PHILIPS

Data handbook

Electronic
components
and materials

Components and materials

Part 4a April 1975

Soft ferrites

COMPONENTS AND MATERIALS

Part 4a

April 1975

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DATA HANDBOOK SYSTEM

Our Data Handbook System is a comprehensive source of information on electronic components, subassemblies and materials; it is made up of three series of handbooks each comprising several parts.

ELECTRON TUBES	**BLUE**
SEMICONDUCTORS AND INTEGRATED CIRCUITS	**RED**
COMPONENTS AND MATERIALS	**GREEN**

The several parts contain all pertinent data available at the time of publication, and each is revised and reissued periodically.

Where ratings or specifications differ from those published in the preceding edition they are pointed out by arrows. Where application information is given it is advisory and does not form part of the product specification.

If you need confirmation that the published data about any of our products are the latest available, please contact our representative. He is at your service and will be glad to answer your inquiries.

ELECTRON TUBES (BLUE SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a	**Transmitting tubes for communications** **and Tubes for r.f. heating Types PB2/500 ÷ TBW15/125**	**April 1973**
Part 1b	**Transmitting tubes for communication** **Tubes for r.f. heating** **Amplifier circuit assemblies**	**August 1974**
Part 2	**Microwave products** Communication magnetrons Magnetrons for micro-wave heating Klystrons Traveling-wave tubes Diodes Triodes T-R Switches Microwave Semiconductor devices Isolators Circulators	**October 1974**
Part 3	**Special Quality tubes;** **Miscellaneous devices**	**January 1975**
Part 4	**Receiving tubes**	**March 1975**
Part 5a	**Cathode-ray tubes**	**November 1973**
Part 5b	**Camera tubes; Image intensifier tubes**	**December 1973**
Part 6	**Products for nuclear technology** **Photodiodes** Photomultiplier tubes Channel electron multipliers Geiger-Mueller tubes Neutron tubes Photodiodes	**January 1974**
Part 7	**Gas-filled tubes** Voltage stabilizing and reference tubes Counter, selector, and indicator tubes Trigger tubes Switching diodes Thyratrons Ignitrons Industrial rectifying tubes High-voltage rectifying tubes	**February 1974**
Part 8	**T.V. Picture tubes**	**May 1974**

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

This series consists of the following parts, issued on the dates indicated.

Part 1a Rectifier diodes and thyristors — **June 1974**

- Rectifier diodes
- Voltage regulator diodes (> 1, 5 W)
- Transient suppressor diodes
- Thyristors, diacs, triacs
- Rectifier stacks

Part 1b Diodes — **July 1974**

- Small signal germanium diodes
- Small signal silicon diodes
- Special diodes
- Voltage regulator diodes (< 1, 5 W)
- Voltage reference diodes
- Tuner diodes

Part 2 Low frequency transistors — **July 1974**

Part 3 High frequency and switching transistors — **October 1974**

Part 4a Special semiconductors — **November 1974**

- Transmitting transistors
- Microwave devices
- Field-effect transistors
- Dual transistors
- Microminiature devices for thick- and thin-film circuits

Part 4b Devices for opto-electronics — **December 1974**

- Photosensitive diodes and transistors
- Light emitting diodes
- Photocouplers
- Infra-red sensitive devices
- Photoconductive devices

Part 5 Linear integrated circuits — **March 1975**

Part 6 Digital integrated circuits — **April 1974**

- DTL (FC family)
- CML (GX family)
- MOS (FD family)
- MOS (FE family)

COMPONENTS AND MATERIALS (GREEN SERIES)

These series consists of the following parts, issued on the dates indicated.

Part 1 Functional units, Input/output devices, Electro-mechanical components, Peripheral devices

June 1974

High noise immunity logic FZ/30-Series
Circuit blocks 40-Series and CSA70
Counter modules 50-Series
Norbits 60-Series, 61-Series
Circuit blocks 90-Series
Input/output devices
Electro-mechanical components
Peripheral devices

Part 2a Resistors

September 1974

Fixed resistors
Variable resistors
Voltage dependent resistors (VDR)
Light dependent resistors (LDR)
Negative temperature coefficient thermistors (NTC)
Positive temperature coefficient thermistors (PTC)
Test switches

Part 2b Capacitors

November 1974

Electrolytic and solid capacitors
Paper capacitors and film capacitors
Ceramic capacitors
Variable capacitors

Part 3 Radio, Audio, Television

February 1975

FM tuners
Loudspeakers
Television tuners, aerial input assemblies
Components for black and white TV
Components for colour television
*)

Part 4a Soft ferrites

April 1975

Ferrites for radio, audio and television
Beads and chokes
Ferroxcube potcores and square cores
Ferroxcube transformer cores

Part 4b Piezoelectric ceramics, Permanent magnet materials

October 1973

Part 5 Ferrite core memory products

January 1974

Ferroxcube memory cores
Matrix planes and stacks
Core memory systems

Part 6 Electric motors and accessories

March 1974

Small synchronous motors
Stepper motors
Miniature direct current motors

Part 7 Circuit blocks

September 1971

Circuit blocks 100 kHz-Series
Circuit blocks-1-Series
Circuit blocks 10-Series
Circuit blocks for ferrite core memory drive

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*) Deflection assemblies for camera tubes are now included in handbook series "Electron tubes", Part 5b.

Properties of manganese zinc and nickel zinc ferrites

INTRODUCTION

The Ferroxcube *) range of manganese-zinc and nickel-zinc magnetically-soft ferrites are intended for use as core material in coils and transformers operating over a wide range of frequencies. Ferroxcube is a ceramic material, manufactured from high-grade raw materials of controlled composition; the composition defines the electrical and mechanical properties.

Ferroxcube products are made by a sequence of ceramic techniques: mixing, pre-firing, milling, drying, shaping by pressing or extrusion, sintering and machining. The finished products have a stable structure and high electrical resistivity. This electrical resistivity allows them to be used at high frequencies without the eddy current losses becoming prohibitively high.
Ferroxcube is made in a wide range of permeabilities.

Ferroxcube cores are available in convenient shapes such as potcores, square cores, E- and I-cores, EC-cores, X-cores, U-cores, toroids, aerial rods, yoke rings, screw cores, rods and tubes.
Potcores, square cores, E-I cores and X cores enable well-defined air gaps to be used without introducing appreciable stray fields. In this way the permeability of the material may be reduced to an effective value at which core and copper losses are matched. The dependence of the permeability on temperature and time is furthermore reduced to values that guarantee correct operation of the equipment.

This section contains comprehensive data on manganese-zinc ferrites (Ferroxcube 3) and nickel-zinc ferrites (Ferroxcube 4) and their various grades.

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*) Our trade name for magnetically soft ferrites.

APPLICATION

The various material grades of Ferroxcube 3 and Ferroxcube 4 and their application as core material are listed in the table below.

grade	available core shapes
3B	potcores, rods, tubes
3B3	frames for i.f. transformers, potcores, rods, screw cores
3B7	potcores and square cores
3C2	yoke rings, L-cores, tooth cores
3C6	E- and U-cores, rods, tubes
→ 3C8	U- and I-cores, E-cores, EC-cores
3D3	potcores, square cores, screw cores
3E1	E- and I-cores, toroids, potcores
3E2	H-cores and toroids
3E3	toroids
3E4	potcores and square cores
3H1	potcores, square cores, small toroids, cross cores
→ 3H2	tubes, rods, tooth cores
4A4	frames for i.f. transformers
4A10	aerial rods
4B1	frames for i.f. transformers, rods and tubes
4C1	rods and tubes
4C6	potcores, square cores, toroids, frames for i.f. transformers, rods and tubes
4D1, 4D2, 4E1	frames for i.f. transformers, screw cores, tubes and rods
4H1	These are special-purpose NiZn ferrites developed for one type of application, namely resonant cavities for particle accelerators. In this field, usually a technical discussion is necessary before the correct material can be determined.
4L$_1$	
4L$_2$	
4MX	

Note - For ordering cores please quote the 12-digit catalogue number given in the data of the relevant core.

SYMBOLS
(in accordance with IEC401)

l_e	effective length of the magnetic path in mm
A_e	cross-section of a homogeneous part of a core in mm^2
$A_{e\,min}$	minimum cross-section of a homogeneous part of a core in mm^2
C_l	core constant = the summation of the effective core lengths divided by the effective area, expressed in mm^{-1} $C_l = \Sigma \frac{l_e}{A_e}$
V_e	effective volume of a core in mm^3 = volume of an ideal toroid in the same material grade and with the same magnetic properties as the core. V_e is calculated from: $V_e = \frac{(\Sigma \frac{l_e}{A_e})^3}{(\Sigma \frac{l_e}{A_e{}^2})^2}$ mm^3
μ_i	relative initial permeability, defined by: $\mu_i = \frac{1}{\mu_0} \lim_{H \to 0} \frac{B}{H}$
μ_Δ	relative incremental permeability, defined by: $\mu_\Delta = \frac{1}{\mu_0} \frac{\Delta B}{\Delta H}$
μ_a	relative amplitude permeability, defined by: $\mu_a = \frac{1}{\mu_0} \frac{B}{H}$
μ_e	relative effective permeability, defined by: $\mu_e = \frac{1}{\mu_0} \frac{\Sigma \frac{l_e}{A_e}}{\Sigma \frac{l_e}{\mu_i A_e}}$
μ_{dif}	relative differential permeability, defined by: $\mu_{dif} = \frac{1}{\mu_0} \frac{dB}{dH}$

α_F	temperature factor, defined by: $\alpha_F = \frac{1}{\mu_i 2} \cdot \frac{d\mu}{d\theta}$ a material parameter for a certain Ferroxcube grade in a certain temperature range. The temperature coefficient (T.C.) of inductance of a core with air gap with a relative effective permeability μ_e is: T.C. = $\mu_e \times \alpha_F$ If $\mu_e = 150$ and $\alpha_F = 1$ ppm/^oC, T.C. = 150 ppm/^oC
D_F	disaccommodation factor, defined by: $D_F = \frac{\mu 1 - \mu 2}{\mu 1^2 \log \frac{t2}{t1}}$ It gives the permeability variation, measured between 10 and 100 minutes after demagnetisation.
Curie point	critical temperature in ^oC above which the ferromagnetic body is paramagnetic.
$\frac{\tan \delta}{\mu_i}$	constant for eddy current and residual losses together at a certain frequency, determined at $\hat{B} \leq 0,1$ mT through the coil. The resulting R/L value for eddy current and residual losses is: $\frac{R}{L} = \frac{\tan \delta}{\mu_i} \times \mu_e \times 2\pi f$ Ω/H (f in Hz)
→ η_B	hysteresis constant, defined by: $\eta_B = \frac{\Delta R_h}{\Delta \hat{B} . \mu . 2\pi f . L}$ T^{-1}, in which $\Delta R_h = R_2 - R_1$ in Ω $\Delta \hat{B} = \hat{B}_2 - \hat{B}_1$ in T f in Hz L in H The series resistance R_1 is measured at the peak induction $\hat{B}_1$, directly there after R_2 at $\hat{B}_2$. The old hysteresis constant $q_{2-24-100}$ (not in accordance with IEC 401) is standardized for an effective volume $V_e = 24$ cm^3 and an effective permeability $\mu_e = 100$. $q_{2-24-100} = 1,63.\,10^3.\,\eta_B \frac{\Omega}{H^{3/2}\,mA}$

$\hat{H}$	peak field strength in A/m	←
H_c	coercivity = field strength at which the induction in the core becomes zero, after the core has been magnetised to saturation.	←
$\hat{B}$	peak induction in T	←
B_r	remanence = induction which remains in the core after the core has been magnetised to saturation and the field strength has been reduced to zero.	←
Δ	length of the air gap in mm	
L	inductance	
α	turns factor = number of turns for 1 mH	
A_L	inductance factor in nH/turn2	
AT	amperes x turns	
N	number of turns	
ρ	specific resistance in Ωm measured with d.c. current	
θ	temperature in ^{o}C	
P	power loss in kW/m^3	
E_1	fundamental voltage	
E_3	third harmonic open-circuit voltage	
f	frequency	

Note

$0,1\ \mathrm{mT} = 10^{-4}\ \mathrm{T} = 10^{-4}\ \mathrm{Vs/m^2} = 10^{-4}\ \mathrm{Wb/m^2}\ (= 1\ \mathrm{Gs})$

$1\ \mathrm{A/m} = \frac{4\pi}{10^3}\ \mathrm{Oe}\ (\approx \frac{1}{80}\ \mathrm{Oe})$

$\mu_0 = 4\pi\,.\,10^{-7}\ \mathrm{H/m}\ (= 1\ \mathrm{Gs/Oe})$

→ Formulae

$$L = \frac{\mu_0 . \mu_e . N^2 . 10^{-3}}{C_1} \text{ H}$$

$$N = \sqrt{\frac{L . 10^9}{A_L}} \text{ turns or } N = \alpha\sqrt{L . 10^3} \text{ turns}$$

$$\hat{B} = \frac{E . 10^9}{4,44 . f . N . A_e} \text{ T (for a sine wave)}$$

$$Q = \frac{1}{\tan \delta_{tot}}$$

$$\frac{E_3}{E_1} = 0,6 . \tan \delta_h \text{ (third harmonic distortion)}$$

$$\tan \delta_h = \mu . \hat{B} . \eta_B$$

TECHNICAL DATA

	(approximate values)
Specific heat at 25 °C	
MnZn ferrites (Fxc3)	1100 J/kg °C
NiZn ferrites (Fxc4)	750 J/kg °C
Thermal conductivity at 25 to 85 °C	3,5 to 4,3 W/m °C
Coefficient of linear expansion	10^{-5}/°C
Modulus of elasticity	15 x 10^4 N/mm^2
Tensile strength	18 N/mm^2
Crushing strength	73 N/mm^2

Note - The tables on the following pages are in accordance with IEC 401.

	unit	3B	3B3	3B7	3C2	3C6	3C8
Initial permeability μ_i at $\hat{B} \leq 0,1$ mT at $\hat{B} = 0,7-1$ mT, $\theta = 10-70\ ^{o}C$ at $\hat{B} = 0,7-1$ mT, $\theta = 25-70\ ^{o}C$		900 ± 20%	900 ± 20%	2300 ± 20%	900 ± 25%	1700 ± 25%	2000 ± 25%
Induction B, ballistically measured at							
H = 250 A/m, $\theta = 100\ ^{o}C$	mT					≥ 290	≥ 330
H = 800 A/m, $\theta = 25\ ^{o}C$	mT	~ 345		~ 430	~ 350		
$\theta = 70\ ^{o}C$	mT			~ 345			
$\theta = 100\ ^{o}C$	mT	~ 230			~ 245		
Eddy current and residual loss factor $\frac{\tan\delta}{\mu_i}$ at $\hat{B} \leq 0,1$ mT, $\theta = 25\ ^{o}C$,							
f = 4 kHz	x 10^{-6}		≤ 7	≤ 1			
f = 50 kHz	x 10^{-6}						
f = 100 kHz	x 10^{-6}		≤ 15	≤ 5			
f = 250 kHz	x 10^{-6}		≤ 27				
f = 450 kHz	x 10^{-6}	≤ 50	≤ 50				
f = 500 kHz	x 10^{-6}						
f = 1000 kHz	x 10^{-6}						
Power loss P at 16 kHz, $\hat{B} = 200$ mT,							
$\theta = 25\ ^{o}C$	kW/m^3 (= mW/cm^3)					≤ 170	≤ 110
$\theta = 50\ ^{o}C$	kW/m^3 (= mW/cm^3)					≤ 160	
$\theta = 100\ ^{o}C$	kW/m^3 (= mW/cm^3)					≤ 140	≤ 100
Hysteresis material constant, η_B at $\hat{B} = 0,3-1,2$ mT, f = 4 kHz, $\theta = 25\ ^{o}C$	x 10^{-3} T^{-1}						
$\hat{B} = 1,5-3,0$ mT, f = 4 kHz, $\theta = 25\ ^{o}C$	x 10^{-3} T^{-1}		≤ 7, 4	≤ 1, 1			
or							
$q_{2-24-100}$, at $\hat{B} = 0,3-1,2$ mT, f = 4 kHz, $\theta = 25\ ^{o}C$	$\Omega/H^{3/2}$ mA						
$\hat{B} = 1,5-3,0$ mT, f = 4 kHz, $\theta = 25\ ^{o}C$	$\Omega/H^{3/2}$ mA		≤ 12	≤ 1, 8			

	unit	3B	3B3	3B7	3C2	3C6	3C8
Resistivity ρ measured with d.c. current	Ω m	≥ 0, 2	≥ 1	≥1	≥0, 1	≥ 1	≥ 1
Disaccommodation factor D_F, between 10 and 100 min after demagnetisation, $\theta = 25 \pm 1$ °C	x 10^{-6}	≤ 10	≤ 11	≤4, 3			
Temperature factor of permeability α_F at θ = +5 to +25 °C +25 to +55 °C +25 to +70 °C	x 10^{-6}/degC	0 to +3	0 to +2	-0,6 to+0,6	0 to +4, 5		
Curie point	°C	≥150	≥150	≥170	≥150	≥190	≥200
Mass density	kg/m^3	4700-4900	4700-4900	4700-4900	4700-4900	4700-4900	4700-4900

Notes - The figures mentioned are valid for toroids of not too small dimensions. For cores of small dimensions and of different shapes translation of these figures in a straightforward way is not always possible.

The temperature factor α_F of 3B7 grade is measured 10 min after demagnetisation, of the other material grades 24 hours after demagnetisation.

	unit	3D3	3E1	3E2	3E3	3E4	3H1	3H2
Initial permeability μ_i								
at $\hat{B} \le 0,1$ mT		750 ± 20%	3800 ± 20%			4700 ± 20%	2300 ± 20%	2300 ± 20%
at $\hat{B} = 0,7-1$ mT, $\theta = 10-70$ °C					≥ 10 000			
at $\hat{B} = 0,7-1$ mT, $\theta = 25-70$ °C				≥ 5000				
Induction B, ballistically measured at								
H = 250 A/m, $\theta = 100$ °C	mT							
H = 800 A/m, $\theta = 25$ °C	mT	~ 350	~ 350	~ 355	~ 380		~ 360	400
= 70 °C	mT		~ 270	~ 260	~ 280		~ 280	
Eddy current and residual loss factor $\frac{\tan\delta}{\mu_i}$ at $\hat{B} \le 0,1$ mT, $\theta = 25$ °C								
f = 4 kHz	x 10^{-6}		≤ 2,5	≤ 2,5	≤ 2,5	≤ 2,5	≤ 1	≤ 1
f = 50 kHz	x 10^{-6}				≤ 20			
f = 100 kHz	x 10^{-6}	≤ 8	≤ 20	≤ 15	≤ 50	≤ 20	≤ 5	≤ 5
f = 500 kHz	x 10^{-6}	≤ 14	≤ 200			≤ 200		
f = 1000 kHz	x 10^{-6}	≤ 30						
Power loss P at 16 kHz, $\hat{B} = 200$ mT,								
$\theta = 25$ °C	kW/m^3 (= mW/cm^3)							
$\theta = 50$ °C	kW/m^3 (= mW/cm^3)							
$\theta = 100$ °C	kW/m^3 (= mW/cm^3)							
Hysteresis material constant,								
η_B at $\hat{B} = 0,3-1,2$ mT, f = 4 kHz $\theta = 25$ °C	x 10^{-3} T^{-1}	≤ 1,8						
$\hat{B} = 1,5-3,0$ mT, f = 4 kHz $\theta = 25$ °C	x 10^{-3} T^{-1}		≤ 1,1	≤ 1,1	≤ 1,1	≤ 0,85	≤ 1,1	≤ 1,1
or								
$q_{2-24-100}$, at $\hat{B} = 0,3-1,2$ mT, f = 4 kHz, $\theta = 25$ °C	$\Omega/H^{3/2}$ mA	≤ 3						
$\hat{B} = 1,5-3,0$ mT, f = 4 kHz, $\theta = 25$ °C	$\Omega/H^{3/2}$ mA		≤ 1,8	≤ 1,8	≤ 1,8	≤ 1,4	≤ 1,8	

	unit	3D3	3E1	3E2	3E3	3E4	3H1	3H2
Resistivity ρ measured with d.c. current	Ωm	≥1, 5	≥0, 3	≥ 0, 1	≥ 0, 05	≥ 0, 3	≥ 1	≥ 1
Disaccommodation factor D_F, between 10 and 100 min after demagnetisation, θ = 25 ± 1 °C	x 10^{-6}	≤ 12		≤ 1, 9	≤ 1, 9	≤ 4, 3	≤ 4, 3	≤ 4, 3
Temperature factor of permeability α_F at θ = +5 to +25 °C	x 10^{-6}/degC		1 ± 1			1 ± 1	1 ± 0, 5	1,2 ± 0,6
+25 to +55 °C			1 ± 1			1 ± 1	1 ± 0, 5	1,2 ± 0,6
+25 to +70 °C		0 to +2	1 ± 1			1 ± 1	1 ± 0, 5	1,2 ± 0,6
Curie point	°C	≥150	≥125	≥130	≥125	≥125	≥130	≥ 160
Mass density	kg/m^3	4500-4900	4700-4900	4700-4900	4800-4950	4700-4900	4700-4900	4700-4900

Notes - The figures mentioned are valid for toroids of not too small dimensions. For cores of small dimensions and of different shapes translation of these figures in a straightforward way is not always possible.

The temperature factor α_F of 3B7 grade is measured 10 min after demagnetisation, of the other material grades 24 hours after demagnetisation.

←

	unit	4A4	4B1	4C1	4C6	4D1	4D2	4E1
Initial permeability μ_i at $\hat{B} \leq 0,1$ mT		500 ± 20%	250 ± 20%	125 ± 20%	120 ± 20%	50 ± 20%	60 ± 10%	15 ± 20%
Induction B, ballistically measured at								
H = 800 A/m, θ = 25 °C	mT	~ 270						
= 70 °C		~ 210						
H = 1600 A/m, θ = 25 °C			~ 325					
= 100 °C			~ 260					
H = 2000 A/m, θ = 25 °C								
ϑ = 70 °C								
H = 2400 A/m, θ = 25 °C				~ 275	~ 380			
θ = 70 °C					~ 350			
θ = 100 °C				~ 245				
H = 3200 A/m, θ = 25 °C						~ 240		
θ = 100 °C						~ 220		
H = 4800 A/m, θ = 25 °C								~ 175
θ = 100 °C								~ 165
Eddy current and residual loss factor $\frac{\tan \delta}{\mu_i}$ at $\hat{B} \leq 0,1$ mT, θ = 25 °C,								
f = 500 kHz	$\times 10^{-6}$	≤ 30						
f = 700 kHz			≤ 70					
f = 1 MHz			≤ 90					
f = 1,5 MHz		≤ 40	≤ 140					
f = 2 MHz		≤ 70		≤ 120	≤ 40			
f = 3 MHz				≤ 160		≤ 180		
f = 5 MHz				≤ 300		≤ 210		
f = 10 MHz					≤ 100	≤ 300	≤ 100	≤ 300
f = 25 MHz							≤ 200	
f = 40 MHz							≤ 600	≤ 360
Hysteresis material constant, η_B at $\hat{B}$ = 0, 3-1,2 mT, f = 100 kHz, θ = 25 °C	$\times 10^{-3} T^{-1}$	≤ 1, 8			≤ 6, 1			
or q2-24-100 at $\hat{B}$ = 0, 3-1, 2 mT, f = 100 kHz θ = 25 °C	$\Omega/H^{3/2}$mA	≤ 3			≤ 10			

MnZn and NiZn ferrites

	unit	4A4	4B1	4C1	4C6	4D1	4D2	4E1
Resistivity ρ measured with d.c. current	Ω m	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$
Dielectric constant ϵ at 1 MHz, $\theta = 25\ ^{o}C$		15–20			10–15			
Disaccommodation factor D_F, between 10 and 100 min after demagnetisation, $\theta = 25 \pm 1\ ^{o}C$	x 10^{-6}	≤ 5			≤ 10			
Temperature factor of permeability α_F at $\theta =$ +5 to +25 ^{o}C	x 10^{-6}/degC				1 ± 3			
+25 to +55 ^{o}C			0 to +8	0 to +12	3 ± 3	0 to +15		0 to +15
+25 to +70 ^{o}C		10 ± 5					0 to +15	
Curie point	^{o}C	≥ 135	≥ 250	≥ 350	≥ 350	≥ 400	≥ 350	≥ 500
Mass density	kg/m^3	4700-5100	4400-4800	4200-4600	4000-5000	4000-4400		3500-4000

Notes - The figures mentioned are valid for toroids of not too small dimensions. For cores of small dimensions and of different shapes translation of these figures in a straightforward way is not always possible.

The temperature factor α_F of all ferroxcube 4 grade materials is measured 24 hours after demagnetisation.

↑

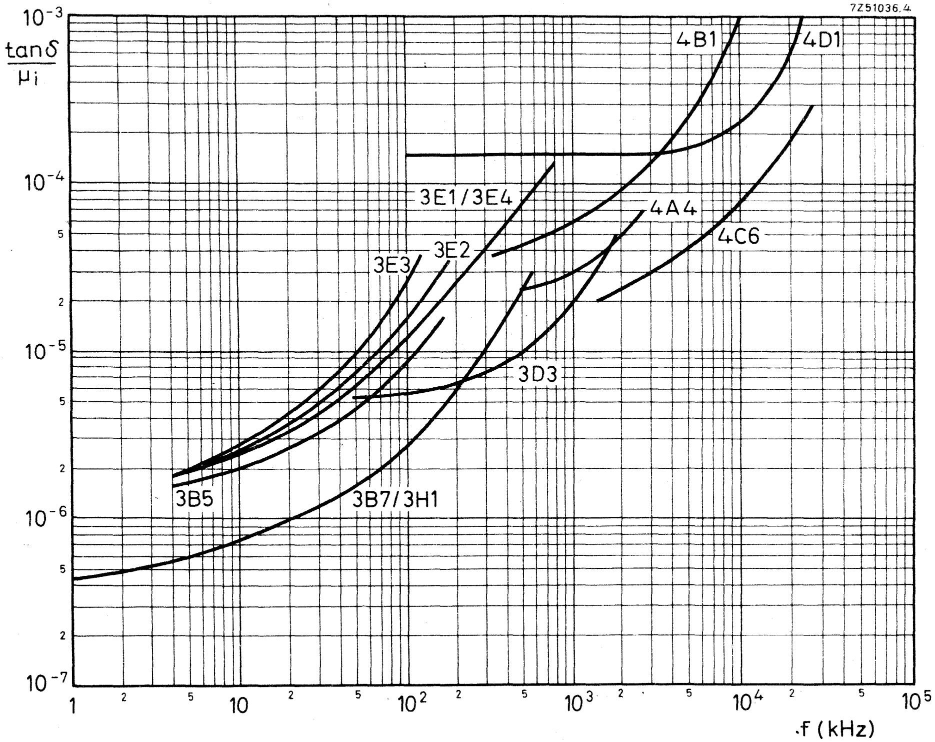
NiZn ferrites for resonant cavities

	4H1	4L1	4L2	4MX
Q80/Q~	0.9	0.7	0.7	0.8
μ_{rem}/μ_i	0.6-0.7	0.7-0.8	0.8-0.9	0.8-0.9
μ in remanent state (μ_{rem}) approx.	170	150	190	130
μQ in remanent state at 1.5 MHz, 5 mT	21400	17800	21400	21800
at 1.5 MHz, 10 mT	16000	14000	17000	20500
at 1.5 MHz, 15 mT	12800	11200	14000	18800
at 1.5 MHz, 20 mT	8600	9200	9700	14000
at 2.5 MHz, 5 mT	15000	13000	17000	
at 2.5 MHz, 10 mT	6000	7200	14500	
at 2.5 MHz, 15 mT		5000	11000	
at 2.5 MHz, 20 mT			8200	
at 5 MHz, 5 mT	5000	10600	12000	19200
at 5 MHz, 10 mT		4600	9700	16000
at 5 MHz, 15 mT			6700	12500
at 5 MHz, 20 mT			4500	5600
at 10 MHz, 5 mT		4200		11200
at 10 MHz, 10 mT				8200
at 10 MHz, 15 mT				5600

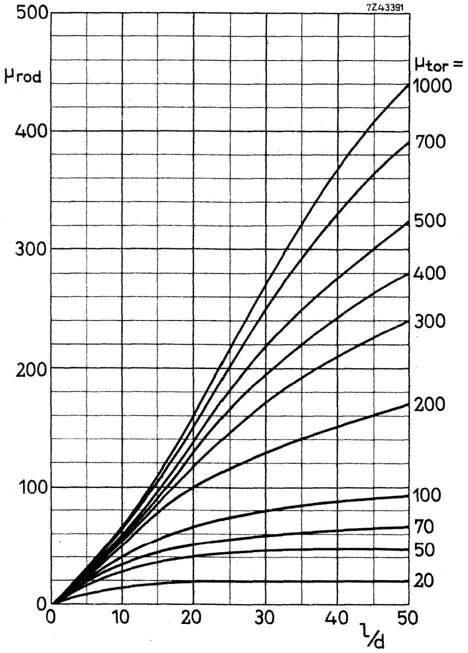
Q80/Q~ indicates the properties under pulse conditions.
Q80 is the quality factor 80 milliseconds after application of a continuous bias of approx. 4000 A/m.
Q~ is the quality factor in the static state.
μ_{rem}/μ_i indicates the squareness of the hysteresis loop.

CHARACTERISTIC CURVES

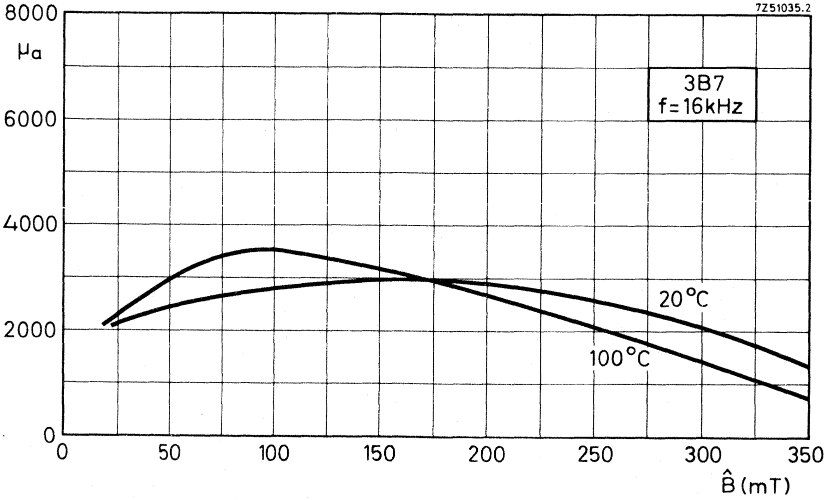
EDDY CURRENT LOSSES AND RESIDUAL LOSSES AS A FUNCTION OF THE FREQUENCY AT LOW INDUCTION LEVEL

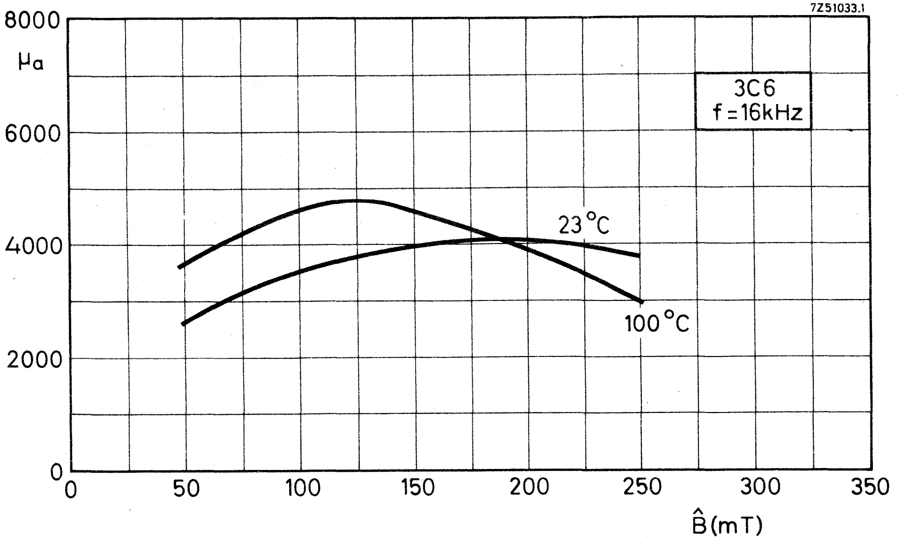


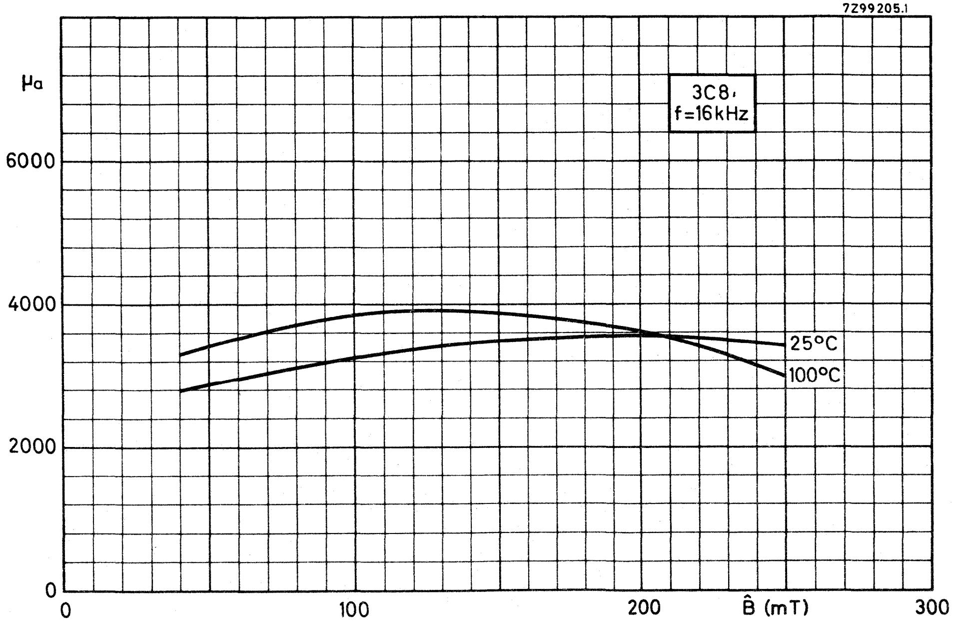
ROD PERMEABILITY AS A FUNCTION OF THE RATIO l/d WITH THE RELATIVE INITIAL PERMEABILITY OF A TOROIDAL CORE AS PARAMETER

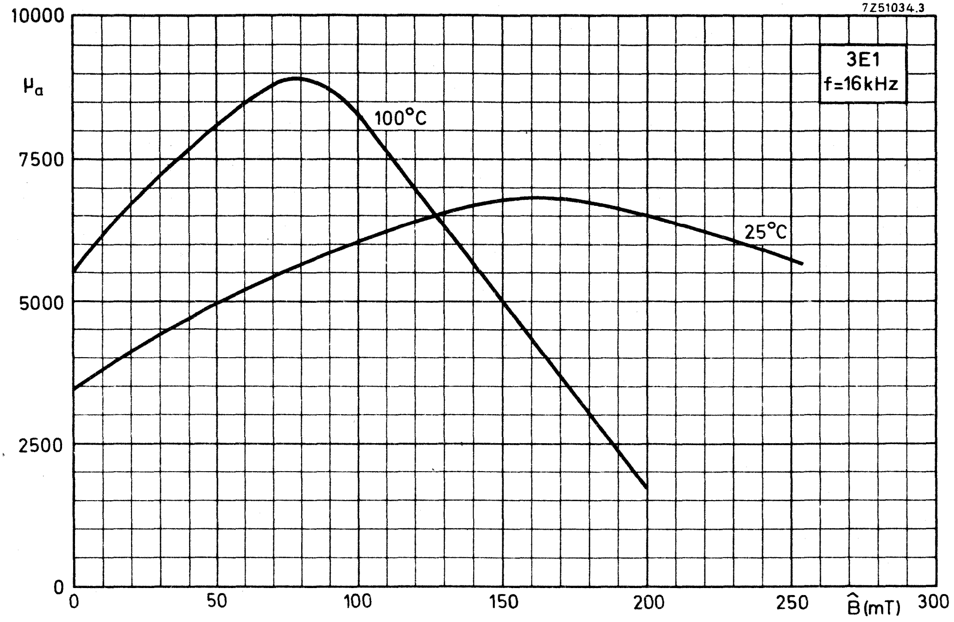


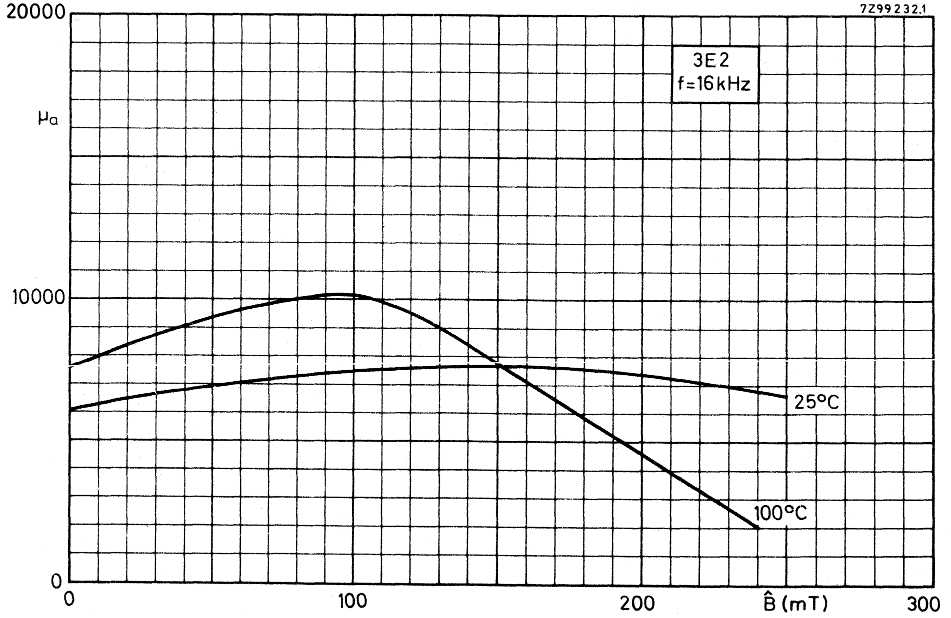
AMPLITUDE PERMEABILITY AS A FUNCTION OF THE INDUCTION

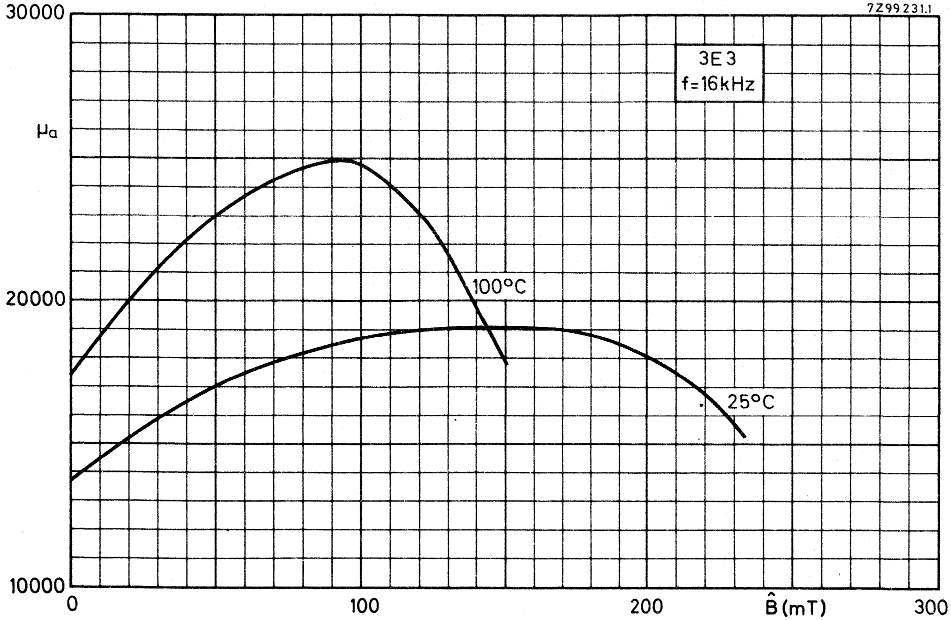


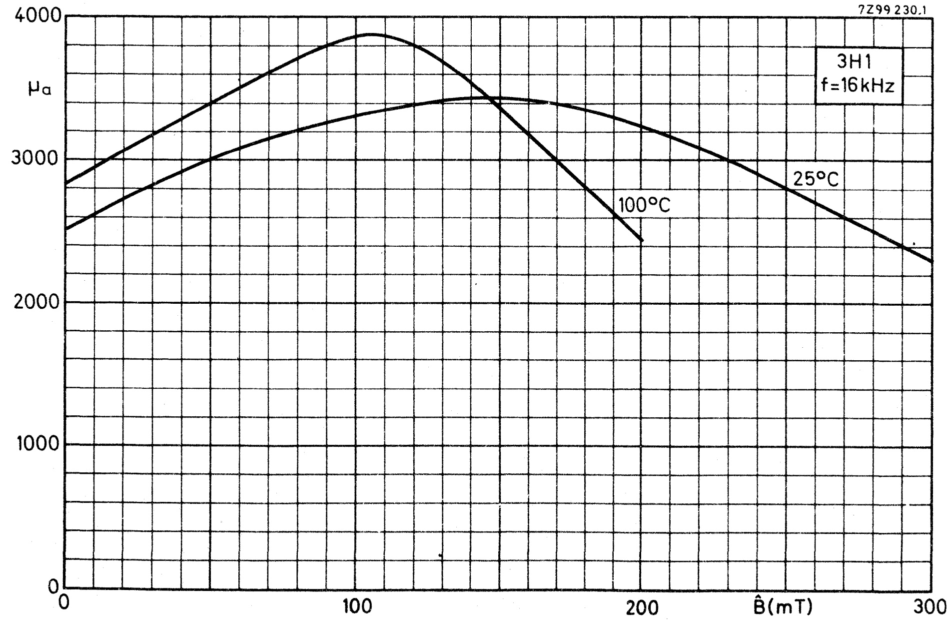

7Z51033.1
8000
μ_a
6000
4000
2000
0
0
50
100
150
200
250
300
350
$\hat{B}$(mT)
3C6
f = 16kHz
23 °C
100 °C


7Z99205.1
μ_a
6000
4000
2000
0
0
100
200
300
$\hat{B}$ (mT)
3C8
f=16kHz
25°C
100°C

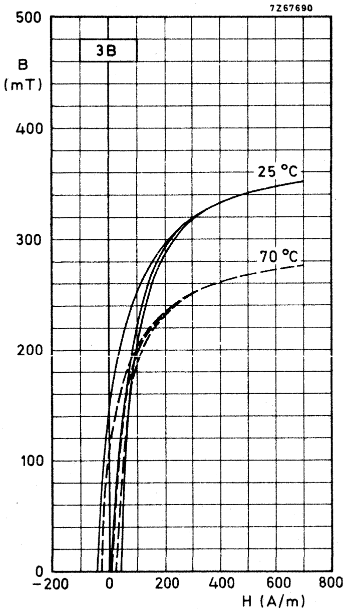

7Z51034.3
10000
7500
5000
2500
0
μ_a
3E1
f=16kHz
100°C
25°C
0
50
100
150
200
250
$\hat{B}$(mT)
300

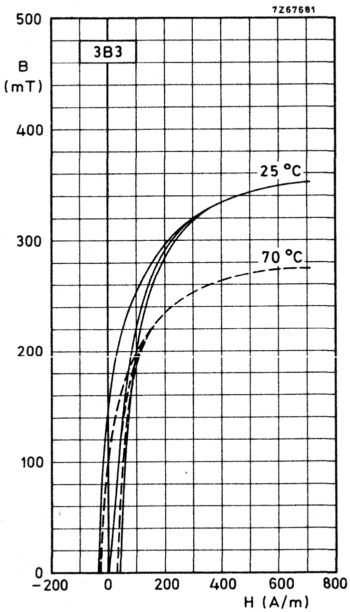

7Z99232.1
20000
10000
0
μ_a
3E2
f=16kHz
25°C
100°C
0
100
200
$\hat{B}$ (mT)
300

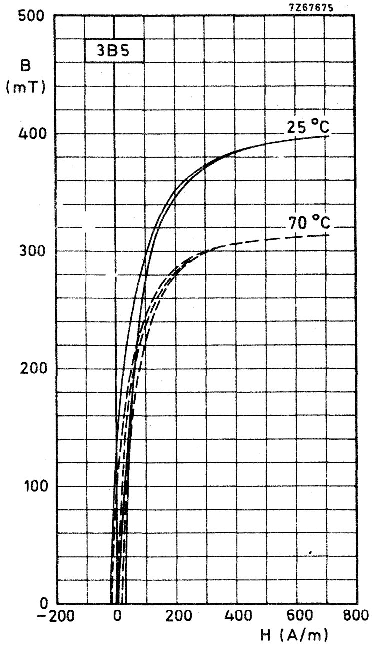

7Z99231.1
3E3
f=16kHz
μa
30000
20000
10000
0
100
200
300
B̂(mT)
100°C
25°C

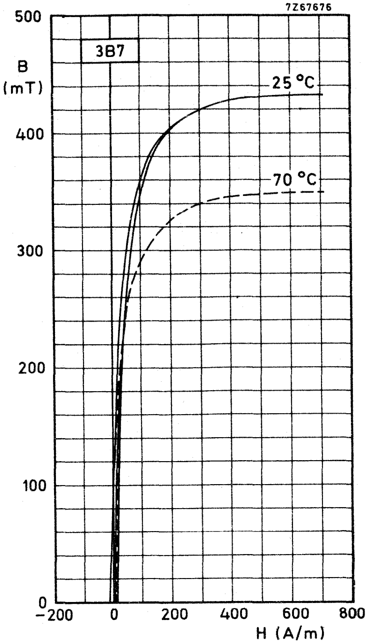

7Z99230.1
3H1
f=16kHz
μa
4000
3000
2000
1000
0
0
100
200
300
B̂(mT)
100°C
25°C

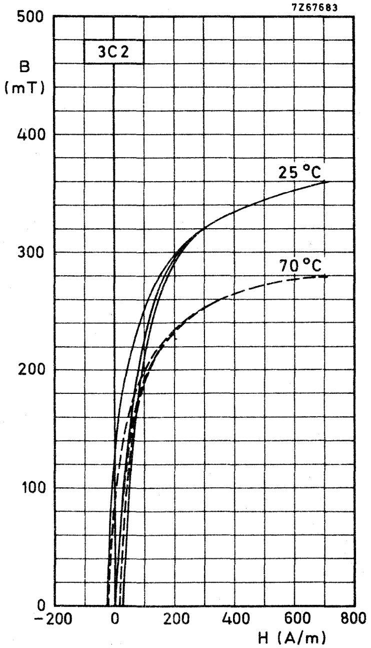
TYPICAL BH-CURVES (ballistically measured)

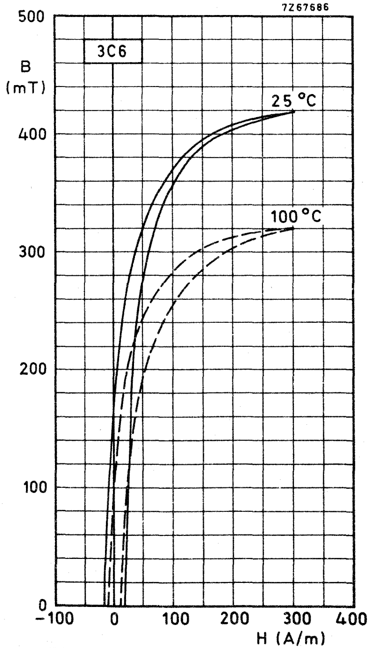


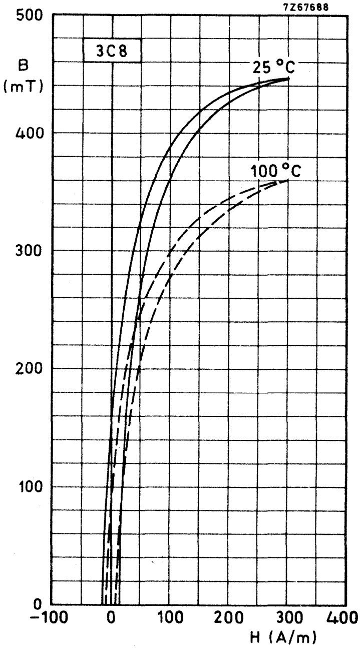


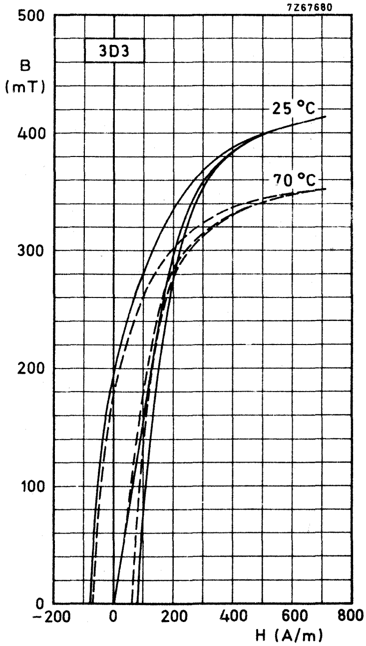

7Z67675
3B5
B
(mT)
500
400
300
200
100
0
25 °C
70 °C
−200
0
200
400
600
800
H (A/m)

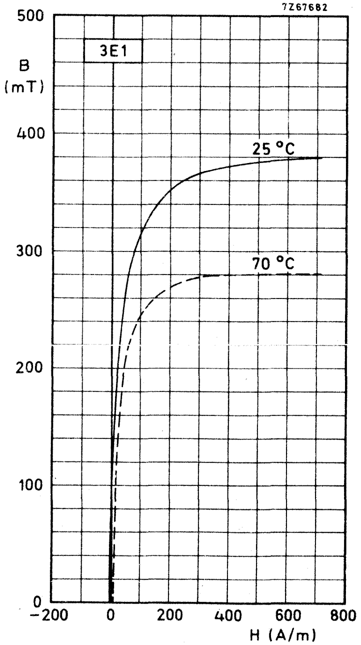

7Z67676
3B7
B
(mT)
500
400
300
200
100
0
25 °C
70 °C
−200
0
200
400
600
800
H (A/m)

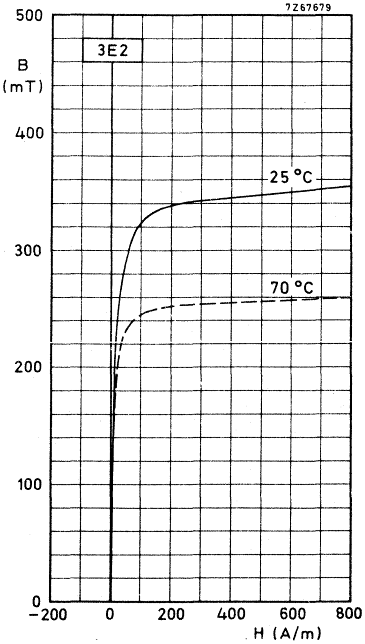

7Z67683
3C2
B
(mT)
500
400
300
200
100
0
25 °C
70 °C
−200
0
200
400
600
800
H (A/m)

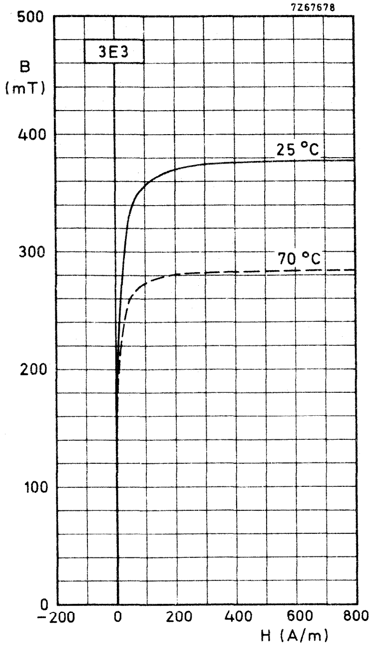

7Z67686
3C6
B
(mT)
500
400
300
200
100
0
25 °C
100 °C
−100
0
100
200
300
400
H (A/m)

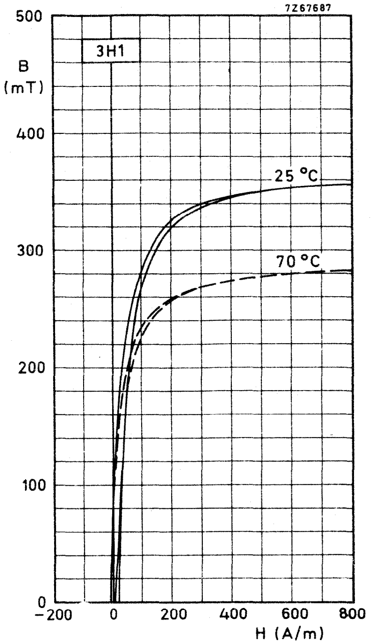

7Z67688
3C8
B (mT)
500
400
300
200
100
0
25 °C
100 °C
−100
0
100
200
300
400
H (A/m)

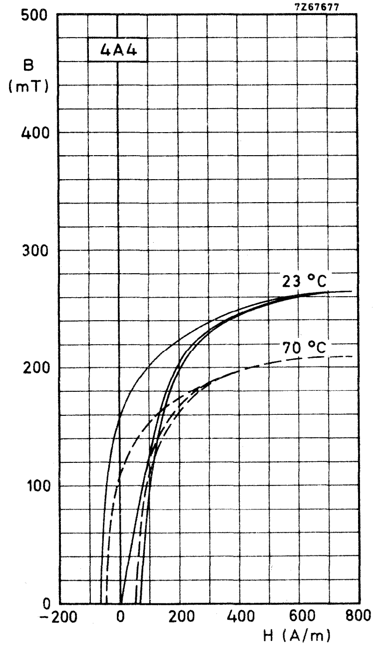

7Z67680
3D3
B (mT)
500
400
300
200
100
0
25 °C
70 °C
−200
0
200
400
600
800
H (A/m)

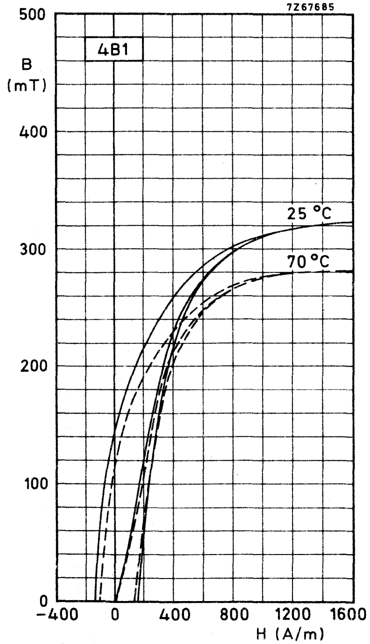

7Z67682
3E1
B (mT)
500
400
300
200
100
0
25 °C
70 °C
−200
0
200
400
600
800
H (A/m)

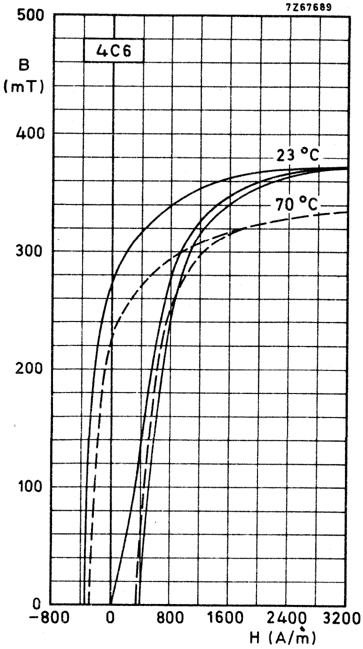

7Z67679
3E2
B (mT)
500
400
300
200
100
0
25 °C
70 °C
−200
0
200
400
600
800
H (A/m)

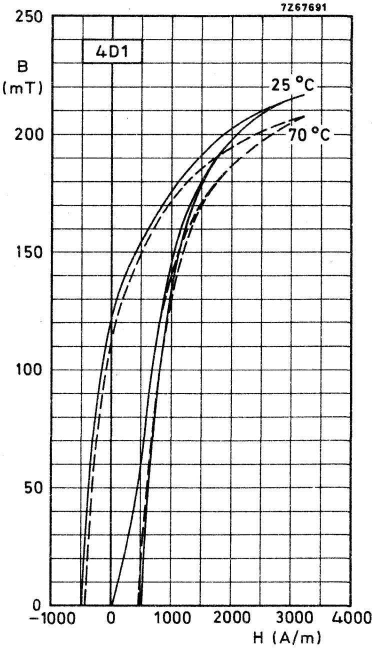

7Z67678
3E3
B
(mT)
500
400
300
200
100
0
−200
0
200
400
600
800
H (A/m)
25 °C
70 °C

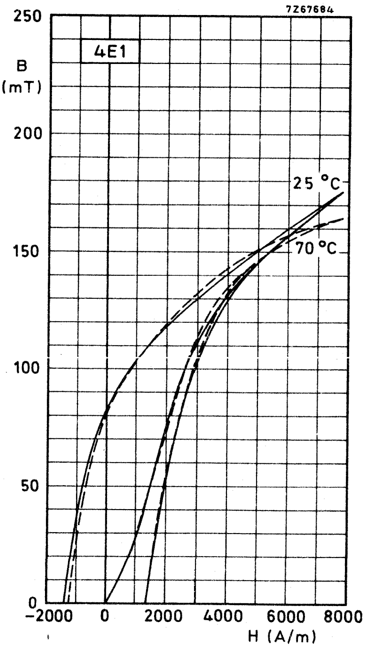

7Z67687
3H1
B
(mT)
500
400
300
200
100
0
−200
0
200
400
600
800
H (A/m)
25 °C
70 °C


7Z67677
4A4
B
(mT)
500
400
300
200
100
0
−200
0
200
400
600
800
H (A/m)
23 °C
70 °C

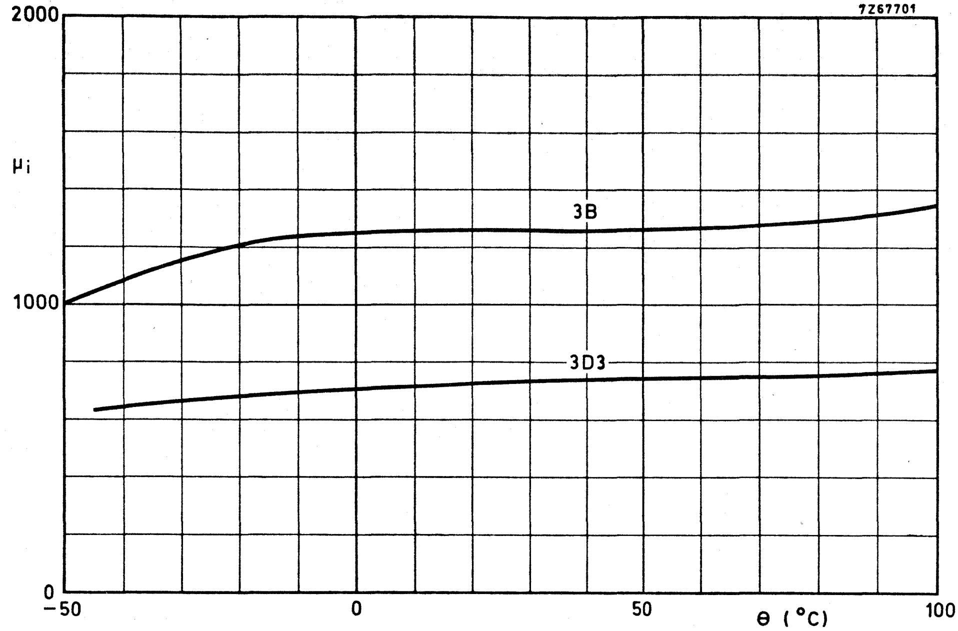

7Z67685
4B1
B
(mT)
500
400
300
200
100
0
−400
0
400
800
1200
1600
H (A/m)
25 °C
70 °C

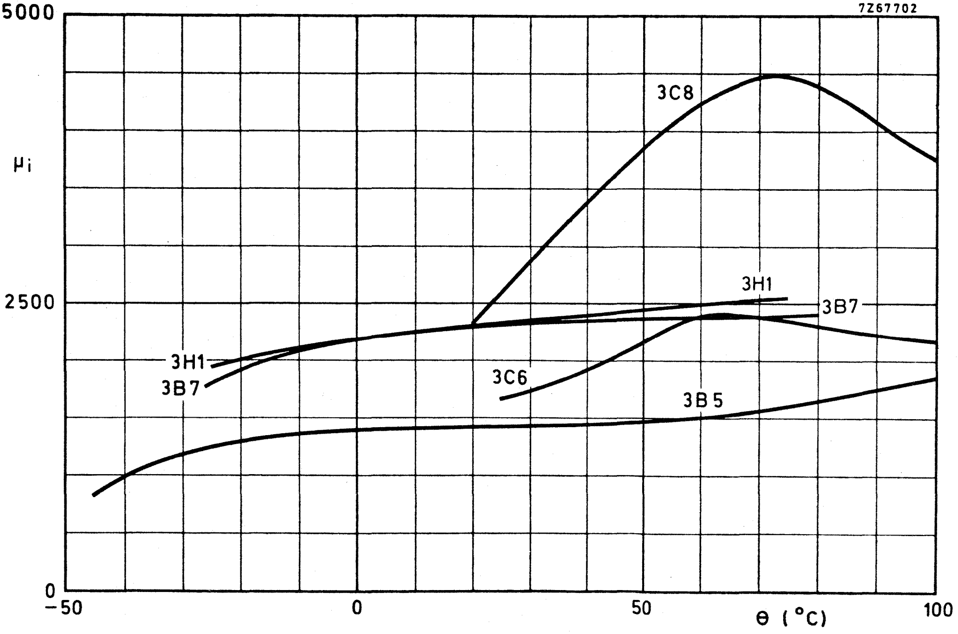

7Z67689
4C6
B (mT)
500
400
300
200
100
0
23 °C
70 °C
−800
0
800
1600
2400
3200
H (A/m)

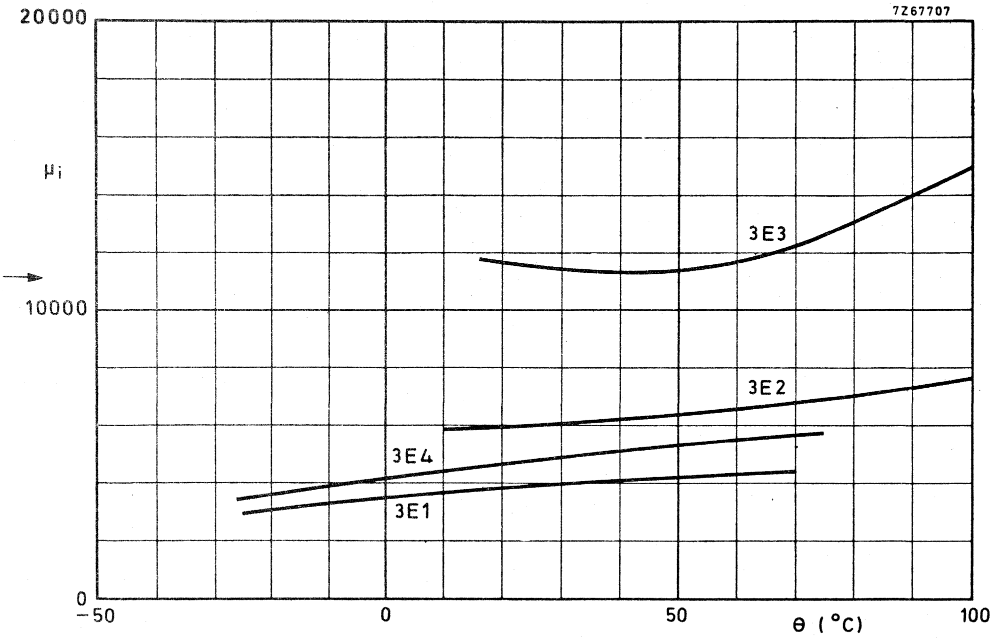

7Z67691
4D1
B (mT)
250
200
150
100
50
0
25 °C
70 °C
−1000
0
1000
2000
3000
4000
H (A/m)

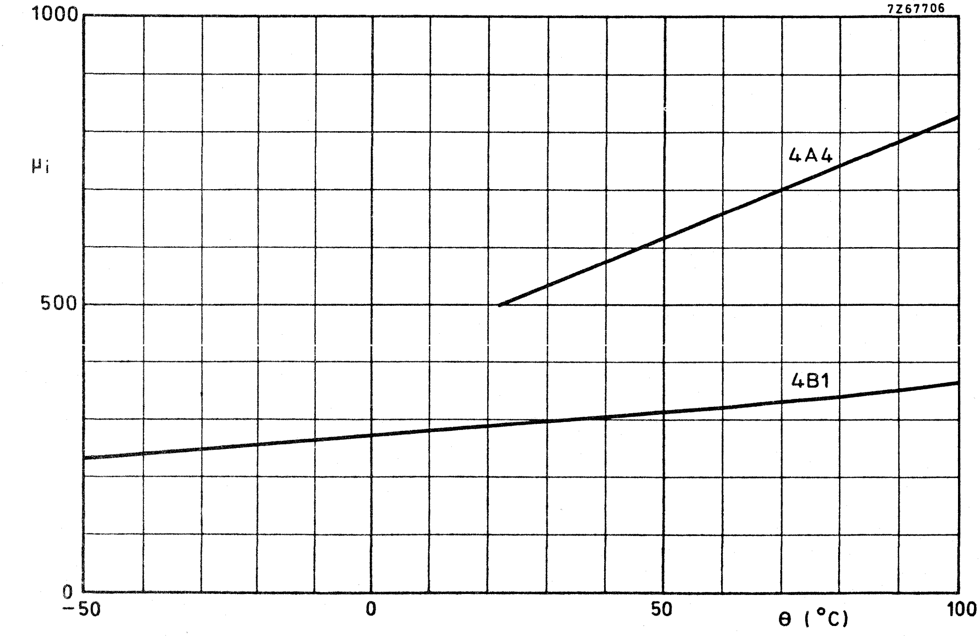

7Z67684
4E1
B (mT)
250
200
150
100
50
0
25 °C
70 °C
−2000
0
2000
4000
6000
8000
H (A/m)

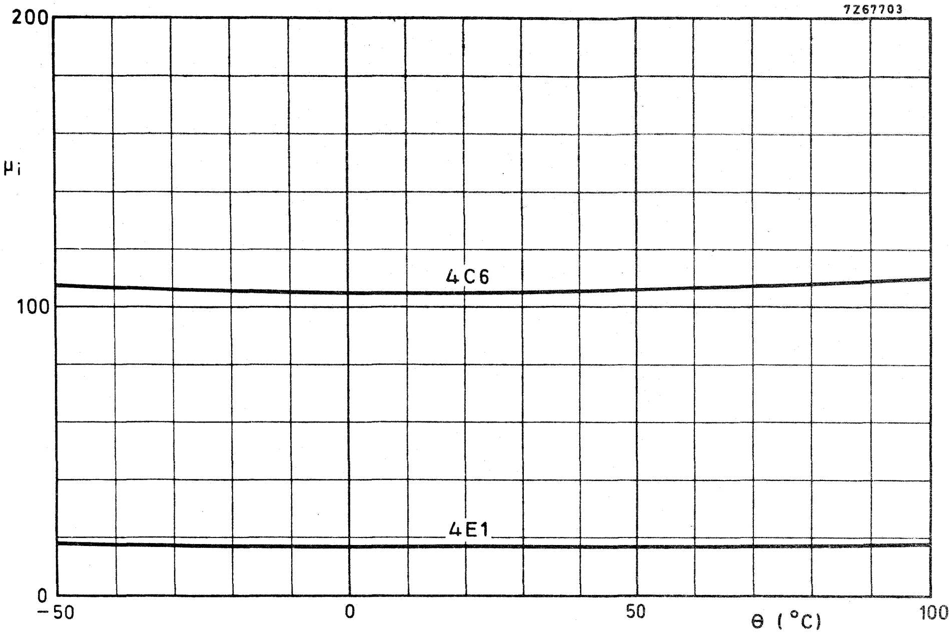
RELATIVE INITIAL PERMEABILITY AS A FUNCTION OF THE TEMPERATURE



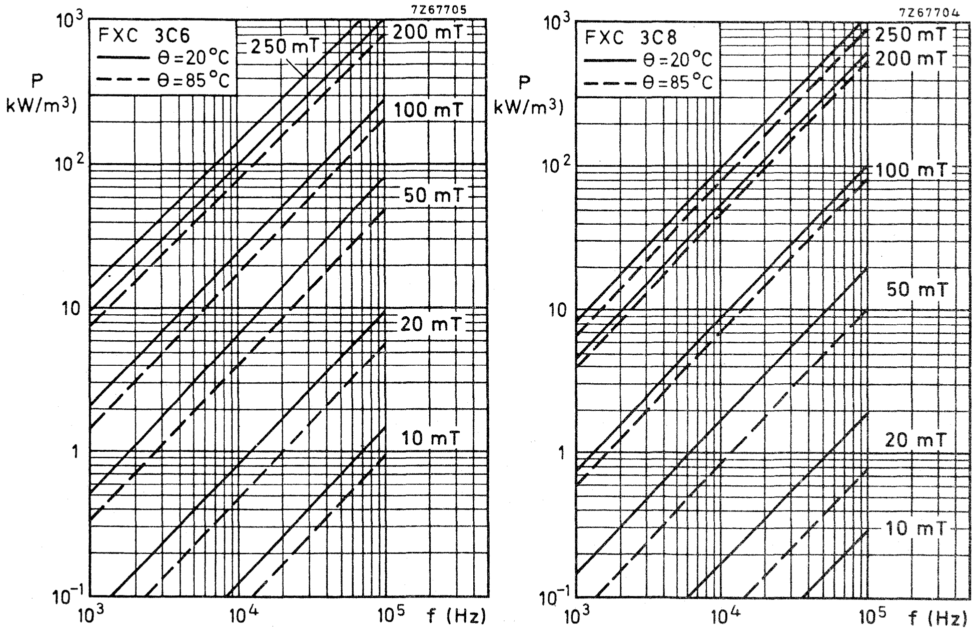



7Z67707
20000
μi
10000
0
3E3
3E2
3E4
3E1
−50
0
50
100
θ (°C)

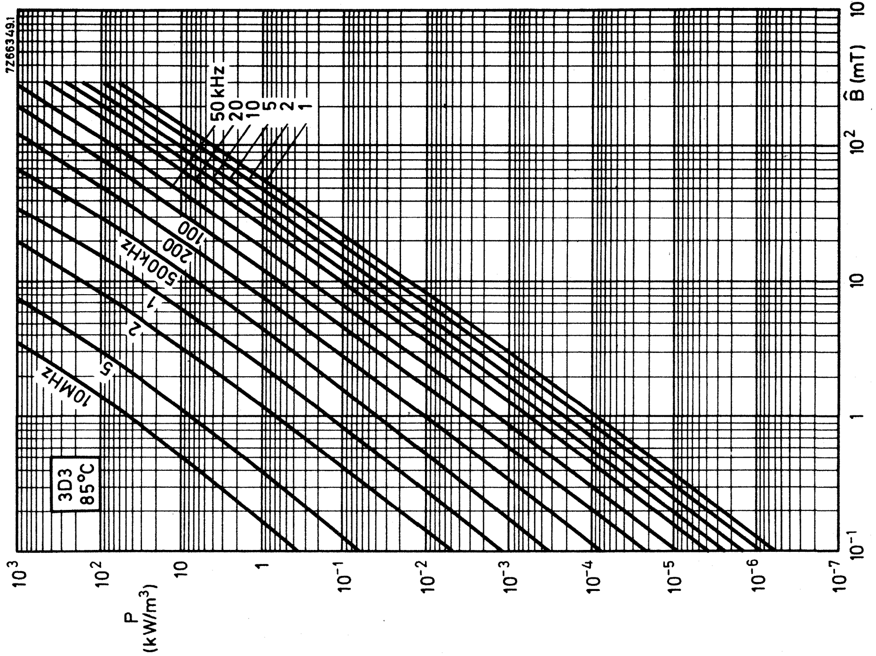

7Z67706
1000
μi
500
0
4A4
4B1
−50
0
50
100
θ (°C)

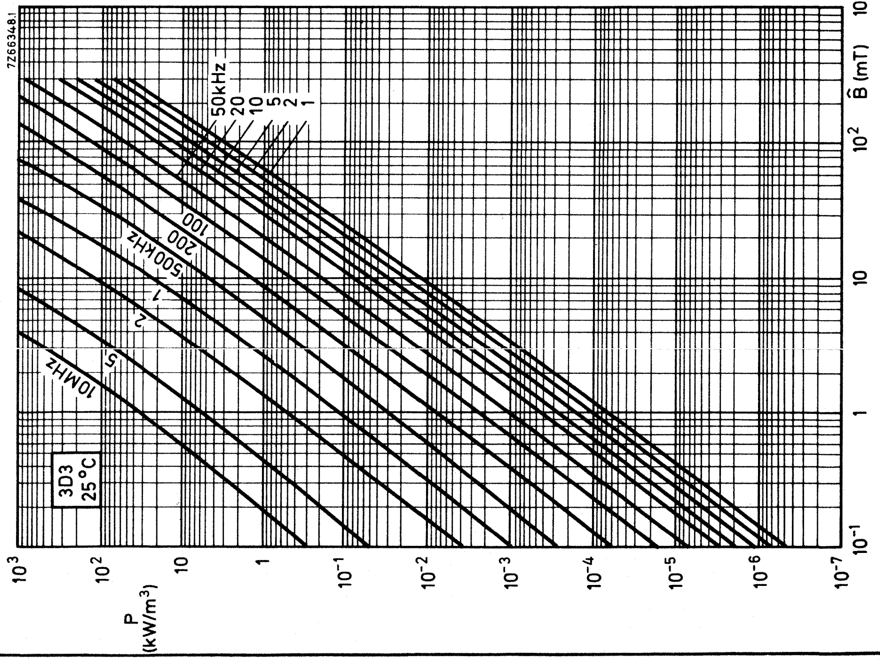


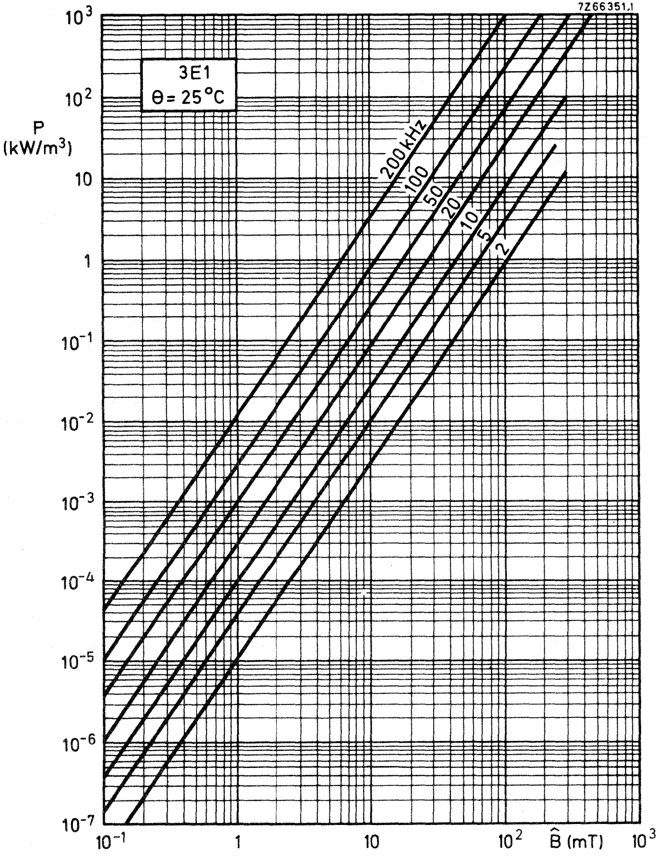
POWER LOSS AS A FUNCTION OF THE FREQUENCY

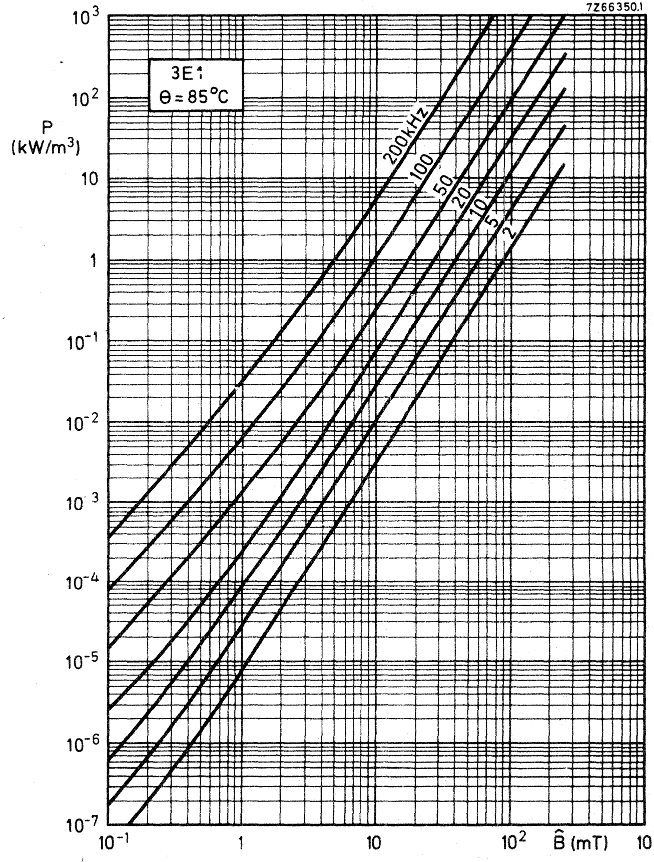


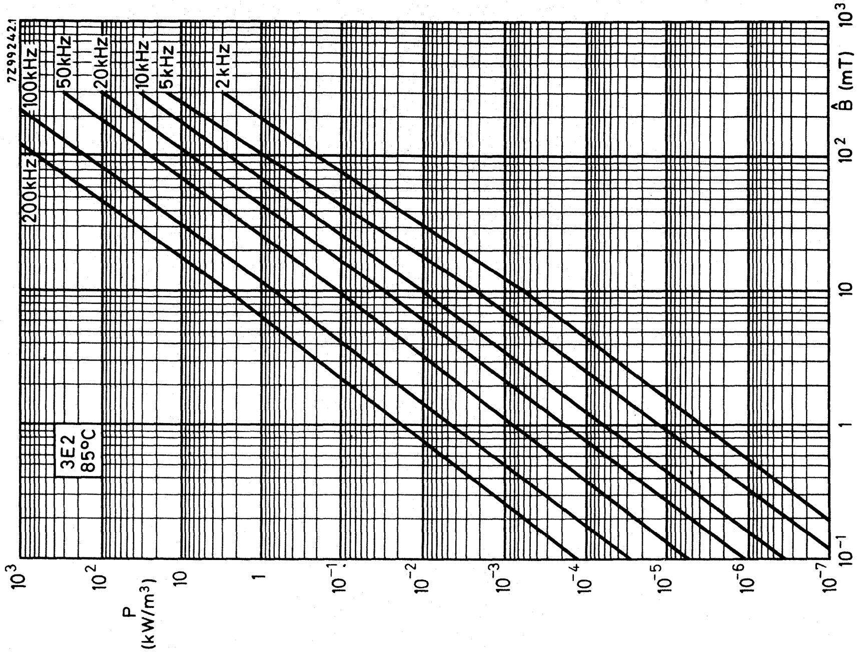
POWER LOSS AS A FUNCTION OF THE INDUCTION

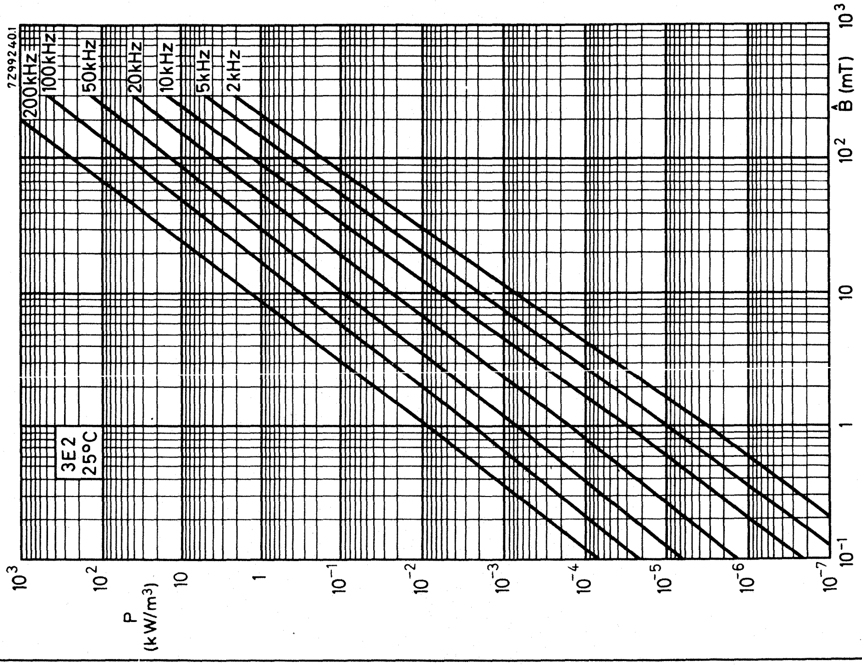


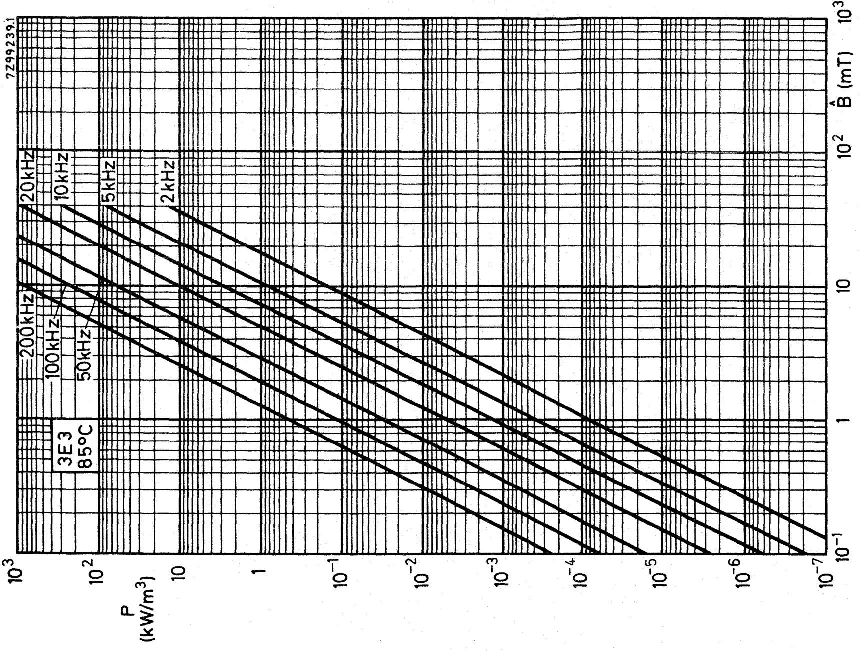


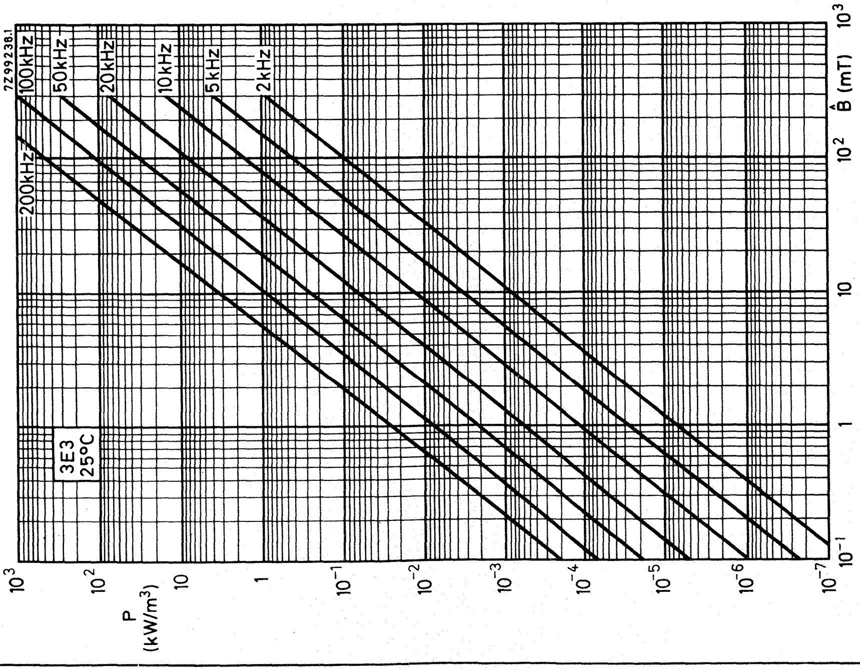

7Z66351.1
3E1
θ = 25°C
P (kW/m³)
10³
10²
10
1
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
200kHz
100
50
20
10
5
2
10⁻¹
1
10
10²
B̂ (mT)
10³

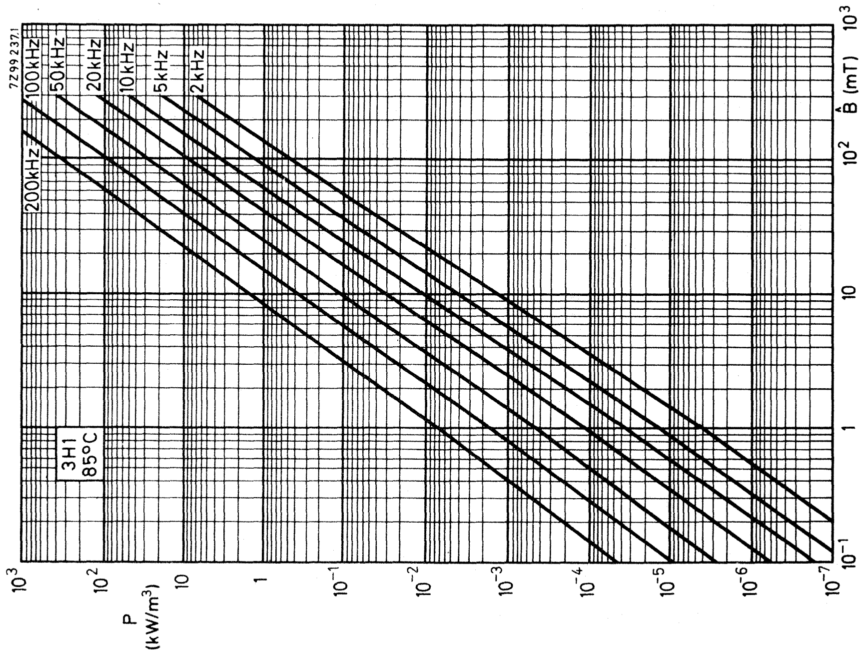

7Z66350.1
3E1
θ = 85°C
P (kW/m³)
10³
10²
10
1
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
200kHz
100
50
20
10
5
2
10⁻¹
1
10
10²
B̂ (mT)
10³

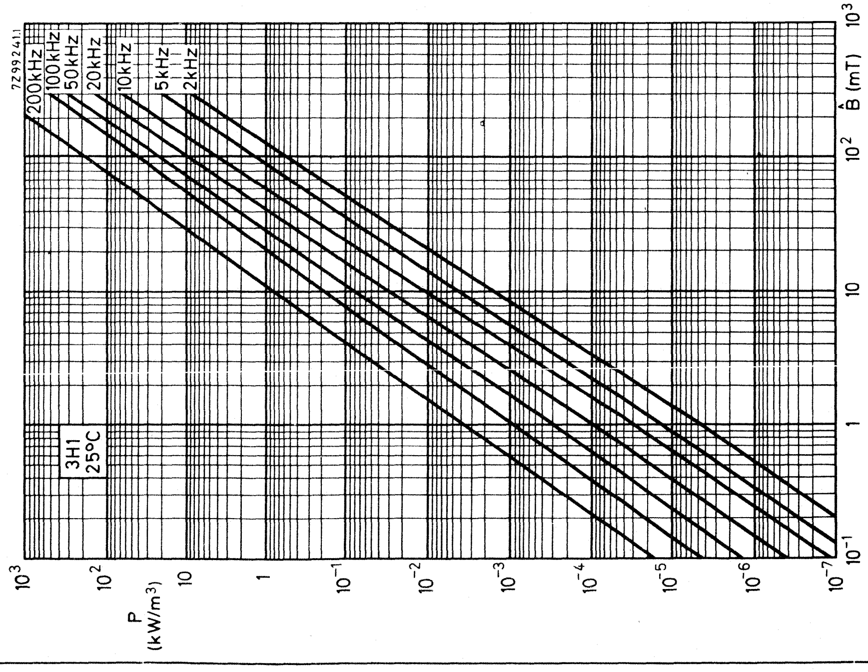

7Z99242.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3E2
85°C
$\hat{B}$ (mT)
10^{-1}
1
10
10^2
10^3
P (kW/m^3)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}

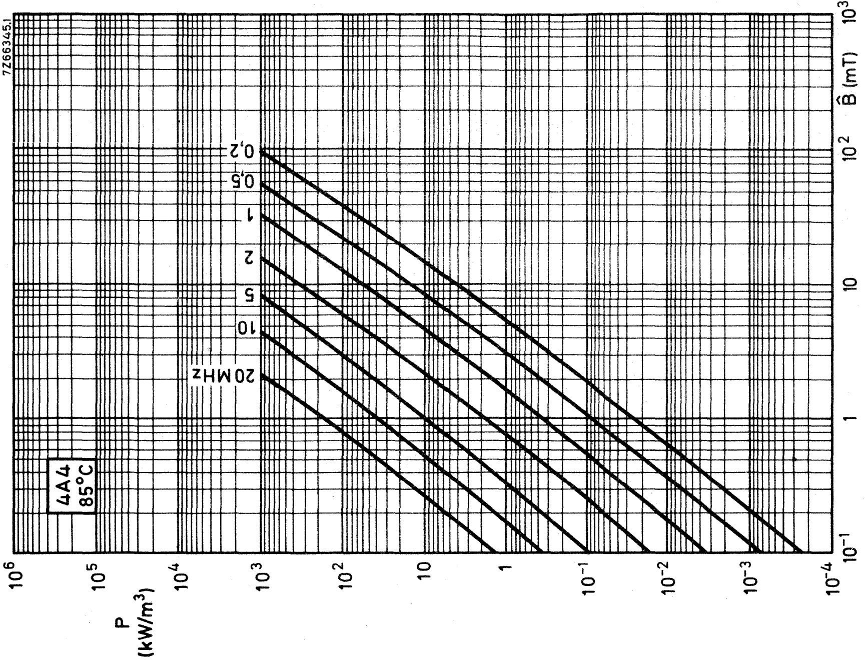

7Z99240.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3E2
25°C
$\hat{B}$ (mT)
10^{-1}
1
10
10^2
10^3
P (kW/m^3)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}

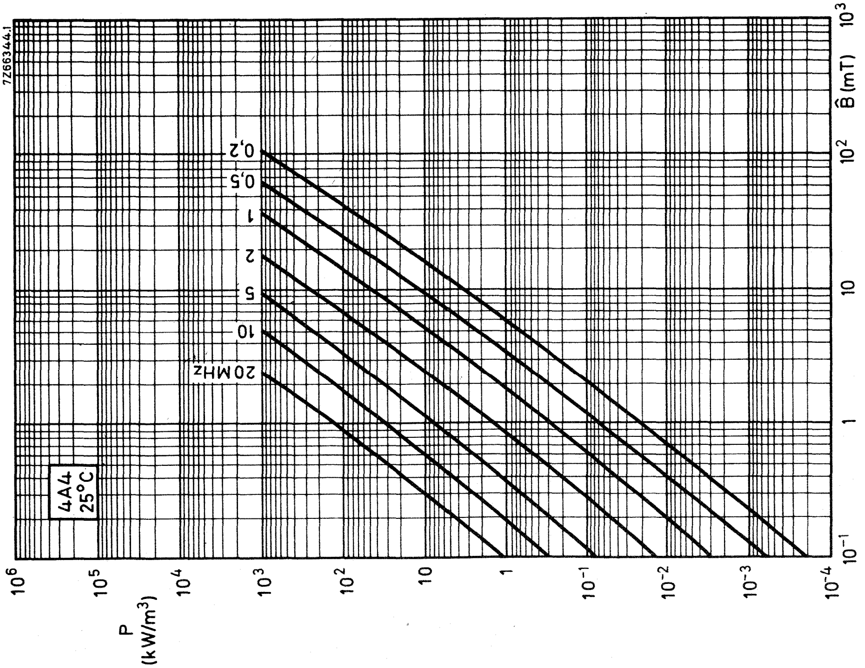

7Z99239.1
3E3
85°C
20kHz
10kHz
5kHz
2kHz
200kHz
100kHz
50kHz
P
(kW/m³)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
B̂ (mT)
10^3
10^2
10
1
10^{-1}

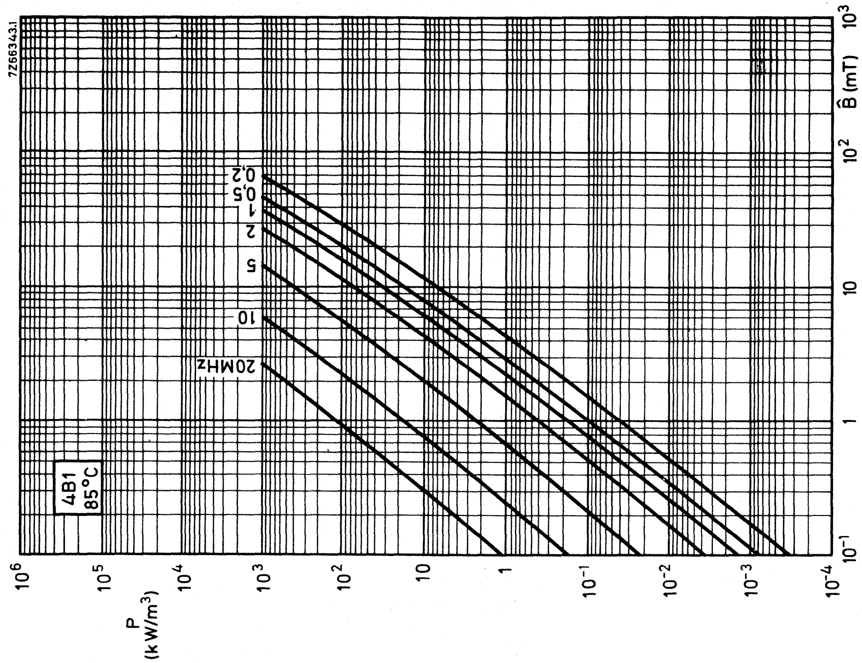

7Z99238.1
3E3
25°C
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
200kHz
P
(kW/m³)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
B̂ (mT)
10^3
10^2
10
1
10^{-1}

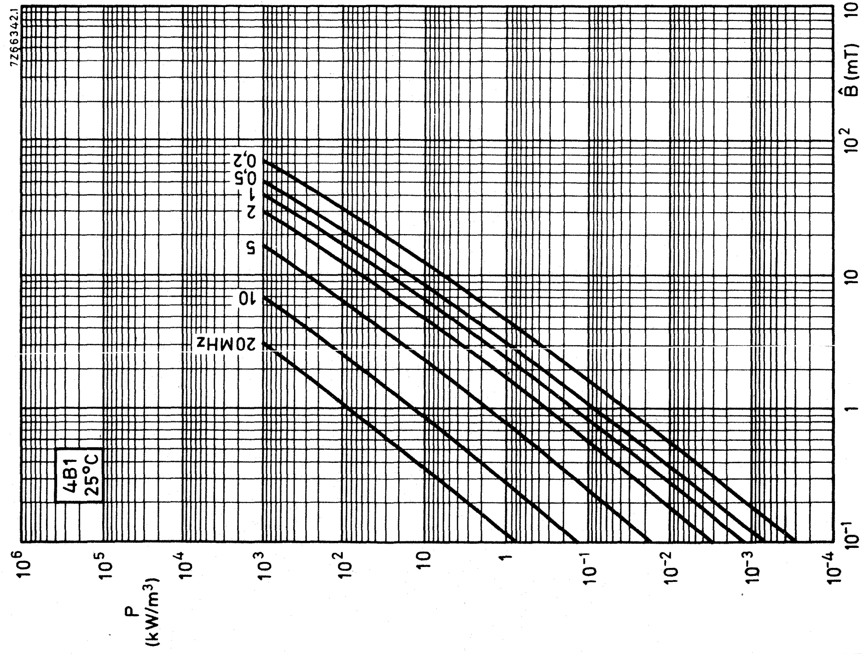

7Z99237.1
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
200kHz
3H1
85°C
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
P
(kW/m³)
10^3
$\hat{B}$ (mT)
10^2
10
1
10^{-1}

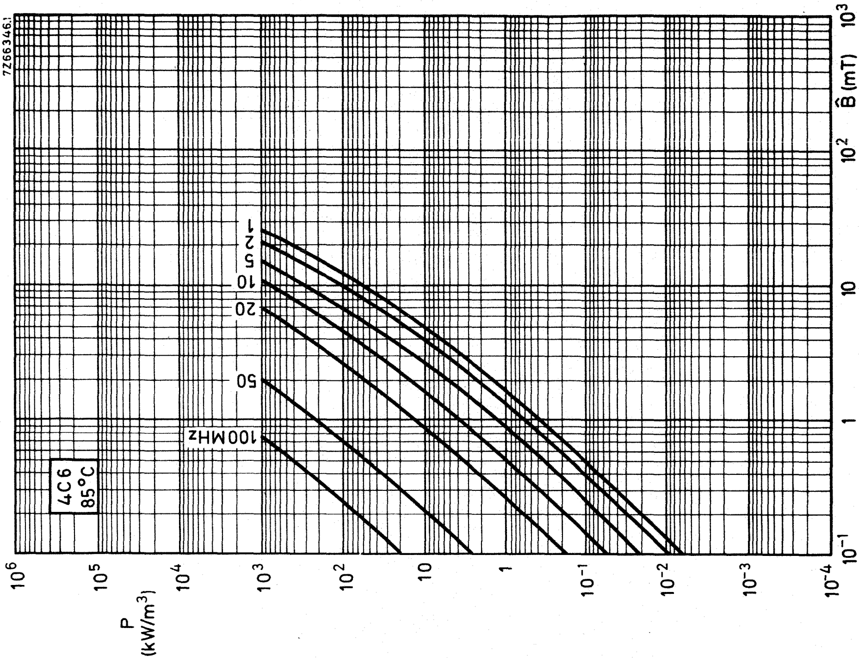

7Z99241.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3H1
25°C
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
P
(kW/m³)
10^3
$\hat{B}$ (mT)
10^2
10
1
10^{-1}

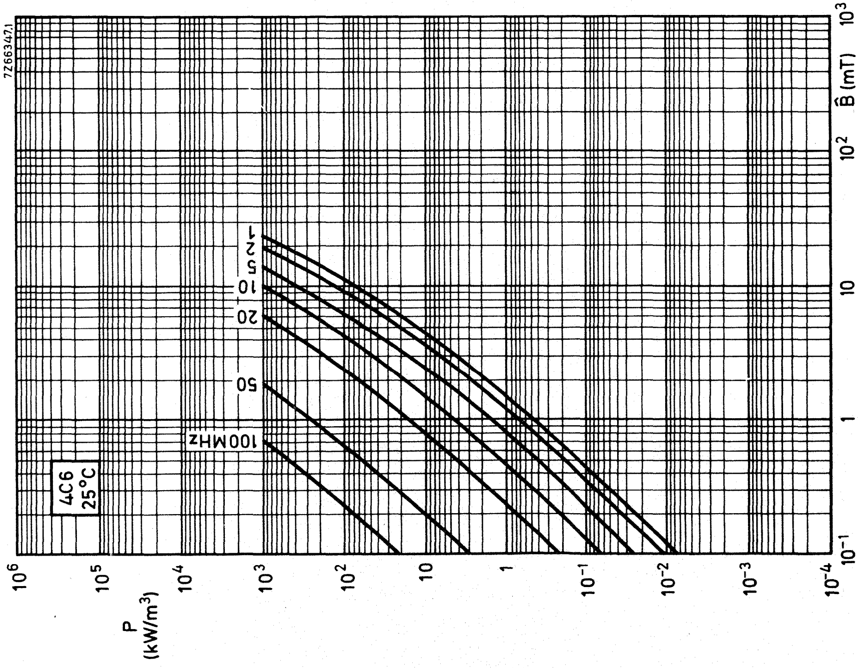

7Z66345.1
4A4
85°C
P
(kW/m³)
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
$\hat{B}$ (mT)
10^{-1}
1
10
10^2
10^3
0,2
0,5
1
2
5
10
20 MHz


7Z66344.1
4A4
25°C
P
(kW/m³)
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
$\hat{B}$ (mT)
10^{-1}
1
10
10^2
10^3
0,2
0,5
1
2
5
10
20 MHz

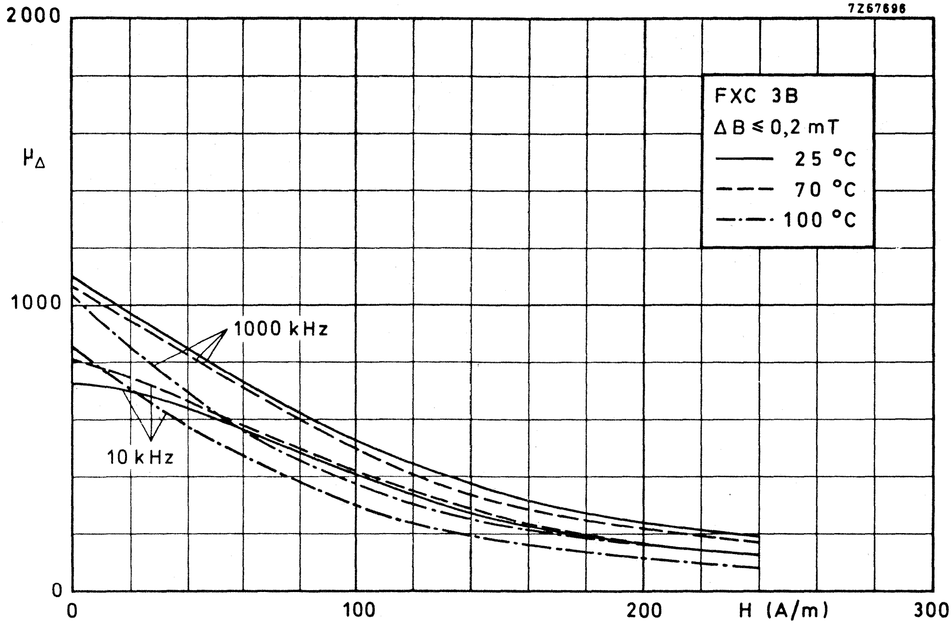

7Z66343.1
4B1
85°C
0,2
0,5
1
2
5
10
20MHz
P
(kW/m^3)
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
$\hat{B}$ (mT)
10^{-1}
1
10
10^2
10^3

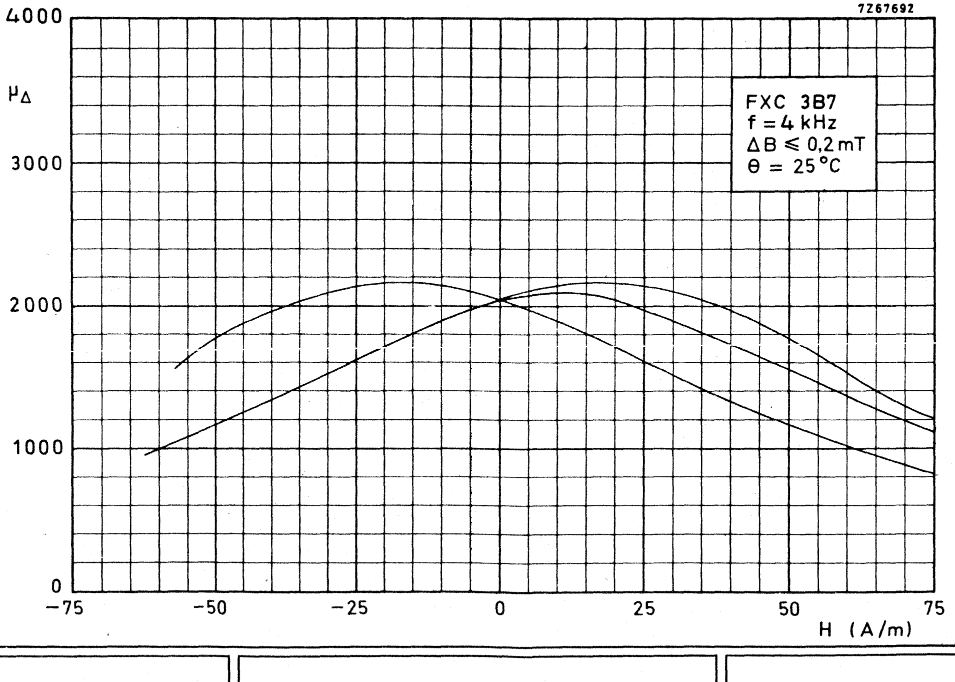

7Z66342.1
4B1
25°C
0,2
0,5
1
2
5
10
20MHz
P
(kW/m^3)
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
$\hat{B}$ (mT)
10^{-1}
1
10
10^2
10^3

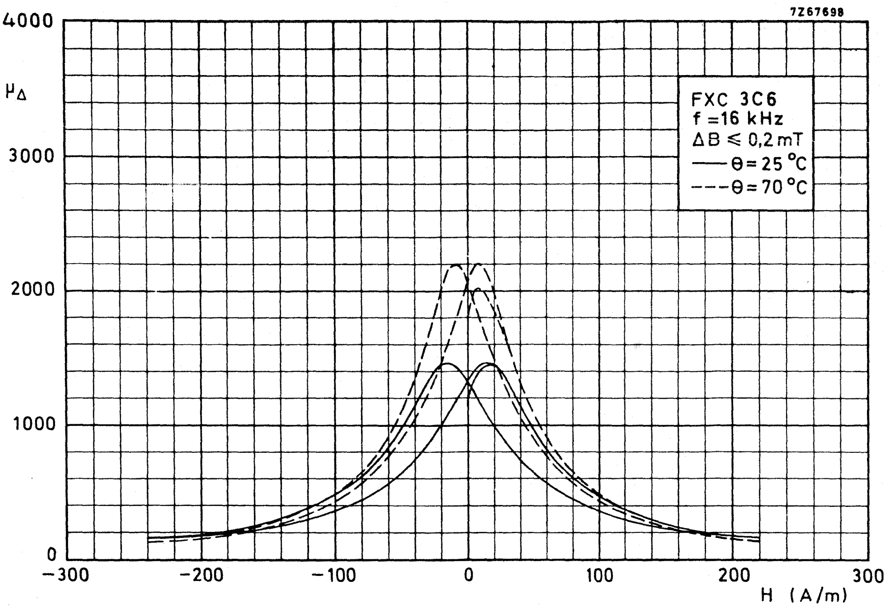

7Z66346.1
4C6
85°C
P
(kW/m³)
$\hat{B}$ (mT)
1
2
5
10
20
50
100 MHz
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-1}
1
10
10^2
10^3

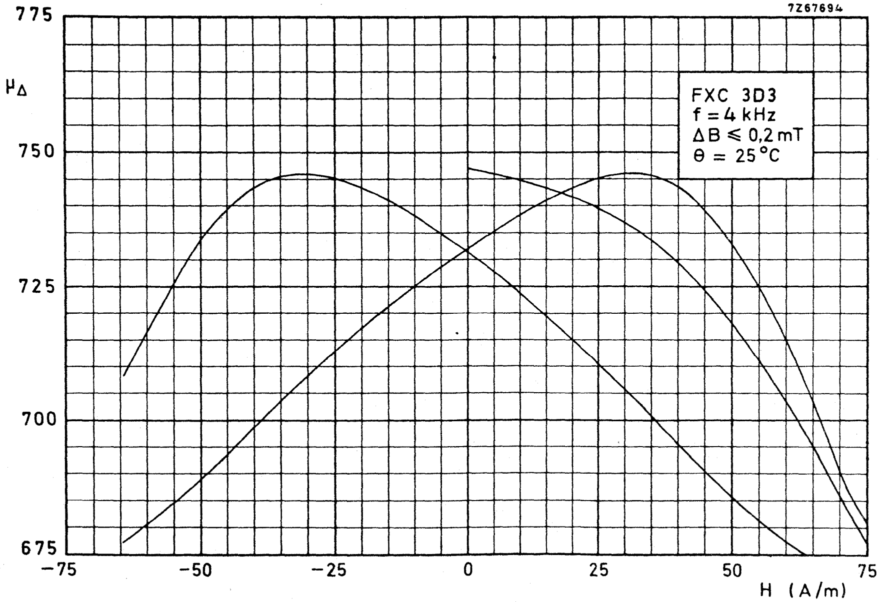

7Z66347.1
4C6
25°C
P
(kW/m³)
$\hat{B}$ (mT)
1
2
5
10
20
50
100 MHz
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-1}
1
10
10^2
10^3

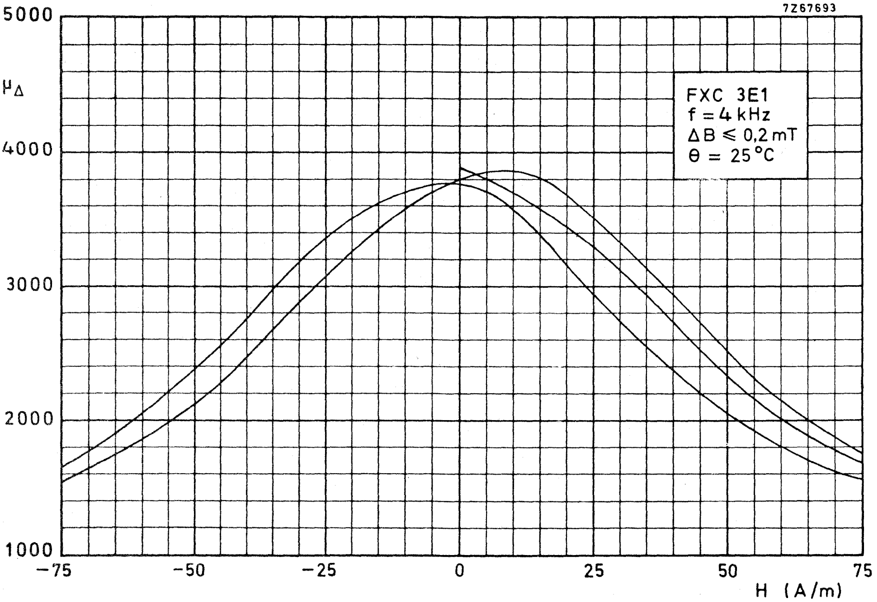
INCREMENTAL PERMEABILITY AS A FUNCTION OF THE FIELD STRENGTH

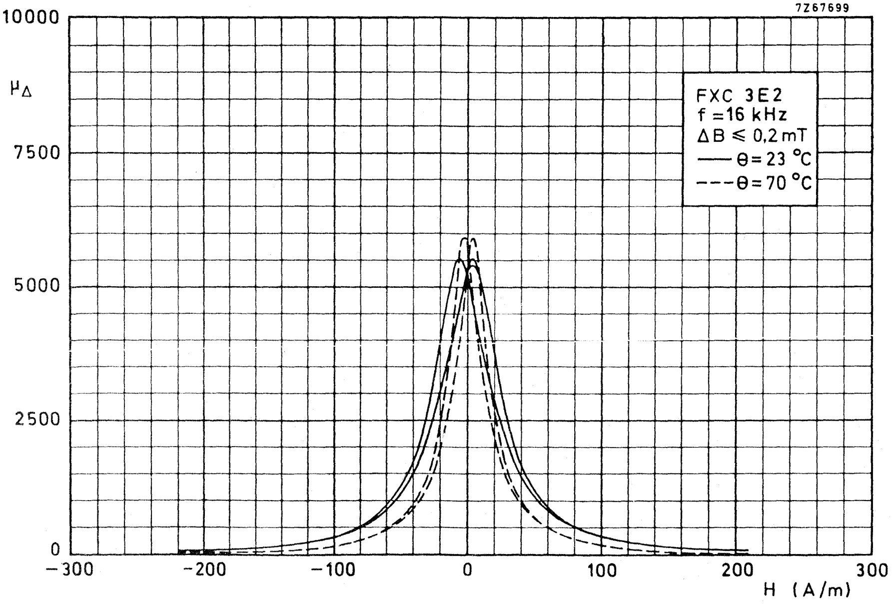


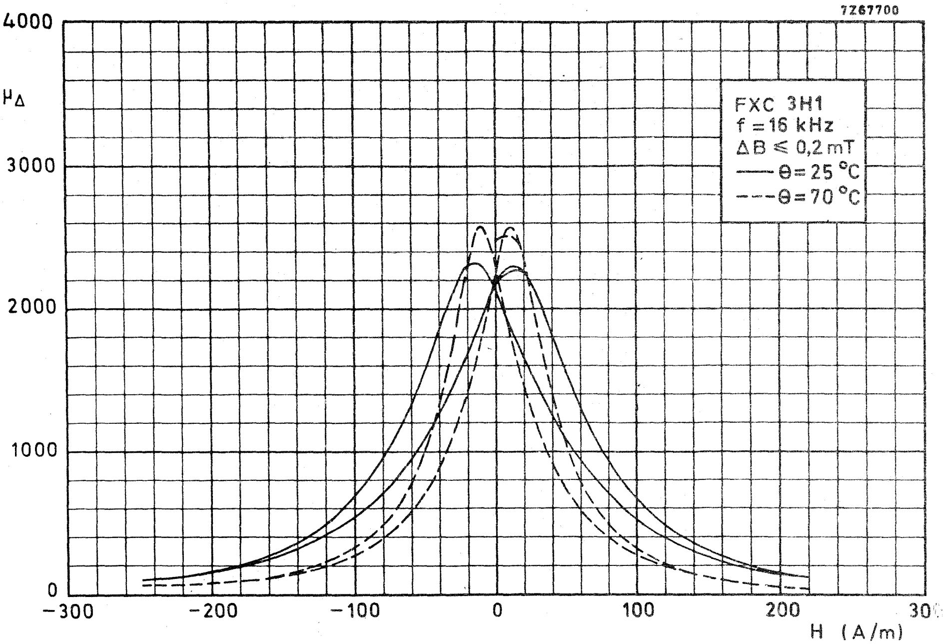


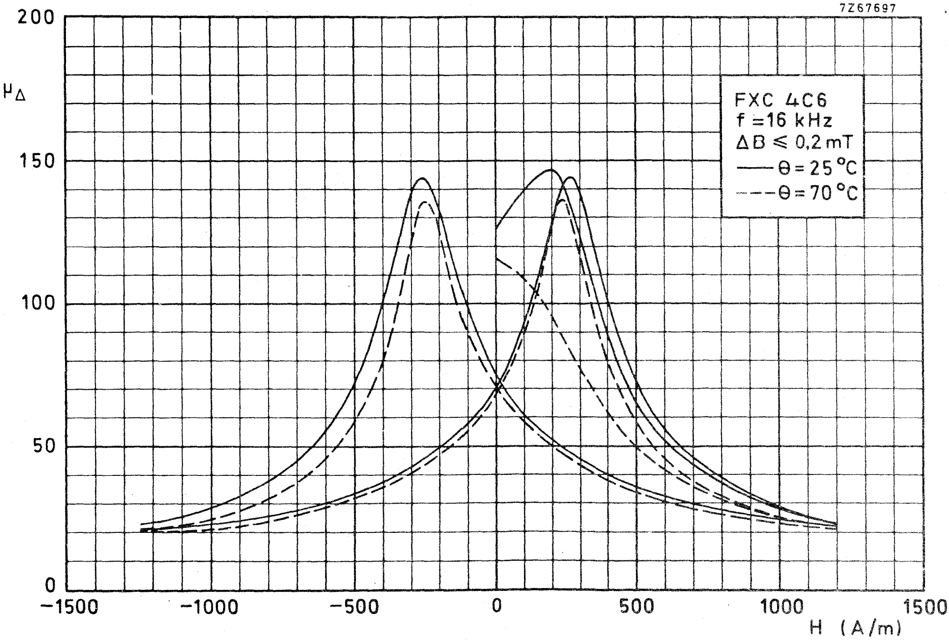

7Z67698
4000
μ_Δ
3000
2000
1000
0
−300
−200
−100
0
100
200
300
H (A/m)
FXC 3C6
f = 16 kHz
ΔB ⩽ 0,2 mT
—— θ = 25 °C
- - - θ = 70 °C

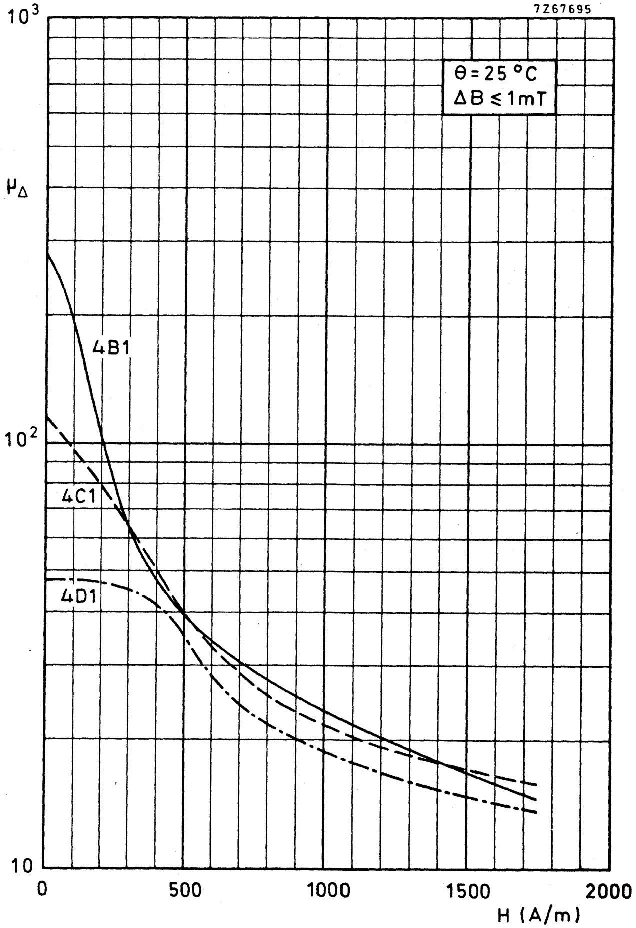

7Z67694
775
μ_Δ
750
725
700
675
−75
−50
−25
0
25
50
75
H (A/m)
FXC 3D3
f = 4 kHz
ΔB ⩽ 0,2 mT
θ = 25 °C


7Z67693
5000
4000
3000
2000
1000
μΔ
FXC 3E1
f = 4 kHz
ΔB ⩽ 0,2 mT
θ = 25 °C
−75
−50
−25
0
25
50
75
H (A/m)


7Z67699
10000
7500
5000
2500
0
μΔ
FXC 3E2
f = 16 kHz
ΔB ⩽ 0,2 mT
—— θ = 23 °C
- - - θ = 70 °C
−300
−200
−100
0
100
200
300
H (A/m)

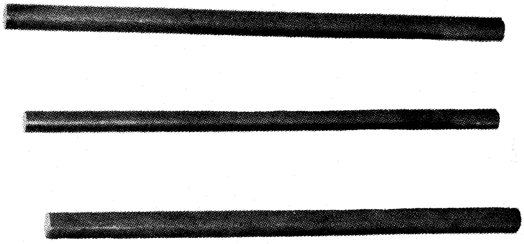

7Z67700
4000
3000
2000
1000
0
μ_Δ
FXC 3H1
f = 16 kHz
ΔB ≤ 0,2 mT
—— θ = 25 °C
- - - θ = 70 °C
−300
−200
−100
0
100
200
300
H (A/m)


7Z67697
200
150
100
50
0
μ_Δ
FXC 4C6
f = 16 kHz
ΔB ≤ 0,2 mT
—— θ = 25 °C
- - - θ = 70 °C
−1500
−1000
−500
0
500
1000
1500
H (A/m)


7Z67695
θ = 25 °C
ΔB ≤ 1mT
μ_Δ
10^3
10^2
10
4B1
4C1
4D1
0
500
1000
1500
2000
H (A/m)

Ferrites for radio, audio and television

ANTENNA RODS



RZ 22938-2

GRADE 4A10 (for long wave and medium wave reception)

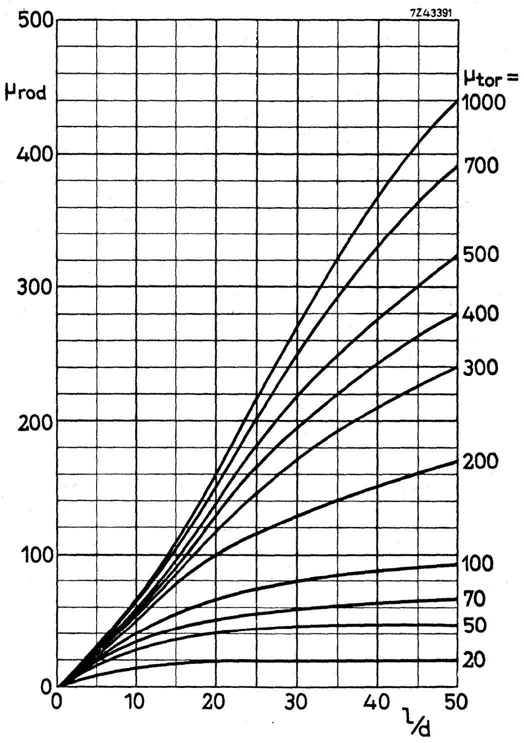
diameter (mm)	length (mm)	L (μH)	Q minimum at 1, 5 MHz	catalogue number
6, 35 ± 0, 2	130 ± 2, 6	500 ± 30	120	4311 020 55420
6, 35 ± 0, 2	140 ± 2, 8	525 ± 30	115	4311 020 55430
10 − 0, 5	100 ± 2	555 ± 30	190	4311 020 55390
10 − 0, 5	140 ± 2, 8	730 ± 41	175	4311 020 55440
10 − 0, 5	160 ± 3, 2	800 ± 47	170	4311 020 55450
10 − 0, 5	170 ± 3, 4	830 ± 50	165	4311 020 55360
10 − 0, 5	180 ± 3, 6	858 ± 53	160	4311 020 55460
10 − 0, 5	200 ± 4	908 ± 61	150	4311 020 55470
10 − 0, 5	210 ± 4, 2	930 ± 65	145	4311 020 55480
10 − 0, 5	240 ± 4, 8	985 ± 76	130	4311 020 55210

- The inductance L is measured with a coil with 97 turns placed on the antenna rod.
- The quality factor Q is measured with a coil with 25 turns placed on the antenna rod.

The winding width of both coils is 68, 3 ± 0, 2 mm.
The measurements are in accordance with DIN 41291 (Blatt 3)

Material properties of 4A10 (valid for toroids of not too small dimensions)

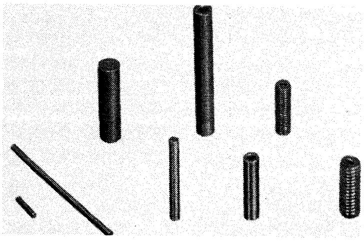
Initial permeability μ_i	350 ± 20%
Loss at low density $\frac{\tan\delta}{\mu_i} \times 10^6$	$\leq 50 \times 10^{-6}$ (1,5 MHz) $\leq 70 \times 10^{-6}$ (2 MHz)
Curie point θ_C	$> 180\ ^{o}C$
Temperature factor of permeability α_F (+25 to +55 °C)	$2,5 \pm 5 \times 10^{-6}$
Resistivity ρ	$> 10^4\ \Omega m$
Density	4,2 ± 0, 15 g/cm^3 4050 to 4350 kg/m^3



Rod permeability as a function of the ratio l/d with the relative initial permeability of a toroidal core as parameter.

CORES FOR SMALL COILS

A 52810-1



Ferroxcube rods, tubes and screws to be used as cores in r.f. and h.f. coils with an open magnetic circuit such as in i.f. transformers. Economic operation helps us to serve you better and keeps your costs down. Whilst still offering you our full range we aim at a gradual transition to a standard range. The lists on the pages B5 and B6 tables the standard range and will help you if the lists on the pages B7 to B10 do not contain your specific requirements.

	ROD CORES				TUBE CORES				
grade	dia. group (mm)	length group (mm)	dia. tol. group (mm)	corresponding length (mm)	outer dia. group (mm)	length group (mm)	outer dia. tol. group (mm)	corresponding length (mm)	inner dia.+ tol.
3B 3B5 3C2 3C3 3C6 3D3 3H2 4A1 4B1 4C1 4C6 4E1	1,6	5-30	-0,2	5-30					see next page
			-0,05	5-8					
			-0,03	5-8					
	2,0	5-30	-0,2	5-30					
			-0,05	5-10					
			-0,03	5-10					
	2,5	5-30	-0,25	5-30	2,5	2,5-30	-0,3	2,5-30	
			-0,05	5-10			-0,1	2,5-20	
			-0,03	5-10			-0,05	2,5-10	
	3,1	5-30	-0,25	5-30	3,1	3 - 30	-0,3	3 - 30	
			-0,1	5-25			-0,1	3 - 25	
			-0,05	5-16			-0,05	3 - 25	
	4,0	8-30	-0,3	8-30	4,0	4 - 40	-0,3	4 - 40	
			-0,1	8-30			-0,1	4 - 30	
			-0,05	8-20			-0,05	4 - 30	
	5,0	10-50	-0,3	10-50	5,0	5 - 50	-0,3	5 - 50	
			-0,1	10-40			-0,1	5 - 50	
							-0,05	5 - 30	
	6,3	10-60	-0,3	10-60	6,3	10 - 60	-0,3	10 - 60	
			-0,1	10-45			-0,1	10 - 50	
	10,0	20-100	-0,5	20-100	8,0	20 - 60	-0,4	20 - 60	

length tolerances (mm)

length	tolerance class	
	coarse	fine
< 6	0 −0, 4	0 −0, 2
6-8	0 −0, 5	0 0, 3
8-10	0 −0, 6	0 −0, 4
10-13	0 −0, 7	0 −0, 4
13-16	0 −0, 8	0 −0, 4
16-20	0 −0, 9	0 −0, 4
> 20	0 −4%	0 −0, 4

inner diameter and tolerance (mm)

1, 6 + 0, 15	
2 + 0, 2	for outer dia. ≥ 4
3 + 0, 2	for outer dia. ≥ 5
4 + 0, 3	for outer dia. ≥ 6, 3

The curvature of rods and tubes is characterized by the maximum deviation from the straight line through the end face centres.
This curvature may be checked by means of a tubular gauge with dimensions as given below:

gauge inner diameter $d = d_1 + \frac{\ell_1}{100}$

gauge length $\ell = \geq \ell_1$

where d_1 = maximum outer dia. of the rod or tube
ℓ_1 = maximum length of the rod or tube

Note:

Beads are tubes of which the dimensions of length and outer diameter are approximately the same.

ROD CORES

diameter (mm)	length (mm)	grade	catalogue number
1,4 -0,02	6,75 -0,1	4C5	3122 104 92040
	6,85 -0,2	3D3	3122 104 91920
1,5 -0,1		3D3	4322 020 39390
-0,05	18 ±0,2	3B	3122 104 93320
1,55 +0,2	6 ±0,2	3B	4312 020 30020
	8 ±0,5	4B1	4312 020 30370
	14,2 -0,4	4B1	4312 020 30560
1,6 +0,05	9 ±0,2	3D3	4312 020 30160
		4B1	3122 104 91060
+0,15 -0,05	11,3 ±0,2	4B1	4311 020 50790
±0,05	14 ±0,2	4E1	4312 020 10840
+0,15 -0,05		3B	4311 020 50110
1,62 ±0,05	17,1 ±0,5	4B1	4313 020 12230
1,65 ±0,05	5,7 -0,3	4E1	4313 020 12330
-0,05	9,2 -0,4	3B	3122 104 91070
	12,2	3B	3122 104 91100
		4B1	3122 104 91110
	14	4B1	4330 020 31770
	19,2	3B	3122 104 91230
	25,2	3B	3122 104 91170
		4B1	3122 104 91180
	28 ±0,2	4B1	4322 020 32090
1,7 -0,15	8,4 -0,4	4D1	3122 104 93160
	8,8	3B	3122 104 90300
	10,2	4D1	4322 020 32040
	14,2	4E1	4322 020 32060
	15,2	4D1	4322 020 32170
	17,8 -1	3B	3122 104 92020
	18,7 -1	3B	3122 104 91900
	28,2 -0,4	4D1	4322 020 32130
		4E1	4322 020 32140
1,75 +0,03	8,8 ±0,15	3D3	4322 020 39480
-0,2	10,2 -0,4	3B	3122 104 91130
	12,2	4B1	3122 104 92070
	18,5 -1	4B1	3122 104 91150
	25 -1	3B	3122 104 91950
1,9 ±0,05	6,5 ±0,2	3B	4313 020 12250
2,2 ±0,2	7,5 ±0,5	4E1	4322 020 39400
	11	4E1	4322 020 39410
	16	4B1	4312 020 30460
-0,05	22	3B	4330 020 31000

ROD CORES (continued)

diameter (mm)	length (mm)	grade	catalogue number
2,3 −0,05	10,2 −0,4	3D3	4312 020 30030
	12 +0,5	3D3	4312 020 30180
	18 +0,5	3D3	4312 020 30200
2,5 −0,25	20 −1	4B1	4312 020 30510
3 +0,2	11 ±0,5	4B1	4330 020 30560
±0,15	24 ±0,35	4B1	4312 020 30520
3,2 ±0,15	10 ±0,3	4E1	4313 020 12470
3,45 −0,05	17 ±0,3	3C6	4312 020 30420
3,5 −0,05	8 +0,5	3B	4312 020 30150
	23,2 −0,4	3C3	3122 104 92080
4 −0,05	18 ±0,2	3C2	4330 020 30640
−0,05	25 ±0,5	3C6	4312 020 30290
4,5 −0,05	7,2 −0,4	3D3	4322 020 39350
4,9 ±0,05	36 −0,5	3C6	3122 104 90490
	40	3C6	4322 020 39430
	50	3C6	3122 134 90110
5 ±0,3	18 ±0,3	4B1	4312 020 30490
−0,3	20 ±0,5	4B1	4312 020 30570
	24 ±0,4	3D3	4312 020 30190
−0,2	25 ±0,5	3B	4322 020 39450
−0,05	30,2 −0,4	3C6	3122 134 91120
−0,2	40 ±1	3B	4322 020 39470
5,4 −0,05	25 ±0,2	4A1	3122 104 93690
6 −0,1	46,2 −0,4	3C2	3122 104 91310
6,3 ±0,2	31,75 ±1	3B5	4313 020 10210
	50,8 ±1,5	3B5	4313 020 10250
6,35	25,4 ±0,75	3B	4313 020 10300
6,4 +0,2	35 ±0,15	3C6	4322 020 39330
6,65 −0,3	40,4 −0,8	3B	4322 020 32160
10 −0,5	50 ±1	3C6	4330 030 30010

ROD CORES (rectangular cross section)

5,1 ±0,2 x 6,3 ±0,25	19,8 ±0,3	3C8	3122 134 90720
7,5 ±0,25 x 7,5 ±0,25	25 ±0,5	3C8	3122 134 90620

TUBE CORES

outer diameter (mm)	inner diameter (mm)	length (mm)	grade	catalogue number
2,35 −0,1	0,9 ±0,1	4,6 ±0,2	3H2	4322 020 38420
2,7 −0,4	1,2 +0,2	3,5 −0,5	4E1	3122 104 91690
−0,15	±0,1	±0,2	3H2	4322 020 38360
2,8 −0,03	+0,2	8,2 −0,4	3B	4322 020 34340
3,47 −0,1	1,7 +0,2	14 ±0,2	3B	3122 134 90000
3,5 +0,1 / −0,2	1,3 +0,2	3 +0,5	3B	4312 020 31050 *)
±0,2		5	3B	4312 020 31060 *)
+0,2	1,2 +0,3	6 ±0,5	4B1	4311 020 54160
±0,2	1,3 +0,2	7,5 +0,5	3B	4312 020 31330
−0,5	1,2	10 ±0,2	3B	4330 020 31050
−0,1	1,7	14,2 −0,4	3B	3122 104 92800
±0,2	1,3 +0,2	15 +0,5	3B	4312 020 31320
3,55 ±0,15	2,5 ±0,15	14,3 ±0,4	3B	4313 020 15840
3,6 −0,1	1,4 ±0,1	4 ±0,2	3B	4322 020 38340
3,7 −0,4	1,2 +0,2	3,5 −0,5	3B	4322 020 34400 *)
			4A1	4322 020 34410
			4B1	4322 020 34420 *)
	1,5		3B	4322 020 34430 *)
3,9 +0,15 / −0,1	±0,15	5,5 ±0,2	4B1	4313 020 15460
±0,05	1,2 +0,2	28	4B1	4330 020 31330
4 ±0,2	2 ±0,2	5 ±0,5	3B5	4313 020 15170
±0,05	1,5 ±0,1	5,5 ±0,25	4E1	4313 020 15630
±0,2	±0,2	6 ±1	3B5	4313 020 18180
±0,15	2 +0,2	36 ±0,6	3C6	4312 020 31450
±0,2	1,5 ±0,2	50 ±1	3B5	4313 020 15010
4,1 ±0,2	±0,3	2,8 ±0,3	4B1	4313 020 17670
+0,2	2 +0,2	3 ±0,2	3B	4330 020 30230
		7	4B1	4311 020 50710
			4A1	4311 020 53460
+0,1			3D3	4312 020 31220
+0,2		11 ±0,5	4B1	4330 020 30830
		12 ±0,2	4D1	4311 020 52100
		30 ±0,15	3B	4312 020 31080
			4B1	4311 020 54310
		35 ±0,7	3B	4311 020 50430
		50 ±0,1	3B	4311 020 50060
4,15 −0,05		12,2 −0,4	4A1	3122 104 90820
			4B1	4322 020 34450
			4C1	4322 020 34460
			4D1	4322 020 34470
		15,2 −0,4	4B1	4322 020 34380
		21,2 −0,4	4A1	4322 020 34390

---

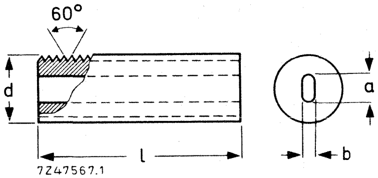
*) Beads

TUBE CORES (continued)

outer diameter (mm)	inner diameter (mm)	length (mm)	grade	catalogue number
4,2 ±0,1	2,1 ±0,1	7 ±0,2	3B	4313 020 15020
	2,3 ±0,1		3B5	4313 020 15120
−0,15	2 +0,3	10 −0,4	4B1	3122 104 91730
4,3 −0,2	+0,2	7,2 −0,4	3B	3122 104 92900
	2,2 −0,2		4D1	3122 104 93890
	2 +0,2	11,5 −0,5	3B	3122 104 94880
4,3 −0,2		12,5 −1	3B	4322 020 34490
		15,4 −0,8	3B	4322 020 36750
		16,5 −0,5	3B	3122 104 94920
		18,5	3B	4322 020 36770
±0,15	+0,3	21,2 −0,4	4B1	4322 020 34480
−0,2	+0,2	25,2 −1	4B1	3122 104 90810
			3B	4322 020 36780
			4C1	3522 200 10950
			4D1	3522 200 10960
			4E1	3522 200 10970
		36,2 −0,4	3B	3522 100 65950
		40,5 −1	3B	3122 104 90800
4,7 ±0,2	±0,2	19 ±0,8	4E1	4313 020 16880
4,9 ±0,05	1,3 +0,2	15 ±0,2	3C3	3122 104 90370
		23	3C3	3122 104 90380
	3 ±0,1	36 −0,5	3C3	3122 104 93760
4,95 ±0,15	2 −0,2	4,3 ±0,5	4D2	3122 104 94990
−0,1	1,3 +0,2	26,5	3C2	4330 020 31060
		40,5 −1	3C3	3122 104 93110
5,3 −0,2	3 +0,2	22,4 −0,8	3B	4322 020 36810
5,4 −0,4	3,6 −0,3	21,2 −0,4	4A1	3104 101 80630
		25,2	4A1	3122 104 93720
6,35 ±0,2	1,4 +0,3	50,8 ±1,5	3B5	4313 020 15280
6,7 −0,4	2,85	33,5 −1	3B	4322 020 34300
7,5 ±0,25	4,5 ±0,15	17 ±0,5	3B5	4313 020 15470
8 +0,3	3,5 +0,3	15 ±0,3	4B1	4312 020 31200
±0,2	4,5 ±0,3	50 ±0,1	3B	4311 020 50030
−0,4	4,2 +0,6	51,4 −2,8	3B	4322 020 34310
			4B1	4322 020 34320
8,4 −0,8	4,3 +0,4	30,2 −0,4	4A1	3122 104 90870
9,5 ±0,3	6,5 ±0,2	17 ±0,05	3B	4313 020 15180

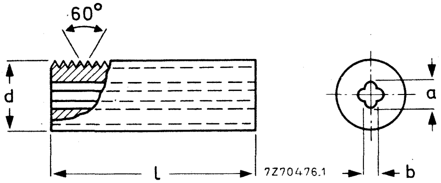
SCREW CORES

Slot trimming hole



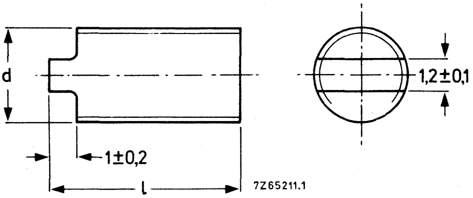
nom. dia. x pitch	l (mm)	d (mm)	a (mm)	b (mm)	grade	catalogue number
3,65 x 0,5	12 ± 0,3	3,65 + 0,05	1,6 ± 0,1	0,7 ± 0,1	3D3	4312 020 32040
5 x 1	15 ± 0,3	5 −0,1	2,2 ± 0,15	1,1 ± 0,1	3D3	3122 104 93610
5 x 1	20 ± 0,3	5 −0,1	2,35 −0,3	1,1 ± 0,1	3D3	4312 020 32130
5,55 x 0,75	13 ± 0,3	5,55 + 0,05	2,65 ± 0,15	1,1 ± 0,1	3D3	4312 020 32060
5,55 x 0,75	25 ± 0,5	5,55 + 0,05	2,65 ± 0,15	1,1 ± 0,1	3D3	4312 020 32070
7,35 x 1,25	16 ± 0,5	7,35 + 0,05	3,65 ± 0,15	1,3 ± 0,1	3D3	4312 020 32110
7,35 x 1,25	25 ± 0,5	7,35 + 0,05	3,65 ± 0,15	1,3 ± 0,1	3D3	4312 020 32120

Cross trimming hole



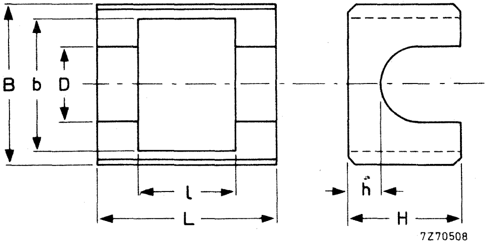
3,5 x 0,7	10 ± 0,25	3,5 ± 0,05	1,4 − 0,1	0,6 − 0,1	3B	3122 104 90750
3,5 x 0,7	10 ± 0,25	3,5 ± 0,05	1,4 − 0,1	0,6 − 0,1	4D2	3122 104 90770
3,5 x 0,7	15 ± 0,25	3,5 ± 0,03	1,4 − 0,1	0,6 − 0,1	3D3	4330 030 36000

Stud trimming



nom. diameter x pitch	l (mm)	d (mm)	grade	catalogue number
3,5 x 0,7	7 ± 0,2	3,5 ± 0,05	4D1	3122 104 90740
3,5 x 0,7	10 ± 0,2	3,5 ± 0,05	3B	3122 104 90550
3,5 x 0,7	10 ± 0,2	3,5 ± 0,05	4D1	3122 104 90590
3,5 x 0,7	15 ± 0,25	3,5 ± 0,03	3B3	4312 020 32150

FRAME CORES



L ± 0,2 (mm)	l ± 0,2 (mm)	B ± 0,2 (mm)	b ± 0,2 (mm)	H ± 0,2 (mm)	h ± 0,2 (mm)	D (mm)	grade	catalogue number
10	6	11,2	8,5	7	2	4,5 +0,2	3B	3122 104 92550
10	6	11,2	8,5	7	2	4,5 +0,2	3B	3122 104 91460 [1]
10	6	11,2	8,5	7	2	4,5 +0,2	3B	4322 020 35250 [2]
10	6	11,2	8,5	7	2	4,5 +0,2	4B1	3122 104 91470 [2]
10	6	11,2	8,5	7	2	4,5 +0,2	4D1	3122 104 91480 [2]
14	10	11,2	8,5	6	4	4,1 ±0,05	4A4	3122 104 94480
14	10	11,2	8,5	6	4	4,25 ±0,05	3D3	4322 020 37030

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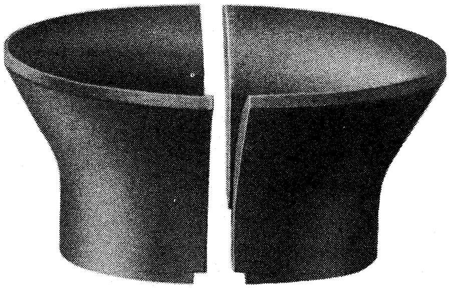
[1] partly lacquered
[2] fully lacquered

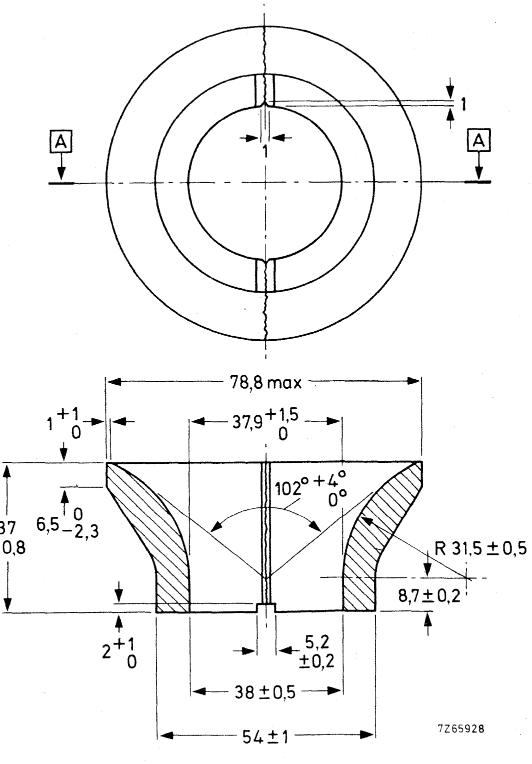
YOKE RINGS FOR USE IN DEFLECTION COILS FOR PICTURE TUBES

FOR 110^o BLACK AND WHITE PICTURE TUBES

Catalogue number	3122 104 92180
Material	Ferroxcube 3C2
Weight	230 g

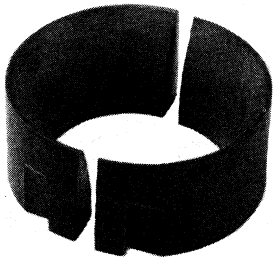

8032/6

Dimensions (mm)



A−A

FOR 110° BLACK AND WHITE PICTURE TUBES

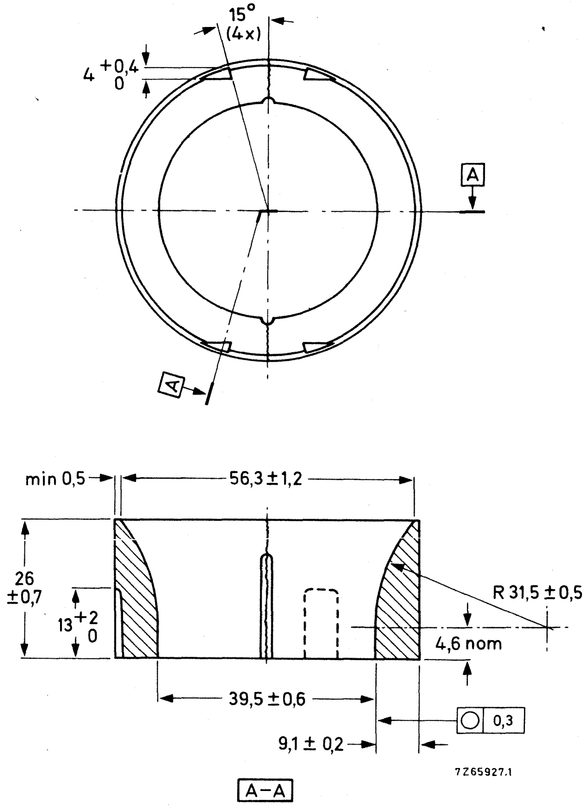


RZ 24668-2

Catalogue number	3122 104 93840
Material	Ferroxcube 3C2
Weight	135 g

Spring clips for assembling can be supplied, catalogue number 3122 101 06340

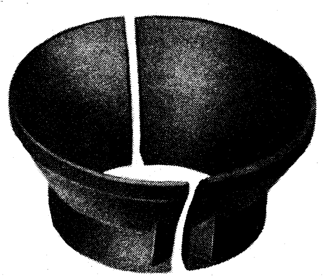
Dimensions (mm)



FOR 110° BLACK AND WHITE PICTURE TUBES (12 inch)

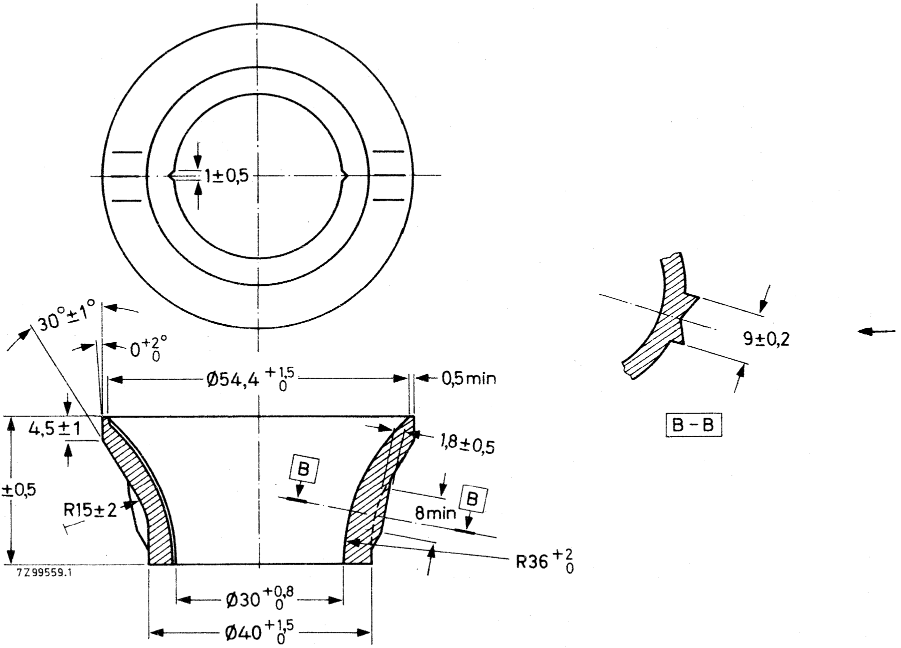
Catalogue number	3122 104 94790
Material	Ferroxcube 3C2
Weight	85 g

Spring clips for assembling can be supplied.
Catalogue number: 3122 101 91850.



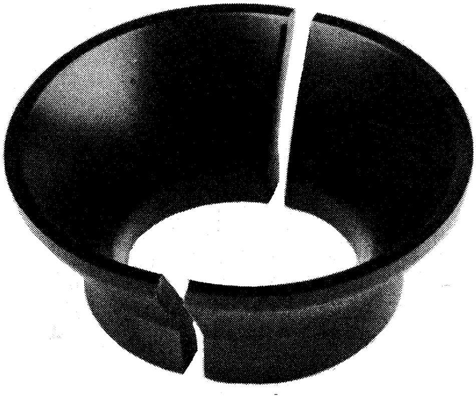
RZ 29121-5

Dimensions (mm)



FOR 90° COLOUR PICTURE TUBES

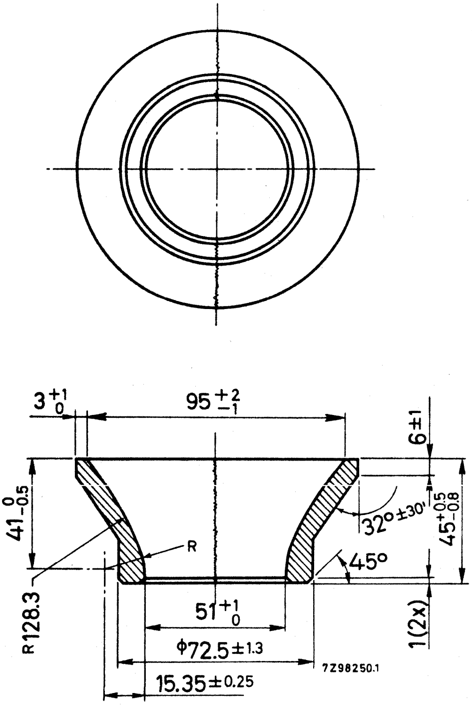
RZ 24668-1



Catalogue number	3122 104 99170
Material	Ferroxcube 3C2
Weight	395 g

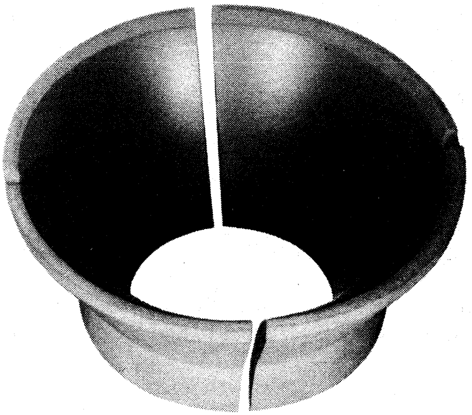
The ring has been lacquered.
Thickness of lacquer ≤ 0, 3 mm

Dimensions (mm) (without lacquer)



FOR 90° COLOUR PICTURE TUBES

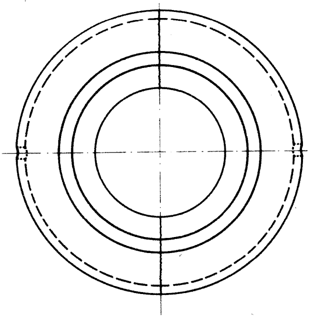
RZ 22938-1

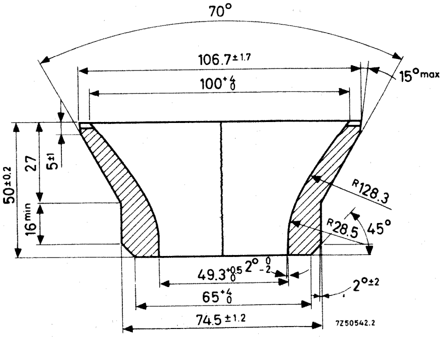


Catalogue number	4313 020 35350
Material	Ferroxcube 3C2
Weight	475 g

The inner surface has been lacquered.
Thickness of lacquer ≤ 0, 3 mm

Dimensions (mm) (without lacquer)





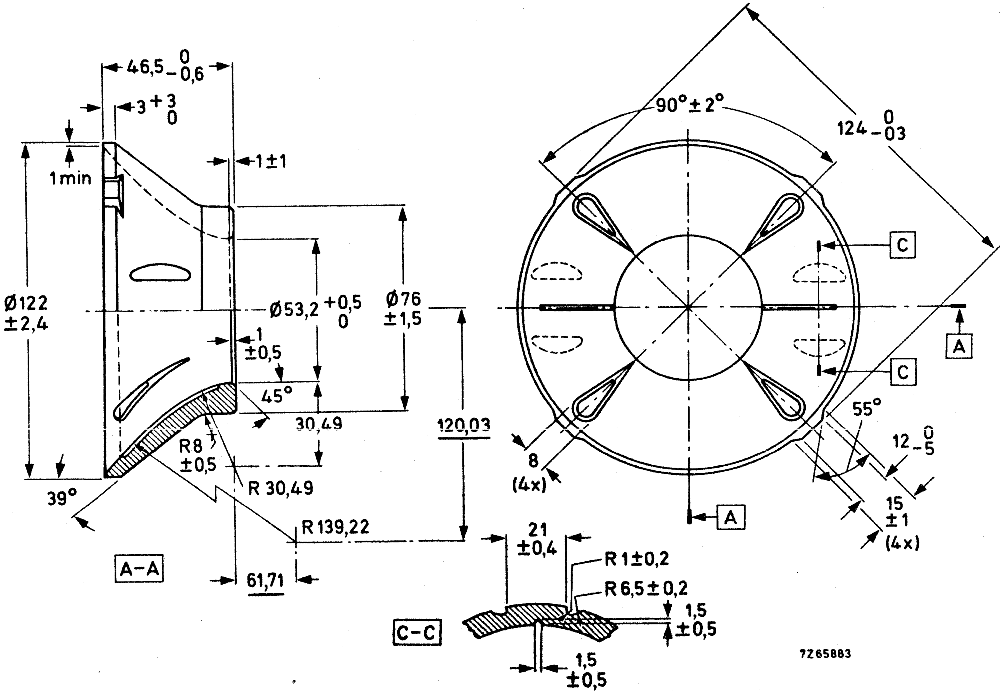
FOR 110° COLOUR PICTURE TUBES

Catalogue number	3122 137 52280
Material	Ferroxcube 3C2
→ Weight	480 g

The inner surface has been lacquered.
Thickness of lacquer ≤ 0, 3 mm

Spring clips for assembling can be supplied.
Catalogue number 3122 101 57350

Dimensions (mm) (without lacquer)



CORES FOR TRANSFORMERS

U-and UI-cores are not only used in line-output transformers for television receivers but also for a number of other applications in the frequency range of 1 kHz to 100 kHz.
On the survey page which follows we have three groups of cores :

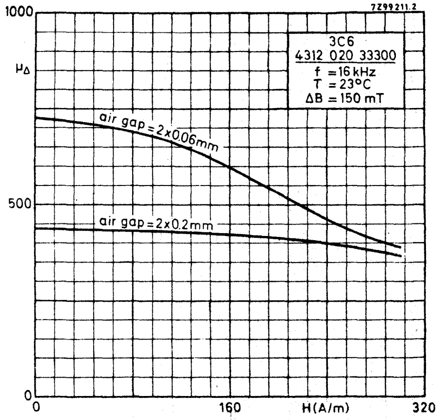
group I :	suitable for the construction of driver transformers, small power transformers, chokes and coils.
group II :	mainly used for line-output transformers.
group III :	for use in power transformers.

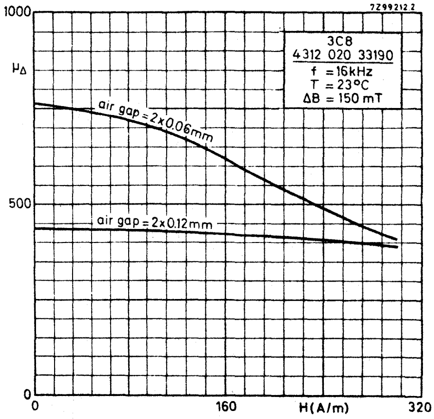
The cores are available in ferroxcube grade 3C6 and 3C8.
See chapter A of this handbook for material properties.

The guaranteed values given under the heading Magnetic Data are found on cores with a roughness of the mating surfaces < 0, 8 µm.
Cores with the usual roughness of 2 µm can yield a lower $\hat{B}$ - value (≈ 3 %).

Test conditions according DIN 42296 (sheet 10).

Two examples are given below of the incremental permeability as a function of the static field strength, viz. an UU-57/57/16 in 3C6 and in 3C8 at two different air gaps.





→ SURVEY

type designation [1]	catalogue number for one core		legs cross-section	group
	grade 3C6	grade 3C8		
U-15/11/6		3122 134 90690	rectangular	I
U-20/16/7		3122 134 90200	square	
U-25/20/13		3122 134 90460	rectangular	
U-30/25/16		3122 134 90760	rectangular	
U-52/27/11		3122 134 90480	round	II
U-57/28/16	4312 020 33300	4312 020 33190	round	
U-64/30/14	4312 020 33320		round	
U-70/31/17	3122 104 93570		round	
U-70/32/16	4312 020 33330		round	
U-70/33/17		3122 104 93950	round	
U-100/57/25	4312 020 33120		square	
U-46/33/11	3122 104 90480		round	
I-46/10/11	3122 104 90470			
U-58/45/16		3122 104 94760	octagonal	
I-58/13/16		3122 104 94770		
U-82/65/18	3122 104 93120		round	
I-82/15/18	3122 104 93130			
U-93/52/30	4312 020 33100		rectangular	III
I-93/28/30	4312 020 33110			
U-93/76/16	4312 020 33070		rectangular	
I-93/28/16	4312 020 33080			
U-93/76/30	4312 020 33090		rectangular	
I-93/28/30	4312 020 33110			
U-100/57/25	4312 020 33120		square	
I-100/25/25	4312 020 33420			

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[1] The type designation gives the approximate overall dimensions and thickness.

Besides the cores listed on the preceding page a series of E- and EC-cores are supplied which suit very well in switched mode power supplies (S.M.P.S.), see table below. For full data see chapter E of this handbook.

type designation	catalogue number of one core	
	grade 3C6	grade 3C8
E20/10/5	4312 020 34070	
E42/21/15		4312 020 34110
E42/21/20		4312 020 34120 [1]
E42/33/20		4312 020 34190 [1]
E55/28/21		4312 020 34100
E55/28/25		3122 134 90210 3122 134 90940 [2]
EC35/17/10		4322 020 52500
EC40/19/12		4322 020 52510
EC53/24/14		4322 020 52520
EC70/34/17		4322 020 52530

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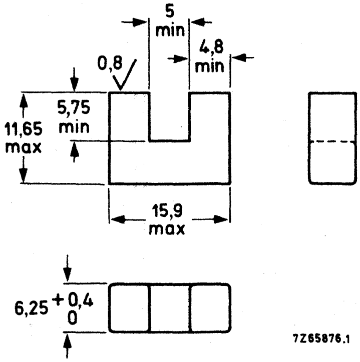
[1] Combination of these two cores, catalogue number 4312 020 34170

[2] Core with an airgap of 1,4 mm.

MECHANICAL DATA

Dimensions (mm)



Weight 4, 35 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-15/22/6.

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C8	25	200	–	≤ 0, 18	3122 134 90690
	25	≥ 140	50	–	
	100	200	–	≤ 0, 16	
	100	≥ 315	250	–	

Magnetic dimensions

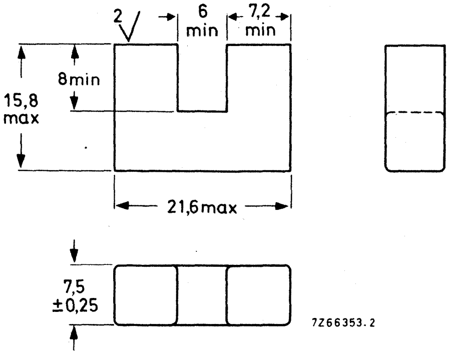
l_e = 48 mm

A_e = 30 mm^2

V_e = 1440 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight 9 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-20/32/7.

grade	temperature (^oC) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C8	25	200	–	≤ 0, 46	3122 134 90200
	100	200	–	≤ 0, 42	
	100	≥ 100	50	–	
	100	≥ 315	250	–	

Magnetic dimensions

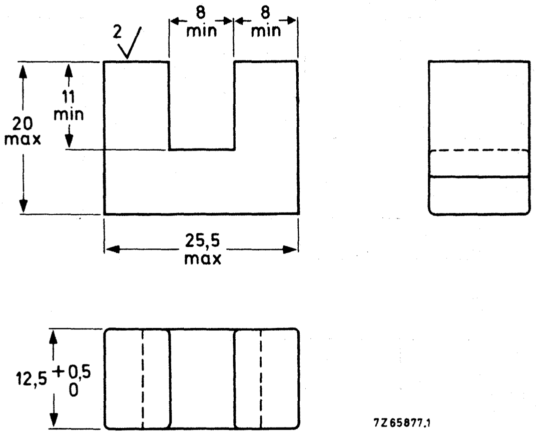
l_e = 68 mm

A_e= 56 mm^2

V_e=3800 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight 21 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-25/40/13.

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C8	25	200	–	≤ 1,1	3122 134 90460
	100	200	–	≤ 1,0	
	100	≥ 100	50	–	
	100	≥ 315	250	–	

Magnetic dimensions

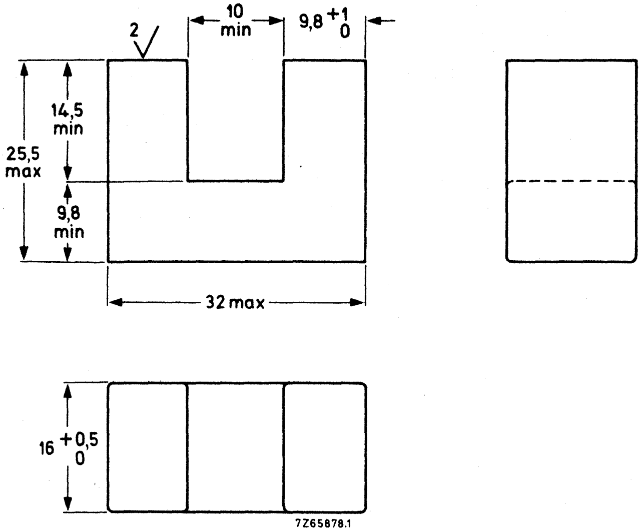
l_e = 86 mm

A_e = 100 mm^2

V_e = 8600 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight 48 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-30/50/16.

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C8	25	200	–	≤ 2,4	3122 134 90760
	100	200	–	≤ 2,0	
	100	≥ 335	400	–	

Magnetic dimensions

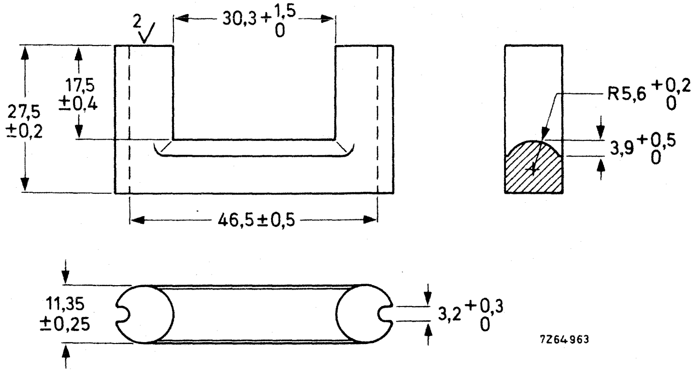
l_e = 111 mm

A_e = 157 mm^2

V_e = 17400 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight 40 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-52/56/11

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C8	25	200	–	≤ 1, 9	3122 134 90480
	100	200	–	≤ 1, 75	
	100	≥ 330	250	–	

Magnetic dimensions

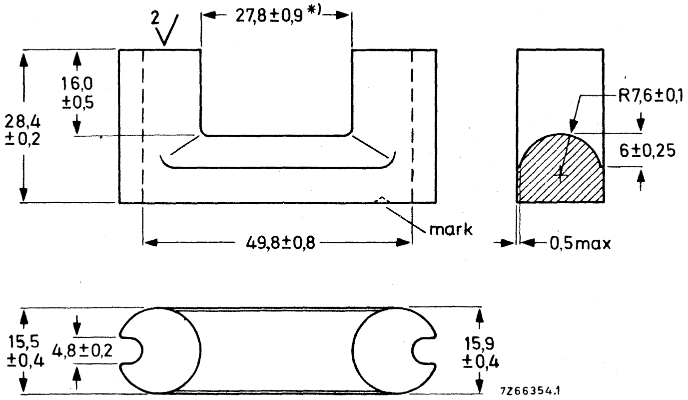
l_e = 165 mm

A_e = 95 mm^2

V_e = 15700 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight 70 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-57/57/16

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C6	25	200	-	≤ 4, 70	4312 020 33300
	100	200	-	≤ 3, 85	
	100	≥ 290	250	-	
3C8	25	200	-	≤ 3, 3	4312 020 33190
	100	200	-	≤ 3, 05	
	100	≥330	250	-	

Magnetic dimensions

l_e = 163 mm

A_e = 171 mm^2

V_e = 27500 mm^3

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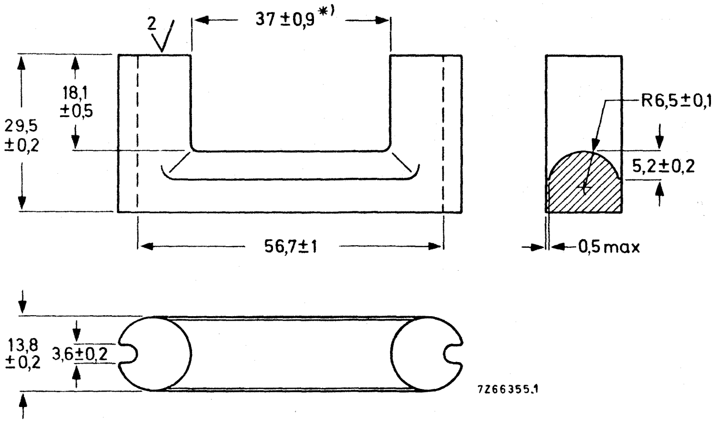
*) The difference in splay between two U-cores taken at random from one packing will never exceed 0,8 mm.

MECHANICAL DATA

Dimensions (mm)



Weight 65 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-64/59/14

grade	temperature (^{o}C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C6	25	200	-	≤ 4,30	4312 020 33320
	100	200	-	≤ 3,55	
	100	≥290	250	-	

Magnetic dimensions

l_e = 185 mm

A_e = 138 mm^2

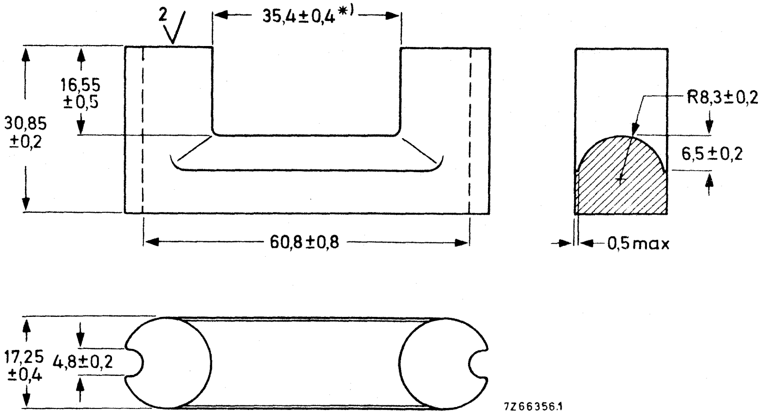
V_e = 25500 mm^3

---

*) The difference in splay between two U-cores taken at random from one packing will never exceed 1mm.

MECHANICAL DATA

Dimensions (mm)



Weight 105 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-70/62/17

grade	temperature ($^{\circ}$C) $\pm$ 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C6	25	200	-	$\leq$ 6.8	3122 104 93570
	100	200	-	$\leq$ 5.6	
	100	$\geq$ 290	250	-	

Magnetic dimensions

l_e = 187 mm

A_e = 214 mm^2

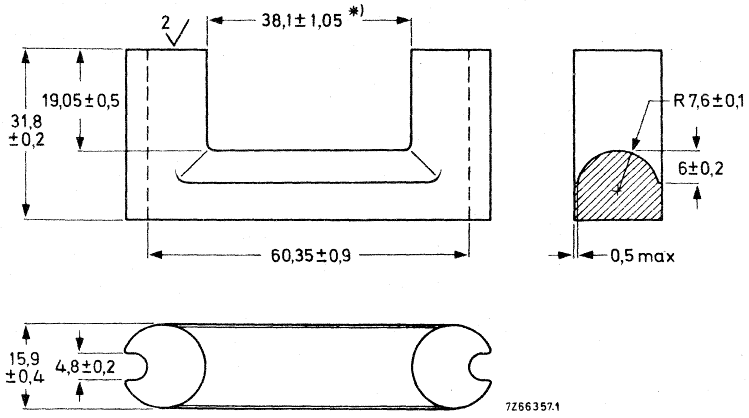
V_e = 40700 mm^3

---

*) The difference in splay between two U-cores taken at random from one packing will never exceed 1 mm.

MECHANICAL DATA

Dimensions (mm)



Weight 87 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-70/64/16

grade	temperature (^oC) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C6	25	200	-	≤5.86	4312 020 33330
	100	200	-	≤4.83	
	100	≥290	250	-	

Magnetic dimensions

l_e = 197 mm

A_e = 177 mm^2

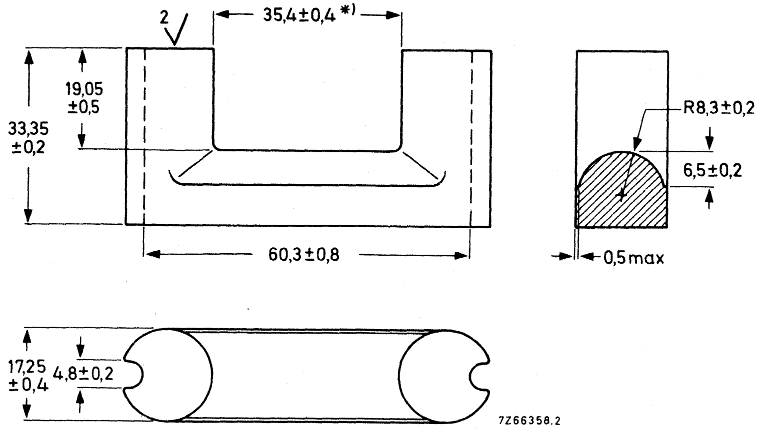
V_e = 34500 mm^3

---

*) The difference in splay between two U-cores taken at random from one packing will never exceed 1 mm.

MECHANICAL DATA

Dimensions (mm)



Weight 108 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-70/67/17.

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C8	25 100 100	200 200 ≥ 330	– – 250	≤ 5,3 ≤ 5,0 –	3122 104 93950

Magnetic dimensions

l_e = 197 mm

A_e = 214 mm^2

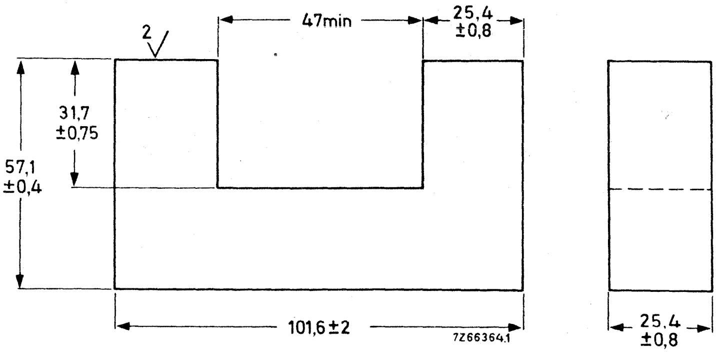
V_e = 43800 mm^3

---

*) The difference in splay between two U-cores taken at random from one packing will never exceed 1 mm.

MECHANICAL DATA

Dimensions (mm)



Weight 506 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-100/114/25

grade	temperature (^{o}C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C6	25	200	-	≤ 33.8	4312 020 33120
	100	200	-	≤ 27.9	
	100	≥ 290	250	-	

Magnetic dimensions

l_e = 308, 4 mm

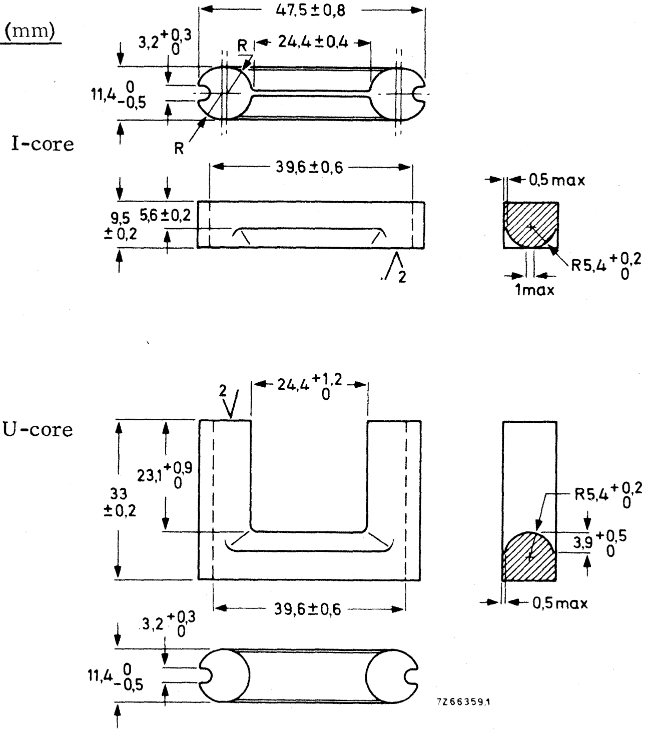
A_e = 645 mm^2

V_e = 198900 mm^3

U-46/33/11
I-46/10/11

MECHANICAL DATA

Dimensions (mm)



Weight U-core 38 g
I-core 20 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-46/43/11

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25	200	-	≤ 1, 97	U	3122 104 90480
	100	200	-	≤ 1, 62	I	3122 104 90470
	100	≥290	250	-		

Magnetic dimensions

l_e = 129 mm

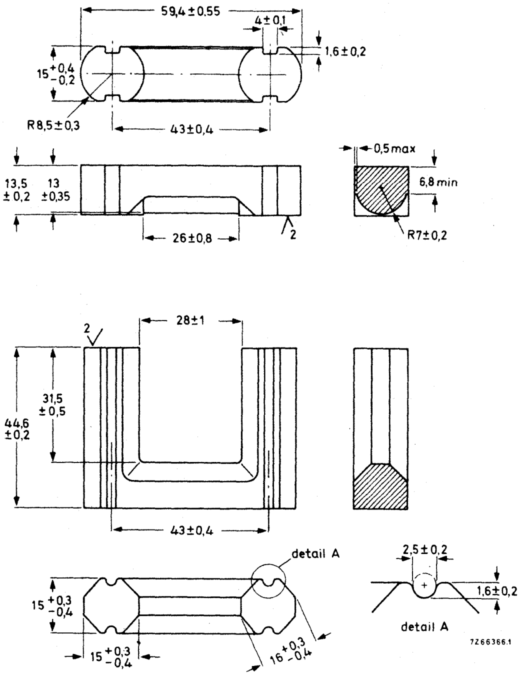
A_e = 88 mm^2

V_e = 11600 mm^3

U-58/45/16
I-58/13/16

MECHANICAL DATA

Dimensions (mm)



Weight U-core 98 g
I-core 50 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-58/58/16.

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C8	25	200	–	≤ 3, 5	U	3122 104 94760
	100	200	–	≤ 3, 2	I	3122 104 94770
	100	≥ 330	250	–		

Magnetic dimensions

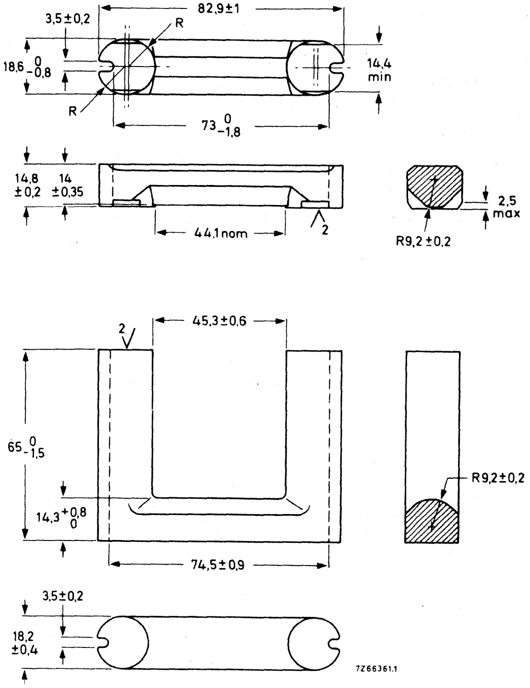
l_e = 164 mm

A_e = 175 mm^2

V_e = 28800 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight	U-core	212 g
	I-core	93 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-82/80/18

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25 100 100	200 200 ≥ 290	– – 250	≤ 10 ≤ 8,3 –	U I	3122 104 93120 3122 104 93130

Magnetic dimensions

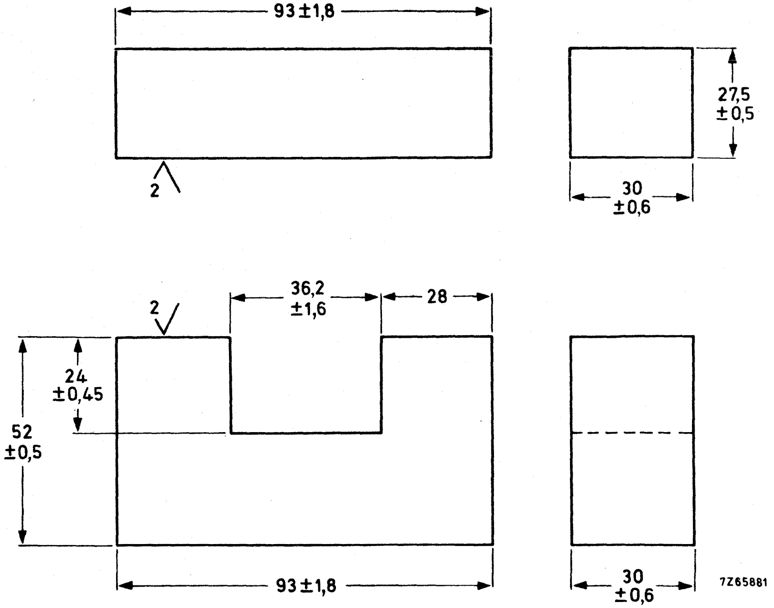
l_e = 243 mm

A_e = 234 mm^2

V_e = 58600 mm^3

MECHANICAL DATA

Dimensions (mm)



Weight	U-core	562 g
	I-core	365 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-93/80/30.

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25	200	–	≤ 29,9	U	4312 020 33100
	100	200	–	≤ 24,6	I	4312 020 33110
	100	≥ 290	250	–		

Magnetic dimensions

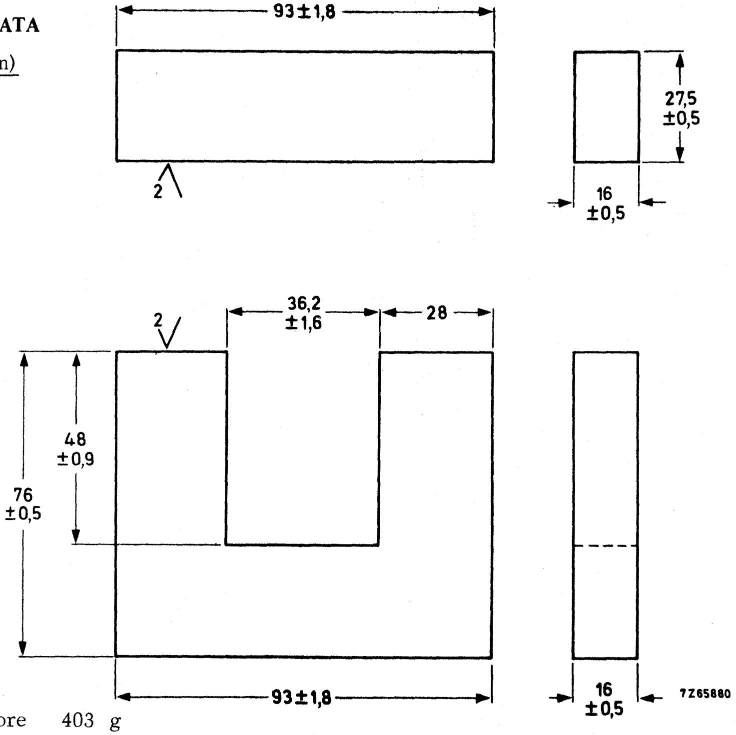
l_e = 209 mm

A_e = 840 mm^2

V_e = 176000 mm^3 ←

MECHANICAL DATA

Dimensions (mm)



Weight			
	U-core	403	g
	I-core	194	g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-93/104/16.

grade	temperature (^{o}C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25 100 100	200 200 ≥ 290	– – 250	≤ 19, 55 ≤ 16, 1 –	U I	4312 020 33070 4312 020 33080

Magnetic dimensions

l_e = 257 mm

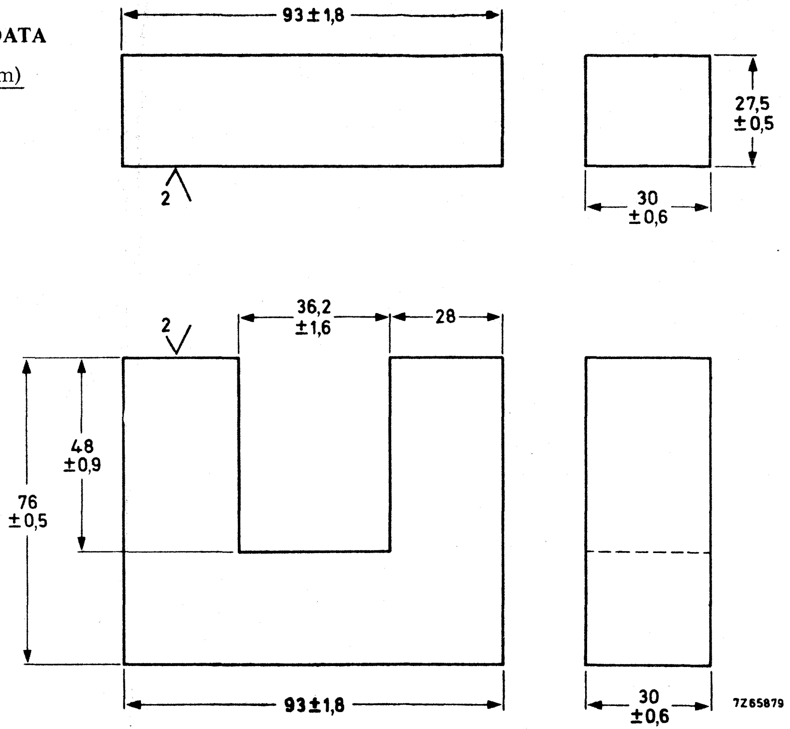
A_e = 448 mm^2

→ V_e =116000 mm^3

U-93/76/30
I- 93/28/30

MECHANICAL DATA

Dimensions (mm)



Weight			
	U-core	756	g
	I-core	365	g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-93/104/30.

grade	temperature (^{o}C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25	200	–	≤ 36,7	U	4312 020 33090
	100	200	–	≤ 30,2	I	4312 020 33110
	100	≥ 290	250	–		

Magnetic dimensions

l_e = 257 mm

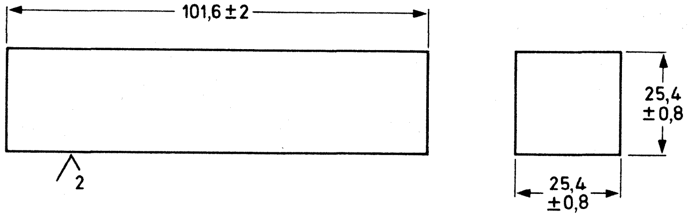
A_e = 840 mm^2

V_e = 215000 mm^3

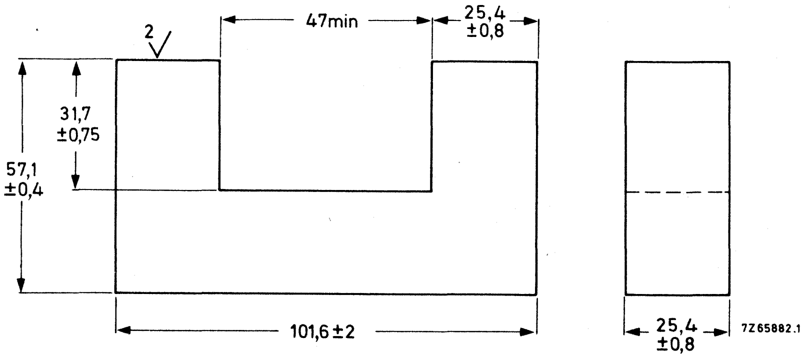
MECHANICAL DATA

Dimensions (mm)

I-core



U-core



Weight U-core 506 g
I -core 310 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UI-100/82/25

grade	temperature (^{o}C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25	200	–	≤ 26, 8	U	4312 020 33120
	100	200	–	≤ 22, 1	I	4312 020 33420
	100	≥ 290	250	–		

→ Magnetic dimensions

l_e = 244 mm

A_e = 645 mm^2

V_e = 157700 mm^3

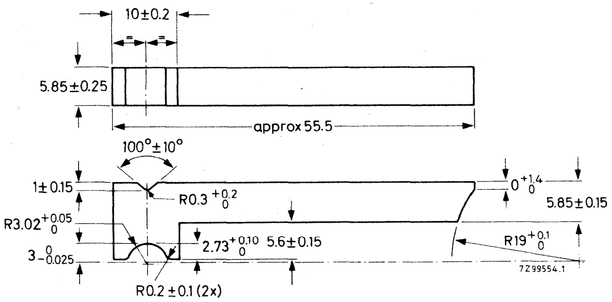
FERRITES FOR TELEVISION COMPONENTS

1. YOKE RINGS See chapter "Yoke rings"

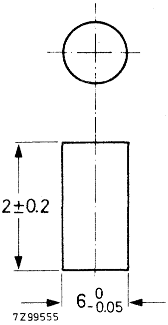
2. U-CORES See chapter "Cores for line-output transformers"

Special ferrite parts are:

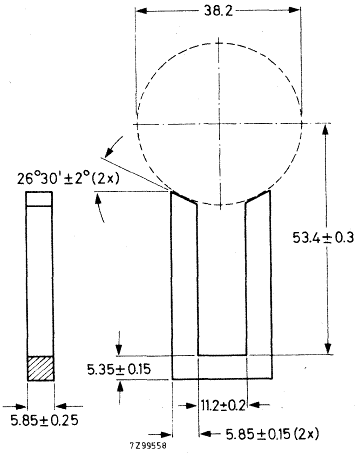
3. FERROXCUBE CORES AND FERROXDURE MAGNET FOR CONVERGENCE UNITS



L-core
Ferroxcube 3C2
Catalogue number 3122 104 94090 } *)
3122 104 94600



Ferroxdure 100 magnet
Catalogue number 3122 104 94330



U-core
Ferroxcube 3C2
Catalogue number 3122 104 93780

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*) Equal quantities of both numbers must be ordered. (two cores form one unit)

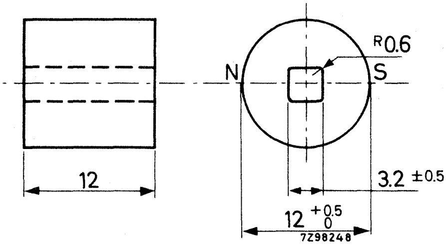
4. FERROXCUBE RODS, TUBES AND FERROXDURE MAGNETS FOR LINEARITY-CONTROL UNITS

Rod cores

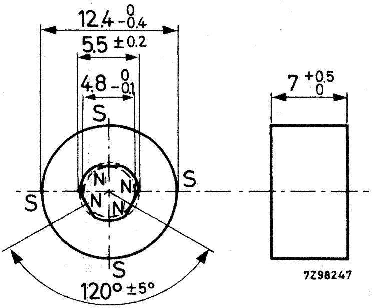
diameter (mm)	length (mm)	grade	catalogue number
4,9 ± 0,05	36 - 0,5	3C6	3122 104 90490
4,9 ± 0,05	50 - 0,5	3C6	3122 134 90110

Tube cores

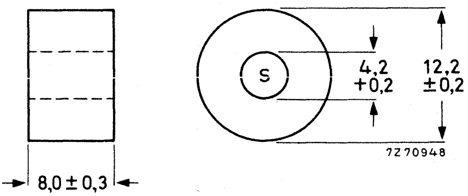
outer diameter (mm)	inner diameter (mm)	length (mm)	grade	catalogue number
4,9 ± 0,05	3 + 0,1	36 - 0,5	3C6	3122 104 93760
4 ± 0,15	2 + 0,2	36 ± 0,6	3C6	4312 020 31450



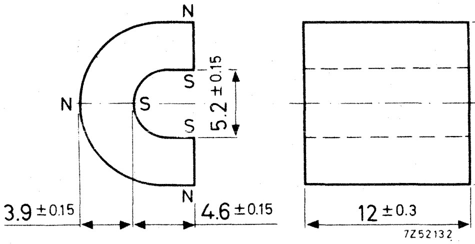
Ring magnet, diametrically magnetized.
Ferroxdure 100.
Catalogue number 3122 104 92690.



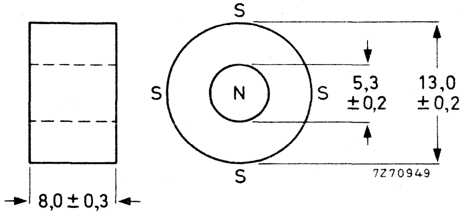
Ring magnet, radially magnetized.
Plastic bonded ferroxdure P40.
Catalogue number 3122 104 93530.



Ring magnet, radially magnetized.
Ferroxdure 100.
Catalogue number 4312 020 63180.



Segment magnet, radially magnetized.
Plastic bonded Ferroxdure P40.
Catalogue number 3122 104 93770



Ring magnet, radially magnetized.
Ferroxdure 100.
Catalogue number 3122 904 92670

5. BLUE LATERAL ROD-CORE

Catalogue number 3122 104 90490 (for dimensions see point 4 of this section)

6. TRANSDUCTOR CORES

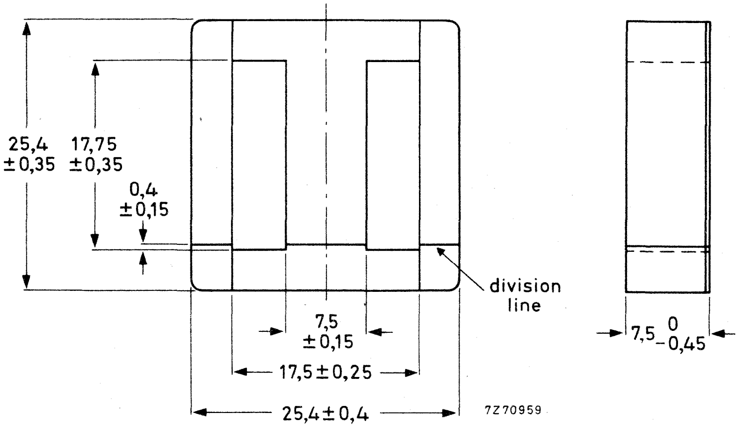
Ferroxcube E + I core for raster correction in grade 3C6 and 3C8

Grade 3C6: catalogue number 3122 134 90960

Magnetic dimensions

dimensions in mm

l_e = 57,5 mm
A_e 55 mm^2
V_e 3160 mm^3



temperature (°C)	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W/pair)	measuring frequency (kHz)
25	200	–	≤ 0,65	16
25	≥ 340	250	–	16
100	≥ 100	50	–	16

grade 3C8: catalogue number 3122 134 90430

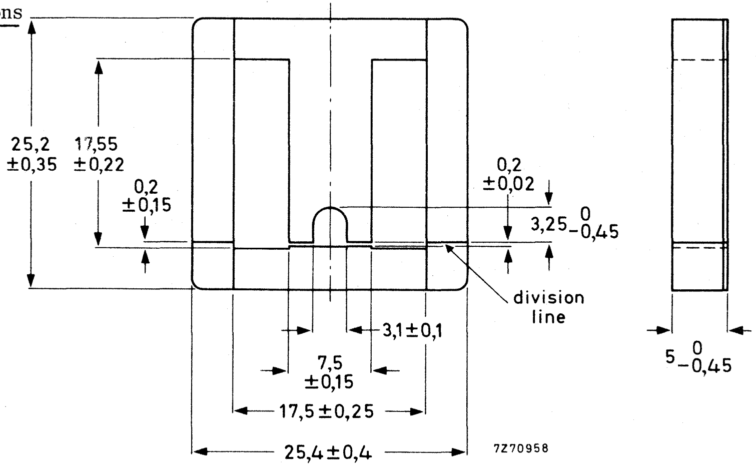
dimensions in mm

magnetic dimensions

l_e = 83 mm

A_e = 19 mm^2

V_e = 1580 mm^3



temperature (°C)	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W/pair)	measuring frequency (kHz)
25	200	–	≤ 0,25	16
25	≥ 380	250	–	16
100	≥ 120	50	–	16

CORES FOR ERASING HEADS

10207

For good erasing of magnetic tape at a low noise level, a frequency is required that is several times higher than the maximum frequency to be recorded. That is why, for use in erasing heads a core material with low eddy current losses is recommended. Low eddy current losses imply low heat dissipation, and consequently less power for the erasing procedure.

Ferroxcube cores possess this property to a much higher degree than laminated metal cores, so that they are ideal for this application.

Each core is machined out of solid after sintering to ensure uniform quality of material and excellent shape-symmetry.

MATERIAL PROPERTIES

←

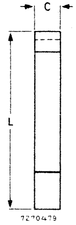
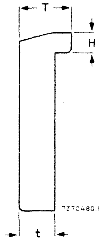
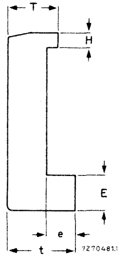
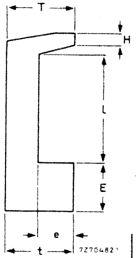
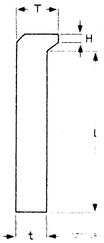
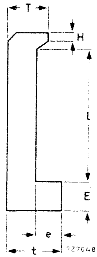
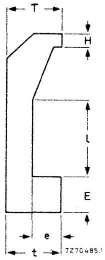
Ferroxcube grade 3H2

Low eddy current losses at frequencies up to 500 kHz

Relative initial permeability is approximately 2300

Saturation flux density at 25 °C is approximately 440 mT

AVAILABLE TYPES

 typical side view							
catalogue number / size (mm)	3103 209 12030	3103 209 12040	3103 224 90150	3103 224 90090	3103 224 90100	3104 101 80720	3104 101 80400	3104 101 80730
L	10,9 ±0,1	10,9 ±0,1	11,2 ±0,2	9 −0,2	9 −0,2	10,7 ±0,1	11 ±0,2	10,7 ±0,1
l	–	–	5 ±0,2	8,1 ±0,1	6,5 +0,1	–	4,7 ±0,2	7,4 +0,1
C	1,7 ±0,1	1,7 ±0,1	14,5 −0,2	2,4 ±0,1	2,4 ±0,1	1,9 +0,2	1,9 +0,2	1,9 +0,2
T	3,25 ±0,1	3,05 ±0,15	4,4 ±0,1	2,6 ±0,1	2,6 ±0,1	1,5 ±0,1	3,5 ±0,1	2,6 −0,2
t	2,1 ±0,1	4,4 ±0,1	4,4 ±0,1	1,8 −0,2	3,5 ±0,1	–	3,5 ±0,1	2,6 −0,2
H	1,4 +0,2	1,0 ±0,1	0,7 ±0,1	0,5 ±0,1	0,5 ±0,1	–	0,9 ±0,1	0,8 ±0,1
E	–	2,2 ±0,3	3,2 −0,4	–	1,7 −0,3	–	2,2 −0,2	1,5 ±0,1
e	–	1,9 ±0,1	2,4 +0,3	–	1,7 ±0,1	–	2,0 ±0,1	1,5 ±0,1

FERROXCUBE FOR MAGNETIC HEADS

INTRODUCTION

The Ferroxcube grades 8C1 (NiZn ferrite) and 8H1 (MnZn ferrite) were developed for application in the production of audio magnetic-video magnetic- and instrumentation magnetic heads.
Their low porosity and high density in respect to the theoretical value of the specific crystal structure gives these materials excellent properties.
The main features are the high resistance to wear and the good magnetic performance incorporated in the well controlled micro-structure.This structure enables high gloss polishing, lapping and glass or metal bonding.
The materials are available in the shape of small blocks (sizes ≈ 17 x 13 x 2 mm) but, on request, specially machined products can be sampled and supplied.

TECHNICAL DATA *)

	unit	8C1 NiZn ferrite	8H1 MnZn ferrite
μ_i at 0, 1 MHz		1500	5000
1 MHz		1300	2000
5 MHz		500	600
μ_{max} at 1 kHz		3200	40 000
Curie point	^oC	125	125
Coercivity (H_c)	A/m	160	20
Induction $\hat{B}$ at H = 800 A/m	mT	350	440
Resistivity	Ωm	10^4	0,01
Density	kg/m^3	5310	5100
Porosity	%	< 0,5	< 0,3
Coefficient of linear expansion	$10^{-6}/^oC$	9	10
Hardness (Vickers)	N/mm^2	7500	6500

The wear of recording heads is due to two mechanisms: abrasive action (grinding) and adhesive action (polishing) by cards or tape.
In a practical test, incorporating both mechanisms, the wear resistance of the ferrite magnetic head was compared with a mu-metal one under the same test conditions (volume "take-off" per time unit over the testing period).
For audio magnetic heads the wear resistance under identical conditions (≈ 40% abrasive and ≈ 60% adhesive) can be a factor 80 better than that of the mu-metal one.

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*) Valid for toroids ≈ 9 x 5 x 1 mm.

Beads and chokes

BEADS FOR SCREENING, DAMPING AND WIDE-BAND H.F. CHOKES

APPLICATION

The beads are available in the ferroxcube materials 3 and 4. They are used in v.h.f. radio and TV receivers and in electric motors, ignition systems etc. to reduce in- or outgoing interference, and also in v.h.f. circuits to avoid troublesome coupling. The supply leads in radio, TV and other electronic equipment often transfer unwanted r.f. and v.h.f. energy from one circuit or stage to another. Capacitive decoupling of the leads will not always be effective by reason of possible resonances. On the same grounds the addition of a series inductance will not always have the required results. In these cases a number of beads (the total length of which is small compared with the wavelength) simply threaded on the supply leads, or a single wideband choke may be used successfully. For the same volume chokes are more effective than beads.

In "damping circuits" either beads or chokes may be used in conjunction with small capacitors, to provide additional filtering of the self-resonant frequency of that capacitor and its leads.

Ferroxcube beads and ferroxcube-cored chokes have the following advantages over air-cored chokes:

small volume;
wide band;
no sharp fall-off;
insensitive to stray circuit capacitance;
no parasitic resonances;
no additional resistor required for damping;
low price.

VERSIONS

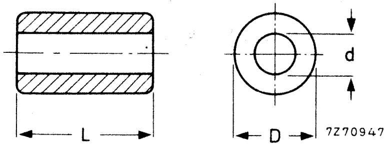


Fig. 1

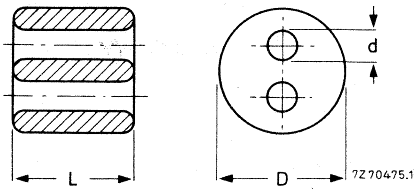


Fig. 2

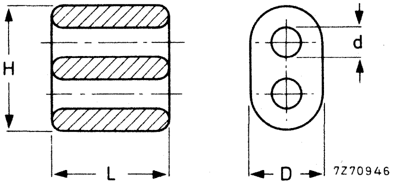


Fig. 3

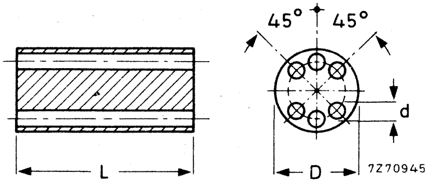


Fig. 4

Fig.	D (mm)	d (mm)	L (mm)	H (mm)	grade	catalogue number
1	$3{,}5^{+0{,}1}_{-0{,}2}$	1,3 +0,2	3 +0,5	–	3B	4312 020 31050
	3,5 ±0,2	1,3 +0,2	5 +0,5	–	3B	4312 020 31060
	3,7 −0,4	1,2 +0,2	3,5 −0,5	–	3B	4322 020 34400
	3,7 −0,4	1,2 +0,2	3,5 −0,5	–	4B1	4322 020 34420
	3,7 −0,4	1,5 +0,2	3,5 −0,5	–	3B	4322 020 34430
2	5,6 ±0,3	0,9 ±0,15	6,35 +0,4	–	4B1	4322 020 38280
	5,6 ±0,25	0,95 +0,15	4,5 −0,5	–	4D1	3122 134 90800
	5,9 −0,6	0,75 +0,3	12,4 −0,8	–	4B1	3122 104 90960
	6,6 −0,6	1,05 +0,3	5 ±0,2	–	4B1	3122 104 94840
	6,6 −0,6	1,05 +0,3	12,4 −0,8	–	4B1	3122 104 90950
	7,2 −0,4	0,7 +0,2	5,1 −0,2	–	4A1	4322 020 36840
3	8,5 −0,5	3,5 +0,5	8 ±0,3	14 +0,5	4B1	4312 020 31570
	8,5 −0,5	3,5 +0,5	14 ±0,4	14 +0,5	4B1	4312 020 31520
4	6 ±0,3	0,7 +0,2	10 ±0,5	–	3B	4312 020 31500
	6 ±0,3	0,7 +0,2	10 ±0,5	–	4B1	4312 020 31550

The beads may be threaded with insulated or bare wire, but if grade 3B is used on bare wire a maximum fall-off in resistance of 8% can be expected, as a result of its lower resistivity.

Fig. 5 shows some performance details of the 3,5 mm long tube beads in the two material grades. It will be noted that above about 60 MHz the impedance of the 3B type is substantially resistive.

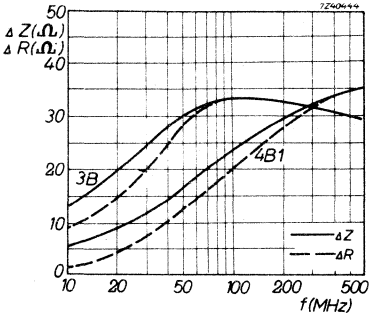


Fig. 5

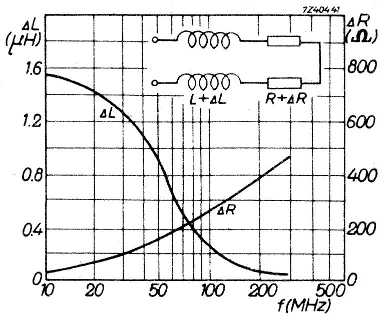


Fig. 6

With twin beads the advantages of mutual inductance can be utilized. Fig. 6 gives the increase of the inductance L and loss resistance R caused by a twin bead 4312 020 31520 on two straight wires.
Grade 4B1 provides ample insulation between the two wires even if bare.

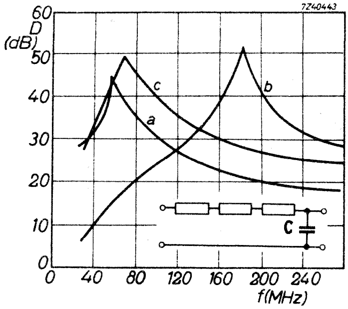


Fig. 7. Damping in an LC circuit consisting of a string of three beads 4322 020 34400 and a ceramic capacitor.

a. C = 1500 pF tubular
b. C = 190 pF tubular
c. C = 1500 pF disc

WIDE-BAND H.F. CHOKES

APPLICATION

See section "Beads for screening and damping and wide-band h.f.chokes"

TECHNICAL DATA

The chokes are supplied with six axial holes through which 1.5, 2.5 or 2 x 1.5 turns of tinned copper wire are threaded.
The table gives the types of choke that are currently available.

Dimensions in mm

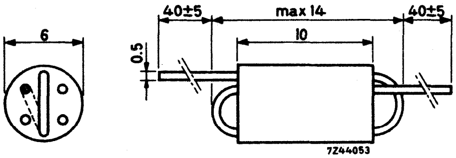


Fig. 1

number of turns	Z_{max} (kΩ)	f at Z_{max} (MHz)	decrease of impedance in the freq. range (MHz)	dB	grade	catalog number
1.5	0.35 ± 20%	120	10-300	≤7	3B	4312 020 36630
1.5	0.45 ± 20%	250	80-300	≤3	4B1	4312 020 36690
2.5	0.75 ± 20%	50	10-220, 30-100	≤7, ≤3	3B	4312 020 36640
2.5	0.85 ± 20%	180	50-300, 80-220	≤6, ≤3	4B1	4312 020 36700
2 x 1.5	0.90 ± 20%	50	10-220, 30-100	≤7, ≤3	3B	4312 020 36650
2 x 1.5	1.00 ± 20%	110	50-300, 80-220	≤7, ≤3	4B1	4312 020 36710

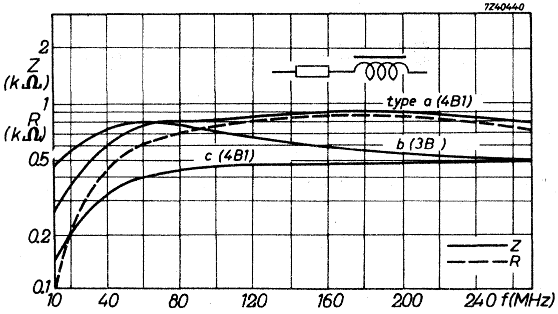


Fig. 2. Performance of three single chokes

Type a = 4312 020 36700
b = 4312 020 36640
c = 4312 020 36690

Fig.2 shows some performance details of three single chokes. It will be noted that above approx. 80 MHz the impedance is substantially resistive and tends to be constant. Double chokes are used for twin leads, in which case the advantages of mutual inductance can be utilized.
Fig. 3 compares the typical obtainable performance.

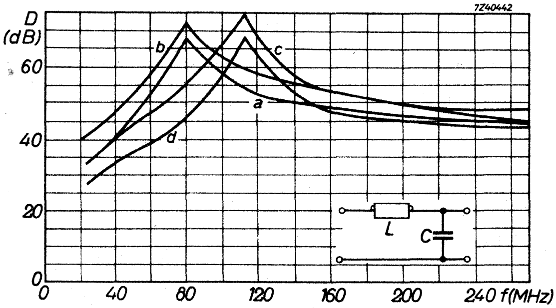


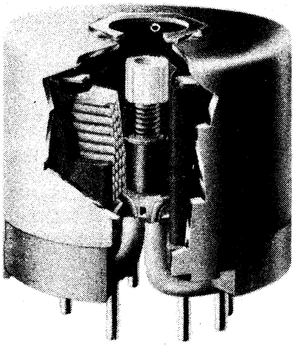
Fig. 3. Damping in an LC circuit consisting of a ferroxcube choke and a ceramic disc capacitor.

a. L = 4312 020 36690, C = 1500 pF
b. L = 4312 020 36700, C = 1500 pF
c. L = 4312 020 36700, C = 550 pF
d. L = 4312 020 36690, C = 550 pF

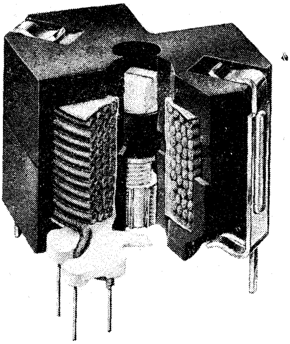
Ferroxcube potcores and square cores

General

INTRODUCTION



RZ 16213 - 3



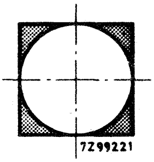
RZ 25252

Ferroxcube potcores and square cores have been developed for stable low loss filters, coils and transformers. Due to their closed shape they combine a low weight with a small volume.

The principal properties of potcores and square cores are the inductance, the quality factor Q, the temperature coefficient α_F , the disaccommodation factor D_F and, if the core is used on higher induction values, the generation of third harmonics.

Our preferred types of potcore are called P-potcores; they are standardized in accordance with the international I.E.C., the British Standards B.S.I., the German D.I.N. and the French F.N.I.E. specifications.

Our preferred types of square core are called RM cores, the I.E.C. and several national standardization committees did already prepare or are preparing standardization.



7Z99221

Square cores have the advantage over conventional (round) potcores that, if mounted on a printed wiring board, the space of the corners (see the adjoining sketch) is used.

PRE-ADJUSTED CORES

In principle potcores and square cores with any μ_e value and A_L-factor can be manufactured. However, in practice the ranges are limited to the μ_e-values and A_L-factors required for the most important fields of application.

Recommended are the pre-adjusted cores which are provided with a nut for an adjustor. However, for those users who prefer to insert the nut themselves, some information is given under Mounting Data in this general part and under Mounting Parts in the data sheets.

For most μ_e-values and A_L-factors of the pre-adjusted cores a continuously variable adjustor mechanism can be delivered. These continuously variable adjustors are specially recommended if the coils are employed as filter coils. The maximum adjustment varies from 8 - 14%, depending on the type.
For the potcores P26/16 and larger a step-by-step adjustor can be delivered, specially recommended if the coils are employed as loading coils. For detailed data see the relevant sections Inductance Adjustors in the data sheets.

When the aforementioned adjustors are used, coils with a higher μ_e value can be designed in order to obtain a maximum quality factor with a minimum volume, maintaining a small inductance tolerance field.

α AND A_L FACTORS

α is the number of turns for an inductance of 1 mH for a given core shape. For other inductance values the number of turns is $N = \alpha \sqrt{L}$ (L in millihenrys).

A_L is the inductance per turn^2 in nanohenrys (10^{-9} H) for a given core shape. For a given number of turns the total inductance is $L = N^2 A_L$ (L in nanohenrys).

The α and A_L values mentioned under "Pre-adjusted cores" in the data sheets are valid for cores without inductance adjustor. The adjustors give an increase in inductance of the potcores as given under "Inductance adjustors".

Measurement

The α and A_L factors given in the data sheets are guaranteed by means of a tolerance on the inductance, which is valid for a set of cores from one compartment of a primary pack, when the 11 following measuring conditions are met:

1. The core should be magnetically conditioned (demagnetised). The α or A_L value should not be measured less than 24 hours after the conditioning (demagnetisation).

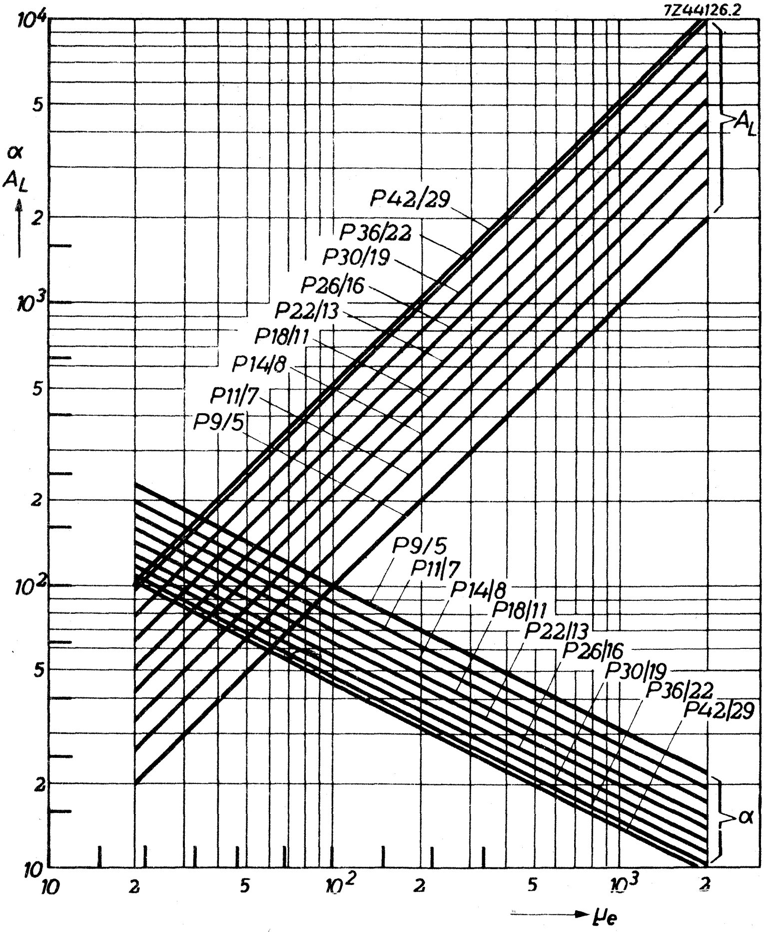
2. The mating surfaces should be carefully cleaned.
3. A standard coil as indicated in the following table should be used.

for series	catalogue number of standard coil	number of turns			number of layers	diam. of copper (mm)
		total	per layer	upper layer		
P 9/5	7622 301 00101	65	11	10	6	0.20
P 11/7	7622 301 00301	71	12	11	6	0.25
P 14/8	7622 301 00501	90	13	12	7	0.30
P 18/11	7622 301 00701	83	12	11	7	0.45
P 22/13	7622 301 00901	71	12	11	6	0.60
P 26/16	7622 301 01101	71	12	11	6	0.70
P 30/19	7622 301 01301	104	15	14	7	0.70
P 36/22	7622 301 01501	135	17	16	8	0.70
P 42/29	7622 301 01701	199	20	19	10	0.80
P 66/56	7622 301 01901	231	29	28	8	1.20
RM 4	7622 300 50101	91	23	22	4	0.224
RM 5	7622 300 50201	107	18	17	6	0.25
RM6-S/ RM6-R	7622 300 50301	113	19	18	6	0.315
RM 8	7622 300 50501	125	21	20	6	0.40

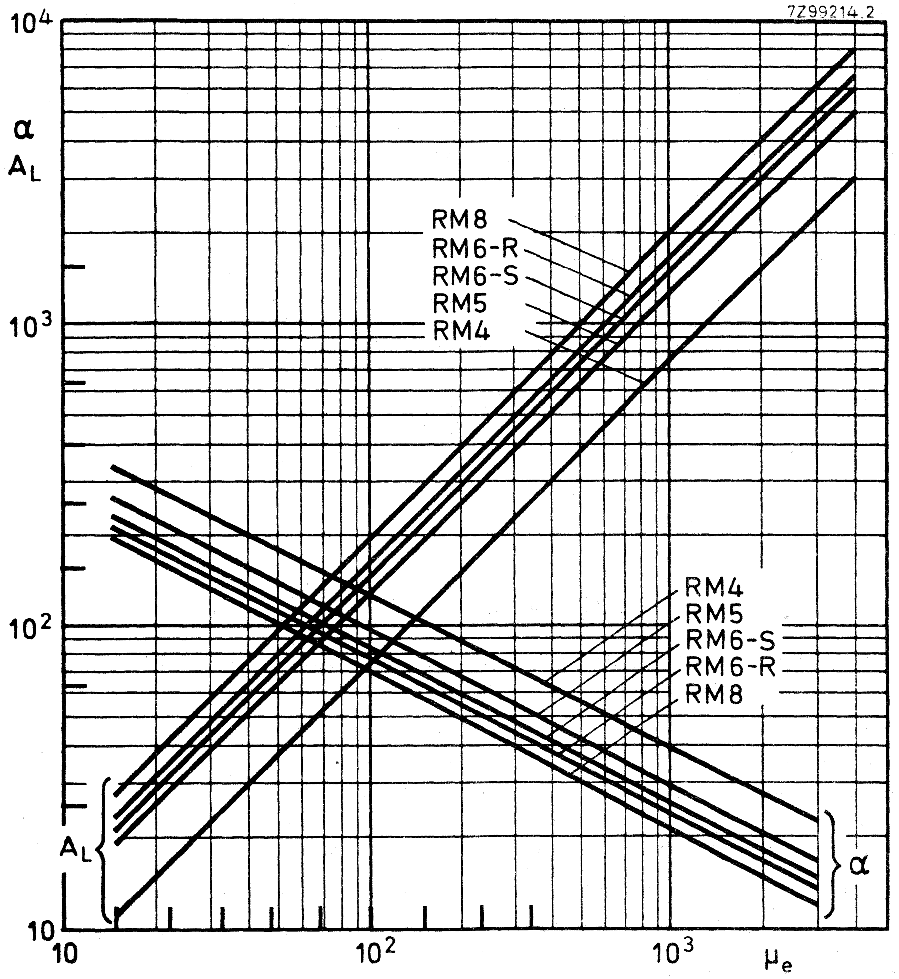
4. The axial lines of the potcore halves should coincide.
5. The silver reference lines (if any) on the circumference of the potcore halves should coincide. If no reference lines are given, the halves may be positioned arbitrarily.
6. A force is applied to the flat sides of the core by means of rings. The inner diameter of these rings should be equal to the average value of the inner diameter of the core.
7. The force mentioned above should be as given in the relevant data sheets.
8. The temperature should be 25 ± 10 °C
9. The frequency should be 4 kHz.
10. The current through or the voltage over the coil should correspond to a peak flux density ($\hat{B}$) in the core of $\leq 0,1$ mT
11. The standard coil is held against the bottom of the lower half (half with protruding coil former pins)

Conversion of μ_e-values into α and A_L values

Potcores



Square cores



Q-CURVES

As so many assumptions have to be made in calculating filter cores, an accuracy in Q-factor of better than ± 15% is difficult to obtain. Because of this, the proper value of μ_e or A_L for a given core is best arrived at by comparing Q-curves for various values of μ_e.

Several curves are included for most potcores and square cores. To simplify comparison, the curves for a given core have been made using identical coil windings.

Consequently curves for different μ_e values and the same core size can be compared, as well as curves for the same μ_e value and different core sizes.

The Q-factors for inductances other than given in the curves may be found by interpolation or extrapolation, as necessary.

MEASUREMENT OF HYSTERESIS, EDDY CURRENT AND RESIDUAL LOSSES

The hysteresis constant for calculating the hysteresis losses is q2-24-100, see the section Symbols in chapter A. For the relation between the several hysteresis constants see the section Hysteresis Constants. For the guaranteed values, measuring frequencies and induction values see the relevant data sheets.

The eddy current and the residual losses are measured at an induction $\hat{B} \leq 0{,}1$ mT and are expressed in a $\frac{\tan\delta}{\mu_i}$ value. For guaranteed values and measuring frequencies see the relevant data sheets.

The windings used for the measurement of the above mentioned quantities are indicated in the following table. The winding data refer to a single-section bobbin.

potcore	FXC grade	4 kHz	100 kHz	0.5 - 1 MHz	2 MHz	5 MHz	10 MHz
P 9/5	3B7/3H1	-	35 t/0.2 E	-	-	-	-
	4C6	-	-	-	17 t/40 x 0.04 E	8 t/0.30 E	6 t/0.30 E
P 11/7	3B7/3H1	-	42 turns 0.18 E	-	-	-	-
	3D3	-	42 turns 0.18 E	22 turns 0.10 E	-	-	-
	4C6	-	-	-	16 turns 45 x 0.04 E	6 turns 40 x 0.04 E.S.	3 turns 1 x 1.55 Cu
P 14/8	3B7/3H1	53 turns 0.25 E	37 turns 0.10 E	-	-	-	-
	3D3	-	37 turns 0.10 E	19 turns 8 x 0.04 E.S.	-	-	-
	4C6	176 turns 0.14 E	-	-	14 turns 0.40 E	6 turns 0.5 x 1.9 Cu	3 turns 0.7 x 1.9 Cu
P 18/11	3B7/3H1	42 turns 0.50 E	35 turns 0.14 E	-	-	-	-
	3D3	-	35 turns 0.14 E	16 turns 12 x 0.04 E.S.	-	-	-
	4C6	150 turns 0.25 E	-	-	12 turns 0.60 E	5 turns 0.7 x 2.75 Cu	2 turns 2.2 x 2.75 Cu
P 22/13	3B7/3H1	37 turns 0.60 E	29 turns 0.20 E	-	-	-	-
	3D3	-	29 turns 0.20 E	16 turns 40 x 0.04 E.S.	-	-	-
	4C6	140 turns 0.25 E	-	-	11 turns 0.70 E	4 turns 1.2 x 3.5 Cu	2 turns 2.8 x 3.5 Cu
P 26/16	3B7/3H1	34 turns 0.70 E	28 turns 0.28 E	-	-	-	-
	3D3	-	28 turns 0.28 E	14 turns 40 x 0.04 E.S.	-	-	-
	4C6	125 turns 0.40 E	-	-	10 turns 0.90 E	4 turns 2.0 x 4.0 Cu	2 turns 3.5 x 4.0 Cu

core	FXC grade	4 kHz	30 kHz	100 kHz	0.5 - 1 MHz	2 MHz	5 MHz
P 30/19	3B7/3H1	30 turns 1.0 E		23 turns 0.40 E	–	–	–
	3D3	–		23 turns 0.40 E	8 turns 2 x (100 x 0.04)E.S.	–	–
P 36/22	3B7/3H1	27 turns 1.2 E		22 turns 0.50 E	–	–	–
	3D3	–		22 turns 0.50 E	7 turns 2 x (100 x 0.04)E.S.	–	–
P 42/29	3B7/3H1	26 turns 1.8 E		20 turns 0.45 E	–	–	–
	3B5	33 turns 1.4 E		32 turns 0.45 E	–	–	–
P 66/56	3H1/3B5	21 turns 1.5 E		18 turns 1.5 E	–	–	–
RM5	3B7/3H1	45 turns 0,30 E	45 turns 0,30 E	17 turns 24 x 0,04			
RM6-R/ RM6-S	3B7/ 3H1	66 turns 0.35 E	66 turns 0,35 E	29 turns 12 x 0,04			
RM8			35 turns 0.50 E	31 turns 20 x 0,04			

ADJUSTMENT MECHANISM

A major feature of our pot and square cores is their adjustment mechanism. The inductance adjustment is achieved by inserting into the central hole of the core a tube made either of Ferroxcube or carbonyl-iron powder. This tube acts as a partial magnetic shunt across the air gap. It is moulded in a thermoplastic carrier having a threaded end. A polycarbonate nut is cemented in the lower pot or square core half. The adjuster is screwed in this nut.

The main features of our adjustment mechanism are:

- the thread on the adjuster and the nut are very closely dimensioned, well within the recommendations of UN-D12 (ISO recommendations R68, R261, DR782, DR979), resulting in a very low torque.
- The operating torque (2 to 50 mNm, depending on type) is mainly determined by the shape of the head of the adjuster. In this way the plastic carrier of the adjuster cannot be twisted nor can it be much distorted.
- The close tolerances on the adjuster and the nut contribute to a smooth adjustment .
- The fine thread ensures precise control of inductance. In practice, a setting inaccuracy of less than 0,03% is obtainable.
- The adjustment mechanism influences the assembly temperature coefficient by only a very small amount.

The following paste is recommended for locking the adjuster head:

1 part by weight castoroil

3 parts by weight aethylcellulose

Only the head is dipped in the paste and only a very small quantity must be applied. The locking paste also acts as a grease during turning in the adjuster. It does not dry out, so that readjustment after some time is possible.

COIL DESIGN AND CALCULATIONS

LOSSES IN A COIL

The losses can be divided into two groups:

Losses in the winding	Losses in the core
- d.c. copper losses	- hysteresis losses
- eddy current losses	- residual and eddy current losses
- dielectric losses	

The screening losses may be neglected when using ferroxcube potcores and square cores. So we can say:

$$\frac{R_t}{L} = \frac{R_o}{L} + \frac{R_{ec}}{L} + \frac{R_d}{L} + \frac{R_h}{L} + \frac{R_{e+r}}{L} \qquad \Omega/H \qquad \text{Eq. (1)}$$

For filter coils as a rule the maximum Q can be obtained if the sum of the copper losses is made equal to the sum of the core losses.

D.C. copper losses

D.C. losses are given with the formula:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \text{ x } \frac{1}{f_{cu}} \text{ x constant }^{*)} \qquad \Omega/H \qquad (2)$$

In this formula μ_e is the effective permeability of the magnetic circuit. f_{cu} is the space factor, which depends on the diameter and insulation of the wire in question, and the method of winding.

Eddy current losses in the winding

$$\frac{R_{ec}}{L} = \frac{C_{wcu}}{\mu_e} \text{ x } V_{cu} \text{ x } f^2 \text{ x } d^2 \qquad \Omega/H \qquad (3)$$

C_{wcu} is the eddy current copper factor, depending on the dimensions of the coil former and the core.

V_{cu} is the copper volume in mm^3
f is the frequency in Hz
d is the diameter of a single wire in mm

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*) For this constant see the coil former data.

Dielectric losses

The capacitances of the coil are not loss-free. These capacitances have a loss angle tan δ_c which increases the a.c. resistance of a coil.

$$\frac{R_d}{L} = \left(\frac{2}{Q} + \tan\delta_c\right) \times \omega^3 \times L \times C \qquad \Omega/H \qquad (4)$$

in which Q is the quality factor of the coil.

ω = 2 x π x f
f in Hz
L in henry
C in farad

Hysteresis losses

These losses depend on the $q_{2-24-100}$ value of the ferroxcube grade concerned, the μ_e value, effective volume of the potcore, inductance and current.

$$\frac{R_h}{L} = q_{2-V-\mu} \times \sqrt{L} \times i \times \frac{f}{800} \qquad \Omega/H \qquad (5)$$

For $q_{2-V-\mu}$ see Survey of symbols.

Eddy current and residual losses

In the core data $\frac{\tan\delta\ e}{\mu_1}$ is given as the sum of eddy current and residual losses. We obtain:

$$\frac{\tan\delta_{e+r}}{\mu_i} = \frac{\tan\delta_e}{\mu_i} + \frac{\tan\delta_r}{\mu_i} = \frac{\tan\delta_r}{\mu_i} + K_1 f \qquad (6)$$

COIL DESIGN

Typical requirements for the design of inductors are:
- inductance value
- minimum Q-factor at the operating frequency
- rms voltage across the inductor
- available space on printed-wiring board or chassis
- maximum and minimum temperature coefficient of inductance
- adjustment range of inductance
- variability

The designer has the choice of:
- core size
- Ferroxcube material grade
- inductance factor (A_L)
- winding wire type (solid or bunched conductors)
- adjuster

The working frequency is a useful guide to the choice of the core:

(a) At frequencies below 20 kHz, the highest Q-factor will be obtained by using large cores in 3H1 or 3B7 material with high inductance factors. The winding wire should normally be a solid conductor with fine covering. It should be noted that cores with high inductance factors give high temperature coefficients of inductance

(b) At frequencies between 20 kHz and 200 kHz, a high Q-factor will usually be obtainable with cores in 3H1 or 3B7 material. An increase in core size will not necessarily produce a higher Q-factor, particularly at the higher frequencies, the choice of inductance factor is less critical. Bunched conductors should be used to reduce the eddy current copper loss; strands of not greater than 0,07 mm diameter are recommended for use above 50 kHz.

(c) At frequencies between 200 kHz and 2 MHz the core material should be Ferroxcube 3D3. Bunched conductors with a strand diameter of not greater than 0,04 mm are recommended.

(d) At frequencies between 2 MHz and 12 MHz the core material should be Ferroxcube 4C6. Bunched conductors with a strand diameter of maximum 0,04 mm are recommended at frequencies below 5 MHz. A solid conductor is recommended for use between 5 and 12 MHz.

A.C. signal level

In most applications the a.c. signal level is low. Whenever possible, it is good practice to keep the operating flux density below 1mT. At such levels effects of hysteresis are usually negligible. At higher flux levels it may be desirable to make some allowance for the hysteresis loss and the increase in inductance. Curves showing typical variation with a.c. signal level for some cores are shown in the relevant data sheets. For low waveform distortion, RM cores with small hysteresis loss factor should be used. As a guide to the amount of distortion, the formula for the third harmonic voltage (see chapter A) may be used.

D.C. polarisation

The effect of d.c. polarisation on RM core inductors is, in general, to decrease the inductance. As with most other inductor characteristics, the decrease depends on the value of effective permeability, the decrease becoming less as the effective permeability decreases. For most applications, the effect is not serious. The decrease for any particular core may be obtained from the curves given in the coloured data sheets.

Design procedure

(1) Select the core size, material grade, the inductance factor, and the wire type using the information from the coloured data sheets.

(2) Using the adjustment curve, check that the adjustment range is sufficient to cover the A_L or μ_e tolerance, the resonating capacitor tolerance, and say ± 1% for unavoidable circuit strays.

(3) Calculate the number of turns needed, using the derived A_L or α values given in the data sheets of the relevant core.

(4) Select a suitable wire size to fill the coil former.

(5) From the known voltage E_{rms} to be applied across the inductor, calculate $\hat{B}_e$, and check if the level is less than 1mT. If $\hat{B}_e$ is greater than 1mT, care should be taken to ensure that the distortion and hysteresis loss are acceptable. Reference should also be made to the a.c. signal level characteristics in the relevant data sheets.

EXAMPLES OF CALCULATION

Example 1:

A filter coil has to be calculated for 2,75 mH with a maximum permissible temperature coefficient of $+8,5 \times 10^{-3}$ between +5 and +55 °C. The Q factor has to be at least 950 at 100 kHz, the alternating current through the coil is 1 mA.

For a positive temperature coefficient and because of the high frequency take Ferroxcube grade 3H1.
The maximum μ_e value is calculated from the maximum temperature coefficient.

$$\text{t.c.} = \left(\frac{\Delta\mu}{\mu_i^2} \times \mu_e + C\right) \times \Delta T \text{ (See T.F. in section Symbols of chapter A) }^{1)}$$

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1) See also Product Information No. 9: Relative Effective Permeability and Inductance Factor of Coils with Ferrxcube Core.

Assume $C = +20 \times 10^{-6}$, then:

$$\mu_e = \frac{t.c. - C \times \Delta T}{\frac{\Delta\mu}{\mu_i^2} \times \Delta T} = \frac{\text{max. } 8.5 \times 10^{-3} - 1000 \times 10^{-6}}{1 \times 10^{-6} \times 50} = \text{max. } 150$$

A comparison of different Q curves for grade 3H1 and $\mu_e = 150$ indicates that potcore P 18/11 is suitable. The pre-adjusted potcore with nut has cat. No. 4322 022 24270, the inductance adjustor to be used is 4322 021 30730.
To allow for ±5% inductance adjustment by the adjustor, the required inductance should be decreased by 5%, thus down to $0.95 \times 2.75 = 2.62$ mH without the adjustor.

The number of turns is $N = \alpha\sqrt{L} = 56.3\sqrt{2.62} = 91$.
The wire diameter can be calculated from the window area given on the P 18/11 coil former data sheet: 63 x 0.04 E.S.
The coil formers 4322 021 30270 and 4322 021 30090 can be used.

Calculation of the losses

Eq. (2): $$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 16.4 \times 10^3 \qquad \Omega/H \text{ (see data P 18/11)}$$

Say $f_{cu} = 0.38$ for this type of wire

$$\frac{R_o}{L} = \frac{1}{150} \times \frac{1}{0.38} \times 16.4 \times 10^3 = 286\ \Omega/H$$

Eq. (3): $$\frac{R_{ec}}{L} = \frac{C_{wcu}}{\mu_e} \times V_{cu} \times f^2 \times d^2 \qquad \Omega/H$$

Assume $C_{wcu} = 100 \times 10^{-9}$

$$\frac{R_{ec}}{L} = \frac{100 \times 10^{-9}}{150} \times 280 \times 10^{10} \times 0.04^2 = 3\ \Omega/H$$

Eq. (4): $$\frac{R_d}{L} = \frac{2}{Q} + \tan\delta_c\ \omega^3 \times L \times C \qquad \Omega/H$$

Assume $\tan\delta_c = 0.01$ and $C = 8$ pF

$$\frac{R_d}{L} = \frac{2}{950} + 0.01 \times (2 \times \pi \times 10^5)^3 \times 2.62 \times 10^{-3} \times 8 \times 10^{-12} = 63\ \Omega/H$$

Eq. (5): $$\frac{R_h}{L} = q_{2\text{-}V\text{-}\mu} \times \sqrt{L} \times i \times \frac{f}{800} \qquad \Omega/H$$

$$q_{2\text{-}V\text{-}\mu} = q_{2\text{-}24\text{-}100} \times \left\{\frac{\mu_e}{100}\right\}^{3/2} \times \sqrt{\frac{24\,000}{V_e}} \qquad \Omega/H^{3/2}\ \text{mA}$$

Take $q_{2\text{-}24\text{-}100} = 0.8\ \Omega/H^{3/2}$ mA for grade 3H1 as an average value.

So $$q_{2\text{-}V\text{-}\mu} = 0.8 \times \left(\frac{150}{100}\right)^3 \times \sqrt{\frac{24\,000}{1120}} = 6.72 \qquad \Omega/H^{3/2}\ \text{mA}$$

Then $$\frac{R_h}{L} = 6.72\sqrt{2.62 \times 10^{-3}} \times 1 \times \frac{10^5}{800} = 43\ \Omega/H$$

Eq. (7): $$\frac{R_{r+e}}{L} = \left\{\frac{\tan \delta_{e+r}}{\mu_i} - K_1 f\right\} \times \mu_e \times 2\pi f \ \Omega/H$$

Take $\frac{\tan \delta_{e+r}}{\mu_i}$ at 100 kHz of grade 3H1 = 3.0×10^{-6} as an average value and

$$K_1 = 0.3 \times 10^{-11}$$

$$\frac{R_{r+e}}{L} = (3 \times 10^{-6} - 0.3 \times 10^{-11} \times 10^5) \times 150 \times 6.28 \times 10^5 = 247 \ \Omega/H$$

Eq. (1): $$\frac{R_t}{L} = \frac{R_o}{L} + \frac{R_{ec}}{L} + \frac{R_d}{L} + \frac{R_h}{L} + \frac{R_{r+e}}{L} \quad \Omega/H$$

$$= 286 + 3 + 63 + 43 + 247 = 642 \quad \Omega/H$$

Quality factor $Q = \frac{2\pi f}{R_t/L} = \frac{6.28 \times 10^5}{642} = 975$

The measured value was 980, according to the relevant Q curve. An accuracy within ±15% for coil calculations is generally regarded as very good, in view of the great number of variables to be taken into account.

Example 2

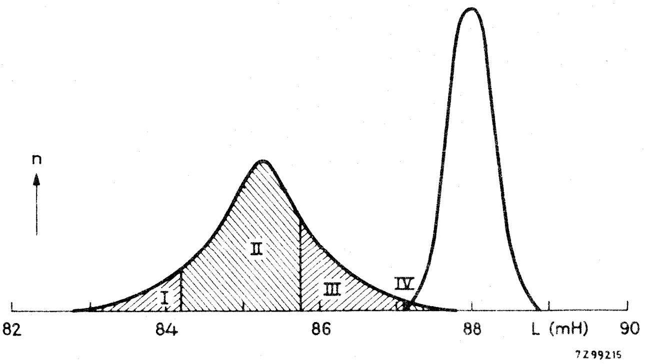
An 88 mH loading coil has to be calculated with optimum results in the smallest possible volume. The requirements are:

Tolerance on inductance	±1 %
D.C. resistance	$\leq 4.8\ \Omega$ (thus $\frac{R_o}{L} \leq \frac{4.8}{0.088} \leq 53.5\ \Omega/H$)
A.C. resistance at 1800 Hz and 1 mA	$\leq 5.8\ \Omega$
Capacitance between the two line windings (C_{a-b})	≤ 200 pF
Inductance unbalance between the two line windings	$\leq 0.1\%$
Resistance unbalance between the two line windings (ΔR_o)	$\leq 0.1\ \Omega$

In order to fulfil the requirement for the D.C. resistance we can take for instance potcore P 30/19, made 3H1, with A_L = 630 or P 26/16, grade 3H1, with A_L = 1000 (μ_e = 318). We choose the latter one because it is smaller.
The published inductance tolerance of ±3% (cores without adjustor) can be reduced to ±1% by using step-by-step adjustors; at the same time the number of turns can be made divisible by 4, as follows:
We choose an average inductance for the coils without adjustor lying more than 2% below the required 88 mH (88×10^6 nH).

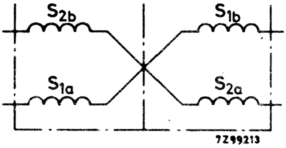
$$N \leq \sqrt{\frac{L}{A_L}} \leq \sqrt{\frac{88 \times 10^6 \times 0.98}{1000}} \leq 294 \text{ turns}$$

We take 292 turns because this number is divisible by 4; the corresponding inductance is 85.25 mH and it will have a tolerance of ±3%, which means values lying between 82.8 and 87.8 mH, see distribution curve.



Distribution curves of coils without (left curve) and with step-by-step adjustor

To shift the inductances to within ±1% distance from 88 mH (i.e. between 87.12 and 88.88 mH), we provide all coils of 82.8 to 84.2 mH (region I) with step-by-step adjustor No.11, which gives a shift of 5.3% (4.4 mH).
For the coils falling in region II we use adjustor No.8, for region III No.4 and no adjustor for the remaining coils (IV).
In order to fulfil the requirements for capacitance and unbalance of inductance and resistance, we divide the 292 turns into four windings of 73 turns, to be wound on a two-section coil former as in the figure below.



Four-winding loading coil on a two-section coil former

The lowest value for R_0/L will be obtained when the available space on the coil former is completely filled with copper wire. Calculations indicate that copper wire with a diameter of 0.28 mm and double polyvinylformal insulation will do very well.

Calculation of the d.c. resistance

Eq. (2): $\frac{R_0}{L} = \frac{1}{318} \times \frac{1}{0.49} \times 7.79 \times 10^3 = 49.9\ \Omega/\mathrm{H}$

Calculation of the a.c. resistance

Eq. (3): $\frac{R_{ec}}{L} = \frac{C_{wcu}}{\mu_e} \times V_{cu} \times f^2 \times d^2$ Ω/H

Assume $C_{wcu} = 100 \times 10^{-9}$

then $\frac{R_{ec}}{L} = \frac{100 \times 10^{-9}}{318} \times 10^3 \times 3.24 \times 10^6 \times 0.28^2 = 0.8$ Ω/H

Eq. (4): $\frac{R_d}{L} = (\frac{2}{Q} + \tan\delta_c)\omega^3 \times L \times C_o$ Ω/H

Assume Q at 1800 Hz = 200, C_o = 60 pF and $\tan\delta_c = 0.01$, then

$$\frac{R_d}{L} = (\frac{2}{200} + 0.01) \times (2\pi \times 1800)^3 \times 88 \times 10^{-3} \times 60 \times 10^{-12} = \text{negligible.}$$

Eq. (5): $\frac{R_h}{L} = q_{2\text{-}V\text{-}\mu} \times \sqrt{L} \times i \times \frac{f}{800}$ Ω/H

$$q_{2\text{-}V\text{-}\mu} = q_{2\text{-}24\text{-}100} \times \left\{\frac{\mu_e}{100}\right\}^{3/2} \times \sqrt{\frac{24\,000}{V_e}} \quad \Omega/H^{3/2}\ \text{mA}$$

Assume $q_{2\text{-}24\text{-}100} = 0.8$, then

$$q_{2\text{-}V\text{-}\mu} = 0.8 \times \frac{318\sqrt{318}}{1000} \times \sqrt{\frac{24\,000}{3530}} = 11.9 \quad \Omega/H^{3/2}\ \text{mA}$$

$$\frac{R_h}{L} = 11.9 \times \sqrt{0.088} \times 1 \times \frac{1800}{800} = 6.4\ \Omega/H$$

Eq. (7): $\frac{R_r}{L} = \left\{\frac{\tan\delta_{e+r}}{\mu_i} - K_1 f\right\} \times \mu_e \times 2\pi f$ Ω/H

Take $\frac{\tan\delta_{e+r}}{\mu_i}$ at 1800 Hz = 0.5×10^{-6} as an average value and

$K_1 = 0.2 \times 10^{-11}$

$$\frac{R_{r+e}}{L} = (0.5 \times 10^{-6} - 0.2 \times 10^{-11} \times 1.8 \times 10^3) \times 318 \times 2\pi \times 1.8 \times 10^3 = 1.8\ \Omega/H$$

Eq. (1): $\frac{R_t}{L} = \frac{R_o}{L} + \frac{R_{ec}}{L} + \frac{R_d}{L} + \frac{R_h}{L} + \frac{R_{r+e}}{L}$ Ω/H

$= 49.9 + 0.8 + 0 + 6.4 + 1.8 = 58.9$ Ω/H

or R_t at 1800 Hz and 1 mA = 5.18 Ω

So we see that the requirement for R_t at 1800 Hz - 1 mA is amply fulfilled and we also notice that the increase of resistance due to the a.c. losses is very low for ferroxcube 3H1.

INDUCTANCE STABILITY

The stability of a correctly assembled pot or square core inductor depends mainly on the extent to which the permeability of the ferrite core varies.

The permeability of a ferrite material may change with temperature, time, mechanical pressure, magnetic polarisation, etc.

The two most important changes affecting the assembly are:

(1) the change of permeability with temperature - temperature coefficient

(2) the change of permeability with time - disaccommodation

Further contributions to inductance variability may arise from:

(a) movement of the adjuster after the final circuit tuning

(b) movement of the wound coil former

(c) relative movement between the two core halves

(d) movement of mechanical piece parts associated with the core assembly

Small movements of the kind indicated above are usually caused by changes of temperature, mechanical vibration, mechanical shock, or a combination of these.

From the formulae given in chapter A it is clear that lowering the value of μ_e will reduce both the temperature coefficient and the effective disaccommodation.

Usually, however, very low values of A_L will prove to be incompatible with the Q requirements and $A_L = 315$ for an RM6 core would be a typical value for a high Q inductor assembly. The corresponding nominal value of temperature coefficient is about + 120 ppm per °C for material grade 3H1. By suitable choice of tuning capacitors, having negative temperature coefficients, a reasonable measure of compensation may be achieved. A popular resonating capacitor is the polystyrene type which usually has a temperature coefficient of about −120 ppm per °C.

The achievement of acceptable long-term inductance stability is mainly a matter of careful assembly and suitable stabilizing treatment before final circuit tuning. If the inductor is to be used in a critical circuit, then it should be artificially aged by temperature cycling as described in this general section under Mounting data. The long term inductance change to be expected in such an assembly is not greater than 500 ppm; this figure assumes that the inductor will be operating at an ambient temperature between 25 °C and 40 °C, and that the operating temperature will not change by more than ± 15 °C.

The inductance change of RM core assemblies, using clips with earthing spikes, when subjected to IEC 68-2-6 test Fc vibration conditions, has been shown to be less than 1000 ppm. This is a severe test and such conditions are unlikely to be met in practice.

Bump tests, using RM core assemblies with earthing spikes, in accordance with IEC 68-2-29, tests method E_b have also been carried out. The observed inductance changes, measured on RM6-R, 3H1, $A_L = 160$ core assemblies, were less than 300 ppm.

HYSTERESIS CONSTANTS

The contribution of the hysteresis losses to the core losses is:

$$\frac{R_h}{L}\ (\frac{\text{ohm}}{\text{henry}}).$$

These losses can be calculated with the aid of several formulas with different constants:

Table I	R	L	B	H	I	V_e	l_e	f
	units							
$\frac{R_h}{L} = q_{2\text{-}24\text{-}100}\sqrt{\frac{24\,000}{V_e}}\sqrt{(\frac{\mu_e}{100})^3}\ \ \sqrt{L}\ .\ I_{rms}\cdot\frac{f}{800}$	Ω	H			mA	mm^3		Hz
$\frac{R_h}{L} = a.\mu.\hat{B}.f$	Ω	H	T					Hz
$\frac{R_h}{L} = \frac{16}{3}\cdot\frac{\nu}{\mu^3}\cdot\mu^2\ .\ \hat{H}.f$	Ω	H		A/m				Hz
$\frac{R_h}{L} = \frac{h}{\mu^2}\cdot\mu^2\cdot\frac{NI_{eff}}{l_{eff}}\cdot\frac{f}{800}$	Ω	H			A		mm	Hz
$\frac{R_h}{L} = \frac{h'}{\mu^2}\cdot\mu^2\ .\ H_{eff}\cdot f$	Ω	H		$\frac{A}{m}$				kHz
$\frac{R_h}{L} = \eta_B\cdot\mu\ .\ \hat{B}\ .\ \omega\ (\omega = 2\pi f)$	Ω	H	T					Hz

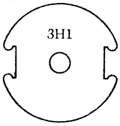
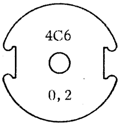
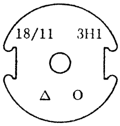
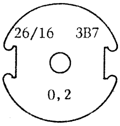
Table II shows the conversion factors for the hysteresis constants given in Table I.

Table II	$q_{2\text{-}24\text{-}100}$ x	a x	$\frac{\nu}{\mu^3}$ x	$\frac{h}{\mu^2}$ x	$\frac{h'}{\mu^2}$ x	η_B x
$q_{2\text{-}24\text{-}100}$ =	1	2.59×10^6	13.8×10^6	1.82×10^3	1.46×10^3	1.63×10^3
a =	0.386×10^{-6}	1	5.33	0.703×10^{-3}	0.563×10^{-3}	0.628×10^{-3}
$\frac{\nu}{\mu^3}$ =	72.4×10^{-9}	0.188	1	0.132×10^{-3}	0.106×10^{-3}	0.118×10^{-3}
$\frac{h}{\mu^2}$ =	0.549×10^{-3}	1.42×10^3	7.58×10^3	1	0.8	0.893
$\frac{h'}{\mu^2}$ =	0.686×10^{-3}	1.78×10^3	9.48×10^3	1.25	1	1.12
η_B =	0.615×10^{-3}	1.59×10^3	8.49×10^3	1.12	0.896	1

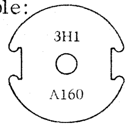
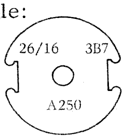
Example: $q_{2\text{-}24\text{-}100} = 1.46 \times 10^3 \times \frac{h'}{\mu^2}$

MARKING

MARKING OF POTCORE HALVES

product		marking on product	marking on primary pack	marking on label of storage pack
diameter ≤ 15 mm	without air gap	material	type, material Δ-sign, 0-sign year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: P9/5 3H1 Δ 0 2 A 17 A	example: 4322 020 20982 07552 17 A 2A 3H1 100
	with air gap	material air gap length (mm)	type, material year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: P14/8 4C6 2 A 17 A	example: 4322 020 21350 07552 17 A 2A 4C6 100
diameter ≥ 15 mm	without air gap	dimensions material Δ-sign, 0-sign	type, material Δ-sign, 0-sign year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: P18/11 3H1 Δ 0 2 A 17 A	example: 4322 020 21511 07552 17 A 2 A 3H1 100
	with air gap	dimensions material air gap length (mm)	type, material year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: P26/16 3B7 2 A 17 A	example: 4322 020 22000 07552 17 A 2 A 3B7 100

MARKING OF PRE-ADJUSTED POTCORES

product		marking on product	marking on primary pack	marking on label of storage pack
diameter ≤ 15 mm	with or without air gap	material μ or A sign *)	type, material A_L or μ_e sign A_L or μ_e value year + manufac. code series number	cat. number, lot number series number year + manufac. code material quantity
		example: 	example: P14/18 3H1 A_L 160 2 A 17 A	example: 4322 022 03252 07552 17 A 2 A 3H1 100
diameter ≥15 mm	with or without air gap	dimensions material μ or A sign	type, material A_L or μ_e sign A_L or μ_e value year + manufac. code series number	cat. number, lot number series number year + manufac. code material quantity
		example: 	example: P26/16 3B7 A_L 250 2 A 17 A	example: 4322 021 09061 07552 17 A 2 A 3B7 100

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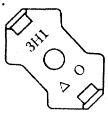
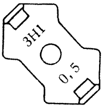
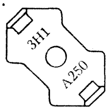
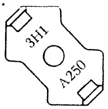
*) If the μ_e-value or A_L-factor is ≥1000, the μ or A sign will be omitted.

MARKING OF SQUARE CORES

product		marking on product	marking on primary pack	marking on label of storage pack
square core halves	without air gap	material Δ-sign 0-sign	type material year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: RM6-S 3H1 2 A 17 A	example: 4322 020 25025 07552 17 A 2 A 3H1 800
	with air gap	material air gap length (mm)	type material year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: RM6-S 3H1 2 A 17 A	example: 4322 020 25025 07552 17 A 2 A 3H1 800
pre-adjusted cores	types RM5 and smaller	material A-sign A_L-factor, *)	type, material A_L-sign, A_L-factor year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: RM6-S 3H1 A_L 250 2 A 17 A	example: 4322 020 59261 07552 17 A 2 A 3H1 400
	types RM6 and larger	material A-sign A_L-factor	type, material A_L-sign, A_L-factor year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example: 	example: RM6-S 3H1 A_L 250 2 A 17 A	example: 4322 020 59261 07552 17 A 2 A 3H1 400

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*) If the A_L factor is ≥1000, the A sign will be omitted.

MOUNTING DATA

ASSEMBLING

To obtain a stable inductance it is advisable to glue the coil former to the inside of one core half. Two small spots of a room temperature curing epoxy adhesive may be applied. When the cores are assembled with the accessories, as stated in the relevant data sheets, they fulfil the normal requirements of temperature stability and stability against shock and vibration. However, if the requirements are extremely severe it is advisable to glue also the core halves to each other.

As the difference between the outer diameter of the adjuster of P-potcores and the diameter of the hole in the potcore is very small the potcore halves must be accurately centred. For small quantity production, assembly plugs are useful aids to this end. These assembly plugs are not supplied, however drawings are shown below.

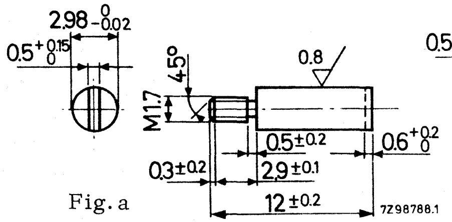


Fig. a

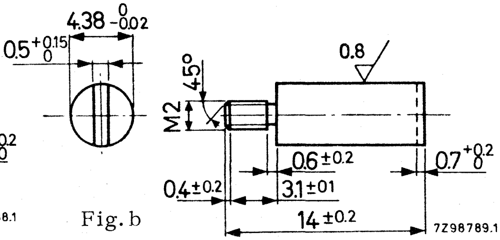


Fig. b

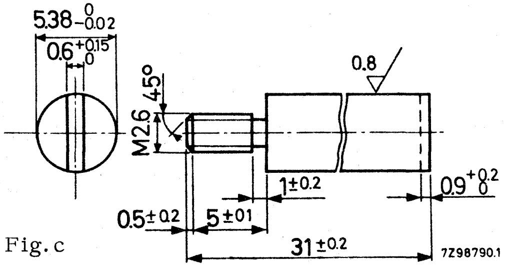


Fig. c

Assembly plugs for centring (a) for P 14/8 and P 18/11, (b) for P 22/13, (c) for P 26/16 to P 42/29. Recommended material is brass.

The centring must be done before any mounting parts are fitted.

The assembly plugs mentioned above can also be used during the impregnation process with wax or other compounds.
After impregnation the plugs must be removed and the inductance adjustors must be inserted; see pages "Inductance adjustment" of the potcore concerned.

For large quantity production special tools have been designed, which first centre the potcore halves and afterwards bend the lips of the containers.
These tools are not supplied, however drawings of the tools are sent on request, see table below.

core type	drawing number of tool
P 11/7	4322 058 00070
P 14/8	4322 058 00000
P 18/11	4322 058 00010
P 22/13	4322 058 00020
P 26/16	4322 058 00030
P 30/19	4322 058 00040
P 36/22	4322 058 00050
P 42/29	4322 058 00060
RM 4	4322 058 00180
RM 5	4322 058 00170
RM 6	4322 058 00150
RM 8	4322 058 00160

See also the section Mounting Parts in the data sheets.

INSERTING THE NUT FOR THE ADJUSTOR

The pre-adjusted cores can be supplied with a nut for the inductance adjustor, cemented into the hole of one of the potcore halves.

For those manufacturers however, who prefer to insert the nut themselves, the following remarks are given.
Push the nut into the centre hole of one of the core halves from the flat side. The recommended distance between the nut and the mating surface of the core is given under "Inductance adjustment".

Cement the nut in the hole of the core half. A suitable adhesive composition is:

1 weight part Araldit DY023
5 weight parts Araldit CY230
2.6 weight parts Versamid 140
} curing time 2 hours at 80 °C

The tools recommended for insertion of the nut are not supplied, but drawings are sent on request. .

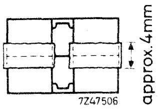
core type	drawing number of insertion tool
P 14/8 and P 18/11	7V48160
P 22/13	7V48161
P 26/16 - P 42/29	7V48198

Also for the dosating devices, recommended for wetting the insides of the centre hole with Araldit, are drawings available:

core type	drawing number of dosating tool
P 14/8 and P 18/11	7V12356
P 22/13	7V12353
P 26/16 - P 42/29	7V12341

CEMENTING THE CORE HALVES TO EACH OTHER

1. Remove all dust from the inside and outside of the core with a dry brush or with a rotating brushing machine.
2. Expose the core to a trichlore vapor bath of at least 10 seconds to remove all grease.
   After cleaning and degreasing, the core must be protected against dust and the joint surfaces must not be touched by hand.
3. Mix Araldit AY18 with hardener HZ18 in a weight ratio of 4:3. If desired, add chalk to the mixture in a maximum ratio of 1:1. The pot life is about two weeks, depending on temperature.
4. Place the coil in the core; if desired, cement the coil former to one of the core halves.
5. Centre the halves and put the core under pressure; the recommended pressure on the contact surface is 0.2 N/mm^2 (0.02 kg/mm^2).
6. Heat the core to about 35 ^{o}C to drive off any moisture.
7. Brush the adhesive onto the cylindrical surface of the core, to approximately 2 mm on each side of the parting line (see figure below).



   With the core still under pressure (see 5 above) put it in a kiln for 1 hour at 70 ^{o}C followed by $1\frac{1}{2}$ hour at 100 ^{o}C to cure the adhesive. Cool the core to room temperature before releasing the applied pressure.

8. With 4C6 material it may be found necessary to apply more than one coat of adhesive, allowing each coat to dry before applying the next. It is only necessary to apply contact pressure to the core halves while curing the adhesive.

IMPREGNATION AND ENCAPSULATION

If additional protection from humidity is required, vacuum impregnation of the wound coil former only is recommended. A good electrical quality wax should be used and the temperature during impregnation should be kept below the maximum operating temperature of the coil former. After impregnation, care should be taken to ensure that any wax scraped off during assembly does not become trapped between the mating faces of the core halves.

Complete impregnation or encapsulation of the assembly is not recommended because it may cause some stressing in the core material. This is almost always accompanied by unacceptable changes in permeability and temperature coefficient.

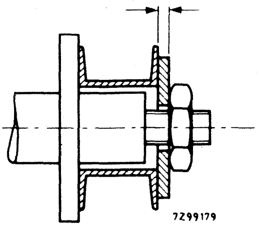
Note

In order to obtain coils which are very stable with temperature variations, it is recommended to subject the complete coil to about five temperature cycles from room temperature to 70 °C. The assembly should then be rested for 24 hours before the final adjustment is made. It has been shown that this procedure is beneficial to all types of assembly.

COIL WINDING RECOMMENDATIONS

PROTECTION OF THE COIL FORMER

Because the flanges of coil formers are thin (down to 0, 2 mm), it is necessary to support them during winding, for instance, with a metal flange of 2 mm thickness, see figure. The barrel must also be supported.



When winding with a wire of an overall diameter of less than approx. 0, 4 mm, no attempt should be made to layer-wind the coil, but the random winding should be built up as evenly as possible. For wires of greater overall diameter, a compromise is usual. Approximate layer winding will be found feasible at the start of the winding, and this should be continued as far as possible in order to achieve a satisfactory packing factor.

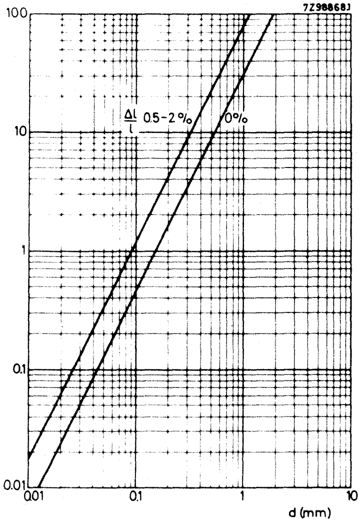
Each lead-out wire should be terminated by a solder joint at the base of a convenient coil former pin. A dip soldering method in a bath is recommended. The temperature of the bath and the length of the soldering time largely depend on the type of wire. The temperature and the soldering time should be no more than is necessary. A good flux is indispensable, preferably a type which can be removed with warm water. Do not dip the pins too far into the bath; this will avoid contamination of the coil former or tag plate. The capillary action of the solder will ensure that good joints are made when the distance between the bath and coil former or tag plate is between 0, 5 and 1 mm.

WIRE TENSION

The following graphs may be used to find the tension necessary in the wire during winding:

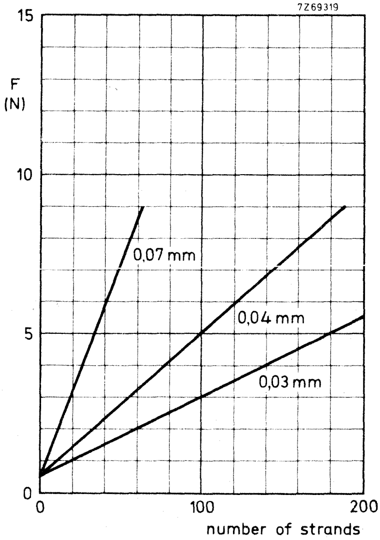
Solid wire

Wire tension (F) as a function of the wire diameter (d) with the occurring stretch ($\frac{\Delta l}{l}$) as parameter



Bunched wire

Wire tension (F) as a function of the number of strands with the strand diameter as parameter



Potcores

POTCORES

INTRODUCTION

Three types of core can be supplied:

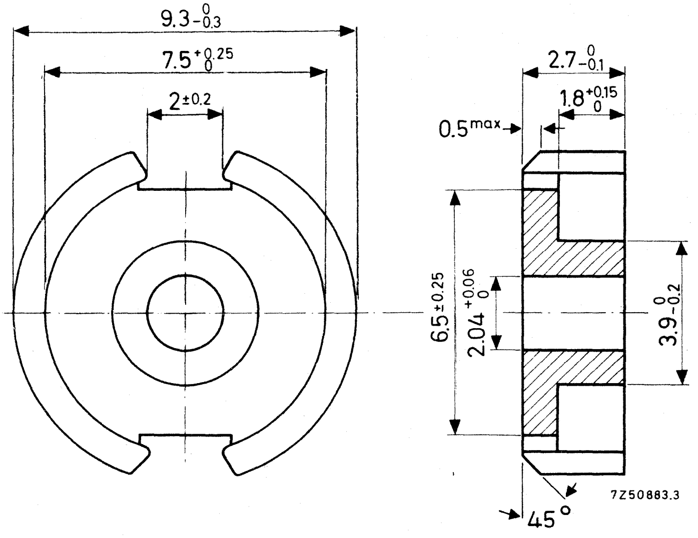
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41 293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number.
Quantity: a primary pack contains 40 potcore halves or 20 pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores.
So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 20970
3H1	4322 020 20980
4C6	4322 020 20940
3D3	4322 020 20900

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I

	temp.	grade			
	(°C)	3B7	3H1	3D3	4C6
$\alpha_F \times 10^6$	+5 to +25	–	+0.5 to +1.5	–	-2 to +4
	+25 to +55	–	+0.5 to +1.5	–	0 to +6
	+25 to +70	-0.6 to +0.6	+0.5 to +1.5 1)	0 to +2	–
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 6	≤ 6	≤ 20	≤ 10

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 25 Newton, the values in Table II are guaranteed at 25±10 °C.

Table II

	$\hat{B}$	freq.	grade			
	(mT)	(MHz)	3B7	3H1	3D3	4C6
μ_e	≤ 0,1	0.1	≥ 915	≥ 915	≥ 475	≥ 93
α	≤ 0,1	0.1	32.7	32.7	≤ 45.5	≤ 103
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0,1	0.1	≤ 6	≤ 6	≤ 10	–
	≤ 0,1	0.5	–	–	≤ 14	–
	≤ 0,1	1	–	–	≤ 30	–
$q_{2-24-100}$	0,3-1,2	0.1	–	–	≤ 4	–
	1,5-3,0	0.004	≤ 2.0	≤ 1.8	–	–
$\eta_B \times 10^3$	0,3-1,2	0.1	–	–	≤ 2.5	≤ 6.2
	1,5-3,0	0.004	≤ 1.2	≤ 1.1	–	–

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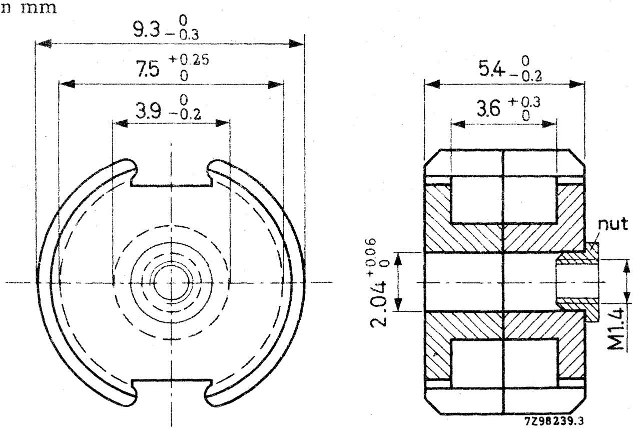
1) For orientation only.

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 6....
Without nut, catalogue number = 4322 022 4.... — suffix, see table

Weight per set 1,3 g

Mean length of lines of force l_e = 12,5 mm

$$\Sigma \frac{l_e}{A_e} = 1,24 \text{ mm}^{-1}$$

Effective volume V_e = 126 mm^3

Pre-adjusted potcores with standard A_L factors

The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

A_L	corresponding μ_e-value	tolerance on inductance (%)	Catal. No.: 4322 022 6.... with nut 4322 022 4.... without nut		
			3B7	3H1	4C6
16	16	± 1	–	–	1800
25	25	± 1	–	–	1810
40	40	± 1	–	–	1820
63	63	± 1	1030	1230	–
100	100	± 1,5	1040	1240	–
160	160	± 2	1050	1250	–

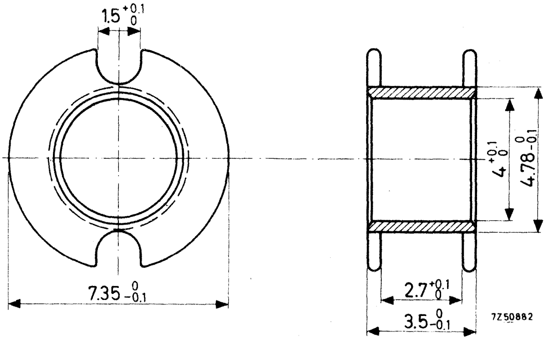
Symmetric air gap for cores with an A_L factor of 16 up-to and including 63
Asymmetric air gap for cores with an A_L factor of 100 and 160

Inductance $L = N^2 A_L$ (in 10^{-9} H)

COIL FORMER

Dimensions (mm)

The dimensions conform with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).



Catalogue number	4322 021 31700
Material	polycarbonate
Window area	3,4 mm^2
Mean length of turn	19 mm
Maximum temperature	130 ^{o}C
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu e} \times \frac{1}{f_{cu}} \times 69,5 \times 10^3\ \Omega/H$
Weight	0,07 g

INDUCTANCE ADJUSTORS

The tolerances on inductance of the pre-adjusted potcores (without adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03% by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the lips of the adjustor head. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different potcores.

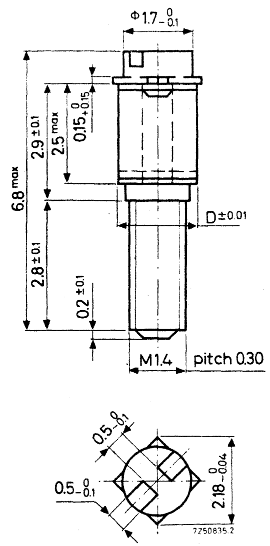


Table I, available types

D	colour	catalog number
1.85	green	4322 021 31250
1.85	yellow	4322 021 31270
1.76	brown	4322 021 31540

Table II, recommended application

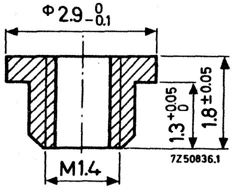
A_L	3B7/3H1/3D3
63	4322 021 31250
100	4322 021 31270
160	4322 021 31540

The adjustors are packed in bags of 100, so please order in multiples of 100.

Dimensions in mm

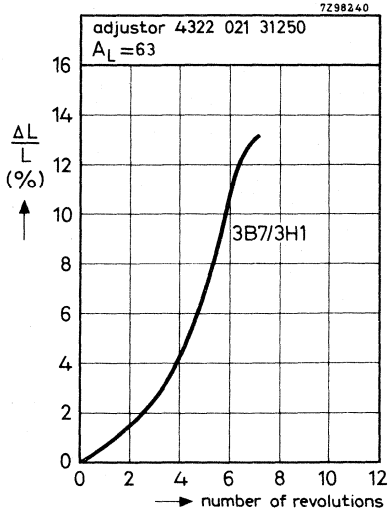
NUT FOR ADJUSTOR

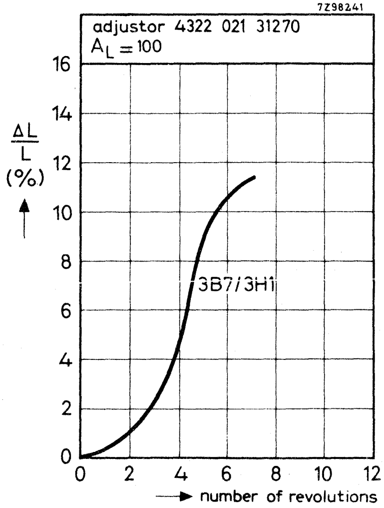
Material: brass,
nickel plated

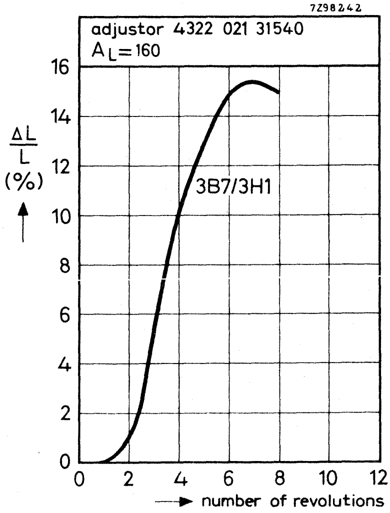


Loose nuts are not delivered.

ADJUSTMENT CURVES







POTCORES

INTRODUCTION

Three types of core can be supplied:

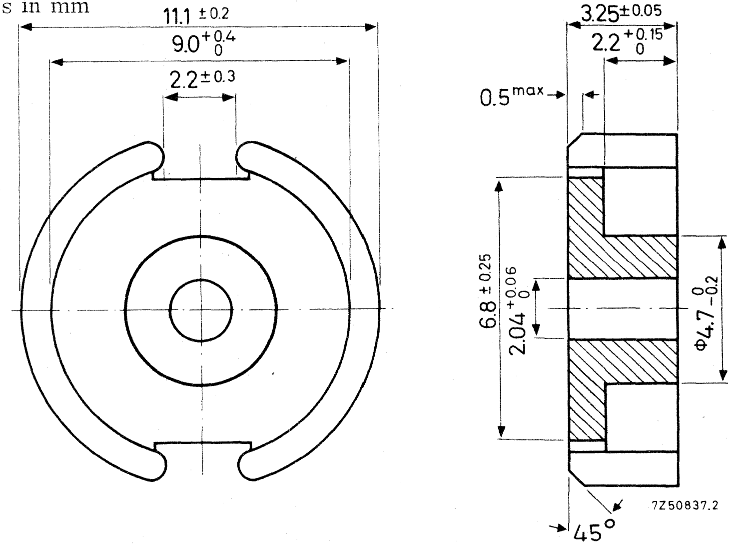
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following spacifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41 293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number.
Quantity: a primary pack contains 40 potcore halves or 20 pieces of pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores.
So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 21000
3H1	4322 020 21010
3D3	4322 020 21020
4C6	4322 020 21140

Properties

For toroidally wound core halves the values in Table I are guaranteed.

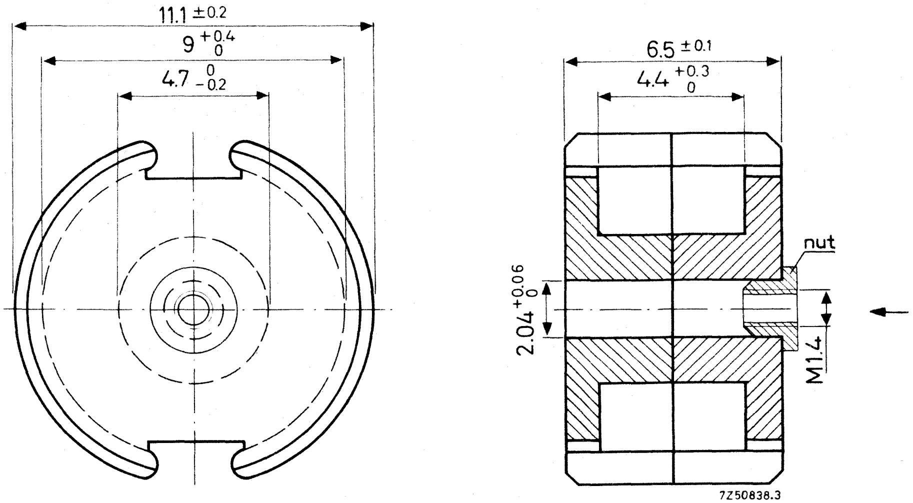
Table I	temp. (°C)	grade				
		3B7	3H1	3D3		4C6
$\alpha_F \times 10^6$	+5 to +25	–	+0.5 to +1.5	–		–2 to +4
	+5 to +55	–	–	–		–
	+25 to +55	–	+0.5 to +1.5	–		0 to +6
	+25 to +70	–0.6 to +0.6		0 to 2		–
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 4.3	≤ 4.3	≤ 15		≤ 10

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 35 Newton, the values in Table II are guaranteed at 25+ 10 °C.

Table II	$\hat{B}$ (mT)	freq. (MHz)	grade				
			3B7	3H1	3D3		4C6
μ_e	≤ 0,1	0.1	≥ 975	≥ 975	≥ 495		≥ 93
α	≤ 0,1	0.1	≤ 27.9	≤ 27.9	≤ 39.2		≤ 90.5
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0,1	0.1	≤ 5	≤ 5	≤ 8		
	≤ 0,1	0.5			≤ 14		
	≤ 0,1	1			≤ 30		
		2					≤ 40
		5					
		10					≤ 100
q2-24-100	0,3-1,2	0.1			≤ 3.0		≤ 10
→	1,5-3,0	0.004	≤ 2.0	≤ 1.8			
$\eta_B \times 10^3$	0,3-1,2	0.1			≤ 1.8		≤ 6.2
	1,5-3,0	0.004	≤ 1.2	≤ 1.1			

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 2....
Without nut, catalogue number = 4322 022 0....

Weight per set 1.8 g

Mean length of lines of force l_e = 15,5 mm

$$\Sigma \frac{l_e}{A_e} = 0,956 \text{ mm}^{-1}$$

Effective volume V_e = 251 mm^3

Notes to the tables on the next page

1. Examples of catalogue number:
   μ_e = 15, grade 4C6, potcore with nut, catalogue number = 4322 022 20810
   A_L = 100, grade 3B7, potcore without nut, catalogue number = 4322 022 01040
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

Pre-adjusted potcores with standard μ_e values [1]

μ_e	α	tolerance on inductance (%)	catal. No.: 4322 022 2.... with nut 4322 022 0.... without nut				
			3B7	3H1	3D3	4C6	
15	225	± 1	-	-	-	0810	
22	186	± 1	-	-	-	0820	
33	152	± 1	-	-	0430	0830	
47	127	± 1	-	-	0440	-	
68	105.8	± 1	0050	0250	0450	-	
100	87.2	± 1.5	0060	0260	-	-	
150	71.2	± 2	0070	0270	-	-	
220	58.8	± 5	0080	0280	-	-	
660	33.9	± 25	-	-	0400*	-	
1300	24.2	± 25	0000*	0200*	-	-	

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)
Symmetric air gap for cores with an μ_e value of 15 up to and including 68
Asymmetric air gap for cores with an μ_e value of 100 up to and including 1300

Pre-adjusted potcores with standard A_L factors [1]

A_L	corresponding μ_e-value	tolerance on inductance (%)	catal. No.: 4322 022 2.... with nut 4322 022 0.... without nut				
			3B7	3H1	3D3	4C6	
16	12.2	± 1	-	-	1400	1800	
25	19.0	± 1	-	-	1410	1810	
40	30.5	± 1	-	-	1420	1820	
63	48	± 1	-	-	1430	-	
100	76	± 1	1040	1240	1440	-	
160	122	± 1.5	1050	1250	-	-	
250	190	± 3	1060	1260	-	-	

Inductance $L = N^2 A_L$ (in 10^{-9} H)
Symmetric air gap for cores with an A_L factor of 16 up to and including 63
Asymmetric air gap for cores with an A_L factor of 100 up to and including 250

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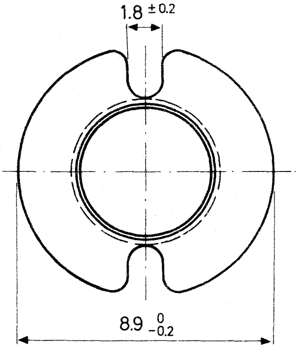
[1] See Notes on the previous page.

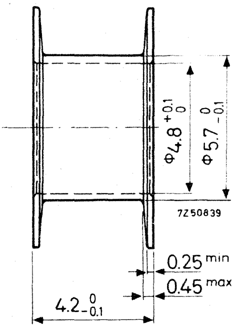
* Only available without nut.

COIL FORMER

Dimensions in mm

The dimensions conform with the following specifications: IEC 133 (international), FNIE ← C93-324 livre 1 (France), DIN 41 294 (Germany) and BS 4061 range 2 (Great Britain).





Catalogue number	4322 021 30240
Material	polycarbonate
Window area	5,5 mm^2
Mean length of turn	23 mm
Max. temperature	130 °C
D.C. losses	$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 58,1 \times 10^3\ \Omega/H$
Weight	0,1 g

INDUCTANCE ADJUSTORS

The tolerances on inductance of the pre-adjusted potcores (without adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy $< 0.03\%$ by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the lips of the adjustor head. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different potcores.

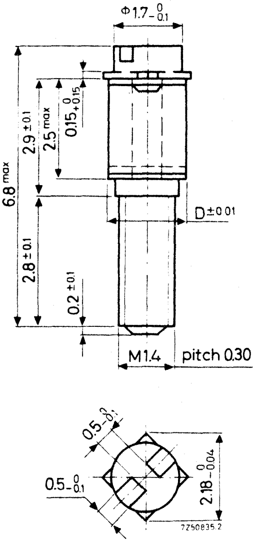


Table I, available types

D	colour	catalog number
1.85	green	4322 021 31250
1.85	red	4322 021 31260
1.85	yellow	4322 021 31270
1.85	grey	4322 021 31280
1.76	brown	4322 021 31540

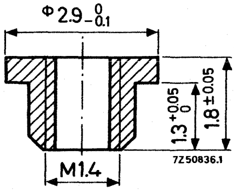
Table II, recommended application

μ_e	A_L	3B7/3H1/3D3
	40	4322 021 31250
33		4322 021 31250
	63	4322 021 31260
47		4322 021 31260
68		4322 021 31270
	100	4322 021 31270
100		4322 021 31540
150	160	4322 021 31540
	250	4322 021 31280
220		4322 021 31280

Dimensions in mm

The adjustors are packed in bags of 100, so please order in multiples of 100.

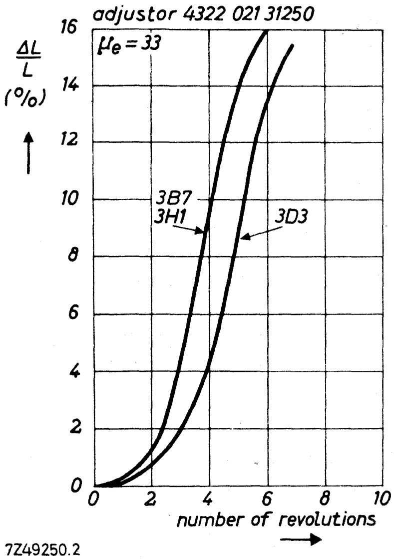
NUT FOR ADJUSTOR



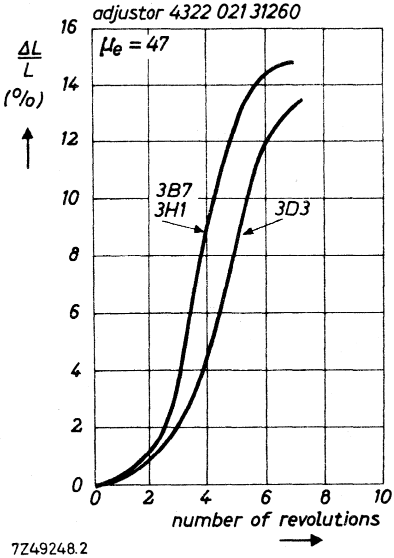
Material brass, nickel plated

Loose nuts are not delivered.

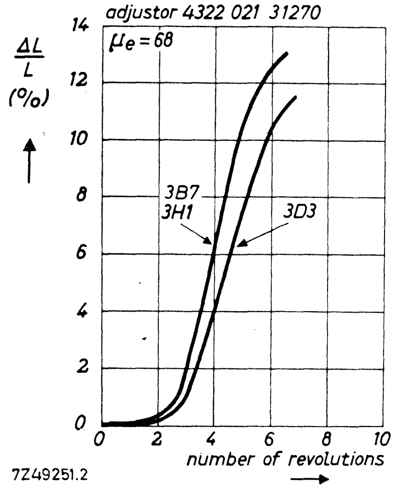
ADJUSTMENT CURVES

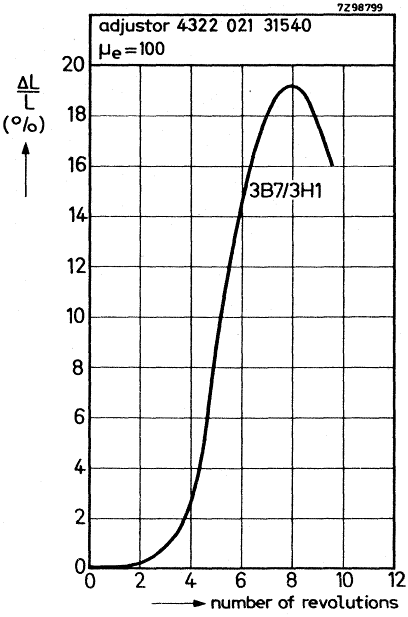


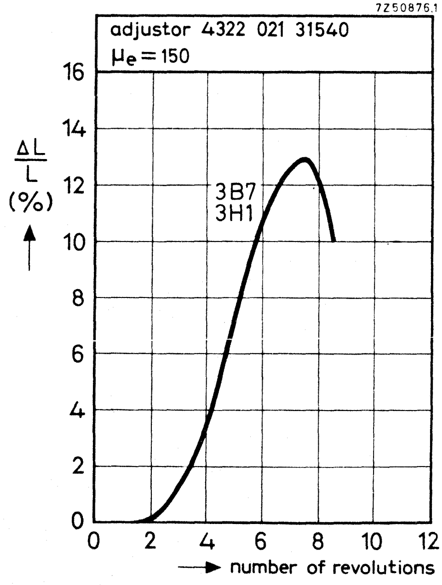
7Z49250.2

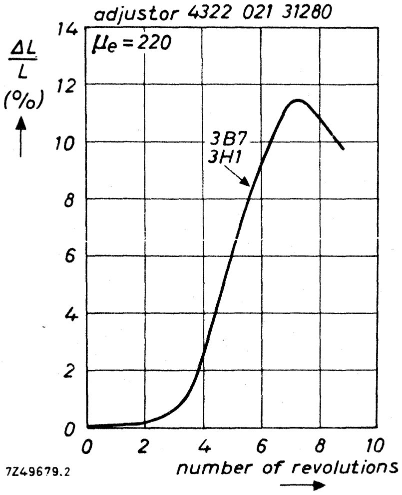


7Z49248.2


adjustor 4322 021 31270
$\mu_e = 68$
$\frac{\Delta L}{L}$ (%)
14
12
10
8
6
4
2
0
0
2
4
6
8
10
number of revolutions
3B7
3H1
3D3
7Z49251.2

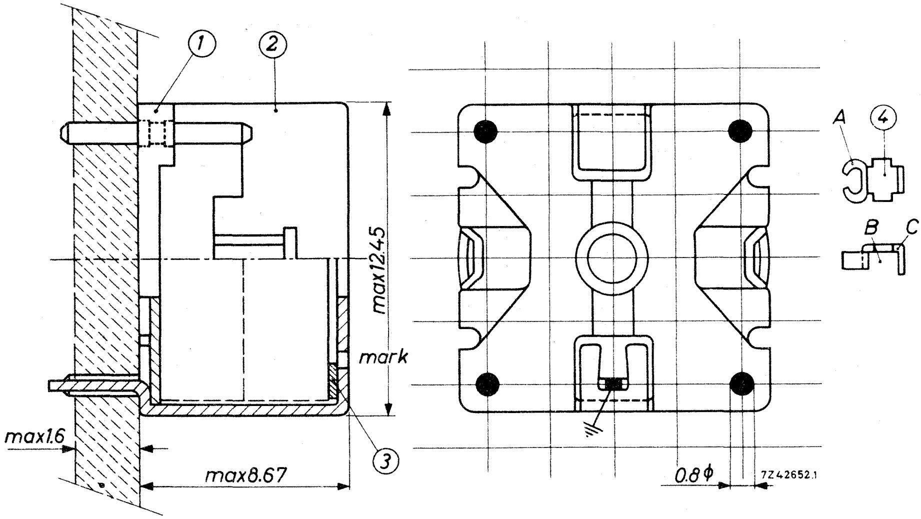

7Z98799
adjustor 4322 021 31540
$\mu_e = 100$
$\frac{\Delta L}{L}$ (%)
20
18
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
number of revolutions
3B7/3H1


7Z50876.1
adjustor 4322 021 31540
$\mu_e = 150$
$\frac{\Delta L}{L}$ (%)
16
14
12
10
8
6
4
2
0
0
2
4
6
8
10
12
number of revolutions
3B7
3H1


adjustor 4322 021 31280
$\mu_e = 220$
$\frac{\Delta L}{L}$ (%)
14
12
10
8
6
4
2
0
0
2
4
6
8
10
number of revolutions
3B7
3H1
7Z49679.2

MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30180
(2) brass container	4322 021 30510
(3) spring	4322 021 30620
(4) soldering spring	4322 021 30700 (4x)

The core is suitable for mounting on printed-wiring boards.

The four soldering pins and the earth tag are arranged so as to fit a grid of 2.52 mm. They will fit printed-wiring boards with a 0.1" grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 1.6 mm. The board should be provided with holes of 1.3 ± 0.1 mm diameter.

If stranded wire is applied the use of a soldering spring (4) is recommended. Part A of this spring is put over the pin, then the wire is put in B and lip C is bent over. For solid wire the soldering spring is not strictly necessary.

The container is provided with an earth tag.

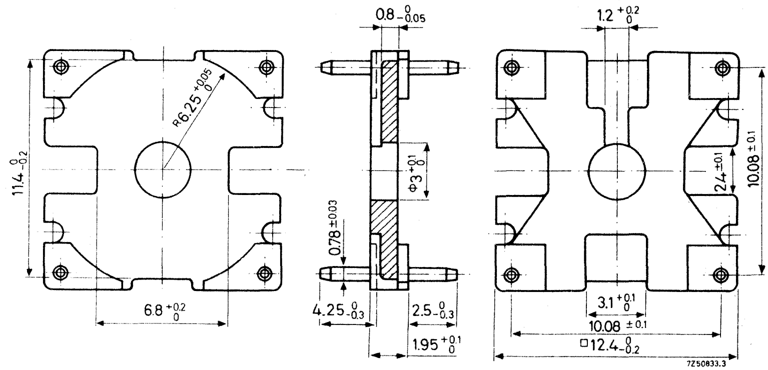
It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 35 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

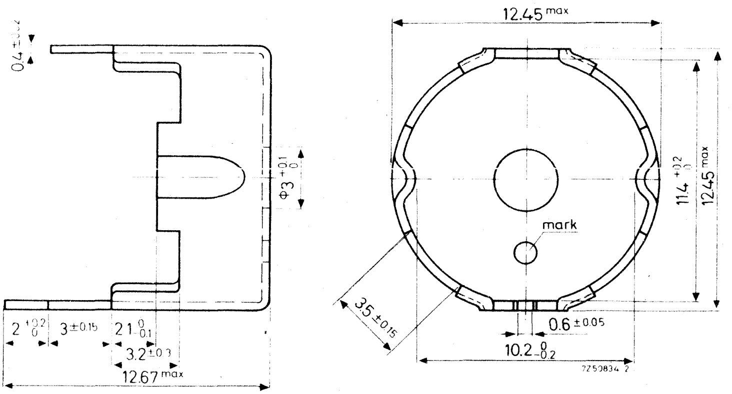
(1) Tag plate 4322 021 30180

Plate : polyester reinforced with glass fibre
Pins : phosphorbronze, dipsoldered



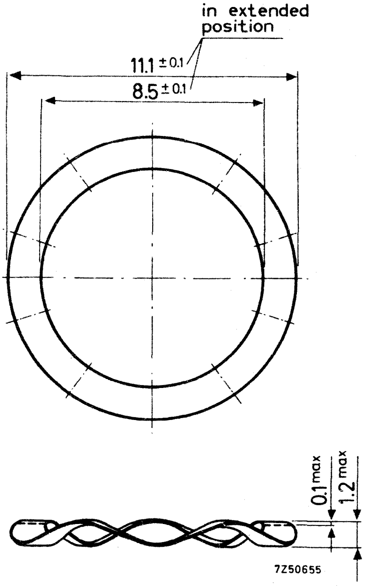
(2) Container 4322 021 30510

Material : brass, nickel plated; tinned soldering pin



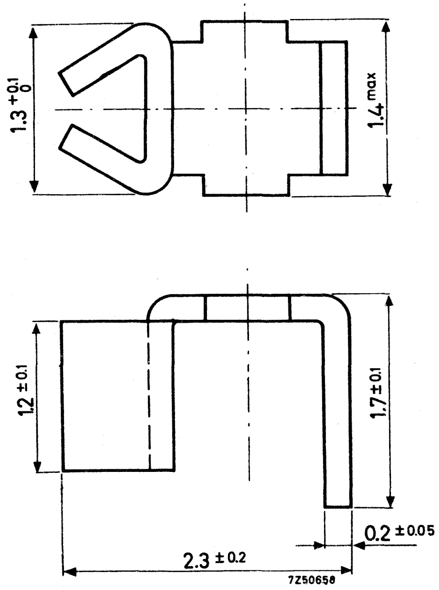
(3) Spring 4322 021 30620

Material : chrome-nickelsteel



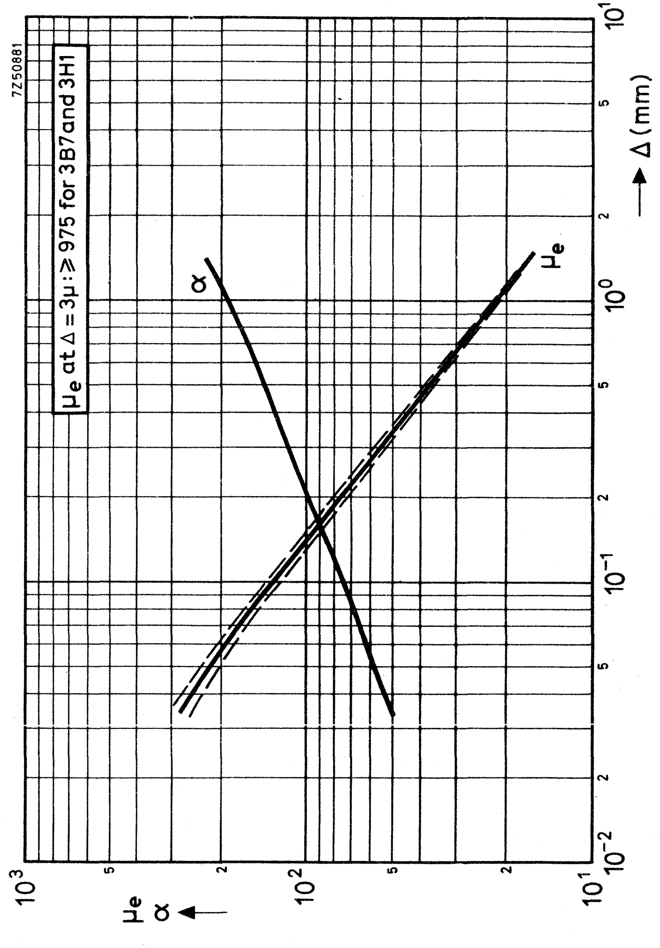
(4) Soldering spring 4322 021 30700

Material : brass, dipsoldered



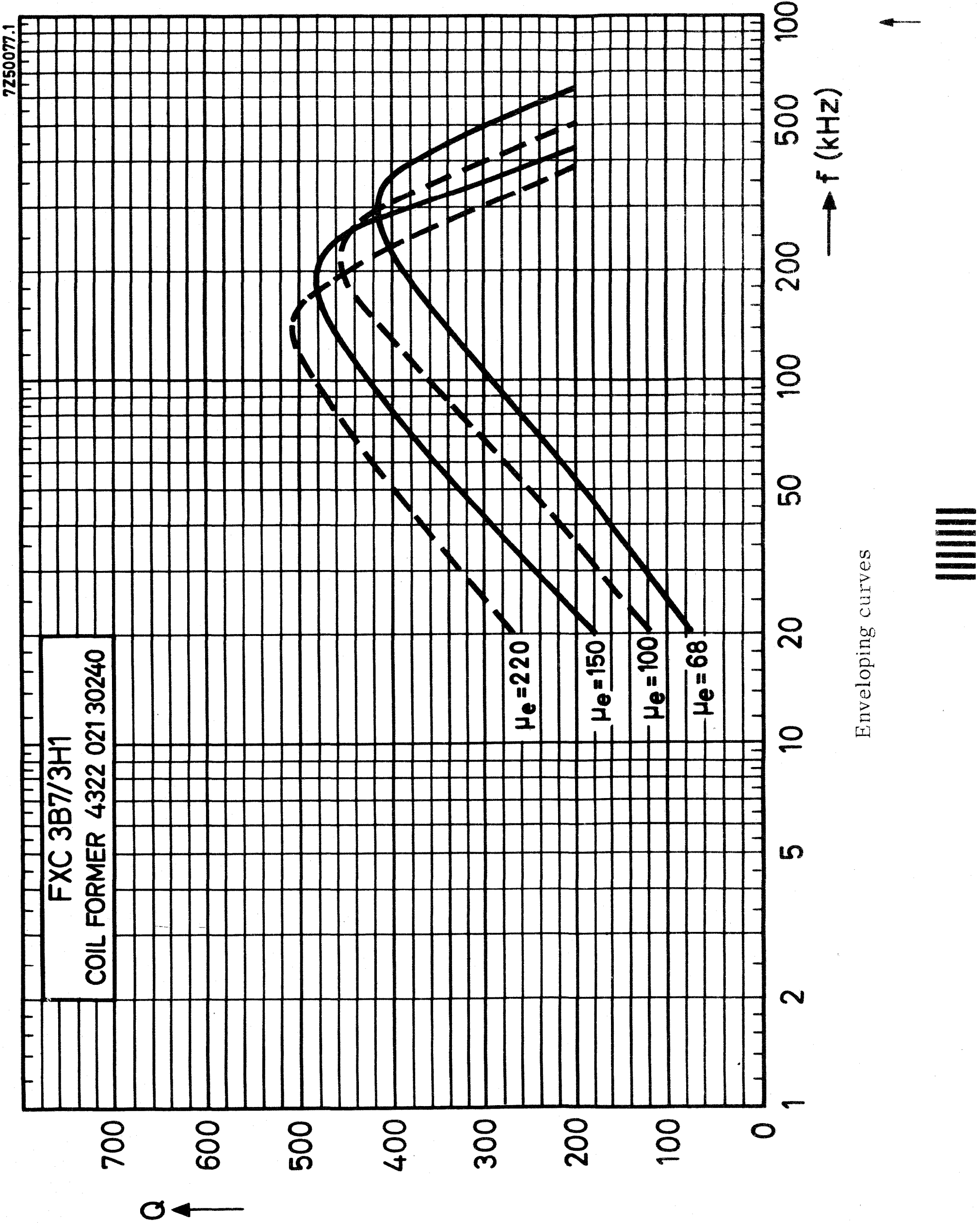
CHARACTERISTIC CURVES

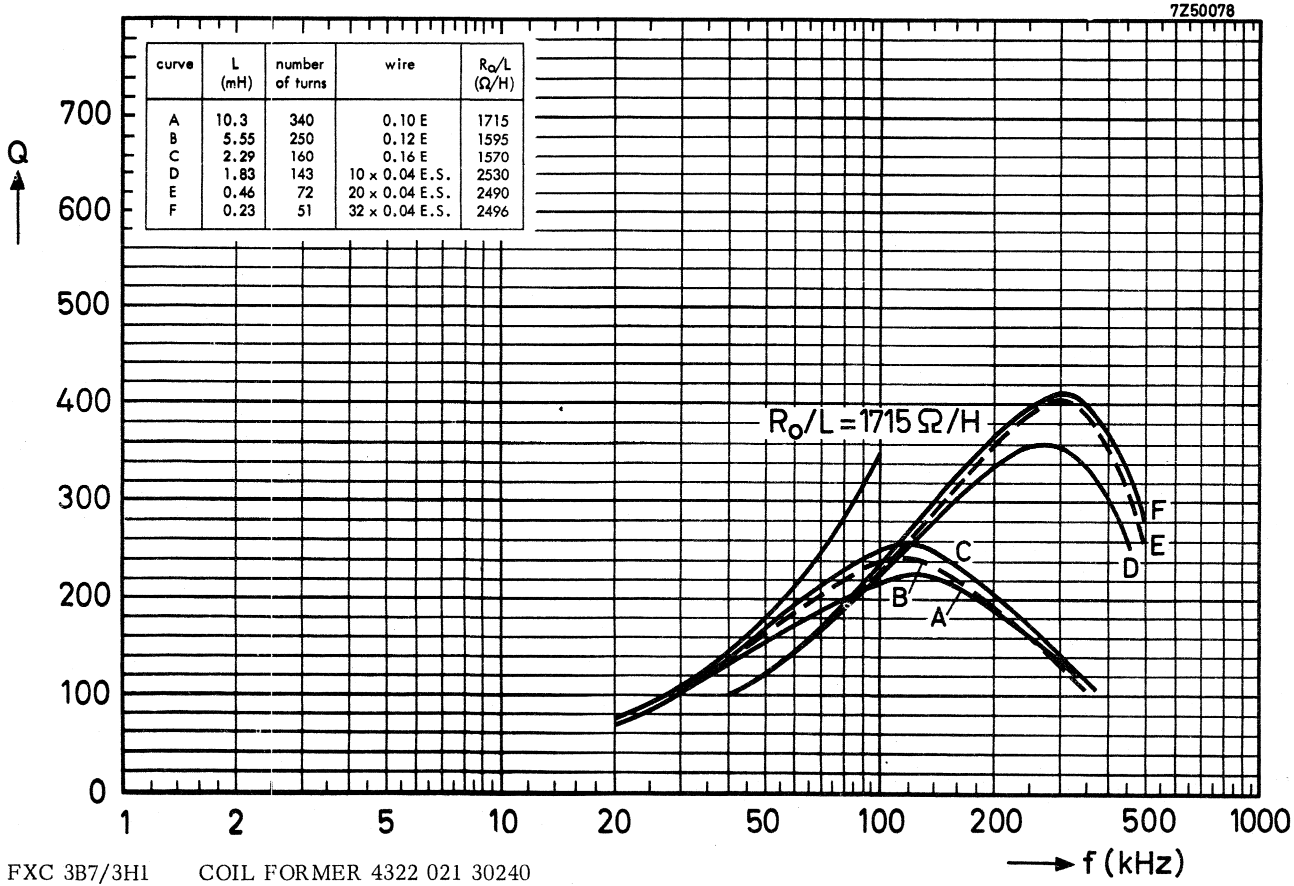
μ_e - α values



Relative effective permeability and turn factor for 1 mH as a function of the air gap length

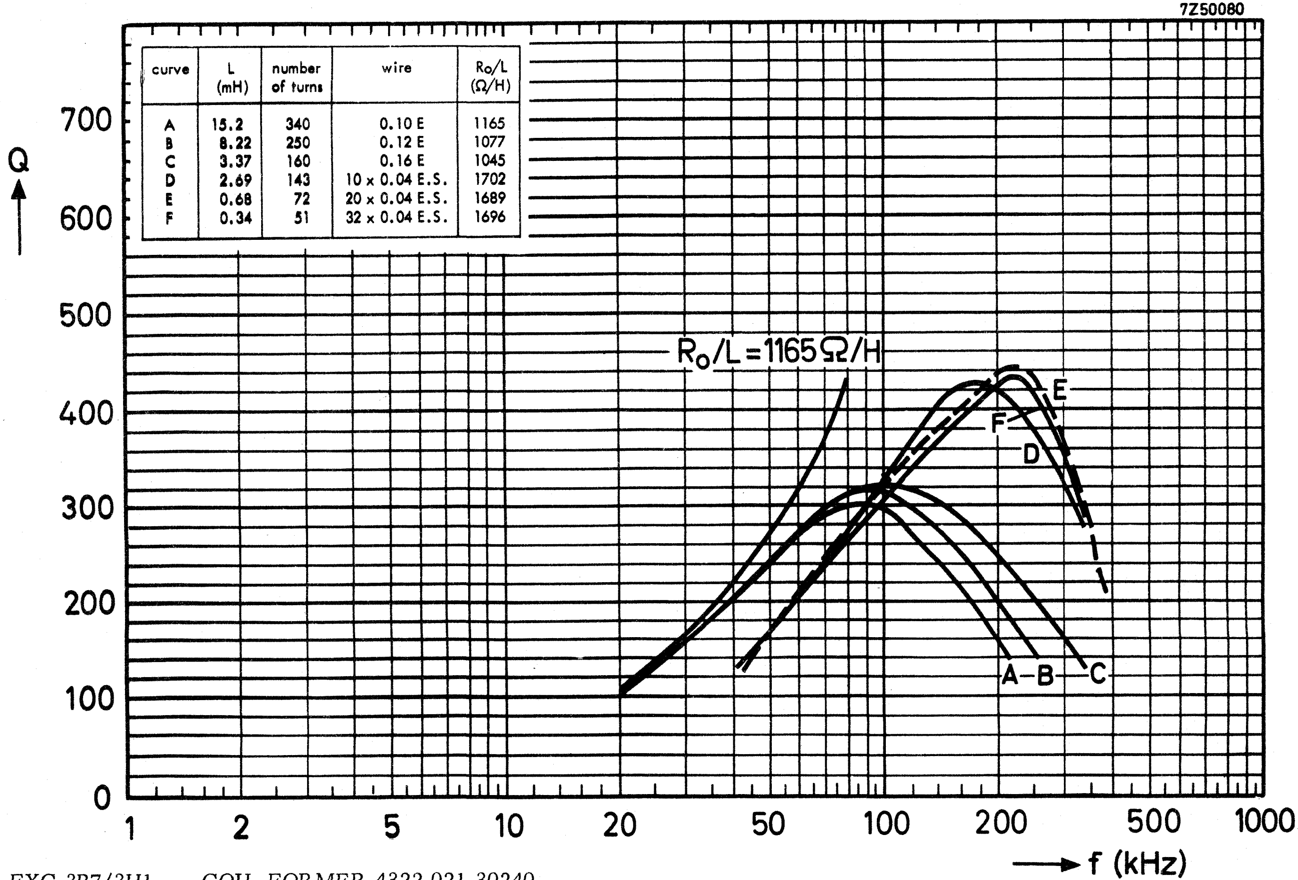
TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1





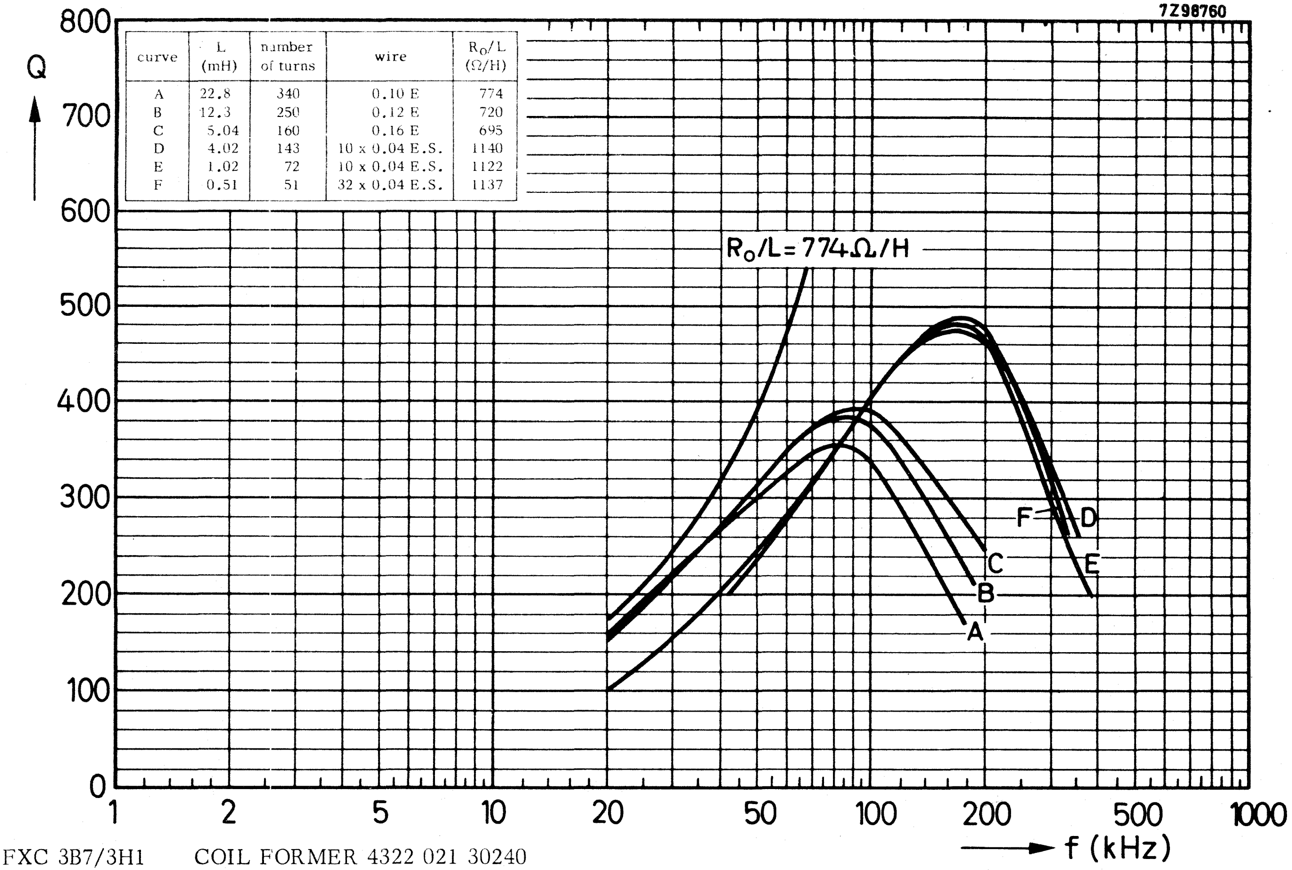
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	10.3	340	0.10 E	1715
B	5.55	250	0.12 E	1595
C	2.29	160	0.16 E	1570
D	1.83	143	10 × 0.04 E.S.	2530
E	0.46	72	20 × 0.04 E.S.	2490
F	0.23	51	32 × 0.04 E.S.	2496

FXC 3B7/3H1 COIL FORMER 4322 021 30240
$\mu_e = 68$



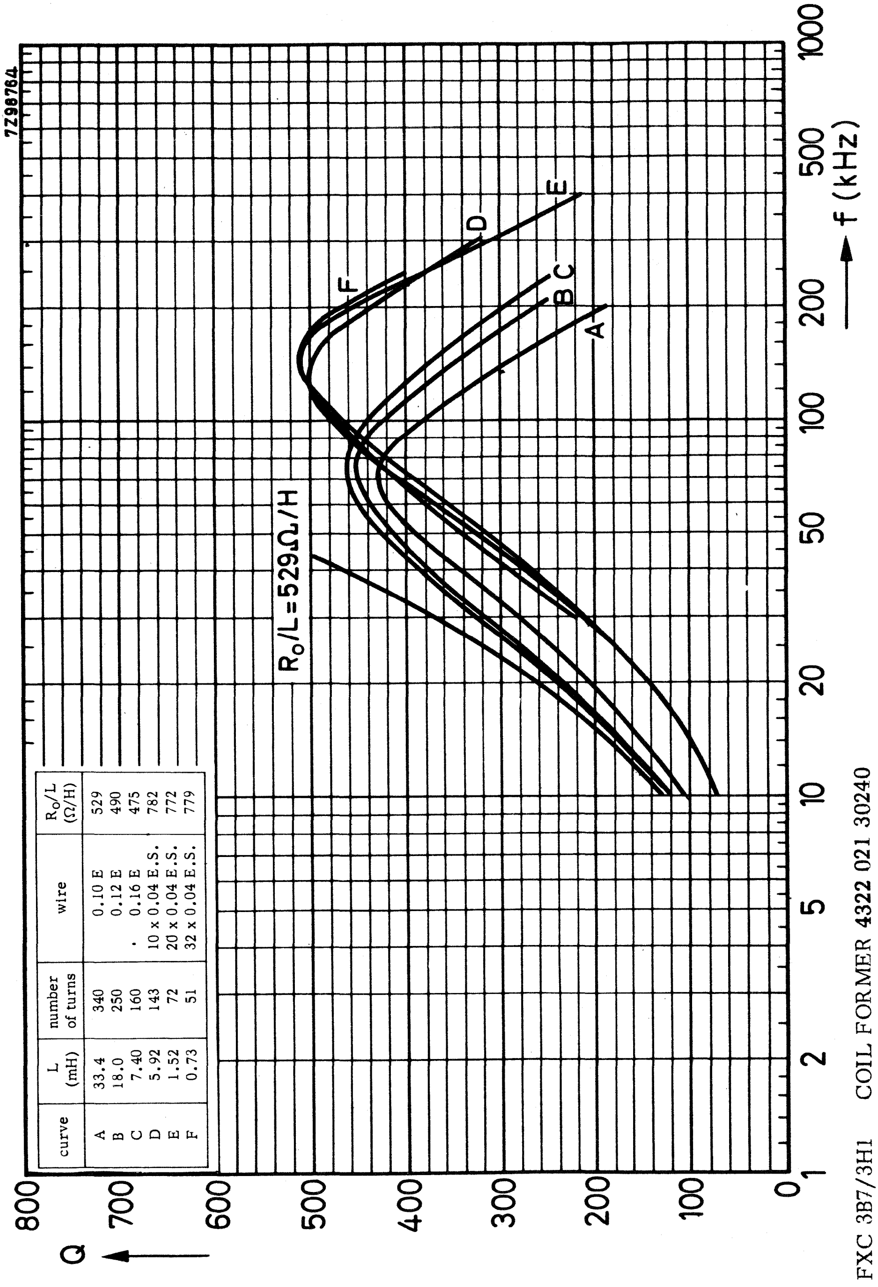
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	15.2	340	0.10 E	1165
B	8.22	250	0.12 E	1077
C	3.37	160	0.16 E	1045
D	2.69	143	10 x 0.04 E.S.	1702
E	0.68	72	20 x 0.04 E.S.	1689
F	0.34	51	32 x 0.04 E.S.	1696

FXC 3B7/3H1 COIL FORMER 4322 021 30240
$\mu_e = 100$



curve	L (mH)	number of turns	wire	R$_o$/L (Ω/H)
A	22.8	340	0.10 E	774
B	12.3	250	0.12 E	720
C	5.04	160	0.16 E	695
D	4.02	143	10 x 0.04 E.S.	1140
E	1.02	72	10 x 0.04 E.S.	1122
F	0.51	51	32 x 0.04 E.S.	1137

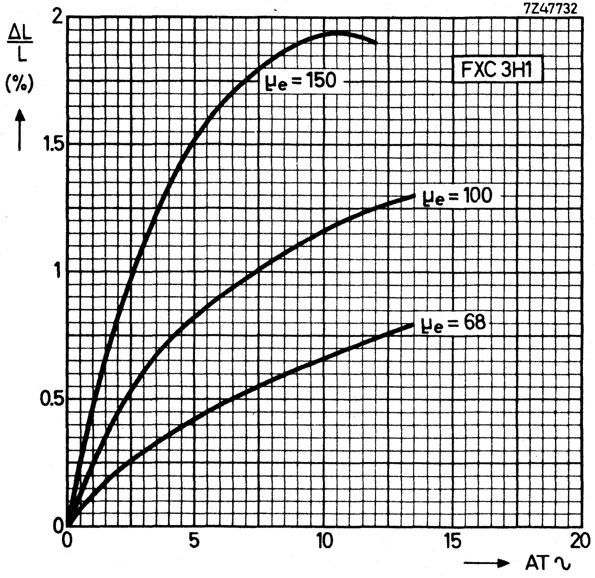
FXC 3B7/3H1 COIL FORMER 4322 021 30240
μ_e = 150

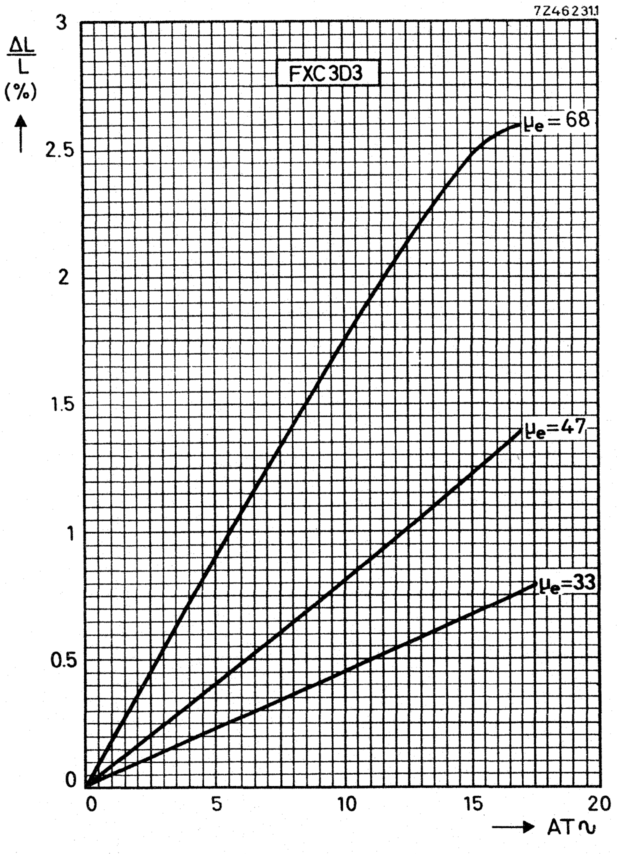


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	33.4	340	0.10 E	529
B	18.0	250	0.12 E	490
C	7.40	160	0.16 E	475
D	5.92	143	10 x 0.04 E.S.	782
E	1.52	72	20 x 0.04 E.S.	772
F	0.73	51	32 x 0.04 E.S.	779

FXC 3B7/3H1 COIL FORMER 4322 021 30240
$\mu_e = 220$

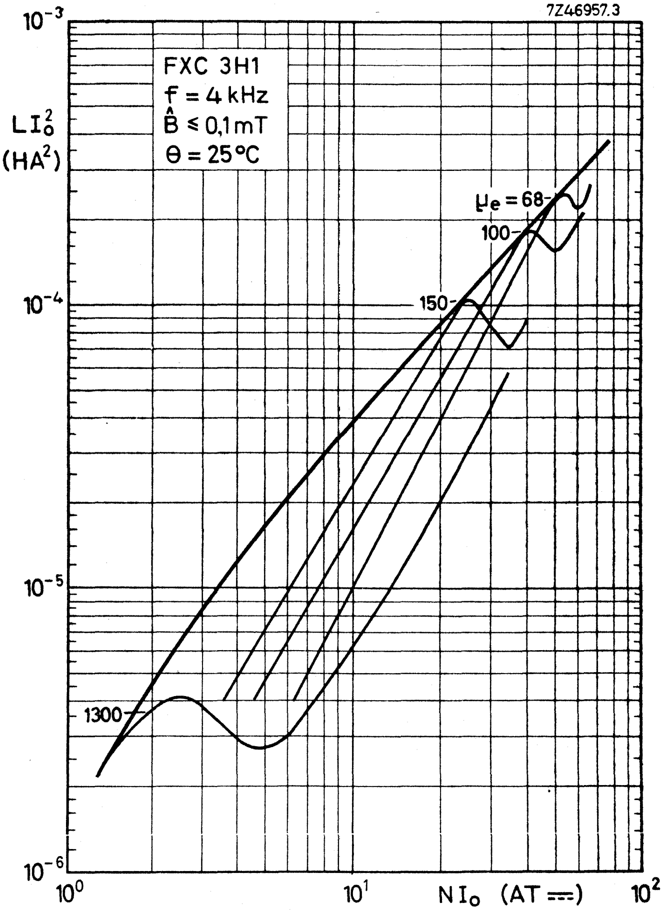
INDUCTANCE VARIATION AS A FUNCTION OF AT ~



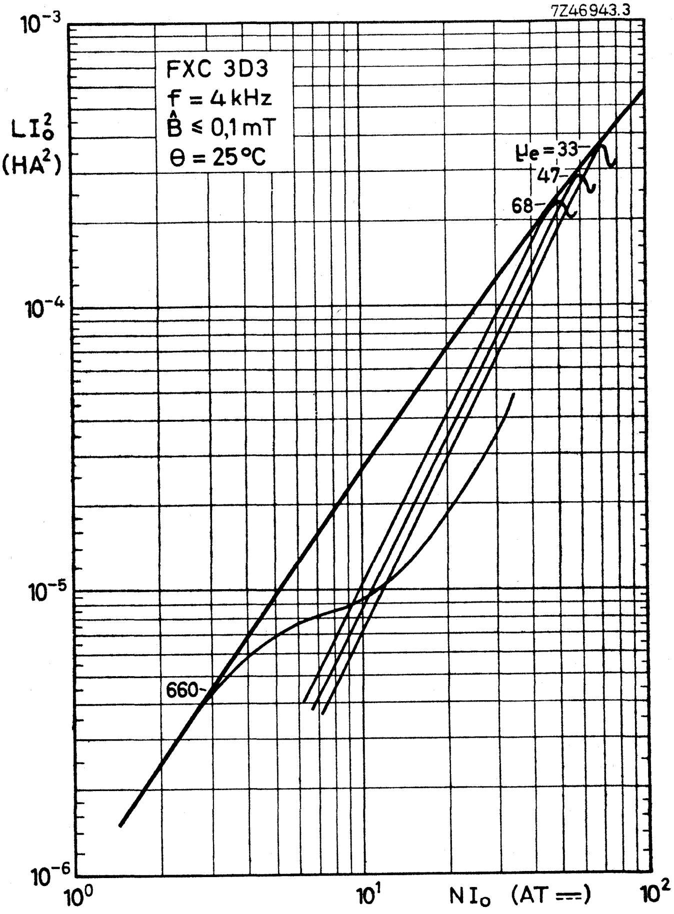

7Z46231.1
FXC 3D3
ΔL/L (%)
3
2.5
2
1.5
1
0.5
0
0
5
10
15
20
AT∿
μe = 68
μe = 47
μe = 33

HANNA CURVES

Indicating the optimum inductance for a certain μ_e-value and direct current. Typical values.



Typical values



POTCORES

INTRODUCTION

Three types of core can be supplied:

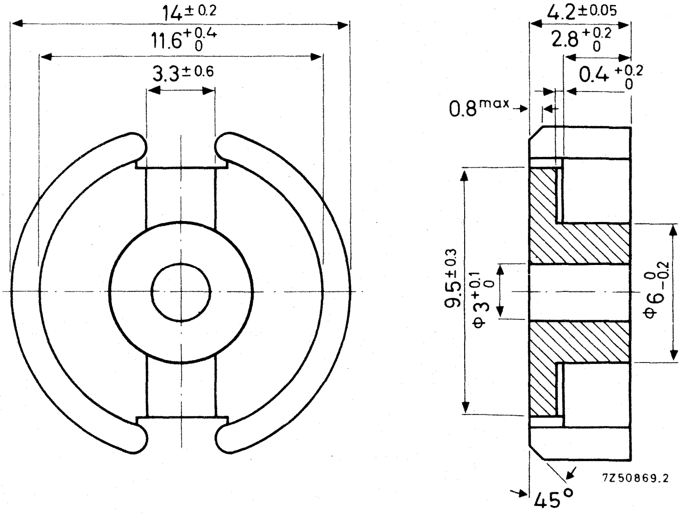
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following specifications:
IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41293 (Germany),
BS 4061 (Gr. Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number.
Quantity: a primary pack contains 40 potcore halves or 20 pieces of pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores. So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 21250
3H1	4322 020 21260
3D3	4322 020 21270
3E1	4322 020 21360
4C6	4322 020 21350

Properties

For toroidally wound core halves the values in Table I are guaranteed.

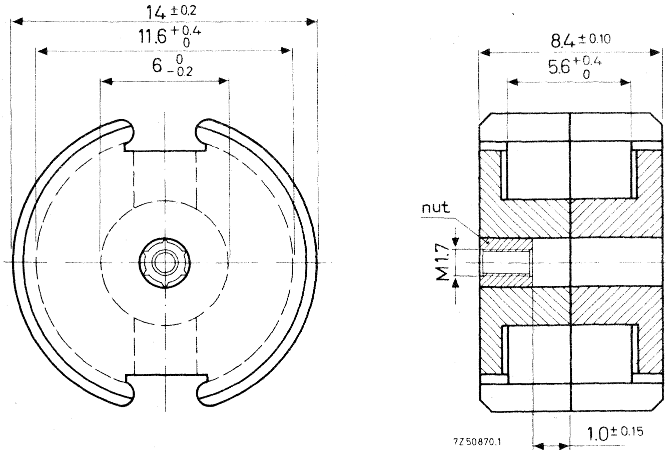
Table I	temp. (^oC)	grade				
		3B7	3H1	3D3	3E1	4C6
$\alpha_F \times 10^6$	+ 5 to +25	-	+0.5 to +1.5	-		-2 to +4
	+ 5 to +55	-	-	-		-
	+25 to +55	-	+0.5 to +1.5	-		0 to +6
	+25 to +70	-0.6 to +0.6		0 to 2	0 to 2	-
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 4.3	≤ 4.3	≤ 12		≤ 10

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 60 Newton, the values in Table II are guaranteed at 25 ± 10 ^oC.

Table II	$\hat{B}$ (mT)	freq. (MHz)	grade				
			3B7	3H1	3D3	3E1	4C6
μ_e	≤0,1	0.004				1910-2810	
	≤0,1	0.1	≥ 1050	≥ 1050	≥ 510		≥ 93
A_L	≤0,1	0.004				3040-4470	
α	≤0,1	0.1	≤ 24.4	≤ 24.4	≤ 35.1		≤ 81.8
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤0,1	0.004			-	≤ 2.5	
	≤0,1	0.1	≤ 5	≤ 5	≤ 8	≤ 20	
	≤0,1	0.5			≤ 14	≤ 200	
	≤0,1	1			≤ 30		
		2					≤ 40
		10					≤ 100
$q_{2\text{-}24\text{-}100}$	0,3-1,2	0.1			≤ 3.0		≤ 10
	1,5-3,0	0.004	≤ 1.8	≤ 1.4		≤ 3	
$\eta_B \times 10^3$	0,3-1,2	0.1			≤ 1.8		≤ 6.2
	1,5-3,0	0.004	≤ 1.1	≤ 0.86		≤ 1.8	

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 2....
Without nut, catalogue number = 4322 022 0....

Weight per set 3.2 g

Mean length of lines of force l_e = 19,8 mm

$\Sigma \frac{l_e}{A_e}$ = 0,789 mm^{-1}

Effective volume V_e = 495 mm^3

Notes to the tables on the next page

1. Examples of catalogue number:
   μ_e = 15, grade 4C6, potcore with nut, catalogue number = 4322 022 22810
   A_L = 100, grade 3B7, potcore without nut, catalogue number= 4322 022 03040
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

Pre- adjusted potcores with standard μ_e values [1])

μ_e	α	tolerance on inductance (%)	catal. No.: 4322 022 2.... with nut 4322 022 0.... without nut				
			3B7	3H1	3D3	4C6	
15	205	± 1	–	–	–	2810	
22	169	± 1	–	–	–	2820	
33	137.9	± 1	2030	2230	2430	2830	
47	115.5	± 1	2040	2240	2440	–	
68	96.1	± 1	2050	2250	2450	–	
100	79.2	± 1.5	2060	2260	–	–	
150	64.6	± 2	2070	2270	–	–	
220	53.3	± 3	2080	2280	–	–	
680	30.3	± 25	–	–	2400*	–	
1400	21.2	± 25	2000*	2200*	–	–	

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 15 up to and including 68
Asymmetric air gap for cores with an μ_e value of 100 up to and including 1400

Pre-adjusted potcores with standard A_L factors [1])

A_L (nH)	corresponding μ_e-value	tolerance on inductance (%)	catal. No.: 4322 022 2.... with nut 4322 022 0.... without nut				
			3B7	3H1	3D3	4C6	
25	15.7	± 1	–	–	–	3810	
40	25	± 1	–	–	3420	3820	
63	39.5	± 1	–	–	3430	3830	
100	63	± 1	3040	3240	3440	–	
160	100.5	± 1.5	3050	3250	–	–	
250	157	± 2	3060	3260	–	–	
315	198	± 2	3070	3270	–	–	
400	252	± 2	3080	3280	–	–	

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Symmetric air gap for cores with an A_L factor of 25 up to and including 100
Asymmetric airgap for cores with an A_L factor of 160 up to and including 400

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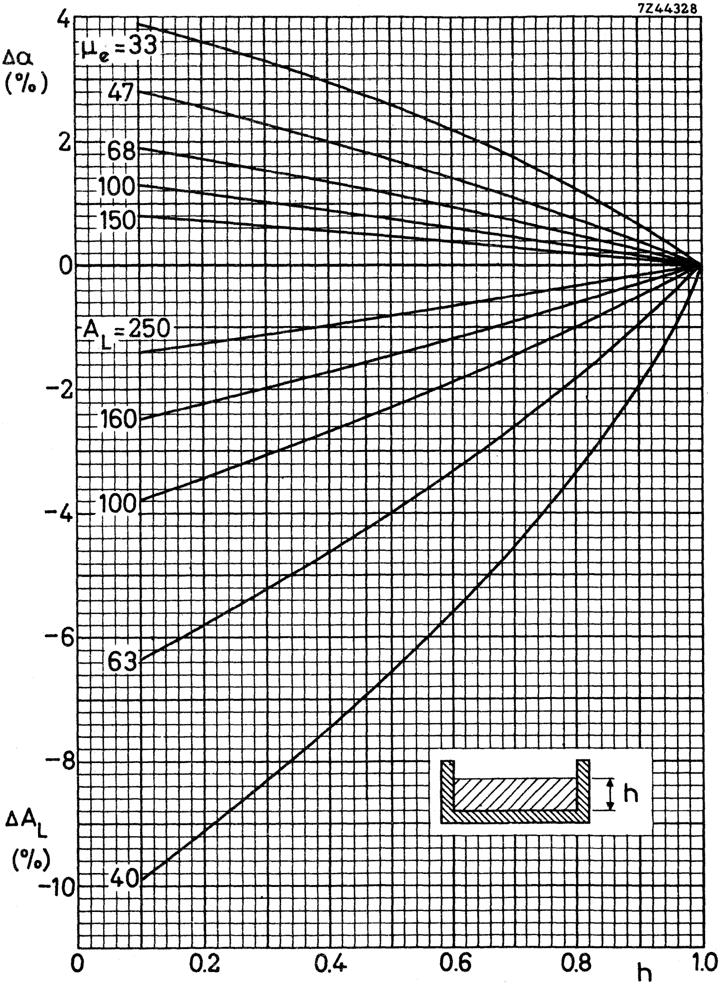
[1]) See Notes on the previous page.

* Only available without nut.

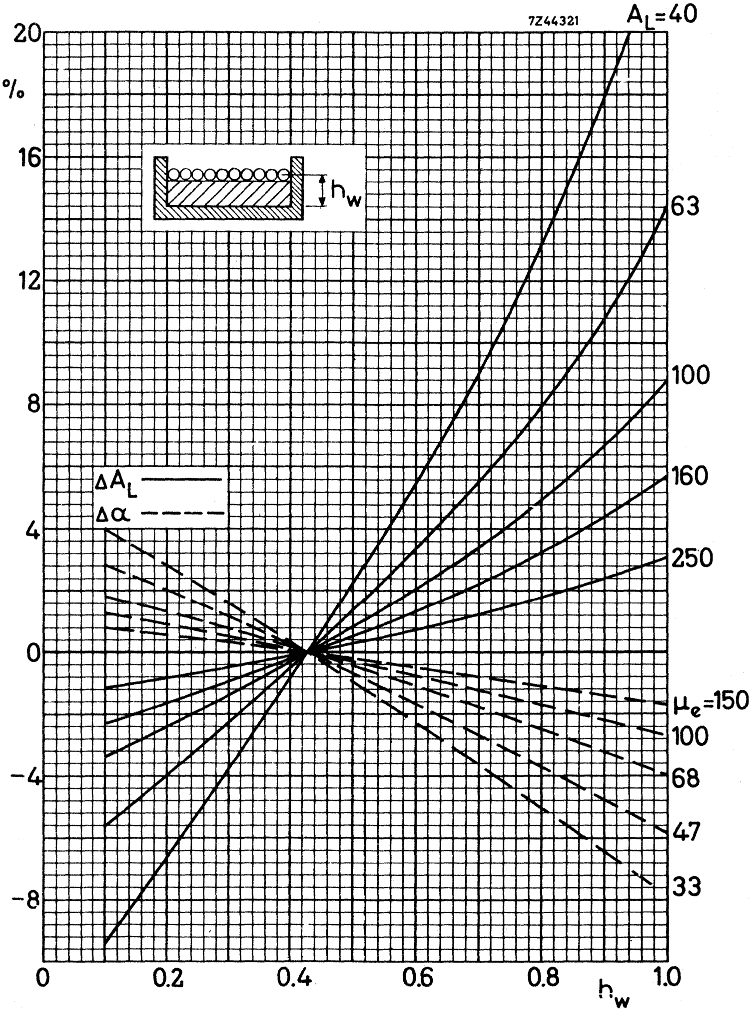
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: On a single-section coil former only 0.4 part of the available height is used. A potcore with μ_e = 68 in that case obtains an α factor of 96.1 + 1.3 %.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_w on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 68 obtains for that winding an α factor of 96.1 - 1.7 %.

COIL FORMERS

GENERAL

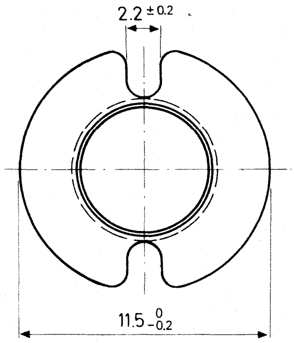
Two types of coil former can be supplied:

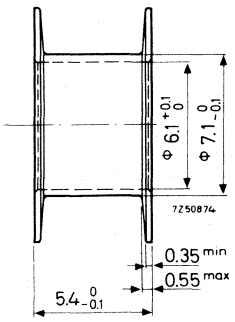
- with one section
- with two sections

The dimensions conform with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41294 (Germany) and BS4061 range 2 (Gr. Britain).

SINGLE-SECTION COIL FORMER

Dimensions (mm)





Catalogue number	4322 021 30250
Material	polycarbonate
Window area	9, 7 mm^2
Mean length of turn	29 mm
Max. temperature	130 ^{o}C

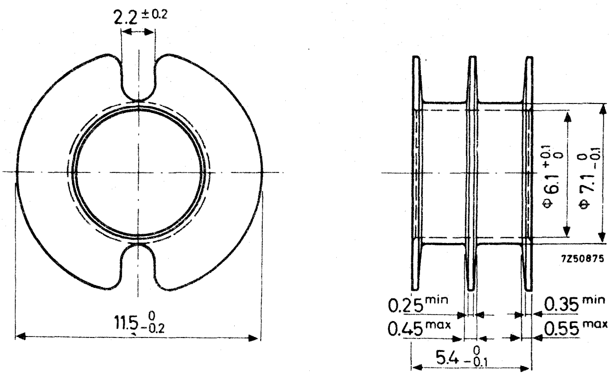
D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} x \frac{1}{f_{cu}} x\ 32,3\ x\ 10^3\ \Omega/H$$

Weight	0, 15 g

TWO-SECTION COIL FORMER

Dimensions (mm)



Catalogue number	4322 021 30260
Material	polycarbonate
Window area	2 x 4,5 mm^2
Mean length of turn	29 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 35,1 \times 10^3\ \Omega/H$$

Weight	0,2 g

INDUCTANCE ADJUSTORS

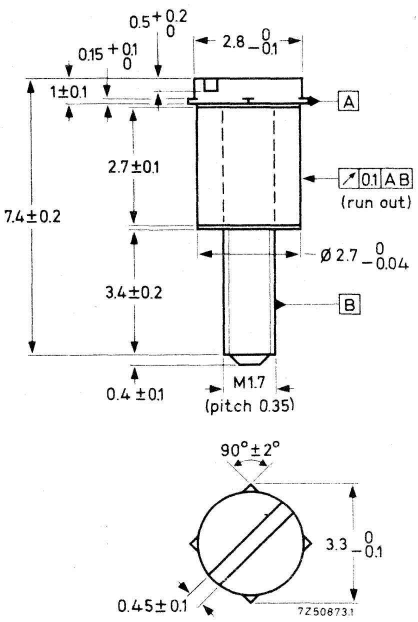


Fig. A

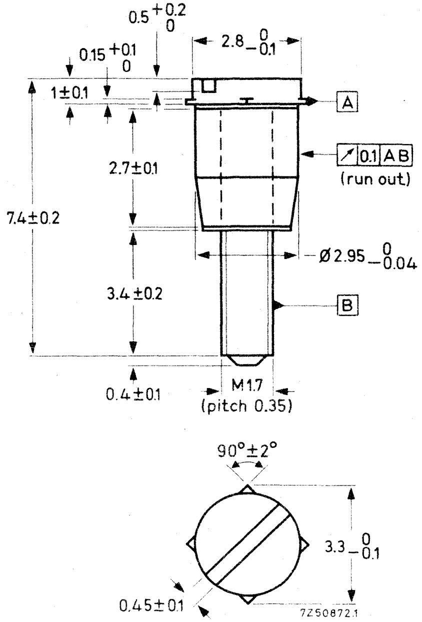


Fig. B

The tolerances on inductance of the pre-adjusted potcores (with adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03% by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.

The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.

The influence of the adjustors on the variability of the inductance is negligible.

The maximum permissible temperature is 110 °C.

Table II shows the type of adjustor recommended for different potcores.

Table I, available types

Fig.	colour	catalogue number
A	red	4322 021 30740
A	green	4322 021 30750
B	yellow	4322 021 30940
B	white	4322 021 30950
A	brown	4322 021 31070
B	grey	4322 021 31130

The adjustors are packed in bags of 100, so please order in multiples of 100.

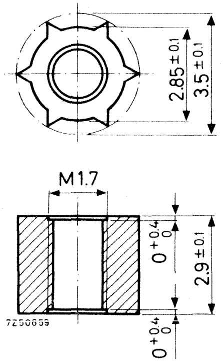
Table II, recommended application

μ_e	A_L	3B7/3H1/3D3	4C6
		cat. number 4322 021	
15		–	30740
	25	–	30740
22		–	30740
	40	30750	30940
33		30750	30950
	63	30740	30940
47		30740	–
	100	30940	–
68		30940	–
100		30950	–
	160	30950	–
150		31070	–
	250	31070	–
220		31130	–
	315	31130	–
	400	31130	–

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.

Dimensions (mm)

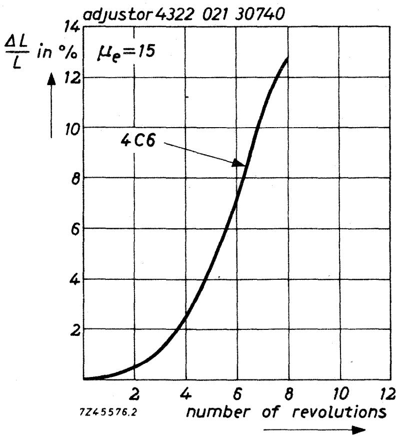


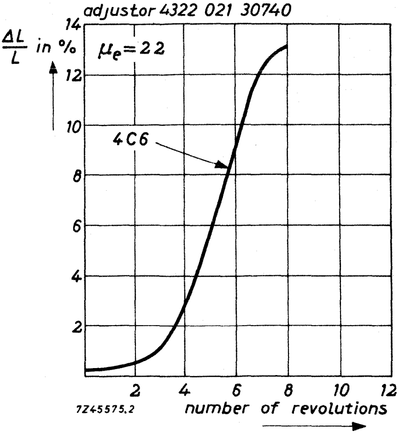
Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 ^{o}C
→ Recommended distance from mating surface to nut	1,0 ± 0,15 mm

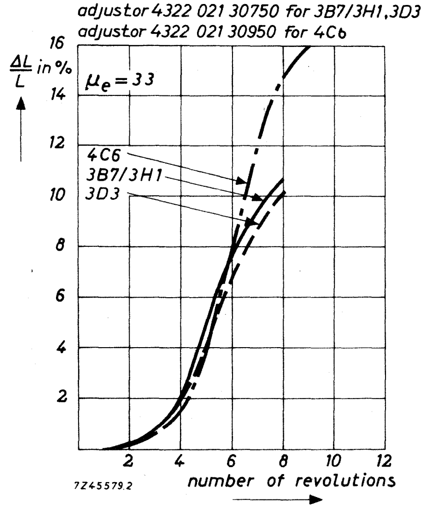
For more information see Potcores General, Mounting data.

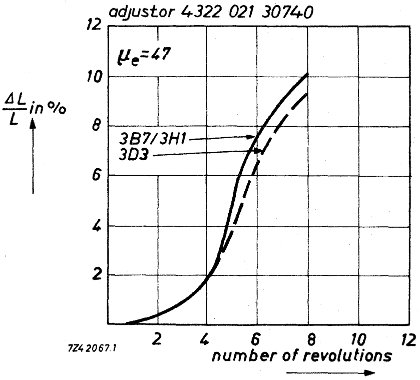
The nuts are packed in bags of 100, so please order in multiples of 100.

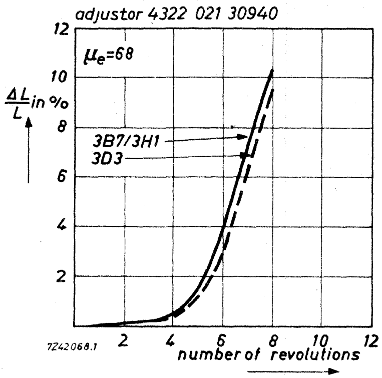
ADJUSTMENT CURVES

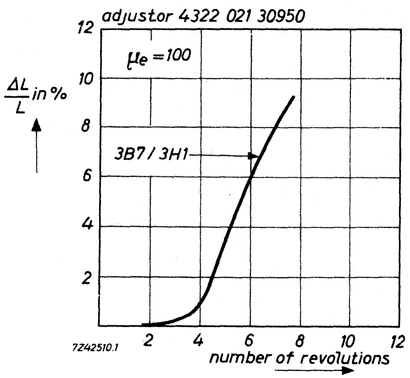


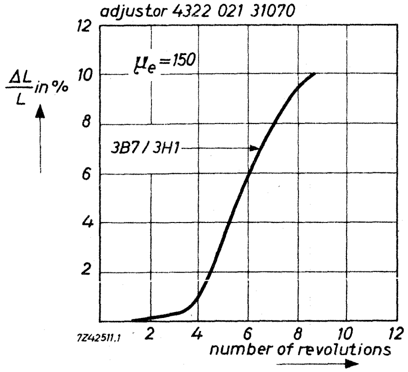


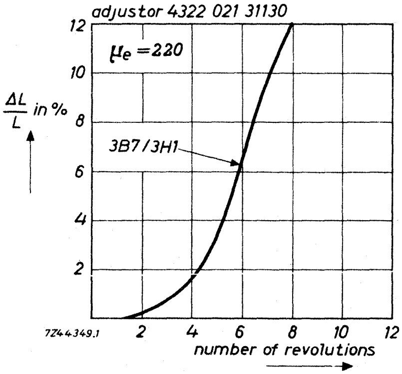





adjustor 4322 021 30940
μ_e=68
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
3B7/3H1
3D3
7Z42068.1
2
4
6
8
10
12
number of revolutions

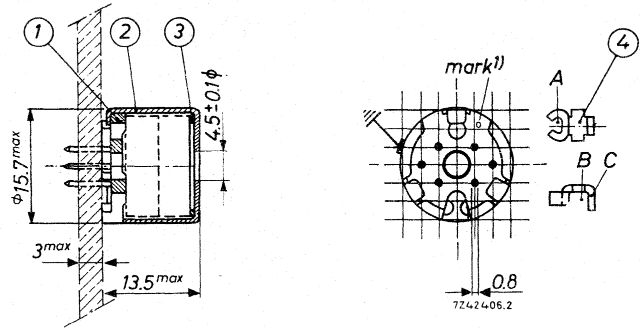

adjustor 4322 021 30950
μ_e =100
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
3B7/3H1
7Z42510.1
2
4
6
8
10
12
number of revolutions


adjustor 4322 021 31070
μ_e =150
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
3B7/3H1
7Z42511.1
2
4
6
8
10
12
number of revolutions


adjustor 4322 021 31130
μ_e =220
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
3B7/3H1
7Z44349.1
2
4
6
8
10
12
number of revolutions

MOUNTING PARTS

MOUNTING ON PRINTED-WIRING BOARDS



(1) tag plate	4322 021 30440
(2) brass container	4322 021 30520
(3) spring	4322 021 30630
(4) soldering spring	4322 021 30700 (6x)

The container is suitable for mounting on printed-wiring boards only.

If stranded wire is applied the use of a soldering spring (4) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over. For solid wire the soldering spring is not strictly necessary.

The six soldering pins are arranged so as to fit a grid of 2.52 mm. They will fit printed-wiring boards with a 0.1" grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1.3 ± 0.1 mm diameter.

The container is provided with an earth tag on its circumference. This tag also serves the purpose of mounting the coil assembly on the printed-wiring board.

It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 60 Newton. After bending the lips the spring will have the correct tension.

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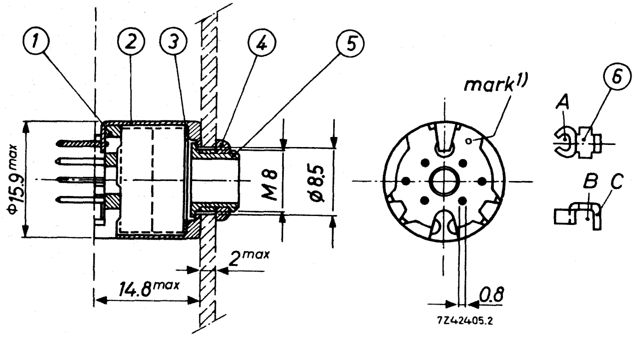
[1] There is another mark hole in a similar position on the top of the container.

MOUNTING ON PANELS



(1) tag plate	4322 021 30440	(4) nut	4322 021 30710
(2) aluminium container	4322 021 30600	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30630	(6) soldering spring	4322 021 30700 (6x)

The container is suitable for mounting on panels only.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The coil assembly may be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 60 Newton. After bending the lips the spring will have the correct tension.

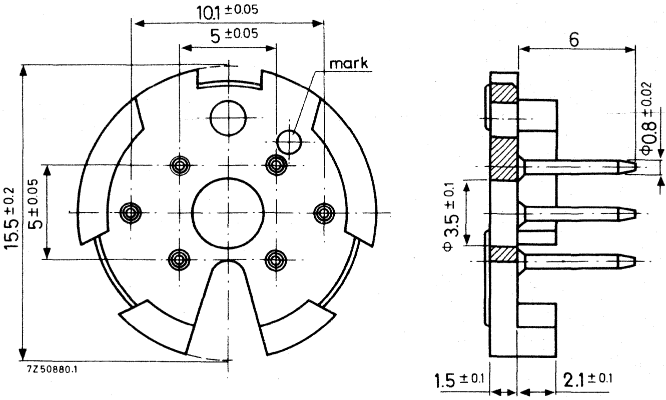
---

[1] There is another mark in a similar position on the top of the container.

PART DRAWINGS (dimensions in mm)

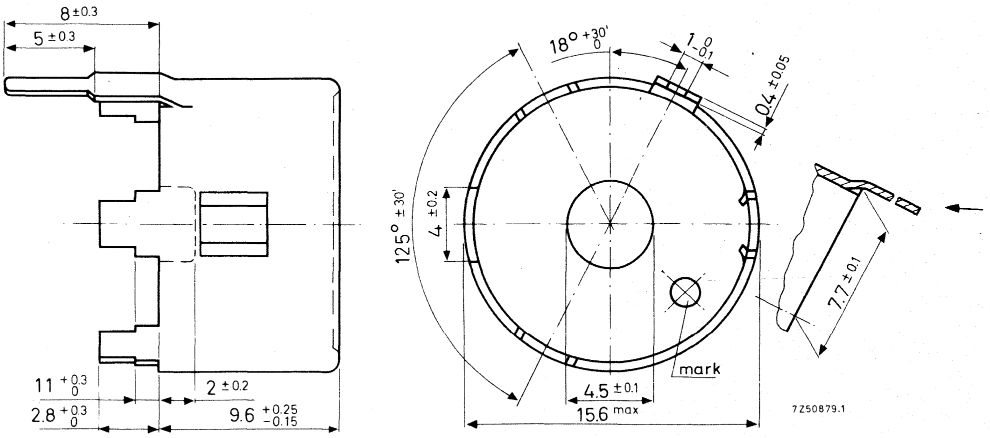
Tag plate 4322 021 30440

Plate : polyester reinforced with glass fibre
Pins : phosphorbronze, dipsoldered

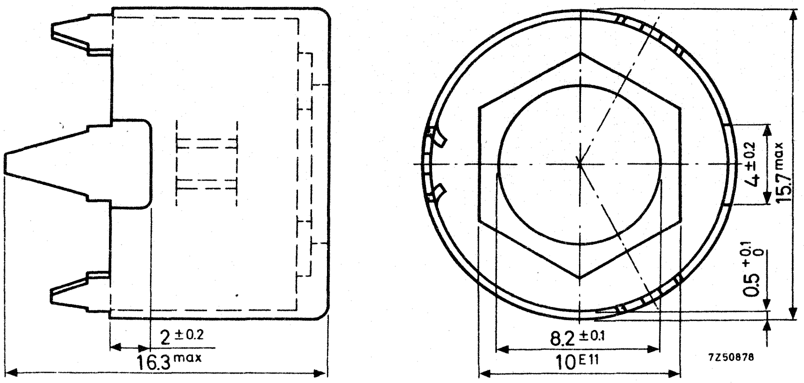


Container for mounting on printed-wiring boards 4322 021 30520

Material : brass, nickel plated; tinned soldering pin

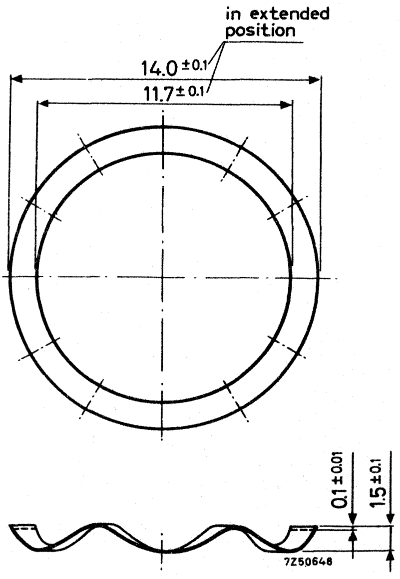


Container for mounting on panels 4322 021 30600 Material: aluminium



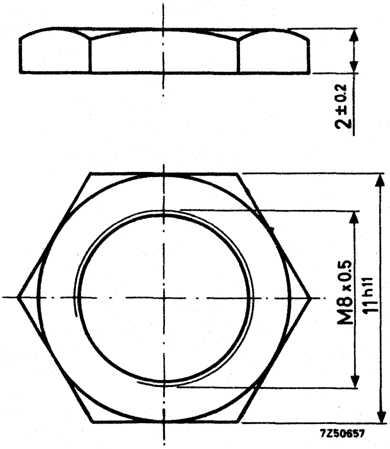
Spring 4322 021 30630

Material : chrome-nickelsteel



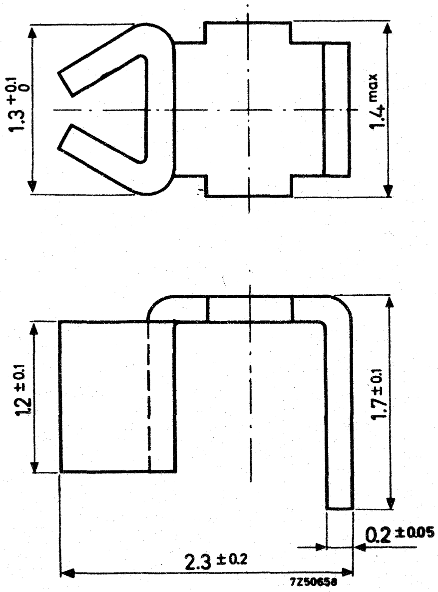
Nut 4322 021 30710

Material: brass, nickel plated



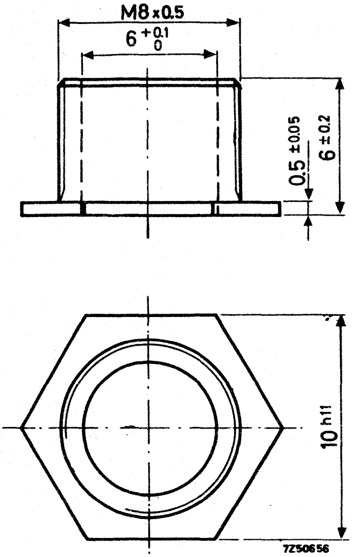
Soldering spring 4322 021 30700

Material: brass, dipsoldered



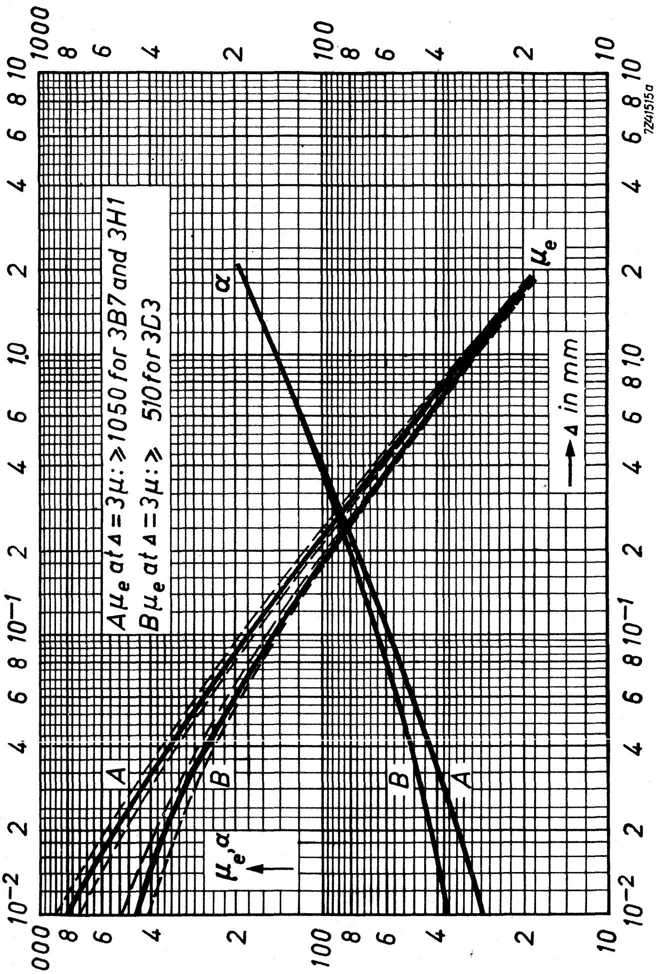
Fixing bush 4322 021 30720

Material: brass, nickel plated



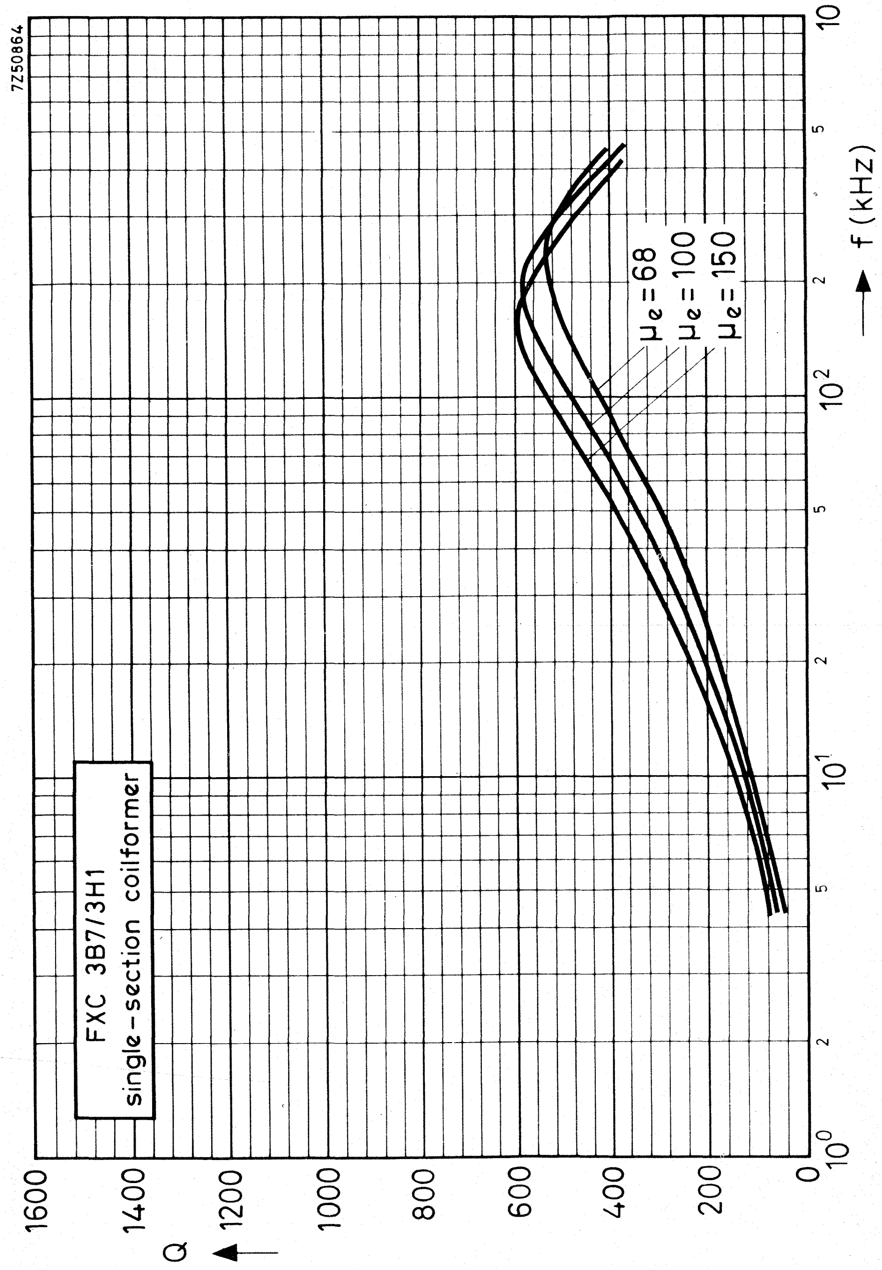
CHARACTERISTIC CURVES

μ_e - α CURVES

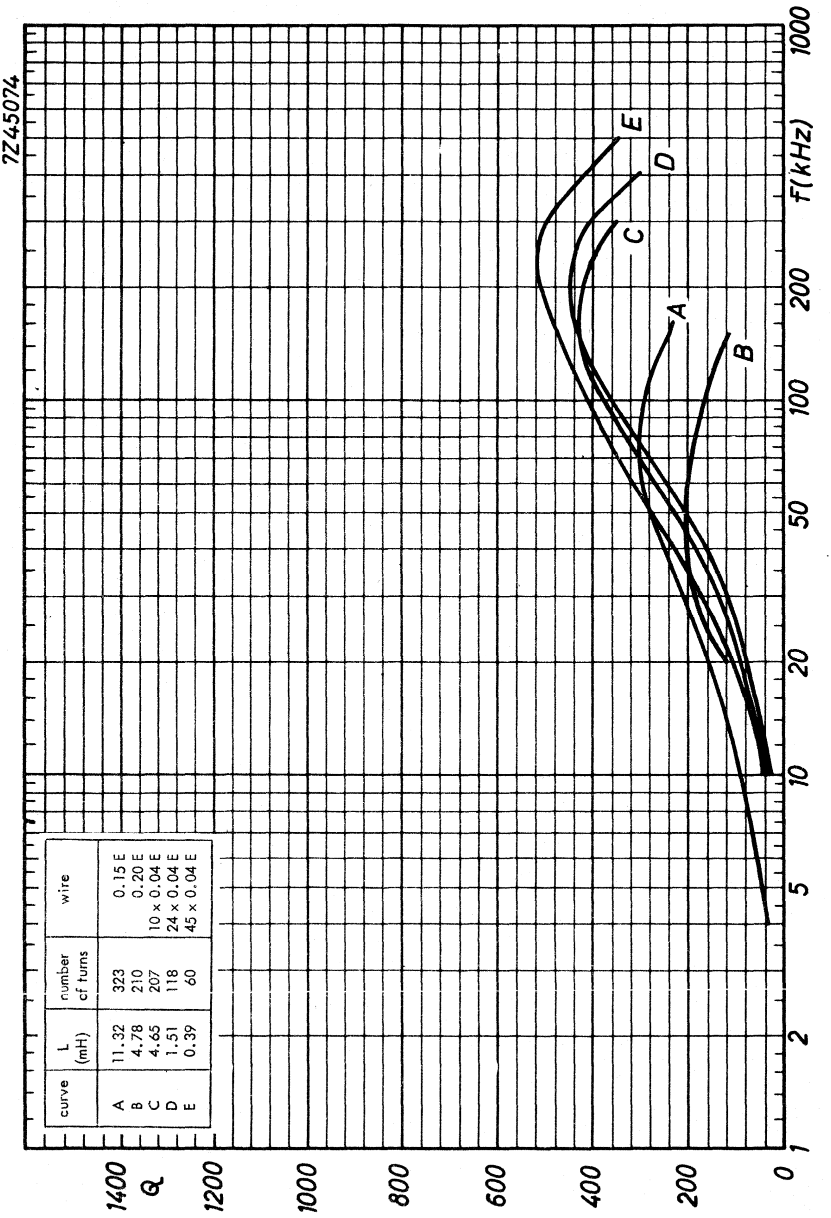


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1

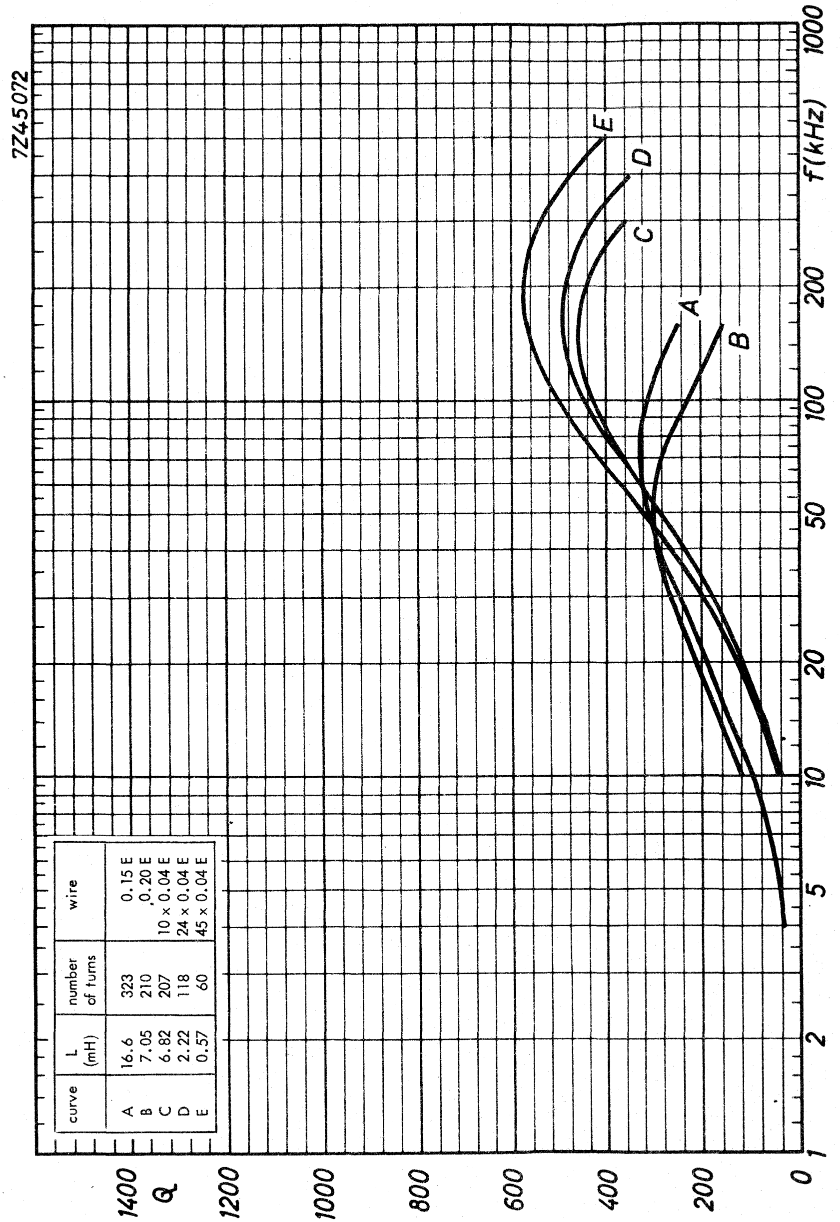


Enveloping curves



curve	L (mH)	number of turns	wire
A	11.32	323	0.15 E
B	4.78	210	0.20 E
C	4.65	207	10 × 0.04 E
D	1.51	118	24 × 0.04 E
E	0.39	60	45 × 0.04 E

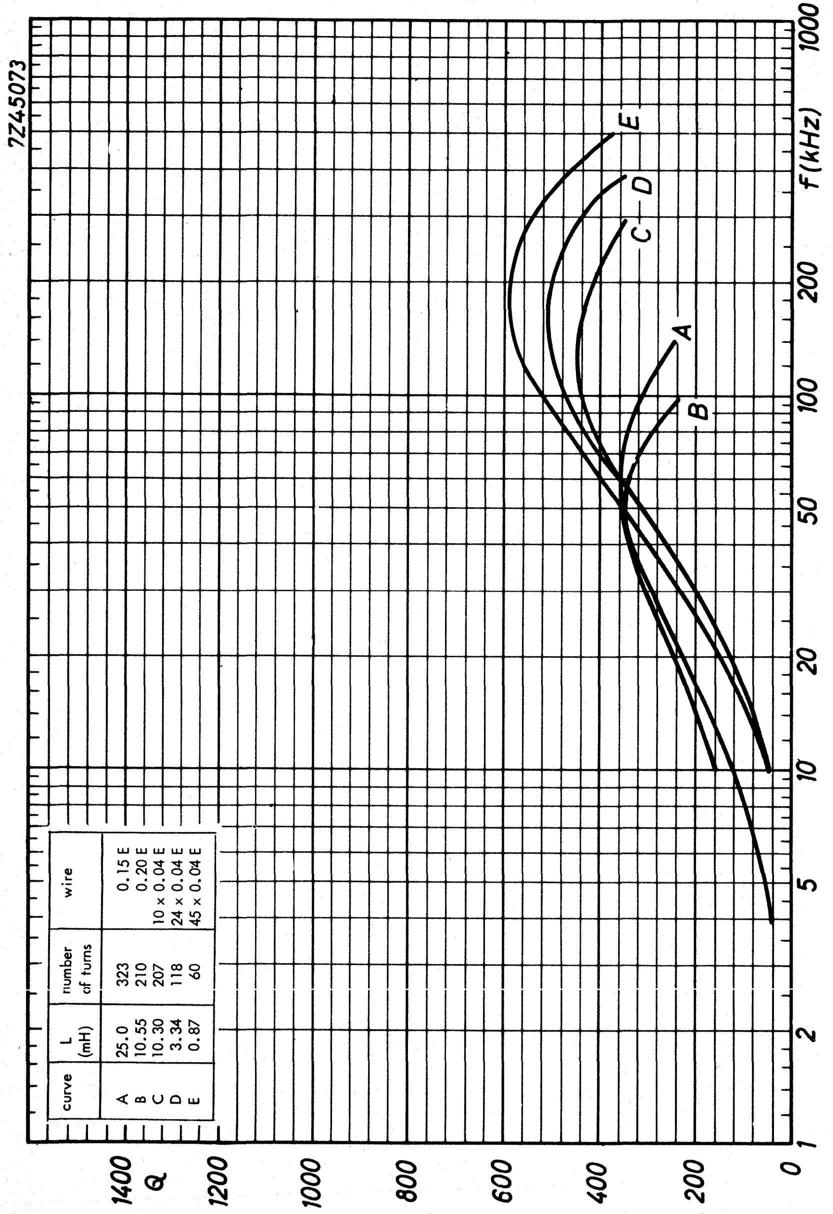
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 68$



curve	L (mH)	number of turns	wire
A	16.6	323	0.15 E
B	7.05	210	0.20 E
C	6.82	207	10 × 0.04 E
D	2.22	118	24 × 0.04 E
E	0.57	60	45 × 0.04 E

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

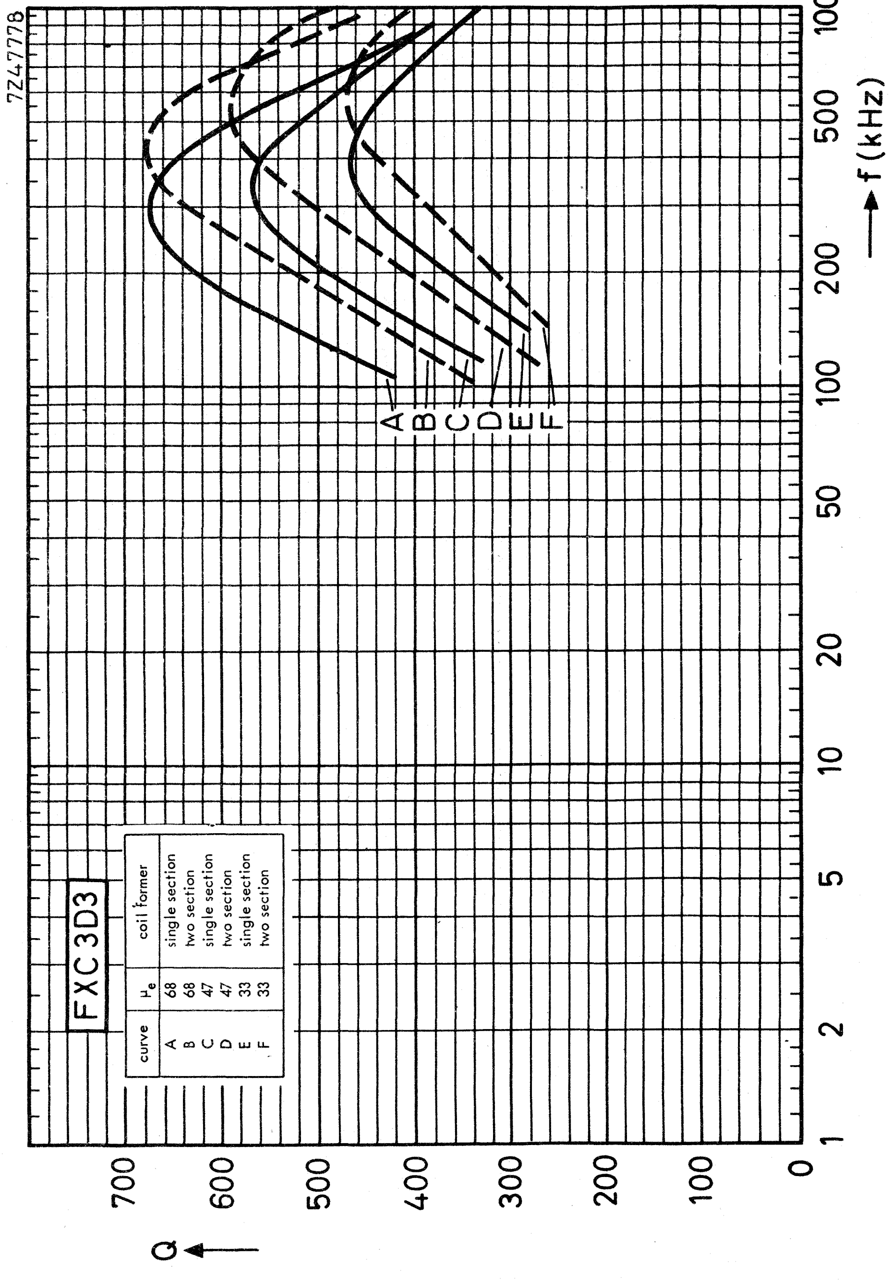
$\mu_e = 100$



curve	L (mH)	number of turns	wire
A	25.0	323	0.15 E
B	10.55	210	0.20 E
C	10.30	207	10 × 0.04 E
D	3.34	118	24 × 0.04 E
E	0.87	60	45 × 0.04 E

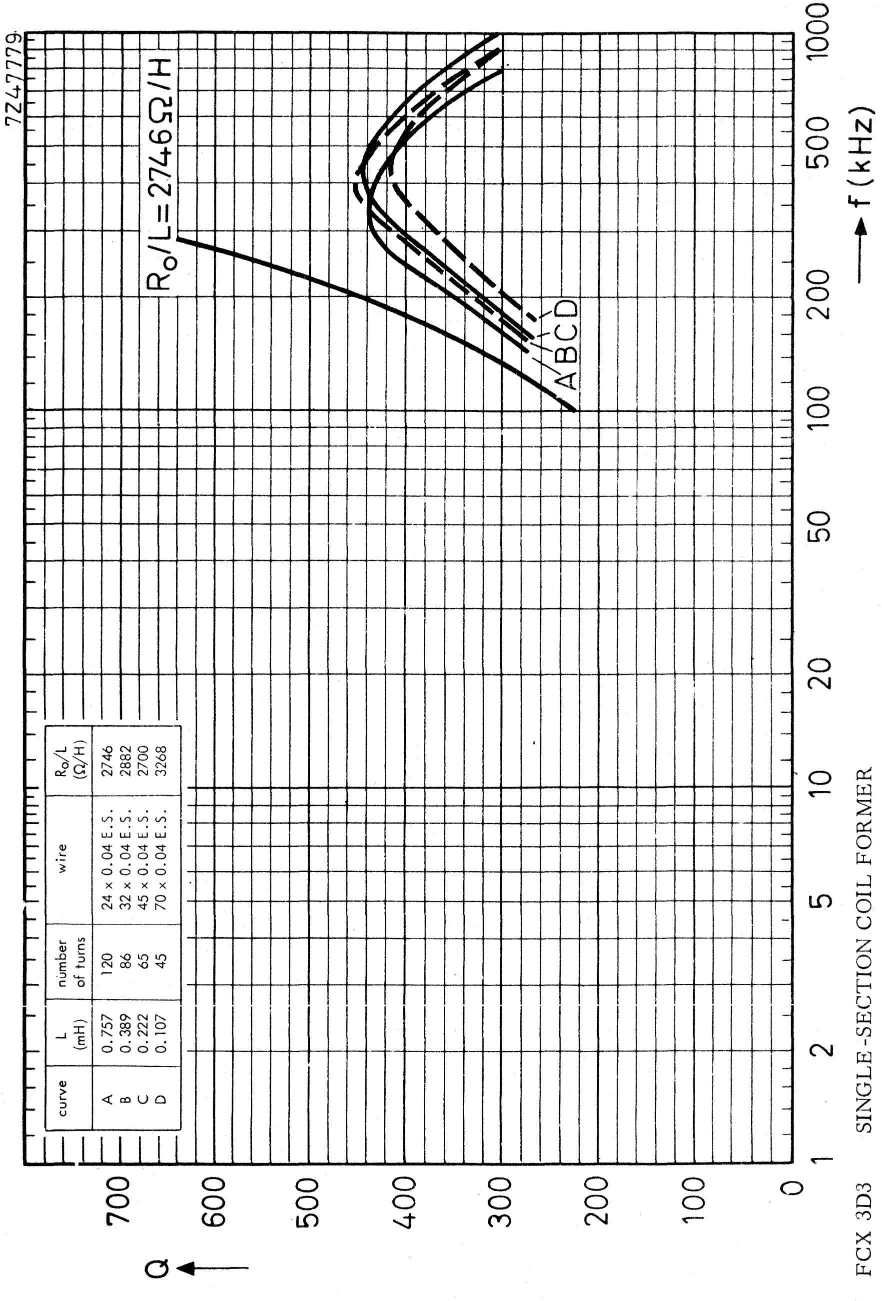
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 150$

TYPICAL Q-CURVES FOR FXC 3D3



curve	μ_e	coil former
A	68	single section
B	68	two section
C	47	single section
D	47	two section
E	33	single section
F	33	two section

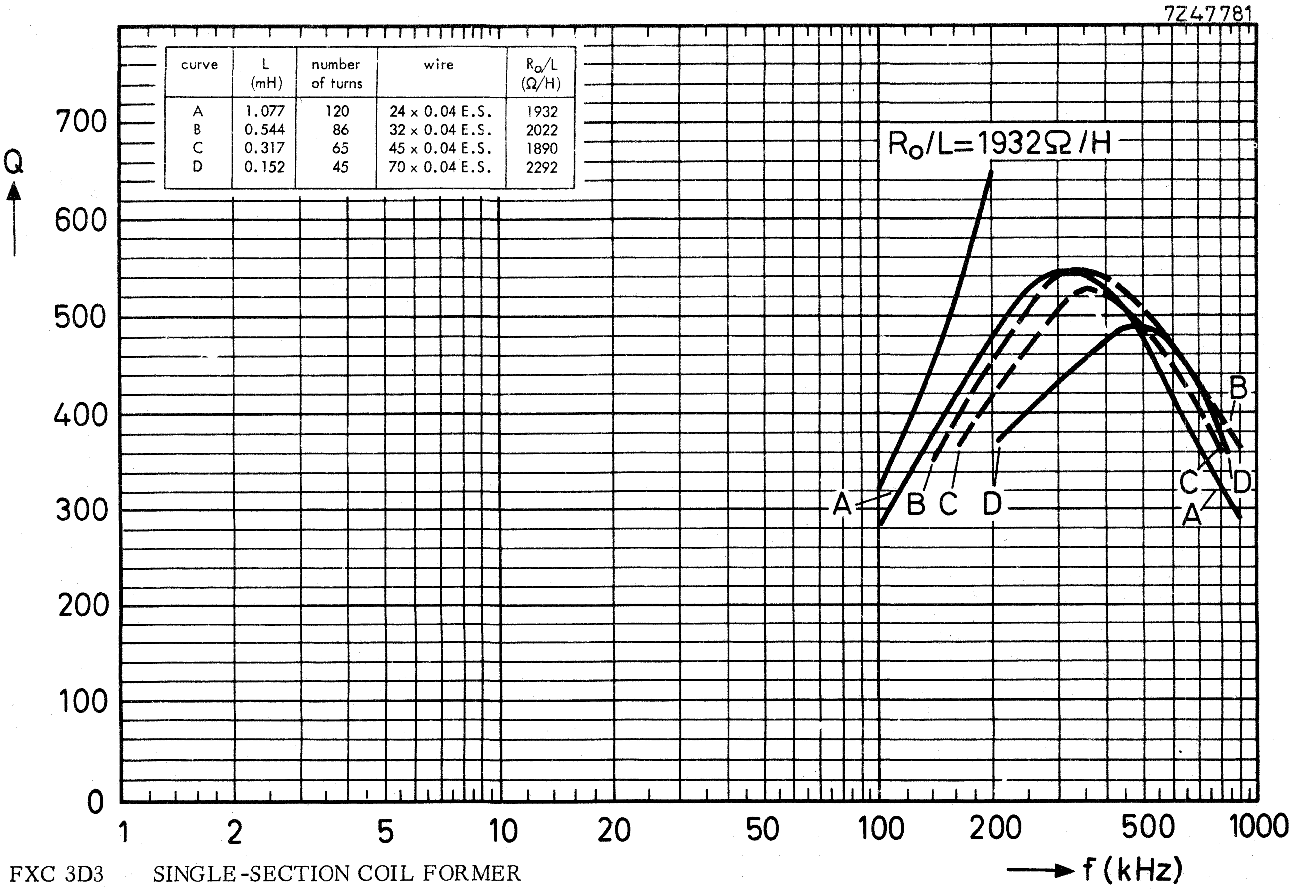
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	0.757	120	24 × 0.04 E.S.	2746
B	0.389	86	32 × 0.04 E.S.	2882
C	0.222	65	45 × 0.04 E.S.	2700
D	0.107	45	70 × 0.04 E.S.	3268

SINGLE-SECTION COIL FORMER

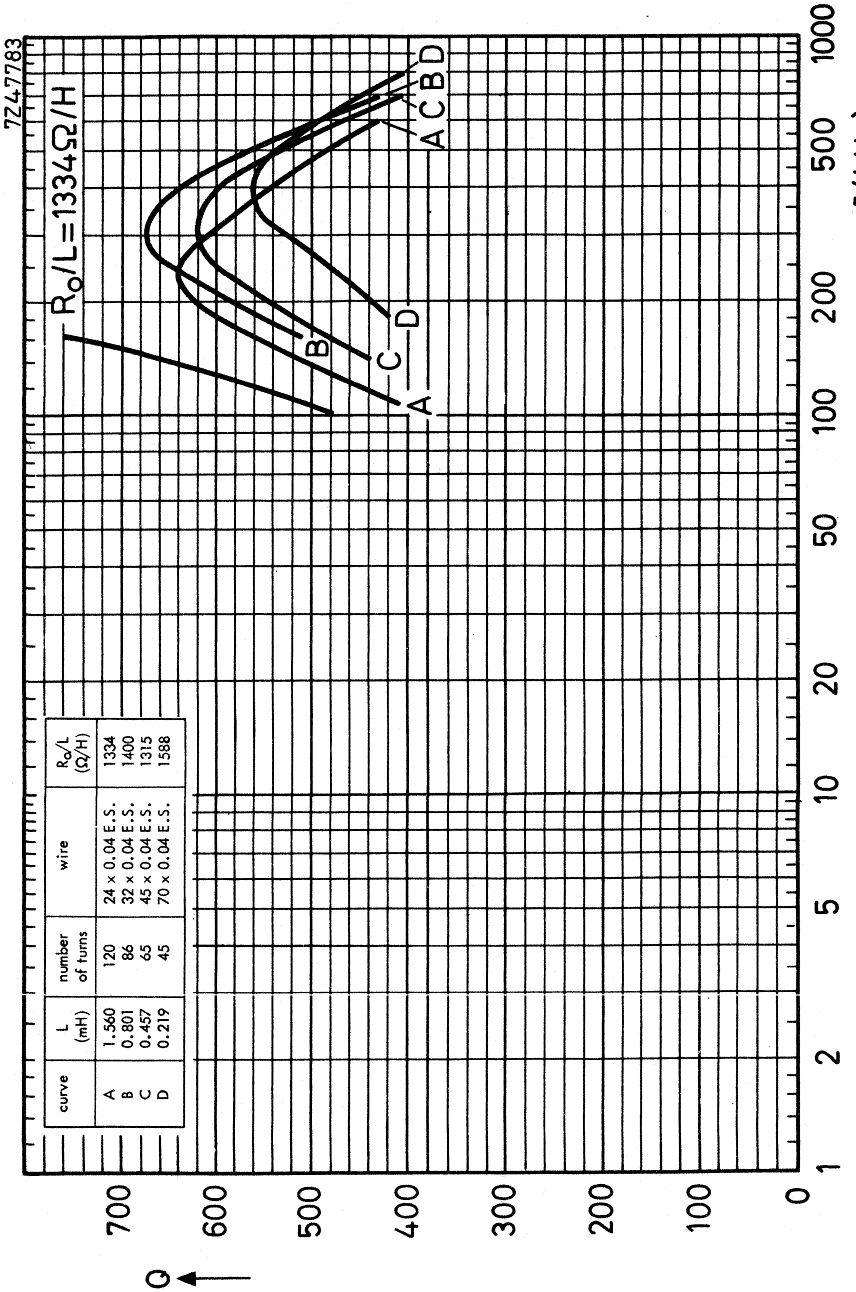
FCX 3D3
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.077	120	24 x 0.04 E.S.	1932
B	0.544	86	32 x 0.04 E.S.	2022
C	0.317	65	45 x 0.04 E.S.	1890
D	0.152	45	70 x 0.04 E.S.	2292

FXC 3D3 SINGLE-SECTION COIL FORMER

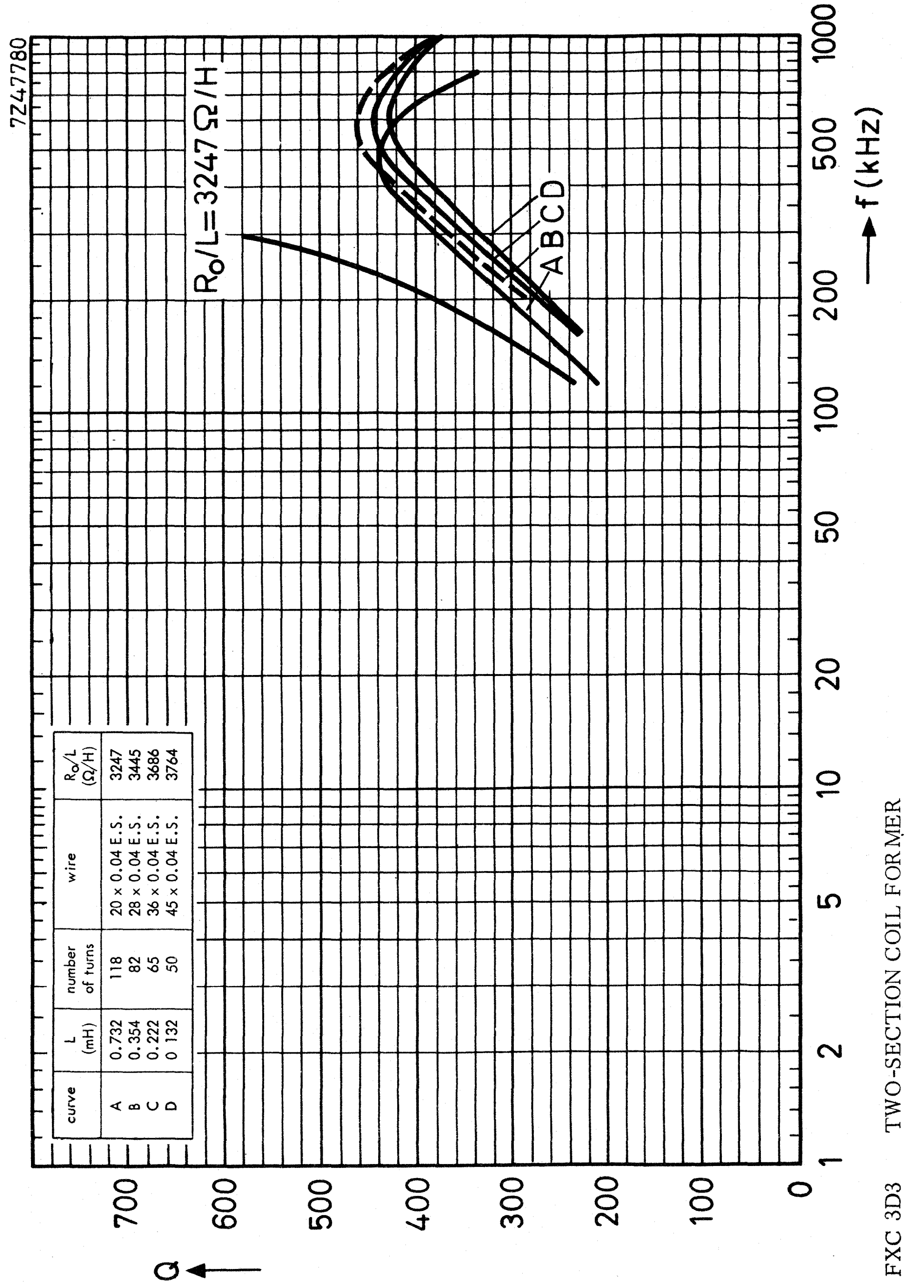
$\mu_e = 47$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.560	120	24 × 0.04 E.S.	1334
B	0.801	86	32 × 0.04 E.S.	1400
C	0.457	65	45 × 0.04 E.S.	1315
D	0.219	45	70 × 0.04 E.S.	1588

SINGLE-SECTION COIL FORMER

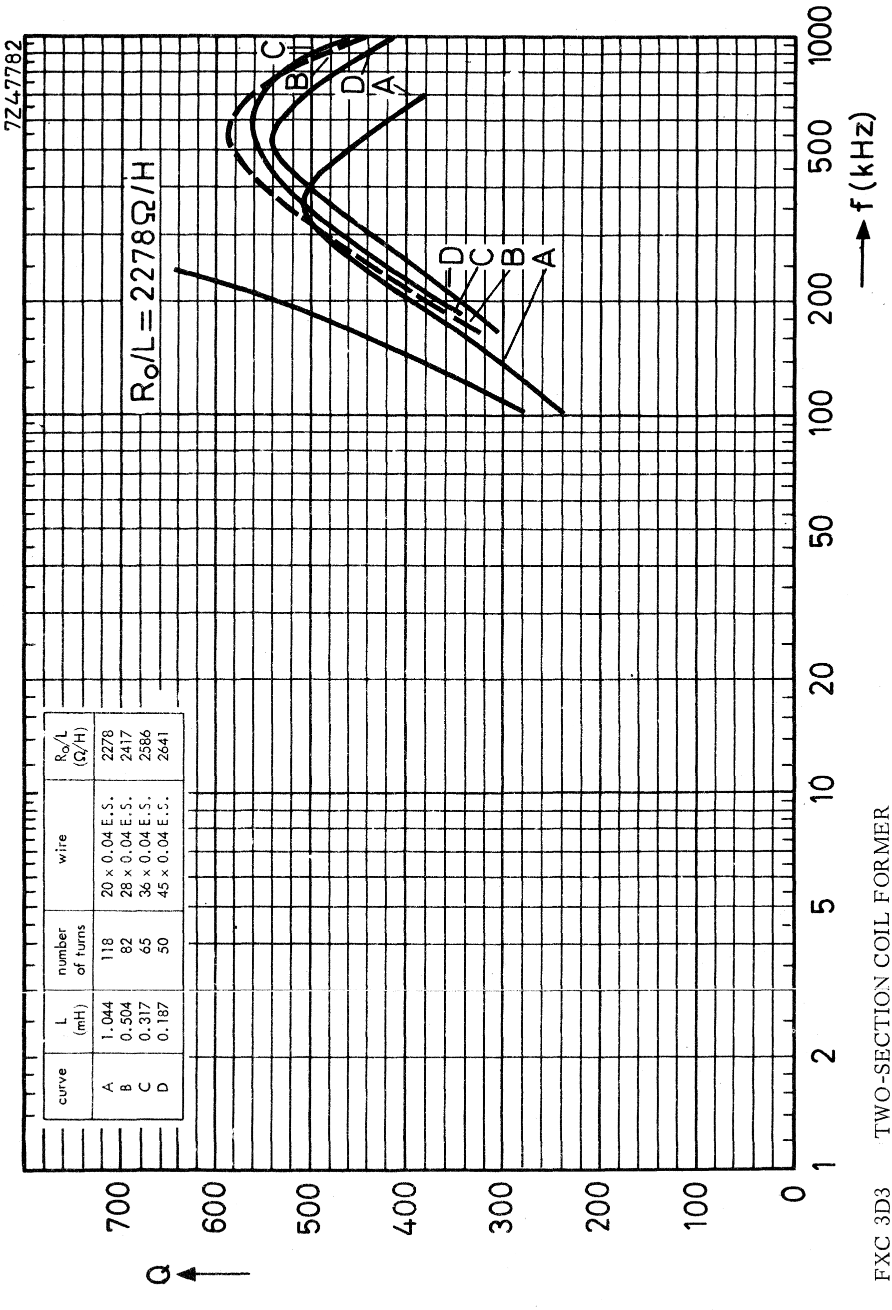
FXC 3D3
$\mu_e = 68$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	0.732	118	20 × 0.04 E.S.	3247
B	0.354	82	28 × 0.04 E.S.	3445
C	0.222	65	36 × 0.04 E.S.	3686
D	0 132	50	45 × 0.04 E.S.	3764

FXC 3D3 TWO-SECTION COIL FORMER

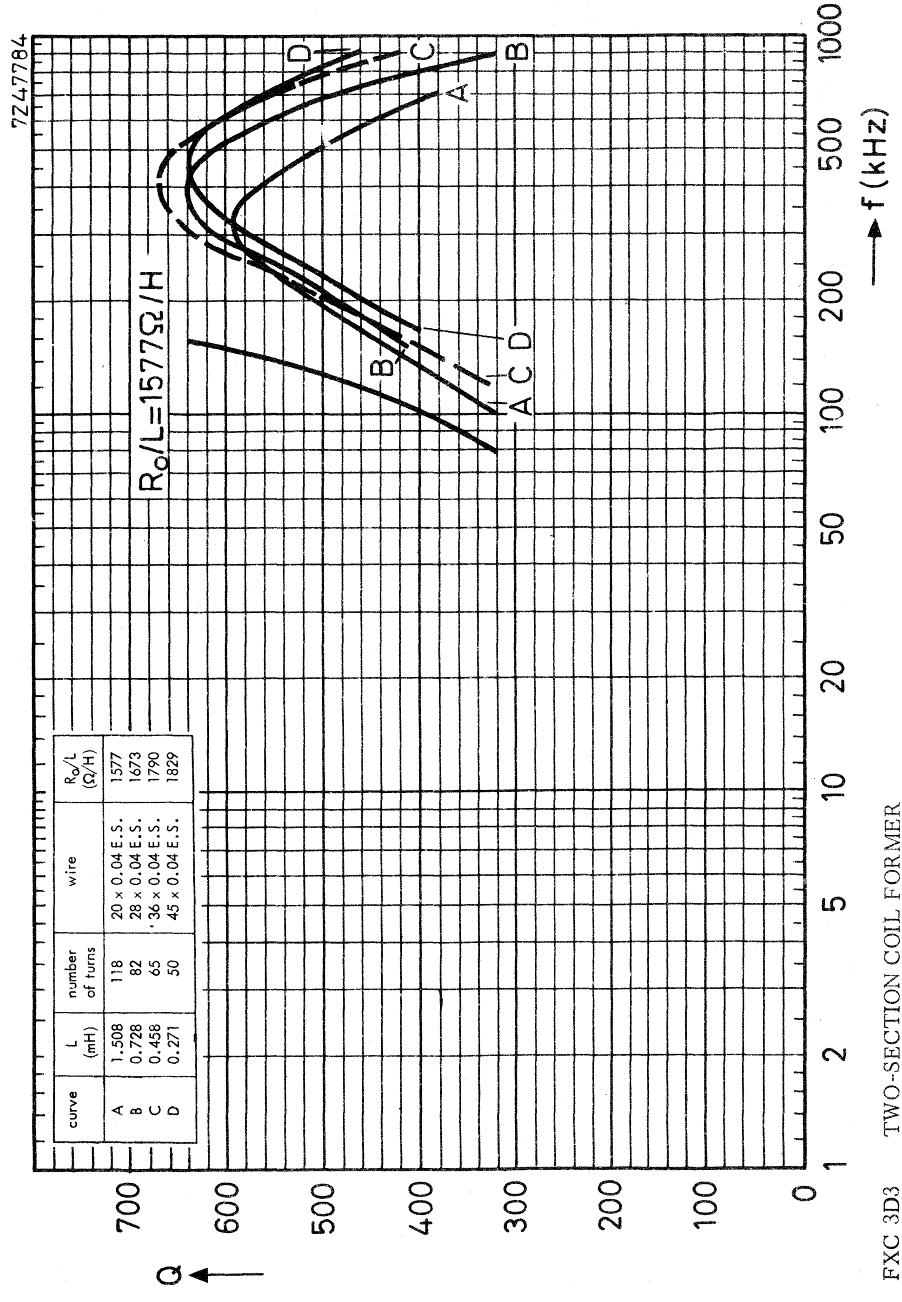
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.044	118	20 × 0.04 E.S.	2278
B	0.504	82	28 × 0.04 E.S.	2417
C	0.317	65	36 × 0.04 E.S.	2586
D	0.187	50	45 × 0.04 E.S.	2641

TWO-SECTION COIL FORMER

FXC 3D3
$\mu e = 47$

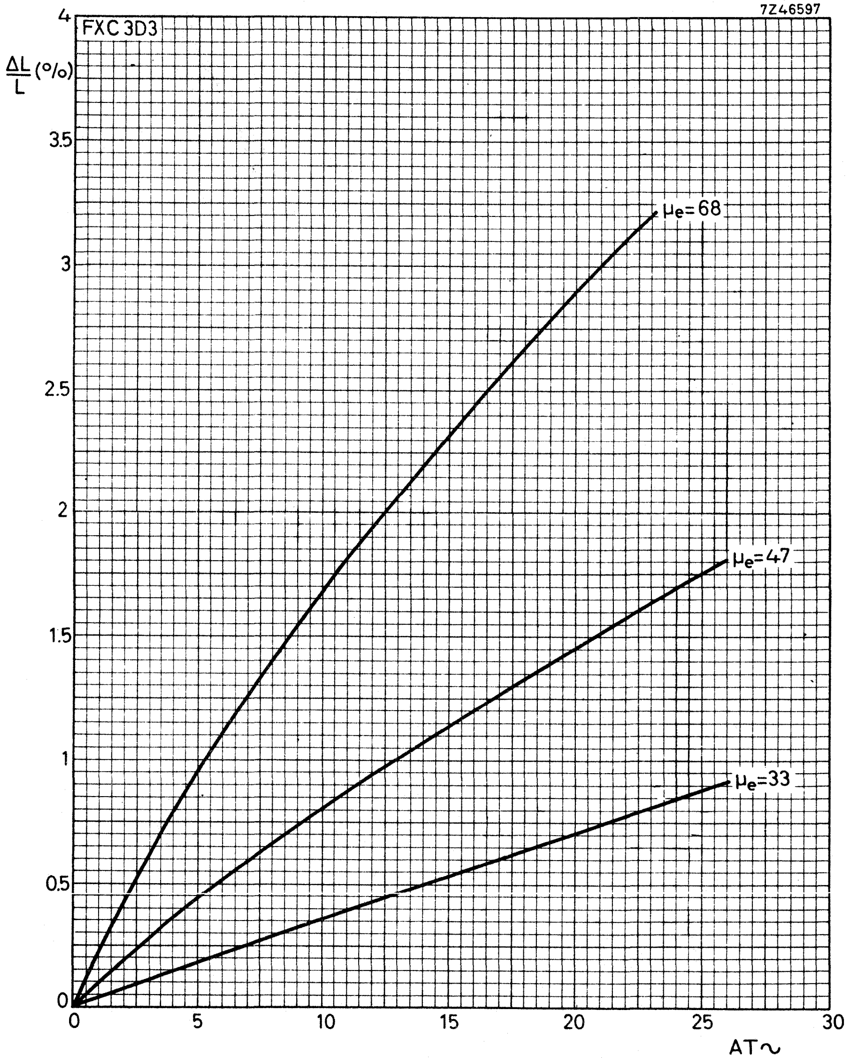


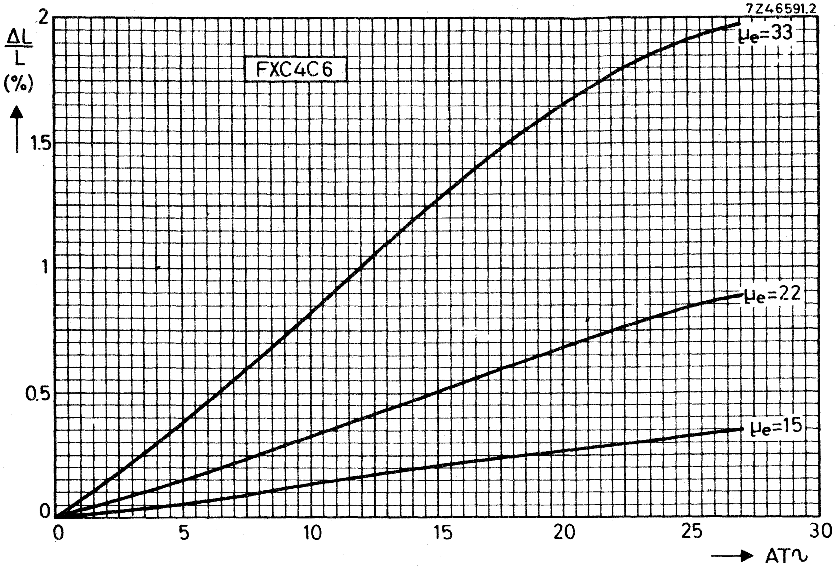
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.508	118	20 × 0.04 E.S.	1577
B	0.728	82	28 × 0.04 E.S.	1673
C	0.458	65	36 × 0.04 E.S.	1790
D	0.271	50	45 × 0.04 E.S.	1829

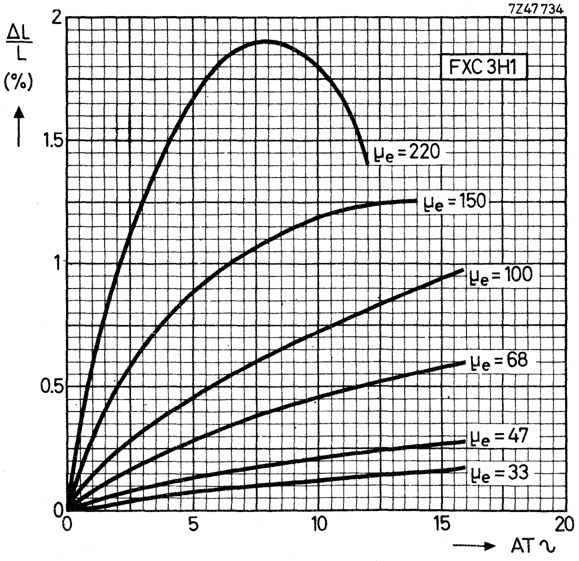
TWO-SECTION COIL FORMER

FXC 3D3
$\mu_e = 68$

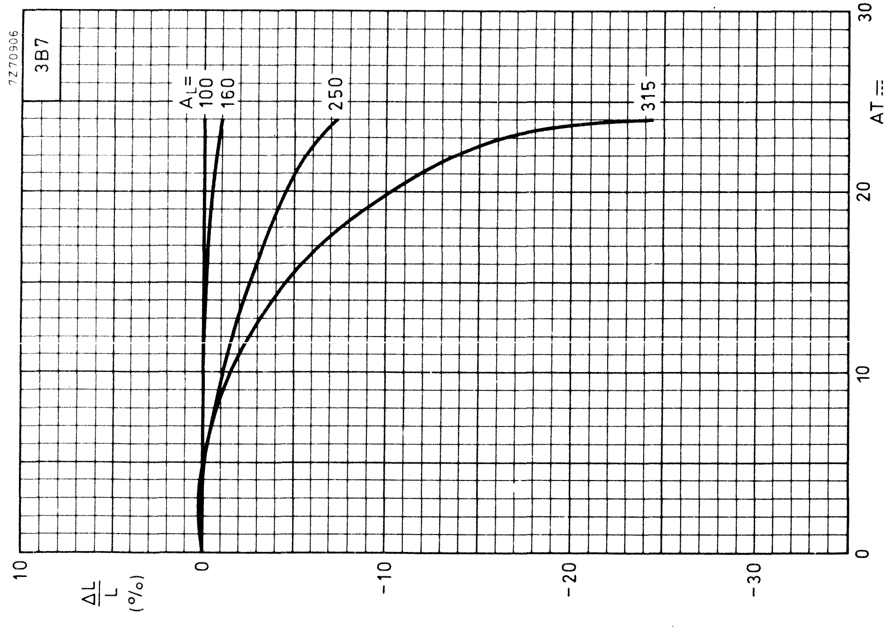
INDUCTANCE VARIATION AS A FUNCTION OF AT~

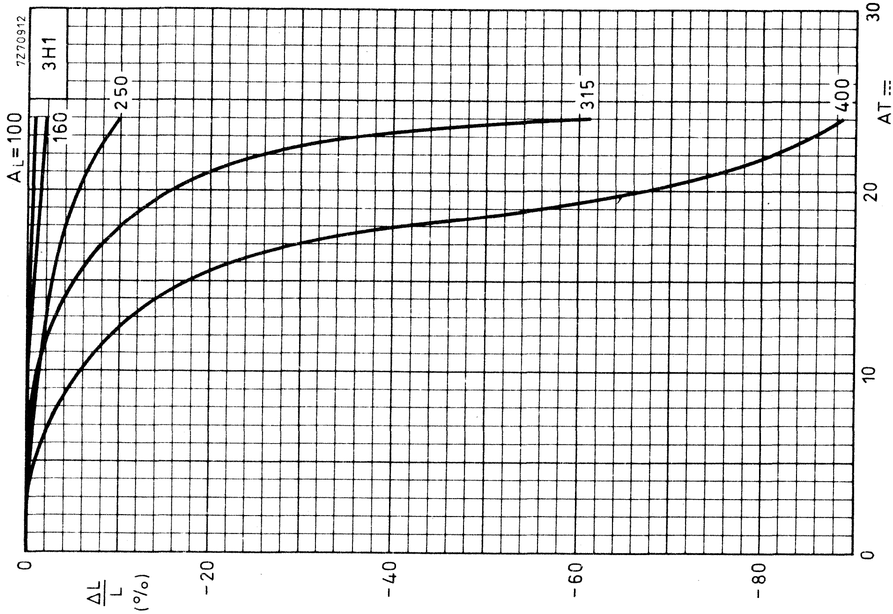



7Z46591.2
FXC4C6
$\frac{\Delta L}{L}$ (%)
0
0.5
1
1.5
2
0
5
10
15
20
25
30
AT∿
$\mu_e = 33$
$\mu_e = 22$
$\mu_e = 15$


7Z47734
FXC 3H1
$\frac{\Delta L}{L}$ (%)
0
0.5
1
1.5
2
0
5
10
15
20
AT∿
$\mu_e = 220$
$\mu_e = 150$
$\mu_e = 100$
$\mu_e = 68$
$\mu_e = 47$
$\mu_e = 33$

INDUCTANCE VARIATION AS A FUNCTION OF AT⎓






7Z70908
3D3
A_L = 100
AT ⎓
0
10
20
30
$\frac{\Delta L}{L}$ (%)
1
0
−1
−2
−3

POTCORES

INTRODUCTION

Three types of core can be supplied:

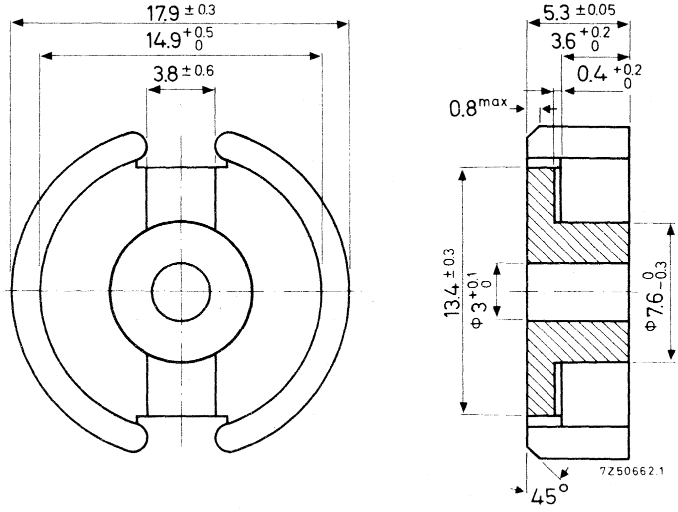
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN41293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 40 potcore halves or 20 pieces of pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores. So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 21500
3H1	4322 020 21510
3D3	4322 020 21520
3E1	4322 020 21640
4C6	4322 020 21610

Properties

For toroidally wound core halves the values in Table I are guaranteed.

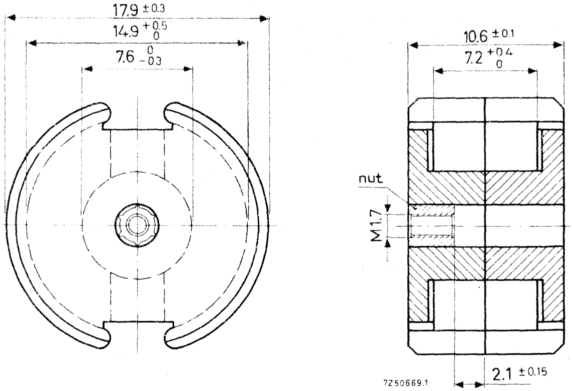
Table I	temp. (^{o}C)	grade				
		3B7	3H1	3D3	3E1	4C6
$\alpha_F \times 10^6$	+ 5 to +25	-	+0.5 to +1.5	-		-2 to +4
	+ 5 to +55	-	-	-		-
	+25 to +55	-	+0.5 to +1.5	-		0 to +6
	+25 to +70	-0.6 to +0.6		0 to 2	0 to 2	
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤4.3	≤4.3	≤12		≤10

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 100 Newton, the values in Table II are guaranteed at 25 ± 10 °C.

Table II	$\hat{B}$ (mT)	freq. (MHz)	grade				
			3B7	3H1	3D3	3E1	4C6
μ_e	≤ 0, 1	0.004	–	–	–	2100-3105	–
	≤ 0, 1	0.1	≥ 1310	≥ 1310	≥ 530	–	≥ 93
A_L	≤ 0, 1	0.004	–	–	–	4420-6530	–
α	≤ 0, 1	0.1	≤ 19.0	≤ 1910	≤ 29.9	–	≤ 71.1
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0, 1	0.004	–	–	–	≤ 2.5	–
	≤ 0, 1	0.1	≤ 5	≤ 5	≤ 8	≤ 20	–
	≤ 0, 1	0.5	–	–	≤ 14	≤ 200	–
	≤ 0, 1	1	–	–	≤ 30	–	–
	–	2	–	–	–	–	≤ 40
	–	10	–	–	–	–	≤ 100
q2-24-100	0, 3–1, 2	0.1	–	–	≤ 3.0	–	≤ 10
	1, 5–3, 0	0.004	≤ 1.8	≤ 1.4	–	≤ 3.0	–
$\eta_B \times 10^3$	0, 3–1, 2	0.1	–	–	≤ 1.8	–	≤ 6.2
	1, 5–3, 0	0.004	≤ 1.1	≤ 0.86	–	≤ 1.8	–

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 2. . . .
Without nut, catalogue number = 4322 022 0. . . .

Weight of a set		6,4 g
Mean length of lines of force	l_e	= 25,8 mm
	$\Sigma \frac{l_e}{A_e}$	= 0,597 mm^{-1}
Effective volume	V_e	= 1120 mm^3

Pre-adjusted potcores with standard μ_e values [1]

μ_e	α	tolerance on inductance (%)	catal. No. 4322 022 2.... with nut 4322 022 0.... without nut			
			3B7	3H1	3D3	4C6
15	178	± 1	-	-	-	4810
22	147	± 1	-	-	-	4820
33	120	± 1	4030	4230	4430	4830
47	100.5	± 1	4040	4240	4440	-
68	83.6	± 1	4050	4250	4450	-
100	68.9	± 1.5	4060	4260	-	-
150	56.3	± 2	4070	4270	-	-
220	46.5	± 3	4080	4280	-	-
705	25.9	± 25	-	-	4400*	-
1750	16.5	± 25	4000*	4200*	-	-

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 15 up to and including 68
Asymmetric air gap for cores with an μ_e value of 100 up to and including 1750

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1) See Notes on the next page.

*) Only available without nut.

Pre-adjusted potcores with standard A_L factor 1)

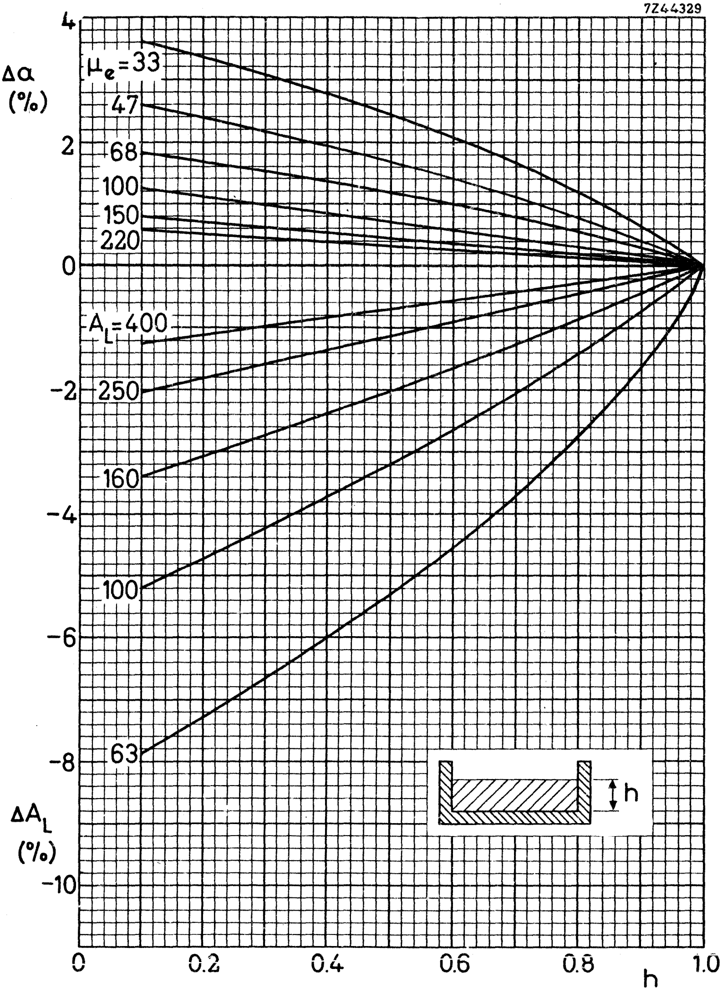
A_L	corre-sponding μ_e - value	tolerance on induc-tance (%)	catal. No. 4322 022 2.... with nut 4322 022 0.... without nut			
			3B7	3H1	3D3	4C6
25	11,9	± 1	–	–	–	5810
40	19,0	± 1	–	–	5420	5820
63	30	± 1	5030	5230	5430	5830
100	47,5	± 1	5040	5240	5440	–
160	76	± 1	5050	5250	5450	–
250	119	± 1,5	5060	5260	–	–
315	149	± 2	5070	5270	–	–
400	190	± 2	5080	5280	–	–
630	298	± 3	5100	5300	–	–
1000	475	± 5	–	5310	–	–

Inductance $L = N^2 A_L$ (in 10^{-9} H)
Symmetric air gap for cores with an A_L factor of 25 up to and including 160
Asymmetric air gap for cores with an A_L factor of 250 up to and including 630

Notes to the tables

1. Examples of catalogue number:
   μ_e = 15, grade 4C6, potcore with nut, catalogue number = 4322 022 24810
   A_L = 100, grade 3B7, potcore without nut, catalogue number = 4322 022 05040
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

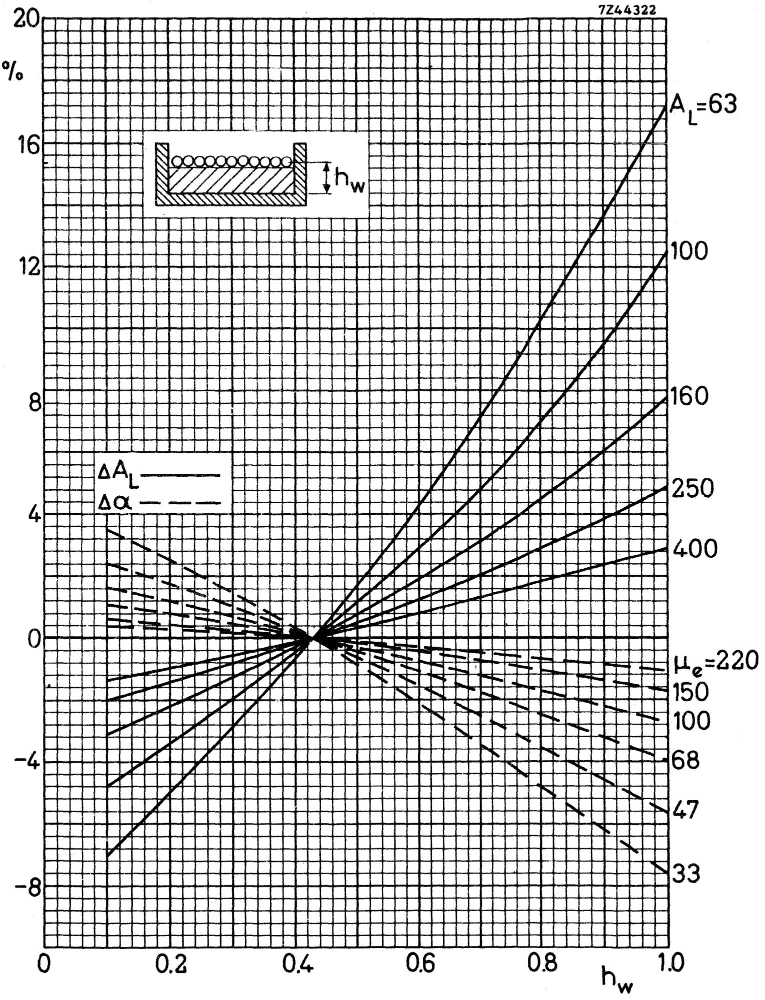
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: Of a single-section coil former only 0.4 part of the available neight is used. A potcore with μ_e = 68 in that case obtains an α factor of 83.6 + 1.30 %.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_w on a single-section coil former.
Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 68 obtains for that winding an α factor of 83.6 - 1.7 %.

COIL FORMERS

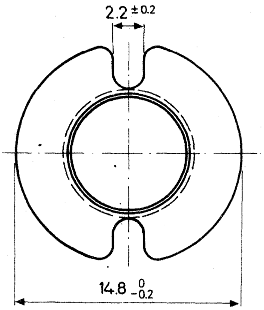
GENERAL

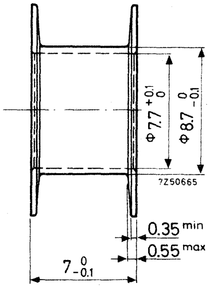
Three types of coil former can be supplied:

- with one section
- with two sections
- with three sections

The dimensions conform with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain). The dimensions in the drawings are in mm.

SINGLE-SECTION COIL FORMER





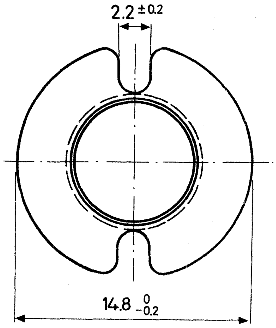
Catalogue number	4322 021 30270
Material	polycarbonate
Window area	18 mm^2
Mean length of turn	37 mm
Max. temperature	130 ^{o}C

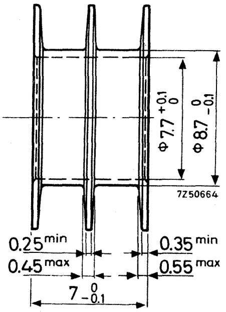
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 16,4 \times 10^3\ \Omega/H$$

Weight 0,35 g

TWO-SECTION COIL FORMER





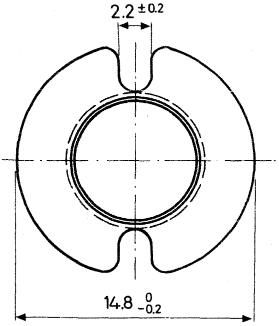
Catalogue number	4322 021 30280
Material	polycarbonate
Window area	2 x 8.7 mm^2
Mean length of turn	37 mm
Max. temperature	130 °C

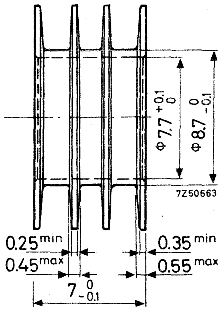
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \mathrm{x} \frac{1}{f_{cu}} \mathrm{x}\ 17.2 \ \mathrm{x}\ 10^3 \quad \Omega/H$$

Weight	0.35 g

THREE-SECTION COIL FORMER





Catalogue number	4322 021 30290
Material	polycarbonate
Window area	3 x 5.4 mm^2
Mean length of turn	37 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 18.4 \times 10^3 \quad \Omega/\mathrm{H}$$

Weight	0.4	g

INDUCTANCE ADJUSTORS

Dimensions in mm

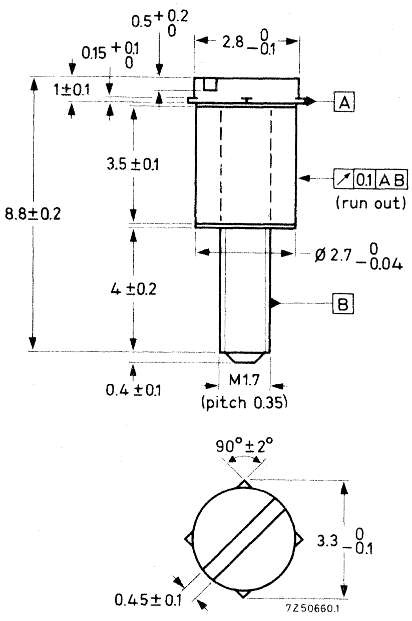


Fig. A

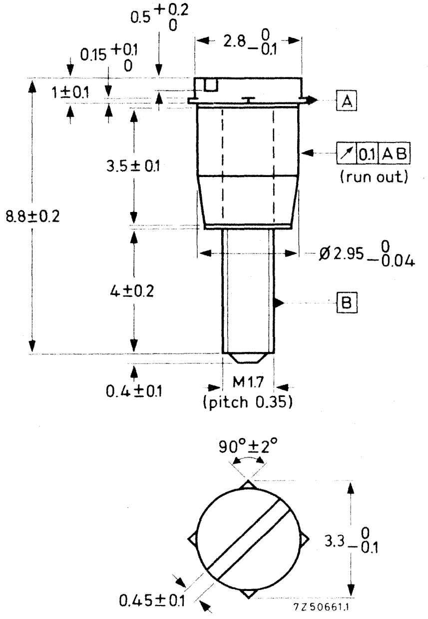


Fig. B

The tolerances on inductance of the pre-adjusted potcores (without adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.

The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.

The influence of the adjustors on the variability of the inductance is negligible.

The maximum permissible temperature is 110 °C.

Table II shows the type of adjustor recommended for different potcores.

Table I, available types:

Fig.	colour	catalogue number
A	brown	4322 021 30730
A	green	4322 021 30760
A	red	4322 021 30770
B	yellow	4322 021 30960
B	white	4322 021 30970
B	grey	4322 021 31080

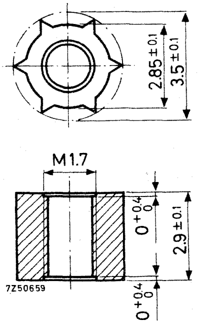
The adjustors are packed in bags of 100 so please order in multiples of 100.

Table II, recommended application:

μ_e	A_L	3B7/3H1/3D3	4C6
		cat. number 4322 021	
15		–	30760
	25	–	30760
	40	–	30770
22		–	30770
	63	30760	–
33		30760	30970
	100	30770	
47		30770	
68		30960	
	160	30960	
	250	30970	
100		30970	
	315	30730	
150		30730	
	400	31080	
220		31080	
	630	31080	

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.

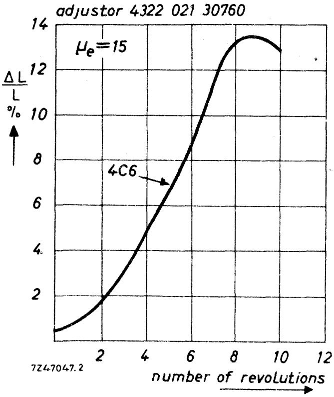


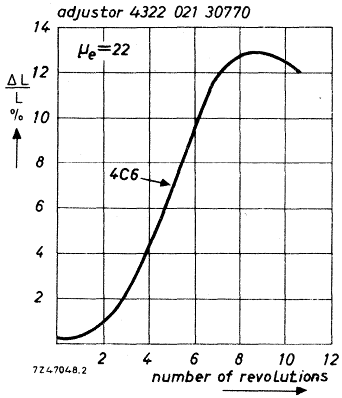
Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2, 1 ± 0, 15 mm

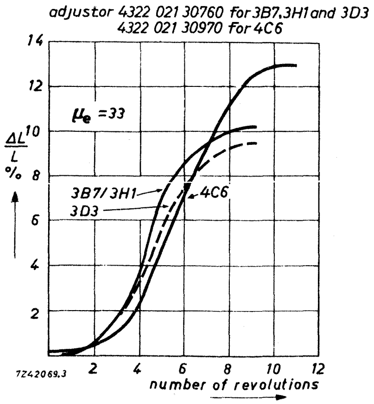
For more information see Potcores General, Inductance adjustment.

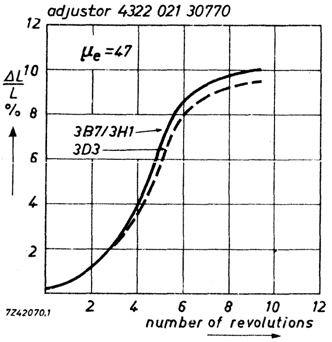
dimensions in mm

ADJUSTMENT CURVES

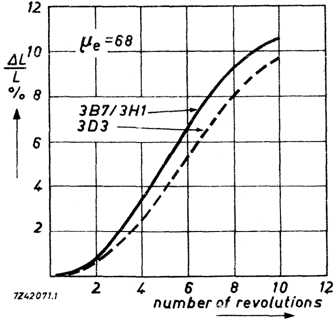




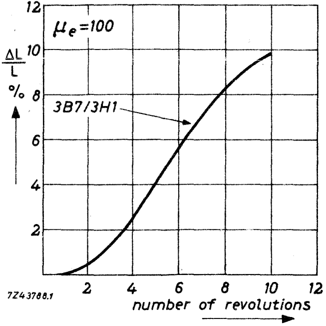




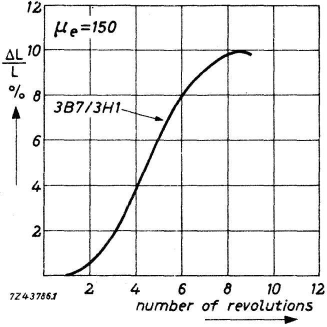
adjustor 4322 021 30960



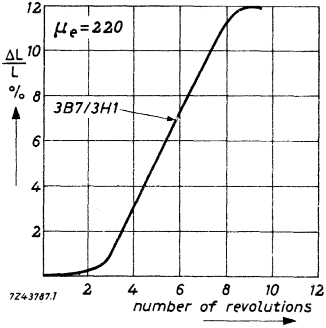
adjustor 4322 021 30970



adjustor 4322 021 30730

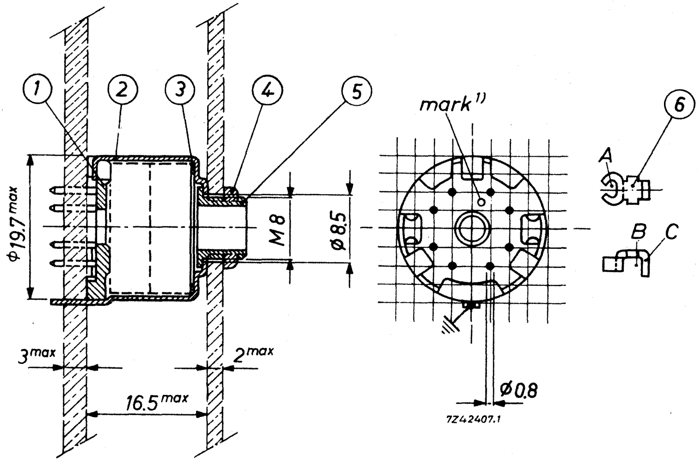


adjustor 4322 021 31080



MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30450	(4) nut	4322 021 30710
(2) brass container	4322 021 30530	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30640	(6) soldering spring	4322 021 30700 (8x)

The core is suitable for mounting on printed-wiring boards and on conventional panels.

The parts 1, 2, 3 (and 6) are sufficient to construct an assembly for use in combination with printed wiring.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The eight soldering pins are arranged so as to fit a grid of 2.52 mm. They will fit printed-wiring boards with a 0.1" grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness up to 3 mm. The board should be provided with holes of 1.3+0.1 mm diameter.

---

1) There is another mark hole in a similar position on the top of the container.

If one-hole mounting is preferred, the parts 4 and 5 should be added. The coil assembly may then be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

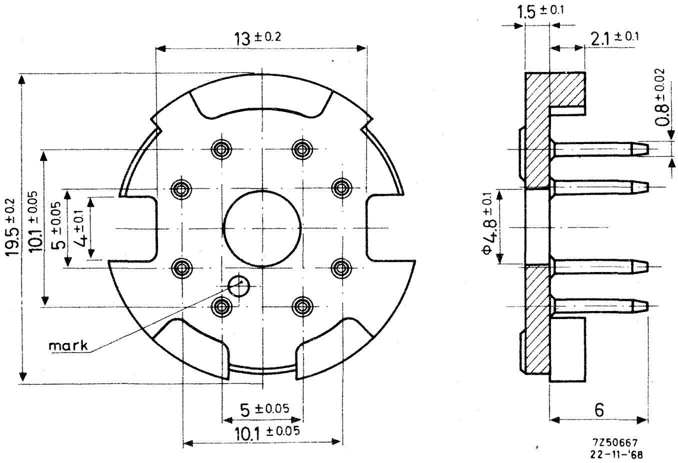
It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 100 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

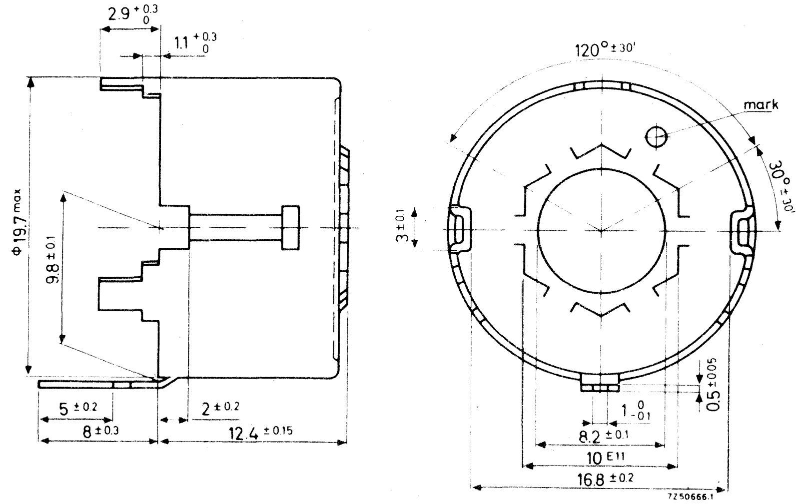
(1) Tag plate 4322 021 30450

Plate : polyester reinforced with glass fibre
Pins : phosphorbronze, dipsoldered



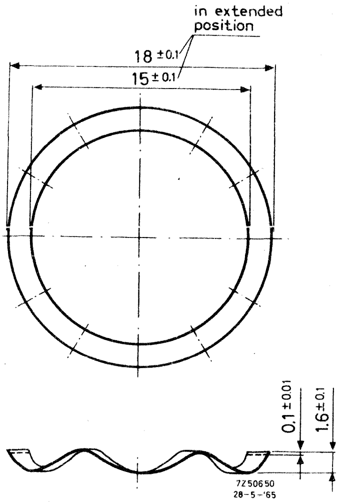
(2) Container 4322 021 30530

Material: brass, nickel plated; tinned soldering pin



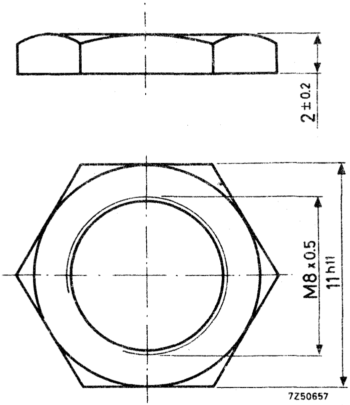
(3) Spring 4322 021 30640

Material: chrome-nickelsteel



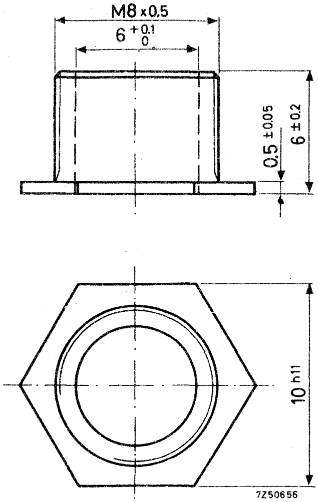
(4) Nut 4322 021 30710

Material : brass, nickel plated



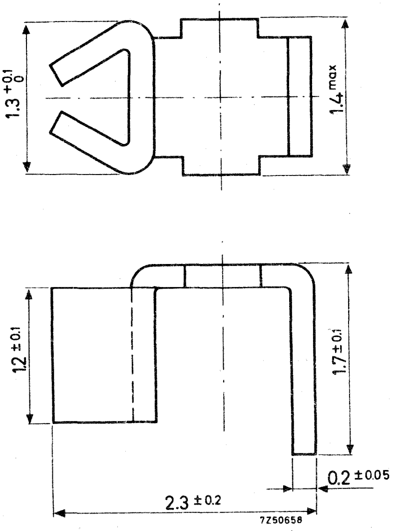
(5) Fixing bush 4322 021 30720

Material : brass, nickel plated



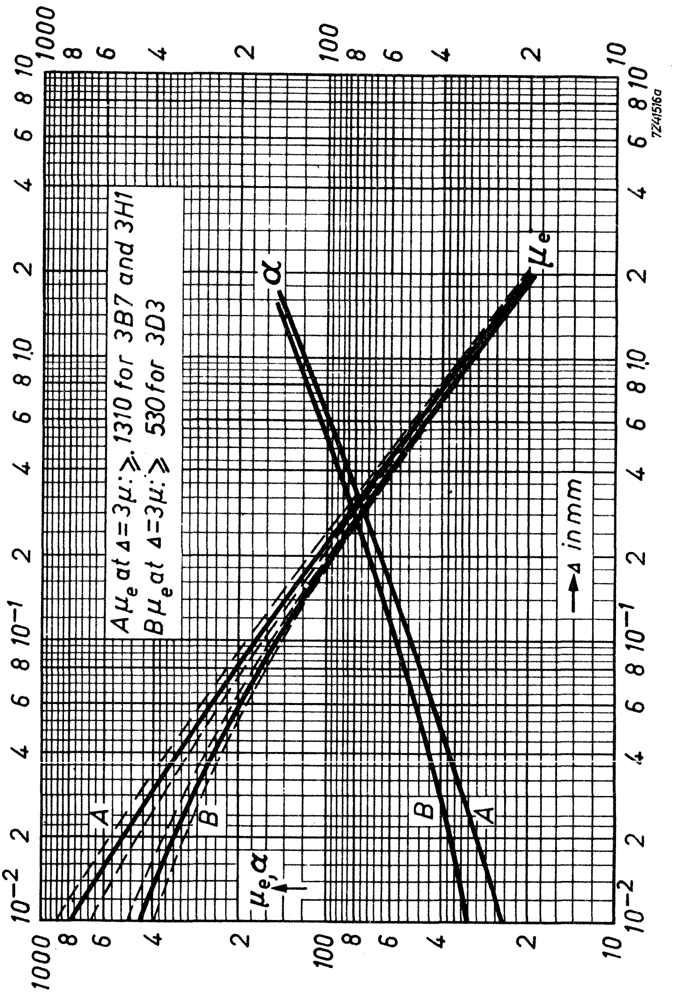
(6) Soldering spring 4322 021 30700

Material : brass, dipsoldered



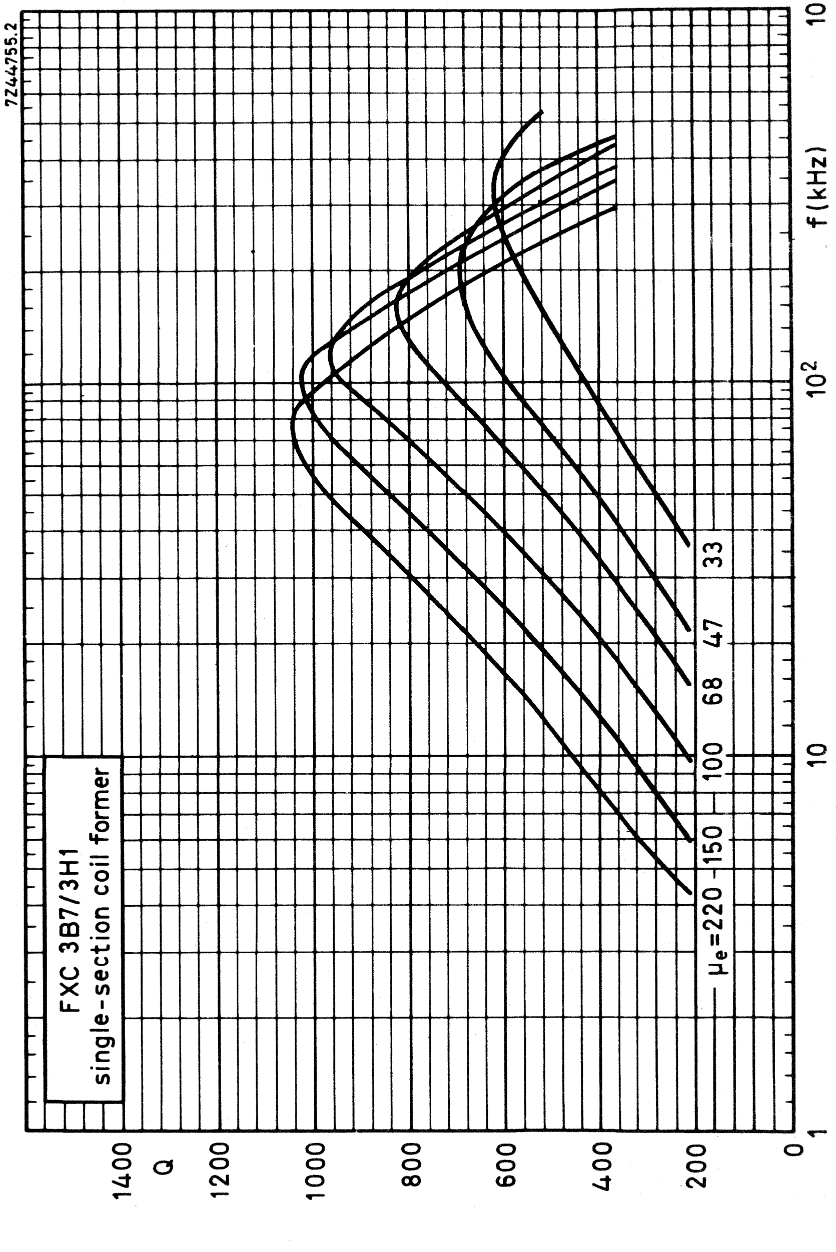
CHARACTERISTIC CURVES

μ_e - α CURVES

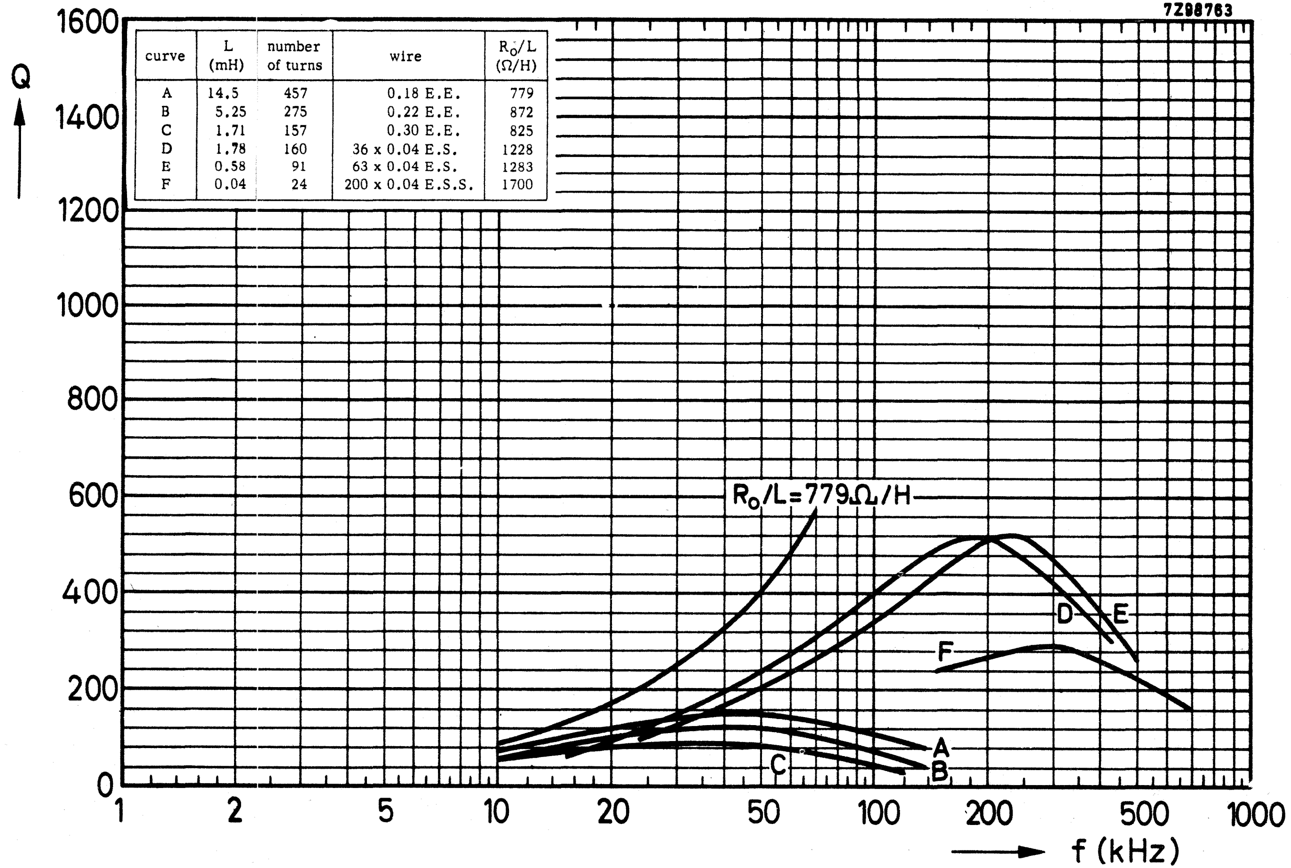


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7/3H1



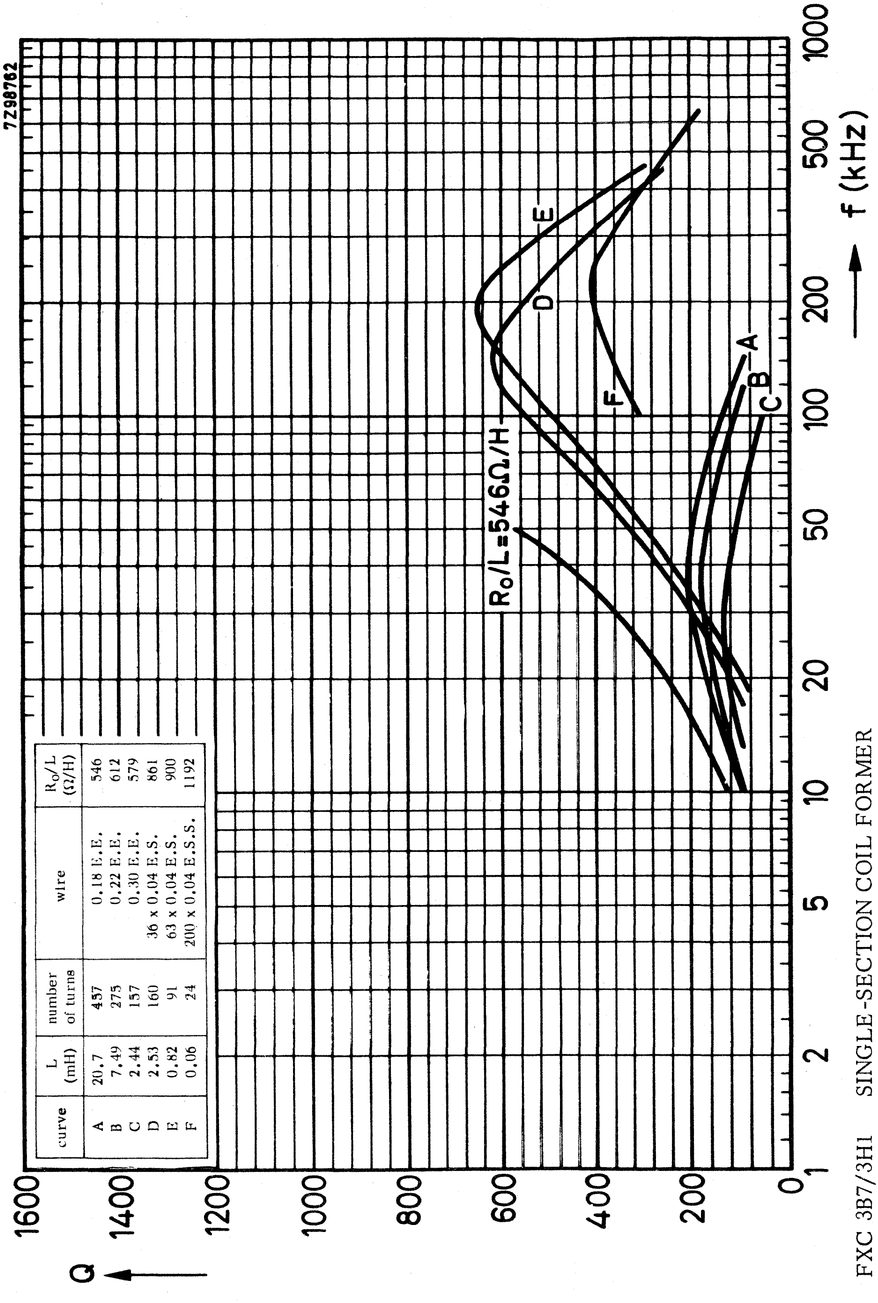
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	14.5	457	0.18 E.E.	779
B	5.25	275	0.22 E.E.	872
C	1.71	157	0.30 E.E.	825
D	1.78	160	36 x 0.04 E.S.	1228
E	0.58	91	63 x 0.04 E.S.	1283
F	0.04	24	200 x 0.04 E.S.S.	1700

FXC3B7/3H1 SINGLE-SECTION COIL FORMER

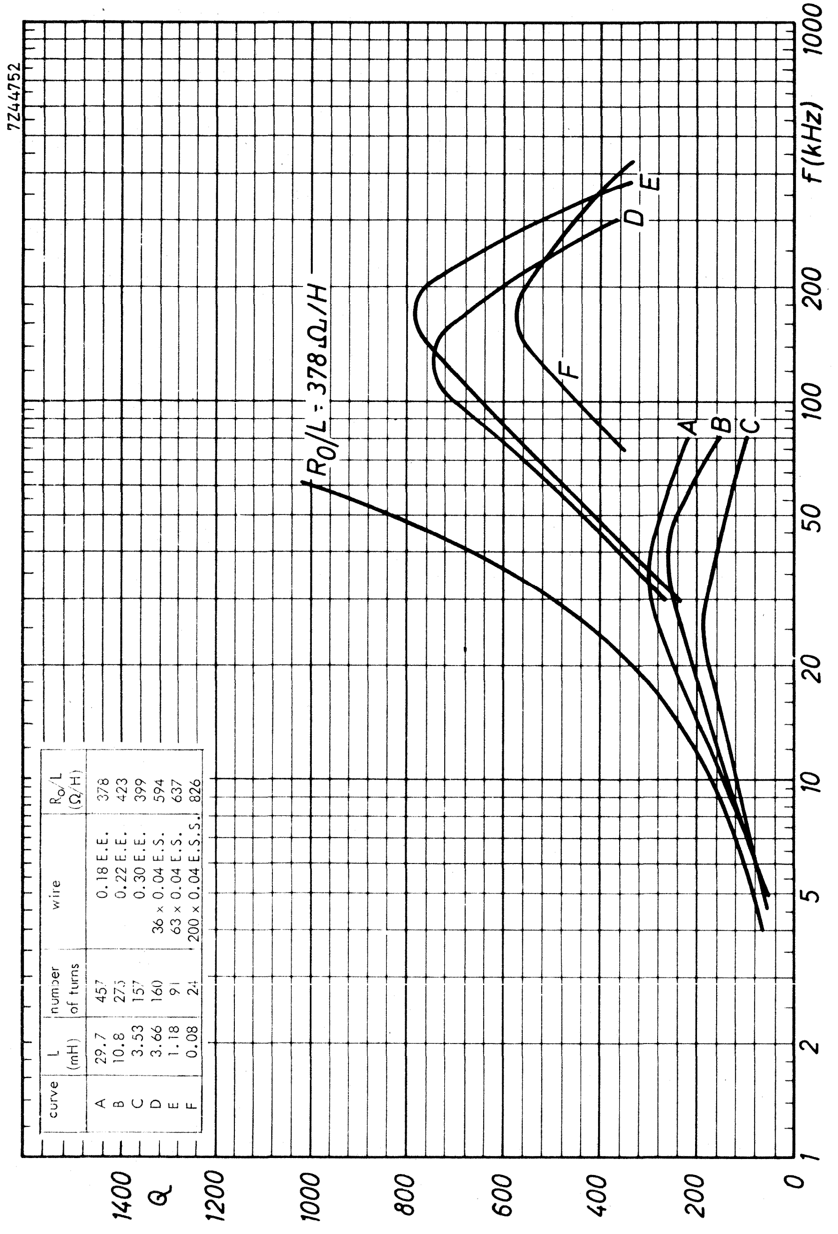
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	20.7	457	0.18 E.E.	546
B	7.49	275	0.22 E.E.	612
C	2.44	157	0.30 E.E.	579
D	2.53	160	36 x 0.04 E.S.	861
E	0.82	91	63 x 0.04 E.S.	900
F	0.06	24	200 x 0.04 E.S.S.	1192

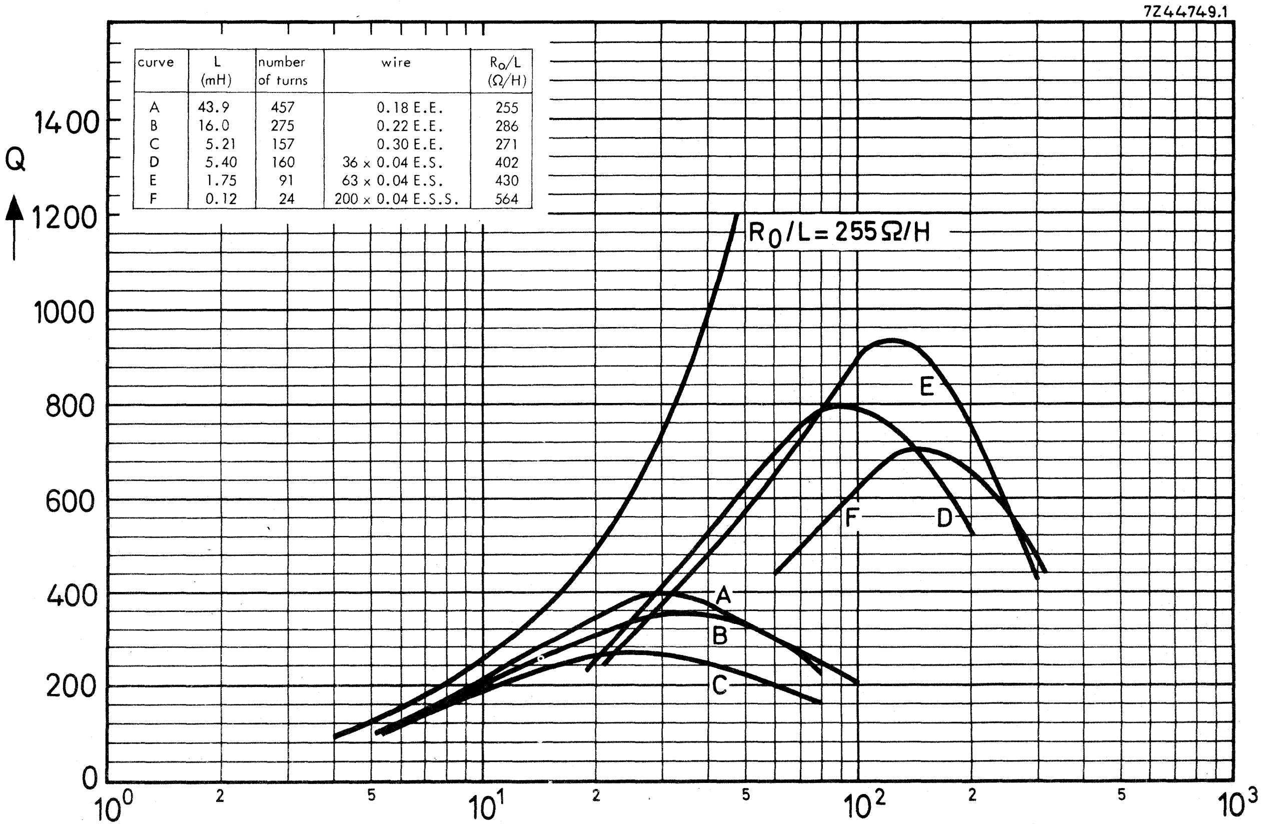
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

$\mu_e = 47$



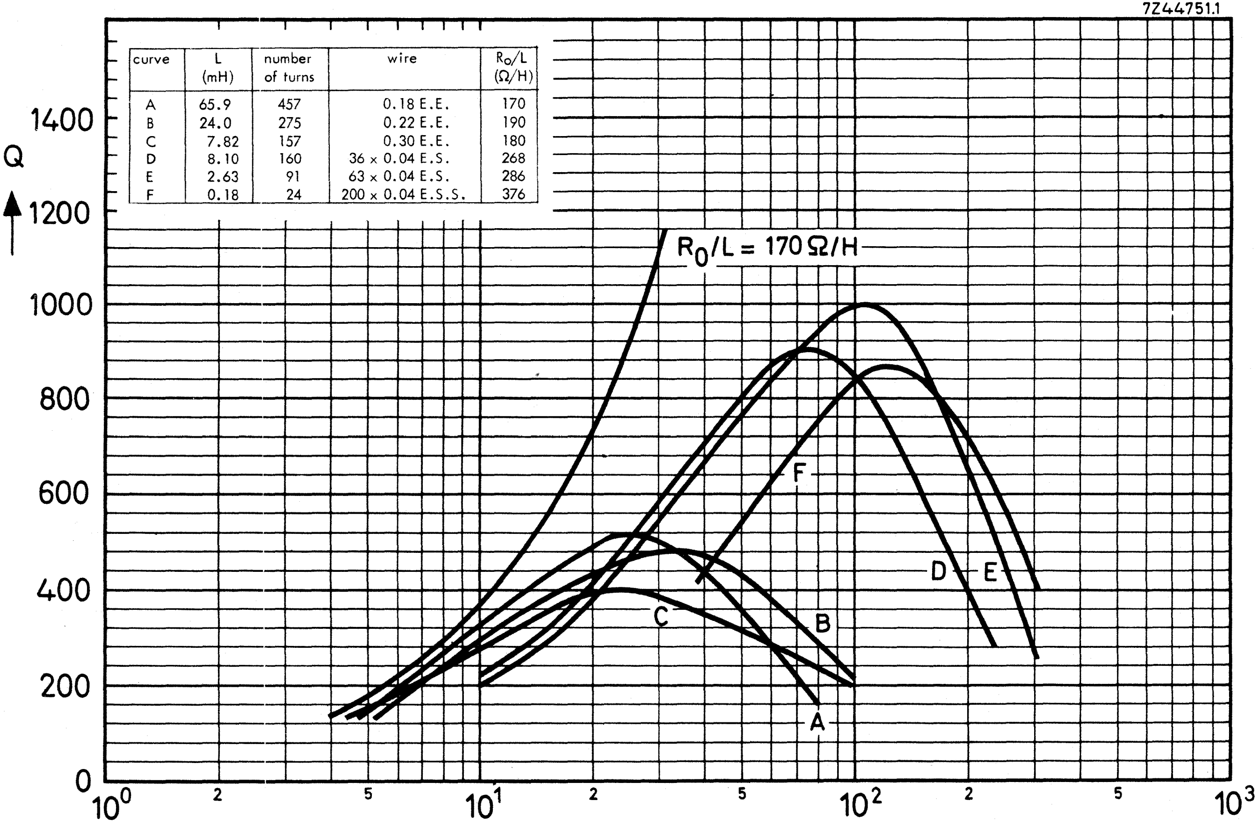
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	29.7	457	0.18 E.E.	378
B	10.8	273	0.22 E.E.	423
C	3.53	157	0.30 E.E.	399
D	3.66	160	36 × 0.04 E.S.	594
E	1.18	91	63 × 0.04 E.S.	637
F	0.08	24	200 × 0.04 E.S.S.	826

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 68$



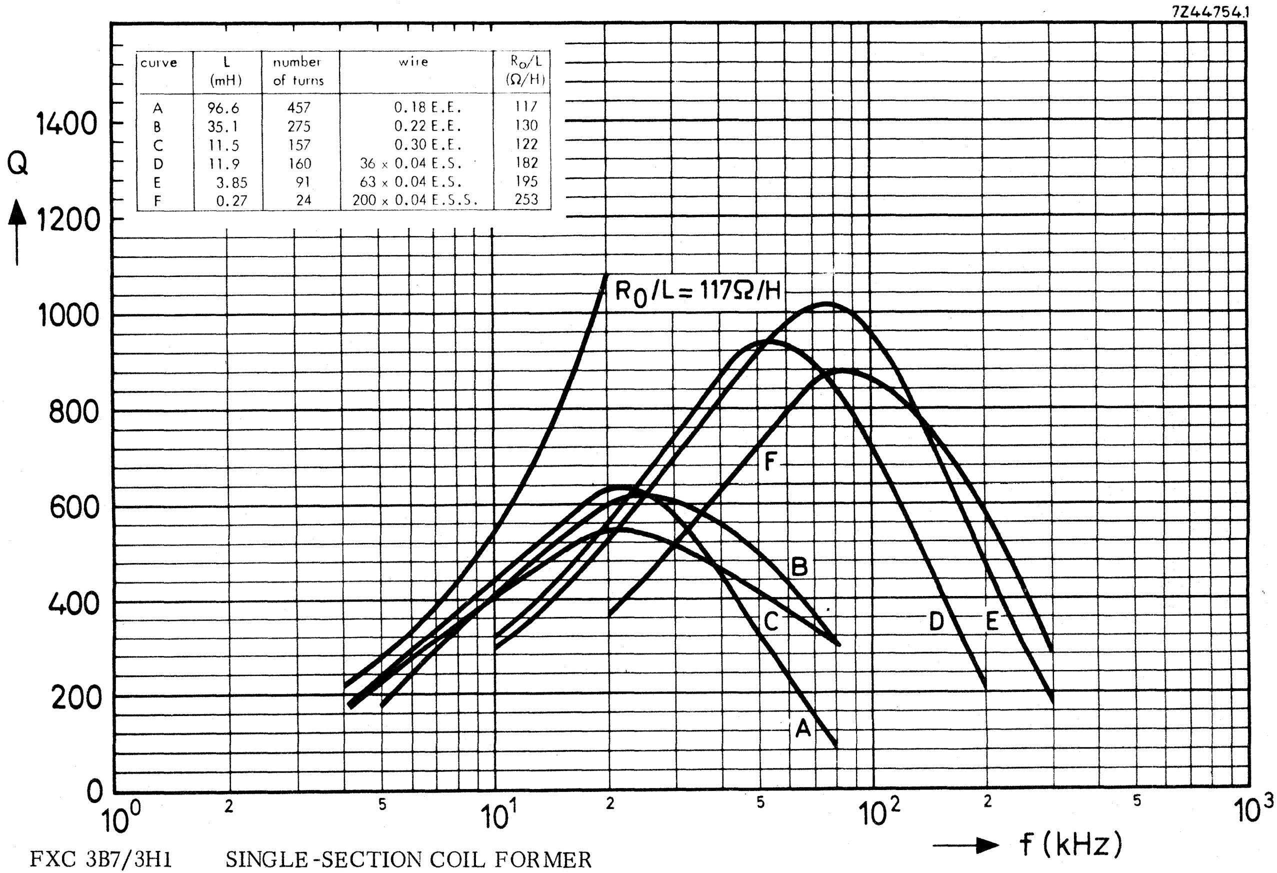
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	43.9	457	0.18 E.E.	255
B	16.0	275	0.22 E.E.	286
C	5.21	157	0.30 E.E.	271
D	5.40	160	36 × 0.04 E.S.	402
E	1.75	91	63 × 0.04 E.S.	430
F	0.12	24	200 × 0.04 E.S.S.	564

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 100$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	65.9	457	0.18 E.E.	170
B	24.0	275	0.22 E.E.	190
C	7.82	157	0.30 E.E.	180
D	8.10	160	36 × 0.04 E.S.	268
E	2.63	91	63 × 0.04 E.S.	286
F	0.18	24	200 × 0.04 E.S.S.	376

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 150$

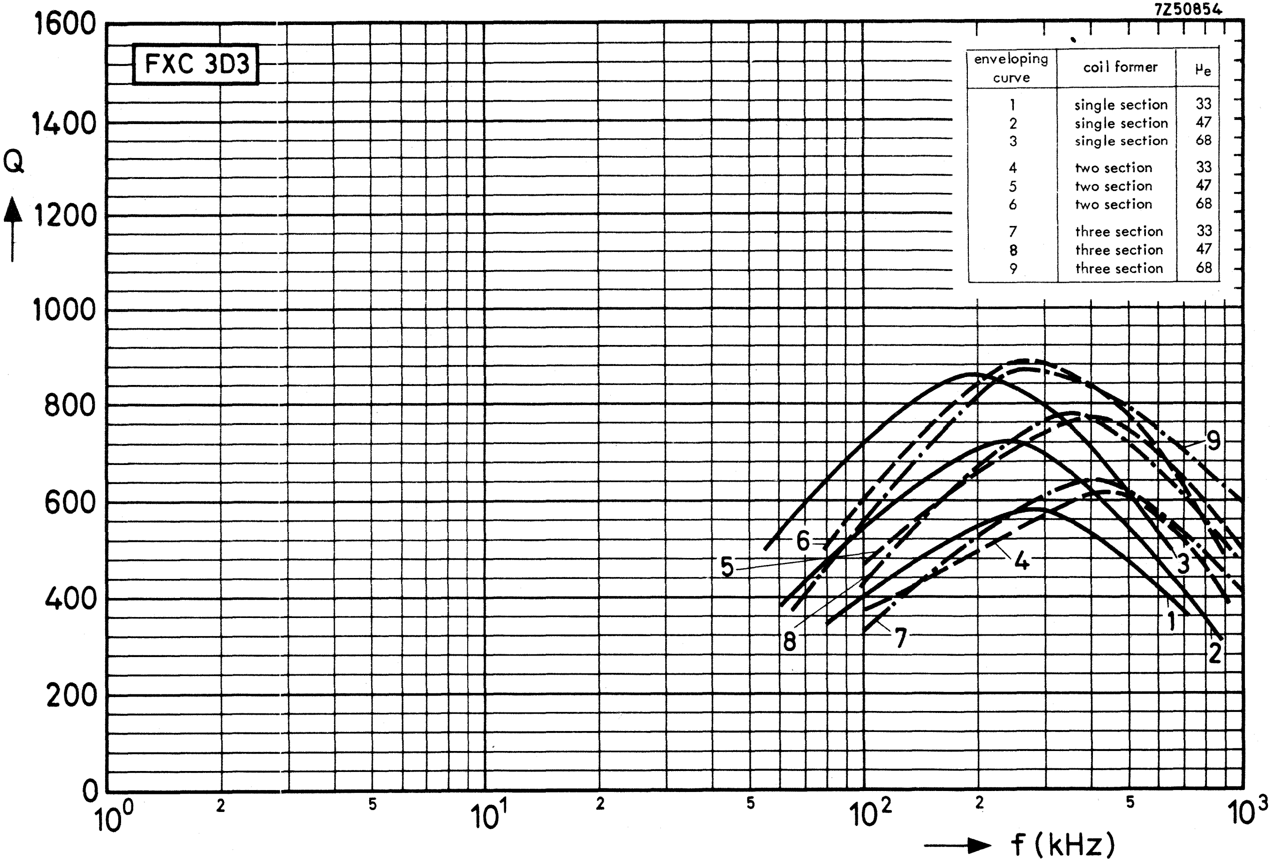


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	96.6	457	0.18 E.E.	117
B	35.1	275	0.22 E.E.	130
C	11.5	157	0.30 E.E.	122
D	11.9	160	36 × 0.04 E.S.	182
E	3.85	91	63 × 0.04 E.S.	195
F	0.27	24	200 × 0.04 E.S.S.	253

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

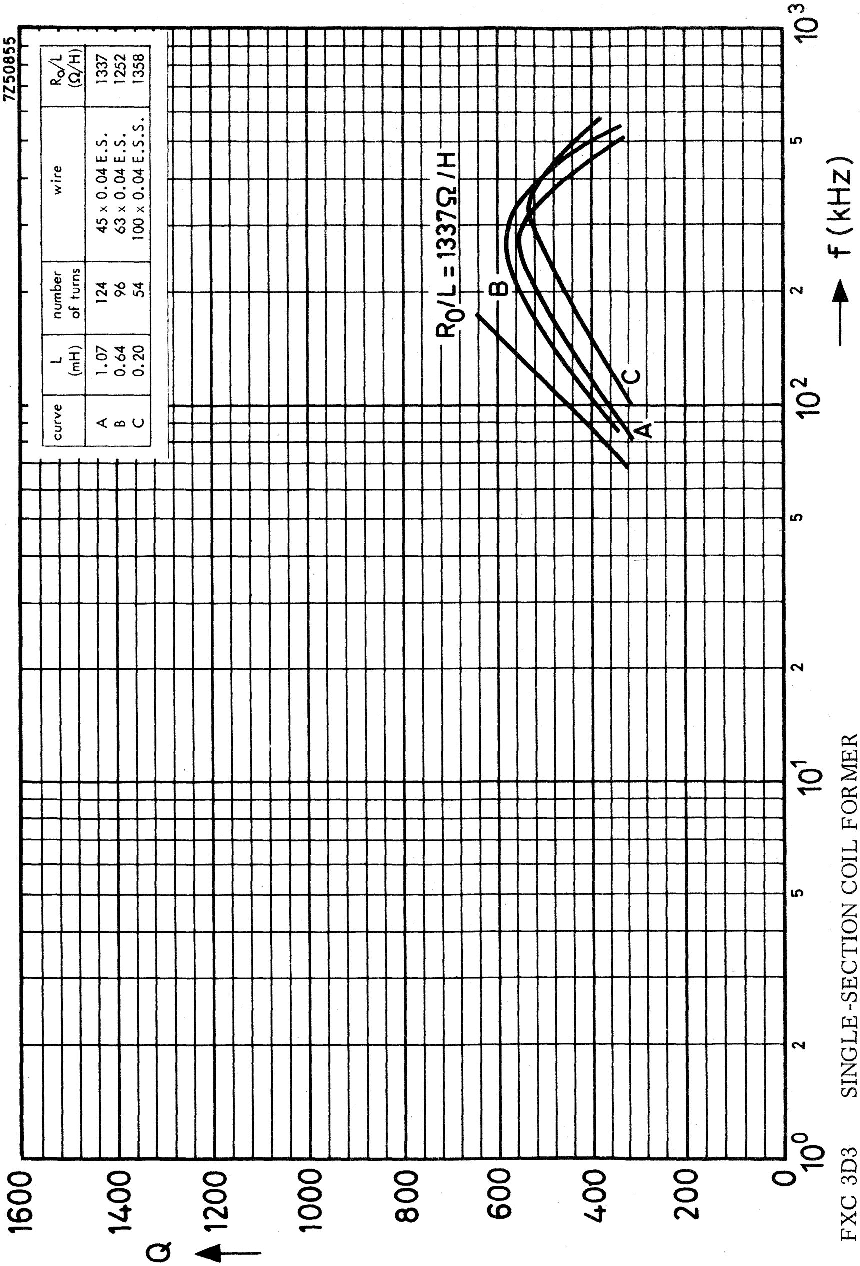
$\mu_e = 220$

TYPICAL Q-CURVES FOR FXC 3D3



enveloping curve	coil former	μ_e
1	single section	33
2	single section	47
3	single section	68
4	two section	33
5	two section	47
6	two section	68
7	three section	33
8	three section	47
9	three section	68

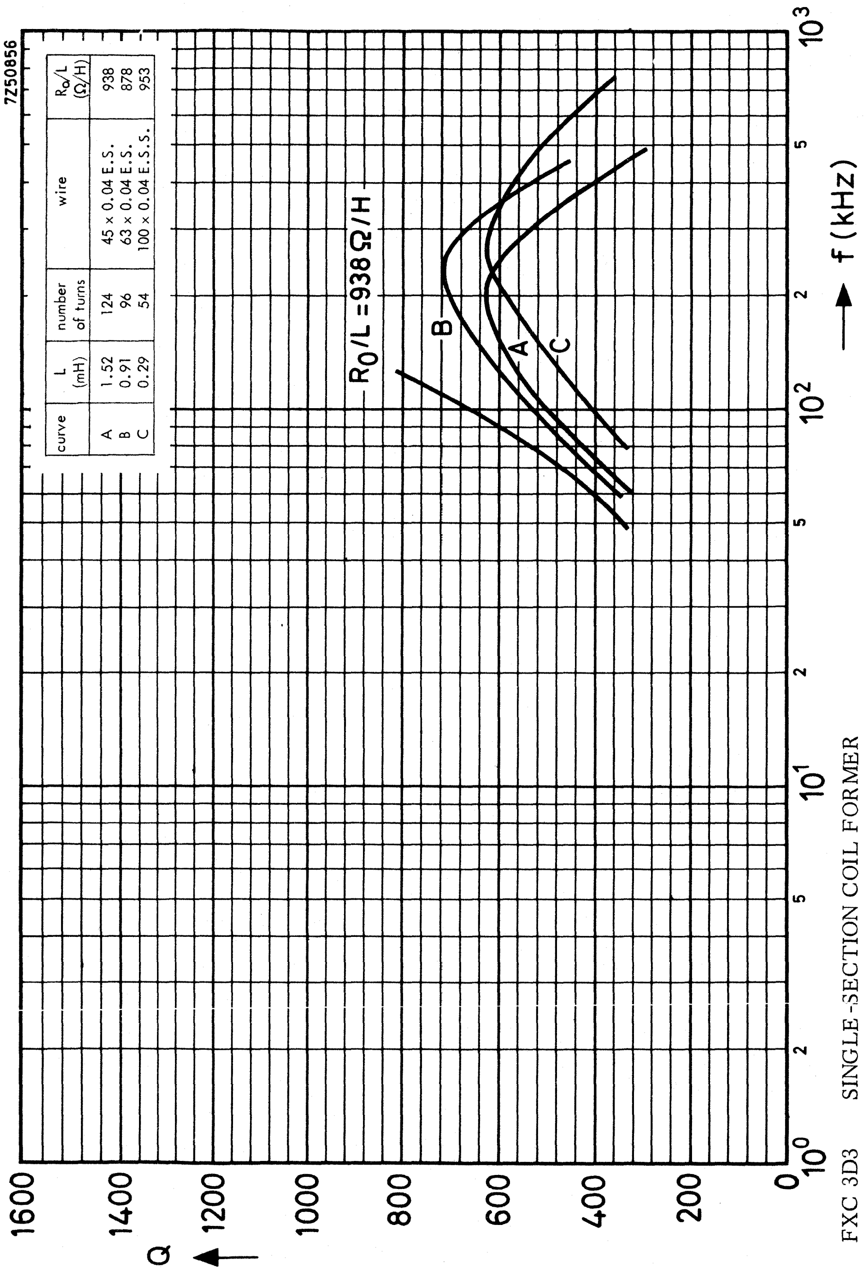
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.07	124	45 × 0.04 E.S.	1337
B	0.64	96	63 × 0.04 E.S.	1252
C	0.20	54	100 × 0.04 E.S.S.	1358

FXC 3D3 SINGLE-SECTION COIL FORMER

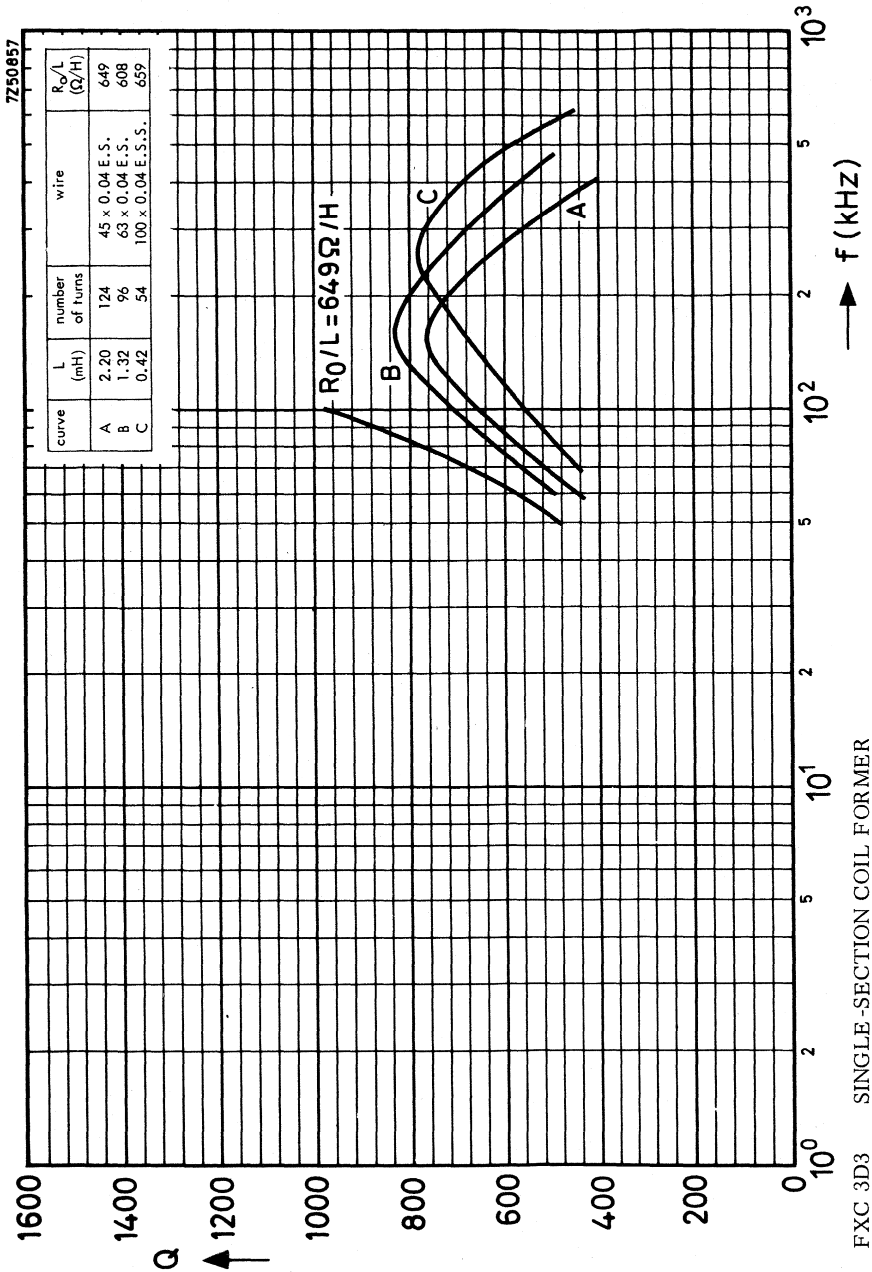
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.52	124	45 × 0.04 E.S.	938
B	0.91	96	63 × 0.04 E.S.	878
C	0.29	54	100 × 0.04 E.S.S.	953

FXC 3D3 SINGLE-SECTION COIL FORMER

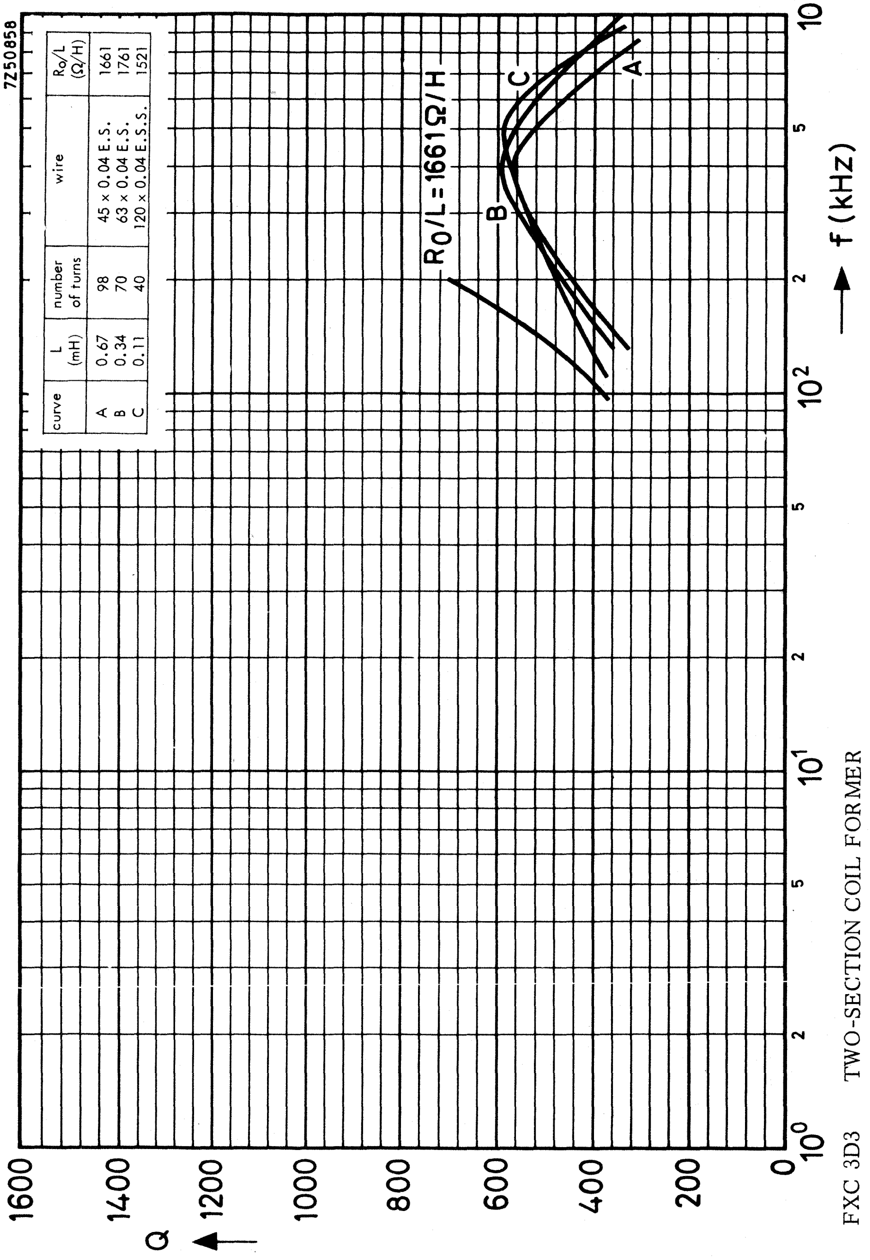
$\mu_e = 47$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	2.20	124	45 × 0.04 E.S.	649
B	1.32	96	63 × 0.04 E.S.	608
C	0.42	54	100 × 0.04 E.S.S.	659

FXC 3D3 SINGLE-SECTION COIL FORMER

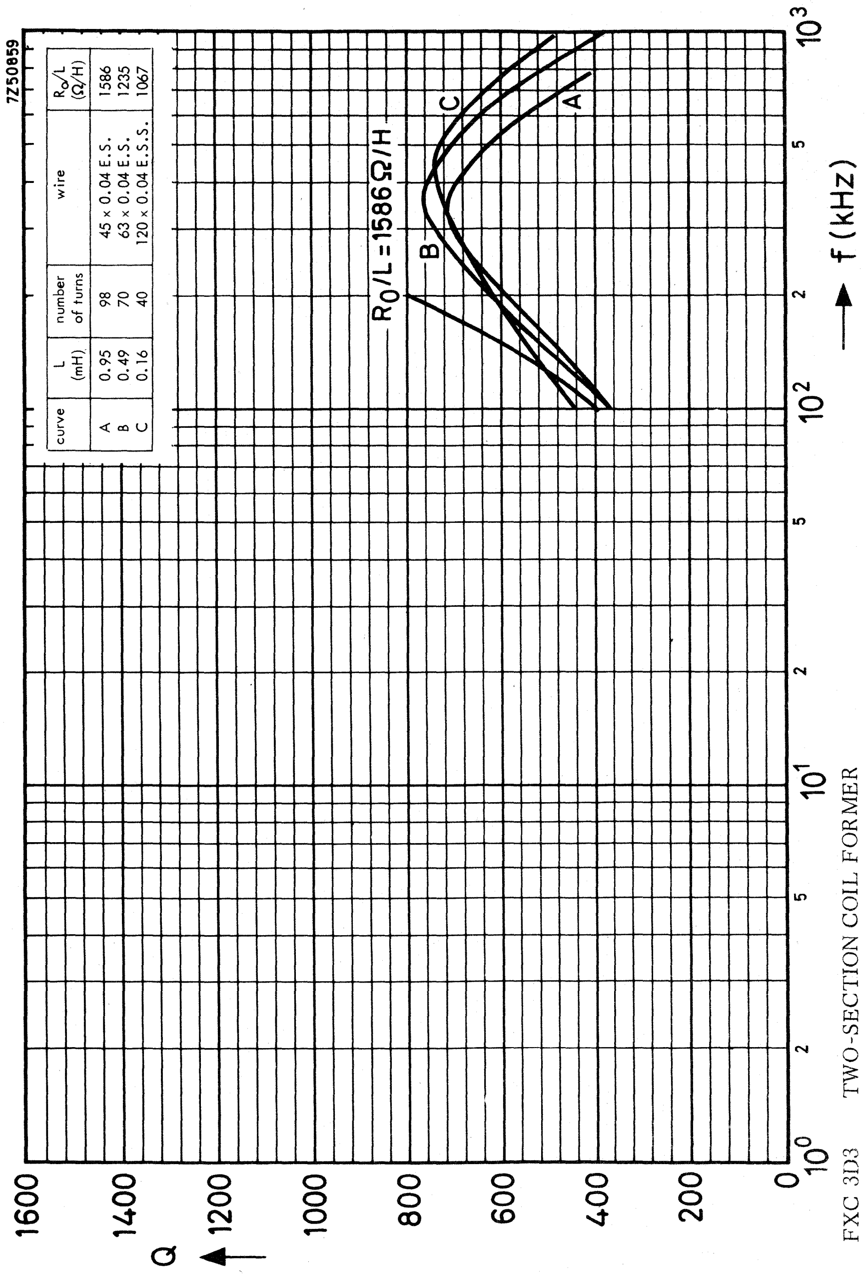
$\mu_e = 68$



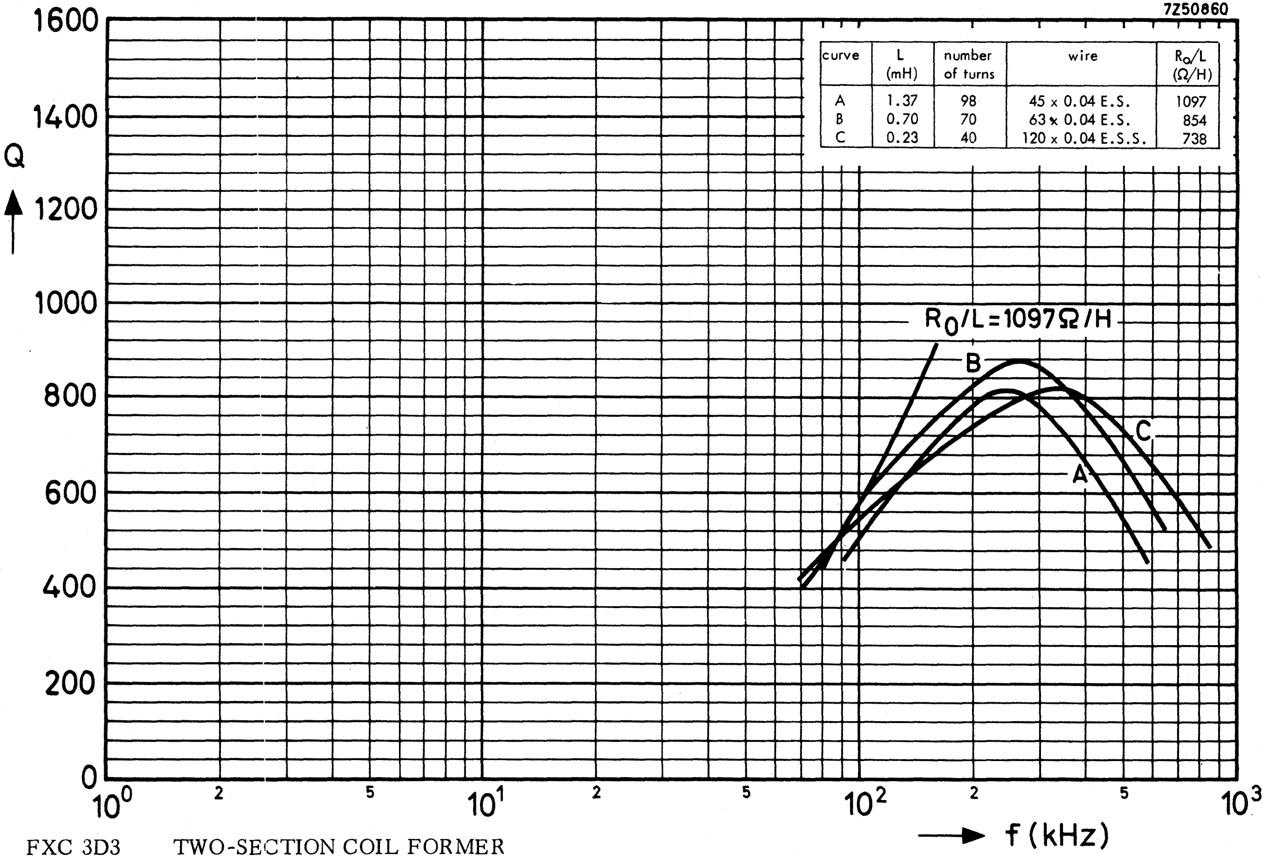
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	0.67	98	45 × 0.04 E.S.	1661
B	0.34	70	63 × 0.04 E.S.	1761
C	0.11	40	120 × 0.04 E.S.S.	1521

FXC 3D3 TWO-SECTION COIL FORMER

$\mu_e = 33$



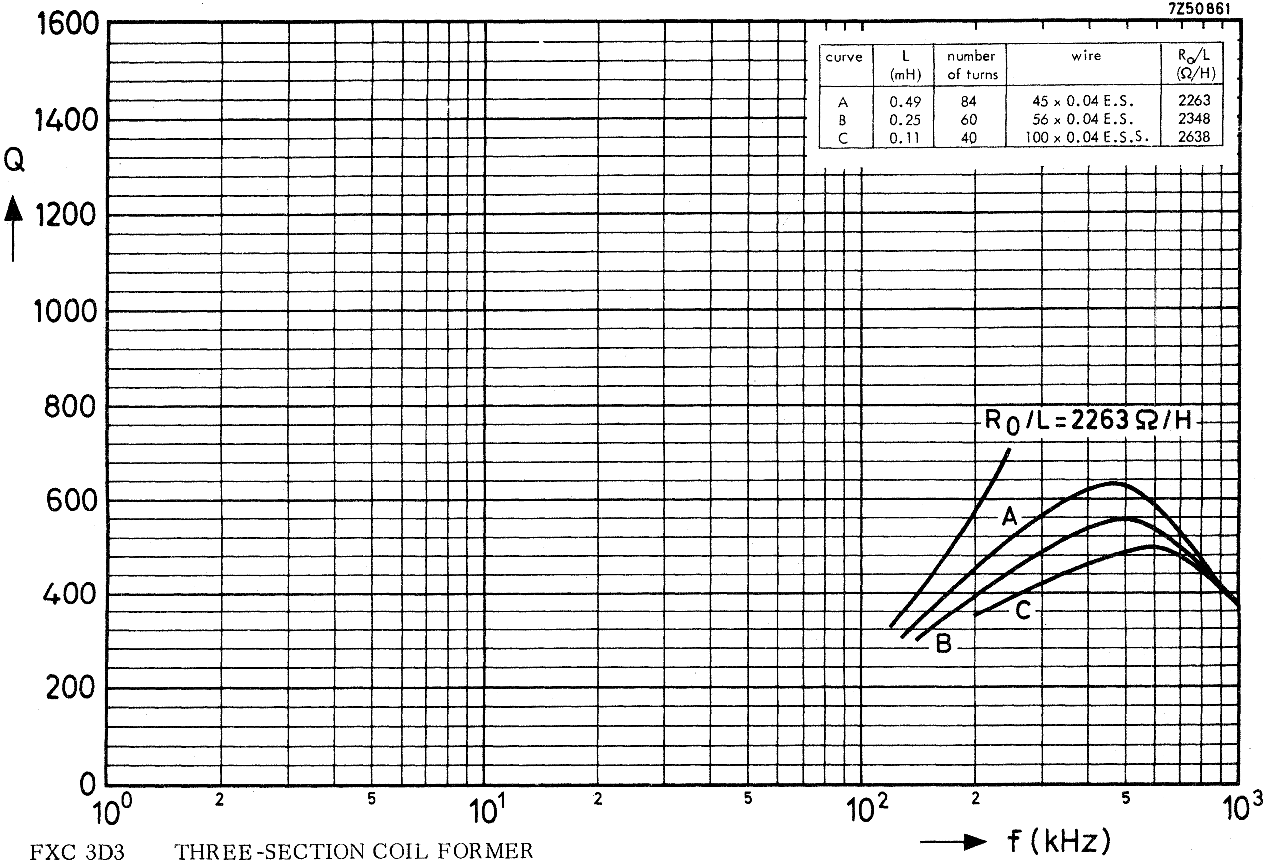
FXC 3D3 TWO-SECTION COIL FORMER
$\mu_e = 47$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.37	98	45 x 0.04 E.S.	1097
B	0.70	70	63 x 0.04 E.S.	854
C	0.23	40	120 x 0.04 E.S.S.	738

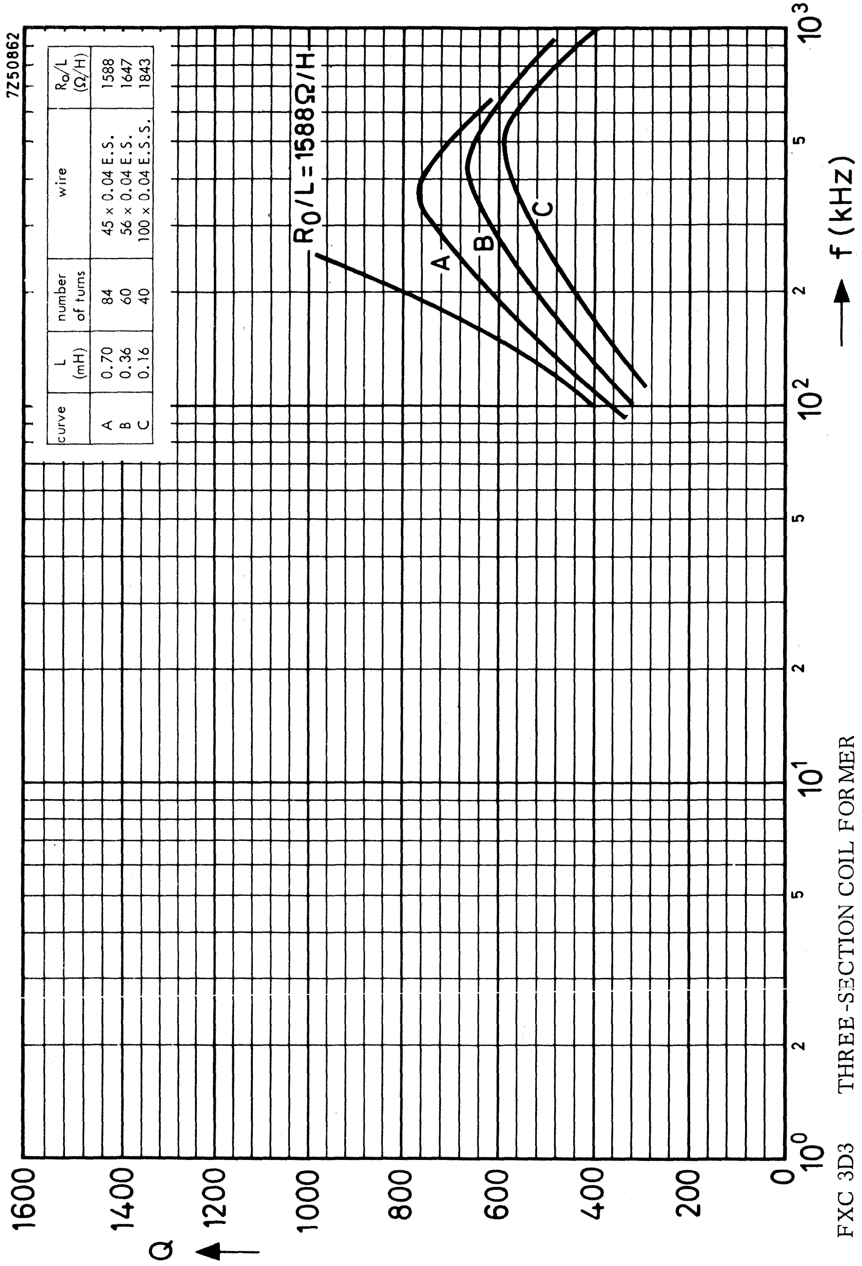
FXC 3D3 TWO-SECTION COIL FORMER

$\mu_e = 68$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	0.49	84	45 × 0.04 E.S.	2263
B	0.25	60	56 × 0.04 E.S.	2348
C	0.11	40	100 × 0.04 E.S.S.	2638

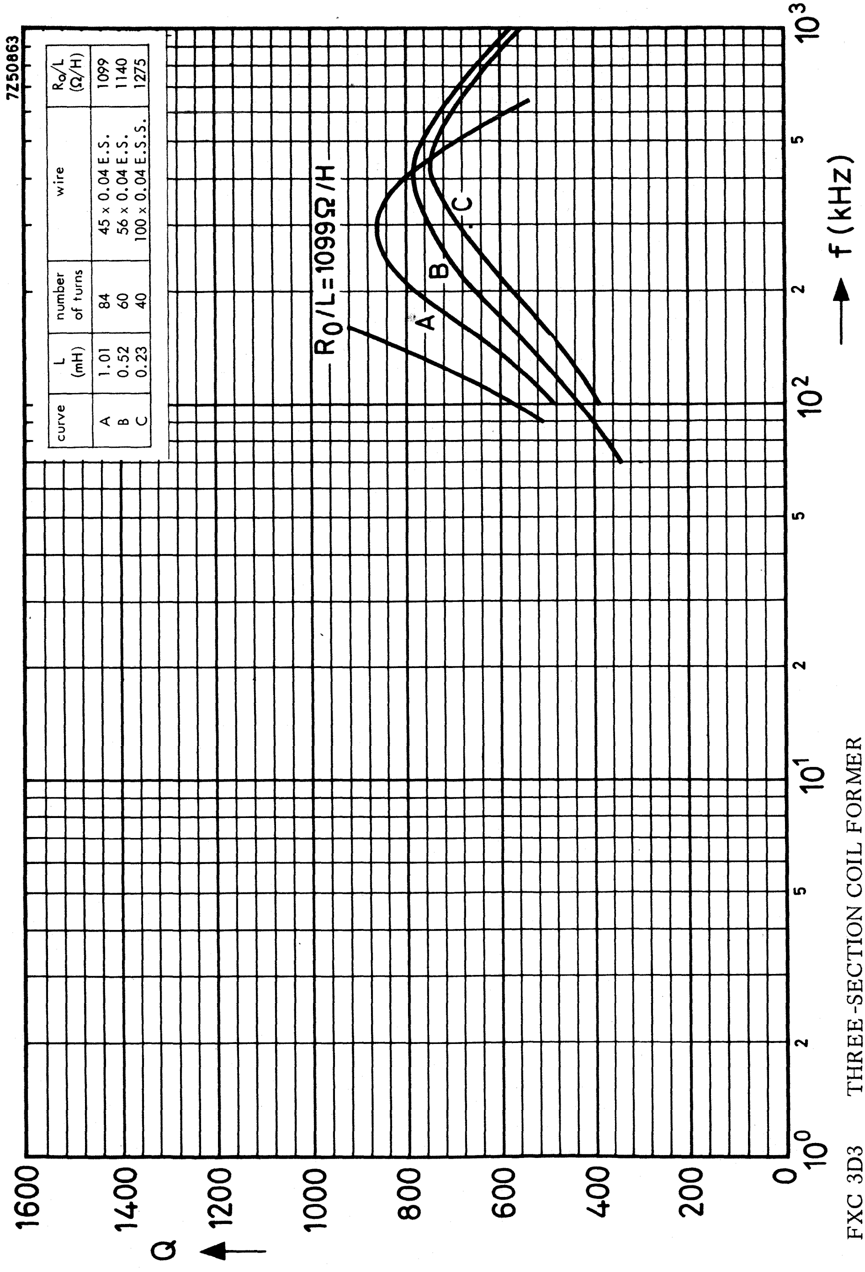
FXC 3D3 THREE-SECTION COIL FORMER
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	0.70	84	45 × 0.04 E.S.	1588
B	0.36	60	56 × 0.04 E.S.	1647
C	0.16	40	100 × 0.04 E.S.S.	1843

FXC 3D3 THREE-SECTION COIL FORMER

$\mu_e = 47$

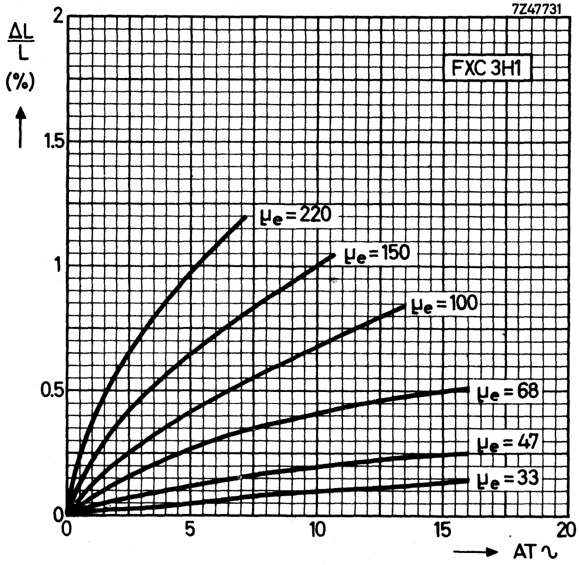


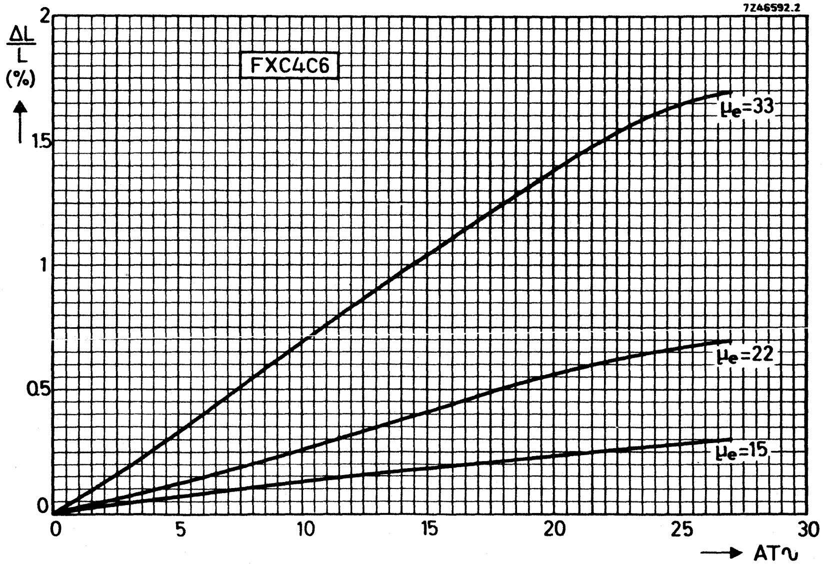
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.01	84	45 x 0.04 E.S.	1099
B	0.52	60	56 x 0.04 E.S.	1140
C	0.23	40	100 x 0.04 E.S.S.	1275

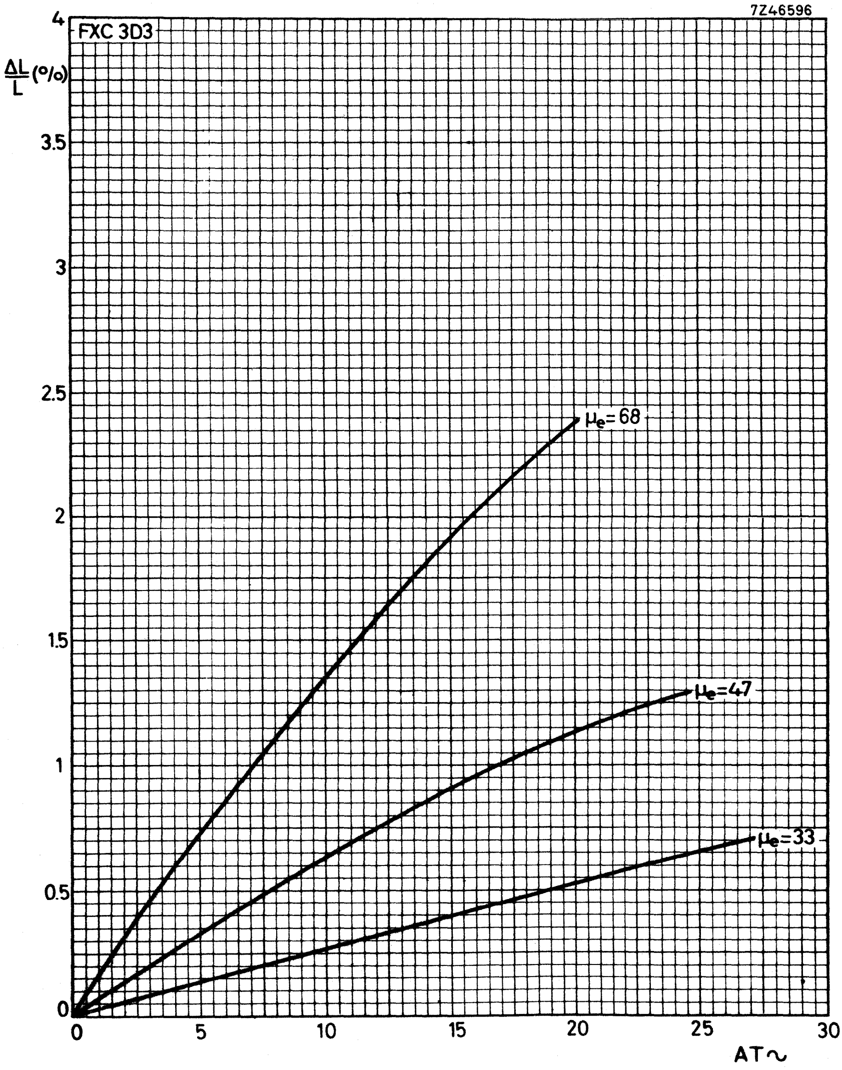
FXC 3D3 THREE-SECTION COIL FORMER

$\mu_e = 68$

INDUCTANCE VARIATION AS A FUNCTION OF AT$_\sim$

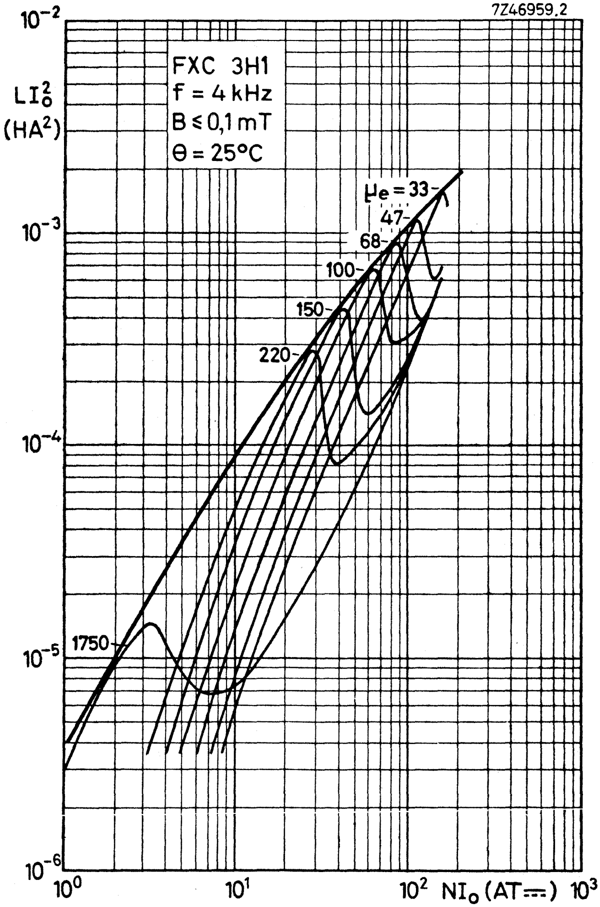


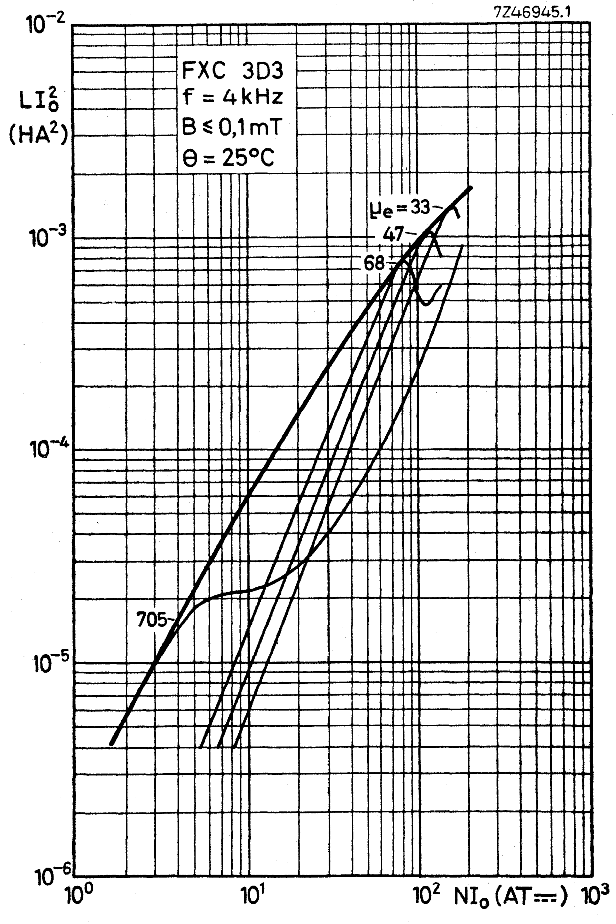



7Z46596
FXC 3D3
$\frac{\Delta L}{L}$ (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
μ_e = 68
μ_e = 47
μ_e = 33
0
5
10
15
20
25
30
AT∼

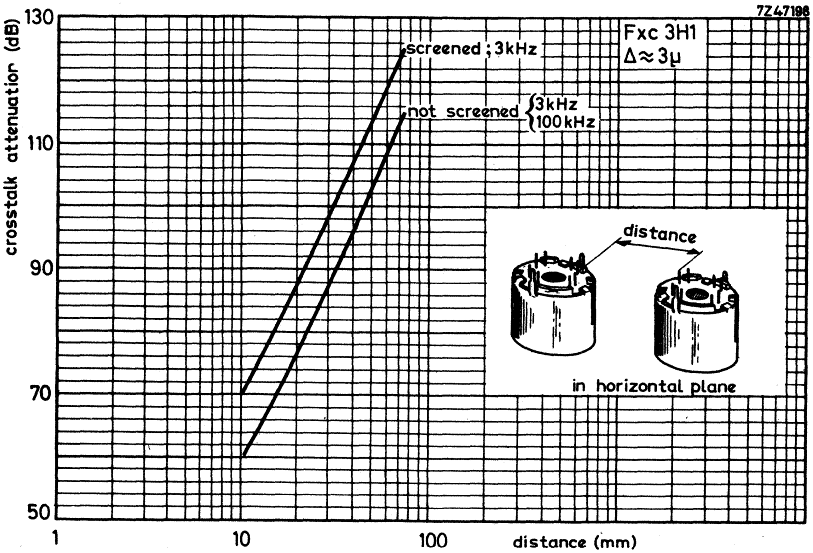
HANNA CURVES (typical values)

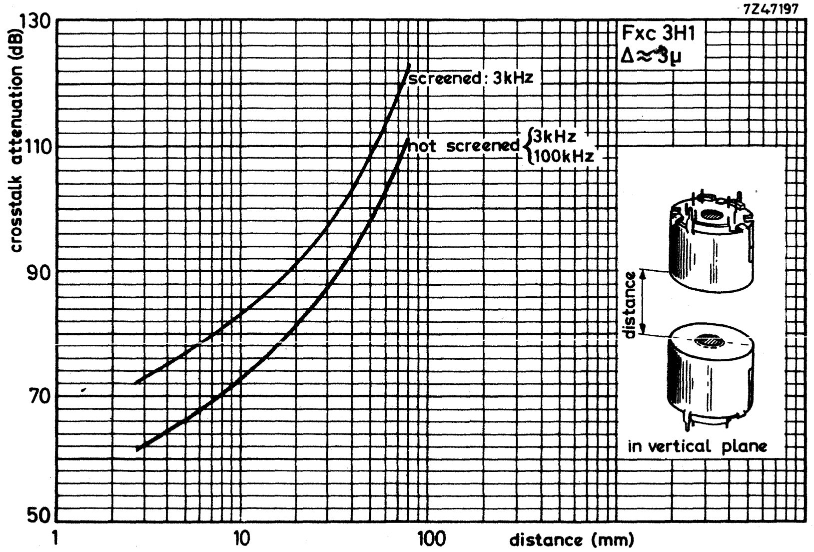
These curves indicate the optimum inductance for a certain μ_e-value and direct current.

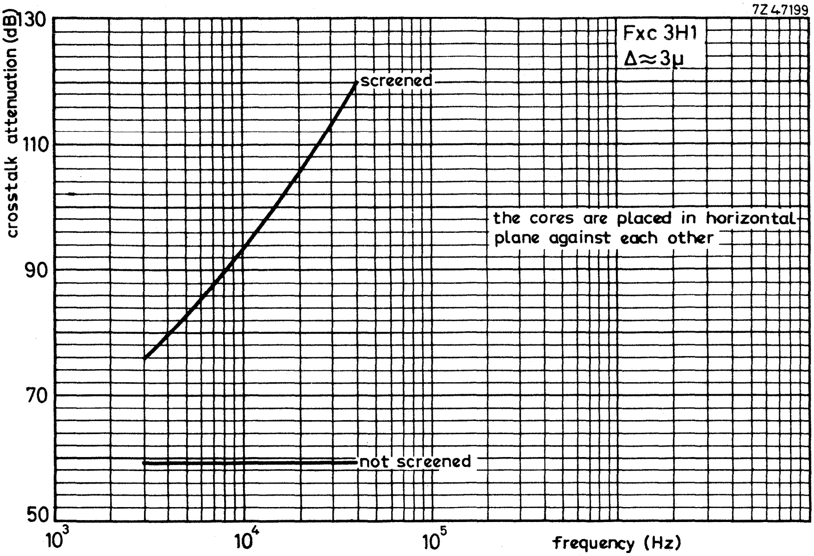



7Z46945.1
FXC 3D3
f = 4 kHz
B ≤ 0,1 mT
Θ = 25°C
LI_0^2 (HA^2)
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
$\mu_e = 33$
47
68
705
10^0
10^1
10^2
NI_0 (AT ⎓)
10^3

CROSSTALK ATTENUATION






7Z47199
Fxc 3H1
Δ≈3μ
crosstalk attenuation (dB)
130
110
90
70
50
screened
not screened
the cores are placed in horizontal plane against each other
10^3
10^4
10^5
frequency (Hz)

POTCORES

INTRODUCTION

Three types of core can be supplied:

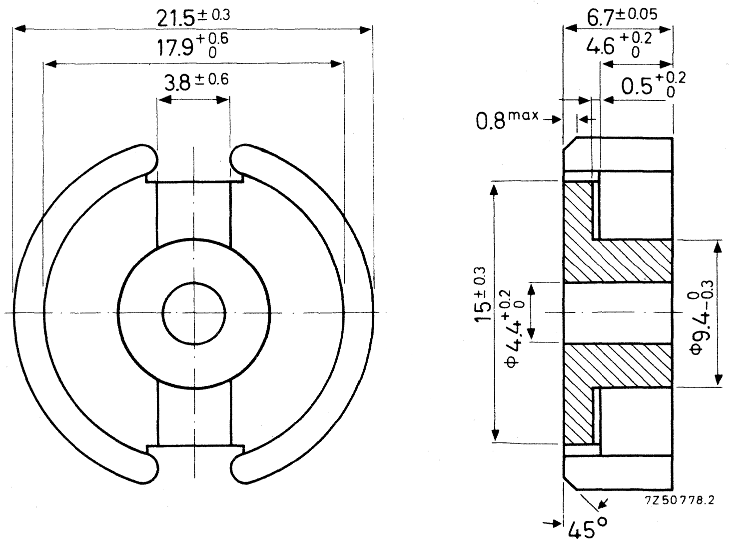
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 40 potcore halves or 20 pieces of pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores. So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 21750
3H1	4322 020 21760
3D3	4322 020 21770
3E1	4322 020 21850
4C6	4322 020 21830

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I

	temp. (^oC)	grade				
		3B7	3H1	3D3	3E1	4C6
$\alpha_F \times 10^6$	+5 to +25	–	+0.5 to +1.5			-2 to +4
	+5 to +55	–	–			–
	+25 to +55	–	+0.5 to +1.5			0 to +6
	+25 to +70	-0.6 to +0.6		0 to 2	0 to 2	–
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 4.3	≤ 4.3	≤ 12		≤ 10

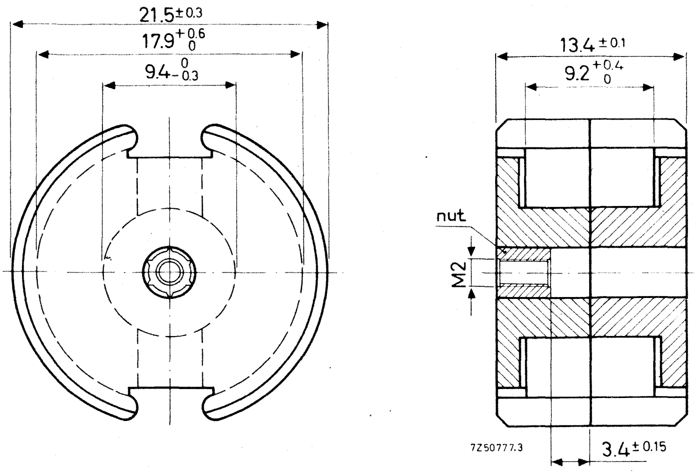
For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 140 Newton, the values in Table II are guaranteed at 25±10 ^oC.

Table II

	$\hat{B}$ (mT)	freq. (MHz)	grade				
			3B7	3H1	3D3	3E1	4C6
μ_e	$\leq 0,1$	0.004	≥ 1400	≥ 1400		2220-3280	
	$\leq 0,1$	0.1			≥ 540		≥ 93
A_L	$\leq 0,1$	0.004				5600-8290	
α	$\leq 0,1$	0.004	≤ 16.8	≤ 16.8			
	$\leq 0,1$	0.1			≤ 27.0		≤ 64.7
$\frac{\tan\delta}{\mu_i} \times 10^6$	$\leq 0,1$	0.004	≤ 1.2	≤ 1.2		≤ 2.5	
	$\leq 0,1$	0.1	≤ 5	≤ 5	≤ 8	≤ 20	
	$\leq 0,1$	0.5			≤ 14	≤ 200	
	$\leq 0,1$	1			≤ 30		
		2					≤ 40
		10					≤ 100
$q_{2-24-100}$	1,5–3,0	0.004	≤ 1.8	≤ 1.4		≤ 3.0	
	0,3–1,2	0.1			≤ 3.0		≤ 10
$\eta_B \times 10^3$	1,5–3,0	0.004	≤ 1.1	≤ 0.86		≤ 1.8	
	0,3–1,2	0.1			≤ 1.8		≤ 6.2

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 2....
Without nut, catalogue number = 4322 022 0....

Weight per set 12 g

Mean length of lines of force l_e = 31,5 mm

$$\Sigma \frac{l_e}{A_e} = 0,497 \text{ mm}^{-1}$$

Effective volume V_e = 2000 mm^3

Pre-adjusted potcores with standard μ_e values [1]

μ_e	α	tolerance on inductance (%)	catal. No. 4322 022 2.... with nut 4322 022 0.... without nut			
			3B7	3H1	3D3	4C6
15	162	± 1	-	-	-	6810
22	134	± 1	-	-	-	6820
33	109.4	± 1	-	-	6430	6830
47	91.7	± 1	-	-	6440	-
68	76.2	± 1	6050	6250	6450	-
100	62.8	± 1.5	6060	6260	-	-
150	51.3	± 2	6070	6270	-	-
220	42.4	± 3	6080	6280	-	-
330	34.6	± 3	6090	6290	-	-
720	23.4	± 25	-	-	6400*	-
1840	14.6	± 25	6000*	6200*	-	-

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 15 up to and including 100
Asymmetric air gap for cores with an μ_e value of 150 up to and including 1840

---

1) See Notes on the next page.

*) Only available without nut.

Pre-adjusted potcores with standard A_L factors [1]

A_L	corresponding μ_e-value	tolerance on inductance %	catalogue No. 4322 022 2.... with nut 4322 022 0.... without nut			
			3B7	3H1	3D3	4C6
25	9, 9	± 1				7810
40	15, 8	± 1	–	–	7420	7820
63	25	± 1	–	–	7430	7830
100	39, 5	± 1	7040	7240	7440	7840
160	63, 5	± 1	7050	7250	7450	–
250	99	± 1, 5	7060	7260	7460	–
315	124, 5	± 2	7070	7270	–	–
400	158	± 2	7080	7280	–	–
630	249	± 3	7100	7300	–	–
1000	395	±3	7110	7310	–	–
1250	495	±3	–	7330	–	–
2500	990	± 10	7130	–	–	–

Inductance $L = N^2 A_L$ (in 10^{-9} H)

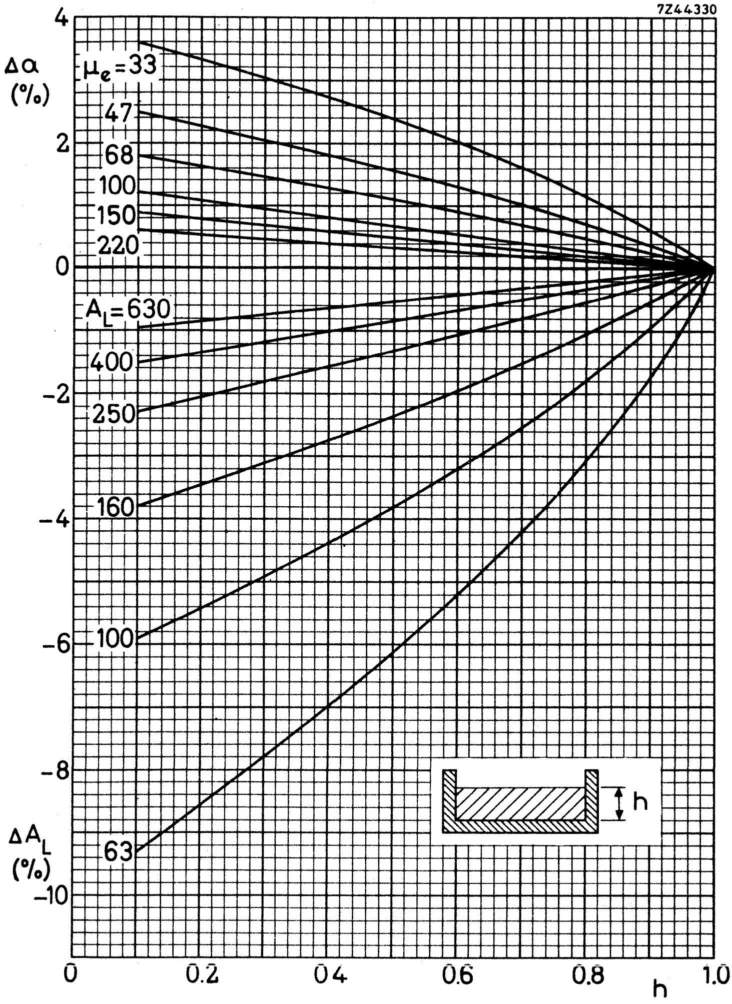
Symmetric air gap for cores with an A_L factor of 25 up to and including 315
Asymmetric air gap for cores with an A_L factor of 400 up to and including 1000

---

[1] Notes to the tables

1. Examples of catalogue number:
   μ_e = 15, grade 4C6, potcore with nut, catalogue number = 4322 022 26810
   A_L = 100, grade 3B7, potcore without nut, catalogue number = 4322 022 07040
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

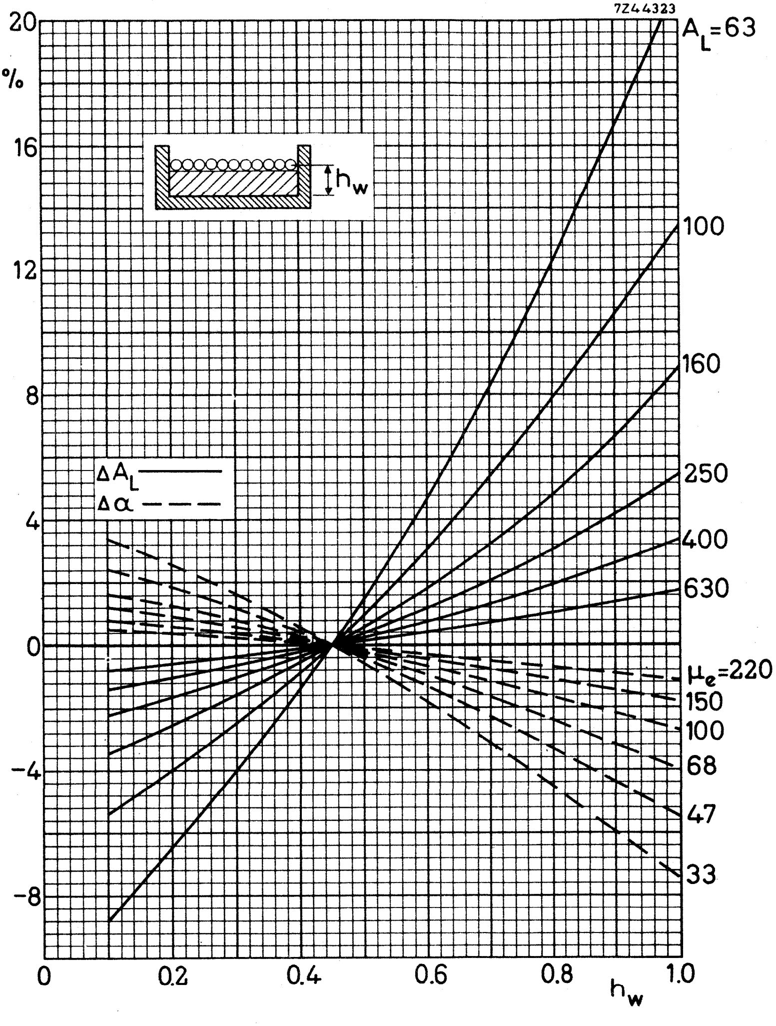
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: On a single-section coil former only 0.4 part of the available height is used. A potcore with μ_e = 68 in that case obtains an α factor of 76.2 + 1.25 %.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_w on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 68 obtains for that winding an α factor of 76.2 - 1.7 %.

COIL FORMERS

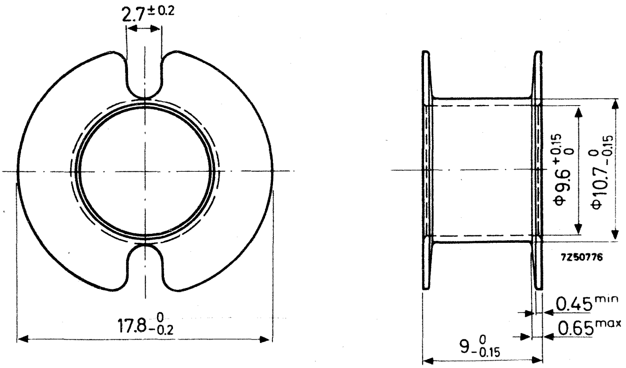
GENERAL

Three types of coil former can be supplied:

- with one section
- with two sections
- with three sections

The dimensions conform with the following specifications : IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain). ←
The dimensions in the drawings are in mm.

SINGLE-SECTION COIL FORMER



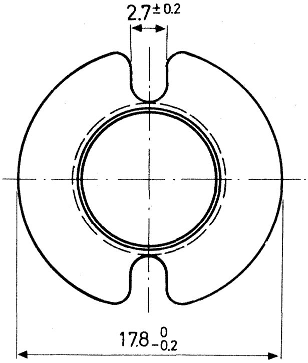
Catalogue number	4322 021 30300
Material	polycarbonate
Window area	28 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

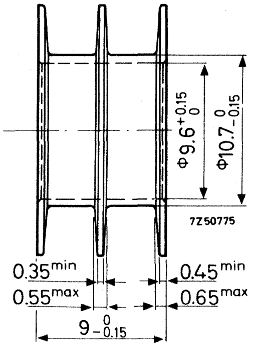
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11,0 \times 10^3\ \Omega/H$$

Weight	0, 35 g

TWO-SECTION COIL FORMER





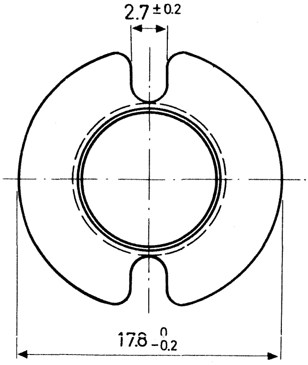
Catalogue number	4322 021 30310
Material	polycarbonate
Window area	2 x 13 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

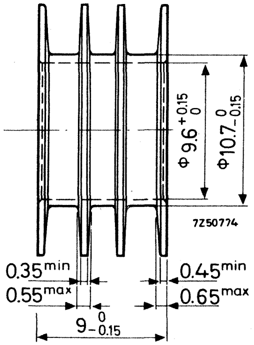
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11.6 \times 10^3 \ \Omega/H$$

Weight 0.4 g

THREE-SECTION COIL FORMER





Catalogue number	4322 021 30320
Material	polycarbonate
Window area	3 x 8.2 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 12.4 \times 10^3 \ \Omega/H$$

Weight 0.45 g

INDUCTANCE ADJUSTORS

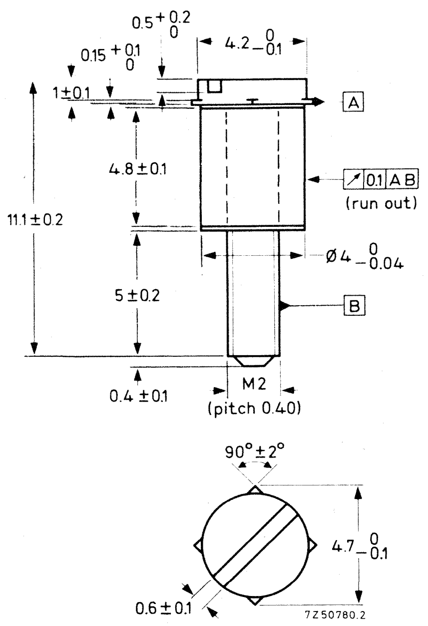


Fig. A

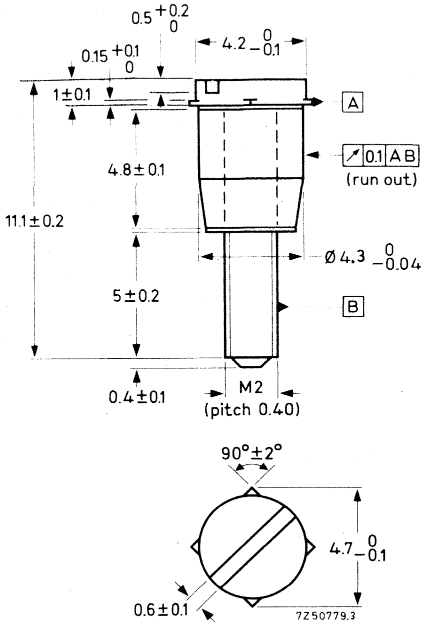


Fig. B

The tolerances on inductance of the pre-adjusted potcores (with adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different potcores.

Table I, types of adjustor

Fig.	colour	catalogue number
B	yellow	4322 021 31000
B	white	4322 021 31020
B	green	4322 021 31040
B	red	4322 021 31060
A	brown	4322 021 31100
B	black	4322 021 31240

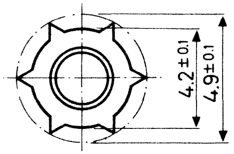
The adjustors are packed in bags of 100, so please order in multiples of 100.

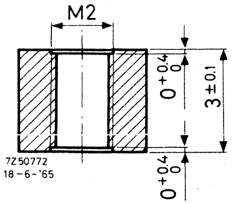
Table II, recommended application

μ_e	A_L	3B7/3H1/3D3	4C6
		catal. No. 4322 021	
	25	–	31060
15		–	31060
	40	–	31060
22		–	31000
	63	31040	31000
33		31040	31020
	100	31060	–
47		31060	–
68		31000	–
	160	31000	–
	250	31020	–
100		31020	–
	315	31020	–
150		31100	–
	400	31100	–
220		31100	–
	630	31100	–
330		31240	–

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.



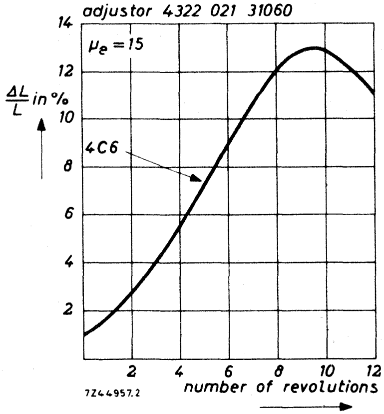


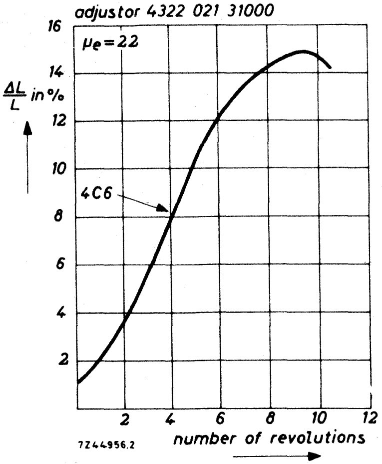
Catalogue number	4322 021 30150
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
→ Recommended distance from mating surface to nut	3, 4 ± 0, 15 mm

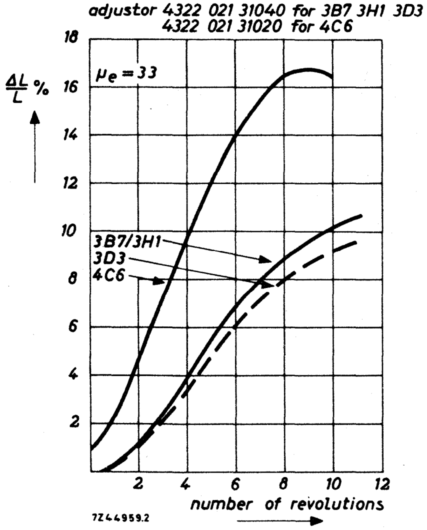
For more information see Potcores General, Inductance adjustment.

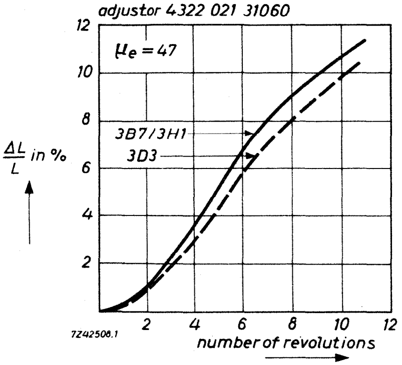
The nuts are packed in bags of 100, so please order in multiples of 100.

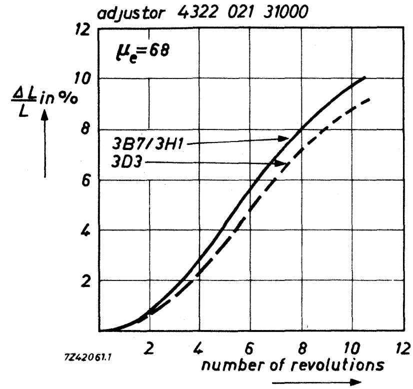
ADJUSTMENT CURVES

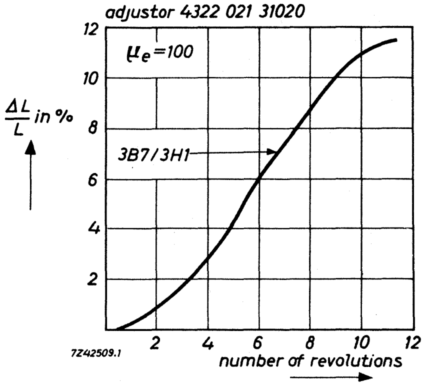


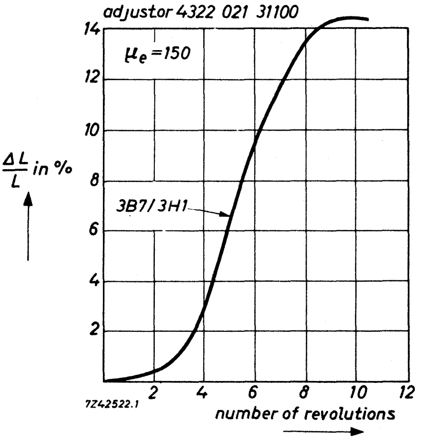


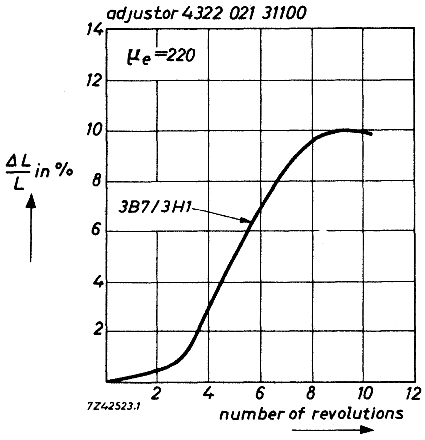


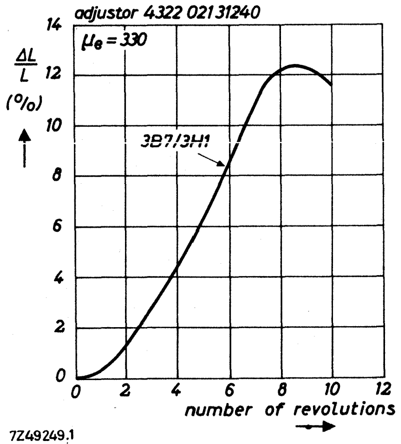



adjustor 4322 021 31000
μ_e=68
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
3B7/3H1
3D3
2
4
6
8
10
12
number of revolutions
7Z42061.1


adjustor 4322 021 31020
μ_e=100
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
3B7/3H1
2
4
6
8
10
12
number of revolutions
7Z42509.1

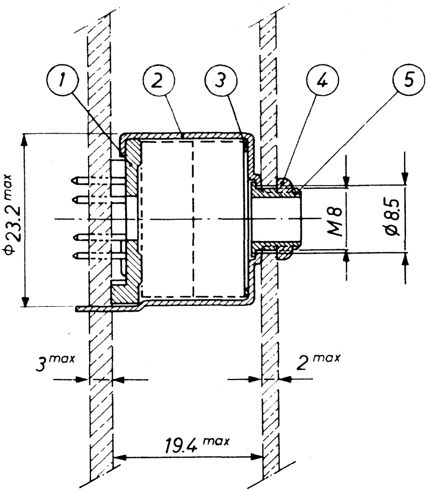

adjustor 4322 021 31100
μ_e=150
$\frac{\Delta L}{L}$ in %
14
12
10
8
6
4
2
3B7/3H1
2
4
6
8
10
12
number of revolutions
7Z42522.1

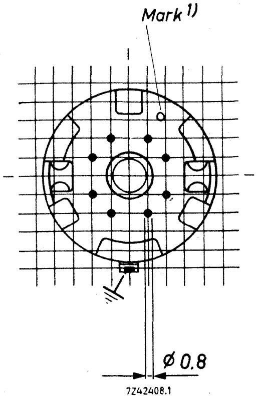

adjustor 4322 021 31100
μ_e=220
$\frac{\Delta L}{L}$ in %
14
12
10
8
6
4
2
3B7/3H1
2
4
6
8
10
12
number of revolutions
7Z42523.1

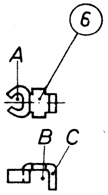

adjustor 4322 021 31240
μ_e = 330
$\frac{\Delta L}{L}$ (%)
14
12
10
8
6
4
2
0
3B7/3H1
0
2
4
6
8
10
12
number of revolutions
7Z49249.1

MOUNTING PARTS

MOUNTING







(1) tag plate	4322 021 30460	(4) nut	4322 021 30710
(2) brass container	4322 021 30540	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30650	(6) soldering spring	4322 021 30700 (8x)

The core is suitable for mounting on printed-wiring boards and on conventional panels.

The parts 1, 2, 3 (and 6) are sufficient to construct an assembly for use in combination with printed wiring.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The eight soldering pins are arranged to fit printed-wiring boards with a 0.1 inch grid as well as those with a 2.50 mm grid.

The pin length is sufficient for a board thickness up to 3 mm. The board should be provided with holes of 1.3 + 0.1 mm diameter.

---

[1] There is another mark hole in a similar position on the top of the container.

If one-hole mounting is preferred, the parts 4 and 5 should be added. The coil assembly may then be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

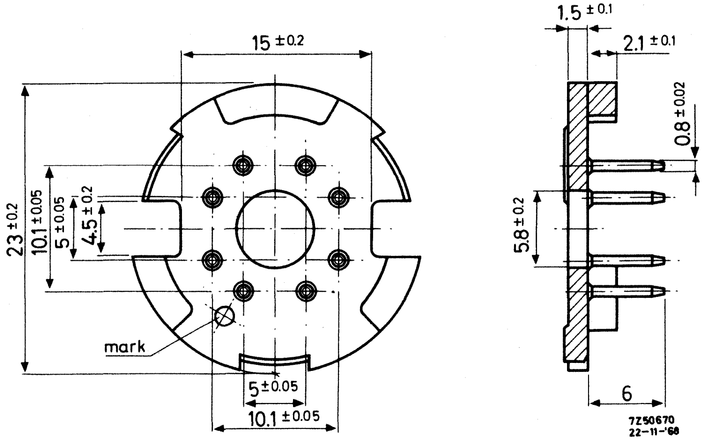
Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 140 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

(1) Tag plate 4322 021 30460

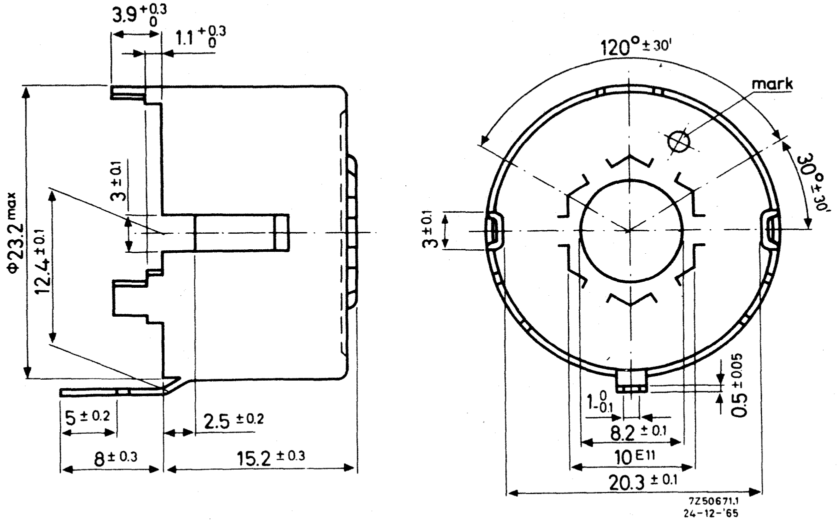
→ Plate : polyester reinforced with glass fibre

Pins : phosphorbronze, dipsoldered



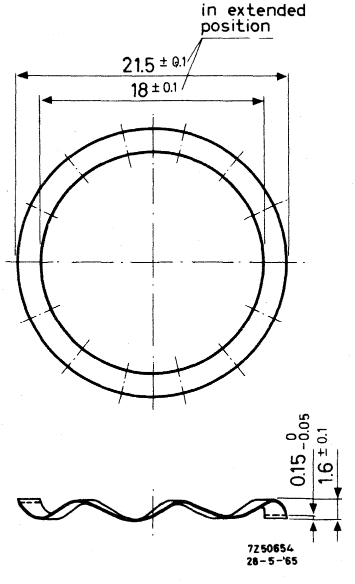
(2) Container 4322 021 30540

Material : brass, nickel plated ; tinned soldering pin



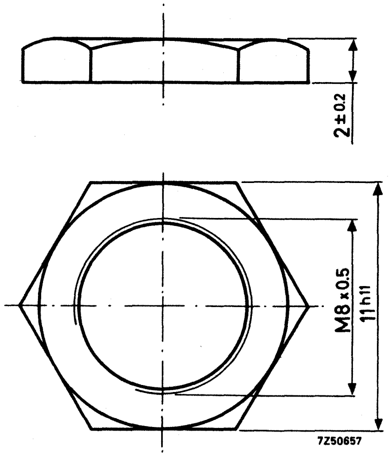
(3) Spring 4322 021 30650

Material : chrome- nickelsteel



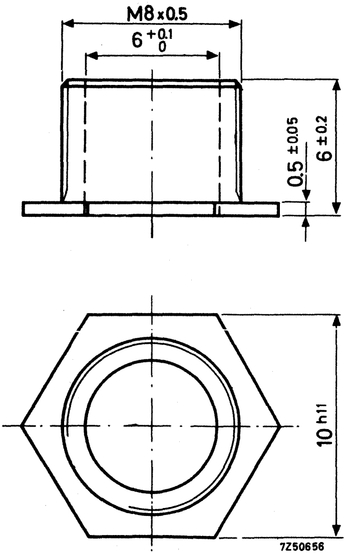
(4) Nut 4322 021 30710

Material: brass, nickel plated



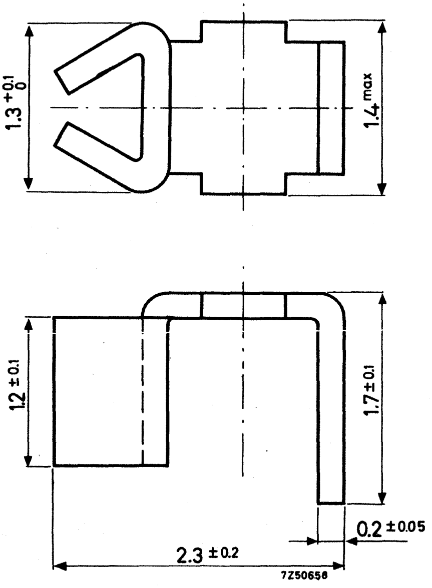
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



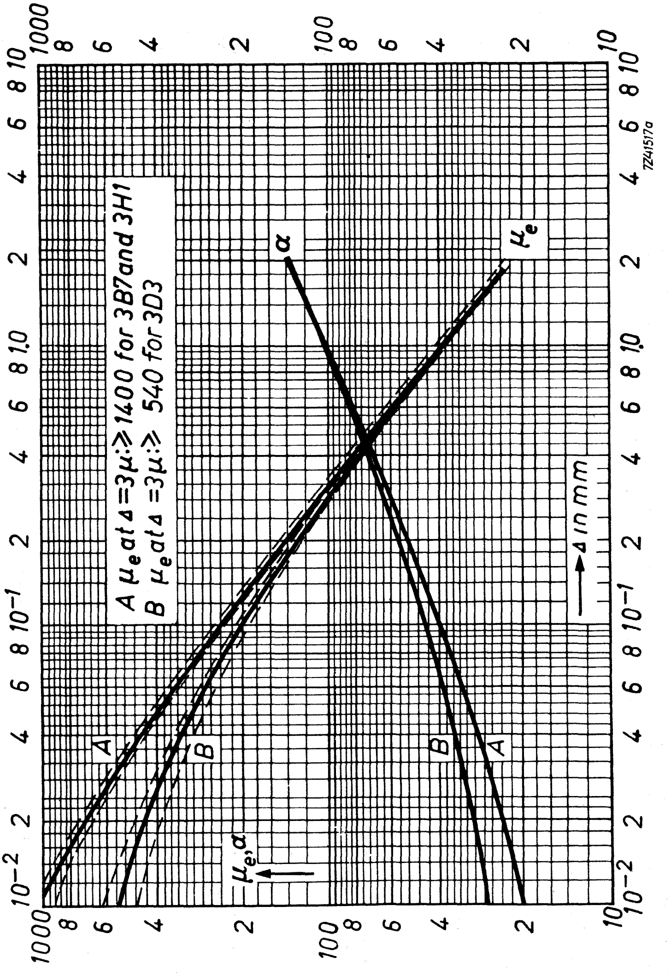
(6) Soldering spring 4322 021 30700

Material: brass, dipsoldered



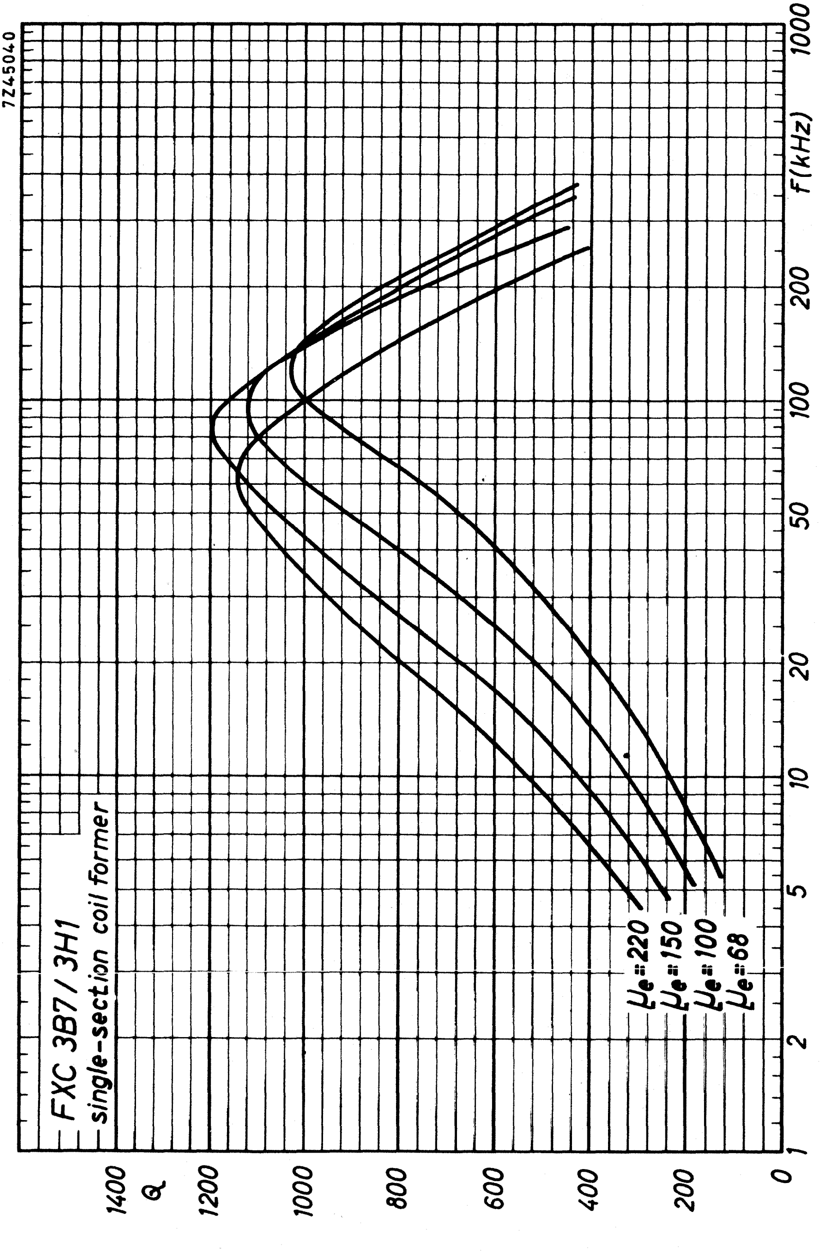
CHARACTERISTIC CURVES

μ_e - α curves

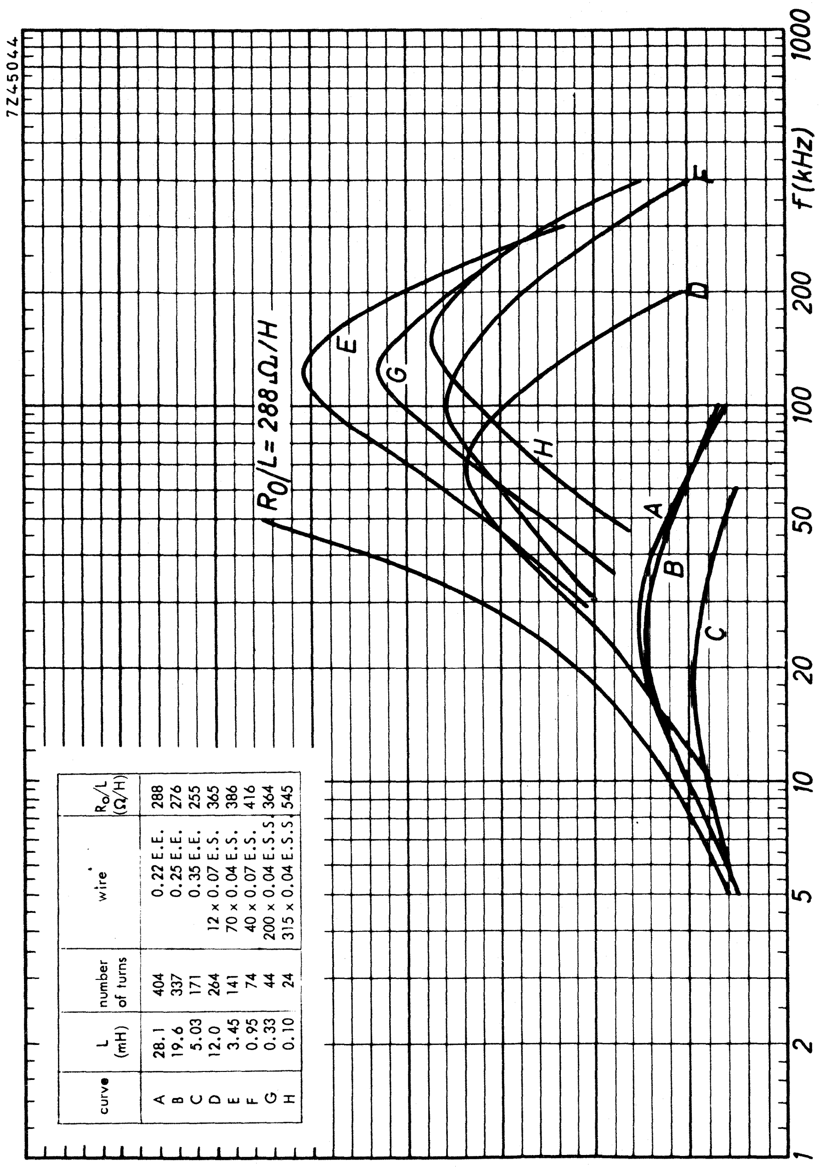


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



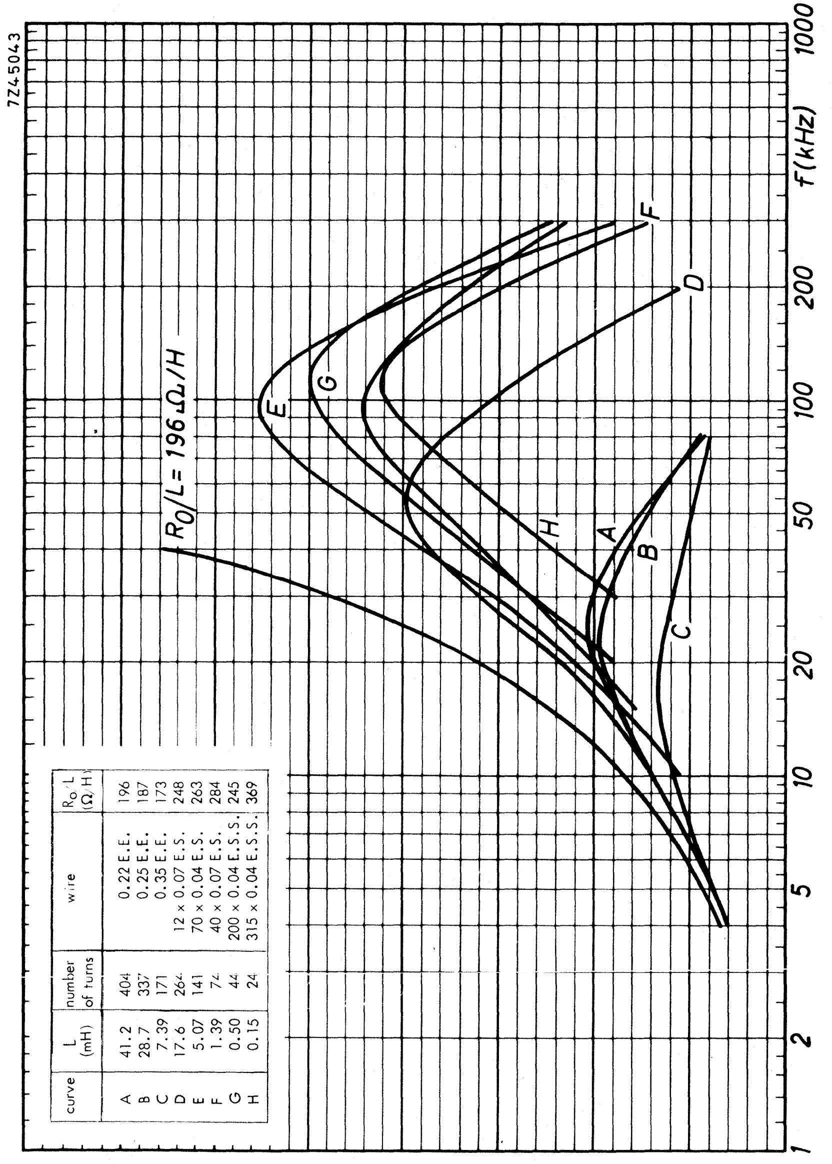
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	28.1	404	0.22 E.E.	288
B	19.6	337	0.25 E.E.	276
C	5.03	171	0.35 E.E.	255
D	12.0	264	12 × 0.07 E.S.	365
E	3.45	141	70 × 0.04 E.S.	386
F	0.95	74	40 × 0.07 E.S.	416
G	0.33	44	200 × 0.04 E.S.S.	364
H	0.10	24	315 × 0.04 E.S.S.	545

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

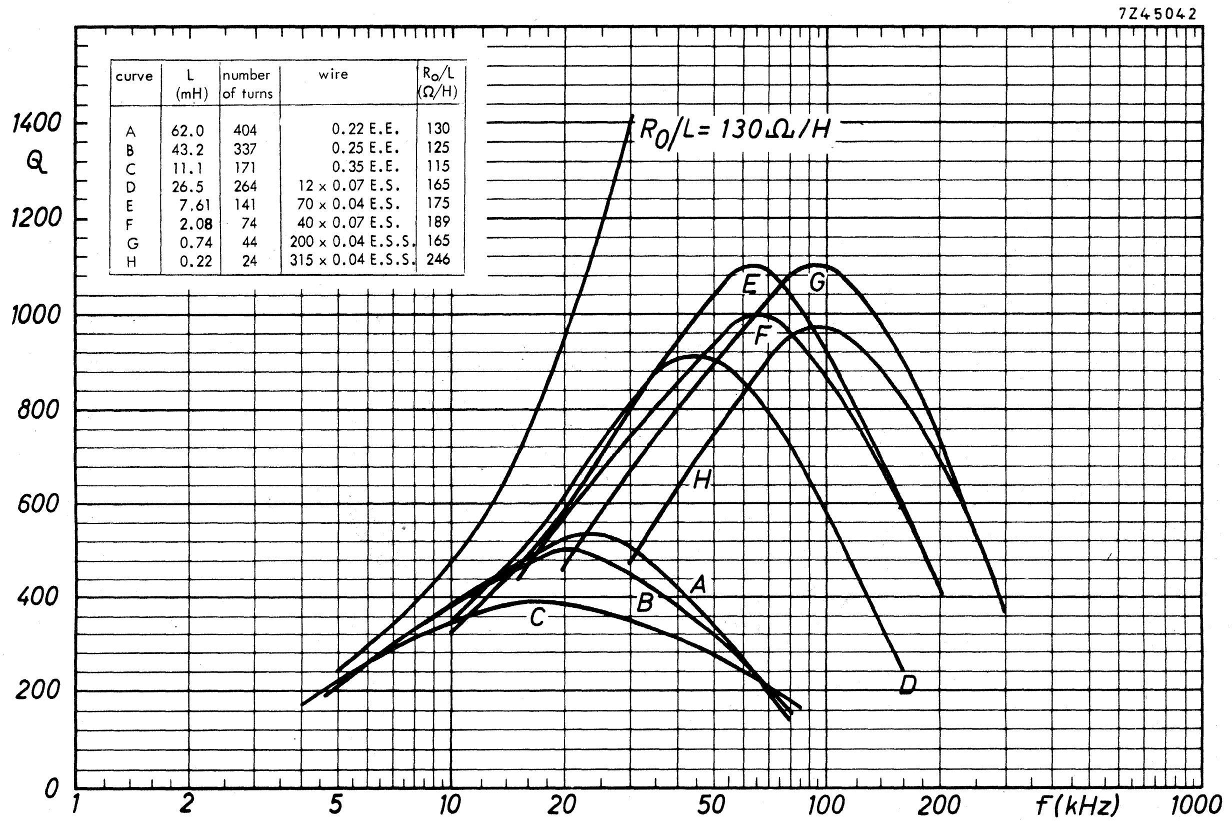
$\mu_e = 68$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	41.2	404	0.22 E.E.	196
B	28.7	337	0.25 E.E.	187
C	7.39	171	0.35 E.E.	173
D	17.6	264	12 × 0.07 E.S.	248
E	5.07	141	70 × 0.04 E.S.	263
F	1.39	74	40 × 0.07 E.S.	284
G	0.50	44	200 × 0.04 E.S.S.	245
H	0.15	24	315 × 0.04 E.S.S.	369

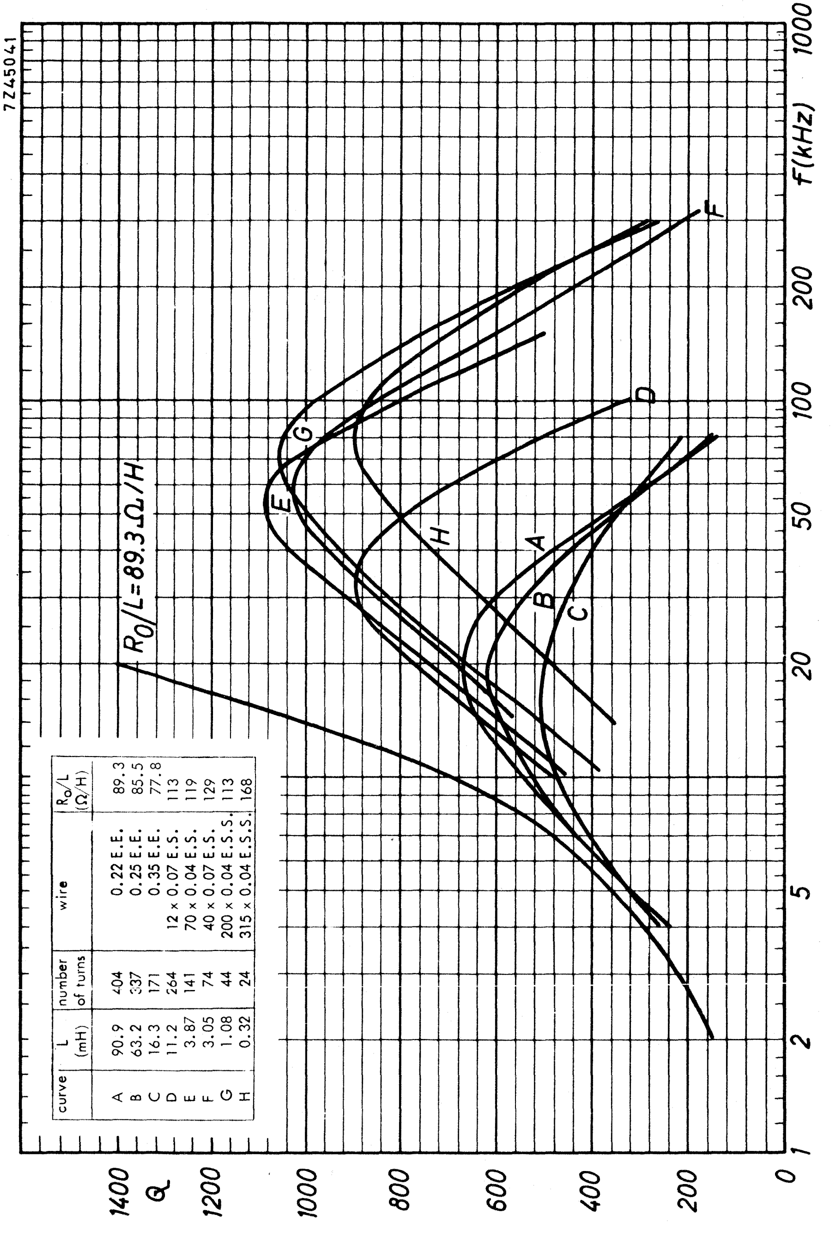
SINGLE-SECTION COIL FORMER

FXC 3B7/3H1
$\mu_e = 100$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	62.0	404	0.22 E.E.	130
B	43.2	337	0.25 E.E.	125
C	11.1	171	0.35 E.E.	115
D	26.5	264	12 × 0.07 E.S.	165
E	7.61	141	70 × 0.04 E.S.	175
F	2.08	74	40 × 0.07 E.S.	189
G	0.74	44	200 × 0.04 E.S.S.	165
H	0.22	24	315 × 0.04 E.S.S.	246

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 150$

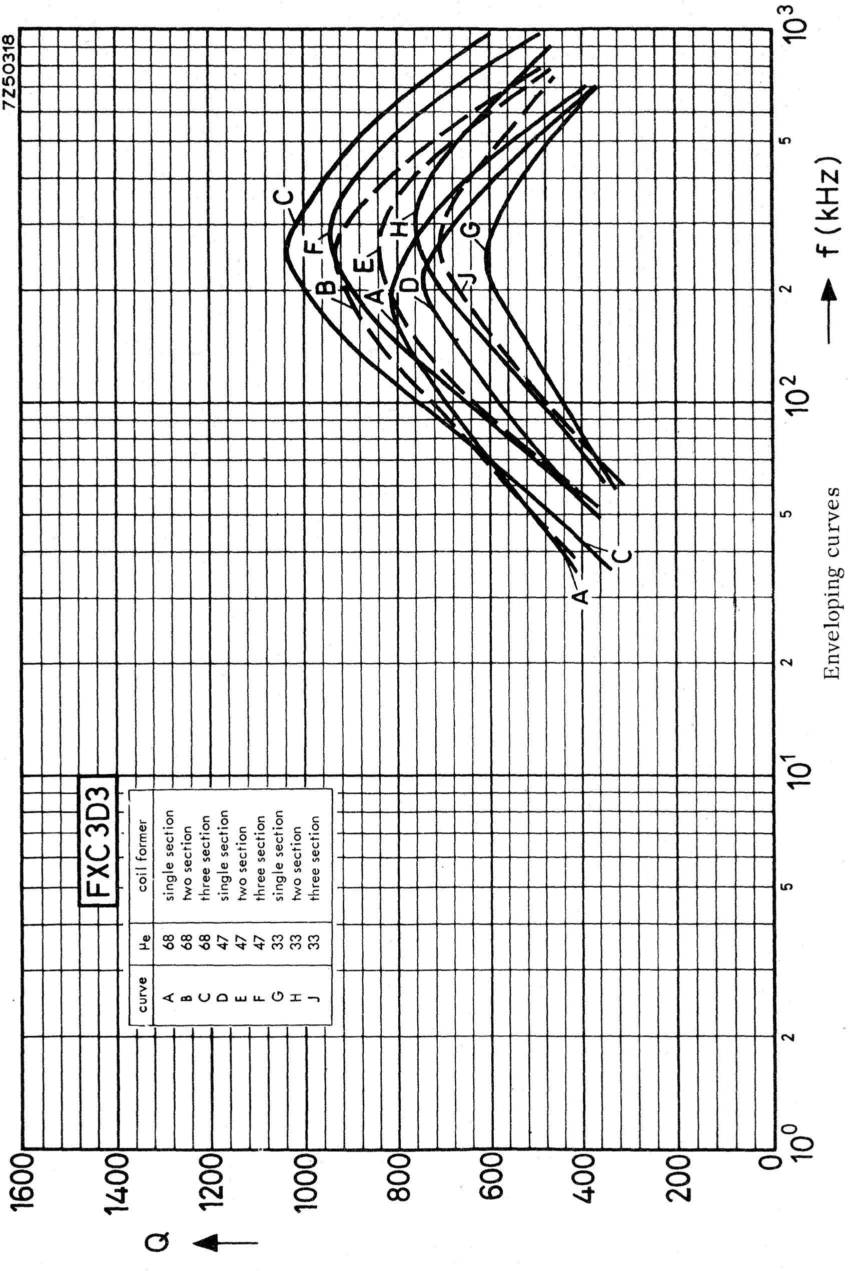


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	90.9	404	0.22 E.E.	89.3
B	63.2	337	0.25 E.E.	85.5
C	16.3	171	0.35 E.E.	77.8
D	11.2	264	12 × 0.07 E.S.	113
E	3.87	141	70 × 0.04 E.S.	119
F	3.05	74	40 × 0.07 E.S.	129
G	1.08	44	200 × 0.04 E.S.S.	113
H	0.32	24	315 × 0.04 E.S.S.	168

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

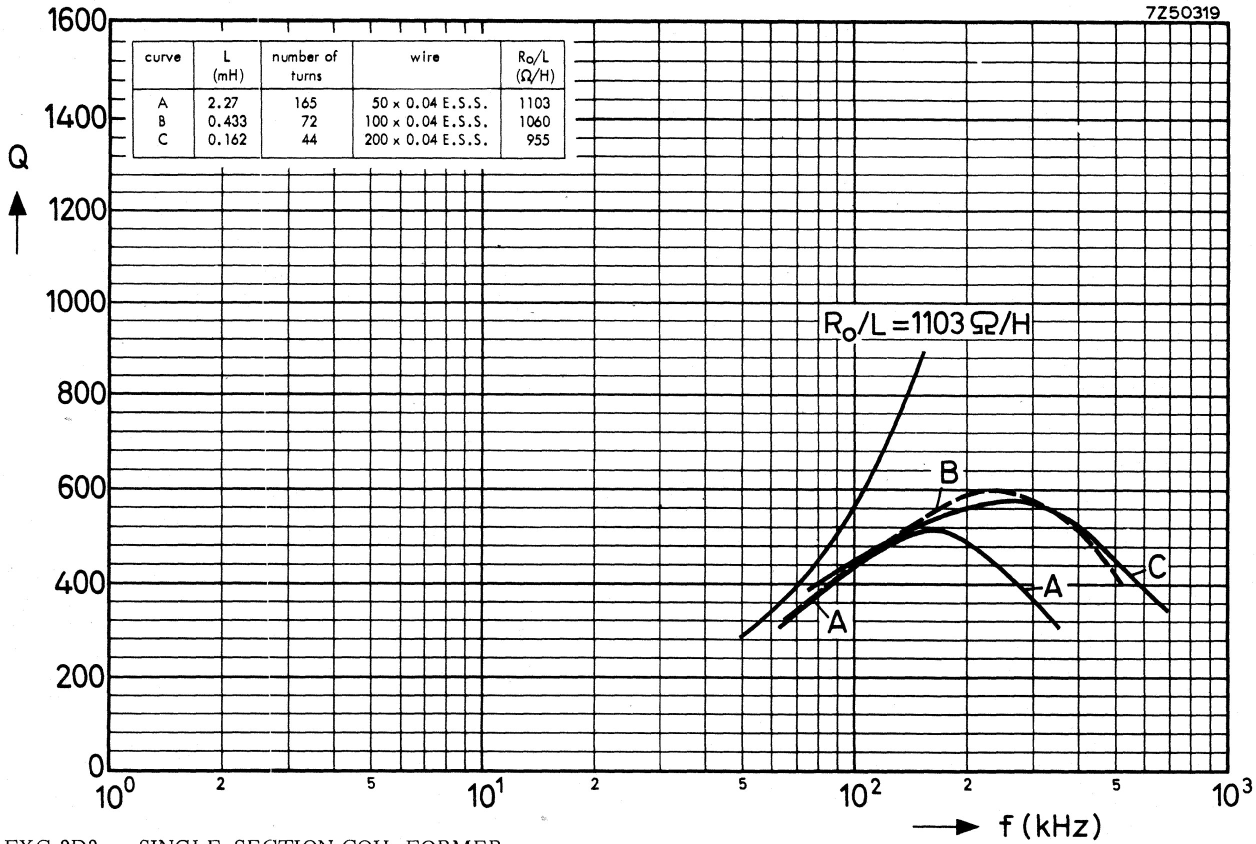
$\mu_e = 220$

TYPICAL Q-CURVES FOR FXC 3D3



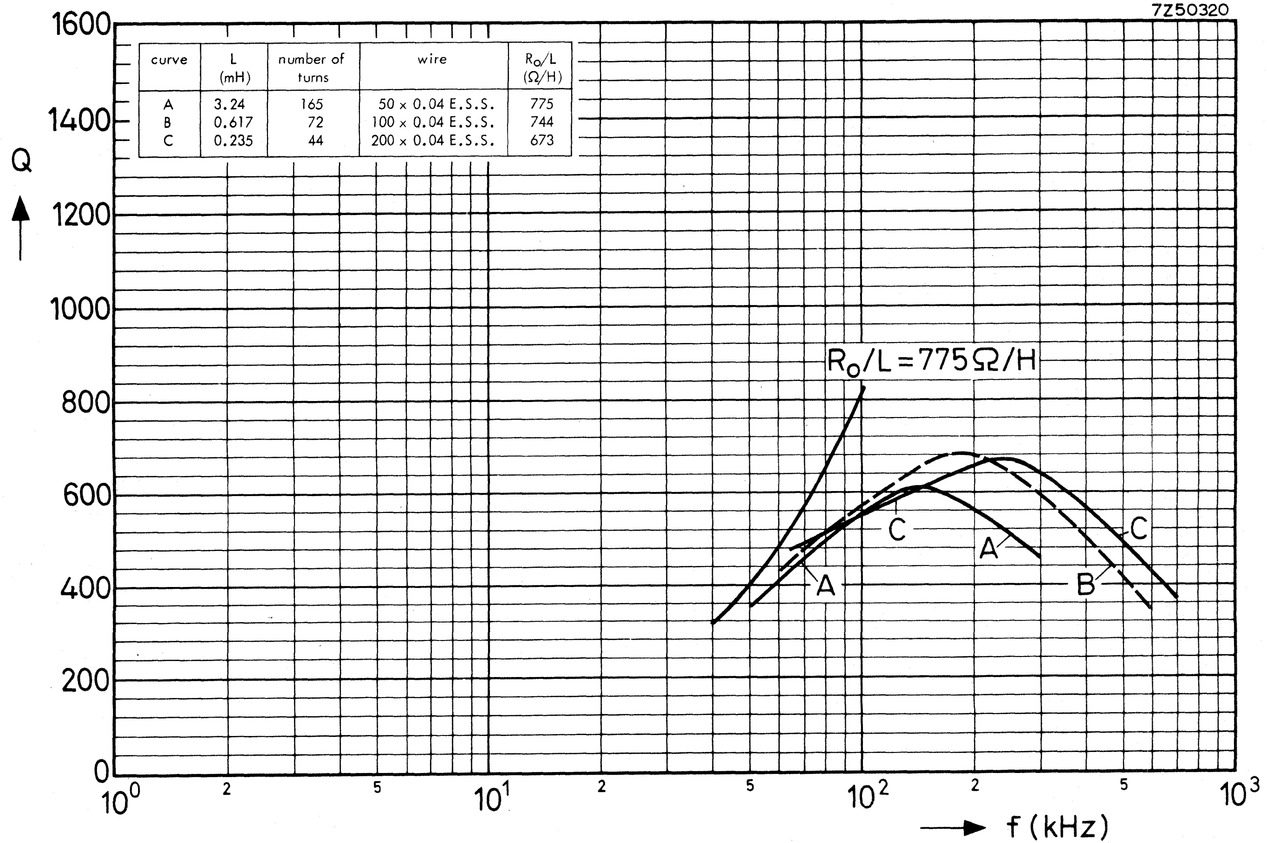
curve	μ_e	coil former
A	68	single section
B	68	two section
C	68	three section
D	47	single section
E	47	two section
F	47	three section
G	33	single section
H	33	two section
J	33	three section

Enveloping curves



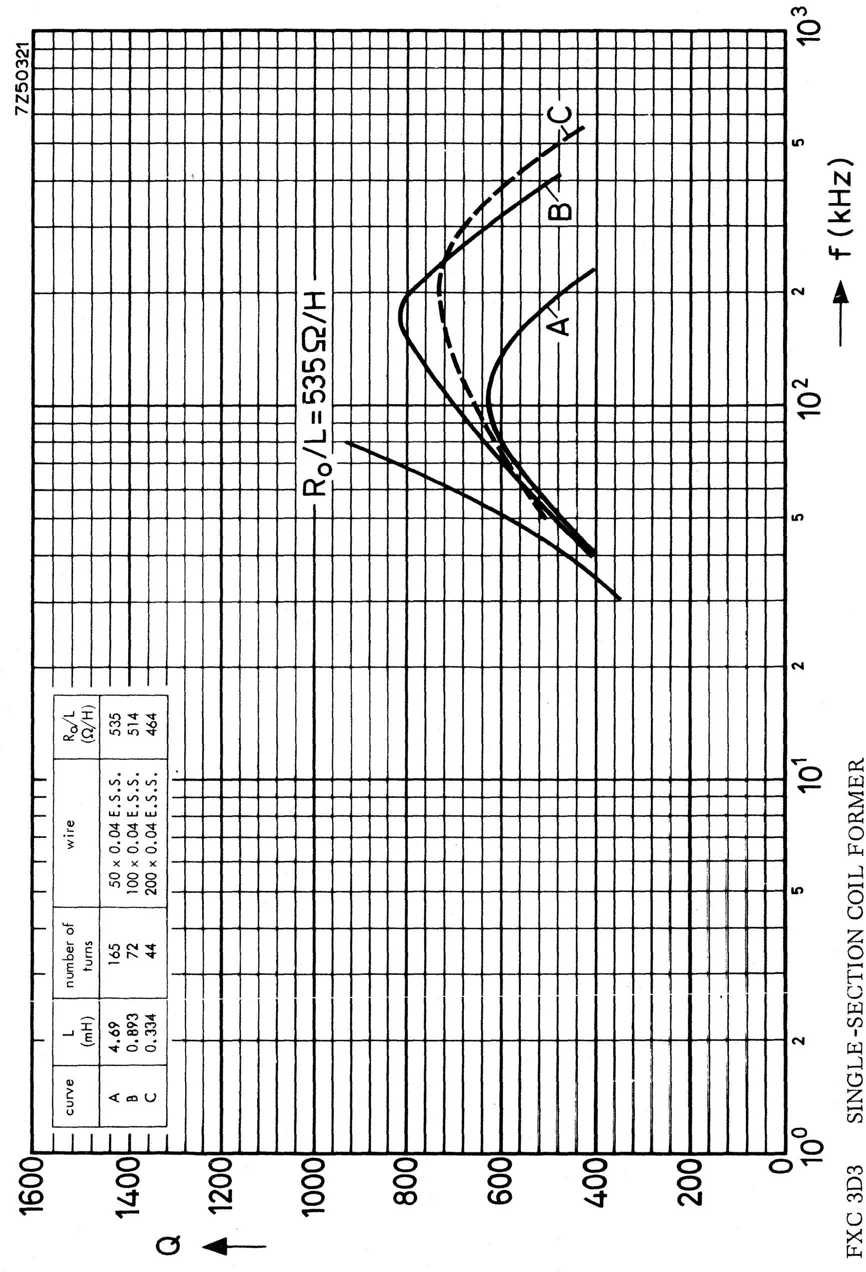
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	2.27	165	50 × 0.04 E.S.S.	1103
B	0.433	72	100 × 0.04 E.S.S.	1060
C	0.162	44	200 × 0.04 E.S.S.	955

FXC 3D3 SINGLE-SECTION COIL FORMER
$\mu_e = 33$



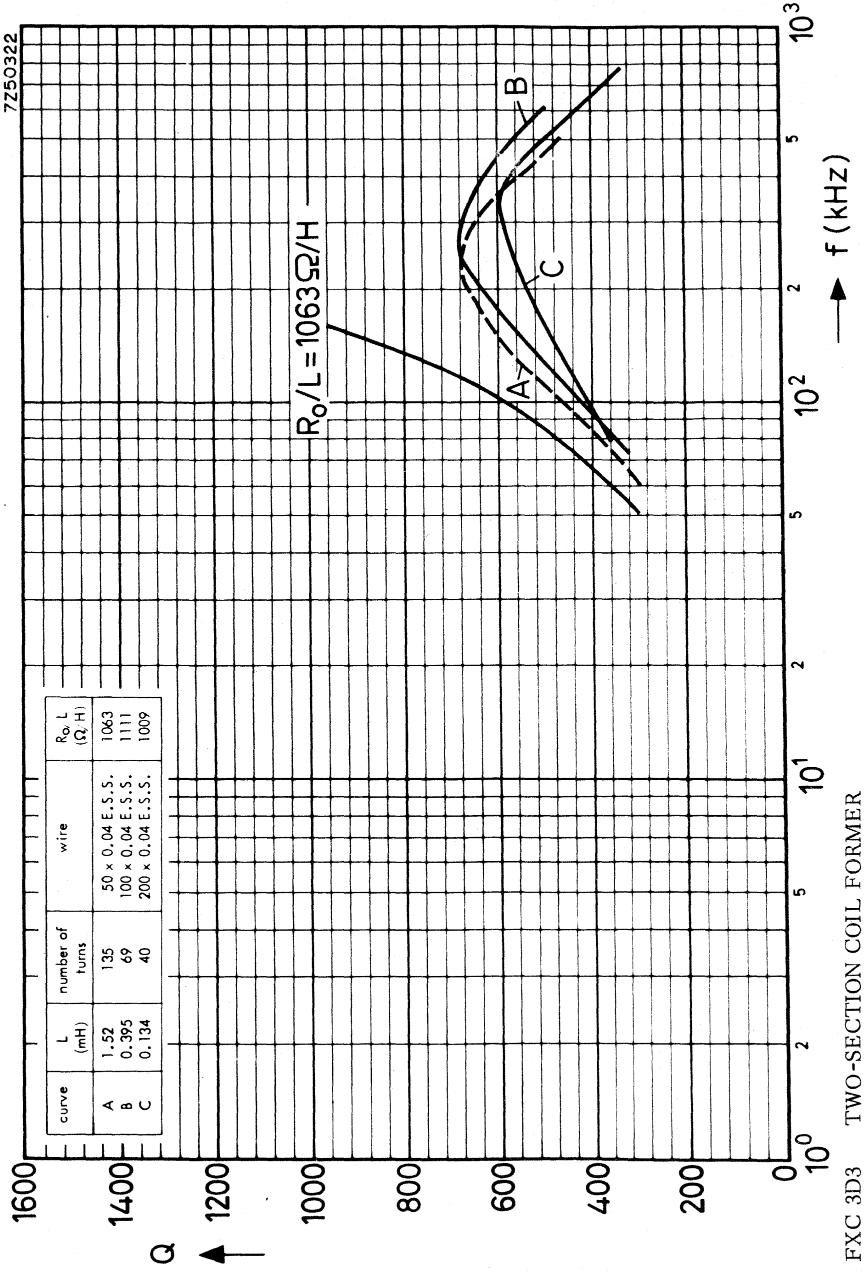
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	3.24	165	50 × 0.04 E.S.S.	775
B	0.617	72	100 × 0.04 E.S.S.	744
C	0.235	44	200 × 0.04 E.S.S.	673

FCX 3D3 SINGLE-SECTION COIL FORMER
$\mu_e = 47$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	4.69	165	50 × 0.04 E.S.S.	535
B	0.893	72	100 × 0.04 E.S.S.	514
C	0.334	44	200 × 0.04 E.S.S.	464

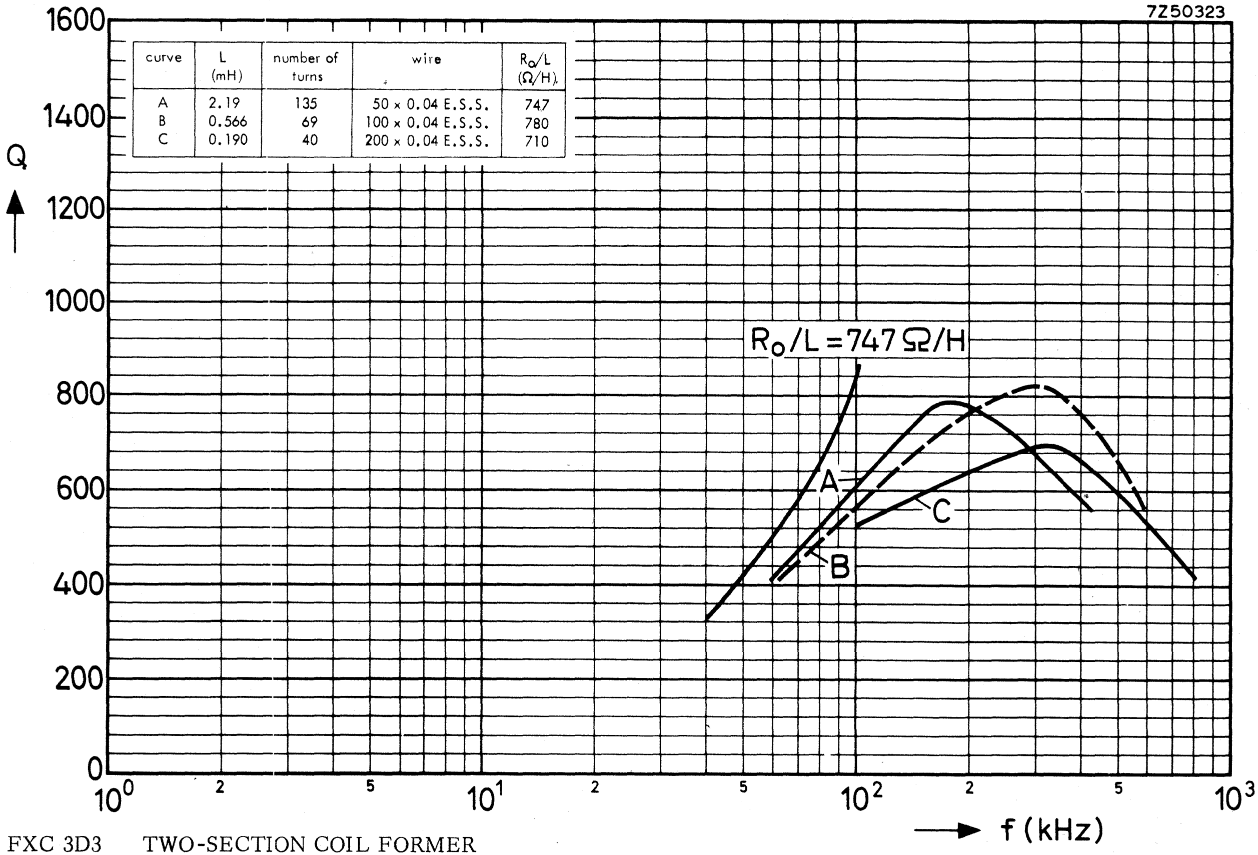
FXC 3D3 SINGLE-SECTION COIL FORMER
$\mu_e = 68$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.52	135	50 × 0.04 E.S.S.	1063
B	0.395	69	100 × 0.04 E.S.S.	1111
C	0.134	40	200 × 0.04 E.S.S.	1009

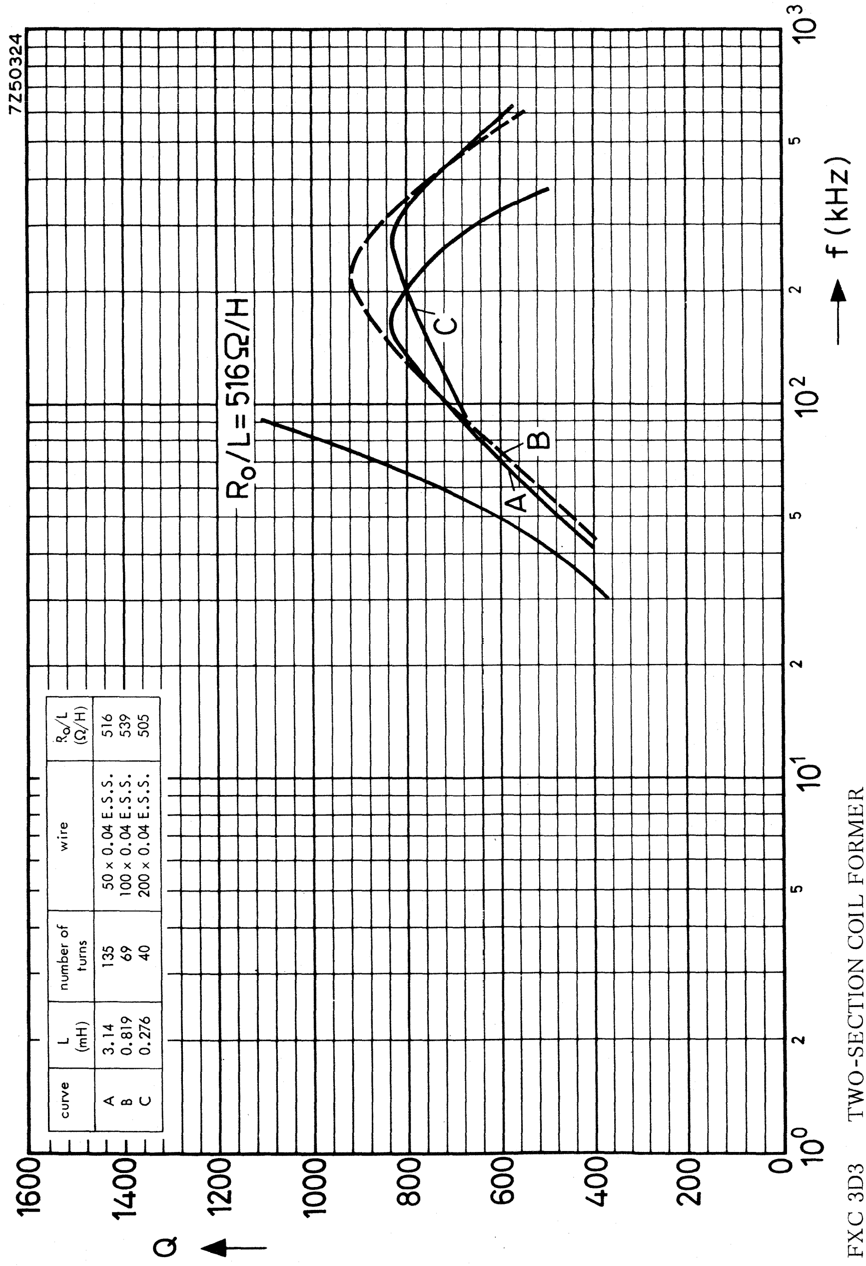
TWO-SECTION COIL FORMER

FXC 3D3
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	2.19	135	50 × 0.04 E.S.S.	747
B	0.566	69	100 × 0.04 E.S.S.	780
C	0.190	40	200 × 0.04 E.S.S.	710

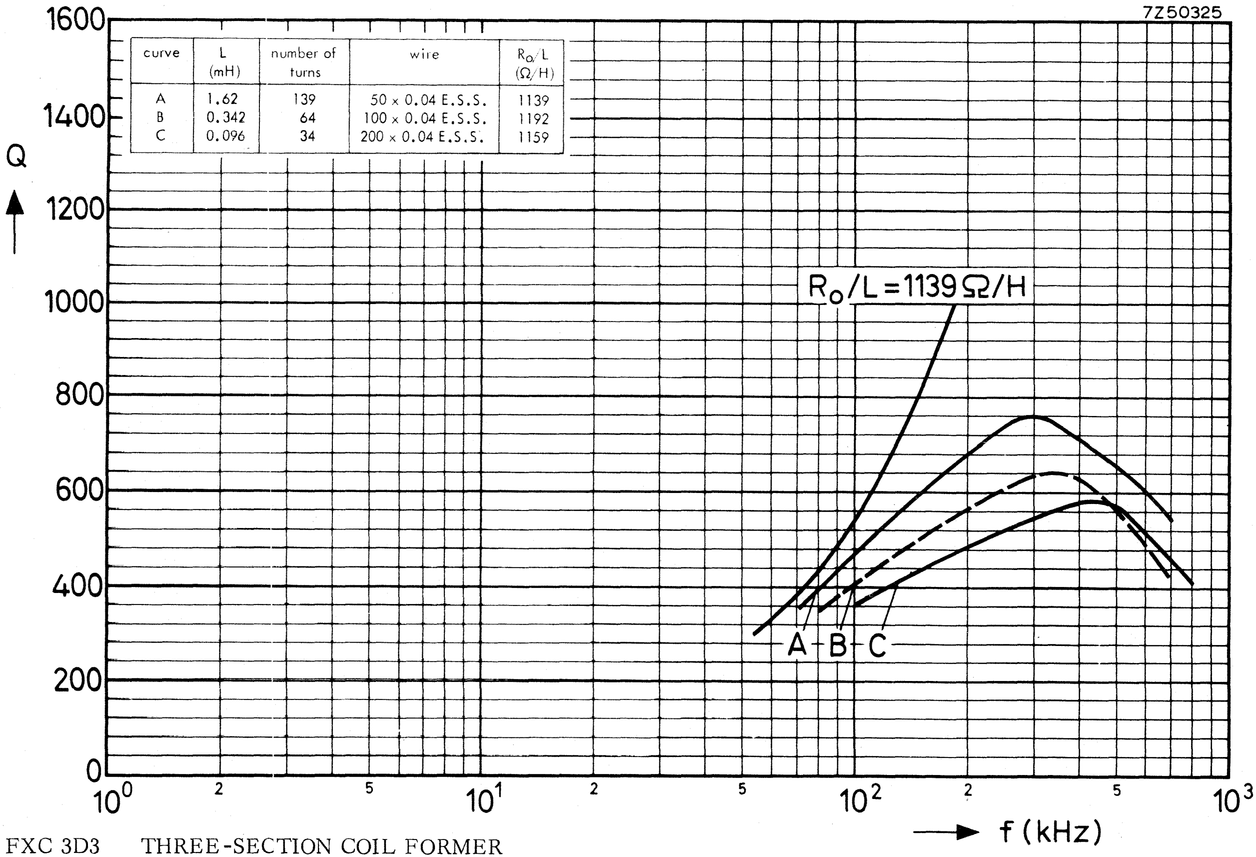
FXC 3D3 TWO-SECTION COIL FORMER
$\mu_e = 47$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	3.14	135	50 × 0.04 E.S.S.	516
B	0.819	69	100 × 0.04 E.S.S.	539
C	0.276	40	200 × 0.04 E.S.S.	505

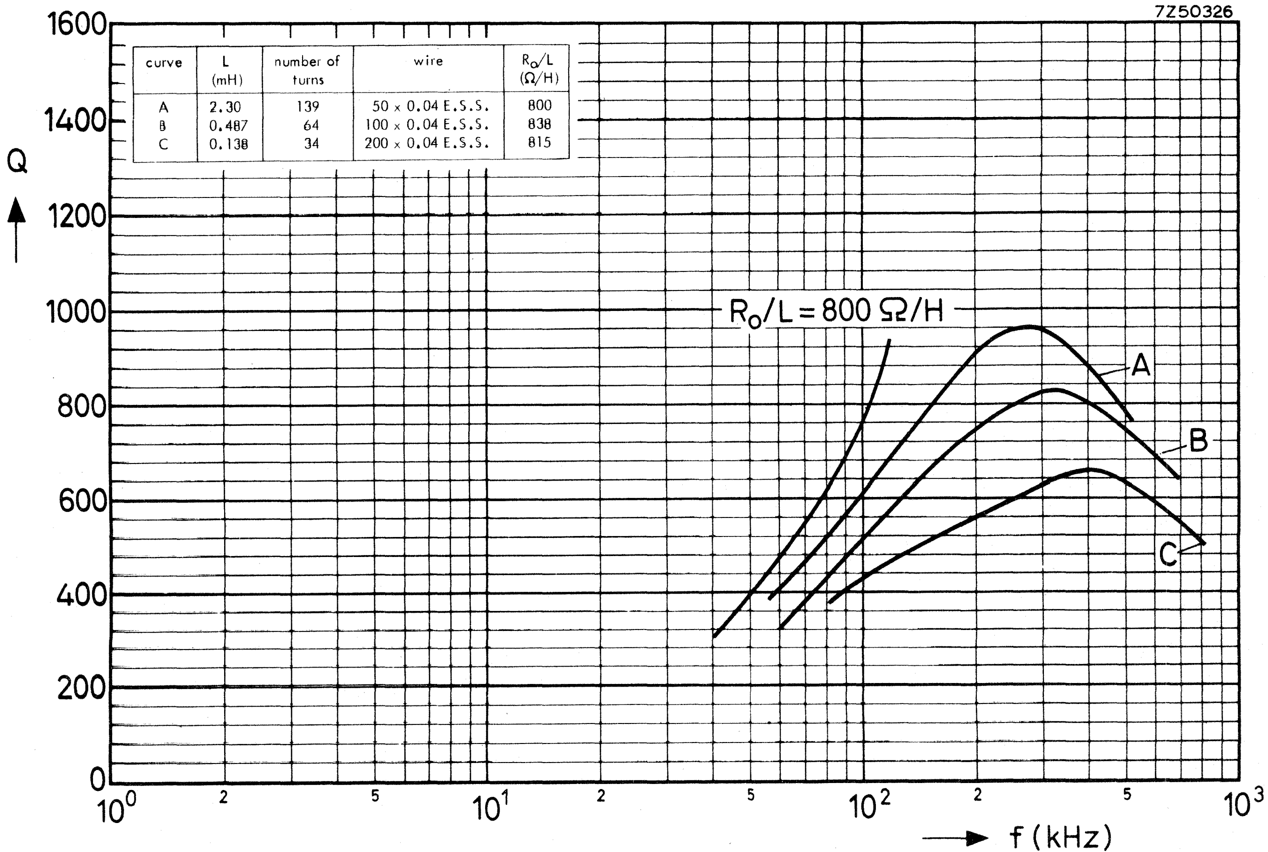
TWO-SECTION COIL FORMER

FXC 3D3
$\mu_e = 68$



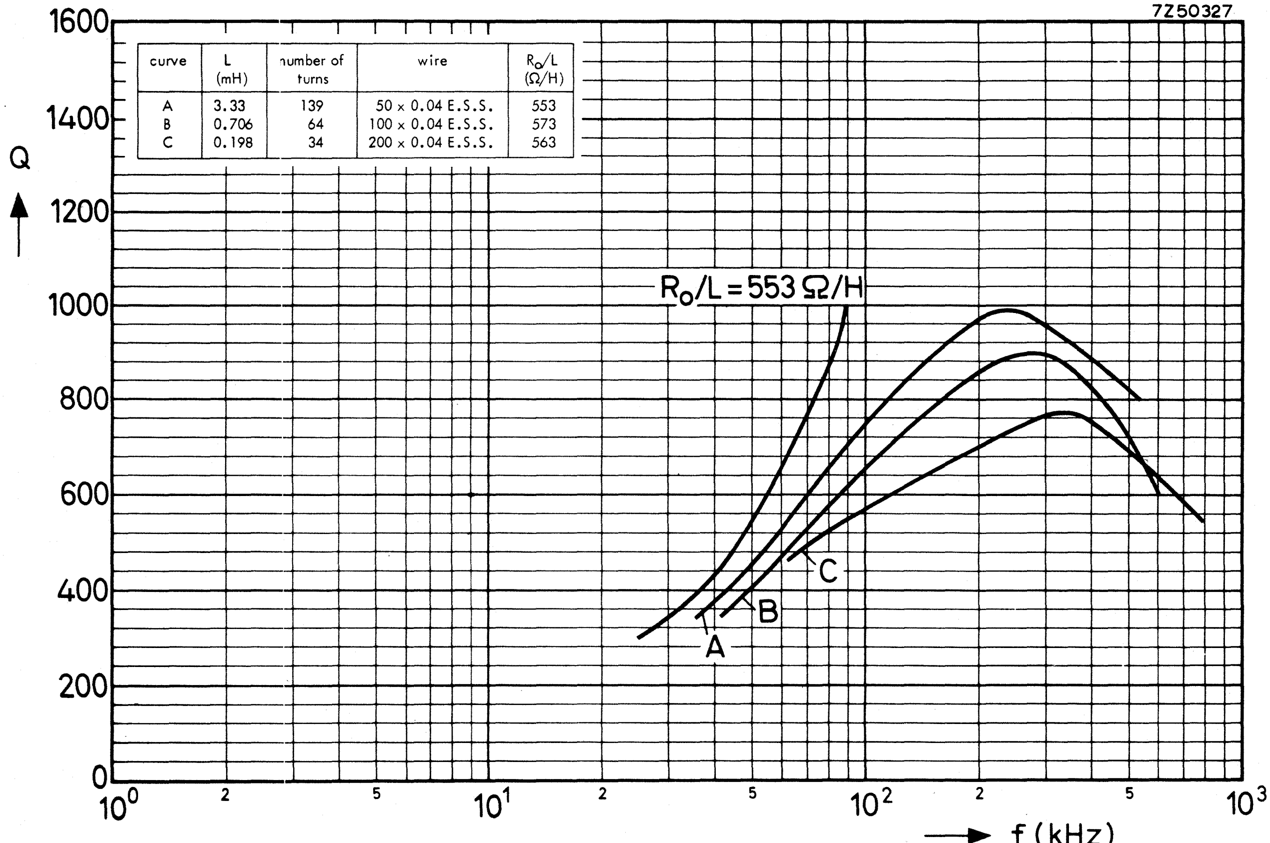
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.62	139	50 × 0.04 E.S.S.	1139
B	0.342	64	100 × 0.04 E.S.S.	1192
C	0.096	34	200 × 0.04 E.S.S.	1159

FXC 3D3 THREE-SECTION COIL FORMER
$\mu_e = 33$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	2.30	139	50 × 0.04 E.S.S.	800
B	0.487	64	100 × 0.04 E.S.S.	838
C	0.138	34	200 × 0.04 E.S.S.	815

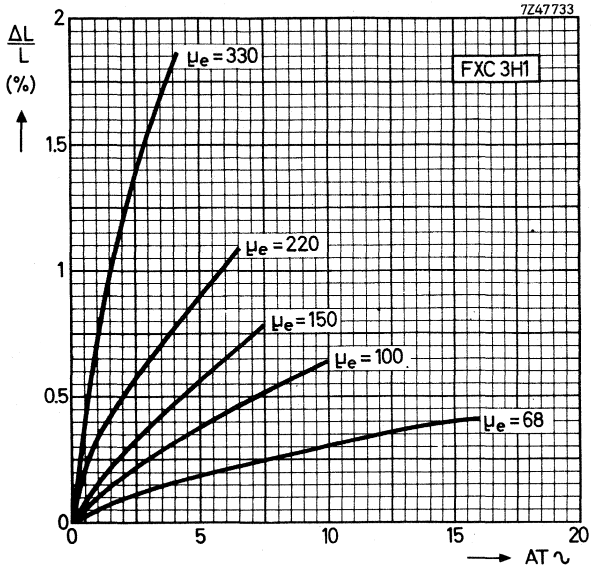
FXC 3D3 THREE-SECTION COIL FORMER
$\mu_e = 47$

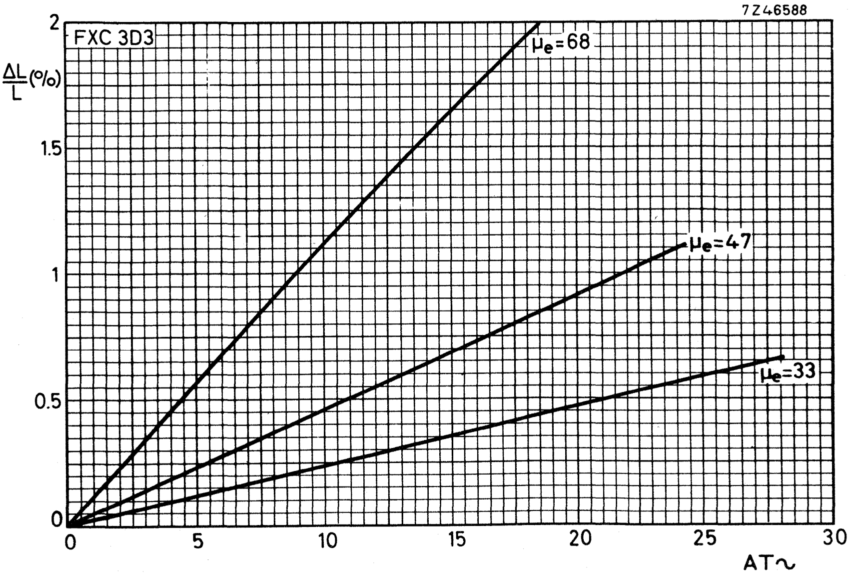


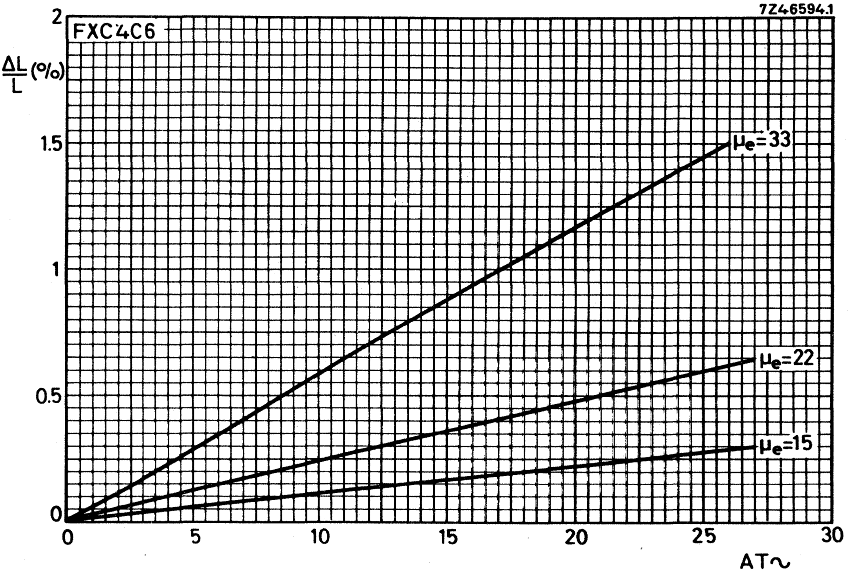
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	3.33	139	50 × 0.04 E.S.S.	553
B	0.706	64	100 × 0.04 E.S.S.	573
C	0.198	34	200 × 0.04 E.S.S.	563

FXC 3D3 THREE-SECTION COIL FORMER
$\mu_e = 68$

INDUCTANCE VARIATION AS A FUNCTION OF AT~

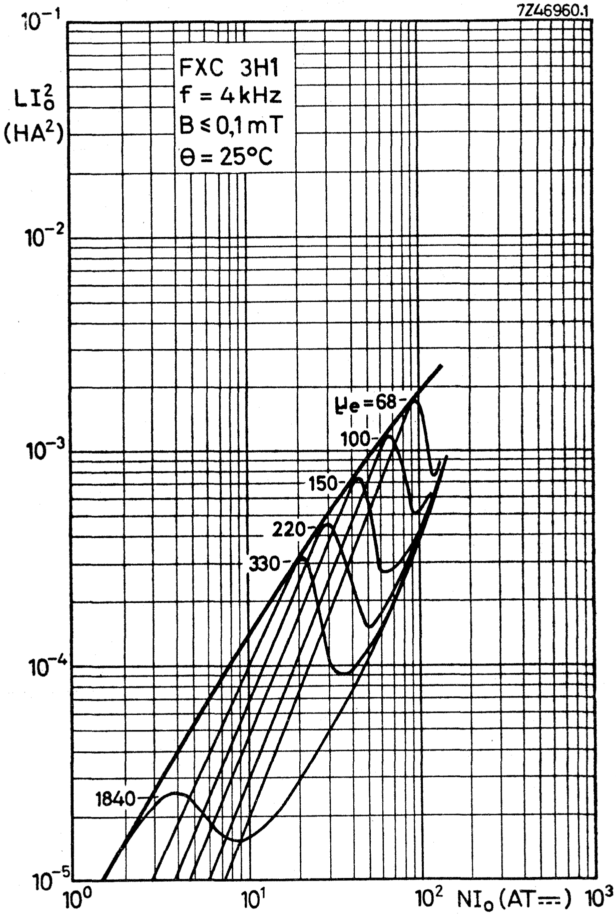




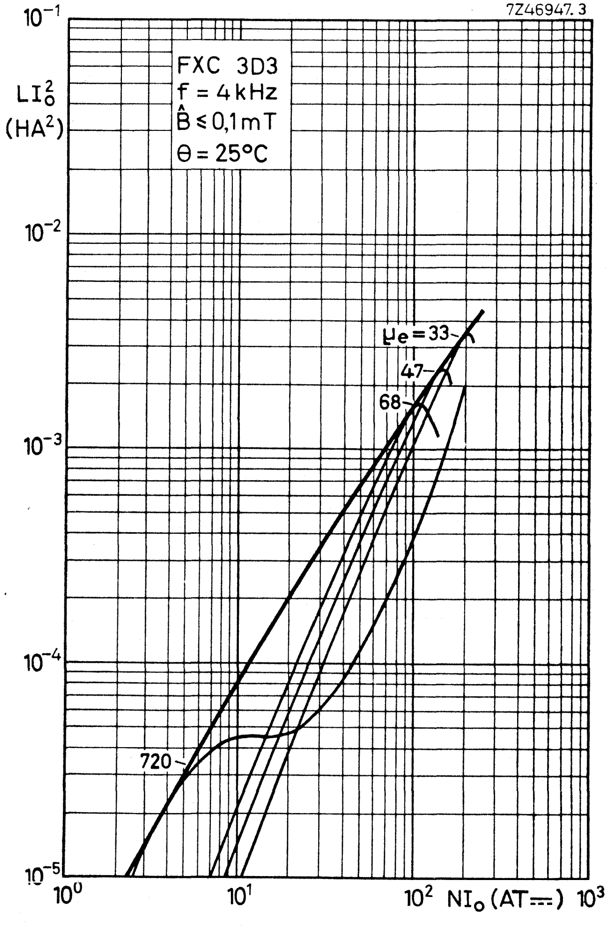

7Z46594.1
FXC4C6
ΔL/L (%)
2
1.5
1
0.5
0
0
5
10
15
20
25
30
AT~
μe=33
μe=22
μe=15

HANNA CURVES

Indicating optimum inductance for a certain μ_e-value and direct current.
Typical values



Typical values



POTCORES

INTRODUCTION

Three types of core can be supplied:

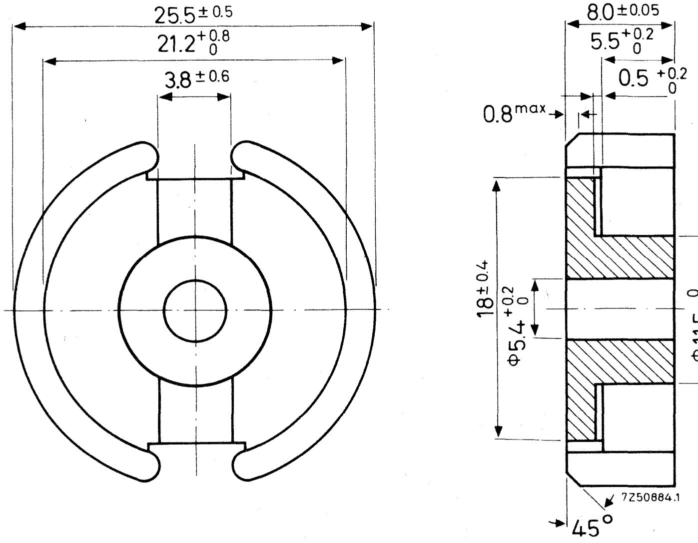
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 40 potcore halves or 20 pieces of pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores. So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 22000
3H1	4322 020 22010
3D3	4322 020 22020
3E1	4322 020 22140
4C6	4322 020 22110

Properties

For toroidally wound core halves the values in Table I are guaranteed.

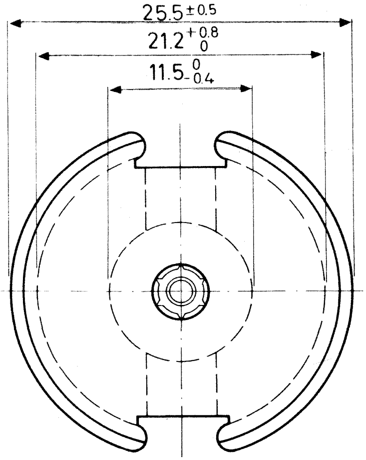
Table I	temp. (^oC)	grade				
		3B7	3H1	3D3	3E1	4C6
$\alpha_F \times 10^6$	+5 to +25	–	+0.5 to +1.5	–	–	−2 to +4
	+5 to +55	–	–	–	–	
	+25 to +55	–	+0.5 to +1.5	–	–	0 to +6
	+25 to +70	−0.6 to +0.6	–	0 to 2	0 to 2	–
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 4.3	≤ 4.3	≤ 12	–	≤ 10

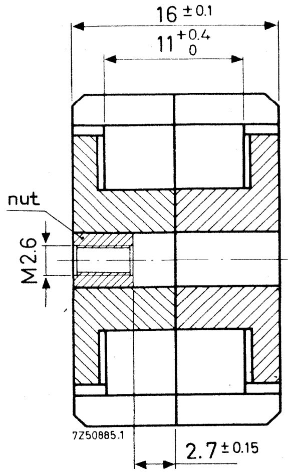
For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 200 Newton, the values in Table II are guaranteed at 25 ± 10 °C.

Table II	$\hat{B}$ (mT)	freq. (MHz)	grade				
			3B7	3H1	3D3	3E1	4C6
μ_e	≤ 0,1	0.004	≥ 1430	≥ 1430	–	2310-3425	–
	≤ 0,1	0.1	–	–	≥ 550	–	≥ 93
A_L	≤ 0,1	0.004	–	–	–	7250-10750	–
α	≤ 0,1	0.004	≤ 14.9	≤ 14.9	–	–	–
$\frac{\tan \delta}{\mu_i} \times 10^6$	≤ 0,1	0.1	–	–	≤ 24.1	–	≤ 58.0
	≤ 0,1	0.004	≤ 1.2	≤ 1.2	–	≤ 2.5	–
	≤ 0,1	0.1	≤ 5	≤ 5	≤ 8	≤ 20	–
	≤ 0,1	0.5	–	–	≤ 14	≤ 200	–
	≤ 0,1	1	–	–	≤ 35	–	–
	≤ 0,1	2	–	–	–	–	≤ 40
	≤ 0,1	10	–	–	–	–	≤ 100
q2-24-100	1,5−3,0	0.004	≤ 1.8	≤ 1.4	–	≤ 3.0	–
	0,3−1,2	0.1	–	–	≤ 3.0	–	≤ 10
$\eta_B \times 10^3$	1,5−3,0	0.004	≤ 1.1	≤ 0.86	–	≤ 1.8	–
	0,3−1,2	0.1	–	–	≤ 1.8	–	≤ 6,2

PRE-ADJUSTED POTCORES

Dimensions in mm





With nut, catalogue number = 4322 022 2....
Without nut, catalogue number = 4322 022 0....

Weight per set = 20 g

Effective length l_e = 37,6 mm

$$\Sigma \frac{l_e}{A_e} = 0,400 \text{ mm}^{-1}$$

Effective volume $V_e = 3530 \text{ mm}^3$

Pre-adjusted potcores with standard μ_e values [1]

μ_e	α	tolerance on inductance (%)	catal. No.: 4322 022 2.... with nut 4322 022 0.... without nut			
			3B7	3H1	3D3	4C6
→ 15	146	± 1	–	–	8410	8810
22	120	± 1	–	–	–	8820
33	98.2	± 1	8030	8230	8430	8830
47	82.3	± 1	8040	8240	8440	–
68	68.4	± 1	8050	8250	8450	–
100	56.4	± 1.5	8060	8260	–	–
150	46.1	± 2	8070	8270	–	–
220	38.1	± 3	8080	8280	–	–
330	31.0	± 3	8090	8290	–	–
730	20.8	± 25	–	–	8400 *	–
1910	12.9	± 25	8000 *	8200 *	–	–

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 15 up to and including 100
Asymmetric air gap for cores with an μ_e value of 150 up to and including 1910

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[1] See Notes on the next page.

*) Only available without nut.

Pre-adjusted potcores with standard A_L factors [1]

A_L	corre-sponding μ_e-value	tolerance on induc-tance (%)	catal. No.: 4322 022 2.... with nut 4322 022 0.... without nut			
			3B7	3H1	3D3	4C6
63	20	± 1	9030	9230	9430	9830
100	31.8	± 1	9040	9240	9440	9840
160	51	± 1	9050	9250	9450	-
250	79.5	± 1	9060	9260	9460	-
315	100.2	± 1.5	9070	9270	-	-
400	127	± 2	9080	9280	9480	-
630	200	± 3	9100	9300	-	-
1000	318	± 3	9110	9310	-	-
1600	510	± 3	9120	9320	-	-

Inductance $L = N^2 A_L$ (in 10^{-9} H)

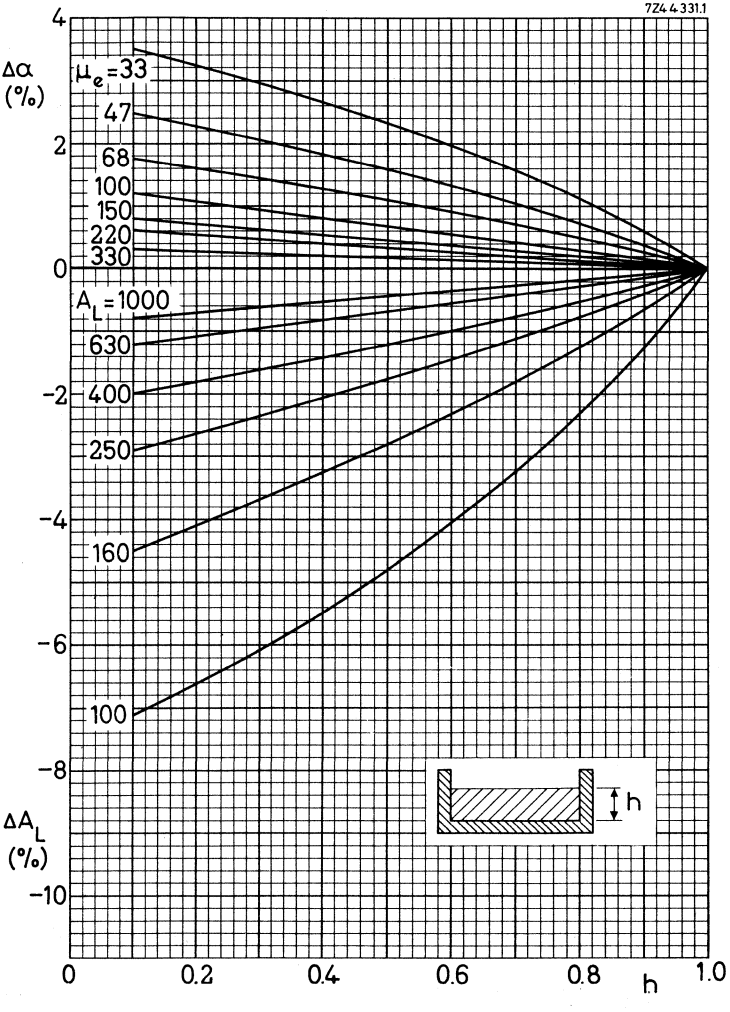
Symmetric air gap for cores with an A_L factor of 63 up to and including 400
Asymmetric air gap for cores with an A_L factor of 630 up to and including 1600

---

[1] Notes to the tables

1. Examples of catalogue number:
   μ_e = 15, grade 4C6, potcore with nut, catalogue number = 4322 022 28810
   A_L = 100, grade 3B7, potcore without nut, catalogue number = 4322 022 09040
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

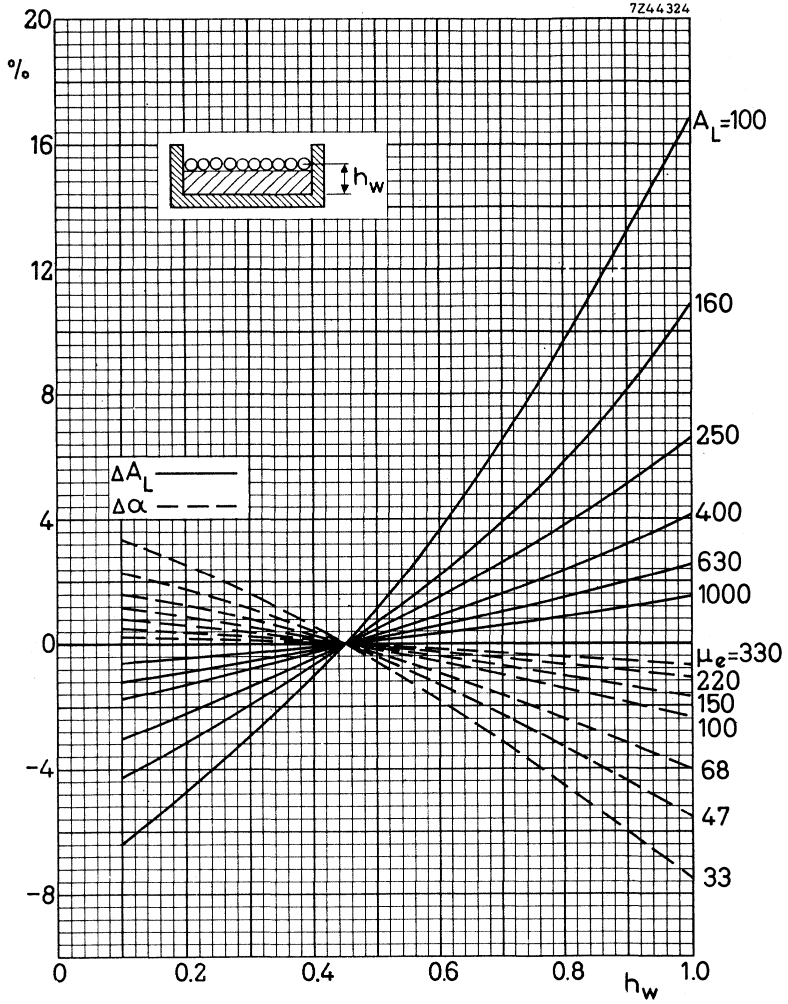
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3 only.

Example: On a single-section coil former only 0.4 part of the available height is used. A potcore with μ_e = 68 in that case obtains an α factor of 68.4 + 1.25 %.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_w on a single-section coil former.
Valid for ferroxcube 3B7, 3H1 and 3D3 only.
Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 68 obtains for that winding an α factor of 68.4 - 1.7 %.

COIL FORMERS

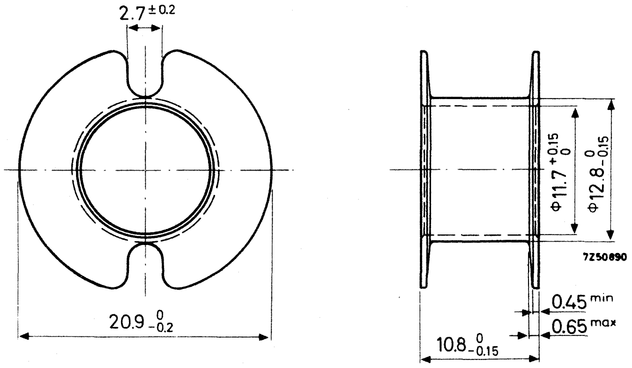
GENERAL

Three types of coil former can be supplied:

- with one section
- with two sections
- with three sections

The dimensions conform with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain). The dimensions in the drawings are in mm.

SINGLE-SECTION COIL FORMER



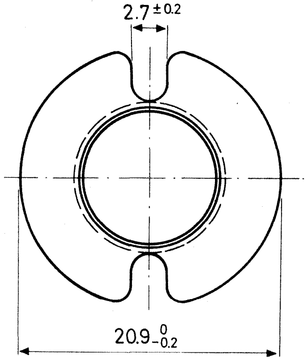
Catalogue number	4322 021 30330
Material	polycarbonate
Window area	39 mm^2
Mean length of turn	53 mm
Max. temperature	130 °C

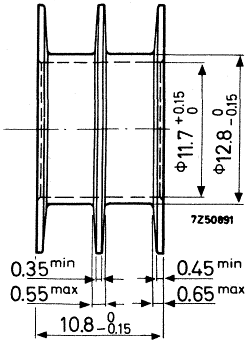
D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 7,42 \times 10^3 \; \Omega/H$$

Weight	0,5 g

TWO-SECTION COIL FORMER





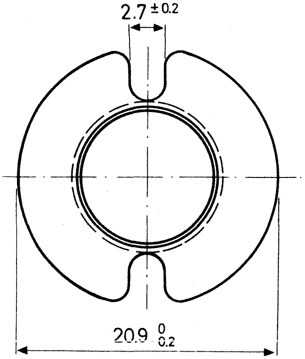
Catalogue number	4322 021 30340
Material	polycarbonate
Window area	2 x 19 mm^2
Mean length of turn	53 mm
Max. temperature	130 °C

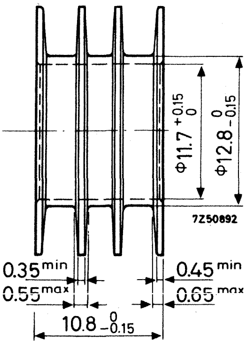
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 7.79 \times 10^3 \ \Omega/H$$

Weight 0.6 g

THREE-SECTION COIL FORMER





Catalogue number	4322 021 30350
Material	polycarbonate
Window area	3 x 12 mm^2
Mean length of turn	53 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 8.18 \times 10^3 \ \Omega/H$$

Weight 0.7 g

INDUCTANCE ADJUSTORS

CONTINUOUS ADJUSTORS

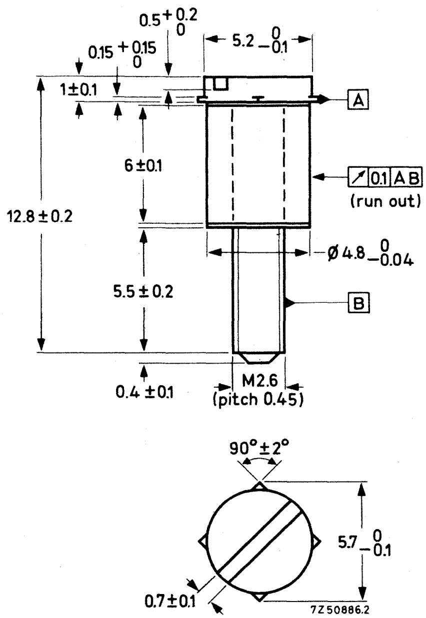


Fig. A

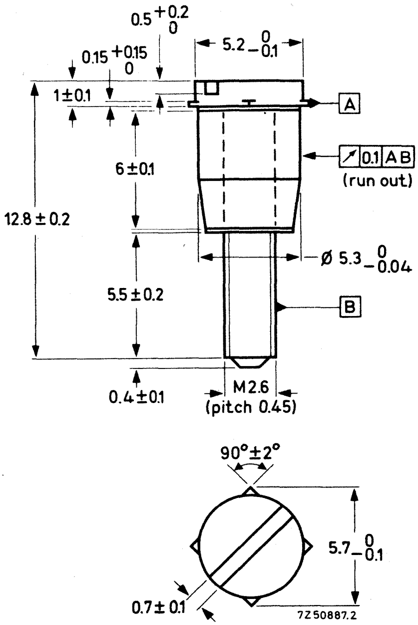


Fig. B

The tolerances on inductance of the pre-adjusted potcores (with adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different potcores.

Table I, types of adjustor

Fig.	colour	catalogue number
A	green	4322 021 30780
A	yellow	4322 021 30790
A	red	4322 021 30800
A	brown	4322 021 30810
B	white	4322 021 30980
B	grey	4322 021 31090

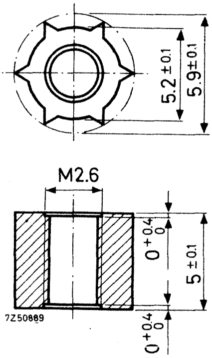
The adjustors are packed in bags of 100, so please order in multiples of 100.

Table II, recommended application

μ_e	A_L	3B7/3H1/3D3	4C6
		catal. No. 4322 021	
15		–	30780
22		–	30780
	63	–	30780
33		30780	30790
	100	30780	30790
47		30800	
	160	30800	
68		30980	
	250	30980	
100	315	30980	
150		30810	
	400	30810	
220		30810	
	630	30810	
330		31090	
	1000	31090	

Nut for adjustor

These data are given for those manufacturers who prefer to insert the nut themselves.

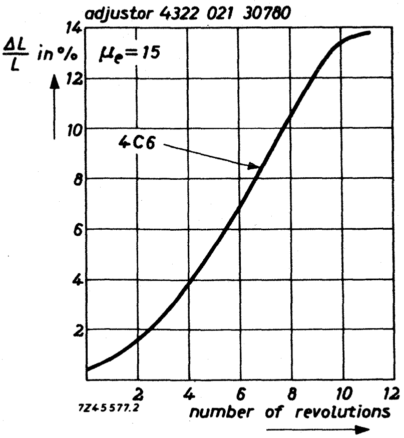


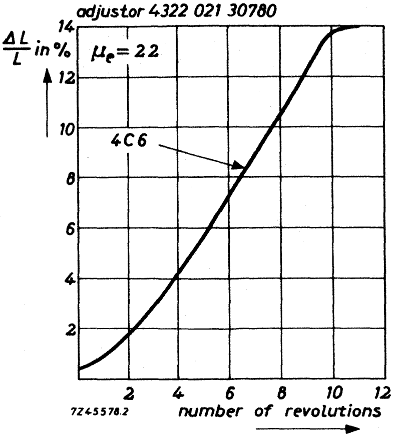
Catalogue number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
→ Recommended distance from mating surface to nut	2,7 ± 0,15 mm

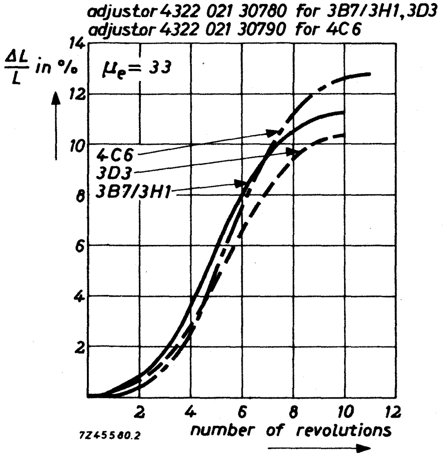
For more information see Potcores General, Mounting data

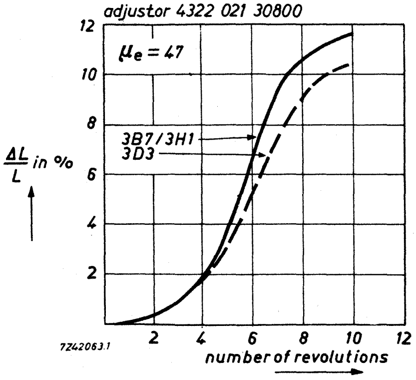
The nuts are packed in bags of 100, so please order in multiples of 100.

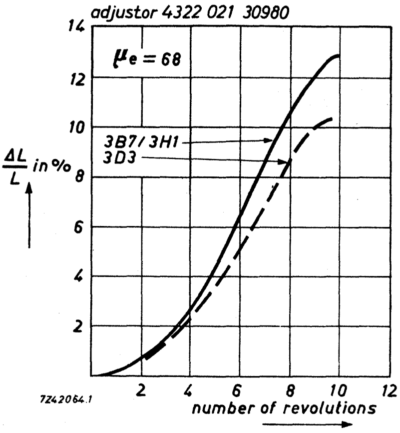
Adjustment curves

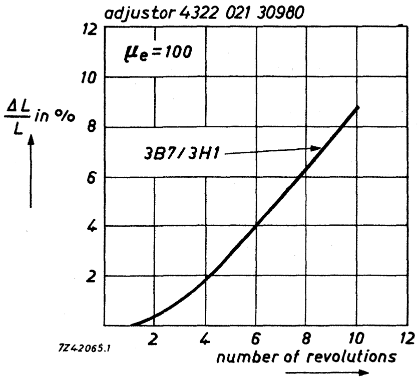


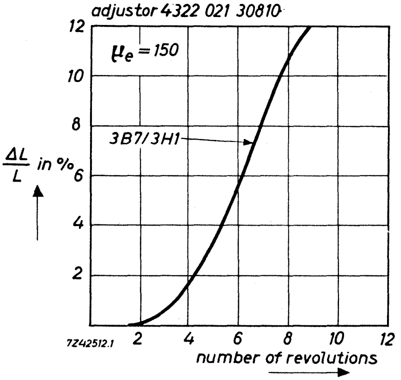


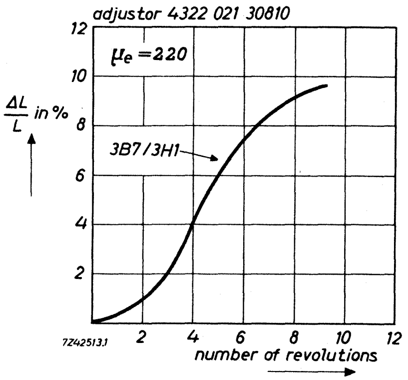


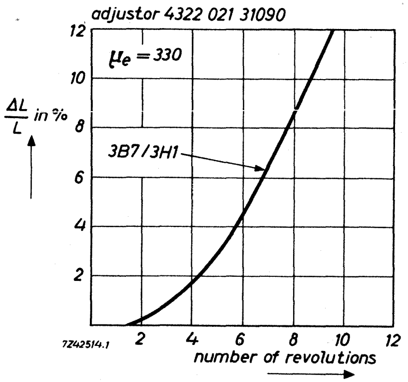



adjustor 4322 021 30980
$\mu_e = 68$
3B7/3H1
3D3
$\frac{\Delta L}{L}$ in %
14
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z42064.1


adjustor 4322 021 30980
$\mu_e = 100$
3B7/3H1
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z42065.1


adjustor 4322 021 30810
$\mu_e = 150$
3B7/3H1
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z42512.1

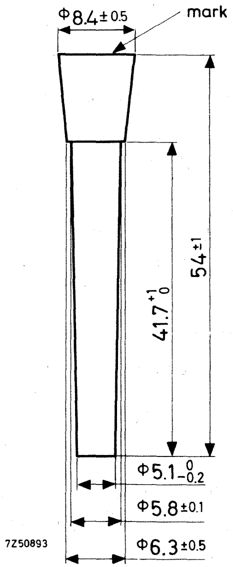

adjustor 4322 021 30810
$\mu_e = 220$
3B7/3H1
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z42513.1

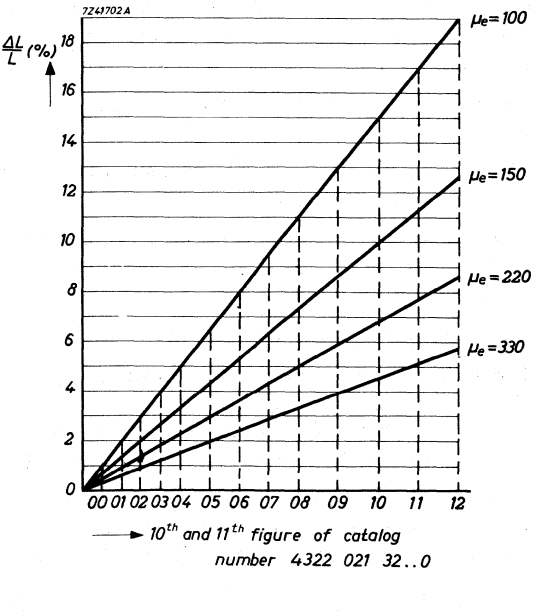

adjustor 4322 021 31090
$\mu_e = 330$
3B7/3H1
$\frac{\Delta L}{L}$ in %
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z42514.1

STEP-BY-STEP ADJUSTORS

These adjustors are used when a continuous adjustment of the inductance is not necessary. For instance, they are applied in loading coils to bring the inductance within a certain tolerance field. They are not suitable for adjusting the inductance to an exact value, as is usually necessary in filters. The increment of the losses caused by these adjustors is negligible.
A range of 13 flexible conical adjustors is available under the catalog numbers 4322 021 32000 up to ..32120. Each adjustor causes an increase in the inductance; the higher the catalog number, the greater the effect. The influence of each adjustor on the inductance at different μ_e values of the potcore can be found from the graph.
The 10th and 11th figure of the catalog number are indicated on the head of the adjustor. It should be borne in mind that, when using these adjustors, the inductance of the coil should initially be lower than the wanted value.
When the correct adjustor has been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond of Good Year) is used as sliding and fixing material. After fixing the protruding ends are cut off.

The maximum impregnation temperature is 150 °C.
The maximum working temperature is 90 °C.
Material: rubber with powder iron.

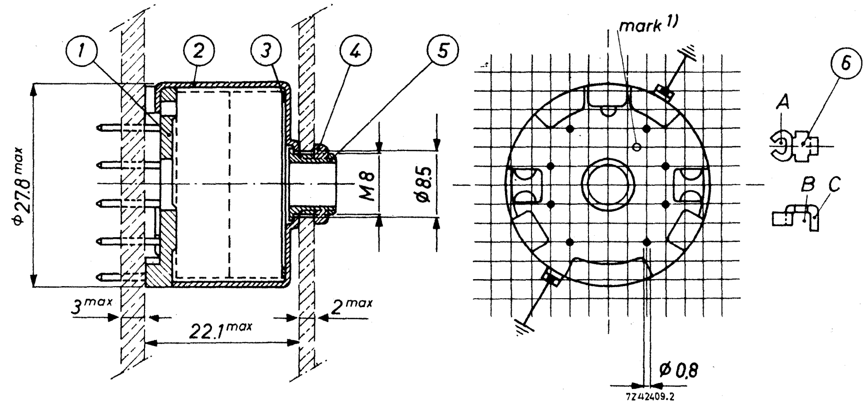




Dimensions in mm

MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30470	(4) nut	4322 021 30710
(2) brass container	4322 021 30550	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30660	(6) soldering spring	4322 021 30700 (8x)

The core is suitable for mounting on printed-wiring boards and on conventional panels.

The parts 1, 2, 3 (and 6) are sufficient to construct an assembly for use in combination with printed wiring.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The eight soldering pins are arranged to fit printed-wiring boards with a 0.1 inch grid as well as those with a 2.50 mm grid.
The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1.3 + 0.1 mm diameter.

If one-hole mounting is preferred, the parts 4 and 5 should be added. The coil assembly may then be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

---

[1] There is another mark hole in a similar position on the top of the container.

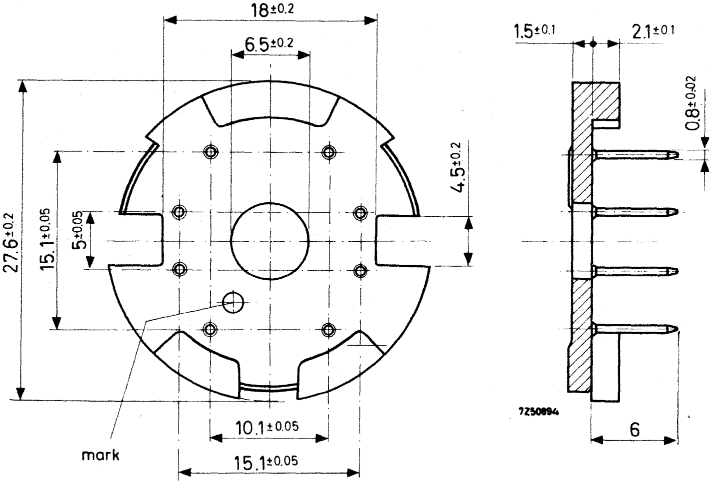
It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.
Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 200 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

(1) Tag plate 4322 021 30470

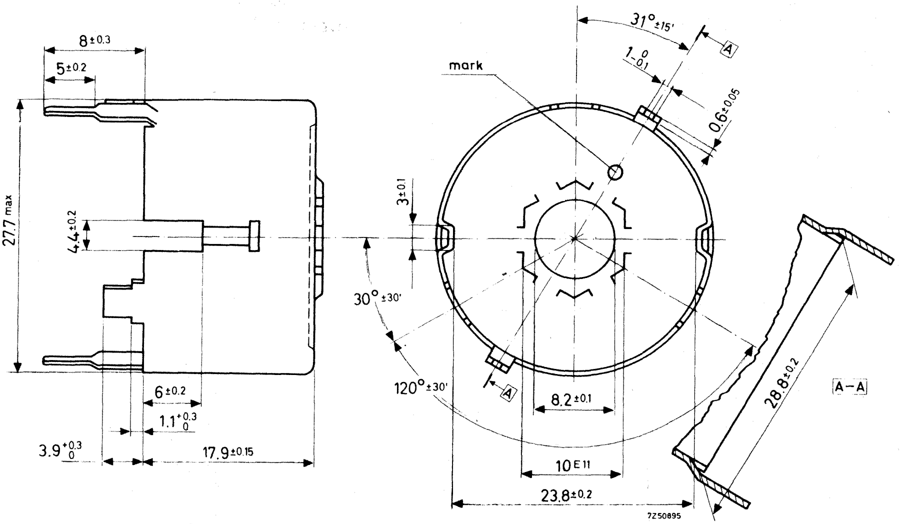
Plate : polyester reinforced with glass fibre

Pins : phosphorbronze, dipsoldered



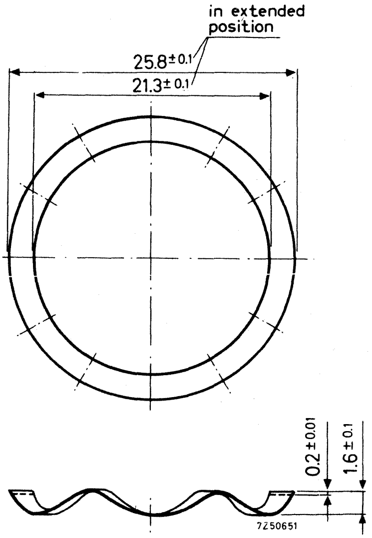
(2) Container 4322 021 30550

→ Material: brass, nickel plated; tinned soldering pins



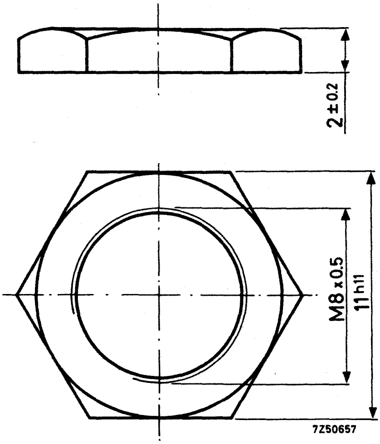
(3) Spring 4322 021 30660

Material: chrome-nickelsteel



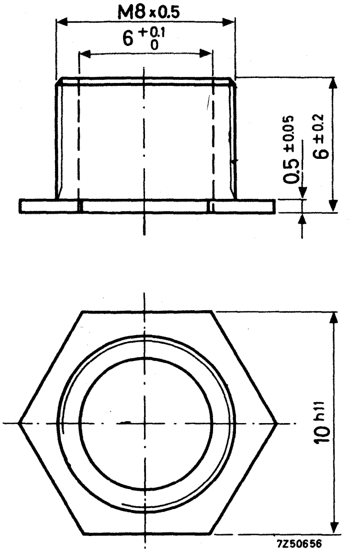
(4) Nut 4322 021 30710

Material: brass, nickel plated



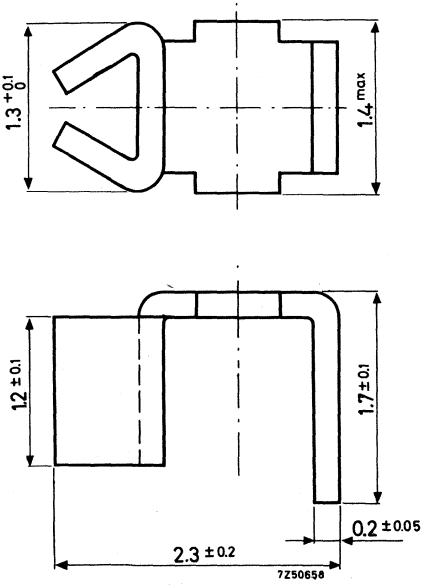
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



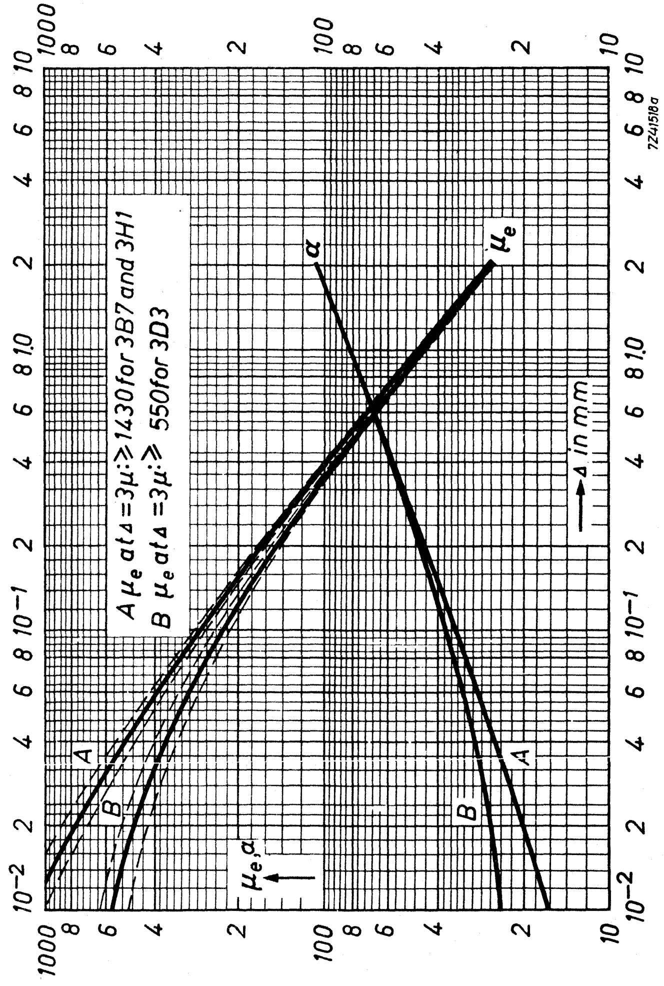
(6) Soldering spring 4322 021 30700

Material : brass, dipsoldered



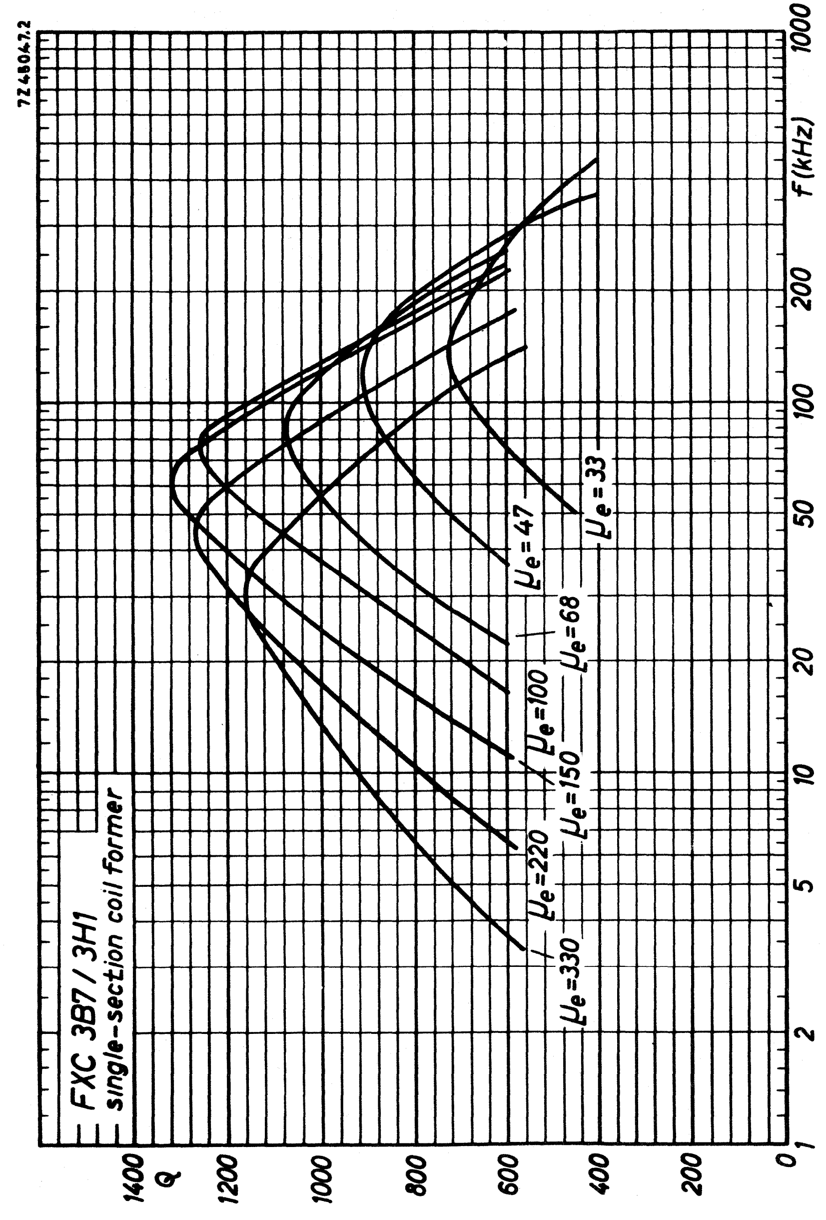
CHARACTERISTIC CURVES

μ_e - α CURVES

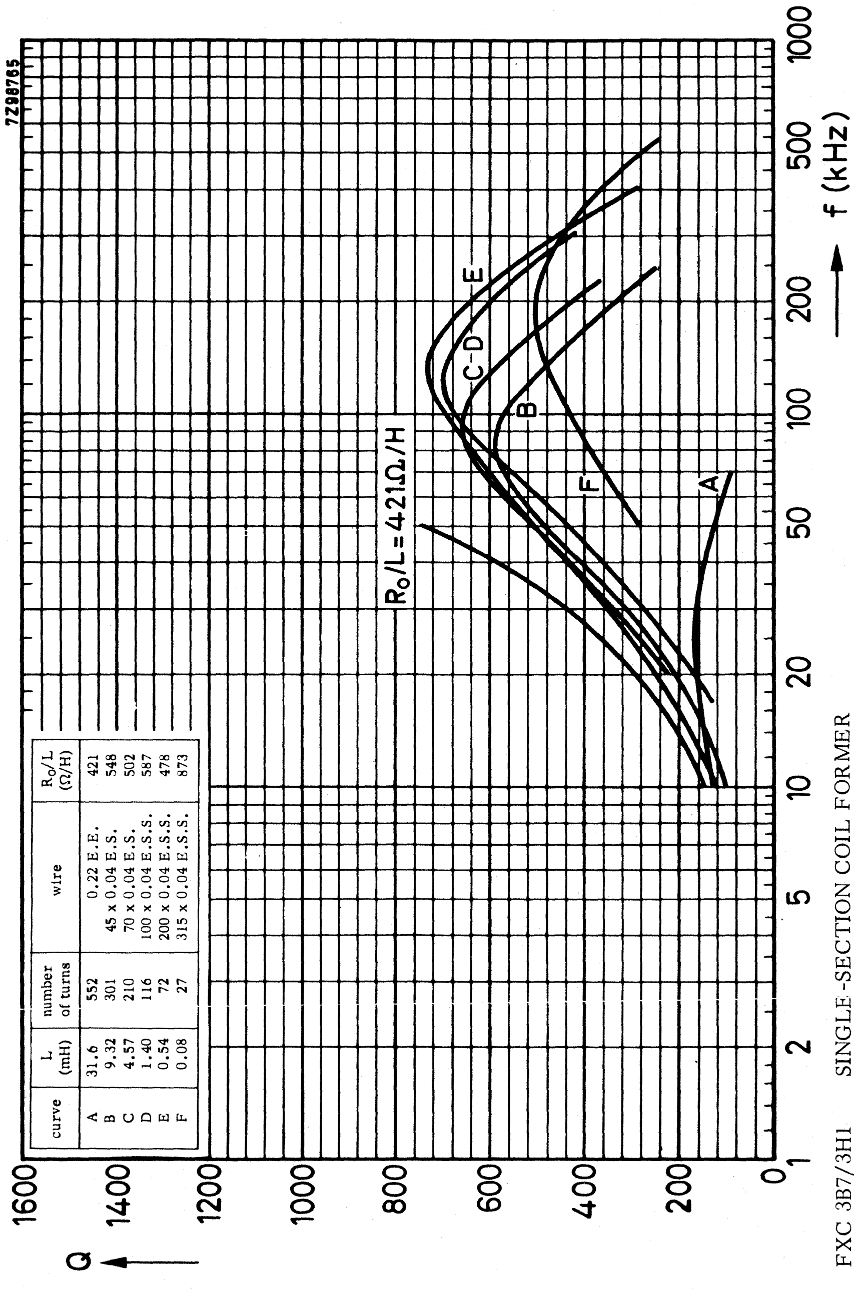


Relative effective permeability and turn factor for 1 mH as a function of the air-gap length.

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



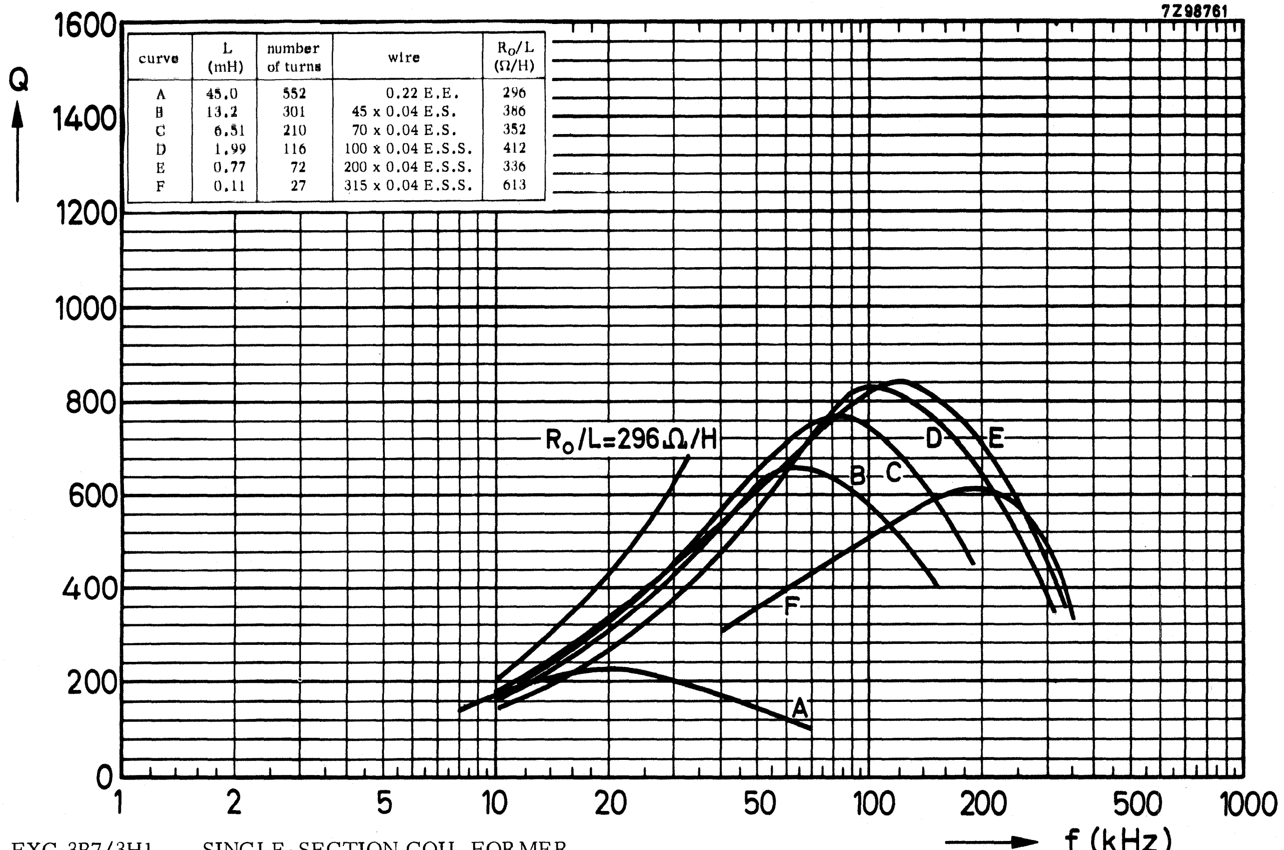
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	31.6	552	0.22 E.E.	421
B	9.32	301	45 x 0.04 E.S.	548
C	4.57	210	70 x 0.04 E.S.	502
D	1.40	116	100 x 0.04 E.S.S.	587
E	0.54	72	200 x 0.04 E.S.S.	478
F	0.08	27	315 x 0.04 E.S.S.	873

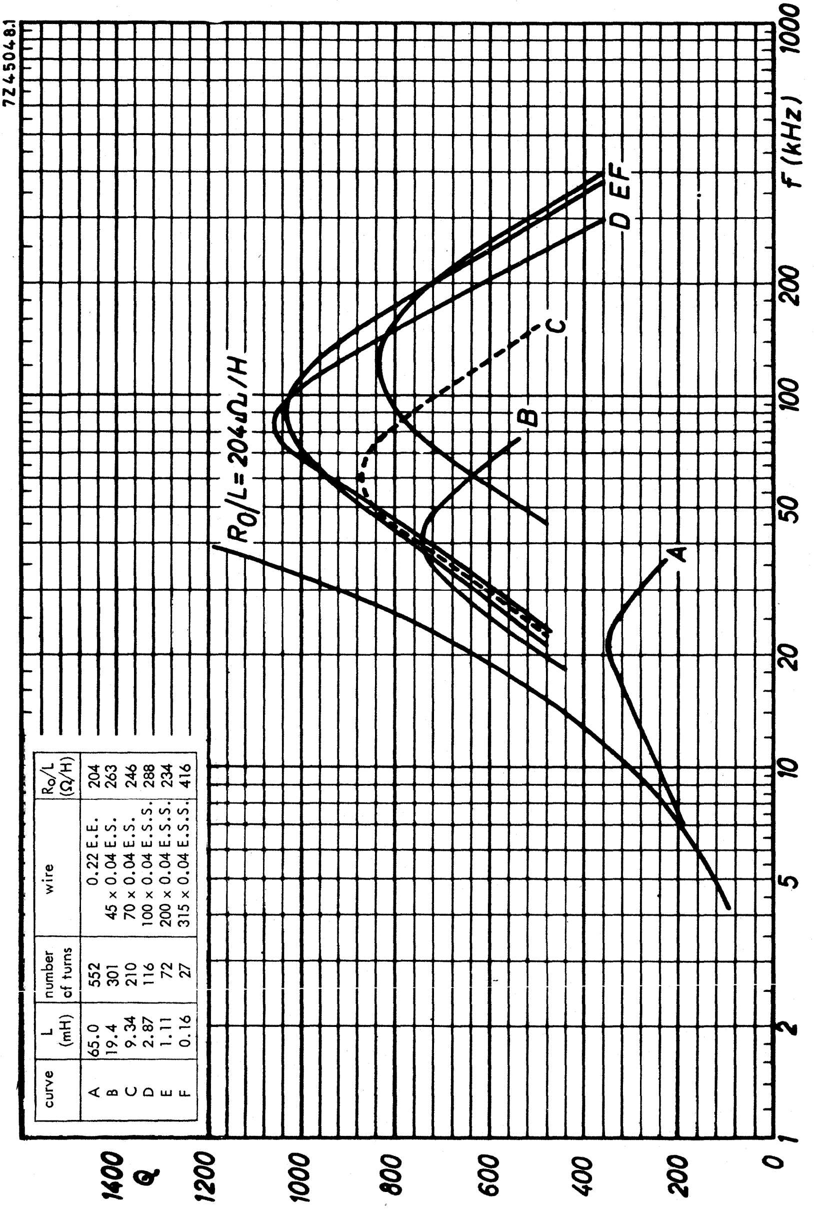
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

$\mu_e = 33$



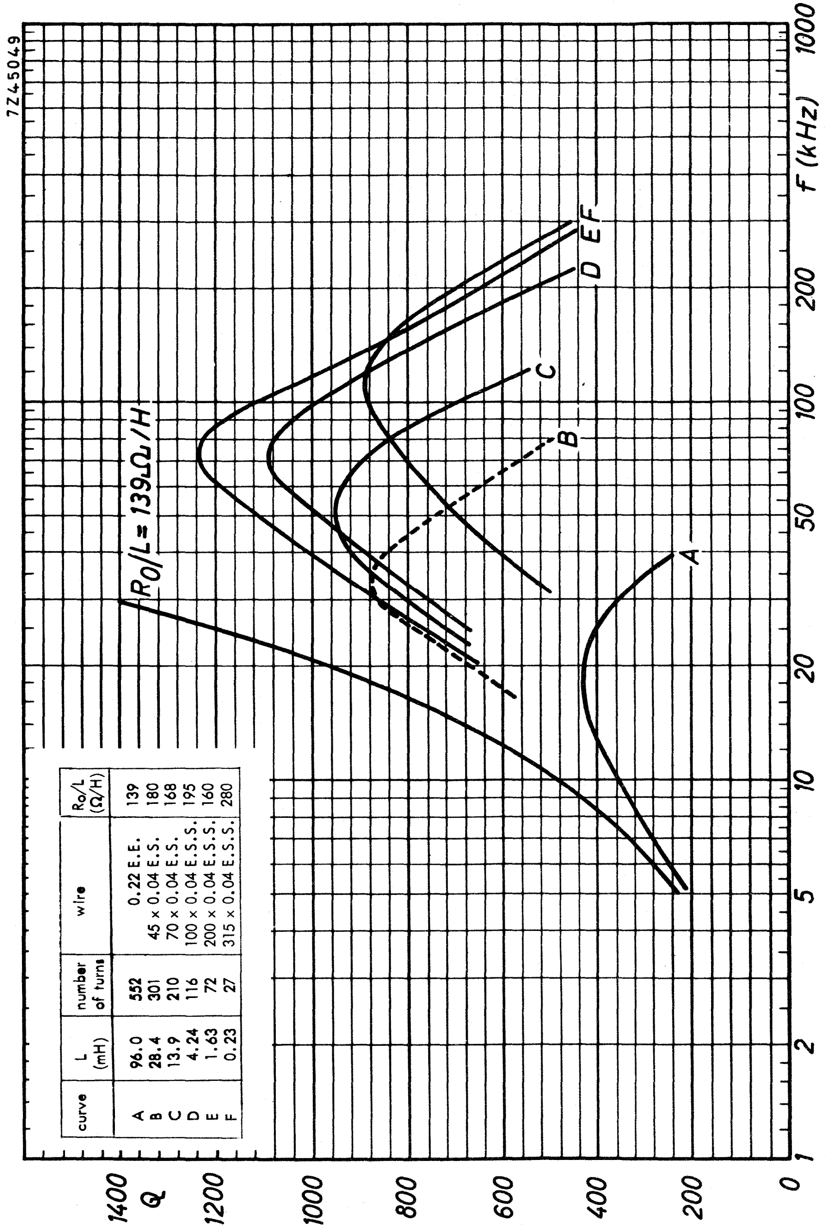
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	45.0	552	0.22 E.E.	296
B	13.2	301	45 x 0.04 E.S.	386
C	6.51	210	70 x 0.04 E.S.	352
D	1.99	116	100 x 0.04 E.S.S.	412
E	0.77	72	200 x 0.04 E.S.S.	336
F	0.11	27	315 x 0.04 E.S.S.	613

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 47$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	65.0	552	0.22 E.E.	204
B	19.4	301	45 × 0.04 E.S.	263
C	9.34	210	70 × 0.04 E.S.	246
D	2.87	116	100 × 0.04 E.S.S.	288
E	1.11	72	200 × 0.04 E.S.S.	234
F	0.16	27	315 × 0.04 E.S.S.	416

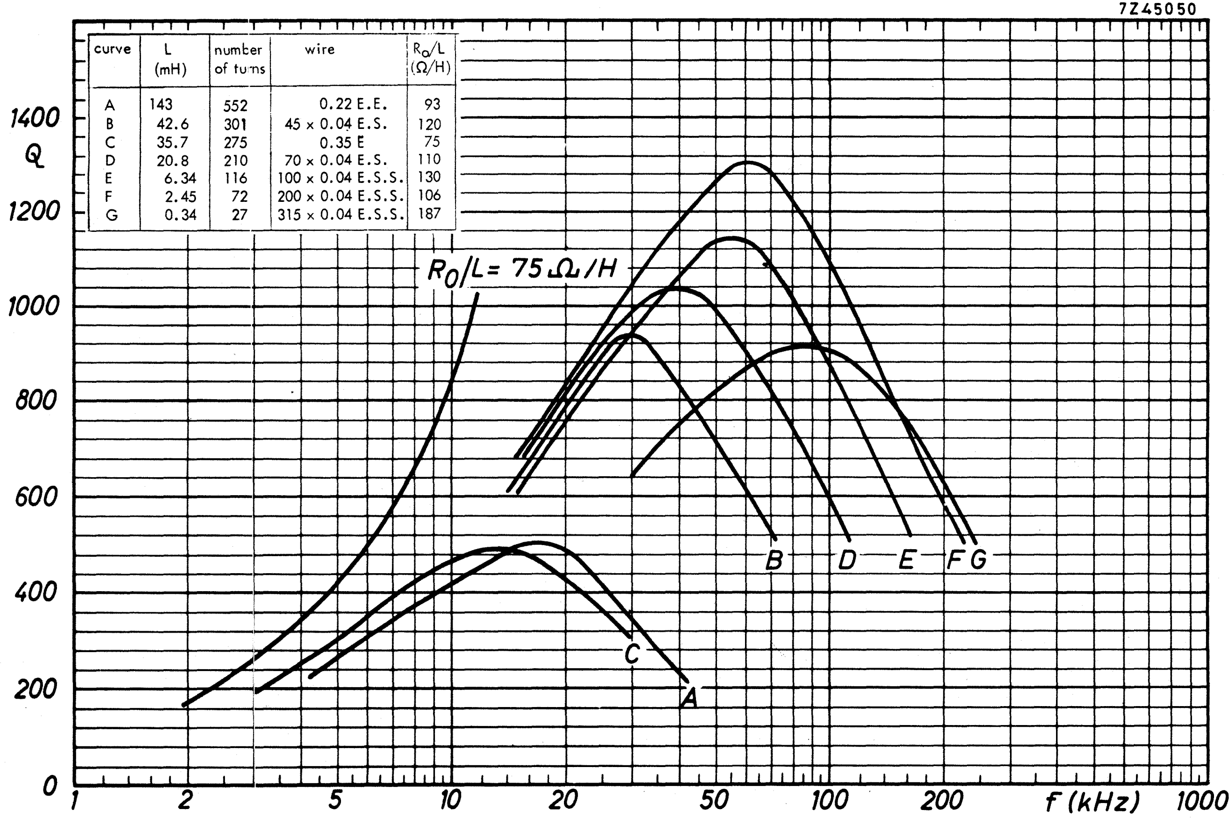
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 68$



curve	L (mH)	number of turns	wire	Ro/L (Ω/H)
A	96.0	552	0.22 E.E.	139
B	28.4	301	45 × 0.04 E.S.	180
C	13.9	210	70 × 0.04 E.S.	168
D	4.24	116	100 × 0.04 E.S.S.	195
E	1.63	72	200 × 0.04 E.S.S.	160
F	0.23	27	315 × 0.04 E.S.S.	280

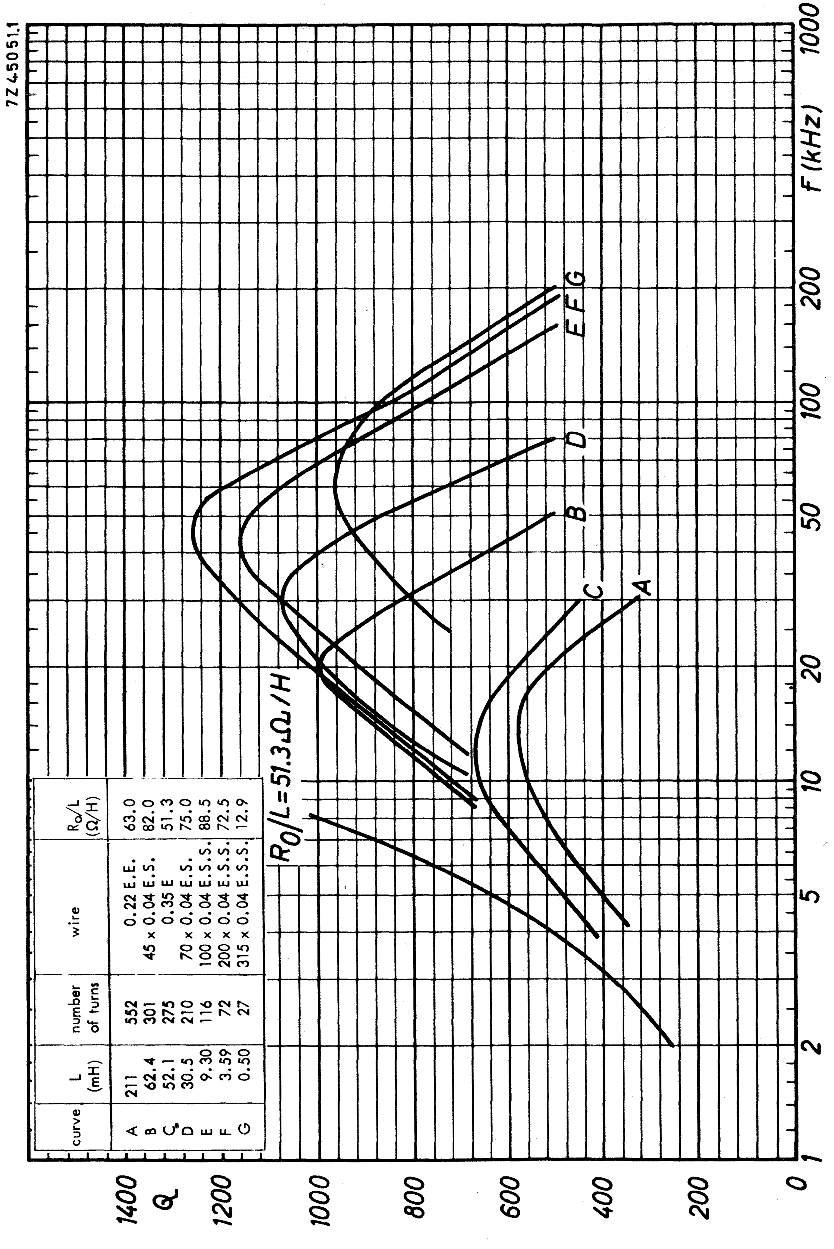
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

$\mu_e = 100$



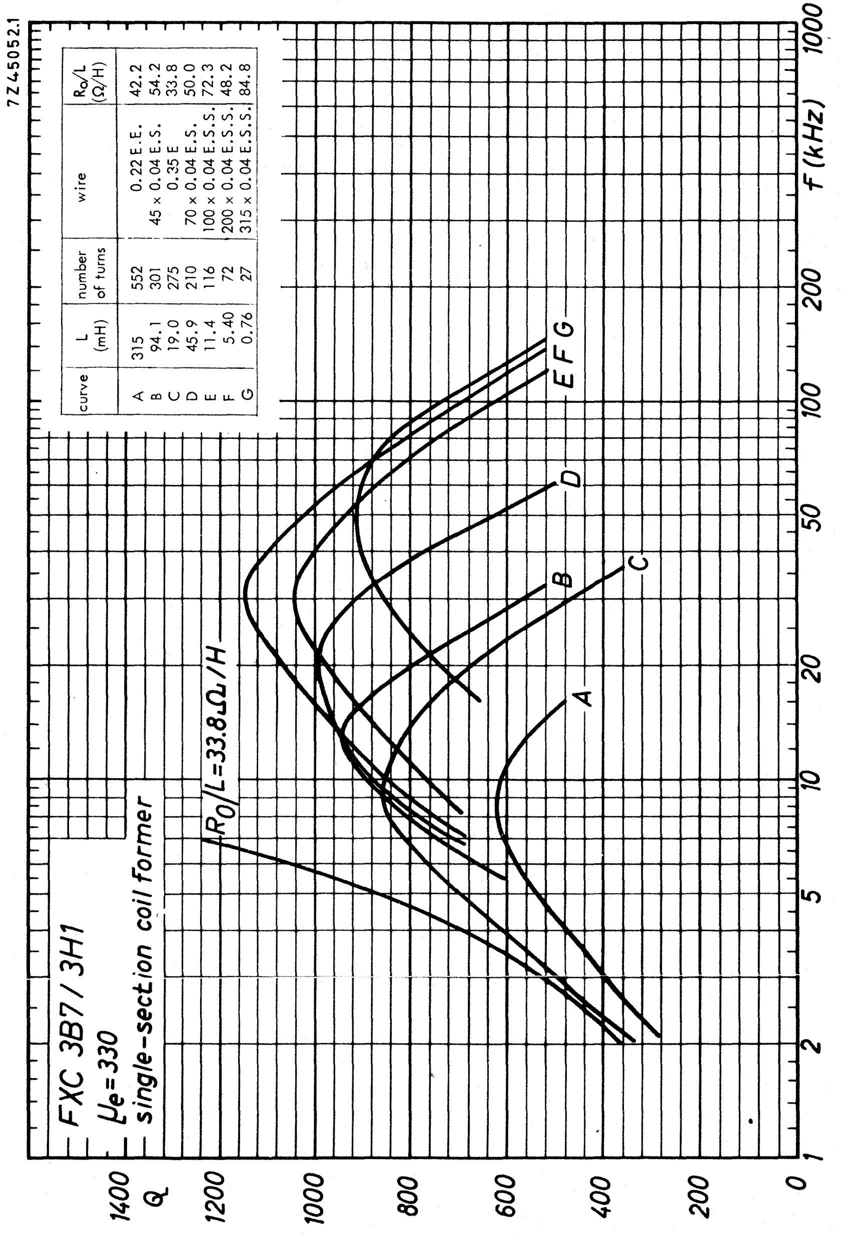
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	143	552	0.22 E.E.	93
B	42.6	301	45 × 0.04 E.S.	120
C	35.7	275	0.35 E	75
D	20.8	210	70 × 0.04 E.S.	110
E	6.34	116	100 × 0.04 E.S.S.	130
F	2.45	72	200 × 0.04 E.S.S.	106
G	0.34	27	315 × 0.04 E.S.S.	187

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 150$



curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	211	552	0.22 E.E.	63.0
B	62.4	301	45 × 0.04 E.S.	82.0
C	52.1	275	0.35 E	51.3
D	30.5	210	70 × 0.04 E.S.	75.0
E	9.30	116	100 × 0.04 E.S.S.	88.5
F	3.59	72	200 × 0.04 E.S.S.	72.5
G	0.50	27	315 × 0.04 E.S.S.	12.9

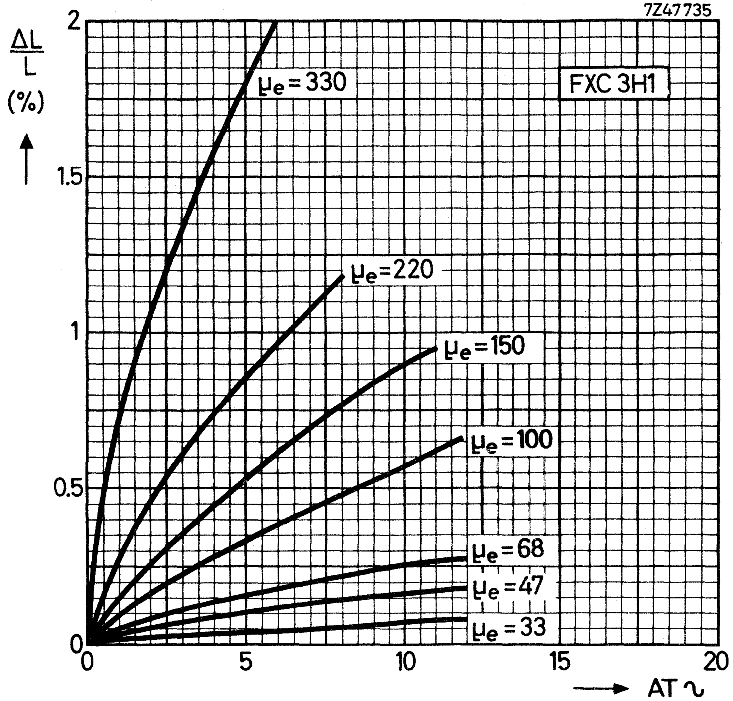
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 220$

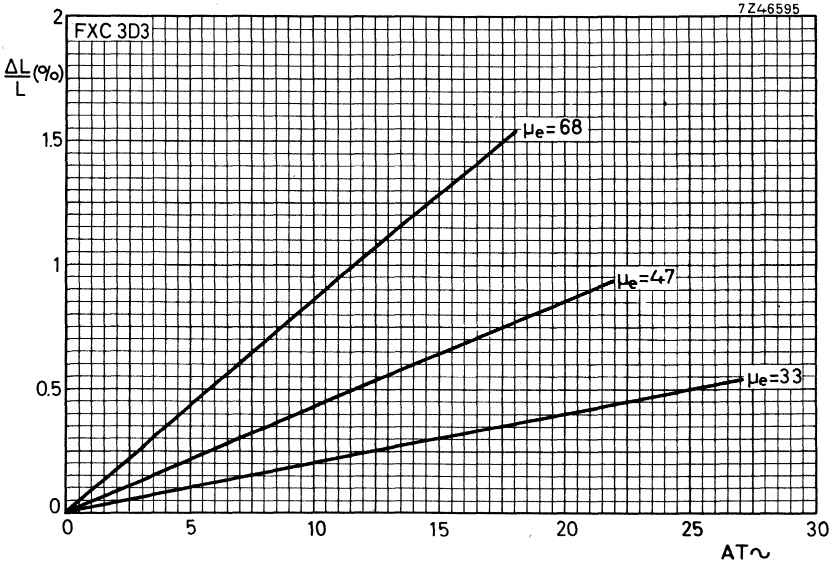


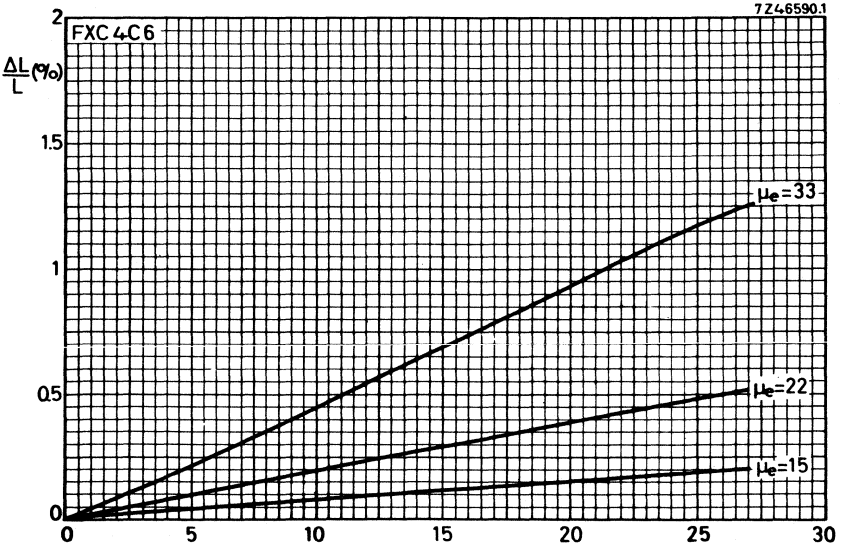
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	315	552	0.22 E.E.	42.2
B	94.1	301	45 × 0.04 E.S.	54.2
C	19.0	275	0.35 E	33.8
D	45.9	210	70 × 0.04 E.S.	50.0
E	11.4	116	100 × 0.04 E.S.S.	72.3
F	5.40	72	200 × 0.04 E.S.S.	48.2
G	0.76	27	315 × 0.04 E.S.S.	84.8

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
μ_e = 330

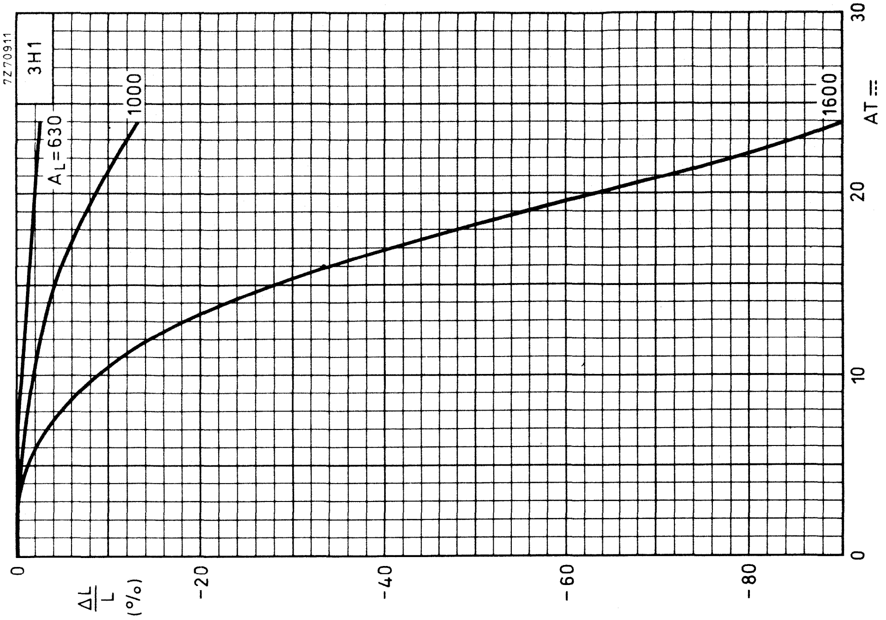
INDUCTANCE VARIATION AS A FUNCTION OF AT ~

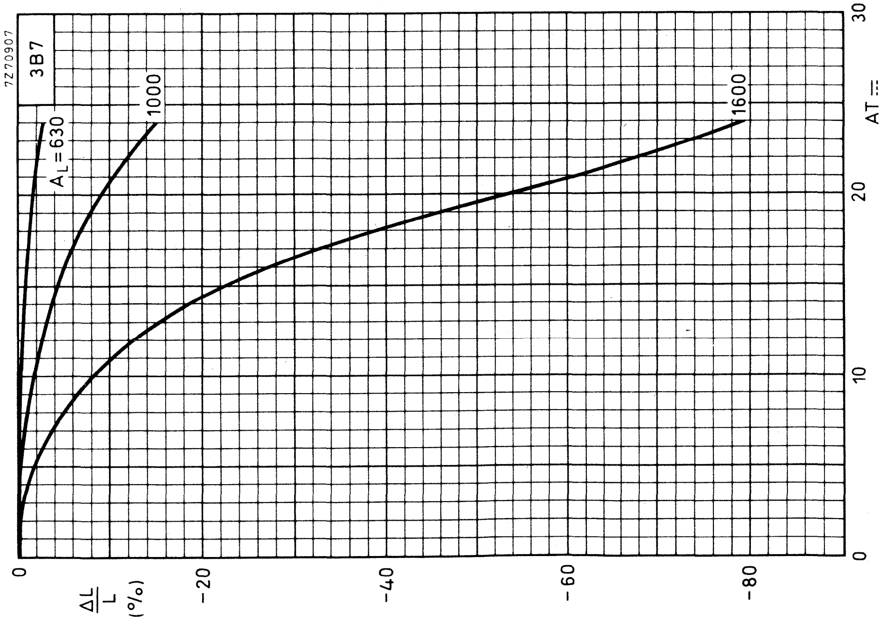


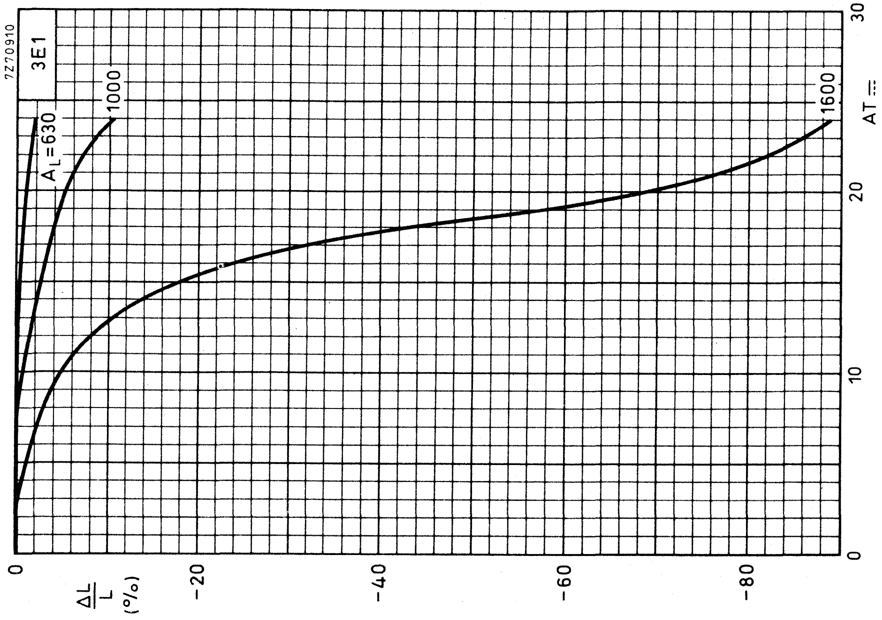

7Z46595
FXC 3D3
ΔL/L (%)
2
1.5
1
0.5
0
0
5
10
15
20
25
30
AT~
μe = 68
μe = 47
μe = 33

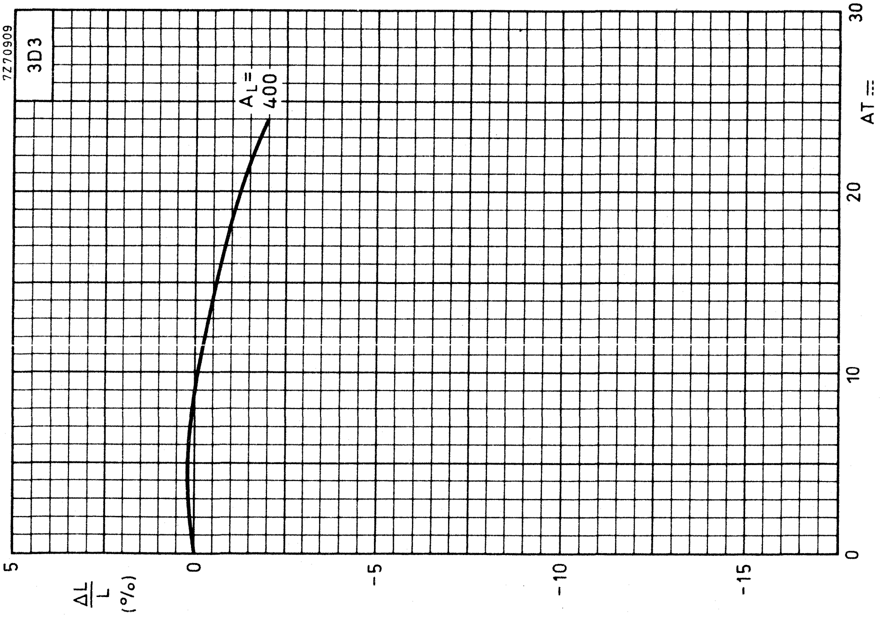

7Z46590.1
FXC 4C6
ΔL/L (%)
2
1.5
1
0.5
0
0
5
10
15
20
25
30
AT~
μe = 33
μe = 22
μe = 15

INDUCTANCE VARIATION AS A FUNCTION OF AT ⎓

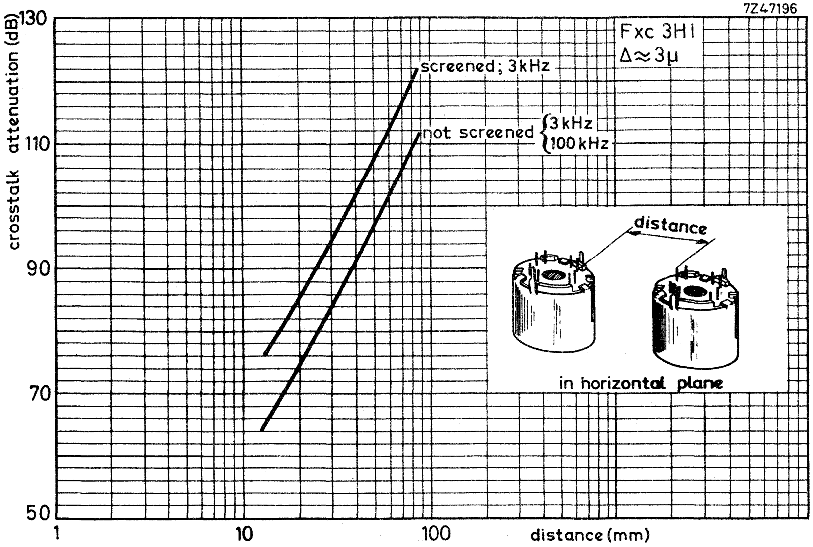


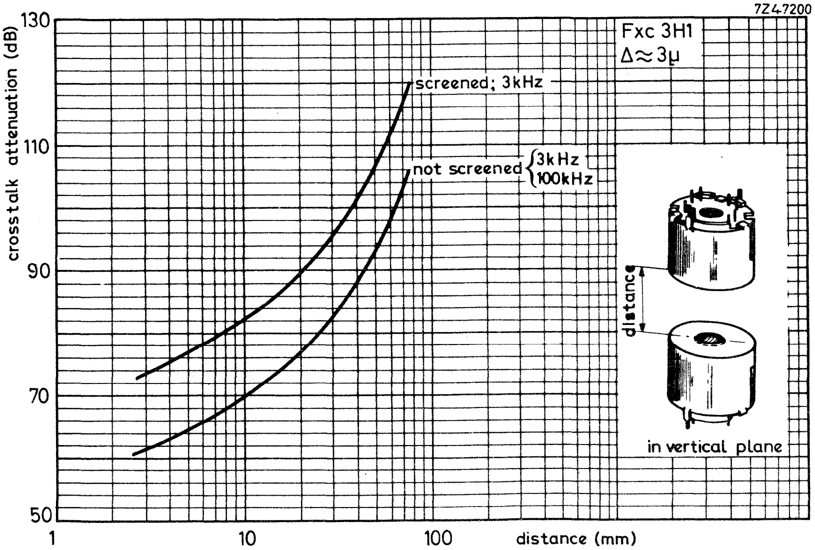


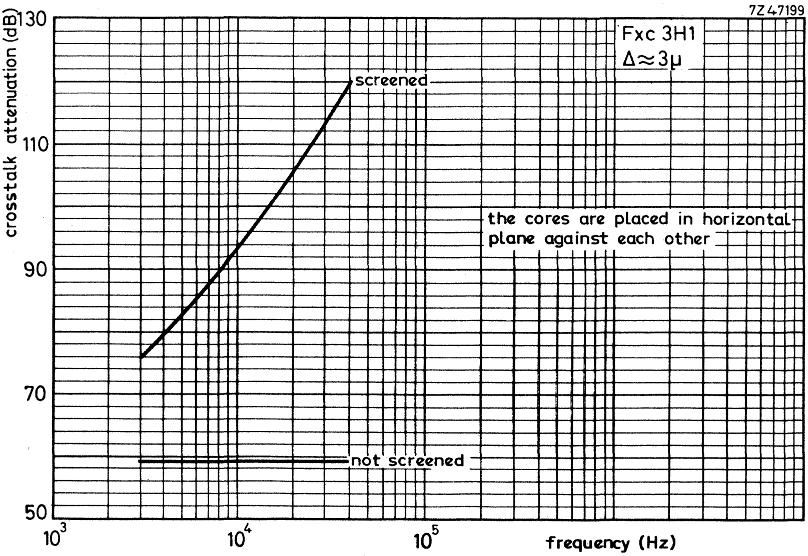

7Z70910
3E1
A_L=630
1000
1600
AT ⎓
0
10
20
30
$\frac{\Delta L}{L}$ (%)
0
-20
-40
-60
-80


7Z70909
3D3
A_L=
400
AT ⎓
0
10
20
30
$\frac{\Delta L}{L}$ (%)
5
0
-5
-10
-15

CROSSTALK ATTENUATION






7Z47199
Fxc 3H1
Δ≈3μ
screened
not screened
the cores are placed in horizontal plane against each other
crosstalk attenuation (dB)
130
110
90
70
50
10^3
10^4
10^5
frequency (Hz)

POTCORES

INTRODUCTION

Three types of core can be supplied:

- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

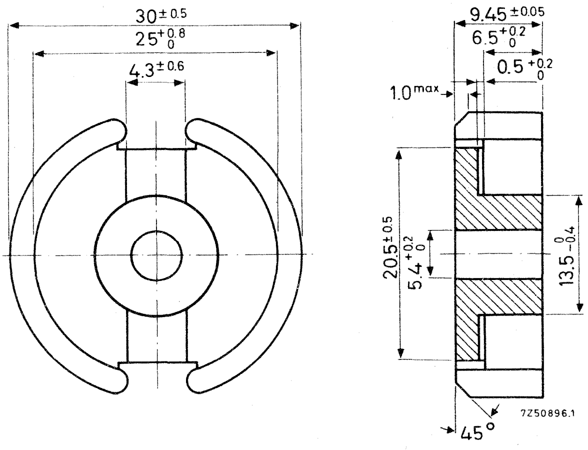
The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number.

Quantity: a primary pack contains 10 potcore halves or 5 pieces of pre-adjusted potcores, a storage pack contains 200 halves or 100 pre-adjusted potcores.
So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 22250
3H1	4322 020 22260
3D3	4322 020 22270
3E1	4322 020 22300

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I	temp. (^{o}C)	grade			
		3B7	3H1	3D3	3E1
$\alpha_F \times 10^6$	+5 to +25	-	+0.5 to +1.5	-	
	+25 to +55	-	+0.5 to +1.5	-	
	+25 to +70	-0.6 to +0.6		0 to +2	0 to +2
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 4.3	≤ 4.3	≤ 12	

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 250 Newton, the values in Table II are guaranteed at 25 ± 10 ^{o}C.

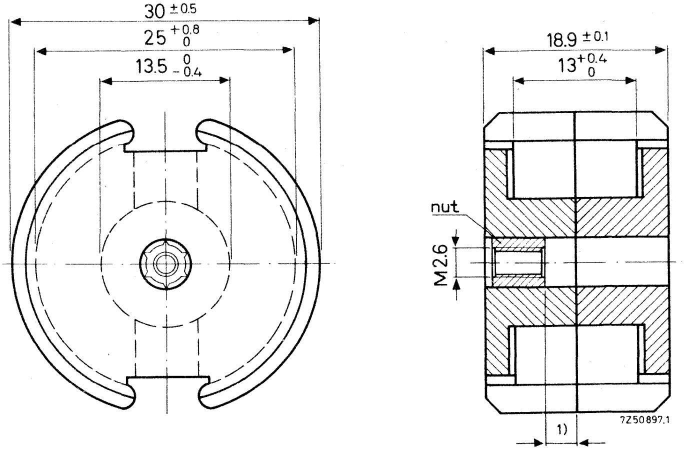
Table II	$\hat{B}$ (mT)	freq. (kHz)	grade			
			3B7	3H1	3D3	3E1
μ_e	≤ 0,1	4	≥ 1490	≥ 1490	-	2185-3280
	≤ 0,1	100	-	-	≥ 555	-
α	≤ 0,1	4	≤ 13.3*	≤ 13.3*	-	-
	≤ 0,1	100	-	-	≤ 21.7*	-
A_L	≤ 0,1	4	-	-	-	8320-12500
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0,1	4	≤ 1.2	≤ 1.2	-	≤ 2.5
	≤ 0,1	100	≤ 6	≤ 6	≤ 8	≤ 20
	≤ 0,1	500	-	-	≤ 16	-
	≤ 0,1	1000	-	-	≤ 40	-
$q_{2-24-100}$	1,5-3,0	4	≤ 1.8	≤ 1	-	≤ 3.0
	0,3-1,2	100	-	-	≤ 3.0	-
$\eta_B \times 10^3$	1,5-3,0	4	≤ 1.1	≤ 0.62	—	≤ 1.8
	0,3-1,2	100	—	-	≤ 1.8	–

---

*) For guidance only.

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 3. . . .
Without nut, catalogue number = 4322 022 1. . . .

Weight per set = 34 g

Effective length l_e = 45,2 mm

$\Sigma \frac{l_e}{A_e}$ = 0,33 mm^{-1}

Effective volume V_e = 6190 mm^3

Notes to the tables on the next page

1. Examples of catalogue number:
   μ_e = 33, grade 3D3, potcore with nut, catalogue number = 4322 022 30430
   A_L = 400, grade 3B7, potcore without nut, catalogue number = 4322 022 11080
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

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[1] For this distance see adjustment curves under Inductance Adjustment.

Pre-adjusted potcores with standard μ_e values [1]

μ_e	α	tolerance on inductance (%)	catal. No. 4322 022 3.... with nut 4322 022 1.... without nut		
			3B7	3H1	3D3
33	89.2	± 1	0030	0230	0430
47	74.7	± 1	-	-	0440
68	62.1	± 1	0050	0250	0450
100	51.3	± 1.5	0060	0260	-
150	41.8	± 2	0070	0270	-
220	34.6	± 3	0080	0280	-
330	28.2	± 3	0090	0290	-
740	18.9	± 25	-	-	0400*
1990	11.5	± 25	0000*	0200*	-

Number of turns $N = \alpha\sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 33 up to and including 100
Asymmetric air gap for cores with an μ_e value of 150 up to and including 1990

Pre-adjusted potcores with standard A_L factors [1]

A_L	corresponding μ_e-value	tolerance on inductance (%)	catal. No. 4322 022 3.... with nut 4322 022 1.... without nut		
			3B7	3H1	3D3
100	26.2	± 1	1040	-	1440
160	42	± 1	1050	-	1450
250	65.5	± 1	1060	1260	1460
400	105	± 1.5	1080	1280	-
630	165	± 2	1100	1300	-
1000	263	± 3	1110	1310	-
1600	420	± 3	1120	1320	-
2500	655	± 3	1130	1330	-

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Symmetric air gap for cores with an A_L factor of 100 up to and including 400
Asymmetric air gap for cores with an A_L factor of 630 up to and including 2500

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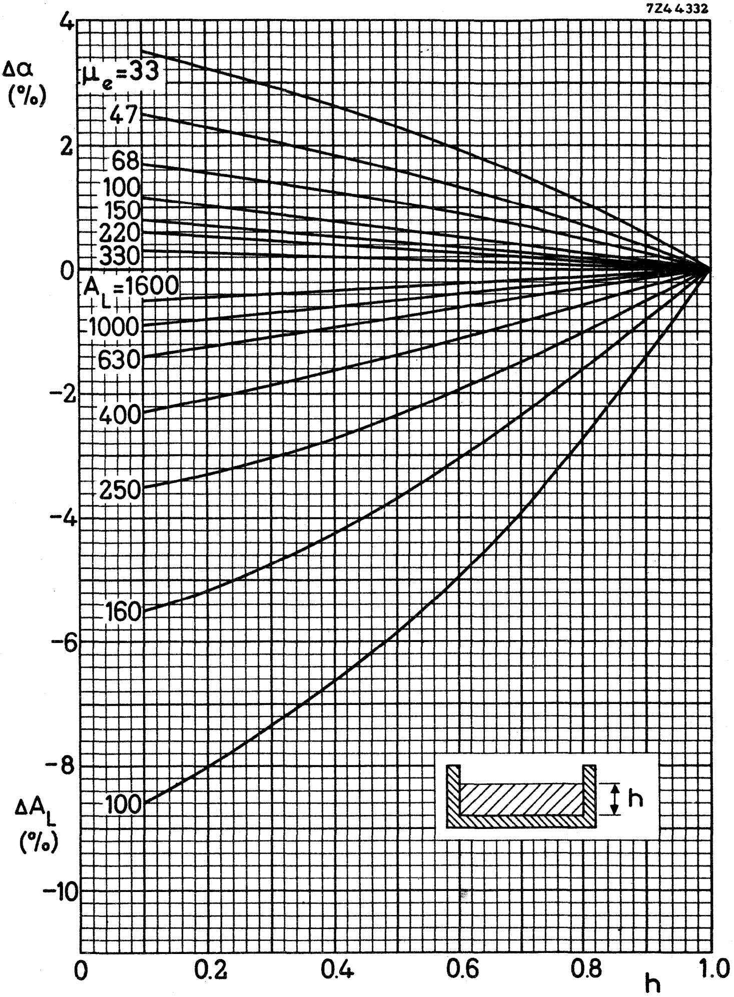
[1] See notes on the previous page.

*) Only available without nut.

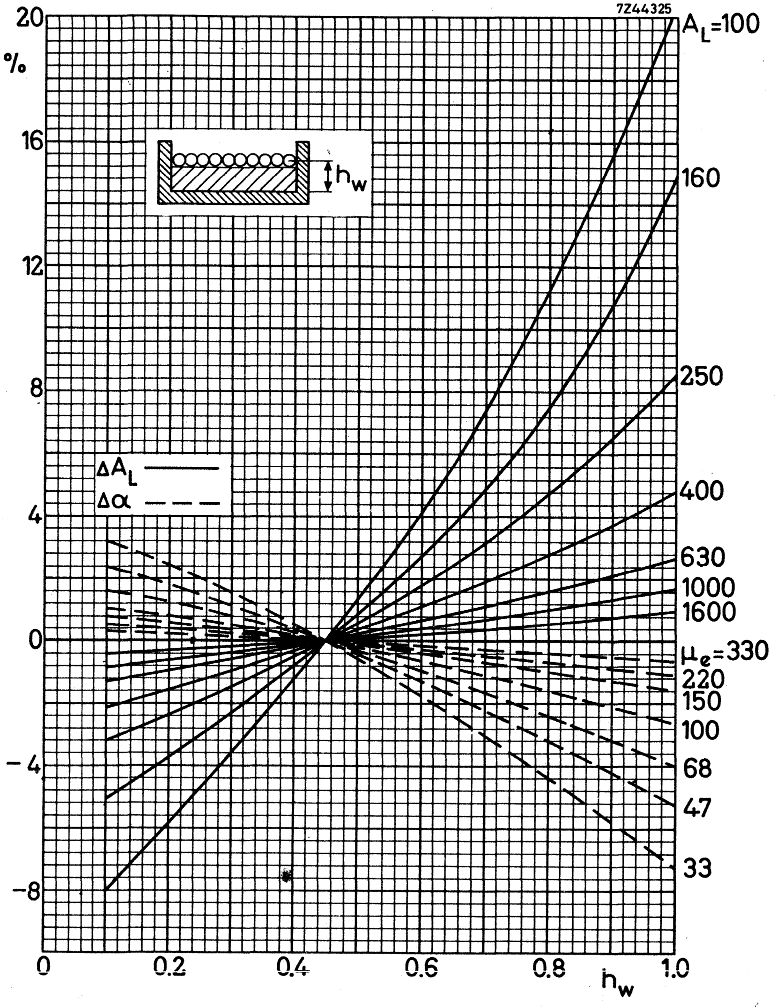
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3.

Example: On a single-section coil former only 0.4 part of the available height is used. A potcore with μ_e = 68 in that case obtains an α factor of 62.1 + 1.25%.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_W on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3.

Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 68 obtains for that winding an α factor of 62.1 - 1.6%.

COIL FORMERS

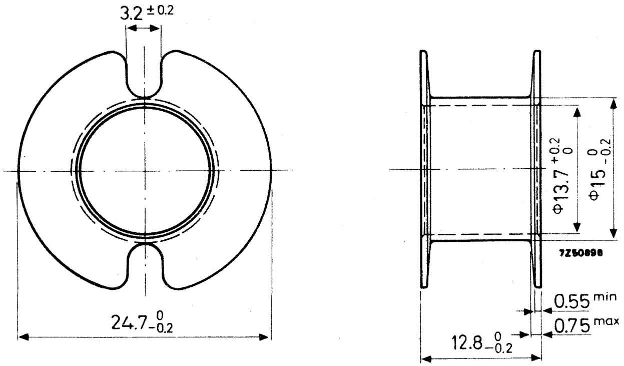
GENERAL

Three types of coil former can be supplied:

- with one section
- with two sections
- with three sections

The dimensions conform with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41 294 (Germany) and BS 4061 range 2 (Great Britain). The dimensions in the drawings are in mm.

SINGLE-SECTION COIL FORMER



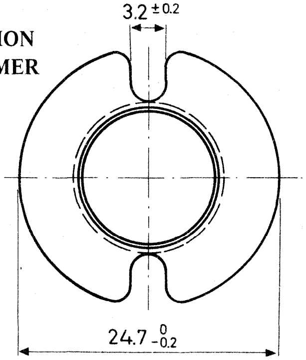
Catalogue number	4322 021 30360
Material	polycarbonate
Window area	55 mm^2
Mean length of turn	62 mm
Max. temperature	130 $^{\circ}$C

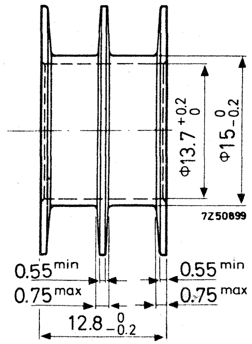
D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5,07 \times 10^3\ \Omega/H$$

Weight 0,75 g

TWO-SECTION COIL FORMER





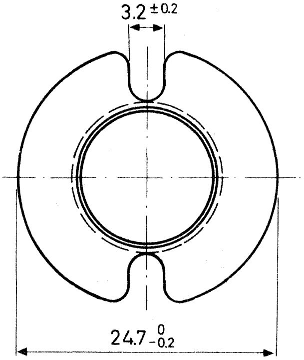
Catalogue number	4322 021 30370
Material	polycarbonate
Window area	2 x 26 mm^2
Mean length of turn	62 mm
Max. temperature	130 °C

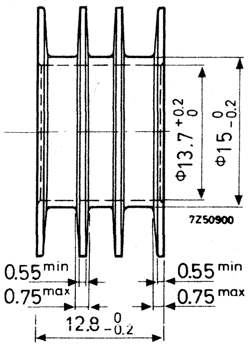
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5.38 \times 10^3 \ \Omega/\text{H}$$

Weight	1.0 g

THREE-SECTION COIL FORMER





Catalogue number	4322 021 30380
Material	polycarbonate
Window area	3 x 16 mm^2
Mean length of turn	62 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5.74 \times 10^3 \ \Omega/\text{H}$$

Weight	1.2 g

INDUCTANCE ADJUSTORS

CONTINUOUS ADJUSTORS

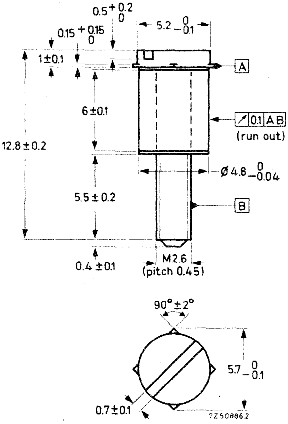


Fig. A

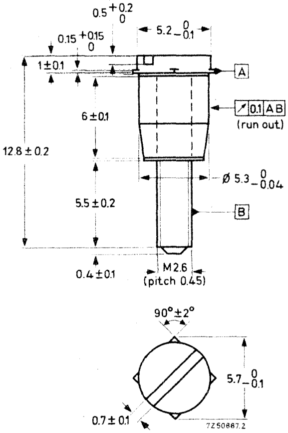


Fig. B

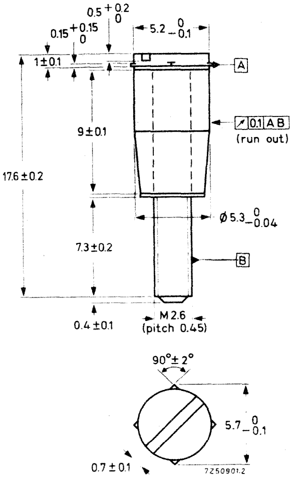


Fig. C

The tolerances on inductance of the pre-adjusted potcores (with adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.

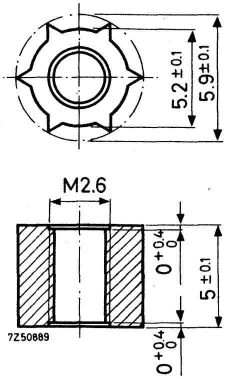
Types of adjustor and recommended applications.

Fig.	colour	catalogue number 4322 021	potcore	
			μ_e	A_L
A	green	30780	33	100
A	red	30800	47	160
B	white	30980	68	250
B	white	30980	100	400
A	brown	30810	150	630
B	grey	31090	220	1000
C	black	31120	330	1600

The adjustors are packed in bags of 100, so please order in multiples of 100.

Nut for adjustor

These data are given for those manufacturers who prefer to insert the nut themselves.

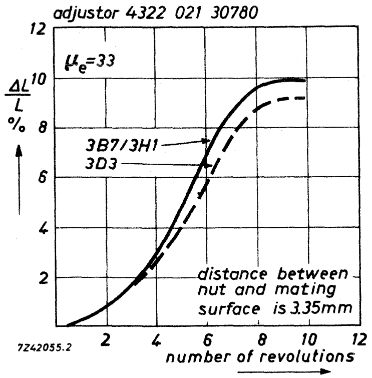


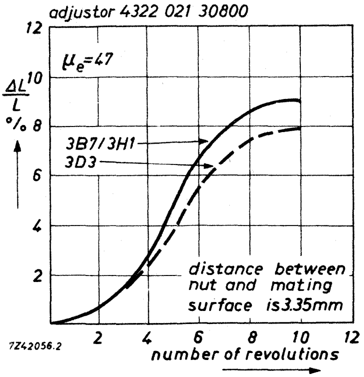
Catalogue number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut (see Adjustment curves)	3.35 ± 0.15 mm or 4.35 ± 0.15 mm

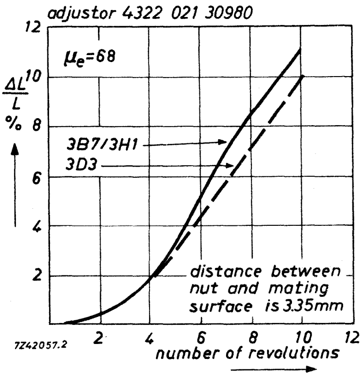
For more information see Potcores General, Mounting data.

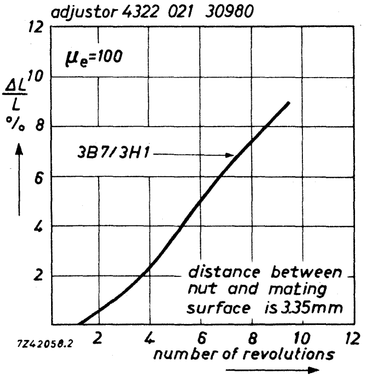
The nuts are packed in bags of 100, so please order in multiples of 100.

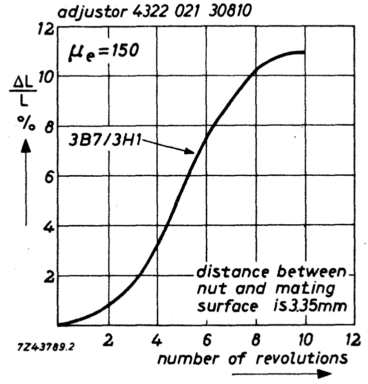
Adjustment curves

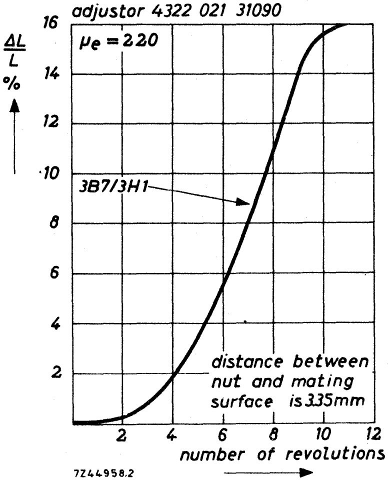


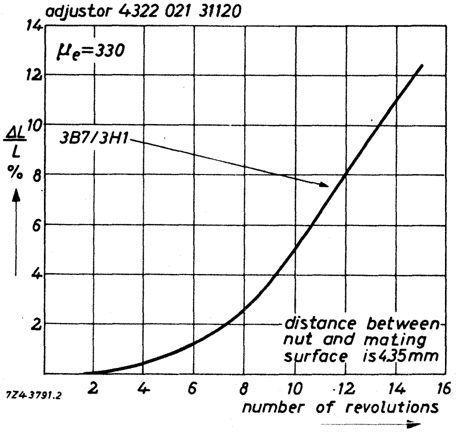







adjustor 4322 021 30810
$\mu_e = 150$
$\frac{\Delta L}{L}$ %
12
10
8
6
4
2
3B7/3H1
distance between nut and mating surface is 3.35mm
2
4
6
8
10
12
number of revolutions
7Z43789.2

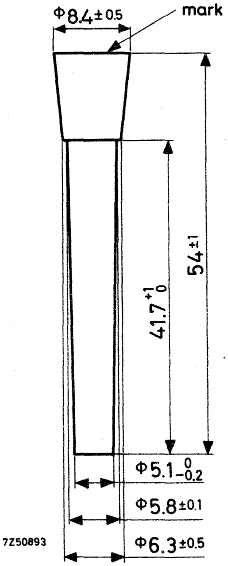

adjustor 4322 021 31090
$\mu_e = 220$
$\frac{\Delta L}{L}$ %
16
14
12
10
8
6
4
2
3B7/3H1
distance between nut and mating surface is 3.35mm
2
4
6
8
10
12
number of revolutions
7Z44958.2

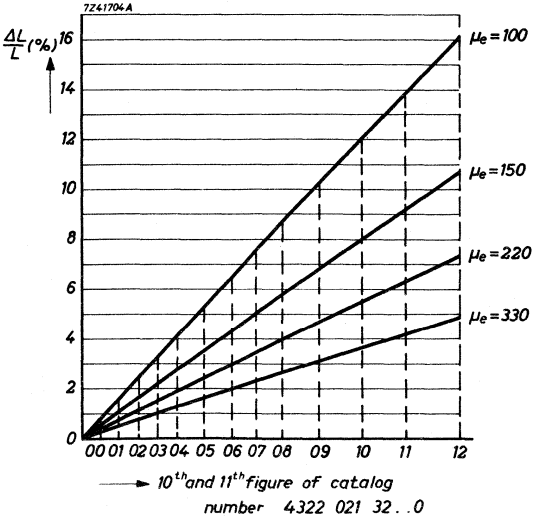

adjustor 4322 021 31120
$\mu_e = 330$
$\frac{\Delta L}{L}$ %
14
12
10
8
6
4
2
3B7/3H1
distance between nut and mating surface is 4.35mm
2
4
6
8
10
12
14
16
number of revolutions
7Z43791.2

STEP-BY-STEP ADJUSTORS

These adjustors are used when a continuous adjustment of the inductance is not necessary. For instance, they are applied in loading coils to bring the inductance within a certain tolerance field. They are not suitable for adjusting the inductance to an exact value, as is usually necessary in filters. The increment of the losses caused by these adjustors is negligible.
A range of 13 flexible conical adjustors is available under the catalog numbers 4322 021 32000 up to 021 32120. Each adjustor causes an increase in the inductance; the higher the catalog number, the greater the effect. The influence of each adjustor on the inductance at different μ_e values of the potcore can be found from the graph.
The 10th and 11th figure of the catalog number are indicated on the head of the adjustor. It should be borne in mind that, when using these adjustors, the inductance of the coil should initially be lower than the wanted value.
When the correct adjustor has been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond of Good Year) is used as sliding and fixing material. After fixing the protruding ends are cut off.

The maximum impregnation temperature is 150 °C.
The maximum working temperature is 90 °C.
Material: rubber with powder iron.

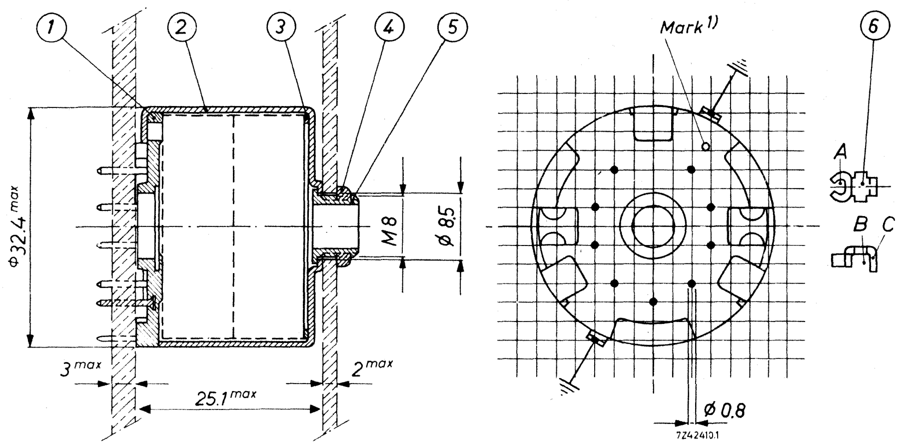




Dimensions in mm

MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30480	(4) nut	4322 021 30710
(2) brass container	4322 021 30560	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30670	(6) soldering spring	4322 021 30700 (9x)

The core is suitable for mounting on printed-wiring boards and on conventional panels.

The parts 1, 2, 3 (and 6) are sufficient to construct an assembly for use in combination with printed wiring.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin: then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The nine soldering pins are arranged to fit printed-wiringboards with a 0.1 inch grid as well as those with a 2.50 mm grid.
The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1.3 ± 0.1 mm diameter.

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[1]) There is another mark in a similar position on the top of the container.

If one-hole mounting is preferred, the parts 4 and 5 should be added. The coil assembly may then be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

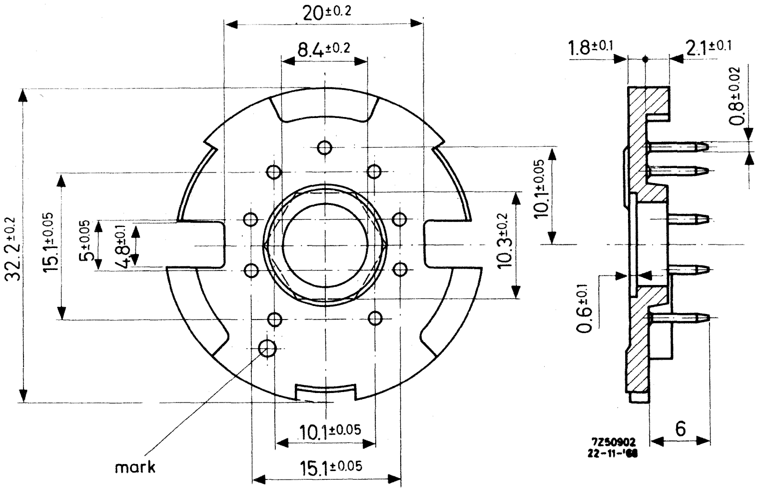
It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 250 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

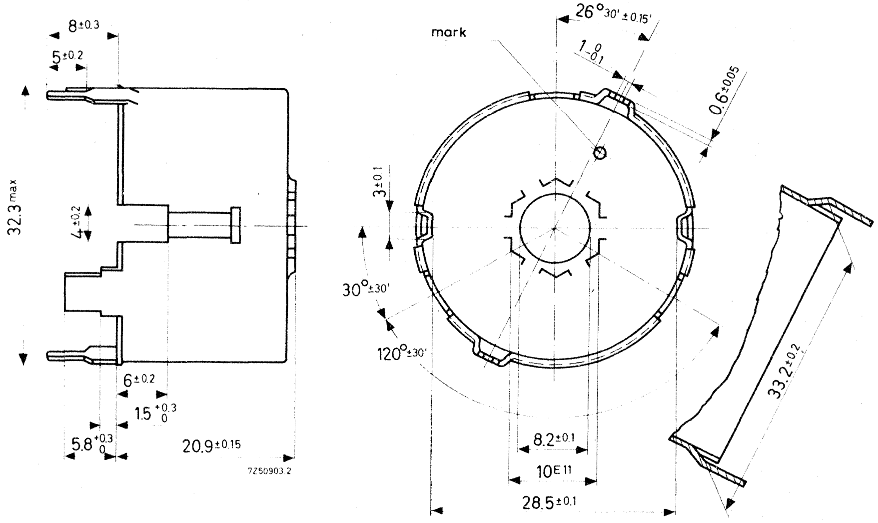
(1) Tag plate 4322 021 30480

Plate: polyester reinforced with glass fibre
Pins : phosphorbronze, dipsoldered



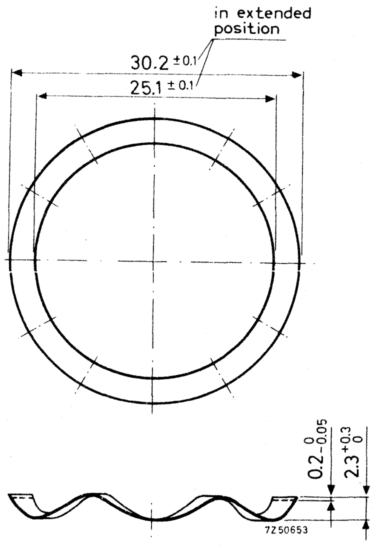
(2) Container 4322 021 30560

Material: brass, nickel plated; tinned soldering pins



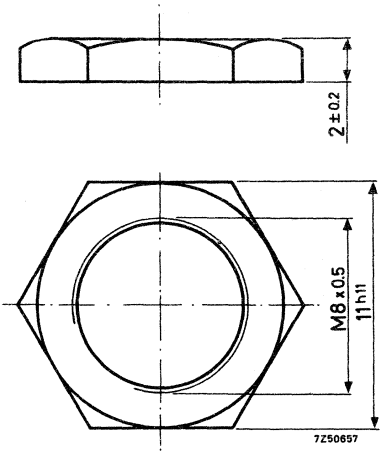
(3) Spring 4322 021 30670

Material: steel



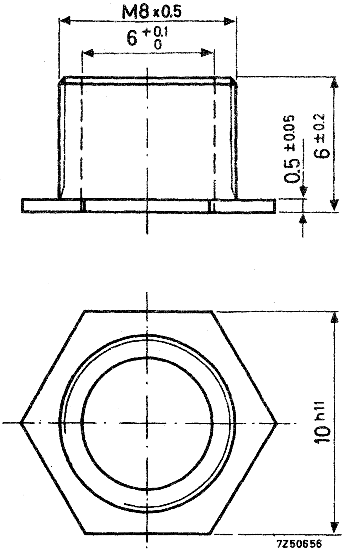
(4) Nut 4322 021 30710

Material: brass, nickel plated



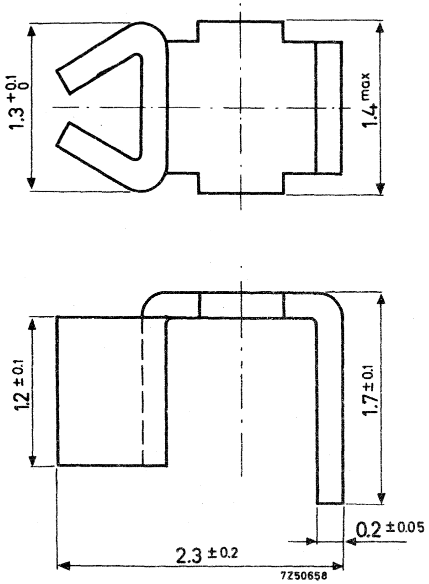
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



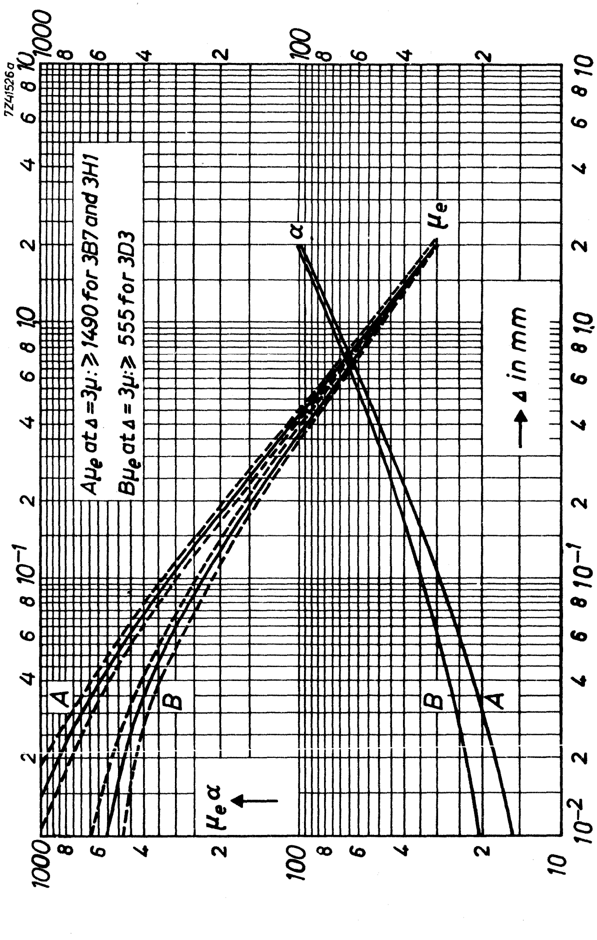
(6) Soldering spring 4322 021 30700

Material: brass, dipsoldered



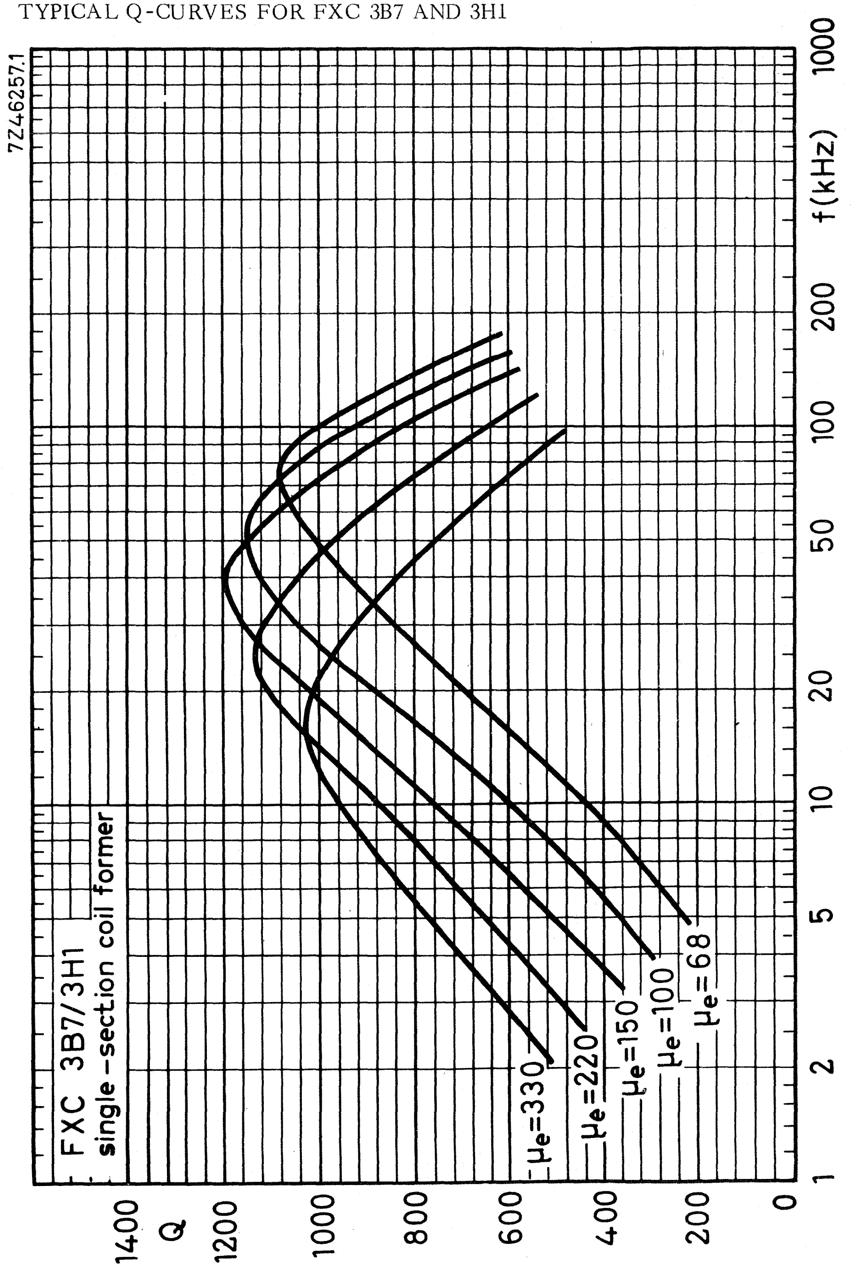
CHARACTERISTIC CURVES

μ_e-α CURVES

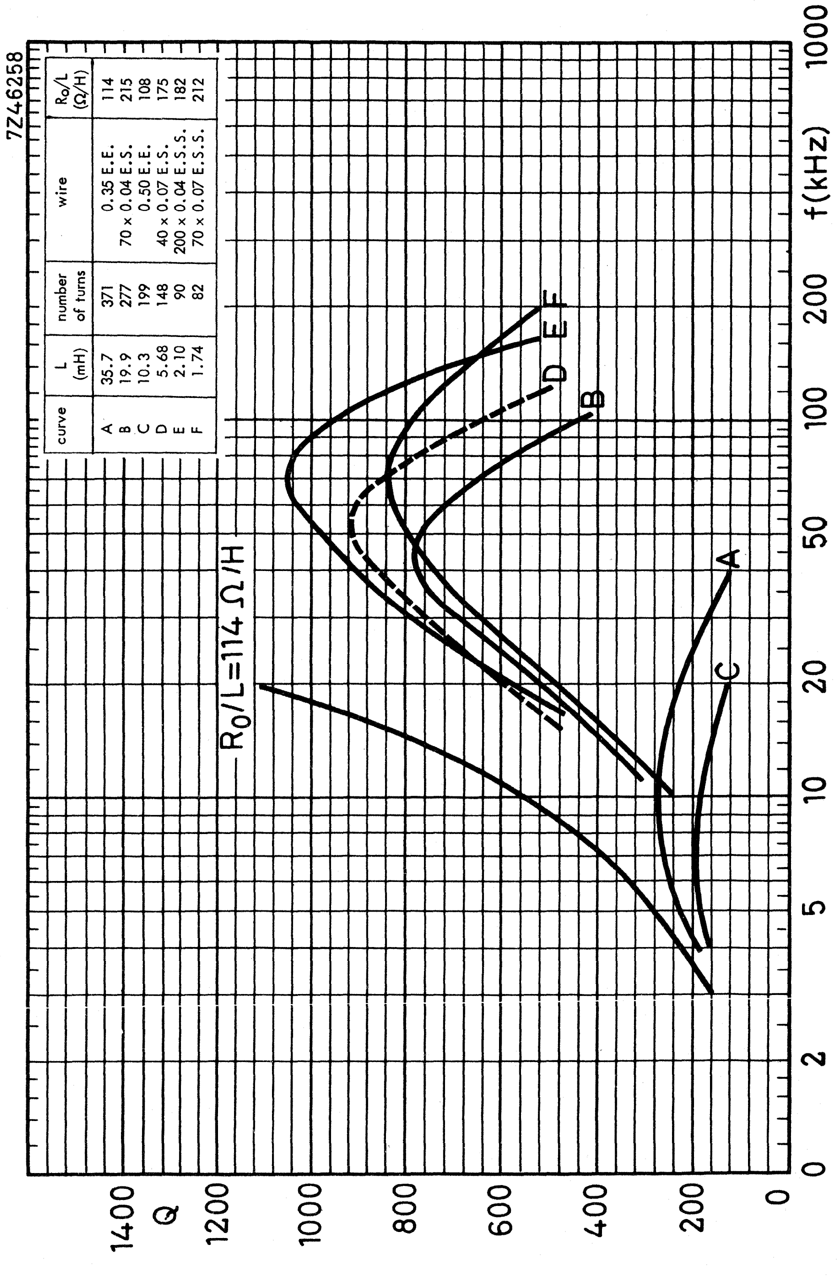


Relative effective permeability and turn factor for 1 mH as a function of the air gap length.

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



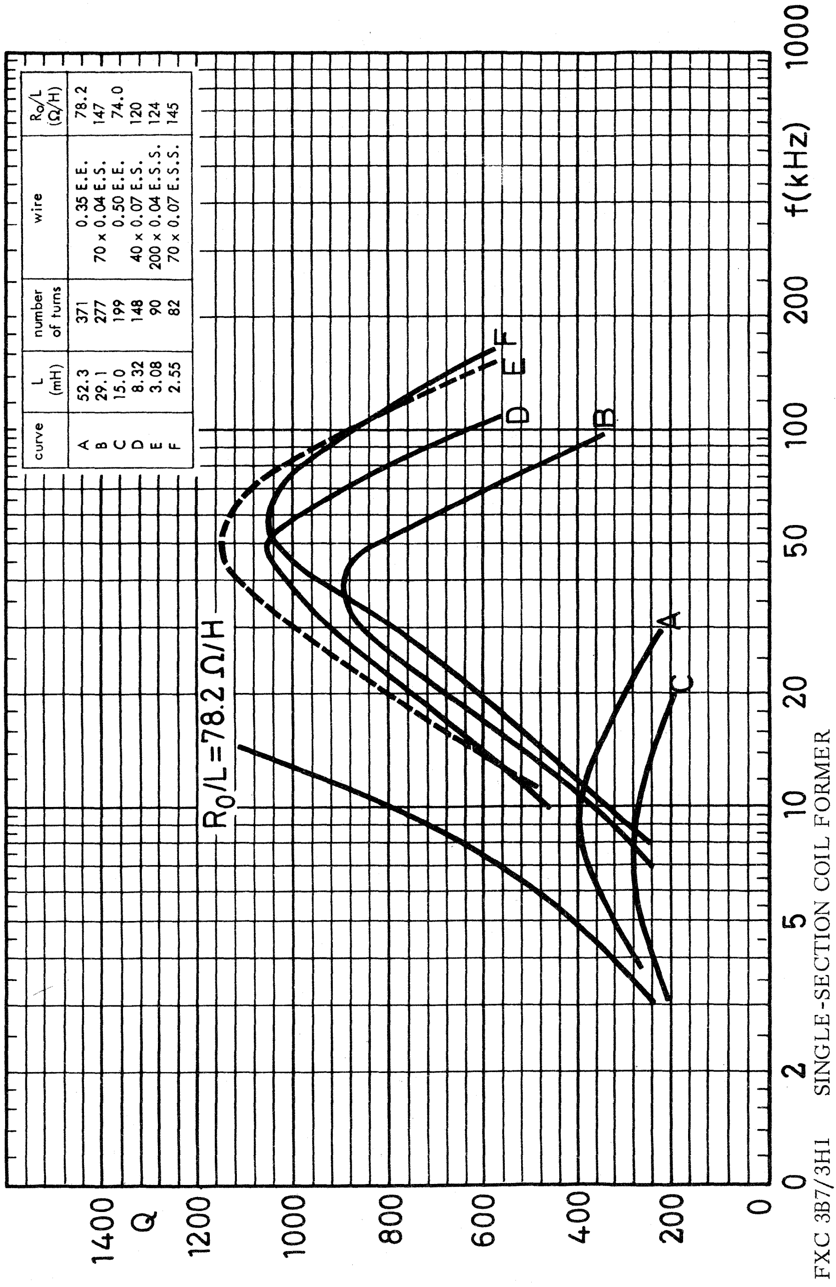
Enveloping curves



curve	L (mH)	number of turns	wire	Ro/L (Ω/H)
A	35.7	371	0.35 E.E.	114
B	19.9	277	70 × 0.04 E.S.	215
C	10.3	199	0.50 E.E.	108
D	5.68	148	40 × 0.07 E.S.	175
E	2.10	90	200 × 0.04 E.S.S.	182
F	1.74	82	70 × 0.07 E.S.S.	212

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

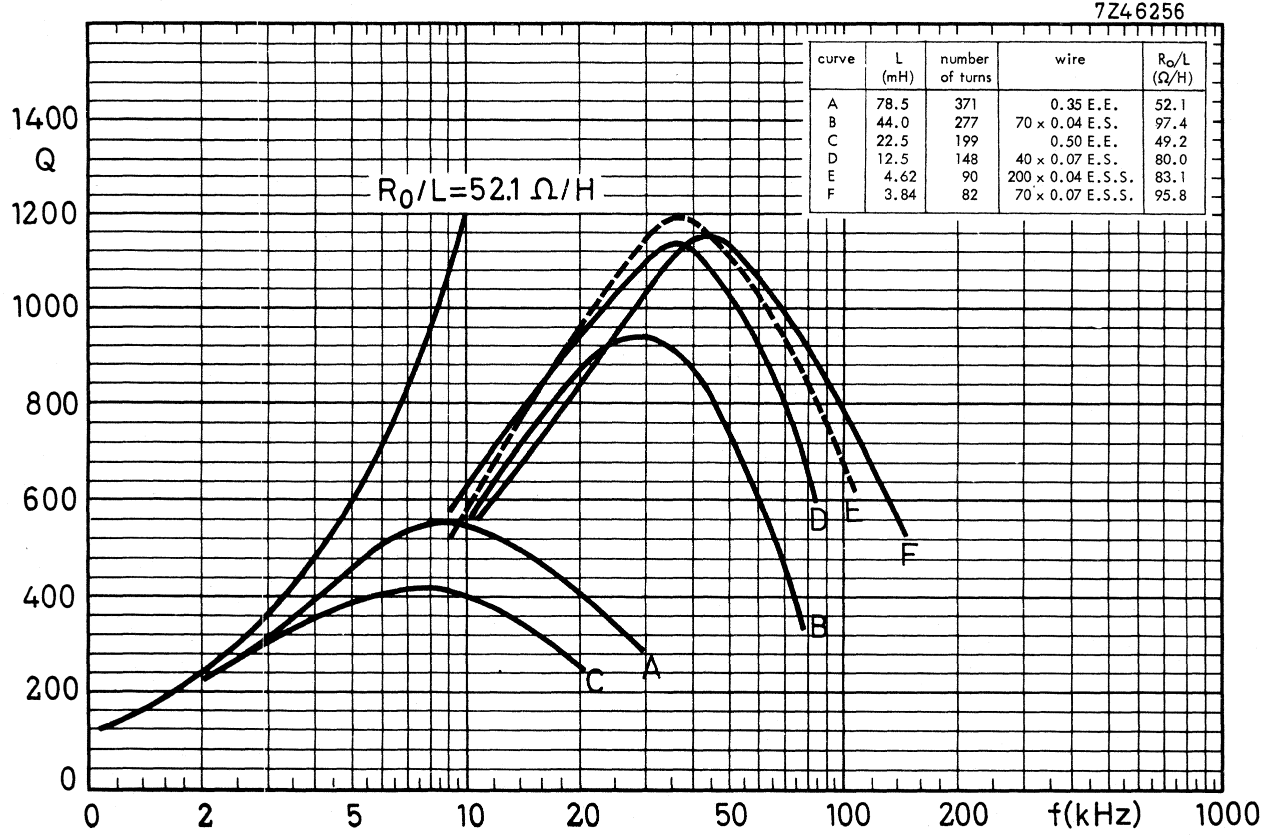
μ_e = 68



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	52.3	371	0.35 E.E.	78.2
B	29.1	277	70 × 0.04 E.S.	147
C	15.0	199	0.50 E.E.	74.0
D	8.32	148	40 × 0.07 E.S.	120
E	3.08	90	200 × 0.04 E.S.S.	124
F	2.55	82	70 × 0.07 E.S.S.	145

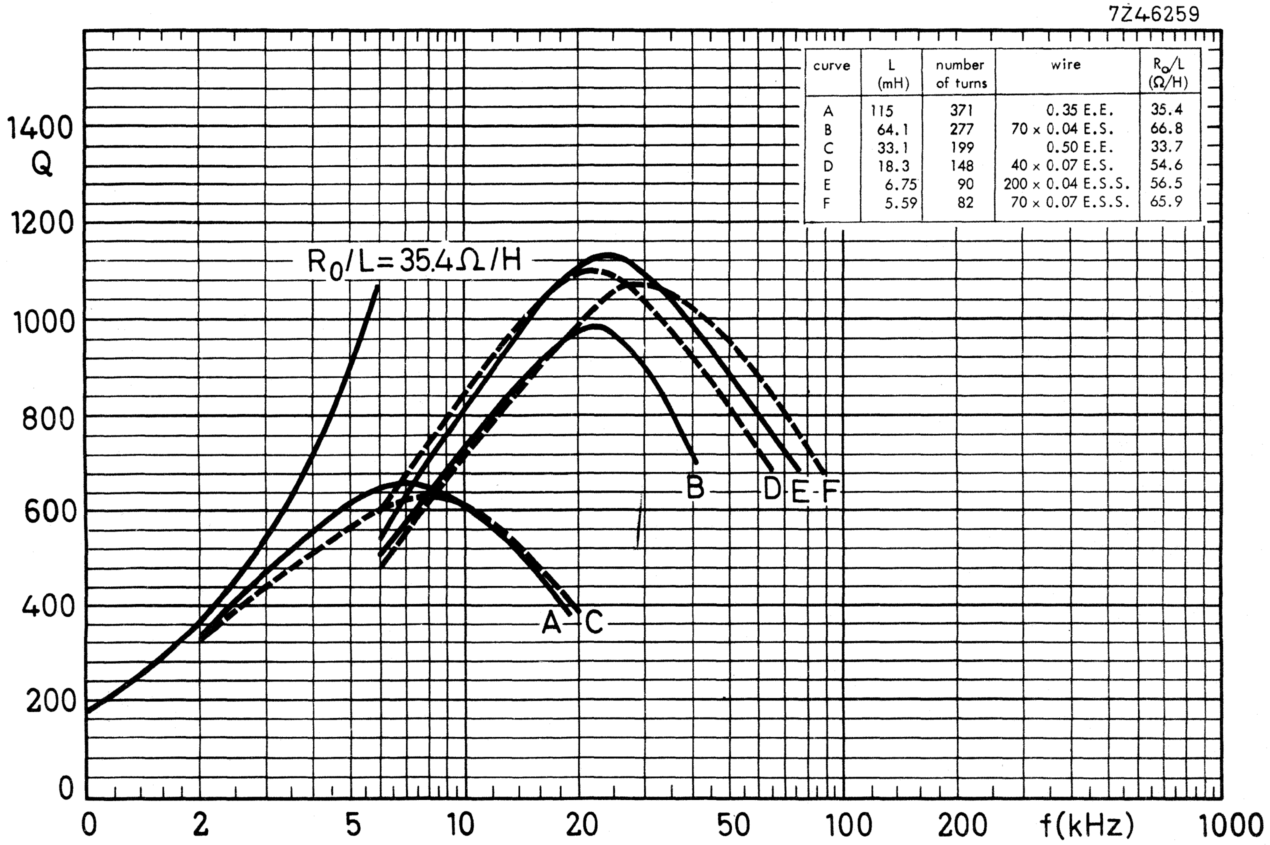
SINGLE-SECTION COIL FORMER

FXC 3B7/3H1
$\mu_e = 100$



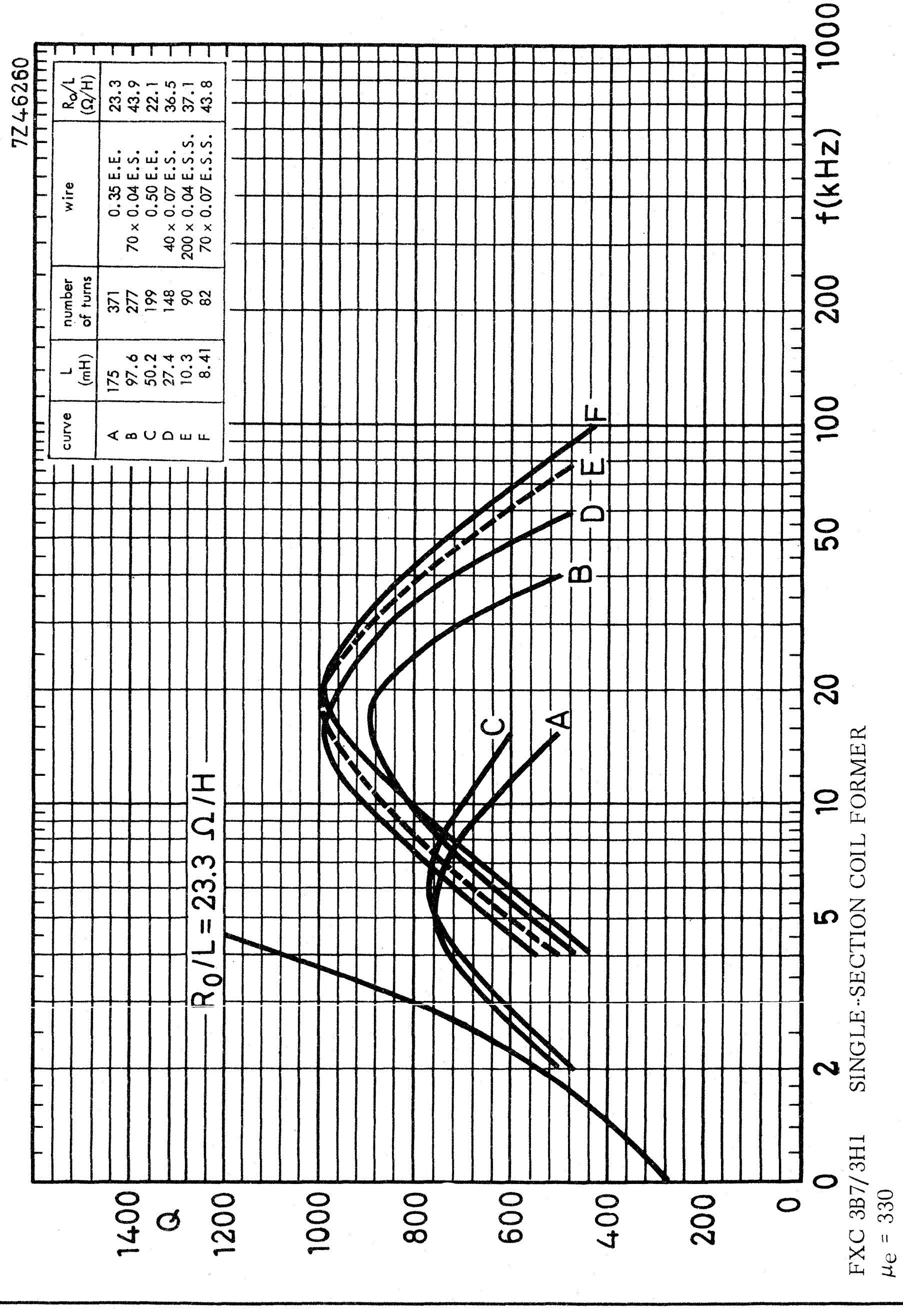
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	78.5	371	0.35 E.E.	52.1
B	44.0	277	70 × 0.04 E.S.	97.4
C	22.5	199	0.50 E.E.	49.2
D	12.5	148	40 × 0.07 E.S.	80.0
E	4.62	90	200 × 0.04 E.S.S.	83.1
F	3.84	82	70 × 0.07 E.S.S.	95.8

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 150$



curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	115	371	0.35 E.E.	35.4
B	64.1	277	70 × 0.04 E.S.	66.8
C	33.1	199	0.50 E.E.	33.7
D	18.3	148	40 × 0.07 E.S.	54.6
E	6.75	90	200 × 0.04 E.S.S.	56.5
F	5.59	82	70 × 0.07 E.S.S.	65.9

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 220$

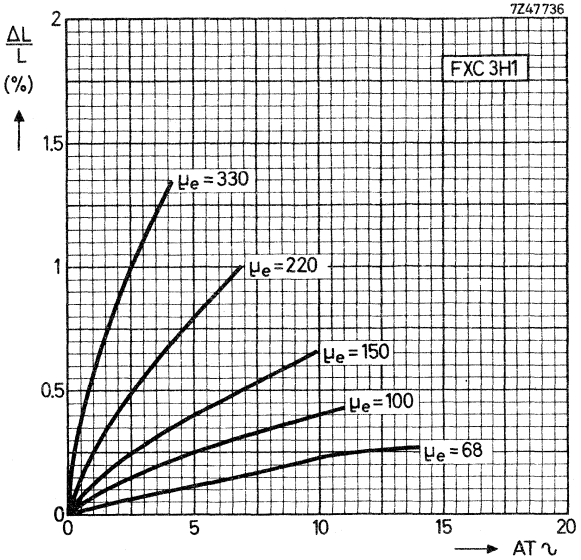


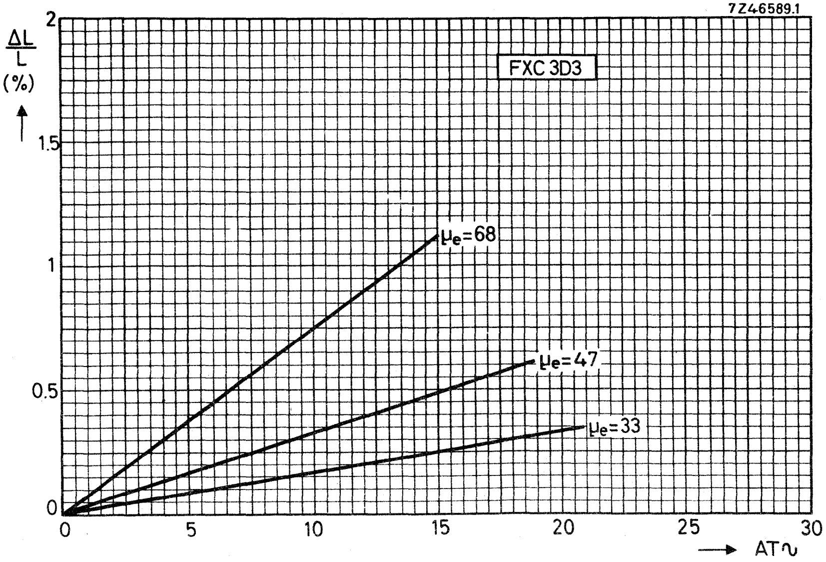
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	175	371	0.35 E.E.	23.3
B	97.6	277	70 × 0.04 E.S.	43.9
C	50.2	199	0.50 E.E.	22.1
D	27.4	148	40 × 0.07 E.S.	36.5
E	10.3	90	200 × 0.04 E.S.S.	37.1
F	8.41	82	70 × 0.07 E.S.S.	43.8

SINGLE-SECTION COIL FORMER

FXC 3B7/3H1
$\mu_e = 330$

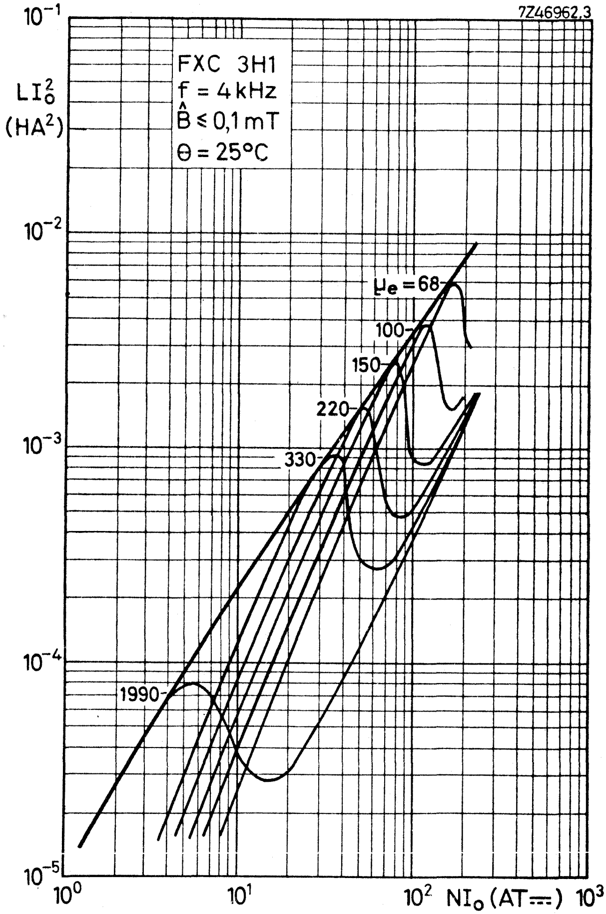
INDUCTANCE VARIATION AS A FUNCTION OF AT~

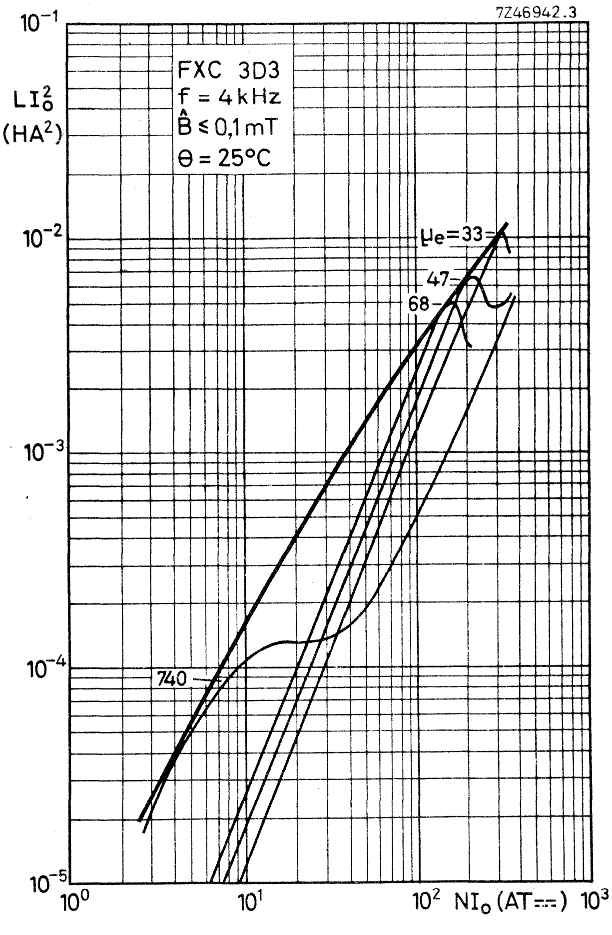




HANNA CURVES

Indicating the optium inductance for a certain μ_e-value and direct current. Typical values.




7Z46942.3
FXC 3D3
f = 4 kHz
$\hat{B} \leq 0{,}1$ mT
$\Theta = 25°C$
LI_o^2 (HA^2)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^0
10^1
10^2
10^3
NI_o (AT ⎓)
μ_e=33
47
68
740

POTCORES

INTRODUCTION

Three types of core can be supplied:

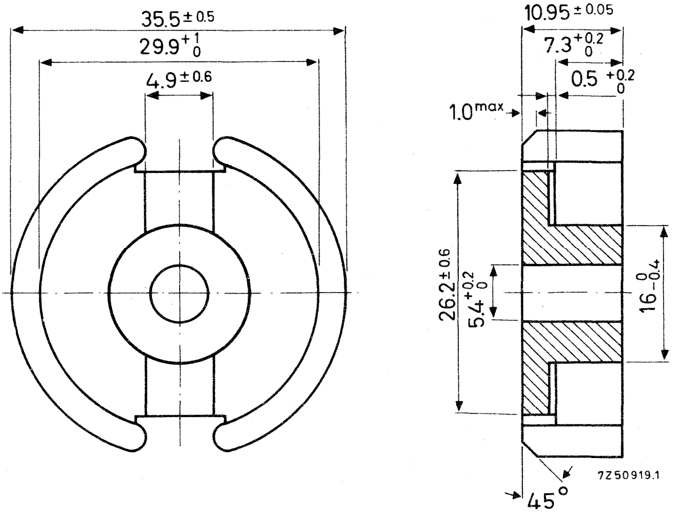
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), DIN 41293 (Germany) and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number.
Quantity: a primary pack contains 10 potcore halves or 5 pieces of pre-adjusted potcores, a storage pack contains 100 halves or 50 pre-adjusted potcores.
So please order in multiples of these quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B7	4322 020 22500
3H1	4322 020 22510
3D3	4322 020 22520
3E1	4322 020 22570

Properties

For toroidally wound core halves the values in Table I are guaranteed.

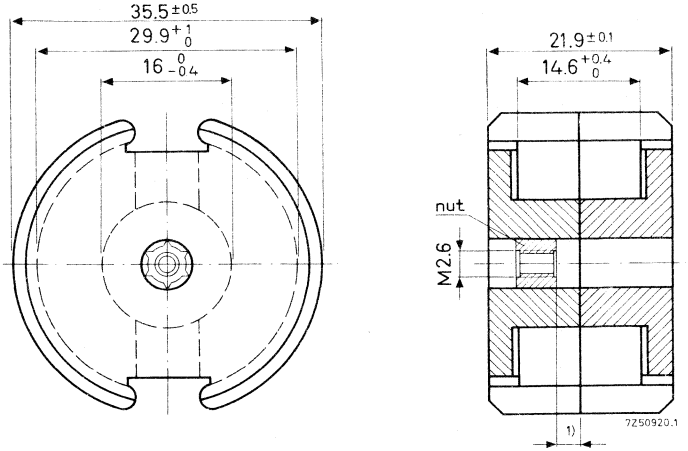
Table I	temp. (^{o}C)	grade			
		3B7	3H1	3D3	3E1
$\alpha_F \times 10^6$	+5 to +25		+0, 5 to +1, 5		
	+25 to +55		+0, 5 to +1, 5		
	+25 to +70	−0, 6 to +0, 6		0 to +2	0 to +2
$D_F \times 10^6$ (10-100 min)	25 + 1	≤ 4, 3	≤ 4, 3	≤ 12	

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 350 Newton, the values in Table II are guaranteed at 25 ± 10 ^{o}C.

Table II	$\hat{B}$ (mT)	freq. (kHz)	grade			
			3B7	3H1	3D3	3E1
μe	≤ 0, 1	4	≥ 1520	≥ 1520		2475-3680
	≤ 0, 1	100			≤ 560	
α	≤ 0, 1	4	≥ 11, 7	≤ 11, 7		
	≤ 0, 1	100			≤ 19, 3	
A_L	≤ 0, 1	4				11750-17500
$\frac{\tan \delta}{\mu_i} \times 10^6$	≤ 0, 1	4	≤ 1, 2	≤ 1, 2		≤ 2, 5
	≤ 0, 1	100	≤ 6	≤ 6	≤ 8	≤ 20
	≤ 0, 1	500			≤ 18	
	≤ 0, 1	1000			≤ 45	
$q_{2-24-100}$	1, 5-3, 0	4	≤ 1, 8	≤ 1, 0		≤ 3, 0
	0, 3-1, 2	100			≤ 3, 0	
$\eta_B \times 10^3$	1, 5-3, 0	4	≤ 1, 1	≤ 0, 62		≤ 1, 8
	0, 3-1, 2	100			≤ 1, 8	

PRE-ADJUSTED POTCORES

Dimensions in mm



With nut, catalogue number = 4322 022 3....
Without nut, catalogue number = 4322 022 1....

Weight per set = 54 g

Effective length l_e = 53,2 mm

$\Sigma \frac{l_e}{A_e}$ = 0,264 mm^{-1}

Effective volume V_e = 10700 mm^3

Notes to the tables on the next page

1. Examples of catalogue number:
   μ_e = 33, grade 3D3, potcore with nut, catalogue number = 4322 022 32430
   A_L = 1600, grade 3B7, potcore without nut, catalogue number = 4322 022 13120
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

---

1) See Adjustment curves.

Pre-adjusted potcores with standard μ_e values 1)

μ_e	α	tolerance on inductance (%)	catal. No.: 4322 022 3.... with nut 4322 022 1.... without nut		
			3B7	3H1	3D3
33	79.7	± 1	2030	–	2430
47	66.8	± 1	–	–	2440
68	55.6	± 1	2050	2250	2450
100	45.8	± 1.5	2060	2260	–
150	37.4	± 2	2070	2270	–
220	30.9	± 3	2080	2280	–
330	25.2	± 3	2090	2290	–
750	16.7	± 25	–	–	2400*
2030	10.2	± 25	2000*	2200*	–

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 33 up to and including 150
Asymmetric air gap for cores with an μ_e value of 220 up to and including 2030

Pre-adjusted potcores with standard A_L factors 1)

A_L	corresponding μ_e-value	tolerance on inductance (%)	catal. No.: 4322 022 3.... with nut 4322 022 1.... without nut		
			3B7	3H1	3D3
40	8.39	± 1	3020	3220	–
100	21	± 1	3040	3240	–
160	33.6	± 1	–	–	3450
250	52.5	± 1	3060	3260	3460
400	84	± 1.5	3080	3280	3480
630	132	± 2	3100	3300	–
1000	210	± 3	3110	3310	–
1600	336	± 3	3120	3320	–
2500	525	± 5	–	3290	–

Inductance $L = N^2 A_L$ (in 10^{-9} H)

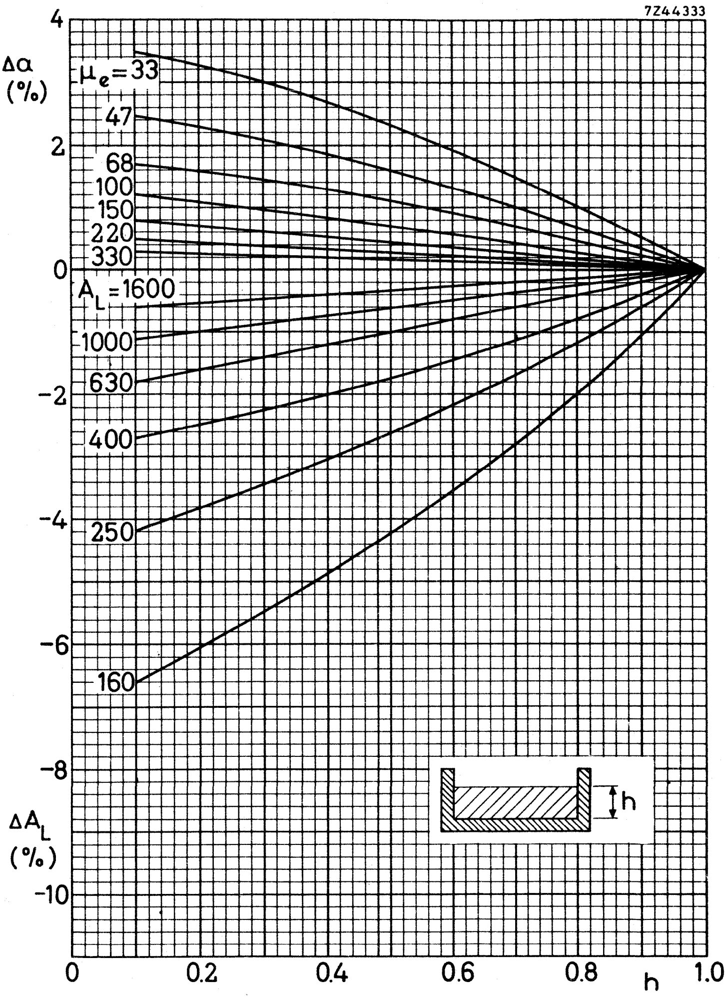
Symmetric air gap for cores with an A_L factor of 40 up to and including 630
Asymmetric air gap for cores with an A_L factor of 1000 and 1600

---

1) See Notes on the previous page.

* Only available without nut.

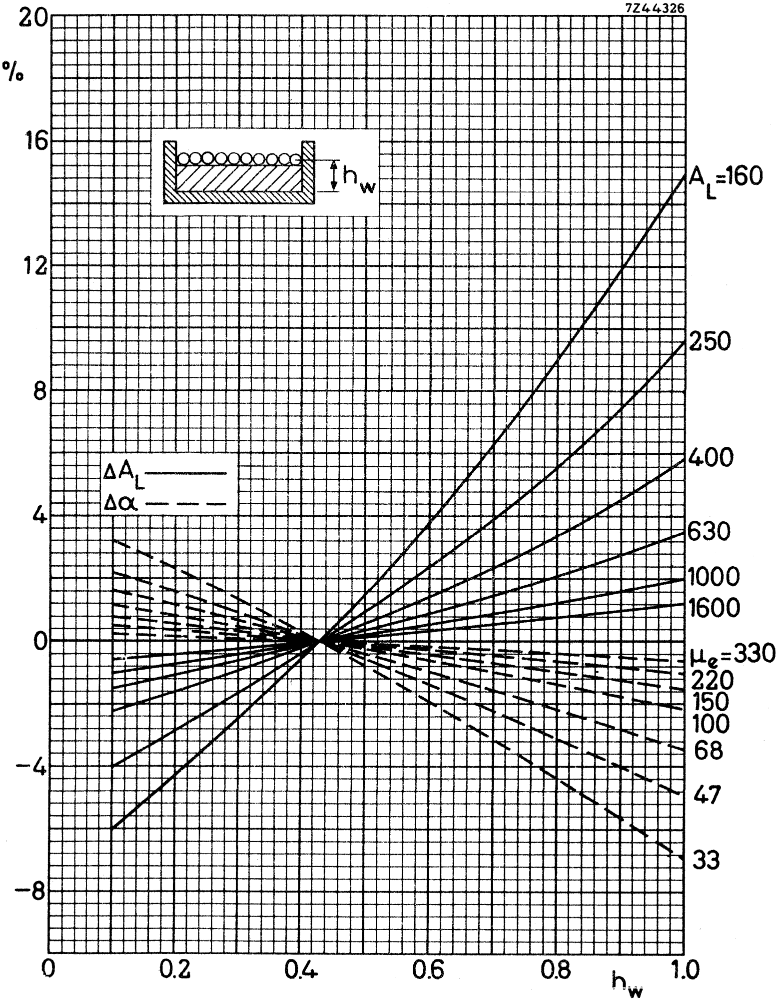
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3.

Example: On a single-section coil former only 0.4 part of the available height is used. A potcore with μ_e = 68 in that case obtains an α factor of 55.6 + 1.20 %.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_w on a single-section coil former.

Valid for ferroxcube 3B7, 3H1 and 3D3.

Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 68 obtains for that winding an α factor of 55.6 - 1.6 %.

COIL FORMERS

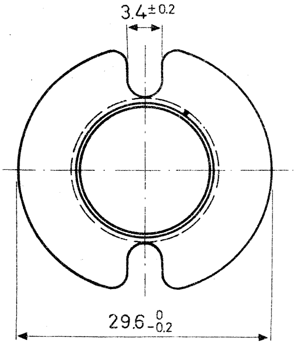
GENERAL

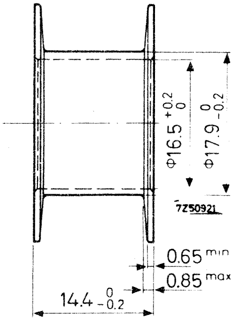
Three types of coil former can be supplied:

- with one section
- with two sections
- with three sections

The dimensions conform with the following specifications: IEC 133 (international), FNIE ← C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain). The dimensions in the drawings are in mm.

SINGLE-SECTION COIL FORMER





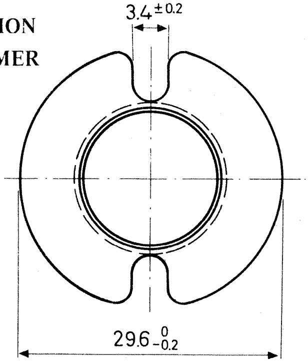
Catalogue number	4322 021 30390
Material	polycarbonate
Window area	75 mm^2
Mean length of turn	74 mm
Max. temperature	130 ^{o}C

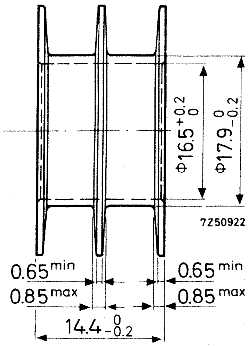
D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3,59 \times 10^3\ \Omega/H$$

Weight	1,2 g

TWO-SECTION COIL FORMER





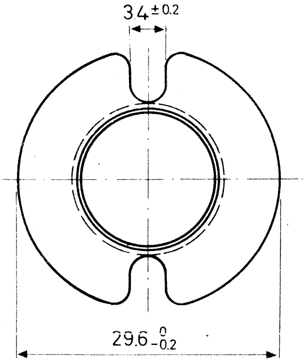
Catalogue number	4322 021 30400
Material	polycarbonate
Window area	2 x 35 mm^2
Mean length of turn	74 mm
Max. temperature	130 °C

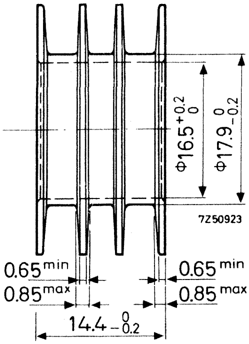
D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3.81 \times 10^3 \quad \Omega/H$$

Weight	1.55 g

THREE-SECTION COIL FORMER





Catalogue number	4322 021 30410
Material	polycarbonate
Window area	3 x 22 mm^2
Mean length of turn	74 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 4.06 \times 10^3 \quad \Omega/H$$

Weight	1.8 g

INDUCTANCE ADJUSTORS

CONTINUOUS ADJUSTORS

The tolerances on inductance of the pre-adjusted potcores (with adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy $< 0.03\ \%$ by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.

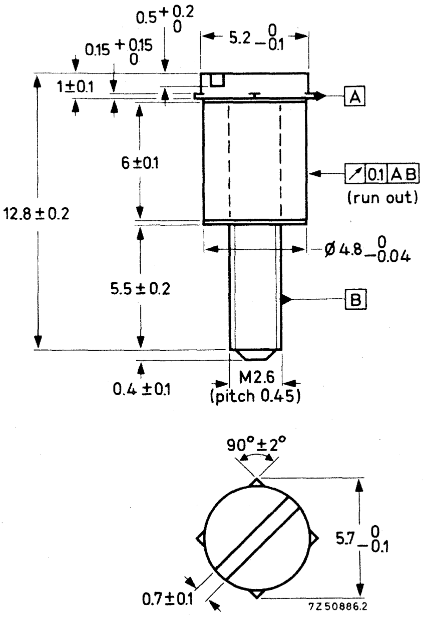


Fig. A

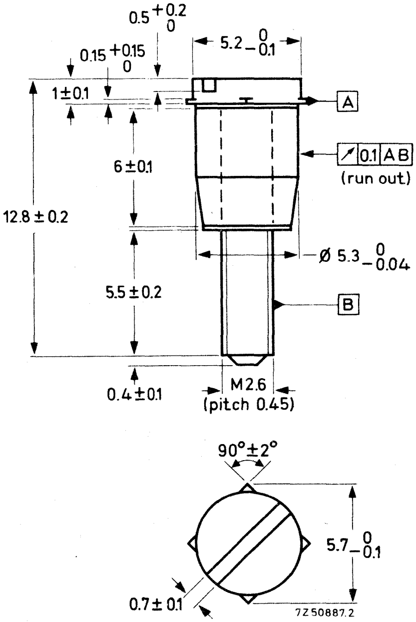


Fig. B

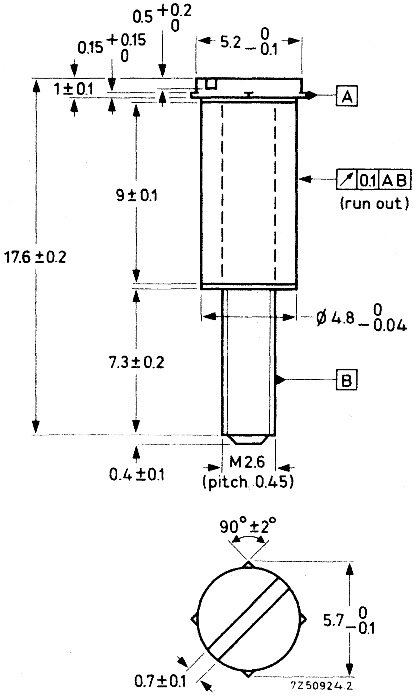


Fig.C

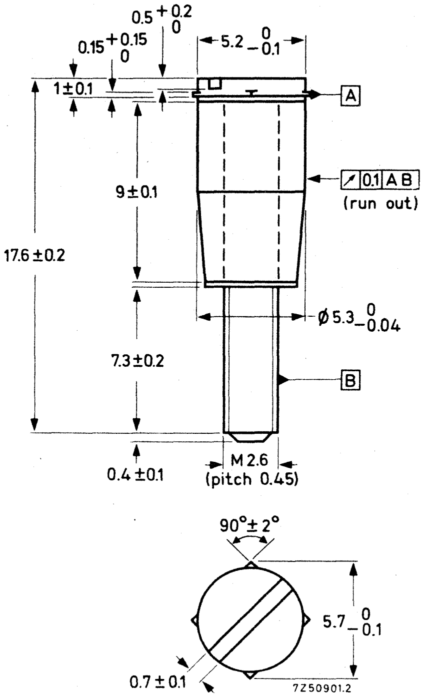


Fig.D

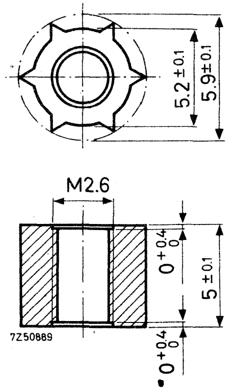
Types of adjustor and recommended applications for potcores with grade 3B7, 3H1 and 3D3:

Fig.	colour	catalog number 4322 021	potcore	
			μ_e	A_L
A	yellow	30790	33	160
B	white	30980	47	250
B	white	30980	68	
A	brown	30810	100	400
A	brown	30810		630
C	grey	31110	150	
B	grey	31090	220	1000
D	black	31120	330	1600

The adjustors are packed in bags of 100, so please order in multiples of 100.

Nut for adjustor

These data are given for those manufacturers who prefer to insert the nut themselves.

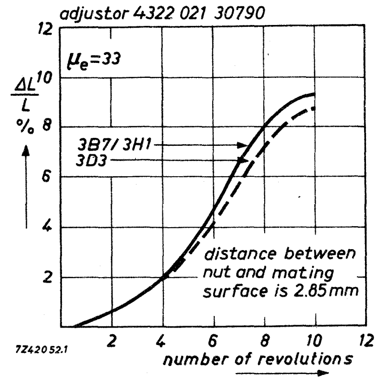


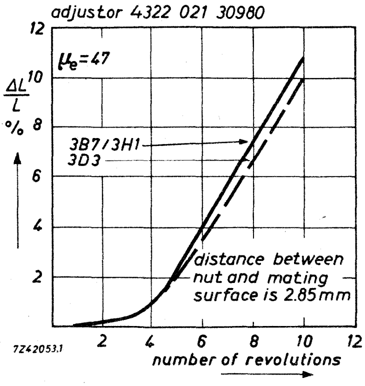
Catalog number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut (See Adjustment curves)	2.85 ± 0.15 mm or 4.95 ± 0.15 mm

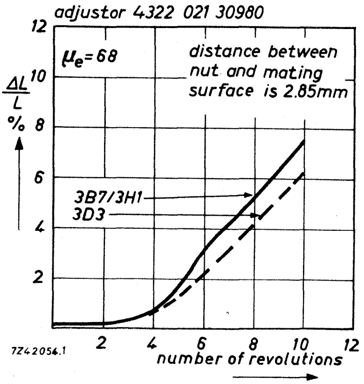
The nuts are packed in bags of 100, so please order in multiples of 100.

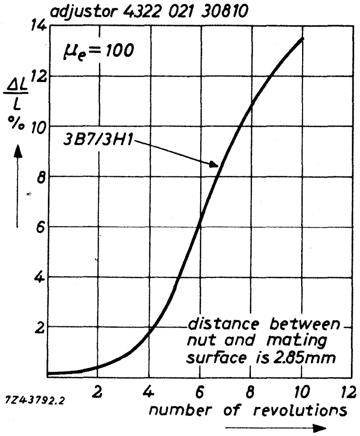
For more information see Potcores General, Mounting data.

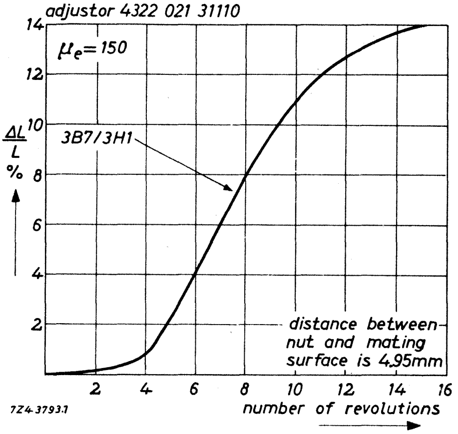
Adjustment curves

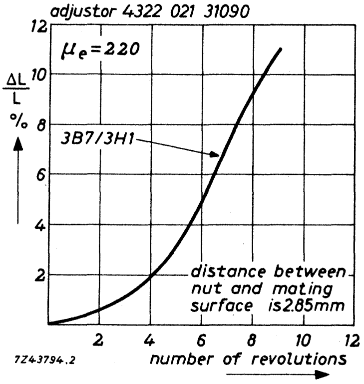


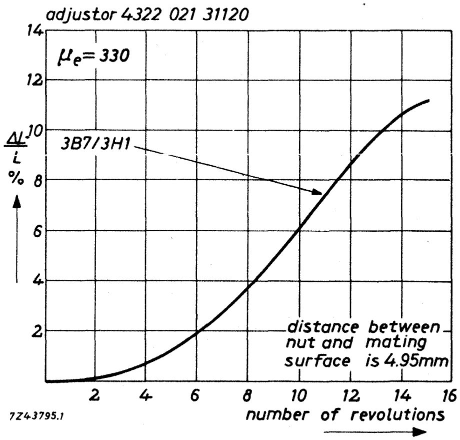



adjustor 4322 021 30980
μ_e=68
distance between nut and mating surface is 2.85mm
$\frac{\Delta L}{L}$ %
3B7/3H1
3D3
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z42056.1


adjustor 4322 021 30810
μ_e=100
$\frac{\Delta L}{L}$ %
3B7/3H1
distance between nut and mating surface is 2.85mm
14
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z43792.2


adjustor 4322 021 31110
μ_e=150
$\frac{\Delta L}{L}$ %
3B7/3H1
distance between nut and mating surface is 4.95mm
14
12
10
8
6
4
2
2
4
6
8
10
12
14
16
number of revolutions
7Z43793.1

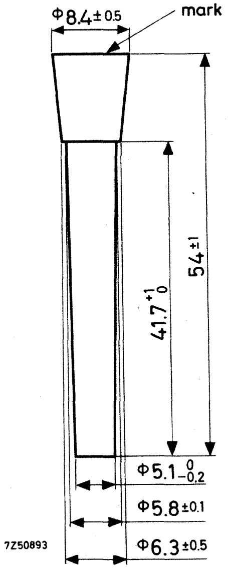

adjustor 4322 021 31090
μ_e=220
$\frac{\Delta L}{L}$ %
3B7/3H1
distance between nut and mating surface is2.85mm
12
10
8
6
4
2
2
4
6
8
10
12
number of revolutions
7Z43794.2


adjustor 4322 021 31120
μ_e=330
$\frac{\Delta L}{L}$ %
3B7/3H1
distance between nut and mating surface is 4.95mm
14
12
10
8
6
4
2
2
4
6
8
10
12
14
16
number of revolutions
7Z43795.1

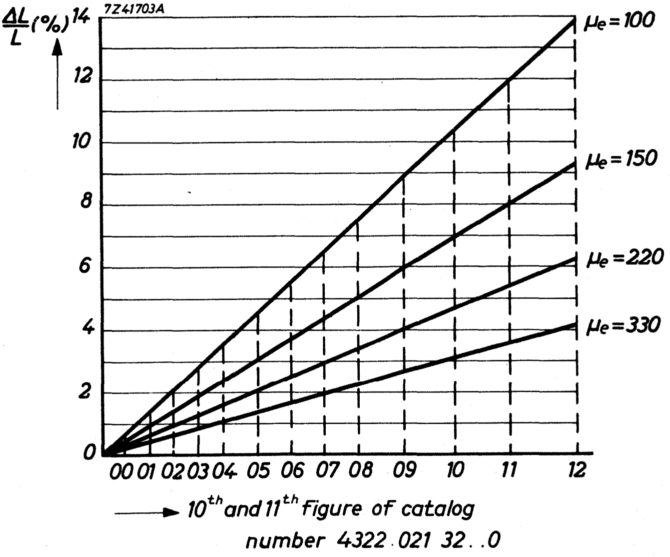
STEP-BY-STEP ADJUSTORS

These adjustors are used when a continuous adjustment of the inductance is not necessary. For instance, they are applied in loading coils to bring the inductance within a certain tolerance field. They are not suitable for adjusting the inductance to an exact value, as is usually necessary in filters. The increment of the losses caused by these adjustors is negligible.
A range of 13 flexible conical adjustors is available under the catalog numbers 4322 021 32000 up to 021 32120. Each adjustor causes an increase in the inductance; the higher the catalog number, the greater the effect. The influence of each adjustor on the inductance at different μ_e values of the potcore can be found from the graph.
The 10th and 11th figure of the catalog number are indicated on the head of the adjustor. It should be borne in mind that, when using these adjustors, the inductance of the coil should initially be lower than the wanted value.
When the correct adjustor has been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond of Good Year) is used as sliding and fixing material. After fixing the protruding ends are cut off.

The maximum impregnation temperature is 150 °C.
The maximum working temperature is 90 °C.
Material: rubber with powder iron.

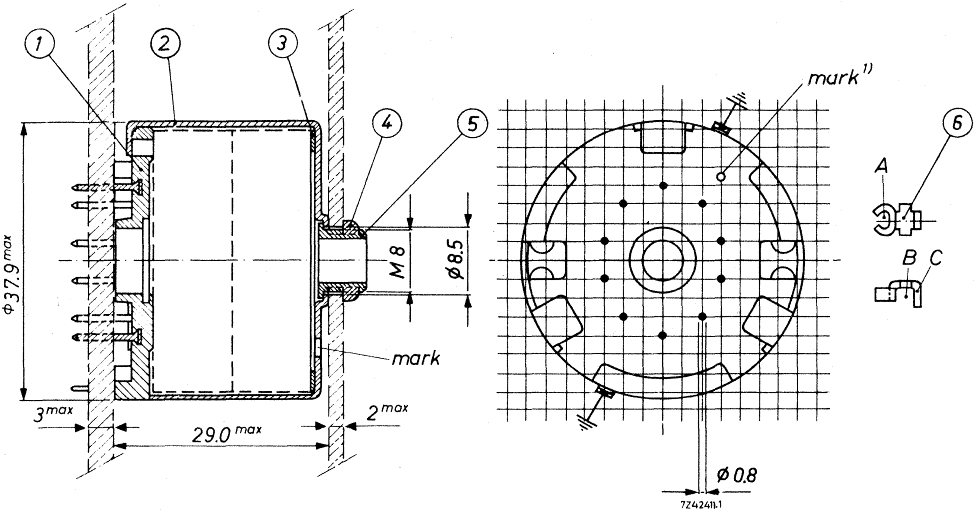


Dimensions in mm



MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30490	(4) nut	4322 021 30710
(2) brass container	4322 021 30570	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30680	(6) soldering spring	4322 021 30700 (10x)

The core is suitable for mounting on printed-wiring boards and on conventional panels.

The parts 1, 2, 3 (and 6) are sufficient to construct an assembly for use in combination with printed wiring.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The ten soldering pins are arranged to fit printed-wiring boards with a 0.1 inch grid as well as those with a 2.50 mm grid.
The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1.3 ± 0.1 mm diameter.

---

[1] There is another mark in a similar position on the top of the container.

If one-hole mounting is preferred, the parts 4 and 5 should be added. The coil assembly may then be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

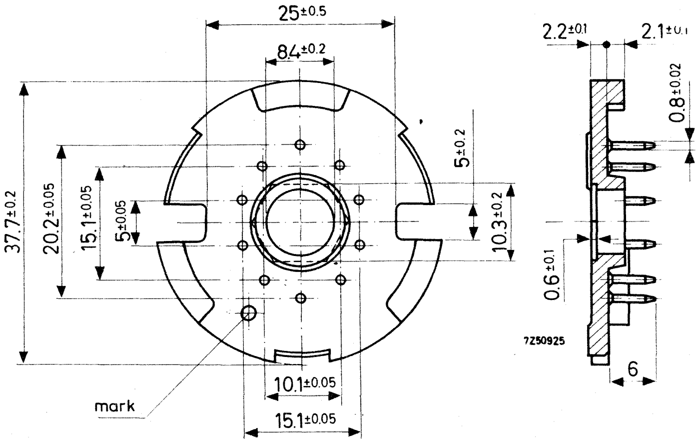
It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 350 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

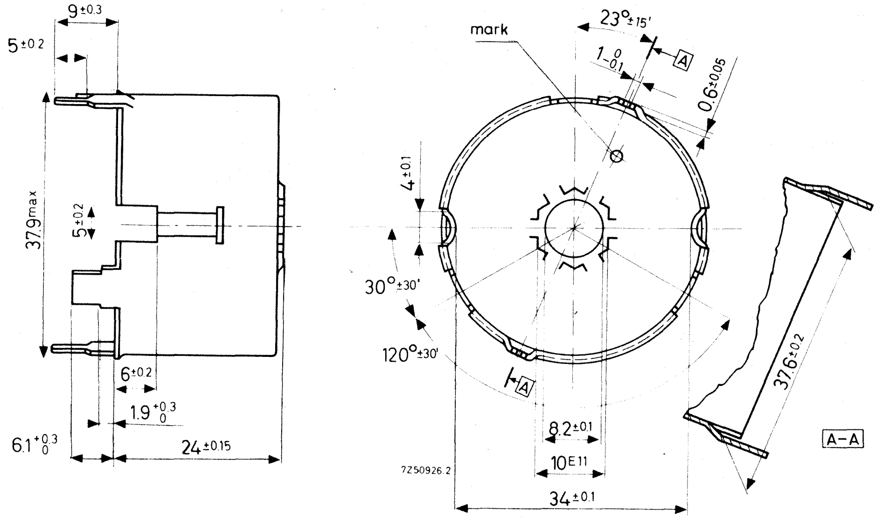
(1) Tag plate 4322 021 30490

Plate : polyester reinforced with glass fibre
Pins : phosphorbronze, dipsoldered



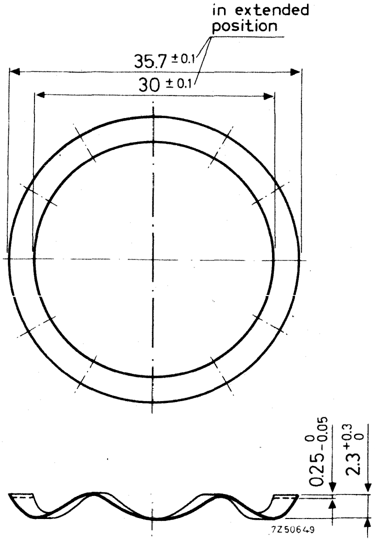
(2) Container 4322 021 30570

Material: brass, nickel plated; tinned soldering pins



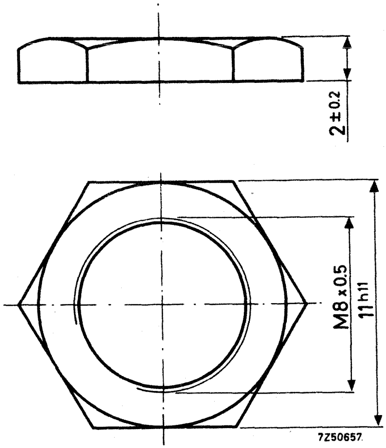
(3) Spring 4322 021 30680

Material: steel



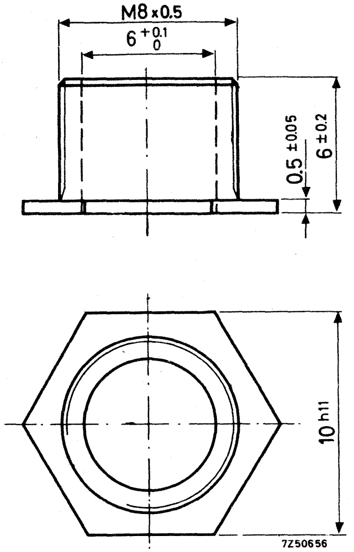
(4) Nut 4322 021 30710

Material : brass, nickel plated



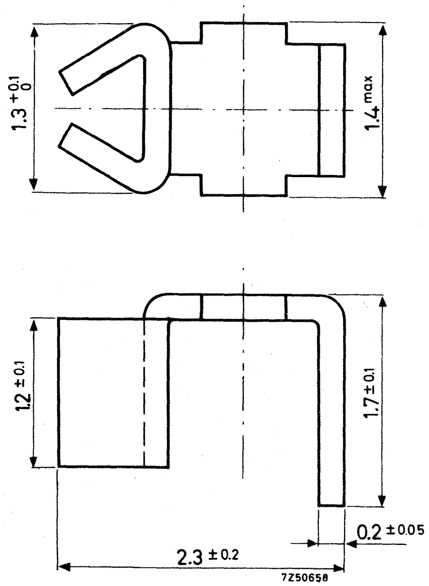
(5) Fixing bush 4322 021 30720

Material : brass, nickel plated



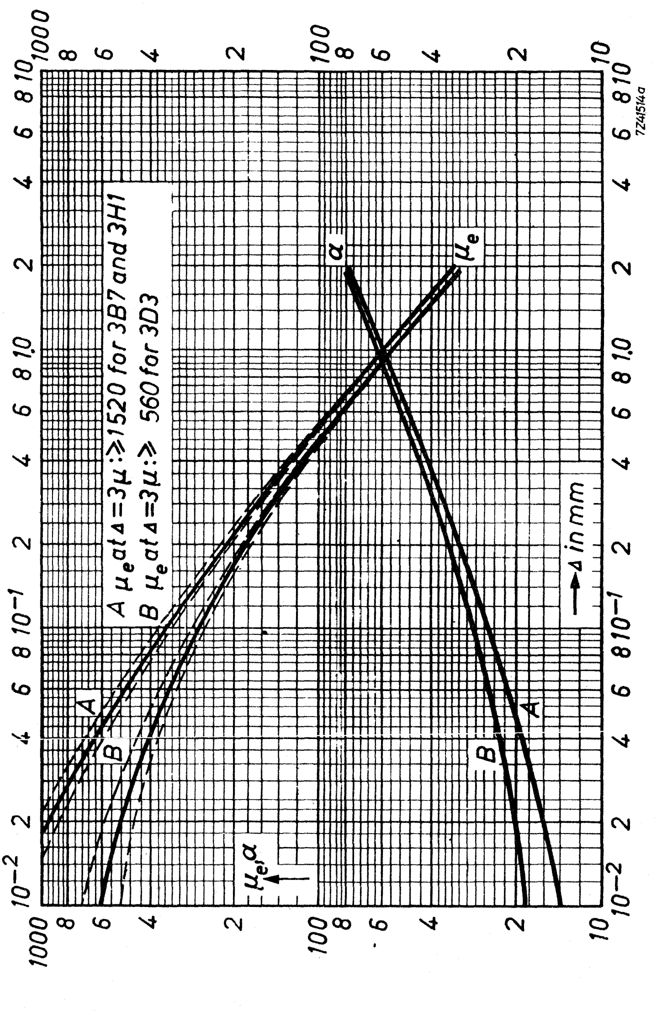
(6) Soldering spring 4322 021 30700

Material : brass, dipsoldered



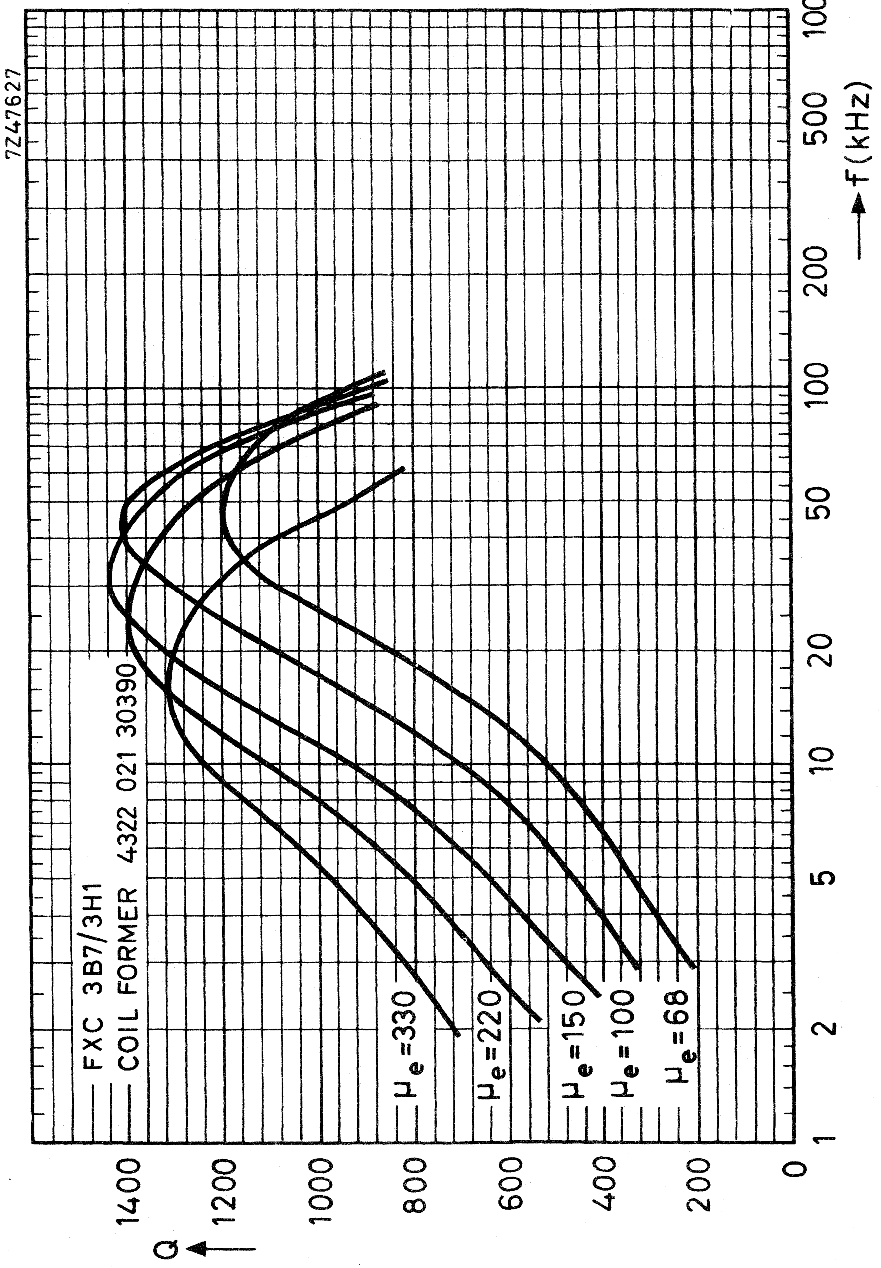
CHARACTERISTIC CURVES

μ_e-α CURVES

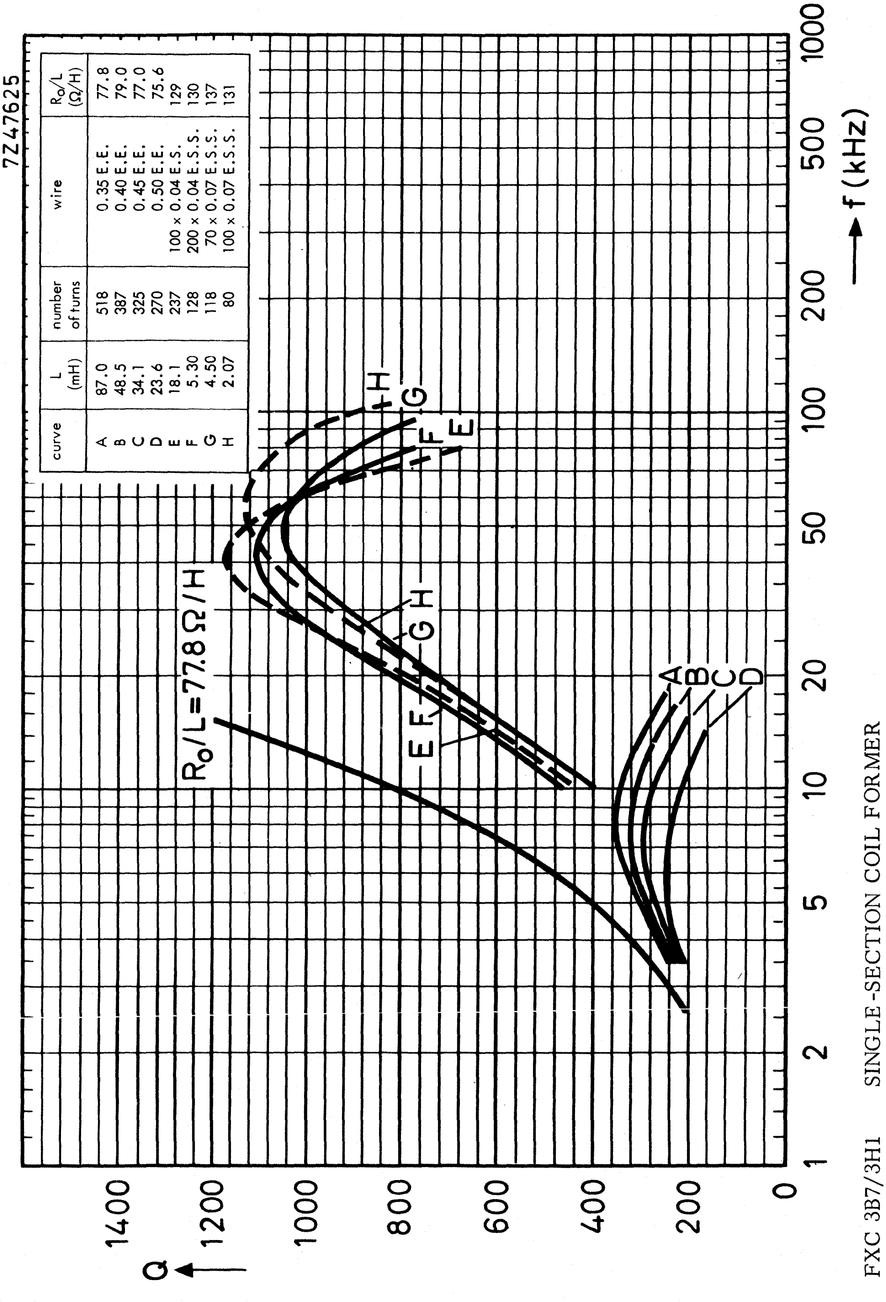


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



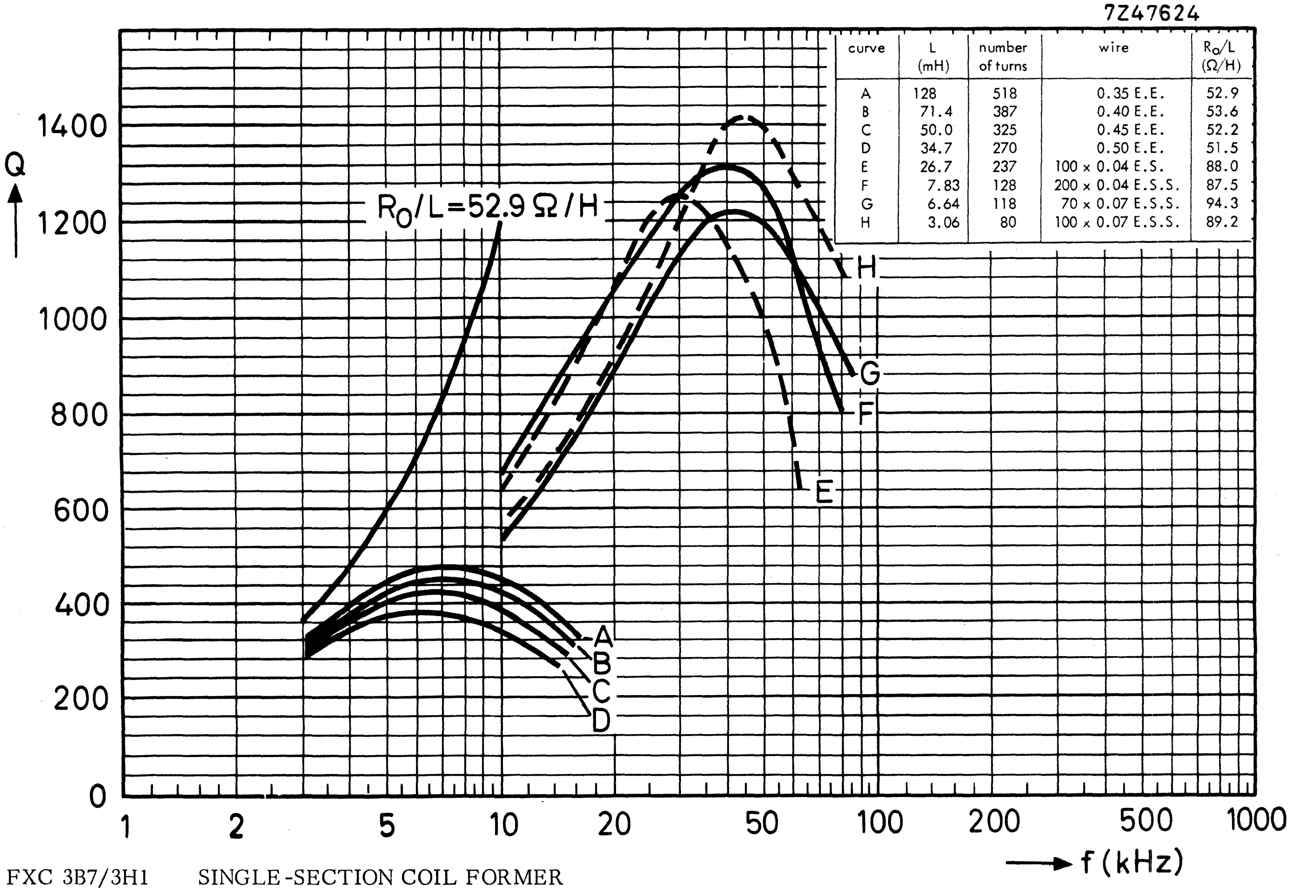
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	87.0	518	0.35 E.E.	77.8
B	48.5	387	0.40 E.E.	79.0
C	34.1	325	0.45 E.E.	77.0
D	23.6	270	0.50 E.E.	75.6
E	18.1	237	100 × 0.04 E.S.	129
F	5.30	128	200 × 0.04 E.S.S.	130
G	4.50	118	70 × 0.07 E.S.S.	137
H	2.07	80	100 × 0.07 E.S.S.	131

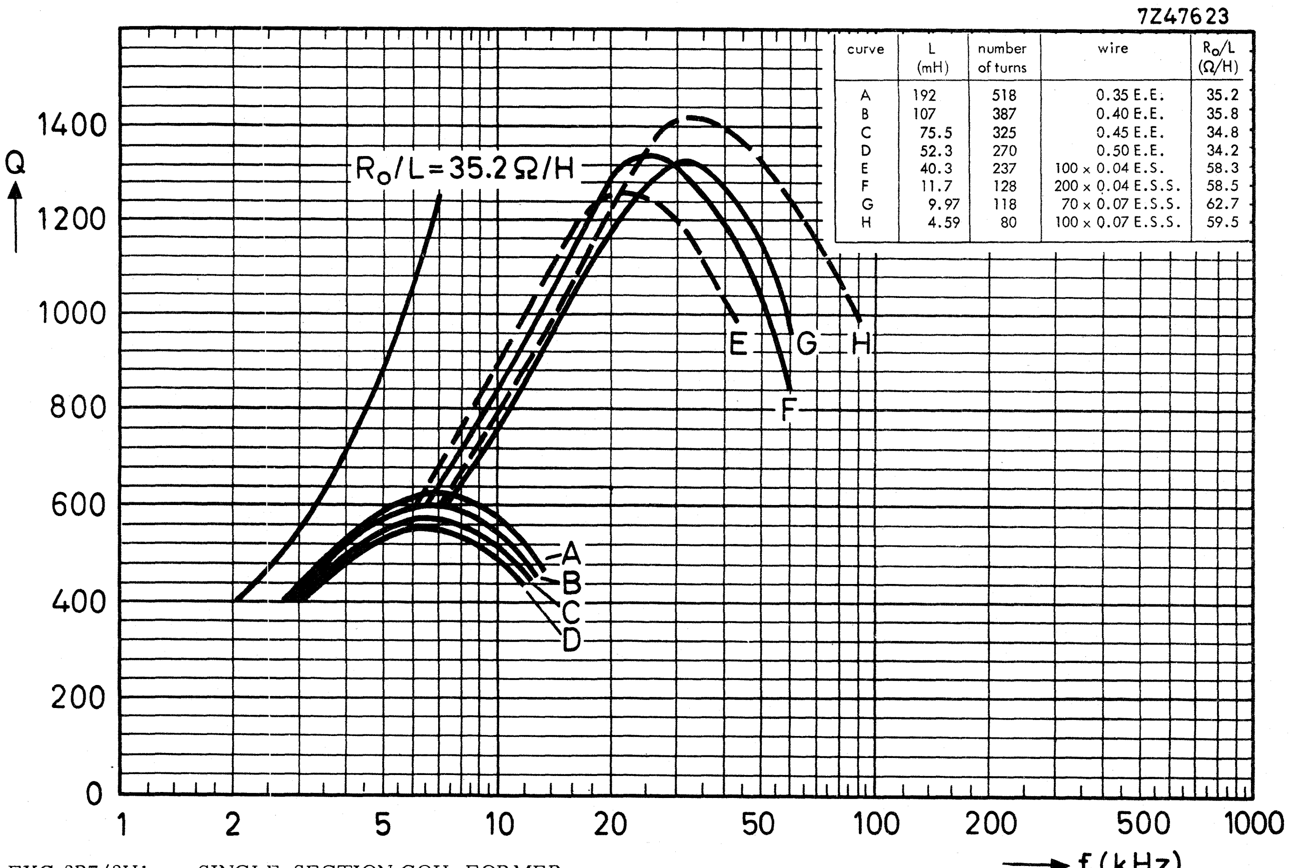
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

$\mu_e = 68$



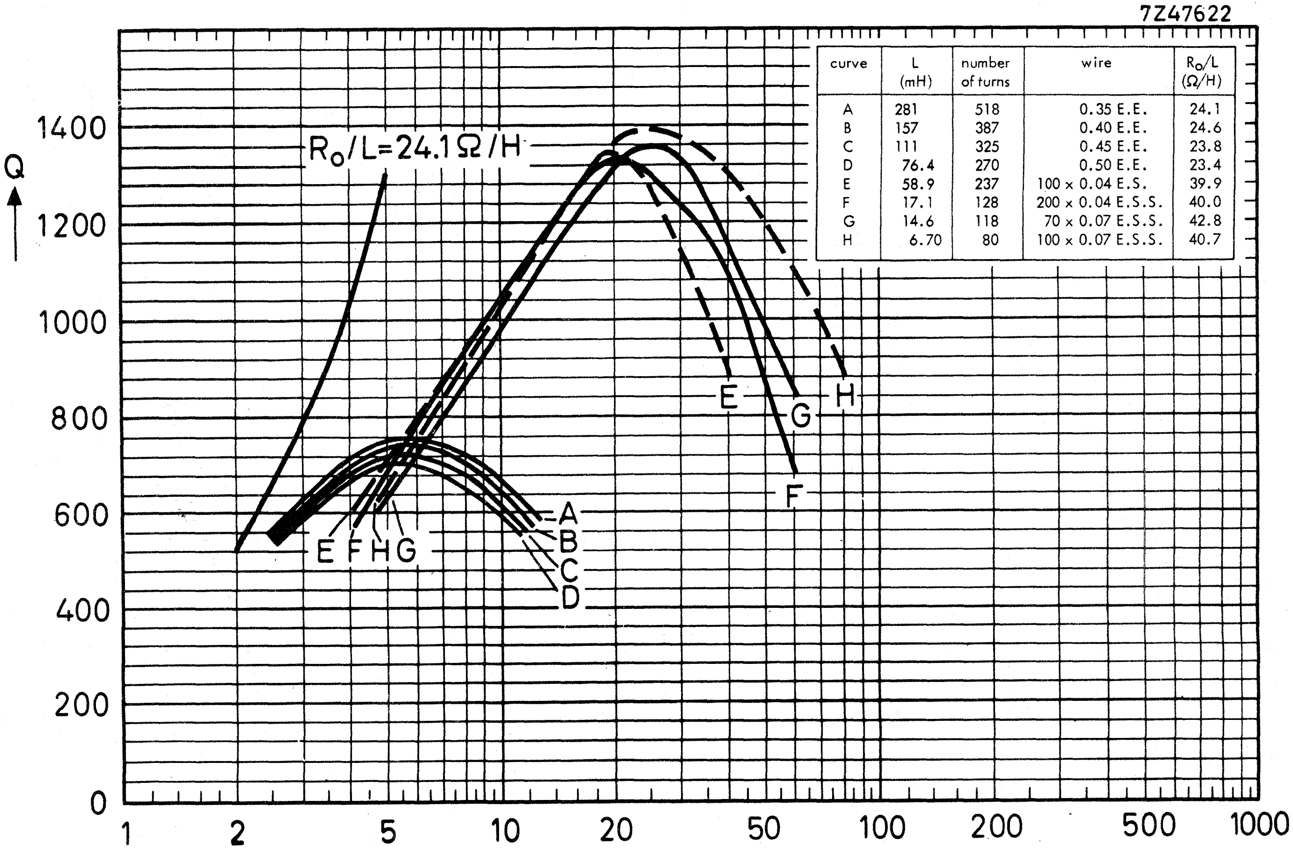
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	128	518	0.35 E.E.	52.9
B	71.4	387	0.40 E.E.	53.6
C	50.0	325	0.45 E.E.	52.2
D	34.7	270	0.50 E.E.	51.5
E	26.7	237	100 × 0.04 E.S.	88.0
F	7.83	128	200 × 0.04 E.S.S.	87.5
G	6.64	118	70 × 0.07 E.S.S.	94.3
H	3.06	80	100 × 0.07 E.S.S.	89.2

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 100$



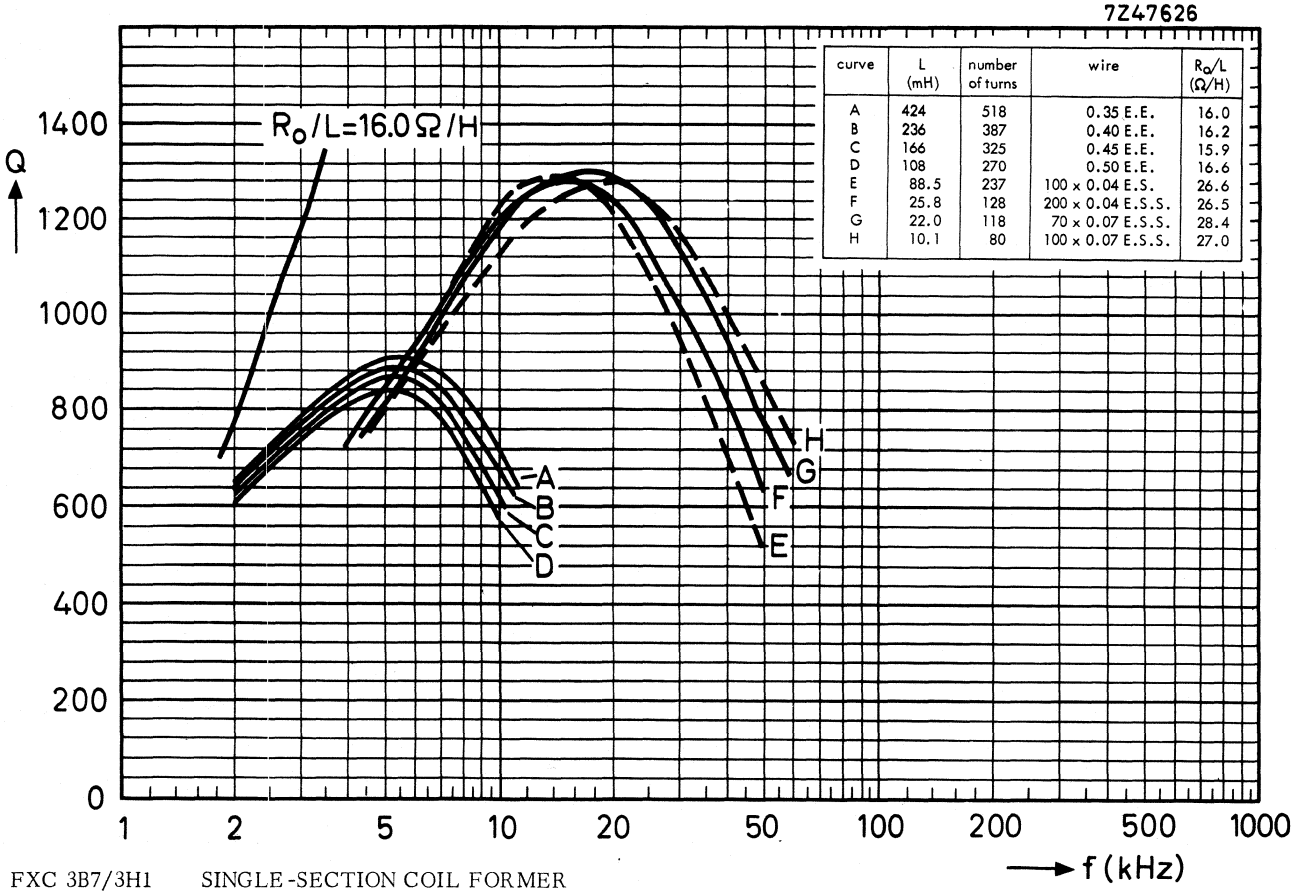
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	192	518	0.35 E.E.	35.2
B	107	387	0.40 E.E.	35.8
C	75.5	325	0.45 E.E.	34.8
D	52.3	270	0.50 E.E.	34.2
E	40.3	237	100 × 0.04 E.S.	58.3
F	11.7	128	200 × 0.04 E.S.S.	58.5
G	9.97	118	70 × 0.07 E.S.S.	62.7
H	4.59	80	100 × 0.07 E.S.S.	59.5

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 150$



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	281	518	0.35 E.E.	24.1
B	157	387	0.40 E.E.	24.6
C	111	325	0.45 E.E.	23.8
D	76.4	270	0.50 E.E.	23.4
E	58.9	237	100 × 0.04 E.S.	39.9
F	17.1	128	200 × 0.04 E.S.S.	40.0
G	14.6	118	70 × 0.07 E.S.S.	42.8
H	6.70	80	100 × 0.07 E.S.S.	40.7

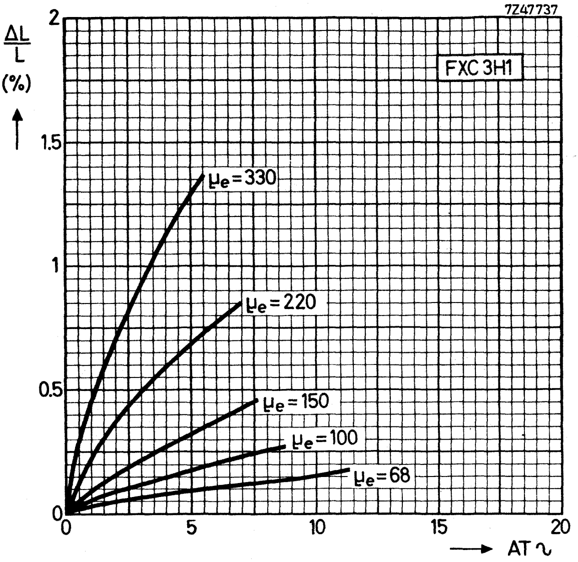
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 220$

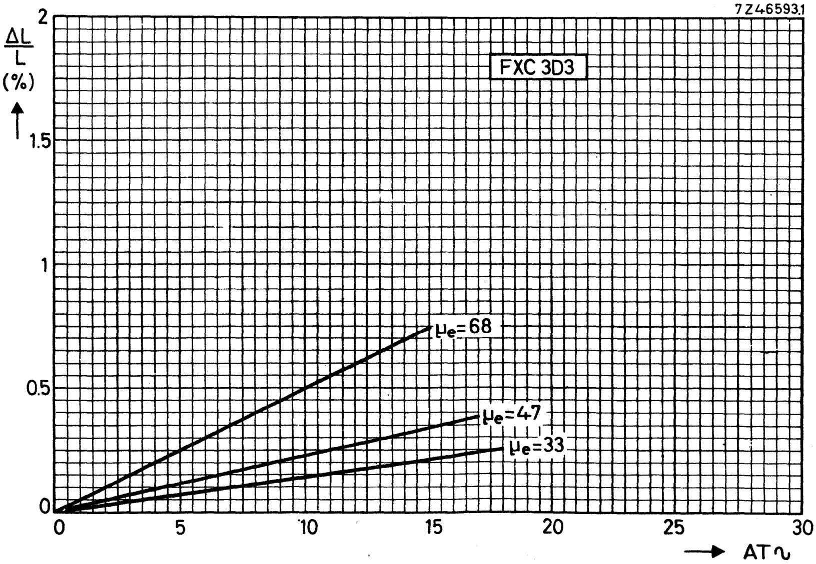


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	424	518	0.35 E.E.	16.0
B	236	387	0.40 E.E.	16.2
C	166	325	0.45 E.E.	15.9
D	108	270	0.50 E.E.	16.6
E	88.5	237	100 x 0.04 E.S.	26.6
F	25.8	128	200 x 0.04 E.S.S.	26.5
G	22.0	118	70 x 0.07 E.S.S.	28.4
H	10.1	80	100 x 0.07 E.S.S.	27.0

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
μ_e = 330

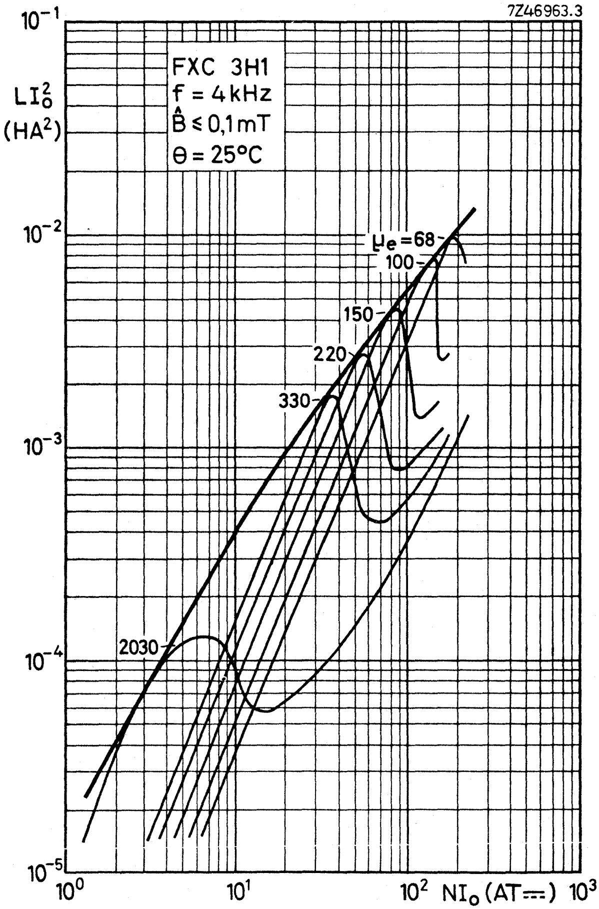
INDUCTANCE VARIATION AS A FUNCTION OF AT ~



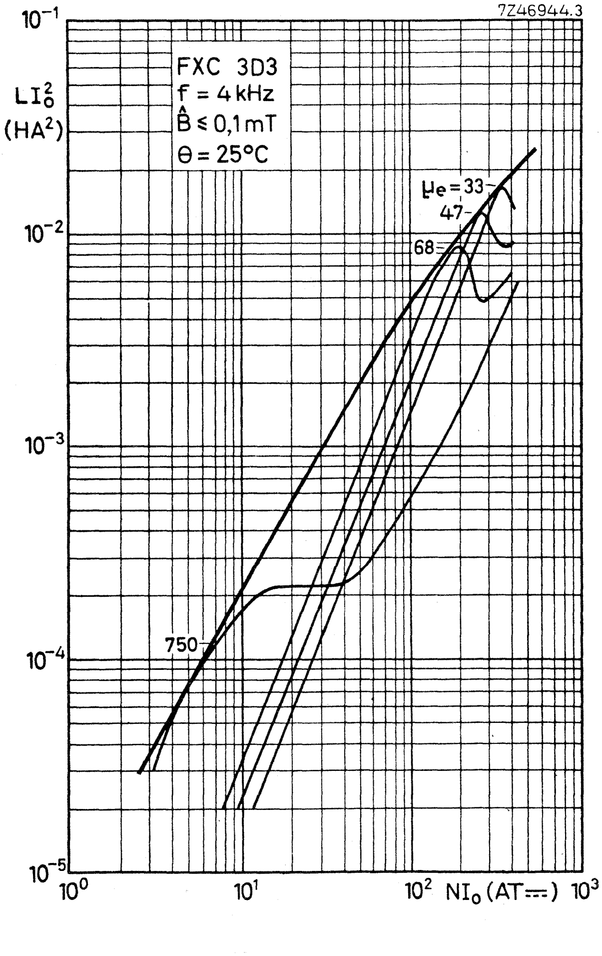


HANNA CURVES

Indicating the optimum inductance for a certain μ_e-value and direct current. Typical values.



Typical values



POTCORES

INTRODUCTION

Three types of core can be supplied:

- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores (potcores with an air gap) which are provided with a nut for an adjustor. These have a relative effective permeability (μ_e) in accordance with the E6 range of values or an inductance factor (A_L) in the R5 range.
- Pre-adjusted potcores without nut.

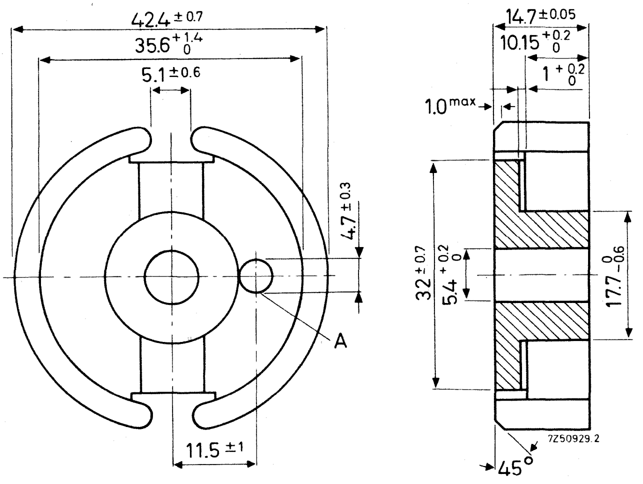
The dimensions of the potcores are in accordance with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France), and BS 4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number.

Quantity: a primary pack contains 10 potcore halves or 5 pre-adjusted potcores.
A storage pack contains 100 halves or 50 pre-adjusted potcores.
So please order in multiples of the quantities.

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number (without hole A)	catalogue number (with hole A)
3B7	4322 020 22750	4322 020 22780
3H1	4322 020 22760	4322 020 22790

The versions without hole A are used for filter coils, the versions with hole A for L-asymmetry adjustment of loading coils.

Properties

For toroidally wound core halves the values in Table I are guaranteed.

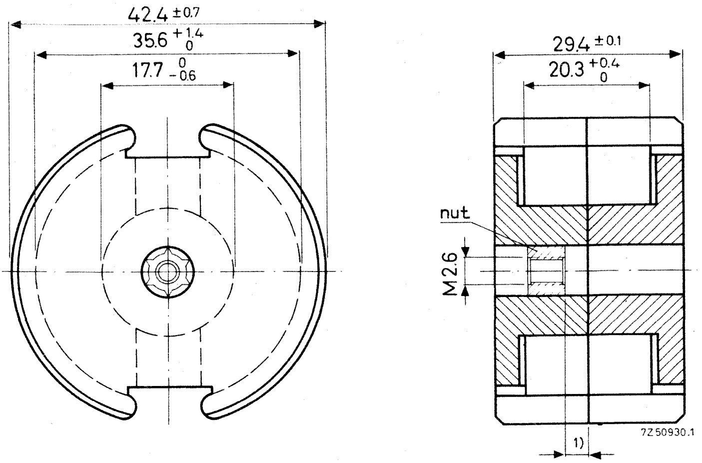
Table I	temp. (^{o}C)	grade		
		3B7	3H1	
$\alpha_F \times 10^6$	+5 to +25		+0.5 to +1.5	
	+25 to +55		+0.5 to +1.5	
	+25 to +70	-0.6 to +0.6		
$D_F \times 10^6$ (10-100 min)	25 ± 1	≤ 4.3	≤ 4.3	

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 550 Newton, the values in Table II are guaranteed at 25 ± 10 ^{o}C.

Table II	$\hat{B}$ (mT)	freq. (kHz)	grade		
				3B7	3H1
μ_e	$\leq 0,1$	4		≥ 1580	≥ 1580
α	$\leq 0,1$	4		$\leq$ 11.4	$\leq$ 11.4
$\frac{\tan\delta}{\mu_i} \times 10^6$	$\leq 0,1$	4		$\leq$ 1.2	$\leq$ 1.2
	$\leq 0,1$	100		$\leq$ 8	$\leq$ 8
$q_{2-24-100}$	1,5-3,0	4		$\leq$ 1.8	$\leq$ 1.0
$\eta_B \times 10^3$	1,5-3,0	4		$\leq$ 1.1	$\leq$ 0.62

PRE-ADJUSTED POTCORES (without hole A)

Dimensions in mm



With nut, catalogue number = 4322 022 3....
Without nut, catalogue number = 4322 022 1....

Weight per set = 104 g

Effective length l_e = 68,6 mm

$\Sigma \frac{l_e}{A_e}$ = 0,259 mm^{-1}

Effective volume V_e = 18200 mm^3

Notes to the tables on the next page

1. Examples of catalogue number:
   μ_e = 100, grade 3B7, potcore with nut, catalogue number = 4322 022 34060
   A_L = 250, grade 3H1, potcore without nut, catalogue number = 4322 022 15260
2. The inductance will only be within the given tolerance if the winding space of the coil is completely filled.
3. The versions marked with a * are only available without nut because adjustment would not be possible as the air gap of these potcores is practically zero.

---

[1] See Adjustment curves.

Pre-adjusted potcores with standard μ_e values [1]

μ_e	α	tolerance on inductance (%)	catal. No. 4322 022 3.... with nut 4322 022 1.... without nut		
			3B7	3H1	
33	78.4	± 1	–	–	
47	65.7	± 1	–	–	
→ 68	55.0	± 1	4050	4250	
100	45.0	± 1.5	4060	4260	
150	36.8	± 2	4070	4270	
220	30.4	± 3	4080	4280	
330	24.8	± 3	4090	4290	
2120	9.85	± 25	4000*	4200*	

Number of turns $N = \alpha \sqrt{L}$ (L in 10^{-3} H)

Symmetric air gap for cores with an μ_e value of 33 up to and including 150
Asymmetric air gap for cores with an μ_e value of 220 up to and including 2120

Pre-adjusted potcores with standard A_L factors [1]

A_L	corresponding μ_e-value	tolerance on inductance (%)	catal. No. 4322 022 3.... with nut 4322 022 1.... without nut		
				3B7	3H1
→ 100	20,5	± 1		5040	5240
250	51	± 1		5060	5260
400	81	± 1		5080	5280
630	130	± 2		5100	5300
1000	205	± 3		5110	5310
1600	325	± 3		5120	5320
→ 2500	510	± 10		5130	–

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Symmetric air gap for cores with an A_L factor of 250 up to and including 630
Asymmetric air gap for cores with an A_L factor of 1000 and 1600

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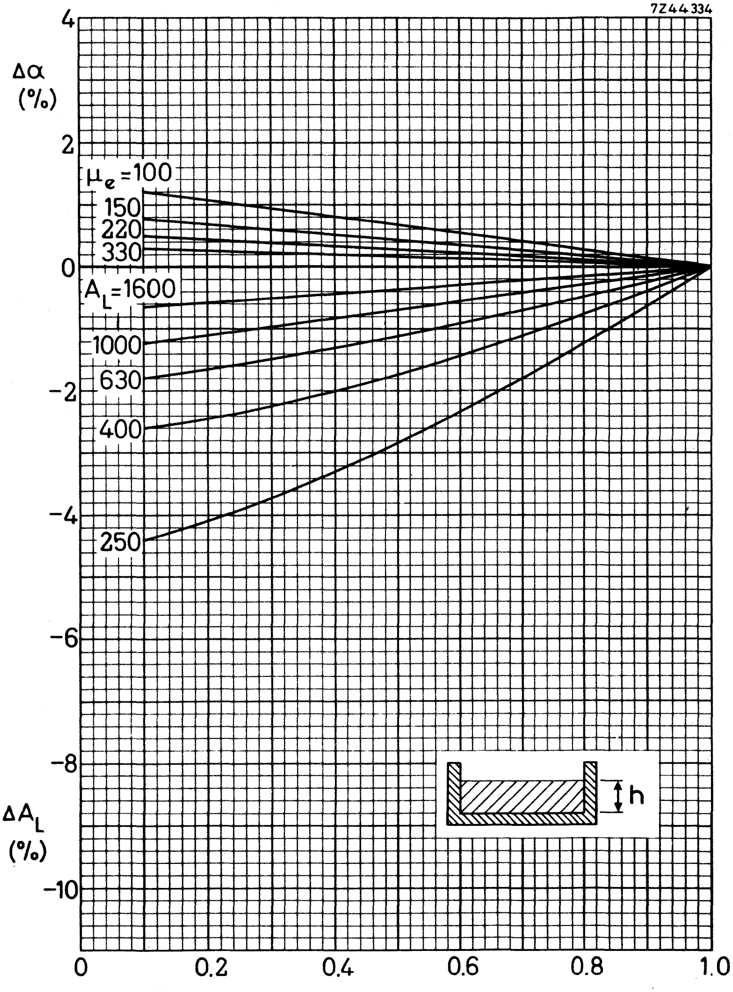
[1] See Notes on the previous page.

*) Only available without nut.

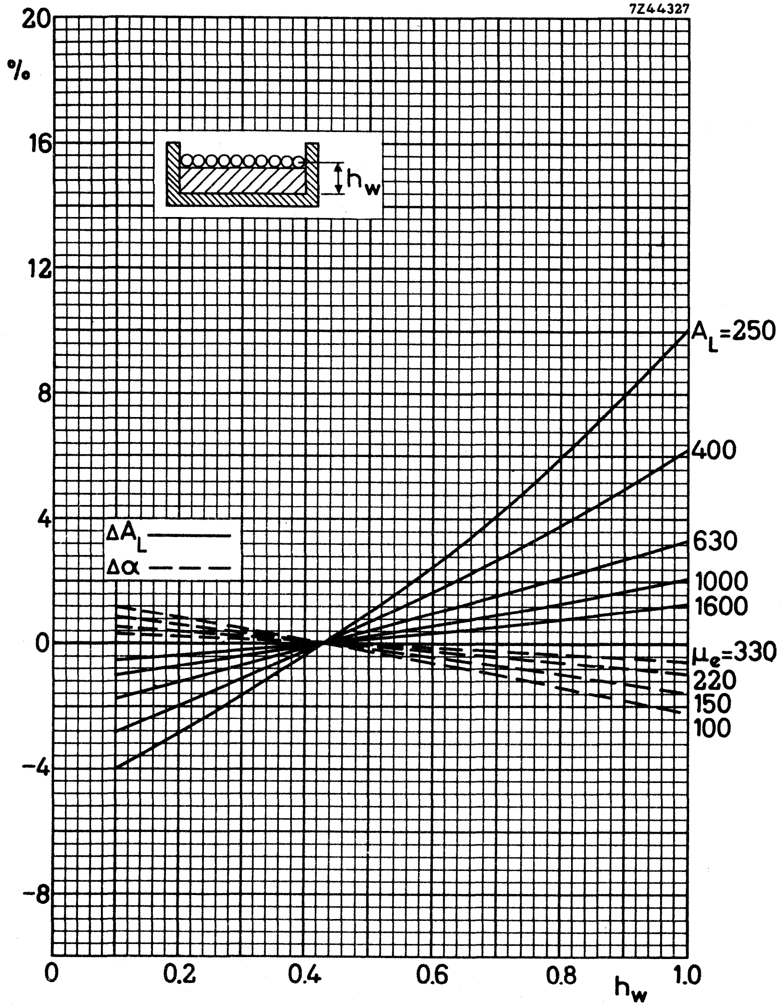
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



Increase of the α and decrease of the A_L factor for different μ_e values and A_L factors as a function of the relative winding height on a single-section coil former.

Valid for ferroxcube 3B5, 3B7 and 3H1.

Example: On a single-section coil former only 0.4 part of the available height is used. A potcore with μ_e = 100 in that case obtains an α factor of 45.0 + 0.75 %.



Variation of the α and A_L factors for a coupling winding of one layer as a function of its winding height h_w on a single-section coil former.

Valid for ferroxcube 3B5, 3B7 and 3H1.

Example: On a single-section coil former a coupling winding is laid on 0.7 of the available height. A potcore with μ_e = 100 obtains for that winding an α factor of 45.0 - 1.0 %.

COIL FORMERS

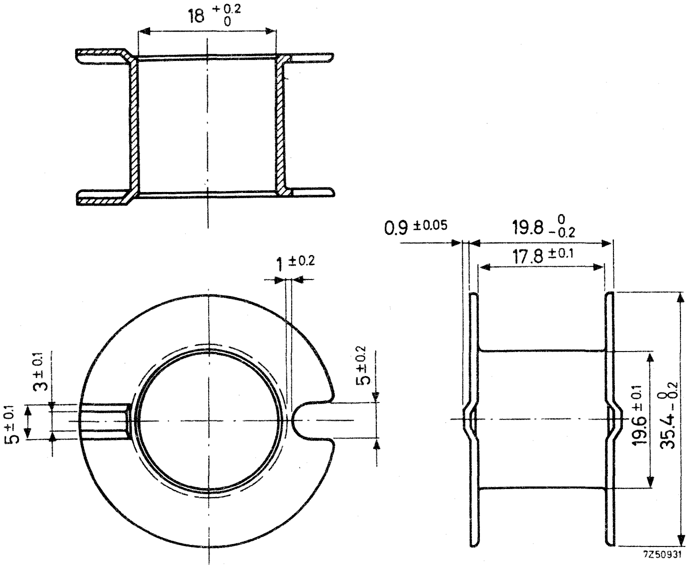
GENERAL

Two types of coil former can be supplied:

- with one section
- with two sections

The dimensions conform with the following specifications: IEC 133 (international), FNIE C93-324 livre 1 (France) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



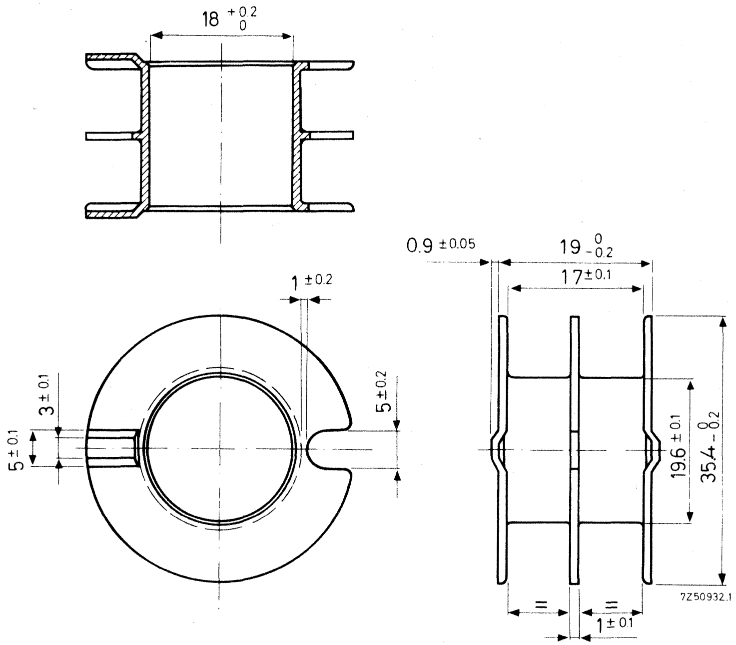
Catalogue number	4322 021 30420
Material	polycarbonate
Window area	140 mm^2
Mean length of turn	86 mm
Max. temperature	130 ^{o}C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 2,16 \times 10^3\ \Omega/H$$

Weight	2,4 g

TWO-SECTION COIL FORMER



Catalogue number	4322 021 30430
Material	polycarbonate
Window area	2 x 63 mm^2
Mean length of turn	86 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 2.40 \times 10^3 \quad \Omega/H$$

Weight 3.0 g

INDUCTANCE ADJUSTORS

CONTINUOUS ADJUSTORS

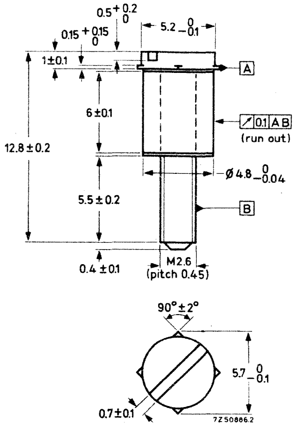


Fig. A

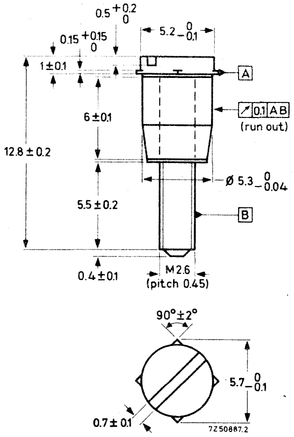


Fig. B

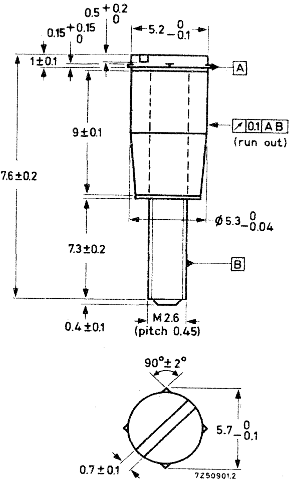


Fig. C

The tolerances on inductance of the pre-adjusted potcores (with adjustor) are given on the pages "Potcores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy <0.03% by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see following pages.
The adjustor is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.

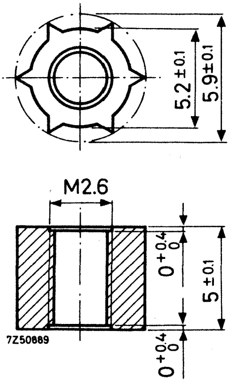
Types of adjustor and recommended applications

Fig.	colour	catalog number 4322 021	potcore	
			μ_e	A_L
B	white	30980	68	250
A	brown	30810	100	400
A	brown	30810		630
B	grey	31090	150	1000
B	grey	31090	220	
C	black	31120	330	1600

The adjustors are packed in bags of 100, so please order in multiples of 100.

Nut for adjustor

These data are given for those manufacturers who prefer to insert the nut themselves.

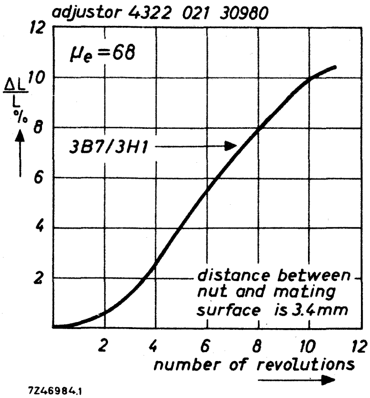


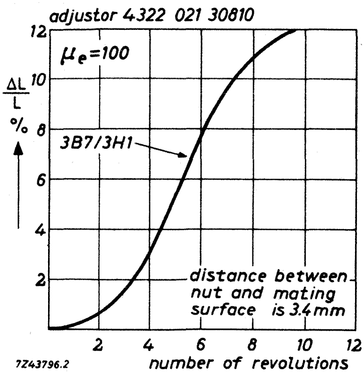
Catalog number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut (see Adjustment curves)	3.4 ± 0.15 mm or 5.0 ± 0.15 mm

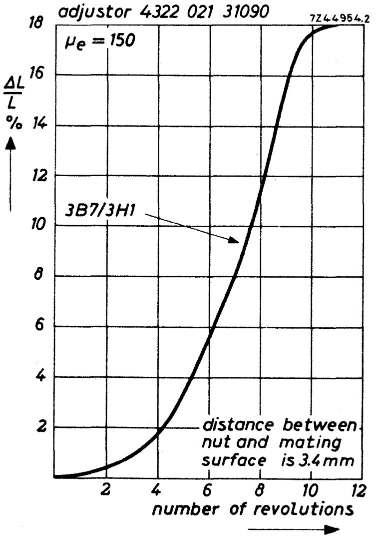
The nuts are packed in bags of 100, so please order in multiples of 100.

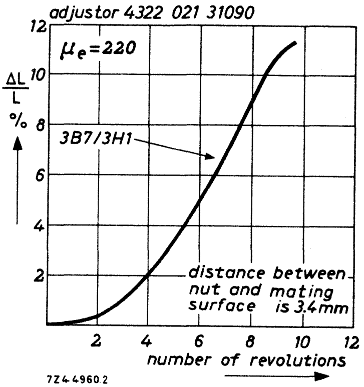
For more information see Potcores General, Mounting Data.

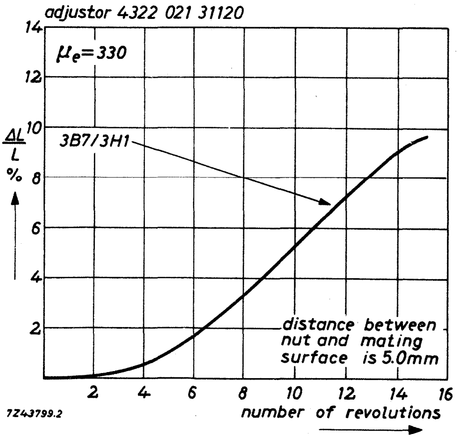
Adjustment curves


adjustor 4322 021 30980


adjustor 4322 021 30810


adjustor 4322 021 31090

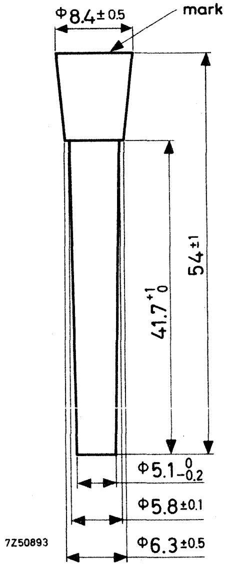

adjustor 4322 021 31090

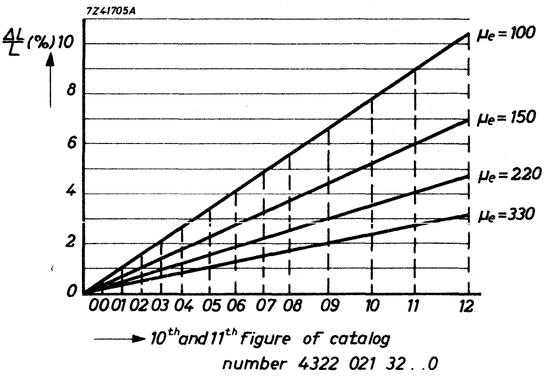

adjustor 4322 021 31120

STEP-BY-STEP ADJUSTORS

These adjustors are used when a continuous adjustment of the inductance is not necessary. For instance, they are applied in loading coils to bring the inductance within a certain tolerance field. They are not suitable for adjusting the inductance to an exact value, as is usually necessary in filters. The increment of the losses caused by these adjustors is negligible.
A range of 13 flexible conical adjustors is available under the catalog numbers 4322 021 32000 up to 021 32120. Each adjustor causes an increase in the inductance; the higher the catalog number, the greater the effect. The influence of each adjustor on the inductance at different μ_e values of the potcore can be found from the graph.
The 10th and 11th figure of the catalog number are indicated on the head of the adjustor. It should be borne in mind that, when using these adjustors, the inductance of the coil should initially be lower than the wanted value.
When the correct adjustor has been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond of Good Year) is used as sliding and fixing material. After fixing the protruding ends are cut off.

The maximum impregnation temperature is 150 °C.
The maximum working temperature is 90 °C.
Material: rubber with powder iron.

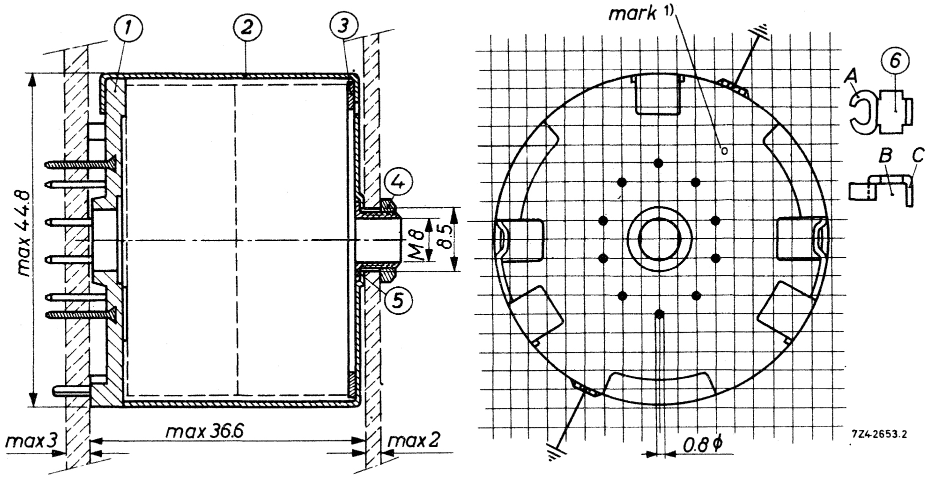




Dimensions in mm

MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30500	(4) nut	4322 021 30710
(2) brass container	4322 021 30580	(5) fixing bush	4322 021 30720
(3) spring	4322 021 30690	(6) soldering spring	4322 021 30700 (10x)

The core is suitable for mounting on printed-wiring boards and on conventional panels.

The parts 1, 2, 3 (and 6) are sufficient to construct an assembly for use in combination with printed wiring.

If stranded wire is applied the use of a soldering spring (6) is recommended. Part A of this spring is put over the pin; then the wire is put in B and lip C is bent over.

For solid wire the soldering spring is not strictly necessary.

The ten soldering pins are arranged to fit printed-wiring boards with a 0.1 inch grid as well as those with a 2.50 mm grid.
The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1.3±0.1 mm diameter.

---

[1] There is another mark in a similar position on the top of the container.

If one-hole mounting is preferred, the parts 4 and 5 should be added. The coil assembly may then be mounted on panels having a thickness of up to 2 mm. The panel should be provided with a hole of 8.5 mm diameter.

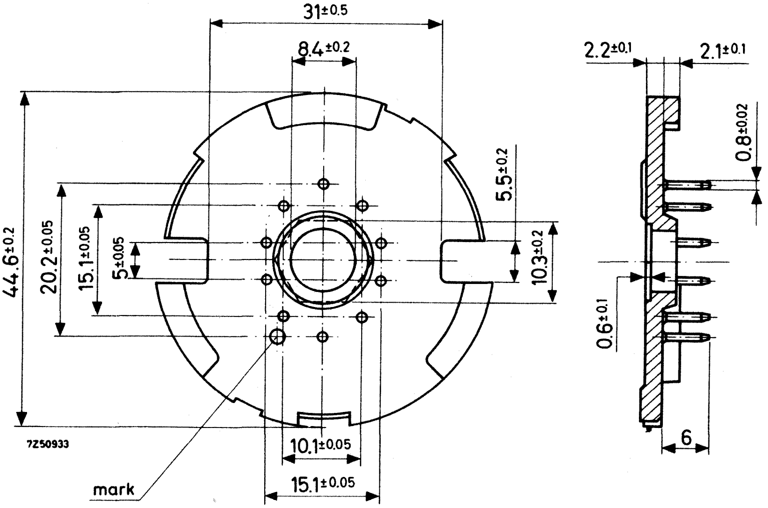
It is recommended to place the spring (3) in the position indicated in order to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exercised evenly on the rim of the tag plate until the latter meets the container. The force which is required is approximately 550 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

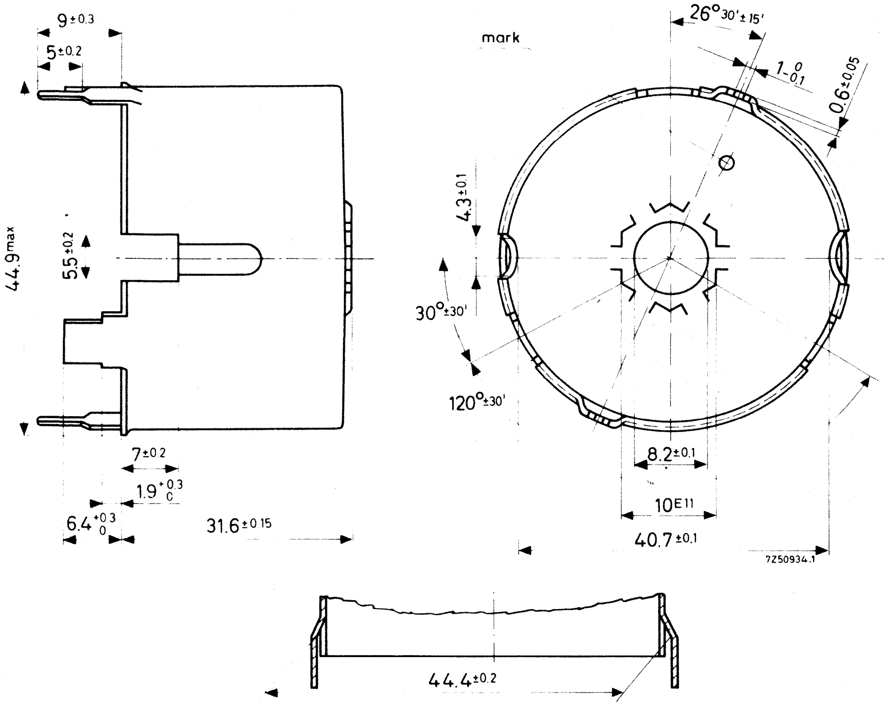
(1) Tag plate 4322 021 30500

Plate: polyester reinforced with glass fibre
Pins : phosphorbronze, dip soldered



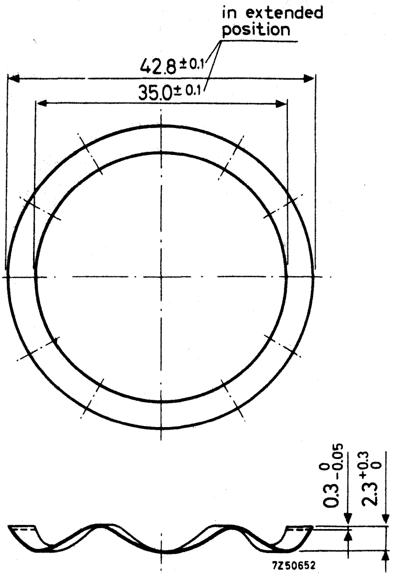
(2) Container 4322 021 30580

Material: brass, nickel plated; tinned soldering pins



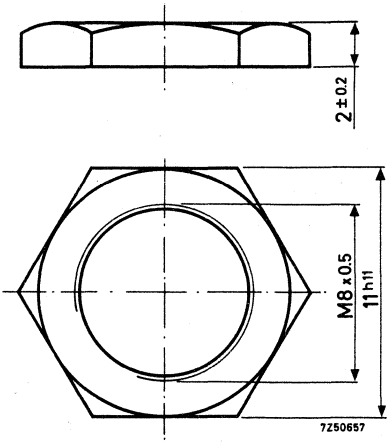
(3) Spring 4322 021 30690

Material: chrome-nickelsteel



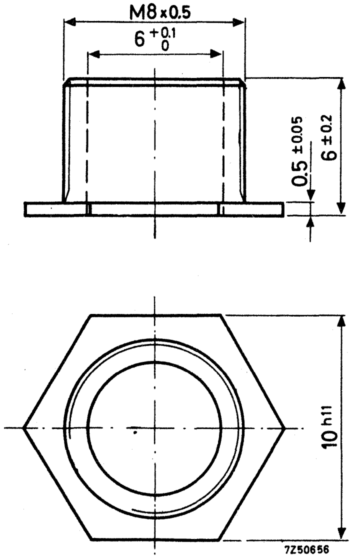
(4) Nut 4322 021 30710

Material: brass, nickel plated



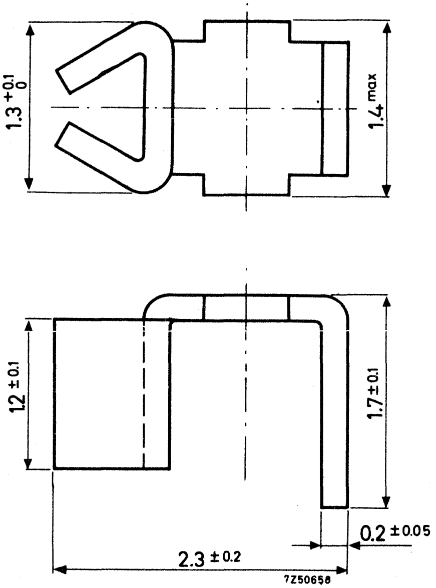
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



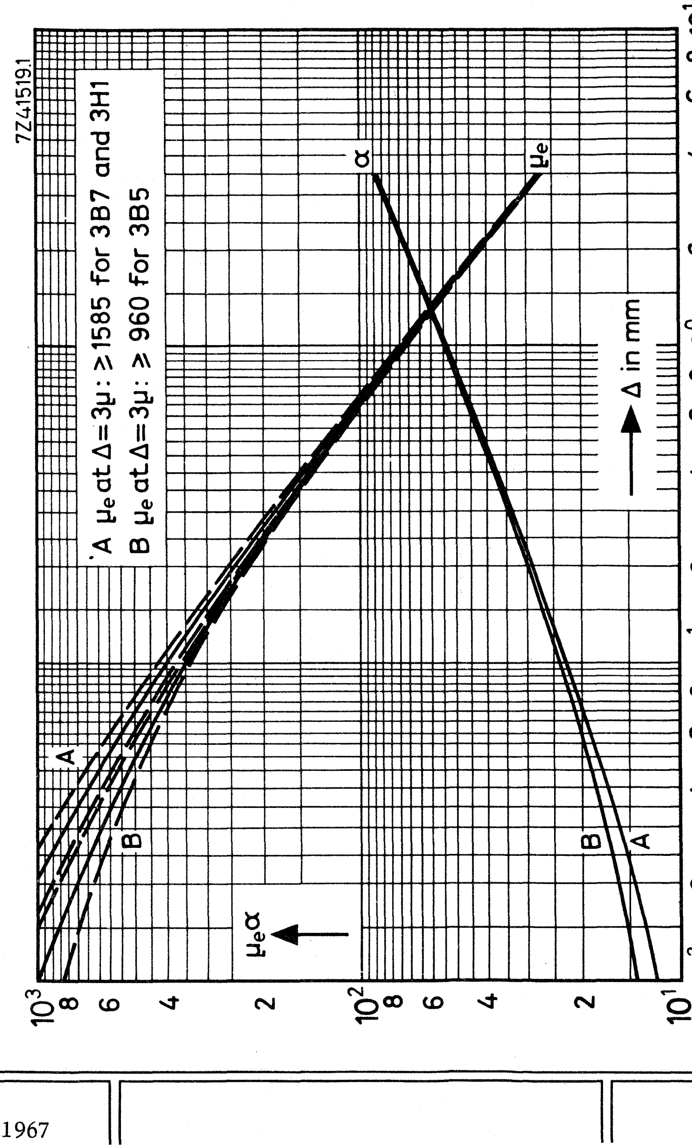
(6) Soldering spring 4322 021 30700

Material: brass, dipsoldered



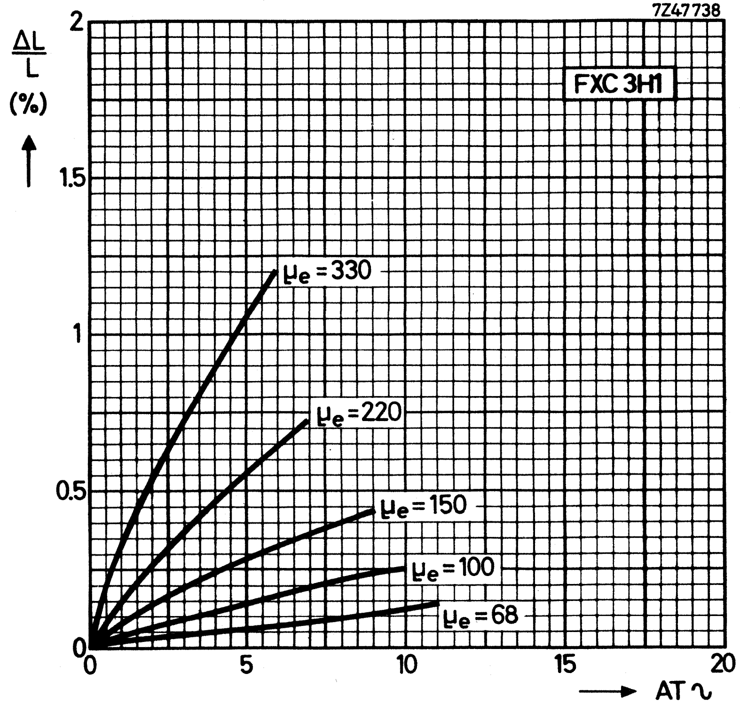
CHARACTERISTIC CURVES

μ_e-α CURVES



Relative effective permeability and turn factor for 1 mH as a function of the air gap length

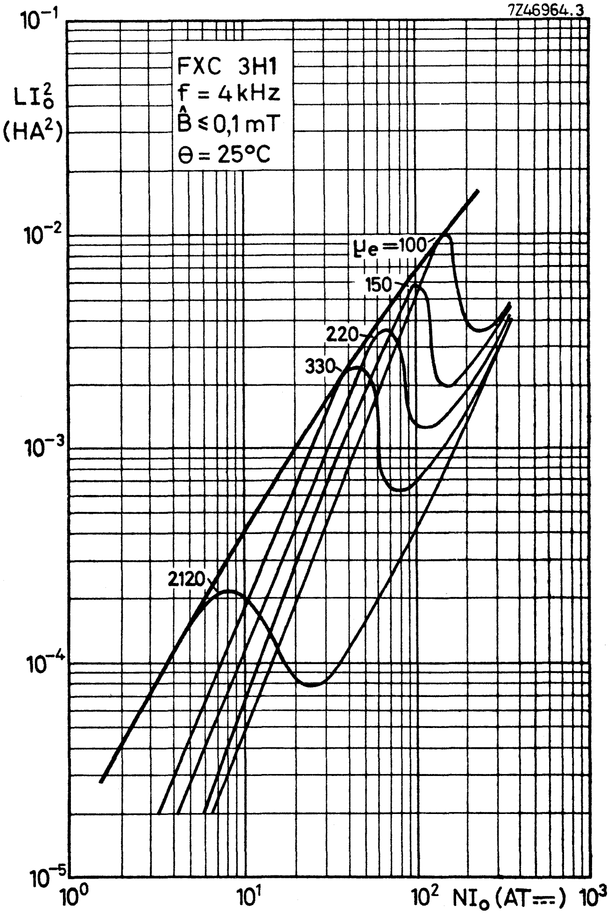
INDUCTANCE VARIATION AS A FUNCTION OF AT ~



HANNA CURVE

Indicating the optimum inductance for a certain μ_e-value and direct current.

Typical values



POTCORES

INTRODUCTION

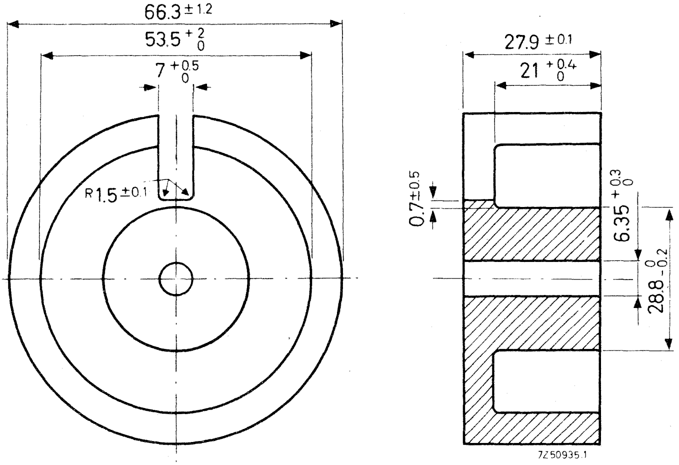
Two types of core can be supplied:

- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted potcores, available to special order. The μ_e values can be chosen from the E_6 standard series of values, the A_L values from the R_5 series.

Potcores and associated parts are ordered by their 12-digit catalog number. Quantity: a storage pack contains 12 halves each packed in corrugated fibre cardboard

SEPARATE POTCORE HALVES

Dimensions in mm



Versions

ferroxcube grade	catalogue number
3B5	4322 020 23010
3E 1	4322 020 23000

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I	temp. (^{o}C)	grade	
		3B5	3E 1
$\alpha_F \times 10^6$	+5 to +23		
	+23 to +55		
	+23 to +70	0 to +2	–
$D_F \times 10^6$ (10-100 min)	+23 ± 1	≤ 7,5	–

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 1700 Newton, the values in Table II are guaranteed at 25 ± 10 ^{o}C.

Table II	$\hat{B}$ (mT)	freq. (kHz)	grade	
			3B5	3E 1
μ_e	≤ 0, 1	4	≥ 1000	≥ 1970
α	≤ 0, 1	4	≤ 11,7	≤ 8,25
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0, 1	4	≤ 2,5	–
	≤ 0, 1	10	≤ 5	–
	≤ 0, 1	100	≤ 25	–
$q_{2\text{-}24\text{-}100}$	1,5–3,0		≤ 2,5	–
$\eta_B \times 10^3$	1,5–3,0		≤ 1,5	–

Weight (two halves) = 550 g

Core factor and effective dimensions:

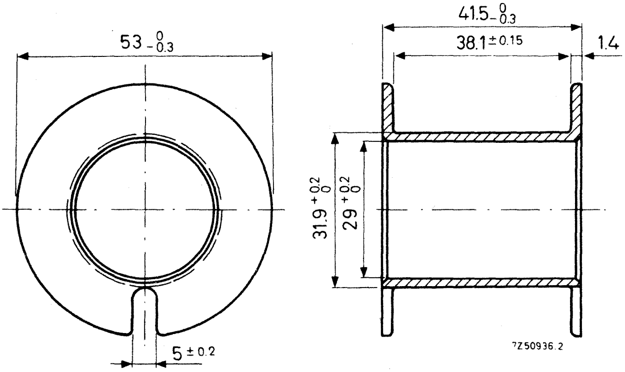
Effective length l_e = 123 mm

$$\Sigma \frac{l_e}{A_e} = 0,172 \text{ mm}^{-1}$$

Effective volume V_e = 88300 mm^3

COIL FORMER

SINGLE-SECTION COIL FORMER



Catalogue number	4322 021 31320
Material	polycarbonate
Window area	400 mm^2
Mean length of turn	130 mm
Max. temperature	130 ^{o}C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 0,80 \times 10^3\ \Omega/H$$

Weight 11,8 g

Square cores

SQUARE CORES

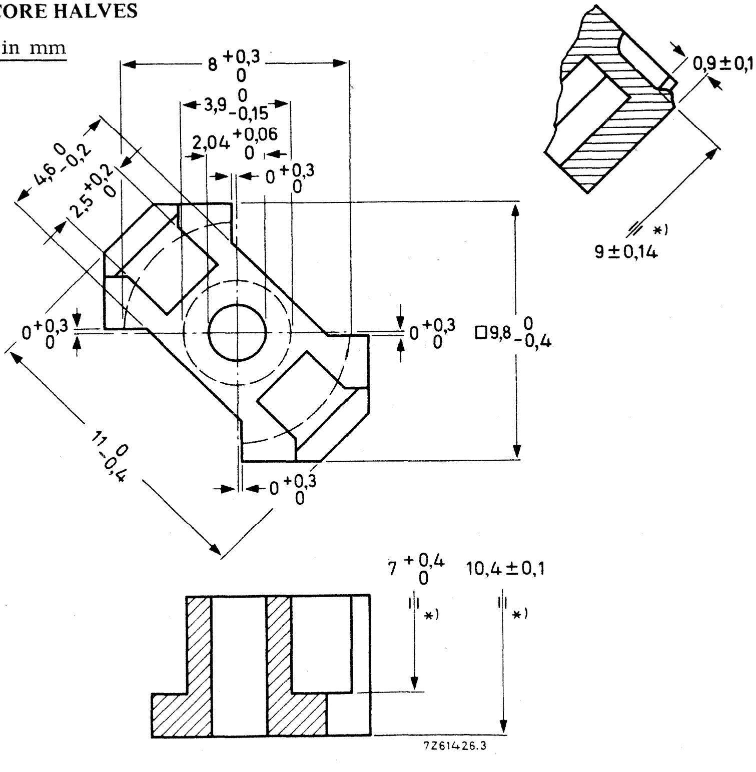
INTRODUCTION

Three types of core can be supplied:
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted cores (2 halves with an air gap) which are provided with a nut for an adjustor. These cores have an inductance factor A_L in accordance with the R5 (R10) range.
- Pre-adjusted cores without nut.

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 40 core halves or 20 pre-adjusted cores, a storage pack 200 or 100 respectively, so please order in multiples of these quantities.

SEPARATE CORE HALVES

Dimensions in mm



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*) Measured on two adjacent core halves

Versions

ferroxcube grade	catalogue number
3H1	4322 020 26510

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 25 Newton.

Table.Values with a * are for guidance only

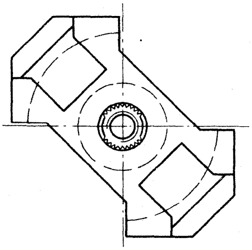
	$\hat{B}$ (mT)	freq. (MHz)	temperature ^{o}C	grade 3H1
μ_e 1)	≤ 0,1	0,1	25 ± 10	1600
A_L 1)	≤ 0,1	0,1	25 ± 10	1040
α 2)	≤ 0,1	0,1	25 ± 10	31,8
$\alpha_F \times 10^6$			5 to 25	+0,5 to +1,5
			25 to 55	+0,5 to +1,5
			25 to 70	+0,5 to +1,5 *
$D_F \times 10^6$ (10 - 100 min)			25 ± 1	≤ 4,3
$\frac{\tan\delta}{\mu} \times 10^6$	≤ 0,1	0,004	25 ± 10	–
	≤ 0,1	0,03	25 ± 10	≤ 3
	≤ 0,1	0,1	25 ± 10	≤ 6
	≤ 0,1	0,5	25 ± 10	–
	≤ 0,1	1	25 ± 10	–
	≤ 0,1	2	25 ± 10	–
	≤ 0,1	10	25 ± 10	–
$q_{2-24-100}$	0,3-1,2	0,1	25 ± 10	–
	1,5-3,0	0,004	25 ± 10	≤ 1,8
$\eta_B \times 10^3$	0,3-1,2	0,1	25 ± 10	–
	1,5-3,0	0,004	25 ± 10	≤ 1,1

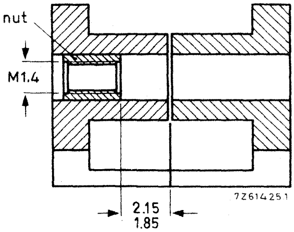
1) tolerance ± 25%

2) tolerance ± 12,5%

PRE-ADJUSTED CORES

Dimensions in mm





Weight	2,5 g
Mean length of lines of force	l_e = 21,3 mm
Mean area of lines of force	A_e = 11 mm^2
	$\Sigma \frac{l_e}{A_e}$ = 1,94 mm^{-1}
Effective volume	V_e = 230 mm^3

Pre-adjusted cores with standard A_L factors

A_L	corre-sponding μ_e-value	tolerance on induc-tance (%)	cat. No.: 4322 022 7.... with nut 4322 022 5.... without nut					
			3B7	3H1	3D3	4C6	3E1	3E4
16	24,2	± 1		–				
25	38	± 1		–				
40	62	± 1		7220				
63	96	± 1,5		7230				
100	152	± 2		7240				
160	242	± 5		7250				
250	380	± 10		7260				
1940	2620	± 25		–				
2790	3760	± 25		–				

Inductance $L = N^2A_L$ (in 10^{-9}H)

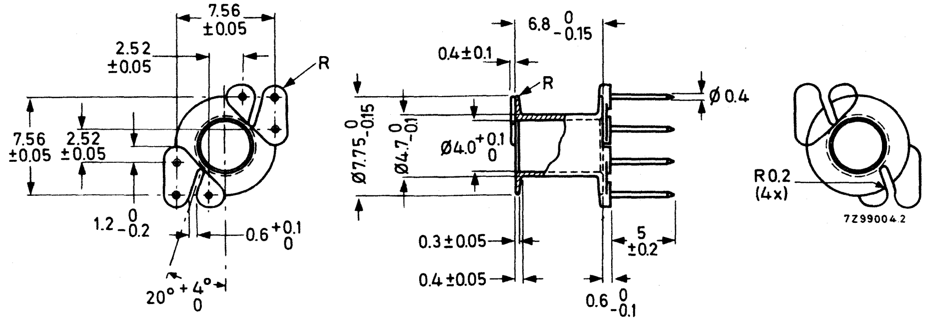
Symmetric airgap for cores with A_L factor of 16 up to and including 40.
Asymmetric airgap for cores with A_L factor of 63 and higher.
The airgap of the types marked with * is practically zero, and consequently inductance adjustment is not possible. Hence these types are not provided with a centre hole, so that maximum performance is achieved.

Notes

1. Example of catalogue number:
   A_L = 63, grade 3H1, core with nut, catalogue number 4322 022 77230
   A_L = 100, grade 3H1, core without nut, catalogue number 4322 022 57240.
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

COIL FORMER

SINGLE-SECTION, 6-PIN COIL FORMER



Catalogue number	4322 021 31800
Material:	polyester reinforced with glass fibre dipsoldered pins
Window area	8.8 mm^2
Mean length of turn	20 mm
Max. temperature	130 °C
Solderability	to IEC68-2-20B part 2, test T (solder bath 235 °C, soldering iron 350 °C) ←

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 55.7 \times 10^3\ \Omega/H$$

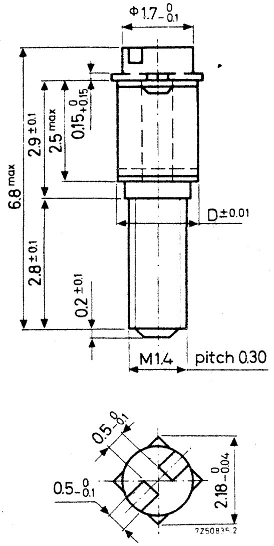
Weight	0.16 g

The arrangement of the soldering pins is suitable for both 0.1" and 2.50 mm grid, see "Mounting".

INDUCTANCE ADJUSTORS

ADJUSTORS

The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.
The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 ^{o}C.
The table shows the type of adjustor recommended for different square cores.

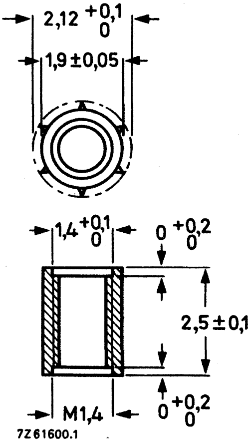


D	A_L of core in 3B7/3H1	recommended adjustor	
		cat. No.	colour
	16		
	25		
1.85	40	4322 021 31250	green
1.85	63	4322 021 31260	red
1.85	100	4322 021 31270	yellow
1.76	160	4322 021 31540	brown
1.85	250	4322 021 31280	grey

The adjustors are packed in bags of 100, so please order in multiples of 100.

NUT FOR ADJUSTOR

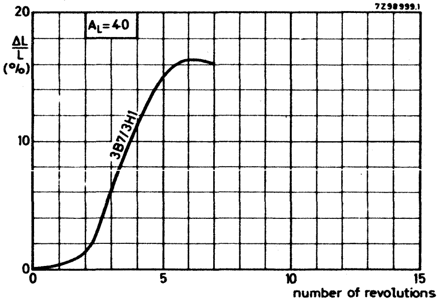
These data are given for those manufacturers who prefer to insert the nut themselves.



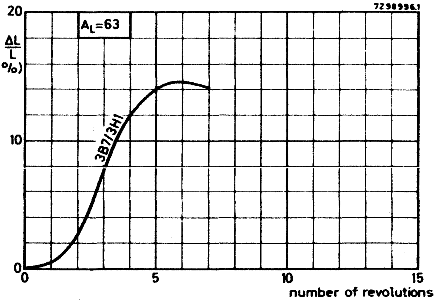
Catalogue number	4322 021 31850
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	2.0 ± 0.15 mm

The nuts are packed in bags of 100, so please order in multiples of 100.

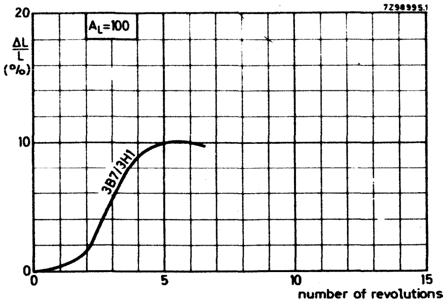
ADJUSTMENT CURVES



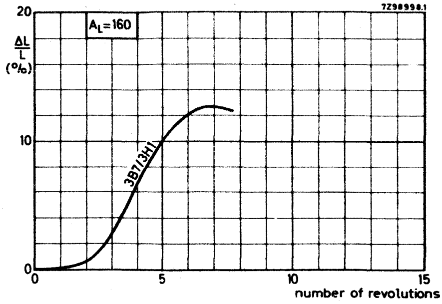
Adjustor 4322 021 31250



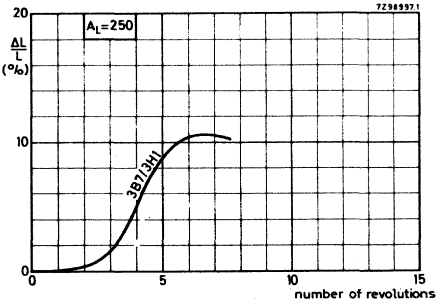
Adjustor 4322 021 31260



Adjustor 4322 021 31270

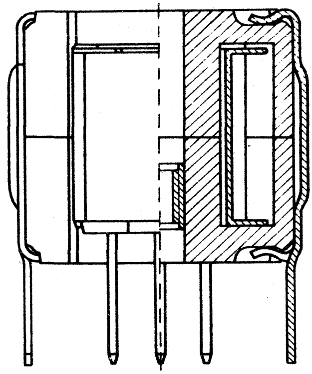


Adjustor 4322 021 31540



Adjustor 4322 021 31280

MOUNTING PARTS



ASSEMBLING

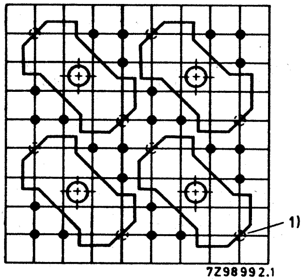
The core halves are clamped together by means of two clips, type 4322 021 31900. As can be seen in the drawing, the hooked ends of either clip fall into recesses made in the core halves.

For a stable inductance we recommend some adhesive to be applied between the coil-former flange and the lower core half. We also recommend that a tool be used for assembling. Drawings of a simple tool are available under number 8222 294 12930.

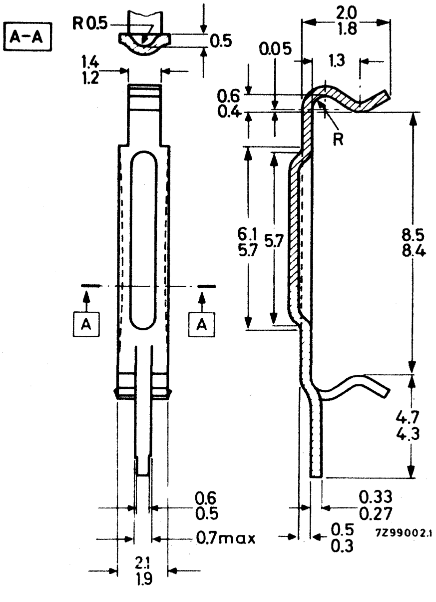
MOUNTING

The two retaining clips are also used for mounting the assembled core on a printed-wiring board: the gold-plated pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing the core.

The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 2,4 mm. The recommended hole diameter in the board is 1 ± 0,1 mm (according to IEC publication 97).



PART DRAWING (dimensions in mm)



Clip 4322 021 31900
Material: steel, nickel and gold plated

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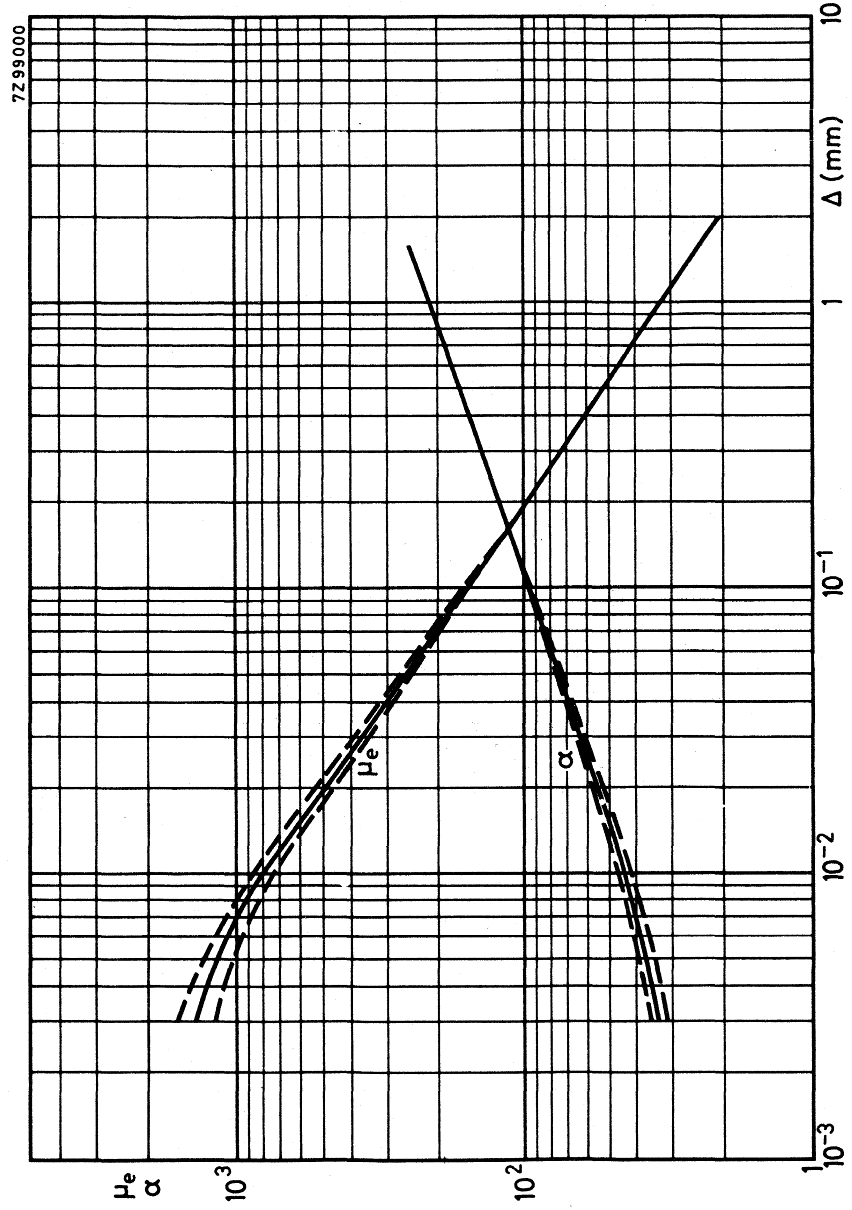
1) Holes for tag on clip 4322 021 31900 (earth points)

CHARACTERISTIC CURVES

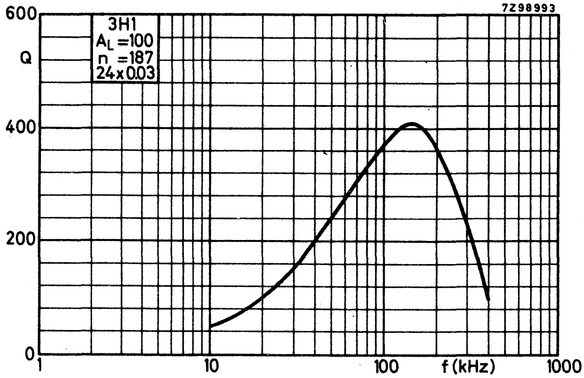
μ_e - α CURVES

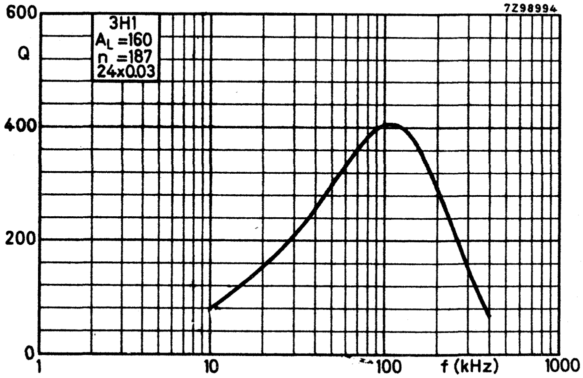


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

$\mu_e \geq 1200$ at $\Delta = 3\,\mu m$ for 3H1

Q-CURVES


7Z98993
3H1
A_L =100
n =187
24x0.03
Q
600
400
200
0
1
10
100
f (kHz)
1000


7Z98994
3H1
A_L =160
n =187
24x0.03
Q
600
400
200
0
1
10
100
f (kHz)
1000

SQUARE CORES

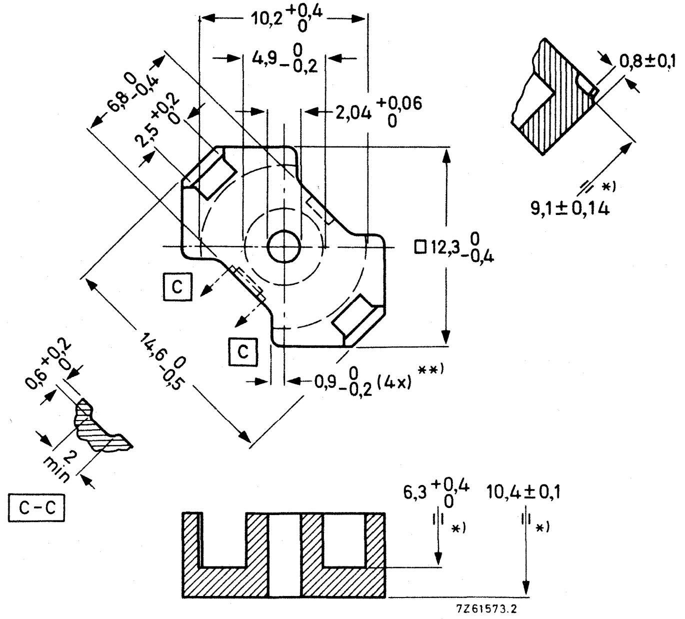
INTRODUCTION

Three types of core can be supplied:
- Separate core halves, air gap to be ground by the user hinself.
- Pre-adjusted cores (2 halves with an air gap) which are provided with a nut for an adjustor. These cores have an inductance factor A_L in accordance with the R5(R10) range.
- Pre-adjusted cores without nut.

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 40 core halves or 20 pre-adjusted cores, a storage pack 200 or 100 respectively, so please order in multiples of these quantities.

SEPARATE CORE HALVES

Dimensions in mm



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*) measured on two adjacent core halves

**) measured on the face with the recesses, 0,8 ± 0,2 on the mating face.

Versions

ferroxcube grade	catalogue number
3B7	4322 020 26750
3H1	4322 020 26760
3D3	4322 020 26770
4C6	4322 020 26780
3E1	only pre-adjusted
3E4	cores are available.

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 35 Newton.

Table. Values with a * are for guidance only

	$\hat{B}$ (mT)	freq. (MHz)	temp. (°C)	grade					
				3B7	3H1	3D3	4C6	3E1	3E4
μ_e 1)	≤ 0, 1	0, 1	25 ± 10	1590	1590	670	124		
A_L 1)	≤ 0, 1	0, 1	25 ± 10	1960	1960	840	150		
α 2)	≤ 0, 1	0, 1	25 ± 10	≤ 23, 1	≤ 23, 1	≤ 35, 3	≤ 82, 3		
$\alpha_F \times 10^6$			5 to 25	−0, 6 to +0, 6*	+0, 5 to 1, 5	–	−2 to +4	–	0 to +2
			25 to 55	−0, 6 to +0, 6	+0, 5 to 1, 5	–	0 to +6	–	0 to +2
			25 to 70	−0, 6 to +0, 6	+0, 5 to 1, 5	0 to +2	–	0 to +2	0 to +2
$D_F \times 10^6$ (10-100 min)			25 ± 1	≤ 4, 3	≤ 4, 3	≤ 12	–	–	≤ 4, 3
$\frac{\tan \delta}{\mu} \times 10^6$	≤ 0, 1	0, 004	25 ± 10	–	–	–	–	≤ 2, 5	≤ 2, 5
	≤ 0, 1	0, 03		≤ 2, 5	≤ 2, 5	–	–	–	–
	≤ 0, 1	0, 1		≤ 5	≤ 5	≤ 8	–	≤ 20	≤ 20
	≤ 0, 1	0, 5		–	–	≤ 14	–	≤ 200	≤ 200
	≤ 0, 1	1		–	–	≤ 30	–	–	–
	≤ 0, 1	2		–	–	–	≤ 40	–	–
	≤ 0, 1	10		–	–	–	≤ 100	–	–
$q_{2-24-100}$	0, 3-1, 2	0, 1	25 ± 10	–	–	≤ 3	≤ 15	–	–
	1, 5-3, 0	0, 004		≤ 1, 8/ ≤ 1, 4 *	≤ 1, 4	–	–	≤ 3	≤ 1, 8
$\eta_B \times 10^3$	0, 3-1, 2	0, 1	25 ± 10	–	–	≤ 1, 8	≤ 9, 2	–	–
	1, 5-3, 0	0, 004		≤ 1, 1/ ≤ 0, 86*	≤ 0, 86	–	–	≤ 1, 8	≤ 1, 1

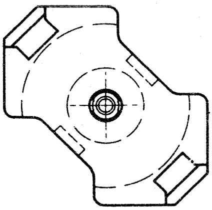
---

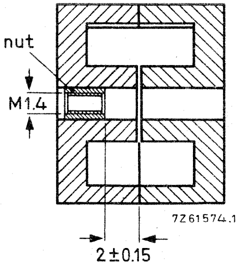
1) tolerance ± 25%

2) tolerance ± 12, 5%

PRE-ADJUSTED CORES

Dimensions in mm





The cores in grade 3E1 and 3E4 have no centre hole.

		with centre hole	without centre hole
Weight		3,0 g	3,2 g
Mean length of lines of force	l_e	21,4 mm	23,2 mm
Mean area of lines of force	A_e	21,2 mm^2	24,8 mm^2
	$\Sigma \frac{l_e}{A_e}$	1,01 mm^{-1}	0,935 mm^{-1}
Effective volume	V_e	450 mm^3	574 mm^3

Pre-adjusted cores with standard A_L factors

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	cat. No. 4322 022 7.... with nut 4322 022 5.... without nut					
			3B7	3H1	3D3	4C6	3E1	3E4
16	13	± 1	–	–		9800		
25	20	± 1	–	–	9410	9810		
40	33	± 1	–	–	9420	9820		
63	51	± 1	9030	9230	9430	9830		
100	82	± 1	9040	9240	9440			
160	130	± 2	9050	9250				
250	200	± 3	9060	9260				
315	250	± 5	9070	9270				
400	330	± 5	9080	9280				
3450	2570	± 25	–	–	–	–	9900*	
4975	3700	± 25	–	–	–	–	–	9990*

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Symmetric airgap for cores with A_L factor of 16 up to and including 100.
Asymmetric airgap for cores with A_L factor of 160 and higher.
The airgap of the types marked with * is practically zero, and consequently inductance adjustment is not possible. Hence these types are not provided with a centre hole, so that maximum performance is achieved.

Notes

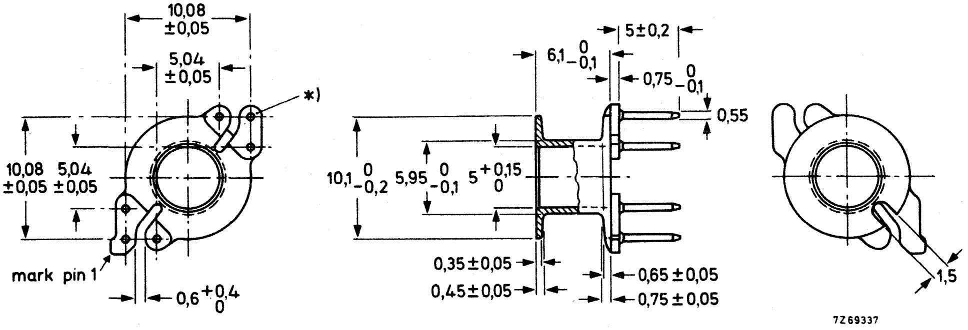
1. Example of catalogue number:
   A_L = 250, grade 3H1, core with nut, catalogue number 4322 022 79260.
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

COIL FORMERS

to DIN 41981

SINGLE-SECTION 4-PIN COIL FORMER, catalogue number 4322 021 32830
SINGLE-SECTION 6-PIN COIL FORMER, catalogue number 4322 021 32840

Dimensions (mm)



Material	phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite); dipsoldered pins
Minimum window area	9,5 mm^2
Mean length of turn	25 mm
Maximum temperature	180 °C
Solderability	to IEC 68-2-20B, part 2, test T (solder bath 235 °C, soldering iron 350 °C)
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu_e} \text{ x } \frac{1}{f_{cu}} \text{ x } 34 \text{ x } 10^3\ \Omega/H$
Weight	0,28 g

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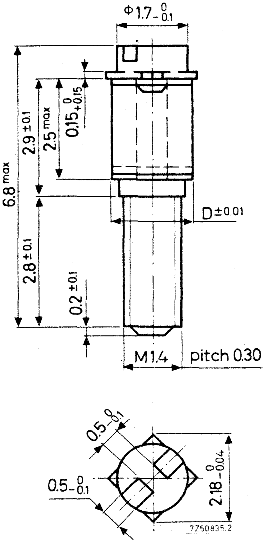
*) the 4-pin coil former does not have the two outermost pins.

INDUCTANCE ADJUSTORS

ADJUSTORS

The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy $< 0.03\ \%$ by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.
The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
The table shows the type of adjustor recommended for different square cores.

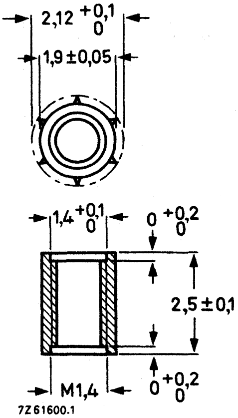


D	A_L of core in 3B7/3H1/3D3	recommended adjustor	
		cat. No.	colour
	16	–	–
	25	–	–
1,85	40	4322 021 31250	green
1,85	63	4322 021 31260	red
1,85	100	4322 021 31270	yellow
1,76	160	4322 021 31540	brown
1,85	250	4322 021 31280	grey
1,88	315	4322 021 32720	black
1,90	400	4322 021 32710	white

The adjustors are packed in bags of 100, so please order in multiples of 100.

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.

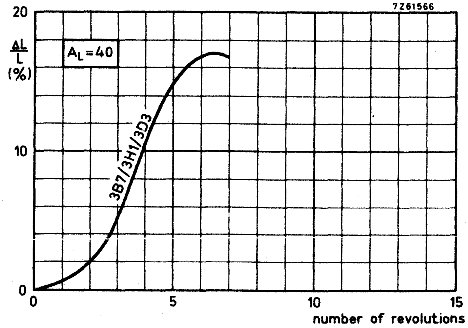


Catalogue number	4322 021 31850
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	2.0 ± 0.15 mm

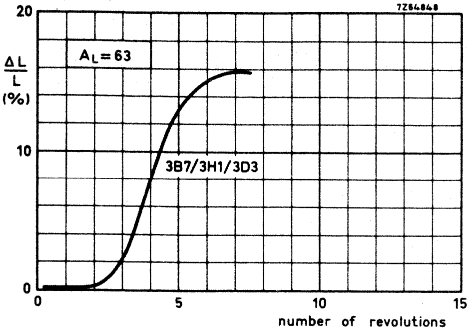
The nuts are packed in bags of 100, so please order in multiples of 100.

ADJUSTMENT CURVES

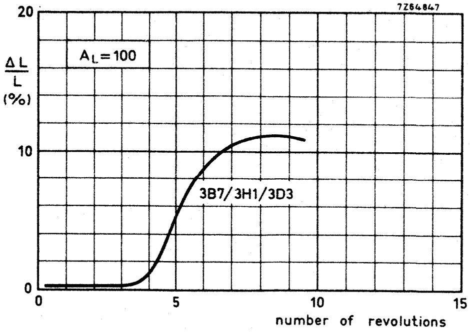
Adjustor 4322 021 31250



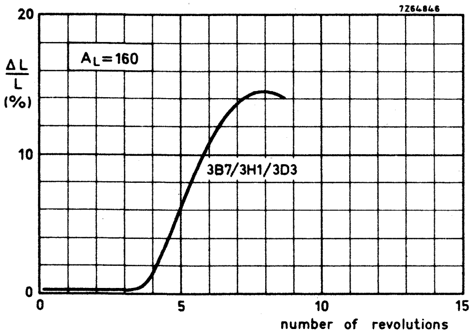
Adjustor 4322 021 31260



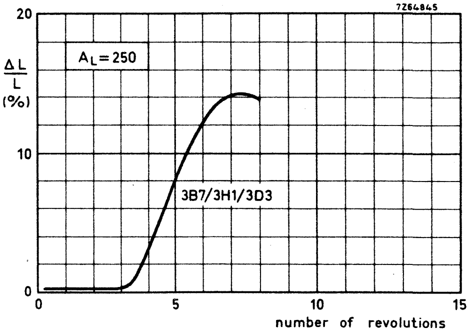
Adjustor 4322 021 31270



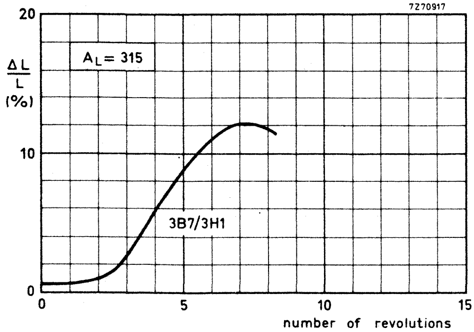
Adjustor 4322 021 31540



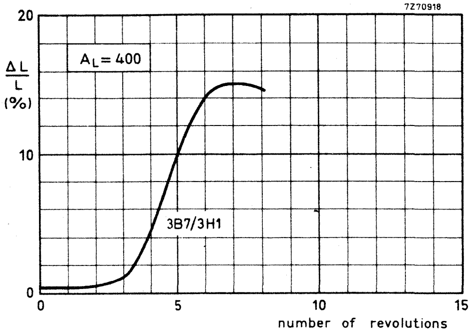
Adjustor 4322 021 31280



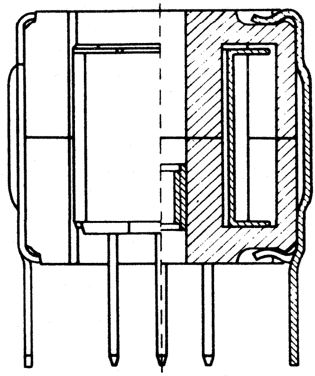
Adjustor 4322 021 32720



Adjustor 4322 021 32710



MOUNTING PARTS



ASSEMBLING

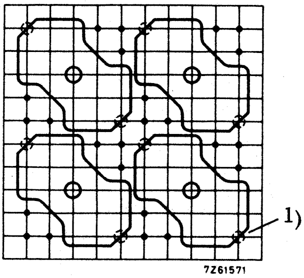
The core halves are clamped together by means of two clips, type 4322 021 31900. As can be seen in the drawing, the hooked ends of either clip fall into recesses made in the core halves.

For a stable inductance we recommend some adhesive to be applied between the coil-former flange and the lower core half. We also recommend that a tool be used for assembling. Drawings of a simple tool are available under number 4322 058 00170.

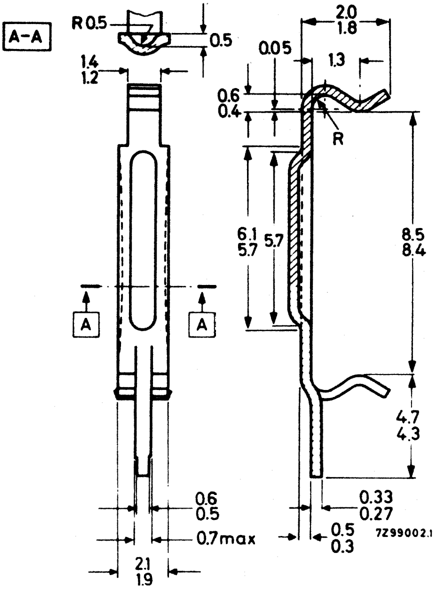
MOUNTING

The two retaining clips are also used for mounting the assembled core on a printed-wiring board: the gold plated pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing the core.

The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 2,4 mm. The recommended hole diameter in the board is 1 ± 0,1 mm (according to IEC publication 97).



PART DRAWING (dimensions in mm)



Clip 4322 021 31900
Material: steel, nickel and gold plated

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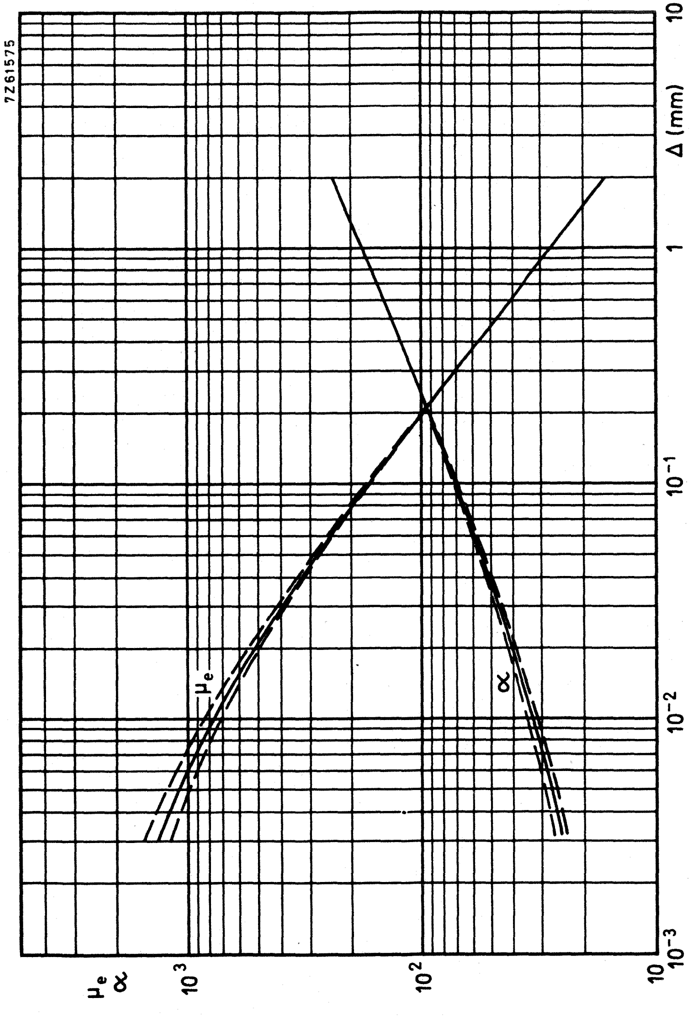
1) Holes for tag on clip 4322 021 31900 (earth points).

CHARACTERISTIC CURVES

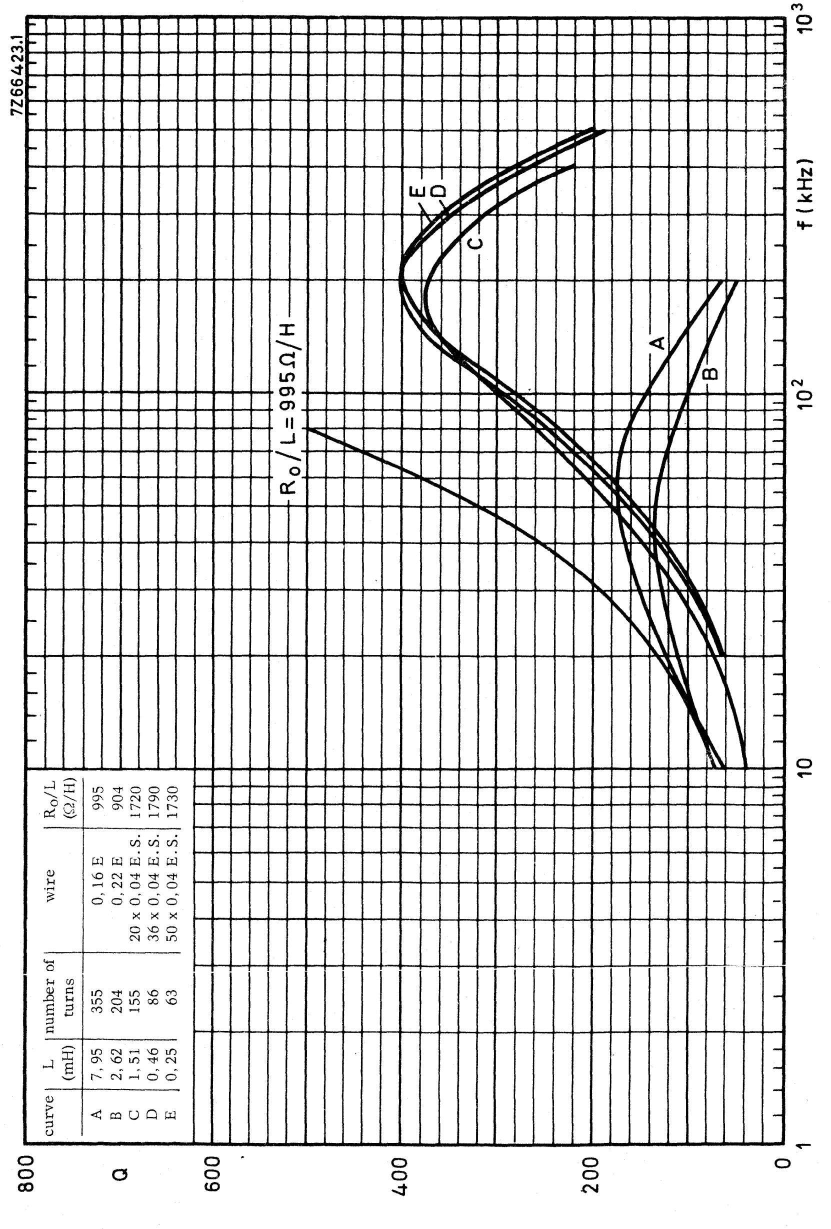
μ_e - α CURVES



Relative effective permeability and turn factor for 1 mH as a function of the air gap length

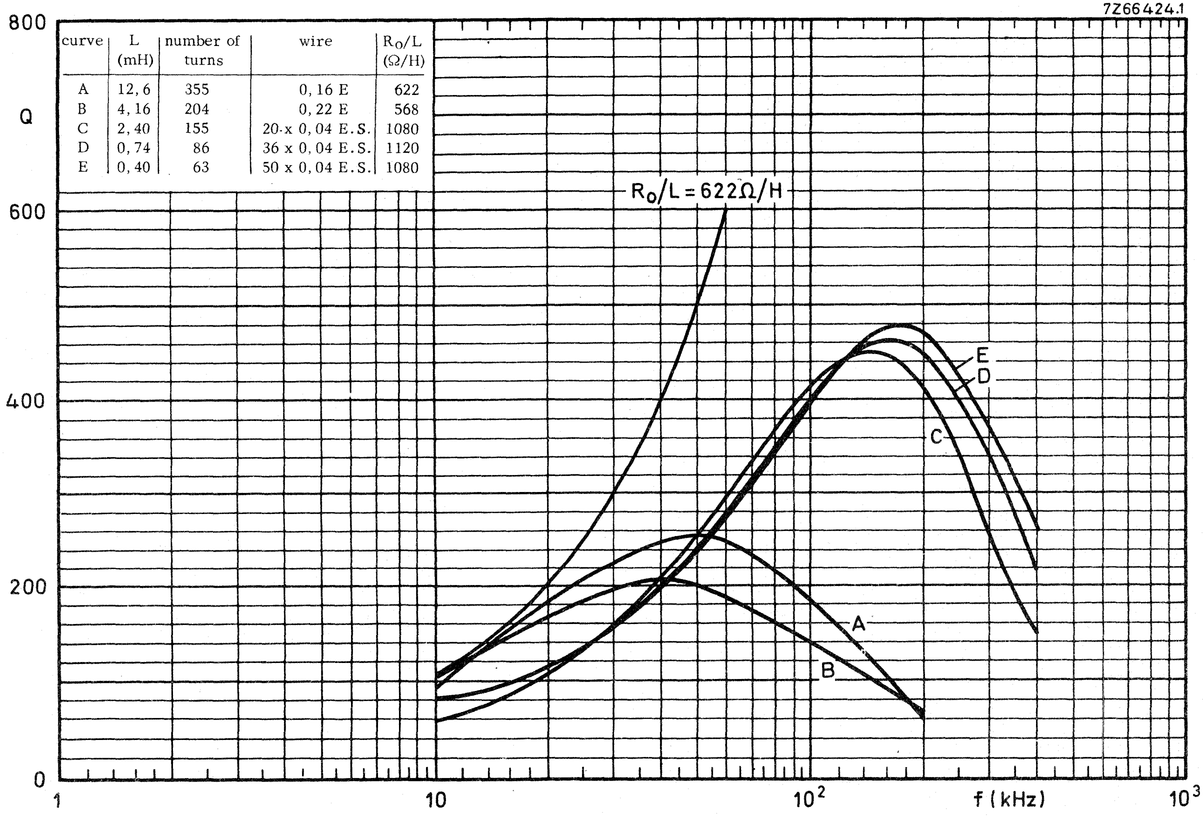
μ_e = 1590 at Δ = 3 μm for 3B7 and 3H1

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



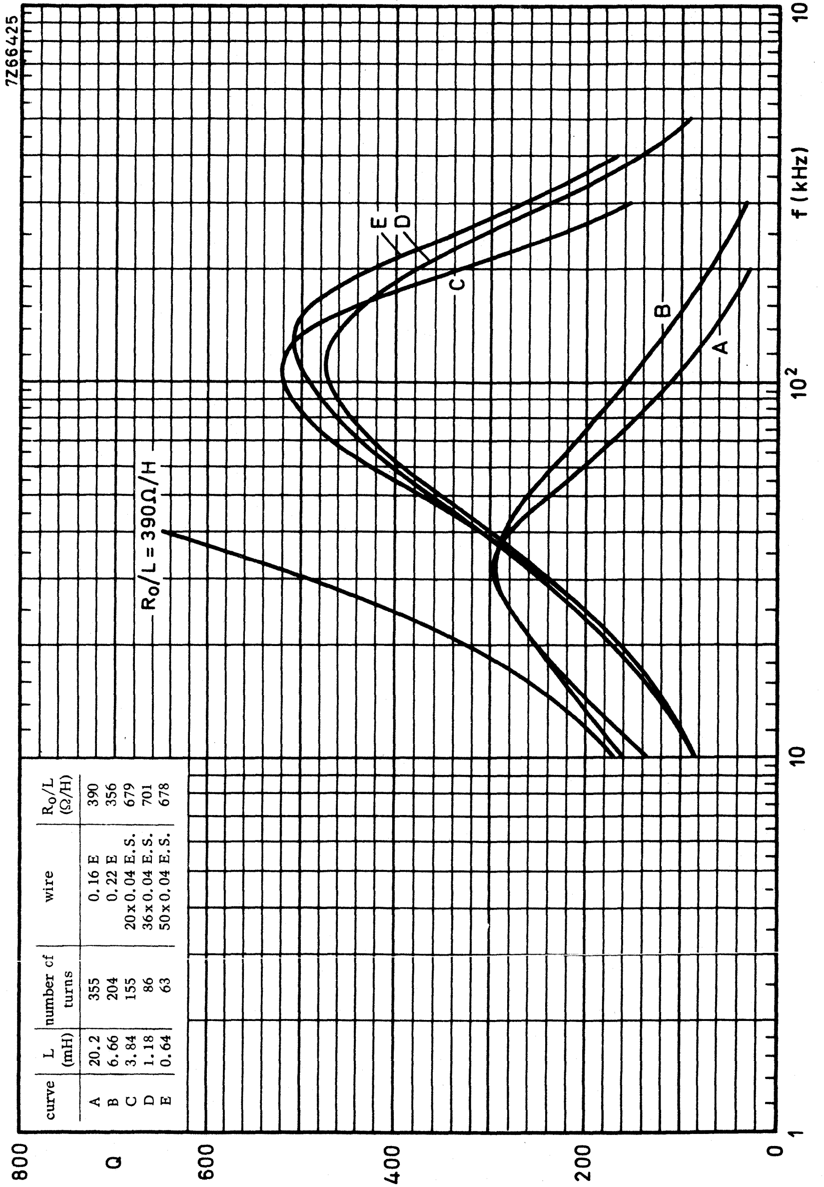
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	7,95	355	0,16 E	995
B	2,62	204	0,22 E	904
C	1,51	155	20 x 0,04 E.S.	1720
D	0,46	86	36 x 0,04 E.S.	1790
E	0,25	63	50 x 0,04 E.S.	1730

FXC 3B7/3H1, single-section coil former, $A_L = 63$



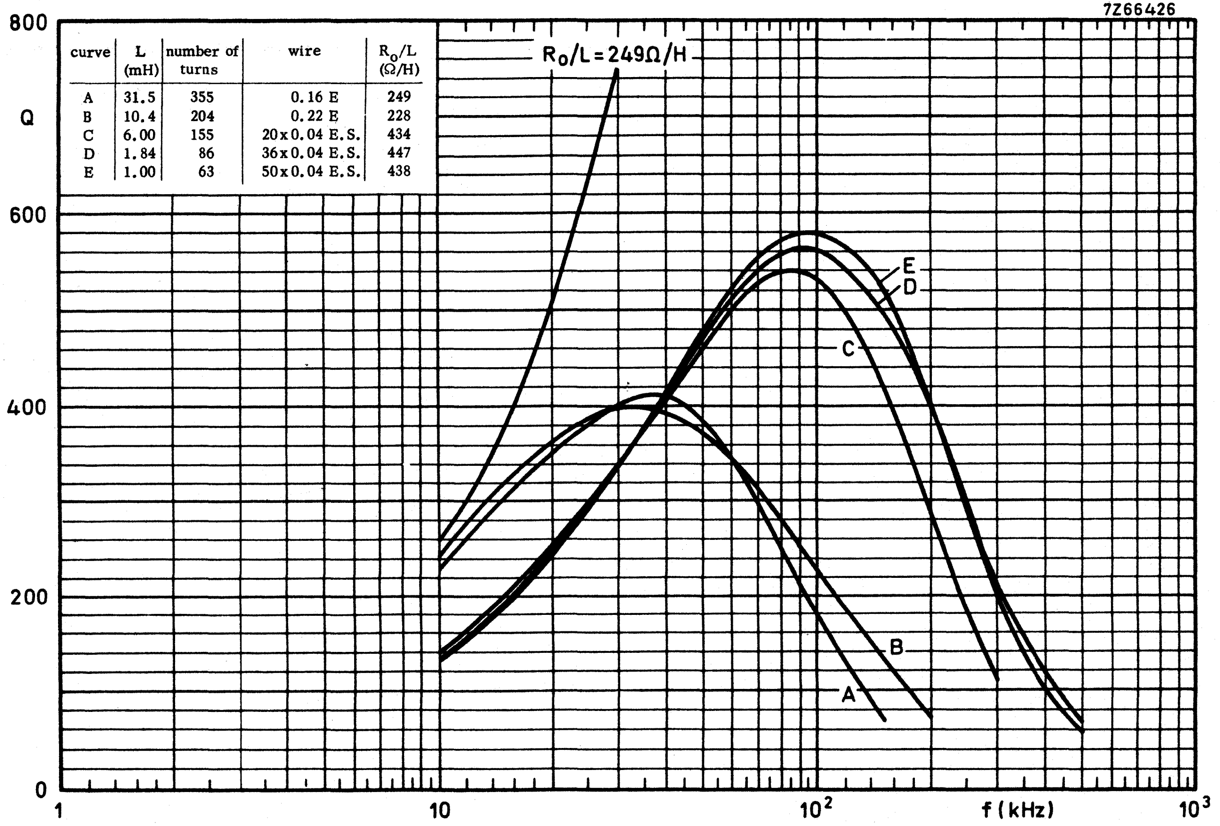
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	12, 6	355	0, 16 E	622
B	4, 16	204	0, 22 E	568
C	2, 40	155	20 x 0, 04 E.S.	1080
D	0, 74	86	36 x 0, 04 E.S.	1120
E	0, 40	63	50 x 0, 04 E.S.	1080

FXC 3B7/3H1, single-section coil former, $A_L = 100$



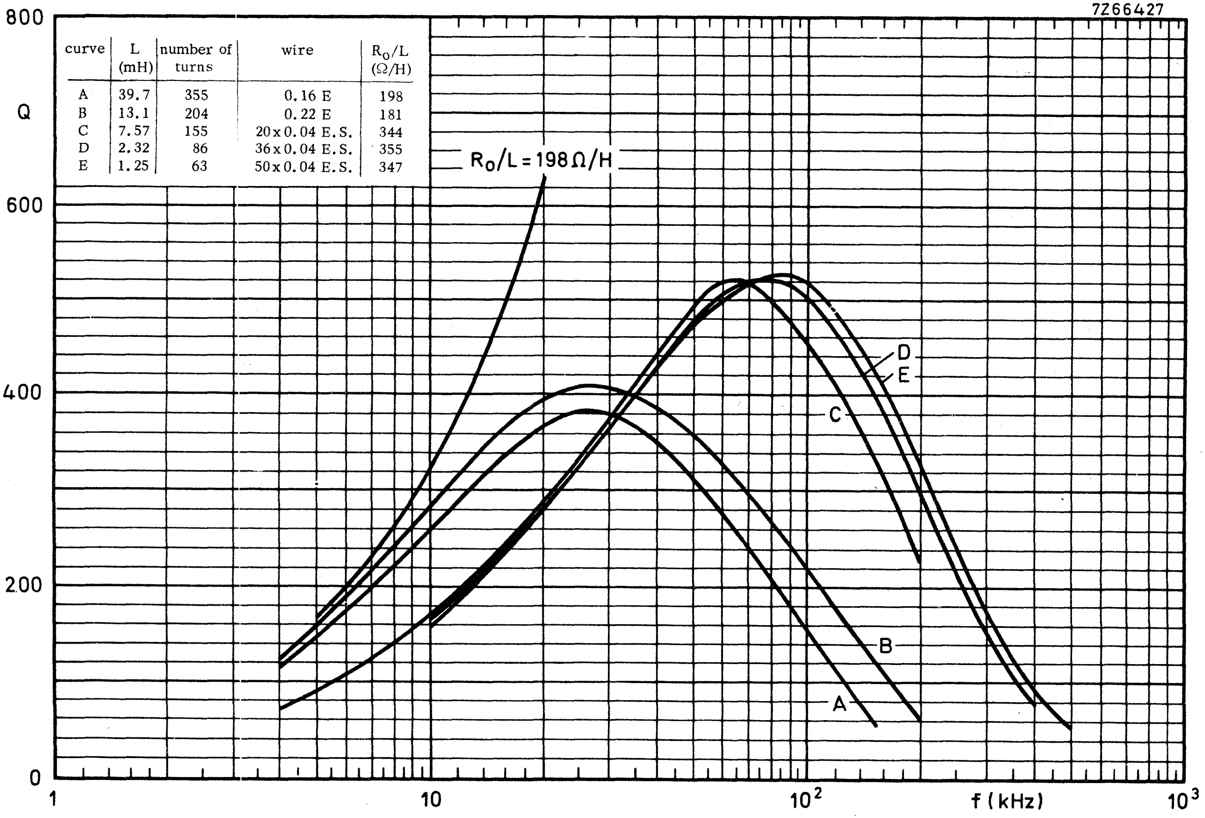
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	20.2	355	0.16 E	390
B	6.66	204	0.22 E	356
C	3.84	155	20 x 0.04 E.S.	679
D	1.18	86	36 x 0.04 E.S.	701
E	0.64	63	50 x 0.04 E.S.	678

FXC 3B7/3H1, single-section coil fromer, $A_L = 160$



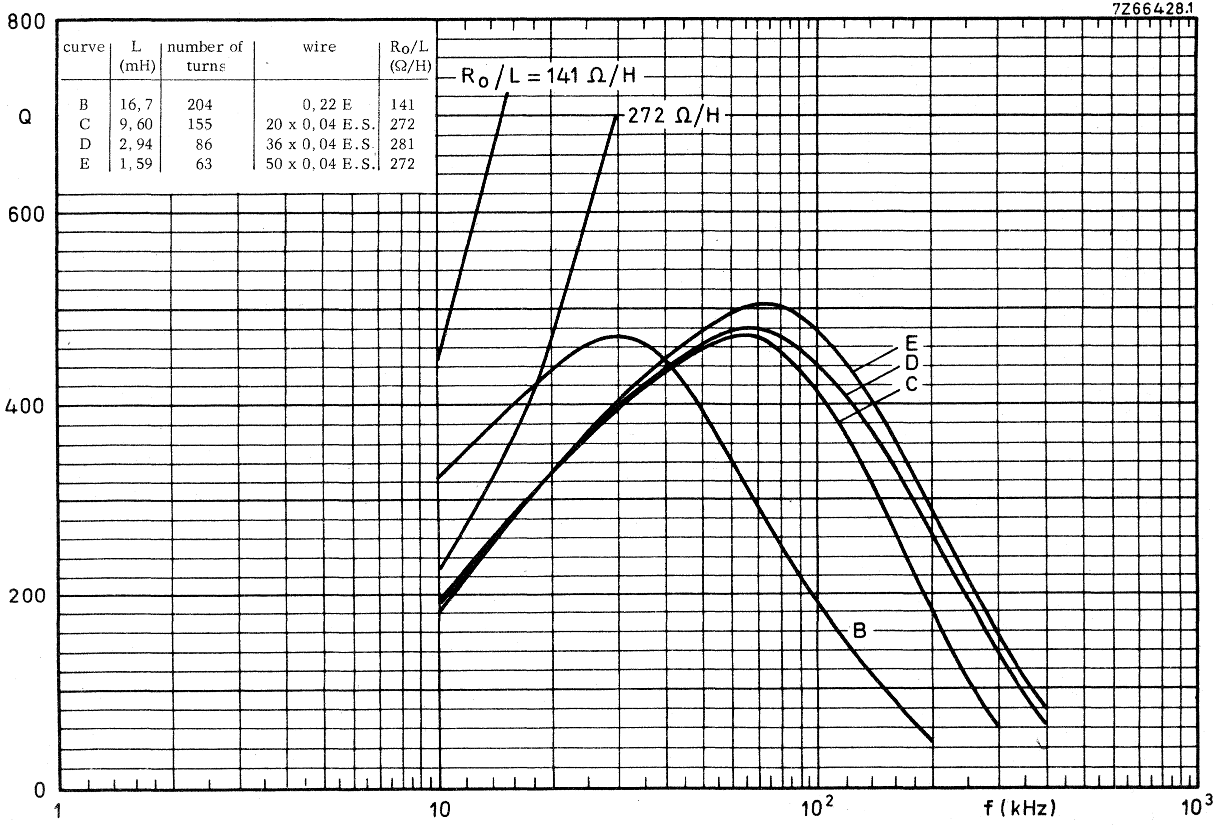
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	31.5	355	0.16 E	249
B	10.4	204	0.22 E	228
C	6.00	155	20x0.04 E.S.	434
D	1.84	86	36x0.04 E.S.	447
E	1.00	63	50x0.04 E.S.	438

FXC 3B7/3H1, single-section coil former, $A_L = 250$



curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	39.7	355	0.16 E	198
B	13.1	204	0.22 E	181
C	7.57	155	20 x 0.04 E.S.	344
D	2.32	86	36 x 0.04 E.S.	355
E	1.25	63	50 x 0.04 E.S.	347

FXC 3B7/3H1, single-section coil former, $A_L = 315$



curve	L (mH)	number of turns	wire	Ro/L (Ω/H)
B	16, 7	204	0, 22 E	141
C	9, 60	155	20 x 0, 04 E.S.	272
D	2, 94	86	36 x 0, 04 E.S.	281
E	1, 59	63	50 x 0, 04 E.S.	272

FXC 3B7/3H1, single-section coil former, $A_L = 400$

SQUARE CORES

INTRODUCTION

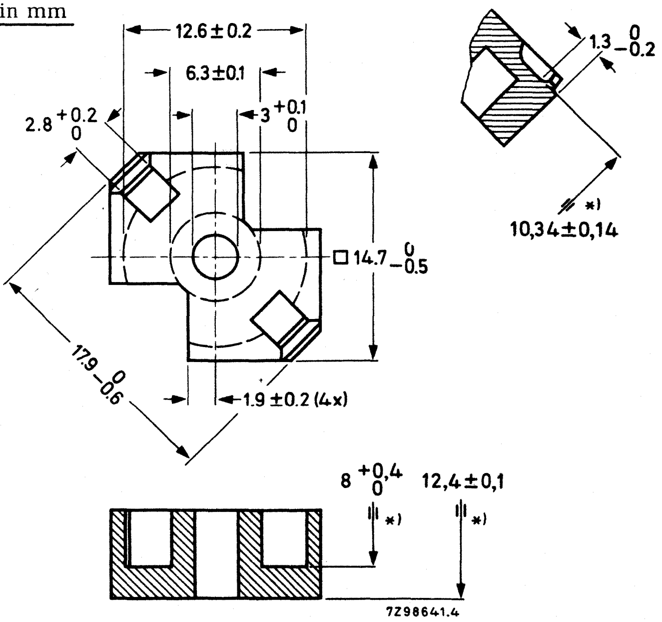
Three types of core can be supplied:
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted cores (2 halves with an air gap) which are provided with a nut for an adjustor. These cores have an inductance factor A_L in accordance with the R5 (R10) range.
- Pre-adjusted cores without nut.

Square cores and associated parts are ordered by their 12-digit catalogue number.

Quantity: a primary pack contains 40 core halves or 20 pre-adjusted cores, a storage pack 200 or 100 respectively, so please order in multiples of these quantities.

SEPARATE CORE HALVES

Dimensions in mm



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*) measured on two adjacent core halves

Versions

ferroxcube grade	catalogue number
3H1	4322 020 25130
3B7	4322 020 25120
3D3	4322 020 25140
4C6	4322 020 25150
3E1	only pre-adjusted cores
3E4	are available

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 50 Newton.

Table. Values with a * are for guidance only

	$\hat{B}$ (mT)	freq. (MHz)	temp. (°C)	grade					
				3H1	3B7	3D3	4C6	3E4	3E1
μ_e 1)	≤ 0,1	0,1	25 ± 10	1700	1700	700	125	–	–
A_L 1)	≤ 0,1	0,1	25 ± 10	2640	2640	1080	194	–	–
α 2)	≤ 0,1	0,1	25 ± 10	19,9	19,9	31,1	73,6	–	–
$\alpha_F \times 10^6$			+5 to +25	+0,5 to +1,5	−0,6 to +0,6*	–	−2 to +4	0 to +2	–
			+25 to +55	+0,5 to +1,5	−0,6 to +0,6	–	0 to +6	0 to +2	–
			+25 to +70	+0,5 to +1,5	−0,6 to +0,6	0 to +2	–	0 to +2	0 to +2
$D_F \times 10^6$ (10-100 min)			25 ± 1	≤ 4,3	≤ 4,3	≤ 12	–	≤ 4,3	–
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0,1	0,004	25 ± 10	–	–	–	–	≤ 2,5	≤ 2,5
	≤ 0,1	0,03		≤ 2,5	≤ 2,5	–	–	–	–
	≤ 0,1	0,1		≤ 5	≤ 5	≤ 8	–	≤ 20	≤ 20
	≤ 0,1	0,5		–	–	≤ 14	–	≤ 200	≤ 200
	≤ 0,1	1,0		–	–	≤ 30	–	–	–
	≤ 0,1	2,0		–	–	–	≤ 40	–	–
	≤ 0,1			–	–	–	≤ 100	–	–
$q_{2-24-100}$	1,5-3,0	0,004	25 ± 10	≤ 1,4	≤ 1,8/ ≤ 1,4*	–	–	≤ 1,8	≤ 3
	0,3-1,2	0,1		–	–	≤ 3	≤ 15	–	–
$\eta_E \times 10^3$	1,5-3,0	0,004	25 ± 10	≤ 0,86	≤ 1,1/ ≤ 0,86*	–	–	≤ 1,1	≤ 1,8
	0,3-1,2	0,1		–	–	≤ 1,8	≤ 9,2	–	–

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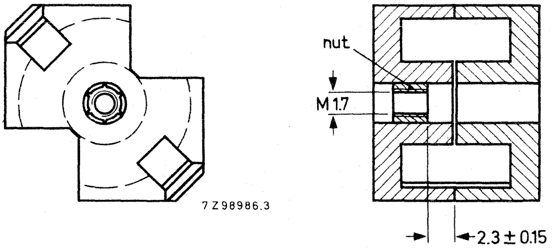
1) tolerance ± 25 %

2) tolerance ± 12,5 %

PRE-ADJUSTED CORES

Dimensions in mm



The cores in grade 3E1 and 3E4 have no centre hole.

	with centre hole	without centre hole
Weight	5,4 g	5,6 g
Mean length of lines of force	l_e = 25,6 mm	27,5 mm
Mean area of lines of force	A_e = 32 mm^2	38 mm^2
	$\Sigma \frac{l_e}{A_e}$ = 0,810 mm^{-1}	0,732 mm^{-1}
Effective volume	V_e = 810 mm^3	1040 mm^3

Pre-adjusted cores with standard A_L values

A_L	corresponding μ_e value	tol. on inductance (%)	catal. No. 4322 022 7.... with nut 4322 022 5.... without nut					
			3B7	3H1	3D3	4C6	3E4	3E1
25	15.6	± 1	–	–	–	5810	–	–
40	24.9	± 1	5020	5220	5420	5820	–	–
63	39.4	± 1	5030	5230	5430	5830	–	–
100	62.4	± 2	5040	5240	5440	–	–	–
160	100	± 2	5050	5250	5450	–	–	–
200	122	± 2	5170	5370	–	–	–	–
250	156	± 2	5060	5260	–	–	–	–
315	197	± 2	5070	5270	–	–	–	–
400	249	± 2	5080	5280	–	–	–	–
630	394	± 3	5100	5300	–	–	–	–
1000	624	± 10	5110	5310	–	–	–	–
1250	780	± 10	5190	5390	–	–	–	–
4780	2780	± 25	–	–	–	–	–	5800*
6710	3950	± 25	–	–	–	–	5900*	–

Inductance $L = N^2 A_L$ (in 10^{-9}H)

Symmetric airgap for cores with A_L factor of 25 up to and including 100.
Asymmetric airgap for cores with A_L factor of 160 and higher.
The airgap of the types marked with * is practically zero, and consequently inductance adjustment is not possible. Hence these types are not provided with a centre hole, so that maximum performance is achieved.

Notes

1. Example of catalogue number:
   A_L = 250, grade 3H1, core with nut, catalogue number 4322 022 75260.
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

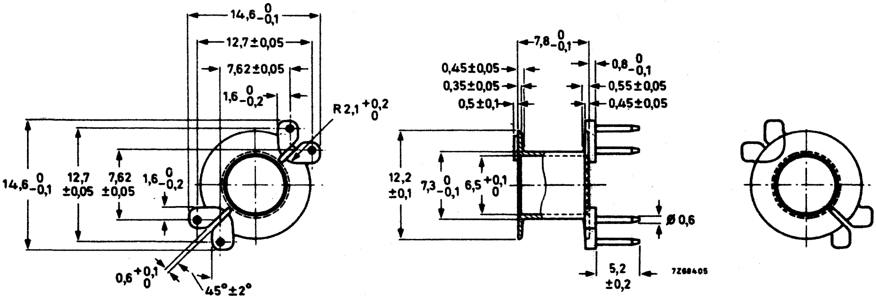
COIL FORMERS

GENERAL

Four types of coil former can be supplied:
- with 1 section and 4 pins
- with 2 sections and 4 pins
- with 1 section and 6 pins
- with 2 sections and 6 pins

The arrangement of the soldering pins is suitable for both 0, 1" and 2, 50 mm grid, see "Mounting".

SINGLE-SECTION, 4-PIN COIL FORMER



Catalogue number	4322 021 32280
Material:	phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)
Window area	17, 3 mm^2
Mean length of turn	3, 0 cm
Max. temperature	180 °C

Solderability according to IEC68-2-20B, part 2, test T

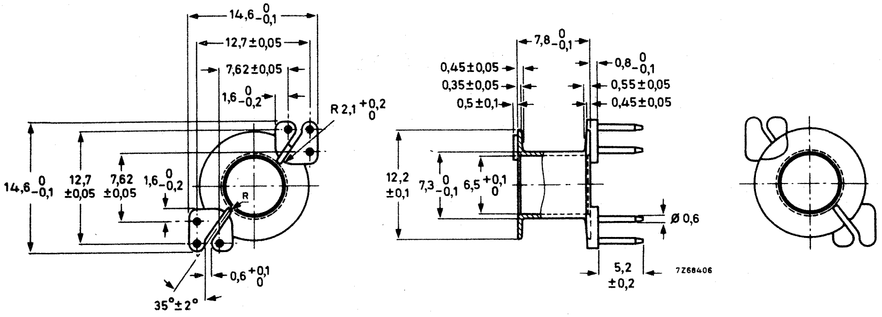
(solder bath 235 °C, soldering iron 350 °C)

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \text{ x } \frac{1}{f_{cu}} \text{ x } 18,9 \text{ x } 10^3 \ \Omega/\text{H}$$

Weight	0, 20 g

SINGLE-SECTION, 6-PIN COIL FORMER



Catalogue number 4322 021 32290

Material: phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)

Window area	17, 3 mm^2
Mean length of turn	3, 0 cm
Max. temperature	180 °C

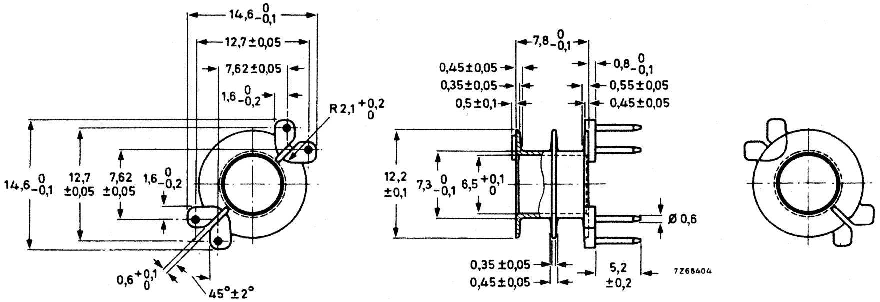
Solderability according to IEC68-2-20B, part 2, test T (solder bath 235 °C, soldering iron 350 °C)

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} x \frac{1}{f_{cu}} x\ 18,9 \times 10^3\ \Omega/H$$

Weight 0, 20 g

TWO-SECTION, 4-PIN COIL FORMER



Catalogue number 4322 021 32300

Material: phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)

Window area	2 x 8, 2 mm^2
Mean length of turn	3, 0 cm
Max. temperature	180 °C

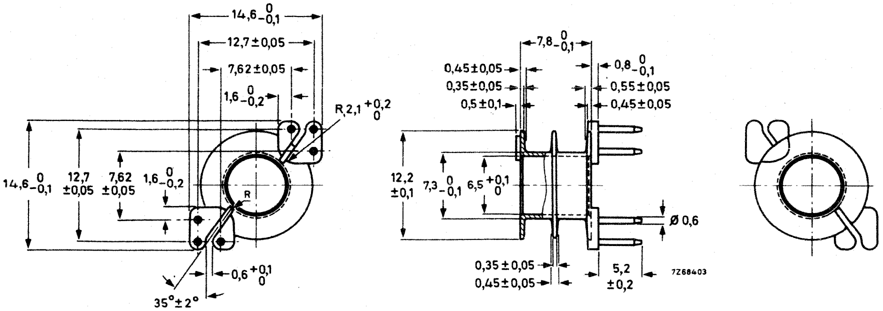
Solderability according to IEC68-2-20B, part 2, test T (solder bath 235 °C, soldering iron 350 °C)

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} x \frac{1}{f_{cu}} x\ 19,9 \times 10^3\ \Omega/H$$

Weight 0, 20 g

TWO-SECTION, 6-PIN COIL FORMER



Catalogue number	4322 021 32310
Material:	phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)
Window area	2 x 8,2 mm^2
Mean length of turn	3,0 cm
Max. temperature	180 °C

Solderability according to IEC68-2-20B, part 2, test T

(solder bath 235 °C, soldering iron 350 °C)

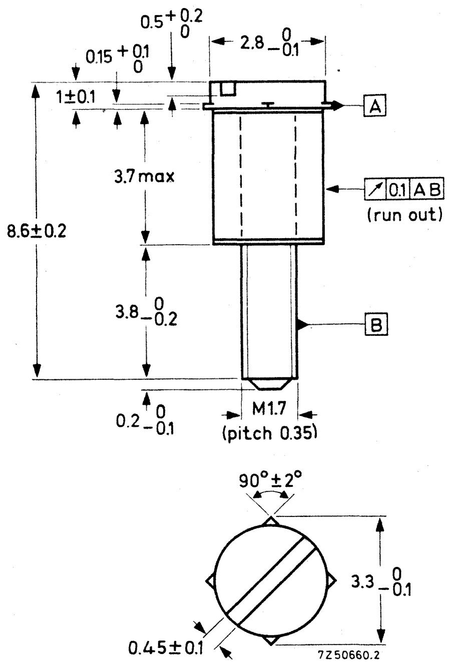
D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 19,9 \times 10^3 \ \Omega/H$$

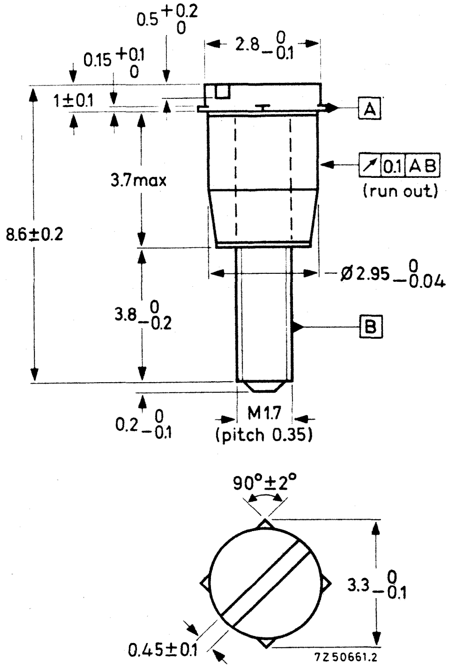
Weight	0,20 g

INDUCTANCE ADJUSTORS

ADJUSTORS



Version A, tube dia 2,5 −0,04 mm
Version B, tube dia 2,7 −0,04 mm
Version C, tube dia 2,77 −0,04 mm



Version D

The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy <0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.
The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
The table shows the type of adjustor recommended for different square cores.

→ Table I, available types:

version	colour	catalogue number
A	white	4322 021 32130
B	brown	4322 021 32140
C	black	4322 021 32150
B	green	4322 021 32160
B	red	4322 021 32170
D	grey	4322 021 32180

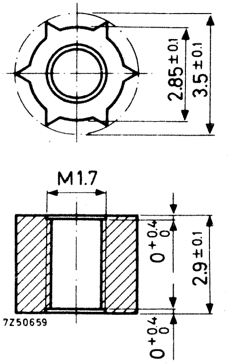
Table II, recommended application

A_L	3B7/3H1/3D3
	catalogue number
40	4322 021 32160
63	4322 021 32160
100	4322 021 32170
160	4322 021 32130
200	4322 021 32130
250	4322 021 32130 or 4322 021 32140
315	4322 021 32140
400	4322 021 32150
630	4322 021 32180

The adjustors are packed in bags of 100, so please order in multiples of 100.

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.

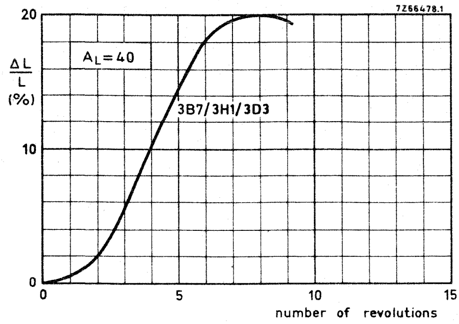


Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2.3 ± 0.15 mm

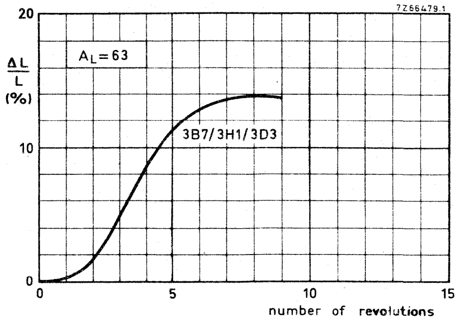
The nuts are packed in bags of 100, so please order in multiples of 100.

ADJUSTMENT CURVES

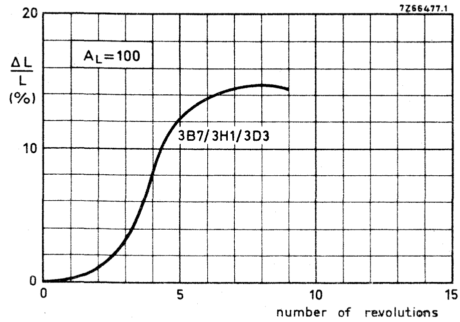
Distance between nut and mating surface = 2.3 mm for all A_L values.



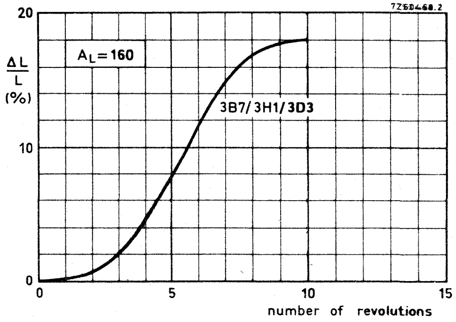
Adjustor 4322 021 32160



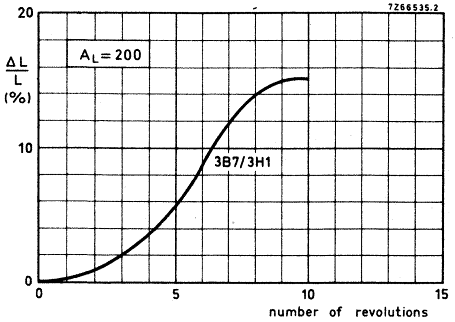
Adjustor 4322 021 32160



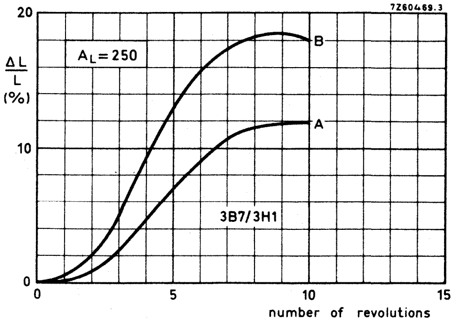
Adjustor 4322 021 32170



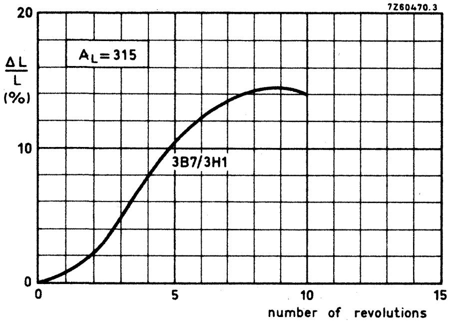
Adjustor 4322 021 32130



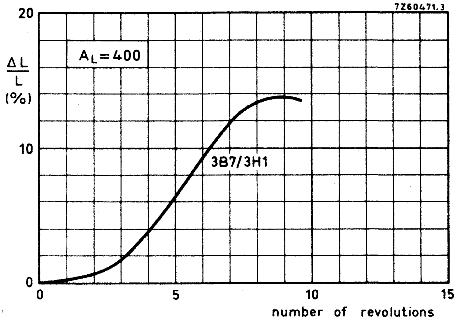
Adjustor 4322 021 32130



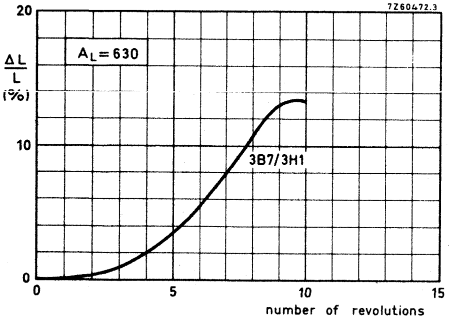
Curve A: adjustor 4322 021 32130
Curve B: adjustor 4322 021 32140



Adjustor 4322 021 32140



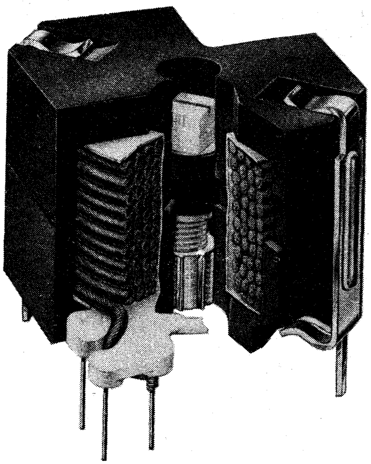
Adjustor 4322 021 32150



Adjustor 4322 021 32180

ASSEMBLING AND MOUNTING

ASSEMBLING



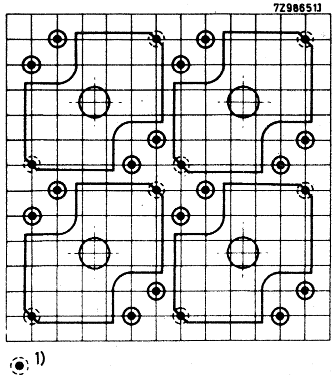
RZ 25252

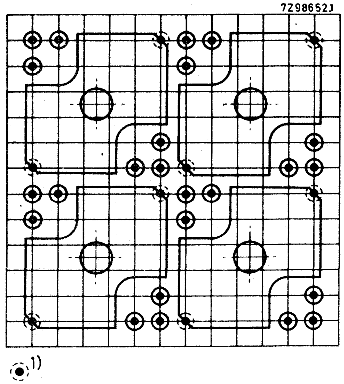
The drawing shows the simplicity of the assembly; the core halves are held together by two clips. The tags of the clips are used for mechanical fastening and/or for earthing.
For a stable inductance it is recommended to cement the lower flange of the coil former in the lower core half.

The use of a tool for attaching the clips is recommended. Drawings of a simple tool for this purpose are available under number 4322 058 00150.

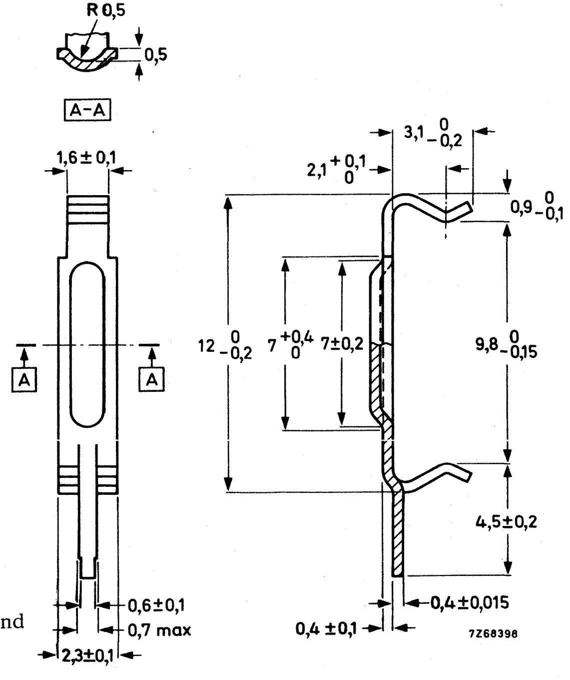
MOUNTING

The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0.1 inch grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm. The recommended hole diameter in the board is 1, 0 ± 0, 1 or 1, 3 ± 0, 1 mm (according to IEC publication 97).





PART DRAWING (dimensions in mm)



Clip 4322 021 31780
Material: steel; nickel and
gold plated

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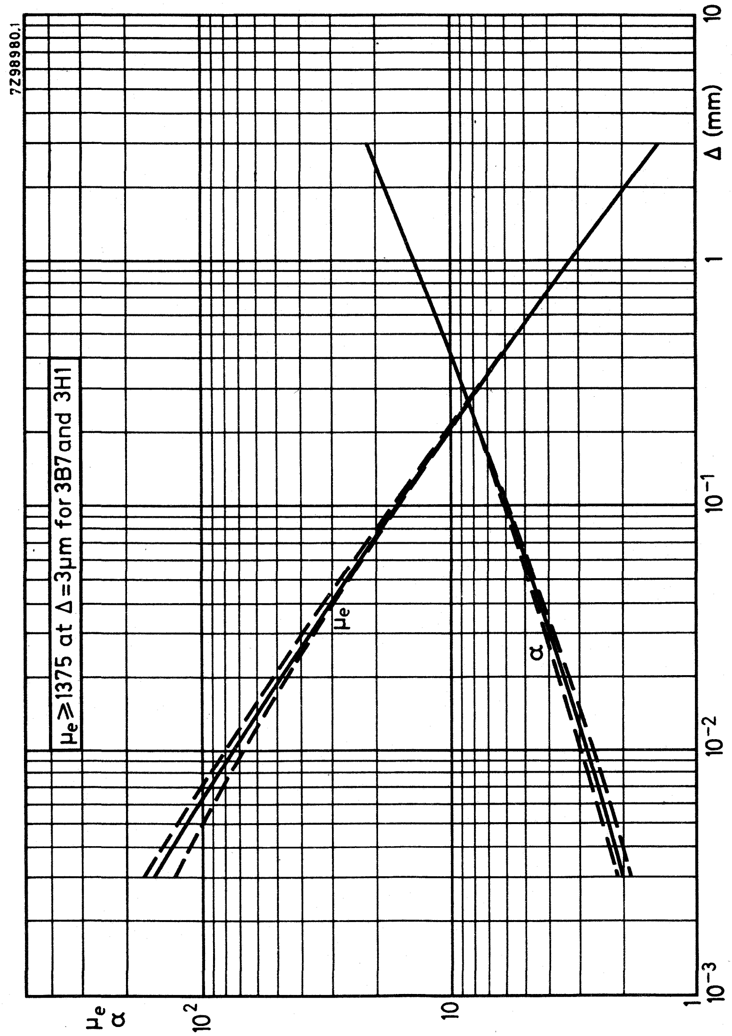
1) Holes for tag on clip 4322 021 31780 (earth points).

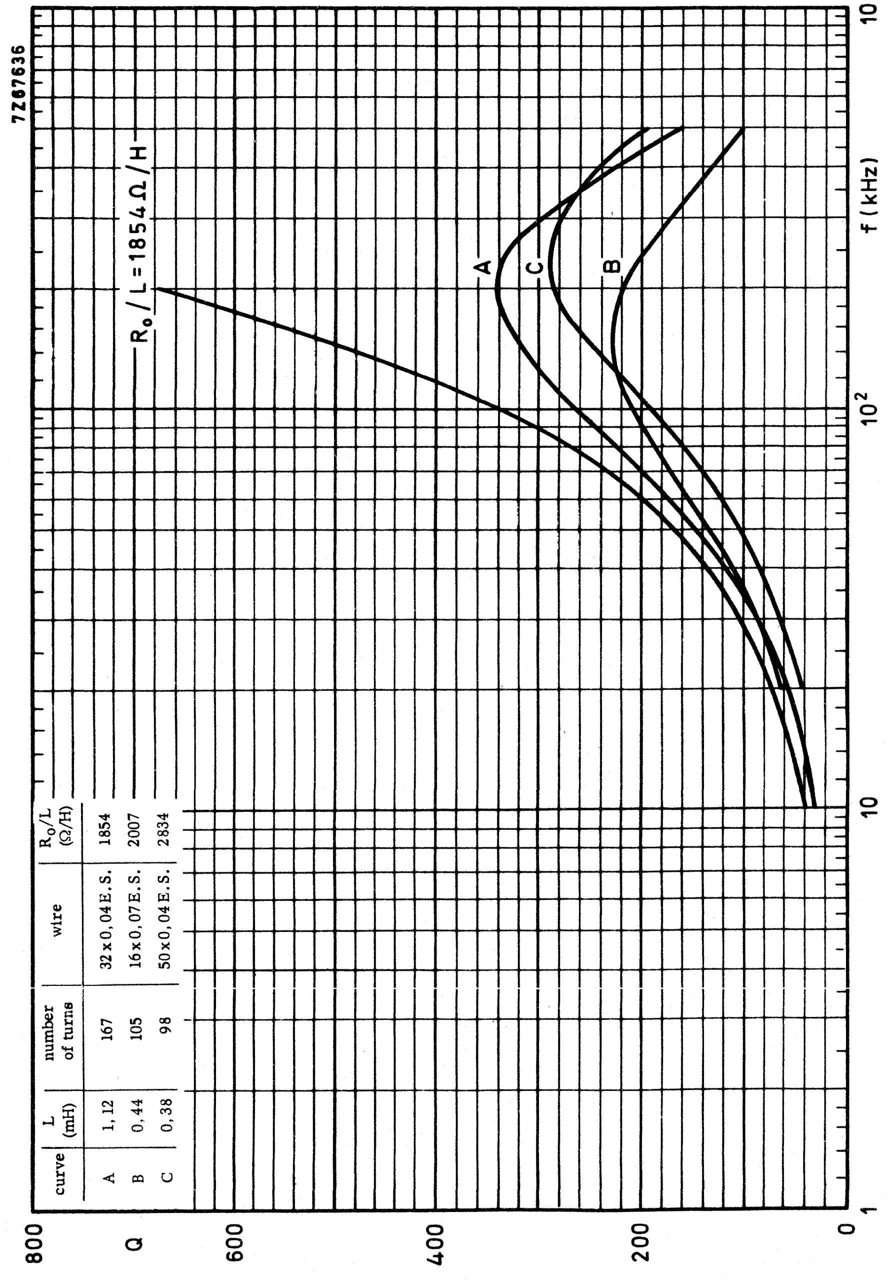
CHARACTERISTIC CURVES

μ_e - α CURVES



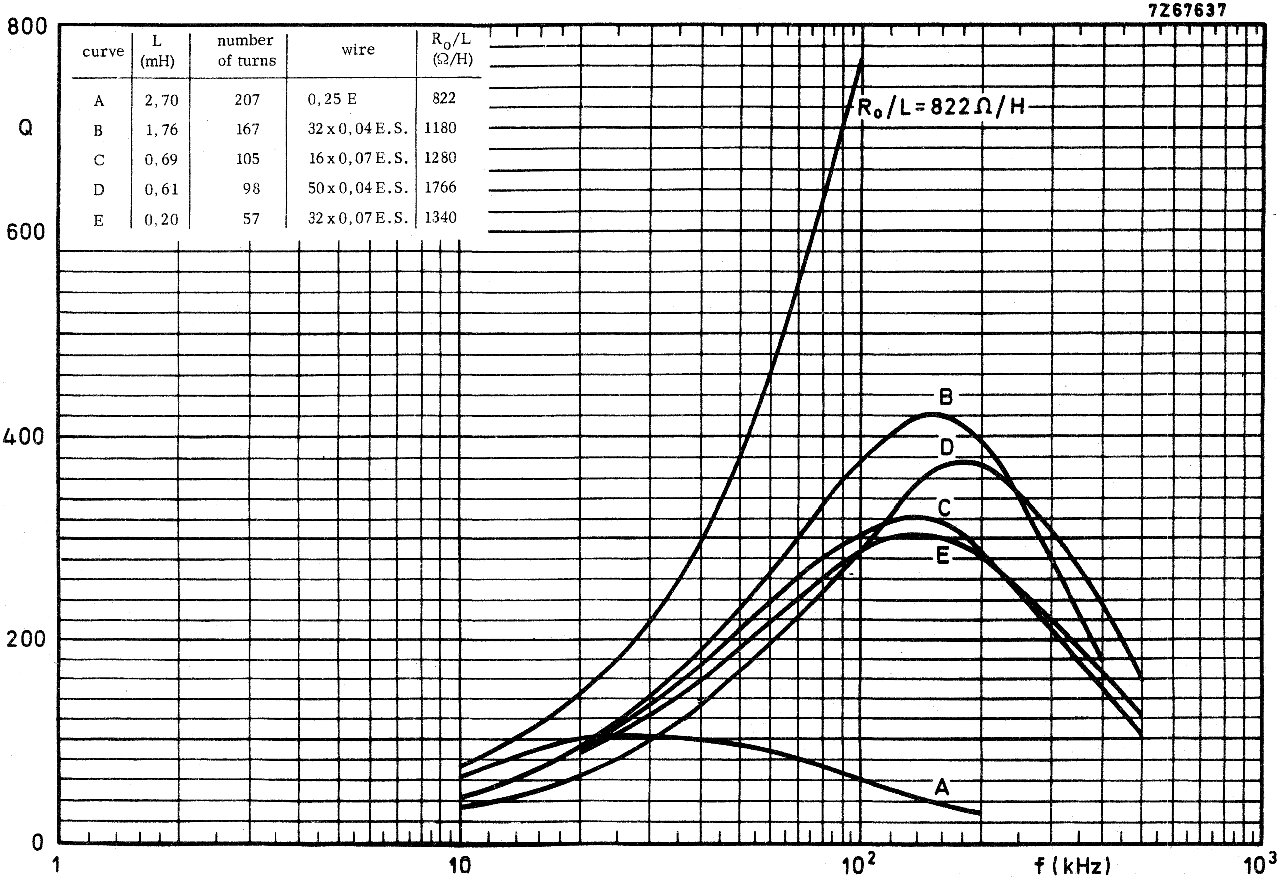
Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES



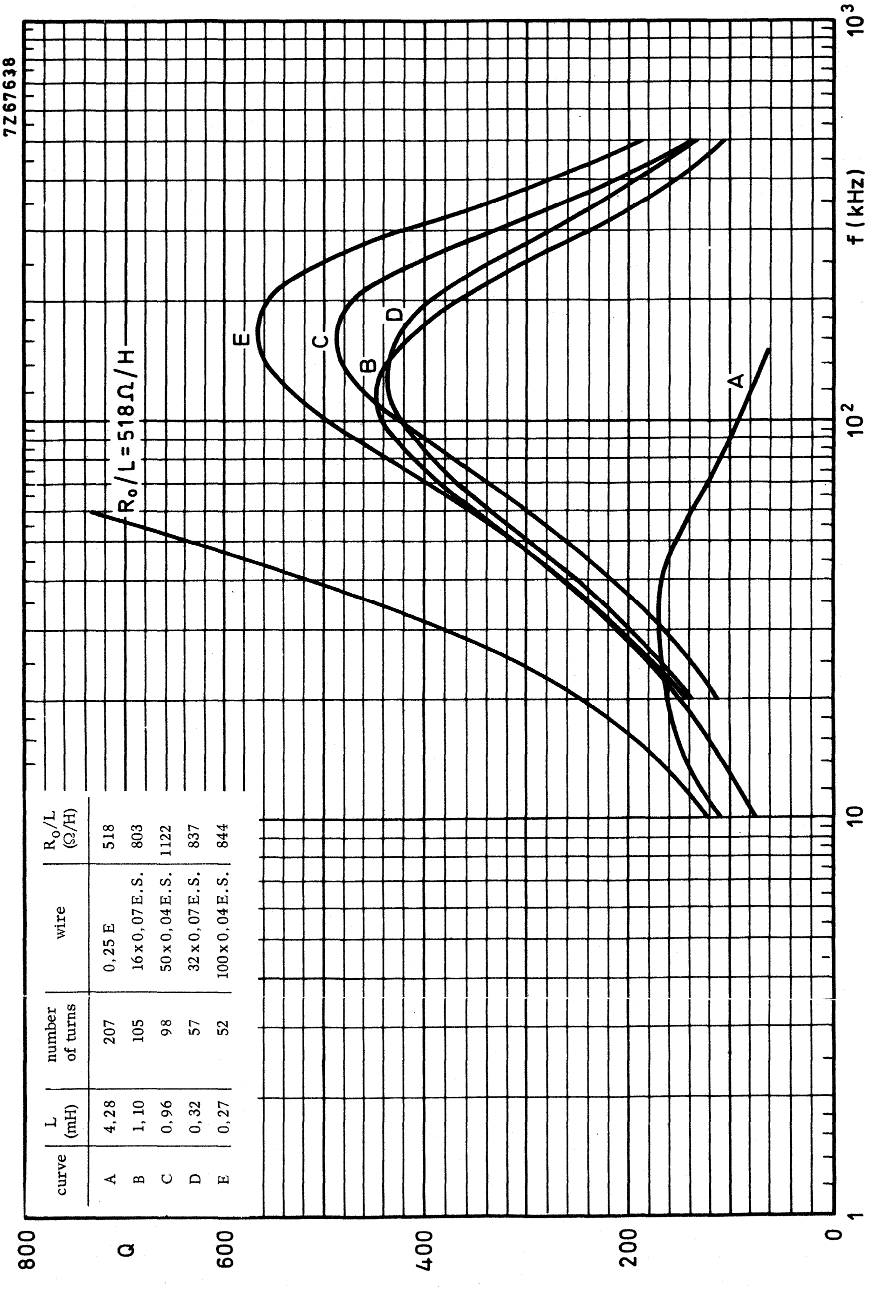
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	1,12	167	32 x 0,04 E.S.	1854
B	0,44	105	16 x 0,07 E.S.	2007
C	0,38	98	50 x 0,04 E.S.	2834

FXC 3B7/3H1, single-section coil former, $A_L = 40$



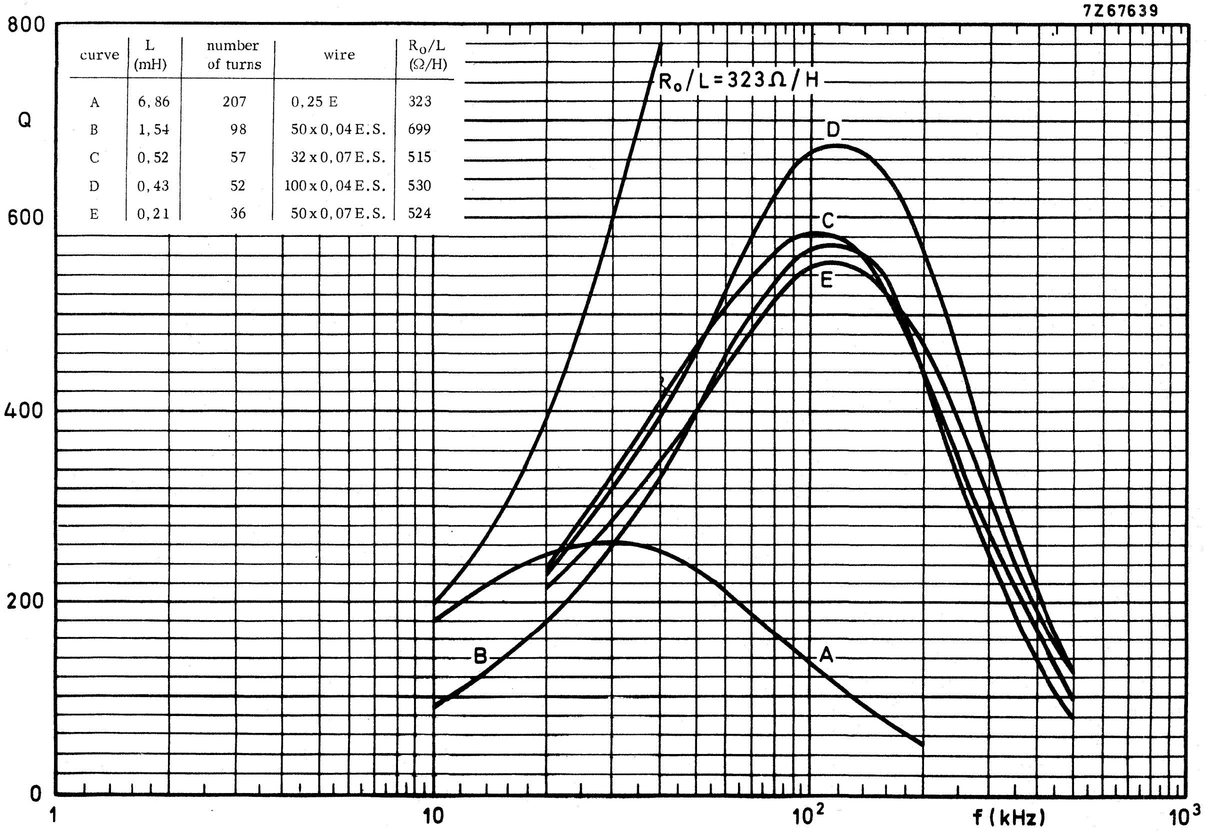
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	2,70	207	0,25 E	822
B	1,76	167	32 x 0,04 E.S.	1180
C	0,69	105	16 x 0,07 E.S.	1280
D	0,61	98	50 x 0,04 E.S.	1766
E	0,20	57	32 x 0,07 E.S.	1340

FXC 3B7/3H1, single-section coil former, $A_L = 63$



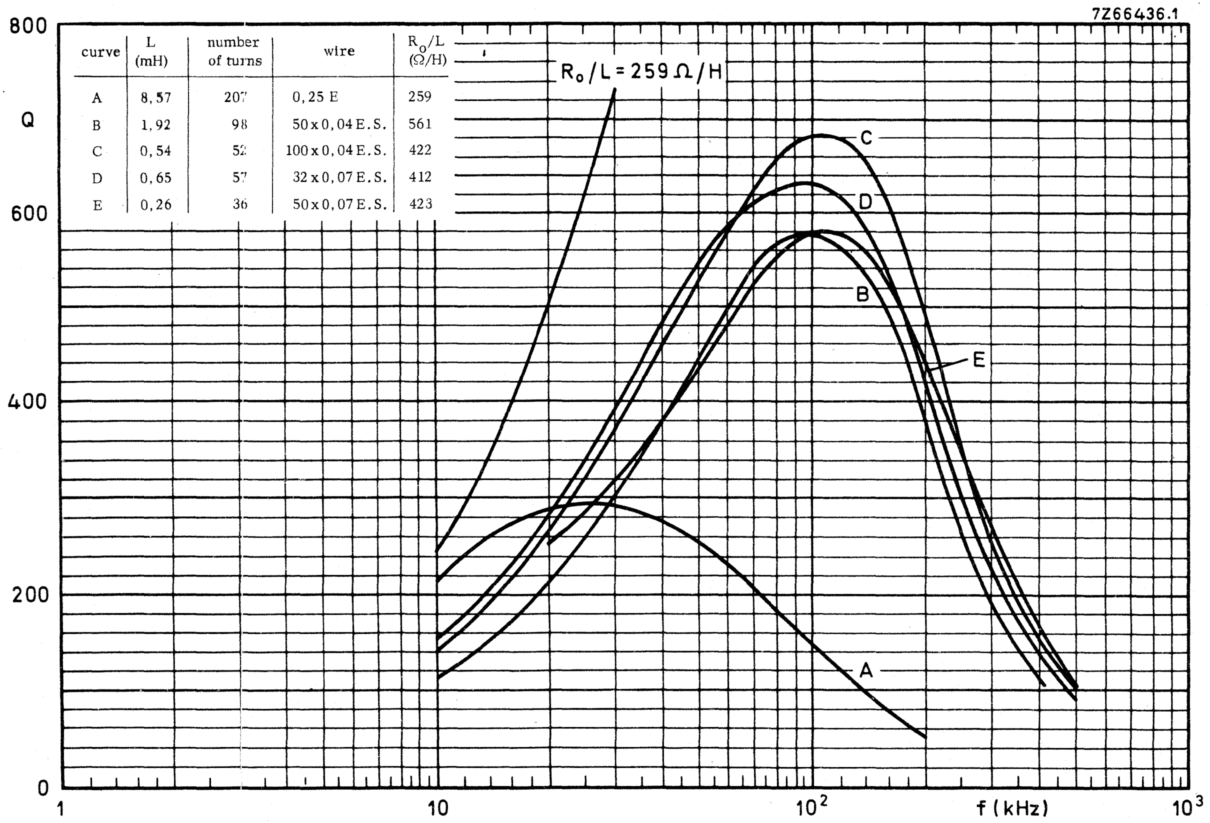
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	4,28	207	0,25 E	518
B	1,10	105	16 x 0,07 E.S.	803
C	0,96	98	50 x 0,04 E.S.	1122
D	0,32	57	32 x 0,07 E.S.	837
E	0,27	52	100 x 0,04 E.S.	844

FXC 3B7/3H1, single-section coil former, $A_L = 100$



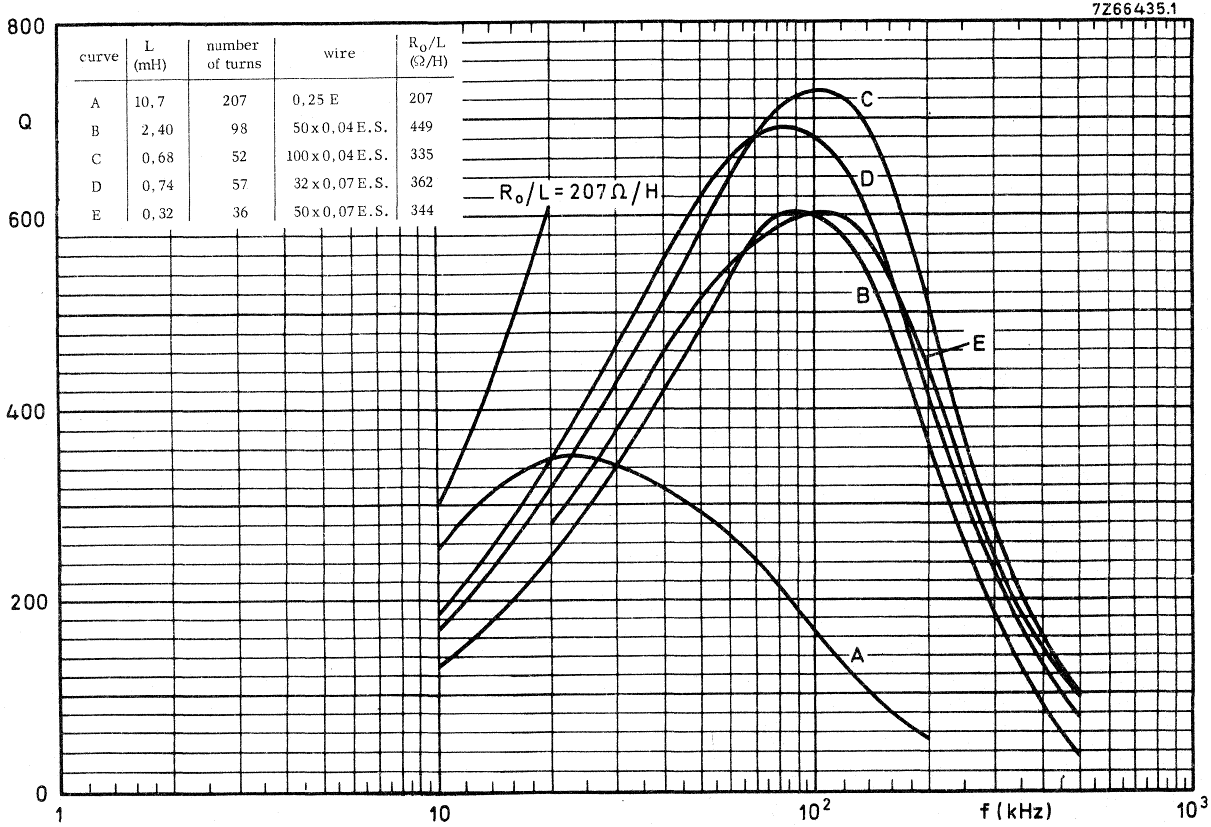
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	6, 86	207	0, 25 E	323
B	1, 54	98	50 x 0, 04 E.S.	699
C	0, 52	57	32 x 0, 07 E.S.	515
D	0, 43	52	100 x 0, 04 E.S.	530
E	0, 21	36	50 x 0, 07 E.S.	524

FXC 3B7/3H1, single-section coil former, $A_L = 160$



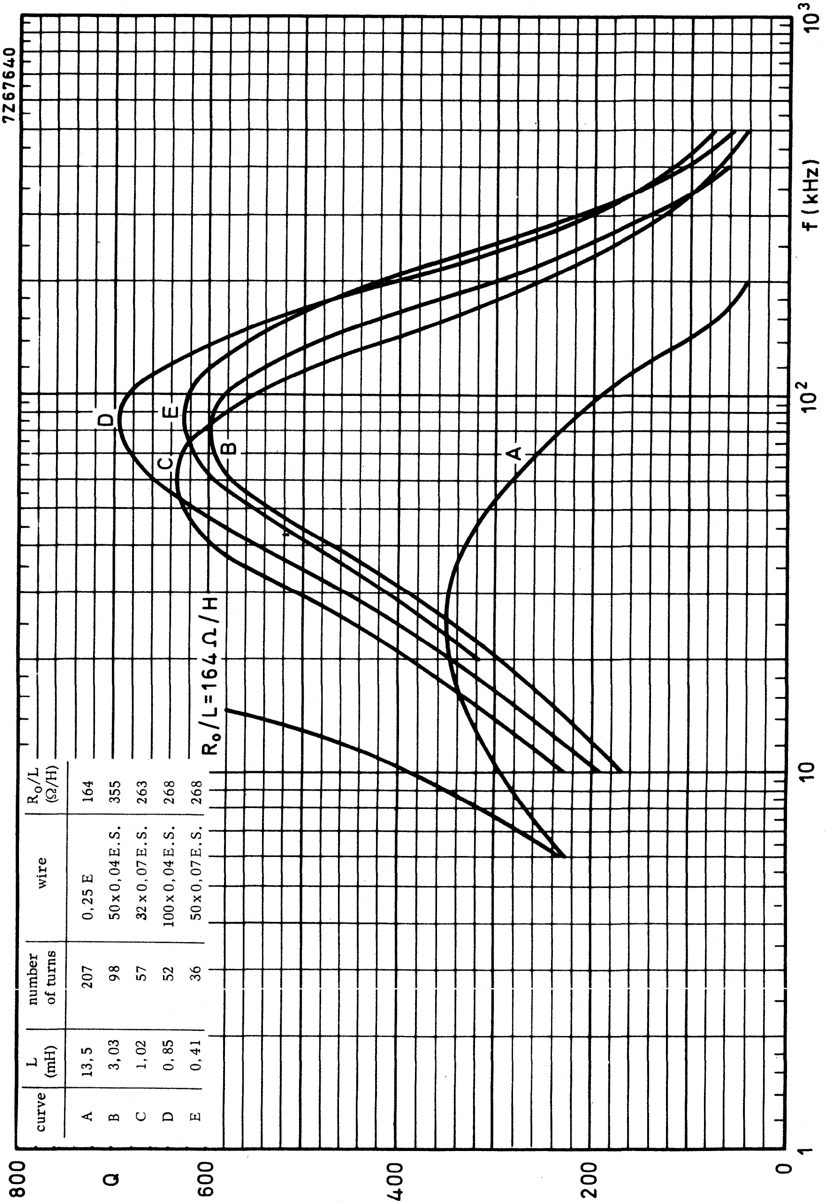
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	8,57	207	0,25 E	259
B	1,92	98	50 x 0,04 E.S.	561
C	0,54	52	100 x 0,04 E.S.	422
D	0,65	57	32 x 0,07 E.S.	412
E	0,26	36	50 x 0,07 E.S.	423

FXC 3B7/3H1, single-section coil former, $A_L = 200$



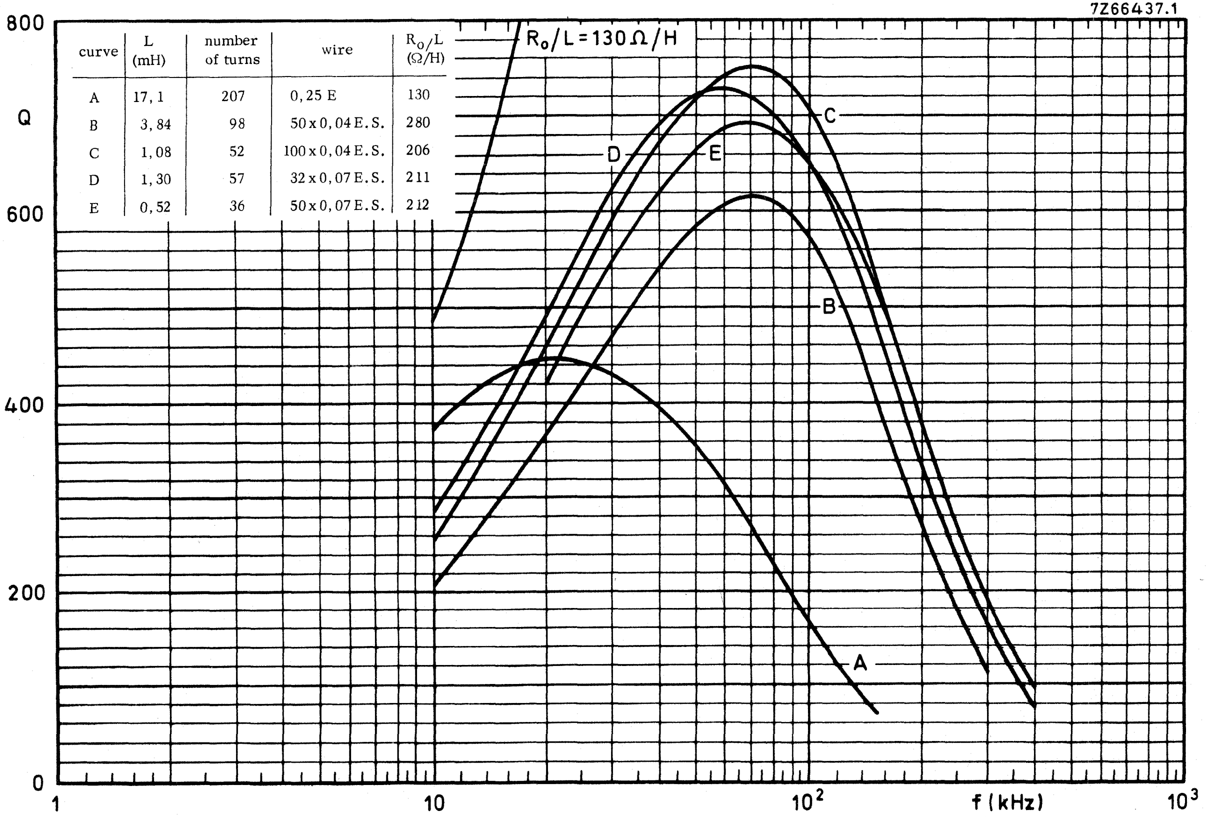
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	10,7	207	0,25 E	207
B	2,40	98	50 x 0,04 E.S.	449
C	0,68	52	100 x 0,04 E.S.	335
D	0,74	57	32 x 0,07 E.S.	362
E	0,32	36	50 x 0,07 E.S.	344

FXC 3B7/3H1, single-section coil former, $A_L = 250$



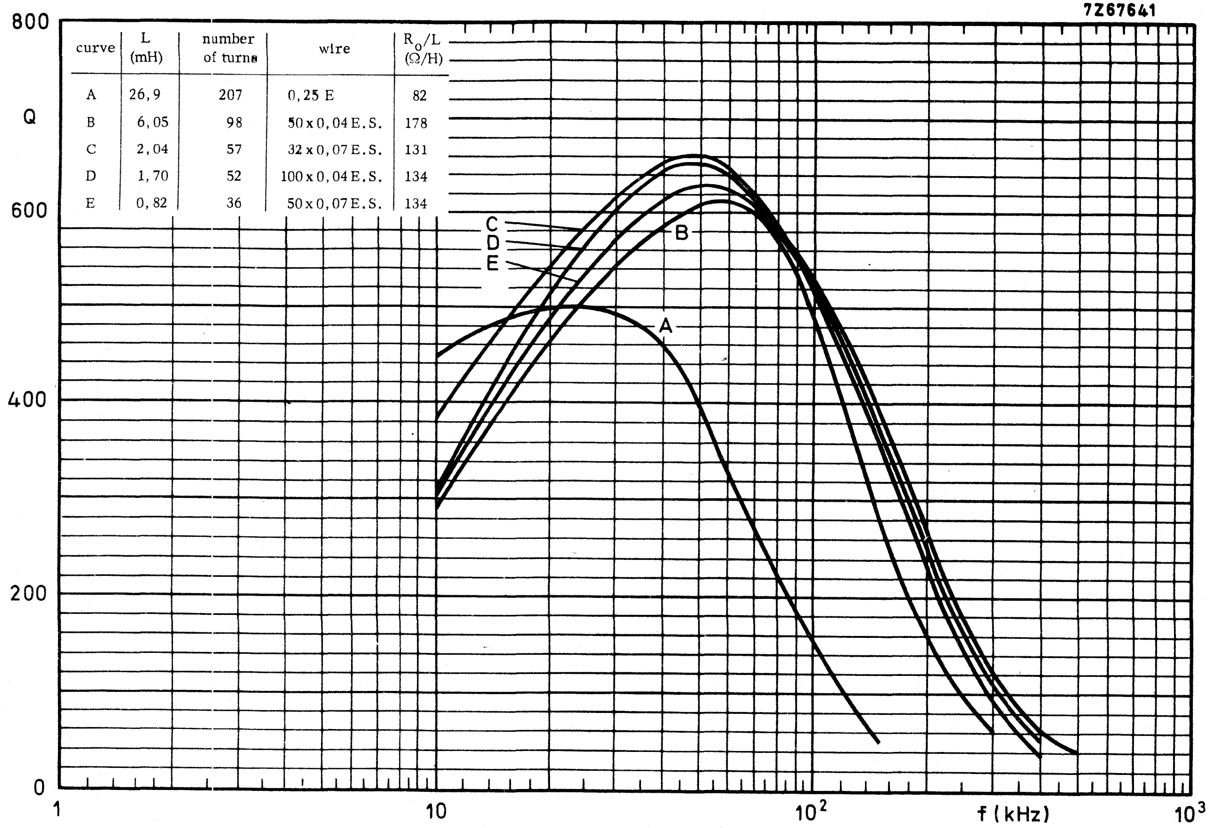
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	13,5	207	0,25 E	164
B	3,03	98	50 x 0,04 E.S.	355
C	1,02	57	32 x 0,07 E.S.	263
D	0,85	52	100 x 0,04 E.S.	268
E	0,41	36	50 x 0,07 E.S.	268

FXC 3B7/3H1, single-section coil former, $A_L = 315$



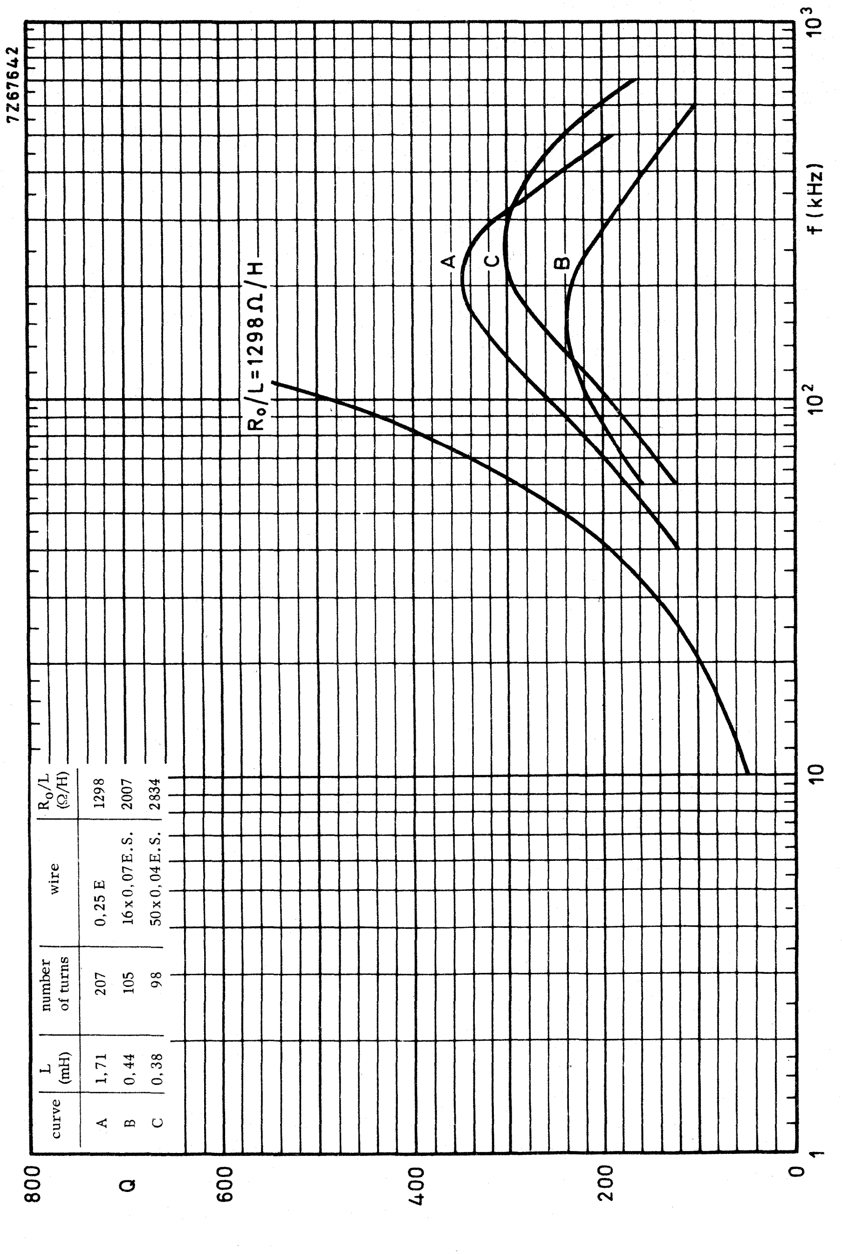
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	17,1	207	0,25 E	130
B	3,84	98	50 x 0,04 E.S.	280
C	1,08	52	100 x 0,04 E.S.	206
D	1,30	57	32 x 0,07 E.S.	211
E	0,52	36	50 x 0,07 E.S.	212

FXC 3B7/3H1, single-section coil former, $A_L = 400$



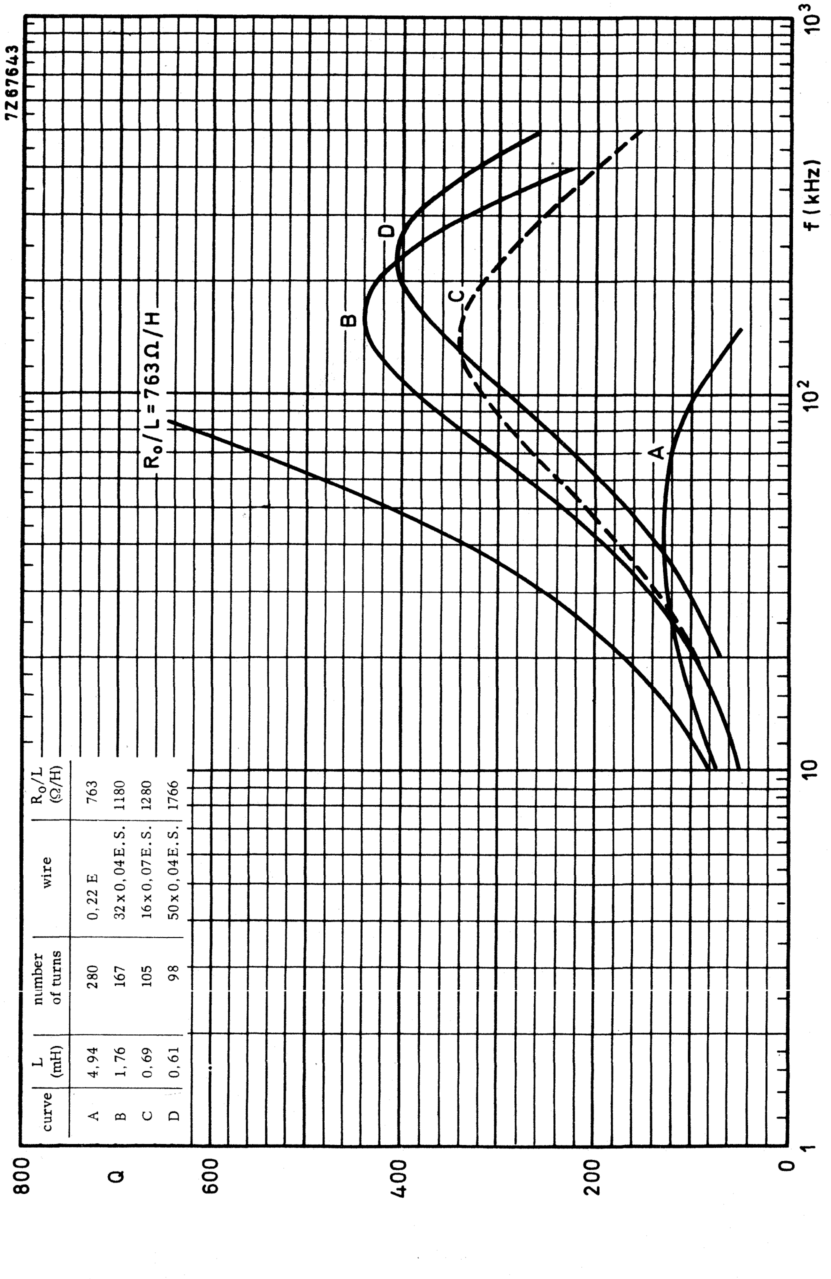
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	26,9	207	0,25 E	82
B	6,05	98	50 x 0,04 E.S.	178
C	2,04	57	32 x 0,07 E.S.	131
D	1,70	52	100 x 0,04 E.S.	134
E	0,82	36	50 x 0,07 E.S.	134

FXC 3B7/3H1, single-section coil former, A_L = 630



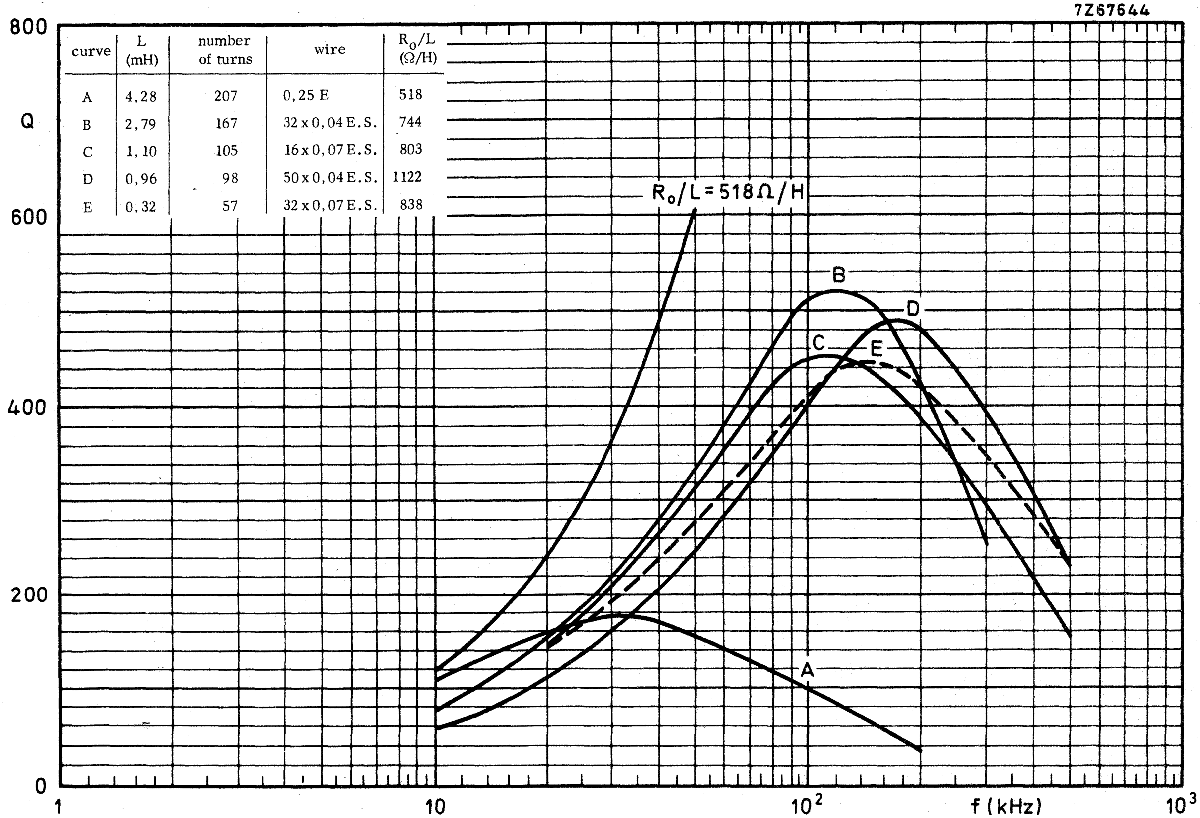
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1,71	207	0,25 E	1298
B	0,44	105	16 x 0,07 E.S.	2007
C	0,38	98	50 x 0,04 E.S.	2834

FXC 3D3, single-section coil former, $A_L = 40$



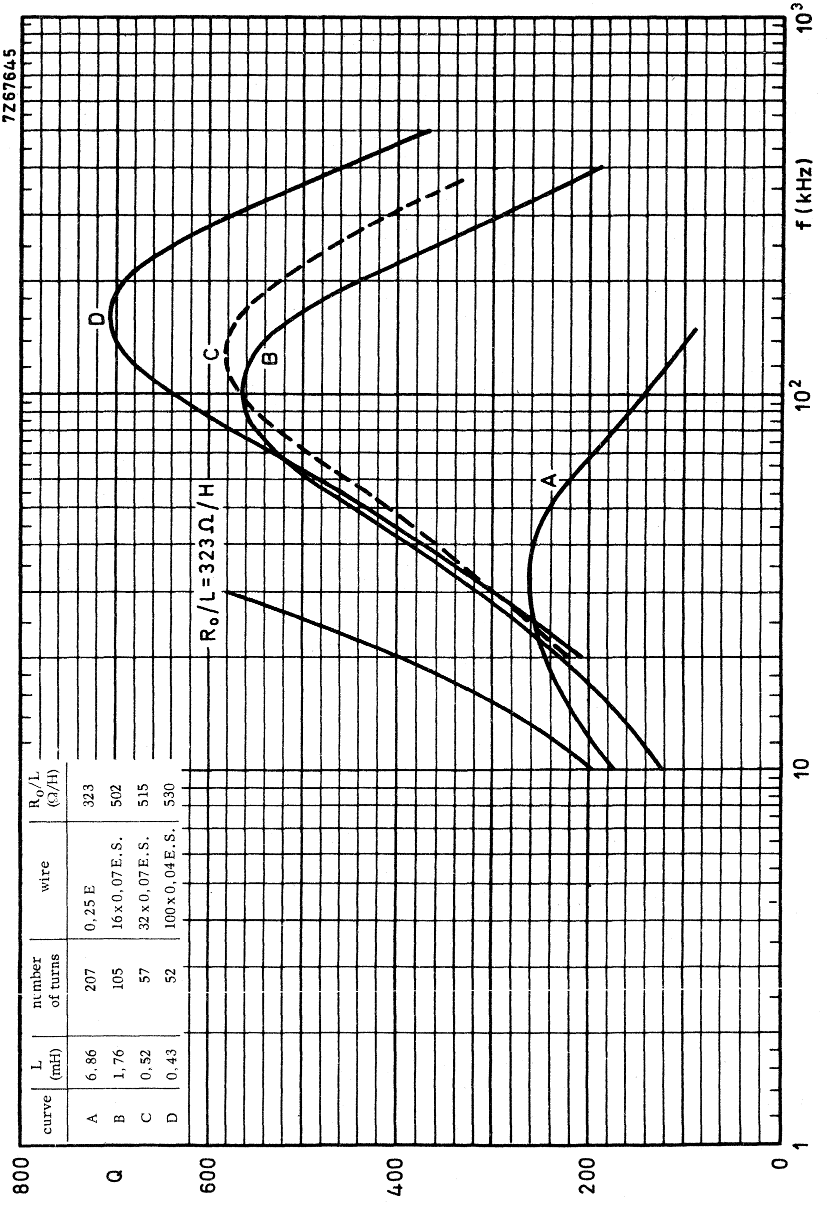
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	4,94	280	0,22 E	763
B	1,76	167	32 x 0,04 E.S.	1180
C	0,69	105	16 x 0,07 E.S.	1280
D	0,61	98	50 x 0,04 E.S.	1766

FXC 3D3, single-section coil former, $A_L = 63$



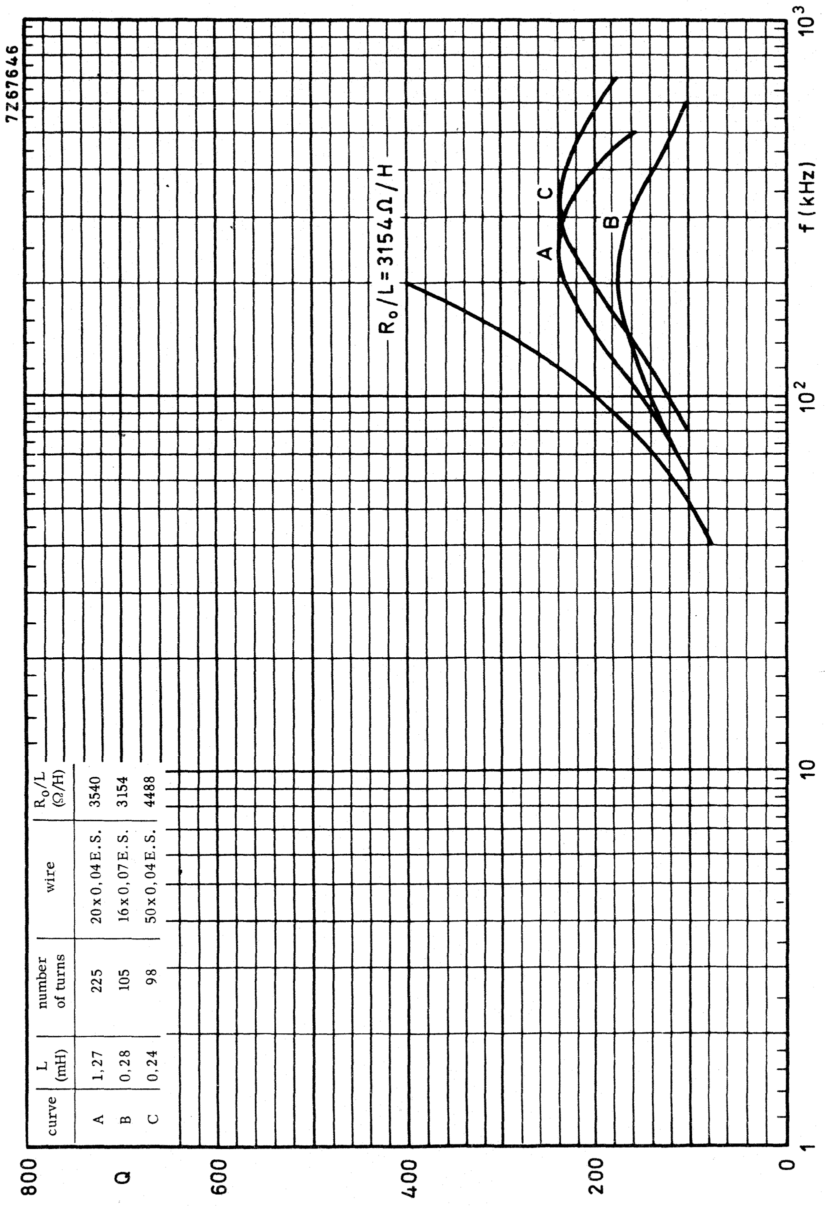
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	4,28	207	0,25 E	518
B	2,79	167	32 x 0,04 E.S.	744
C	1,10	105	16 x 0,07 E.S.	803
D	0,96	98	50 x 0,04 E.S.	1122
E	0,32	57	32 x 0,07 E.S.	838

FXC 3D3, single-section coil former, A_L = 100



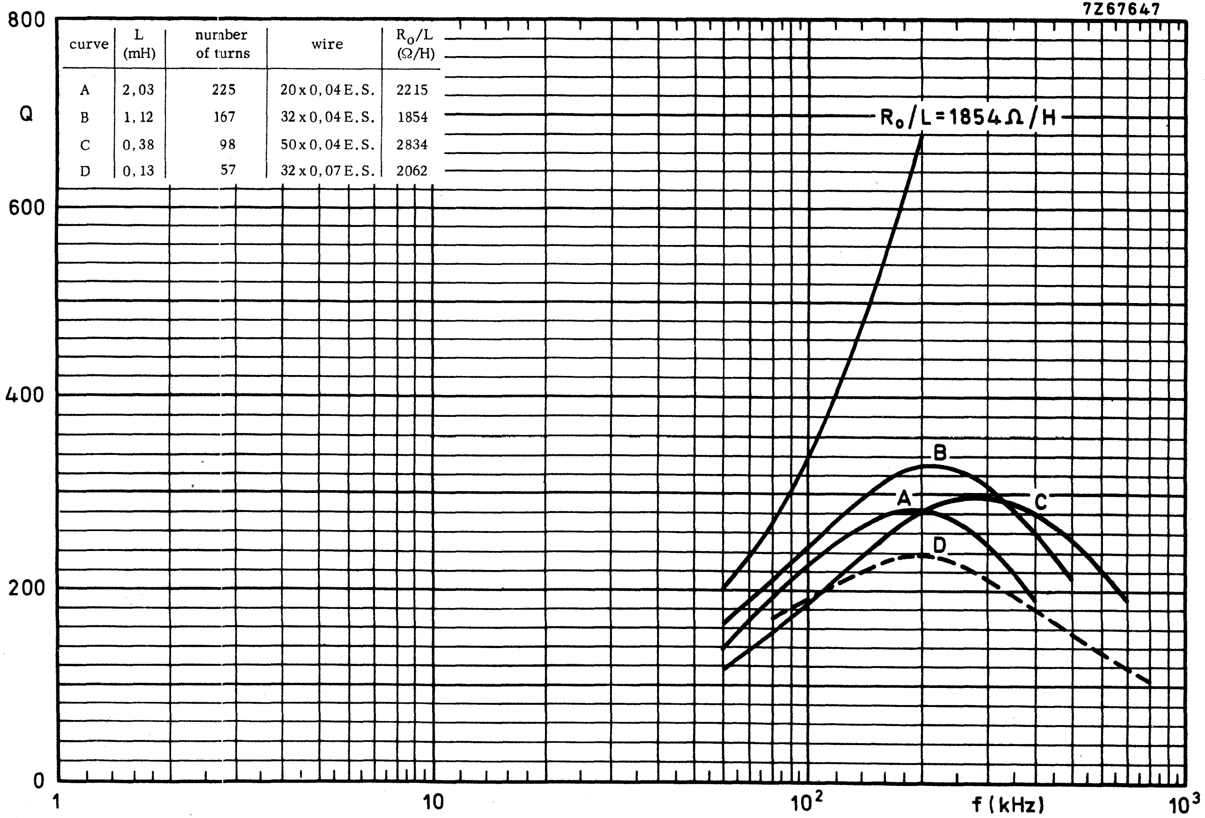
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	6,86	207	0,25 E	323
B	1,76	105	16 x 0,07 E.S.	502
C	0,52	57	32 x 0,07 E.S.	515
D	0,43	52	100 x 0,04 E.S.	530

FXC 3D3, single-section coil former, $A_L = 160$



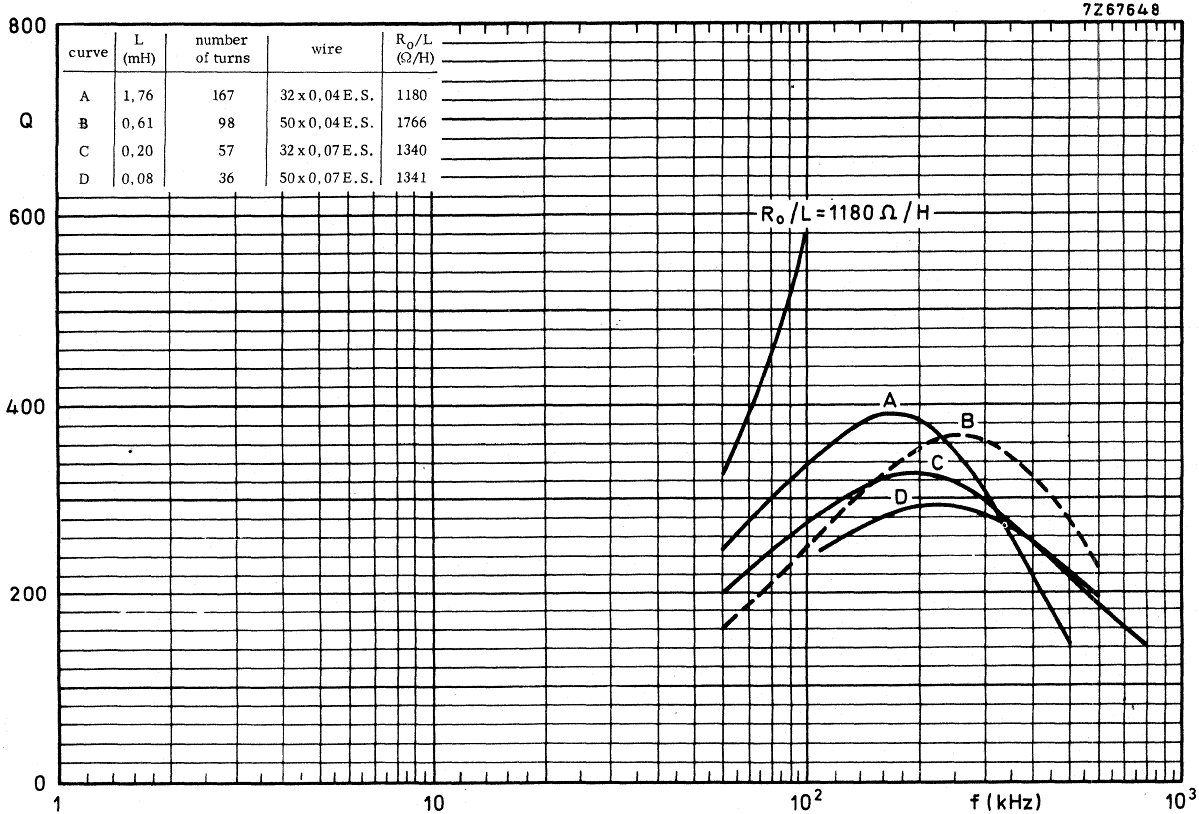
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1,27	225	20 x 0,04 E.S.	3540
B	0,28	105	16 x 0,07 E.S.	3154
C	0,24	98	50 x 0,04 E.S.	4488

FXC 4C6, single-section coil former, $A_L = 25$



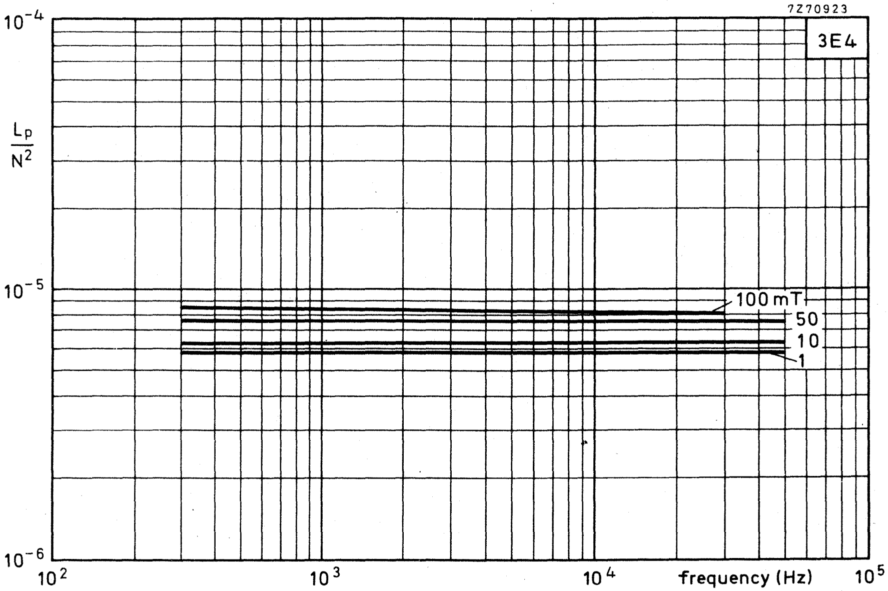
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	2,03	225	20 x 0,04 E.S.	2215
B	1,12	167	32 x 0,04 E.S.	1854
C	0,38	98	50 x 0,04 E.S.	2834
D	0,13	57	32 x 0,07 E.S.	2062

FXC 4C6, single-section coil former, $A_L = 40$

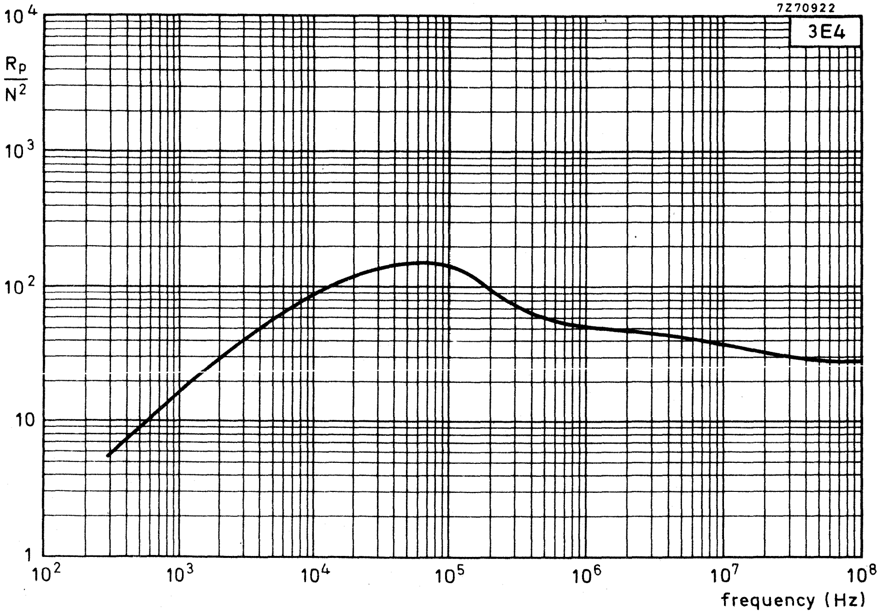


curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	1,76	167	32 x 0,04 E.S.	1180
B	0,61	98	50 x 0,04 E.S.	1766
C	0,20	57	32 x 0,07 E.S.	1340
D	0,08	36	50 x 0,07 E.S.	1341

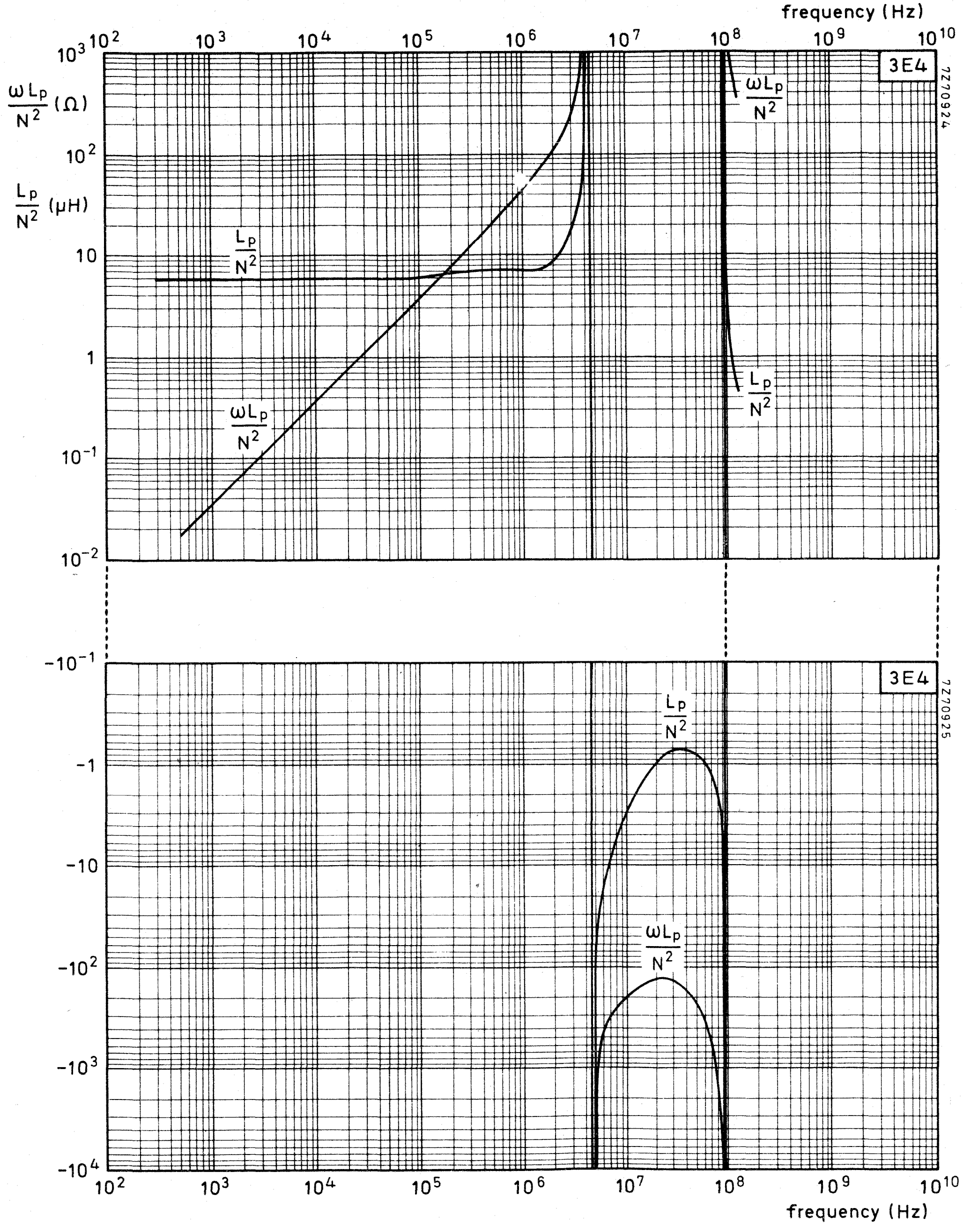
FXC 4C6, single-section coil former, $A_L = 63$



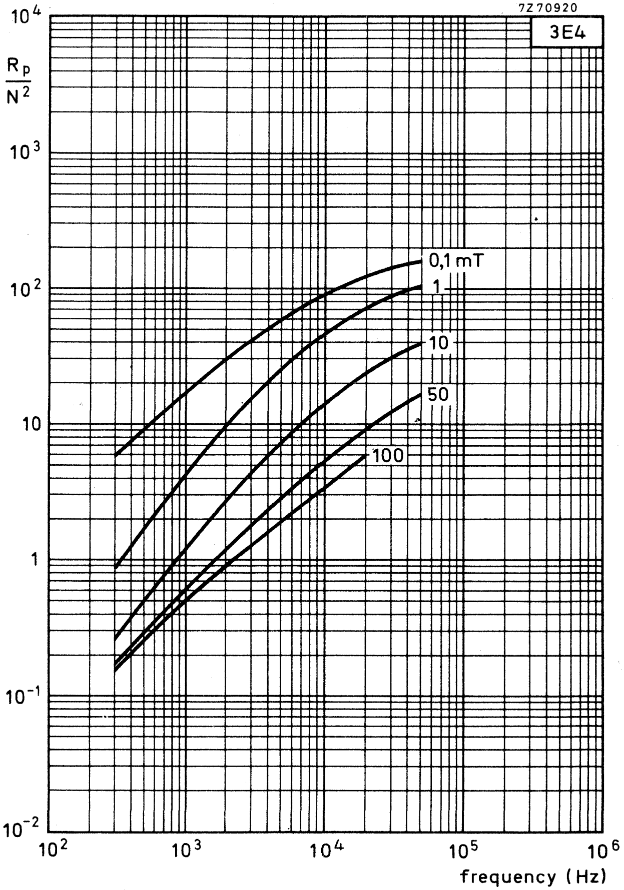
Inductance as a function of the frequency (typical values)



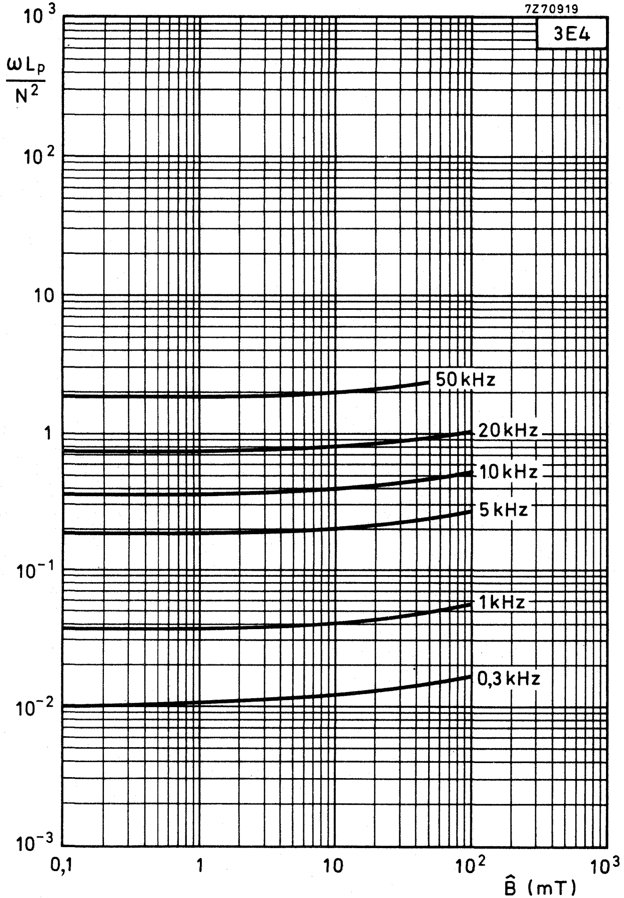
Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT (typical values)



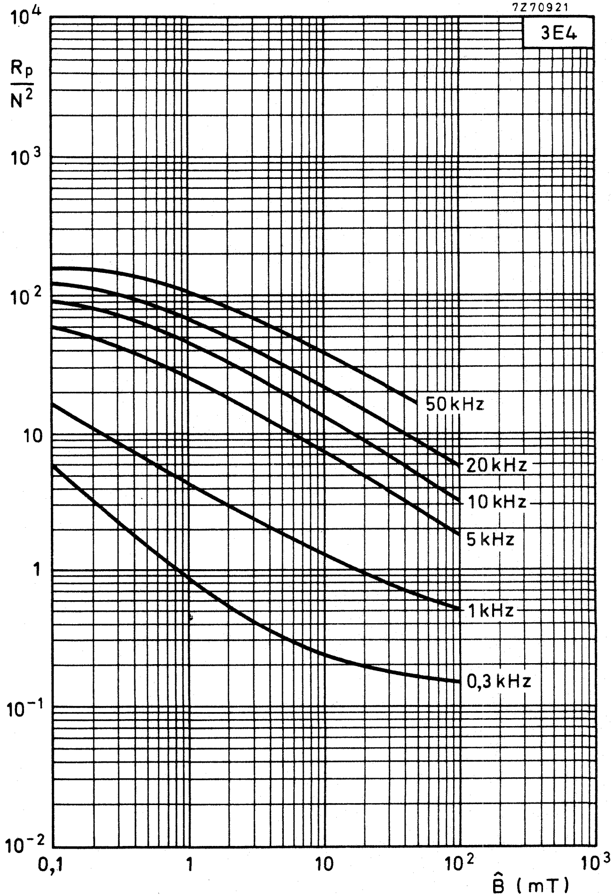
Inductance as a function of the frequency (typical values)



Losses as a function of the frequency (typical values)

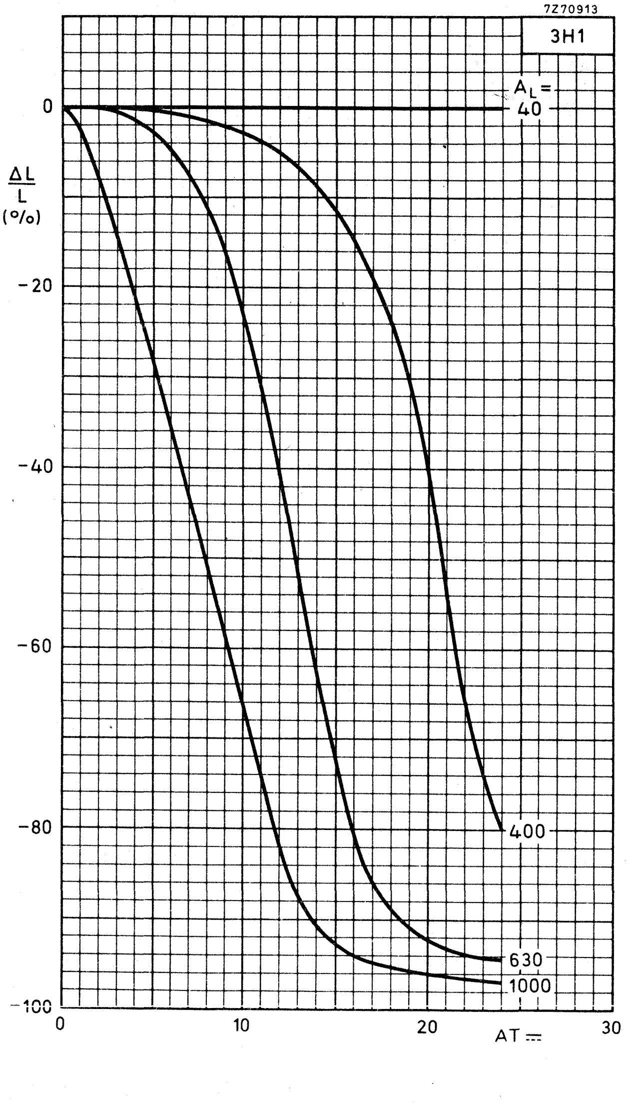


Inductance as a function of the peak induction



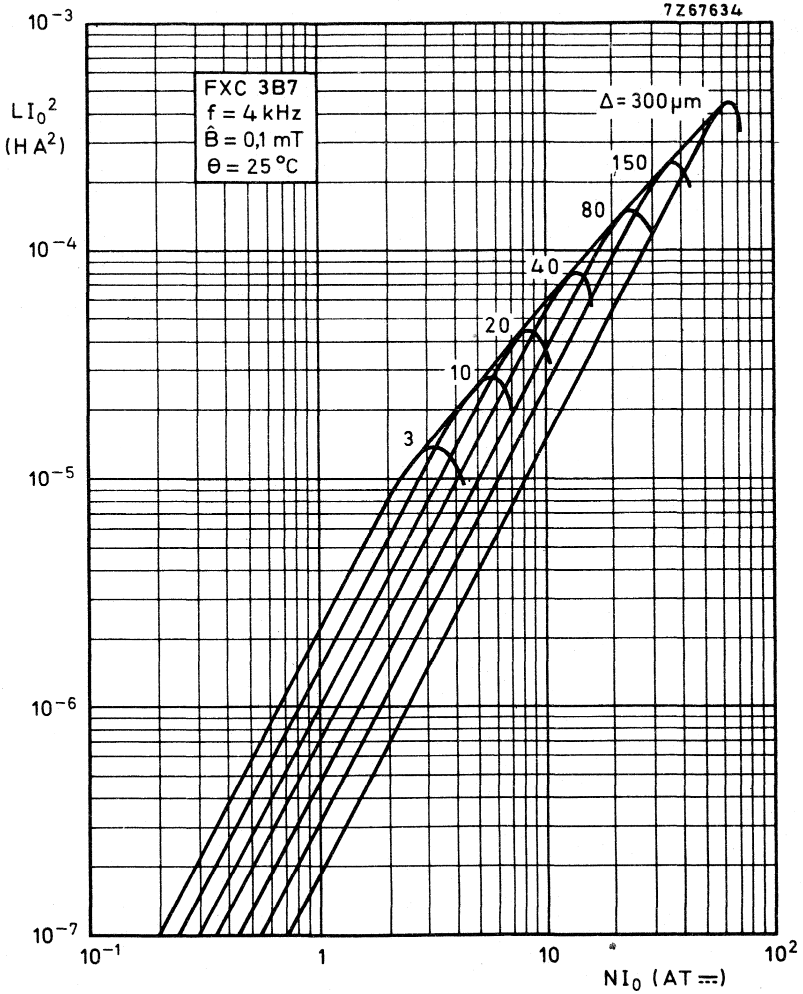
Losses as a function of the peak induction

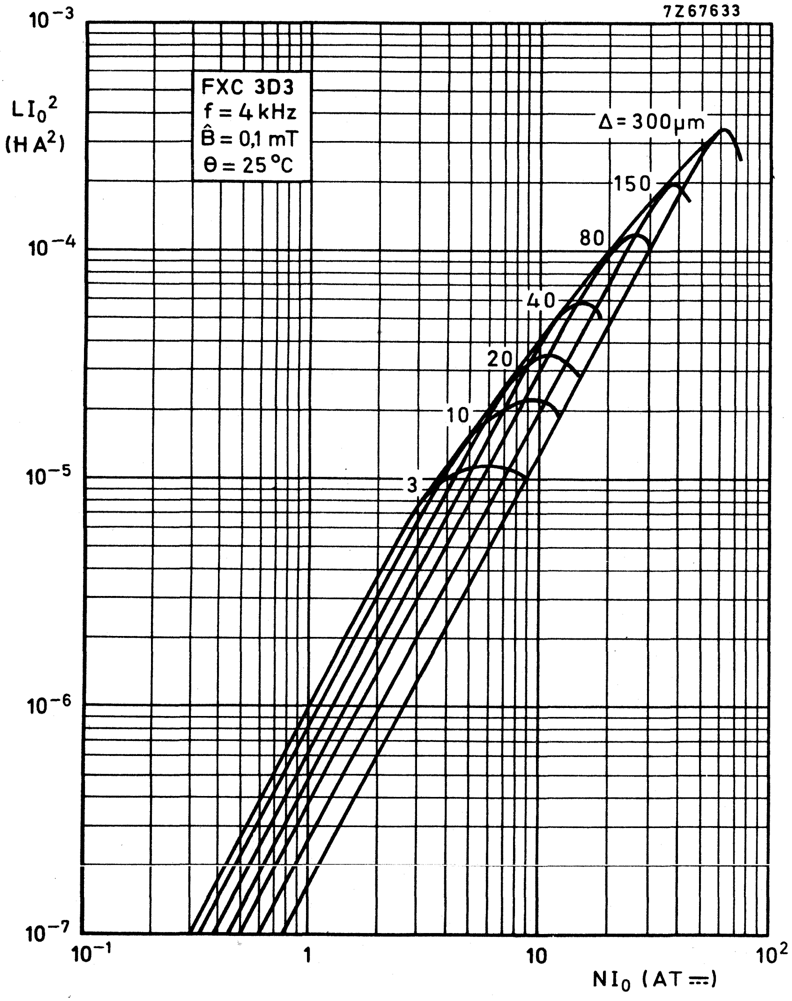
(typical values)

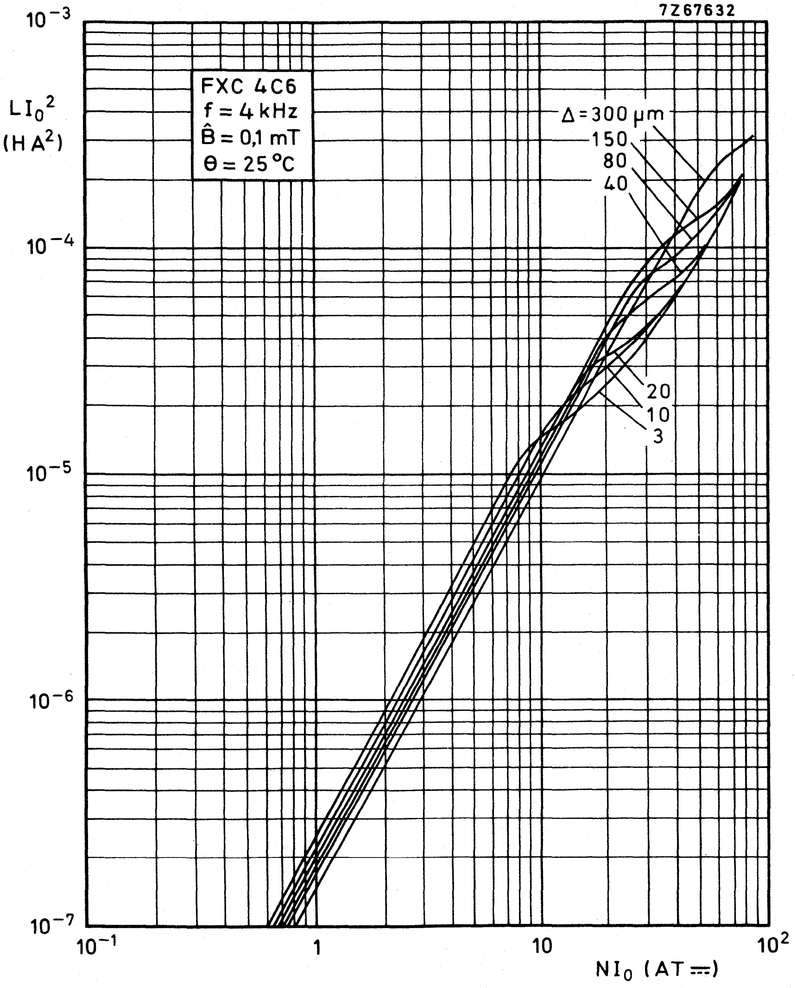

7Z70913
3H1
$\frac{\Delta L}{L}$
(%)
0
-20
-40
-60
-80
-100
A_L =
40
400
630
1000
0
10
20
30
AT ⎓

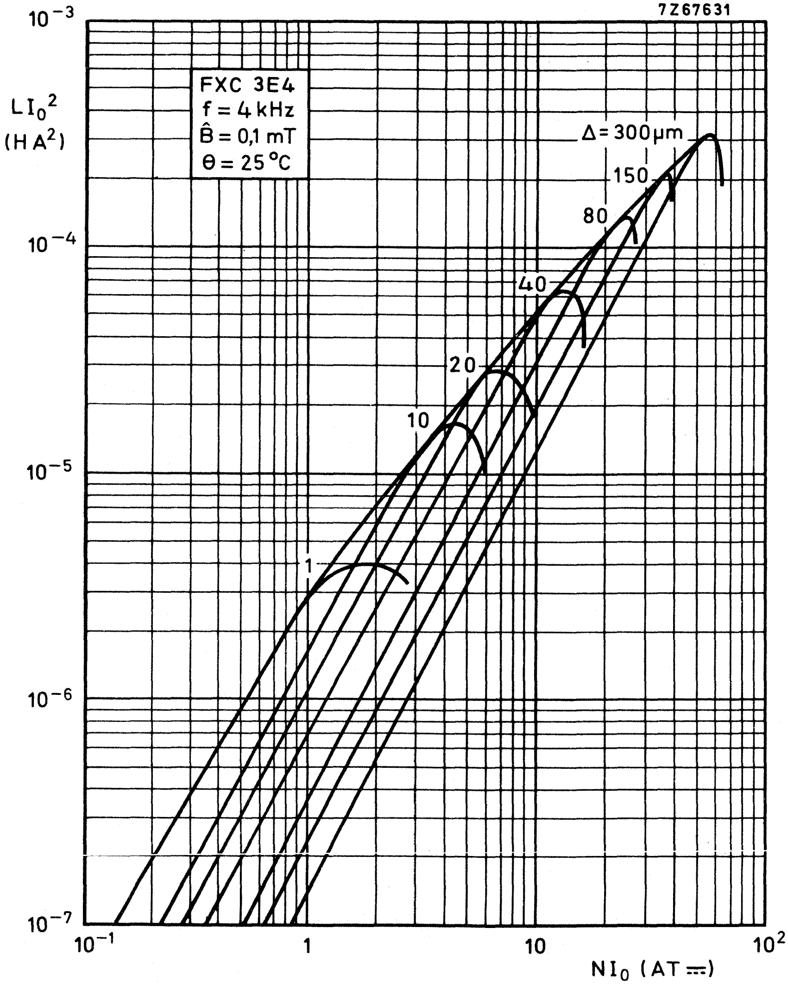
HANNA CURVES (typical values)
for different material grades.

Indicating optimum inductance for a certain airgap and direct current

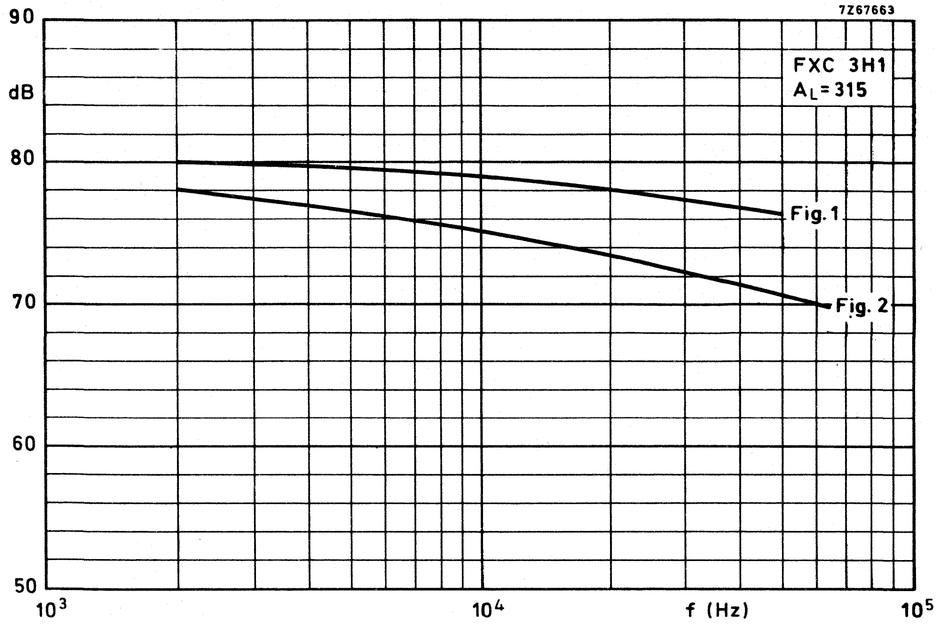



7Z67633
LI_0^2
(HA^2)
FXC 3D3
$f = 4$ kHz
$\hat{B} = 0{,}1$ mT
$\theta = 25$ °C
$\Delta = 300 \mu m$
150
80
40
20
10
3
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
1
10
10^2
NI_0 (AT ⎓)


7Z67632
LI_0^2 (HA^2)
FXC 4C6
f = 4 kHz
$\hat{B}$ = 0,1 mT
θ = 25 °C
Δ = 300 μm
150
80
40
20
10
3
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
1
10
10^2
NI_0 (AT ⎓)


7Z67631
LI_0^2
(HA^2)
FXC 3E4
f = 4 kHz
$\hat{B}$ = 0,1 mT
Θ = 25 °C
Δ = 300 μm
150
80
40
20
10
1
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
1
10
10^2
NI_0 (AT ⎓)

CROSSTALK ATTENUATION



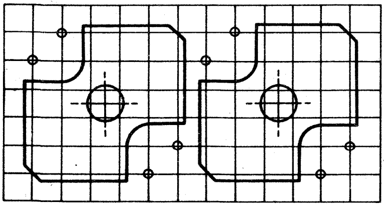


Fig. 1

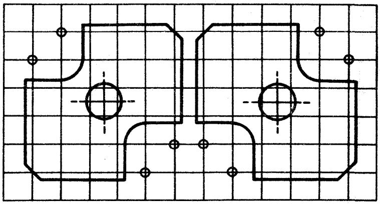


Fig. 2

SQUARE CORES

INTRODUCTION

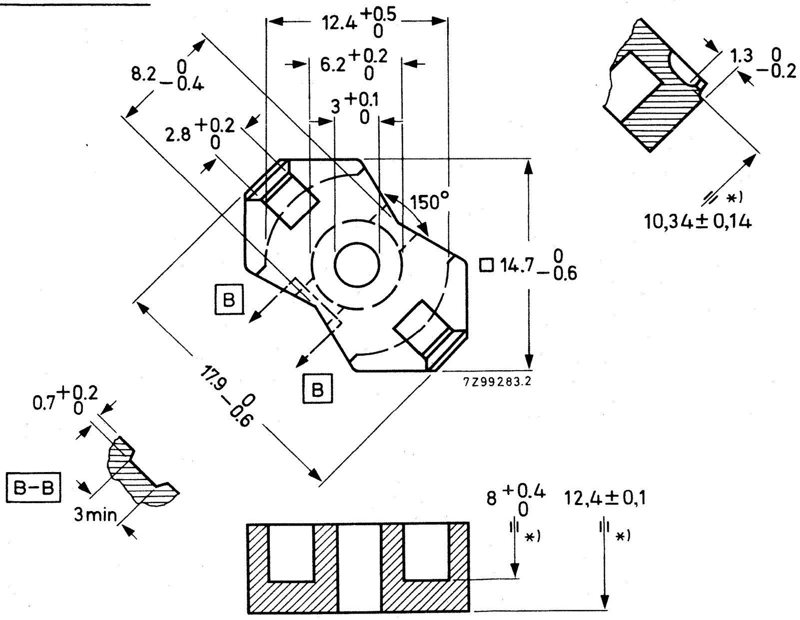
Three types of core can be supplied:
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted cores (2 halves with an airgap) which are provided with a nut for an adjustor. These cores have an inductance factor A_L in accordance with the R5 (R10) range.
- Pre-adjusted cores without nut.

Square cores and associated parts are ordered by their 12-digit catalogue number.

Quantity: a primary pack contains 40 core halves or 20 pre-adjusted cores, a storage pack 200 or 100 respectively, so please order in multiples of these quantities.

SEPARATE CORE HALVES

Dimensions in mm



*) measured on two adjacent core halves

Versions

ferroxcube grade	catalogue number
3H1	4322 020 25020
3B7	4322 020 25040
3D3	4322 020 25060
4C6	4322 020 25080
3E1	only pre-adjusted cores
3E4	are available

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 50 Newton.

	$\hat{B}$ (mT)	freq. (MHz)	temp. °C	grade					
				3H1	3B7	3D3	4C6	3E1	3E4
μ_e	≤ 0, 1	0, 004	25 ± 10						
(tol. ± 25%)	0, 7-1	0, 004							
	≤ 0, 1	0, 1		1710	1710	700	125		
A_L	≤ 0, 1	0, 004	25 ± 10						
(tol. ± 25%)	0, 7-1	0, 004							
	≤ 0, 1	0, 1		2480	2480	1020	182		
α	≤ 0, 1	0, 004	25 ± 10						
(tol. ± 12, 5%)	0, 7-1	0, 004							
	≤ 0, 1	0, 1		20, 6	20, 6	32, 2	76		
$\alpha_F \times 10^6$			+5 to +25	+0,5 to +1,5	−0,6 to +0,6 *	–	−2 to +4	–	0 to +2
			+25 to +55	+0,5 to +1,5	−0,6 to +0,6	–	0 to +6	–	0 to +2
			+25 to +70	+0,5 to +1,5	−0,6 to +0,6	0 to +2		0 to +2	0 to +2
$D_F \times 10^6$									
(10-100 min)			25 ± 1	≤ 4, 3	≤ 4, 3	≤ 12	≤ 10	–	≤ 4, 3
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0, 1	0, 004	25 ± 10					≤ 2, 5	≤ 2, 5
	≤ 0, 1	0, 03		≤ 2, 5	≤ 2, 5				
	≤ 0, 1	0, 1		≤ 5	≤ 5	≤ 8		≤ 20	≤ 20
	≤ 0, 1	0, 5				≤ 14		≤ 200	≤ 200
	≤ 0, 1	1, 0				≤ 30			
	≤ 0, 1	2, 0					≤ 40		
	≤ 0, 1	10, 0					≤ 100		
$q_{2-24-100}$	1,5-3	0, 004	25 ± 10	≤ 1, 4	≤ 1,8/≤ 1,4 *			≤ 3, 0	≤ 1, 8
	0,3-1,2	0, 1				≤ 3, 0	≤ 15		
$\eta_B \times 10^3$	1,5-3	0, 004	25 ± 10	≤ 0, 86	≤ 1,1/≤ 0,86 *			≤ 1, 8	≤ 1, 1
	0,3-1,2	0, 1				≤ 1, 8	≤ 9, 2		

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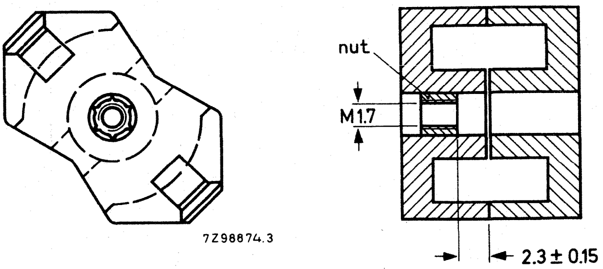
*) For guidance only.

PRE-ADJUSTED CORES

Dimensions in mm



Cores in grades 3E1 and 3E4 have no centre hole.

		with centre hole	without centre hole
Weight		5,2 g	5,6 g
Mean length of lines of force	l_e	27,3 mm	29,2 mm
Mean area of lines of force	A_e	31 mm^2	37 mm^2
	$\sum \frac{l_e}{A_e}$	0,863 mm^{-1}	0,784 mm^{-1}
Effective volume	V_e	840 mm^3	1090 mm^3

Pre-adjusted cores with A_L values

A_L	corre-sponding μ_e value	tol. on induct-ance (%)	catal. No. 4322 0226....with nut 4322 0224....without nut					
			3B7	3H1	3D3	4C6	3E4	3E1
25	17.1	±1				7810		
40	27.4	±1			7420	7820		
63	43.1	±1			7430	7830		
100	62.0	±2			7440			
160	110	±2	7050	7250	7450			
200	137	±2		7350				
250	171	±2	7060	7260				
315	216	±2	7070	7270				
400	274	±2	7080	7280				
630	431	±3	7100	7300				
1000	620	±10	7110	7310				
1250	856	±10	7190	7390				
4840	3050	±25	–	–	–	–	–	7910*
6050	3800	±25	–	–	–	–	7920*	–

Inductance L = N^2A_L (in 10^{-9}H)

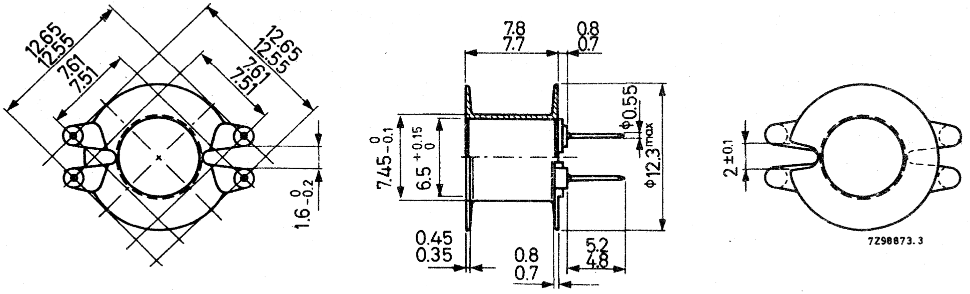
Symmetric airgap for cores with A_L factor of 25 up to and including 160.
Asymmetric airgap for cores with A_L factor of 160 and higher.
The airgap of the types marked with * is practically zero, and consequently inductance adjustment is not possible. Hence these types are not provided with a centre hole, so that maximum performance is achieved.

Notes

1. Example of catalogue number:
   A_L = 250, grade 3H1, core with nut, catalogue number 4322 022 67260.
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

COIL FORMERS

SINGLE-SECTION, FOUR-PIN COIL FORMER



Catalogue number	4312 021 29240
Material	phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)
Window area	16, 2 mm^2
Mean length of turn	30 mm
Max. temperature	180 ^oC

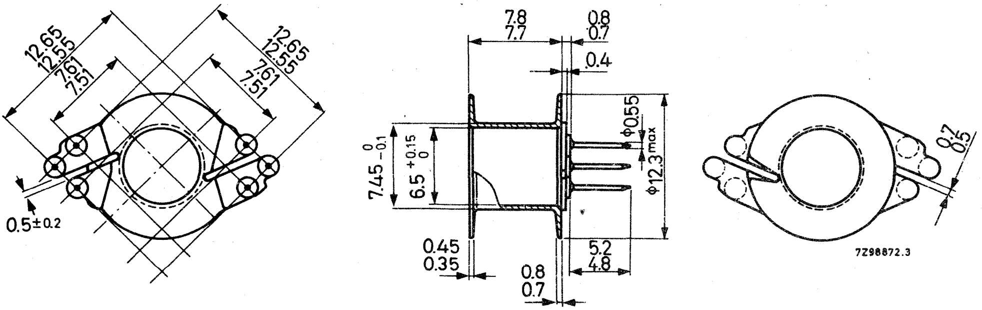
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 22,6 \times 10^3\ \Omega/H$$

Solderability according to IEC 68-2-20B, part 2, test T (solder bath 235 ^oC, soldering iron 350 ^oC)

Weight 0, 4 g

SINGLE-SECTION, SIX-PIN COIL FORMER



Catalogue number	4312 021 29250
Material	phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)
Window area	16, 2 mm^2
Mean length of turn	30 mm
Max. temperature	180 ^oC

D.C. losses

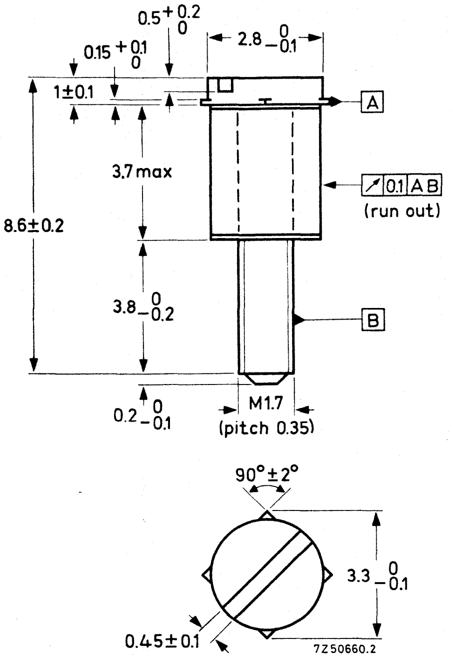
$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 22,6 \times 10^3\ \Omega/H$$

Solderability according to IEC 68-2-20B, part 2, test T (solder bath 235 ^oC, soldering iron 350 ^oC)

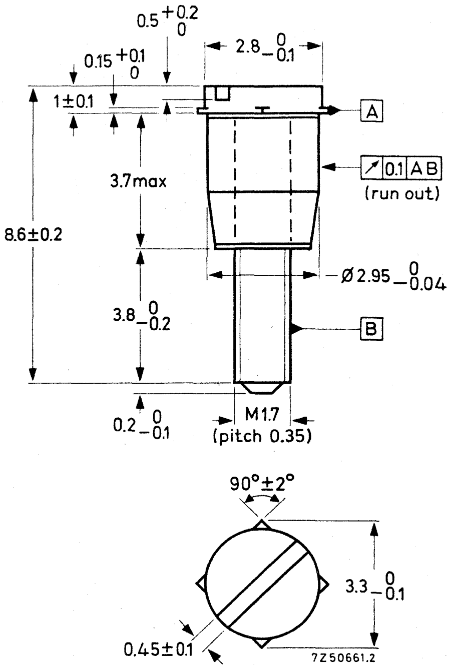
Weight 0, 4 g

INDUCTANCE ADJUSTORS

ADJUSTORS



Version A, tube dia 2,5 − 0,04 mm
Version B, tube dia 2,7 − 0,04 mm
Version C, tube dia 2,77 − 0,04 mm



Version D

The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy <0.03 % by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.
The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different cores.

Table I, available types

version	colour	catalogue number
A	white	4322 021 32130
B	brown	4322 021 32140
C	black	4322 021 32150
B	green	4322 021 32160
B	red	4322 021 32170
D	grey	4322 021 32180

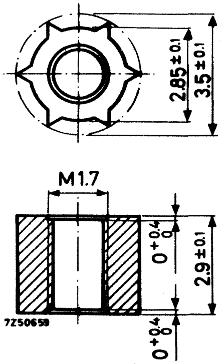
Table II, recommended application

A_L	catalogue number
40	4322 021 32160
63	4322 021 32160
100	4322 021 32170
160	4322 021 32130
200	4322 021 32130
250	4322 021 32130 or 4322 021 32140
315	4322 021 32140
400	4322 021 32150
630	4322 021 32180

The adjustors are packed in bags of 100, so please order in multiples of 100.

NUT FOR ADJUSTOR

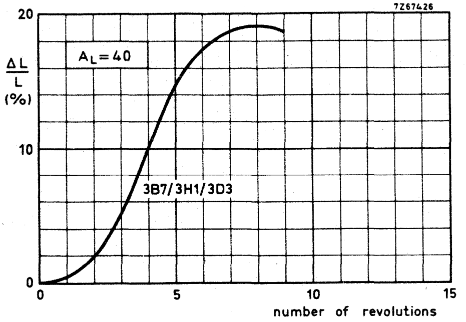
These data are given for those manufacturers who prefer to insert the nut themselves.



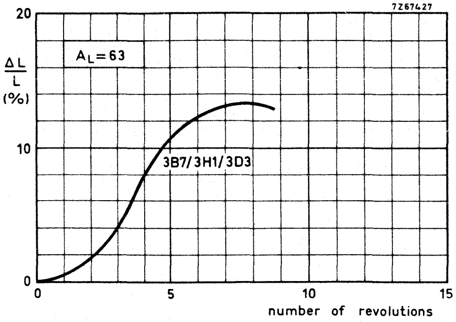
Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2.3 ± 0.15 mm

The nuts are packed in bags of 100, so please order in multiples of 100.

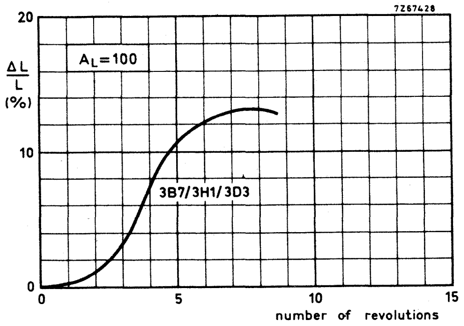
ADJUSTMENT CURVES



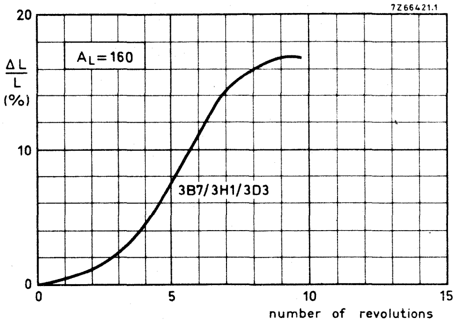
Adjustor 4322 021 32160



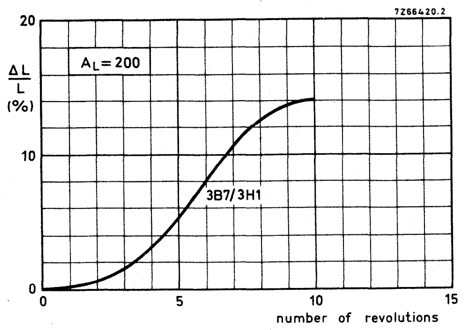
Adjustor 4322 021 32160



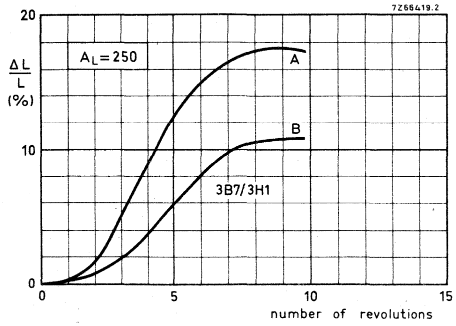
Adjustor 4322 021 32170



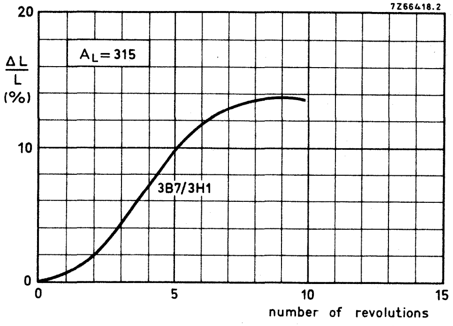
Adjustor 4322 021 32130



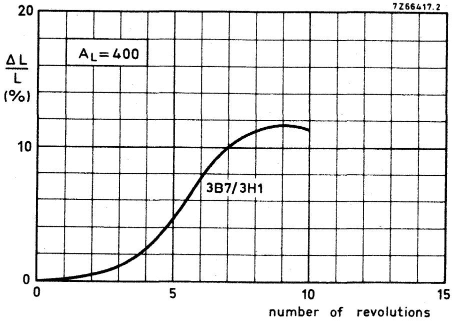
Adjustor 4322 021 32130



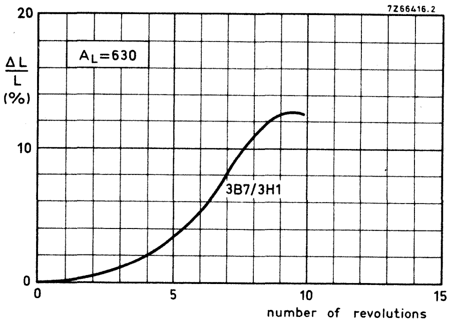
Curve A: adjustor 4322 021 32140
Curve B: adjustor 4322 021 32130



Adjustor 4322 021 32140



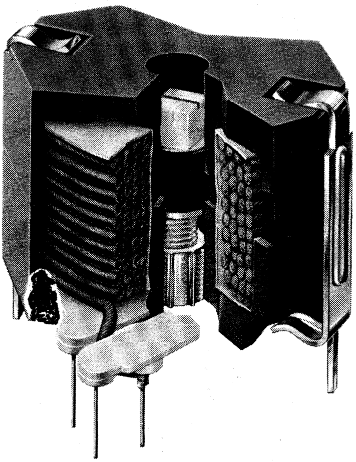
Adjustor 4322 021 32150



Adjustor 4322 021 32180

ASSEMBLING AND MOUNTING

ASSEMBLING



A 52776

Cementing

During the cementing procedure care must be taken that the centre holes are kept in one line.

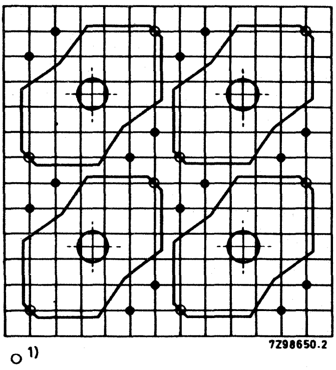
Assembly with clips

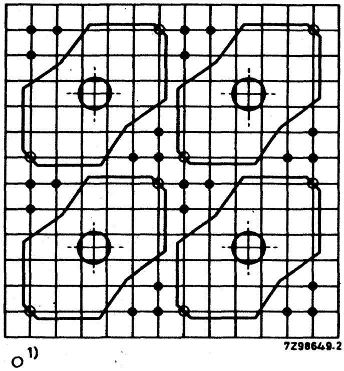
The core halves can be clamped together in an easy way by using two clips. The tags of the clips are used for mechanical fastening and/or for earthing.
For a stable inductance it is recommended to cement the lower flange of the coil former in the lower core half.

The use of a tool for attaching the clips is recommended. Drawings of a simple tool for this purpose are available under number 4322 058 00150

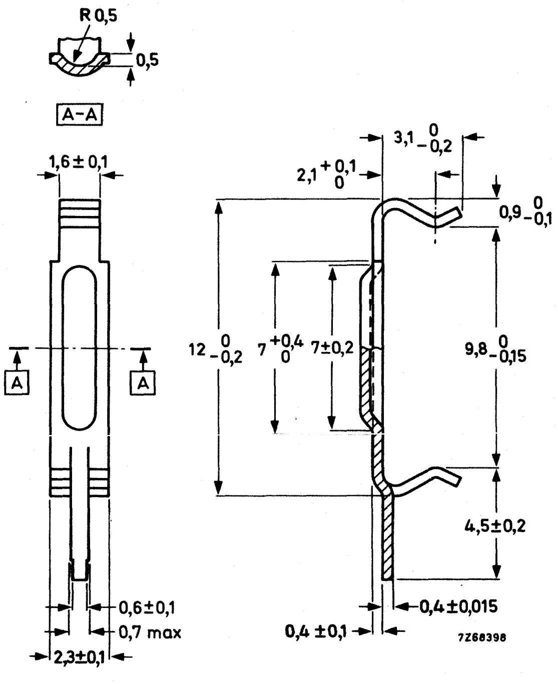
MOUNTING

The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 2,4 mm. The recommended hole diameter in the board is 1,0 ± 0,1 or 1,3 ± 0,1 mm (according to IEC publication 97).





PART DRAWING (dimensions in mm)



Clip 4322 021 31780
Material: steel, nickel and
gold plated

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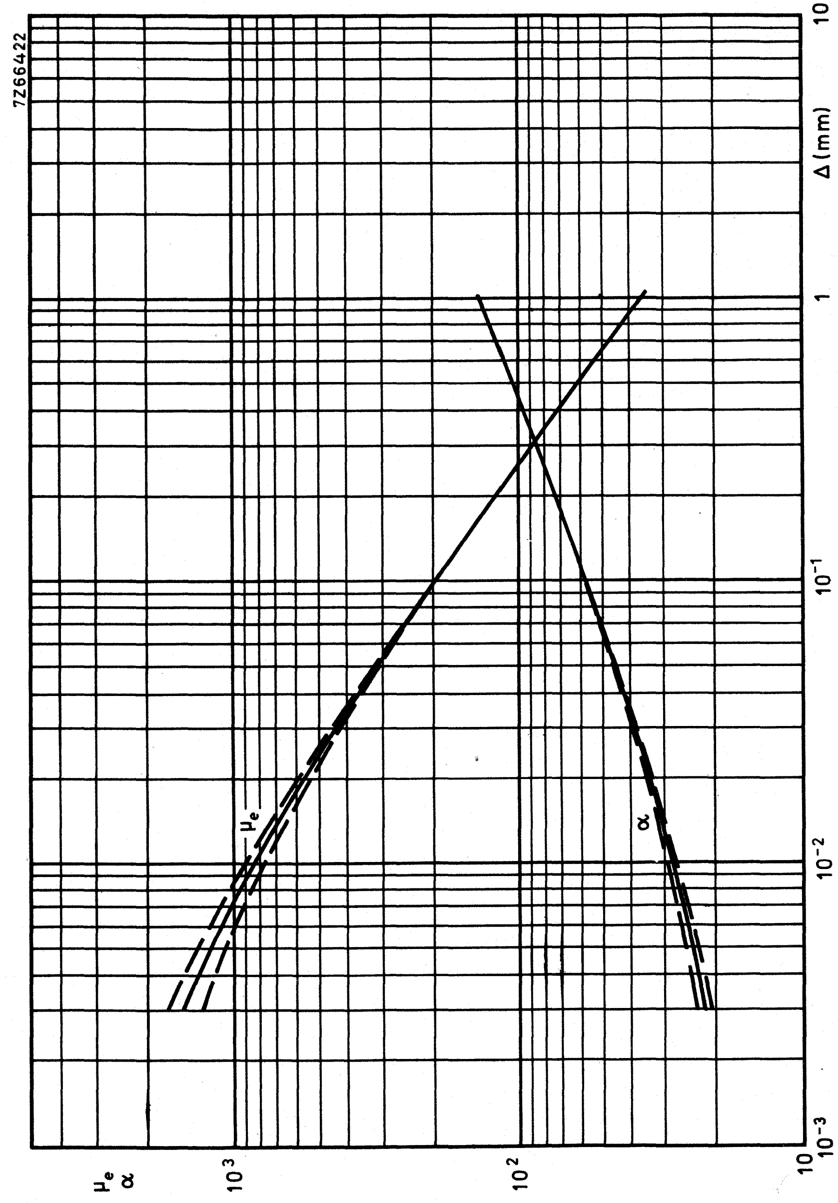
[1]) Holes for tag on clip 4322 021 31780 (earth points).

CHARACTERISTIC CURVES

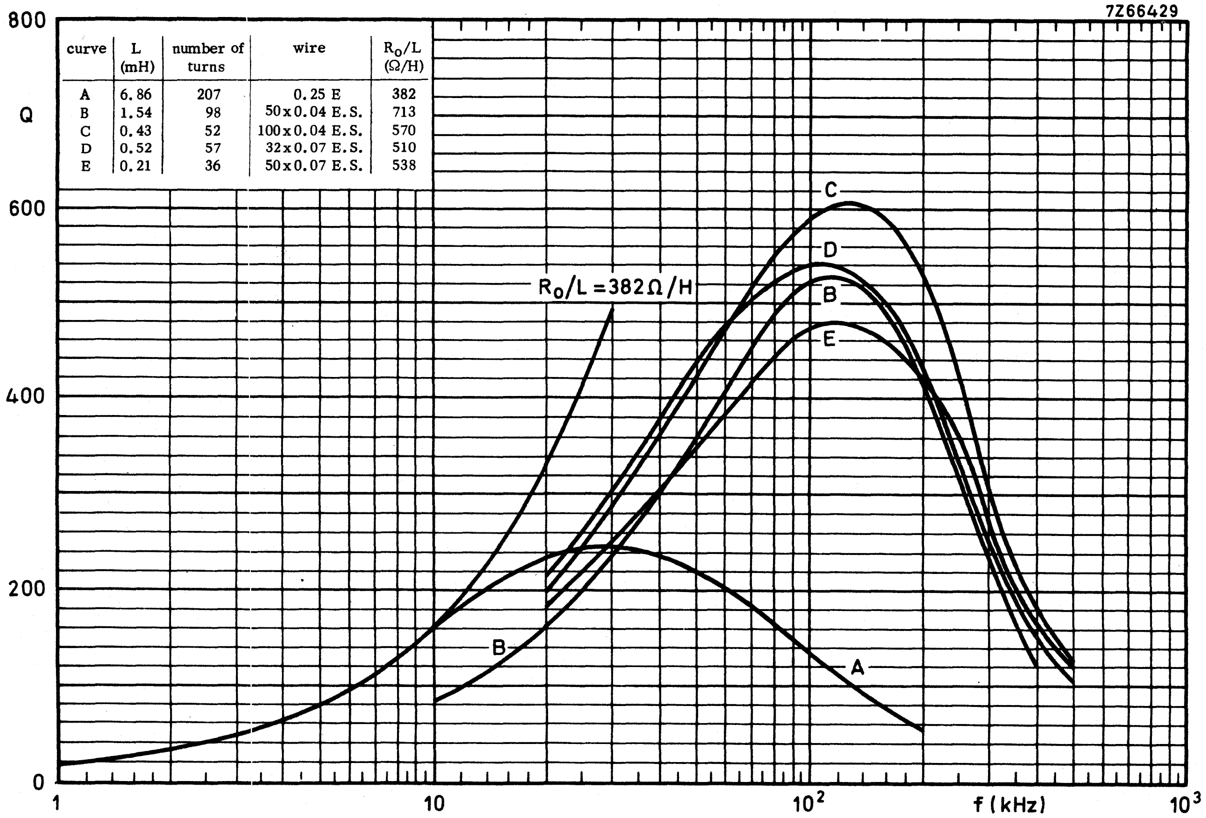
μ_e - α CURVES



Relative effective permeability and turn factor for 1 mH as a function of the air gap length

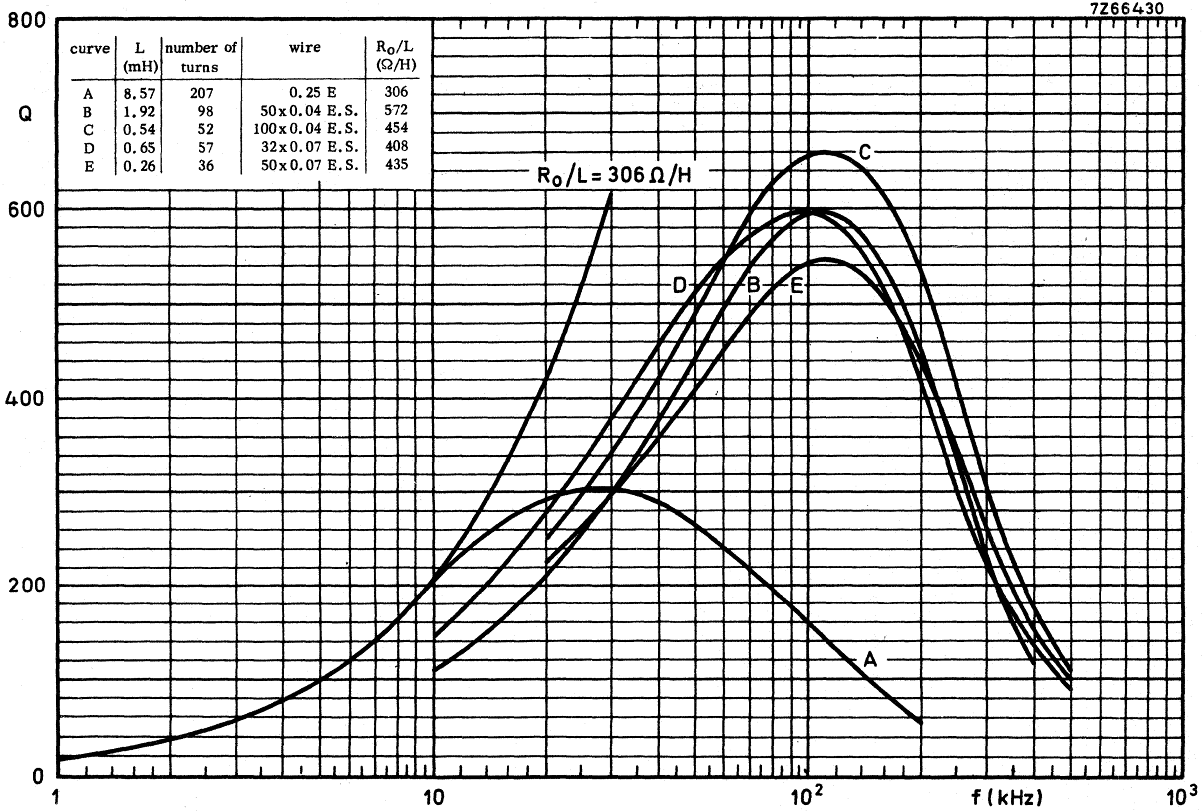
$\mu_e \geq 1280$ at $\Delta = 3\ \mu m$ for 3B7 and 3H1

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



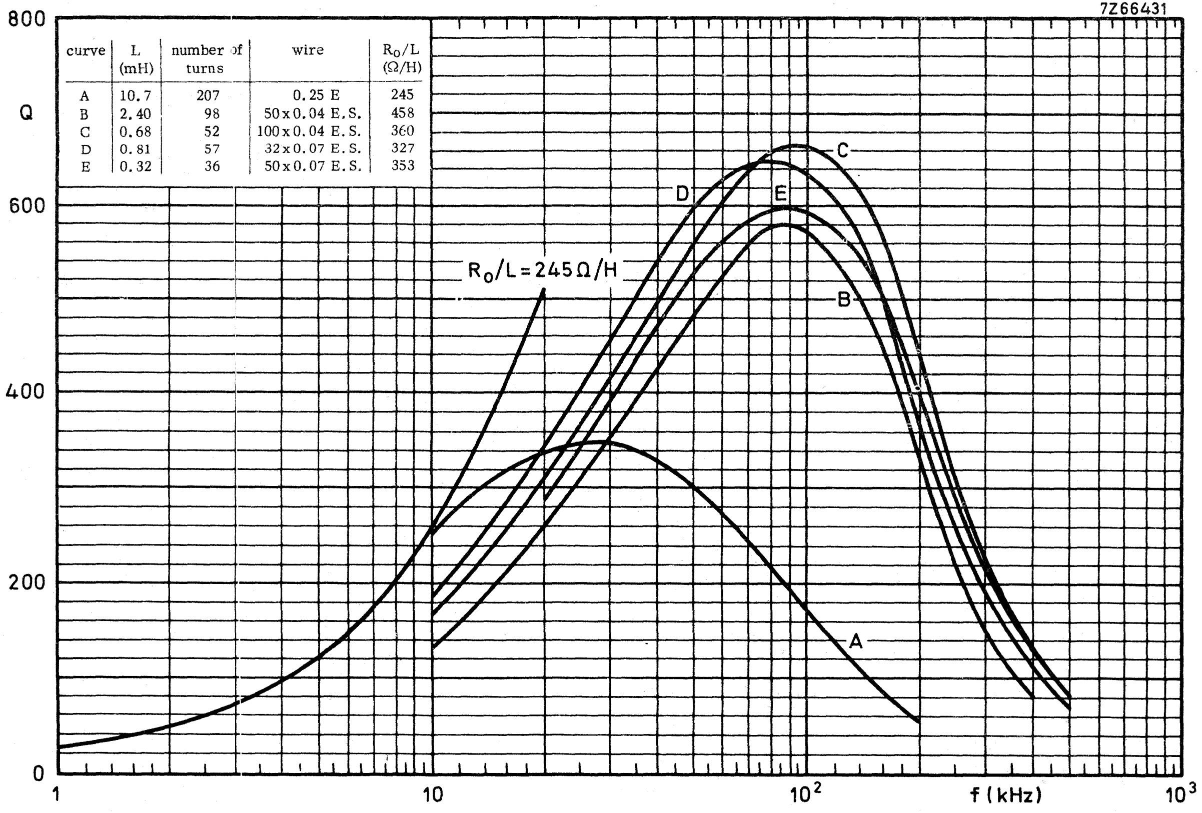
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	6.86	207	0.25 E	382
B	1.54	98	50 x 0.04 E.S.	713
C	0.43	52	100 x 0.04 E.S.	570
D	0.52	57	32 x 0.07 E.S.	510
E	0.21	36	50 x 0.07 E.S.	538

FXC 3B7/3H1, single-section coil former, $A_L = 160$



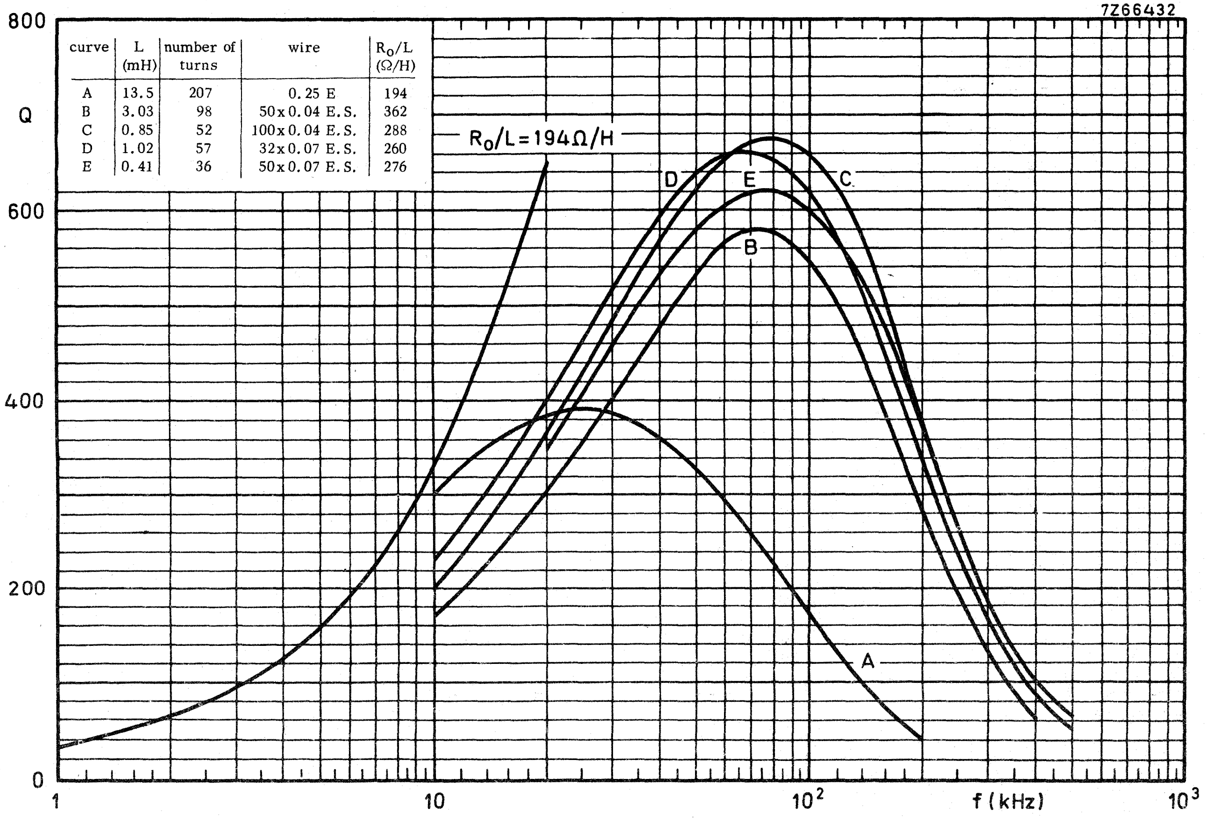
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	8.57	207	0.25 E	306
B	1.92	98	50x0.04 E.S.	572
C	0.54	52	100x0.04 E.S.	454
D	0.65	57	32x0.07 E.S.	408
E	0.26	36	50x0.07 E.S.	435

FXC 3B7/3H1, single-section coil former, A_L = 200



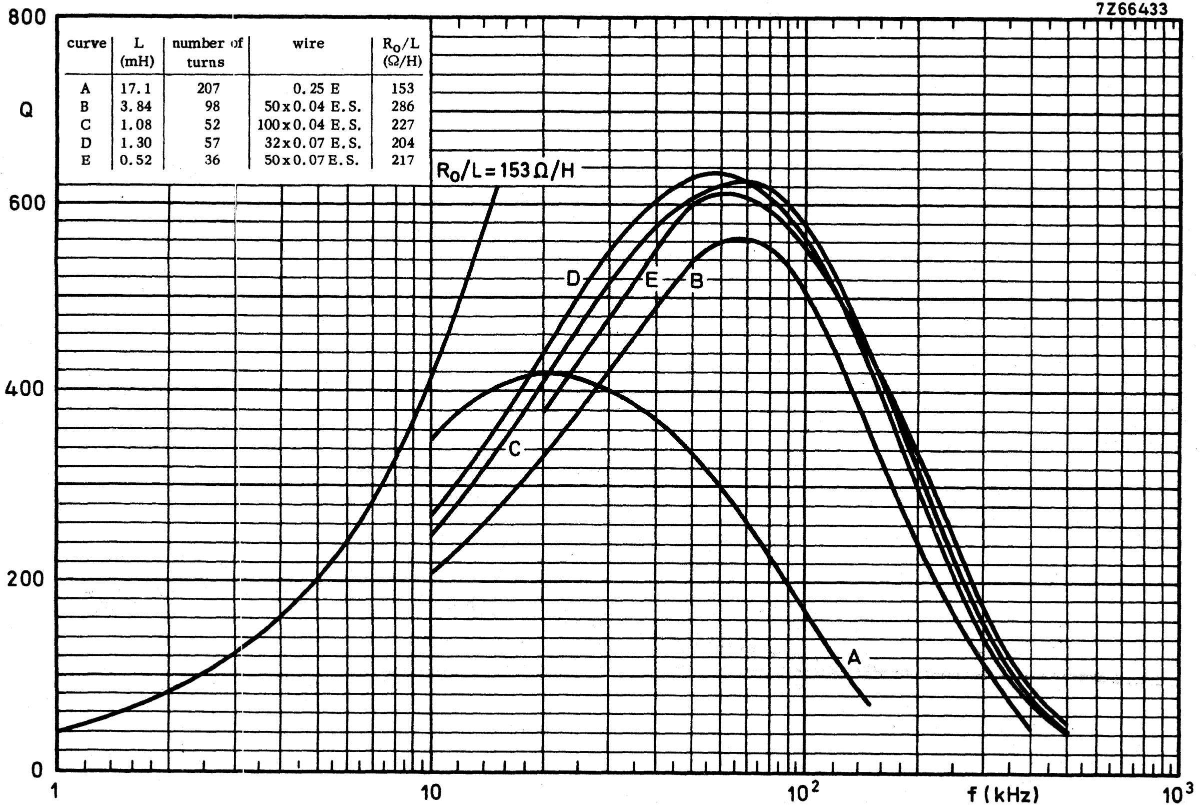
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	10.7	207	0.25 E	245
B	2.40	98	50 x 0.04 E.S.	458
C	0.68	52	100 x 0.04 E.S.	360
D	0.81	57	32 x 0.07 E.S.	327
E	0.32	36	50 x 0.07 E.S.	353

FXC 3B7/3H1, single-section coil former, A_L = 250



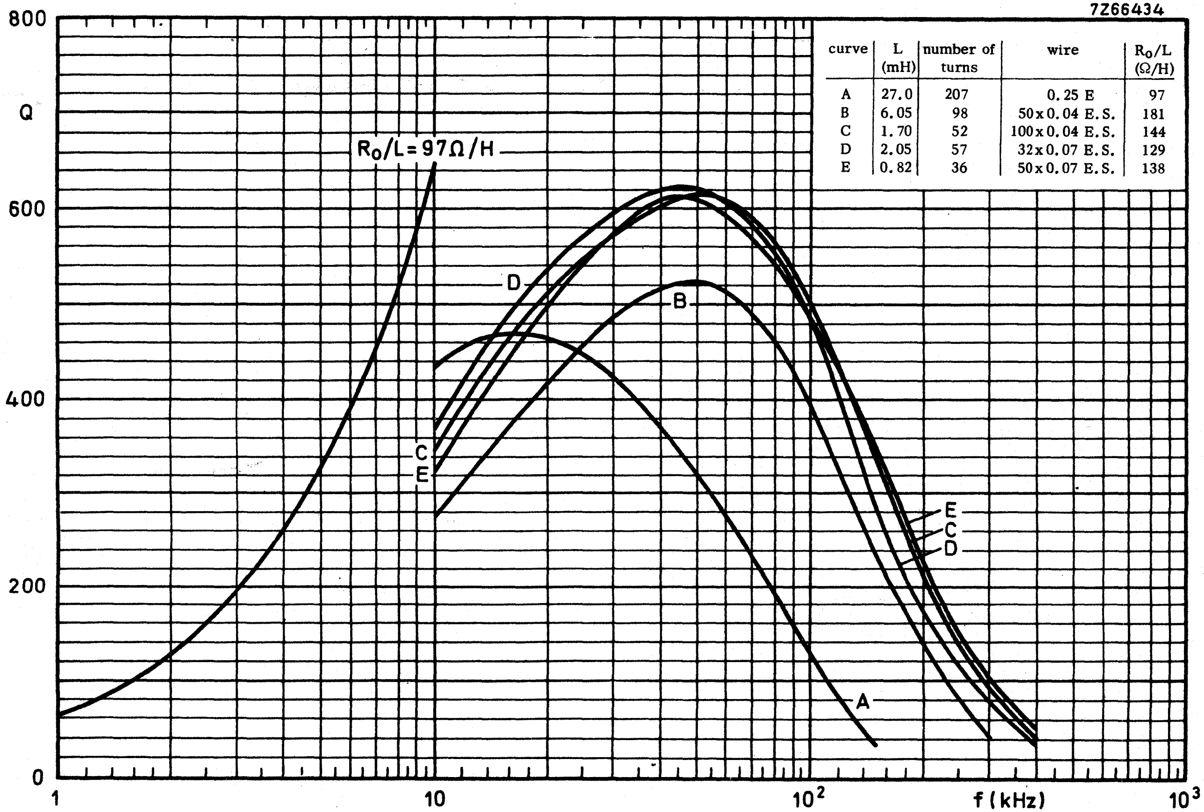
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	13.5	207	0.25 E	194
B	3.03	98	50x0.04 E.S.	362
C	0.85	52	100x0.04 E.S.	288
D	1.02	57	32x0.07 E.S.	260
E	0.41	36	50x0.07 E.S.	276

FXC 3B7/3H1, single-section coil former, $A_L = 315$



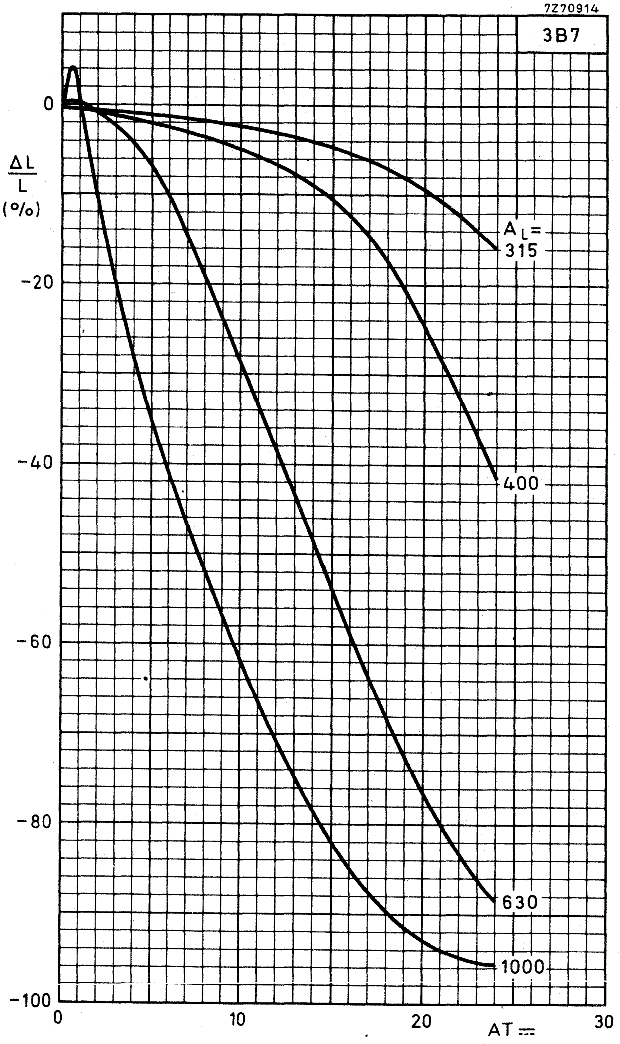
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	17.1	207	0.25 E	153
B	3.84	98	50 x 0.04 E.S.	286
C	1.08	52	100 x 0.04 E.S.	227
D	1.30	57	32 x 0.07 E.S.	204
E	0.52	36	50 x 0.07 E.S.	217

FXC 3B7/3H1, single-section coil former, $A_L = 400$

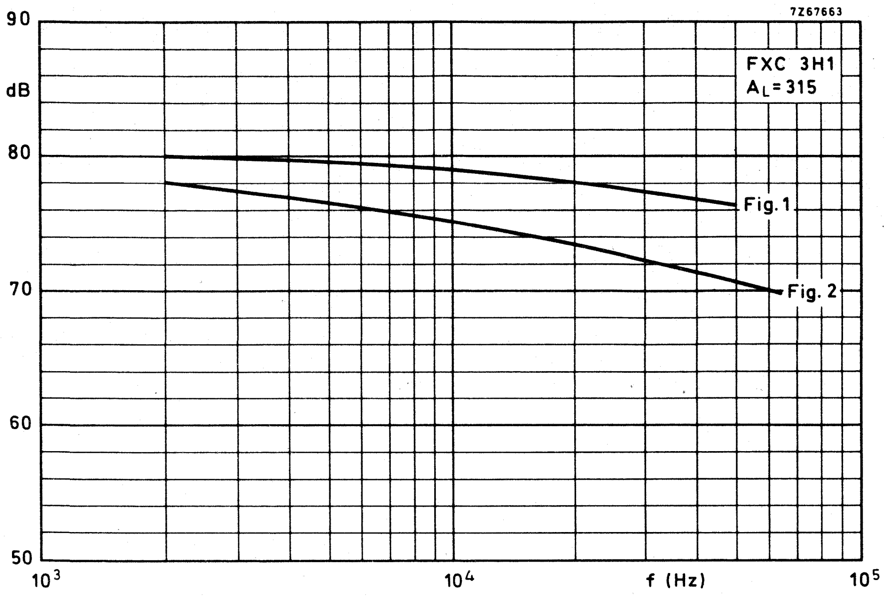


curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	27.0	207	0.25 E	97
B	6.05	98	50x0.04 E.S.	181
C	1.70	52	100x0.04 E.S.	144
D	2.05	57	32x0.07 E.S.	129
E	0.82	36	50x0.07 E.S.	138

FXC 3B7/3H1, single-section coil former, $A_L = 630$


7Z70914
3B7
0
ΔL/L (%)
-20
-40
-60
-80
-100
0
10
20
30
AT ⎓
A_L = 315
400
630
1000

CROSSTALK ATTENUATION



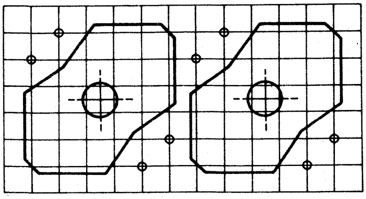


Fig. 1

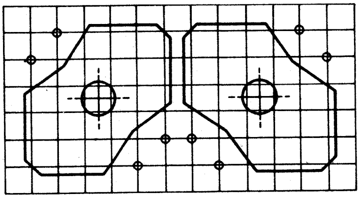


Fig. 2

SQUARE CORES

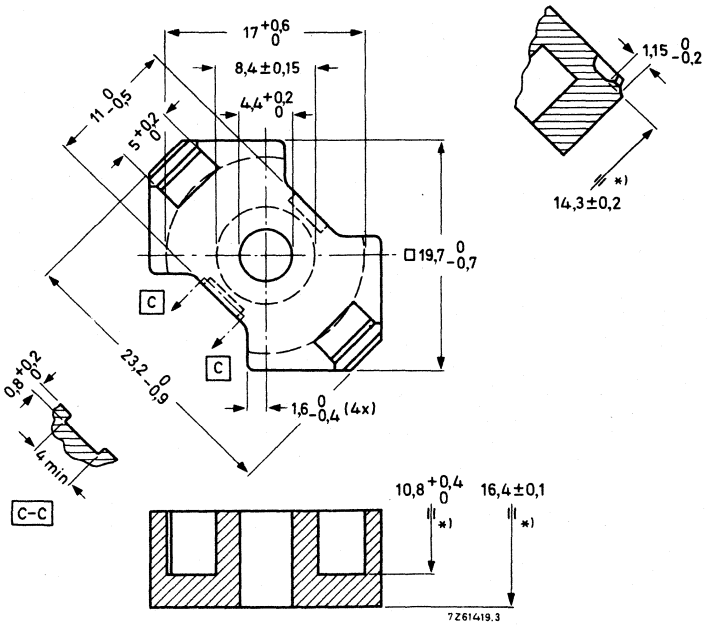
INTRODUCTION

Three types of core can be supplied:
- Separate core halves, air gap to be ground by the user himself.
- Pre-adjusted cores (2 halves with an air gap) which are provided with a nut for an adjustor. These cores have an inductance factor A_L in accordance with the R5(R10) range.
- Pre-adjusted cores without nut.

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 40 core halves or 20 pre-adjusted cores, a storage pack 200 or 100 respectively, so please order in multiples of these quantities.

SEPARATE CORE HALVES

Dimensions in mm



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*) Measured on two adjacent core halves.

Versions

ferroxcube grade	catalogue number
3B7	4322 020 27250
3H1	4322 020 27260
3D3	4322 020 27270
4C6	4322 020 27280
3E1	only pre-adjusted cores are available
3E4	

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 95 Newton.

Table II	$\hat{B}$ (mT)	freq. (MHz)	temp. (^{o}C)	grade					
				3B7	3H1	3D3	4C6	3E1	3E4
μ_e (tol. ± 25%)	≤ 0, 1	0, 004	25 ± 10	–	–	–	–	–	–
	≤ 0, 1	0, 1		1840	1840	720	126	–	–
A_L (tol. ± 25%)	≤ 0, 1	0, 004	25 ± 10	–	–	–	–	–	–
	≤ 0, 1	0, 1		3400	3400	1330	230	–	–
α (tol. ± 12, 5%)	≤ 0, 1	0, 004	25 ± 10	–	–	–	–	–	–
	≤ 0, 1	0, 1		17, 6	17, 6	28, 1	67, 4	–	–
$\alpha_F \times 10^6$			5 to 25	−0, 6 to + 0, 6*	+ 0, 5 to + 1, 5	–	−2 to + 4	–	0 to + 2
			25 to 55	−0, 6 to + 0, 6	+ 0, 5 to + 1, 5	–	0 to + 6	–	0 to + 2
			25 to 70	−0, 6 to + 0, 6	+ 0, 5 to + 1, 5	0 to + 2	0 to + 2	–	0 to + 2
$D_F \times 10^6$ (10-100 min)			25 ± 1	≤ 4, 3	≤ 4, 3	≤ 12	–	–	≤ 4, 3
$\frac{\tan \delta}{\mu_i} \times 10^6$	≤ 0, 1	0, 004	25 ± 10	–	–	–	–	≤ 2, 5	≤ 2, 5
	≤ 0, 1	0, 03		≤ 2, 5	≤ 2, 5	–	–	–	–
	≤ 0, 1	0, 1		≤ 5	≤ 5	≤ 8	–	≤ 20	≤ 20
	≤ 0, 1	0, 5		–	–	≤ 14	–	≤ 200	
	≤ 0, 1	1, 0		–	–	≤ 30	–	–	–
	≤ 0, 1	2, 0		–	–	–	≤ 40	–	–
	≤ 0, 1	10, 0		–	–	–	≤ 100	–	–
$q_{2-24-100}$	1, 5-3	0, 004	25 ± 10	≤ 1, 8/≤ 1, 4*	≤ 1, 4	–	–	≤ 3	≤ 1, 8
	0, 3-1, 2	0, 1		–	–	≤ 3	≤ 15	–	–
$\eta_B \times 10^3$	1, 5-3	0, 004	25 ± 10	≤ 1, 1/≤ 0, 86*	≤ 0, 86	–	–	≤ 1, 8	≤ 1, 1
	0, 3-1, 2	0, 1		–	–	≤ 1, 8	≤ 9, 2	–	–

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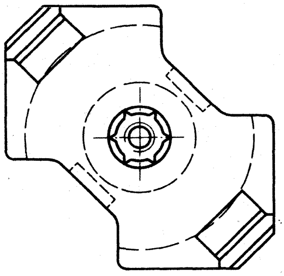
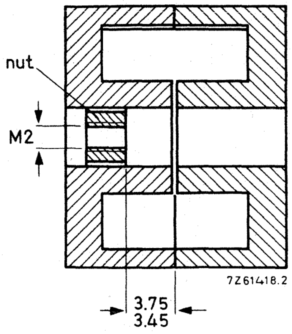
*) For guidance only.

PRE-ADJUSTED CORES

Dimensions in mm





The cores in grades 3E1 and 3E4 have no centre hole.

		with centre hole	without centre hole
Weight		17,5 g	18,7 g
Mean length of lines of force	l_e	35,5 mm	38,4 mm
Mean area of lines of force	A_e	52 mm^2	63 mm^2
	$\Sigma \frac{l_e}{A_e}$	0,682 mm^{-1}	0,604 mm^{-1}
Effective volume	V_e	1850 mm^3	2440 mm^3

Pre-adjusted cores with standard A_L factors

A_L	corresponding μ_e-value	tol. on inductance (%)	cat. No.: 4322 022 7.... with nut 4322 022 5.... without nut					
			3B7	3H1	3D3	4C6	3E1	3E4
40	22	± 1	–	–	1420	1820		
63	34	± 1	1030	1230	1430	1830		
100	54	± 1	1040	1240	1440	1840		
160	88	± 1.5	1050	1250	1450	1850		
250	135	± 2	1060	1260				
315	170	± 2	1070	1270				
400	220	± 3	1080	1280				
630	340	± 3	1100	1300				
1000	540	± 10	1110	1310				
1250	680	± 10	1190	1390				
6300	3050	± 25	–	–	–	–	1800*	
8000	3850	± 25	–	–	–	–	–	1900*

Inductance $L = N^2 A_L$ (in 10^{-9} H)

Symmetric airgap for cores with A_L factor of 40 up to and including 250.
Asymmetric airgap for cores with A_L factor of 315 and higher.
The airgap of the types marked with * is practically zero, and consequently inductance adjustment is not possible. Hence these types are not provided with a centre hole, so that maximum performance is achieved.

Notes

1. Example of catalogue number:
   A_L = 250, grade 3H1, core with nut, catalogue number 4322 022 71260.
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

COIL FORMERS

Four types of coil former can be supplied:

- Single-section, 4-pin coil former, Fig. 1, catalogue number 4322 021 32360
- Single-section, 8-pin coil former, Fig. 2, catalogue number 4322 021 32380
- Single-section, 12-pin coil former, Fig. 3, catalogue number 4322 021 32390
- Two-section, 8-pin coil former, Fig. 4, catalogue number 4322 021 32420

<u>Properties</u>

Material of former	phenolformaldehyde reinforced with glass fibre, K618, green (vyncolite)
of pins	phosphorbronze dipsoldered
Window area	
single-section coil former	34,2 mm^2
two-section coil former	34,0 mm^2
Mean length of turn	41 mm
Maximum temperature	180 °C
Solderability	to IEC 68-2-20B, part 2, test T (solder bath 235 °C, soldering iron 350 °C)
D.C. losses, $\frac{R_o}{L}$	$\frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11,4 \times 10^3\ \Omega/H$
Weight	0,55 g

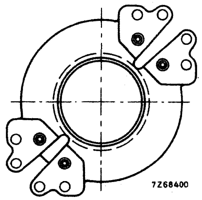


Fig. 1

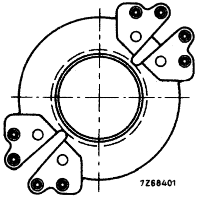


Fig. 2

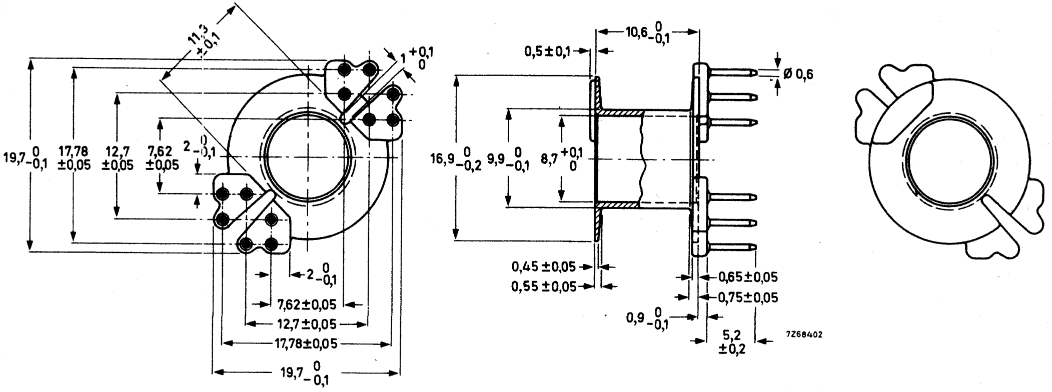


Fig. 3

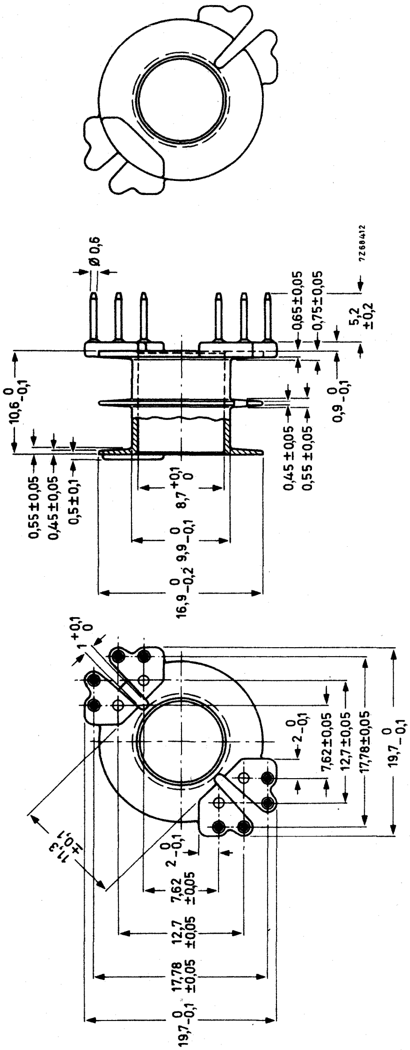

Ø 0,6
7Z68412
0,65±0,05
0,75±0,05
5,2 ±0,2
10,6 $^{0}_{-0,1}$
0,9 $^{0}_{-0,1}$
0,45 ±0,05
0,55 ±0,05
0,55±0,05
0,45±0,05
0,5±0,1
8,7 $^{+0,1}_{0}$
9,9 $^{0}_{-0,1}$
16,9 $^{0}_{-0,2}$
1 $^{+0,1}_{0}$
2 $^{0}_{-0,1}$
7,62±0,05
12,7±0,05
17,78±0,05
19,7 $^{0}_{-0,1}$
11,3 $^{+0,1}$
2 $^{0}_{-0,1}$
7,62 ±0,05
12,7 ±0,05
17,78 ±0,05
19,7 $^{0}_{-0,1}$

Fig. 4

INDUCTANCE ADJUSTORS

ADJUSTORS

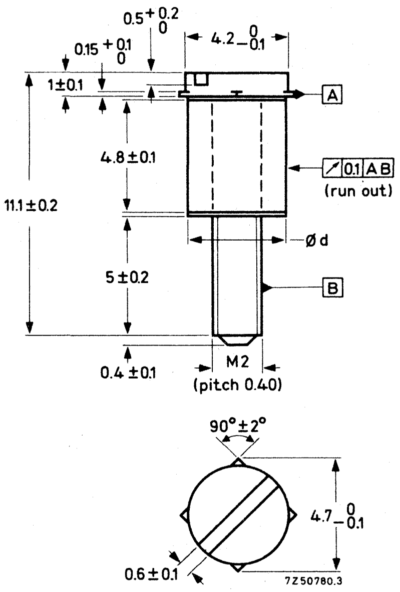


Fig. A. d = 4 mm, tol. -0,04 mm
Fig. C. d = 3, 85 mm, tol. -0,04 mm

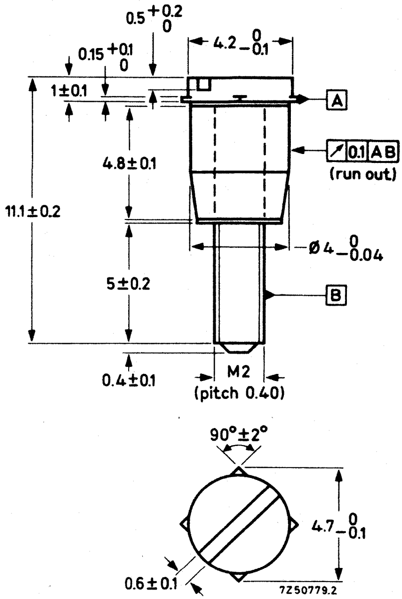


Fig. B

The tolerances on inductance of the pre-adjusted cores (without adjustor) are given below "Pre-adjusted Cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0, 03% by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil (see following pages).
The adjustor is screwed through the centre hole of the core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower A_L value.
The influence of the adjustor on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different square cores.

Table I, types of adjustor

Fig.	colour	catalogue number
B	yellow	4322 021 31000
B	white	4322 021 31020
B	red	4322 021 31060
A	brown	4322 021 31100
B	black	4322 021 31240
C	grey	4322 021 32190

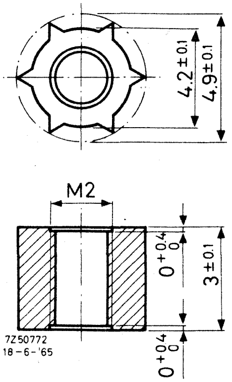
Table II, recommended application

A_L	3B7/3H1/3D3	4C6
	cat. No. 4322 021	
40	31060	
63	31060	
100	31000 or 31060	
160	31000 or 31020	
250	31020	
315	32190	
400	31100	
630	31240	

The adjustors are packed in bags of 100, so please order in multiples of 100.

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.

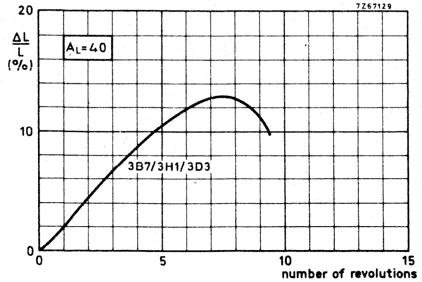


7Z50772
18-6-'65

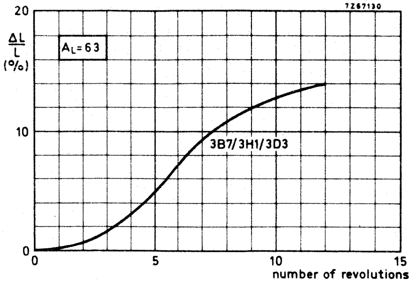
Catalogue number	4322 021 30150
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	3.6 ± 0.15 mm

The nuts are packed in bags of 100, so please order in multiples of 100.

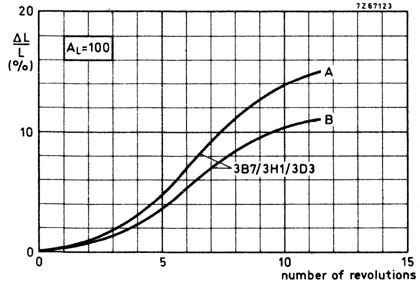
ADJUSTMENT CURVES



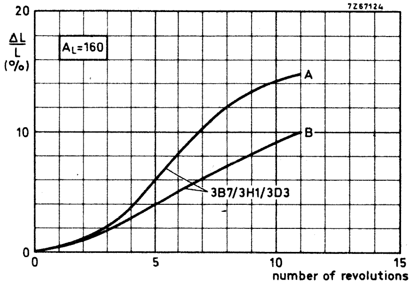
Adjustor 4322 021 31060



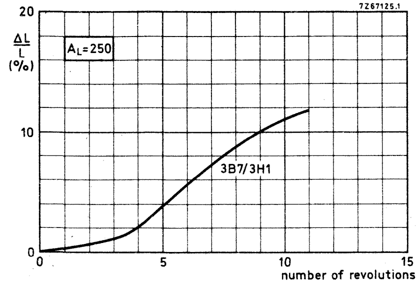
Adjustor 4322 021 31060



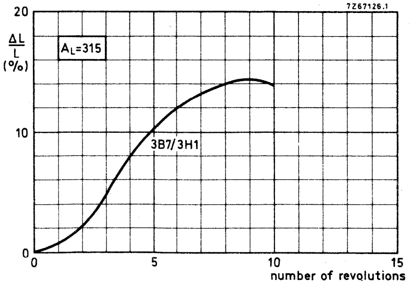
Adjustor 4322 021 31000 (curve A)
Adjustor 4322 021 31060 (curve B)



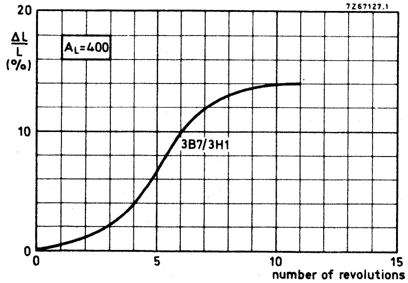
Adjustor 4322 021 31020 (curve A)
Adjustor 4322 021 31000 (curve B)



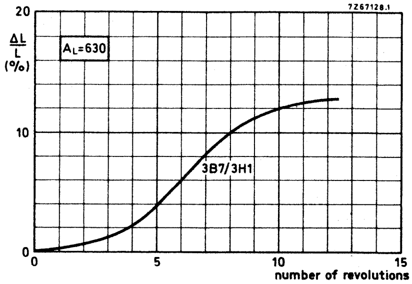
Adjustor 4322 021 31020



Adjustor 4322 021 32190

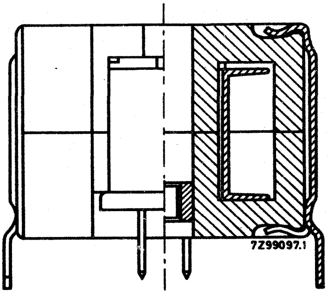


Adjustor 4322 021 31100



Adjustor 4322 021 31240

MOUNTING PARTS



ASSEMBLING

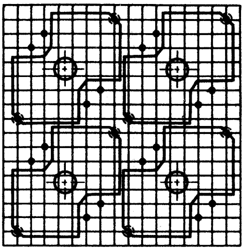
The core halves are clamped together by means of two clips, type 4322 021 31840. As can be seen in the drawing, the hooked ends of either clip fall into recesses made in the core halves.

For a stable inductance we recommend some adhesive to be applied between the coil-former flange and the lower core half. We also recommend that a tool be used for assembling. Drawings of a simple tool are available under number 4322 058 00160.

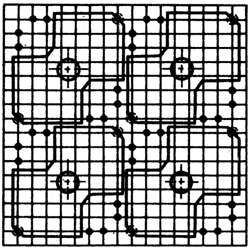
MOUNTING

The two retaining clips are also used for mounting the assembled core on a printed-wiring board: the gold-plated pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing the core.

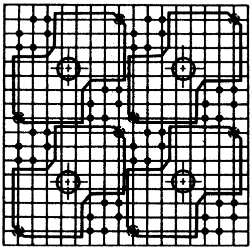
The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 2.4 mm. The recommended hole diameter in the board is 1,0 ± 0,1 or 1,3 ± 0,1 mm (according to IEC publication 97).



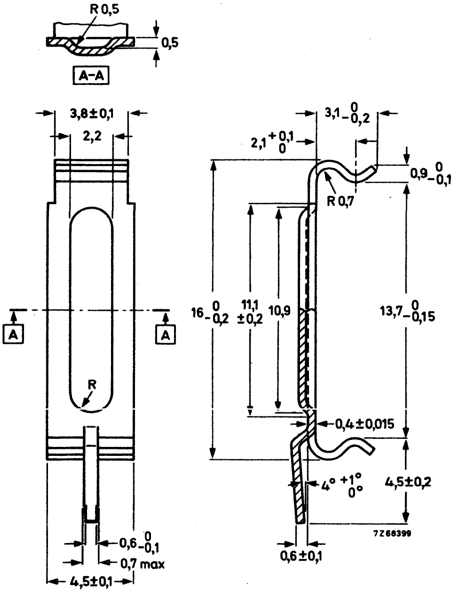
⊛ 1)



⊛ 1)



⊛ 1)



PART DRAWING (dimensions in mm)

Clip 4322 021 31840
Material: steel, nickel and
gold plated

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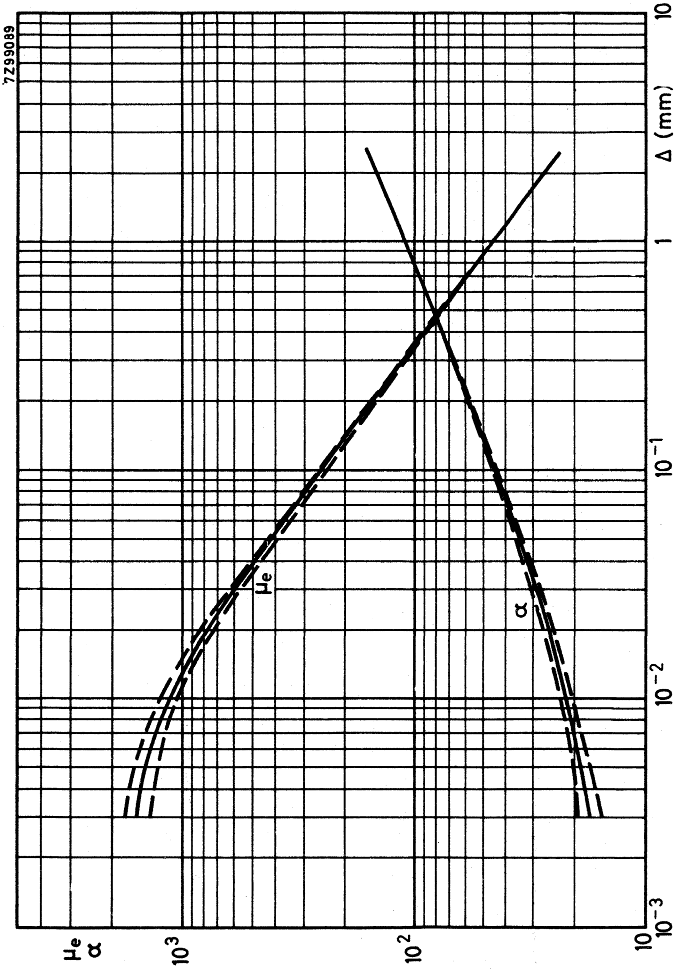
1) Holes for tag on clip 4322 021 31840

CHARACTERISTIC CURVES

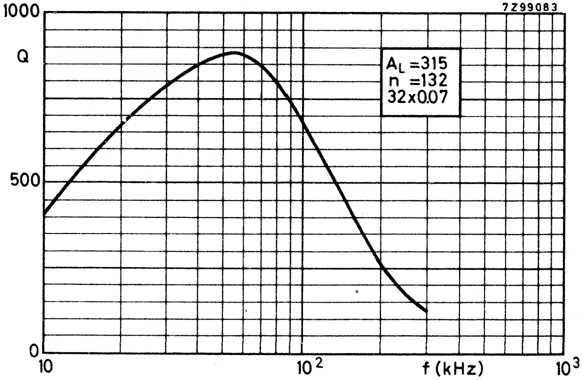
μ_e - α CURVES



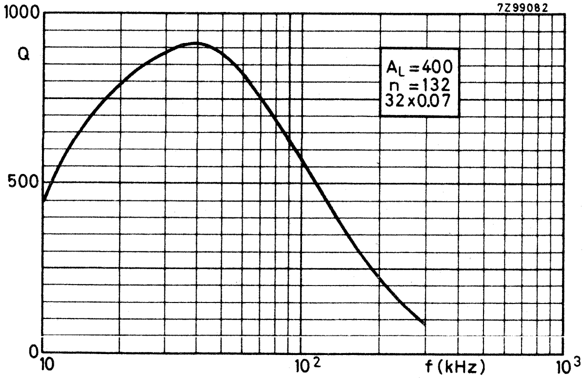
Relative effective permeability and turn factor for 1 mH as a function of the air gap length

$\mu_e = 1840 \pm 25\%$ at $\Delta = 3\ \mu m$ for 3B7 and 3H1

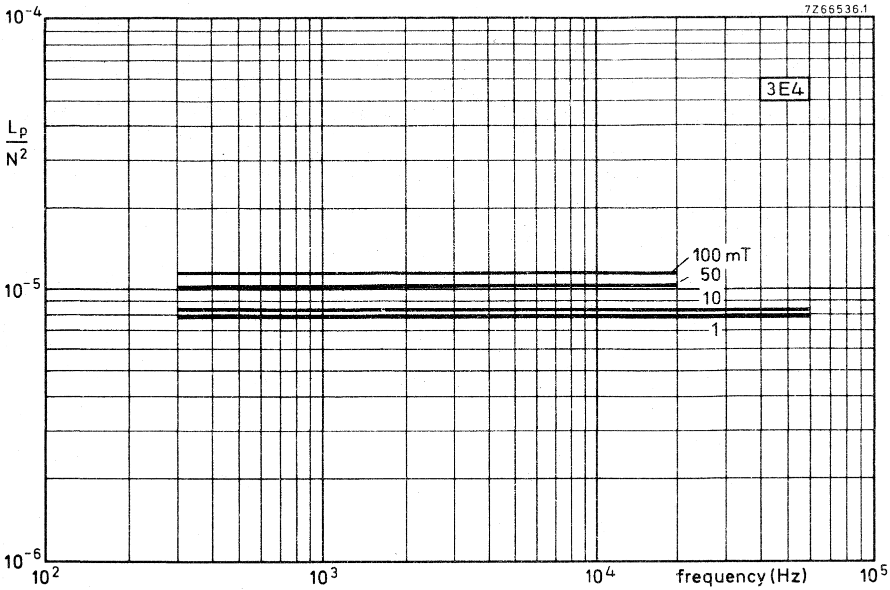
Q-CURVES



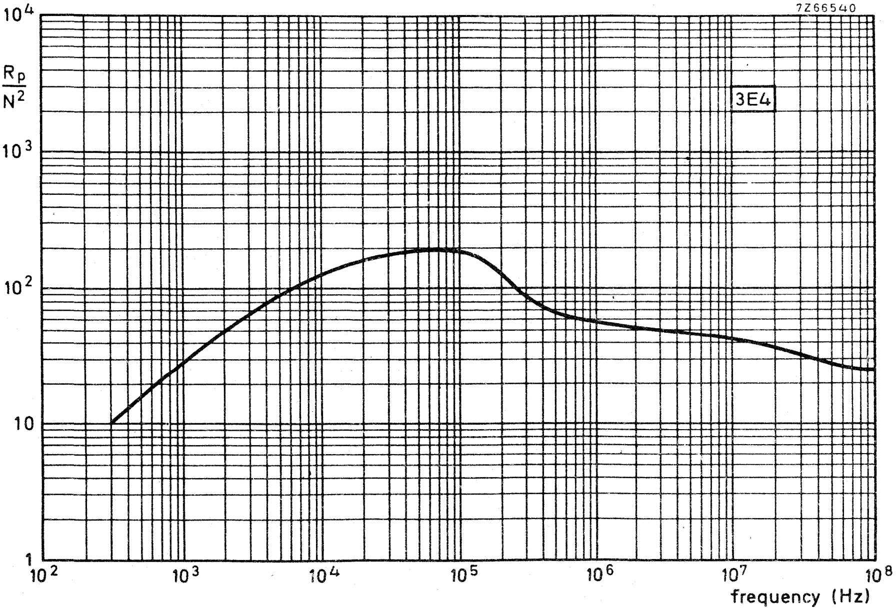
Provisional curve



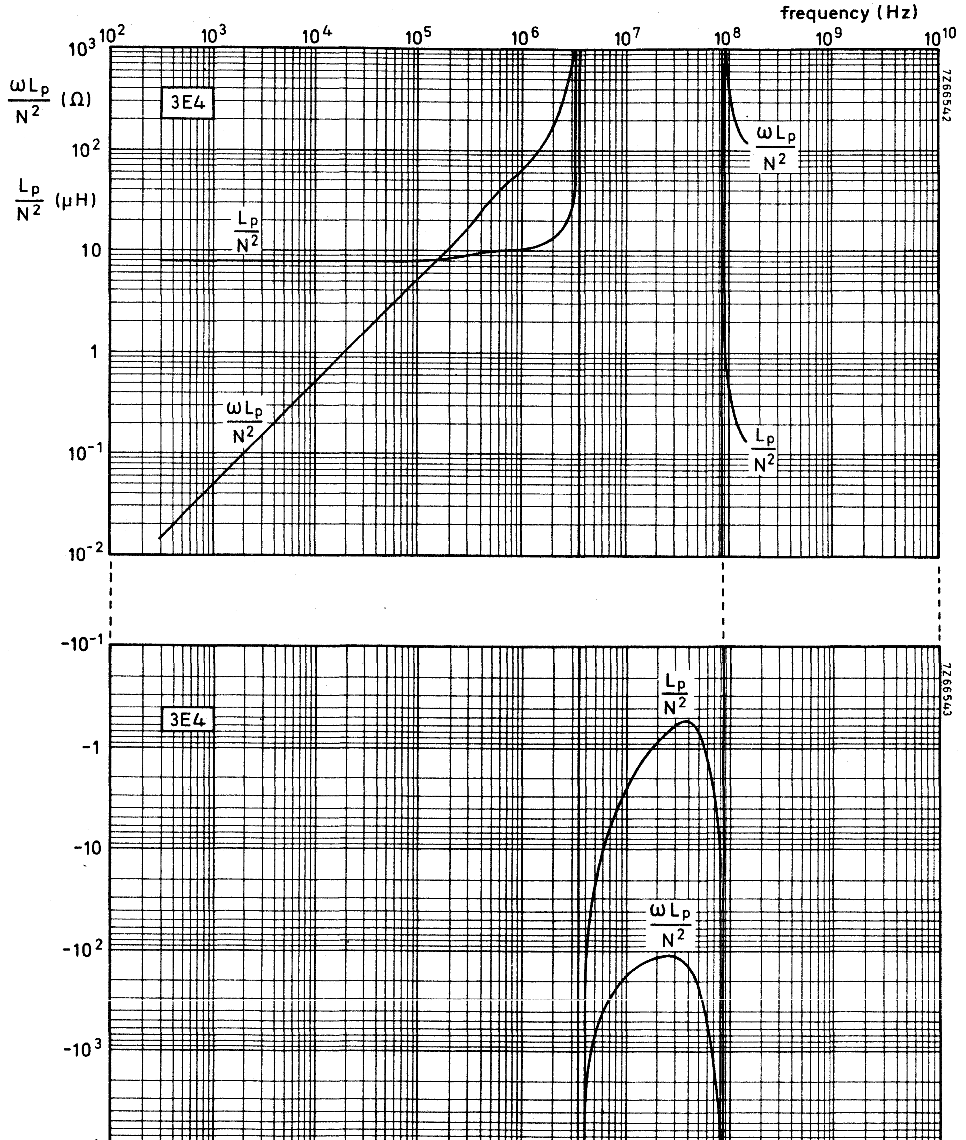
Provisional curve



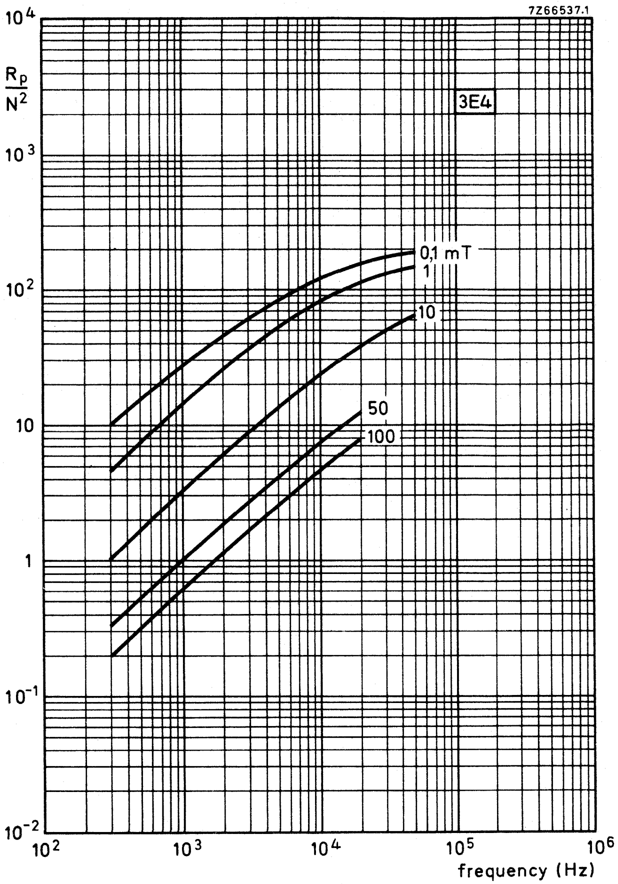
Inductance as a function of the frequency (typical values)



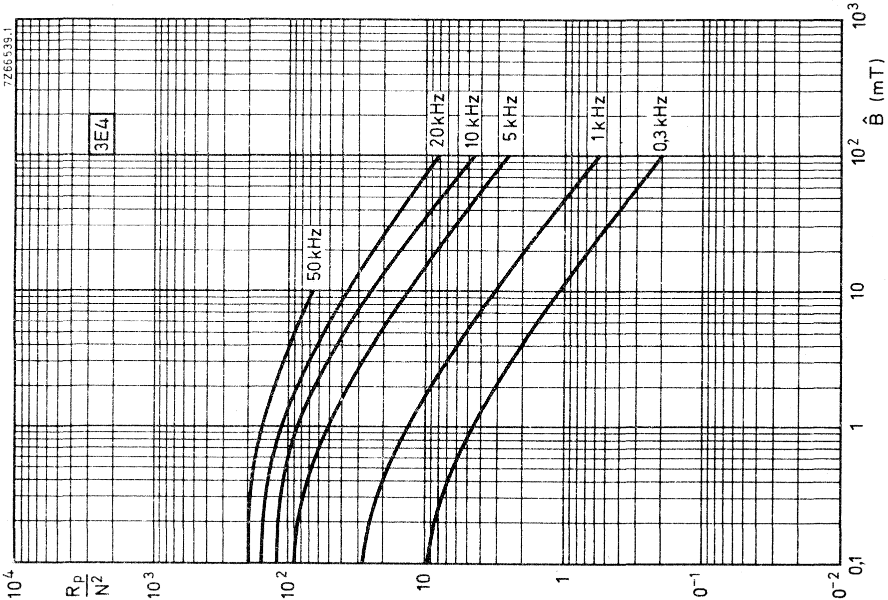
Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT (typical values)



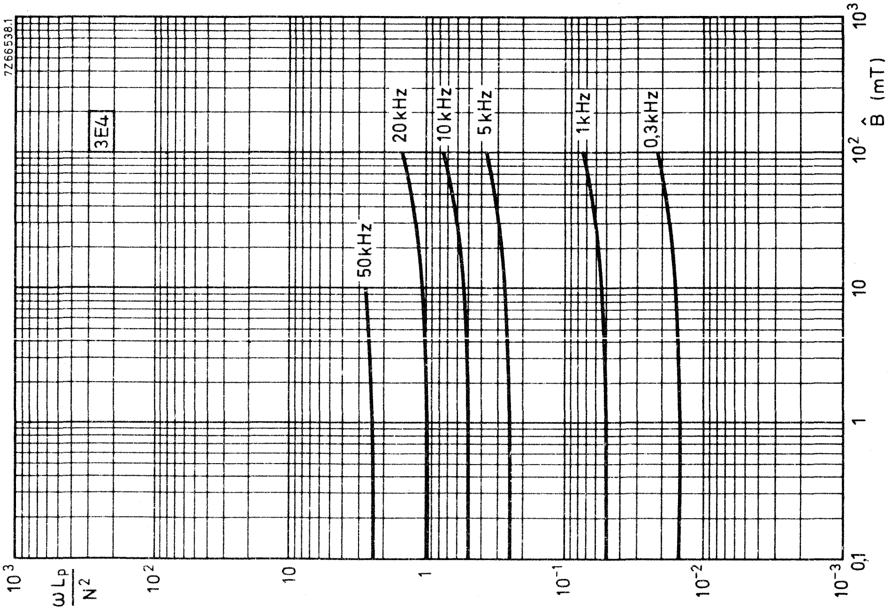
Inductance as a function of the frequency (typical values)



Losses as a function of the frequency (typical values)



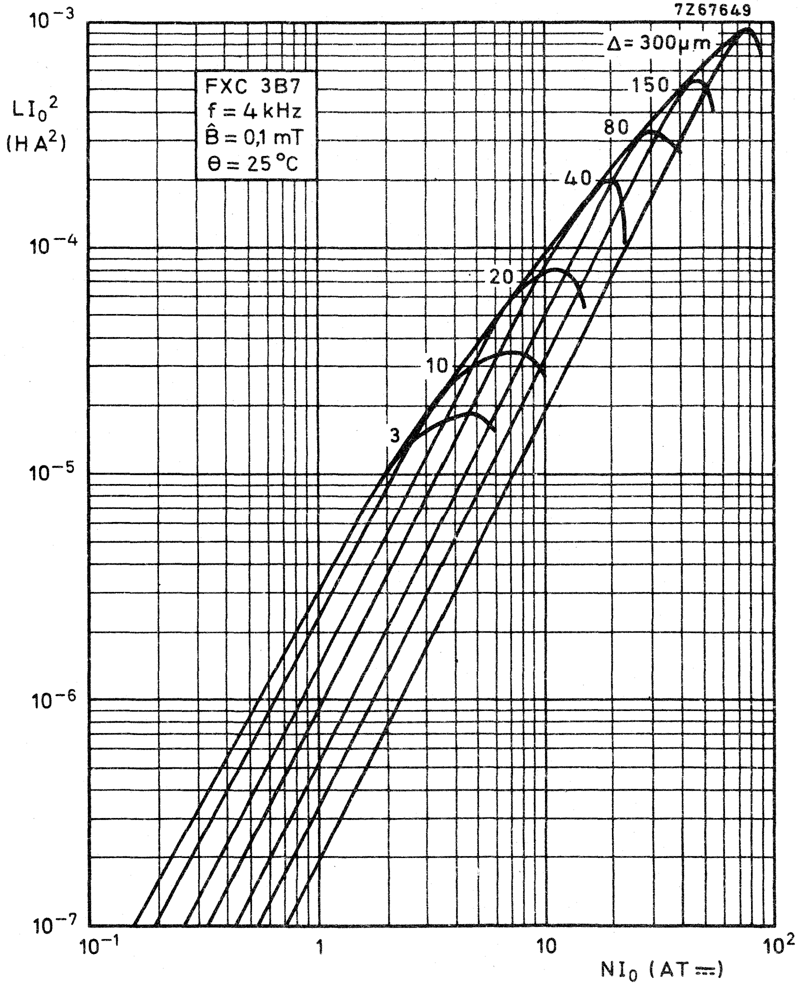
Losses as a function of the peak induction (typical values)

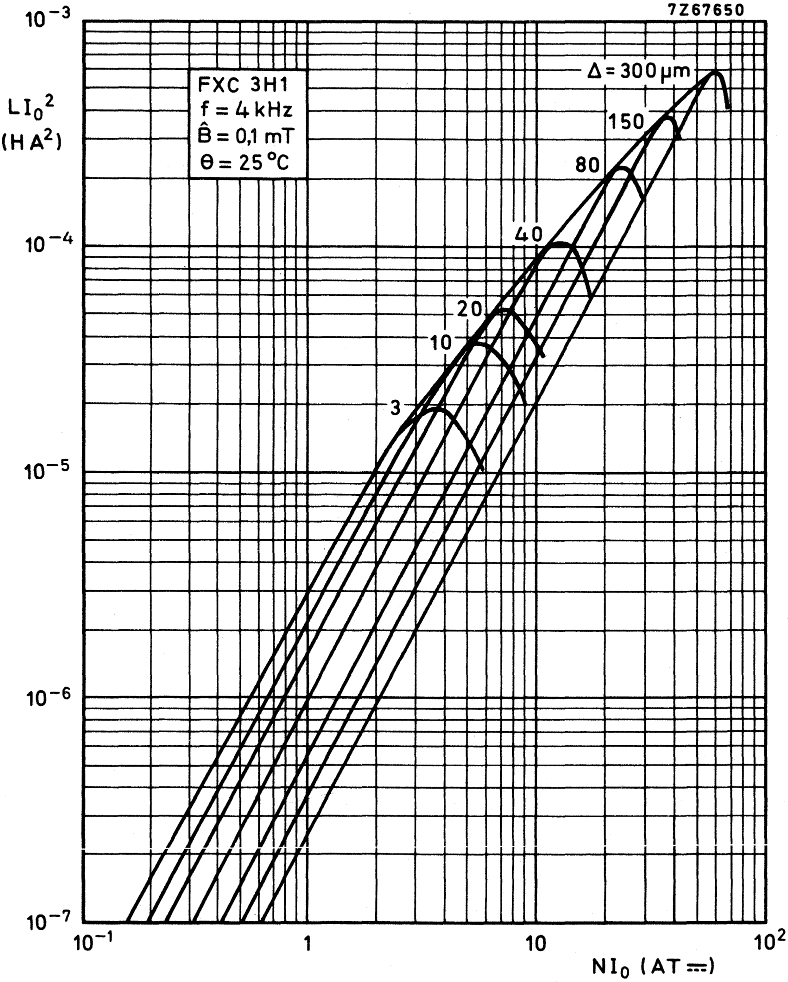


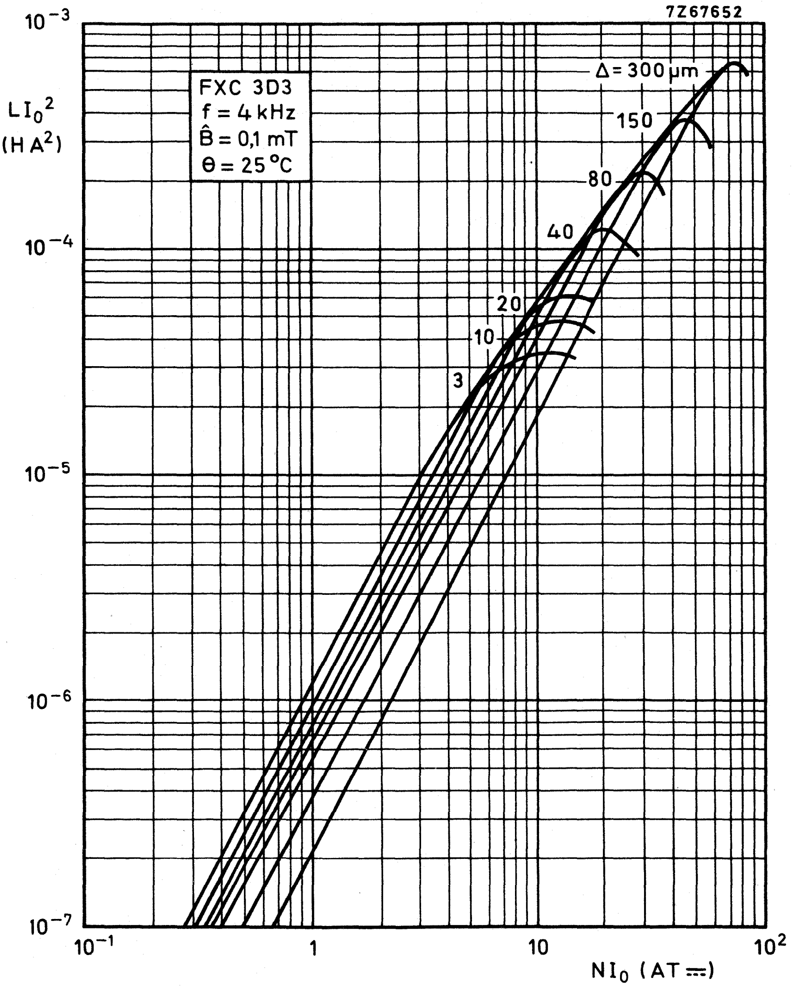
Inductance as a function of the peak induction (typical values)

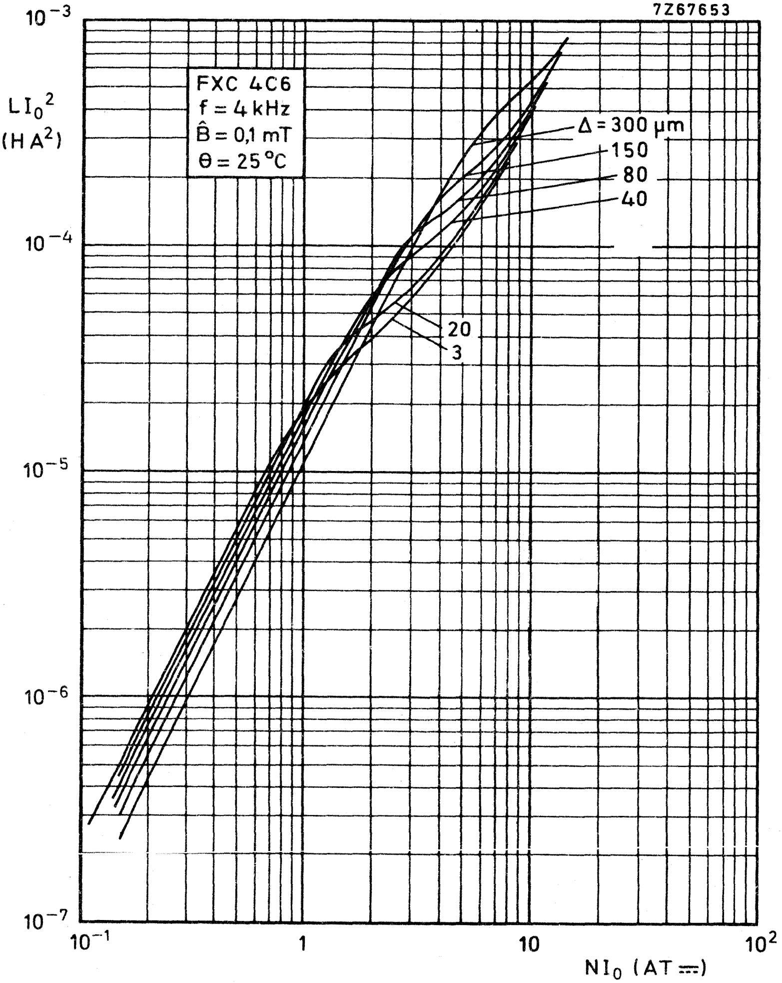
HANNA CURVES (typical values)
for different material grades.

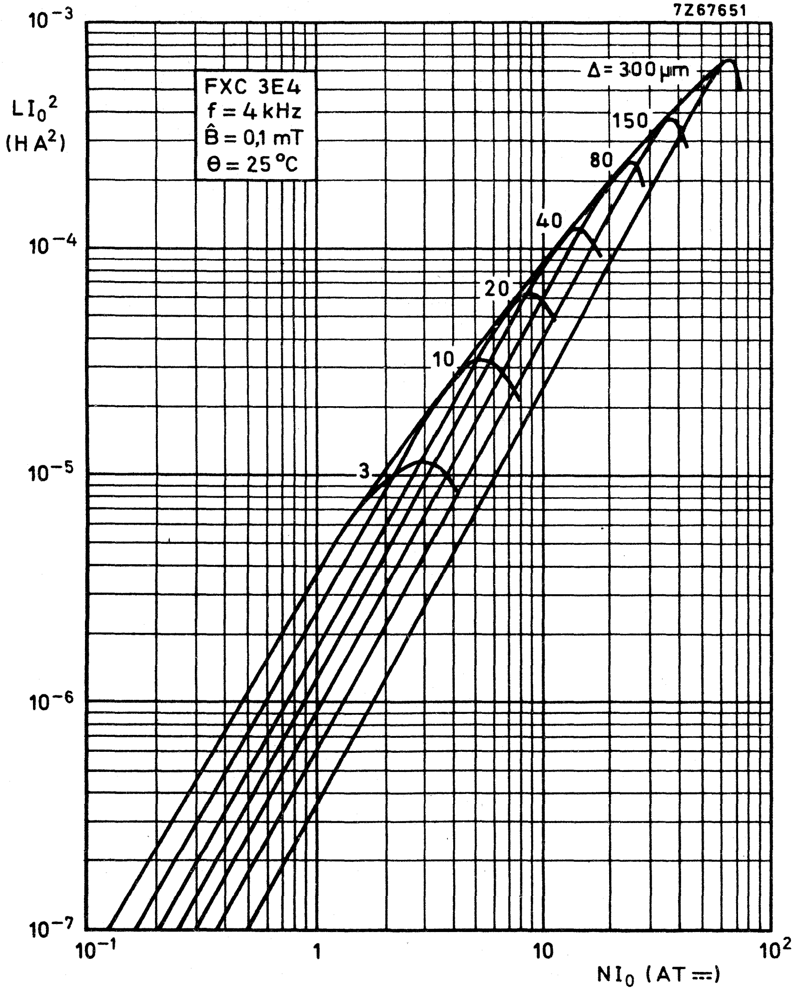
Indicating optimum inductance for a certain airgap and direct current.




7Z67650
LI_0^2 (HA^2)
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
FXC 3H1
f = 4 kHz
$\hat{B}$ = 0,1 mT
Θ = 25 °C
Δ = 300 μm
150
80
40
20
10
3
10^{-1}
1
10
10^2
NI_0 (AT ⎓)


7Z67652
FXC 3D3
f = 4 kHz
B̂ = 0,1 mT
θ = 25 °C
LI_0^2 (HA^2)
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
1
10
10^2
NI_0 (AT ⎓)
Δ = 300 μm
150
80
40
20
10
3


7Z67653
FXC 4C6
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI₀²
(H A²)
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
Δ = 300 μm
150
80
40
20
3
10⁻¹
1
10
10²
NI₀ (AT ⎓)


7Z67651
FXC 3E4
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI_0^2 (HA^2)
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
1
10
10^2
NI_0 (AT ⎓)
Δ = 300 µm
150
80
40
20
10
3

Ferroxcube transformer cores

GENERAL

INTRODUCTION

Although potcores can often be used with much success for transformers, there are a number of specific core shapes available, such as E-, EC-, X-, H-cores and toroids, ← which have especially been designed for this purpose. For a short description of these shapes the relevant sections should be consulted.

At higher frequencies they are superior to dust or laminated cores because of the low eddy current losses and higher permeability of Ferroxcube.

The high permeability of Ferroxcube makes it suitable for low frequencies as well, especially H-cores and toroids in the 3E2 and 3E3 grades, which have a μ_i value of > 5000 and $> 10\,000$ respectively.

At frequencies of 10 kHz or higher EC-cores and E-cores in the 3C8 grade are very ← suitable for power applications, e.g. in switched-mode power supplies and coupling transformers in power amplifiers. The maximum operation frequency depends on the mode of operation.

DETERMINING THE A_L- AND μ_e- VALUE

The A_L- or α-factor of transformer cores is determined with the following number of turns:

core type	number of turns	wire diam. (mm)	catalog number of measuring coil
E20	60	0,30	3U71065/14
E30	50	0,30	3U71065/15
E42	35	0,50	3U71065/16
E55	25	1,2	3U71065/3
E65	35	1,0	3U71065/10
X22	175	0,40 ortho-	7622 301 04011
X30	175	0,70 cyclic	7622 301 04111
X35	251	0,70 wound	7622 301 04211
H10	20 (one layer)	0,20	–

From the measured value of L, A_L and α can be calculated using the following formulas:

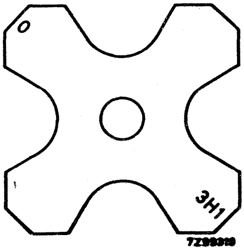
$$L = N^2 A_L \text{ and } \alpha = \frac{10^3}{\sqrt{A_L}} \quad \text{(L in nH)}$$

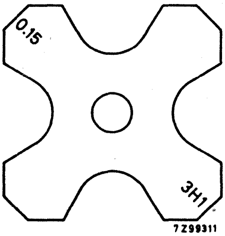
and the value of μ_e from

$$L = \frac{0,4\,\pi\, N^2 .\, \mu_e .\, 10^{-5}}{\Sigma \frac{l_e}{A_e}} \quad \text{(L in mH)}$$

$\Sigma \frac{l_e}{A_e}$ can be found in the pages relevant to the transformer cores.

MARKING

type	type designation	example	position of marking
E cores without airgap length > 26 mm	E and dimensions material date manufacturer	E 42/21/15 3E1 B7A	on half of the backface E42/21/15 3E1 B7A
length < 26 mm	material	3E1	on half of the backface 3E1
	E and dimensions date manufacturer	E 20/10/5 B7A	on the primary pack
E cores with airgap length > 26 mm	E and dimensions material airgap	E 42/21/15 3E1 0.9	on half of the backface E42/21/15 3E1 0.9
	date manufacturer	B7A	on the primary pack
length < 26 mm	material, airgap	3E1 0.05	on the backface 3E1 0.05
	E and dimensions date manufacturer	E 20/10/5 B7A	on the primary pack
cross cores without airgap	material zero (0)	3H1 0	on the back of two opposite legs 
	catalogue number date manufacturer	4322 020 23752 B7A	on the primary pack

type	type designation	example	position of marking
cross cores with airgap	material airgap	3H1 0, 15	on the back of two opposite legs 
	catalogue number date manufacturer	4322 020 23982 B7A	on the primary pack

→ Note - EC-cores are not marked.

MOUNTING DATA

Special tools have been designed for bending the lips of the containers of X and H-cores. We do not supply these tools, but we are prepared to provide drawings of them on request.

Catalogue numbers of the tools are:

for X22	4322 058 00080
X30	4322 058 00090
X35	4322 058 00100
H10	4322 058 00120

See also the remarks with regard to the mounting parts in the pages relevant to the transformer cores.

E- and I- cores

INTRODUCTION

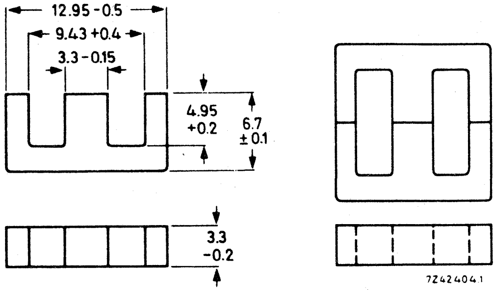
The Ferroxcube E and I-cores are typical transformer cores. They can be used from voice frequencies up to some MHz.
In comparison with conventional laminated iron cores a much higher frequency can be chosen, as a result of the very low eddy current losses of the Ferroxcube. This means that the dimensions can be smaller compared with conventional cores.

The hysteresis losses, and consequently the third harmonic distortion of Ferroxcube cores are lower than that of other materials.
For the low induction applications an additional advantage of Ferroxcube E and I-cores is, that the initial permeability remains constant over a very large frequency range.

Ferroxcube E-cores in the 3C8 grade are also very suitable for power applications at frequencies of 10 kHz to approx. 100 kHz.

E-CORE

Dimensions in mm



Weight	approx. 0, 83 g
Ferroxcube grade	3H1
Catalogue number of E-core	4322 020 34510

SHELL TYPE TRANSFORMER EE13/13/3

A transformer core can be built up by combining an even number of E-cores.
A shape that is often chosen is the shell type transformer EE13/13/3 composed of two cores type E13/7/3.

Effective parameters for a pair of cores

Effective magnetic path length	$l_e = 31,4$ mm
Effective cross-sectional area	$A_e = 10,1$ mm^2
Core constant	$C_1 (= \Sigma \frac{l_e}{A_e}) = 3,09$ mm^{-1}
Effective core volume	$V_e = 318$ mm^3

Magnetic properties at 25 ± 10 °C

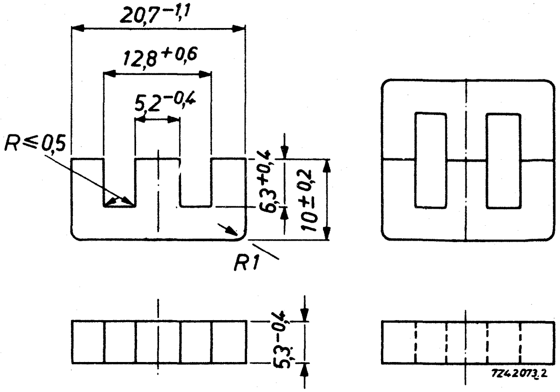
For the combination of two E-cores randomly chosen from a batch and pressed together with a force of 30 N, the values given below are guaranteed.

	μ_e	≥ 1390
	A_L	≥ 566
	α	≤ 42, 1
At f = 4 kHz and $\hat{B}$ between 1, 5 and 3 mT	$\eta_B \times 10^3$	≤ 1, 1 T^{-1}

Note - Number of turns for LmH: $N = \alpha \sqrt{L}$

E-CORES

DIMENSIONS AND WEIGHT



The dimensions are according to D.I.N. 41295.

Weight	approx. 4 g

VERSIONS

Ferroxcube grade	3E1	3C6
Catalogue number of E-core	4322 020 34830	4312 020 34070
Catalogue number of E-core with air gap 0,15 ± 0,015 mm	4322 020 34550	

SHELL TYPE TRANSFORMER EE20/20/5

A transformer core can be built up by combining an even number of E-cores.
A shape that is often chosen is the shell type transformer EE20/20/5 composed of two cores type E20/10/5.

Effective parameters for a pair of cores

Effective magnetic path length	$l_e = 42,8$ mm
Effective cross-sectional area	$A_e = 31,2$ mm^2
Core constant	$C_1\ (= \Sigma \frac{l_e}{A_e}) = 1,37$ mm^{-1}
Effective core volume	$V_e = 1340$ mm^3

Magnetic properties

For the combination of two E-cores randomly chosen from a batch and pressed together with a force of 55 N, the values given below are guaranteed.

Magnetic properties at 25 ± 10 °C for grade 3E1; $\Delta = 0$

	$\mu_e = 2100\text{-}3155$ *)
	$A_L = 1920\text{-}2890$
At f = 4 kHz and $\hat{B}$ between 1,5 and 3 mT	$\eta_B \times 10^3 \leq 1,8\ T^{-1}$
At f = 4 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6 \leq 2,5$
At f = 100 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6 \leq 20$
At f = 500 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6 \leq 200$

→ Magnetic properties for grade 3C6; $\Delta = 0$

At f = 16 kHz, $\hat{B} = 200$ mT and	
$\theta = 25$ °C	$P \leq 0,3$ W
$\theta = 100$ °C	$P \leq 0,25$ W
At f = 16 kHz, $\hat{B} \geq 275$ mT and $\theta = 100$ °C	$\hat{H} = 250$ A/m

Note - Number of turns for LmH: $N = \alpha\sqrt{L}$

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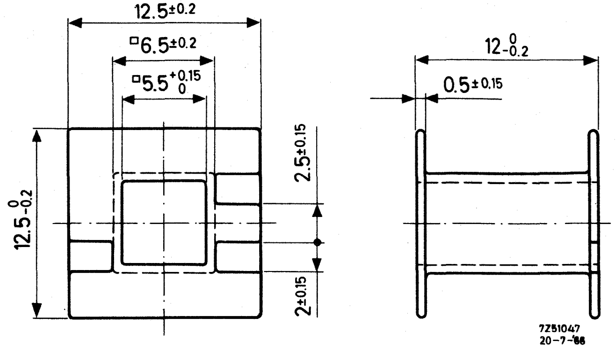
*) In the temperature range +23 to +70 °C $\mu_e \geq 2100$.

COIL FORMERS

for shell type transformer EE20/20/5 (M20)



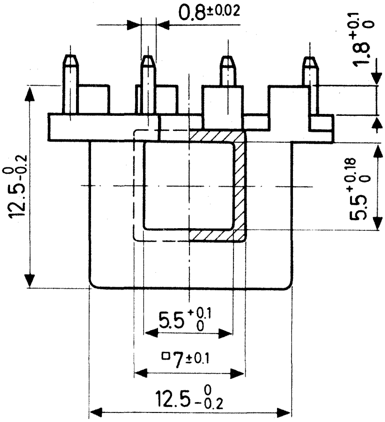
catalogue number	4312 021 28431
material	polycarbonate
minimum window area in mm^2	27
mean length of turn in mm	38
approximate weight in g	0, 5
maximum temperature in ^{o}C	130

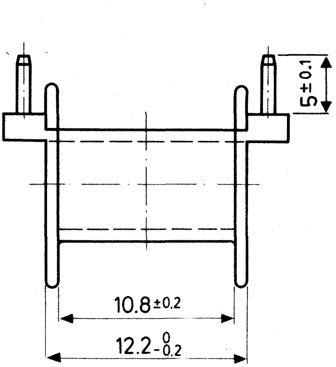
The dimensions are practically according to German specification D. I. N. 41305.

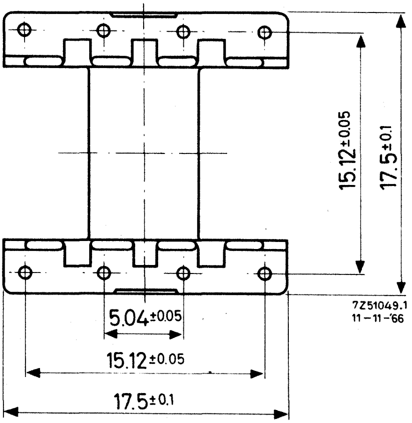
E20/10/5
(E20)

COIL FORMERS
for shell type transformer EE20/20/5(M20)

With soldering pins.

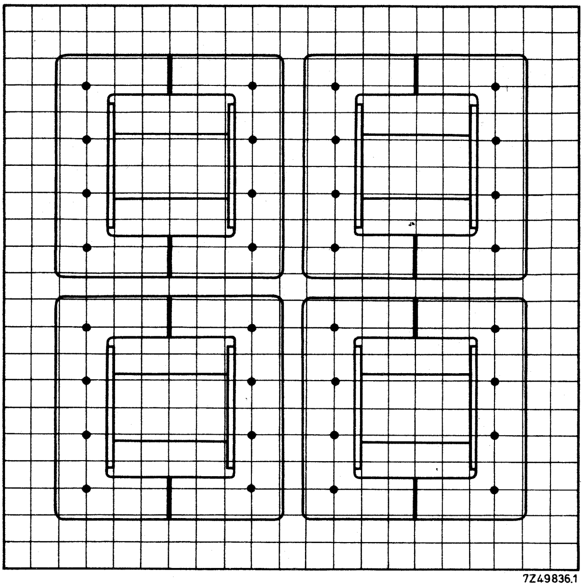






catalogue number	4322 021 20240
material	phenolformaldehyde reinforced with glass fibre ; brass dipsolder pins
minimum window area in mm^2	27
mean length of turn in mm	38
approximate weight in g	
maximum temperature for dipsoldering during 5-6 s in °C	280
maximum working temperature in °C	130

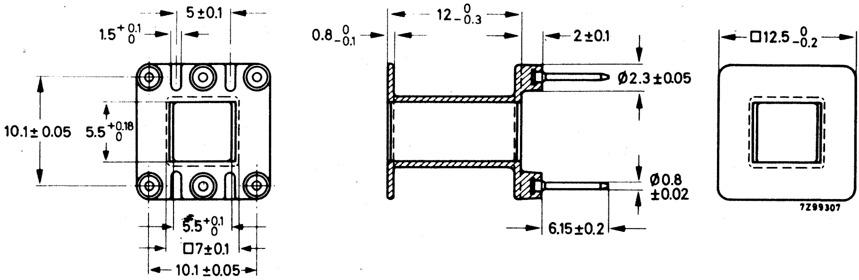
The coil former fits a shell type transformer EE20/20/5(M20). The soldering pins are so arranged as to fit a grid of 2,52 mm. They will fit printed-wiring boards with 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1,3 ± 0,1 mm diameter.



E20/10/5
(E20)

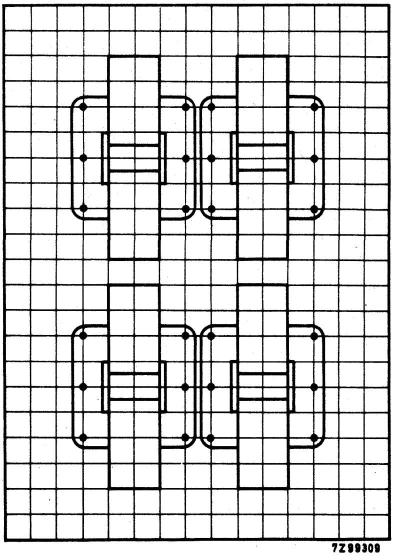
COIL FORMERS
for shell type transformer EE20/20/5(M20)

With soldering pins.

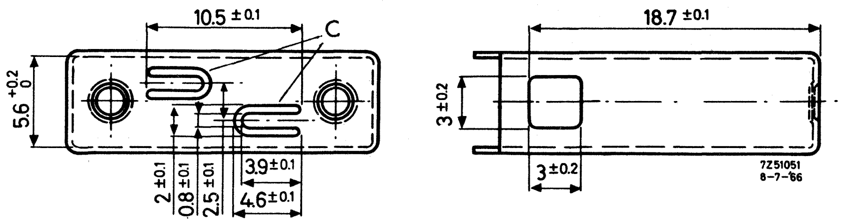


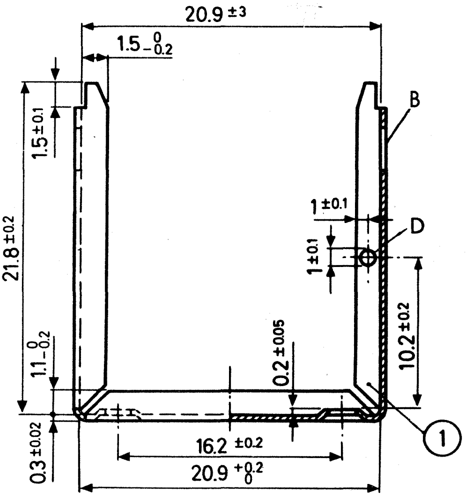
catalogue number	4322 021 20140
material	phenolformaldehyde reinforced with glass fibre ; brass dipsolder pins
minimum window area in mm^2	27
mean length of turn in mm	38
approximate weight in g	
maximum temperature for dipsoldering during 5-6 s in °C	280
maximum working temperature in °C	130

The coil former fits a shell type transformer EE20/20/5(M20). The soldering pins are so arranged as to fit a grid of 2.52 mm. They will fit printed-wiring boards with 0.1 in grid as well as those with a 2.50 mm grid. The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1.3 ± 0.1 mm diameter.

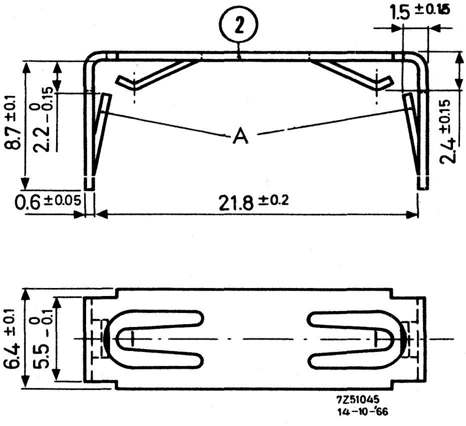


MOUNTING PARTS





(1). Clasp 4322 021 20160
Material: brass, tin-plated



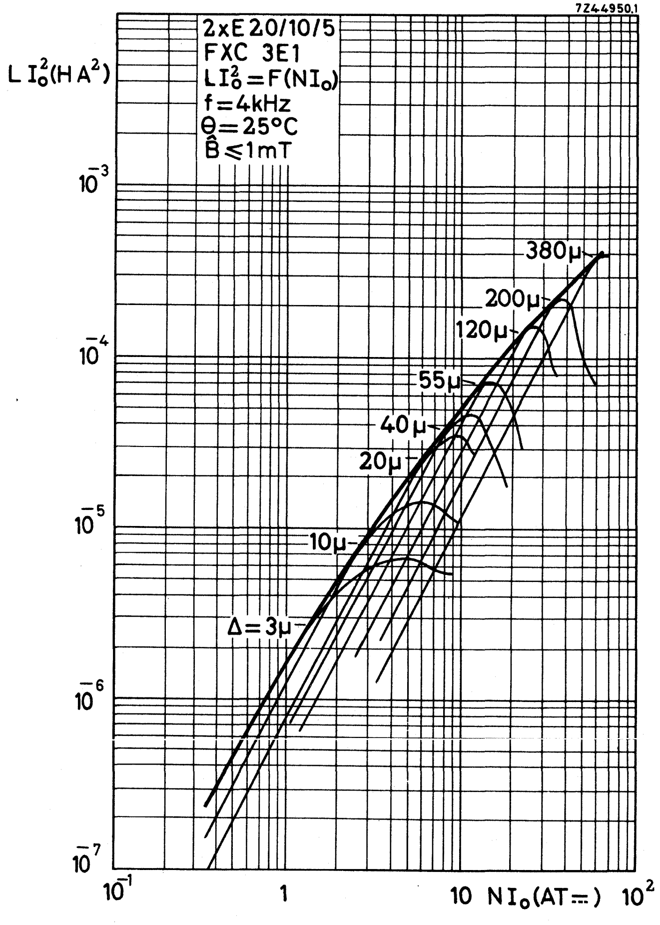
(2). Spring 4322 021 20220
Material: phosphorbronze, tin-plated

The construction is mounted by pushing the spring over the clasp in such a way that the lips A of the spring catch in the square holes B of the clasp. The mechanical pressure, required to keep the two E-cores together is exercised by means of two lips on top of the spring. No special tool is required for mounting the construction.

The construction can be used in horizontal and vertical position.
If the construction is used in vertical position, the lips C of the clasp must be bent. The dimensions and mutual distance of these lips are chosen in such a way that they fit printed-wiring boards with a grid of 0.1" as well as those with a grid of 2.50 mm.
If used in a horizontal position the clasp can be earthed by means of a copper wire soldered in hole D.

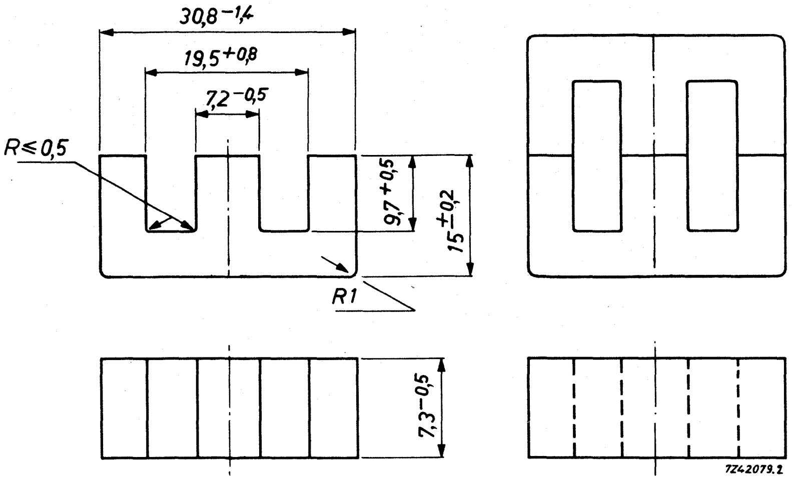
CHARACTERISTIC CURVES

HANNA CURVES (typical values)
Indicating optimum inductance for a certain airgap and direct current.



E-CORES

DIMENSIONS AND WEIGHT



The dimensions are according to D.I.N. 41295.

Weight	approx. 11 g

VERSIONS

Ferroxcube grade	3E1
Catalogue number of E-core	4322 020 34840
Catalogue number of E-core	
with air gap 0,15 ± 0,015	4322 020 34650
with air gap 0,30 ± 0,015	4322 020 34660

SHELL TYPE TRANSFORMER EE30/30/7

A transformer core can be built up by combining an even number of E-cores.
A shape that is often chosen is the shell type transformer EE30/30/7 composed of two cores type E30/15/7.

Effective parameters for a pair of cores

Effective magnetic path length	$l_e = 66,9$ mm
Effective cross-sectional area	$A_e = 59,7$ mm^2
Core constant	$C_1 \left(= \Sigma \frac{l_e}{A_e}\right) = 1,12$ mm^{-1}
Effective core volume	$V_e = 4000$ mm^3

Magnetic properties at 25 ± 10 ^{o}C; $\Delta = 0$

For the combination of two E-cores randomly chosen from a batch and pressed together with a force of 110 N, the values given below are guaranteed.

	μ_e	= 2375-3565*)
	A_L	= 2660-4000
At 4 kHz and $\hat{B}$ between 1,5 and 3 mT	$\eta_B \times 10^3$	$\leq$ 1,8 T^{-1}
At 4 kHz and $\hat{B} \leq$ 0,1 mT	$\frac{\tan\delta}{\mu_i} \times 10^6$	$\leq$ 2,5
At 100 kHz and $\hat{B} \leq$ 0,1 mT	$\frac{\tan\delta}{\mu_i} \times 10^6$	$\leq$ 20
At 500 kHz and $\hat{B} \leq$ 0,1 mT	$\frac{\tan\delta}{\mu_i} \times 10^6$	$\leq$ 200

Note - Number of turns for LmH: $N = \alpha\sqrt{L}$

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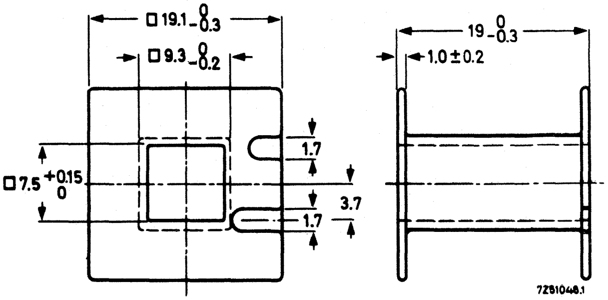
*) In the temperature range + 23 to + 70 ^{o}C $\mu_e \geq 2375$.

COIL FORMERS

for shell type transformer EE30/30/7 (M30)



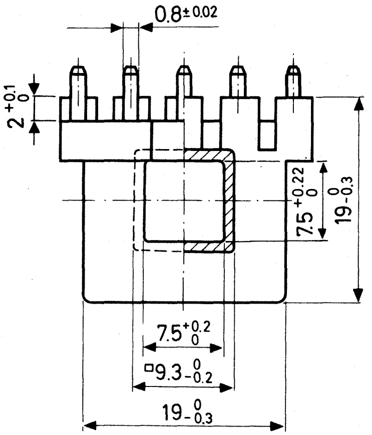
catalogue number	4312 021 28550
material	polycarbonate
minimum window area in mm^2	80
mean length of turn in mm	56
approximate weight in g	1, 3
maximum temperature in ^{o}C	130

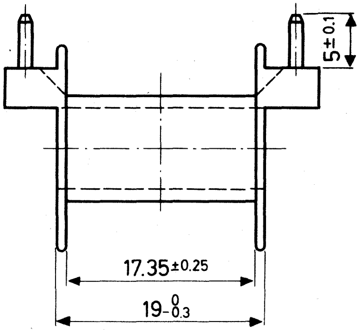
The dimensions are practically according to German specification D.I.N. 41305.

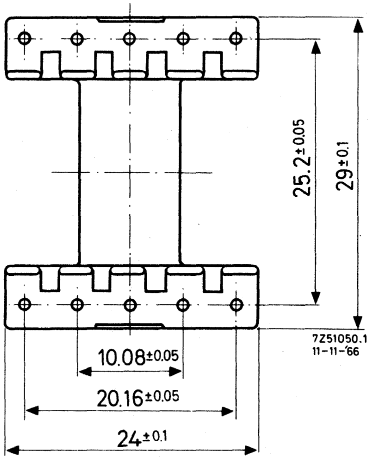
E30/15/7
(E30)

COIL FORMERS
for shell type transformer EE30/30/7(M30)

With soldering pins.

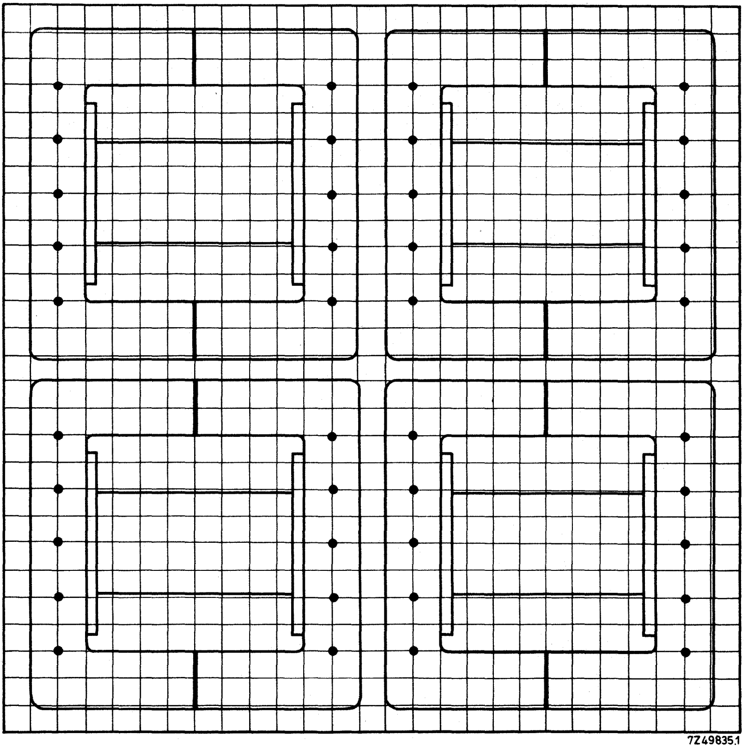




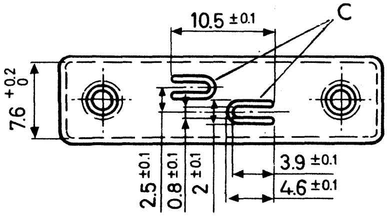


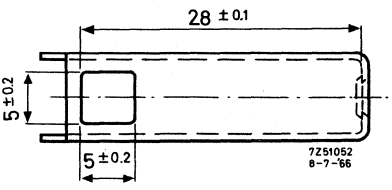
catalogue number	4322 021 20250
material	phenolformaldehyde reinforced with glass fibre ; brass dipsolder pins
minimum window area in mm^2	80
mean length of turn in mm	56
approximate weight in g	
maximum temperature for dipsoldering during 5-6 s in ^{0}C	280
maximum working temperature in ^{0}C	130

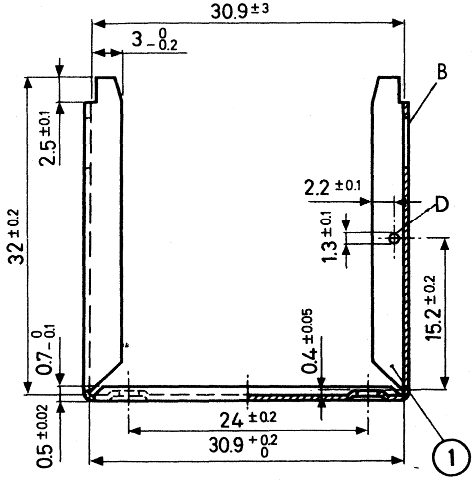
The coil former fits a shell type transformer EE30/30/7(M30). The soldering pins are so arranged as to fit a grid of 2,52 mm. They will fit printed-wiring boards with 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1,3 ± 0,1 mm diameter.



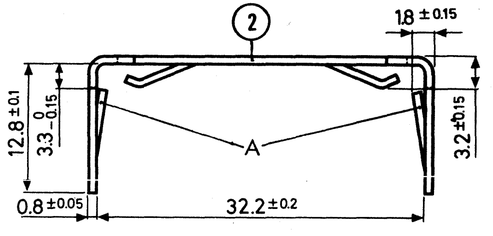
MOUNTING PARTS



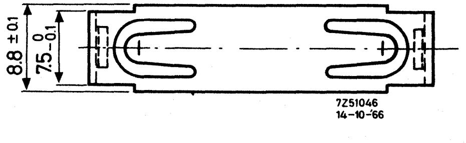




(1). Clasp 4322 021 20170
Material: brass, tin-plated



(2). Spring 4322 021 20230
Material: phosphorbronze, tin-plated



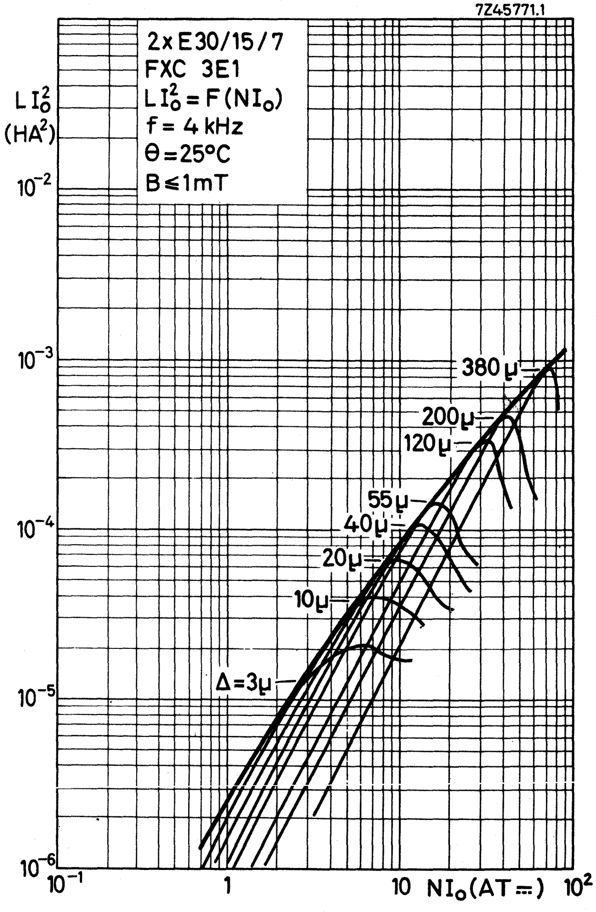
The construction is mounted by pushing the spring over the clasp in such a way that the lips A of the spring catch in the square holes B of the clasp. The mechanical pressure, required to keep the two E-cores together is exercised by means of two lips on top of the spring. No special tool is required for mounting the construction.

The construction can be used in horizontal and vertical position.
If the construction is used in vertical position, the lips C of the clasp must be bent. The dimensions and mutual distance of these lips are chosen in such a way that they fit printed-wiring boards with a grid of 0.1" as well as those with a grid of 2.50 mm.
If used in a horizontal position the clasp can be earthed by means of a copper wire soldered in hole D.

CHARACTERISTIC CURVES

HANNA CURVES (typical values)

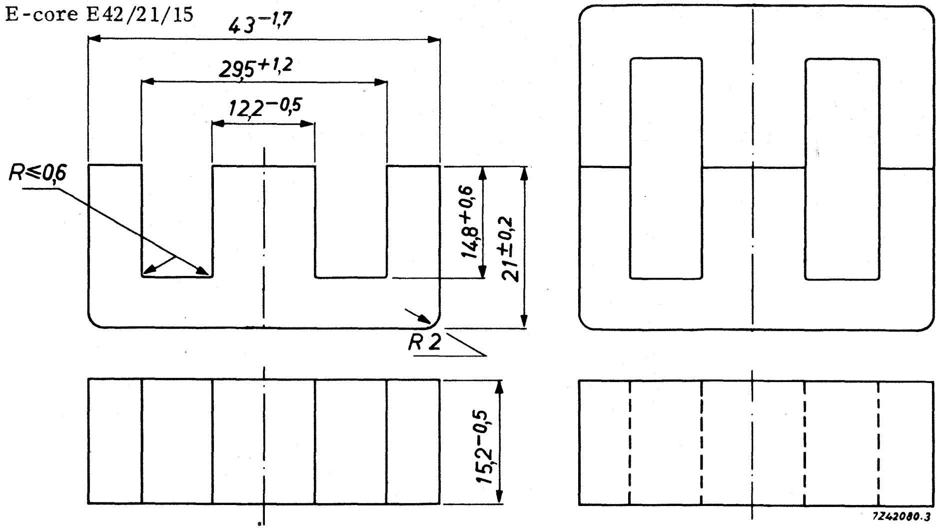
Indicating optimum inductance for a certain airgap and direct current



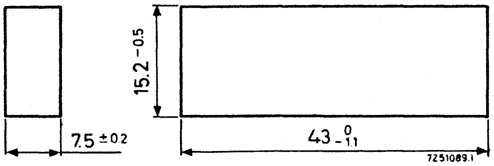
E- AND I-CORES

DIMENSIONS AND WEIGHT

E-core E42/21/15



I-core I42/7,5/15



The dimensions are according to D.I.N. 41295.

Weight approx. 42 g

VERSIONS

Ferroxcube grade	3E 1	3C8	
Catalogue number of E-core	4322 020 34850	4312 020 34110	←
Catalogue number of E-core			
with air gap 0,25 ± 0,015	4322 020 34740		←
with air gap 0,50 ± 0,015	4322 020 34750		←
Catalogue number of I-core	4322 020 37320		

SHELL TYPE TRANSFORMERS EE42/42/15 AND EI42/29/15

A transformer core can be built up by combining an even number of E-cores. A shape that is often chosen is the shell type transformer EE42/42/15 composed of two cores type E42/21/15 or the E-I combination EI42/29/15.

Effective parameters for a pair of cores

Shell type transformer		EE42/42/15	EI42/29/15
Effective magnetic path length	l_e	= 97,0 mm	67,2 mm
Effective cross-sectional area	A_e	= 182 mm^2	183 mm^2
Core constant	$C_1 (= \Sigma \frac{l_e}{A_e})$	= 0,534 mm^{-1}	0,367 mm^{-1}
Effective core volume	V_e	= 17600 mm^3	12300 mm^3

Magnetic properties

For the combination of two E-cores or one E- and one I-core randomly chosen from a batch and pressed together with a force of 280 N, the values given below are guaranteed.

Magnetic properties at 25 ± 10 °C for grade 3E1; $\Delta = 0$

	EE42/42/15	EI42/29/15
μ_e	= 2570-3855 *)	2400-3600
A_L	= 6040-9070	8210-12320

At 4 kHz and $\hat{B}$ between 1,5 and 3 mT	$\eta_B \times 10^3 \leq 1,8\ T^{-1}$
At 4 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6 \leq 2,5$
At 100 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6 \leq 20$

→ Magnetic properties for grade 3C8; $\Delta = 0$

At 16 kHz, $\hat{B}$ = 200 mT and θ = 100 °C	$P \leq 2$ W
At 16 kHz, $\hat{B} \geq 315$ mT and θ = 100 °C	$\hat{H}$ = 250 A/m
At 16 kHz, $\hat{B} \geq 90$ mT and θ = 100 °C	$\hat{H}$ = 50 A/m

Note - Number of turns for LmH: $N = \alpha \sqrt{L}$

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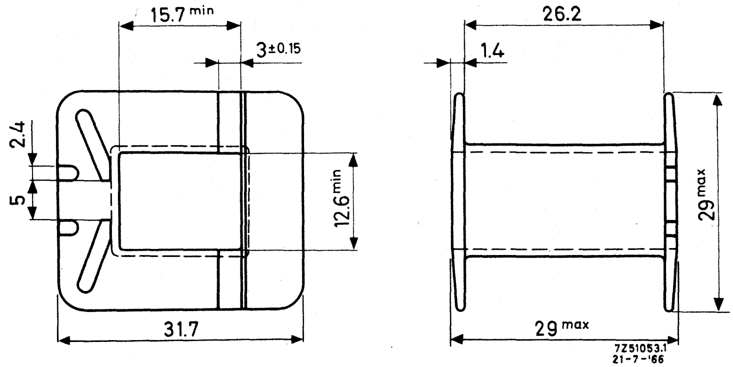
*) In the temperature range +23 to +70 °C $\mu_e \geq 2575$.

COIL FORMERS

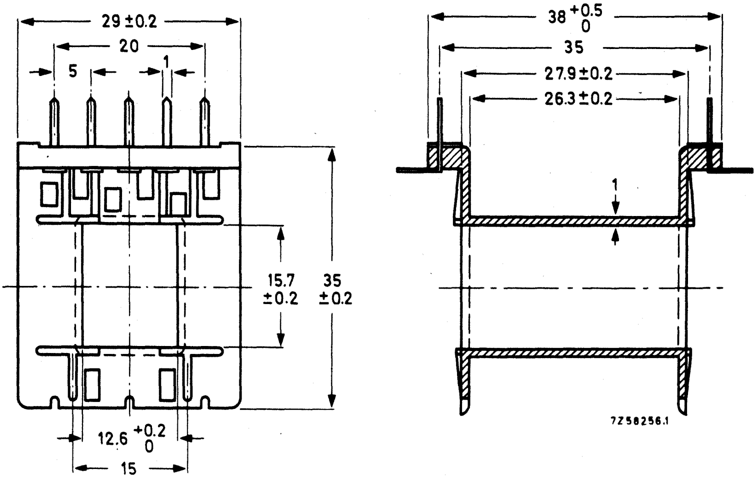
for shell type transformer EE42/42/15 (M42)

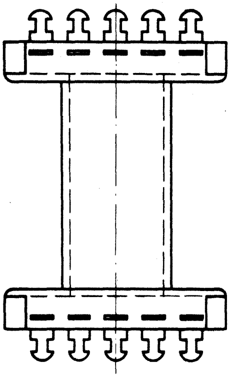


catalogue number	4312 021 28622
material	reinforced polyamide
minimum window area in mm^2	178
mean length of turn in mm	93
approximate weight in g	4
maximum temperature in ^{0}C	180

The dimensions are practically according to German specification D.I.N. 41305.

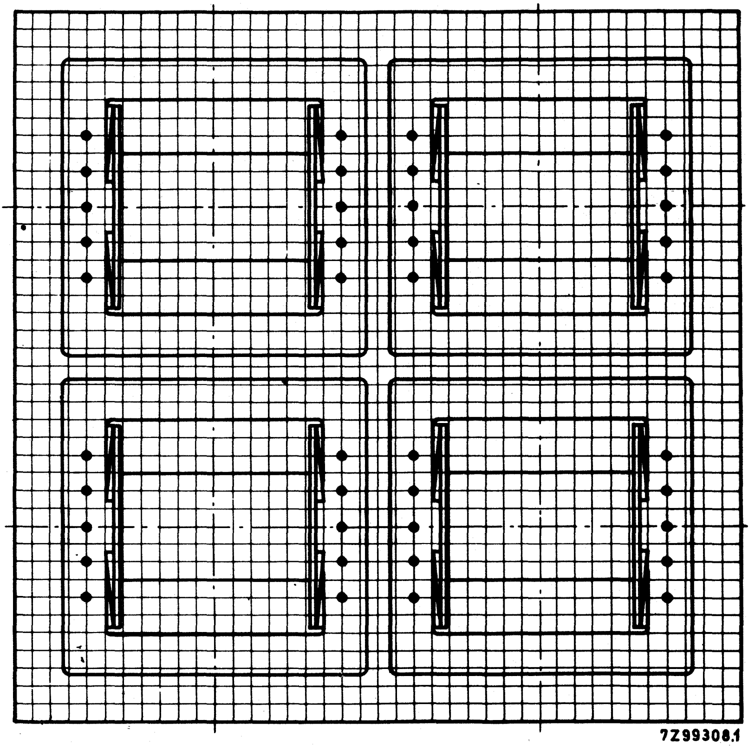
With soldering pins



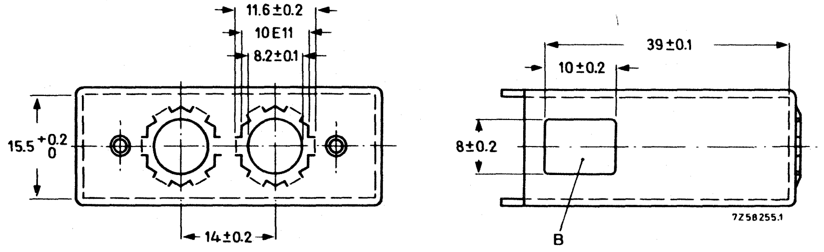


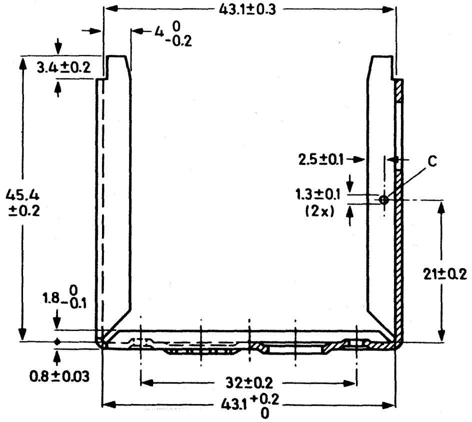
catalogue number	4322 021 31830
material	reinforced polyamide with brass dipsoldered pins
minimum window area in mm^2	178
mean length of turn in mm	93
approximate weight in g	4
maximum temperature in ^{o}C	180

The coil former fits a shell type transformer EE42/42/15(M42). The soldering pins are so arranged as to fit a grid of 2,52 mm. They will fit printed-wiring boards with 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1,3 ± 0,1 mm diameter.

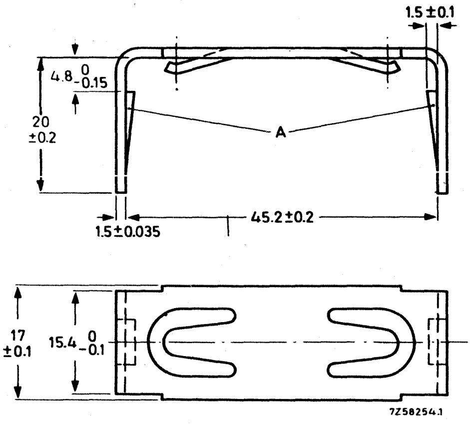


MOUNTING PARTS





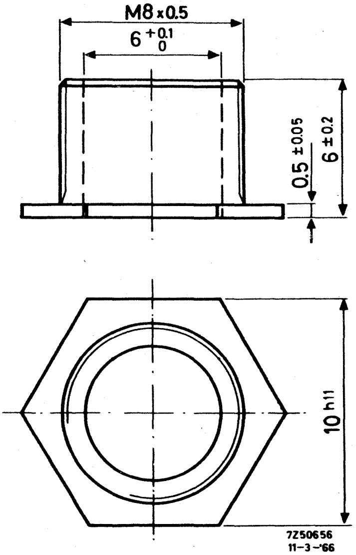
Clasp 4322 021 31910
Material: steel, copper-plated,
nickel-plated



Spring 4322 021 31920
Material: phosphorbronze,
nickel-plated

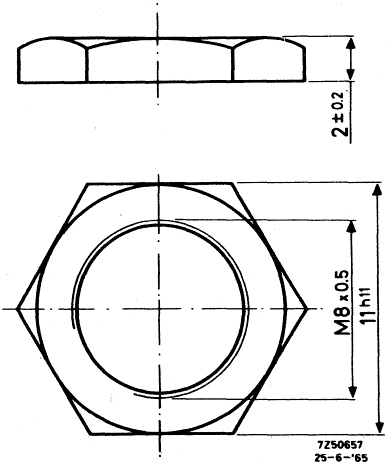
The construction is mounted by pushing the spring over the clasp in such a way that the lips A of the spring catch in the square holes B of the clasp. The mechanical pressure, required to keep the two E-cores together is exercised by means of two lips on top of the spring. No special tool is required for mounting the construction.

The construction can be used in horizontal and vertical position.
If the construction is used in vertical position, two fixing bushes 4322 021 30720 with nuts 4322 021 30710 must be applied in the holes of the clasp.
If used in a horizontal position the clasp can be earthed by means of a copper wire soldered in hole C.



Fixing bush 4322 021 30720

Material: brass, nickel plated



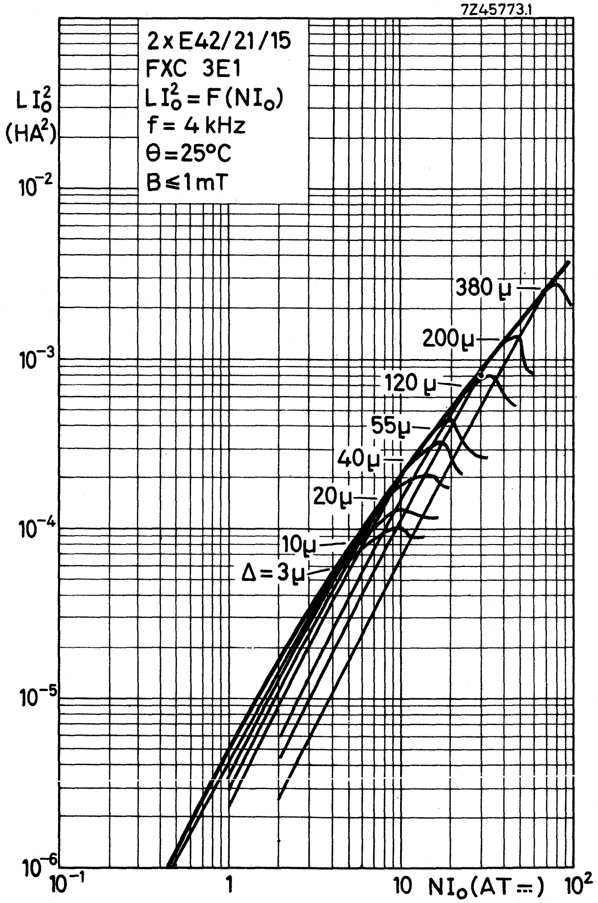
Nut 4322 021 30710

Material: brass, nickel plated

CHARACTERISTIC CURVES

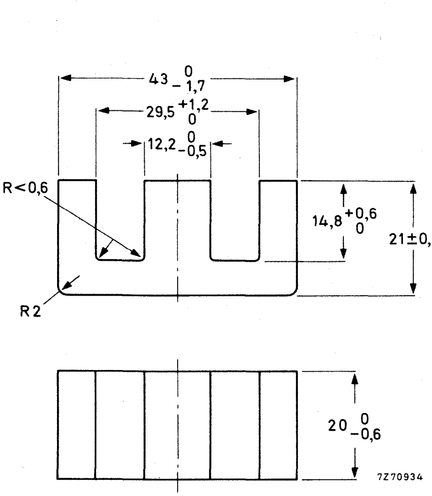
HANNA CURVES (typical values)

Indicating optimum inductance for a certain airgap and direct current

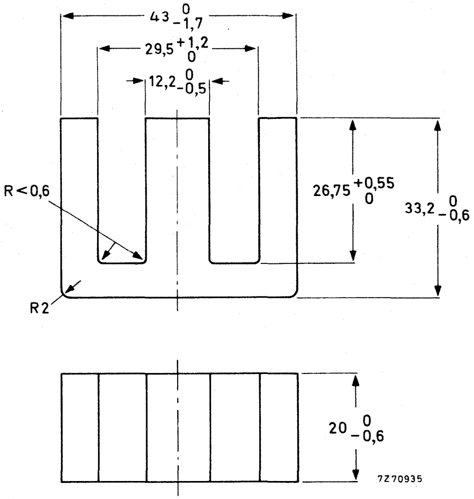


E-CORES

Dimensions in mm



E42/21/20



E42/33/20

Ferroxcube grade	3C8
Catalogue number of core E42/21/20	4312 020 34120
E42/33/20	4312 020 34190
Catalogue number of combination of cores E42/21/20 + E42/33/20	4312 020 34170

SHELL TYPE TRANSFORMERS EE42/42/20 AND EE42/54/20

A transformer core can be built up by combining an even number of E-cores.
A shape that is often chosen is the shell type transformer EE42/42/20 composed of two cores E42/21/20 and shell type transformer EE42/54/20 composed of one core E42/21/20 and one core E42/33/20.

Effective parameters for a pair of cores

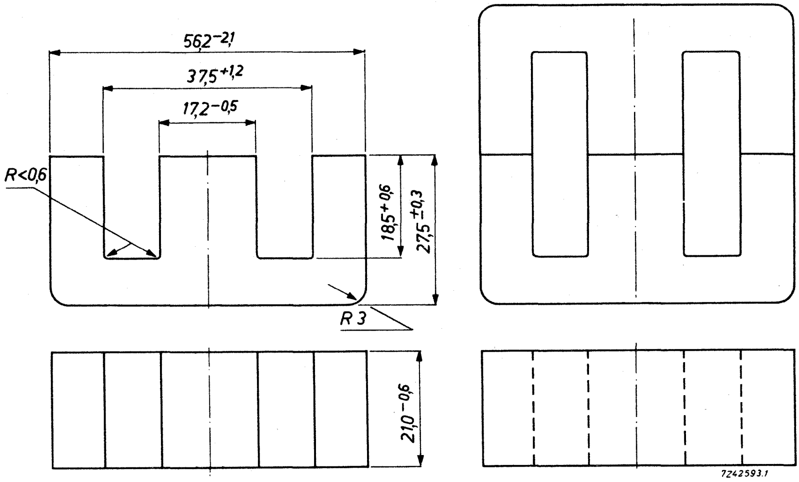
		EE42/42/20	EE42/54/20
Effective magnetic path length	l_e =	98 mm	122 mm
Effective cross-sectional area	A_e =	236 mm^2	236 mm^2
Core constant	$C_1 (= \Sigma \frac{l_e}{A_e})$ =	0,415 mm^{-1}	0,517 mm^{-1}
Effective core volume	V_e =	23100 mm^3	28800 mm^3

Magnetic properties

At f = 16 kHz, $\hat{B}$ = 200 mT, θ = 25 °C	P		≤ 3,5 W
θ = 100 °C	P	≤ 2,6 W	≤ 3,2 W
At f = 16 kHz, $\hat{B} \geq$ 90 mT, θ = 100 °C	$\hat{H}$ =	50 A/m	
$\hat{B} \geq$ 315 mT, θ = 100 °C	$\hat{H}$ =	250 A/m	250 A/m

E-CORES

DIMENSIONS AND WEIGHT



The dimensions are according to D.I.N. 41295.

Weight	approx. 115 g

VERSIONS

Ferroxcube grade	3E 1	3C8
Catalogue number of E-core	4322 020 34900	4312 020 34100

SHELL TYPE TRANSFORMER EE55/55/21

A transformer core can be built up by combining an even number of E-cores. A shape that is often chosen is the shell type transformer EE55/55/21 composed of two cores type E55/28/21.

Effective parameters for a pair of cores

Effective magnetic path length	$l_e = 123$ mm
Effective cross-sectional area	$A_e = 354$ mm^2
Core constant	$C_1 \left(= \Sigma \frac{l_e}{A_e}\right) = 0,348$ mm^{-1}
Effective core volume	$V_e = 43700$ mm^3

Magnetic properties

For the combination of two E-cores randomly chosen from a batch and pressed together with a force of 550 N, the values given below are guaranteed.

Magnetic properties at 25 ± 10 °C for grade 3E1; $\Delta = 0$

$\mu_e = 2645\text{-}3970$

$A_L = 9545\text{-}14330$

At 4 kHz and $\hat{B}$ between 1,5 and 3 mT — $\eta_B \times 10^3 \leq 2,5\ T^{-1}$

→ Magnetic properties for grade 3C8; $\Delta = 0$

At 16 kHz, $\hat{B} = 200$ mT and $\theta = 25$ °C — $P \leq 5,5$ W

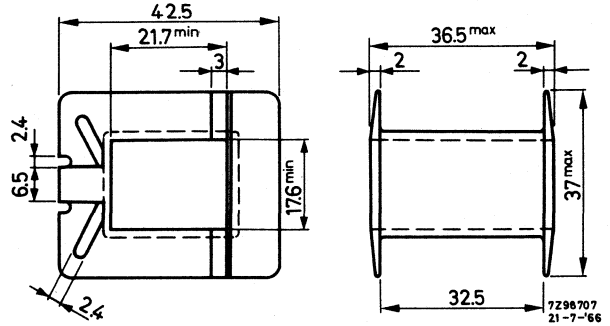
$\theta = 100$ °C — $P \leq 5,0$ W

At 16 kHz, $\hat{B} \geq 315$ mT and $\theta = 100$ °C — $\hat{H} = 250$ A/m

Note - Number of turns for LmH: $N = \alpha \sqrt{L}$

COIL FORMER

for shell type transformer EE55/55/21



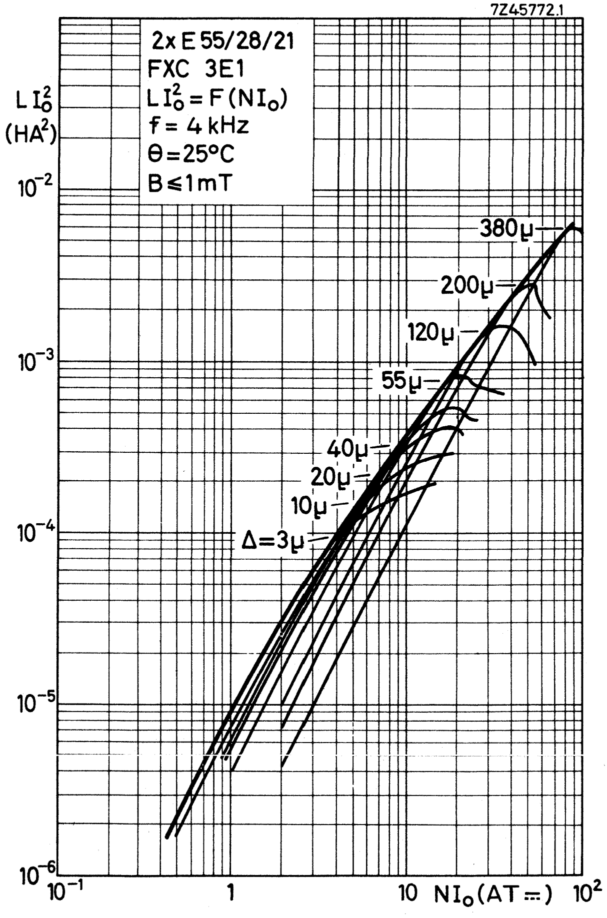
catalogue number	4312 021 28711
material	reinforced polyamide
minimum window area in mm^2	250
mean length of turn in mm	116
approximate weight in g	9
maximum temperature in $^{\circ}$C	180

The dimensions are according to German specification D.I.N. 41305.

CHARACTERISTIC CURVES

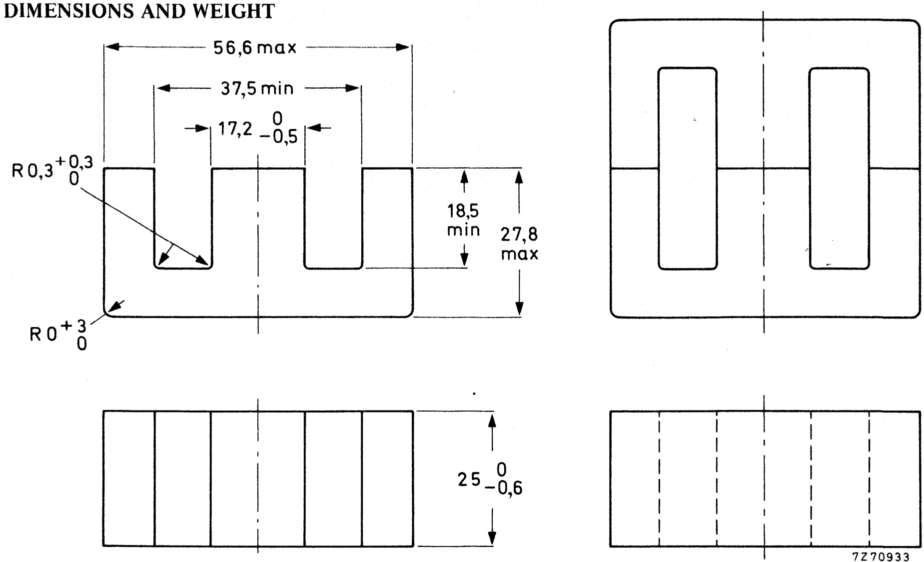
HANNA CURVES (typical values)

Indicating optimum inductance for a certain airgap and direct current



E-CORE

DIMENSIONS AND WEIGHT



Weight	approx. 130 g

VERSIONS

Ferroxcube grade	3C8
Catalogue number of E-core	3122 134 90210
Catalogue number of E-core with air gap 1, 4 mm	3122 134 90940

SHELL TYPE TRANSFORMER EE55/55/25

A transformer core can be built up by combining an even number of E-cores.
A shape that is often chosen is the shell type transformer EE55/55/25 composed of two cores type EE55/28/25.

Effective parameters for a pair of cores

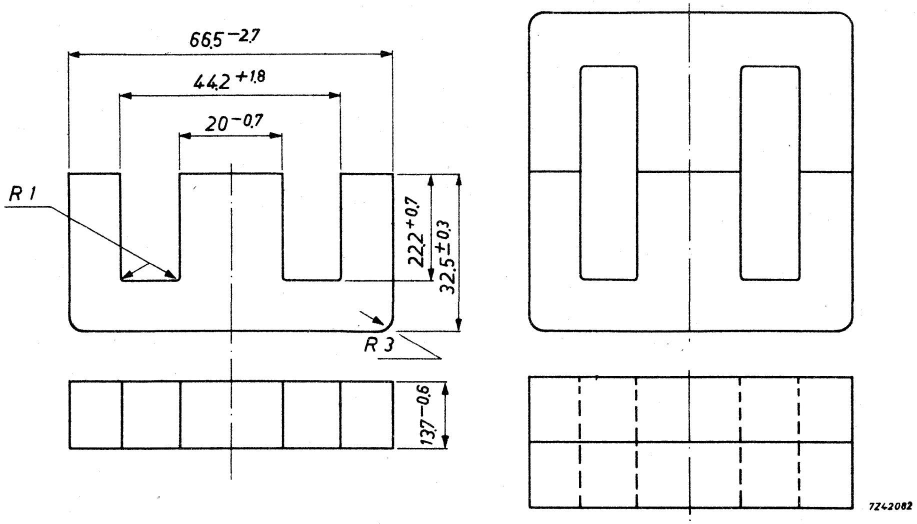
Effective magnetic path length	l_e = 123 mm
Effective cross-sectional area	A_e = 420 mm^2
Core constant	C_1 (= $\Sigma \frac{l_e}{A_e}$) = 0,293 mm^{-1}
Effective core volume	V_e = 52000 mm^3

Magnetic properties; $\Delta = 0$

At f = 16 kHz, $\hat{B}$ = 200 mT, θ = 25 °C	P ≤ 6, 2 W
θ = 100 °C	P ≤ 5, 7 W
At f = 16 kHz, $\hat{B}$ ≥ 315 mT, θ = 100 °C	$\hat{H}$ = 250 A/m

E-CORE

DIMENSIONS AND WEIGHT



The dimensions are according to D.I.N. 41295.

Weight	approx. 76 g

VERSIONS

Ferroxcube grade	3E 1
Catalogue number of E-core	4322 020 34910

SHELL TYPE TRANSFORMER 65/65/27

A transformer core can be built up by combining an even number of E-cores.
A shape that is often chosen is the shell type transformer 65/65/27 composed of four cores type E65/32/13.

Effective parameters for a pair of cores

Effective magnetic path length	l_e = 147 mm
Effective cross-sectional area	A_e = 532 mm^2
Core constant	C_1 (= $\Sigma \frac{l_e}{A_e}$) = 0,275 mm^{-1}
Effective core volume	V_e = 78200 mm^3

Magnetic properties at 25 ± 10 °C; $\Delta = 0$

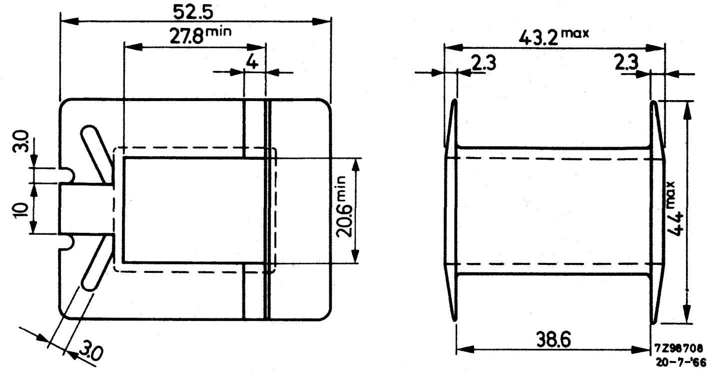
For the combination of four E-cores randomly chosen from a batch and pressed together with a force of 400 N, the values given below are guaranteed.

	μ_e = 2705-4060
	A_L = 12355-18545
At 4 kHz and $\hat{B}$ between 1,5 and 3 mT	$\eta_B \times 10^3 \leq 4,3\ T^{-1}$

Note - Number of turns for LmH: $N = \alpha \sqrt{L}$

COIL FORMER

for shell type transformer 65/65/27 (M65)



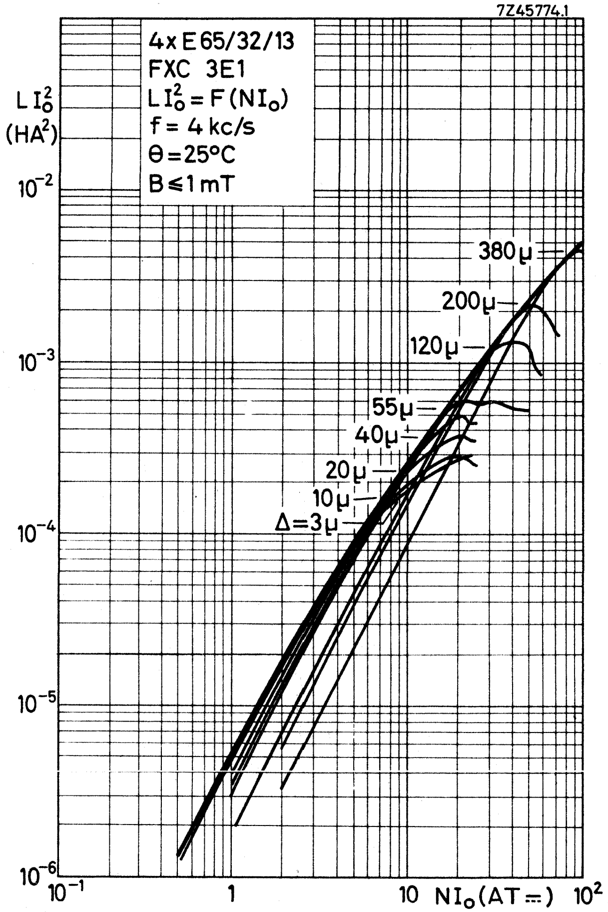
catalogue number	4312 021 28721
material	reinforced polyamide
minimum window area in mm^2	394
mean length of turn in mm	150
approximate weight in g	13
maximum temperature in °C	180

The dimensions are according to German specification D.I.N. 41305.

CHARACTERISTIC CURVES

HANNA CURVES (typical values)

Indicating optimum inductance for a certain airgap and direct current



EC-cores

INTRODUCTION

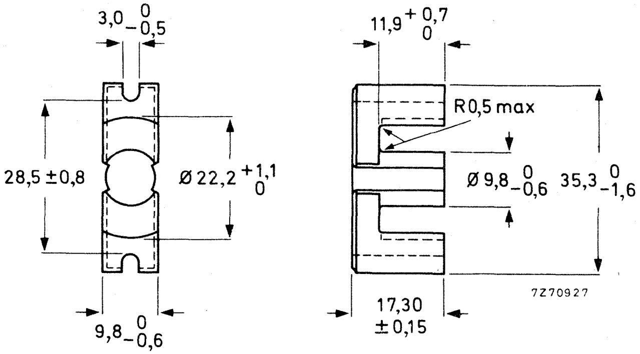
Ferroxcube EC-cores are specially designed to meet the stringent demands placed on power supply transformers (e.g. switched mode power supplies) operating at 10 kHz or higher. At these high frequencies the eddy current losses in the Ferroxcube are very low due to its high resistivity and the permeability of the Ferroxcube is still the same as at low frequencies. In general, therefore, this means a much smaller transformer can be designed than with laminated iron cores.

EC-cores are supplied in the 3C8 manganese zinc ferrite grade, which meets the main magnetic requirements for power transformer cores, namely:
- high maximum flux density (B) and high relative amplitude permeability (μ_a)
- high resistivity (ρ) to ensure low eddy current losses
- high Curie point, so that magnetic properties are retained at high temperature (up to 200 °C)
- in the operating temperature range (up to 100 °C), losses drop with increasing temperature.

Note - The E-cores E42/21/20, E42/33/20 and E55/28/25 are also suited for use in power supplies. For data on these cores, see the preceding section.

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Weight	approx. 18 g
Catalogue number for ordering	4322 020 52500

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *)	C_1	= 0,918 mm^{-1}
Minimum cross-sectional centre pole area	A_{CPmin}	= 66,5 mm^2
Cross-sectional centre pole area	A_{CP}	= 71,0 mm^2
Back and leg cross-sectional area	A_b	= 96,0 mm^2
Centre pole volume	V_{CP}	= 1740 mm^3
Back and leg volume	V_b	= 6040 mm^3
Total core volume	V_f	= 7780 mm^3
Effective magnetic path length *)	l_e	= 77,4 mm
Effective cross-sectional area *)	A_e	= 84,3 mm^2
Effective core volume *)	V_e	= 6530 mm^3

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*) According to IEC 205

MAGNETIC PROPERTIES FOR A PAIR OF CORES

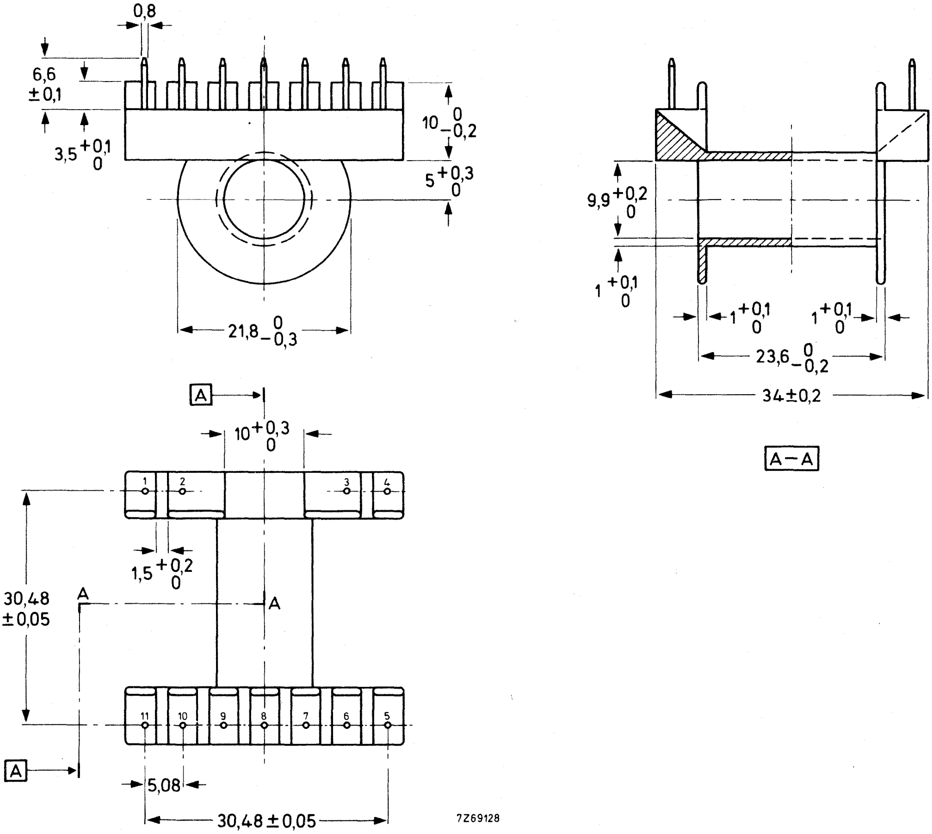
Relative amplitude permeability (μ_a) at θ = 100 °C, B = 320 mT	> 1000
Permissible induction in centre pole ($\hat{B}$) with min. cross-sectional area, at θ = 100 °C	≤ 320 mT
Resistivity (ρ), measured with d.c. current	≥ 1 Ωm
Curie point	≥ 200 °C
Effective total core loss (P) at f = 25 kHz, θ = 100 °C, B = 160 mT	≤ 1,1 W

MOUNTING

The cores may be mounted by means of M2 screws or studs through the slots provided in the cores.

COIL FORMER

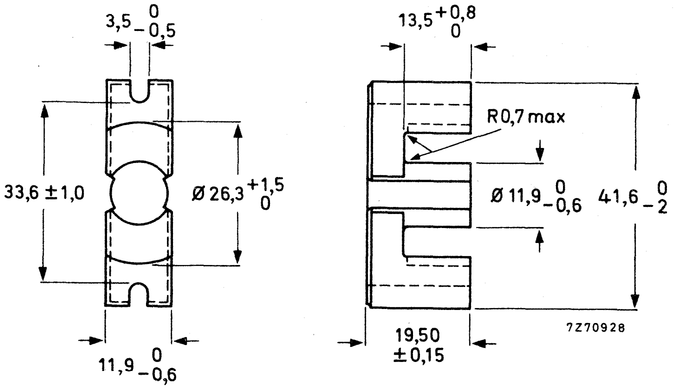
Dimensions in mm



Material	phenolformaldehyde reinforced with glass fibre; brass dipsolder pins
Mean length of turn	50 mm
Weight	approx. 6 g
Maximum temperature	140 °C
Catalogue number for ordering	8222 294 38650

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Weight	approx. 26 g
Catalogue number for ordering	4322 020 52510

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *)	C_1	$= 0{,}735\ \text{mm}^{-1}$
Minimum cross-sectional centre pole area	A_{CPmin}	$= 100{,}3\ \text{mm}^2$
Cross-sectional centre pole area	A_{CP}	$= 106\ \text{mm}^2$
Back and leg cross-sectional area	A_b	$= 130\ \text{mm}^2$
Centre pole volume	V_{CP}	$= 2950\ \text{mm}^3$
Back and leg volume	V_b	$= 9650\ \text{mm}^3$
Total core volume	V_f	$= 12600\ \text{mm}^3$
Effective magnetic path length *)	l_e	$= 89{,}3\ \text{mm}$
Effective cross-sectional area *)	A_e	$= 121\ \text{mm}^2$
Effective core volume *)	V_e	$= 10800\ \text{mm}^3$

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*) According to IEC 205

MAGNETIC PROPERTIES FOR A PAIR OF CORES

Relative amplitude permeability (μ_a) at θ = 100 °C, B = 320 mT	> 1000
Permissible induction in centre pole ($\hat{B}$) with min. cross-sectional area, at θ = 100 °C	≤ 320 mT
Resistivity (ρ), measured with d.c. current	≥ 1 Ωm
Curie point	≥ 200 °C
Effective total core loss (P) at f = 25 kHz, θ = 100 °C, B = 160 mT	≤ 2,2 W

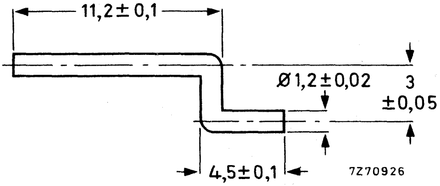
MOUNTING

The cores may be mounted by means of M2,5 screws or studs through the slots provided in the cores.

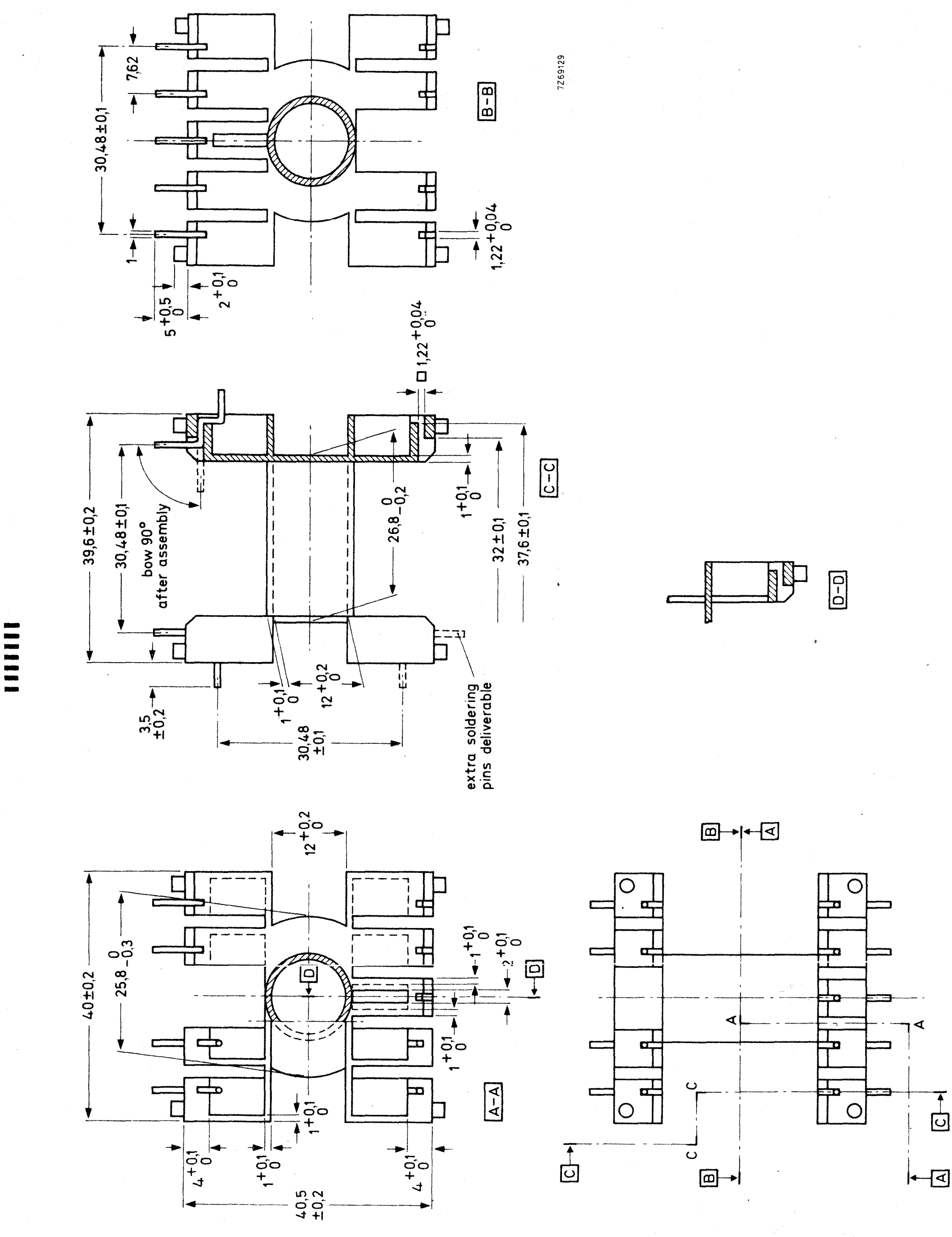
COIL FORMER

Dimensions in mm	see drawing on the next page
Material	phenolformaldehyde reinforced with glass fibre
Mean length of turn	60 mm
Weight, without pins	approx. 10 g
Maximum temperature	120 °C
Catalogue number for ordering	8222 294 38660

Note - The coil former is supplied without pins, These must be ordered separately under the catalogue number 8222 294 38770. The minimum order quantity is 5000 pins.

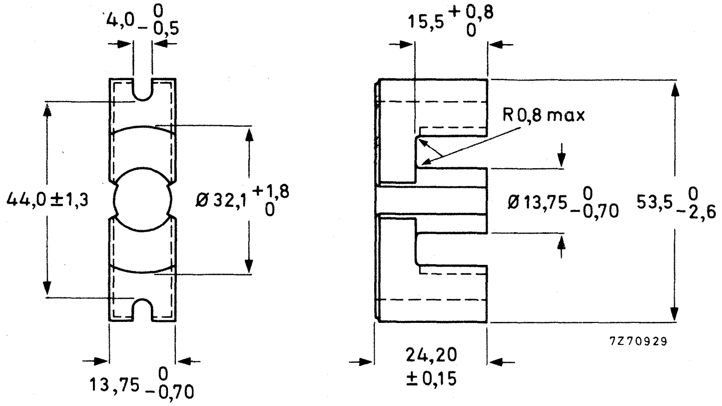


Brass dipsolder pin


7Z69129
B-B
7,62
30,48±0,1
1
5 +0,5 0
2 +0,1 0
1,22 +0,04 0
□ 1,22 +0,04 0
C-C
39,6±0,2
30,48±0,1
bow 90° after assembly
26,8 0 −0,2
1 +0,1 0
32±0,1
37,6±0,1
3,5 ±0,2
1 +0,1 0
12 +0,2 0
30,48 ±0,1
extra soldering pins deliverable
D-D
A-A
12 +0,2 0
40±0,2
25,8 0 −0,3
D
1 +0,1 0
2 +0,1 0
1 +0,1 0
1 +0,1 0
4 +0,1 0
1 +0,1 0
4 +0,1 0
40,5 ±0,2
B
A
C

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Weight	approx. 55,5 g
Catalogue number for ordering	4322 020 52520

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *)	C_1	= 0,581 mm^{-1}
Minimum cross-sectional centre pole area	A_{CPmin}	= 133,8 mm^2
Cross-sectional centre pole area	A_{CP}	= 141,0 mm^2
Back and leg cross-sectional area	A_b	= 222,0 mm^2
Centre pole volume	V_{CP}	= 4480 mm^3
Back and leg volume	V_b	= 19820 mm^3
Total core volume	V_f	= 24300 mm^3
Effective magnetic path length *)	l_e	= 105 mm
Effective cross-sectional area *)	A_e	= 180 mm^2
Effective core volume *)	V_e	= 18800 mm^3

---

*) According to IEC 205

MAGNETIC PROPERTIES FOR A PAIR OF CORES

Relative amplitude permeability (μ_a) at θ = 100 °C, B = 320 mT	> 1000
Permissible induction in centre pole ($\hat{B}$) with min. cross-sectional area, at θ = 100 °C	≤ 320 mT
Resistivity (ρ), measured with d.c. current	≥ 1 Ωm
Curie point	≥ 200 °C
Effective total core loss (P) at f = 25 kHz, θ = 100 °C, B = 160 mT	≤ 2,7 W

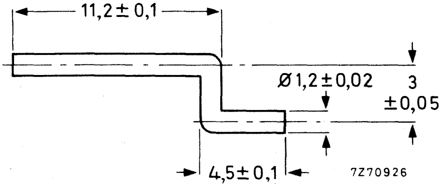
MOUNTING

The cores may be mounted by means of M3 screws or studs through the slots provided in the cores.

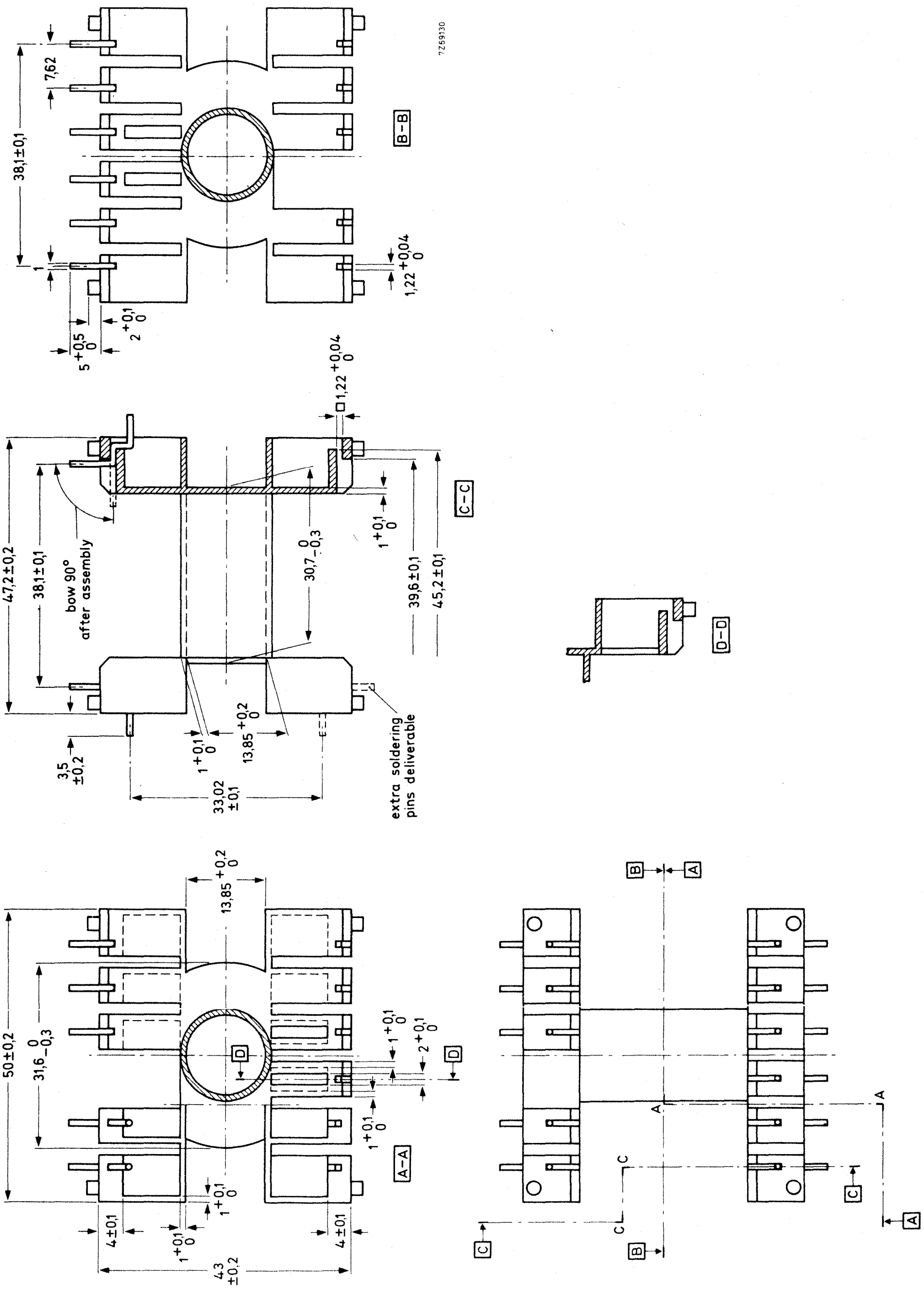
COIL FORMER

Dimensions in mm	see drawing on the next page
Material	phenolformaldehyde reinforced with glass fibre
Mean length of turn	73 mm
Weight, without pins	approx. 15 g
Maximum temperature	120 °C
Catalogue number for ordering	8222 294 38670

Note - The coil former is supplied without pins. These must be ordered separately under the catalogue number 8222 294 38770. The minimum order quantity is 5000 pins.

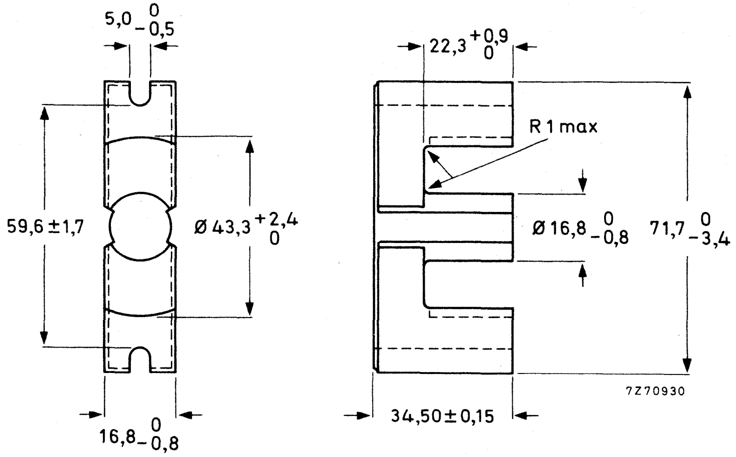


Brass dipsolder pin


7Z69130
B-B
38,1±0,1
7,62
1
5 +0,5 0
2 +0,1 0
1,22 +0,04 0
C-C
□1,22 +0,04 0
47,2±0,2
38,1±0,1
bow 90° after assembly
30,7 0 -0,3
1 +0,1 0
39,6±0,1
45,2±0,1
3,5 ±0,2
1 +0,1 0
13,85 +0,2 0
33,02 ±0,1
extra soldering pins deliverable
D-D
A-A
13,85 +0,2 0
50±0,2
31,6 0 -0,3
D
1 +0,1 0
2 +0,1 0
D
1 +0,1 0
1 +0,1 0
4±0,1
1 +0,1 0
4±0,1
43 ±0,2
B
A
A
A
C
C
C
B
A
C

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Weight	approx. 126, 5 g
Catalogue number for ordering	4322 020 52530

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *)	C_1	$= 0,514\ \mathrm{mm}^{-1}$
Minimum cross-sectional centre pole area	A_{CPmin}	$= 201,1\ \mathrm{mm}^2$
Cross-sectional centre pole area	A_{CP}	$= 211,0\ \mathrm{mm}^2$
Back and leg cross-sectional area	A_b	$= 386,0\ \mathrm{mm}^2$
Centre pole volume	V_{CP}	$= 9600\ \mathrm{mm}^3$
Back and leg volume	V_b	$= 46000\ \mathrm{mm}^3$
Total core volume	V_f	$= 55600\ \mathrm{mm}^3$
Effective magnetic path length *)	l_e	$= 144\ \mathrm{mm}$
Effective cross-sectional area *)	A_e	$= 279\ \mathrm{mm}^2$
Effective core volume *)	V_e	$= 40100\ \mathrm{mm}^3$

---

*) According to IEC 205

MAGNETIC PROPERTIES FOR A PAIR OF CORES

Relative amplitude permeability (μ_a) at θ = 100 ^oC, B = 320 mT	> 1000
Permissible induction in centre pole ($\hat{B}$) with min. cross-sectional area, at θ = 100 ^oC	≤ 320 mT
Resistivity (ρ), measured with d.c. current	≥ 1 Ωm
Curie point	≥ 200 ^oC
Effective total core loss (P) at f = 25 kHz, θ = 100 ^oC, B = 160 mT	≤ 5 W

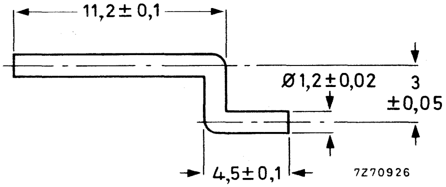
MOUNTING

The cores may be mounted by means of M4 screws or studs through the slots provided in the cores.

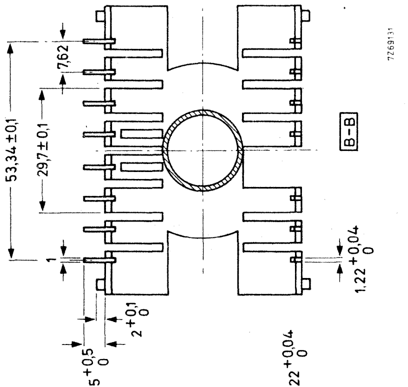
COIL FORMER

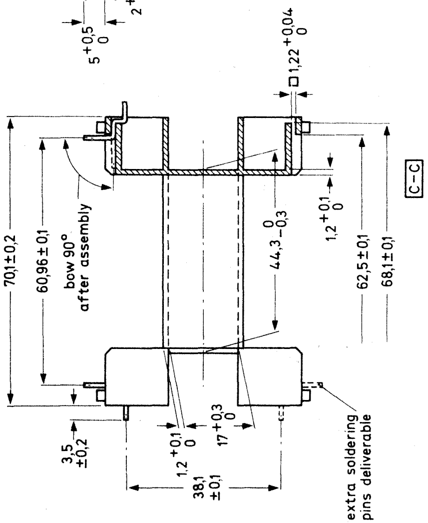
Dimensions in mm	see drawing on the next page
Material	phenolformaldehyde reinforced with glass fibre
Mean length of turn	95 mm
Weight, without pins	approx. 35 g
Maximum temperature	120 °C
Catalogue number for ordering	8222 294 38680

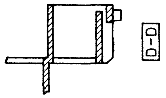
Note - The coil former is supplied without pins. These must be ordered separately under the catalogue number 8222 294 38770. The minimum order quantity is 5000 pins.

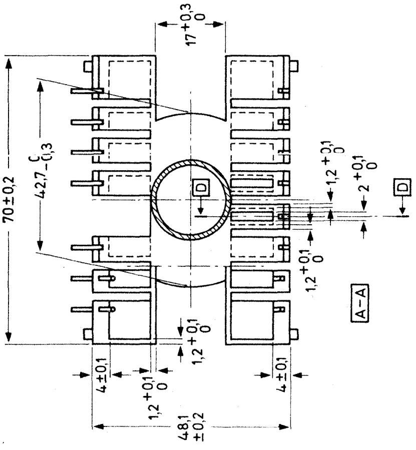


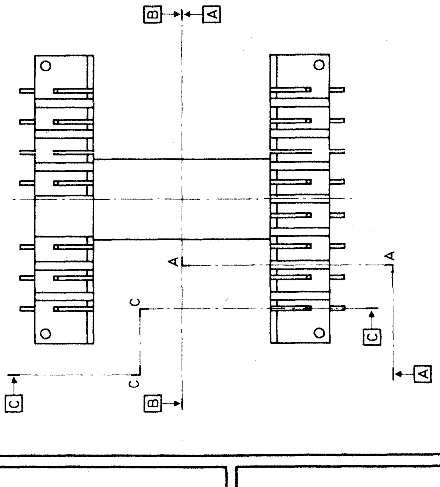
Brass dipsolder pin


7,62
53,34 ±0,1
29,7 ±0,1
1
1,22 +0,04 0
2 +0,1 0
5 +0,5 0
B–B
7269131


□ 1,22 +0,04 0
70,1±0,2
60,96±0,1
bow 90° after assembly
44,3 0 −0,3
1,2 +0,1 0
62,5±0,1
68,1±0,1
C–C
3,5 ±0,2
1,2 +0,1 0
17 +0,3 0
38,1 ±0,1
extra soldering pins deliverable


D–D


17 +0,3 0
70±0,2
42,7 0 −0,3
D
D
1,2 +0,1 0
2 +0,1 0
1,2 +0,1 0
1,2 +0,1 0
A–A
4±0,1
1,2 +0,1 0
4±0,1
48,1 ±0,2


B
A
A
A
C
C
C
C
A
B

H- cores

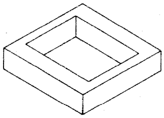
INTRODUCTION

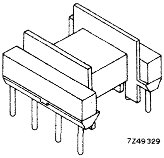
The development of magnetic core materials with high initial permeability for series production opened the way for the construction of transformer cores of very small dimensions without the loss of transformer performance.
One of the problems immediately arising when miniaturizing magnetic cores is that the high initial material permeability practically always is reduced considerably by an unavoidable airgap except when the toroid shape is used. However, for application in transformers the toroid has the disadvantage of being difficult to wind and time consuming in assembly.
The H-core transformer shape overcomes the above mentioned disadvantages with a minimum of component parts and has moreover the advantage that it may be wound on simple conventional winding machines.
The magnetic circuit is closed by a core in the shape of a rectangular window.
The two parts are sufficient to construct a complete transformer suitable for mounting on a printed-wiring board, since the coil former, which forms one piece with the H-core, is provided with soldering pins on grid module distances.

The material grade used is Ferroxcube 3E2.

The high A_L values realised with this small core combined with the proper winding technique lead to small stray capacitances and small stray inductances, in this way permitting the design of wide band transformers in a small volume.

H-CORE





The H10-core consists of a ferroxcube H-shape with coil former, a ferroxcube window, a brass container and a phosphorbronze spring.
All these components are adapted to each other.

The H10-core can only be supplied as a complete assembly.

Catalogue number of the assembly : 4322 020 33040
Approximate weight of the assembly: 2,0 g

The applied ferroxcube material is the high permeable 3E2 grade.

The jointing surfaces are very flat and smoothly lapped.

Dimensional quantities

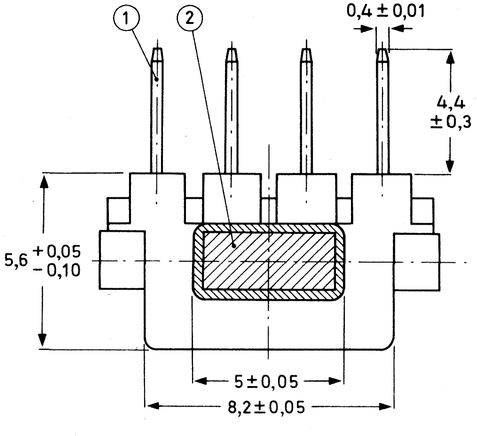
Mean length of lines of force $l_e = 22,5$ mm
Mean area of lines of force $A_e = 7,5$ mm^2
$\Sigma \frac{l_e}{A_e} = 3$ mm^{-1}
Effective volume $V_e = 170$ mm^3

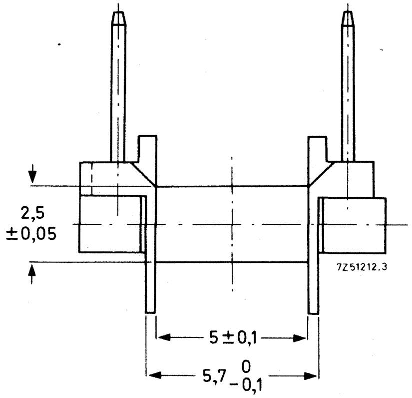
Electrical requirements, measured with 20 windings of 0,20 mm wire, at $\hat{B} = 0,7-1$ mT, f = 4 kHz and a mechanical force of 1,5 N in the temperature range from +23 till +70 °C, 24 hours after demagnetisation.

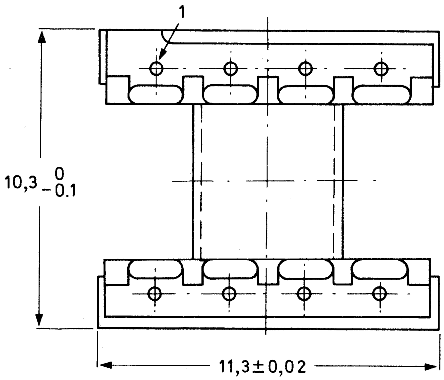
$\mu_e \geq 3820$
$\alpha \leq 25,0$
$A_L \geq 1600$

The eight soldering pins are arranged so as to fit printed-wiring boards with 0,1 in grid as well as those with a 2,50 mm grid. The board should be provided with holes of max. $0,8 + 0,1$ mm ϕ.

COIL FORMER







(1) Pins: nickel copper wire, dipsoldered
(2) H-core: ferroxcube

The coil former and the ferroxcube H-shape are combined to one part.

Material of coil former	polyamide with dipsoldered pins of nickel copper wire ←
Window area in mm^2	7,6
Mean length of turn in mm	21,7
Max. temperature for dipsoldering	
for 5-6 s in ^oC	280
for 1-2 s in ^oC	360-400
Max. working temperature in ^oC	80

For speeding up the soldering operation of the winding wire to the pins, the use of self fluxing wire is advised. In case a terminal of the winding must be connected to the container, it should be soldered to pin 1 (see figure on preceding page).
The side of the coil former where the soldering pins protrude is asymmetrical providing a means for numbering the connections.

In order to avoid damage of the ferroxcube H-shape, care should be taken that during winding the turning couple exercised on this ferroxcube part is not too high.

MOUNTING PARTS

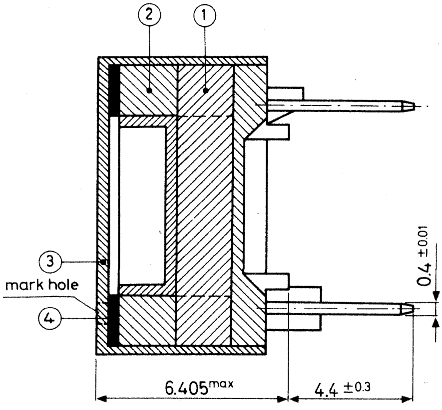


Fig. 1

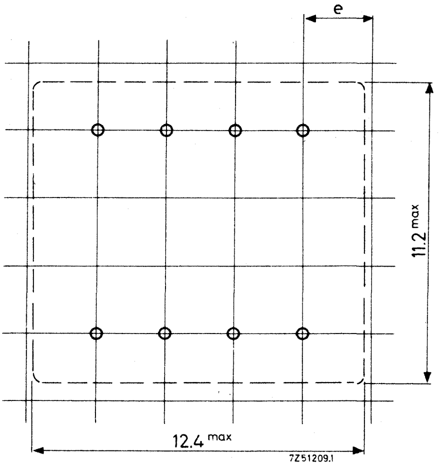


Fig. 2. Hole pattern.
e = 0, 1" or 2, 50 mm.

The H10-core is only applied as a complete assembly.

→ Catalogue number of the assembly: 4322 020 33040

Components according to Fig. 1:

→ (1) Ferroxcube H-shape with polyamide coil former
(2) Ferroxcube window
(3) Brass container 4322 021 20020
(4) Phosphorbronze spring 4322 021 20390

Take care that the jointing surfaces of the two parts are very clean.

The silver reference lines on one side of the H-shape and on one side of the window should coincide. If no reference lines are given, the parts may be arbitrary positioned.

When glueing is desired, apply a suitable adhesive around the jointing surfaces of the H-shape and the window (see Fig. 3). The spots where the adhesive is to be applied should first be degreased thoroughly. A suitable adhesive is e.g. Araldit type D, with Versamide 140, mixing ratio is 70 : 30: curing time at least 24 hours at room temperature.
There is a marking hole on the top side of the container (see Fig. 1). This hole must be in one line with soldering pin 1. This pin can easely be recognised by the asymmetrical shape of the coil former under side.

If the brass container must be earthed, the longer (tin-plated) lip must be soldered to pin 1 after bending the lips.
For bending the container lips, a simple tool (placed in a press with cranked levers) has been developed.
This tool can not be supplied, however drawings of this tool are supplied on request under cat. number 4322 058 00120.

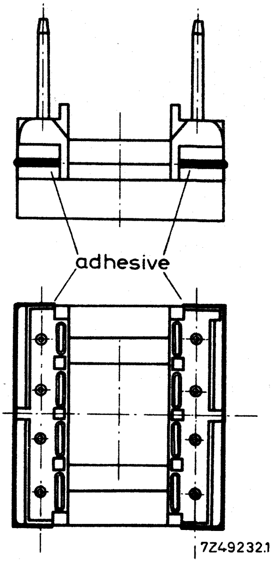
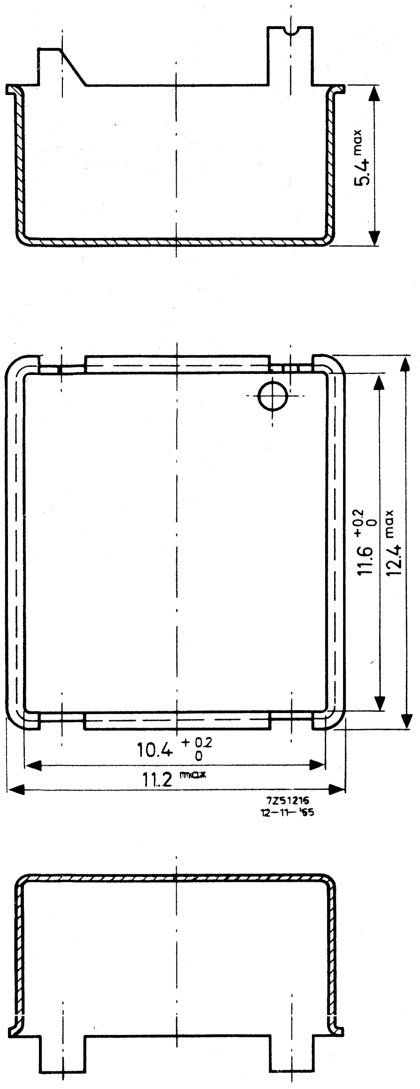
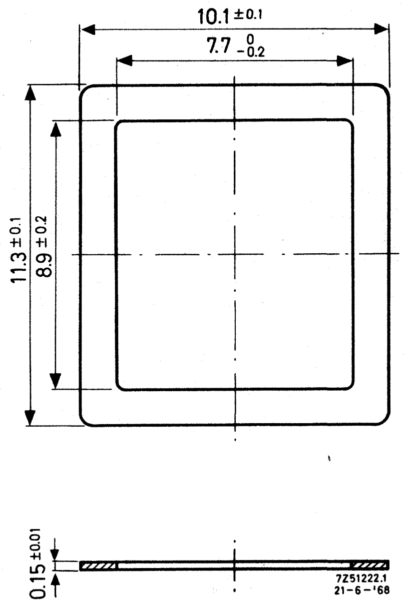


Fig. 3



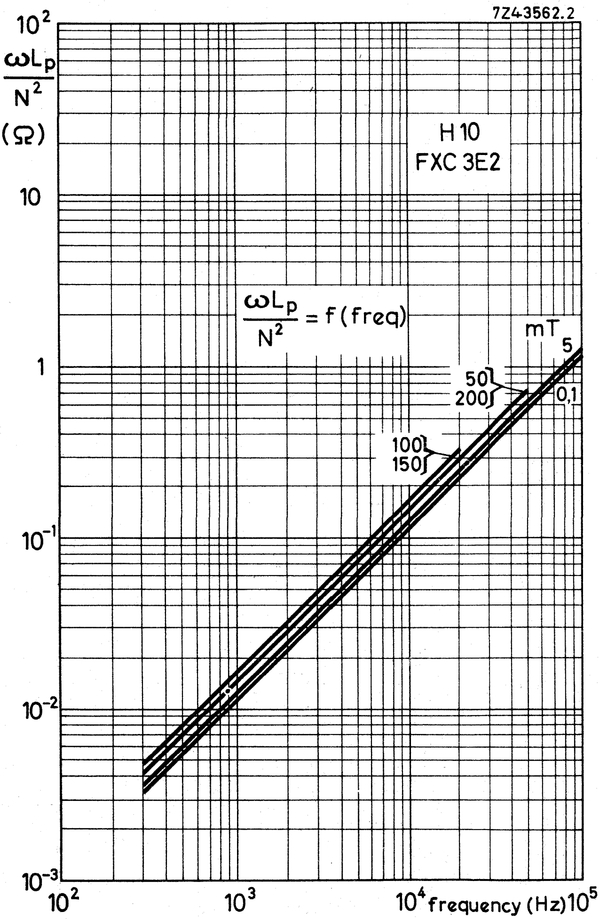
(3) Container 4322 021 20020
Material: brass, nickel-plated

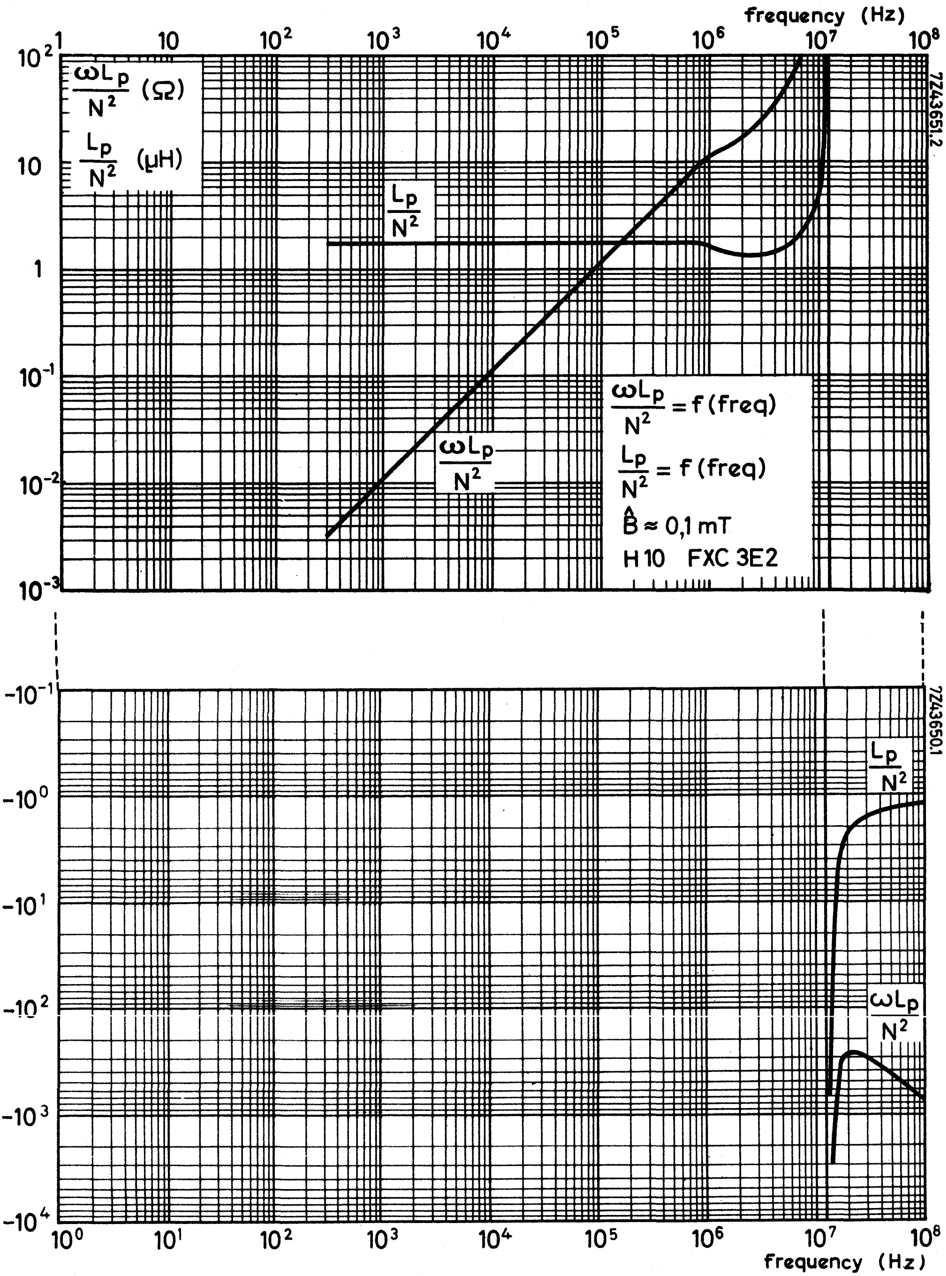


(4) Spring 4322 021 20390
Material: phosphorbronze, nickel-plated

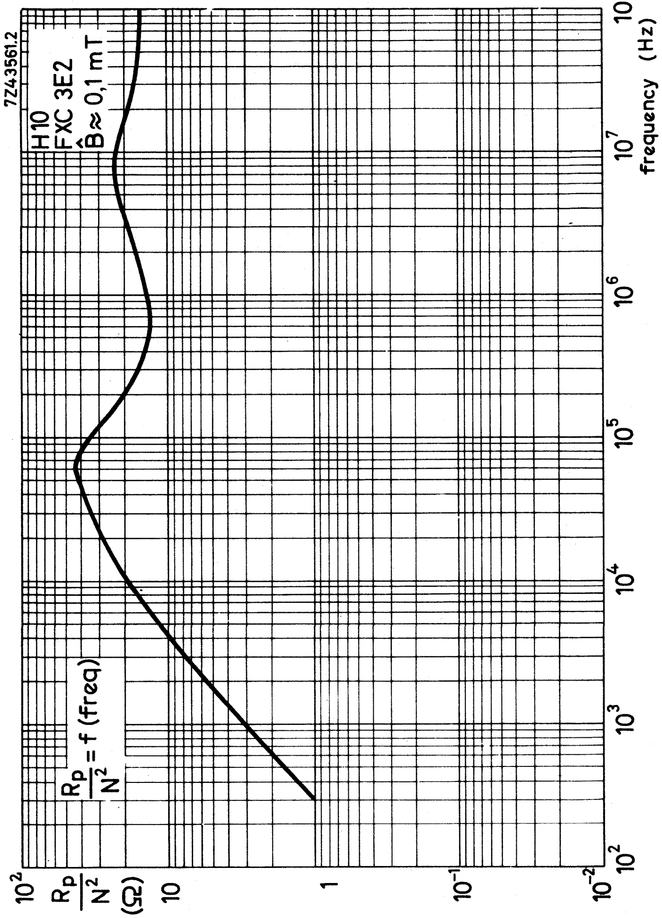
CHARACTERISTIC CURVES

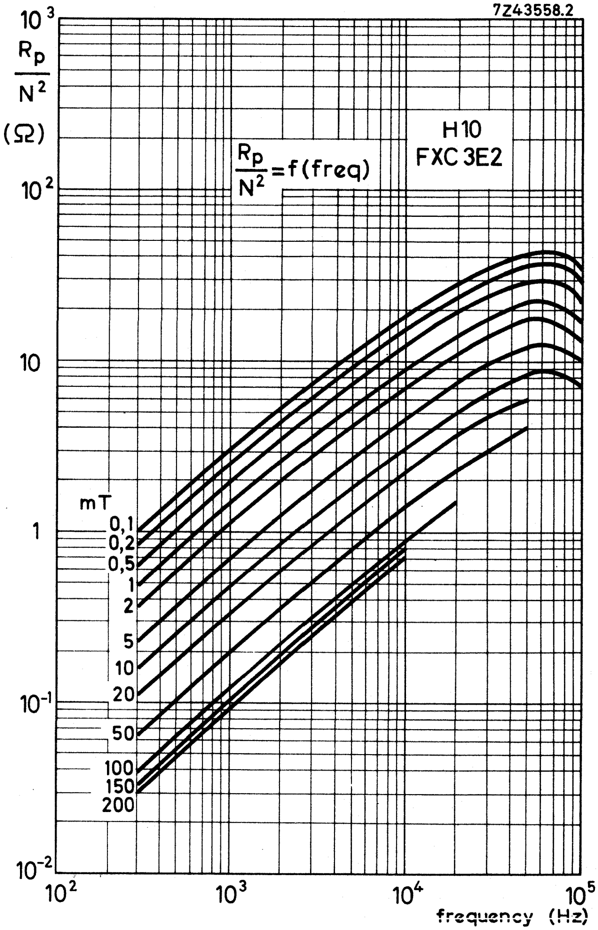
INDUCTANCE AS A FUNCTION OF THE FREQUENCY (typical values)

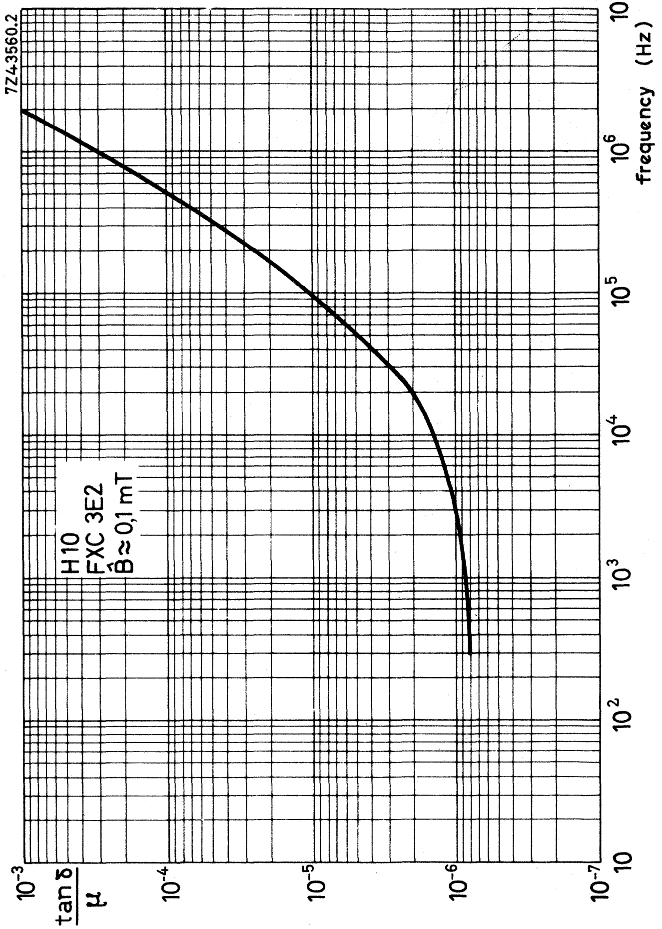



frequency (Hz)
1
10
10^2
10^3
10^4
10^5
10^6
10^7
10^8
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
$\frac{\omega L_p}{N^2}$ (Ω)
$\frac{L_p}{N^2}$ (μH)
7Z43651.2
$\frac{L_p}{N^2}$
$\frac{\omega L_p}{N^2}$
$\frac{\omega L_p}{N^2} = f\,(freq)$
$\frac{L_p}{N^2} = f\,(freq)$
$\hat{B} \approx 0{,}1\,mT$
H 10 FXC 3E2
-10^{-1}
-10^0
-10^1
-10^2
-10^3
-10^4
7Z43650.1
$\frac{L_p}{N^2}$
$\frac{\omega L_p}{N^2}$
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7
10^8
frequency (Hz)

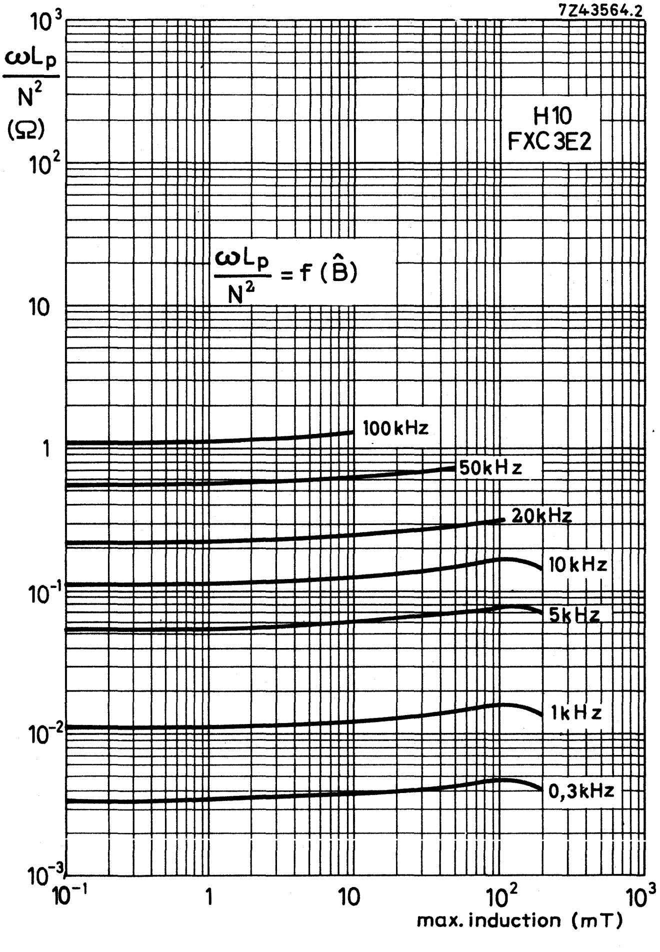
LOSSES AS A FUNCTION OF THE FREQUENCY (typical values)



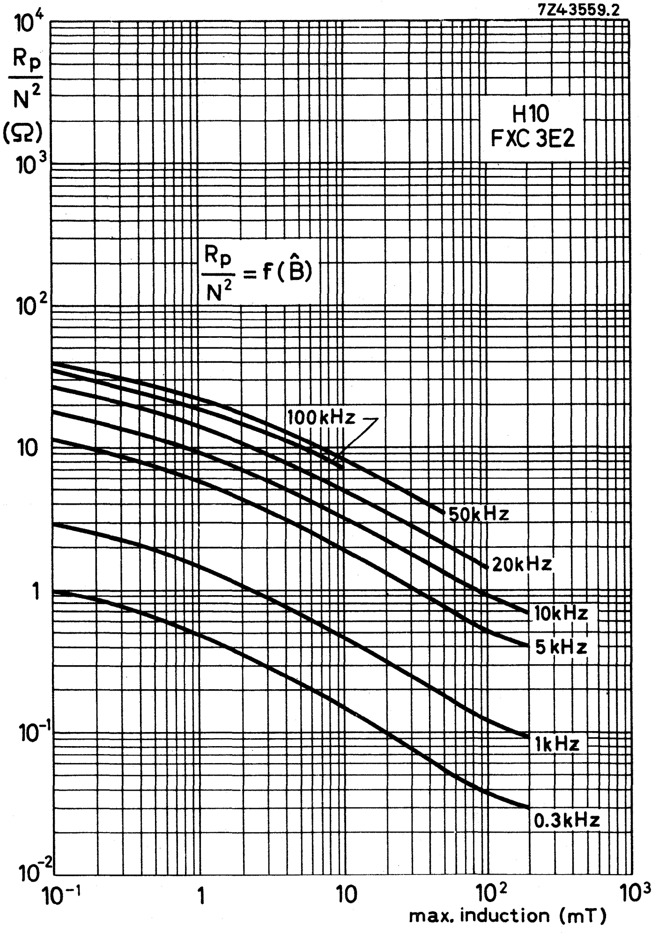

7Z43558.2
10^3
$\frac{R_p}{N^2}$
(Ω)
10^2
10
1
10^{-1}
10^{-2}
$\frac{R_p}{N^2} = f(freq)$
H 10
FXC 3E2
mT
0,1
0,2
0,5
1
2
5
10
20
50
100
150
200
10^2
10^3
10^4
10^5
frequency (Hz)


7Z43560.2
H10
FXC 3E2
$\hat{B} \approx 0{,}1$ mT
$\frac{\tan\delta}{\mu}$
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10
10^2
10^3
10^4
10^5
10^6
10^7
frequency (Hz)

INDUCTANCE AS A FUNCTION OF THE INDUCTION (typical values)

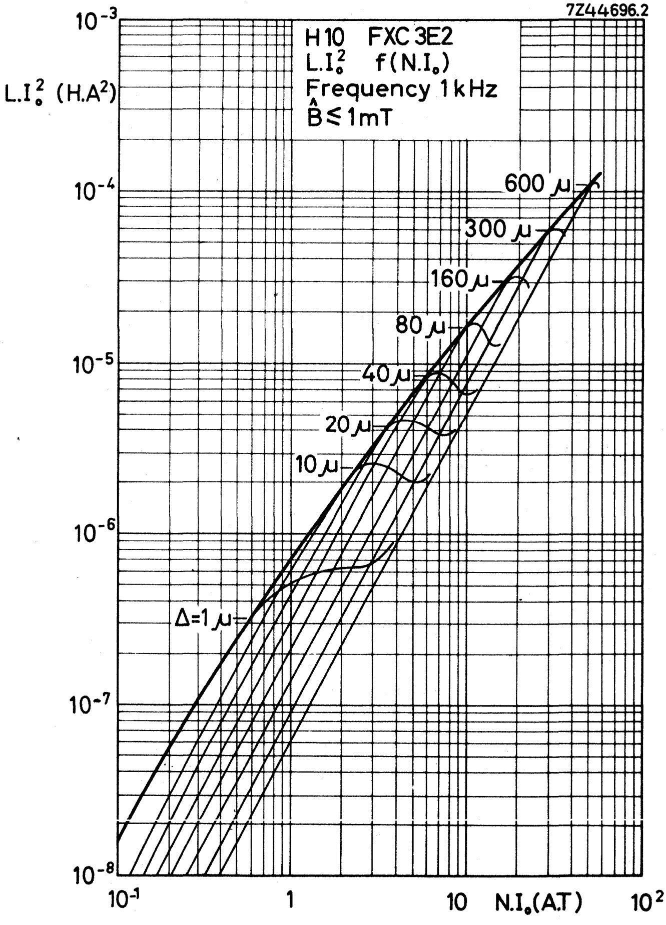


LOSSES AS A FUNCTION OF THE INDUCTION (typical values)

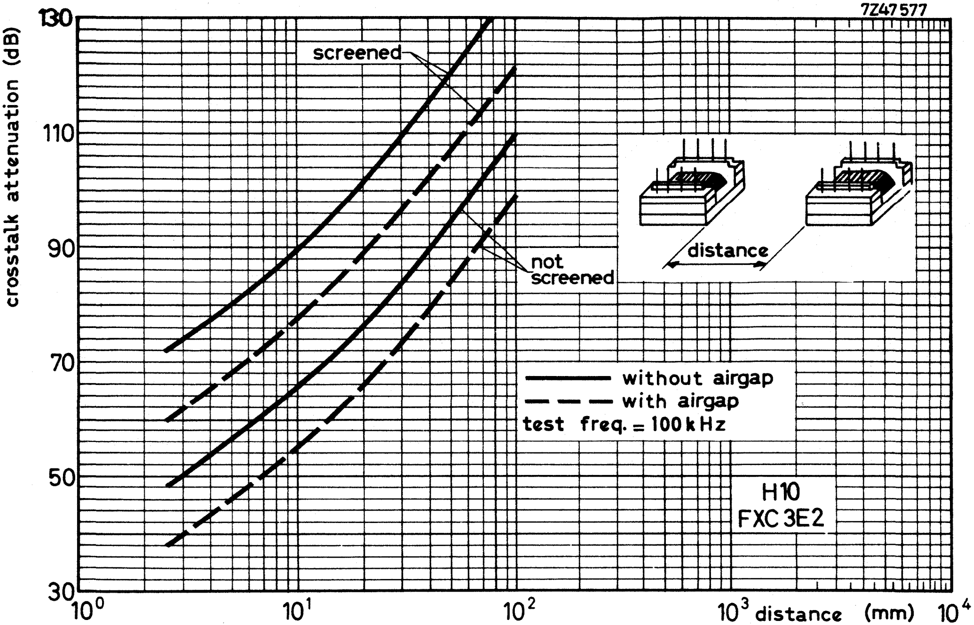


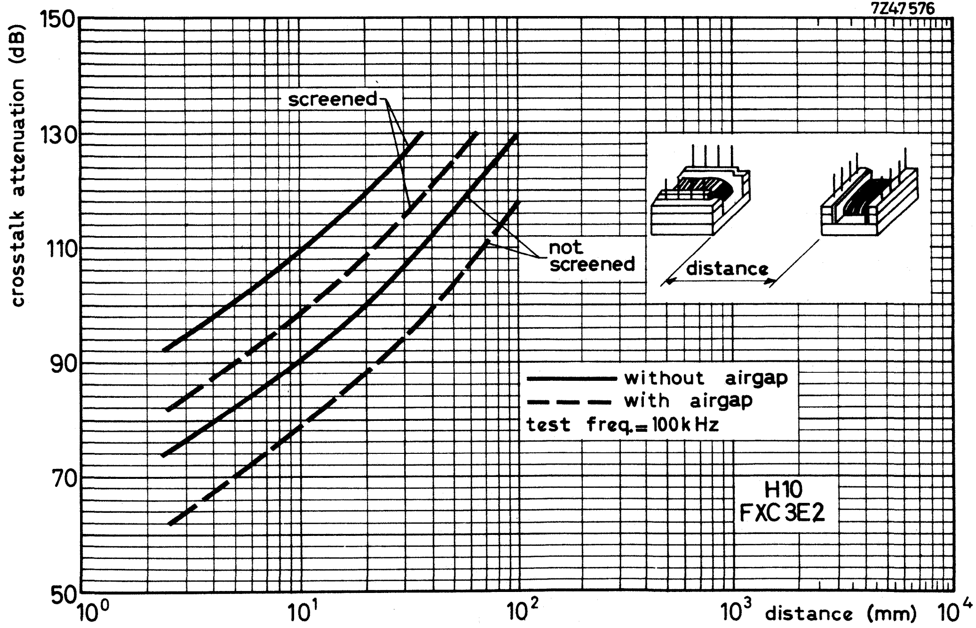
HANNA CURVE (typical values)

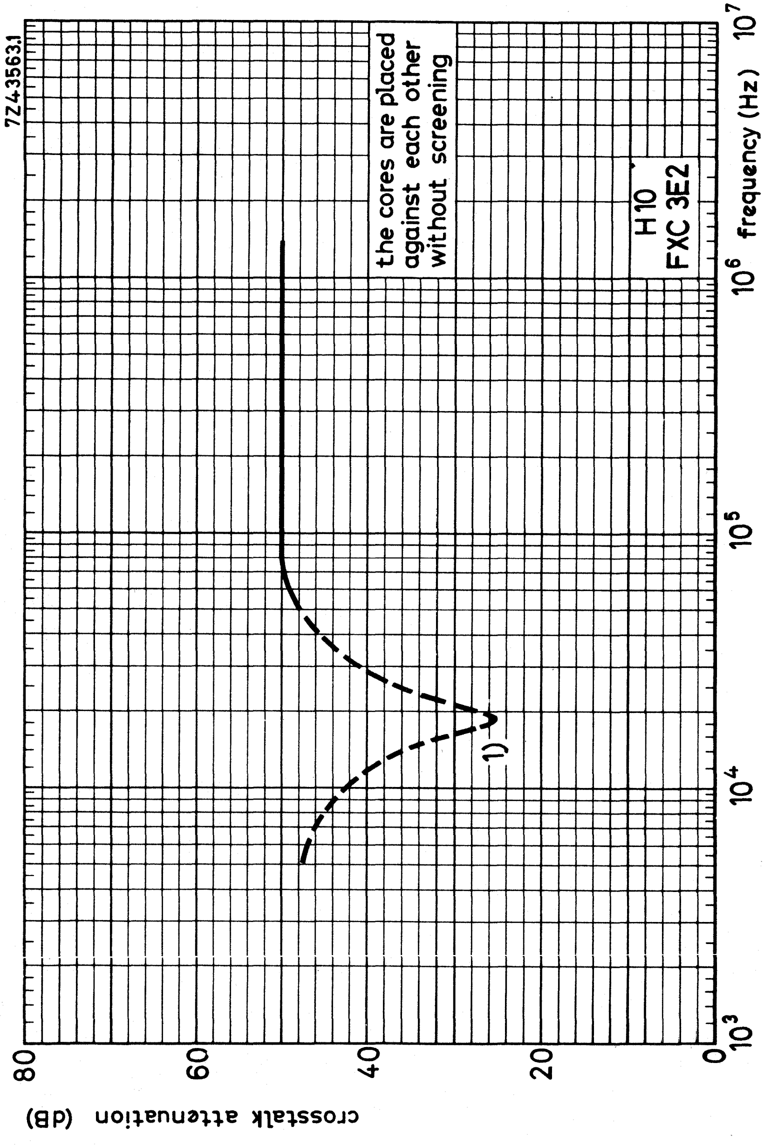
Indicating optimum inductance for a certain airgap and direct current



CROSS TALK ATTENUATION (typical values)







1) This dip does not depend on the magnetic circuit. It is caused by resonances of the inductance and stray capacitance of the two components in the test circuit.

Cross cores

INTRODUCTION

Ferroxcube cross cores have been especially developed for transformers to be used on printed-wiring boards. To this end these cores have coil formers with soldering pins which are positioned according to a grid. The height of the cores is restricted due to the small available distance between two printed-wiring boards.

The optimal height of the cross cores is approximately 0.8x the side of the square bottom surface. (In some cases a somewhat lower height than the optimal one is chosen to adapt the core to currently used heights in equipment design).

The maximum height of the assembled cross core is given under "Mounting parts".

To save space on the mounting board the connection pins of the coil former have been designed to fit within the waste space enclosed by the outer dimensions of the core (see hatched parts in Fig.2). This could be achieved, without loosing much of the dimensional quantities of the magnetic circuit with respect to potcores, by giving the core the X-shape.

The coilformers of the cross cores have the advantage that the fragile lead-out wires can be soldered to the pins directly after winding, resulting in less rejects by wire damage at the production.

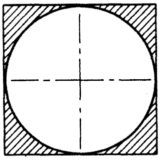


fig.1

7Z43008

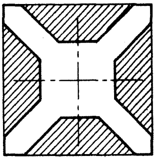


fig.2

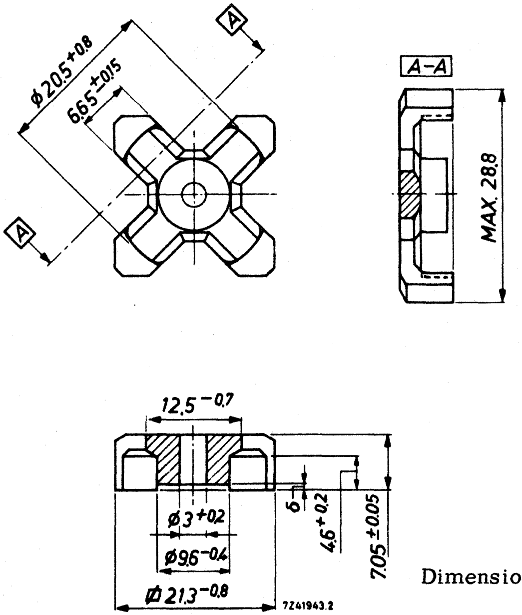
ASSEMBLY

Special tools have been designed which first centre the cross core halves and afterwards bend the lips of the containers.
These tools are not supplied, however drawings of the tools are supplied on request. For cat. numbers of these tools, see table below.

core type	catalog number of recommended tool
X 22	4322 058 00080
X 30	4322 058 00090
X 35	4322 058 00100

See also the remarks with regard to the mounting parts of the cross cores.

CROSS CORES



Dimensions in mm

Two types of core halve can be supplied:
(1) without air-gap, and
(2) with air-gap. Standardised air-gap lengths in each core half are:
0.02, 0.05, 0.15 and 0.25 mm.

The dimensions of the cross cores meet the following specifications: I.E.C. 226 (international) and C.C.T.U. 06-10 (France).

Cross core halves and associated parts are ordered by their 12-digit catalogue number.

CORE HALVES WITHOUT AIR GAP

Versions

ferroxcube grade	catalogue number
3B7	3522 200 08770
3H1	4322 020 23510
3E1	4322 020 23530
3D3	3522 200 03480
4C6	3522 200 03490

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I

	at temp. (^oC)	grade				
		3B7	3H1	3E1	3D3	4C6
α_F x 10^6	+5 to +23	-	+0.5 to +1.5	-	-	-2 to +4
	+23 to +55	-	+0.5 to +1.5	-	-	0 to +6
	+23 to +70	-0.6 to +0.6	+0.5 to +1.5 1)	-	0 to +2	-
D_F x 10^6 (10-100 min)	23 ± 1	≤ 4.3	≤ 4.3	-	≤ 12	≤ 10

For the combination of two cross core halves randomly chosen from a batch and pressed together with a force of 120 N, the values in Table II are guaranteed at 25 ± 10 ^oC.

Table II	at $\hat{B}$ (mT)	at freq. (MHz)	grade				
			3B7	3H1	3E1	3D3	4C6
μ_e	≤0, 1	0, 004	≥ 1440	≥ 1440	2000-3325[2]	-	-
	≤0, 1	0, 1	-	-	-	≥ 550	≥ 93
α	≤0, 1	0, 004	≤ 17, 8	≤ 17, 8	-	-	-
	≤0, 1	0, 1	-	-	-	≤ 28, 8	≤ 70
A_L	≤0, 1	0, 004	-	-	4350-7250	-	
$\frac{\tan \delta}{\mu_i}$ x 10^6	≤0, 1	0, 004	≤ 1, 6	≤ 1, 2	≤ 2, 5	-	-
	≤0, 1	0, 1	≤ 6	≤ 5	≤ 20	≤ 8	-
	≤0, 1	0, 5	-	-	≤ 200	≤ 14	-
	≤0, 1	1	-	-	-	-	-
	≤0, 1	2	-	-	-	-	≤ 40
	≤0, 1	10	-	-	-	-	≤ 100
q2-24-100	1, 5-3	0, 004	≤ 1, 8	≤ 1, 8	3, 0	-	-
	0,3-1,2	0, 1	-	-	-	≤ 3, 0	≤ 10
η_B x 10^3	1, 5-3	0, 004	≤ 1, 1	≤ 1, 1			
	0,3-1,2	0, 1				≤ 1, 8	≤ 6, 2

Weight per half core 6 g approx.

Mean length of line of force l_e = 38 mm (two halves)

A_e = 66 mm^2 (two halves)

$\Sigma \frac{l_e}{A_e}$ =0, 575 mm^{-1} (two halves)

V_e = 2510 mm^3 (two halves)

---

1) Orientation value

2) In the temperature range +23 to +70 ^oC $\mu_e \geq 2000$

CORE HALVES WITH AIR GAP

ferroxcube grade	air gap length in mm	catalog number
3H1	0.02 ± 0.01	4322 020 23710
3H1	0.05 ± 0.015	4322 020 23720
3H1	0.15 ± 0.015	4322 020 23730
3H1	0.25 ± 0.015	4322 020 23740
3E1	0.15 ± 0.015	4322 020 23700

The electrical properties are measured on cores without air gap.

PRE-ADJUSTED CROSS CORES

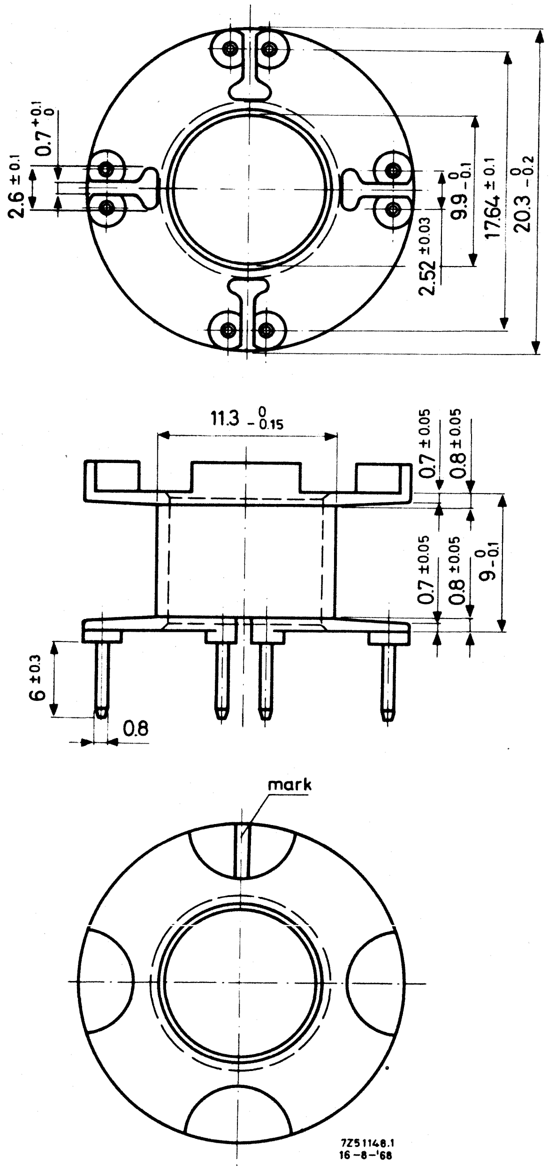
With nut : catalog number 4322 022 6....
Without nut: catalog number 4322 022 4....

Cross cores with standard A_L factors

A_L	corresponding μ_e-value	tolerance on inductance (%)	catalog number 4322 022 6...., with nut 4322 022 4...., without nut
			grade 3H1
160	73	± 1	5250
250	115	± 1.5	5260
400	180	± 2	5280
630	290	± 3	5300

Inductance $L = N^2A_L$ (in 10^{-9} H)

COIL FORMER


0.7 +0.1 0
2.6 ±0.1
9.9 0 -0.1
17.64 ±0.1
20.3 0 -0.2
2.52 ±0.03
11.3 0 -0.15
0.7 ±0.05
0.8 ±0.05
0.7 ±0.05
0.8 ±0.05
9 0 -0.1
6 ±0.3
0.8
mark
7Z51148.1
16-8-'68

catalogue number	4322 021 31770
Material	reinforced polyester
Window area in mm^2	33,5
Mean length of turn in mm	49
Max. temperature for dipsoldering for 5-6 s in ^{o}C	280
Max. working temperature in ^{o}C	130
Force for pulling out pins during 1 min at 25 ^{o}C in N	≥ 15
Max. test voltage (50 Hz) between pins during 2 min in V_{rms}	500

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 9,9 \times 10^3 \; \Omega/H$$

INDUCTANCE ADJUSTORS

ADJUSTORS

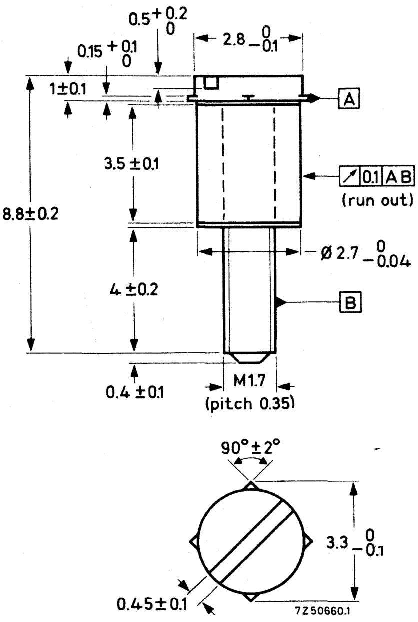


Fig. A

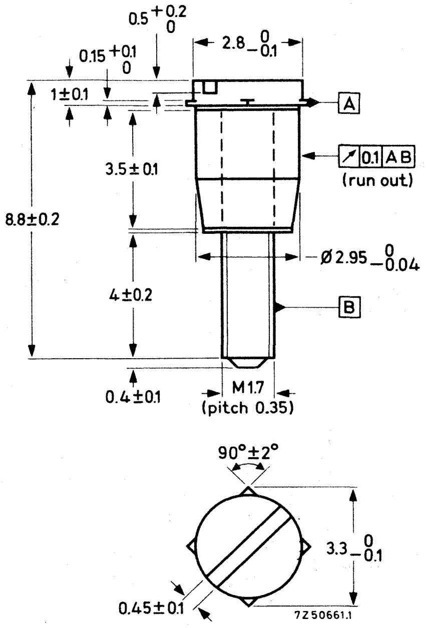


Fig. B

The tolerances on inductance of the pre-adjusted cross cores (without adjustor) are given in section "cross cores", paragraph "Pre-adjusted cross cores". After inserting a coil (impregnated or not) in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0.03% by means of a continuous inductance adjustor. Such an adjustor increases the inductance of the coil, see "Adjustment curves". The adjustor is screwed through the cross core into the nut and is held in position by the four protrusions near the top of the adjustor. For special requirements a bigger or smaller adjustment range may be obtained by using an adjustor belonging to the next higher or lower effective permeability.
The influence of the adjustors on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.
Table II shows the type of adjustor recommended for different cross cores.
The adjustors are packed in bags of 100, so please order in multiples of 100.

Table I, available types:

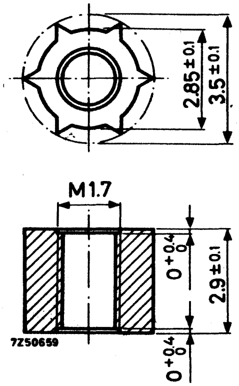
Fig.	colour	catalogue number
A	brown	4322 021 30730
B	white	4322 021 30970
B	grey	4322 021 31080

Table II, recommended application:

A_L	catalogue number
	grade 3H1
160	4322 021 30970
250	4322 021 30970 or 4322 021 30730
400	4322 021 30730 or 4322 021 31080
630	4322 021 31080
1000	4322 021 31080

NUT FOR ADJUSTOR

These data are given for those manufacturers who prefer to insert the nut themselves.

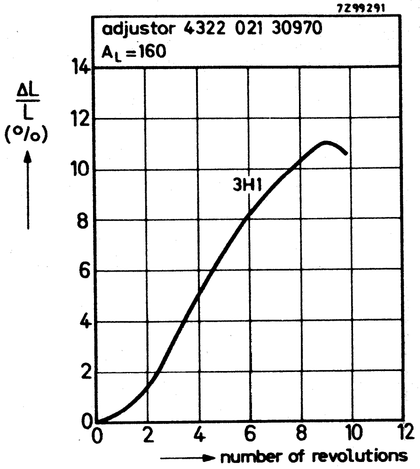


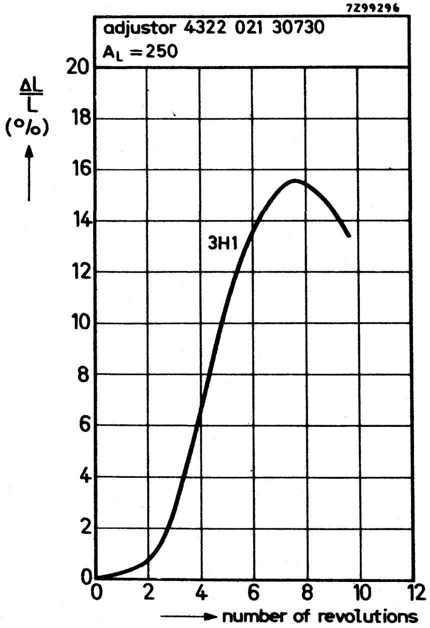
Catalogue number	4322 021 30140
Material	polycarbonate
Maximum impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2.3 ± 0.15 mm

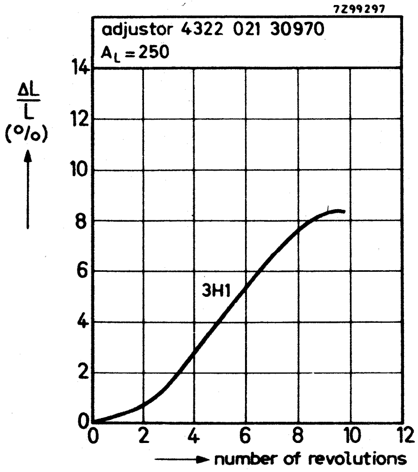
For more information see Potcores General, paragraph "Inserting the nut for the adjustor" (core type P18/11).

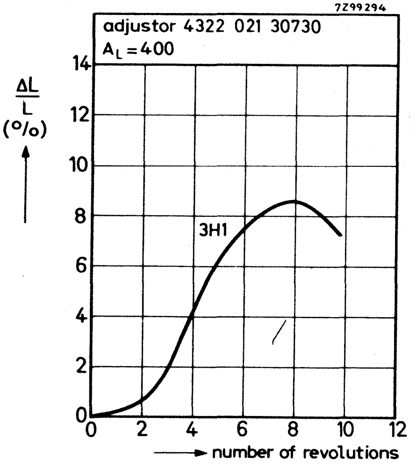
The nuts are packed in bags of 100, so please order in multiples of 100.

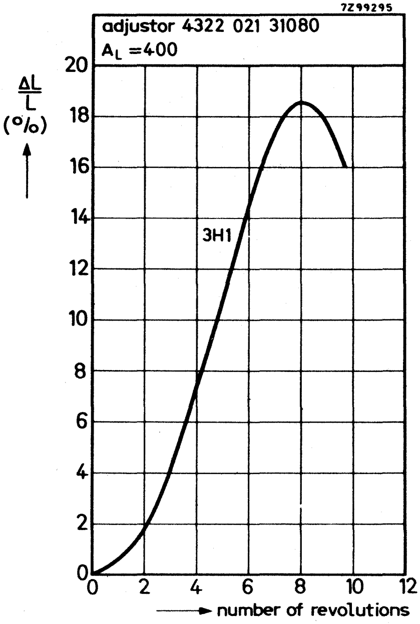
ADJUSTMENT CURVES

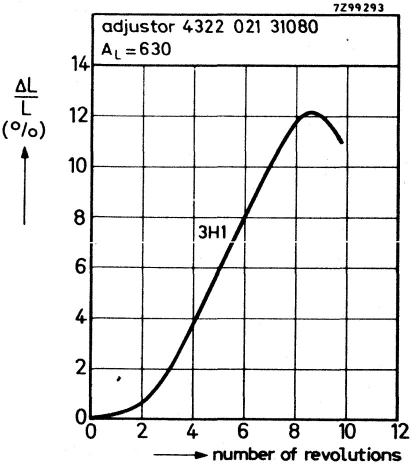


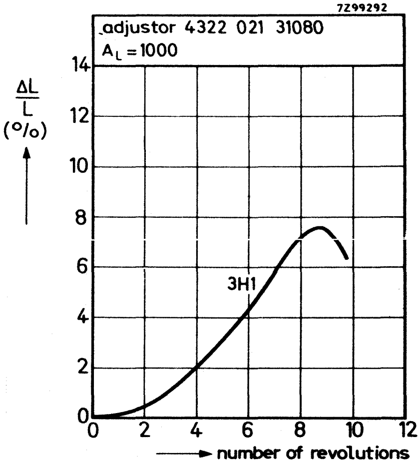




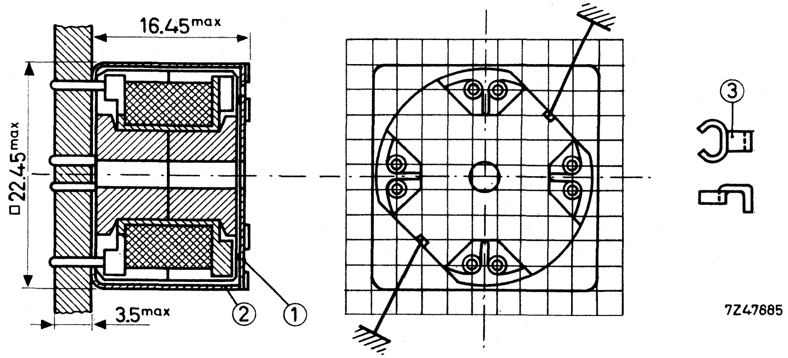

7Z99294
adjustor 4322 021 30730
A_L = 400
ΔL/L (%)
0
2
4
6
8
10
12
14
3H1
0
2
4
6
8
10
12
number of revolutions


7Z99295
adjustor 4322 021 31080
A_L = 400
ΔL/L (%)
0
2
4
6
8
10
12
14
16
18
20
3H1
0
2
4
6
8
10
12
number of revolutions


7Z99293
adjustor 4322 021 31080
A_L = 630
ΔL/L (%)
0
2
4
6
8
10
12
14
3H1
0
2
4
6
8
10
12
number of revolutions


7Z99292
adjustor 4322 021 31080
A_L = 1000
ΔL/L (%)
0
2
4
6
8
10
12
14
3H1
0
2
4
6
8
10
12
number of revolutions

MOUNTING PARTS



(1). Cover 4322 021 30230
(2). Container 4322 021 30040
(3). Soldering spring 4322 021 30700

The cross core has been developed especially for transformers to be mounted on printed-wiring boards.

An advantage of this construction is that the leading-out wires are soldered to the pins which are directly mounted on the coil former.

The eight soldering pins are positioned according to a grid of 2.52 mm. They will fit printed-wiring boards with a 0.1" grid as well as those with a 2.50 mm grid. The pin length is sufficient for board thicknesses up to 3.5 mm. The printed-wiring board should be provided with holes of 1.3 ± 0.1 mm in diameter.

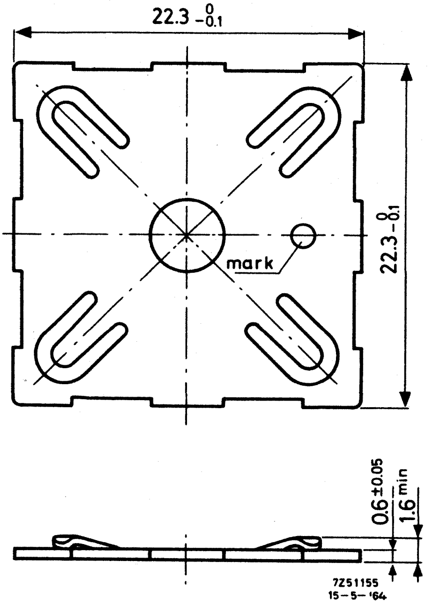
If stranded wire is employed, the use of a soldering spring (pos. 3) is recommended, which facilitates the soldering of the wires to the pins on the coil former. For solid wire the spring is not necessary.

The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

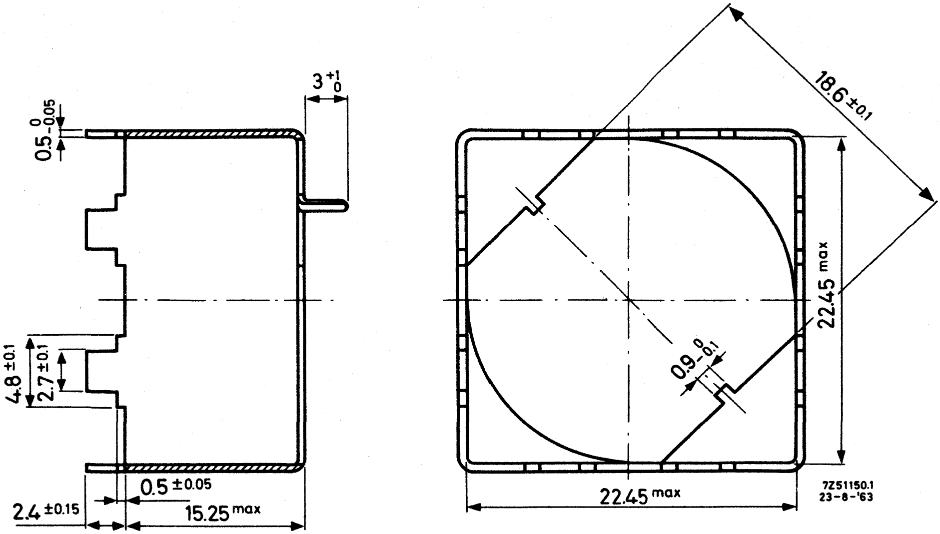
The cover is provided with a marking hole. The mark of the coil former (see the Fig. of coil former) has to be in one line with this hole. These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

It is recommended to cement the coil former in one of the cross core halves in order to obtain the most possible stable construction.

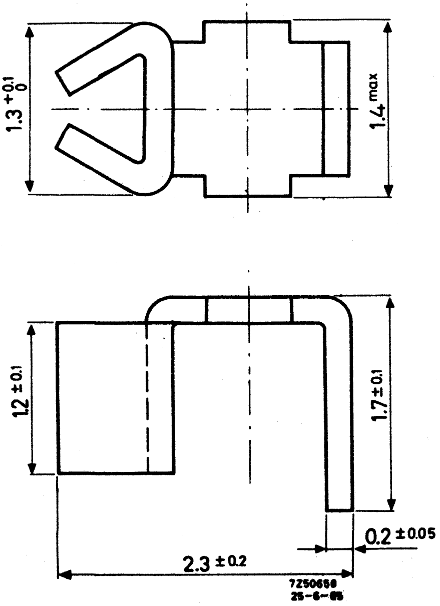
Before bending the lips of the container, pressure should be exercised evenly on the four corners of the cover until the latter meets the container. The required force is approximately 120 Newton. After bending the lips, the core will have the correct tension.



(1) Cover 4322 021 30230
Material: phosphorbronze, nickel plated



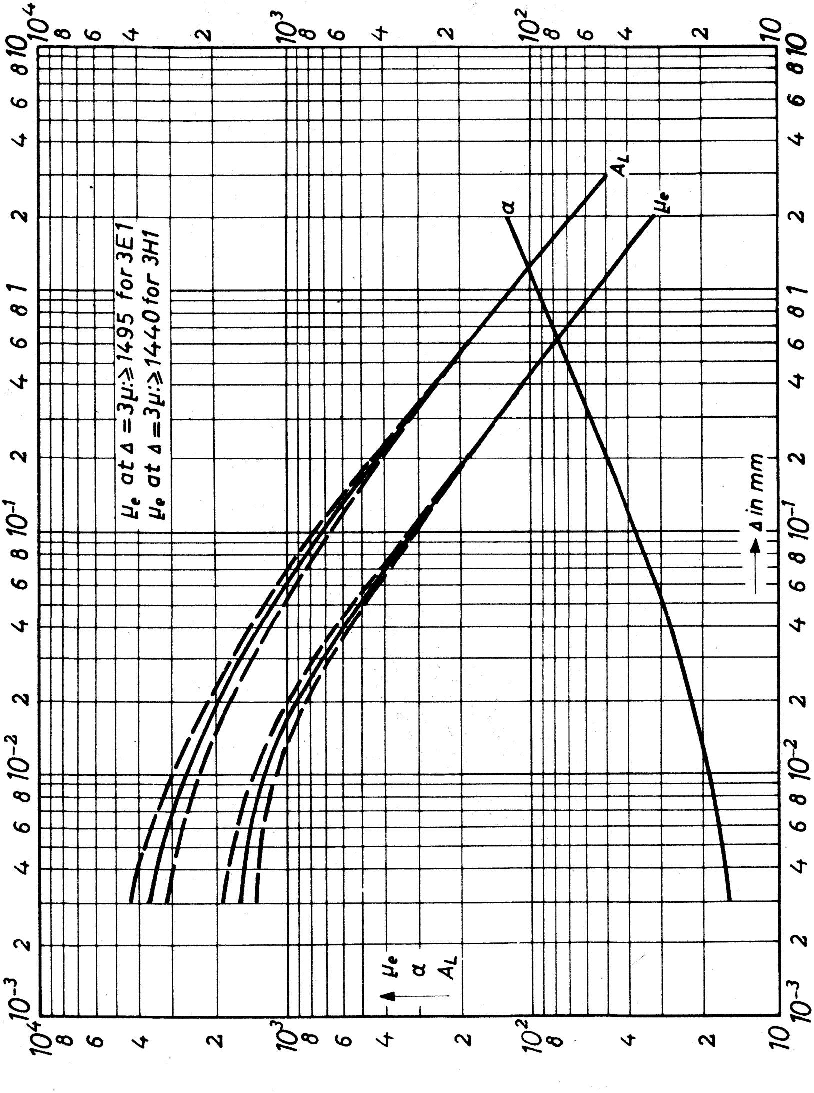
(2) Container 4322 021 30040
Material: brass, nickel plated



(3) Soldering spring 4322 021 30700
Material: brass, dipsoldered

CHARACTERISTIC CURVES

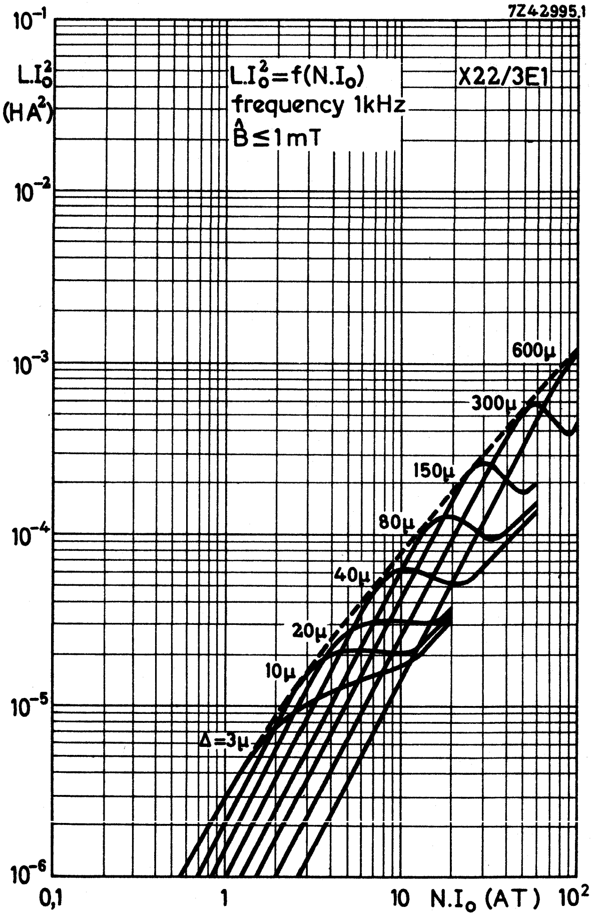
μ_e - α and A_L CURVES.



Effective permeability (μ_e), turn factor for 1 mH (α) and inductance factor in nanohenry (A_L) as a function of the airgap length for grades 3E1 and 3H1.

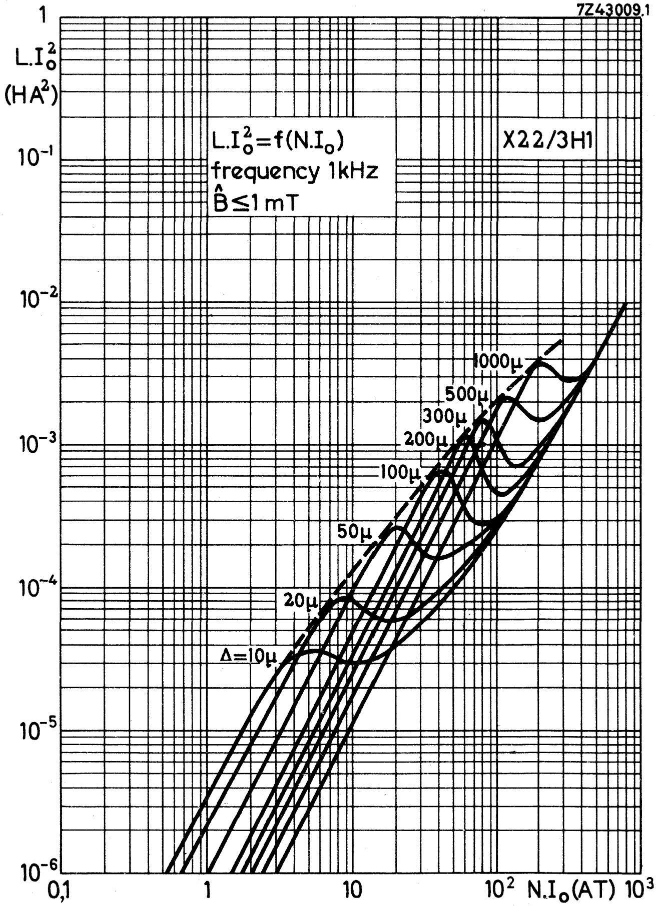
HANNA CURVE (typical values)

Indicating optimum inductance for a certain airgap and direct current.

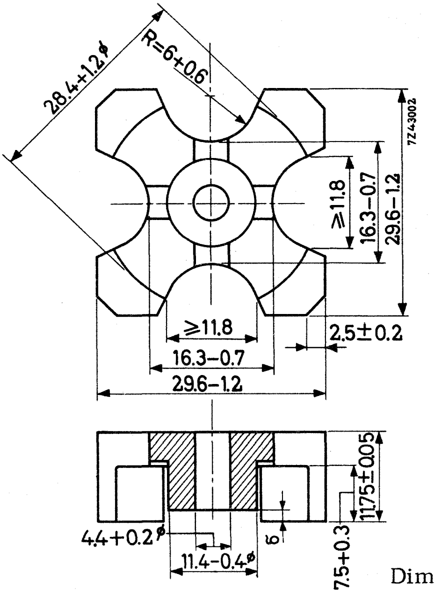


HANNA CURVE (typical values)

Indicating optimum inductance for a certain airgap and direct current.



CROSS CORES



Dimensions in mm

Two types of core halve can be supplied:
1) without airgap
2) with airgap
Standardised air-gap lengths in each core half are: 0.02, 0.05, 0.15 and 0.25 mm.

The dimensions of the cross cores meet the following specifications: I.E.C. 226 (international) and C.C.T.U.06-10 (France).

Cross core halves and associated parts are ordered by their 12-digit catalogue number.

CORE HALVES WITHOUT AIRGAP

Versions

ferroxcube grade	catalog number
3H1	4322 020 23750
3E1	4322 020 23760

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I

	at temp. (^{o}C)	grade	
		3H1	3E1
$\alpha_F \times 10^6$	+5 to +23	+0.5 to +1.5	–
	+23 to +55	+0.5 to +1.5	–
	+23 to +70	+0.5 to +1.5 [1])	–
$D_F \times 10^6$	23 ± 1	≤ 4.3	–

For the combination of two cross core halves randomly chosen from a batch and pressed together with a force of 250 N, the values in Table II are guaranteed at 25 ± 10 ^{o}C.

Table II

	at $\hat{B}$ (mT)	at freq. (kHz)	grade	
			3H1	3E1
μ_e	≤ 0, 1	4	≥ 1525	2200-3675[2])
α	≤ 0, 1	4	≤ 15.9	–
A_L	≤ 0, 1	4	–	5650-9400
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0, 1	4	≤ 1.2	≤ 2.5
	≤ 0, 1	100	≤ 6	≤ 20
q2-24-100	1,5-3	4	≤ 1.8	≤ 3.0
$\eta_B \times 10^3$	1,5-3	4	≤ 1.1	≤ 1.8

Weight per half core 19 g approx.

Mean length of lines of force l_e = 55, 8 mm (two halves)

A_e = 114 mm^2 (two halves)

$\Sigma \frac{l_e}{A_e}$ = 0, 49 mm^{-1} (two halves)

V_e = 6360 mm^3 (two halves)

CORE HALVES WITH AIR GAP

ferroxcube grade	airgap length in mm	catalogue number
3H1	0.02 ± 0.01	4322 020 23960
3H1	0.05 ± 0.015	4322 020 23970
3H1	0.15 ± 0.015	4322 020 23980
3H1	0.25 ± 0.015	4322 020 23990

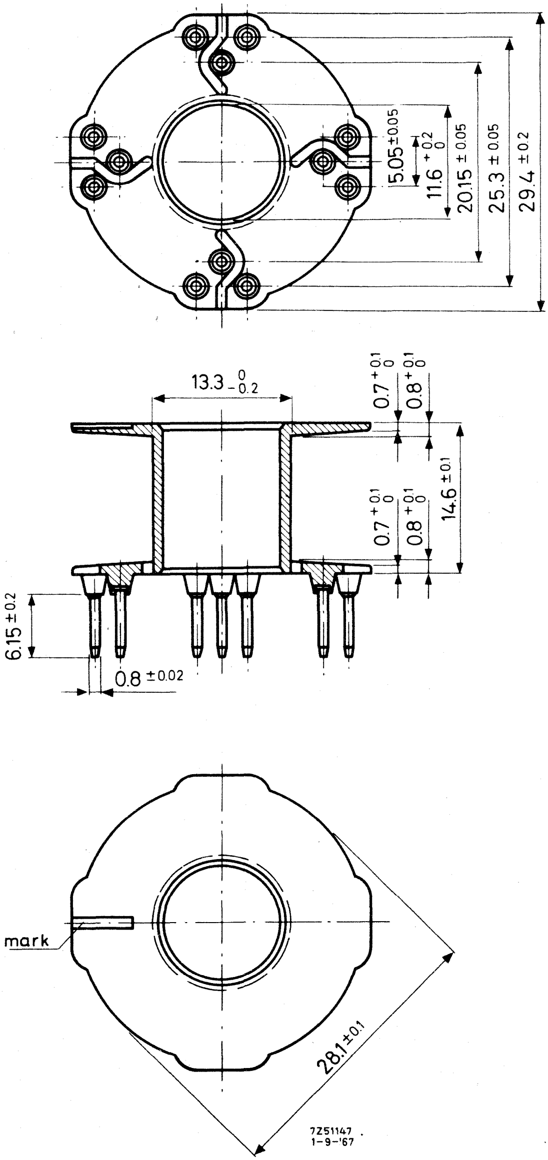
The electrical properties are measured on cores without air gap.

---

[1]) Orientation value

[2]) In the temperature range +23 to +70 ^{o}C $\mu_e \geq 2200$

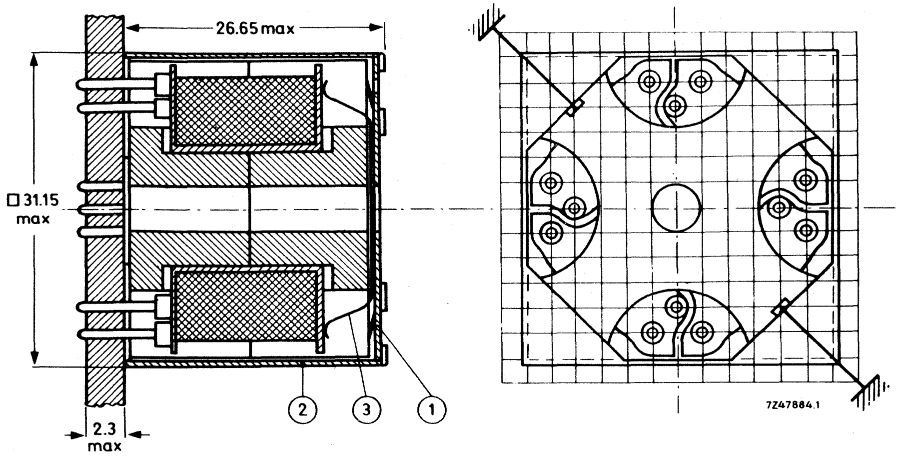
COIL FORMER


5.05 ±0.05
11.6 +0.2 0
20.15 ±0.05
25.3 ±0.05
29.4 ±0.2
13.3 0 −0.2
0.7 +0.1 0
0.8 +0.1 0
14.6 ±0.1
0.7 +0.1 0
0.8 +0.1 0
6.15 ±0.2
0.8 ±0.02
mark
28.1 ±0.1
7Z51147
1-9-'67

COIL FORMER

Catalogue number	4322 021 31190
Material	reinforced polyester
Window area	97 mm^2
Mean length of turn	65 mm
Max. dipsolder temperature (5 to 6 s)	280 °C
Max. working temperature	130 °C
Tensile strength of pins (1 minute at 25 °C)	$\geq$ 20 N
A.C. test voltage between pins (50 Hz, 2 min)	2000 V

MOUNTING PARTS



(1) Cover 4322 021 31150
(2) Container 4322 021 31170
(3) Spring 4322 021 30210
(4) Soldering spring 4322 021 30700 (see below)

The cross core has been developed especially for transformers to be mounted on printed-wiring boards.

An advantage of this construction is that the leading-out wires are soldered to the pins which are directly mounted on the coil former.

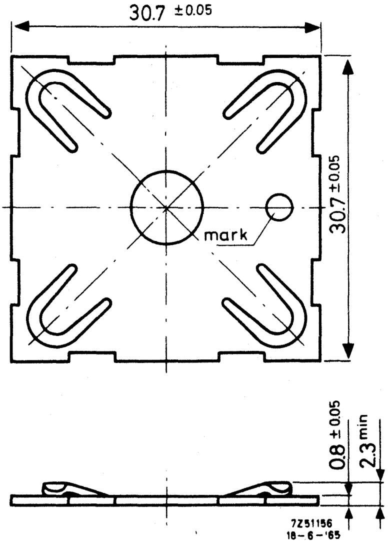
The twelve soldering pins are positioned according to a grid of 2.52 mm. They will fit printed-wiring boards with a 0.1" grid as well as those with a 2.50 mm grid. The pin length is sufficient for board thicknesses up to 2.3 mm. The printed-wiring board should be provided with holes of 1.3 ± 0.1 mm in diameter.

The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

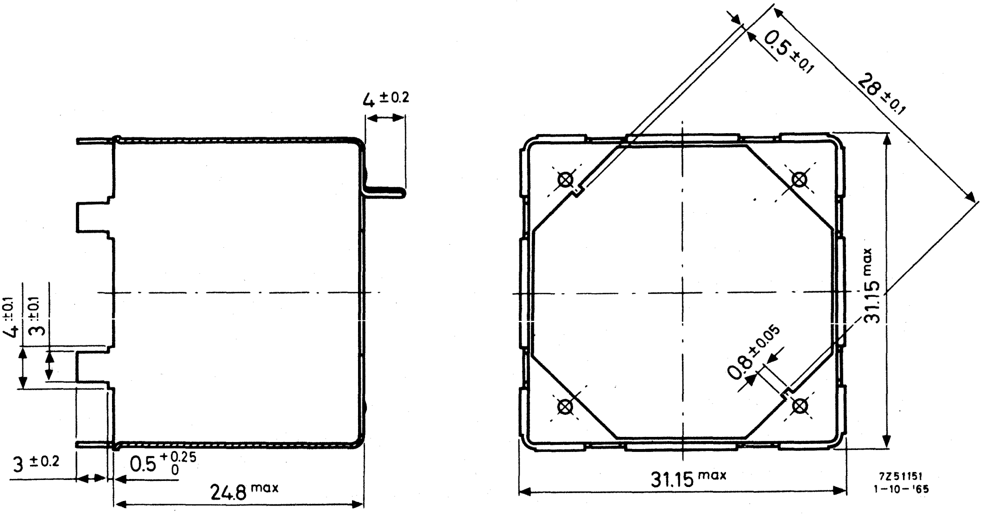
The cover is provided with a marking hole. The mark of the coil former (see the Fig. of coil former) has to be in one line with this hole. These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

It is recommended to cement the coil former in one of the cross-core halves or to use the spring (pos. 3) in order to obtain the most stable construction.

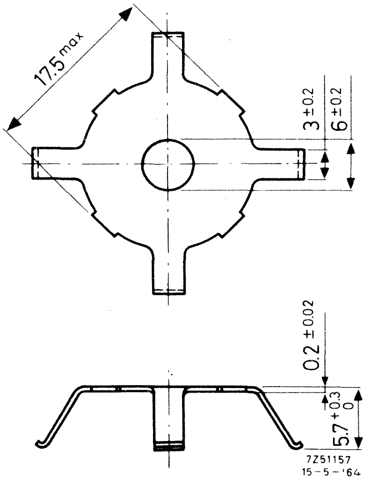
Before bending the lips of the container, pressure should be exercised evenly on the four corners of the cover until the latter meets the container. The required force is approximately 250 Newton. After bending the lips, the core will have the correct tension.



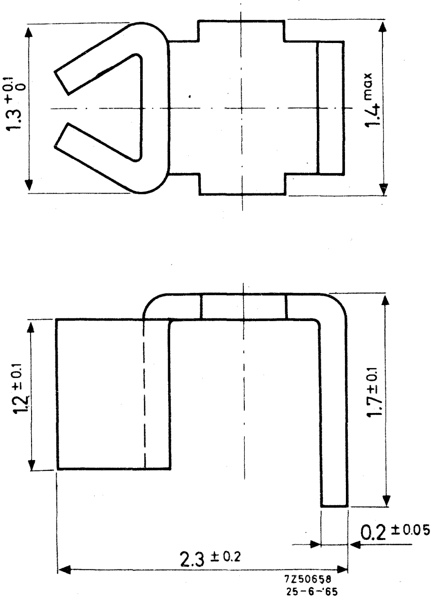
(1) Cover 4322 021 31150
Material: phosphorbronze, nickel plated



(2) Container 4322 021 31170
Material: brass, nickel plated



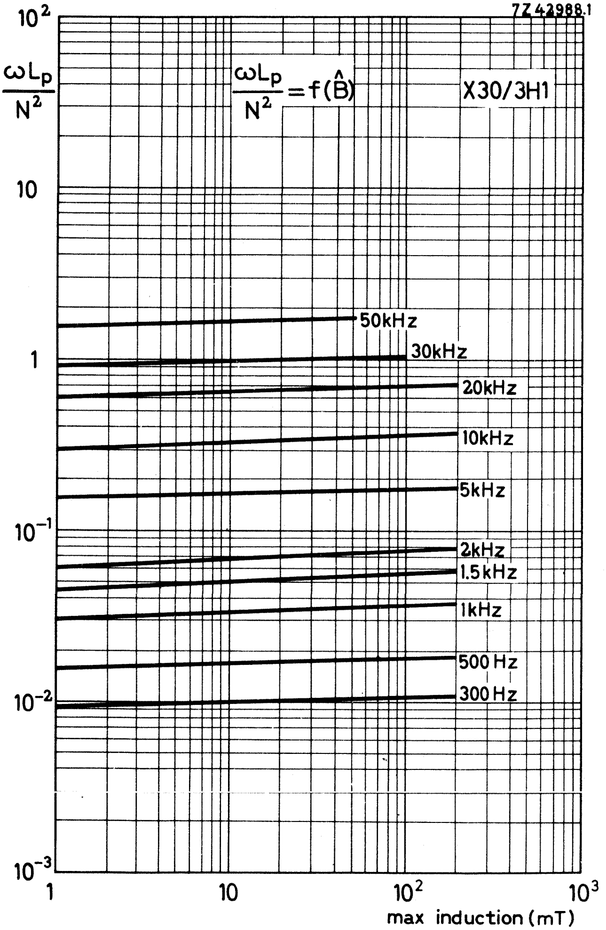
(3) Spring 4322 021 30210
Material: phosphorbronze



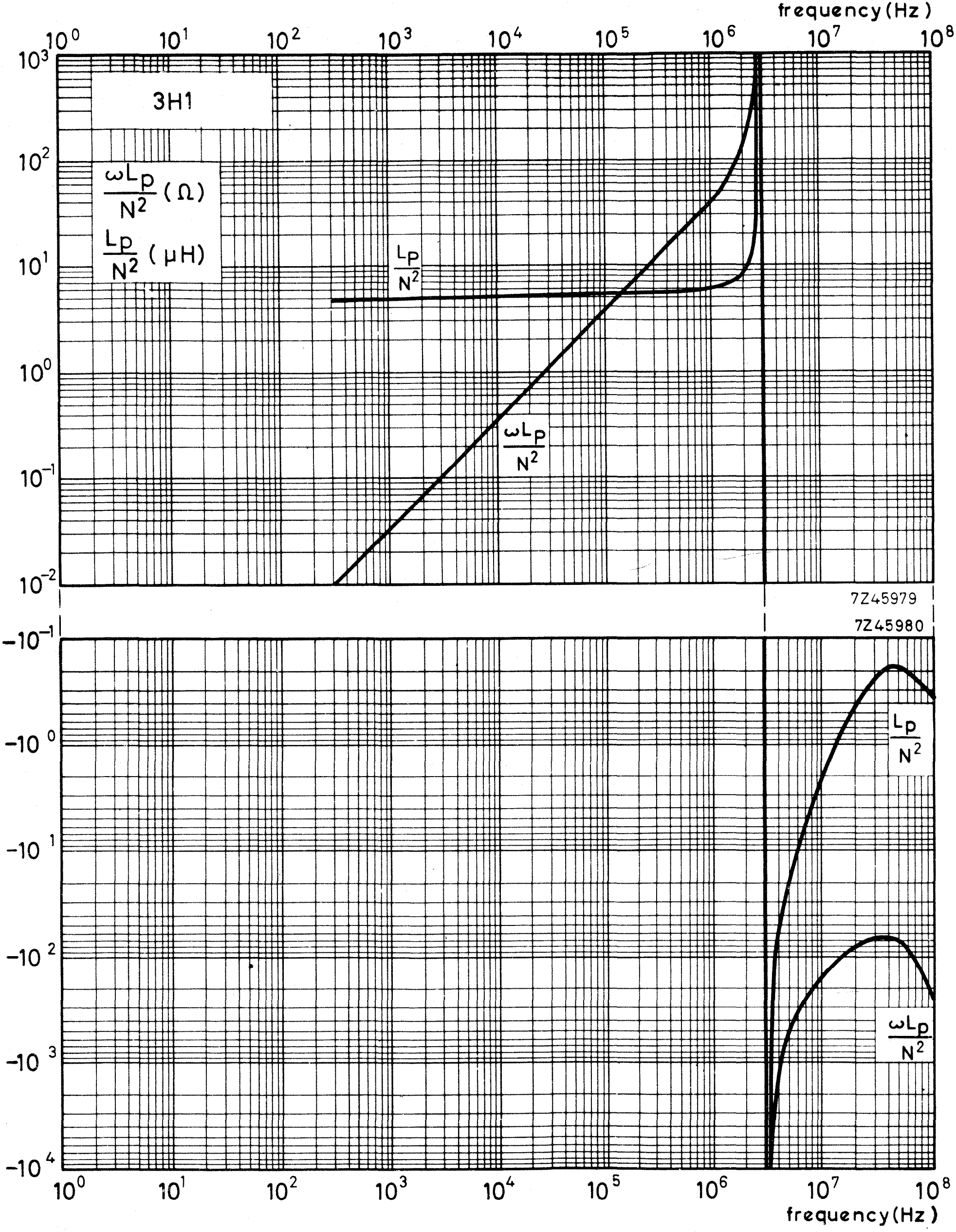
(4) Soldering spring 4322 021 30700
Material: brass, dipsoldered

CHARACTERISTIC CURVES

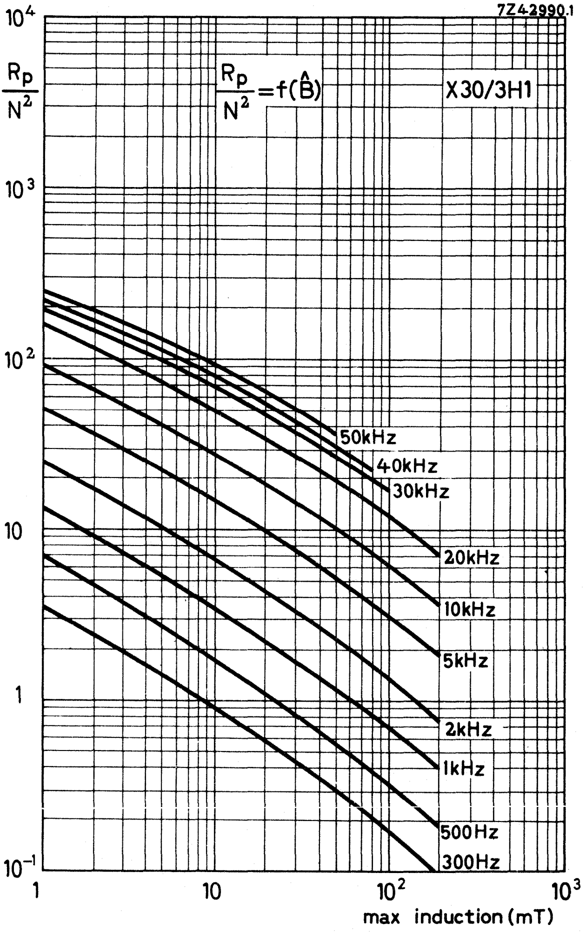
INDUCTANCE AS A FUNCTION OF THE INDUCTION (typical values)



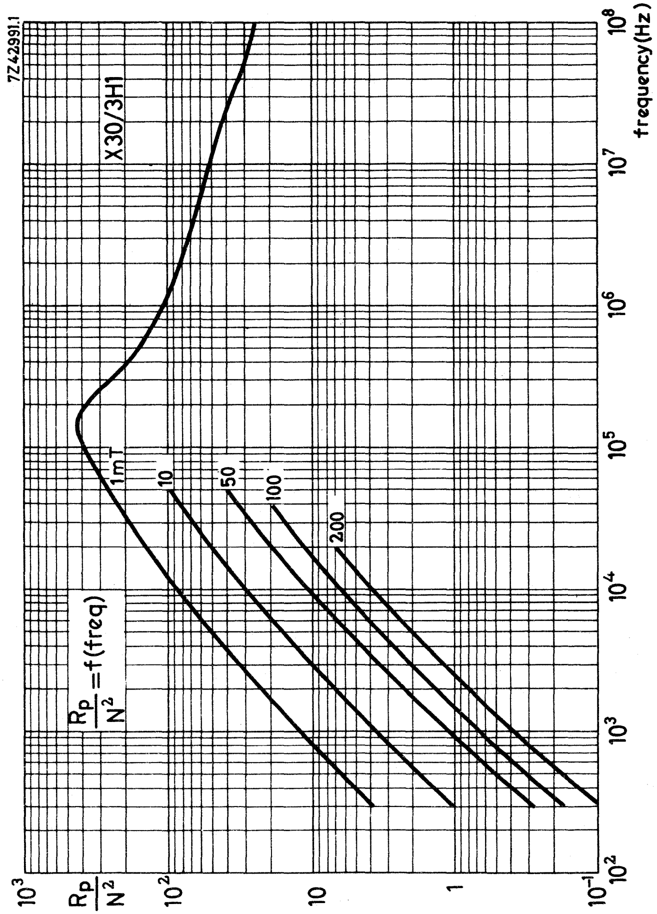
INDUCTANCE AS A FUNCTION OF THE FREQUENCY (typical curves)



CORE LOSSES AS A FUNCTION OF THE INDUCTION (typical values)

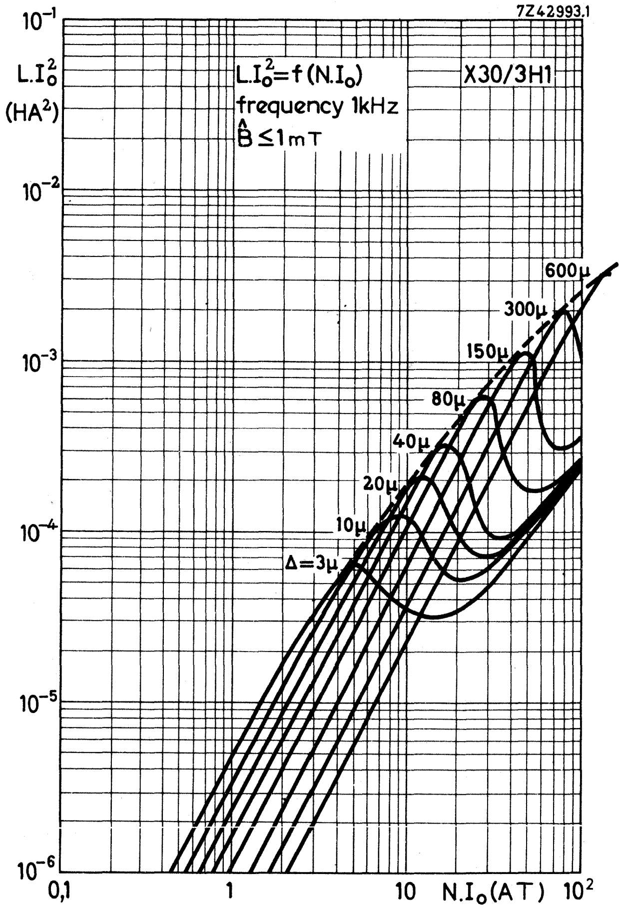


CORE LOSSES AS A FUNCTION OF THE FREQUENCY (typical values)

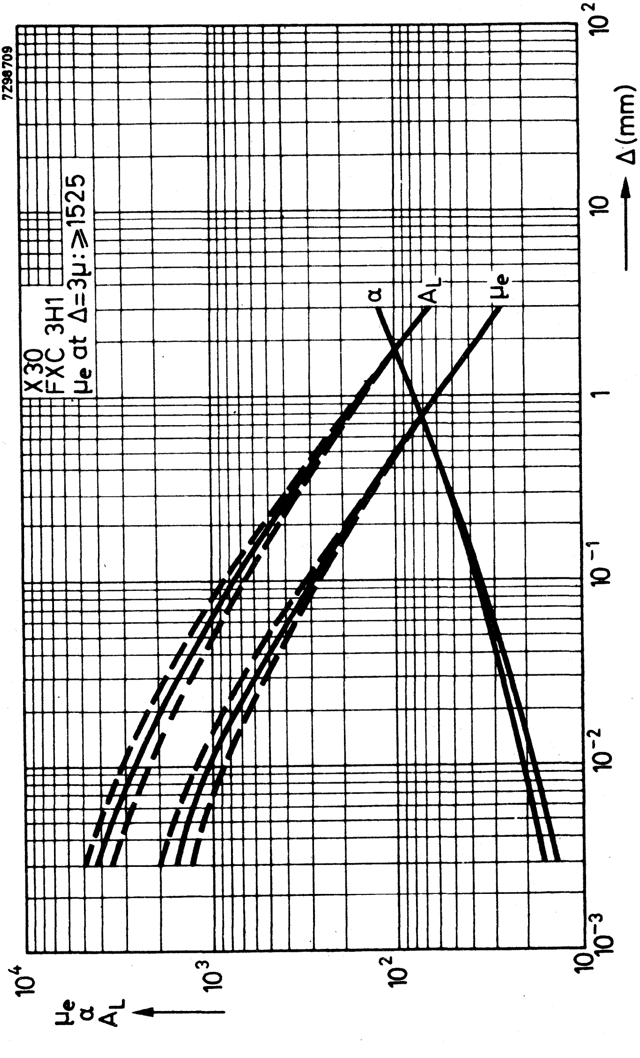


HANNA CURVE (typical values)

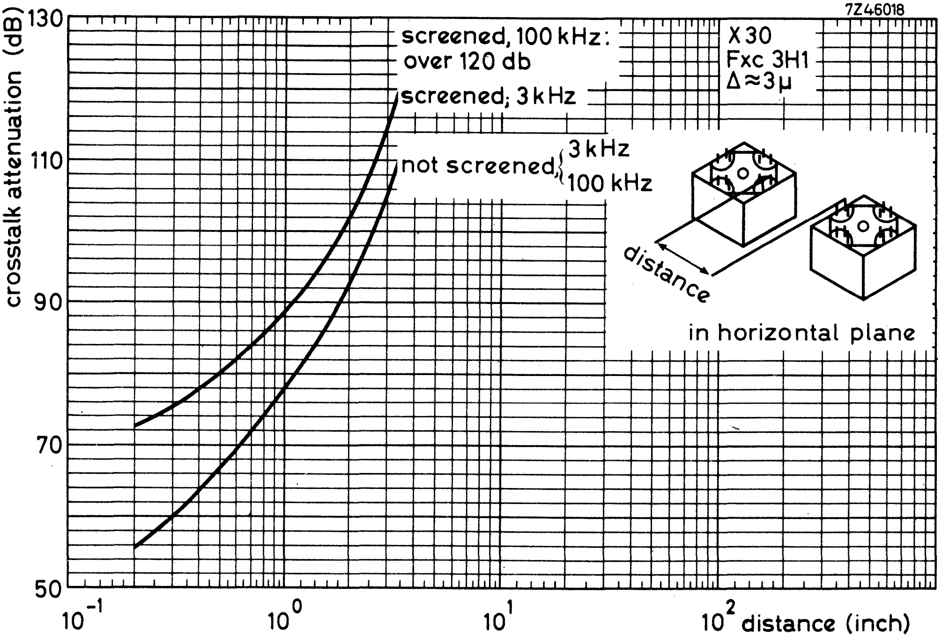
Indicating optimum inductance for a certain airgap and direct current.

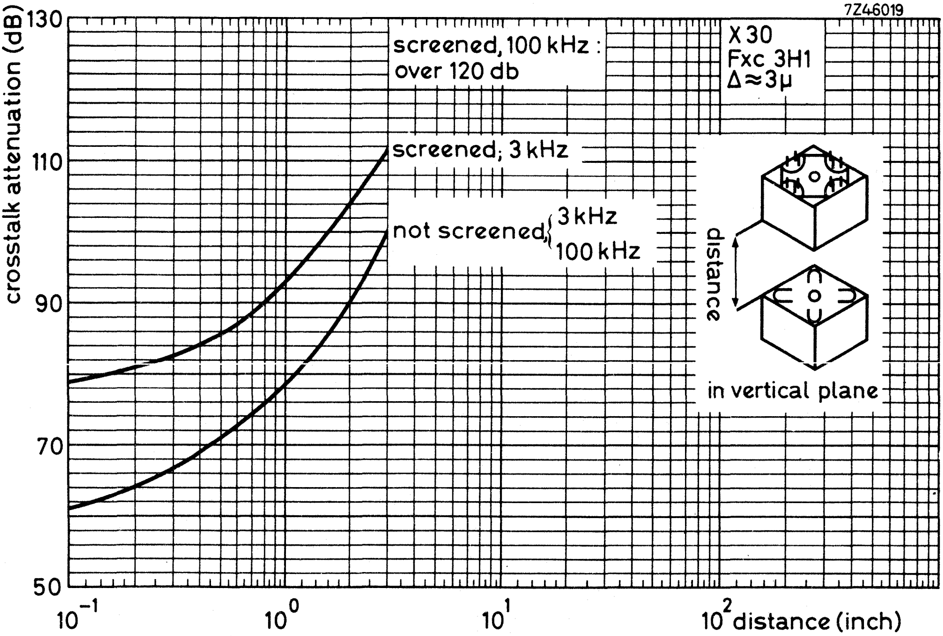


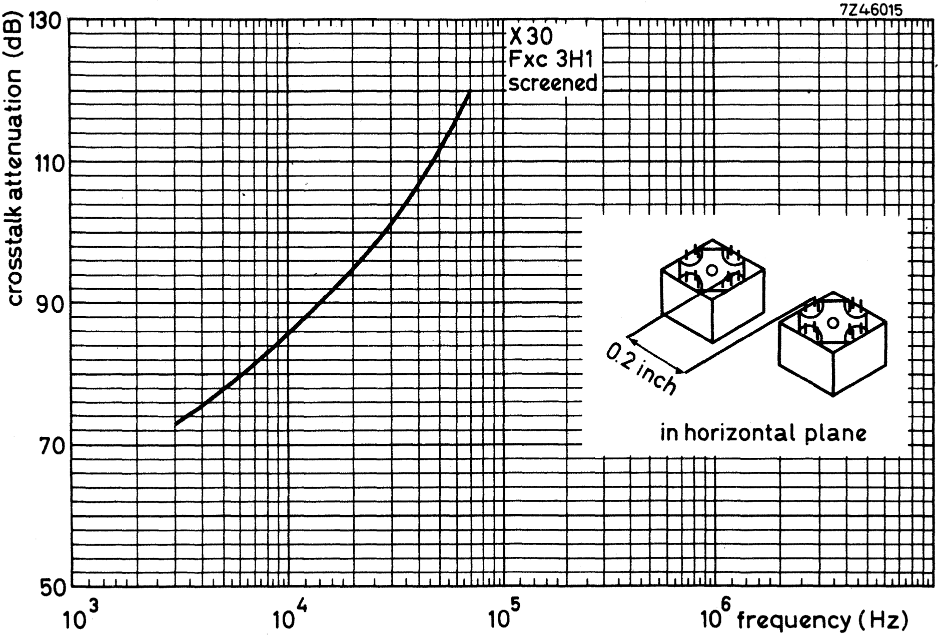
μ_e - α AND A_L CURVES



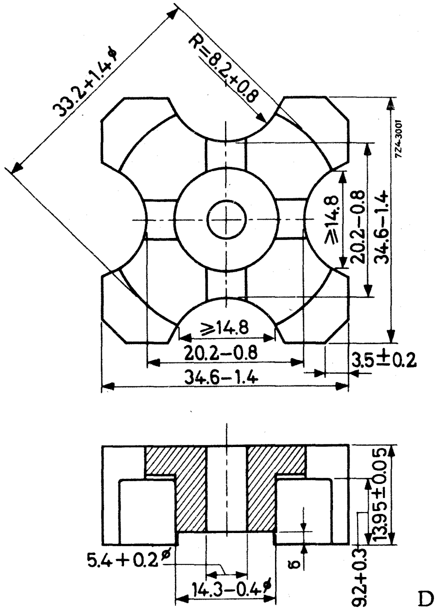
CROSSTALK ATTENUATION






7Z46015
X 30
Fxc 3H1
screened
crosstalk attenuation (dB)
130
110
90
70
50
10^3
10^4
10^5
10^6
frequency (Hz)
0.2 inch
in horizontal plane

CROSS CORES



Dimensions in mm

Two types of core halve can be supplied:

1) without airgap

2) with airgap. Standardised airgap lengths in each core half are: 0.02, 0.05, 0.15 and 0.25 mm.

The dimensions of the cross cores meet the following specifications: I.E.C. 226 (international) and C.C.T.U. 06-10 (France).

Cross core halves and associated parts are ordered by their 12-digit **catalog** number.

CORE HALVES WITHOUT AIR GAP

Version

ferroxcube grade	catalog number
3H1	4322 020 24000

Properties

For toroidally wound core halves the values in Table I are guaranteed.

Table I

	at temp. (°C)	grade 3H1
$\alpha_F \times 10^6$	+5 to +23	+0.5 to +1.5
	+23 to +55	+0.5 to +1.5
	+23 to +70	+0.5 to +1.5 *)
$D_F \times 10^6$	23 ± 1	$\leq$ 4.3

For the combination of two cross core halves randomly chosen from a batch and pressed together with a force of 330 N, the value in Table II are guaranteed at 25 ± 10 °C.

Table II

	at $\hat{B}$ (mT)	at freq. (kHz)	grade 3H1
μ_e	$\leq$ 0, 1	4	$\geq$ 1580
α	$\leq$ 0, 1	4	$\leq$ 14, 4
$\frac{\tan \delta}{\mu_i} \times 10^6$	$\leq$ 0, 1	4	$\leq$ 1, 2
	$\leq$ 0, 1	100	$\leq$ 7
$q_{2-24-100}$	1, 5-3	4	$\leq$ 1, 8
$\eta_B \times 10^3$	1, 5-3	4	$\leq$ 1, 1

Weigth per half core 29 g approx.

Mean length of lines of force l_e = 67, 3 mm (two halves)

A_e = 164 mm^2 (two halves)

$\Sigma \frac{l_e}{A_e}$ =0, 410 mm^{-1}(two halves)

V_e = 11000 mm^3 (two halves)

---

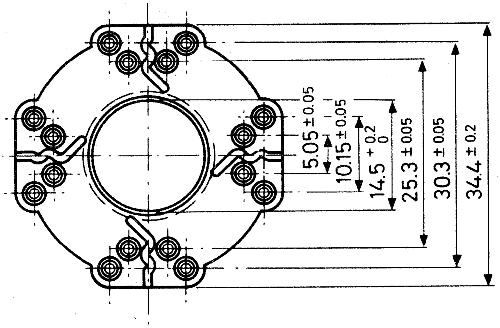
*) Orientation value

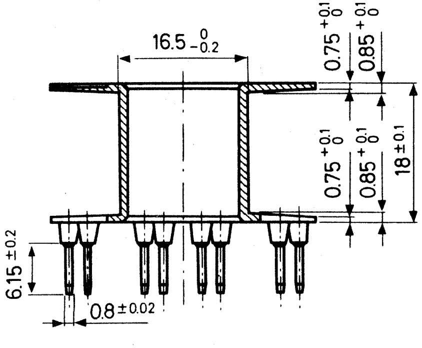
CORE HALVES WITH AIR GAP

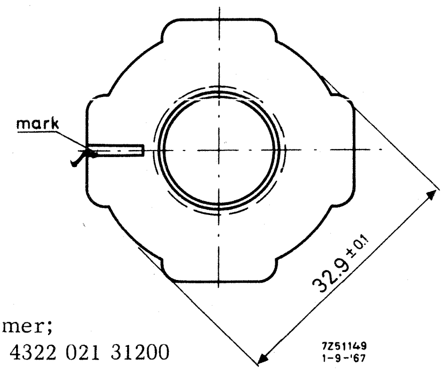
ferroxcube grade	air gap length in mm	catalog number
3H1	0.02 ± 0.01	4322 020 24210
3H1	0.05 ± 0.015	4322 020 24220
3H1	0.15 ± 0.015	4322 020 24230
3H1	0.25 ± 0.015	4322 020 24240

The electrical properties are measured on cores without air gap.

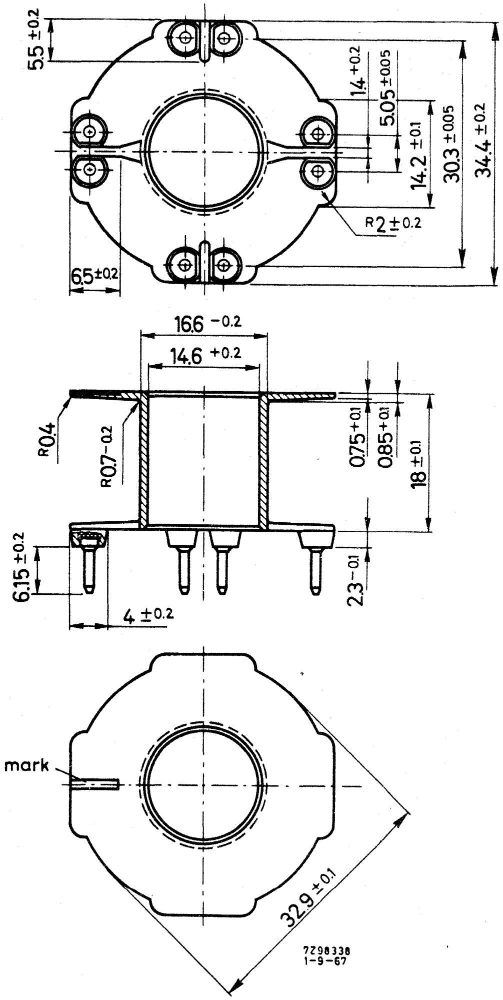
COIL FORMERS







16 pins coil former;
catalog number 4322 021 31200

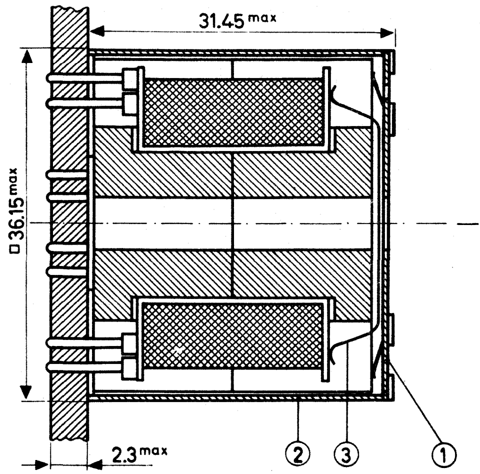


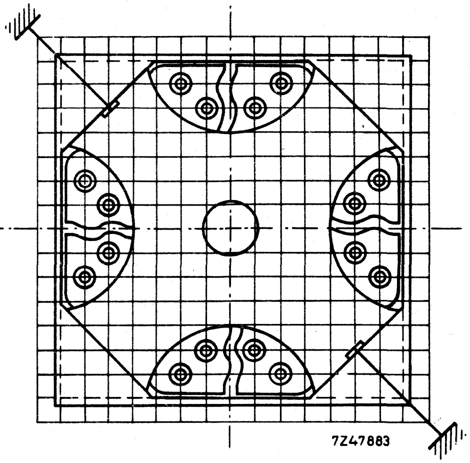
8 pins coil former;
catalog number 4322 021 30190

Properties of the coil formers

Material	reinforced polyester
Window area	134 mm^2
Mean length of turn	77,5 mm
Max. dipsolder temperature (5 to 6 s)	280 °C
Max. working temperature	130 °C
Tensile strength of pins (1 minute at 25 °C)	$\geq$ 20 N
A.C. test voltage between pins (50 Hz, 2 min)	2000 V

MOUNTING PARTS





(1) Cover 4322 021 31160
(2) Container 4322 021 31180
(3) Spring 4322 021 30220
(4) Soldering spring 4322 021 30700 (see below)

The cross core has been developed especially for transformers to be mounted on printed-wiring boards.

An advantage of this construction is that the leading-out wires are soldered to the pins, which are directly mounted on the coil former.

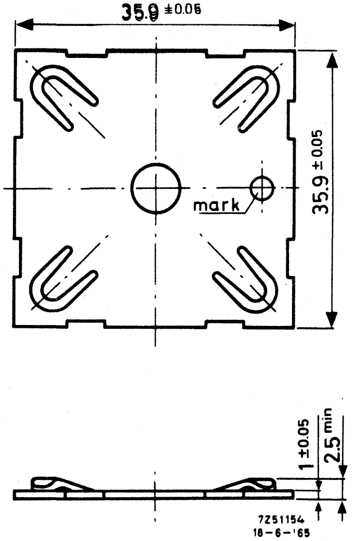
The sixteen soldering pins are positioned according to a grid of 2.52mm. They will fit printed-wiring boards with a 0.1" grid as well as those with a 2.50mm grid. The pin length is sufficient for board thicknesses up to 2.3mm. The printed-wiring board should be provided with holes of 1.3 ± 0.1mm in diameter.

The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

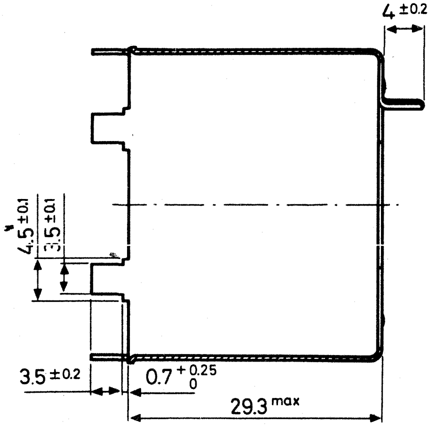
The cover is provided with a marking hole. The mark of the coil former (see the Fig. of coil former)has to be in one line with this hole.These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

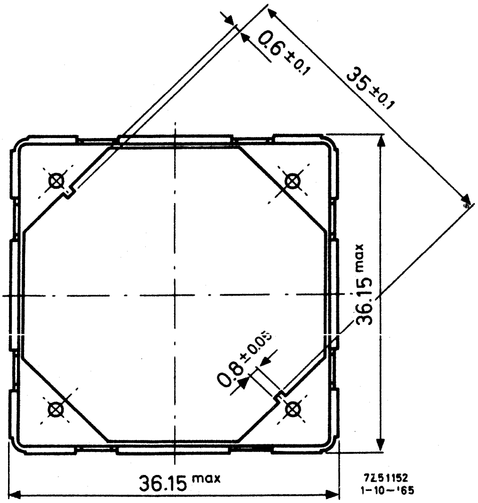
It is recommended to cement the coil former in one of the cross-core halves or to use the spring (pos. 3) in order to obtain the most stable construction.

Before bending the lips of the container, pressure should be exercised evenly on the four corners of the cover until the latter meets the container. The required force is approximately 330 Newton. After bending the lips, the core will have the correct tension.

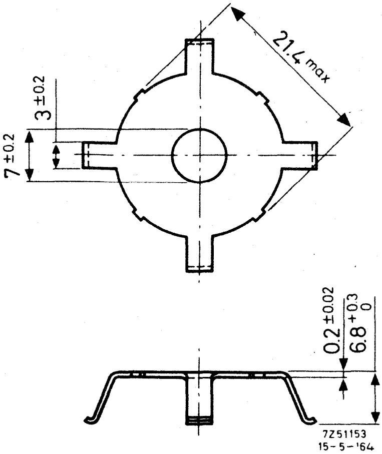


(1) Cover 4322 021 31160
Material: phosphorbronze, nickel plated

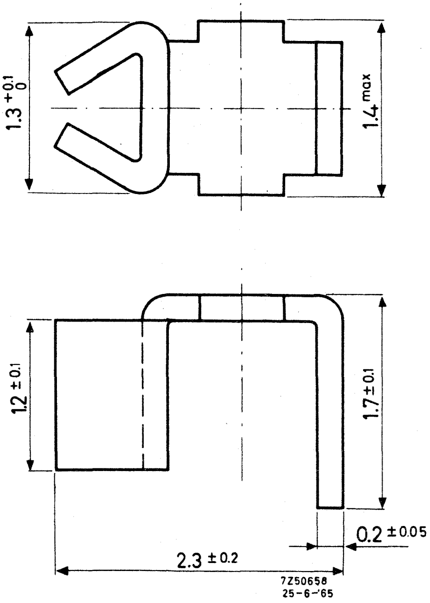




(2) Container 4322 021 31180
Material: brass, nickel plated



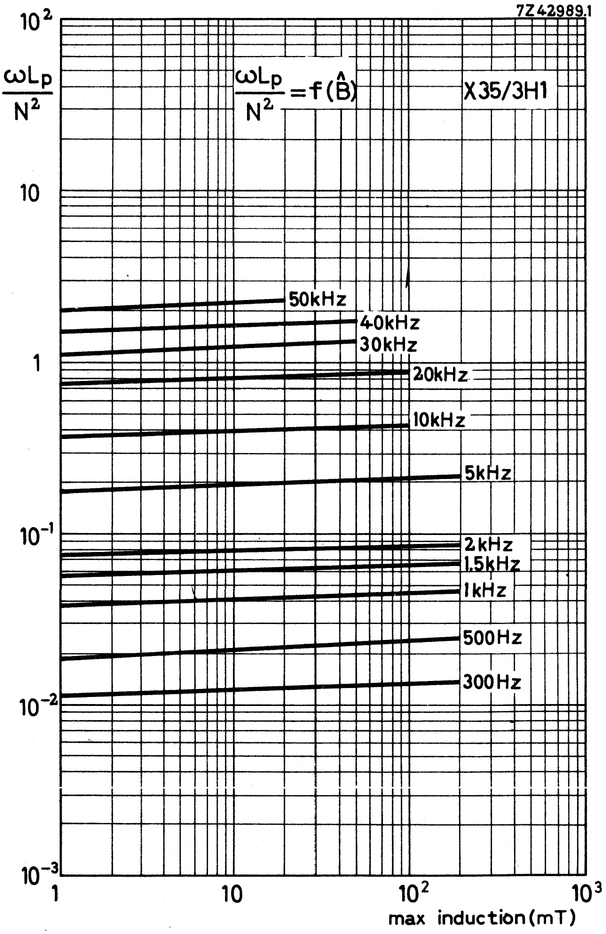
(3) Spring 4322 021 30220
Material: phosphorbronze



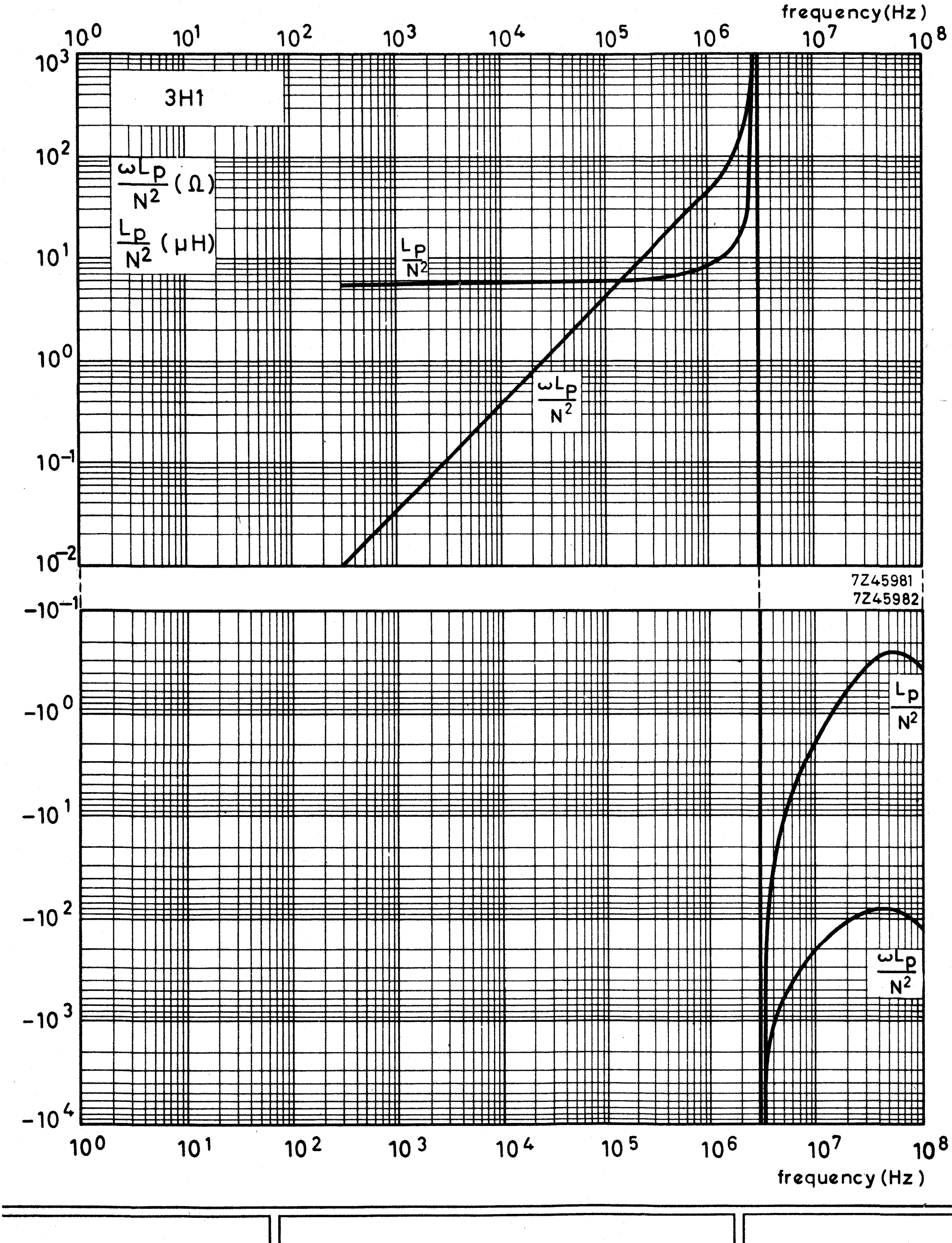
(4) Soldering spring 4322 021 30700
Material: brass, dipsoldered

CHARACTERISTIC CURVES

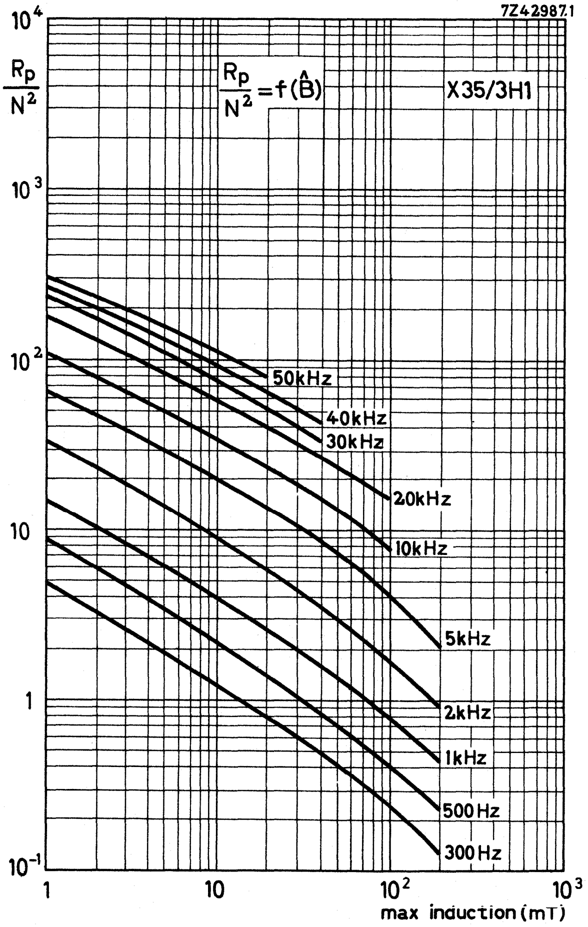
INDUCTANCE AS A FUNCTION OF THE INDUCTION (typical values)



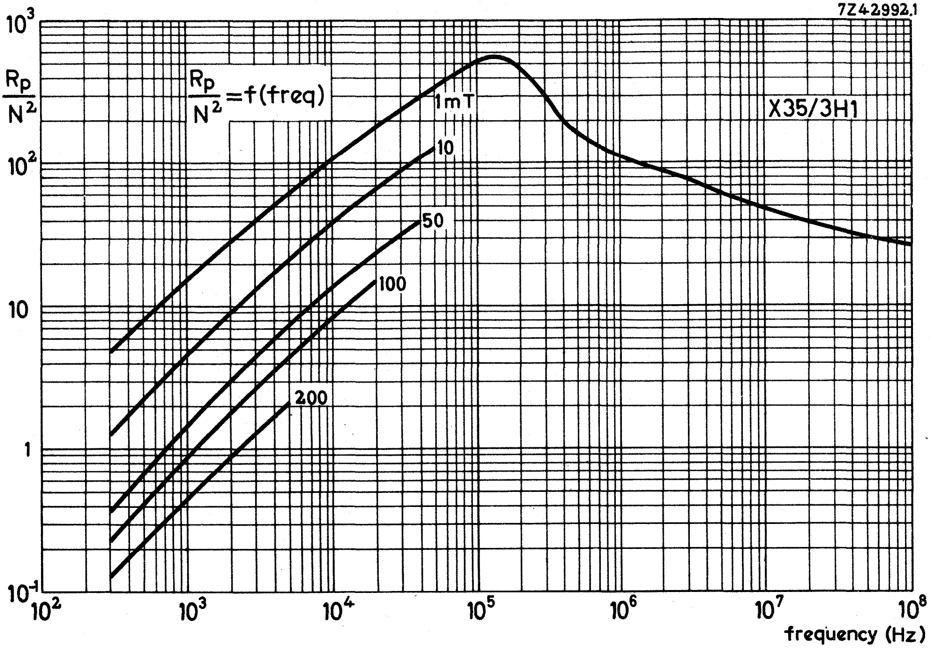
INDUCTANCE AS A FUNCTION OF THE FREQUENCY (typical curves)



CORE LOSSES AS A FUNCTION OF THE INDUCTION (typical values)

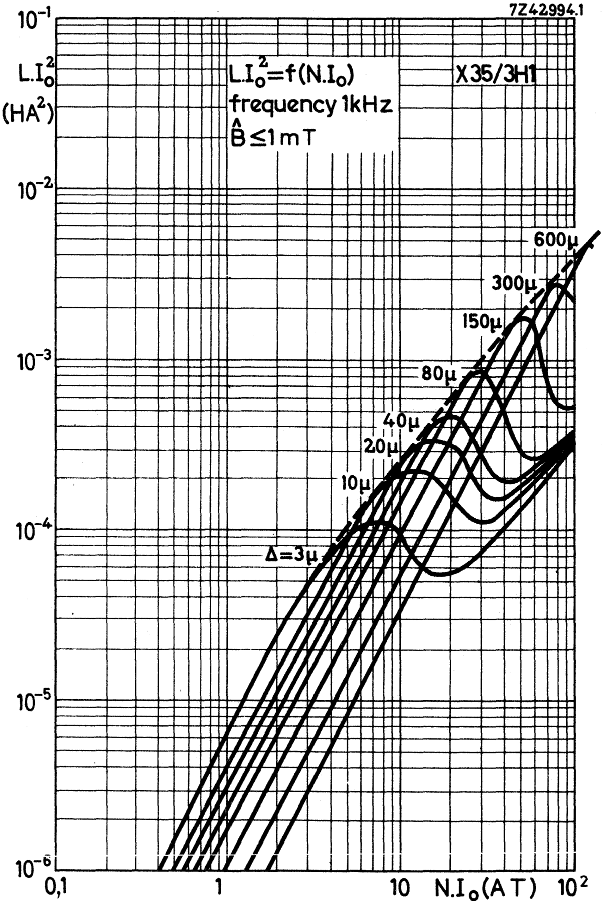


CORE LOSSES AS A FUNCTION OF THE FREQUENCY (typical values)

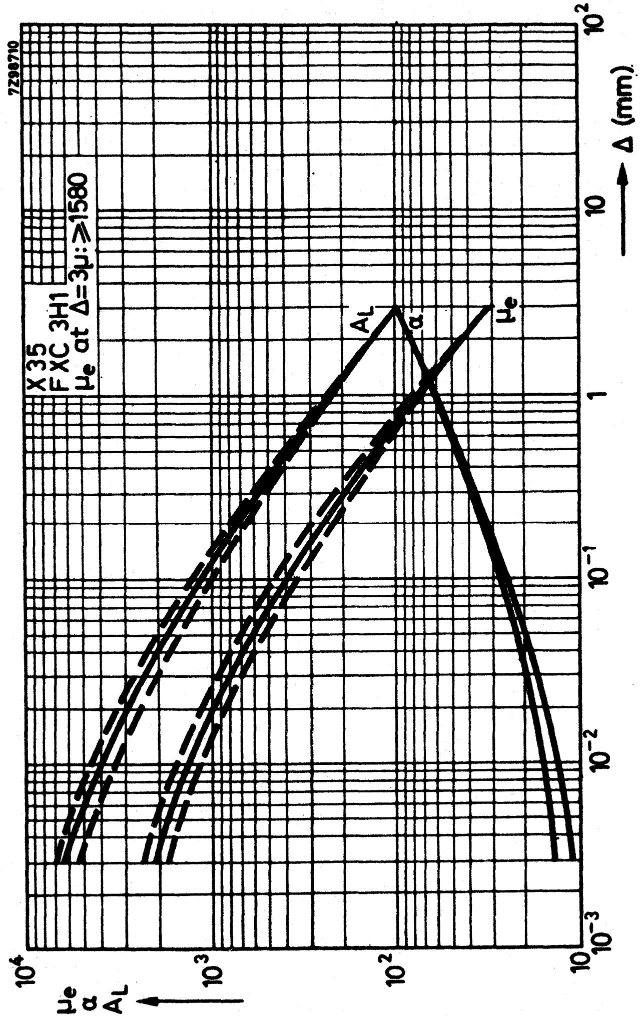


HANNA CURVE (typical values)

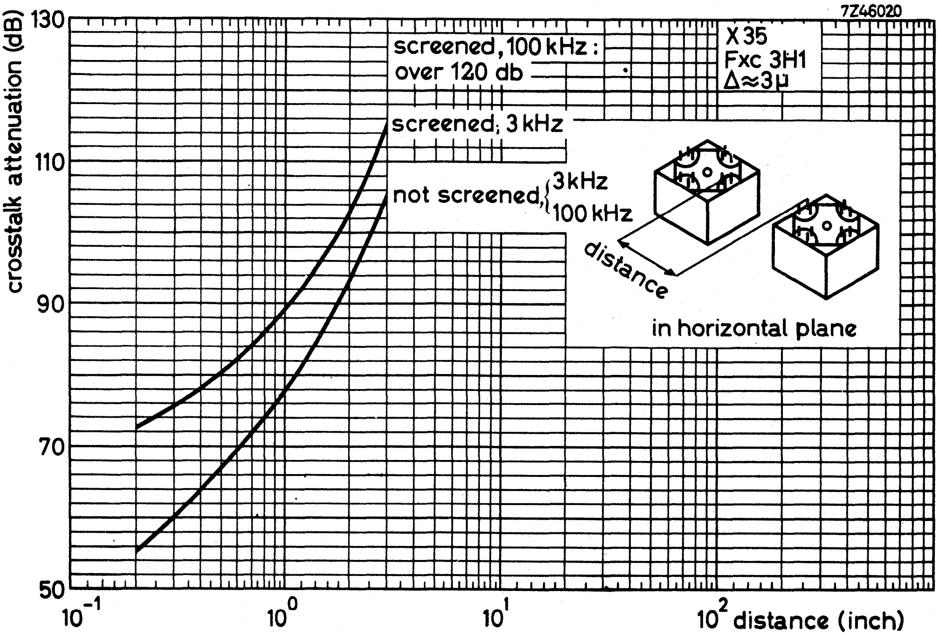
Indicating optimum inductance for a certain airgap and direct current.

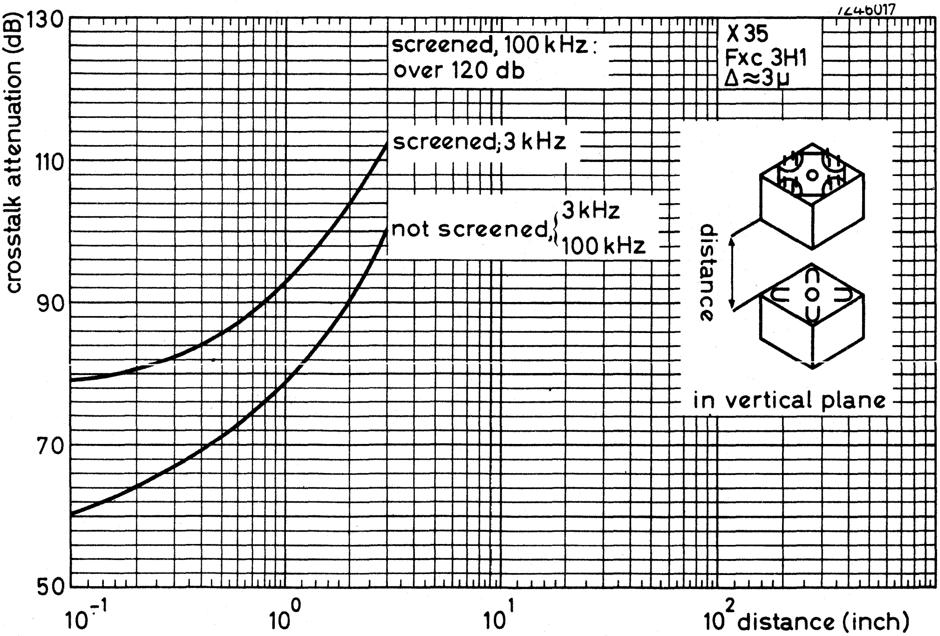


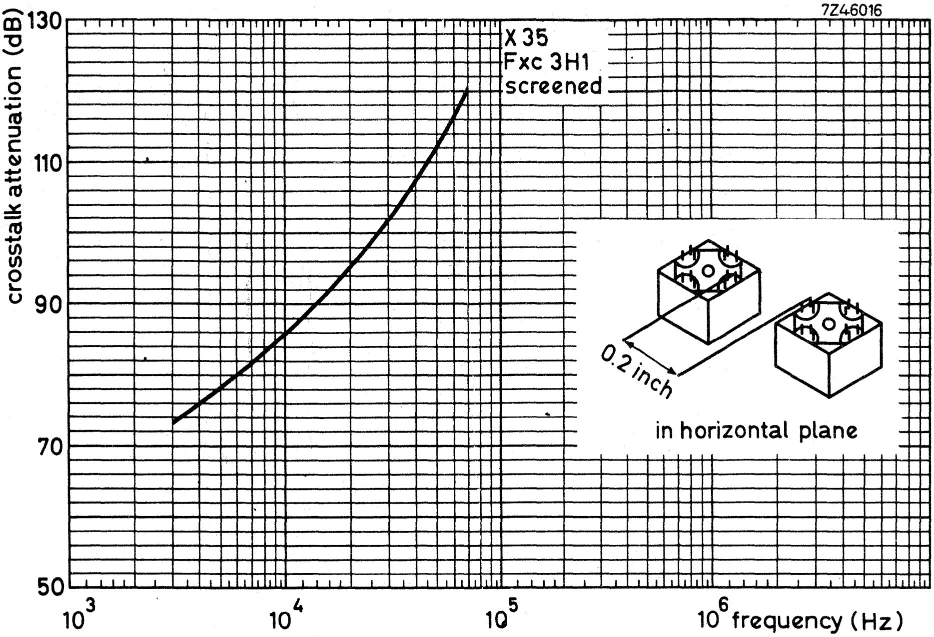
μ_e - α AND A_L CURVES



CROSSTALK ATTENUATION






7Z46016
X 35
Fxc 3H1
screened
crosstalk attenuation (dB)
130
110
90
70
50
10³
10⁴
10⁵
10⁶
frequency (Hz)
0.2 inch
in horizontal plane

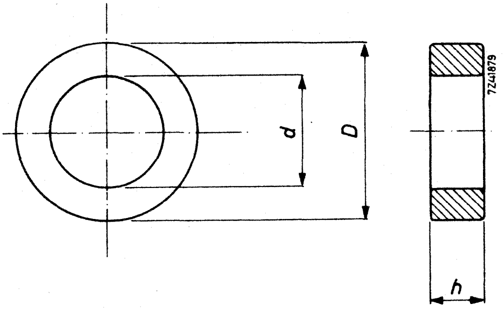
Toroids

INTRODUCTION

Toroids, having no air gap, posses a small magnetic stray field and a high permeability.
In spite of the closed magnetic circuit the losses are low due to the favourable properties of ferroxcube.

Toroids are mainly used in small broadband transformers, pulse transformers and chokes. If, however, the direct current through the transformer is relatively large, transformer cores with an air gap are to be preferred.
Toroids are not recommended for tuned circuits.

TOROIDS



Ferroxcube toroids are used in small broadband transformers, pulse transformers, etc.
Toroids are available in various sizes and ferroxcube grades. They are barrel-finished and coated with an insulating lacquer.

DIMENSIONAL QUANTITIES, TOLERANCES AND WEIGHTS (Table I)

D (mm)	d (mm)	h (mm)	l_e (mm)	$\Sigma\frac{l_e}{A_e}$ (mm^{-1})	V_e (mm^3)	weight (g)
2 ±0.1	1.3 ±0.1	0.7 ±0.1	5,11	20,8	1,25	0.006
3.93 ±0.13	2.23 ±0.09	1.27 ±0.09	–	8,74	–	–
4 ±0.1	2.2 ±0.1	1.1 ±0.1	9,46	9,56	9,37	0.045
4.83 ±0.25	2.28 ±0.25	1.27 ±0.25	–	6,63	–	–
5.84 ±0.13	3.05 ±0.2	1.52 ±0.13	–	6,34	–	–
6 ±0.15	4 ±0.15	2 ±0.1	15,5	7,75	31,0	0.15
9 ±0.2	6 ±0.2	3 ±0.1	23,3	5,17	105	0.50
9.53 ±0.25	4.75 ±0.25	3.18 ±0.25	–	2,84	–	–
14 ±0.3	9 ±0.25	5 ±0.15	35,5	2,85	445	2.14
23 ±0.5	14 ±0.35	7 ±0.2	57,0	1,81	1790	8.6
29 ±0.5	19 ±0.4	7.5 ±0.2	75,0	2,01	2580	13
36 ±0.7	23 ±0.5	10 ±0.2	92,0	1,42	5600	29
36 ±0.7	23 ±0.5	15 ±0.2	92,0	0,942	8500	44

Notes

1. All dimensions apply to non-lacquered toroids.
2. All μ-values in the following are determined with the $\Sigma\frac{l_e}{A_e}$ values of Table I at 25 °C.
   The relevant A_L values can be calculated with the formula $A_L = \frac{0,4\pi\mu}{\Sigma\frac{l_e}{A_e}}$
3. The smaller a toroid, the more its properties deviate from the material properties. Therefore a straight-forward translation of the material figures is not always possible.

GRADES AND SIZES

Toroids of ferroxcube 3E1

μ_{tor} = 2700 ±20% at 23 ± 1 °C
Lacquered green

dimensions (mm)	catalog number
29 x 19 x 7.5	4322 020 36550
36 x 23 x 10	4322 020 36560
36 x 23 x 15	4322 020 36570

Toroids of ferroxcube 3E2

$\mu_{tor} > 5000$ at +23 to +70 °C
Lacquered blue

dimensions (mm)	catalog number
4 x 2.2 x 1.1	4322 020 36650
6 x 4 x 2	4322 020 36660
9 x 6 x 3	4322 020 36670
14 x 9 x 5	4322 020 36680
23 x 14 x 7	4322 020 36690

Toroids of ferroxcube 3E3

$\mu_{tor} > 10\,000$ at +10 to +70 °C
Lacquered brown
* Not lacquered

dimensions (mm)	catalog number
*2 x 1.3 x 0.7	4322 020 90950
4 x 2.2 x 1.1	4322 020 36700
6 x 4 x 2	4322 020 36710
9 x 6 x 3	4322 020 36720

Toroids of ferroxcube 3H1

Sorted into μ groups.
Lacquered orange
$D_F \leq 4.3 \times 10^{-6}$ at 23 ± 1 °C

dimensions (mm)	catalog number
4 x 2.2 x 1.1	4322 020 36590
6 x 4 x 2	4322 020 36600
9 x 6 x 3	4322 020 36610
14 x 9 x 5	4322 020 36620
23 x 14 x 7	4322 020 36630

For the convenience of the user the toroids of ferroxcube 3H1 are delivered sorted into groups of approximately equal μ-value. The μ-value is indicated by the code colour of one of the surfaces of the toroid, see Table II. Groups are not separately available.

Table II (for toroids of the 3H1 grade)

group	code colour	μ_{tor} at 23 ± 1 °C	4322 020				
			36590	36600	36610	36620	36630 ←
					α-factor		
2	red	2140-2360	58,3	52,3	42,8	31,8	25,3
3	orange	2300-2540	56,0	50,3	41,2	30,6	24,4
4	yellow	2480-2740	54,0	48,6	39,8	29,5	23,5
5	green	2680-2960	51,8	46,6	38,2	28,3	22,6
6	blue	2900-3210	49,9	44,8	36,7	27,3	21,7
7	violet	3150-3480	48,0	43,2	35,4	26,2	20,9
8	grey	3420-3780	46,2	41,4	34,0	25,2	20,1
9	white	3720-4110	44,2	39,7	32,5	24,1	19,2

Number of turns for L mH: $N = \alpha \sqrt{L}$

The α factors are mean values, except those of the last group.

Between +23 and +70 °C the min μ_{tor} of the product is higher than the min μ_{tor} of the group.

Toroids of ferroxcube 4C6

$\mu_{tor} > 100$ at +5 to +55 °C
Lacquered violet

dimensions (mm)	catalog number
6 x 4 x 2	4322 020 91000
9 x 6 x 3	4322 020 91010
14 x 9 x 5	4322 020 91020
23 x 14 x 7	4322 020 91070
36 x 23 x 15	4322 020 91090

Toroids of ferroxcube 3B7

Between 0 and +60 °C the deviation in A_L is max. +10/−6% with regard to A_L at the reference temperature +23 °C.
Not lacquered.

dimensions (mm)	A_L ± 20% at 23 ± 1 °C	catalog number
3,93 x 2,23 x 1,27	360	4322 020 90820
4,83 x 2,28 x 1,27	475	4322 020 90830
5,84 x 3,05 x 1,52	495	4322 020 90840
9,53 x 4,75 x 3,18	1100	4322 020 90850

Ferroxcube memory cores

STANDARD RANGE For complete information refer to data Handbook series "Components and Materials" Part 5

core type	old type number	temperature range	C4 **)	nominal operating conditions $T_{amb} = 25\ ^oC$, D.R. = 0,50			relevant typical output characteristics $V_{ref} = 0,1\ rV_1$				
				I	t_r	t_d	uV_1	rV_1	wV_z	t_p	t_s
			(mA/^{o}C)	(mA)	(µs)	(µs)	(mV)	(mV)	(mV)	(µs)	(µs)
18H51	–	medium	1,3	555	0,05	0,30	45	44	5	0,120	0,240
18H53	–	medium	1,3	560	0,05	0,30	45	44	4,5	0,135	0,250
18H61	–	medium	1,4	644	0,05	0,25	55	53	5	0,110	0,210
18H81	6H11	medium	2,0	800	0,05	0,20	66	64	6	0,095	0,170
18H83	–	medium	2,0	833	0,05	0,30	55	54	4	0,105	0,190
18H86	6H6	standard	1,3	825	0,05	0;21	53	52	5	0,095	0,175
20H74	6H4	standard	2,7	710	0,05	0,26	66	63	5	0,110	0,220
20H83 *)	6H3	standard	3,5	890	0,05	0,23	49	48	4	0,105	0,190
20H85	6H5	medium	1,6	865	0,05	0,23	65	63	8	0,100	0,190
20H89	6H9	medium	2,0	800	0,05	0,25	64	61	8,5	0,110	0,210
20H92	6H2	medium	1,4	973	0,05	0,26	52	51	4	0,110	0,210
30F78	6F8	standard	3,1	710	0,1	0,50	63	61	5	0,200	0,40
30F83	6F3	medium	1,3	800	0,15	0,59	68	67	5	0,270	0,49
50C51 *)	6C1	standard	2,3	530	0,2	1,1	63	60	8	0,46	0,87
50C82 *)	6C2	medium	1,1	805	0,25	1,2	100	98	7	0,45	1,00
50D35 *)	6D5	standard	2,4	395	0,2	1,5	64	62	9	0,58	1,18
50D49 *)	6D9	standard	1,5	475	0,2	1,5	60	58	8	0,55	1,20
150E31 *)	6E1	standard	2,7	385	0,8	12	115	110	22	2,9	6,4

150E31:
- 31 (internal ref. no.)
- 3 first figure of nominal current at 25 ^oC
- E basic ferroxcube grade
- 150 outer dia in mil

*) maintenance type

**) rate of change of full drive current for constant uV_1

Contents

Potcores

FERROXCUBE TRANSFORMER CORES

Printed in the Netherlands 9399 261 23501