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Equipment for harvesting — Combine harvesters — Test procedure and performance assessment

Matériel de récolte — Moissonneuses-batteuses — Mode opératoire d'essai et évaluation des performances

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

The procedures used to develop this document and those intended for its further maintenance are described in the ISO/IEC Directives, Part 1. In particular, the different approval criteria needed for the different types of ISO documents should be noted. This document was drafted in accordance with the editorial rules of the ISO/IEC Directives, Part 2 (see www.iso.org/directives).

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights. Details of any patent rights identified during the development of the document will be in the Introduction and/or on the ISO list of patent declarations received (see www.iso.org/patents).

Any trade name used in this document is information given for the convenience of users and does not constitute an endorsement.

For an explanation of the voluntary nature of standards, the meaning of ISO specific terms and expressions related to conformity assessment, as well as information about ISO's adherence to the World Trade Organization (WTO) principles in the Technical Barriers to Trade (TBT), see www.iso.org/iso/foreword.html.

This document was prepared by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, Subcommittee SC 7, *Equipment for harvesting and conservation*.

This second edition of ISO 8210 cancels and replaces ISO 8210:1989 and ISO 6689-2:1997, which have been technically revised.

The main changes compared to the previous edition are as follows.

— Test and performance requirements formerly found in ISO 6689-2 have been added.

— Keys have been added to Figures 1 and 2.

— Clarifications have been made in Clause 7.

Any feedback or questions on this document should be directed to the user's national standards body. A complete listing of these bodies can be found at www.iso.org/members.html.

Equipment for harvesting — Combine harvesters — Test procedure and performance assessment

1 Scope

This document specifies a test procedure for the measurement and testing of combine harvesters. It applies to either self-propelled or trailed type, either directly cutting the crop or picking it up from a windrow, for use in several crops.

This document specifies the terminology and methods to be used for measuring important characteristics of combine harvesters. It includes both functional and capacity tests, in other words, those conducted over an extended period when ease of operation, ease of adjustment, rate of work and general operating characteristics can be assessed, and those carried out on specific occasions for the determination of grain loss and capacity characteristics.

It applies to all types of combine harvesters.

2 Normative references

The following documents are referred in the text in such a way that some or all of their content constitutes requirements of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 789-3, *Agricultural tractors — Test procedures — Part 3: Turning and clearance diameters*

ISO 4254-7, *Agricultural machinery — Safety — Part 7: Combine harvesters, forage harvesters, cotton harvesters and sugar cane harvesters*

ISO 5007, *Agricultural wheeled tractors — Operator's seat — Laboratory measurement of transmitted vibration*

ISO 5131, *Tractors for agriculture and forestry — Measurement of noise at the operator's position — Survey method*

ISO 5687, *Equipment for harvesting — Combine harvesters — Determination and designation of grain tank capacity and unloading device performance*

ISO 5702, *Equipment for harvesting — Combine harvester component parts — Equivalent terms*

ISO 6689-1[1], *Equipment for harvesting — Combine harvesters and functional components — Vocabulary*

ISO 14396, *Reciprocating internal combustion engines — Determination and method for the measurement of engine power — Additional requirements for exhaust emission tests in accordance with ISO 8178*

3 Terms and definitions

For the purposes of the documents, the terms and definitions given in ISO 5702, ISO 6689, ISO 4254-7 and the following apply.

ISO and IEC maintain terminological databases for use in standardization at the following addresses:

— ISO Online browsing platform: available at https://www.iso.org/obp

1) Under preparation. Stage at the date of publication: ISO/FDIS 6689:2021.

— IEC Electropedia: available at http://www.electropedia.org/

3.1
test combine harvester
subject combine harvester or combine harvester configuration to be tested

3.2
comparison combine harvester
other combine harvester or combine harvester configuration to which the test machine is compared, if applicable

3.3
test series
all events and data comprising several *test runs* (3.4)

3.4
test run
events necessary to record a single set of measurements

3.5
catch
mass of any material collected during the *test run* (3.4)

3.5.1
grain catch
material collected through the primary clean grain discharge point for the purpose of sample analysis

3.5.2
separator catch
material collected from the machine's normal point of discharge from the separator

3.5.3
cleaning catch
material collected from the machine's normal point of discharge from the cleaning system

4 General requirements

4.1 The way in which the combine was selected or obtained for testing and the approximate duration of any running prior to test shall be stated in the test report.

4.2 The combine harvester shall normally be operated in accordance with the manufacturer's instructions. The test report shall record and give reasons for any significant departure from them.

4.3 Commercially available accessories as necessary or desirable for the various crops in which the combine is to be used shall be reported.

4.4 Setting and adjustments of the machine shall be generally in accordance with the manufacturer's operator's manual. The actual settings shall be recorded and reported.

5 Characteristics of machine

5.1 Significant details

All significant details of the combine harvester shall be established and verified in accordance with the definitions, characteristics and performance criteria laid down in ISO 6689. All dimensions and performance relating to combine harvesters and their functional components, shall be assessed in accordance with ISO 6689 and any requirements in this document.

5.2 Speeds

5.2.1 For self-propelled combine harvesters, measurements of the speed of any component shall be made under "no-load" conditions with the governor control lever set in the normal working position corresponding to the required working combine harvester regime.

5.2.2 For power take-off (PTO) driven machines, these speeds shall be measured at standard PTO rotational frequency (540 min^{-1} ± 10 min^{-1} or 1 000 min^{-1} ± 25 min^{-1}). (See ISO 500-1).

5.2.3 Ground speeds shall be measured on a hard, horizontal surface (see ISO 3965), with the governor control lever in the normal working position and the crop processing mechanism disengaged.

5.2.4 If the combine harvester is fitted with stepless speed change mechanism, the maximum and minimum speeds obtained for each gear shall be measured. Otherwise, speeds obtained for all combinations of the gears shall be measured.

5.3 Configurations

Component modes for each configuration shall be in accordance with the manufacturer's recommendations. Refer to the combine harvester's operator's manual for applicable configuration for each operating environment.

NOTE Table 1 is presented for reference.

Table 1 — Component modes for each configuration

		Position of component	
Item #	**Component**	**Transport**	**Field**
1	Front axle	Transport mode	Operational
2	Rear axle	Transport mode	Operational
3	Auxiliary axle	Down	Up
4	Operator access ladders	Narrowest	Safest position
5	Covers/shielding/cosmetic panels	Narrowest	Operational
6	Unload device	Cradle	Outermost limit
7	Unload device auxiliary	Collapsed	Operational
8	Feederhouse	Recommended	Operational
9	Straw and/or chaff spreader	Transport mode	Operational
10	Grain tank extension	Transport mode	Operational
11	Lighting and marking	Transport mode	Operational
12	Mirrors	Transport mode	Operational
13	Antennas	Transport mode	Operational

5.4 Dimensions

Dimensions of combine harvesters shall be measured according to either field operation or transport operation as indicated in Table 2 and as defined in 5.4.1 to 5.4.8.

Table 2 — Summary of machine configurations for each measurement

		Configuration	
Subclause reference	**Measurement**	**Transport**	**Field**
5.4.1	Combine harvester length	X	X
5.4.2	Combine harvester height	X	X
5.4.3	Combine harvester width	X	X
5.4.4	Turning diameter	X	X
5.4.5	Clearance diameter	X	X
5.4.6	Head working widths		X
5.4.7	Head working widths - Maize		X
5.4.8	Ground clearance		X
5.4.8	Maximum discharge height		X
5.4.8	Maximum clearance height		X
5.4.8	Maximum reach		X
5.4.8	Height of cutterbar		X

5.4.1 Combine harvester length shall be measured, both in transport configuration and equipped for field configuration. In the field conditions, the head shall be fully raised and the reel fully forward; the longest available divider shall be fitted. If other equipment, options or attachments affect the length, such equipment shall be specified.

5.4.2 Combine harvester height shall be measured with all components in position for transport configuration. The height with all components in position for field configuration shall be measured. It shall be stated whether or not the combine harvester is fitted with a cab.

5.4.3 Combine harvester width shall be measured both in the transport configuration and equipped for field configuration. In the field condition, the head fitted shall be the same as that fitted when determining head working width and effective cutterbar width as specified in ISO 6689.

5.4.4 The turning diameter shall be measured in accordance with ISO 789-3 without applying the brakes.

If the left-hand and right-hand turning radius are not equal, both should be stated.

5.4.5 The clearance diameter shall be measured in accordance with ISO 789-3.

If the left-hand and right-hand clearance diameter are not equal, both should be stated.

5.4.6 Where adjustable dividers are used, the minimum and maximum head working widths shall be indicated.

5.4.7 Where the header width is adjustable, the minimum and maximum effective working widths of maize head cutters shall be indicated, including the number of picking units.

5.4.8 The ground clearance, the maximum discharge height, the maximum clearance height, the maximum reach, length of unloader, and the height of the cutterbar shall be determined under the following conditions.

a) Tyre and wheel or track equipment shall be stated, and tyres shall be inflated to the field operating pressures recommended by the combine harvester manufacturer.

b) The plane on which the combine harvester is standing shall be substantially level.

c) The size and type of head and reel installed at the time of measuring shall be stated.

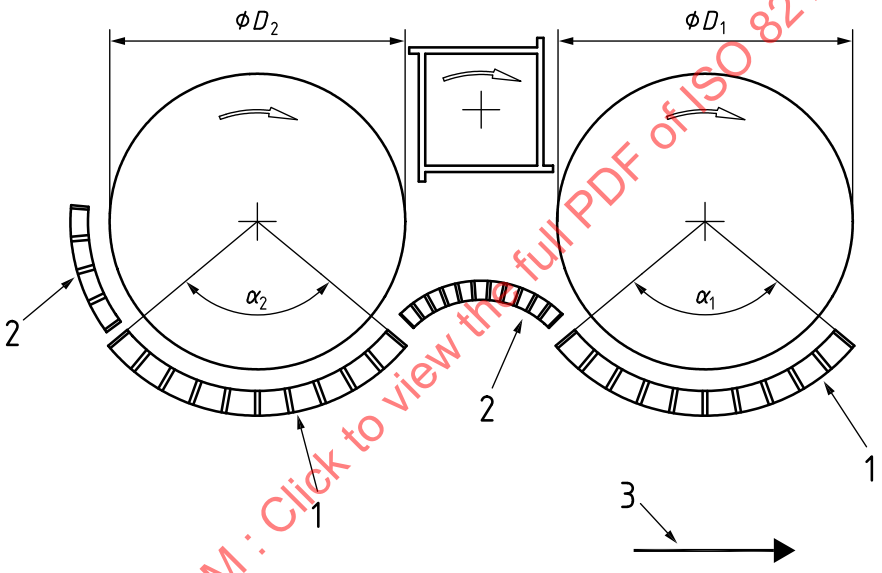
d) All optional equipment mounted on the combine harvester shall be specified.

5.4.9 Furthermore, the height of the cutterbar shall be stated as the highest point and the lowest point to which the cutterbar can be raised or lowered, measured from the ground plane to the tip of the knife section.

5.5 Other measurements

5.5.1 Cylinders and rotors

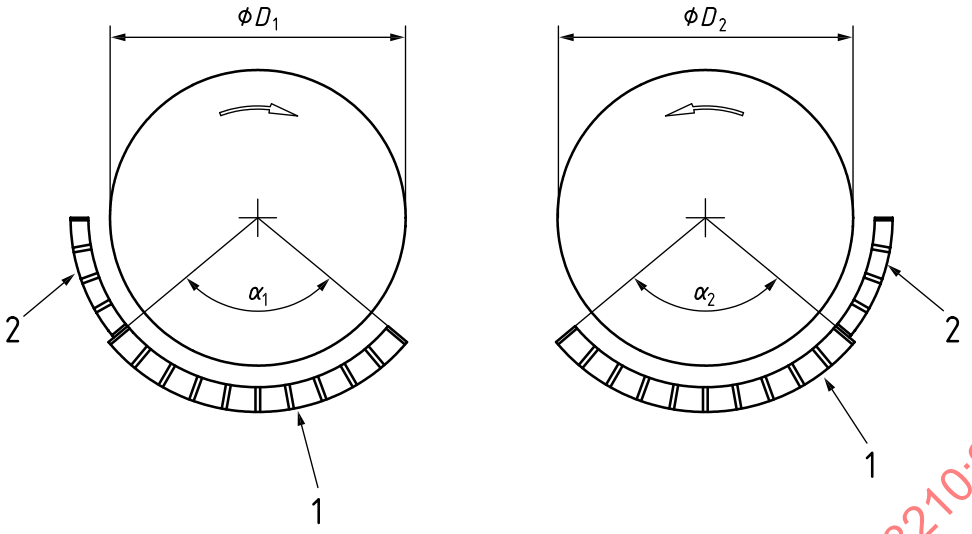
Single or multiple cylinders or rotors may be disposed laterally (see Figure 1) or longitudinally (see Figure 2) within the combine harvester. If multiple cylinders or rotors are used, the number shall be stated, and the dimensions given as in Figures 1 and 2.



Key

1	concave grate
2	concave grate extension
3	direction of combine harvester travel
α_1	concave arc
α_2	concave arc
ϕD_1	threshing cylinder diameter
ϕD_2	separating cylinder diameter

Figure 1 — Laterally disposed cylinders or rotors



Key

1	concave grate
2	concave grate extension
α_1	concave arc #1
α_2	concave arc #2
ϕD_1	rotor diameter #1
ϕD_2	rotor diameter #2

Figure 2 — Longitudinally disposed cylinders or rotors (viewed from rear)

5.5.2 Concaves

5.5.2.1 If more than one concave is used, the dimensions and surfaces of each of them shall be indicated separately. The concave grate surfaces are cumulative.

5.5.2.2 If the combine harvester has more than one rotor, with its related concave and separating grates, the quantity shall be indicated with the length and the area of the separating grate.

5.5.2.3 When using concave arc to describe the concave, the diameter of the associated cylinder, or rotor, shall also be noted (see Figures 1 and 2). If the concave arc varies with concave adjustment, then the ranges of arc should be noted.

5.5.3 Separating devices

5.5.3.1 5.5.2.2 also applies for separating grates and secondary separating grates.

5.5.3.2 The surface of auxiliary separating devices shall not be added to that of separating devices.

5.5.4 Straw walker

If there are adjustable sections at the rear of the straw walker, they shall be fully extended when determining the length of the walkers.

5.5.5 Conveying devices

Devices that only convey material within the combine harvester (for example, grain pans, augers, paddles and other non-permeable conveyors) while they can contribute to good separation by stratifying

the material advantageously, do no actual separation of grain from material other than grain (MOG), and their areas may not be classified as separating areas, or added to the other separating areas.

5.5.6 Sieves and sieve area

To determine the sieve area where sieve extensions are used in the standard specifications of the combine harvester, their surfaces shall be measured by the same means and these conditions shall be stated. The component sieves and sieve extensions may be totalled and represented as total sieve area. If a grain pan extension comb (grate or fingers) is used to achieve suspension of the grain mat, its area should not be included when establishing the cleaning area.

5.5.7 Dirt screens, recleaners and other auxiliary cleaning devices

These surface areas of these devices shall be specified.

5.5.8 Permeable surfaces

Sieve area and pneumatic cleaning areas shall be calculated and expressed.

5.5.9 Functional components

For the purposes of reporting combine harvester specifications, the functional component areas defined in ISO 6689:—, 3.6 and covered in 5.5 shall be listed separately and individually. Areas shall not be used singly or in combination as a measure of a combine harvester's capacity, performance or value.

5.6 Other characteristics

5.6.1 The engine net power shall be determined in accordance with ISO 14396.

5.6.2 The throughputs defined in ISO 6689:—, 4.1 and measured in 7.2.5, shall be indicated with the corresponding MOG:G ratio value.

5.6.3 When indicating the combine harvester mass equipped for operation in the field, the accessories fitted to the combine harvester shall be listed and their mass indicated.

5.7 Position of centre of gravity

5.7.1 It shall be specified, for the machine tested, whether it is equipped with powered rear-wheel drive or not and if it has a chopper attachment. This is a supplementary measurement applicable to self-propelled combine harvesters only.

5.7.2 The position of the centre of gravity shall be determined under the conditions outlined in Table 3. See also ISO 16231-2.

Table 3 — Machine configuration for determining centre of gravity

Component or entity	Condition
Machine	Empty of crop
Header	Fully raised
Reel	Most forward position
Fuel tank(s)	Full
Grain tank(s)	Full
Driver	Simulated by the mass of 75 kg placed on the driver's seat
Bagger platform	Sacks placed to represent most unstable condition of normal field operation

5.8 Grain tank

The grain tank capacity and unloading time shall be measured in accordance with ISO 5687.

6 Functional field tests

6.1 General

Functional field tests shall be carried out over an extended period, for example, several months or a complete harvesting season in a particular area and shall include as wide a range as practicable of crops, crop varieties and/or crop conditions which are important to that area.

6.2 Information to be recorded

In each field worked, the following information shall be recorded:

a) atmospheric conditions;

b) slope and state of ground;

c) shape of field;

d) height of crop and stubble;

e) crop: variety, condition, weed content, grain moisture, residue moisture, and approximate yield;

f) machine hours of operation (for example, engine, separator, header);

g) approximate area harvested;

h) approximate volume of fuel used.

6.3 Behaviour and performance of combine harvester

6.3.1 General

Throughout the test period, the general behaviour and performance of the combine harvester shall be kept under observation, and shall subsequently be reported on, with particular reference to the information outlined in 6.3.2 to 6.3.5.

6.3.2 Functional aspects

The operator shall observe and report on the following aspects of the behaviour and performance of the combine harvester:

a) the effectiveness of cutting, gathering and/or picking up of the crop;

b) the occurrence of blockages;

c) the adequacy of engine power, governor control and cooling system;

d) the grain tank filling or bagging arrangements;

e) the discharge of non-grain crop materials;

f) the stability of the combine harvester as a whole;

g) the adequacy of the means of adjustment to limit grain damage, limit grain loss, maximize cleanliness;

h) the speed of response to controls of individual mechanisms;

i) the effectiveness of grain unloading devices, particularly with moist grain;

j) the frequency of refilling consumable fluids;

k) the particulars of circumstances limiting performance;

l) the tractive performance in adverse conditions.

6.3.3 Comfort, convenience and safety

6.3.3.1 Observations related to non-compliance with relevant provisions of ISO 4254-7 shall be reported.

6.3.3.2 General remarks on the ease of access to the driving position, the identification and ease of operation of the controls, the visibility of the grain tank contents, the grain unloader, and the cutterbar shall also be included in the test report.

6.3.3.3 Information on the adequacy, identification and visibility of instruments shall be included in the test report along with details relating to seating comfort and freedom from vibration, noise, dust, fumes, etc.

6.3.3.4 Measurements of seat vibrations and noise level at the operator's workplace, if made, shall be in accordance with ISO 5131 and ISO 5007, respectively.

6.3.3.5 The test report shall also include information on:

a) the adequacy and ease of control of cab climate control system, if fitted;

b) the adequacy of lighting arrangements, particularly for working after dark;

c) the turning radius (see ISO 789-3);

d) the general ease of handling, and stability of the combine harvester, when manoeuvring or driving under road conditions;

e) any hazardous features noticed and not covered by ISO 4254-7.

6.3.4 Ease of adjustment and routine maintenance

The test report shall include information on the following aspects relating to the ease of adjustment and routine maintenance:

a) the clarity of instructions in the operator's manual (see ISO 3600);

b) the ease of adjustment, particularly for changes of crop or crop conditions;

c) the ease of changing from field condition to transport condition, and vice versa;

d) the ease of carrying out routine maintenance operations, for example, cleaning air filters, changing oils and filters, greasing, checking oil levels, adjusting belt tensions;

e) the arrangements for observation of fuel level and refuelling;

f) the cleaning out provisions for the machine, especially for changing from one crop to another, and for clearing blockages;

g) the arrangements for cleaning out the stone trap, if fitted;

h) the time needed to install the header.

6.3.5 Repairs

Any significant failures or repairs necessary during the test period shall be reported.

7 Capacity tests

7.1 General

Capacity tests shall be carried out on specific occasions, under particular conditions, to determine the combine harvester capacity as defined in ISO 6689 and the following subclauses. Because crop conditions are variable and uncontrollable, the procedure provides only for the comparative testing of one combine harvester, or combine harvester configuration, relative to each other, in a particular crop condition.

Combine harvesters with systems that automatically adjust feedrate, threshing, cleaning of other settings may be tuned for different objectives, for example, minimizing costs, maximizing capacity, minimizing foreign material in the clean grain. Systems do this using an algorithm with many inputs and variations that might not be repeatable or perceptible to the test supervisor. For this reason, this document is not able to evaluate whether the algorithm is making the optimum decision relative to the objective, but it does allow comparison of the algorithm outcome. As systems may require time to learn conditions, sufficient operating time may be necessary to accomplish this learning process following the manufacturer's instructions. Performance of automated system should not be based on these capacity tests alone.

7.2 Crop selection and field conditions

7.2.1 Capacity tests shall preferably be carried out on the crops and in the conditions specified in Table 4. Where this requirement has not been met, the reasons for departures shall be stated in the test report.

7.2.2 The ground shall be as level and as even as practicable, unless tests on sloping ground, as specified in Annex A, are to be carried out.

7.2.3 Test runs shall be made in a direction relative to the wind direction which does not interfere with the performance of the functional elements of the combine harvester.

7.2.4 Crops used for tests shall be reasonably uniform, free of disease, weeds and other crops. The crops shall in general be standing well; if local climatic conditions and/or local practices lead to different conditions typical of the locality (for example, widespread lodging or the wind-rowing of crops), the circumstances shall be stated in the test report.

7.2.5 The type of crop, its general condition, the MOG:G ratio and the moisture content of the grain and other materials, expressed in percentages, shall be indicated and shall be representative of typical harvest conditions for the area.

Table 4 — Crops and conditions for capacity testing

Crop	Acceptable range of MOG to grain ratio	Range of moisture content, percent		Processing loss level, percent[a]
		Grain	MOG	
Wheat	0,6 to 1,2	10 to 25	6 to 50	1;1,5
Barley	0,4 to 1,2	10 to 25	6 to 50	1;1,5
Rice	1,0 to 2,4	15 to 28	20 to 60	1;1,5
Sorghum	0,4 to 0,8	10 to 17	15 to 40	1;1,5
Corn/Maize	0,4 to 1	10 to 35	10 to 40	0,5;1
Rape/Canola	1,0 to 5,0	8 to 25	10 to 70	2;3
Soybeans	0,5 to 1,5	10 to 15	10 to 20	0,5;1

NOTE In case the crop and/or climatic conditions does not permit test data to be obtained to the values in this table, see 7.2.6.

[a] These values recognize that acceptable loss values can vary based upon yield. Generally, higher yields result in losses being more easily visible and hence lower losses are tolerated.

7.2.6 If crop and/or climatic conditions do not permit test data to be obtained to the above standards, the circumstances shall be reported and the actual results shall be recorded.

7.2.7 If a combine harvester is unable to achieve a loss level in Table 4, the capacity shall be the highest throughput achieved and the loss level and limitation shall be noted.

7.2.8 Because the functional characteristics of the conventional walker-type combines are so different from those of the axial, rotary, tangential-flow, or other non-conventional combines, no attempt shall be made to equate areas of these functional components from the one type of combine to another. This is particularly dangerous when there is intent to use these areas to indicate, or imply, differences in capacity between combines of similar size.

7.2.9 Moisture content of the crop shall be expressed on the wet basis. The percentage moisture of the grain shall be determined from samples taken from the grain flow into the grain tank, during the test runs. The MOG samples shall be taken from the deposited residue behind the combine harvester, applicable to a test run just made. Both samples shall be sealed in air-tight containers.

7.2.10 Material flow into the combine harvester shall be controlled during the test series, for each crop indicated, so as to give a range of processing loss levels above and below the two values specified in Table 4.

7.3 Test and comparison combine harvesters

7.3.1 If a comparison combine harvester is used, it shall be fully identified as to make, model, year and other pertinent information. It shall be functionally sound and shall be a combine harvester which has been available on the open market for a continuous period of at least one year prior to the date of the test.

7.3.2 At the time of test, both test and comparison combine harvesters shall be in good working order with all working surfaces free of thick or sticky paint, rust, grease, or other impediments to smooth operation. A run-in period of 25 h is required to ensure this condition on a new combine harvester or one that has not been used recently.

7.4 Adjustment of test and comparison combine harvesters

7.4.1 Both test and comparison combine harvesters shall, immediately before being tested, be adjusted for optimum performance with the same crop which will be used for the tests.

7.4.2 Pre-test adjustments shall aim for optimum performance with harvesting conditions typical of normal practice in the relevant locality and for equivalent, and still locally acceptable, levels of foreign material in the "clean" grain discharged from both combine harvesters. The condition of the sample shall be stated in terms of foreign material, broken grain and unthreshed grain.

7.4.3 Persons responsible for adjusting the combine harvesters shall be given adequate time and opportunity to do so, with due regard being paid to the time requirements indicated for carrying out the test properly. They shall also be responsible for deciding when the optimum adjustments have been attained for the top throughput level that is possible with satisfactory gathering and cutting of the crop.

7.4.4 Operator adjustment of the threshing, separating or cleaning mechanisms shall be permitted only between test series. If combine harvester software-controlled automatic adjustment systems are used, their use and software version shall be recorded.

7.5 Catching apparatus

Apparatus for catching crop material discharged from the combine harvester shall be built and operated so that the following requirements are met.

a) The whole of the effluents from the machine separator and cleaning systems shall be caught during the catch period.

b) The components for collecting crop material shall be such that the safety of the test personnel is not endangered.

c) Catches shall be started and stopped without the combine harvester mechanism or forward travel being interrupted.

d) The apparatus shall neither significantly interfere with the combine harvester's normal performance (e.g. with the flow of air from the cleaning mechanism) nor cause any change in the condition of the material normally discharged from the combine harvester.

e) Catches shall be taken separately, from the points of normal discharge from the combine harvester's separating and primary cleaning mechanisms, at the normal rate of discharge. Conveyor-type apparatus for improving the accessibility of the catch points is permitted but it shall cause no change in the condition of the crop material as discharged from the combine harvester. If separating and cleaning discharge cannot be gathered independently when testing, then such configurations are to be noted.

f) If a combine harvester is equipped with an auxiliary cleaning device, the output in each grade of recleaned grain delivered from it shall be added together to calculate the rate of grain output.

g) Samples of grain for analysis shall be taken by passing a container through the stream of grain at the catching point immediately after taking the main catch.

h) Storage containers shall be completely filled and airtight.

i) In case the grain catch is delayed after initiation of material-other-than-grain, MOG, catch to compensate for the time the grain spends in the conveyance, this circumstance shall be reported.

7.6 Conditions and procedure for collecting catch

7.6.1 Prior to each catching period, operate the combine harvester for a minimum of 50 m or for a distance taking at least 20 s, whichever is the longer, to ensure that conditions have become stabilized throughout the relevant mechanisms.

7.6.2 During this period and during the catching periods, the full gathering width of the header shall be utilized. If the crop is wind-rowed, the wind-row(s) shall be picked up wholly and smoothly to ensure flow of crop across substantially the full width of the threshing mechanism. In certain limited conditions, if the test supervisor deems this impractical (for example, the header width improperly sized for crop volume), then a width less than full header width may be used.

7.6.3 If less than a full header width is used, the combine harvester shall be operated in a manner that presents a uniform width and consistent, symmetrical delivery of crop to the machine. Document width of crop harvested and reason for deviation in the final report.

7.6.4 Field speed and stubble height shall be kept constant for a more consistent feedrate during each test run. The only adjustments permitted are reel speed, reel height, reel fore-and-aft settings, pick-up speed, or gathering chain speed to accommodate differences in ground speed.

7.6.5 Successive runs shall be made at different forward speeds to cover the full range of practical throughputs. Field speeds for test runs shall be selected to start below the speed used during the pre-test adjustment period and should be carried high enough to perceptibly indicate that maximum feasible feed rate has been reached. At the highest feasible throughput level, record any factor(s) limiting a further increase in forward speed, for example, insufficient engine power, cutting, feeding or threshing difficulties or excessive gathering, threshing or separation losses.

7.6.6 The time of day selected for the test shall be when crop conditions are most stable. Comparative tests shall be carried out in conditions as close as possible to those of the actual test as far as time and locations in the field are concerned. Differing circumstances shall be reported.

7.6.7 The catches of crop material discharged from the combine harvester shall be taken over a minimum length of 10 m or amount in total to a minimum of 50 kg.

7.6.8 A test series shall consist of at least five, and preferably not less than seven, test runs, at different field speeds.

7.6.9 The test supervisor may discard attempted test runs at the time of tests if, in his judgement, there is good reason for doing so (for example, functional failure, detrimental foreign objects entering the machine, overfilling or spillage from catch receptacle). Otherwise, the results of all test runs made shall be entered in the test report and comments on any unusual circumstance shall be included.

7.6.10 Samples for grain analysis shall be at least three in number, taken throughout the test series and these samples shall preferably be not less than 1 000 cm^3 in volume.

7.6.11 Grain damage percentages reported shall be established:

— from samples taken at the final delivery point of the unloading system when fully charged with grain harvested during the test run;

— in accordance with methods generally recognized in the locality where the tests are carried out and the results shall be expressed on the basis of relative mass.

7.6.12 Straw samples of at least 0,5 kg each for moisture testing shall be at least three in number and taken throughout the test series. They shall be taken from the straw discharged immediately after the end of the catching period and shall be stored in completely filled, airtight containers until analysed. Requirements are similar with regard to straw moisture measurements made by portable meter.

7.7 Treatment and analysis of catches

7.7.1 The separation and cleaning of catches shall be as fully mechanized as practicable to ensure consistency. Relatively low feed rates shall be aimed for when feeding crops so as to retain at least 99 % of the free grain contained in the samples before processing.

7.7.1.1 Clean the separating mechanism catch to separate free grain from MOG.

7.7.1.2 Clean the cleaning mechanism catch to separate free grain from MOG.

7.7.1.3 Process the collected MOG from 7.7.1.1 to recover grain remaining unthreshed.

7.7.1.4 Process the collected MOG from 7.7.1.2 to recover grain remaining unthreshed.

7.7.2 Separation and analysis of the constituents of grain samples shall be carried out in accordance with methods generally recognized for determining grain quality in the locality where the tests are carried out.

7.8 Test data

7.8.1 The following data from the test runs shall be included in the test report:

a) location of test site;

b) catch duration, in seconds to the nearest 0,1 s;

c) test run length, in metres;

d) date and time of starting and stopping tests;

e) combine harvester identification numbers as applicable;

f) crop, crop variety, and crop conditions;

g) combine harvester settings and adjustments of crop handling systems;

h) field speed, in kilometres per hour to the nearest 0,1 km/h;

i) grain catch, in kilograms to the nearest 0,5 kg;

j) separating mechanism catch in kilograms to the nearest 0,5 kg;

k) cleaning mechanism catch in kilograms to the nearest 0,5 kg;

l) free grain from separating mechanism in kilograms to the nearest 0,005 kg;

m) free grain from cleaning mechanism in kilograms to the nearest 0,005 kg;

n) grain mass from rethreshed separating mechanism MOG catch in kilograms to the nearest 0,005 kg;

o) grain mass from rethreshed cleaning mechanism MOG catch in kilograms to the nearest 0,005 kg;

p) moisture content of grain and straw samples, expressed on the wet basis to the nearest whole percentage: method of measurement to be included;

q) sample constituents, in accordance with 7.7.2.

7.8.2 The test report shall include a section in which the test supervisor shall record those results specified above together with notes of unusual changes in weather or other conditions during the tests, and general comments on the behaviour of the combine harvesters and the conduct of the tests.

7.8.3 Measurement of gathering losses is not required, but appropriate comments arising from observation of them may be included in the test report.

7.9 Calculations

7.9.1 Calculations shall include, for each test run on each combine harvester, and as defined in ISO 6689, the following:

a) the total feed rate, MOG feed rate, and grain feed rate, in metric tons per hour (t/h);

b) the mean test run yield. Grain loss shall be added back into the grain mass used to determine yield;

c) the processing losses, recorded to the nearest 0,1 %;

d) the MOG/grain ratio for the crop (in other words, the ratio of total amounts entering the combine harvester) and the mean value from all runs in a series for each combine harvester;

e) the mean moisture content of the grain and MOG samples.

7.9.2 The results from these calculations shall be tabulated in the test report.

NOTE See Annex B.

7.10 Graphical presentation of results to obtain capacity

7.10.1 Graphs with linear scales shall be used for presentation of processing loss results, with total feed rate, MOG feed rate, or grain feed rate specified as the horizontal coordinate and percentage loss as the vertical coordinate. The data points for each test run shall be plotted on the graphs. The MOG feed rate is suggested for crops with large MOG: grain ratios (for example, cereals) and grain feed rate is suggested for crops with small MOG: grain ratios (for example, maize).

7.10.2 The capacity of each combine harvester shall be the feed rate level at which its loss curve intersects the specified level of loss, as defined in Table 4.

8 Test report

8.1 General

All original data and measurements recorded for both test and comparison combine harvesters shall be included in the test report. This data shall include the following:

a) the way in which the combine harvester was selected or obtained for testing (see 4.1);

b) reasons for any departure from the manufacturer's instructions as far as the operation of the test combine harvester is concerned (see 4.2);

c) full details about the combine harvester and header;

d) settings and adjustments for the combine harvester, in particular those relevant to the crop-handling mechanisms, including height and width of cut;

e) the location of the test site;

f) the date and time of starting and stopping the tests;

g) the duration of the running-in period prior to testing (see 4.1);

h) details about the crop, in other words, variety, crop conditions and yield.

8.2 Functional field tests

In addition to the data specified in 8.1, the following test data relating to the functional field tests shall be included in the test report:

a) general information on each field worked (for example, atmospheric and ground conditions, shape of field, crop details); (see 6.2);

b) information about the behaviour and performance of the test combine harvester, including:

- functional aspects (see 6.3.2),
- comfort, convenience and safety (see 6.3.3),
- ease of adjustment and routine maintenance (see 6.3.4),
- repairs (see 6.3.5).

8.3 Capacity tests

In addition to the data specified in 8.1, the following test data relating to the capacity tests shall be included in the test report:

a) crop selection, crop and field conditions, and any departure from the requirements laid down in ISO 6689 (see 7.2);

b) any local climatic conditions and/or local practices of relevance (see 7.2);

c) full details about the comparison combine harvester (see 7.3);

d) any differences with regard to time and location between the comparative and actual tests (see 7.6.6);

e) the results and data pertaining to the test runs, as specified in 7.8;

f) any unusual conditions, as recorded by the test supervisor (see 7.8);

g) general comments by the test supervisor on the behaviour of the combine harvesters and the conduct of the test (see 7.8);

h) comments on the measurement of gathering losses, if appropriate (see 7.8);

i) the calculated results, as specified in 7.9, in tabulated form;

j) the capacity of the combine harvester, as obtained from the graphical presentation of the test results (see 7.10).