ECSS 704

ECA-I Honeycomb
Material specification for industrial applications

1 INTRODUCTION

This specification establishes the basic data for aramid honeycomb core material to be used in general purpose applications. For general purpose applications the ECA-I honeycomb is assembled into sandwiched type constructions utilizing a variety of industrial techniques. Structural and non-structural parts may be so obtained.
Sample applications can be:

- ship partitions, boat hulls
- racing car bodies
- road transport containers
- lift cabins
- special purpose sanitaries
- ski structures, civil structures
- panels for trucks and busses

1.1 Scope

ECA-I core is a non-metallic honeycomb manufactured from industrial grade aramid-fiber and is coated with the heat resistant phenolic resin. The choice of materials together in combination with a controlled production process support the outstanding durability and mechanical properties of this product.

2 PRODUCT TYPE

Product types are designated by cell size and nominal density. ECA-I honeycomb is available in hexagonal as well as in rectangular shaped cells. Hexagonal cells assure best strength and stiffness whereas the rectangular cells provide best drapability and are adaptable to curved sandwich structures.

2.1 Range of availability by product designation

Hexagonal Type:

Cell Size		**Density Range**	
mm	inch	kg/m³	PCF
3.2	1/8	48 - 144	3.0 - 9.0
4.0	5/32	29 - 144	1.8 - 9.0
4.8	3/16	32 - 123	2.0 - 7.7
6.4	1/4	24 - 64	1.5 - 4.0
9.6	3/8	24 - 48	1.5 - 3.0
12.8	1/2	32 - 64	2.0 - 4.0
19.2	3/4	24 - 32	1.5 - 2.0

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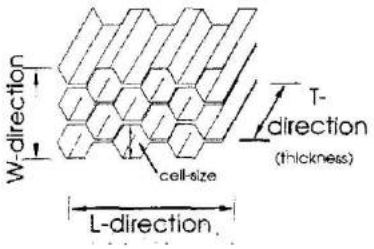
Rectangular Type:

Cell Size		**Density Range**	
mm	inch	kg/m3	PCF
R-4.8	Ox-3/16	29 - 96	1.8 - 6.0
R-6.4	Ox-1/4	48 - 64	3.0 - 4.0

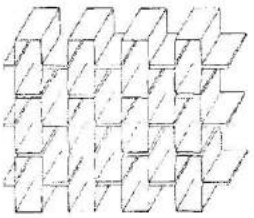
2.2 Product forms

ECA-I honeycomb is available in precut sheets. Sheet thickness can be processed to the customer requirements. Minimum thickness is 2.0 mm (0.08 in).

Hexagonal cell



Rectangular cell



2.3 Product dimensions and tolerances

The standard product dimension is adjusted to 1220(L) x 2440(W) mm or (48"Lx96"W) for hexagonal cell configurations and 915(L) x 2440(W) mm or (36"L x 96"W) for rectangular cell configurations. The thickness tolerance in T direction is +/- 0,25 mm (0.01 in) up to 50 mm (2") total gauge. Above a total gauge of 50 mm (2.00 in) the tolerance is better than +/- 0.400 mm (0.015").
For particular dimension and thickness requirements refer to our sales support department.

3 TYPICAL MATERIAL PROPERTIES

The honeycomb material has a service temperature range from -42°C (-45°F) to 175°C (350°F).
The shelf life is not limited. Thermal resistance is of excellent behavior. Heat transfer of ECA-I honeycomb is low compared to most metallic structures. Impact resistance of ECA-I honeycombs is an outstanding feature and can be used in most structures for enhanced capabilities of energy absorption.
The mechanical properties have been outlined in appended tables for average guarantee data as obtained from laboratory testing using specimens of 0.500" (12.70 mm) thickness.
Moisture resistance using samples of standard quality in absence of material faults tested for compressive strength is above 90% on equal comparison basis when submerged into water at room temperature for a period of 6 days.

3.1 Material density tolerances

The nominal product density is stated with the product designation. The allowance for density variations within a designation is +/-16 %.

3.2 Material workmanship

- ECA-I honeycomb is manufactured uniform in quality and appearance, clean of machining dust and foreign materials except on nested cells and flat cells.
- Nested cells and flat cells are permitted to the extend of up to 6% over the surface.
- Broken cell walls and or offset bonding of cells is permitted to the extend of up to 4 affected cells per square foot (300 x 300 mm).
- Deviation from the nominal cell size configuration is permitted to the extend of +/-12 % as measured by taking the average of 6 random measurements of ten cells each in the direction of the cell expansion.
- Excess resin accumulations in the cells are spottwise permitted to the extend of up to 6% over the surface.
- Resin starved cells are permitted to the extend of up to 3 % over the surface at random distribution.
- Resin free cells are permitted only to the extend of up to 2 cells per square foot.

4 PACKAGING AND MARKING

1. Packaging is accomplished in such a manner as to ensure delivery of the material and to retain the properties required by this specification.
   Each package of core shall be stored so that the cells are in a vertical position.
2. Each container is identified with a box identification card with the following informations:
3. • name of manufacturer
   • product design
   • purchase order number
   • quantity
4. If required by the customer, each supplied part will additionally be identified with an identification tag, having the product designation and thickness data.
   This shall be specified with the purchasing agreements.

ECA-I honeycomb (Table 1/2):
Average mechanical metric/imperial values are obtained from specimens with 12.70 mm/0.500" in thickness. Data is representative at the nominal product density. The information is based on results gained from tests and experience.

Herein disclosed data are believed to be accurate yet without acceptance of liability for loss or damage, for any material application or end use. The data are presented as a possible aid to the customer in selecting an appropriate material.

Table 1 Average values 12.7 mm (0.500") thickness

Designation	Cell size mm		Density kg/m³	Compression Strength N/mm²	L-Shear N/mm²	W-Shear N/mm²
ECA-I	3.2	-	48	1.90	1.16	0.62
ECA-I	3.2	-	64	3.10	1.48	0.82
ECA-I	3.2	-	80	4.70	1.95	1.05
ECA-I	3.2	-	96	6.60	2.45	1.42
ECA-I	3.2	-	128	11.30	2.95	1.78
ECA-I	3.2	-	144	13.20	3.05	1.90
ECA-I	4.0	-	29	0.60	0.45	0.26
ECA-I	4.0	-	80	5.10	1.90	0.98
ECA-I	4.0	-	144	13.00	3.60	2.00
ECA-I	4.8	-	32	0.90	0.58	0.36
ECA-I	4.8	-	48	2.60	0.98	0.56
ECA-I	4.8	-	64	3.40	1.70	0.92
ECA-I	4.8	-	80	6.00	1.95	1.10
ECA-I	4.8	-	96	7.30	2.26	1.32
ECA-I	4.8	-	123	9.30	3.40	1.86
ECA-I	6.4	-	24	0.54	0.34	0.18
ECA-I	6.4	-	32	0.80	0.54	0.30
ECA-I	6.4	-	48	2.05	1.00	0.56
ECA-I	6.4	-	64	3.40	1.54	0.79
ECA-I	9.6	-	24	0.52	0.32	0.16
ECA-I	9.6	-	32	0.68	0.56	0.29
ECA-I	9.6	-	48	1.80	1.15	0.66
ECA-I	12.8	-	32	0.75	0.46	0.26
ECA-I	12.8	-	64	2.80	1.60	0.88
ECA-I	19.2	-	24	0.50	0.50	0.22
ECA-I	19.2	-	32	0.70	0.60	0.32
ECA-R-I	4.8	-	29	0.60	0.31	0.32
ECA-R-I	4.8	-	48	2.30	0.60	0.72
ECA-R-I	4.8	-	64	3.80	0.72	0.90
ECA-R-I	4.8	-	72	4.20	0.84	1.03
ECA-R-I	4.8	-	80	5.30	0.88	1.17
ECA-R-I	4.8	-	96	6.70	0.92	1.28
ECA-R-I	6.4	-	48	2.30	0.60	0.72
ECA-R-I	6.4	-	64	3.20	0.72	0.90

Table 2 Average values 12.7 mm (0.500") thickness

Designation	Cell Size Inch		Density PCF	Compression Strength PSI	L-Shear PSI	W-Shear PSI
ECA-I	1/8	-	3.0	276	168	90
ECA-I	1/8	-	4.0	450	215	119
ECA-I	1/8	-	5.0	682	283	152
ECA-I	1/8	-	6.0	957	355	206
ECA-I	1/8	-	8.0	1639	428	258
ECA-I	1/8	-	9.0	1914	442	276
ECA-I	5/32	-	1.8	87	65	38
ECA-I	5/32	-	5.0	740	276	142
ECA-I	5/32	-	9.0	1885	522	290
ECA-I	3/16	-	2.0	131	84	52
ECA-I	3/16	-	3.0	377	142	81
ECA-I	3/16	-	4.0	493	247	133
ECA-I	3/16	-	5.0	870	283	160
ECA-I	3/16	-	6.0	1059	328	191
ECA-I	3/16	-	7.7	1349	493	270
ECA-I	1/4	-	1.5	78	49	26
ECA-I	1/4	-	2.0	116	78	44
ECA-I	1/4	-	3.0	297	145	81
ECA-I	1/4	-	4.0	493	223	115
ECA-I	3/8	-	1.5	75	46	23
ECA-I	3/8	-	2.0	99	81	42
ECA-I	3/8	-	3.0	261	167	96
ECA-I	1/2	-	2.0	109	67	38
ECA-I	1/2	-	4.0	406	232	128
ECA-I	3/4	-	1.5	73	73	32
ECA-I	3/4	-	2.0	102	87	46
ECA-R-I	3/16	-	1.8	87	45	46
ECA-R-I	3/16	-	3.0	334	87	104
ECA-R-I	3/16	-	4.0	551	104	131
ECA-R-I	3/16	-	4.5	609	122	149
ECA-R-I	3/16	-	5.0	769	128	170
ECA-R-I	3/16	-	6.0	972	133	186
ECA-R-I	1/4	-	3.0	334	87	104
ECA-R-I	1/4	-	4.0	464	104	131

ECA-I Honeycomb

Mechanical Properties

Designation				Compression Strength	L-Shear	W-Shear
	Cell size mm		Density kg/m³	N/mm²	N/mm²	N/mm²
ECA-I	3.2	-	48	1.90	1.16	0.62
ECA-I	3.2	-	64	3.10	1.48	0.82
ECA-I	3.2	-	80	4.70	1.95	1.05
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ECA-I	4.8	-	32	0.90	0.58	0.36
ECA-I	4.8	-	48	2.60	0.98	0.56
ECA-I	4.8	-	64	3.40	1.70	0.92
ECA-I	4.8	-	80	6.00	1.95	1.10
ECA-I	4.8	-	96	7.30	2.26	1.32
ECA-I	6.4	-	24	0.54	0.34	0.18
ECA-I	6.4	-	32	0.80	0.54	0.30
ECA-I	6.4	-	48	2.05	1.00	0.56
ECA-I	6.4	-	64	3.40	1.54	0.79
ECA-I	9.6	-	24	0.52	0.32	0.16
ECA-I	9.6	-	32	0.68	0.56	0.29
ECA-I	9.6	-	48	1.80	1.15	0.66
ECA-R-I	4.8	-	29	0.60	0.31	0.32
ECA-R-I	4.8	-	48	2.30	0.60	0.72
ECA-R-I	4.8	-	64	3.80	0.72	0.90
ECA-R-I	4.8	-	72	4.00	0.75	0.92
ECA-R-I	4.8	-	80	5.30	0,88	1.17
ECA-R-I	4.8	-	96	6.70	0,92	1.28
ECA-R-I	6.4	-	48	2.30	0.60	0.72
ECA-R-I	6.4	-	64	3.20	0.72	0.90

This table presents average values of ECA-I honeycomb obtained from testing specimens of 12,7mm thickness at RT. All data are representative at the nominal product density. Data is based on gain from experience and tests and is believed to be accurate yet without acceptance of liability for loss or damage incurred and attributable to reliance there on as conditions of use lie outside our control.

Density tolerances +/-16%.