INTERNATIONAL STANDARD

ISO 12195

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Threshed tobacco — Determination of residual stem content

Tabac battu — Détermination de la teneur en côtes résiduelles

Reference number
ISO 12195:1995(E)

Foreword

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International Standard ISO 12195 was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*, Subcommittee SC 2, *Leaf tobacco*.

Annex A forms an integral part of this International Standard. Annexes B to D are for information only.

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Threshed tobacco — Determination of residual stem content

1 Scope

This International Standard specifies a method for the measurement of the stem content of strips of leaf tobacco.

It is applicable to strips arising from the operation of threshing or hand-stripping leaf tobacco, which can be from any tobacco type including flue-cured, burley and cigar tobacco.

The test method consists of taking of a sample of tobacco strips and passing it through a stem tester.

2 Definitions

For the purposes of this International Standard, the following definitions apply.

2.1 stem: Main vein of a tobacco leaf.

2.2 lamina: Area between the veins of a tobacco leaf.

2.3 strips: Long pieces of threshed or stripped lamina.

2.4 threshing: Removal of the stem and side veins of tobacco leaves by mechanical means.

2.5 stripping: Removal of the stem from tobacco leaves, leaving the halves of the leaf more or less intact.

2.6 stem tester: Small-scale thresher and separating tower which threshes and classifies the residual stem from the lamina in a controlled manner.

2.7 stacked sieve-type shaker: Shaker which reproduces the circular and tapping motion given to test screens in sieving in a uniform manner.

3 Apparatus

3.1 Stem tester

The main operating features of the stem tester are given in 3.1.1 to 3.1.11, and are illustrated in figure 1.

3.1.1 Static pressure tapping apparatus and manometer

The tapping apparatus shall be fitted 254 mm above the flange, immediately above the doors of the separating tower and as flush as possible to the internal wall. This is to avoid air turbulence and thus erratic readings. The static tapping apparatus is illustrated in figure 2.

A suitable manometer with a full-scale range of at least 0 mmH_2O to 5 mmH_2O is fitted to the tapping apparatus and set to zero. It indicates the air velocity in the separating tower.

3.1.2 Stem-deflector plates

Two stem-deflector plates are required to stop free stem and "heavies" being kicked out of the thresher and lost to the test. The first is fitted to the end of the vibratory conveyor feeding into the top of the thresher housing; the second is fitted to the base of the thresher (see figures 3 and 4).

Damper C sited at the air-flow inlet below the thresher shall be removed (see 3.1.8).

3.1.3 Thresher, having the following characteristics.

Rows of thresher teeth	4
Teeth per row	31
Tooth dimensions	96,8 mm × 25,4 mm × 3,2 mm
Teeth spacing	3,2 mm

See figure B.1 and table B.1 for more details.

3.1.4 Thresher basket, having the following characteristics.

Hole size	19 mm diameter punched holes
Hole distribution	see figure B.2
Basket size	479,3 mm × 263,5 mm × 3,2 mm
Outside radius	154 mm

See figure B.2 and table B.2 for more details.

3.1.5 Shaft

Shaft speeds shall be as follows.

Thresher	(1 150 ± 20) r/min
Vibratory conveyor bearing	(450 ± 20) r/min
Winnower	(950 ± 20) r/min
Both tangential separator rotary air locks	(70 ± 5) r/min

3.1.6 Tobacco-strip conveyor, having the following characteristics.

Dimensions	2 438 mm × 457 mm × 152 mm
Cycle time	4 min
Sample delivery time	160 s
Belt speed	914 mm/min

3.1.7 Air-inlet vanes

The vanes shall be fixed securely in the following positions.

Top vane	34° to the horizontal
Middle vane	34° to the horizontal
Bottom vane	29° to the horizontal

3.1.8 Dampers, having the following settings and uses.

Damper A is sited downstream of the 14/24 tangential "lights" separator and is used to adjust the air flow through the separating tower.

Damper B is sited downstream of the 14/18 tangential "heavies" separator and shall be kept in the wide-open position to prevent stems building up in the tangential separator.

Damper C is sited at the air-duct inlet below the thresher and shall be removed to prevent deposits of free stem and "heavies" building up behind the closed or partly closed damper; a stem deflector plate is fitted at the base of the thresher (see 3.1.2). If required, a large-mesh screen can be fitted to the end of the air duct to trap any foreign matter picked up by the air flow; if fitted, it shall be kept clean.

Damper D is sited in the air duct after the tresher and shall be kept closed.

See figure 5 for the positions of these dampers.

3.1.9 Separating tower

The vibrating conveyor screen shall be of 20 mesh, wire diameter 0,36 mm, open area 51 %. The mesh is supported by a wire grid.

The vibrating conveyor screen shall have a 25,4 mm clearance at the point of exit from the separating tower to allow the "heavies" to pass through to the thresher.

The winnower selvedge shall clear the winnower housing by 6,4 mm to 9,5 mm.

3.1.10 Fan

The fan should be capable of providing an air-flow rate of over 119 m^3/min at a pressure of 127 mmH_2O, but its speed may need adjusting to compensate for changes in air density at higher altitudes.

3.1.11 Discs

Strips for different tobacco types can differ in their bulk density and therefore require different sample masses to ensure a constant volume feed through the stem tester. This avoids overloading the thresher and separating tower, which would lead to variable and erratic results.

Tobacco types can also differ in the air-flow rate required to separate the stem from the strips. The separating tower needs to be set up to a different standard air flow for these tobaccos.

The air-flow rates are standardized by means of plastic discs which are described more fully in annex C, clause C.1, and their design is shown in figure C.1.

The recommended sample mass disc specifications together with their tolerances for the three major tobacco types are detailed in table 1.

Table 1 — Tobacco sample size and disc mass

Tobacco tape	Sample mass g	Disc mass mg	
		Light	Heavy
Flue-cured	3 000 ±300	328 ±4	420 ±4
Burley	3 000 ±300	265 ±4	328 ±4
Cigar	1 000 ±100	210 ±4	290 ±4

3.2 Stacked sieve-type shaker, 200 mm in diameter[1)]

The test method can be extended by taking the stem product collected from the stem tester (3.1) and, after weighing, screening it into various size classes by means of a sieve-type shaker.

The stacked sieve-type shaker shall have the following characteristics.

Elliptical diameter	32 mm × 25 mm approx.
Frequency of shaking	280 r/min to 290 r/min
Hammer drop	33 mm ± 2 mm
Frequency of striking	150 r/min to 157 r/min

All sieves shall be of the standard size 203,2 mm in diameter and 50,8 mm deep. They are designed to nest together to form a stable sieve stack in the following order:

a) a 2,38 mm slotted-plate screen (made to order) (see figure 6),

b) 280 mm sieve,

c) 1,70 mm sieve,

d) pan.

1) An example of a suitable sieve shaker available commercially is the C.E. Tyler Ro-Tap, Mod. RH-19, Mod. B.

This information is given for the convenience of users of this International Standard and does not constitute an endorsement by ISO of the product named. Equivalent equipment may be used if it can be shown to lead to the same results.

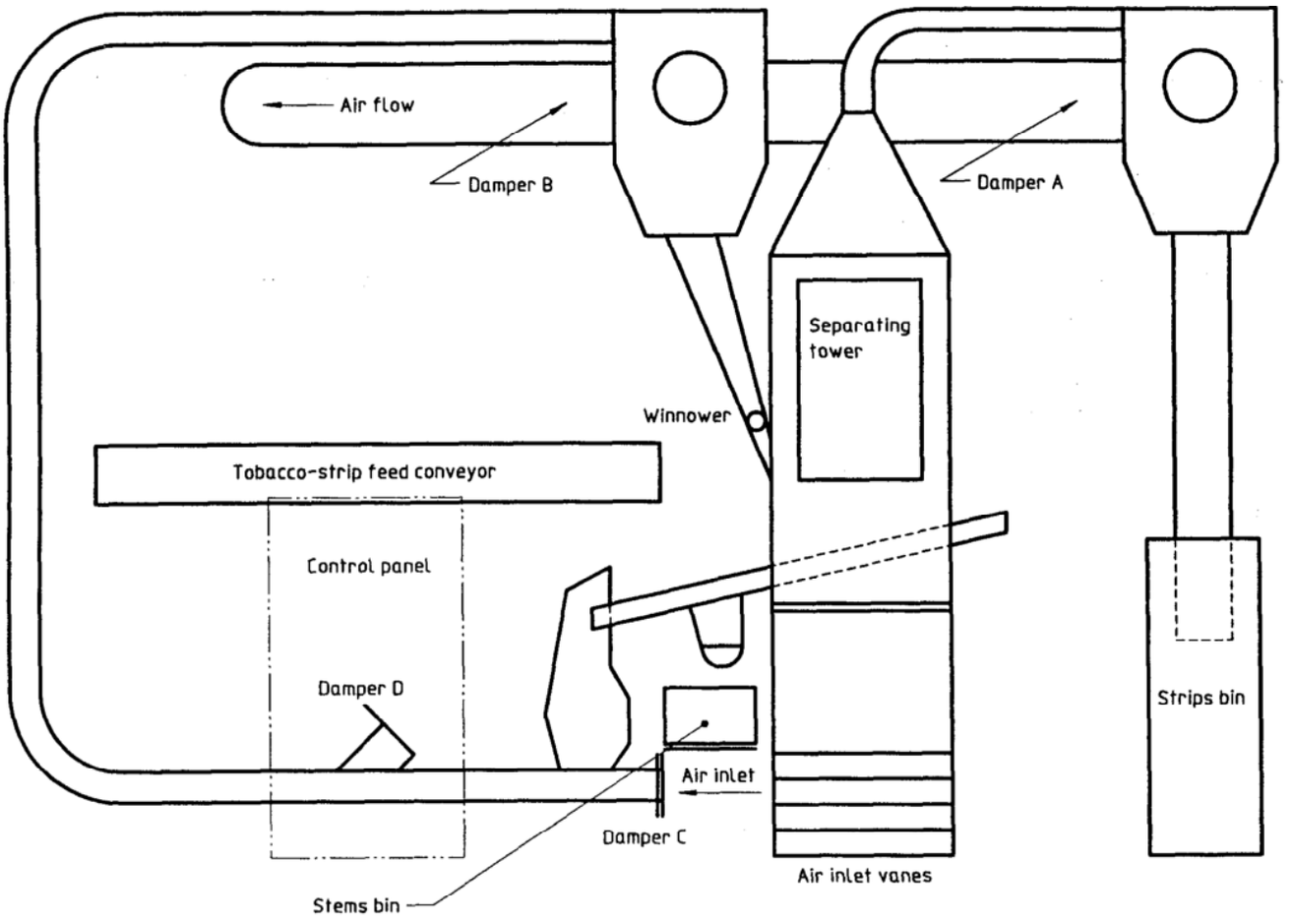


Figure 1 — Stem tester

Dimensions in millimetres

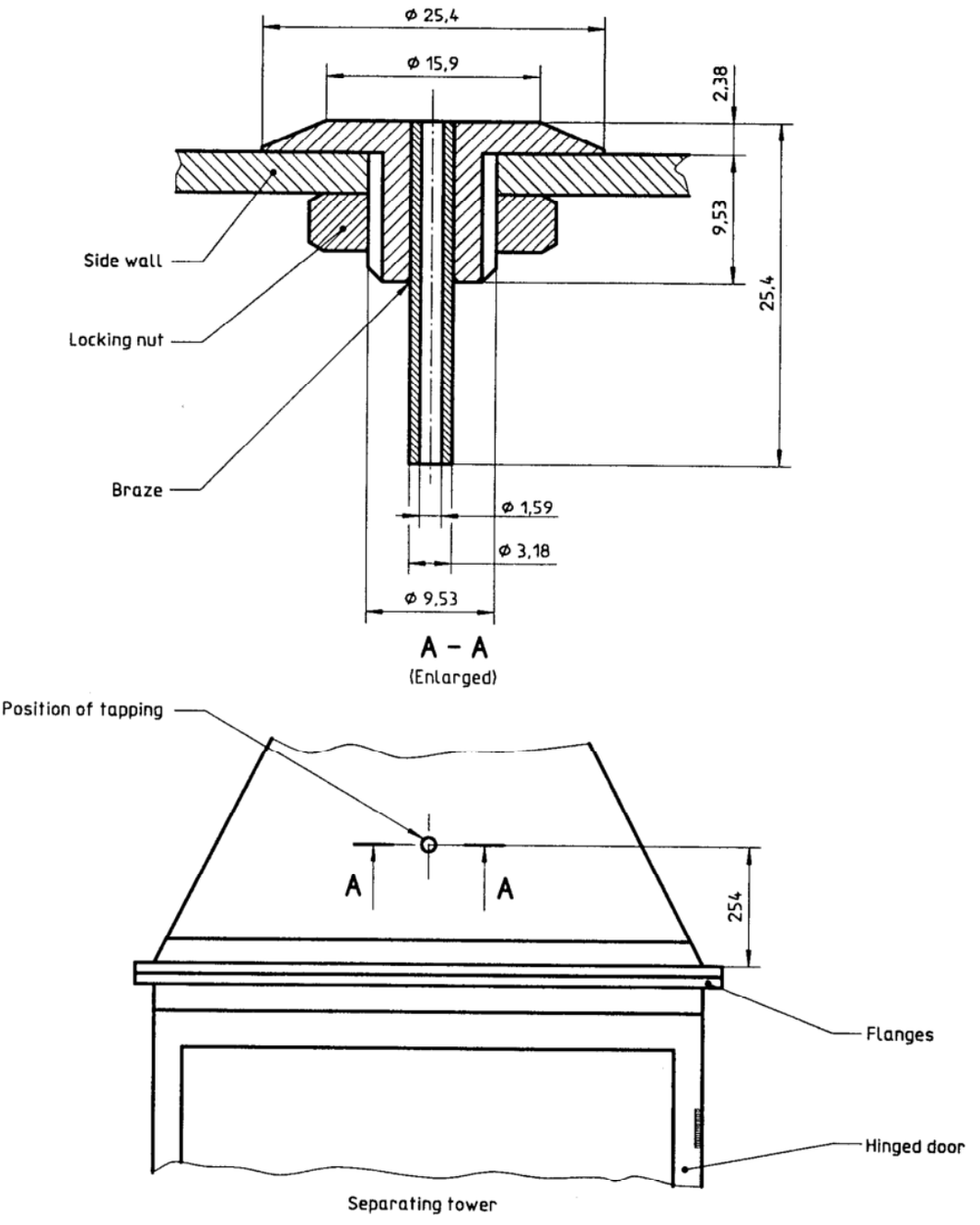
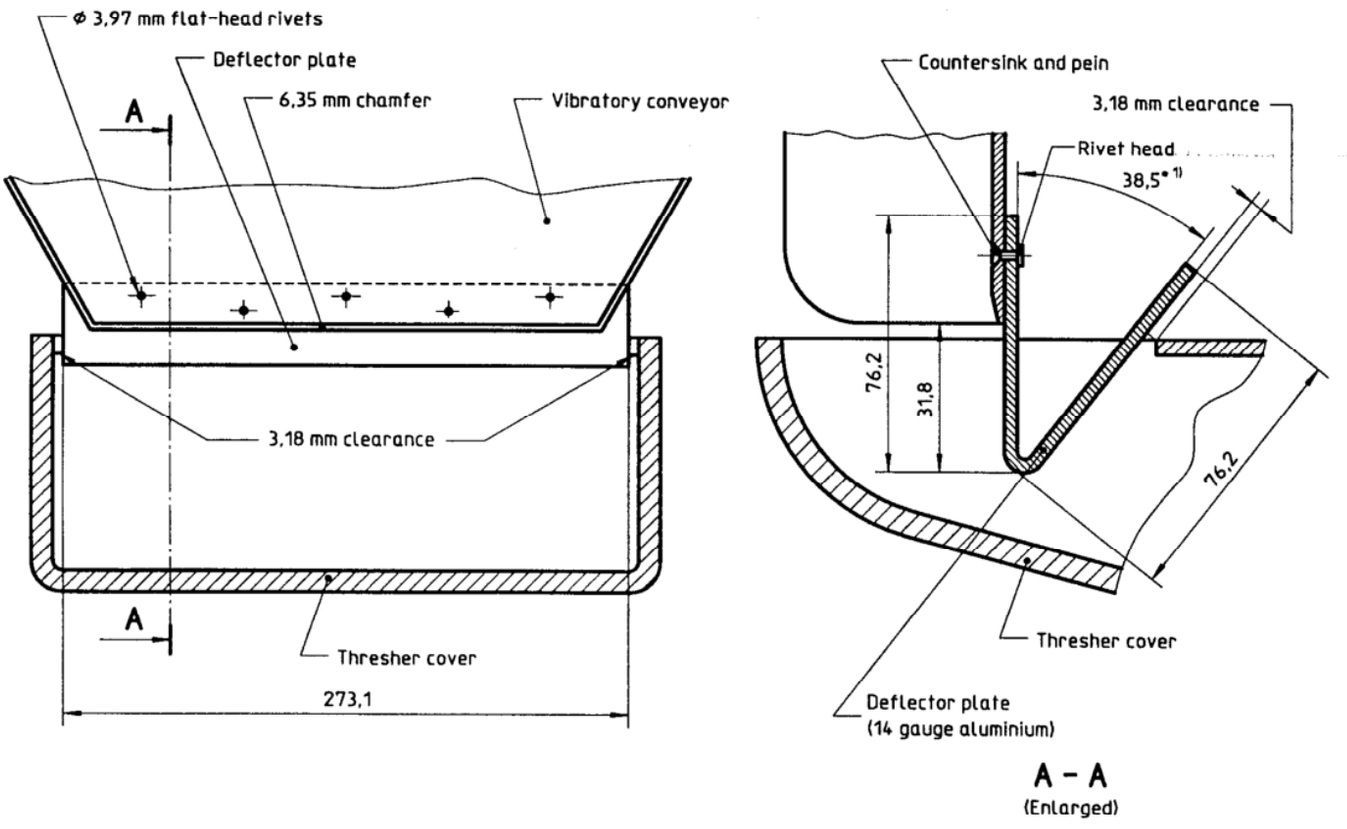


Figure 2 — Standard static-pressure tapping apparatus

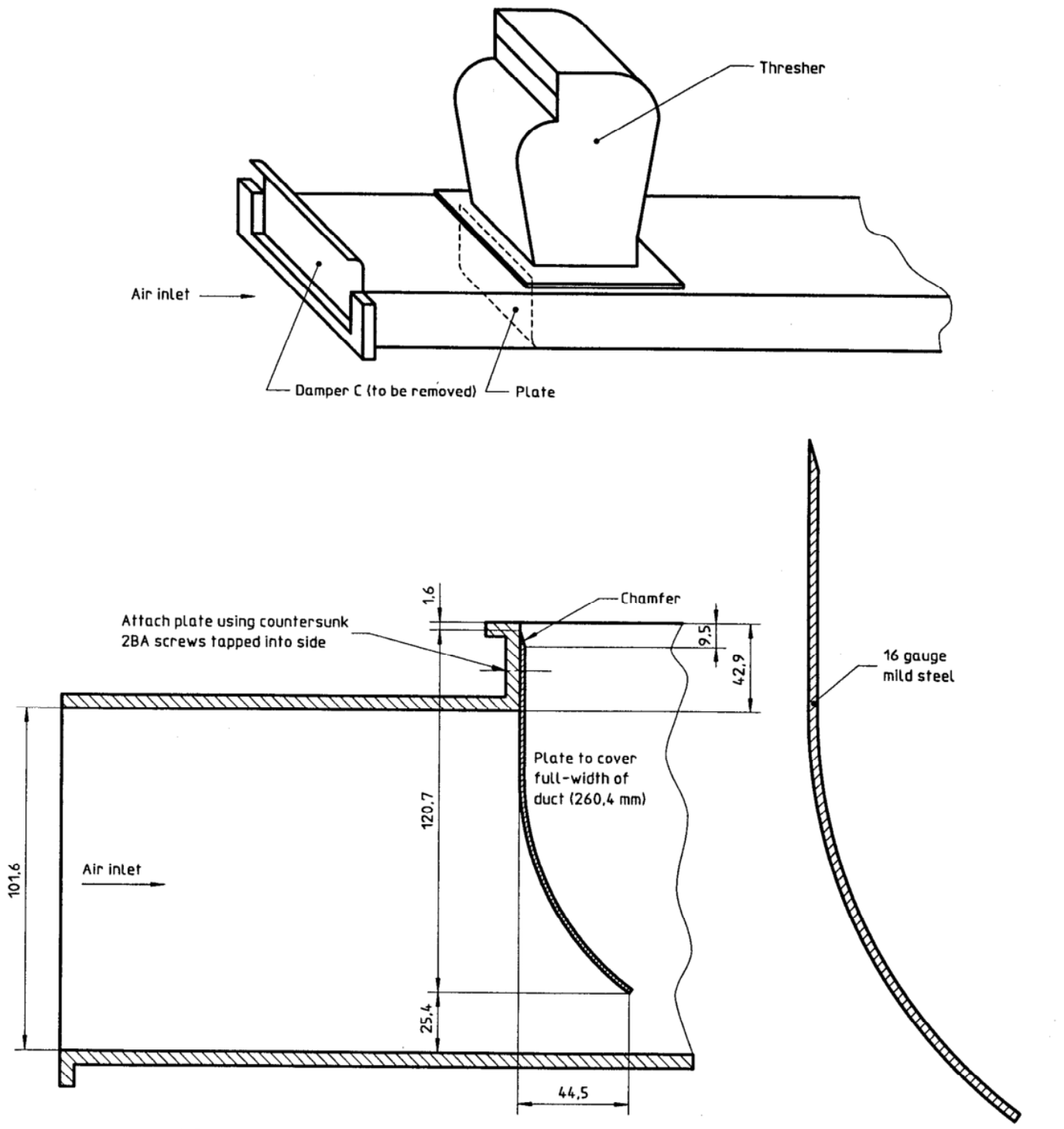
Dimensions in millimetres



1) This angle may have to be changed to suit some machines.

Figure 3 — Inlet of thresher stem-deflector plate

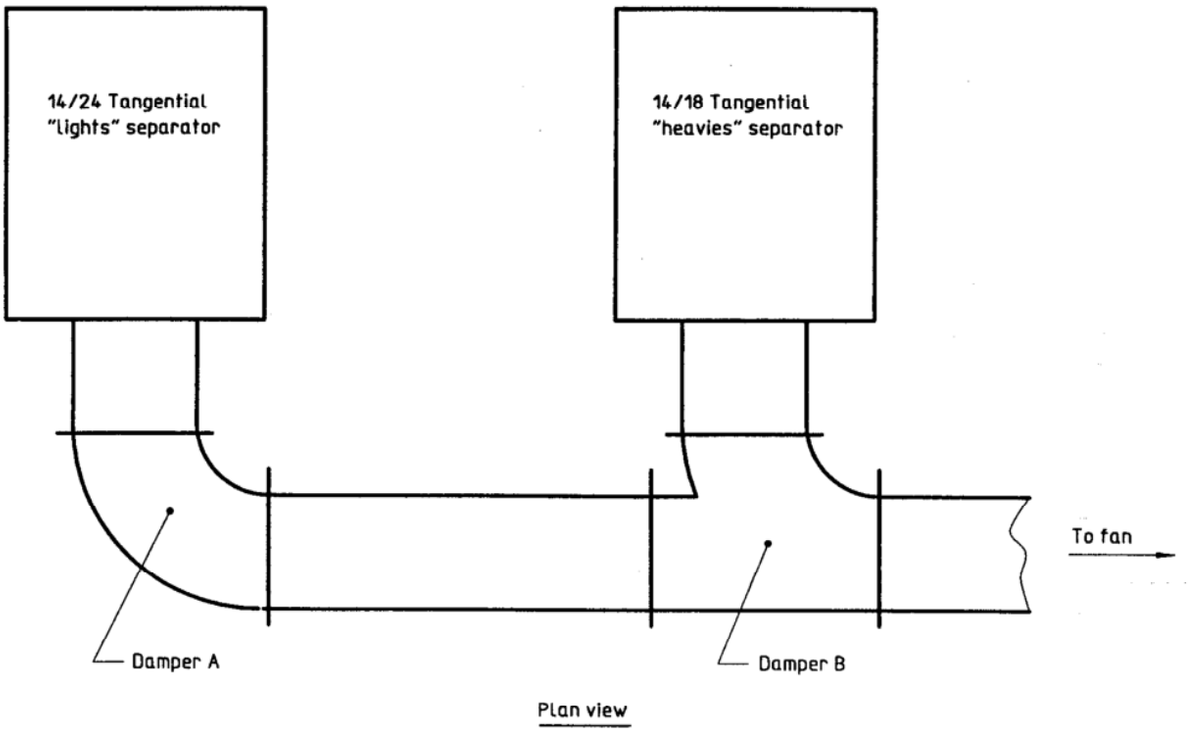
Dimensions in millimetres



a) Cross-sectional side view of duct showing position of plate

b) Full-scale cross section of plate. Use template with this contour

Figure 4 — Outlet of thresher stem-deflector plate



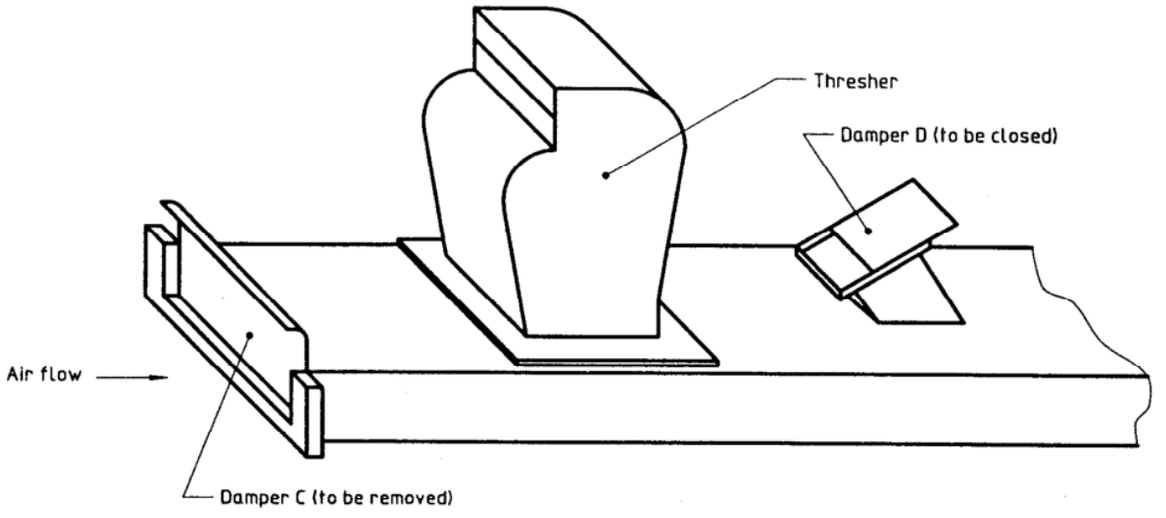
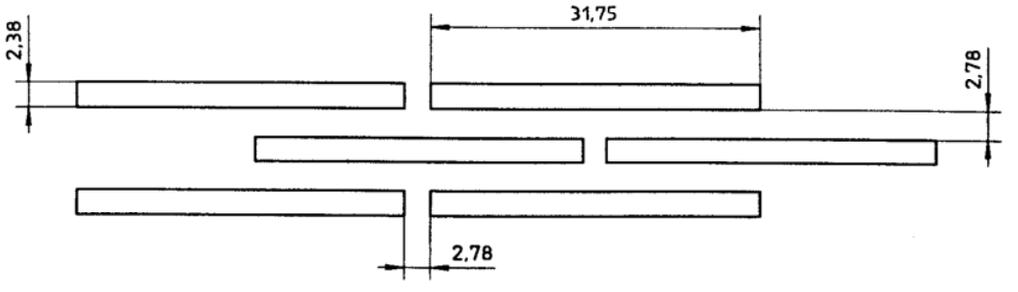


Figure 5 — Location of dampers

Dimensions in millimetres



NOTE — This 2,38 mm slotted-plate screen shall be fitted to a standard size sieve, 203,2 mm in diameter and 50,8 mm deep.

Figure 6 — A 2,38 mm slotted-plate screen for stacked-sieve-type stem shaker

4 Test method

A sample of tobacco strips is spread evenly across the feed conveyor (3.1.6) and is thus fed into the thresher (3.1.3) at a uniform rate. The threshed sample is pneumatically conveyed to a separating tower (3.1.9) where the lamina is removed from the threshed material using a defined and controlled air-flow rate, and discharged into a bin. The "heavies" from this separation are returned to the thresher for rethreshing. The operation continues for 4 min when the "heavies"-discharge door automatically opens and discharges the residual stems into a container for weighing.

Different types of tobacco strip, with differing bulk densities, will require different masses of sample to achieve the same volume feed into the thresher and different air-flow rates in the thresher and different air-flow rates in the separating tower to achieve the required separation of stem and lamina.

4.1 Sampling

Ensure the air-flow rate through the tower separator is set to standard in accordance with annex A. The nominal mass of sample to be used for the different tobacco types is given in table 1. If a sample is taken which is outside these limits, it should be discarded and a fresh sample taken. The sample can be freshly taken or can be the recombined residue from a lamina strip particle size test.[2)]

4.2 Procedure

4.2.1 Weigh the sample and spread the sample evenly over the length and width of the feed conveyor. Ensure the "heavies"-discharge door and the separating tower doors are closed.

4.2.2 Switch on the power and then switch on the following equipment in the order given:

a) the fan,

b) the 14/18 tangential "heavies"-separator airlock,

c) the 14/24 tangential "lights"-separator airlock,

d) the thresher,

e) the vibratory conveyor,

f) the winnower.

4.2.3 Set the automatic timer to exactly 4 min. (This allows 160 s for the sample to feed into the thresher and 80 s for the thresher to clean the "heavies".) Wait for the manometer reading to settle and check that its reading is the same as that achieved during the setting-up procedure. If it differs from this figure, then check for possible causes such as those given in annex A and annex D and then repeat the setting-up procedure detailed in annex A.

Start the test by pressing the feed-conveyor start button. This automatically starts the timer. As the last of the sample feeds into the thresher, brush any residual strip particles from the feed conveyor into the thresher. After the test time of 4 min, the "heavies"-discharge door will open automatically and stems will be discharged from the machine and collected in a bin. Allow 60 s for the stems to discharge. Small deposits of fine stems remaining in the separating tower may be ignored.

4.2.4 Return the light strips collected in the bin to the feed conveyor and spread them evenly over its length and width for a second pass. Close the "heavies"-discharge door and repeat the test procedure starting from 4.2.2. Collect any additional stem separated and add it to that from the first pass. Weigh the stem sample to the nearest ±1 g.

Turn the power off.

4.2.5 When samples are tested at frequent intervals, for quality control or for other purposes, it may be more convenient to keep the machine running between tests. In this case, only the vibratory and feed conveyors need be stopped and started between tests. Stopping the feed conveyor automatically resets the timer and re-energizes the discharge door solenoid. The discharge door shall be closed before each test.

4.3 Categorization of the stem content using the sieve-type shaker

All stem product, measured as "total stem content", from the stem tester is weighed and placed on the top screen (this will generally range between 50 g and 150 g).

Start the sieve-type shaker with the hammer engaged and simultaneously start a stop clock or electronic timer and run the shaker for exactly 5 min. Remove the sieve stack.

Remove any lamina bullets and record the mass of stem remaining on each screen and pan.

2) ISO 12194:1995, *Leaf tobacco — Determination of strip particle size.*

5 Expression of results

5.1 Calculation of stem content

Calculate the total stem content, as a percentage, as follows:

$$\frac{m \times 100}{M}$$

where

m is the individual mass, in grams;

M is the mass of the original strip sample, in grams.

5.2 Calculation of various categories of stem

Calculate the percentages of the various categories of stem in accordance with 4.3 as follows:

a) Stem more than 2,38 mm:

$$(\text{Mass of stem on 2,38 mm screen}) \times \frac{100}{M}\ \%$$

b) Stem less than 2,38 mm, less fibre:

$$(\text{Mass of stem on 2,80 mm + 1,70 mm screens}) \times \frac{100}{M}\ \%$$

c) Fibre stem:

$$(\text{Mass of stem in pan}) \times \frac{100}{M}\ \%$$

6 Test report

The test report shall specify the result(s) obtained. shall also mention all operating details not specified this International Standard or regarded as optiona together with details of any incidents which may hav influenced the test result(s).

The test report shall include all information necessai for the complete identification of the sample.

Annex A
(normative)

Setting the separating tower air flow to standard performance

Ensure the stem tester is set up in accordance 3.1.1 to 3.1.11. Turn the power off and set the manometer to zero. Fix and seal an aluminium plate (457 mm wide, 356 mm high and 13 mm thick) to the exit wall of the separating tower with plastic adhesive tape, leaving a 13 mm clearance between the vibratory screen and the lower edge of the plate. Fix a 50 mm wide, 180 mm long, piece of plastic adhesive tape to the mesh vibratory screen, 50 mm from the opposite wall and in the centre of the screen. This is illustrated in figure A.1. Ensure the "heavies"-discharge door is open.

Open the separating tower door and place at random ten heavy and ten light discs on the plastic tape. (The discs should be selected according to tobacco type as described in 3.1.11.) Turn the power on. Start the fan and the 14/24 tangential "lights"-separator airlock. Close the separating tower door. Allow 40 s for the air flow to stabilize and the manometer to settle then make a note of its reading.

Start the vibratory conveyor and a stop clock simultaneously. The light discs should collect in the lamina hopper and the heavy discs in the "heavies" hopper. After precisely 30 s, open the separating tower door. This will allow the remaining discs in the tower to discharge through the "heavies"-discharge door. Ensure that no discs are lost on opening the door.

Collect and count separately the discs that have collected in the "lights" bin and in the "heavies" bin. Replace the 20 discs on the plastic tape, close the tower door, and adjust damper A (sited downstream of the 14/24 tangential "lights" separator, see 3.1.8) as follows:

a) if more than one disc passes through the "heavies"-discharge door, increase the static pressure by opening damper A;

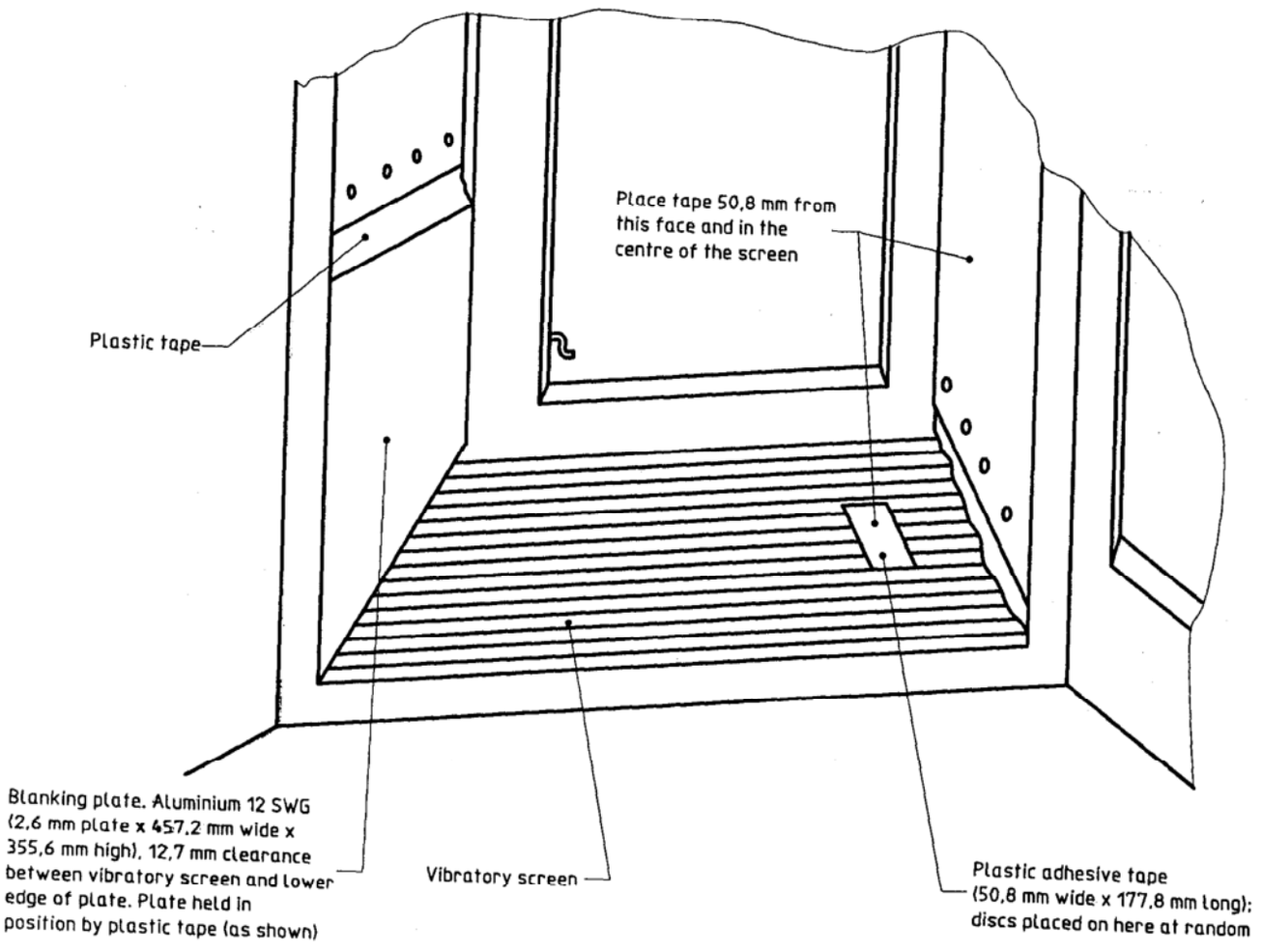
b) if more than one heavy disc is carried over to the "lights" bin, reduce the static pressure by closing damper A.

Repeat these procedures until at least nine heavy discs are discharged through the "heavies"-discharge door or at least nine light discs are collected in the "lights" bin. Repeat these procedures at the same damper setting at least three times to confirm the separating performance. Note the manometer reading, tighten the damper locking nut and remove the plastic tape and aluminium blanking plate from the separating tower.

The disc method is designed to ensure that a standard separating performance is obtained in the separating tower irrespective of changes in air density, altitude and temperature.

When the separating tower is set to standard air flow conditions, the operator should expect to see the discs separate cleanly into ten light and ten heavy discs most of the time. The tolerance of one disc in the 20 discs mentioned above is to allow for light discs being trapped in the separating tower and for small irregularities in the air-flow distribution in the tower causing heavy discs to be carried over with the light ones.

If damper A is fully open and there is insufficient air flow to carry the light discs over, then check to see that damper B is fully open, that there is no obstruction, such as tobacco debris in the system, and that the fan is running at the appropriate speed.



NOTE — Standard mesh dimensions are:

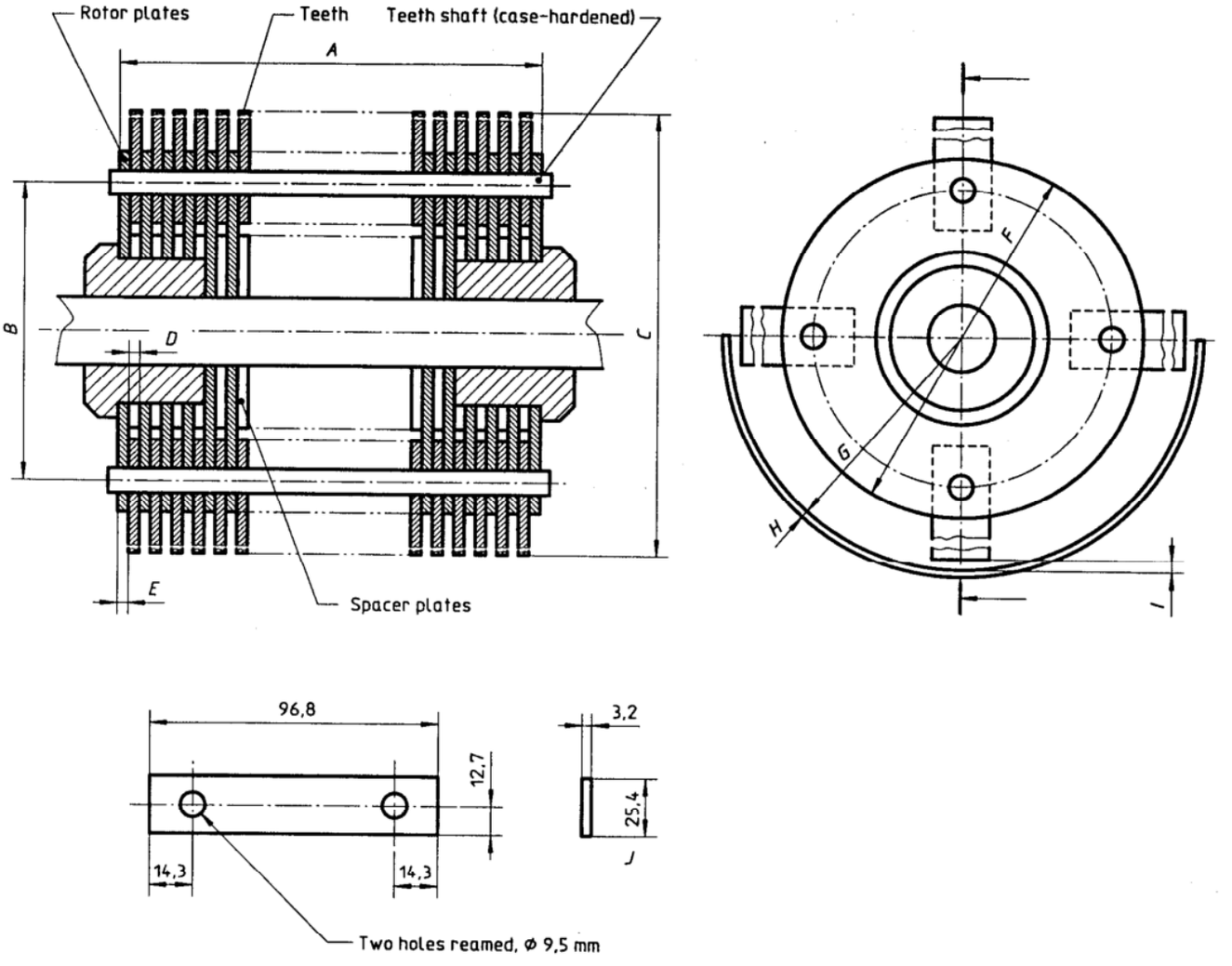
20 mesh per 25,4 mm; wire diameter 0,36 mm; opening 0,91 mm; 51,8 % open area.

Figure A.1 — Set-up to standardize air flow in the separating tower

Annex B
(informative)

Threshing equipment

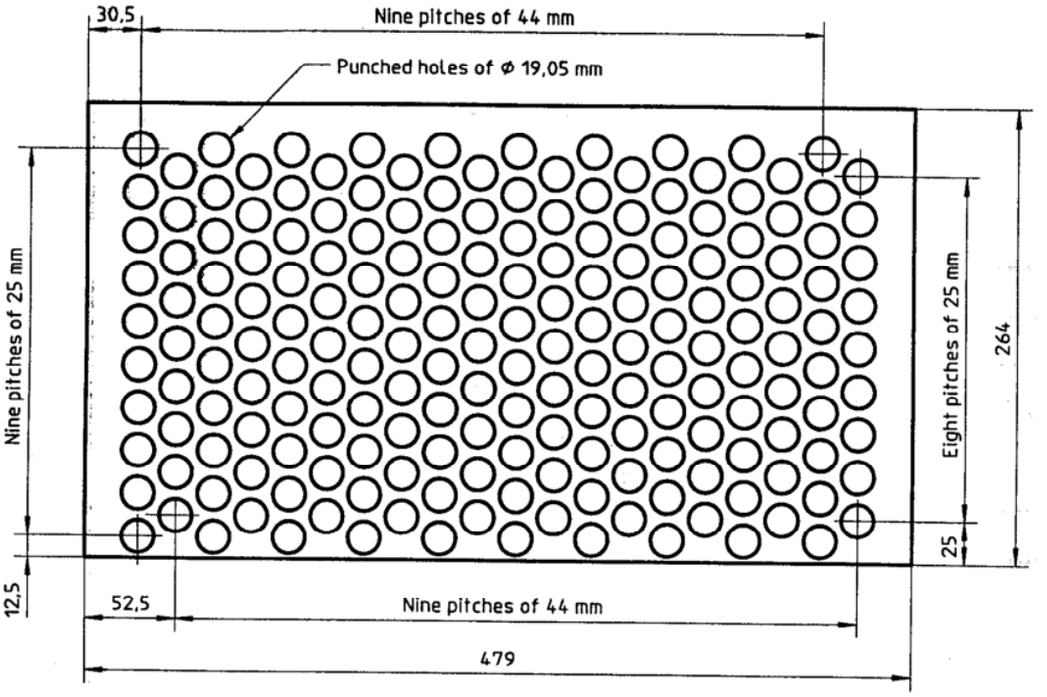
Dimensions in millimetres



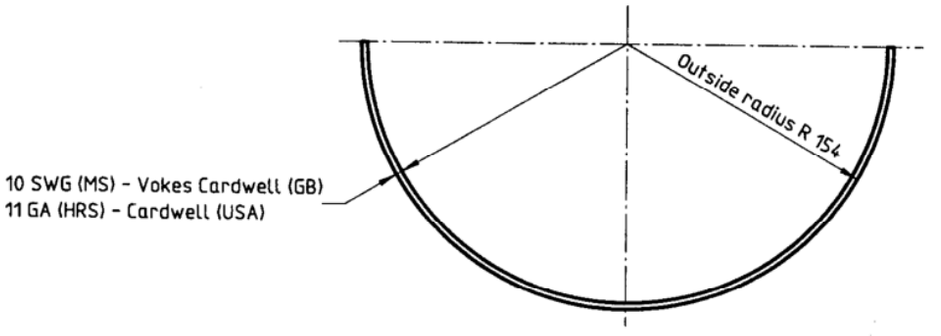
NOTE — See table B.2 for dimensions.

Figure B.1 — Example of thresher assembly

Dimensions in millimetres



a) Before rolling



b) After rolling

NOTE — Edges of holes shall be free of burrs.

Figure B.2 — Example of thresher basket

Table B.1 — Standard configuration of thresher

No. of rows of teeth	4
No. of teeth per row	31
Total No. of teeth	124
Total No. of spacer plates	31
Total No. of rotor plates	32

Table B.2 — Standard dimensions of basket

Dimensions in millimetres

Symbol[1)]	Parameter	Standard dimension and tolerance	Dimension of Vokes-Cardwell (GB) apparatus	Dimension of Cardwell (USA) apparatus
A	Overall length of plate assembly	228,6 ± 2,38	230,19	227,0
B	PCD of teeth shaft	123,8 ± 0,794	same	same
C	Distance between teeth tips	289,0 ± 0,794	289	289
D	Thickness of spacer plates	4,11 ± 0,25	4,064	4,176
E	Thickness of rotor plates	3,15 ± 0,305	3,251	3,038
F	Diameter of rotor plate	152,4 ± 0,794	same	same
G	Outside radius of basket	154,0 ± 0,794	153,99	153,99
H	Thickness of basket	3,15 ± 0,305	3,251	3,038
I	Gap between tooth and basket	6,35 ± 0,794	6,460	6,502
J	Tooth dimensions	0,794	same	same

1) See figure B.1.

Annex C
(informative)

Guidance notes

C.1 Use of discs to define the air-flow conditions in the separating tower

C.1.1 Stem varies in thickness from the butt to the vein. However, only stem above a certain thickness is usually regarded as objectionable, so any mechanical method of measuring stem in lamina must be set up and standardized to recognize this arbitrary criterion.

Aerodynamic separation as used in the Cardwell-type stem-in-lamina tester cannot give a sharp separation by stem thickness. Any method that removes the relatively thick objectionable stem will inevitably remove some of the thinner stem. Small differences in air-flow rate or air distribution in the separating tower will also affect the result.

Changes in air density affect the lift characteristics in a separating tower and require corresponding changes in air-flow rate to compensate for them.

A straightforward velocity correction may not always produce a standard separating performance and may not be easily achieved across the wide variety of climates, altitudes and locations in which the stem tester may be operated. A simple non-technical method was required which would enable the stem tester to be easily standardized.

C.1.2 Polypropylene discs were introduced as a means of solving this problem. These discs can be made to varying thickness, and therefore mass, and it is easily shown that there is a linear relationship between the separating tower static pressure and the mass of a disc carried over into the air stream.

Propylene discs, 25,4 mm in diameter, have the following characteristics.

a) Propylene is a relatively low-density material so a disc thickness between 0,508 mm et 1,016 mm will cover the full static pressure range in the separating tower and such discs are easy to machine. Denser materials would require thinner discs to cover the same range, giving less control during manufacture.

b) Propylene discs may be turned accurately and simply from 25,4 mm diameter bars and they are virtually non-hygroscopic. Some plastic materials, such as nylon, are found to absorb moisture and therefore can gain or lose mass. This has a dramatic effect on the separating static pressure required to lift the discs.

c) The parting-off nipple remaining on the disc after turning is only 2 % of the disc mass and, as the nipples appear to act as a form of aerodynamic ballast, they are not removed from the discs.

A drawing of the disc design is given in figure C.1.

C.1.3 A relationship between the disc mass and the static tower pressure at which

— all discs separate from the tower, and

— all discs remain in the tower,

is shown in figure C.2.

This relationship enables a set of light discs and heavy discs to be specified for any required static pressure in the separating tower.

C.2 Subjective and objective assessment of objectionable stem

Several grades of tobacco lamina, of varying stem content, should be tested over a range of separating tower static pressures and the "heavies" collected. The "heavies" product from these tests should be inspected by senior leaf and quality control personnel within a company to determine which samples represent their view of objectionable stem. These will lie somewhere between "heavies" collected at the higher static pressure range containing only the larger stems and those collected at the lower static pressure range containing these larger stems plus quantities of thinner stems and veins. The tower static pressure at which the selected samples were separated is recorded and a set of discs manufactured using the relationships between the tower static pressure and the relevant light and heavy disc masses described in C.1.3.

The procedure described above must be repeated for each type of tobacco strip requiring testing for stem in

lamina. The air-flow characteristics of most cigar tobaccos, for example, differ markedly from most flue-cured tobaccos. The sample masses and stem-in-lamina targets are also likely to differ between tobacco types.

C.3 Sampling positions

The majority of strips sampled for stem-in-lamina testing are taken at the end of the threshing line as a quality-control measure. These samples generally range from 16 % to 20 % moisture content.

Tobacco strips are also, from time to time, sampled and tested from the exit of the redrier and out of the packed case or hogshead immediately after packing. Samples are also taken and tested before and after blending of strips during cigarette manufacture. The sampling and handling of dry lamina must be carried out carefully to avoid degradation.

The moisture content of some of these samples may range from 10 % to 14 % and they will need to be reconditioned to at least 15 % to 16 % moisture content before testing.

It should be recognized that although the total stem content of the lamina strips sampled from all test locations are likely to be similar, there is no guarantee of this. Test data should only be compared and ranked from within one sampling location.

it is not just differences in moisture content at the time of the test that may affect the result, but also physical changes to the lamina and stem arising from their being subjected to the redrying and packing process. This may affect both the relative densities and aerodynamic properties of the sample.

Dimensions in millimetres

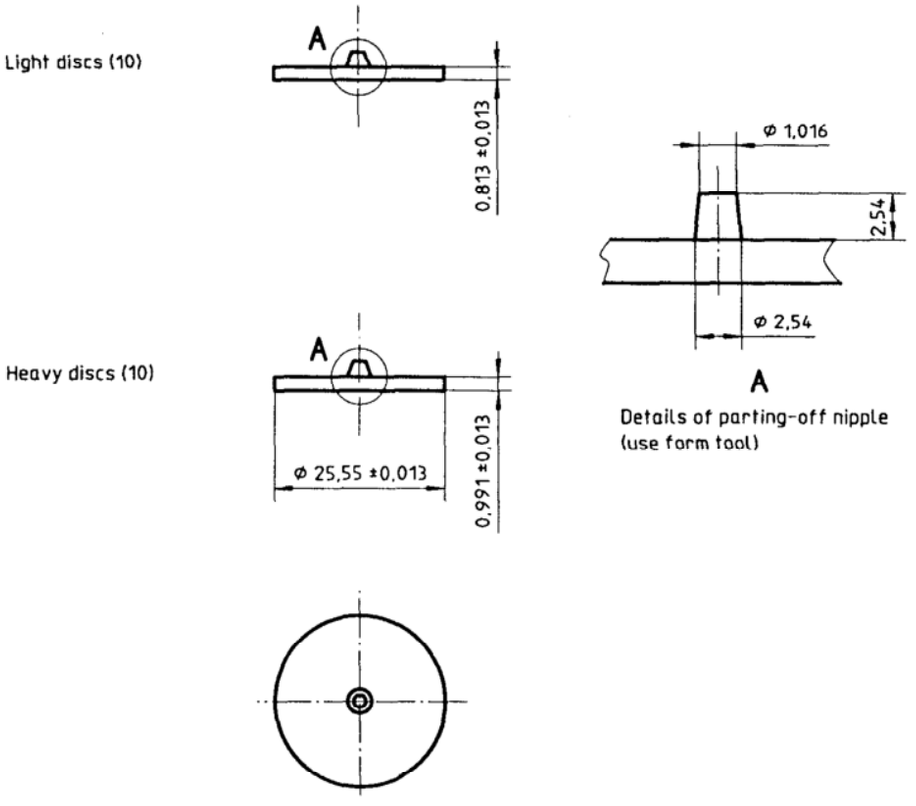


Figure C.1 — Disc design

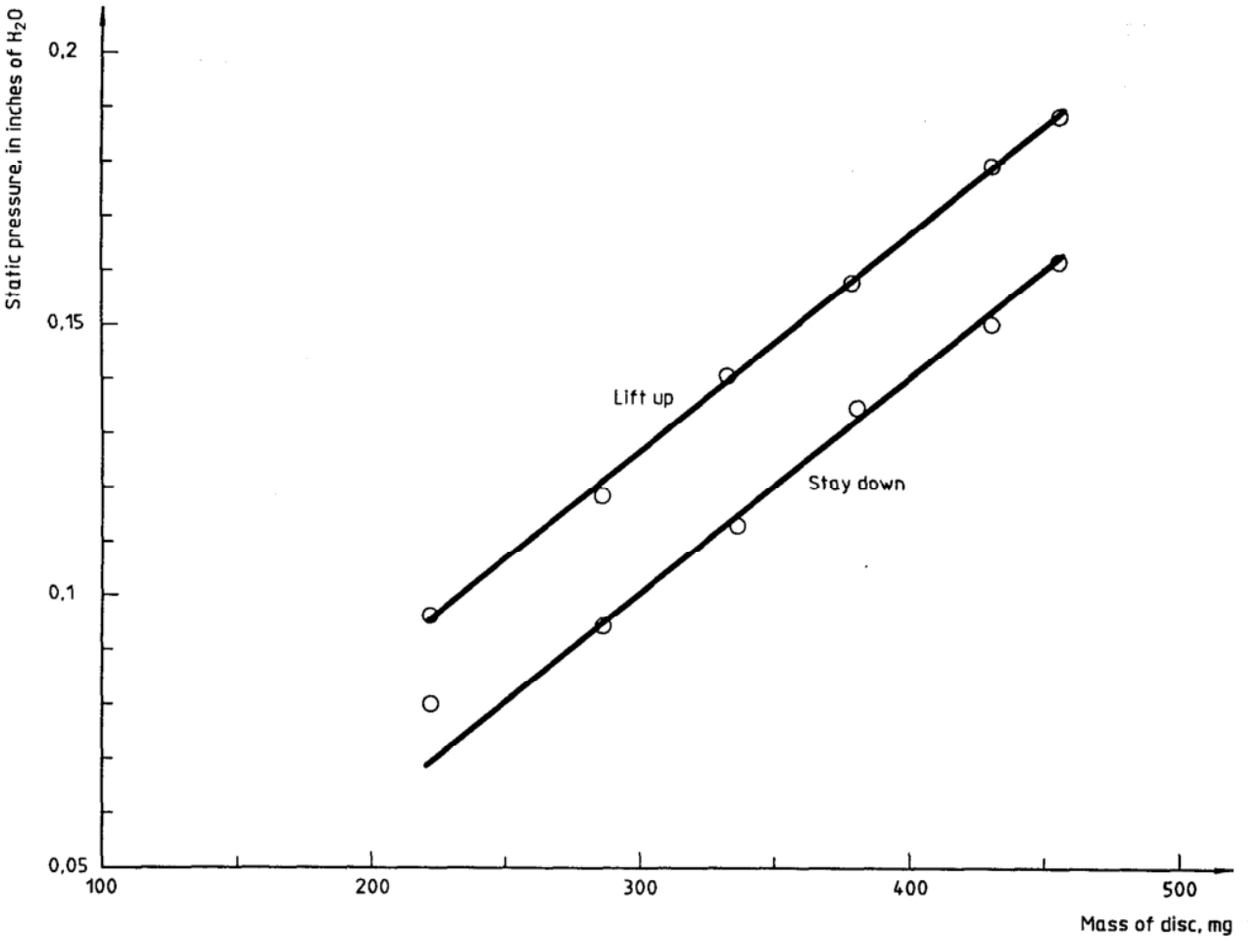


Figure C.2 — Separating tower conditions and disc mass for polypropylene discs 25,4 mm in diameter

Annex D
(informative)

Routine checking and cleaning procedures

a) Check and clean daily the following.

1) The threshing basket: remove any tobacco debris.

2) The static tapping apparatus and manometer: ensure the static tapping apparatus sensing hole is free of tobacco fines and dirt and the manometer is correctly filled and zeroed.

3) The vibratory screen: ensure the wire mesh screen has not become blinded with tobacco dust.

4) The floor area surrounding the stem tester.

5) Remove any stem deposits that may have built up in the

— 14/18 tangential "heavies" separator;

— thresher and its surrounds;

— duct inlet below the thresher;

— the winnower shelf;

— the vibratory conveyor screen.

b) Check weekly the following.

1) The threshing teeth: these are case-hardened, but look for excessive wear and elongation of the holes in the teeth.

2) The air-inlet guide vane settings.

c) At least once a year, all ducting should be dismantled and cleaned thoroughly.

d) Maintain the stem tester in accordance with the manufacturer's manual.

ICS 65.160

Descriptors: tobacco, tests, determination, stems (plants), sieve analysis.

Price based on 19 pages