International Standard 5704

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Equipment for vine cultivation and wine making — Grape-harvesting machinery — Test methods

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Foreword

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Draft International Standards adopted by the technical committees are circulated to the member bodies for approval before their acceptance as International Standards by the ISO Council.

International Standard ISO 5704 was developed by Technical Committee ISO/TC 23, *Tractors and machinery for agriculture and forestry*, and was circulated to the member bodies in August 1979.

It has been approved by the member bodies of the following countries :

Australia	India	South Africa, Rep. of
Austria	Italy	Spain
Brazil	Libyan Arab Jamahiriya	Switzerland
Bulgaria	New Zealand	Turkey
Czechoslovakia	Philippines	USSR
France	Portugal	
Germany, F.R.	Romania	

No member body expressed disapproval of the document.

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Equipment for vine cultivation and wine making — Grape-harvesting machinery — Test methods

0 Introduction

Tests for grape-harvesting machinery are designed with a view to :

a) assessing their performance, particularly with respect to :

— quality of grapes and beverages produced therefrom;

— exfoliation of grape-vines;

— damage to vine-stock likely to affect subsequent pruning;

— "visible" losses on grape-vine or ground;

— loss of juice from crushed grapes;

b) recording their performance in terms of operating time;

c) observing their mechanical operation, reliability and performance on varying ground, and any possible effects on stake and wire arrangements.

1 Scope and field of application

This International Standard specifies technical methods for testing grape-harvesting machinery, i.e. machines designed for carrying out all operations involved in grape-harvesting.

The method applies in cases where the grapes are used for wine making. It may also be applied in cases where the grapes are used for making other beverages (grape-juice, spirit-of-wine, etc.).

2 Definitions

2.1 operating time :

2.1.1 actual time : operating time of machine

2.1.2 additional time : turning, manoeuvering

2.1.3 idling time : stand-by periods, breakdowns

(2.1.1 + 2.1.2 + 2.1.3) = overall time

2.2 speed of travel : Length of rows travelled divided by actual time.

2.3 efficiency on site : Actual time divided by overall time.

2.4 overall time per unit of area : Overall time divided by area harvested.

2.5 output : Mass of grapes harvested divided by actual time.

3 Principle

Determination of the technological characteristics of the grape-harvesting machine under test and of the quality of the harvested grapes. Comparison of the quality of the wine obtained by appropriate means, using both chemical and sensory analyses, with that of the wine obtained from a manual harvest.

4 Apparatus

4.1 At the vineyard

The following list of apparatus is not exclusive.

4.1.1 Mechanical measurements

— reporting forms (see annexes B and C)

— revolution counter

— metre rule

4.1.2 Time measurements

— reporting forms (see annexes D, E and F)

— surveyor's plane-table

— ten-metre tape

— pegs

— chronometers

— impulse counter

4.1.3 Measurement of work quality

- reporting forms (see annexes G and H)
- impulse counter for counting damaged vines
- weighed buckets
- pruning shears
- grape containers
- roman scales
- precision scale
- bridge scale
- harvesting bins and tractors
- plastic bags
- labels
- calculators
- random tables and square tables
- camera.

4.2 At the wine-cellar

- all wine making equipment currently used in the district under consideration
- all relevant oenological apparatus.

5 Test procedure

5.1 At the vineyard

5.1.1 Mechanical measurements

With the machine at rest, carefully complete the form describing the machine (see annex B). With the machine running, record all relevant settings on the appropriate form (see annex C). Also complete the form describing the transport equipment (see annex F).

5.1.2 Time measurements

Prior to the test, complete the plot description form (see annex D), noting in particular the ground conditions (type, moisture content, slope) and draw a detailed sketch showing :

- the length of rows
- the number of vines per row
- the spacing of vines along each row and between rows
- width of headlands
- width of any service lanes
- distance from plot to cellar, indicating profile and state of track surface.

During the test, carry out a series of time measurements, recording any unusual features noted in the performance of work on the relevant form (see annex E).

During maintenance of the machine, record cleaning, lubricating, repair times, etc.

5.1.3 Measurement of work quality

5.1.3.1 Measurement of losses

For each variety of grape-vine and cultivation method to be tested, choose a plot as uniform[1] as possible and count the total number of stocks (n_t)[2].

Assess the average produce per stock with an error $\leqslant$ 5 % with a probability of 95 %. For this purpose, determine the size n of the sample using the formula

$$n \geqslant 1\,764 \left(\frac{s}{\bar{x}} \right)^2 \qquad \ldots (1)$$

where $\bar{x}$ and s are the average error and the standard error obtained for a sample n_c = 100 stocks (at least 40), chosen at random and harvested entirely by hand, the produce from each vine being weighed separately.

Then harvest the ($n - n_c$) vines chosen at random from the same plot, proceeding entirely by hand.

1) The method of determination of uniformity results from work of W. SNEDECOR and G. COCHRAN, *Statistical methods*, VI edition, Iowa State University Press.

2) For the purpose of this method and according to the cultivation method used, an item may be a single vine, one metre of row of vines or 1 m^2 of vineyard. In this International Standard, an item is taken to include one vine-stock. The test report and the annexes shall indicate which unit was used as an item in the measurements.

Check formula (1), taking the average error and the standard error obtained from the sample of n items for x and s, and repeat the procedure until the difference obtained is satisfactory. The last average obtained being taken as the required estimate, the mass of grapes per vine may be assumed to be :

$$M_0 = \bar{x}$$

Then check that

$$0{,}1\ n_t \leqslant n \leqslant 0{,}2\ n_t$$

where

n is the size of the sample considered;

n_t is the total number of grape-vines in the plot.

If the above condition is satisfied, calculate the significant value of the sample :

$$\frac{n}{n_t} \times 100$$

and record this value on the form (see annex I).

If not, select another, more uniform test plot.

Then proceed immediately to harvesting the remaining vines in the test plot using the machine under test, with all settings made by the manufacturer and checked by the tester.

On the bridge-scale, weigh the total harvest and determine the mass per stock M_1 of machine-harvested grapes.

The mass M_0 is equal to :

$$M_1 + M_2$$

where M_2 is the mass per stock of losses in various forms.

The losses M_2 can be subdivided as follows :

a) Loss directly measurable after the machine has passed, and consisting of :

— bunches or parts of bunches remaining on the grape-vine in the form of single grapes : m_0

— bunches, parts of bunches or single grapes fallen to the ground : m_1

b) Non-measurable losses consisting in juice not collected in the grape bin and lost for various reasons, mainly by dripping onto the ground or splashing onto different parts of the grape-vine, expelled leaves or the machine : m_2

M_1, m_0 and m_1 can be accurately determined in the same way as M_0, by calculating the size of the required sample using the method already applied in determining M_0 and checking a number of vines at random among those harvested by machine.

Determine m_2 by subtraction using the formula :

$$m_2 = M_0 - (M_1 + m_0 + m_1 + m_3)$$

where m_3 is the mass of stalks remaining on the vines.

During the mechanical harvest, take a sample of about 10 kg of grapes at the machine outlet.

From this sample, establish the percentage in mass of :

— bunches or fragments of bunches

— whole grapes

— whole stalks

— parts of stalks

— leaves

— other fragments

— free grape must.

5.1.3.2 Assessment of exfoliation

Assess exfoliation just before and immediately after the machine has passed, using the following marking system :

5 = foliage intact;
4 = slight exfoliation;
3 = medium exfoliation;
2 = severe exfoliation;
1 = very severe exfoliation;
0 = total exfoliation.

At the same time, make photographic records before and after the machine has passed.

5.1.3.3 Damage count

Count the occurrences of damage on a number of vines proportionally equivalent to 100 vines per hectare, selected at random, and report any damage likely to affect subsequent pruning operations.

5.2 At the wine-cellar

Using the machine-harvested grapes, carry out the necessary operations for making 8 hl of wine.

Compare this vinification with a simultaneous reference vinification using the same method (including transport) on the manual harvest obtained from the vines used to determine M_0. If the harvest from these n vines does not produce the required 8 hl, carry out a further manual harvest from the same plot.

During the vinification process, carry out all oenological tests usually applied in that district, in particular the following :

— alcohol proof

— total acidity

— pH

— free acidity

— malolactic fermentation (yes/no)

— sulphur dioxide (free/total)

— dry extract

— metals content (iron, copper, sodium)

— colour (intensity, hue)

— oxygen reduction capacity

— oxydation rate

— tannin content

and complete the vinification process form, reporting in particular any change in density or temperature noted during fermentation (see annexes J and K).

On completion of the vinification process, compare the taste of the two wines.

For these oenological tests, apply the methods recognized by the Office international de la vigne et du vin (OIV), if any. Otherwise, state the methods used in the test report.

6 Expression of results

All units shall be those of the international system (SI), as applicable.

6.1 Operating time

— Overall time = { actual time + additional time + idling time

— Speed of travel

— Efficiency on site

— Overall time per unit of area

— Output.

6.2 Work quality

— Losses : total losses
loss of juice

— Exfoliation : Assessment mark 0 to 5

— Damage count, expressed in terms of 100 vines per hectare

— Matter remaining in the harvest at the machine outlet.

6.3 Oenological results

Note in particular any significant differences between the wine obtained from the mechanical harvest and the reference wine obtained from the manual harvest.

NOTE — As a rule, record all results in tabular form in order to facilitate subsequent comparisons.

7 Test report

The test report shall include the following particulars :

a) all vineyard and cellar forms;

b) the results obtained with an indication of their accuracy;

c) any features not dealt with in this International Standard;

d) any circumstances that may have affected the results, in particular any breakdowns and their duration.

In addition, the test report shall indicate the following :

— ease of cleaning and maintenance operations;

— safety performance.

Annex A

Summary of test procedure

1) Select the test plot.
(Complete form D.)

2) Record the dimensions and characteristics of the harvesting machine.
(Complete form B.)

3) Specify the transport facilities available.
(Complete first part of form F)

4) Determine the total number n_t of vines, the size of sample n and the average mass per stock M_0.
(Complete form I.)

5) Transfer the manual harvest to the cellar for the reference vinification, if necessary together with the complementary harvest.

6) Carry out the mechanical harvest and record harvesting times (form E) and transport times (form F, second part).

7) During the mechanical harvesting, take the required samples and check the quality of the work (form G).

8) Check the losses (according to form H) by gathering by hand any grapes remaining on the mechanically harvested vines, grapes fallen to the ground, grapes on the vine (explored and non-explored areas) and any complete or broken grapeless stalks remaining on vines after the machine has passed.

9) Carry out the wine-making operations on both the mechanical and the manual harvests and complete the relevant forms (forms J and K).

10) Complete the overall results form (form L).

Annex B

Machine description form[1]

Manufacturer : ..... **Model** : ..... **Serial No.** : .....

Type :

— Straddler ☐

— Between rows ☐

a) Self-propelled ☐

b) Trailed, with power take-off ☐

c) Trailed, with auxiliary engine ☐

d) Half-carried ☐

e) Carried ☐

f) Other ☐

(Provide sketch of machine[2] giving characteristic dimensions, in particular the following) :

Dimensions[2]

— Overall length : .....

— Overall width : .....

— Total height max. : .....
min. : .....

— Ground clearance : .....

— Headland circle : .....

— Turning circle : .....

Position of centre of gravity[2]

— Height above ground : .....

— Distance ☐ in front of ☐ behind the vertical plane containing the drive wheels : .....

or,

— Distance from the plane parallel to and equidistant from the median planes of both drive wheels : .....

Total mass[2] : .....

Chassis frame .....

Tilt control automatic ☐ manual ☐

Protective cabin yes ☐ no ☐

1) Tick the appropriate boxes.

2) In the case of a carried or half-carried machine, the information provided (sketches, mass, dimensions, etc.) shall refer to the machine mounted on the appropriate tractor.

Engine (Types a, c)

Manufacturer and type : .....
.....

Serial No. : .....

— Max. power of engine : .....

— at nominal speed of : .....

— Fuel type : petrol ☐ diesel ☐

— No. of cylinders : .....

— Tank capacity : .....

— Cooling system : water ☐ air ☐

Tractor (Types b, c, d, e, f)

Manufacturer and type : .....
.....

Serial No. : .....

Crawler ☐ Wheels ☐

— Max. power of engine : .....

— at nominal speed of : .....

— Fuel type : petrol ☐ diesel ☐

— No. of cylinders : .....

— Tank capacity : .....

— Cooling system : water ☐ air ☐

Transmission (type a) mechanical ☐ combined ☐ hydraulic ☐

— Clutch : mechanical ☐ hydraulic ☐

Gear box

No. of forward speeds : .....

No. of reverse speeds : .....

Hydraulic motor in the wheels : yes ☐ no ☐

Hydraulic cooling system : yes ☐ no ☐

Rear axle : locking differential : yes ☐ no ☐

Capacity of transmission fluid tank : .....
.....

Drive and steering system[1)]

— Crawler ☐

— No. of segments : .....

Dimensions : .....
.....
.....
.....

— Track width : .....

— Track length : .....

— Assisted steering : yes ☐ no ☐

— Wheels ☐

— No. of drive wheels : .....

Tyre characteristics : .....

Rated pressure : .....

— No. of wheels steered front : .....
rear : .....

Tyre characteristics : .....

Rated pressure : .....

— Front track width : .....

— Reat track width : .....

— Wheel base : .....

1) In the case of a carried or half-carried machine, the information provided (sketches, mass, dimensions, etc.) shall refer to the machine mounted on the appropriate tractor.