DESIGNER'S COMMENTS

Tweeter

SH25-76

The SH25-76 is a 25mm soft dome tweeter designed and built by ATC Loudspeaker Technology and exclusively employed on ATC's SCM7, 11, 19 and 40 'passive series' speakers. The drive unit has been designed with the same no compromise philosophy as all other ATC drive units.

Sharing technology with the SM75-150 mid-range, the SH25-76 employs a dual suspension design, ensuring pistonic motion and suppressing rocking modes even at high drive levels. This also enables the use of a narrow magnetic gap and negates the requirement for ferrofluid. The SH25-76 is therefore, free from the detrimental effects of ferrofluid drying out over time.

A short coil, long gap configuration ensures linearity and incredibly low distortion through its intended operating band. The soft dome diaphragm is based on a complex geometry which maximises power transfer from the former, extending the high frequency response and giving a smooth off-axis response.

The FEA optimised neodymium motor with heat treated top plate is designed to give 15,000 Gauss (1.5 Tesla) in the magnetic gap and the motor assembly also performs the secondary function of

dissipating heat away from the voice coil, ensuring high power handling and low power compression. The underhung design, small coil-gap clearance and black plating ensures heat dissipation is as efficient as possible.

The geometry of the waveguide is designed for optimum dispersion and the flattest possible on-axis frequency response. It is made from a precision machined alloy so that the entire structure is extremely rigid and free from resonances.

Bass Driver

SB45-125SC

The bass driver used in the SCM7 is a proprietary design, manufactured in-house. Like the vast majority of all our larger drive units, the so called 'underhung' design uses a short coil operating in long magnetic gap for the best possible linearity. The advantages of this type of motor topology are:

1. Less variation in the force acting on the coil vs excursion.
2. Less variation in coil inductance vs excursion.

The result is that distortion is greatly reduced. The music benefits from greater clarity and tonal balance and the listener benefits from reduced listening fatigue.

The voice coil technology employed greatly benefits the performance of the loudspeaker. Firstly, a large voice coil diameter is chosen for

increased power handling and, as important, low power compression. Loudspeakers are quite inefficient and much of the amplifier power ends up heating the voice coil. This, in turn causes:

1. A rise in resistance.
2. A drop in efficiency.
3. Increase of the system low frequency ‘Q’ (causing a tendency for pronounced ‘boomy’ bass).
4. Modification of the crossover performance which, in turn, changes the perceived balance of the loudspeaker.

Using the largest possible voice coil diameter increases the coil surface area which reduces the rate of voice coil heating and minimises the problems associated with it.

Not only is great attention paid to the coil but also to the wire we wind the coil from. Round wire does not ‘pack’ (tessellate) well, leaving gaps between the windings (think pool balls racked before a break). These gaps are wasted space and fill with glue and air, slowing the escape of heat from the coil. ATC chooses to use the more complex and costly process of winding flat ‘ribbon’ wire voice coils. The ribbon wire, when wound on edge, results in a greater volume of copper in the magnetic gap (vs round wire) and the efficiency of the drive mechanism is improved. The air and glue filled gaps are also greatly reduced, leading to a more rapid escape of heat from the voice coil.

The cone and dust cap of the bass driver used in the SCM7 are formed into curve-linear profiles from resin impregnated fabric. The fabric chosen uses a very strong and dense weave, with high internal damping. Two different polymer coatings are then applied to the fabric surface: a PVA based coating to the rear and a proprietary coating to the front. Both of these coatings increase cone stiffness and also, very importantly, the mechanical damping of the cone structure. Materials high in damping suppress resonances, minimising the audibility of cone break up modes and extending the useable bandwidth at the top of the bass driver's range. This in turn greatly simplifies crossover design (which I'll get to shortly). ATC believes that as a loudspeaker manufacturer, you are defined by your drive unit components and that is why every loudspeaker system we produce begins with in-house designed and built components, optimised for their application.

Crossover

By investing heavily in the drive unit engineering, ATC produces components with a well-controlled response that require only simple filters to integrate into multi-driver systems. The SCM7 employs 2nd order filters for both the low-pass and high-pass sections. The bass section also uses a R-C zobel network to correct for the rising bass driver impedance, ensuring correct operation of the bass low pass filter. The high frequency section uses a resistive 'T' attenuation network to pad the tweeter output down to match the bass. All of the inductors used are air-cored types for lowest distortion and the

capacitors are 250Vdc rated metallised polypropylene parts. An area of the crossover design we pay particular attention to is that of impedance vs frequency and ensuring the loudspeaker system (drivers + crossover + wiring) present an easy load for an amplifier to drive. The loudspeaker load an amplifier 'sees' is just as important as the sensitivity of the loudspeaker, although loudspeaker load doesn't seem to be debated quite so regularly. Not only must the magnitude of the impedance be balanced with a reasonable system sensitivity, the phase angle must also be considered. Low impedance values or large phase angles will lead to large current demands from an amplifier and could lead to increased distortion and, at worst, amplifier hard clipping. The combination of both a low impedance magnitude and large phase angle is very difficult for an amplifier, especially when it occurs at a frequency where music has a great deal of energy. Through careful drive unit design which, in turn, allows simple crossover design, free from 'ringing' filters that are used to reinforce a frequency band lacking in energy, we can deliver a loudspeaker that presents an easy load to an amplifier.

Ben Lilly, ATC Technical Sales Manager, February 2016