CUMING MICROWAVE

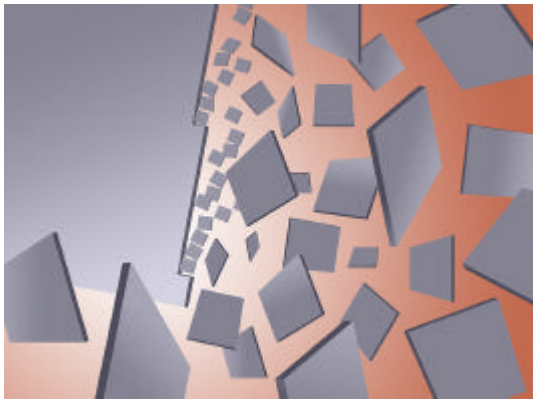
Technical Bulletin 310-1

C-RAM FLX

THIN, FLEXIBLE, WEATHERPROOF MICROWAVE ABSORBER

RoHS Compliant

C-RAM FLX is a series of flexible sheet materials which absorb approximately 99% of incident RF energy at design frequencies in the range of 1 to 35 GHz. The material is weatherproof and will withstand a wide temperature range. It will conform to complex shapes and is readily bonded to metal surfaces. C-RAM FLX is intended for attachment to aircraft structures, nose cones, ship masts, instrument housings, and other surfaces for the reduction of specular radar reflections.



ELASTOMER SELECTION

SILICONE

Typical Hardness-Shore A: 60-70
Temperature Range: -80 to 400 ºF
Advantages: Excellent heat resistance, good flexibility at low temperature, excellent ozone and sunlight.
Disadvantages: Silicone adhesives are necessary to bond. Fair resistance to solvents, poor abrasion resistance.
Typical Use: The elastomer of choice for high and low temperature applications. Silicone finds wide acceptance in electronic housings.

URETHANE

Typical Hardness Shore A: 80-85
Temperature Range: -80 to 275 ºF
Advantages: Excellent abrasion resistance and tear, good weather resistance, excellent tensile strength and elongation.
Disadvantages: poor resistance to hot water, acids, and alkalis.
Typical Use: Because of its outstanding abrasion resistance urethane is widely used on aircraft. Urethane can be easily bonded with a variety of urethane adhesives. Urethanes are readily painted and accept rain erosions coatings.

NEOPRENE

Typical Hardness Shore A: 60-80
Temperature Range: -45 to 212 ºF
Advantages: Excellent resistance to outdoor exposure, moderate resistance to oil and gas.
Disadvantages: limited low temperature flexibility, fair resistance to aromatic and oxygenated solvents.
Typical Use: Neoprene elastomers are ideally suited for marine environments. They are easily painted and adhered. They are resistant to stack gas and salt water.

Consult with an Applications Engineer in the Microwave Materials Department on specific details.

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TYPICAL PROPERTIES

Color: Grey
Flammability: non-flammable
Reflectivity Performance: <-20 dB at the nominal resonant frequency. Typical performance is shown on reverse.
Thickness and weight:

Grade	Approx. Thk. mm (inches)	Weight kg/m^2 (lb/ft^2)	
FLX-1.0	6.4 (.250")	24.4	(5.0)
FLX-1.5	5.3 (.210")	19.0	(3.9)
FLX-2.0	3.2 (.125")	14.6	(3.0)
FLX-2.5	3.2 (.125")	12.2	(2.5)
FLX-3.0	3.2 (.125")	11.2	(2.3)
FLX-3.5	2.4 (.094")	10.7	(2.2)
FLX-4.0	2.4 (.094")	10.2	(2.1)
FLX-4.5	2.4 (.094")	9.3	(1.9)
FLX-5.0	2.0 (.078")	8.3	(1.7)
FLX-5.5	2.0 (.078")	8.3	(1.7)
FLX-6.0	2.0 (.078")	7.8	(1.6)
FLX-6.5	2.0 (.078")	7.8	(1.6)
FLX-7.0	1.6 (.062")	7.3	(1.5)
FLX-7.5	1.6 (.062")	6.8	(1.4)
FLX-8.0	1.6 (.062")	6.4	(1.3)
FLX-8.5	1.6 (.062")	6.4	(1.3)
FLX-9.0	1.6 (.062")	6.4	(1.3)
FLX-9.5	1.6 (.062")	5.9	(1.2)
FLX-10	1.6 (.062")	5.4	(1.1)
FLX-10.5	1.6 (.062")	5.4	(1.1)
FLX-11	1.6 (.062")	4.9	(1.0)
FLX-12	1.6 (.062")	4.4	(0.9)
FLX-13	1.6 (.062")	3.9	(0.8)
FLX-14	1.6 (.062")	3.9	(0.8)
FLX-15	1.6 (.062")	3.4	(0.7)
FLX-16	1.2 (.047")	3.4	(0.7)
FLX-17	1.2 (.047")	2.9	(0.6)
FLX-18	1.2 (.047")	2.9	(0.6)
FLX-24	1.1 (.042")	2.4	(0.5)
FLX-35	0.6 (.025")	1.5	(0.3)

METHOD OF APPLICATION

All C-RAM FLX rubber sheets must be in intimate contact with a metal surface for proper resonant behavior.

The normal method of applying C-RAM FLX silicone to a substrate is with a silicone RTV adhesive. For best results, the rubber sheet and the metal should be scuffed with sandpaper, wiped with alcohol to remove dust and grease, and have a silicone primer applied, such as C-PRIME 215. The silicone adhesive, such as C-BOND 255 or equivalent, is brushed or rolled onto one of the surfaces, and the sheet is then applied to the metal. Overnight cure is generally required, and a modest temperature cycle, such as a few hours at 150 ºF, helps the bond.

Alternately, a silicone caulking tube adhesive can also be used and does not require a primer. Simply apply a thin layer of adhesive, 2 to 4 mils thick, to the rubber sheet and the metal surface, and mate the two together, making sure to work the sheet down from one edge to the other to help prevent air entrapment.

For C-RAM FLX urethane, neoprene, and nitrile, scuff sand the back of the rubber sheet and the metal, and clean with alcohol of lacquer thinner. In certain applications it is good practice to prime the bare metal surface, and bond with a urethane adhesive, silicone adhesive, or neoprene contact adhesive. Temperature and application requirements dictate adhesive choice.

Gap fillers can be provided or recommended from the factory. If the material will see outdoor exposure, Cuming Microwave can recommend applicable paints to maintain microwave performance.

Consult the factory if further detail is required.

C-RAM FLX can also be supplied with a pressure sensitive adhesive backing. While not as strong as liquid adhesives, it will provide an adequate bond in many applications, particularly when one is bonding smaller pieces. Simply peel off the backing, and press the part onto the cleaned substrate surface. If additional bond strength is required, apply the part to a primed surface, and apply heat with a heat gun for 1-2 minutes to effect a good bond.

AVAILABILITY

Standard product sizes for all grades are flat sheets 310 x 310 mm (12 x 12 in) and 400 x 500 mm (16 x 20 in), in the nominal thicknesses given in the above table. Specify the part as C-RAM FLX-xx, where xx is the nominal resonant frequency, and include the dimensions.

Specify a urethane sheet as FLX-U, neoprene as FLX-N. FLX without a suffix designates silicone as a default.

We can supply other dimensions, and can die-cut or water-jet parts to your drawings.

C-RAM FLX can also be supplied with a peel-and-stick pressure sensitive adhesive backing. Specify by adding a /PSA suffix to the part name. It is also available with a metal foil reflective backing; specify by adding a /MTL suffix.

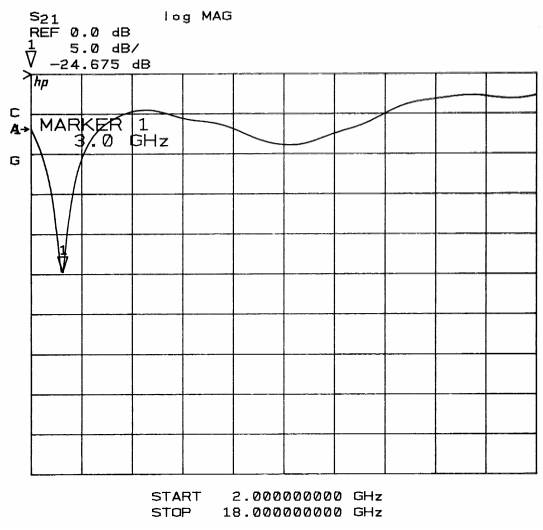
TYPICAL REFLECTIVITY

The graphs on page 4 show typical reflectivity performance of a few of the grades of C-RAM FLX, expressed as a dB down from metal plate reflection, as a function of frequency. These are measured on NRL near-field type arches.

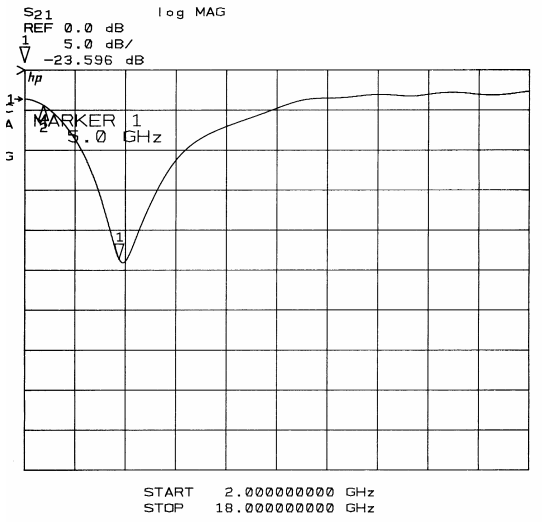
TYPICAL REFLECTIVITY CURVES OF C-RAM FLX GRADES AT 3, 5, 10, AND 15 GHz.

(all graphs show performance 2-18 GHz; scale is 5 dB/division, with reference at top)

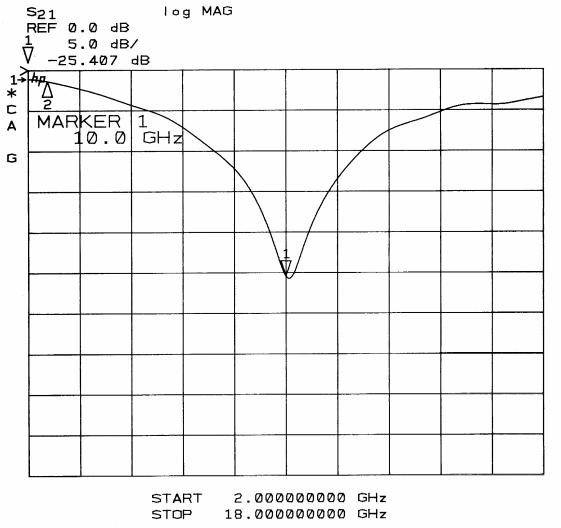
FLX-3.0



FLX-5.0



FLX-10



FLX-15