

Voluntary Technical Standard

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Reviewed

Paper Honeycomb Determination of Cell Geometry

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EMPHA operates within the regulatory framework of competition law as set out by the European Union and national legal systems and respects all rules thereof. The purpose of EMPHA Voluntary Technical Standards is to support the use of paper honeycomb by making its properties clear and measurable. EMPHA does not accept responsibility or liability for any misuse, abuse or exploitation of the contents addressed on this document.

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Foreword

EMPHA is the European Manufacturers Paper Honeycomb Association, with headquarters located at The Hague, The Netherlands.

Within EMPHA organization, a Technical Task Team has been created to address the issue of Voluntary Technical Standards. The goal for this committee is to create a set of technical standards and methods that can be used, on a voluntary basis, to create and maintain transparent and measurable parameters that define the specific quality of the paper honeycomb.

In relation to the subject of Cell Geometry the Technical Team has found many methods to identify the Cell Geometry.

None of the methods matched with the goals to be able to compare the Cell Geometries and to allow a simple guideline for production floors to check whether they have the good expansion.

This has led the Technical Team to formulate the Cell Geometry identification as being a combination of Pitch and Glue line width.

To this document a table has been added which is showing a relation between the different Pitch of the glue lines and the glue line width. The value in the table is a relative indicator for the kg/m² material of the honeycomb corresponding with the Pitch and Glue line value.

It is at the same time the distance that one should measure between two glue lines when the honeycomb is expanded to 75% of the un-expanded width. This value is called the Cell Indicator. An explanation is given in the Table added in the appendix.

The Standard for the determination of the Compression Strength has been approved by the members of the EMPHA in the General Assembly of June 2012.

This Standard has been reviewed by the EMPHA Technical Committee in 2021.

Introduction

Paper Honeycomb is generally supplied to customers in non expanded condition.

The parameters that determine expanded cell geometry are discussed in this standard.

The rate of expansion is in this context not discussed. As a standard 75% expansion is used in the calculations.

Methods to determine these measurable parameters shall be clearly defined.

With this standard we introduce a new way to identify Cell Geometry.

The Cell Geometry will be indicated now by mentioning the Pitch value and the Glue line width value. This will be for example: 36/4; which means that we here have a Cell with a Pitch of 36 mm and a Glue line width of 4 mm.

1. Scope

This Voluntary Technical Standard describes the method of measuring glue line width and pitch.

For the comparison of the cell geometries a table is given in Appendix 1.

This comparison allows the user to value the cell geometry on the basis of material input and it is a simple guideline for the proper application of the honeycomb on the production floors.

The method assumes that the honeycomb product is 'isoform'.

2. Normative references

ISO 187 - Paper, board and pulps – Standard atmosphere for conditioning and testing and procedure for monitoring the atmosphere and conditioning of samples

ISO 186 – Paper and board – Sampling to determine average quality

3. Terms and Definitions

Paper Honeycomb: In the context of the EMPHA, paper honeycomb is considered as a paper product consisting of paper strips glued together in a way that forms hexagonal shaped cells when expanded.

Cell Geometry: The combination of the pitch and the glue line width. The Cell Geometry will be indicated now by mentioning the Pitch value and the Glue line width value. This will be for example: 36/4; which means that we here have a Cell with a Pitch of 36 mm and a Glue line width of 4 mm.

Cell Indicator: The distance between two following glue lines when honeycomb is expanded to 75% of the unexpanded width.

Pitch: The distance between the center of a glue line and the center of the second next glue line measured across the unexpanded honeycomb.

Glue line width: the average width of the glue lines measured in one specimen.

Isoform: The honeycomb cell is considered to be a symmetric hexagon.

ISO 186 gives definitions for 'lot', 'specimen', 'sample', 'test piece' etc.

4. Principle

From a pallet of product (fig. 1) a specimen (fig. 2) is taken.

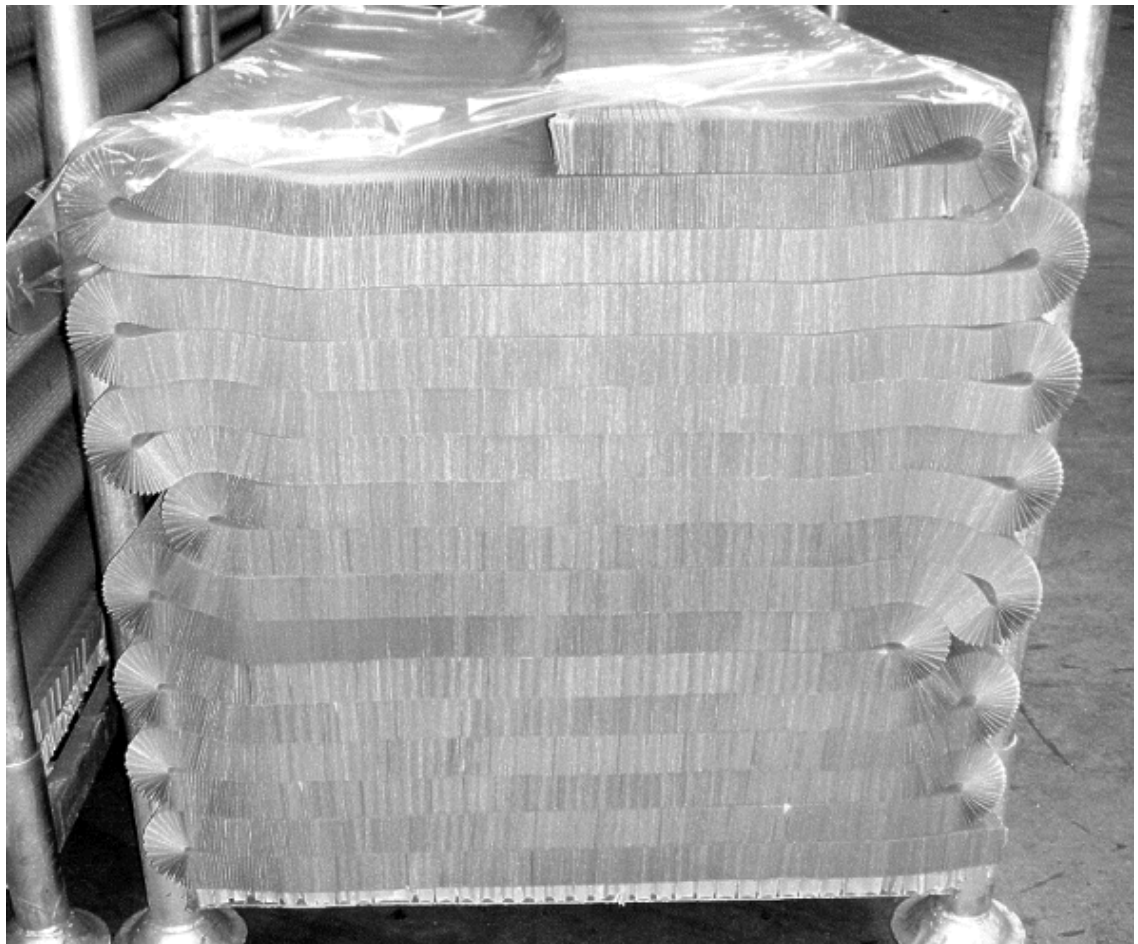


Figure 1

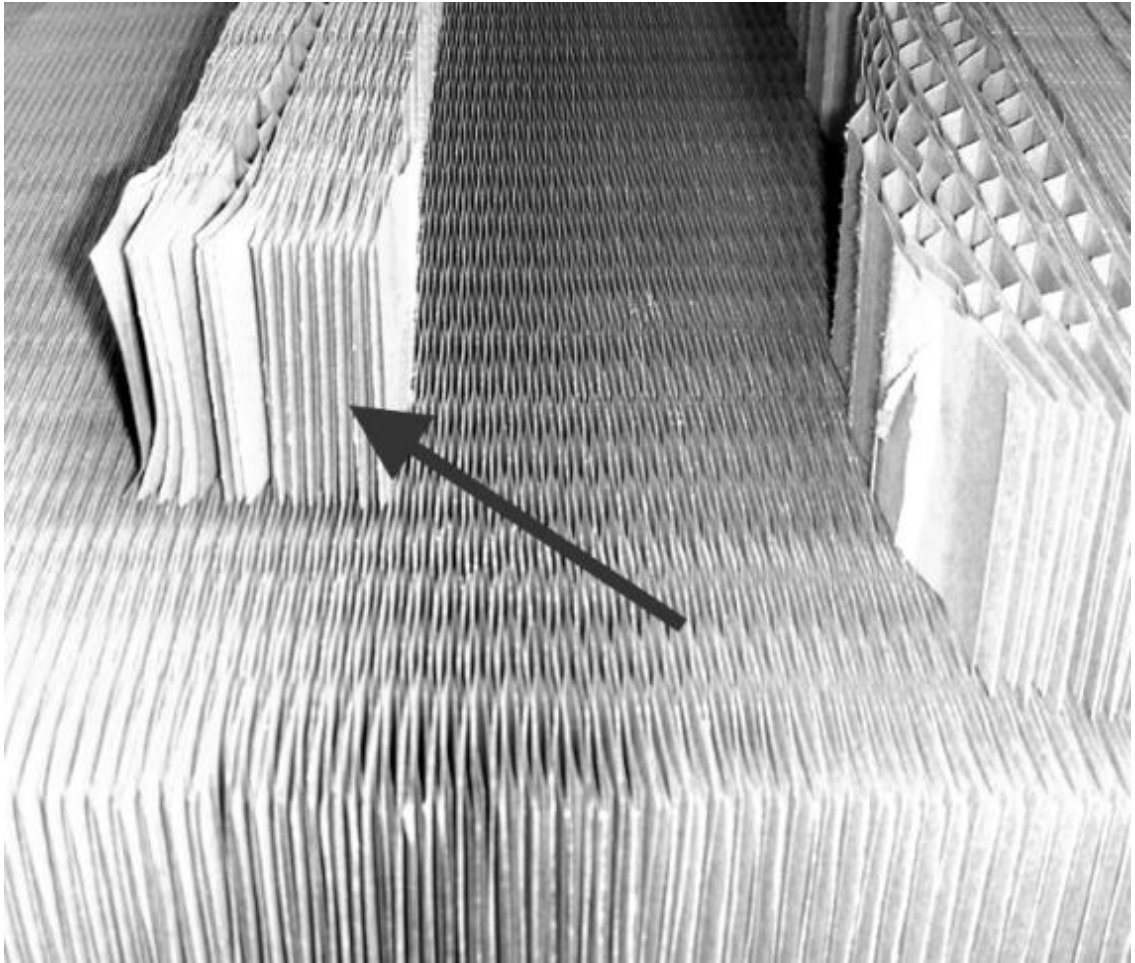


Figure 2

5. Apparatus

A measuring tape with an accuracy of 1 mm and a caliper with an accuracy of 0, 1 mm.

6. Sampling

According to determine an average quality for a lot (ISO 186) at least 10 specimens are needed for lot sizes of 1 to 1000 articles. In case there is a single article per pallet the pallet will be considered as one article. Specimens will be taken from as many different articles as possible.

Between supplier and customer other quantities to perform the testing with can be agreed upon and in case this has the quantity used has to be mentioned in the specification sheet of the product.

7. Conditioning

The testing is done in accordance with ISO 187.

8. Preparation of test pieces

Specimen size

A sufficient size of specimen must be obtained to enable all measurements.

For these measurements the specimen needs not to be divided in test pieces.

9. Procedure

Pitch measurement

The specimen is marked in the centers of n glue lines (with a minimum of 5 for n) as defined under Pitch in chapter 3. (fig. 3).

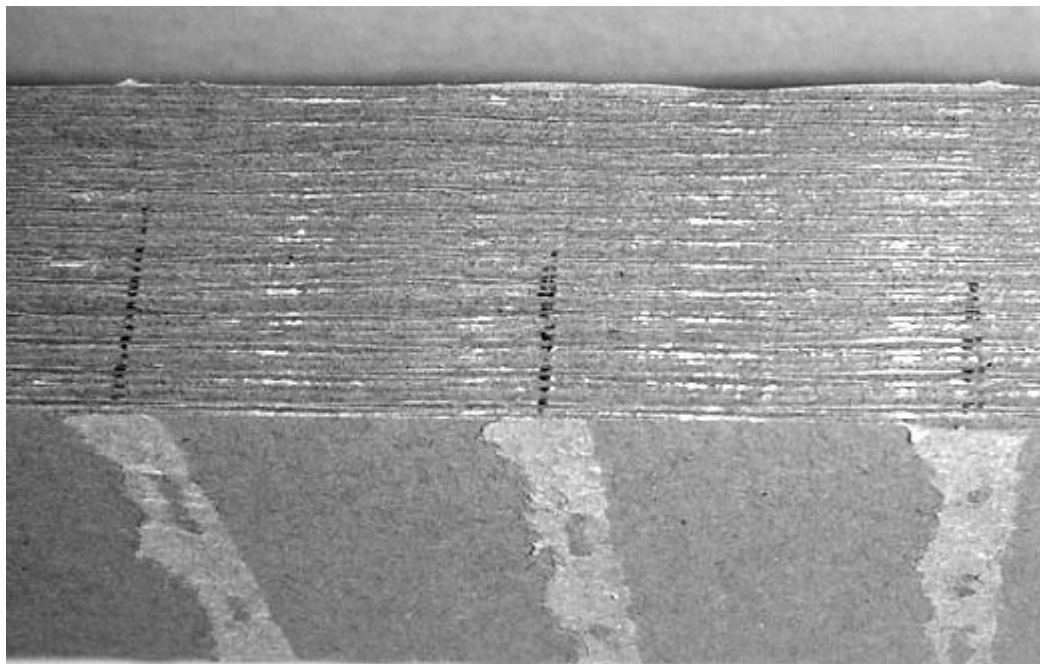


Figure 3

With a measuring tape the distance between the first and the fifth marker is measured in mm's (fig. 4) and divided by n-1.

This value is called the pitch.

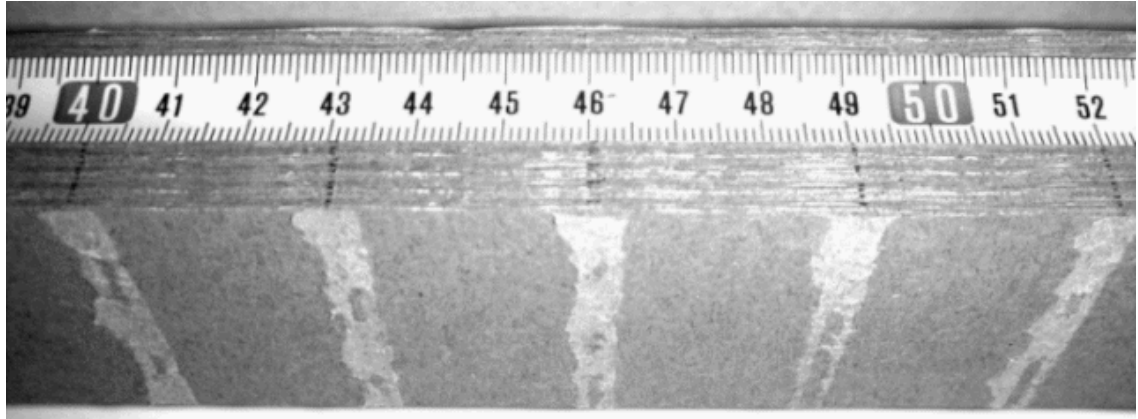


Figure 4

Repeat this measurement sequential in the direction of the expanding of the honeycomb as many times, as the number of glue applicators used to produce the honeycomb.

Each individual measurement has to conform to the specification.

Glue line width

With a caliper the glue line width is measured (fig. 5). This measure is taken from n randomly chosen glue lines (with a minimum of 10) in a specimen of which the average value in (in mm) is called ' glue line width'.

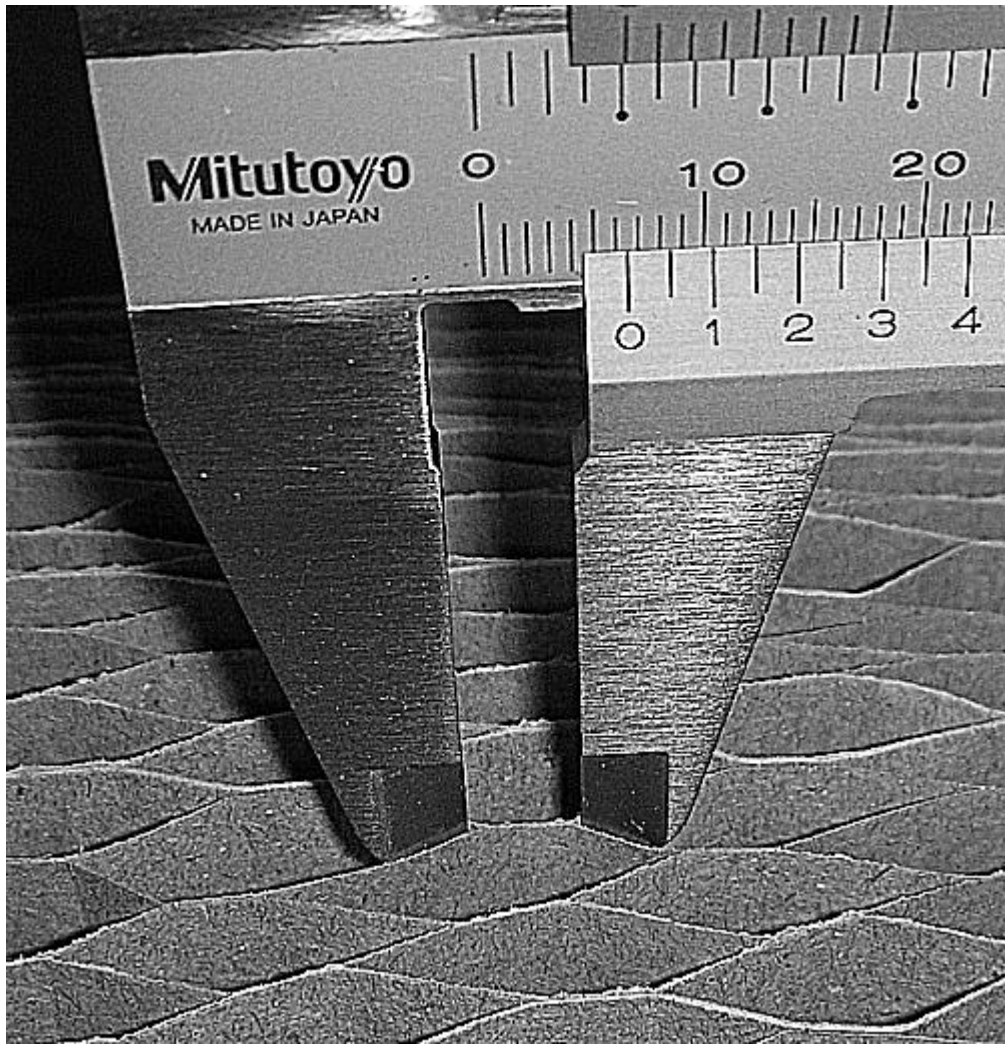


Figure 5

10. Expression of results

Average value will be given in 0, 1 mm accuracy.

11. Test report

The test report shall include the following information:

- a) a reference to this Voluntary technical standard
- b) the date and place of testing and testing person
- c) a description and identification of the product tested
- d) test pieces conditioning – ISO 187
- e) results for each measurement and the average for the sample.
- f) remarks when necessary

12. Document Review

F01-2012: Original Issue

F02-2021: Reviewed and section 12 added

Appendix 1 Comparison model for Cell Geometrys defined by Pitch and Glue line width



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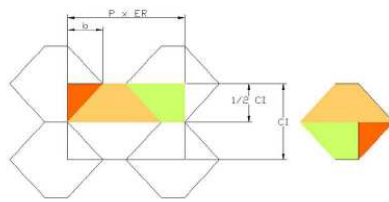
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Definitions:

CI	Cell Indicator	[mm]
CA	Cell Area	[mm ²]
P	Pitch	[mm]
G	Gluewidth	[mm]
ER	Expansion rate	[-]
H	Honeycomb height	[mm]
ρ	Density of paper	[kg/m ³]

Drawings:



Formula's:

$$CI = 2 \times \sqrt{((P + 2) - G)^2 - b^2}$$

$$b = ((G + ((P + 2) - G)) \times ER) - G$$

$$CA = \frac{1}{2} CI \times (P \times ER)$$

$$PAPER\ USE \left[\frac{KG}{M^2} \right] = \frac{2}{CI \times ER} \times H \times \rho$$

Line of Hexagonal with all legs equal length.

CI at ER of	0,75 (ER = changable)																								
Gluewidth	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Gluewidth
Pitch																									Pitch
6	1,9																								6
7	2,7																								7
8	3,5	2,0																							8
9	4,2	2,9																							9
10	4,9	3,7																							10
11	5,6	4,5	3,0																						11
12	6,2	5,2	3,9																						12
13	6,9	5,9	4,7	3,0																					13
14	7,6	6,6	5,5	4,0																					14
15	8,3	7,3	6,2	4,8																					15
16	8,9	8,0	6,9	5,7	4,0																				16
17	9,6	8,7	7,6	6,4	4,9																				17
18	10,3	9,4	8,4	7,2	5,8	4,0																			18
19	11,0	10,0	9,1	7,9	6,6	5,0																			19
20	11,6	10,7	9,7	8,7	7,4	5,9																			20
21	12,3	11,4	10,4	9,4	8,2	6,8	5,0																		21
Gluewidth	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Gluewidth



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Gluewidth	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Gluewidth	
22	13,0	12,1	11,1	10,1	8,9	7,6	6,0																		22	
23	13,6	12,7	11,8	10,8	9,7	8,4	6,9	4,9																		23
24	14,3	13,4	12,5	11,5	10,4	9,2	7,7	6,0																		24
25	14,9	14,1	13,2	12,2	11,1	9,9	8,6	7,0																		25
26	15,6	14,8	13,8	12,9	11,8	10,7	9,4	7,9	6,0																	26
27	16,3	15,4	14,5	13,6	12,5	11,4	10,1	8,7	7,0																	27
28	16,9	16,1	15,2	14,2	13,2	12,1	10,9	9,5	7,9	5,9																28
29	17,6	16,8	15,9	14,9	13,9	12,8	11,7	10,3	8,8	7,0																29
30	18,3	17,4	16,5	15,6	14,6	13,6	12,4	11,1	9,7	8,0																30
31	18,9	18,1	17,2	16,3	15,3	14,3	13,1	11,9	10,5	8,9	7,0															31
32	19,6	18,8	17,9	17,0	16,0	15,0	13,9	12,6	11,3	9,8	8,0															32
33	20,3	19,4	18,6	17,6	16,7	15,7	14,6	13,4	12,1	10,7	9,0	6,9														33
34	20,9	20,1	19,2	18,3	17,4	16,4	15,3	14,1	12,9	11,5	9,9	8,0														34
35	21,6	20,8	19,9	19,0	18,1	17,1	16,0	14,9	13,6	12,3	10,8	9,0														35
36	22,2	21,4	20,6	19,7	18,7	17,7	16,7	15,6	14,4	13,1	11,6	9,9	7,9													36
37	22,9	22,1	21,2	20,3	19,4	18,4	17,4	16,3	15,1	13,9	12,4	10,9	9,0													37
38	23,6	22,8	21,9	21,0	20,1	19,1	18,1	17,0	15,9	14,6	13,3	11,7	10,0	7,9												38
39	24,2	23,4	22,6	21,7	20,8	19,8	18,8	17,7	16,6	15,4	14,1	12,6	10,9	9,0												39
40	24,9	24,1	23,2	22,4	21,4	20,5	19,5	18,4	17,3	16,1	14,8	13,4	11,8	10,0												40
41	25,6	24,7	23,9	23,0	22,1	21,2	20,2	19,1	18,0	16,9	15,6	14,2	12,7	11,0	8,9											41
42	26,2	25,4	24,6	23,7	22,8	21,9	20,9	19,8	18,8	17,6	16,4	15,0	13,6	11,9	10,0											42
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44	27,5	26,7	25,9	25,0	24,1	23,2	22,2	21,2	20,2	19,1	17,9	16,6	15,2	13,7	12,0	9,9										44
45	28,2	27,4	26,6	25,7	24,8	23,9	22,9	21,9	20,9	19,8	18,6	17,3	16,0	14,5	12,9	11,0										45
46	28,9	28,1	27,2	26,4	25,5	24,6	23,6	22,6	21,6	20,5	19,3	18,1	16,8	15,4	13,8	12,0	9,9									46
47	29,5	28,7	27,9	27,0	26,2	25,2	24,3	23,3	22,3	21,2	20,1	18,9	17,6	16,2	14,6	12,9	11,0									47
48	30,2	29,4	28,6	27,7	26,8	25,9	25,0	24,0	23,0	21,9	20,8	19,6	18,3	17,0	15,5	13,9	12,0	9,8								48
49	30,9	30,1	29,2	28,4	27,5	26,6	25,7	24,7	23,7	22,6	21,5	20,3	19,1	17,8	16,3	14,7	13,0	10,9								49
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51	32,2	31,4	30,6	29,7	28,8	27,9	27,0	26,1	25,1	24,0	22,9	21,8	20,6	19,3	17,9	16,5	14,8	13,0	10,9							51
52	32,8	32,0	31,2	30,4	29,5	28,6	27,7	26,7	25,7	24,7	23,6	22,5	21,3	20,1	18,7	17,3	15,7	14,0	12,0							52
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54	34,2	33,4	32,6	31,7	30,9	30,0	29,0	28,1	27,1	26,1	25,1	24,0	22,8	21,6	20,3	18,9	17,4	15,8	14,0	11,9						54
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59	37,5	36,7	35,9	35,0	34,2	33,3	32,4	31,5	30,5	29,6	28,5	27,5	26,4	25,3	24,1	22,8	21,5	20,0	18,5	16,9	15,0	12,9				59
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61	38,8	38,0	37,2	36,4	35,5	34,7	33,8	32,8	31,9	30,9	29,9	28,9	27,8	26,7	25,5	24,3	23,0	21,7	20,2	18,6	16,9	15,0	12,8			61
62	39,5	38,7	37,9	37,0	36,2	35,3	34,4	33,5	32,6	31,6	30,6	29,6	28,5	27,4	26,3	25,1	23,8	22,4	21,0	19,5	17,8	16,0	13,9			62
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 Paper Honeycomb – Determination of Cell Geometry



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Gluewidth	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Gluewidth
65	41,5	40,7	39,9	39,0	38,2	37,3	36,4	35,5	34,6	33,7	32,7	31,7	30,6	29,6	28,4	27,3	26,0	24,8	23,4	22,0	20,5	18,8	17,0	14,9	65
66	42,1	41,3	40,5	39,7	38,9	38,0	37,1	36,2	35,3	34,3	33,4	32,4	31,3	30,3	29,2	28,0	26,8	25,5	24,2	22,8	21,3	19,7	17,9	16,0	66
67	42,8	42,0	41,2	40,4	39,5	38,7	37,8	36,9	36,0	35,0	34,1	33,1	32,0	31,0	29,9	28,7	27,5	26,3	25,0	23,6	22,1	20,6	18,9	17,0	67
68	43,4	42,6	41,8	41,0	40,2	39,3	38,5	37,6	36,6	35,7	34,7	33,7	32,7	31,7	30,6	29,4	28,3	27,0	25,7	24,4	23,0	21,4	19,8	18,0	68
69	44,1	43,3	42,5	41,7	40,9	40,0	39,1	38,2	37,3	36,4	35,4	34,4	33,4	32,4	31,3	30,2	29,0	27,8	26,5	25,2	23,8	22,3	20,7	18,9	69
70	44,8	44,0	43,2	42,4	41,5	40,7	39,8	38,9	38,0	37,1	36,1	35,1	34,1	33,1	32,0	30,9	29,7	28,5	27,3	26,0	24,6	23,1	21,5	19,8	70
71	45,4	44,6	43,8	43,0	42,2	41,3	40,5	39,6	38,7	37,7	36,8	35,8	34,8	33,8	32,7	31,6	30,5	29,3	28,0	26,7	25,4	23,9	22,4	20,7	71
72	46,1	45,3	44,5	43,7	42,8	42,0	41,1	40,2	39,3	38,4	37,5	36,5	35,5	34,5	33,4	32,3	31,2	30,0	28,8	27,5	26,2	24,7	23,2	21,6	72
73	46,7	46,0	45,2	44,3	43,5	42,7	41,8	40,9	40,0	39,1	38,2	37,2	36,2	35,2	34,1	33,0	31,9	30,7	29,5	28,3	26,9	25,5	24,1	22,5	73
74	47,4	46,6	45,8	45,0	44,2	43,3	42,5	41,6	40,7	39,8	38,8	37,9	36,9	35,9	34,8	33,7	32,6	31,5	30,3	29,0	27,7	26,3	24,9	23,4	74
75	48,1	47,3	46,5	45,7	44,8	44,0	43,1	42,3	41,4	40,4	39,5	38,5	37,6	36,6	35,5	34,4	33,3	32,2	31,0	29,8	28,5	27,1	25,7	24,2	75
76	48,7	47,9	47,1	46,3	45,5	44,7	43,8	42,9	42,0	41,1	40,2	39,2	38,2	37,2	36,2	35,1	34,0	32,9	31,7	30,5	29,2	27,9	26,5	25,0	76
77	49,4	48,6	47,8	47,0	46,2	45,3	44,5	43,6	42,7	41,8	40,9	39,9	38,9	37,9	36,9	35,8	34,8	33,6	32,5	31,3	30,0	28,7	27,3	25,9	77
78	50,1	49,3	48,5	47,7	46,8	46,0	45,1	44,3	43,4	42,5	41,5	40,6	39,6	38,6	37,6	36,5	35,5	34,3	33,2	32,0	30,8	29,5	28,1	26,7	78
79	50,7	49,9	49,1	48,3	47,5	46,7	45,8	44,9	44,1	43,1	42,2	41,3	40,3	39,3	38,3	37,2	36,2	35,1	33,9	32,7	31,5	30,2	28,9	27,5	79
80	51,4	50,6	49,8	49,0	48,2	47,3	46,5	45,6	44,7	43,8	42,9	42,0	41,0	40,0	39,0	37,9	36,9	35,8	34,6	33,5	32,2	31,0	29,7	28,3	80
81	52,0	51,3	50,5	49,7	48,8	48,0	47,1	46,3	45,4	44,5	43,6	42,6	41,7	40,7	39,7	38,6	37,6	36,5	35,4	34,2	33,0	31,7	30,4	29,1	81
82	52,7	51,9	51,1	50,3	49,5	48,7	47,8	46,9	46,1	45,2	44,2	43,3	42,4	41,4	40,4	39,3	38,3	37,2	36,1	34,9	33,7	32,5	31,2	29,9	82
83	53,4	52,6	51,8	51,0	50,2	49,3	48,5	47,6	46,7	45,8	44,9	44,0	43,0	42,1	41,1	40,0	39,0	37,9	36,8	35,7	34,5	33,2	32,0	30,6	83
84	54,0	53,2	52,4	51,6	50,8	50,0	49,1	48,3	47,4	46,5	45,6	44,7	43,7	42,7	41,7	40,7	39,7	38,6	37,5	36,4	35,2	34,0	32,7	31,4	84
85	54,7	53,9	53,1	52,3	51,5	50,7	49,8	48,9	48,1	47,2	46,3	45,3	44,4	43,4	42,4	41,4	40,4	39,3	38,2	37,1	35,9	34,7	33,5	32,2	85
86	55,4	54,6	53,8	53,0	52,2	51,3	50,5	49,6	48,7	47,9	46,9	46,0	45,1	44,1	43,1	42,1	41,1	40,0	38,9	37,8	36,7	35,5	34,2	33,0	86
87	56,0	55,2	54,4	53,6	52,8	52,0	51,1	50,3	49,4	48,5	47,6	46,7	45,8	44,8	43,8	42,8	41,8	40,7	39,6	38,5	37,4	36,2	35,0	33,7	87
88	56,7	55,9	55,1	54,3	53,5	52,6	51,8	51,0	50,1	49,2	48,3	47,4	46,4	45,5	44,5	43,5	42,5	41,4	40,3	39,2	38,1	36,9	35,7	34,5	88
89	57,3	56,6	55,8	55,0	54,1	53,3	52,5	51,6	50,7	49,9	49,0	48,0	47,1	46,2	45,2	44,2	43,2	42,1	41,1	40,0	38,8	37,7	36,5	35,2	89
90	58,0	57,2	56,4	55,6	54,8	54,0	53,1	52,3	51,4	50,5	49,6	48,7	47,8	46,8	45,9	44,9	43,9	42,8	41,8	40,7	39,5	38,4	37,2	36,0	90
91	58,7	57,9	57,1	56,3	55,5	54,6	53,8	53,0	52,1	51,2	50,3	49,4	48,5	47,5	46,6	45,6	44,6	43,5	42,5	41,4	40,3	39,1	37,9	36,7	91
92	59,3	58,5	57,7	56,9	56,1	55,3	54,5	53,6	52,8	51,9	51,0	50,1	49,1	48,2	47,2	46,2	45,2	44,2	43,2	42,1	41,0	39,8	38,7	37,5	92
93	60,0	59,2	58,4	57,6	56,8	56,0	55,1	54,3	53,4	52,5	51,7	50,7	49,8	48,9	47,9	46,9	45,9	44,9	43,9	42,8	41,7	40,6	39,4	38,2	93
94	60,6	59,9	59,1	58,3	57,5	56,6	55,8	55,0	54,1	53,2	52,3	51,4	50,5	49,6	48,6	47,6	46,6	45,6	44,6	43,5	42,4	41,3	40,1	38,9	94
95	61,3	60,5	59,7	58,9	58,1	57,3	56,5	55,6	54,8	53,9	53,0	52,1	51,2	50,2	49,3	48,3	47,3	46,3	45,3	44,2	43,1	42,0	40,8	39,7	95
96	62,0	61,2	60,4	59,6	58,8	58,0	57,1	56,3	55,4	54,6	53,7	52,8	51,8	50,9	50,0	49,0	48,0	47,0	46,0	44,9	43,8	42,7	41,6	40,4	96
97	62,6	61,9	61,1	60,3	59,5	58,6	57,8	57,0	56,1	55,2	54,3	53,4	52,5	51,6	50,6	49,7	48,7	47,7	46,7	45,6	44,5	43,4	42,3	41,1	97
98	63,3	62,5	61,7	60,9	60,1	59,3	58,5	57,6	56,8	55,9	55,0	54,1	53,2	52,3	51,3	50,4	49,4	48,4	47,3	46,3	45,2	44,1	43,0	41,9	98
99	64,0	63,2	62,4	61,6	60,8	60,0	59,1	58,3	57,4	56,6	55,7	54,8	53,9	52,9	52,0	51,0	50,1	49,1	48,0	47,0	45,9	44,8	43,7	42,6	99
100	64,6	63,8	63,0	62,2	61,4	60,6	59,8	58,9	58,1	57,2	56,3	55,5	54,5	53,6	52,7	51,7	50,7	49,7	48,7	47,7	46,6	45,6	44,4	43,3	100
101	65,3	64,5	63,7	62,9	62,1	61,3	60,5	59,6	58,8	57,9	57,0	56,1	55,2	54,3	53,4	52,4	51,4	50,4	49,4	48,4	47,3	46,3	45,2	44,0	101
102	65,9	65,2	64,4	63,6	62,8	61,9	61,1	60,3	59,4	58,6	57,7	56,8	55,9	55,0	54,0	53,1	52,1	51,1	50,1	49,1	48,0	47,0	45,9	44,7	102
103	66,6	65,8	65,0	64,2	63,4	62,6	61,8	60,9	60,1	59,2	58,4	57,5	56,6	55,6	54,7	53,8	52,8	51,8	50,8	49,8	48,7	47,7	46,6	45,5	103
104	67,3	66,5	65,7	64,9	64,1	63,3	62,4	61,6	60,8	59,9	59,0	58,1	57,2	56,3	55,4	54,4	53,5	52,5	51,5	50,5	49,4	48,4	47,3	46,2	104
105	67,9	67,1	66,4	65,6	64,8	63,9	63,1	62,3	61,4	60,6	59,7	58,8	57,9	57,0	56,1	55,1	54,2	53,2	52,2	51,2	50,1	49,1	48,0	46,9	105
106	68,6	67,8	67,0	66,2	65,4	64,6	63,8	62,9	62,1	61,2	60,4	59,5	58,6	57,7	56,7	55,8	54,8	53,9	52,9	51,9	50,8	49,8	48,7	47,6	106
107	69,2	68,5	67,7	66,9	66,1	65,3	64,4	63,6	62,8	61,9	61,0	60,1	59,3	58,3	57,4	56,5	55,5	54,6	53,6	52,6	51,5	50,5	49,4	48,3	107

DOC CODE: EMPHA.TTT.CG.2021.F02
 Paper Honeycomb – Determination of Cell Geometry



European Manufacturers Paper Honeycomb Association

Gluewidth	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	Gluewidth
108	69.9	69.1	68.3	67.5	66.7	65.9	65.1	64.3	63.4	62.6	61.7	60.8	59.9	59.0	58.1	57.2	56.2	55.2	54.2	53.2	52.2	51.2	50.1	49.0	108
109	70.6	69.8	69.0	68.2	67.4	66.6	65.8	64.9	64.1	63.2	62.4	61.5	60.6	59.7	58.8	57.8	56.9	55.9	54.9	53.9	52.9	51.9	50.8	49.7	109
110	71.2	70.5	69.7	68.9	68.1	67.3	66.4	65.6	64.8	63.9	63.0	62.2	61.3	60.4	59.4	58.5	57.6	56.6	55.6	54.6	53.6	52.6	51.5	50.4	110
111	71.9	71.1	70.3	69.5	68.7	67.9	67.1	66.3	65.4	64.6	63.7	62.8	61.9	61.0	60.1	59.2	58.2	57.3	56.3	55.3	54.3	53.3	52.2	51.1	111
112	72.6	71.8	71.0	70.2	69.4	68.6	67.8	66.9	66.1	65.2	64.4	63.5	62.6	61.7	60.8	59.9	58.9	58.0	57.0	56.0	55.0	54.0	52.9	51.8	112
113	73.2	72.4	71.7	70.9	70.1	69.2	68.4	67.6	66.8	65.9	65.0	64.2	63.3	62.4	61.5	60.5	59.6	58.6	57.7	56.7	55.7	54.7	53.6	52.5	113
114	73.9	73.1	72.3	71.5	70.7	69.9	69.1	68.3	67.4	66.6	65.7	64.8	64.0	63.1	62.1	61.2	60.3	59.3	58.4	57.4	56.4	55.4	54.3	53.3	114
115	74.5	73.8	73.0	72.2	71.4	70.6	69.8	68.9	68.1	67.2	66.4	65.5	64.6	63.7	62.8	61.9	61.0	60.0	59.0	58.1	57.1	56.0	55.0	54.0	115
116	75.2	74.4	73.6	72.8	72.0	71.2	70.4	69.6	68.8	67.9	67.0	66.2	65.3	64.4	63.5	62.6	61.6	60.7	59.7	58.7	57.7	56.7	55.7	54.7	116
117	75.9	75.1	74.3	73.5	72.7	71.9	71.1	70.3	69.4	68.6	67.7	66.8	66.0	65.1	64.2	63.2	62.3	61.4	60.4	59.4	58.4	57.4	56.4	55.4	117
118	76.5	75.7	75.0	74.2	73.4	72.6	71.7	70.9	70.1	69.2	68.4	67.5	66.6	65.7	64.8	63.9	63.0	62.0	61.1	60.1	59.1	58.1	57.1	56.1	118
119	77.2	76.4	75.6	74.8	74.0	73.2	72.4	71.6	70.7	69.9	69.0	68.2	67.3	66.4	65.5	64.6	63.7	62.7	61.8	60.8	59.8	58.8	57.8	56.7	119
120	77.8	77.1	76.3	75.5	74.7	73.9	73.1	72.2	71.4	70.6	69.7	68.8	68.0	67.1	66.2	65.3	64.3	63.4	62.4	61.5	60.5	59.5	58.5	57.4	120
121	78.5	77.7	77.0	76.2	75.4	74.6	73.7	72.9	72.1	71.2	70.4	69.5	68.6	67.8	66.9	65.9	65.0	64.1	63.1	62.2	61.2	60.2	59.2	58.1	121
122	79.2	78.4	77.6	76.8	76.0	75.2	74.4	73.6	72.7	71.9	71.0	70.2	69.3	68.4	67.5	66.6	65.7	64.8	63.8	62.8	61.9	60.9	59.9	58.8	122
123	79.8	79.1	78.3	77.5	76.7	75.9	75.1	74.2	73.4	72.6	71.7	70.9	70.0	69.1	68.2	67.3	66.4	65.4	64.5	63.5	62.6	61.6	60.6	59.5	123
124	80.5	79.7	78.9	78.1	77.3	76.5	75.7	74.9	74.1	73.2	72.4	71.5	70.6	69.8	68.9	68.0	67.0	66.1	65.2	64.2	63.2	62.2	61.2	60.2	124
125	81.2	80.4	79.6	78.8	78.0	77.2	76.4	75.6	74.7	73.9	73.0	72.2	71.3	70.4	69.5	68.6	67.7	66.8	65.8	64.9	63.9	62.9	61.9	60.9	125
126	81.8	81.0	80.3	79.5	78.7	77.9	77.1	76.2	75.4	74.6	73.7	72.9	72.0	71.1	70.2	69.3	68.4	67.5	66.5	65.6	64.6	63.6	62.6	61.6	126
127	82.5	81.7	80.9	80.1	79.3	78.5	77.7	76.9	76.1	75.2	74.4	73.5	72.7	71.8	70.9	70.0	69.1	68.1	67.2	66.3	65.3	64.3	63.3	62.3	127
128	83.1	82.4	81.6	80.8	80.0	79.2	78.4	77.6	76.7	75.9	75.0	74.2	73.3	72.4	71.6	70.7	69.7	68.8	67.9	66.9	66.0	65.0	64.0	63.0	128
129	83.8	83.0	82.2	81.5	80.7	79.9	79.0	78.2	77.4	76.6	75.7	74.9	74.0	73.1	72.2	71.3	70.4	69.5	68.6	67.6	66.7	65.7	64.7	63.7	129
130	84.5	83.7	82.9	82.1	81.3	80.5	79.7	78.9	78.1	77.2	76.4	75.5	74.7	73.8	72.9	72.0	71.1	70.2	69.2	68.3	67.3	66.4	65.4	64.4	130
131	85.1	84.4	83.6	82.8	82.0	81.2	80.4	79.6	78.7	77.9	77.0	76.2	75.3	74.5	73.6	72.7	71.8	70.8	69.9	69.0	68.0	67.0	66.1	65.1	131
132	85.8	85.0	84.2	83.4	82.6	81.8	81.0	80.2	79.4	78.6	77.7	76.9	76.0	75.1	74.2	73.3	72.4	71.5	70.6	69.6	68.7	67.7	66.7	65.7	132
133	86.4	85.7	84.9	84.1	83.3	82.5	81.7	80.9	80.1	79.2	78.4	77.5	76.7	75.8	74.9	74.0	73.1	72.2	71.3	70.3	69.4	68.4	67.4	66.4	133
134	87.1	86.3	85.6	84.8	84.0	83.2	82.4	81.5	80.7	79.9	79.0	78.2	77.3	76.5	75.6	74.7	73.8	72.9	71.9	71.0	70.1	69.1	68.1	67.1	134
135	87.8	87.0	86.2	85.4	84.6	83.8	83.0	82.2	81.4	80.6	79.7	78.9	78.0	77.1	76.2	75.4	74.5	73.5	72.6	71.7	70.7	69.8	68.8	67.8	135
136	88.4	87.7	86.9	86.1	85.3	84.5	83.7	82.9	82.0	81.2	80.4	79.5	78.7	77.8	76.9	76.0	75.1	74.2	73.3	72.4	71.4	70.5	69.5	68.5	136
137	89.1	88.3	87.5	86.8	86.0	85.2	84.4	83.5	82.7	81.9	81.0	80.2	79.3	78.5	77.6	76.7	75.8	74.9	74.0	73.0	72.1	71.1	70.2	69.2	137
138	89.8	89.0	88.2	87.4	86.6	85.8	85.0	84.2	83.4	82.5	81.7	80.9	80.0	79.1	78.3	77.4	76.5	75.6	74.6	73.7	72.8	71.8	70.9	69.9	138
139	90.4	89.6	88.9	88.1	87.3	86.5	85.7	84.9	84.0	83.2	82.4	81.5	80.7	79.8	78.9	78.0	77.1	76.2	75.3	74.4	73.5	72.5	71.5	70.6	139
140	91.1	90.3	89.5	88.7	87.9	87.1	86.3	85.5	84.7	83.9	83.0	82.2	81.3	80.5	79.6	78.7	77.8	76.9	76.0	75.1	74.1	73.2	72.2	71.2	140
141	91.7	91.0	90.2	89.4	88.6	87.8	87.0	86.2	85.4	84.5	83.7	82.9	82.0	81.1	80.3	79.4	78.5	77.6	76.7	75.7	74.8	73.9	72.9	71.9	141
142	92.4	91.6	90.9	90.1	89.3	88.5	87.7	86.9	86.0	85.2	84.4	83.5	82.7	81.8	80.9	80.0	79.2	78.3	77.3	76.4	75.5	74.5	73.6	72.6	142
143	93.1	92.3	91.5	90.7	89.9	89.1	88.3	87.5	86.7	85.9	85.0	84.2	83.3	82.5	81.6	80.7	79.8	78.9	78.0	77.1	76.2	75.2	74.3	73.3	143
144	93.7	93.0	92.2	91.4	90.6	89.8	89.0	88.2	87.4	86.5	85.7	84.9	84.0	83.1	82.3	81.4	80.5	79.6	78.7	77.8	76.8	75.9	74.9	74.0	144
145	94.4	93.6	92.8	92.1	91.3	90.5	89.7	88.8	88.0	87.2	86.4	85.5	84.7	83.8	82.9	82.1	81.2	80.3	79.4	78.4	77.5	76.6	75.6	74.7	145
146	95.0	94.3	93.5	92.7	91.9	91.1	90.3	89.5	88.7	87.9	87.0	86.2	85.3	84.5	83.6	82.7	81.8	80.9	80.0	79.1	78.2	77.3	76.3	75.3	146
147	95.7	94.9	94.2	93.4	92.6	91.8	91.0	90.2	89.4	88.5	87.7	86.9	86.0	85.1	84.3	83.4	82.5	81.6	80.7	79.8	78.9	77.9	77.0	76.0	147
148	96.4	95.6	94.8	94.0	93.2	92.4	91.6	90.8	90.0	89.2	88.4	87.5	86.7	85.8	84.9	84.1	83.2	82.3	81.4	80.5	79.5	78.6	77.7	76.7	148
149	97.0	96.3	95.5	94.7	93.9	93.1	92.3	91.5	90.7	89.9	89.0	88.2	87.3	86.5	85.6	84.7	83.9	83.0	82.1	81.1	80.2	79.3	78.3	77.4	149
150	97.7	96.9	96.1	95.4	94.6	93.8	93.0	92.2	91.3	90.5	89.7	88.8	88.0	87.1	86.3	85.4	84.5	83.6	82.7	81.8	80.9	80.0	79.0	78.1	150