

First edition  
2003-02-01

---

---

## **Tobacco and tobacco products — Monitor test piece — Requirements and use**

*Tabac et produits du tabac — Éprouvette de contrôle — Exigences et  
utilisation*



Reference number  
ISO 16055:2003(E)

© ISO 2003

**PDF disclaimer**

This PDF file may contain embedded typefaces. In accordance with Adobe's licensing policy, this file may be printed or viewed but shall not be edited unless the typefaces which are embedded are licensed to and installed on the computer performing the editing. In downloading this file, parties accept therein the responsibility of not infringing Adobe's licensing policy. The ISO Central Secretariat accepts no liability in this area.

Adobe is a trademark of Adobe Systems Incorporated.

Details of the software products used to create this PDF file can be found in the General Info relative to the file; the PDF-creation parameters were optimized for printing. Every care has been taken to ensure that the file is suitable for use by ISO member bodies. In the unlikely event that a problem relating to it is found, please inform the Central Secretariat at the address given below.

© ISO 2003

All rights reserved. Unless otherwise specified, no part of this publication may be reproduced or utilized in any form or by any means, electronic or mechanical, including photocopying and microfilm, without permission in writing from either ISO at the address below or ISO's member body in the country of the requester.

ISO copyright office  
Case postale 56 • CH-1211 Geneva 20  
Tel. + 41 22 749 01 11  
Fax + 41 22 749 09 47  
E-mail [copyright@iso.org](mailto:copyright@iso.org)  
Web [www.iso.org](http://www.iso.org)

Published in Switzerland

# Contents

Page

<b>Foreword</b> .....	<b>iv</b>
<b>1 Scope</b> .....	<b>1</b>
<b>2 Normative references</b> .....	<b>1</b>
<b>3 Terms and definitions</b> .....	<b>1</b>
<b>4 Requirements</b> .....	<b>2</b>
<b>5 Testing</b> .....	<b>2</b>
<b>6 Data sheet information</b> .....	<b>2</b>
<b>7 Use</b> .....	<b>3</b>
<b>Annex A (informative) Control charts</b> .....	<b>6</b>
<b>Bibliography</b> .....	<b>13</b>

## 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.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

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.

ISO 16055 was prepared by Technical Committee ISO/TC 126, *Tobacco and tobacco products*.

# Tobacco and tobacco products — Monitor test piece — Requirements and use

## 1 Scope

This International Standard describes the requirements for a monitor test piece as well as its use.

## 2 Normative references

The following referenced documents are indispensable for the application 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 3308, *Routine analytical cigarette-smoking machine — Definitions and standard conditions*

ISO 4387, *Cigarettes — Determination of total and nicotine-free dry particulate matter using a routine analytical smoking machine*

ISO 5725-2, *Accuracy (trueness and precision) of measurement methods and results — Part 2: Basic method for the determination of repeatability and reproducibility of a standard measurement method*

ISO 7870, *Control charts — General guide and introduction*

ISO 7873, *Control charts for arithmetic average with warning limits*

ISO 8258:1991, *Shewhart control charts*

ISO 10315, *Cigarettes — Determination of nicotine in smoke condensates — Gas-chromatographic method*

ISO 10362-1, *Cigarettes — Determination of water in smoke condensates — Part 1: Gas-chromatographic method*

## 3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

### 3.1

#### **monitor test piece**

a cigarette taken from a batch produced under particularly strictly controlled manufacturing conditions

**NOTE** The cigarettes in such a batch show the greatest possible homogeneity with regard to their physical, chemical and smoke yield characteristics.

### 3.2

#### **analysis value**

the result, based on the testing of 5 or 20 items (depending on the type of smoking machine used), of a smoking test and analysis carried out in accordance with ISO 4387, ISO 10315 and ISO 10362-1

## 4 Requirements

- 4.1** The monitor test pieces shall be produced from one production batch.
- 4.2** The number of monitor test pieces produced shall be sufficient to cover the needs of a period of at least 2 years.
- 4.3** For reasons of homogeneity, the cut tobacco used shall be taken from one well-mixed batch (if possible, it is advisable to use a single grade of tobacco with no addition of further materials, such as stems, humectants or flavours, to avoid unnecessary heterogeneity of the blend).
- 4.4** The non-tobacco materials used, such as cigarette paper and filters, shall be taken from one production batch and strict quality-control measures shall be applied during the production of the filters.
- 4.5** Specifications for the length and diameter of the monitor test piece, and for its filter length, tipping length and filter material, shall be set before production. If the design of the product includes filter ventilation, this shall also be specified prior to production.
- 4.6** The production tolerances on tobacco mass, circumference and draw resistance of the monitor test piece shall be controlled as precisely as possible. It will normally be necessary to increase the quality-control measures and to decrease the production machine speed to obtain the required consistency in physical, chemical and smoke yields of the monitor test pieces.
- 4.7** The monitor test pieces in a lot shall show consistent values for the content of nicotine-free dry particulate matter and for nicotine in their smoke. This consistency shall be assessed by means of a comparative study of sufficient size, the size chosen depending on whether the monitor is for local or broader use (see ISO 5725-2).
- 4.8** The packaged monitor test pieces shall be stored at a temperature below +4 °C until they are to be used.

**NOTE** Other reference standards in the tobacco field require a storage temperature below –16 °C for reasons of hygiene. Normally, a storage temperature of +4 °C is sufficient for monitor test pieces.

## 5 Testing

Testing of the lot, including determination of the values for nicotine-free dry particulate matter and nicotine in the smoke, shall be carried out in accordance with ISO 4387, ISO 10315 and ISO 10362-1 in the form of an inter-laboratory trial run in accordance with ISO 5725-2. The study shall be performed by using the butt length given in the data sheet accompanying the monitor test piece.

Monitor test pieces for daily routine use may be produced by the individual company for its own purposes. However, for the purposes of inter-laboratory comparisons or for comparison of analytical consistency between laboratories, it is advised to use monitor test pieces from a common source. At present, a monitor test piece is available from CORESTA<sup>1)</sup>. The CORESTA monitor test piece is tested annually for consistent smoke yields in an international comparative study in accordance with ISO 5725-2.

## 6 Data sheet information

### 6.1 General

A data sheet from the source of supply of the monitor test piece shall be included. It shall contain the information set out in 6.2 and 6.3.

---

1) Address: CORESTA, 11, rue du Quatre-Septembre, F-75002 Paris.

## 6.2 General production specifications

The specifications for length, diameter, filter length, tipping length and filter material.

## 6.3 Analysis values from inter-laboratory testing

The results from the inter-laboratory testing of the monitor test piece, comprising:

- the butt length used;
- the type of smoking machine used;
- the average and standard deviation of the results for nicotine in the smoke;
- the average and standard deviation of the results for nicotine-free dry particulate matter;
- the two-sided confidence interval for the mean values, with a confidence level of 95 %.

## 7 Use

### 7.1 General

Monitor test pieces are used to monitor the stability of the analytical processes involved when using a cigarette-smoking machine for routine analyses in accordance with ISO 3308. In particular, they are used to assess whether the analytical process related to the machine-smoking of cigarettes (described in ISO 4387, ISO 10315 and ISO 10362-1) is “in statistical control” (see ISO 7870).

NOTE 1 As monitor test pieces are produced for process-control purposes, the product design is chosen to give smoke yields which are well suited to these purposes and thus may well not conform to official declaration restrictions. In this context, it should be understood that the monitor test piece is not to be regarded as a commercial cigarette.

The routine use of monitor test pieces may vary from laboratory to laboratory and between the two commonly used types of analytical smoking machine. The general principle is to evaluate the consistency of the values of the essential parameters (such as puff number, total particulate matter, nicotine and water in smoke condensate and nicotine-free dry particulate matter) by using control charts.

Monitor test pieces are not to be used for calibration purposes, and the results obtained with monitor test pieces shall not be used for correcting or calculating analytical data from investigation samples.

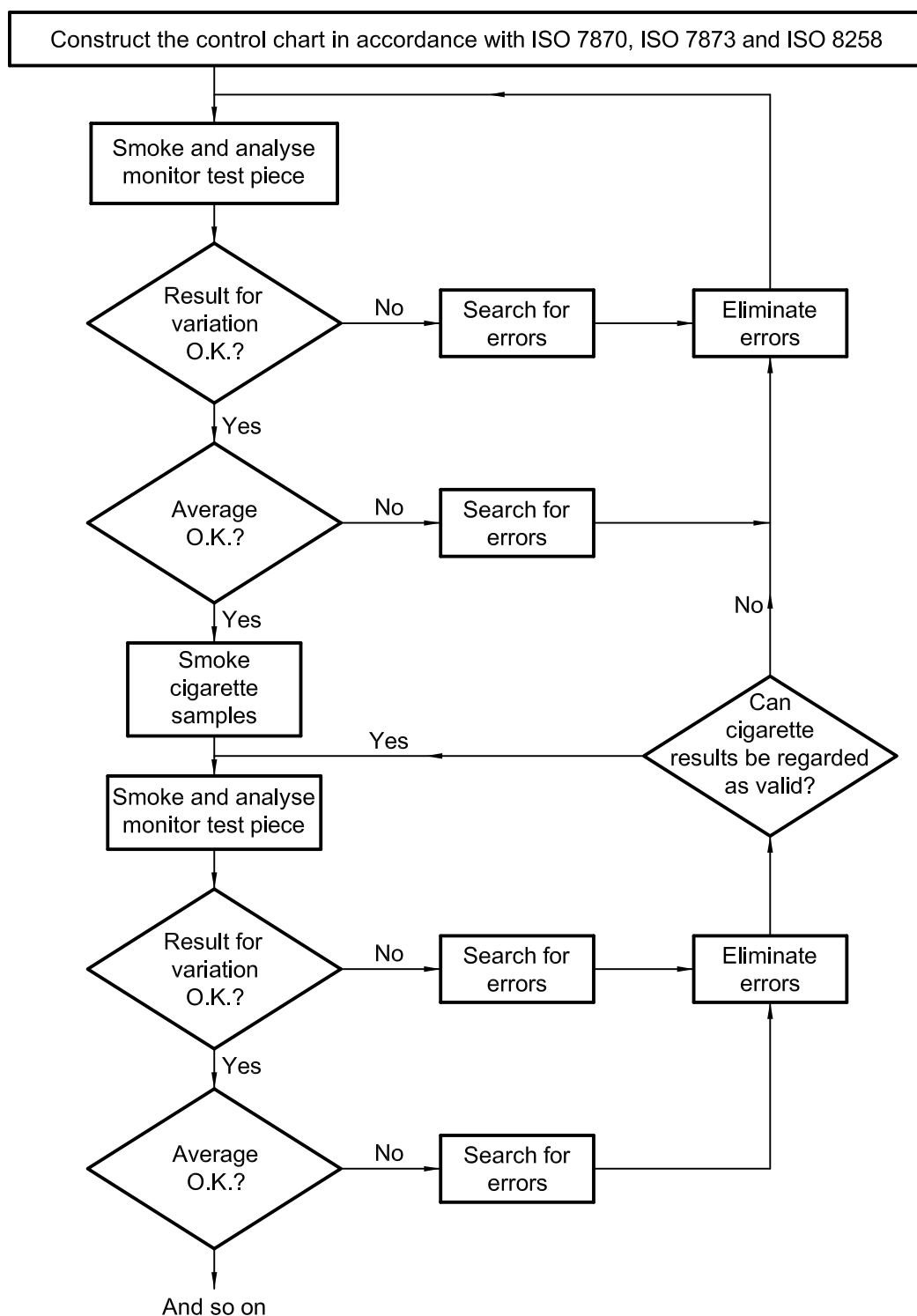
The smoke yields will normally be based upon the smoking of at least 20 cigarettes as described in ISO 4387.

The smoking of 20 cigarettes will give one average result from a rotary smoking machine whereas a linear smoking machine will give 4 average results from smoking 5 cigarettes in each of 4 channels. This means that the variation in the smoking process has to be determined by different methods for the two smoking machines. For the rotary machine, the variation may be determined as a “between smoke runs” variation whereas the variation for the linear machine may be determined from the 4 individual results from the 4 channels. In other words, the process variation from the rotary smoking machine is based on “independent” single results while the variation from the linear smoking machine can be based on 4 results from one smoke run but from 4 “independent” channels.

This means that different types of control chart have to be used for the two smoking machines. The actual choice shall be made according to the actual demands and cannot be specified to fit all needs. Annex A gives advice on, and examples of, the practical use of control charts.

NOTE 2 This advice is based on the statistical theory described in ISO 7870, ISO 7873 and ISO 8258 combined with practical experience from daily use.

Figure 1 illustrates the use of monitor test pieces in routine smoking analysis.



**IMPORTANT:** When analysing the control chart, always test for assignable causes in accordance with ISO 8258 and ISO 7873.

**Figure 1 — Flow chart for use of monitor test pieces in routine analytical smoking**



## 7.2 Practical procedures for the use of monitor test pieces

The practical procedures for use of monitor test pieces are based upon the condition that the consistency of a process can be evaluated by analysing control samples at chosen intervals, and comparison of the test results graphically in a control chart (see ISO 7870).

The frequency at which the monitor test pieces shall be analysed cannot be specified. It depends on the local need. But the following considerations describe the importance of a practical choice (see also ISO 8258:1991, 10.4).

Under the condition that the analytical process is consistent (stable), it is assumed that all the analytical results obtained between two valid results from the monitor test pieces are also valid. In contrast, results obtained during a period which begins with a valid check result and ends with a non-valid check result must be regarded as non-valid until further investigations have indicated their validity. Thus there is a risk of having to reject these results and having to repeat the analysis. To avoid the loss of large numbers of results, it is important to analyse the monitor test piece at intervals which are not "too great". It becomes a balance between analytical capacity and need for confirmation of consistency.

The procedure for the two types of smoking machine will be different but based, of course, upon the same principle — sequential smoking and confirmation of the validity of the smoking results.

The following procedure can be recommended:

**For the rotary smoking machine:** At the beginning of a series of smoking analyses, a smoking run and an analysis is performed with the monitor test piece. At practical intervals (for example for each 10 to 15 smoke runs), this procedure should be repeated, ending the day with smoking of the monitor test piece.

**For the linear smoking machine:** At the beginning of a series of smoking analyses, the monitor test piece is smoked on a selection of channels (4 would normally fit into a smoking plan). During the daily smoking, this could be repeated at a practical frequency, with test pieces being smoked on 4 channels for every 2 or 3 smoke runs. To secure the best information, it is important that smoking of the monitor test piece is evenly distributed on all 20 channels over a period of time.

## 7.3 Practical use of control charts

The analysis values from smoking and analysis of monitor test pieces are plotted on the appropriate control charts (see Annex A and ISO 7870, ISO 7873 and ISO 8258) so that the results for average and for variation can be evaluated.

It is possible to use control charts where standard values are given, but also where the standard values are not given (see ISO 8258:1991, 4.1, 4.2 and Clause 12). This means that control charts can be constructed for the individual laboratory without knowledge of the official target values for the test piece, but the control chart can also be constructed with reference to target values.

The control charts may have both warning and action limits (see ISO 7873) or have only one set of control limits (see ISO 8258). Either kind of control chart can be used, but for the correct evaluation of the consistency of the analytical process it is very important that the rules for testing for assignable causes (see ISO 8258:1991, introduction and Clause 7) are followed.

It is a matter of choice whether to use control charts with or without target values combined with one set or two sets of control limits. It depends on the actual needs. It may be practical to combine the target values from the inter-laboratory testing with the results from the individual laboratory's own routine check. On the other hand, this may be impractical for laboratories which have analytical averages which differ from the target values. In these cases, the consistency check will be affected by the obstruction of the control limits by the official target values, and it may be better to determine any difference between the local average and the official average by other statistical methods for differences between variances and between averages.

## **Annex A** (informative)

### **Control charts**

#### **A.1 General**

The choice of control charts for plotting results from smoking and analysis of the monitor test piece is illustrated below by three examples which are by no means mandatory or complete. (For further information, see e.g. ISO 8258, ISO 7870 and ISO 7873 which describe the theory and use of control charts. ISO 8258 also includes information about the eight tests necessary for interpreting patterns in the control charts — tests which are vital before the decision is made that a control chart is “in control”.) The first two examples describe different types of control chart — one for smoking processes which give more than one result per smoke run (typically smoking on several channels on linear smoking machines) and the other for smoking processes which give only one result per smoke run (typically smoking on a rotary smoking machine). The third example is a control chart with standard values given and may be used in cases where smoking analysis is not performed continuously.

#### **A.2 Calculation of control chart limits**

##### **A.2.1 Examples 1 and 2**

###### **A.2.1.1 General**

A suitable control chart for linear machines can be a “mean and standard deviation” chart (or a “mean and range” chart). For the rotary smoking machine, an “individuals” chart (also known as a “mean and moving range” chart) is described.

Two sets of results for calculation of control limits for nicotine-free dry particulate matter (NFDPM) are given in Table A.1, in which the subgroup averages in Example 1 and the results in Example 2 have been chosen so that they are identical. The examples are chosen to be as realistic as possible and in fact could be seen as practical laboratory results. The calculations are performed as described in ISO 8258. The control charts are shown in Figures A.1 and A.2. Please note that in Figure A.1 the 12th result in the mean chart is “out of control” which ought, of course, to have prompted deliberations concerning the actual consistency of the smoke analysis immediately after the analysis.

The examples given are control charts without warning limits. Should warning limits be required, they can be calculated at a distance from the central line equal to  $2\sigma$ .

**NOTE** The number of subgroups necessary for the construction of a control chart is important. ISO 8258 recommends in the text that 20 to 25 subgroups should be obtained but the examples go as low as 15. No safe number can be given, but care should be exercised that the analytical process during the initial collection of data is not influenced intermittently by extraneous changes such as in machine settings or other external factors.

Table A.1 — Examples of the calculation of control chart limits

EXAMPLE 1			EXAMPLE 2		
Linear smoking machine (smoking on 4 channels)			Rotary smoking machine		
Mean and standard deviation chart			Mean and moving range chart		
Subgroup number	Subgroup average mg NFDPM	Subgroup standard deviation mg NFDPM	Subgroup number	Result mg NFDPM	Moving range $R$ mg NFDPM
1	15,0	0,52	1	15,0	—
2	15,2	0,54	2	15,2	0,2
3	15,2	0,24	3	15,2	0,0
4	15,8	0,22	4	15,8	0,6
5	15,6	0,47	5	15,6	0,2
6	15,7	0,69	6	15,7	0,1
7	15,1	0,57	7	15,1	0,6
8	16,0	0,29	8	16,0	0,9
9	14,9	0,12	9	14,9	1,1
10	14,9	0,55	10	14,9	0,0
11	15,4	0,67	11	15,4	0,5
12	14,5	0,63	12	14,5	0,9
13	15,6	0,56	13	15,6	1,1
14	15,1	0,33	14	15,1	0,5
15	15,5	0,43	15	15,5	0,4
Mean	$\bar{\bar{x}} = 15,30$	$\bar{s} = 0,455$	Mean	$\bar{x} = 15,30$	$\bar{R} = 0,51$
UCL	16,04	1,03	UCL	16,20	1,67
LCL	14,56	0	LCL	14,40	0

NOTE UCL = Upper control limit; LCL = Lower control limit.

### A.2.1.2 Formulae for the calculation of UCL and LCL in the mean and standard deviation chart (Example 1)

$UCL_{\bar{x}}$  and  $LCL_{\bar{x}}$ , expressed in mg of NFDPM, are given by the equations:

$$UCL_{\bar{x}} = \bar{\bar{x}} + 1,628 \times \bar{s}$$

$$LCL_{\bar{x}} = \bar{\bar{x}} - 1,628 \times \bar{s}$$

where

1,628 is the factor for the control limits (see ISO 8258:1991, Table 2,  $A_3$  for  $n = 4$ );

$UCL_s$  and  $LCL_s$ , expressed in mg of NFDPM, are given by the equations:

$$UCL_s = 2,266 \times \bar{s}$$

2,266 being the factor for the control limits (see ISO 8258:1991, Table 2,  $B_4$  for  $n = 4$ ),

$$LCL_s = 0 \times \bar{s}$$

0 being the factor for the control limits (see ISO 8258:1991, Table 2,  $B_3$  for  $n = 4$ ).

#### A.2.1.3 Formulae for the calculation of UCL and LCL in the mean and range chart (Example 2)

$UCL_x$  and  $LCL_x$ , expressed in mg of NFDPM, are given by the equations:

$$UCL_x = \bar{x} + \frac{2}{1,128} \times \bar{R}$$

$$LCL_x = \bar{x} - \frac{2}{1,128} \times \bar{R}$$

where

$\frac{2}{1,128}$  is the factor for the control limits (see ISO 8258:1991, Table 3,  $E_2 = \frac{2}{d_2}$ , and Table 2,  $d_2 = 1,128$ , for  $n = 2$ );

$UCL_R$  and  $LCL_R$ , expressed in mg of NFDPM, are given by the equations:

$$UCL_R = 3,267 \times \bar{R}$$

3,267 being the factor for the control limits (see ISO 8258:1991, Table 2,  $D_4$  for  $n = 2$ ),

$$LCL_R = 0 \times \bar{R}$$

0 being the factor for the control limits (see ISO 8258:1991, Table 2,  $D_3$  for  $n = 2$ ).

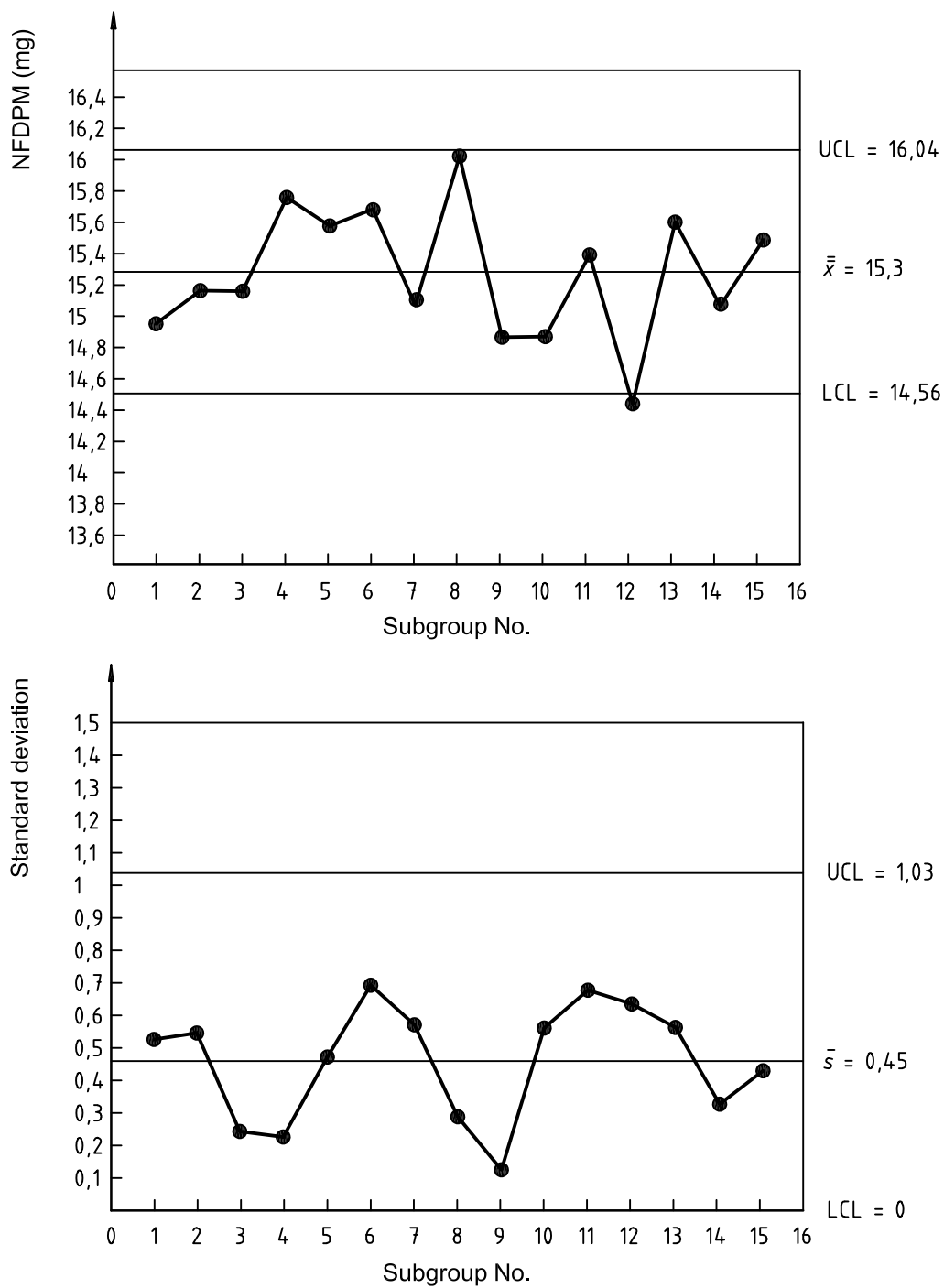


Figure A.1 — Mean and standard deviation chart

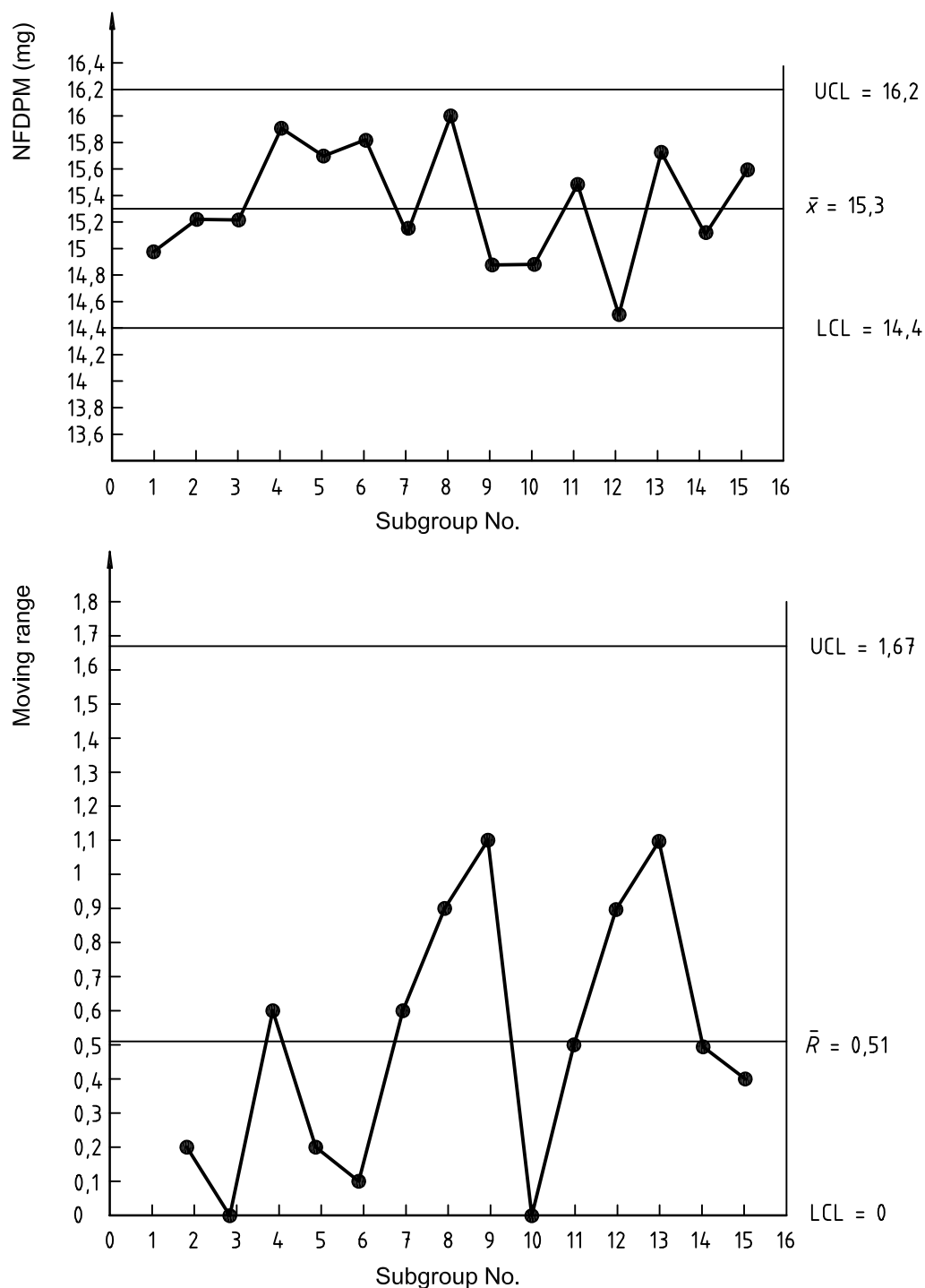


Figure A.2 — Mean and moving range chart

### A.2.2 Example 3

#### A.2.2.1 General

Control charts with standard values may be used in cases where a laboratory does not perform smoking analysis continuously. The control charts are intended for use only as an internal control of the consistency of the smoking analysis within the laboratory.

In contrast to Examples 1 and 2, no explicit data are given for this example, only a raw control chart being shown in Figure A.3. The standard values for this control chart should be taken from an inter-laboratory trial (see the note) in which the smoke yields between individual laboratories may exhibit greater scatter than the smoke yields within an individual laboratory. Thus it is necessary to assume that not every individual laboratory will obtain results which approximate to the mean values from the inter-laboratory trial. This means that the individual laboratory can have mean smoke yields which differ from the standard values and at the same time still be regarded as smoking correctly as long as the control chart is in control and the smoke yields are within the variation over time to be expected from the inter-laboratory trial.

If smoke yields deviate systematically from the standard values (i.e. their scatter has e.g. a high variation over the whole range), it is advisable for the laboratory to try to detect and correct the possible causes of this deviation, but under no circumstances should the laboratory correct the level-of-smoke results by taking any non-scientific measures or by making any arithmetic calculations.

**NOTE** At the time of publication of this International Standard, the only international inter-laboratory smoking trial which exists is the annual smoking trial with the CORESTA monitor test piece which is performed by the CORESTA Routine Analytical Chemistry Sub-Group. Results from this trial can be obtained from the Secretary-General of CORESTA.

### A.2.2.2 Formulae for the mean chart

The mean value ( $x_0$ ) and standard deviation ( $\sigma_0$ ) for NFDPM are taken from the CORESTA annual smoking trial using the CORESTA CM 3 monitor test piece (1999).  $LCL_x$  and  $UCL_x$  are given by the following equations:

$$LCL_x = x_0 - 3\sigma_0 = 13,71$$

$$UCL_x = x_0 + 3\sigma_0 = 16,55$$

where

$x_0$  is the mean of the subgroup measurements ( $x_0 \triangleq \bar{x} = 15,13$ );

$\sigma_0$  is the standard variation of the laboratory mean values in the inter-laboratory study ( $\sigma_0 = s = 0,473$ ).

### A.2.2.3 Formulae for moving range chart

For control of the intra-laboratory variation, the mean value of the intra-laboratory variation ( $\sigma_1 = 0,275$ ) is used for the moving range chart. The central line (CL),  $LCL_R$  and  $UCL_R$  are given by the following equations:

$$CL = 1,128 \times \sigma_1 = 0,310$$

$$LCL_R = 0 \times \sigma_1$$

$$UCL_R = 3,686 \times \sigma_1$$

where

1,128 is the factor for the control limits (see ISO 8258:1991, Table 3 and Table 2,  $d_2$  for  $n = 2$ );

0 is the factor for the control limits (see ISO 8258:1991, Table 3 and Table 2,  $D_1$  for  $n = 2$ );

3,686 is the factor for the control limits (see ISO 8258:1991, Table 3 and Table 2,  $D_2$  for  $n = 2$ ).

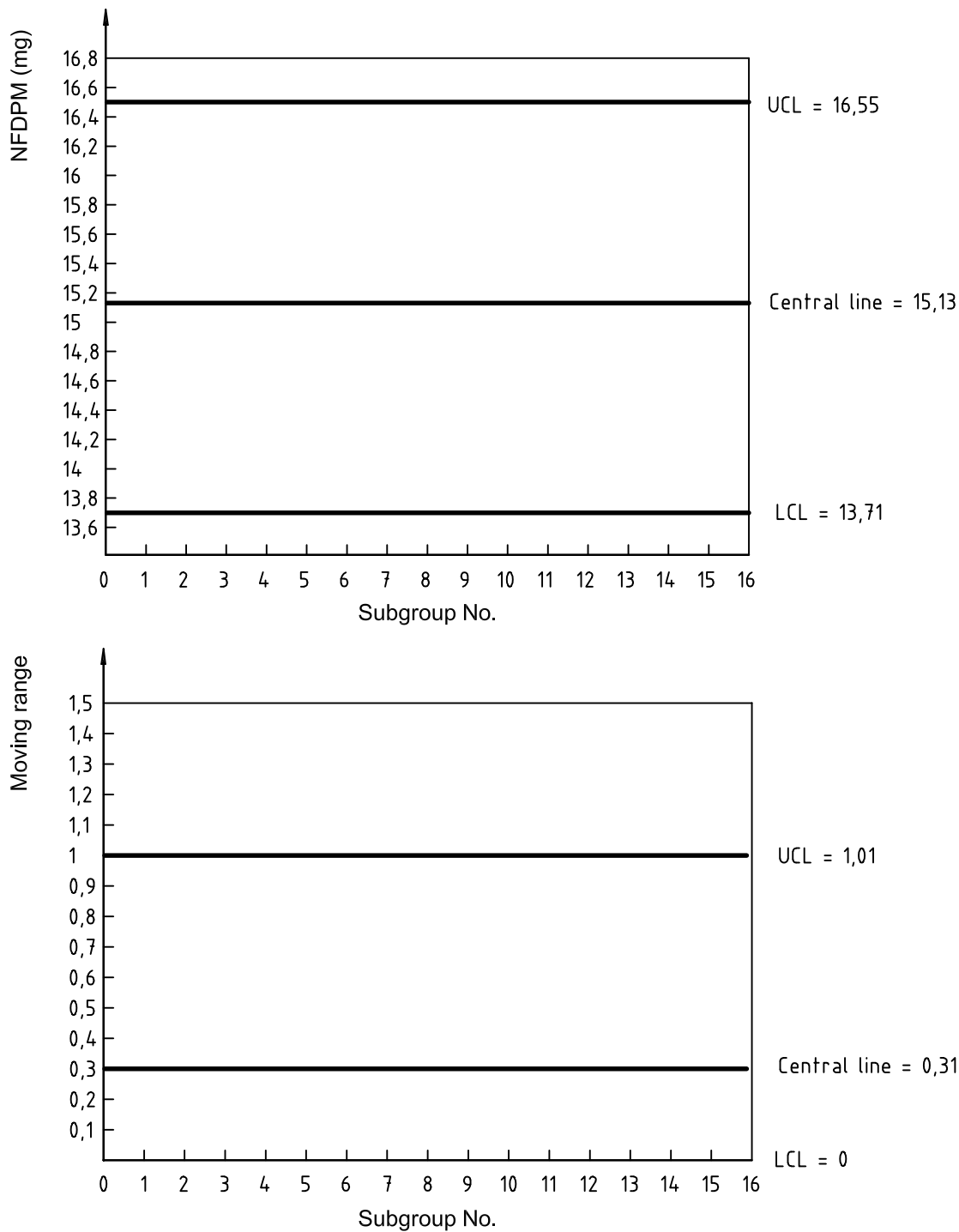


Figure A.3 — Mean and moving range chart



## Bibliography

- [1] ISO 3400, *Cigarettes — Determination of alkaloids in smoke condensates — Spectrometric method*
- [2] ISO 3402, *Tobacco and tobacco products — Atmosphere for conditioning and testing*

1  
2  
3  
4  
5  
6  
7  
8  
9  
10  
11  
12  
13  
14  
15  
16  
17  
18  
19  
20  
21  
22  
23  
24  
25  
26  
27  
28  
29  
30  
31  
32  
33  
34  
35  
36  
37  
38  
39  
40  
41  
42  
43  
44  
45  
46  
47  
48  
49  
50  
51  
52  
53  
54  
55  
56  
57  
58  
59  
60  
61  
62  
63  
64  
65  
66  
67  
68  
69  
70  
71  
72  
73  
74  
75  
76  
77  
78  
79  
80  
81  
82  
83  
84  
85  
86  
87  
88  
89  
90  
91  
92  
93  
94  
95  
96  
97  
98  
99  
100  
101  
102  
103  
104  
105  
106  
107  
108  
109  
110  
111  
112  
113  
114  
115  
116  
117  
118  
119  
120  
121  
122  
123  
124  
125  
126  
127  
128  
129  
130  
131  
132  
133  
134  
135  
136  
137  
138  
139  
140  
141  
142  
143  
144  
145  
146  
147  
148  
149  
150  
151  
152  
153  
154  
155  
156  
157  
158  
159  
160  
161  
162  
163  
164  
165  
166  
167  
168  
169  
170  
171  
172  
173  
174  
175  
176  
177  
178  
179  
180  
181  
182  
183  
184  
185  
186  
187  
188  
189  
190  
191  
192  
193  
194  
195  
196  
197  
198  
199  
200  
201  
202  
203  
204  
205  
206  
207  
208  
209  
210  
211  
212  
213  
214  
215  
216  
217  
218  
219  
220  
221  
222  
223  
224  
225  
226  
227  
228  
229  
230  
231  
232  
233  
234  
235  
236  
237  
238  
239  
240  
241  
242  
243  
244  
245  
246  
247  
248  
249  
250  
251  
252  
253  
254  
255  
256  
257  
258  
259  
260  
261  
262  
263  
264  
265  
266  
267  
268  
269  
270  
271  
272  
273  
274  
275  
276  
277  
278  
279  
280  
281  
282  
283  
284  
285  
286  
287  
288  
289  
290  
291  
292  
293  
294  
295  
296  
297  
298  
299  
300  
301  
302  
303  
304  
305  
306  
307  
308  
309  
310  
311  
312  
313  
314  
315  
316  
317  
318  
319  
320  
321  
322  
323  
324  
325  
326  
327  
328  
329  
330  
331  
332  
333  
334  
335  
336  
337  
338  
339  
340  
341  
342  
343  
344  
345  
346  
347  
348  
349  
350  
351  
352  
353  
354  
355  
356  
357  
358  
359  
360  
361  
362  
363  
364  
365  
366  
367  
368  
369  
370  
371  
372  
373  
374  
375  
376  
377  
378  
379  
380  
381  
382  
383  
384  
385  
386  
387  
388  
389  
390  
391  
392  
393  
394  
395  
396  
397  
398  
399  
400  
401  
402  
403  
404  
405  
406  
407  
408  
409  
410  
411  
412  
413  
414  
415  
416  
417  
418  
419  
420  
421  
422  
423  
424  
425  
426  
427  
428  
429  
430  
431  
432  
433  
434  
435  
436  
437  
438  
439  
440  
441  
442  
443  
444  
445  
446  
447  
448  
449  
450  
451  
452  
453  
454  
455  
456  
457  
458  
459  
460  
461  
462  
463  
464  
465  
466  
467  
468  
469  
470  
471  
472  
473  
474  
475  
476  
477  
478  
479  
480  
481  
482  
483  
484  
485  
486  
487  
488  
489  
490  
491  
492  
493  
494  
495  
496  
497  
498  
499  
500  
501  
502  
503  
504  
505  
506  
507  
508  
509  
510  
511  
512  
513  
514  
515  
516  
517  
518  
519  
520  
521  
522  
523  
524  
525  
526  
527  
528  
529  
530  
531  
532  
533  
534  
535  
536  
537  
538  
539  
540  
541  
542  
543  
544  
545  
546  
547  
548  
549  
550  
551  
552  
553  
554  
555  
556  
557  
558  
559  
560  
561  
562  
563  
564  
565  
566  
567  
568  
569  
570  
571  
572  
573  
574  
575  
576  
577  
578  
579  
580  
581  
582  
583  
584  
585  
586  
587  
588  
589  
590  
591  
592  
593  
594  
595  
596  
597  
598  
599  
600  
601  
602  
603  
604  
605  
606  
607  
608  
609  
610  
611  
612  
613  
614  
615  
616  
617  
618  
619  
620  
621  
622  
623  
624  
625  
626  
627  
628  
629  
630  
631  
632  
633  
634  
635  
636  
637  
638  
639  
640  
641  
642  
643  
644  
645  
646  
647  
648  
649  
650  
651  
652  
653  
654  
655  
656  
657  
658  
659  
660  
661  
662  
663  
664  
665  
666  
667  
668  
669  
670  
671  
672  
673  
674  
675  
676  
677  
678  
679  
680  
681  
682  
683  
684  
685  
686  
687  
688  
689  
690  
691  
692  
693  
694  
695  
696  
697  
698  
699  
700  
701  
702  
703  
704  
705  
706  
707  
708  
709  
710  
711  
712  
713  
714  
715  
716  
717  
718  
719  
720  
721  
722  
723  
724  
725  
726  
727  
728  
729  
730  
731  
732  
733  
734  
735  
736  
737  
738  
739  
740  
741  
742  
743  
744  
745  
746  
747  
748  
749  
750  
751  
752  
753  
754  
755  
756  
757  
758  
759  
760  
761  
762  
763  
764  
765  
766  
767  
768  
769  
770  
771  
772  
773  
774  
775  
776  
777  
778  
779  
780  
781  
782  
783  
784  
785  
786  
787  
788  
789  
790  
791  
792  
793  
794  
795  
796  
797  
798  
799  
800  
801  
802  
803  
804  
805  
806  
807  
808  
809  
810  
811  
812  
813  
814  
815  
816  
817  
818  
819  
820  
821  
822  
823  
824  
825  
826  
827  
828  
829  
830  
831  
832  
833  
834  
835  
836  
837  
838  
839  
840  
84

**ICS 65.160**

Price based on 13 pages