Loudspeakers

CONTENTS

SURVEY OF LOUDSPEAKER TYPES

STANDARD RANGE

nominal size (inches)	shape of flange	basic part of type No. [1]	versions [2]	max. power (W)	old type number (basic part)	page
2½	round	AD2070	Z4, Z8, Z15, Z25	0.5	AD3207	D31
3	round	AD3070	Y4, Y8, Y15, Y25	1	–	D33
3	square	AD3370	Y150	1	–	4)
3 x 5	oval	AD3590	X4, X8, X15, X50, X400	2	AD3359	D37
4	round	AD4070	Y4, Y8, Y15, Y25	1	–	D43
4	round	AD4080	X4, X8, X15, X25	3	–	D45
4	round	AD4090	X8, X15	2	AD3419	D47
			X400	0.6		
3 x 8	oval	–	(X4)	2	AD3386RX	D35
			(X15)	2	AD3386PX	
3 x 8	oval	AD3890	X4, X8	2	–	4)
4 x 6	oval	AD4680	Z4, Z8, Z15, Z25	3	–	D51
			M4, M8, M15, M25	4		
			X4, X8, X15, X25	6		
4 x 6	oval	AD4690	M4, M50, M400,	4	AD3469	
			M800	4		4)
5	octag.	AD5080	Z4, Z8, Z15, Z25	3	–	D57
			M4, M8, M15, M25	4		
			X4, X8, X15, X25	6		
5 x 7	oval	AD5780	X4, X8, X15, X25	4	–	D59
			M4, M8, M15, M25	4		
6½	octag.	AD7080	M4, M8	4	–	D65
			X4, X8	6		
6½	octag.	AD7091 [3]	X4, X8	3	AD3729	D67
			M4, M800	3		

1) A complete type No. is composed of a basic part, a stroke and a version code, e.g. AD2070/Z4, AD7091/M800.

2) Letter for type of response characteristic (see General section), followed by the nominal impedance in Ω.

3) Inverted magnet system.

4) Data sheets will be issued separately.

nominal size (inches)	shape of flange	basic part of type No. 1)	versions 2)	max. power (W)	old type number (basic part)	page
6 x 9	oval	–	(X4)	6	AD3696RX	D39
			(M4)	6	AD3696RM	
			(M8)	6	AD3696SM	
6 x 9	oval	AD6980	X4, X8, M4, M8	6	–	4)
8	octag.	–	(X4)		AD3806RX	D41
			(X8)		AD3806SX	
			(M4)		AD3806RM	
			(M8)		AD3806SM	
8	octag.	AD8080	X4, X8, M4, M8	6	–	4)

SPECIAL AND HIGH QUALITY LOUDSPEAKERS

Tweeters

$2\frac{1}{4}$	round	AD2070	T4, T8	10 5)	–	D29
4	square	AD4490	T4, T8	10	AD3408	D49

Woofers

5	octag.	AD5060	W4, W8	10 6)	AD3503	D55
$6\frac{1}{2}$	octag.	AD7065	W8	20 6)	AD3703	D63
8	octag.	AD8065	W8	20 6)	AD3803	D71
10	round	AD1055	W8	40 6)	–	D11
12	round	AD1255	W8	20	AD5201	D17

Wide frequency range

5	octag.	AD5060	M4, M8	6	AD3501	D53
$6\frac{1}{2}$	octag.	AD7060	M5	10	AD3701	D61
8	octag.	AD8050	M5	6	AD4800	D69
$8\frac{1}{2}$	round	–	M7	10	9710M/01	D73
			M800	10	9710AM/01	
10	round	AD1050	M7, M800	10	AD4000	D9
12	round	AD1250	M7, M800	20	AD4200	D11
12	round	AD1255	M7, M800	20	AD5200	D15
12	round	AD1260	M5	10	AD4201	D27

4) Data sheets will be issued seperately.
5) With 5 μF in series.
6) In a closed acoustic box of specified volume.

GENERAL

INTRODUCTION

A correctly chosen loudspeaker is essential to obtain adequate acoustic results from electro-acoustic equipment. The following factors should be considered.

- Shape, size and attachment with reference to the available space.
- Quality and sensitivity, a compromise between fidelity of reproduction and price.
- The frequency-response characteristic in relation to the kind of application.
- Impedance and power-handling capacity, which should be adapted to the output stage of the equipment.
- Appearance and finish.

With a view to these factors our loudspeakers are divided into three groups:

Standard speakers

The standard speakers form an extensive group offering a diversity in characteristics, size and price for all kinds of radio and television sets, gramophones, tape recorders, sound columns, etc.

Most standard speakers have a flat magnet system of powerful Ferroxdure. For television sets and other applications where the leakage field should be as small as possible, there are loudspeakers having a Ticonal magnet in a pot system. Due to the use of Ticonal 750 these pot systems are very small.

Special speakers

The special speakers have specific applications.

High-quality speakers

The high-quality speakers have been specially designed for use in Hi-Fi equipment, where a high power-handling capacity, a very wide frequency-range and a negligible distortion level are required. Examples of application: acoustic boxes, bass-reflex boxes, juke boxes, Hi-Fi enclosures with or without cross-over network and stereo columns.

NEW COMMERCIAL CODING SYSTEM

AD5080/M25
AD1255/W8

ADxx xx/xx

Nominal size and shape

20 = $2\frac{1}{4}$-$2\frac{1}{2}$ in round
30 = 3 in round
33 = 3 in square
35 = 3 x 5 in oval
38 = 3 x 8 in oval
40 = 4 in round
44 = 4 in square
46 = 4 x 6 in oval
50 = 5 in round
57 = 5 x 7 in oval
69 = 6 x 9 in oval
70 = $6\frac{1}{2}$ in round
80 = 8 in round
10 = 10 in round
12 = 12 in round

Nominal impedance: direct in Ω

Type of response curve

Z = Notably higher sensitivity around a response peak at about 3 kHz
Y = Notably higher response level in the region 2 to 6 kHz
X = Same as Y, but a wider frequency range
M = Smooth response over wide frequency range
W = Woofer, extremely low resonance frequency
T = Tweeter, high frequency range

Magnet system

90[1] = sinterpot
80 = ferroxdure standard round
70 = ferroxdure square
65 = ferroxdure big, high quality
60 = ferroxdure small, high quality
55 = "Ticonal" big, high quality
50 = "Ticonal" small, high quality

IMPEDANCES

The nominal impedance is the lowest impedance on the impedance/frequency curve measured at the high-frequency side of the resonance peak.
Loudspeakers with impedances not given in the data sheets are available to special order. Details on request.

1) Mechanical or acoustical variations are indicated by replacing 0 or 5 by some other figure (91 = Sinterpot Wafer).

FREQUENCY RESPONSE CURVES

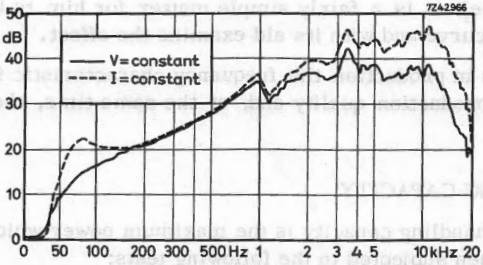
Measuring conditions

The frequency-response curves are measured under the following conditions:

1. recorded in anechoic room;
2. without baffle;
3. microphone in axis of loudspeaker at a distance of 50 cm;
4. input 50 mW (12" high-quality types 25 mW);
5. constant voltage;
6. 0 dB of the curves corresponds with 52 dB above 2×10^{-4} μbar.

Comparing a constant-current characteristic of any loudspeaker with a constant-voltage one, we find the latter flatter in the region of the resonance frequency, whereas it drops more abruptly at the higher frequencies. This is explained as follows:

The power which moves the coil and the cone is proportional to the current through the coil. In the case of constant voltage the current will decline, as a consequence of rising coil impedance, in the neighbourhood of the resonance frequency and at higher frequencies. The result is a dropping sound pressure in these frequency regions. This should be borne in mind when comparing our response curves with those of other documentations.



The use of response curves

First of all we wish to emphasise that these curves should be used exclusively for comparison.

Never compare curves which are not based on one and the same measuring method (identical measuring equipment, measuring room, distance, power input and, even, identically mounted speakers). Only experienced experts are able to compare response curves not based on exactly identical conditions. Also the condition of the anechoic chamber may greatly affect the results.

Contrary to many other manufacturers' methods, frequency characteristics of our loudspeakers were determined without a baffle.

The response curves for making comparisons

The response curve does help us to disclose differences in reproduction quality. The comparison of curves determined under identical conditions may give a picture of a few acoustical aspects. A difference in level means a difference in sensitivity (efficiency) in various frequency regions. A difference in width means a difference in frequency range.

One should never forget, however, that the curves represent the sound pressure only in the centre of a circular plane. Since the distribution of the sound pressure is not uniform over the plane and different in various cases, the sound impression may differ more than the response curves suggest.

It will be evident that a high degree of expertness is required to interpret the differences in response curves. For the greater part, this expertness is gained through experience.

Response curves an aid for the manufacturer

Response curves play a great part in the development of loudspeakers, pinpointing their acoustic characteristics, manufacture and production checks.

It is but a small problem for the development engineer to establish response curves required for a particular application. And then, as the acoustic characteristics of a speaker are largely associated with its moving parts (coil, centring ring and cone), it is a fairly simple matter for him to base modifications on the frequency curve and with its aid examine the effect.

For loudspeakers in production the frequency characteristic is excellently useful to check the production quality and, at the same time, the sensitivity of the magnet system.

POWER HANDLING CAPACITY

The rated power handling capacity is the maximum power which the loudspeaker can withstand, when subjected to the following tests:

1. Operational test.
   A test voltage of audio frequency is applied to the loudspeaker. The loudspeaker is then checked for buzz, chips, rattle, or cone break-up. The test voltage $V = 0.7 \times \sqrt{Z \times P_{max}}$, where Z = nominal impedance in ohms and P_{max} = power handling capacity in watts.
2. Continuous load test.
   100 hours life-test conforming to DIN 45573 - sheet 2 with a test-power of P_{max} and a white noise generator.

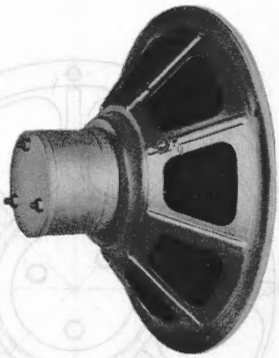
FINISH

The loudspeakers are tropic-proof, and cadmium-plated to prevent corrosion.

10" HIGH-QUALITY LOUDSPEAKERS

Primary application

Hi-Fi and stereo equipment (see "Enclosures").

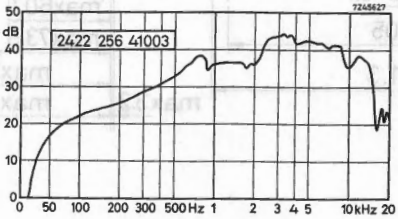


RZ 14210-5

Details

Very high sensitivity, Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curves.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

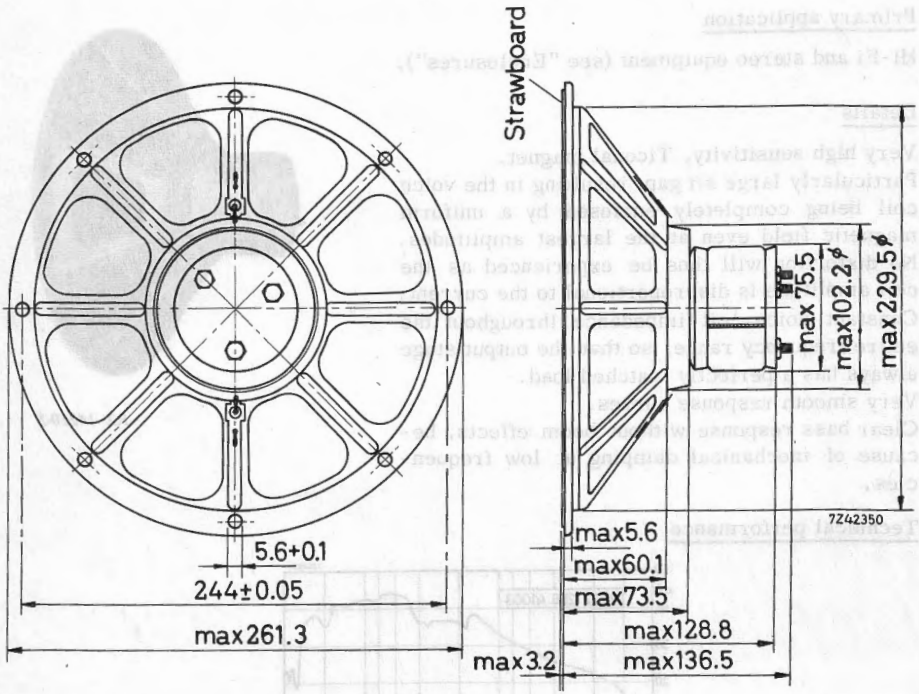
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M7	M	7	10	50	98 000	8000	2422 256 41003
M800	M	800	10	50	98 000	8000	2422 156 41002

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

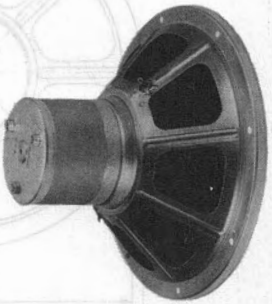


Weight: 1.77 kg

10 in HIGH-QUALITY WOOFER LOUDSPEAKER

Application

In acoustic enclosures for Hi-Fi reproduction; suitable for frequencies of 18 to 1000 Hz. See data sheet on the 40 W combination with AD5060/M8 and AD3506SM or AD5080/M8 in an acoustic box of 35 litres.

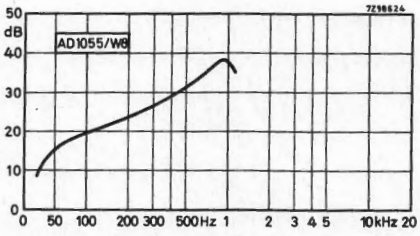


RZ 25052-31

Construction

Ticonal magnet.
Weight of magnet 880 g.
Constant flux through moving voice coil resulting in a low distortion.
Rigid paper cone with highly flexible butyl-rubber suspension.

Technical performance

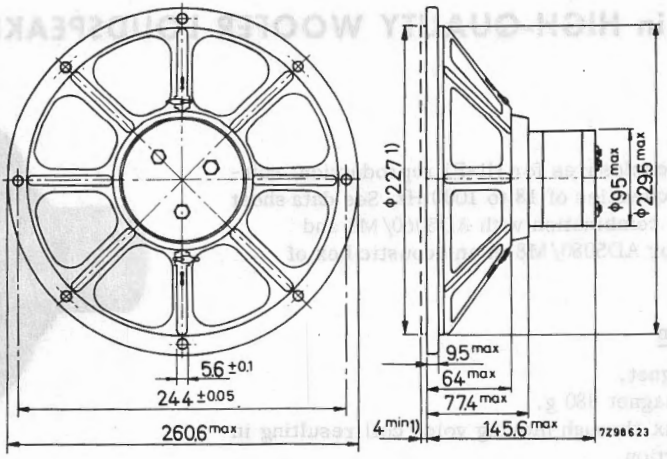


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [2]
W8	W	8	40 [1]	24	130 000	> 9000	4304 078 70261

[1]) In an acoustic enclosure of max. 35 litres, and conforming to DIN45573.

[2]) For bulk packing the catal. No. is 4304 079 01001; for single-unit packing the catal. No. is 4304 079 01021.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at 40 W input.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 3 kg

12" HIGH-QUALITY LOUDSPEAKERS

RZ 19741-15

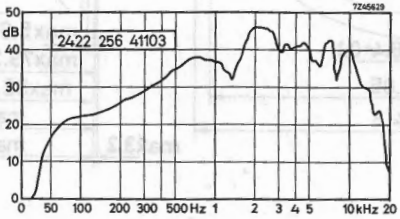
Primary application

Hi-Fi installations.

Details

Very high sensitivity, Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curve.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

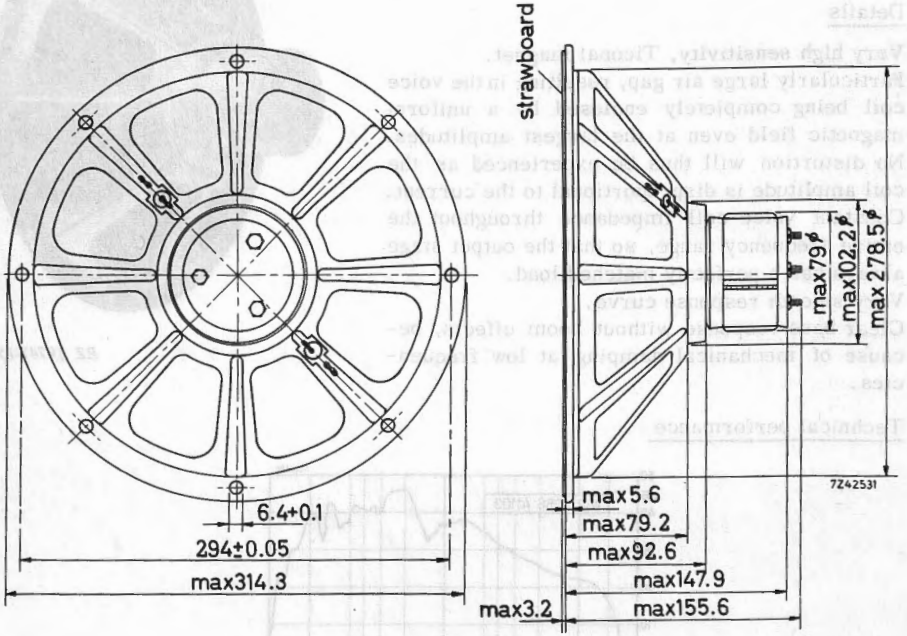
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M7	M	7	20	50	98 000	8000	2422 256 41103
M800	M	800	20	50	98 000	8000	2422 256 41102

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 1.8 kg

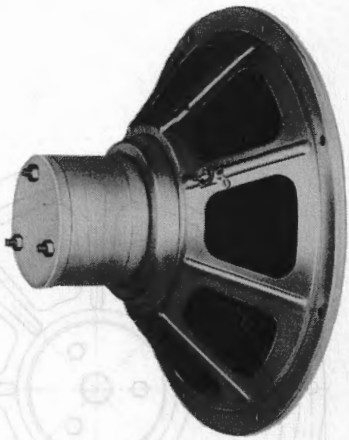
12" HIGH-QUALITY LOUDSPEAKERS

Primary application

Hi-Fi installations.

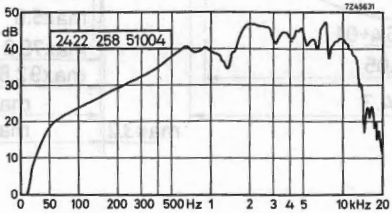
Details

Extremely high sensitivity thanks to the use of a very powerful Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curves.
Clear bass response without boom effects, because of mechanical damping at low frequencies.



C 65219

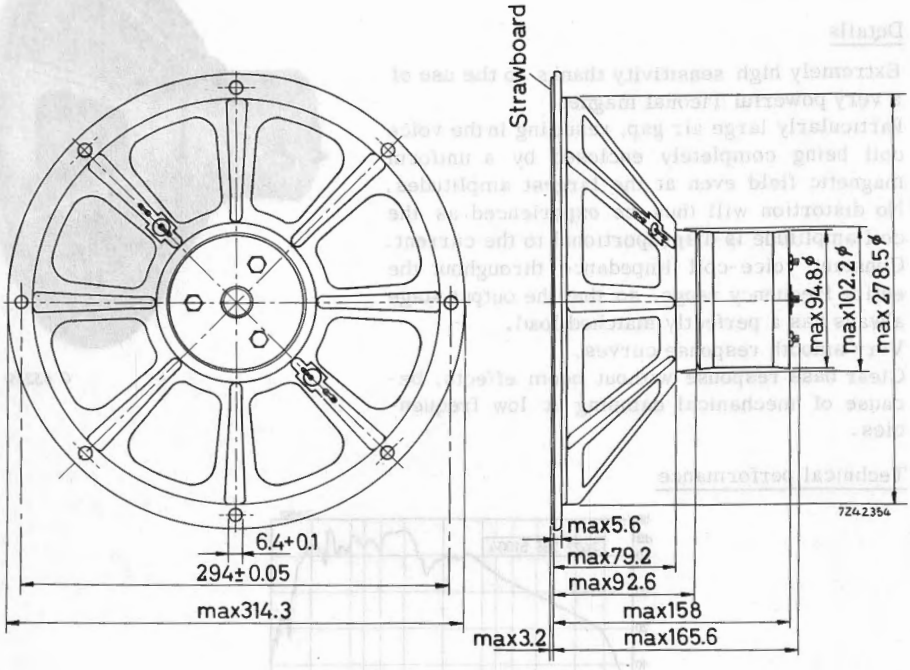
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M7	M	7	20	50	134 000	11 000	2422 258 51004
M800	M	800	20	50	134 000	11 000	2422 258 51003

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 3.5 kg

12" HIGH-QUALITY WOOFER LOUDSPEAKER

RZ 19218-1

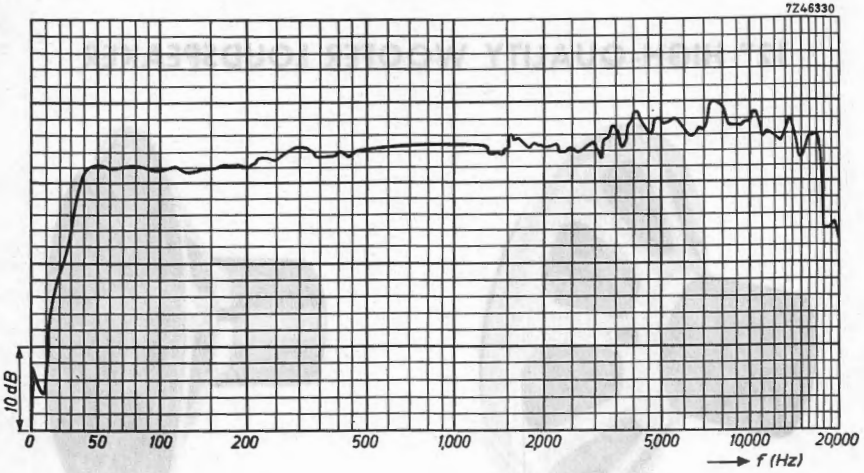
RZ 19218-2

Though the design of this woofer is based on the normal electrodynamical principle, a number of striking features make it unique in its kind. The use of new materials and techniques allowed the development of a Hi-Fi low-note speaker which, in conjunction with high and medium-note speakers and housed in an acoustically adequate enclosure, will be found a major contribution towards natural sound reproduction. Because of its specific design and characteristics, this speaker is a solitary in our programme.

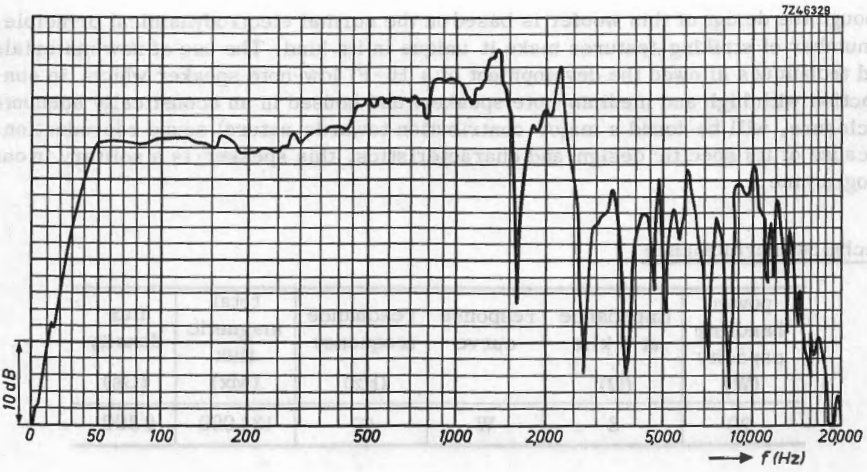
Technical performance

power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)
20	8	W	29	134 000	9 300

Catalog number, bulk packing : 2422 258 41121
single-unit packing : 2422 258 41161
on loudspeaker itself: 2422 258 41101



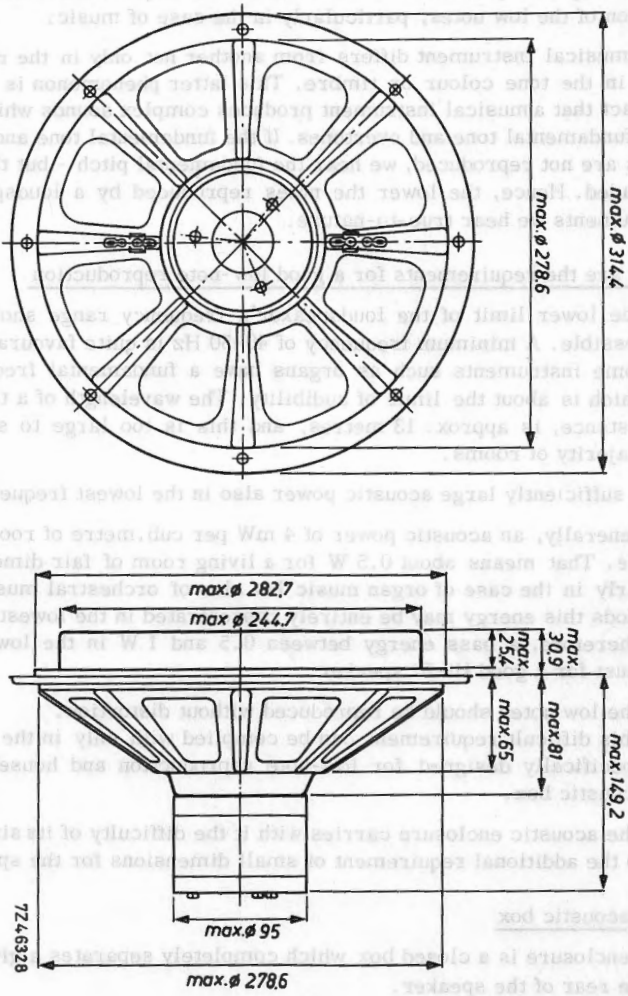
Response of the woofer in conjunction with two 5 x 7" standard speakers (M4 version) and a cross-over filter in a 45-litre acoustic box.



Response of the woofer (alone) in a 45-litre acoustic box.

Note: See also "Recommended enclosures".

Dimensions in mm



Weight: 3.5 kg

REMARKS ON LOW-NOTE REPRODUCTION

Introduction

Low notes are a perpetual obstacle on the way to Hi-Fi reproduction. Prior to discussing this problem, let us consider the importance of an effective reproduction of the low notes, particularly in the case of music.

One musical instrument differs from another not only in the range of notes but also in the tone colour or timbre. This latter phenomenon is a consequence of the fact that a musical instrument produces complex sounds which are composed of a fundamental tone and overtones. If the fundamental tone and the lower overtones are not reproduced, we hear the fundamental pitch - but the timbre will be degraded. Hence, the lower the notes reproduced by a loudspeaker, the more instruments we hear true-to-nature.

What are the requirements for a good low-note reproduction

1. The lower limit of the loudspeaker's frequency range should be as low as possible. A minimum frequency of 40-50 Hz is quite favourable.
   Some instruments such as organs have a fundamental frequency of 16 Hz, which is about the limit of audibility. The wavelength of a tone of 25 Hz, for instance, is approx. 13 metres, and this is too large to sound well in the majority of rooms.
2. A sufficiently large acoustic power also in the lowest frequencies.
3. Generally, an acoustic power of 4 mW per cub.metre of room volume is ample. That means about 0.5 W for a living room of fair dimensions. Particularly in the case of organ music but also of orchestral music, for short periods this energy may be entirely concentrated in the lowest octaves.
   Therefore, a bass energy between 0.5 and 1 W in the lowest octaves is a must for a good Hi-Fi speaker.
4. The low notes should be reproduced without distortion.
   This difficult requirement can be complied with only in the case of speakers specifically designed for low-note reproduction and housed in an adequate acoustic box.
5. The acoustic enclosure carries with it the difficulty of its size, and this leads to the additional requirement of small dimensions for the speaker system.

The acoustic box

The enclosure is a closed box which completely separates a given volume of air at the rear of the speaker.

Advantages

1. Between the so-called relaxation frequency (800-1000 Hz) and the frequency resonance, the low-note reproduction is improved by about 6 dB per octave with regard to a speaker without baffle.
   The acoustic box acts, as it were, as a baffle of infinite size.
2. The separated air volume accomplishes an effective damping and, hence, an increased loadability.
3. The separated air volume increases the stiffness of the cone suspension and so prevents distortion due to non-linearity of the cone movement.

Drawbacks

1. The separated air raises the resonance frequency of the system.
2. The large box occupies much space.
   With this woofer, these drawbacks are limited to the strict minimum.

The loudspeaker

The following equation applies to the acoustic power produced by a loudspeaker:

$W = k \times f^4 \times s^2 \times A^2$, where
W = the acoustic energy in watts,
f = the frequency,
s = the stroke of the moving coil,
A = the area of the cone.

This implies that the product sA should be large enough to render, also in the lowest octaves, the required quantity of acoustic power (s is two times the amplitude of the coil movement in the air gap).

For a satisfactory low-note reproduction, the self-resonance of the speaker should be as low as possible, and also the resonance increase resulting from the insertion in a box. This increase will be greater when the box volume is smaller and the cone diameter larger. Hence, to obtain the final resonance-frequency of the system as low as possible at a box volume as small as possible, the cone diameter should not be chosen too large.

In order nevertheless to have a large product sxA, a large stroke is therefore a requirement of pre-eminent importance.
For the avoidance of distortion, notwithstanding the long stroke of the coil, the following requirements should be met.

Even in its ultimate positions, the coil should remain within the homogeneous magnetic field.
The reaction of cone and centring ring should always be in accordance with the coil movements.

This means that the cone suspension should be flexible, that the cone itself should be stiff, and that the non-harmonic movements of cone and centring ring should be adequately damped. Furthermore, an efficiency as high as possible is of importance to acquire the maximum acoustic output with the minimum electric input. This requires, among other things, a powerful magnetic field, a light cone and a light centring ring. Requirements to obtain a low resonance frequency are, inter alia, a flexible cone suspension and a not too small cone mass, which involves a fairly large cone diameter.

To complete the situation, we observe that an adequate loadability requires an effective damping and, therefore, a not too large volume of separated air, a sufficiently strong cone and a sturdy suspension.

From the above, the following will be clear.

The loudspeaker should have a cone of great stiffness, a powerful magnetic field, a large coil stroke in a homogeneous field, and a low resonance frequency.

The optimum compromise should be found for the stiffness of the cone suspension, the cone diameter, the cone weight and the box volume.
After a great numbre of experiments, we obtained the following as the optimum result.

DESIGN OF THE WOOFER

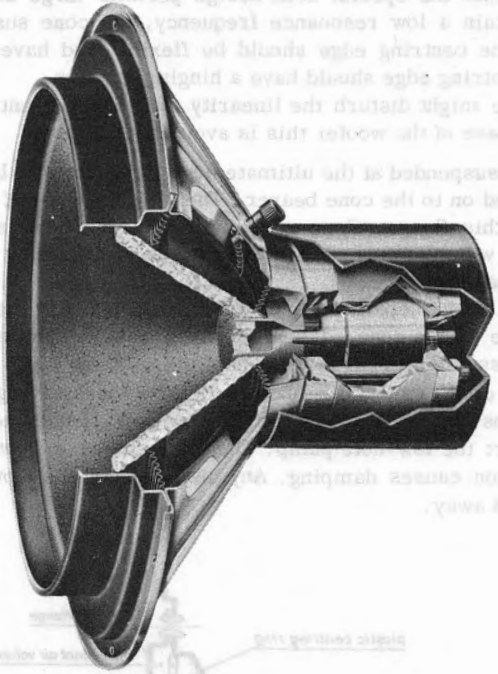
The cone

Foam plastic as the cone material guarantees a combination of great stiffness and a low mass.

Of course, though not ideal, paper is not a bad cone material; until recently, there was no second of equal strength, lightness and acoustic effect. The specific weight of cone paper is 0.2. However, the lacquer required to obtain resistance to moisture, raises the specific weight to 0.5.

The specific weight of the plastic foam used for the woofer is 0.02. That means, the thickness may be 25 times as large before the weight of a corresponding cone in paper is reached. Thus, diaphragms having a thickness of 1 cm and more can be used that are perfectly rigid. These diaphragms, included the voice coil, do not weigh more than about 12 g.

In this case, it is not necessary to stiffen the cone artificially through the box to reduce the distortion, and the dimensions of the box can be chosen purely in view of the low-note reproduction. Distortions as a result of deformations of the diaphragms are likewise out of the question.



Frequency characteristic

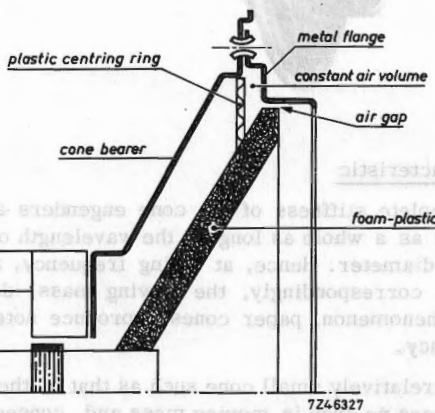
The almost complete stiffness of the cone engenders a drawback. Paper diaphragms vibrate as a whole as long as the wavelength of the tone produced exceeds the cone diameter. Hence, at rising frequency, the effective area of the paper cone and, correspondingly, the moving mass, decrease steadily. As a result of this phenomenon, paper cones reproduce notes beyond 1 kHz with an adequate efficiency.

In the case of a relatively small cone such as that of the woofer, however, rise in frequency causes no drop in moving mass and, consequently, beyond the frequency at which the cone ceases to act as a piston, no effective output is to be expected. Therefore, the woofer should be used exclusively in conjunction with other speakers for reproduction of the high and the medium notes.

Cone suspension

It will be clear that the special cone design permits large amplitudes. Therefore, and to obtain a low resonance frequency, the cone suspension should be flexible. Also the centring edge should be flexible and have a large area; the ridges in the centring edge should have a hinging function.
The hinging edge might disturb the linearity of the movement and so cause distortion. In the case of the woofer this is avoided as follows.

The cone is not suspended at the ultimate edge but somewhat lower, and a metal flange is attached on to the cone bearer. The ultimate edge of the cone moves to and fro within this flange. Cone edge, centring ring and flange form a ring-shaped chamber which is only connected to the external air by means of a narrow gap between cone and flange.
The dimensions of the separate air chamber are such that theoretically, during the entire stroke of the cone edge, the volume of the chamber remains almost constant if we assume a linear movement of the centring ring. According as non-linearity in the cone suspension tends to deform the centring ring, any change in volume pumps the air through the narrow gap. Hence the surname of this original speaker: the low-note pump. The gap acts as a flow resistance whose energy absorption causes damping. Any distortion of the moving system is, as it were, pumped away.



The permissible stroke of the cone

All causes of distortion resulting from diaphragm deformations now being eliminated, or at least substantially reduced, it is all the more important to avoid any distortion resulting from non-linearity in the diaphragm drive as well.

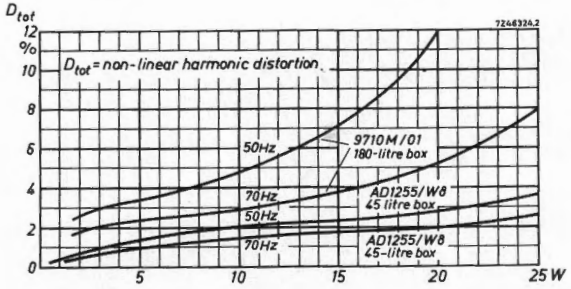
The force exerted on the voice coil is 0.1 x B x I x L, where B, is the induction, I the current through the coil and L the length of wire. At any moment and independent of the position of the coil, this force should be proportional to I and, therefore, the coil should be always in a field of constant intensity.

In principle, there are two manners to meet this condition. The first one is making the coil considerably longer than the thickness of the pole plate or, in other words, the height of the field in the air gap. An advantage of this method is a high field-intensity without a heavy magnet, which tends to keep the price low.

A disadvantage is a significant increase in mass and resistance of the coil, resulting in a drop in efficiency. Therefore, a more powerful amplifier will be required and the price of the total equipment will rise. Of even greater consequence may be the fact that the inactive part of the coil increases the internal resistance of the amplifier and so adversely affects the damping factor.

An alternative is heightening the air gap so as to keep the coil movement within the homogeneous field. In this case, the mass and the resistance of the coil can be kept as small as possible - but a drawback is, of course, the necessity of a much larger magnet. Freedom of distortion cannot be obtained on the cheap.

It is the second method that was applied to the woofer. The thickness of the pole plate is two times the length of the coil which can, thus, make a stroke of 8 mm within the homogeneous part of the filed. This stroke is an enormous feature of this speaker, the more so as - even at the stroke of this length - no distortion whatever of the signal occurs.



Non-linear distortion as a function of the input power compared with that of an $8\frac{1}{2}$", 10 W high-quality loudspeaker.

The acoustic box

Building the speaker into an enclosure of about 40 litres nett, makes the resonance frequency of 29 Hz rise to about 50 Hz.

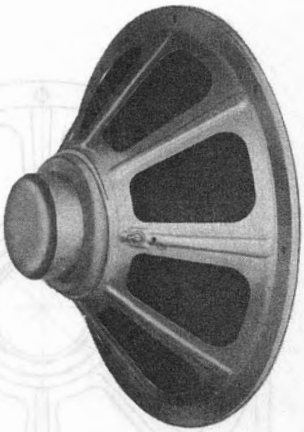
Measurements in a box of this volume demonstrated that even a 50-W load did not cause any audible distortion; in larger boxes, an energy of at least 20 W is permissible (these figures apply to normal orchestral music). In the case of musical passages such as low organ notes, where almost the entire reproduction occurs in the lowest frequencies, a smaller electric energy suffices for an adequate sound intensity.

To obtain the optimum reproduction quality, we advice to build the speaker in an enclosure of 40-50 litres nett, which results in an almost flat response curve between 40 and 1000 Hz. At a load of 30 W, the distortion is max. 3 % at half an octave beyond the resonance frequency.

Reproduction of the high and medium notes

If the speakers for these notes are housed in the same enclosure - of course in a separate room - it is not necessary to choose the cross-over frequency extra low: this would cause difficulties as regards the filter dimensions. A cross-over frequency of 800 Hz and a cut-off rate of 12 dB per octave are recommended.

12" SPECIAL LOUDSPEAKERS



RZ 14211-10

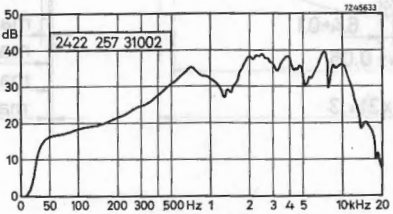
Primary application

Juke boxes; acoustic boxes for musical installations. See "Recommended enclosures".

Details

Inexpensive speaker with a reasonably good efficiency, well suitable for those installations where both costs and quality are factors of importance.
Suited for stereo reproduction because of its wide frequency range.
Ferroxdure magnet.

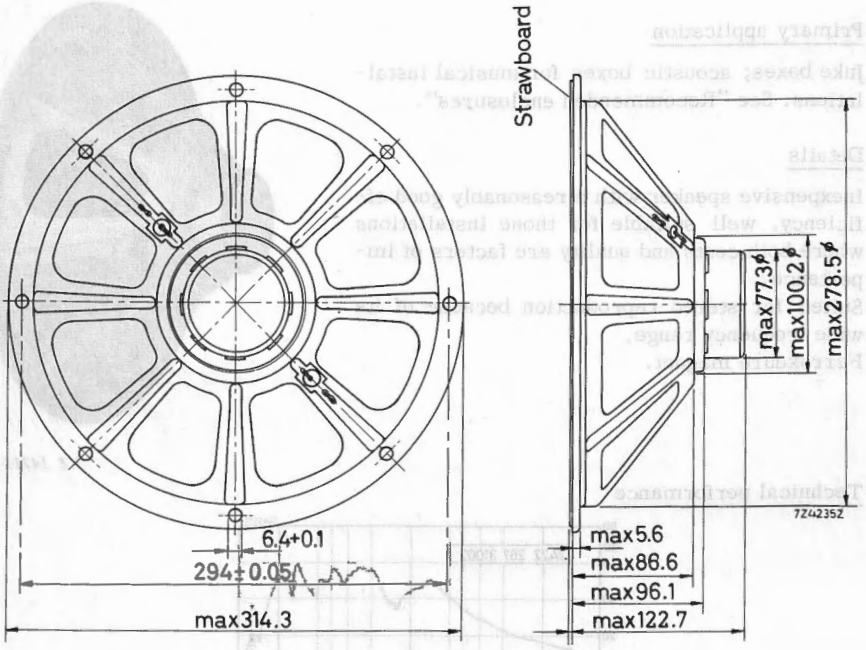
Technical performance



power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number (bulk packing) [1]
10	5	M	50	42 600	9 500	2422 257 31002

[1] When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

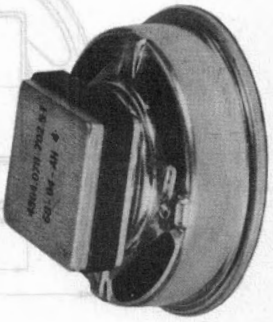


Weight: 850 g

2 1/4 in TWEETER LOUDSPEAKERS

Application

In acoustic enclosures; suitable for frequencies of 800 Hz to 19 kHz. These tweeters can be combined with the 5 in woofer AD5060/W without extra loudspeaker being necessary for the medium frequency range.

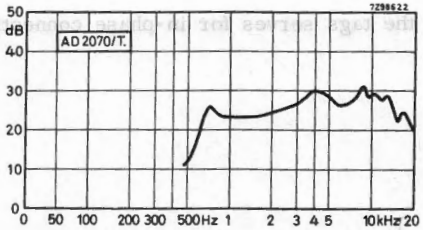


RZ 25052-32B

Construction

Flat square magnet of Ferroxdure 300 R.
Weight of magnet 20 g.

Technical performance

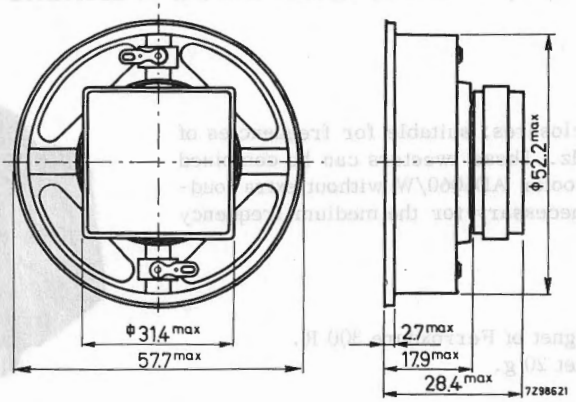


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
T4	T	4	10 1)	800	6900	> 6900	2422 257 22001
T8	T	8	10 1)	800	6900	> 6900	2422 257 22002

1) With a capacitor of 5 μF in series and a signal in conformity with DIN45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm



Baffle hole diameter 52 mm

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 70 g

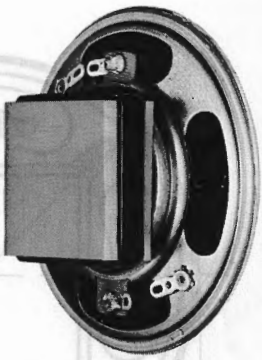
2½ in STANDARD LOUDSPEAKERS

Application

Small transistorized radios.

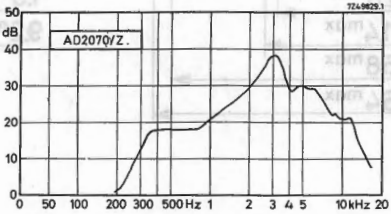
Construction

Flat square magnet of Ferroxdure 300R.



RZ 20704-2

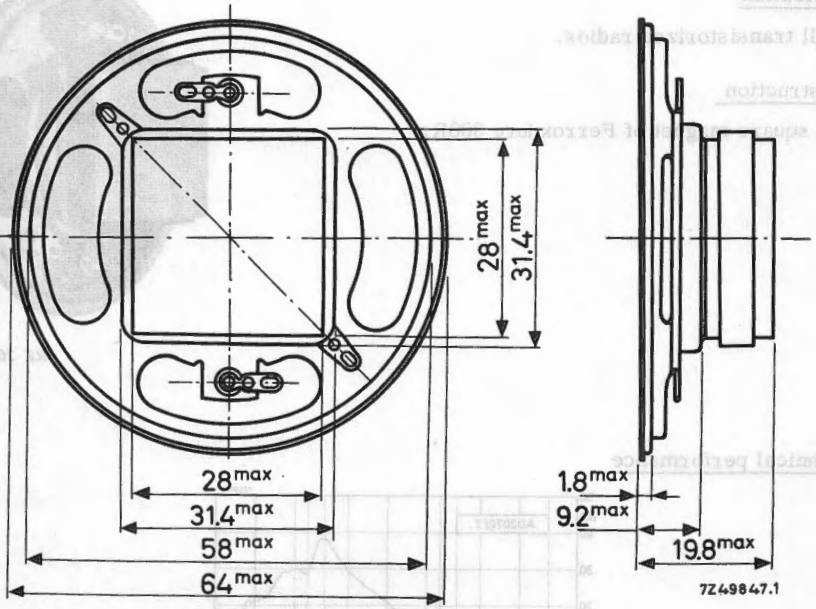
Technical performance



version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalogue number 1)
Z4	Z	4	0.5	360	6300	> 7400	2422 257 23801
Z8	Z	8	0.5	360	6300	> 7400	2422 257 23802
Z15	Z	15	0.5	360	6300	> 7400	2422 257 23803
Z25	Z	25	0.5	330	6300	> 7400	2422 257 23804

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimension in mm



Baffle hole diameter 59 mm.

Weight: 65 g

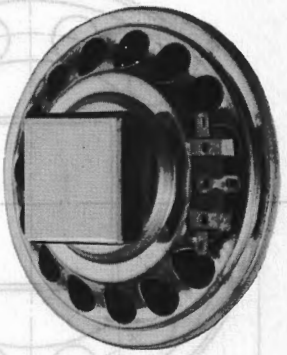
3 in STANDARD LOUDSPEAKERS

Application

Portable receivers.

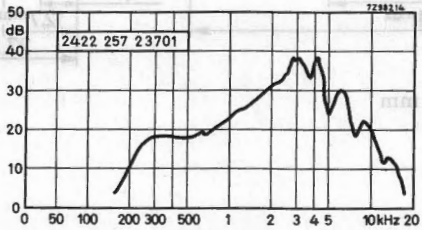
Construction

Flat square magnet system of Ferroxdure 300R.



RZ 24408-4

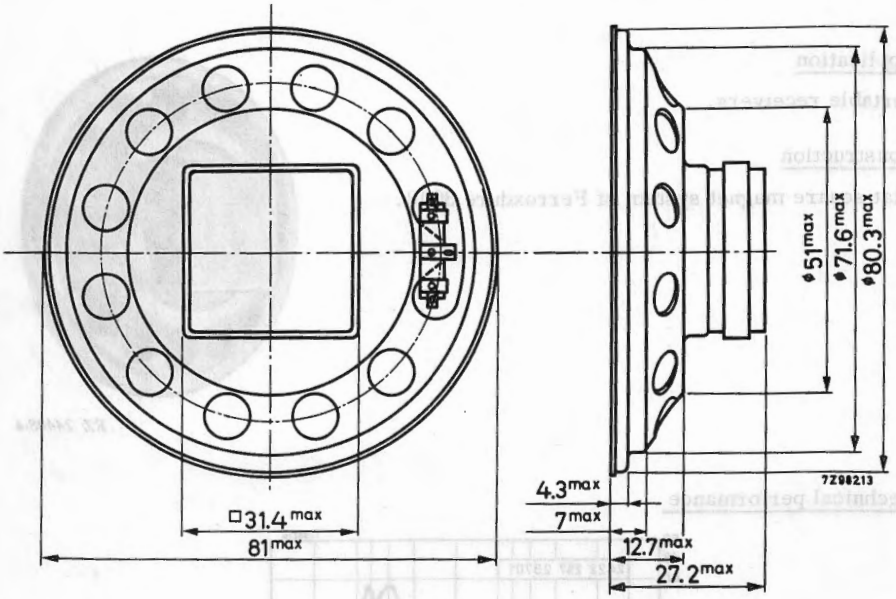
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
Y4	Y	4	1	250	6300	7500	2422 257 23701
Y8	Y	8	1	250	6300	7500	2422 257 23702
Y15	Y	15	1	250	6300	7500	2422 257 23703
Y25	Y	25	1	250	6300	7500	2422 257 23704

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Baffle hole diameter 72 mm

Weight: 75 g

3"×8" STANDARD LOUDSPEAKERS

RZ 21906-9

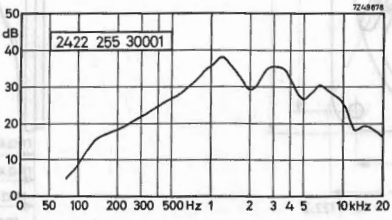
Primary application

Radio and TV receivers.

Details

Magnet of Ticonal 750 and a pressed voice coil.

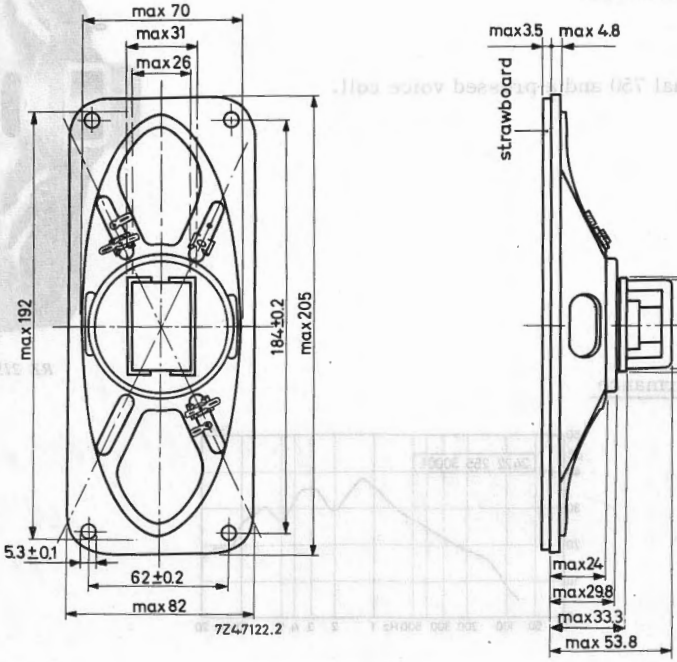
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
RX	X	4	2	130	15 800	8800	2422 255 30001
PX	X	15	2	130	15 800	8800	2422 255 30002

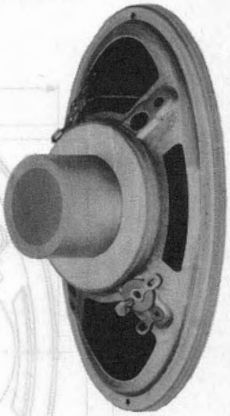
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 210 g

3 X 5 in STANDARD LOUDSPEAKERS



RZ 20704-3

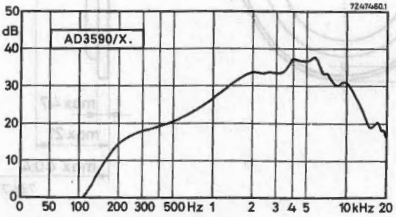
Application

TV sets, portable radios, tape recorders

Construction

Equipped with a powerful magnet of Ticonal 750 and a pot of sintered iron.
Negligible stray field (at 1 mm distance from the magnet system, the stray field is hardly measurable).

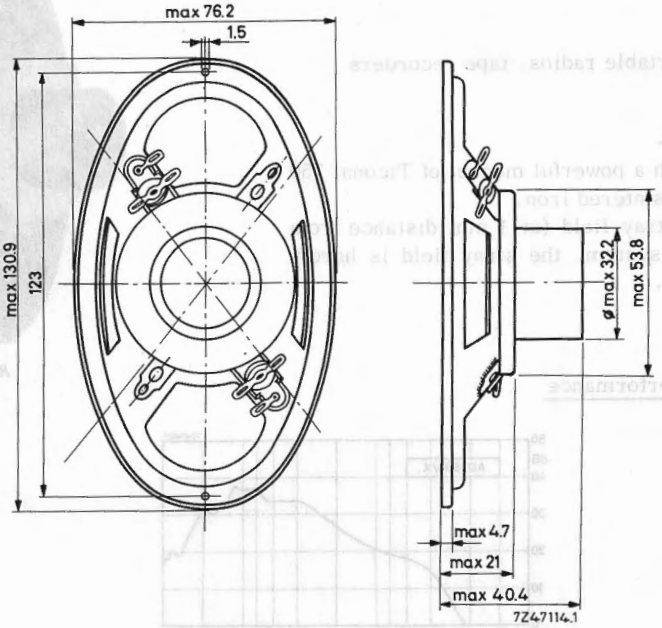
Technical performance



version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
X4	X	4	2	200	11 800	10 000	2422 256 30301
X8	X	8	2	200	11 800	10 000	2422 256 30304
X15	X	15	2	200	11 800	10 000	2422 256 30305
X50	X	50	2	200	11 800	10 000	2422 256 30302
X400	X	400	2	200	11 800	10 000	2422 256 30303

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 135 g

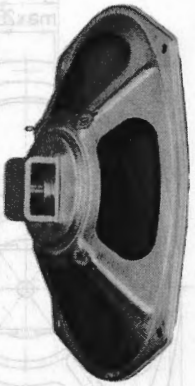
6"×9" STANDARD LOUDSPEAKERS

Primary application

AM/FM receivers, TV receivers, radiograms.

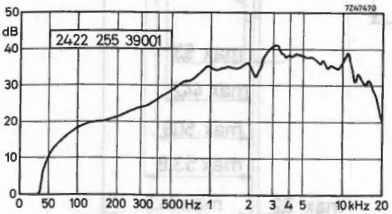
Details

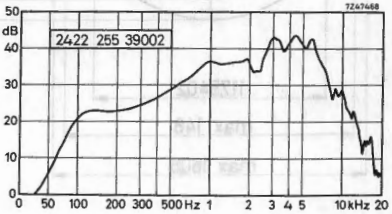
Equipped with a powerful magnet of Ticonal 750 and a pressed voice coil.



RZ 21096-6

Technical performance

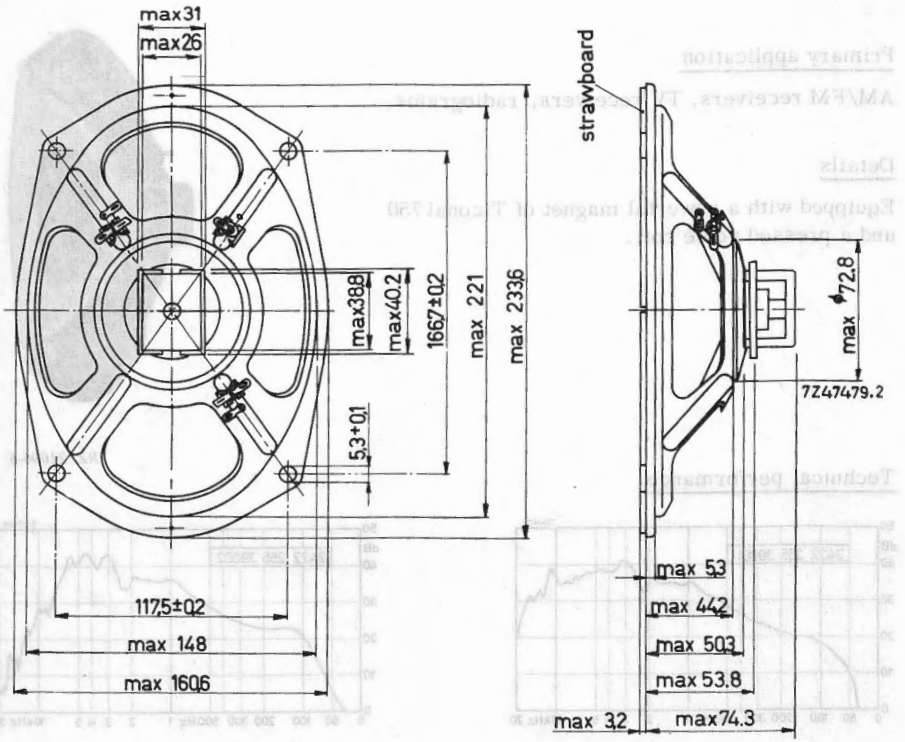




version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [1]
RM	M	4	6	77	14 500	8100	2422 255 39001
SM	M	8	6	77	14 500	8100	2422 255 39004
RX	X	4	6	85	15 800	8800	2422 255 39002

[1]) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 310 g

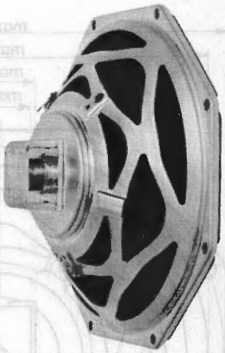
8" STANDARD LOUDSPEAKERS

Primary application

Radio and TV receivers.

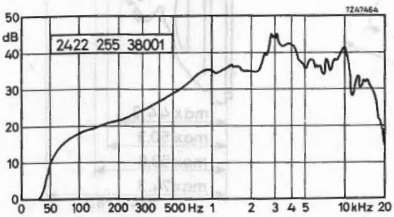
Details

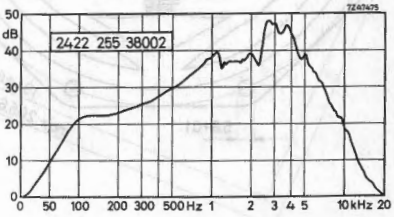
Equipped with a powerful magnet of Ticonal 750 and a pressed voice coil.



RZ 20890-12

Technical performance

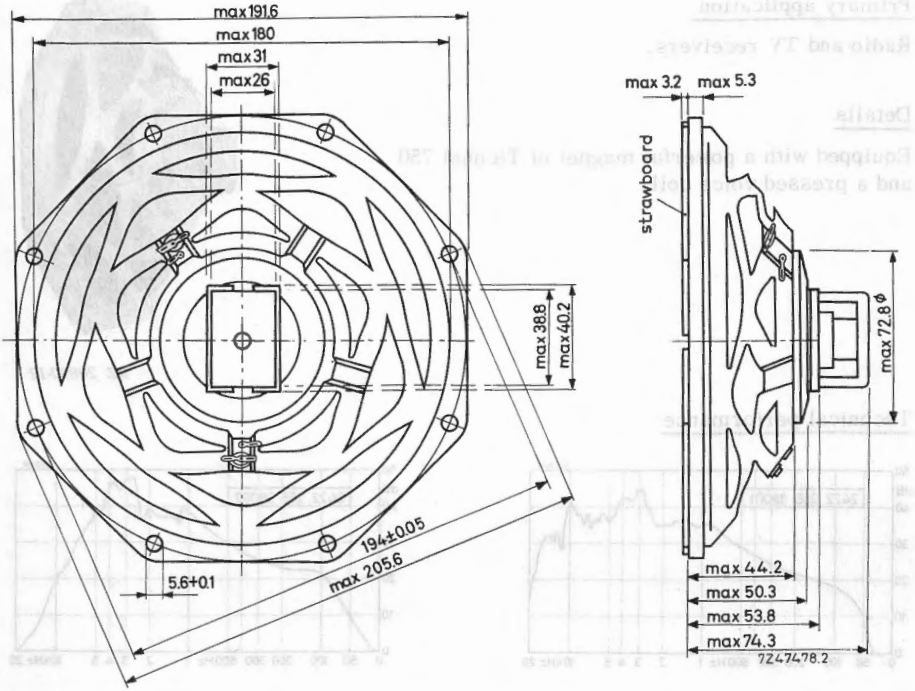




version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
RM	M	4	6	75	14 500	8100	2422 255 38001
SM	M	8	6	75	14 500	8100	2422 255 38004
RX	X	4	6	95	15 800	8800	2422 255 38002
SX	X	8	6	95	15 800	8800	2422 255 38003

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 280 g

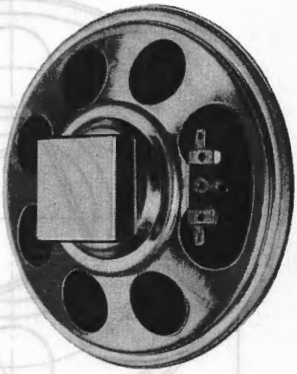
4 in STANDARD LOUDSPEAKERS

Application

Portable receivers, small tape recorders, intercoms.

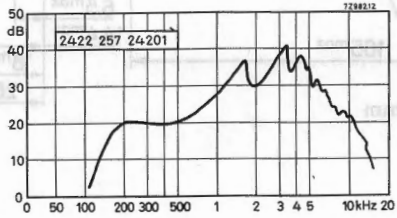
Construction

Flat square magnet system of Ferroxdure 300R.



RZ 22408-3

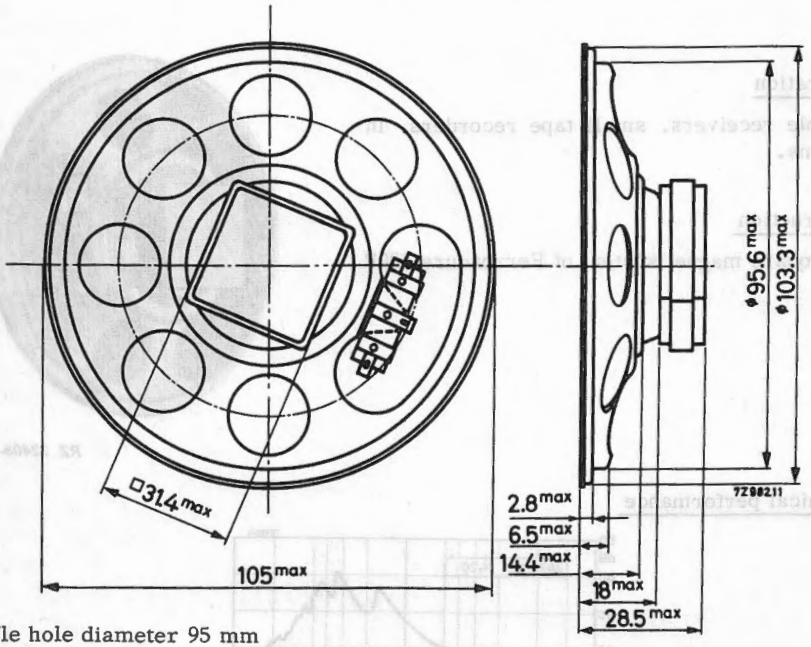
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
Y4	Y	4	1	200	6300	7400	2422 257 24201
Y8	Y	8	1	200	6300	7400	2422 257 24202
Y15	Y	15	1	200	6300	7400	2422 257 24203
Y25	Y	25	1	200	6300	7400	2422 257 24204

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Baffle hole diameter 95 mm

Weight: 85 g

4 in STANDARD LOUDSPEAKERS

Application

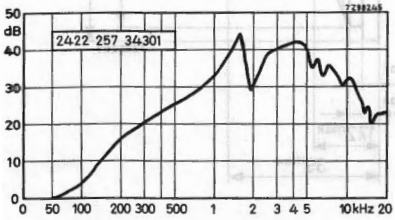
Portable receivers, small tape recorders, intercoms.

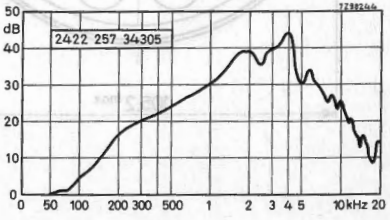
Construction

Highly sensitive magnet system of Ferroxdure 300R.

RZ 24635-1

Technical performance

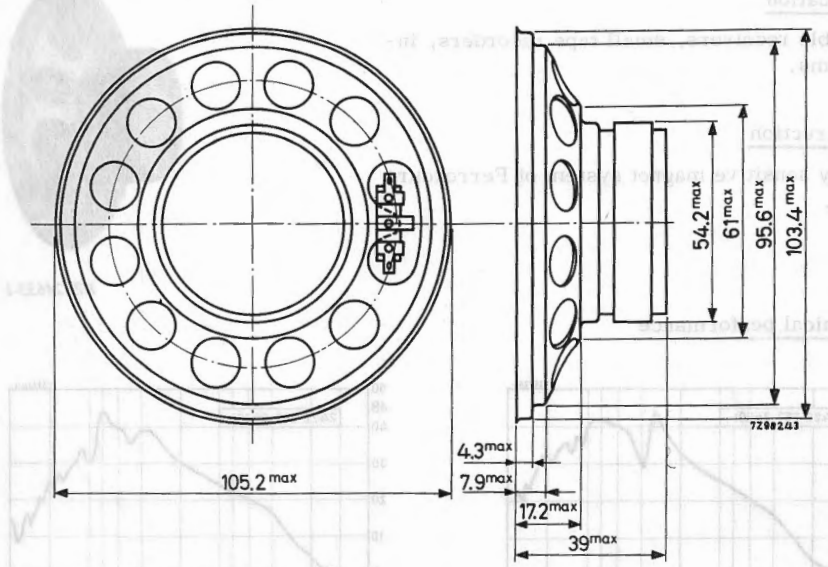




version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 1)
X4	X	4	3	165	17500	9800	2422 257 34301
X8	X	8	3	165	17500	9800	2422 257 34302
X15	X	15	3	165	17500	9800	2422 257 34303
X25	X	25	3	165	17500	9800	2422 257 34304
Z4	Z	4	3	185	17500	9800	2422 257 34305
Z8	Z	8	3	185	17500	9800	2422 257 34306
Z15	Z	15	3	185	17500	9800	2422 257 34307
Z25	Z	25	3	185	17500	9800	2422 257 34308

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Baffle hole diameter 96 mm

version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number [1]
X4	X	4	3	165	17500	9800	2422 257 34304
X8	X	8	3	165	17500	9800	2422 257 34302
X15	X	15	3	165	17500	9800	2422 257 34303
X25	X	25	3	165	17500	9800	2422 257 34304
Z4	Z	4	3	185	17500	9800	2422 257 34305
Z8	Z	8	3	185	17500	9800	2422 257 34306
Z15	Z	15	3	185	17500	9800	2422 257 34307
Z25	Z	25	3	185	17500	9800	2422 257 34308

Weight: 250 g

[1] When ordering, the last but one digit should be 2 for bulk packing and 0 for single-unit packing.

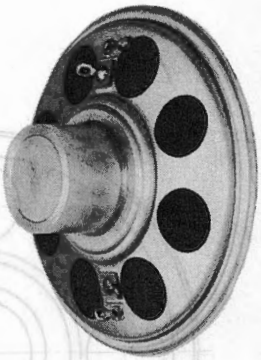
4 in STANDARD LOUDSPEAKERS

Primary application

Portable receivers (in particular for AM/FM)

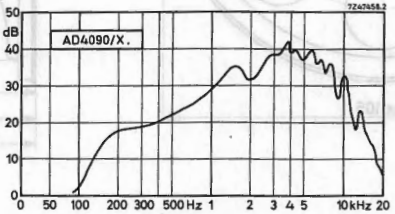
Details

High sensitivity
Magnet of Ticonal 750 and a pot of sintered iron.
Negligible stray field (at 1 mm distance from the magnet system, the stray field is hardly measurable).



RZ 20704-5

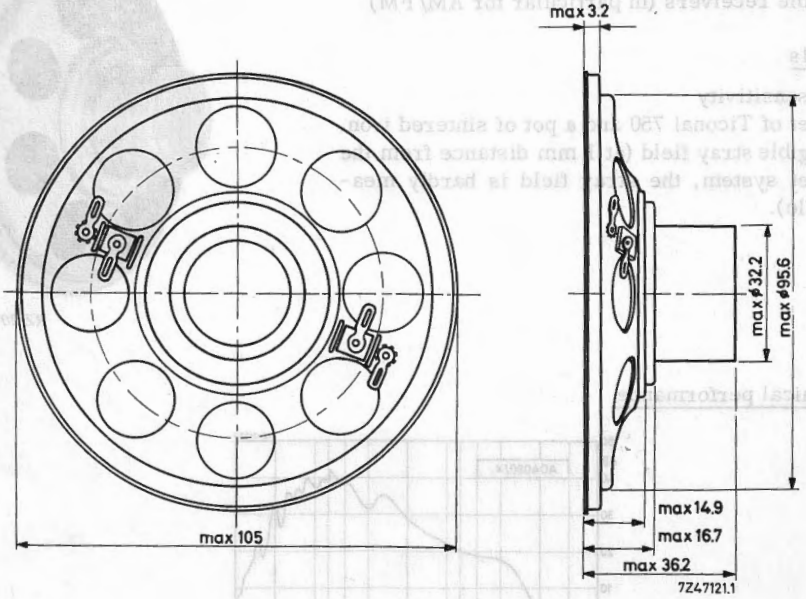
Technical performance



version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number [1]
X8	X	8	2	180	11 800	10 000	2422 256 34301
X15	X	15	2	175	11 800	10 000	2422 256 34302
X400	X	400	0.6	190	11 800	10 000	2422 256 34303

[1] When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

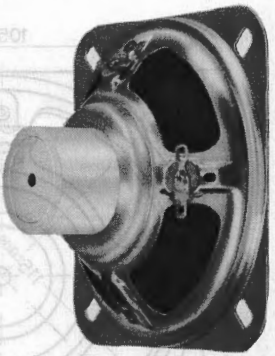


Weight: 125 g

4" HIGH-QUALITY TWEETER LOUDSPEAKERS

Primary applications

Hi-Fi high-note reproduction. Particularly suitable for use in combination with high-quality loudspeakers for low- and medium-note reproduction.

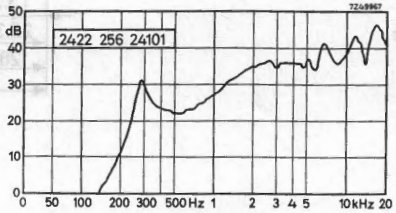


RZ 21906-5

Details

Equipped with a relatively small, but nevertheless powerful magnet of Ticonal 750, which ensures a high efficiency.
Rigid cone suspension.
Reproduction of high frequencies up to over 20 kHz.

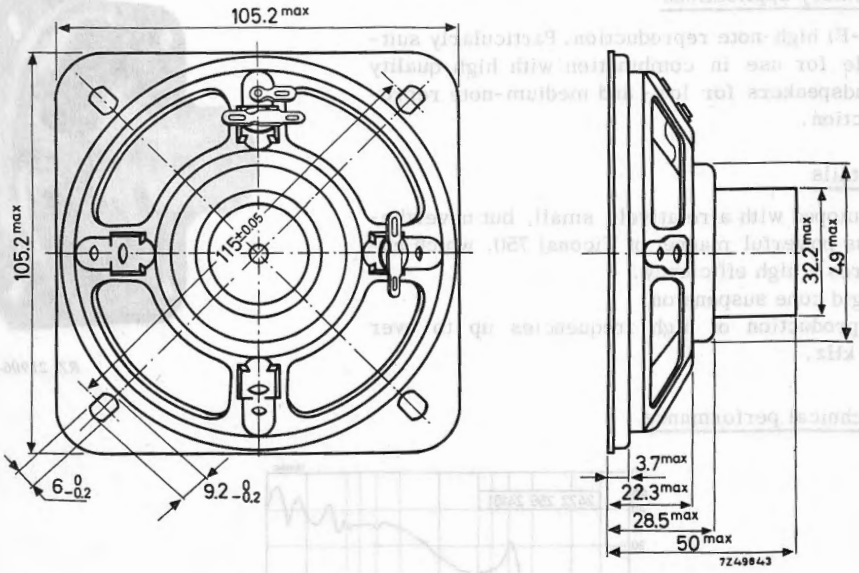
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [1]
T4	T	4	10	300	18 800	> 7000	2422 256 24102
T8	T	8	10	300	18 800	> 7000	2422 256 24101

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

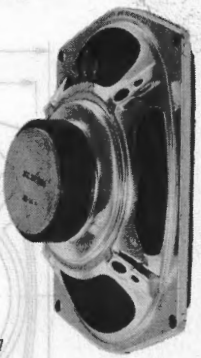


Baffle hole diameter 96 mm.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 140 g

4 x 6 in STANDARD LOUDSPEAKERS



RZ 25809-1

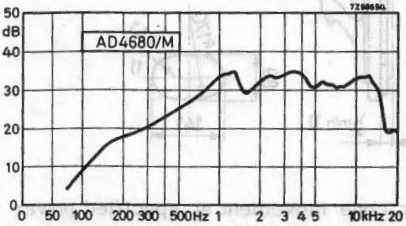
Application

Radios (car and domestic), tape recorders and TV receivers.

Construction

Round magnet of Ferroxdure 300R.
Weight of magnet 100 g.
Pressed voice coil.

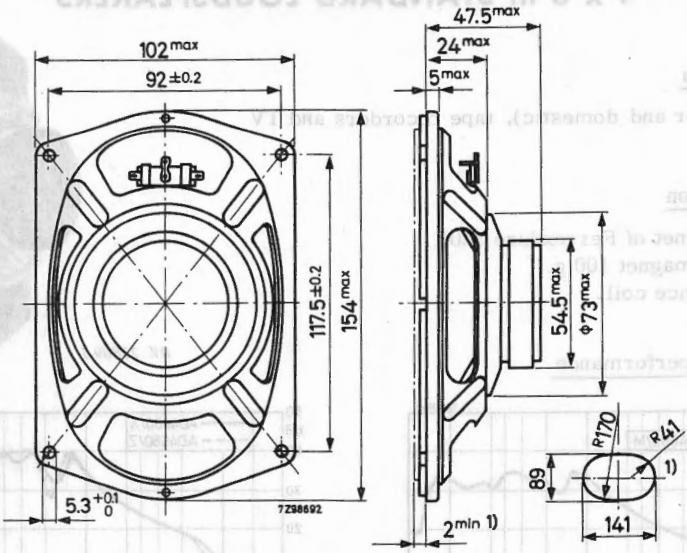
Technical performance



version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
M4	M	4	4 1)	125	18 000	> 10 000	2422 257 30209
M8	M	8					2422 257 30211
M15	M	15					2422 257 30212
M25	M	25					2422 257 30213
X4	X	4	6 1)	140	18 000	> 10 000	2422 257 30205
X8	X	8					2422 257 30206
X15	X	15					2422 257 30207
X25	X	25					2422 257 30208
Z4	Z	4	3 1)	155	18 000	> 10 000	2422 257 30201
Z8	Z	8					2422 257 30202
Z15	Z	15					2422 257 30203
Z25	Z	25					2422 257 30204

1) With an input signal in conformity with DIN 45573.
2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at specified power handling capacity.

A red mark near one of the tags serves for in-phase connection with other loudspeakers.

Weight: 0.26 kg.

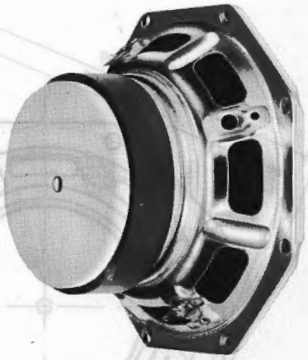
5 in HIGH-QUALITY LOUDSPEAKERS

Primary application

5-8 litres acoustic enclosures.

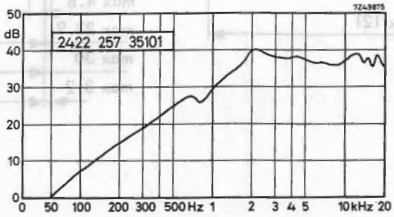
Details

Equipped with a very sensitive Ferroxdure magnet system.
Special textile cone rim allows large amplitudes of the cone movements at low frequencies. This results in an optimum bass reproduction in the smallest enclosures. Low resonance frequency and wide frequency range.



RZ 21906-13

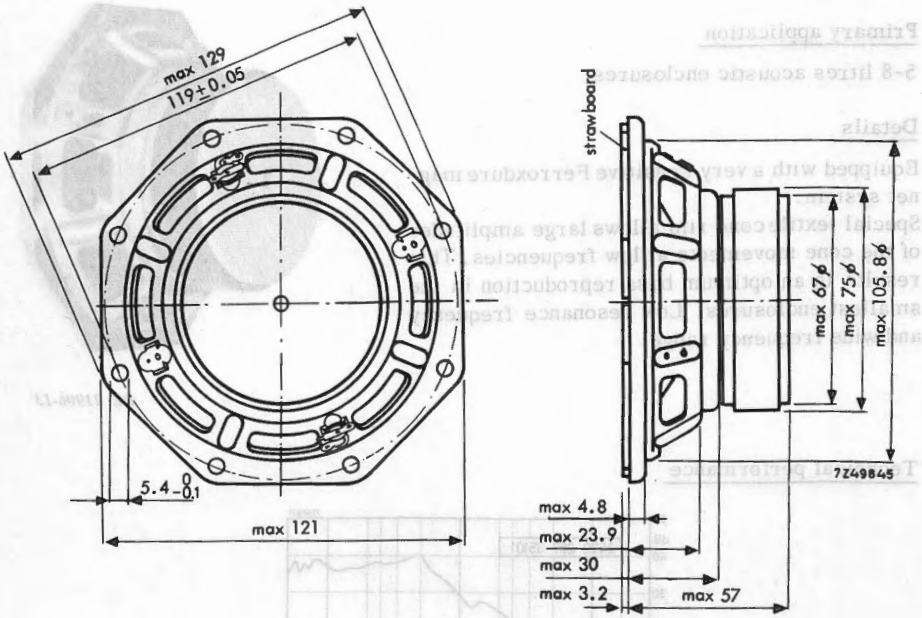
Technical performance



version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [1]
M4	M	4	6	85	29400	9800	2422 257 35101
M8	M	8	6	85	29400	9800	2422 257 35102

[1]) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 655 g

5 in WOOFER LOUDSPEAKERS

Application

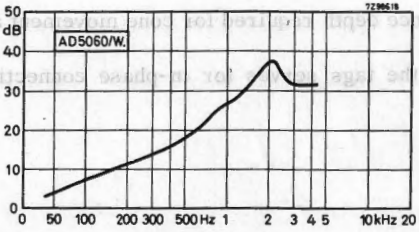
In very small acoustic enclosures; suitable for frequencies of 38 to 2000 Hz. See data sheet on the 10 W combination with tweeter AD2070/T in an acoustic box of 3 litres.

RZ 25052-32A

Construction

Round magnet of Ferroxdure 300R.
Weight of magnet 260 g.
Constant flux through moving voice coil. Rigid paper cone with a highly flexible butyl-rubber suspension.

Technical performance

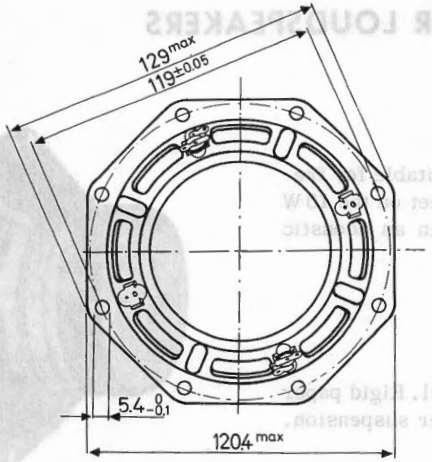


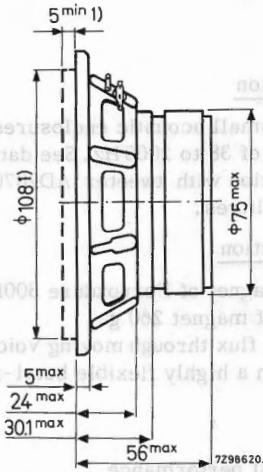
version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [2]
W4	W	4	10 [1]	50	39000	> 9300	2422 257 35301
W8	W	8	10 [1]	50	39000	> 9300	2422 257 35302

1) In an acoustic enclosure of max. 3 litres, and conforming to DIN45573.

2) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm





1) Baffle hole and clearance depth required for cone movement at 10 W input.

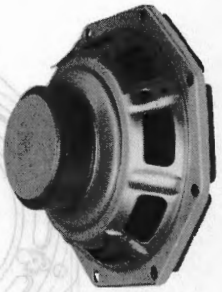
A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 700 g

5 in STANDARD LOUDSPEAKERS

Application

Radios (car and domestic), television sets, tape recorders, portable gramophones, intercoms.

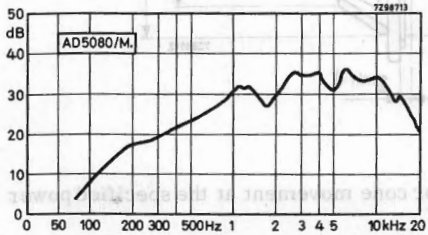


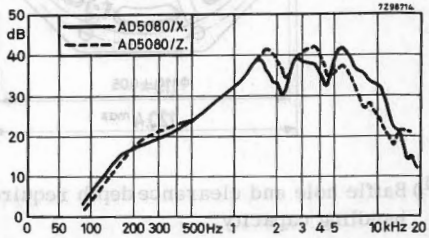
Construction

Round magnet of Ferroxdure 300R.
Magnet mass 100 g.

Technical performance

RZ 25905-1



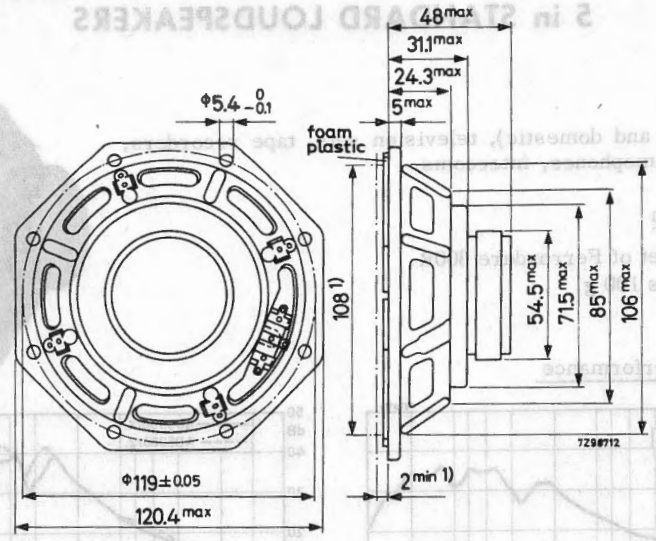


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 2)
M4	M	4	4 1)	130	18000	> 10000	2422 257 35209
M8		8					11
M15		15					12
M25		25					13
X4	X	4	6 1)	140	18000	> 10000	2422 257 35205
X8		8					06
X15		15					07
X25		25					08
Z4	Z	4	3 1)	155	18000	> 10000	2422 257 35201
Z8		8					02
Z15		15					03
Z25		25					04

1) Signal in conformity with DIN45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at the specified power handling capacity.

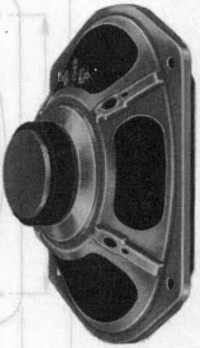
A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 260 g

5x7 in STANDARD LOUDSPEAKERS

Application

Radios (car and domestic), television sets, portable gramophones, acoustic enclosures.

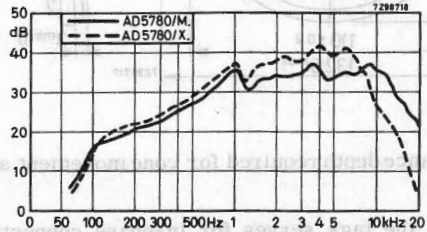


RZ 25809-4

Construction

Round magnet of Ferroxdure 300R.
Magnet mass 100 g.

Technical performance

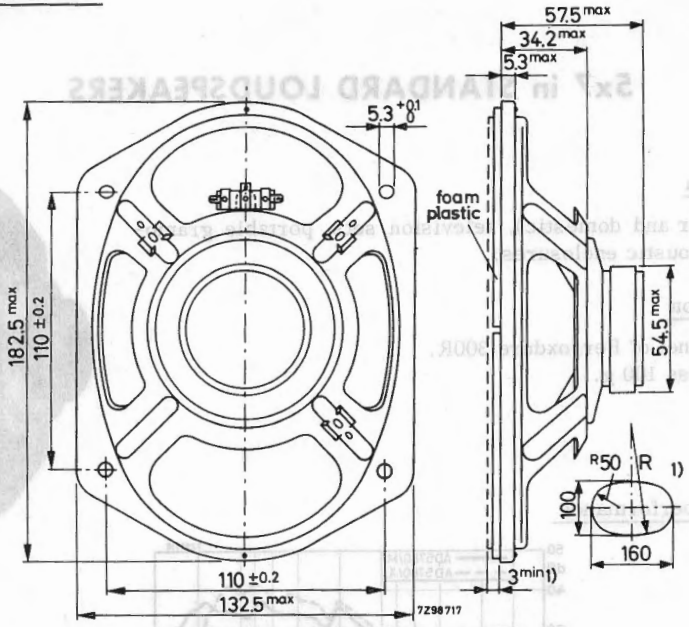


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 2)
M4	M	4	4 1)	100	17 500	> 9800	2722 257 36105
M8		8					06
M15		15					07
M25		25					08
X4	X	4	3 1)	115	17 500	> 9800	2722 257 36101
X8		8					02
X15		15					03
X25		25					04

1) Signal in conformity with DIN 45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at the specified power handling capacity.

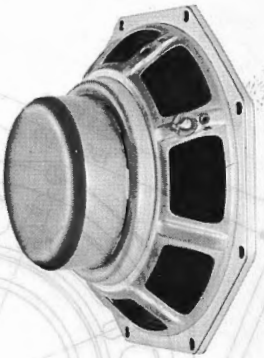
A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 320 g.

6½ in HIGH QUALITY LOUDSPEAKERS

Primary application

Small closed cabinets for monophonic and stereophonic reproduction. See "Recommended enclosures".

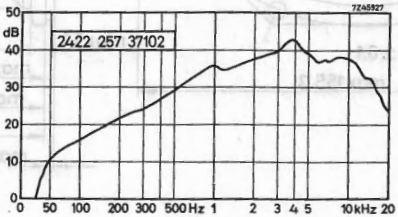


RZ 14210-9

Details

Hi-Fi reproduction over a very wide frequency range owing to the special double cone which has a very low resonance frequency and reproduces even the highest tones so as to ensure a true timbre.
Great power-handling capacity when placed in a closed cabinet having a volume of maximum 25 litres.
Very high sensitivity owing to the large annular Ferroxdure magnet.

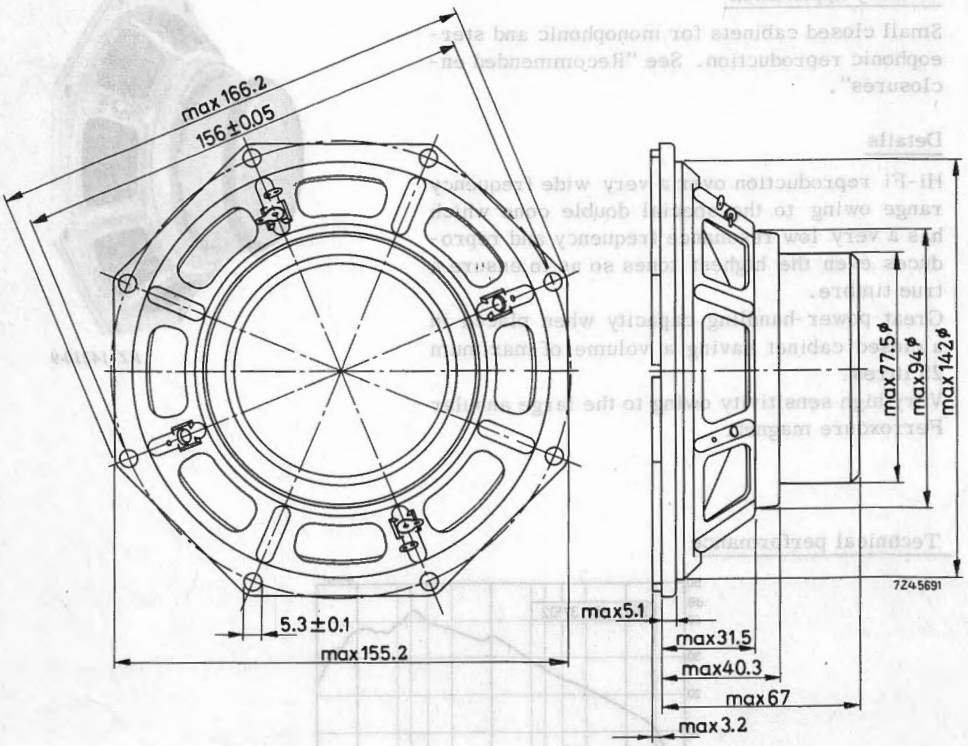
Technical performance



power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [1]
10	5	M	55	42 600	9500	2422 257 37102

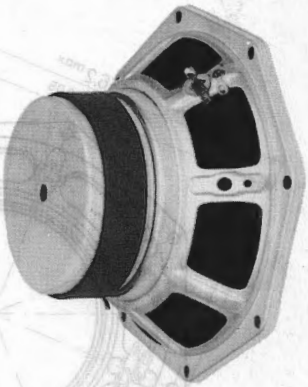
[1] When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 525 g

6½" HIGH-QUALITY WOOFER LOUDSPEAKER



RZ 23783-1

Primary application

Small acoustic enclosures for low-note reproduction.

Details

Very low resonance frequency, thanks to the rigid paper cone together with butyl-rubber cone rim. High flexible suspension of the cone, resulting in a sound reproduction with extremely low distortion, even at high powers.
Housed in a well damped acoustic box, even in a small volume of 9 litres, and in combination with the right loudspeaker for the medium and high-note reproduction [1], this 6½" woofer loudspeaker meets the requirements of DIN 45500 (Hi-Fi) specifications.

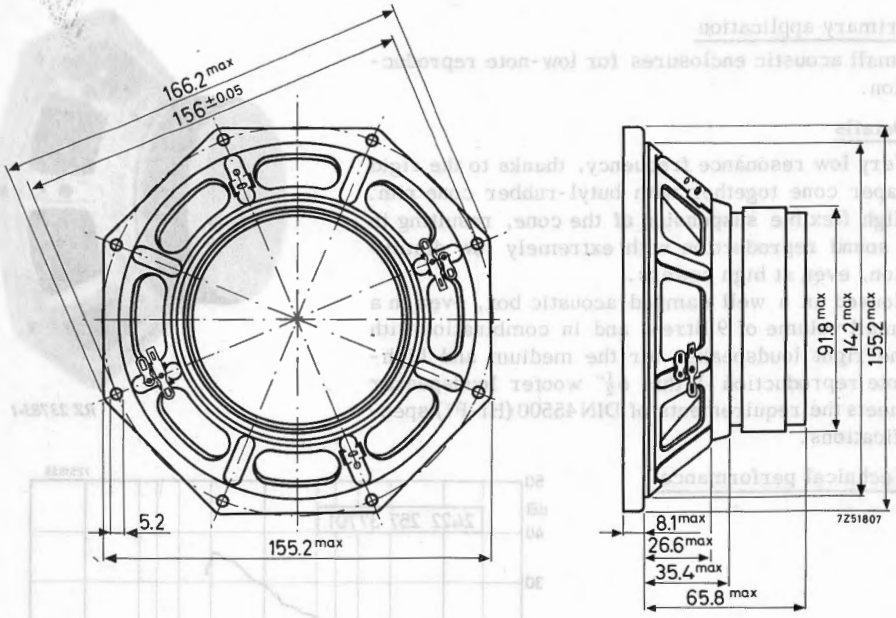
Technical performance

Material of magnet system	Ferroxdure 300R
Weight of magnet system	450 g
Height of air gap	5 mm
Length of voice coil	9.5 mm

power handling capacity (W)	nominal impedance (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number [3]
20 [2]	8	W	28	45 000	9600	2422 257 37701

1) See data sheet "9 l acoustic box for AD7065/W8 and AD5080/M4".
2) In an acoustic box of 30 litres or smaller conforming to the recommendations of DIN 45573, page 2.
3) For bulk packing the catalog number is 2422 257 37721, for single-unit packing the catalog number is 2422 257 37761.

Dimensions in mm



Baffle hole diameter 95 mm.

Weight: 1.2 kg

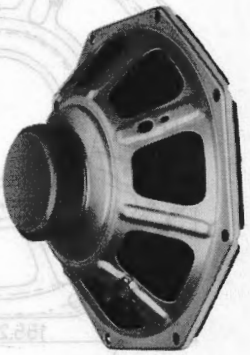
6½ in STANDARD LOUDSPEAKERS

Application

Radios (car and domestic), television sets, acoustic enclosures.

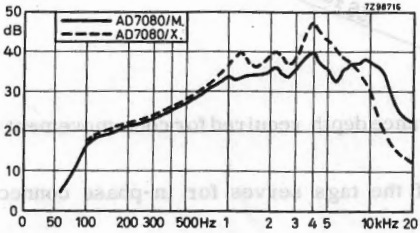
Construction

Round magnet of Ferroxdure 300R.
Magnet mass 100 g.



RZ 25905-5

Technical performance

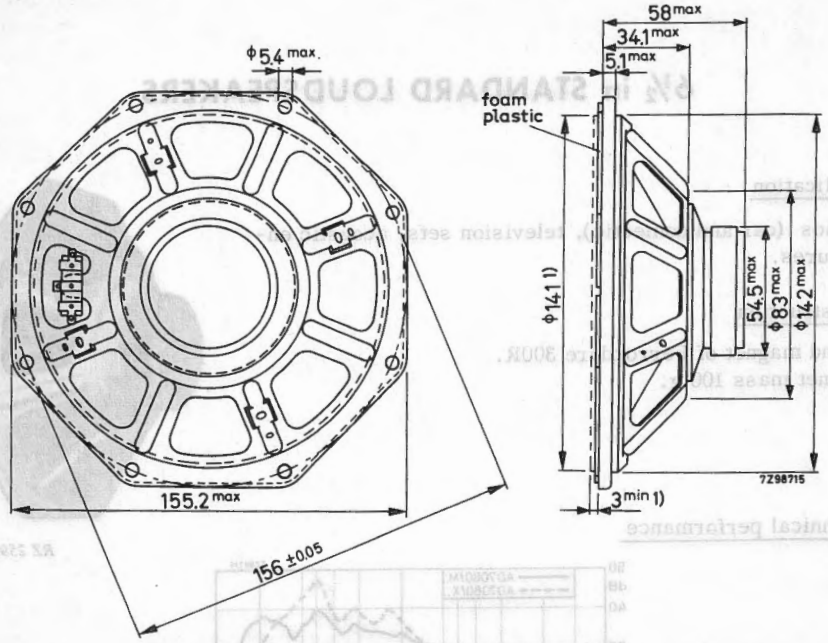


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catal. number 2)
M4 M8	M	4 8	4 1)	95	17 500	> 9800	2422 257 37803 04
X4 X8	X	4 8	6	110	17 500	> 9800	2422 257 37801 02

1) Signal in conformity with DIN45573.

2) When ordering bulk packing add 20 to the last two digits; when ordering single-unit packing add 60 to the last two digits.

Dimensions in mm



1) Baffle hole and clearance depth required for cone movement at the specified power handling capacity.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 300 g

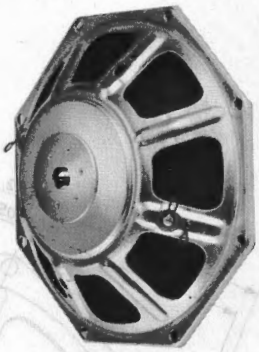
6½ in STANDARD LOUDSPEAKERS

Application

TV receivers.

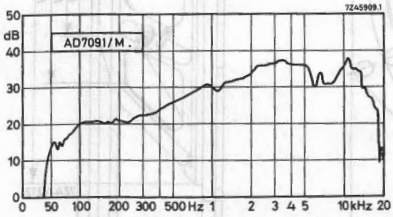
Construction

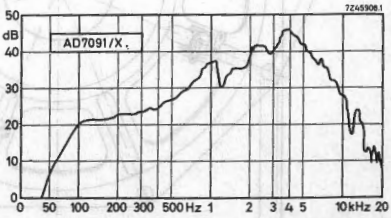
Small mounting depth as a result of the inverted construction.
High sensitivity owing to the use of a Ticonal 650 magnet.
Absence of a stray field.
When the speakers, which are supplied in a plastic envelope, are built in, the front must be covered with a piece of muslin so as to prevent dust from entering the air gap.



RZ 19741-14

Technical performance

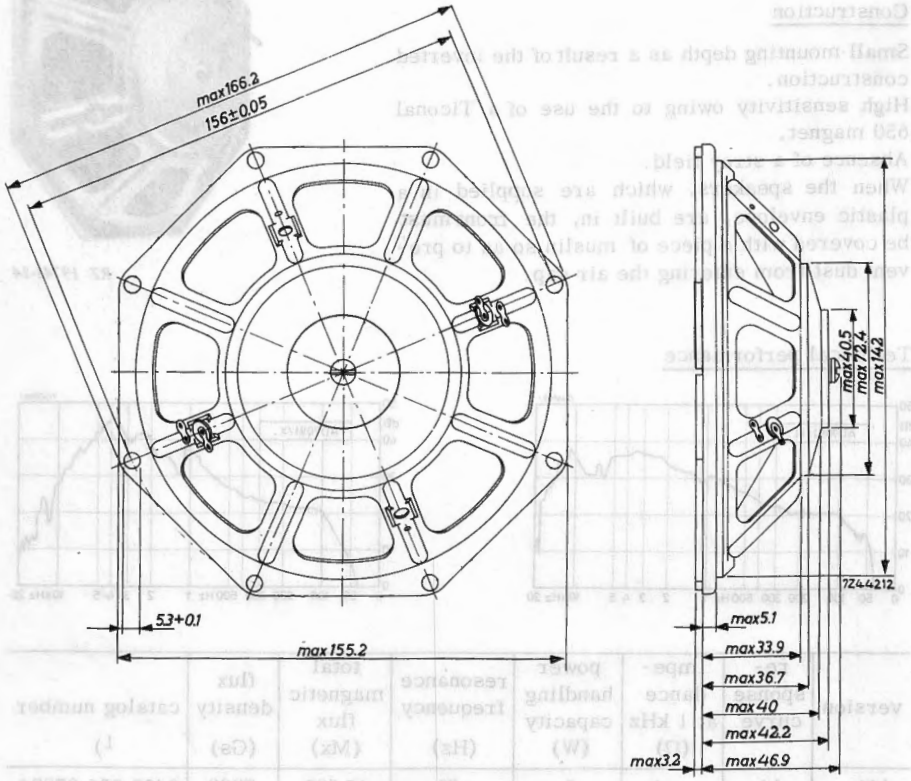




version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M4	M	4	3	95	18 900	7000	2422 256 37004
M800	M	800	3	95	18 900	7000	2422 256 37001
X4	X	4	3	100	18 900	7000	2422 256 37005
X800	X	800	3	100	18 900	7000	2422 256 37002

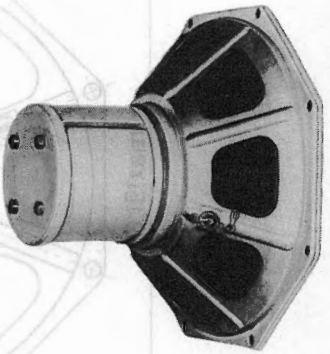
1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm



Weight: 250 g

8" HIGH-QUALITY LOUDSPEAKERS



A 46102

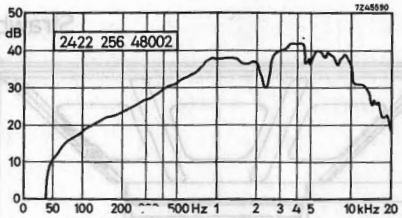
Primary application

Hi-Fi and stereo equipment. See "Recommended enclosures"

Details

High sensitivity, Ticonal magnet.
When these speakers are placed in an acoustic box or any other suitable enclosure, their sensitivity and response qualities result in an almost constant sound pressure over the entire audible frequency range.
Practically undistorted sound reproduction.

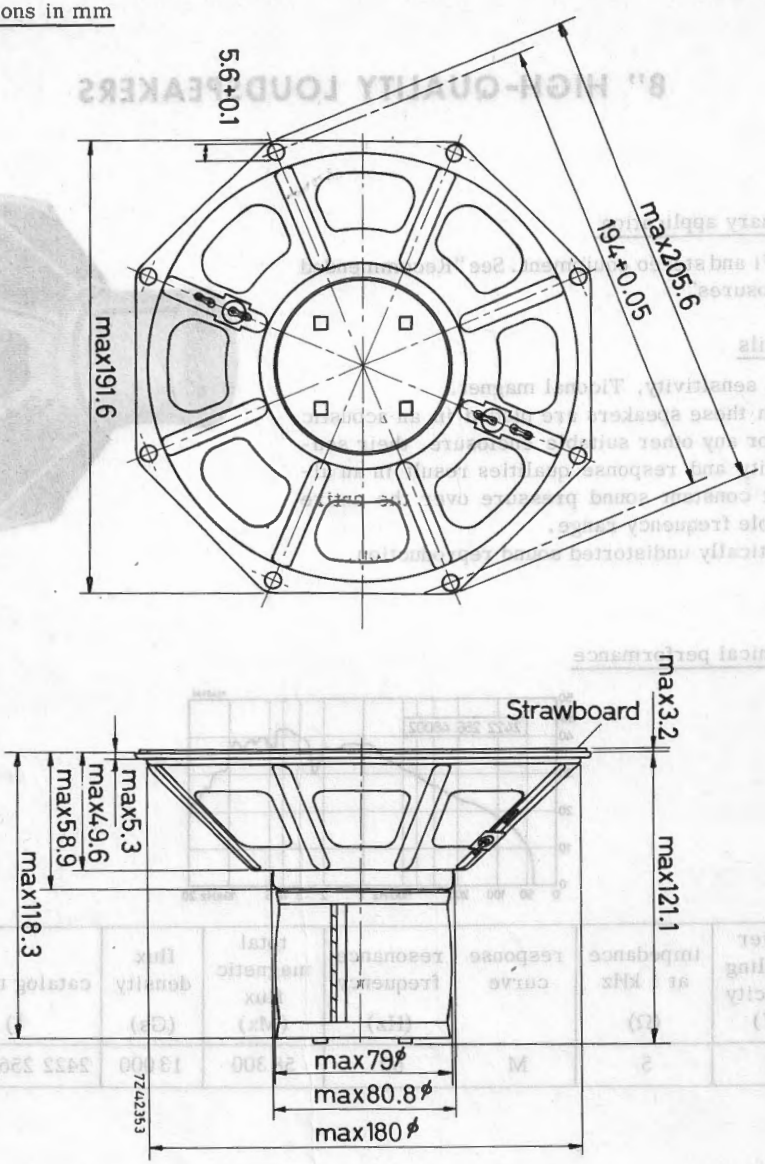
Technical performance



power handling capacity (W)	impedance at 1 kHz (Ω)	response curve	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
6	5	M	60	58 300	13 000	2422 256 48002

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm

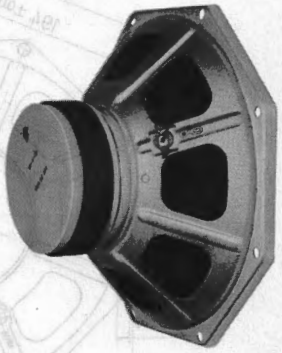


Weight: 1.5 kg

8 in HIGH-QUALITY WOOFER LOUDSPEAKER

Application

In small acoustic enclosures for Hi-Fi reproduction; suitable for frequencies of 22 to 1800 Hz. See data sheet on the 20 W combination with AD5780/M4 in an acoustic box of 15 litres.

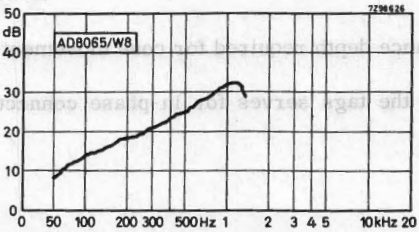


RZ 24709-5

Construction

Round magnet of Ferroxdure 300 R.
Weight of magnet 450 g.
Constant flux through moving voice coil, resulting in a low distortion.
Rigid paper cone with highly flexible butyl-rubber suspension.

Technical performance

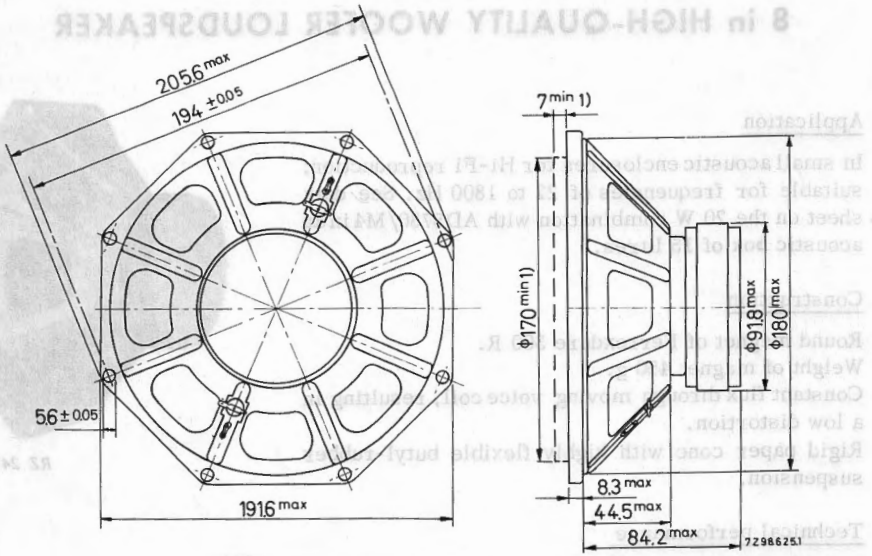


version	response curve	nom. impedance (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 2)
W8	W	8	20 1)	28	45000	> 9000	2422 257 38101

1) In an acoustic enclosure of max. 15 litres, and conforming to DIN45573.

2) For bulk packing the catalog number is 2422 257 38121, for single-unit packing 2422 257 38161.

Dimensions in mm

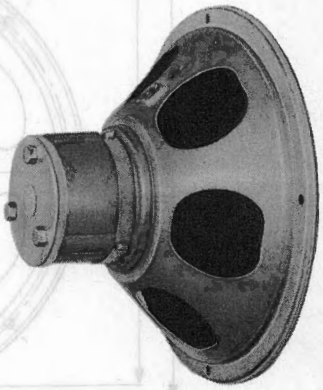


1) Baffle hole and clearance depth required for cone movement at 20 W input.

A red mark near one of the tags serves for in-phase connection with other loudspeakers of our range.

Weight: 1.35 kg

8½" HIGH-QUALITY LOUDSPEAKERS



C 65233

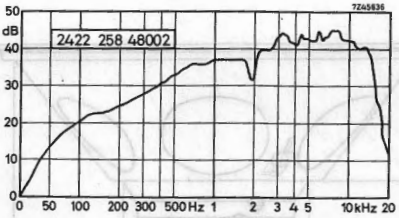
Primary application

Hi-Fi equipment. See "Recommended enclosures".

Details

High sensitivity, Ticonal magnet.
Particularly large air gap, resulting in the voice coil being completely enclosed by a uniform magnetic field even at the largest amplitudes. No distortion will thus be experienced as the coil amplitude is disproportional to the current.
Constant voice-coil impedance throughout the entire frequency range, so that the output stage always has a perfectly matched load.
Very smooth response curve.
Clear bass response without boom effects, because of mechanical damping at low frequencies.

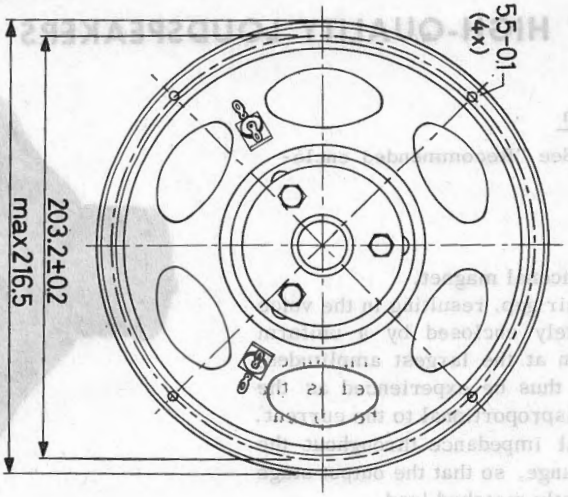
Technical performance

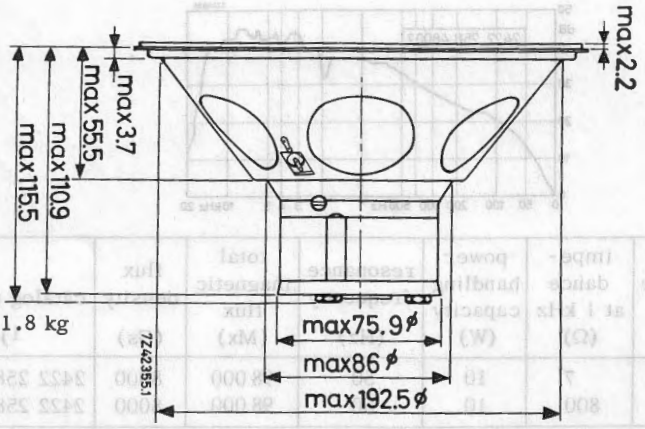


version	response curve	impedance at 1 kHz (Ω)	power handling capacity (W)	resonance frequency (Hz)	total magnetic flux (Mx)	flux density (Gs)	catalog number 1)
M/01	M	7	10	50	98 000	8000	2422 258 48002
AM/01	M	800	10	50	98 000	8000	2422 258 48004

1) When ordering, the last but one digit should be 2 for bulk packing and 6 for single-unit packing.

Dimensions in mm





Weight: 1.8 kg

GENERAL

INTRODUCTION

On the following pages drawings are shown of enclosures which will give good results when used in combination with the indicated loudspeaker types.
We distinguish standard class and high-fidelity class combinations.

Standard class

In some of the combinations of standard quality, less expensive standard loudspeakers are employed, and the acoustic boxes can in general be made cheaply by the user himself. Yet, used in conjunction with a good radio, tape recorder or record player with amplifier, the enclosures will give the builder much pleasure because of their good quality of reproduction.

High-fidelity class

Combinations of this class have an exceptional performance thanks to the use of high-quality loudspeakers. Users are recommended to employ hi-fi equipment for best results.

POINTS TO OBSERVE WHEN ASSEMBLING ACOUSTIC BOXES

All boxes are built up of three mains parts:

- a front panel (1)
- four side panels, fastened together (2)
- a rear panel (3).

These components can be screwed together. Of course, the handy man may well decide to join the front panel and the four side panels together in his own way. He should, however, remember the following pieces of advice:

1. Use strong and rigid material for the sides, preferably multi-layer plywood or chipboard.
2. Minimum wall thickness is indicated on the Installation drawings.
3. A suitable damping lining must be provided, e.g. cotton wool 2 cm thick.
4. The enclosure must be acoustically sealed.
5. Make sure that the loudspeaker is properly fastened and that there are no loose component parts.
6. Make sure to use suitable loudspeaker cloth because otherwise the sound might be muffled.

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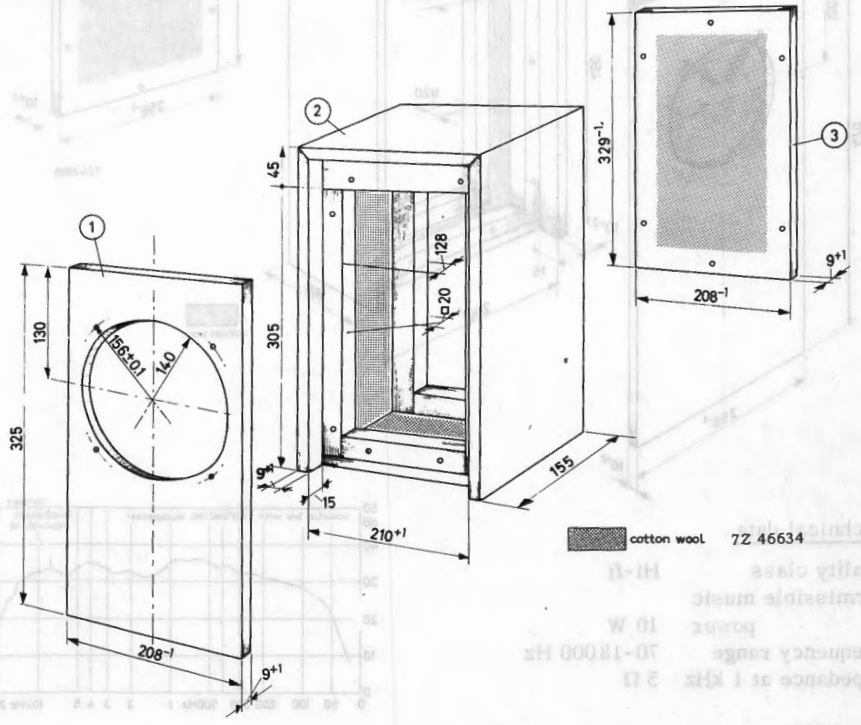
6. Make sure to use suitable loudspeaker cloth because otherwise the sound might be muffled.

ACOUSTIC BOX FOR 6½" LOUDSPEAKER

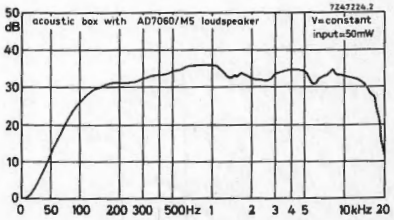
This enclosure can be built for loudspeaker AD7060/M5 (AD3701M).

Installation drawing (dimensions in mm)



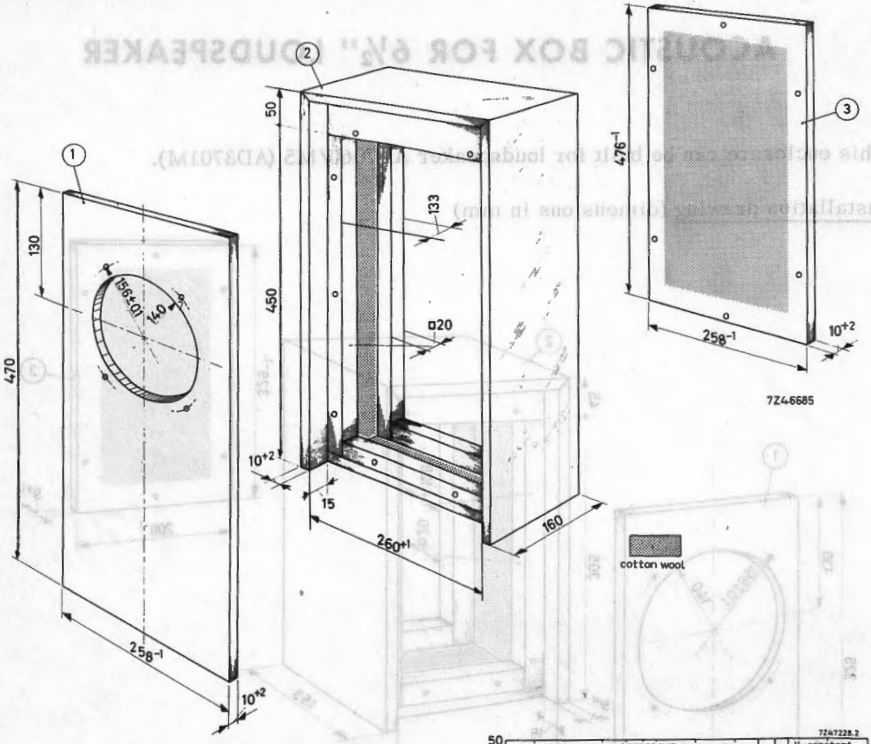
Technical data

Quality class	Hi-fi
Permissible music power	10 W
Frequency range	100-18 000 Hz
Impedance at 1 kHz	5 Ω



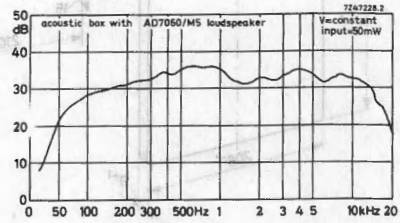
This enclosure can be built for loudspeaker AD7060/M5 (AD3701M).

Installation drawing (dimentions in mm)



Technical data

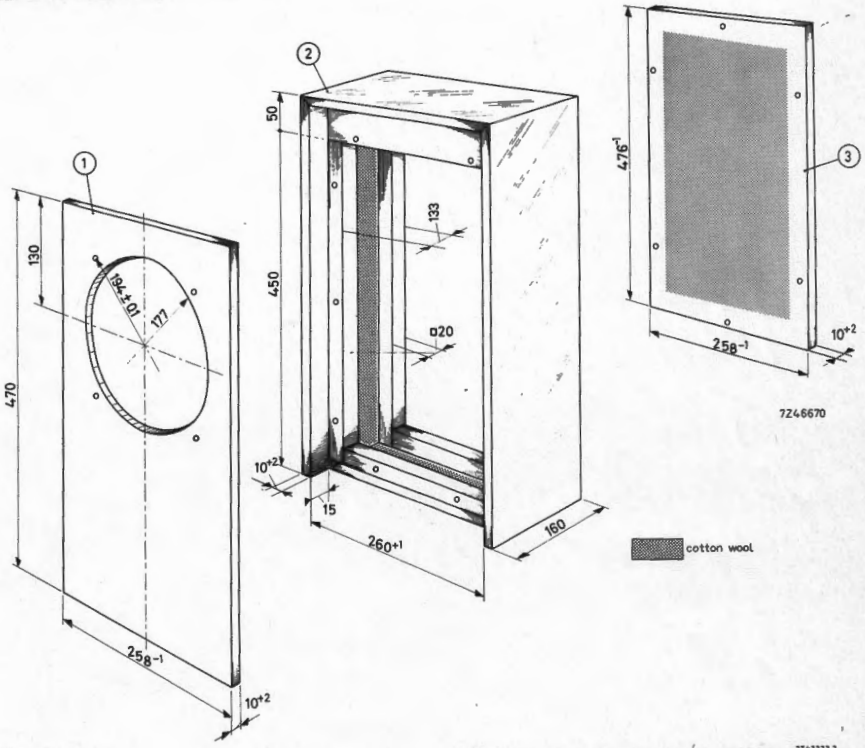
Quality class	Hi-fi
Permissible music power	10 W
Frequency range	70-18 000 Hz
Impedance at 1 kHz	5 Ω



ACOUSTIC BOX FOR 8" LOUDSPEAKER

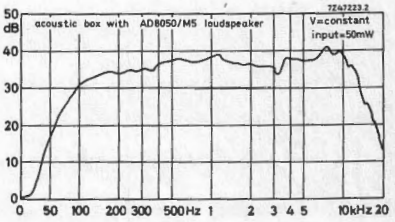
This enclosure can be built for loudspeaker AD8050/M5 (AD4800M).

Installation drawing (dimensions in mm)



Technical data

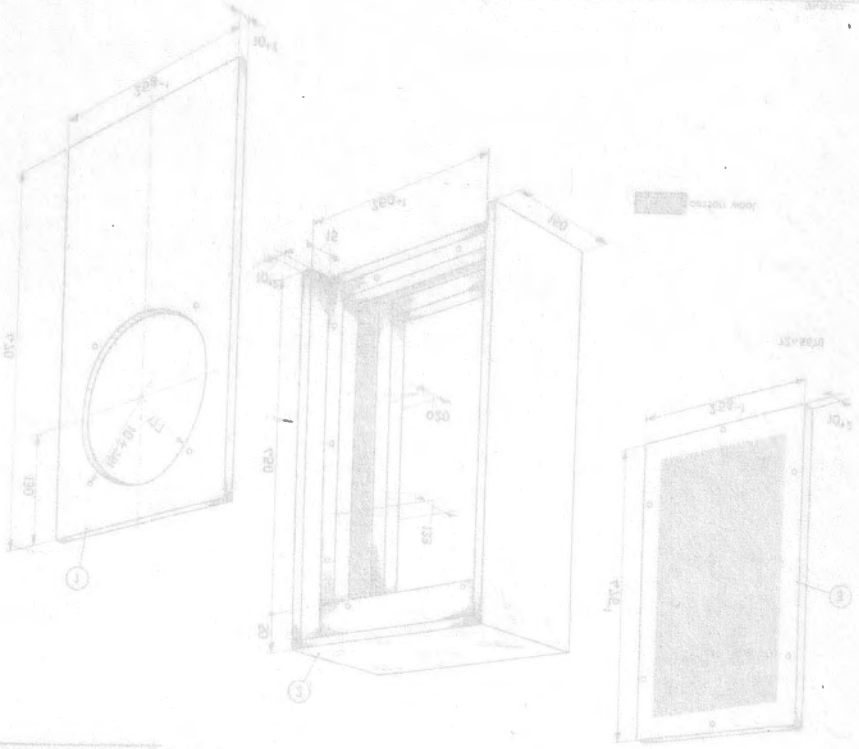
Quality class	Hi-Fi
Permissible music power	15 W
Frequency range	80-18 000 Hz
Impedance at 1 kHz	5 Ω



ACOUSTIC BOX FOR 8" LOUDSPEAKER

This enclosure can be built for loudspeaker AD8020/M8 (AD4800M).

Installation drawing (dimensions in mm)



Technical data

Quality class	HI-FI
Recommended amplifier power	15 W
Frequency range	80-18 000 Hz
Impedance at 1 kHz	8 Ω

ENCLOSURES RECOMMENDED

3 l ACOUSTIC BOX FOR AD5060/W. AND AD2070/T.

This box can be built for the 5 in woofer AD5060/W4 or /W8 and the $2\frac{1}{4}$ in tweeter AD2070/T4 or T8.
Main properties: max. 10 W; 90-20 000 Hz; simple filter.

Constructional data

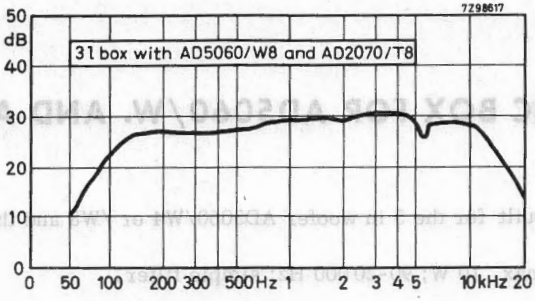
Nett volume	3 litres
Wall thickness	min. 7 mm
Damping	5 cm damping material against the back panel
Fastening of the panels	with glue, baffle with screws

Both loudspeakers to be mounted behind the baffle, the tweeter acoustically sealed off from the woofer.
The clearance depth for the woofer's cone movement falls within baffle thickness.

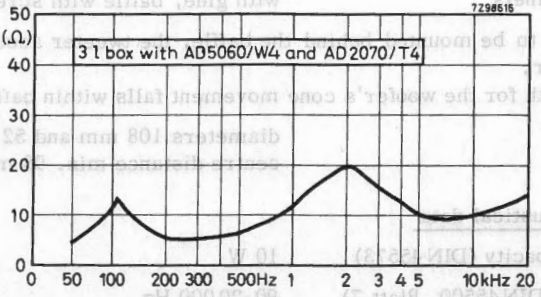
Baffle holes	diameters 108 mm and 52 mm, centre to centre distance min. 98 mm

Electrical and acoustical data

Power handling capacity (DIN 45573)	10 W
Frequency range (DIN 45500, Blatt 7)	90-20 000 Hz
Cross-over filter	1 mH in series with the woofer 5 μF in series with the tweeter
Cross-over frequency	2000 Hz
Resonance frequency	110 Hz
Nominal impedance	4 Ω or 8 Ω
Sensitivity: input power for an average sound level of 86 dB (4 μbar) over 50-12 500 Hz at 3 m distance from the box	8 W



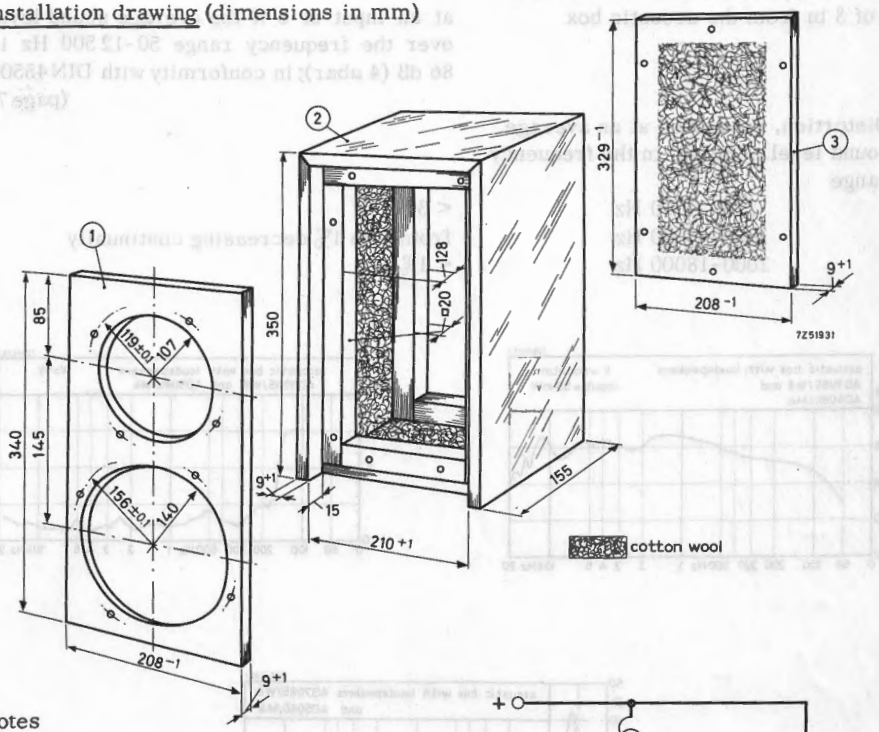
0 dB corresponds with 52 dB above 2×10^{-4} μbar
V = constant; input = 50 mW at 400 Hz; microphone at 50 cm



9 l ACOUSTIC BOX FOR AD7065/W8 AND AD5080/M4

This box can be built for the $6\frac{1}{2}$ in woofer AD7065/W8 and the 5 in loudspeaker AD5080/M4. (Instead of the 5 in loudspeaker, the 4 in tweeter AD4490/T4 can be used) Main properties: max. 20 W; 50-18 000 Hz; filter available.

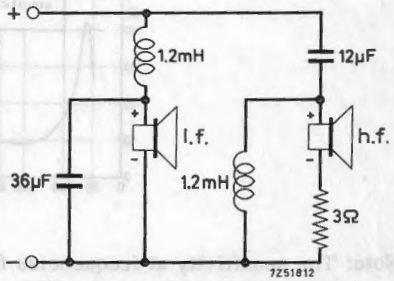
Installation drawing (dimensions in mm)



Notes

The 5" loudspeaker must be acoustically sealed off from the remainder of the enclosure.

The use of the cross-over filter, given in the adjacent figure, is recommended. This filter has its cross-over frequency at 850 Hz; it can be ordered under the catalog number 4304.078 71330.

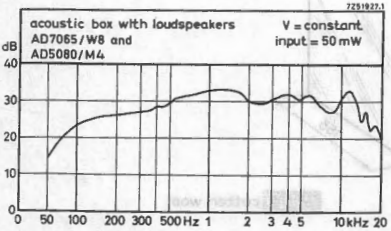


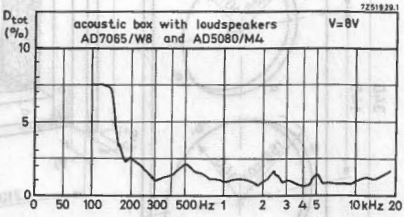
TECHNICAL DATA

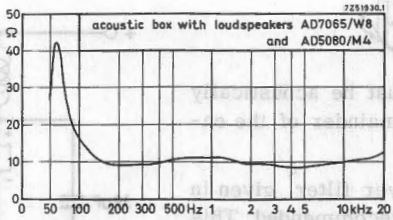
Quality class	Hi-fi; in conformity with DIN 45500 (page 7)
Nett volume	9 litres
Permissible music power	20 W; in conformity with DIN 45573 (page 2)
Frequency range	50-18 000 Hz; in conformity with DIN 45500 (page 7)
Resonance frequency	60 Hz
Impedance	8 Ω
Sensitivity, measured at a distance of 3 m from the acoustic box	at an input of 8 W the average sound level over the frequency range 50-12 500 Hz is 86 dB (4 μbar); in conformity with DIN 45500 (page 7)

Distortion, measured at an average sound level of 86 dB, in the frequency range

250- 1000 Hz	< 3%
1000- 2000 Hz	from 3 to 1% decreasing continually
2000-18000 Hz	< 1%







Note: The sensitivity at frequencies from 1.5 kHz upwards will be about 3 dB higher, if the M8 version of the 5" loudspeaker is used, and the 3 Ω resistor in the cross-over filter is short-circuited.

15 l ACOUSTIC BOX FOR AD8065/W8 AND AD3576RM

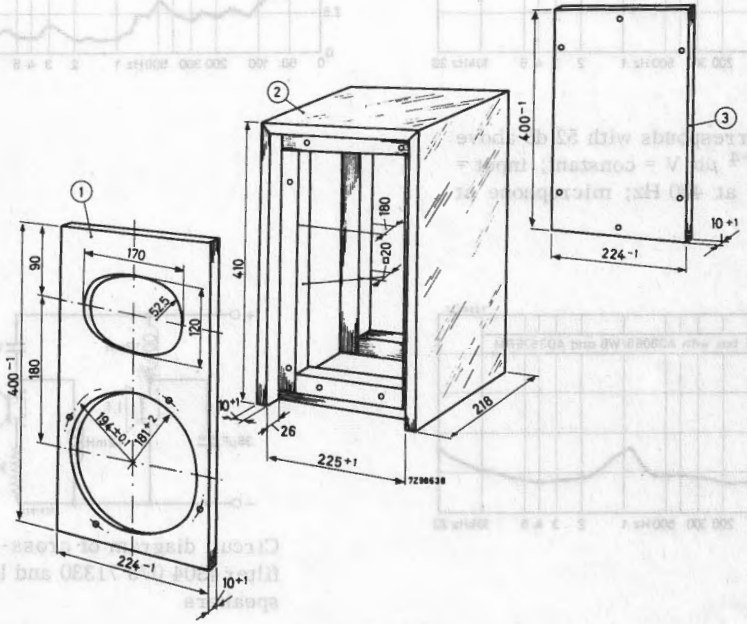
This box can be built for the 8 in woofer AD8065/W8 and the 5x7 in loudspeaker AD3576RM (or AD5780/M4).

Main properties: max. 20 W; 50-16 000 Hz; filter available.

Constructional data

Nett volume	15 litres
Inside height x width x depth	400x225x180 mm
Wall thickness	10 mm (minimum)
Damping	5 cm damping material against the back panel

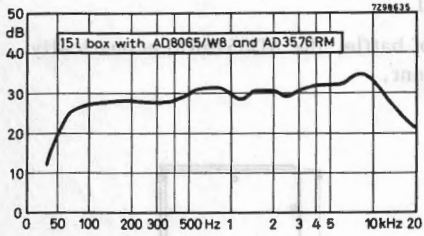
Both loudspeakers to be mounted against front of baffle, the AD3576RM acoustically sealed off from the remainder of the compartment.

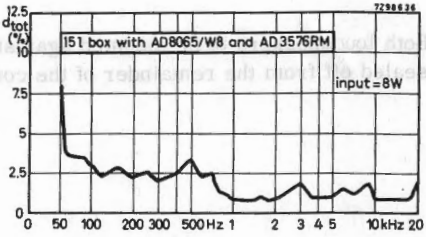


Installation drawing (dimensions in mm)

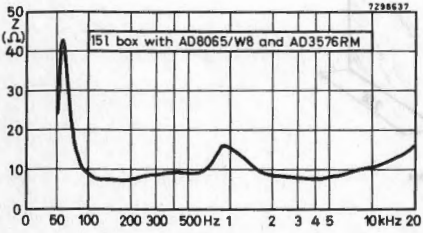
Electrical and acoustical data

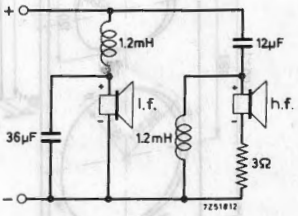
Power handling capacity (DIN 45573)	20 W
Frequency range (DIN 45500, Blatt 7)	50-16 000 Hz
Cross-over filter	catalog number 4304 078 71330
Cross-over frequency	850 Hz
Resonance frequency	55 Hz
Nominal impedance	8 Ω
Sensitivity: input power for an average sound level of 86 dB (4 μb) over 50-12 500 Hz at 3 m from the box	8 W
Distortion, measured at an average sound level of 86 dB	conforms to DIN 45500, Blatt 7; see curve.





0 dB corresponds with 52 dB above 2 x 10^{-4} μb V = constant; input = 50 mW at 400 Hz; microphone at 50 cm





Circuit diagram of cross-over filter 4304 078 71330 and loudspeakers

35 l ACOUSTIC BOX FOR AD1055/W8, AD5060/M8 AND AD3506SM

This box can be built for the 10 in woofer AD1055/W8, the 5 in loudspeaker AD5060/M8 (AD3501SM) for the medium notes and the 5 in loudspeaker AD3506SM or AD5080/M8 for the high notes.
Main properties: max. 40 W; 40-20 000 Hz

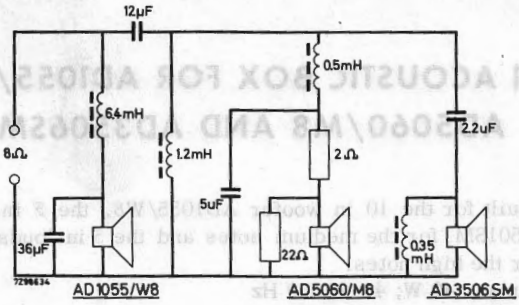
Constructional data

Nett volume	35 l
Wall thickness	min. 13 mm
Damping	box entirely filled with damping material
Mounting of the loudspeakers	behind baffle, each fixed by 8 screws. The AD5060/M8 and the AD3506SM should be acoustically sealed off from the woofer.
Baffle hole diameters	227 mm, 105 mm and 105 mm

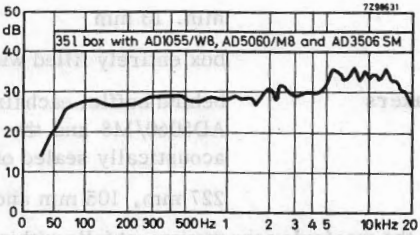
The clearance depth for the woofer's cone movement falls within the baffle thickness.

Electrical and acoustical data

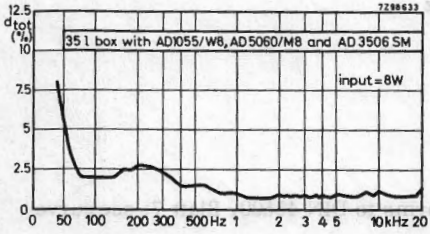
Power handling capacity (DIN 45573)	40 W
Frequency range (DIN 45500, Blatt 7)	40-20 000 Hz
Cross-over network	see below
Cross-over frequencies	500 Hz and 4000 Hz
Resonance frequency	48 Hz
Nominal impedance	8 Ω
Sensitivity; input power for an average sound level of 86 dB (4 μb) over 50-12 500 Hz at 3 m from the box	8 W
Distortion, measured at an average sound level of 86 dB	conforms to DIN 45500, Blatt 7; see curve

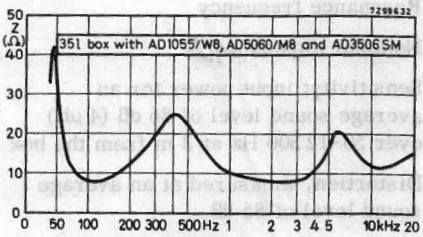


cross-over network



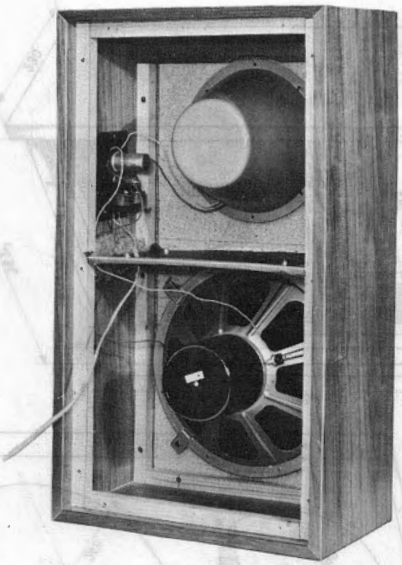
0 dB corresponds with 52 dB above 2×10^{-4} µbar. V = constant; input = 50 mW at 400 Hz; microphone at 50 cm





45 l ACOUSTIC BOX FOR AD1255/W8 AND 9710/01

This enclosure can be built for the high-quality loudspeakers 9710M/01 and the AD1255/W8 (AD5201S/77). This is a combination of one of the best middle and high-note loudspeakers and that remarkable woofer (also called "Bombardon") which has a resonance frequency of 29 Hz.

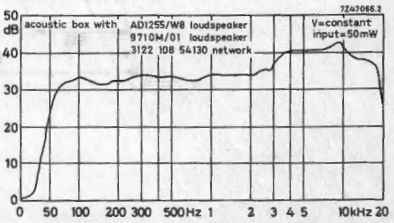


RZ 20890-9

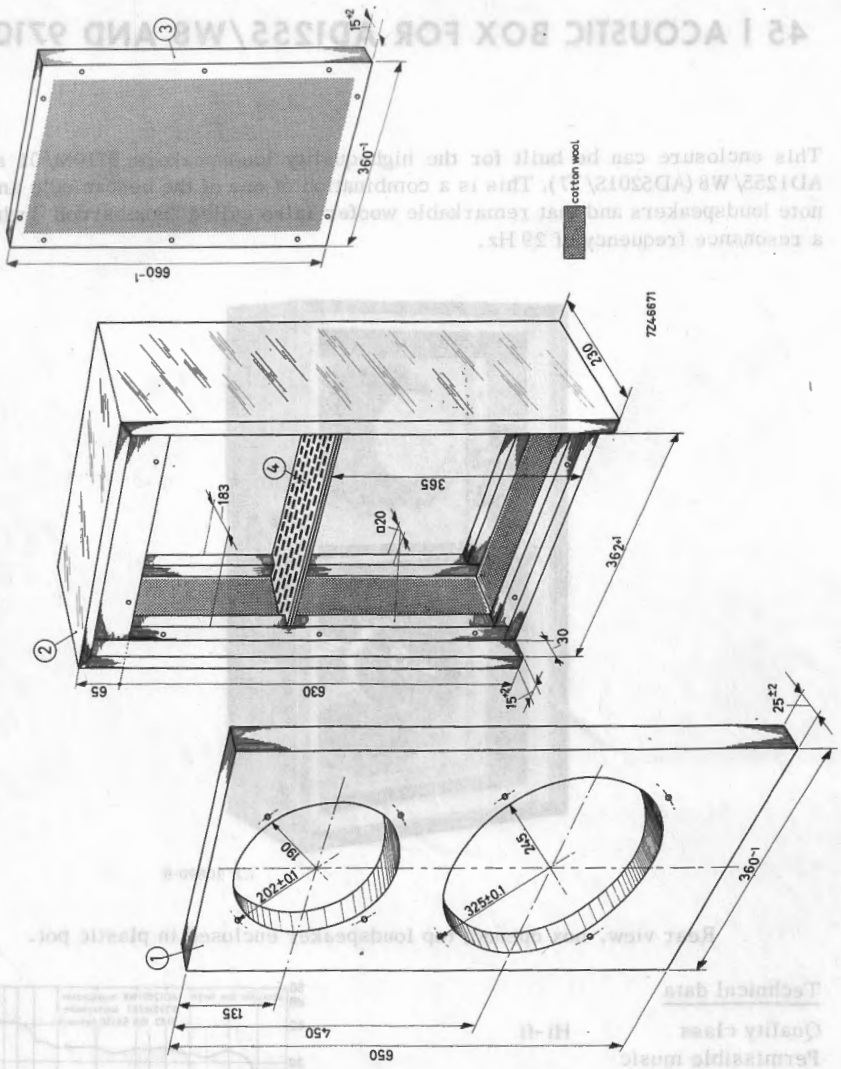
Rear view, box opened; top loudspeaker enclosed in plastic pot.

Technical data

Quality class	Hi-fi
Permissible music power	40 W
Frequency range	40-18 000 Hz
Impedance at 1 kHz	7 Ω

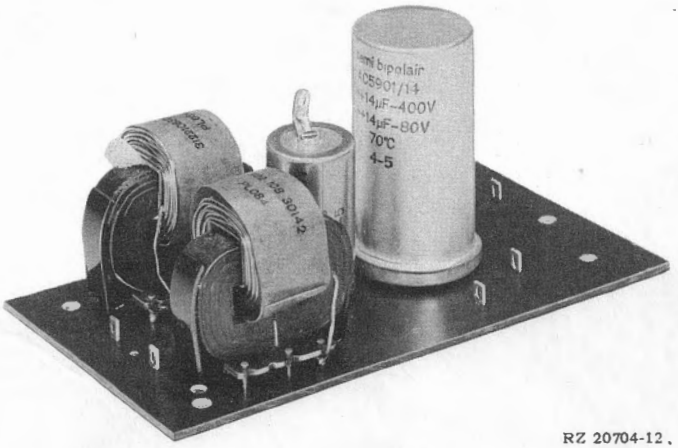


Installation drawing (without plastic pot, dimensions in mm)



Notes

1. The top loudspeaker must be acoustically sealed off from the remainder of the enclosure, otherwise it will affect the reproduction quality of the low-tone loudspeaker. The polystyrene pot is not available, a cubic wooden enclosure is a good alternative.
2. For proper damping of the low tones, a partition must be placed between the two loudspeakers; this should be made from a perforated plate covered by two layers of flannel.
3. The use of a cross-over filter is recommended. The one shown below has its cross-over frequency at 450 Hz and a rate of attenuation of 12 dB per octave; it can be ordered under No.3122 108 54130.



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