Wood-based panels — Determination of characteristic 5-percentile values and characteristic mean values

ICS 79.060.01

British Standards

National foreword

This British Standard is the UK implementation of EN 1058:2009. It supersedes BS EN 1058:1996 which is withdrawn.

The UK participation in its preparation was entrusted to Technical Committee B/541, Wood based panels.

A list of organizations represented on this committee can be obtained on request to its secretary.

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Wood-based panels - Determination of characteristic 5-percentile values and characteristic mean values

Panneaux à base de bois - Détermination des valeurs caractéristiques correspondant au fractile à 5 % d'exclusion et des valeurs caractéristiques moyennes

Holzwerkstoffe - Bestimmung der charakteristischen 5-%-Quantil Werte und charakteristischen Mittelwerte

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Foreword

This document (EN 1058:2009) has been prepared by Technical Committee CEN/TC 112 “Wood-based panels”, the secretariat of which is held by DIN.

This European Standard shall be given the status of a national standard, either by publication of an identical text or by endorsement, at the latest by May 2010, and conflicting national standards shall be withdrawn at the latest by May 2010.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. CEN [and/or CENELEC] shall not be held responsible for identifying any or all such patent rights.

This document has been prepared under a mandate given to CEN by the European Commission and the European Free Trade Association, and supports essential requirements of EC Directive(s).

This document supersedes EN 1058:1995, the statistical evaluation of which had to be corrected. The statistical evaluation follows the principles of Annex D of EN 1990:2002, of EN 1995-1-1:1993, *Eurocode 5: Design of timber structures – Part 1-1: General – Common rules and rules for buildings*, and of EN 14358:2006, *Timber structures – Calculation of characteristic 5-percentile values and acceptance criteria for a sample*.

Compared to EN 1058:1995 the following modifications have been made:

a) For the determination of strength and stiffness properties for log-normal distributed test data reference is made to EN 14358;

b) The calculation of the 5-percentile characteristic value of log-normal distributed test data according to EN 14358 is described in Annex A and is explained by examples;

c) The calculation of the characteristic mean value (50-percentile value) of normal distributed test data is described in Annex B and is explained by examples.

According to the CEN/CENELEC Internal Regulations, the national standards organizations of the following countries are bound to implement this European Standard: Austria, Belgium, Bulgaria, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Norway, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, Switzerland and the United Kingdom.

1 Scope

On the basis of test results from wood-based panel products for structural purposes, this European Standard specifies a method for the determination of:

— characteristic 5-percentile values of mechanical properties under the assumption of a log-normal distribution of the test data according to EN 14358; and

— characteristic mean values (50-percentile values) of physical properties under the assumption of a normal distribution of the test data.

Test data should be determined from tests using the test methods outlined in EN 789.

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.

EN 326-1, *Wood-based panels — Sampling, cutting and inspection — Part 1: Sampling and cutting of test pieces and expression of test results*

EN 789, *Timber structures — Test methods — Determination of mechanical properties of wood based panels*

EN 14358, *Timber structures — Calculation of characteristic 5-percentile values and acceptance criteria for a sample*

3 Terms and definitions

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

3.1
characteristic value
value of a material property which is defined as a fractile of the distribution of that property within the total population of that material

NOTE For all strength properties, this fractile is the fifth percentile. For stiffness properties as well as physical properties, two different characteristic values can be used: the fifth percentile and the mean value.

3.2
panel
piece of wood-based sheet material large enough to permit the cutting of test pieces

3.3
reference population
wood-based panels for which the characteristic values are relevant

3.4
production site
any single production line

3.5
sample
number of panels of one population

NOTE Unless otherwise agreed, the panels of the sample are drawn at random.

3.6
shift
continuous period of production by the same group of workers

NOTE Normally 8 h.

3.7
test piece
piece of panel cut to the size required for testing a specific property

4 Symbols

L	Lower specification limit
$\bar{x}_{05}$	Characteristic value of a log-normal distributed property
$\bar{x}_{50}$	Characteristic mean value of a normal distributed property
U	Upper specification limit
$v_{\ln \bar{x}}$	Coefficient of variation of a log-normal distributed sample
$v_{\bar{x}}$	Coefficient of variation of a normal distributed sample

5 Reference population

The reference population is in accordance with EN 326-1 defined by parameters such as type and manufacturing process, thickness range, grade, lay-up and quality classification of wood-based panels and is consistent with the material that is or can be supplied commercially and is capable of being identified at all stages of production, supply and in service.

6 Determination of characteristic values of mechanical and physical properties

6.1 Sampling

A total of at least 32 panels of the same type, grade, thickness range and/or lay-up shall be sampled at random from the production sites. Where there are fewer than 32 shifts, the total number of panels shall be obtained by taking a maximum of four panels from each shift at each production site.

Sampling of test pieces from panels shall be in accordance with the procedures given in EN 789.

6.2 Testing

Testing shall be carried out in accordance with either EN 789 (for strength and stiffness properties) or EN 326-1 (for physical properties).

6.3 Analysis of data

6.3.1 General

According to the distribution of the test data, the characteristic values shall be calculated either on the basis of log-normal distribution (in case of strength properties) or normal distribution (in case of physical properties and modulus of elasticity).

If exceptionally, the number of panels is less than 32, the reasons for that have to be declared specifically in the test report.

6.3.2 Strength and stiffness properties

The procedure of calculating the characteristic value $\overline{x}_{05}$ of log-normal distributed test data with known or unknown coefficient of variation $v_{\ln \overline{x}}$ according to EN 14358 is given in Annex A.

6.3.3 Characteristic mean value (50-percentile characteristic value)

The procedure of calculating the estimates of the characteristic mean value ${}_L\overline{x}_{50}$ and ${}_U\overline{x}_{50}$, respectively, of normal distributed test data with known or unknown coefficient of variation $v_{\overline{x}}$ is given in Annex B.

7 Test report

The test report shall contain the following statements:

a) date and place of sampling;

b) product type sampled;

c) number of panels sampled and their dates of production;

d) method of sampling and calculation;

e) test results of 6.3.2 or 6.3.3, respectively.

Annex A
(informative)

Calculation of the 5-percentile characteristic value of log-normal distributed test data according to EN 14358

A.1 Symbols

A.1.1 Letter symbols

f	Strength property, in newtons per square millimetre (N/mm²)
k	Statistical factor
$k(n)$	Statistical factor for a population with known coefficient of variation
L	Lower specification limit
m_k	Characteristic value of log-normal distributed test data
n	Number of test results (panel means) of the sample
$s_{\ln \bar{x}}$	Standard deviation between panel means of a log-normal distributed property $\bar{x}_j$
$\bar{x}_j$	Panel mean
$\bar{\bar{x}}$	Grand mean

A.1.2 Indices

j	Test panel serial number ($j = 1......n$)
k	Characteristic value of a log-normal distributed property
L	Related to lower specification limit
s	Index of the statistical factor for a population with unknown coefficient of variance
$\ln \bar{x}$	Related to log-normal distributed test data
05	5-percentile characteristic value of a log-normal distributed property

A.2 Analysis of data

A.2.1 Characteristic value m_k of test data with unknown coefficient of variation

The characteristic value m_k of a log-normal distributed property is in accordance with EN 14358 defined as:

$$m_k = \bar{x}_{05} = \exp\left(\frac{1}{n} \times \sum_{j=1}^{j=n} \ln \bar{x}_j - k_s \times s_{\ln \bar{x}}\right) \tag{A.1}$$

where:

$$s_{\ln \bar{x}} = \sqrt{\frac{\sum_{j=1}^{j=n} \left(\ln \bar{x}_j - \frac{1}{n} \times \sum_{j=1}^{j=n} \ln \bar{x}_j\right)^2}{n-1}} = \sqrt{\frac{\sum_{j=1}^{j=n} \ln \bar{x}_j^{\,2} - \frac{\sum_{j=1}^{j=n} \ln \bar{x}_j \times \sum_{j=1}^{j=n} \ln \bar{x}_j}{n}}{n-1}} \tag{A.2}$$

For k_s – values see Table A.1.

Table A.1 — Factor k_s – values for test data, the coefficient of variation is unknown

Number of test data n	5	10	15	20	30	**32**	40	50	100
k_s – value	2,46	2,10	1,99	1,93	1,87	**1,86**	1,83	1,81	1,75

A.2.2 Characteristic value m_k of test data with known coefficient of variation

If the coefficient of variation $v_{\ln \bar{x}}$ is known from prior knowledge, e.g. from production control of a period of one year or more, the factor $k(n)$ shall be taken as k_s in Equation (A.1). If the known coefficient of variation $v_{\ln \bar{x}}$ is greater than 0,05, the standard deviation $s_{\ln \bar{x}}$ shall be calculated according to Equation (A.3):

$$v_{\ln \bar{x}} = \frac{s_{\ln \bar{x}}}{\bar{\bar{x}}_{\ln \bar{x}}} = \frac{\exp(\ln \bar{\bar{x}}_{\ln \bar{x}}) - \exp(\ln \bar{\bar{x}}_{\ln \bar{x}} - \ln s_{\ln \bar{x}})}{\exp(\ln \bar{\bar{x}}_{\ln \bar{x}})} \tag{A.3}$$

For $k(n)$ – values see Table A.2.

If the known coefficient of variation $v_{\ln \bar{x}}$ is smaller than 0,05, the standard deviation $s_{\ln \bar{x}}$ shall be $0{,}05 \times \bar{\bar{x}}_{\ln \bar{x}}$.

Table A.2 — Factor $k(n)$ – values for test data, the coefficient of variation is unknown

Number of test data n	5	10	15	20	30	**32**	40	50	100
$k(n)$ – value	1,95	1,86	1,82	1,80	1,77	**1,76**	1,75	1,74	1,69

A.3 Acceptance criteria for a sample

If the characteristic value of a property $\overline{x}_{05}$, calculated according to Equation (A.1), is equal or greater than the lower specification limit L given in the respective performance standard, the requirements are fulfilled.

A.4 Examples of calculation

A.4.1 Determination of the characteristic value of the modulus of bending $\bar{f}_{05}$ of particle boards with unknown coefficient of variation

Number of test results: $n = 32$

Coefficient of variation: $v_{\ln \bar{x}} : unknown$

Lower specification limit: $L = 14 \frac{\mathrm{N}}{\mathrm{mm}^2}$

Assumed test data are given in Table A.3.

Table A.3 — Tabulated test results

Panel number j	$\bar{f}_j$	$\ln \bar{f}_j$	$(\ln \bar{f}_j)^2$	Panel number j	$\bar{f}_j$	$\ln \bar{f}_j$	$(\ln \bar{f}_j)^2$
1.1	18,0	2,890 4	8,354 25	1.21	16,6	2,809 4	7,892 74
1.2	15,1	2,714 7	7,369 57	1.22	13,7	2,617 4	6,850 76
1.3	16,6	2,809 4	7,892 74	1.23	17,6	2,867 9	8,224 84
1.4	20,1	3,000 7	9,004 32	1.24	15,9	2,766 3	7,652 52
1.5	16,3	2,791 2	7,790 60	1.25	18,4	2,912 3	8,481 79
1.6	18,7	2,928 5	8,576 25	1.26	19,2	2,954 9	8,731 49
1.7	18,2	2,901 4	8,418 25	1.27	18,6	2,923 2	8,544 87
1.8	19,4	2,965 3	8,792 84	1.28	19,8	2,985 7	8,914 30
1.9	16,8	2,821 4	7,960 18	1.29	20,4	3,015 5	9,093 45
1.10	17,8	2,879 2	8,289 78	1.30	17,0	2,833 2	8,027 10
1.11	18,9	2,939 2	8,638 67	1.31	22,3	3,104 6	9,638 46
1.12	20,9	3,039 7	9,240 07	1.32	18,8	2,933 9	8,607 52
1.13	18,0	2,820 4	8,354 25				
1.14	17,2	2,844 9	8,093 51				
1.15	15,7	2,753 7	7,582 65				
1.16	18,4	2,912 4	8,481 79				
1.17	19,5	2,970 4	8,823 36				
1.18	20,3	3,010 6	9,063 84				
1.19	17,5	2,862 2	8,192 19				
1.20	18,8	2,933 8	8,607 52				
				Σ		**92,583 8**	**268,186 47**

$$\sum_{j=1}^{j=n} \ln \bar{f}_j = 92{,}583\,8; \quad \ln \bar{\bar{f}}_{\ln \bar{f}} = \frac{92{,}583\,8}{32} = 2{,}893\,2$$

$$\sum_{j=1}^{j=n} (\ln \bar{f}_j)^2 = 268{,}186\,47$$

$$\ln s_{\ln \bar{f}} = \sqrt{\frac{268{,}186\,47 - \dfrac{92{,}583\,8 \times 92{,}583\,8}{32}}{31}} = 0{,}101\,436$$

The grand mean value of the modulus of bending $\bar{\bar{f}}_{\ln \bar{x}}$ is:

$$\bar{\bar{f}}_{\ln \bar{x}} = \exp(2{,}893\,2) = 18{,}05 \frac{\text{N}}{\text{mm}^2}$$

The characteristic value of the modulus of bending $\bar{f}_{05}$ of a sample with unknown coefficient of variation being greater than 0,05, is according to Equation (A.1):

$$\bar{f}_{05} = \exp(\frac{92{,}583\,8}{32} - 1{,}86 \times 0{,}101\,436) = \exp(2{,}704\,53) = 14{,}95 \frac{\text{N}}{\text{mm}^2}$$

Since $\bar{f}_{05} > L$, the requirement of the specification standard is fulfilled.

A.4.2 Determination of the characteristic value of the modulus of bending $\bar{f}_{05}$ of particle boards with known coefficient of variation

Number of test results: $n = 32$

Coefficient of variation: $v_{\ln \bar{x}} = 0{,}075$

Lower specification limit: $L = 14 \,\dfrac{\mathrm{N}}{\mathrm{mm}^2}$

Assumed test data a given in Table A.4.

Table A.4 — Tabulated test results

Panel number j	$\bar{f}_j$	$\ln \bar{f}_j$	$(\ln \bar{f}_j)^2$
2.1	11,7	2,459 6	6,049 58
2.2	15,4	2,734 4	7,476 77
2.3	16,1	2.778 8	7,721 84
2.4	17,4	2,856 5	8,159 42
2.5	17,6	2,867 9	8,224 84
2.6	19,0	2,944 4	8,669 72
2.7	19,5	2,970 4	8,823 36
2.8	20,1	3,000 7	9,004 32
2.9	20,4	3,015 5	9,093 45
2.10	21,7	3,077 3	9,469 85
2.11	13,3	2,587 8	6,696 52
2.12	15,7	2,753 7	7,582 65
2.13	16,5	2,803 4	7,858 83
2.14	17,4	2,856 5	8,159 42
2.15	17,7	2,873 6	8,257 37
2.16	19,1	2,949 7	8,700 66
2.17	19,7	2,980 6	8,884 09
2.18	20,2	3,005 7	9,034 13
2.19	20,5	3,020 4	9,122 97
2.20	21,9	3,086 5	9,526 40
2.21	14,0	2,809 4	6,964 62
2.22	15,9	2,617 4	7,652 52
2.23	17,0	2,867 9	8,027 10
2.24	17,5	2,766 3	8,192 19
2.25	18,6	2,912 3	8,544 87
2.26	19,4	2,954 9	8,792 84
2.27	19,8	2,923 2	8,914 30
2.28	20,2	2,985 7	9,034 13
2.29	21,5	3,015 5	9,412 95
2.30	16,3	2,833 2	7,790 60
2.31	19,2	3,104 6	8,731 49
2.32	23,1	2,933 9	9,858 55
Σ		**92,558 1**	**268,432 35**

$$\sum_{j=1}^{j=n} \ln \bar{f}_j = 92{,}558\,1; \quad \ln \bar{\bar{f}}_{\ln \bar{f}} = \frac{92{,}583\,8}{32} = 2{,}892\,24$$

$$\sum_{j=1}^{j=n} (\ln \bar{f}_j)^2 = 268{,}432\,35$$

$$\ln s_{\ln \bar{f}} = \sqrt{\frac{268{,}432\,35 - \dfrac{92{,}558\,1 \times 92{,}558\,1}{32}}{31}} = 0{,}151\,72$$

The grand mean value of the modulus of bending $\bar{\bar{f}}_{\ln \bar{x}}$ is:

$$\bar{\bar{f}}_{\ln \bar{f}} = \exp(2{,}892\,44) = 18{,}04 \frac{\mathrm{N}}{\mathrm{mm}^2}$$

The characteristic value of the modulus of bending $\bar{f}_{05}$ of the second sample with known coefficient of variation being greater than 0,05, is according to Equation (A.1):

$$\bar{f}_{05} = \exp(\frac{92{,}558\,1}{32} - 1{,}76 \times \ln s_{known}) \; .$$

The standard deviation of the log-normal distributed test data $s_{\ln \bar{f}}$ is according to Equation (A.3):

$$s_{\ln \bar{f}} = 0{,}075 \times \bar{\bar{f}}_{\ln \bar{f}} = 0{,}075 \times 18{,}04 = 1{,}353 \frac{\mathrm{N}}{\mathrm{mm}^2} \, .$$

$$\ln(\bar{\bar{f}}_{\ln \bar{f}} - s_{known}) = \ln(18{,}04 - 1{,}35) = \ln 16{,}69 = 2{,}814\,8$$

$$\ln s_{known} = \ln 18{,}04 - \ln 16{,}69 = 2{,}892\,44 - 2{,}814\,8 = 0{,}077\,6$$

Therefore:

$$\bar{f}_{05} = \exp(\frac{92{,}558\,1}{32} - 1{,}76 \times 0{,}077\,6) = \exp(2{,}755\,9) = 15{,}74 \frac{\mathrm{N}}{\mathrm{mm}^2}$$

Since $\bar{f}_{05} > L \;\; (15{,}74 > 14{,}0)$, the requirement of the specification standard is fulfilled.

Annex B
(normative)

Calculation of the characteristic mean value (50-percentile value) of normal distributed test data

B.1 Symbols

B.1.1 Letter symbols (see also Annex A)

E Modulus of elasticity, in newtons per square millimetre (N/mm²)

$s_{\bar{x}}$ Standard deviation between panel means of a normal distributed property $\bar{x}_j$

U Upper specification limit

${}_L\bar{x}_{50}$ Characteristic mean value of a normal distributed property with regard to a lower specification limit L

${}_U\bar{x}_{50}$ Characteristic mean value of a normal distributed property with regard to an upper specification limit U

ρ Density, in kg/m³

B.1.2 Indices (see also Annex A)

$_L$ Related to a lower specification limit

$_U$ Related to an upper specification limit

$_{\bar{x}}$ Related to normal distributed test data

$_{50}$ 50-percentile characteristic mean value of a normal distributed property

B.2 Analysis of data

B.2.1 50-percentile characteristic values (characteristic mean values)

The lower characteristic mean value ${}_L\bar{x}_{50}$ and the upper characteristic value ${}_U\bar{x}_{50}$, respectively, of a normal distributed property with unknown coefficient of variation $v_{\bar{x}}$ is calculated according to Equations (B.1) and (B.2), respectively:

$$ {}_L\bar{x}_{50} = \bar{\bar{x}} - \frac{k_s \times s_{\bar{x}}}{\sqrt{n}} \qquad \text{(B.1)}$$

and

$$_U\bar{x}_{50} = \bar{\bar{x}} + \frac{k_s \times s_{\bar{x}}}{\sqrt{n}} \quad \text{(B.2)}$$

where

$$s_{\bar{x}} = \sqrt{\frac{\sum_{j=1}^{j=n}(\bar{x}_j - \bar{\bar{x}})^2}{n-1}} = \sqrt{\frac{\sum_{j=1}^{j=n}\bar{x}_j^{\,2} - \frac{\sum_{j=1}^{j=n}\bar{x}_j \times \sum_{j=1}^{j=n}\bar{x}_j}{n}}{n-1}} \quad \text{(B.3)}$$

For k_s – values see Table A.1.

NOTE The lower characteristic mean value $_L\bar{x}_{50}$ may be valid for e.g. stiffness properties and the upper characteristic mean value $_U\bar{x}_{50}$ may be valid for e.g. physical properties (such as density, moisture content).

If the coefficient of variation $v_{\bar{x}}$ is known from prior knowledge, e.g. from production control of one year or more, the factor k(n) shall be taken as k_s and in Equations (B.1) and (B.2), respectively. If the known coefficient of variation $v_{\bar{x}}$ is greater than 0,05, the standard deviation $s_{\bar{x}}$ shall be calculated according to Equation (B.4):

$$s_{\bar{x}} = \bar{\bar{x}}_{\bar{x}} \times v_{\bar{x}} \quad \text{(B.4)}$$

For $k(n)$ – values see Table A.2.

If the known coefficient of variation $v_{\bar{x}}$ is smaller than 0,05, the standard deviation $s_{\bar{x}}$ shall be $0{,}05 \times \bar{\bar{x}}_{\bar{x}}$.

B.3 Acceptance criteria for a sample

If the lower characteristic mean value of a property $_L\bar{x}_{50}$ calculated according to Equation (B.1), is equal or greater than the specification mean value in the respective performance standard L_{50} or if the upper characteristic mean value of a property $_U\bar{x}_{50}$, calculated according to Equation (B.2) is equal or smaller than the specification mean value in the respective performance standard U_{50}, the requirements are fulfilled.

B.4 Examples of calculation

B.4.1 Determination of the lower 50-percentile characteristic value (lower characteristic mean value) of the modulus of elasticity $_L\bar{E}_{50\%}$ parallel to the production line of OSB of a normal distributed sample with unknown coefficient of variation

Number of test results: $n = 32$,

Coefficient of variation: $\nu_{\overline{E}}$: *unknown* and > 0,05

Assumed test data are given in Table B.1.

Table B.1 — Tabulated test results

Panel number j	$\overline{E}_j$	$\overline{E}_j^{\,2}$
1.1	7 010	49 140 100
1.2	9 430	88 924 900
1.3	6 160	37 945 600
1.4	7 950	63 202 500
1.5	8 360	69 889 600
1.6	8 400	70 560 000
1.7	7 210	51 984 100
1.8	8 320	69 222 400
1.9	7 540	56 851 600
1.10	8 510	72 420 100
1.11	8 950	80 102 500
1.12	8 090	65 448 100
1.13	8 520	72 590 400
1.14	8 020	64 320 400
1.15	8 390	70 392 100
1.16	8 850	78 322 500
1.17	7 410	54 908 100
1.18	8 090	65 448 100
1.19	9 250	85 562 500
1.20	8 670	75 168 900

Panel number j	$\overline{E}_j$	$\overline{E}_j^{\,2}$
1.21	8 240	67 897 600
1.22	6 810	46 376 100
1.23	9 770	95 452 900
1.24	7 850	61 622 500
1.25	8 830	77 968 900
1.26	8 610	74 132 100
1.27	8 990	80 820 100
1.28	8 260	68 227 600
1.29	7 830	61 308 900
1.30	8 610	74 132 100
1.31	7 620	58 064 400
1.32	8 240	67 897 600
Σ	**262 790**	**2 176 305 300**

$$\sum_{j=1}^{j=n} \overline{E}_j = 262\,790; \quad {}_L\overline{\overline{E}}_{\overline{x}} = \frac{262\,790}{32} = 8\,210\,\frac{\text{N}}{\text{mm}^2}$$

$$\sum_{j=1}^{j=n} \overline{E}_j^{\,2} = 2\,176\,305\,300$$

$$s_{\overline{E}} = \sqrt{\frac{2\,176\,305\,300 - \dfrac{262\,790 \times 262\,790}{32}}{31}} = 767$$

The grand mean value of the modulus of elasticity $\overline{\overline{E}}_{\overline{E}}$ is:

$$\overline{\overline{E}}_{\overline{E}} = \frac{262\,790}{32} = 8\,210\,\frac{\text{N}}{\text{mm}^2}$$

The lower characteristic mean value of the modulus of elasticity ${}_L\overline{E}_{50}$ of the sample with unknown coefficient of variation $\nu_{\overline{E}}$ being greater than 0,05, is according to Equation (B.1):

$$_{L}\overline{E}_{50} = 8\,210 - \frac{1{,}86 \times 767}{\sqrt{32}} = 7\,958 \ \frac{\text{N}}{\text{mm}^2} \tag{B.5}$$

B.4.2 Determination of the upper 50-percentile characteristic value (upper characteristic mean value) of the density $_{U}\overline{\rho}_{50}$ of a normal distributed sample of particle boards with known coefficient of variation $v_{\overline{\rho}}$

Number of test results: $n = 32$

Known coefficient of variation: $v_{\overline{E}} = 0{,}043 < 0{,}05$

Assumed test data are given in Table B.2.

Table B.2 — Tabulated test results

Panel number j	$\overline{\rho}_j$
2.1	630
2.2	649
2.3	584
2.4	621
2.5	633
2.6	675
2.7	668
2.8	609
2.9	628
2.10	559
2.11	618
2.12	636
2.13	642
2.14	576
2.15	630
2.16	636
2.17	657
2.18	690
2.19	640
2.20	592
2.21	640
2.22	646
2.23	656
2.24	619
2.25	624
2.26	638
2.27	644
2.28	625
2.29	651
2.30	613
2.31	639
2.32	643
Σ	**20 211**

$$\sum_{j=1}^{j=n} \overline{\rho}_j = 20\,211$$

The grand mean value of the density $\overline{\overline{\rho}}_{\overline{\rho}}$ is:

$$\overline{\overline{\rho}}_{\overline{\rho}} = \frac{20\,211}{32} = 632 \ \frac{\text{kg}}{\text{m}^3}$$

The upper characteristic mean value of the density $_{U}\overline{\rho}_{50}$ of a sample with known coefficient of variation $v_{\overline{\rho}} \leq 0{,}05$ is according to Equation (B.2):

$$_{U}\overline{\rho}_{50} = 632 + \frac{1{,}76 \times 0{,}05 \times 632}{\sqrt{32}} = 642 \ \frac{\text{kg}}{\text{m}^3} \tag{B.6}$$

Bibliography

[1] EN 326-2, *Wood-based panels — Sampling, cutting and inspection — Part 2: Quality control in the factory*

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