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भारतीय मानक

कंबाइन हारवेस्टर-थ्रेशर की परीक्षण संहिता

भाग 1 शब्दावली

( पहला पुनरीक्षण )

*Indian Standard*

TEST CODE FOR COMBINE  
HARVESTER-THRESHER

PART 1 TERMINOLOGY

( *First Revision* )

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## FOREWORD

This Indian Standard ( First Revision ) was adopted by the Bureau of Indian Standards, after the draft finalized by the Harvesting and Threshing Equipment Sectional Committee had been approved by the Food and Agriculture Division Council.

Combine-harvester-thresher, commonly known as combine, is being increasingly used for a combination of operations, such as, harvesting, threshing, separating and cleaning, particularly for cereal crops in the country. As a result of its increasing use, the need for standardized tests for helping the testing authorities for the assessment of the performance of the combine on uniform and rationalized basis was felt and accordingly this standard was published in 1976.

This test code was published in two parts. This part ( Part 1 ) covering definitions of the different terms most commonly used in relation to the combines to help in proper and uniform understanding to various terms, was published in 1976. The other part covering the methods of tests for performance of combine was published in 1981. Now, this part is being revised to incorporate the following points raised by the testing authorities and manufacturers in addition to Amendments No. 1 and 2 issued to this part:

- i) Change of definition of combine capacity;
- ii) Change of conditions for capacity testing with various crops given in Table 1; and
- iii) Addition of conditions for capacity testing with Soyabean and barley and modification of definition for grain output.

In the revision of this part assistance has been derived from the document ISO 6689 : 1961 'Equipment for harvesting-combines and functional components — definitions, specifications and performance', issued by the International Organization for Standardization.

# *Indian Standard*

## TEST CODE FOR COMBINE HARVESTER-THRESHER

### PART 1 TERMINOLOGY

#### ( *First Revision* )

#### 1 SCOPE

This standard ( Part 1 ) covers the definitions for various terms most commonly used in relation to combine-harvester-thresher ( combine ).

#### 2 REFERENCES

2.1 IS 10000 ( Part 4 ) : 1980 'Declaration of power efficiency fuel consumption and lubricating oil consumption' and IS 8122 ( Part 2 ) : 1981 'Test code for combine harvester-thresher : Part 2 Performance test' are necessary adjuncts to this standard.

#### 3 GENERAL

3.1 For the purpose of this standard, the terms have been classified in two groups, namely, combine and its components, and combine operation and performance.

#### 4 COMBINE AND ITS COMPONENTS

##### 4.1 Baffle-Plate

An element ( see 1 in Fig. 1 ) placed near the rear beater ( see 4.45 ) to prevent grain from being thrown to the straw walkers ( see 4.60 ).

##### 4.2 Blower

A rotary device ( see 2 in Fig. 1 ) which produces a draught or air across the chaffer ( see 4.3 ) and cleaning sieve(s) ( see 4.8 ) to blow away the material lighter than grains.

##### 4.3 Chaffer

The upper sieve on which grain and chaff mixture falls from stepped grain bed ( see 4.53 ) for initial cleaning. The sieve is oscillated so as to toss the chaff and unthreshed material rearward while the grains sift through chaffer openings ( see 3 in Fig. 1 ).

##### 4.4 Chaffer Extension or Finger Grate

The bars ( see 4 in Fig. 1 ) provided at the rearward of chaffer ( see 4.3 ) to receive the material passed by chaffer for separating unthreshed grains, chaff and remaining grains to the tailing auger ( see 4.61 ).

##### 4.5 Cleaning Area, Pneumatic

The product of the width and depth of the air stream at the point of contact of the air with the crop material expressed in square millimetres.

The depth shall be measured normal to the direction of the air flow.

#### NOTES

1 This shall be applicable where chaff is removed by aerodynamic means only.

2 The depth shall be measured normal to the direction of the air flow chaffer ( see 4.3 ).

##### 4.6 Cleaning Area, Total

The sum of the area of each chaffer extension ( see 4.4 ), cleaning sieve(s) ( see 4.8 ) and sieve extension(s), if any, is obtained by using the outside dimensions of the sievable surface expressed in square millimetres ( see *S* in Fig. 2 ).

NOTE — The grain pan extension combine should not be included when establishing the cleaning area.

##### 4.7 Cleaning Areas, Other

Dirt screens, recleaners and other auxiliary cleaning devices. The areas shall be specified.

##### 4.8 Cleaning Sieve(s)

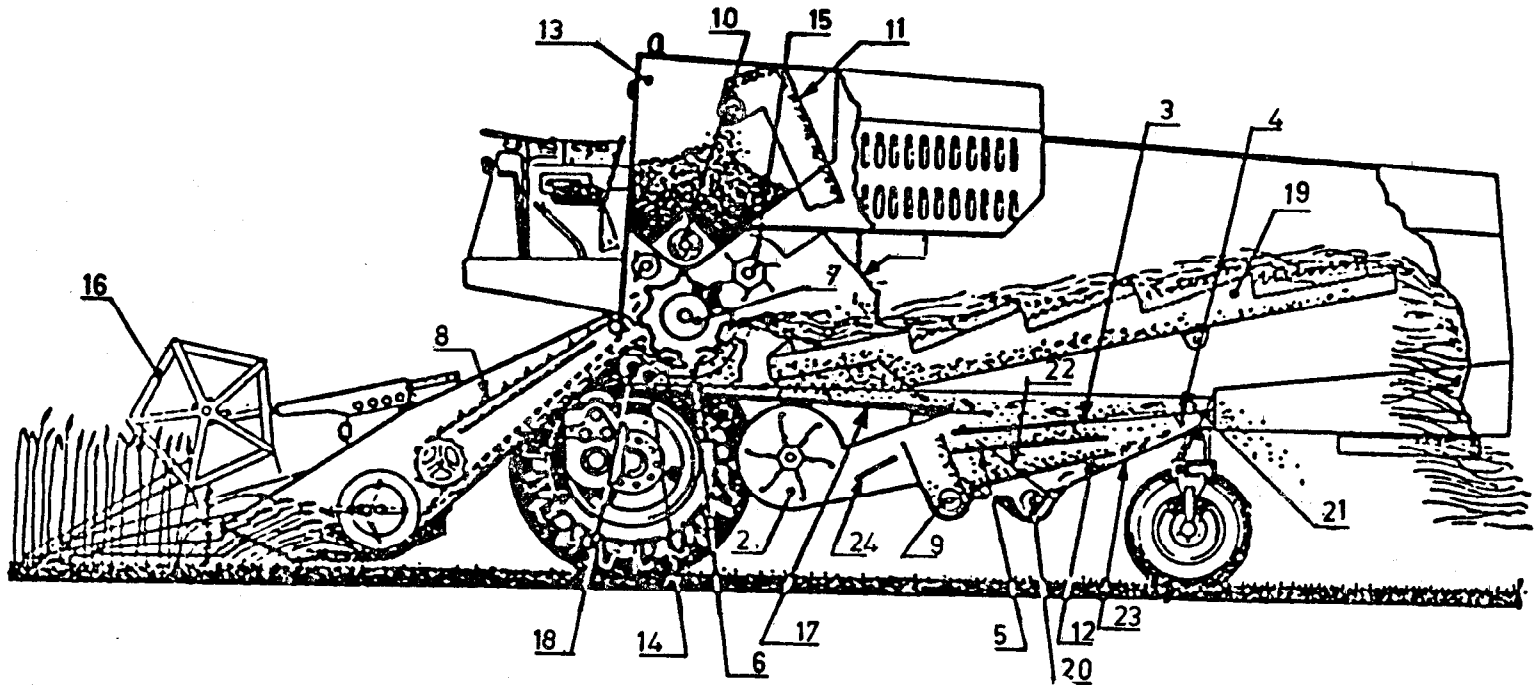
One sieve or a set of sieves ( see 5 in Fig. 1 ) which separate chaff and other undesirable elements from grain after being received from chaffer ( see 4.3 ) and chaffer extension ( see 4.4 ).

##### 4.9 Clearance Radius

The distance from the turning centre to the outermost point of the combine executing its shortest turn without brakes in operation. If equipment options or attachments affect this dimension, such equipment shall be specified. The wheel base and guide wheel tread width shall be the same as in 4.66. Clearance radius shall be expressed in centimetres.

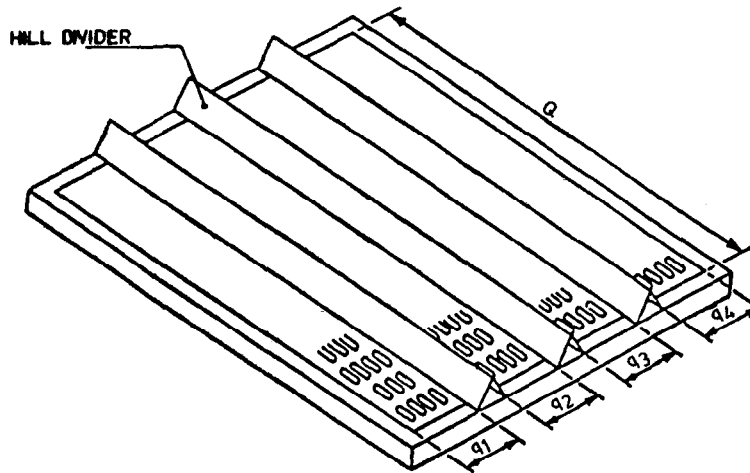
##### 4.10 Combine-Harvester-Thresher

A machine ( see Fig. 1 ) designed for harvesting, threshing, separating, cleaning, collecting, unloading grain while moving through the standing crop. Bagging arrangement may be provided, with a pick-up attachment ( see 4.44 ), it may be used for handling crop that has been swathed. It may be of self-propelled type or tractor-operated (trailed or side-mounted) type.



All dimensions in millimetres.

FIG. 1 COMBINE AND ITS COMPONENTS



$$q = q_1 + q_2 + q_3 + q_4$$

$$S = Q \times q$$

FIG. 2 CHAFFER

#### 4.10.1 Self-Propelled Combine

A combine on which an engine of suitable power rating is mounted to serve as a source of power. This may be wheeled type or track-laying type.

##### 4.10.1.1 Wheel combine

A combine in which the pneumatic wheels are used.

##### 4.10.1.2 Track-laying combine

A combine fitted with full or half tracks instead of pneumatic wheels.

#### 4.10.2 Tractor-Operated Combine

A combine which requires a tractor of suitable power rating to serve as a source of power for its working. It may be trailed type or side-mounted type.

#### 4.11 Combine Height

The vertical distance from the horizontal plane on which the combine ( see 4.8 ) is standing to the highest point on the combine expressed in centimetres.

##### NOTES

- 1 Tyre and wheel or track shall be stated and tyre shall be inflated to the field operating pressure recommended by the manufacturer.
- 2 The plane on which the combine is standing shall be substantially level.
- 3 The size and type of header and reel installed at the time of measurement shall be stated.
- 4 The grain tank shall be effectively empty and the fuel, radiator, hydraulic and lubrication tank shall be full.
- 5 The height with all components in position for transport and with all components in position for field operation shall be specified.

6 It shall be stated whether the combine is fitted with cab.

7 The maximum and minimum dimensions shall be the highest point and the lowest point to which the cutter bar can be raised or lowered, measured from the Ground plane to the tip of the knife section.

#### 4.12 Combine Length

The overall length, from the foremost point to the rearmost point of the combine ( see 4.10 ) equipped for field operation, measured parallel to the longitudinal centre line of the combine expressed in centimetres.

##### NOTES

- 1 The header installed shall be stated and any other attachments which affect the length shall be specified.
- 2 In case of tractor-operated combines ( see 4.10.2 ), the tractor shall be excluded.
- 3 In the field condition, the table shall be fully raised and the reel fully forward; the longest available divider shall be fitted.

#### 4.13 Combine Mass

The mass of the complete combine ( see 4.10 ) equipped for field operation expressed in kilograms to the nearest 10 kg.

*Alternate Definition* — The mass of the combine shall be determined separately for front and rear axles with empty grain tank, full fuel tank and including standard mass of 75 kg in the operator's position.

##### NOTES

- 1 The mass shall be determined under the conditions specified in Notes 1 to 4 under 4.11.
- 2 Any other attachments, which affect the mass, shall be specified.

#### 4.14 Combine Width

The overall width measured horizontally covering outer extremities of combine expressed in centimetres.

NOTE — The overall width shall be measured in both road travel condition and equipped for field of operation. In the field condition, the header fitted shall be the same as that fitted when determining cutter bar working width ( see 4.17.4 ) and effective header width ( see 4.35.1 ).

#### 4.15 Concave

A concave shaped metal grating ( see 6 in Fig. 1 ) partly surrounding the cylinder ( see 4.18 ) against which the cylinder rubs the grain from the ears and through which the grains fall on the sieve.

##### 4.15.1 Concave Arc

A means of defining the width of a concave in degrees ( see  $\alpha$  in Fig. 3 ). This shall be measured from the front of the first bar to the rear of the last bar and in relation to the centre of the cylinder ( see 4.18 ).

##### NOTES

1 While using this means of defining the concave width, it is essential that the cylinder diameter ( see 4.20 ) is also quoted.

2 It shall not be assumed that this concave arc, so described, is totally permeable unless it is so stated ( see angle  $\alpha$  in Fig. 3 ).

#### 4.15.2 Concave Area

The product of concave length or width ( see 4.15.7 ) and concave arc length ( see 4.15.8 ) expressed in square millimetres.

##### NOTES

1 Concave area is not to be taken as means of indicating a component of separation, since there is no distinction between a closed and an open or partly open concave. To indicate the size of concave in the context of separating characteristics, the concave grate area ( 4.15.4 ) shall be used.

2 Where more than one concave is used, the separate area for each shall be calculated.

#### 4.15.3 Concave Grate

That portion of the concave ( see  $L$  in Fig. 4 ) area which is sievable for separation.

#### 4.15.4 Concave Grate Area

The product of concave grate arc length ( see  $L$ , Fig. 4 ) and concave length ( see  $L_2$ , Fig. 5 ) that portion of the concave area which is sievable for separation. This area shall be calculated using the outside dimensions of the sievable surface, and shall be expressed in square centimetres.

NOTE — Where two or more concaves are fitted their separate grate areas shall be stated.

#### 4.15.5 Concave Grate Extension

A sievable element ( see Fig. 4 ) approximately concentric with the cylinder and generally

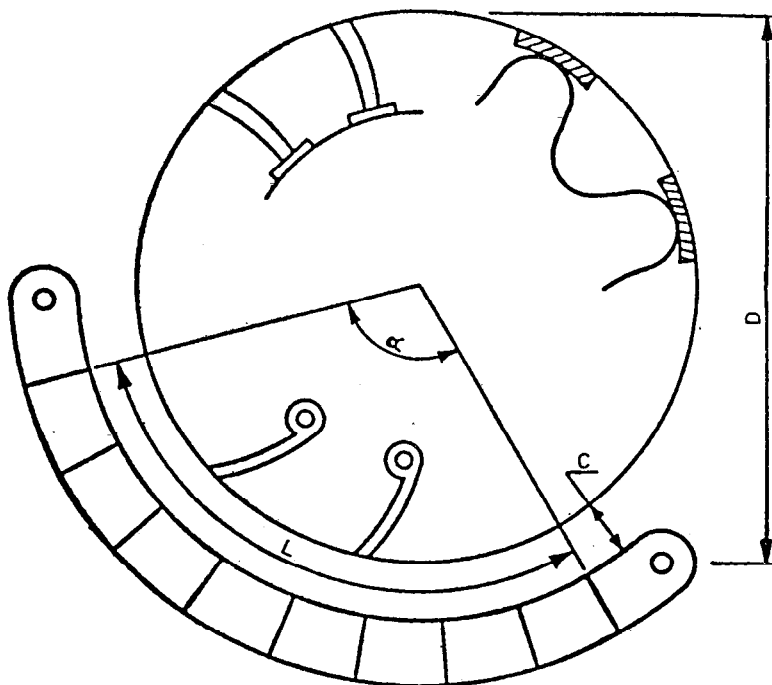


FIG. 3 CONCAVE ARC

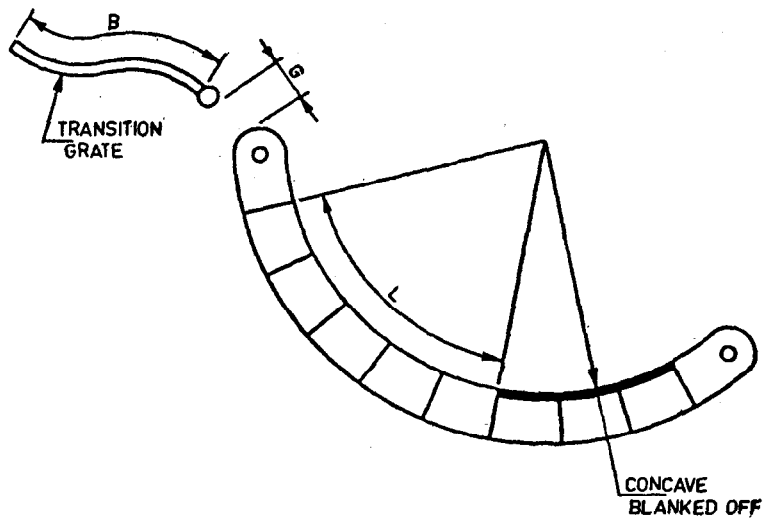


FIG. 4 CONCAVE GRATE EXTENSION

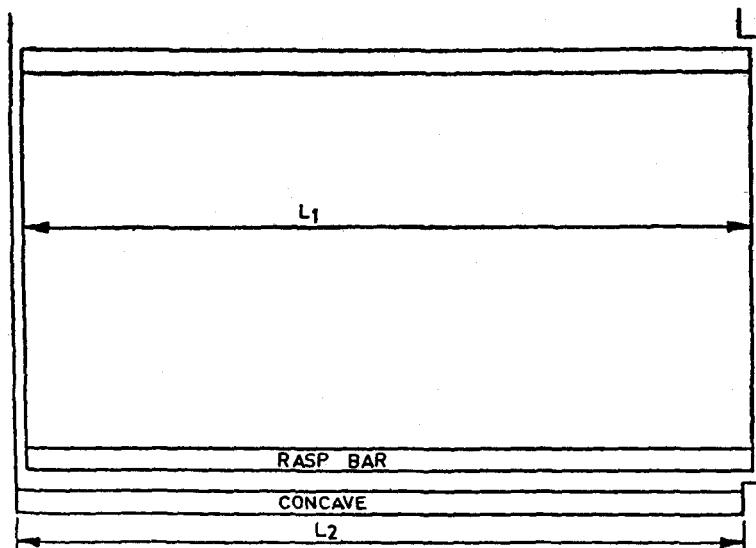


FIG. 5 CYLINDER AND CONCAVE LENGTHS

forming an extension of the concave contour and helps in separating and bringing loose straw to straw walkers ( see 4.60 ).

**4.15.6 Concave Grate Extension Area**

The product of concave grate extension width ( see G in Fig. 4 ) and the concave length ( see 4.15.7 ) expressed in square centimetres.

**4.15.7 Concave Width or Length**

The minimum distance between the two panels

of the combine in which the concave is mounted ( see L<sub>2</sub> in Fig. 5 ) expressed in centimetres.

**4.15.8 Concave Arc Length**

The distance from the front of the first bar to the rear of the last bar, measured along the contour formed by the inner surfaces of the concave bar ( see L in Fig. 3 ) expressed in centimetres.

**4.16 Conveyor Platform**

An assembly for carrying the cut crop to the

threshing unit or to the feeder conveyor ( see 4.25 ).

#### 4.17 Cutter Bar

The assembly comprising finger bar, fingers, knife guides, wearing plate, outer shoe and main shoe, that is, the non-reciprocating part of the cutting mechanism ( see Fig. 6 ).

##### 4.17.1 Cutter Bar Effective Width

The distance between the points at which the tips of the knife sections meet the last effective shearing edges of the guards ( fingers ) or shoes at the extremities of the cutter bar expressed in centimetres ( see Fig. 6 ).

##### 4.17.2 Cutter Bar Height

The height of the forward tip of any knife section above the plane on which the combine is standing expressed in centimetres. Where the height is adjustable, maximum and minimum values shall be measured.

NOTE — The height shall be measured under the conditions given in Notes 1 to 4 under 4.11.

##### 4.17.3 Cutter Bar Lift

Arrangement provided for lifting of the cutter bar.

##### 4.17.4 Cutter Bar Working Width

The distance expressed in centimetres ( see Fig. 6 ) between two vertical planes passing through the points of the outermost dividers and parallel to the centre line of the cutter bar ( see 4.17 ). If adjustable dividers are used, the maximum and minimum dimensions shall be stated.

#### 4.18 Cylinder or Drum

A balanced rotating assembly comprising rasp, beater bars, spikes or bow-wire teeth on its periphery and their support for threshing the crop ( see 7 in Fig. 1 ).

##### 4.18.1 Beater Bar Drum

A cylinder having helically arranged rubber-faced angle iron beater bars.

##### 4.18.2 Peg Drum

A cylinder having rows of spikes or pegs.

##### 4.18.3 Rasp Drum

A cylinder having bars with serrations.

##### 4.18.4 Head-feed Threshing Cylinder

Balanced rotating assembly, comprising bow-wire teeth or spikes on its periphery and their supports, for threshing the crop in the way that the ears and/or upper parts of the crop clamped vertically by the table conveying mechanism, are fed in the cylinder from the front end and stalks are discharged from the rear end.

##### 4.18.5 Auxiliary Cylinder

Rotating component, used in head-feed combines, for rethreshing and separating.

#### 4.19 Cylinder or Concave Clearance

The gap between the tip of the cylinder ( see 4.18 ) to the inner surface of the concave ( see 4.15 ) expressed in millimetres ( see C in Fig. 3 ). The minimum and maximum clearance in a particular setting and adjustment range for both the front and the rear side of the concave shall be stated.

#### 4.20 Cylinder Diameter

The diameter of the circle generated by the outermost point of the cylinder threshing elements ( see D in Fig. 3 ) expressed in millimetres.

NOTE — One or more threshing cylinders can be disposed laterally or axially within the combine.

#### 4.21 Cylinder Length or Width

The distance between the outermost points of the cylinder threshing elements ( see L<sub>1</sub> in Fig. 5 ) expressed in millimetres.

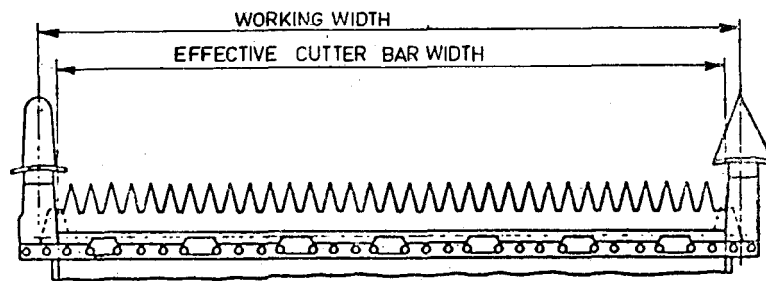


FIG. 6 CUTTER BAR



## NOTES

1 If more than one cylinder is used, this shall be stated and the dimensions of all the cylinders shall be measured.

2 The terms 'cylinder width' shall be used in reference to cylinders disposed laterally; 'cylinder length' in reference to those disposed axially.

3 Single or multiple cylinders or rotors may be disposed laterally ( Fig. 4 ) within the combine. If multiple cylinders or rotors are used, the number shall be stated and the dimensions given as in Fig. 3 and 4.

**4.22 Engine Power**

The corrected gross, rated, brake horse power measured as per IS 10000 ( Part 4 ) : 1980.

**4.23 Engine Displacement**

Engine displacement shall be expressed in cubic centimetres.

**4.24 Feeder Beater**

In front of the threshing cylinder ( *see 4.18* ) and rotating in the same direction, the beater is provided to aid in stripping the crop from the conveyor and feeding it to the cylinder.

**4.25 Feeder Conveyor**

The auxiliary conveyor ( *see 8* in Fig. 1 ) to assist in feeding the crop to the cylinder ( *see 4.18* ).

**4.26 Gathering Width**

The distance between the centre lines of the outermost divider points, expressed in centimetres. Where adjustable dividers are used, the maximum and minimum dimensions shall be stated.

**4.27 Grain Auger**

The device ( *see 9* in Fig. 1 ) which carries the grain to grain elevator ( *see 4.30* ).

**4.28 Grain Discharge Auger**

The device ( *see 10* in Fig. 1 ) which carries the grain from tank to discharge elevator ( *see 4.29* ).

**4.29 Grain Discharge Elevator**

A device to discharge the grain from tank through grain auger ( *see 4.27* ).

**4.29.1 Clearance Height of Unloader or Maximum Clearance Height**

The vertical distance from the plane on which the combine is standing to a point on the underside of the unloader at a horizontal distance of 1 000 mm from lowermost point of the

discharge opening ( *see Fig. 7* ) expressed in centimetres.

NOTE — The height shall be measured under the conditions specified in Notes 1 to 4 under 4.11.

**4.29.2 Discharge Height of Unloader or Maximum Discharge Height**

The vertical distance from the plane on which the combine is standing to the lowermost point under discharge opening with the unloader in operation position ( *see Fig. 7* ) expressed in centimetres.

NOTE — The height shall be measured under conditions specified in Notes 1 to 4 under 4.11.

**4.29.3 Reach of Unloader or Maximum Reach**

The horizontal distance measured perpendicular to the longitudinal centre line of the combine from the innermost point of the unloader discharge opening to the outermost point of the header on the unloader side ( *see Fig. 7* ) expressed in centimetres.

NOTE — The reach shall be measured under the condition specified in Notes 1 to 4 under 4.11.

**4.30 Grain Elevator**

The device ( *see 11* in Fig. 1 ) which carries the grains from grain auger ( *see 4.27* ) to grain tank or bin ( *see 4.32* ).

**4.31 Grain Pan**

The pan ( *see 12* in Fig. 1 ) for collecting the clean grains after being passed through cleaning sieve(s) for conveying to grain auger ( *see 4.27* ).

**4.32 Grain Tank or Bin**

A tank ( *see 13* in Fig. 1 ) to hold the grain after having received from grain elevator ( *see 4.30* ).

**4.33 Ground Clearance**

The height of the lowest point of the combine ( *see 4.10* ) from a level supporting surface when the combine is fitted with all its usual accessories, fuel, radiator, hydraulic, lubrication and grain tank full and the tyres inflated to recommended pressure for field work and expressed in centimetres.

NOTE — The ground clearance shall be measured under the conditions given in 4.11.

**4.34 Ground Contact Area ( Track )**

Product of track chain length ( *see 4.39* ) and width on ground ( *see 4.69* ) multiplied by two (  $\text{Length} \times \text{Width} \times 2$  ) expressed in square centimetres.

**4.35 Header**

The portion of the combine ( *see 4.10* ) comprising the mechanism for gathering, cutting,

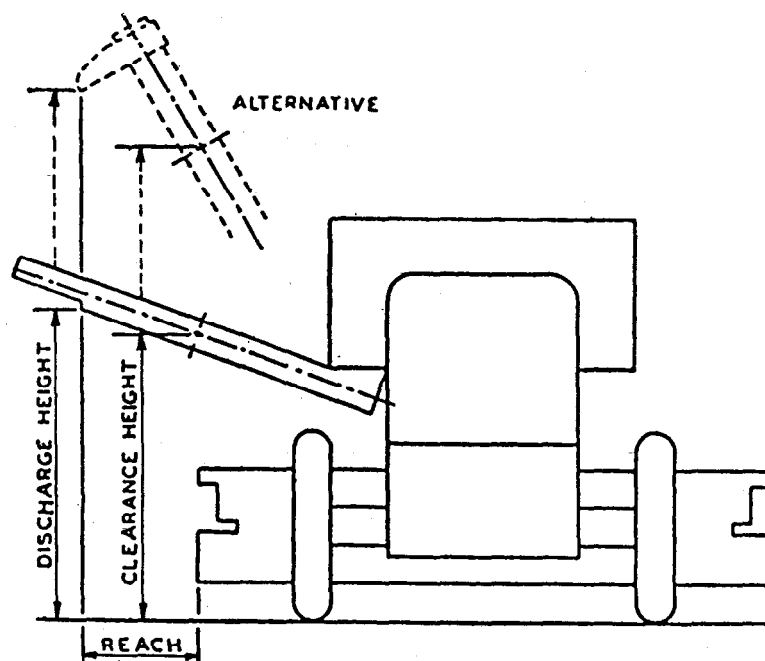


FIG. 7 UNLOADER ( REACH, CLEARANCE HEIGHT AND DISCHARGE HEIGHT )

stripping or picking the crop and deliver it to the cylinder ( see 4.18 ).

NOTE — Small combines often use scoop-type headers with a canvas conveyor to take the crop to the cylinder. Large combines use T-type headers with auger tables which bring the crop to a conveyor feeding to the cylinder. Auger tables have now largely replaced the canvas tables.

#### 4.35.1 Grain Header Width

The distance between the side sheets of the feed table measured immediately above the tips of the knife sections expressed in centimetres. Where the feed table is offset from the centre line of the machine, the amount of offset and whether it is to left or right shall be stated.

#### 4.35.2 Header Working Width

Distance between the centre lines of the outermost divider points, expressed in centimetres. Where adjustable dividers are used, the maximum and minimum dimensions shall be stated.

#### 4.36 Hill Divider

The projections provided on stepped grain bed ( see 4.53 ), chaffer ( see 4.3 ) and cleaning sieve(s) ( see 4.8 ), to prevent material from sliding to one side specially when working on slopes ( see Fig. 2 ).

#### 4.37 Hummeler Plate

A plate attached below the feed of the concave

( see 4.15 ) for removing awns from the grains ( see 14 in Fig. 1 ).

NOTE — In some combines, a separate deawning unit which could be engaged or disengaged is provided.

#### 4.38 Knife

The reciprocating part of the cutting mechanism comprising knife head, knife back and knife sections.

##### 4.38.1 Knife Frequency

The number of the cycles the knife makes in a given period of time. One cycle is full movement of the knife in one direction and its return to the starting point. Frequency shall be expressed in whole cycles per second.

##### 4.38.2 Knife Registration

The alignment of centre line of knife section with the centre line of guard.

##### 4.38.3 Knife Stroke

The distance that a point of the knife travels with respect to the centre line of a guard in one half cycle expressed in millimetres.

#### 4.39 Length of Track-Chain on Ground

Length at base of track shoes disregarding the grouser, as measured between first and last track roller centres, or from front idler wheels centre

line if they are so designed as to hold the track chain level with the track rollers expressed in centimetres ( see  $L$  in Fig. 8 ).

#### 4.40 Lifter

Device for gathering a crop from a windrow and conveying the cut crop to the table conveying mechanism.

#### 4.41 Lifting Speed Index

The ratio between the peripheral speed of lifting chains and the operating speed of combines.

#### 4.42 Maize Header Effective Width

The average distance between the centre lines of adjacent picking units multiplied by the number of units. Where the header width is adjustable, maximum and minimum dimensions shall be stated. Effective width shall be expressed in centimetres and the number of picking units shall be stated.

#### 4.43 Median Plain of Wheels or Tracks

It is equidistant from the two planes containing the periphery of the rim or tracks at their outer edges.

#### 4.44 Pick-up Attachment

A device for gathering the crop from a windrow.

##### 4.44.1 Pick-up Attachment Width

The minimum distance including the width of the outermost conveying elements but not including the gather of the flared side sheets expressed in centimetres.

#### 4.45 Rear Beater

An element ( see 15 in Fig. 1 ) placed on the rear side of the cylinder ( see 4.18 ) and above

to rear ward of concave ( see 4.15 ) or concave grate extension ( see 4.15.5 ) or transition grate ( see 4.65 ) to assist the deflection of straw on straw walker ( see 4.60 ). It also assists in stripping the straw from the cylinder ( see 4.10 ) and prevents it from wrapping around.

#### 4.46 Reel

Revolving slats or arms with battens ( see 16 in Fig. 1 ), arranged parallel to the cutter bar ( see 4.17 ) to hold the crop being cut by the knife ( see 4.38 ) and to push and guide it to a conveyor platform ( see 4.16 ) or feeder conveyor ( see 4.25 ) auger. The reels may be of spring-tine type or slat type.

#### 4.47 Rotary Combine Separation Element

Permeable element or elements approximately concentric with the rotating member or members.

##### 4.47.1 Rotary Separation Length

Longitudinal length of the permeable area measured parallel to the axis of the rotor or rotors expressed in centimetres.

##### 4.47.2 Rotary Separation Width

Distance of the permeable area measured around the contour formed by the inner surfaces expressed in centimetres.

##### 4.47.3 Rotary Separation Area

Product of the separation width and length expressed in square centimetres. Where two or more individual centrifugal separation assemblies are used in a combine, the rotary separation area shall be the summation of the permeable area around the separator sections of the rotating components.

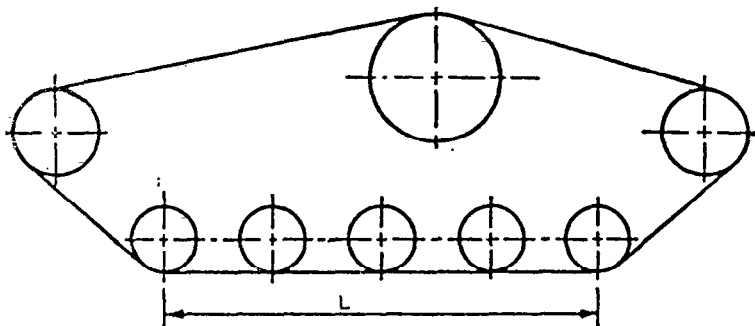


FIG. 8 TRACK-CHAIN

#### 4.47.4 Rotary Separator

An alternative form for a rotary device, similar to a cylinder, which is fitted to promote separation only.

#### 4.48 Rotary Cutter

Rotary component of the header for cutting the crop.

#### 4.49 Separating Devices

All non-threshing separation elements.

##### 4.49.1 Separating Grate

A permeable element, which in conjunction with a relatively-moving device adjacent to it, is fitted to promote separation.

##### 4.49.2 Separating Grate Length or Width

The outside dimension of the permeable area including frame members, measured parallel to the axis of its associated cylinder or rotor; expressed in centimetres.

##### 4.49.3 Separating Grate Arc Length

The outside dimension of the permeable area including frame members, measured in a plane perpendicular to the axis of its associated cylinder or rotor; expressed in millimetres. It may be expressed in degrees if the diameter of the associated cylinder or rotor is also quoted ( see 4.15.1 and 4.15.8 ).

##### 4.49.4 Separating Grate Area

The product of separating grate length ( or width ) and arc length; expressed in square centimetres to the nearest hundredth.

##### 4.49.5 Separating Drum

A rotating permeable drum, with its axis approximately horizontal, in which separation is promoted by the tumbling action of the crop material contained within.

##### 4.49.6 Separating Drum Area

The product of the length and inside perimeter of the permeable area; expressed in squaremetres to the nearest hundredth. Drum inside diameter, expressed in centimetres, should also be stated.

##### 4.49.7 Auxiliary Separating Devices

Means of separating, auxiliary to the main separating mechanisms, and other than those items mentioned in 4.49.1, 4.60.2, and 4.49.5.

#### 4.50 Shoe

The oscillating structure which supports cleaning sieve(s) ( see 4.8 ) and which may also support the chaffer ( see 4.3 ) and chaffer extension ( see 4.4 ) ( see Fig. 9 and 10 ).

#### 4.51 Snapping Rolls

Device for gathering a maize and picking up cobs.

#### 4.52 Specific Ground Pressure

The quotient of front axle mass ( or combine mass in case of full-track-laying combines ) and ground contact area ( see 4.34 ) giving a rating comparable to tyre pressure in case of wheeled combine expressed in kPa.

#### 4.53 Stepped Grain Bed

An oscillating bed or pan ( see 17 in Fig. 1 ) on which the grain and chaff mixture fall from the cylinder ( see 4.18 ) and straw walker ( see 4.60 ).

#### 4.54 Stone Trap

A device ( see 18 in Fig. 1 ) mounted on the feeding side of the cylinder ( see 4.18 ) to trap the stones or any other similar objects in order to avoid any damage to the crop conveying and threshing unit.

#### 4.55 Straw Choppers

Devices for chopping stalks.

#### 4.56 Straw Spreaders

Devices for spreading stalks in the field.

#### 4.57 Straw Collectors

Devices for collecting stalks and placing stalks in stacks in the field.

#### 4.58 Straw Rack

An oscillating rack assembly of one piece construction which separates the remaining grain from straw.

#### 4.59 Straw Spreader-cum-Cutter

A component used to cut the straw in pieces coming out from walker ( see 4.60 ) or rack ( see 4.58 ) and to spread in the field.

#### 4.60 Straw Walker

The assembly of two or more racks ( see 4.58 ) which agitates the straw and separates the remaining grains from straw ( see 19 in Fig. 1 ).

##### 4.60.1 Straw Raddle Area

The product of raddle length ( see C in Fig. 10 ) and the exposed width of raddle ( see R in Fig. 11 ) expressed in square centimetres.

##### 4.60.2 Straw Walker or Straw Rack Area

The product of the straight length ( see P in Fig. 9 and 10 ) and the inside width ( see G in Fig. 11 ) of the separator side structure

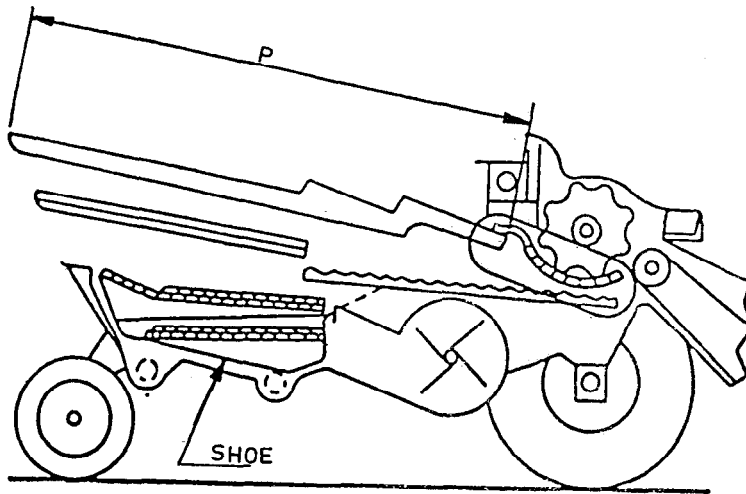


FIG. 9 COMBINE SIDE VIEW

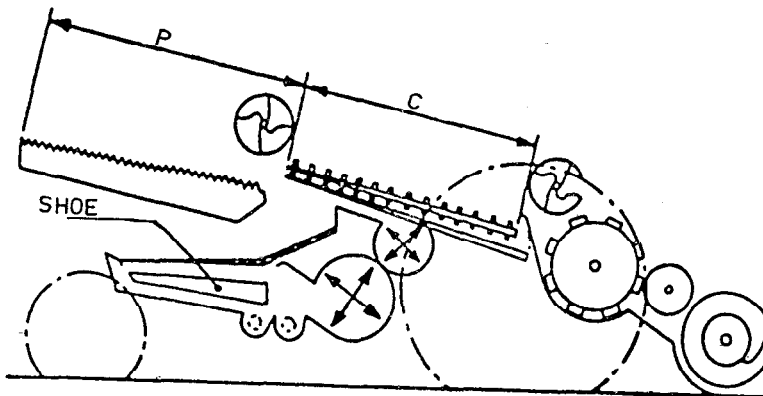


FIG. 10 COMBINE SIDE VIEW

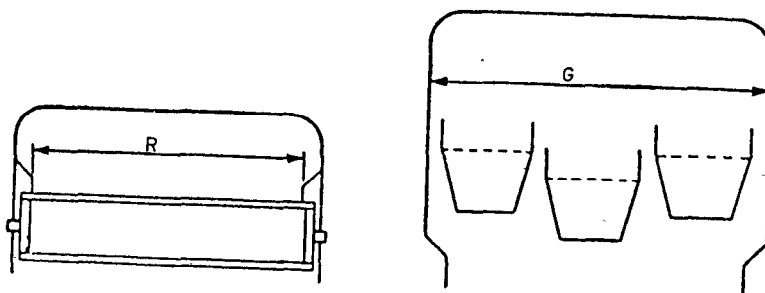


FIG. 11 STRAW RADDLE AND STRAW WALKER ,

immediately adjacent to the straw walker or rack, expressed in square centimetres.

NOTE — Where walker extensions are used, the length ( *see P* in Fig. 9 and 10 ) shall be taken with the adjustable portion fully extended.

#### 4.61 Tailing Auger

A device ( *see 20* in Fig. 1 ) which carries tailings from pan ( *see 4.64* ) to elevator ( *see 4.63* ).

#### 4.62 Tailing Board

A device ( *see 21* in Fig. 1 ) provided at rear side of the cleaning unit to prevent unthreshed material from passing out of the combine ( *see 4.10* ).

#### 4.63 Tailing Elevator

A device ( *see 22* in Fig. 1 ) to carry tailings from auger ( *see 4.61* ) to cylinder ( *see 4.18* ) for rethreshing.

#### 4.64 Tailing Pan

A pan ( *see 23* in Fig. 1 ) on which the unthreshed grains and ears are collected after being removed from cleaning unit.

#### 4.65 Transition Grate

A permeable element or elements ( *see Fig. 4* ) to provide transition from the concave ( *see 4.15* ) or concave grate extension ( *see 4.15.5* ) to the straw rack ( *see 4.58* ), walker ( *see 4.60* ) or a second concave.

##### 4.65.1 Transition Grate Area

The product of the transition grate width ( *see 4.65.2* ) and the concave length ( *see 4.15.7* ) expressed in square centimetres.

##### 4.65.2 Transition Grate Width

The distance along the contour of the upper surface of the transition grate ( *see 4.65* ) expressed in millimetres ( *see B* in Fig. 4 ).

#### 4.66 Turning Radius

The distance from the turning centre to the centre of ground contact of the wheel describing the largest circle while the combine is taking its shortest turn for the respective steering brake condition expressed in centimetres.

#### NOTES

1 It shall be measured on a clean, dry, level concrete or equivalent hard surface for both left- and right-hand turning with and without steering brakes in use.

2 The wheel base and guide wheel track width shall be stated.

3 The combine shall be operated at a speed not exceeding 2 km/h.

#### 4.67 Turning Space

The diameter of the circle, described by the

outermost point of the combine when it takes shortest turn, expressed in centimetres.

#### NOTES

1 Any other attachments affecting this dimensions shall be specified.

2 The wheel base and guide wheel tread width shall be stated.

3 The combine shall be operated at a speed not exceeding 2 km/h.

#### 4.68 Unloading Platform

A flat table for placing grain sacks and providing for operators to stand on.

#### 4.69 Wheel Base

The horizontal distance between front and rear wheels on a wheeled combine ( *see 4.10.1.1* ) measured at the centre or ground contact.

#### 4.70 Wheel Track

The distance between the median planes of wheels or tracks ( *see 4.43* ) on the same axle measured at the point of ground contact.

#### 4.71 Width of Track-Chain on Ground

Width of track shoes including rounded ends, if any, expressed in centimetres.

#### 4.72 Wind Deflector

A device ( *see 24* in Fig. 1 ) to direct the air blast over the sieve(s) ( *see 4.8* ). The upper wind deflector is set to throw the air blast to the front of the shoe ( *see 4.50* ) while lower to direct the air more towards the centre of the shoe to avoid accumulation of the material.

### 5 COMBINE OPERATION AND PERFORMANCE

#### 5.1 Operations

##### 5.1.1 Chaffing

The process of pneumatic cleaning of grain.

##### 5.1.2 Cleaning

The operation of isolating the desired grain from chaff, small debris, and incompletely unthreshed grains.

##### 5.1.2.1 Screening

The operation of isolating the desired grains by a mechanical device where the desired grain is carried over the device and the undesired material penetrates the device.

##### 5.1.2.2 Sieving

The operation of separating the desired grains by a mechanical device where the desired grain penetrates the device and the undesired material is carried over the device.

##### 5.1.3 Feeding

The operation of conveying the cut crop into threshing unit.

### 5.1.4 Harvesting

The operation of detaching, picking or cutting the crop from the undesired portion of the same rooted to the ground.

### 5.1.5 Returns

The process for recirculating incompletely threshed or completely unthreshed grain for further processing.

### 5.1.6 Separating

The operation of isolating the detached grain, small debris and incompletely threshed or completely unthreshed grain from the bulk of straw, stem or stalk.

### 5.1.7 Threshing

The operation of detaching the grains from the ear head, cob or pod.

## 5.2 Performance

### 5.2.1 Capacities

#### 5.2.1.1 Combine capacity

The maximum sustained total feed rate in standing crop at which the processing loss ( see 5.2.10.5 ) is within the limit specified in col 6, Table 1. When the combine is operating at rated speed on level ground without chocking of threshing, separating, cleaning and grain conveying mechanism and without stalling of prime mover. It shall be expressed in metric tons per hour or kilograms per hour. The test shall be conducted in accordance with IS 8122 ( Part 2 ) : 1981. The crop, its general condition, the material-other-than-grain to grain ratio

( MOG : G ) and moisture content of the grain and material-other-than-grain expressed in percent shall be stated. A typical range of material-other-than-grain to grain ratio ( MOG : G ) and the percentage moisture content within which performance testing should be conducted is given in Table 1 for guidance.

#### 5.2.1.2 Grain output capacity

The mass of the grain mixture delivered by the combine per unit of time, at which the processing loss, with the combine in field operation on level ground is within the limits specified in Table 1. It shall be expressed in metric tons per hour or kilograms per hour.

NOTE — In all combines, grain is cleaned at least once by a primary cleaning mechanism to remove impurities, such as chaff, etc. In some combines, the mixture resulting from such primary cleaning is further graded or cleaned by a secondary cleaning mechanism. In such cases, the output of the two or more cleaning and/or grading mechanism shall be added together to obtain the total grain output.

#### 5.2.1.3 Grain tank capacity

The number of the volumetric units of wheat that are unloaded by its own unloading system expressed in cubic metres grain throughout.

#### 5.2.1.4 Straw output

The mass of the straw and chaff, net of grain losses, delivered by the combine per unit of time.

### 5.2.2 Efficiencies

#### 5.2.2.1 Cleaning efficiency

Clean grains ( see 5.2.5.1 ) present in the total grain obtained from the main outlet expressed in percentage by mass.

**Table 1 Suggested Crops and Conditions for Capacity Testing**

( Foreword and Clause 5.2.1.1 )

Sl No.	Crop	Acceptable Range of Straw Grain Ratio	Range of Moisture Content in Percent		Acceptable Limit of Processing Loss in Percent, Max
			Grain	Straw	
(1)	(2)	(3)	(4)	(5)	(6)
i)	Wheat	0.6 to 1.5	5 to 15	5 to 10	( 2.5 )
ii)	Paddy	1.0 to 2.4	10 to 25	20 to 70	( 2.5 )
iii)	Gram	0.6 to 1.2	5 to 15	5 to 15	( 2.5 )
iv)	Soyabean	0.5 to 2.5	10 to 20	20 to 70	( 4.0 )

### NOTES

1 If crop and/or climate conditions do not permit test data to be obtained under the conditions listed in Table 1, the circumstances shall be reported and actual values reported against such observed readings and shall not be taken for capacity for each loss evaluation.

2 The graphs shall be plotted for presentation of processing loss results, with total feed rate, MOG feed rate or grain feed rate as horizontal coordinate. The test values for each test run shall be plotted on graphs.

3 The capacity of the machine shall be the feed rate level at which the loss curve intersects the specified level of processing loss as given in Table 1.

4 Straw grain ratio means weight of straw decided by grain feed to the combine including header losses.

### 5.2.2.2 Field efficiency

The quotient of effective field capacity and theoretical field capacity expressed in percent.

### 5.2.2.3 Threshing efficiency

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.

## 5.2.3 Feed Rates

### 5.2.3.1 Grain feed rate

The mass of the grain including processing loss passing through the combine per unit of time expressed in kilograms per second or tonnes per hour.

### 5.2.3.2 Material-other-than-grain ( MOG ) feed rate

The mass of the material-other-than-grain passing through the combine per unit of time expressed in kilograms per second or tonnes per hour.

### 5.2.3.3 Total feed rate

The sum of grain feed rate and ( MOG ) feed rate. The total feed rate shall be expressed in kilograms per second or tonnes per hour and the material-other-than-grain to grain ratio ( MOG : G ) shall be specified.

## 5.2.4 Foreign Matter

Includes inorganic and organic matter. The inorganic matter shall include sand, gravel, dirt, pebbles, stones, lumps of earth, clay, mud and iron chips. The organic matter shall include chaff, straw, weedseeds and other inedible grains.

## 5.2.5 Grains

### 5.2.5.1 Clean grain

The threshed grain free from damaged grain ( see 5.2.5.2 ) and foreign matter ( see 5.2.4 ).

### 5.2.5.2 Damaged grain

Wholly or partially cracked or broken grains.

### 5.2.5.3 Grain mixture

The mixture of clean ( see 5.2.5.1 ), damaged ( see 5.2.5.2 ), unthreshed grain ( see 5.2.5.4 ) and foreign matter ( see 5.2.4 ) coming out of the grain outlet.

### 5.2.5.4 Unthreshed grain

Grain still in the pads or ear heads after the threshing.

## 5.2.6 Grain Tank Unloading Time

It is the minimum time in seconds, required to unload the grain tank capacity ( see 5.2.1.3 ).

## 5.2.7 Moisture Content

Moisture content of the crop shall be expressed on the wet basis. The percentage moisture content of grain and the moisture content of material other than grain shall be determined from sample taken from the discharge of the combine during the test period.

## 5.2.8 Plant Length

The length of the plant from its base at ground level to its top when the plant is straightened; expressed in centimetres.

## 5.2.9 Stubble Length

The length of the plant stalk attached to the ground immediately after harvesting; expressed in millimetres to the nearest 10.

## 5.2.10 Losses

### 5.2.10.1 Collectable loss

The unthreshed ear heads in main grain outlet or grain tank; threshed, unthreshed and damaged grains from the secondary cleaning or grading unit.

### 5.2.10.2 Header loss

The loss of grains and ear heads being shed and left over on the ground as a result of operations of cutter bar and header unit.

### 5.2.10.3 Non-collectable loss

The header loss, shoe loss, rock loss and secondary blower loss.

### 5.2.10.4 Pre-harvest loss

The loss of grain or ear heads from the standing crop prior to the operation of combine in the field.

### 5.2.10.5 Processing loss

The loss of grains in terms of damaged, unthreshed and threshed obtained after completion of threshing, separating and cleaning operations.

- a) *Cylinder loss* — The loss of unthreshed heads and damaged grains passing out of threshing cylinder, rock and shoe loss.
- b) *Rack loss* — The threshed grains passing out in the straw.
- c) *Shoe loss* — The threshed grains blown or carried out with the chaff.

NOTE — The processing loss and header loss shall be expressed as percentage of the grain feed rate.

### 5.2.10.6 Leakage loss

Any involuntary loss of grain from the combine other than those described above.

## 5.2.11 Unloading Rate

The volume of grain unloaded per unit time expressed in cubic centimetre per second.



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