

# PROFESSIONAL LOUDSPEAKERS



**ALPSALPINE**



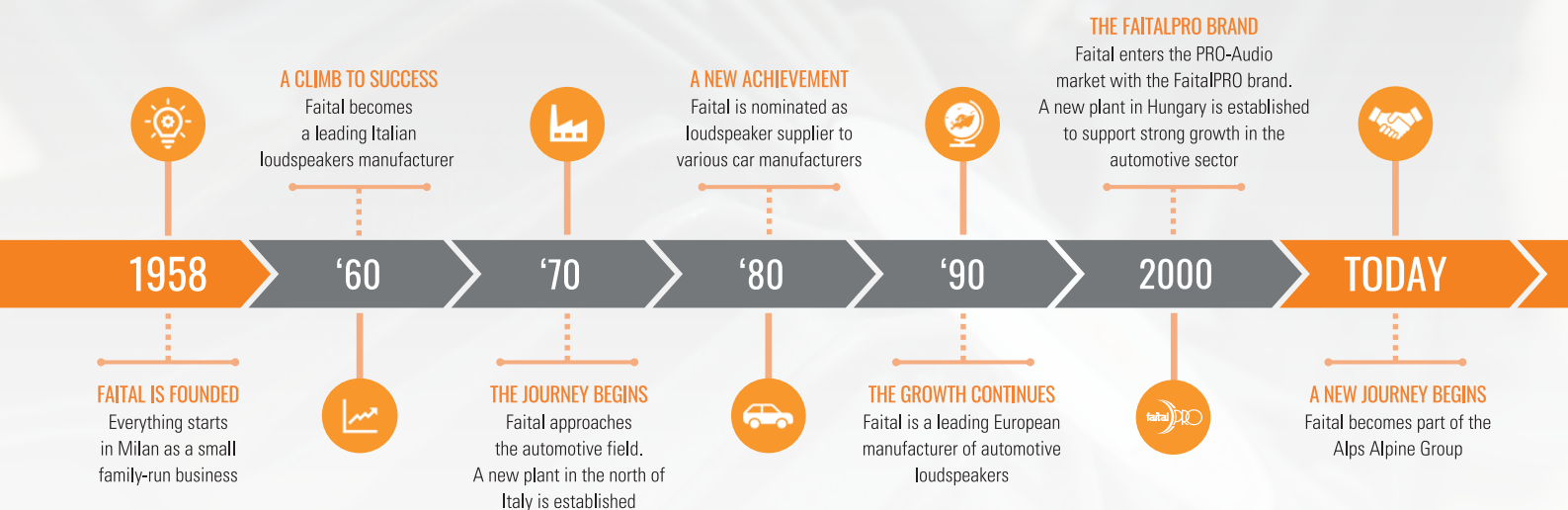
## **SOUND IS BEAUTY AND EMOTION**

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Vibrations moving through the air taking completely the mind. Amplifying these emotions for FaitalPRO is a commitment which goes beyond professionalism. It's an inborn passion: the privilege of working in an environment that IS art, genius and excitement and which is corresponded by FaitalPRO with precisely the same enthusiasm, respect and admiration.

# A BIT ABOUT US

Faital's history reflects constant development and growth over the last 60 years. The various milestones that have been achieved since the Company was established in 1958 have allowed it to become an important point of reference in the world markets.



## TODAY

Holding strong to the fundamental passion for good sound driving its evolution since inception, Fital incessantly pursues its core values, Technological Development, Total Quality, Customer Service and Competitiveness.

FaitalPRO is an affirmed brand of Professional Loudspeakers specifically designed for the most demanding Professional Audio applications and manufactured combining superb craftsmanship with the latest industrial technologies. FitalPRO stands for superior loudspeakers, expressing the highest standards of reliability and sound quality available on the market today.

### 1960s



Fital S.p.A. is founded in Milan in 1958 as a small family-run business. At the end of the 60s, Fital becomes one of the main Italian loudspeaker manufacturers, accounting for 40% of national demand. Fital initially manufactures loudspeakers for radios and audio systems and later introduces its products into the market for television amplifier systems. As a result of constant technical and business development, the company gradually expands to cover many areas of industry.

### 1970s



Fital enters the automotive field and ventures beyond national boundaries with their first European clients. In order to satisfy increasing market demand and their new European clients, in 1974 the company opens a new plant in Chieve, near Crema, Italy.



### 1980s



The growth trend continues. Fital becomes the official loudspeaker supplier to various car manufacturers. The company undertakes an innovation and technological development process with investments aimed at updating plants and enhancing the areas of R&D and Human Resources. The company commits to TOTAL QUALITY and sets their main objective as "Zero Defects".

### 1990s



In the early 1990s, Sofaital S.A. is established in France and a new plant is opened, in Argenteuil, near Paris. A few years later, FAITAL contributes to the establishment of a new manufacturing facility in Vacarisses, Spain near Barcelona. With the addition of Sofaital in France and Fabrica Iberica in Spain, the Fital Group becomes the leading European manufacturer of loudspeakers for the automotive industry. The Group considers with increasing interest the possibility of entering the North American market.

### EARLY 2000s

In the new millennium, the company enters the North American market and begins to meet local market requirements. Fital consolidates its achievements after almost half a century in business. In order to enter the North American automotive market successfully, the company establishes a commercial office and a new warehouse in New Jersey to provide logistical support to its clients. Similarly, to increase its capacity and competitiveness, Fital establishes a new manufacturing facility in Hungary and a new sales & logistics center in Hong Kong to support its Asian clients.

The early 2000s also mark the beginning of a diversification strategy for Fital that leads to the development of the FitalPRO brand.

# HOW WE DO WHAT WE DO

## R&D AND MANUFACTURING BY FAITAL

Every FaitalPRO driver is meticulously designed using the latest CAD and FEA modelling techniques. All electro-acoustic and mechanical performances are simulated and then carefully studied by a team of "sound fanatic" engineers. The individual parts of each loudspeaker are directly designed in this way, in order to ensure that the end product will meet the Client's electro-acoustic and environmental requirements and special attention is given to compliance of the finished product with environmental requirements and international standards.

### Design

Creating a loudspeaker system involves a combination of design, technology and sensory considerations. Emotions, communicated by listening to an audio system, are the result of a complex process. Faital's Research and Development laboratory is a centre of excellence in the fields of research, planning, development, testing and support for the manufacture of loudspeaker systems.

In the following pages, Faital will take you on a guided tour of the various stages involved in manufacturing its products, which is undoubtedly part of one of the most advanced processes in the industry. You will be able to experience first-hand the commitment, expertise and quality that underline each of our products.

### OEM Co-Design

The major component of an audio system is the enjoyment that it transmits to the end user. This is the result of work that begins early on, once design models are ready. Initially customers' requirements are clearly defined. Therefore, Faital works in synergy with the customers right from the beginning. A number of meetings are required with the customer and the other suppliers involved in the project, in order to outline an initial concept of what the loudspeaker system will be like. A work group is set up within Faital, with representatives from all company departments, including design, sales, purchasing, quality, production and logistics. Based on their work, valuable suggestions will be proposed to the customer during the project, as well as strict quality control criteria at each stage of the project. Firstly the type, number and size of loudspeakers in the audio system need to be determined, as well as their position in relation to listeners in a room or in an open environment. The performance of the sound system will largely depend on this positioning, which is often the result of an optimisation based upon the customer design choices and needs.

### CAD System

At the design stage, work begins on drawing individual loudspeakers and their specific components using three-dimensional modeling software. In order to do this, both Faital and the customer can use compatible software and quickly exchange files containing the drawings. Faital currently has 8 workstations and is able to carry out drawings using three different CAD systems: CATIA, Autocad and NX. At the same time, an electro-acoustic simulation of the various loudspeakers in development is carried out using "Finite Element Analysis" software based on the required physical and dimensional parameters, this way their acoustic performance can be predicted before they are built in the laboratory. The materials and single components that will be used are also tested using engineering simulation software. Faital has also acquired over the years the ability to create a feedback system that enables the R&D dept to feed actual performance data into the FEA system which in turn is constantly becoming more precise and reliable.



### Prototyping

When the process of drawing and defining the technical characteristics of the various parts of the new models designed has been sufficiently consolidated, Faital builds the first version of the loudspeakers. This phase is achieved by the construction of pilot tools or the use of rapid prototyping techniques, such as laser sintering of baskets, so that parts very similar to the final ones can be quickly assembled.

The first prototypes can then be measured to verify that all electrical and acoustic parameters comply with the initial design specifications. At this stage the work-group assigned to the project, co-ordinated by the project leader, can predict reliability problems in the final product using third-generation DFMEA methods. In addition, aspects relating to the industrial manufacturing of individual parts can be assessed, providing an initial outline of production flow and defining any special manufacturing equipment that will be required.

This verification stage is extremely important because, in addition to allowing the required adjustments and changes to be made to the loudspeaker designs, it provides an opportunity to present useful suggestions to the R&D dept or the customer for improving the overall product and the final application.

All problems arising at this point and any changes that need to be made to individual parts are discussed at constant inter-functional progress meetings. This allows to assess their possible impact, both economic and industrial making use of advanced PFMEA's for a detailed reliability evaluation, all the while ensuring that development deadlines are met. At this stage the customer can also be involved so that any changes to the initial technical requirements can be evaluated and agreed upon.

### Off Tool Parts

Once this stage has been completed, work can start on the production of final tools and equipment for the manufacture of all parts. Attention is now focused on second-level suppliers and production methods: purchasing, quality of suppliers and production methods, play an important role in this stage. At the proposed production plant an initial review of the manufacturing process for the loudspeaker being developed is carried out. This allows control plans and production flow process to be optimized by clearly identifying process variables. On receiving final of tool parts and equipment, the supplier quality department and the laboratory carry out a key role once again. While the laboratory undertakes manual assembly of all loudspeakers required for the audio system in order to verify their compliance with project specifications, the quality department "certifies" the quality of supplies. This is carried out using the pre-series products in accordance with similar criteria as to that required by the end customer. This process continues even after mass production start up and is based on a continuous performance-monitoring plan.

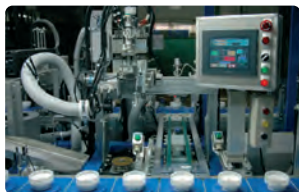


## Acoustic Testing

In addition to instrumental testing, the prototypes produced in the laboratory are also subjected to a series of tests ranging from installation testing to dimensional compatibility, as well as verifying their acoustic performance. Final adjustments could still be possible at this stage by fine tuning and implementing minor changes, this way the final characteristics of the manufactured product can be finally set. Sound is evaluated by tests using instruments and through a series of listening sessions carried out by specially trained engineers. Carefully selected pieces of music are used in order to highlight specific features of the audio system's acoustic performance. The listening tests are also compared with audio recordings that have been made in a reference environment, such as a state of the art listening room.

## Pre-Series Production

When the results that have been achieved are considered satisfactory of all technical requirements, a pre-series production is undertaken at the manufacturing plant chosen for the project. This allows for verification that the products manufactured in the final production process comply with the initial project specifications. Pre-series production, which is carried out using the final manufacturing equipment and components on the proposed manufacturing line is also subjected to product and process validation carried out by the R&D laboratory. This marks the beginning of product and process validation both of which aspects are subject to careful quality control. At this point the plant committee, along with the engineers from the R&D laboratory, carries out an initial review of the effectiveness of the production processes that had been previously planned. At this stage a verification is carried out to ensure that process variables are under control, based on accurate measurements and using appropriate statistical methods. Any deviations or problems that are found generate immediate feedback regarding the project, in addition to the necessary corrective action being taken in relation to the product, processes and suppliers.



## Validation Testing

The loudspeakers from the pre-series production are also used for validation testing, which is carried out by Faital's R&D dept. The tests used to verify the reliability and performance of loudspeakers during their lifecycle vary enormously from customer to customer and from application to application. Faital, having acquired an invaluable experience in this area, is able to share its know-how with customers by suggesting the most appropriate solutions and methods if needed. Faital has for some time implemented a series of routine activities for the validation process of products; these activities include salt fog tests, life tests, temperature shock, humidity, UV exposure and vibration test either carried out singularly or combined together, as well as all the most advanced electro-acoustic measurements, including linear parameters measurement, large signal identification, thermal behaviour, suspension part measurement and scanning vibrometer systems. All these activities result in a detailed report completing the validation phase.



## Production

The project has been completed. From this point on, the production department is responsible for ensuring that production volumes required are met and verified using R@R (Run @ Rate) tests, in accordance with product characteristics set in the project specifications. Production processes are verified and optimized through continuous quality control on the production line. All loudspeakers manufactured by the Faital group are fully checked at the end of the assembly line. Loudspeakers are tested individually also using proprietary computerized equipment, which verifies in real time six electro-acoustic parameters relating to nominal use conditions specific to each product. Defective items are always set aside for careful analysis and possible feedback to the R&D dept. Quality Assurance and the Plant Committee continuously monitor production progress. In the case of non-conformities or deterioration in the level of production rejects, corrective actions, either internal or relating to suppliers, are identified and implemented. In addition, a general management committee oversees the progress of all Faital plants globally, in order to ensure that a uniform level of product quality is achieved wherever a product is manufactured. Most of a product is emotion and Faital ensures the emotion of a perfect sound.

## FaitalPRO Products

The use of NdFeB throughout the entire range of FaitalPRO drivers allows for an important weight reduction. In fact, when confronting ferrite and NdFeB magnets with the same magnetic induction in the gap, the results show that NdFeB transducers weigh from 3 to 6 times less than ferrite. This aspect is an evident advantage for manufacturers of speaker boxes allowing them to design products that are easier to move and to implement in projects with simpler structures for speaker support and fixing points. The same concept can be considered for Line Array applications that use numerous transducers in modular blocks. The complete FaitalPRO line of drivers is produced using state of the art materials. Our team of engineers design all acoustical components as well as all hard parts. A special heat dissipation system, designed by our R&D team, allows outstanding power handling capability while improving the drivers' reliability. Cones and suspensions, as well as voice coils, undergo a special treatment in order to provide reliable performance even in the most severe environmental conditions. The specifically selected adhesives and the curing phase during the production process are a guarantee for product reliability and durability. The entire line of FaitalPRO drivers has been tested and verified to withstand the most severe working environments. . With this in mind Faital has chosen to carry out life tests in accordance with the severe AES 2 - 1984 Rev.2003. norm. Every FaitalPRO driver is manufactured combining superb craftsmanship with the latest industrial technologies and rigorous tests are constantly performed during quality checks. All driver components are put through continuous visual, mechanical and electrical tests to verify their conformity to the design parameters. This procedure is in place to keep production tolerances within very tight limits ensuring consistency in quality and reliability over time. As quality and environmental protection are of utmost importance to us, Faital has been certified for many years in accordance with the following international standards:

- IATF 16949
- ISO 9001
- ISO 14001
- ISO 50001



# "BEHIND THE SCENES" OF A PROJECT BY FAITAL

## The Design of a magnet assembly

The magnet assemblies of all products in the FaitalPRO range are carefully designed to guarantee the nominal performance of each loudspeaker during its lifetime.

Detailed simulations using FEA techniques have allowed evaluations to be made on both flux density as well as thermal equilibrium. The presence of high temperature in the magnet assembly is a result of the voice coil overheating. This, in turn, is linked to the Joule effect produced by the current that circulates in the coil windings on the basis of the power supplied from the source and the electro-acoustical yield of the loudspeakers itself. For this reason a great deal of attention has gone into designing products capable of efficiency ( $\eta_{\text{a0}}$ ) in the area of 2.70% - 3.00%. Furthermore the magnet assemblies have been conceived to have a double function: guaranteeing performance and, at the same time, contributing and optimizing the coil heat dissipation. This takes place by maximizing the surface area available for heat exchange of the voice coil in the air gap, easing the thermal radiation, and quickly transporting the absorbed energy to the aluminum basket.

Great care has been taken in the design phase to allow for the correct distribution of the magnetic flux within the air gap and avoiding areas of saturation in the iron parts of the magnet assembly itself.

## Thermal behaviour of the voice coil

The voice coils have been designed to withstand high temperatures (up to 240° C on the windings) as well as the mechanical stress of the support during normal use. For this reason the material chosen for the former is glass fiber. A special joint has also been designed to ensure that the correct cylindrical shape is maintained. The coil windings are positioned to form two layers, one on the outer surface and the other on the inner surface of the former. This doubles the surface area available for heat exchange from the coil to the magnet assembly.

This way heat dissipation by convection is also made easier. The airways inside the magnet assembly have been studied to make the outward movement of dissipated energy as efficient as possible. This is helped by the geometry of the magnet assembly and the specific structure of the base of the speaker basket itself. The movement of the mobile parts of the speaker allows the hot air to be forced out, especially in the frequency range under 400Hz.

The thermal energy generated by the coil in free air is approximately 2.5 x 108 W/m<sup>3</sup>. Exceeding this limit during the design phase will certainly result in the destruction of the coil in a real application. This parameter therefore constitutes a fundamental aspect in regards to reliability and has been taken into consideration in the design phase of the magnet assembly and the definition of the maximum power associated with each model of speaker in the range.

The application of energy dissipation techniques is another measure that guarantees the reliability and performance during the products' life.

## Electro-acoustical behaviour

FEA analyses allow the dynamic behaviour of a magnet assembly to be studied. In this way it is possible to study the Eddy currents calculating the loss and the impedance. In parallel an analysis is carried out on the compliance and the non-linearity of the spider using specific instruments. Consolidating together the data obtained allows for a final analysis that simulates the behaviour of the loudspeaker at low frequencies. This is carried out using another one of Faital's simulation tools called "Data Processing Engine", allowing for the prediction of resonance frequency, excursion, distortion, and other loudspeaker parameters.

The structural analysis and frequency response, permits the acoustical verification to be completed. This also permits to define, at a design level, all necessary parameters for acoustical optimization.

## Experimental tests and reliability

The parameters previously simulated are used as the starting point for a performance verification of all the components that make up a FaitalPRO transducer. Once the speakers are made using definitive production tools Faital carries out an in-depth laboratory activity of each component's performance. The objective is to verify that every product in the FaitalPRO range corresponds to the design parameters.

Particular attention is paid to the verification of:

- Magnetic properties
- Electro-acoustical characteristics
- Mechanical performance
- Climatic and environmental performance
- Reliability and product life

Faital's 50 years of activity has allowed the company to consolidate its experience. Working in markets where defects are calculated in ppm (parts per million) and every product issue causes a series of costs that are much higher than the cost of the individual loudspeaker, Faital has invested in the latest technology and instrumentation allowing this kind of verification to be carried out. Faital's Research & Development Department has at its disposal three anechoic chambers with integrated and computerized instruments capable of satisfying any requirement from the market. When it comes to reliability and products' capabilities to maintain and guarantee the performance for which they were originally designed, Faital's position is to go beyond the standard criteria used and to test all its products with a far greater level of severity. With this in mind Faital has chosen to carry out life tests in accordance with the severe norm AES 2-1984 Rev. 2003, that requires the driver to function in free air for 2 hours at nominal power, powering the unit with DIN filtered Pink Noise. This test is by far more severe than that normally used by our leading competitors who usually test their speakers for a much lower number of hours as well as fitting the speaker in a vented acoustic box. The tests carried out allow Faital to face the Professional Audio market with the guarantee of offering its clients a complete family of transducers that are in line with the highest market standards and that are produced using the most advanced technologies. All the products are designed at Faital's headquarters and main R&D laboratory in S. Donato Milanese, near Milan in Italy. The woofer's production takes place at Faital's Manufacturing plant in Chieve, about 40 Km from the company's headquarters. The compression drivers are produced in Spain near Barcelona in the Vacarisses plant. All of Faital's plants are certified ISO TS16949:2009, ISO 14001:2004, ISO 9001:2008.

## FaitalPRO Range

The range comprises a complete series of woofers, compression drivers and horns in every category the market needs be it equipped with Ferrite or Neodymium magnets. These products are only a starting point, in fact Faital's intention is to expand and improve the entire FaitalPRO line of products with the goal of continuing to satisfy even the most demanding clients. In order to achieve this goal Faital will continue to invest in its research R&D and will maintain the production sites updated by continuously applying the latest technologies.



# ECO-CONSCIOUS

*by Faital*

## SOLAR ENERGY

### THE NEXT STEP FORWARD FOR FAITALPRO!

**Pressing on with our environmental efforts, we at Faital added to our already highly technological profile an ecologically conscious approach by harnessing solar power.**

The Chieve plant, in the Cremona province, is the location chosen by Faital to install the manufacturing operations for the entire range dedicated to the professional audio world, in other words, the FaitalPRO division. This modern manufacturing facility has constantly sustained technological innovation over time and is now equipped with a powerful photovoltaic system of extremely modern conception which is, above all, **dedicated to energy savings and reducing Faital's Carbon footprint.**

Initially opened in 1978, the Chieve production plant has continuously been updated following and at times even anticipating the most advanced technological trends, including the installation of highly automated production lines, that guarantee the accurate reproduction and consistently high quality of the entire pro-audio range. The Chieve plant roof presented the ideal layout and orientation for the solar panels planned for this project. This new power generation system was designed and built to achieve outstanding production efficiency - thus significant savings – as well as to continue on Faital's pursuit for always more "ecologically conscious" operations and guaranteeing FaitalPRO's ever "greener" signature. In fact, Faital states that on a power level, this new installation is aligned with the global policy for energy savings in terms of consumption and it is not by chance that this photovoltaic system was **designed to cover 40% of the internal energy requirements.** On the other hand, from the increasingly important ecological point of view, the new system will also prevent dumping several tons of harmful CO2 into the atmosphere every year.



The system's installed capacity is 199 KWp with an annual estimated contribution of **210,000 kWh**, equivalent to about 40% of the Chieve plant's current annual consumption. The official data indicate a significant savings of carbon dioxide released into the atmosphere, almost 111,000 kg per year, which means **sparing more than 2,000 metric tons of CO2 emissions** over the next 20 year.

The system was officially activated the last week of June 2012 and the entire installation was completed in a record two months time. In all the setup includes 848 polycrystalline panels (Sovello Pure Power L with 235 Wp each and a guaranteed output for at least 25 years) and eight Delta Solivia 20TL inverters, all Made in Germany.

With a useful life of over 25 years, this system is the latest step forward in **Faital's long term and long established consideration for the safety of the environment.**

# ENVIRONMENTAL COMPLIANCE

Over the years Faital has always stayed ahead of the European Union's environmental requirements. Continuous studies and implementation of changes and controls are aimed at guaranteeing a lower impact on the environment of all Faital processes. This led to the attainment of the important and certainly not widely awarded ISO 14001, a certification that is exclusively bestowed on companies that respect very stringent, specifically defined "environmental management requisites" and that is not a requirement but a voluntary act of those who seek coherent, efficient and sustainable improvement in environmental protection matters: a certification with the goal of - "establishing/implementing/actively maintaining/improving a system of sustainable environmental management".

Faital S.p.A. is committed to complying with all applicable laws and regulations, including the European Union's Waste Electrical and Electronic Equipment (WEEE) and Restriction of Hazardous Substances (RoHS3) directives.

## WEEE Directive (2012/19/EU)



The WEEE Directive (2012/19/EU) The Waste Electrical and Electronic Equipment Directive (WEEE) of the European Parliament and of the Council of July 4th, 2012 applies to companies that manufacture, sell, distribute, recycle or treat electrical and electronic equipment to consumers in the European Union (EU). It covers all large and small household appliances, IT equipment, radio and audio equipment, electrical tools and telecommunications equipment. The Directive aims to reduce the waste arising from electrical and electronic equipment and to improve the environmental performance of all those involved in the life cycle of these products.

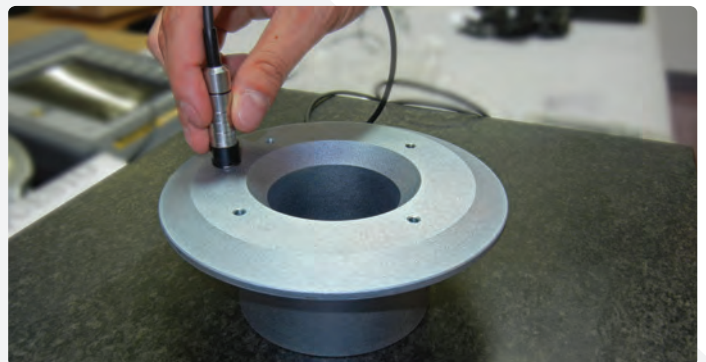
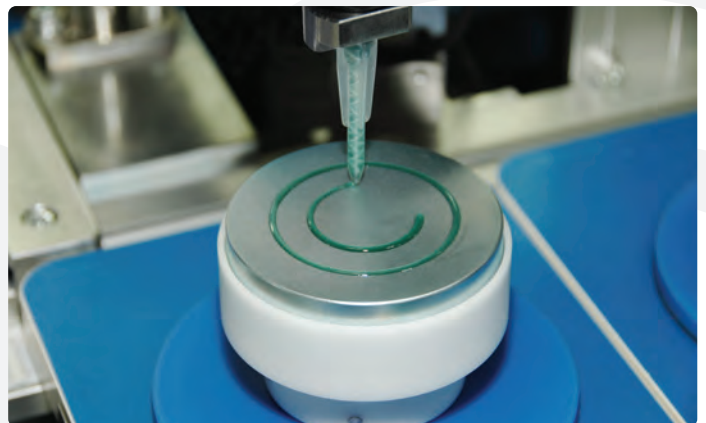
## RoHS3 Directive (2015/863/EU)

Commission Delegated Directive (EU) 2015/863 of 31 (March 2015) amending Annex II to Directive 2011/65/EU of the European Parliament and of the Council as regards the list of restricted substances. It affects manufacturers, sellers, distributors and recyclers of electrical and electronic equipment containing: Cadmium (Cd), Lead (Pb), Mercury (Hg), Hexavalent Chromium (Cr VI), Polybrominated Biphenyls (PBB), Polybrominated Diphenyl Ethers (PBDE), Bis(2-Ethylhexyl) phthalate (DEHP), Benzyl butyl phthalate (BBP), Dibutyl phthalate (DBP) and Diisobutyl phthalate (DIBP).

FaitalPRO has established a number of Project Teams to assess implementation alternatives and to understand the supply chain issues associated with conformance to these Directives.

These teams are working with our suppliers to ensure that RoHS3 compliant materials are provided and do not adversely impact the quality and reliability of our products. In addition, these teams oversee several complex engineering projects to ensure that our manufacturing processes continue to meet our high quality standards after the transition has been made. Material composition data and certification is continuously being collected/updated for all components and parts and are available upon request.

**FaitalPRO processes and products fully comply with both the WEEE and the RoHS3 directives.**



If you have any specific questions with reference to WEEE or RoHS3 status for any FaitalPRO product or Faital's efforts with respect to complying with WEEE and RoHS3 compliance, please contact your local representative. A full list is available on the FaitalPRO website **[www.faitalpro.com](http://www.faitalpro.com)**.

# COAXIAL LOUDSPEAKERS

## QUALITY AND RELIABILITY

FaitalPRO is a complete line of high power neodymium drivers suitable for use in heavy duty applications. Our products are specifically engineered for professional applications and are industrialized and manufactured to the highest standards of components' quality, reliability, high power handling, sturdiness and acoustic quality. FaitalPRO won't settle for less.

# 15HX500

LF 15" - 400 W - 97 dB  
HF 90 W - 105 dB



## NOMINAL SPECIFICATIONS

Nominal Diameter	380 mm (15 in)
Overall Diameter	393 mm (15.47 in)
Bolt Circle Diameter	374 mm (14.72 in)
Baffle Cutout Diameter	352 mm (13.86 in)
Depth	200 mm (7.87 in)
Flange and gasket Thickness	14 mm (0.55 in)
Net Weight	6.1 kg (13.4 lb)
Shipping Box	422 x 417 x 264 mm
(Single Carton Box)	(16.6 x 16.4 x 10.4 in)
Shipping Weight	7 kg (15.4 lb)

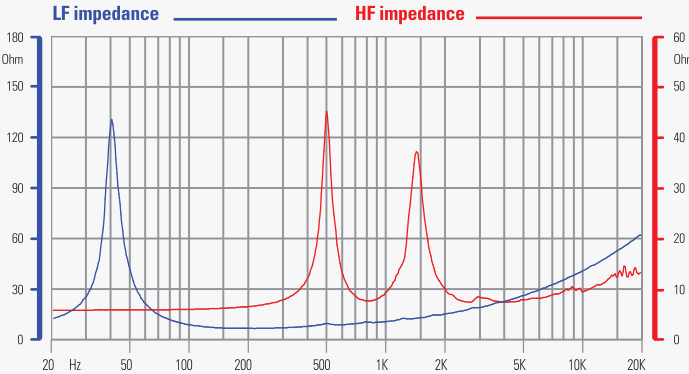
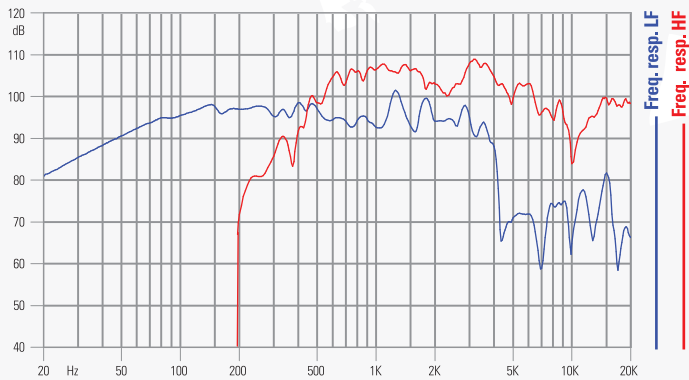
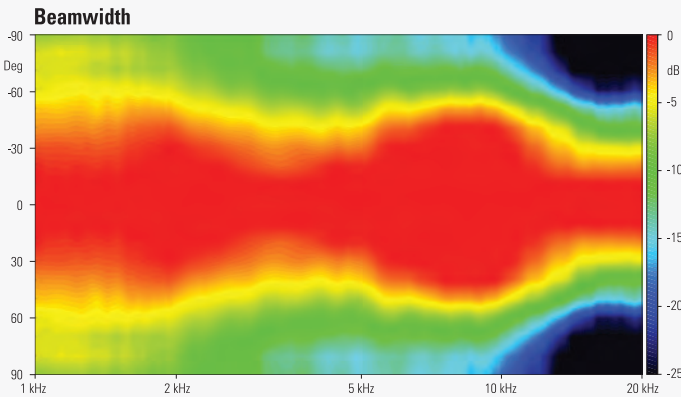
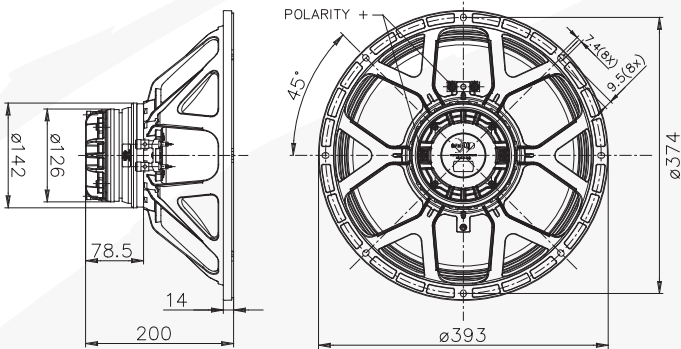
- NOTES:**
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

## TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 $\Omega$	8 $\Omega$
Minimum Impedance	6.6 $\Omega$	7.2 $\Omega$
AES Power Handling (1)	400 W	90 W
Maximum Power Handling (4)	800 W	180 W
Sensitivity (1W/1m) (7)	97 dB	105 dB
Frequency Range	40÷3150 Hz	500÷20000 Hz
Voice Coil Diameter	77 mm (3 in)	74 mm (2.9 in)
Winding Material	Cu	Al
Former Material	Glass Fiber	Kapton
Winding Depth	21.8 mm (0.86 in)	3.5 mm (0.14 in)
Magnetic Gap Depth	9 mm (0.35 in)	3.7 mm (0.15 in)
Flux Density	1.2 T	2 T
Min. Crossover Frequency (6)	-	900 Hz
Dispersion Angle	-	100°
Diaphragm Material	-	Titanium
Diaphragm Shape	-	Dome
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	3.4 dm³ (0.120 ft³)	-
Spider Profile	1x variable height waves	-

## THIELE & SMALL PARAMETERS

Fs	40 Hz
Re [LF]	5 $\Omega$
Re [HF]	5.6 $\Omega$
Qes	0.29
Qms	5.5
Qts	0.28
Vas	150.1 dm³ (5.30 ft³)
Sd	864 cm² (133.94 in²)
Xmax (2)	9.40 mm
Xdamage (3)	18.5 mm
Mms	110.0 g
Bl	22.2 N/A
Le	0.84 mH
Mmd	81.3 g
Cms	0.14 mm/N
Rms	5.0 kg/s
$\eta_e$ (Eta Zero)	3.32 %
EBP	138 Hz



# 12HX500

LF 12" - 400 W - 95 dB

HF 90 W - 105 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	300 mm (12 in)
Overall Diameter	316 mm (12.44 in)
Bolt Circle Diameter	298.5 mm (11.75 in)
Baffle Cutout Diameter	280 mm (11.02 in)
Depth	175 mm (6.89 in)
Flange and gasket Thickness	12 mm (0.47 in)
Net Weight	5.5 kg (12.1 lb)
Shipping Box	350 x 346 x 216 mm
(Single Carton Box)	(13.8 x 13.6 x 8.5 in)
Shipping Weight	6.2 kg (13.7 lb)

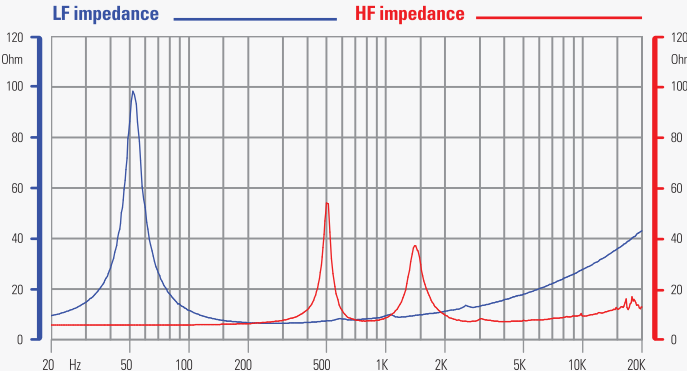
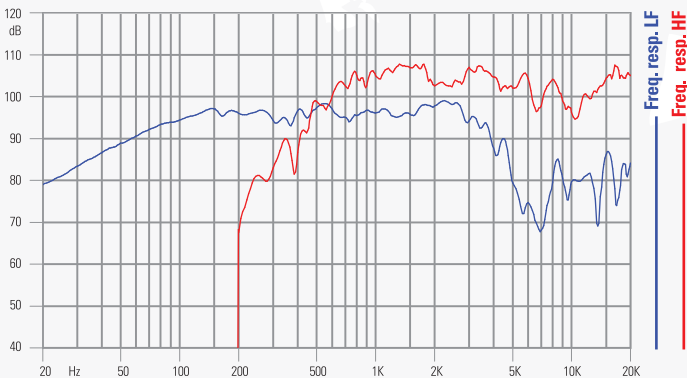
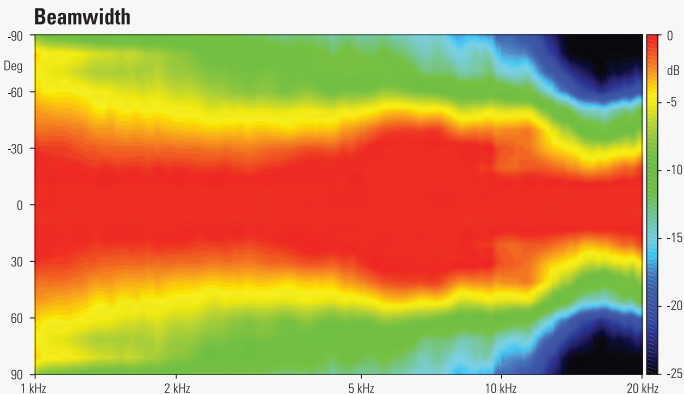
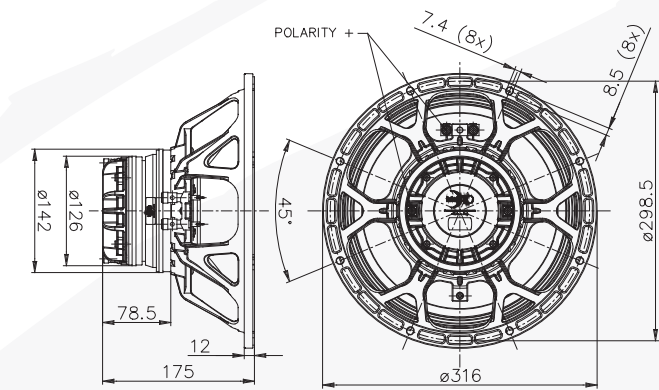
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.6 Ω	7.2 Ω
AES Power Handling (1)	400 W	90 W
Maximum Power Handling (4)	800 W	180 W
Sensitivity (1W/1m) (7)	95 dB	105 dB
Frequency Range	50÷4000 Hz	500÷20000 Hz
Voice Coil Diameter	77 mm (3 in)	74 mm (2.9 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	21.5 mm (0.85 in)	3.5 mm (0.14 in)
Magnetic Gap Depth	9 mm (0.35 in)	3.7 mm (0.15 in)
Flux Density	1.2 T	2 T
Min. Crossover Frequency (6)	-	0.9 kHz
Dispersion Angle	-	100°
Diaphragm Material	-	Titanium
Diaphragm Shape	-	Dome
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	2.5 dm³ (0.088 ft³)	-
Spider Profile	1x variable height waves	-

THIELE & SMALL PARAMETERS

Fs	55 Hz
Re [LF]	5.6 Ω
Re [HF]	5.6 Ω
Qes	0.39
Qms	7.3
Qts	0.37
Vas	57.8 dm³ (2.04 ft³)
Sd	540 cm² (83.62 in²)
Xmax (2)	9.25 mm
Xdamage (3)	18.5 mm
Mms	58.88 g
Bl	17.4 N/A
Le	0.57 mH
Mmd	44.7 g
Cms	0.14 mm/N
Rms	2.8 kg/s
η <sub>o</sub> (Eta Zero)	2.48 %
EBP	141 Hz



12HX240

LF 12" - 250 W - 97 dB  
HF 30 W - 107 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	300 mm (12 in)
Overall Diameter	316 mm (12.44 in)
Bolt Circle Diameter	298.5 mm (11.75 in)
Baffle Cutout Diameter	280 mm (11.02 in)
Depth	162 mm (6.38 in)
Flange and gasket Thickness	12 mm (0.47 in)
Net Weight	4.2 kg (9.3 lb)
Shipping Box	350 x 346 x 216 mm
(Single Carton Box)	(13.8 x 13.6 x 8.5 in)
Shipping Weight	5 kg (11.0 lb)

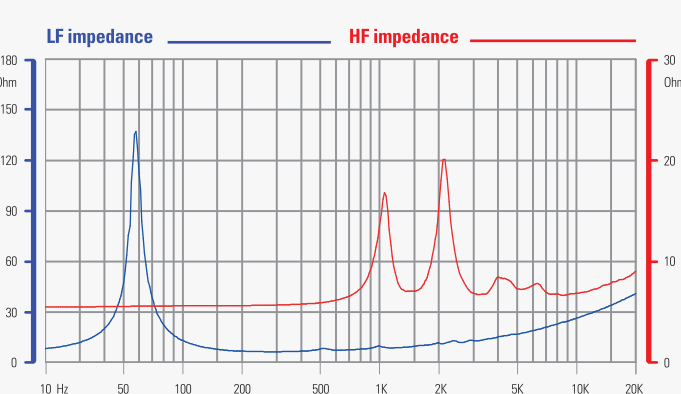
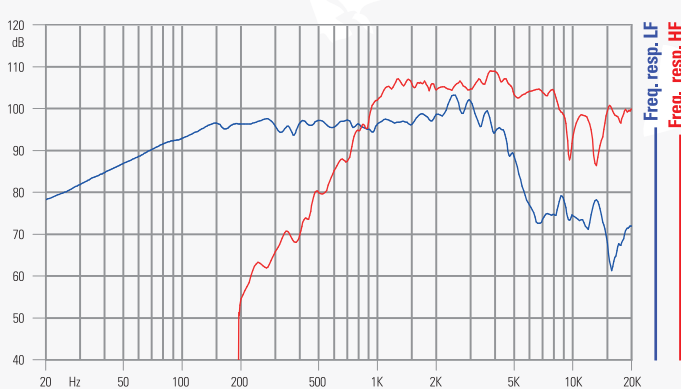
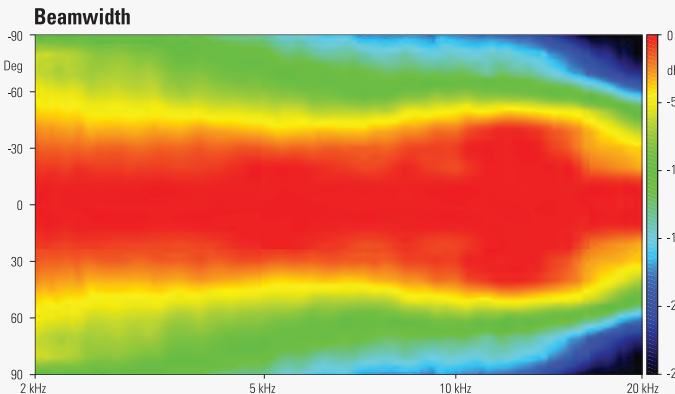
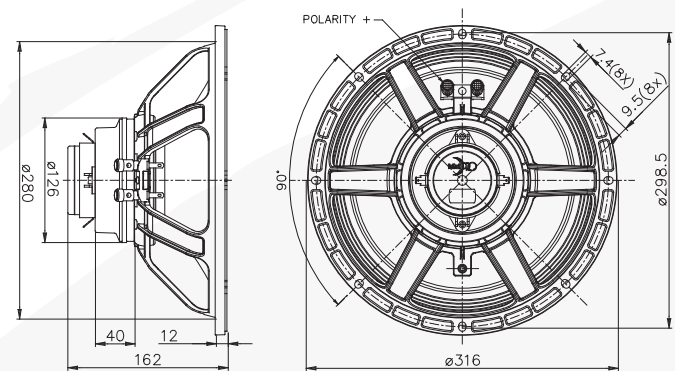
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.4 Ω	6.8 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	97 dB	107 dB
Frequency Range	55÷5000 Hz	1500÷20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	17.4 mm (0.69 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.25 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	100°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	1.9 dm³ (0.067 ft³)	-
Spider Profile	1x variable height waves	-

THIELE & SMALL PARAMETERS

Fs	56 Hz
Re [LF]	5.3 Ω
Re [HF]	5.5 Ω
Qes	0.38
Qms	11.3
Qts	0.37
Vas	61.1 dm³ (2.16 ft³)
Sd	539 cm² (83.55 in²)
Xmax (2)	7.37 mm
Xdamage (3)	17.4 mm
Mms	53.6 g
Bl	16 N/A
Le	0.45 mH
Mmd	39.5 g
Cms	0.15 mm/N
Rms	1.7 kg/s
η <sub>l</sub> (Eta Zero)	2.67 %
EBP	147 Hz



# 12HX230

LF 12" - 250 W - 97 dB

HF 30 W - 107 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	300 mm (12 in)
Overall Diameter	316 mm (12.44 in)
Bolt Circle Diameter	298.5 mm (11.75 in)
Baffle Cutout Diameter	282 mm (11.10 in)
Depth	162 mm (6.38 in)
Flange and gasket Thickness	12 mm (0.47 in)
Net Weight	5.2 kg (11.5 lb)
Shipping Box	350 x 346 x 190 mm
(Single Carton Box)	(13.8 x 13.6 x 8.5 in)
Shipping Weight	5.7 kg (12.6 lb)

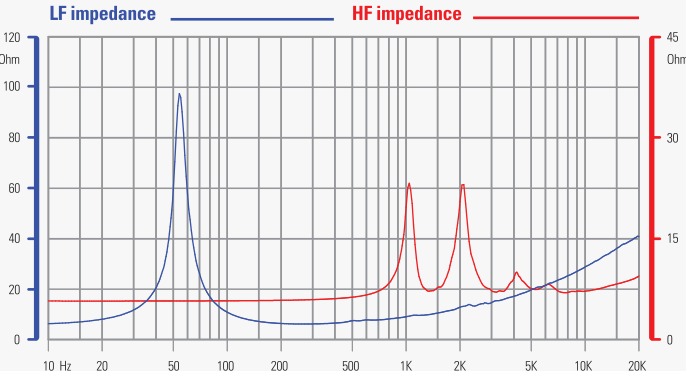
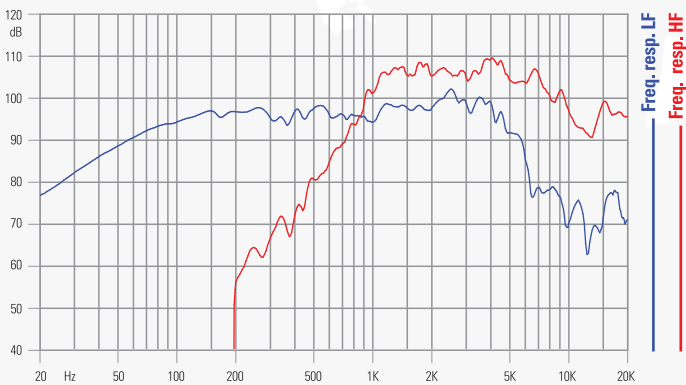
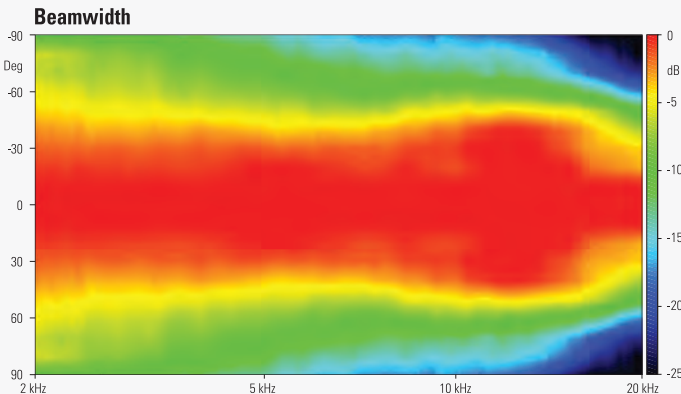
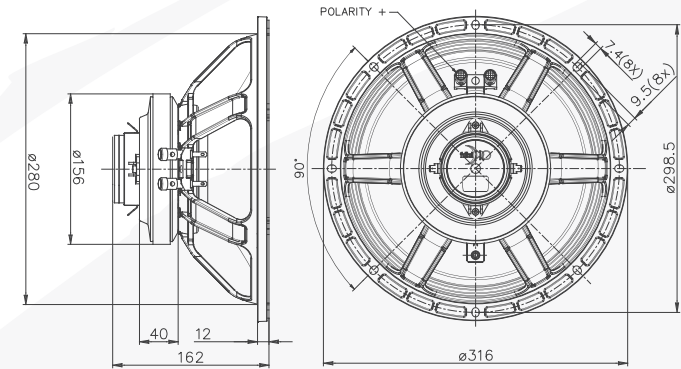
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.4 Ω	7 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	97 dB	107 dB
Frequency Range	55÷5000 Hz	1500÷20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	17.4 mm (0.69 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.15 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	100°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Ferrite Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	1.5 dm³ (0.053 ft³)	-
Spider Profile	1x variable height waves	-

THIELE & SMALL PARAMETERS

Fs	55 Hz
Re [LF]	5.3 Ω
Re [HF]	5.5 Ω
Qes	0.46
Qms	7.4
Qts	0.43
Vas	67.7 dm³ (2.39 ft³)
Sd	539 cm² (83.55 in²)
Xmax (2)	7.37 mm
Xdamage (3)	15.25 mm
Mms	50.2 g
Bl	14.1 N/A
Le	0.62 mH
Mmd	36.1 g
Cms	0.17 mm/N
Rms	2.3 kg/s
η <sub>e</sub> (Eta Zero)	2.36 %
EBP	120 Hz



# 10HX240

LF 10" - 250 W - 96 dB  
HF 30 W - 107 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	250 mm (10 in)
Overall Diameter	261 mm (10.28 in)
Bolt Circle Diameter	246 mm (9.69 in)
Baffle Cutout Diameter	230 mm (9.06 in)
Depth	137 mm (5.39 in)
Flange and gasket Thickness	12 mm (0.47 in)
Net Weight	4.1 kg (9.0 lb)
Shipping Box	282 x 280 x 140 mm
(Single Carton Box)	(11.1 x 11.0 x 5.5 in)
Shipping Weight	4.5 kg (9.9 lb)

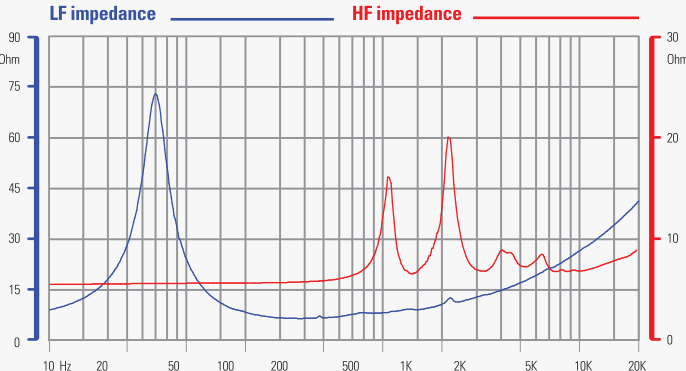
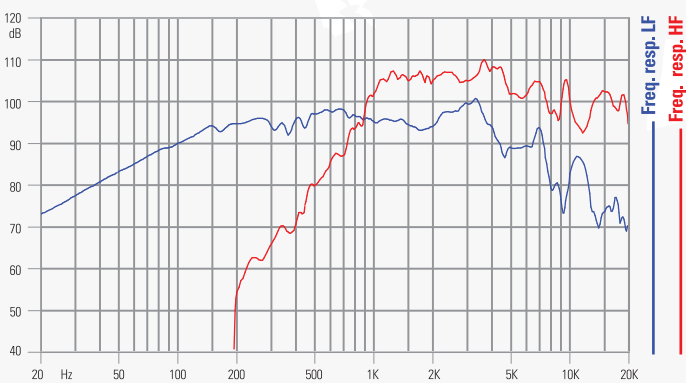
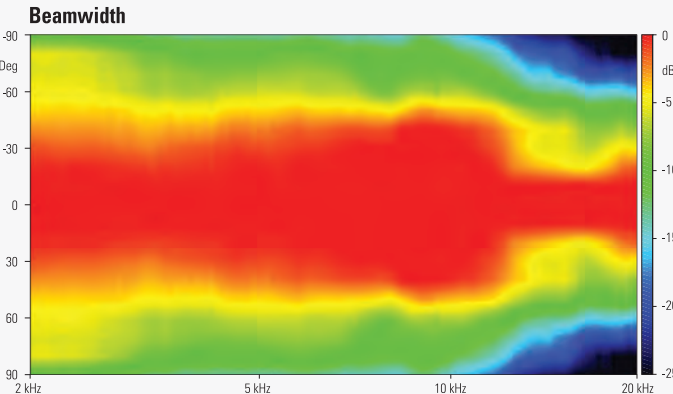
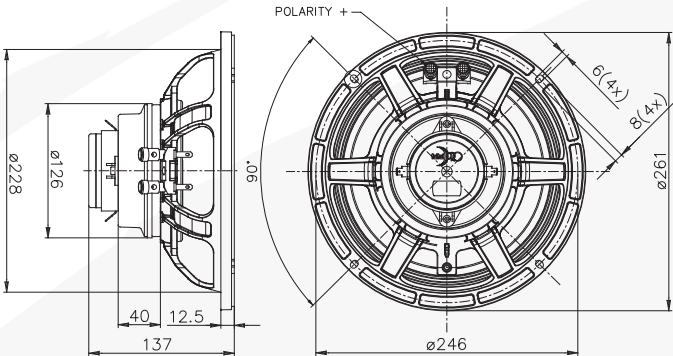
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.4 Ω	6.8 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	96 dB	107 dB
Frequency Range	65÷4000 Hz	1500÷20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	17.4 mm (0.69 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.25 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	110°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	1.25 dm³ (0.044 ft³)	-
Spider Profile	1x variable height waves	-

THIELE & SMALL PARAMETERS

Fs	65 Hz
Re [LF]	5.3 Ω
Re [HF]	5.5 Ω
Qes	0.3
Qms	3.3
Qts	0.28
Vas	31.8 dm³ (1.12 ft³)
Sd	347 cm² (53.71 in²)
Xmax (2)	7.37 mm
Xdamage (3)	14.8 mm
Mms	31.6 g
Bl	15.5 N/A
Le	0.45 mH
Mmd	24.3 g
Cms	0.19 mm/N
Rms	3.9 kg/s
η <sub>e</sub> (Eta Zero)	2.98 %
EBP	217 Hz



# 10HX230

LF 10" - 250 W - 96 dB

HF 30 W - 107 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	250 mm (10 in)
Overall Diameter	261 mm (10.28 in)
Bolt Circle Diameter	246 mm (9.69 in)
Baffle Cutout Diameter	230 mm (9.06 in)
Depth	136.5 mm (5.37 in)
Flange and gasket Thickness	12 mm (0.47 in)
Net Weight	5 kg (11.0 lb)
Shipping Box	282 x 280 x 140 mm
(Single Carton Box)	(9.3 x 9.3 x 6.1 in)
Shipping Weight	5.4 kg (11.9 lb)

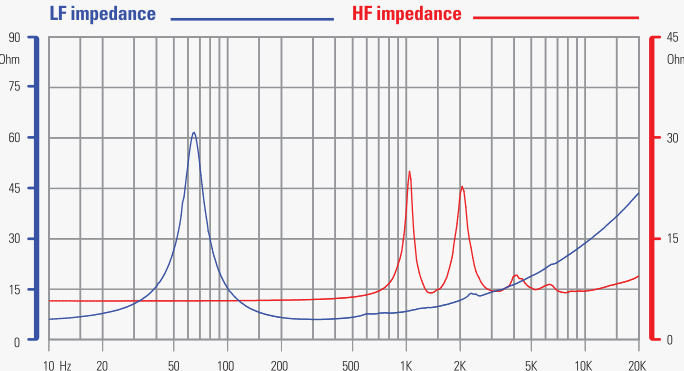
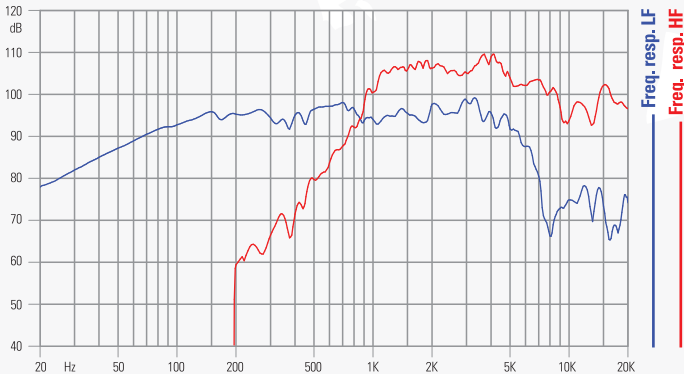
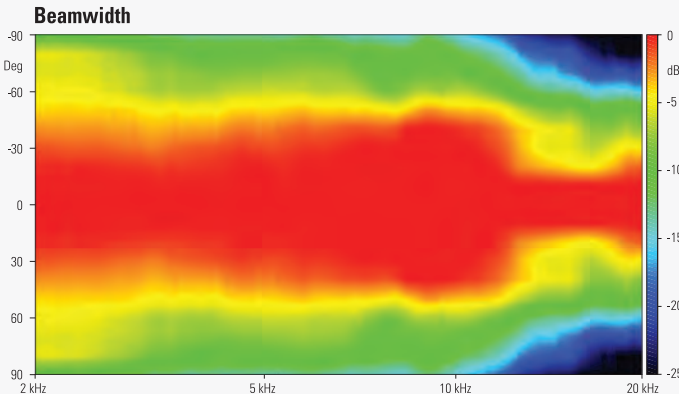
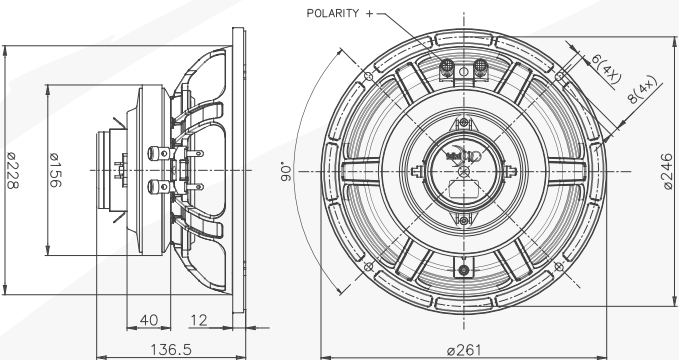
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.4 Ω	6.9 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	96 dB	107 dB
Frequency Range	65-4000 Hz	1500-20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	17.4 mm (0.69 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.15 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	110°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Ferrite Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	1.5 dm³ (0.053 ft³)	-
Spider Profile	1x variable height waves	-

THIELE & SMALL PARAMETERS

Fs	65 Hz
Re [LF]	5.3 Ω
Re [HF]	5.5 Ω
Qes	0.42
Qms	5.8
Qts	0.39
Vas	30.5 dm³ (1.08 ft³)
Sd	347 cm² (53.71 in²)
Xmax (2)	7.37 mm
Xdamage (3)	14.8 mm
Mms	33.0 g
Bl	13.1 N/A
Le	0.54 mH
Mmd	25.7 g
Cms	0.18 mm/N
Rms	2.4 kg/s
η <sub>e</sub> (Eta Zero)	1.95 %
EBP	155 Hz



# 8HX240

LF 8" - 250 W - 94 dB  
HF 30 W - 107 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	200 mm (8 in)
Overall Diameter	223.75/207.9 mm (8.81/8.18 in)
Bolt Circle Diameter	210 mm (8.27 in)
Baffle Cutout Diameter	181 mm (7.13 in)
Depth	125.5 mm (4.94 in)
Flange and gasket Thickness	10.7 mm (0.42 in)
Net Weight	3.9 kg (8.6 lb)
Shipping Box	235 x 235 x 155 mm
(Single Carton Box)	(9.3 x 9.3 x 6.1 in)
Shipping Weight	4.2 kg (9.3 lb)

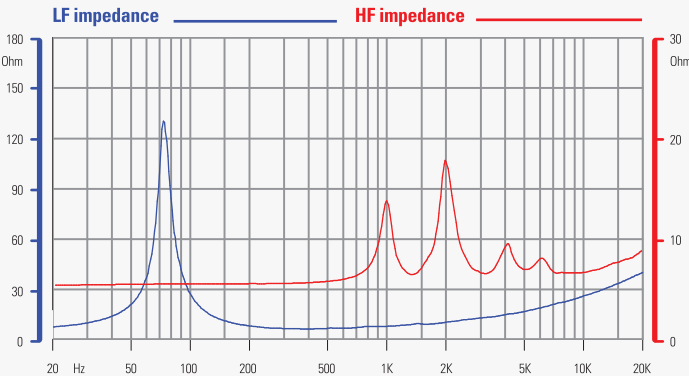
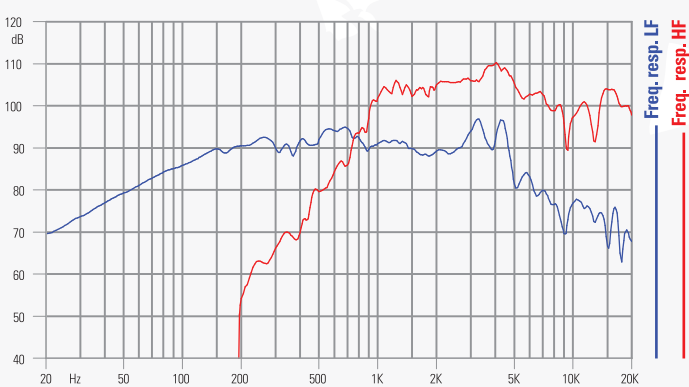
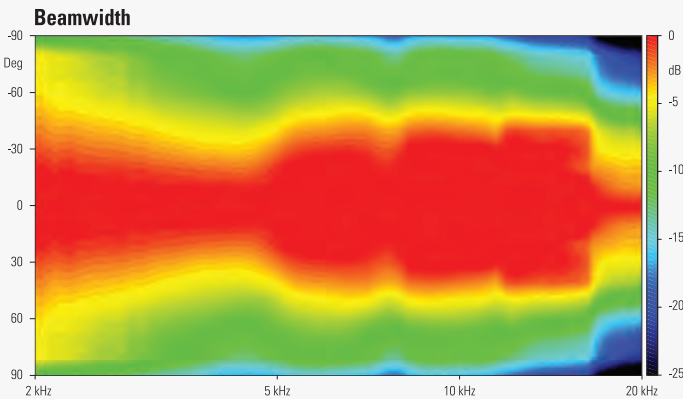
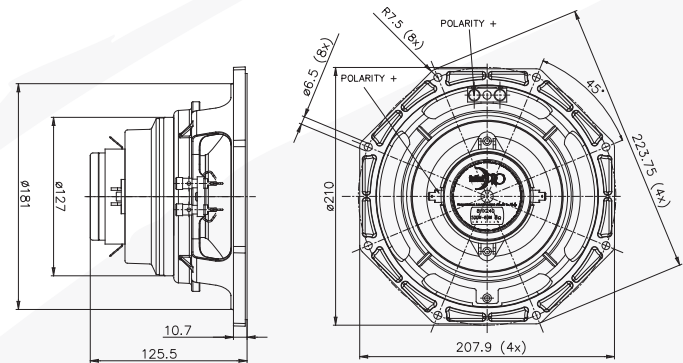
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.4 Ω	6.8 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	94 dB	107 dB
Frequency Range	70÷4000 Hz	1200÷20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	15 mm (0.59 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.15 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	100°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	0.95 dm³ (0.034 ft³)	-
Spider Profile	1x variable height waves	-

THIELE & SMALL PARAMETERS

Fs	70 Hz
Re [LF]	5 Ω
Re [HF]	5.5 Ω
Qes	0.31
Qms	8.1
Qts	0.30
Vas	12.9 dm³ (0.46 ft³)
Sd	223 cm² (34.57 in²)
Xmax (2)	6.17 mm
Xdamage (3)	15.2 mm
Mms	27.7 g
Bl	13.8 N/A
Le	0.49 mH
Mmd	24.0 g
Cms	0.19 mm/N
Rms	1.5 kg/s
η <sub>e</sub> (Eta Zero)	1.34 %
EBP	226 Hz



# 8HX200

LF 8" - 250 W - 95 dB  
HF 30 W - 107 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	200 mm (8 in)
Overall Diameter	223.75/207.9 mm (8.81/8.18 in)
Bolt Circle Diameter	210 mm (8.27 in)
Baffle Cutout Diameter	183 mm (7.20 in)
Depth	110.7 mm (4.36 in)
Flange and gasket Thickness	10.7 mm (0.42 in)
Net Weight	2.7 kg (6.0 lb)
Shipping Box	227 x 224 x 132 mm
(Single Carton Box)	(8.9 x 8.8 x 5.2 in)
Shipping Weight	3.4 kg (7.5 lb)

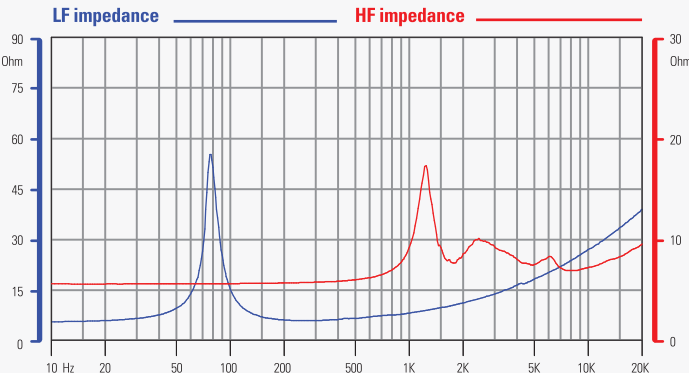
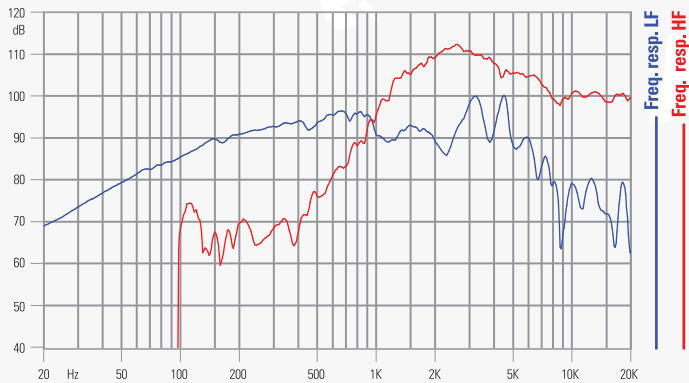
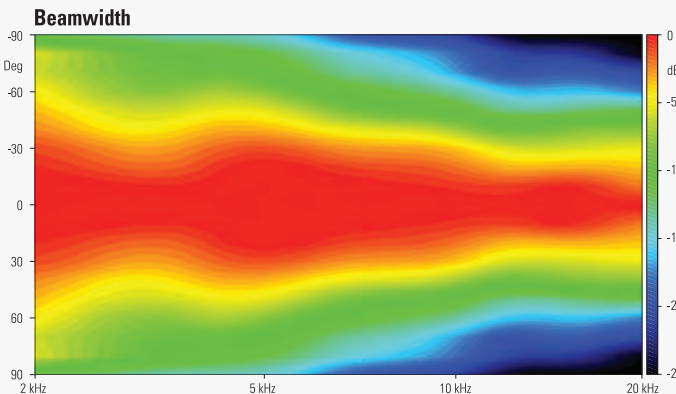
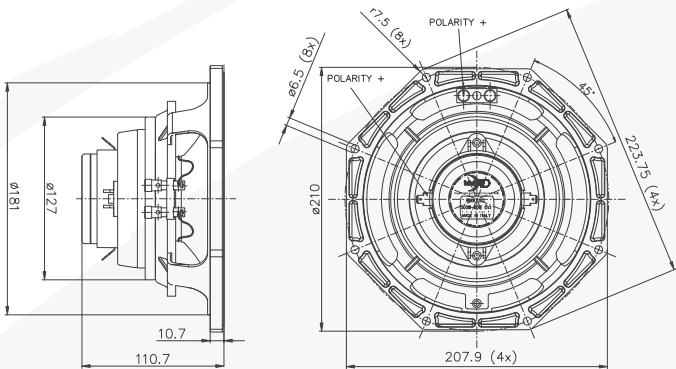
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.6 Ω	6.9 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	95 dB	107 dB
Frequency Range	75÷4000 Hz	1500÷20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	12.5 mm (0.49 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.2 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	90°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	0.8 dm³ (0.028 ft³)	-
Spider Profile	1x constant height waves	-

THIELE & SMALL PARAMETERS

Fs	76 Hz
Re [LF]	5.5 Ω
Re [HF]	5.5 Ω
Qes	0.31
Qms	10.5
Qts	0.30
Vas	13.1 dm³ (0.46 ft³)
Sd	217.2 cm² (33.67 in²)
Xmax (2)	4.92 mm
Xdamage (3)	10.2 mm
Mms	22.0 g
Bl	13.8 N/A
Le	0.51 mH
Mmd	18.4 g
Cms	0.20 mm/N
Rms	1 kg/s
η <sub>e</sub> (Eta Zero)	1.84 %
EBP	245 Hz



# 8HX230

LF 8" - 250 W - 94 dB

HF 30 W - 105 dB



### NOMINAL SPECIFICATIONS

Nominal Diameter	200 mm (8 in)
Overall Diameter	223.75/207.9 mm (8.81/8.18 in)
Bolt Circle Diameter	210 mm (8.27 in)
Baffle Cutout Diameter	183 mm (7.20 in)
Depth	126.5 mm (4.98 in)
Flange and gasket Thickness	10.7 mm (0.42 in)
Net Weight	4.7 kg (10.4 lb)
Shipping Box	235 x 235 x 155 mm
(Single Carton Box)	(9.3 x 9.3 x 6.1 in)
Shipping Weight	5 kg (11.0 lb)

### NOTES:

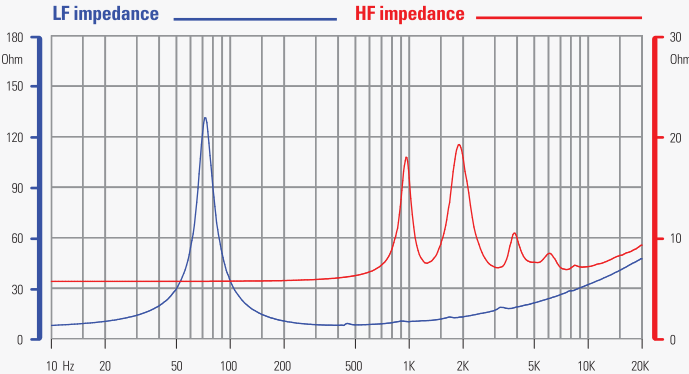
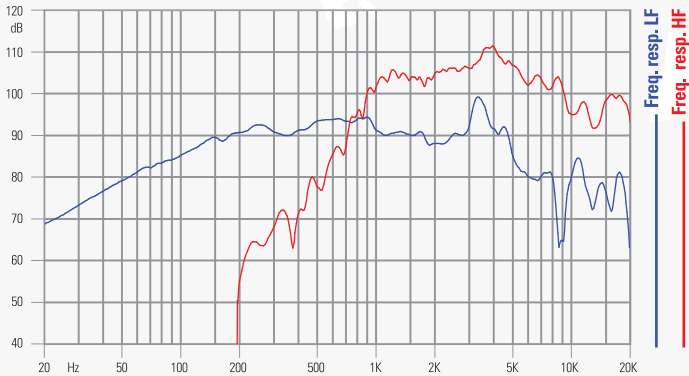
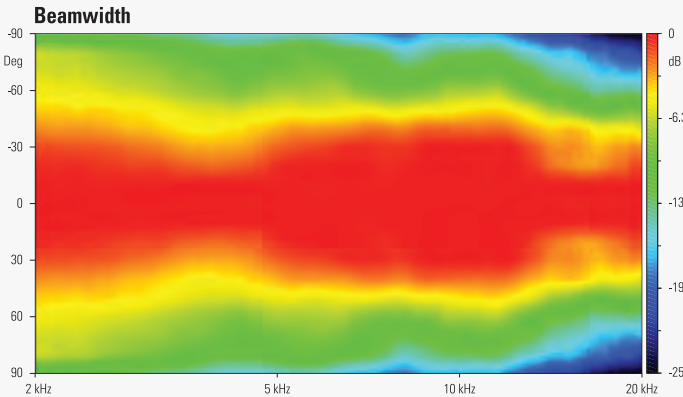
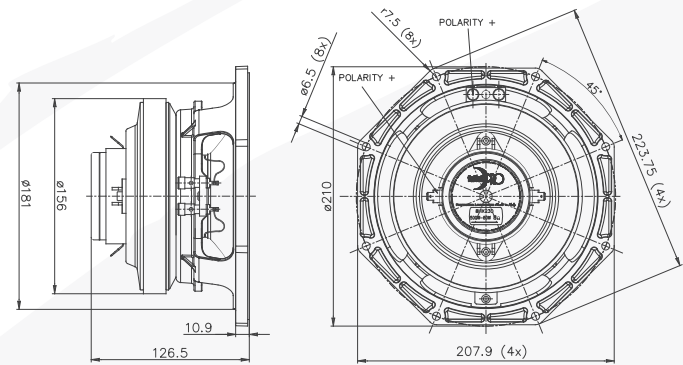
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
- (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
- (3) Maximum excursion before permanent damage
- (4) Maximum power is defined as 3dB greater than nominal power
- (5) Treated Polycotton
- (6) 12 dB/oct or higher slope high-pass filter
- (7) HF sensitivity averaged within the frequency range

### TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	8 Ω	7 Ω
AES Power Handling (1)	250 W	30 W
Maximum Power Handling (4)	500 W	60 W
Sensitivity (1W/1m) (7)	94 dB	105 dB
Frequency Range	70÷4000 Hz	1200÷20000 Hz
Voice Coil Diameter	65 mm (2.56 in)	37 mm (1.46 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	15 mm (0.59 in)	2.1 mm (0.08 in)
Magnetic Gap Depth	8 mm (0.31 in)	2.6 mm (0.10 in)
Flux Density	1.12 T	1.85 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	100°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Annular
Magnet	Ferrite Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	1 dm³ (0.035 ft³)	-
Spider Profile	1x variable height waves	-

### THIELE & SMALL PARAMETERS

Fs	70 Hz
Re [LF]	6.5 Ω
Re [HF]	5.5 Ω
Qes	0.31
Qms	6.0
Qts	0.29
Vas	14.7 dm³ (0.52 ft³)
Sd	223 cm² (34.57 in²)
Xmax (2)	6.17 mm
Xdamage (3)	15.5 mm
Mms	24.4 g
Bl	15 N/A
Le	0.59 mH
Mmd	20.6 g
Cms	0.21 mm/N
Rms	1.8 kg/s
η <sub>e</sub> (Eta Zero)	1.58 %
EBP	226 Hz





**HF** 15 W - 104 dB

Nominal Diameter	200 mm (8 in)
Overall Diameter	223.75/207.9 mm (8.81/8.18 in)
Bolt Circle Diameter	210 mm (8.27 in)
Baffle Cutout Diameter	183 mm (7.20 in)
Depth	111.7 mm (4.40 in)
Flange and gasket Thickness	10.7 mm (0.42 in)
<b>Net Weight</b>	<b>3.6 kg (7.9 lb)</b>
Shipping Box	227 x 224 x 132 mm
(Single Carton Box)	(8.9 x 8.8 x 5.2 in)
Shipping Weight	4.3 kg (9.5 lb)

Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.6 Ω	6.3 Ω
AES Power Handling (1)	250 W	15 W
Maximum Power Handling (4)	500 W	30 W
Sensitivity (1W/1m) (7)	94 dB	104 dB
Frequency Range	75÷4000 Hz	1500÷18000 Hz
Voice Coil Diameter	65 mm (2.56 in)	25 mm (1 in)
Winding Material	Al	Al
Former Material	Glass Fiber	Kapton
Winding Depth	12.5 mm (0.49 in)	1.7 mm (0.07 in)
Magnetic Gap Depth	8 mm (0.31 in)	2 mm (0.08 in)
Flux Density	1 T	1.3 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	90°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Dome
Magnet	Ferrite Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	No	-
Cone Surround (5)	Triple Roll	-
NET Air Volume filled by Loudspeaker	0.96 dm³ (0.034 ft³)	-
Spider Profile	1x constant height waves	-

Fs	76 Hz
Re [LF]	5.5 $\Omega$
Re [HF]	6 $\Omega$
Qes	0.43
Qms	9.5
Qts	0.41
Vas	13.0 dm <sup>3</sup> (0.46 ft <sup>3</sup> )
Sd	217.2 cm <sup>2</sup> (33.67 in <sup>2</sup> )
Xmax <b>(2)</b>	4.92 mm
Xdamage <b>(3)</b>	10.25 mm
Mms	22.3 g
BI	11.6 N/A
Le	0.51 mH
Mmd	18.7 g
Cms	0.20 mm/N
Rms	1.1 kg/s
$\eta_{\text{L}}$ (Eta Zero)	1.27 %
EBP	177 Hz

(1) 2 Hours Test According to AES 2-1984 Rev. 2003

$$(2) X_{\max} = [(Winding \text{ Depth} - \text{magnetic gap depth})/2] + (\text{magnetic gap depth} / 3)$$

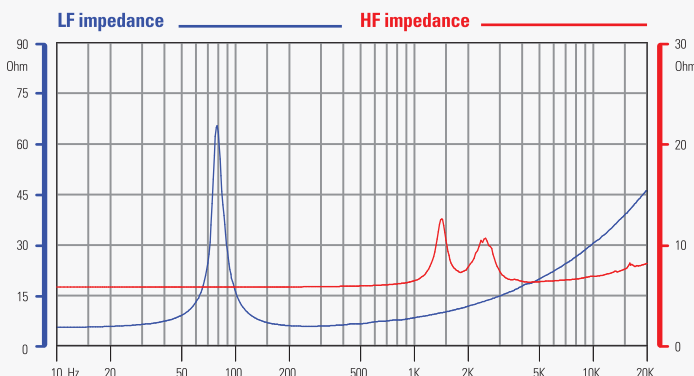
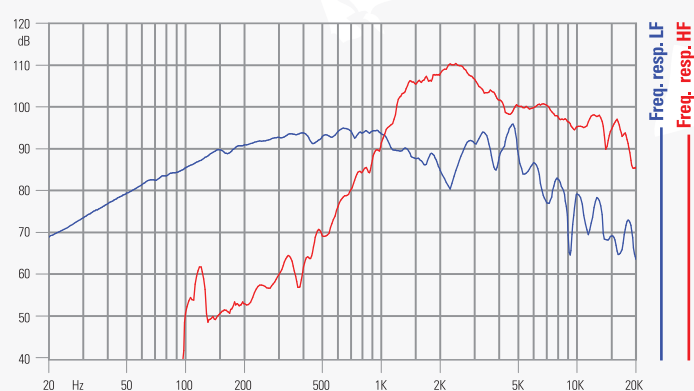
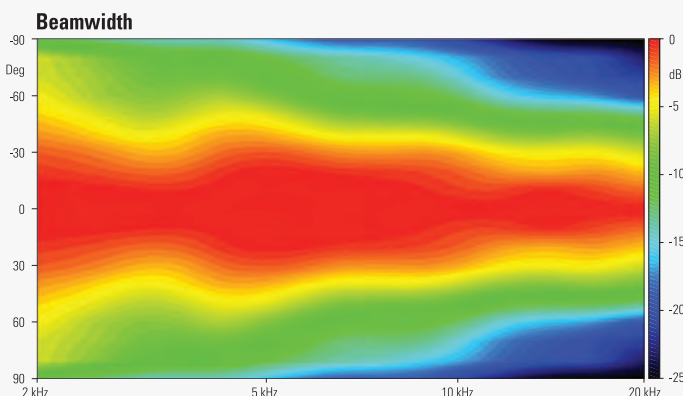
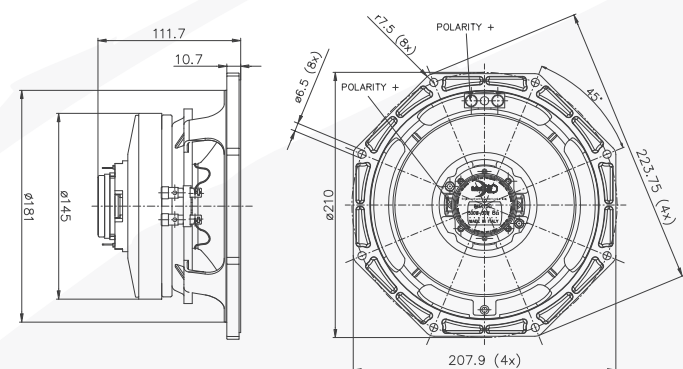
**(3) Maximum excursion before permanent damage**

(4) Maximum power is defined as 3dB greater than nominal power

**(5) Treated Polycotton**

**(6)** 12 dB/oct or higher slope high-pass filter

(7) HF sensitivity averaged within the frequency range



# 6HX150

LF 6" - 150 W - 93 dB  
HF 15 W - 104 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	160 mm (6 in)
Overall Diameter	186.5/162 mm (7.34/6.37 in)
Bolt Circle Diameter	172 mm (6.77 in)
Baffle Cutout Diameter	147 mm (5.79 in)
Depth	95 mm (3.74 in)
Flange and gasket Thickness	9.3 mm (0.37 in)
Net Weight	1.3 kg (2.9 lb)
Shipping Box	202 x 202 x 134 mm
(Single Carton Box)	(8.0 x 8.0 x 5.3 in)
Shipping Weight	2.8 kg (6.2 lb)

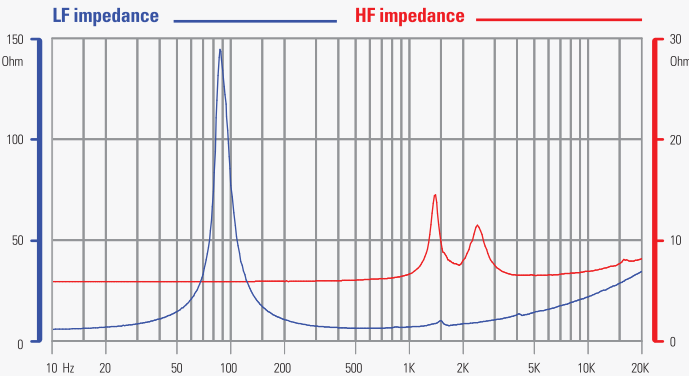
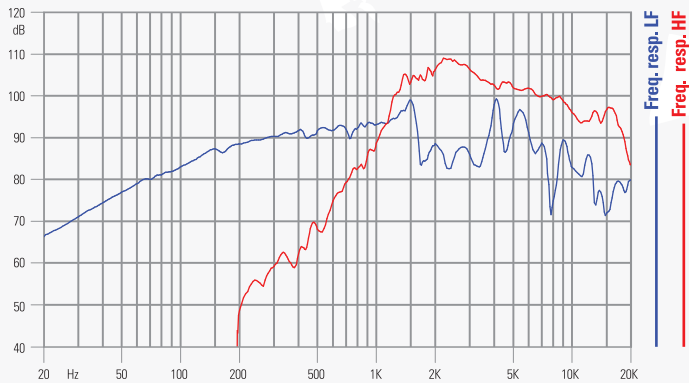
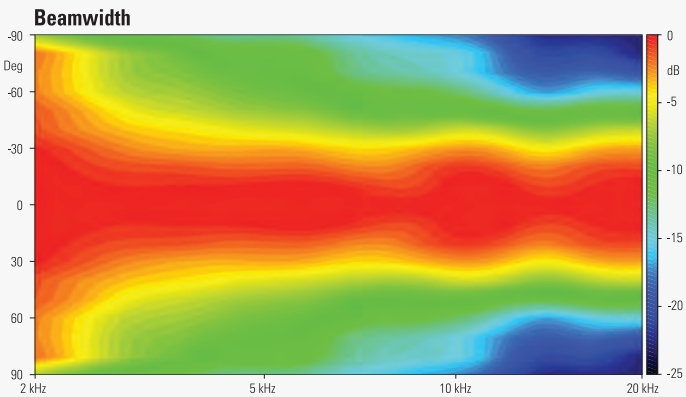
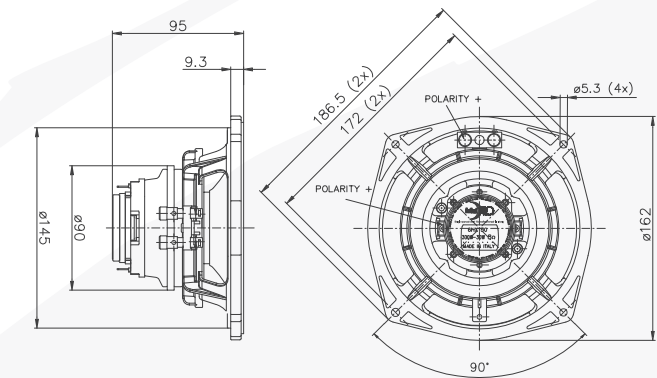
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6 Ω	6.3 Ω
AES Power Handling (1)	150 W	15 W
Maximum Power Handling (4)	300 W	30 W
Sensitivity (1W/1m) (7)	93 dB	104 dB
Frequency Range	90-5000 Hz	1500-18000 Hz
Voice Coil Diameter	52 mm (2 in)	25 mm (1 in)
Winding Material	Cu	Al
Former Material	Glass Fiber	Kapton
Winding Depth	10.7 mm (0.42 in)	1.7 mm (0.07 in)
Magnetic Gap Depth	6 mm (0.24 in)	2 mm (0.08 in)
Flux Density	1.35 T	1.3 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	90°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Dome
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	Half Roll	-
NET Air Volume filled by Loudspeaker	0.6 dm³ (0.021 ft³)	-
Spider Profile	1x constant height waves	-

THIELE & SMALL PARAMETERS

Fs	88 Hz
Re [LF]	5.5 Ω
Re [HF]	6 Ω
Qes	0.35
Qms	8.3
Qts	0.34
Vas	6.3 dm³ (0.22 ft³)
Sd	139.2 cm² (21.58 in²)
Xmax (2)	4.35 mm
Xdamage (3)	10.15 mm
Mms	14 g
Bl	12 N/A
Le	0.64 mH
Mmd	12.1 g
Cms	0.23 mm/N
Rms	0.9 kg/s
η <sub>l</sub> (Eta Zero)	1.41 %
EBP	251 Hz



# 5HX140

LF 5" - 120 W - 91 dB  
HF 15 W - 101 dB



NOMINAL SPECIFICATIONS

Nominal Diameter	130 mm (5 in)
Overall Diameter	150/128.2 mm (5.91/5.05 in)
Bolt Circle Diameter	139 mm (5.47 in)
Baffle Cutout Diameter	118 mm (4.65 in)
Depth	74 mm (2.91 in)
Flange and gasket Thickness	9 mm (0.35 in)
Net Weight	1.22 kg (2.7 lb)
Shipping Box	185 x 170 x 122 mm
(Single Carton Box)	(7.3 x 6.7 x 4.8 in)
Shipping Weight	1.4 kg (3.1 lb)

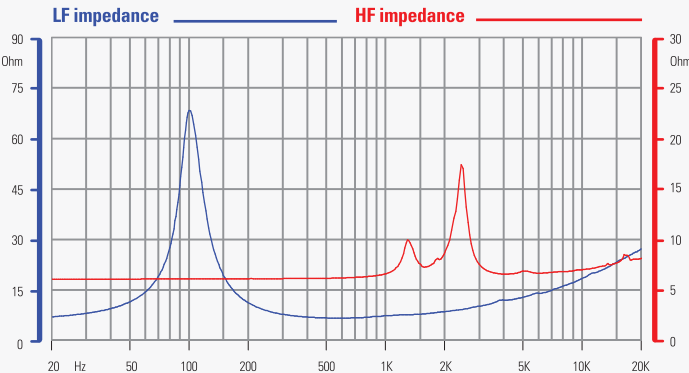
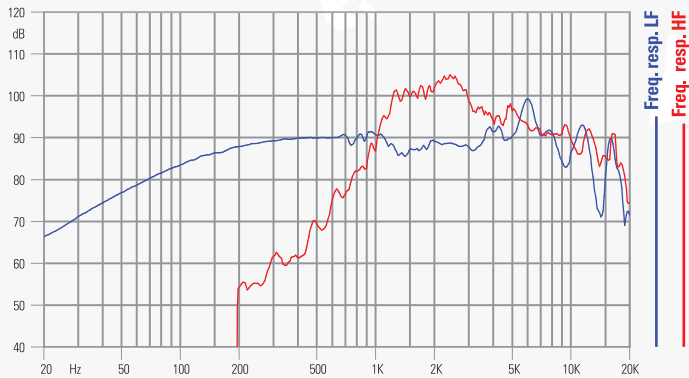
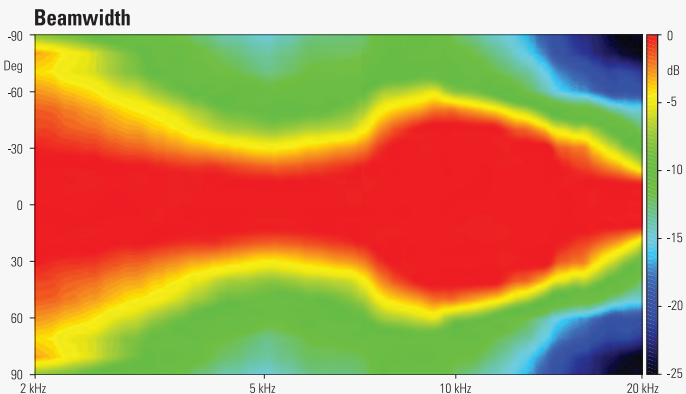
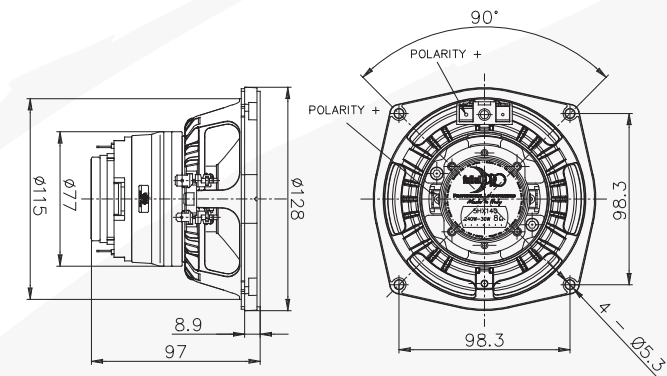
- NOTES:
- (1) 2 Hours Test According to AES 2-1984 Rev. 2003
  - (2)  $X_{max} = [(Winding\ Depth - magnetic\ gap\ depth)/2] + (magnetic\ gap\ depth / 3)$
  - (3) Maximum excursion before permanent damage
  - (4) Maximum power is defined as 3dB greater than nominal power
  - (5) Treated Polycotton
  - (6) 12 dB/oct or higher slope high-pass filter
  - (7) HF sensitivity averaged within the frequency range

TECHNICAL PARAMETERS

	LF	HF
Nominal Impedance	8 Ω	8 Ω
Minimum Impedance	6.7 Ω	6.6 Ω
AES Power Handling (1)	120 W	15 W
Maximum Power Handling (4)	240 W	30 W
Sensitivity (1W/1m) (7)	91 dB	101 dB
Frequency Range	100-8000 Hz	1500-18000 Hz
Voice Coil Diameter	37 mm (1.46 in)	25 mm (0.98 in)
Winding Material	Al	Al
Former Material	Kapton	Kapton
Winding Depth	12.2 mm (0.48 in)	1.7 mm (0.07 in)
Magnetic Gap Depth	6 mm (0.24 in)	2 mm (0.08 in)
Flux Density	1.3 T	1.3 T
Min. Crossover Frequency (6)	-	1.7 kHz
Dispersion Angle	-	90°
Diaphragm Material	-	Ketone Polymer
Diaphragm Shape	-	Dome
Magnet	Neodymium Ring	Neodymium Ring
Basket Material	Aluminum	-
Demodulation	Aluminum Ring	-
Cone Surround (5)	M-Roll	-
NET Air Volume filled by Loudspeaker	0.34 dm³ (0.012 ft³)	-
Spider Profile	1x constant height waves	-

THIELE & SMALL PARAMETERS

Fs	100 Hz
Re [LF]	5.9 Ω
Re [HF]	6 Ω
Qes	0.45
Qms	4.8
Qts	0.41
Vas	3.4 dm³ (0.12 ft³)
Sd	85 cm² (13.18 in²)
Xmax (2)	5.10 mm
Xdamage (3)	16.85 mm
Mms	7.5 g
Bl	8 N/A
Le	0.29 mH
Mmd	6.6 g
Cms	0.34 mm/N
Rms	1.0 kg/s
η <sub>o</sub> (Eta Zero)	0.76 %
EBP	222 Hz



## NOTES

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