PRECISION ACOUSTICS
A Coda Octopus Company

# AptFlex F50


AptFlex F50, from Acoustic Polymers Ltd, is a glass-sphere syntactic foam made by using a high-performance epoxy resin as the polymeric binder. The product can be supplied as a 2 part 'liquid' kit, or as a moulded product in rod or sheet form. Supplied in 2 component kit form it presents the end-user with the option of casting detailed shapes without subsequent and costly machining. The cured product is hard, tough and of low specific gravity. Mouldings can be easily machined to produce intricate and detailed components.

**Precision Acoustics Ltd** Hampton Farm Business Park, Higher Bockhampton, Dorchester, Dorset DT2 8QH, UK

**t.** +44 (0) 1305 264669 **e.** office@acoustics.co.uk **w.** acoustics.co.uk

## THIS COMBINATION OF PROPERTIES PRODUCES A MATERIAL THAT CAN BE USED IN AREAS SUCH AS:

- Structural buoyancy modules
- Transducer construction
- Thermal insulation cladding
- Acoustic de-coupling and isolation

The system exhibits a high hydrostatic compressive strength and excellent chemical resistance to a wide range of media.

AptFlex F50 is part of a range of syntactic foams and provides the greatest crush strength within the range. However, it can only achieve this higher performance by having reduced buoyancy and higher acoustic impedance.

## TYPICAL PROPERTIES

| | |
|---|---|
| Appearance | Light Blue |
| Mix ratio (by mass) | 2.40: 1 (A: B) |
| Shore D hardness | 70 ± 3 |
| Density | 720 ± 20 kg / $m^3$ |
| Density Part A | 615 ± 20 kg / $m^3$ |
| Density Part B | 973 ± 20 kg / $m^3$ |
| Average wave speed (1 MHz to 10 MHz) | 2350 ± 30 m / s |
| Acoustic impedance | 1.7 MRayls |
| Tensile strength | 28 ± 2 MPa |
| Tensile modulus | 1.7 ± 0.1 GPa |
| Poisson's ratio | 0.38 ± 0.05 |
| Hydrostatic crush strength* | 69 MPa / 10,000 psi |
| Equivalent ocean failure depth* | 6850 meters / 22500 feet |
| Operating temperature of cured material[1] | 130 °C (long-term)<br>160 °C (short-term <30 mins) |
| Water absorption % weight gain | < 2% after 200 hours @ 20 °C<br>< 3% after 1000 cycles to 4,500 psi @ 20 °C |
| Heat deflection temperature | Cured 10 days @ 25 °C<br>Load 0.455 MPa = 44 °C, Load 1.820 MPa = 40 °C<br>Cured 2 hours @ 80 ° C + 3 hours @ 125 °C<br>Load 0.455 MPa = 65 °C, Load 1.820 MPa = 54 °C |
| Thermal Conductivity | 0.120 W $m^{-1}$ $K^{-1}$ |
| Coefficient of thermal expansion | 20 x $10^{-6}$ mm/m/ °C |

(* foam survived beyond the capability of the test facility)

[1]These figures are maximum temperatures, beyond which the chemical structure of the components may begin to thermally degrade; they are not intended as guides to the mechanical or acoustic properties of the material at elevated temperatures. We recommend carrying out thorough testing, specific to your application, prior to integration into devices.

## CURING TIMES

| | |
|---|---|
| Pot life | 2-3 hours |

| | | |
|---|---|---|
| Gel time | 5-6 hours | |
| Cure time | @ 20 °C | 1-2 weeks |
| | @ 60 °C | 16 hours |

## INSERTION LOSS

Insertion loss (IL) is defined as

$$IL = -20 \log_{10}\left(\frac{P_t}{P_i}\right)$$

where $P_t$ is the amplitude of the acoustic pressure transmitted through a sample and $P_i$ is the amplitude of the acoustic pressure incident upon it.
These values have been experimentally determined for two samples of AptFlex F50, and this is shown in Figure 1.
The dynamic range of IL measurement procedure is approximately 40 dB and values higher than this cannot be guaranteed.

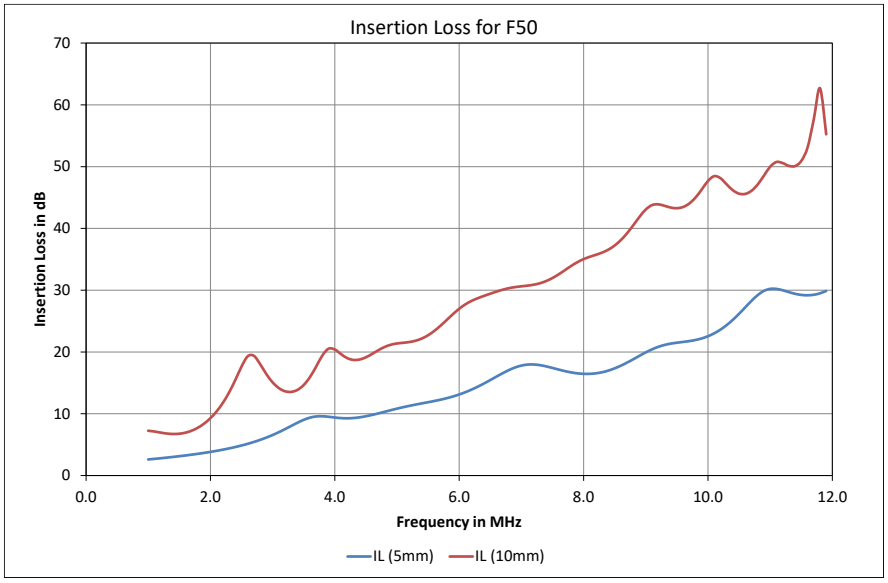


**Figure 1** – Insertion loss vs Frequency for AptFlex F50

## ATTENUATION

Attenuation (α) is evaluated from the measurement of Insertion Loss for 2 samples of the same material, but of different thicknesses. It is calculated as

$$\alpha = \frac{IL_1 - IL_2}{\Delta z}$$

where $IL_1$ is Insertion loss of sample 1, $IL_2$ is Insertion loss of sample 2 and Δz is the difference of between the thickness of the two samples. This has been experimentally determined

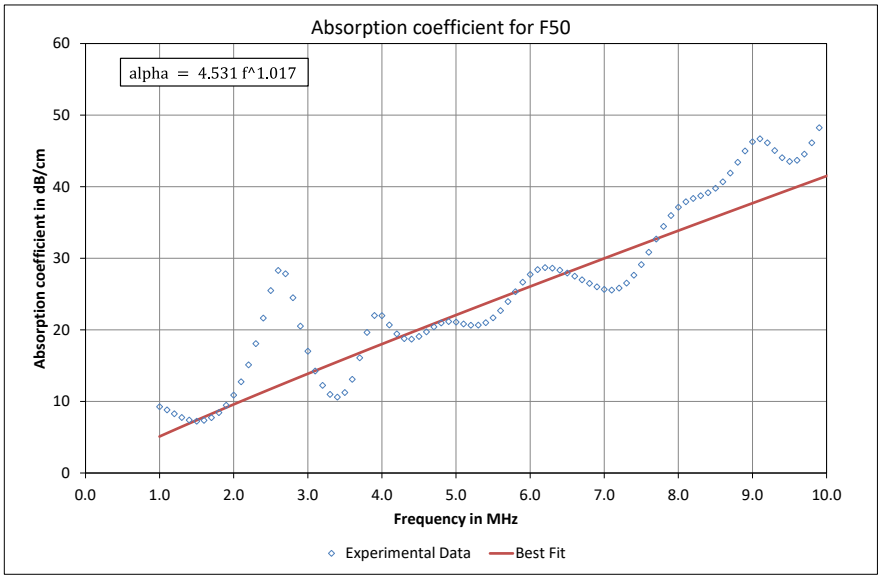


**Figure 2** – Attenuation vs Frequency for AptFlex F50

for AptFlex F50, and this is shown in Figure 2.

## ECHO REDUCTION

Echo Reduction (ER) is defined as

$$ER = -20 \log_{10}\left(\frac{P_r}{P_i}\right)$$

where $P_r$ is the amplitude of the acoustic pressure reflected from a sample and $P_i$ is the amplitude of the acoustic pressure incident upon it.

This has been experimentally determined for two samples of AptFlex F50, and this is shown in Figure 3.

The dynamic range of ER measurement is approximately 40 dB and values higher than this cannot be guaranteed.

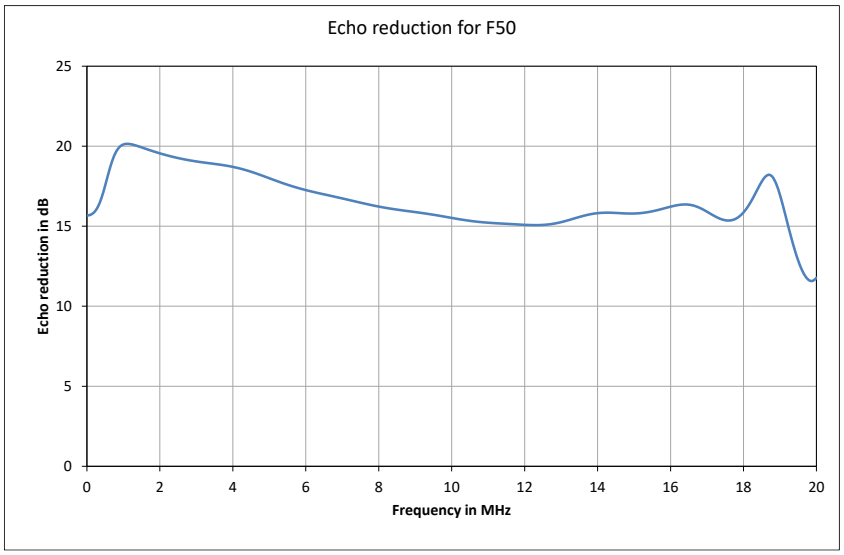


**Figure 3** – Echo Reduction vs Frequency for AptFlex F50

## PHASE VELOCITY

Phase velocity is evaluated from the measurement of transit time across 2 samples of the same material.

This has been experimentally determined for AptFlex F50, and this is shown in Figure 4.

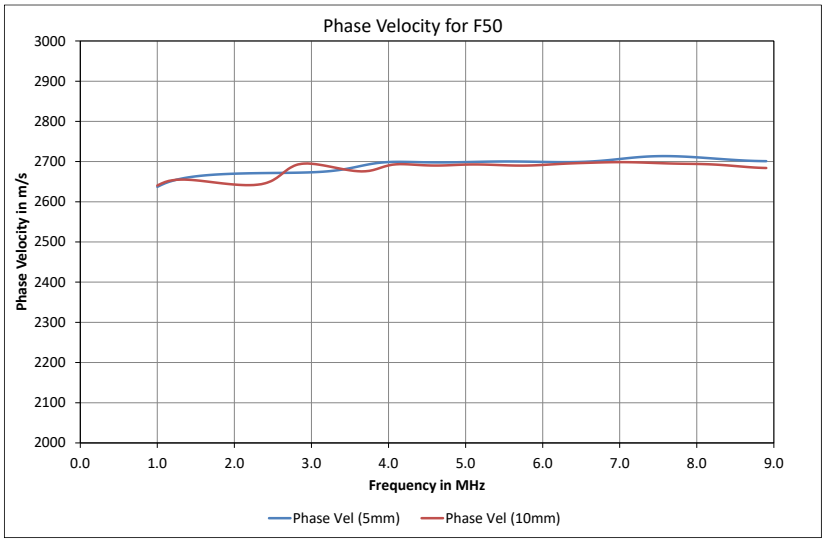


**Figure 4** – Phase velocity vs Frequency for AptFlex F50

*All information is based on results gained from experience and tests, and is believed to be accurate but is given without acceptance of liability for loss or damage attributable to reliance thereon as conditions of use lie outside the control of Precision Acoustics Ltd or Acoustic Polymers Limited.*