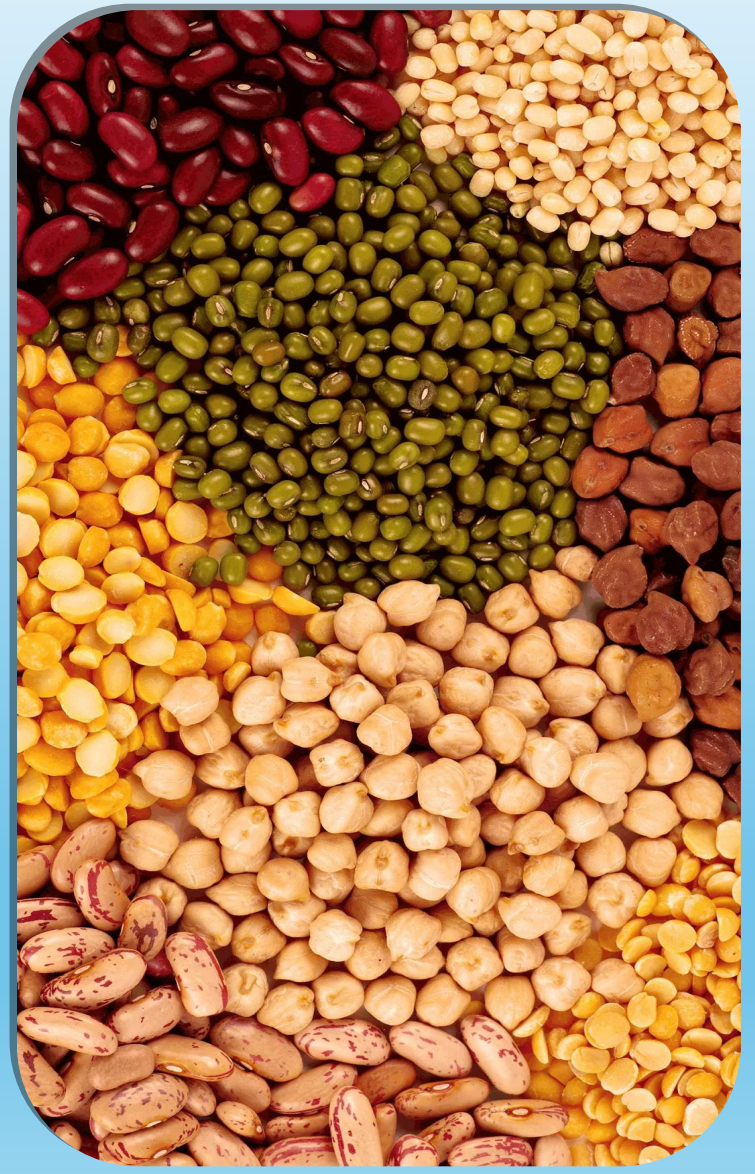
Department

1. Introduction

What is Post Harvest Processing?

An activity which is performed to maintain or improve the quality or to change the form or characteristics of an agricultural product. It is undertaken to add value to agricultural materials after their production. The main purpose of it is to minimize the qualitative and quantitative deterioration of the material after harvest. Some of the agricultural processing operations performed on various crops (cereals, pulses and oilseeds) are such as :

- ✓ **Cleaning, Grading and Sorting**: Initial operations involve removing foreign materials and sorting products based on quality, size, and other criteria to ensure uniformity.
- ✓ **Drying and Storage**: Crucial steps to reduce moisture content, preventing spoilage and maintaining quality during storage.
- ✓ **Milling and Food Engineering**: Processes like milling grains or engineering food products enhance usability and value of raw agricultural commodities.
- ✓ **Value Addition and Waste Utilization**: Techniques aim to enhance economic returns by adding value to agricultural products or agricultural waste through processing and refining.



2. Overview of Indian Standards on Equipment

Indian Standards formulated by FAD 20

Aspect wise

- TOTAL STANDARDS : **61**
- PRODUCT SPECIFICATION : **37**
- CODE OF PRACTICES: **01**
- METHODS OF TEST : **14**
- TERMINOLOGY : **06**
- DIMENSIONS : **01**
- SAFETY STANDARD : **02**

Area wise

- RICE MILLING : **13**
- FRUIT & VEGETABLE PROCESSING : **3**
- COTTON PROCESSING : **9**
- SEED CLEANING AND PROCESSING : **13**
- Others : **13**
- MILLETS PROCESSING EQUIPMENT : **4**

Selection of equipment based on the physical property of produce

- **Disc/intended cylinder separator**: Relative length or difference in length
- **Spiral separator**: Roundness
- **Destoner/specific gravity separator**: Density and specific gravity
- **Cyclone separator**: Centrifugal force and density difference
- **Inclined draper/velvet roll separator**: Difference in shape and surface texture
- **Magnetic separator**: Stickiness and surface texture
- **Pneumatic separator**: Difference in aerodynamic properties
- **Fluidized bed separator**: Difference in Size and density (terminal velocity also if given in option

3. Indian Standards on Rice Milling Equipment

Why Standardization of Post-Harvest Equipment is Required ?

As the processing equipment manufacturing sector in India is not organized and there are number of manufacturers available where the major portion includes local artesian, there is a need of standardization in this field which will affect the farmer and manufacturers both in a positive manner with the many aspects such as:

- Cost-effectiveness: Standards ensure farmers invest in durable equipment, reducing lifecycle costs.
- Performance Assurance: Standards guarantee equipment meets functional and operational requirements effectively.
- Maintenance Ease: Standardized parts availability simplifies repair and maintenance, reducing downtime.
- Operator Safety: Standards mandate safety features, enhancing equipment usability without compromising safety.
- Efficiency and Capacity: Standards promote energy-efficient designs, boosting equipment capacity and reducing operational costs..

Role of Equipment in Effective Post Harvest Processing?

Efficiency: It automates tasks like sorting and cleaning, speeding up processing.

Cost Reduction: It lowers labor costs and minimizes product loss.

Precision: It offers precise control over variables like moisture content and temperature.

Safety: Its automated system reduces risks associated with manual handling and processing.

Energy Efficiency: Efficient equipment designs save energy during processing.

Rice Milling

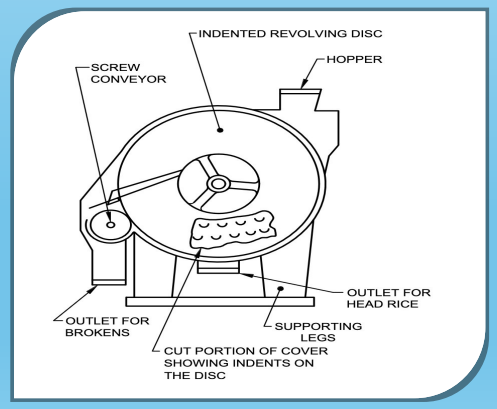
Rice milling involves a series of processes aimed at transforming harvested paddy into edible, marketable rice products. Here's a brief overview of what it covers:

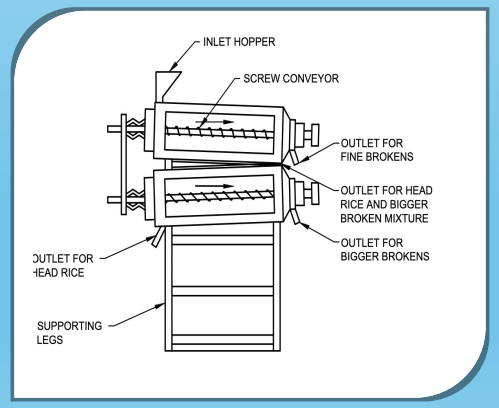
- ✓ **Cleaning**: Removal of impurities like dust, stones, and husks from the rice grains.
- ✓ **Husking**: Removal of the outer husk layer to expose the brown rice kernel.
- ✓ **Milling**: Removal of the bran layer and germ to produce polished white rice.
- ✓ **Polishing**: Buffing of the rice surface to enhance appearance and texture
- ✓ **Grading**: Sorting rice grains by size and quality based on length and color.
- ✓ **By-products**: Processing of by-products like rice bran and broken rice for various uses.

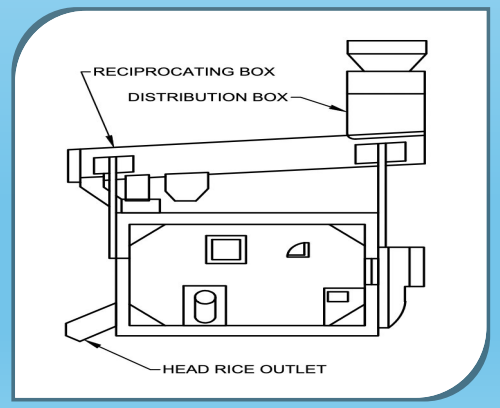
IS 10048 : 2024 RICE LENGTH GRADER ❑ SPECIFICATION

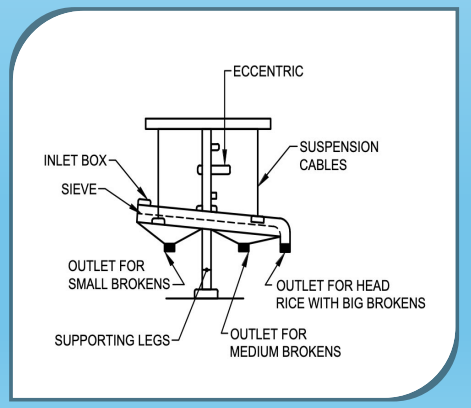
This standard specifies material, constructional performance, and other requirements of rice length grader.

Types of Rice Grader	
Indented Type	Indented Disc Type
	Indented Drum Type
Sieve Type	Sieve Aspirator Type
	Gyro-Sifter Type









IS 10048: 2024 RICE LENGTH GRADER ❑ SPECIFICATION

Material Requirements

Sl. No.	Component	Material	Reference to IS
i)	Feed hopper	Mild steel	IS 2062
		Galvenized steel	IS 277
		Stainless steel	IS 6911
ii)	Feed rate/distribution plates	Mild steel	IS 2062
		Stainless steel	IS 6911
iii)	Screens/sieves	Stainless steel	IS 6911
iv)	Shafts	Mild steel	IS 2062
v)	Main Frame	Mild steel	IS 2062
		Cast iron	IS 210
vi)	Pulley	Cast iron	IS 210
		Mild steel	IS 2062
vii)	Plumber block	Cast iron	IS 210
viii)	Outlet for head rice	Stainless steel (SS 204 / 304)	IS 6911
ix)	Outlet for brokens	Stainless steel (SS 204 / 304)	IS 6911
x)	Receiprocating box	Wood	IS 399
		Mild steel	IS 2062
xi)	Indented disc	Stainless steel (SS 204 / 304)	IS 6911
xii)	Indented drum / cylinder	Stainless steel (SS 204 / 304)	IS 6911
xiii)	Belt guard	Mild steel	IS 2062
xiv)	Cam / eccentric	Cast Iron	IS 210
		Mild steel	IS 2062

IS 10048: 2024 RICE LENGTH GRADER ❑ SPECIFICATION

Constructional Requirements

- Proper frame design
- Hopper with a feed regulating device
- One or two oscillating and / or rotary screens
- Blower with a control to regulate air flow rate.

IS 10048: 2024 RICE LENGTH GRADER ❑ SPECIFICATION

Constructional Requirements

- Suitable power transmitting system.
- Transmission guards for operator's safety.
- All guards should be either permanently attached or firmly.
- Guard should have strength to support a load of 1200 N applied at any point over an area of 0.1 m^2 without a permanent set.

IS 10048: 2024 RICE LENGTH GRADER ❑ SPECIFICATION

Other Requirements

- Properly aligned shaft with finish to close tolerances at the bearings.
- Provisions for lubrication.
- Easily accessible controls.
- Safety instructions by manufacturers.
- Provision for tightening the belt.
- Provision for cleaning the screens.

Workmanship and Finish

- All the components free from cracks, pits, holes, and other visual.
- Non-porous and smooth welding.
- A protective anti-corrosive coating .

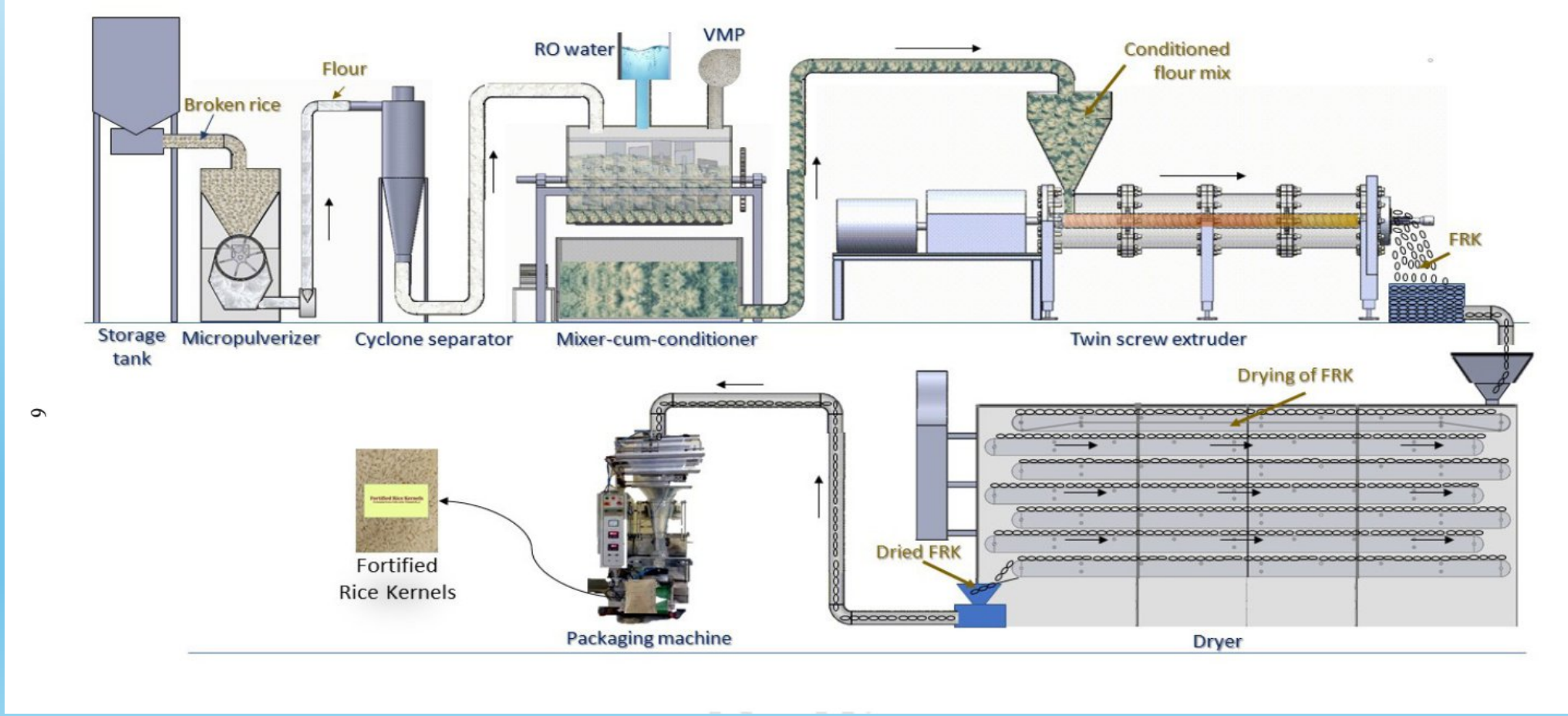
IS 10048: 2024 RICE LENGTH GRADER ❑ SPECIFICATION

Tests

Test at No Load	Test at Load	Long Run Test at No Load
Empty run at no load for 30 min at the specified speed and it shall not show the following: ➢ Any marked vibration during the operation, ➢ Undue knocking or rattling sound, ➢ Frequent slippage of belts, ➢ Unusual wear or slackness in any component, and ➢ Any marked rise in bearing temperature.	Operated at its specified speed for 15 min at a feed rate slightly below the rated input capacity specified by the manufacturer. ➢ Three sets of samples of graded fractions like brokens and head rice at an interval of 5 min at each outlet. ➢ The main shaft's speed and the reading of the energy meter or dynamometer shall be recorded.	Run for 20 h at no load, which could be covered by a continuous run of at least 5 h. no breakdown or defect shall develop in the grader.

IS 17853: 2022 EQUIPMENT FOR MANUFACTUREOF FORTIFIED RICE KERNEL — SPECIFICATION

This standard prescribes the requirements of the equipment used in production of fortified rice kernel.



IS 17853: 2022 EQUIPMENT FOR MANUFACTURE OF FORTIFIED RICE KERNEL — SPECIFICATION

Constructional Requirements for Micro-Pulverizer

- ***Hopper*** — with proper feeding arrangement provided to control the feed rate of broken rice and a magnet to trap metal impurities.
- ***Grinding Chamber*** — with proper clearance between hammer & screen and suitable inlet for receiving broken rice/rice and outlet for rice flour.
- ***Screen*** — wear resistant screen to obtain rice flour size of less than 250 µm (preferably 150 µm).
- ***Hammer*** — Wear resistant duly balanced.
- ***Cyclone*** — suitable connecting pipes and fittings, dust collecting bag/filters to collect the fine dust releasing with exit air out of the cyclone.
- ***Control Panel*** — includes feed rate controller and LCD/LED/HMI screen to control process parameters such as feed rate, level of grains in hopper, etc.

IS 17853: 2022 EQUIPMENT FOR MANUFACTURE OF FORTIFIED RICE KERNEL — SPECIFICATION

Table 1 Material of Construction of Micro-Pulverizer
(*Clause* 4.1)

Sl No.	Component	Grade of Material	Conforming to Indian Standard
(1)	(2)	(3)	(4)
i)	Hopper	Stainless steel grade X04Cr19Ni9	IS 6911
ii)	Grinding chamber	Stainless steel grade X04Cr19Ni9	IS 6911
iii)	Screen	Stainless steel grade X04Cr19Ni9	IS 6911
iv)	Hammer	Stainless steel grade X04Cr19Ni9	IS 7283
v)	Cyclone	Stainless steel grade X04Cr19Ni9	IS 6911
vi)	Pipes and fittings	Stainless steel grade X04Cr19Ni9	IS 6911
vii)	Supporting frame	Stainless steel grade X04Cr19Ni9	IS 6911

Performance Requirement for Micro-Pulverizer

- Average particle size of rice flour shall be less than 250 µm (preferably below 150 µm).
- Rice flour obtained after pulverization shall be free from metal or foreign impurities.

IS 17853: 2022 EQUIPMENT FOR MANUFACTURE OF FORTIFIED RICE KERNEL — SPECIFICATION

Mixer

Constructional Requirements	Performance Requirements
➢ Capacity as per the agreement between the manufacturer and the purchaser. ➢ Proper water spray arrangement ➢ Lump breaking arrangement to break the lumps formed during mixing. ➢ Automatic feeding unit for VMP mixture. ➢ Suitable size of electric motor to provide required rpm to the shaft of the mixer.	➢ Uniform blending of Iron, folic acid and vitamin B12. ➢ Uniform moisture distribution without lumps ➢ The final mixture free from any metal impurities.

IS 17853: 2022 EQUIPMENT FOR MANUFACTURE OF FORTIFIED RICE KERNEL — SPECIFICATION

Extruder

Constructional Requirements	Performance Requirements
➢ ***Barrel*** — square or circular type. Suitable heaters to heat the barrel to the required temperature (automatically controlled as per the set conditions). ➢ ***Screw*** — Wear- resistant, suitable to sustain high pressure. ➢ ***Feeder*** — Single/ twin-screw type with precise control depending upon the capacity. ➢ ***Die Head*** — Provided with temperature and pressure sensor. ➢ **Die** — Such that kernels should not stick together while cutting.	➢ Size and weight of FRK should be uniform.

IS 17853: 2022 EQUIPMENT FOR MANUFACTURE OF FORTIFIED RICE KERNEL — SPECIFICATION

Dryer

Constructional Requirements	Performance Requirements
➢ Dryer shall perform in such a way that colour change and fissure formation shall be avoided. ➢ food grade material used in dryer belt. ➢ suitable heating and cooling arrangement to control temperature and relative humidity. ➢ Suitable sized blower to control the airflow. ➢ Temperature sensors, airflow meter and relative humidity (RH) sensors are used.	➢ FRK after drying shall not have more than 12 percent moisture. ➢ FRK is free from fissures. ➢ The FRK shall not show any colour change in FRK. ➢ The FRK obtained after drying shall be free from metal impurities and foreign matter.

4. Indian Standards on Chaff Cutters

Chaff Cutting

- ✓ **Purpose of Chaff Cutting**: Chaff cutting is essential for reducing the size of fodder crops to make them consumable for animals, as fodder grown at farms cannot be directly consumed.

- ✓ **Role in Animal Husbandry**: Proper feed availability is crucial for the rapid growth of the animal husbandry sector, which is significant in countries like India that lead in milk production globally.

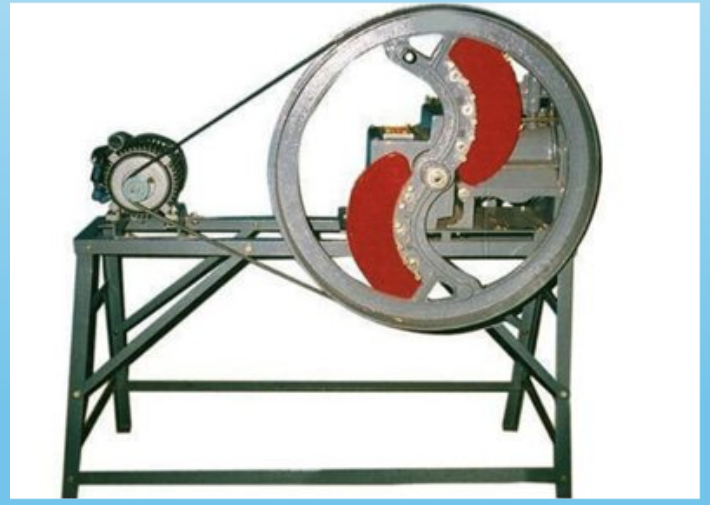
- ✓ **Mechanism of Chaff Cutters**: Chaff cutters achieve size reduction of fodder crops through a cutting mechanism, which can be either manually or power operated.

- ✓ **Impact on Feed Efficiency**: By cutting fodder into smaller pieces, chaff cutters improve the efficiency of feed consumption, contributing to better nutrition and productivity of livestock.

- ✓ **Importance of Standards**: Adherence to Indian standards on chaff cutters is important to ensure the equipment's effectiveness, safety, and reliability in the feed preparation process.

IS 11459 : 2024 POWER OPERATED CHAFF CUTTER — SPECIFICATION & TEST CODE

It covers material, construction, safety requirements and method of testing for power- operated chaff cutter run by electric motor, diesel engine, tractor PTO or any source providing the required rotary power.



Electric Motor Driven

Diesel Engine Driven

PTO Driven

Types of Power-Operated Chaff Cutter on the basis of

cutting mechanism,	Based on feed dropping	feeding system
Flywheel type	Let-fall type	Chute-fed
Cylinder type	Throw-away type	Conveyor-fed
	Blow-up type.	

- IS 11459 : 2024 POWER OPERATED CHAFF CUTTER — SPECIFICATION & TEST CODE (*First Revision*)

IS 11459 : 2024 POWER OPERATED CHAFF CUTTER — SPECIFICATION & TEST CODE (*First Revision*)

Material Requirements

Components	Material	Relevant IS
Flywheel	MS/CI	IS 2062/IS 210
Cylinder	MS	IS 2062
Frame	CI/MS	IS 210/ IS 2062
Shear plate	CI/MS/AS	IS 210/ IS 2062/ IS 4711
Feed rolls	CI/MS	IS 210/ IS 2062
Feed roll shafts	CI/MS	IS 210/ IS 2062
Shaft and axles	MS	IS 2062
Pulley	CI	IS 210
Blower	MS	IS 2062
Discharge box	MS/CRCA Sheets	IS 2062/ IS 513
Spring	Spring steel	IS 4454 (Part 1)

MS – Mild Steel

CI – Cast Iron

AS – Alloy Steel

IS 11459 : 2024 POWER OPERATED CHAFF CUTTER — SPECIFICATION & TEST CODE

(First Revision)

Constructional Requirements

Cutter Head - Provision For Lubricating Bearings At Each End Of The Real Shaft.

Blower - Centrifugal Type Blower

Transmission System - The Gears Shall Properly Mesh And Shall Be Suitably Covered

Mounting Of Power Source – To Be Mounted On A Frame Made Of MS Angle (Minimum 35 Mm × 35 Mm × 5 Mm).

Cylinder – To Be Made Up Of MS Sheet Of Minimum 2 Mm Thickness .

Feeding Systems - The Minimum Length Of Chute And Conveyor Shall Be 900 mm And 200 Mm Respectively.

IS 11459 : 2024 POWER OPERATED CHAFF CUTTER — SPECIFICATION & TEST CODE (*First Revision*)

Tests : General

- **Checking of Specifications** – e.g. make, model, type and dimensions etc.
- **Checking of Material** – for all the components
- **Visual Observations** – e.g. smoothness of castings, to check loose fasteners, welding of seams and other necessary provisions etc.

Tests : at no-load

- **Power Consumption** – by running chaff cutter for 30 min
- **Visual Observations** – e.g. to check any marked oscillation, knocking, slippage in belts, bearing temperature etc.

Tests : at Load

- To check quality and quantity of cut piece.
- Power requirement
- Performance index
- Blowing efficiency

IS 11459 : 2024 POWER OPERATED CHAFF CUTTER — SPECIFICATION & TEST CODE

(*First Revision*)

Safety Requirements

Provision for blade guard
Warning roller at feeding chute
Feeding chute cover of minimum 450mm
Height of feeding chute should be 750 mm to 1100 mm from ground
A minimum cautionary notice to be followed during operation
Providing operator's manual

Workmanship and Finish

- All components should free from cracks
- Welding should be non-porous
- Avoiding sharp corners and protruding fasteners
- Suitably painted

5. Indian Standards on Millet Processing Equipment

Millet Processing

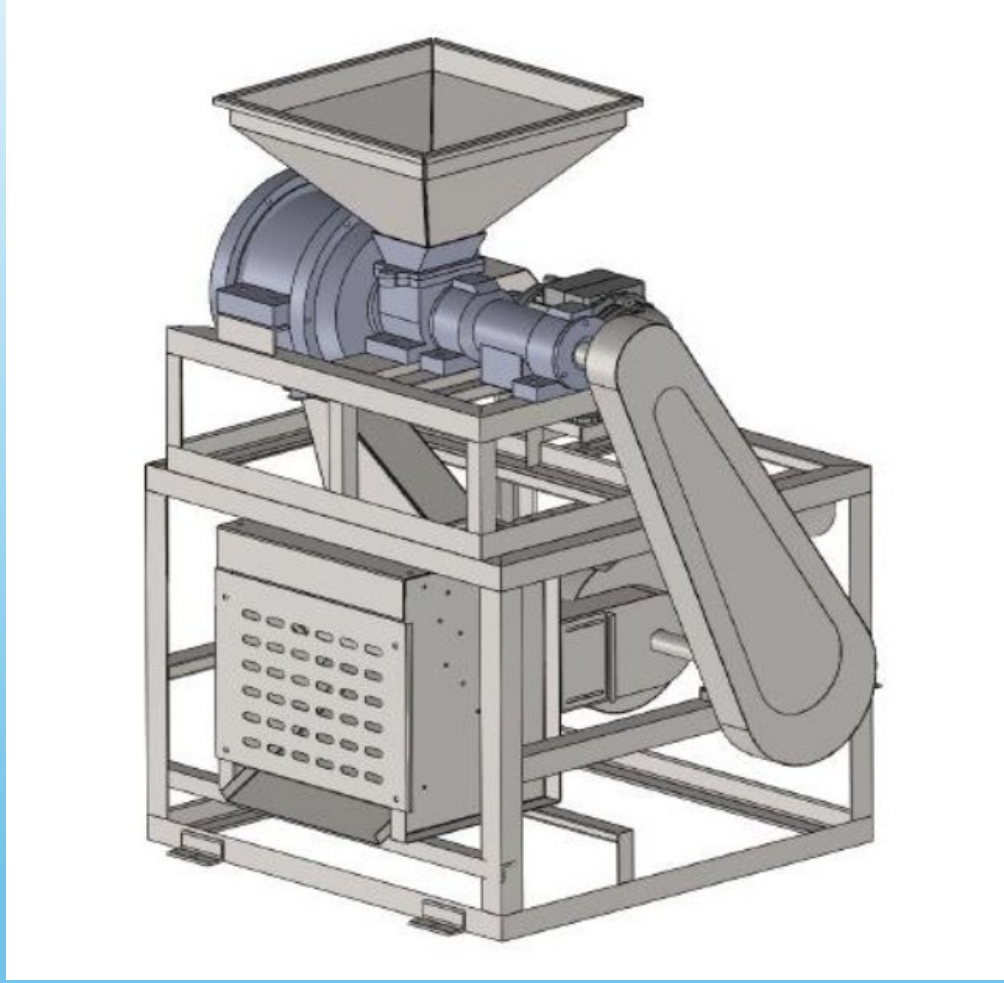
Millet processing is important because it enhances the nutritional value, palatability, and shelf life of millet grains. It removes impurities and antinutritional factors, making millets more suitable for human consumption. This process also increases market value, supports food security, and provides economic benefits to farmers and producers.

- ✓ **Pre-cleaning and Cleaning**: Removal of impurities such as dust and other foreign materials from the harvested millets to ensure purity and quality.

- ✓ **Dehusking** : Removing the outer husk or hull of the millet grains to make them more digestible and suitable for further processing and consumption.

- ✓ **Destoning**: Removal of stones from millet so that it can be further pearled or polished.

- ✓ **Pearling and polishing**: Smoothing and enhancing the appearance of the millet grains or flour to improve their marketability and consumer appeal by removing the bran layer from dehusked millet grain.

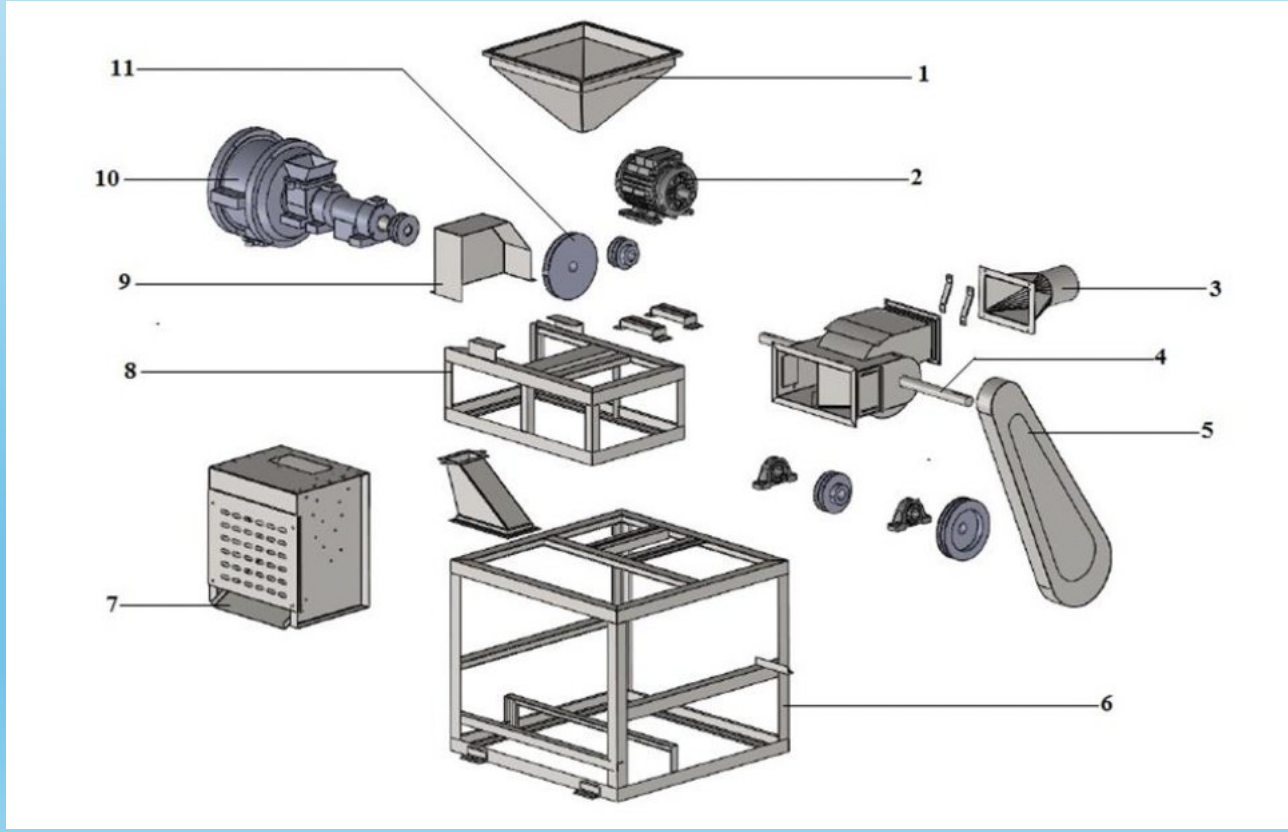


It covers material, performance, constructional and other requirements for millet dehusker of centrifugal type millet dehusker

IS 19040 : 2024 MILLET DEHUSKER — CENTRIFUGAL TYPE — SPECIFICATION & TEST CODE

IS 19040 : 2024 MILLET DEHUSKER — CENTRIFUGAL TYPE — SPECIFICATION & TEST CODE

Exploded view of millet dehusker



1) Feed hopper
2) Electric motor;
3) Husk outlet
4) Machine/Aspirator shaft
5) Dehusker belt guard
6) Machine frame
7) Dehusked millet outlet
8) Dehusker frame
9) Belt guard
10) Dehusker chamber
11) Dehusker impeller

IS 19040 : 2024 MILLET DEHUSKER — CENTRIFUGAL TYPE — SPECIFICATION & TEST CODE

Material Requirements

Components	Material	Conforming to
Belt guard	MS	IS 2062
Blower/aspirator	MS	IS 2062
Husk outlet/aspirator	MS	IS 2062
Impeller shaft	MS	IS 2062
Dehusking chamber	CI	IS 210
Frame	MS	IS 2062
Dehusker impeller	SS (SS 304)	IS 6911
Dehusked millet outlet	SS (SS 304)	IS 2062/IS 6911
Feed hopper	MS/SS (SS 304)	IS 6911
Rubber ring/lining	Food grade rubber sheet and moulded rubber	-

IS 19040 : 2024 MILLET DEHUSKER — CENTRIFUGAL TYPE — SPECIFICATION & TEST CODE

Constructional Requirements

Aspirator – to be balanced and mounted on self-aligned bearings to run without vibration

Dehusking chamber - provided with crank gear and provision to rotate the chamber to facilitate uniform wear of the rubber lining.

Feed screw – Should feed feed the millets uniformly

Frame – Should be covered wherever required

Feed Hopper – To be provided with a feed regulating device

Impeller – Should withstand the rotation at 2 000 rpm to 2 800 rpm

Outlets (of husk and millet both) – To be placed at the suitable height from ground for easy collection.

Shafts – To be supported with suitable bearings on the stable part of machine.

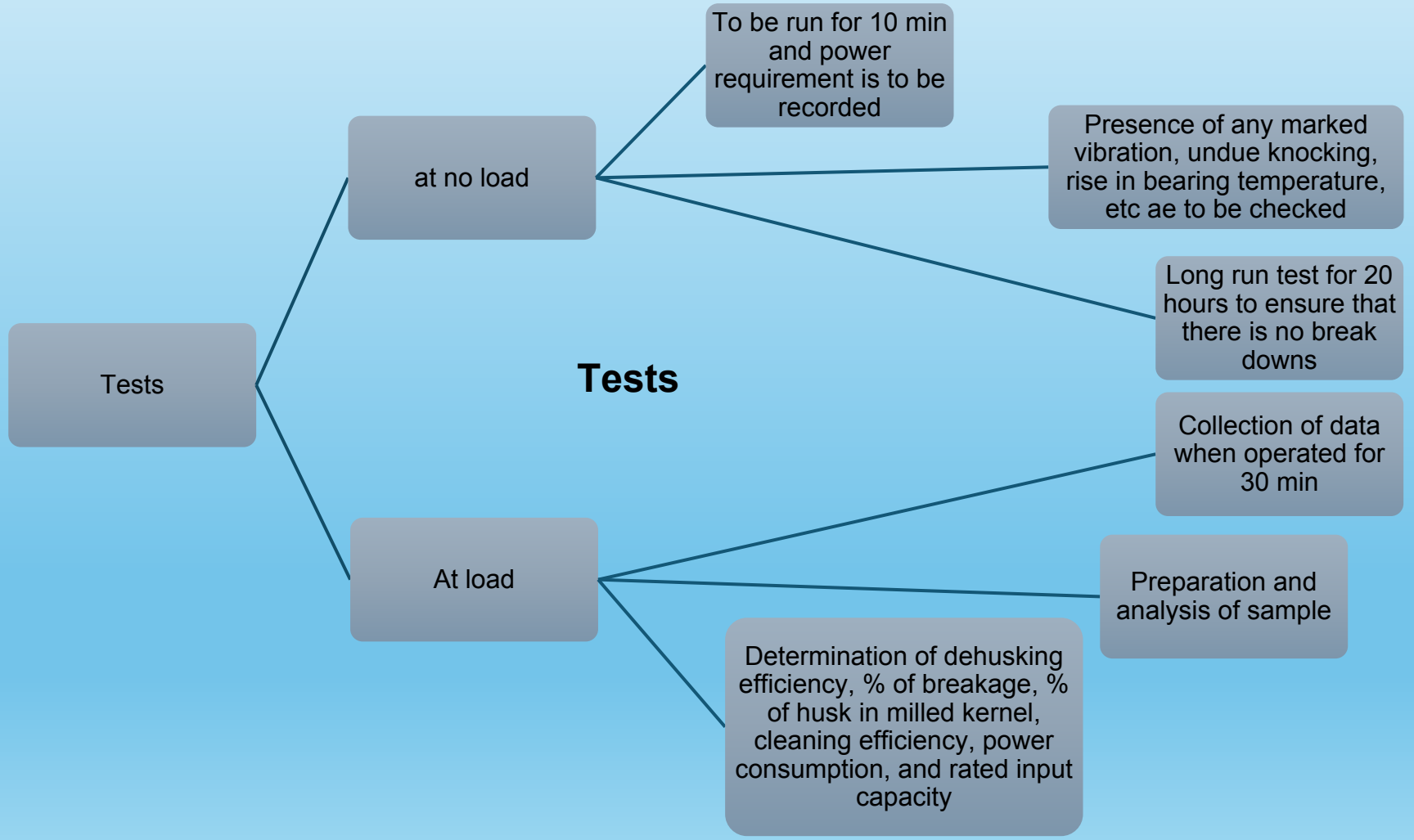
Transmission Drive - To be provided with suitable guard/cover.

IS 19040 : 2024 MILLET DEHUSKER — CENTRIFUGAL TYPE — SPECIFICATION & TEST CODE

Workmanship and Finish

- All the welding joints should be non-porous
- Any sharp corners and protruding fasteners shall be avoided.
- All the components shall be finished smooth and properly painted.

IS 19040 : 2024 MILLET DEHUSKER CENTRIFUGAL TYPE — SPECIFICATION & TEST CODE



6. Conclusion
(recap points)

- ✓Importance of post-harvest processing in reducing the losses percentage
- ✓key areas of the post-harvest processing where Indian Standards have been developed so far
- ✓Indian Standards on Rice Milling Equipment
- ✓Indian Standards on Chaff Cutters
- ✓Indian Standards on Millet Processing Equipment

Thank you