

Indian Standards on Farm Power and Machinery (Tractors, Power Tillers, Harvesters and Power Threshers)



S K Singh,
Scientist-F/ Sr Director & Head
Bureau of Indian Standards
Surat

FAD 11 Agricultural Machinery and Equipment Sectional committee

- **Tractors and Power Tillers** : **84**
- **Harvesting/Threshing** : **31**
- **Sowing Machines** : **10**
- **Tillage Machines** : **24**
- **Gardening and Forestry Tools** : **45**
- **Crop Protection Equipment** : **27**

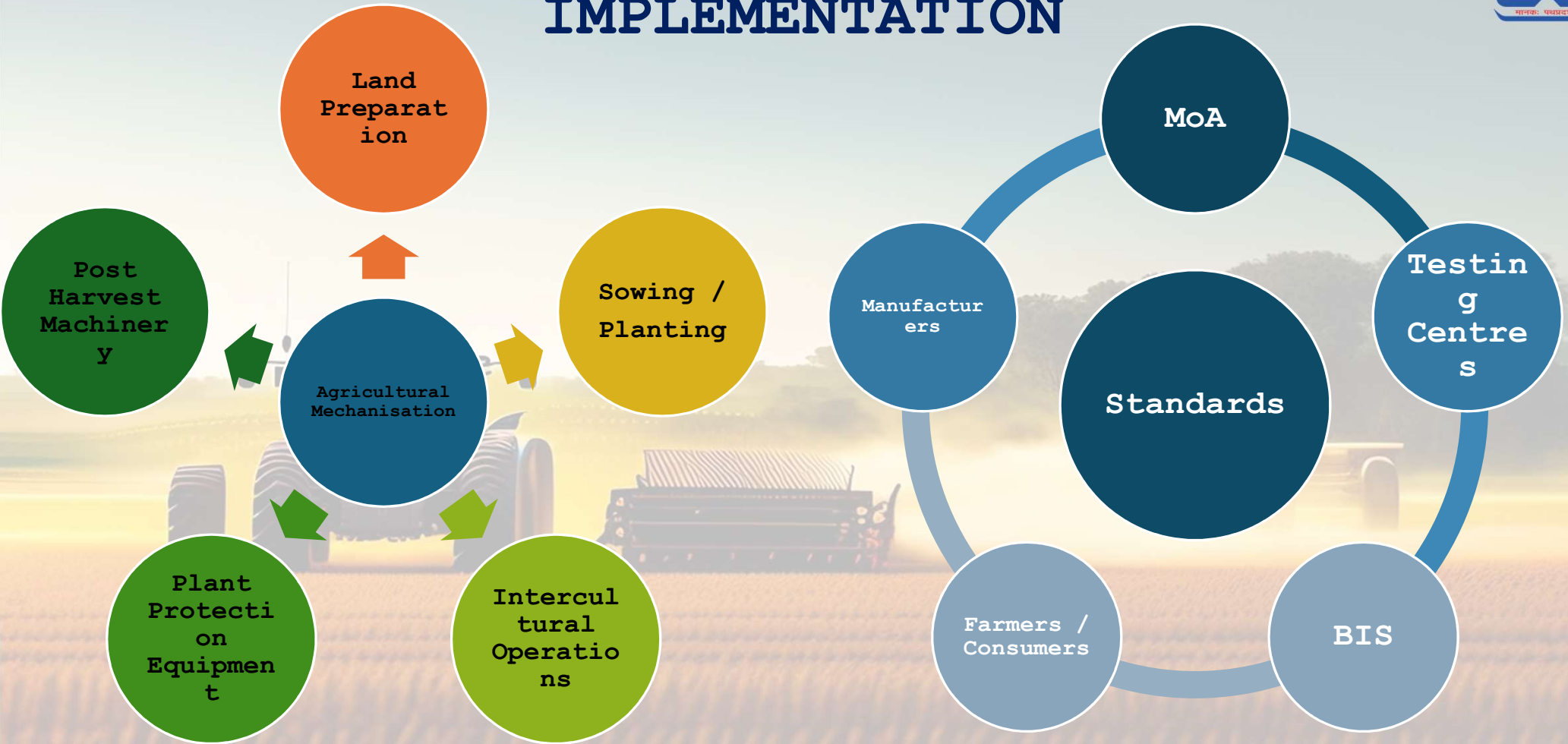
The List of Standards –

- **Number of Total Standards** : **221**
- **Number of Product Specification:** **128**
- **Code of Practices** : **14**
- **Methods of Test** : **48**
- **Terminology** : **15**
- **Dimensions** : **05**
- **Safety Standard** : **01**
- **Other** : **10**



Microsoft Word
Document

IMPLEMENTATION



Sub Mission on Agriculture Mechanisation , Crop Residue Management



TESTING CENTRES

Under Ministry of Agriculture

1. Central Farm Machinery Training and Testing Institute, Budni
2. Northern Region Farm Machinery Training and Testing Institute, Hisar
3. Southern Region Farm Machinery Training and Testing Institute, Anantpur
4. North Eastern Region Farm Machinery Training and Testing Institute, Biswanath Chirali

Recognised by Ministry of Agriculture

There are total 38 Testing Centres Recognised by Ministry of Agriculture for Testing of Farm Machinery. The List can be accessed through link given below-
[Testing Centre](#)

IS 12207 : 2022 Agricultural tractors — Recommendations on selected performance characteristics (*fifth revision*)

- This standard specifies the recommendations on selected performance characteristics of agricultural and forestry tractors fitted with diesel engines only.
- Main purpose of this standard is to assess the conformity of various models of Agricultural Tractors to performance characteristics for introducing or launched in India and also selecting the same for financing.
- **Evaluative Requirements** - Requirements under this category are the ones which are mandatory for acceptance of the tractor for the purpose of subsidies/financing.
- **Non Evaluative Requirements** - Requirements under this category are the ones which are not mandatory for acceptance of the tractor for the purpose of subsidies/financing. However, the authorized testing institute shall observe the performance for these requirements and record in the test report.



IS 12207 : 2022 Agricultural tractors — Recommendations on selected performance characteristics (*fifth revision*)

- Important Performance Characteristics are:
 - PTO Performance parameters
 - Engine Performance parameters
 - Drawbar
 - Hydraulic Pump & Lift
 - Brakes
 - Mechanical Vibration & Noise
 - Safety Features
 - Wetland Cultivation



IS 12207 : 2022 Agricultural tractors — Recommendations on selected performance characteristics (*fifth revision*)

This standards specifies the following:

- Assessment of the evaluative requirements applicable for qualifying minimum performance criteria of the agricultural tractors,
- Tolerances on the values declared by the manufacturer and in certain cases **minimum/maximum values of the performance characteristics** and statutory requirements under the relevant act(s) of the agricultural tractors,
- Criteria for **determining variants and new model of tractors** for the purpose of testing and certification, and
- Criteria for providing **administrative extension and technical extension** to earlier tested tractor model



Parameters Applicable for Qualifying Minimum Performance Criteria

Characteristics	Category (Evaluative / Non Evaluative)	Requirement	Tolerance
PTO Performance			
Maximum power under 2 h test, kW Maximum engine power 2 h test, in case of PTO shaft is not provided, (kW)	Evaluative	To be declared by manufacturer	Declared value to be achieved with a tolerance of: $\pm 5\%$ for PTO power or engine power > 26 kW, $\pm 10\%$ for PTO power or Engine power ≤ 26 kW.
Power at rated engine speed, (kW)	Non-Evaluative	-do-	-do-
Specific fuel consumption corresponding to maximum power, (g/kWh)	Evaluative	-do-	should not be more than 10 % of declared value
Maximum equivalent crankshaft torque, (Nm)	Non Evaluative	-do-	$\pm 8\%$
Back-up torque, percent	Evaluative	Should be Min 12%	Nil
Engine oil consumption, (g/kWh)	Evaluative	Not exceeding 1% of SFC at <i>Max</i> power under natural ambient conditions	
Smoke level, (m-1)	Evaluative	<i>Max</i> light absorption coefficient of 3.25 per metre or equivalent BOSCH No. 5.2 or 75 Hatridge value	

Parameters Applicable for Qualifying Minimum Performance Criteria

Characteristics	Category (Evaluative / Non Evaluative)	Requirement	Tolerance
Drawbar performance			
Max. drawbar pull with ballast corresponding to 15 percent wheel slip or 7 percent track slip, kN	Non-Evaluative	Minimum 70 % of static mass with ballast	Nil
Maximum drawbar pull without ballast or with standard ballast corresponding to 15 percent wheel slip or 7 percent track slip, (kN)	Evaluative	<p>In case of tractors having total static mass \geq 1500 kg, Minimum 70 percent of static mass of tractor without ballast or with standard ballast, as the case may be.</p> <p>In case of light weight tractors having \leq1500 kg total static mass of tractor, Minimum 65 percent of static mass of tractor without ballast or with standard ballast, as the case may be.</p>	Nil
Maximum drawbar power without ballast or with standard ballast as the case may be, kW	Evaluative	<p><i>Min</i> 80% of PTO power as referred in SI No. i) a) of PTO performance in case of tractors having total static mass $>$ 1 500 kg.</p> <p><i>Min</i> 75% of PTO power as referred in SI No. i) a) of PTO performance in case of light weight tractors having \leq 1 500 kg total static mass of tractor.</p> <p><i>Min</i> 75% of the engine power as referred in SI No. i) a) of engine performance in case of tractors which do not have a PTO shaft.</p>	Nil

Parameters Applicable for Qualifying Minimum Performance Criteria

Characteristics	Category (Evaluative / Non Evaluative)	Requirement	Tolerance
Power lift and hydraulic pump performance			
1) At hitch points	Evaluative	To be declared by the manufacturer.	Should not be less than 90 percent of declared value.
2) With the standard frame	Evaluative	The lift capacity should at least be 24 kg/PTO kW and it should be 21.5 kg/engine kW where the tractor is not provided with a PTO shaft.	Nil
Brake performance at 25 kmph travel speed			
Maximum stopping distance at a force equal to or less than 600 N on brake pedal with road ballast, (m):			
1) Cold brake	Evaluative	10 m	
2) Hot brake	Evaluative	10 m	
3) Whether parking brake is effective at a force of 600 N at foot pedal(s) or 400N at hand lever, N	Evaluative	Yes/No	
Safety features			
Guards against moving and hot parts	Evaluative	Belt drives, pulleys, silencer, hydraulics pipes (as per IS 12239 (Part 2))	
Lighting arrangement	Evaluative	As per CMVR	
Seating requirements (Tractors having more than 1150 mm rear track width)	Non Evaluative	Should meet the requirements of IS 12343 (as amended from time to time)	

Parameters Applicable for Qualifying Minimum Performance Criteria

Characteristics	Category (Evaluative / Non Evaluative)	Requirement	Tolerance
Noise measurement			
Maximum ambient noise emitted by the tractor dB(A)	Evaluative	As per CMVR requirement in force	
Maximum noise at operator's ear level dB(A)	Evaluative	As per CMVR requirement in force	
Amplitude of mechanical vibrations at:			
1)Foot rest (Left and Right)	Evaluative		100 microns <i>Max</i>
2)Seat (with driver seated)	Evaluative		100 microns <i>Max</i>
3)Steering control wheel	Evaluative		100 microns <i>Max</i>
Air cleaner oil pull over	Evaluative		0.25% <i>Max</i>
Other safety Requirements			
Technical requirements for PTO shaft		Should meet the requirements of IS 4931	
Specifications of swinging drawbar(wherever fitted)		Should meet the requirements of IS 12362 (Part 3)	
Audible warning signal on tractor		<p>If tractor travel speed in reverse gear exceeds 20 kmph, an audible warning signal on tractor shall get activated.</p> <p>A sticker to the effect that "operating the tractor beyond 20 kmph speed in reverse gear is not safe" should be prominently displayed</p>	

Parameters Applicable for Qualifying Minimum Performance Criteria

ACCEPTANCE CRITERIA IN CASE OF BREAKDOWNS/DEFECTS

Sl No.	During Initial Commercial Test	During Batch Test
a)	There is no 'critical breakdown' during the course of testing	There is no 'critical breakdown' during the course of testing.
b)	There are not more than 2 major breakdowns and neither of them is of repetitive nature	There are not more than 1 major breakdowns and neither of them is of repetitive nature
c)	There are not more than 5 minor defects during the test and the frequency of each is not be more than two	There are not more than 3 minor defects during the test and the frequency of each is not be more than two
d)	In no case, the total number of breakdowns should exceed five that is, (2 major + 3 minor) or (1 major + 4 minor) or 5 minor breakdowns	In no case, the total number of breakdowns should exceed four that is, (1 major + 3 minor) or 4 minor breakdowns



Different Test Performed on Agricultural Tractors:

- ✓ PTO Performance (IS 12036)
- ✓ Drawbar performance (IS 12226)
- ✓ Power lift and hydraulic pump performance (IS 12224)
- ✓ Brake performance at 25 kmph travel speed (IS 12224)
- ✓ Noise measurement (IS 12180 Part 1 & 2)
- ✓ Air cleaner oil pull over (IS 5994)
- ✓ Wetland cultivation (To be done if recommended)
- ✓ Safety features
- ✓ Labelling of Tractors



Different Test Performed on Agricultural Tractors

IS 12036 (PTO)

Maximum power absolute

Maximum power at rated engine speed

Power at Varying Speed at Full Load

Varying Load Tests

IS 12226 (Drawbar)

Transmission Characteristic Test

Varying Drawbar Pull and Speed at Full Load

Fuel Consumption

Ten-Hour Test

IS 12224 (Hydraulics)

Hydraulic Lift Capacity Test

Hydraulic Power Test

Hydraulic Pump Test

Maintenance of Lift of Load



BENEFITS OF USING TRACTORS COMPLIANT WITH PERFORMANCE PARAMETERS AS PER IS 12207

- Accepted for Financing and subsidy
- Compliance of regulatory requirements of CMVR for lighting, noise, vibration etc
- Fuel Saving
- Reduced oil consumption
- Higher Backup Torque
- Improved drawbar performance resulting in better field performance
- Compliance of Break performance results in improved road safety
- Suitability for wetland cultivation
- Better Lifting capacity and hydraulic pump performance results in better performance in operating heavy equipment like land leveler etc

Implementation of IS 12207:2023 Agricultural tractors — Recommendations on selected performance characteristics

ACCEPTANCE CRITERIA FOR PERFORMANCE CHARACTERISTICS

- *The tractor may be accepted for the purpose of subsidy/financing if it meets all the evaluative requirements specified in this Standard and number of breakdowns should not exceed acceptance criteria in case of breakdowns/defects. This is however subject to the provision of repeat test which can be conducted for once only.*
- *In case of a parameter not meeting evaluative requirements of this standard, the 'repeat test' may be conducted. In case of a parameter not meeting evaluative requirements of this standard even after the repeat test, the manufacturer shall withdraw the tractor from test and 'withdrawn' commercial test report shall be released by the testing authority. Subsequently, the manufacturer shall offer a fresh sample for complete initial commercial test again.*

IS 12239 (Part 1) : 2018/ ISO 4254-1 : 2013 GUIDE FOR SAFETY AND COMFORT OF OPERATOR OF AGRICULTURAL TRACTORS AND POWER TILLERS PART 1 GENERAL REQUIREMENTS

- This Standard specifies the safety requirements and the means of their verification for the design and construction of self-propelled ride-on machines, mounted, semi-mounted and trailed machines used in agriculture in order to deal with the hazards which are typical for most of the machines.
- In addition, it specifies the type of information on safe working practices including information about residual risks to be provided by the manufacturer.
- This Standard deals with significant hazards, hazardous situations and events, relevant to this agricultural machinery when used as intended and under the conditions of misuse foreseeable by the manufacturer during normal operation and service.





IS 12239 (Part 1) : 2018/ ISO 4254-1 : 2013 GUIDE FOR SAFETY AND COMFORT OF OPERATOR OF AGRICULTURAL TRACTORS AND POWER TILLERS PART 1 GENERAL REQUIREMENTS

Safety requirements and/or measures applicable to all machines

1) Fundamental principles, design guidance

- A risk assessment should be carried out by the manufacturer to determine the hazards that are applicable to various machines.
- The manufacturer is responsible for the specification and provision of safety measures to deal with all hazards
- Functional components which need to be exposed for proper function, drainage or cleaning shall be guarded without causing other hazards, for example risk of fire due to the accumulation of organic material during the intended use, and without interfering with the proper function, drainage or cleaning



Safety requirements and/or measures applicable to all machines

2) Protection from moving parts involved in the work

- Within the intended use and reasonably foreseeable misuse of the machine, if guards cannot be used to prevent inadvertent contact with moving parts involved in the machine's work process, then other appropriate measures to prevent inadvertent contact shall be provided.

3) Noise

- *Recommended practice for the design of low-noise machinery and equipment* shall be used as means to design low noise machinery. Noise emission values, if required to be declared

4) Vibration

- Mechanical vibrations are caused by the unevenness of the travelling surface and the unbalanced movement of machine-related components such as engine, gearbox, drives and working tools. Technical measures for the reduction of vibrations are, for example, isolators, dampening or suspension systems.



Safety requirements and/or measures applicable to all machines

5) Controls

- The function of control devices and their different positions shall be identified at the operating position and explained in the operator's manual
- Pedals shall have a slip-resistant surface and be easy to clean.
- Hand-operated controls requiring an actuating force ≥ 100 N shall have a minimum clearance of 50 mm between the outer contours or from adjacent parts of the machine. Controls requiring an actuating force < 100 N shall have a minimum clearance of 25 mm. This requirement does not apply to fingertip operation controls (e.g. push-buttons, electric switches).
- Unless specified otherwise, actuating forces, displacement, location and the method of operation shall be in accordance with relevant Indian Standards
- Controls shall be located outside the hazard zones. This requirement is also applicable to machine components (e.g. hydraulic valves) which need to be manually operated or controlled in case of malfunction of the primary control system.



Safety requirements and/or measures applicable to all machines

6) Automatic mode of operation

- Machinery functioning in automatic mode shall bring itself automatically to a safe state when the work cycle is involuntarily stopped or interrupted (e.g. blockage, overload, malfunction). Following an involuntary stop or interruption, a re-start of the work cycle shall be possible only after an intentional actuation of a control located outside the hazard zone.

7) Operator stations - Boarding means

- If the vertical height of the operator station floor above ground level exceeds 550 mm, measured on level ground and with the specified tyres with the maximum diameter at specified inflation pressure, or specified tracks, a boarding means shall be provided.
- Whenever the boarding means is located directly in line and forward of a wheel or track (i.e. within the track of the machine), provision shall be made for a guardrail to be located on the wheel or track side. This does not apply when the machine is in the transport configuration.
- Shielding shall be provided on the back of steps or ladders whenever a protruding hand or foot can contact a hazardous part of the machine, e.g. wheel.



Safety requirements and/or measures applicable to all machines

8) Steps and ladders

- The height of the first step shall be achieved with the specified tyres and with the maximum diameter at specified inflation pressure. The vertical distance between successive steps shall be equal within a tolerance of ± 20 mm. Each step shall have a slip-resistant surface, a lateral stop at each end and be so designed (e.g. mudguards, perforated steps) that an accumulation of mud and/or snow is minimized under normal work conditions.
- A flexible connection(s) between the first and second steps is permitted. If parts of the boarding means are moveable, the operating force shall not exceed 200 N as the average value when moving from the start position to the stop position. The peak(s) shall not exceed 400 N.
- When moving the boarding means, there shall be no shearing, pinching or uncontrollable movement hazards to the operator.
- Where, on tracked machines, the track shoes and track pad surfaces are intended to be used as access steps, three-point contact support shall be provided to ensure safe boarding for the operator



Safety requirements and/or measures applicable to all machines

- **9) Handrails/handhold**

- Handrails or handholds shall be provided on both sides of the boarding means and shall be so designed that the operator can maintain three-point contact support at all times. The width of the handrail/handhold cross section shall be between 25 mm and 38 mm. The lower end of the handrail/handhold shall be located no higher than 1 500 mm from the ground surface. A minimum clearance of 50 mm shall be provided for hand clearance between the handrail/handhold and the adjacent parts except at attaching points.
- A handrail/handhold shall be provided above the uppermost step/rung of the boarding means at a height between 850 mm and 1 100 mm above the uppermost step/rung. The handhold shall be at least 150 mm long.



Safety requirements and/or measures applicable to all machines

• 10) Platforms

- Platforms shall be flat and have a slip-resistant surface and, if necessary, provision for drainage.
- Platforms — except those only used when the machine is stationary and which are less than 1 000 mm above the ground — shall be equipped with a foot guard, hand rail and intermediate rail around the edge of the platform with the dimensions shown in Figure 4. No foot guard shall be provided at the entrance of the platform.
- If the boarding means of platforms and cabs are made movable for transport purposes, provision shall be made for railing off access to the platform or cab. For cabs equipped with a door, the cab door satisfies this requirement.



Safety requirements and/or measures applicable to all machines

- **11) Operator seat**
- Machines shall be provided with a seat for each ride-on driver and operator. When for technical reasons or due to the function, the driver or operator needs to stand upright on the machine, this exemption and relevant specific hazards may be dealt with in the machine-specific standard of the machine concerned.
- **12) Place to stand**
- A place provided for standing shall have sufficient space for both of the operator's feet, be flat and have a slip-resistant surface. Depending on the machine configuration, it may consist of two separate surfaces and may use machine components. It shall be positioned so the operator can maintain stability while carrying out the service required and be on the same height level with a tolerance of ± 50 mm.
- Handhold(s) and/or railings shall be provided in order to allow three-point contact. Parts of the machine can be considered to fulfil this requirement.
- When access is needed above or next to the PTO (power take-off) drive shaft, an adequate place to stand and boarding means shall be provided in order to eliminate the need to use the PTO drive shaft or its guard as a step or a place to stand.



Safety requirements and/or measures applicable to all machines

- **13) Folding elements**
 - In the case of mechanical or hydraulic locking devices, the unlocking and unfolding of the elements shall be controlled by means of separate actions by the operator.
- **14) Strength requirements for guards and barriers**
 - Barriers used as protection against hazards related to moving working parts shall withstand the following horizontal loads:
 - — 1 000 N, up to 400 mm from the ground in the working position;
 - — 600 N, above 400 mm from the ground in the working position.
- **15) Supports for service and maintenance**
 - When it is necessary for the operator to work under raised parts of the machine in order to carry out maintenance or service, mechanical supports or hydraulic locking devices shall be provided to prevent inadvertent lowering.



Safety requirements and/or measures applicable to all machines

16) Mechanical supports

- Mechanical supporting devices shall withstand a load of 1,5 times the maximum static load to be supported.
- Detachable mechanical supports shall be retained in position on the machine. If this is not practicable, they shall have a dedicated and clearly visible and identifiable storage position on the machine allowing the safe storage of the support.

18) Electromagnetic compatibility

19) Access to operator's seat

- For access to the operator's seat, the floor area shall have a minimum width of 300 mm. Devices such as rearview mirrors shall not intrude into the access space in any of their engaged/disengaged positions, except in the case of devices intended to restrict the operator encountering hazards during normal operation.



Safety requirements and/or measures applicable to all machines

20) Operator's seat

- On machines on which the operator is required to sit, a seat shall be provided which adequately supports the operator in all working and operating modes. Information on the seat adjustment shall be provided in the operator's manual.
- The driver's seat adjustment mechanism(s) shall prevent unintended seat movement and shall have stops at the ends of the adjustment range. The suspension system, if provided, shall be adjustable to accommodate the weight of the driver.

21) Electromagnetic compatibility

22) Access to operator's seat

- For access to the operator's seat, the floor area shall have a minimum width of 300 mm. Devices such as rearview mirrors shall not intrude into the access space in any of their engaged/disengaged positions, except in the case of devices intended to restrict the operator encountering hazards during normal operation.



Safety requirements and/or measures applicable to all machines

21) Operator's seat

- On machines on which the operator is required to sit, a seat shall be provided which adequately supports the operator in all working and operating modes. Information on the seat adjustment shall be provided in the operator's manual.
- The driver's seat index point (SIP) dimension above the platform shall be 500 mm minimum and 650 mm maximum. The driver's seat adjustment mechanism(s) shall prevent unintended seat movement and shall have stops at the ends of the adjustment range. The suspension system, if provided, shall be adjustable to accommodate the weight of the driver.
- If the machine is equipped with a roll-over protective structure (ROPS), the operator's station shall be equipped with a the seat and restraint system.

• 22) Propulsion and steering

- The controls used to activate machine propulsion shall be located or designed so that they can only be operated from the operator's station.
- The steering mechanism shall be so designed as to reduce the transmission of force to the operator's hand in the event of any sudden movement of the steering-wheel or - lever(s) in reaction to the steered wheel(s).



Safety requirements and/or measures applicable to all machines

- **23) Shearing and pinching points**
- In the operator's workplace, there shall be no shearing or pinching points within hand or foot reach of the operator when seated in the seat provided.
- **24) Emergency exit**
- When the operator's station is equipped with a cab, provisions shall be made for an emergency exit. In addition to the primary door, at least one other exit shall be provided as an emergency exit
- Emergency exits shall be of a size to accommodate as a minimum an ellipse with principal axes of 640 mm and 440 mm;
- — be labelled with the user instructions if the intended emergency exit is not routinely used or if location and use is not obvious.
- **25 Cab material burning rate**
- The burning rate of cab interior material such as seat covering, wall, floor and headliner coverings when provided shall not exceed the maximum rate of 150 mm/min



Safety requirements and/or measures applicable to all machines

- **26). Visibility**
- The design and position of the operator's station shall be such that the operator has adequate visibility direct or indirect to operate the machine and view the work area of the machine.
- When the operator's station is equipped with a cab, a windscreen wiper shall be provided.
- Provisions for installing working lights shall be available.
- **27) Starting and stopping the engine**
- To avoid unauthorized activation of the engine starting, means such as the following shall be provided to avoid unauthorized activation:
 - — key-operated ignition or starting switch;
 - — lockable cab;
 - — lockable cover for the ignition or starting switch;
 - — security ignition or starting lock;
 - — lockable battery disconnecting switch
- Provisions shall be made to prevent the engine starter, if provided, from engaging unless
 - — the traction transmission(s) is (are) in the neutral or parked position; or
 - — the traction clutch is disengaged; and
 - — the master implement clutch (PTO) is disengaged.
- Stopping the engine shall be achieved by a device constructed so that
 - — the engine's stop device does not require sustained manual operation, and
 - — when the device is set at the "off" or "stop" position, the engine cannot be re-started, unless the device has been reset.



Safety requirements and/or measures applicable to all machines

- **28) Attachments for towing**

- Attachment points for retrieving and towing (hooks, rings, ears, etc.) shall be provided at the front and/or rear of the machine. If these attachment points are not obvious, they shall be clearly indicated on the machine and in the operator's manual [see 8.2.3 n) and 8.4].

- **29) Moveable attachments**

- Means shall be provided to maintain movable attachments in their transport position.

- **30) Use of lifting jacks**

- Application points for use with jacks when raising the machine shall be clearly marked, if not obvious, and their location and the procedure for using jacks shall be described in the operator's manual



Safety requirements and/or measures applicable to all machines

- **31) Attachments for towing**

- Attachment points for retrieving and towing (hooks, rings, ears, etc.) shall be provided at the front and/or rear of the machine. If these attachment points are not obvious, they shall be clearly indicated on the machine and in the operator's manual.

- **32) Moveable attachments**

- Means shall be provided to maintain movable attachments in their transport position.

- **33) Use of lifting jacks**

- Application points for use with jacks when raising the machine shall be clearly marked, if not obvious, and their location and the procedure for using jacks shall be described in the operator's manual
- The jack-up points shall have the appropriate strength and be constructed so that a laden machine can be lifted from the ground (e.g. to change the wheels)



Safety requirements and/or measures applicable to all machines

- **34) Electric**

- Batteries shall be located so they can be properly maintained and exchanged, from the ground or a platform, and shall be secured to remain in position and located or constructed and sealed so as to reduce the possibility of spillage in the event of a machine overturn. The electrical, non-earth terminals of batteries shall be protected to prevent unintentional contact and shorting to earth.
- It shall be possible to easily disconnect the battery electrical circuit (e.g. without tools, with common tools or a mechanical or electrical switch).
- Information on service and replacement of the battery shall be provided in the operator's manual



Safety requirements and/or measures applicable to all machines

- **35) Fuel tank**

- Fuel tank filler(s) shall be located outside the cab.
- Fuel tanks shall be corrosion-resistant and shall satisfy leakage tests at a pressure equal to double the working pressure, but in any event not less than 30 kPa.
- Fuel cap design shall not allow leaking while the engine is at the normal operating temperature and in all machine working positions. Seepage from the fuel tank ventilation system shall not be considered as a leaking condition.
- Information on filling of the fuel tank shall be provided in the operator's manual.

- **36) Hot surfaces**

- Hot surfaces which can be reached inadvertently by the operator during normal operation of the machine shall be covered or insulated. This requirement applies to hot surfaces which are near steps, handrails, handholds and integral machine parts used as boarding means and which can be inadvertently touched.



Safety requirements and/or measures applicable to all machines

37) Exhaust gases

- The outlet of the exhaust pipe shall be located and directed in such a way that the operator or any other person required on the machine during operation are not normally exposed to harmful concentrations of noxious gases or fumes.

• 38) Safety requirements and/or measures — Mounted, semi-mounted and

- trailed machines
- Controls
- Stability
- Mounted and semi-mounted machines - If a supporting device is necessary for storing the machine, this device shall remain attached to the machine.
- Hitches for towing
- Transmission of mechanical power between self-propelled machines/tractors and recipient machinery
- Stationary operation - PTO-driven equipment designed to operate in a stationary position shall be provided with means to prevent separation of the PTO drive shaft

STEPS FOR SAFELY USING A FARM TRACTOR

Mind the other farm labours around the tractor

Drive with care

Hitching safely

Mind the Living

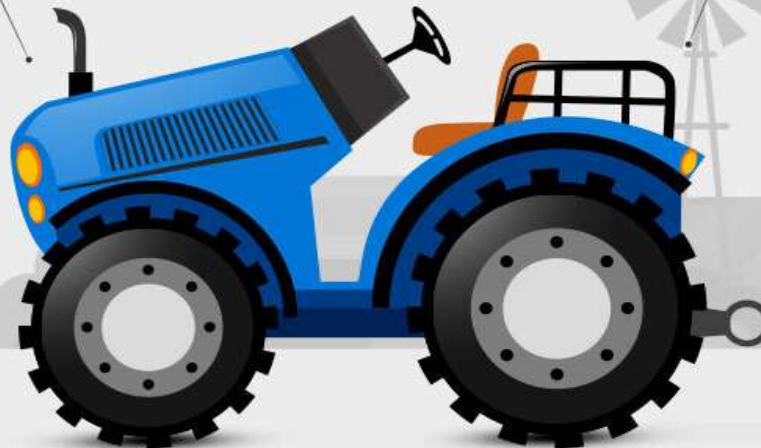
Other implements and their safety operation

The driver's seat matters

Lookout for overhead electric powerlines

Being cautious is the key

How to prevent overturning?



Safety Requirements for Agricultural Tractors, IS 1239(Part 2)



With the increased use of agricultural tractors and power tillers for various agricultural operations, the need of human safety has attained importance. This standard indicates appropriate safety parameters to be met when designing tractors.

This standard (Part 2) covers constructional and operational requirements for improving the degree of personal safety of operator of the agricultural tractor .

Important Safety Features for Agricultural Tractors are:

- a)) Dimensions and Couplings of Three Point Hitch Linkage
- b) Guards on Moving and Hot Parts
- c) Clearance around various controls
- d) Operators Workplace and Seat
- e) Provision Roll Over Protection devices
- f) Brake Performance on Roads
- g) Slow Moving Vehicle Emblem
- h) Minimum Cautionary Notices and Safety Symbols

Tractor Safety

Tractor overturn prevention tips:



- When given the option, drive tractors on the flattest possible land.
- Keep side mounted implements on the uphill side of the tractor.
- Avoid turning on slopes. Turn downhill, when turning is a necessity.
- Stay away from the edge of ditches and steep slopes.
- Attach hitches to the drawbar.
- Make sure tires are not frozen to the ground or mired in mud before moving the tractor.

Safety Requirements for Agricultural Tractors, IS 1239(Part 2)



Three-Point Linkages

- The hazards of coupling implements with three point linkages can be reduced by the use of semi-automatic implement couplers (quick coupling devices).
- All controls shall be identifiable. If symbols are used for controls, they shall be in accordance with IS 6283 (Part 1 and 2).
- **Location and movement of operator shall be in accordance with Table 1 of IS 8133.**
- **It should be possible to activate the controls with reasonable force, where appropriate, in accordance with IS 10703.**
- Hand controls should be of a shape and size permit an adequate grasp and hand clearance. The clearance around these controls shall be not less than 70 mm.
- The pedals shall be in position where all free play is removed. The steering wheel shall be adjusted to its mid position. The pedals shall be placed in the following order from the left hand side to the right hand side
- Clutch (operated by left foot), and Brake(s) (operated by right foot).
- The accelerator pedal, if installed should normally be operated by right foot.
- When seated, no shearing or pinching points are permitted within reach of the operator's hands or feet

Minimum Internal Clearance Dimensions

Distance	Dimension, Min (mm)
Distance from the seat index point to any part of the cab ceiling surface, above, forward of and to either side of the operator's head ¹⁾	960
Distance from the seat index point to the cab back wall at a height between 210 mm above the seat index point and the line roof contour defined by the 960 mm radius plus the 150 mm blend radius ²⁾	365
Lateral clearance at any distance between 310 mm above the seat index point and the roof contour defined by the 960 mm radius plus the 45° line, perpendicular to the vertical reference plane for a distance of 235 mm ² rearward from the seat index point	450
Distance from the outer side of the steering wheel rim to the cab surface or other hand controls ³⁾	80

¹⁾Soft materials such as padding may penetrate into the free space up to a maximum of 50 mm.

²⁾If the horizontal seat adjustment provide exceeds ± 75 mm from the mid-position, then any dimensions forward from the seat index point shall be reduced, and dimensions to the rear from the seat index point increased, on the basis :
[Total adjustment to the rear of the seat mid position minus 75 mm]

³⁾Excluding hand controls mounted on the steering column.

Clearance Dimensions Around the Controls

Type of Control	Dimension ¹⁾ , Min (mm)
For engine controls and controls which require an operating force of more than 150 N	50
For controls, other than engine controls, which require an operating force of 80 N to 150 N	25

¹⁾These minimum distances shall be valid for all control positions

Other Safety Requirements –

- If any parts protrude from the standing area (for example clutch pedal), provisions shall be made to enable one foot to be placed either in front of, rearward or at the side of such parts
- For narrow-track tractor, the exhaust system, whether vertical or horizontal, shall be positioned so that its hot parts cannot be touched by the driver whilst gaining access to the tractor seat or sitting at the controls.

Guards

- Guards shall be provided wherever necessary, particularly on following points.

i) Hot Parts

- A guard or shield shall be fitted to reduce to a minimum, the possibility of inadvertent contact during normal operations with any exposed hot element that may cause harm when the operator is seated in the normal operating position. The guard should be constructed of heat-insulating material, or positioned and mounted in such a manner that it will not itself become hot

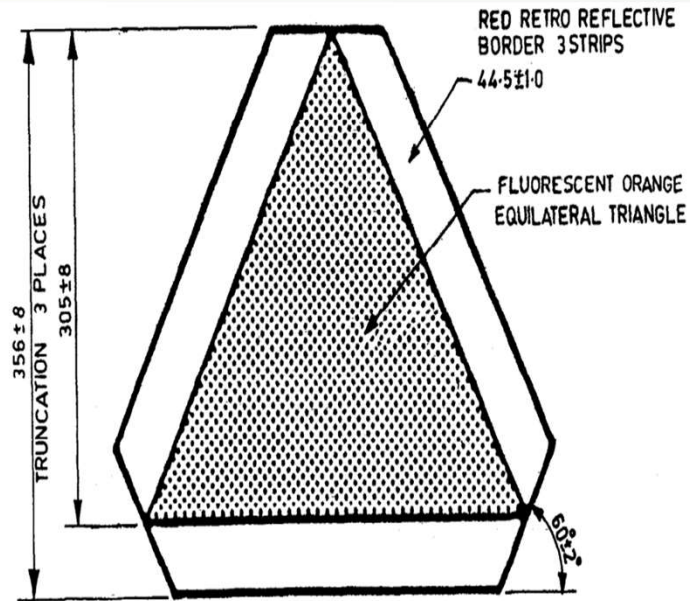
Safety Requirements for Agricultural Tractors, IS 1239(Part 2)

- **ii)Rear Wheels or Tracks** – All tractors shall be provided with rear wheel or full track guards (mud guards) which should be higher than the circumference of the wheels or track and so far ahead that the operator's or passenger's feet cannot come into contact with the wheels or track. The wheel guard may be omitted when the wheels are already protected by other means, such as, auxiliary equipment.
- **iii)Fans** - All propeller or axial fans which are exposed and within the reach of the ground, the operator's position or the passenger's position shall be guarded against contact.
- **iv)Pulleys and Belts**
 - Tractor belt pulleys shall be so located and guarded that while in operation if the belt breaks or slips off, it should not strike the operator and there is no risk of contact with the nip point. Open gears, belts and chain drives, and idlers shall have nip points protected by guards or by other parts of the equipment. Chain drives as well as belts that are joined in such a manner as to prevent protrusions, shall be guarded over their entire length if there would be a possibility of contact with them.

SLOW MOVING VEHICLE EMBLEM

- One SMV (Slow Moving Vehicle) identification emblem as shown in Fig. 9 consisting of a fluorescent orange equilateral triangle with a red retro-reflector border positioned with a point of triangle up shall be provided on the rear side of the vehicle. The red retro-reflector border defines the shape of the fluorescent colour in daylight and appears as a hollow red triangle with path of motor vehicle headlight in the night. The emblem shall be mounted in a plane perpendicular to the direction of travel and shall be visible from the rear of SMV. It shall be located 0.6 m to 1.8 m above the ground.

Safety Requirements for Agricultural Tractors, IS 12239(Part 2)- Slow Moving Vehicle Emblem



NOTE — Emblem must be mounted with the point upward.

FIG. 9 SLOW-MOVING VEHICLE IDENTIFICATION EMBLEM





Safety Requirements for Agricultural Tractors, IS 1239(Part 2)

Cautionary Notice

A minimum cautionary notice worded as under shall be written in *vernacular* language legibly and prominently on a label fixed on the tractor:

- DO NOT MAKE ADJUSTMENTS WHEN TRACTOR IS IN OPERATION;
- DO NOT USE INTOXICANTS LIKE LIQUOR, OPIUM, ~ETC, WHILE OPERATING;
- DO NOT PUT OR TAKE OFF BELT WHILE PULLEY IS RUNNING;
- DO NOT SIT OR STAND OR SIT IN AN UNSAFE PLACE SUCH AS ROOF, DRAWBAR, MUDGUARD, RUNNING BOARD OR LOAD WHEN THE TRACTOR IS MOVING;
- NO PERSON SHOULD MOUNT OR DISMOUNT FROM A TRACTOR WHILE IT IS IN MOTION EXCEPT IN AN EMERGENCY;
- THE OPERATORS OF TRACTOR SHOULD:
 - 1) BE ADEQUATELY TRAINED AND WHEN REQUIRED, PROPERLY LICENSED,
 - 2) OBTAIN AND READ THE OPERATING MANUAL BEFORE USING A TRACTOR FOR THE FIRST TIME;
 - 3) WEAR ADEQUATE AND WELLFITTING FOOTWEAR;
 - 4) WEAR SNUG-FITTING CLOTHING;
 - 5) KEEP HANDS, FEET AND CLOTHING AWAY FROM ALL MOVING PARTS;
 - 7) PUT THE GEAR SELECTOR, POWER OPERATED ATTACHMENTS AND
 - 8) POWER TAKE-OFF TO NEUTRAL AND LOWER THE ATTACHED EQUIPMENT TO THE GROUND BEFORE LEAVING THE STOPPED TRACTOR;
 - 9) LOCK THE BRAKE PEDALS TOGETHER WHEN TRAVELLING ON PUBLIC ROADS; AND
 - 10) STOP AT ALL UNGUARDED RAILWAY CROSSINGS AND MAKE SURE THAT NO TRAINS ARE COMING



Benefits of compliance to the Safety Requirements for Agricultural Tractors, IS 12239(Part 2)

- Improved safety during Road Transport
- Roll over Protection devices prevent turning over of tractors during field operations
- Proper clearance around operators work place ensure safety of operators
- Guards over moving parts prevent accidents due to strangling of clothing or body parts getting inside the moving parts
- Guards over hot parts prevent from coming in contact of body parts.
- Safety compliance of drawbar and three point hitch prevent accidents during coupling and handling of tillage implements and other machinery
- Improved degree of personal safety of operator

IS 13539 : 2018 Power tiller — Recommendations on selected performance and other characteristics (second revision)



- Power Tiller is an agricultural machinery used for soil preparation having a single axle, in which the direction of travel and its control during field operation is performed by the operator.
- It is self-powered, self-propelled, and can pull cultivator, harrow, plough, various seeder, harvester and such other suitable attachments.
- The equipment may be walk behind or riding attachment type and should be capable of being coupled to a trailer that can be used for transportation of goods of not less than 1 ton capacity.
- The maximum speed of the power tiller when coupled to a trailer shall not exceed 22 kmph.
- The minimum rated horse power output of the power tiller engine shall not be less than 8 bhp (Break Horse Power)



IS 13539 : 2018 Power tiller — Recommendations on selected performance and other characteristics (*second revision*)

This standard specifies the following:

- Criteria for determining Tolerances on the values declared by the manufacturer and in certain cases minimum/maximum values of the performance characteristics, statutory requirements under the relevant Act(s) of the agricultural power tillers; and
- Determining variants and new model of power tillers for the purpose of testing and certification.



Different Test Performed on Power Tillers:

- ✓ Engine Performance
- ✓ Rotary Shaft Performance
- ✓ Drawbar Performance
- ✓ Brake performance
- ✓ Noise measurement
- ✓ Air cleaner oil pull over
- ✓ Wetland cultivation
- ✓ Safety features
- ✓ Labelling



Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
1.	Engine Performance:				
	a) Maximum power under 2h test, kW (hp)	Evaluative	To be declared by the manufacturer	Declared value to be achieved with a tolerance of ± 10 percent	—
	b) Power at rated engine speed, kW (hp)	Non-Evaluative	-do-	-do-	—
	c) Specific fuel consumption corresponding to maximum power [see (a) above, g/kWh (g/bhph)]	Evaluative	-do-	+ 5 percent	—
	d) Specific fuel consumption corresponding to power at rated engine speed [see (b) above, g/kWh (g/bhph)]	Non-Evaluative	To be declared by the manufacturer	+ 5 percent	—
	e) Maximum equivalent crankshaft torque, Nm	Evaluative	To be declared by the manufacturer	± 10 percent	—

Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
g)	Lubricating oil consumption, g/kWh (g/bhph)	Evaluative	Not exceeding 1 percent of SFC at maximum power under high ambient conditions	Nil	The value would be based on the test conducted under high ambient conditions.
h)	Maximum coolant (water) consumption (percent of total coolant capacity)	Evaluative	Coolant consumption should not exceed 35 percent of the total coolant capacity under high ambient condition.	Nil	—
j)	Smoke level	Evaluative	As per CMVR requirements	Nil	—
k)	Overheating tendency of the engine	Evaluative	Satisfactory completion of two hours test under high ambient condition	—	—

Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
2.	Rotary Shaft Performance:				
	a) Maximum power, kW (Ps)	Evaluative	Minimum 80 percent of observed maximum bhp of power tiller	—	—
	b) Power at rated engine speed, kW (Ps)	Evaluative	Minimum 75 percent of observed rated bhp of power tiller	—	—
	c) Specific fuel consumption corresponding to power at rated engine speed [g/kWh (g/bhph)]	Evaluative	To be declared by the manufacturer	+ 5 percent	—
	d) Maximum equivalent rotary shaft torque, Nm (kgf.m)	Evaluative	-do-	± 8 percent	—
	e) Maximum operating temperature of rotary transmission oil °C	Evaluative	-do-	Nil	The applicant shall supply the recommendation of oil company along with the application form.

Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
3.	Drawbar Performance:				
	a) Concrete track (with pneumatic wheels):				
	i) Maximum drawbar pull corresponding to 15 percent wheel slip, (kgf)	Evaluative	Minimum 65 percent of static mass with ballast	Nil	—
	ii) Maximum drawbar power, kW (Ps)	Evaluative	To be declared by the manufacturer	-10 percent	—
	iii) Maximum transmission oil temperature, °C	Evaluative	To be declared by the manufacturer	Nil	The declared value should not exceed the maximum value specified by the oil company and the observed value should not exceed the declaration. Applicant shall supply the recommendation of oil company along with the application form.

Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
4.	Brake Performance:				
	a) Service brakes:				
	i) Service brakes	Evaluative	Should meet the requirements under CMVR	—	IS 9935 may also be referred
	ii) Maximum force exerted to apply the brake, N	Evaluative	As per the requirements under CMVR	—	IS 9935 may also be referred. Based on the test conducted 'Yes/No' as applicable may be indicated
	iii) Observation on rotation on drive wheels (power tillers) at a slope of 12 percent with trailer having gross mass recommended for haulage	Evaluative	As per CMVR	—	Based on the test conducted 'Yes/No' as applicable may be indicated
	b) Parking brakes:				
	Observation on rotation of cranked wheels at the slope of 18 percent, facing up and facing down	Evaluative	No rotation of drive wheels at a slope of 18 percent facing up and facing down	—	Based on the test conducted 'Yes/No' as applicable may be indicated

Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
5.	Air Cleaner Oil Pull Over: Maximum percentage of oil pull over (mass basis)	Evaluative	0.20 percent	—	—
6.	Noise Level: a) Maximum ambient noise emitted by the power tiller, dB(A)	Evaluative	As per CMVR	—	The observed value should be within the permissible limits
	b) Maximum noise at operator's ear level dB(A)	-do-	As per CMVR	—	-do-

CMVR Limits for Noise for Power Tillers

Parameters Applicable for Qualifying Minimum Performance Criteria

Sl. No.	Characteristic	Category (Evaluative/ Non-evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
7.	Amplitude of Mechanical Vibration at:				
	a) Steering handle grips	Non-evaluative	100 μ , Max	—	—
	b) Gear levers	-do-	100 μ , Max	—	—
	c) Clutch/brake lever(s)	-do-	100 μ , Max	—	—
	d) Rotary shaft speed change lever	-do-	100 μ , Max	—	—
	e) Steering clutch levers	-do-	100 μ , Max	—	—
	f) Accelerator lever	-do-	100 μ , Max	—	—
	g) Operators seat	-do-	100 μ , Max	—	—
	h) Foot rest (if provided)	-do-	100 μ , Max	—	—
8.	Haulage Performance:				
	a) Gross load of trailer (t)	Non Evaluative	To be declared by the manufacturer	—	—
	b) Distance travelled/litre of fuel consumption, km	-do-	-do-	+ 10 percent	—
	c) Fuel consumption (cc/km/ gross load tonne)	-do-	-do-	+ 10 percent	—
9.	Wet Land Cultivation :				
	Suitability for Wet Land Cultivation	Evaluative	Effective sealing to be provided for engine sump, clutch assembly, gear box, chain case and rotary shaft housing	—	The entry of mud/ water should not take place in components/ sub-assemblies such as engine, clutch, gear box, chain case and rotary shaft housing



BENEFITS OF USING POWER TILLERS COMPLIANT WITH PERFORMANCE PARAMETERS AS PER IS 13539 : 2018

- Accepted for Financing and Subsidy
- Compliance of regulatory requirements of CMVR for lighting, noise, vibration etc
- Fuel Saving
- Reduced oil consumption
- Reduced coolant consumption
- Better rotary shaft performance
- Compliance of Break performance results in improved road safety
- Suitability for wetland cultivation

IS 15806 : 2018 COMBINE HARVESTER — RECOMMENDATIONS ON SELECTED PERFORMANCE AND OTHER CHARACTERISTICS (*First Revision*)

Combine harvester, commonly known as combine, is used for a combination of operations, such as harvesting, threshing, separating, and cleaning of various crops grown in the country.

➤ This standards specifies the following:

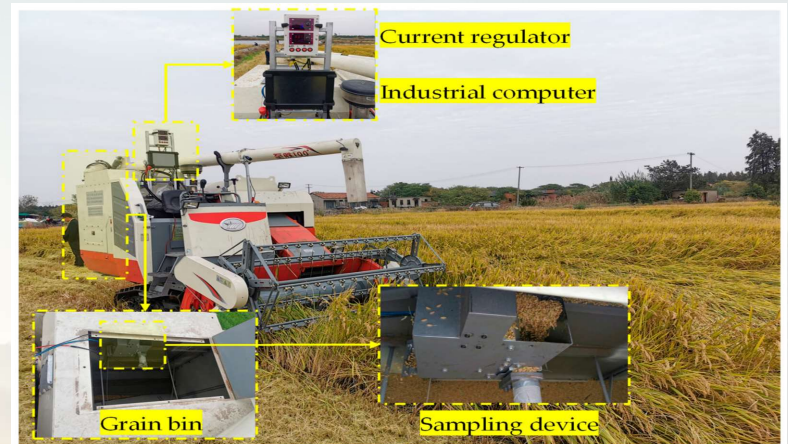
- An assessment of the evaluative requirements applicable for qualifying minimum performance criteria of the combine harvesters,
- Tolerances on the values declared by the manufacturer, and in certain cases minimum/maximum values of the performance characteristics, and statutory requirements under the relevant Act(s) of the combine harvesters,
- The criteria for determining variants and new model of combine harvesters for the purpose of testing and certification,
- Definitions of some of the terms commonly used in relation to testing of combine harvester, and
- Minimum performance criteria for testing of Straw Management System (SMS), if fitted is also given.



IS 15806 : 2018 COMBINE HARVESTER — RECOMMENDATIONS ON SELECTED PERFORMANCE AND OTHER CHARACTERISTICS (*First Revision*)

Important Performance Characteristics:

1. Prime mover performance
2. Brake Performance at 24 km/h or Maximum Speed whichever is Less.
3. Mechanical Vibration (Amplitude Vibration)
4. Air cleaner oil pull over
5. Noise Measurement
6. Header Lifting Capacity
7. Field Performance
 - i) Suitability for crops
 - ii) Processing loss
 - iii) Threshing efficiency
 - iv) Cleaning efficiency
 - v) Grain breakage in main grain tank
 - vi) Non collectable losses
8. Safety requirements
9. Field Performance for Straw Management System (if fitted)
 - i) Uniformity of straw spread, Cv (percent)
 - ii) Weighted mean size of chopped straw, cm
10. Discard Limits



IS 15806 : 2018 COMBINE HARVESTER — RECOMMENDATIONS ON SELECTED PERFORMANCE AND OTHER CHARACTERISTICS (*First Revision*)

Threshing Efficiency (Eth) –

Threshed grains from all the outlets of the combine with respect to total grains obtained from all outlets of thresher expressed in percentage by mass.

Eth = 100 – Percentage of unthreshed grains

Percentage of unthreshed grains = $(D*100)/A$
 $A = B + C + D$

where,

A = Total grain output per unit of time;

B = quantity (threshed, clean) grain collected from all outlets, namely, grain tank, straw walker and sieve etc, per unit time;

C = quantity of broken grain from all outlets, namely, grain tank, straw walker and sieve etc, per unit of time; and

D = quantity of un-threshed grain from all outlets, namely, grain tank, straw walker and sieve etc, per unit of time.



IS 15806 : 2018 COMBINE HARVESTER — RECOMMENDATIONS ON SELECTED PERFORMANCE AND OTHER CHARACTERISTICS (*First Revision*)

Field Performance Parameters

Processing Losses (L_p)

$$L_p = D_c + C_c + L_r + L_s$$

where,

D_c = Percentage of unthreshed grain in the grain tank;

C_c = Percentage of broken grain in the grain tank;

L_r = Rack loss, in percentage; and

L_s = Shoe loss, in percentage.

Non-collectable Losses (L_{nc})

$$L_{nc} = L_r + L_s + L_h$$

where,

L_r = Rack loss, in percentage;

L_s = Shoe loss, in percentage; and

L_h = Header loss in percentage.

Rack Loss (L_r)

L_r = Percentage of threshed, unthreshed and broken grains passing out of the straw walker.

Shoe Loss (L_s)

L_s = Percentage of threshed, unthreshed and broken grains passing out of the sieve(s).

Collectable Losses (L_c)

L_c = Percentage of broken and unthreshed grain in the grain tank.

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

Sl No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Prime mover performance				
a)	<i>Max.</i> Power (absolute) average <i>max.</i> power observed during 2 h <i>max.</i> power test in natural ambient condition, kW	Evaluative	To be declared by the manufacturer	Declared value to be achieved with a tolerance of ± 5 percent	—
b)	<i>Max.</i> power observed during test after adjusting the no load engine speed as per recommendation of the manufacturer for field work, kW	Evaluative	To be declared by the manufacturer	- do -	—
c)	Power at rated engine speed, kW	Non-evaluative	To be declared by the manufacturer	- do -	—
d)	Specific fuel consumption corresponding to average maximum power under 2 h maximum power test, g/kWh.	Evaluative	-do-	+ 5 percent (<i>max</i>)	—
e)	<i>Max.</i> smoke density (Bosch no.) at 80 percent load between the speed at <i>max.</i> power and 55 percent of speed at <i>max.</i> or 1 000 rpm whichever is higher	Evaluative	As per Central Motor Vehicles (CMV) Rules	NIL	—

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
f)	<i>Max.</i> crank shaft torque, (Nm) observed during the test after no load engine speed is adjusted as per manufacturer's recommendation for field work	Evaluative	To be declared by the manufacturer	± 8 percent	—
g)	Back up torque, percent	Evaluative	7 percent, (minimum)	NIL	—
h)	<i>Max.</i> operating temperature, °C	Evaluative	To be declared by manufacturer	NIL	The observed value under high ambient condition should not exceed maximum safe value specified by the oil company which will be provided by the applicant.
	(i) Engine oil				
	(ii) Coolant	Evaluative	To be declared by manufacturer	NIL	The declared value should not exceed the boiling temperature of coolant under the pressurized or otherwise and the observed value under high ambient condition should not exceed the declaration.

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
i)	Lubrication oil consumption, g/kWh	Evaluative	Not exceeding 1 percent of specific fuel consumption at maximum power under high ambient condition	NIL	The value would be based on the test conducted under high ambient condition
ii)	Brake Performance at 24 km/h or Maximum Speed whichever is Less.				
a)	Max. stopping distance at a force equal to or less than 600 N on brake pedal (m) – (cold brake and hot brake)	Evaluative	As per requirements of CMVR	NIL	
b)	Max. force exerted on brake pedal to achieve a deceleration of 2.5 m/sec ² .	Evaluative	≤ 600N.	NIL	
c)	Effectiveness of parking brake at a force of 600 N at foot pedal or 400 N at hand lever	Evaluative	As per requirements of CMVR	NIL	Based on the test conducted, Yes/No, as the case may be , should be indicated

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
iii)	Mechanical Vibration (Amplitude of Vibration)				
a)	Operator's platform	Non-evaluative	120 μm <i>max.</i>	NIL	—
b)	Steering wheel	Non-evaluative	150 μm <i>max.</i>		
c)	Seat with driver seated	Non-evaluative	120 μm <i>max.</i>		
iv)	Air cleaner oil pull over				
	Max. oil pull over in percentage when tested in accordance with IS8122 (Part 2).	Evaluative	0.20 percent <i>max.</i>	NIL	—
v)	Noise Measurement				
a)	<i>Max.</i> ambient noise emitted by combine at bystanders position dB (A)	Evaluative	As per CMV Rules	NIL	As per road transport condition
b)	<i>Max.</i> noise at operator's ear level dB (A)	Evaluative	As per CMVR	NIL	In actual field condition

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
viii)	Field Performance				
a)	Suitability for crops	Evaluative	Wheat and paddy (wheel type), paddy (track type)	NIL	—
b)	Processing losses, (percent)	Evaluative			
		Wheat	Avg. 3 percent	NIL	
		Barley	Avg. 4 percent	NIL	—
		Rice	Avg. 4 percent	NIL	—
		Sorghum	Avg. 3 percent	NIL	—
		Maize	Avg. 5 percent	NIL	—
		Oilseed rape	Avg. 4 percent	NIL	—
		Soya-beans	Avg. 5 percent	NIL	—
c)	Threshing efficiency	Evaluative	≥ 98 percent for wheat and paddy	NIL	
d)	Cleaning efficiency	Evaluative	≥ 96 percent for wheat and paddy	NIL	
e)	Grain breakage in main grain tank	Evaluative	≤ 2.5 percent	NIL	
f)	Non collectable losses	Evaluative	≤ 2.5 percent for wheat, paddy and gram ≤ 4.0 percent for soybean	NIL	

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
x)	Safety requirement				
a)	Guards against all moving parts/ drives and hot parts	Evaluative	Belt and chain drives, pulleys, hydraulic pipes (Around operators workplace)	—	As per IS 12239 (Part 1)
b)	Lighting arrangement	Evaluative	Essential as per CMVR	—	—
c)	Grain tank cover	Evaluative	Essential	—	—
d)	Spark arrester in engine's exhaust in case naturally aspirated engine	Evaluative	Essential	—	—
e)	Stone trap before concave bars	Evaluative	Essential	—	—
f)	Rear view mirror	Evaluative	Essential	—	—
g)	Fire extinguisher	Evaluative	Essential	—	—
h)	Slip clutch at following drives—			—	—
	1) Cutting platform	Evaluative	Essential		
	2) Under shot conveyor drive	Non-Evaluative	Optional		
	3) Grain and tailing elevator	Non-Evaluative	Optional		

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
x)	Safety requirement				
j)	Anti-slip surfaces at operator platform and ladder and proper gripping for the control levers	Evaluative	Essential	—	As per IS 12239 (Part 1)
k)	Working clearance around the controls	Evaluative	—	—	As per IS 12239 (Part 1)
m)	Labeling of control gauges and all operating controls	Evaluative	Essential	—	As per IS 6283 (Part 1)
xi)	Material of construction: Guards, knife blades and knife back	Non-Evaluative	Conforming to IS 6024, IS 6025 and IS 10378 respectively	—	—
xiv)	Hardness of flail blades for Straw Management System (SMS):	Evaluative	Bush section: 20 to 35 HRC Edge section (Hardened zone) : 48 to 58 HRC Remainder zone: 20 to 35 HRC	—	—

PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA FOR COMBINE HARVESTERS

SI No.	Characteristic	Category (Evaluative / Non-Evaluative)	Requirement	Tolerance	Remarks
(1)	(2)	(3)	(4)	(5)	(6)
x)	Safety requirement				
xv)	Hardness of serrated blades for Straw Management System (SMS):	Evaluative	Bush section: 20 to 35 HRC Edge section (Hardened zone) : 48 to 58 HRC Remainder zone: 20 to 35 HRC	—	—
xvi)	Safety Requirements for Straw Management System, (if Fitted):				
a)	Guards against all moving parts/ drives and hot parts	Evaluative	Essential	—	—
b)	RPM indicator for rotor	Evaluative	Desirable	—	—
c)	Overlapping of flail and fixed serrated blades	Evaluative	Essential		The clearance of the flail and fixed serrated blades should be adjustable



BENEFITS OF USING COMBINE HARVESTERS COMPLIANT WITH PERFORMANCE PARAMETERS AS PER IS 15806 : 2024

- Accepted for Financing and Subsidy
- Compliance of regulatory requirements of CMVR for lighting, noise, etc
- Fuel Saving and Reduced oil consumption
- Reduced Field Losses
- Higher threshing efficiency
- Higher cleaning efficiency
- Less non-collectible losses
- Compliance of Break performance results in improved safety during travel on Road
- Suitability for Straw Management

IS 18717 : 2024 STRAW MANAGEMENT SYSTEM (SMS) FOR COMBINE HARVESTERS — PERFORMANCE TEST METHOD



Straw management system (SMS) for combine harvesters is an agricultural machinery used to facilitate in-situ management of crop residue. Generally, SMS is attached near to the straw discharge outlet of combine harvester to collect, chop and uniformly spread loose chopped straw on the harvested field.

This standard covers the methods of tests to be conducted to assess the performance of straw management system (SMS) mounted on a combine harvester

Acceptance Criteria in Case of Breakdowns/ Defects

The product may be accepted subject to the following conditions:

- a) There is no 'critical breakdown' during the course of testing.
- b) There are not more than two 'major breakdowns' and neither of them is of repetitive nature;
- c) There are not more than five 'minor defects' during the test and the frequency of any defect is not more than two; and
- d) In no case, the total no. of breakdowns exceeds five that is, (2 major + 3 minor) or (1 major + 4 minor) or 5 minor breakdowns.



PARAMETERS APPLICABLE FOR QUALIFYING MINIMUM PERFORMANCE CRITERIA STRAW MANAGEMENT SYSTEM (SMS) FOR COMBINE HARVESTERS

SI No.	Characteristics	Category (Evaluative/ Non-Evaluative)	Requirement (R)/ Declaration (D)	Tolerance
(1)	(2)	(3)	(4)	(5)
i)	Field performance for straw management system			
a)	Uniformity of straw spread, CV (%)	Evaluative	20 (Max) (R)	–
b)	Weighed mean size of chopped straw, cm	Evaluative	20 (Max) (R)	–
ii)	Safety requirements for straw management system			
a)	Guards against all moving parts/drives and hot parts	Evaluative	Essential (R)	–
b)	RPM indicator for rotor	Evaluative	Desirable	–
c)	Overlapping of flail and fixed serrated blades	Evaluative	Essential (R)	–
			The clearance of the flail and fixed serrated blades should be adjustable	

Uniformity of Spreading in terms of coefficient of variation (C_v), percent



FIG. 1 CHOPPED STRAW OVER COLLECTION CLOTH



FIG. 2 COLLECTION OF CHOPPED STRAW SAMPLES FOR ANALYSIS

Data related to weight of loose chopped straw in each sample area shall be recorded and analyzed for uniformity of spreading in terms of coefficient of variation (CV).

$$CV = \sigma/\mu$$

where

σ = standard deviation of samples; and

μ = mean of samples.

Determination of weighted Mean Chop Size

For determining average weighted mean chop size, minimum three sample area of chopped straw shall be selected. The chopped straw collected in each sample area shall be segregated based on the size of chopped straw as shown in Fig. below. Weight of each sub-sample shall be recorded as percentage of total chopped straw collected.

Data from above exercise shall be recorded into tabular form for determining weighted mean chop size of the SMS. Minimum three observations shall be taken to determine average weighted mean chop size.



SPECIFICATION OF STRAW MANAGEMENT SYSTEM (SMS) FOR COMBINE HARVESTERS

<i>Sl No.</i>	<i>Parameters</i>	<i>Specification</i>	
		Self-Propelled	Track Type
(1)	(2)	(3)	(4)
Rotor			
i)	Rotor pipe diameter, mm	110 to 165	70 to 210
ii)	No. of lugs on rotor in a row	3 (<i>Min</i>)	3 (<i>Min</i>)
iii)	No. of rows in periphery	4	4
iv)	Length of pivotal flail (blade) from centre of hole to tip, mm	100 to 180	100 to 180
v)	Width of flail (blade), mm	Straight 50 to 60 Tapered 25 to 60	Straight 25 to 60
vi)	Thickness of flail (blade), mm	3.0 (<i>Min</i>)	3.0 (<i>Min</i>)
vii)	No. of flails (blade) in one set	1 (<i>Min</i>)	
viii)	No. of rows/bars of blades	1	
ix)	Spacing between blades, mm	20 (<i>Min</i>)	
x)	Overlapping of pivotal blade on serrated/plain blade, mm	25 (<i>Min</i>) (adjustable)	

SPECIFICATION OF STRAW MANAGEMENT SYSTEM (SMS) FOR COMBINE HARVESTERS

<i>Sl No.</i>	<i>Parameters</i>	<i>Specification</i>	
		Self-Propelled	Track Type
(1)	(2)	(3)	(4)
Spreader			
xi)	Length of flap, mm	200 (<i>Min</i>)	
xii)	Distance between flaps (left to right)	Adjustable	
xiii)	Spreader angle with horizontal, degree	Adjustable preferably downwards	
xiv)	Spread sheet thickness, mm	1.5 (<i>Min</i>)	
xv)	SMS sheet thickness, mm	1.5 (<i>Min</i>)	
xvi)	Rotor balancing	Should be dynamically balanced	
xvii)	Rotor rpm	1 500 (<i>Min</i>)	1 200 (<i>Min</i>)
xviii)	Peripheral speed, m/s	40 (<i>Min</i>)	40 (<i>Min</i>)
xix)	Fitting of SMS on combine harvester	Rigidly fixed to the combine chassis	
xx)	Fitting of power transmission system on combine harvester	Rigidly fixed to the combine chassis	

IS 9020:2002 SAFETY REQUIREMENTS FOR POWER THRESHERS



Mechanization of the threshing operations in the country also brought in its wake a chain of accidents to farm workers resulting in their temporary or permanent disability. This brought to the fore the need for some immediate measures to safeguard the farm workers against avoidable accidents be it due to any of the vulnerable factors of machine, man, etc. As a number of reports of many farm workers specially the young losing their limbs poured in, the urgency to provide for safety provisions in the threshers became more pronounced.

Punjab Agricultural University, Ludhiana conducted a survey on the accidents during the wheat threshing season of 1976. 294 cases were examined and it was observed that the factors responsible for accidents are as under:

<i>Factors of Accidents</i>	<i>Percentage</i>
Human	72.9
Machine	12.9
Crop	9.0
Situational	5.2

Observing the Criticality of the machinery, the standard was developed to cover the safety requirements of Power Threshers :

INDIAN STANDARDS ON POWER THRESHERS (IS 11691, IS 6320 & IS 9020)



Types of Power Threshers:

1. Spike Tooth Type
2. Hammer Mill type
3. Chaff-cutter Type
4. Raspbar Type
5. Drummy Type

Thresher Performance Characteristics

1. Input Capacity, kg per kW
2. Threshing efficiency - The threshed grain received from all outlets with respect to total grain input expressed as percentage by mass.
3. Cleaning Efficiency - Clean grain received at main grain outlet(s) with respect to the total grain mixture received at main grain outlet(s) expressed as percentage by mass.
4. Total Losses:
5. Broken Grain percentage :



IS 9020:2002 SAFETY REQUIREMENTS FOR POWER THRESHERS

General Safety Requirements

- Fastening connections between different components shall be made in such a way that they will not get loosened due to vibration or such other forces as may occur during normal operation.
- The thresher shall be so designed that general maintenance, cleaning, replacement of parts can be done without damage to the components or danger to the operator.
- Proper arrangements for lubrication of moving components shall be provided.
- Bearings shall be adequately protected against the ingress of dust.
- In case the prime mover is to be mounted on the thresher, a protective cover shall be provided to prevent it from dust or straw falling on it and to ensure operator's safety.
- Provisions shall be made for tightening of the belts.
- Threshing drum shall be statically balanced.
- Provision for easy adjustments of concave clearance, airflow rate, screen pitch, sieve speed, eccentricity of shaking mechanism, sieve clearance, etc, should be made.
- Provision for easy transportation of the thresher and towing with the tractor shall be provided.
- Each thresher shall be provided with an operator's manual in Hindi or English or any other vernacular language.

IS 9020:2002 SAFETY REQUIREMENTS FOR POWER THRESHERS

GUARDING OF TRANSMISSION SYSTEM

- Guards shall be provided on all moving parts of the thresher to prevent accidental contact of persons or parts of clothing being caught. In case of PTO driven threshers guards shall be provided on the PTO shaft.
- The guards shall be made of blind sheets of mild steel having a minimum thickness of 1.6 mm.
- The guards shall be so designed as not to hinder in easy adjustment, servicing and operation of the thresher.
- All guards shall be either permanently attached or firmly secured to prevent their removal without the aid of tools.
- The servicing and adjustments should be possible without complete removal of the guards.

WORKMANSHIP AND FINISH

- The components shall be free from rust and shall have protective coating to prevent corrosion and surface deterioration in transit and storage.
- The components should be free from pits, burrs and other defects that may be detrimental for their use.

IS 9020:2002 SAFETY REQUIREMENTS FOR POWER THRESHERS

FEEDING SYSTEMS

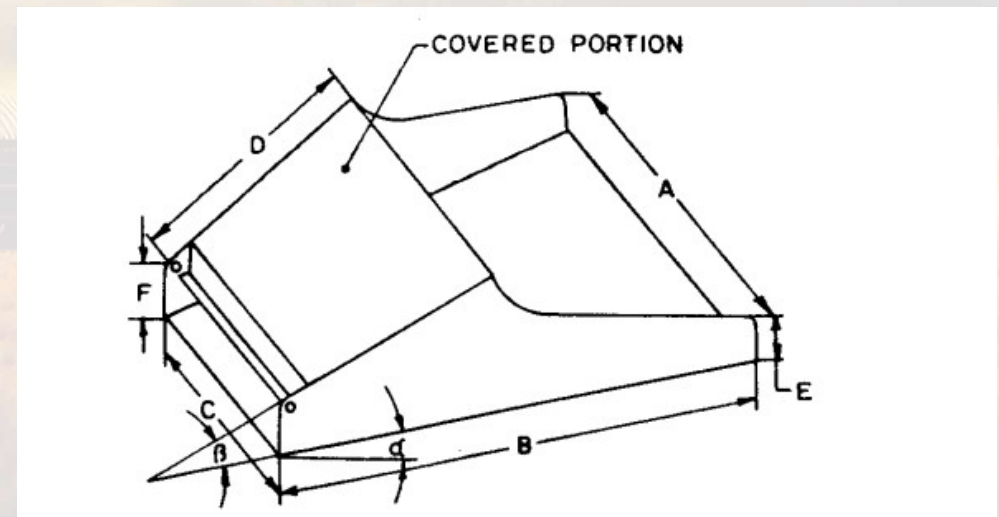
The feeding system in power threshers shall be of the following types :

- a) Chute,
- b) Hopper,
- c) Conveyor, and
- d) Feed roller

Feeding Chute - The total length of chute, length of covered portion (see **B** and **D** in Fig.) shall be 900 mm, **Min** and 450 mm, **Min** respectively. The angle of lift of covered portion (see α in Fig.) shall be between 10° to 30° . However, the length of the covered portion of chute for chaff-cutter type thresher shall not be less than 550 mm.

Recommended Dimensions of Chute for Hammer Mill, Drummy and Chaff-Cutter Type Threshers

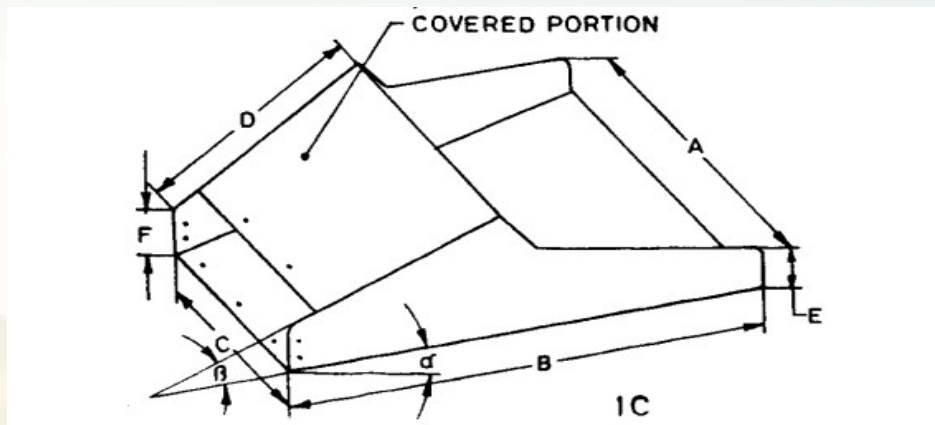
Sl No.	Size of the Prime Mover for the Thresher, kW	A mm	C mm	E mm	F mm
(1)	(2)	(3)	(4)	(5)	(6)
i)	3.7	500	200	50	125
ii)	5.5	550	200	60	175
iii)	7.5	600	220	60	190
iv)	11 and above	650	220	60	200



IS 9020:2002 SAFETY REQUIREMENTS FOR POWER THRESHERS

IMPROVED FEEDING CHUTE

Recommended Dimensions for Chute for Spike Tooth Cylinder Type Threshers



Sl No.	Size of the Prime Mover for Thresher kW	A mm	C mm	E mm	F mm
(1)	(2)	(3)	(4)	(5)	(6)
i)	3.7	440	350	60	190
ii)	5.5	480	400	60	190
iii)	7.5	540	480	60	190
iv)	11 and above	590	530	60	210

Other Requirements

- To facilitate easy and smooth feeding of the crop during operation, the feeding chute shall be properly mounted on the thresher. In the mounted position, angle alpha (see Fig. 1) shall be kept as under
 - a) For hammer-mill and drummy-type threshers — 10° to 15°
 - b) For chaff-cutter type threshers — 0° to 5°
 - c) For spike tooth type threshers — 10° to 15°
- No sharp edges shall be provided on the feeding chute.
- The covered portion of the chute shall be rigidly attached and shall not be able to be detached without cutting.
- The feeding chute shall be so fixed with the thresher that it is not possible to remove it easily.

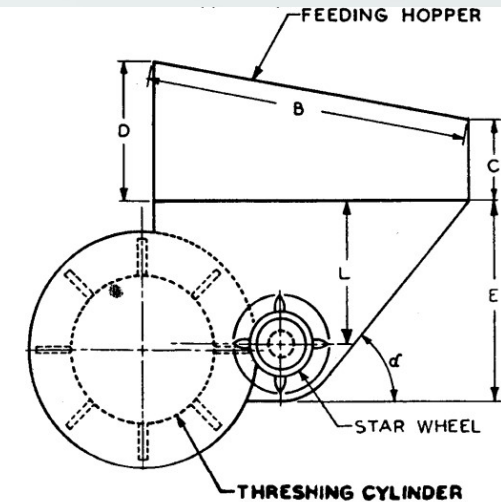
IS 9020:2002 SAFETY REQUIREMENTS FOR POWER THRESHERS

Dimensions of Hopper and Star Wheel

Sl No.	Size of the Prime Mover for Thresher kW	B Min mm	C Min mm	D Min mm	E Min mm	F mm	G mm	H mm	α ± 5 deg
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
i)	7.5	900	180	340	75	280	45	20	50
ii)	11	900	200	370	500	280	45	20	50
iii)	15	925	220	400	535	280	45	20	50
iv)	18.7 and above	950	240	430	565	280	45	20	50

NOTE — Hopper feeding system is normally used with the threshers of 7.5 kW or more power ratings.

DETAILS OF FEEDING HOPPER



Mounting Dimensions

- The feed hopper shall be built as an integral part of the thresher.
- The location of the star wheels in relation to hopper sides (see **J** in Fig.) shall be 75 mm. The centre to centre distance of two star wheels (see **K** in Fig. 2) shall be 220 mm.
- The fixation of star wheel shaft in hopper (see **L** in Fig.) and fixation of star wheel in relation to centre of threshing cylinder (see **M** in Fig.) shall be 350 mm and 450 mm respectively.

PROBLEMS FACED DUE TO NON-COMPLIANCE TO SAFETY REQUIREMENTS AS PER IS 9020:2002



- With improper feeding systems and feeding hoppers, hands getting inside the thresher during feeding of crop resulting in serious accidents
- In the absence of guards over moving parts, cloths may get caught in the moving parts resulting in serious accidents
- Poor Strength of guards and sheet if less thickness is used
- More accidents due machine causes
- Undue sound or chatter or vibrations during operation of thresher
- Accidents may occur due to overturning if power thresher is not stable

IS 17626:2021 SELF-PROPELLED SUGARCANE HARVESTER - TEST CODE



Tests Covered

Laboratory Tests

- a) Specification checking;
- b) Material analysis;
- c) Visual observations and checking of provision for adjustments;
- d) Power tests;
- e) Sugarcane harvester unit(s) lifting test;
- f) Noise level measurement;
- g) Vibration test;
- h) Operator's field of vision;
- j) Brake test;
- k) Air cleaner oil pull-over test (if applicable);
- m) Turning ability test(s):
 - 1) Determination of turning and clearance diameter; or
 - 2) Determination of steering effort.
- n) Position of centre of gravity; and
- p) Components/assembly inspection.



IS 17626:2021 SELF-PROPELLED SUGARCANE HARVESTER - TEST CODE



A sugarcane harvester is a large agricultural machinery used to harvest and partially process sugarcane. Sugarcane harvester should be able to cut the whole cane from base, detrash it, detop it and may put the cut cane in the container attached behind or may windrow the cut crop

Scope: This standard covers the following:

- a) Methods of performance testing of Self-propelled type sugarcane harvester and,
- b) Criteria for determining variant model and new model of sugarcane harvesters

Types of Sugarcane Harvesters:

1) Whole Stalk Harvester — The machine harvests, handles and delivers the cane in the form of whole stalk. A typical whole stalk harvester system consists of a topper, a base cutter, a feeding mechanism, and a discharging mechanism. The topper is designed to sever cane tops and then discharge the severed tops to the side of harvesting rows. Topped cane stalks are then cut by the base cutters at about 30 mm above the ground level. The feeding mechanism includes a set of rollers to convey the cane stalks to the discharging mechanism. The discharging mechanism then delivers harvested stalks to either a wagon or onto the field.

2) Cut-Chop Harvester or Chopper Harvester — The machine harvests, chops, cleans and handles the cane in the form of billets. A typical chopper harvester system includes extra components such as chopper and extractors in addition to other components available in whole stalk harvester. The functionality of the chopper and extractor are to chop whole stalk into billets and separate leafy materials. The discharging mechanism is used to deliver the billets to a wagon or a truck.

IS 17626:2021 SELF-PROPELLED SUGARCANE HARVESTER - TEST CODE



Sugarcane Harvester and its Component/Units

3.2.1 Topper Unit — Topper unit located at the upper front side of the sugarcane harvester which gathers cut and discharge the cane tops away from sugarcane harvester and crop.

3.2.2 Crop Dividers — Crop dividers are unit located at the lower front of sugarcane harvester which assists in separating downed or tangled cane. A twin spiral conical-screw divider system separates throws of cane, diverting them to the base cutter.

3.2.3 Disc Cutters — This can be of two types single disc cutter and multiple disc cutter. This type of cutter works on rotary motion .

3.2.4 Knock-Down Rollers — Down rollers push the cane forward, before it is cut by the base cutter, allowing it to fall in the optimal position for feeding into the Sugarcane harvester.

3.2.5 Base Cutter — The base cutter is a set of counter-rotating disks with replaceable blades designed to cut the cane at ground level without splitting it .

3.2.6 Feed Rollers — The feed rollers carry the cane from the base cutter to the chopper .

3.2.7 Chopper — The chopper system cuts the whole cane in to billets by using two drums with replaceable blades running in opposite direction, slices the cane and then delivers the billets to the elevator .

3.2.8 Extractor — Using a fan, the extractor removes trash, leaves and dirt from the cane as it is dropped into the elevator basket. The separated debris and leaves are directed onto the ground behind the harvester by the extractor hood. This is a major part of the cleaning process .

3.2.9 Elevator — The elevator is a conveyor system which delivers the cane billets to a container either to the rear left or right-hand side of the harvester

IS 17626:2021 SELF-PROPELLED SUGARCANE HARVESTER -TEST CODE

- **Performance Related Definitions**
- *Growing Density* — The effective plant grown in sugar-cane ridge of each meter.
- *Impurity* — The organic or inorganic impurities that are not for sugar making other than cane stalk.
- *Ground (Dropping) Loss* — The missing-cutting and dropped cane when the sugarcane harvesting machinery is working.
- *Stubble Loss* — The cane stalk stubble after harvesting that is more than 75 mm above the top of the ridge.
- *Damaged Cane-stalk (Collectable Loss)* — The cane damaged due to machine harvesting (like damages caused due to crop divider, base cutter)

Safety

- The manufacturer shall also provide the information on safe working practices which eliminate or reduce the hazards arising from the intended use of these machines by operator in the course of normal operation and service.
- Provision shall be made for the attachment of portable fire extinguishers located near the operator's Work station. The manufacturer shall give in the operator's manual recommendations about the number, type and location of the fire extinguishers. If only one fire extinguisher is specified, then the recommendation shall be that it be located near the operator's work station.

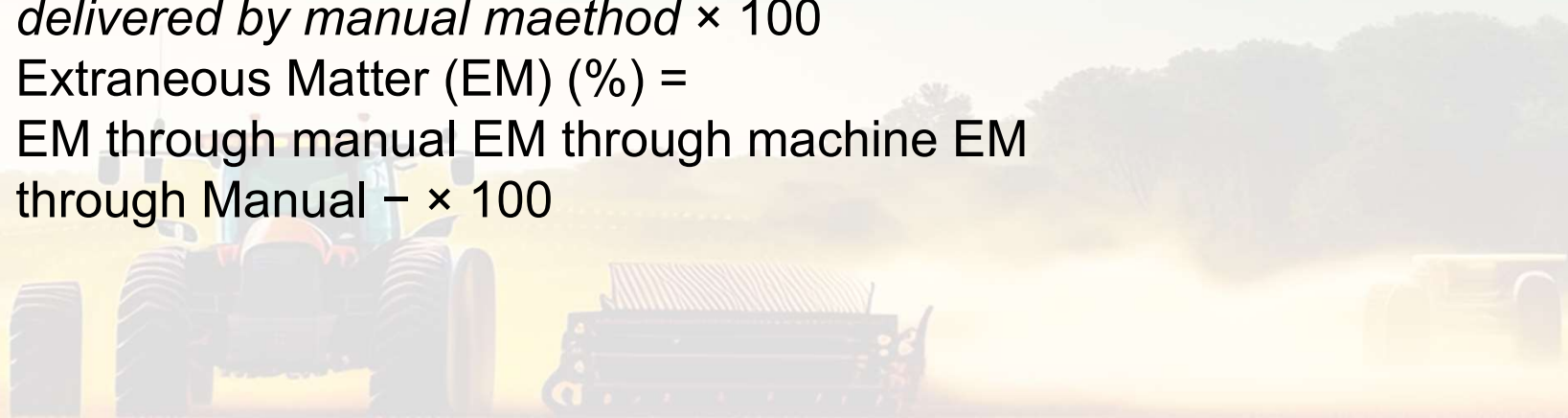
Presentation of Results

Cane collection efficiency (%) =

$\frac{\text{Net cane delivered by machine}}{\text{Net cane delivered by manual method}} \times 100$

Extraneous Matter (EM) (%) =

$\frac{\text{EM through manual} - \text{EM through machine}}{\text{EM through Manual}} \times 100$





THANK YOU