



ALUMINIUM HONEYCOMB AIR VENTILATION PANELS FOR RFI/EMI SHIELDING

Product Overview

Kemtron Limited (Kemtron), now part of TE Connectivity, manufactures a range of aluminum honeycomb air ventilation panels consisting of an aluminium honeycomb foil held in a rigid extruded aluminium mounting frame. The foil, formed and laminated into a series of honeycomb cells that are glued and perforated or laser welded at the join, ensures a conductive path at each join. Although the foil is conductive in all directions, to enhance EMI performance, two pieces of honeycomb polarised at 90° to each other are recommended.

The frame can be supplied with an integral or separate EMI/RFI gasket, and can be treated with a variety of finishes to provide corrosion protection or improve conductivity.

How do honeycomb vents work

The principle is that of “waveguide beyond cutoff”. The honeycomb vent is series of tubes that acts as a waveguide, guiding electromagnetic waves into or out of the enclosure, but as the tubes are long enough then it attenuates those waves. Typically the tube should be at least 3 times as long as the diameter. Good practice is 4 times. Therefore a 3.18mm cell should be 12.7mm long. Honeycomb material is used because it offers high shielding performance, light weight and good airflow.

A standard range of honeycomb vents are available, drawings and part numbers are shown at the end of this data sheet.

Applications

Ventilation panels are designed for use in electronic enclosures where good air flow is required for cooling and ventilation but where EMC compliance must be ensured.

Typical applications are:

- Electronic Enclosures
- Air Conditioning Units
- Fan Housings
- EMC Racks
- Communication Shelters

Availability

An extensive range of aluminium extrusion mounting frames are available from stock offering a choice of mounting methods and sizes.

Available as custom sizes with no additional cost.

Frames can be supplied with fixing holes or captive threaded inserts to aid mounting.

Honeycomb can be supplied in a number of configurations to suit different EMI/RFI shielding performance requirements, such as straight through, polarized and a choice of cell size.

Standard perforated honeycomb is available with 30°, 45°, 60° and 90° angles from stock and laser welded aluminium honeycomb is also available to special order.

For vulnerable situations, weld mesh or expanded aluminium kick plates can be fitted.

Removable dust filters and integral insect screens can also be provided.

A range of low cost standard fan vents are available to meet commercial applications where lower performance is acceptable, consisting of one layer of aluminium honeycomb held in a plastic frame.



Design Considerations

Any environmental conditions such as moisture and dust control including:

- Air flow requirement
- External louvres for rain protection
- Drain holes
- Any additional gasketing

Constructional Requirements and Finishes Including

- Angled honeycomb for rain protection or directional air flow
- Rigidity of vent frame and enclosure so as to prevent bowing of either surface when compressing the gasket
- Fixing requirements e.g. holes or threaded inserts ensuring appropriate position and size of hole-centres, (Holes in the corners of the frame should be avoided)
- If specifying captive inserts in both sides of the frame, offset the positions by 10mm minimum
- Round vents tend to be an expensive option due to the complexity of manufacturing method
- Fully welded corners
- Type of gasket required
- Frame style
- Honeycomb configuration
- Corrosion, electrical conductivity etc, (see Finishes section)
- Weld mesh or expanded aluminium kick plates
- Removable dust filters and integral insect screens can be provided

Production Capabilities

Kemtron manufactures its range of EMC vent panels using the latest technology and, with the exception of painting and plating, all processes are kept in house, giving us flexibility and total control over quality. Kemtron has invested heavily in this area making us the market leaders for price, delivery, quality and availability.

Fully programmable CNC machines for the notching & cutting of the frame extrusions and drilling of exact and repeatable holes combined with the latest TIG welding equipment allows Kemtron to offer a fast delivery of its competitive range of aluminium vent panels produced to customer designs. This advanced technology also eliminates the need for additional tooling and set-up charges. Kemtron holds a large range of aluminium extrusions and aluminium honeycomb in stock.

In addition to vent panels, Kemtron manufactures a huge range of EMI shielding products, including conductive elastomers, oriented wire, knitted wire mesh, connector gaskets.

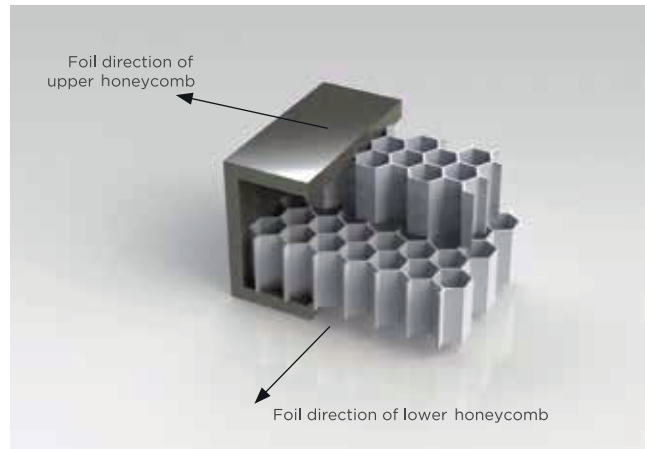
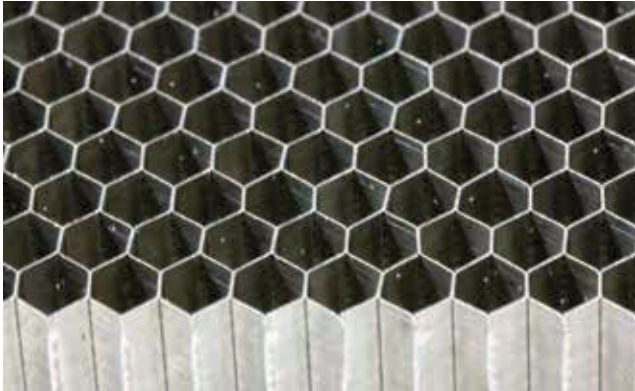
Vent panels made with styles 1701, 1703, 1705, 1706 & 1707 are supplied with 3 corners notched and the 4th joined corner welded and have an external corner radii of 3mm.

Honeycomb Specification and Availability

Kemtron uses 5052 grade aluminium foil which is a lightweight material offering superior strength and corrosion resistance over commercial grade aluminium foils. It meets all the requirements of MIL-C-7438.

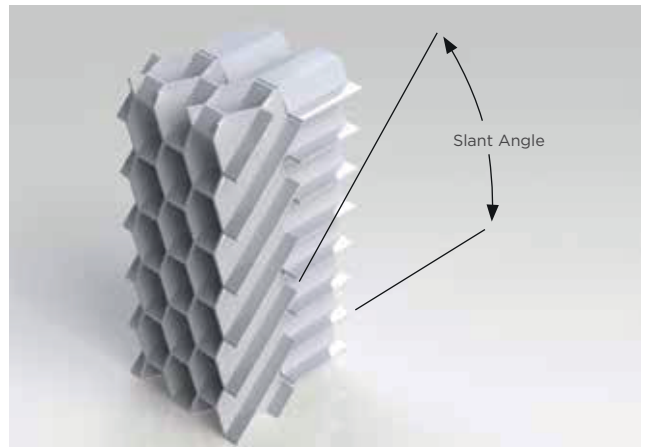
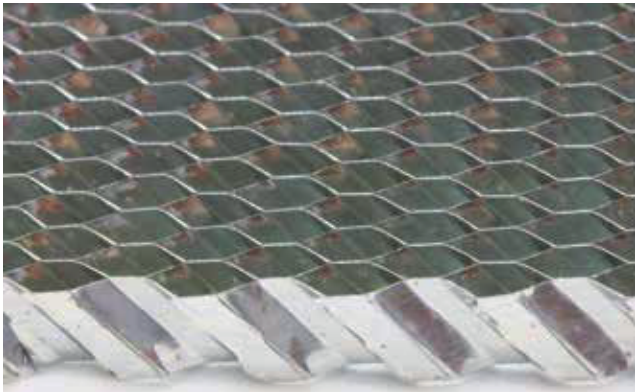
Standard straight cell size & thickness held in stock

- 3.2mm (0.125") cell x 12.70mm (0.50") thick
- 3.2mm (0.125") cell x 6.35mm (0.25") thick
- 1.6mm (0.0625") cell x 6.35mm (0.25") thick
- 3.2mm (0.125") cell x 3.2mm (0.125") thick



Standard slant cell sizes, angles & thicknesses held in stock

- 3.2mm (0.125") cell x 6.35mm (0.25") thick x 30° angle
- 3.2mm (0.125") cell x 6.35mm (0.25") thick x 45° angle
- 3.2mm (0.125") cell x 6.35mm (0.25") thick x 60° angle



Frame Styles Available

Frame styles 1701,1702,1703,1704 and 1707 will accommodate:

- 2 layers of 3.2 x 6.35mm thick honeycomb
- 1 layer of 3.2mm cell x 6.35mm thick and one layer of 3.2mm x 6.35mm thick angled honeycomb
- 1 layer 12.7mm thick honeycomb

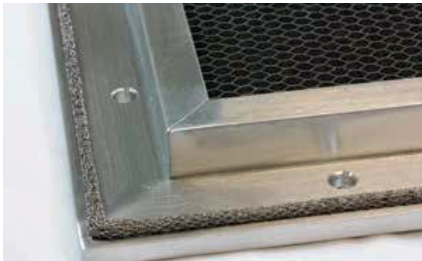
Frame styles 1705 and 1706 will accommodate:

- 1 layer of 3.2 or 1.6mm cell x 6.35mm thick honeycomb
- 2 layers of 3.2mm cell x 3.2mm thick honeycomb

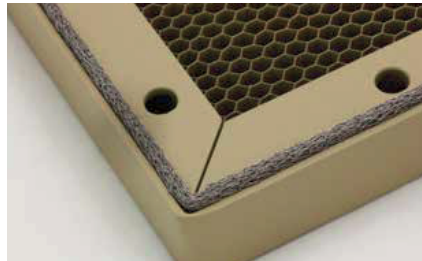
Frame style 1709 main use is for dust filter panels that can be fitted over EMC vent panels, but can accommodate one layer of 3.2 or 1.6mm cell x 6.35mm thick honeycomb, however this is not recommended.

Frame style 1708 is a dividing/support bar for large vents.

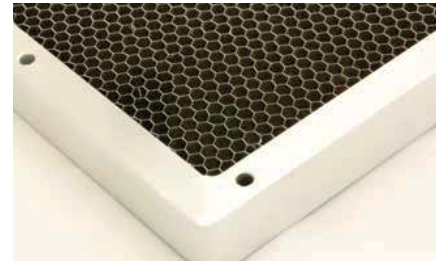
Vents are normally supplied with three notched and one welded corner to achieve the best trade off between cost and performance. This combined with an EMC gasket is normally sufficient for all but the most demanding EMC specifications. In the event that the best possible attenuation is required all corners can be supplied fully welded. Please note that styles 1702 & 1704 are always supplied fully welded due to the nature of their construction.



FULLY WELDED CORNER



NOTCHED CORNER



FULLY WELDED CORNER

Finishes

Kemtron's standard finish (Surtec 650) for aluminium vent panels fully meets the RoHS directive.

Vent panels can be supplied with a range of finishes, including:

- Surtec 650 - Trivalent chromium
- Tin or nickel plating
- Painted
- Alochrome 1200 - Hexavalent chromium

Kemtron's in-house hexavalent chromium process applies a trivalent chromium passivation. The surface finish is conductive with a low contact resistance and meets all requirements of MIL-DTL-5541F Type II Class 3 for corrosion resistance and electrical conductivity. We are also able to offer a comprehensive range of painted finishes to complement our standard Surtec 650 finish. Using industry leading wet paint solutions from Trimite, we offer full painting and preparation to DEF STAN specifications including matt and gloss finishes.

In addition we can also offer infrared reflecting (IRR) matte finishes complying with DEF STAN 00-23, 80-166 and STANAG 2338.

For less critical/commercial applications requiring a protected finish we recommend polyester powder coating. This is tough material that offers excellent resistance to fresh and saltwater, petrol, linseed and penetrating oils, along with limited resistance to various acids. We are happy to advise on specific examples if required. As the epoxy process is an electrostatic method, it offers excellent penetration of the honeycomb cells, further aiding resistance to corrosion. With both processes, we are able to offer a full range of colors to meet RAL/BS standards.



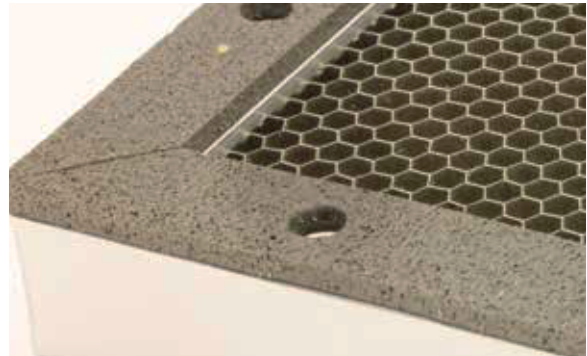
Gaskets for Vents

- Knitted wire mesh = Frames with a gasket groove
- oriented wire in silicone
- Knitted Monel wire mesh with a neoprene sponge carrier 2.4mm thick
- Beryllium copper finger stock

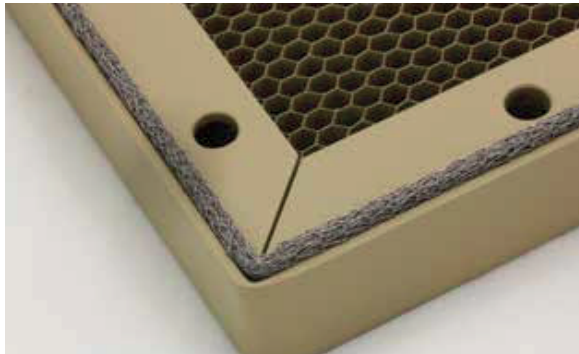
Other gasket types are available if required.



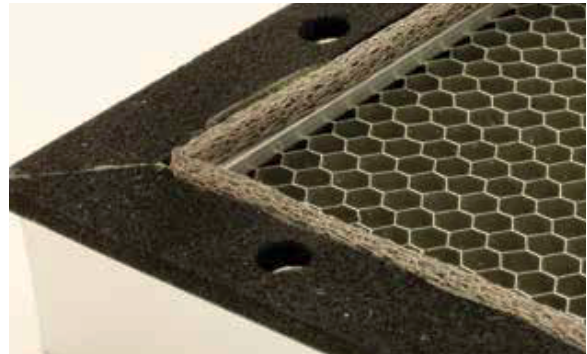
BERYLLIUM COPPER GASKET



ORIENTED WIRES IN SILICONE GASKET



KNITTED WIRE MESH GASKET



KNITTED WIRE MESH WITH NEOPRENE GASKET

Kick Plates

Aluminium honeycomb is fragile so for high traffic areas or where honeycomb damage could easily occur kick plates can be fitted.

Two types are stocked as standard, however custom designs to customers specific requirements (i.e. louvred openings) are available.



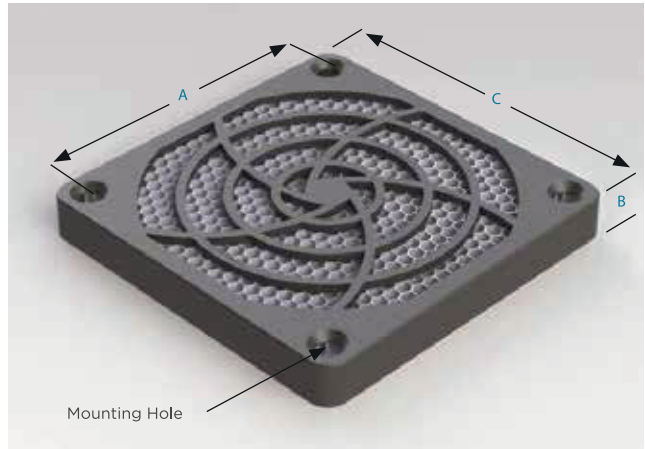
EXPANDED ALUMINIUM:
MAX PROTECTION / REDUCED AIR FLOW



WOVEN STAINLESS STEEL:
LOW PROTECTION / HIGH AIR FLOW

Fan Vents

TE Connectivity/Kemtron offer a range of low cost plastic EMC vents for use with 40mm, 60mm, 80mm, 92mm & 120mm fans. They provide EMC shielding where applications demand a low cost solution, whilst still providing an adequate shielding performance. A high impact ABS UL94 V-0 fire retardant moulding is fitted with one layer of 3.2mm cell x 6.35mm thick honeycomb and a nickel/copper fabric gasket to ground the honeycomb to the metalwork. The vents have 4 countersunk holes to suit standard fan mountings.



Measured shielding performance in accordance with Mil Std 285 (80mm size tested)

Frequency	Field	Typical (dB)
200 KHz	H	53
100 MHz	E	102
500 MHz	P	85
2 GHz	P	74
10 GHz	P	58

Type	A	B	C	Part number
Kemvent40	32.0mm	8.0mm	45.5mm	2430084-1
Kemvent60	50.0mm	9.0mm	64.5mm	2430085-1
Kemvent80	71.5mm	10.0mm	84.5mm	2430086-1
Kemvent92	82.0mm	10.0mm	97.0mm	2430087-1
Kemvent120	104.0mm	10.0mm	125.0mm	2430088-1

Optional Removable Dust Filters and Insect Screen

Dust Filter

This consists of a aluminium frame 1701, 1705, 1706, 1707 & 1709 which holds a polyester polyurethane dust filter. This is held in place on one side by a stainless steel weld mesh. This frame then mounts on to one side of the honeycomb vent panel by captive screws. Easily removed for cleaning with a mild detergent and rinsed with water. A range of different filter options are available.

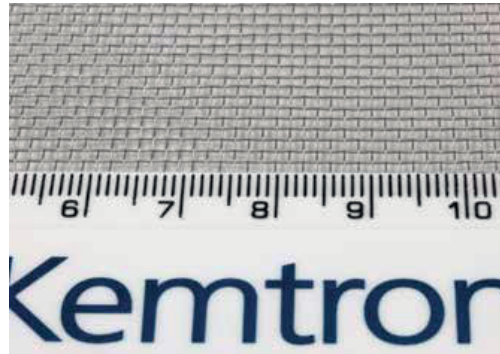
Aluminium honeycomb vent panels fitted with removable dust filters usually require assisted air flow.

Standard filter foam is stocked in two thicknesses to suit the above frame styles.

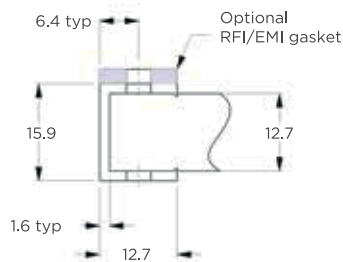
30, 45 and 60 pores per inch are available, and others to meet specific requirements.

Insect Screen

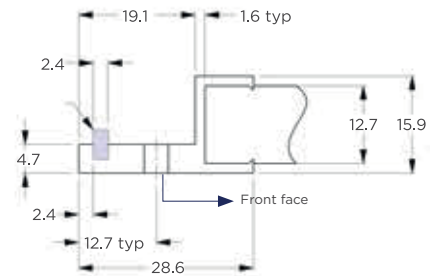
This is a woven aluminium cloth inserted on one face or between the honeycomb and provides protection from the ingress of insects. Wire dia 0.28mm open area 66%.



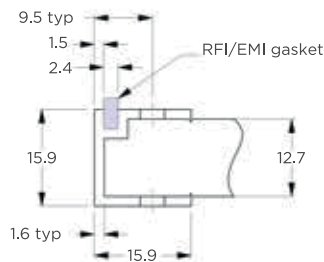
Frame style: 1701



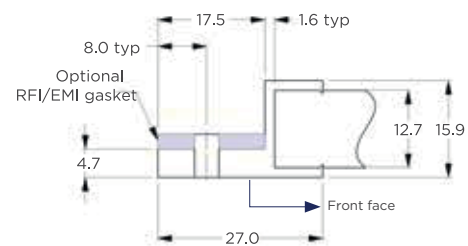
Frame style: 1702



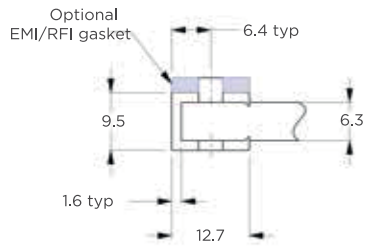
Frame style: 1703



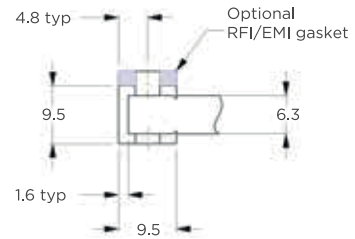
Frame style: 1704



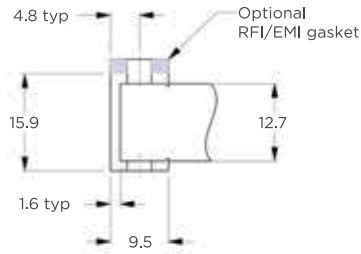
Frame style: 1705



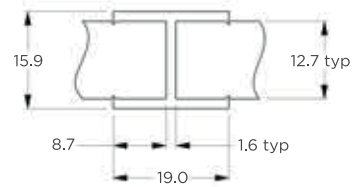
Frame style: 1706



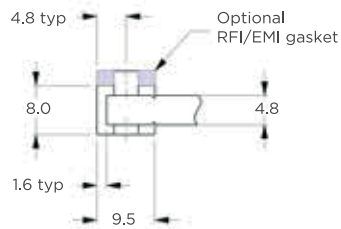
Frame style: 1707



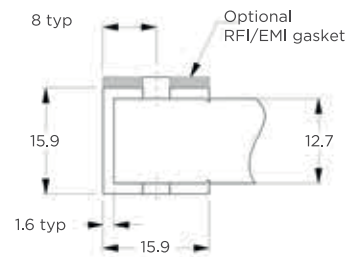
Frame style: 1708



Frame style: 1709



Frame style: 1710



Tolerances

- Standard tolerances for overall finished vent dimensions are $\pm 0.8\text{mm}$.
- Standard tolerances on hole centres are $\pm 0.4\text{mm}$.
- Typical corner radii on frame styles 1701, 1703, 1705, 1706 & 1707 are R3.0mm
- 1702 & 1704 frame styles have square corners and are fully welded on the front face

Specifications

Aluminium Frame	6063-T6
Aluminium Honeycomb	5052 Grade
Monel Wire	BS3075 NA13
Neoprene Sponge	Mil-R-6130 Type 11 Grade A condition soft
Beryllium Copper	Alloy 25 (CA172)
Silicone Rubber	ZZ-R-765 Class 2 Grade 40
Aluminium Wire	5056

EMC Performance (dB)

Honeycomb Type

Frequency	Field	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
200 kHz	H	66	39	65	71	71	78
100 MHz	E	105	80	105	105	105	100
500 MHz	P	81	55	50	93	93	55
2 GHz	P	85	52	60	94	94	96
10 GHz	P	85	61	72	82	90	80

Honeycomb

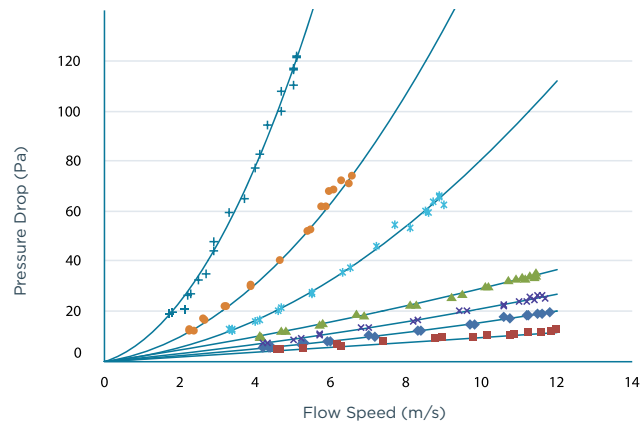
Type 1	2 layers 3.2 cell x 3.2mm thick honeycomb (total 6.4mm)
Type 2	1 layer 3.2 cell x 6.35mm thick honeycomb
Type 3	1 layer 1.6 cell x 6.35mm thick honeycomb
Type 4	2 layers 3.2 cell x 6.35mm thick honeycomb (total 12.7mm)
Type 5	1 layer 3.2 cell x 6.35mm thick honeycomb + 1 layer 3.2 cell x 6.35mm thick slant honeycomb (total 12.7mm)
Type 6	1 layer 3.2 cell x 12.7mm thick honeycomb

Honeycomb Combinations

Frame	Type 1	Type 2	Type 3	Type 4	Type 5	Type 6
1701				✓	✓	✓
1702				✓	✓	✓
1703				✓	✓	✓
1704				✓	✓	✓
1705	✓	✓	✓			
1706	✓	✓				
1707				✓	✓	✓
1709		✓				

All of the above frame styles and honeycomb combinations are available with the option of a stainless steel kick-plate.

Air Flow Results Graph



Graph Key

+	Type 5 60°
●	Type 5 45°
* (light blue)	Type 5 30°
× (purple)	Type 4 & Type 6
▲ (green)	Type 3
■ (red)	1 layer 3.2 cell x 12.7mm thick Type 2 k honeycomb
◆ (blue)	Type 1

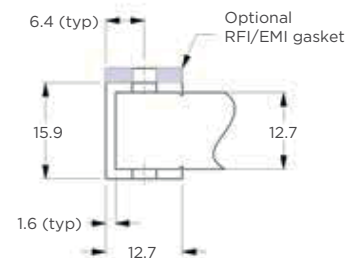
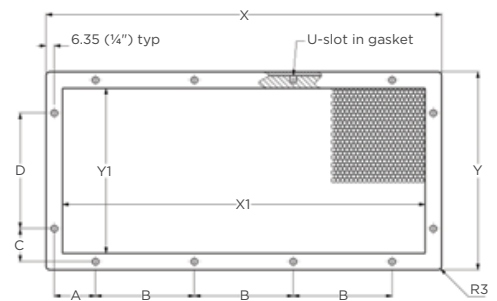
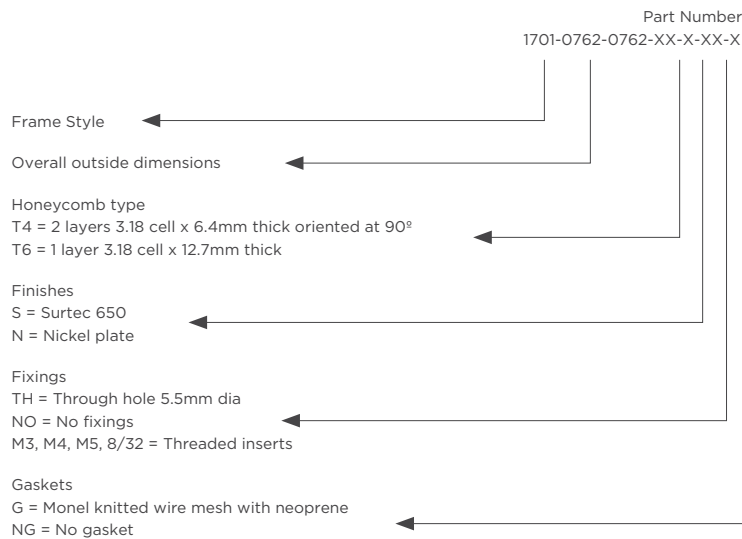
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1701 Standard Frames

Custom sizes and shapes available.

Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1						A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.	cm2	in.2	X	Y	mm	in.	mm	in.	mm	in.	mm	in.
1701-0762-0762-XXX-X-XX-X	76.2	3	76.2	3	50.8	2	50.8	2	25.8	4	1	1	31.75	1.25	-	-	31.75	1.25	-	-
1701-1016-1016-XXX-X-XX-X	101.6	4	101.6	4	76.2	3	76.2	3	58.1	9	1	1	44.45	1.75	-	-	44.45	1.75	-	-
1701-1524x1016-XXX-X-XX-X	152.4	6	101.6	4	127	5	76.2	3	96.8	15	2	1	25.4	1	88.9	3.5	44.45	1.75	-	-
1701-1270-1270-XXX-X-XX-X	127	5	127	5	101.6	4	101.6	4	103.2	16	2	1	19.05	0.75	76.2	3	57.15	2.25	-	-
1701-2032-1016-XXX-X-XX-X	203.2	8	101.6	4	177.8	7	76.2	3	135.5	21	3	1	19.05	0.75	76.2	3	44.45	1.75	-	-
1701-1778-1270-XXX-X-XX-X	177.8	7	127	5	152.4	6	101.6	4	154.8	24	2	1	38.1	1.5	88.9	3.5	57.15	2.25	-	-
1701-1524-1524-XXX-X-XX-X	152.4	6	152.4	6	127	5	127	5	161.3	25	2	2	25.4	1	88.9	3.5	25.4	1	88.9	3.5
1701-3048-1016-XXX-X-XX-X	304.8	12	101.6	4	279.4	11	76.2	3	212.9	33	4	1	31.75	1.25	76.2	3	44.45	1.75	-	-
1701-2032-1524-XXX-X-XX-X	203.2	8	152.4	6	177.8	7	127	5	225.8	35	3	2	19.05	0.75	76.2	3	31.75	1.25	76.2	3
1701-1778-1778-XXX-X-XX-X	177.8	7	177.8	7	152.4	6	152.4	6	232.3	36	2	2	38.1	1.5	88.9	3.5	38.1	1.5	88.9	3.5
1701-2540-1270-XXX-X-XX-X	254	10	127	5	228.6	9	101.6	4	232.3	36	3	1	31.75	1.25	88.9	3.5	57.15	2.25	-	-
1701-2032x2032-XXX-X-XX-X	203.2	8	203.2	8	177.8	7	177.8	7	316.1	49	3	2	19.05	0.75	76.2	3	50.8	2	88.9	3.5
1701-2540-1778-XXX-X-XX-X	254	10	177.8	7	228.6	9	152.4	6	348.4	54	3	2	31.75	1.25	88.9	3.5	38.1	1.5	88.9	3.5
1701-3048-1524-XXX-X-XX-X	304.8	12	152.4	6	279.4	11	127	5	354.8	55	4	2	31.75	1.25	76.2	3	25.4	1	88.9	3.5
1701-2540x2032-XXX-X-XX-X	254	10	203.2	8	228.6	9	177.8	7	406.5	63	3	2	31.75	1.25	88.9	3.5	50.8	2	88.9	3.5
1701-3048-2032-XXX-X-XX-X	304.8	12	203.2	8	279.4	11	177.8	7	496.8	77	4	3	31.75	1.25	76.2	3	19.05	0.75	76.2	3
1701-2540-2540-XXX-X-XX-X	254	10	254	10	228.6	9	228.6	9	522.6	81	3	3	31.75	1.25	88.9	3.5	31.75	1.25	88.9	3.5
1701-3048-3048-XXX-X-XX-X	304.8	12	304.8	12	279.4	11	279.4	11	780.6	121	4	4	31.75	1.25	76.2	3	31.75	1.25	76.2	3

1701 Frames

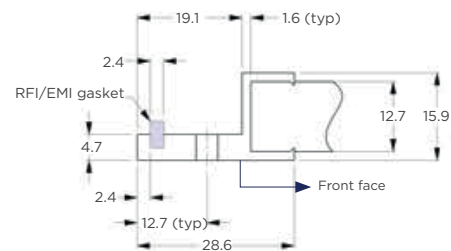
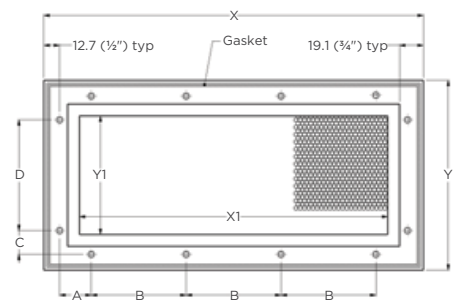
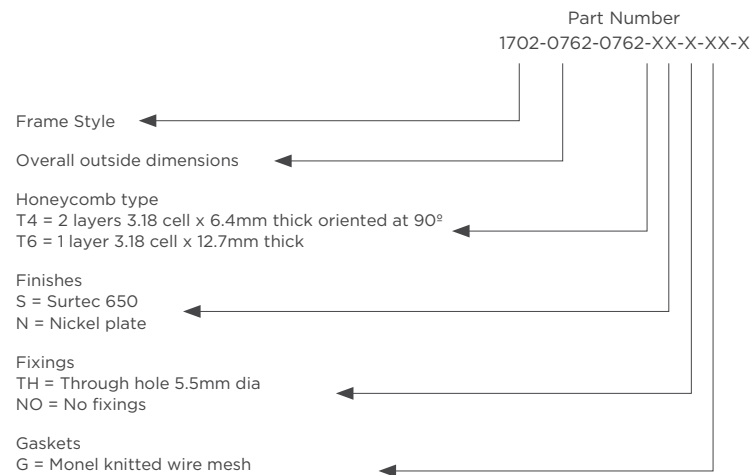


1702 Standard Frames

Custom sizes and shapes available.

Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1						A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.	cm ²	in. ²	X	Y	mm	in.	mm	in.	mm	in.	mm	in.
1702-0762-0762-XXXX-X-XX-G	76.2	3	76.2	3	19.1	0.75	19.1	0.75	3.6	0.563	1	1	25.4	1			25.4	1		
1702-1016-1016-XXXX-X-XX-G	101.6	4	101.6	4	44.5	1.75	44.5	1.75	19.8	3.063	1	1	38.1	1.5			38.1	1.5		
1702-1524-1016-XXXX-X-XX-G	152.4	6	101.6	4	95.3	3.75	44.5	1.75	42.3	6.563	2	1	19.05	0.75	88.9	3.5	38.1	1.5		
1702-1270-1270-XXXX-X-XX-G 2430089-1	127	5	127	5	69.9	2.75	69.9	2.75	48.8	7.563	2	1	12.7	0.5	76.2	3	50.8	2		
1702-2032-1016-XXXX-X-XX-G	203.2	8	101.6	4	146.1	5.75	44.5	1.75	64.9	10.063	3	1	12.7	0.5	76.2	3	38.1	1.5		
1702-1778-1270-XXXX-X-XX-G	177.8	7	127	5	120.7	4.75	69.9	2.75	84.3	13.063	2	1	31.75	1.25	88.9	3.5	50.8	2		
1702-1524-1524-XXXX-X-XX-G	152.4	6	152.4	6	95.3	3.75	95.3	3.75	90.7	14.063	2	2	19.05	0.75	88.9	3.5	19.05	0.75	88.9	3.5
1702-3048-1016-XXXX-X-XX-G	304.8	12	101.6	4	247.7	9.75	44.5	1.75	110.1	17.063	4	1	25.4	1	76.2	3	38.1	1.5		
1702-2032-1524-XXXX-X-XX-G	203.2	8	152.4	6	146.1	5.75	95.3	3.75	139.1	21.563	3	2	12.7	0.5	76.2	3	25.4	1	76.2	3
1702-1778-1778-XXXX-X-XX-G	177.8	7	177.8	7	120.7	4.75	120.7	4.75	145.6	22.563	2	2	31.75	1.25	88.9	3.5	31.75	1.25	88.9	3.5
1702-2540-1270-XXXX-X-XX-G	254	10	127	5	196.9	7.75	69.9	2.75	137.5	21.313	3	1	25.4	1	88.9	3.5	50.8	2		
1702-2032-2032-XXXX-X-XX-G 2430090-1	203.2	8	203.2	8	146.1	5.75	146.1	5.75	213.3	33.063	3	2	12.7	0.5	76.2	3	44.45	1.75	88.9	3.5
1702-2540-1778-XXXX-X-XX-G	254	10	177.8	7	196.9	7.75	120.7	4.75	237.5	36.813	3	2	25.4	1	88.9	3.5	31.75	1.25	88.9	3.5
1702-3048-1524-XXXX-X-XX-G	304.8	12	152.4	6	247.7	9.75	95.3	3.75	235.9	36.563	4	2	25.4	1	76.2	3	19.05	0.75	88.9	3.5
1702-2540-2032-XXXX-X-XX-G	254	10	203.2	8	196.9	7.75	146.1	5.75	287.5	44.563	3	2	25.4	1	88.9	3.5	44.45	1.75	88.9	3.5
1702-3048-2032-XXXX-X-XX-G	304.8	12	203.2	8	247.7	9.75	146.1	5.75	361.7	56.063	4	3	25.4	1	76.2	3	12.7	0.5	76.2	3
1702-2540-2540-XXXX-X-XX-G	254	10	254	10	196.9	7.75	196.9	7.75	387.5	60.063	3	3	25.4	1	88.9	3.5	25.4	1	88.9	3.5
1702-3048-3048-XXXX-X-XX-G	304.8	12	304.8	12	247.7	9.75	247.7	9.75	613.3	95.063	4	4	25.4	1	76.2	3	25.4	1	76.2	3

1702 Frames

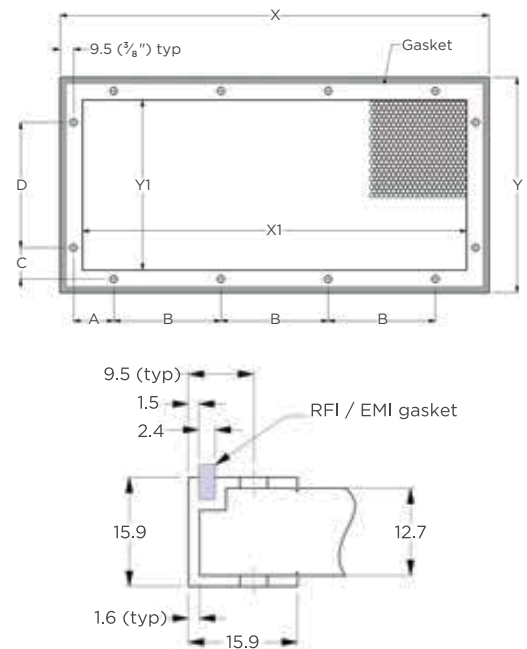
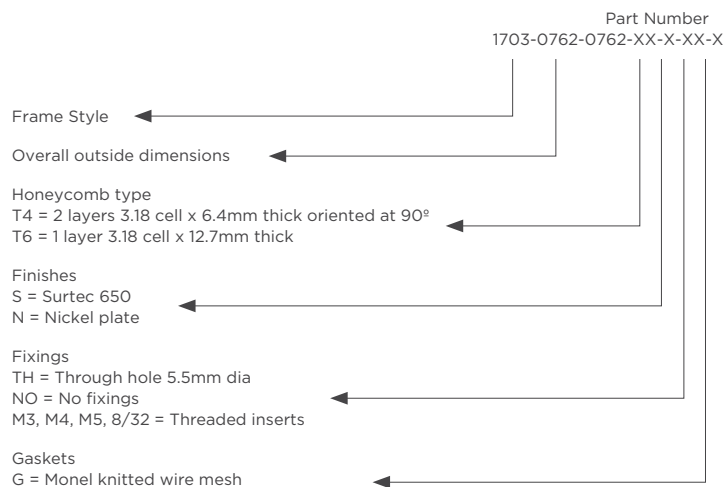


1703 Standard Frames

Custom sizes and shapes available.

Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1		cm2	in.2	X	Y	A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.					mm	in.	mm	in.	mm	in.	mm	in.
1703-0762-0762-XXX-X-XX-G	76.2	3	76.2	3	44.5	1.75	44.5	1.75	19.8	3.063	1	1	28.58	1.125	-	-	28.58	1.125	-	-
1703-1016-1016-XXX-X-XX-G	101.6	4	101.6	4	69.9	2.75	69.9	2.75	48.8	7.563	1	1	41.28	1.625	-	-	41.28	1.625	-	-
1703-1524-1016-XXX-X-XX-G	152.4	6	101.6	4	120.7	4.75	69.9	2.75	84.3	13.063	2	1	22.23	0.875	88.9	3.5	41.28	1.625	-	-
1703-1270-1270-XXX-X-XX-G	127	5	127	5	95.3	3.75	95.3	3.75	90.7	14.063	2	1	15.88	0.625	76.2	3	53.98	2.125	-	-
1703-2032-1016-XXX-X-XX-G 2430091-1	203.2	8	101.6	4	171.5	6.75	69.9	2.75	119.8	18.563	3	1	15.88	0.625	76.2	3	41.28	1.625	-	-
1703-1778-1270-XXX-X-XX-G	177.8	7	127	5	146.1	5.75	95.3	3.75	139.1	21.563	2	1	34.93	1.375	88.9	3.5	53.98	2.125	-	-
1703-1524-1524-XXX-X-XX-G	152.4	6	152.4	6	120.7	4.75	120.7	4.75	145.6	22.563	2	2	22.23	0.875	88.9	3.5	22.23	0.875	88.9	3.5
1703-3048-1016-XXX-X-XX-G	304.8	12	101.6	4	273.1	10.75	69.9	2.75	190.7	29.563	4	1	28.58	1.125	76.2	3	41.28	1.625	-	-
1703-2032-1524-XXX-X-XX-G	203.2	8	152.4	6	171.5	6.75	120.7	4.75	206.5	32.063	3	2	15.88	0.625	76.2	3	28.58	1.125	76.2	3
1703-1778-1778-XXX-X-XX-G	177.8	7	177.8	7	146.1	5.75	146.1	5.75	213.3	33.063	2	2	34.93	1.375	88.9	3.5	34.93	1.375	88.9	3.5
1703-2540-1270-XXX-X-XX-G	254	10	127	5	222.3	8.75	95.3	3.75	211.7	32.813	3	1	28.58	1.125	88.9	3.5	53.98	2.125	-	-
1703-2032-2032-XXX-X-XX-G 2430092-1	203.2	8	203.2	8	171.5	6.75	171.5	6.75	294	45.563	3	2	15.88	0.625	76.2	3	47.63	1.875	88.9	3.5
1703-2540-1778-XXX-X-XX-G	254	10	177.8	7	222.3	8.75	146.1	5.75	324.6	50.313	3	2	28.58	1.125	88.9	3.5	34.93	1.375	88.9	3.5
1703-3048-1524-XXX-X-XX-G	304.8	12	152.4	6	273.1	10.75	120.7	4.75	329.4	51.063	4	2	28.58	1.125	76.2	3	2.23	0.875	88.9	3.5
1703-2540-2032-XXX-X-XX-G	254	10	203.2	8	222.3	8.75	171.5	6.75	381	59.063	3	2	28.58	1.125	88.9	3.5	47.63	1.875	88.9	3.5
1703-3048-2032-XXX-X-XX-G	304.8	12	203.2	8	273.1	10.75	171.5	6.75	468.1	72.563	4	3	28.58	1.125	76.2	3	15.88	0.625	76.2	3
1703-2540-2540-XXX-X-XX-G	254	10	254	10	222.3	8.75	222.3	8.75	494	76.563	3	3	28.58	1.125	88.9	3.5	28.58	1.125	88.9	3.5
1703-3048-3048-XXX-X-XX-G	304.8	12	304.8	12	273.1	10.75	273.1	10.75	745.6	115.563	4	4	28.58	1.125	76.2	3	28.58	1.125	76.2	3

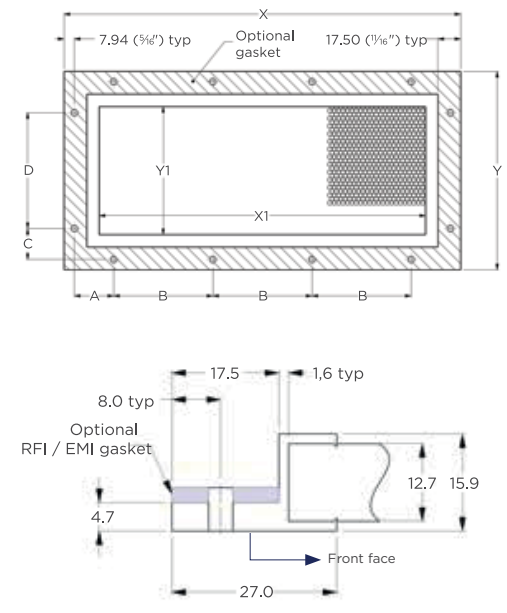
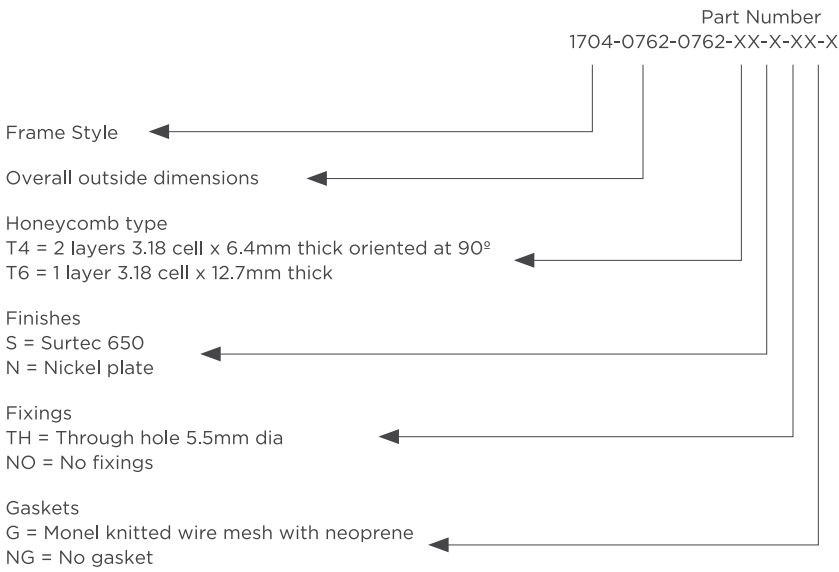
1703 Frames



1704 Standard Frames

Custom sizes and shapes available.

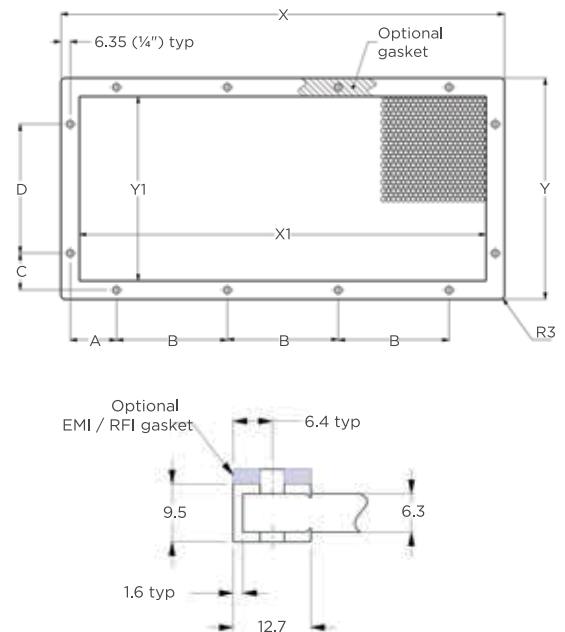
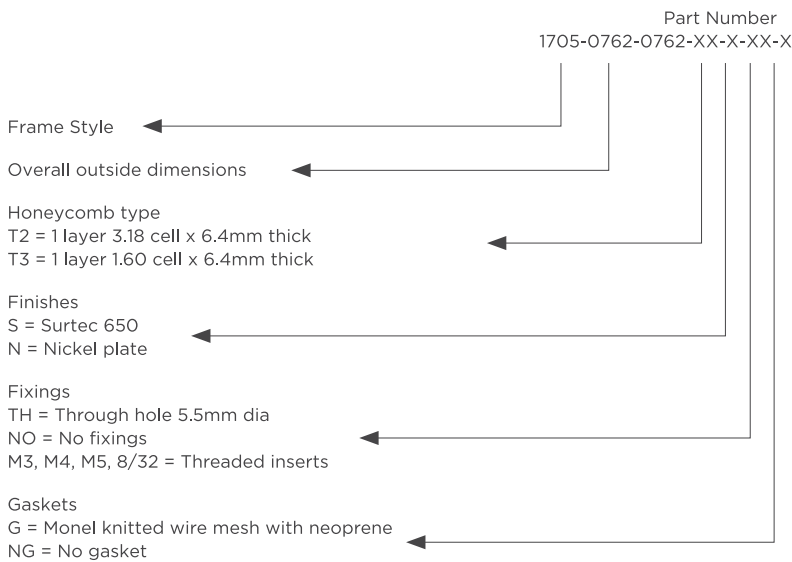
Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1						A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.	cm ²	in. ²	X	Y	mm	in.	mm	in.	mm	in.	mm	in.
1704-0762-0762-XXX-X-XX-X	76.2	3	76.2	3	22.2	0.875	22.2	0.875	4.9	0.766	1	1	30.16	1.187			30.16	1.187		
1704-1016-1016-XXX-X-XX-X	101.6	4	101.6	4	47.6	1.875	47.6	1.875	22.7	3.515	1	1	42.86	1.687			42.86	1.687		
1704-1524-1016-XXX-X-XX-X	152.4	6	101.6	4	98.4	3.875	47.6	1.875	46.9	7.265	2	1	23.81	0.937	88.9	3.5	42.86	1.687		
1704-1270-1270-XXX-X-XX-X	127	5	127	5	73	2.875	73	2.875	53.3	8.265	2	1	17.46	0.687	76.2	3	55.56	2.187		
1704-2032-1016-XXX-X-XX-X	203.2	8	101.6	4	149.2	5.875	47.6	1.875	71.1	11.015	3	1	17.46	0.687	76.2	3	42.86	1.687		
1704-1778-1270-XXX-X-XX-X	177.8	7	127	5	123.8	4.875	73	2.875	90.4	14.015	2	1	36.51	1.437	88.9	3.5	55.56	2.187		
1704-1524-1524-XXX-X-XX-X	152.4	6	152.4	6	98.4	3.875	98.4	3.875	96.9	15.015	2	2	23.81	0.937	88.9	3.5	23.81	0.937	88.9	3.5
1704-3048-1016-XXX-X-XX-X	304.8	12	101.6	4	250.8	9.875	47.6	1.875	119.5	18.515	4	1	60.16	1.187	76.2	3	42.86	1.687		
1704-2032-1524-XXX-X-XX-X	203.2	8	152.4	6	149.2	5.875	98.4	3.875	146.9	22.765	3	2	17.46	0.687	76.2	3	30.16	1.187	76.2	3
1704-1778-1778-XXX-X-XX-X	177.8	7	177.8	7	123.8	4.875	123.8	4.875	153.3	23.765	2	2	36.51	1.437	88.9	3.5	36.51	1.437	88.9	3.5
1704-2540-1270-XXX-X-XX-X	254	10	127	5	200	7.875	73	2.875	146.1	22.64	3	1	30.16	1.187	88.9	3.5	55.56	2.187		
1704-2032-2032-XXX-X-XX-X	203.2	8	203.2	8	149.2	5.875	149.2	5.875	222.7	34.515	3	2	17.46	0.687	76.2	3	49.21	1.937	88.9	3.5
1704-2540-1778-XXX-X-XX-X	254	10	177.8	7	200	7.875	123.8	4.875	247.7	38.39	3	2	30.16	1.187	88.9	3.5	36.51	1.437	88.9	3.5
1704-3048-1524-XXX-X-XX-X	304.8	12	152.4	6	250.8	9.875	98.4	3.875	246.9	38.265	4	2	30.16	1.187	76.2	3	23.81	0.937	88.9	3.5
1704-2540-2032-XXX-X-XX-X	254	10	203.2	8	200	7.875	149.2	5.875	298.5	46.265	3	2	30.16	1.187	88.9	3.5	49.21	1.937	88.9	3.5
1704-3048-2032-XXX-X-XX-X	304.8	12	203.2	8	250.8	9.875	149.2	5.875	374.3	58.015	4	3	30.16	1.187	76.2	3	17.46	0.687	76.2	3
1704-2540-2540-XXX-X-XX-X	254	10	254	10	200	7.875	200	7.875	400.1	62.015	3	3	30.16	1.187	88.9	3.5	30.16	1.187	88.9	3.5
1704-3048-3048-XXX-X-XX-X	304.8	12	304.8	12	250.8	9.875	250.8	9.875	629.1	97.515	4	4	30.16	1.187	76.2	3	30.16	1.187	76.2	3



1705 Standard Frames

Custom sizes and shapes available.

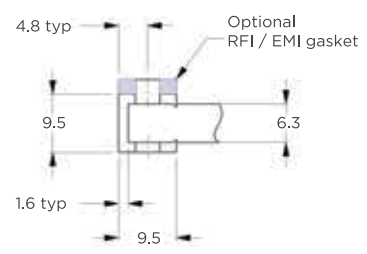
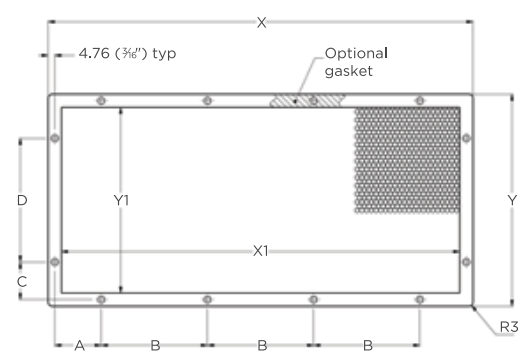
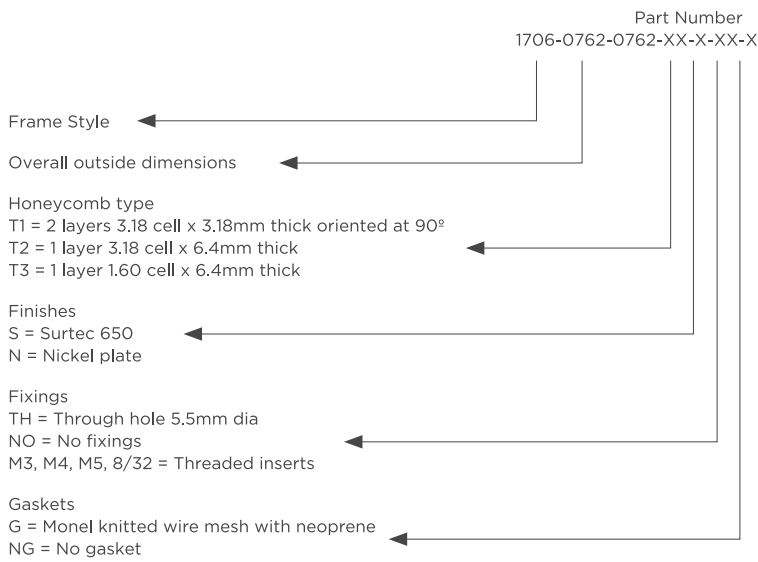
Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1						A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.	cm2	in.2	X	Y	mm	in.	mm	in.	mm	in.	mm	in.
1705-0762-0762-XXX-X-XX-X	76.2	3	76.2	3	50.8	2	50.8	2	25.8	4	1	1	31.75	1.25	-	-	31.75	1.25	-	-
1705-1016-1016-XXX-X-XX-X	101.6	4	101.6	4	76.2	3	76.2	3	58.1	9	1	1	44.45	1.75	-	-	44.45	1.75	-	-
1705-1524-1016-XXX-X-XX-X	152.4	6	101.6	4	127	5	76.2	3	96.8	15	2	1	25.4	1	88.9	3.5	44.45	1.75	-	-
1705-1270-1270-XXX-X-XX-X	127	5	127	5	101.6	4	101.6	4	103.2	16	2	1	19.05	0.75	76.2	3	57.15	2.25	-	-
1705-2032-1016-XXX-X-XX-X	203.2	8	101.6	4	177.8	7	76.2	3	135.5	21	3	1	19.05	0.75	76.2	3	44.45	1.75	-	-
1705-1778-1270-XXX-X-XX-X	177.8	7	127	5	152.4	6	101.6	4	154.8	24	2	1	38.1	1.5	88.9	3.5	57.15	2.25	-	-
1705-1524-1524-XXX-X-XX-X	152.4	6	152.4	6	127	5	127	5	161.3	25	2	2	25.4	1	88.9	3.5	25.4	1	88.9	3.5
1705-3048-1016-XXX-X-XX-X	304.8	12	101.6	4	279.4	11	76.2	3	212.9	33	4	1	31.75	1.25	76.2	3	44.45	1.75	-	-
1705-2032-1524-XXX-X-XX-X	203.2	8	152.4	6	177.8	7	127	5	225.8	35	3	2	19.05	0.75	76.2	3	31.75	1.25	76.2	3
1705-1778-1778-XXX-X-XX-X	177.8	7	177.8	7	152.4	6	152.4	6	232.3	36	2	2	38.1	1.5	88.9	3.5	38.1	1.5	88.9	3.5
1705-2540-1270-XXX-X-XX-X	254	10	127	5	228.6	9	101.6	4	232.3	36	3	1	31.75	1.25	88.9	3.5	57.15	2.25	-	-
1705-2032-2032-XXX-X-XX-X	203.2	8	203.2	8	177.8	7	177.8	7	316.1	49	3	2	19.05	0.75	76.2	3	50.8	2	88.9	3.5
1705-2540-1778-XXX-X-XX-X	254	10	177.8	7	228.6	9	152.4	6	348.4	54	3	2	31.75	1.25	88.9	3.5	38.1	1.5	88.9	3.5
1705-3048-1524-XXX-X-XX-X	304.8	12	152.4	6	279.4	11	127	5	354.8	55	4	2	31.75	1.25	76.2	3	25.4	1	88.9	3.5
1705-2540-2032-XXX-X-XX-X	254	10	203.2	8	228.6	9	177.8	7	406.5	63	3	2	31.75	1.25	88.9	3.5	50.8	2	88.9	3.5
1705-3048-2032-XXX-X-XX-X	304.8	12	203.2	8	279.4	11	177.8	7	496.8	77	4	3	31.75	1.25	76.2	3	19.05	0.75	76.2	3
1705-2540-2540-XXX-X-XX-X	254	10	254	10	228.6	9	228.6	9	522.6	81	3	3	31.75	1.25	88.9	3.5	31.75	1.25	88.9	3.5
1705-3048-3048-XXX-X-XX-X	304.8	12	304.8	12	279.4	11	279.4	11	780.6	121	4	4	31.75	1.25	76.2	3	31.75	1.25	76.2	3



1706 Standard Frames

Custom sizes and shapes available.

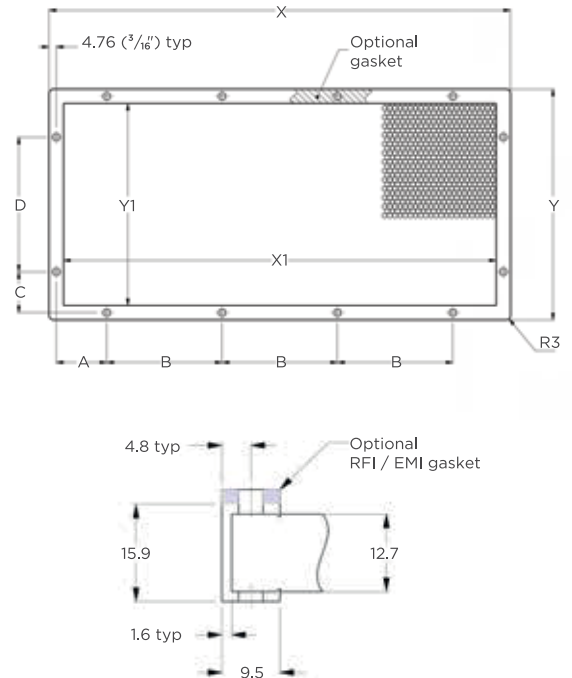
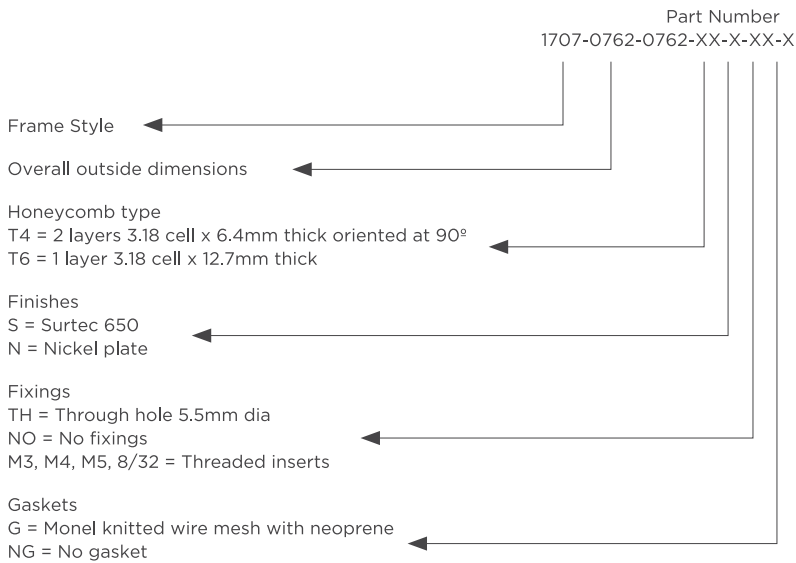
Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1						A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.	cm2	in.2	X	Y	mm	in.	mm	in.	mm	in.	mm	in.
1706-0762-0762-XXX-X-XX-X	76.2	3	76.2	3	57.2	2	57.2	2	32.7	5	1	1	33.34	1.313	-	-	33.34	1.313	-	-
1706-1016-1016-XXX-X-XX-X	101.6	4	101.6	4	82.6	3	82.6	3	68.1	11	1	1	46.04	1.813	-	-	46.04	1.813	-	-
1706-1524-1016-XXX-X-XX-X	152.4	6	101.6	4	133.4	5	82.6	3	110.1	17	2	1	26.99	1.063	88.9	3.5	46.04	1.813	-	-
1706-1270-1270-XXX-X-XX-X	127	5	127	5	108	4	108	4	116.5	18	2	1	20.64	0.813	76.2	3	58.74	2.313	-	-
1706-2032-1016-XXX-X-XX-X	203.2	8	101.6	4	184.2	7	82.6	3	152	24	3	1	20.64	0.813	76.2	3	46.04	1.813	-	-
1706-1778-1270-XXX-X-XX-X	177.8	7	127	5	158.8	6	108	4	171.4	27	2	1	39.69	1.563	88.9	3.5	58.74	2.313	-	-
1706-1524-1524-XXX-X-XX-X	152.4	6	152.4	6	133.4	5	133.4	5	177.8	28	2	2	26.99	1.063	88.9	3.5	26.99	1.063	88.9	3.5
1706-3048-1016-XXX-X-XX-X	304.8	12	101.6	4	285.8	11	82.6	3	235.9	37	4	1	33.34	1.313	76.2	3	46.04	1.813	-	-
1706-2032-1524-XXX-X-XX-X	203.2	8	152.4	6	184.2	7	133.4	5	245.6	38	3	2	20.64	0.813	76.2	3	33.34	1.313	76.2	3
1706-1778-1778-XXX-X-XX-X	177.8	7	177.8	7	158.8	6	158.8	6	252	39	2	2	39.69	1.563	88.9	3.5	36.69	1.563	88.9	3.5
1706-2540-1270-XXX-X-XX-X	254	10	127	5	235	9	108	4	253.6	39	3	1	33.34	1.313	88.9	3.5	58.74	2.313	-	-
1706-2032-2032-XXX-X-XX-X	203.2	8	203.2	8	184.2	7	184.2	7	339.1	53	3	2	20.64	0.813	76.2	3	52.39	2.063	88.9	3.5
1706-2540-1778-XXX-X-XX-X	254	10	177.8	7	235	9	158.8	6	373	58	3	2	33.34	1.313	88.9	3.5	39.69	1.563	88.9	3.5
1706-3048-1524-XXX-X-XX-X	304.8	12	152.4	6	285.8	11	133.4	5	381	59	4	2	33.34	1.313	76.2	3	26.99	1.063	88.9	3.5
1706-2540-2032-XXX-X-XX-X	254	10	203.2	8	235	9	184.2	7	432.7	67	3	2	33.34	1.313	88.9	3.5	52.39	2.063	88.9	3.5
1706-3048-2032-XXX-X-XX-X	304.8	12	203.2	8	285.5	11	184.2	7	526.2	82	4	3	33.34	1.313	76.2	3	20.64	0.813	76.2	3
1706-2540-2540-XXX-X-XX-X	254	10	254	10	235	9	235	9	552	86	3	3	33.34	1.313	88.9	3.5	33.34	1.313	88.9	3.5
1706-3048-3048-XXX-X-XX-X	304.8	12	304.8	12	285.8	11	285.8	11	816.5	127	4	4	33.34	1.313	76.2	3	33.34	1.313	76.2	3



1707 Standard Frames

Custom sizes and shapes available.

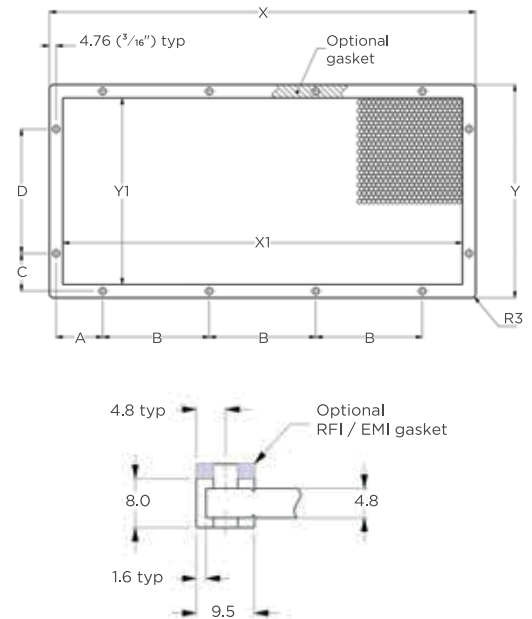
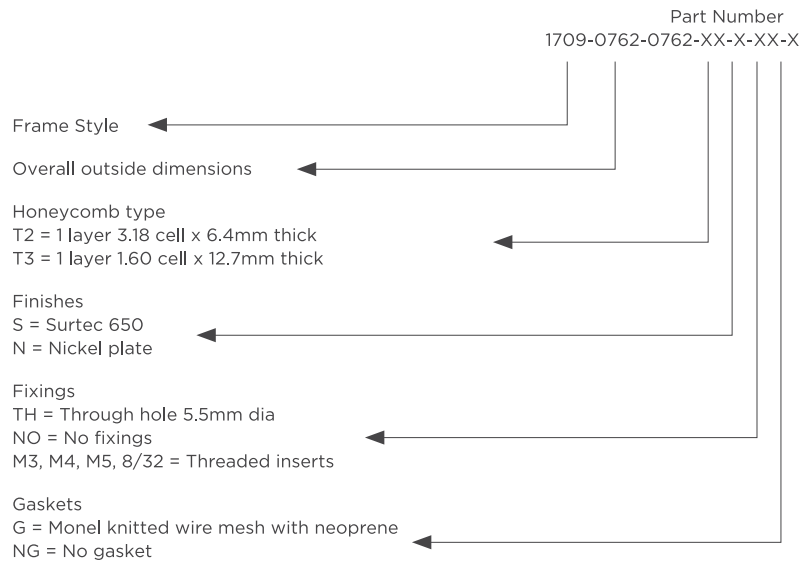
Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1		cm2	in.2	X	Y	A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.					mm	in.	mm	in.	mm	in.	mm	in.
1707-0762-0762-XXX-X-XX-X	76.2	3	76.2	3	57.2	2	57.2	2	32.7	5	1	1	33.34	1.313	-	-	33.34	1.313	-	-
1707-1016-1016-XXX-X-XX-X	101.6	4	101.6	4	82.6	3	82.6	3	68.1	11	1	1	46.04	1.813	-	-	46.04	1.813	-	-
1707-1524-1016-XXX-X-XX-X	152.4	6	101.6	4	133.4	5	82.6	3	110.1	17	2	1	26.99	1.063	88.9	3.5	46.04	1.813	-	-
1707-1270-1270-XXX-X-XX-X	127	5	127	5	108	4	108	4	116.5	18	2	1	20.64	0.813	76.2	3	58.74	2.313	-	-
1707-2032-1016-XXX-X-XX-X	203.2	8	101.6	4	184.2	7	82.6	3	152	24	3	1	20.64	0.813	76.2	3	46.04	1.813	-	-
1707-1778-1270-XXX-X-XX-X	177.8	7	127	5	158.8	6	108	4	171.4	27	2	1	39.69	1.563	88.9	3.5	58.74	2.313	-	-
1707-1524-1524-XXX-X-XX-X	152.4	6	152.4	6	133.4	5	133.4	5	177.8	28	2	2	26.99	1.063	88.9	3.5	26.99	1.063	88.9	3.5
1707-3048-1016-XXX-X-XX-X	304.8	12	101.6	4	285.8	11	82.6	3	235.9	37	4	1	33.34	1.313	76.2	3	46.04	1.813	-	-
1707-2032-1524-XXX-X-XX-X	203.2	8	152.4	6	184.2	7	133.4	5	245.6	38	3	2	20.64	0.813	76.2	3	33.34	1.313	76.2	3
1707-1778-1778-XXX-X-XX-X	177.8	7	177.8	7	158.8	6	158.8	6	252	39	2	2	39.69	1.563	88.9	3.5	39.69	1.563	88.9	3.5
1707-2540-1270-XXX-X-XX-X	254	10	127	5	235	9	108	4	253.6	39	3	1	33.34	1.313	88.9	3.5	58.74	2.313	-	-
1707-2032-2032-XXX-X-XX-X	203.2	8	203.2	8	184.2	7	184.2	7	339.1	53	3	2	20.64	0.813	76.2	3	52.39	2.063	88.9	3.5
1707-2540-1778-XXX-X-XX-X	254	10	177.8	7	235	9	158.8	6	373	58	3	2	33.34	1.313	88.9	3.5	39.69	1.563	88.9	3.5
1707-3048-1524-XXX-X-XX-X	304.8	12	152.4	6	285.8	11	133.4	5	381	59	4	2	33.34	1.313	76.2	3	26.99	1.063	88.9	3.5
1707-2540-2032-XXX-X-XX-X	254	10	203.2	8	235	9	184.2	7	432.7	67	3	2	33.34	1.313	88.9	3.5	52.39	2.063	88.9	3.5
1707-3048-2032-XXX-X-XX-X	304.8	12	203.2	8	285.8	11	184.2	7	526.2	82	4	3	33.34	1.313	76.2	3	20.64	0.813	76.2	3
1707-2540-2540-XXX-X-XX-X	254	10	254	10	235	9	235	9	552	86	3	3	33.34	1.313	88.9	3.5	33.34	1.313	88.9	3.5
1707-3048-3048-XXX-X-XX-X	304.8	12	304.8	12	285.5	11	285.5	11	816.2	127	4	4	33.34	1.313	76.2	3	33.34	1.313	76.2	3



1709 Standard Frames

Custom sizes and shapes available.

Part Number	Outer Dimensions				Open Area				Open Area ²		Fixings		Fixing Locations							
	X		Y		X1		Y1						A		B		C		D	
	mm	in.	mm	in.	mm	in.	mm	in.	cm2	in.2	X	Y	mm	in.	mm	in.	mm	in.	mm	in.
1709-0762-0762-XXX-X-XX-X	76.2	3	76.2	3	57.2	2	57.2	2	32.7	5	1	1	33.34	1.313	-	-	33.34	1.313	-	-
1709-1016-1016-XXX-X-XX-X	101.6	4	101.6	4	82.6	3	82.6	3	68.1	11	1	1	46.04	1.813	-	-	46.04	1.813	-	-
1709-1524-1016-XXX-X-XX-X	152.4	6	101.6	4	133.4	5	82.6	3	110.1	17	2	1	26.99	1.063	88.9	3.5	46.04	1.813	-	-
1709-1270-1270-XXX-X-XX-X	127	5	127	5	108	4	108	4	116.5	18	2	1	20.64	0.813	76.2	3	58.74	2.313	-	-
1709-2032-1016-XXX-X-XX-X	203.2	8	101.6	4	184.2	7	82.6	3	152	24	3	1	20.64	0.813	76.2	3	46.04	1.813	-	-
1709-1778-1270-XXX-X-XX-X	177.8	7	127	5	158.8	6	108	4	171.4	27	2	1	39.69	1.563	88.9	3.5	58.74	2.313	-	-
1709-1524-1524-XXX-X-XX-X	152.4	6	152.4	6	133.4	5	133.4	5	177.8	28	2	2	26.9	1.063	88.9	3.5	26.99	1.063	88.9	3.5
1709-3048-1016-XXX-X-XX-X	304.8	12	101.6	4	285.8	11	82.6	3	235.9	37	4	1	33.34	1.313	76.2	3	46.04	1.813	-	-
1709-2032-1524-XXX-X-XX-X	203.2	8	152.4	6	184.2	7	133.4	5	245.6	38	3	2	20.64	0.813	76.2	3	33.34	1.313	76.2	3
1709-1778-1778-XXX-X-XX-X	177.8	7	177.8	7	158.8	6	158.8	6	252	39	2	2	36.69	1.563	88.9	3.5	39.69	1.563	88.9	3.5
1709-2540-1270-XXX-X-XX-X	254	10	127	5	235	9	108	4	253.6	39	3	1	33.34	1.313	88.9	3.5	58.74	2.313	-	-
1709-2032-2032-XXX-X-XX-X	203.2	8	203.2	8	184.2	7	184.2	7	339.1	53	3	2	20.64	0.813	76.2	3	52.39	2.063	88.9	3.5
1709-2540-1778-XXX-X-XX-X	254	10	177.8	7	235	9	158.8	6	373	58	3	2	33.34	1.313	88.9	3.5	39.69	1.563	88.9	3.5
1709-3048-1524-XXX-X-XX-X	304.8	12	152.4	6	285.8	11	133.4	5	381	59	4	2	33.34	1.313	76.2	3	26.99	1.063	88.9	3.5
1709-2540-2032-XXX-X-XX-X	254	10	203.2	8	235	9	184.2	7	432.7	67	3	2	33.34	1.313	88.9	3.5	52.39	2.063	88.9	3.5
1709-3048-2032-XXX-X-XX-X	304.8	12	203.2	8	285.8	11	184.2	7	526.2	82	4	3	33.34	1.313	76.2	3	20.64	0.813	76.2	3
1709-2540-2540-XXX-X-XX-X	254	10	254	10	235	9	235	9	552	86	3	3	33.34	1.313	88.9	3.5	33.34	1.313	88.9	3.5
1709-3048-3048-XXX-X-XX-X	304.8	12	304.8	12	285.8	11	285.8	11	816.5	127	4	4	33.34	1.313	76.2	3	33.34	1.313	76.2	3



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