SELENIUM CAR DIVISION

TORNADO SELENIUM

18SW3A 4Ω

The 18SW3A is a high-power 18-inch subwoofer, designed for use in car audio applications. It is specifically designed to reproduce the range of 38 to 150 Hz in a small vented box enclosure

The 18SW3A is capable of handling up to 1100 watts RMS (AES or 2200 watts continuous program power).

A bumped and undercut T-yoke assures a minimum of magnetic rectification (off-centering) and a compatible maximum displacement (Xlim). The extended pole ensure a correct magnetic flux distribution and improve the thermal dissipation The magnet circuit was optimized by finite element software. Special attention was given to the driver's behavior under mechanical overload conditions, meaning that all but the most severe abuse will be tolerated - without failure.

The 18SW3A employ a 4” (100mm) diameter 4-layer aluminum round wire voice-coil. This is wound on a fiberglass-composite former, twice the thickness of typical formers, to drive the moving assembly with great rigidity.

The pressed-long-fiber-coated pulp cone has the necessary mass and stiffness to withstand the tremendous accelerating forces required, and is precisely centered by two counter-balancing, distortion canceling, polyester-cotton-fiber spiders.

A reinforced aluminum frame is highly effective in withstanding mechanical shocks and vibration. It also acts as a heat-sink for the motor, without removing energy from the loudspeakers intended magnetic gap. The aluminum frame includes six vents that allow air exchange between the spider and the top-plate. This helps to reduce top-plate temperature, in turn cooling the voice-coil. The magnetic-circuit also employs a multi-cooling system (patent pending) consisting of a large diameter center hole, surrounded by six smaller holes that forces cool air across the voice-coil. These features insure an extremely efficient heat transfer from voice-coil to surroundings, resulting in very high thermal power handling.

SPECIFICATIONS

Nominal diameter	460 (18)	mm (in)
Nominal impedance	4	Ω
Minimum impedance @ 88.6 Hz	3.97	Ω
Power handling		
Musical program[1]	2200	W
AES[2]	1100	W
Sensitivity (2.0V@1m) averaged from 50 to 150 Hz	94	dB SPL
Power compression @ 0 dB (nom. power)	3.4	dB
Power compression @ -3 dB (nom. power)/2	2.8	dB
Power compression @ -10 dB (nom. power)/10	1.1	dB
Frequency response @ -10 dB	38 to 1,500	Hz

[1] Power handling specifications refer to normal speech and/or music program material, reproduced by an amplifier producing no more than 5% distortion. Power is calculated as true RMS voltage squared divided by the nominal impedance of the loudspeaker.
[2] AES Standard (60 - 600 Hz).

THIELE-SMALL PARAMETERS

Fs	41	Hz
Vas	126.3(4.46)	l (ft^3)
Qts	0.55	
Qes	0.57	
Qms	11.51	
ηo (half space)	2.42%	
Sd	0.1194 (185.07)	m^2 (in^2)
Vd (Sd x Xmax)	925.9 (56.4)	cm^3 (in^3)
Xmax (max. excursion (peak) with 10% distortion)	7.75 (0.27)	mm (in)
Xlim (max.excursion (peak) before physical damage)	21.0 (0.83)	mm (in)

Atmospheric conditions at TS parameter measurements:

Temperature	23 (73.4)	°C (°F)
Atmospheric pressure	1,010	mb
Humidity	44	%

Thiele-Small parameters are measured after a 2-hour power test using half AES power . A variation of ± 15% is allowed.

ADDITIONAL PARAMETERS

βL	18.7	Tm
Flux density	0.58	T
Voice coil diameter	100 (4)	mm (in)
Voice coil winding length	46.5 (152.4)	m (ft)
Wire temperature coefficient of resistance (α25)	0.00380	1/°C
Maximum voice coil operating temperature	305 (572)	°C (°F)
θvc (max.voice coil operating temp./max.power)	0.27 (0.52)	°C/W(°F/W)
Hvc (voice coil winding depth)	27.0 (1.06)	mm (in)
Hag (air gap height)	11.5 (0.44)	mm (in)
Re	3.19	Ω
Mms	239,4 (0.54)	g (lb)
Cms	60.0	μm/N
Rms	3.47	kg/s

NON-LINEAR PARAMETERS

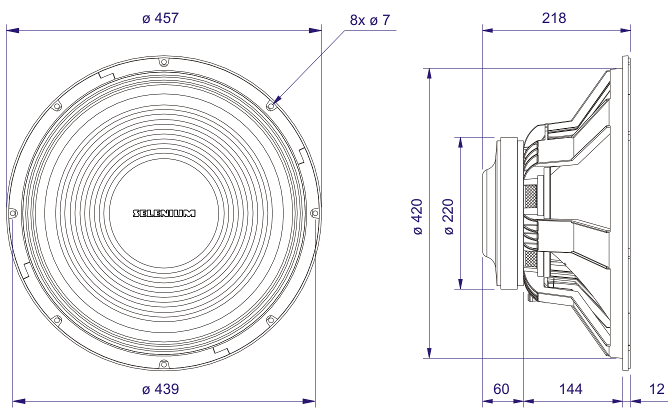
Le @ Fs (voice coil inductance @ Fs)	5.576	mH
Le @ 1 kHz (voice coil inductance @ 1 kHz)	2.853	mH
Le @ 20 kHz (voice coil inductance @ 20 kHz)	1.521	mH
Red @ Fs	0.33	Ω
Red @ 1 kHz	6.692	Ω
Red @ 20 kHz	111.82	Ω
Krm	1.8	Ω
Kxm	17.9	mH
Erm	0.94	
Exm	0.79	

ADDITIONAL INFORMATION

Magnet material	Barium ferrite	
Magnet weight	3,440 (120)	g (oz)
Magnet diameter x depth	220 x 24 (8.66 x 0.95)	mm (in)
Magnetic assembly weight	9,350 (20.61)	g (lb)
Frame material	Aluminum	
Frame finish	Black epoxy	
Voice coil material	Aluminum	
Voice coil former material	Fiberglass	
Cone material	Non pressed long fiber pulp	
Volume displaced by woofer	8.6 (0.304)	l (ft^3)
Net weight	11,380 (25.10)	g (lb)
Gross weight	13,030 (28.95)	g (lb)
Carton dimensions (W x D x H)	48 x 48 x 25 (18.9 x 18.9 x 9.9)	cm (in)

MOUNTING INFORMATION

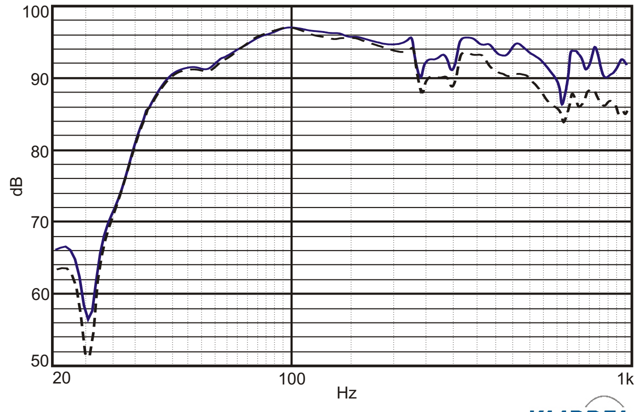
Number of bolt-holes	8	
Bolt-hole diameter	7.0 (0.27)	mm (in)
Bolt-circle diameter	439 (17.28)	mm (in)
Baffle cutout diameter (front mount)	422 (16.61)	mm (in)
Baffle cutout diameter (rear mount)	412 (16.22)	mm (in)
Connectors	Silver-plated push terminals	
Polarity	Positive voltage applied to the positive terminal (red) gives forward cone motion	
Minimum clearance between the back of the magnetic assembly and the enclosure wall	75 (3)	mm (in)



Dimensions in mm.

18SW3A 4Ω

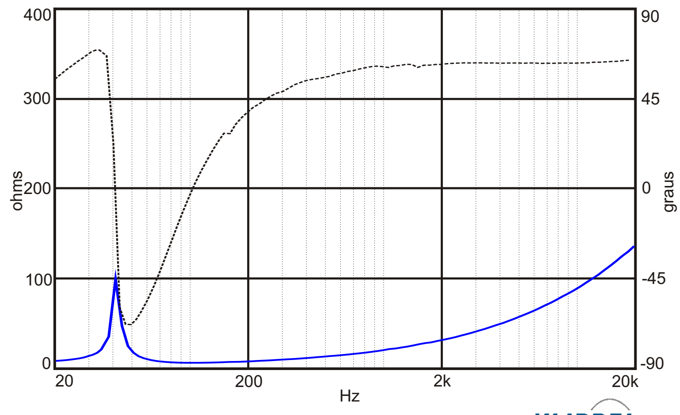
RESPONSE CURVES (0° AND 45°) IN A TEST ENCLOSURE IN ANECHOIC CHAMBER, 1 W / 1m



Response Curve at 0°.
Response Curve at 45°.

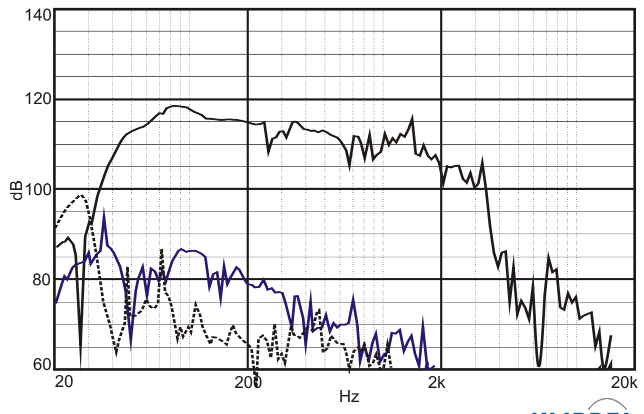
Response curves measured in anechoic chamber with the subwoofer installed in a test enclosure, 1 W / 1 m.

IMPEDANCE AND PHASE CURVES, MEASURED IN FREE-AIR



Impedance Curve.
Phase Curve.

HARMONIC DISTORTION CURVES MEASURED AT 10% AES INPUT POWER IN A TEST ENCLOSURE INSIDE AN ANECHOIC CHAMBER, 1 m

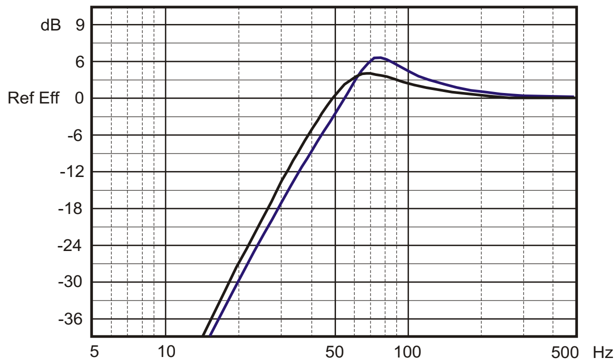


Response Curve.
Distortion Curve, 2nd harmonic.
Distortion Curve, 3rd harmonic.

TEST ENCLOSURE

191-liter volume with 3 ducts ø 6" by 7.87" length.

SOFTWARE SIMULATED FREQUENCY RESPONSE CURVE



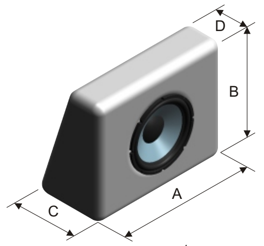
Closed box130l.
Vented Box 100l.

SUGGESTED ENCLOUSURES

TYPE	CLOSED BOX	VENTED BOX		
	Internal Volume (Liters)	Internal Volume (Liters)	Vent (s) Qty	Vent (s) Diam. x Length (cm)
18SW3A	XX	130 100	3 3	10 x 10 10 x 05

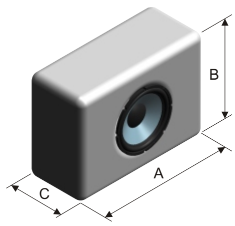
ENCLOUSURE INTERNAL VOLUME CALCULATION INSTRUCTIONS

TRAPEZOID RECTANGULAR



$$\text{Internal Volume} = \frac{A \times B \times \left(\frac{C + D}{2}\right)}{1000}$$

RECTANGULAR



$$\text{Internal Volume} = \frac{A \times B \times C}{1000}$$

A, B C and D are internal dimension (in cm). The internal volume result is given in liters.

The suggested enclosure volumes are related to only one speaker, including woofer and duct(s) displaced volume.

For enclosure with more than one speaker, it is necessary to multiply the suggested volume and duct(s) by the quantity of speakers and build them with separated chambers (internal division).

Box volumes considering the bass lift inside the car with closed apertures.

HOW TO CHOOSE THE RIGHT AMPLIFIER

The power amplifier must be able to supply twice the RMS driver power. This 3 dB headroom is necessary to handle the peaks that are common to musical programs. When the amplifier clips those peaks, high distortion arises and this may damage the transducer due to excessive heat. The use of compressors is a good practice to reduce music dynamics to safe levels.

FINDING VOICE COIL TEMPERATURE

It is very important to avoid maximum voice coil temperature. Since moving coil resistance (R_E) varies with temperature according to a well known law, we can calculate the temperature inside the voice coil by measuring the voice coil DC resistance:

$$T_B = T_A + \left(\frac{R_B}{R_A} - 1\right)\left(T_A - 25 + \frac{1}{\alpha_{25}}\right)$$

T_A , T_B= voice coil temperatures in °C.
R_A , R_B= voice coil resistances at temperatures T_A and T_B, respectively.
α_{25}= voice coil wire temperature coefficient at 25 °C.

POWER COMPRESSION

Voice coil resistance rises with temperature, which leads to efficiency reduction. Therefore, if after doubling the applied electric power to the driver we get a 2 dB rise in SPL instead of the expected 3 dB, we can say that power compression equals 1 dB. An efficient cooling system to dissipate voice coil heat is very important to reduce power compression.

NON-LINEAR VOICE COIL PARAMETERS

Due to its close coupling with the magnetic assembly, the voice coil in electrodynamic loudspeakers is a very non-linear circuit. Using the non- linear modeling parameters Krm, Kxm, Erm and Exm from an empirical model, we can calculate voice coil impedance with good accuracy.