PHILIPS

Data handbook

PHILIPS

Electronic components and materials

Components and materials

Part 4a November 1978

Soft ferrites

COMPONENTS AND MATERIALS

Part 4a **November 1978**

MANY ASSEMBLIES USING FERRITES
ARE DESCRIBED IN PART 3

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)

Part 1a	December 1975	ET1a 12-75	**Transmitting tubes for communication, tubes for r.f. heating** Types PE05/25 to TBW15/25
Part 1b	August 1977	ET1b 08-77	**Transmitting tubes for communication, tubes for r.f. heating, amplifier circuit assemblies**
Part 2a	November 1977	ET2a 11-77	**Microwave tubes** Communication magnetrons, magnetrons for microwave heating, klystrons, travelling-wave tubes, diodes, triodes T-R switches
Part 2b	May 1978	ET2b 05-78	**Microwave semiconductors and components** Gunn, Impatt and noise diodes, mixer and detector diodes, backward diodes, varactor diodes, Gunn oscillators, sub-assemblies, circulators and isolators
Part 3	January 1975	ET3 01-75	**Special Quality tubes, miscellaneous devices**
Part 4	March 1975	ET4 03-75	**Receiving tubes**
Part 5a	March 1978	ET5a 03-78	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
Part 5b	May 1975	ET5b 05-75	**Camera tubes, image intensifier tubes**
Part 6	January 1977	ET6 01-77	**Products for nuclear technology** Channel electron multipliers, neutron tubes, Geiger-Müller tubes
Part 7a	March 1977	ET7a 03-77	**Gas-filled tubes** Thyratrons, industrial rectifying tubes, ignitrons, high-voltage rectifying tubes
Part 7b	March 1977	ET7b 03-77	**Gas-filled tubes** Segment indicator tubes, indicator tubes, switching diodes, dry reed contact units
Part 8	May 1977	ET8 05-77	**TV picture tubes**
Part 9	March 1978	ET9 03-78	**Photomultiplier tubes; phototubes**

SEMICONDUCTORS AND INTEGRATED CIRCUITS (RED SERIES)

Part 1a	**August 1978**	**SC1a 08-78**	**Rectifier diodes, thyristors, triacs** Rectifier diodes, voltage regulator diodes (> 1,5 W), transient suppressor diodes, rectifier stacks, thyristors, triacs
Part 1b	**May 1977**	**SC1b 05-77**	**Diodes** Small signal germanium diodes, small signal silicon diodes, special diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes
Part 2	**November 1977**	**SC2 11-77**	**Low-frequency and dual transistors**
Part 3	**January 1978**	**SC3 01-78**	**High-frequency, switching and field-effect transistors**
Part 4a	**June 1976**	**SC4a 06-76**	**Special semiconductors*** Transmitting transistors, field-effect transistors, dual transistors, microminiature devices for thick and thin-film circuits
Part 4b	**September 1978**	**SC4b 09-78**	**Devices for optoelectronics** Photosensitive diodes and transistors, light emitting diodes, photocouplers, infrared sensitive devices, photoconductive devices
Part 4c	**July 1978**	**SC4c 07-78**	**Discrete semiconductors for hybrid thick and thin-film circuits**
Part 5a	**November 1976**	**SC5a 11-76**	**Professional analogue integrated circuits**
Part 5b	**March 1977**	**SC5b 03-77**	**Consumer integrated circuits** Radio-audio, television
Part 6	**October 1977**	**SC6 10-77**	**Digital integrated circuits** LOCMOS HE4000B family
Signetics integrated circuits 1978			Bipolar and MOS memories Bipolar and MOS microprocessors Analogue circuits

* The most recent information on field-effect transistors can be found in SC3 01-78, on dual transistors in SC2 11-77, and on microminiature devices in SC4c 07-78.

COMPONENTS AND MATERIALS (GREEN SERIES)

Part 1	June 1977	CM1 06-77	**Assemblies for industrial use** High noise immunity logic FZ/30-series, counter modules 50-series, NORbits 60-series, 61-series, circuit blocks 90-series, circuit block CSA70(L), PLC modules, input/output devices, hybrid circuits, peripheral devices, ferrite core memory products
Part 2a	October 1977	CM2a 10-77	**Resistors** 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	February 1978	CM2b 02-78	**Capacitors** Electrolytic and solid capacitors, film capacitors, ceramic capacitors, variable capacitors
Part 3	January 1977	CM3 01-77	**Radio, audio, television** Components for black and white television, components for colour television
Part 3a	September 1978	CM3a 09-78	**FM tuners, television tuners, surface acoustic wave filters**
Part 3b	October 1978	CM3b 10-78	**Loudspeakers**
Part 4a	November 1978	CM4a 11-78	**Soft ferrites** Ferrites for radio, audio and television, beads and chokes, Ferroxcube potcores and square cores, Ferroxcube transformer cores
Part 4b	December 1976	CM4b 12-76	**Piezoelectric ceramics, permanent magnet materials**
Part 6	April 1977	CM6 04-77	**Electric motors and accessories** Small synchronous motors, stepper motors, miniature direct current motors
Part 7	September 1971	CM7 09-71	**Circuit blocks** Circuit blocks 100 kHz-series, circuit blocks 1-series, circuit blocks 10-series, circuit blocks for ferrite core memory drive
Part 8	February 1977	CM8 02-77	**Variable mains transformers**
Part 9	March 1976	CM9 03-76	**Piezoelectric quartz devices**
Part 10	April 1978	CM10 04-78	**Connectors**

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, tubes, beads and cores for magnetic recording.
Potcores, square cores, E and 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 and nickel-zinc ferrites and their various grades.

* Our trade name for magnetically soft ferrites.

APPLICATION

→ The various material grades of Ferroxcube indicated by digits and their application as cores 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
3B8	potcores, square cores, cross cores (with d.c. polarization)
→ 3C2	yoke rings, L-cores
3C6	E and U-cores, rods, tubes
3C7	E and I-cores, U-cores
3C8	U and I-cores, E-cores, EC-cores for power applications
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
3E5	square cores
→ 3H1	potcores, square cores, cross cores
→ 3H2	tubes, rods, tooth cores, toroids
3H3	potcores, square 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, 4L1, 4L2, 4MX	These are special-purpose NiZn ferrites developed for one type of application, namely resonant cavities for particle accelerators. In this field, a technical discussion is usually necessary before the correct material can be determined.
→ 8C1, 8H1	cores for magnetic recording

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

SYMBOLS AND DEFINITIONS OF TERMS
(in accordance with IEC401 and IEC125)

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_1 — core constant = the summation of the effective core lengths divided by the effective area, expressed in mm^{-1}

$$C_1 = \Sigma \frac{1}{A}$$

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:

$$V_e = \frac{(\Sigma \frac{1}{A})^3}{(\Sigma \frac{1}{A^2})^2} \ mm^3$$

μ_i — relative initial permeability = the ratio of the induction change ΔB to the field strength change ΔH, measured on a magnetic closed circuit without air gap. The magnetization is executed with a very small field change $\Delta H \rightarrow 0$. (We recommend $B \le 0{,}1$ mT.)

$$\mu_i = \frac{1}{\mu_0} \lim_{H \rightarrow 0} \frac{B}{H}$$

μ_Δ — relative incremental permeability; dependent on a d.c. polarization on which a very small sinusoidal signal with $B \rightarrow 0$ is superimposed. This a.c. signal is so small that the small ellipse becomes a straight line. The slope of the straight line is the relative incremental permeability. (We recommend $B \le 0{,}2$ mT and f = 4 kHz.)

$$\mu_\Delta = \frac{1}{\mu_0} \frac{\Delta B}{\Delta H}$$

μ_a — relative amplitude permeability = the permeability of a core with a larger a.c. signal than mentioned under μ_Δ, consequently the relative amplitude permeability is dependent on the induction B

$$\mu_a = \frac{1}{\mu_0} \frac{B}{H}$$

μ_e relative effective permeability = permeability of a core with air gap

$$\mu_e = \frac{C_1}{\Sigma \frac{l}{\mu A}}$$

α_F temperature factor of a core without air gap, defined by

$$\alpha_F = \frac{\mu_\theta - \mu_{ref}}{\mu_{ref}^2 (\theta - \theta_{ref})}, \text{ according to IEC 133,} \quad (1)$$

or

$$\alpha_F = \frac{\mu_\theta - \mu_{ref}}{\mu_\theta \cdot \mu_{ref} (\theta - \theta_{ref})}, \text{ according to IEC 367-1,} \quad (2)$$

α_F can be calculated more accurately with equation (2) than with equation (1), which was in use until 1976. The introduction of equation (2) becomes necessary for new products with small tolerances, or for products which are guaranteed over a wide temperature range. Equation (1) is maintained for products made from long-standing materials. Where data are given in accordance with equation (2), they are marked with an asterisk.

The temperature coefficient (α_μ) of a core with ground air gap, with a relative effective permeability μ_e, is approx.

$$\alpha_\mu = \alpha_F \cdot \mu_e$$

The temperature coefficient of a core with ground air gap, with an inductance factor A_L, is approx.

$$\alpha_\mu = \alpha_F \frac{C_1}{\mu_0} A_L$$

These approximate values of α_μ hold true when the change in μ_e or A_L in the temperature range considered is relatively small.

D_F disaccommodation factor, gives the permeability variation, measured between 10 and 100 min after demagnetization

$$D_F = \frac{\mu 1 - \mu 2}{\mu_1^2 \log \frac{t2}{t1}}$$

Curie point critical temperature in ^{o}C 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 across the coil. The resulting R/L value for eddy current and residual losses is:

$$\frac{R}{L} = \frac{\tan\delta}{\mu_i} \cdot \mu_e \cdot 2\pi f \Omega/H \text{ (f in Hz)}$$

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 $\hat{B}_1$, followed directly by R_2 at $\hat{B}_2$.

β_F constant for d.c. sensitivity. ←

$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \cdot \mu_{e\Delta}}$$

in which $\mu_{e\Delta}$ is the relative incremental permeability of the magnetic circuit.

$\hat{H}$	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 magnetized to saturation
$\hat{B}$	peak induction in T
B_r	remanence = induction which remains in the core after the core has been magnetized 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/turn^2
AT	amperes x turns
N	number of turns
ρ	specific resistance in Ωm measured with d.c. current
μ_θ	permeability at a certain temperature θ
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

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

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

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

Formulae

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

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

$$A_L = \frac{\mu_o \mu_e}{C_1} 10^6 \text{ nH/N}^2$$

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

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

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

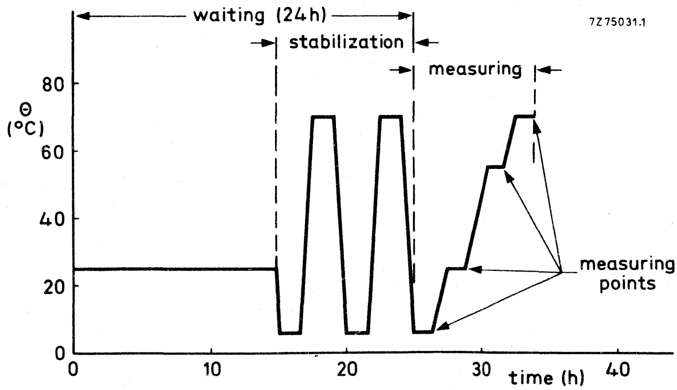
$$\tan \delta_h = \mu . \hat{B} . \eta_B$$

TECHNICAL DATA

Specific heat at 25 °C		approx. values
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	10.10^{-6} to 12.10^{-6}/°C	
Modulus of elasticity	15×10^4 N/mm^2	
Tensile strength	18 N/mm^2	
Crushing strength	73 N/mm^2	

The tables on the following pages are in accordance with IEC 401.
Notes to these tables:

- The figures mentioned are valid for toroids of not too small dimensions and should be considered as a guide. For cores of small dimensions and of different shapes, translation of these figures in a straightforward way is not always possible. For guarantees on products the pages on the relevant products should be consulted.
- The temperature factor α_F is determined on circuits without ground air gap, with the exception of 3B7 products for which α_F is measured on toroidally wound core halves. For FXC3 products the measuring sequence is given in the graph below. 3B7 products however, are measured 10 min after demagnetization at each measuring temperature. The measuring circuits for FXC 3H3 and FXC4 products are thermally demagnetized by heating approximately 25 °C above the Curie temperature: they are then cooled down slowly to room temperature, again given 24 hours waiting time, etc.



	unit	3B	3B3
Initial permeability μ_i at $\hat{B} \leq 0,1$ mT, $\theta = 25$ °C at $\hat{B} = 0,7\text{-}1$ mT, $\theta = 10\text{-}70$ °C at $\hat{B} = 0,7\text{-}1$ mT, $\theta = 25\text{-}70$ °C		 900 ± 20%	 900 ± 20%
Induction B, ballistically measured at H = 250 A/m, $\theta = 25$ °C $\theta = 100$ °C H = 800 A/m, $\theta = 25$ °C $\theta = 70$ °C $\theta = 100$ °C	mT	 ~345 ~230	
Eddy current and residual loss factor $\frac{\tan\delta}{\mu_i}$ at $\hat{B} \leq 0,1$ mT, $\theta = 25$ °C, f = 4 kHz f = 50 kHz f = 100 kHz f = 250 kHz f = 450 kHz f = 500 kHz f = 1000 kHz	$\times 10^{-6}$	 ≤ 50	 ≤ 7 ≤ 15 ≤ 27 ≤ 50
Power loss P at 16 kHz, $\hat{B} = 200$ mT $\theta = 25$ °C $\theta = 50$ °C $\theta = 100$ °C	kW/m^3 $(= mW/cm^3)$		
Hysteresis material constant, η_B at $\hat{B} = 0,3\text{-}1,2$ mT, f = 100 kHz, $\theta = 25$ °C $\hat{B} = 1,5\text{-}3,0$ mT, f = 4 kHz, $\theta = 25$ °C	 $\times 10^{-3}\ T^{-1}$ $\times 10^{-3}\ T^{-1}$		 ≤ 7,4
→ **d.c. sensitivity constant β_F at** $\frac{\mu_e \cdot NI_o}{l_e} = 1,20 \cdot 10^5$ A/m $= 1,80 \cdot 10^5$ A/m $= 2,60 \cdot 10^5$ A/m			
Resistivity ρ measured with d.c. current	Ω m	≥ 0,2	≥ 1
Disaccommodation factor D_F, between 10 and 100 min after demagnetization at $\hat{B} \leq 0,1$ mT, $\theta = 25 \pm 1$ °C	$\times 10^{-6}$	≤ 10	≤ 11
Temperature factor of permeability α_F at $\hat{B} \leq 0,1$ mT, θ = +5 to +25 °C +25 to +55 °C +25 to +70 °C	$\times 10^{-6}/°C$	0 to +3	0 to +2
Curie point	°C	≥ 150	≥ 150
Mass density	kg/m^3	4700-4900	4700-4900

3B7	3B8	3C2	3C6	3C7	3C8
2300 ± 20%	2300 ± 20%	900 ± 25%	1700 ± 25%	2400 ± 20%	2000 ± 25%
~430 ~345	~300 ~490 ~420 ~380	~350 ~245	≥ 290	≥ 330	≥ 330
≤ 1 ≤ 5	≤ 1,2 ≤ 5				
			≤ 170 ≤ 160 ≤ 140	≤ 140	≤ 110 ≤ 100
≤ 1,1	≤ 1,0				
	$\leq 120 \cdot 10^{-6}$ $\leq 300 \cdot 10^{-6}$ $\leq 1000 \cdot 10^{-6}$				
≥ 1	≥ 1	≥ 0,1	≥ 1	≥ 1	≥ 1
≤ 4,3	≤ 8				
-0,6 to +0,6	0 to +4 0 to +4	0 to +4,5		0 to +5	
≥ 170	≥ 200	≥ 150	≥ 190	≥ 190	≥ 200
4700-4900	4700-4900	4700-4900	4750-4850	4750-4850	4750-4850

	unit	3D3	3E1	
Initial permeability μ_i at $\hat{B} \leq 0,1$ mT, $\theta = 25$ °C at $\hat{B} = 0,7$-1 mT, $\theta = 10$-70 °C at $\hat{B} = 0,7$-1 mT, $\theta = 25$-70 °C		750 ± 20%	3800 ± 20%	
Induction B, ballistically measured at H = 250 A/m, $\theta = 100$ °C H = 800 A/m, $\theta = 25$ °C $\theta = 70$ °C	mT	 ~350	 ~350 ~270	
Eddy current and residual loss factor $\frac{\tan\delta}{\mu_i}$ at $\hat{B} \leq 0,1$ mT, $\theta = 25$ °C f = 4 kHz f = 30 kHz f = 50 kHz f = 100 kHz f = 500 kHz f = 1000 kHz	x 10^{-6}	 ≤ 8 ≤ 14 ≤ 30	 ≤ 2,5 ≤ 20 ≤ 200 	
Power loss P at 16 kHz, $\hat{B} = 200$ mT, $\theta = 25$ °C $\theta = 50$ °C $\theta = 100$ °C	kW/m^3 (= mW/cm^3)			
Hysteresis material constant η_B at $\hat{B} = 0,3$-$1,2$ mT, f = 100 kHz $\theta = 25$ °C $\hat{B} = 1,5$-$3,0$ mT, f = 4 kHz $\theta = 25$ °C	 x 10^{-3} T^{-1} x 10^{-3} T^{-1}	 ≤ 1,8 	 ≤ 1,1	
→ Resistivity ρ measured with d. c. current	Ωm	≥ 1,5	≥ 0,3	
Disaccommodation factor D_F, between 10 and 100 min after demagnetization at → $\hat{B} \leq 0,1$ mT, $\theta = 25 \pm 1$ °C	x 10^{-6}	≤ 12	≤ 4,3	
Temperature factor of permeability α_F at $\hat{B} \leq 0,1$ mT, θ = +5 to +25 °C +25 to +55 °C +25 to +70 °C	x 10^{-6}/°C	 0 to +2	 1 ± 1 1 ± 1 1 ± 1	
Curie point	°C	≥ 150	≥ 125	
Mass density	kg/m^3	4500-4900	4700-4900	

3E2	3E3	3E4	3E5	3H1	3H2	3H3
≥ 5000	≥ 10 000	4700 ± 20%	10 000 ± 20%	2300 ± 20%	2300 ± 20%	2000 ± 20%
~ 355 ~ 260	~ 380 ~ 280			~ 360 ~ 280	400	
≤ 2,5 ≤ 15	≤ 2,5 ≤ 20 ≤ 50	≤ 2,5 ≤ 20 ≤ 200	≤ 3 ≤ 25 ≤ 75	≤ 1 ≤ 5	≤ 1 ≤ 5	1,2 ± 0,4 2 ± 0,5
≤ 1,1	≤ 1,1	≤ 0,85	≤ 0,85	≤ 0,85	≤ 1,1	≤ 0,5 (at 100 kHz : ≤ 0,6)
≥ 0,1	≥ 0,05	≥ 0,3		≥ 1	≥ 1	
≤ 1,9	≤ 1,9	≤ 4,3	≤ 4,3	≤ 4,3	≤ 4,3	≤ 3,0 [1]
		1 ± 1 1 ± 1 1 ± 1	0,60 ± 0,60 0,60 ± 0,60 0,60 ± 0,60	1 ± 0,5 1 ± 0,5 1 ± 0,5	1,2 ± 0,6 1,2 ± 0,6	0,7 ± 0,25 0,7 ± 0,25 0,7 ± 0,25
≥ 130	≥ 125	≥ 125	≥ 115	≥ 130	≥ 160	≥ 160
4700-4900	4800-4950	4700-4900		4700-4900	4700-4900	

[1]) At any temperature between 25 and 70 °C.

	unit	4A4	4B1
Initial permeability μ_i at $\hat{B} \leq 0,1$ mT, $\theta = 25$ °C		500 ± 20%	250 ± 20%
Induction B, ballistically measured at			
H = 800 A/m, θ = 25 °C	mT	~270	
θ = 70 °C	mT	~210	
H = 1600 A/m, θ = 25 °C	mT		~325
θ = 100 °C	mT		~260
H = 2000 A/m, θ = 25 °C	mT		
θ = 70 °C	mT		
H = 2400 A/m, θ = 25 °C	mT		
θ = 70 °C	mT		
θ = 100 °C	mT		
H = 3200 A/m, θ = 25 °C	mT		
θ = 100 °C	mT		
H = 4800 A/m, θ = 25 °C	mT		
θ = 100 °C	mT		
Eddy current and residual loss factor $\frac{\tan \delta}{\mu_i}$ at $\hat{B} \leq 0,1$ mT, $\theta = 25$ °C,			
f = 500 kHz	x 10^{-6}	≤ 30	
f = 700 kHz	x 10^{-6}		≤ 70
f = 1 MHz	x 10^{-6}		≤ 90
f = 1,5 MHz	x 10^{-6}	≤ 40	≤ 140
f = 2 MHz	x 10^{-6}	≤ 70	
f = 3 MHz	x 10^{-6}		
f = 5 MHz	x 10^{-6}		
f = 10 MHz	x 10^{-6}		
f = 25 MHz	x 10^{-6}		
f = 40 MHz	x 10^{-6}		
Hysteresis material constant, η_B at $\hat{B} = 0,3-1,2$ mT, f = 100 kHz, or $\theta = 25$ °C	x 10^{-3} T^{-1}	≤ 1,8	
Resistivity ρ measured with d.c. current	Ωm	≥ 10^3	≥ 10^3
Dielectric constant ϵ at 1 MHz, $\theta = 25$ °C		15-20	
Disaccommodation factor D_F, between 10 and 100 min after demagnetization, $\hat{B} \leq 0,1$ mT, $\theta = 25 \pm 1$ °C	x 10^{-6}	≤ 5	
Temperature factor of permeability α_F at $\hat{B} < 0,1$ mT, θ = +5 to +25 °C	x 10^{-6}/°C		
+25 to +55 °C	x 10^{-6}/°C		0 to +8
+25 to +70 °C	x 10^{-6}/°C	10 ± 5	
Curie point	°C	≥ 135	≥ 250
Mass density	kg/m^3	4700-5100	4400-4800

4C1	4C6	4D1	4D2	4E1
125 ± 20%	120 ± 20%	50 ± 20%	60 ± 10%	15 ± 20%
~275 ~245	~380 ~350	~240 ~220		~175 ~165
≤ 120 ≤ 160 ≤ 300	≤ 40 ≤ 100	≤ 180 ≤ 210 ≤ 300	≤ 100 ≤ 200 ≤ 600	≤ 300 ≤ 360
	≤ 6,2			
$\geq 10^3$	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$	$\geq 10^3$
	10-15			
	≤ 10			
0 to +12	1 ± 3 3 ± 3	0 to +15	0 to +15	0 to +15
≥ 350	≥ 350	≥ 400	≥ 350	≥ 500
4200-4600	4000-5000	4000-4400		3500-4000

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.

NiZn ferrites for proton accelerators.

Listed below are the properties of two grades — 8C11 and 8C12 — which are valid for toroids measuring ϕ 36 x ϕ 28 x 5 mm, measured 24 h after demagnetization and at a relative humidity of 45 to 75%, an atmospheric pressure of 8,6 to 10,6 N/cm^2 and at a temperature of 25 ± 5 °C, unless otherwise indicated. The properties of other products in these materials may deviate, dependend of the shape and dimensions.

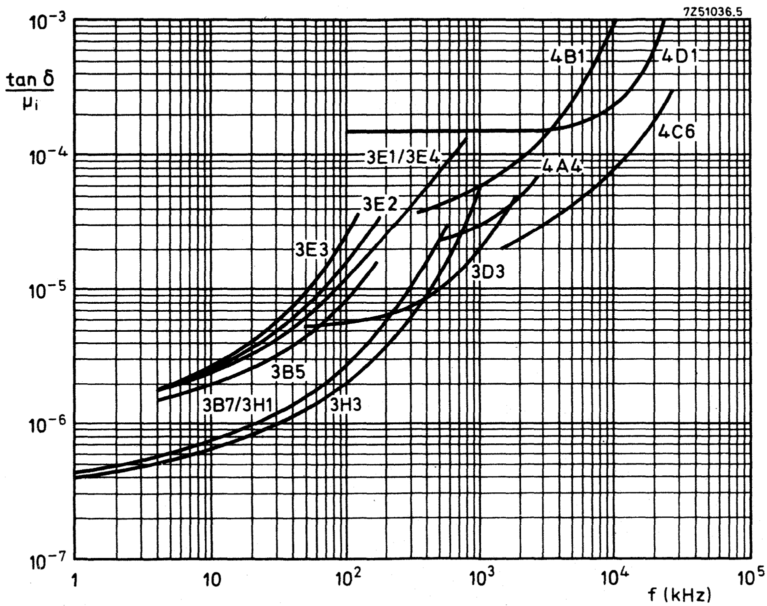
property	symbol	unit	measuring conditions			requirement	
			frequency kHz	inductance mT	fieldstrength A/m	8C11	8C12
initial permeability	μ_i	—	4	⩽ 0,1		⩾ 1000	1000
saturation-induction	B_{sat}	mT	ballis-tically		796	⩾ 300	280
					796	⩾ 280 *	
coercivity	H_c	A/m		⩽ 0,1	796	⩽ 19,9 **	
μ in remanent state	μ_{rem}	—	4	⩽ 0,1	1990		550 **
μ decrease	$\frac{\mu_{rem}}{100}$	A/m	4	⩽ 0,1			1433
quality factor	Q	—	1000	⩽ 0,1			18
				⩽ 1			12
				⩽ 2			9
				⩽ 4			8,5
				⩽ 6			8
				⩽ 8			5,6
				⩽ 10			4
temperature factor	α_F	10^{-6}/°C	100	⩽ 0,1			
Curie point	θ	°C	4	⩽ 0,1		⩾ 125	⩾ 125
specific-resistivity	p	Ω cm	d.c.	—		⩾ 10^5	⩾ 10^5
density	—	g/cm^3				⩾ 5,1	4,9

* Temperature 40 ± 2 °C.
** Measured after application of a continuous bias.

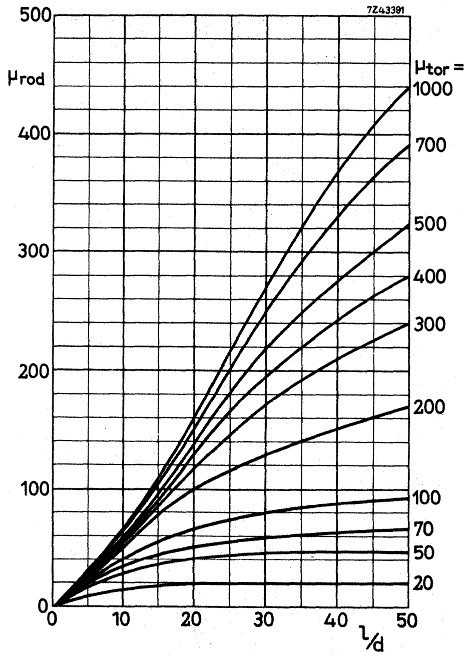
CHARACTERISTIC CURVES

The curves are valid for toroids of not too small dimensions and should be considered as a guide. For guarantees on products, refer to the pages on the relevant products.

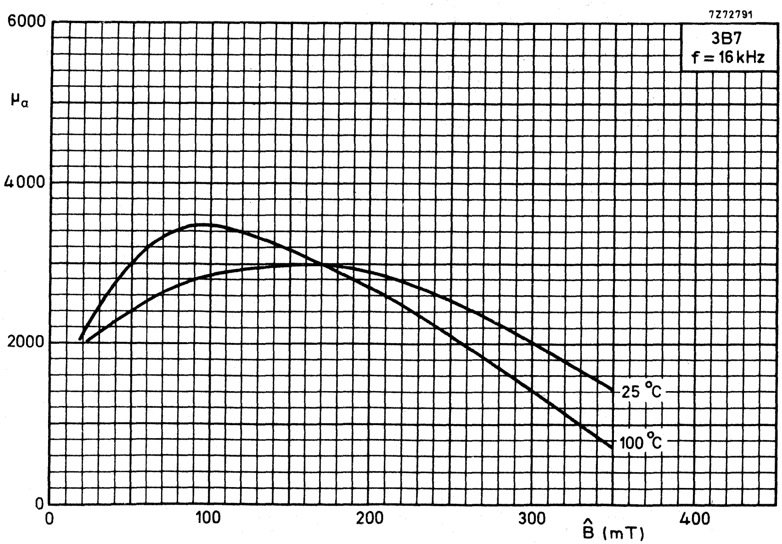
EDDY CURRENT LOSSES AND RESIDUAL LOSSES AS A FUNCTION OF THE FREQUENCY AT LOW INDUCTION LEVEL

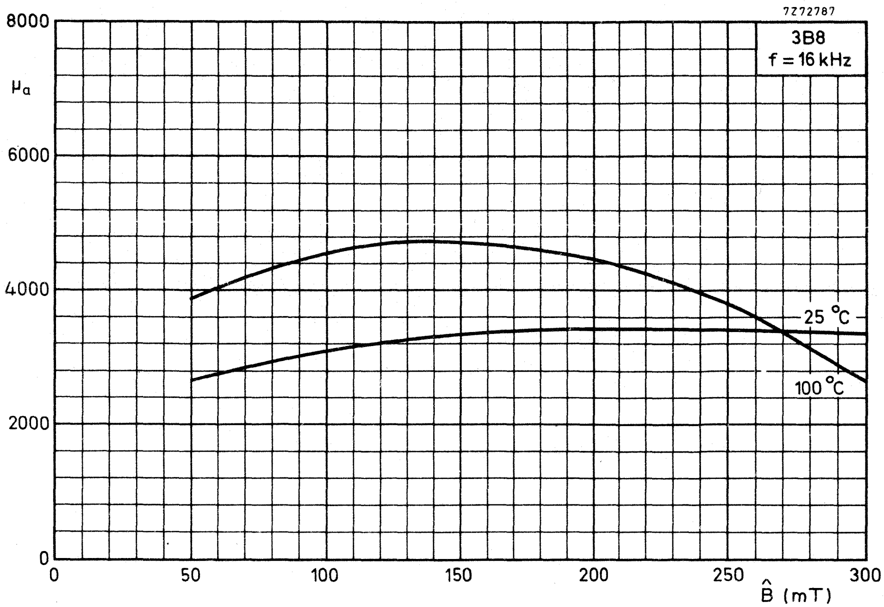


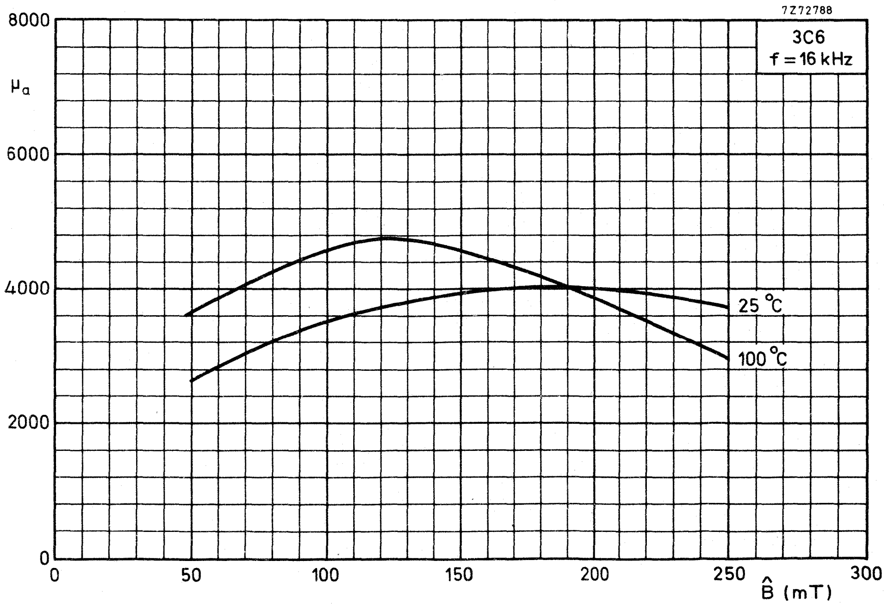
ROD PERMEABILITY AS A FUNCTION OF THE RATIO l/d WITH THE RELATIVE INITIAL PERMEABILITY OF A TOROIDAL CORE AS PARAMETER

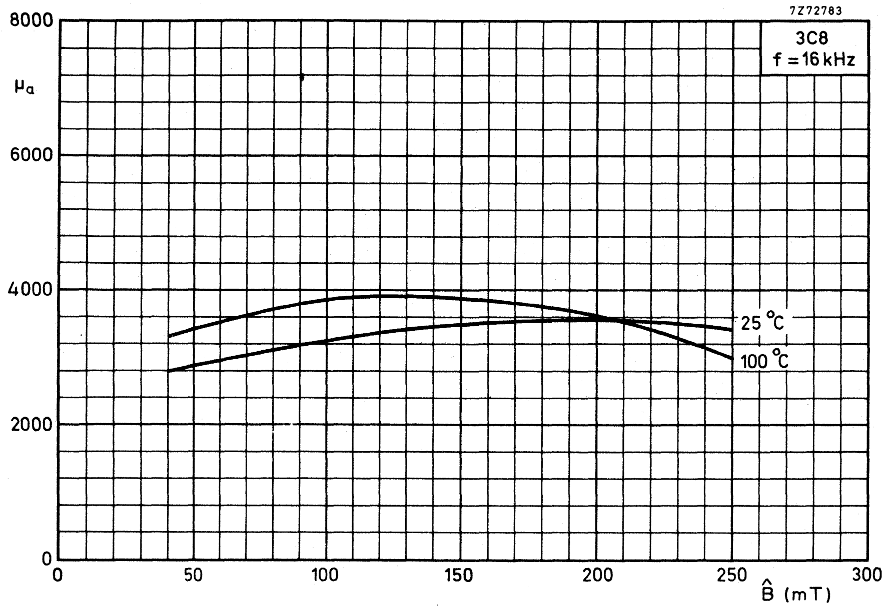


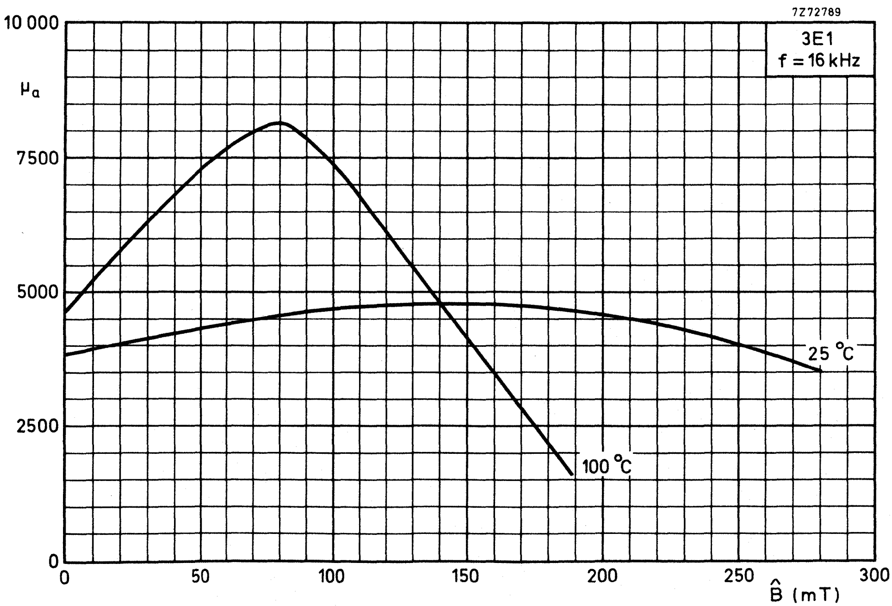
AMPLITUDE PERMEABILITY AS A FUNCTION OF THE INDUCTION

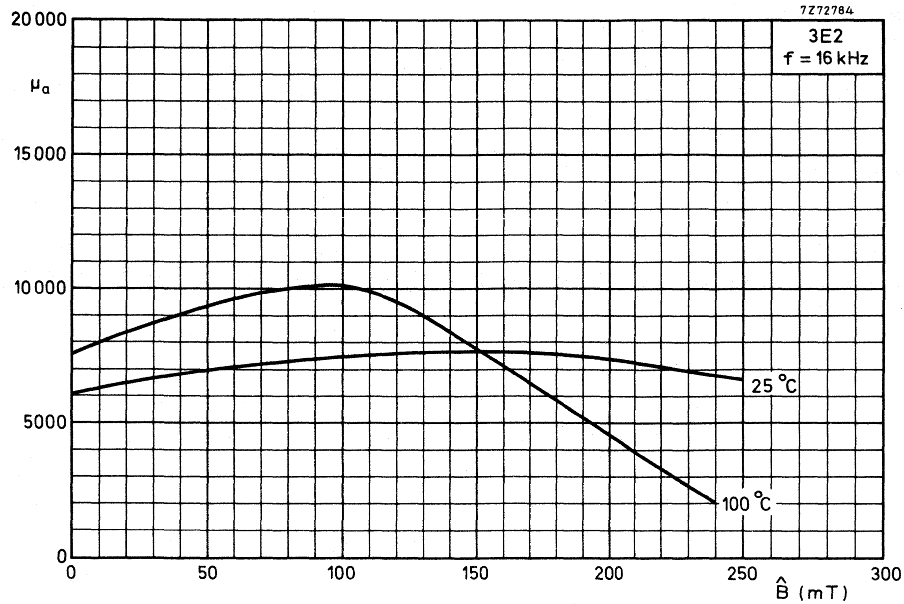


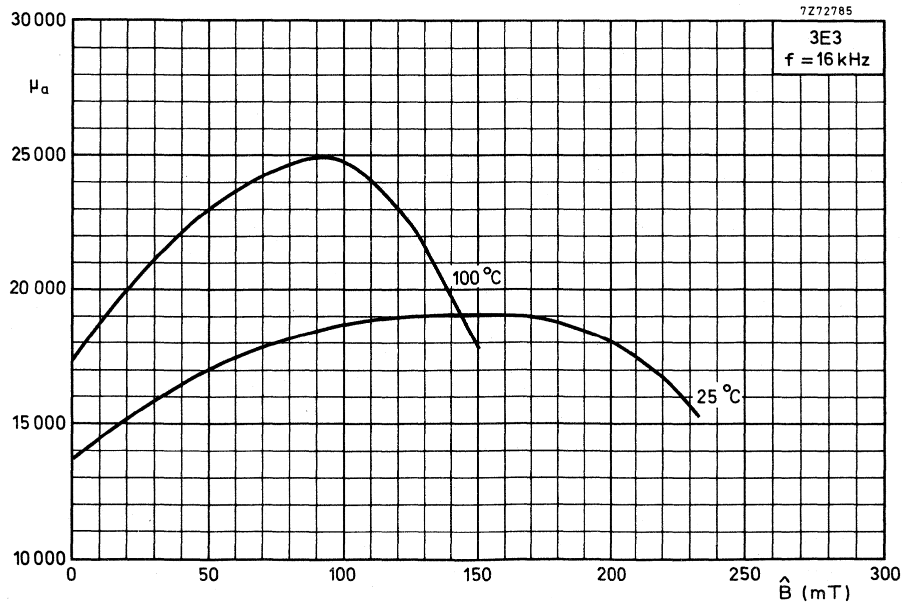

7Z72787
3B8
f = 16 kHz
μ_a
8000
6000
4000
2000
0
0
50
100
150
200
250
300
$\hat{B}$ (mT)
25 °C
100 °C

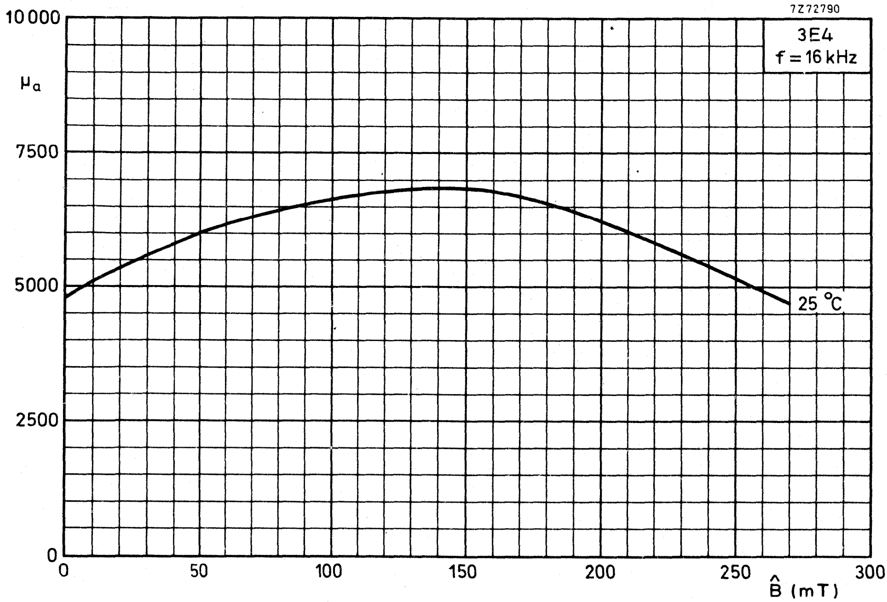

7Z72788
3C6
f = 16 kHz
μ_a
8000
6000
4000
2000
0
0
50
100
150
200
250
300
$\hat{B}$ (mT)
25 °C
100 °C

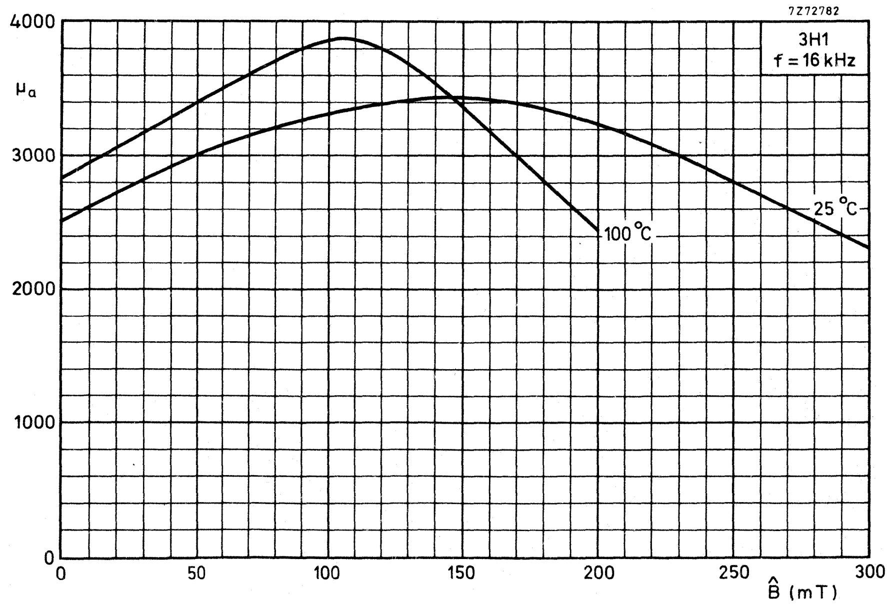

7Z72783
3C8
f = 16 kHz
8000
μ_a
6000
4000
2000
0
0
50
100
150
200
250
300
$\hat{B}$ (mT)
25 °C
100 °C

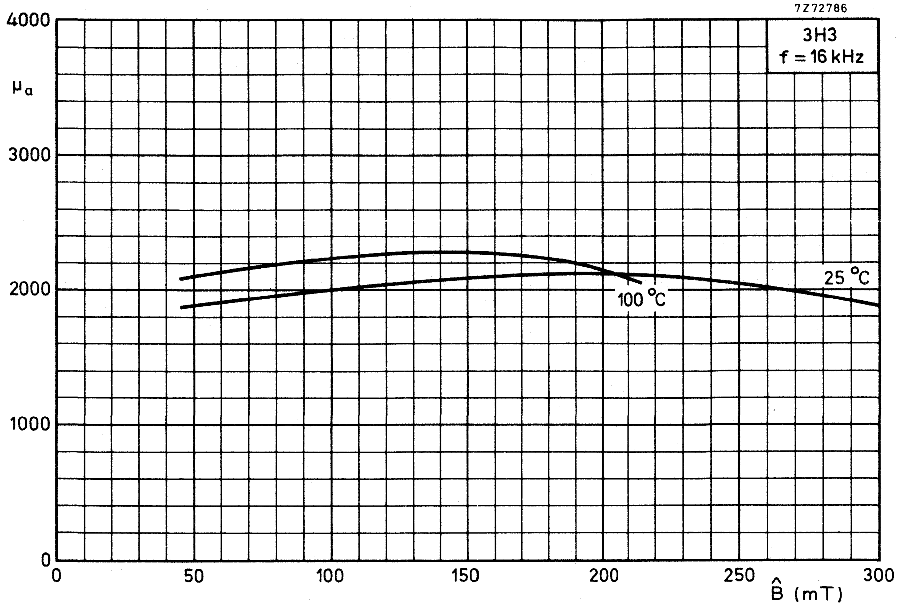

7Z72789
3E1
f = 16 kHz
10 000
μ_a
7500
5000
2500
0
0
50
100
150
200
250
300
$\hat{B}$ (mT)
25 °C
100 °C

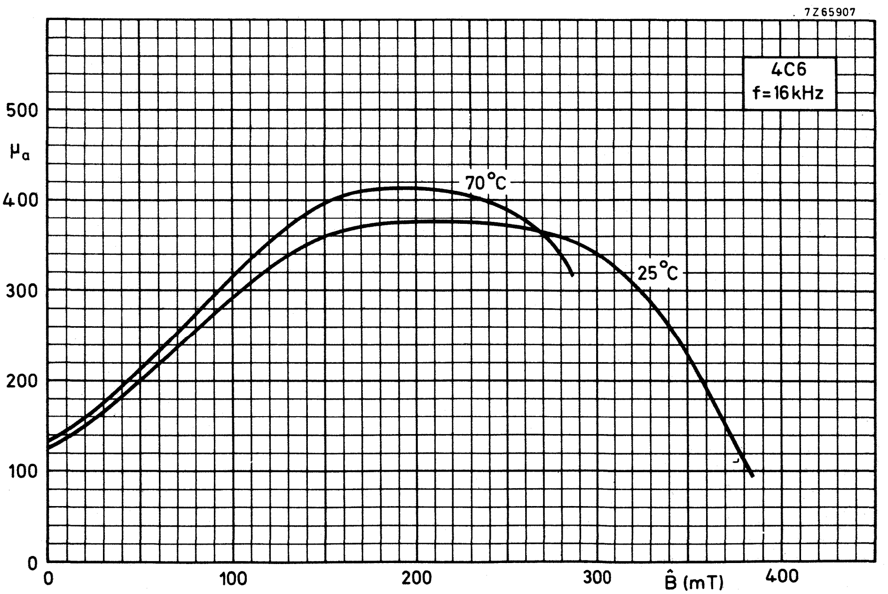

7Z72784
3E2
f = 16 kHz
20 000
μa
15 000
10 000
5000
0
25 °C
100 °C
0
50
100
150
200
250
300
B̂ (mT)


7Z72785
3E3
f = 16 kHz
30 000
μa
25 000
20 000
15 000
10 000
100 °C
25 °C
0
50
100
150
200
250
300
B̂ (mT)


7Z72790
3E4
f = 16 kHz
μa
10 000
7500
5000
2500
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C

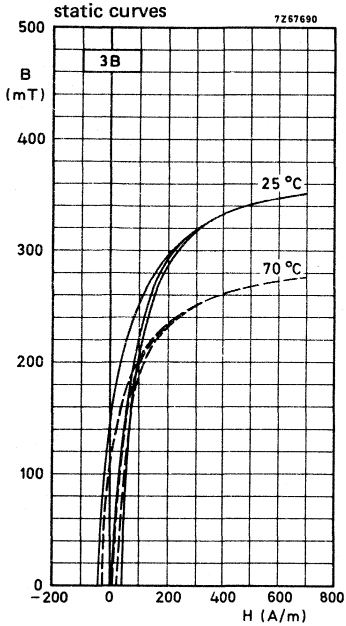

7Z72782
3H1
f = 16 kHz
μa
4000
3000
2000
1000
0
0
50
100
150
200
250
300
B̂ (mT)
100 °C
25 °C


7Z72786
3H3
f = 16 kHz
μa
4000
3000
2000
1000
0
0
50
100
150
200
250
300
100 °C
25 °C
B̂ (mT)

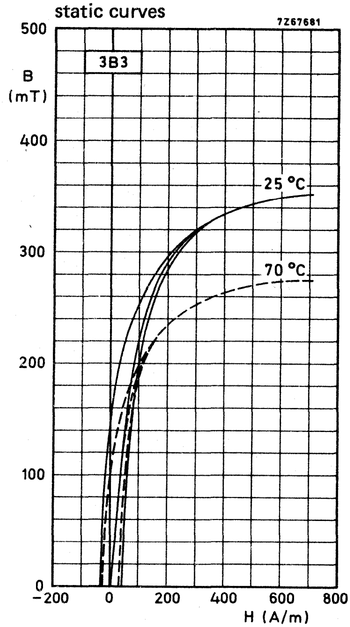

7Z65907
4C6
f=16kHz
μa
500
400
300
200
100
0
0
100
200
300
400
70 °C
25 °C
B̂ (mT)

TYPICAL BH-CURVES (measured ballistically)

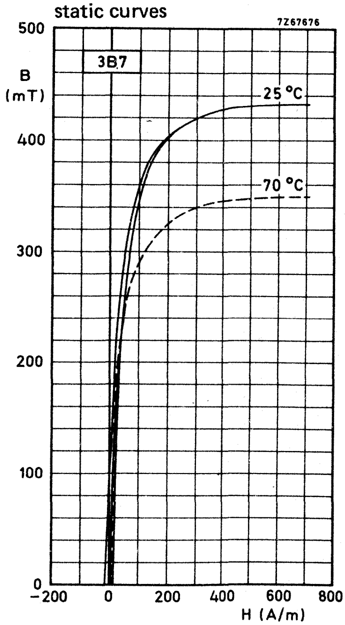
static curves



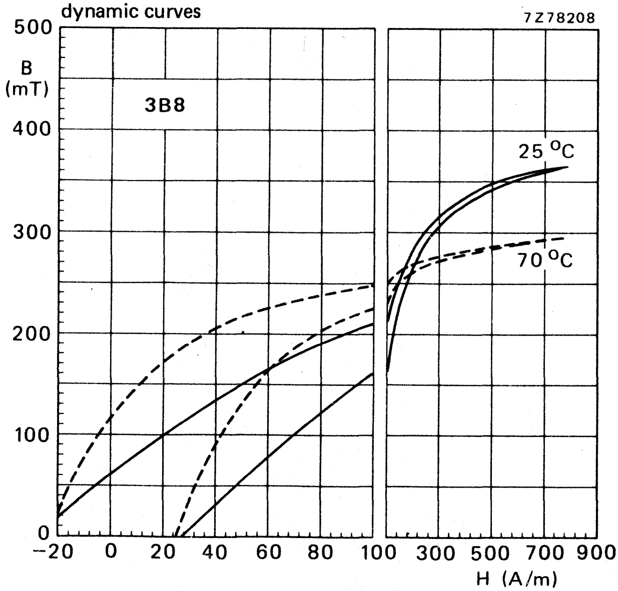
static curves

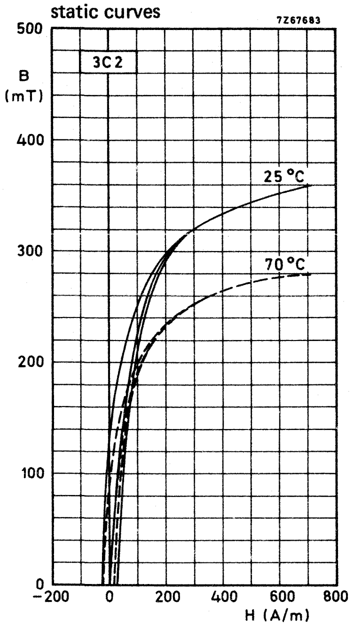


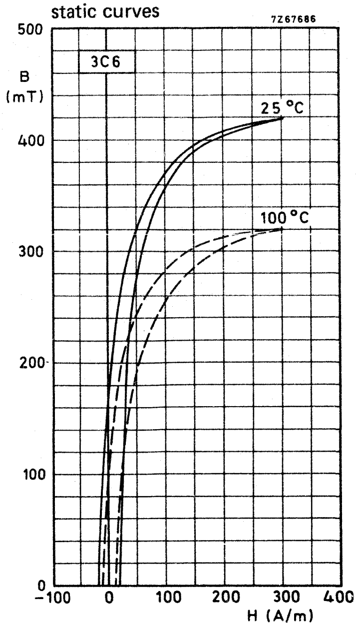
static curves

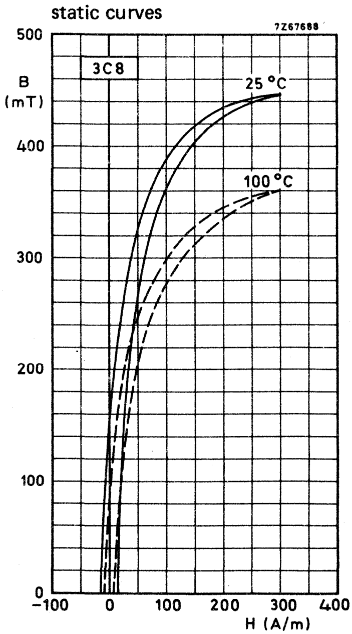


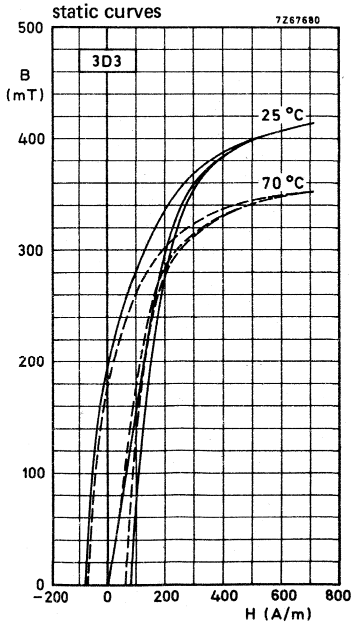
dynamic curves

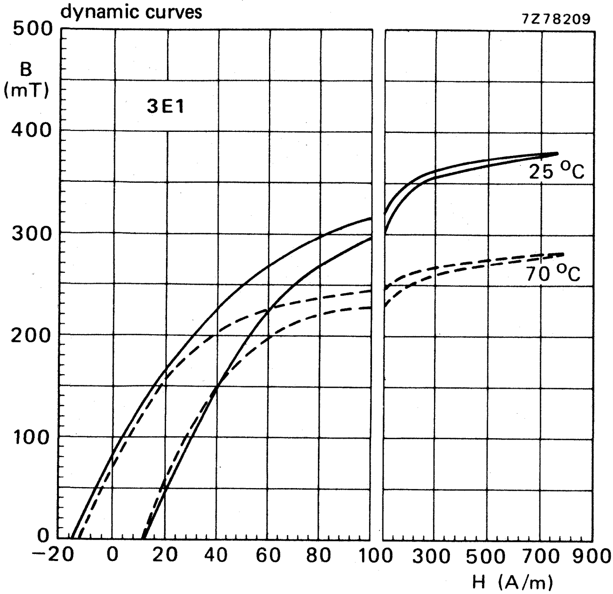


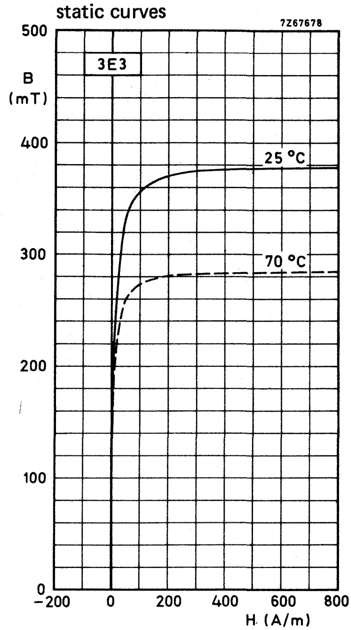

static curves
7Z67683
3C2
B (mT)
25 °C
70 °C
H (A/m)

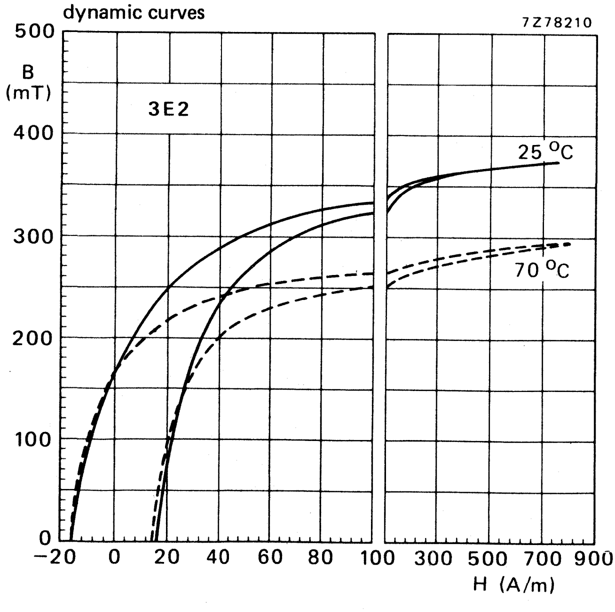

static curves
7Z67686
3C6
B (mT)
25 °C
100 °C
H (A/m)

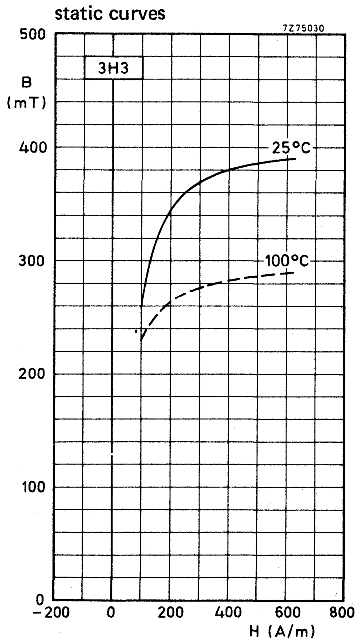

static curves
7Z67688
3C8
B (mT)
25 °C
100 °C
H (A/m)

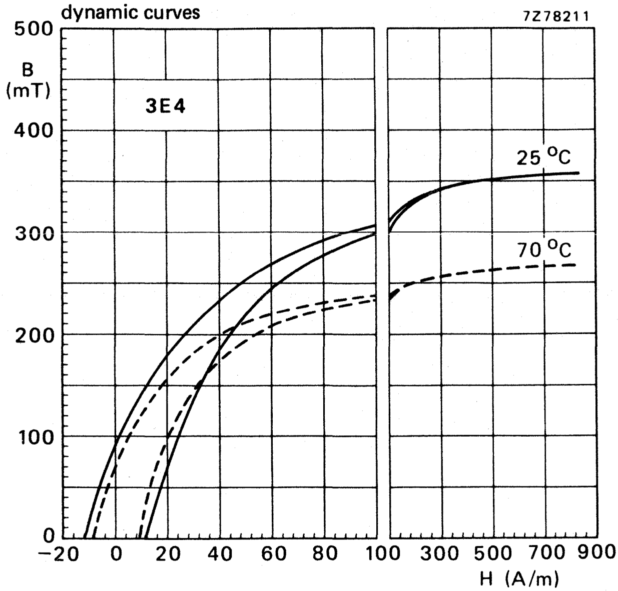

static curves
7Z67680
3D3
B (mT)
25 °C
70 °C
H (A/m)

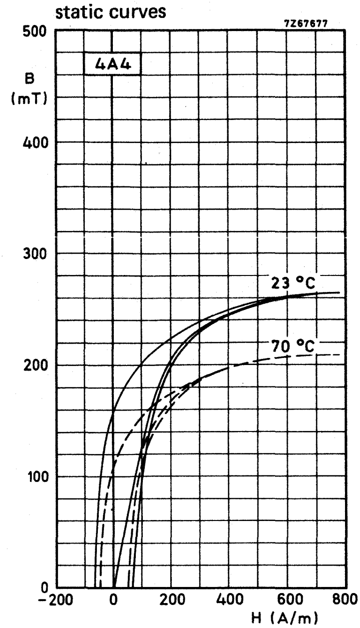

dynamic curves
7Z78209
3E1
B (mT)
25 °C
70 °C
H (A/m)
500
400
300
200
100
0
−20
0
20
40
60
80
100
300
500
700
900

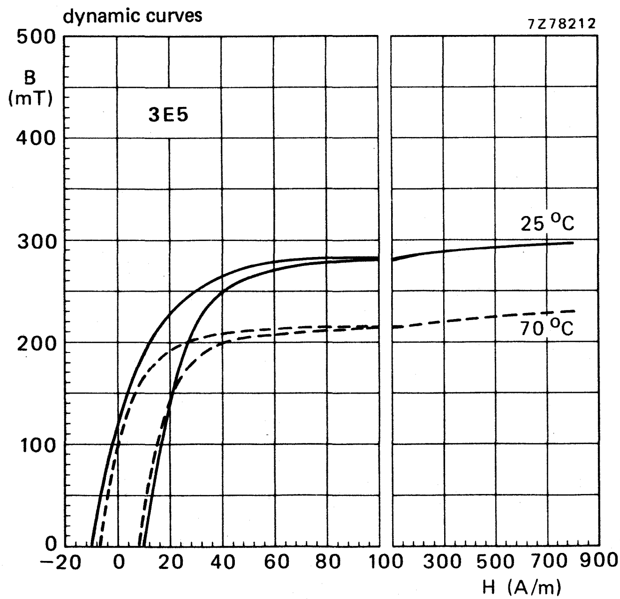

static curves
7Z67678
3E3
B (mT)
25 °C
70 °C
H (A/m)
500
400
300
200
100
0
−200
0
200
400
600
800

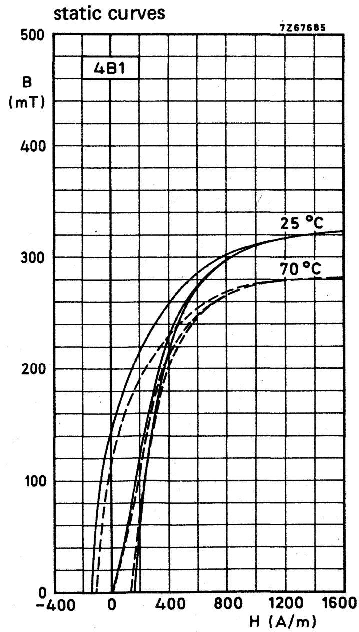

dynamic curves
7Z78210
3E2
B (mT)
25 °C
70 °C
H (A/m)
500
400
300
200
100
0
−20
0
20
40
60
80
100
300
500
700
900

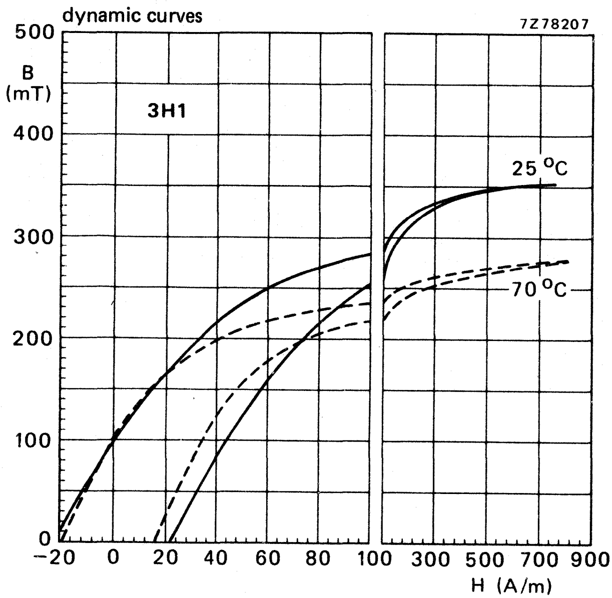

static curves
7Z75030
3H3
B (mT)
25°C
100°C
H (A/m)
500
400
300
200
100
0
−200
0
200
400
600
800

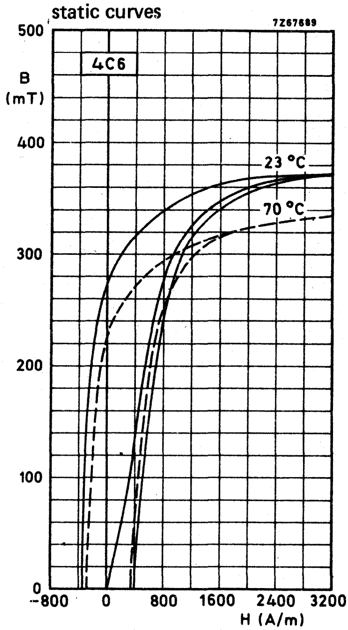

dynamic curves
7Z78211
3E4
B (mT)
500
400
300
200
100
0
25 °C
70 °C
−20 0 20 40 60 80 100 300 500 700 900
H (A/m)

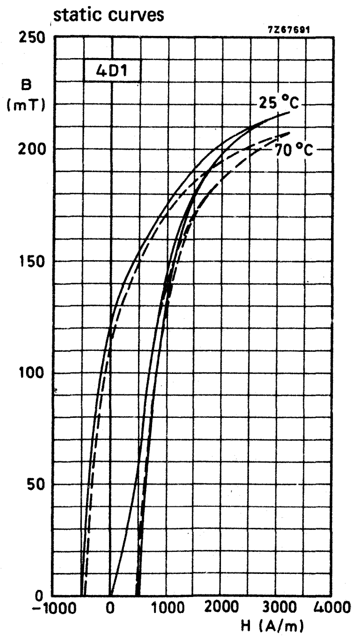

static curves
7Z67677
4A4
B (mT)
500
400
300
200
100
0
23 °C
70 °C
−200 0 200 400 600 800
H (A/m)

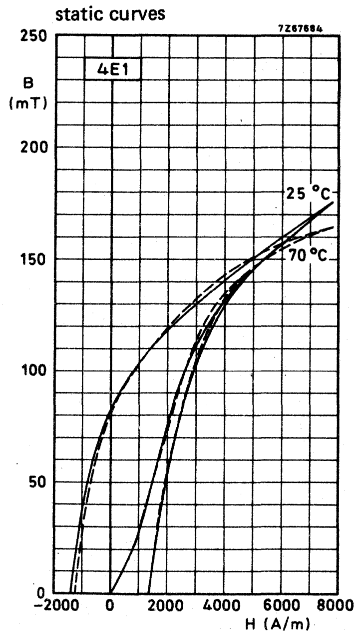

dynamic curves
7Z78212
3E5
B (mT)
500
400
300
200
100
0
25 °C
70 °C
−20 0 20 40 60 80 100 300 500 700 900
H (A/m)


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

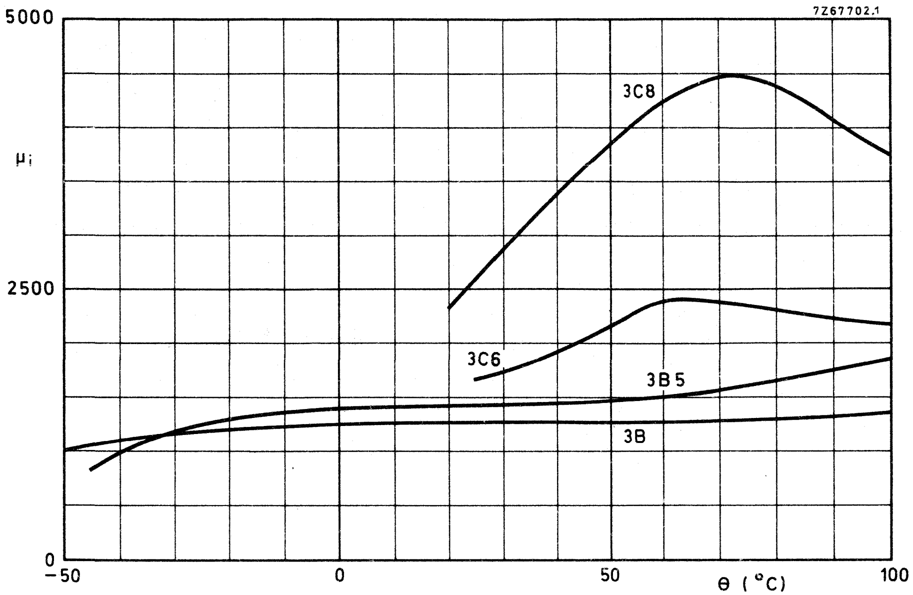

dynamic curves
7Z78207
3H1
B (mT)
25 °C
70 °C
H (A/m)
500
400
300
200
100
0
−20
0
20
40
60
80
100
300
500
700
900

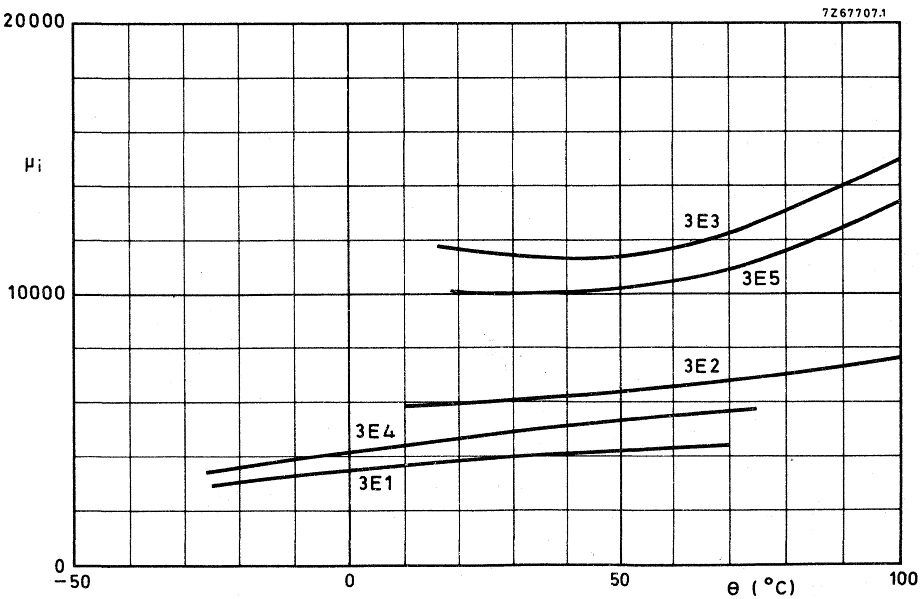

static curves
7Z67689
4C6
B (mT)
23 °C
70 °C
H (A/m)
500
400
300
200
100
0
−800
0
800
1600
2400
3200

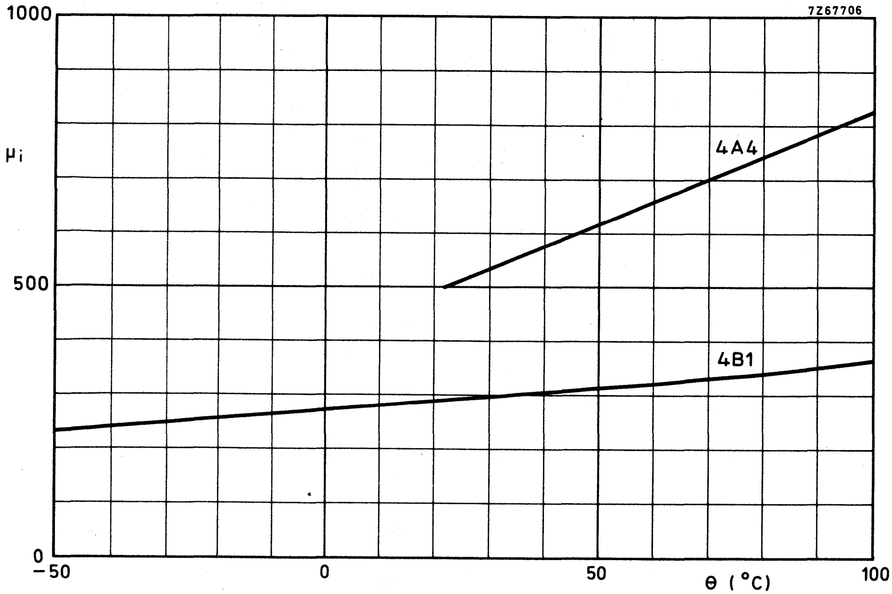

static curves
7Z67691
4D1
B (mT)
25 °C
70 °C
H (A/m)
250
200
150
100
50
0
−1000
0
1000
2000
3000
4000

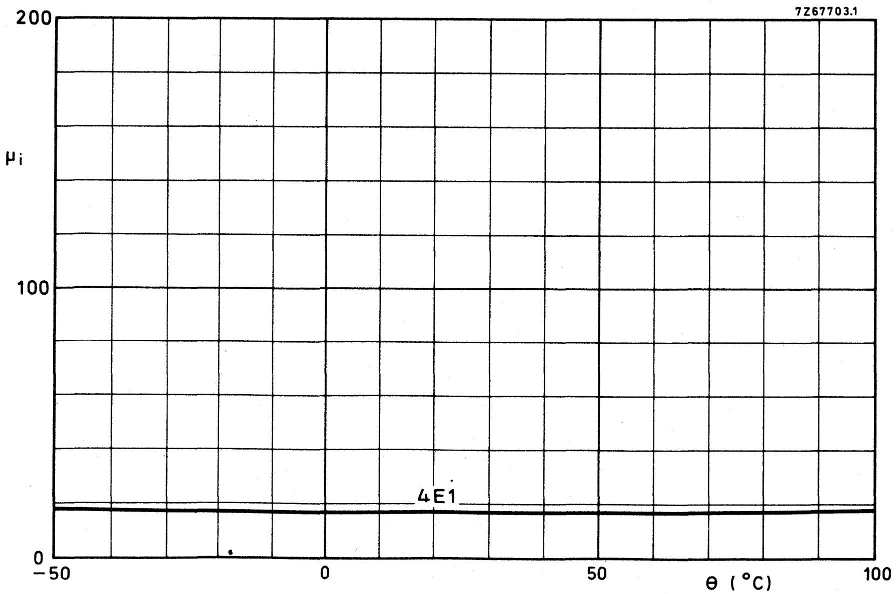

static curves
7Z67684
4E1
B (mT)
25 °C
70 °C
H (A/m)
250
200
150
100
50
0
−2000
0
2000
4000
6000
8000

RELATIVE INITIAL PERMEABILITY AS A FUNCTION OF THE TEMPERATURE

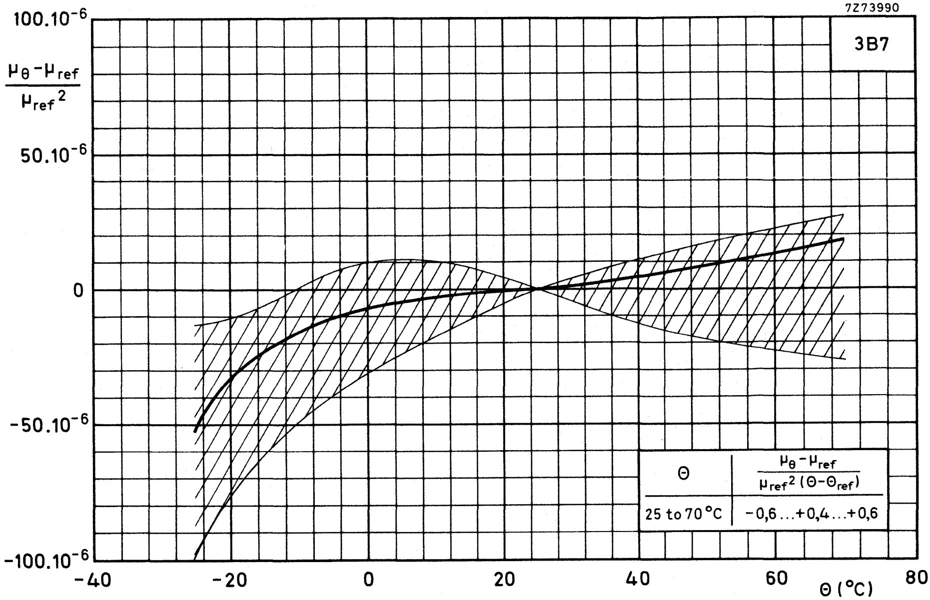


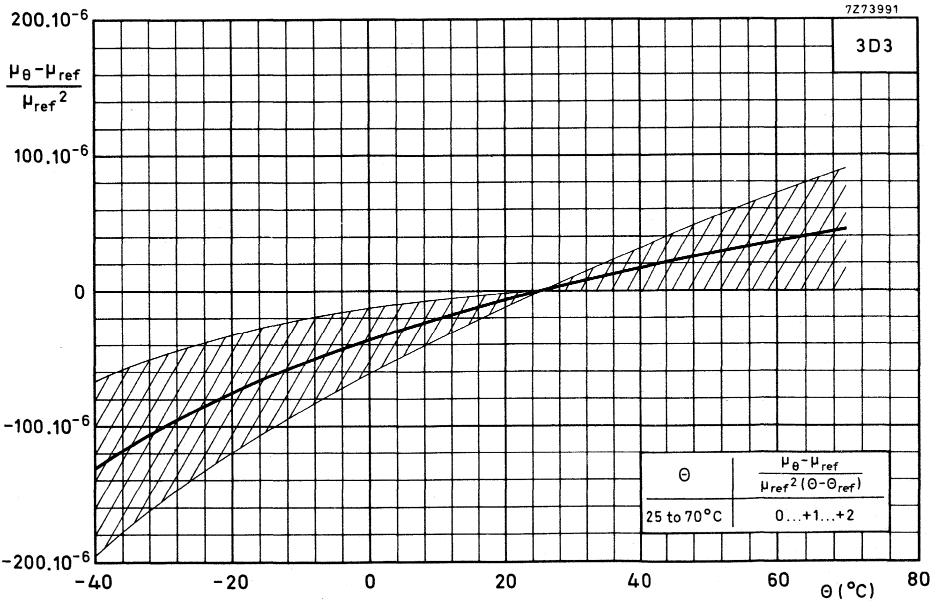


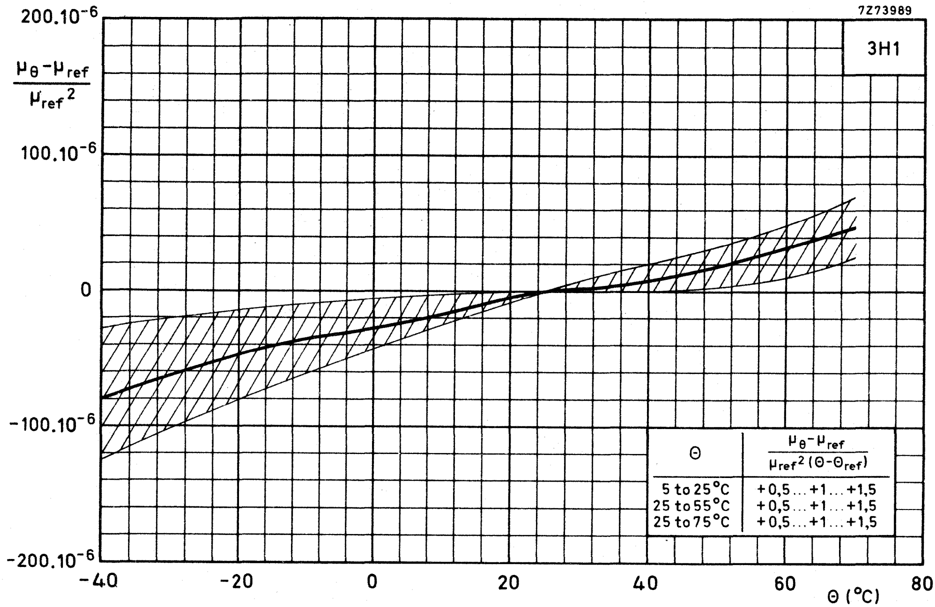

7Z67706
1000
500
0
μ_i
4A4
4B1
−50
0
50
100
θ (°C)

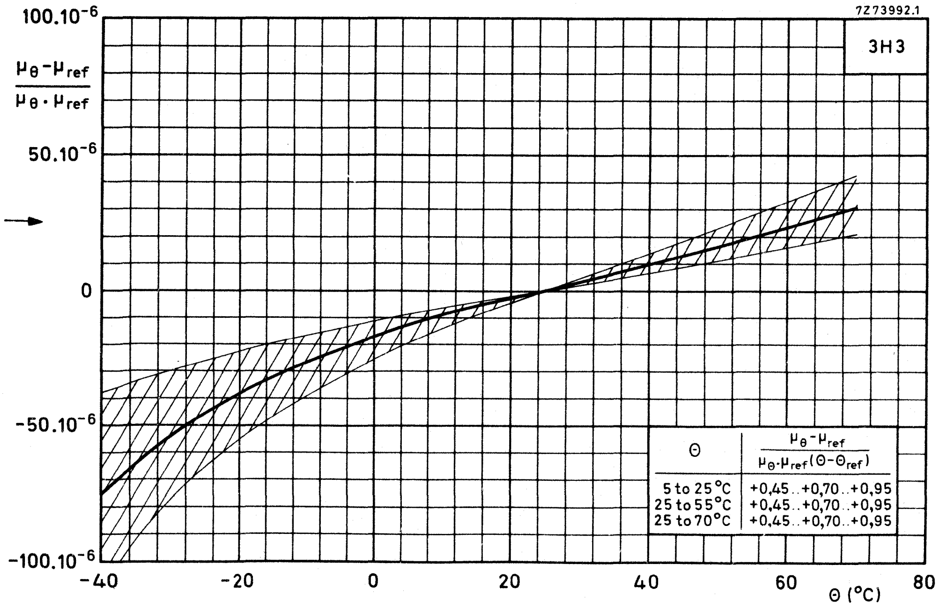

7Z67703.1
200
100
0
μ_i
4E1
−50
0
50
100
θ (°C)

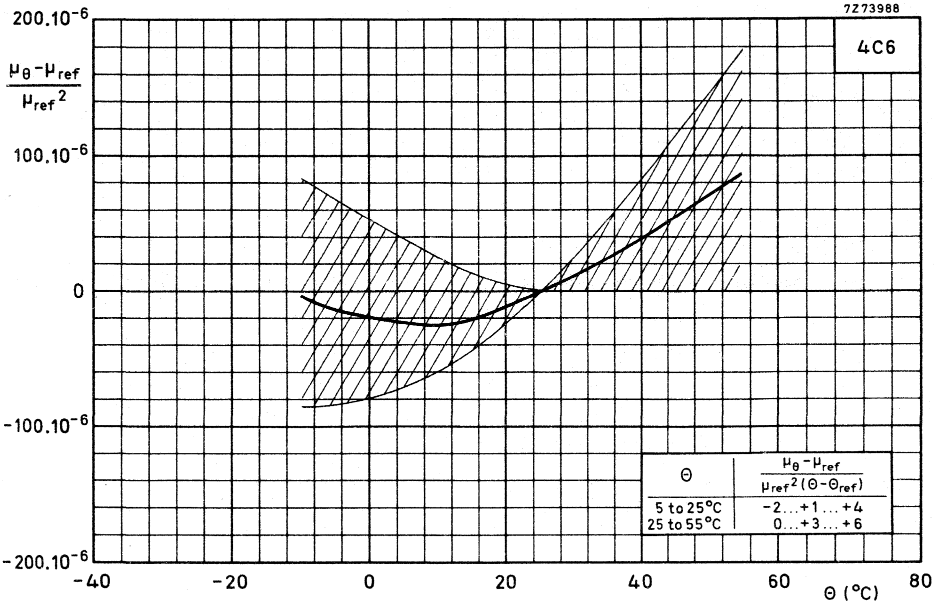
PERMEABILITY FACTOR AS A FUNCTION OF THE TEMPERATURE



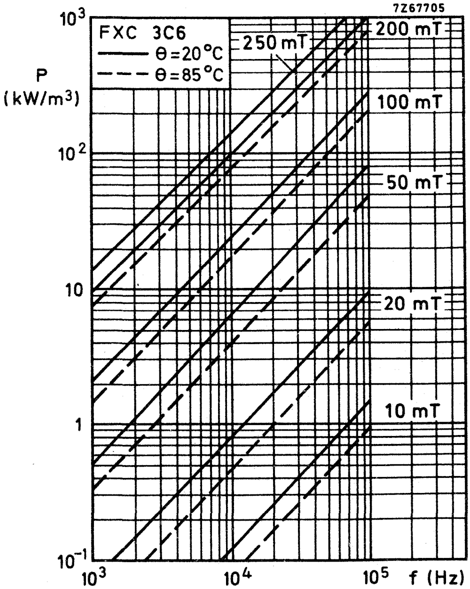


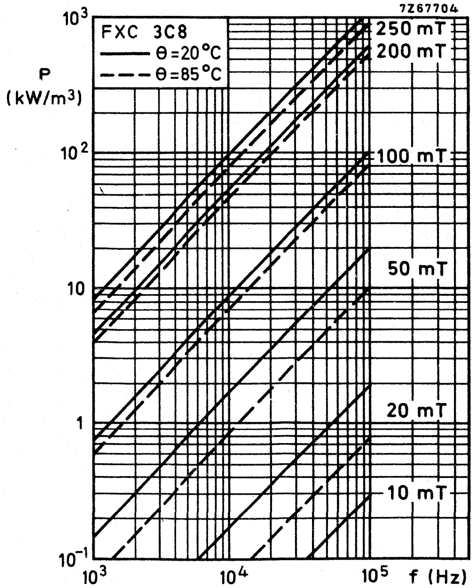

7Z73989
3H1
200.10⁻⁶
μθ−μref / μref²
100.10⁻⁶
0
−100.10⁻⁶
−200.10⁻⁶
−40
−20
0
20
40
60
80
Θ (°C)
Θ
μθ−μref / μref²(Θ−Θref)
5 to 25°C +0,5…+1…+1,5
25 to 55°C +0,5…+1…+1,5
25 to 75°C +0,5…+1…+1,5


7Z73992.1
3H3
100.10⁻⁶
μθ−μref / μθ·μref
50.10⁻⁶
0
−50.10⁻⁶
−100.10⁻⁶
−40
−20
0
20
40
60
80
Θ (°C)
Θ
μθ−μref / μθ·μref(Θ−Θref)
5 to 25°C +0,45..+0,70..+0,95
25 to 55°C +0,45..+0,70..+0,95
25 to 70°C +0,45..+0,70..+0,95

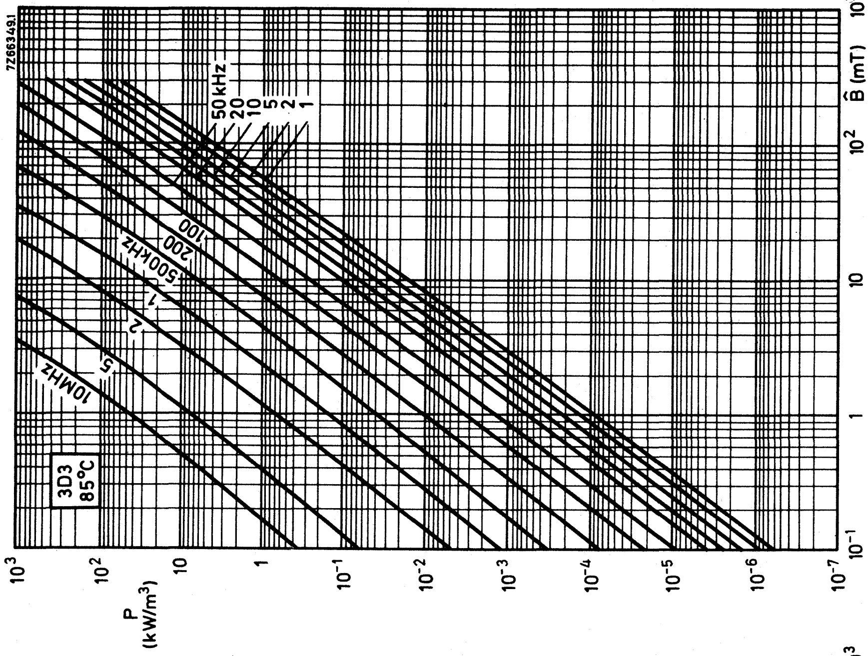


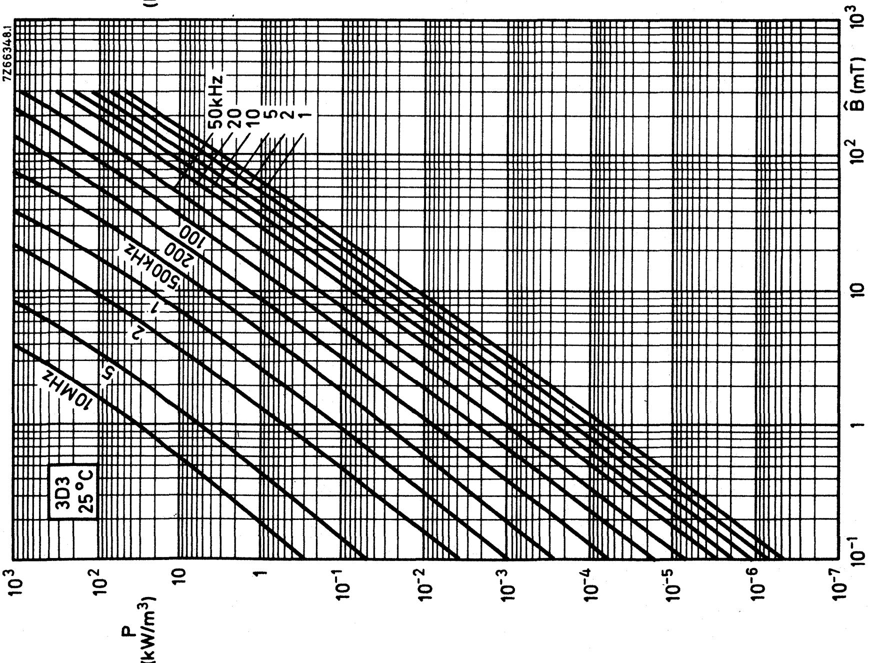
POWER LOSS AS A FUNCTION OF THE FREQUENCY

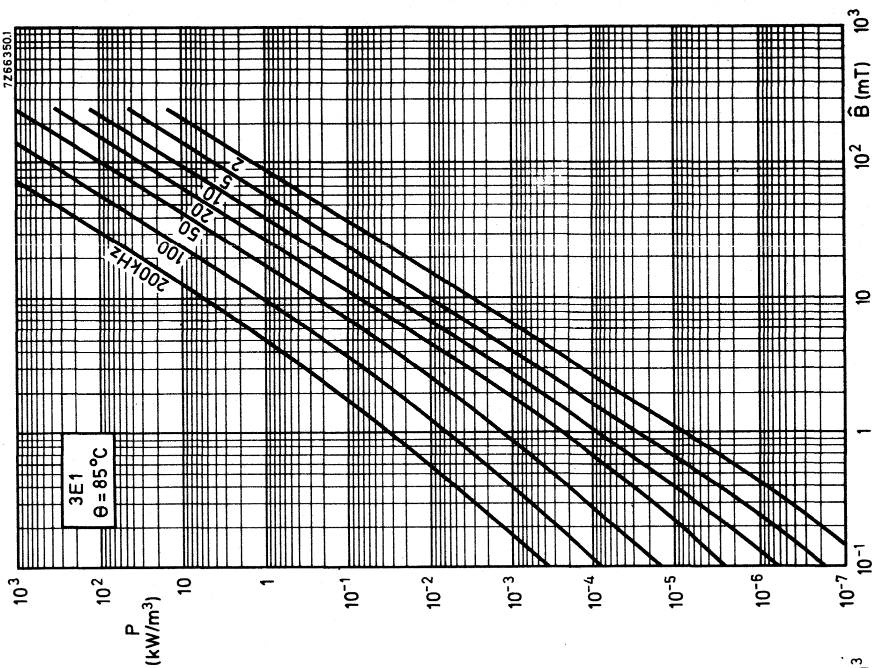


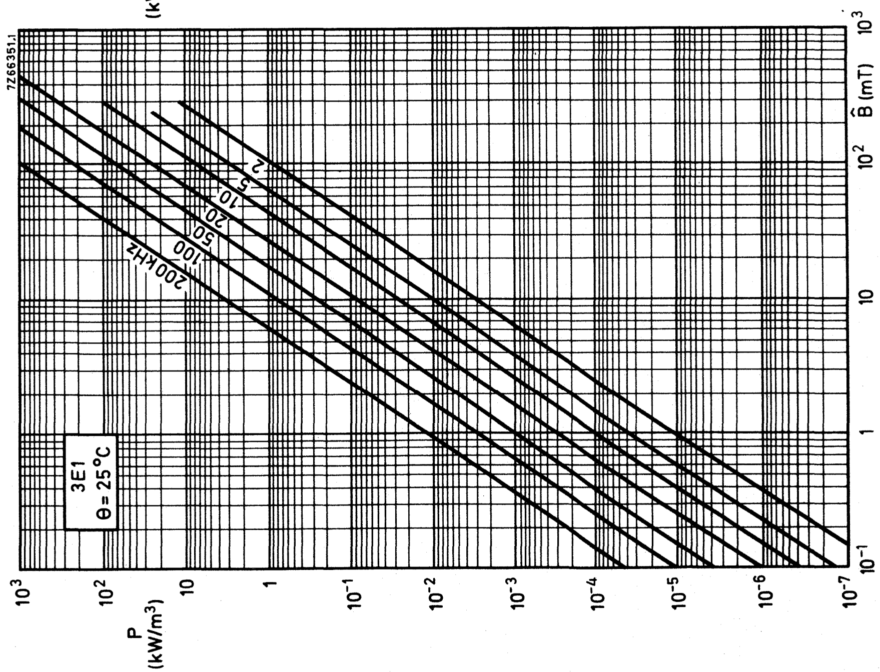


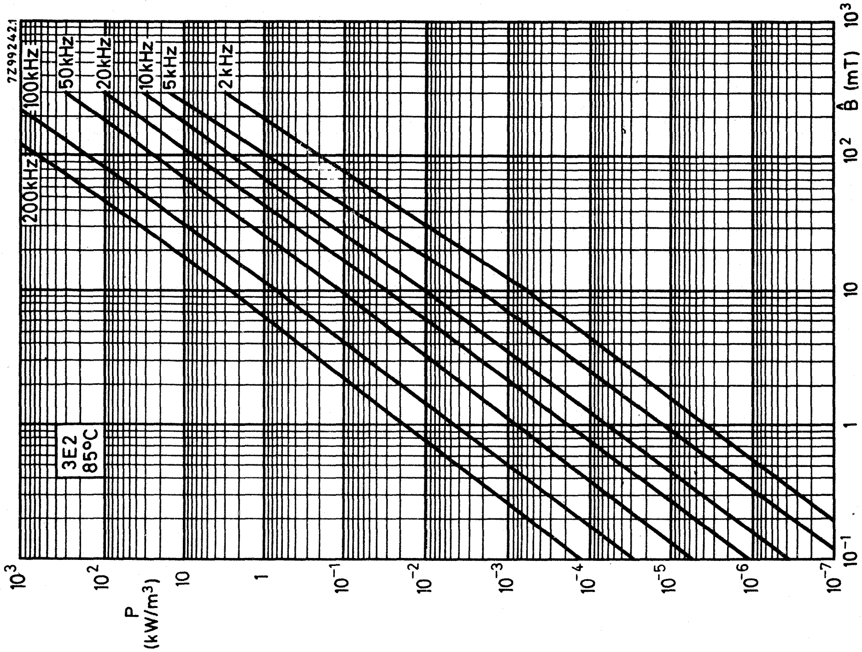
POWER LOSS AS A FUNCTION OF THE INDUCTION

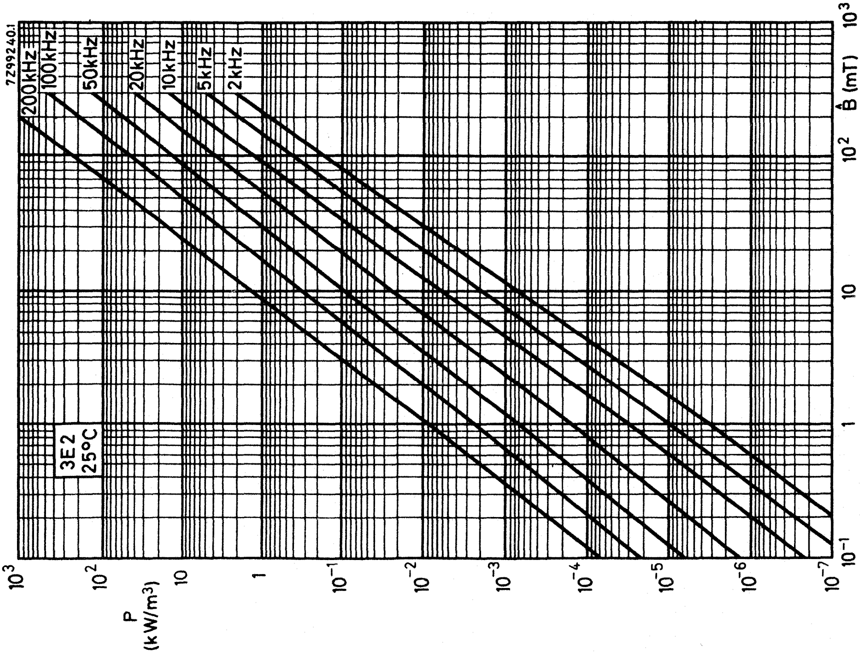


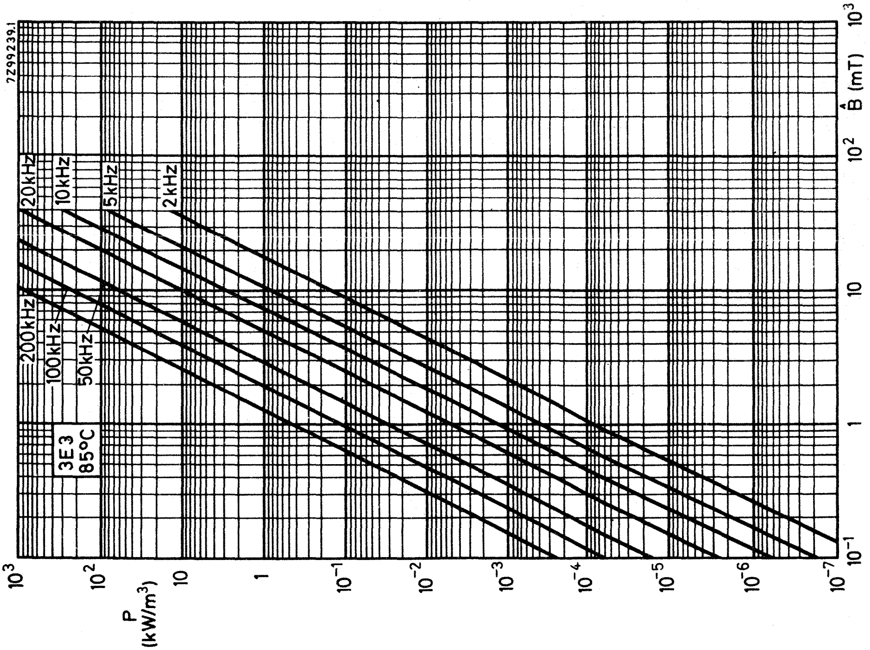


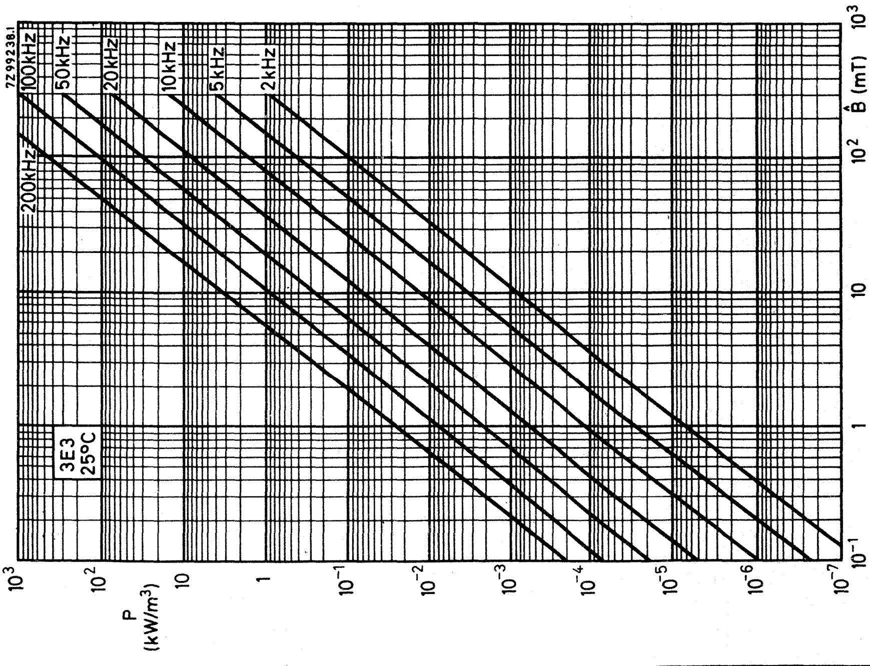

7Z66350.1
3E1
θ = 85°C
P (kW/m³)
B̂ (mT)
2
5
10
20
50
100
200 kHz

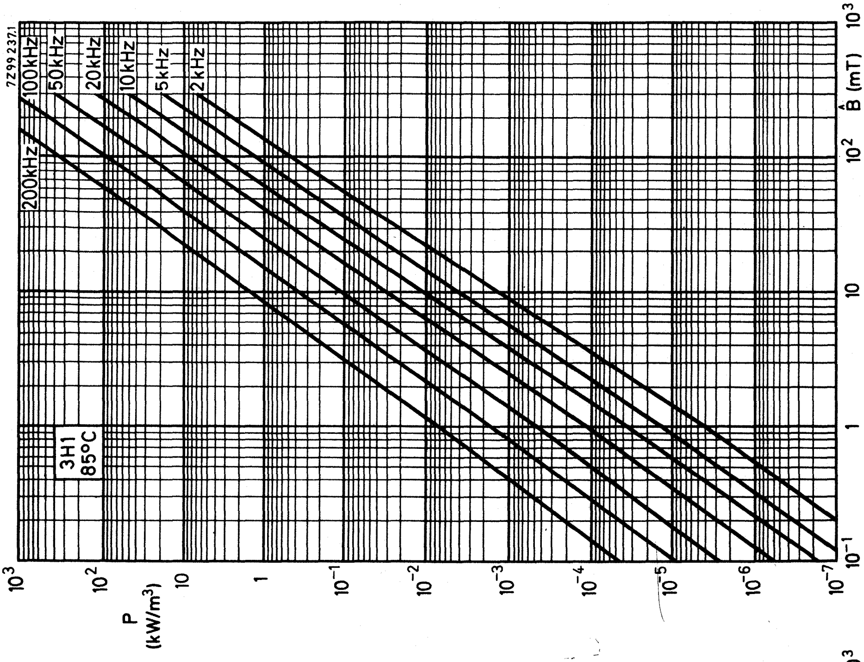

7Z66351.1
3E1
θ = 25°C
P (kW/m³)
B̂ (mT)
2
5
10
20
50
100
200 kHz

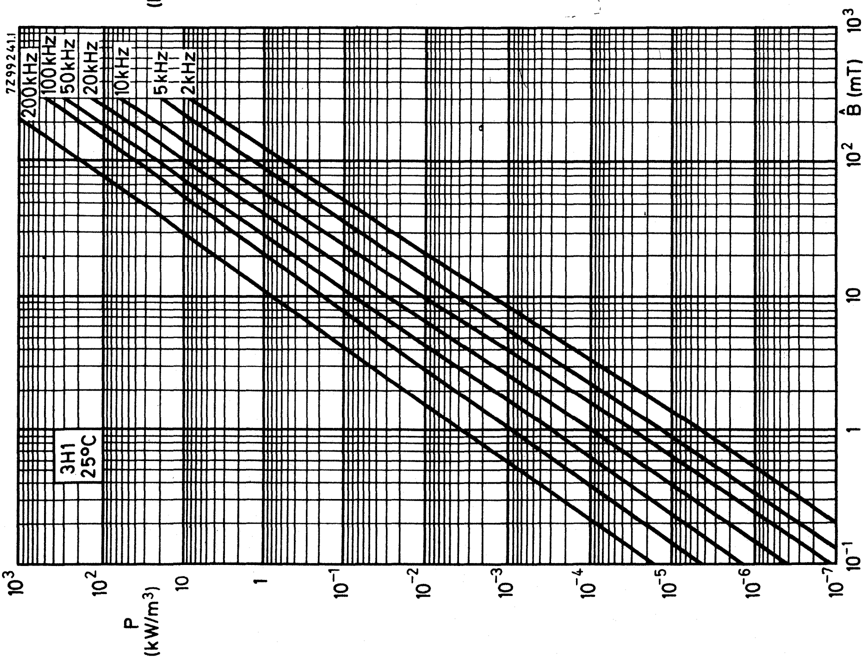

7Z99242.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3E2
85°C
$\hat{B}$ (mT)
P (kW/m^3)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}

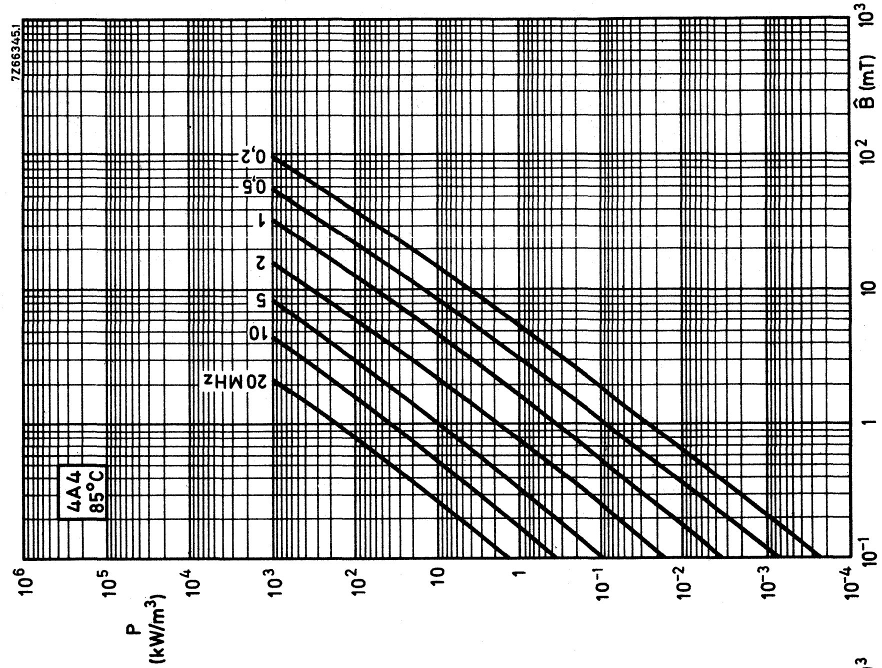

7Z99240.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3E2
25°C
$\hat{B}$ (mT)
P (kW/m^3)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}

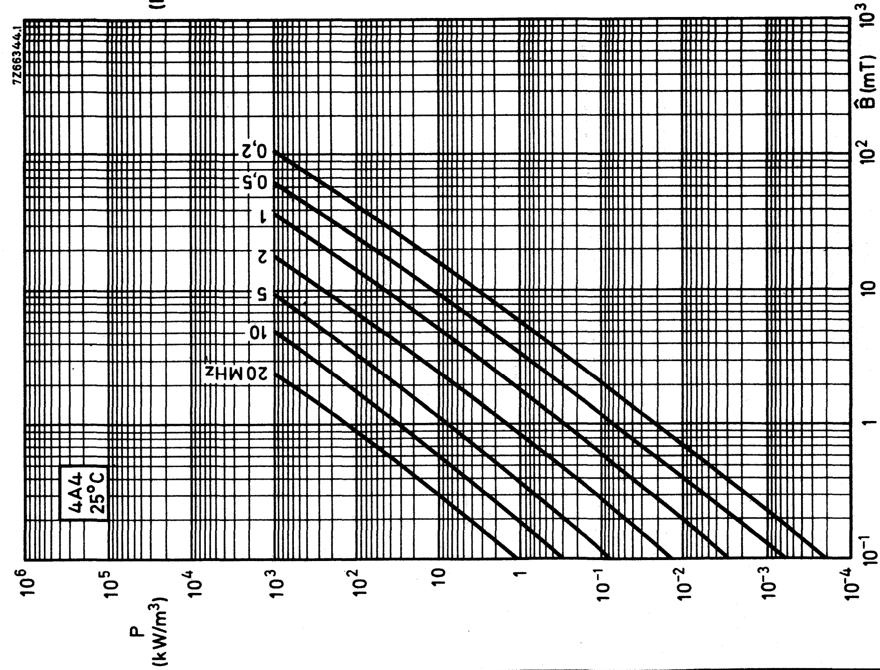

7Z99239.1
3E3
85°C
2kHz
5kHz
10kHz
20kHz
50kHz
100kHz
200kHz
P (kW/m^3)
B̂ (mT)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}

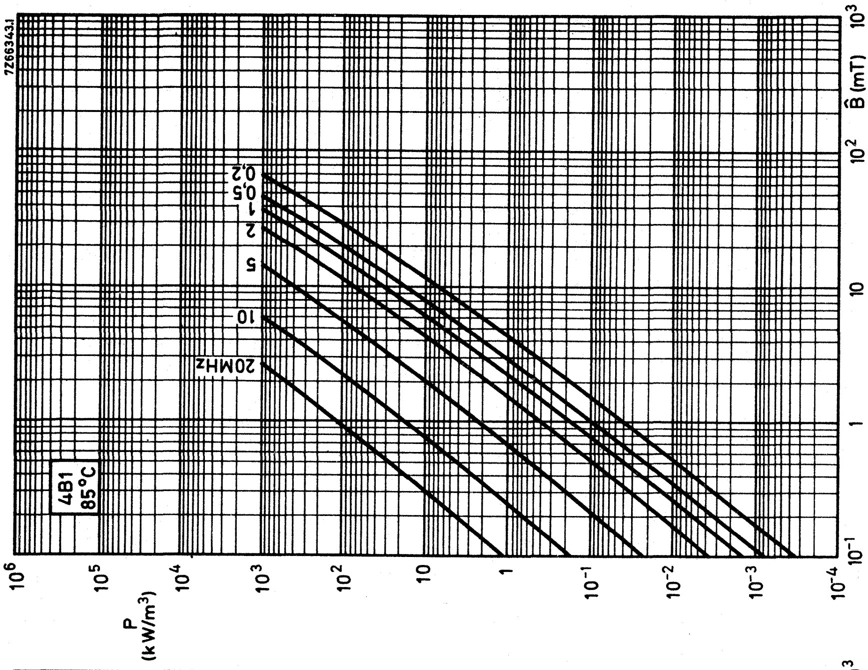

7Z99238.1
3E3
25°C
2kHz
5kHz
10kHz
20kHz
50kHz
100kHz
200kHz
P (kW/m^3)
B̂ (mT)
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}

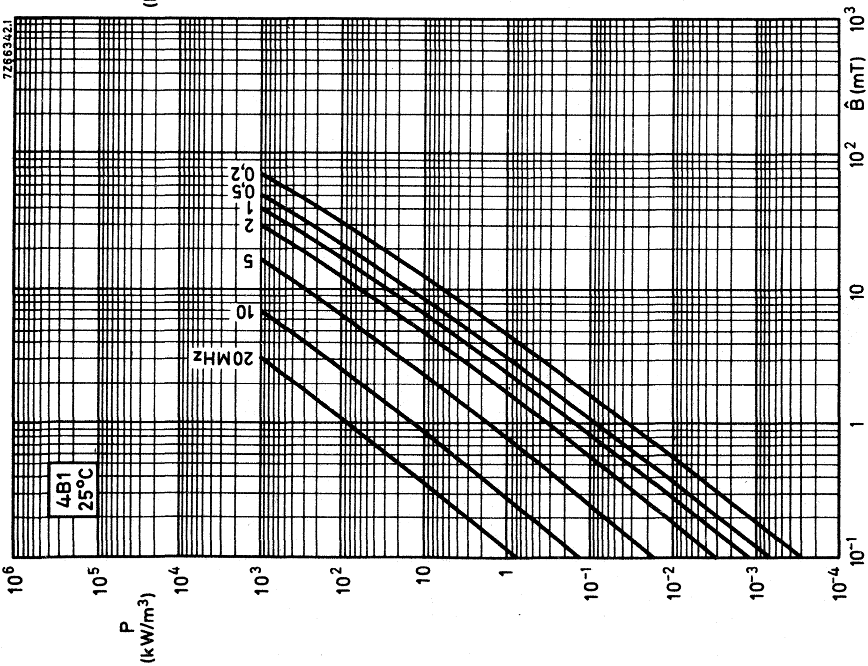

7Z99237.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3H1
85°C
B̂ (mT)
P (kW/m³)

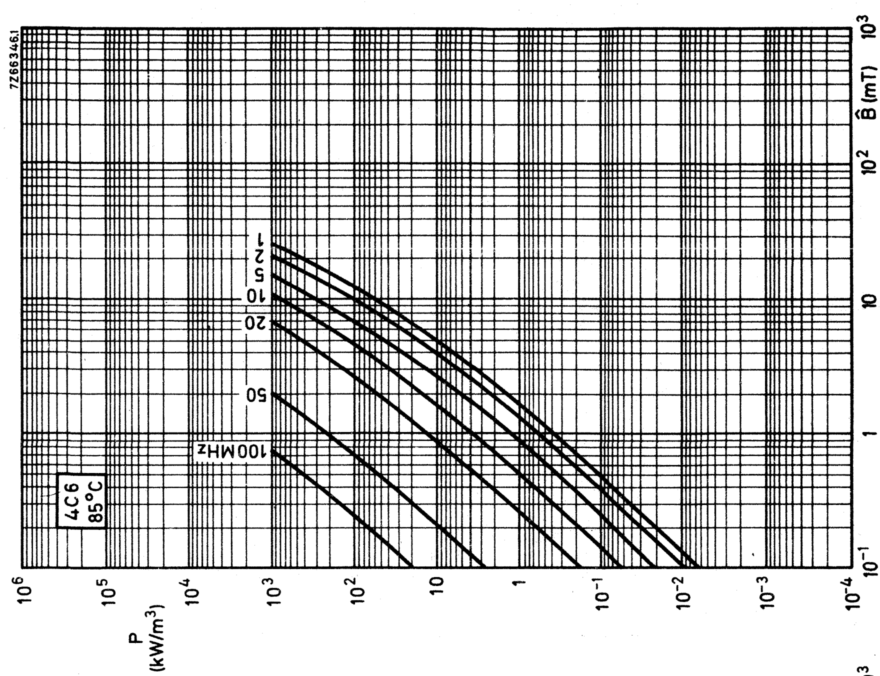

7Z99241.1
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
3H1
25°C
B̂ (mT)
P (kW/m³)

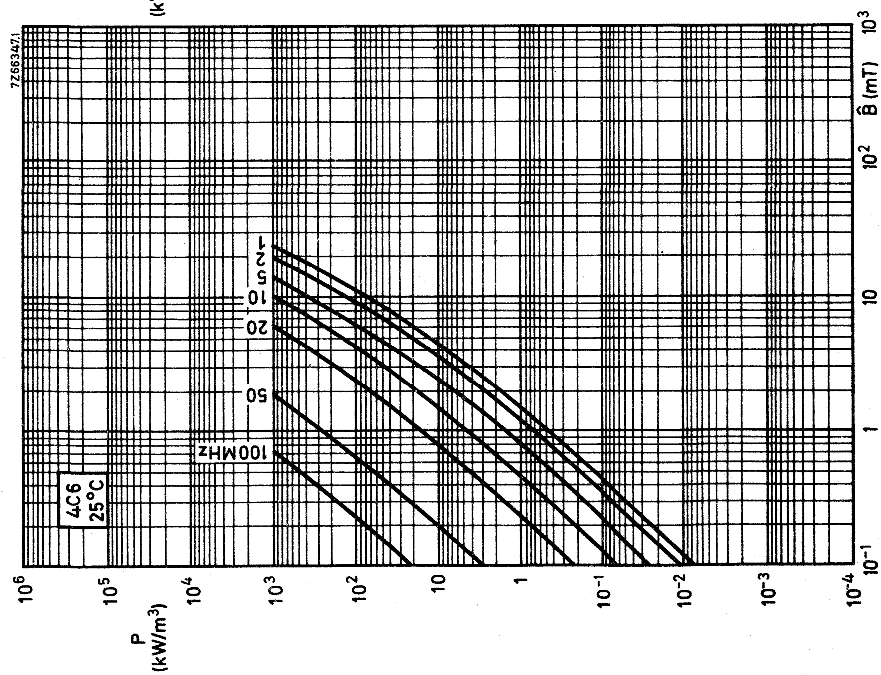

7Z66345.1
4A4
85°C
0,2
0,5
1
2
5
10
20 MHz
P (kW/m³)
B̂ (mT)
10^6
10^5
10^4
10^3
10^2
10
1
10^-1
10^-2
10^-3
10^-4
10^-1
1
10
10^2
10^3


7Z66344.1
4A4
25°C
0,2
0,5
1
2
5
10
20 MHz
P (kW/m³)
B̂ (mT)
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

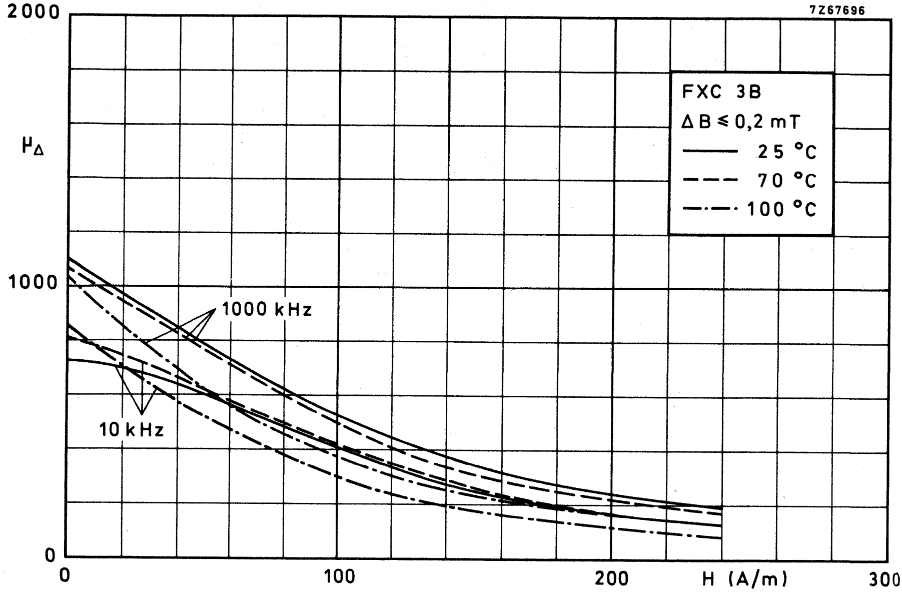

7Z66343.1
4B1
85°C
P
(kW/m³)
B̂ (mT)
0,2
0,5
1
2
5
10
20MHz

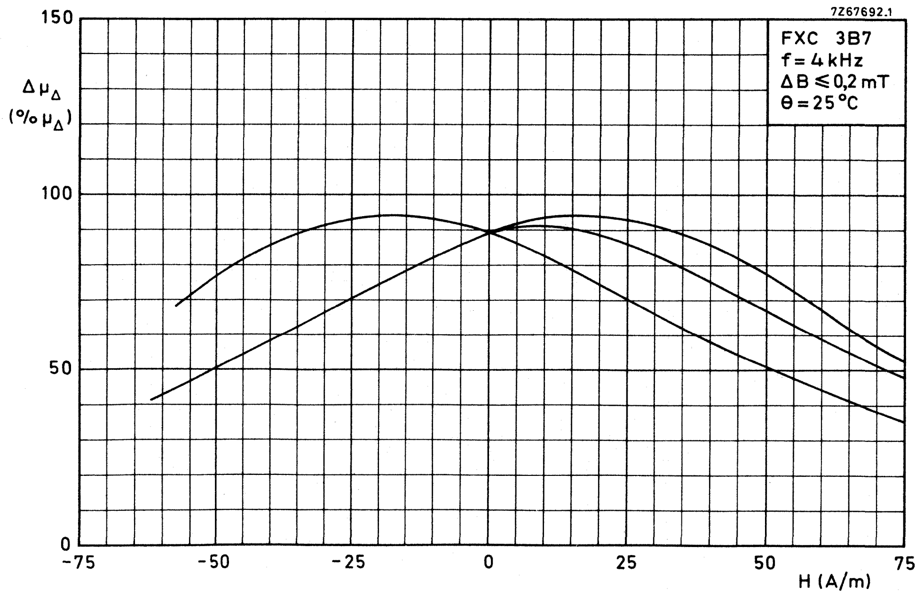

7Z66342.1
4B1
25°C
P
(kW/m³)
B̂ (mT)
0,2
0,5
1
2
5
10
20MHz

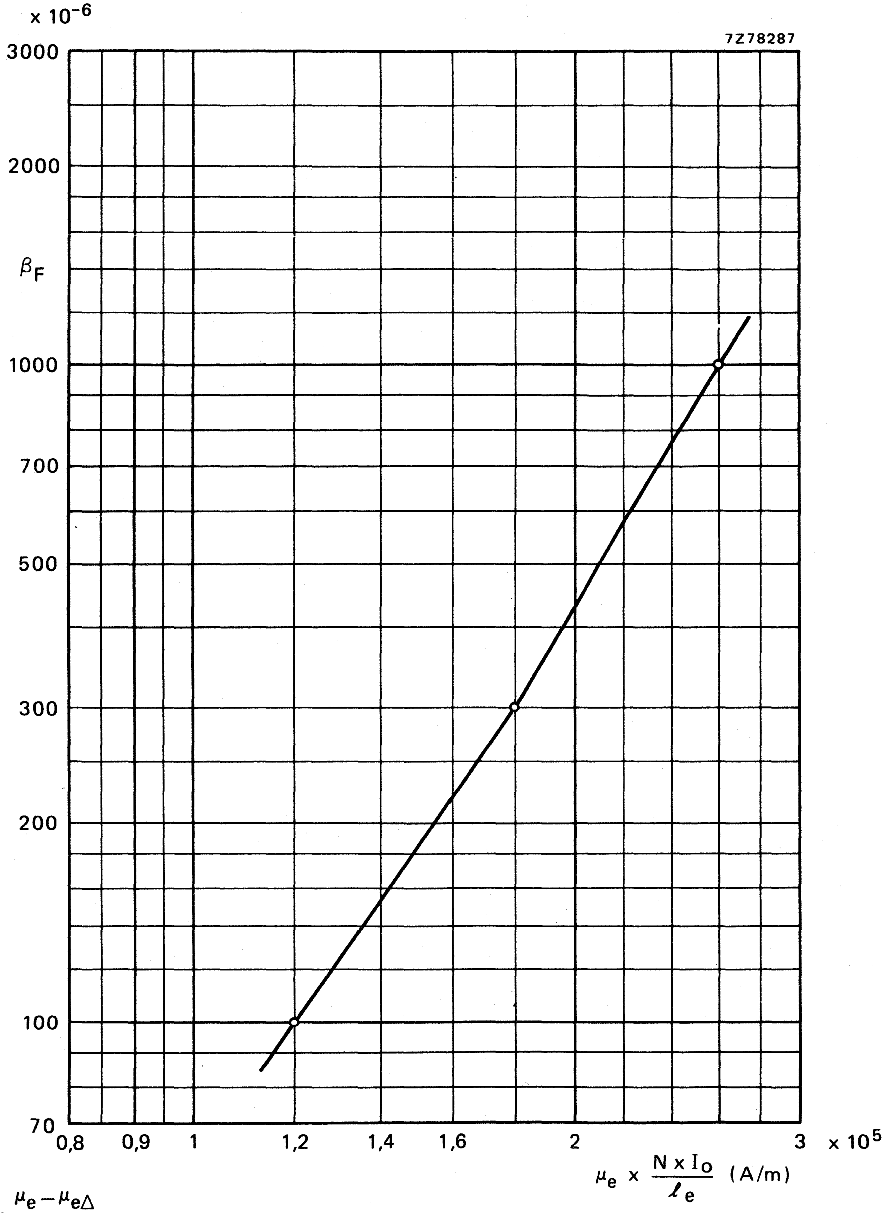

7Z66346.1
4C6
85°C
100 MHz
50
20
10
5
2
1
P
(kW/m³)
B̂ (mT)
10^6
10^5
10^4
10^3
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^3
10^2
10
1
10^{-1}


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

INCREMENTAL PERMEABILITY AS A FUNCTION OF THE FIELD STRENGTH

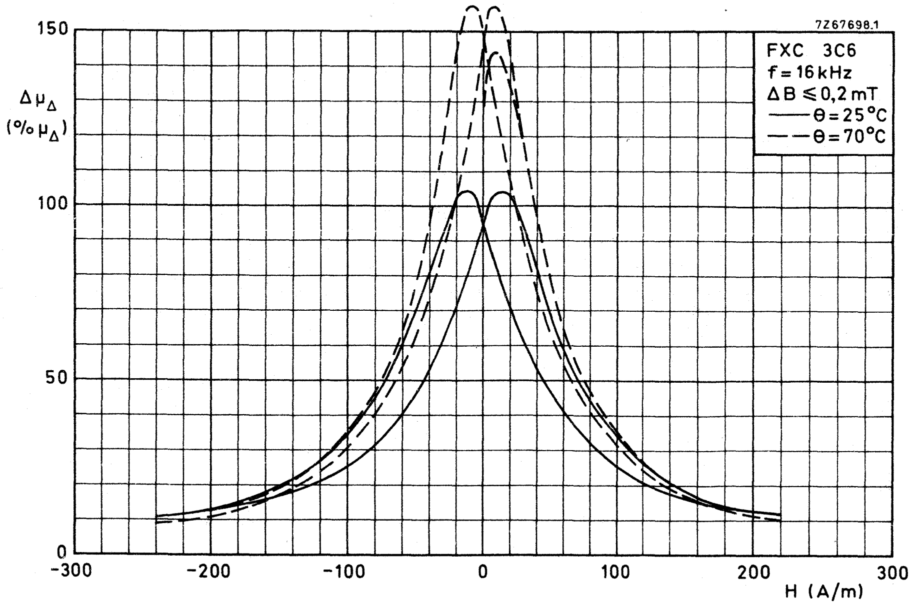


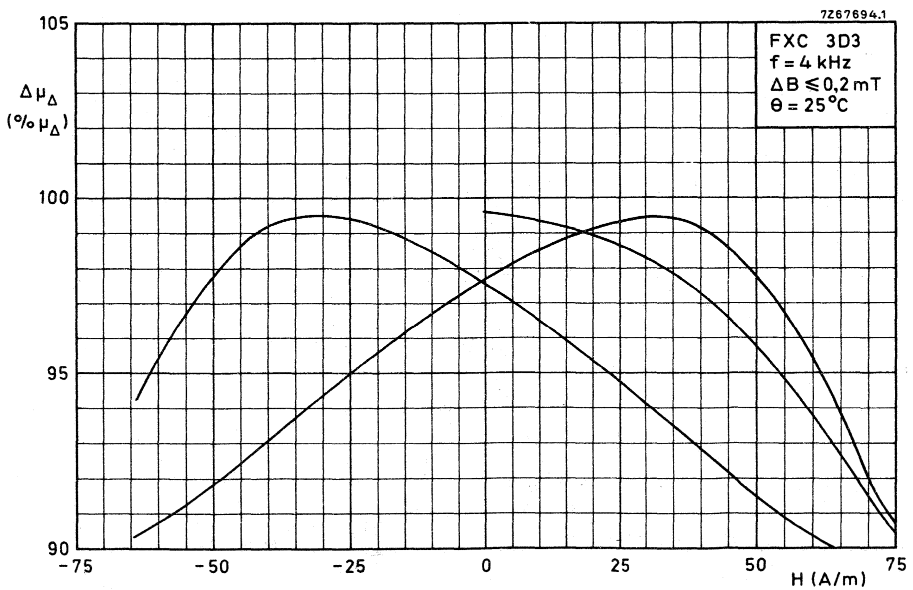


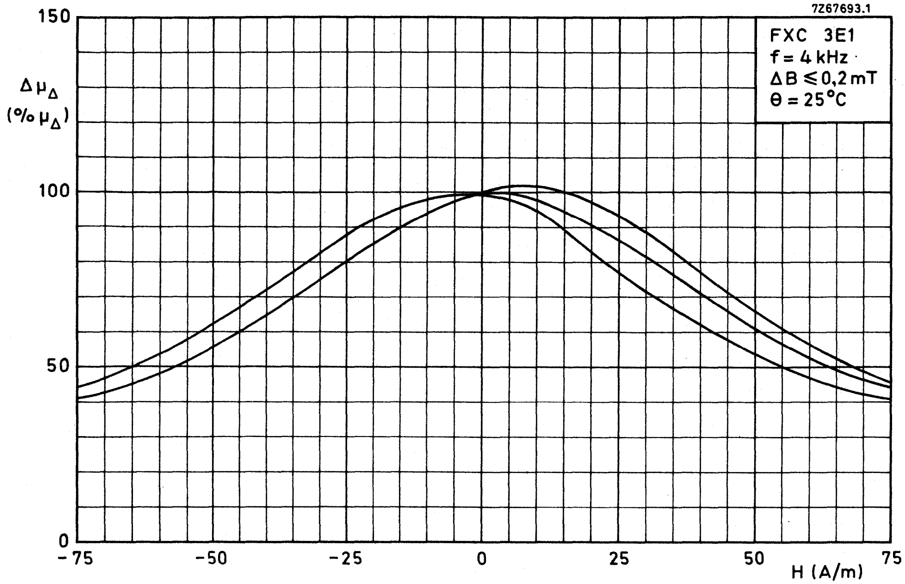


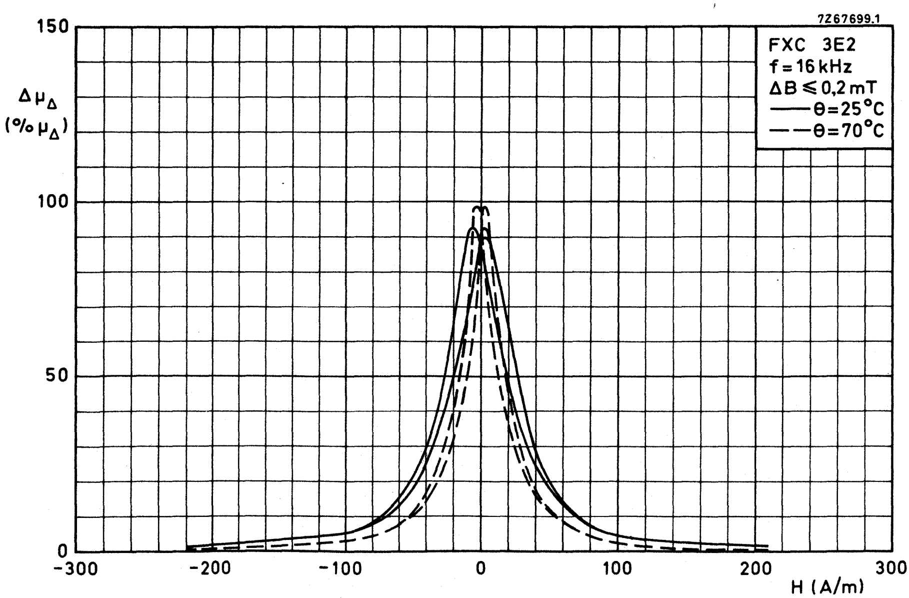
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

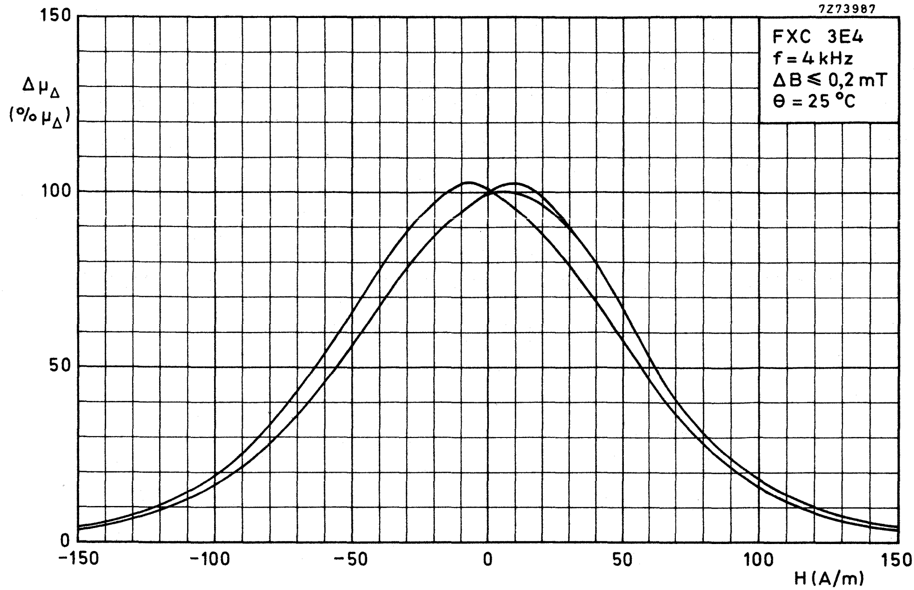
Ferroxcube 3B8.

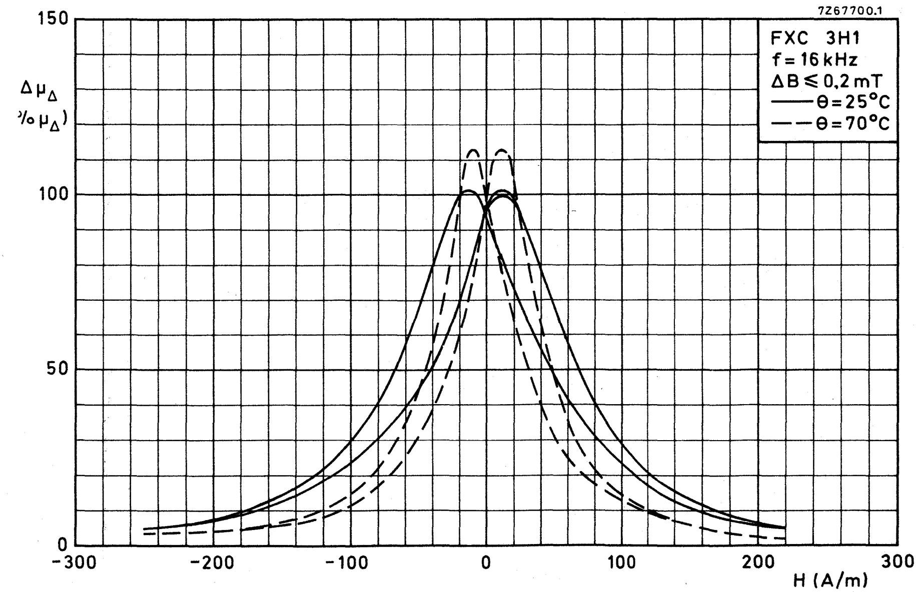

7Z67698.1
FXC 3C6
f = 16 kHz
ΔB ⩽ 0,2 mT
θ = 25 °C
θ = 70 °C
Δμ_Δ (% μ_Δ)
150
100
50
0
−300
−200
−100
0
100
200
300
H (A/m)

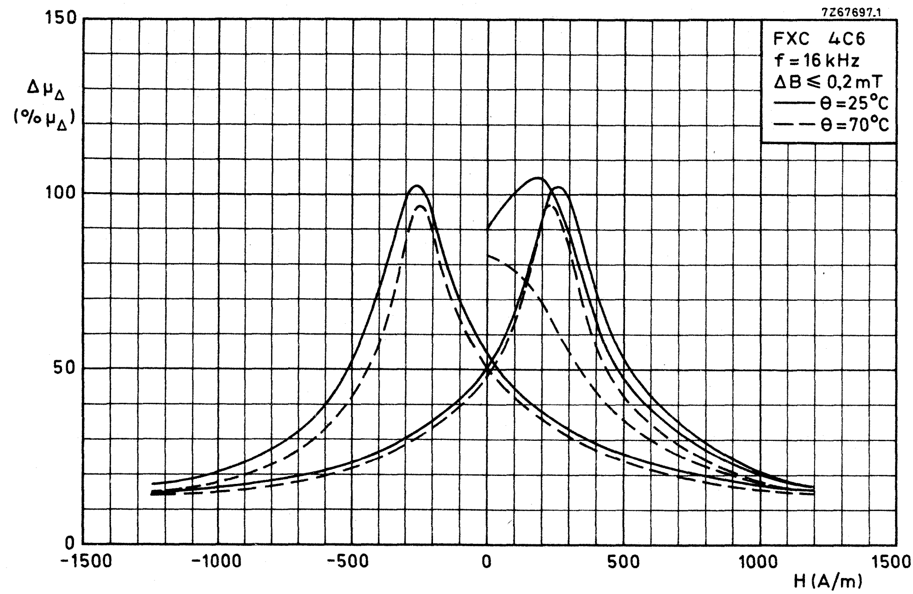

7Z67694.1
FXC 3D3
f = 4 kHz
ΔB ⩽ 0,2 mT
θ = 25 °C
Δμ_Δ (% μ_Δ)
105
100
95
90
−75
−50
−25
0
25
50
75
H (A/m)

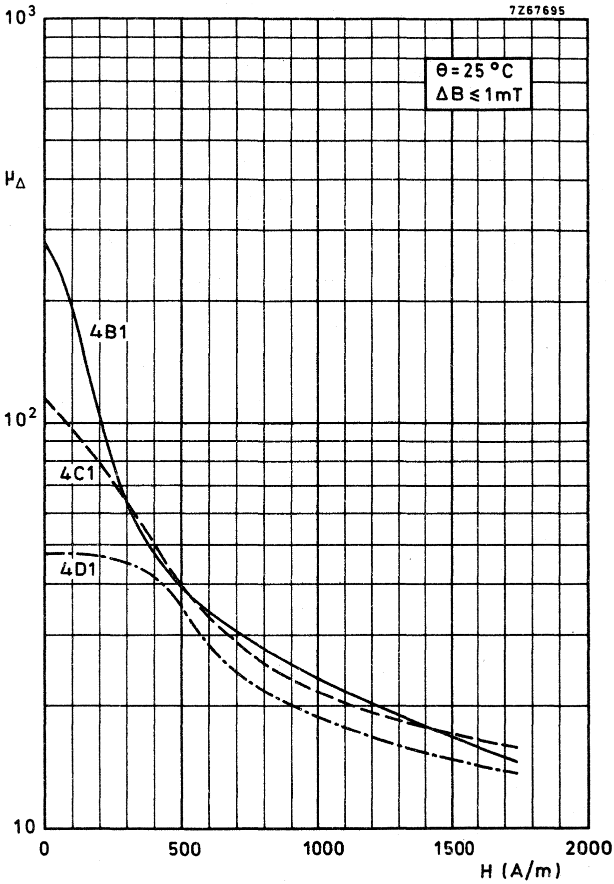

7Z67693.1
FXC 3E1
f = 4 kHz
ΔB ≤ 0,2 mT
θ = 25°C
Δμ_Δ (% μ_Δ)
150
100
50
0
−75
−50
−25
0
25
50
75
H (A/m)


7Z67699.1
FXC 3E2
f = 16 kHz
ΔB ≤ 0,2 mT
θ = 25°C
θ = 70°C
Δμ_Δ (% μ_Δ)
150
100
50
0
−300
−200
−100
0
100
200
300
H (A/m)


7Z73987
FXC 3E4
f = 4 kHz
ΔB ⩽ 0,2 mT
θ = 25 °C
Δμ$_Δ$
(% μ$_Δ$)
150
100
50
0
−150
−100
−50
0
50
100
150
H (A/m)


7Z67700.1
FXC 3H1
f = 16 kHz
ΔB ⩽ 0,2 mT
θ = 25°C
θ = 70°C
Δμ$_Δ$
% μ$_Δ$)
150
100
50
0
−300
−200
−100
0
100
200
300
H (A/m)

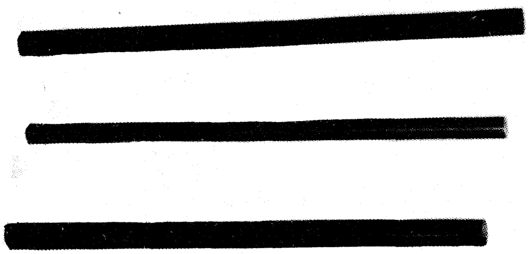

7Z67697.1
FXC 4C6
f = 16 kHz
ΔB ≤ 0,2 mT
—— θ = 25°C
– – – θ = 70°C
Δμ_Δ (% μ_Δ)
150
100
50
0
-1500
-1000
-500
0
500
1000
1500
H (A/m)


7Z67695
θ = 25 °C
ΔB ≤ 1mT
10^3
μ_Δ
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)

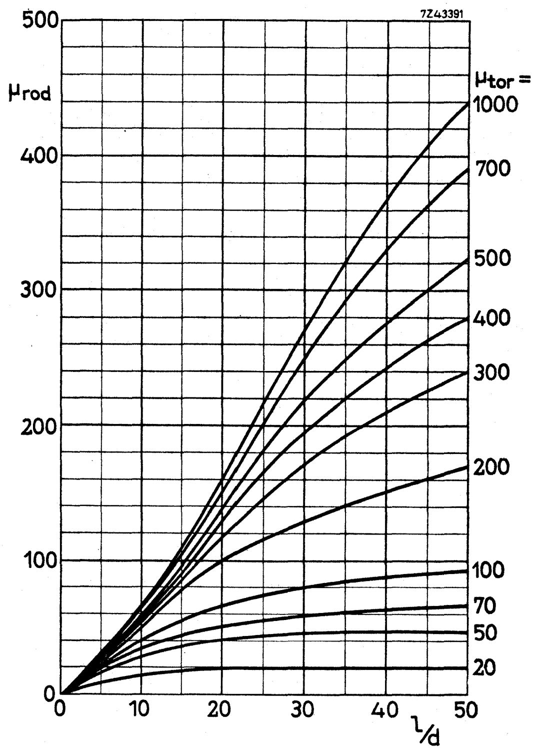
diameter (mm)	length (mm)	L (μH)	Q minimum at 1, 5 MHz	catalogue number
6, 35 ± 0, 2	130 ± 2, 6	500 ± 30	120	4311 020 55420
6, 35 ± 0, 2	140 ± 2, 8	525 ± 30	115	4311 020 55430
10 − 0, 5	100 ± 2	555 ± 30	190	4311 020 55390
10 − 0, 5	140 ± 2, 8	730 ± 41	175	4311 020 55440
10 − 0, 5	160 ± 3, 2	800 ± 47	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 °C
Temperature factor of permeability α_F	
+ 5 to +25 °C	$\leq 15 \times 10^{-6}$
+25 to +70 °C	$\leq 10 \times 10^{-6}$
Resistivity ρ	$> 10^4$ Ωm
Density	4, 2 ± 0, 15 g/cm³ 4050 to 4350 kg/m³



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

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, fixed inductances, adjustable inductances and cross-over filters. 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 pages B5 and B6 table the preferred 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.
	1, 6	5-30	−0, 2	5-30					
			−0, 05	5-8					see next page
			−0, 03	5-8					
	2, 0	5-30	−0, 2	5-30					
			−0, 05	5-10					
3B			−0, 03	5-10					
3B5	2, 5	5-30	−0, 25	5-30	2, 5	2, 5-30	−0, 3	2, 5-30	
3C2			−0, 05	5-10			−0, 1	2, 5-20	
3C6	3, 1	5-30	−0, 25	5-30	3, 1	3 - 30	−0, 3	3 - 30	
3D3			−0, 1	5-25			−0, 1	3 - 25	
3H2			−0, 05	5-16			−0, 05	3 - 25	
4A1	4, 0	8-30	−0, 3	8-30	4, 0	4 - 40	−0, 3	4 - 40	
4B1			−0, 1	8-30			−0, 1	4 - 30	
4C1			−0, 05	8-20			−0, 05	4 - 30	
4C6	5, 0	10-50	−0, 3	10-50	5, 0	5 - 50	−0, 3	5 - 50	
4E1			−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	6,85 −0,2	4C5	3122 104 92040
	6,85 −0,2	3D3	3122 104 91920
1,4 −0,02	6,85 −0,2	4C6	3122 104 94500
1,4 −0,02	6,85 −0,2	4D1	3122 104 91910
1,5 −0,05	18 ±0,2	3B	3122 104 93320
1,55 +0,2	14,2 −0,4	4B1	4312 020 30560
1,6 +0,05	9 ±0,2	3D3	4312 020 30160
		4B1	3122 104 91060
1,6 −0,1	15,2 −0,4	3B	3122 104 91270
	3,95 −0,2	4D2	3122 134 91190
1,6 +0,15 / −0,05	14 ±0,2	3B	4311 020 50110
1,62 ±0,05	17,1 ±0,5	4B1	4313 020 12230
1,65 −0,05	9,2 −0,4	3B	3122 104 91070
1,65 −0,05	12,2 −0,4	3B	3122 104 91100
		4B1	3122 104 91110
1,65 −0,05	14 −0,4	4B1	4330 020 31770
1,65 −0,05	19,2 −0,4	3B	3122 104 91230
1,65 −0,05	25,2 −0,4	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
1,7 −0,15	10,2 −0,4	4D1	4322 020 32040
1,7 −0,15	14,2 −0,4	4E1	4322 020 32060
1,7 −0,15	15,2 −0,4	4D1	4322 020 32170
1,7 −0,15	17,8 −1	3B	3122 104 92020
1,7 −0,15	18,7 −1	3B	3122 104 91900
1,75 +0,03	8,8 −0,15 / +0,3	3D3	4322 020 39480
1,75 −0,2	10,2 −0,4	3B	3122 104 91130
1,75 −0,2	12,2 −0,4	4B1	3122 104 92070
1,75 −0,2	18,5 −1	4B1	3122 104 91150
1,75 −0,2	25 −1	3B	3122 104 91950

ROD CORES (continued)

diameter (mm)	length (mm)	grade	catalogue number
2,2 ±0,2	16 ±0,5	4B1	4312 020 30460
2,3 −0,05	10,2 −0,4	3D3	4312 020 30030
2,3 −0,2	12 −0,7	4E1	4322 020 39410
2,5 −0,25	20 −1	4B1	4312 020 30510
3 +0,2	11 ±0,5	4B1	4330 020 30560
3 ±0,15	24 ±0,35	4B1	4312 020 30520
3,2 ±0,15	10 ±0,3	4E1	4313 020 12470
4 −0,05	18 ±0,2	3C2	4330 020 30640
4 −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
4,9 ±0,05	40 −0,5	3C6	4322 020 39430
4,9 ±0,05	50 −0,5	3C6	3122 134 90110
5 −0,3	18 ±0,3	4B1	4312 020 30490
5 −0,2	25 ±0,5	3B	4322 020 39450
5 −0,3	25 −1	4B1	4330 030 30080
5 −0,3	30 −1,2	4B1	4330 030 30030
5 −0,05	30,2 −0,4	3C6	3122 134 91120
5,4 −0,05	25 ±0,2	4A1	3122 104 93690
6 −0,1	46,2 −0,4	3C2	3122 104 91310
6,35 ±0,2	31,75 ±1	3B5	4313 020 10210
6,35 ±0,2	50,8 ±1,5	3B5	4313 020 10250
6,35 ±0,2	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)

2,9 −0,15 x 2,9 −0,15	15 ±0,3	3C6	3122 134 90730
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
2,7 −0,15	1,2 ±0,1	3,5 ±0,2	3H2	4322 020 38360
2,8 −0,05	1,2 +0,2	8,2 ±0,2	3B	4322 020 34340
3,0 −0,2	0,9 +0,1	6,5 −0,4	4A4	4330 030 32000
3,1 −0,02	1,3 +0,2	18,8 −0,5	3B	3122 134 90770
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*
3,5 ±0,2	1,3 +0,2	5 +0,5	3B	4312 020 31060*
3,5 ±0,2	1,3 +0,2	7,5 +0,5	3B	4312 020 31330
3,5 −0,5	1,2 +0,2	10 ±0,2	3B	4330 020 31050
3,5 −0,1	1,7 +0,2	14,2 −0,4	3B	3122 104 92800
3,5 ±0,2	1,3 +0,2	15,2 −0,4	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	3D3	4322 020 38340
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	4A1	4322 020 34410
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*
3,9 +0,15 / −0,1	1,5 ±0,15	5,5 ±0,2	4B1	4313 020 15460
4 ±0,2	2 ±0,2	5 ±0,5	3B5	4313 020 15170
4 ±0,15	2 +0,2	36 ±0,6	3C6	4312 020 31450
4 ±0,2	1,5 ±0,2	50 ±1	3B5	4313 020 15010
4,1 ±0,2	2 ±0,3	3 ±0,2	3B	4330 020 30230
4,1 −0,05	1,5 ±0,1	4,5 ±0,2	3H2	4322 020 38320
4,1 +0,2	2 +0,2	7 ±0,2	4B1	4311 020 50710
4,1 +0,2	2 +0,2	7 ±0,2	4A1	4311 020 53460
4,1 +0,1	2 +0,2	7 ±0,2	3D3	4312 020 31220
4,1 +0,1	2 +0,2	11 ±0,2	3D3	4312 020 31250
4,1 +0,2	2 +0,2	12 ±0,2	4D1	4311 020 52100
4,1 +0,2	2 +0,2	30 ±0,5	4B1	4311 020 54310
4,1 +0,2	2 +0,2	35 ±0,7	3B	4311 020 50430
4,15 −0,05	2 +0,2	7,2 −0,4	4A1	4322 020 34440
4,15 −0,05	2 +0,2	12,2 −0,4	4B1	4322 020 34450
4,15 −0,05	2 +0,2	12,2 −0,4	4C1	4322 020 34460

* Beads

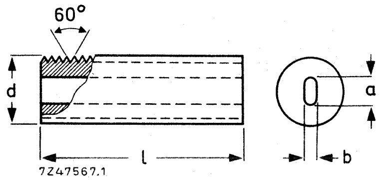
→ **TUBE CORES** (continued)

outer diameter mm	inner diameter mm	length mm	grade	catalogue number
4,15 −0,05	2 +0,2	12,2 −0,4	4D1	4322 020 34470
4,15 −0,05	2 +0,2	15,2 −0,4	4B1	4322 020 34380
4,15 −0,05	2 +0,2	21,2 −0,4	4A1	4322 020 34390
4,2 ±0,1	2,3 ±0,1	7 ±0,2	3B5	4313 020 15120
4,3 −0,2	2 +0,2	7,2 −0,4	3B	3122 104 92900
4,3 −0,2	2,2 −0,2	7,2 −0,4	4D1	3122 104 93890
4,3 −0,2	2 +0,2	11,5 −0,5	3B	3122 104 94880
4,3 −0,2	2 +0,2	12,5 ±0,3	3B	4322 020 34490
4,3 −0,2	2 +0,2	15,4 −0,8	3B	4322 020 36750
4,3 −0,2	2 +0,2	18,5 −0,5	3B	4322 020 36770
4,3 ±0,15	2 +0,3	21,2 −0,4	4B1	4322 020 34480
4,3 −0,2	2 +0,2	25,5 −1	3B	4322 020 36780
4,3 −0,2	2 +0,2	40,5 −1	3B	3122 104 90800
4,9 ±0,05	1,3 +0,2	15 ±0,2	3C6	3122 104 90370
4,9 ±0,05	1,3 +0,2	23 ±0,2	3C6	3122 104 90380
4,9 ±0,05	1,4 ±0,1	25 ±0,5	3C6	4313 020 18250
4,9 ±0,05	3 ±0,1	36 −0,5	3C6	3122 104 93760
4,9 ±0,05	1,3 +0,2	40 ±0,5	3C6	3122 104 93110
4,95 −0,1	1,3 +0,2	26,2 −0,5	3C6	3122 104 94030
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
5,4 −0,4	3,6 −0,3	25,2 −0,4	4A1	3122 104 93720
6 ±0,15	4 ±0,15	2 ±0,1	4C4	4322 020 31250*
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 +0,5	3,5 +0,3	15 ±0,3	4B1	4312 020 31200
8 −0,4	4,2 +0,6	51,4 −2,8	3B	4322 020 34310
8 −0,4	4,2 +0,6	51,4 −2,8	4B1	4322 020 34320
9,5 ±0,3	6,2 ±0,2	17 ±0,05	3B	4313 020 15180
9,5 −0,5	4,5 ±0,2	16 −0,8	4B1	4330 030 32020
10,0 +0,5 −0,1	6 −1	50 ±1	4B1	4311 020 50520
10,8 −0,5	6,7 +0,4	19,5 −0,4	4A4	3122 134 90780
14 ±0,5	7,8 ±0,5	25 ±3	4A1	4311 020 51880

* Bead.

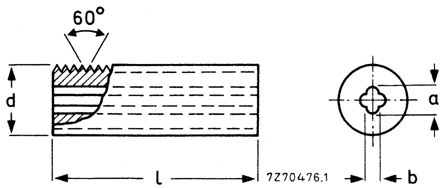
SCREW CORES

Slot trimming hole



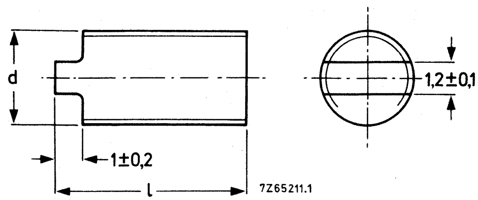
nom. dia. x pitch	l (mm)	d (mm)	a (mm)	b (mm)	grade	catalogue number
3,65 x 0,5	12 ± 0,3	3,65 + 0,05	1,6 ± 0,1	0,7 ± 0,1	3D3	4312 020 32040
5 x 1	15 ± 0,3	5 −0,1	2,2 ± 0,15	1,1 ± 0,1	3D3	3122 104 93610
5 x 1	20 ± 0,3	5 −0,1	2,35 −0,3	1,1 ± 0,1	3D3	4312 020 32130
5,55 x 0,75	13 ± 0,3	5,55 + 0,05	2,65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

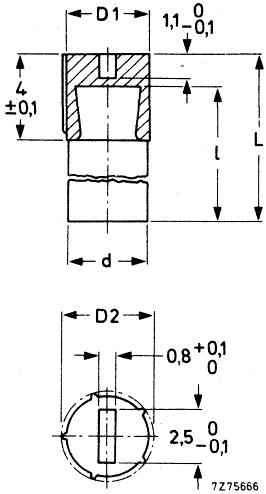
Stud trimming



nom. diameter x pitch	l (mm)	d (mm)	grade	catalogue number
3,5 x 0,7	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	3D3	4312 020 32150 ←

PLASTIC HEADED ADJUSTER CORES

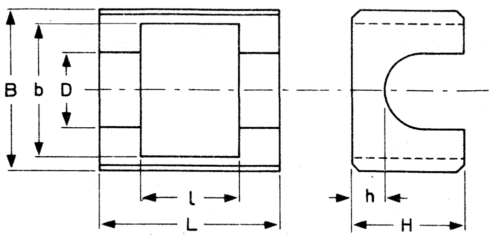
Plastic headed adjuster cores are used for coil adjustment. With help of the ridged elastic polypropylene head the core is fixed in the threaded coil former.



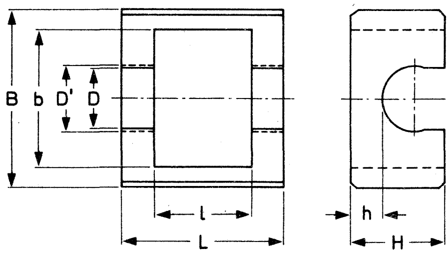
d mm	l mm	D1 mm	D2 mm	L mm	grade	catalogue number
3,1	5,2	3,2 −0,05	3,6 −0,05	6,7 ± 0,1	4D2	3122 104 99150
3,7	15	3,8 −0,05	4,2 −0,05	16,5 ± 0,1	3B	3122 104 99250
4,4	20	4,5 −0,05	5 −0,05	21,5 ± 0,1	3B	3122 104 99020
6,3	35	6,4 −0,05	7,1 −0,05	36,5 ± 0,1	3C6	3122 104 99270

FRAME CORES

For use in small coils, i.f. transformers, etc.



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	4322 020 35250*
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



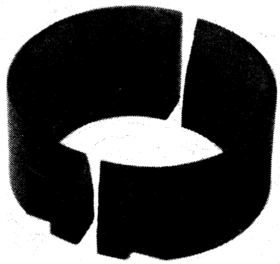
L ± 0,2 mm	l ± 0,2 mm	B ± 0,2 mm	b ± 0,2 mm	H ± 0,2 mm	h ± 0,2 mm	D ± 0,05 mm	D' ± 0,05 mm	grade	catalogue number
10	6	11,2	8,5	6	2	3,8	4,05	4C6	3122 104 92780
10	6	11,2	8,5	6	2	3,8	4,05	4A4	3122 104 92790

* Fully lacquered.

YOKE RINGS FOR USE IN DEFLECTION COILS FOR PICTURE TUBES

FOR 110° BLACK AND WHITE PICTURE TUBES

RZ 24668-2

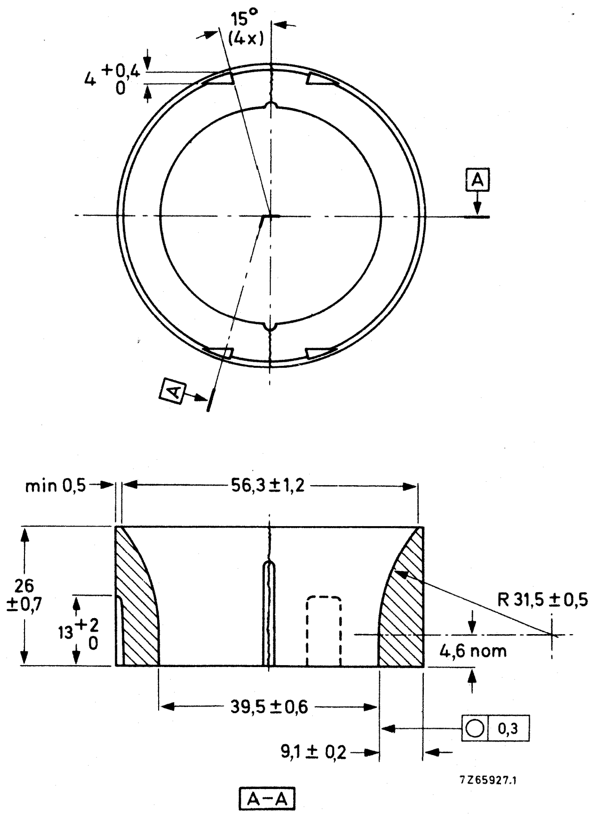


Catalogue number 3122 104 93840

Material Ferroxcube 3C2

Weight 135 g

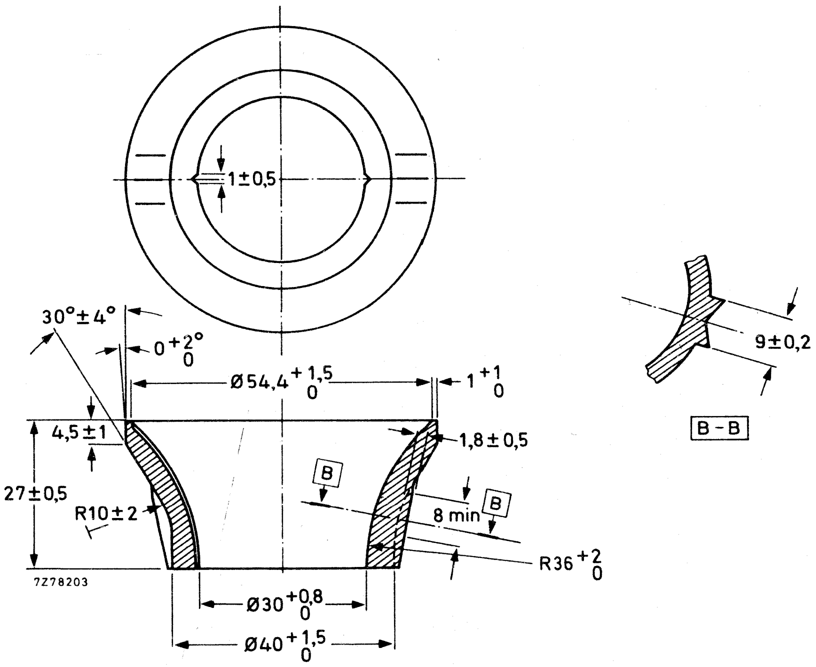
Dimensions (mm)



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

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

<u>Dimensions (mm)</u>

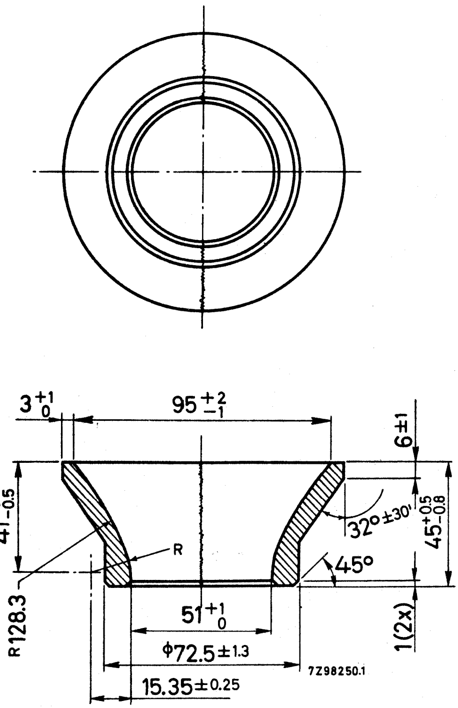


FOR 90° COLOUR PICTURE TUBES

Catalogue number	3122 104 99170
Material	Ferroxcube 3C2
Mass	380 g

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

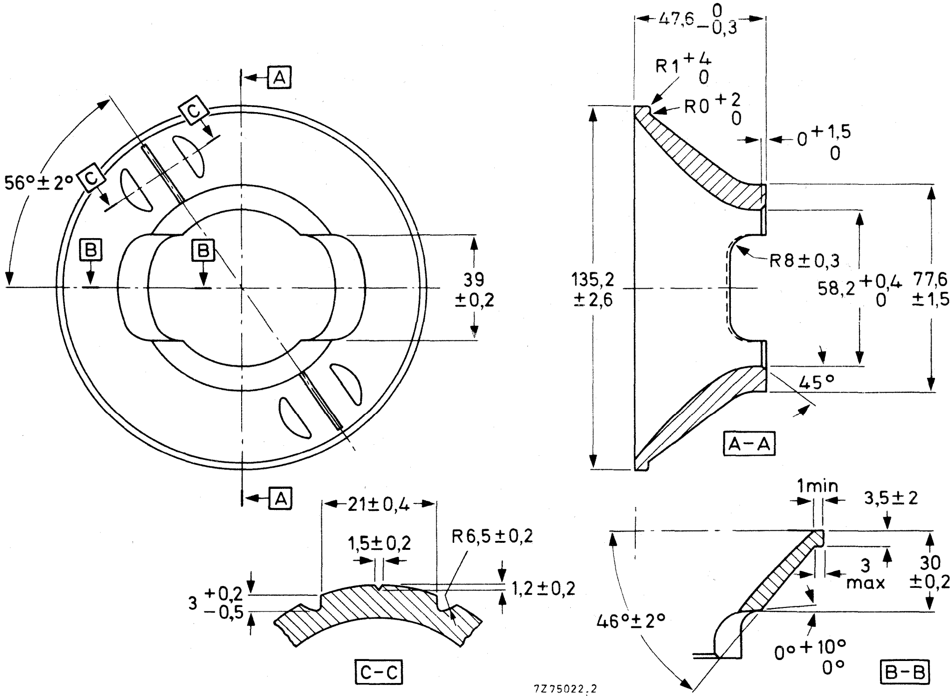
Dimensions (mm) (without lacquer)



FOR 110° COLOUR PICTURE TUBES

Catalogue number	3122 134 90970
Material	3C2
Mass	545 g

Dimensions (mm)



FOR 90° HYBRID 20 INCH COLOUR PICTURE TUBES

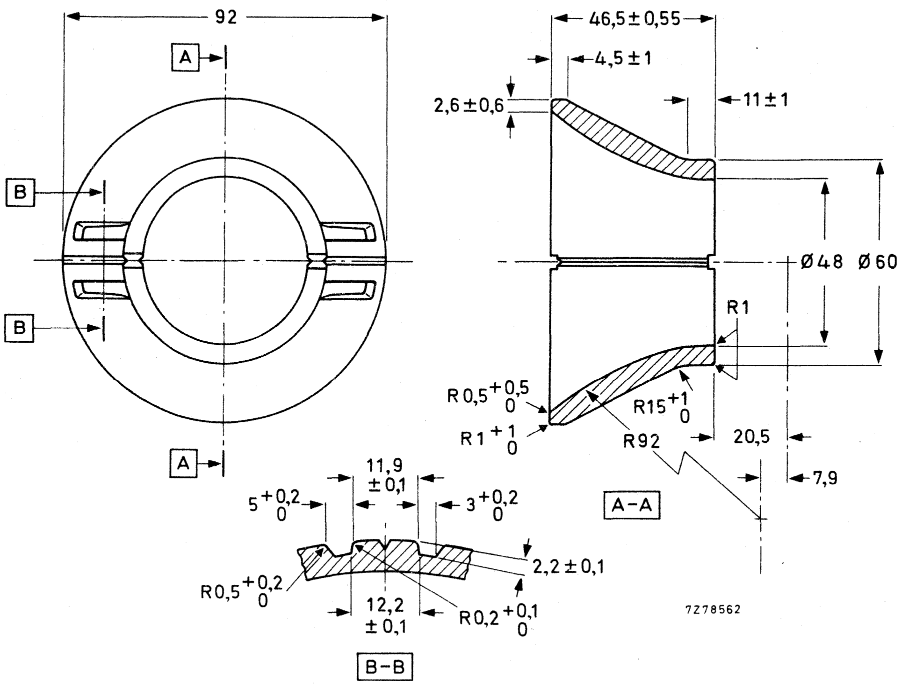
Catalogue number: 3122 134 91610

Material: Ferroxcube 2A2

Mass: 268 g

MECHANICAL DATA

Dimensions in mm



CORES FOR TRANSFORMERS

U-and U I-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 :

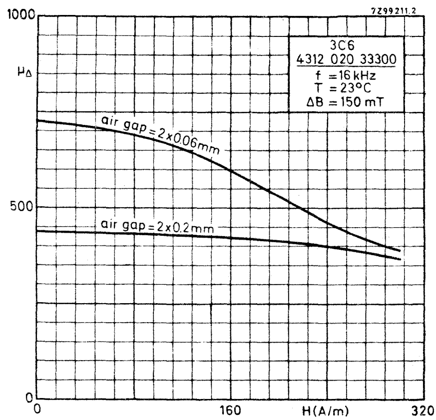
- group I : suitable for the construction of driver transformers, small power transformers, chokes and coils.
- group II : mainly used for line-output transformers.
- group III : for use in power transformers.

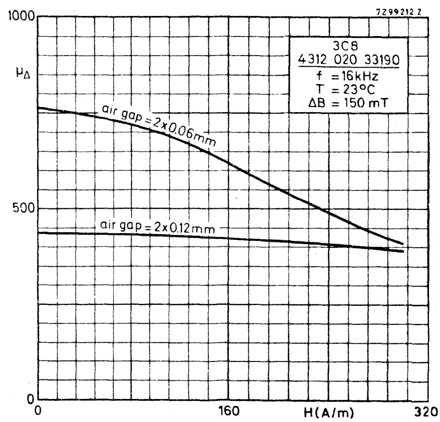
The cores are available in ferroxcube grade 3C6 and 3C8.
See chapter A of this handbook for material properties.

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

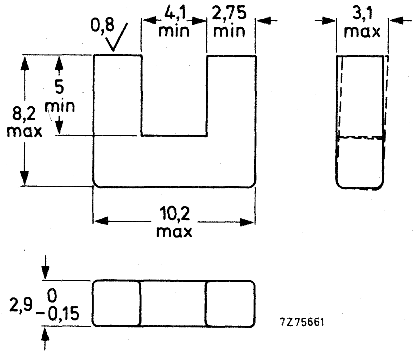
type designation [1]	catalogue number for one core		legs cross-section	group
	grade 3C6	grade 3C8		
→ U-10/8/3		3122 134 91160	square	I
U-15/11/6		3122 134 90690	rectangular	I
U-20/16/7		3122 134 90200	square	I
U-25/20/13		3122 134 90460	rectangular	I
U-30/25/16		3122 134 90760	rectangular	I
U-52/27/11		3122 134 90480	round	II
U-57/28/16	4312 020 33300	4312 020 33190	round	II
→ U-64/30/14		4312 020 33450	round	II
U-64/40/20		3122 134 91390	round	II
U-70/31/17	3122 104 93570		round	II
U-70/32/16	4312 020 33330		round	II
U-70/33/17		3122 104 93950	round	II
→ U-70/35/17		3122 134 90130	round	II
U-46/33/11	3122 104 90480		round	II
I-46/10/11	3122 104 90470			II
U-58/45/16		3122 104 94760	octagonal	II
I-58/13/16		3122 104 94770		II
U-82/65/18	3122 104 93120		round	II
I-82/15/18	3122 104 93130			II
U-93/52/30	4312 020 33100		rectangular	III
I-93/28/30	4312 020 33110			III
U-93/76/16	4312 020 33070		rectangular	III
I-93/28/16	4312 020 33080			III
U-93/76/30	4312 020 33090		rectangular	III
I-93/28/30	4312 020 33110			III
U-100/57/25	4312 020 33120		square	III
I-100/25/25	4312 020 33420			III

[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 (SMPS), see table below.
For full data see chapter E of this handbook.

type designation	catalogue number of one core		
	grade 3C6	grade 3C8	
		without air gap	with air gap
E20/10/5	4312 020 34070		
E25/13/7		4312 020 34020	
E42/21/15		4312 020 34110	4312 020 34280 4312 020 34370
E42/21/20		4312 020 34120 [1]	4312 020 34360 3122 134 91360
E42/33/20		4312 020 34190 [1]	
E55/28/21		4312 020 34100	4312 020 34430
E55/28/25		3122 134 90210	3122 134 90940
E65/33/27		4312 020 34380	
EC35/17/10		4322 020 52500	8213 140 25270
EC40/19/12		4322 020 52510	8213 140 25280
EC53/24/14		4322 020 52520	8213 140 25290
EC70/34/17		4322 020 52530	8213 140 25300

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



Mass 0,85 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-10/16/3.

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	–	–	3122 134 91160
	25	⩾ 140	50	–	
	100	⩾ 200	–	–	
	100	⩾ 315	250	–	

Magnetic dimensions

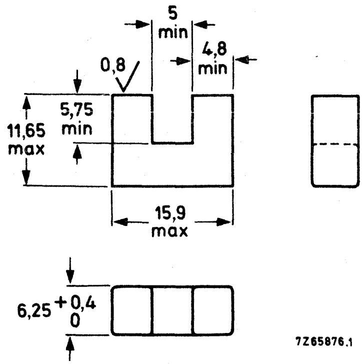
l_e = 40 mm

A_e = 7,9 mm²

V_e = 320 mm³

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

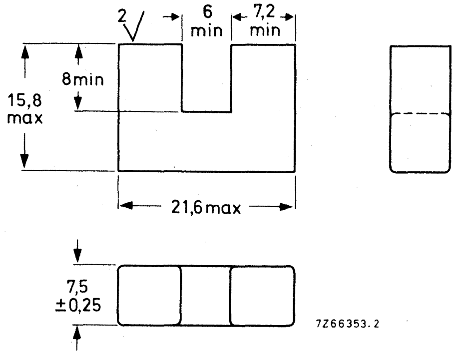
l_e = 48 mm

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 (°C) ± 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

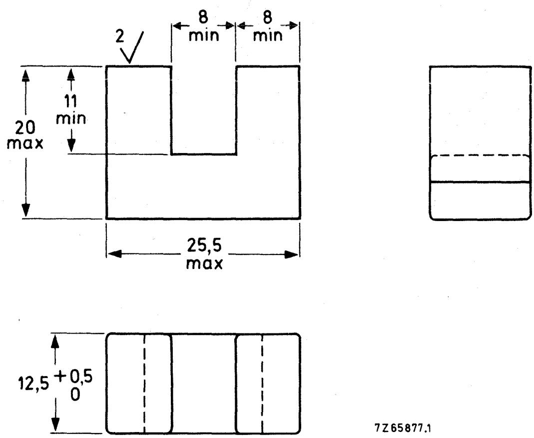
l_e = 68 mm

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

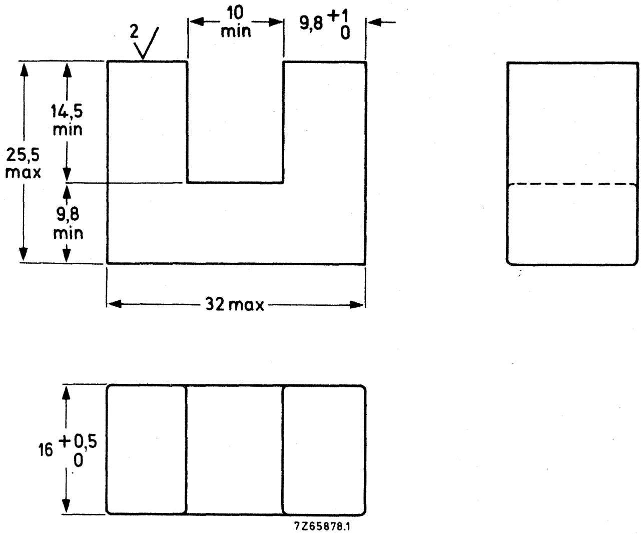
l_e = 86 mm

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	25 100 100	200 200 ≥ 335	– – 400	≤ 2,4 ≤ 2,0 –	3122 134 90760

Magnetic dimensions

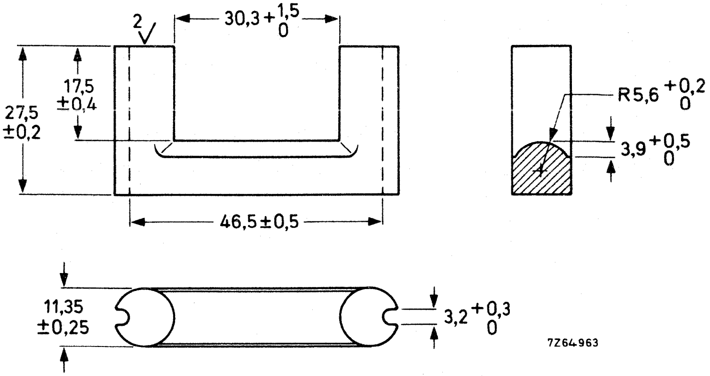
l_e = 111 mm

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

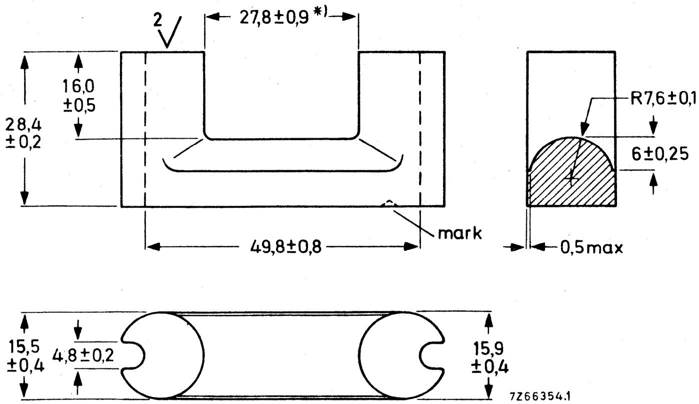
l_e = 165 mm

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

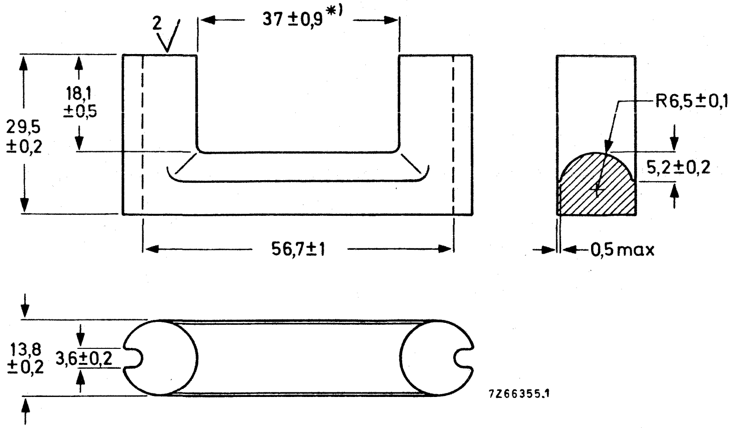
A_e = 171 mm^2

V_e = 27500 mm^3

*) 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 64 g

MAGNETIC DATA

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

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	-	≤ 3, 04	4312 020 33450
	100	200	-	≤ 2, 8	
	100	≥ 330	250	-	

Magnetic dimensions

l_e = 185 mm

A_e = 138 mm^2

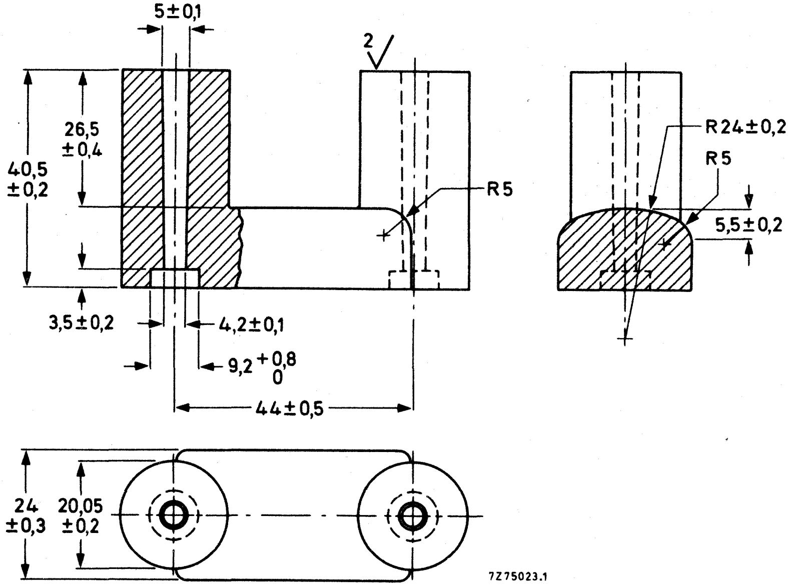
V_e = 25300 mm^3 ←

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

MECHANICAL DATA

Dimensions in mm

Outlines



Mass 155 g

MAGNETIC DATA

Guaranteed values, measured at 16 kHz, for a core-pair UU-64/79/20

grade	temperature (°C) ± 5	induction $\hat{B}$ (mT)	field strength H (A/m)	losses W	catalogue number of one U-core
3C8	25 100 100	200 200 ⩾ 330	– – 250	⩽ 8,5 ⩽ 7,0 –	3122 134 91390

Magnetic dimensions

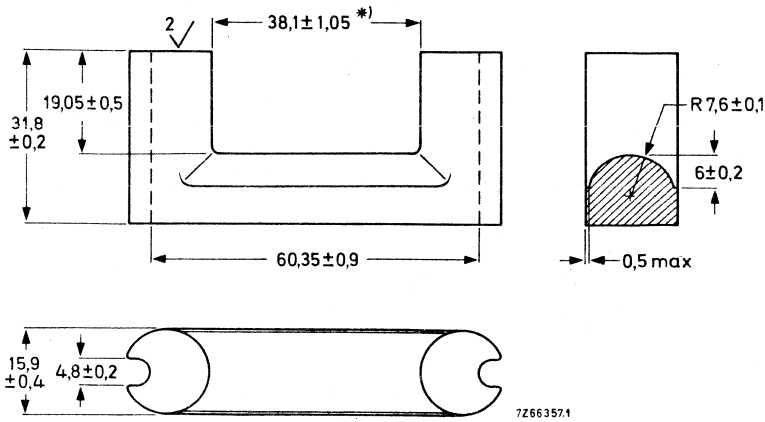
l_e = 210 mm

A_e = 290 mm²

V_e = 61000 mm³

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 (°C) ± 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

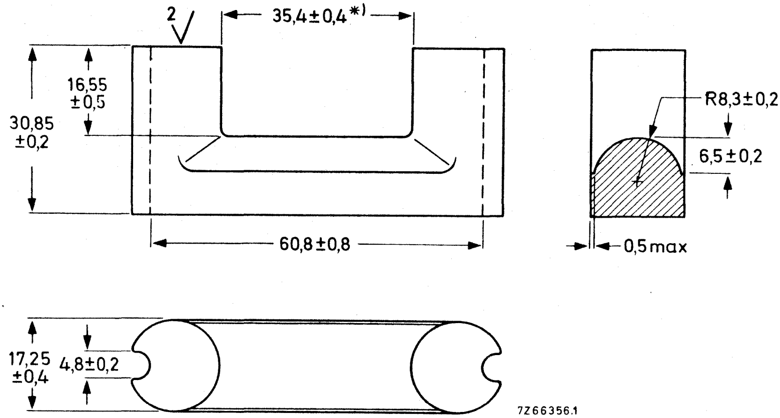
A_e = 177 mm^2

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 105 g

MAGNETIC DATA

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

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	-	≤ 6.8	3122 104 93570
	100	200	-	≤ 5.6	
	100	≥ 290	250	-	

Magnetic dimensions

l_e = 187 mm

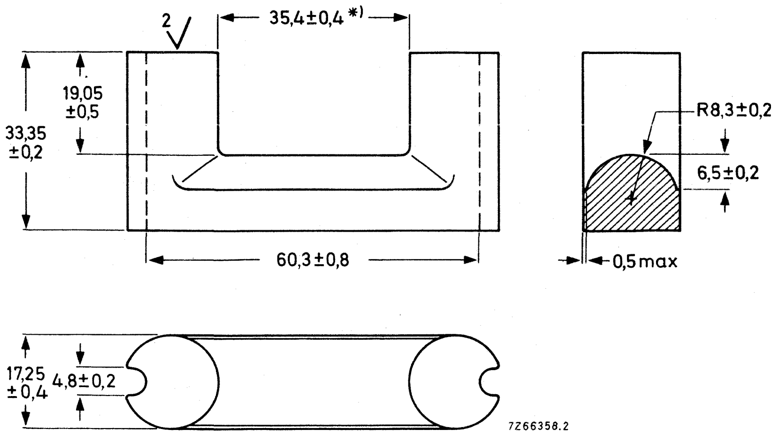
A_e = 214 mm^2

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 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	200	–	≤ 5,3	3122 104 93950
	100	200	–	≤ 5,0	
	100	≥ 330	250	–	

Magnetic dimensions

l_e = 197 mm

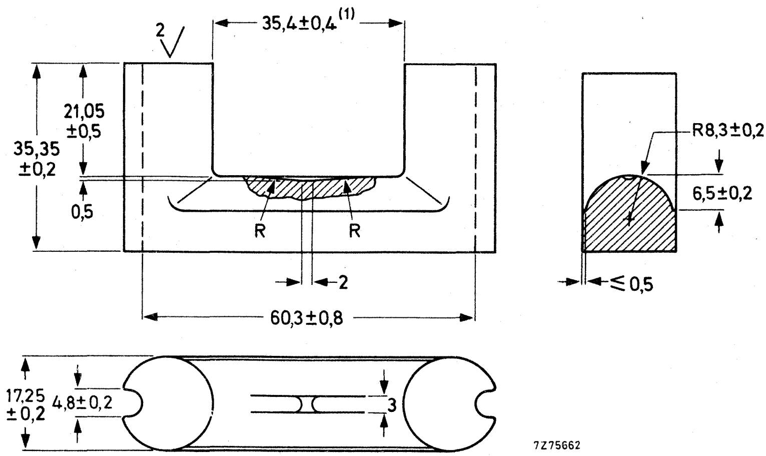
A_e = 214 mm^2

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)



Mass 120 g

MAGNETIC DATA

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

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 ⩽ 4,8 –	3122 134 90130

Magnetic dimensions

l_e = 205 mm

A_e = 214 mm²

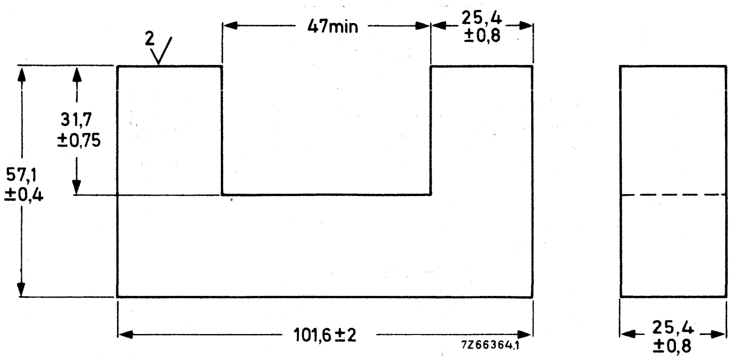
V_e = 43900 mm³

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

MECHANICAL DATA

Dimensions in mm

Outlines



Mass 506 g

MAGNETIC DATA

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

grade	temperature (^oC) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	catalogue number of one U-core
3C6	25 100 100	200 200 ≥ 290	– – 250	≤ 32,4 ≤ 26,7 –	4312 020 33120

Magnetic dimensions

l_e = 310 mm

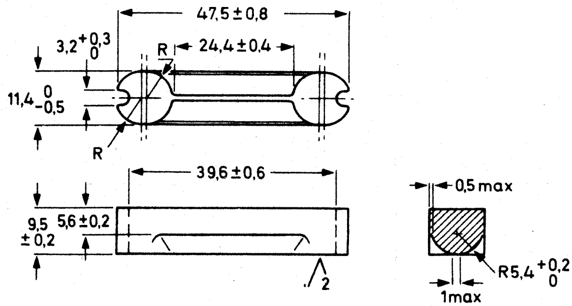
A_e = 620 mm^2

V_e = 191000 mm^3

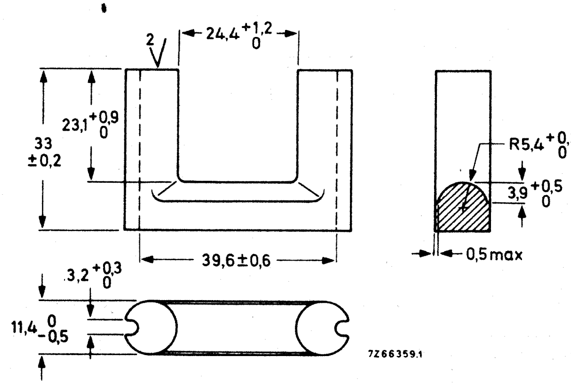
MECHANICAL DATA

Dimensions (mm)

I-core



U-core



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 (^{o}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

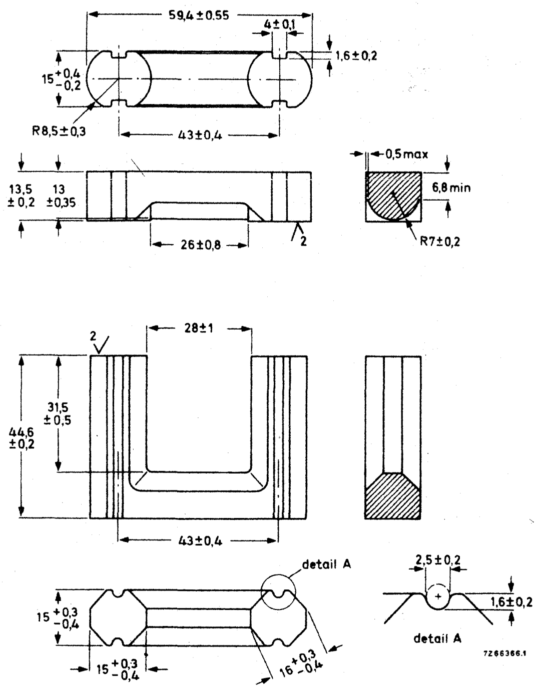
l_e = 129 mm

A_e = 88 mm^2

V_e = 11600 mm^3

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	25 100 100	200 200 ≥ 330	– – 250	≤ 3,5 ≤ 3,2 –	U I	3122 104 94760 3122 104 94770

Magnetic dimensions

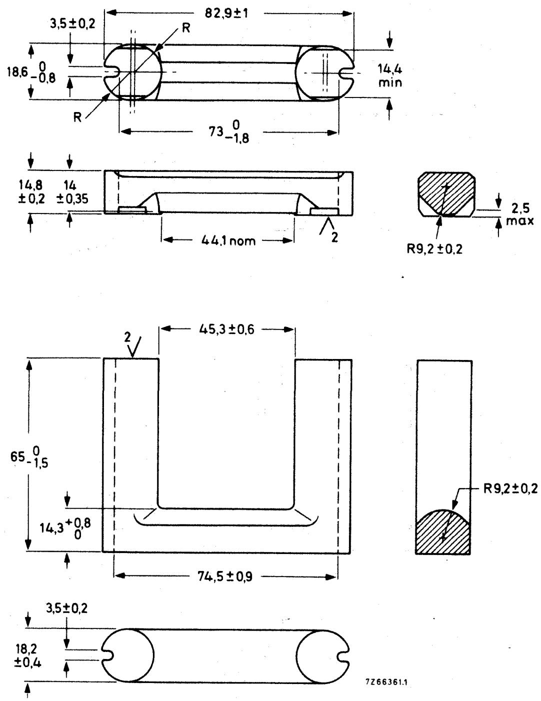
l_e = 164 mm

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	200	–	≤ 10	U	3122 104 93120
	100	200	–	≤ 8, 3	I	3122 104 93130
	100	≥ 290	250	–		

Magnetic dimensions

l_e = 243 mm

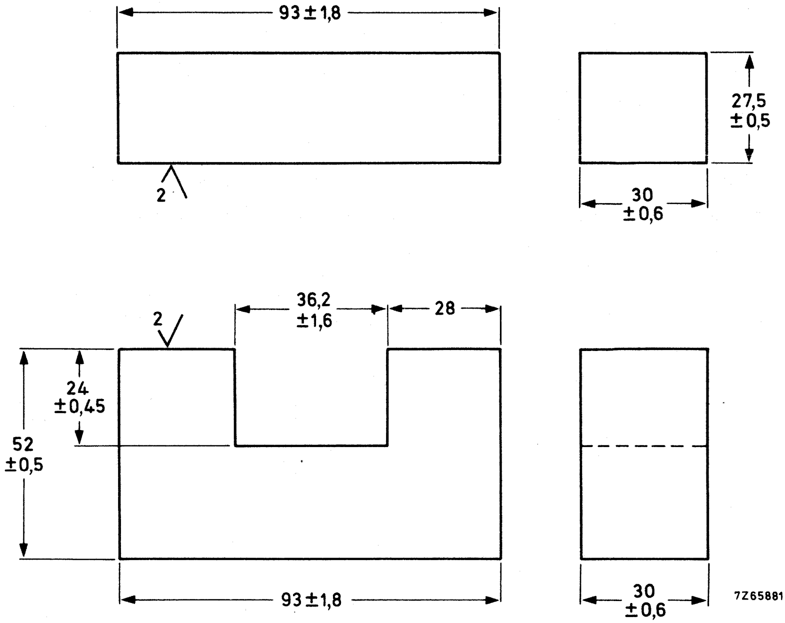
A_e = 234 mm^2

V_e = 58600 mm^3

MECHANICAL DATA

Dimensions in mm

Outlines



Mass	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	–	≤ 26,9	U	4312 020 33100
	100	200	–	≤ 22,2	I	4312 020 33110
	100	≥ 290	250	–		

Magnetic dimensions

l_e = 204 mm

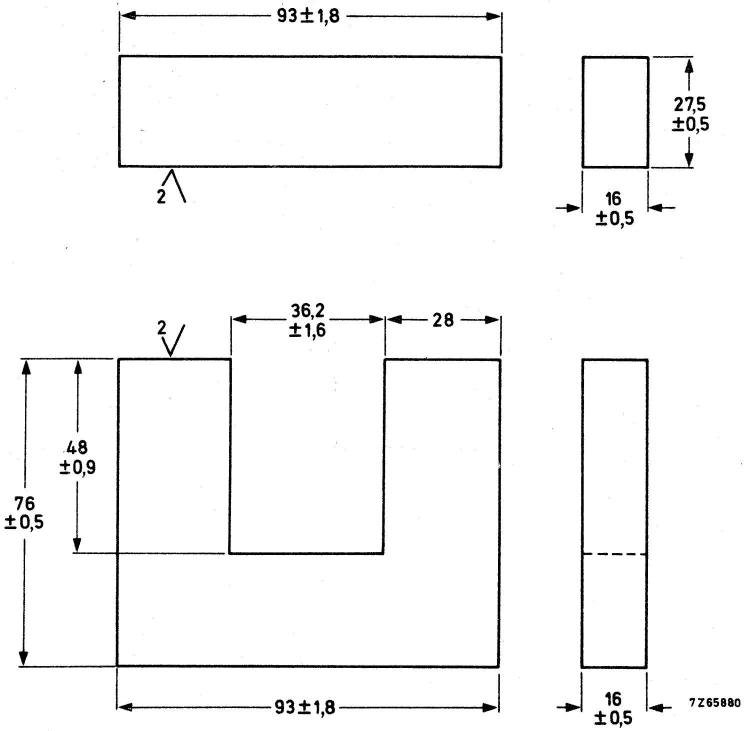
A_e = 780 mm^2

V_e = 158000 mm^3

MECHANICAL DATA

Dimensions in mm

Outlines



Mass 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	200	–	≤ 18,2	U	4312 020 33070
	100	200	–	≤ 15,0	I	4312 020 33080
	100	≥ 290	250	–		

Magnetic dimensions

l_e = 254 mm

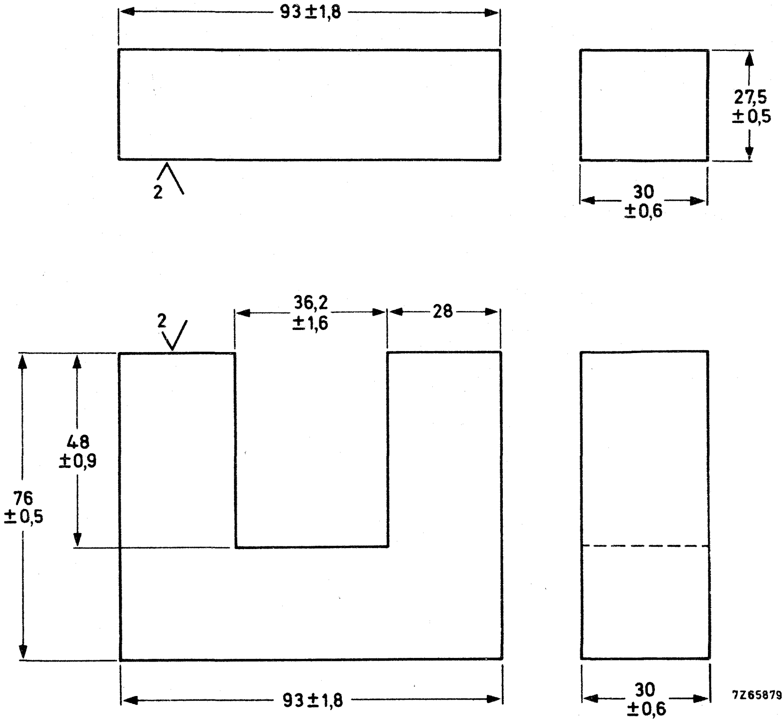
A_e = 420 mm^2

V_e = 107000 mm^3

MECHANICAL DATA

Dimensions in mm

Outlines



Mass 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 (°C) ± 5	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W)	shape	catalogue number of one core
3C6	25	200	–	≤ 34,0	U	4312 020 33090
	100	200	–	≤ 28,0	I	4312 020 33110
	100	≥ 290	250	–		

Magnetic dimensions

l_e = 254 mm

A_e = 780 mm^2

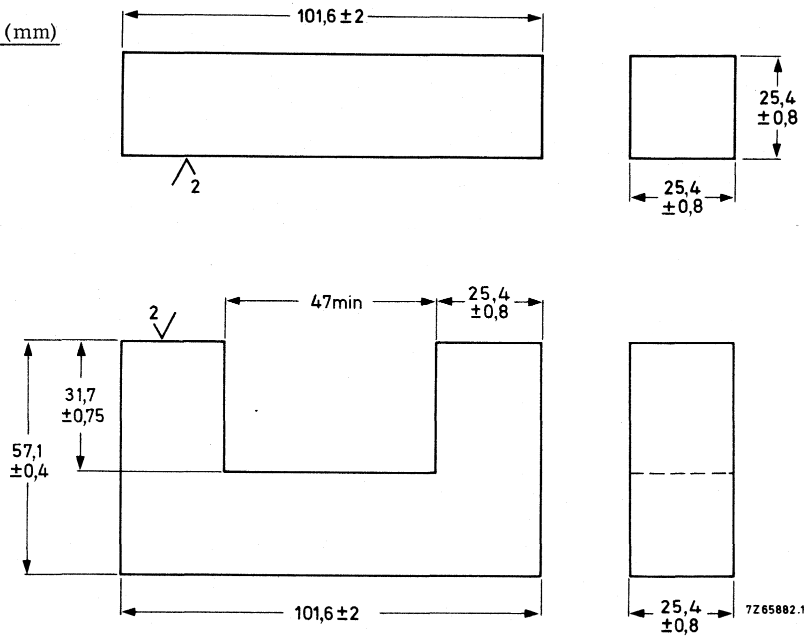
V_e = 200000 mm^3

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 (°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

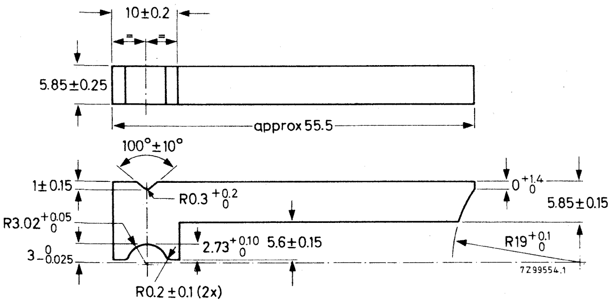
FERRITES FOR TELEVISION COMPONENTS

1. YOKE RINGS See chapter "Yoke rings"

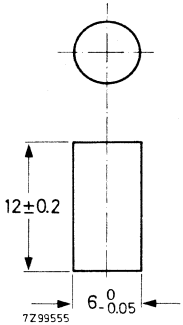
2. U-CORES See chapter "Cores for line-output transformers"

Special ferrite parts are:

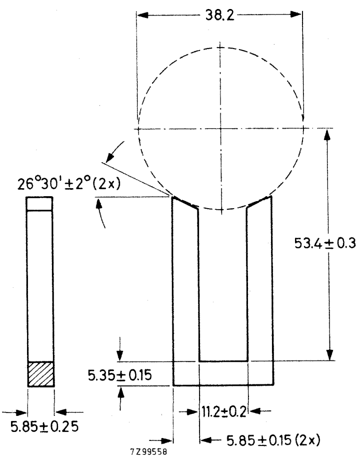
3. FERROXCUBE CORES AND FERROXDURE MAGNET FOR CONVERGENCE UNITS



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

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

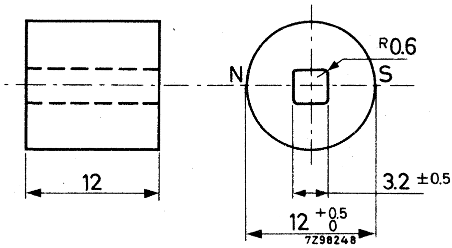
4. FERROXCUBE RODS, TUBES AND FERROXDURE MAGNETS FOR LINEARITY-CONTROL UNITS

Rod cores

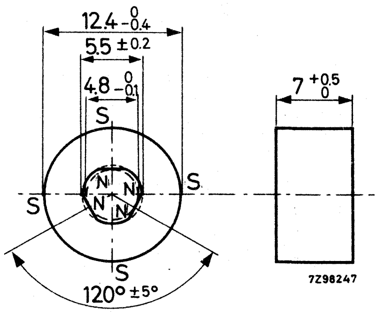
diameter (mm)	length (mm)	grade	catalogue number
4,9 ± 0,05	36 - 0,5	3C6	3122 104 90490
4,9 ± 0,05	50 - 0,5	3C6	3122 134 90110

Tube cores

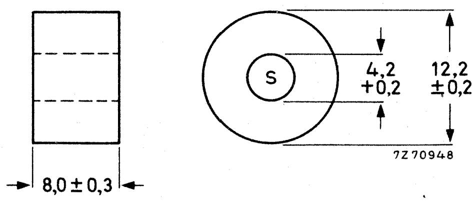
outer diameter (mm)	inner diameter (mm)	length (mm)	grade	catalogue number
4,9 ± 0,05	3 + 0,1	36 - 0,5	3C6	3122 104 93760
4 ± 0,15	2 + 0,2	36 ± 0,6	3C6	4312 020 31450



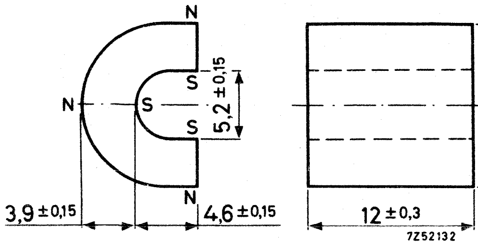
Ring magnet, diametrically magnetized.
Ferroxdure 100.
Catalogue number 3122 104 92690.

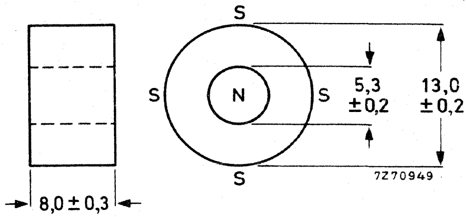


Ring magnet, radially magnetized.
Plastic bonded ferroxdure P40.
Catalogue number 3122 104 93530.



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 3C7 and 3C8

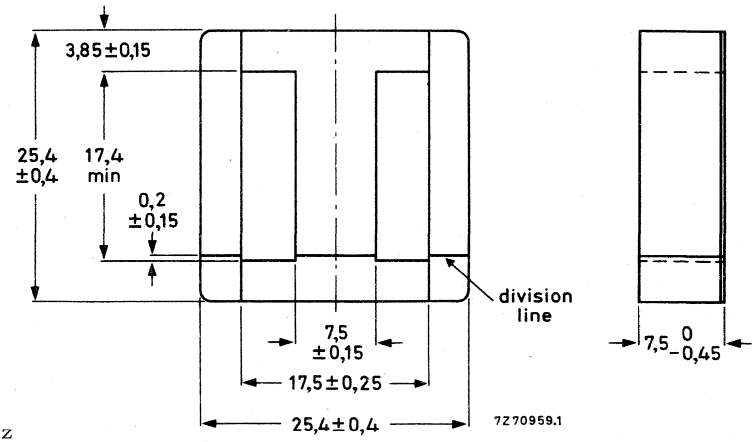
Magnetic dimensions

Dimensions in mm

l_e = 57,5 mm

A_e = 52,5 mm^2

V_e = 3020 mm^3



Magnetic data

Measured at 16 kHz

grade	temperature (°C)	induction $\hat{B}$ (mT)	field strength $\hat{H}$ (A/m)	losses (W/pair)	catalogue number
3C7	25	200	–	≤ 0,45	4312 020 34340
	25	≥ 400	250	–	
	100	≥ 150	50	–	
3C8	25	200	–	≤ 0,65	3122 134 90960
	25	≥ 380	250	–	
	100	≥ 100	50	–	

grade 3C8 : catalogue number 3122 134 90430

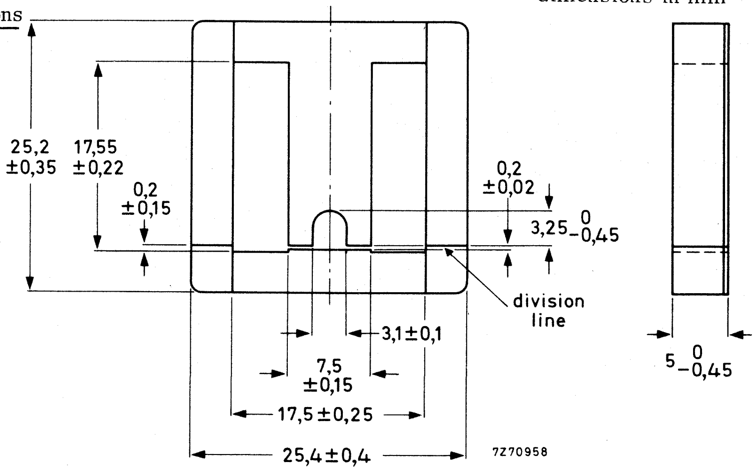
dimensions in mm

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

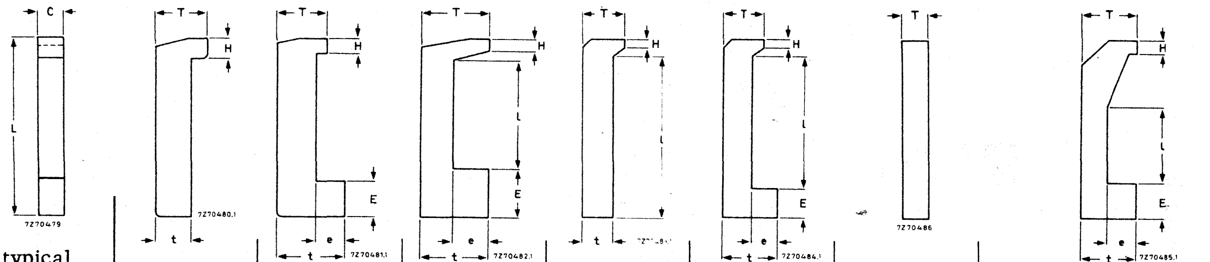
Ferroxcube grade 3H2

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

size (mm) \ catalogue number	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	3000
1 MHz		1300	1700
5 MHz		500	700
μ_{max} at 1 kHz		3200	40 000
Curie point	^oC	125	125
Coercivity (H_c)	A/m	20	8
Induction $\hat{B}$ at H = 800 A/m	mT	350	460
Resistivity	Ωm	10^4	0, 03
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.

*) 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

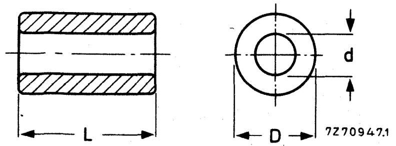


Fig. 1.

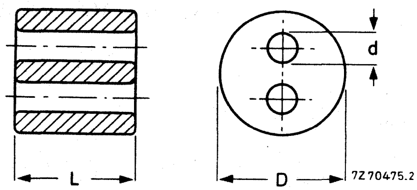


Fig. 2.

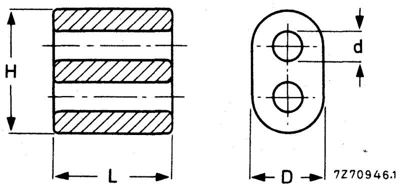


Fig. 3.

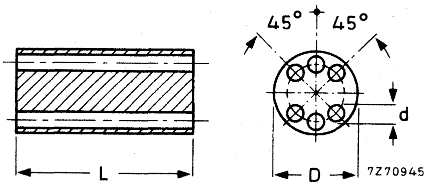


Fig. 4.

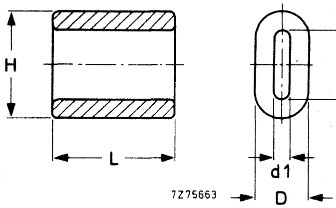


Fig. 5.

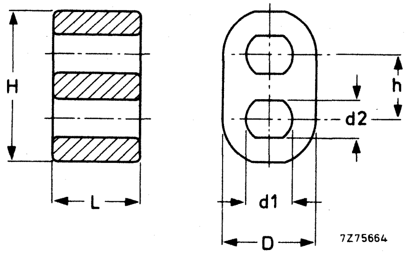


Fig. 6.

Fig.	D mm	d mm	d_2 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
	6 ±0,15	4 ±0,15	–	2 ±0,1	–	4C4	4322 020 31250
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
5	5,2 ±0,2	1,6 ±0,2	6,6 ±0,2	14,8 ±0,2	10,2 ±0,2	3B	4330 030 32060
6	8,6 ±0,3	2,6 ±0,1	3,45 ±0,15	8 ±0,3	13,8 ±0,4*	4C6	3122 104 94700

* h = 6 ±0,25 mm.

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.

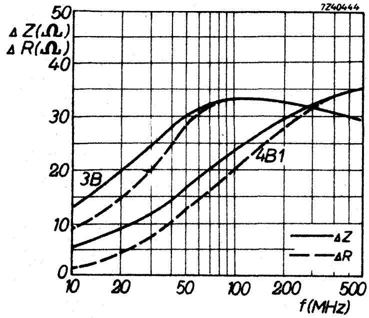


Fig. 5

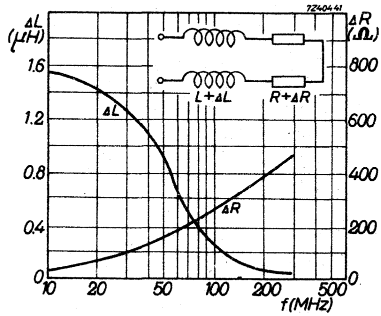


Fig. 6

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.

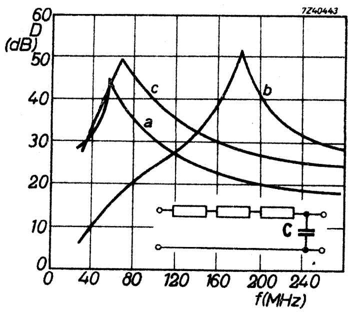


Fig. 7. Damping in an LC circuit consisting of a string of three beads 4322 020 34400 and a ceramic capacitor.

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, damping and wide-band h.f. chokes" of this chapter.

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 chokes that are currently available.

Dimensions in mm

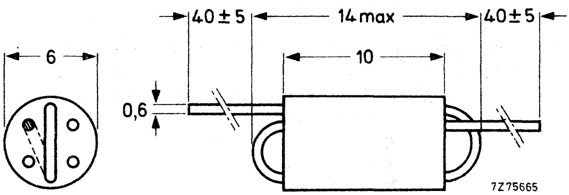


Fig. 1.

number of turns	Z_{max} kΩ	f at Z_{max} MHz	decrease of impedance in the freq. range MHz	dB	grade	catalogue 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

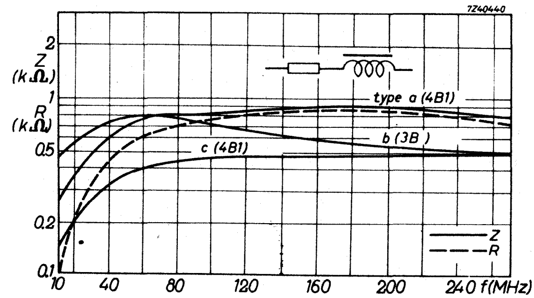


Fig. 2 Performance of three single chokes.

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.

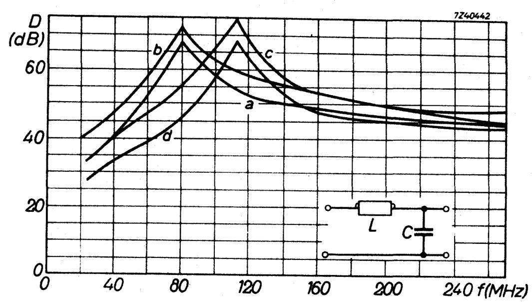


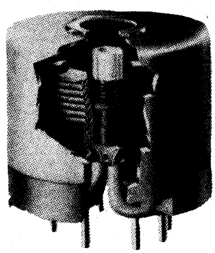
Fig. 3 Damping in an LC circuit consisting of a Ferroxcube choke and a ceramic disc capacitor.

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



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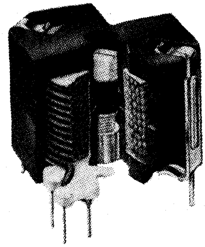

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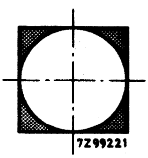
Ferroxcube potcores and square cores have been developed for stable low loss filter coils and transformers. Due to their closed shape they combine a low weight with a small volume.

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 potcores are called P-potcores. Our preferred types of square cores are called RM-cores. These P-potcores and our RM-cores are standardized in accordance with the international IEC and with several national normalization papers.



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

The pre-adjusted cores which are provided with a nut for an adjuster are recommended. 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 adjuster mechanism can be delivered. These continuously variable adjusters are specially recommended if the coils are employed as filter coils. The maximum adjustment varies from 10 to 20% depending on the type.

For the potcores P26/16 and larger, a step-by-step adjuster can be delivered, specially recommended if the coils are employed as loading coils. For detailed data see the relevant sections Inductance Adjusters in the data sheets.

When the step-by-step adjusters are used, cores 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 nH).

A_L is the inductance per turn^2 in nanohenry (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 mH).

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

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 (demagnetized). The α or A_L value should not be measured less than 24 hours after the conditioning (demagnetization).

2. The mating surfaces should be carefully cleaned.

3. A standard coil as indicated in the following table should be used.

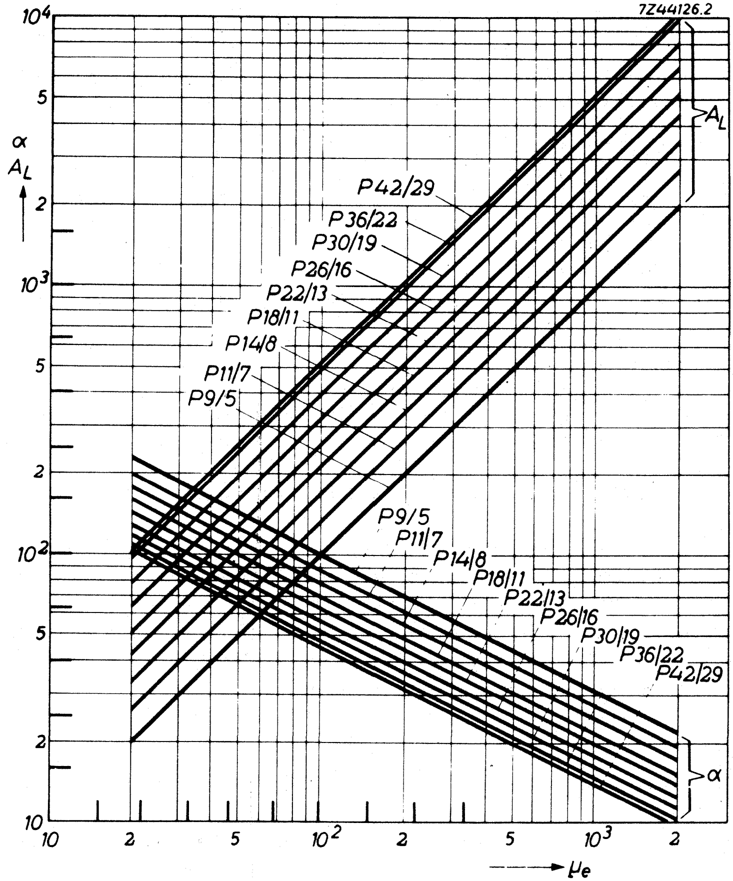
for series	catalogue number of standard coil	number of turns			number of layers	dia. of copper mm
		total	per layer	upper layer		
P9/5	7622 301 00101	65	11	10	6	0,20
P11/7	7622 301 00301	71	12	11	6	0,25
P14/8	7622 301 00501	90	13	12	7	0,30
P18/11	7622 301 00701	83	12	11	7	0,45
P22/13	7622 301 00901	71	12	11	6	0,60
P26/16	7622 301 01101	71	12	11	6	0,70
P30/19	7622 301 01301	104	15	14	7	0,70
P36/22	7622 301 01501	135	17	16	8	0,70
P42/29	7622 301 01701	199	20	19	10	0,80
P66/56	7622 301 01901	231	29	28	8	1,20
RM4	7622 300 50101	91	23	22	4	0,224
RM5	7622 300 50201	107	18	17	6	0,25
RM6-S/RM6-R	7622 300 50301	113	19	18	6	0,315
RM8	7622 300 50501	125	21	20	6	0,40
RM10	7622 300 50601	101	17	16	6	0,56
RM14	7622 300 50701	113	19	18	6	0,90

The standard coils for RM series are in accordance with IEC publication 431A.

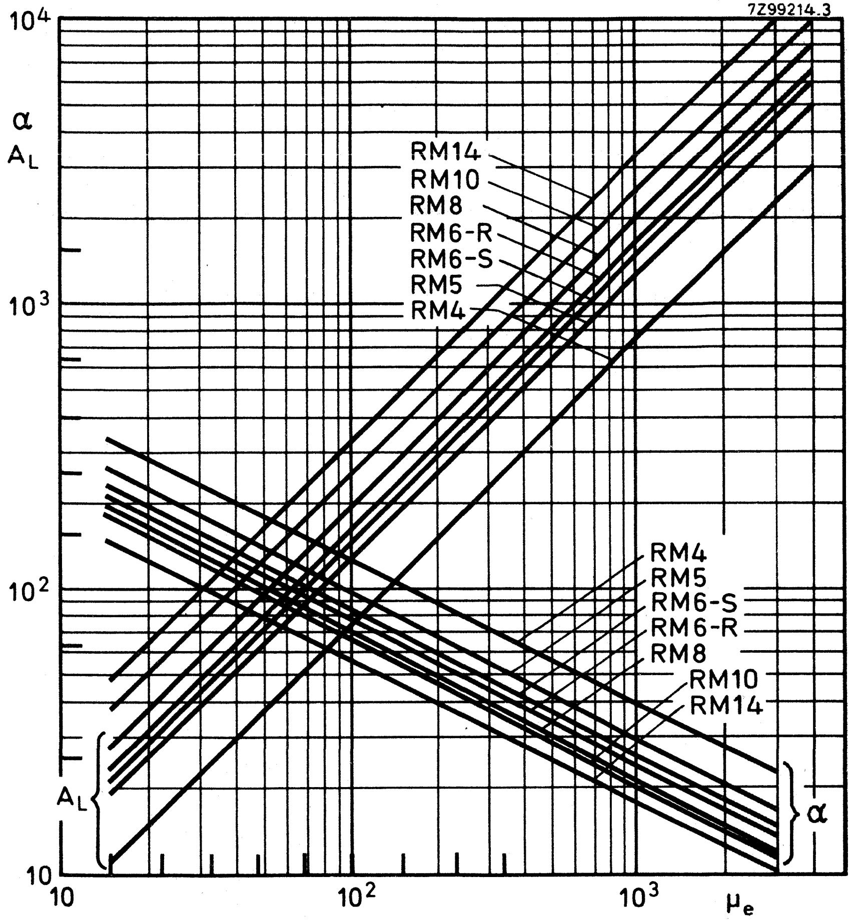
4. The axial lines of the cores halves should coincide.
5. The silver reference lines (if any) on the circumference of the core halves should coincide. If no reference lines are given, the halves may be positioned arbitrarily.
6. A force is applied to the flat sides of the core by means of rings. The 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 $\leqslant$ 0,1 mT.
11. The standard coil is held against the bottom of the lower half (half with nut or half without marking).

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 η_B, 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 $\hat{B} \leqslant 0,1$ mT and are expressed in a tan δ/μ_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. The indicated values are valid 5 minutes after clamping.

core type	FXC grade	4 kHz	30 kHz	100 kHz	0,5 to 1 MHz	2 MHz	10 MHz
P9/5	3B7/3H1	60 turns 0,1E		35 turns 0,2E			
	3D3			45 turns 0,16E	10 turns 0,22E		
	4C6			90 turns 0,12E		17 turns 40 x 0,04E	6 turns 40 x 0,04E
P11/7	3B7/3H1	42 turns 0,18E		42 turns 0,18E			
	3D3			42 turns 0,18E	22 turns 0,1E		
	4C6			85 turns 0,10E		16 turns 45 x 0,04E	6 turns 45 x 0,04E
P14/8	3B7/3H1	53 turns 0,25E		37 turns 0,10E			
	3D3			37 turns 0,10E	19 turns 8 x 0,04E		
	4C6			176 turns 0,14E		14 turns 0,40E	6 turns 0,5 x 1,9 Cu
P18/11	3B7/3H1	42 turns 0,50E		20 turns 100 x 0,04			
	3D3			35 turns 0,14E	16 turns 12 x 0,04E		
	3E1	42 turns 0,50E		350 turns 0,14E	12 turns 0,60E		
	3H3		20 turns 100 x 0,04E	20 turns 100 x 0,04E			
	4C6			150 turns 0,25E		12 turns 0,60E	5 turns 0,7 x 2,75 Cu
P22/13	3B7/3H1	37 turns 0,60E		29 turns 0,20E			
	3D3			29 turns 0,20E	16 turns 40 x 0,04E		
	3E1	37 turns 0,60E		29 turns 0,20E	11 turns 0,70E		
	3E4	37 turns 0,60E		29 turns 0,20E	4 turns 1,2 x 3,5 Cu		
	4C6			140 turns 0,25E		11 turns 0,70E	4 turns 1,2 x 3,5 Cu

core type	FXC grade	4 kHz	30 kHz	100 kHz	0,5 to 1 MHz	2 MHz	10 MHz
P26/16	3B7/3H1	34 turns 0,70E		28 turns 0,28E			
	3B8	34 turns 0,70E		28 turns 0,28E			
	3D3			28 turns 0,28E	14 turns 40 x 0,04E		
	3E1	34 turns 0,70E		34 turns 0,70E	4 turns 2,0 x 4,0 Cu		
	4C6			125 turns 0,40E		10 turns 0,90E	4 turns 2,0 x 4,0 Cu
P30/19	3B7/3H1	30 turns 1,0E		23 turns 0,40E			
	3B8	30 turns 1,0E		23 turns 0,40E			
	3D3			23 turns 0,40E	8 turns 2 x 100 x 0,04E		
	3E1	23 turns 0,40E		23 turns 0,40E			
P36/22	3B7/3H1	27 turns 1,2E		22 turns 0,50E			
	3B8	27 turns 1,2E		22 turns 0,50E			
	3D3			22 turns 0,50E	7 turns 2 x 100 x 0,04E		
	3E1	27 turns 1,2E		22 turns 0,50E			
P42/29	3B5	33 turns 1,4E		32 turns 0,45E			
	3B7/3H1	26 turns 1,8E		20 turns 0,45E			
RM4	3B7/3H1	60 turns 0,18E	60 turns 0,18E	36 turns 0,14E			
	3D3			60 turns 0,18E	20 turns 0,30E		
	3E1	60 turns 0,18E		60 turns 0,18E			
	3E4	60 turns 0,18E		60 turns 0,18E	8 turns 0,60E		
	4C6			60 turns 0,18E		17 turns 0,30E	8 turns 0,60E

core type	FXC grade	4 kHz	30 kHz	100 kHz	0,5 to 1 MHz	2 MHz	10 MHz
RM5	3B7/3H1	45 turns 0,30E	26 turns 80 x 0,04E	26 turns 80 x 0,04E			
	3D3			45 turns 0,30E	15 turns 0,30E		
	3E1	45 turns 0,30E		45 turns 0,30E	9 turns 0,55E		
	3E4	45 turns 0,30E		45 turns 0,30E	9 turns 0,55E		
	3E5	17 turns 24 x 0,04E		45 turns 0,30E	9 turns 0,55E		
	3H3		26 turns 80 x 0,04E	26 turns 80 x 0,04E			
	4C6			45 turns 0,30E		15 turns 0,30E	3 turns 0,50E
RM6R/ RM6S	3B7/3H1	66 turns 0,35E	23 turns 100 x 0,04E	23 turns 100 x 0,04E			
	3D3			66 turns 0,35E	8 turns 0,80E		
	3E1	40 turns 0,45E		40 turns 0,80E	8 turns 0,80E		
	3H3		23 turns 100 x 0,04E	23 turns 100 x 0,04E			
	4C6			66 turns 0,35E		14 turns 0,40E	4 turns 0,60E
RM8	3B7/3H1	35 turns 0,50E	35 turns 0,50E	31 turns 20 x 0,04E			
	3B8		30 turns 100 x 0,04E				
	3D3			31 turns 20 x 0,04E	15 turns 24 x 0,07E		
	3E1	35 turns 0,50E		35 turns 0,50E	6 turns 0,80E		
	3E4	35 turns 0,50E		35 turns 0,50E	6 turns 0,80E		
	3E5	35 turns 0,50E		35 turns 0,50E	6 turns 0,80E		
	3H3	35 turns 0,50E	35 turns 0,50E	31 turns 20 x 0,04E			
	4C6			70 turns 0,30E			
RM14	3B8		30 turns 100 x 0,04E				

ADJUSTMENT MECHANISM

A major feature of our potcores 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 nut is injection moulded or cemented in the lower potcore 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 avry 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 temperature coefficient of the assembly is hardly influenced by the adjustment mechanism.

If one wishes to lock the adjuster head, the following paste is recommended:
1 part by weight castor oil;
3 parts by weight ethyl cellulose.

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:

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

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:

$$\frac{R_o}{L} = \frac{l}{\mu_e} \times \frac{l}{f_{cu}} \times \text{constant. *} \qquad \Omega/H \qquad (2)$$

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

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

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

* 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.

$\omega = 2 \times \pi \times f$
f in Hz
L in henry
C in farad

Hysteresis losses

These losses depend on the η_B value of the Ferroxcube grade concerned, the μ_e value, effective volume of the potcore, inductance and current.

$$\frac{R_h}{L} = \eta_B \times \widehat{B} \times \mu \times 2\pi f. \qquad \Omega/H \qquad (5)$$

For η_B see Survey of symbols. $\widehat{B}$ in tesla.

Eddy current and residual losses

In the core data $\frac{\tan \delta_e}{\mu_i}$ 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;
- r.m.s. 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, 3H3 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 1 mT. 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. polarization

The effect of d.c. polarization 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 relevant data sheets. Note that the 3B8 grade is the one specially designed for use with d.c. polarization.

Design procedure

(1) Select the core size, material grade, the inductance factor, and the wire type using the information from the relevant 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 $\hat{B}$, and check if the level is less than 1 mT. If $\hat{B}$ is greater than 1 mT, 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 x 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.

$$\text{t.c.} = \left(\frac{\Delta\mu}{\mu_i^2} \times \mu_e + C \right) \times \Delta T.$$

Assume C = + 20 x 10^{-6}, then:

$$\mu_e = \frac{\text{t.c.} - C \times \Delta T}{\frac{\Delta\mu}{\mu_i^2} \times \Delta T} = \frac{\text{max. } 8{,}5 \times 10^{-3} - 1000 \times 10^{-6}}{1 \times 10^{-6} \times 50} = \text{max. } 150.$$

A comparison of different Q-curves for grade 3H1 and μ_e = 150 indicates that potcore P18/11 is suitable. The catalogue number of the pre-adjusted potcore with nut is 4322 022 24270, the inductance adjuster to be used is 4322 021 30730. To allow for ± 5% inductance adjustment by the adjuster, the required inductance should be decreased by 5%, thus down to 0,95 x 2,75 = 2,62 mH without the adjuster.

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 in the P18/11 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

Equation (2): $$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 16{,}4 \times 10^3 \ \ \Omega/\text{H (see data P18/11)}.$$

Say f_{cu} = 0,38 for this type of wire, then

$$\frac{R_o}{L} = \frac{1}{150} \times \frac{1}{0{,}38} \times 16{,}4 \times 10^3 = 286 \ \ \Omega/\text{H}.$$

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

Assume C_{wcu} = 100 x 10^{-9}

$$\frac{R_{ec}}{L} = \frac{100 \times 10^{-9}}{150} \times 280 \times 10^{10} \times 0{,}04^2 = 3 \ \ \Omega/\text{H}.$$

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

Assume $\tan\delta_c$ = 0,01 and C = 8 pF,

$$\frac{R_d}{L} = \frac{2}{950} + 0{,}01 \times (2 \times \pi \times 10^5)^3 \times 2{,}62 \times 10^{-3} \times 8 \times 10^{-12} = 63 \ \ \Omega/\text{H}.$$

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

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

Take $q_{2\text{-}24\text{-}100} = 0{,}8\ \Omega/H^{3/2}$ mA for grade 3H1 as an average value.

So $q_{2\text{-}V\text{-}\mu} = 0{,}8 \times \left(\frac{150}{100}\right)^{3} \times \sqrt{\frac{24\,000}{1120}} = 6{,}72\ \Omega/H^{3/2}$ mA.

Then $\frac{R_h}{L} = 6{,}72 \sqrt{(2{,}62 \times 10^{-3})} \times 1 \times \frac{10^5}{800} = 43\ \Omega/H.$

Equation (6): $\frac{R_{r+e}}{L} = \left(\frac{\tan \delta_{e+r}}{\mu_i} - K_1 f\right) \times \mu_e \times 2\pi f\ \Omega/H.$

Take $\frac{\tan \delta_{e+r}}{\mu_i}$ at 100 kHz of grade 3H1 = $3{,}0 \times 10^{-6}$ as an average value and $K_1 = 0{,}3 \times 10^{-11}$.

$$\frac{R_{r+e}}{L} = (3 \times 10^{-6} - 0{,}3 \times 10^{-11} \times 10^5) \times 150 \times 6{,}28 \times 10^5 = 247\ \Omega/H.$$

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

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

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	$\leqslant 4{,}8\ \Omega$ (thus $\frac{R_o}{L} \leqslant \frac{4{,}8}{0{,}088} \leqslant 53{,}5\ \Omega/H$)
A.C. resistance at 1800 Hz and 1 mA	$\leqslant 5{,}8\ \Omega$
Capacitance between the two line windings ($C_{a\text{-}b}$)	$\leqslant 200$ pF
Inductance unbalance between the two line windings	$\leqslant 0{,}1\%$
Resistance unbalance between the two line windings (ΔR_o)	$\leqslant 0{,}1\ \Omega$

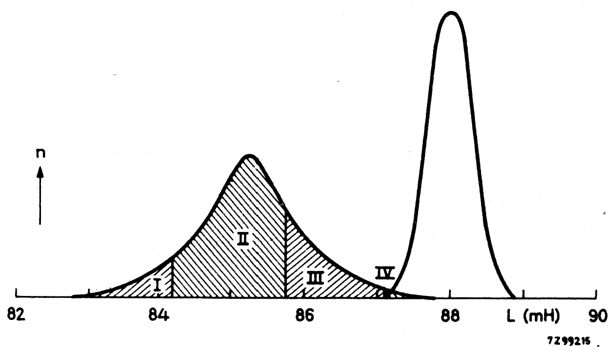
In order to fulfil the requirement for the d.c. resistance we can take for instance potcore P30/19, grade 3H1, with $A_L = 630$, or P26/16, grade 3H1, with $A_L = 1000$ ($\mu_e = 318$). We choose the latter one because it is smaller.

The published inductance tolerance of ± 3% (cores without adjuster) can be reduced to ± 1% by using step-by-step adjusters; 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 adjuster lying more than 2% below the required 88 mH (88 x 10^6 nH).

$$N \leqslant \sqrt{\frac{L}{A_L}} \leqslant \sqrt{\left(\frac{88 \times 10^6 \times 0{,}98}{1000}\right)} \leqslant 294 \text{ turns.}$$

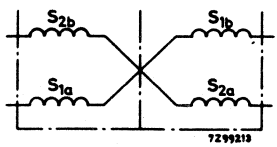
We take 292 turns because this number is divisible by 4. The corresponding inductance is 85,25 mH and it will have a tolerance of ± 3%, which means values lying between 82,8 and 87,8 mH, see distribution curve.



Distribution curves of coils without and with step-by-step adjuster (left and right curves respectively).

To shift the inductances to within ± 1% of 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 adjuster 4322 021 32110, which gives a shift of 5,3% (4,4 mH). For coils in region II we use adjuster 4322 021 32080 and for coils in region III we use adjuster 4322 021 32040, and no adjuster for the remaining coils in region IV. For more details on these step-by-step adjusters, see Inductance Adjusters in the data on potcore P26/16.

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

Equation (2): $$\frac{R_o}{L} = \frac{1}{318} \times \frac{1}{0,49} \times 7,79 \times 10^3 = 49,9\ \Omega/H.$$

Calculation of the a.c. resistance

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

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

$$\frac{R_{ec}}{L} = \frac{100 \times 10^{-9}}{318} \times 10^3 \times 3,24 \times 10^6 \times 0,28^2 = 0,8\ \Omega/H.$$

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

Assume Q at 1800 Hz = 200, C_o = 60 pF and $\tan \delta_c$ = 0,01, then

$$\frac{R_d}{L} = \left(\frac{2}{200} + 0,01 \right) \times (2\pi \times 1800)^3 \times 88 \times 10^{-3} \times 60 \times 10^{-12}$$ which is negligible.

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

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

Assume $q_{2\text{-}24\text{-}100}$ = 0,8, then

$$q_{2\text{-}V\text{-}\mu} = 0,8 \times \frac{318\sqrt{318}}{1000} \times \sqrt{\frac{24\,000}{3530}} = 11,9\ \ \Omega/H^{3/2}\ mA.$$

$$\frac{R_h}{L} = 11,9 \times \sqrt{0,088} \times 1 \times \frac{1800}{800} = 6,4\ \ \Omega/H.$$

Equation (6): $$\frac{R_r}{L} = \left(\frac{\tan \delta_{e+r}}{\mu_i} - K_1 f \right) \times \mu_e \times 2\pi f\ \ \Omega/H.$$

Take $\frac{\tan \delta_{e+r}}{\mu_i}$ at 1800 Hz = $0,5 \times 10^{-6}$ as an average value and $K_1 = 0,2 \times 10^{-11}$

$$\frac{R_{r+e}}{L} = (0,5 \times 10^{-6} - 0,2 \times 10^{-11} \times 1,8 \times 10^3) \times 318 \times 2\pi \times 1,8 \times 10^3 = 1,8\ \ \Omega/H.$$

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

$$= 49,9 + 0,8 + 0 + 6,4 + 1,8 = 58,9\ \ \Omega/H,$$

or R_t at 1800 Hz and 1 mA = 5,18 Ω.

So we see that the requirement for R_t at 1800 Hz and 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 potcore 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 polarization, 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.

Form 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/^{o}C for material grade 3H1. A reasonable measure of compensation may be achieved by suitable choice of tuning capacitors, having negative temperature coefficients. A popular resonating capacitor is the polystyrene type which usually has a temperature coefficient of about −120 ppm/^{o}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 ^{o}C and 40 ^{o}C, and that the operating temperature will not change by more than ± 15 ^{o}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:

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

These losses can be calculated with the aid of several formulae with different constants.

Table 1.	R	L	B	H	I	V_e	l_e	f
	units							
$\frac{R_h}{L} = q_{2\text{-}24\text{-}100} \sqrt{\frac{24\,000}{V_e}} \sqrt{\left(\frac{\mu_e}{100}\right)^3} \sqrt{(L)} \times I_{rms} \cdot \frac{f}{800}$	Ω	H			mA	mm^3		Hz
$\frac{R_h}{L} = a.\mu.\hat{B}.f$	Ω	H	T					Hz
$\frac{R_h}{L} = \frac{16}{3} \cdot \frac{\nu}{\mu^3} \cdot \mu^2 \cdot \hat{H}.f$	Ω	H		A/m				Hz
$\frac{R_h}{L} = \frac{h}{\mu^2} \cdot \mu^2 \cdot \frac{N\,I_{eff}}{l_{eff}} \cdot \frac{f}{800}$	Ω	H			A		mm	Hz
$\frac{R_h}{L} = \frac{h'}{\mu^2} \cdot \mu^2 \cdot H_{eff} \cdot f$	Ω	H		$\frac{A}{m}$				kHz
$\frac{R_h}{L} = \eta_B \cdot \mu \cdot \hat{B} \cdot \omega \; (\omega = 2\pi f)$	Ω	H	T					Hz

Table 2. shows the conversion factors for the hysteresis constants given in Table 1.

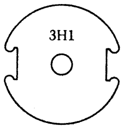
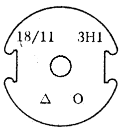
Table 2.

	$q_{2\text{-}24\text{-}100}$ 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	$2{,}59 \times 10^6$	$6{,}9 \times 10^6$	$1{,}82 \times 10^3$	$1{,}46 \times 10^3$	$1{,}63 \times 10^3$
a =	$0{,}386 \times 10^{-6}$	1	2,67	$0{,}703 \times 10^{-3}$	$0{,}563 \times 10^{-3}$	$0{,}628 \times 10^{-3}$
$\frac{\nu}{\mu^3}$ =	$144{,}8 \times 10^{-9}$	0,376	1	$0{,}264 \times 10^{-3}$	$0{,}212 \times 10^{-3}$	$0{,}236 \times 10^{-3}$
$\frac{h}{\mu^2}$ =	$0{,}549 \times 10^{-3}$	$1{,}42 \times 10^3$	$3{,}79 \times 10^3$	1	0,8	0,893
$\frac{h'}{\mu^2}$ =	$0{,}686 \times 10^{-3}$	$1{,}78 \times 10^3$	$4{,}74 \times 10^3$	1,25	1	1,12
η_B =	$0{,}615 \times 10^{-3}$	$1{,}59 \times 10^3$	$4{,}25 \times 10^3$	1,12	0,896	1

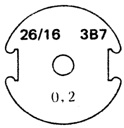
Example: $q_{2\text{-}24\text{-}100} = 1{,}46 \times 10^3 \times \frac{h'}{\mu^2}$.

MARKING

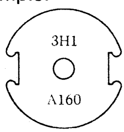
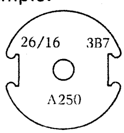
MARKING OF POTCORE HALVES

<table>
<tr><th colspan="2">product</th><th>marking on product</th><th>marking on primary pack</th><th>marking on label of storage pack</th></tr>
<tr><td rowspan="4">diameter ⩽ 15 mm</td><td rowspan="2">without air gap</td><td>material</td><td>type, material
Δ-sign, 0-sign
year + manufac. code
series number</td><td>cat. number, lot number
series number
year + manufac. code
material, quantity</td></tr>
<tr><td>example:
</td><td>example
P9/5 3H1
Δ 0 2 A 17 A</td><td>example:
4322 020 20982
07552 17 A 2A
3H1 100</td></tr>
<tr><td rowspan="2">with air gap</td><td>material
air-gap length (mm)</td><td>type, material
year + manufac. code
series number</td><td>cat. number, lot number
series number
year + manufac. code
material, quantity</td></tr>
<tr><td>example:
</td><td>example:
P14/8 4C6
2 A 17 A</td><td>example:
4322 020 21350
07552 17 A 2A
4C6 100</td></tr>
<tr><td rowspan="2">diameter ⩾ 15 mm</td><td rowspan="2">without air gap</td><td>dimensions
material
Δ-sign, 0-sign</td><td>type, material
Δ-sign, 0-sign
year + manufac. code
series number</td><td>cat. number, lot number
series number
year + manufac. code
material, quantity</td></tr>
<tr><td>example:
</td><td>example:
P18/11 3H1
Δ 0 2 A 17 A</td><td>example:
4322 020 21511
07552 17 A 2 A
3H1 100</td></tr>
</table>

MARKING OF POTCORE HALVES (continued)

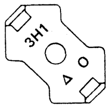
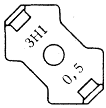
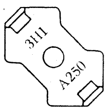
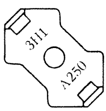
product		marking on product	marking on primary pack	marking on label of storage pack
diameter ⩾ 15 mm	with air gap	dimensions material air-gap length (mm)	type, material year + manufac. code series number	cat. number, lot number series number year + manufac. code material, quantity
		example:  	example: P26/16 3B7 2 A 17 A	example: 4322 020 22000 07552 17 A 2 A 3B7 100

MARKING OF PRE-ADJUSTED POTCORES

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
	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

* 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

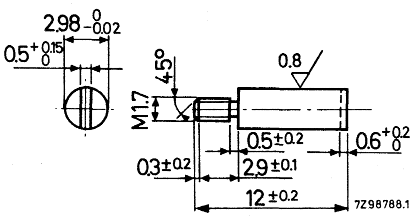
* If the A_L factor is ⩾ 1000, the A sign will be omitted.

MOUNTING DATA

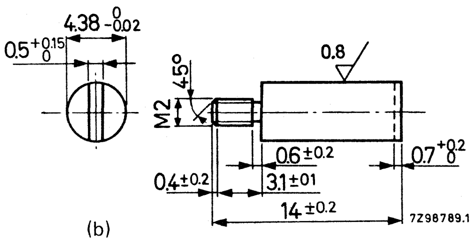
ASSEMBLING

To obtain a stable inductance it is advisable to glue the coil former to the inside the core half with nut. 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.

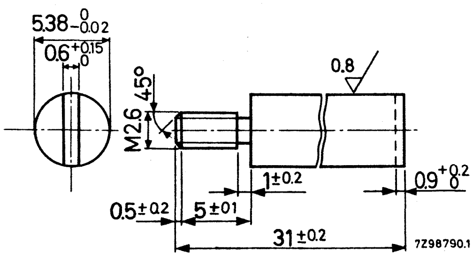
As the difference between the outer diameter of the adjuster of P-potcores and the diameter of the hole in the potcore is very small the potcore halves must be accurately centred. *For small quantity production,* assembly plugs are useful aids to this end. These assembly plugs are not supplied, however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



(a)



(b)



(c)

Assembly plugs for centring (a) P14/8 and P18/11, (b) P22/13, (c) P26/16 to P42/29. 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 adjusters 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
P11/7	4322 058 00070
P14/8	4322 058 00000
P18/11	4322 058 00010
P22/13	4322 058 00020
P26/16	4322 058 00030
P30/19	4322 058 00040
P36/22	4322 058 00050
P42/29	4322 058 00060
RM4	4322 058 00180
RM5	4322 058 00170
RM6	4322 058 00150
RM8	4322 058 00160

See also the section Mounting Parts in the data sheets.

INSERTING THE NUT FOR THE ADJUSTER

The pre-adjusted cores can be supplied with a nut for the inductance adjuster, injection moulded or cemented in one potcore half. For those manufacturers who prefer to cement 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	part by weight	Araldite	DY023	curing time 2 hours at 80 °C
5	parts by weights	Araldite	CY230	
2,6	parts by weights	Versamid	140	

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

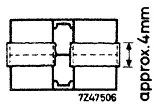
core type	drawing number of insertion tool
P14/8 and P18/11	7V48160
P22/13	7V48161
P26/16 to P42/29	7V48198

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

core type	drawing number of dosating tool
P14/8 and P18/11	7V12356
P22/13	7V12353
P26/16 to P42/29	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 Araldite 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 ^oC 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 ^oC followed by 1½ hour at 100 ^oC 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.

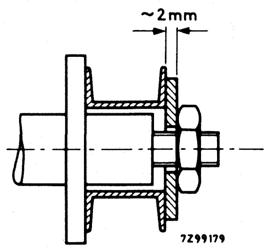
Note

In order to obtain coils which are very stable with temperature variations, it is recommended that the complete coil be subjected to about five temperature cycles from room temperature to 70 $^{\circ}C$. The assembly should than 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.

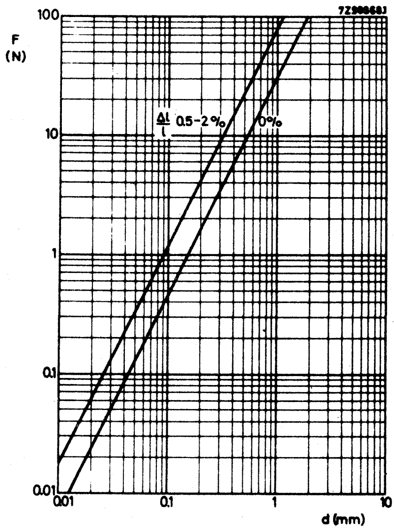
Each lead-out wire should be terminated by a solder joint at the base of a convenient coil former pin. A dip-soldering method in a bath is recommended. The temperature of the bath and the length of the soldering time largely depend on the type of wire. The temperature and the soldering time should be 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:

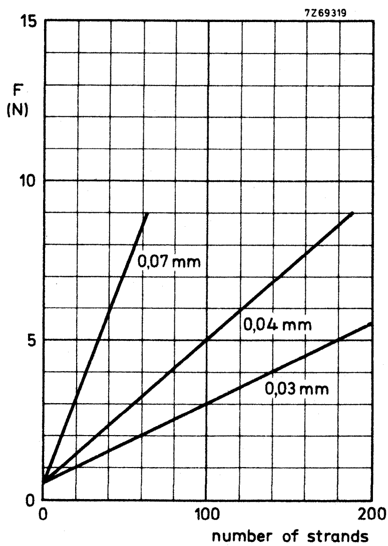
Solid wire

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



Bunched wire

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



Potcores

POTCORES

Three types of core can be supplied:

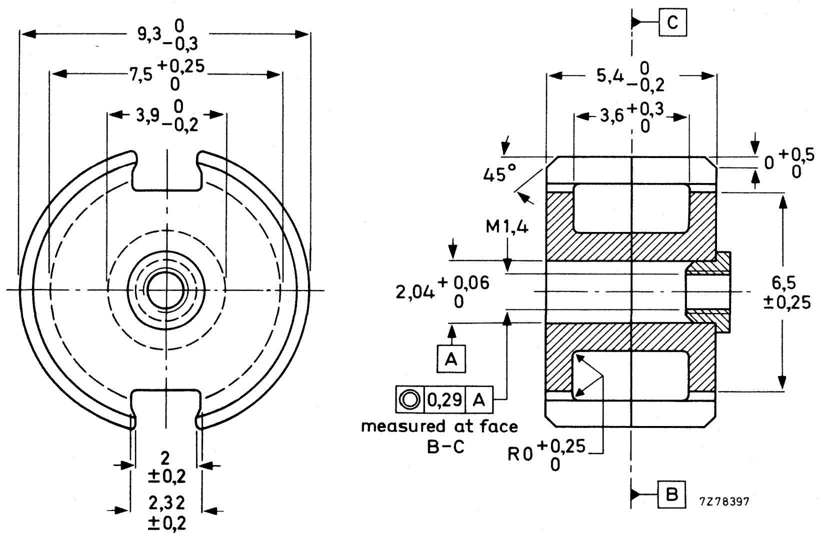
- CORE SETS provided with a nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (France), DIN 41293 (Germany) and BS4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 1,24\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0,124\ mm^{-3}$; $V_e = 126\ mm^3$; $l_e = 12,5\ mm$; $A_e = 10,1\ mm^2$.

Mass of a core set: 1,3 g

Pulling-out force of the nut: ⩾ 10 N

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 25 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	grade 3D3	grade 3H1	grade 4C6
A_L ± 25%	100	≤ 0,1	25 ± 1	1260	630	1260	125
μ_e ± 25%	100	≤ 0,1	25 ± 1	1260	630	1260	125
α	100	≤ 0,1	25 ± 1	≤ 32,7	≤ 45,5	≤ 32,7	≤ 103
$\frac{\tan \delta}{\mu_i} \times 10^6$							
	100	≤ 0,1	25 ± 1	≤ 6,0	≤ 10	≤ 6,0	
	500	≤ 0,1	25 ± 1		≤ 14		
	1000	≤ 0,1	25 ± 1		≤ 30		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	≤ 1,2		≤ 1,1	
	100	0,3 to 1,2	25 ± 1		≤ 2,5		≤ 6,2
$\alpha_F \times 10^6/°C$	≤ 100	≤ 0,1	5 to 25			+0,5 to 1,5	−2 to +4
	≤ 100	≤ 0,1	25 to 55			+0,5 to 1,5	0 to +6
	≤ 100	≤ 0,1	25 to 70	−0,6 to +0,6	0 to +2	+0,5 to 1,5	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1	≤ 6	≤ 20	≤ 4,3	≤ 10

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022 . . . . . 3B7 with nut	3B7 without nut	3H1 with nut	3H1 without nut	4C6 with nut	4C6 without nut
16 ± 1%	16					61800	41800
25 ± 1%	25					61810	41810
40 ± 1%	40					61820	41820
63 ± 1%	63	61030	41030	61230	41230		
100 ± 1,5%	100	61040	41040	61240	41240		
160 ± 2%	160	61050	41050	61250	41250		
250 ± 5%	250			61260			

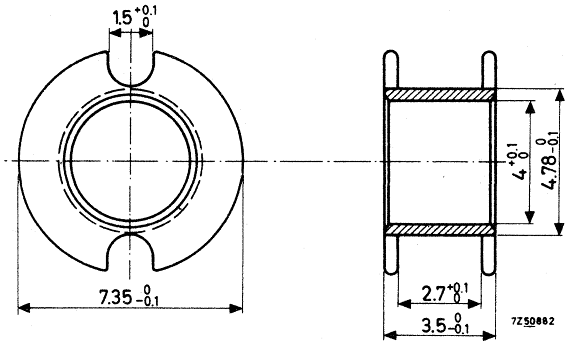
Core halves without air gap, without nut

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

COIL FORMER

The dimensions conform with the following specifications: IEC 133 (international), UTE C93-324 livre 1 (France), DIN41294 (Germany) and BS4061 range 2 (Great Britain).

Dimensions in mm



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

INDUCTANCE ADJUSTERS

The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 adjuster. Such an adjuster increases the inductance of the coil, see following pages.

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

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C. Table 2 shows the type of adjuster recommended for different potcores.

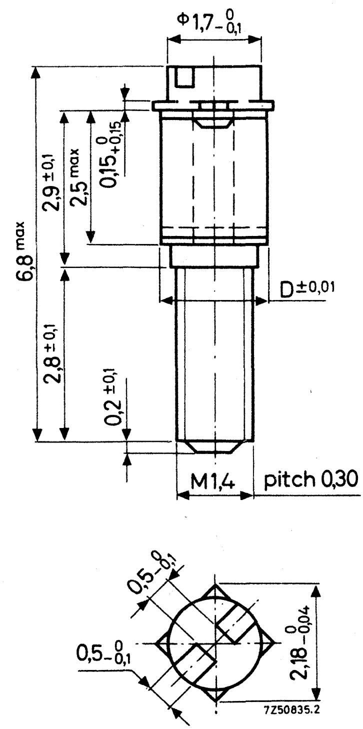


Table 1, available types

D	colour	catalogue number
1,85	green	4322 021 31250
1,85	yellow	4322 021 31270
1,76	brown	4322 021 31540

Table 2, recommended application

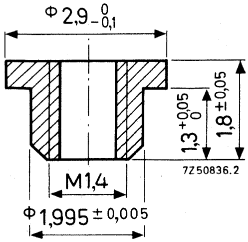
A_L	3B7/3H1/3D3
63	4322 021 31250
100	4322 021 31270
160	4322 021 31540

The adjusters are packed in bags of 100. Please order in multiples of this quantity.

Dimensions in mm

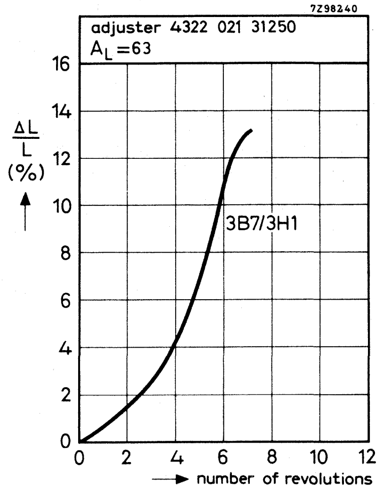
LOOSE NUT FOR ADJUSTER

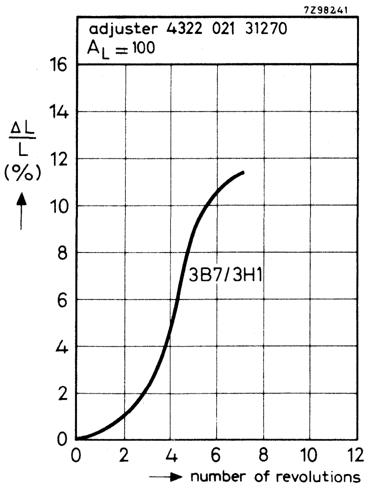
These data are given for those manufacturers who prefer to insert a nut themselves.

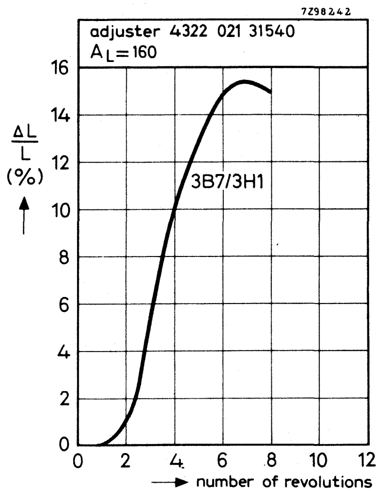


Catalogue number	4322 021 31630
Material	brass, nickel plated

ADJUSTMENT CURVES







POTCORES

Three types of core can be supplied:

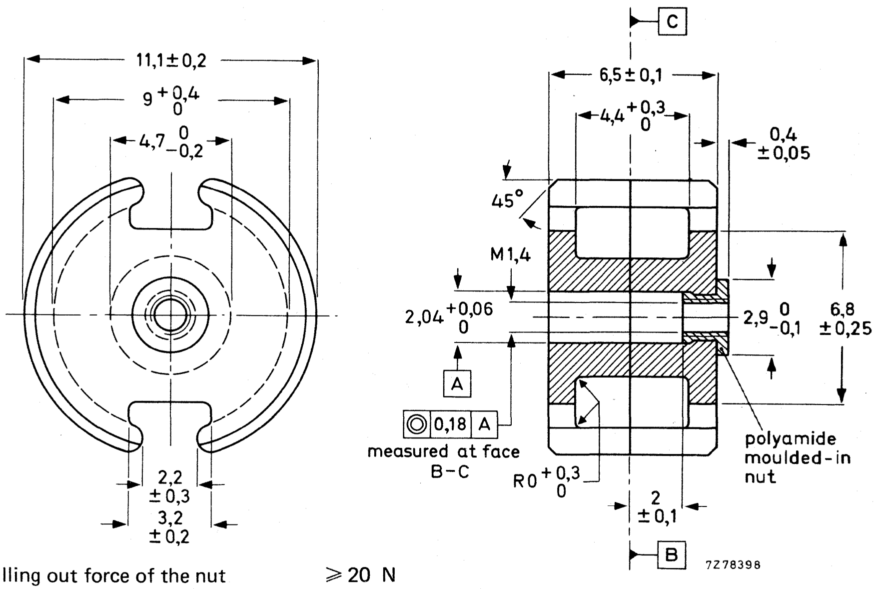
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (France), DIN41293 (Germany) and BS4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling out force of the nut ⩾ 20 N

Torque of the screw thread ⩽ 0,4 N

Extraction force of adjuster from nut ⩾ 20 N

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}956\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}059\ mm^{-3}$; $V_e = 251\ mm^3$; $l_e = 15{,}5\ mm$; $A_e = 16{,}2\ mm^3$.

Mass of a core set: 1,8 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 35 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	3B8	3D3		3H1		4C6
$A_L \pm 25\%$	100	$\leqslant 0,1$	25 ± 1	1700	$\geqslant 1240$	870		1700		160
$\mu_e \pm 25\%$	100	$\leqslant 0,1$	25 ± 1	1300	$\geqslant 950$	660		1300		125
α	100	$\leqslant 0,1$	25 ± 1	$\leqslant 27,9$	$\leqslant 28,3$	$\leqslant 39,2$		$\leqslant 27,9$		$\leqslant 90,5$
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	$\leqslant 0,1$	25 ± 1		$\leqslant 1,5$					
	100	$\leqslant 0,1$	25 ± 1	$\leqslant 5,0$	$\leqslant 6,0$	$\leqslant 8,0$		$\leqslant 5,0$		
	500	$\leqslant 0,1$	25 ± 1			$\leqslant 14$				
	1 000	$\leqslant 0,1$	25 ± 1			$\leqslant 30$				
	2 000	$\leqslant 0,1$	25 ± 1							$\leqslant 40$
	10 000	$\leqslant 0,1$	25 ± 1							$\leqslant 100$
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	$\leqslant 1,2$	$\leqslant 1,0$			$\leqslant 1,1$		
	100	0,3 to 1,2	25 ± 1			$\leqslant 1,8$				$\leqslant 6,2$
$\alpha_F \times 10^6/°C$	$\leqslant 100$	$\leqslant 0,1$	5 to 25		0 to + 6			+ 0,5 to 1,5		−2 to + 4
	$\leqslant 100$	$\leqslant 0,1$	25 to 55		0 to + 6			+ 0,5 to 1,5		0 to + 6
	$\leqslant 100$	$\leqslant 0,1$	25 to 70	−0,6 to + 0,6		0 to + 2				
$D_F \times 10^6$ (10-100 min)	$\leqslant 100$	$\leqslant 0,1$	$25 \pm 0,1$	$\leqslant 4,3$	$\leqslant 8,0$	$\leqslant 15$		$\leqslant 4,3$		$\leqslant 10$
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:										
at $\mu_e \times \frac{N \times I_o}{l_e} = 1,00 \times 10^5$ A/m					$\leqslant 120$					
$= 1,55 \times 10^5$ A/m					$\leqslant 300$					
$= 2,25 \times 10^5$ A/m					$\leqslant 1100$					

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022					
		3B7	3B8	3D3	3H1		4C6
16 ± 1%	12,2			21400			21800
25 ± 1%	19			21410			21810
40 ± 1%	30,5			21420			21820
63 ± 1%	48			21430			
100 ± 1%	76	21040		21440	21240		
160 ± 1,5%	122	21050			21250		
250 ± 3%	190	21060	01920*		21260		
400 ± 8%	305		01940*				

Core sets with nut and pre-adjusted on μ_e.

μ_e	α		catalogue number 4322 022				
		3B7		3D3	3H1		4C6
15 ± 1%	225						20810
22 ± 1%	186						20820
33 ± 1%	152			20430			20830
47 ± 1%	127			20440			
68 ± 1%	105,8	20050		20450	20250		
100 ± 1,5%	87,5	20060			20260		
150 ± 2%	71,2	20070			20270		
220 ± 5%	58,8	20080			20280		
660 ± 25%	33,9			20400*			
1300 ± 25%	24,2	20000*			20200*		

Core sets without nut: replace the eighth digit of the catalogue number (2) by 0.
Cores with $A_L \leqslant 63$, or $\mu_e \leqslant 68$, have a symmetrical air gap.
Cores with $A_L \geqslant 100$, or $\mu_e \geqslant 100$, have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

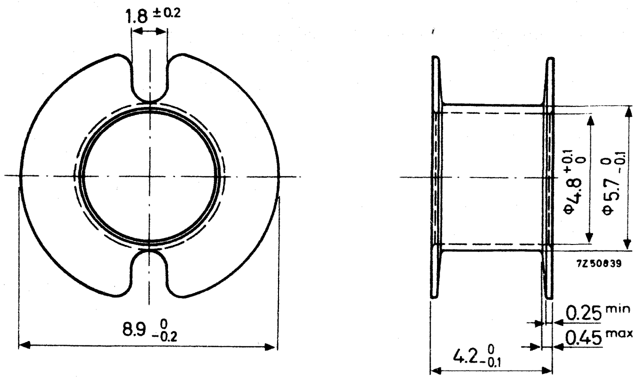
Core halves without air gap, without nut

Ferroxcube grade	catalogue number
3B7	4322 020 21000
3B8	4322 020 28760
3D3	4322 020 21020
3H1	4322 020 21010
4C6	4322 020 21140

COIL FORMER

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

Dimensions in mm



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	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 58{,}1 \times 10^3\ \Omega/H$
Mass	0,1 g

INDUCTANCE ADJUSTERS

The tolerances on inductance of the pre-adjusted potcores (without adjuster) 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 adjuster. Such an adjuster increases the inductance of the coil, see following pages.

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

The influence of the adjuster on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C. Table 2 shows the type of adjuster recommended for different potcores.

Dimensions in mm

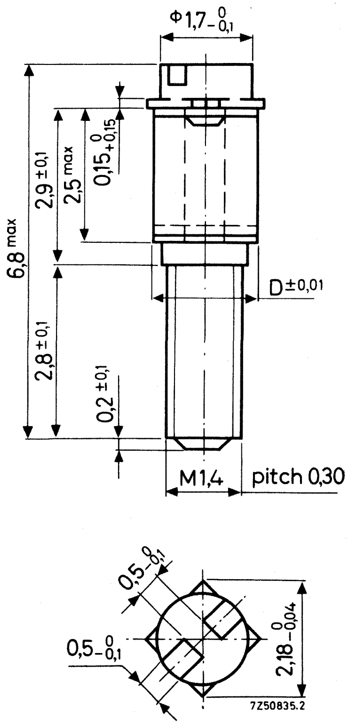


Table 1, available types

D	colour	catalogue 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

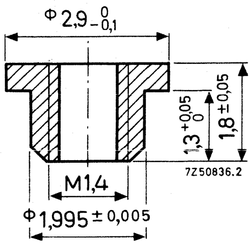
Table 2, recommended application

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

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

LOOSE NUT FOR ADJUSTER

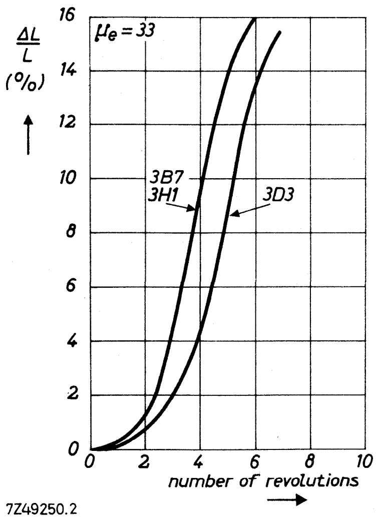
These data are given for those manufacturers who prefer to insert a nut themselves.



Catalogue number 4322 021 31630

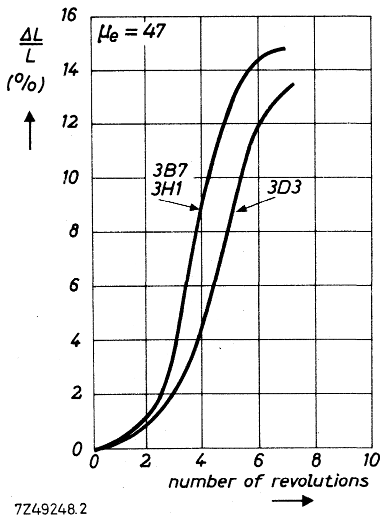
Material brass, nickel plated

ADJUSTMENT CURVES



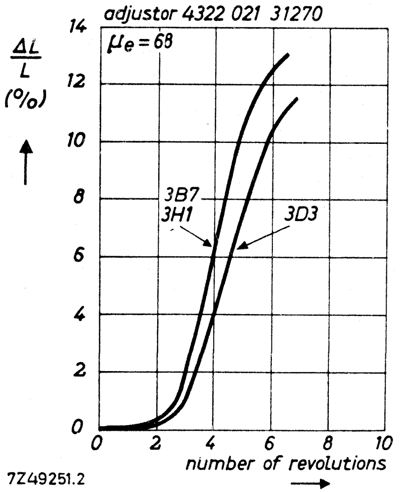
7Z49250.2

adjuster 4322 021 31250

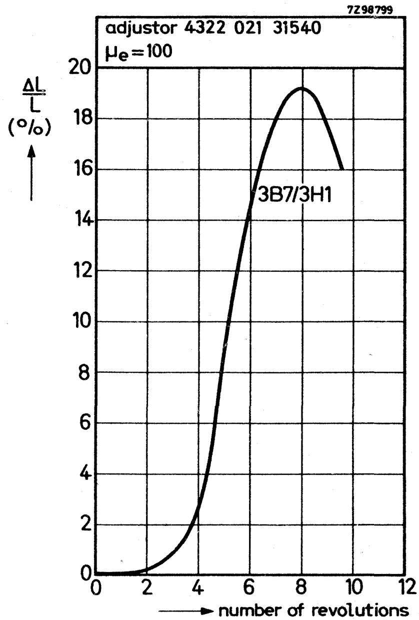


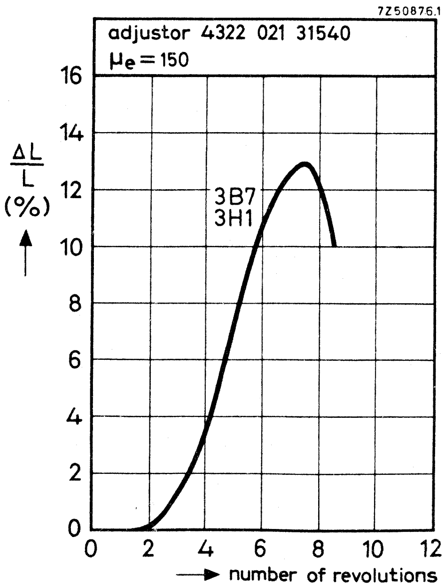
7Z49248.2

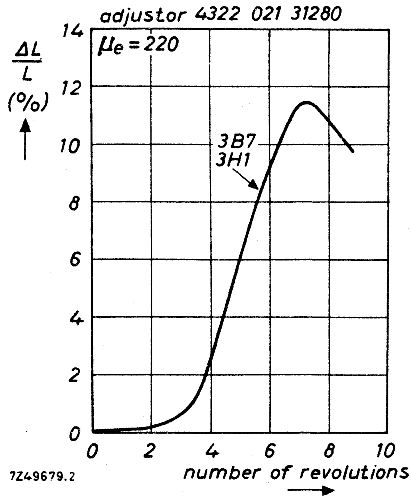
adjuster 4322 021 31260



7Z49251.2



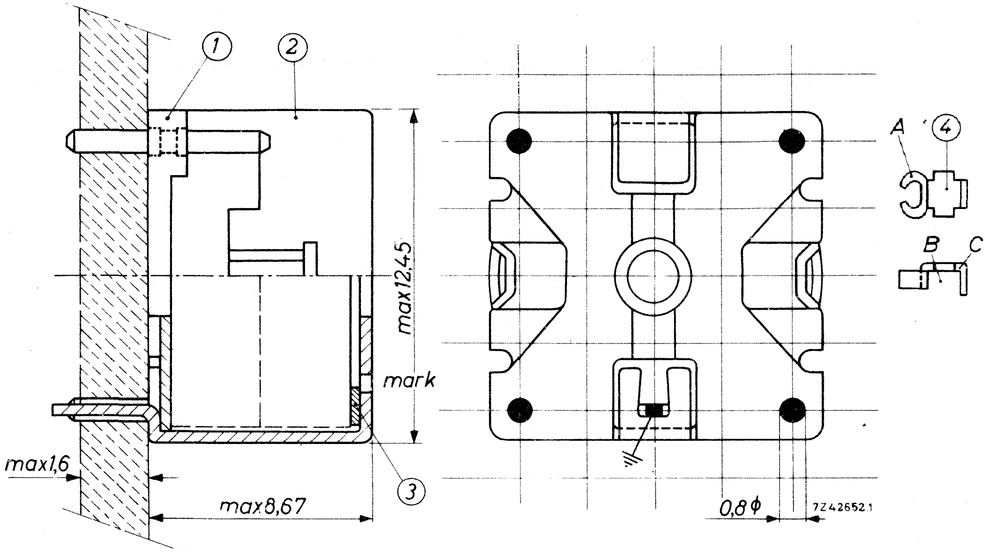




7Z49679.2

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, 54 mm (0, 1 inch). 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.

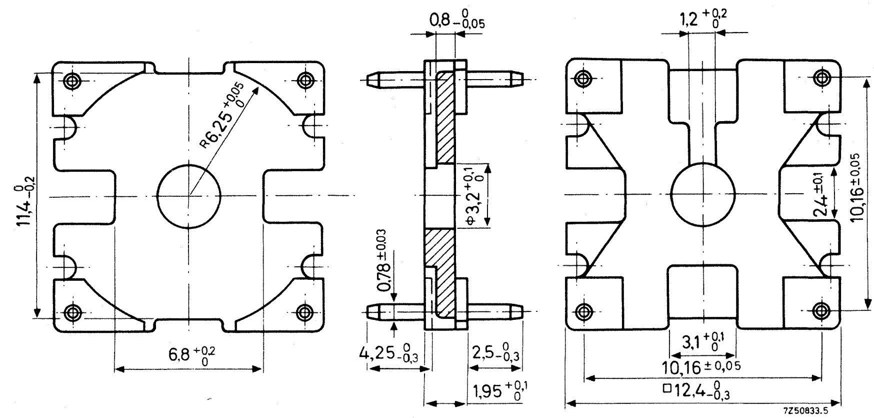
It is recommended that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it 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

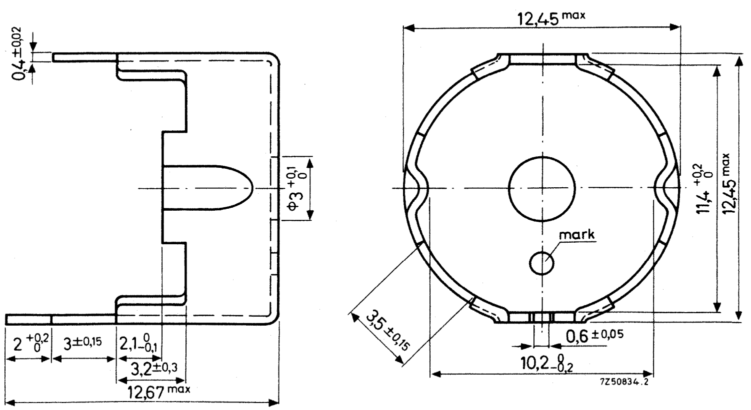
Plate: polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s.
Pins : phosphor bronze, dip-soldered



The tag plates are packed in units of 1000 pieces; please order in multiples of this quantity.

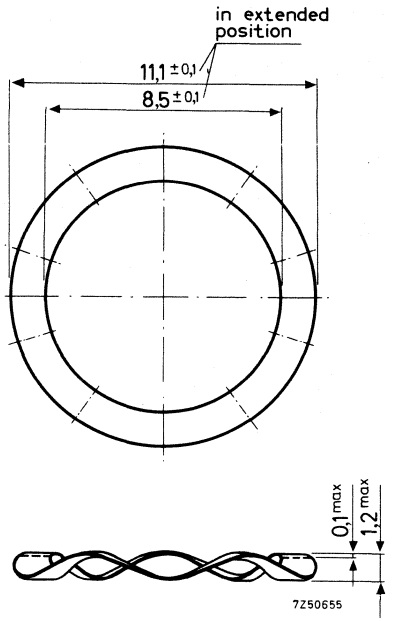
(2) **container** 4322 021 30510

Material: brass, nickel plated; tinned soldering pin



(3) Spring 4322 021 30620

Material: chrome-nickel steel

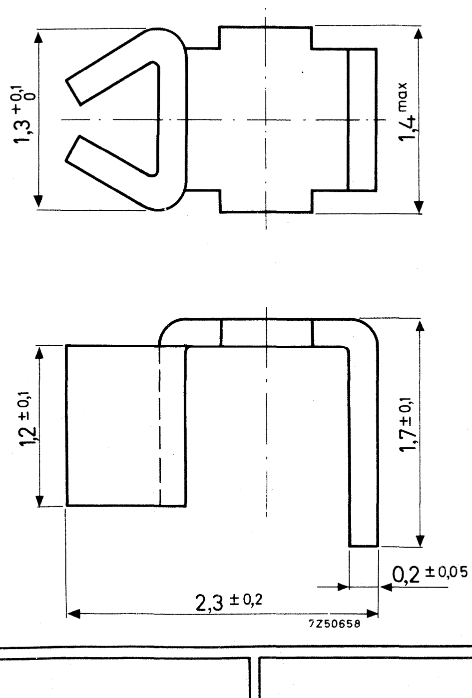


A force of min. 25 N is required to compress the spring to 0,5 mm.
A force of max. 55 N is required to compress the spring to 0,2 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

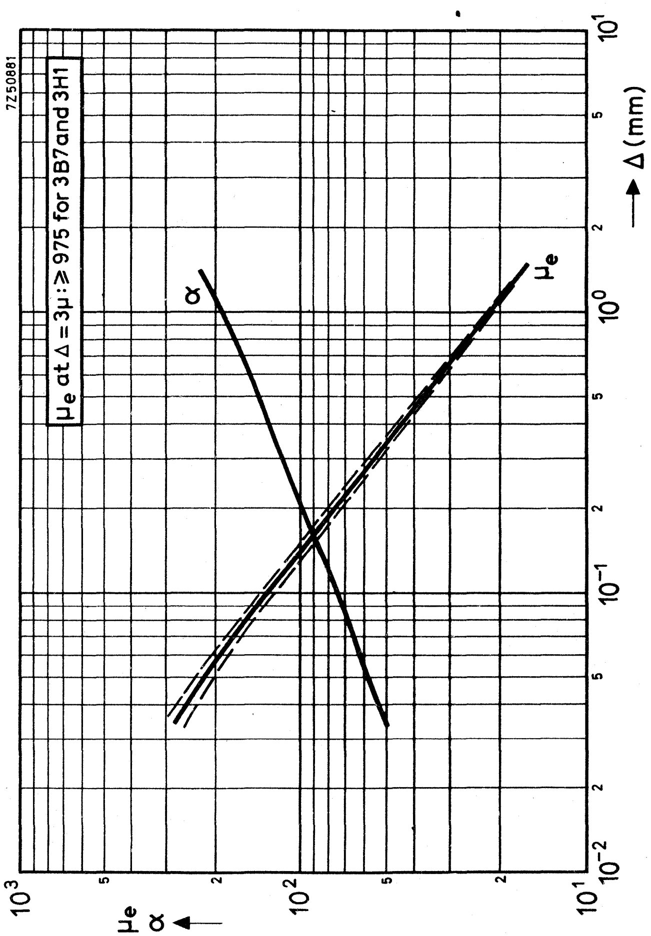
(4) Soldering spring 4322 021 30700

Material: brass, dip-soldered



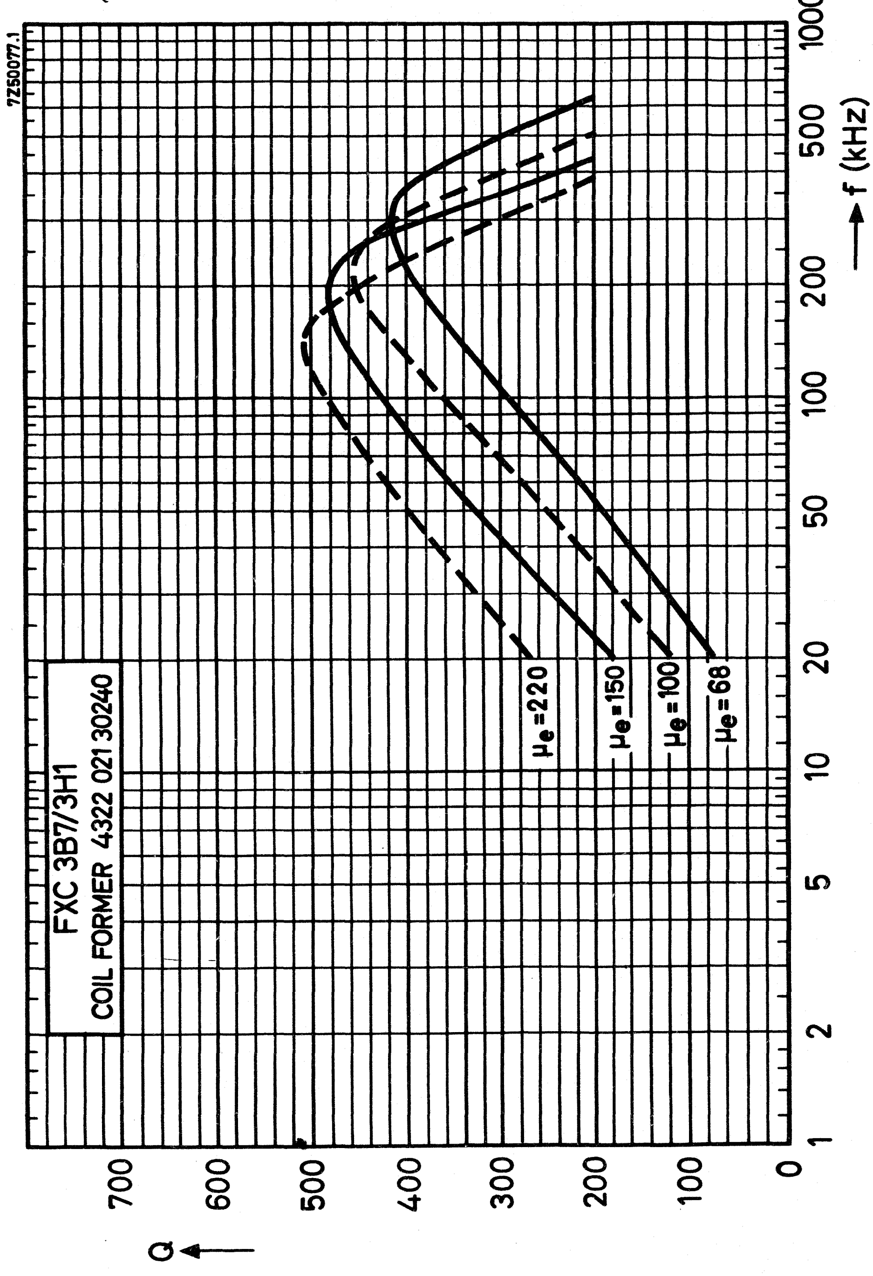
CHARACTERISTIC CURVES

μ_e - α values

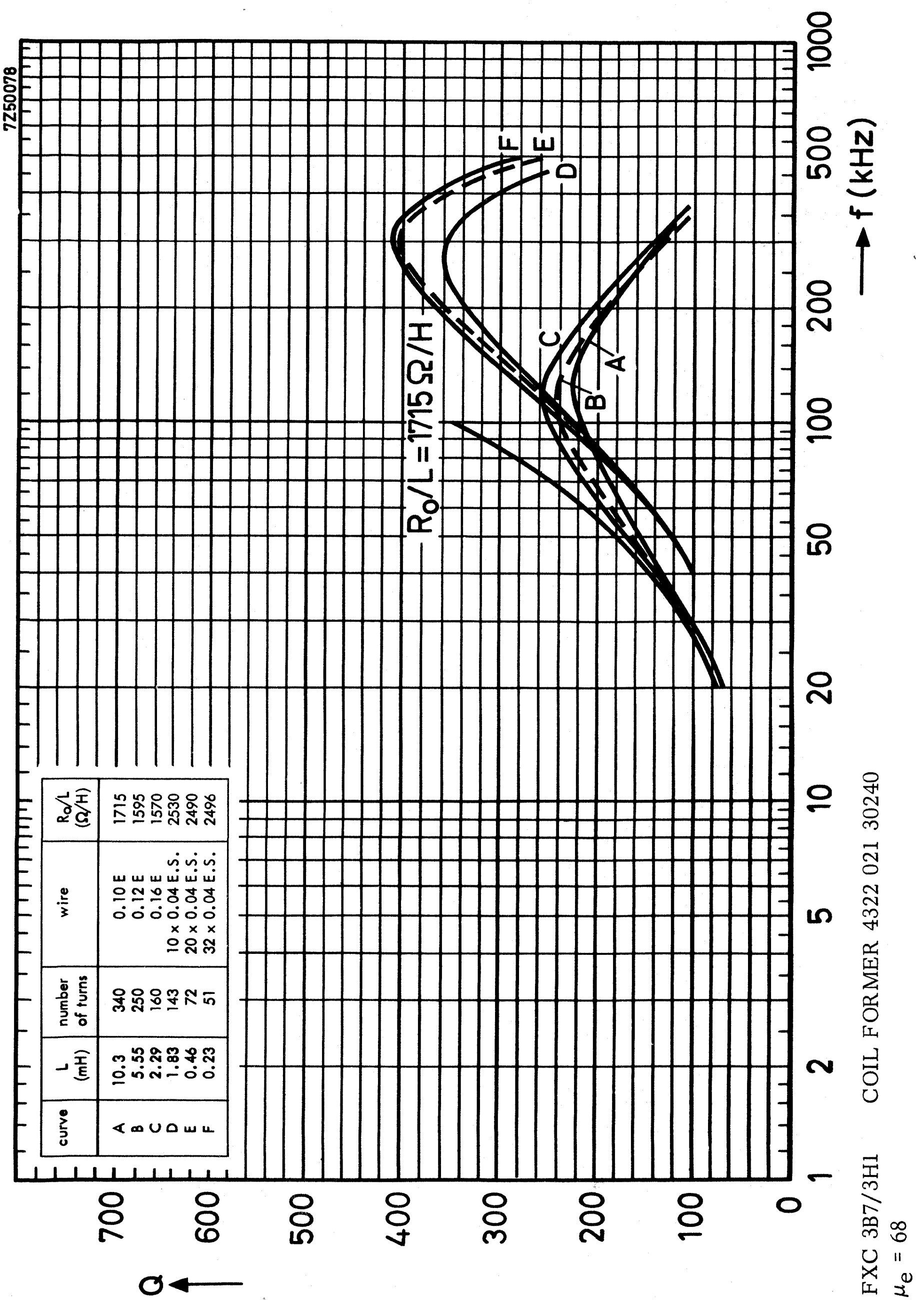


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



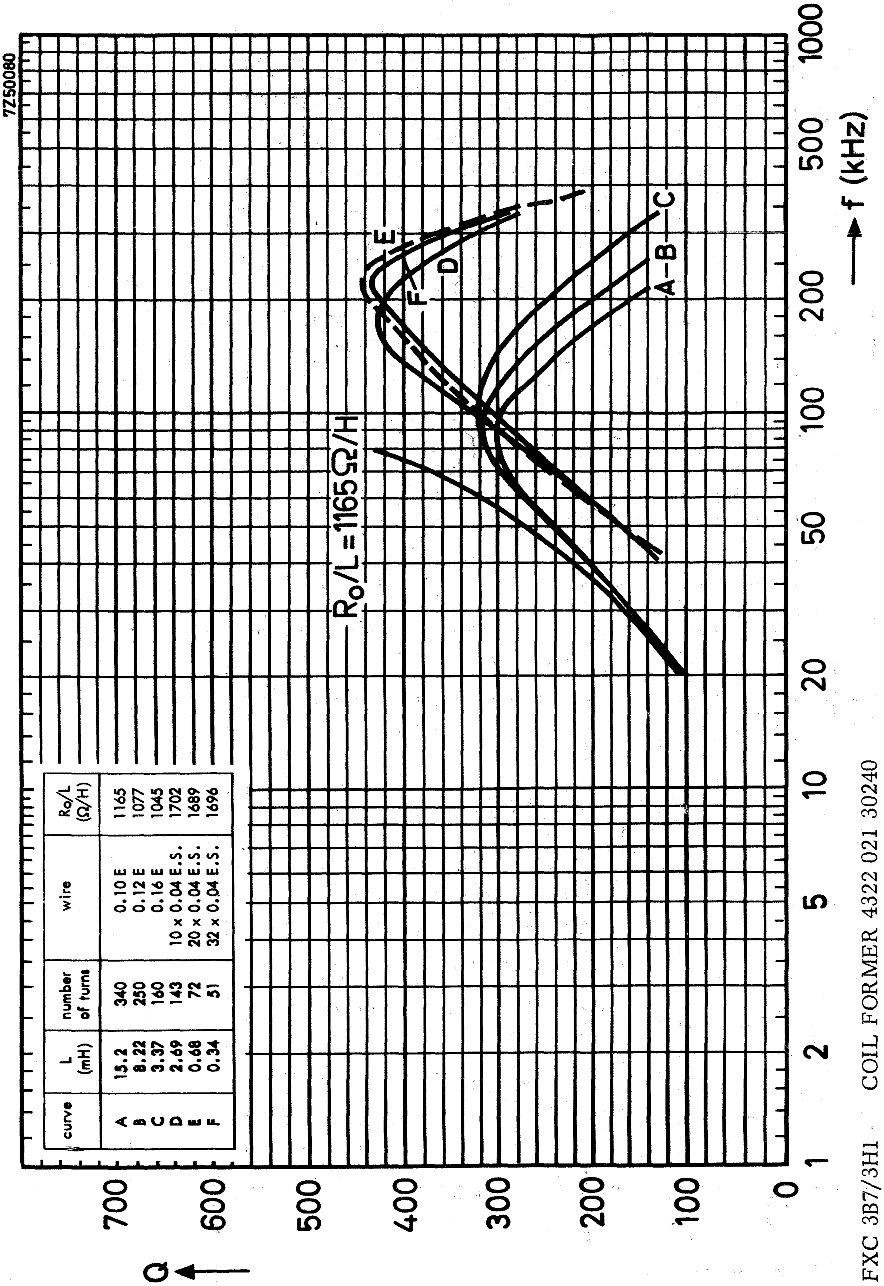
Enveloping curves



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

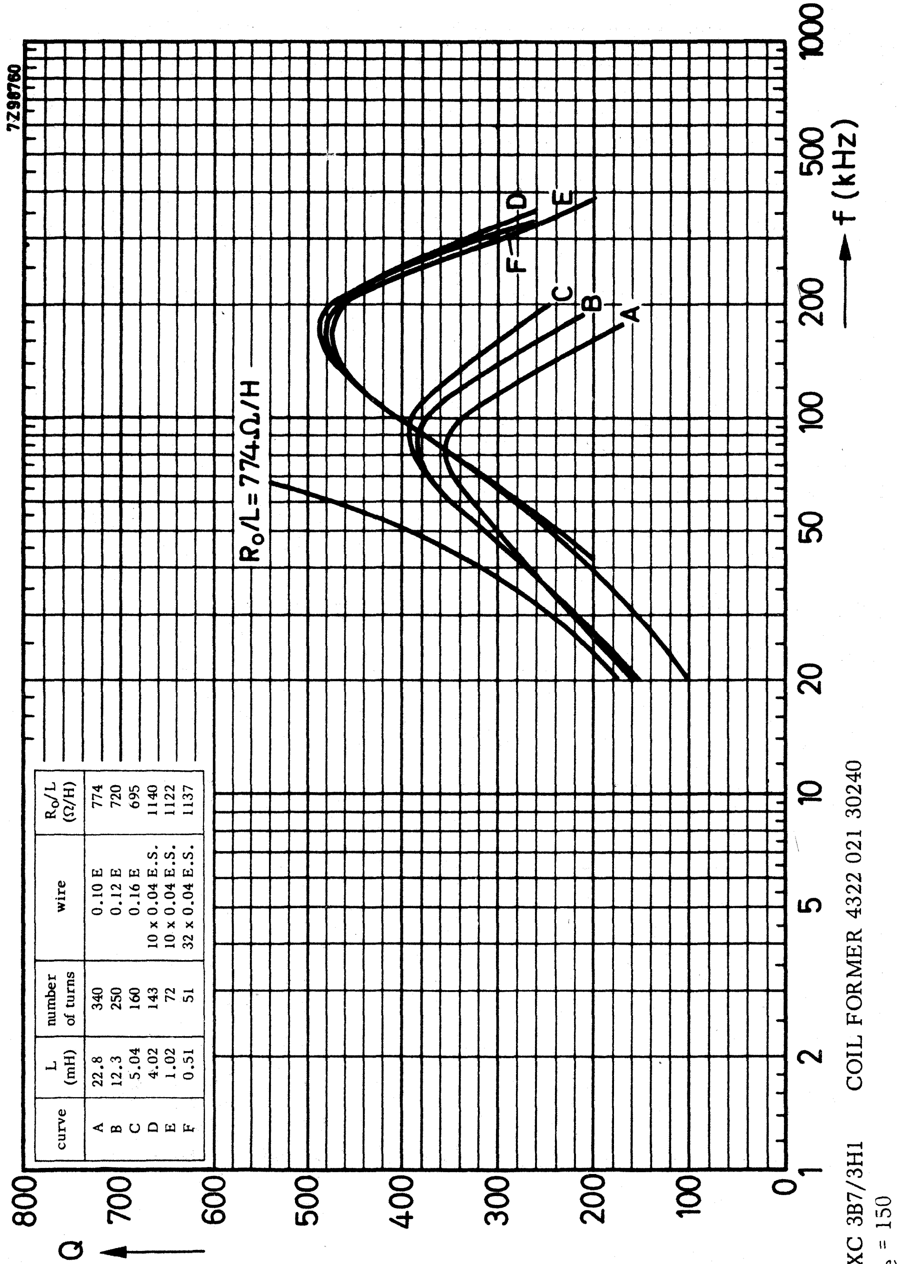
FXC 3B7/3H1 COIL FORMER 4322 021 30240

$\mu_e = 68$



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 × 0.04 E.S.	1702
E	0.68	72	20 × 0.04 E.S.	1689
F	0.34	51	32 × 0.04 E.S.	1696

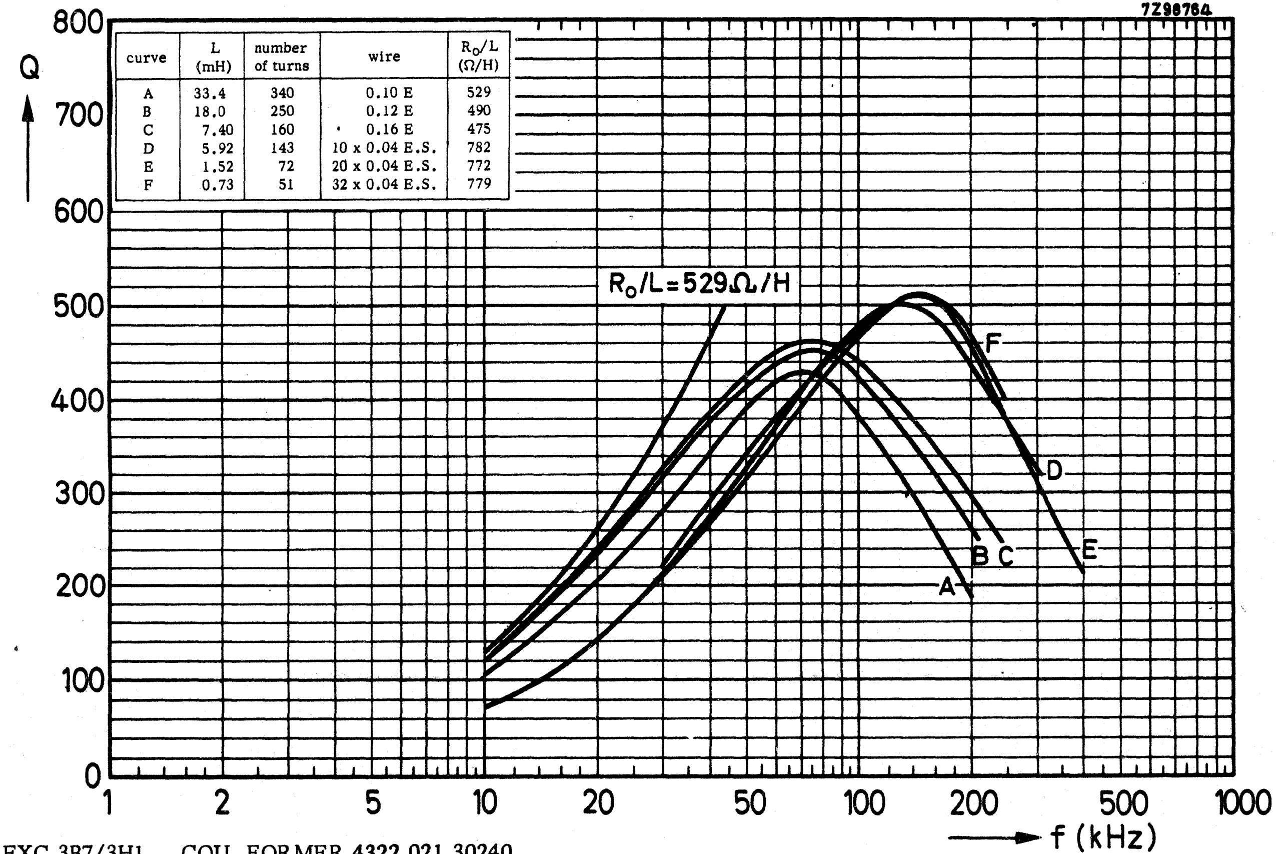
FXC 3B7/3H1 COIL FORMER 4322 021 30240
$\mu_e = 100$



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

$\mu_e = 150$

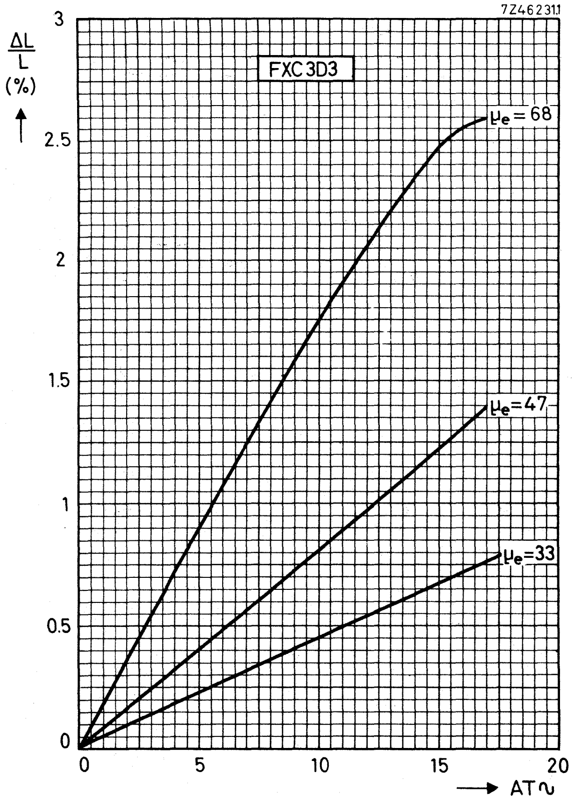


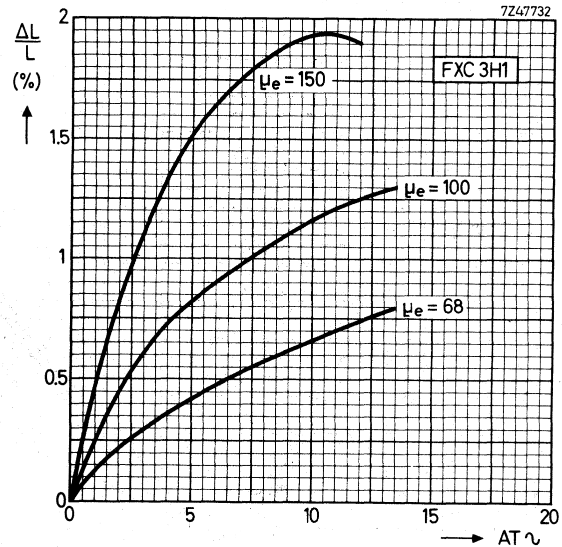
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	33.4	340	0.10 E	529
B	18.0	250	0.12 E	490
C	7.40	160	0.16 E	475
D	5.92	143	10 x 0.04 E.S.	782
E	1.52	72	20 x 0.04 E.S.	772
F	0.73	51	32 x 0.04 E.S.	779

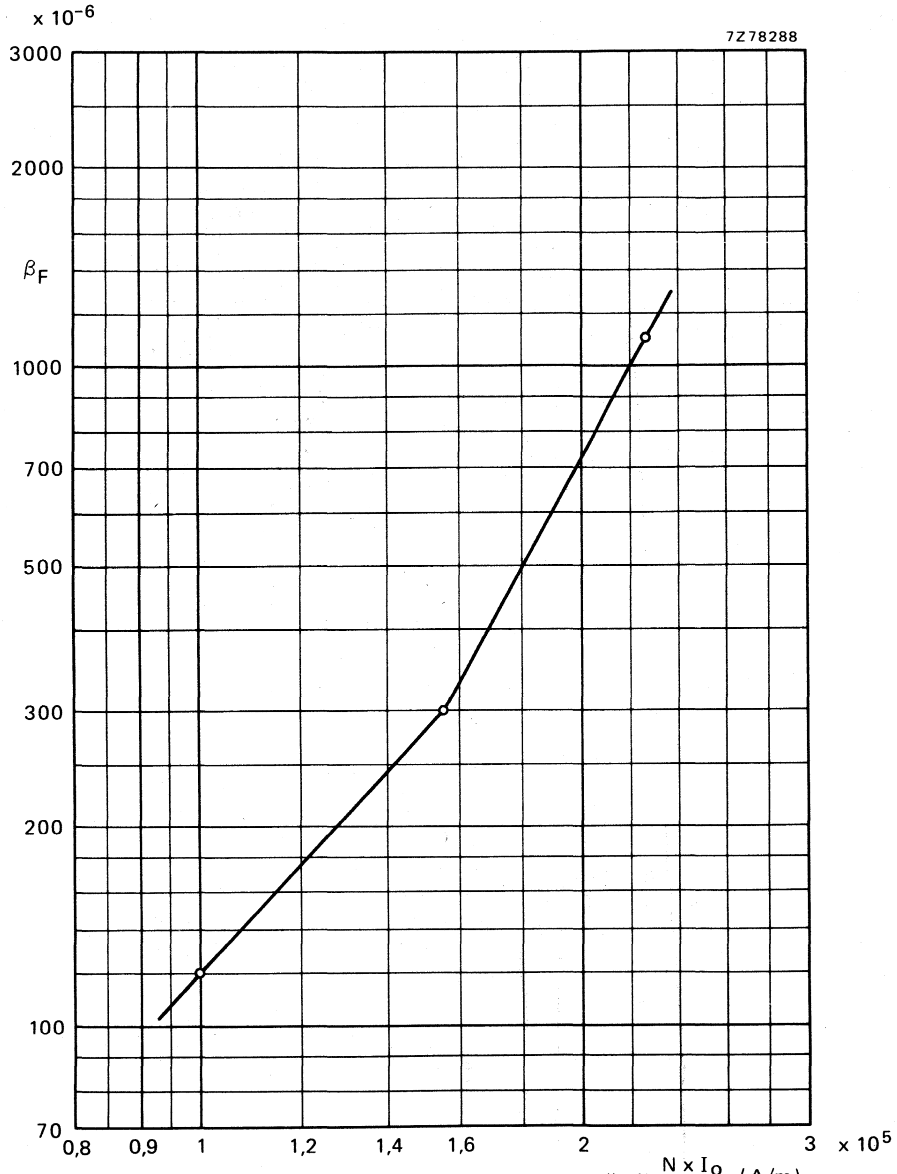
FXC 3B7/3H1 COIL FORMER **4322** 021 30240

$\mu_e = 220$

INDUCTANCE VARIATION AS A FUNCTION OF AT ~



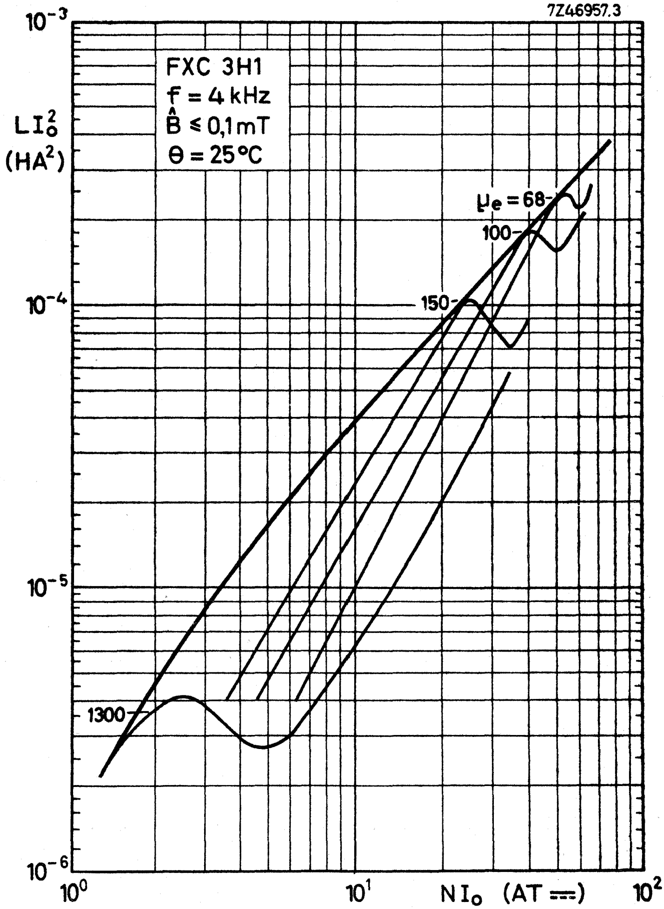




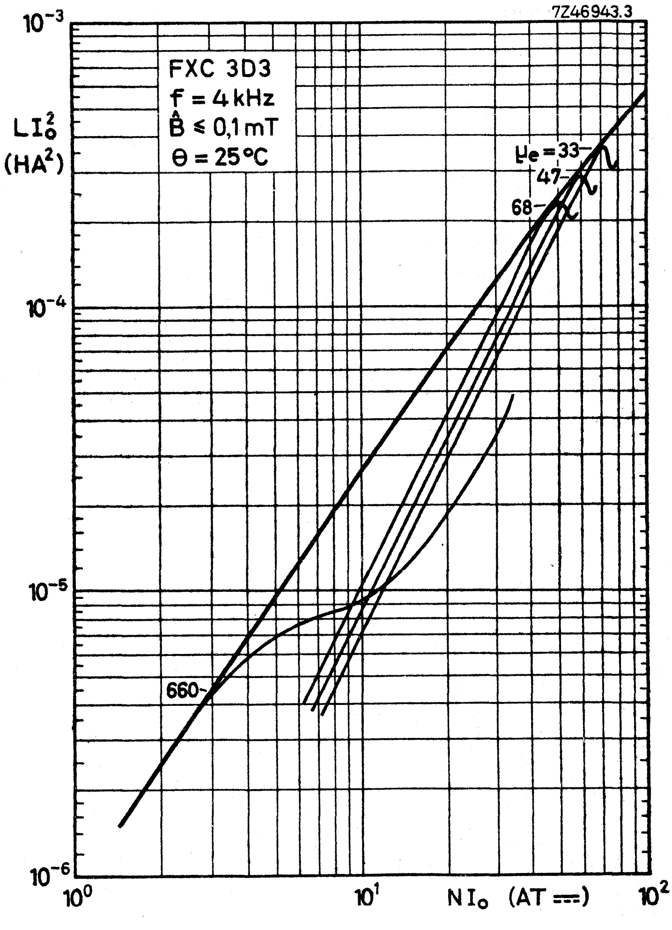
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

HANNA CURVES

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



Typical values



POTCORES

Three types of core can be supplied:

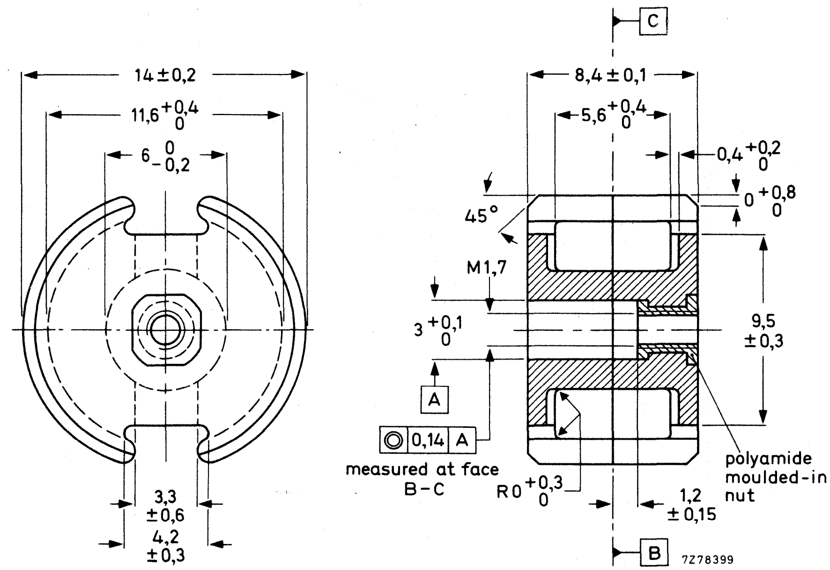
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (France), DIN41293 (Germany) and BS4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling out force of the nut ⩾30 N

Torque of the screw thread ⩽0,8 N

Extraction force of adjuster from nut ⩾ 20 N

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}789\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00315\ mm^{-3}$; $V_e = 495\ mm^3$; $l_e = 19{,}8\ mm$; $A_e = 25{,}1\ mm^3$.

Mass of a core set: 3,2 g

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 60 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	B mT	temp. °C	grade 3B7	3B8	3D3	3E1	3H1	3H3	4C6
A_L ± 25%	100	≤ 0,1	25 ± 1	2200	≥ 1670	1080	4050	2200	2170	200
μ_e ± 25%	100	≤ 0,1	25 ± 1	1400	≥ 1050	680	2550	1400	1360	125
α	100	≤ 0,1	25 ± 1	≤ 24,4	≤ 24,5	≤ 35,1	≤ 18,1	≤ 24,4	≤ 24,0	≤ 81,8
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1		≤ 1,5		≤ 2,5			
	30	≤ 0,1	25 ± 1						≤ 1,8	
	100	≤ 0,1	25 ± 1	≤ 5,0	≤ 6,0	≤ 8,0	≤ 20	≤ 5,0	≤ 2,6	
	500	≤ 0,1	25 ± 1			≤ 14	≤ 200			
	1 000	≤ 0,1	25 ± 1			≤ 30				
	2 000	≤ 0,1	25 ± 1							≤ 40
	10 000	≤ 0,1	25 ± 1							≤ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	≤ 1,1	≤ 1,0		≤ 1,8	≤ 0,86		
	30	1,5 to 3,0	25 ± 1						≤ 0,65	
	100	0,3 to 1,2	25 ± 1			≤ 1,8				≤ 6,2
$\alpha_F \times 10^6$/°C	≤ 100	≤ 0,1	5 to 25		0 to + 6			+ 0,5 to 1,5	+ 0,7 ± 0,25	−2 to + 4
	≤ 100	≤ 0,1	25 to 55		0 to + 6			+ 0,5 to 1,5	+ 0,7 ± 0,25	0 to + 6
	≤ 100	≤ 0,1	25 to 70	−0,6 to + 0,6		0 to + 2	0 to + 2			
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1	≤ 4,3	≤ 8,0	≤ 12	≤ 4,3	≤ 4,3	≤ 3,0 *	≤ 10
$\beta_F \times 10^6$, measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C: at $\mu_e \times \frac{N \times I_o}{l_e}$ = 0,90 x 10^5 A/m					≤ 100					
= 1,50 x 10^5 A/m					≤ 300					
= 2,15 x 10^5 A/m					≤ 1050					

* This value is valid within the temperature range of 25 to 70 °C.

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022					
		3B7	3B8	3D3	3H1	3H3	4C6
25 ± 1%	15,7						23810
40 ± 1%	25			23420			23820
63 ± 1%	39,5			23430			23830
100 ± 1%	63	23040		23440	23240		
160 ± 1,5%	100,5	23050			23250	23550	
250 ± 2%	157	23060			23260	23560	
315 ± 2%	198	23070			23270	23570	
400 ± 2%	252	23080			23280	23580	
630 ± 3%	396				23300 *		

Core sets with nut and pre-adjusted on μ_e.

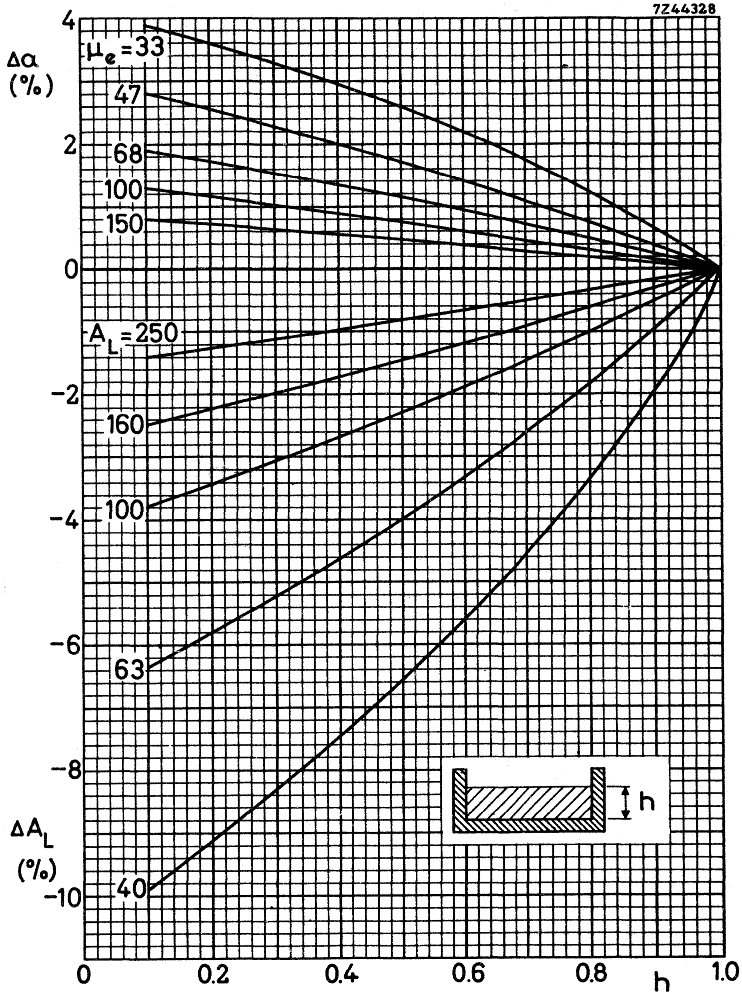
μ_e	α	catalogue number 4322 022					
		3B7	3B8	3D3	3H1	3H3	4C6
15 ± 1%	205						22810
22 ± 1%	169						22820
33 ± 1%	137,9	22030		22430	22230		22830
47 ± 1%	115,5	22040		22440	22240		
68 ± 1%	96,1	22050		22450	22250		
100 ± 1,5%	79,2	22060			22260		
150 ± 2%	64,6	22070			22270		
220 ± 3%	53,3	22080			22280		
680 ± 25%	30,3			22400 *			
1400 ± 25%	21,2	22000 *			22200 *		

Core sets without nut: replace the eighth digit of the catalogue number (2) by 0.
Cores with $A_L \leqslant 100$, or $\mu_e \leqslant 68$, have a symmetrical air gap.
Cores with $A_L \geqslant 160$, or $\mu_e \geqslant 100$, have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B7	4322 020 21250
3B8	4322 020 21400
3D3	4322 020 21270
3E1	4322 020 21360
3H1	4322 020 21260
3H3	4322 020 21370
4C6	4322 020 21350

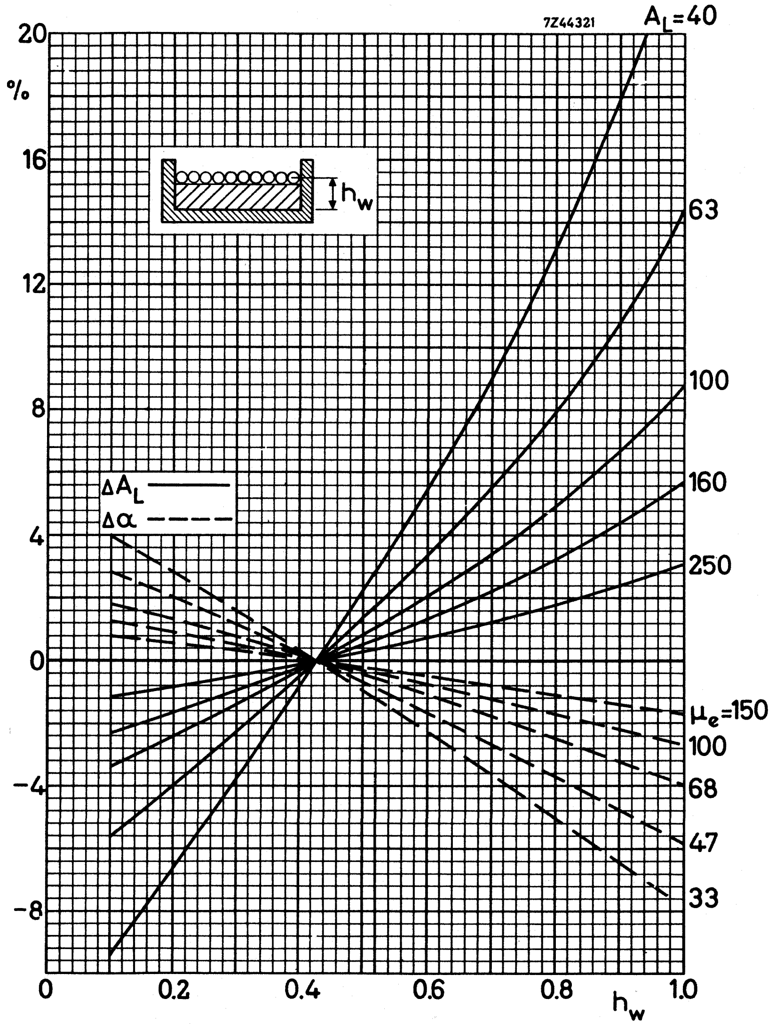
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



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 %.

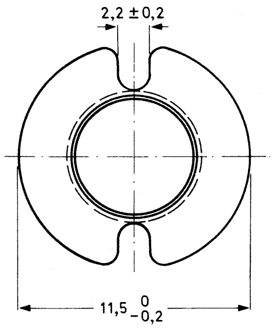
COIL FORMERS

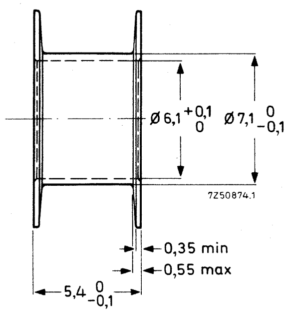
Two types of coil former can be supplied:

– with one section;
– with two sections.

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

SINGLE-SECTION COIL FORMER Dimensions in mm





Catalogue number	4322 021 30250
Material	polycarbonate
Window area	9,7 mm²
Mean length of turn	29 mm
Max. temperature	130 °C

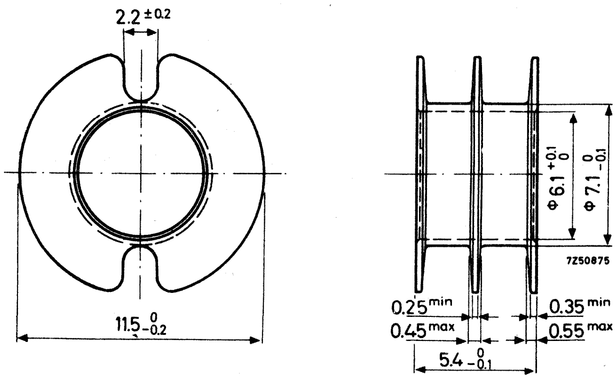
D.C. losses

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

mass 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 ADJUSTERS

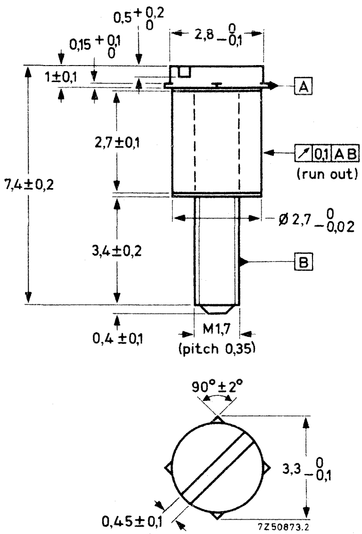


Fig. A

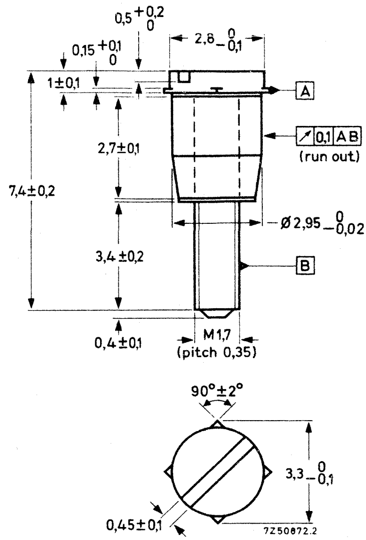


Fig. B

The tolerances on inductance of the pre-adjusted potcores (with adjuster) are given under 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 adjuster. Such an adjuster increases the inductance of the coil, see following pages.

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

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

Table 2 shows the type of adjuster recommended for different potcores.

Table 1, available types

Fig.	colour	catalogue number
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 adjusters are packed in bags of 100. Please order in mutliples of this quantity.

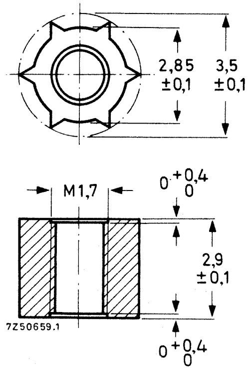
Table 2, recommended application

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

LOOSE NUT FOR ADJUSTER

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

Dimensions in mm

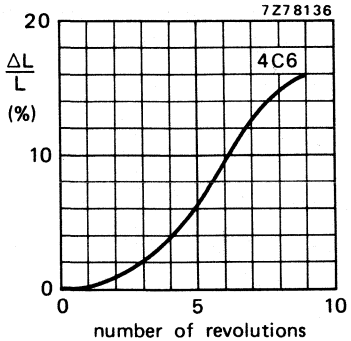


Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	1,2 ± 0,15 mm

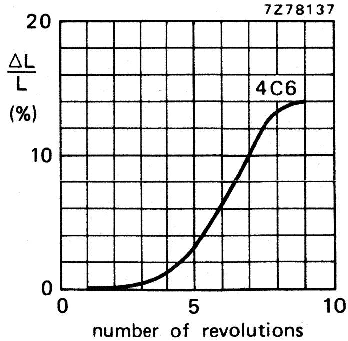
For more information see Potcores General, mounting data.

The nuts are packed in bags of 100. Please order in multiples of this quantity.

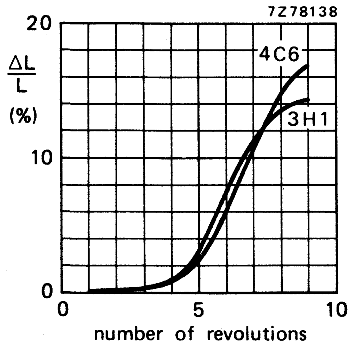
ADJUSTMENT CURVES



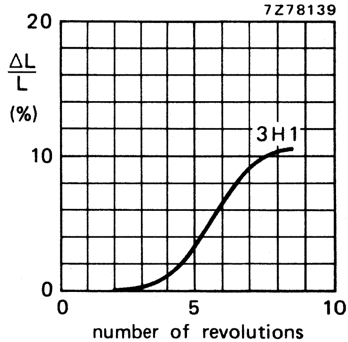
$\mu_e = 15$
Adjuster 4322 021 30750.



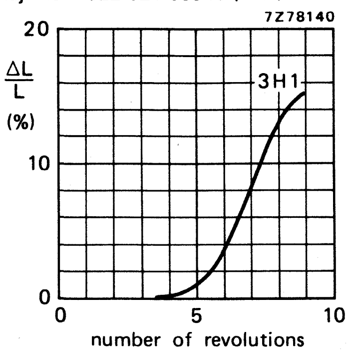
$\mu_e = 22$
Adjuster 4322 021 30750.



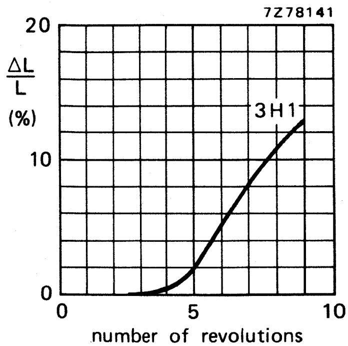
$\mu_e = 33$
Adjuster 4322 021 30750 (3H1).
Adjuster 4322 021 30940 (4C6).



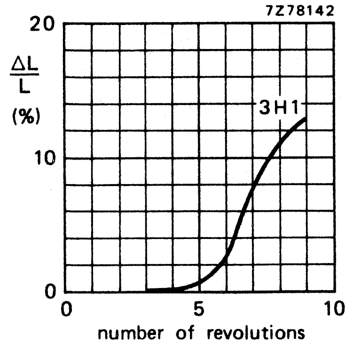
$\mu_e = 47$
Adjuster 4322 021 30750.



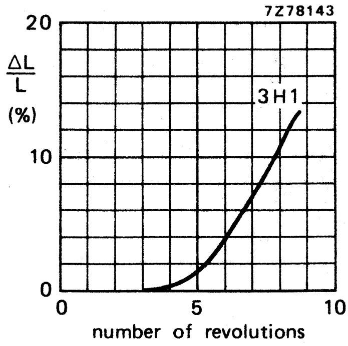
$\mu_e = 68$
Adjuster 4322 021 30940.



$\mu_e = 100$
Adjuster 4322 021 30950.



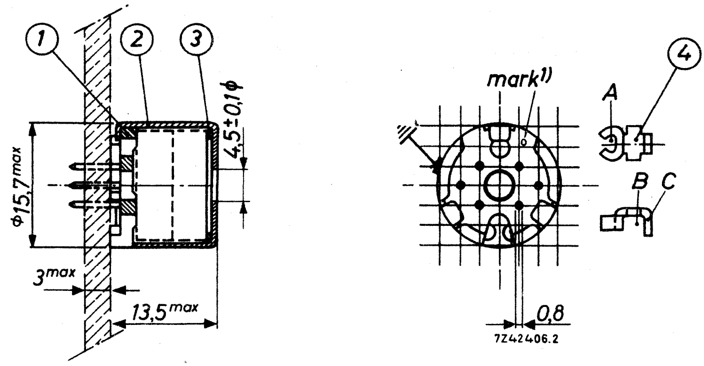
$\mu_e = 150$
Adjuster 4322 021 31070.



$\mu_e = 220$
Adjuster 4322 021 31130.

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 only for mounting on printed-wiring boards.

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 2,54 mm (0,1 inch). 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 that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it 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 hole in a similar position on the top of the container.

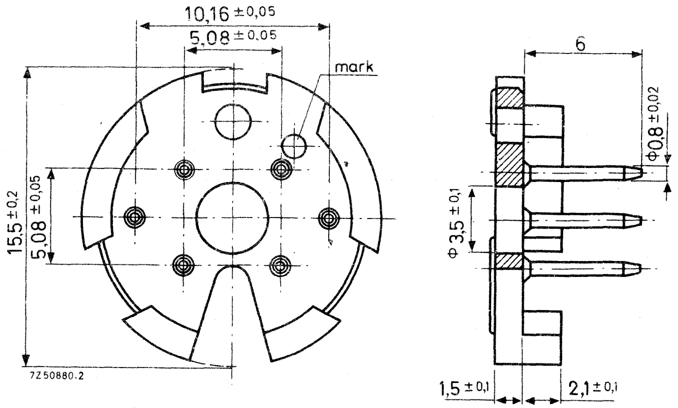
PART DRAWINGS

Dimensions in mm

Tag plate 4322 021 30440

Plate : polyester reinforced with glass fibre resistant against dip-soldering at 400 °C for 2 s.

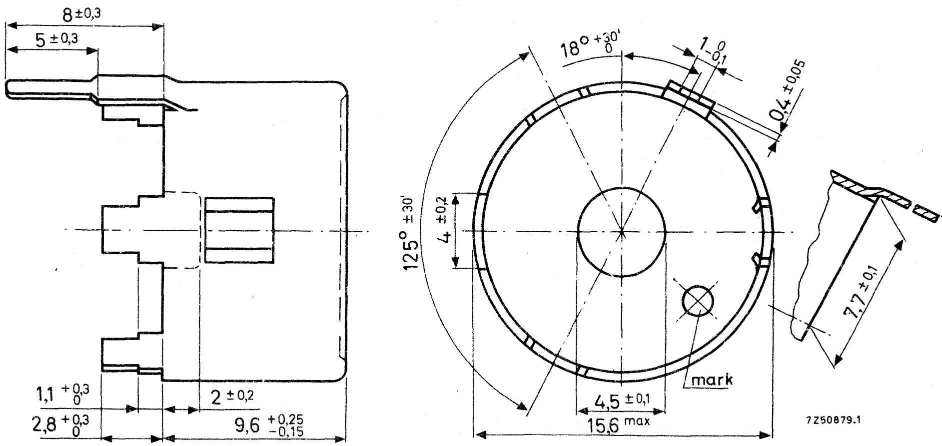
Pins : phosphor bronze, dip-soldered



The tag plates are packed in units of 100 pieces on a polystyrene plate, and with 5 plates to a cardboard box. Please order in multiples of these quantities.

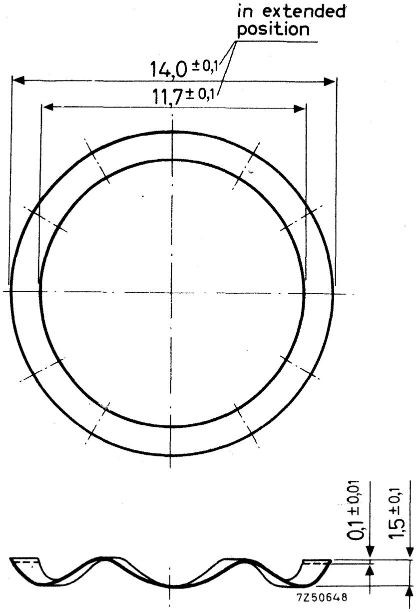
Container for mounting on printed-wiring boards 4322 021 30520

Material : brass, nickel plated; tinned soldering pin



Spring 4322 021 30630

Material: chrome-nickel steel

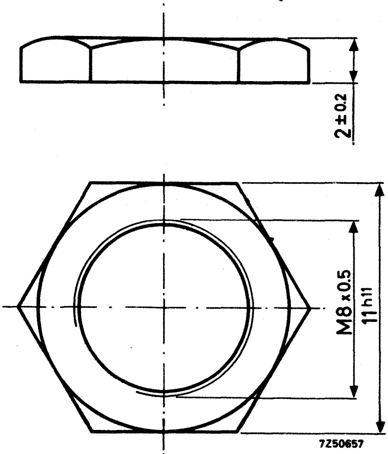


A force of 45 to 75 N is required to compress the spring to 0,35 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

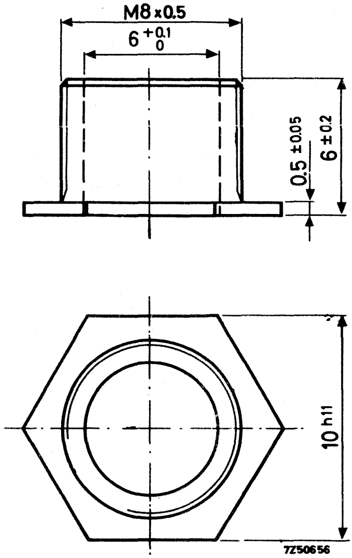
Nut 4322 021 30710

Material: brass, nickel plated



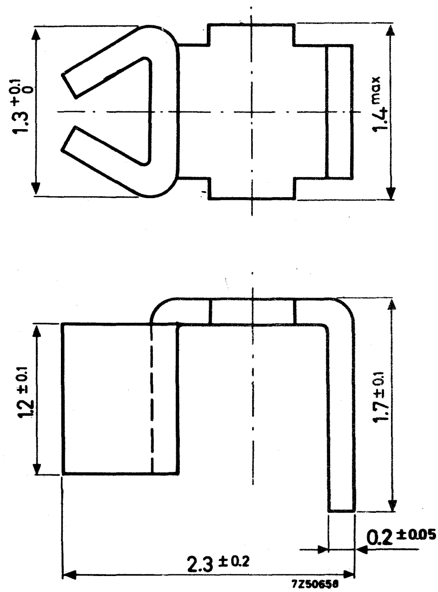
Fixing bush 4322 021 30720

Material: brass, nickel plated



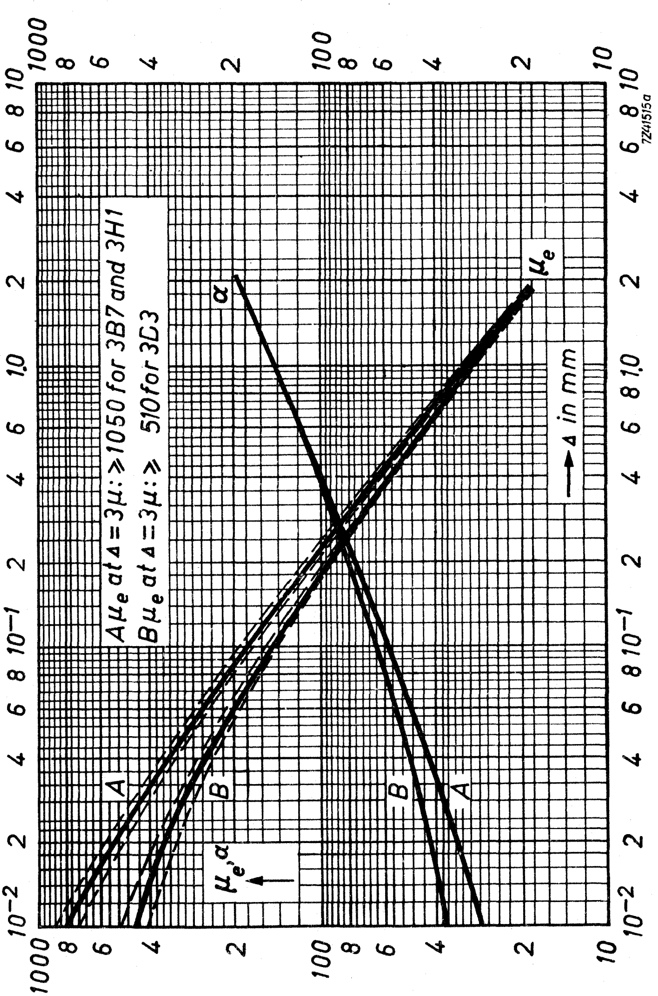
Soldering spring 4322 021 30700

Material: brass, dipsoldered



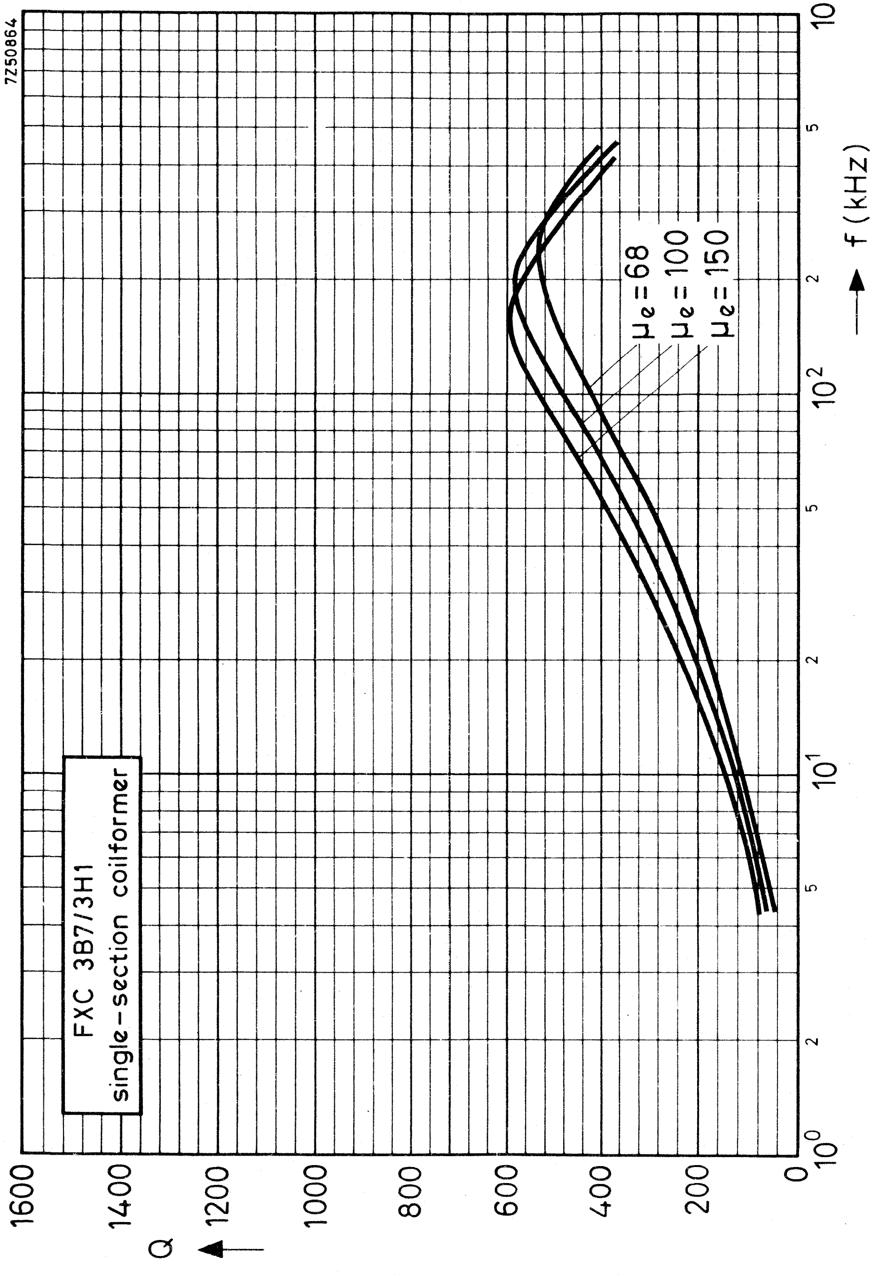
CHARACTERISTIC CURVES

μ_e - α CURVES

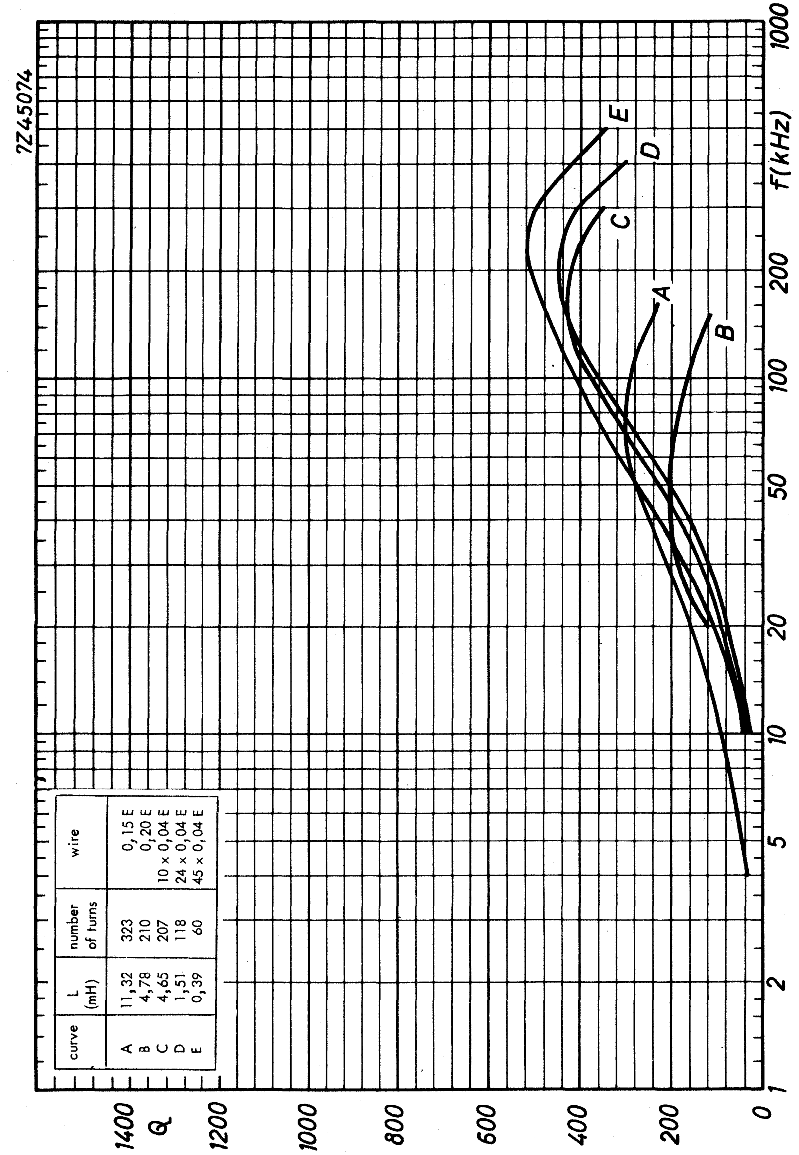


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



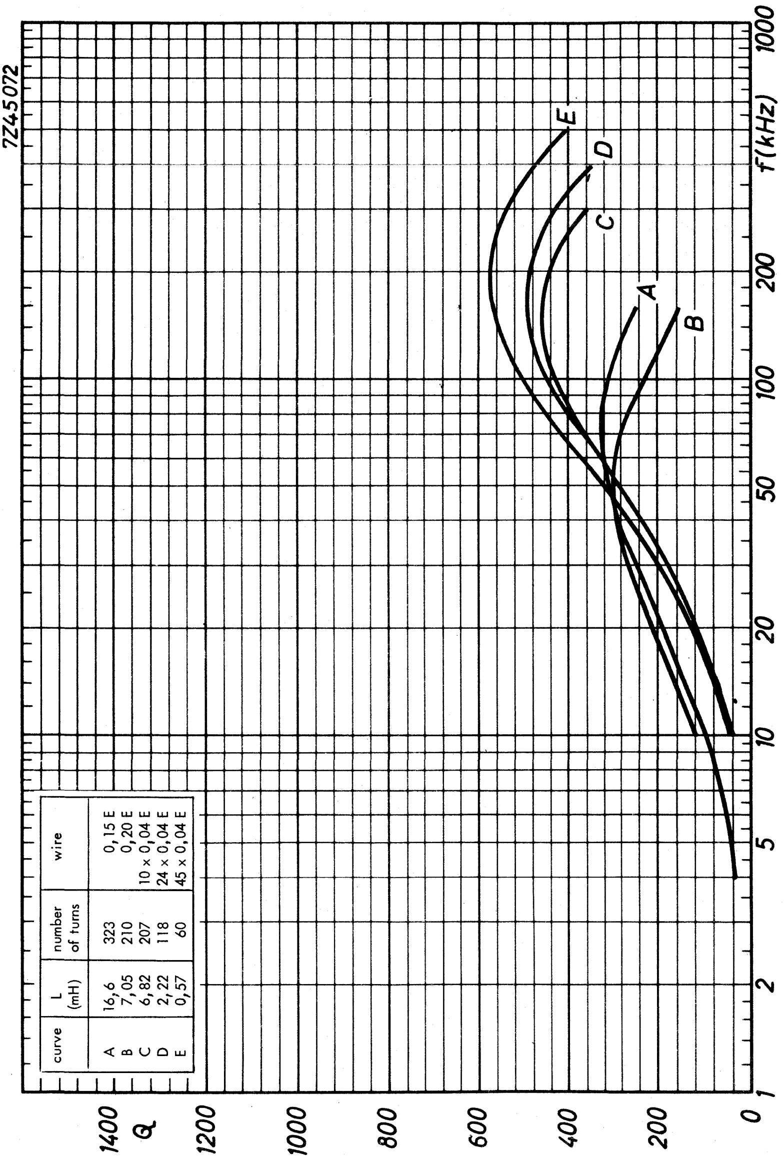
Enveloping curves



curve	L (mH)	number of turns	wire
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

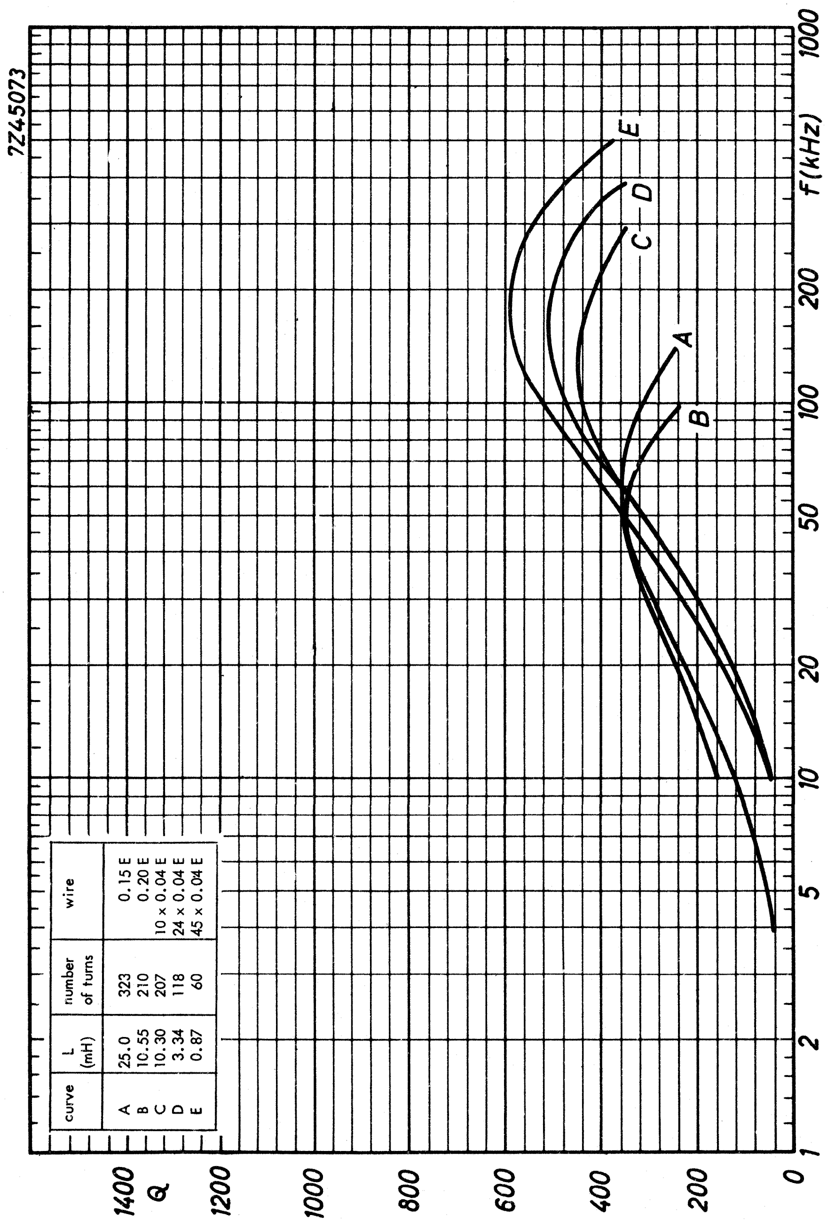
$\mu_e = 68$



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

$\mu_e = 100$

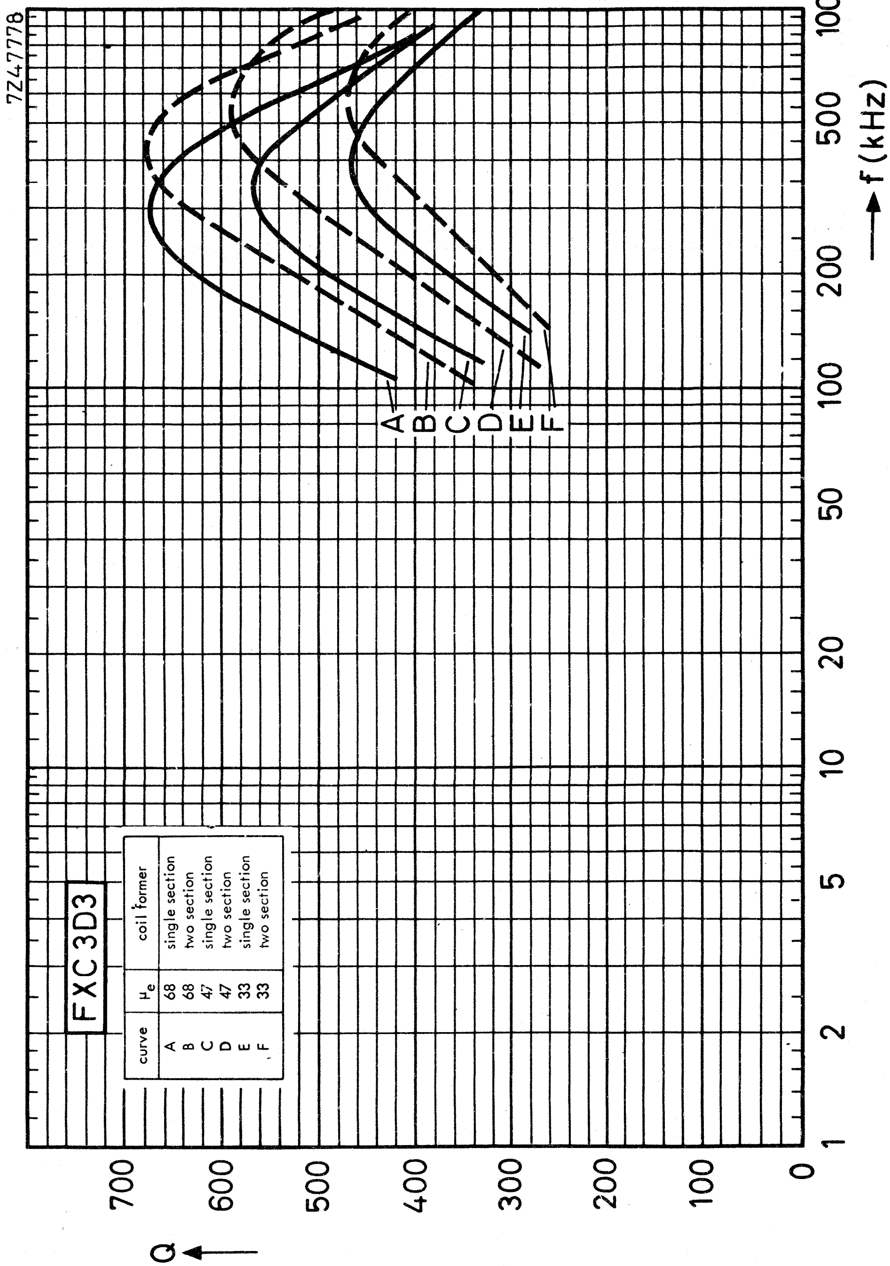


curve	L (mH)	number of turns	wire
A	25.0	323	0.15 E
B	10.55	210	0.20 E
C	10.30	207	10 × 0.04 E
D	3.34	118	24 × 0.04 E
E	0.87	60	45 × 0.04 E

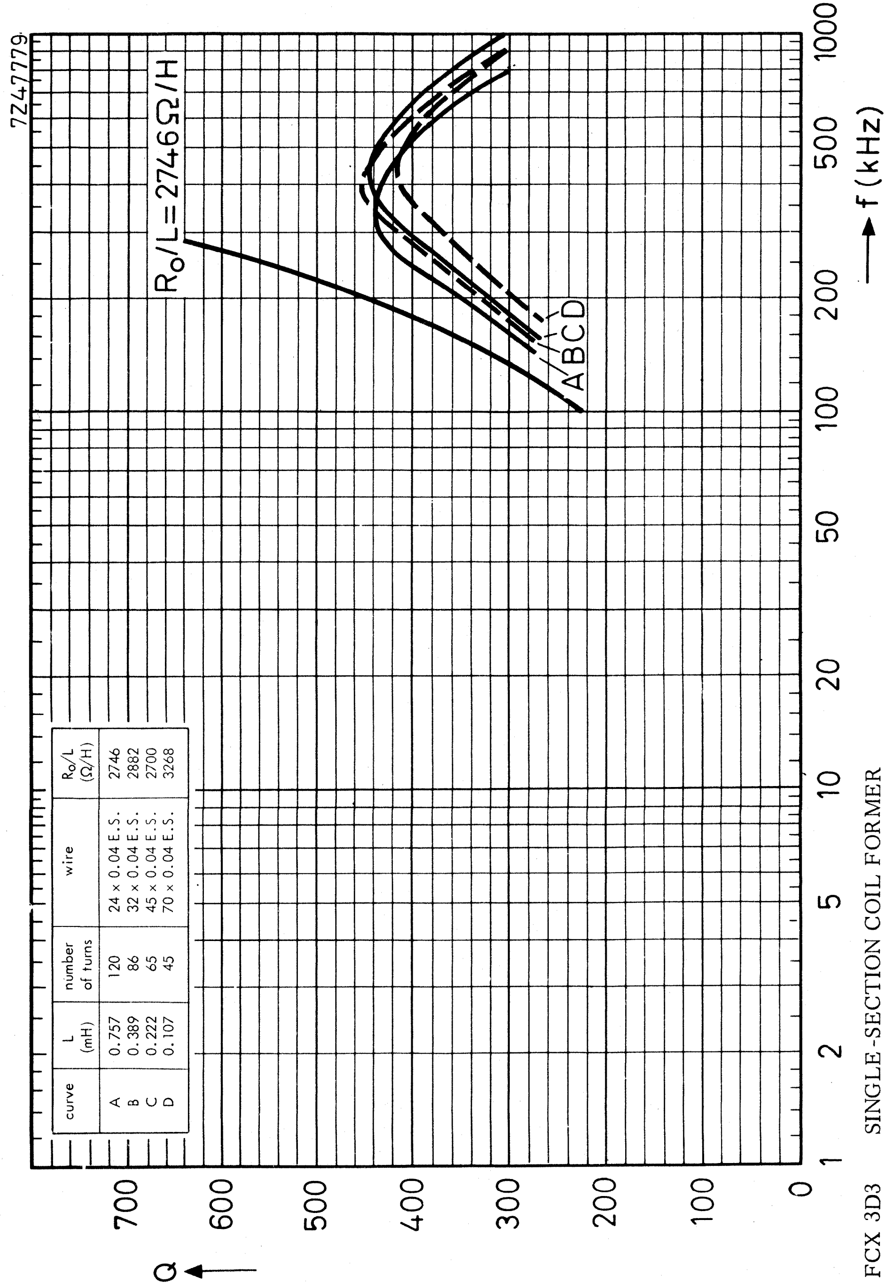
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

μ_e = 150

TYPICAL Q-CURVES FOR FXC 3D3



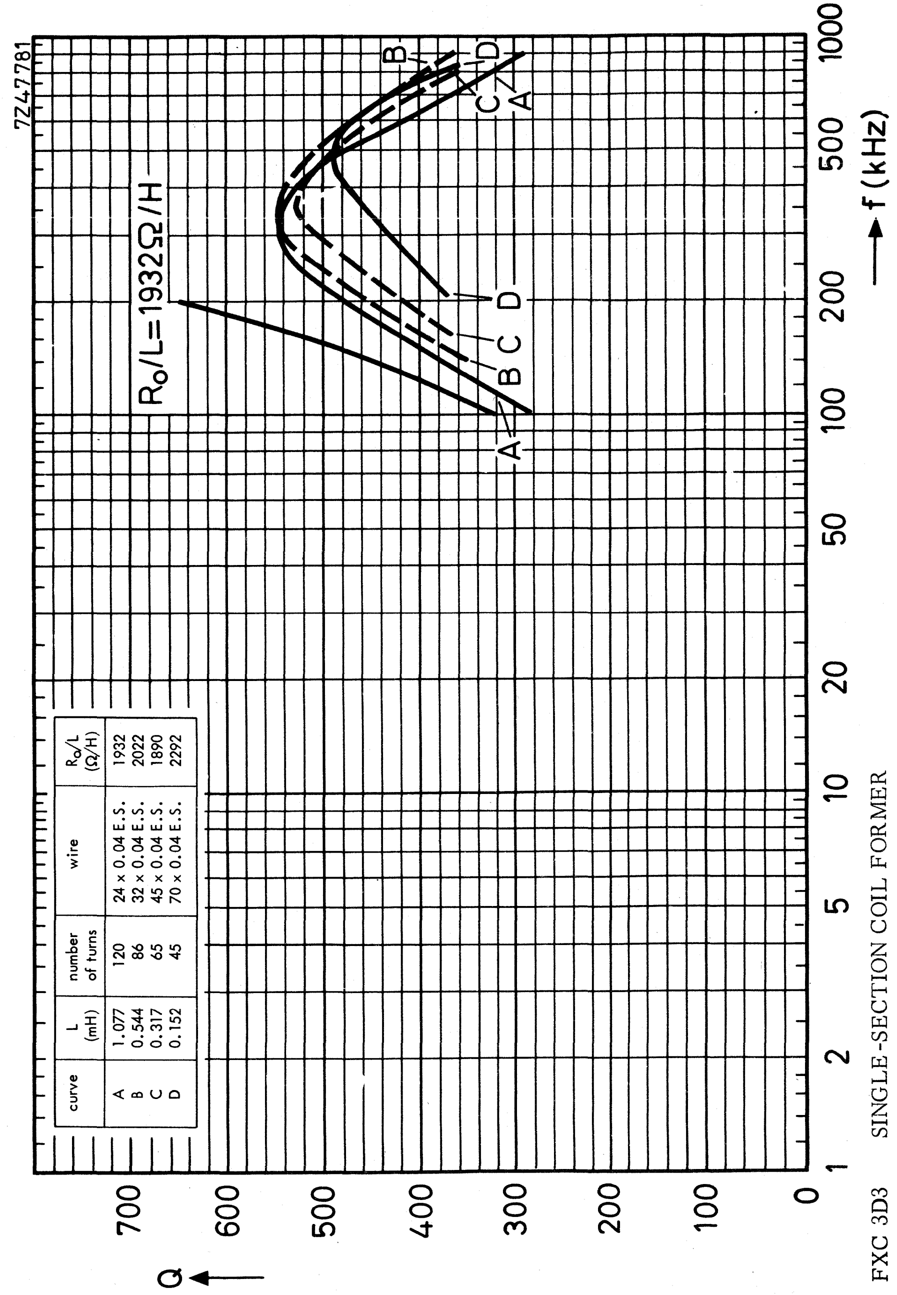
Enveloping curves



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

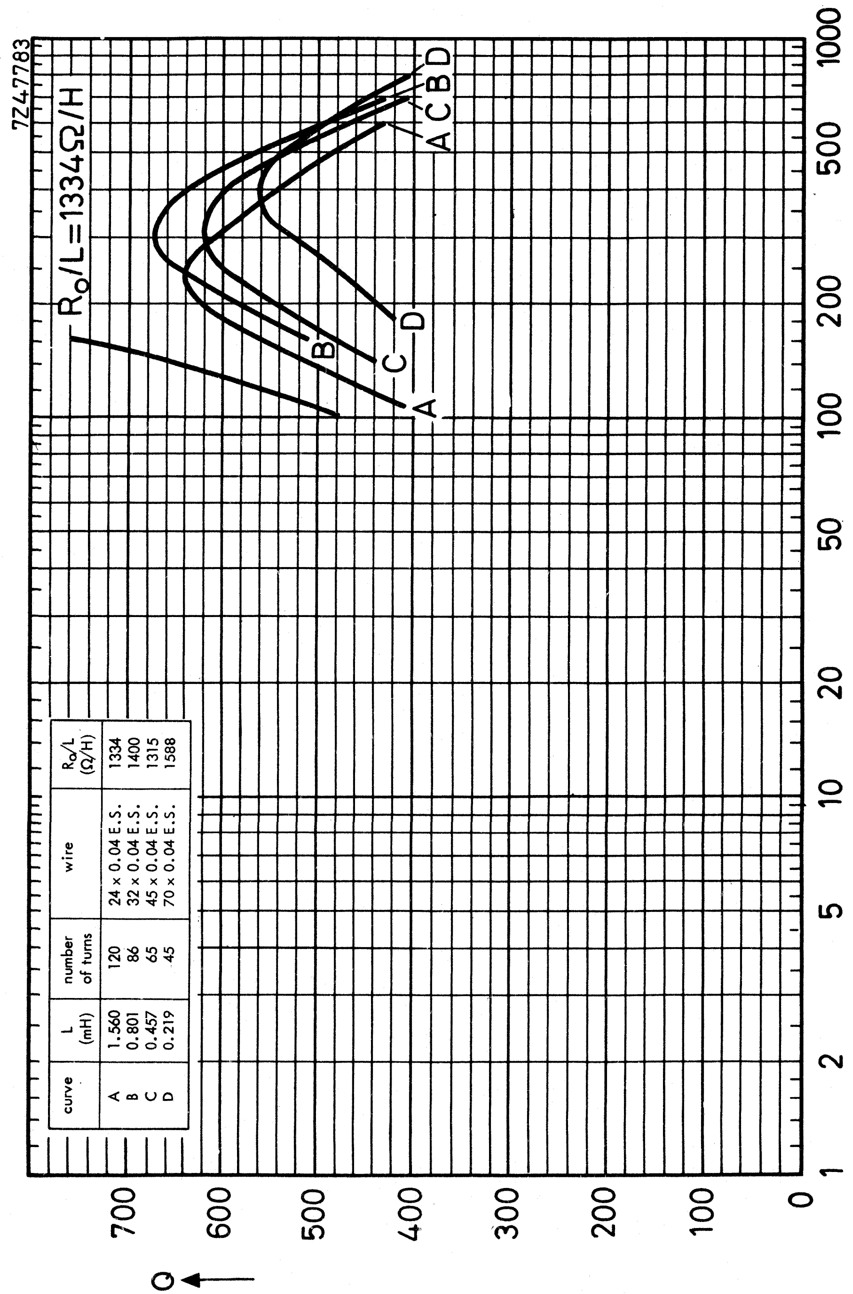
FCX 3D3
$\mu_e = 33$



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

SINGLE-SECTION COIL FORMER

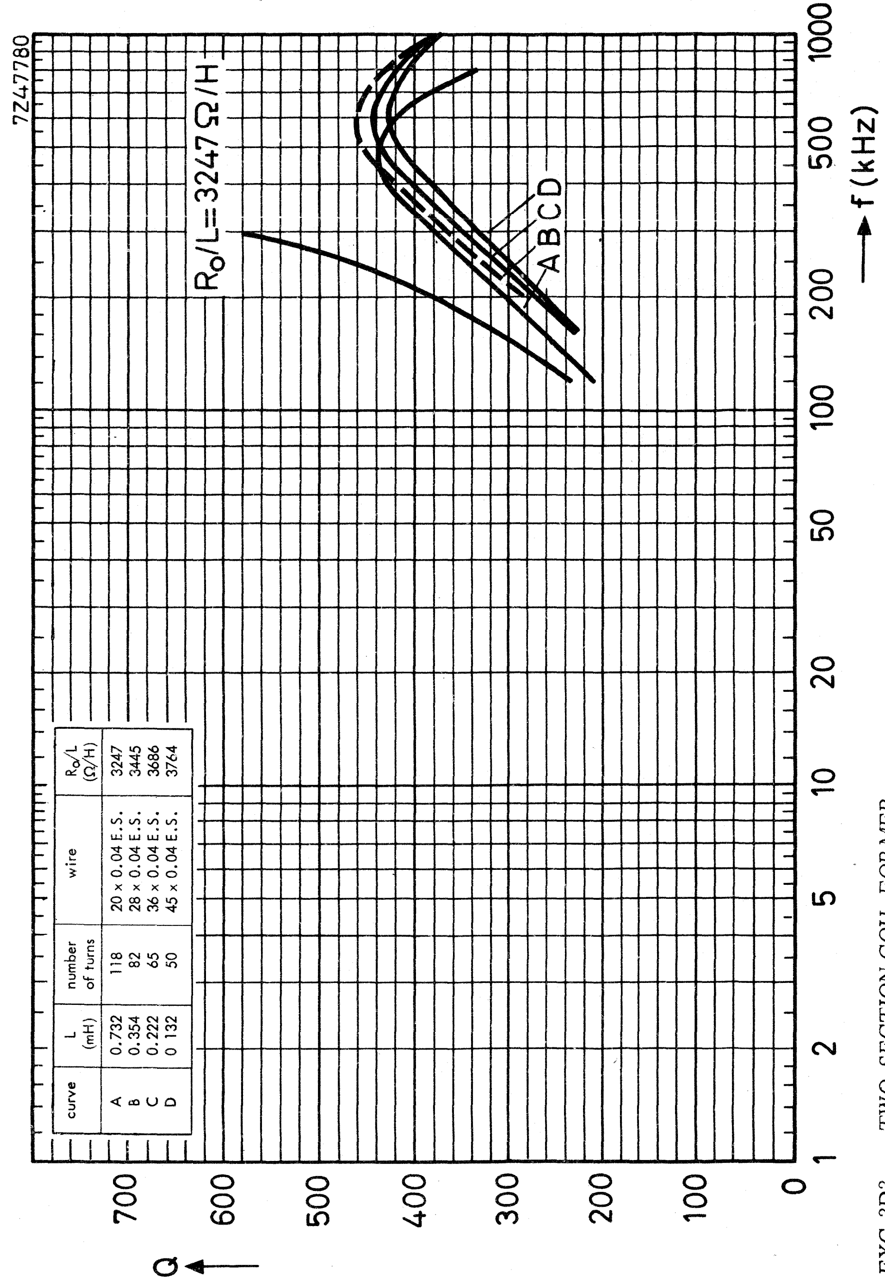
FXC 3D3
$\mu_e = 47$



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

FXC 3D3 SINGLE-SECTION COIL FORMER

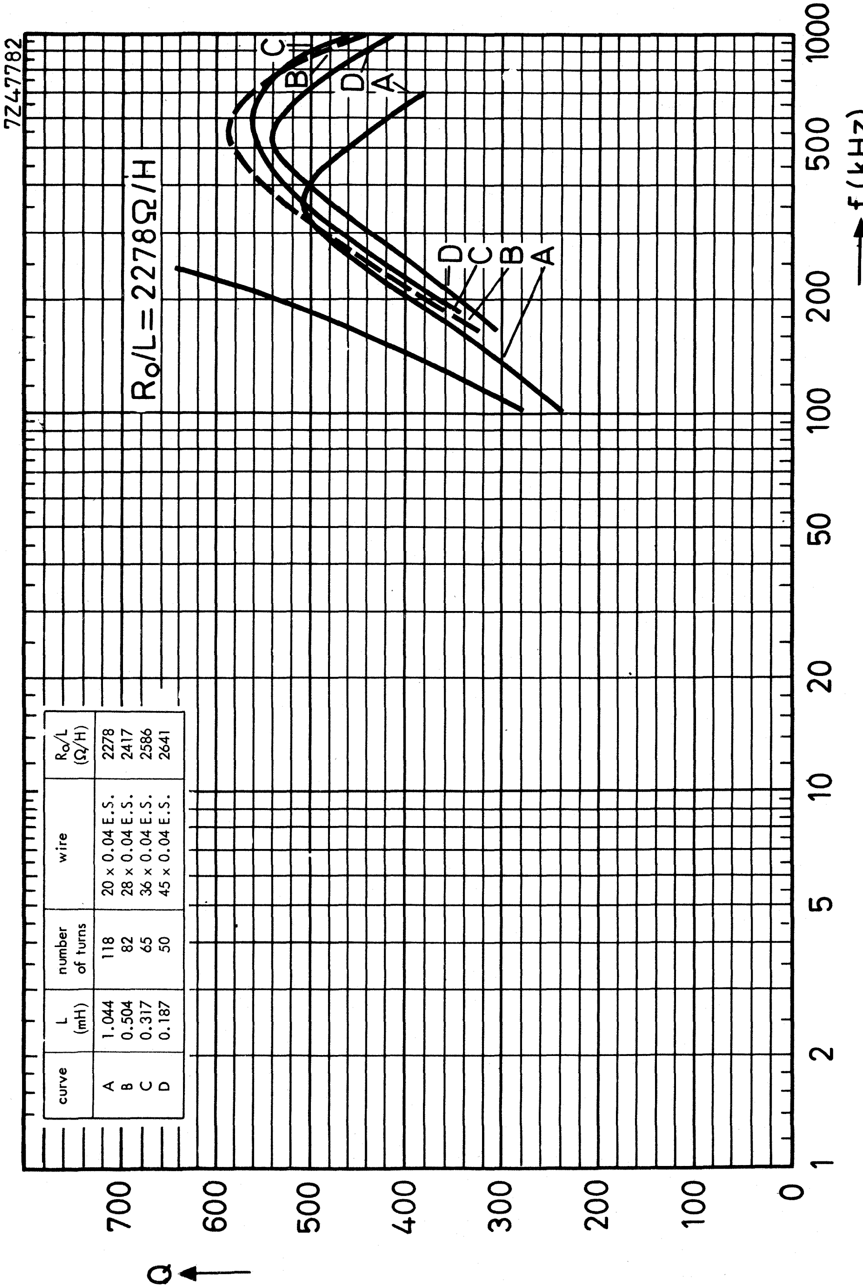
$\mu_e = 68$



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

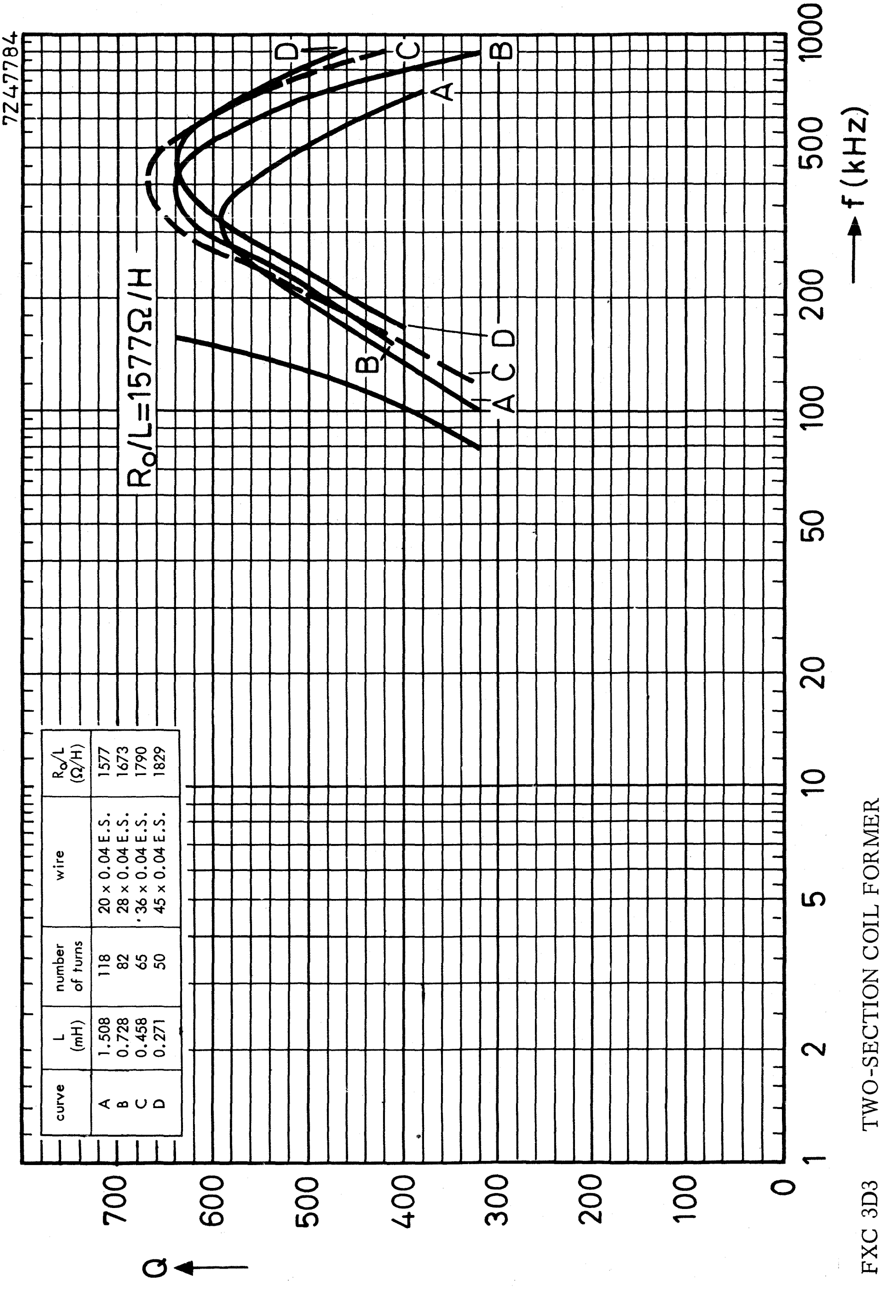
$\mu_e = 33$



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

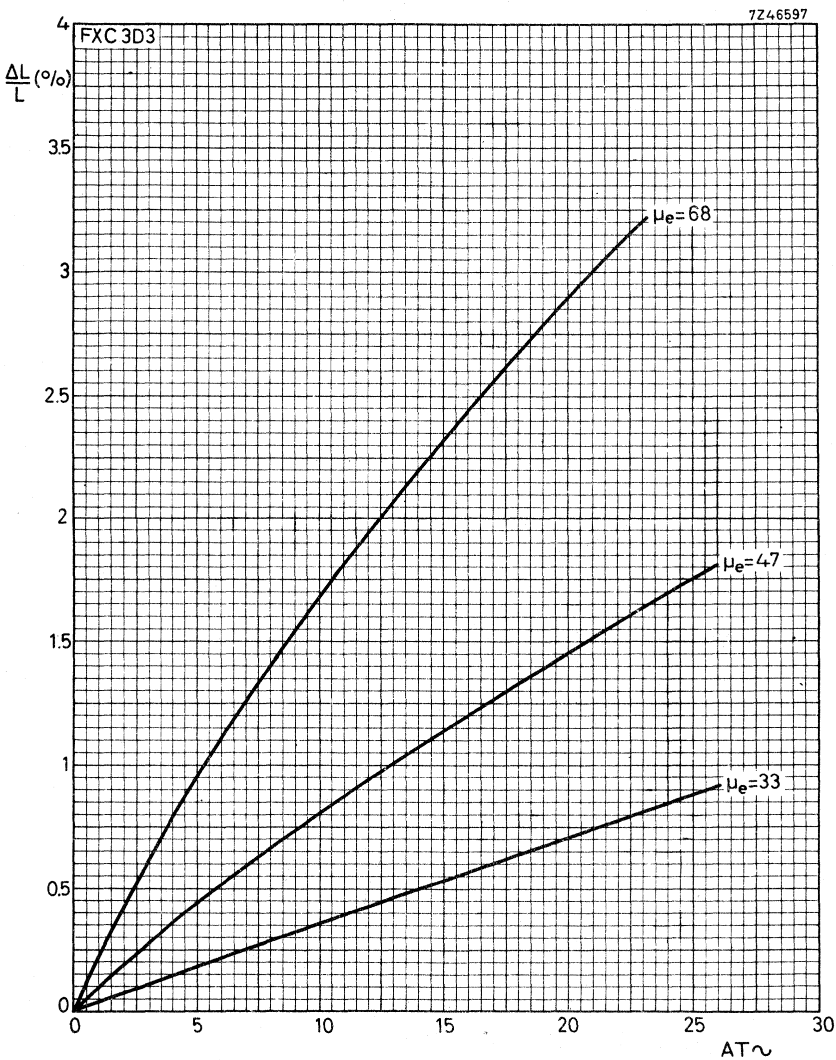
FXC 3D3
$\mu_e = 47$

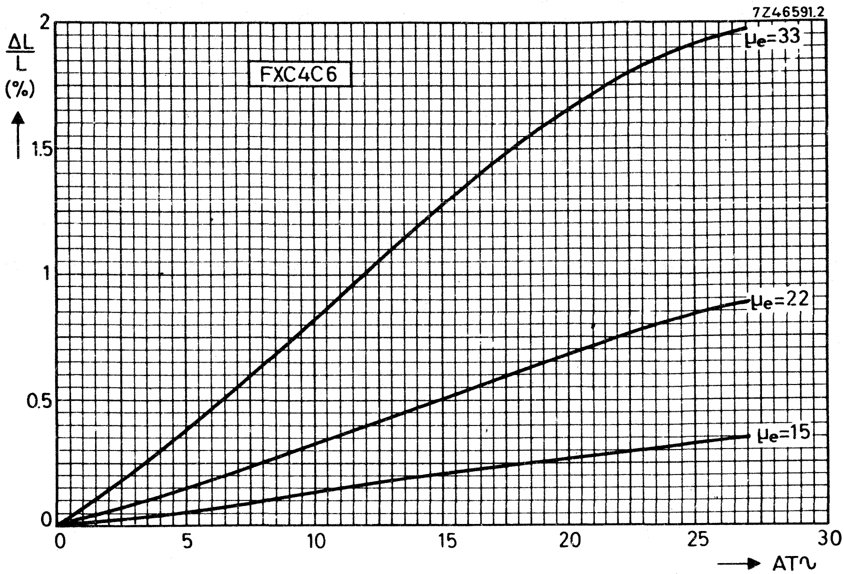


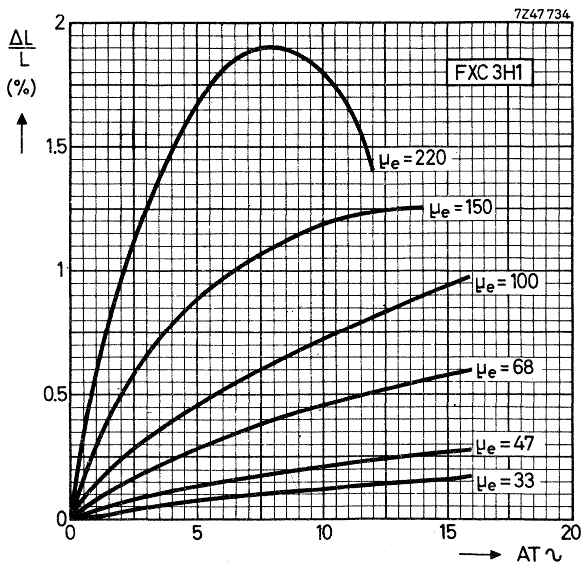
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.508	118	20 × 0.04 E.S.	1577
B	0.728	82	28 × 0.04 E.S.	1673
C	0.458	65	36 × 0.04 E.S.	1790
D	0.271	50	45 × 0.04 E.S.	1829

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

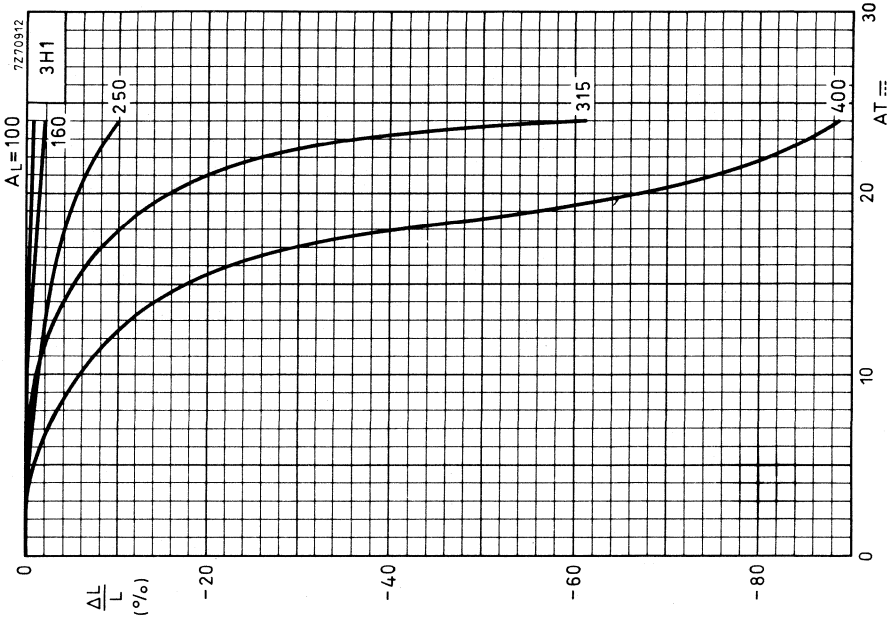
INDUCTANCE VARIATION AS A FUNCTION OF AT~

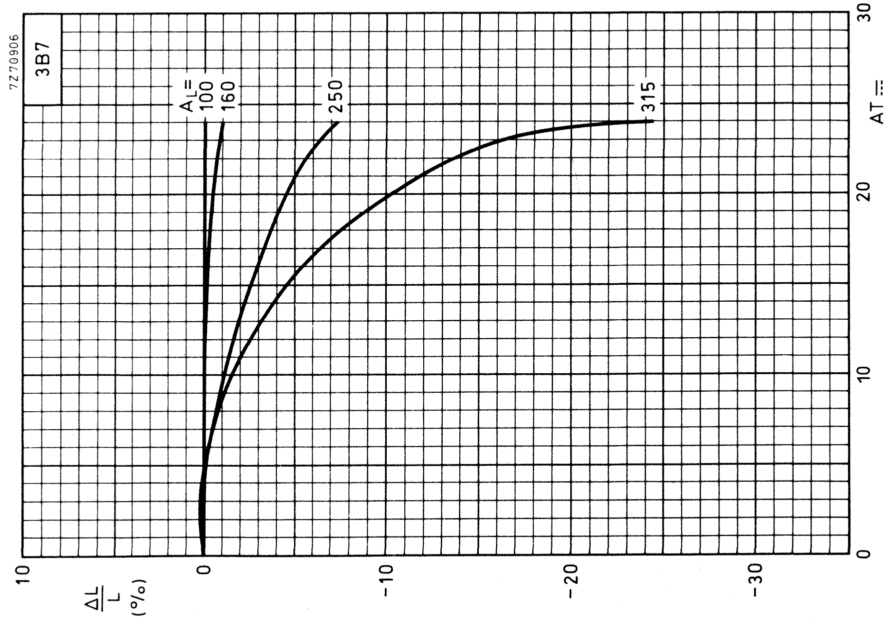


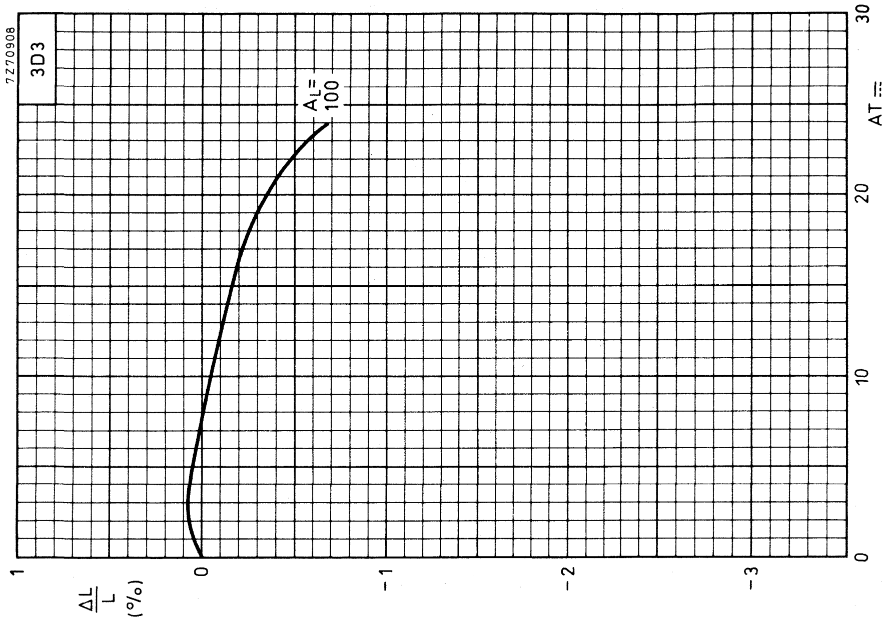

7Z46591.2
ΔL/L (%)
FXC4C6
μe=33
μe=22
μe=15
0
0.5
1
1.5
2
0
5
10
15
20
25
30
AT∿

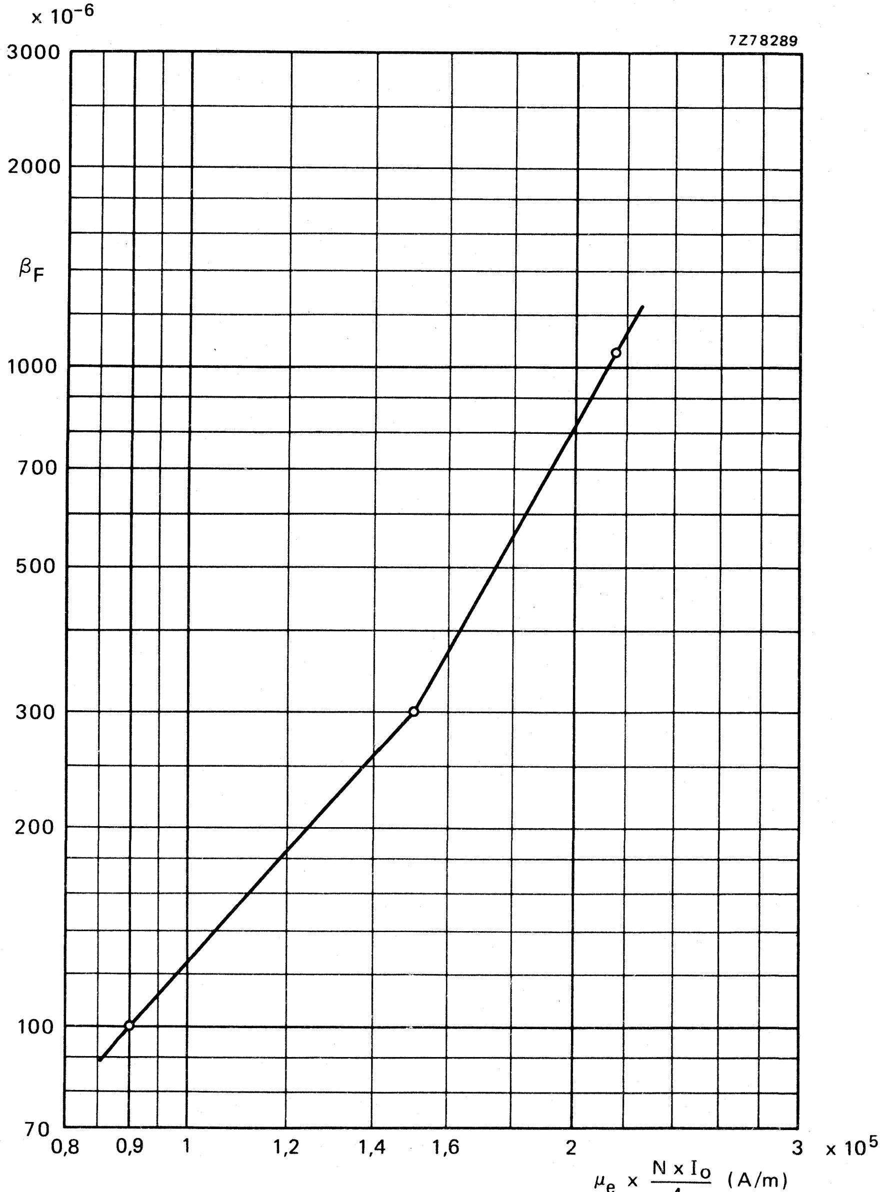

7Z47734
ΔL/L (%)
FXC 3H1
μe = 220
μe = 150
μe = 100
μe = 68
μe = 47
μe = 33
0
0.5
1
1.5
2
0
5
10
15
20
AT∿

INDUCTANCE VARIATION AS A FUNCTION OF AT






7Z70908
3D3
AL=
100
AT ⎓
0
10
20
30
ΔL/L
(%)
1
0
-1
-2
-3



$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

POTCORES

Three types of core can be supplied:

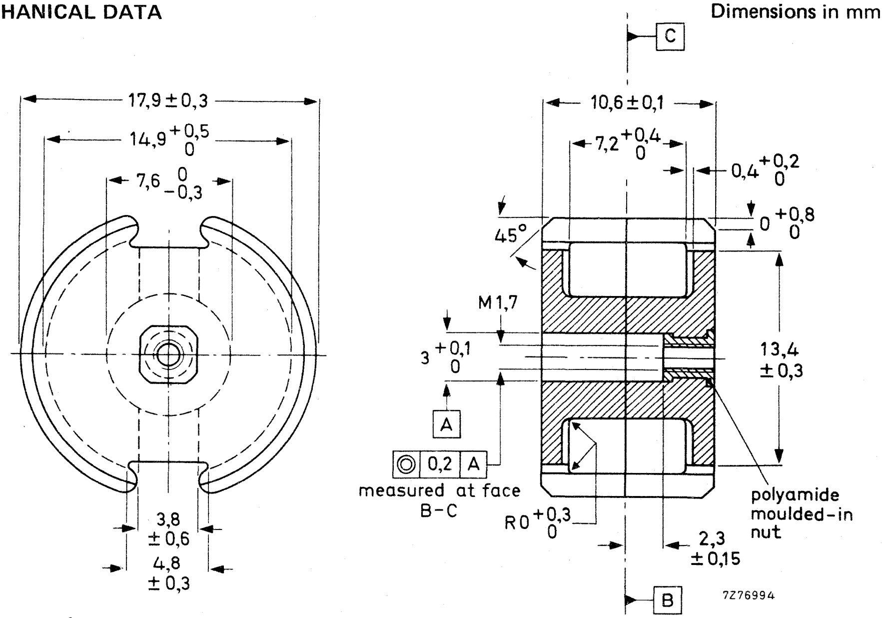
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (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 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut	⩾ 30 N
Torque of the screw thread	⩽ 0,8 N
Extraction force of adjuster from nut	⩾ 20 N

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}597\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0138\ mm^{-3}$; $V_e = 1120\ mm^3$; $l_e = 25{,}8$ mm; $A_e = 43{,}3\ mm^2$.

Mass of a core set: 6,4 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 100 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq.	$\hat{B}$	temp.	grade						
	kHz	mT	°C	3B7	3B8	3D3	3E1	3H1	3H3	4C6
A_L ± 25%	100	≤ 0,1	25 ± 1	3650	≥ 2310	1500	5900	3650	3300	260
μ_e ± 25%	100	≤ 0,1	25 ± 1	1750	≥ 1100	700	2800	1750	1575	125
α	100	≤ 0,1	25 ± 1	≤ 19,0	≤ 20,8	≤ 29,9	≤ 13,0	≤ 19,0	≤ 17,4	≤ 71,1
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1		≤ 1,5		≤ 2,5			
	30	≤ 0,1	25 ± 1						≤ 1,8	
	100	≤ 0,1	25 ± 1	≤ 5,0	≤ 6,0	≤ 8,0	≤ 20	≤ 5,0	≤ 2,6	
	500	≤ 0,1	25 ± 1			≤ 14	≤ 200			
	1 000	≤ 0,1	25 ± 1			≤ 30				
	2 000	≤ 0,1	25 ± 1							≤ 40
	10 000	≤ 0,1	25 ± 1							≤ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	≤ 1,1	≤ 1,0		≤ 1,8	≤ 0,86		
	30	1,5 to 3,0	25 ± 1						≤ 0,65	
	100	0,3 to 1,2	25 ± 1			≤ 1,8				≤ 6,2
$\alpha_F \times 10^6$/°C	≤ 100	≤ 0,1	5 to 25		0 to + 6			+ 0,5 to 1,5	+ 0,7 ± 0,25	−2 to + 4
	≤ 100	≤ 0,1	25 to 55		0 to + 6			+ 0,5 to 1,5	+ 0,7 ± 0,25	0 to + 6
	≤ 100	≤ 0,1	25 to 70	−0,6 to + 0,6		0 to + 2	0 to + 2			
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1	≤ 4,3	≤ 8,0	≤ 12	≤ 4,3	≤ 4,3	≤ 3,0 *	≤ 10
$\beta_F \times 10^6$, measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C: at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,00 x 10^5 A/m					≤ 120					
= 1,60 x 10^5 A/m					≤ 300					
= 2,30 x 10^5 A/m					≤ 1100					

* This value is valid within the temperature range of 25 to 70 °C.

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022					
		3B7	3B8	3D3	3H1	3H3	4C6
25 ± 1%	11,9						25810
40 ± 1%	19,0			25420			25820
63 ± 1%	30	25030		25430	25230		25830
100 ± 1%	47,5	25040		25440	25240		
160 ± 1%	76	25050		25450	25250		
250 ± 1,5%	119	25060			25260	25560	
315 ± 2%	149	25070			25270	25570	
400 ± 2%	190	25080	25940*		25280	25580	
630 ± 3%	298	25100			25300	25600	
1000 ± 5%	475				25310		
1250 ± 5%	593				25370*		

Core sets with nut and pre-adjusted on μ_e.

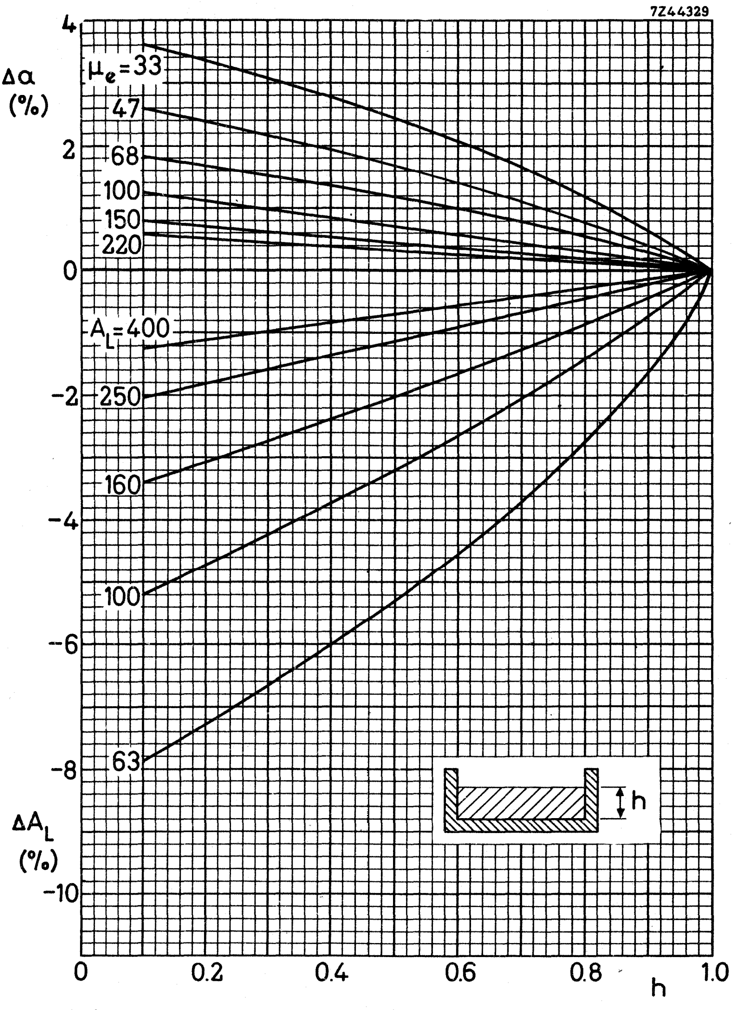
μ_e	α	catalogue number 4322 022					
		3B7	3B8	3D3	3H1	3H3	4C6
15 ± 1%	178						24810
22 ± 1%	147						24820
33 ± 1%	120	24030		24430	24230		24830
47 ± 1%	100,5	24040		24440	24240		
68 ± 1%	83,6	24050		24450	24250		
100 ± 1,5%	68,9	24060			24260		
150 ± 2%	56,3	24070			24270		
220 ± 3%	46,5	24080			24280		
705 ± 25%	25,9			24400*			
1750 ± 25%	16,5	24000*			24200*		

Core sets without nut: replace the eighth digit of the catalogue number (2) by 0.
Cores with $A_L \leqslant 160$, or $\mu_e \leqslant 68$, have a symmetrical air gap.
Cores with $A_L \geqslant 250$, or $\mu_e \geqslant 100$, have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut

Ferroxcube grade	catalogue number
3B7	4322 020 21500
3B8	4322 020 21670
3D3	4322 020 21520
3E1	4322 020 21640
3H1	4322 020 21510
3H3	4322 020 21650
4C6	4322 020 21610

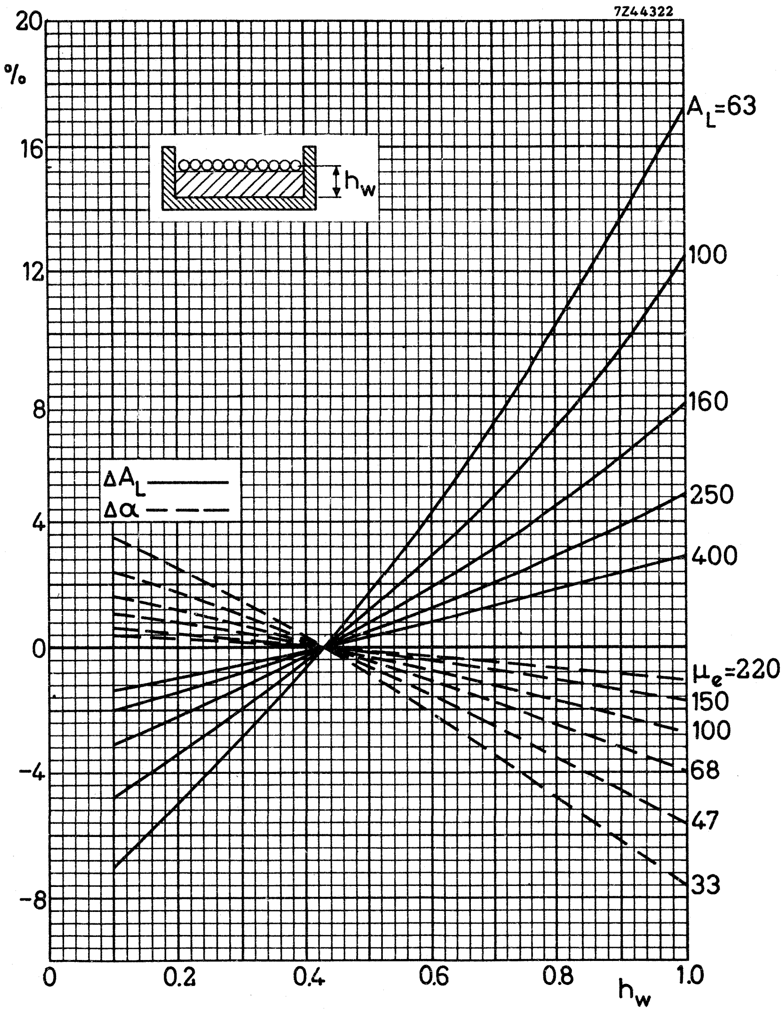
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



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

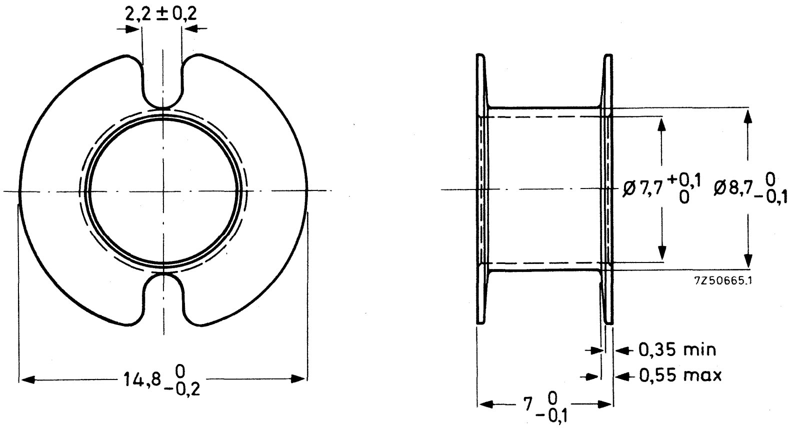
Three types of coil former can be supplied:

- with one section;
- with two sections;
- with three sections.

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

SINGLE-SECTION COIL FORMER

Dimensions in mm



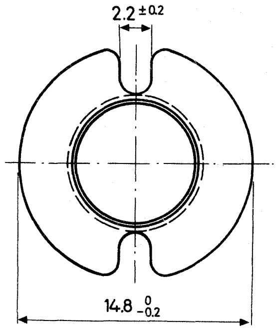
Catalogue number	4322 021 30270
Material	polycarbonate
Window area	18 mm^2
Mean length of turn	37 mm
Max. temperature	130 ^{o}C

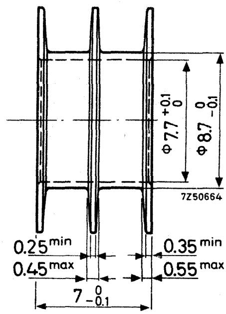
D.C. losses

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

Mass 0,35 g

TWO-SECTION COIL FORMER





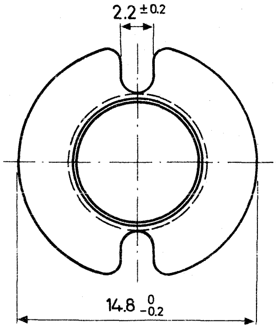
Catalogue number	4322 021 30280
Material	polycarbonate
Window area	2 x 8.7 mm^2
Mean length of turn	37 mm
Max. temperature	130 ^{o}C

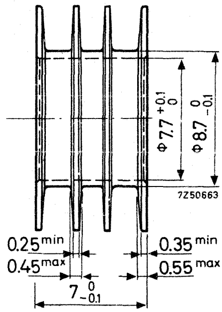
D.C. losses

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

Weight 0.35 g

THREE-SECTION COIL FORMER





Catalogue number	4322 021 30290
Material	polycarbonate
Window area	3 x 5.4 mm²
Mean length of turn	37 mm
Max. temperature	130 °C

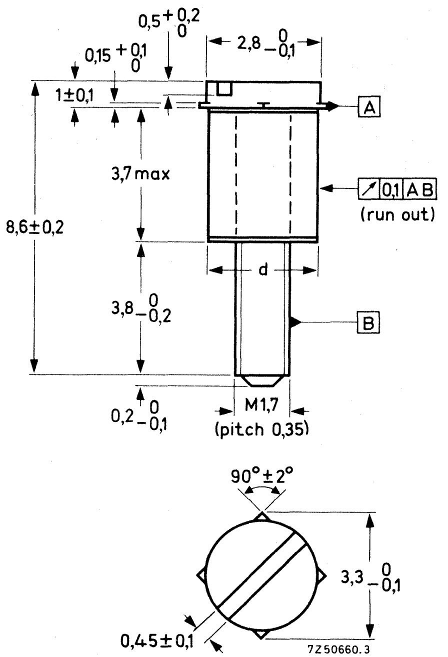
D.C. losses

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

Weight 0.4 g

INDUCTANCE ADJUSTERS

Dimensions in mm



See next page for diameter, d, of magnetic tubes.

The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 an continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

Table 2 shows the type of adjuster recommended for different potcores.

Table 1, available types

d mm	colour	catalogue number
2,5 −0,02	white	4322 021 32130
2,7 −0,02	brown	4322 021 32140
2,77−0,02	black	4322 021 32150
2,7 −0,02	green	4322 021 32160
2,7 −0,02	red	4322 021 32170

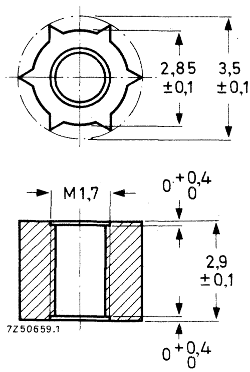
The adjusters are packed in bags of 100. Please order in multiples of this quantity.

Table 2, recommended application

μ_e	A_L	3B7/3H1/3D3	4C6
		cat. number 4322 021	
15			32160
	25		32160
	40		32160
22			32160
	63	32160	
33		32160	32170
	100	32160	
47		32160	
68		32170	
	160	32170	
	250	32130	
100		32130	
	315	32140	
150		32140	
	400	32150	
220		32150	
	630	32150	

LOOSE NUT FOR ADJUSTER

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

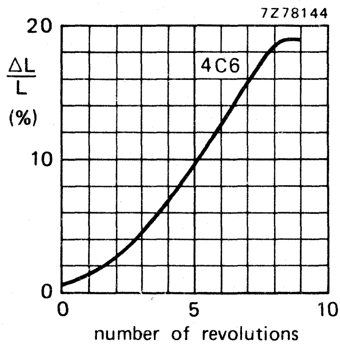


Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2,3 ± 0,15 mm

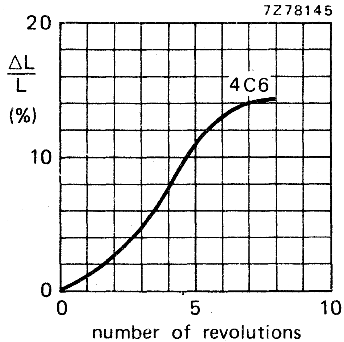
For more information see Potcores General, inductance adjustment.

Dimensions in mm

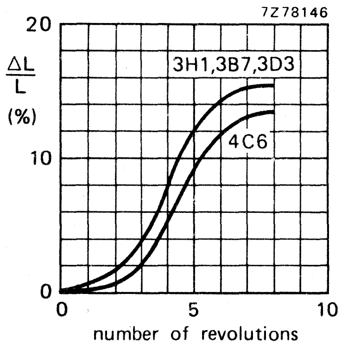
ADJUSTMENT CURVES



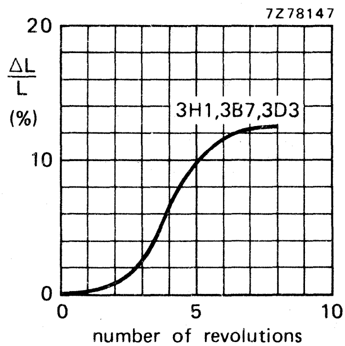
$\mu_e = 15$
Adjuster 4322 021 32160



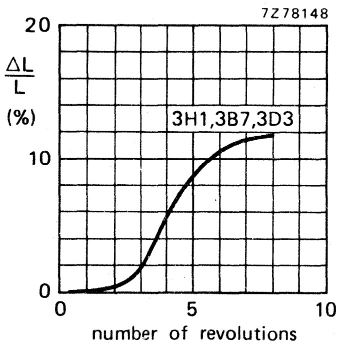
$\mu_e = 22$
Adjuster 4322 021 32160



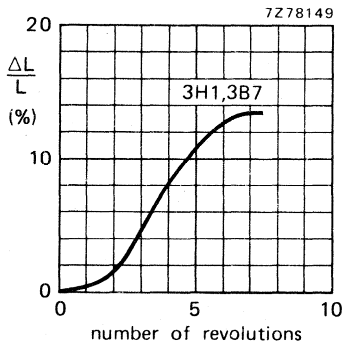
$\mu_e = 33$
Adjuster 4322 021 32160 for 3B7, 3H1 and 3D3
4322 021 32170 for 4C6



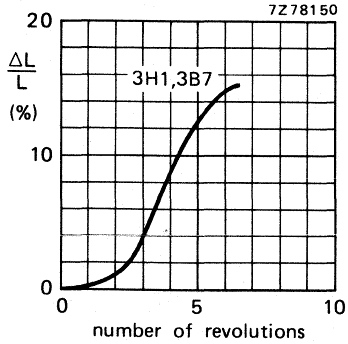
$\mu_e = 47$
Adjuster 4322 021 32160



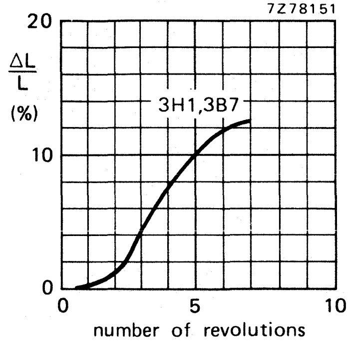
$\mu_e = 68$
Adjuster 4322 021 32170



$\mu_e = 100$
Adjuster 4322 021 32130



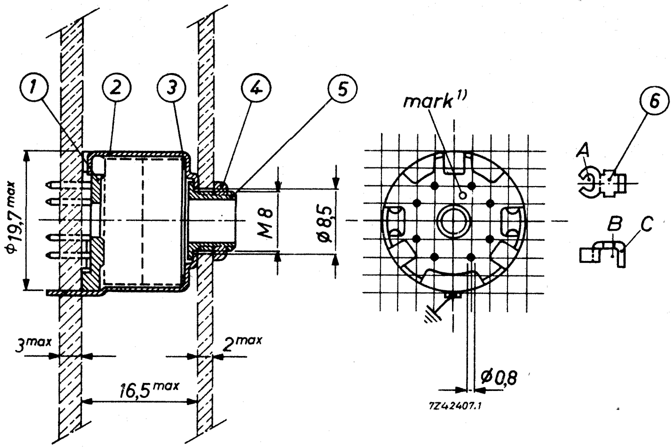
μ_e = 150
Adjuster 4322 021 32140



μ_e = 220
Adjuster 4322 021 32150

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, 54 mm (0, 1 inch). 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 that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

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

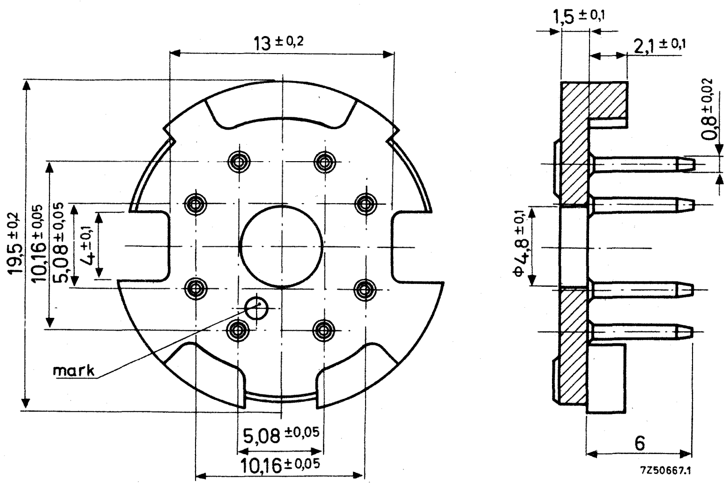
PART DRAWINGS

Dimensions in mm

(1) Tag plate 4322 021 30450

Plate : polyester reinforced with glass fibre, resistant against dip-soldering at 400°C for 2 s.

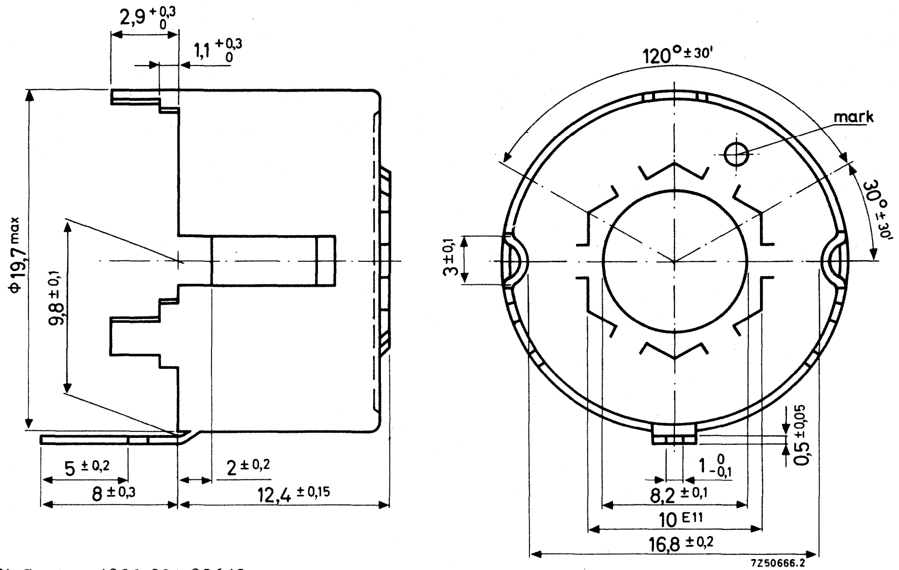
Pins : phosphor-bronze, dip-soldered.



The tag plates are packed in units of 75 pieces on a polystyrene plate, and with 5 plates to a cardboard box. Please order in multiples of these quantities.

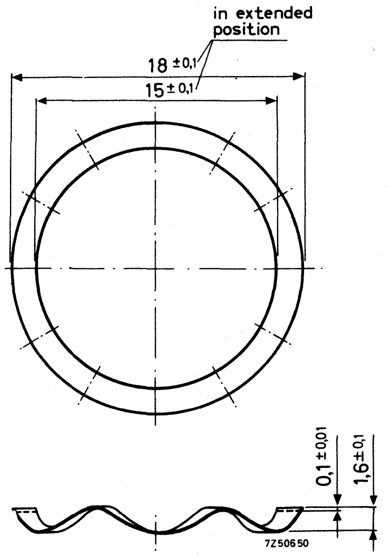
(2) Container 4322 021 30530

Material: brass, nickel plated; tinned soldering pin



(3) Spring 4322 021 30640

Material: chrome-nickel steel

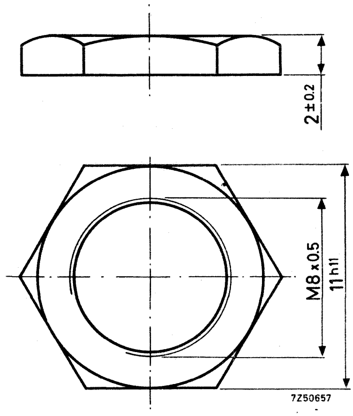


A force of 68 to 113 N is required to compress the spring to 0, 55 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

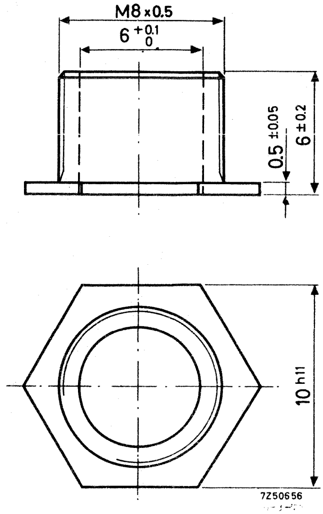
(4) Nut 4322 021 30710

Material : brass, nickel plated



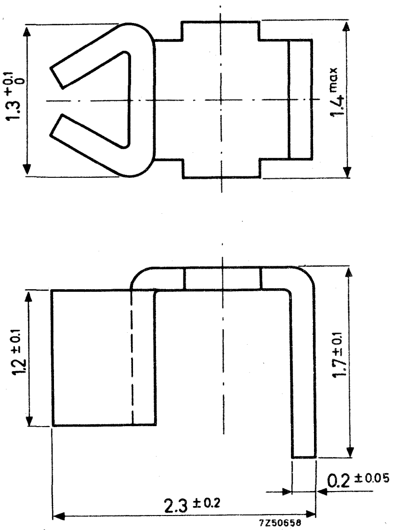
(5) Fixing bush 4322 021 30720

Material : brass, nickel plated



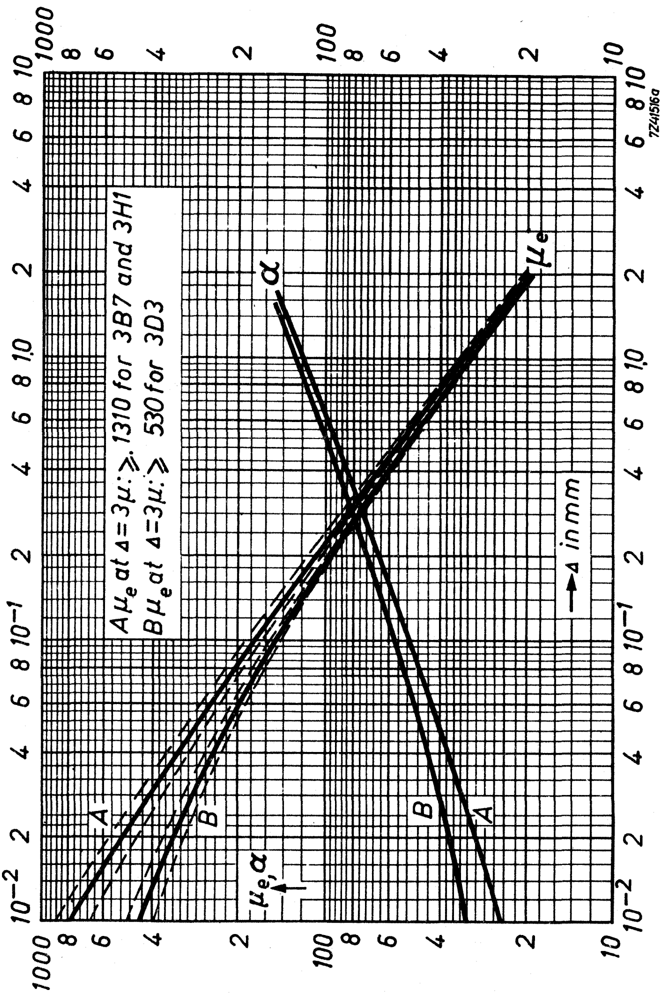
(6) Soldering spring 4322 021 30700

Material : brass, dipsoldered



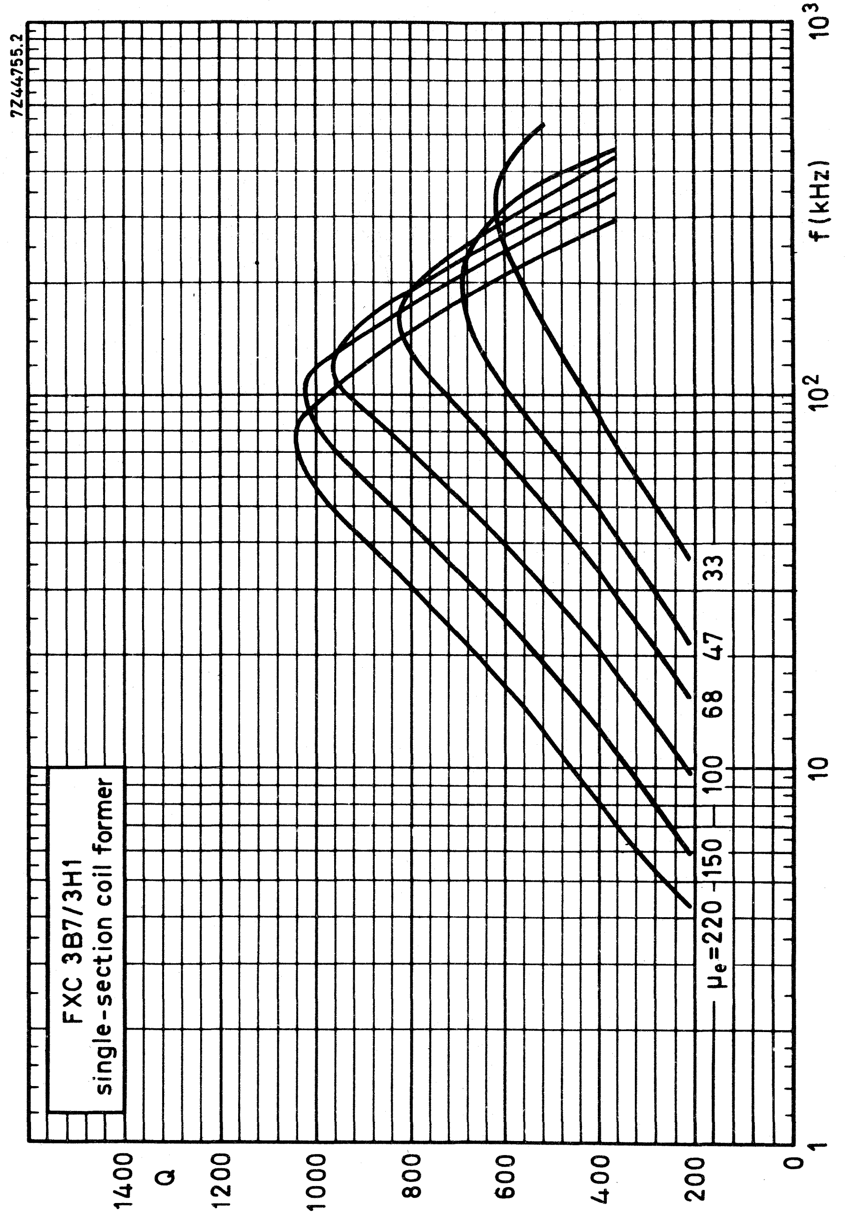
CHARACTERISTIC CURVES

μ_e - α CURVES

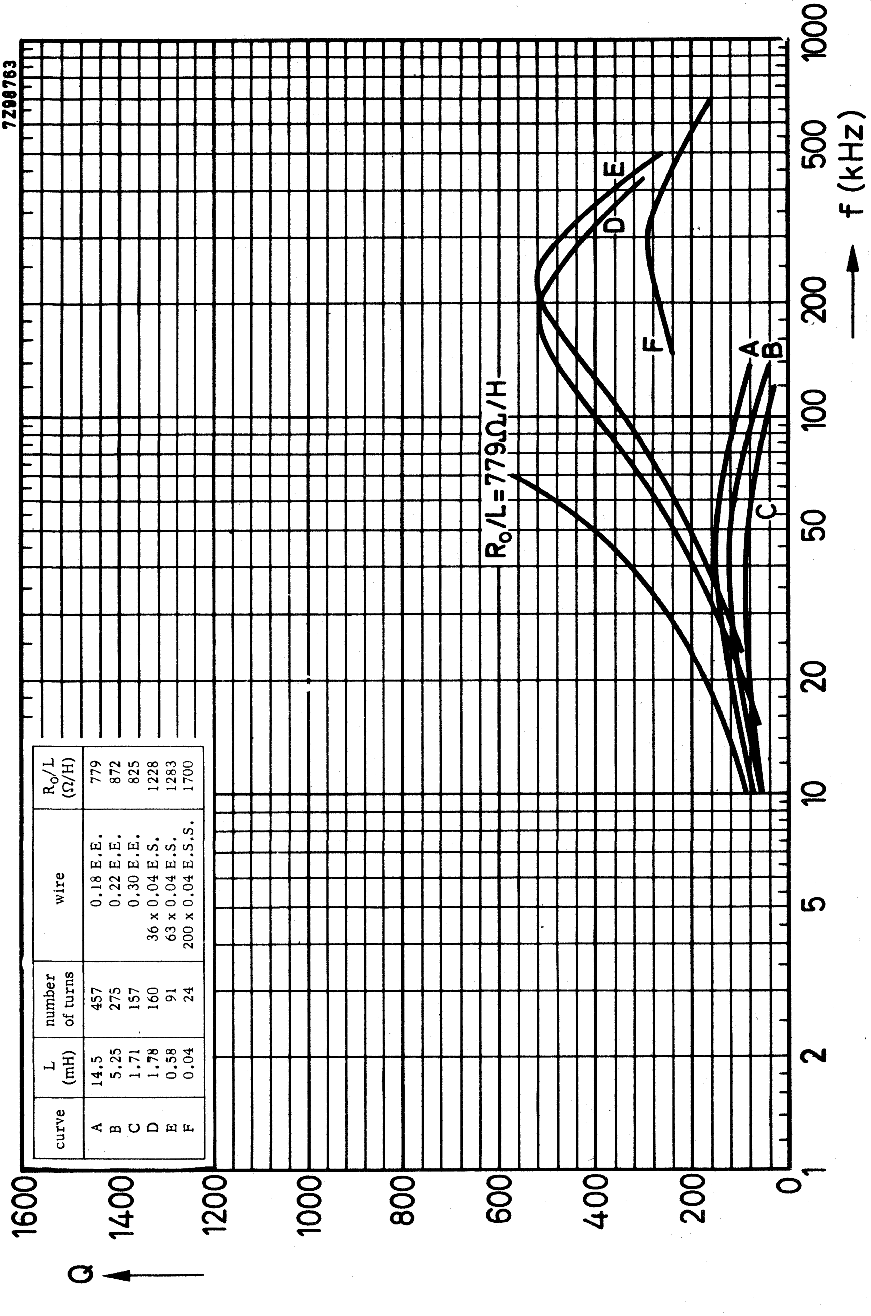


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7/3H1



Enveloping curves

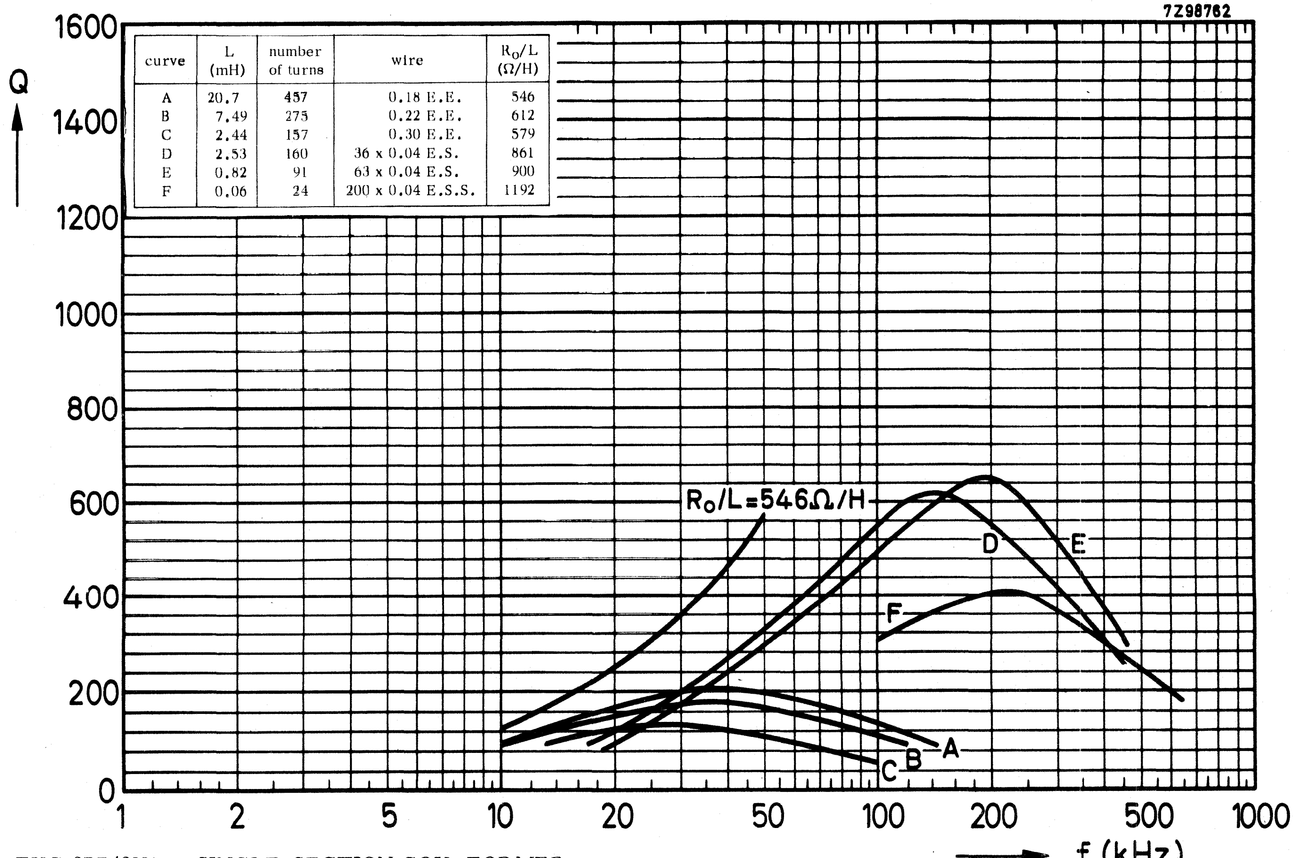


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	14.5	457	0.18 E.E.	779
B	5.25	275	0.22 E.E.	872
C	1.71	157	0.30 E.E.	825
D	1.78	160	36 x 0.04 E.S.	1228
E	0.58	91	63 x 0.04 E.S.	1283
F	0.04	24	200 x 0.04 E.S.S.	1700

FXC3B7/3H1 SINGLE-SECTION COIL FORMER

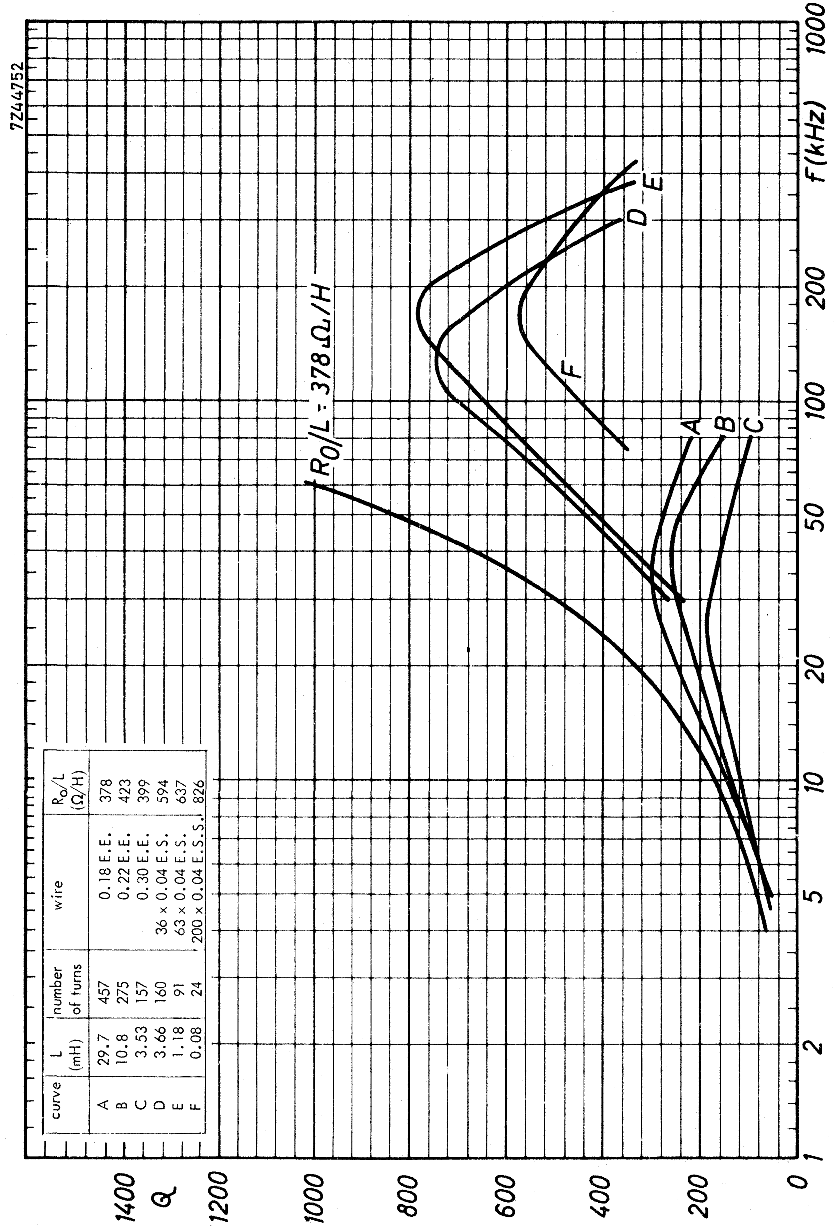
$\mu_e = 33$

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



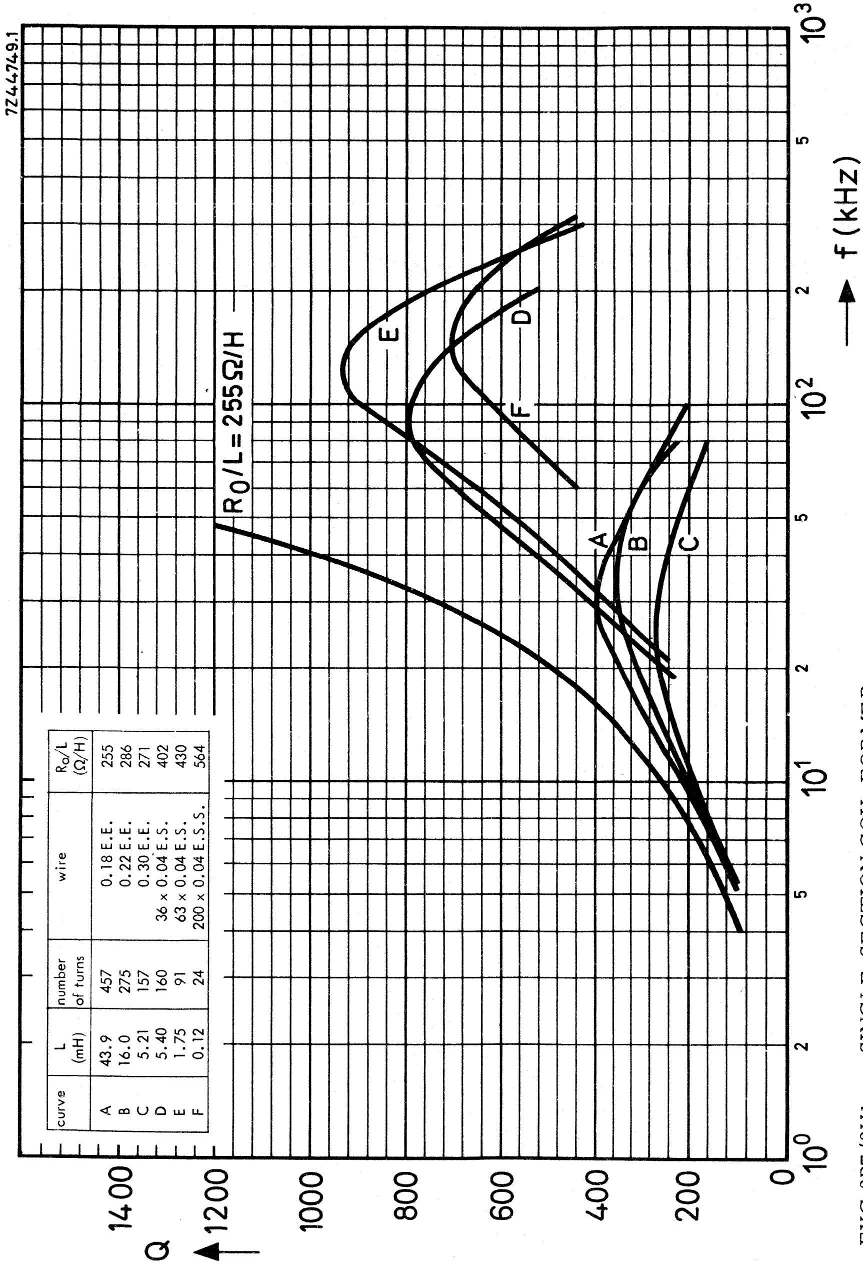
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

$\mu_e = 47$



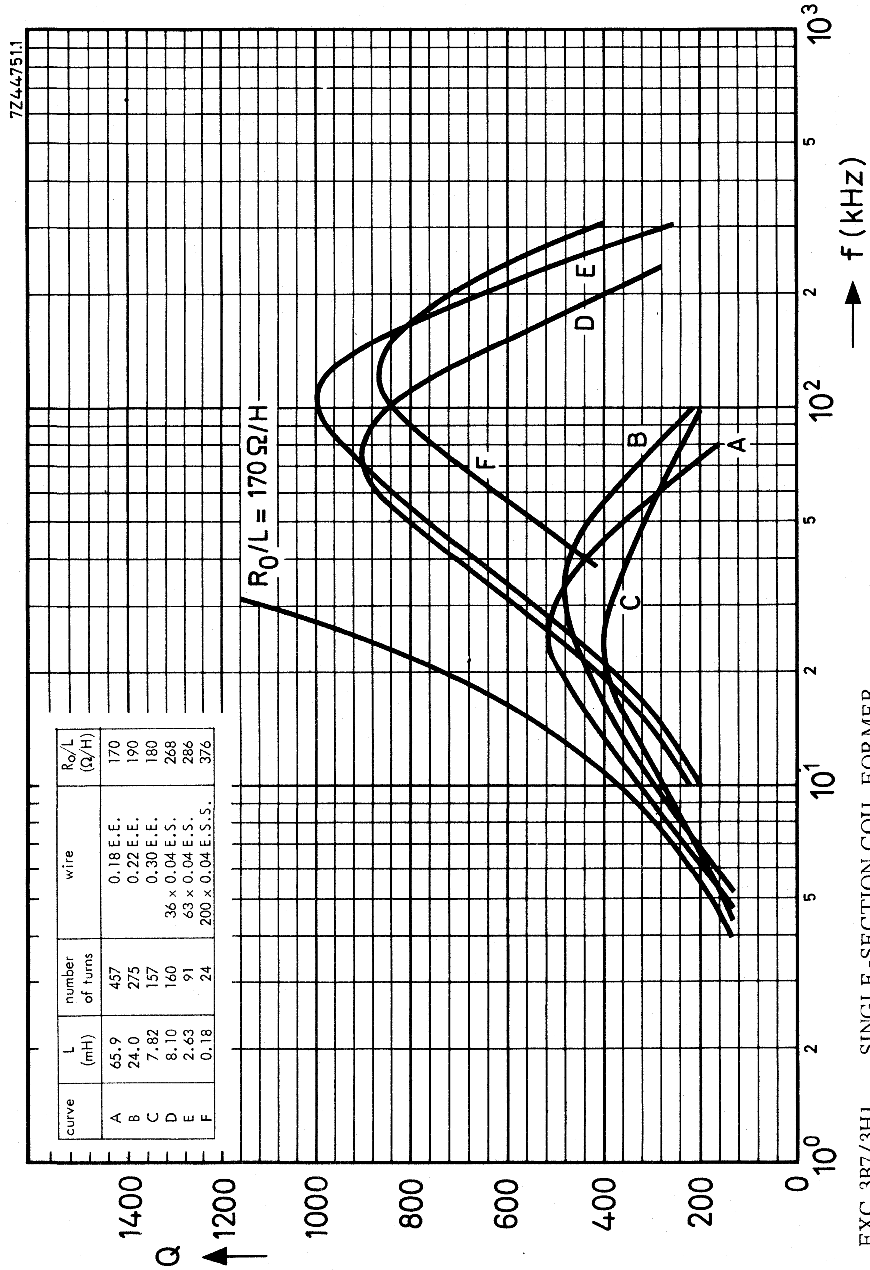
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	29.7	457	0.18 E.E.	378
B	10.8	275	0.22 E.E.	423
C	3.53	157	0.30 E.E.	399
D	3.66	160	36 × 0.04 E.S.	594
E	1.18	91	63 × 0.04 E.S.	637
F	0.08	24	200 × 0.04 E.S.S.	826

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

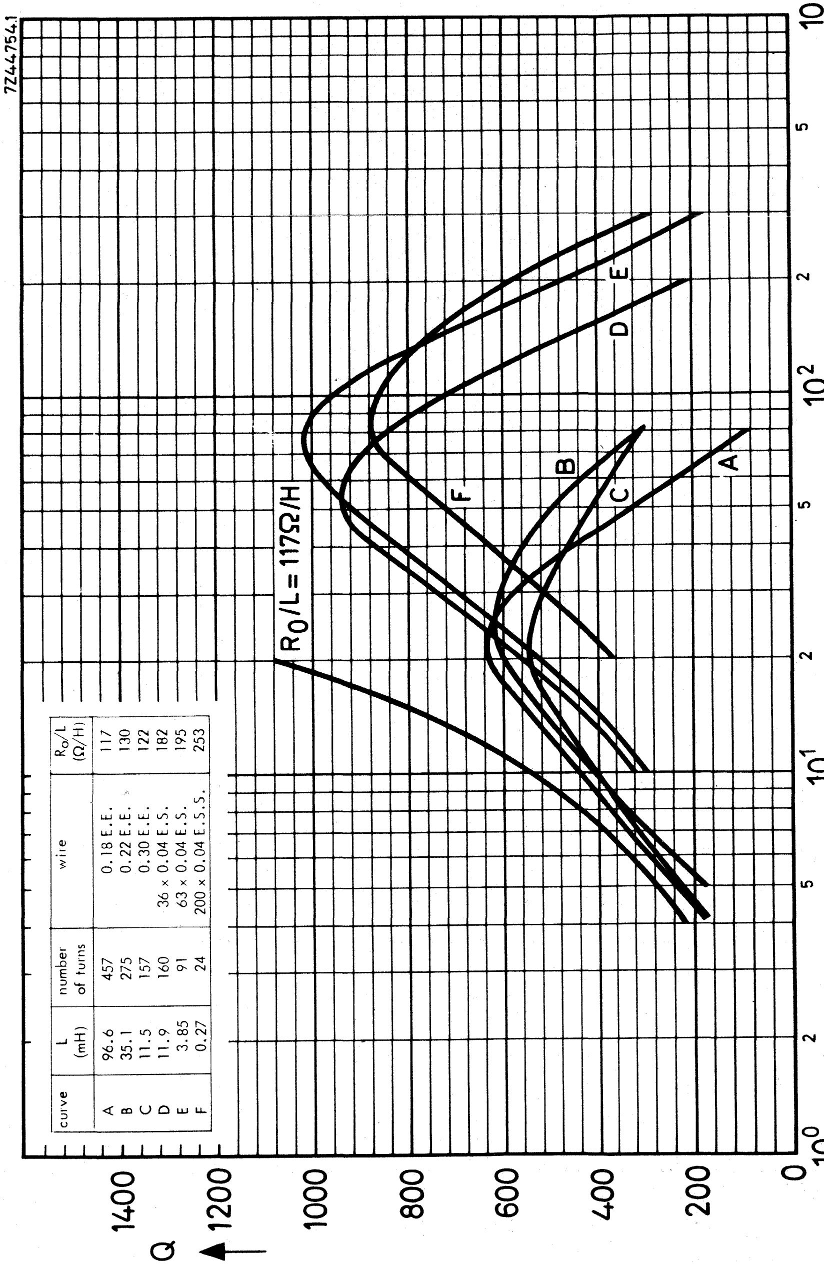
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 100$



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

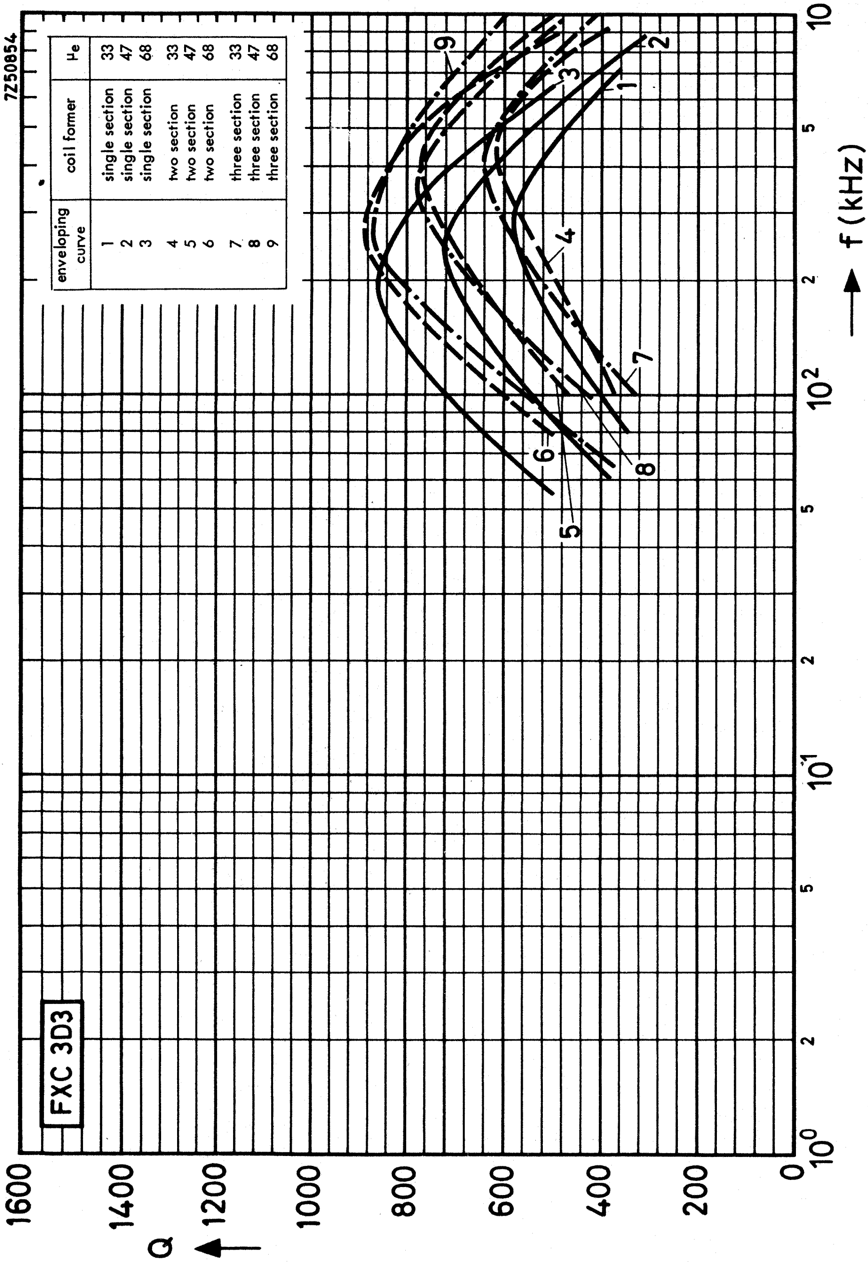
$\mu_e = 150$



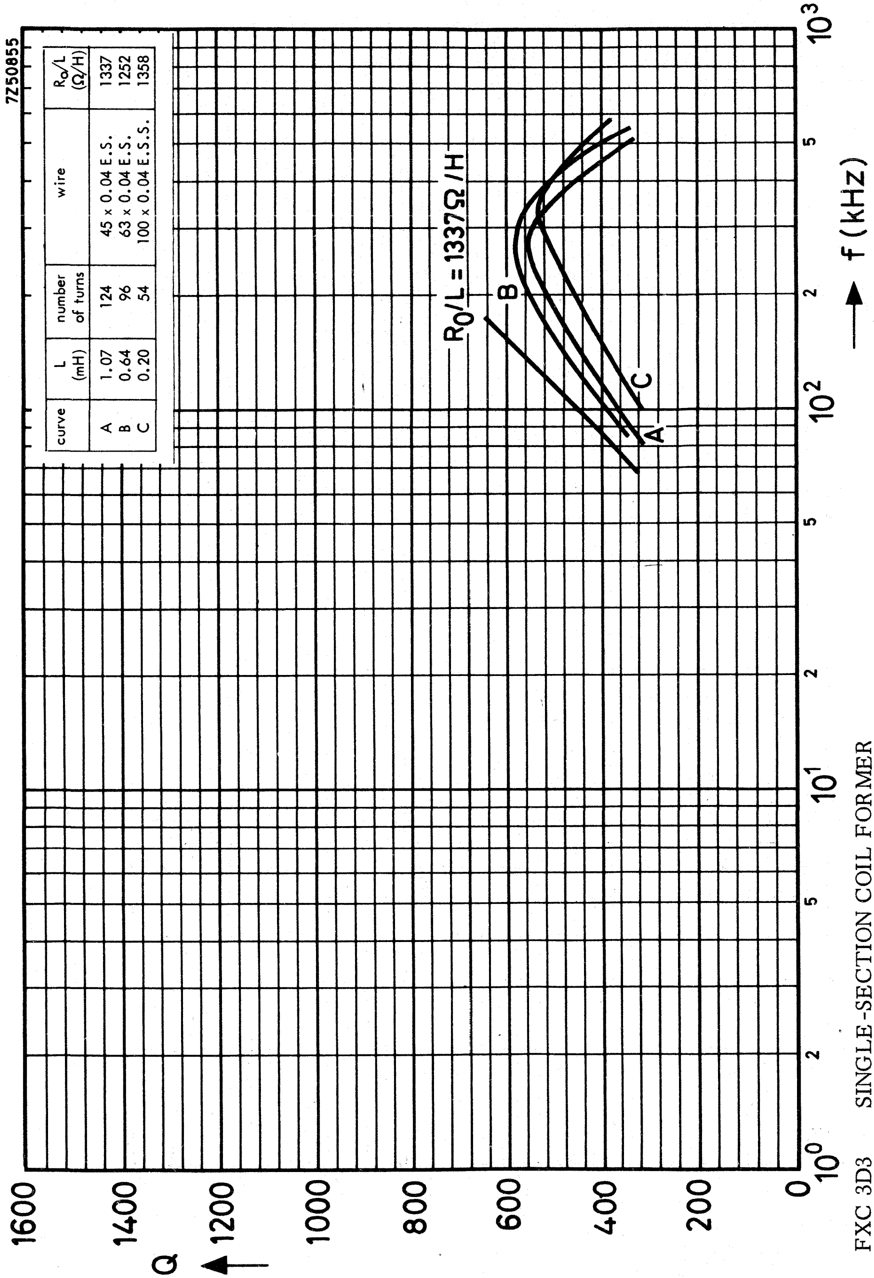
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	96.6	457	0.18 E.E.	117
B	35.1	275	0.22 E.E.	130
C	11.5	157	0.30 E.E.	122
D	11.9	160	36 × 0.04 E.S.	182
E	3.85	91	63 × 0.04 E.S.	195
F	0.27	24	200 × 0.04 E.S.S.	253

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

TYPICAL Q-CURVES FOR FXC 3D3

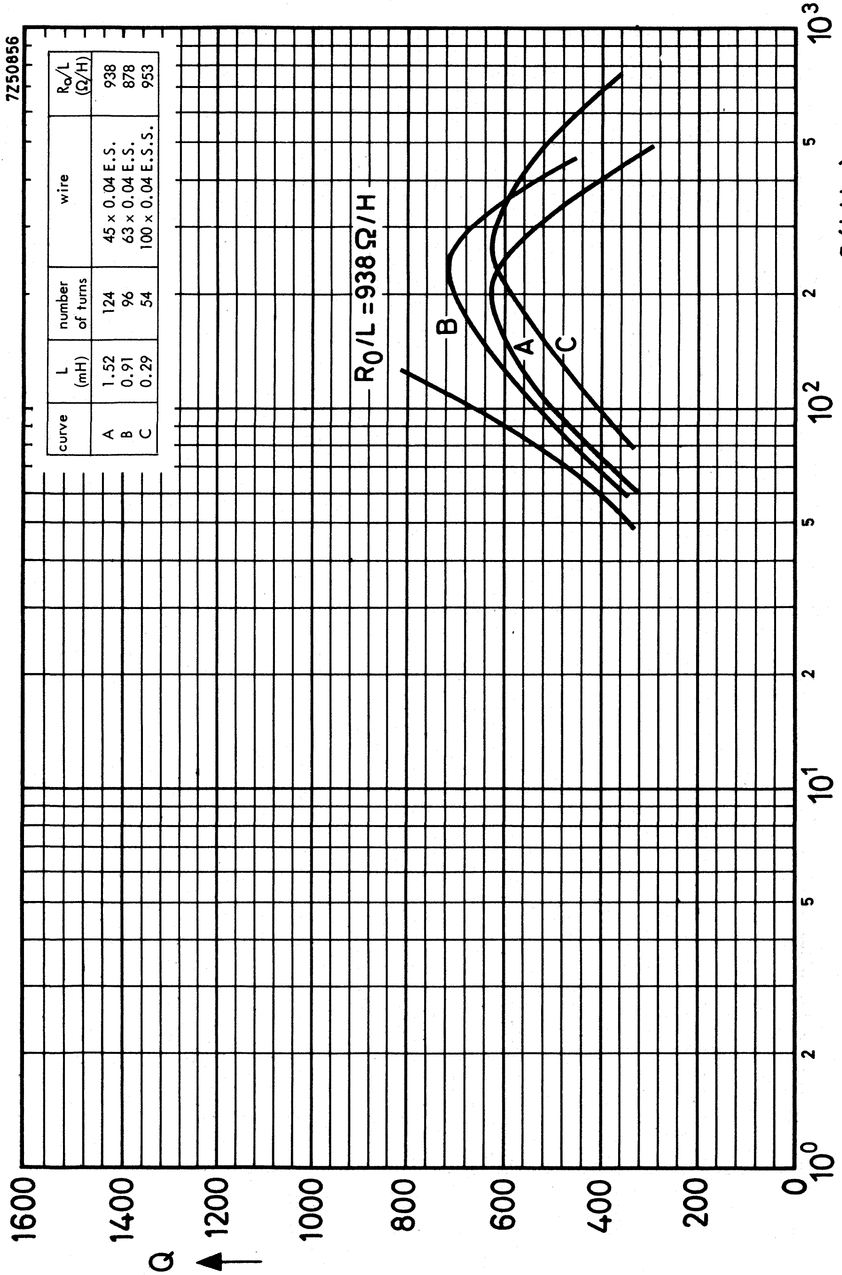


Enveloping curves

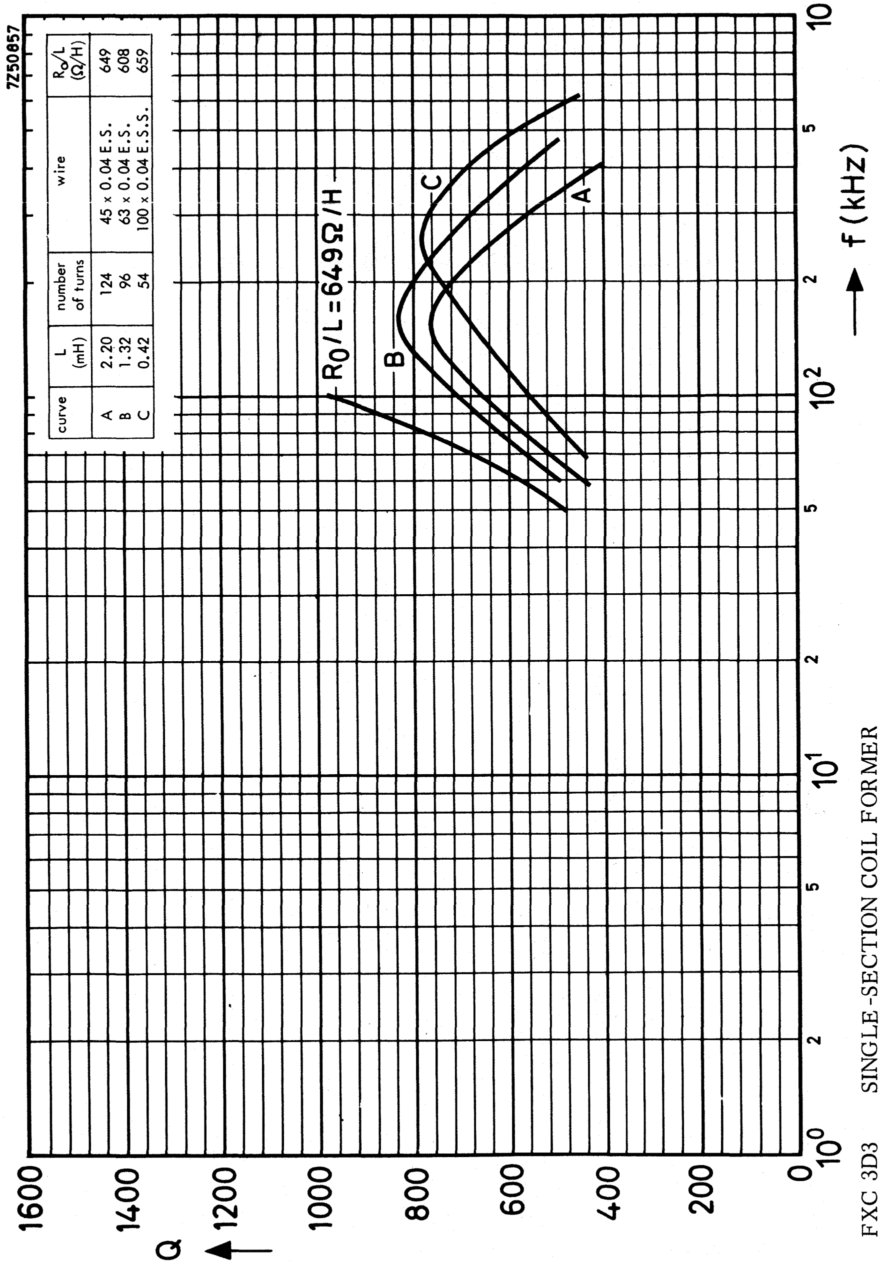


curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	1.07	124	45 x 0.04 E.S.	1337
B	0.64	96	63 x 0.04 E.S.	1252
C	0.20	54	100 x 0.04 E.S.S.	1358

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

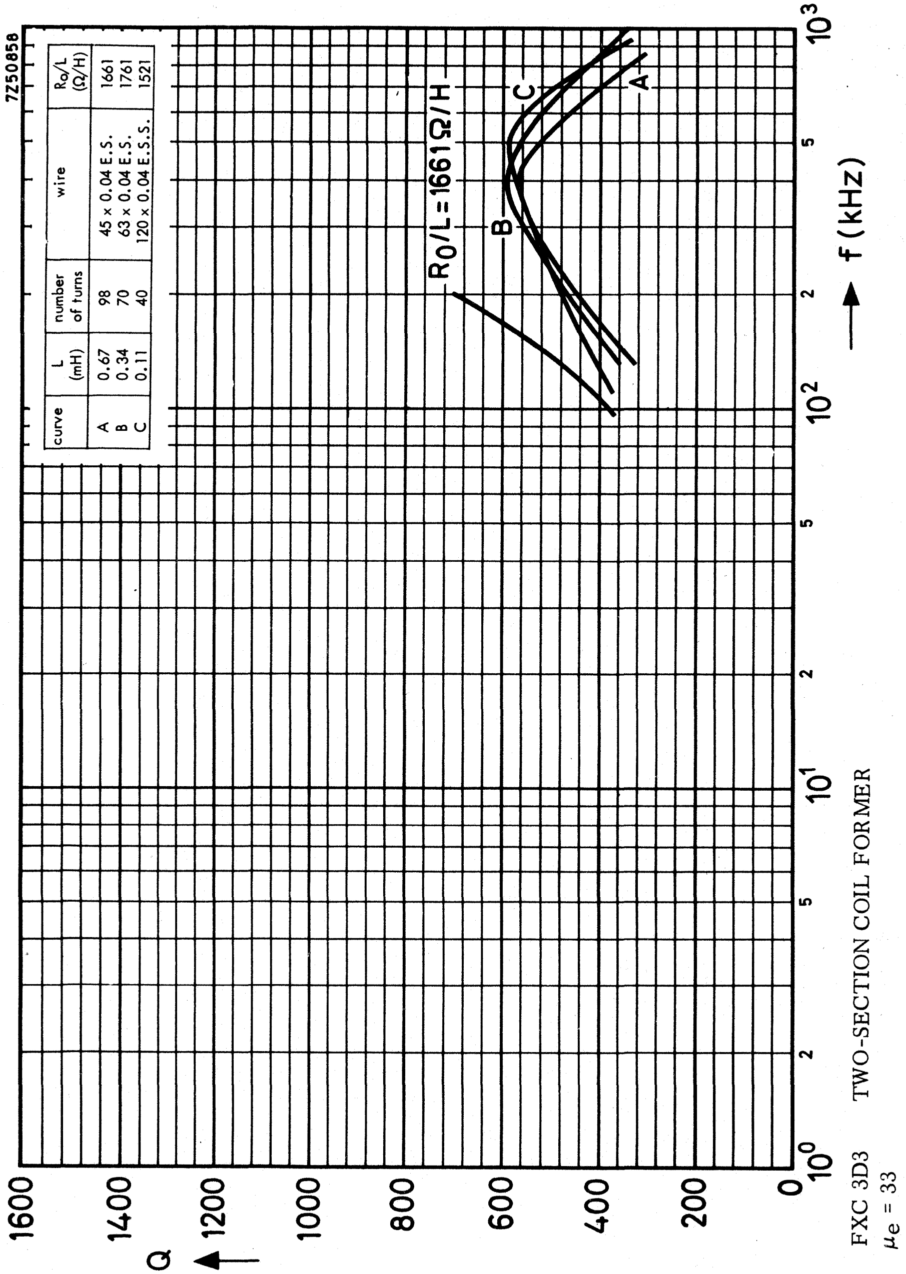


FXC 3D3 SINGLE-SECTION COIL FORMER
$\mu_e = 47$



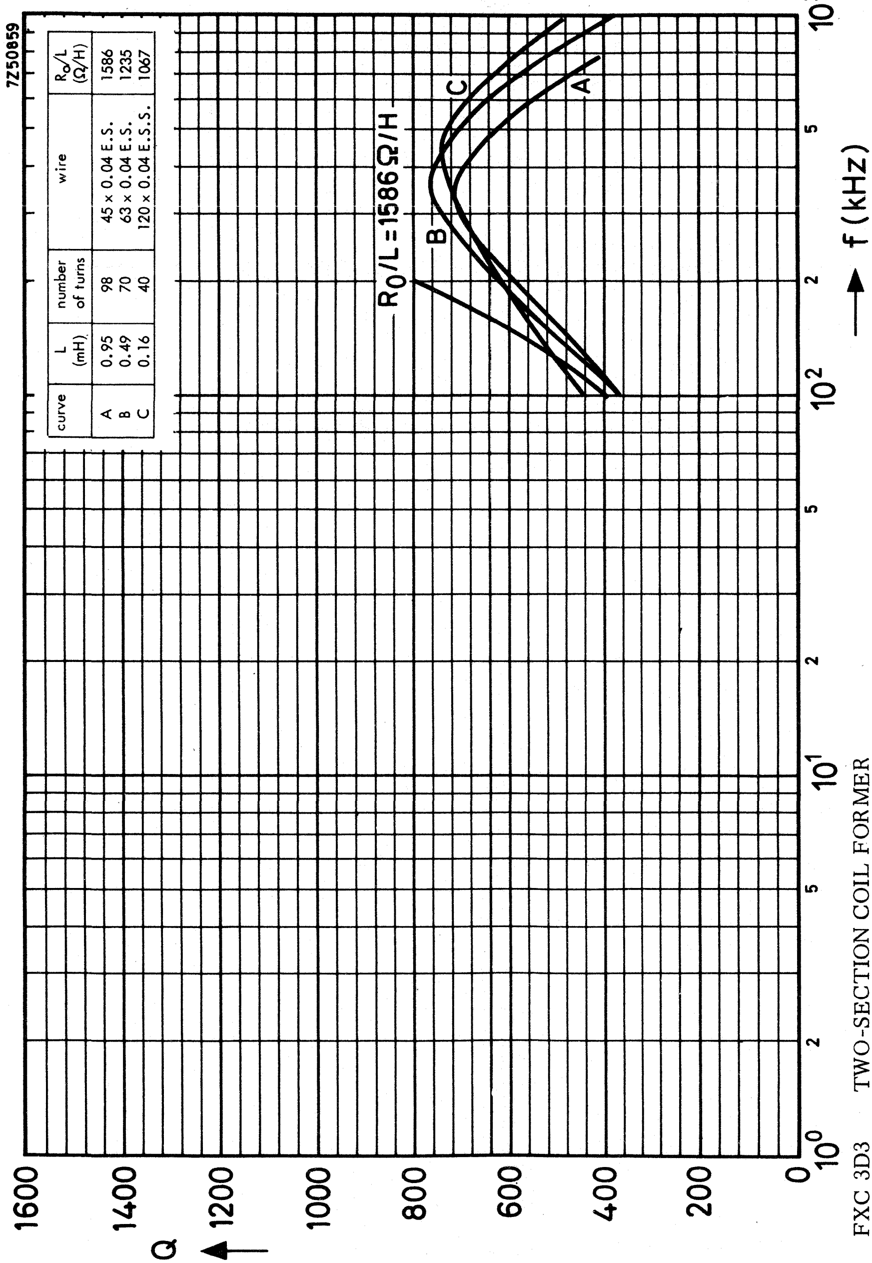
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	2.20	124	45 x 0.04 E.S.	649
B	1.32	96	63 x 0.04 E.S.	608
C	0.42	54	100 x 0.04 E.S.S.	659

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



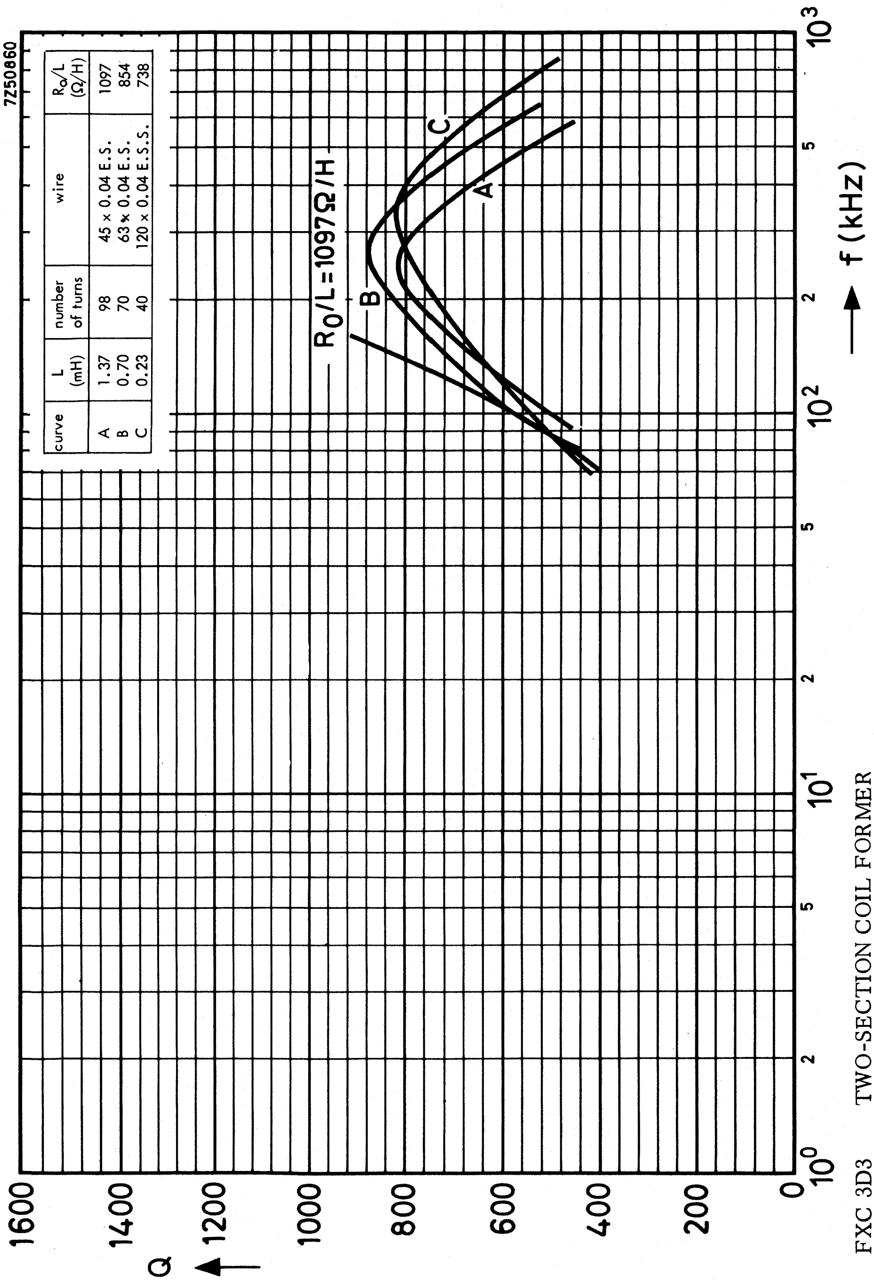
TWO-SECTION COIL FORMER

FXC 3D3
$\mu_e = 33$



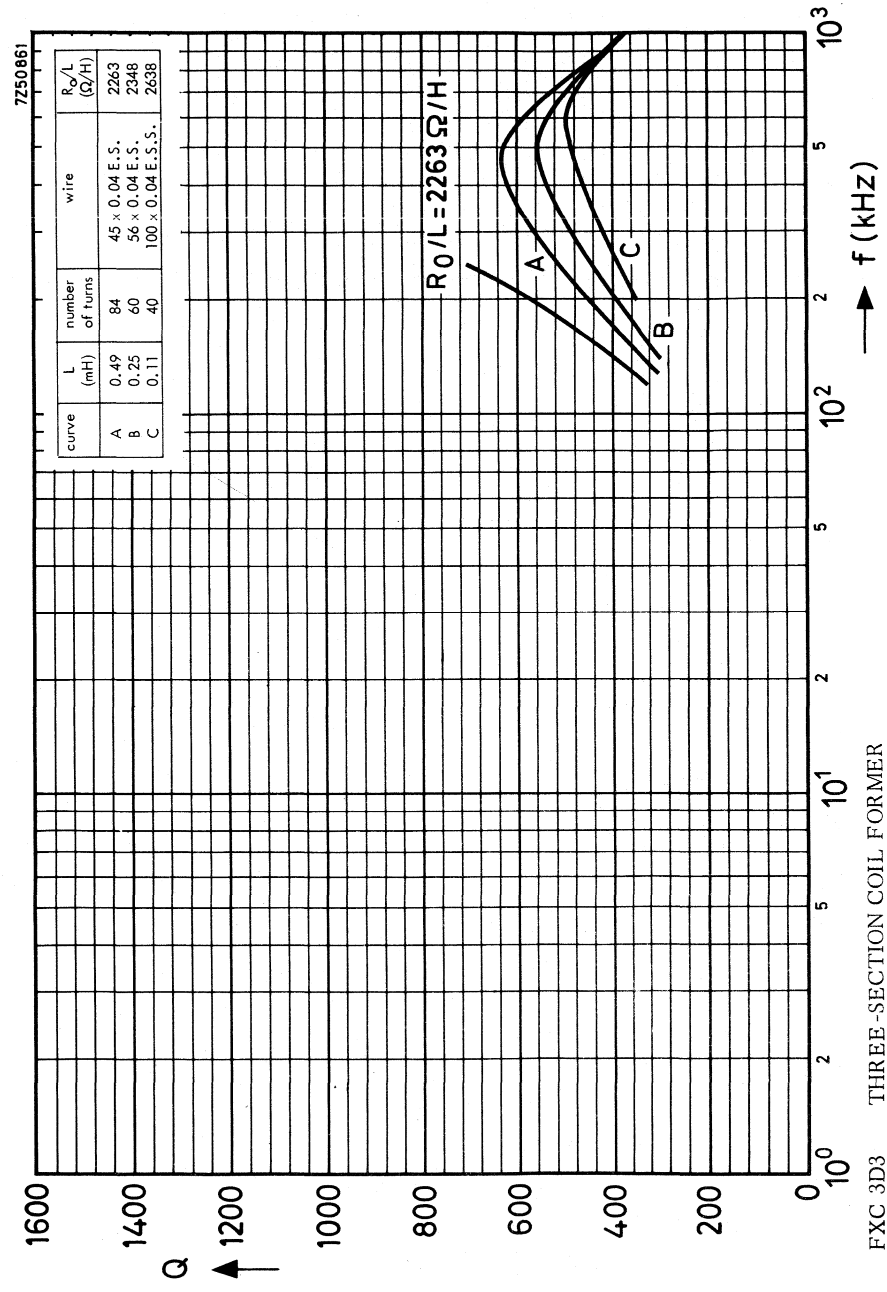
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	0.95	98	45 × 0.04 E.S.	1586
B	0.49	70	63 × 0.04 E.S.	1235
C	0.16	40	120 × 0.04 E.S.S.	1067

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



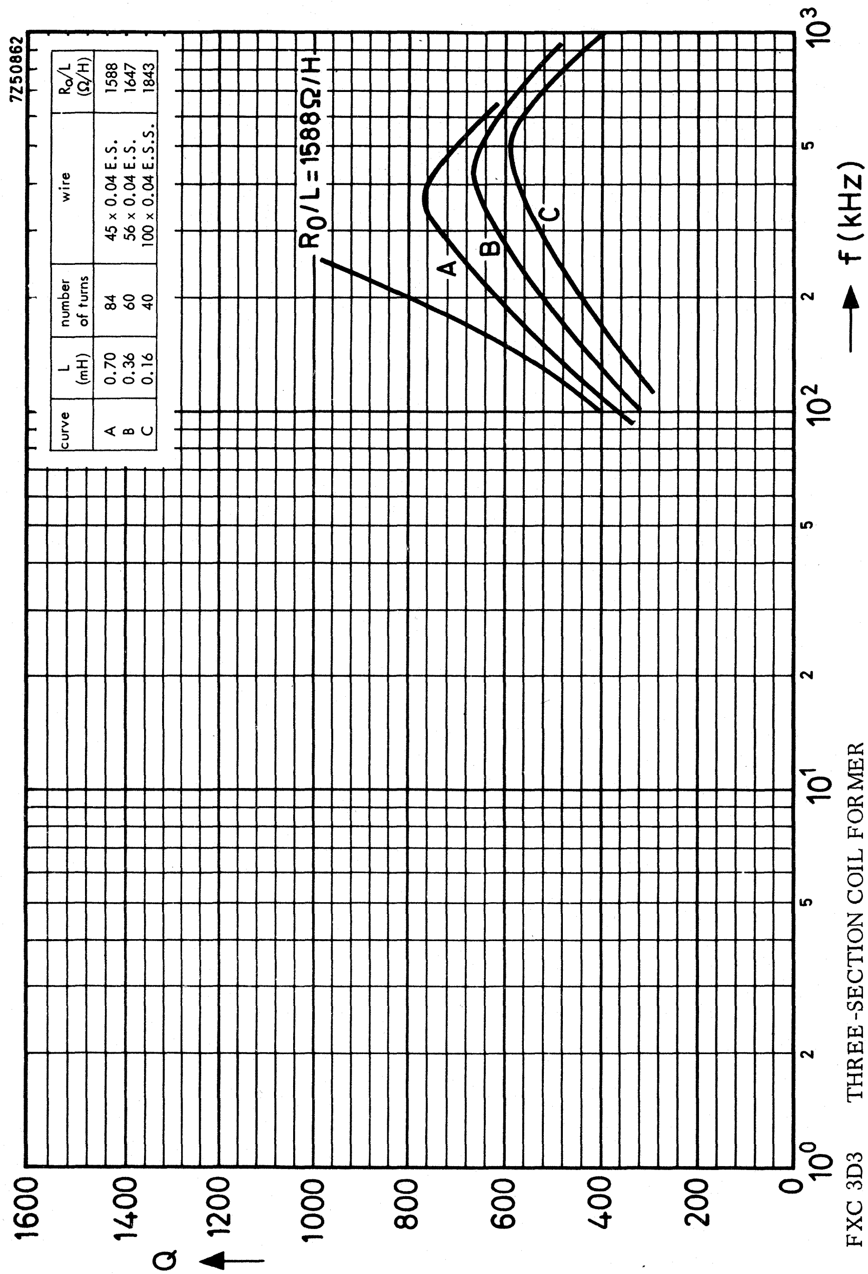
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1.37	98	45 × 0.04 E.S.	1097
B	0.70	70	63 × 0.04 E.S.	854
C	0.23	40	120 × 0.04 E.S.S.	738

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



THREE-SECTION COIL FORMER

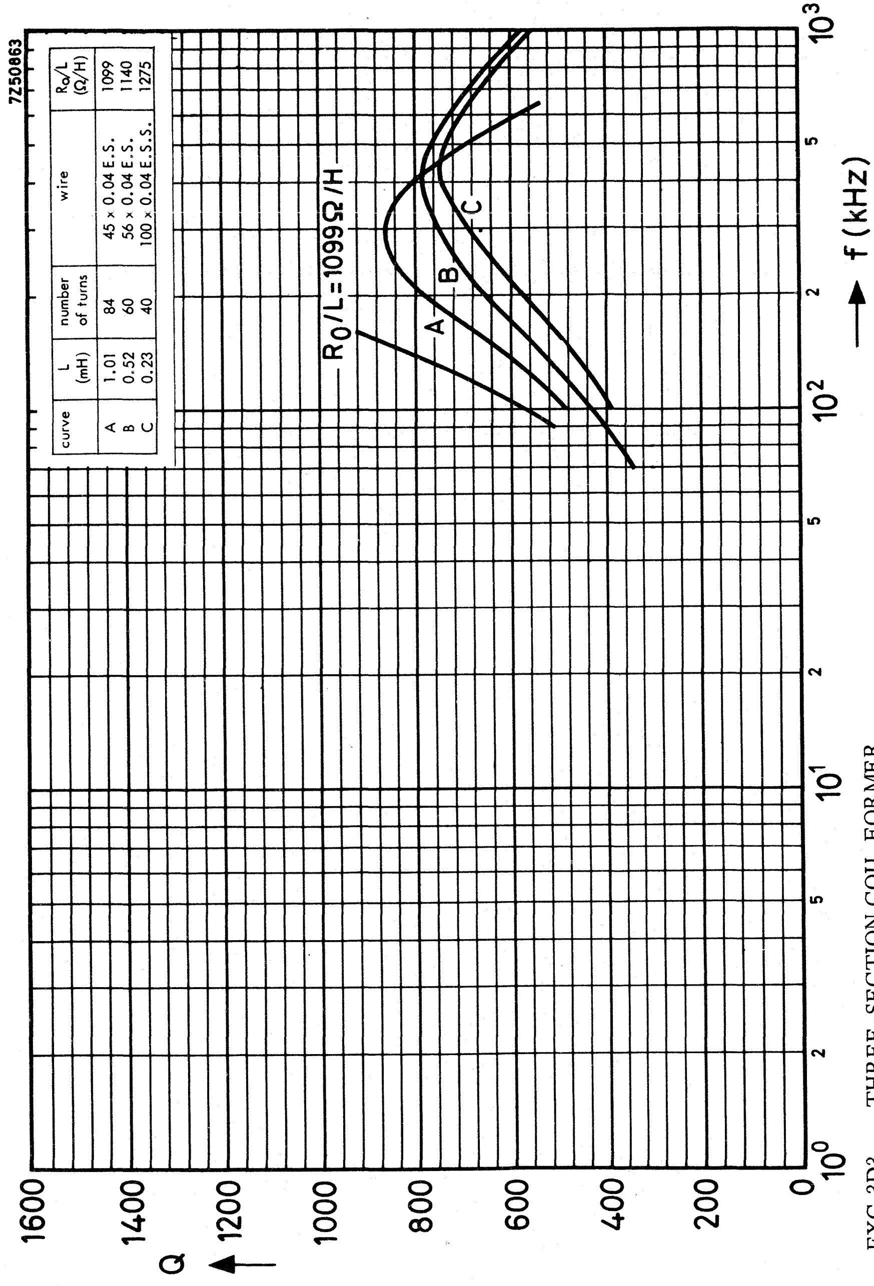
FXC 3D3
$\mu_e = 33$



THREE-SECTION COIL FORMER

FXC 3D3

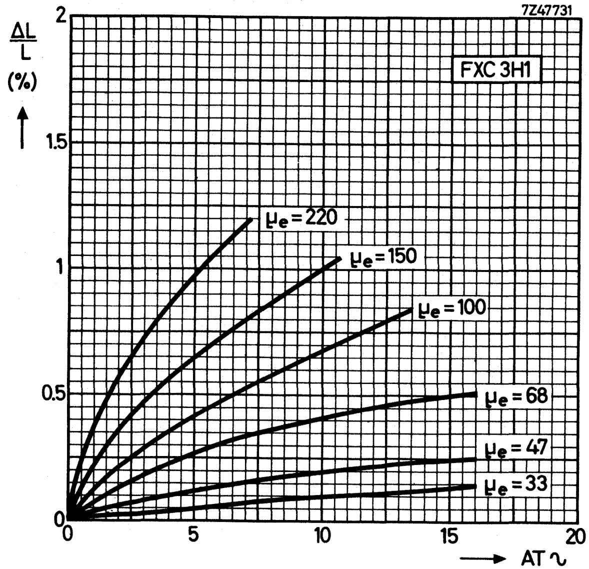
$\mu_e = 47$

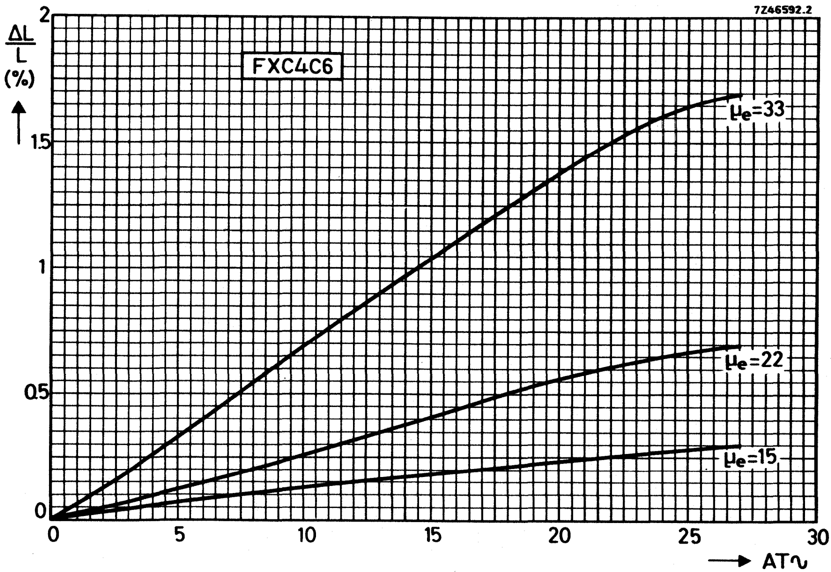


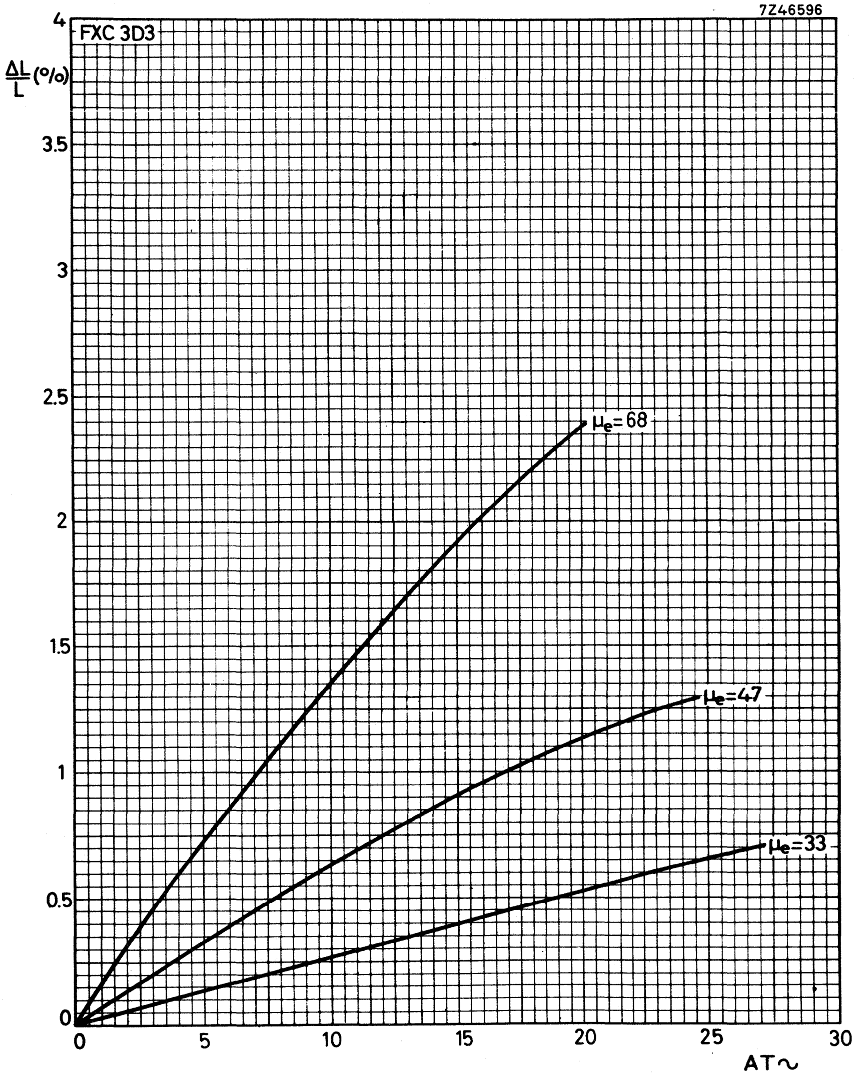
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	1.01	84	45 × 0.04 E.S.	1099
B	0.52	60	56 × 0.04 E.S.	1140
C	0.23	40	100 × 0.04 E.S.S.	1275

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

INDUCTANCE VARIATION AS A FUNCTION OF AT~

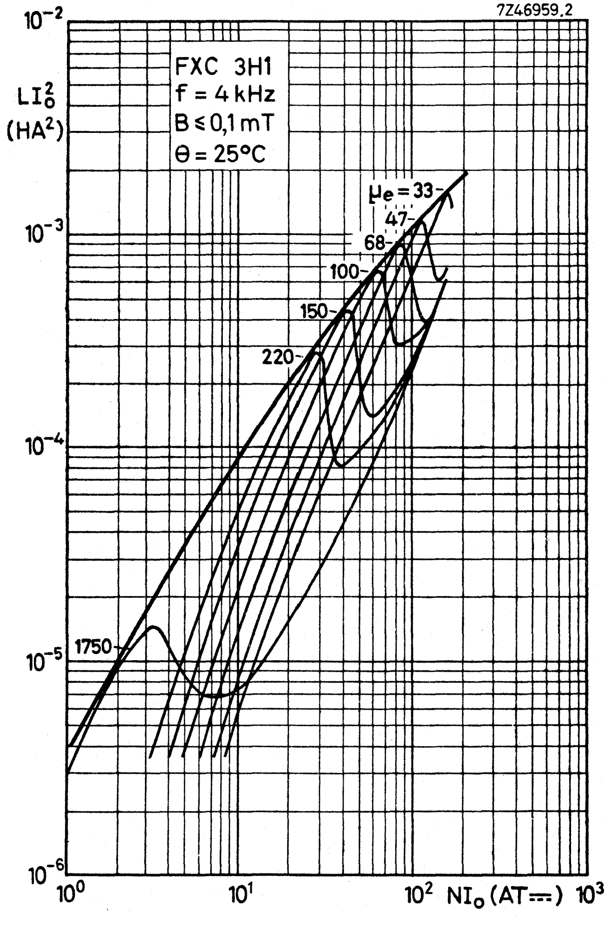


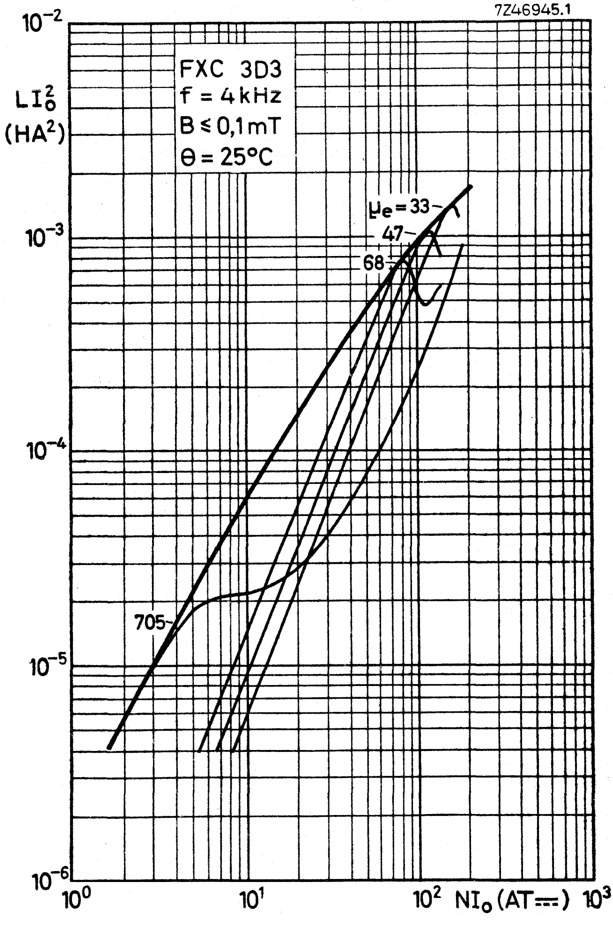



7Z46596
FXC 3D3
ΔL/L (%)
4
3.5
3
2.5
2
1.5
1
0.5
0
μ_e=68
μ_e=47
μ_e=33
0
5
10
15
20
25
30
AT~

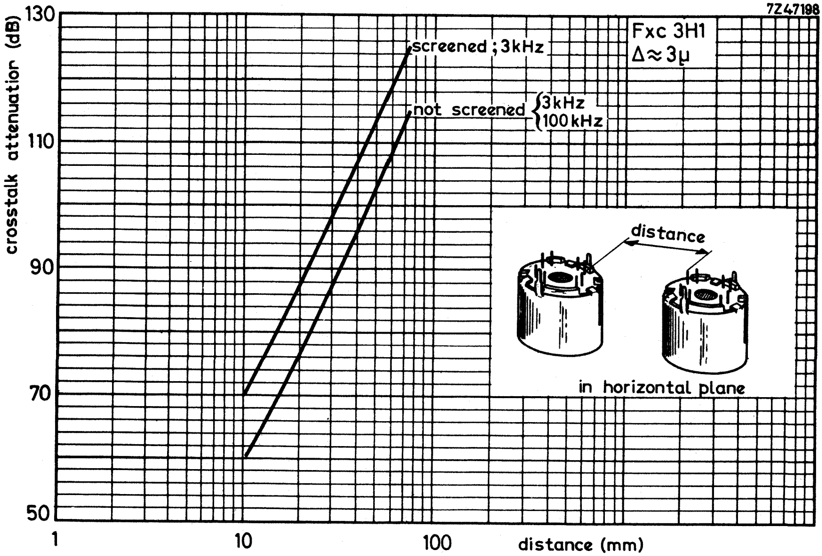
HANNA CURVES (typical values)

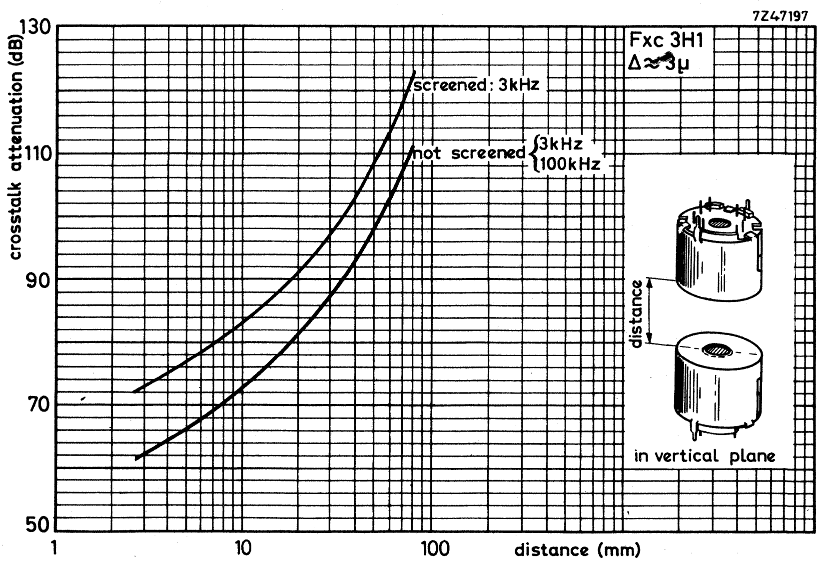
These curves indicate the optimum inductance for a certain μ_e-value and direct current.

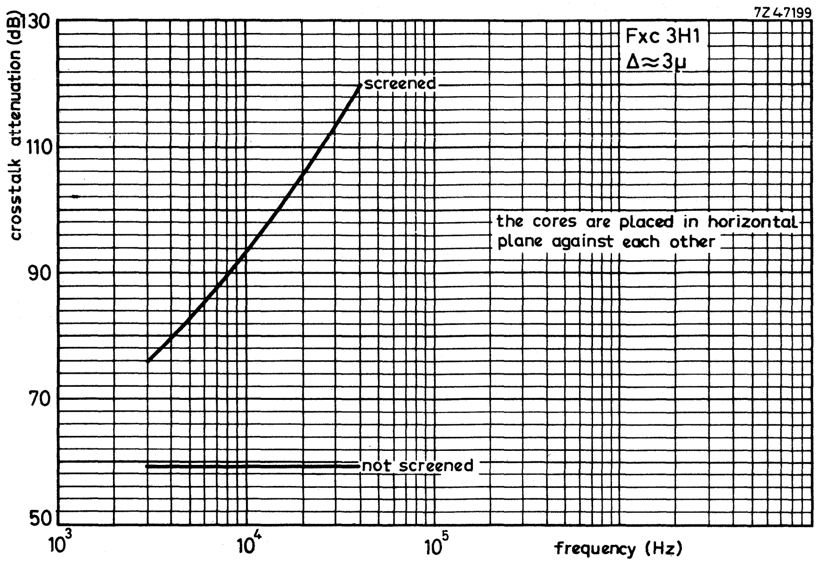


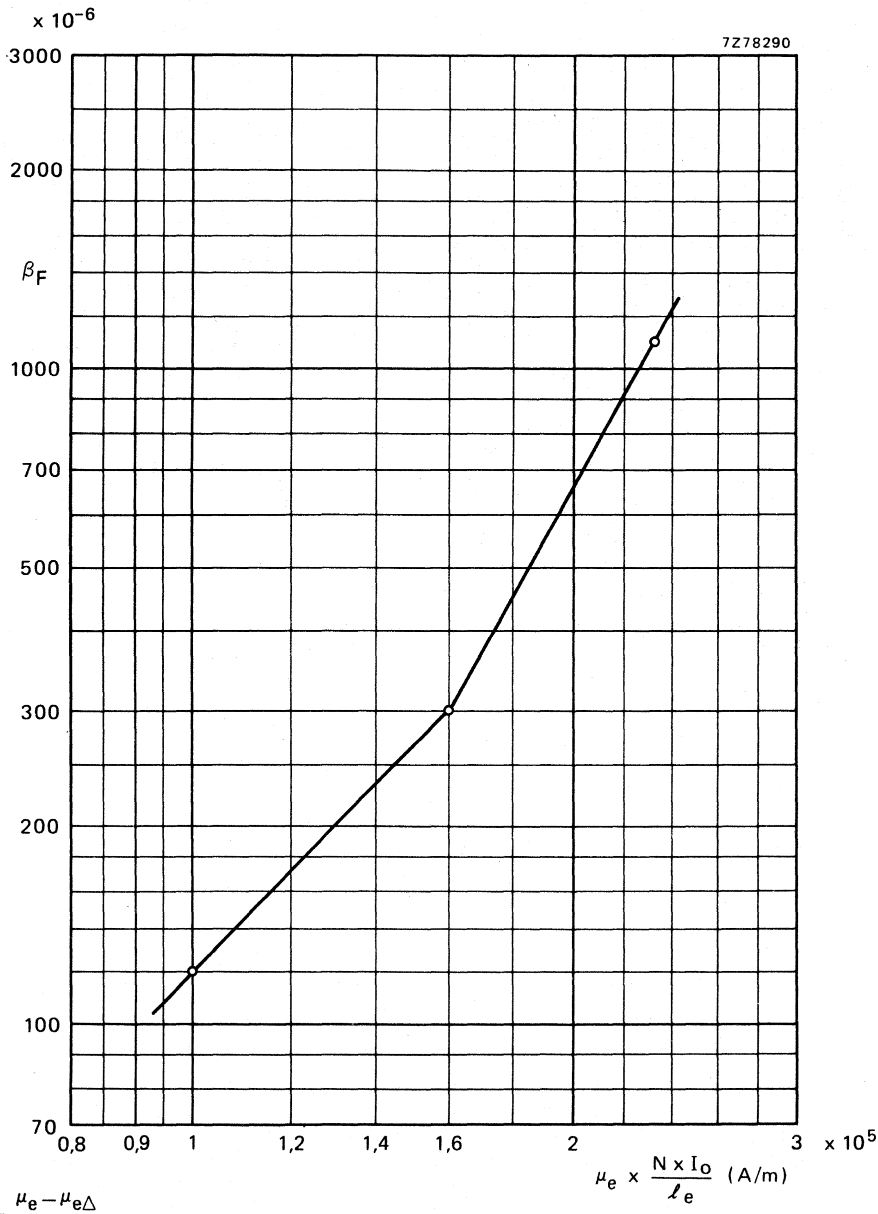

7Z46945.1
FXC 3D3
f = 4 kHz
B ≤ 0,1 mT
θ = 25°C
LI$_o^2$ (HA^2)
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^{-6}
μe = 33
47
68
705
10^0
10^1
10^2
NI$_o$ (AT ⎓)
10^3

CROSSTALK ATTENUATION






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



$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

POTCORES

Three types of core can be supplied:

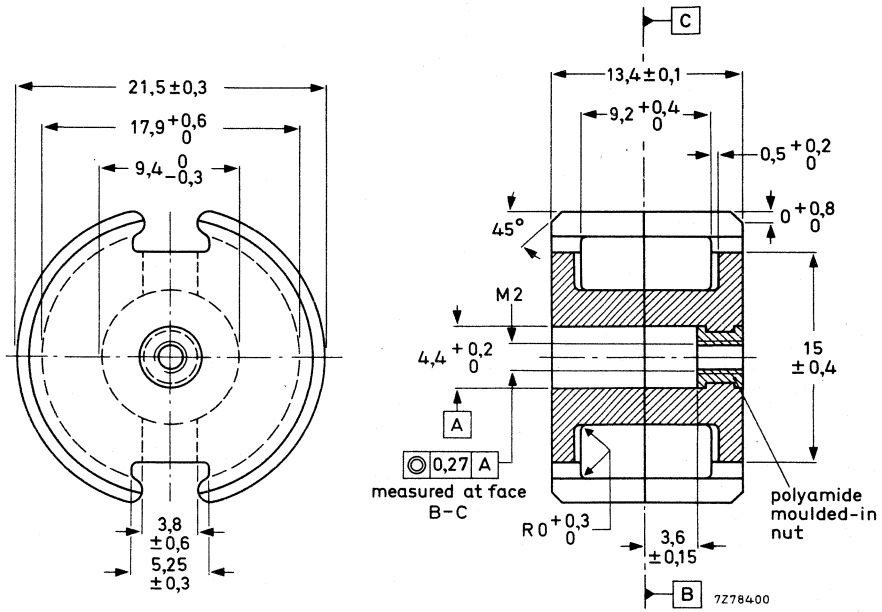
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (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 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling out force of the nut	⩾ 40 N
Torque of the screw thread	⩽ 1,0 N
Extraction force of adjuster from nut	⩾ 30 N

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}497\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00784\ mm^{-3}$; $V_e = 2000\ mm^3$; $l_e = 31{,}5\ mm$; $A_e = 63{,}4\ mm^3$.

Mass of a core set: 12 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 140 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	3B8	3D3	3E1	3H1		4C6
	4	≤ 0,1	25 ± 1	4650	≥ 2900		7450	4650		
A_L ± 25%	100	≤ 0,1	25 ± 1			1810				320
	4	≤ 0,1	25 ± 1	1860	≥ 1150		2950	1860		
μ_e ± 25%	100	≤ 0,1	25 ± 1			720				125
	4	≤ 0,1	25 ± 1	≤ 16,8	≤ 18,6		≤ 13,4	≤ 16,8		
α	100	≤ 0,1	25 ± 1			≤ 27,0				≤ 64,7
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1	≤ 1,2	≤ 1,5		≤ 2,5			
	100	≤ 0,1	25 ± 1	≤ 5,0	≤ 6,0	≤ 8,0	≤ 20	≤ 5,0		
	500	≤ 0,1	25 ± 1			≤ 14	≤ 200			
	1000	≤ 0,1	25 ± 1			≤ 30				
	2000	≤ 0,1	25 ± 1							≤ 40
	10 000	≤ 0,1	25 ± 1							≤ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	≤ 1,1	≤ 1,0		≤ 1,8	≤ 0,86		
	100	0,3 to 1,2	25 ± 1			≤ 1,8				≤ 6,2
$\alpha_F \times 10^6$/°C	≤ 100	≤ 0,1	5 to 25		0 to +6			+0,5 to 1,5		−2 to +4
	≤ 100	≤ 0,1	25 to 55		0 to +6			+0,5 to 1,5		0 to +6
	≤ 100	≤ 0,1	25 to 70	−0,6 to +0,6		0 to +2	0 to +2			
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1	≤ 4,3	≤ 8,0	≤ 12	≤ 4,3	≤ 4,3		≤ 10
$\beta_F \times 10^6$, measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C: at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,00 x 10^5 A/m					≤ 120					
= 1,55 x 10^5 A/m					≤ 300					
= 2,20 x 10^5 A/m					≤ 1050					

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022					
		3B7	3D3	3E4	3H1	3H3	4C6
25 ± 1%	9,9						27810
40 ± 1%	15,8		27420				27820
63 ± 1%	25		27430				27830
100 ± 1%	39,5	27040	27440		27240		27840
160 ± 1%	63,5	27050	27450		27250	27550	
250 ± 1,5%	99	27060	27460		27260	27560	
315 ± 2%	125	27070			27270	27570	
400 ± 2%	158	27080			27280	27580	
630 ± 3%	249	27100			27300	27600	
1000 ± 3%	395	27110			27310		
1250 ± 3%	495				27390		
2500 ± 10%	990	27130					
10 000 ± 25%	3955			27900*			

Core sets with nut and pre-adjusted on μ_e.

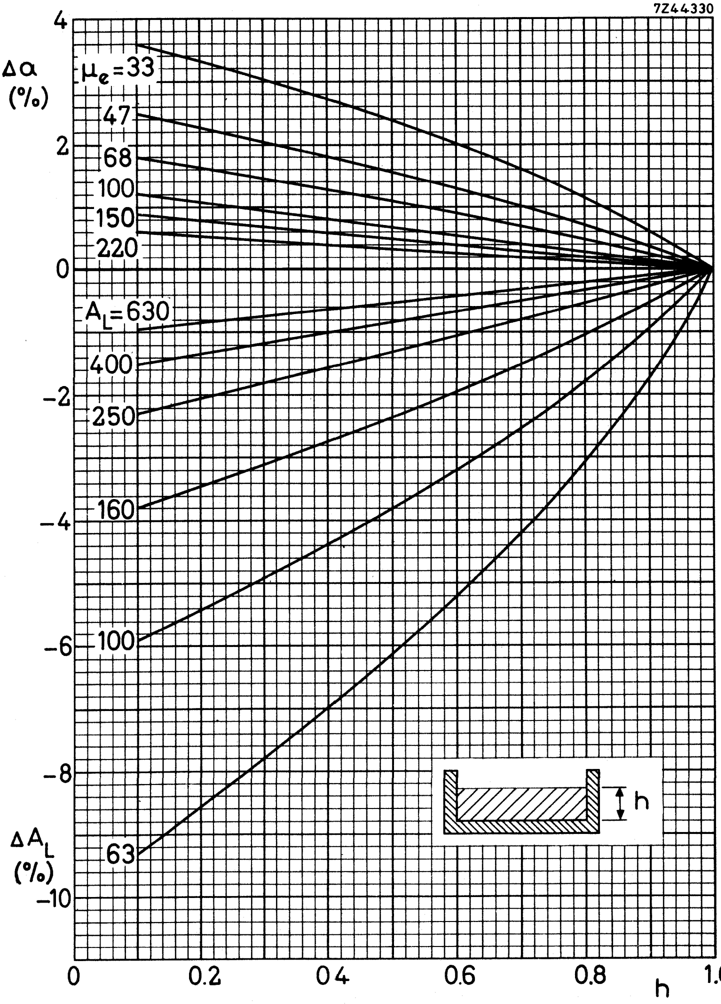
μ_e	α	catalogue number 4322 022					
		3B7		3D3	3H1		4C6
15 ± 1%	162						26810
22 ± 1%	134						26820
33 ± 1%	109,4			26430			26830
47 ± 1%	91,7			26440			
68 ± 1%	76,2	26050		26450	26250		
100 ± 1,5%	62,8	26060			26260		
150 ± 2%	51,3	26070			26270		
220 ± 3%	42,4	26080			26280		
330 ± 3%	34,6	26090			26290		
720 ± 25%	23,4			26400			
1840 ± 25%	14,6	26000*			26200*		

Core sets without nut: replace the eighth digit of the catalogue number (2) by 0.
Cores with $A_L \leqslant 315$, or $\mu_e \leqslant 100$, have a symmetrical air gap.
Cores with $A_L \geqslant 400$, or $\mu_e \geqslant 150$, have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B7	4322 020 21750
3B8	4322 020 21940
3D3	4322 020 21770
3E1	4322 020 21850
3H1	4322 020 21760
4C6	4322 020 21830

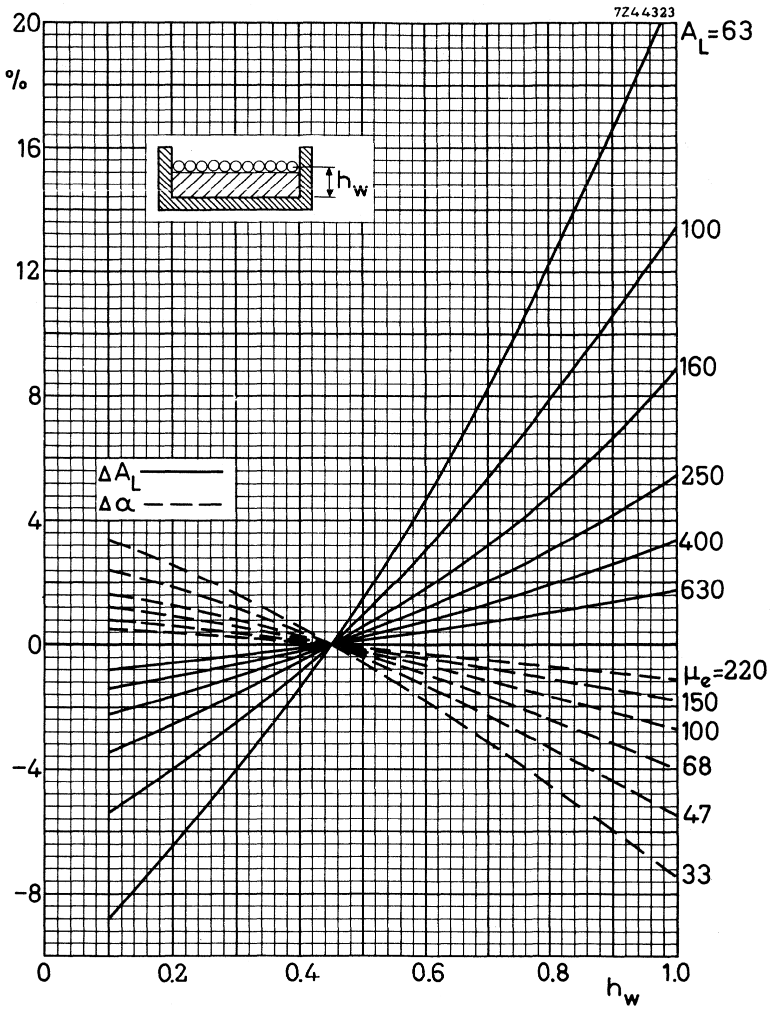
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



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 %.

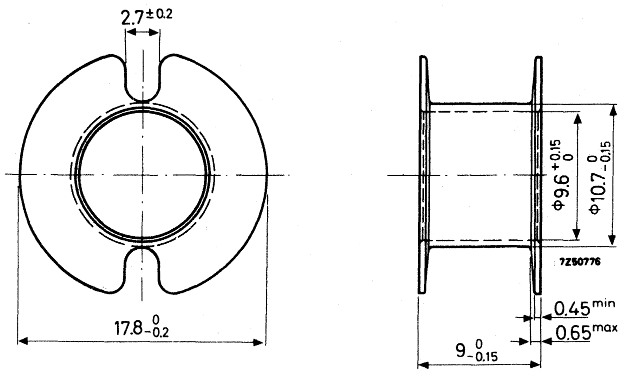
COIL FORMERS

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), UTE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER Dimensions in mm



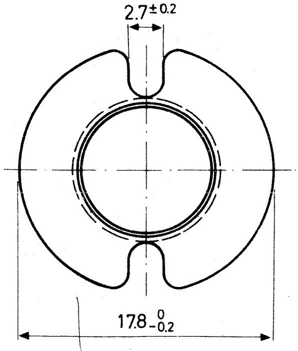
Catalogue number	4322 021 30300
Material	polycarbonate
Window area	28 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

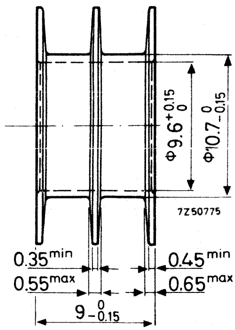
D.C. losses

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

Mass 0,35 g

TWO-SECTION COIL FORMER





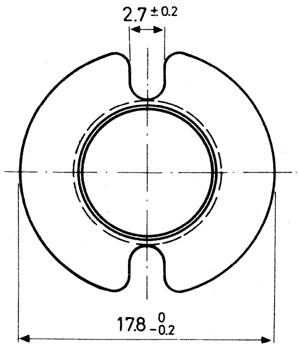
Catalogue number	4322 021 30310
Material	polycarbonate
Window area	2 x 13 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

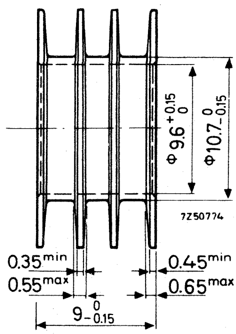
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11,6 \times 10^3 \ \Omega/H$$

Mass 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

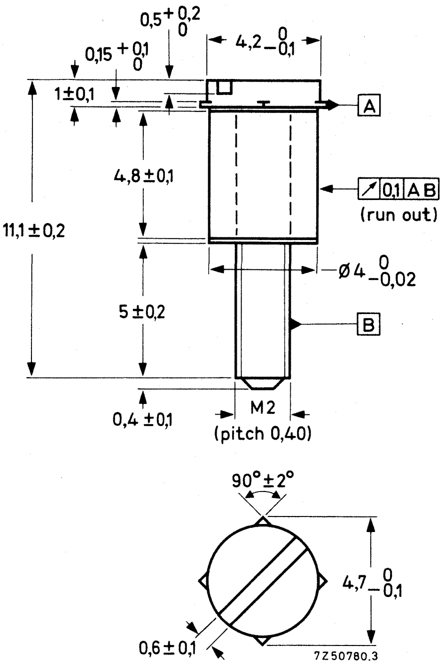
D.C. losses

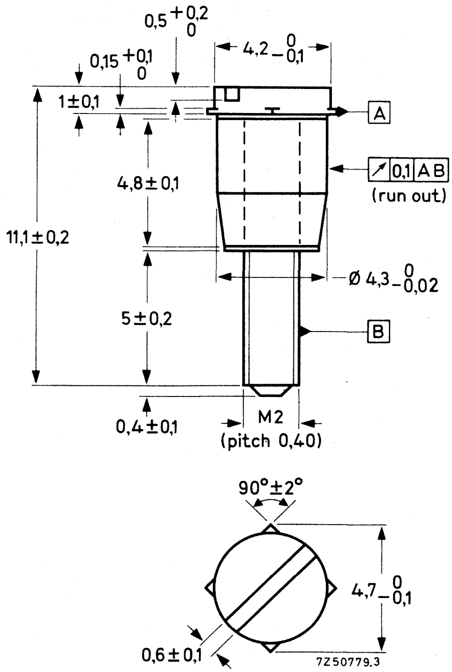
$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 12,4 \times 10^3 \ \Omega/H$$

Mass 0,45 g

INDUCTANCE ADJUSTERS

Dimensions in mm





The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 an continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

Table 2 shows the type of adjuster recommended for differenct potcores.

Table 1, available types

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

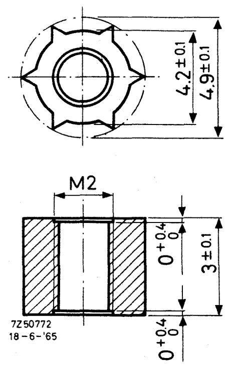
The adjusters are packed in bags of 100. Please order in multiples of this quantity.

Table 2, recommended application

μ_e	A_L	3B7/3H1/3D3	4C6
		catalogue 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	–

LOOSE NUT FOR ADJUSTER

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

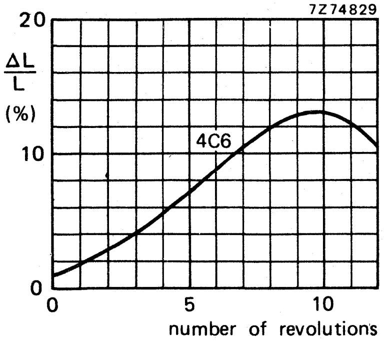


Catalogue number	4322 021 30150
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	3, 4 ± 0,15 mm

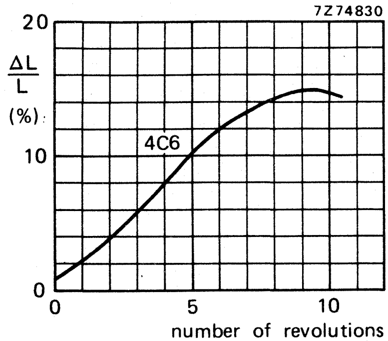
For more information see Potcores General, inductance adjustment.

The nuts are packed in bags of 100. Please order in multiples of this quantity.

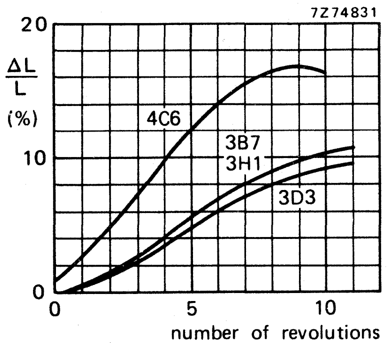
ADJUSTMENT CURVES



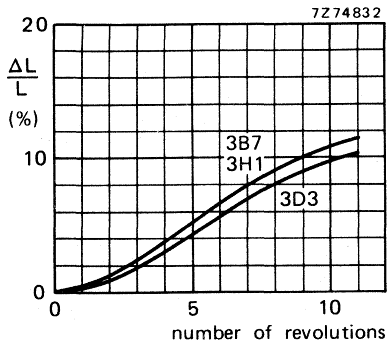
Adjuster 4322 021 31060, $\mu_e = 15$.



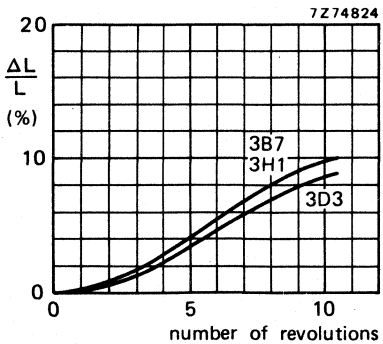
Adjuster 4322 021 31000, $\mu_e = 22$.



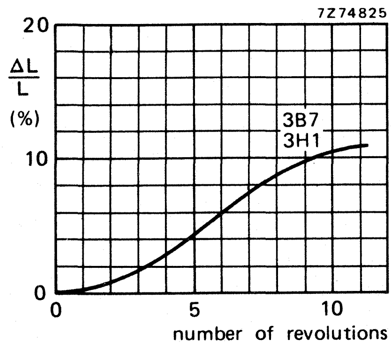
Adjuster 4322 021 31040 (3B7, 3H1, 3D3)
Adjuster 4322 021 31020 (4C6), $\mu_e = 33$.



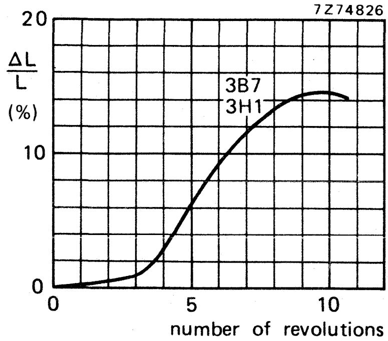
Adjuster 4322 021 31060, $\mu_e = 47$.



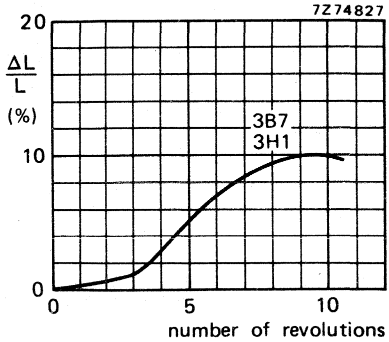
Adjuster 4322 021 31000, $\mu_e = 68$.



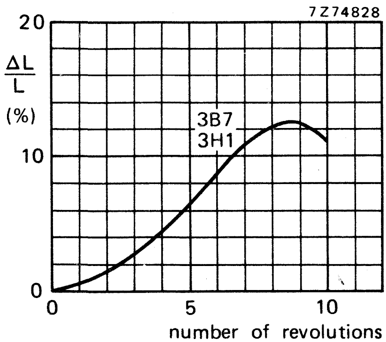
Adjuster 4322 021 31020, $\mu_e = 100$.



Adjuster 4322 021 31100, μ_e = 150.



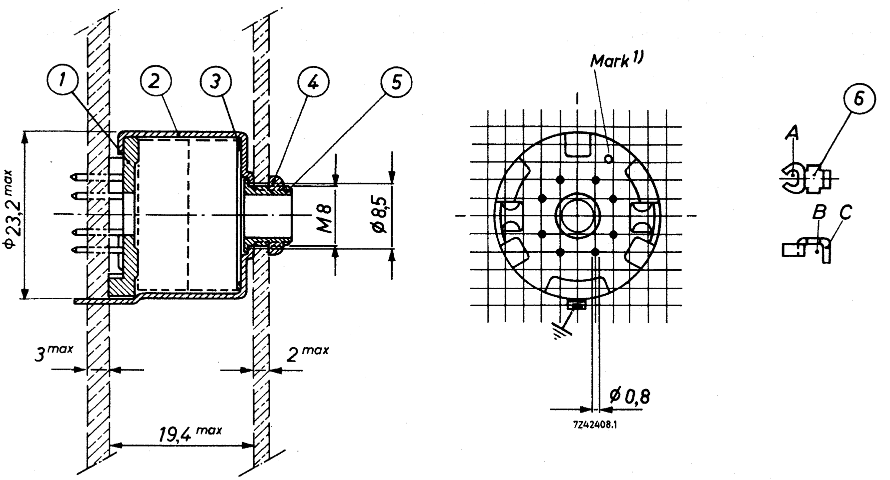
Adjuster 4322 021 31100, μ_e = 220.



Adjuster 4322 021 31240, μ_e = 330.

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 grid of 2, 54 mm (0, 1 inch).

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 that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

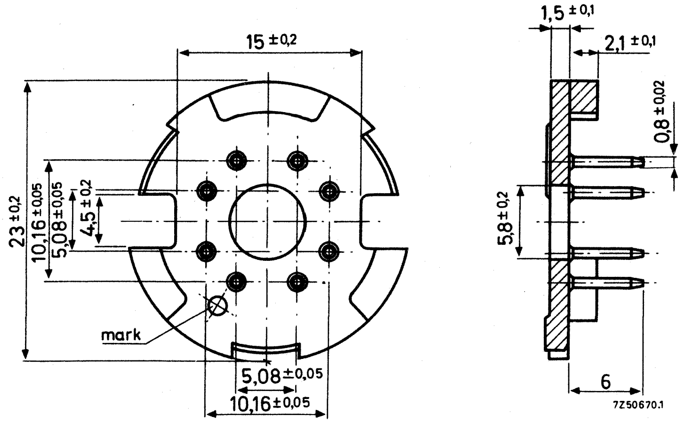
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 140 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS — Dimensions in mm

(1) Tag plate 4322 021 30460

→ Plate: polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s.

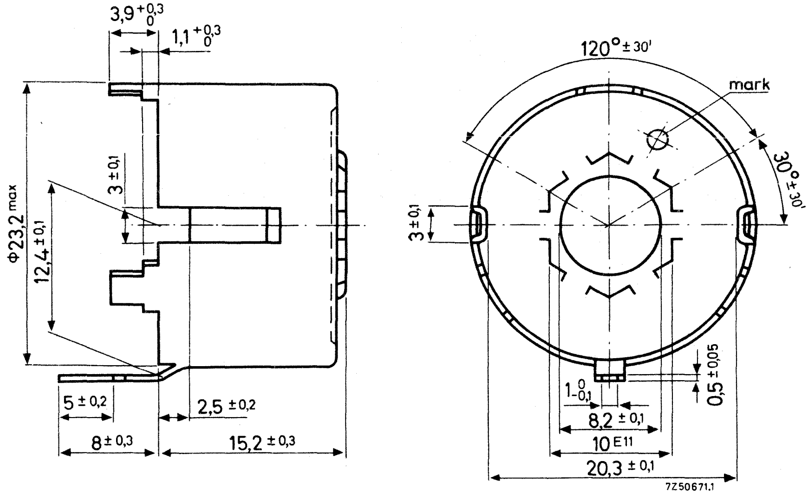
Pins : phosphor bronze, dip-soldered



→ The tag plates are packed in units of 65 pieces on a polystyrene plate. 450 pieces are packed in a cardboard box. Please order in multiples of these quantities.

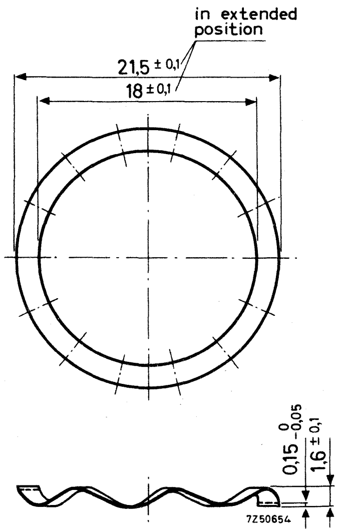
(2) Container 4322 021 30540

Material: brass, nickel plated; tinned soldering pin



(3) Spring 4322 021 30650

Material: chrome-nickel steel

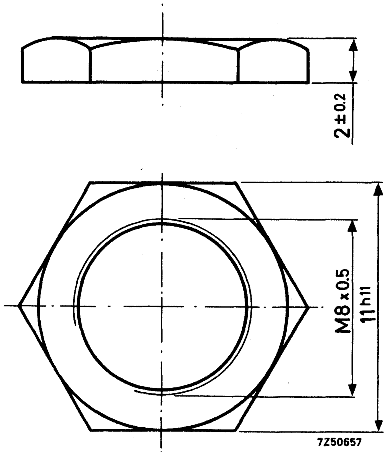


A force of 94 to 156 N is required to compress the spring to 0, 45 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

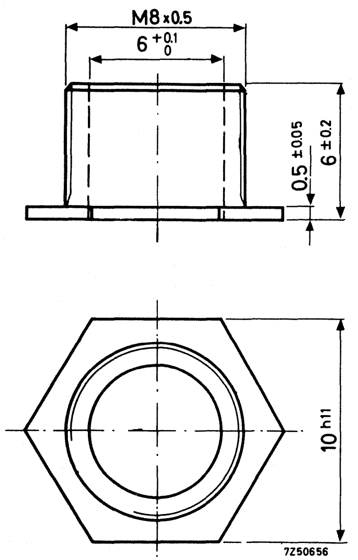
(4) Nut 4322 021 30710

Material: brass, nickel plated



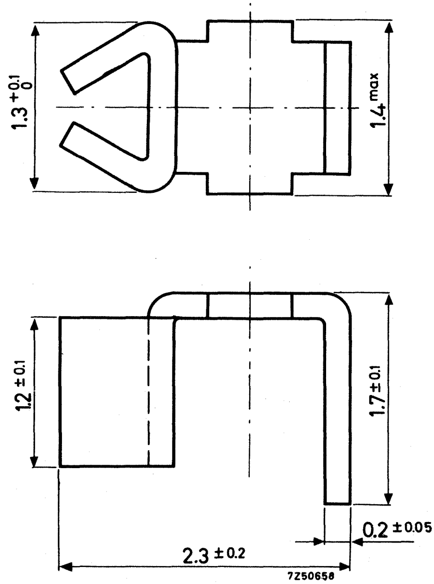
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



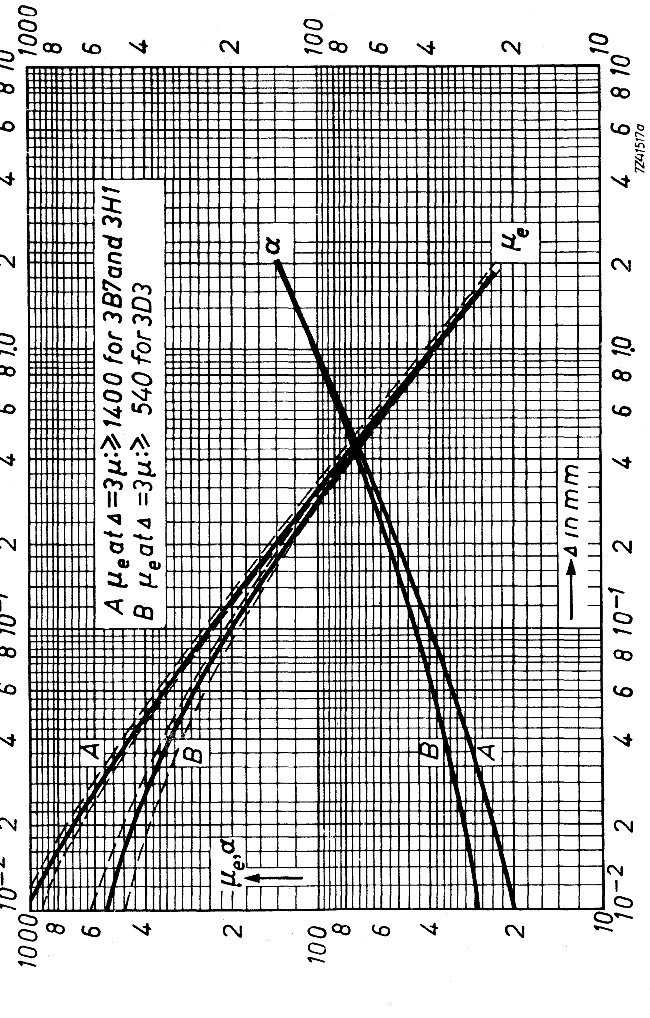
(6) Soldering spring 4322 021 30700

Material: brass, dipsoldered



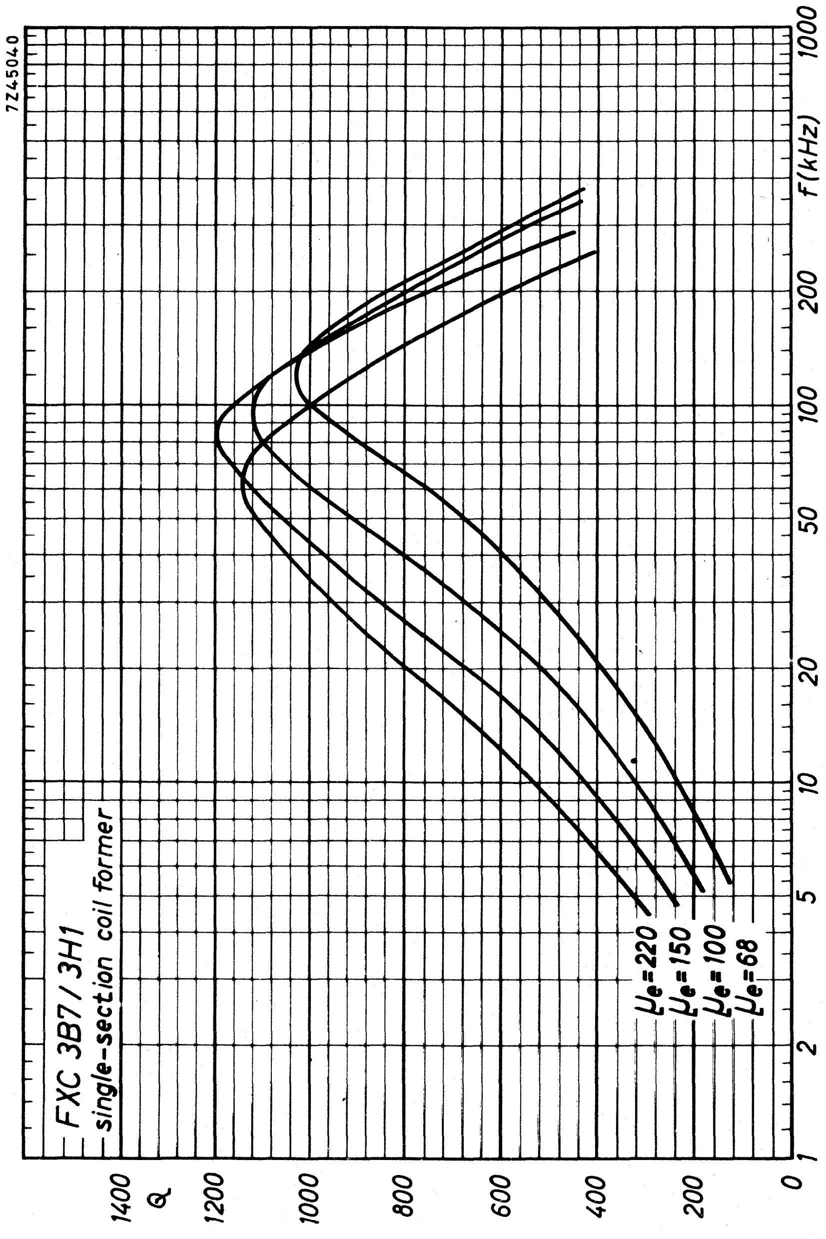
CHARACTERISTIC CURVES

μ_e - α curves

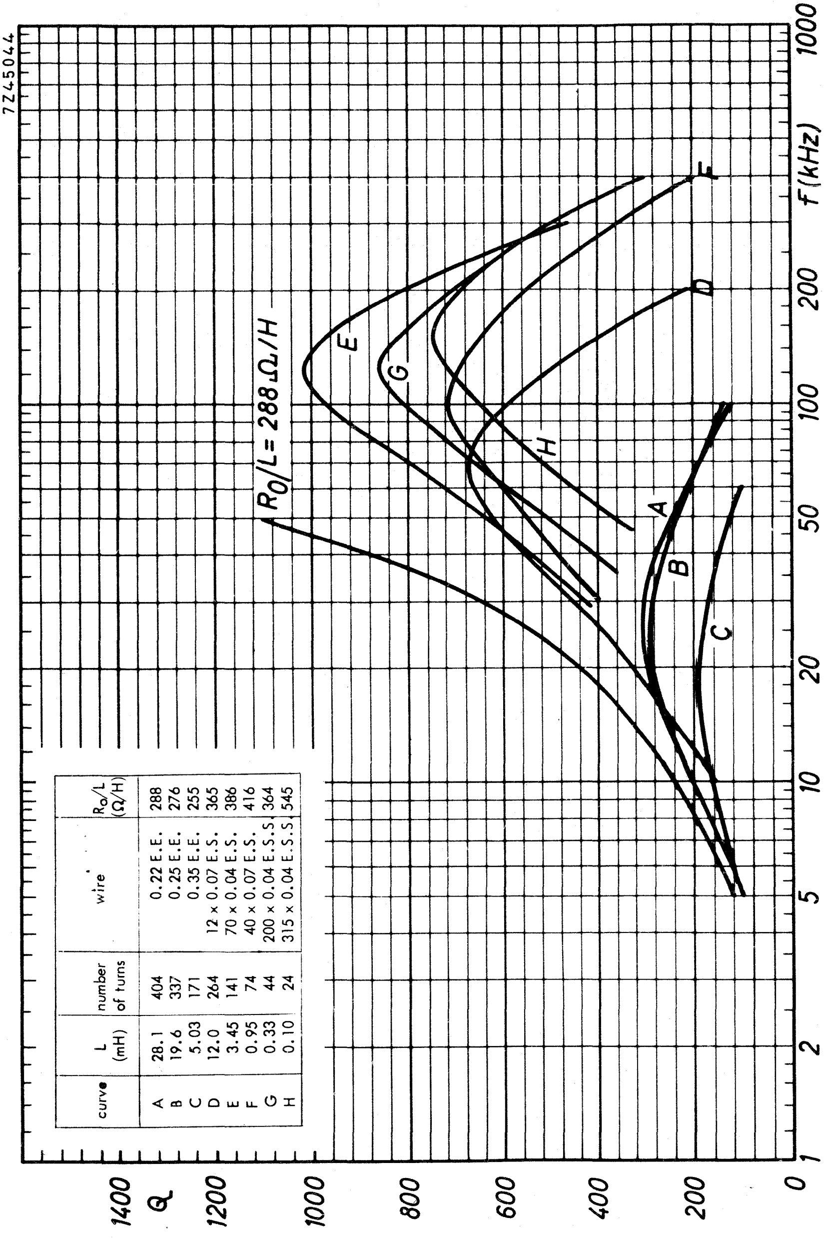


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



Enveloping curves

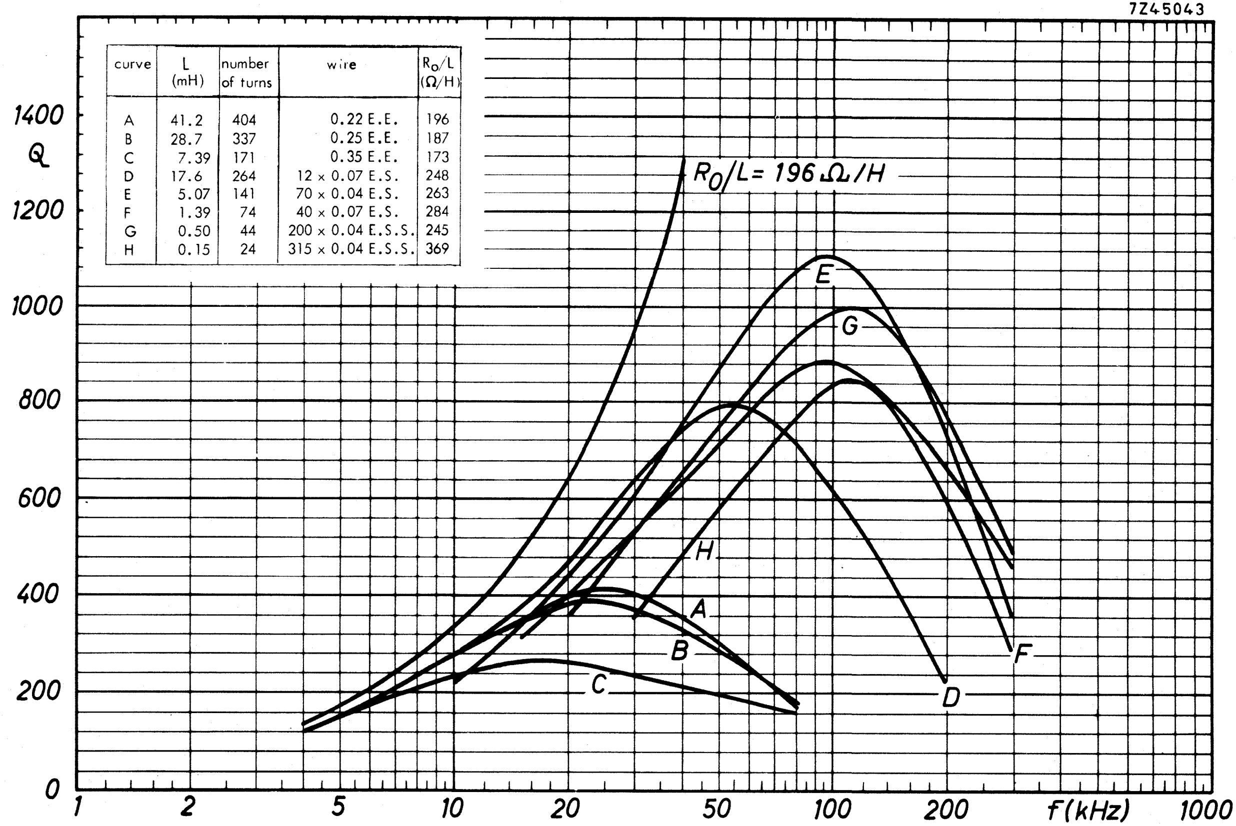


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	28.1	404	0.22 E.E.	288
B	19.6	337	0.25 E.E.	276
C	5.03	171	0.35 E.E.	255
D	12.0	264	12 × 0.07 E.S.	365
E	3.45	141	70 × 0.04 E.S.	386
F	0.95	74	40 × 0.07 E.S.	416
G	0.33	44	200 × 0.04 E.S.S.	364
H	0.10	24	315 × 0.04 E.S.S.	545

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

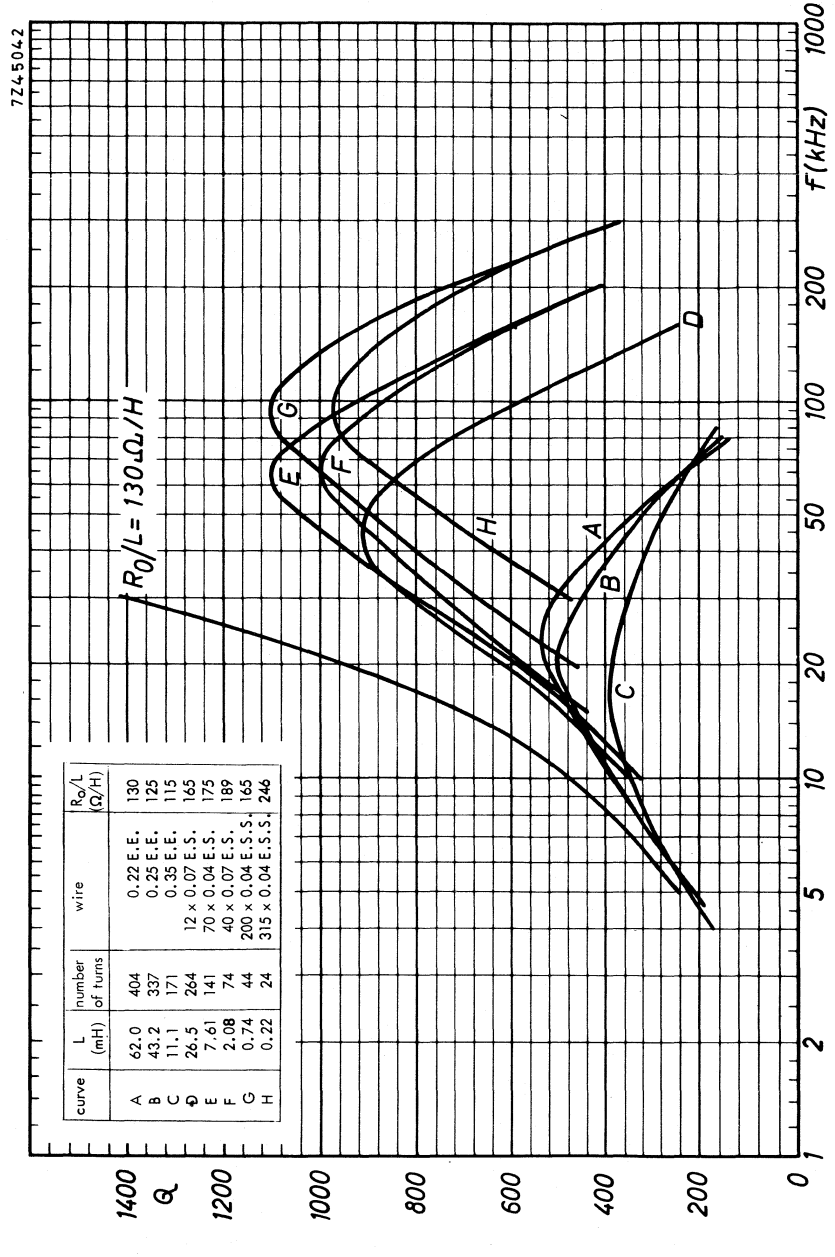
$\mu_e = 68$

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



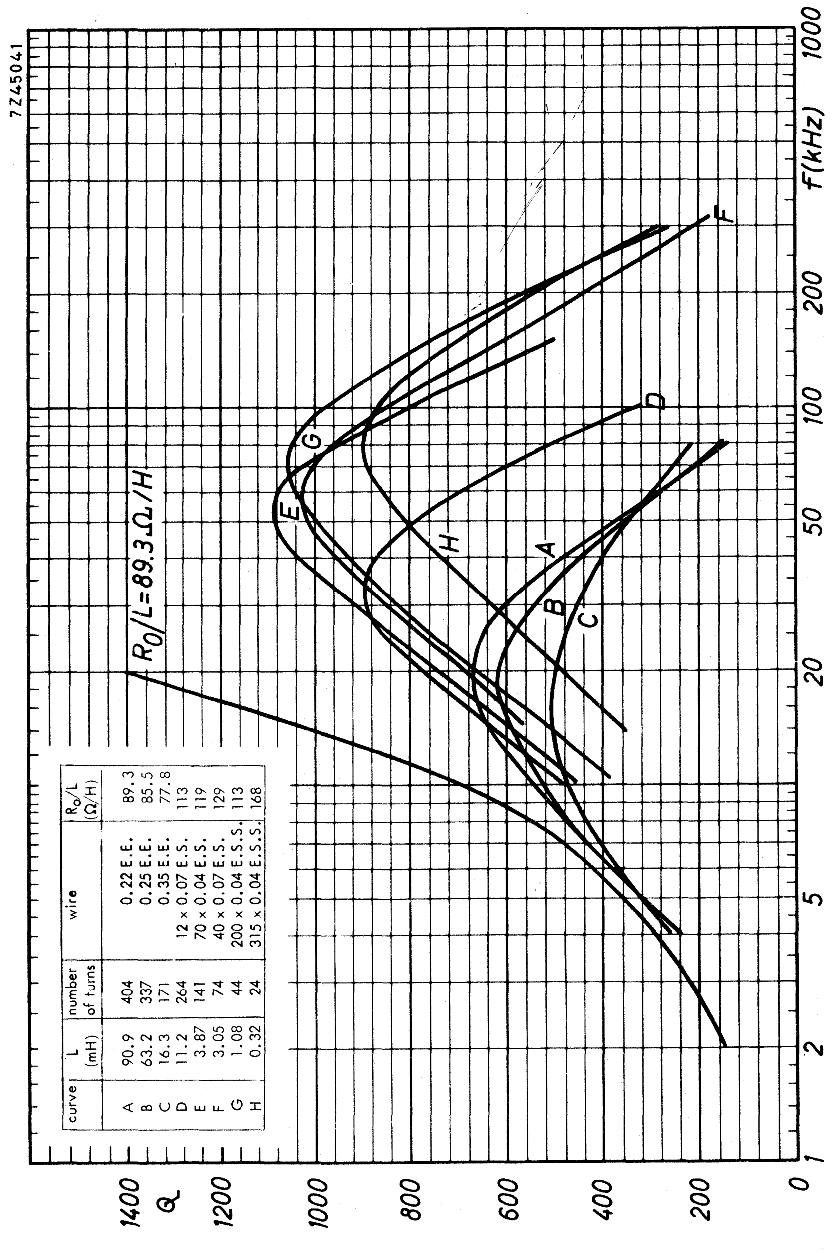
FXC 3B7/3H1   SINGLE-SECTION COIL FORMER

$\mu_e = 100$



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
$\mu_e = 150$

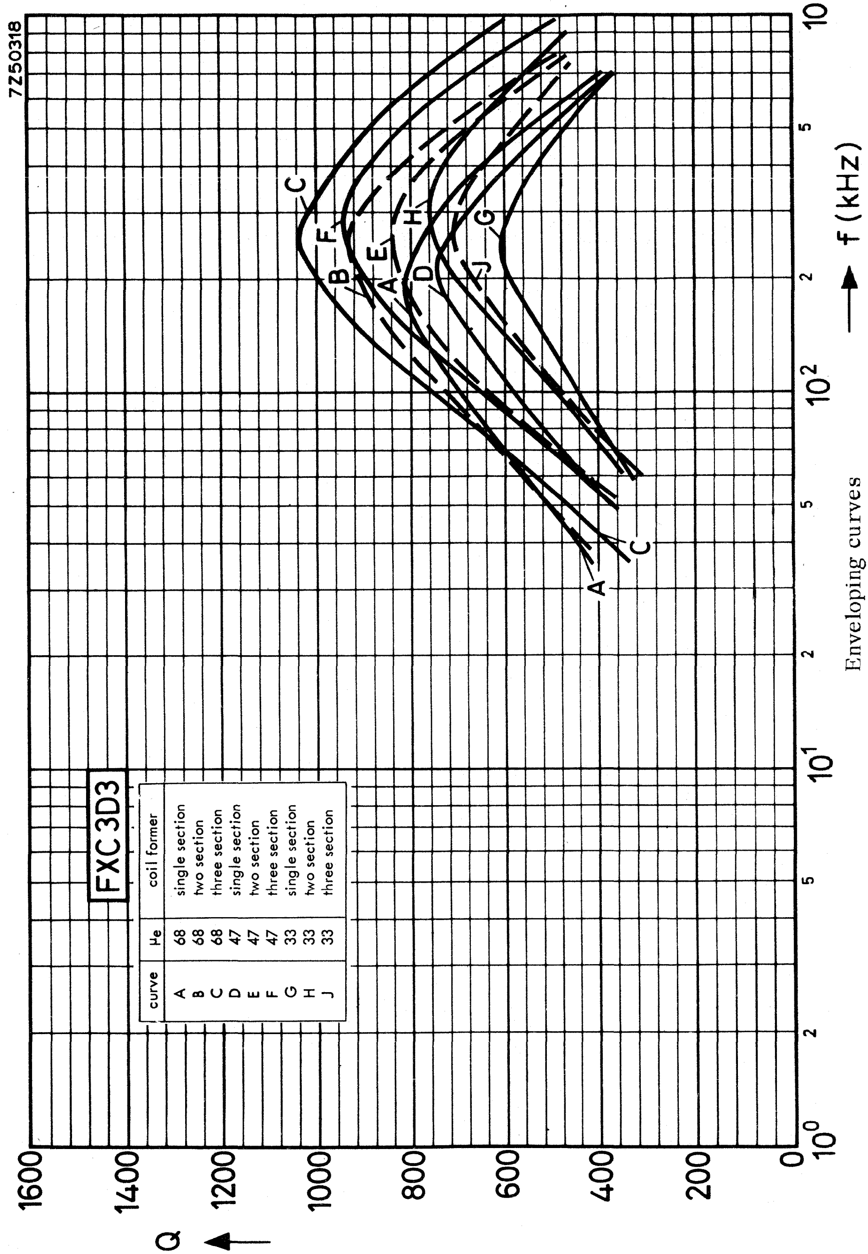


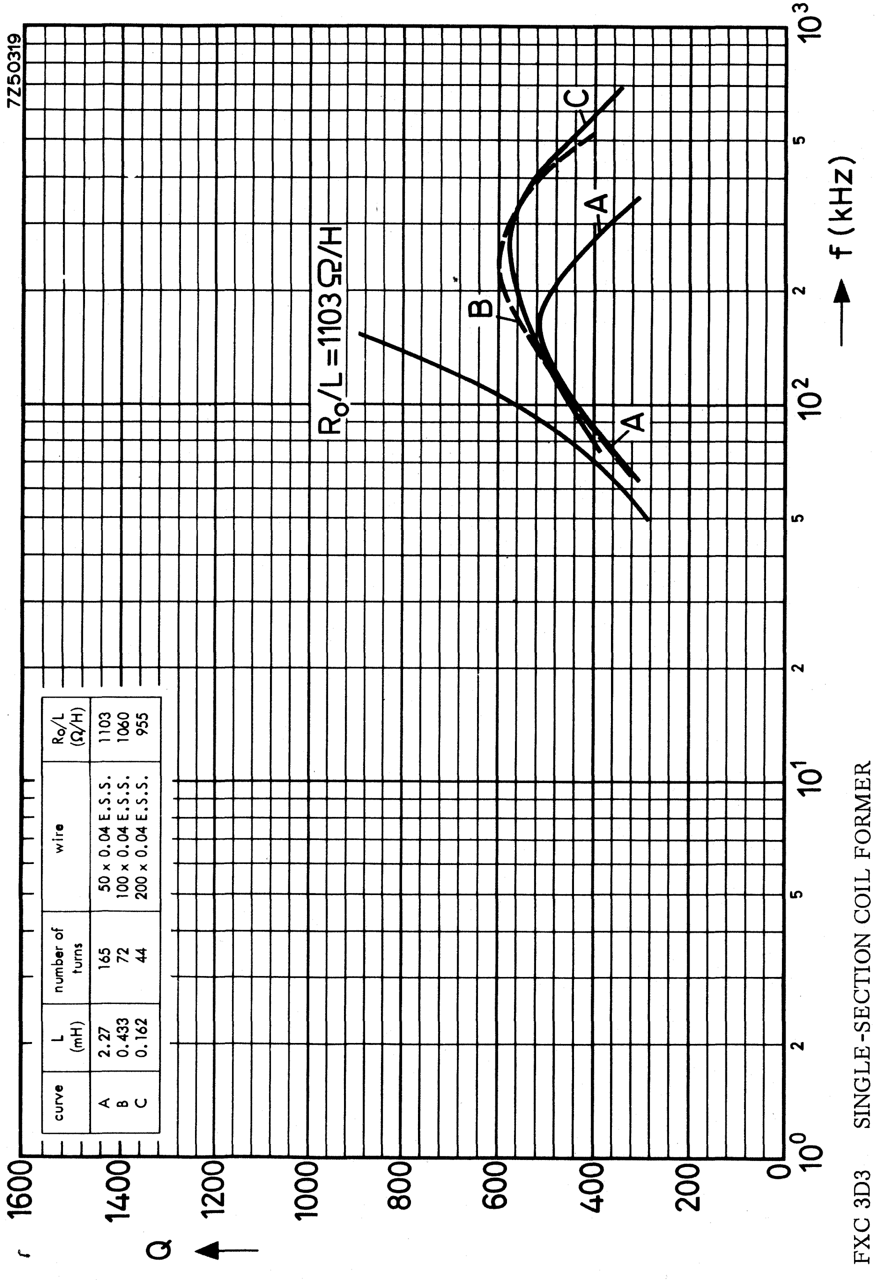
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	90.9	404	0.22 E.E.	89.3
B	63.2	337	0.25 E.E.	85.5
C	16.3	171	0.35 E.E.	77.8
D	11.2	264	12 × 0.07 E.S.	113
E	3.87	141	70 × 0.04 E.S.	119
F	3.05	74	40 × 0.07 E.S.	129
G	1.08	44	200 × 0.04 E.S.S.	113
H	0.32	24	315 × 0.04 E.S.S.	168

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

$\mu_e = 220$

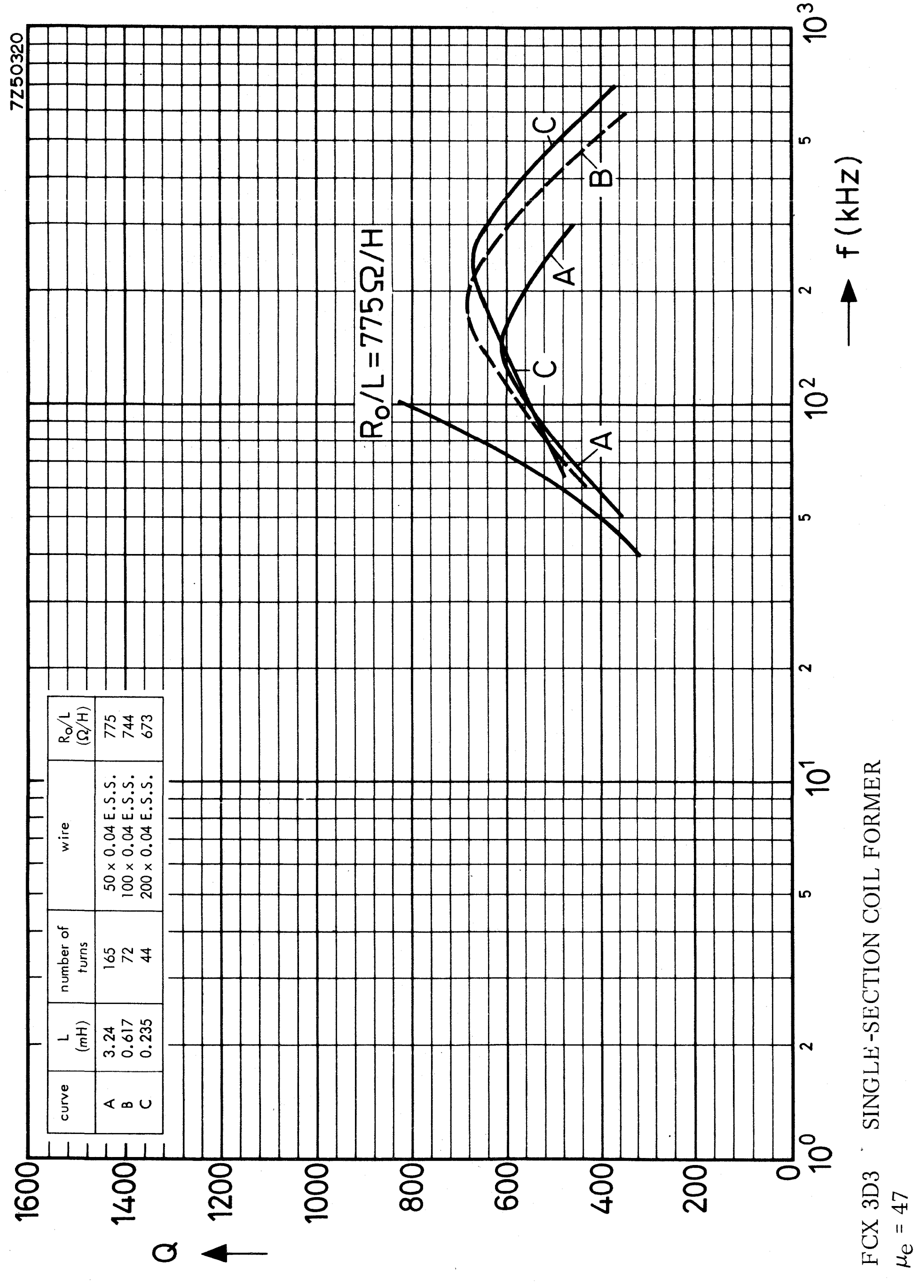
TYPICAL Q-CURVES FOR FXC 3D3





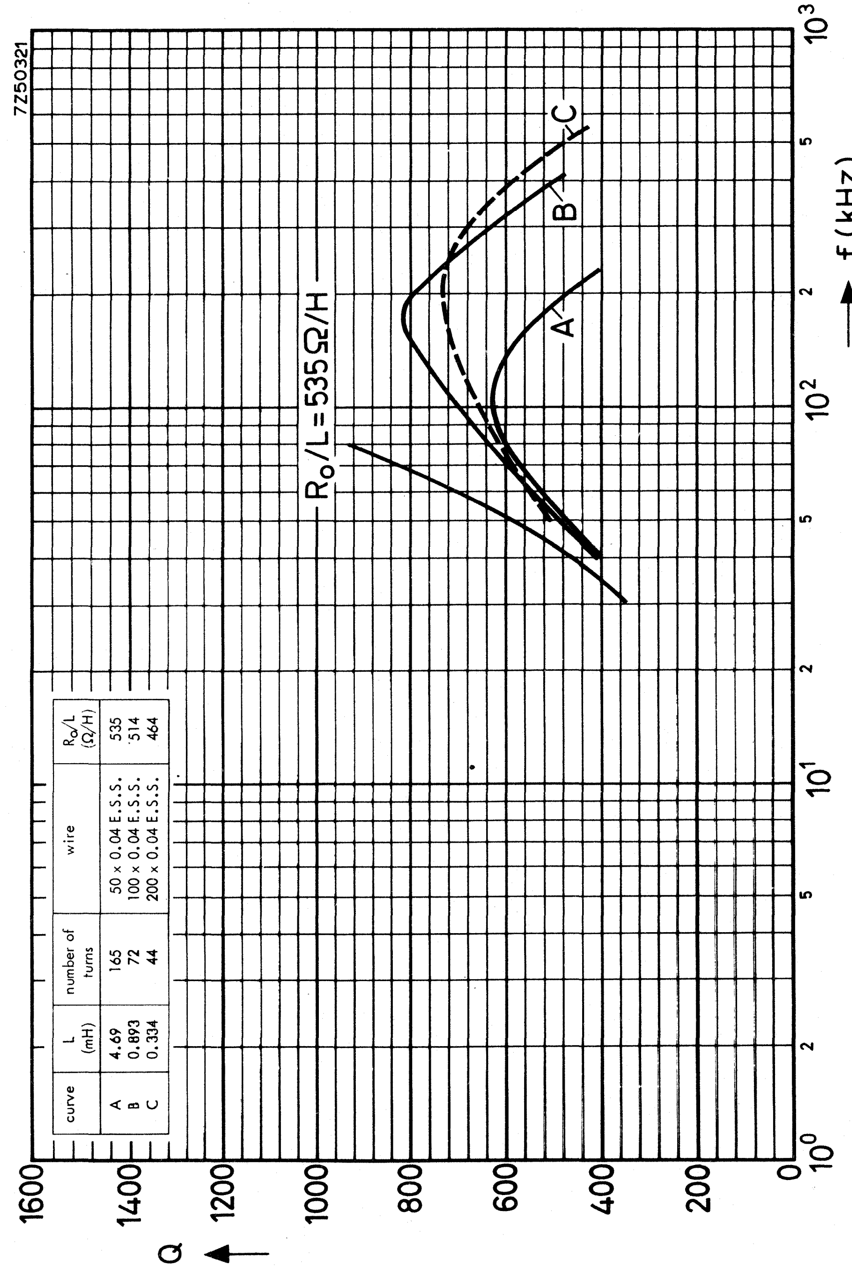
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	2.27	165	50 × 0.04 E.S.S.	1103
B	0.433	72	100 × 0.04 E.S.S.	1060
C	0.162	44	200 × 0.04 E.S.S.	955

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
$\mu_e = 47$

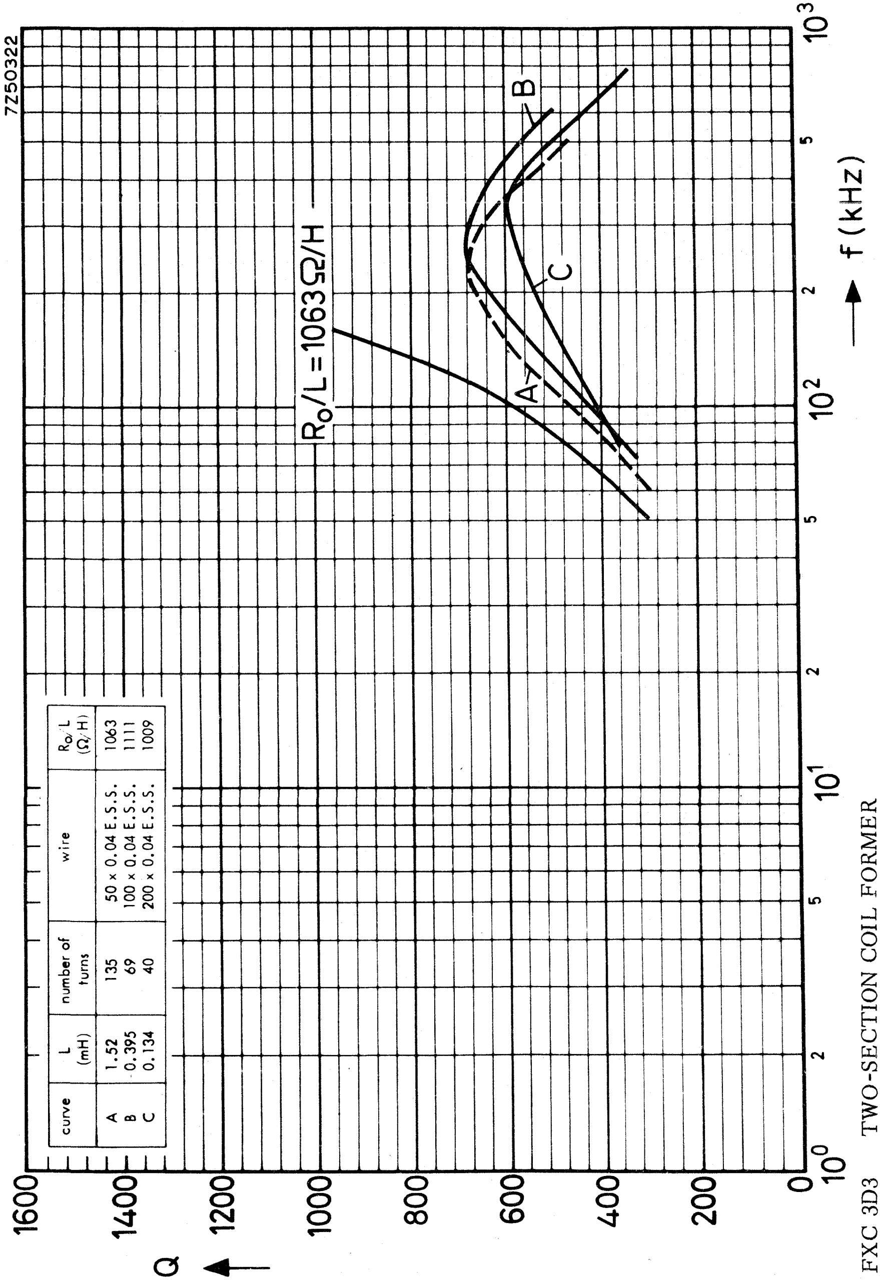


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	4.69	165	50 × 0.04 E.S.S.	535
B	0.893	72	100 × 0.04 E.S.S.	514
C	0.334	44	200 × 0.04 E.S.S.	464

SINGLE-SECTION COIL FORMER

FXC 3D3

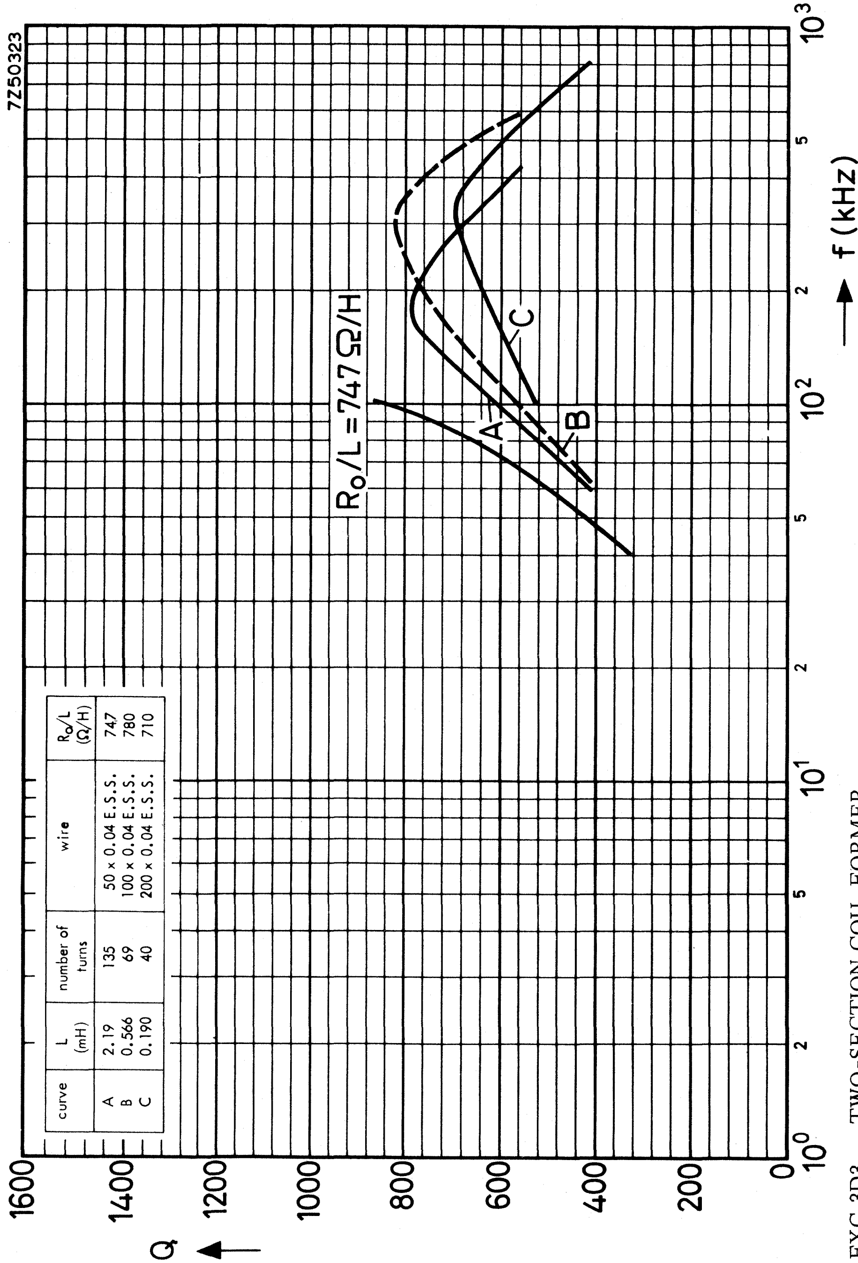
$\mu_e = 68$



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

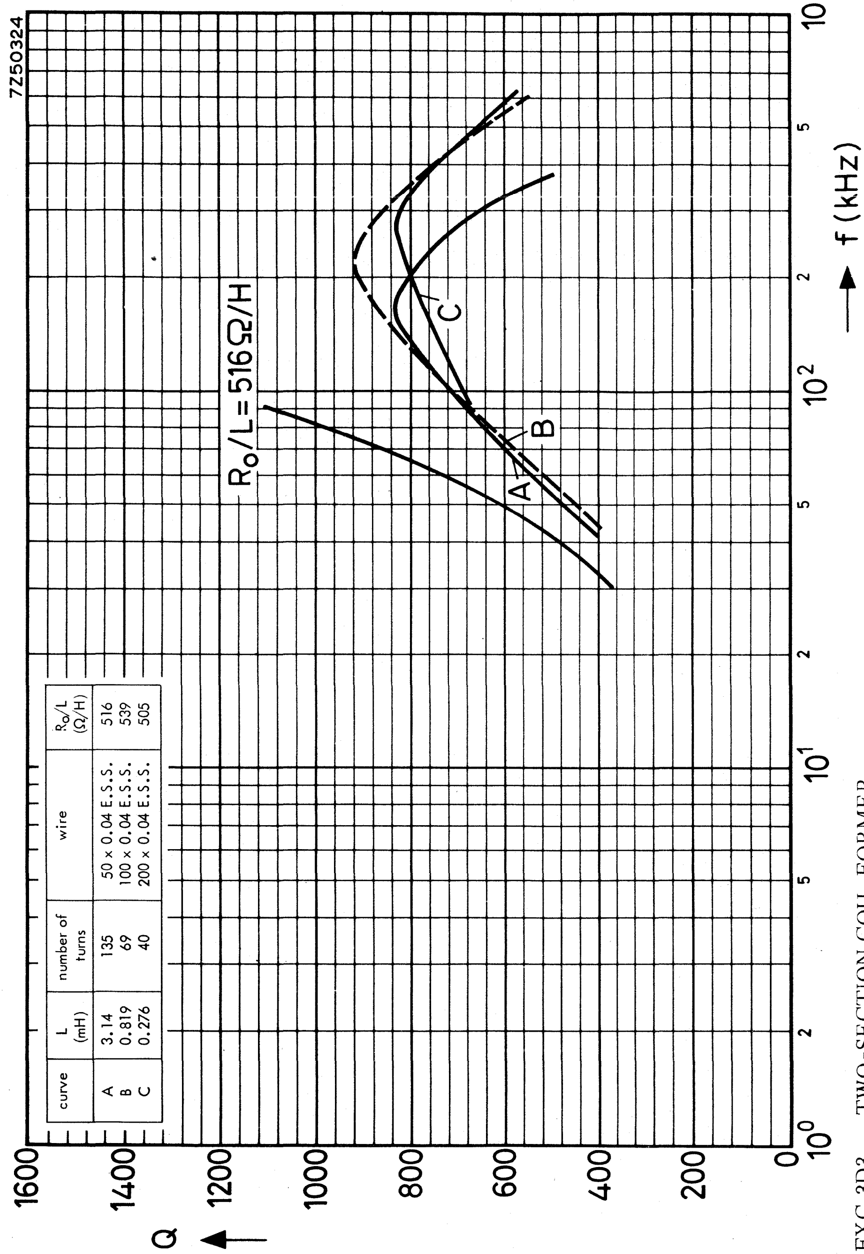
TWO-SECTION COIL FORMER

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

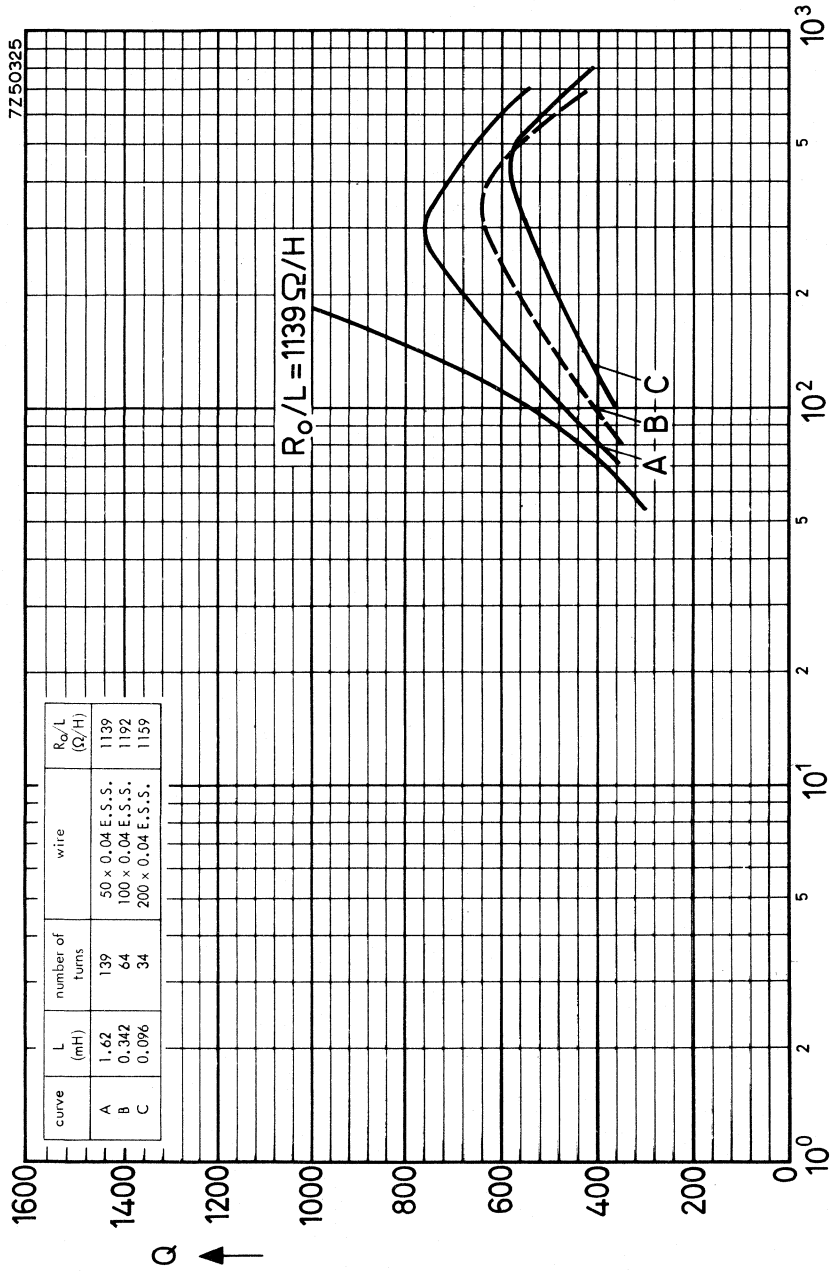
FXC 3D3 TWO-SECTION COIL FORMER
$\mu_e = 47$



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

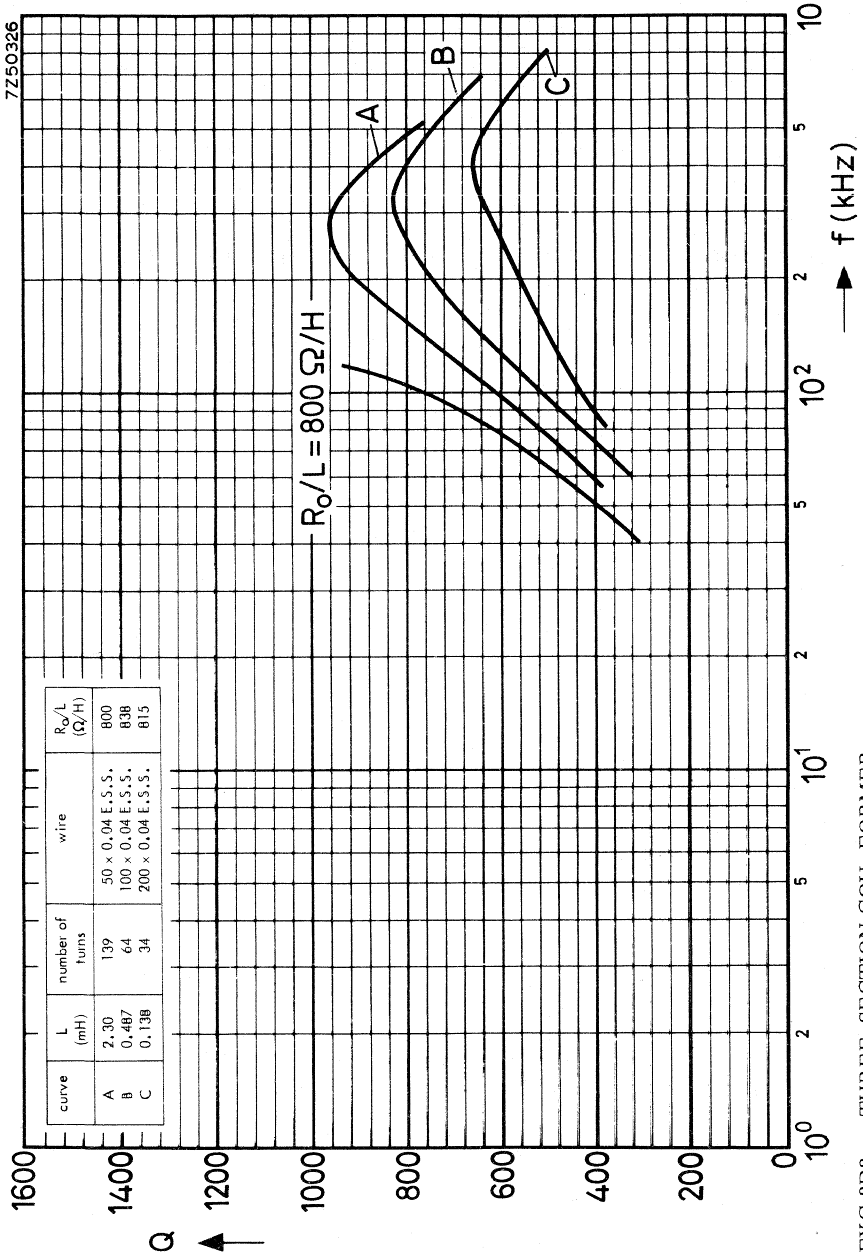
FXC 3D3
$\mu_e = 68$



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

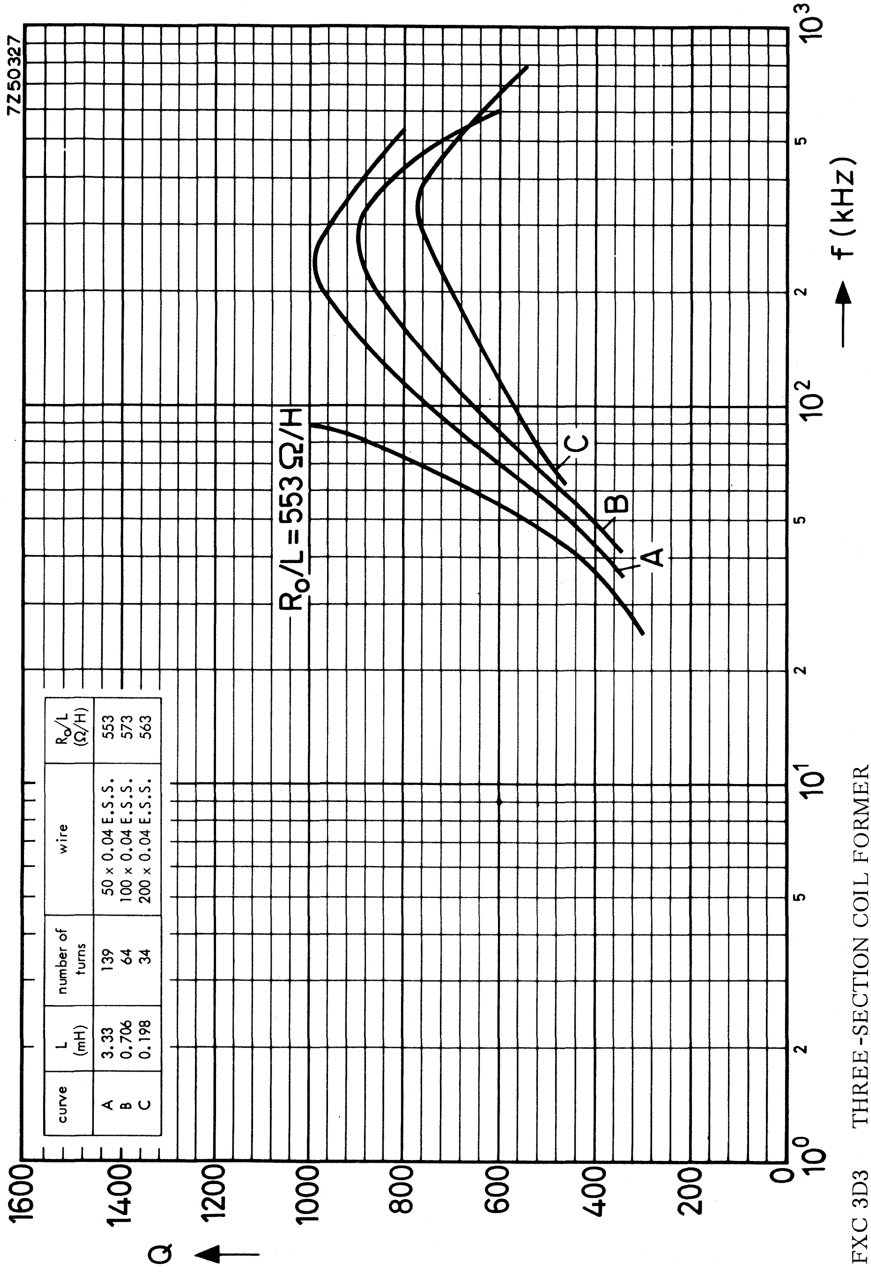
FXC 3D3 THREE-SECTION COIL FORMER

$\mu_e = 33$



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
$\mu_e = 47$

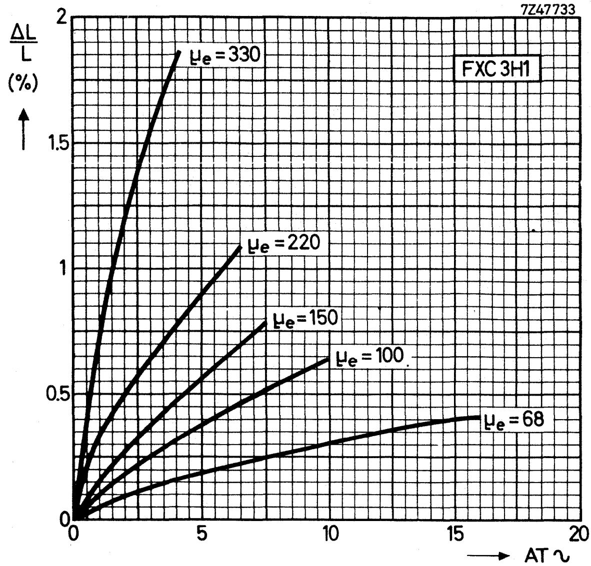


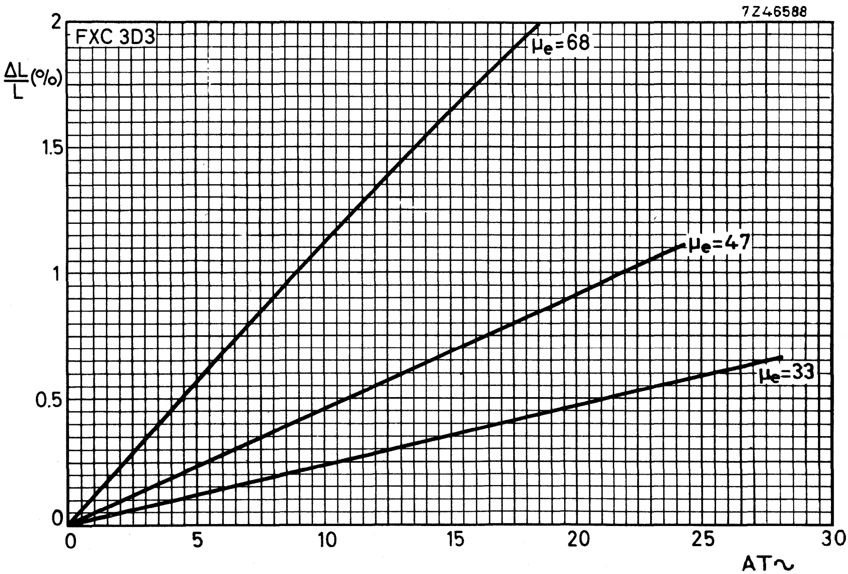
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	3.33	139	50 × 0.04 E.S.S.	553
B	0.706	64	100 × 0.04 E.S.S.	573
C	0.198	34	200 × 0.04 E.S.S.	563

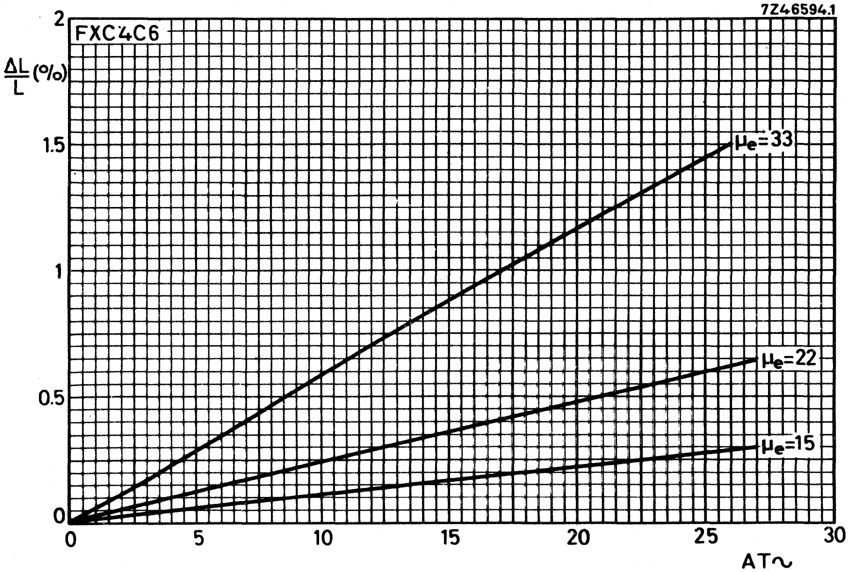
FXC 3D3 THREE-SECTION COIL FORMER

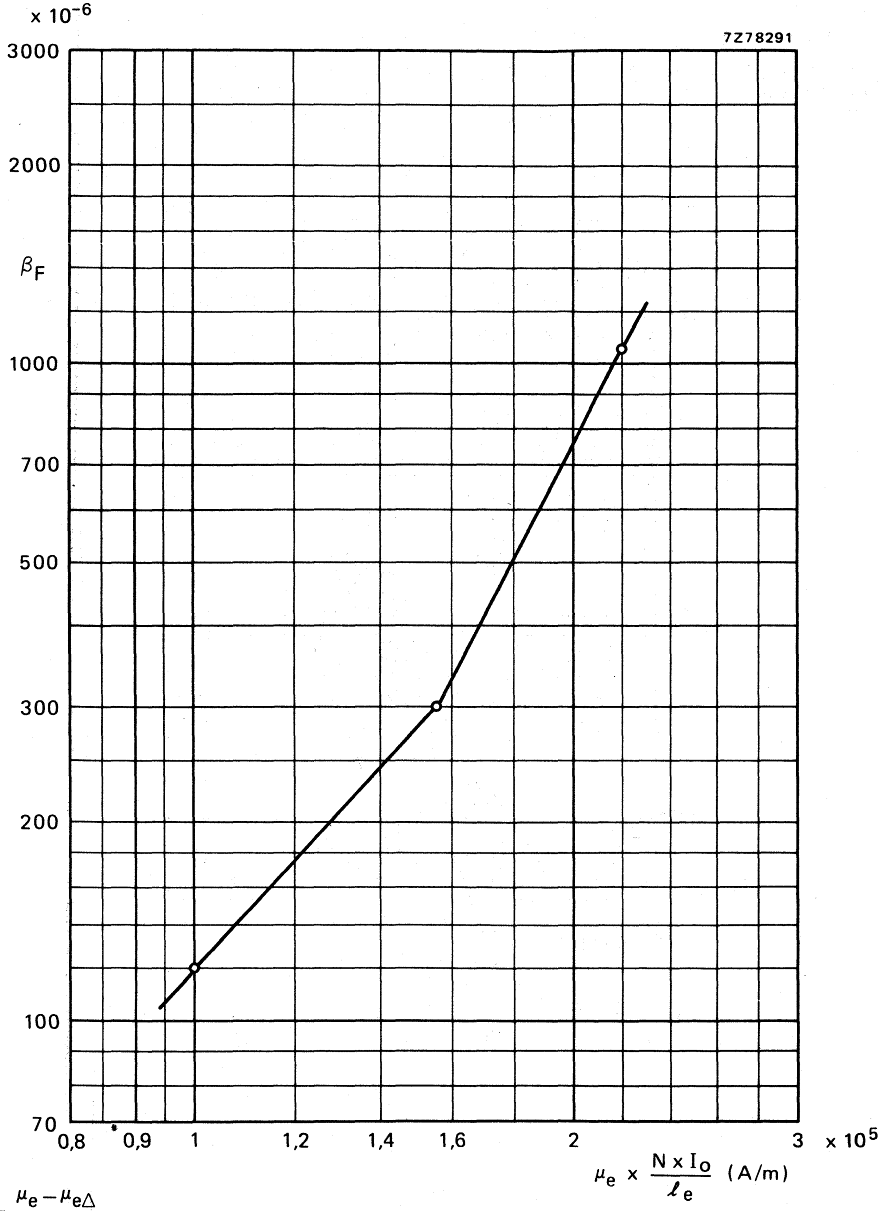
$\mu_e = 68$

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

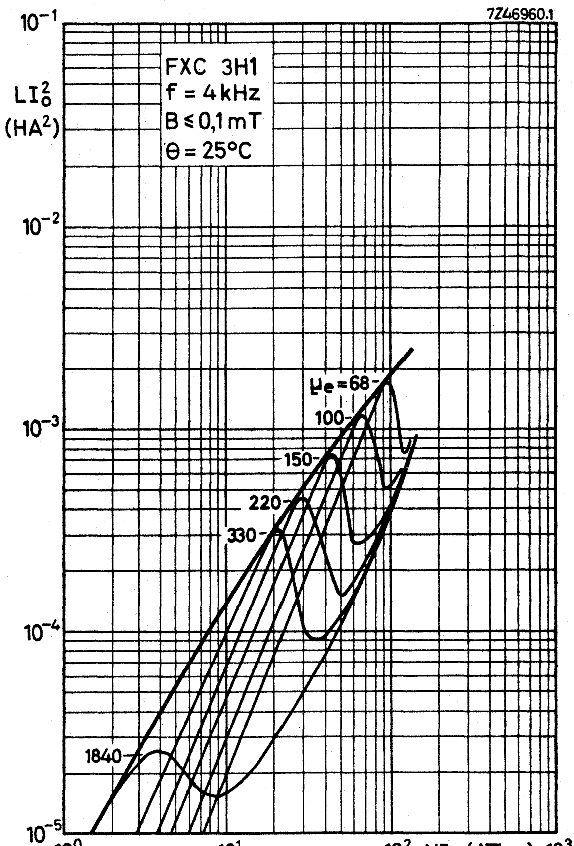


$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

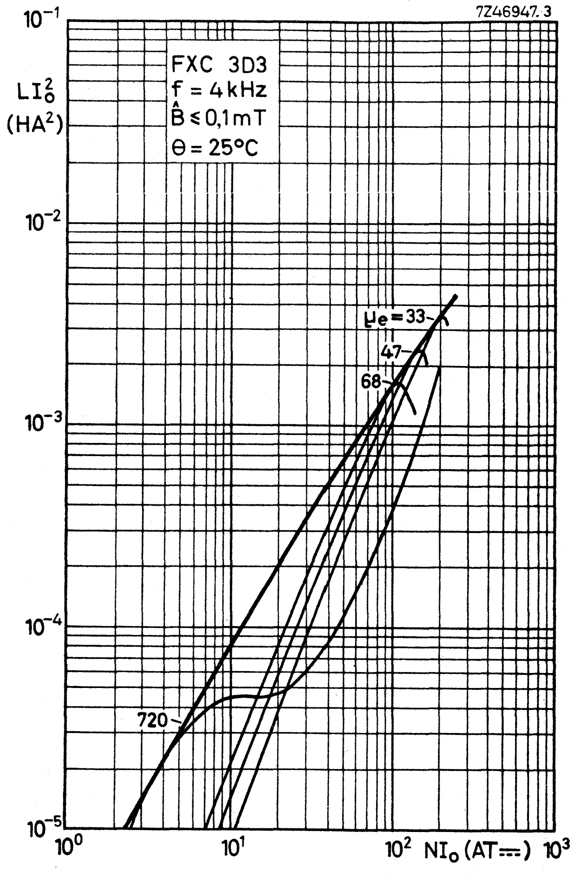
Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

HANNA CURVES

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



Typical values



POTCORES

Three types of core can be supplied:

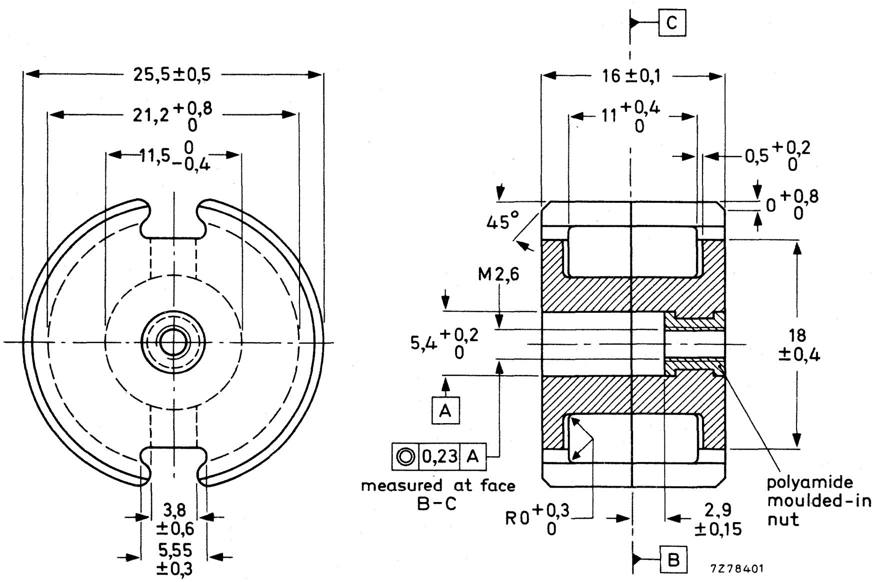
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (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 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut	⩾ 50 N
Torque of the screw thread	⩽ 1 N
Extraction force of adjuster from nut	⩾ 40 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}400\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00426\ mm^{-3}$; $V_e = 3530\ mm^3$; $l_e = 37{,}6\ mm$; $A_e = 93{,}9\ mm^2$.

Mass of a core set: 20 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 200 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq.	$\hat{B}$	temp.	grade						
	kHz	mT	°C	3B7	3B8	3D3	3E1	3H1		4C6
$A_L \pm 25\%$	4	⩽ 0,1	25 ± 1	5900	⩾ 3770	—	9650	5900		—
	100	⩽ 0,1	25 ± 1	5900	⩾ 3770	230	—	—		400
$\mu_e \pm 25\%$	4	⩽ 0,1	25 ± 1	1900	⩾ 1200	—	3075	1900		—
	100	⩽ 0,1	25 ± 1	1900	⩾ 1200	730	—	—		125
α	4	⩽ 0,1	25 ± 1	⩽ 14,9	⩽ 16,3	—	⩽ 11,8	⩽ 14,9		—
	100	⩽ 0,1	25 ± 1	⩽ 14,9	⩽ 16,3	⩽ 24,1	—	—		⩽ 58,0
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1		⩽ 1,5		⩽ 2,5	⩽ 1,2		
	100	⩽ 0,1	25 ± 1	⩽ 5,0	⩽ 6,0	⩽ 8,0	⩽ 20	⩽ 5,0		
	500	⩽ 0,1	25 ± 1			⩽ 14	⩽ 200			
	1 000	⩽ 0,1	25 ± 1			⩽ 30				
	2 000	⩽ 0,1	25 ± 1							⩽ 40
	10 000	⩽ 0,1	25 ± 1							⩽ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,1	⩽ 1,0		⩽ 1,8	⩽ 0,86		
	100	0,3 to 1,2	25 ± 1			⩽ 1,8				⩽ 6,2
$\alpha_F \times 10^6/°C$	⩽ 100	⩽ 0,1	5 to 25		0 to + 6			+ 0,5 to 1,5		−2 to + 4
	⩽ 100	⩽ 0,1	25 to 55		0 to + 6			+ 0,5 to 1,5		0 to + 6
$D_F \times 10^6$ (10-100 min)	⩽ 100	⩽ 0,1	25 to 70	−0,6 to + 0,6		0 to + 2	0 to + 2			
	⩽ 100	⩽ 0,1	25 ± 0,1	⩽ 4,3	⩽ 8,0	⩽ 12	⩽ 4,3	⩽ 4,3		⩽ 10
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:										
at $\mu_e \times \frac{N \times I_o}{l_e} = 1{,}00 \times 10^5$ A/m					⩽ 120					
$= 1{,}55 \times 10^5$ A/m					⩽ 300					

Core sets with nut and pre-adjusted on A_L.

A_L	corresponding μ_e-value	catalogue number 4322 022					
		3B7	3B8	3D3	3H1	3H3	4C6
63 ± 1%	20	29030		29430	29230		29830
100 ± 1%	31,8	29040		29440	29240		29840
160 ± 1%	51	29050		29450	29250		
250 ± 1%	79,5	29060	29860 *	29460	29260	29560	
315 ± 1,5%	100,2	29070			29270	29570	
400 ± 2%	127	29080		29480	29280	29580	
630 ± 3%	200	29100	29890 *		29300	29600	
1000 ± 3%	318	29110			29310	29610	
1600 ± 3%	510	29120			29320		

Core sets with nut and pre-adjusted on μ_e.

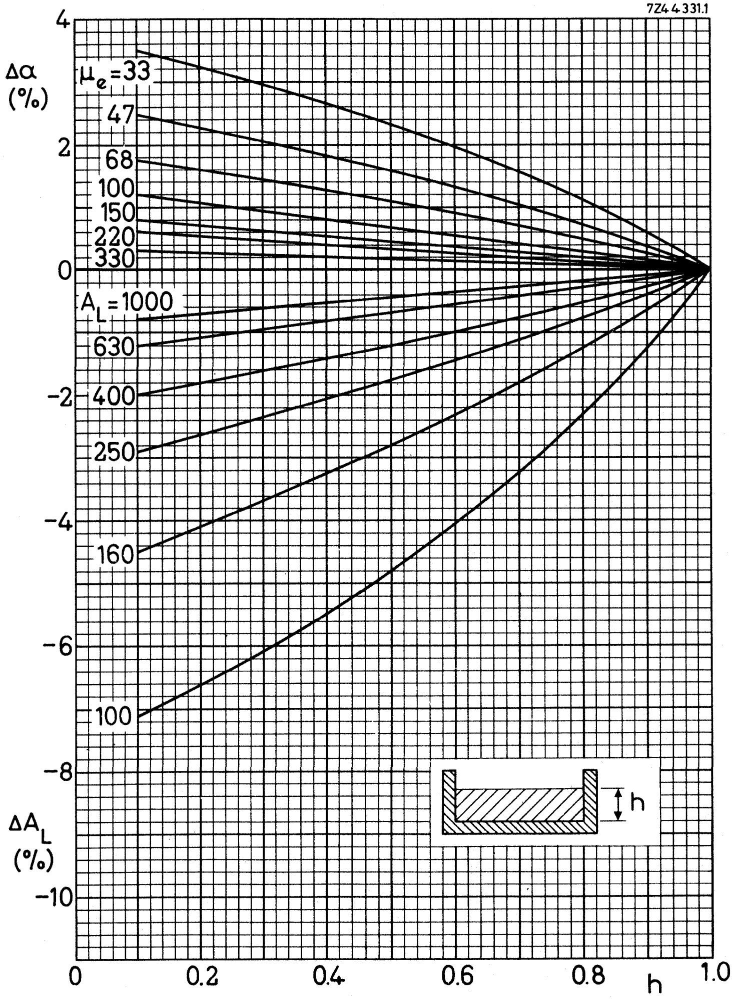
μ_e	α	catalogue number 4322 022					
		3B7	3B8	3D3	3H1	3H3	4C6
15 ± 1%	146			28410			28810
22 ± 1%	120						28820
33 ± 1%	98,2	28030		28430	28230		28830
47 ± 1%	82,3	28040		28440	28240		
68 ± 1%	68,4	28050		28450	28250		
100 ± 1,5%	56,4	28060			28260		
150 ± 2%	46,1	28070			28270		
220 ± 3%	38,1	28080			28280		
330 ± 3%	31,0	28090			28290		
730 ± 25%	20,8			28400 *			
1910 ± 25%	12,9	28000 *			28200 *		

Core sets without nut: replace the eighth digit of the catalogue number (2) by 0.
Cores with $A_L \leqslant 400$ or $\mu_e \leqslant 100$, have a symmetrical air gap.
Cores with $A_L \geqslant 630$ or $\mu_e \geqslant 150$, have a asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B7	4322 020 22000
3B8	4322 020 22220
3D3	4322 020 22020
3E1	4322 020 22140
3H1	4322 020 22010
4C6	4322 020 22110

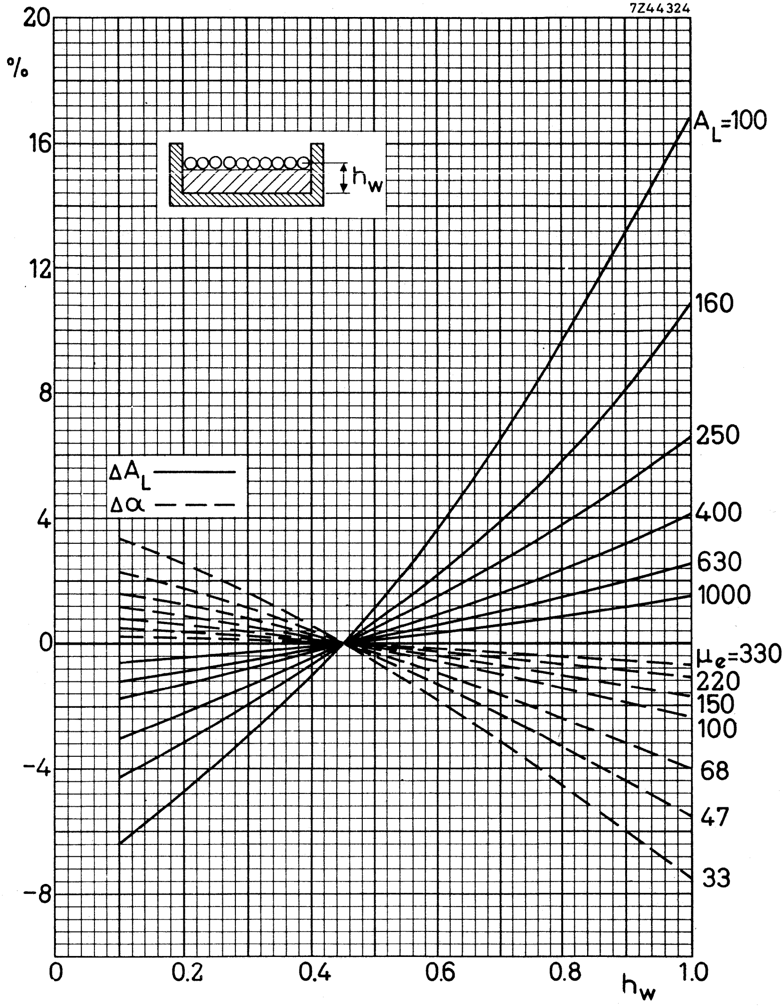
DATA FOR WHEN THE COIL FORMER IS PARTLY FILLED



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 %.

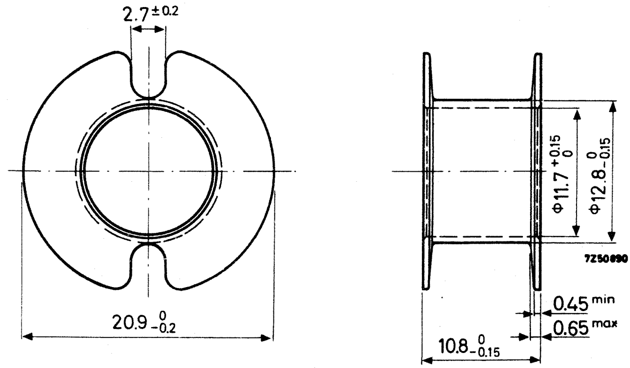
COIL FORMERS

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), UTE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER Dimensions in mm



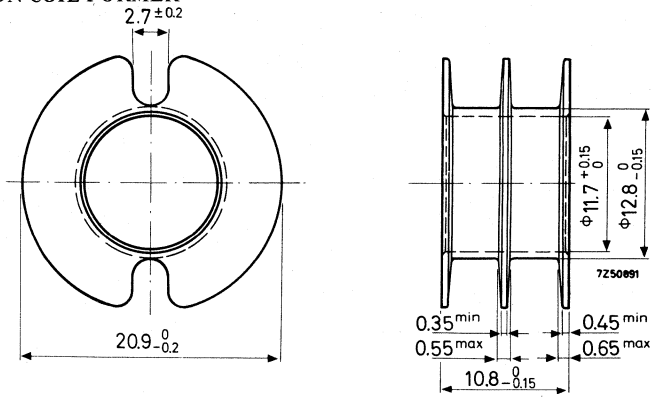
Catalogue number	4322 021 30330
Material	polycarbonate
Window area	39 mm²
Mean length of turn	53 mm
Max. temperature	130 °C

D.C. losses

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

Mass 0,5 g

TWO-SECTION COIL FORMER



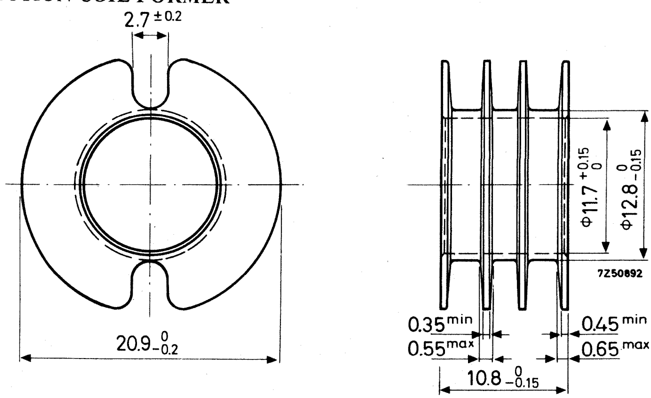
Catalogue number	4322 021 30340
Material	polycarbonate
Window area	2 x 19 mm^2
Mean length of turn	53 mm
Max. temperature	130 °C

D.C. losses

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

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

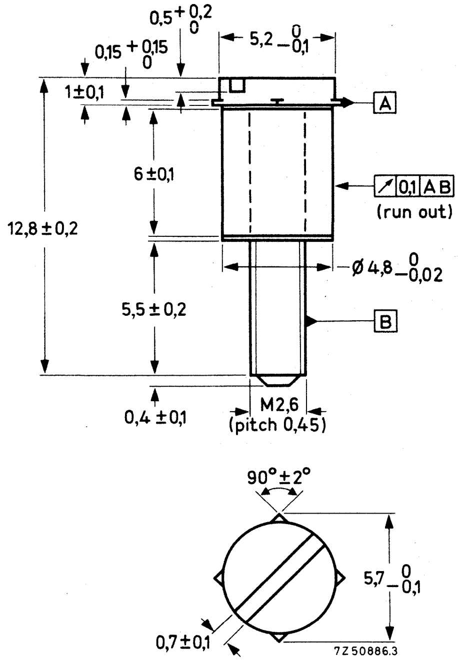
$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 8.18 \times 10^3 \quad \Omega/H$$

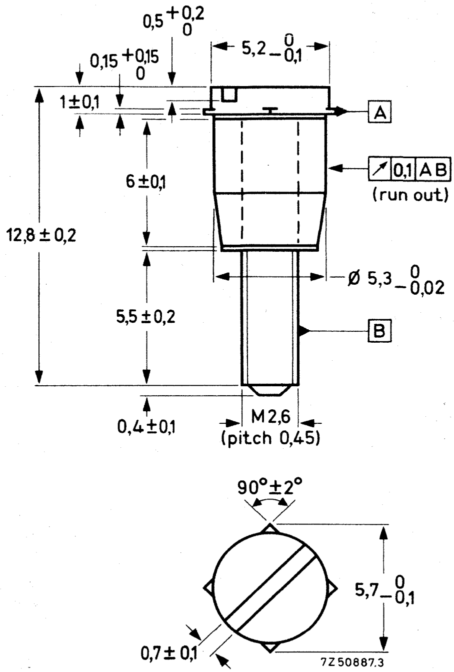
Weight 0.7 g

INDUCTANCE ADJUSTERS

CONTINUOUS ADJUSTERS

Dimensions in mm





The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 an continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

Table 2 shows the type of adjuster 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

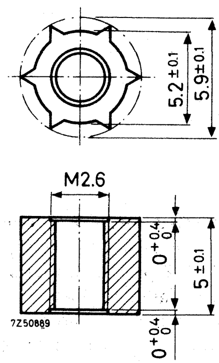
The adjustors are packed in bags of 100, so please order in multiples of 100.

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.

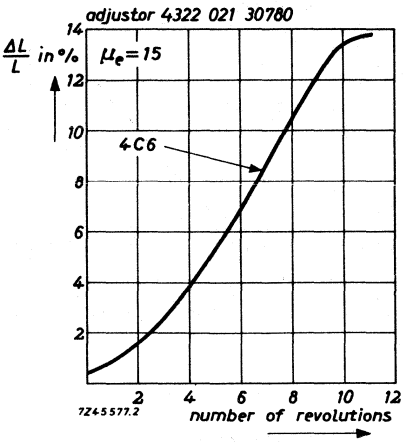


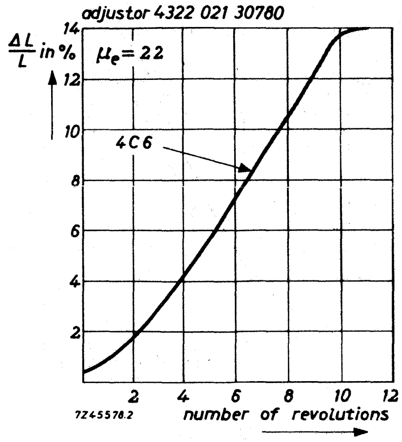
Catalogue number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	2,7 ± 0,15 mm

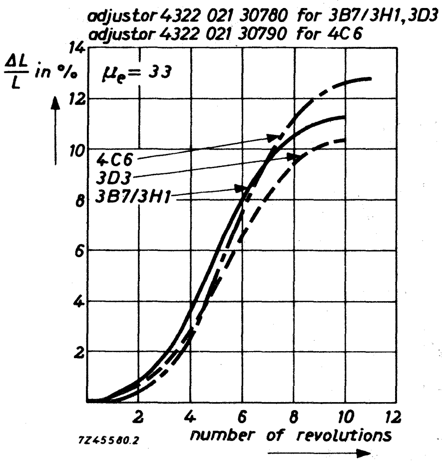
For more information see Potcores General, Mounting data

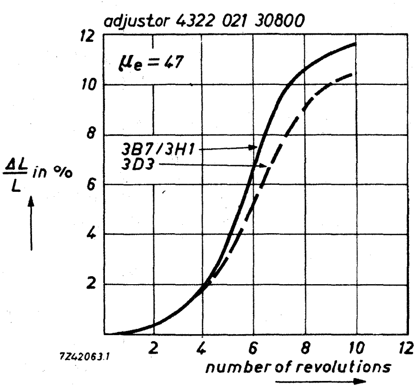
The nuts are packed in bags of 100, so please order in multiples of 100.

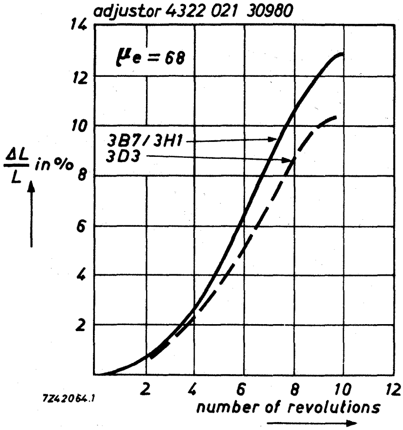
Adjustment curves

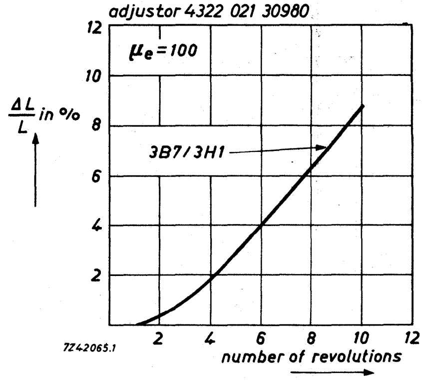


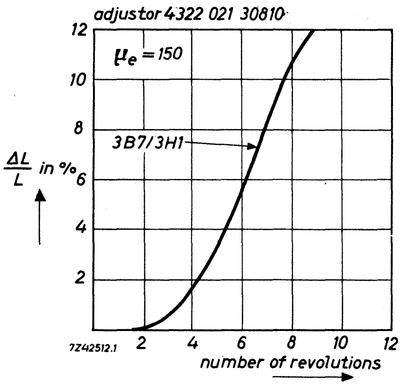


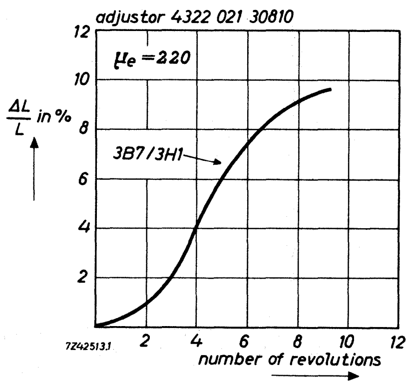


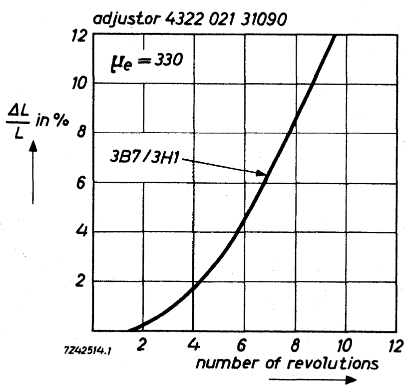



adjustor 4322 021 30980
$\mu_e = 68$
3B7/3H1
3D3
$\frac{\Delta L}{L}$ in %
number of revolutions
7Z42064.1


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


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


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


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

STEP-BY-STEP ADJUSTERS

These adjusters 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 adjusters is negligible.

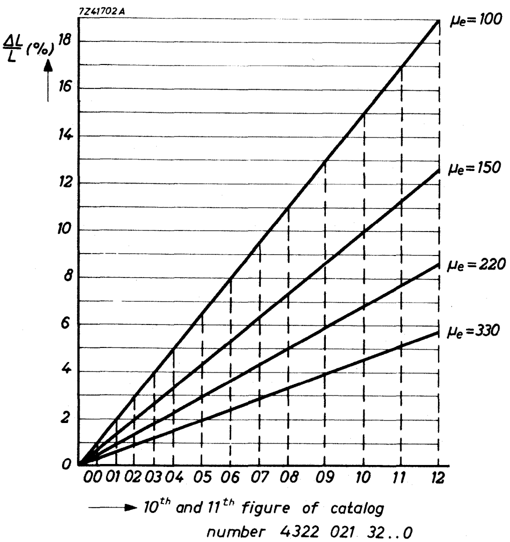
A range of 13 flexible conical adjusters is available under the catalogue numbers 4322 021 32000 up to 4322 021 32120. Each adjuster causes an increase in the inductance; the higher the catalogue number, the greater the effect. The influence of each adjuster on the inductance at different μ_e values of the potcore can be found from the graph.

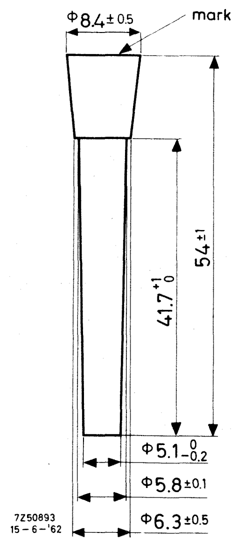
The 10th and 11th figure of the catalogue number are indicated on the head of the adjuster. It should be borne in mind that, when using these adjusters, the inductance of the coil should initially be lower than the wanted value.

When the correct adjuster ahs been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond or 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.

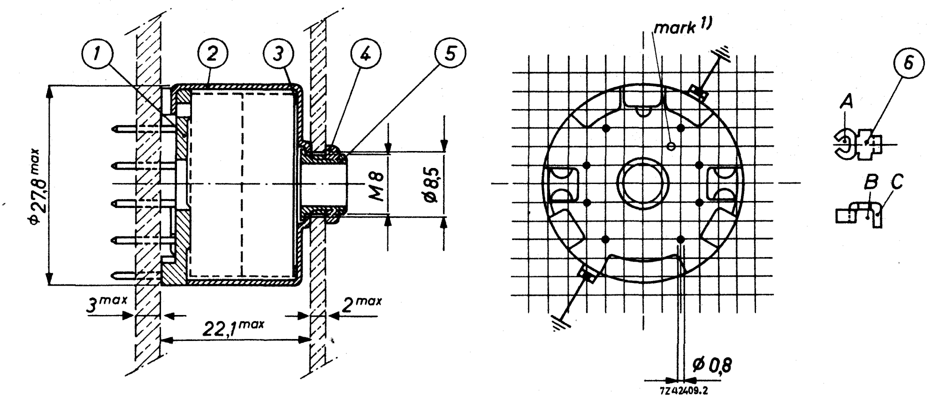
Dimensions in mm





MOUNTING PARTS

MOUNTING



(1) tag plate	4322 021 30470	(4) nut	4322 021 30710
(2) brass container	4322 021 30550	(5) fixing brush	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 a grid of 2, 54 mm (0, 1 inch).

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

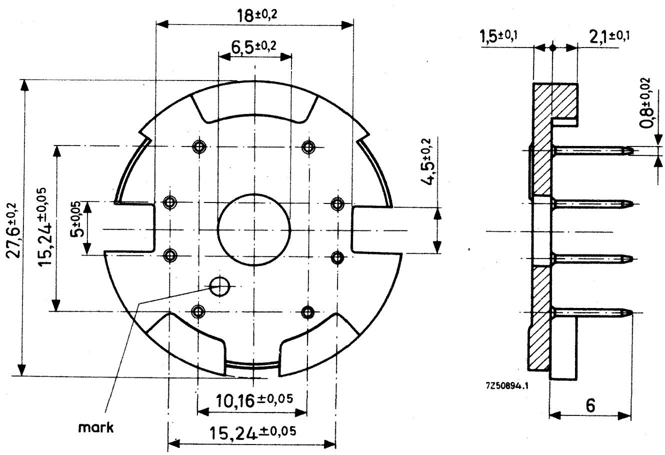
PART DRAWINGS

Dimensions in mm

(1) Tag plate 4322 021 30470

Plate : polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s.

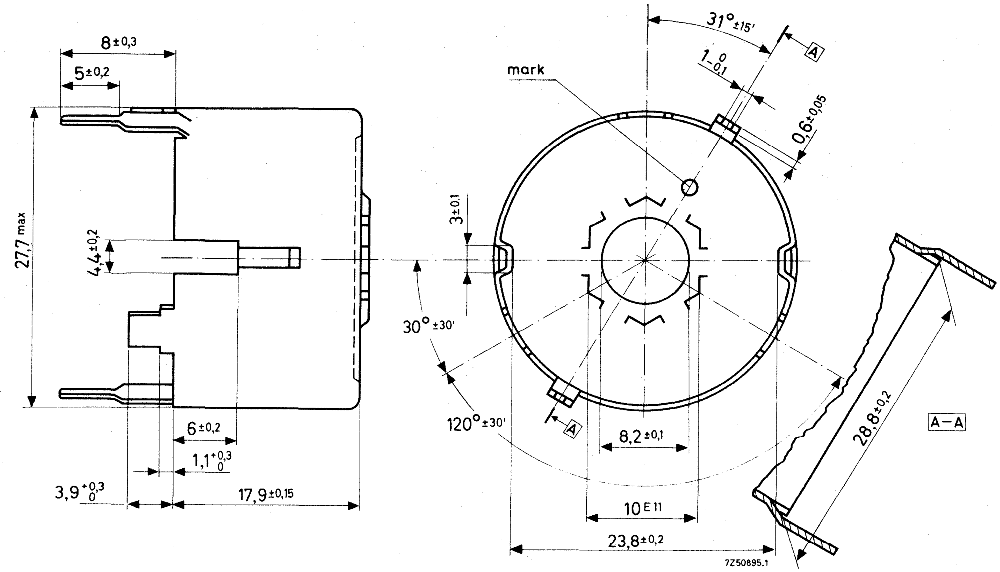
Pins : phosphor bronze, dip-soldered



The tag plates are packed in units of 40 pieces on a polystyrene plate, and with 250 pieces in a cardboard box. Please order in multiples of these quantities.

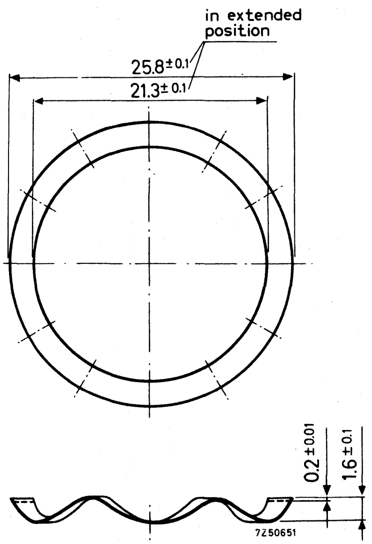
(2) Container 4322 021 30550

Material: brass, nickel plated; tinned soldering pins



→ (3) Spring 4322 021 30660

Material: chrome-nickel steel

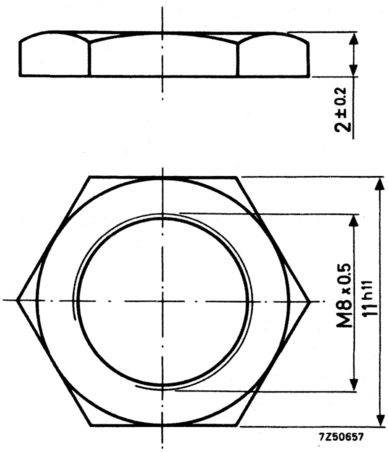


A force of 136 to 225 N is required to compress the spring to 0,55 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

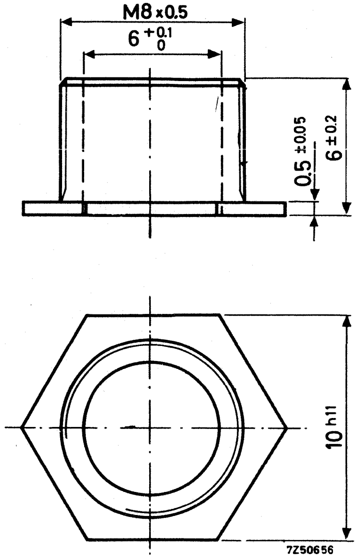
(4) Nut 4322 021 30710

Material: brass, nickel plated



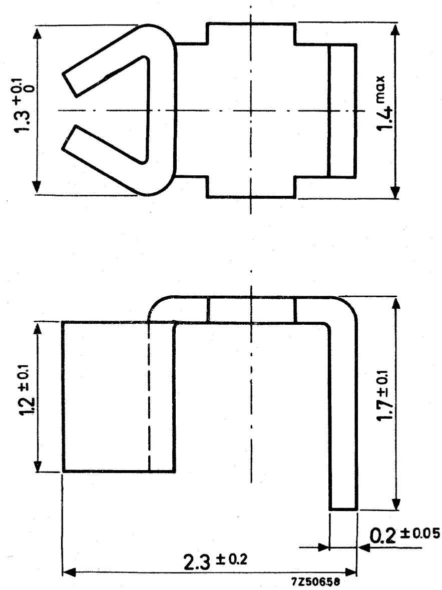
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



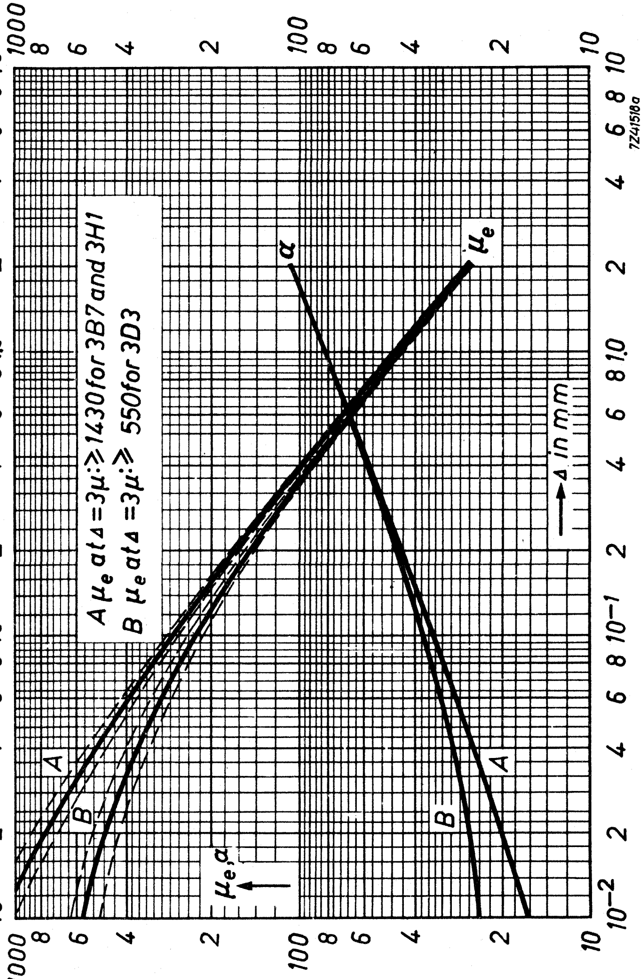
(6) Soldering spring 4322 021 30700

Material : brass, dipsoldered



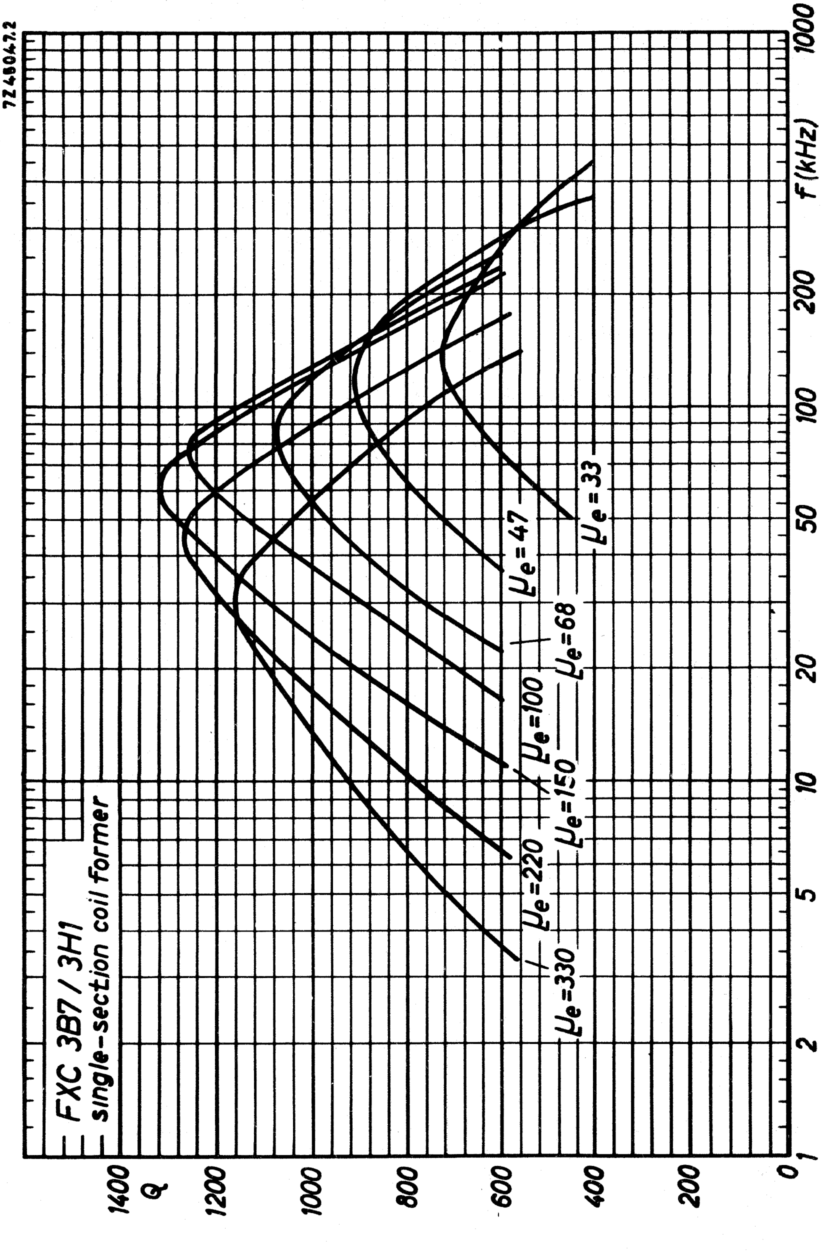
CHARACTERISTIC CURVES

μ_e - α CURVES

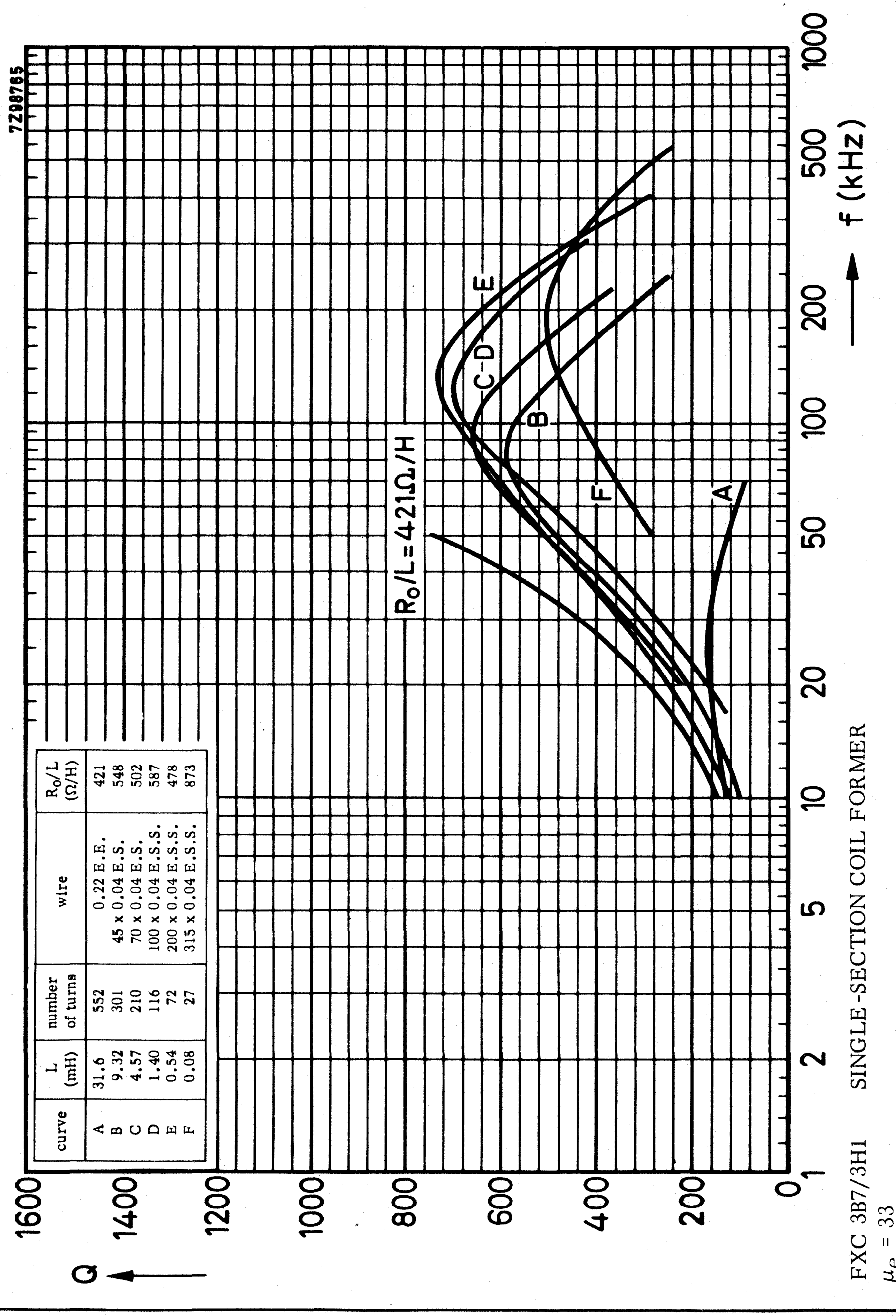


Relative effective permeability and turn factor for 1 mH as a function of the air-gap length.

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



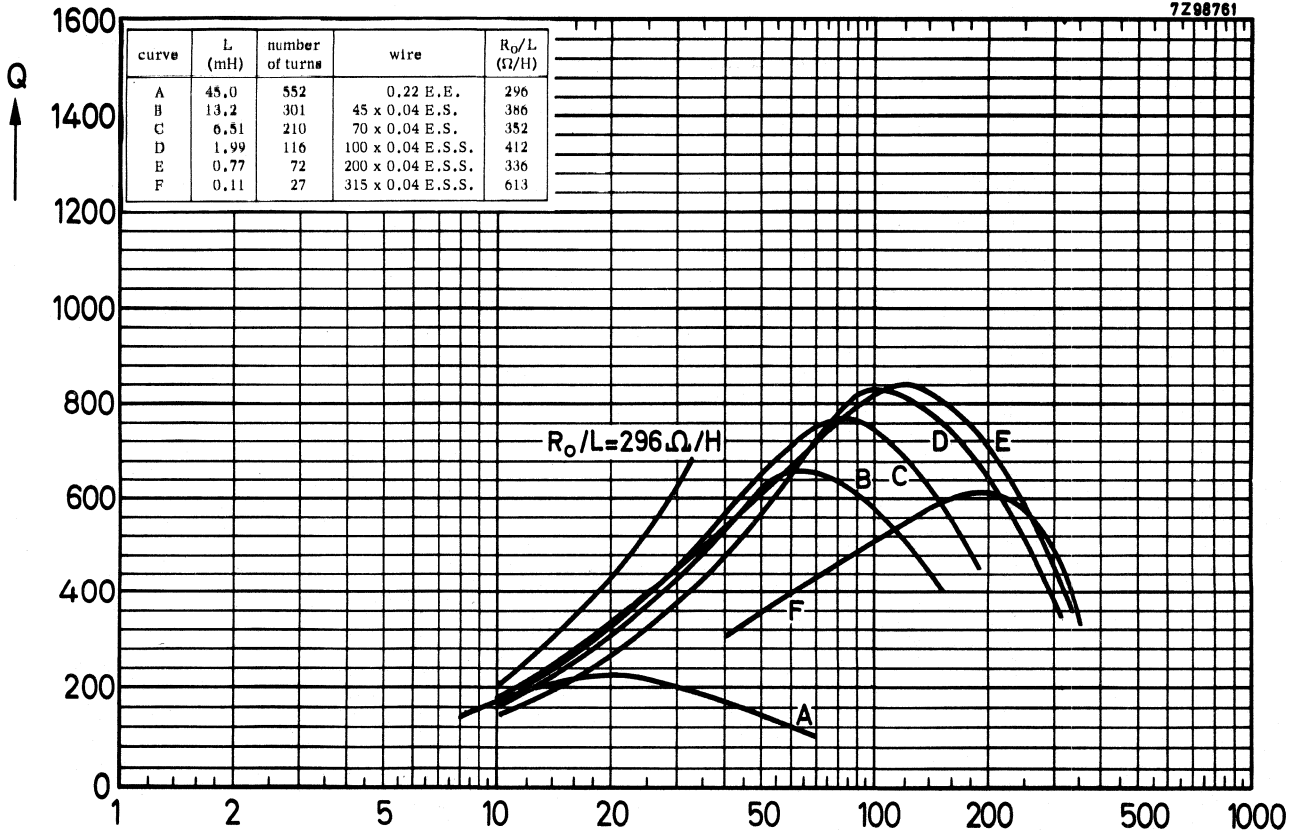
Enveloping curves



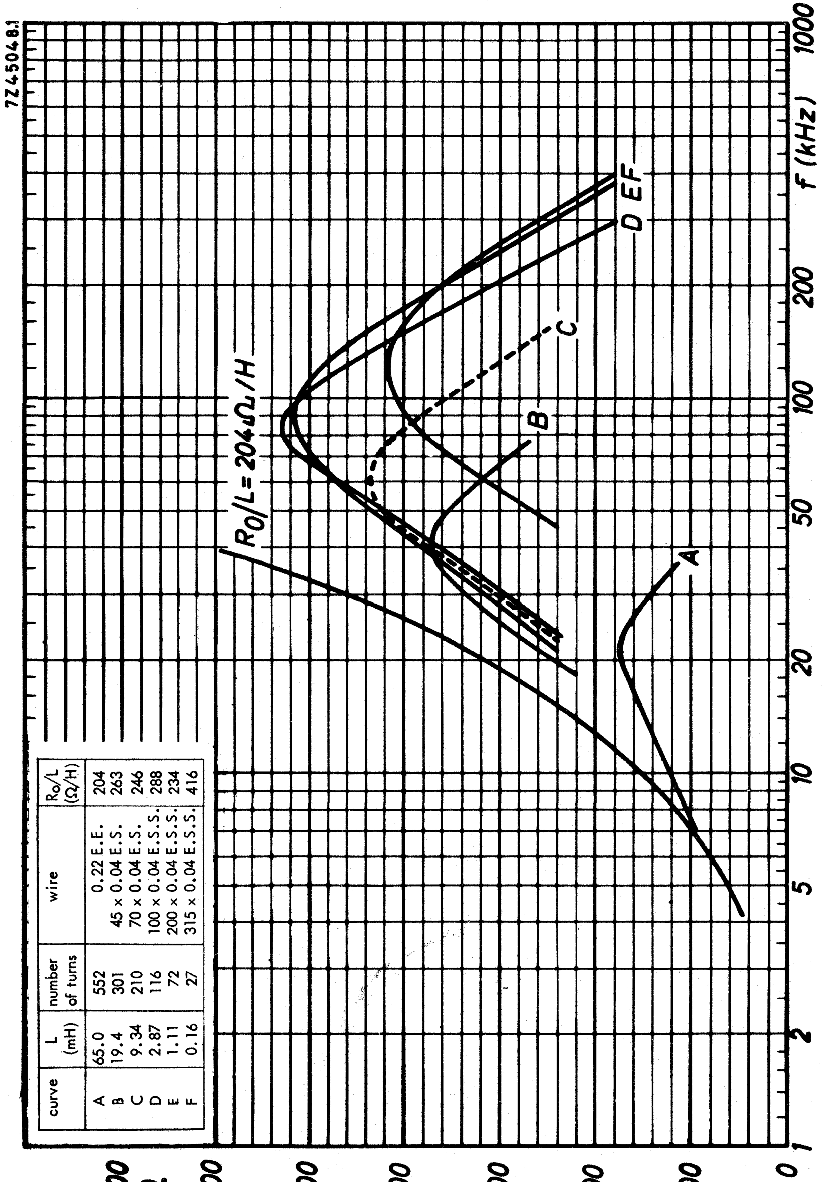
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	31.6	552	0.22 E.E.	421
B	9.32	301	45 x 0.04 E.S.	548
C	4.57	210	70 x 0.04 E.S.	502
D	1.40	116	100 x 0.04 E.S.S.	587
E	0.54	72	200 x 0.04 E.S.S.	478
F	0.08	27	315 x 0.04 E.S.S.	873

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

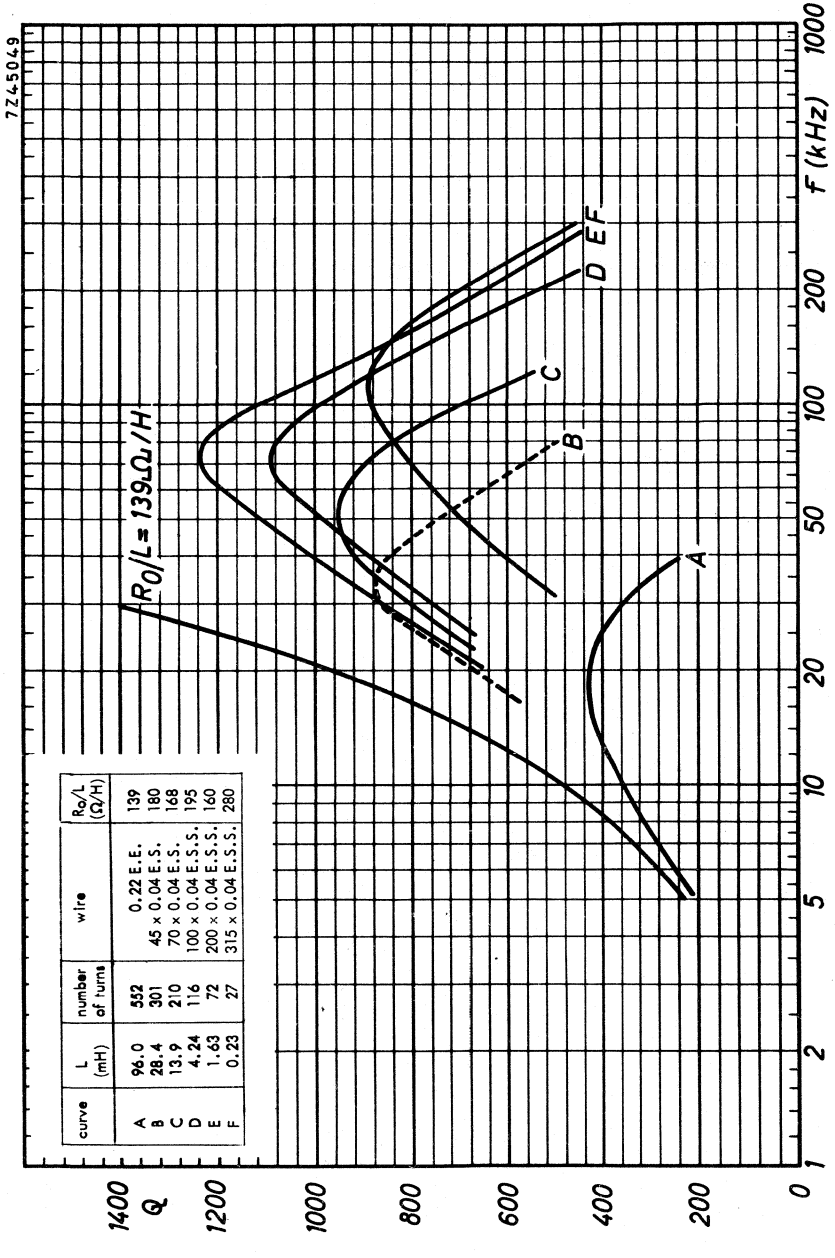


FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
μ_e = 47



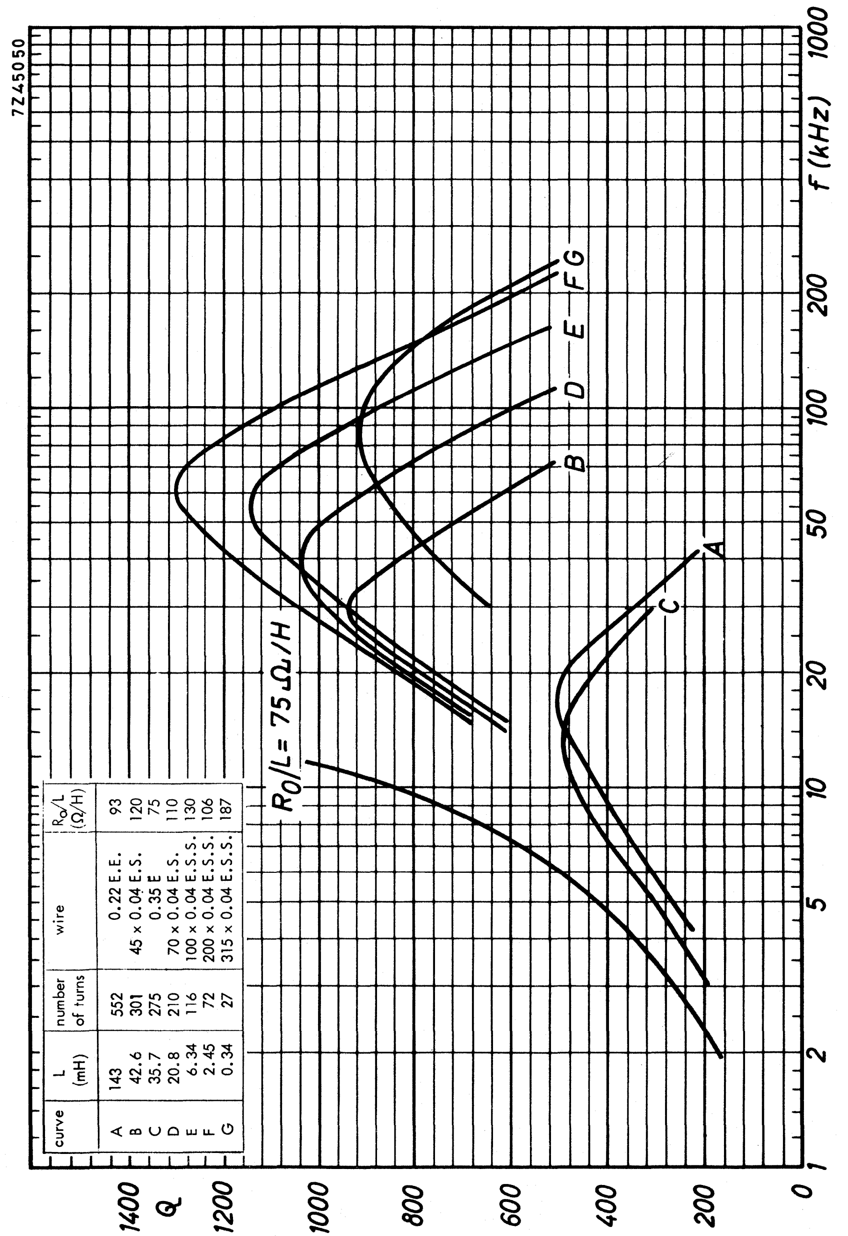
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	65.0	552	0.22 E.E.	204
B	19.4	301	45 × 0.04 E.S.	263
C	9.34	210	70 × 0.04 E.S.	246
D	2.87	116	100 × 0.04 E.S.S.	288
E	1.11	72	200 × 0.04 E.S.S.	234
F	0.16	27	315 × 0.04 E.S.S.	416

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



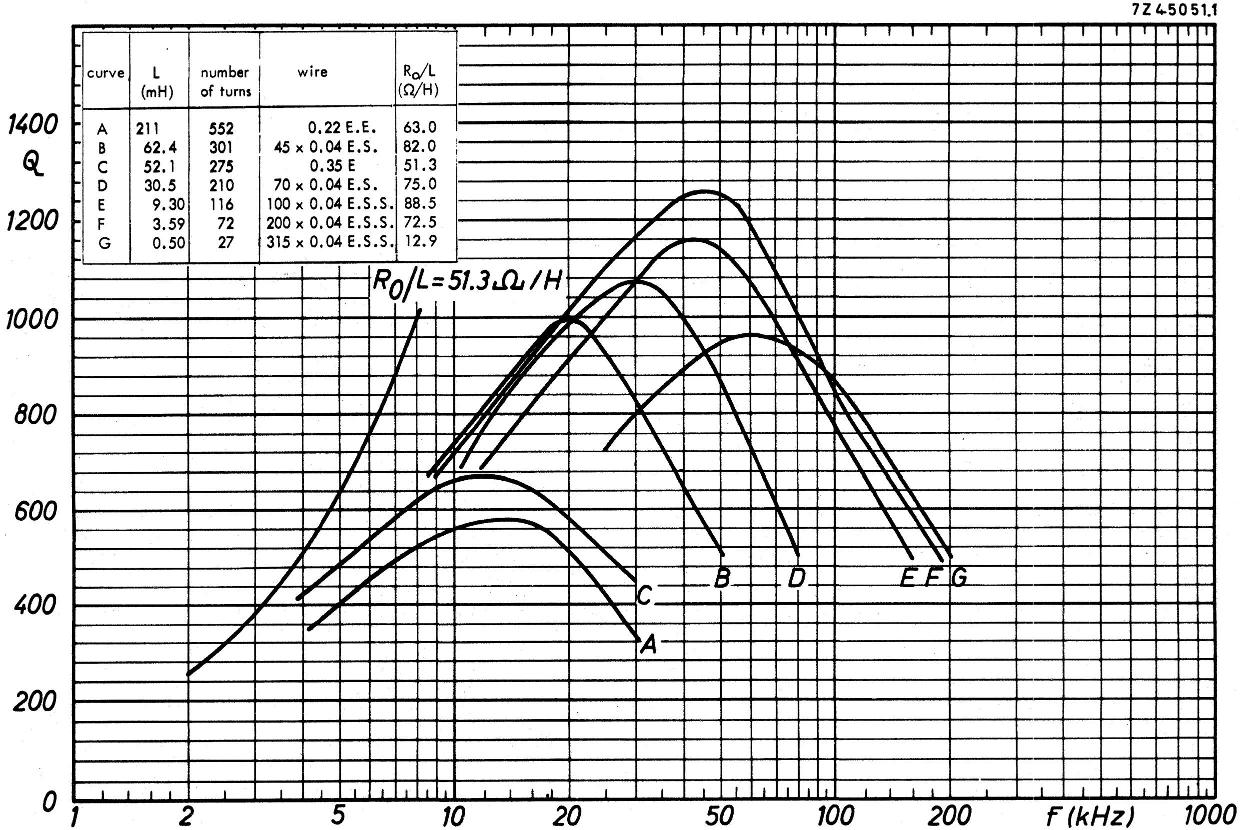
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	96.0	552	0.22 E.E.	139
B	28.4	301	45 × 0.04 E.S.	180
C	13.9	210	70 × 0.04 E.S.	168
D	4.24	116	100 × 0.04 E.S.S.	195
E	1.63	72	200 × 0.04 E.S.S.	160
F	0.23	27	315 × 0.04 E.S.S.	280

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



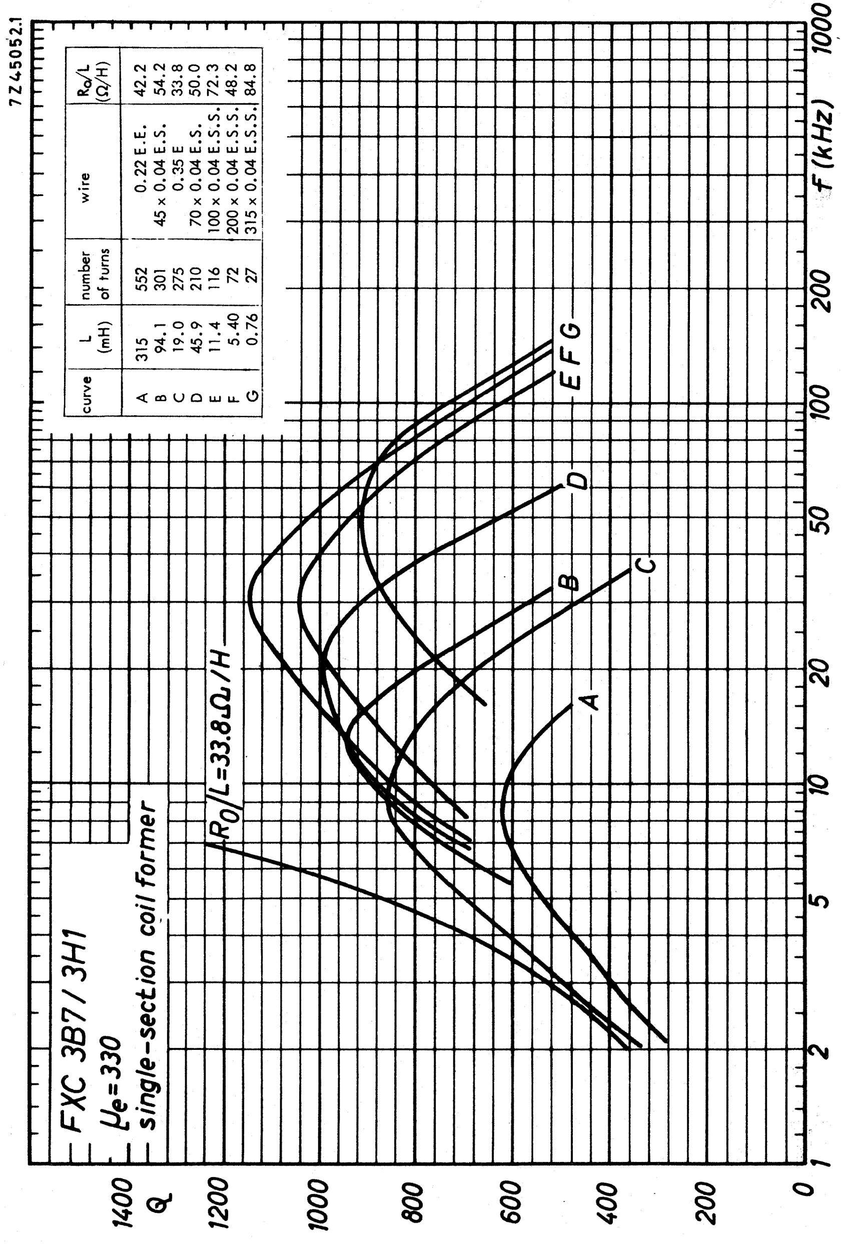
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	143	552	0.22 E.E.	93
B	42.6	301	45 × 0.04 E.S.	120
C	35.7	275	0.35 E	75
D	20.8	210	70 × 0.04 E.S.	110
E	6.34	116	100 × 0.04 E.S.S.	130
F	2.45	72	200 × 0.04 E.S.S.	106
G	0.34	27	315 × 0.04 E.S.S.	187

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



curve	L (mH)	number of turns	wire	R_o/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

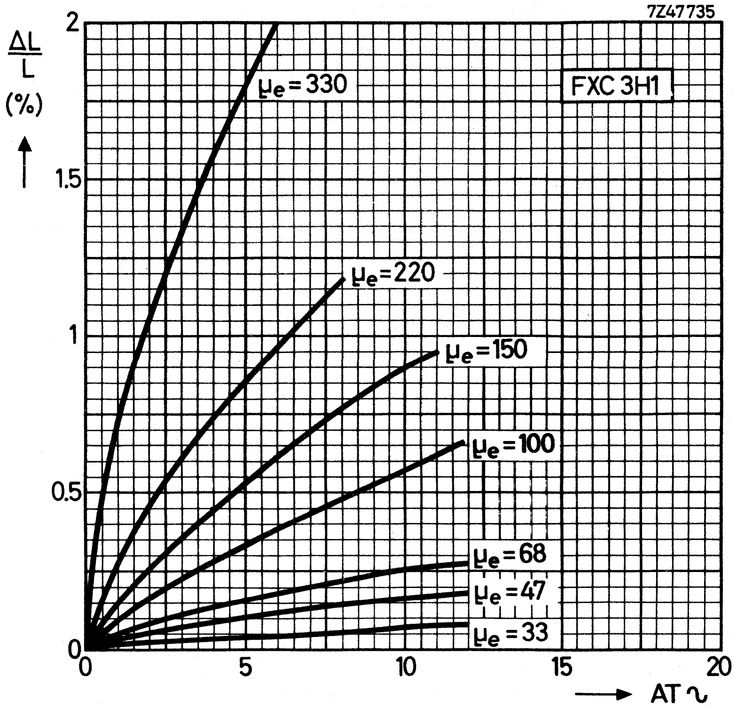
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 220$

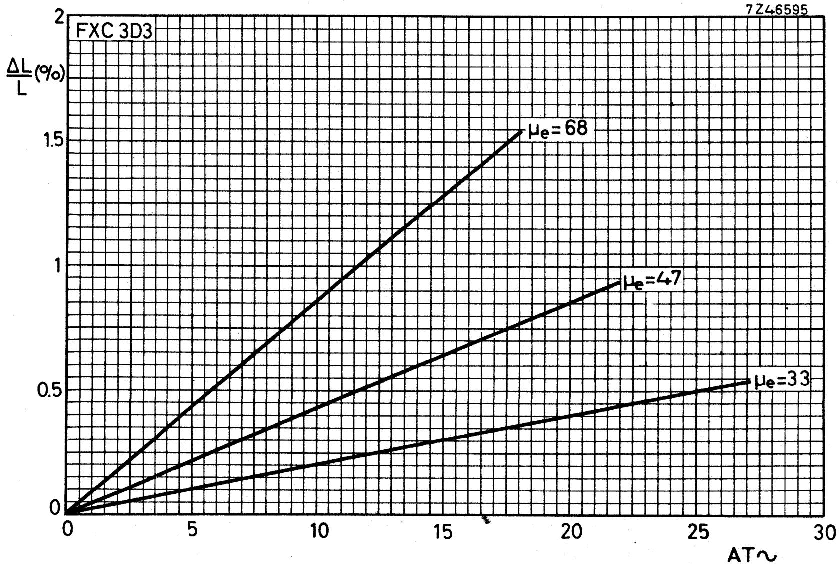


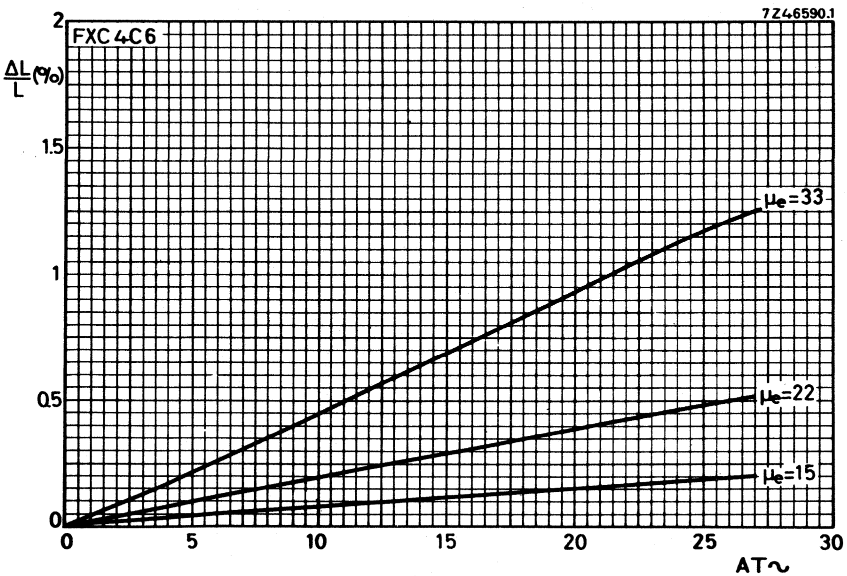
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	315	552	0.22 E.E.	42.2
B	94.1	301	45 × 0.04 E.S.	54.2
C	19.0	275	0.35 E	33.8
D	45.9	210	70 × 0.04 E.S.	50.0
E	11.4	116	100 × 0.04 E.S.S.	72.3
F	5.40	72	200 × 0.04 E.S.S.	48.2
G	0.76	27	315 × 0.04 E.S.S.	84.8

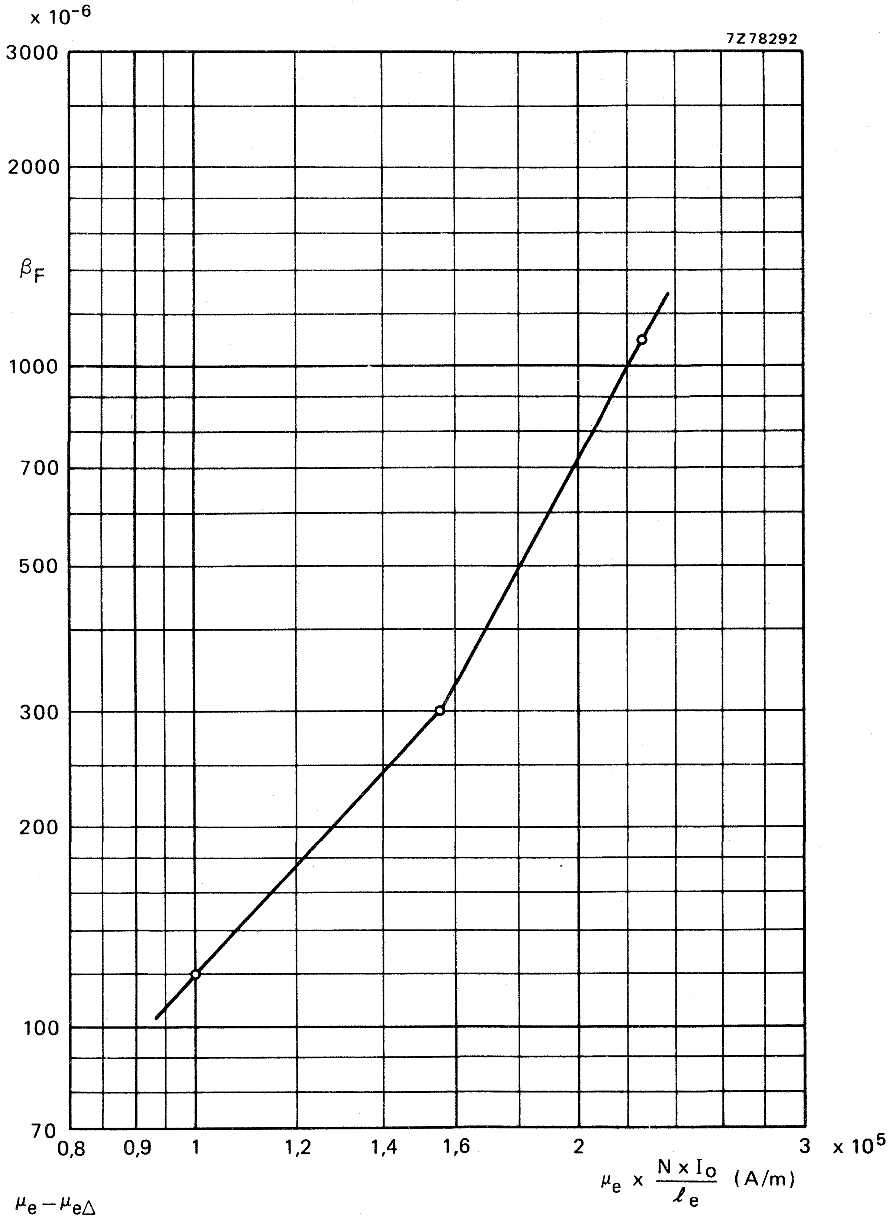
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
μ_e = 330

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

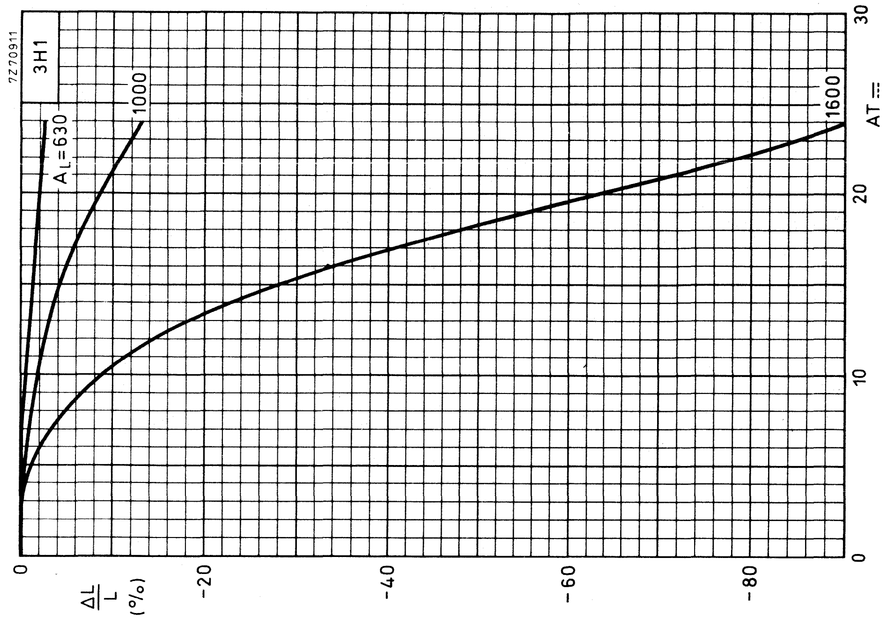

7Z46590.1
FXC 4C6
ΔL/L (%)
2
1.5
1
0.5
0
0
5
10
15
20
25
30
AT~
μe = 33
μe = 22
μe = 15

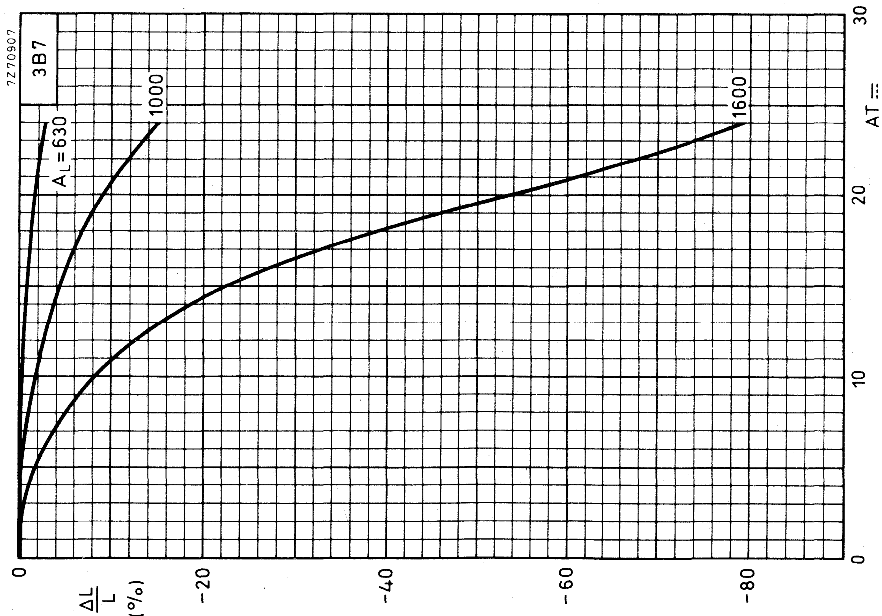


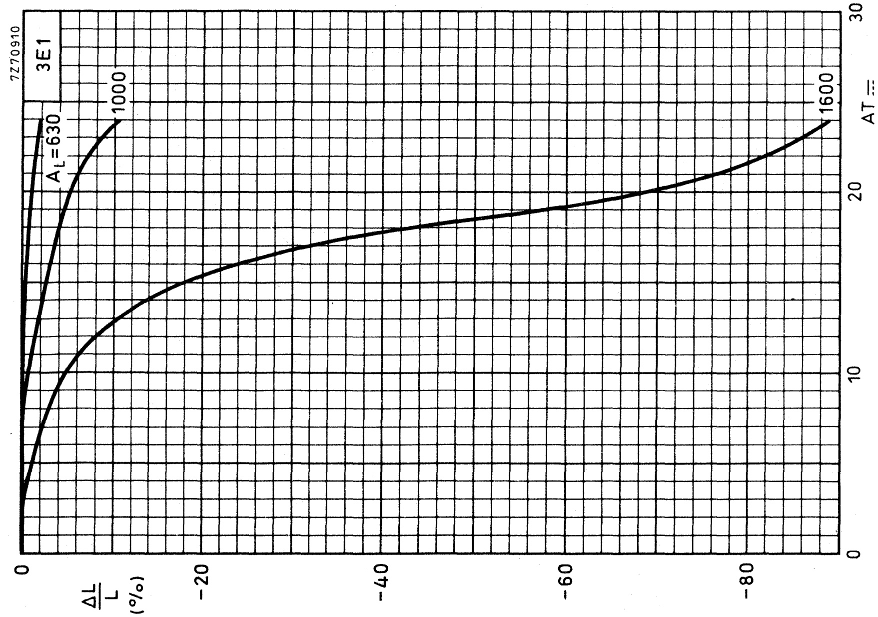
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

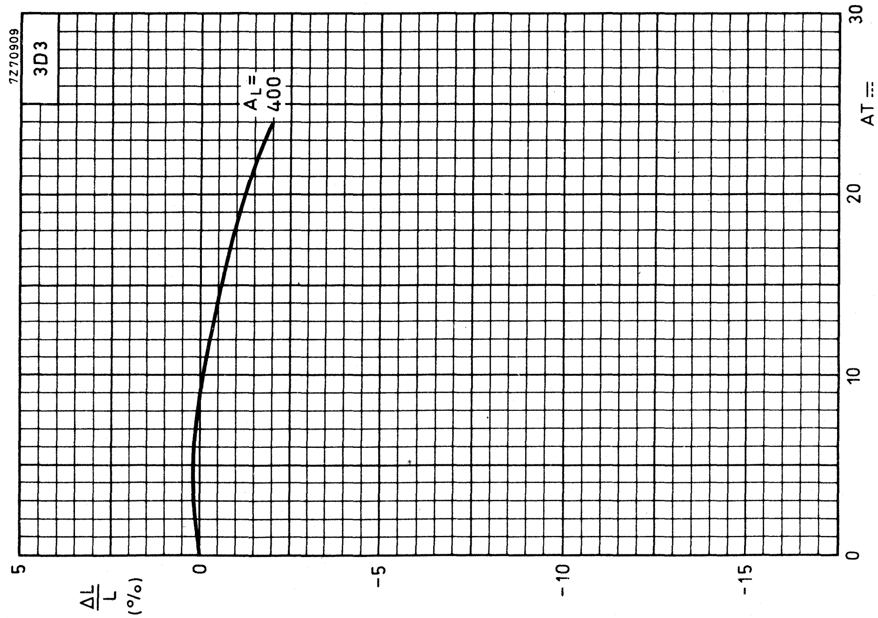
Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

INDUCTANCE VARIATION AS A FUNCTION OF AT ⎓

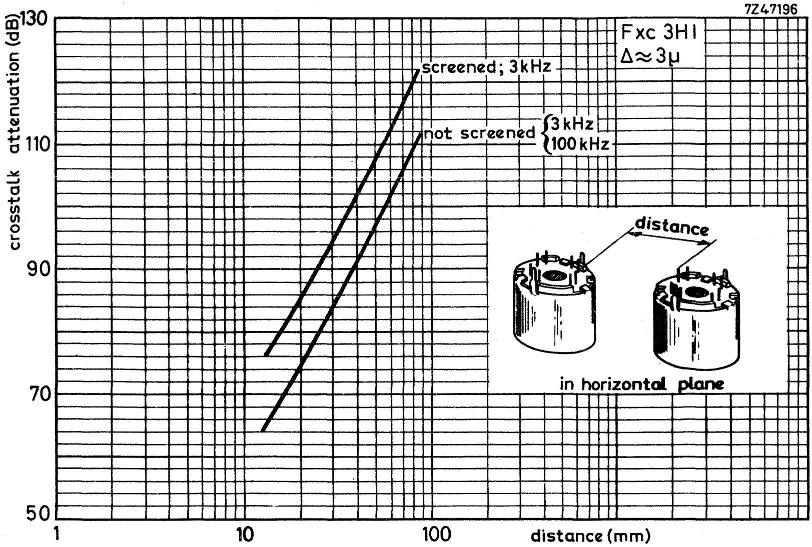


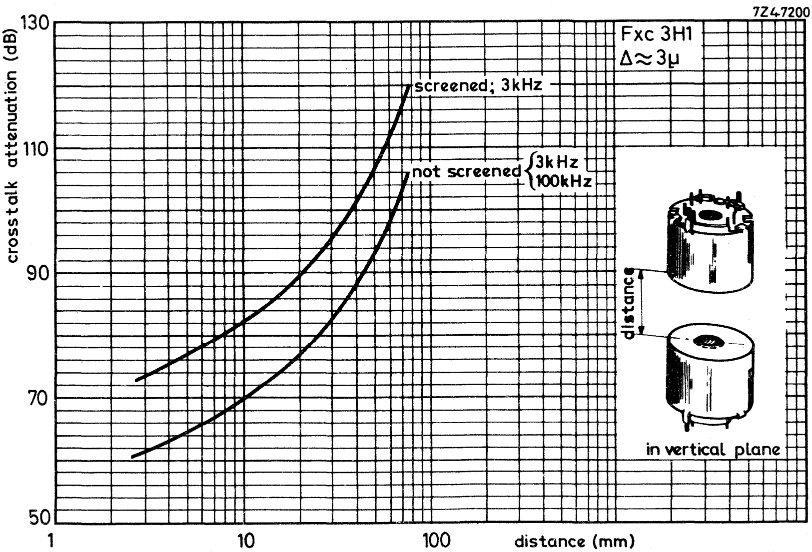


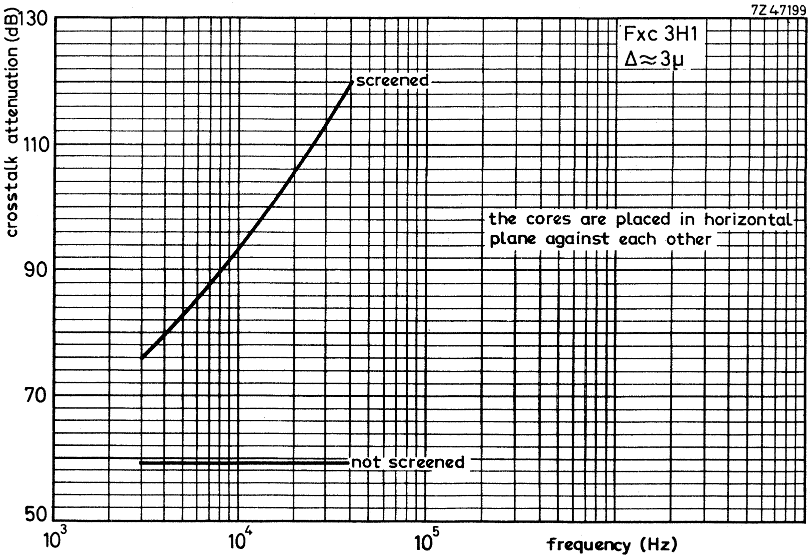

7Z70910
3E1
A_L=630
1000
1600
AT
ΔL/L (%)
0
-20
-40
-60
-80
0
10
20
30


7Z70909
3D3
A_L= 400
AT
ΔL/L (%)
5
0
-5
-10
-15
0
10
20
30

CROSSTALK ATTENUATION






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

POTCORES

Three types of core can be supplied:

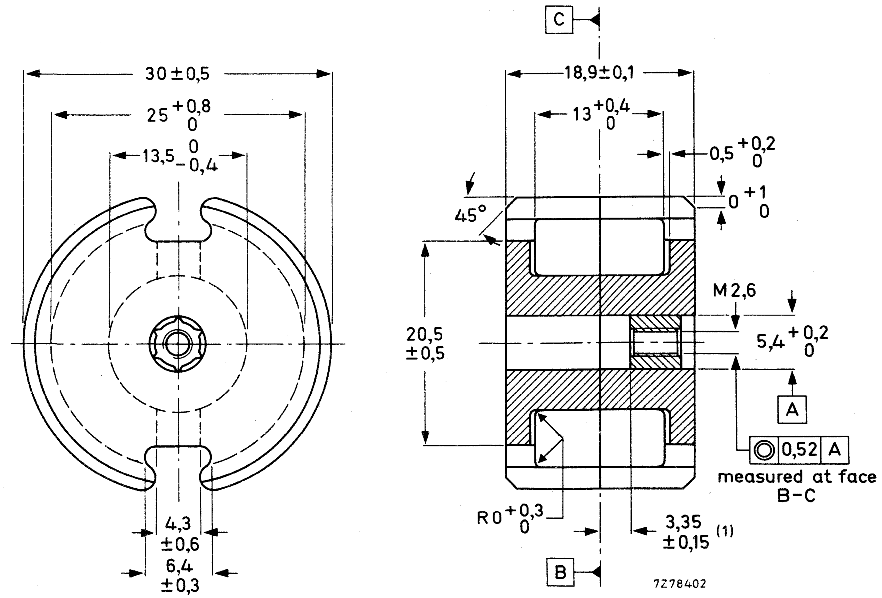
- CORE SETS provided with a nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (France), DIN41293 (Germany) and BS4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 5 core sets or 10 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut ⩾ 50 N

At distance (1) 3,35 ± 0,15 mm, the concentricity is ◎ 0,52 A

At distance (1) 5,4 ± 0,2 mm, the concentricity is ◎ 0,63 A

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}330\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00241\ mm^{-3}$; $V_e = 6190\ mm^{-3}$; $l_e = 45{,}2$ mm; $A_e = 137\ mm^2$.

Mass of core set: 34 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 250 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	3B8	3D3	3E1	3H1		
$A_L \pm 25\%$	4	≤ 0,1	25 ± 1	7500	≥ 4760	2800	11 000	7500		
$\mu_e \pm 25\%$	4	≤ 0,1	25 ± 1	1985	≥ 1250	740	2920	1985		
α	4	≤ 0,1	25 ± 1	≤ 13,3	≤ 14,5	≤ 21,7	≤ 11,0	≤ 13,3		
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1	≤ 1,2	≤ 1,5		≤ 2,5	≤ 1,2		
	100	≤ 0,1	25 ± 1	≤ 6,0	≤ 6,0	≤ 8,0	≤ 20	≤ 6,0		
	500	≤ 0,1	25 ± 1			≤ 16	≤ 200			
	1000	≤ 0,1	25 ± 1			≤ 40				
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1				≤ 1,8			
	100	1,5 to 3,0	25 ± 1	≤ 1,1	≤ 1,0			≤ 0,62		
	100	0,3 to 1,2	25 ± 1			≤ 1,8				
$\alpha_F \times 10^6/°C$	≤ 100	≤ 0,1	5 to 25		0 to + 6			+ 0,5 to 1,5		
	≤ 100	≤ 0,1	25 to 55		0 to + 6			+ 0,5 to 1,5		
	≤ 100	≤ 0,1	25 to 70	− 0,6 to + 0,6		0 to + 2	0 to +2			
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1	≤ 4,3	≤ 8,0	≤ 4,3	≤ 4,3	≤ 4,3		
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:										
at $\mu_e \times \frac{N \times I_o}{l_e} = 1{,}00 \times 10^5$ A/m					≤ 110					
$= 1{,}60 \times 10^5$ A/m					≤ 300					
$= 2{,}30 \times 10^5$ A/m					≤ 1100					

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022					
		3B7		3D3	3H1		
100 ± 1%	26,2	31040		31440			
160 ± 1%	42	31050		31450			
250 ± 1%	65,5	31060		31460	31260		
315 ± 1,5%	83	31070					
400 ± 1,5%	105	31080			31280		
630 ± 2%	165	31100			31300		
1000 ± 3%	263	31110			31310		
1600 ± 3%	420	31120			31320		
2500 ± 3%	655	31130			31330		

Core sets with nut and pre-adjusted on μ_e.

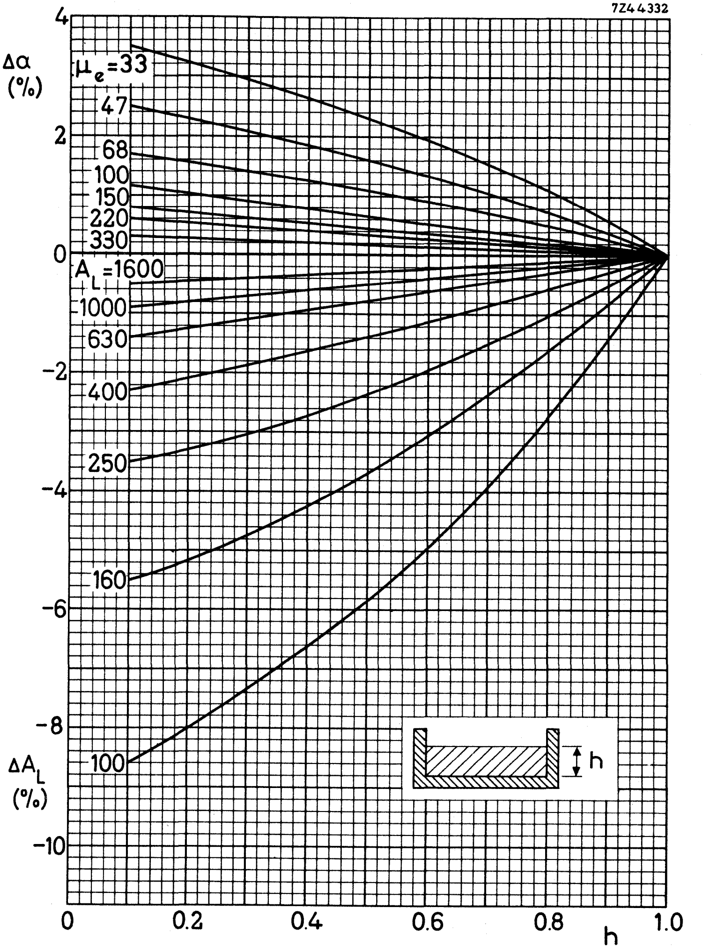
μ_e	α	catalogue number 4322 022					
		3B7		3D3	3H1		
33 ± 1%	89,2	30030		30430	30230		
47 ± 1%	74,7			30440			
68 ± 1%	62,1	30050		30450	30250		
100 ± 1,5%	51,3	30060			30260		
150 ± 2%	41,8	30070			30270		
220 ± 3%	34,6	30080			30280		
330 ± 3%	28,2	30090			30290		
740 ± 25%	18,9			30400*			
1990 ± 25%	11,5	30000*			30200*		

Core sets without nut: replace the eighth digit of the catalogue number (3) by 1.
Cores with $A_L \leqslant 400$, or $\mu_e \leqslant 100$ have a symmetrical air gap.
Cores with $A_L \geqslant 630$, or $\mu_e \geqslant 150$ have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut.

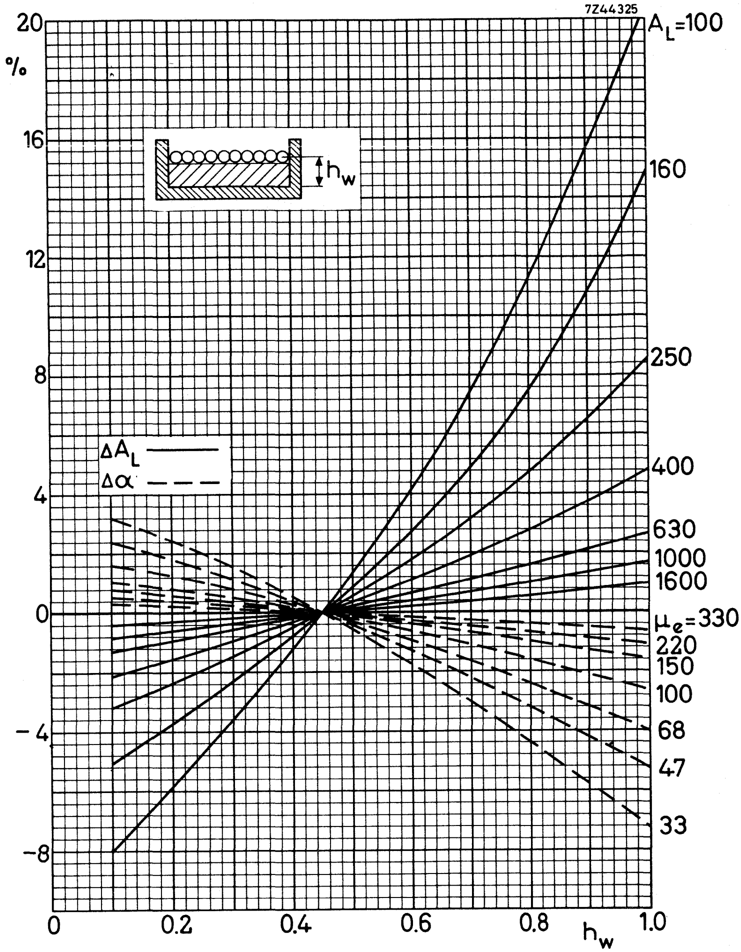
Ferroxcube grade	catalogue number
3B7	4322 020 22250
3B8	4322 020 22390
3D3	4322 020 22270
3E1	4322 020 22300
3H1	4322 020 22260

DATA FOR PARTLY FILLED COIL FORMER



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

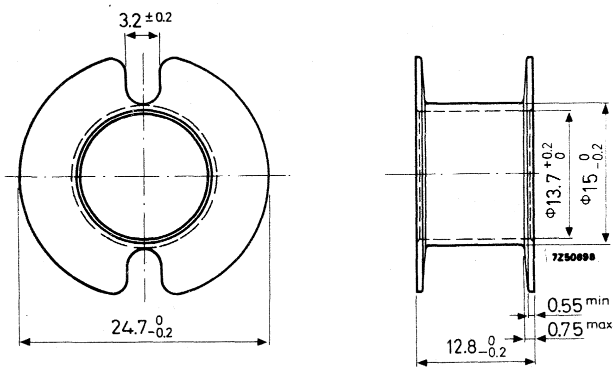
Three types of coil former can be supplied:

- with one section;
- with two sections;
- with three sections.

The dimensions conform with the following specifications: IEC 133 (international), UTE C93-324 livre 1 (France), DIN41294 (Germany) and BS4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER

Dimensions in mm



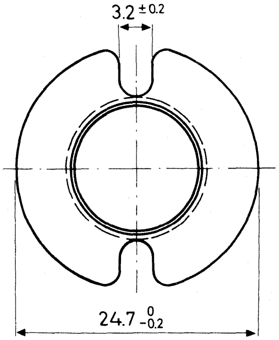
Catalogue number	4322 021 30360
Material	polycarbonate
Window area	55 mm^2
Mean length of turn	62 mm
Max. temperature	130 °C

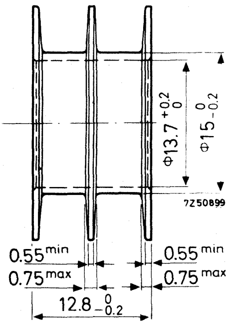
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5{,}07 \times 10^3 \ \Omega/\mathrm{H}$$

Mass 0,75 g

TWO-SECTION COIL FORMER





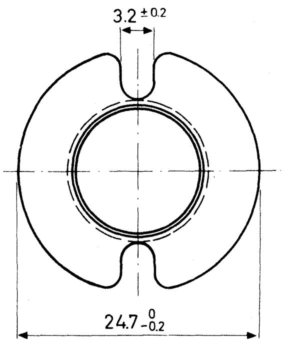
Catalogue number	4322 021 30370
Material	polycarbonate
Window area	2 x 26 mm^2
Mean length of turn	62 mm
Max. temperature	130 °C

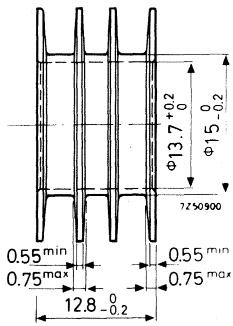
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5{,}38 \times 10^3 \ \Omega/H$$

Mass 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

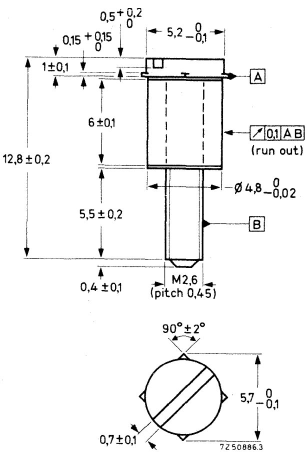
$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5{,}74 \times 10^3 \ \Omega/H$$

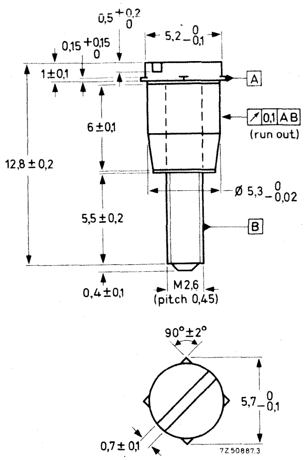
Mass 1,2 g

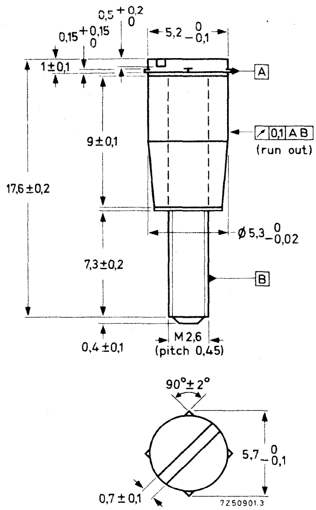
INDUCTANCE ADJUSTERS

CONTINUOUS ADJUSTERS

Dimensions in mm







The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 an continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

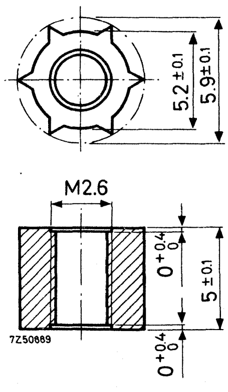
Types of adjustor and recommended applications.

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.

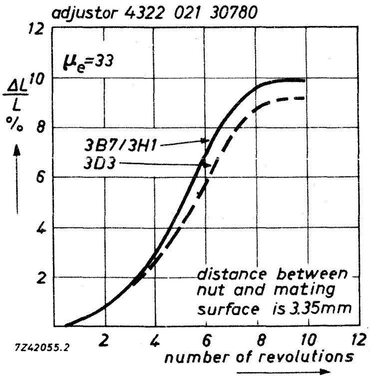


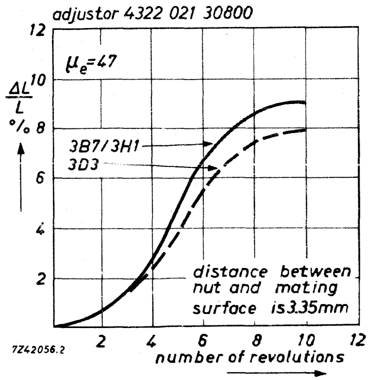
Catalogue number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut (see Adjustment curves)	3.35 ± 0.15 mm or 4.35 ± 0.15 mm

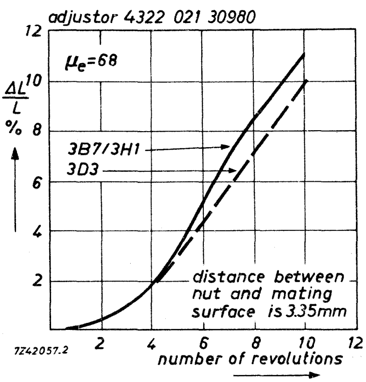
For more information see Potcores General, Mounting data.

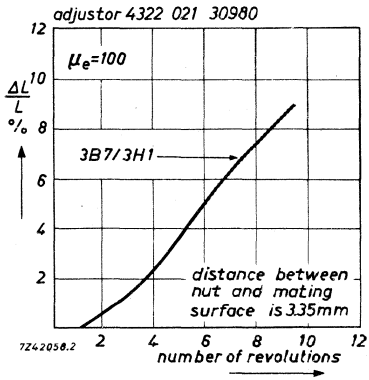
The nuts are packed in bags of 100, so please order in multiples of 100.

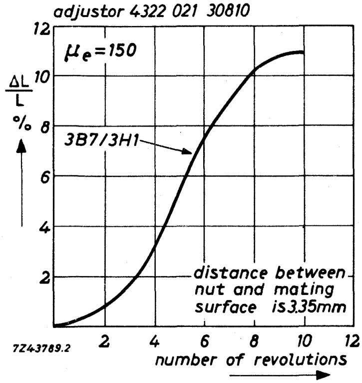
Adjustment curves

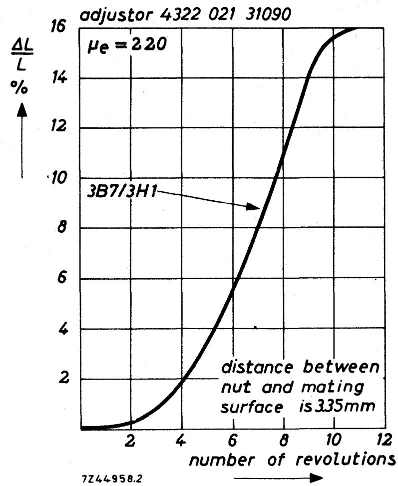


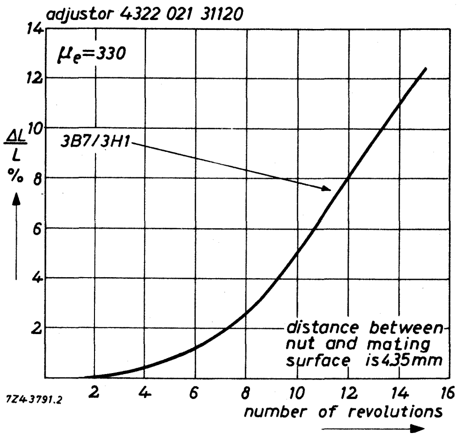







adjustor 4322 021 30810
μ_e=150
ΔL/L %
3B7/3H1
distance between nut and mating surface is 3.35mm
number of revolutions
7Z43789.2
2 4 6 8 10 12


adjustor 4322 021 31090
μ_e = 220
ΔL/L %
3B7/3H1
distance between nut and mating surface is 3.35mm
number of revolutions
7Z44958.2
2 4 6 8 10 12 14 16


adjustor 4322 021 31120
μ_e=330
ΔL/L %
3B7/3H1
distance between nut and mating surface is 4.35mm
number of revolutions
7Z43791.2
2 4 6 8 10 12 14 16

STEP-BY-STEP ADJUSTERS

These adjusters 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 adjusters is negligible.

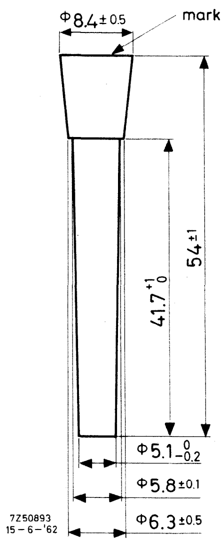
A range of 13 flexible conical adjusters is available under the catalogue numbers 4322 021 32000 up to 4322 021 32120. Each adjuster causes an increase in the inductance; the higher the catalogue number, the greater the effect. The influence of each adjuster on the inductance at different μ_e values of the potcore can be found from the graph.

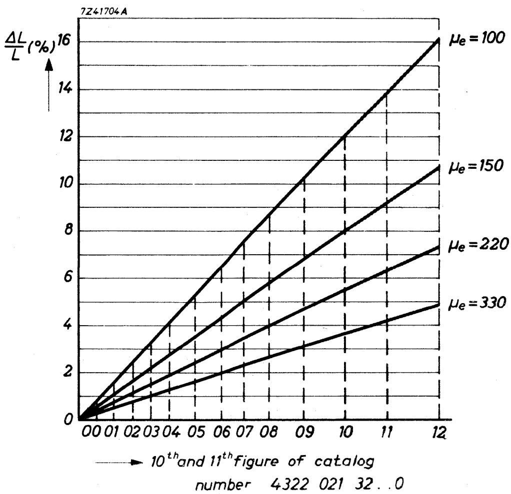
The 10th and 11th figure of the catalogue number are indicated on the head of the adjuster. It should be borne in mind that, when using these adjusters, the inductance of the coil should initially be lower than the wanted value.

When the correct adjuster has been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond or 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.

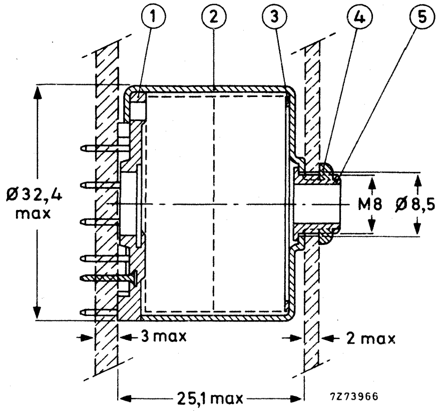
Dimensions in mm

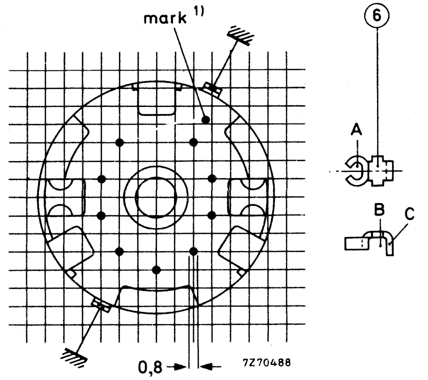




MOUNTING PARTS

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 a grid of 2,54 mm (0,1 inch).
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 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 diameter.

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

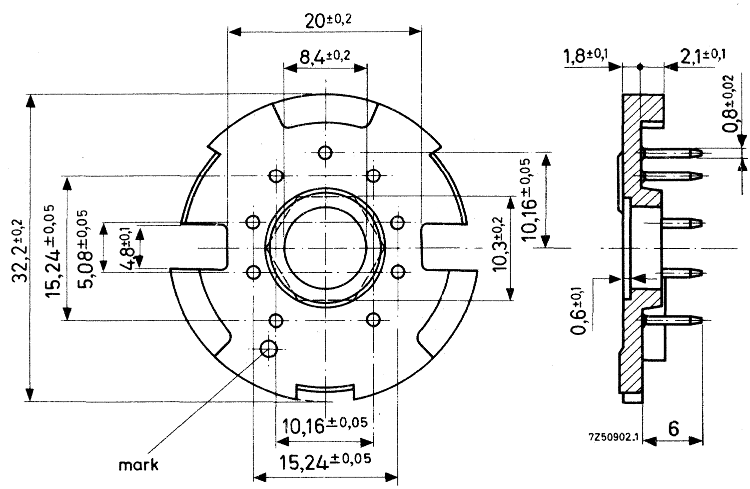
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 250 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

(1) Tag plate 4322 021 30480

Plate : polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s.

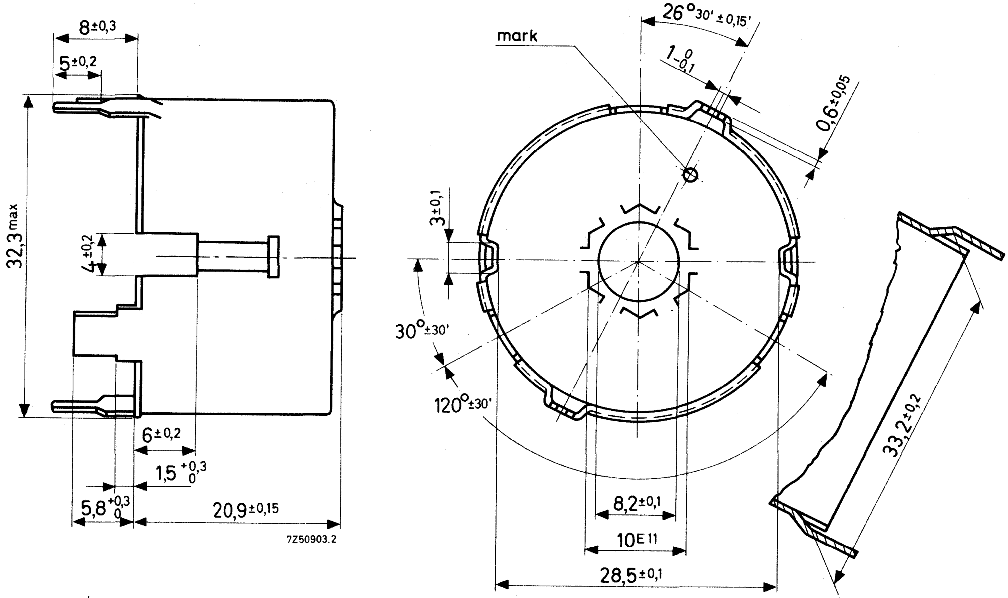
pins : phosphor bronze, dip-soldered



The tag plates are packed in units of 30 pieces on a polystyrene plate, and with 200 pieces in a cardboard box. Please order in multiples of these quantities.

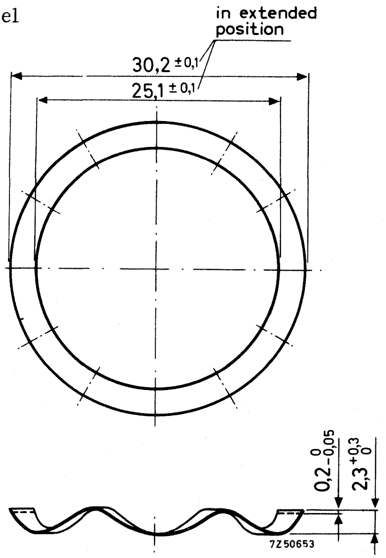
(2) Container 4322 021 30560

Material: brass, nickel plated; tinned soldering pins



(3) Spring 4322 021 30670

Material: steel

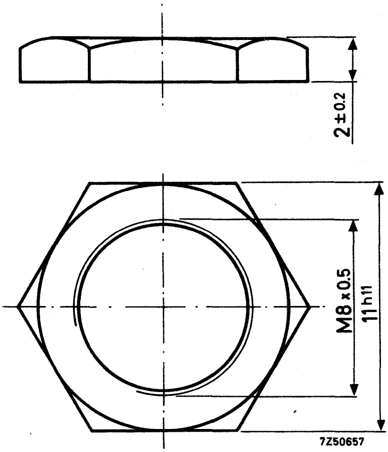


A force of 169 to 281 N is required to compress the spring to 0,45 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

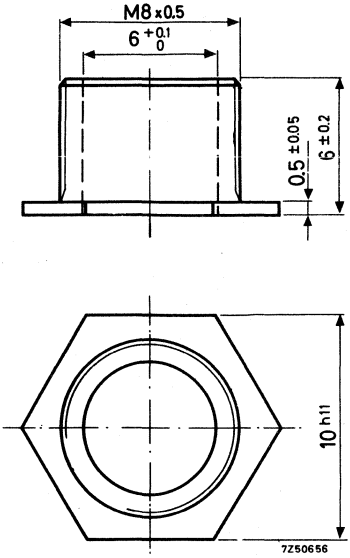
(4) Nut 4322 021 30710

Material: brass, nickel plated



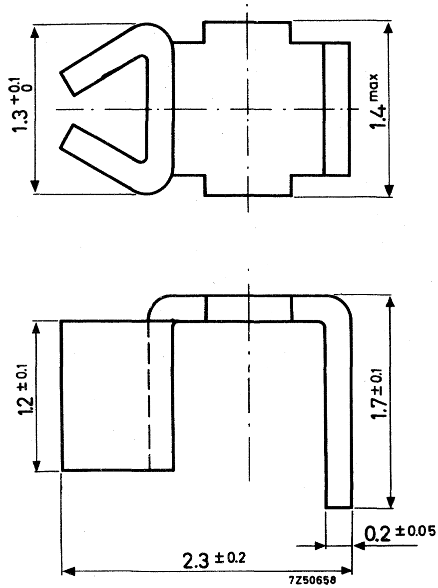
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



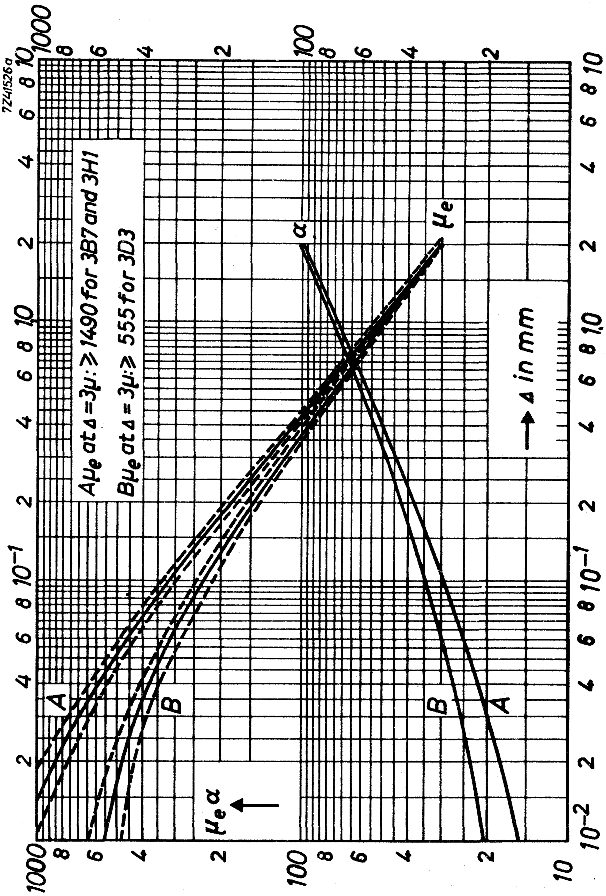
(6) Soldering spring 4322 021 30700

Material: brass, dipsoldered



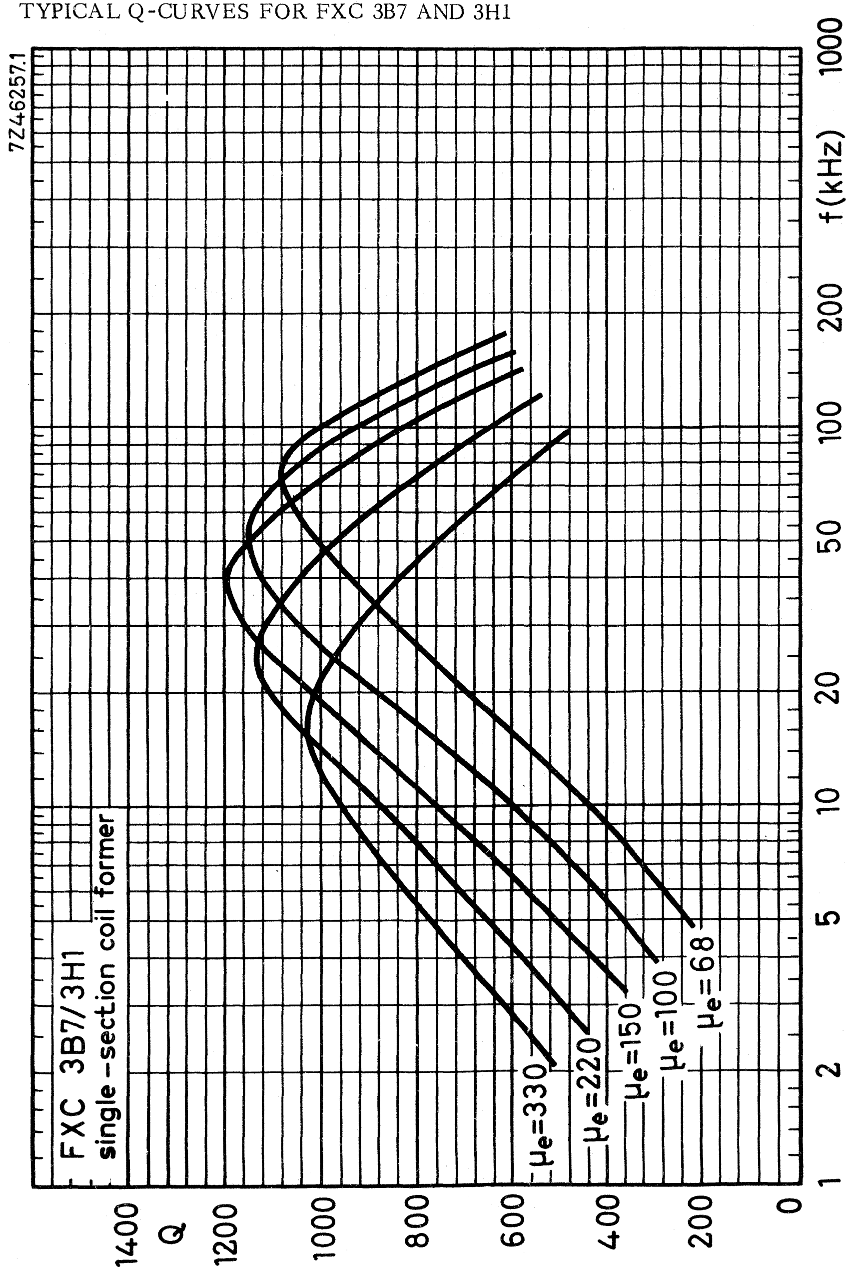
CHARACTERISTIC CURVES

μ_e-α CURVES

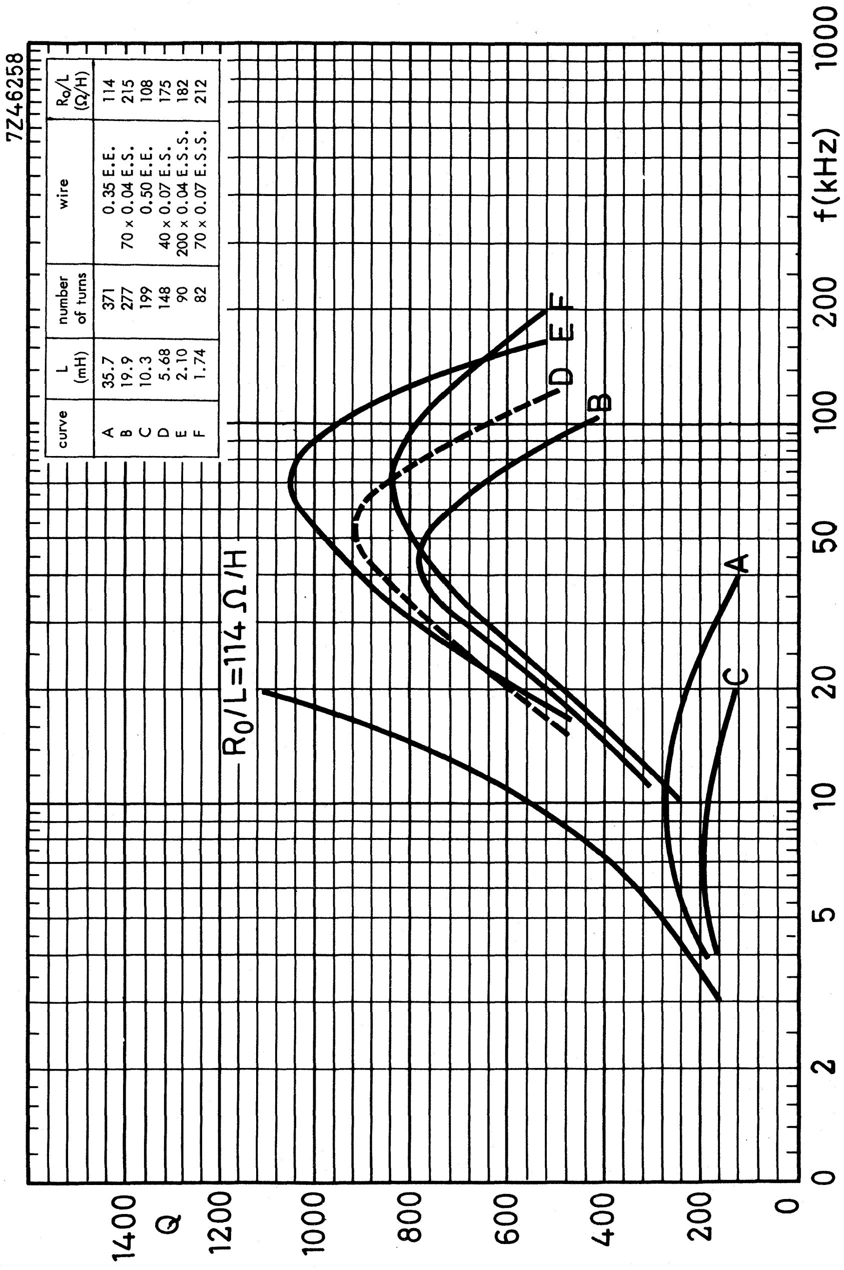


Relative effective permeability and turn factor for 1 mH as a function of the air gap length.

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



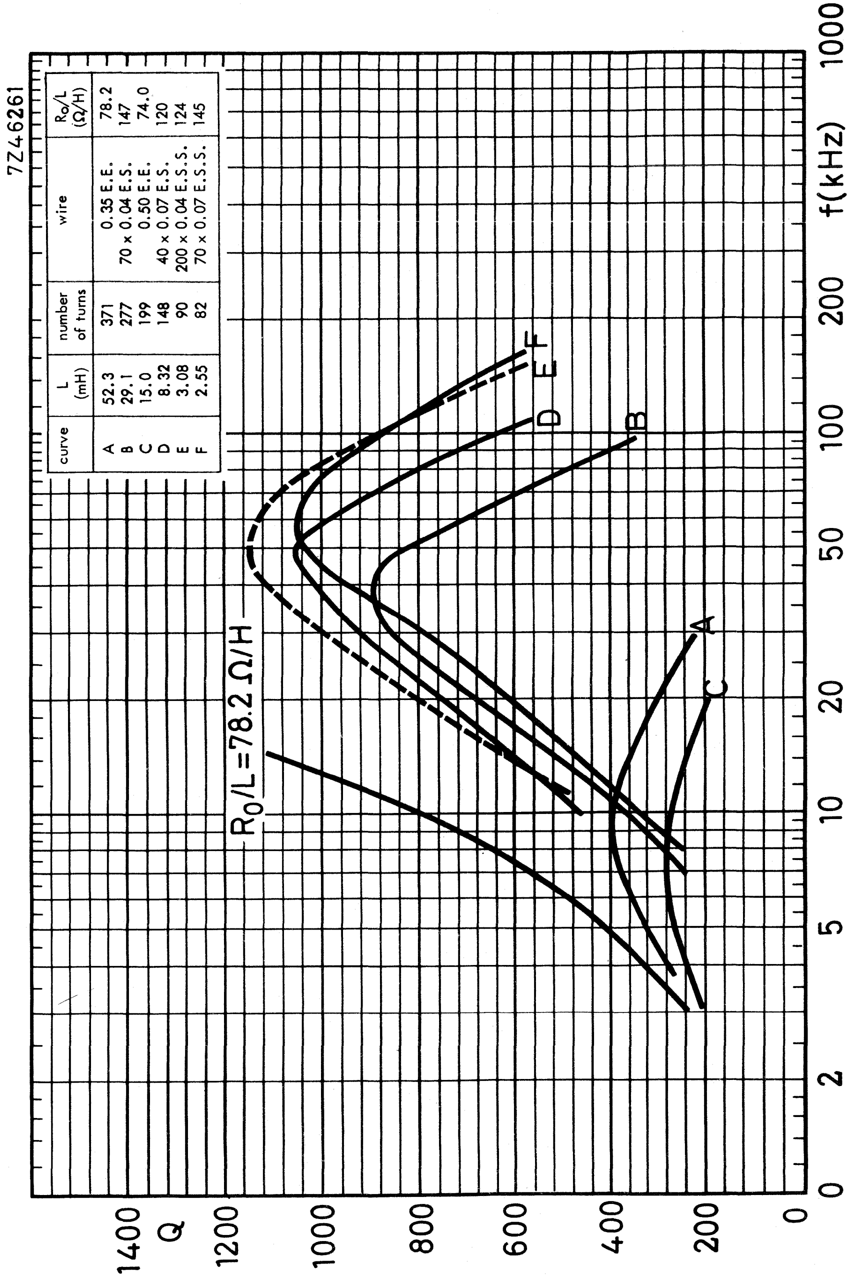
Enveloping curves



curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	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

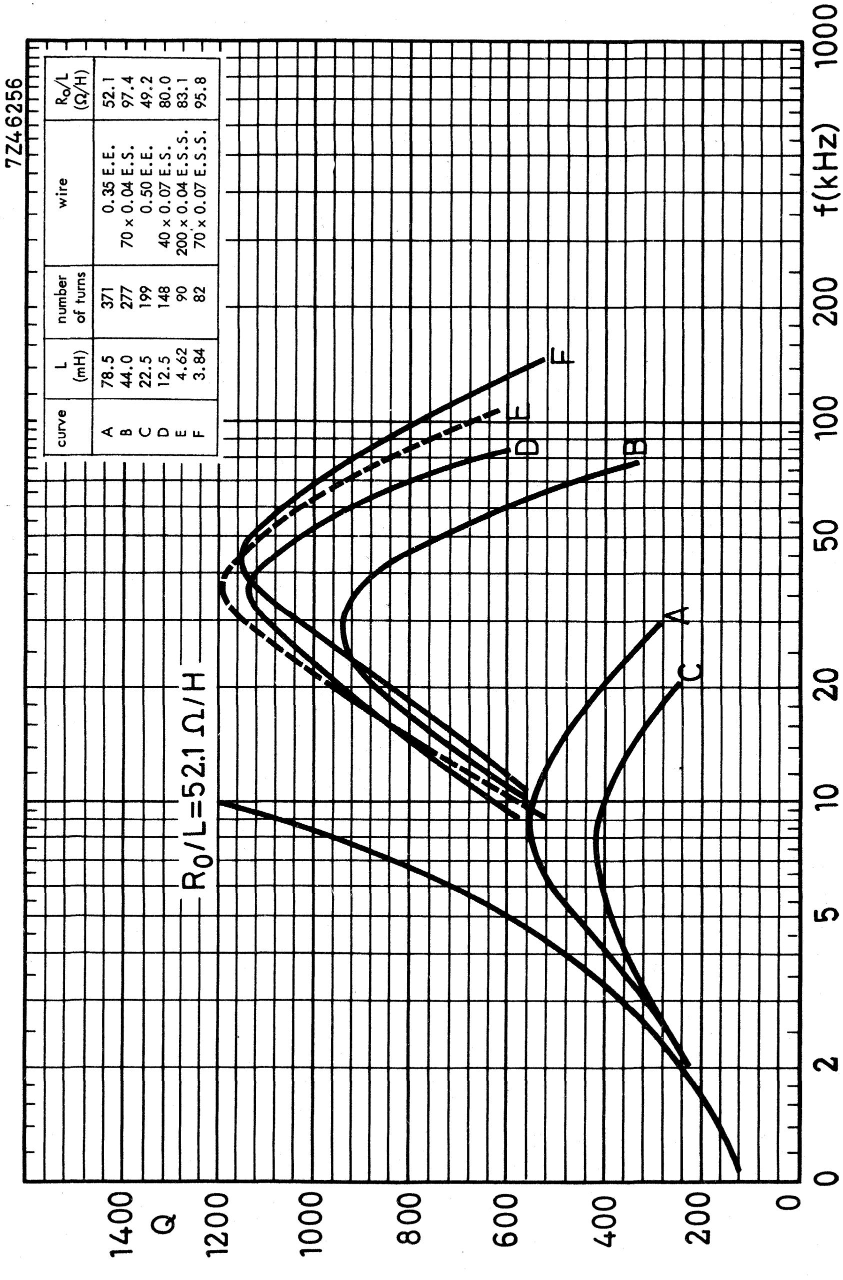
$\mu_e = 68$



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

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER

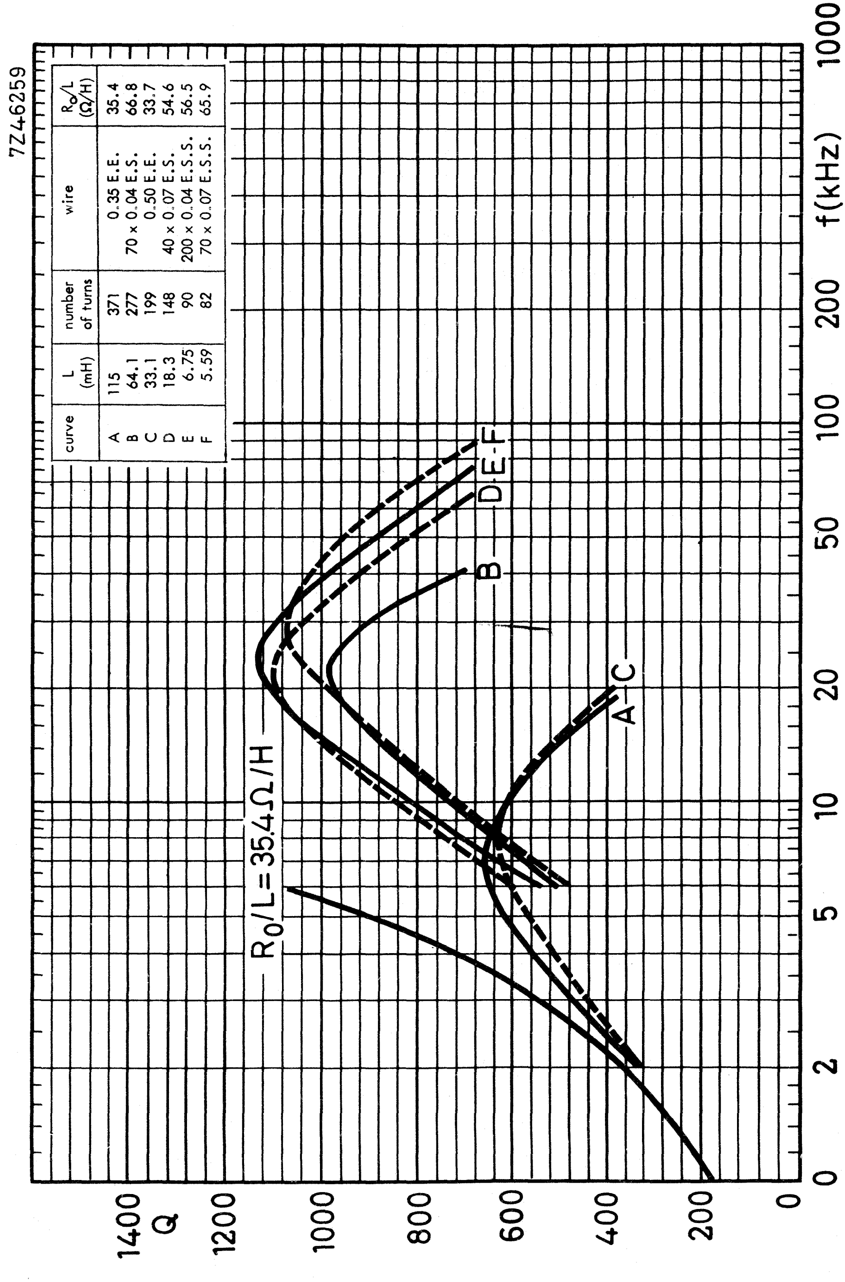
$\mu_e = 100$



curve	L (mH)	number of turns	wire	R_0/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

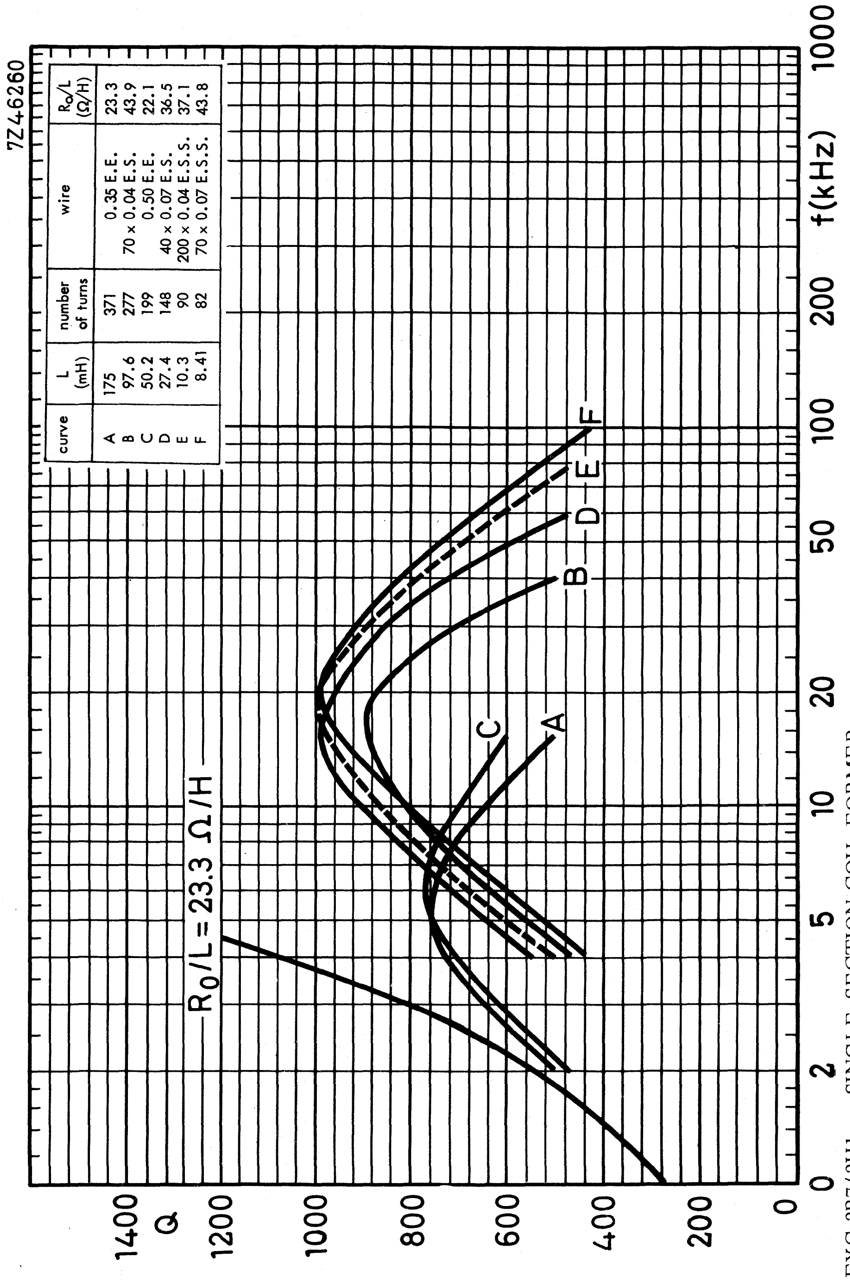
SINGLE-SECTION COIL FORMER

FXC 3B7/3H1
$\mu_e = 150$



curve	L (mH)	number of turns	wire	R_o/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

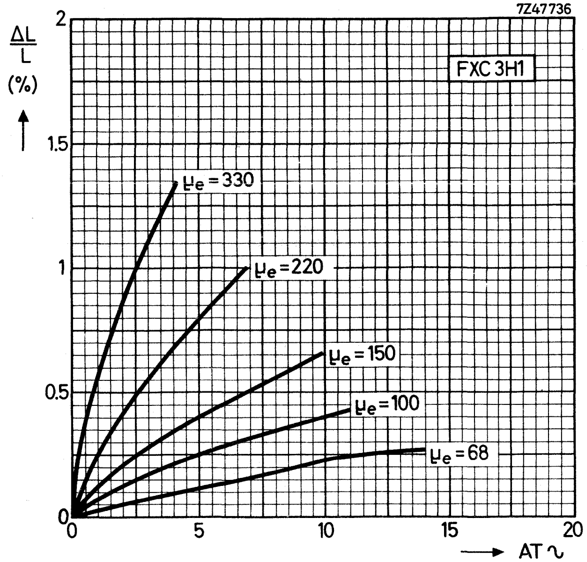
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 220$

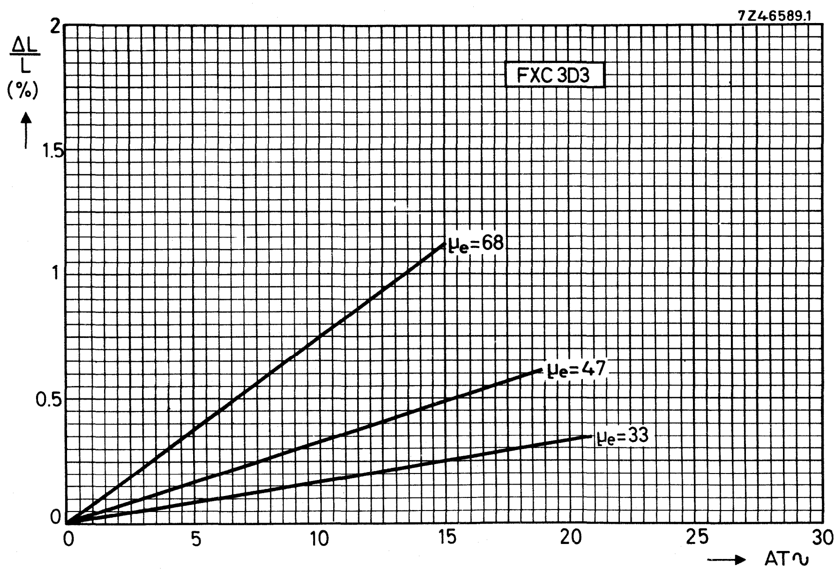


curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	175	371	0.35 E.E.	23.3
B	97.6	277	70 × 0.04 E.S.	43.9
C	50.2	199	0.50 E.E.	22.1
D	27.4	148	40 × 0.07 E.S.	36.5
E	10.3	90	200 × 0.04 E.S.S.	37.1
F	8.41	82	70 × 0.07 E.S.S.	43.8

FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 330$

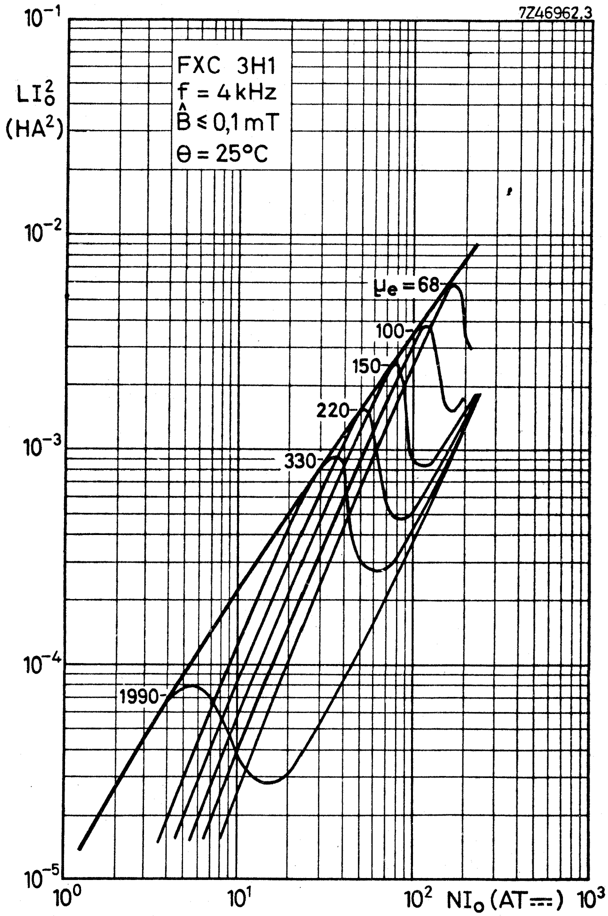
INDUCTANCE VARIATION AS A FUNCTION OF AT~

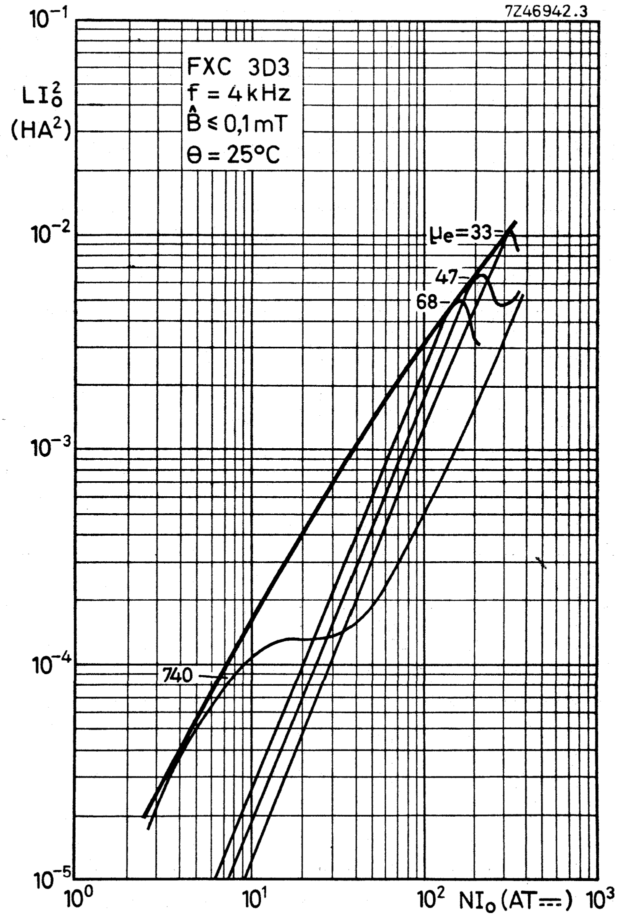


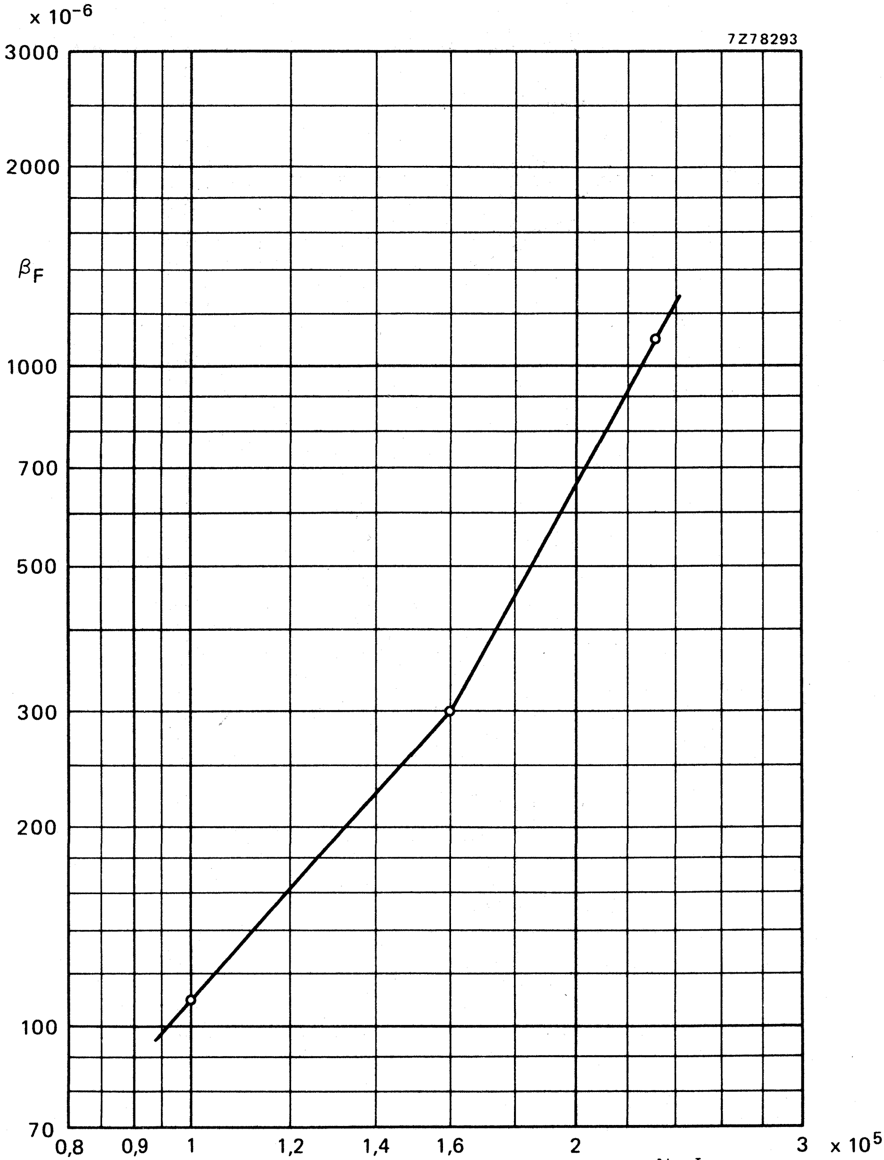


HANNA CURVES

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
Θ = 25°C
LI_o^2
(HA²)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
μe = 33
47
68
740
10^0
10^1
10^2
10^3
NI_o (AT ⎓)



$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

POTCORES

Three types of core can be supplied:

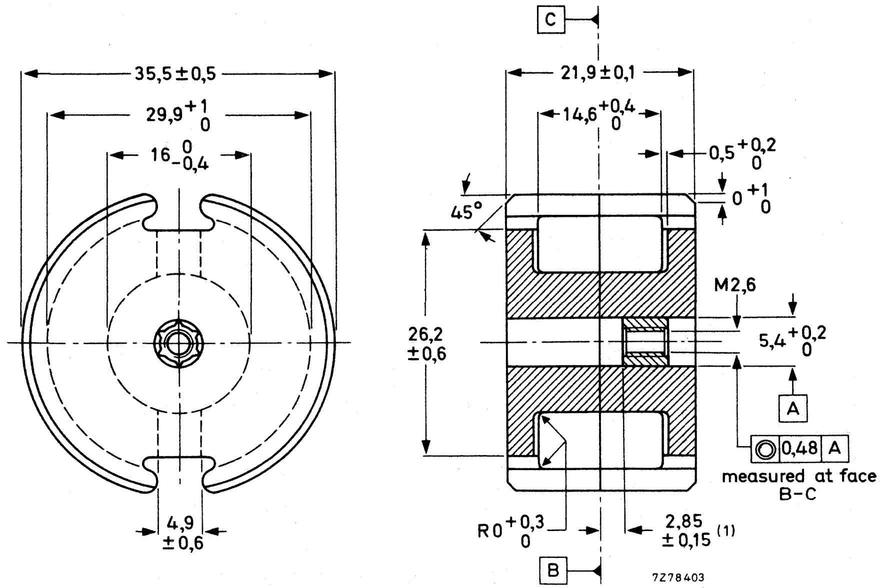
- CORE SETS provided with a nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (France), DIN41293 (Germany) and BS4061 range 2 (Great Britain).

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 5 core sets or 10 core halves; a storage pack contains 50 core sets or 100 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut ⩾ 50 N

At distance (1) 2,85 ± 0,15, the concentricity is ◎ 0,48 A

At distance (1) 4,95 ± 0,15, the concentricity is ◎ 0,69 A

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}264\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00131\ mm^{-3}$; $V_e = 10700\ mm^3$; $l_e = 53{,}2\ mm$; $A_e = 202\ mm^2$.

Mass of core set: 54 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 350 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	B mT	temp. °C	grade 3B7	3B8	3D3	3E1	3H1		
$A_L \pm 25\%$	4	⩽ 0,1	25 ± 1	9500	⩾ 6190	—	14 400	9500		
	100	⩽ 0,1	25 ± 1	—	—	3550	—	—		
$\mu_e \pm 25\%$	4	⩽ 0,1	25 ± 1	2025	⩾ 1300	—	3040	2025		
	100	⩽ 0,1	25 ± 1	—	—	745	—	—		
α	4	⩽ 0,1	25 ± 1	⩽ 11,7	⩽ 12,7	—	⩽ 9,6	⩽ 11,7		
	100	⩽ 0,1	25 ± 1	—	—	⩽ 19,3	—	—		
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1	⩽ 1,2	⩽ 1,5		⩽ 2,5	⩽ 1,2		
	100	⩽ 0,1	25 ± 1	⩽ 6,0	⩽ 6,0	⩽ 8,0	⩽ 20	⩽ 6,0		
	500	⩽ 0,1	25 ± 1			⩽ 18				
	1000	⩽ 0,1	25 ± 1			⩽ 45				
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,1	⩽ 1,0		⩽ 1,8	⩽ 0,62		
	100	0,3 to 1,2	25 ± 1			⩽ 1,8				
$\alpha_F \times 10^6/^{\circ}C$	⩽ 100	⩽ 0,1	5 to 25		0 to + 6			+ 0,5 to 1,5		
	⩽ 100	⩽ 0,1	25 to 55		0 to + 6			+ 0,5 to 1,5		
	⩽ 100	⩽ 0,1	25 to 70	–0,6 to + 0,6		0 to + 2	0 to + 2			
$D_F \times 10^6$ (10-100 min)	⩽ 100	⩽ 0,1	25 ± 0,1	⩽ 4,3	⩽ 8,0	⩽ 12	⩽ 4,3	⩽ 4,3		
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:										
at $\mu_e \times \frac{N \times I_o}{l_e} = 1{,}00 \times 10^5$ A/m					⩽ 110					
$= 1{,}60 \times 10^5$ A/m					⩽ 300					
$= 2{,}30 \times 10^5$ A/m					⩽ 1050					

Core sets with nuts and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022					
		3B7	3B8	3D3	3H1		
40 ± 1%	8,39	33020			33220		
100 ± 1%	21	33040			33240		
160 ± 1%	33,6	33050		33450	33250		
250 ± 1%	52,5	33060		33460	33260		
400 ± 1,5%	84	33080	13830 *	33480	33280		
630 ± 2%	132	33100			33300		
1000 ± 3%	210	33110			33310		
1250 ± 3%	262				33980		
1600 ± 3%	336	33120			33320		
2500 ± 5%	525				33290		

Core sets with nut and pre-adjusted on μ_e.

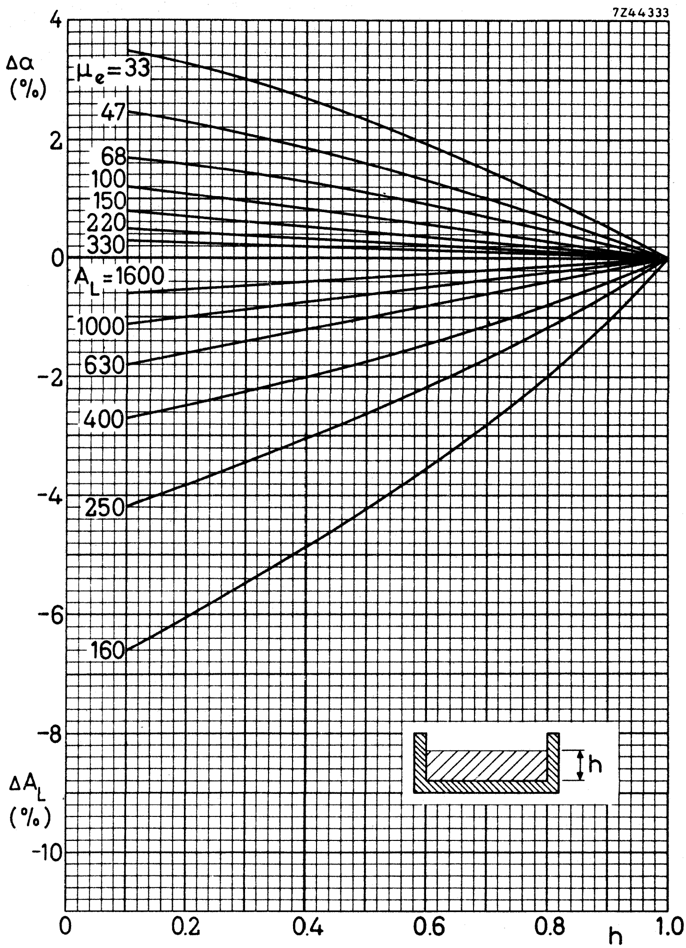
μ_e	α	catalogue number 4322 022					
		3B7		3D3	3H1		
33 ± 1%	79,7	32030		32430			
47 ± 1%	66,8			32440			
68 ± 1%	65,6	32050		32450	32250		
100 ± 1,5%	45,8	32060			32260		
150 ± 2%	37,4	32070			32270		
220 ± 3%	30,9	32080			32280		
330 ± 3%	25,2	32090			32290		
750 ± 25%	16,7			32400*			
2030 ± 25%	10,2	32000*			32200*		

Core sets without nut: replace the eighth digit of the catalogue number (3) by 1.
Cores with $A_L \leqslant 630$, or $\mu_e \leqslant 150$, have a symmetrical air gap.
Cores with $A_L \leqslant 1000$, or $\mu_e \geqslant 220$, have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B7	4322 020 22500
3B8	4322 020 22610
3D3	4322 020 22520
3E1	4322 020 22570
3H1	4322 020 22510

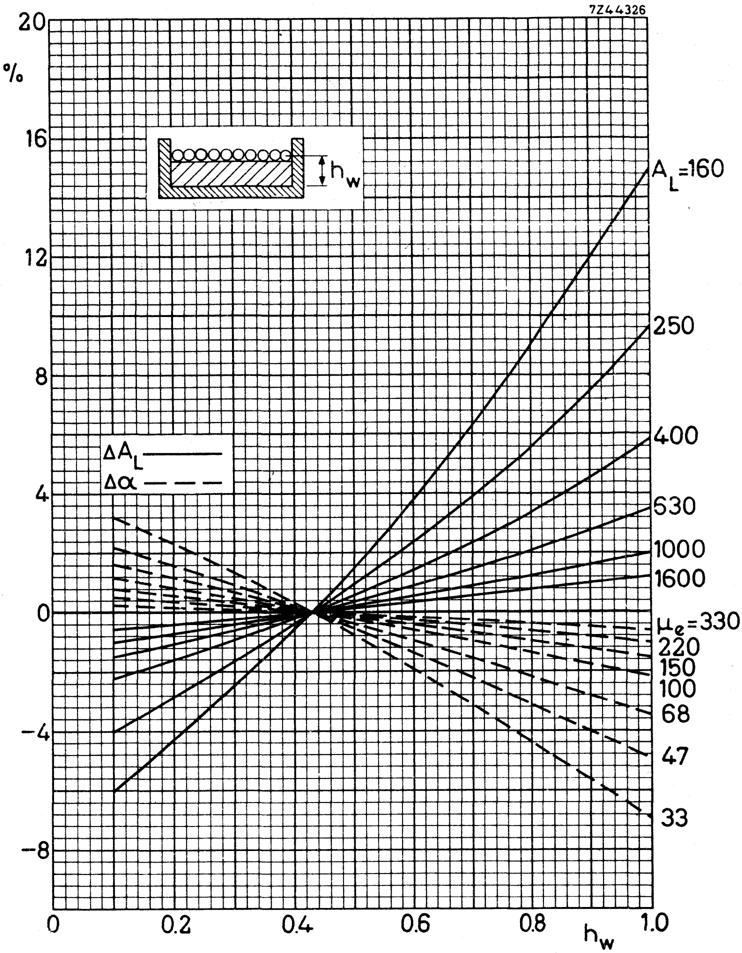
DATA FOR PARTLY FILLED COIL FORMER



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 + 1,2%.



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%.

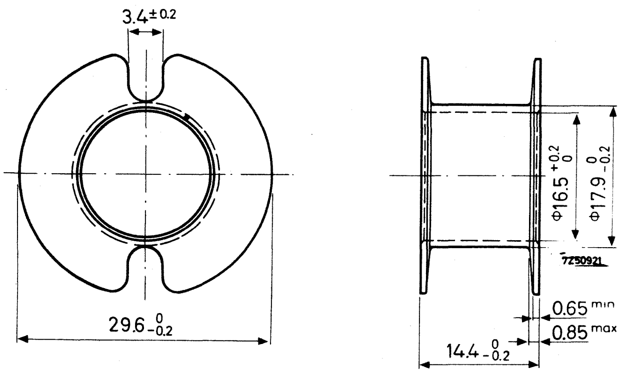
COIL FORMERS

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), UTE C93-324 livre 1 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER Dimensions in mm



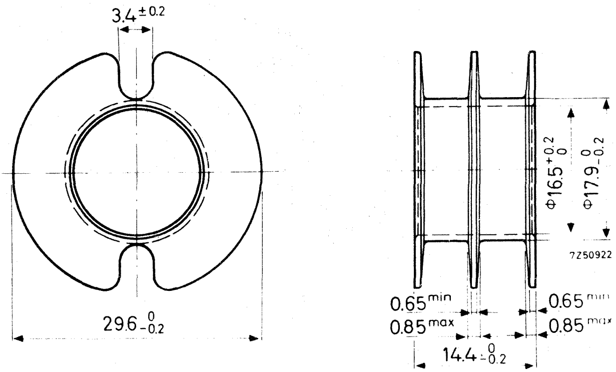
Catalogue number	4322 021 30390
Material	polycarbonate
Window area	75 mm^2
Mean length of turn	74 mm
Maximum temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} = 3{,}59 \times 10^3\ \Omega/H$$

Mass 1,3 g

TWO-SECTION COIL FORMER



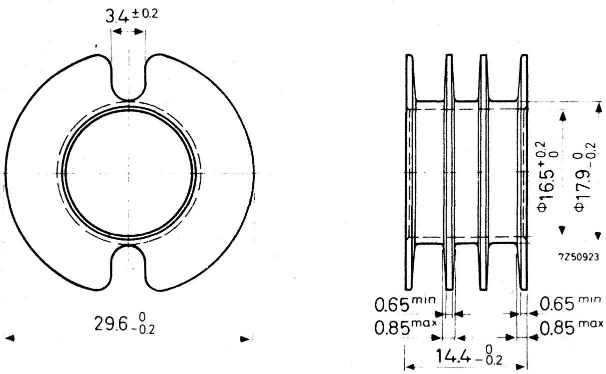
Catalogue number	4322 021 30400
Material	polycarbonate
Window area	2 x 35 mm^2
Mean length of turn	74 mm
Maximum temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3{,}81 \times 10^3\ \Omega/H$$

Mass 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
Maximum temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 4{,}06 \times 10^3\ \Omega/H$$

Mass

INDUCTANCE ADJUSTERS

CONTINUOUS ADJUSTERS

The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 an continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

Table 2 shows the type of adjuster recommended for different potcores.

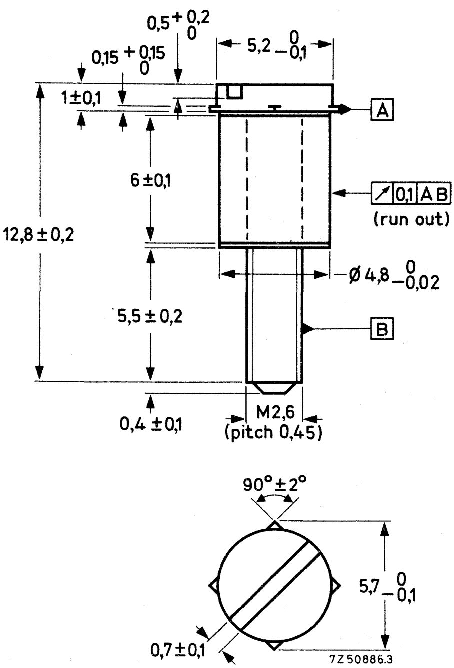


Fig. A.

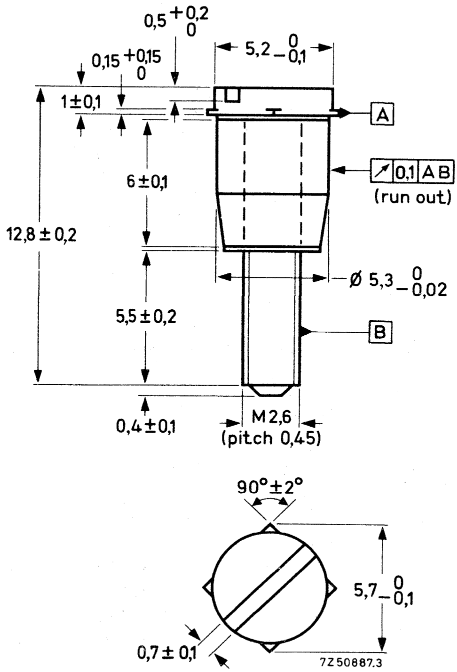


Fig. B.

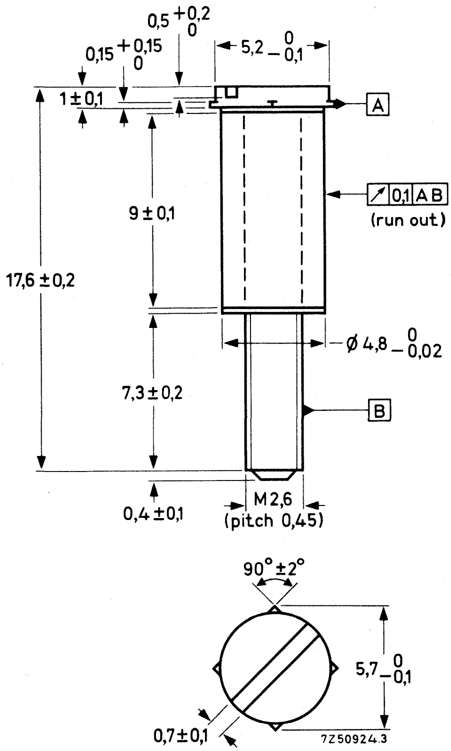


Fig. C.

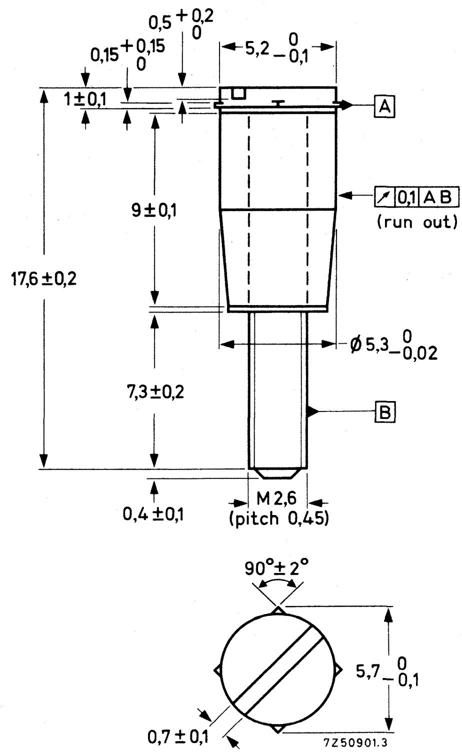


Fig. D.

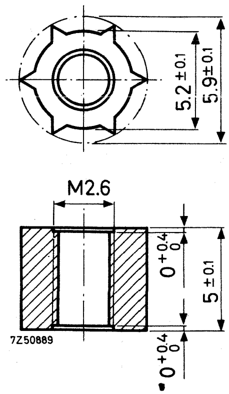
Types of adjuster and recommended applications for potcores with grade 3B7, 3H1 and 3D3:

Fig.	colour	catalogue 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 adjusters are packed in bags of 100. Please order in multiples this quantity.

Nut for adjustor

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

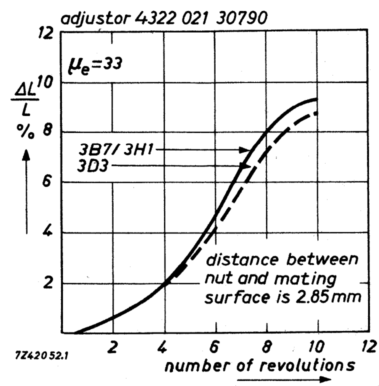


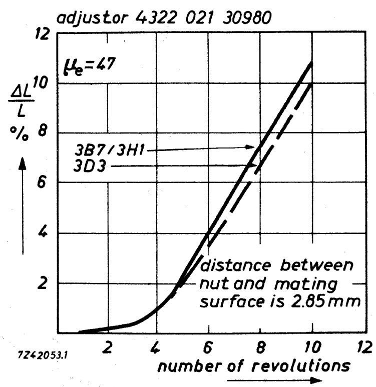
Catalog number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut (See Adjustment curves)	2.85 ± 0.15 mm or 4.95 ± 0.15 mm

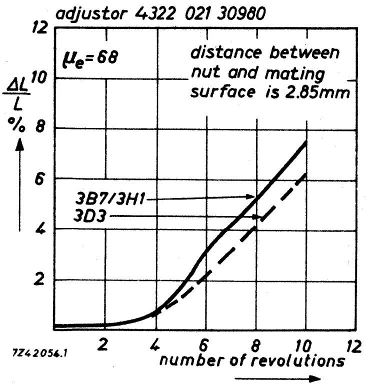
The nuts are packed in bags of 100, so please order in multiples of 100.

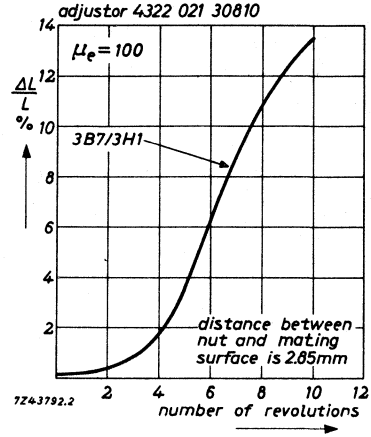
For more information see Potcores General, Mounting data.

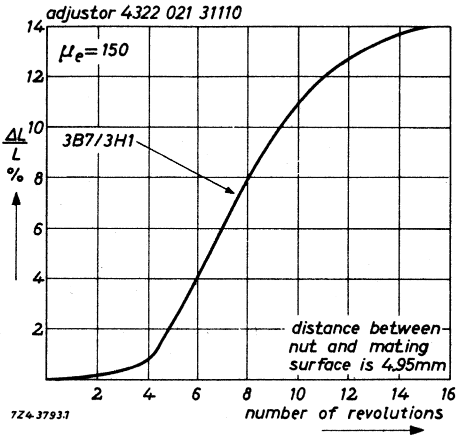
Adjustment curves

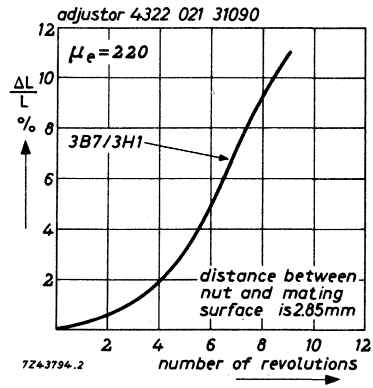


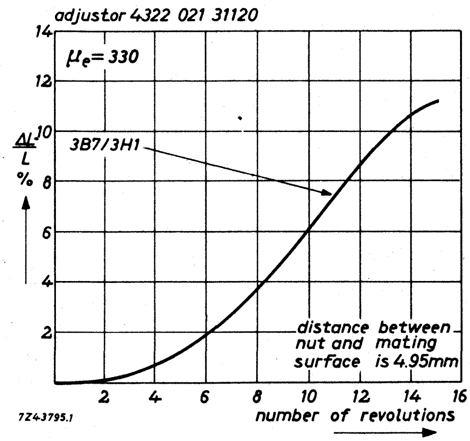



adjustor 4322 021 30980
μ_e = 68
distance between nut and mating surface is 2.85mm
ΔL/L %
3B7/3H1
3D3
number of revolutions
7Z42054.1


adjustor 4322 021 30810
μ_e = 100
ΔL/L %
3B7/3H1
distance between nut and mating surface is 2.85mm
number of revolutions
7Z43792.2


adjustor 4322 021 31110
μ_e = 150
ΔL/L %
3B7/3H1
distance between nut and mating surface is 4.95mm
number of revolutions
7Z43793.1


adjustor 4322 021 31090
μ_e = 220
ΔL/L %
3B7/3H1
distance between nut and mating surface is 2.85mm
number of revolutions
7Z43794.2


adjustor 4322 021 31120
μ_e = 330
ΔL/L %
3B7/3H1
distance between nut and mating surface is 4.95mm
number of revolutions
7Z43795.1

STEP-BY-STEP ADJUSTERS

These adjusters 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 adjusters is negligible.

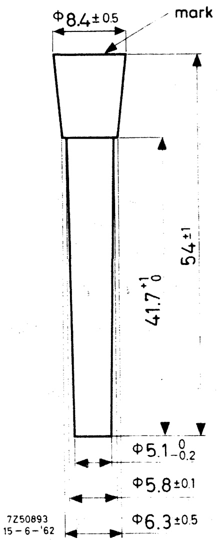
A range of 13 flexible conical adjusters is available under the catalogue numbers 4322 021 32000 up to 4322 021 32120. Each adjuster causes an increase in the inductance; the higher the catalogue number, the greater the effect. The influence of each adjuster on the inductance at different μ_e values of the potcore can be found from the graph.

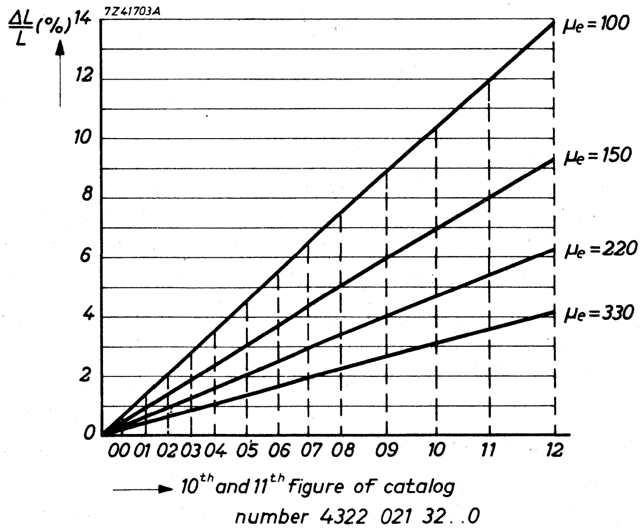
The 10th and 11th figure of the catalogue number are indicated on the head of the adjuster. It should be borne in mind that, when using these adjusters, the inductance of the coil should initially be lower than the wanted value.

When the correct adjuster has been found, it is inserted in the centre hole of the pot. An adhesive (for instance Pliobond or 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.

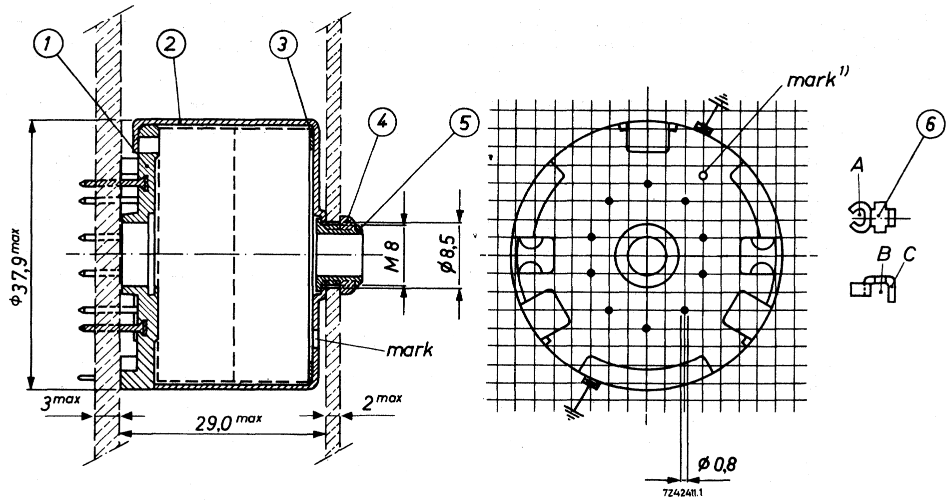
Dimensions in mm





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 a grid of 2,54 mm (0,1 inch).
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 that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

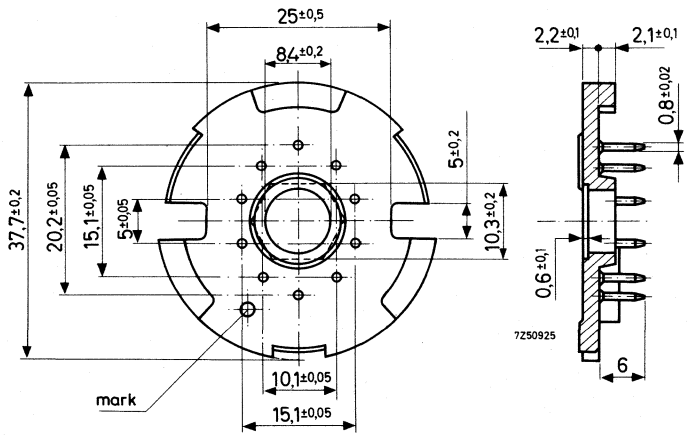
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 350 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS Dimensions in mm

(1) Tag plate 4322 021 30490

Plate : polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s.

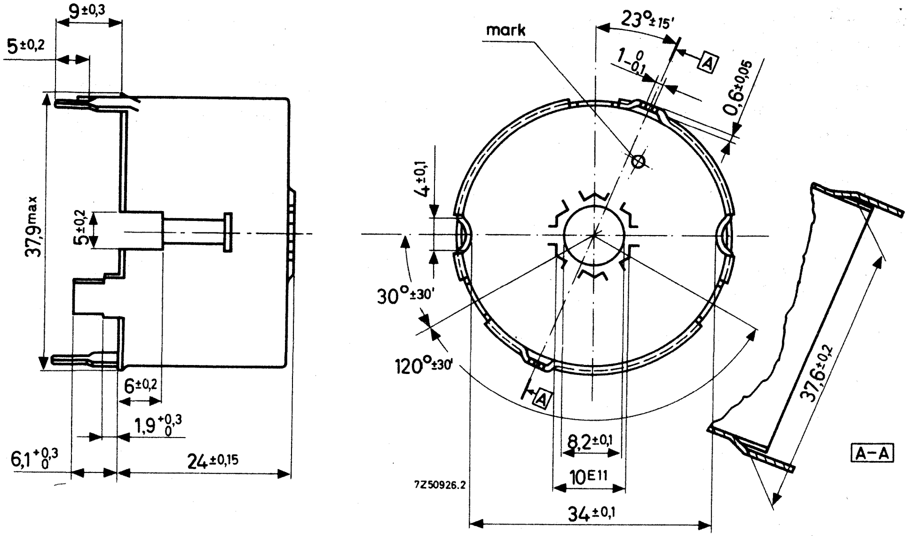
Pins : phosphor bronze, dip-soldered



The tag plates are packed in units of 24 pieces on a polystyrene plate, and with 150 pieces in a cardboard box. Please order in multiples of these quantities.

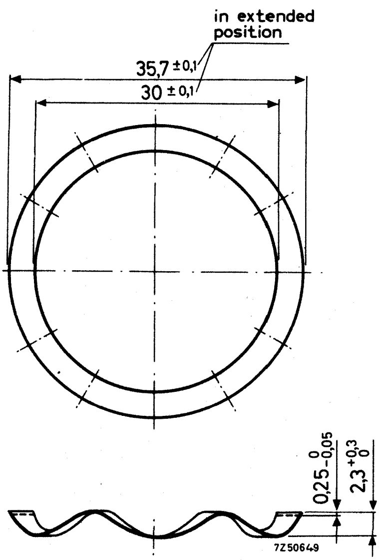
(2) Container 4322 021 30570

Material: brass, nickel plated; tinned soldering pins



(3) Spring 4322 021 30680

Material: steel

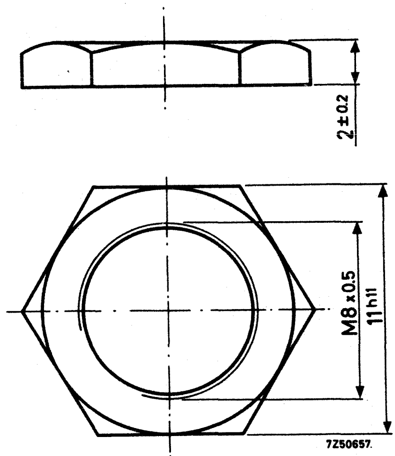


A force of 255 to 425 N is required to compress the spring to 0,55 mm..

The spring are packed in units of 100 pieces.
Please order in multiples of this quantity.

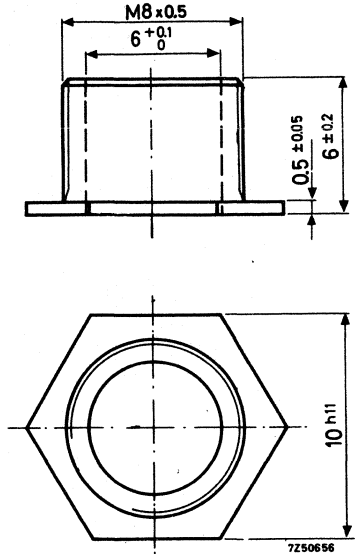
(4) Nut 4322 021 30710

Material : brass, nickel plated



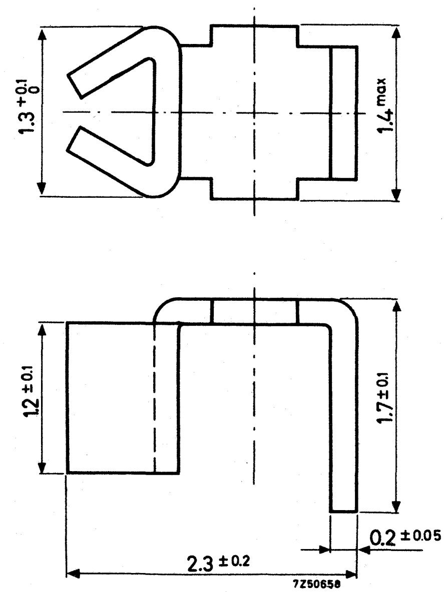
(5) Fixing bush 4322 021 30720

Material : brass, nickel plated



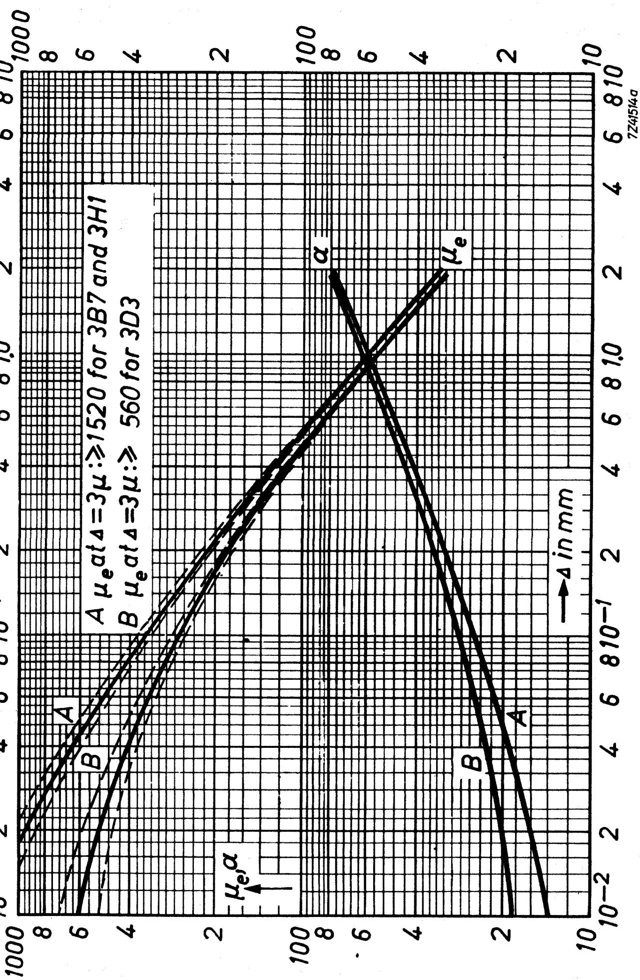
(6) Soldering spring 4322 021 30700

Material : brass, dipsoldered



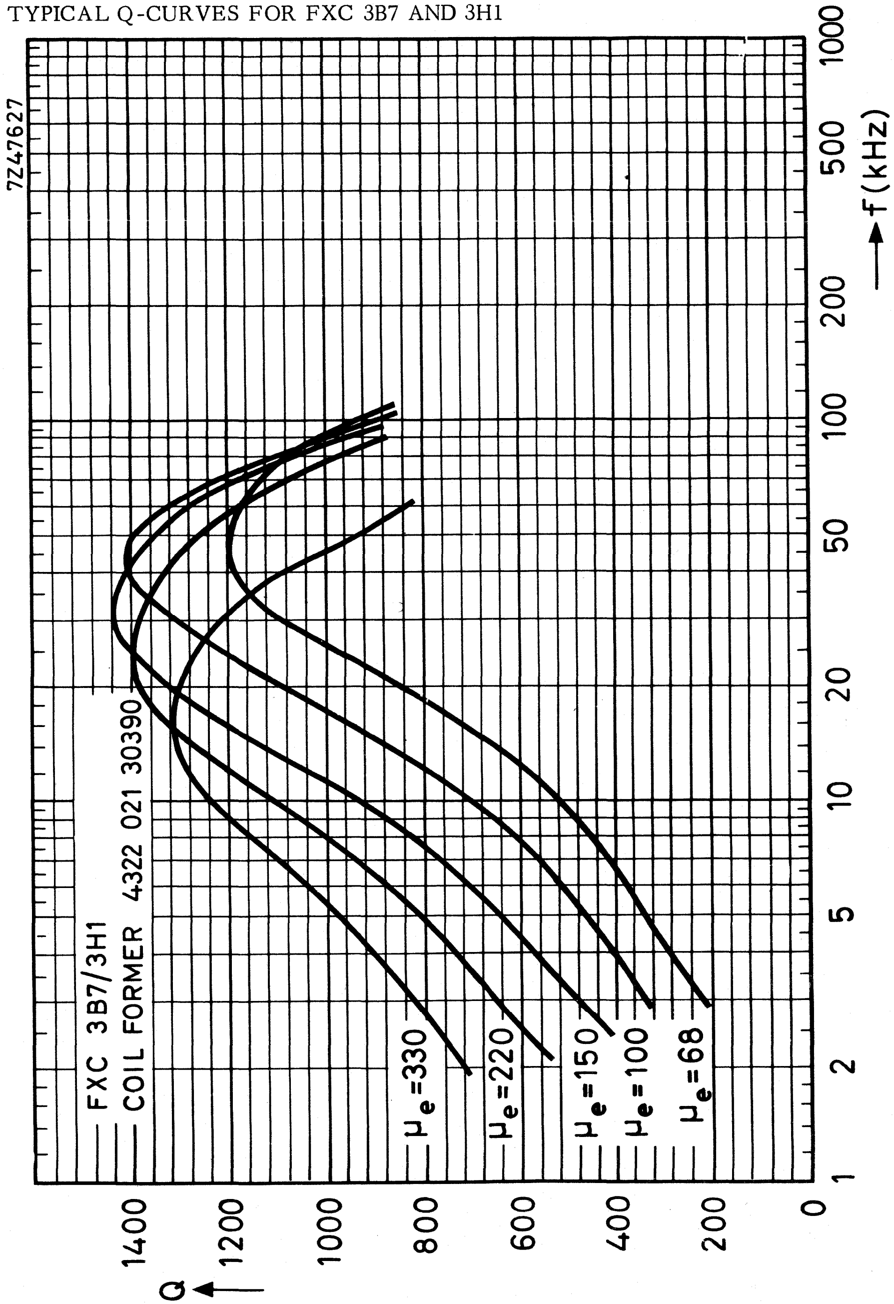
CHARACTERISTIC CURVES

μ_e-α CURVES

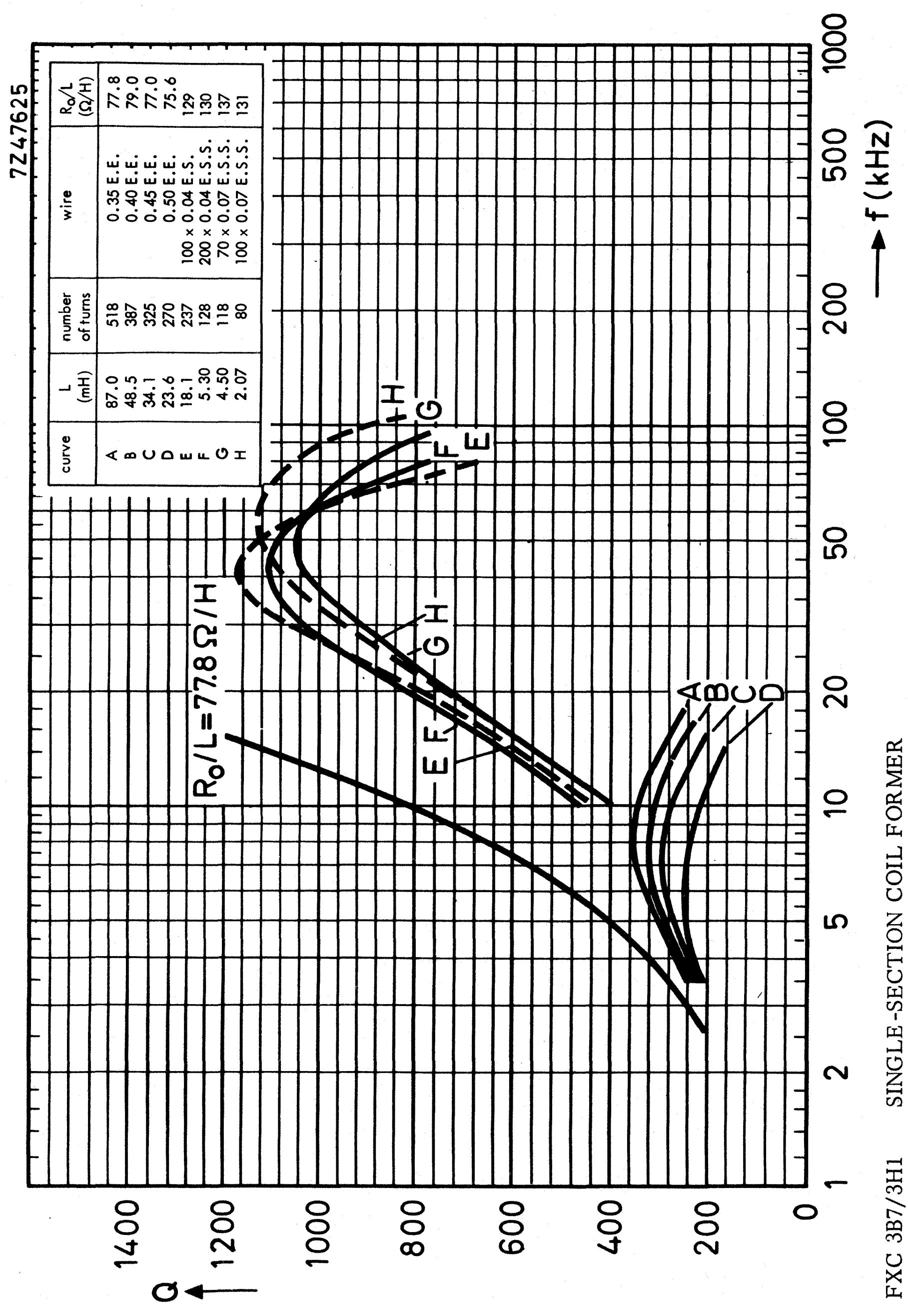


Relative effective permeability and turn factor for 1 mH as a function of the air gap length

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1

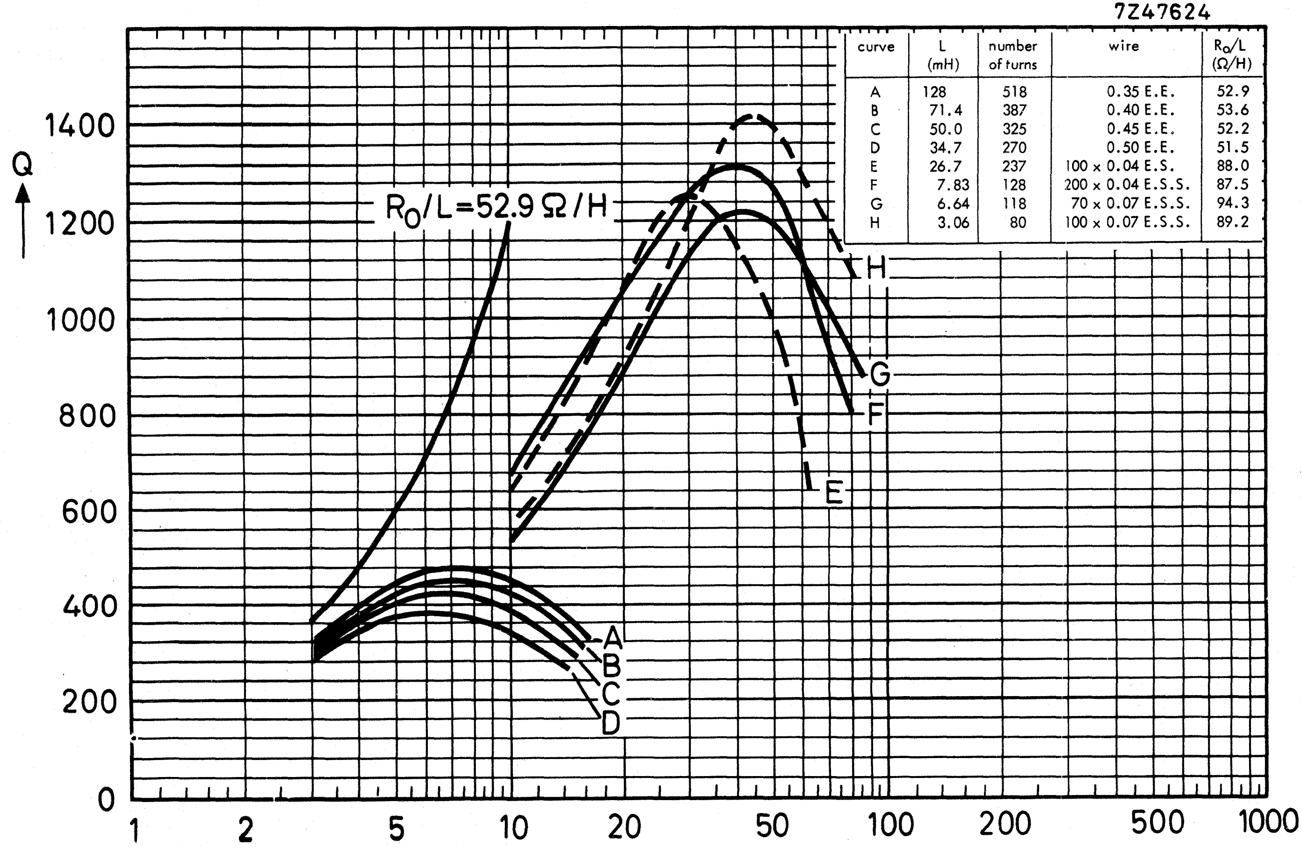


Enveloping curves



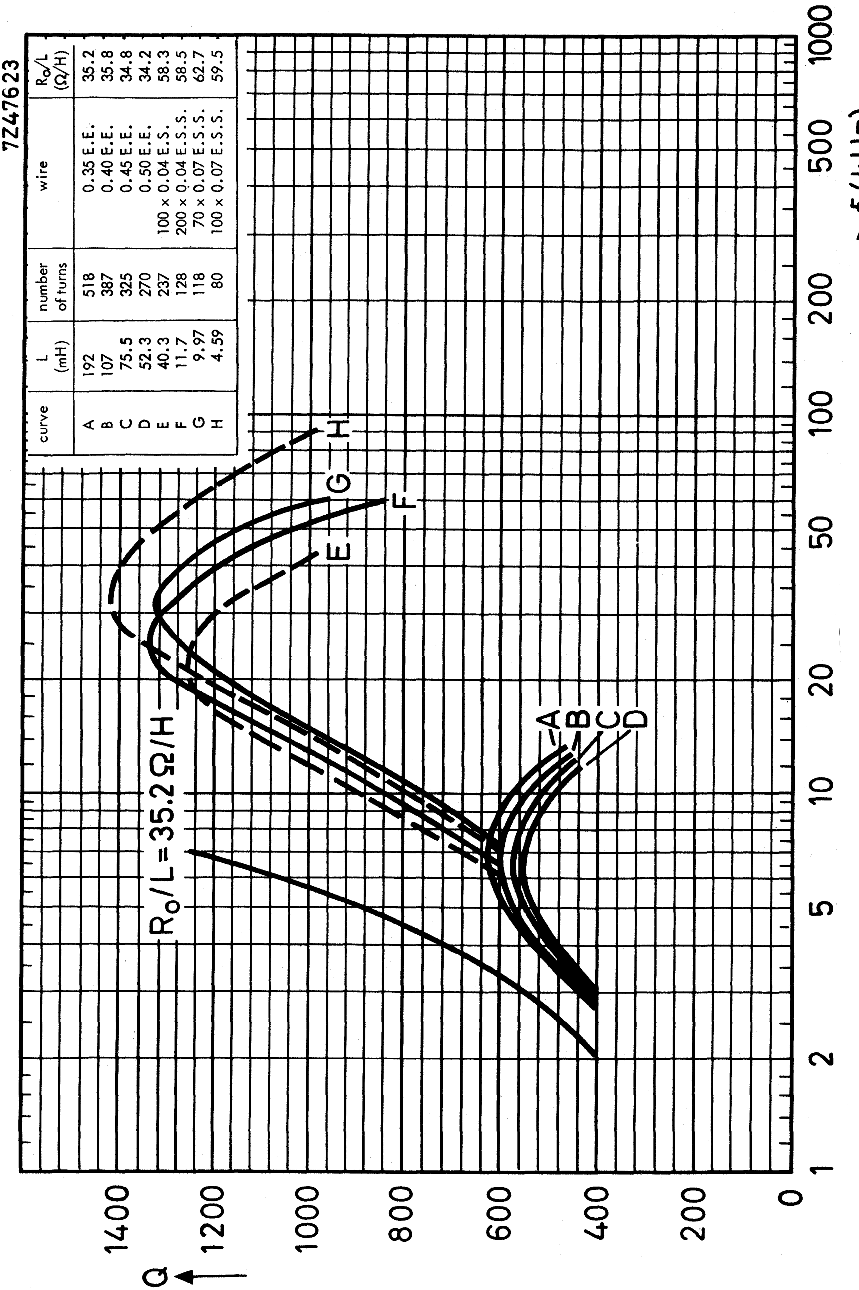
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	87.0	518	0.35 E.E.	77.8
B	48.5	387	0.40 E.E.	79.0
C	34.1	325	0.45 E.E.	77.0
D	23.6	270	0.50 E.E.	75.6
E	18.1	237	100 × 0.04 E.S.	129
F	5.30	128	200 × 0.04 E.S.S.	130
G	4.50	118	70 × 0.07 E.S.S.	137
H	2.07	80	100 × 0.07 E.S.S.	131

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



curve	L (mH)	number of turns	wire	R_o/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 x 0.04 E.S.	88.0
F	7.83	128	200 x 0.04 E.S.S.	87.5
G	6.64	118	70 x 0.07 E.S.S.	94.3
H	3.06	80	100 x 0.07 E.S.S.	89.2

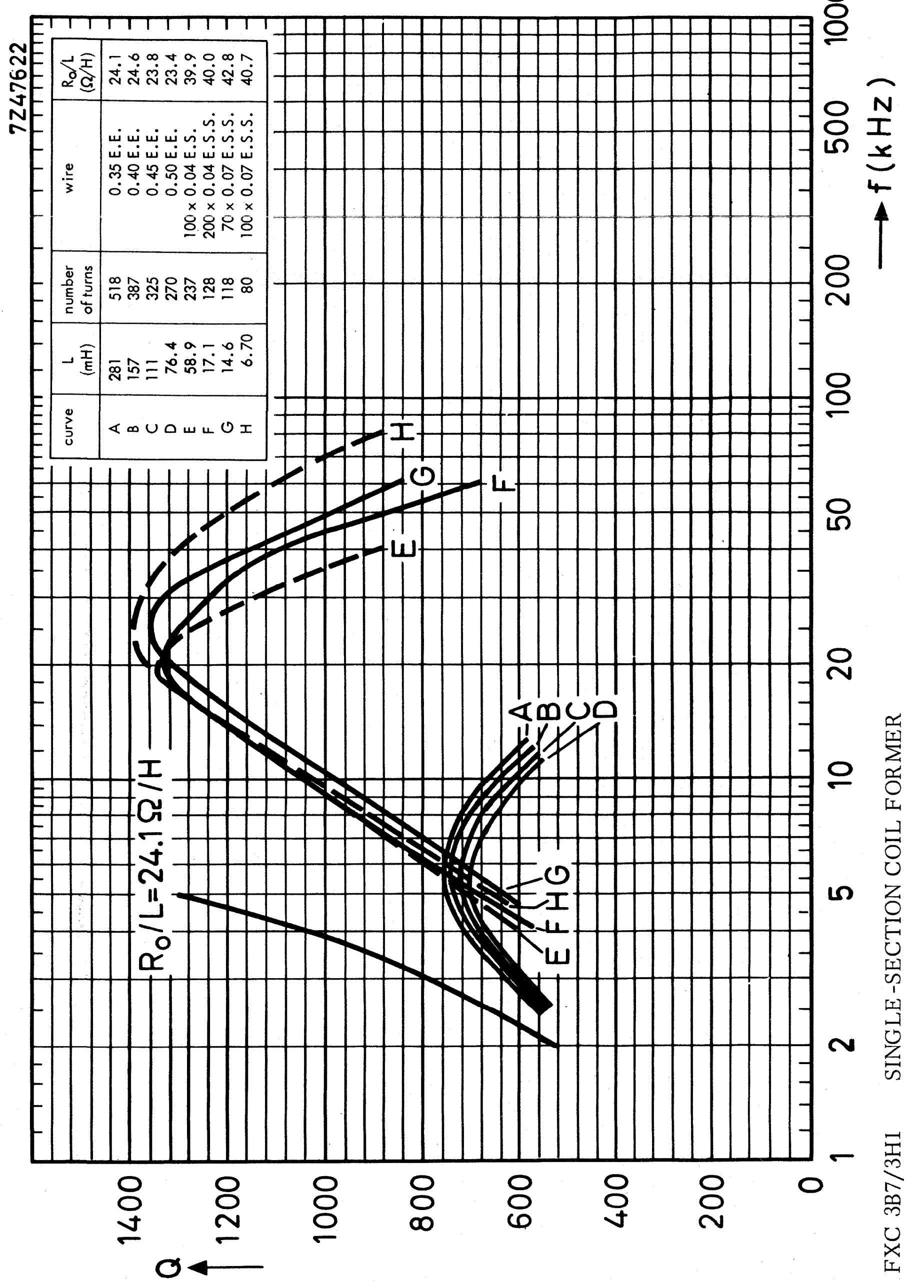
FXC 3B7/3H1 SINGLE-SECTION COIL FORMER
$\mu_e = 100$



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
$\mu_e = 150$

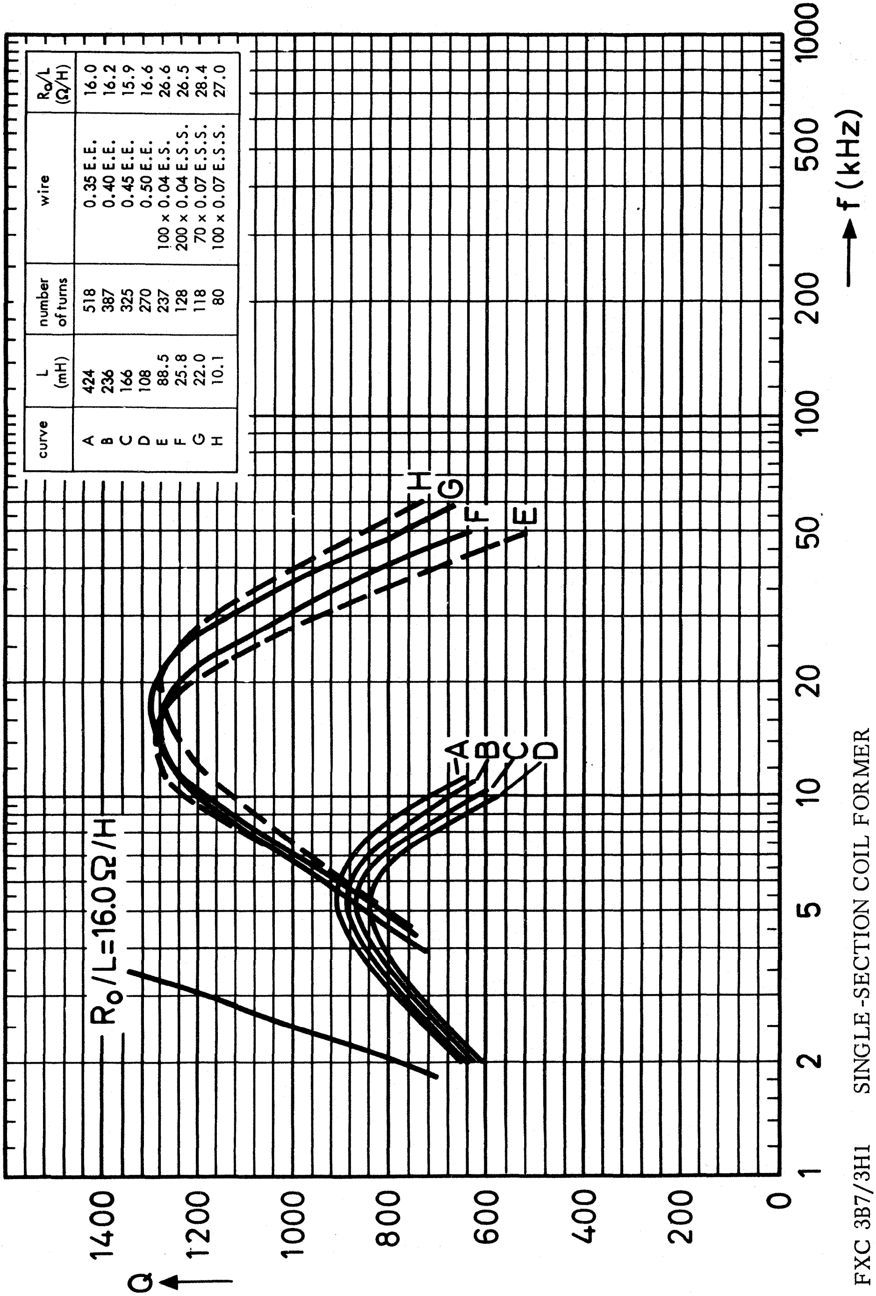
7Z47622



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

$\mu_e = 220$



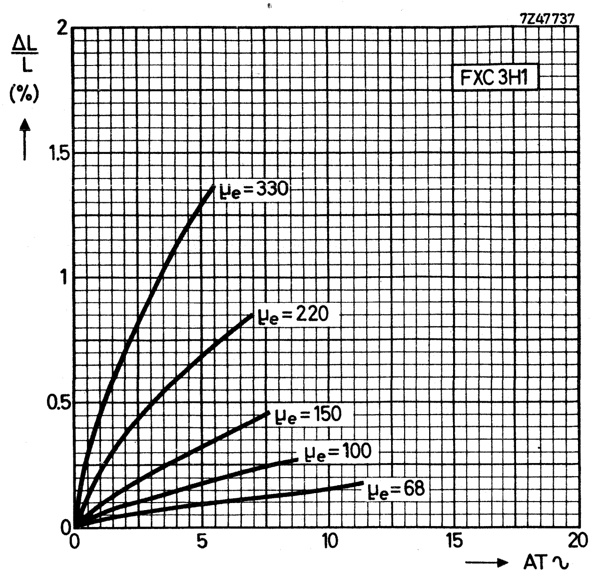
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	424	518	0.35 E.E.	16.0
B	236	387	0.40 E.E.	16.2
C	166	325	0.45 E.E.	15.9
D	108	270	0.50 E.E.	16.6
E	88.5	237	100 × 0.04 E.S.	26.6
F	25.8	128	200 × 0.04 E.S.S.	26.5
G	22.0	118	70 × 0.07 E.S.S.	28.4
H	10.1	80	100 × 0.07 E.S.S.	27.0

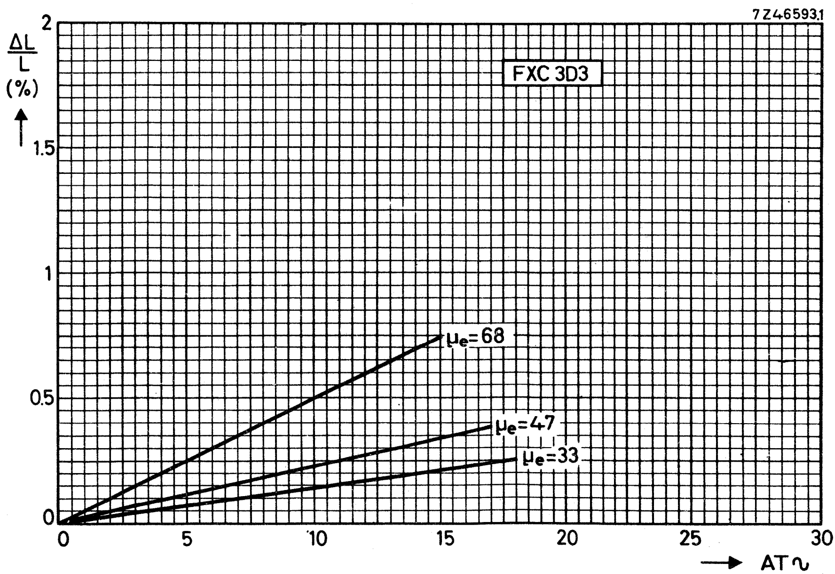
SINGLE-SECTION COIL FORMER

FXC 3B7/3H1

$\mu_e = 330$

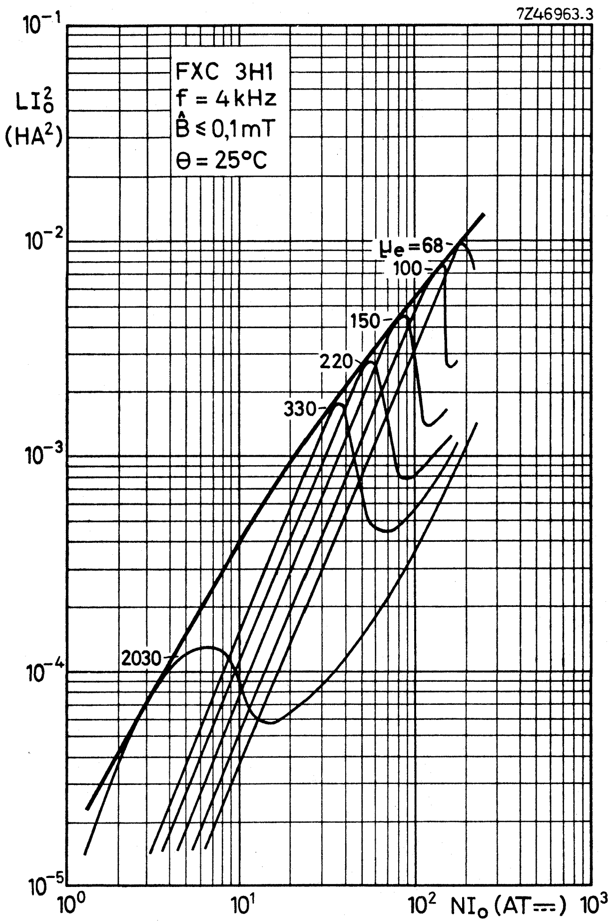
INDUCTANCE VARIATION AS A FUNCTION OF AT ~



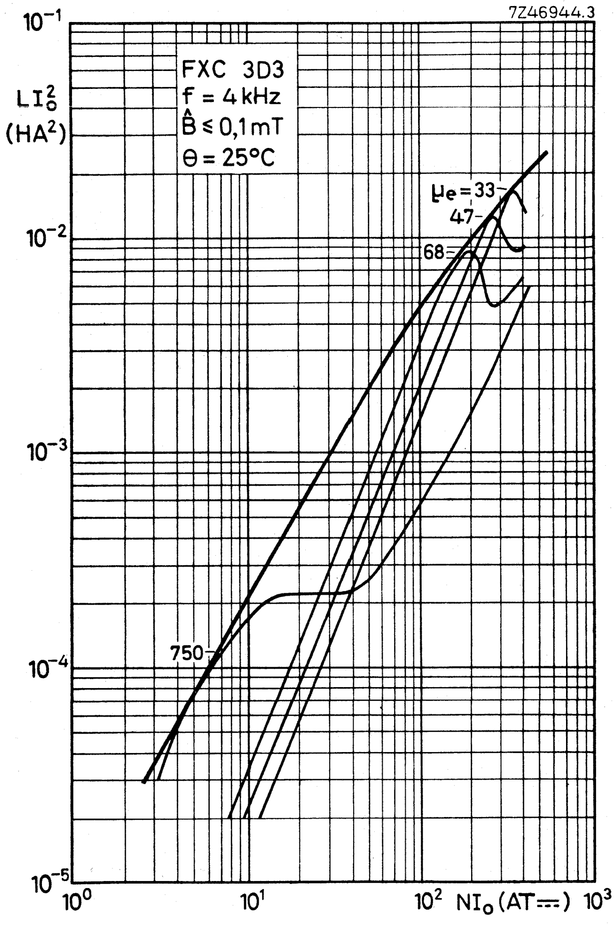


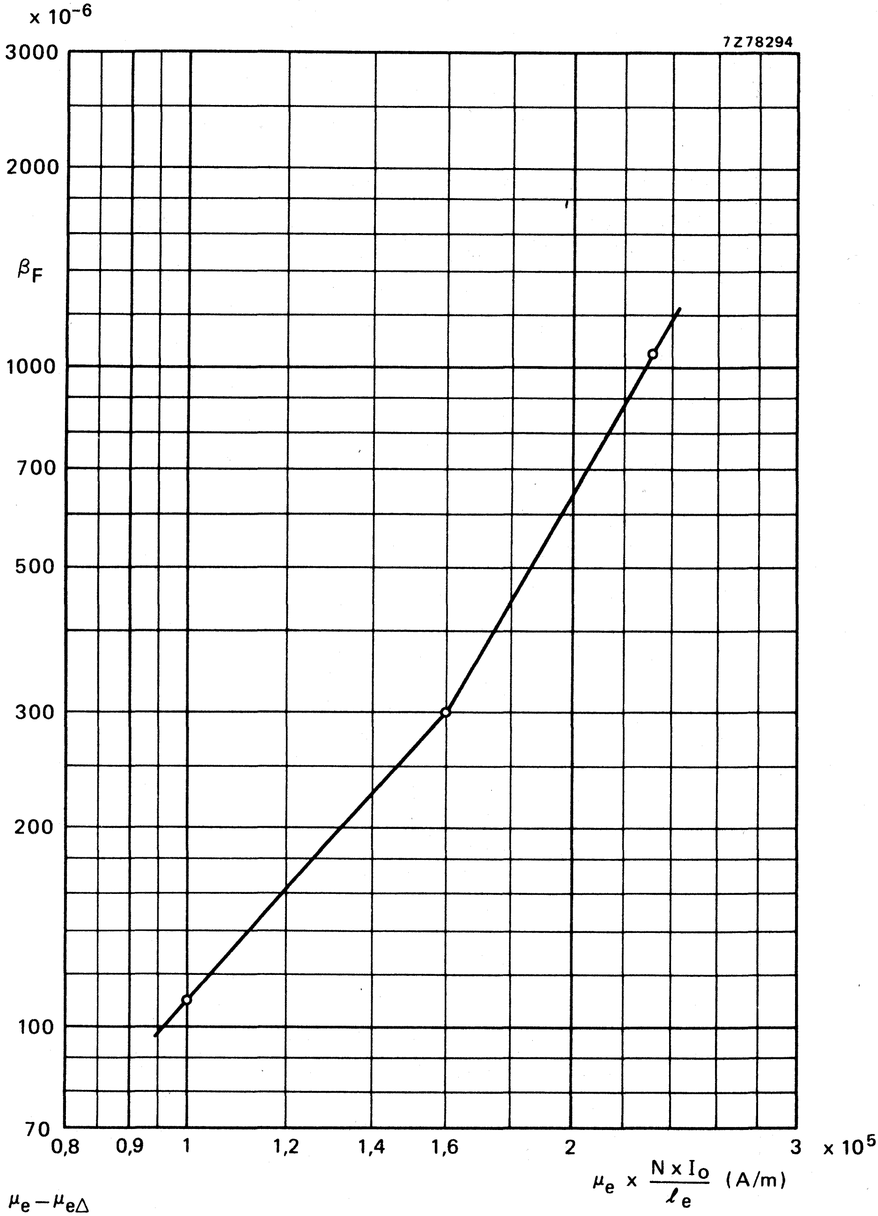
HANNA CURVES

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



Typical values





$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

POTCORES

Three types of cores can be supplied:

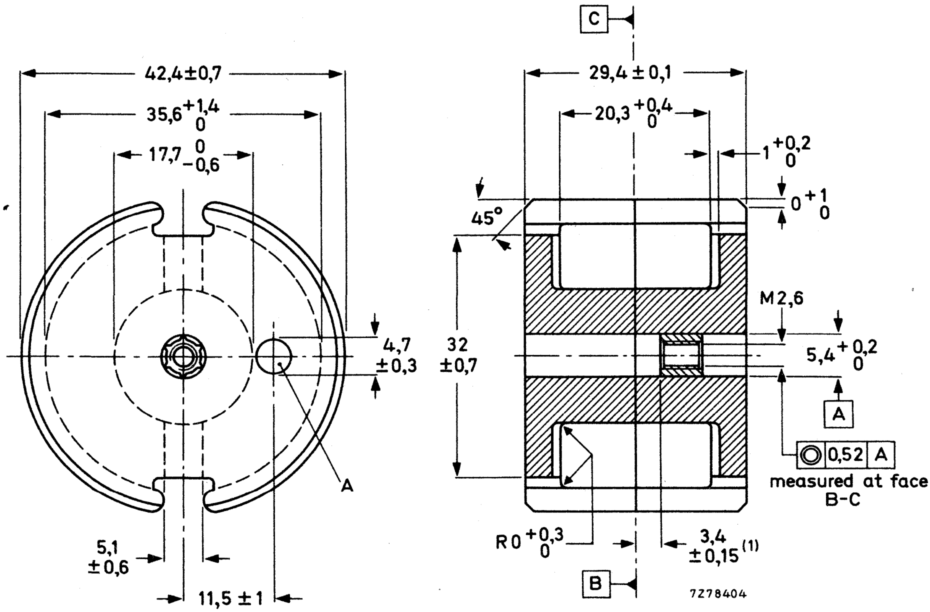
- CORE SETS provided with a nut for an adjuster and pre-adjusted on an inductance factor A_L or on a relative effective permeability value μ_e.
- CORE SETS without nut and pre-adjusted on an A_L or a μ_e value.
- CORE HALVES without air gap.

The potcores are in accordance with the following specifications: IEC 133 (international), C93-324 (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 5 core sets or 10 core halves; a storage pack contains 50 core sets or 100 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut ⩾ 50 N

At distance (1) 3,4 ± 0,15 mm, the concentricity is ◎ 0,52 A

At distance (1) 5,0 ± 0,5 mm, the concentricity is ◎ 0,70 A

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}259\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}000977\ mm^{-3}$; $V_e = 18\,200\ mm^3$; $l_e = 68{,}6\ mm$;

$A_e = 265\ mm^2$.

Mass of core set: 104 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 550 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F of grade 3B7 are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	grade 3H1
$A_L \pm 25\%$	4	$\leqslant 0{,}1$	25 ± 1	10 250	10 250
$\mu_e \pm 25\%$	4	$\leqslant 0{,}1$	25 ± 1	2100	2100
α	4	$\leqslant 0{,}1$	25 ± 1	$\leqslant 11{,}4$	$\leqslant 11{,}4$
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	$\leqslant 0{,}1$	25 ± 1	$\leqslant 1{,}2$	$\leqslant 1{,}2$
	100	$\leqslant 0{,}1$	25 ± 1	$\leqslant 8$	$\leqslant 8$
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	$\leqslant 1{,}1$	$\leqslant 0{,}62$
$\alpha_F \times 10^6/°C$	$\leqslant 100$	$\leqslant 0{,}1$	5 to 25		+ 0,5 to 1,5
	$\leqslant 100$	$\leqslant 0{,}1$	25 to 55		+ 0,5 to 1,5
	$\leqslant 100$	$\leqslant 0{,}1$	25 to 70	–0,6 to + 0,6	
$D_F \times 10^6$ (10-100 min)	$\leqslant 100$	$\leqslant 0{,}1$	$25 \pm 0{,}1$	$\leqslant 4{,}3$	$\leqslant 4{,}3$

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022	
		3B7	3H1
100 ± 1%	20,5	35040	35240
250 ± 1%	51	35060	35260
400 ± 1%	81	35080	35280
630 ± 2%	130	35100	35300
1000 ± 3%	205	35110	35310
1600 ± 3%	325	35120	35320
2500 ± 10%	510	35130	–

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022	
		3B7	3H1
68 ± 1%	55,0	34050	34250
100 ± 1,5%	45,0	34060	34260
150 ± 2%	36,8	34070	34270
220 ± 3%	30,4	34080	34280
330 ± 3%	24,8	34090	34290
2120 ± 25%	9,85	34000*	34200*

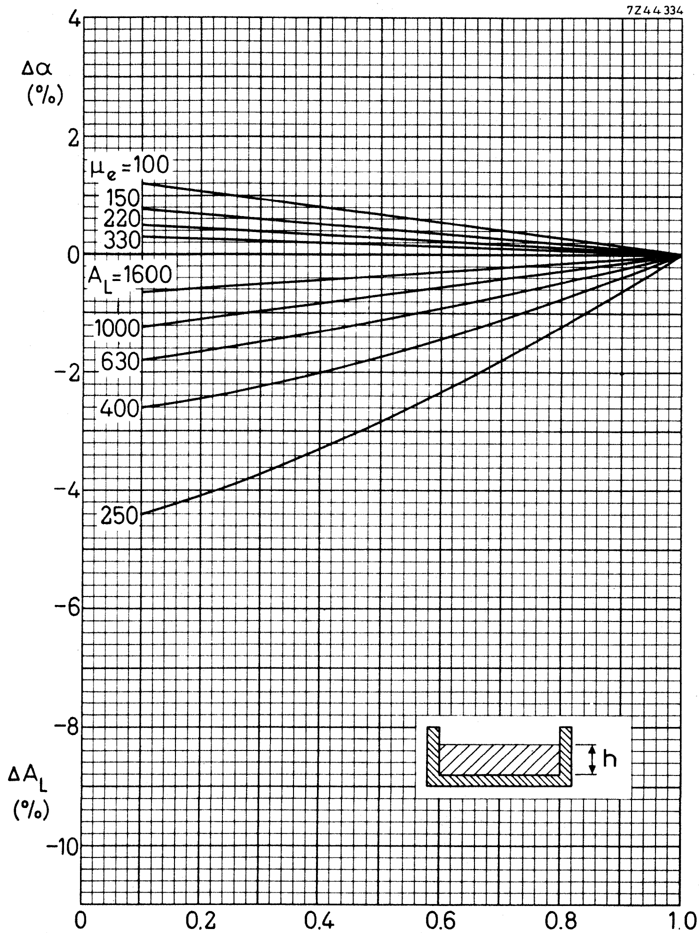
Core sets without nut: replace the eight digit of the catalogue number (3) by 1.
Cores with $A_L \leqslant 630$, or $\mu_e \leqslant 150$ have a symmetrical air gap.
Cores with $A_L \geqslant 1000$, or $\mu_e \geqslant 220$ have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

Core halves without air gap, without nut

Ferroxcube grade	catalogue number (with hole A)	catalogue number (without hole A)
3B7	4322 020 22780	4322 020 22750
3H1	4322 020 22790	4322 020 22760

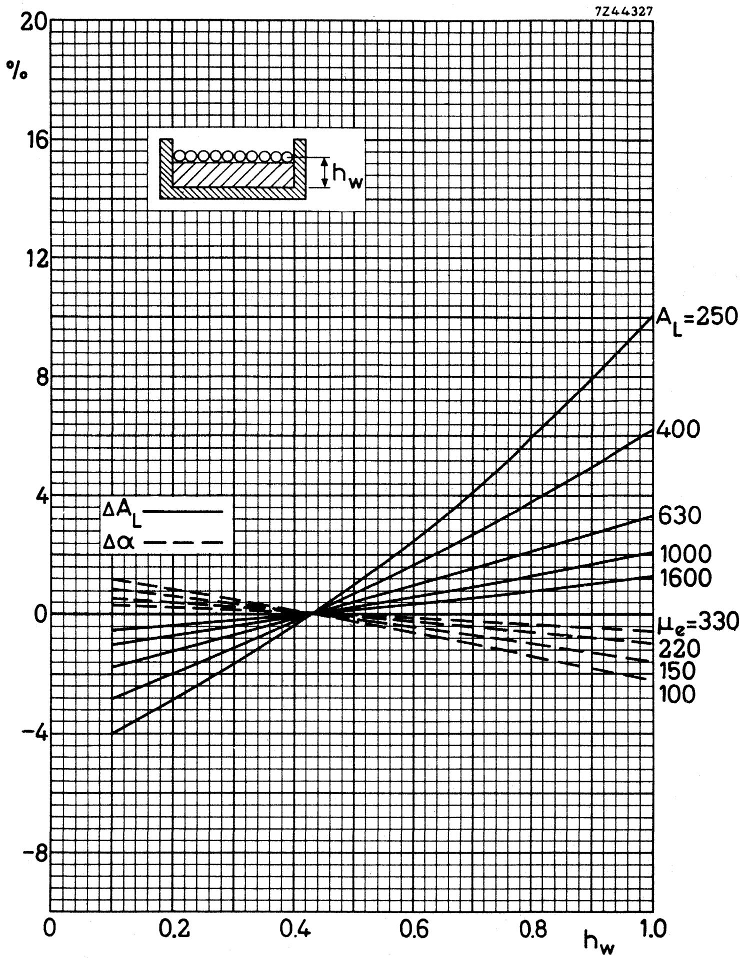
The versions without hole A are used for filter coils, the versions with hole A for L-asymmetry adjustment of loading coils.

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

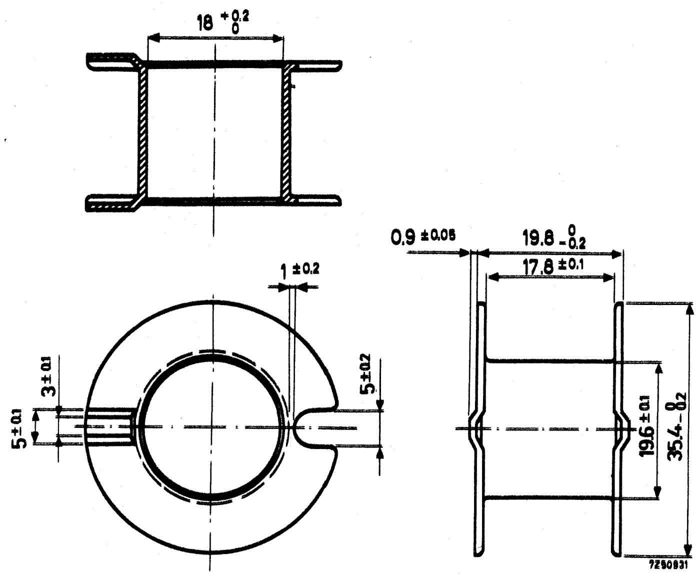
GENERAL

Two types of coil former can be supplied:

- with one section;
- with two sections.

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

SINGLE-SECTION COIL FORMER



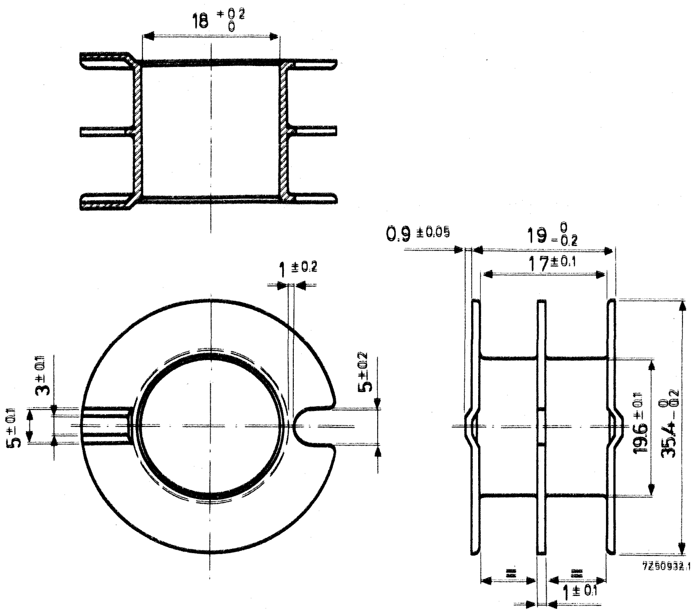
Catalogue number	4322 021 30420
Material	polycarbonate
Window area	140 mm^2
Mean length of turn	86 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 2,16 \times 10^3\ \Omega/H$$

Mass 2,4 g

TWO-SECTION COIL FORMER



Catalogue number	4322 021 30430
Material	polycarbonate
Window area	2 x 63 mm²
Mean length of turn	86 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 2{,}40 \times 10^3 \ \Omega/H$$

Mass 3,0 g

INDUCTANCE ADJUSTERS

CONTINUOUS ADJUSTERS

Dimensions in mm

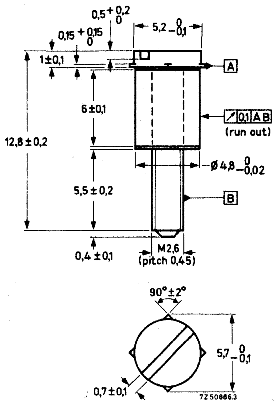


Fig. A.

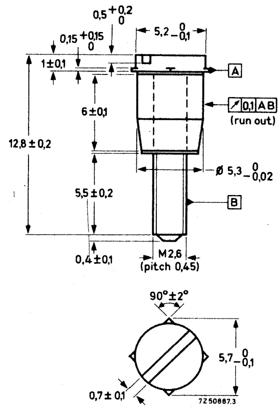


Fig. B.

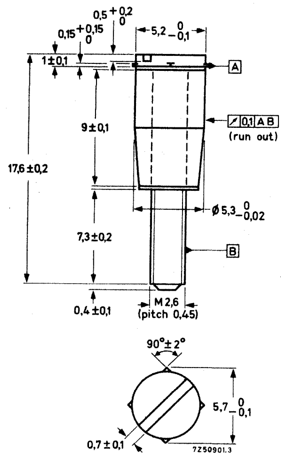


Fig. C.

The tolerances on inductance of the pre-adjusted potcores (without adjuster) are given under 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 an continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the potcore into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the vaiability of the inductance is negligible. The maximum permissible temperature is 110 $^{\circ}$C.

The table on the next page shows the type of adjuster recommended for different potcores.

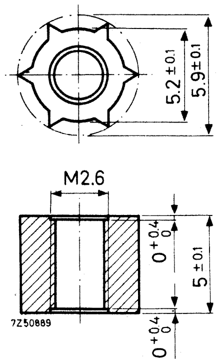
Types of adjuster and recommended applications

Fig.	colour	catalogue number 4322 021	potcore μ_e	potcore 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 adjusters are packed in bags of 100, so please order in multiples of 100.

Nut for adjuster

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

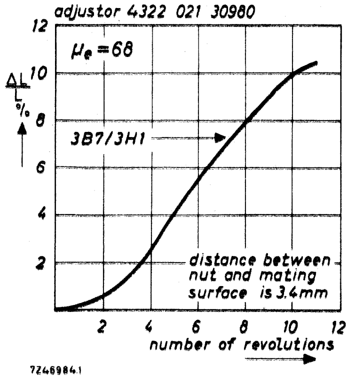


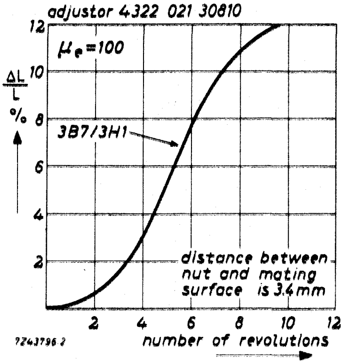
Catalogue number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut (see Adjustment curves)	3,4 ± 0,15 mm or 5,0 ± 0,15 mm

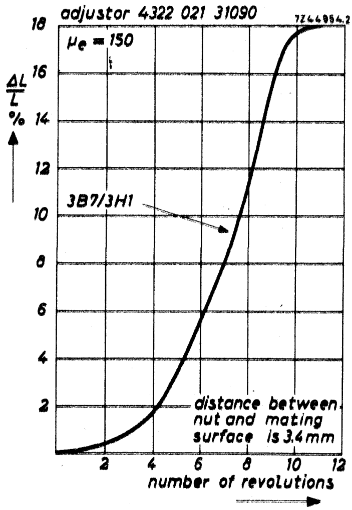
The nuts are packed in bags of 100, so please order in multiples of 100.

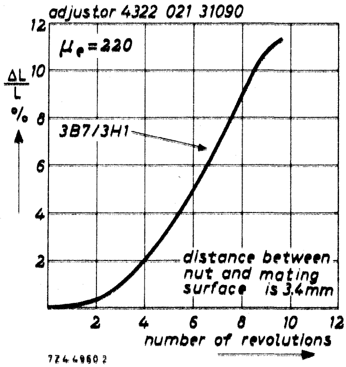
For more information see Potcores General, Mounting Data.

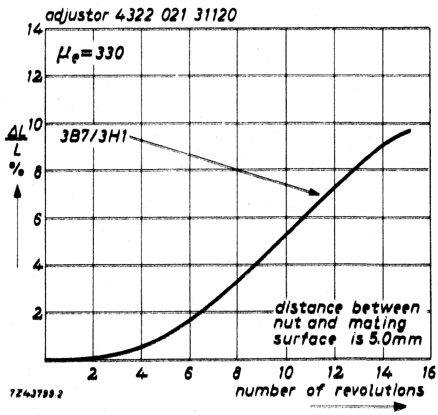
Adjustment curves











STEP-BY-STEP ADJUSTERS

These adjusters 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 adjusters is negligible.

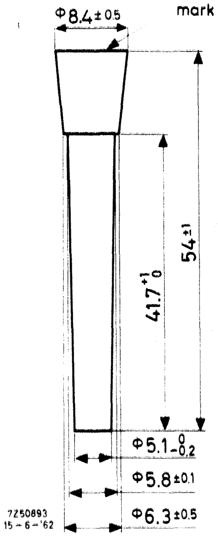
A range of 13 flexible conical adjusters is available under the catalogue numbers 4322 021 32000 up to 021 32120. Each adjuster causes an increase in the inductance; the higher the catalogue number, the greater the effect. The influence of each adjuster on the inductance at different μ_e values of the potcore can be found from the graph.

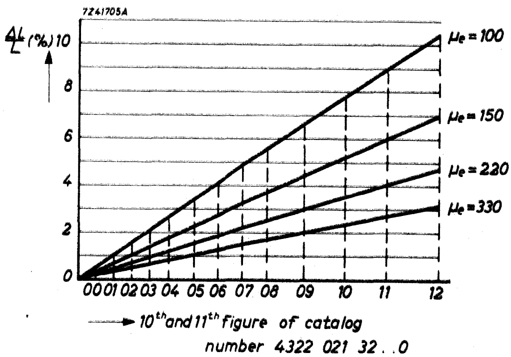
The 10th and 11th figure of the catalogue number are indicated on the head of the adjuster. It should be borne in mind that, when using these adjusters, the inductance of the coil should initially be lower than the required value.

When the correct adjuster 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.

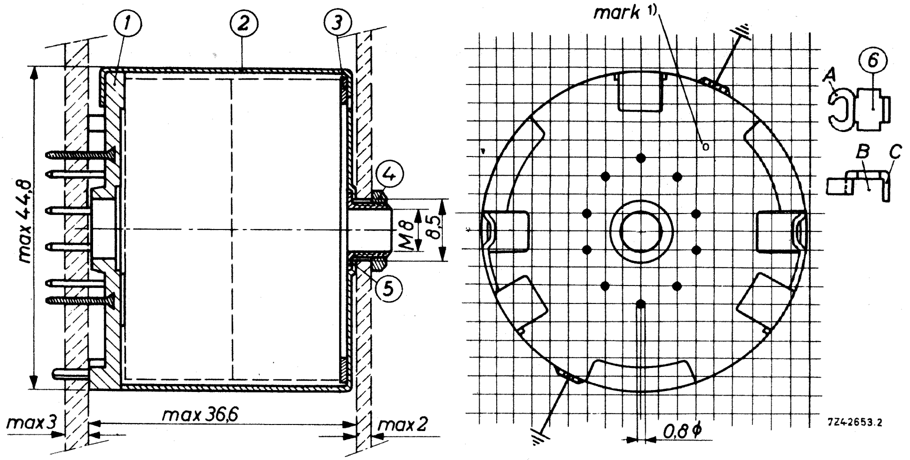
Dimensions in mm





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 a grid of 2,54 mm (0,1 inch).
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 that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

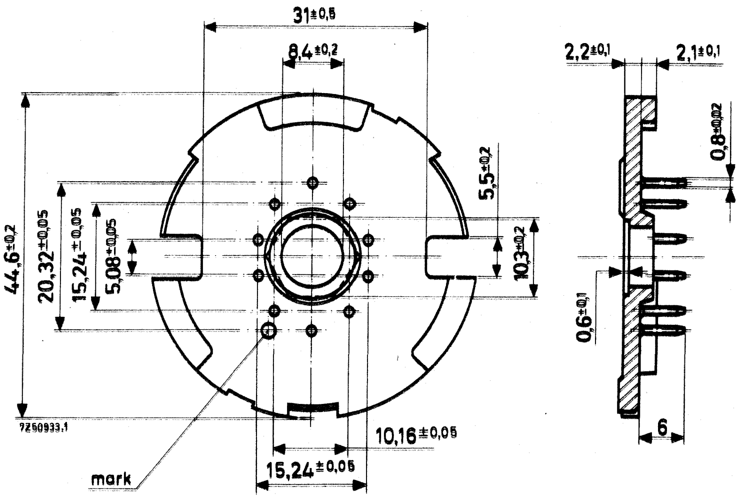
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 550 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS Dimensions in mm

(1) Tag plate 4322 021 30500

Plate : polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s

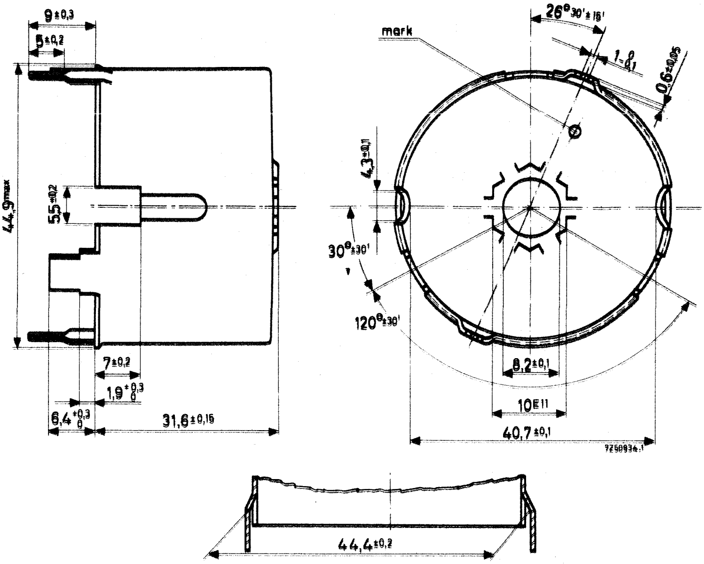
Pins : phosphor bronze, dip-soldered



The tag plates are packed in units of 15 pieces on a polystyrene plate, and with 100 pieces in a cardboard box. Please order in multiples of these quantities.

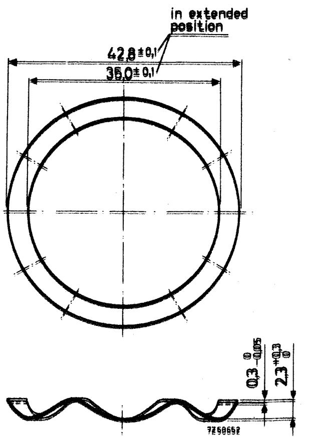
(2) Container 4322 021 30580

Material: brass, nickel plated; tinned soldering pins



(3) Spring 4322 021 30690

Material: chrome-nickel steel

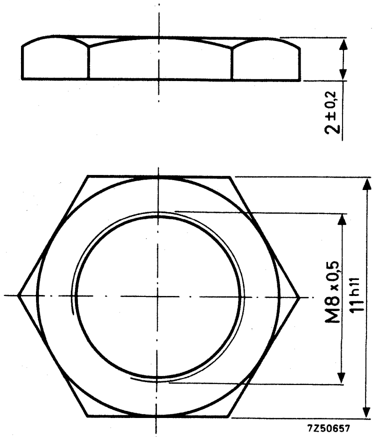


A force of 383 to 638 N is required to compress the spring to 0,67 mm.

The springs are packed in units of 100 pieces. Please order in multiples of this quantity.

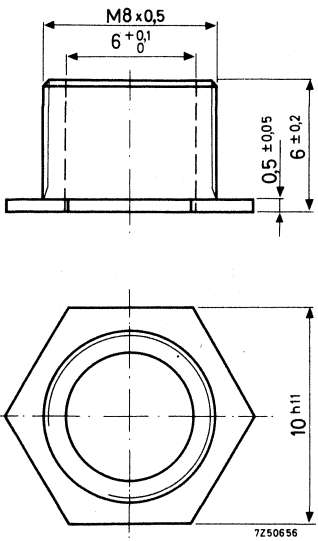
(4) Nut 4322 021 30710

Material: brass, nickel plated



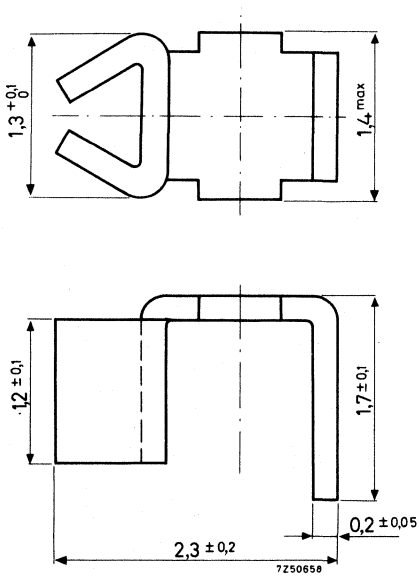
(5) Fixing bush 4322 021 30720

Material: brass, nickel plated



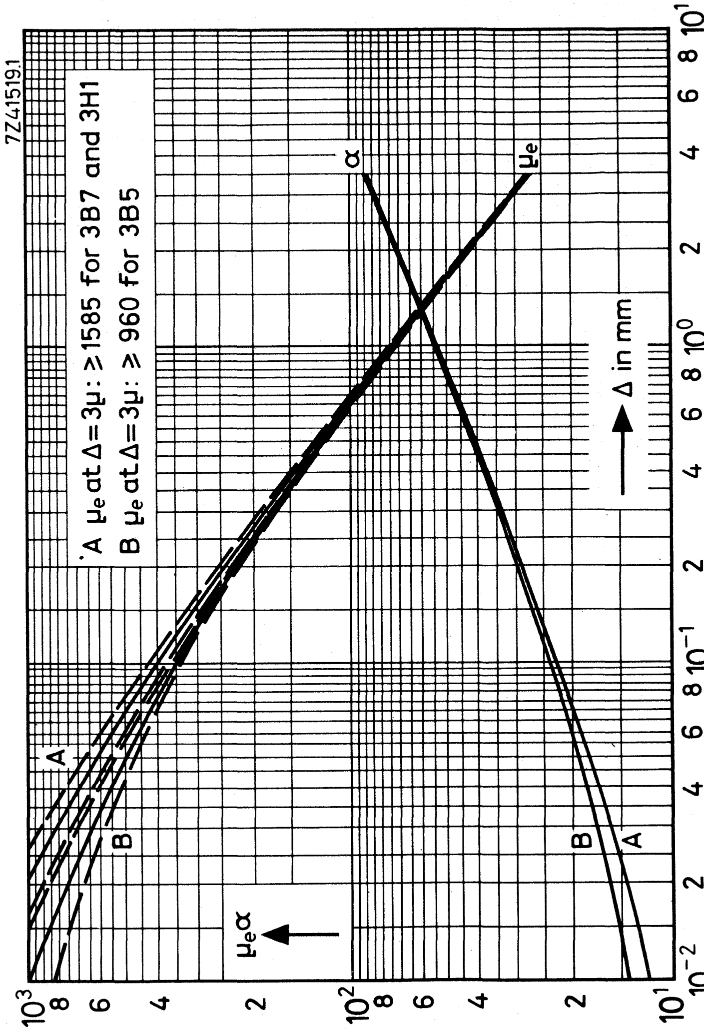
(6) Soldering spring 4322 021 30700

Material: brass, dip-soldered



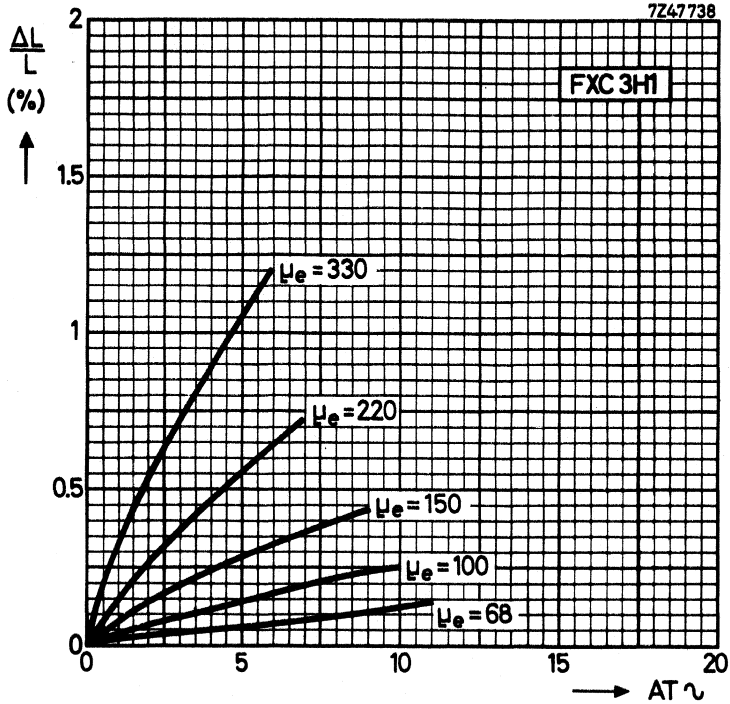
CHARACTERISTIC CURVES

μ_e-α CURVES



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

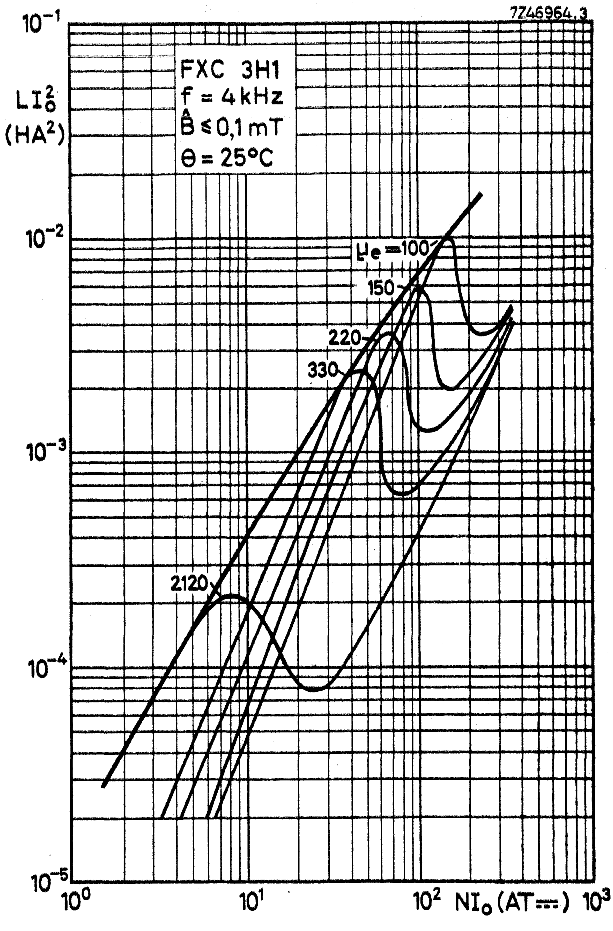
INDUCTANCE VARIATION AS A FUNCTION OF AT ~



HANNA CURVE

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

Typical values



POTCORES

INTRODUCTION

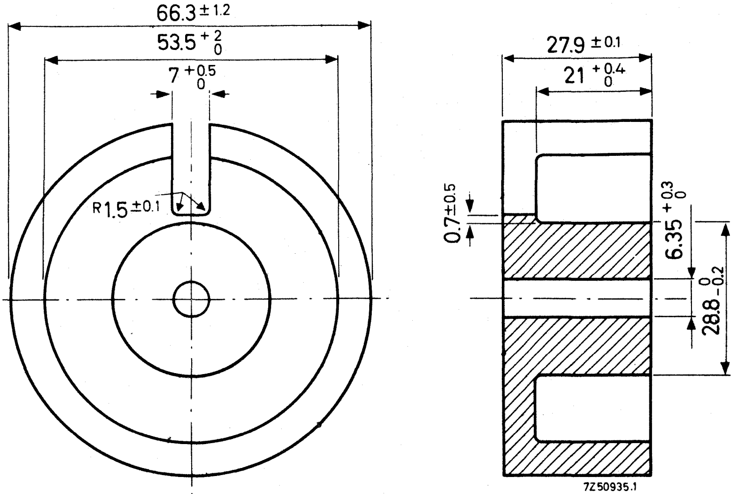
Two types of core can be supplied:

- 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 **E6** standard series of values, the A_L values from the R5 series.

Potcores and associated parts are ordered by their 12-digit catalogue number.
Quantity: a storage pack contains 12 halves each packed in corrugated fibre cardboard, catalogue number 4322 020 23000, grade 3E1.

MECHANICAL DATA

Dimensions in mm



Mass (two halves) 550 g

Core factor and effective dimensions:

Effective length l_e = 123 mm

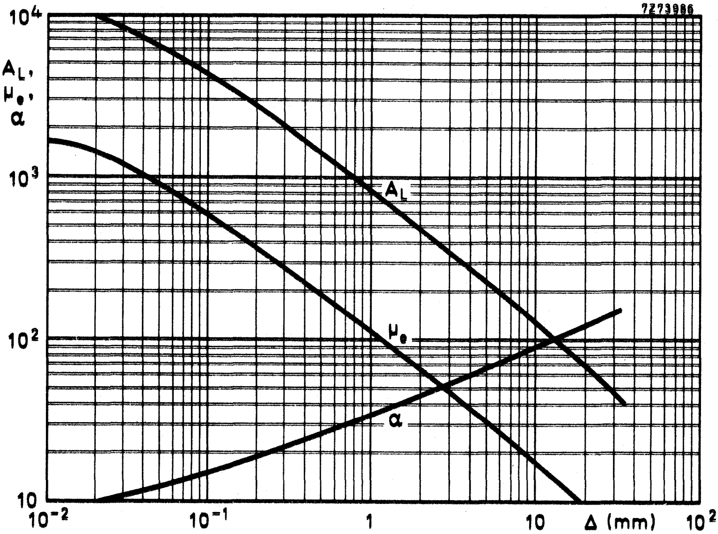
Effective volume V_e = **88 300 mm³**

$$\Sigma \frac{l}{A} = 0{,}172\ \text{mm}^{-1}$$

For the combination of two potcore halves randomly chosen from a batch and pressed together with a force of 1700 N, the values below are guaranteed at 25 ± 10 °C.

	$\hat{B}$ mT	freq. kHz	grade
μ_e	$\leqslant$ 0,1	4	$\geqslant$ 1970
α	$\leqslant$ 0,1	4	$\leqslant$ 8,25

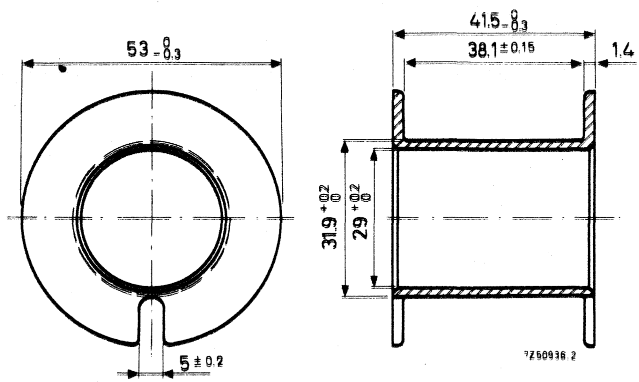
CHARACTERISTIC CURVES



Inductance factor, relative effective permeability and turns factor as a function of the air gap length.

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 ^oC

D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 0,80 \times 10^3\ \Omega/H$$

Weight 11,8 g

Square cores

SQUARE CORES

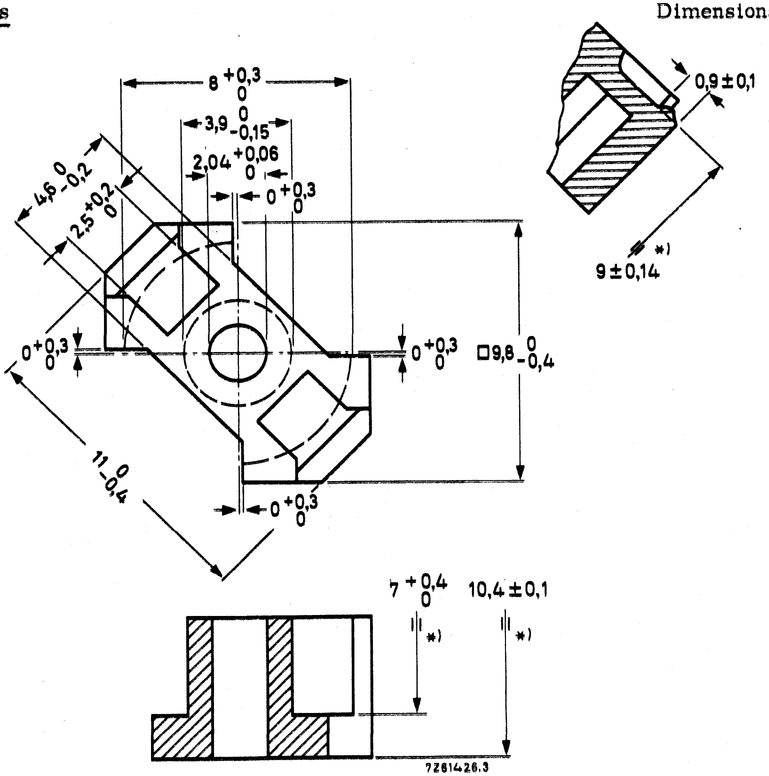
Three types of core can be supplied:
- Separate core halves, air gap to be ground by the user.
- Pre-adjusted cores (2 halves with an air gap) which are provided with a nut for an adjuster. These cores have an inductance factor A_L in accordance with the R5 (R10) range.
- Pre-adjusted cores without nut.

The square cores are in accordance with the following specifications: IEC 431 (international), UTE C93-324 (France), DIN 41980 (Germany).
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. Please order in multiples of these quantities.

SEPARATE CORE HALVES

Outlines

Dimensions in mm



*) Measured on two adjacent core halves.

Versions

Ferroxcube grade	catalogue number
3E4	only pre-adjusted cores are available
3H1	4322 020 26510

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 25 N, the values in the table below are guaranteed.

	$\hat{B}$ (mT)	freq. (MHz)	temperature °C	grade 3E4	grade 3H1
μ_e 1)	≤ 0,1	0,1	25 ± 5		1600
A_L 1)	≤ 0,1	0,1	25 ± 5		1040
α 2)	≤ 0,1	0,1	25 ± 5		31,8
$\alpha_F \times 10^6$			5 to 25	0 to 2	+0,5 to +1,5
			25 to 55	0 to 2	+0,5 to +1,5
			25 to 70	0 to 2	+0,5 to +1,5 3)
$D_F \times 10^6$ (10-100 min)			25 ± 1		≤ 4,3
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0,1	0,004	25 ± 10	≤ 2,5	
	≤ 0,1	0,03	25 ± 10		≤ 3
	≤ 0,1	0,1	25 ± 10	≤ 2,0	≤ 6
	≤ 0,1	0,5	25 ± 10	≤ 200	
	≤ 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	≤ 1,1

1) Tolerance ± 25%.

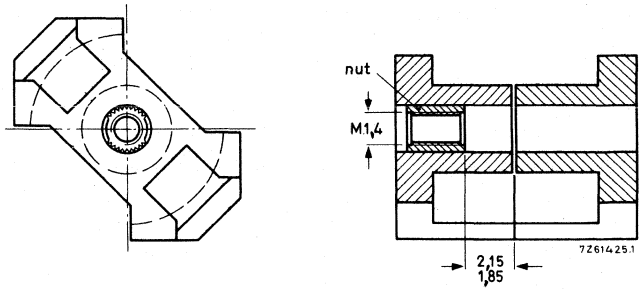
2) Tolerance ± 12,5%.

3) For guidance only.

PRE-ADJUSTED CORES

Outlines

Dimensions in mm



Mass (per set) 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

$\Sigma \frac{l}{A} = 1,94$ mm^{-1}

Effective volume $V_e = 230$ mm^3

Pre-adjusted cores with standard A_L values

A_L	corre-sponding μ_e-value	tolerance on induc-tance (%)	cat. no.: 4322 022 7.... with nut; 4322 022 5.... without nut	
			3E4	3H1
40	62	± 1		7220
63	96	± 1,5		7230
100	152	± 2		7240
160	242	± 5		7250
250	380	± 10		7260
2790	3760	± 25	7900 *	

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

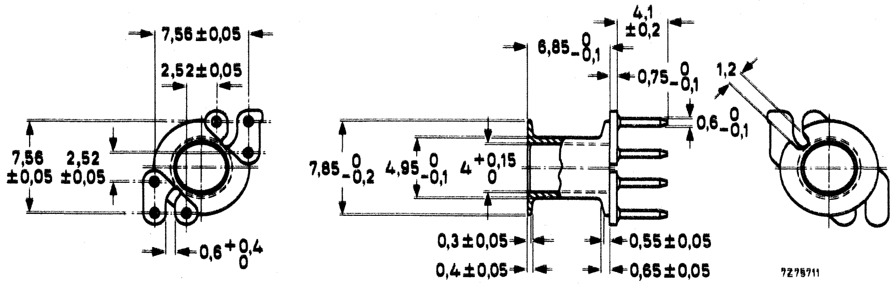
Symmetrical air gap for cores with A_L factor of 40.
Asymmetrical air gap for cores with A_L factor of 63 and higher.
The air gap of the types marked * is practically zero, and consequently inductance adjustment is not possible. Hence these types are not provided with a centre hole, so that maximum performance 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



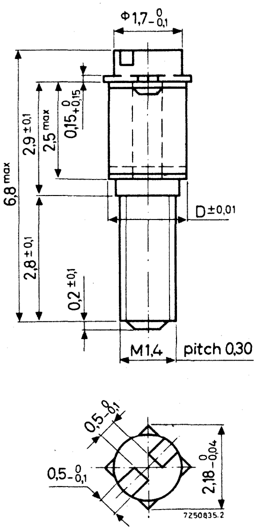
Catalogue number	4322 021 32210
Material	phenol formaldehyde reinforced with glass fibre, dip-soldered pins
Window area	8,8 mm²
Mean length of turn	20 mm
Max. temperature	130 °C
Solderability	resistant against dip-soldering at 400 °C for 2 s
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 55,7 \times 10^3\ \Omega/H$
Mass	0,16 g

The coil formers are packed on polystyrene plates with 200 pieces. Please order in multiples of these quantities.

INDUCTANCE ADJUSTERS

ADJUSTERS

The tolerances on inductance of the pre-adjusted cores (without adjuster) are given in the table of pre-adjusted cores with standard A_L values. 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 adjuster. Such an adjuster increases the inductance of the coil (see following pages).
The adjuster 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 adjuster. For special requirements a larger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower A_L value.
The influence of the adjuster on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
The table shows the type of adjuster recommended for different square cores.

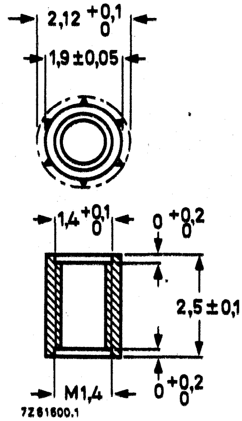


D	A_L of core in 3E4/3H1	recommended adjuster cat. no.	colour
1,85	40	4322 021 31250	green
1,85	63	4322 021 31260	red
1,85	100	4322 021 31270	yellow
1,76	160	4322 021 31540	brown
1,85	250	4322 021 31280	grey

The adjusters are packed in bags of 100.
Please order in multiples of 100.

NUT FOR ADJUSTER

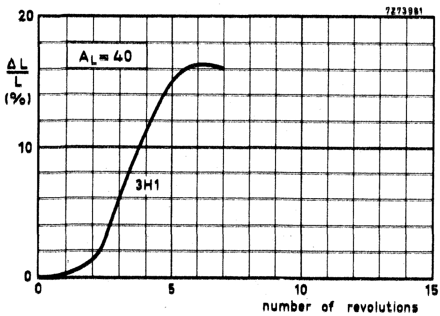
These data are given for those manufacturers who prefer to insert the nut themselves.



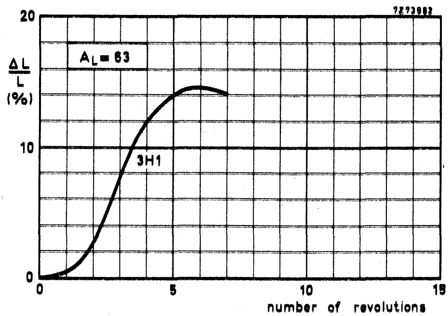
Catalogue number	4322 021 31850
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	2,0 ± 0,15 mm

The nuts are packed in bags of 100. Please order in multiples of 100.

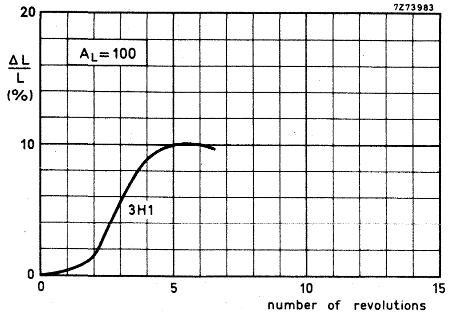
ADJUSTMENT CURVES



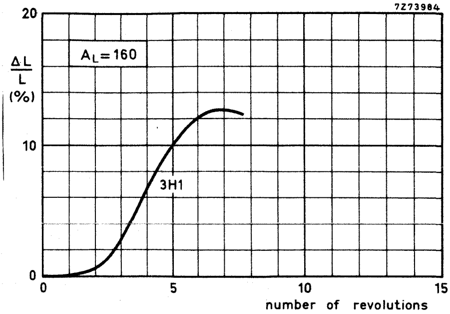
Adjuster 4322 021 31250



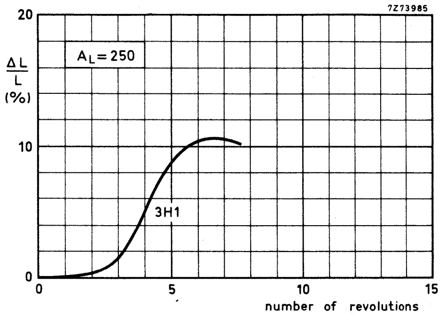
Adjuster 4322 021 31260



Adjuster 4322 021 31270

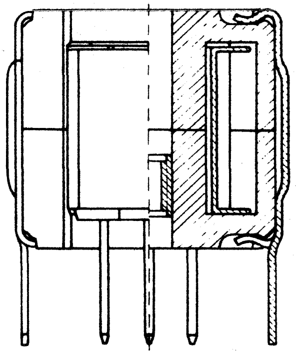


Adjuster 4322 021 31540



Adjuster 4322 021 31280

ASSEMBLING AND MOUNTING



ASSEMBLING

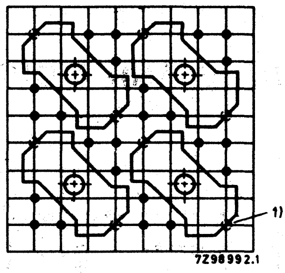
The core halves are clamped together by means of two clips, type 4322 021 31900. As can be seen in the drawing, the hooked ends of each clip fit into recesses made in the core halves.

For a stable inductance we recommend that an adhesive 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 00180.)

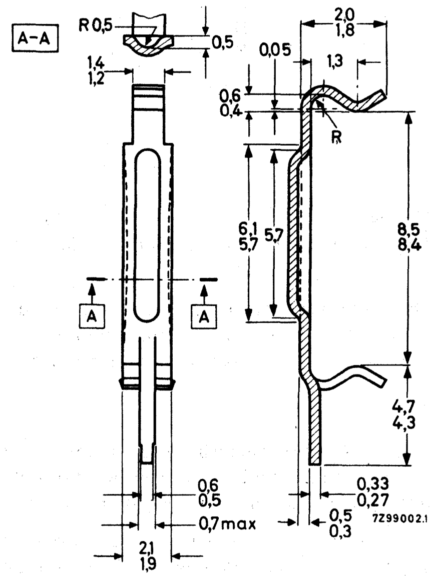
MOUNTING

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)

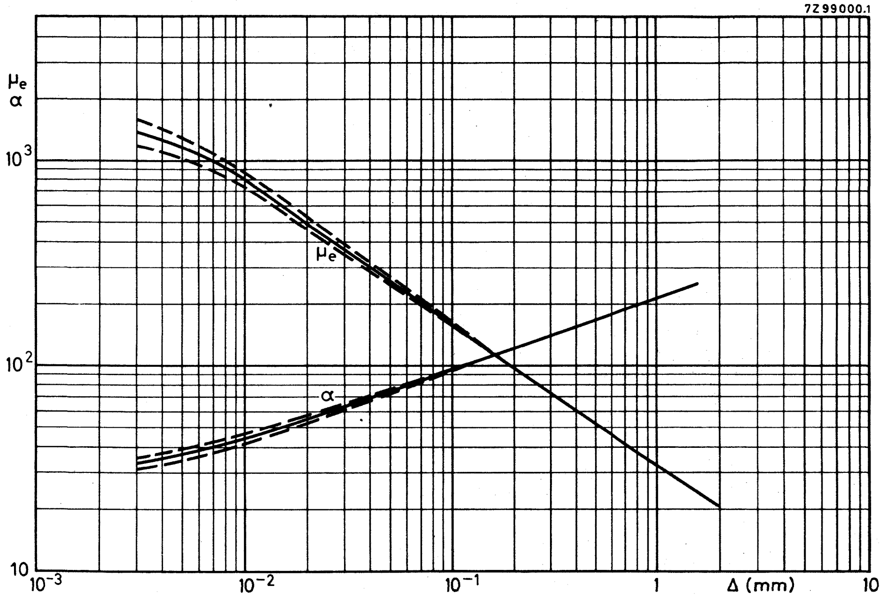


Clip 4322 021 31900
Material: steel, gold plated over nickel.

1) Holes for tag on clip 4322 021 31900 (earth points).

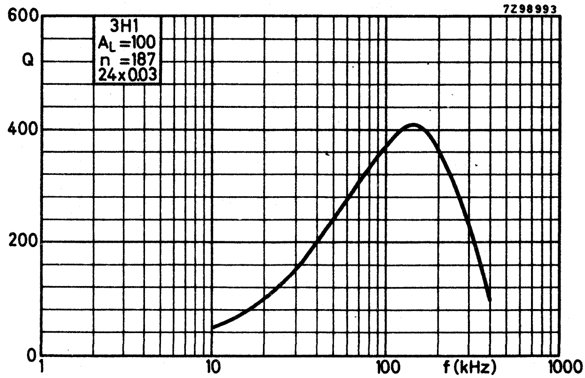
CHARACTERISTIC CURVES

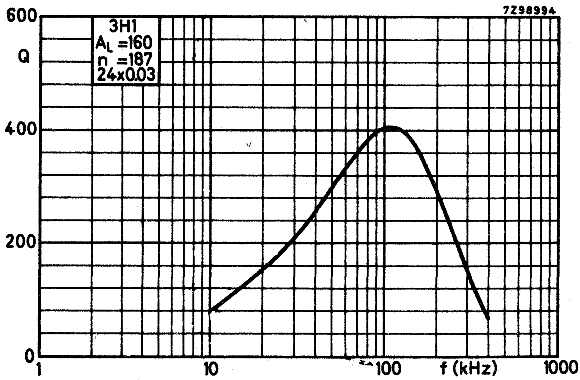
μ_e - α CURVES



Relative effective permeability and turns 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
600
Q
400
200
0
1
10
100
f (kHz)
1000


7Z98994
3H1
A_L = 160
n = 187
24x0.03
600
Q
400
200
0
1
10
100
f (kHz)
1000

SQUARE CORES

Three types of core can be supplied:

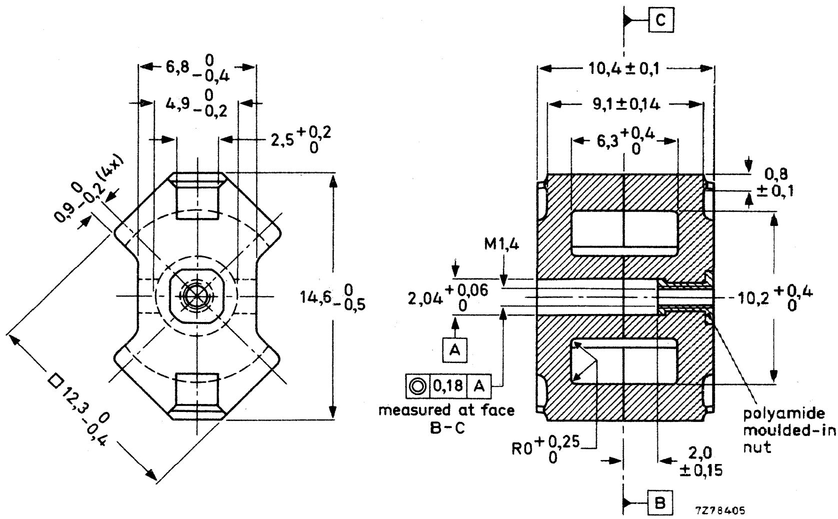
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L.
- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without air gap.

The square cores are in accordance with the following specifications: IEC 431 (international), C93-324 (France), DIN 41980 (Germany).

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut	⩾ 20 N
Torque of the screw thread	⩽ 0,4 N
Extraction force of adjuster from nut	⩾ N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 1{,}01\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0479\ mm^{-3}$; $V_e = 450\ mm^3$; $l_e = 21{,}4\ mm$; $A_e = 21{,}2\ mm^2$.

Mass of a core set: 3,0 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}935\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0378\ mm^{-3}$; $V_e = 574\ mm^3$; $l_e = 23{,}2\ mm$; $A_e = 24{,}8\ mm^2$.

Mass of a core set: 3,2 g.

ELECTRICAL DATA

The combination of two square core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 35 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	3D3	3E1	3E4	3H1	3H3	4C6
A_L ± 25%	100	⩽ 0,1	25 ± 1	1960	840			1960	1790	150
μ_e ± 25%	100	⩽ 0,1	25 ± 1	1590	670			1590	1435	124
α	100	⩽ 0,1	25 ± 1	⩽ 26,0	⩽ 39,7			⩽ 26,0	⩽ 27,3	⩽ 92,6
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1			⩽ 2,5	⩽ 2,5			
	30	⩽ 0,1	25 ± 1	⩽ 2,5				⩽ 2,5	⩽ 1,8	
	100	⩽ 0,1	25 ± 1	⩽ 5,0	⩽ 8	⩽ 20	⩽ 20	⩽ 5,0	⩽ 2,8	
	500	⩽ 0,1	25 ± 1		⩽ 14	⩽ 200	⩽ 200			
	1 000	⩽ 0,1	25 ± 1		⩽ 30					
	2 000	⩽ 0,1	25 ± 1							⩽ 40
	10 000	⩽ 0,1	25 ± 1							⩽ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 0,86		⩽ 1,8	⩽ 1,1	⩽ 0,86		
	30	1,5 to 3,0	25 ± 1						⩽ 0,85	
	100	0,3 to 1,2	25 ± 1		⩽ 1,8					⩽ 9,2
$\alpha_F \times 10^6/°C$	⩽ 100	⩽ 0,1	5 to 25				0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	−2 to + 4
	⩽ 100	⩽ 0,1	25 to 55	−0,6 to + 0,6			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	0 to + 6
	⩽ 100	⩽ 0,1	25 to 70	−0,6 to + 0,6	0 to + 2	0 to + 2	0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	
$D_F \times 10^6$ (10 - 100 min)	⩽ 100	⩽ 0,1	25 ± 0,1	⩽ 4,3	⩽ 12	⩽ 4,3	⩽ 4,3	⩽ 4,3	⩽ 3,0 *	⩽ 10

* This value is valid within the temperature range of 25 to 70 °C.

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	cat. no. 4322 022						
			3B7	3D3	3E1	3E4	3H1	3H3	4C6
16	13	± 1							79800
25	20	± 1		79410					79810
40	33	± 1		79420					79820
63	51	± 1	79030	79430			79230	79530	79830
100	82	± 1	79040	79440			79240	79540	
160	130	± 2	79050				79250	79550	
200	160	± 2						79690	
250	200	± 3	79060				79260	79560	
315	250	± 5	79070				79270	79570	
400	330	± 5	79080				79280	79580	
3450	2570	± 25			59900 *				
4600	3700	± 25				59930			
4975	3700	± 25				59990 *			

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

Core sets without nut: replace the eighth digit of the catalogue number (7) by 5.
Cores with $A_L \leqslant 100$ have a symmetrical air gap.
Cores with $A_L \geqslant 160$ have an asymmetrical air gap.
Types marked * are only available without adjuster nut and have no centre hole.

In order to obtain better performance, types 4322 022 59900 and 4322 022 59990 are made without centre hole.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B7	4322 020 26750
3D3	4322 020 26770
3H1	4322 020 26760
3H3	4322 020 26790
4C6	4322 020 26780

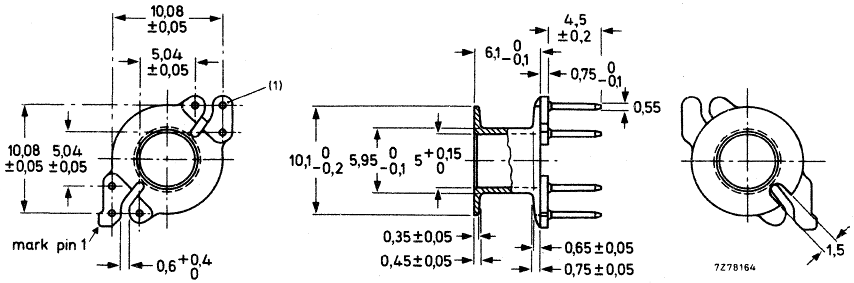
COIL FORMERS

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

Outlines

Dimensions in mm



(1) The 4-pin coil former does not have the two outermost pins.

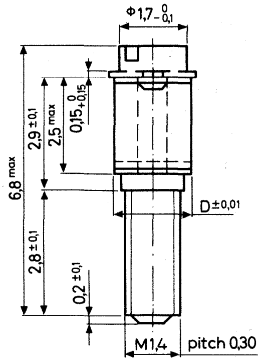
Material	phenolformaldehyde reinforced with glass fibre, dip-soldered pins
Minimum window area	9,5 mm^2
Mean length of turn	25 mm
Maximum temperature	180 °C
Solderability	resistant against dipsoldering at 400 °C for 2 s
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} = 34 \times 10^3\ \Omega/H$
Mass	0,28 g

The coil formers are packed on a polystyrene plate of 150 or in a cardboard box of 750. Please order in multiples of these quantities.

INDUCTANCE ADJUSTERS

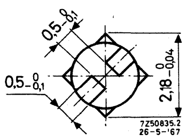
ADJUSTERS

The tolerances on inductance of the pre-adjusted cores (without adjuster) are given in the table of pre-adjusted cores with standard A_L values. 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 continous inductance adjuster. Such an adjuster increases the inductance of the coil (see following pages).
The adjuster 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 adjuster. For special requirements a larger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower A_L value.
The influence of the adjuster on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
The table shows the type of adjuster recommended for different square cores.



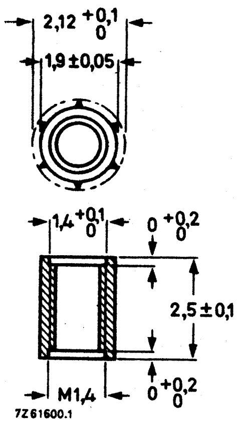
D	A_L of core in 3B7/3H1/3D3	recommended adjuster	
		cat. no.	colour
1, 85	40	4322 021 31250	green
1, 85	63	4322 021 31260	red
1, 85	100	4322 021 31270	yellow
1, 76	160	4322 021 31540	brown
1, 85	250	4322 021 31280	grey
1, 88	315	4322 021 32720	black
1, 90	400	4322 021 32710	white

The adjusters are packed in bags of 100.
Please order in multiples of 100.



NUT FOR ADJUSTER

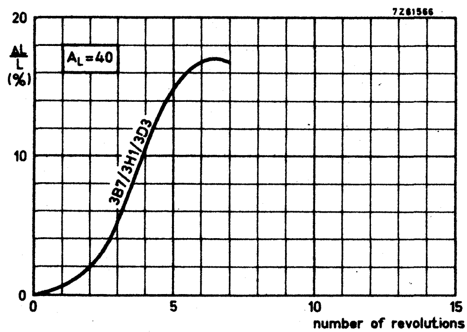
These data are given for those manufacturers who prefer to insert the nut themselves.



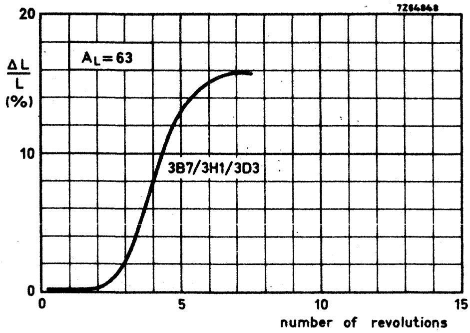
Catalogue number	4322 021 31850
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	2,0 ± 0,15 mm

The nuts are packed in bags of 100. Please order in multiples of 100.

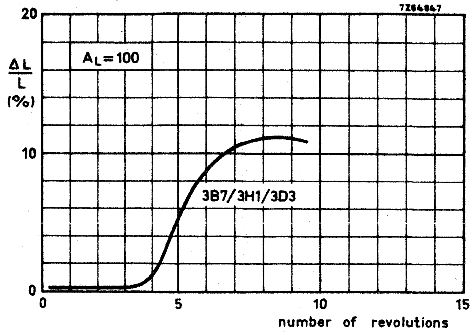
ADJUSTMENT CURVES



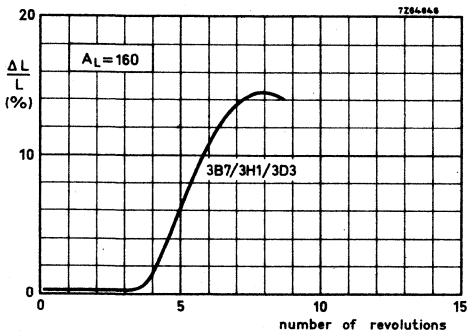
Adjuster 4322 021 31250



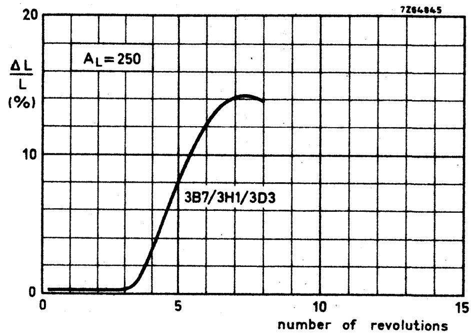
Adjuster 4322 021 31260



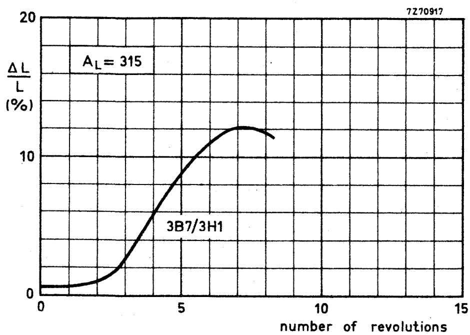
Adjuster 4322 021 31270



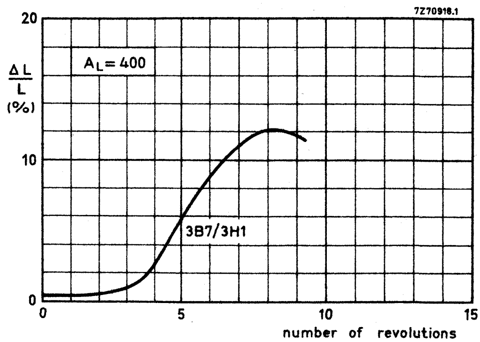
Adjuster 4322 021 31540



Adjuster 4322 021 31280

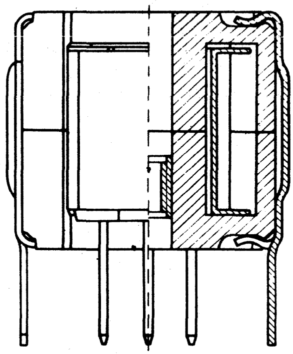


Adjuster 4322 021 32720



Adjuster 4322 021 32710

ASSEMBLING AND MOUNTING



7Z99011.1

ASSEMBLING

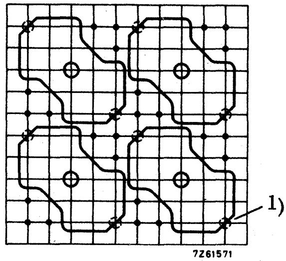
The core halves are clamped together by means of two clips, type 4322 021 31900. As can be seen in the drawing, the hooked ends of each clip fit into recesses made in the core halves.

For a stable inductance we recommend that an adhesive 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.)

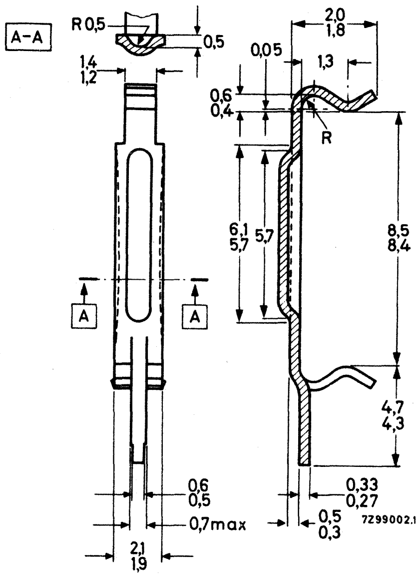
MOUNTING

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-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, 1 mm (according to IEC publication 97).



PART DRAWING (dimensions in mm)

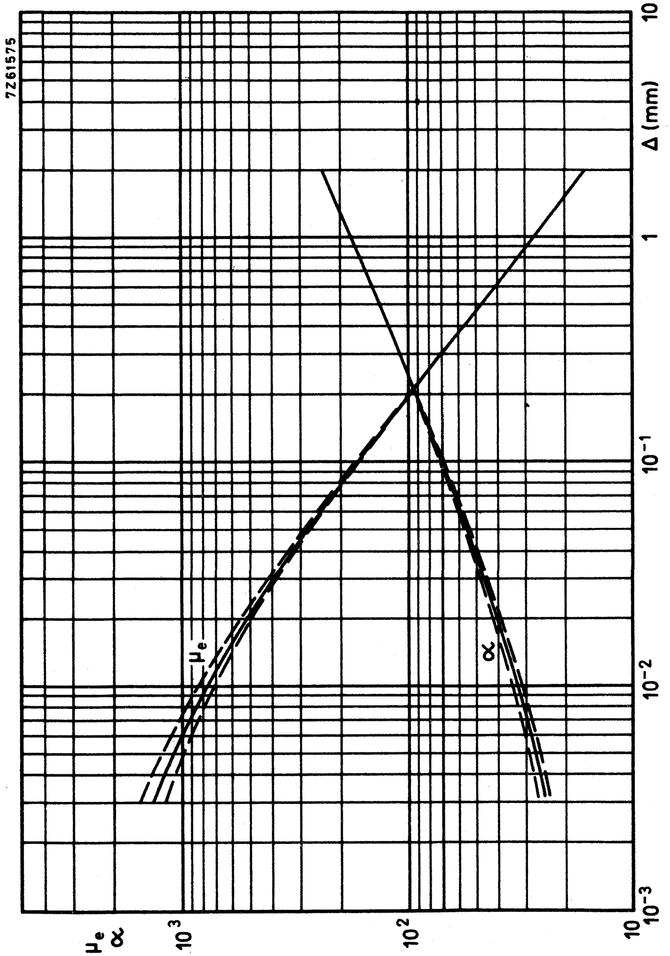


Clip 4322 021 31900
Material: steel, gold plated over nickel

1) Holes for tag on clip 4322 021 31900 (earth points).

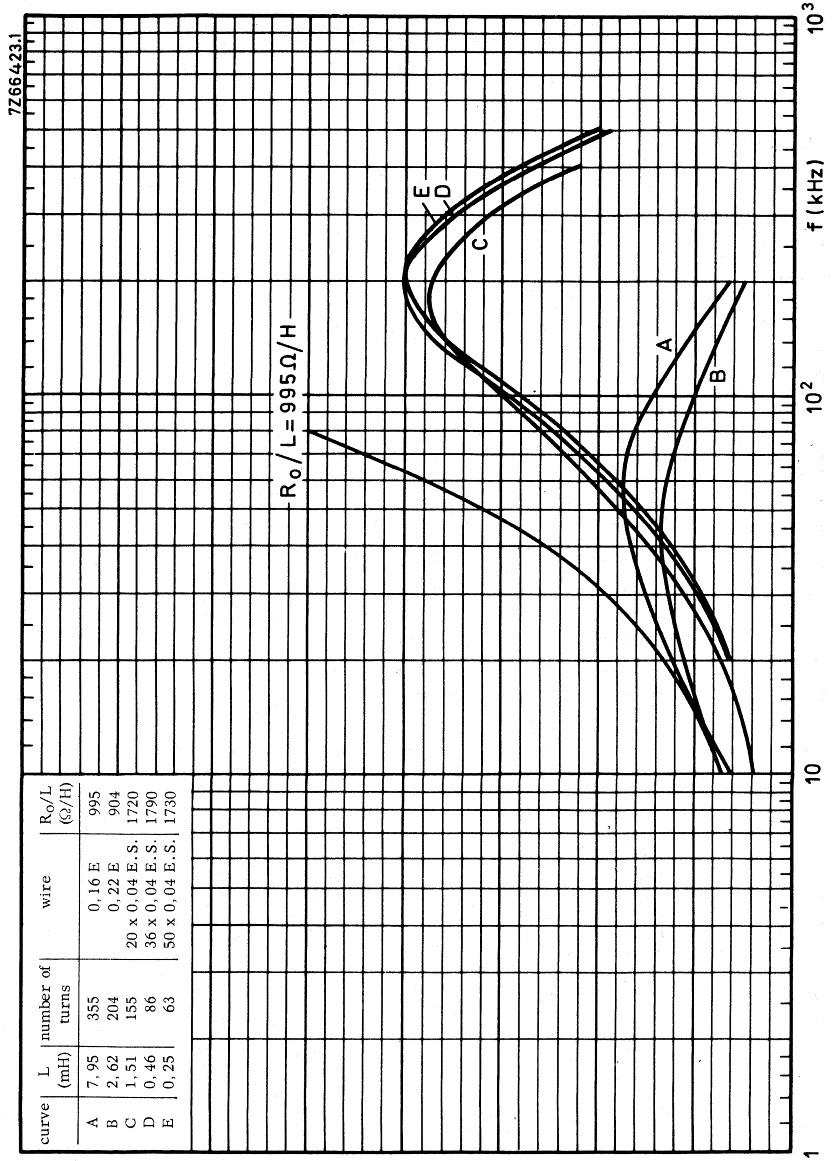
CHARACTERISTIC CURVES

μ_e - α **CURVES**



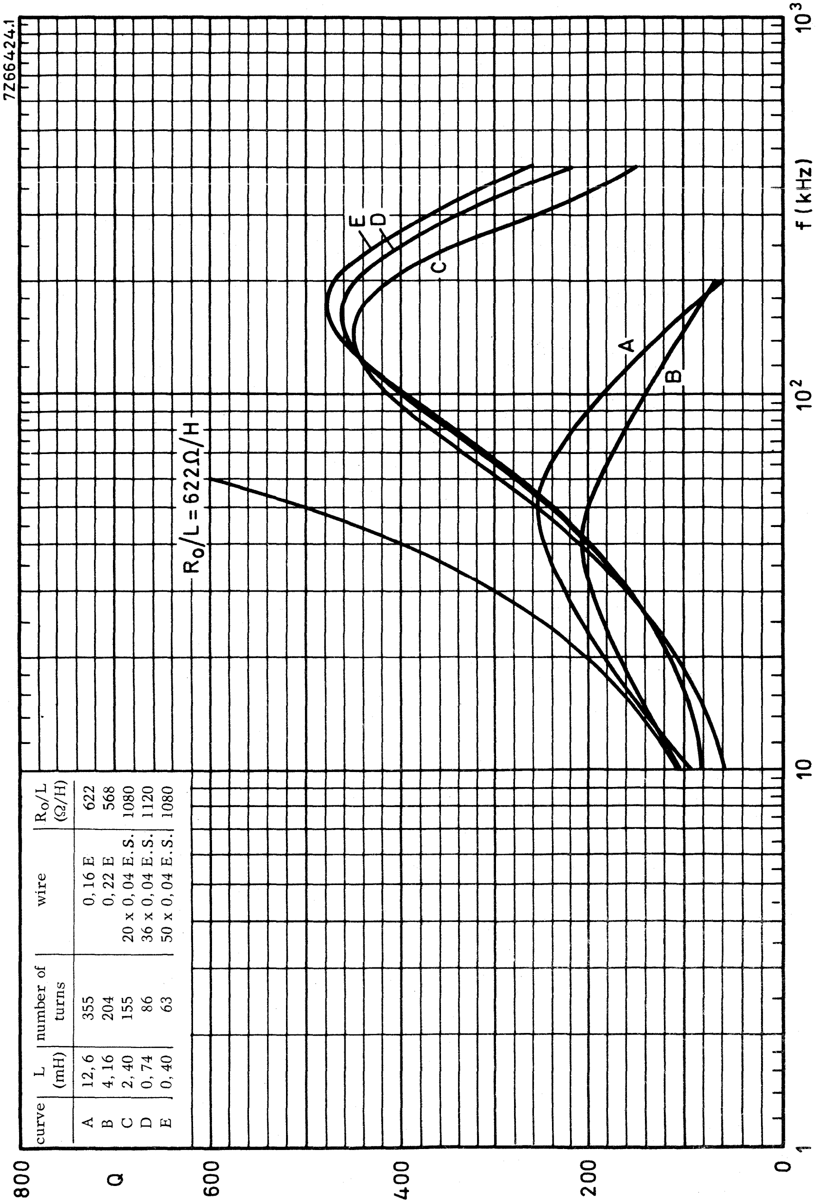
Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
μ_e = 1590 at Δ = 3 μm for 3B7 and 3H1.

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



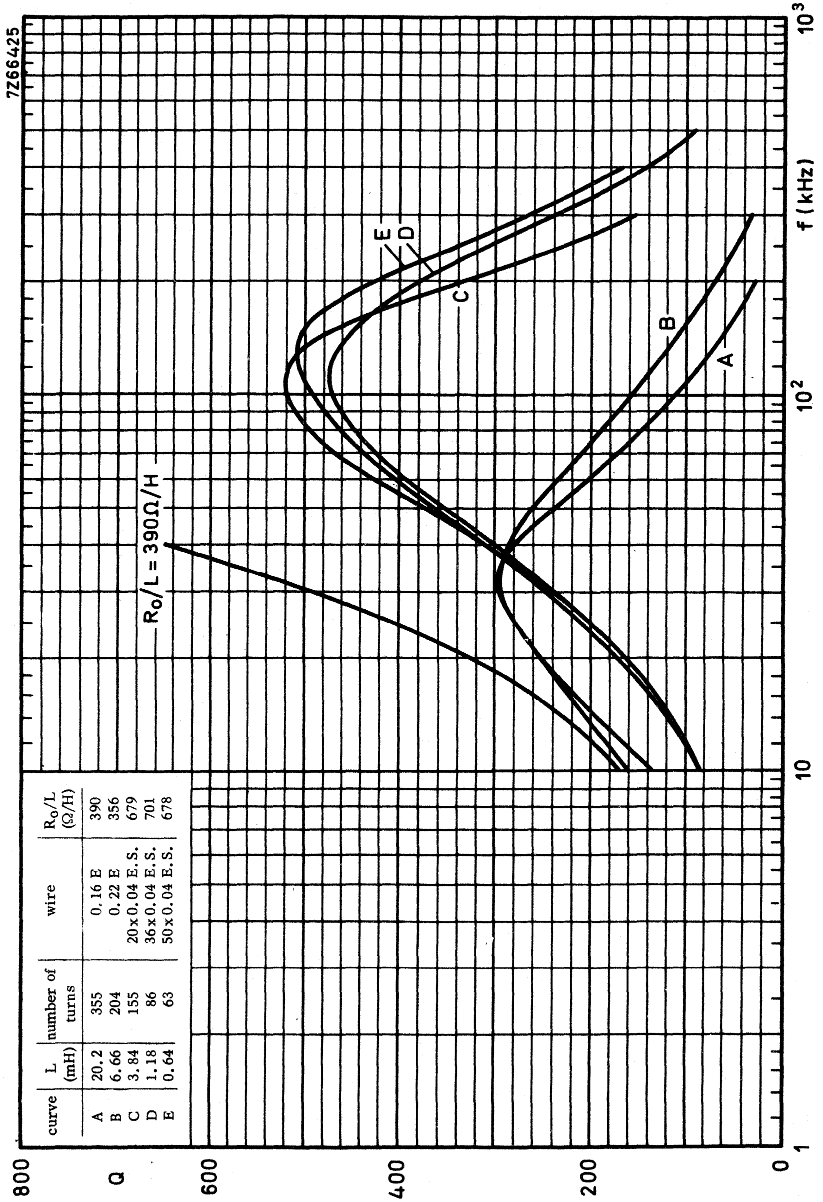
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	7,95	355	0,16 E	995
B	2,62	204	0,22 E	904
C	1,51	155	20 x 0,04 E.S.	1720
D	0,46	86	36 x 0,04 E.S.	1790
E	0,25	63	50 x 0,04 E.S.	1730

FXC 3B7/3H1, single-section coil former, $A_L = 63$



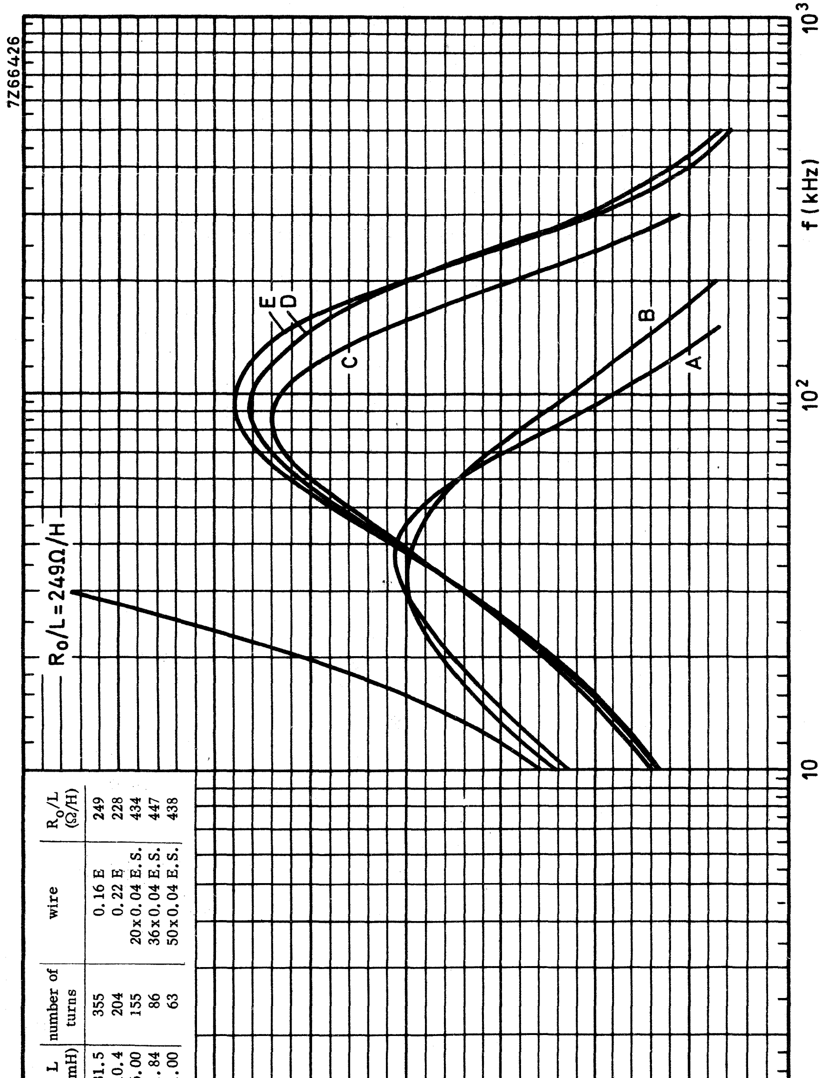
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	12,6	355	0,16 E	622
B	4,16	204	0,22 E	568
C	2,40	155	20 x 0,04 E.S.	1080
D	0,74	86	36 x 0,04 E.S.	1120
E	0,40	63	50 x 0,04 E.S.	1080

FXC 3B7/3H1, single-section coil former, $A_L = 100$



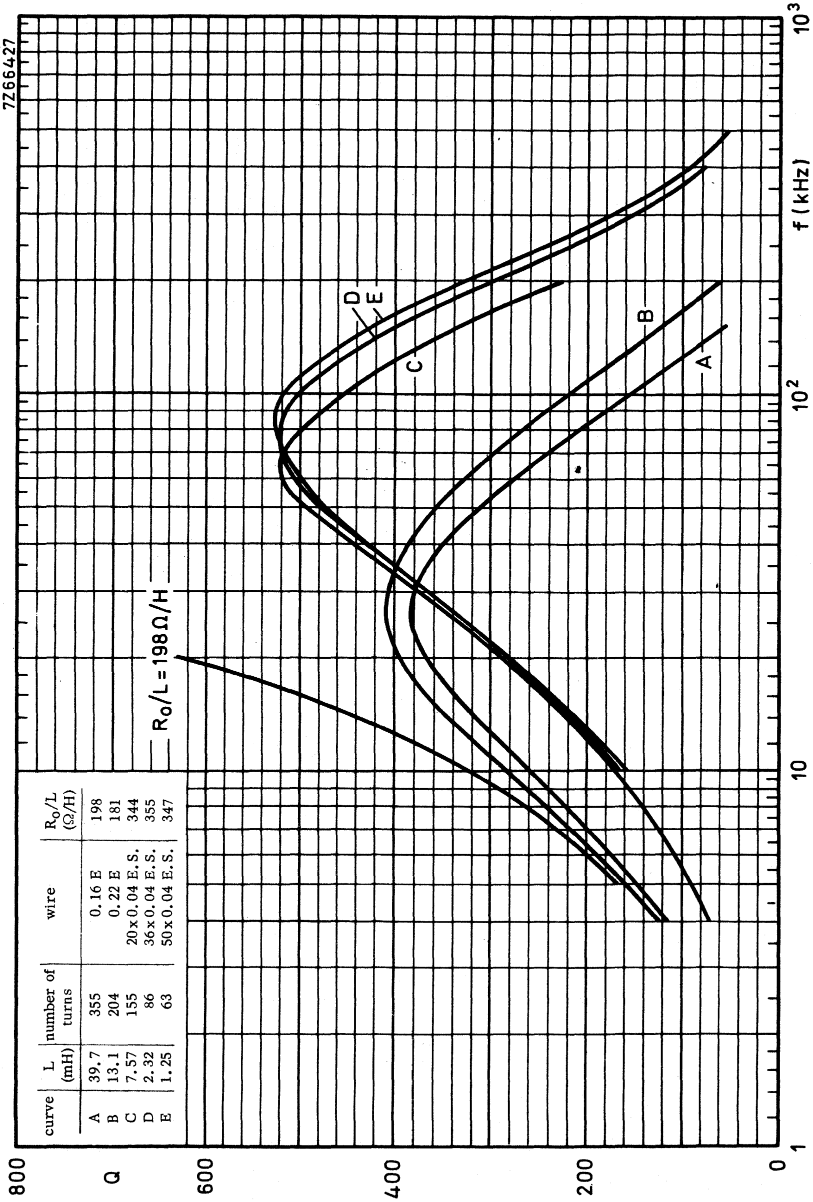
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	20.2	355	0.16 E	390
B	6.66	204	0.22 E	356
C	3.84	155	20 x 0.04 E.S.	679
D	1.18	86	36 x 0.04 E.S.	701
E	0.64	63	50 x 0.04 E.S.	678

FXC 3B7/3H1, single-section coil fromer, $A_L = 160$



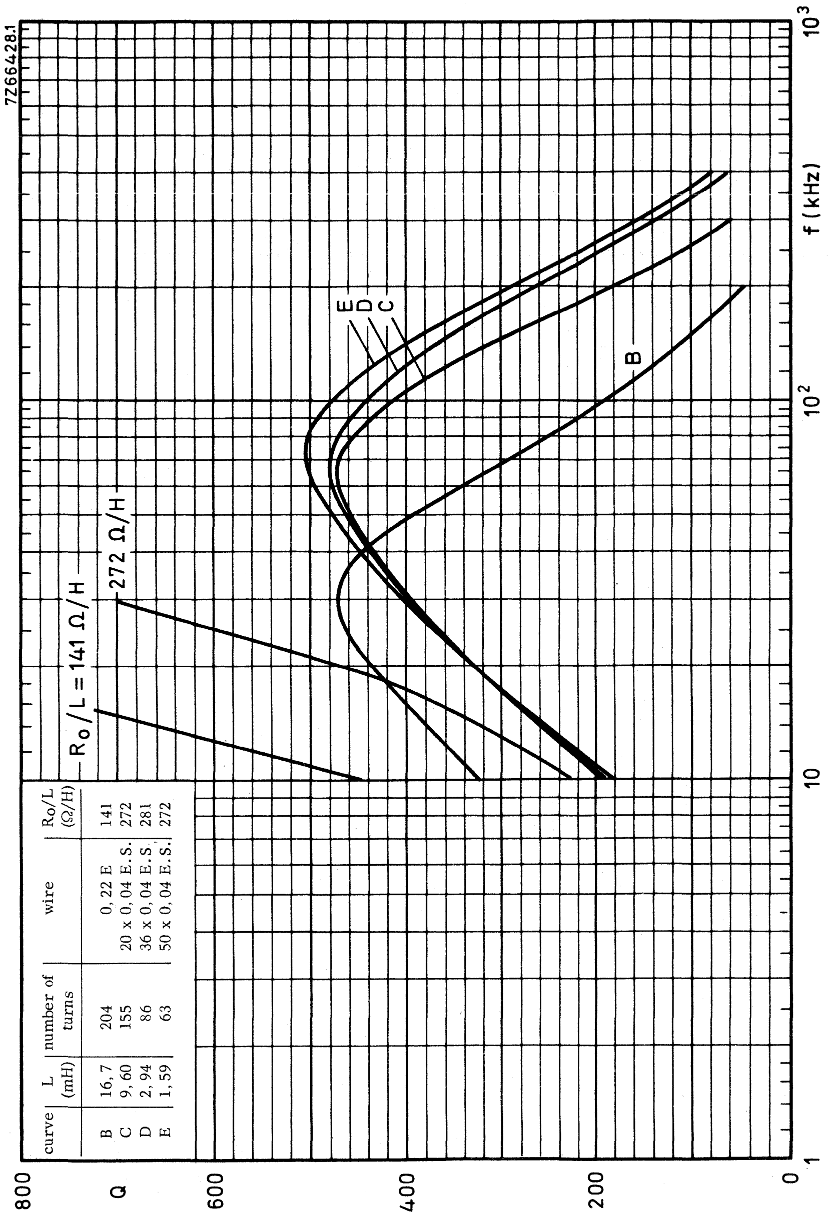
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	31.5	355	0.16 E	249
B	10.4	204	0.22 E	228
C	6.00	155	20x0.04 E.S.	434
D	1.84	86	36x0.04 E.S.	447
E	1.00	63	50x0.04 E.S.	438

FXC 3B7/3H1, single-section coil former, $A_L = 250$



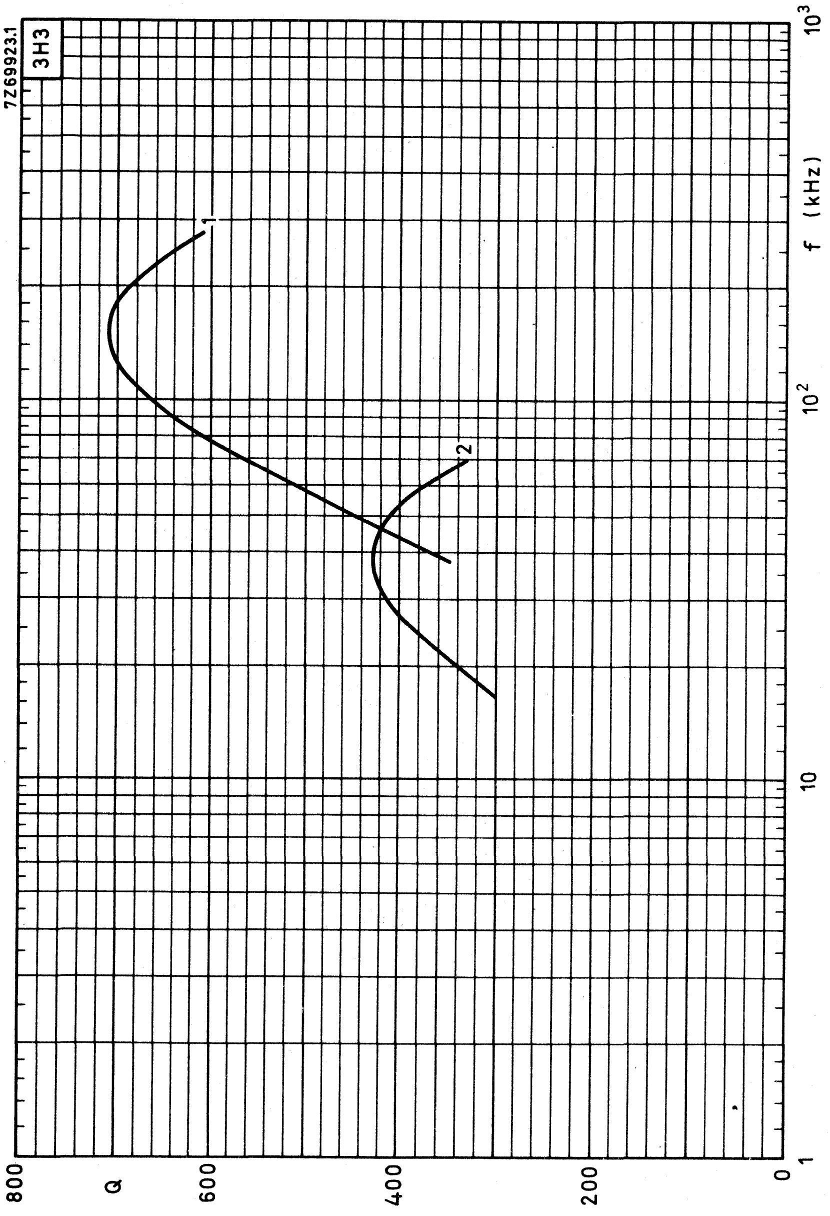
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	39.7	355	0.16 E	198
B	13.1	204	0.22 E	181
C	7.57	155	20 x 0.04 E.S.	344
D	2.32	86	36 x 0.04 E.S.	355
E	1.25	63	50 x 0.04 E.S.	347

FXC 3B7/3H1, single-section coil former, $A_L = 315$

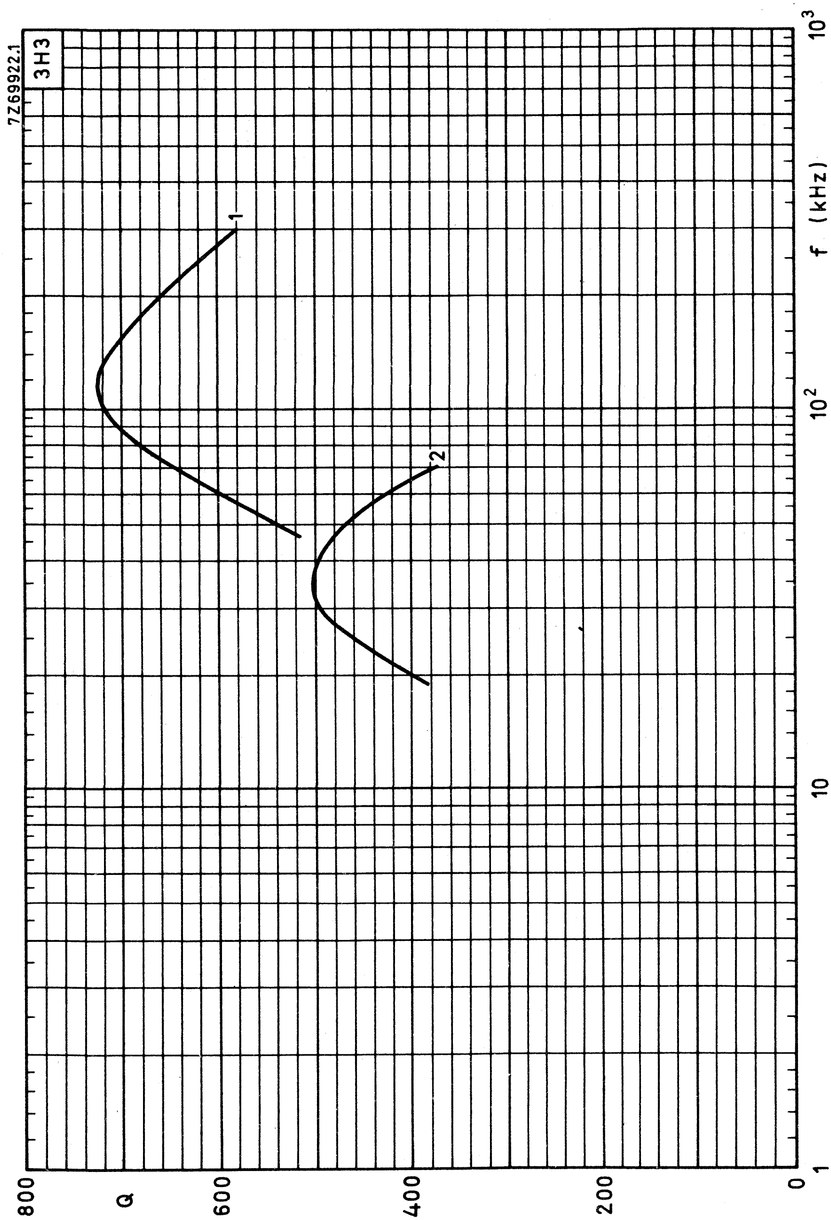


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
B	16,7	204	0,22 E	141
C	9,60	155	20 x 0,04 E.S.	272
D	2,94	86	36 x 0,04 E.S.	281
E	1,59	63	50 x 0,04 E.S.	272

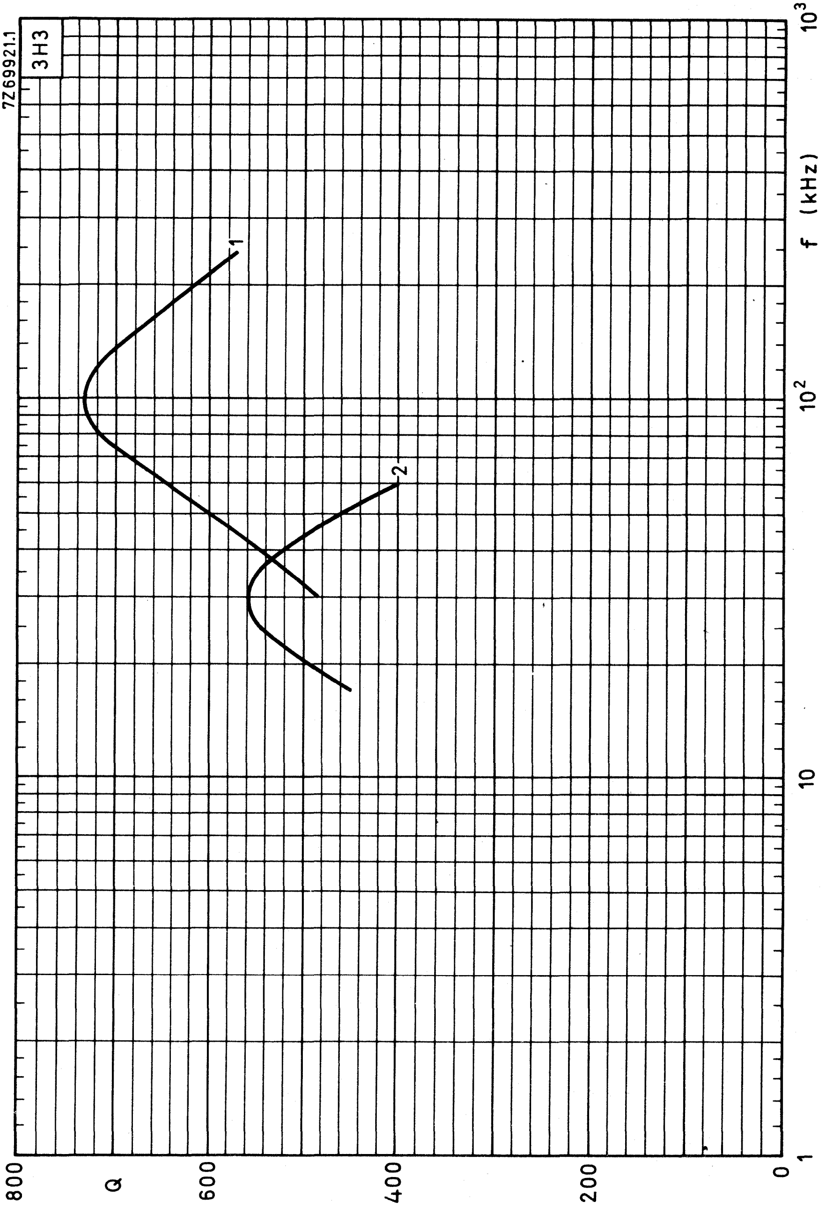
FXC 3B7/3H1, single-section coil former, A_L = 400



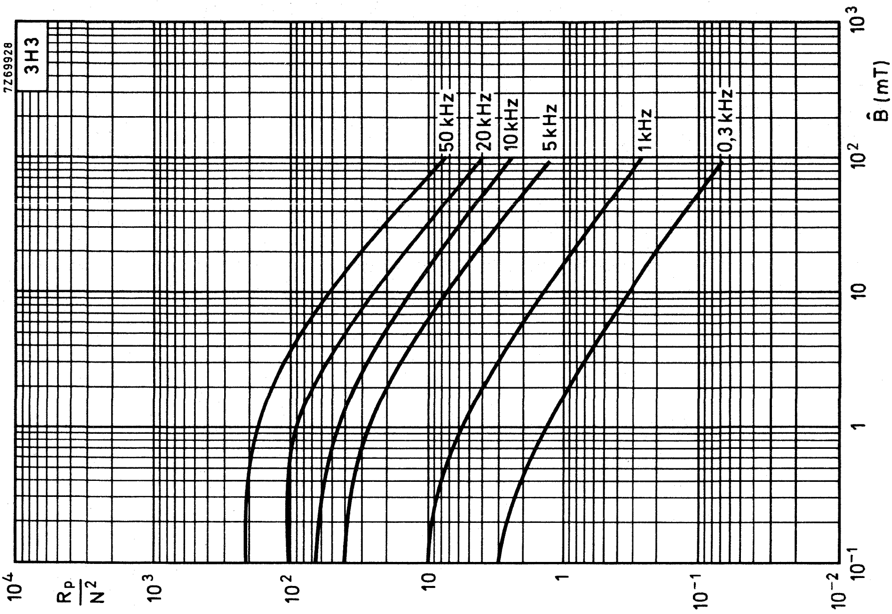
Q-curves. Single-section coil former; curve 1: 63 turns (50 x 0,04 E.S. wire)
A_L = 200 curve 2: 355 turns (0,16 E wire).



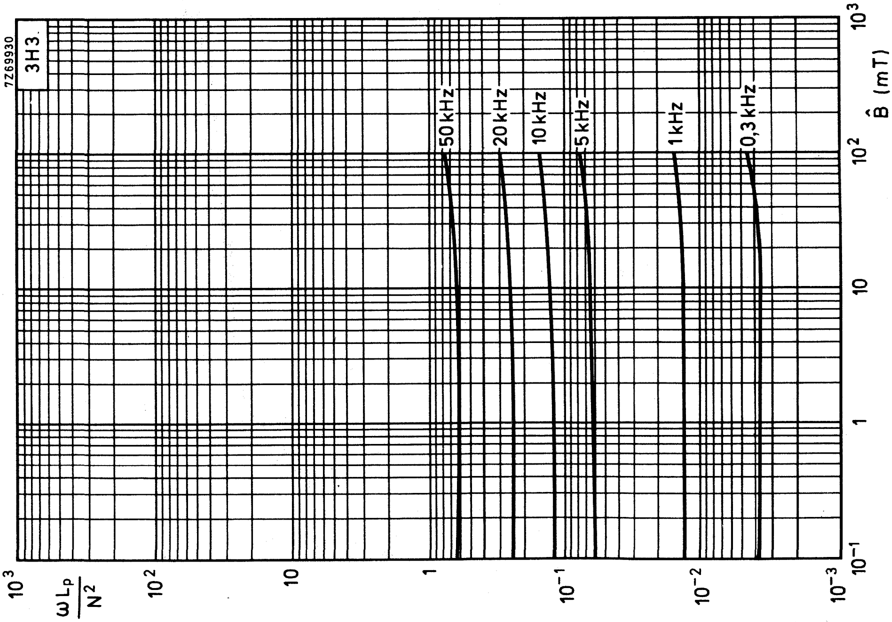
Q-curves. Single-section coil former; curve 1 : 63 turns (50 x 0,04 E.S. wire)
curve 2 : 355 turns (0,16 E wire).
$A_L = 250$



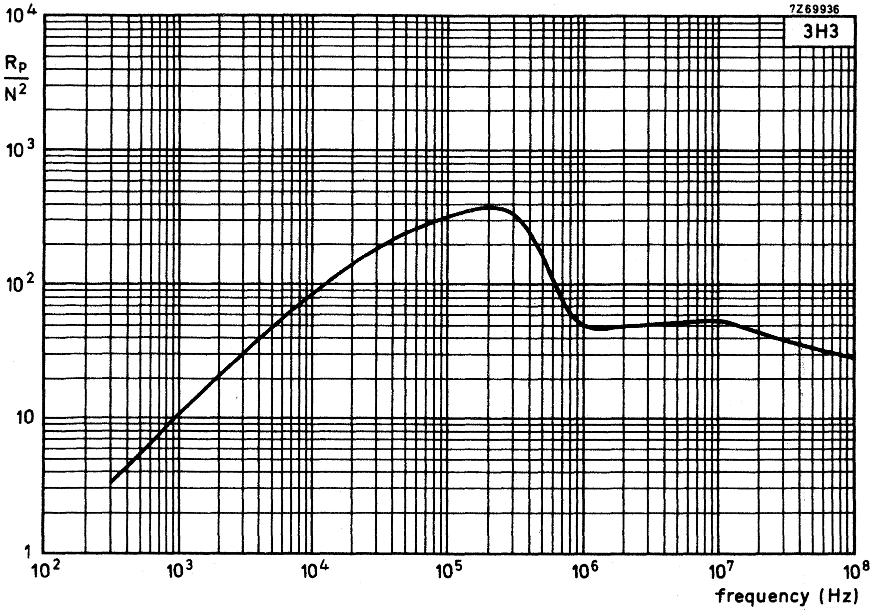
Q-curves. Single-section coil former; curve 1 : 63 turns (50 x 0,04 E.S. wire)
curve 2 : 355 turns (0,16 E wire).
A_L = 315



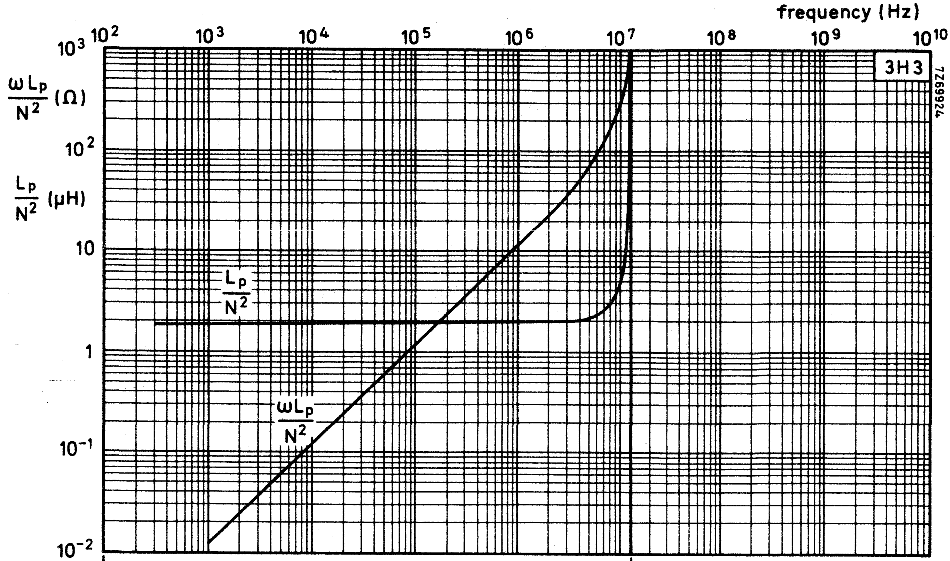
Losses as a function of the peak induction.

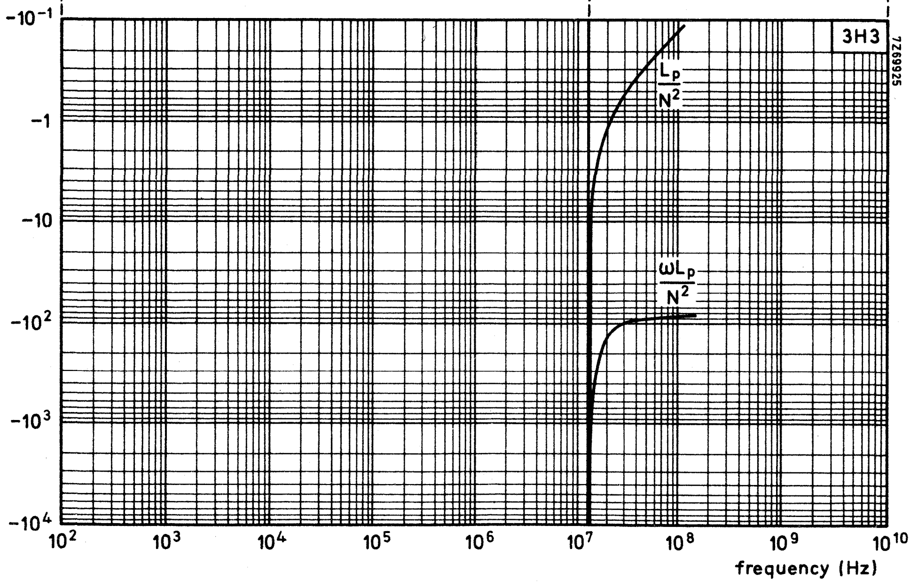


Inductance as a function of the peak induction.

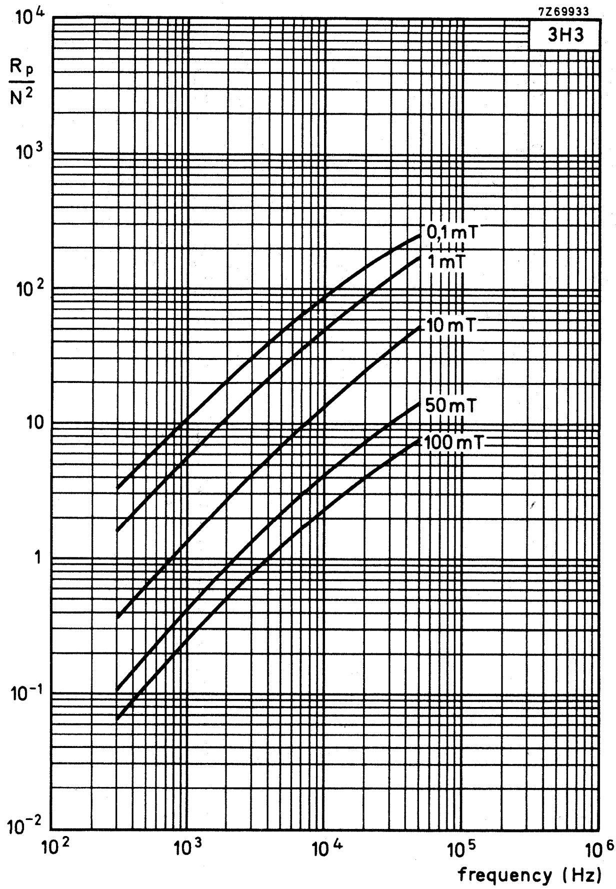


Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT.





Inductance as a function of the frequency.



Losses as a function of the frequency.

SQUARE CORES

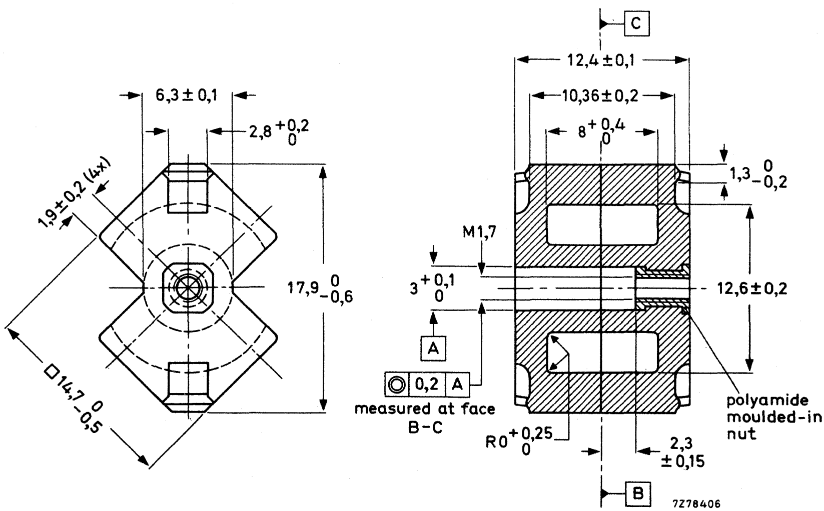
Three types of core can be supplied:

- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L.
- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without air gap.

The square cores are in accordance with the following specifications: IEC 431 (international), C93-324 (France), DIN 41980 (Germany)

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA Dimensions in mm



Pulling-out force of the nut	⩾ 30 N
Torque of the screw thread	⩽ 0,8 N
Extraction force of adjuster from nut	⩾ 20 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}810\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0257\ mm^{-3}$; $V_e = 810\ mm^3$; $l_e = 25{,}6\ mm$; $A_e = 32{,}0\ mm^2$.

Mass of a core set: 4,5 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}732\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0194\ mm^{-3}$; $V_e = 1040\ mm^3$; $l_e = 27{,}5\ mm$; $A_e = 38{,}0\ mm^2$.

Mass of a core set: 4,7 g.

ELECTRICAL DATA

The combination of two square core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 50 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp °C	grade 3B7	3B8	3D3	3E1	3E4	3H1	3H3	4C6
A_L ± 25%	100	⩽ 0,1	25 ± 1	2640	2410	1080			2640	2310	194
μ_e ± 25%	100	⩽ 0,1	25 ± 1	1700	1400	700			1700	1500	125
α	100	⩽ 0,1	25 ± 1	⩽ 22,4	⩽ 23,6	⩽ 35,0			⩽ 22,4	⩽ 17,4	⩽ 82,8
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1				⩽ 2,5	⩽ 2,5			
	30	⩽ 0,1	25 ± 1	⩽ 2,5	⩽ 4,0				⩽ 2,5	⩽ 1,6	
	100	⩽ 0,1	25 ± 1	⩽ 5,0	⩽ 6,0	⩽ 8,0	⩽ 20	⩽ 20	⩽ 5,0	⩽ 2,6	
	500	⩽ 0,1	25 ± 1			⩽ 14	⩽ 200	⩽ 200			
	1 000	⩽ 0,1	25 ± 1			⩽ 30					
	2 000	⩽ 0,1	25 ± 1								⩽ 40
	10 000	⩽ 0,1	25 ± 1								⩽ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,1		⩽ 1,8	⩽ 1,8	⩽ 1,1	⩽ 0,86		
	30	1,5 to 3,0	25 ± 1		⩽ 1,5					⩽ 0,65	
	100	0,3 to 1,2	25 ± 1								⩽ 9,2
$\alpha_F \times 10^6$/°C	⩽ 100	⩽ 0,1	5 to 25		0 to + 6			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	−2 to + 4
	⩽ 100	⩽ 0,1	25 to 55	−0,6 to + 0,6	0 to + 6			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	0 to + 6
	⩽ 100	⩽ 0,1	25 to 70	−0,6 to + 0,6		0 to + 2	0 to + 2	0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	
$D_F \times 10^6$ (10 - 100 min)	⩽ 100	⩽ 0,1	25 ± 0,1	⩽ 4,3	⩽ 8,0	⩽ 12	⩽ 4,3	⩽ 4,3	⩽ 4,3	⩽ 3,0 *	⩽ 10
$\beta_F \times 10^6$ measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C: at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,00 x 10^5 A/m					120						
= 1,55					300						
= 2,25					1100						

* This value is valid within the temperature range of 25 to 70 °C.

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 022						
			3B7	3D3	3E1	3E4	3H1	3H3	4C6
25	16,1	± 1							75810
40	25,8	± 1	75020	75420			75220		75820
63	40,6	± 1	75030	75430			75230		75830
100	64,5	± 2	75040	75440			75240		
160	103	± 2	75050	75450			75250		
200	129	± 2					75370	75680	
250	161	± 2	75060				75260	75560	
315	203	± 2	75070				75270	75570	
400	258	± 2	75080				75280	75580	
630	406	± 3	75100				75300	75600	
1000	645	± 10	75110				75310		
1250	806	± 10	75190				75390		
4780	2780	± 25			55800 *				
6100	3910	± 25				55900 *			
6710	3930	± 25				55890 *			

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

Core sets without nut: replace the eighth digit of the catalogue number (7) by 5.
Cores with $A_L \leqslant 100$ have a symmetrical air gap.
Cores with $A_L \geqslant 160$ have an asymmetrical air gap.
Types marked * are only available without adjuster nut.
In order to obtain better performance, the types 4322 022 55800 and 55900 are executed without centre hole.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number	
3B7	4322 020 25120	
3B8	4322 020 27630	(without centre hole)
3D3	4322 020 25140	
3H1	4322 020 25130	
3H3	4322 020 25190	
4C6	4322 020 25150	

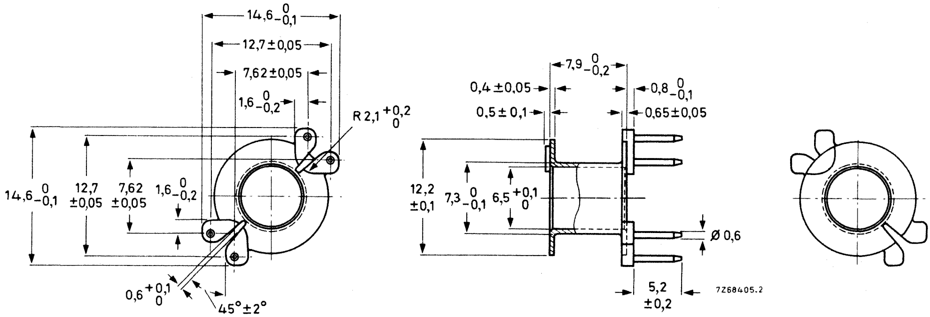
COIL FORMERS

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".
The coil formers are packed in a polystyrene plate of 200 or in a cardboard box of 500. Please order in multiples of these quantities.

SINGLE-SECTION, 4-PIN COIL FORMER



Catalogue number 4322 021 32280

Material: phenolformaldehyde reinforced with glass fibre

Window area 17,3 mm^2

Mean length of turn 30 mm

Max. temperature 180 °C

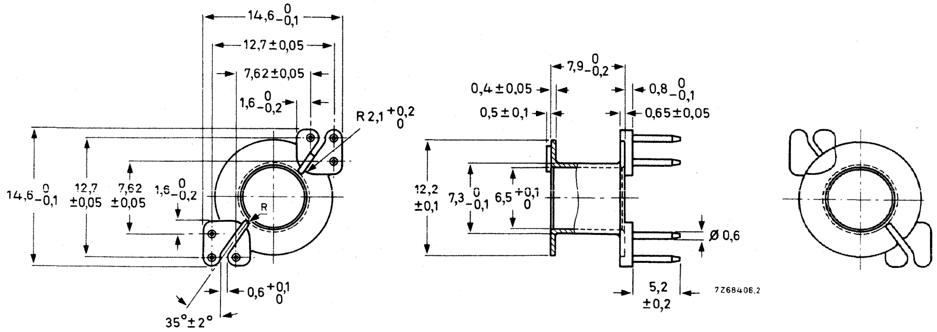
Solderability resistant against dip-soldering at 400 °C for 2 s

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 18,9 \times 10^3\ \Omega/H$$

Mass 0,4 g

SINGLE-SECTION, 6-PIN COIL FORMER



Catalogue number 4322 021 32290

Material: phenolformaldehyde reinforced with glass fibre

Window area 17,3 mm^2

Mean length of turn 30 mm

Max. temperature 180 ^{o}C

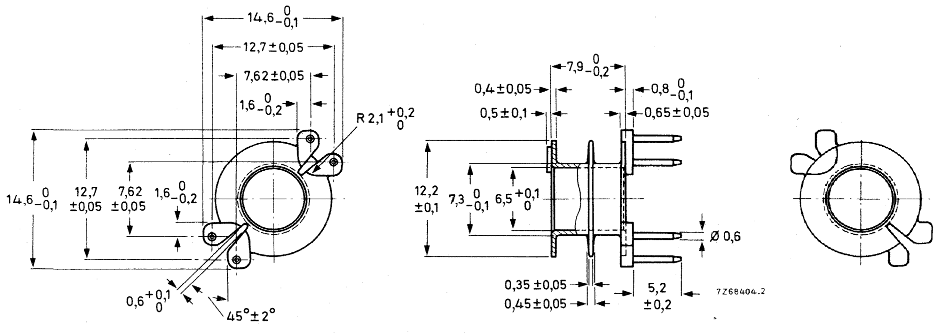
Solderability resistant against dip-soldering at 400 ^{o}C for 2 s

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 18,9 \times 10^3\ \Omega/H$$

Mass 0,4 g

TWO-SECTION, 4-PIN COIL FORMER



Catalogue number 4322 021 32300

Material: phenolformaldehyde reinforced with glass fibre

Window area 2 x 8,2 mm^2

Mean length of turn 30 mm

Max. temperature 180 ^{o}C

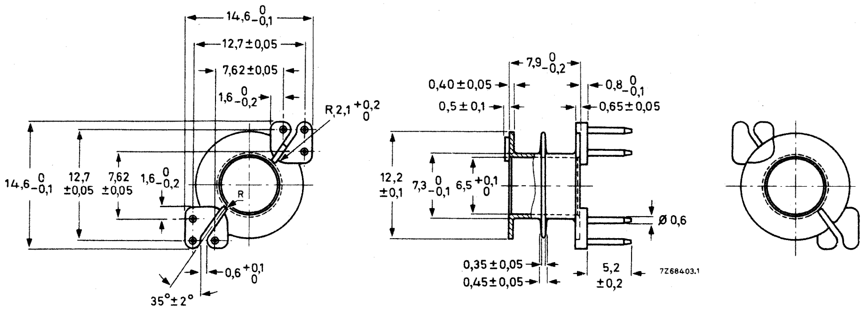
Solderability resistant against dip-soldering at 400 ^{o}C for 2 s

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 19,9 \times 10^3\ \Omega/H$$

Mass 0,4 g

TWO-SECTION, 6-PIN COIL FORMER



Catalogue number 4322 021 32310

Material: phenolformaldehyde reinforced with glass fibre

Window area $2 \times 8,2\ mm^2$

Mean length of turn 30 mm

Max. temperature 180 °C

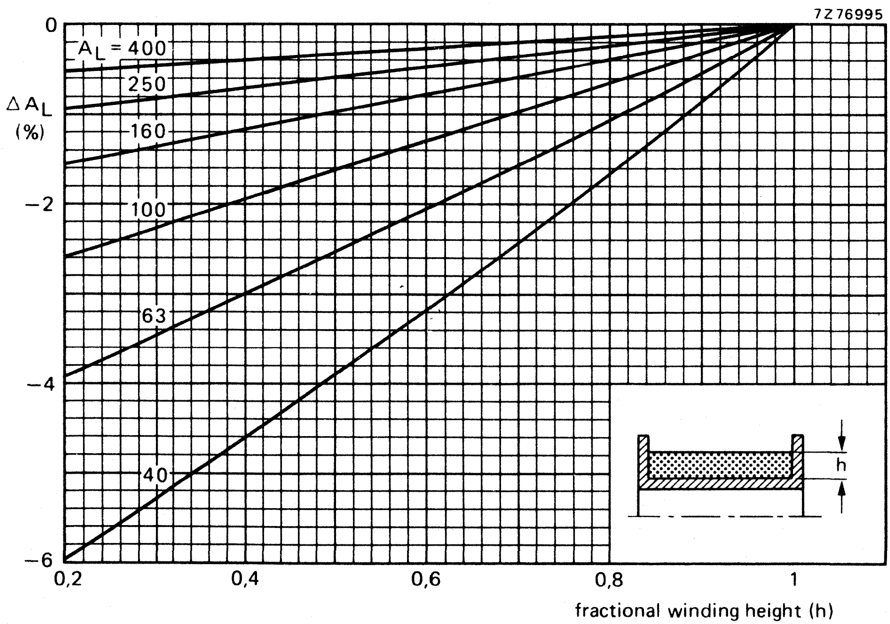
Solderability resistant against dip-soldering at 400 °C for 2 s

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 19,9 \times 10^3\ \Omega/H$$

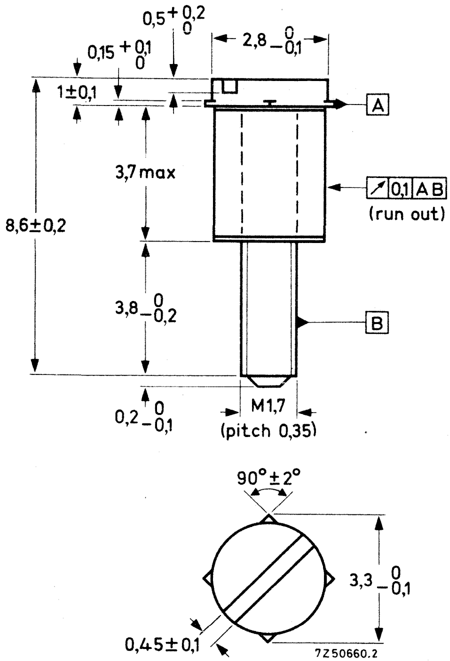
Mass 0,4 g

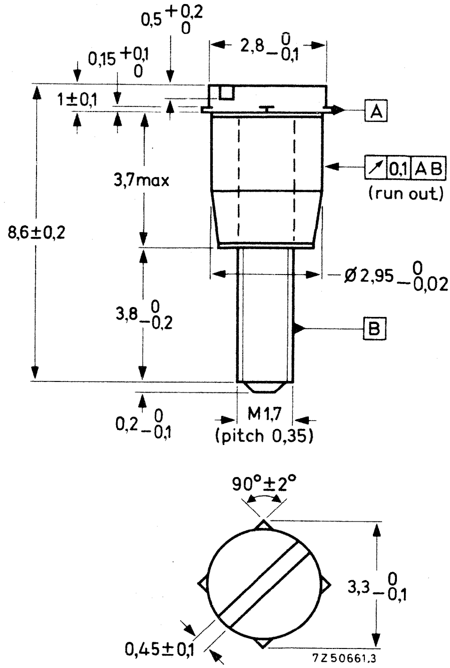
Data for when the coil former is partly filled.



INDUCTANCE ADJUSTERS

ADJUSTERS





Version A, tube dia. 2,5 −0,02 mm
Version B, tube dia. 2,7 −0,02 mm
Version C, tube dia. 2,77−0,02 mm

Version D

The tolerances on inductance of the pre-adjusted cores (without adjuster) are given in the table of pre-adjusted cores with standard A_L values. 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 adjuster. Such an adjuster increases the inductance of the coil (see following pages).
The adjuster 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 adjuster. For special requirements a larger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower A_L value.
The influence of the adjuster on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
The table shows the type of adjuster 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

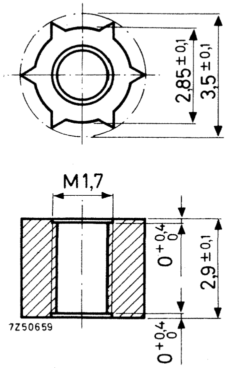
Table II, recommended application

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 adjusters are packed in bags of 100. Please order in multiples of 100.

NUT FOR ADJUSTER

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

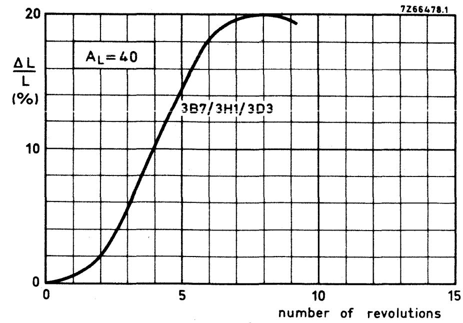


Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2,3 ± 0,15 mm

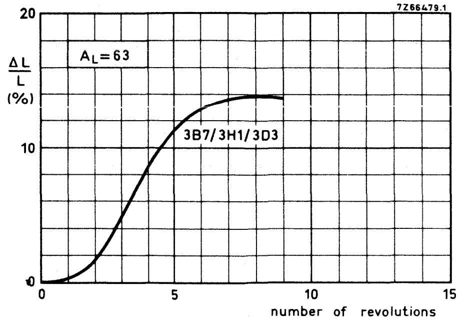
The nuts are packed in bags of 100. Please order in multiples of 100.

ADJUSTMENT CURVES

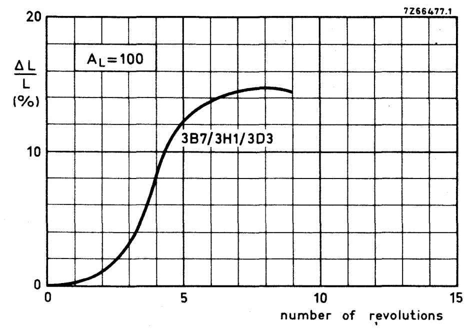
Distance between nut and mating surface = 2,3 mm for all A_L values.



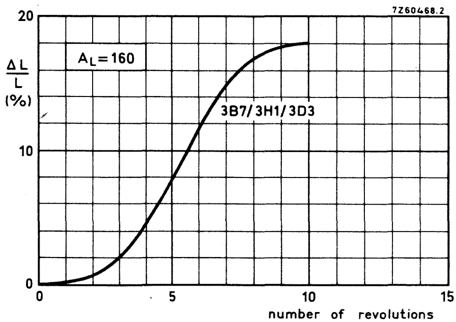
Adjuster 4322 021 32160



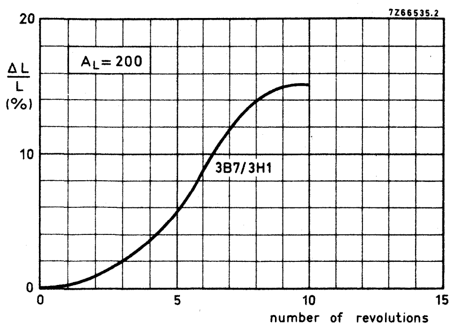
Adjuster 4322 021 32160



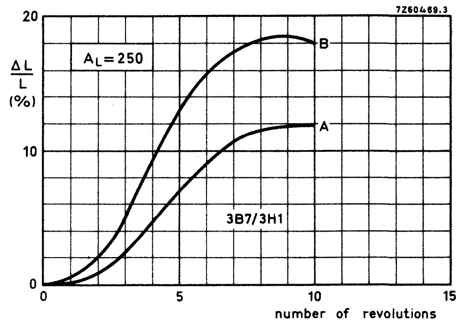
Adjuster 4322 021 32170



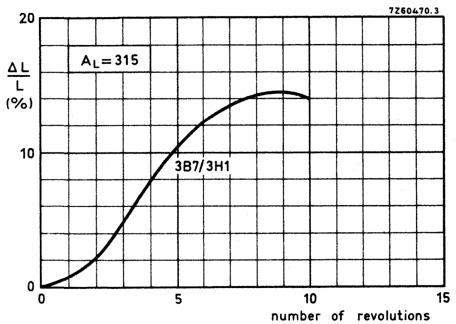
Adjuster 4322 021 32130



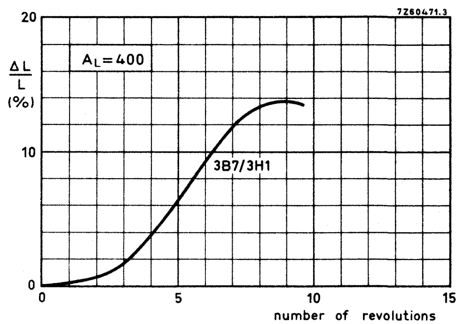
Adjuster 4322 021 32130



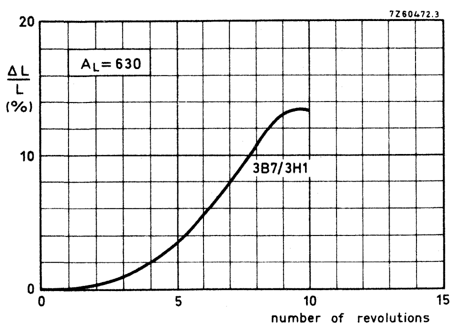
Curve A : adjuster 4322 021 32130
Curve B : adjuster 4322 021 32140



Adjuster 4322 021 32140



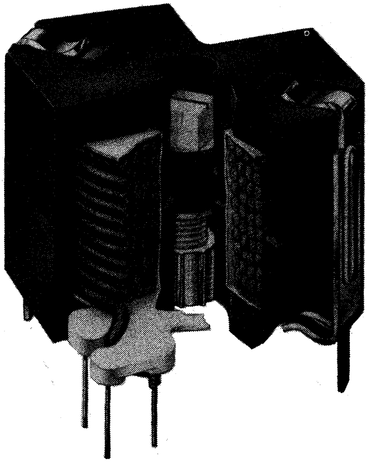
Adjuster 4322 021 32150



Adjuster 4322 021 32180

ASSEMBLING AND MOUNTING

ASSEMBLING



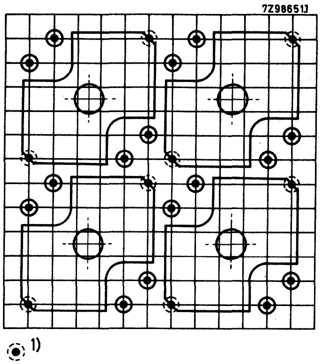
RZ25252

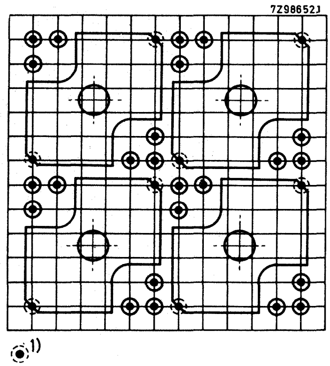
The illustration shows the simplicity of the assembly; the core halves are held together by two clips. The tags of the clips are used for mechanical fastening and/or for earthing. For a stable inductance we recommend that an adhesive be applied between the coil former flange and the lower core half.

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.)

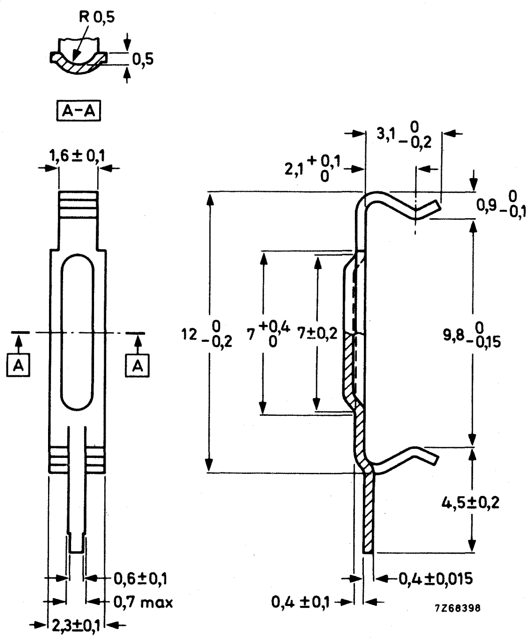
MOUNTING

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 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)

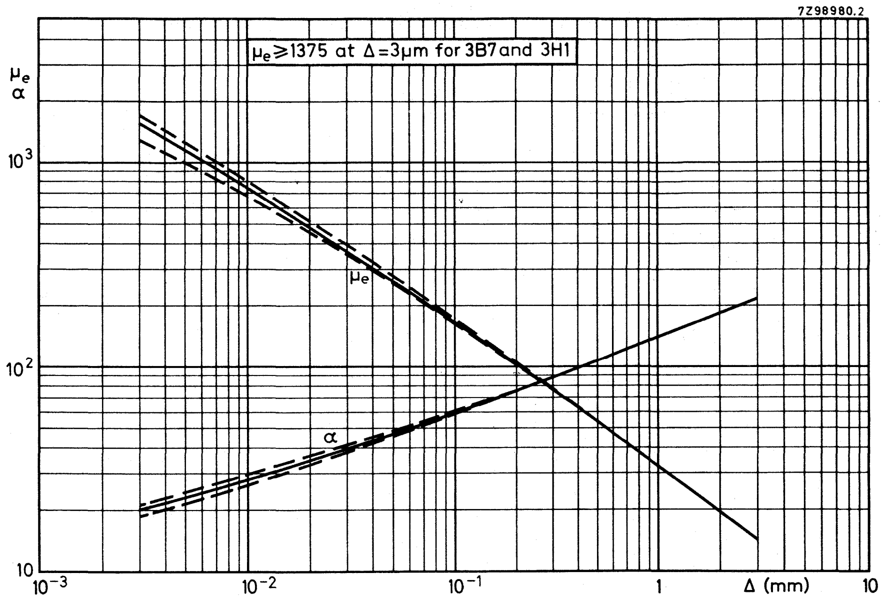


Clip 4322 021 31780
Material: steel; gold plated over nickel

1) Holes for tag on clip 4322 021 31780 (earth points).

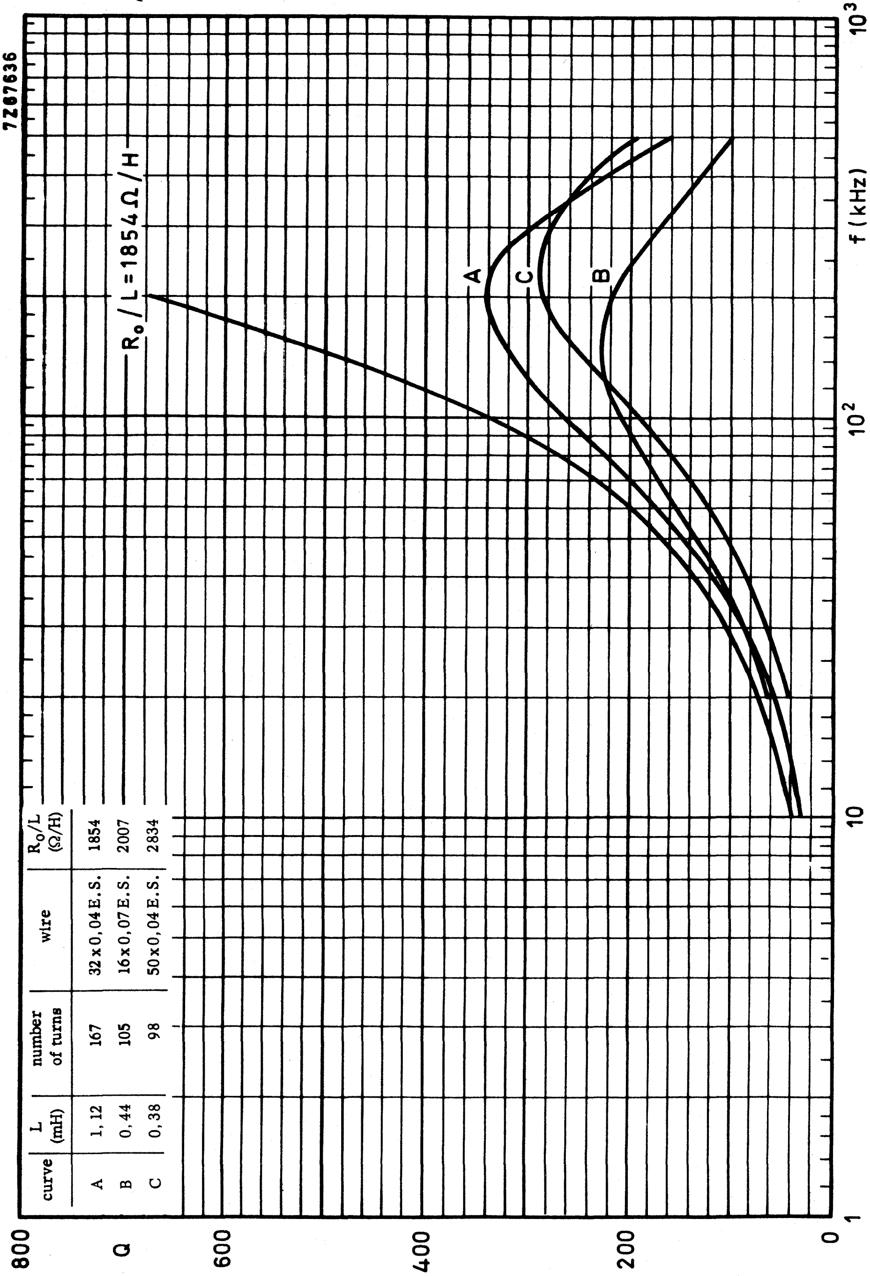
CHARACTERISTIC CURVES

μ_e - α **CURVES**



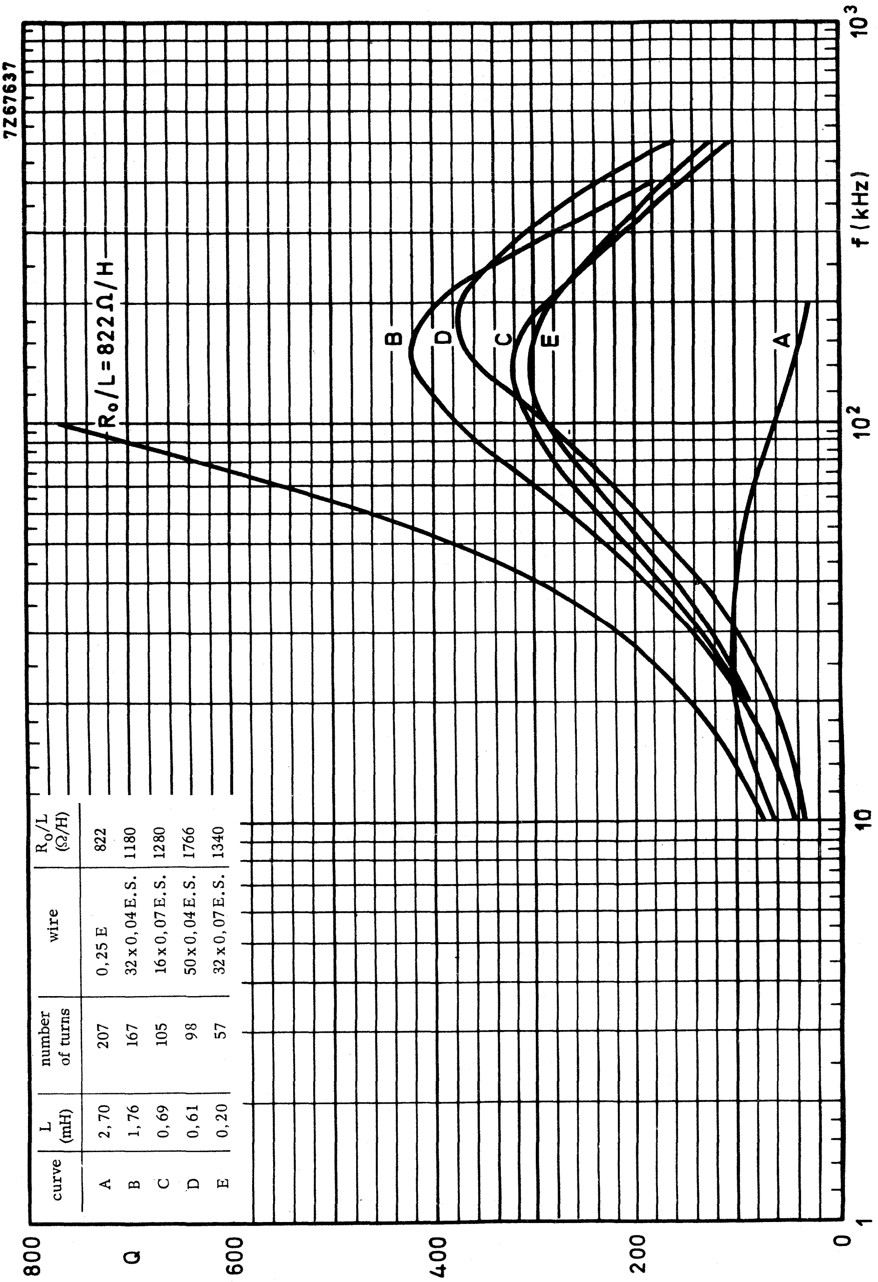
Relative effective permeability and turns factor for 1 mH as a function of the air gap length.

TYPICAL Q-CURVES



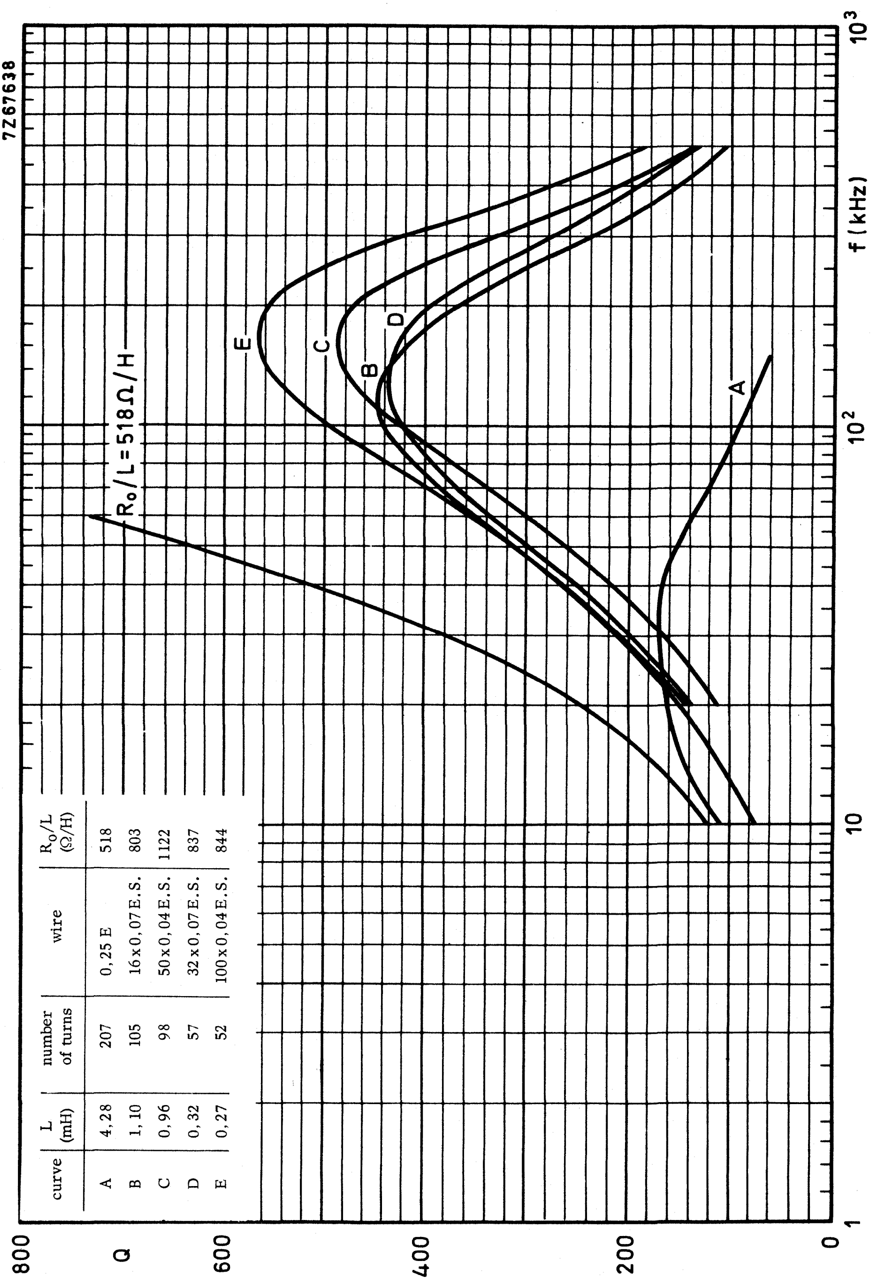
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	1,12	167	32 x 0,04 E.S.	1854
B	0,44	105	16 x 0,07 E.S.	2007
C	0,38	98	50 x 0,04 E.S.	2834

FXC 3B7/3H1, single-section coil former, $A_L = 40$



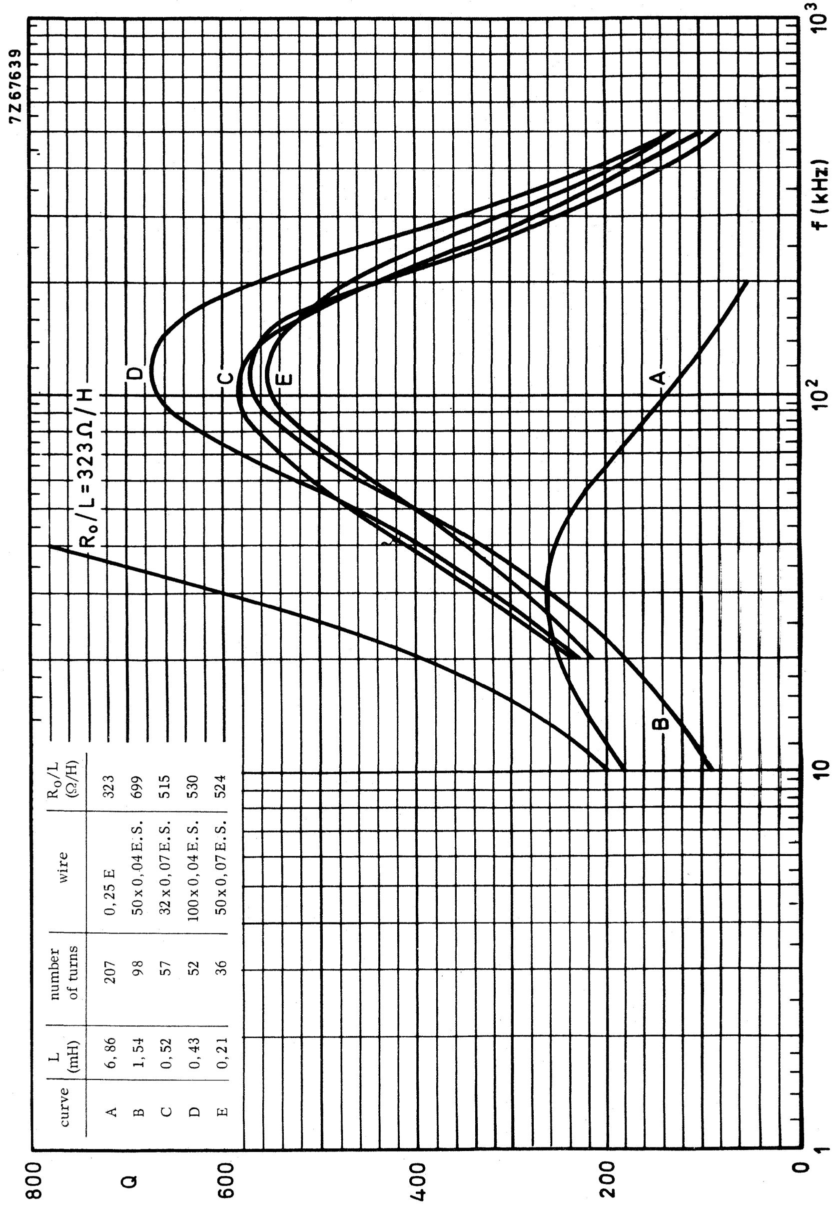
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	2,70	207	0,25 E	822
B	1,76	167	32 x 0,04 E.S.	1180
C	0,69	105	16 x 0,07 E.S.	1280
D	0,61	98	50 x 0,04 E.S.	1766
E	0,20	57	32 x 0,07 E.S.	1340

FXC 3B7/3H1, single-section coil former, $A_L = 63$



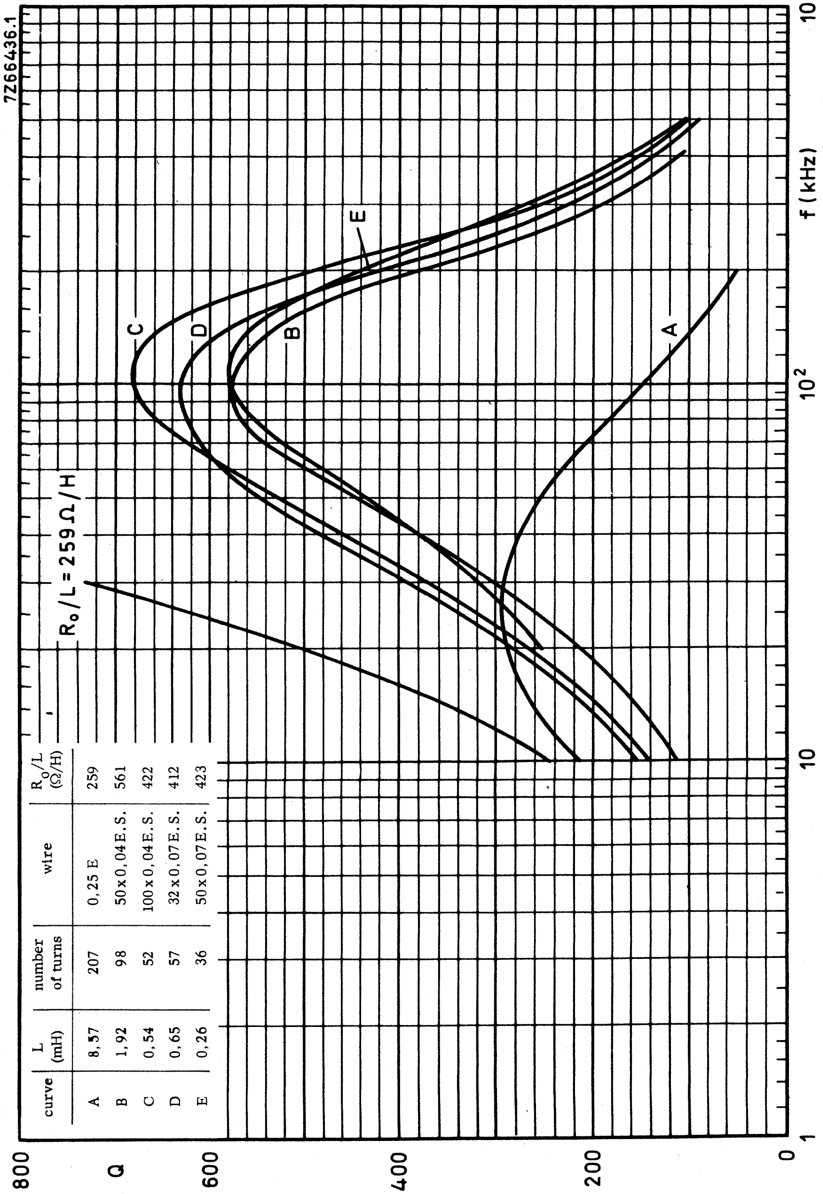
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	4,28	207	0,25 E	518
B	1,10	105	16 x 0,07 E.S.	803
C	0,96	98	50 x 0,04 E.S.	1122
D	0,32	57	32 x 0,07 E.S.	837
E	0,27	52	100 x 0,04 E.S.	844

FXC 3B7/3H1, single-section coil former, $A_L = 100$



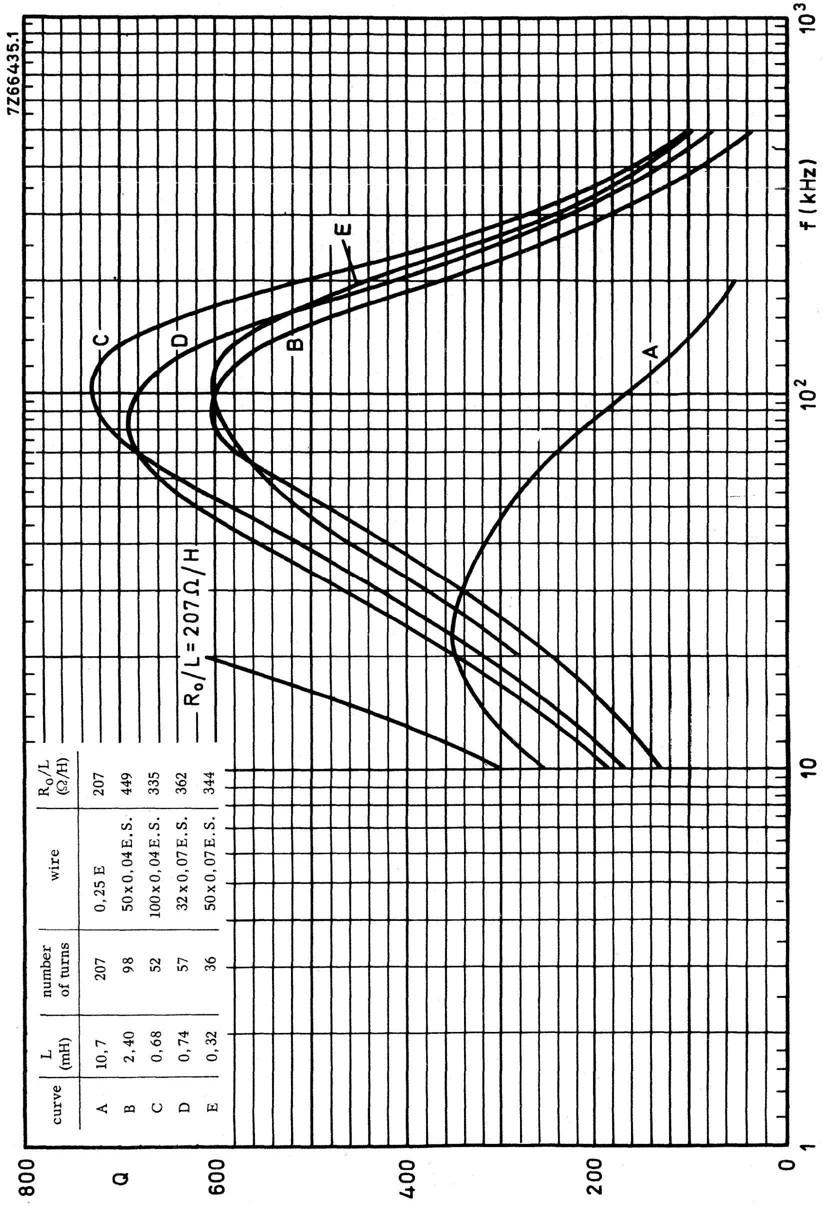
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	6,86	207	0,25 E	323
B	1,54	98	50 x 0,04 E.S.	699
C	0,52	57	32 x 0,07 E.S.	515
D	0,43	52	100 x 0,04 E.S.	530
E	0,21	36	50 x 0,07 E.S.	524

FXC 3B7/3H1, single-section coil former, A_L = 160



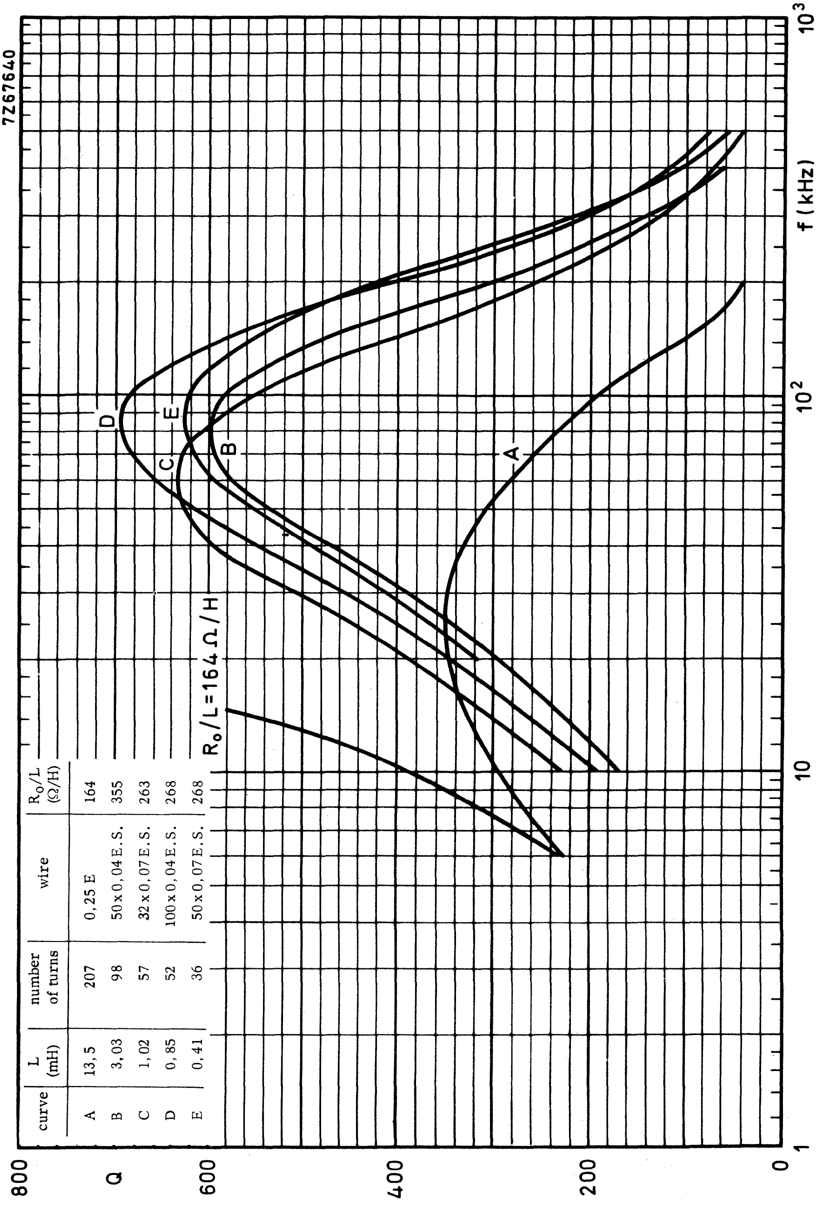
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	8,57	207	0,25 E	259
B	1,92	98	50 x 0,04 E.S.	561
C	0,54	52	100 x 0,04 E.S.	422
D	0,65	57	32 x 0,07 E.S.	412
E	0,26	36	50 x 0,07 E.S.	423

FXC 3B7/3H1, single-section coil former, $A_L = 200$



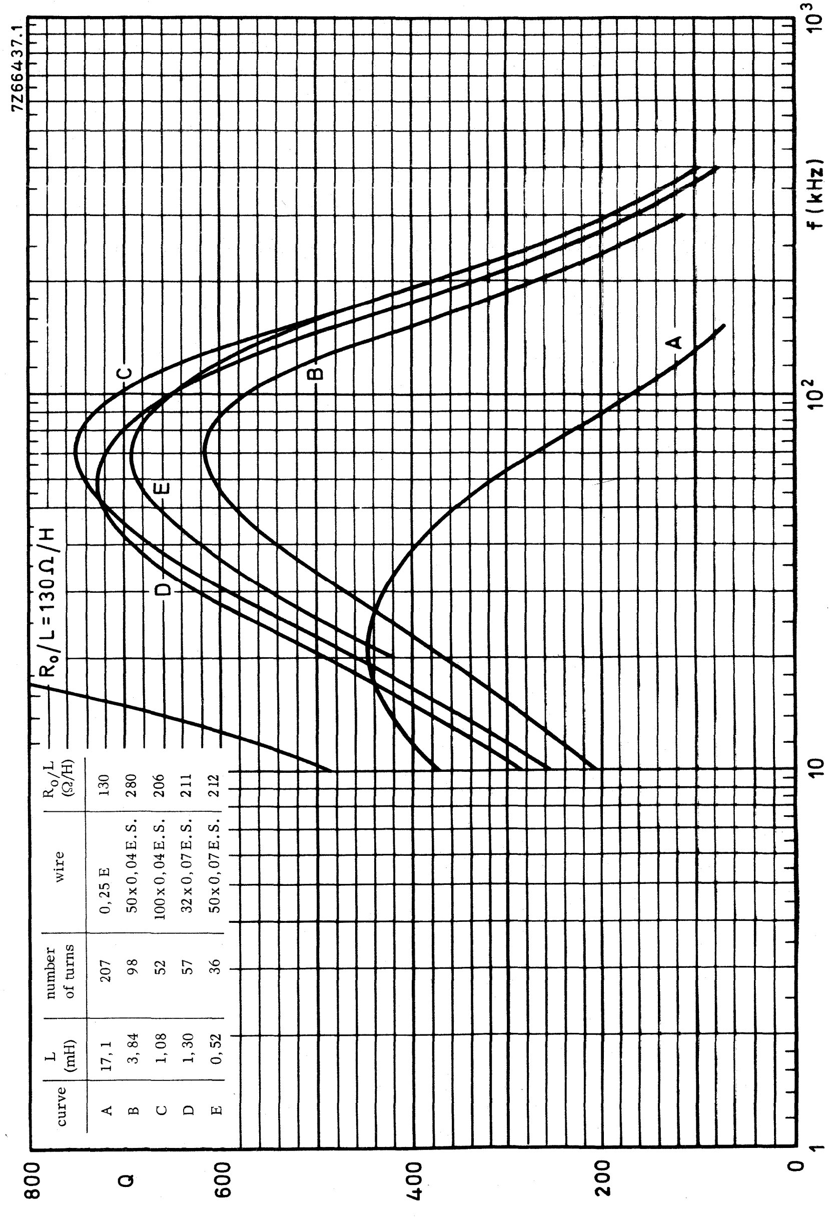
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	10,7	207	0,25 E	207
B	2,40	98	50 x 0,04 E.S.	449
C	0,68	52	100 x 0,04 E.S.	335
D	0,74	57	32 x 0,07 E.S.	362
E	0,32	36	50 x 0,07 E.S.	344

FXC 3B7/3H1, single-section coil former, $A_L = 250$



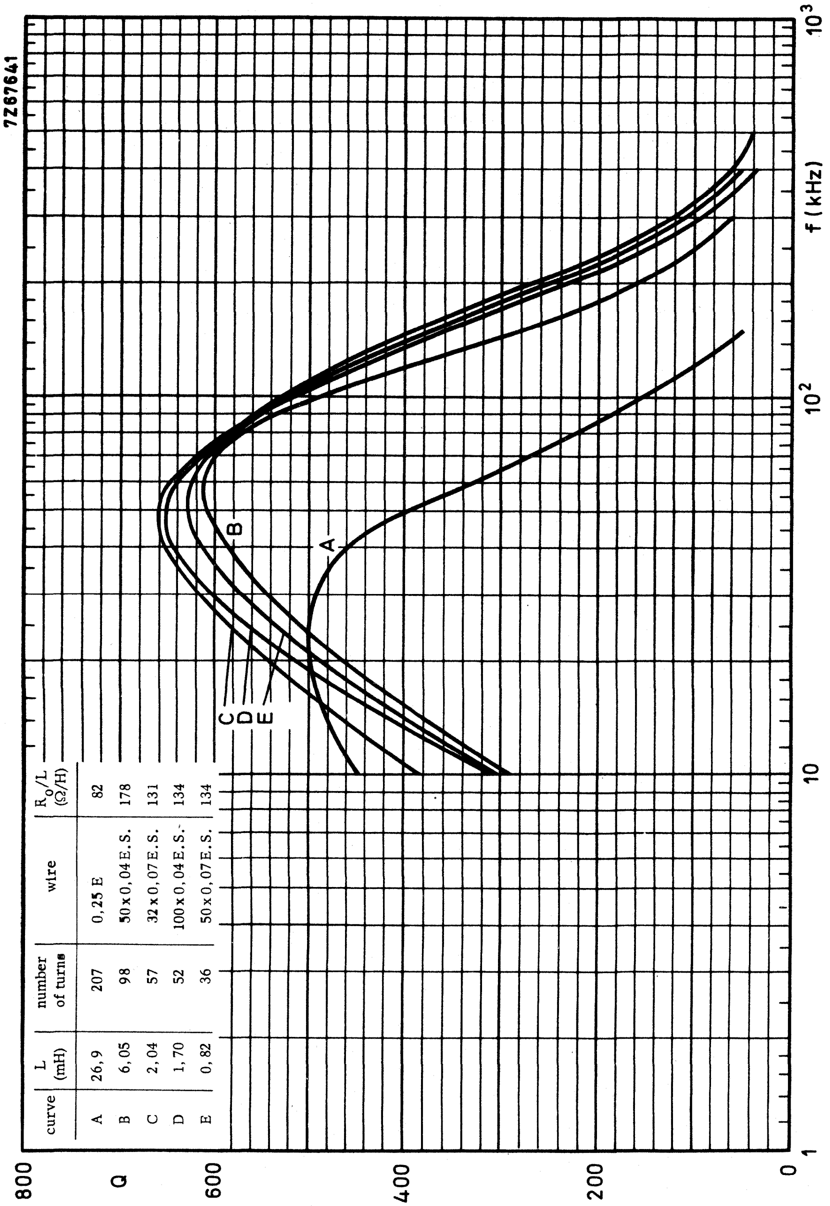
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	13,5	207	0,25 E	164
B	3,03	98	50 x 0,04 E.S.	355
C	1,02	57	32 x 0,07 E.S.	263
D	0,85	52	100 x 0,04 E.S.	268
E	0,41	36	50 x 0,07 E.S.	268

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

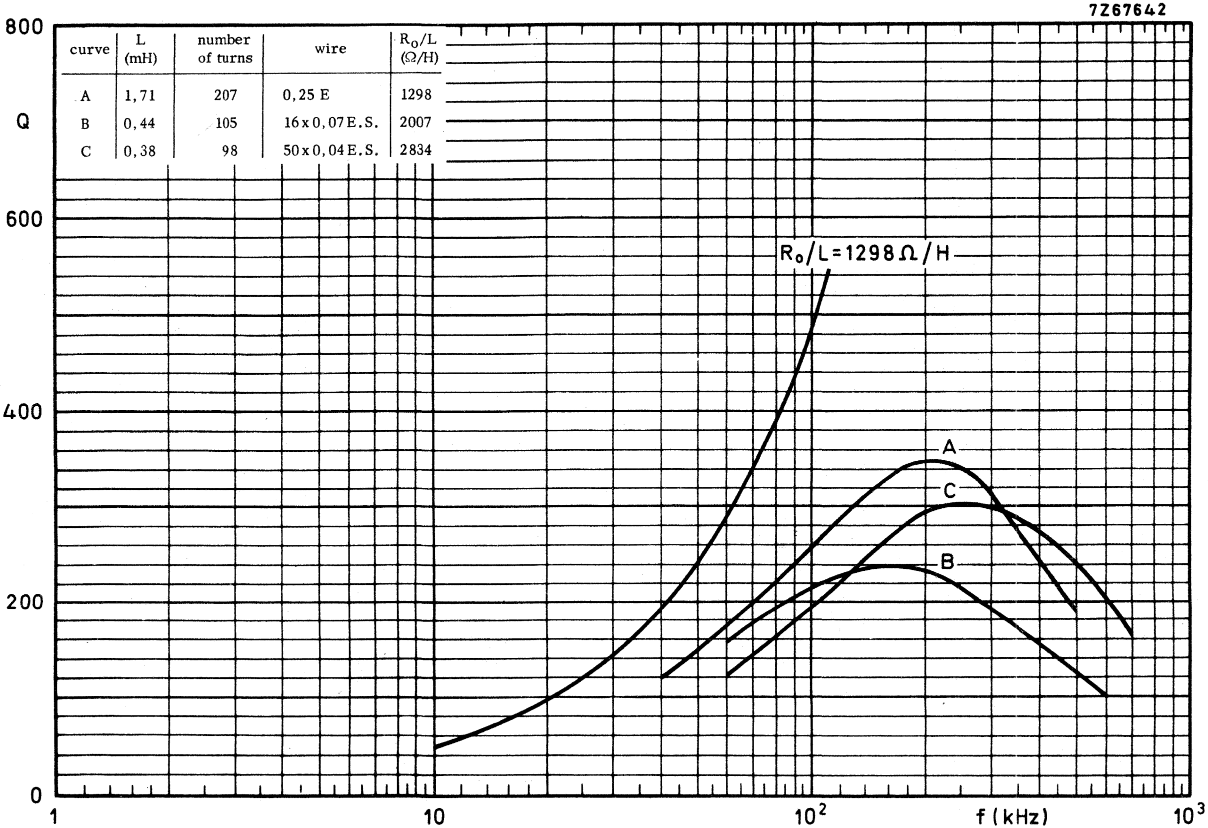
FXC 3B7/3H1, single-section coil former, $A_L = 400$



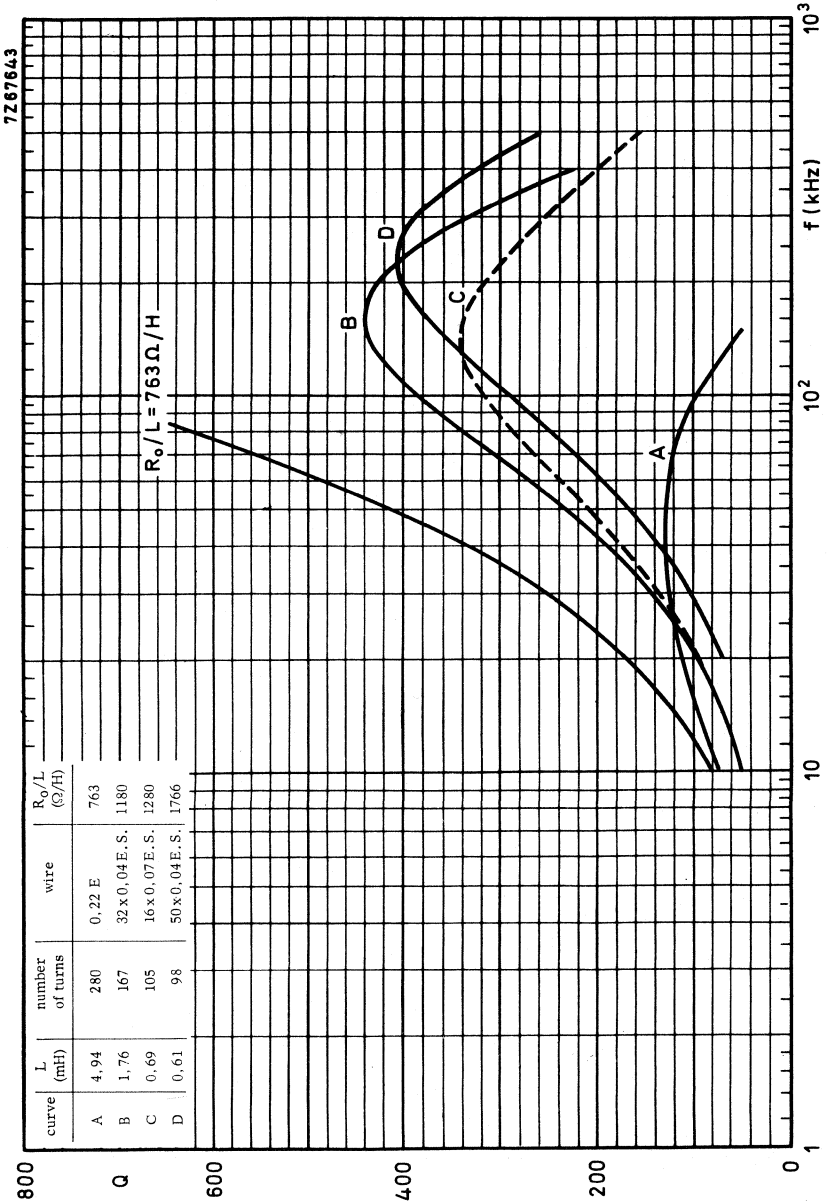
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	26,9	207	0,25 E	82
B	6,05	98	50 x 0,04 E.S.	178
C	2,04	57	32 x 0,07 E.S.	131
D	1,70	52	100 x 0,04 E.S.	134
E	0,82	36	50 x 0,07 E.S.	134

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

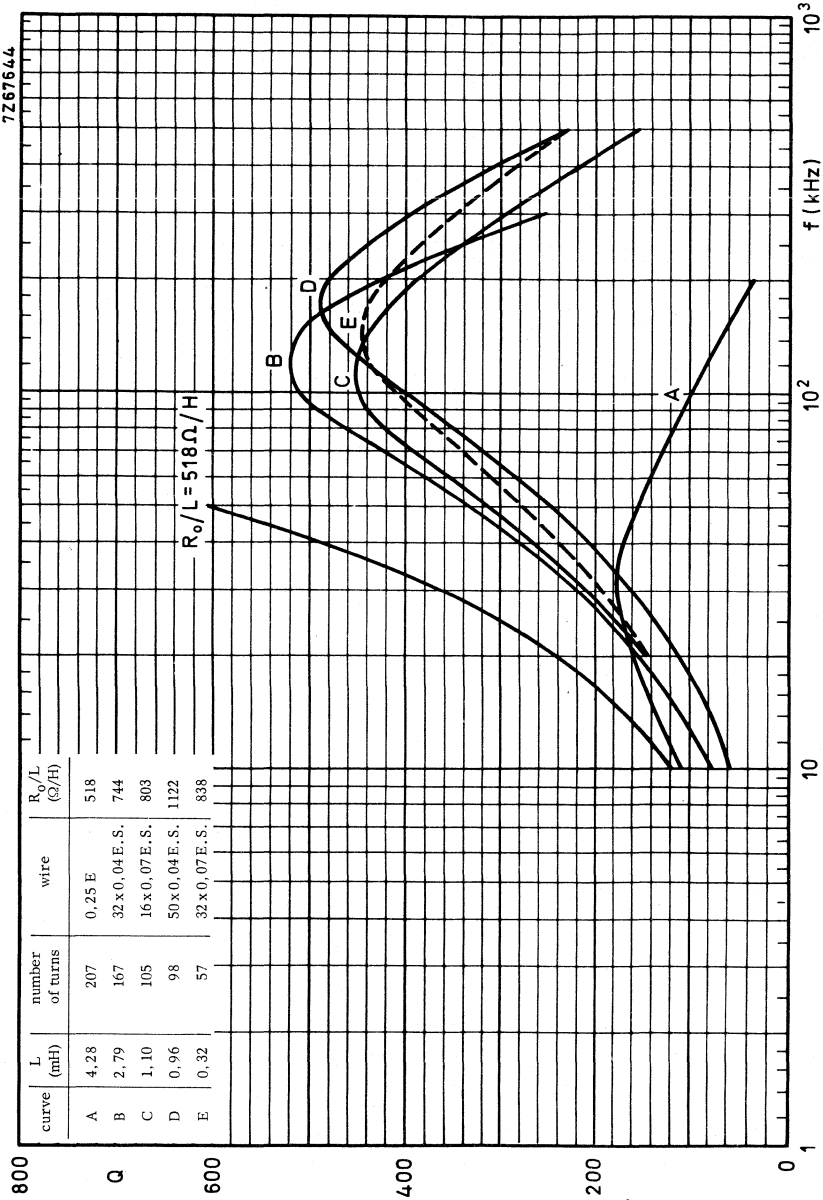


FXC 3D3, single-section coil former, A_L = 40



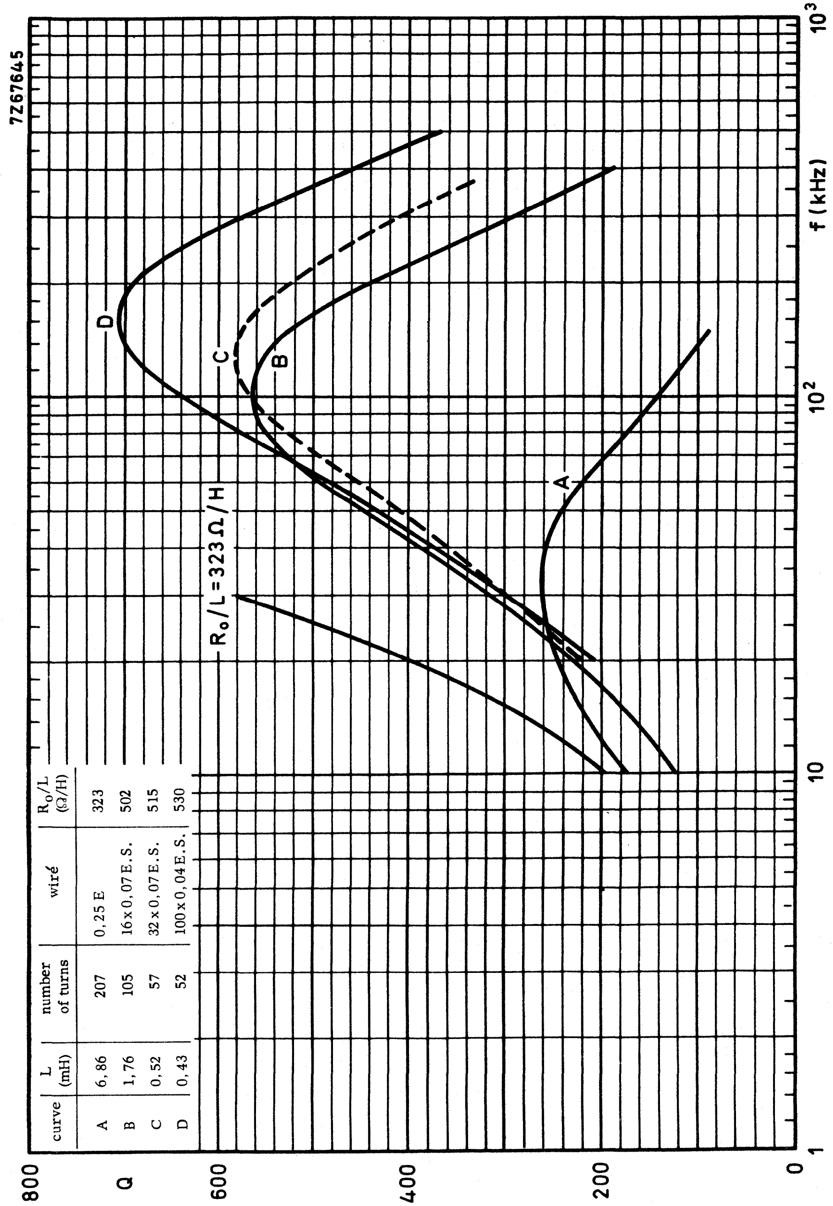
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	4,94	280	0,22 E	763
B	1,76	167	32 x 0,04 E.S.	1180
C	0,69	105	16 x 0,07 E.S.	1280
D	0,61	98	50 x 0,04 E.S.	1766

FXC 3D3, single-section coil former, $A_L = 63$



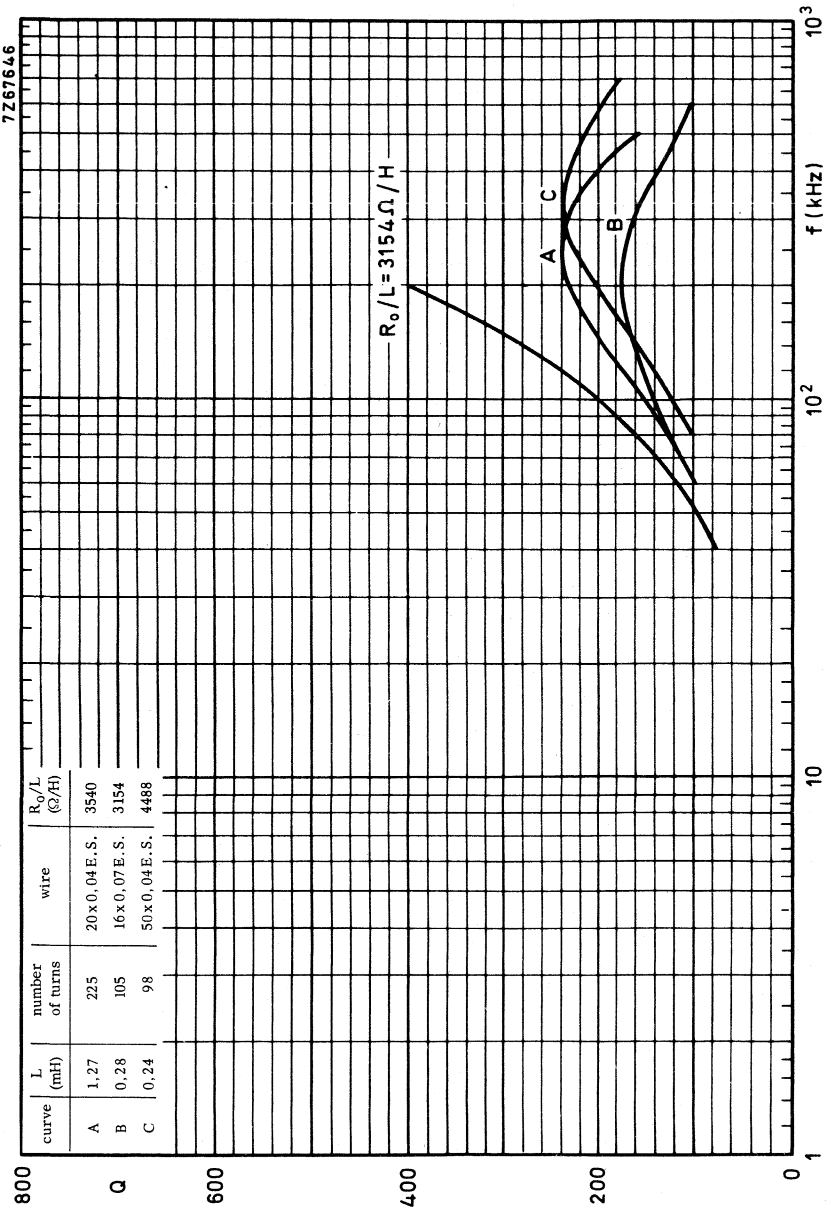
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	4,28	207	0,25 E	518
B	2,79	167	32 x 0,04 E.S.	744
C	1,10	105	16 x 0,07 E.S.	803
D	0,96	98	50 x 0,04 E.S.	1122
E	0,32	57	32 x 0,07 E.S.	838

FXC 3D3, single-section coil former, A_L = 100



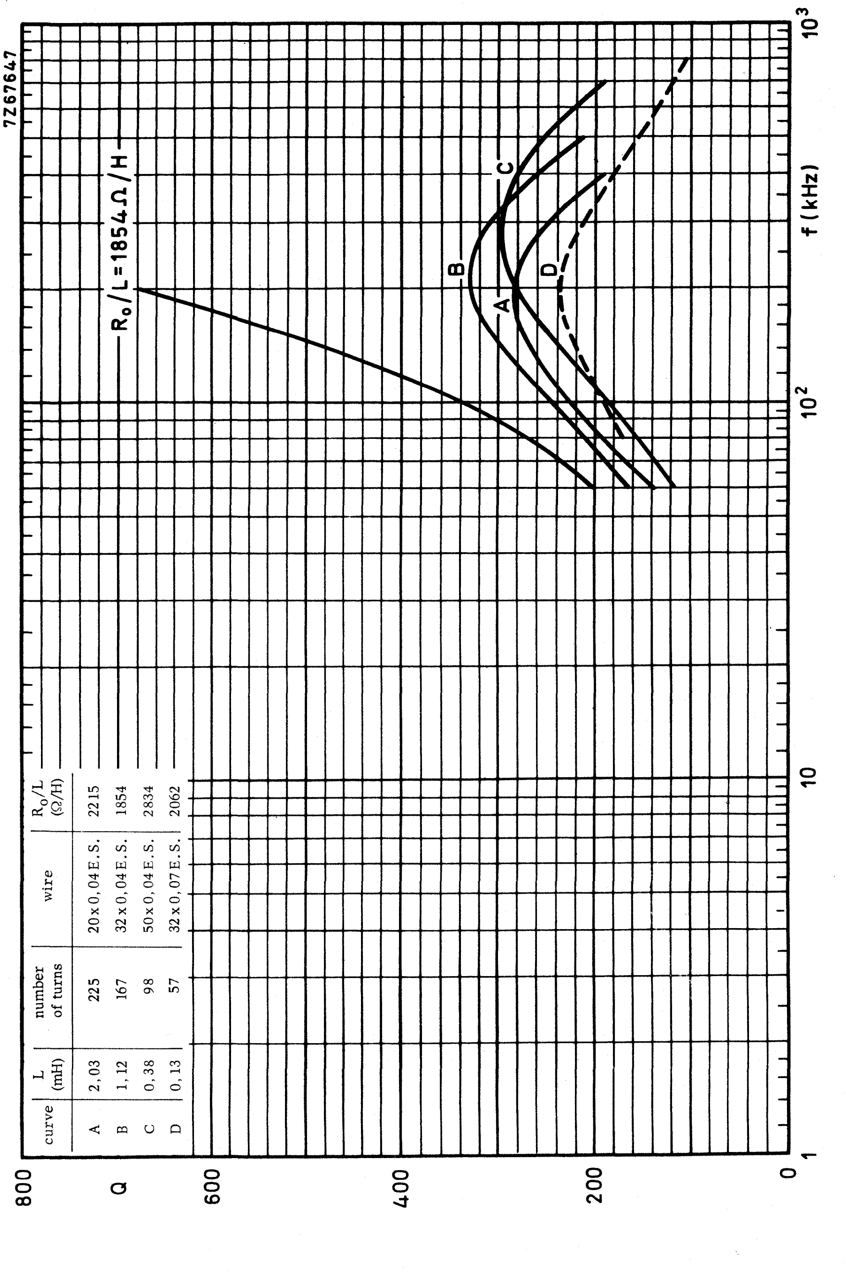
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	6,86	207	0,25 E	323
B	1,76	105	16 x 0,07 E.S.	502
C	0,52	57	32 x 0,07 E.S.	515
D	0,43	52	100 x 0,04 E.S.	530

FXC 3D3, single-section coil former, $A_L = 160$



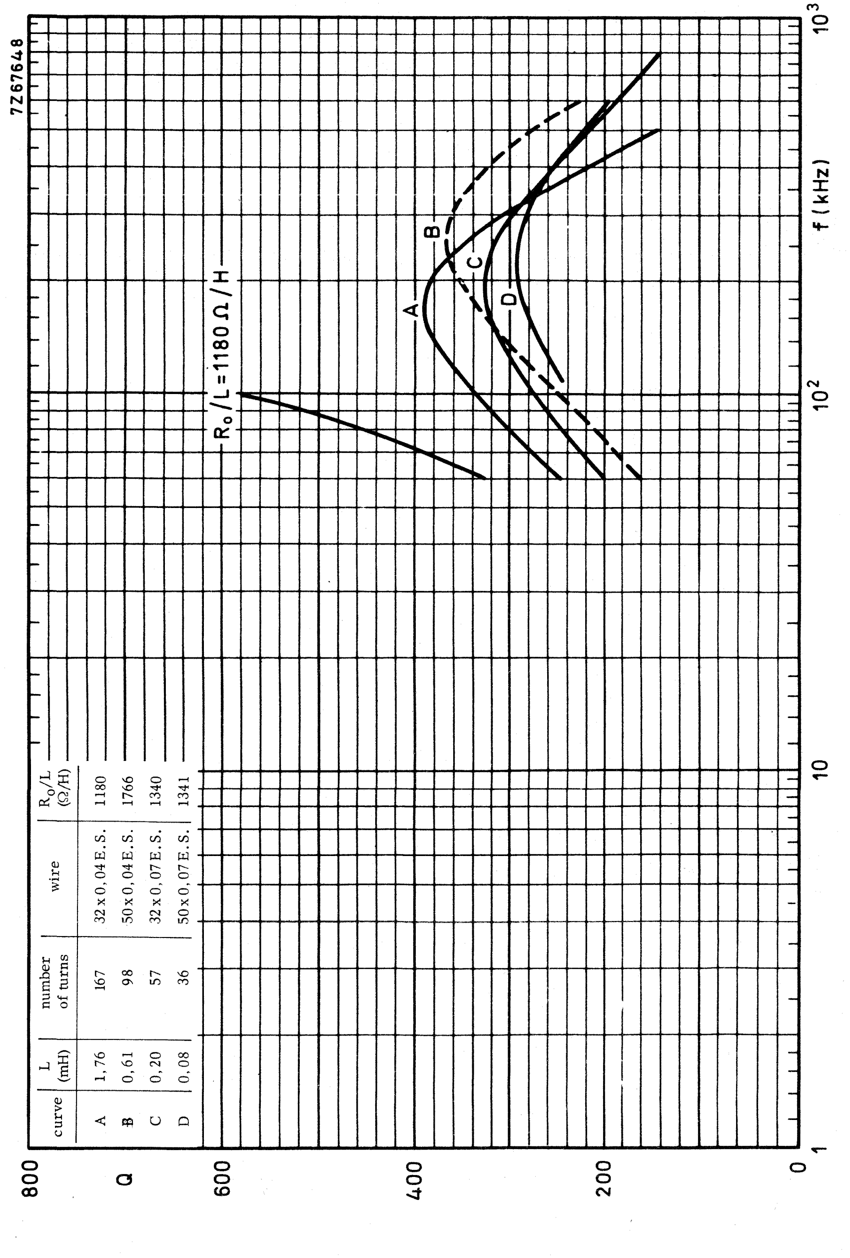
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	1,27	225	20 x 0,04 E.S.	3540
B	0,28	105	16 x 0,07 E.S.	3154
C	0,24	98	50 x 0,04 E.S.	4488

FXC 4C6, single-section coil former, $A_L = 25$



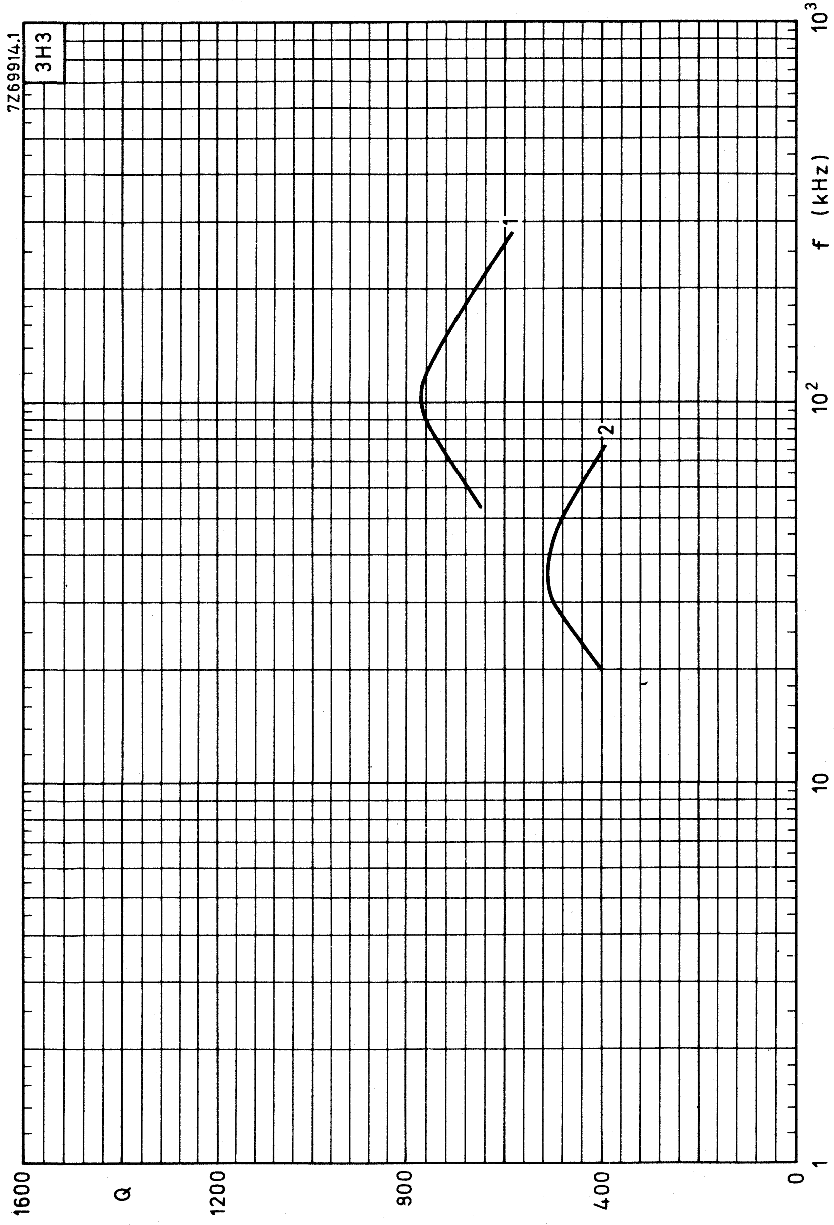
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	2,03	225	20 x 0,04 E.S.	2215
B	1,12	167	32 x 0,04 E.S.	1854
C	0,38	98	50 x 0,04 E.S.	2834
D	0,13	57	32 x 0,07 E.S.	2062

FXC 4C6, single-section coil former, $A_L = 40$

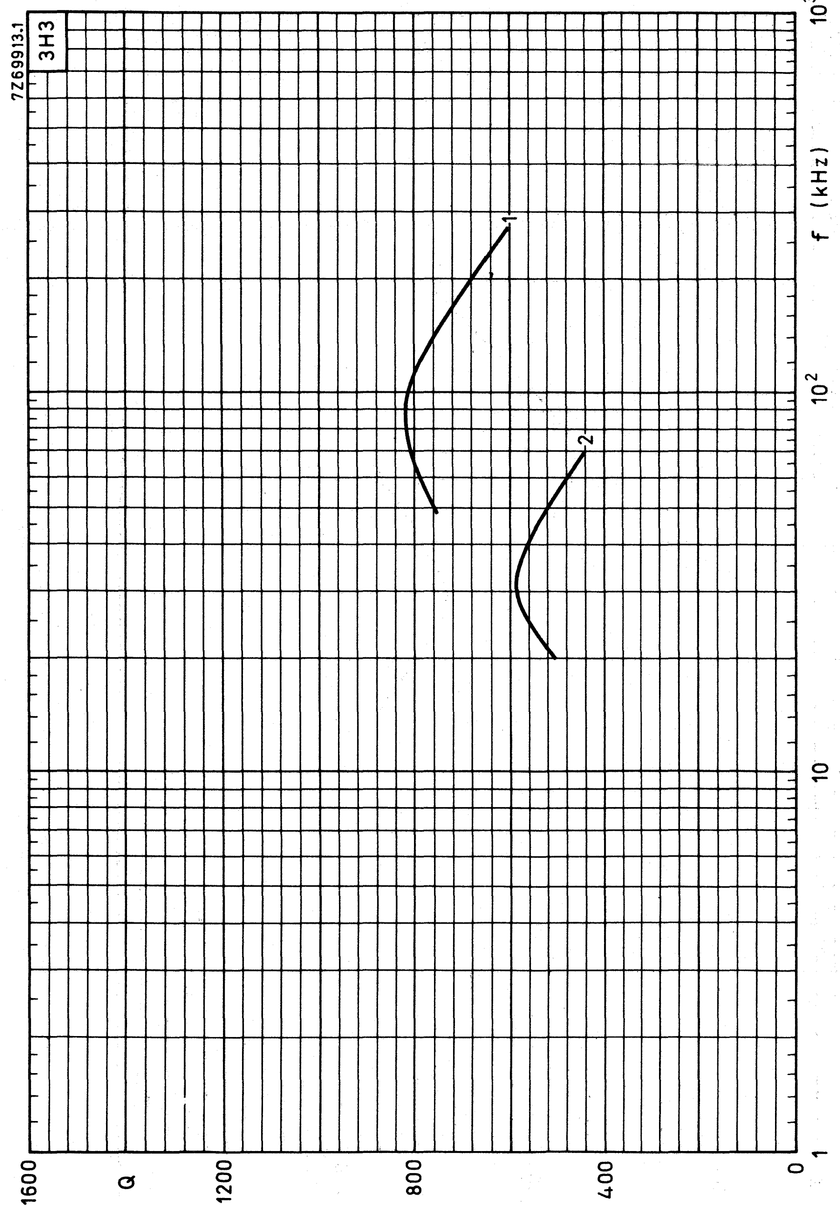


curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	1,76	167	32 x 0,04 E.S.	1180
B	0,61	98	50 x 0,04 E.S.	1766
C	0,20	57	32 x 0,07 E.S.	1340
D	0,08	36	50 x 0,07 E.S.	1341

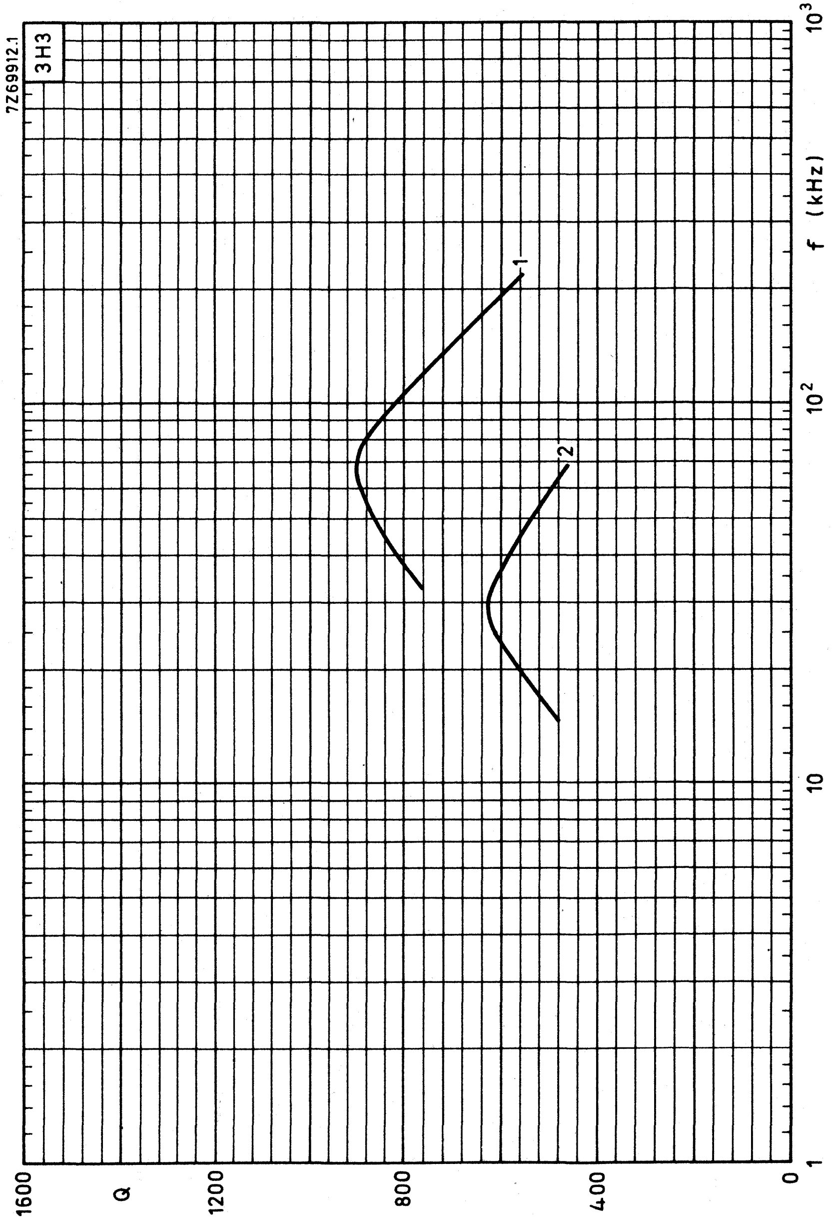
FXC 4C6, single-section coil former, A_L = 63



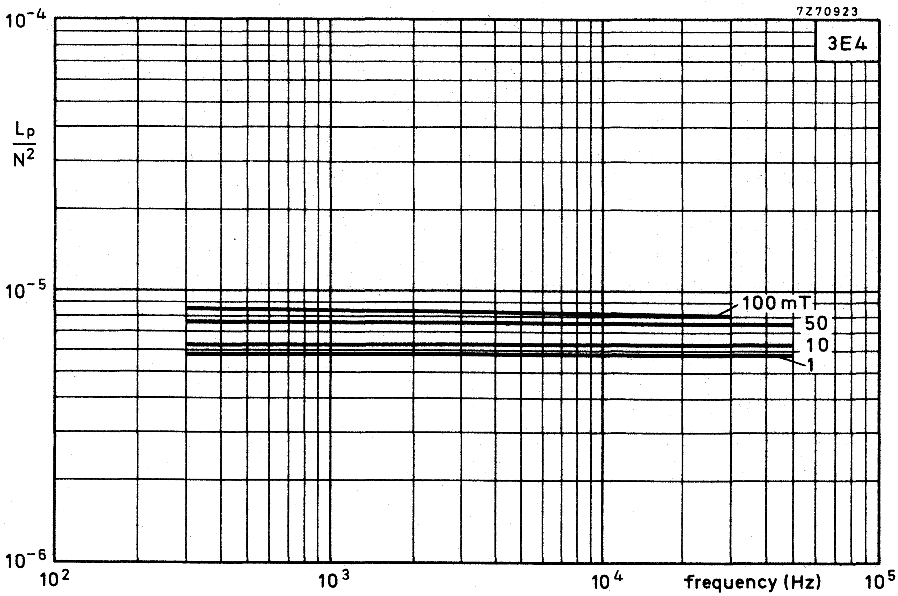
Q-curves. Single-section coil former; curve 1 : 57 turns (32 x 0,07 E.S. wire)
curve 2 : 207 turns (0,25 E wire).
$A_L = 250$



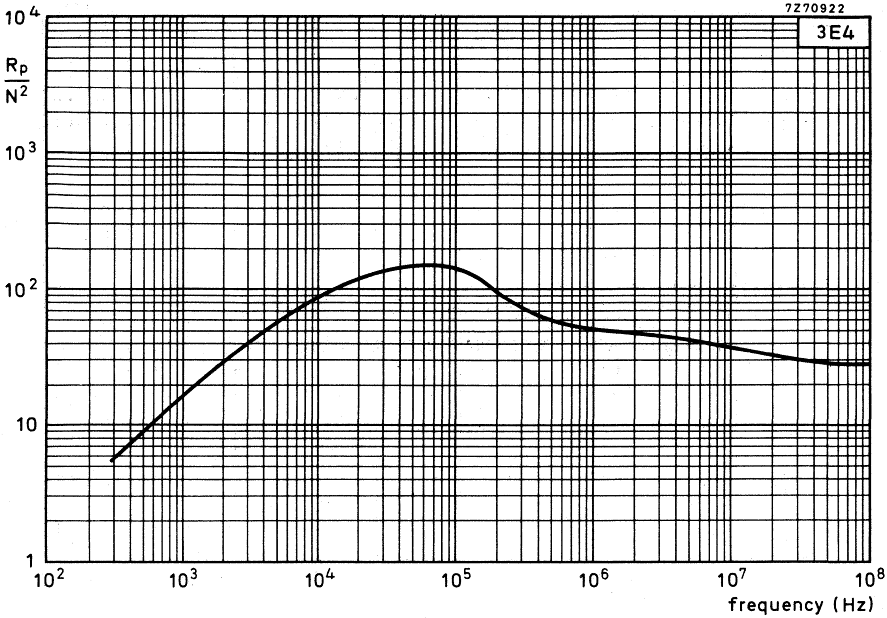
Q-curves. Single-section coil former; curve 1 : 57 turns (32 x 0,07 E.S. wire)
curve 2 : 207 turns (0,25 E wire).
$A_L = 315$



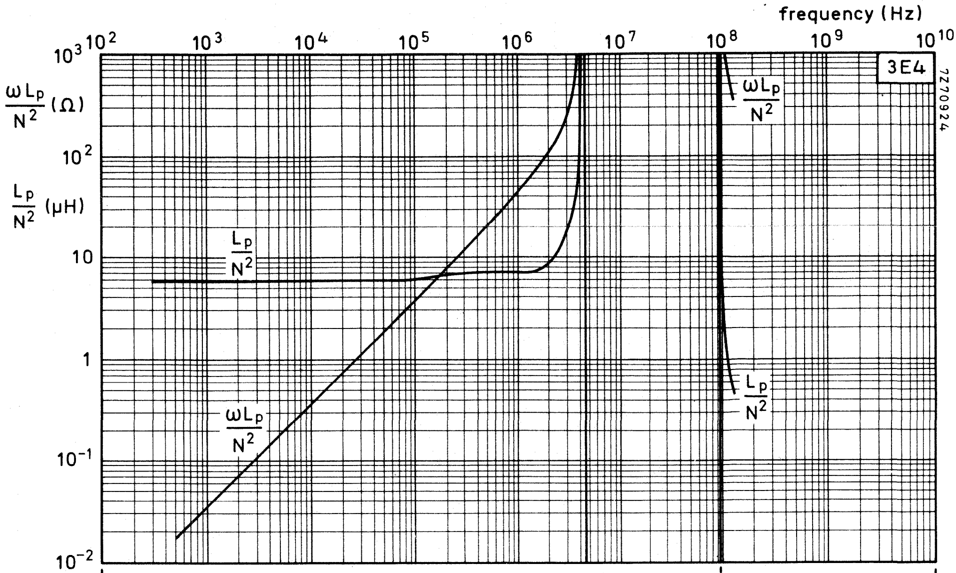
Q-curves. Single-section coil former; curve 1 : 57 turns (32 x 0,07 E.S. wire)
curve 2 : 207 turns (0,25 E wire).
$A_L = 400$

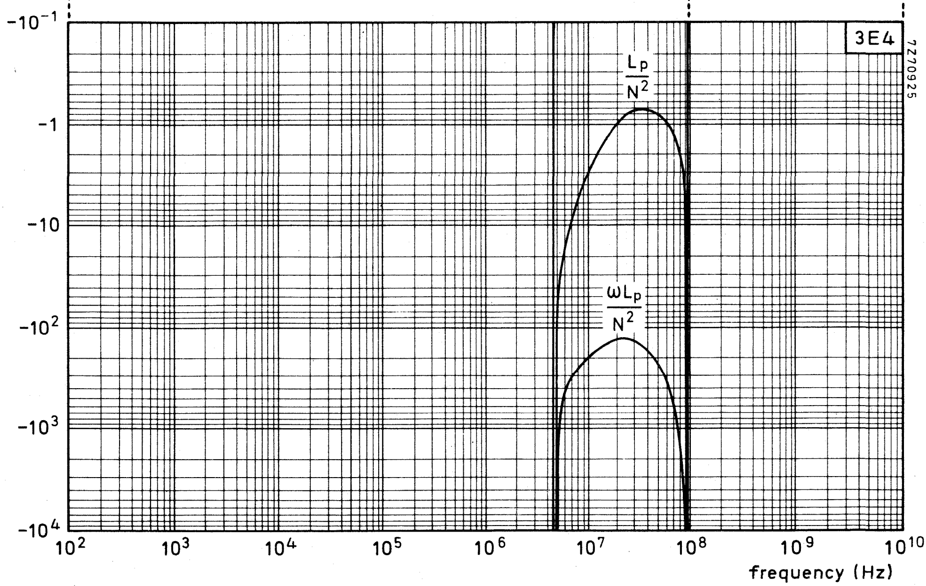


Inductance as a function of the frequency (typical values).

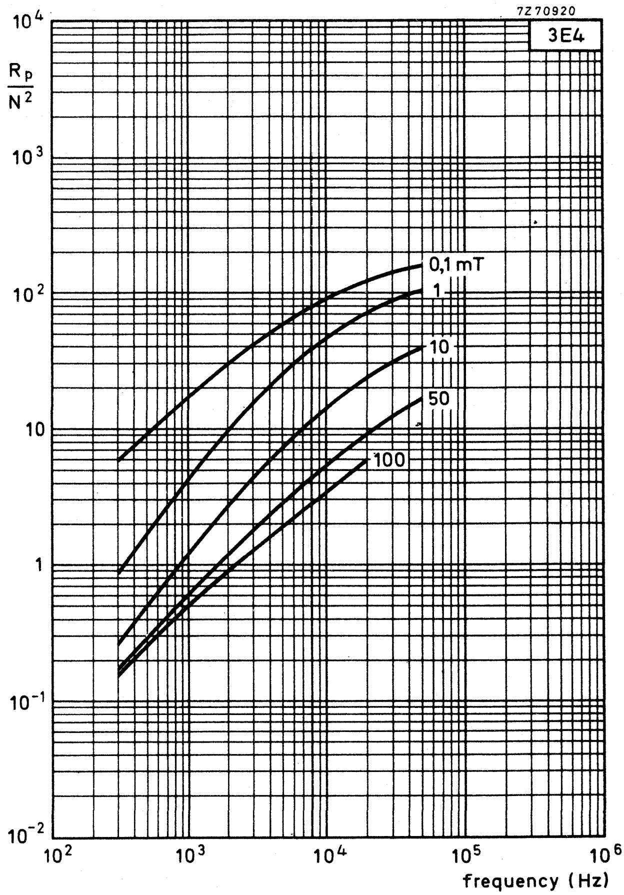


Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT (typical values).

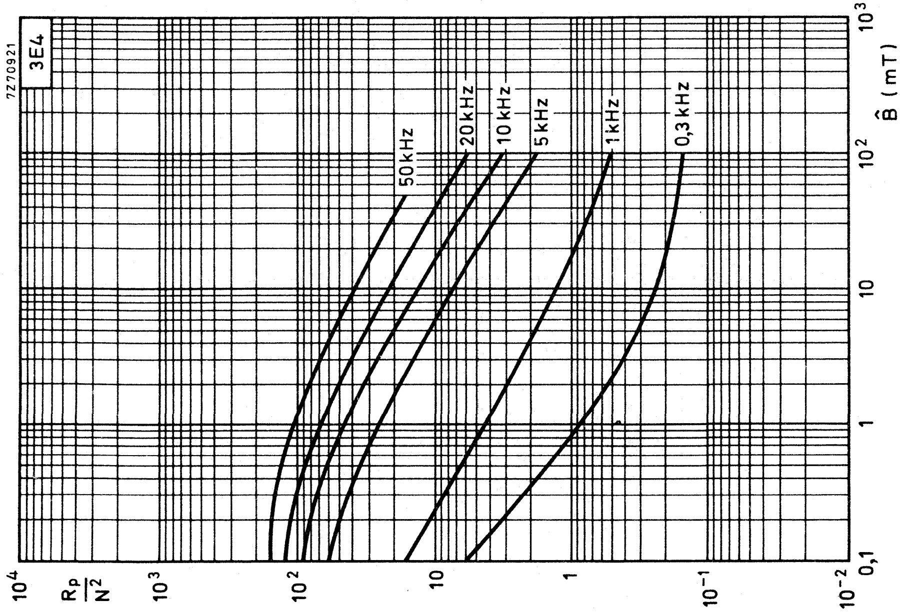




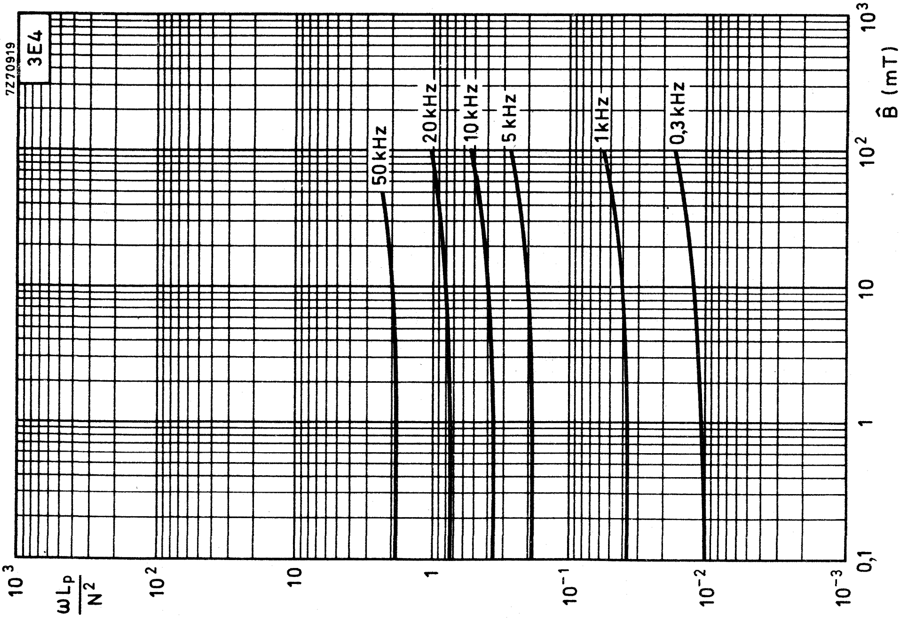
Inductance as a function of the frequency (typical values)



Losses as a function of the frequency (typical values)

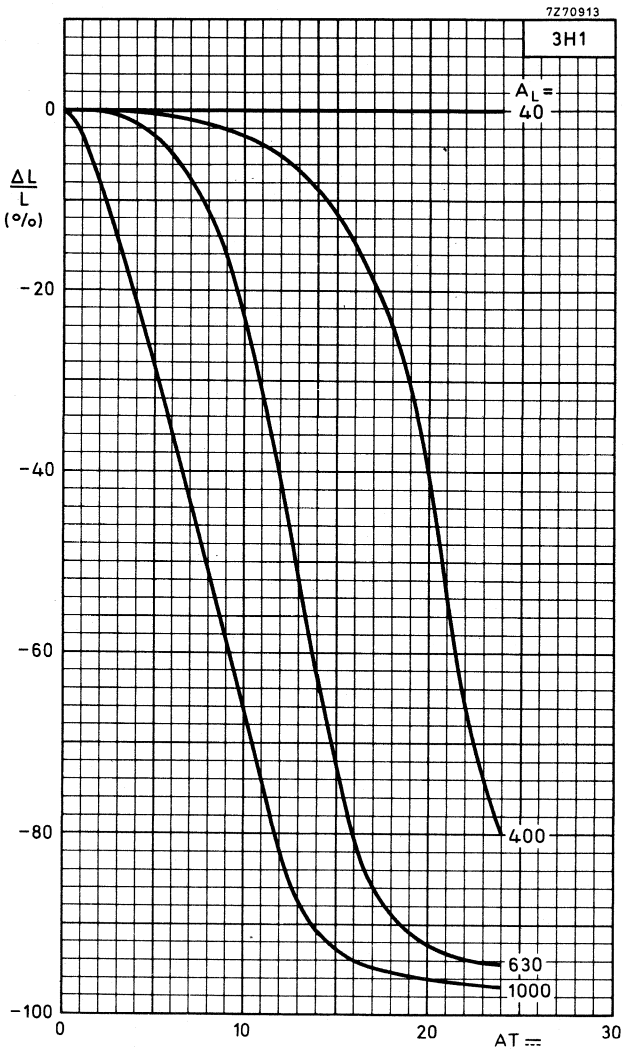


Losses as a function of the peak induction



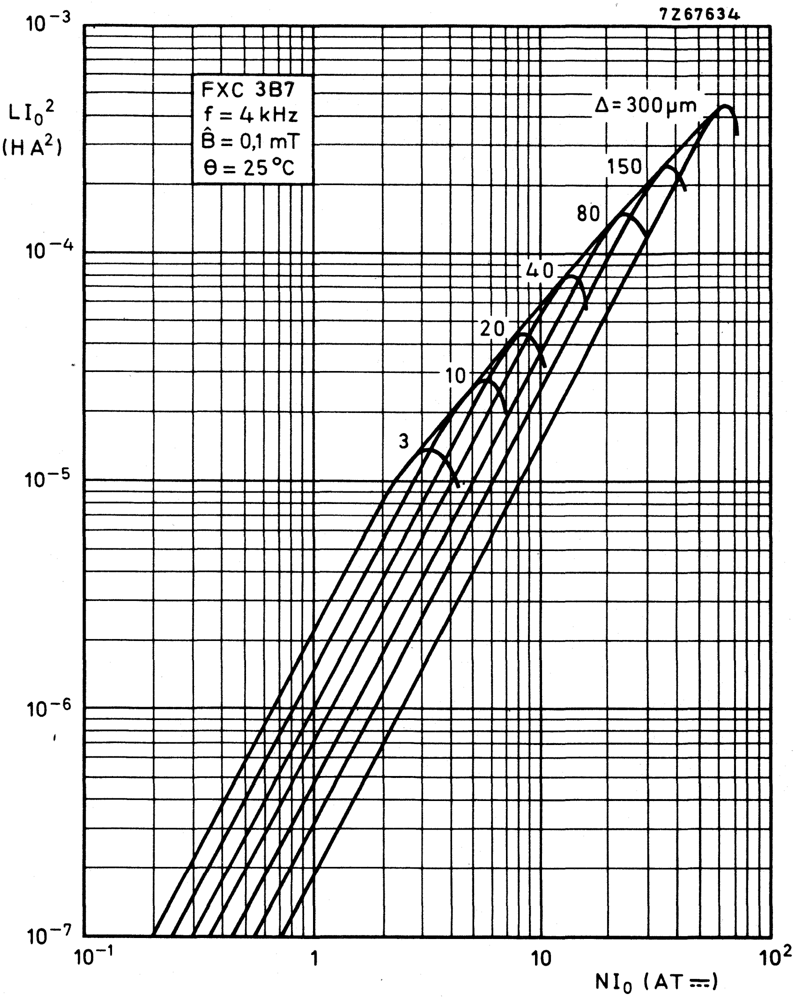
Inductance as a function of the peak induction

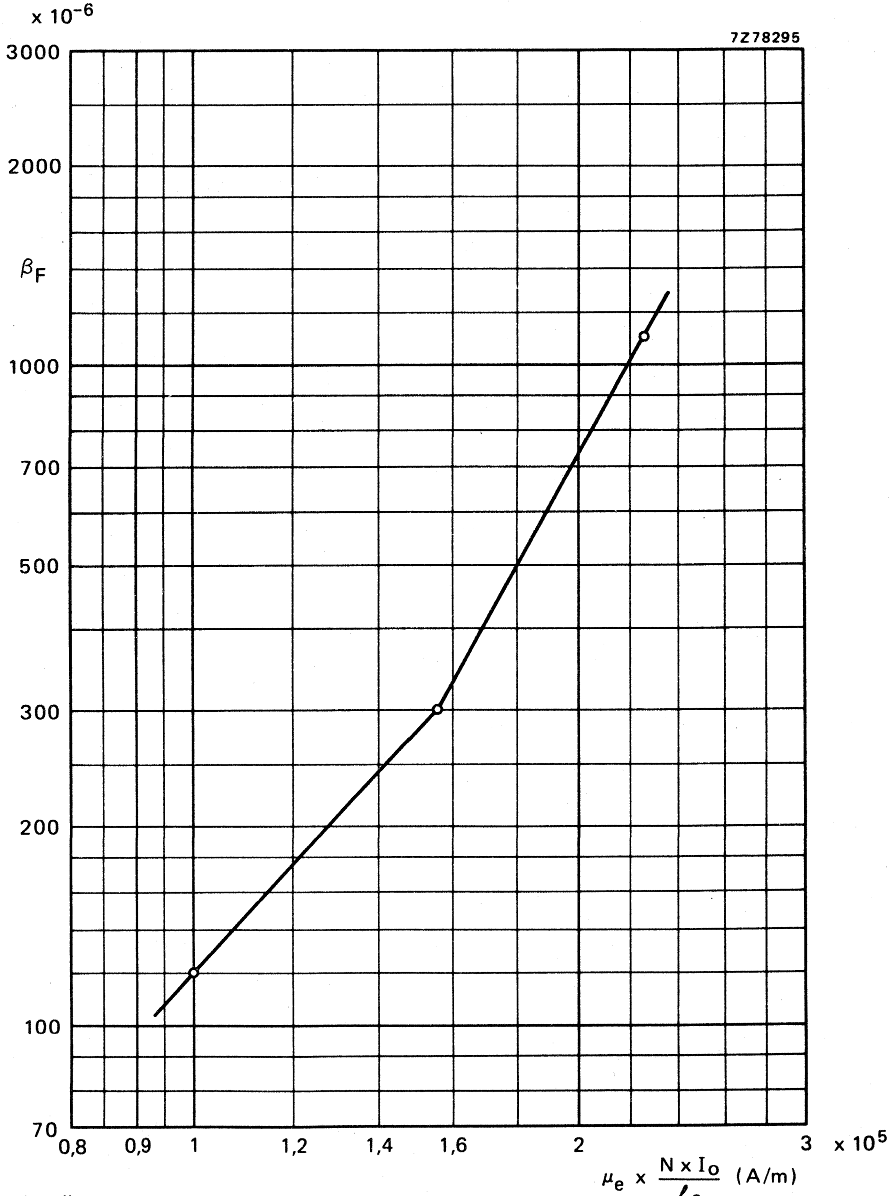
(typical values)


7Z70913
3H1
A_L =
40
400
630
1000
$\frac{\Delta L}{L}$ (%)
0
-20
-40
-60
-80
-100
0
10
20
30
AT ⎓

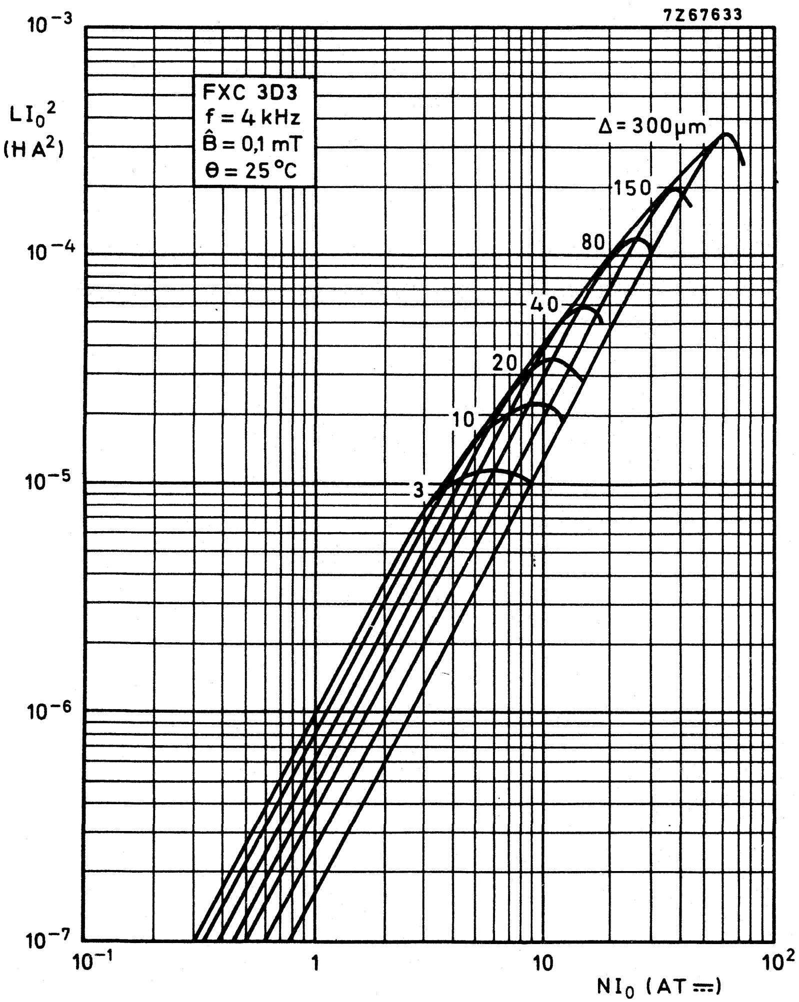
HANNA CURVES (typical values)
for different material grades.

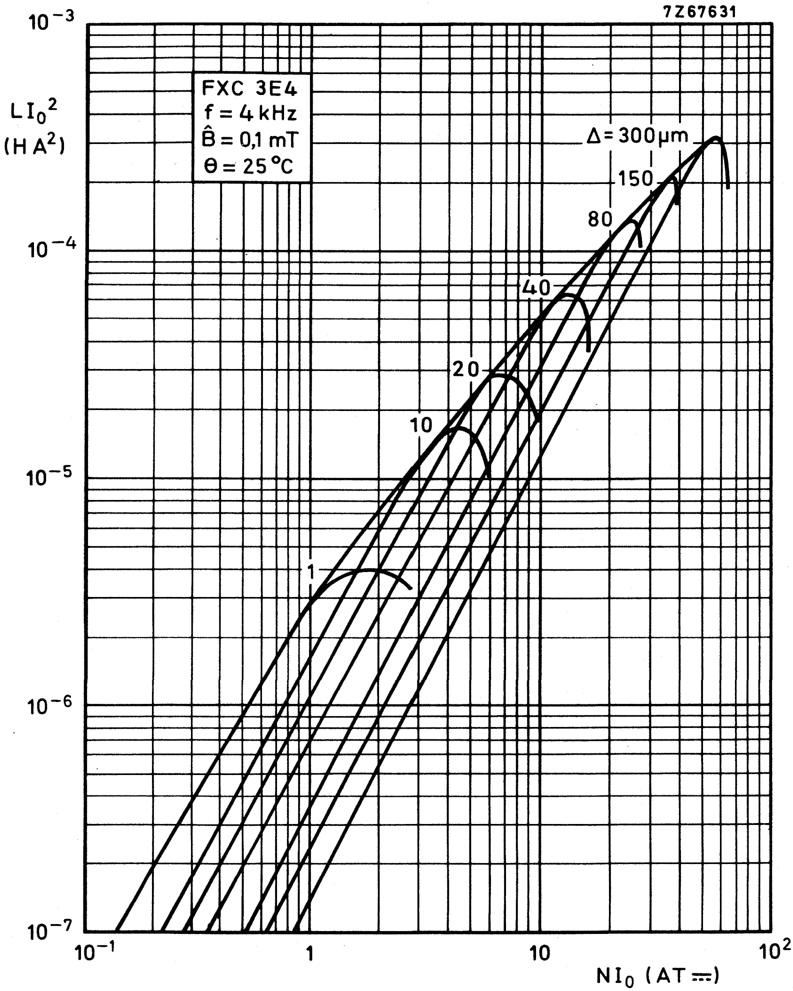
Indicating optimum inductance for a certain airgap and direct current

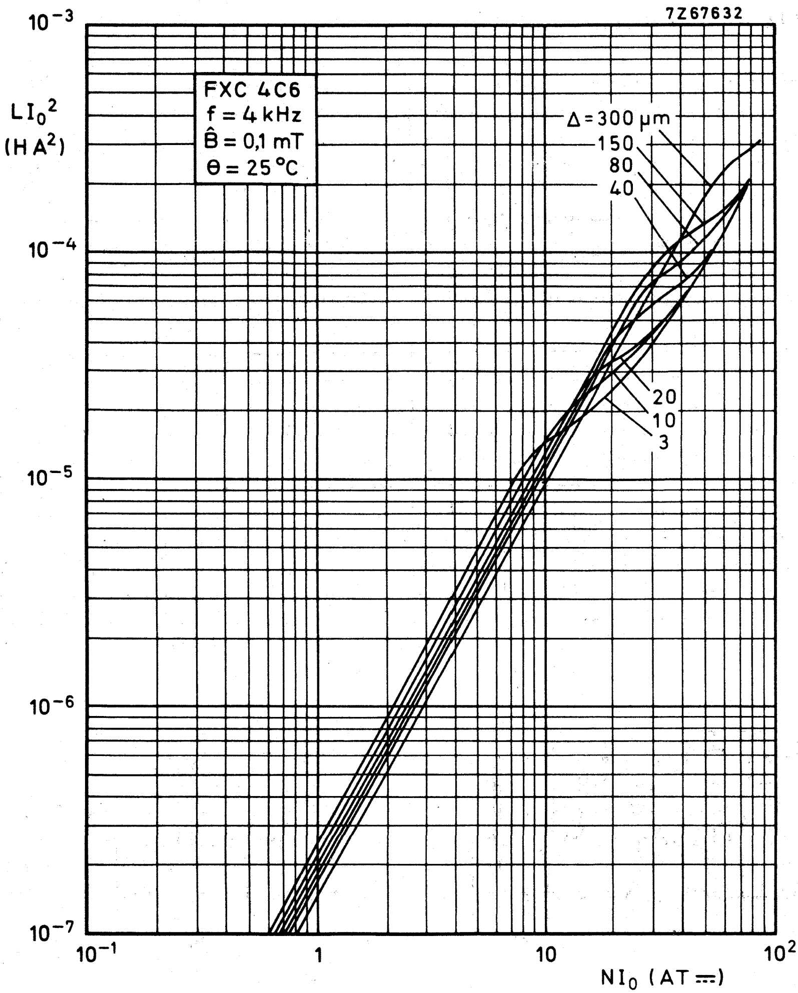




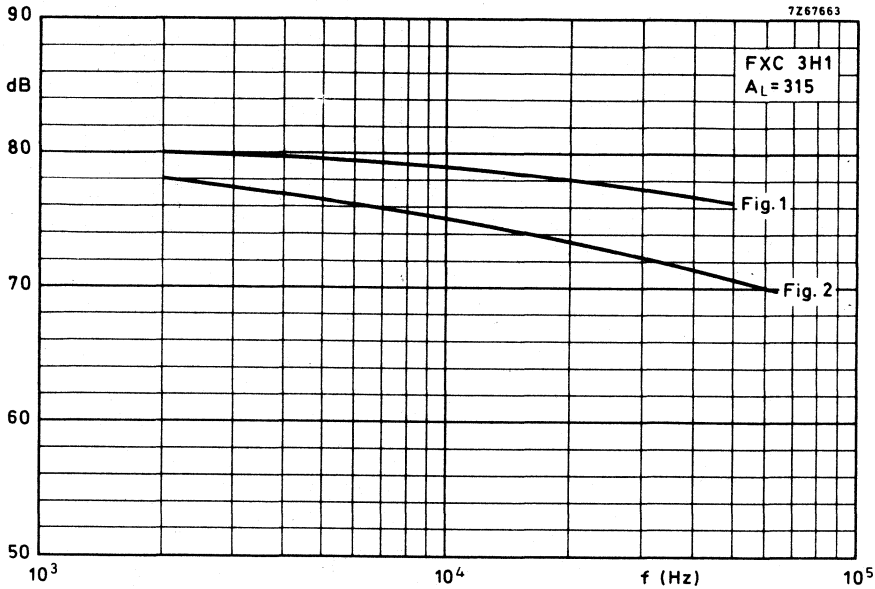
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$


7Z67633
FXC 3D3
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI0²
(H A²)
Δ = 300µm
150
80
40
20
10
3
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
10⁻¹
1
10
10²
NI0 (AT ⎓)


7Z67631
FXC 3E4
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI_0^2
(H A²)
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
Δ = 300 μm
150
80
40
20
10
1
10^{-1}
1
10
10^2
NI_0 (AT ⎓)


7Z67632
FXC 4C6
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI_0^2
(H A²)
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
Δ = 300 μm
150
80
40
20
10
3
10^{-1}
1
10
10^2
NI_0 (AT ⎓)

→ CROSSTALK ATTENUATION



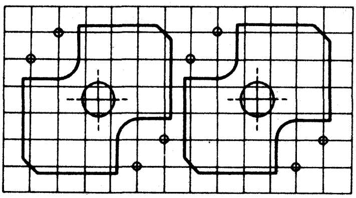


Fig. 1 7Z67659

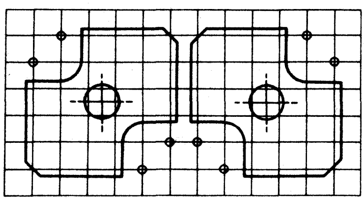


Fig. 2 7Z67660

SQUARE CORES

Three types of core can be supplied:

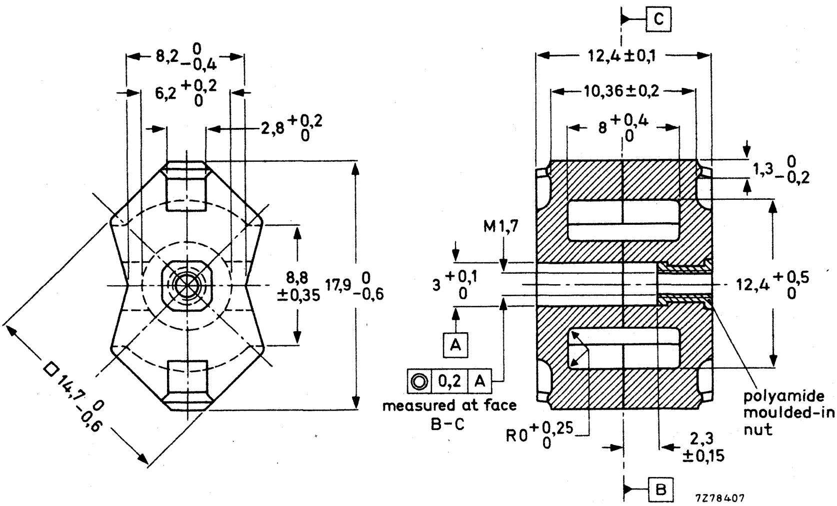
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L.
- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without air gap.

The square cores are in accordance with the following specifications: IEC 431 (international), C93-324 (France), DIN 41980 (Germany).

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut	⩾ 30 N
Torque of the screw thread	⩽ 0,8 N
Extraction force of adjuster from nut	⩾ 20 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}863\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0287\ mm^{-3}$; $V_e = 840\ mm^3$; $l_e = 27{,}3\ mm$; $A_e = 31\ mm^2$.

Mass of a core set: 4,5 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}784\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0210\ mm^{-3}$; $V_e = 1090\ mm^3$; $l_e = 29{,}2\ mm$; $A_e = 37\ mm^2$.

Mass of a core set: 4,7 g.

ELECTRICAL DATA

The combination of two square core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 50 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade							
				3B7	3B8	3D3	3E1	3E4	3H1	3H3	4C6
A_L ± 25%	100	⩽ 0,1	25 ± 1	2480	1940	1020			2480	2415	182
μ_e ± 25%	100	⩽ 0,1	25 ± 1	1710	1330	700			1710	1657	125
α	100	⩽ 0,1	25 ± 1	⩽ 23,2	⩽ 26,2	⩽ 36,2			⩽ 23,2	⩽ 25,0	⩽ 85,5
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1				⩽ 2,5	⩽ 2,5			
	30	⩽ 0,1	25 ± 1	⩽ 2,5	⩽ 4,0				⩽ 2,5	⩽ 1,6	
	100	⩽ 0,1	25 ± 1	⩽ 5,0	⩽ 6,0	⩽ 8,0	⩽ 20	⩽ 20	⩽ 5,0	⩽ 2,6	
	500	⩽ 0,1	25 ± 1			⩽ 14	⩽ 200	⩽ 200			
	1 000	⩽ 0,1	25 ± 1			⩽ 30					
	2 000	⩽ 0,1	25 ± 1								⩽ 40
	10 000	⩽ 0,1	25 ± 1								⩽ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 0,86			⩽ 1,8	⩽ 1,1	⩽ 0,86		
	30	1,5 to 3,0	25 ± 1		⩽ 1,5					⩽ 0,65	
	100	0,3 to 1,2	25 ± 1			⩽ 1,8					⩽ 9,2
$\alpha_F \times 10^6$/°C	⩽ 100	⩽ 0,1	5 to 25		0 to + 6			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	−2 to + 4
	⩽ 100	⩽ 0,1	25 to 55	−0,6 to + 0,6	0 to + 6			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	0 to + 6
	⩽ 100	⩽ 0,1	25 to 70	−0,6 to + 0,6		0 to + 2	0 to + 2	0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,25	
$D_F \times 10^6$ (10 - 100 min)	⩽ 100	⩽ 0,1	25 ± 0,1	⩽ 4,3	⩽ 8,0	⩽ 12	⩽ 4,3	⩽ 4,3	⩽ 4,3	⩽ 3,0 *	⩽ 10
$\beta_F \times 10^6$ measured on sets with μ_e = 300 ± 10% at 25 ± 1 °C: at $\mu_e \times \frac{N \times I_o}{l_e}$ = 0,90 x 10^5 A/m					⩽ 120						
= 1,35 x 10^5 A/m					⩽ 300						
= 2,00 x 10^5 A/m					⩽ 1100						

* This value is valid within the temperature range of 25 to 70 °C.

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance %	catalogue number 4322 022						
			3B7	3D3	3E1	3E4	3H1	3H3	4C6
25	17,1	± 1							67810
40	27,4	± 1		67420					67820
63	43,1	± 1		67430					67830
100	68,7	± 2		67440					
160	110	± 2	67050	67450			67250		
200	137	± 2					67350	67680	
250	171	± 2	67060				67260	67560	
315	216	± 2	67070				67270	67570	
400	274	± 2	67080				67280	67580	
630	431	± 3	67100				67300	67600	
1000	687	± 10	67110				67310		
1250	856	± 10	67190				67390		
4400	3050	± 25			47800 *				
4840	3050	± 25			47910 *				
5500	3800	± 25				47900 *			
6050	3800	± 25				47920 *			

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

Core sets without nut: replace the eighth digit of the catalogue number (6) by 4.
Cores with $A_L \leqslant 100$, have a symmetrical air gap.
Cores with $A_L \geqslant 160$, have an asymmetrical air gap.
Types marked * are only available without adjuster nut.

In order to obtain better performance the types 4322 020 47910 and 47920 are executed without centre holes.

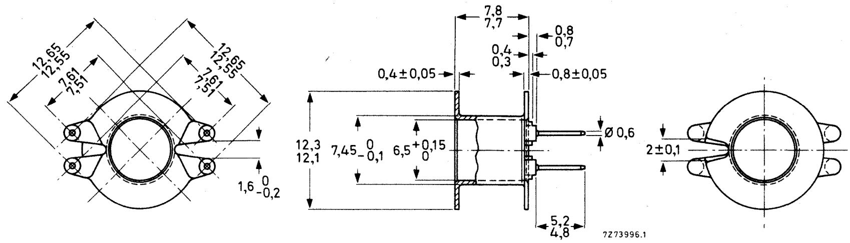
1. Example of catalogue number:
   A_L = 250, grade 3H1, core with nut, catalogue number 4322 022 67260.
2. The inductance will only be within the given tolerance if the winding space of the coil former is completely filled.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B7	4322 020 25040
3B8	4322 020 27850
3D3	4322 020 25060
3H1	4322 020 25020
3H3	4322 020 25200
4C6	4322 020 25080

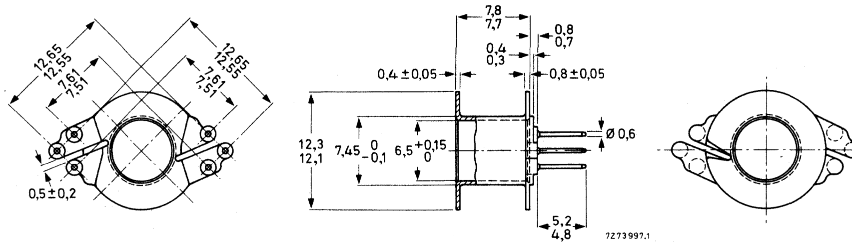
COIL FORMERS

SINGLE-SECTION, FOUR-PIN COIL FORMER



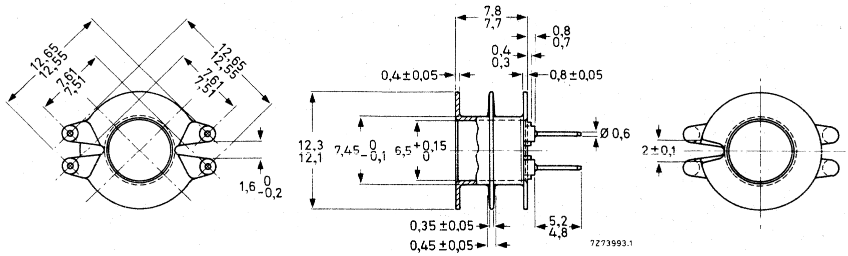
Catalogue number	4312 021 29240	D.C. losses
Material	phenolformaldehyde reinforced with glass fibre	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 22,6 \times 10^3\ \Omega/H$
Window area	16,2 mm^2	Solderability: resistant against dip-soldering at 400 °C for 2 s
Mean length of turn	30 mm	
Max. temperature	180 °C	Mass 0,4 g

SINGLE-SECTION, SIX-PIN COIL FORMER



Catalogue number	4312 021 29250	D.C. losses
Material	phenolformaldehyde reinforced with glass fibre	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 22,6 \times 10^3\ \Omega/H$
Window area	16,2 mm^2	Solderability: resistant against dip-soldering at 400 °C for 2 s
Mean length of turn	30 mm	
Max. temperature	180 °C	Mass 0,4 g

TWO-SECTION, FOUR-PIN COIL FORMER



Catalogue number	4322 021 **32940**
Material	phenolformaldehyde reinforced with glass fibre
Window area	2 x 7,7 mm^2
Mean length of turn	30 mm
Max. temperature	180 ^{o}C

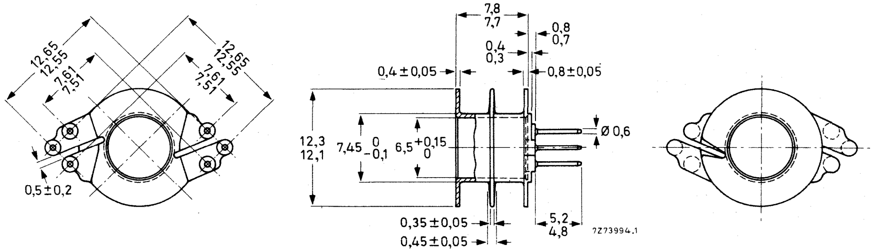
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 23,6 \times 10^3 \ \Omega/H$$

Solderability : resistant against dip-soldering at 400 ^{o}C for 2 s

Mass 0,4 g

TWO-SECTION, SIX-PIN COIL FORMER



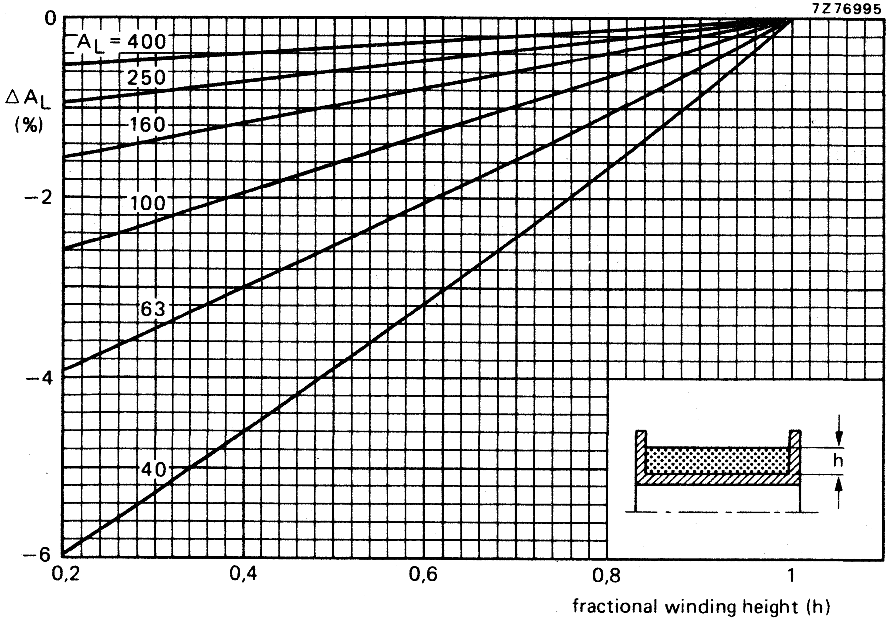
Catalogue number	4322 021 **32950**
Material	phenolformaldehyde reinforced with glass fibre
Window area	2 x 7,7 mm^2
Mean length of turn	30 mm
Max. temperature	180 ^{o}C

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 23,6 \times 10^3 \ \Omega/H$$

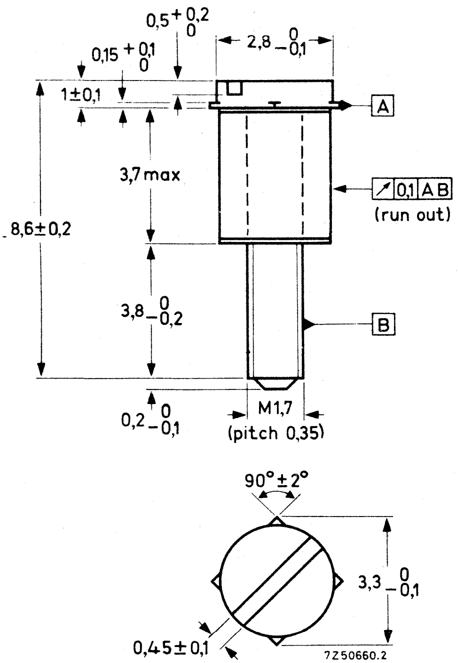
Solderability : resistant against dip-soldering at 400 ^{o}C for 2 s

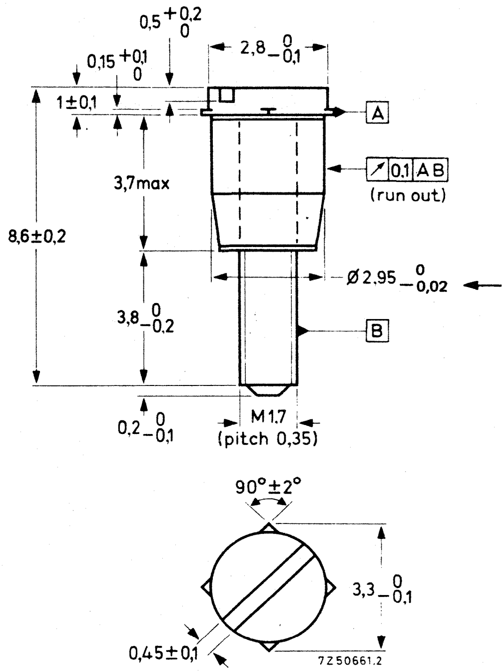
Mass 0,4 g


7Z76995
0
−2
−4
−6
ΔA_L
(%)
A_L = 400
250
160
100
63
40
0,2
0,4
0,6
0,8
1
fractional winding height (h)
h

INDUCTANCE ADJUSTERS

ADJUSTERS





Version A, tube dia. 2,5 −0,02 mm
Version B, tube dia. 2,7 −0,02 mm
Version C, tube dia. 2,77−0,02 mm

Version D

The tolerances on inductance of the pre-adjusted cores (without adjuster) are given in the table of pre-adjusted cores with standard A_L values. 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 adjuster. Such an adjuster increases the inductance of the coil (see following pages).
The adjuster 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 adjuster. For special requirements a larger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower A_L value.
The influence of the adjuster on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
The table shows the type of adjuster 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

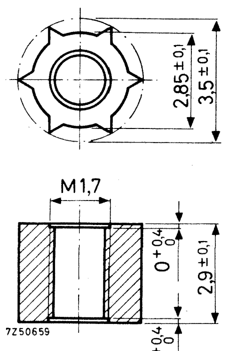
Table II, recommended application

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 adjusters are packed in bags of 100. Please order in multiples of 100.

NUT FOR ADJUSTER

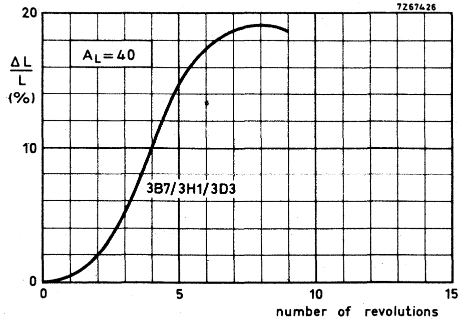
These data are given for those manufacturers who prefer to insert the nut themselves.



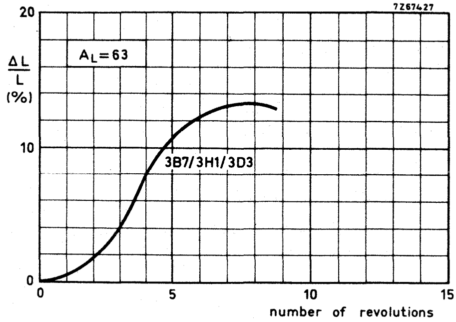
Catalogue number	4322 021 30140
Material	polycarbonate
Max. impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2,3 ± 0,15 mm

The nuts are packed in bags of 100. Please order in multiples of 100.

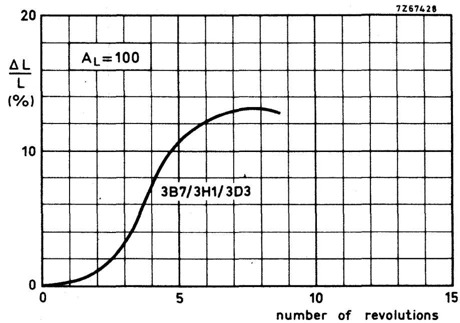
ADJUSTMENT CURVES



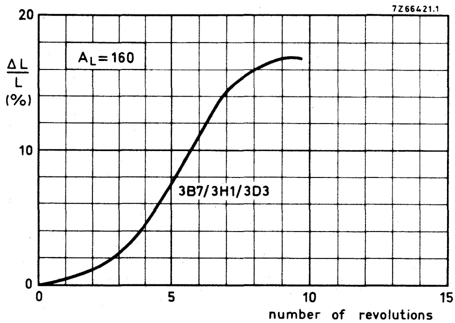
Adjuster 4322 021 32160



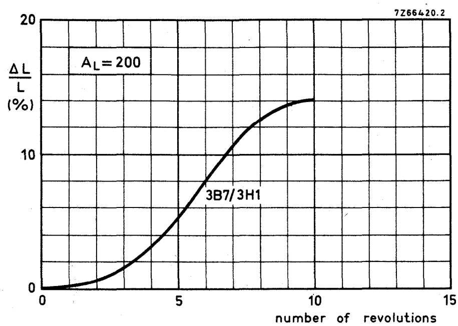
Adjuster 4322 021 32160



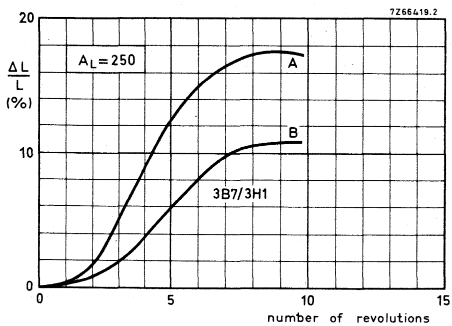
Adjuster 4322 021 32170



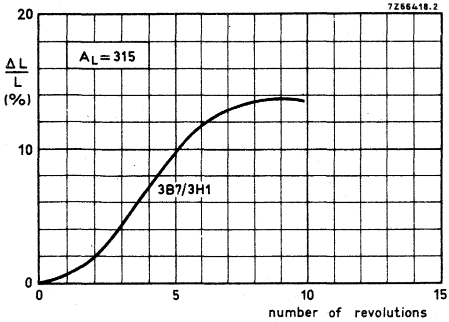
Adjuster 4322 021 32130



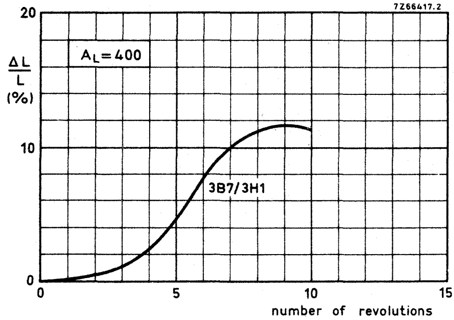
Adjuster 4322 021 32130



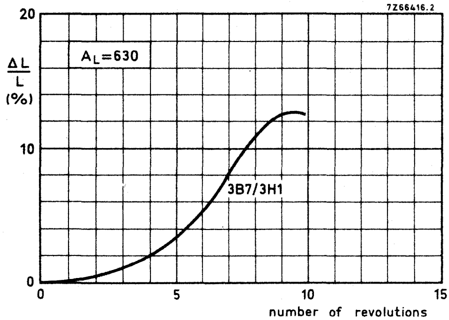
Curve A: adjuster 4322 021 32140
Curve B: adjuster 4322 021 32130



Adjuster 4322 021 32140



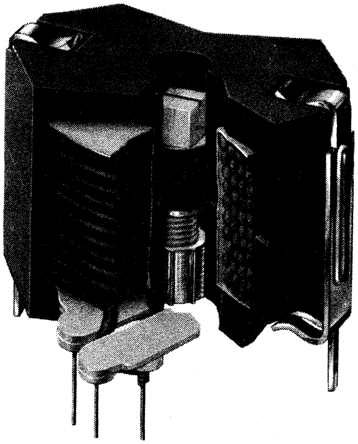
Adjuster 4322 021 32150



Adjuster 4322 021 32180

ASSEMBLING AND MOUNTING

ASSEMBLING



A52776

Cementing

During the cementing procedure care must be taken that the centre holes are kept in line.

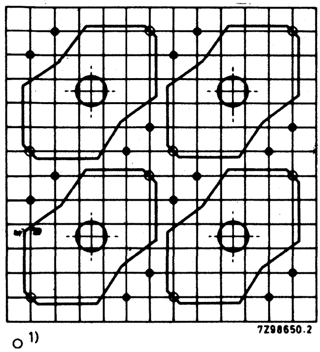
Assembly with clips

The core halves can be clamped together by using two clips. The tags of the clips are used for mechanical fastening and/or for earthing.
For a stable inductance we recommend that an adhesive be applied between the coil former and the lower core half.

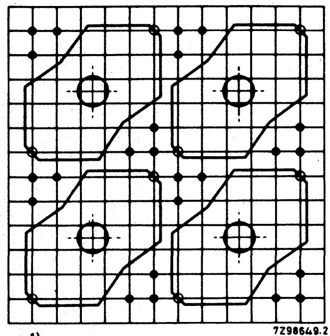
The use of a tool for attaching the clips is recommended. (Drawings of a simple tool for this purpose are available under number 4322 058 00150.)

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).

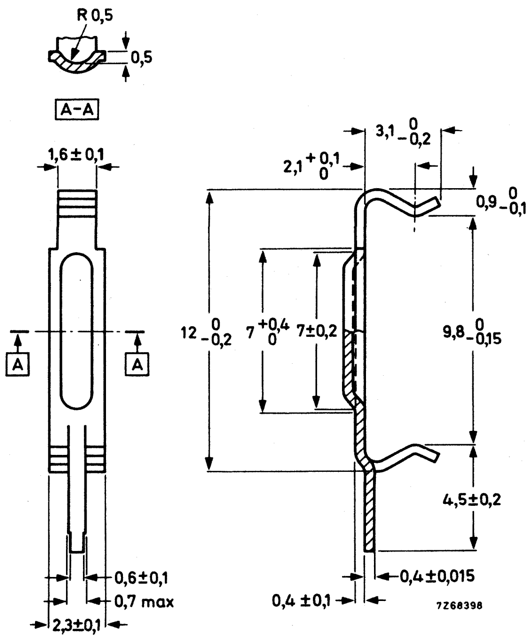


o 1)



o 1)

PART DRAWING (dimensions in mm)

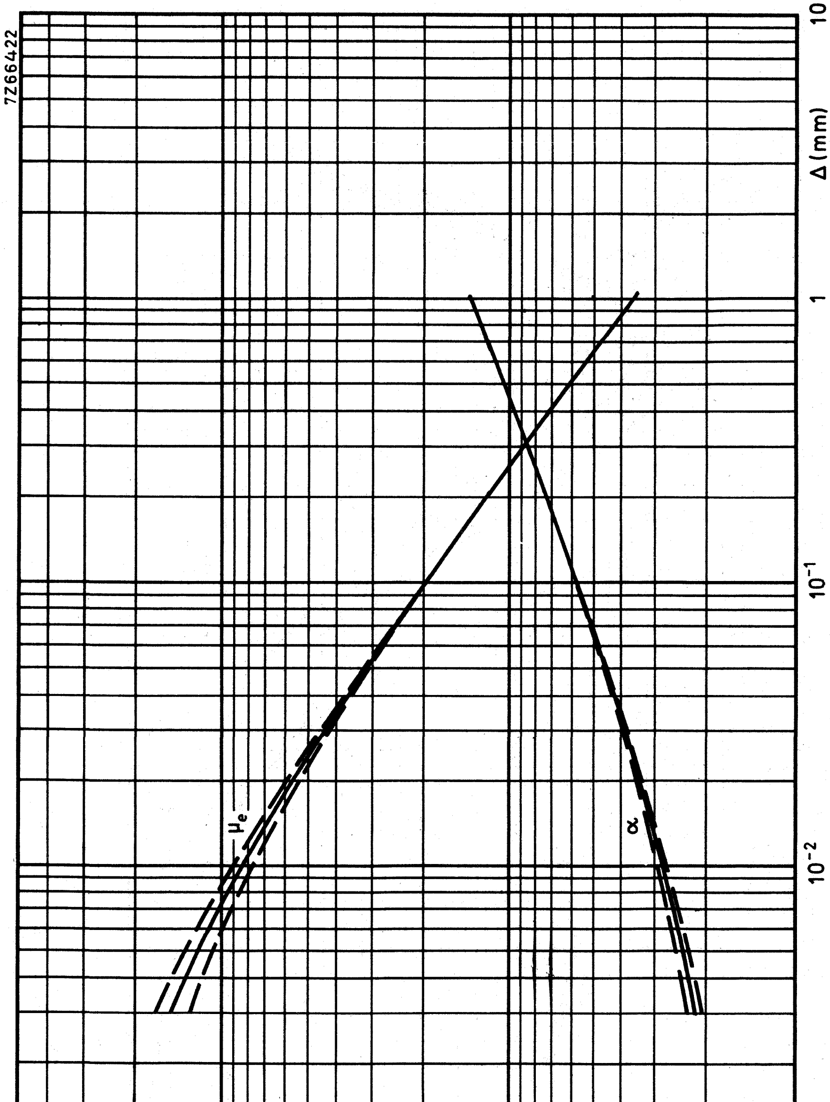


Clip 4322 021 31780
Material: steel, gold plated over nickel

1) Holes for tag on clip 4322 021 31780 (earth points).

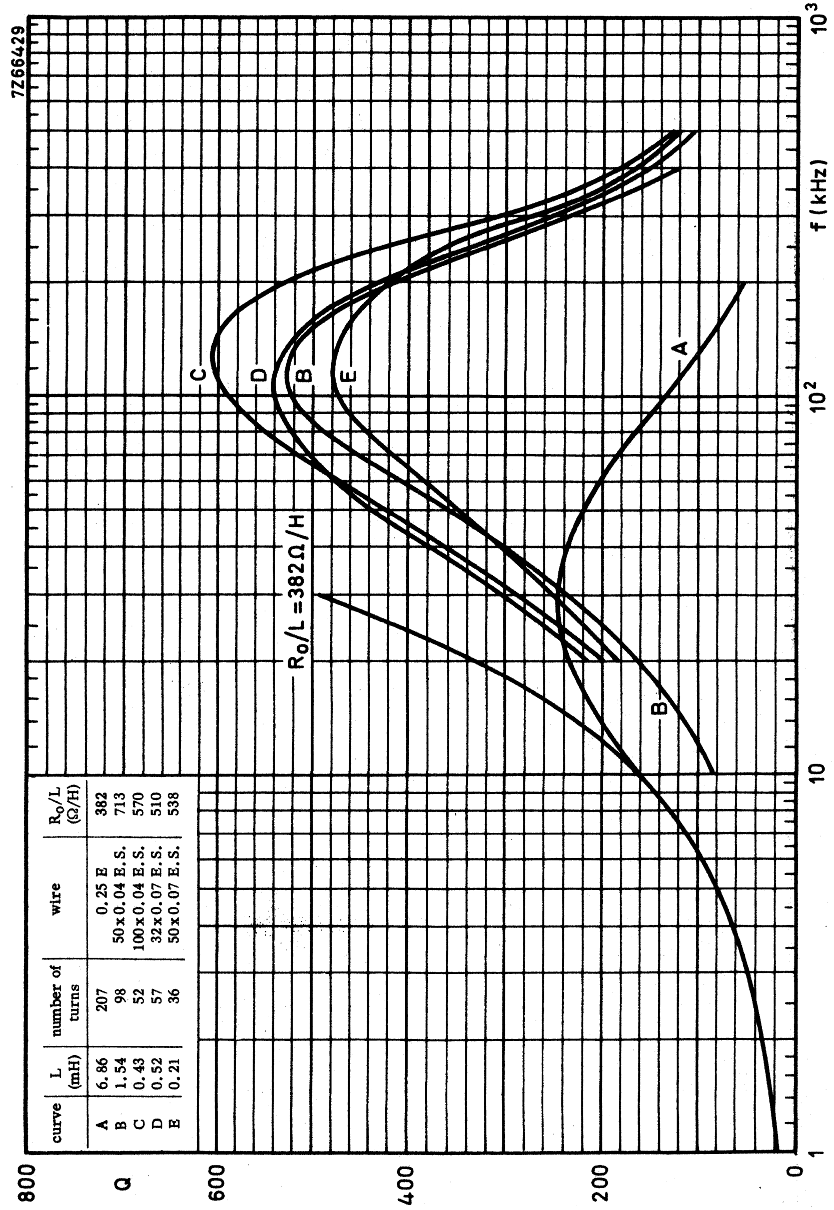
CHARACTERISTIC CURVES

μ_e - α CURVES



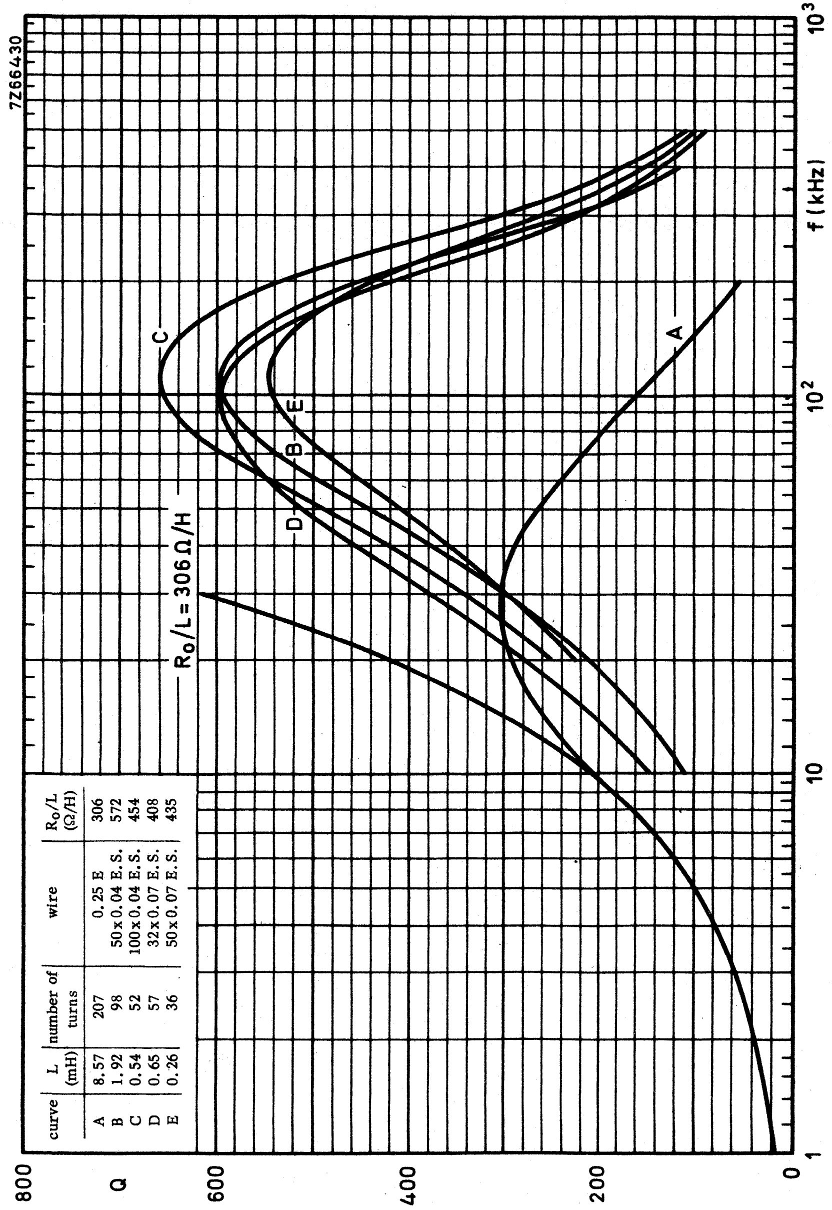
Relative effective permeability and turn factor for 1 mH as a function of the air gap length
$\mu_e \geq 1280$ at $\Delta = 3\ \mu m$ for 3B7 and 3H1

TYPICAL Q-CURVES FOR FXC 3B7 AND 3H1



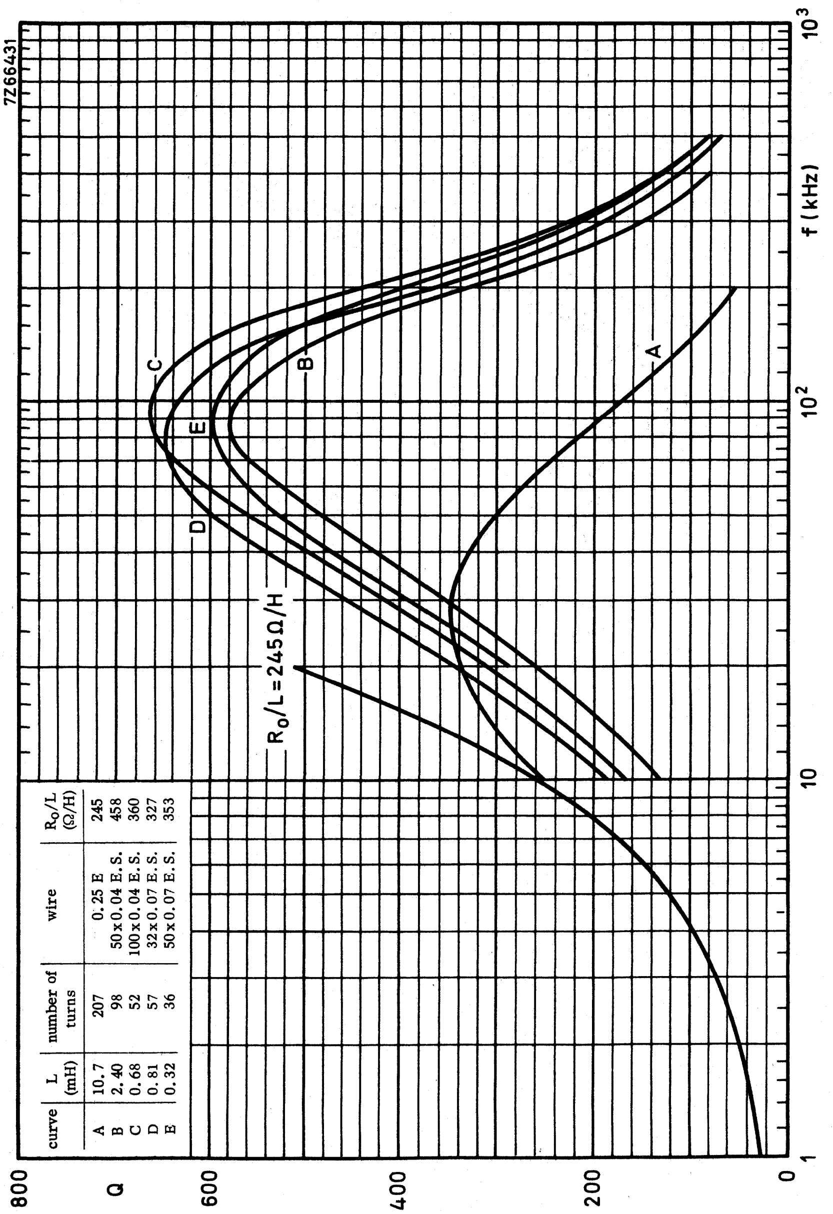
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	6.86	207	0.25 E	382
B	1.54	98	50x0.04 E.S.	713
C	0.43	52	100x0.04 E.S.	570
D	0.52	57	32x0.07 E.S.	510
E	0.21	36	50x0.07 E.S.	538

FXC 3B7/3H1, single-section coil former, $A_L = 160$



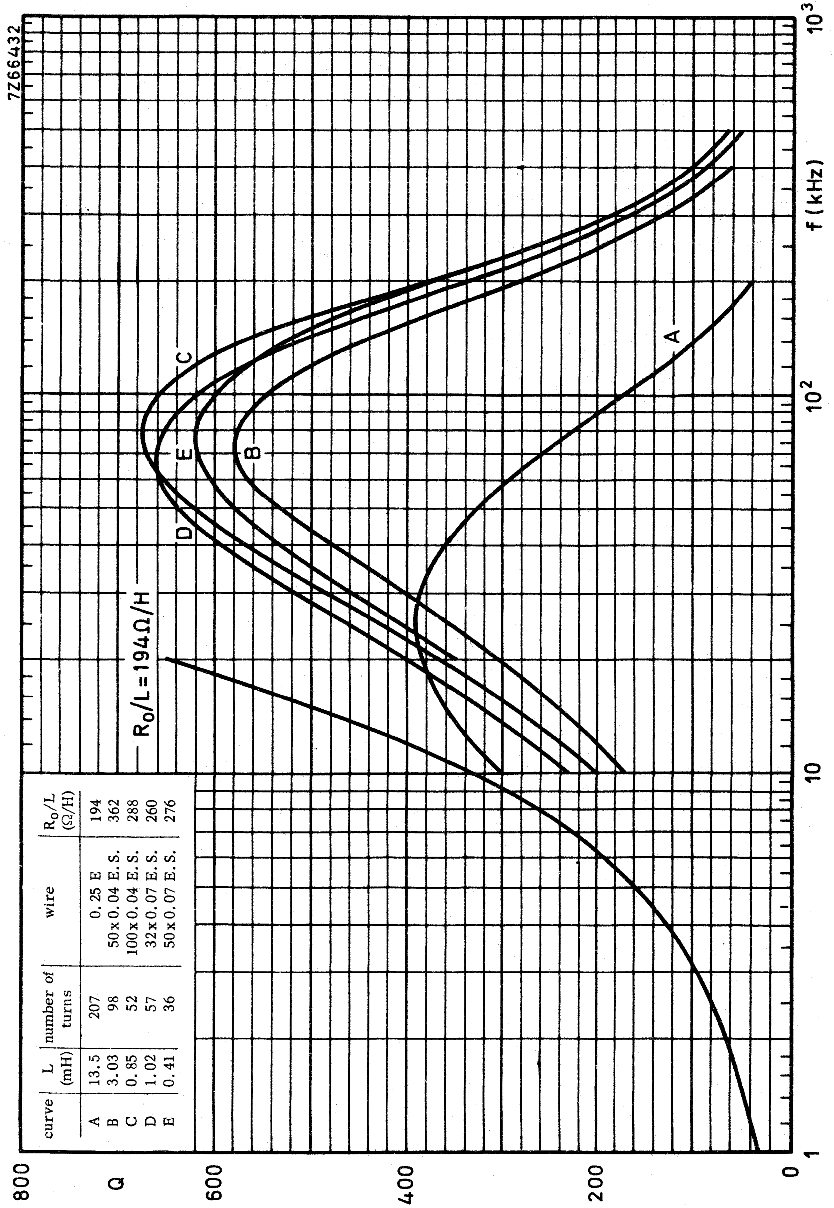
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	8.57	207	0.25 E	306
B	1.92	98	50 x 0.04 E.S.	572
C	0.54	52	100 x 0.04 E.S.	454
D	0.65	57	32 x 0.07 E.S.	408
E	0.26	36	50 x 0.07 E.S.	435

FXC 3B7/3H1, single-section coil former, A_L = 200



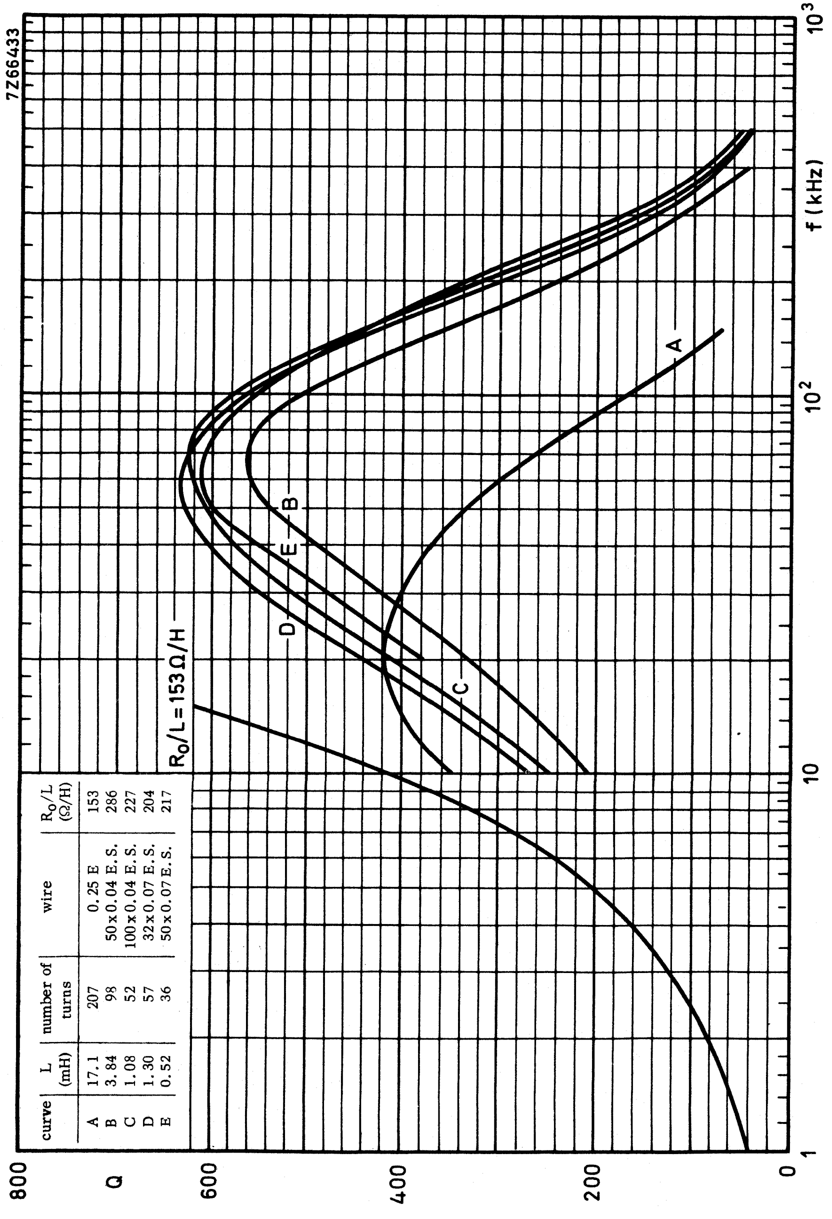
curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	10.7	207	0.25 E	245
B	2.40	98	50 x 0.04 E.S.	458
C	0.68	52	100 x 0.04 E.S.	360
D	0.81	57	32 x 0.07 E.S.	327
E	0.32	36	50 x 0.07 E.S.	353

FXC 3B7/3H1, single-section coil former, A_L = 250



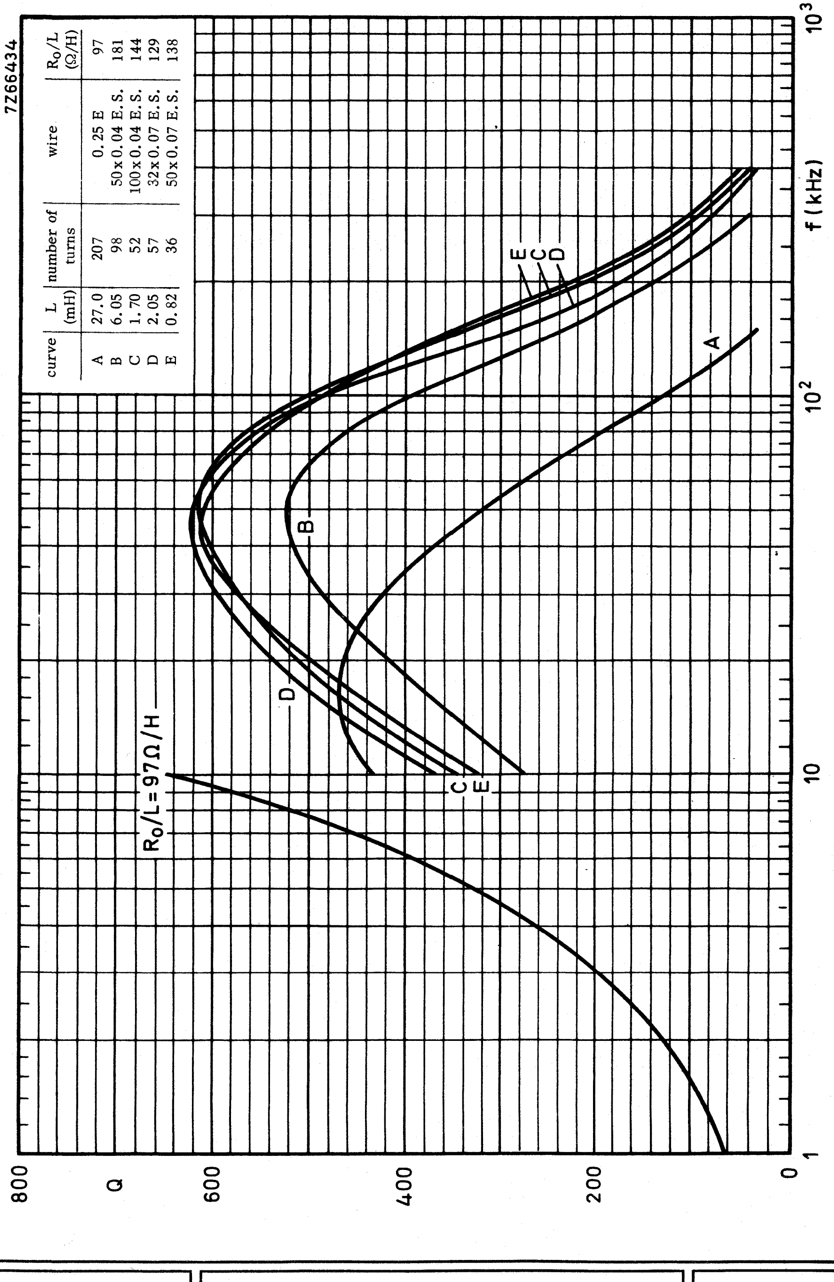
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	13.5	207	0.25 E	194
B	3.03	98	50 x 0.04 E.S.	362
C	0.85	52	100 x 0.04 E.S.	288
D	1.02	57	32 x 0.07 E.S.	260
E	0.41	36	50 x 0.07 E.S.	276

FXC 3B7/3H1, single-section coil former, $A_L = 315$



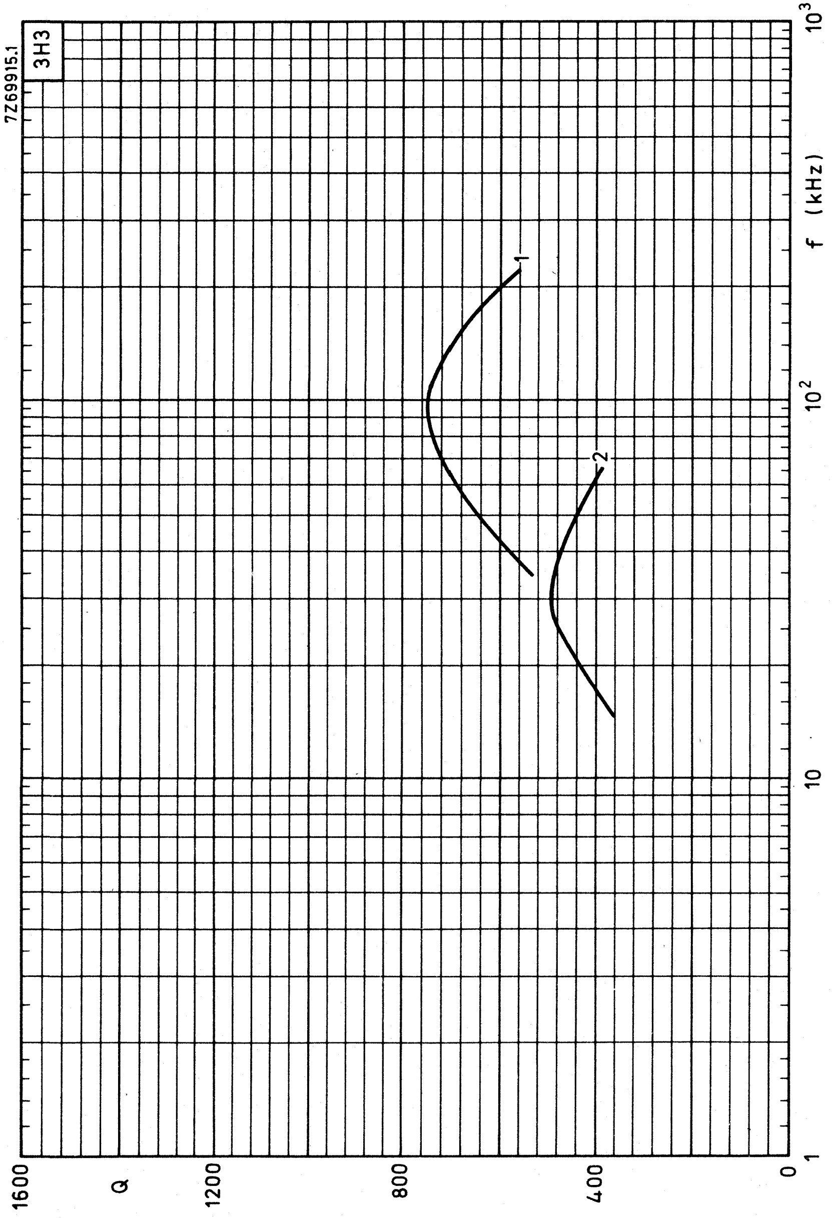
curve	L (mH)	number of turns	wire	R_0/L (Ω/H)
A	17.1	207	0.25 E	153
B	3.84	98	50 x 0.04 E.S.	286
C	1.08	52	100 x 0.04 E.S.	227
D	1.30	57	32 x 0.07 E.S.	204
E	0.52	36	50 x 0.07 E.S.	217

FXC 3B7/3H1, single-section coil former, $A_L = 400$

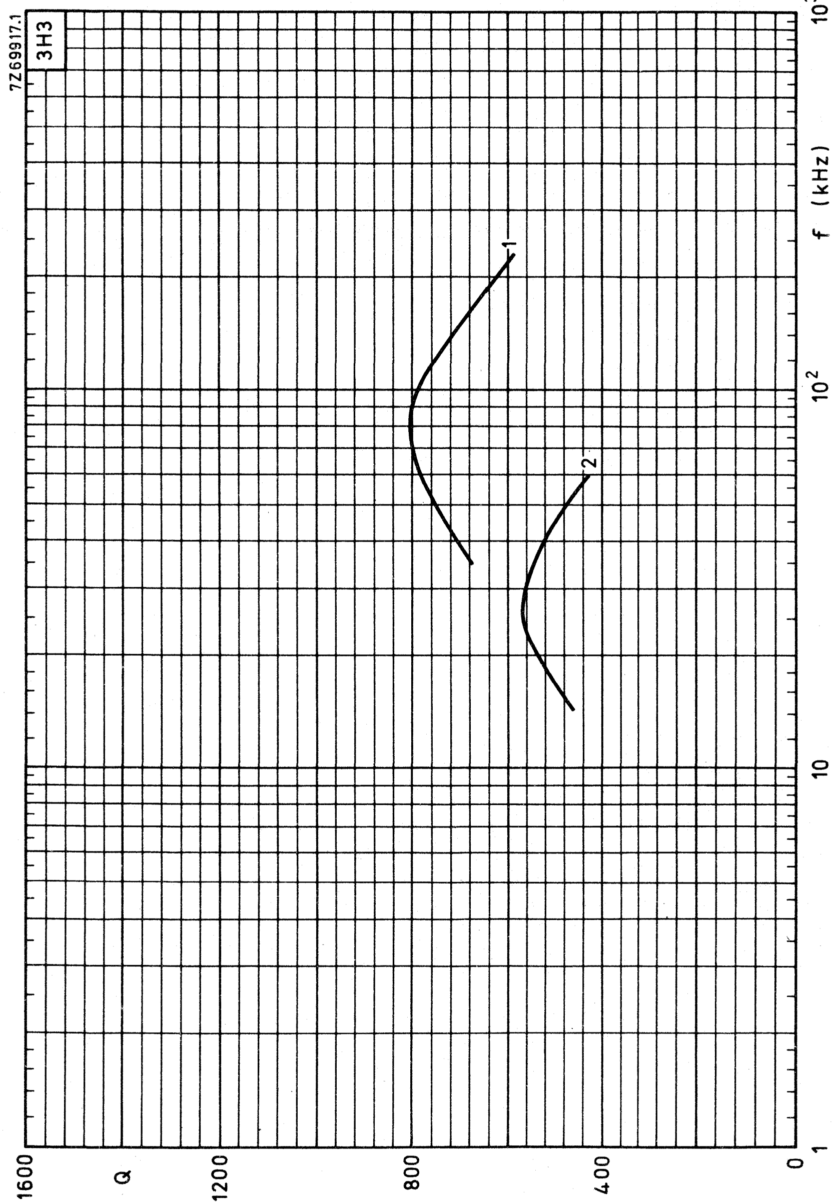


curve	L (mH)	number of turns	wire	R_o/L (Ω/H)
A	27.0	207	0.25 E	97
B	6.05	98	50 x 0.04 E.S.	181
C	1.70	52	100 x 0.04 E.S.	144
D	2.05	57	32 x 0.07 E.S.	129
E	0.82	36	50 x 0.07 E.S.	138

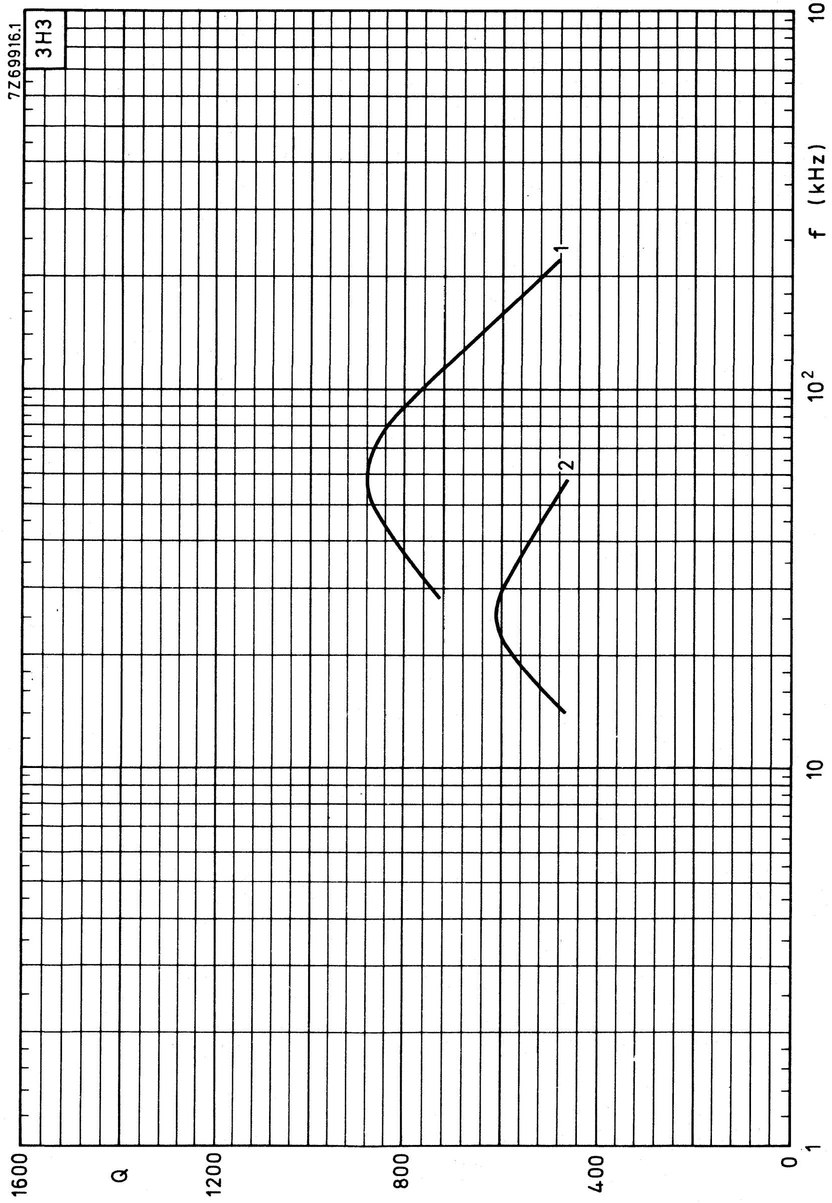
FXC 3B7/3H1, single-section coil former, $A_L = 630$



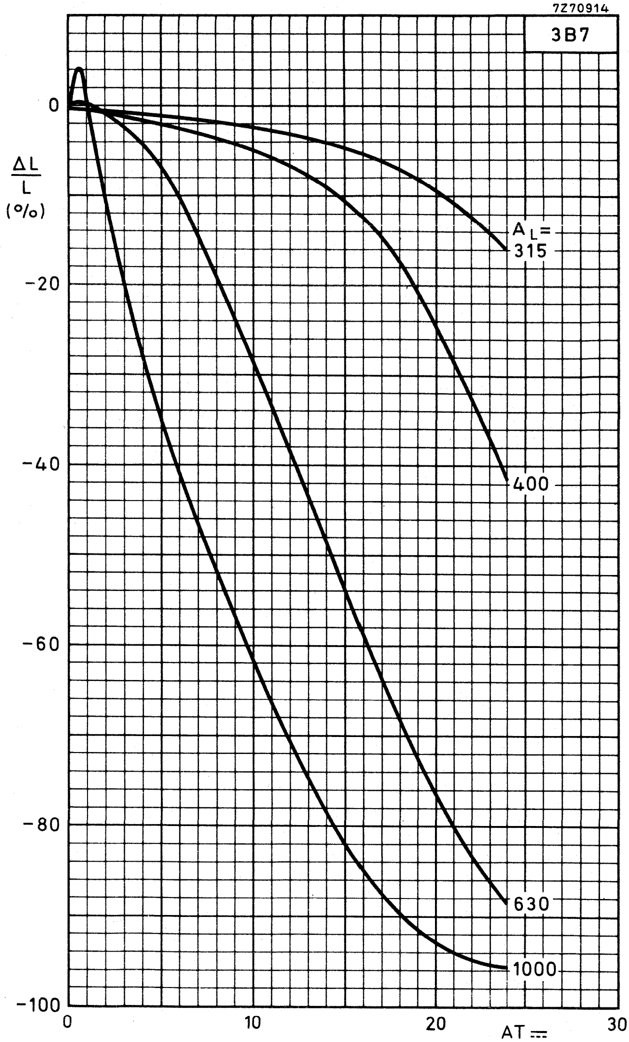
Q-curves. Single-section coil former; curve 1 : 57 turns (32 x 0, 07 E. S. wire)
curve 2 : 207 turns (0, 25 E wire).
A_L = 250

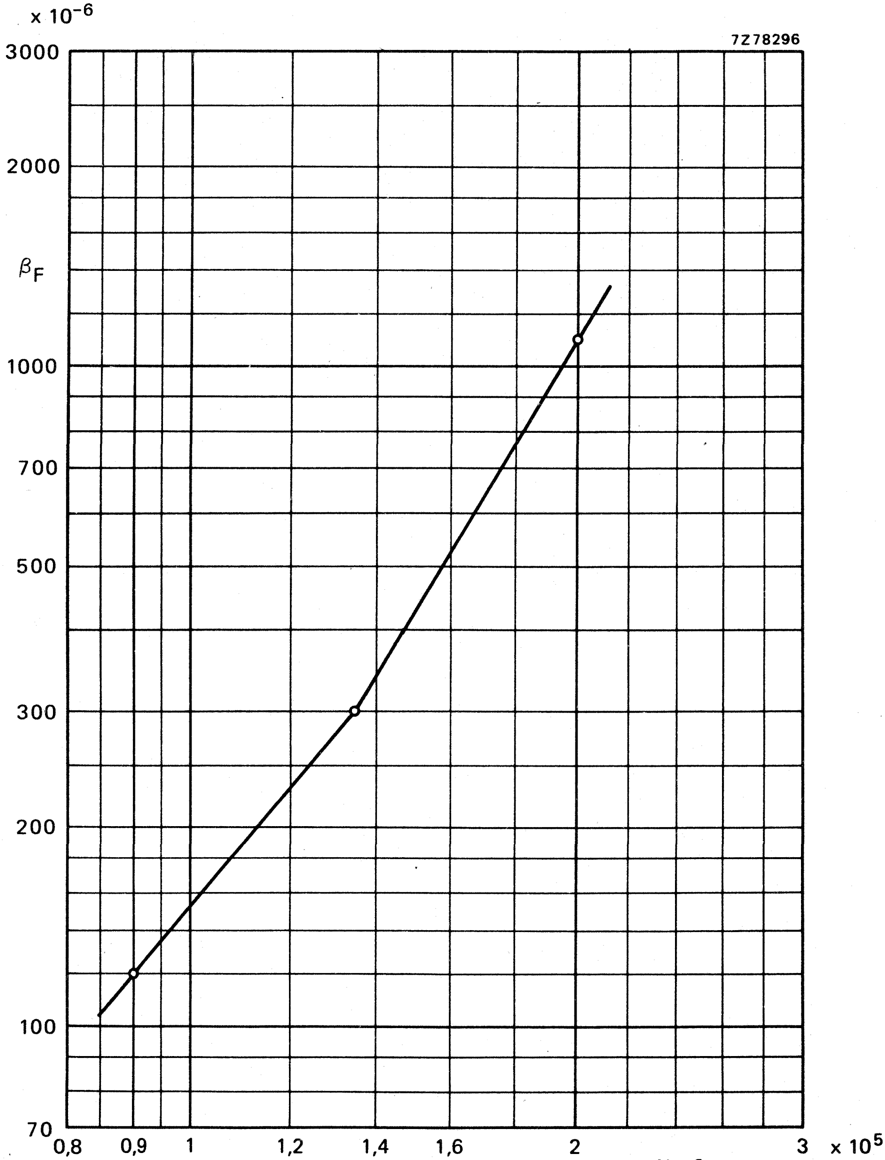


Q-curves. Single-section coil former; curve 1 : 57 turns (32 x 0,07 E.S. wire)
curve 2 : 207 turns (0,25 E wire).
A_L = 315



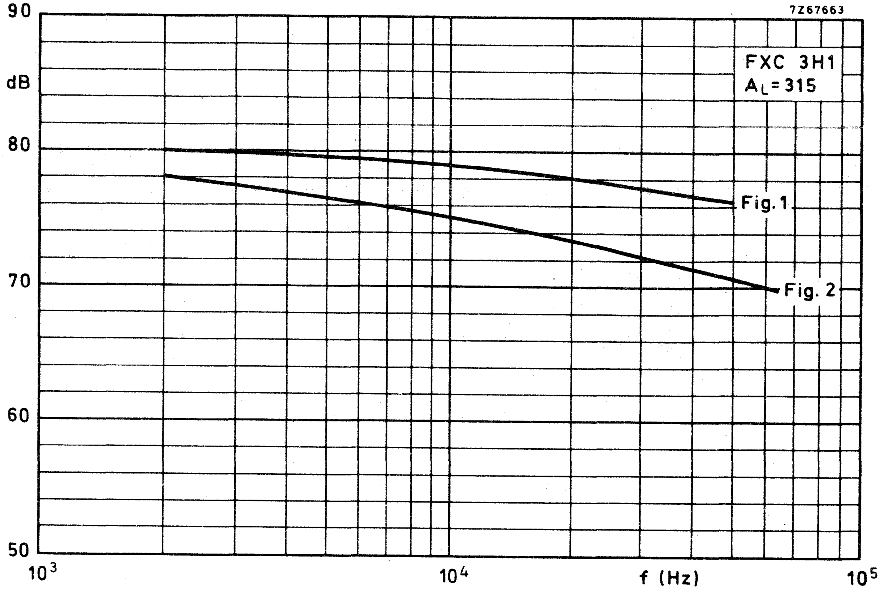
Q-curves. Single-section coil former; curve 1: 57 turns (32 x 0, 07 E. S. wire)
curve 2: 207 turns (0, 25 E wire).
$A_L = 400$


7Z70914
3B7
0
ΔL/L (%)
-20
-40
-60
-80
-100
0
10
20
30
AT ⎓
A L = 315
400
630
1000



$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

CROSSTALK ATTENUATION



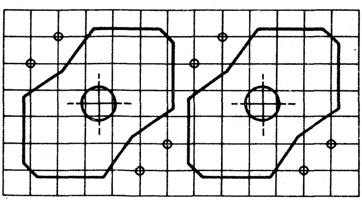


Fig. 1 7Z67662

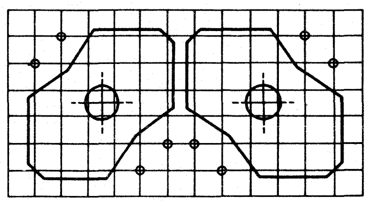
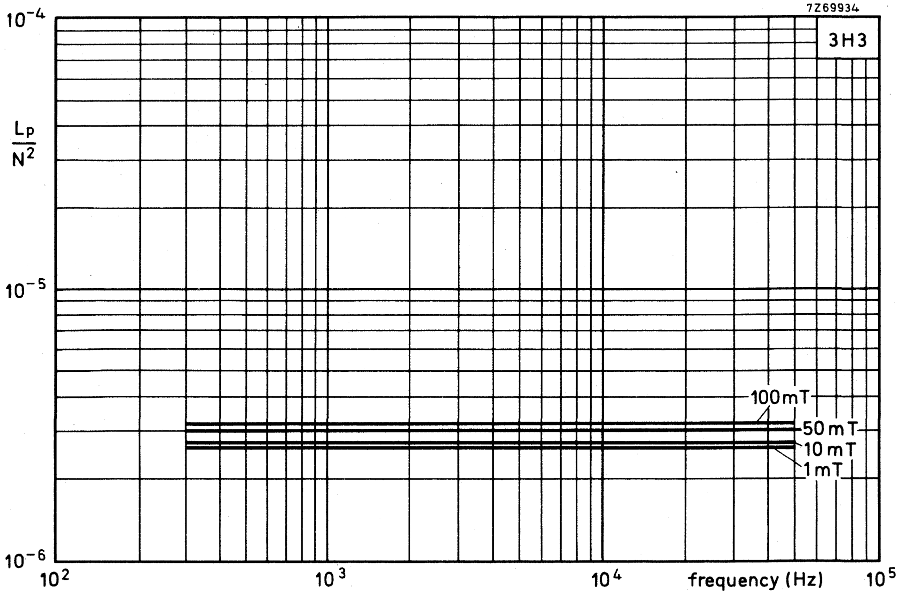
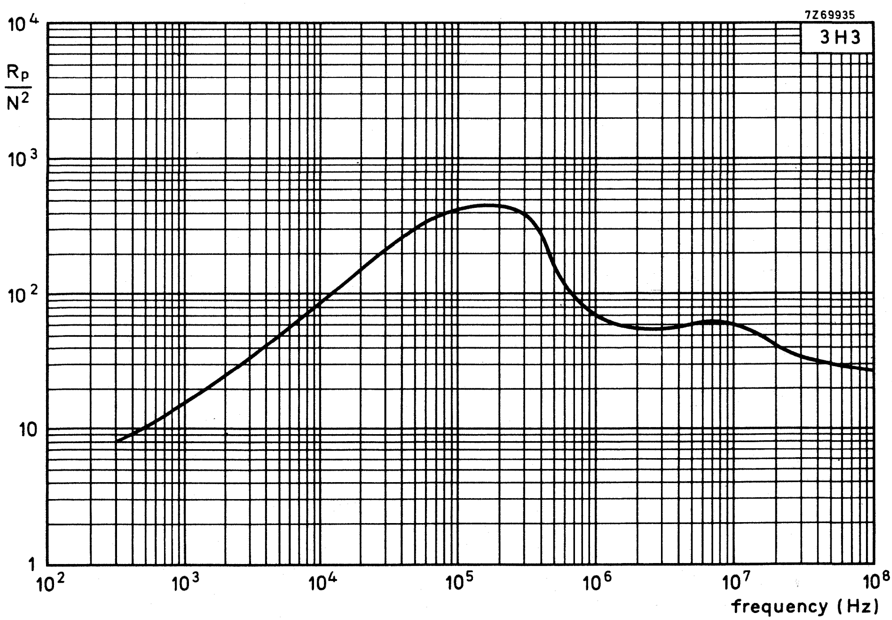


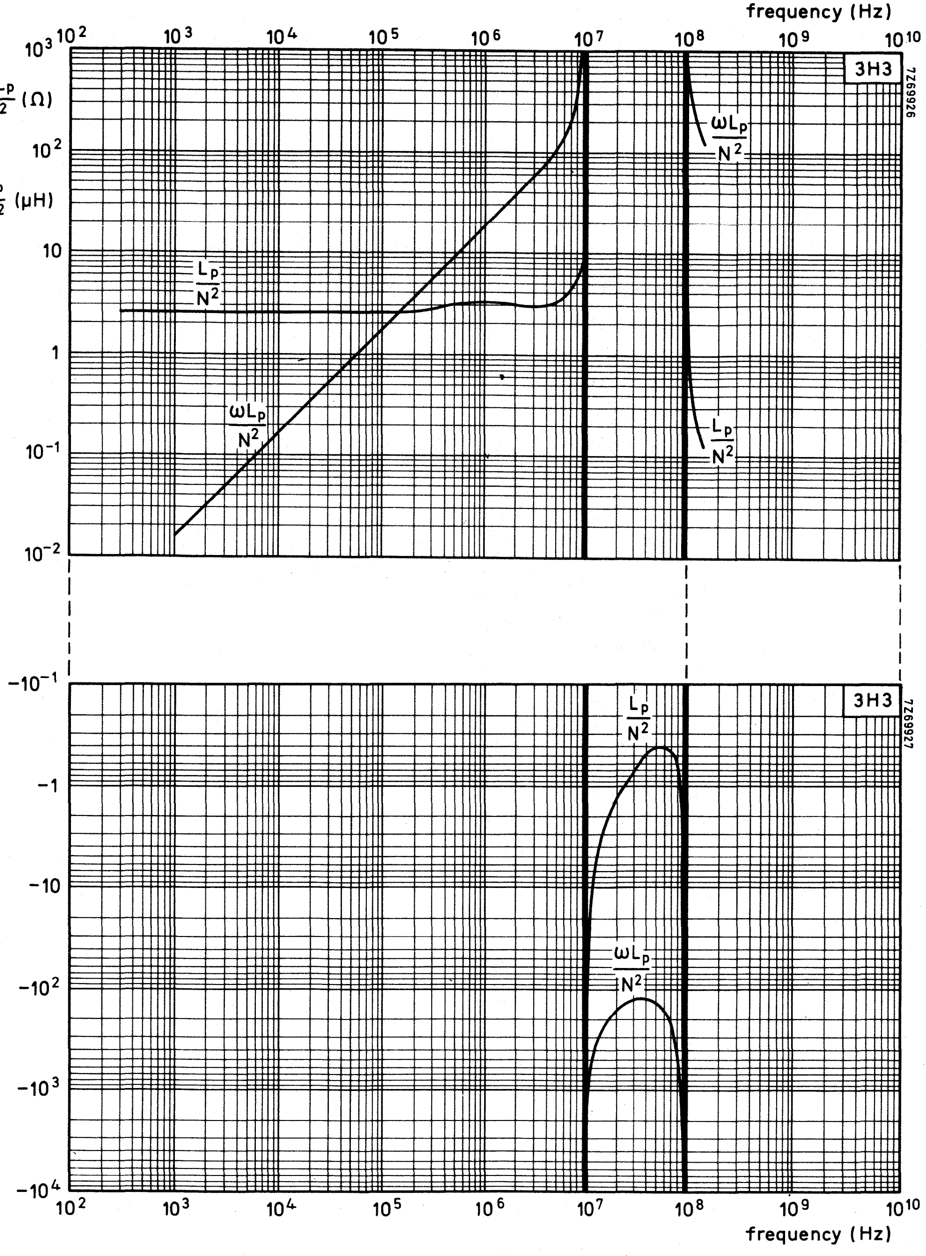
Fig. 2 7Z67661



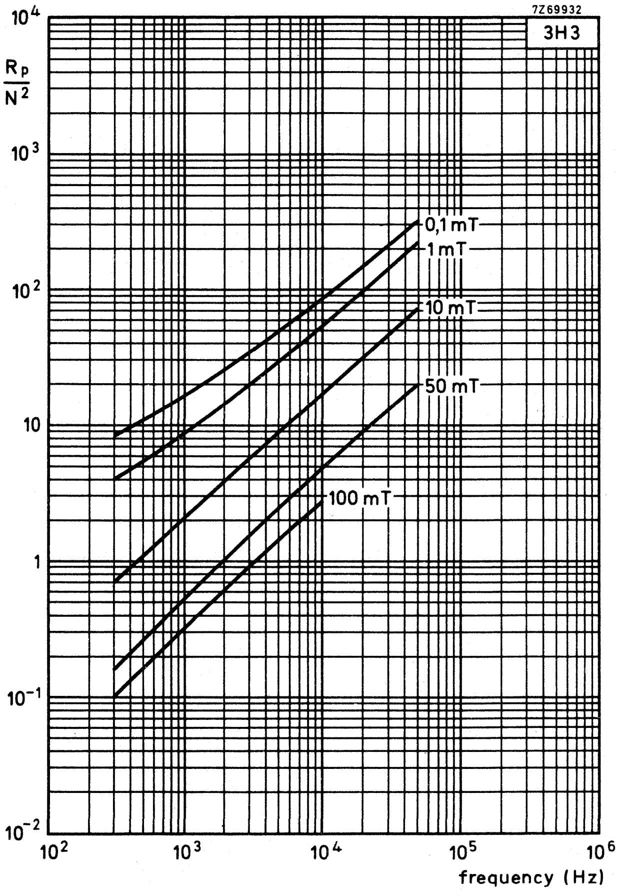
Inductance as a function of the frequency.



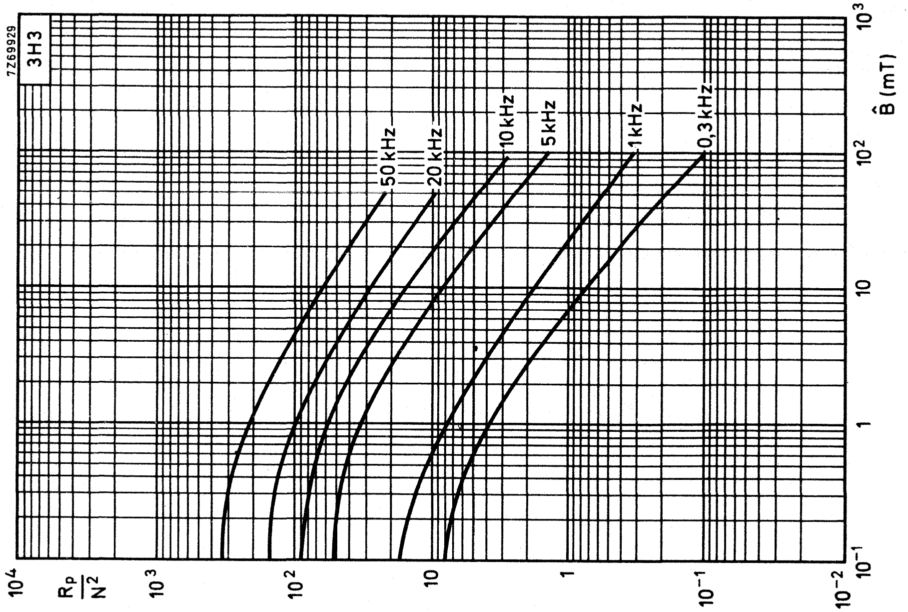
Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT.



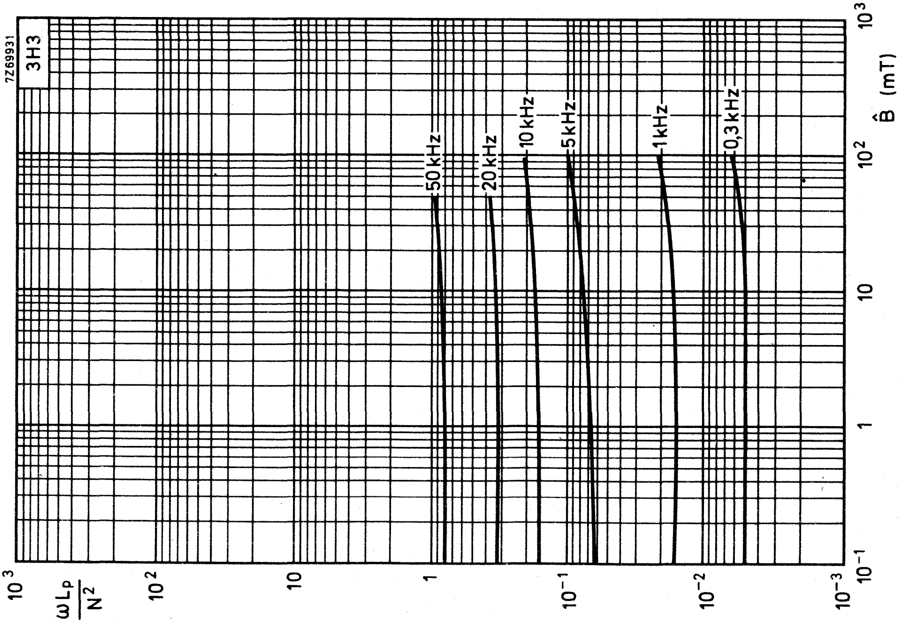
Inductance as a function of the frequency.



Losses as a function of the frequency.



Losses as a function of the peak induction.



Inductance as a function of the peak induction.

SQUARE CORES

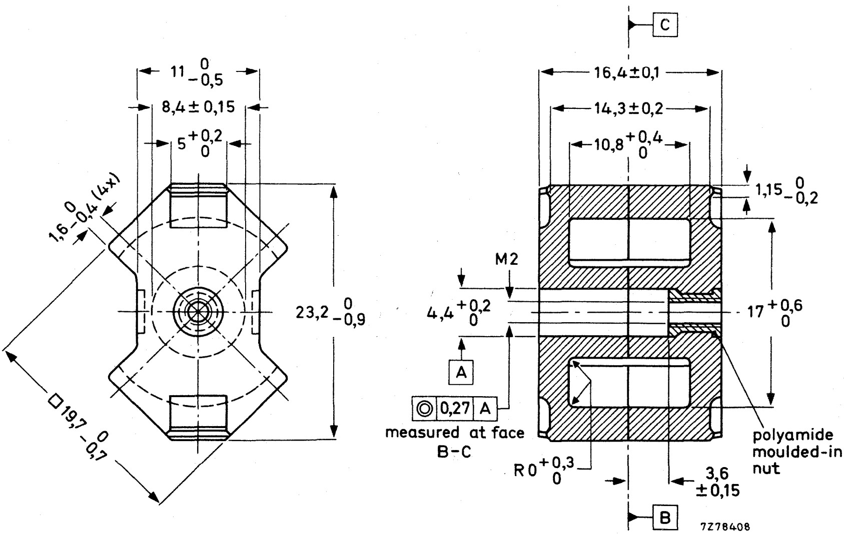
Three types of core can be supplied:

- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L.
- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without air gap.

The square cores are in accordance with the following specifications: IEC 431 (international), C93-324 (France), DIN 41980 (Germany).

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA Dimensions in mm



Pulling-out force of the nut	⩾ 40 N
Torque of the screw thread	⩽ 1 N
Extraction force of adjuster from nut	⩾ 30 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}682\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0131\ mm^{-3}$; $V_e = 1850\ mm^3$; $l_e = 35{,}5\ mm$; $A_e = 52{,}0\ mm^2$.

Mass of a core set: 17,5 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}604\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00952\ mm^{-3}$; $V_e = 2440\ mm^3$; $l_e = 38{,}4\ mm$; $A_e = 63{,}0\ mm^2$.

Mass of a core set: 18,7 g.

ELECTRICAL DATA

The combination of two square core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 95 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	3B8	3D3	3E1	3E4	3H1	4C6
$A_L \pm 25\%$	4	$\leqslant 0{,}1$	25 ± 1	3400	2700	1330			3400	230
$\mu_e \pm 25\%$	4	$\leqslant 0{,}1$	25 ± 1	1840	1455	720			1840	126
α	4	$\leqslant 0{,}1$	25 ± 1	$\leqslant 19{,}8$	$\leqslant 22{,}2$	$\leqslant 31{,}6$			$\leqslant 19{,}8$	$\leqslant 75{,}8$
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	$\leqslant 0{,}1$	25 ± 1				$\leqslant 2{,}5$	$\leqslant 2{,}5$		
	30	$\leqslant 0{,}1$	25 ± 1	$\leqslant 2{,}5$	$\leqslant 4{,}0$				$\leqslant 2{,}5$	
	100	$\leqslant 0{,}1$	25 ± 1	$\leqslant 5{,}0$	$\leqslant 6{,}0$	$\leqslant 8{,}0$	$\leqslant 20$	$\leqslant 20$	$\leqslant 5{,}0$	
	500	$\leqslant 0{,}1$	25 ± 1			$\leqslant 14$	$\leqslant 200$	$\leqslant 200$		
	1 000	$\leqslant 0{,}1$	25 ± 1			$\leqslant 30$				
	2 000	$\leqslant 0{,}1$	25 ± 1							$\leqslant 40$
	10 000	$\leqslant 0{,}1$	25 ± 1							$\leqslant 100$
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	$\leqslant 1{,}1$		$\leqslant 1{,}8$	$\leqslant 1{,}8$		$\leqslant 0{,}86$	
	30	1,5 to 3,0	25 ± 1		$\leqslant 1{,}5$					
	100	0,3 to 1,2	25 ± 1							$\leqslant 9{,}2$
$\alpha_F \times 10^6/°C$	$\leqslant$ 100	$\leqslant 0{,}1$	5 to 25					0 to + 2	+ 0,5 to 1,5	−2 to + 4
	$\leqslant$ 100	$\leqslant 0{,}1$	25 to 55	−0,6 to + 0,6	0 to + 6			0 to + 2	+ 0,5 to 1,5	0 to + 6
	$\leqslant$ 100	$\leqslant 0{,}1$	25 to 70	−0,6 to + 0,6	0 to + 6	0 to + 2	0 to + 2	0 to + 2	+ 0,5 to 1,5	
$D_F \times 10^6$ (10 - 100 min)	$\leqslant$ 100	$\leqslant 0{,}1$	25 ± 0,1	$\leqslant 4{,}3$	$\leqslant 8{,}0$	$\leqslant 12$	$\leqslant 4{,}3$	$\leqslant 4{,}3$	$\leqslant 4{,}3$	$\leqslant 10$
$\beta_F \times 10^6$ measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C: at $\mu_e \times \frac{N \times I_o}{l_e} = 0{,}90 \times 10^5$ A/m					$\leqslant 110$					
$= 1{,}45 \times 10^5$ A/m					$\leqslant 300$					
$= 2{,}10 \times 10^5$ A/m					$\leqslant 1100$					

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance %	catalogue number 4322 022					
			3B7	3D3	3E1	3E4	3H1	4C6
40	22	± 1		71420				71820
63	34	± 1	71030	71430			71230	71830
100	54	± 1	71040	71440			71240	71840
160	88	± 1,5	71050	71450			71250	71850
250	135	± 2	71060				71260	
315	170	± 2	71070				71270	
400	220	± 3	71080				71280	
630	340	± 3	71100				71300	
1000	540	± 10	71110				71310	
1250	680	± 10	71190				71390	
5500	2985	± 25			51950 *			
6300	3050	± 25			51800 *			
7100	3850	± 25				51890 *		
8000	3850	± 25				51900 *		

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

Core sets without nut: replace the eighth digit of the catalogue number (7) by 5.
Cores with $A_L \leqslant 250$ have a symmetrical air gap.
Cores with $A_L \geqslant 315$ have an asymmetrical air gap.
Types marked * are only available without adjuster nut.
In order to obtain better performance the types 4322 022 51800 and 51900 are executed without centre hole.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number	
3B7	4322 020 27250	
3B8	4322 020 27420	(without centre hole)
3D3	4322 020 27270	
3H1	4322 020 27260	
4C6	4322 020 27280	

COIL FORMERS

Four types of coil former can be supplied:

- Single-section, 4-pin coil former, catalogue number 4322 021 32360 (Fig. 1)
- Single-section, 8-pin coil former, catalogue number 4322 021 32380 (Fig. 2)
- Single-section, 12-pin coil former, catalogue number 4322 021 32390 (Fig. 3)
- Two-section, 8-pin coil former, catalogue number 4322 021 32420 (Fig. 4)

The coil formers are packed on a polystyrene plate of 100 or in a cardboard box of 500. Please order in multiples of these quantities.

Properties

Material of former	phenolformaldehyde reinforced with glass fibre,
Material of pins	phosphor bronze, dip-soldered
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 ^oC
Solderability	resistant against dip-soldering at 400 ^oC for 2 s
D.C. losses, $\frac{R_o}{L}$	$\frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11{,}4 \times 10^3\ \Omega/H$
Mass	0,55 g

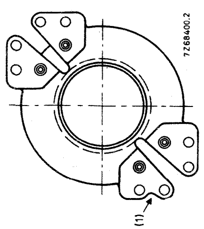


Fig. 1.

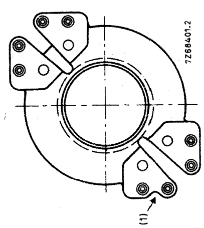


Fig. 2.

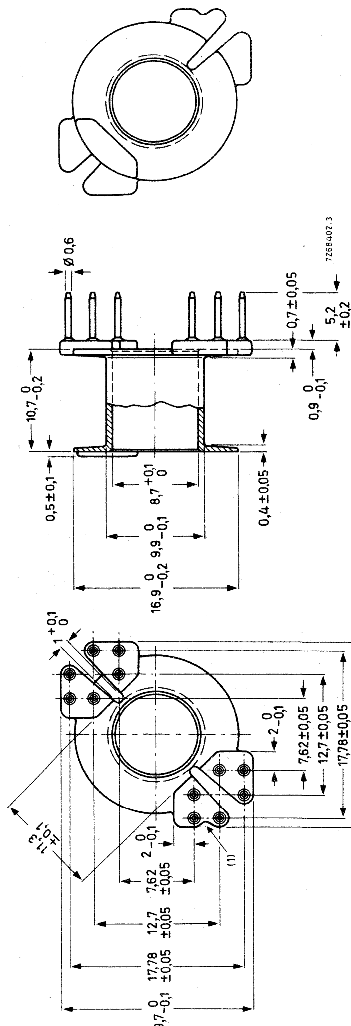


Fig. 3.

(1) Marking point.

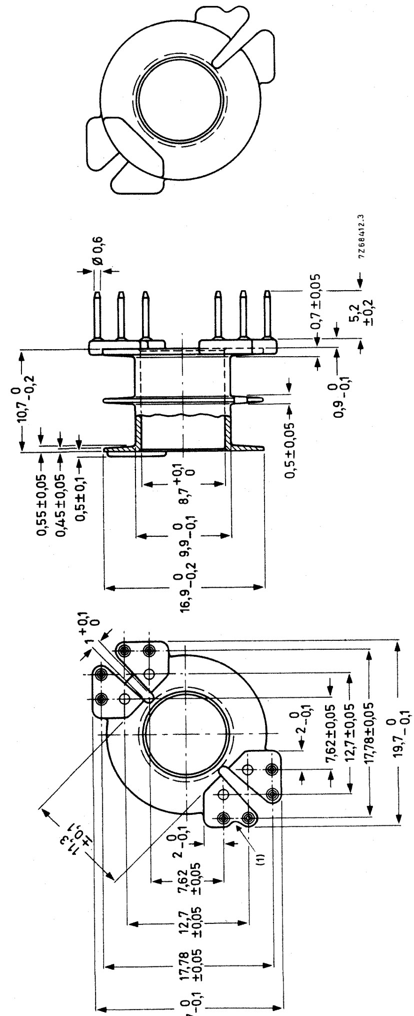
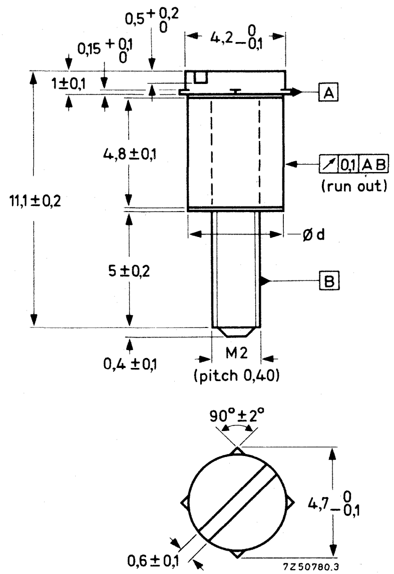


Fig. 4.

(1) marking point

INDUCTANCE ADJUSTERS

ADJUSTERS



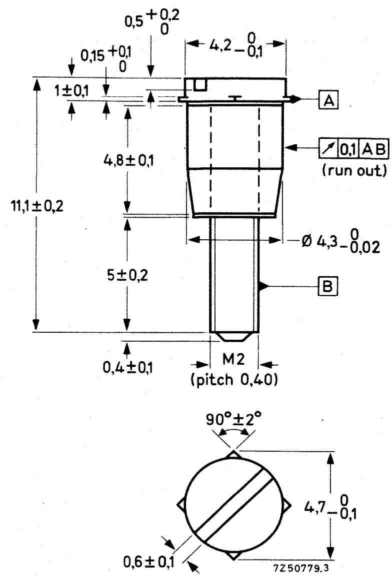


Fig. A. d = 4 mm, tol. −0,02 mm
Fig. C. d = 3,85 mm, tol. −0,02 mm

Fig. B.

The tolerances on inductance of the pre-adjusted cores (without adjuster) are given in the table pre-adjusted cores with standard A_L values. 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 adjuster. Such an adjuster increases the inductance of the coil (see following pages).
The adjuster 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 adjuster. For special requirements a larger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower A_L value.
The influence of the adjuster on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.
Table II shows the type of adjuster recommended for different square cores.

Table I, types of adjuster

Fig. 1	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

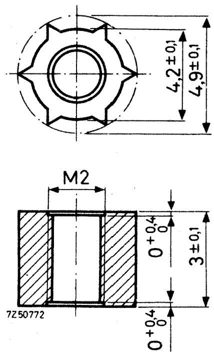
Table II, recommended application

A_L	3B7/3H1/3D3 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 adjusters are packed in bags of 100. Please order in multiples of 100.

NUT FOR ADJUSTER

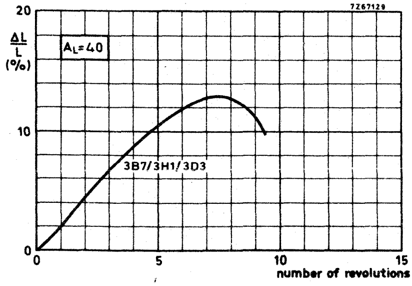
These data are given for those manufacturers who prefer to insert the nut themselves.



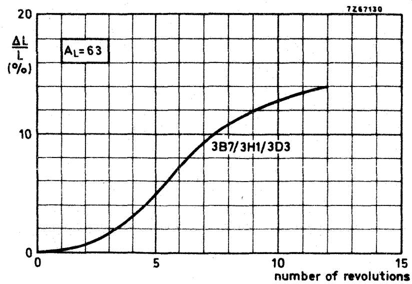
Catalogue number	4322 021 30150
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	3,6 ± 0,15 mm

The nuts are packed in bags of 100. Please order in multiples of 100.

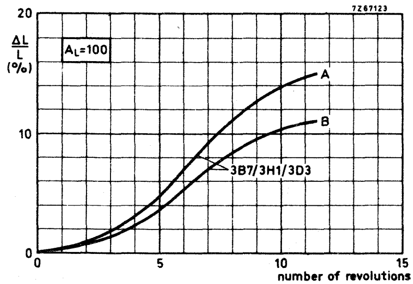
ADJUSTMENT CURVES



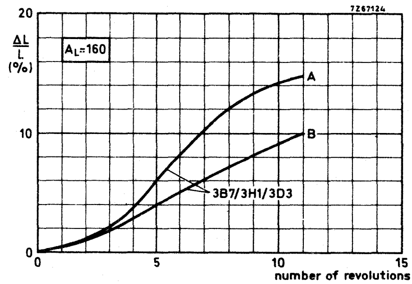
Adjuster 4322 021 31060



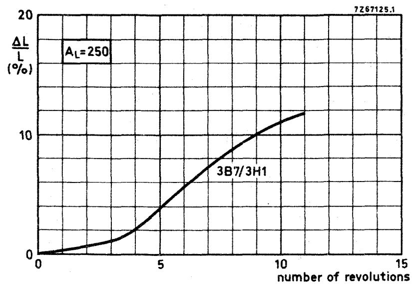
Adjuster 4322 021 31060



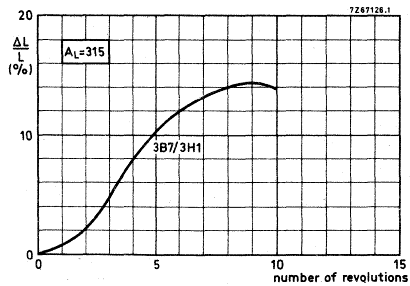
Adjuster 4322 021 31000 (curve A)
Adjuster 4322 021 31060 (curve B)



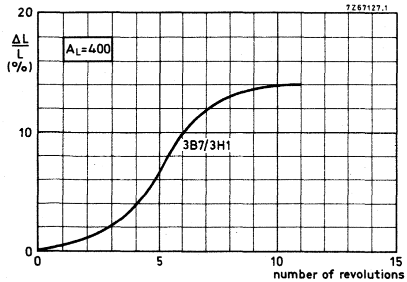
Adjuster 4322 021 31020 (curve A)
Adjuster 4322 021 31000 (curve B)



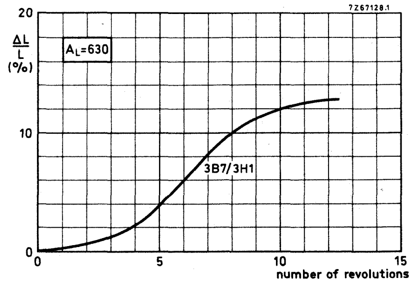
Adjuster 4322 021 31020



Adjuster 4322 021 32190

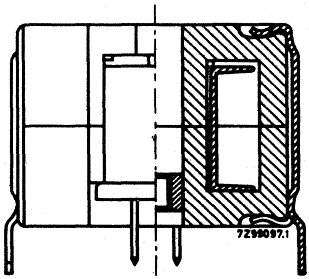


Adjuster 4322 021 31100



Adjuster 4322 021 31240

ASSEMBLING AND MOUNTING



ASSEMBLING

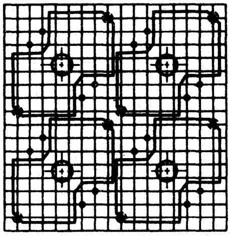
The core halves are clamped together by means of two clips, type 4322 021 31840. As can be seen in the drawing, the hooked ends of each clip fit into recesses made in the core halves.

For a stable inductance we recommend that an adhesive 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.)

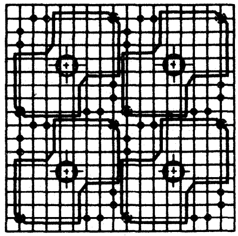
MOUNTING

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.

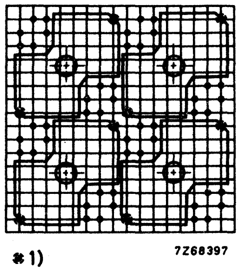
The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0,1 - inch grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 2,4 mm. The recommended hole diameter in the board is 1,0 ± 0,1 or 1,3 ± 0,1 mm (according to IEC publication 97).



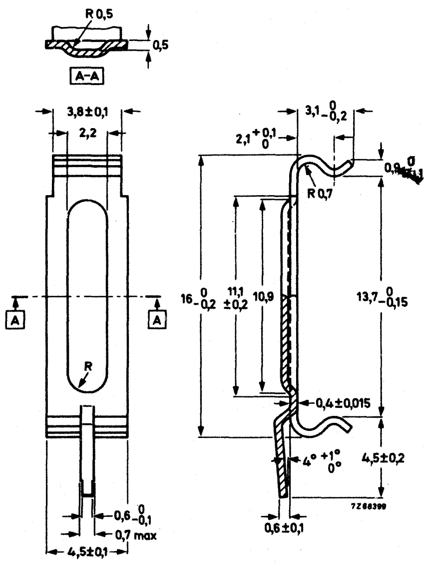
* 1)



* 1)



* 1)



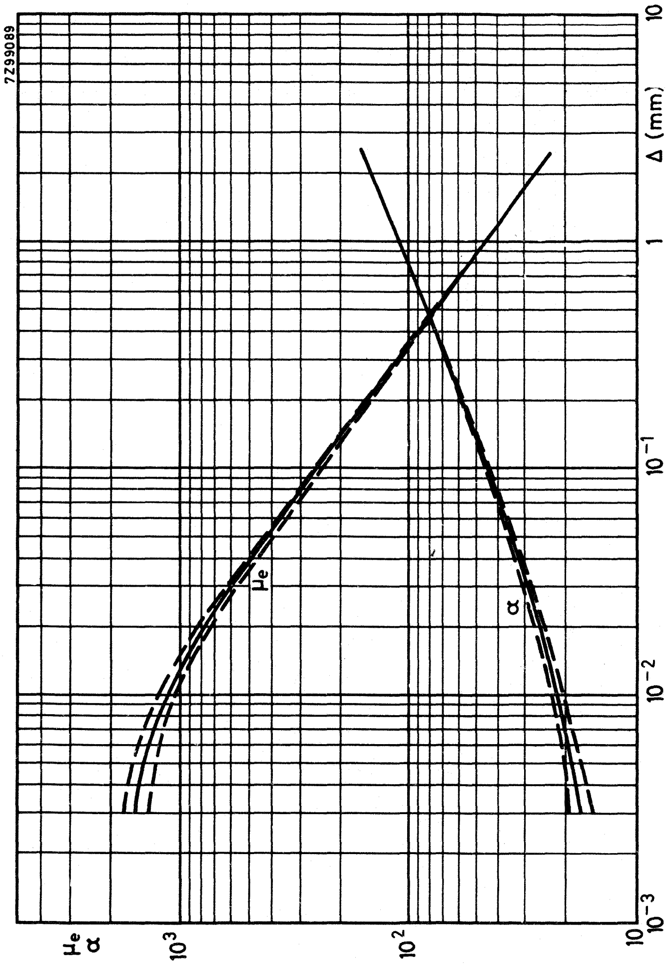
PART DRAWING (dimensions in mm)

Clip 4322 021 31840
Material: steel, gold plated over nickel

1) Holes for tag on clip 4322 021 31840.

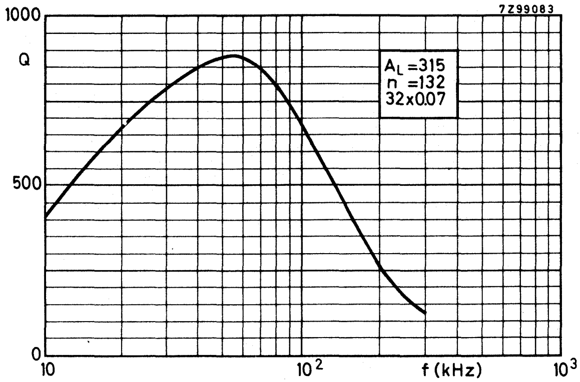
CHARACTERISTIC CURVES

μ_e - α CURVES

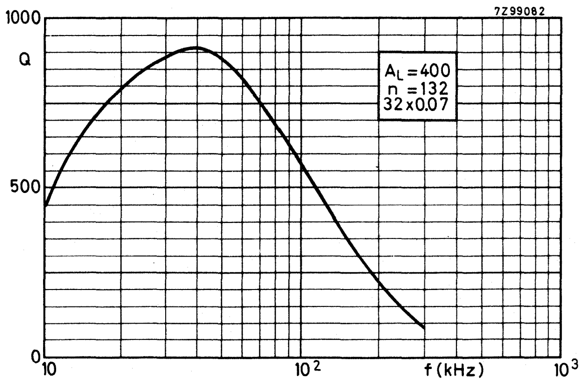


Relative effective permeability and turn factor for 1 mH as a function of the air gap length
$\mu_e = 1840 \pm 25\%$ at $\Delta = 3$ μm for 3B7 and 3H1

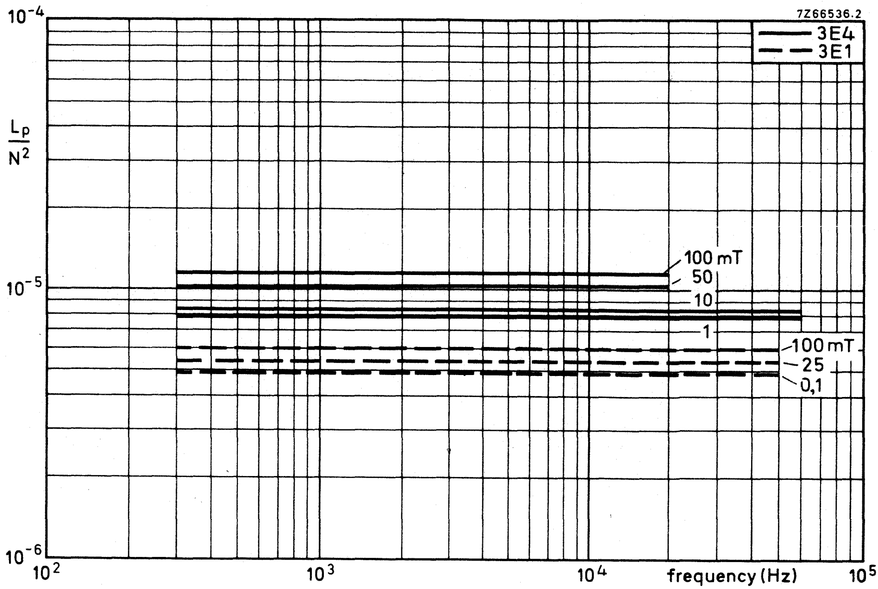
Q-CURVES



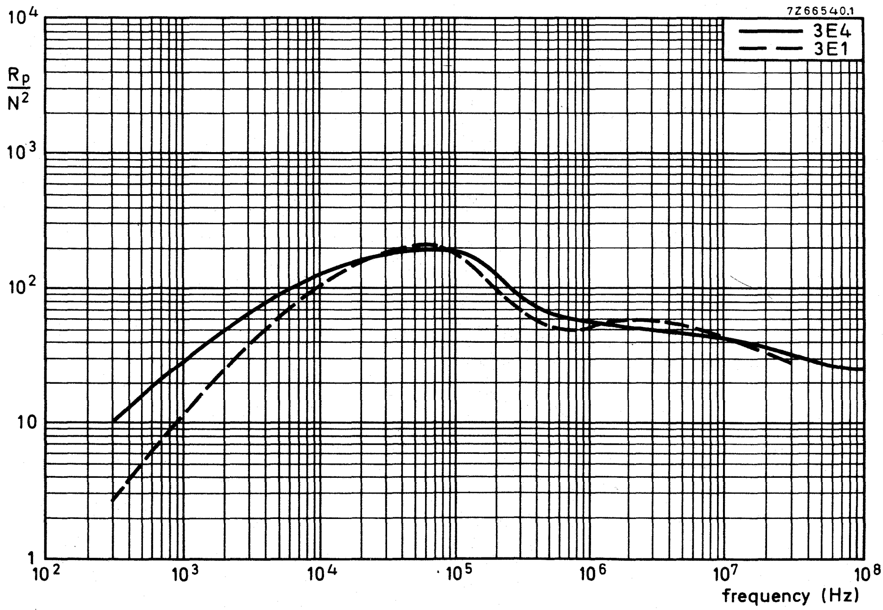
Provisional curve



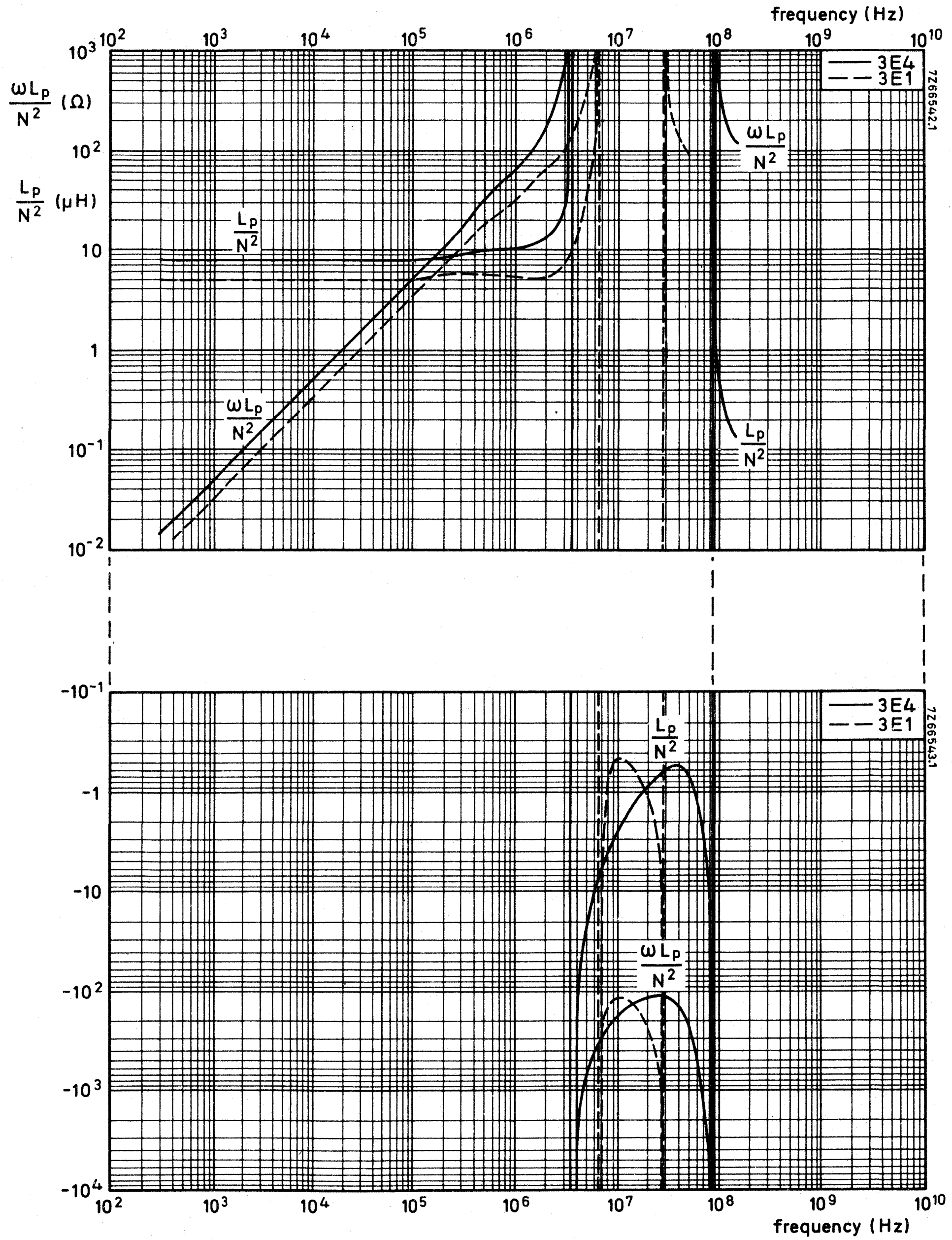
Provisional curve



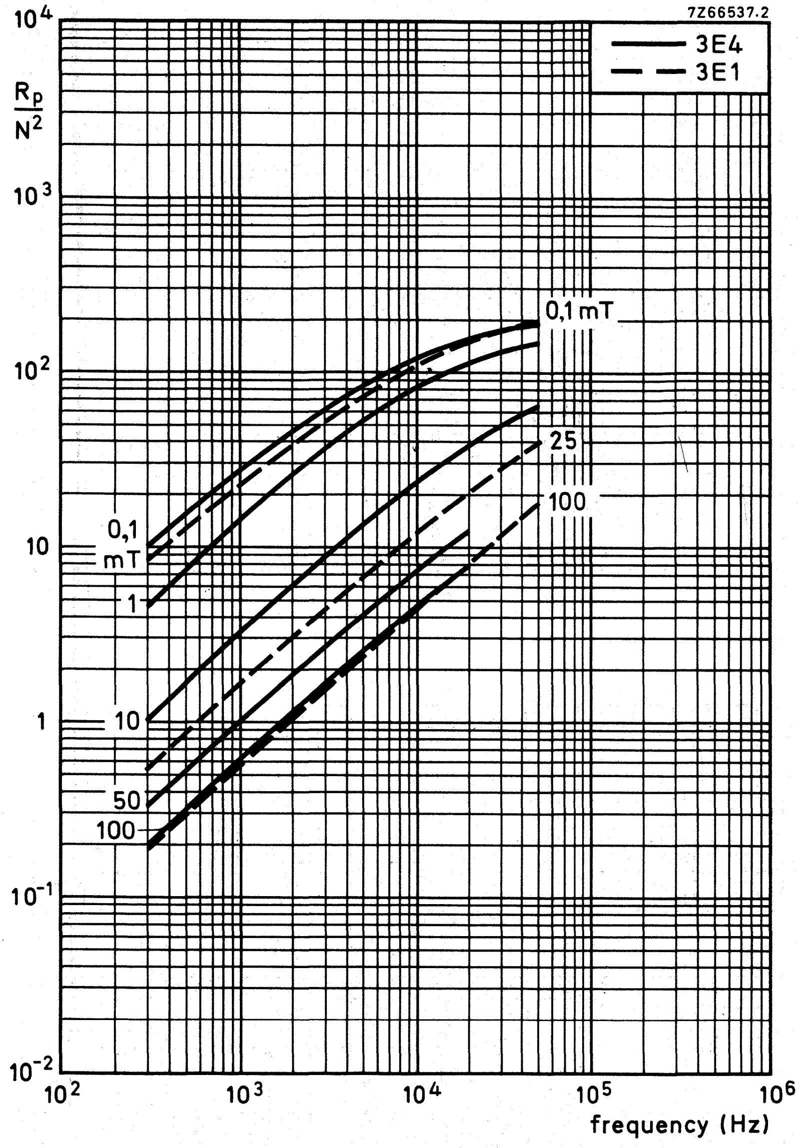
Inductance as a function of the frequency (typical values)



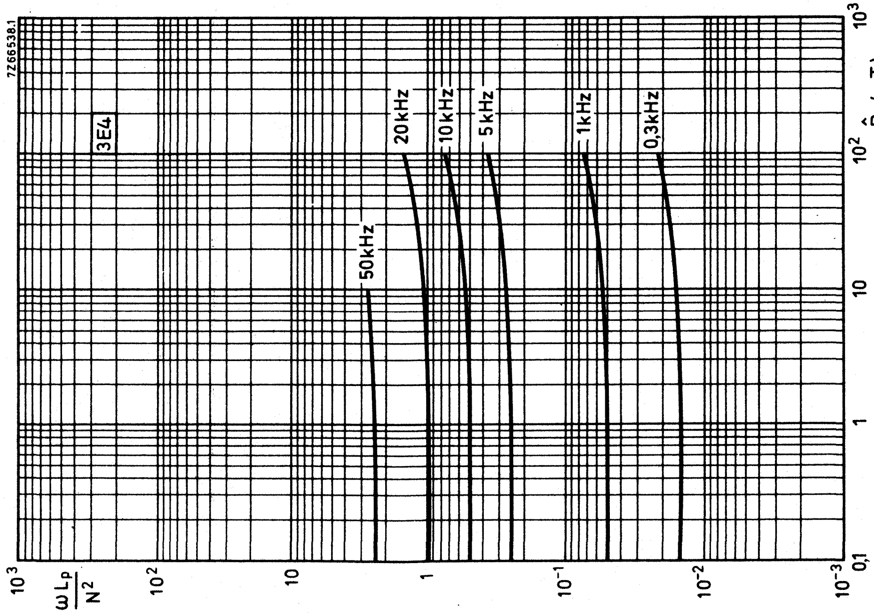
Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT (typical values)



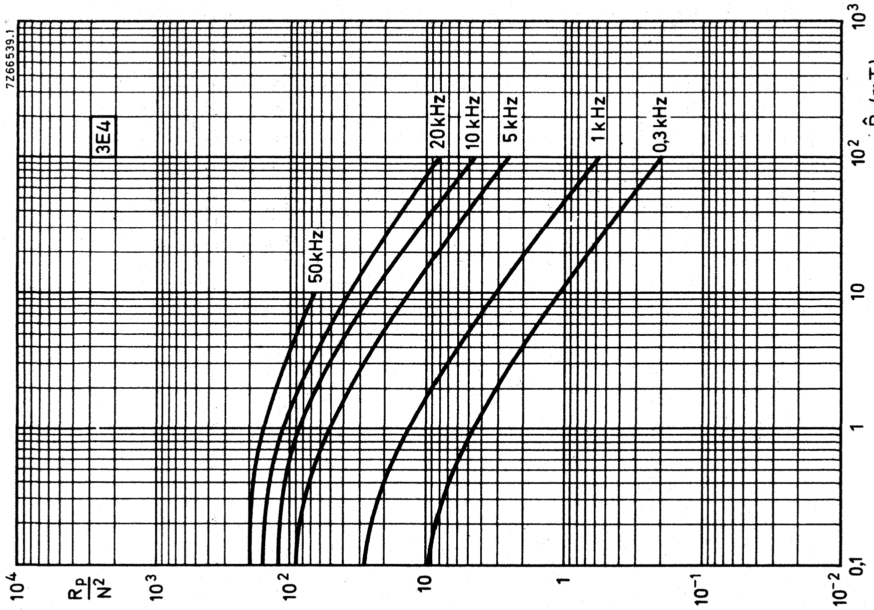
Inductance as a function of the frequency (typical values)



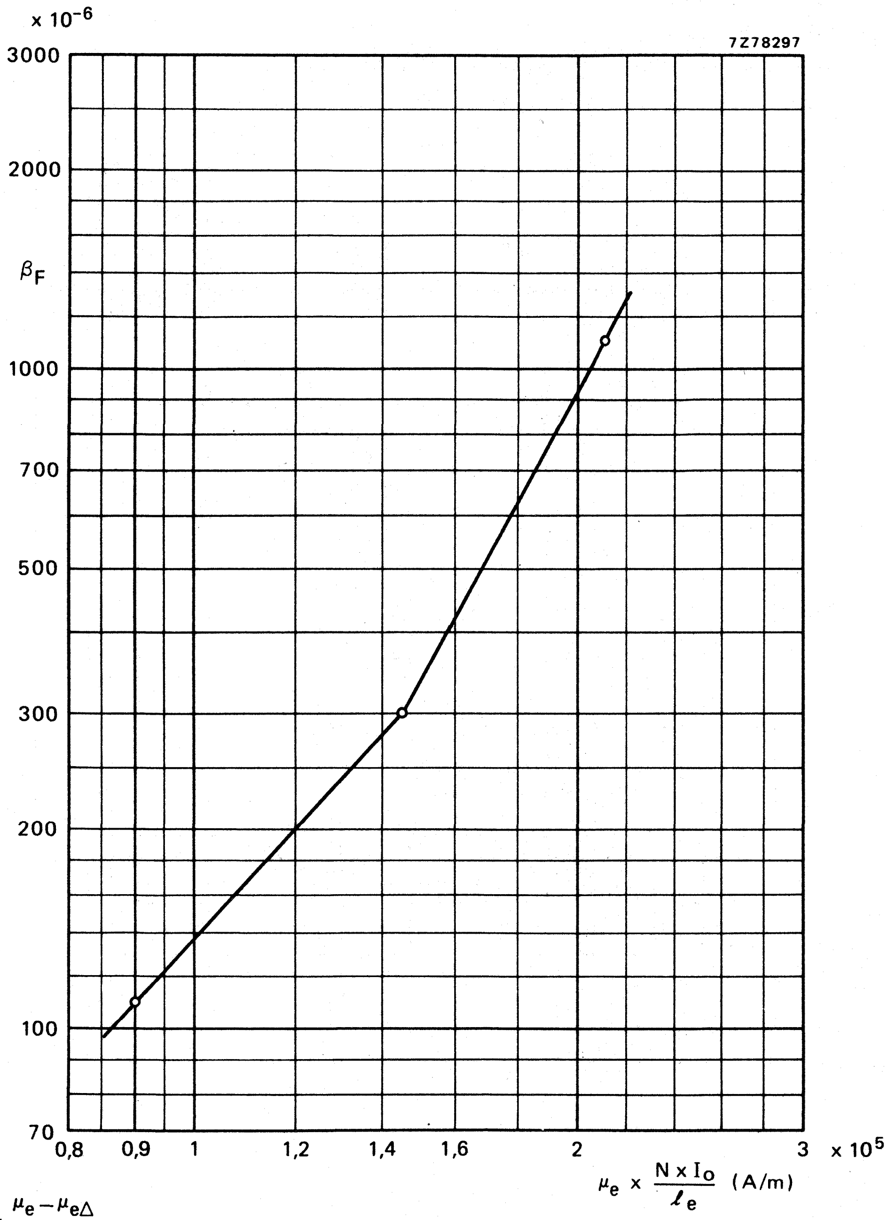
Losses as a function of the frequency (typical values)



Inductance as a function of the peak induction (typical values)

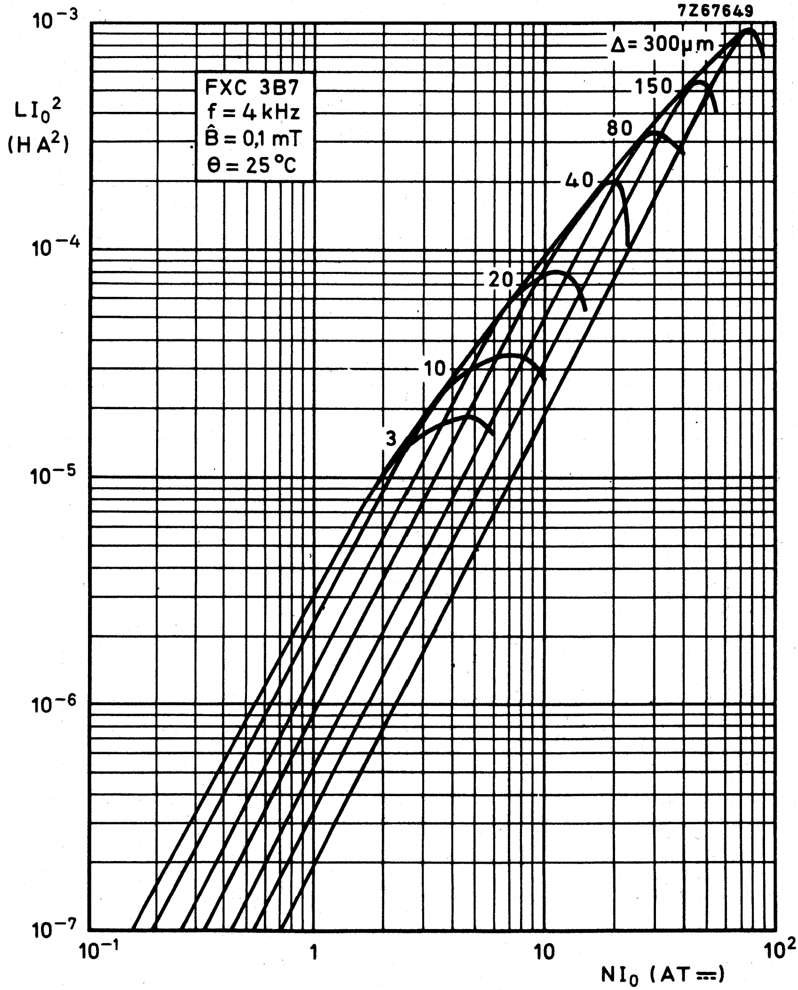


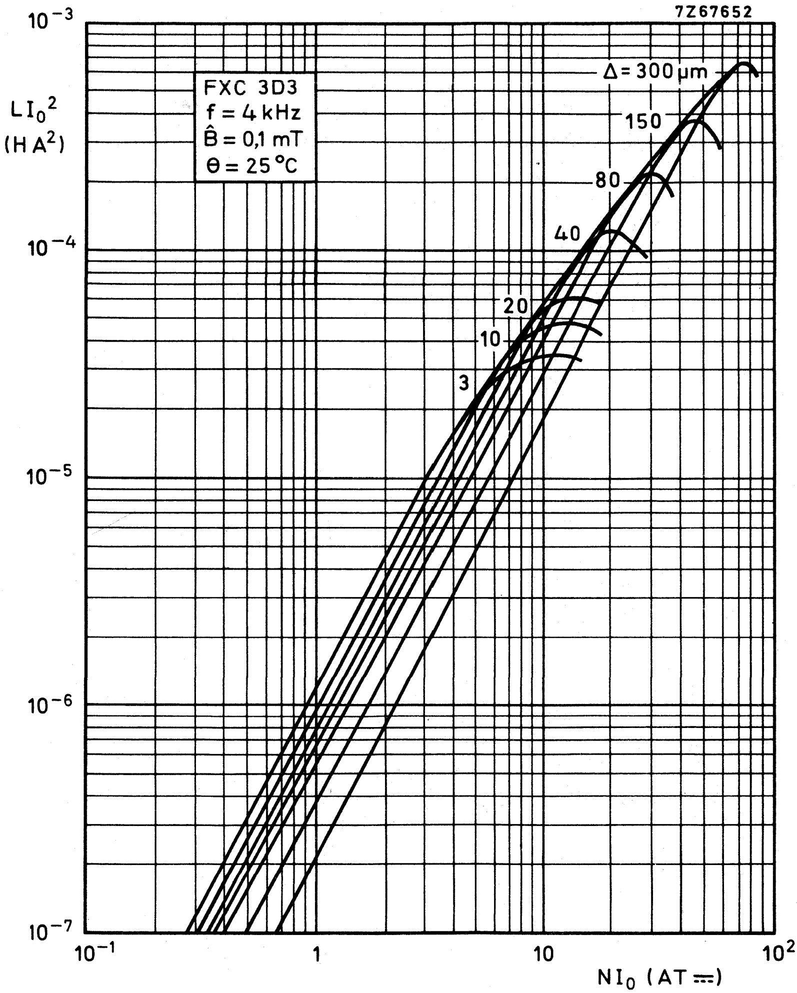
Losses as a function of the peak induction (typical values)

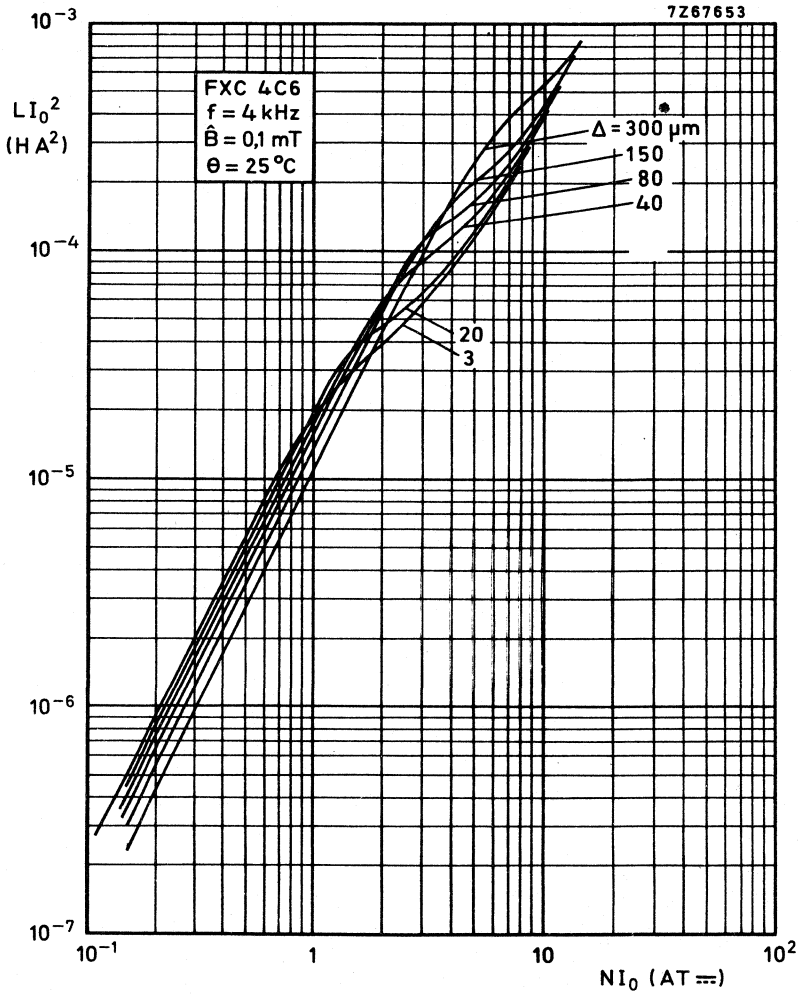


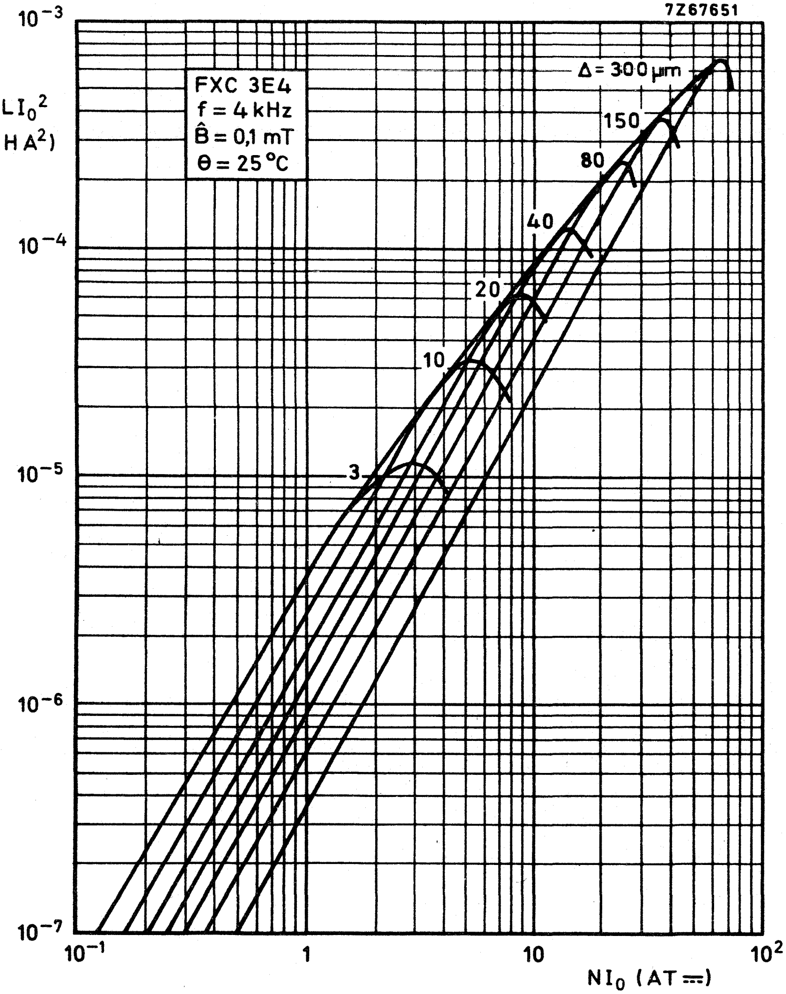
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

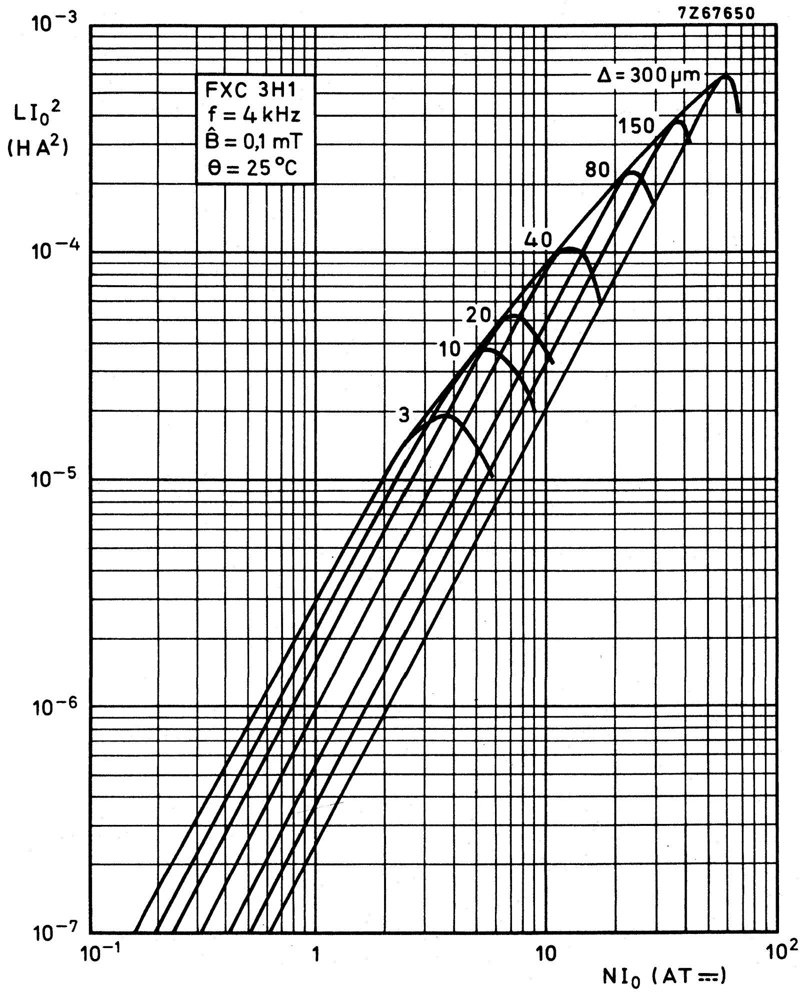
HANNA CURVES (typical values)
for different material grades.
Indicating optimum inductance for a certain air gap and direct current.




7Z67652
FXC 3D3
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI0² (HA²)
NI0 (AT ⎓)
Δ = 300 μm
150
80
40
20
10
3
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
10⁻¹
1
10
10²


7Z67653
FXC 4C6
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI0^2
(H A^2)
10^-3
10^-4
10^-5
10^-6
10^-7
Δ = 300 μm
150
80
40
20
3
10^-1
1
10
10^2
NI0 (AT ⎓)


7Z67651
FXC 3E4
f = 4 kHz
$\hat{B}$ = 0,1 mT
θ = 25 °C
LI_0^2
(H A^2)
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 ⎓)


7Z67650
FXC 3H1
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI0² (HA²)
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
Δ = 300 μm
150
80
40
20
10
3
10⁻¹
1
10
10²
NI0 (AT ⎓)

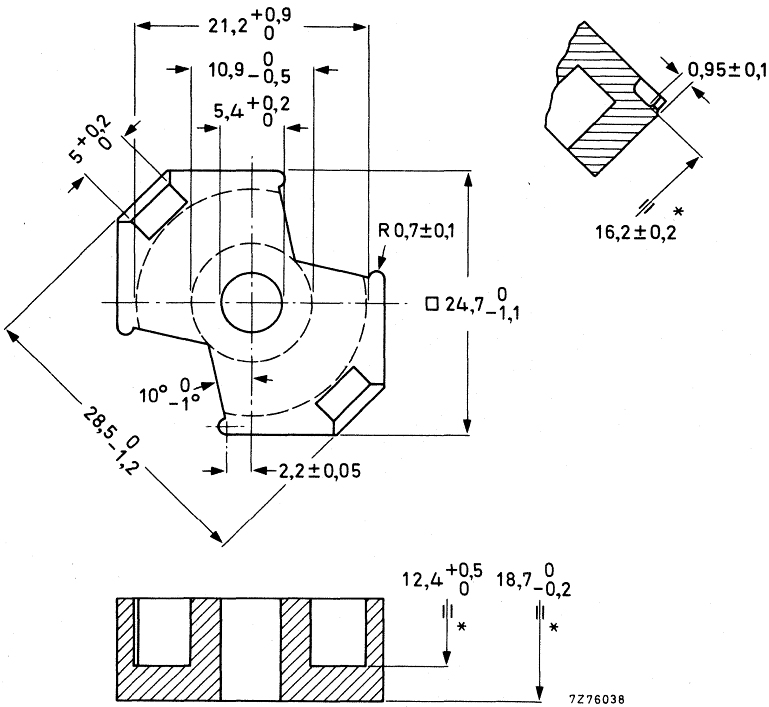
SQUARE CORES

Three types of core can be supplied:

- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an A_L value.
- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without an air gap.

The square cores are in accordance with the following specifications: IEC 431 (international), DIN 41980 (Germany).
Square cores and associated parts are ordered by their 12-digit catalogue number.
Quantity: a primary pack contains 10 core sets or 20 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



* Measured on two adjacent core halves.

Properties

For the combination of two halves randomly chosen from a batch and pressed together with a force of 130 N, the values in the table below are guaranteed.

	$\hat{B}$ mT	freq. kHz	temp. °C	grade 3C8	3E4	3H1
μ_e ± 25%	≤ 0,1	4	25 ± 5	1620	4190	1900
A_L ± 25%	≤ 0,1	4	25 ± 5	**4065**	10000	**4765**
α	≤ 0,1	4	25 ± 5	≤ 18,0	≤ 11,2	≤ 16,6
$\alpha_F \times 10^6$	≤ 0,1	≤ 100	5 to 25		0 to +2	+0,5 to +1,5
			25 to 55		0 to +2	+0,5 to 1,5
			25 to 70		0 to +2	+0,5 to 1,5
$D_F \times 10^6$ (10-100 min)	≤ 0,1	≤ 100	25 ± 1		≤ 4,3	≤ 4,3
$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 0,1	0,004	25 ± 5		≤ 2,5	
	≤ 0,1	0,030	25 ± 5			≤ 2,5
	≤ 0,1	0,100	25 ± 5	≤ 10	≤ 20	≤ 5,0
	≤ 0,1	0,500	25 ± 5		≤ 200	
$\eta_B \times 10^3$	1,5-3,0	0,004	25 ± 5		≤ 1,1	≤ 1,1

Versions

A. Halves

Ferroxcube grade	catalogue number
3C8	4322 020 28350
3E4	4322 020 28290
3H1	4322 020 28270

B. Pre-adjusted types

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number	
			3H1 with nut	3C8 without nut
160	64	± 2	4322 022 70250	4322 022 50650
250	100	± 2	70260	50660
315	126	± 2	70270	50670
400	160	± 3	70280	50680
630	251	± 4	70300	50700
1000	399	± 10	70310	50710
1600	638	± 10	70320	

Mass per core set 20 g

Mean length of lines of force $l_e = 41{,}7$ mm

Mean area of lines of force $A_e = 83{,}2$ mm^2

$$C_1 = \Sigma \frac{l_e}{A_e} = 0{,}501 \text{ mm}^{-1}$$

Effective volume $V_e = 3470$ mm^3

COIL FORMERS

Three types of coil formers can be supplied:

- Single-section, 5-pin, catalogue number 4313 021 03620 (Fig. 1)
- Single-section, 8-pin, catalogue number 4313 021 03630 (Fig. 2)
- Two-section, 8-pin , catalogue number 4313 021 03670 (Fig. 3)

The arrangement of the soldering pins is suitable for both 0,1 inch and 2,50 mm grid. See "Mounting".

SINGLE-SECTION

Properties

Material	phenolformaldehyde reinforced with glass fibre
Window area	55,4 mm^2
Mean length of turn	50 mm
Max. temperature	180 ^{o}C

Solderability : resistant against dip-soldering at 400 ^{o}C for 2 s

D.C. losses :

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 6,22 \times 10^3\ \Omega/H$$

Mass 1,5 g

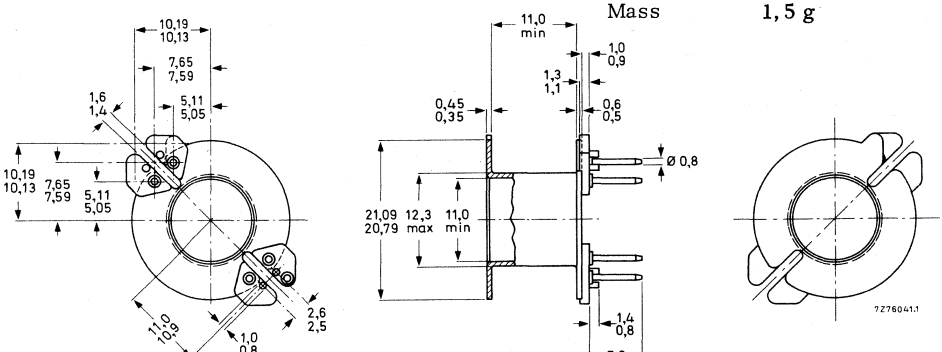


Fig. 1.

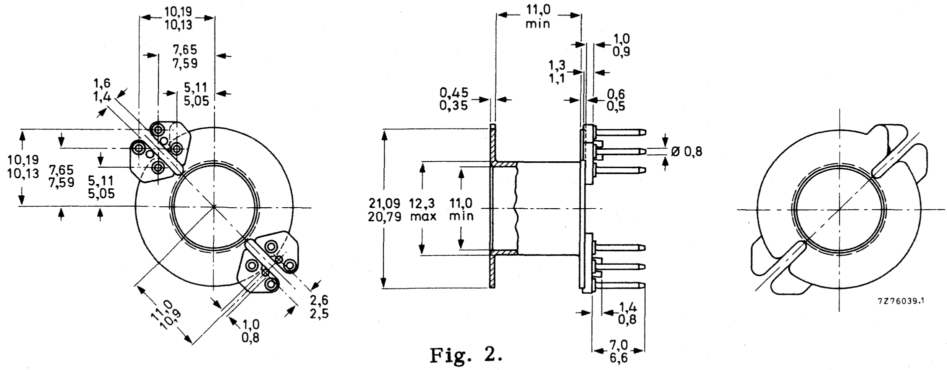


Fig. 2.

TWO-SECTION

Properties

Material	phenolformaldehyde reinforced with glass fibre
Window area	52,7 mm^2
Mean length of turn	50 mm
Max. temperature	180 °C

Solderability: resistant against dip-soldering at 400 °C for 2 s

D.C. losses:

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5,91 \times 10^3 \ \Omega/H$$

Mass 1,7 g

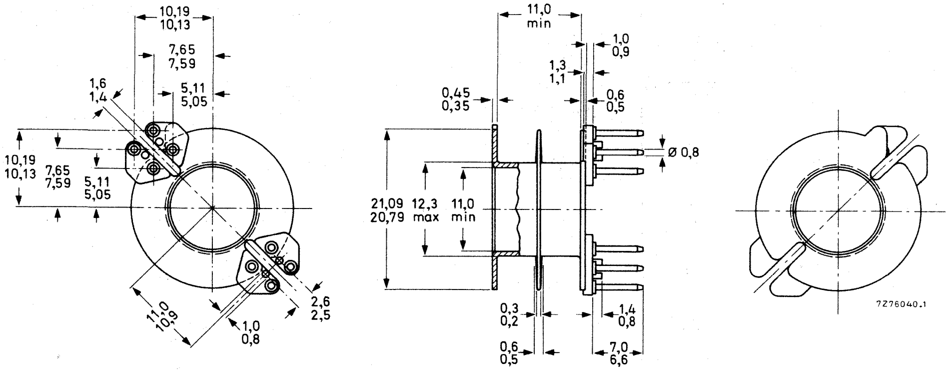


Fig. 3

INDUCTANCE ADJUSTERS

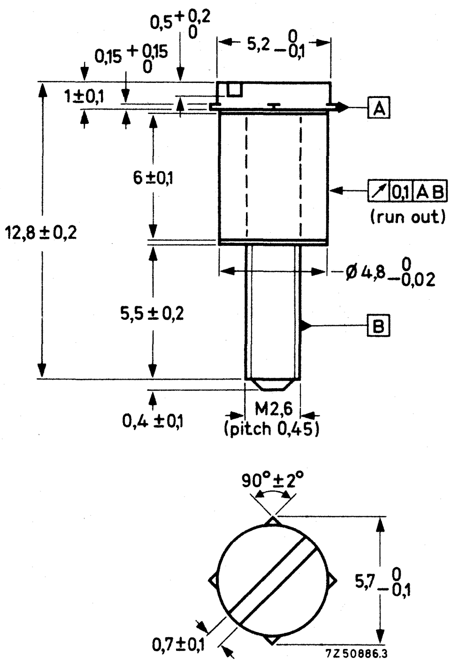


Fig. A.

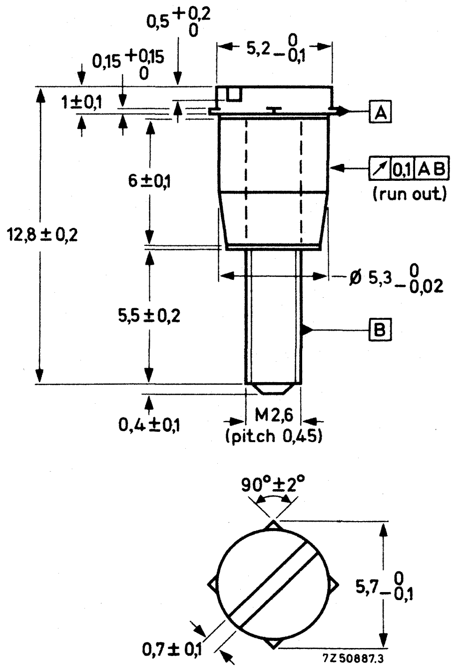


Fig. B.

The tolerances on inductance of the pre-adjusted square cores (with adjuster) are given on the previous page. 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 adjuster. Such an adjuster increases the inductance of the coil, see following pages.

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

The influence of the adjusters on the variability of the inductance is negligible.
The maximum permissible temperature is 110 °C.
The table shows the type of adjuster recommended for different square cores.

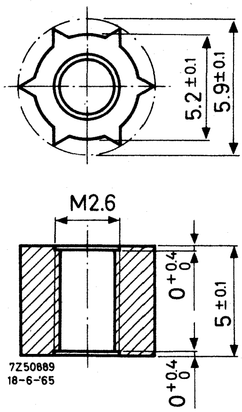
Types of adjuster and recommended applications

Fig.	colour	catalogue number 4322 021	A_L
A	brown	30810	315
A	brown	30810	400
B	grey	31090	630
B	grey	31090	1000

The adjusters are packed in bags of 100, so please order in muliples of 100.

Nut for adjuster

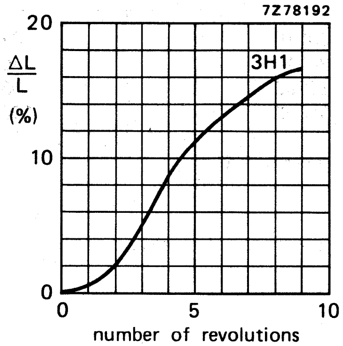
These data are given for those manufacturers who prefer to insert the nut themselves.



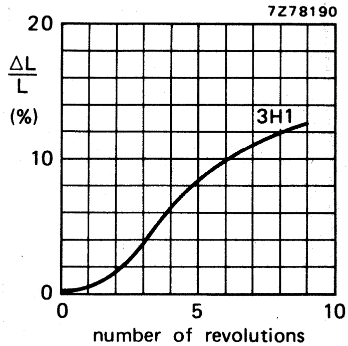
Catalogue number	4322 021 30160
Material	polycarbonate
Max. impregnation temperature for 24 hours	120 °C
Recommended distance from mating surface to nut	3,35 ± 0,15 mm

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

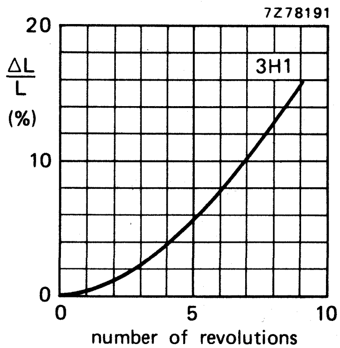
ADJUSTMENT CURVES



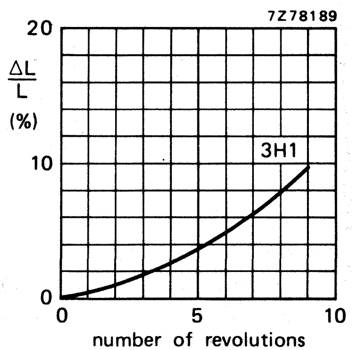
Adjuster 4322 021 30810, A_L = 315.



Adjuster 4322 021 30810, A_L = 400.

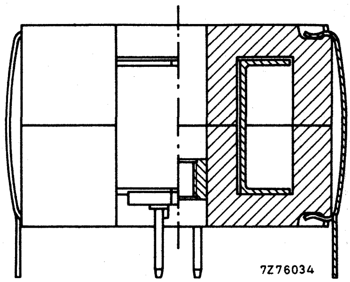


Adjuster 4322 021 31090, A_L = 630.



Adjuster 4322 021 31090, A_L = 1000.

ASSEMBLING AND MOUNTING



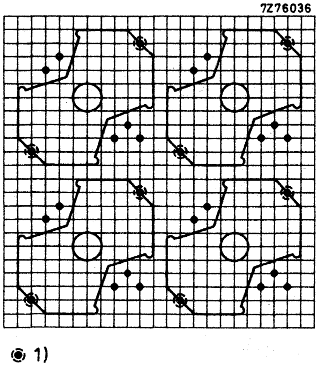
ASSEMBLING

The core halves are clamped together by means of two clips, catalogue number 4313 021 04120. As can be seen in the drawing the hooked ends of both clips fit into the recesses, made in the halves.
For a stable inductance we recommend that an adhesive be applied between the coil former flange and the lower core half. Also the use of a suitable tool for attaching the clips is recommended.

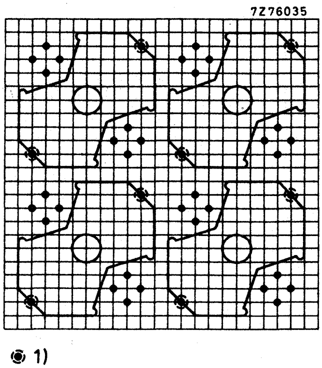
MOUNTING

The two retaining clips are also used for mounting the assembled core on a printed-wiring board. The pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing.

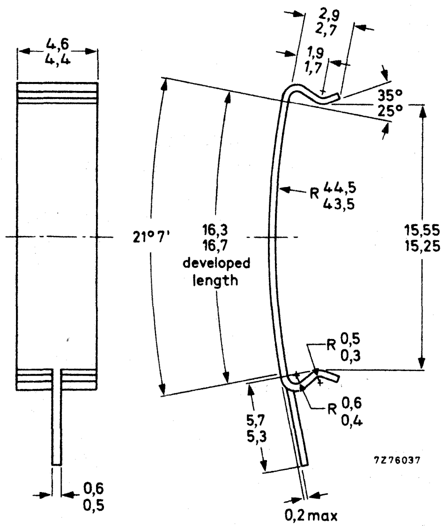
The soldering pins of coil formers and clips are so arranged that they will fit printed-wiring boards with a 0,1 inch grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 2,4 mm.
The recommended hole diameter in the board is 1,0 ± 0,1 or 1,3 ± 0,1 mm (according to IEC publication 97).



Hole pattern for an assembly of 4 cores, each fitted with an 5-pin coil former.



Hole pattern for an assembly of 4 cores, each fitted with an 8-pin coil former.



PART DRAWING
(dimensions in mm)

Clip 4313 021 04120

Material: steel, tin plated.

1) Holes for tag on clip 4313 021 04120 (earth points).

SQUARE CORES

Three types of core can be supplied:

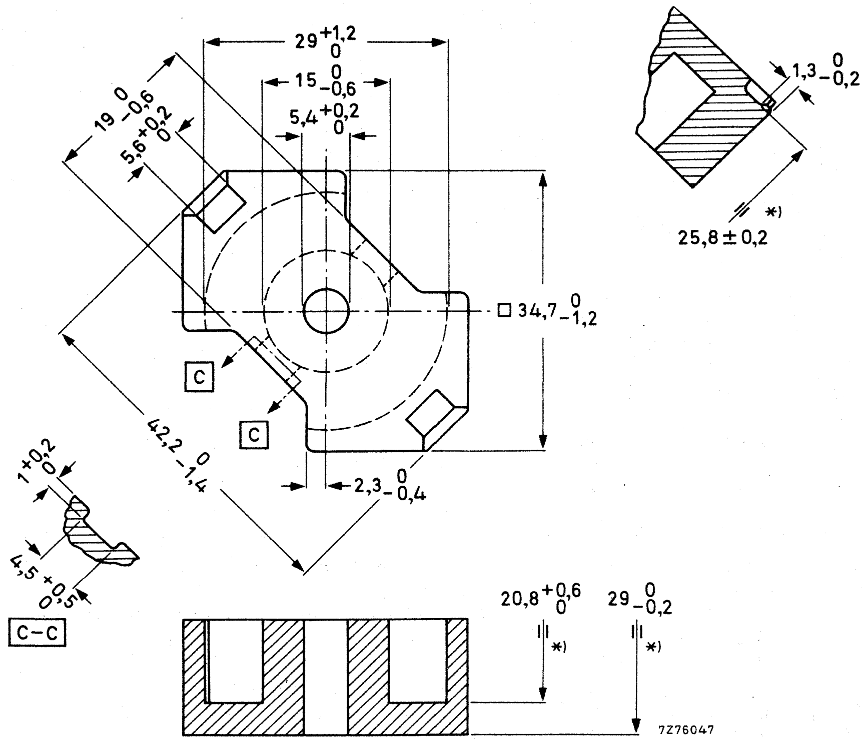
- CORE SETS provided with an injection-moulded nut for an adjuster and pre-adjusted on an inductance factor A_L.
- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without air gap.

The square cores are in accordance with the following specifications: IEC 431 (international), C93-324 (France), DIN 41980 (Germany).

Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains core sets or core halves; a storage pack contains 75 core sets or 150 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm



Pulling-out force of the nut	⩾ 30 N
Torque of the screw thread	⩽ 1,0 N
Extraction force of adjuster from nut	⩾ 30 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0,390$ mm^{-1}; $C_2 = \Sigma \frac{l}{A^2} = 0,00219$ mm^{-3}; $V_e = 12400$ mm^3; $l_e = 70,0$ mm; $A_e = 178$ mm^2.

Mass of a core set: 65,5 g.

ELECTRICAL DATA

The combination of two square core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. A measuring coil as described in the General section Potcores and square cores is inserted; the halves are pressed together with a force of 80 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade	
					3B8
$A_L \pm 25\%$	30	$\leqslant 0,1$	25 ± 1		5560
$\mu_e \pm 25\%$	30	$\leqslant 0,1$	25 ± 1		1740
α	30	$\leqslant 0,1$	25 ± 1		$\leqslant 15,3$
$\frac{\tan\delta}{\mu_i} \times 10^6$	30	$\leqslant 0,1$	25 ± 1		$\leqslant 4,0$
$\eta_B \times 10^3$	30	1,5 to 3,0	25 ± 1		$\leqslant 1,0$
$\alpha_F \times 10^6$/°C	$\leqslant 100$	$\leqslant 0,1$	5 to 25		0 to +6
	$\leqslant 100$	$\leqslant 0,1$	25 to 55		0 to +6
$D_F \times 10^6$ (10 - 100 min)	$\leqslant 100$	$\leqslant 0,1$	25 ± 0,1		$\leqslant 8,0$
$\beta_F \times 10^6$ measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:					
at $\mu_e \times \frac{N \times I_o}{l_e}$ = $1,00 \times 10^5$ A/m					$\leqslant 120$
= $1,55 \times 10^5$ A/m					$\leqslant 300$
= $2,25 \times 10^5$ A/m					$\leqslant 1100$

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number, grade 3B8
250	77,6	± 2	4322 022 56950 (without nut)
400	124	± 2	
630	196	± 3	4322 022 56890 (without nut), 4322 022 76890 (with nut)
1000	310	± 5	
1250	388	± 5	
1600	497	± 10	4322 022 56930 (without nut)
2000	621	± 10	
2500	776	± 10	4322 022 56940 (without nut)

Core half without air gap, without nut, Ferroxcube grade 3B8, catalogue number 4322 020 28320.

COIL FORMERS

Two types of coil former can be supplied:

- Single section, 10-pin, catalogue number 8222 294 37350 (Fig. 1, see page D448).
- Single section, 12-pin, catalogue number 8222 294 39680 (Fig. 2, see page D448).

The arrangement of the soldering pins is suitable for both 0, 1 inch and 2, 50 mm grid. See "Mounting".

Properties

Material: phenolformaldehyde reinforced with glass fibre

Window area	112 mm^2
Mean length of turn	71 mm
Max. temp.	180 °C

Solderability: resistant against dip-soldering at 400 °C for 2 s.

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3,50 \times 10^3 \ \Omega/H$$

Mass 3 g

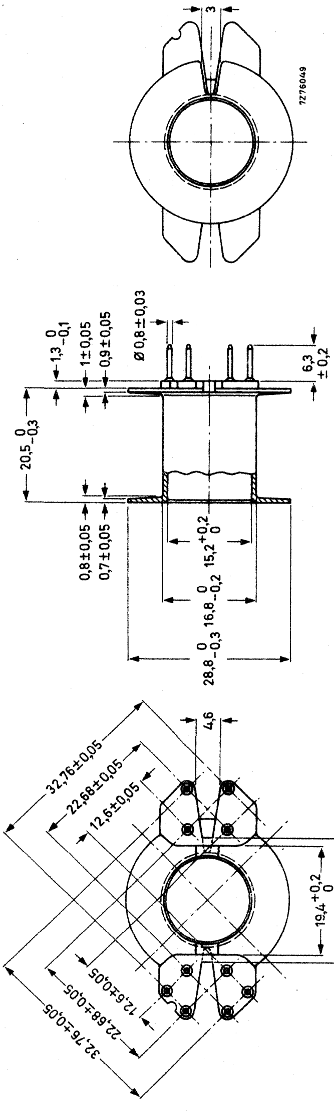

3
7Z76049
1,3 0 −0,1
1±0,05
0,9±0,05
Ø 0,8±0,03
6,3 ±0,2
20,5 0 −0,3
0,8±0,05
0,7±0,05
15,2 +0,2 0
16,8 0 −0,2
28,8 0 −0,3
4,6
32,76±0,05
22,68±0,05
12,6±0,05
19,4 +0,2 0
22

Fig. 1

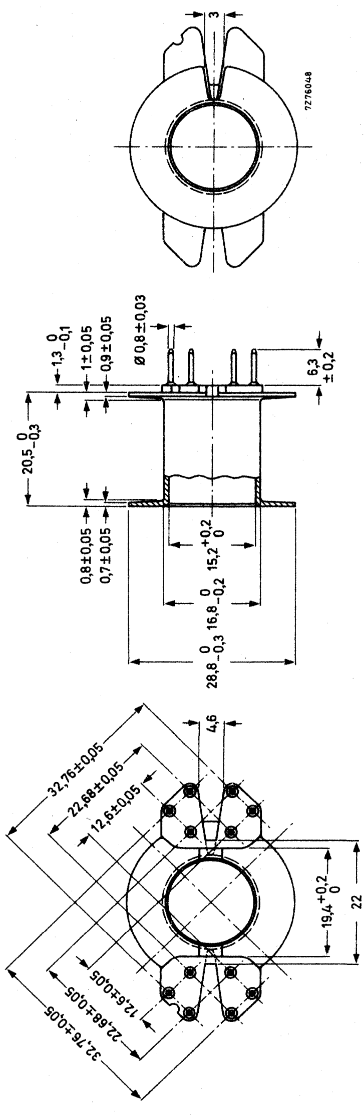
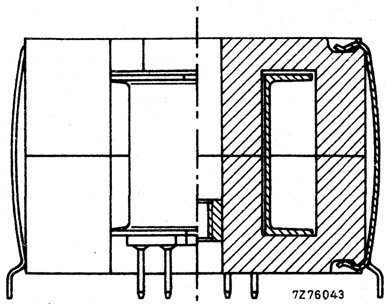

3
7Z76048
1,3 0 −0,1
1±0,05
0,9±0,05
Ø 0,8±0,03
6,3 ±0,2
20,5 0 −0,3
0,8±0,05
0,7±0,05
15,2 +0,2 0
16,8 0 −0,2
28,8 0 −0,3
4,6
32,76±0,05
22,68±0,05
12,6±0,05
19,4 +0,2 0
22

Fig. 2

ASSEMBLING AND MOUNTING



ASSEMBLING

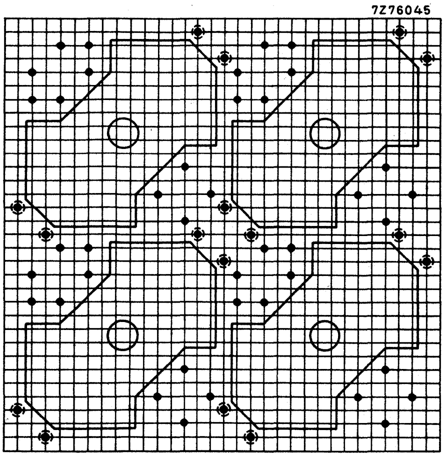
The core halves are clamped together by means of two clips, catalogue number 8222 294 37370. As can be seen in the drawing the hooked ends of both clips fit into the recesses, made in the halves.

For a stable inductance we recommend that an adhesive be applied between the coil former flange and the lower core half and around the two core halves, see page D31.

MOUNTING

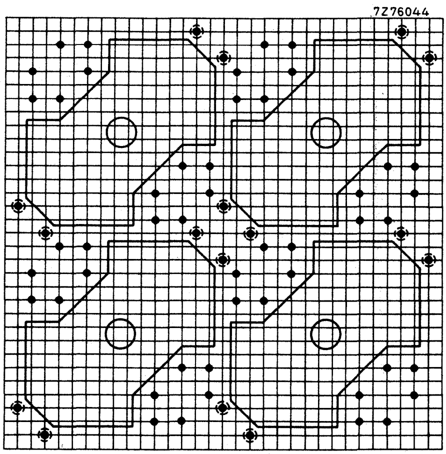
The two retaining clips are also used for mounting the assembled core on a printed-wiring board. The pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing.

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 1,3 ± 0,1 mm (according to IEC publication 97).



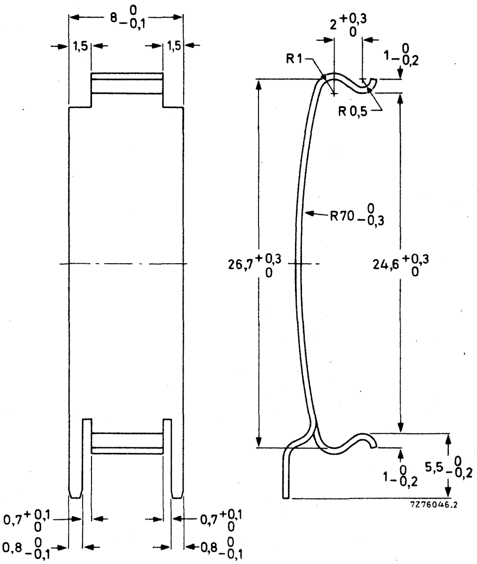
◎ 1)

Hole pattern for an assembly of 4 cores, each fitted with a 10-pin coil former.



◎ 1)

Hole pattern for an assembly of 4 cores, each fitted with a 12-pin coil former.

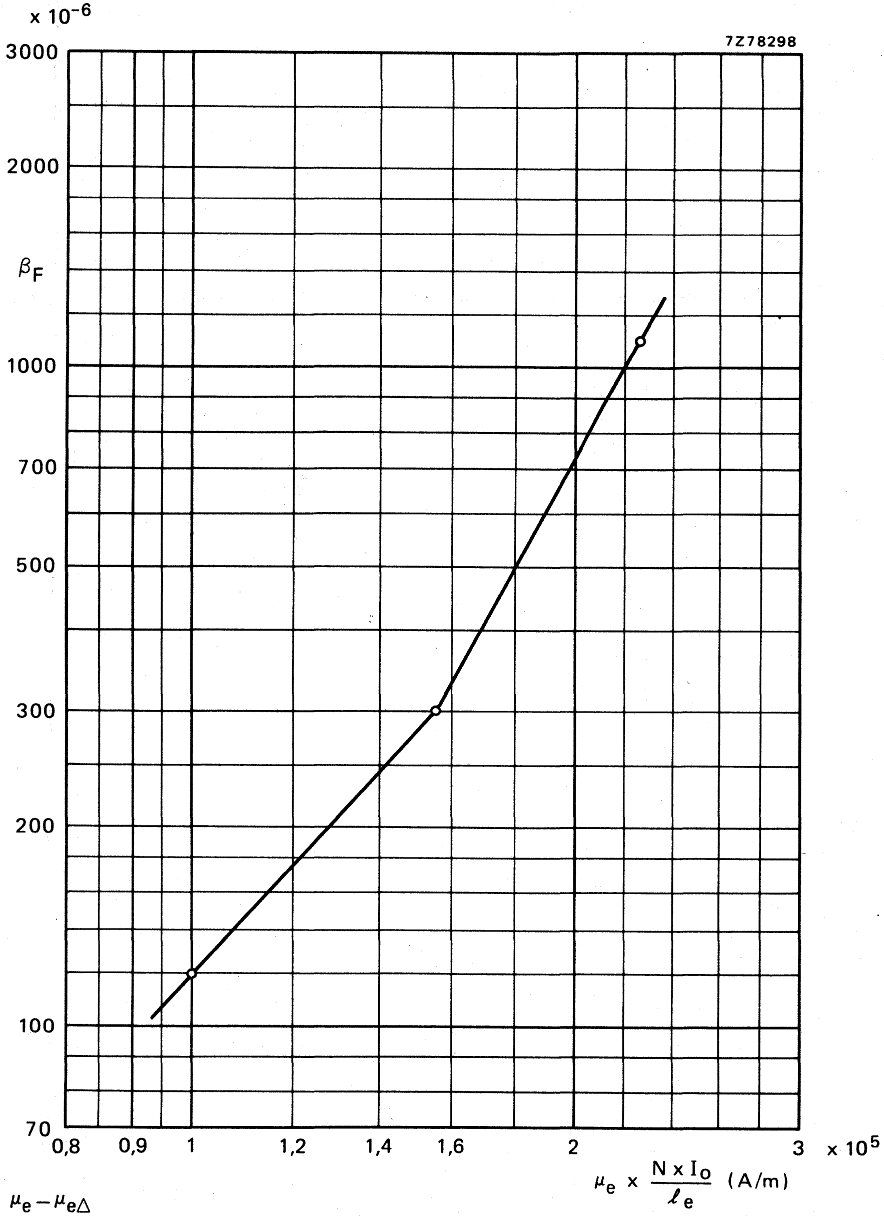


PART DRAWING
(dimensions in mm)

Clip: 8222 294 37370

Material: steel, tin plated

1) Holes, ϕ 1,3 ± 0,1 mm, for tags on clip 8222 294 37370 (earth points).



$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

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:

$$L = N^2 A_L \text{ and } \alpha = \frac{10^3}{\sqrt{A_L}} \quad \text{(L in nH)}$$

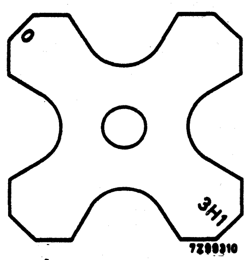
and the value of μ_e from

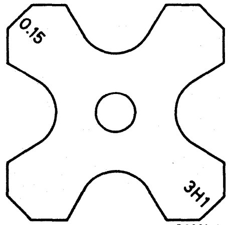
$$L = \frac{0,4\,\pi\, N^2 .\, \mu_e .\, 10^{-5}}{\Sigma \frac{l}{A}} \quad \text{(L in mH)}$$

$\Sigma \frac{l}{A}$ 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

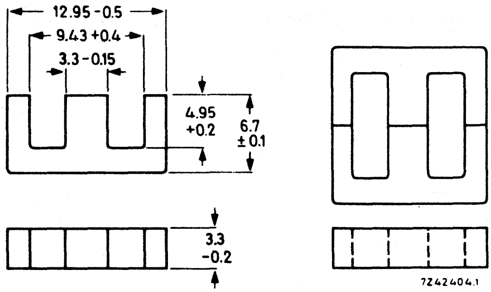
The Ferroxcube E and I-cores are typical transformer cores. They can be used from voice frequencies up to some MHz.
In comparison with conventional laminated iron cores a much higher frequency can be chosen, as a result of the very low eddy current losses of the Ferroxcube. This means that the dimensions 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 EE 13/13/3 composed of two cores type E 13/7/3.

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	$C_1 (= \Sigma \frac{l}{A}) = 3,09$ mm^{-1}
Effective core volume	$V_e = 318$ mm^3

Magnetic properties at 25 ± 10 °C

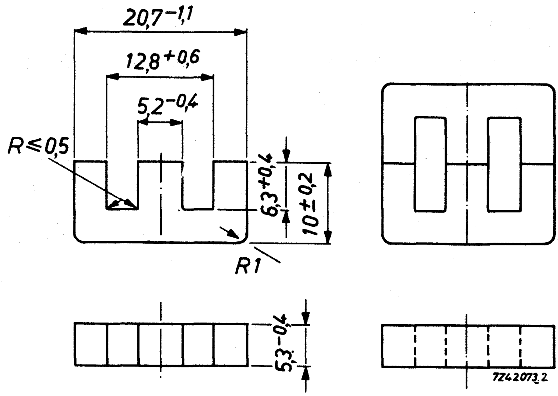
For the combination of two E-cores randomly chosen from a batch and pressed together with a force of 30 N, the values given below are guaranteed.

	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	3E 1	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 (= $\Sigma \frac{l}{A}$) = 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.

<u>Magnetic properties at 25 ± 10 °C for grade 3E1; Δ = 0</u>

	μ_e = 2100-3155*)
	A_L = 1920-2890
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	$\frac{\tan\delta}{\mu_i} \times 10^6 \leq 200$

<u>Magnetic properties for grade 3C6; Δ = 0</u>

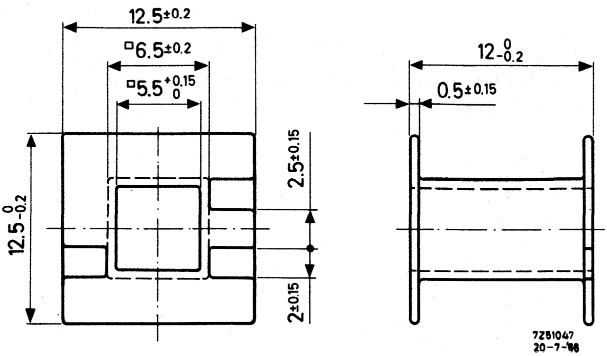
At f = 16 kHz, $\hat{B}$ = 200 mT and	
θ = 25 °C	P ≤ 0,3 W
θ = 100 °C	P ≤ 0,25 W
At f = 16 kHz, $\hat{B} \geq 275$ mT and θ = 100 °C	$\hat{H}$ = 250 A/m

Note - Number of turns for LmH: $N = \alpha\sqrt{L}$

*) In the temperature range +23 to +70 °C $\mu_e \geq 2100$.

COIL FORMERS

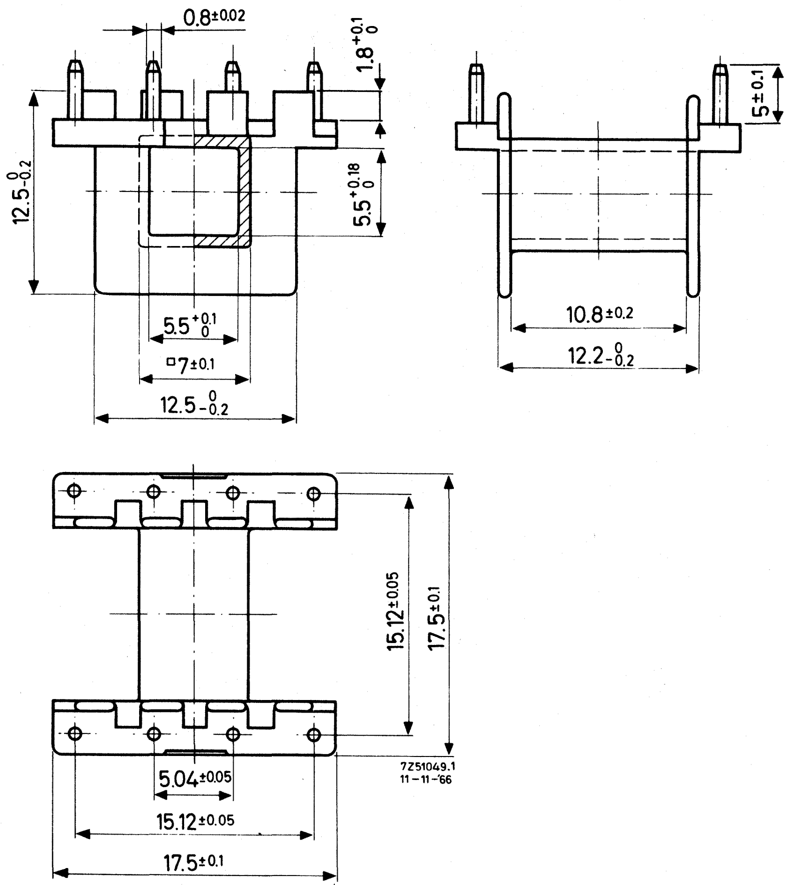
for shell type transformer EE20/20/5 (M20)



catalogue number	4312 021 28431
material minimum window area in mm^2 mean length of turn in mm approximate weight in g maximum temperature in ^oC	polycarbonate 27 38 0,5 130

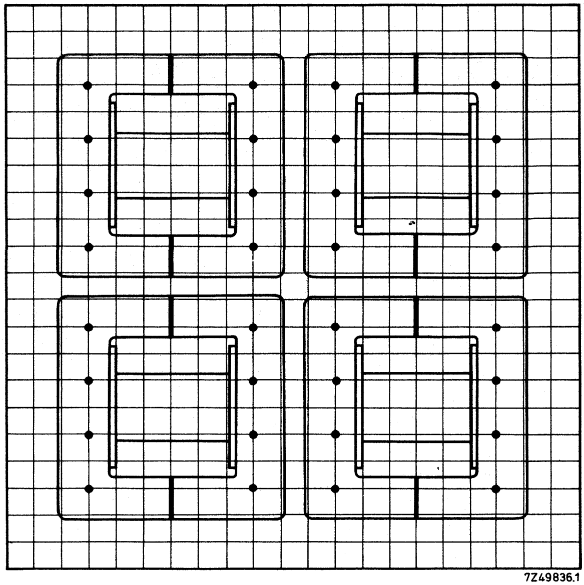
The dimensions are practically according to German specification D.I.N. 41305.

With soldering pins.

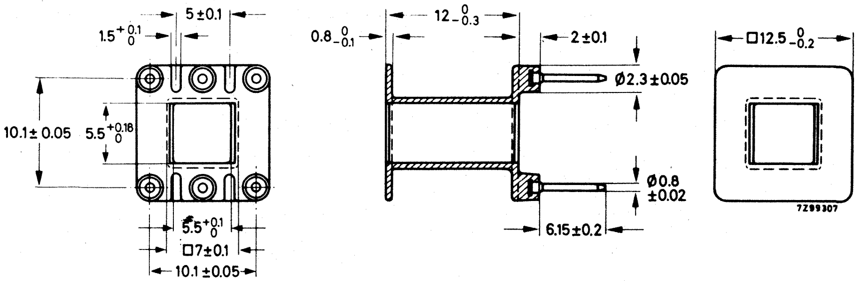


catalogue number	4322 021 20240
material	phenolformaldehyde reinforced with glass fibre ; brass dipsolder pins
minimum window area in mm^2	27
mean length of turn in mm	38
approximate weight in g	
maximum temperature for dipsoldering during 5-6 s in ^oC	280
maximum working temperature in ^oC	130

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.

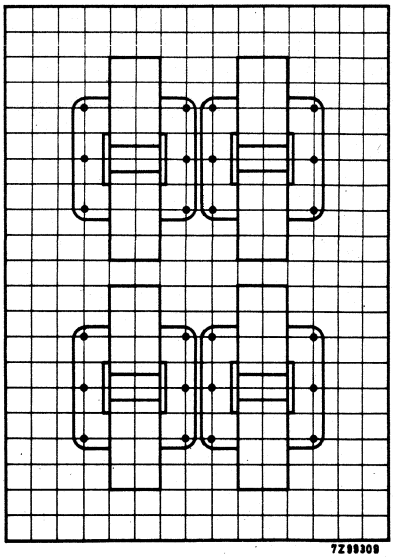


With soldering pins.

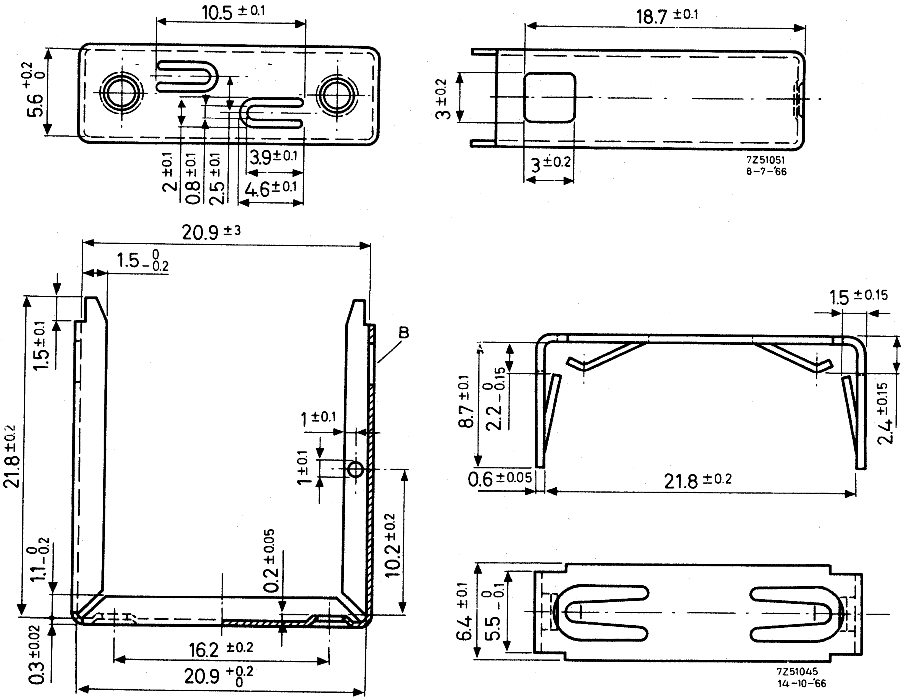


catalogue number	4322 021 20140
material	phenolformaldehyde reinforced with glass fibre ; brass dipsolder pins
minimum window area in mm^2	27
mean length of turn in mm	38
approximate weight in g	
maximum temperature for dipsoldering during 5-6 s in ^{o}C	280
maximum working temperature in ^{o}C	130

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.

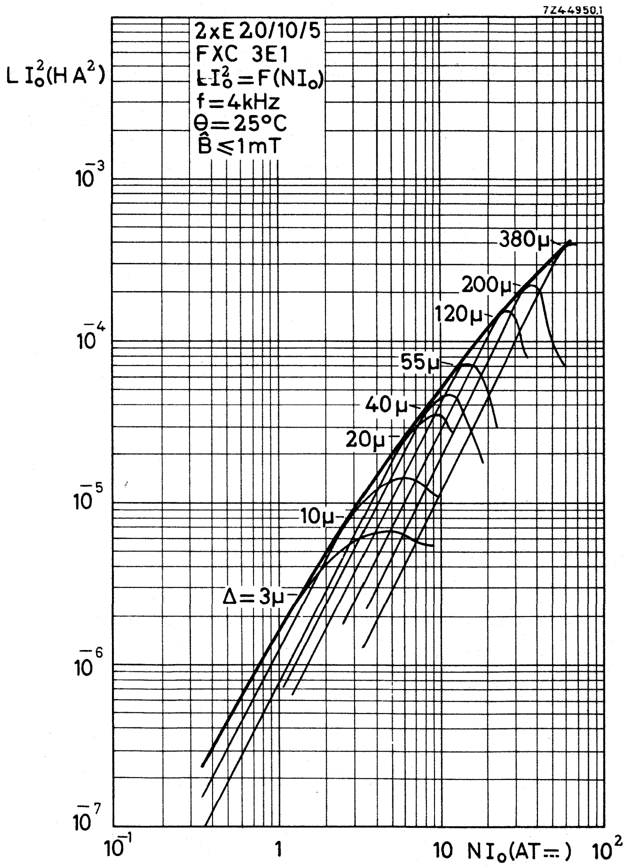
(2). Spring 4322 021 20220.
Material: phosphor-bronze, tin-plated.

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.

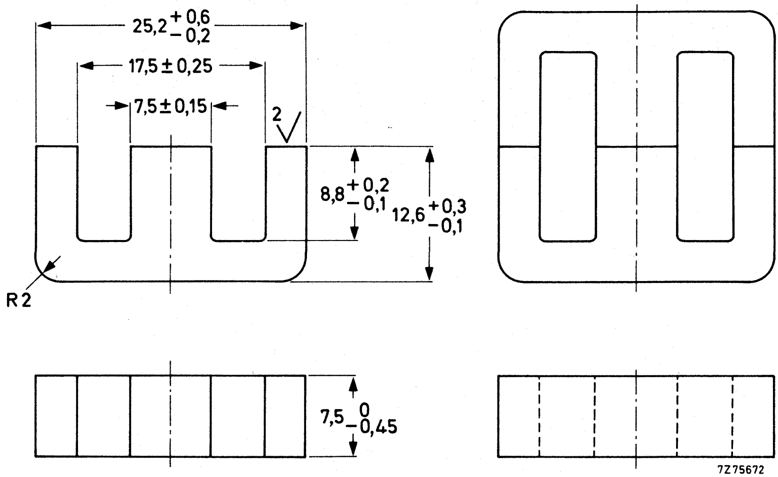
CHARACTERISTIC CURVES

HANNA CURVES (typical values) indicating optimum inductance for a certain air gap and direct current.



E-CORES

Dimensions
E-core E25/13/7



Mass	8,1 g
Ferroxcube grade	3C8
Catalogue number	4312 020 34020

SHELL TYPE TRANSFORMER EE25/25/7

A transformer core can be built up by combining an even number of E-cores. A shape that is often chosen is the shell transformer EE25/25/7 composed of two cores type E25/13/7.

Effective parameters for a pair of cores (according to IEC 205)

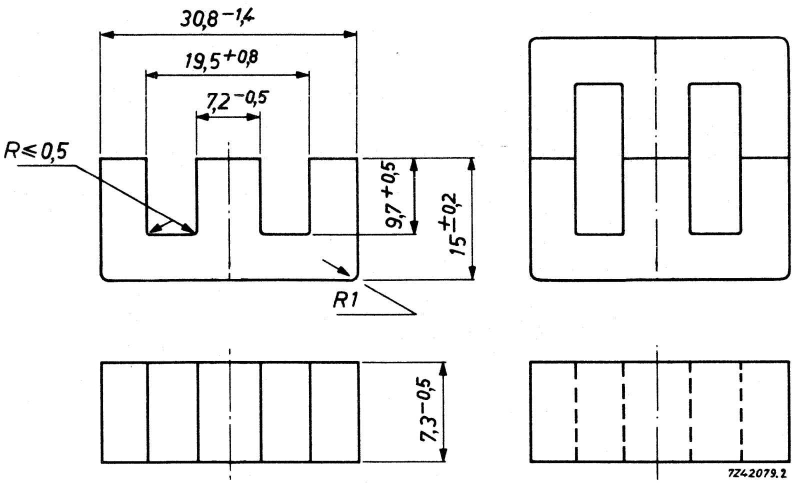
Effective magnetic path length		l_e	= 57,5 mm
Effective cross-sectional area		A_e	= 55 mm^2
Core constant	C_1 (= $\Sigma \frac{l}{A}$)		= 1,045 mm^{-1}
Effective core volume		V_e	= 3160 mm^3

Guaranteed values, measured at 16 kHz, for a core pair EE25/25/7

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

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	$C_1 (= \Sigma \frac{l}{A}) = 1,12\ mm^{-1}$
Effective core volume	V_e = 4000 mm^3

Magnetic properties at 25 ± 10 °C; Δ = 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.

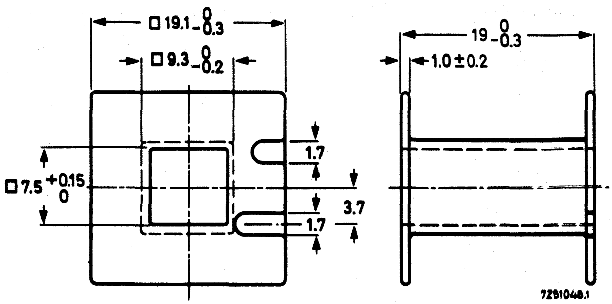
	μ_e	= 2375-3565*)
	A_L	= 2660-4000
At 4 kHz and $\hat{B}$ between 1, 5 and 3 mT	$\eta_B \times 10^3$	≤ 1, 8 T^{-1}
At 4 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 2, 5
At 100 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 20
At 500 kHz and $\hat{B} \leq 0,1$ mT	$\frac{\tan\delta}{\mu_i} \times 10^6$	≤ 200

Note - Number of turns for LmH: $N = \alpha\sqrt{L}$

*) In the temperature range + 23 to + 70 °C $\mu_e \geq 2375$.

COIL FORMERS

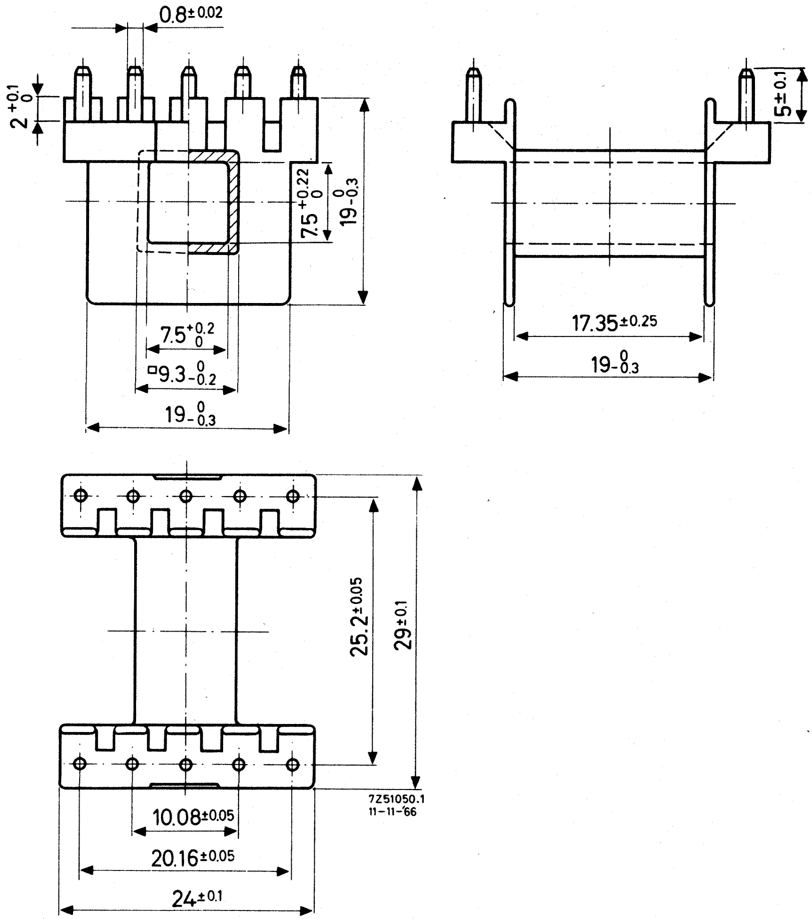
for shell type transformer EE30/30/7 (M30)



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

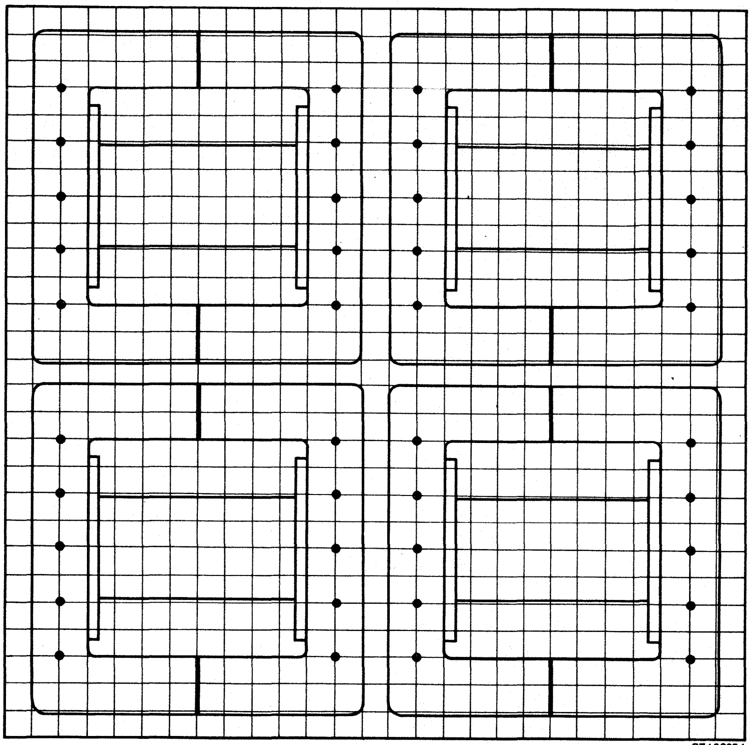
The dimensions are practically according to German specification D.I.N. 41305.

With soldering pins.



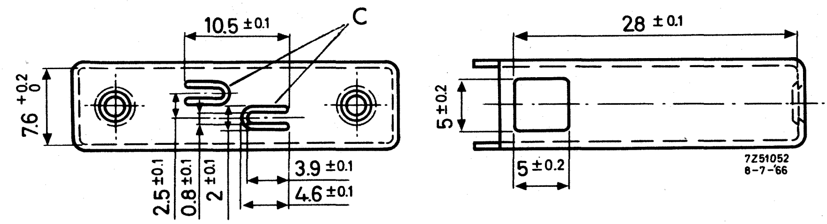
catalogue number	4322 021 20250
material	phenolformaldehyde reinforced with glass fibre ; brass dipsolder pins
minimum window area in mm^2	80
mean length of turn in mm	56
approximate weight in g	
maximum temperature for dipsoldering during 5-6 s in ^{o}C	280
maximum working temperature in ^{o}C	130

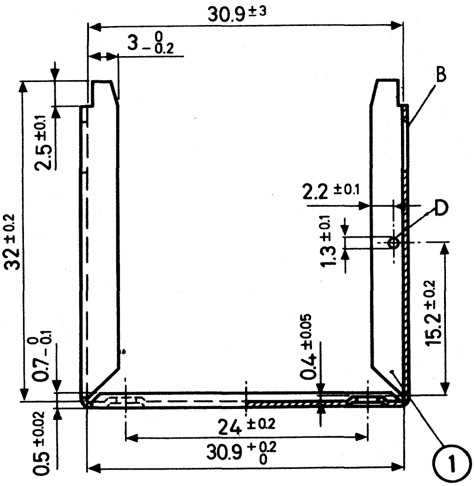
The coil former fits a shell type transformer EE30/30/7(M30). The soldering pins are so arranged as to fit a grid of 2,52 mm. They will fit printed-wiring boards with 0,1 in grid as well as those with a 2,50 mm grid. The pin length is sufficient for a board thickness of up to 3 mm. The board should be provided with holes of 1,3 ± 0,1 mm diameter.



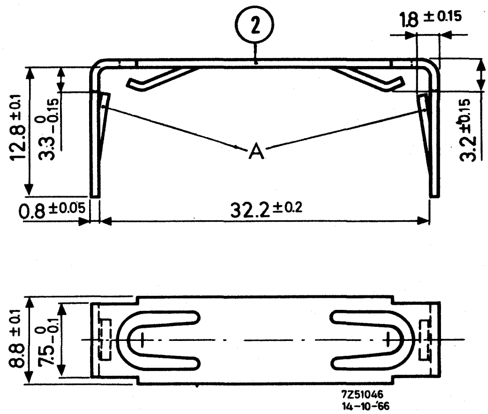
7Z49835.1

MOUNTING PARTS





(1). Clasp 4322 021 20170
Material: brass, tin-plated



(2). Spring 4322 021 20230
Material: phosphorbronze, tin-plated

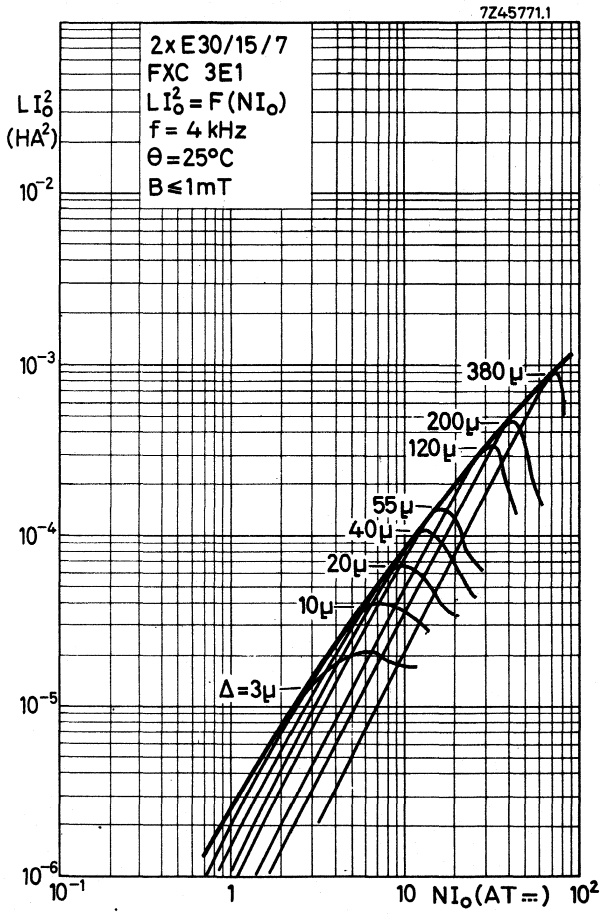
The construction is mounted by pushing the spring over the clasp in such a way that the lips A of the spring catch in the square holes B of the clasp. The mechanical pressure, required to keep the two E-cores together is exercised by means of two lips on top of the spring. No special tool is required 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)

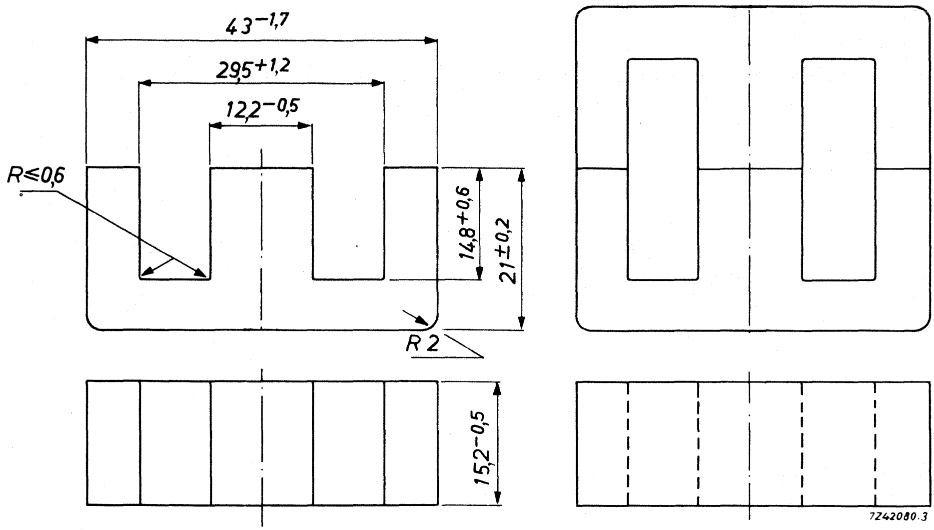
Indicating optimum inductance for a certain airgap and direct current

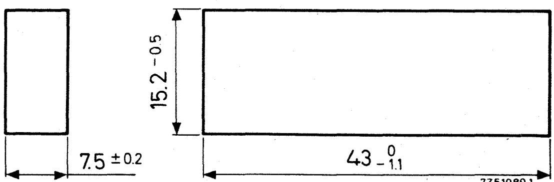


E- AND I-CORES

Dimensions in mm

According to DIN 41295.
E-core E42/21/15





Mass approx. 42 g

VERSIONS

Ferroxcube grade	3E1	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	
with air gap 1,4 ± 0,1		4312 020 34280 ←
with air gap in one of the outer legs 0,8 ± 0,05		4312 020 34370 ←
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 (= $\Sigma \frac{l}{A}$)	= 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; Δ = 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; Δ = 0

At 16 kHz, $\hat{B}$ = 200 mT and θ = 100 °C: P ≤ 2 W

At 16 kHz, $\hat{B}$ ≥ 315 mT and θ = 100 °C: $\hat{H}$ = 250 A/m

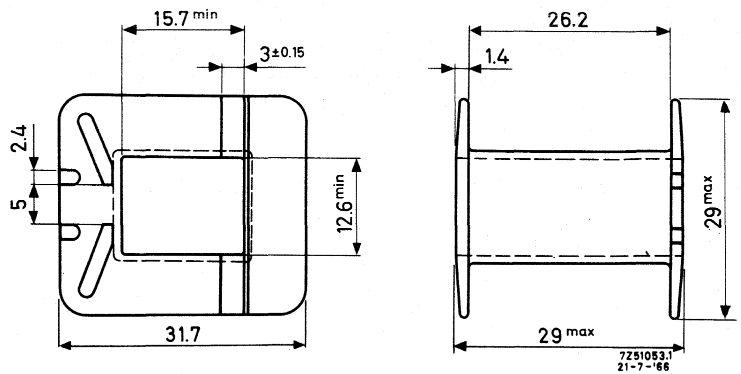
At 16 kHz, $\hat{B}$ ≥ 90 mT and θ = 100 °C: $\hat{H}$ = 50 A/m

Note - Number of turns for LmH: $N = \alpha\sqrt{L}$

*) In the temperature range +23 to +70 °C $\mu_e \geq 2575$.

COIL FORMERS

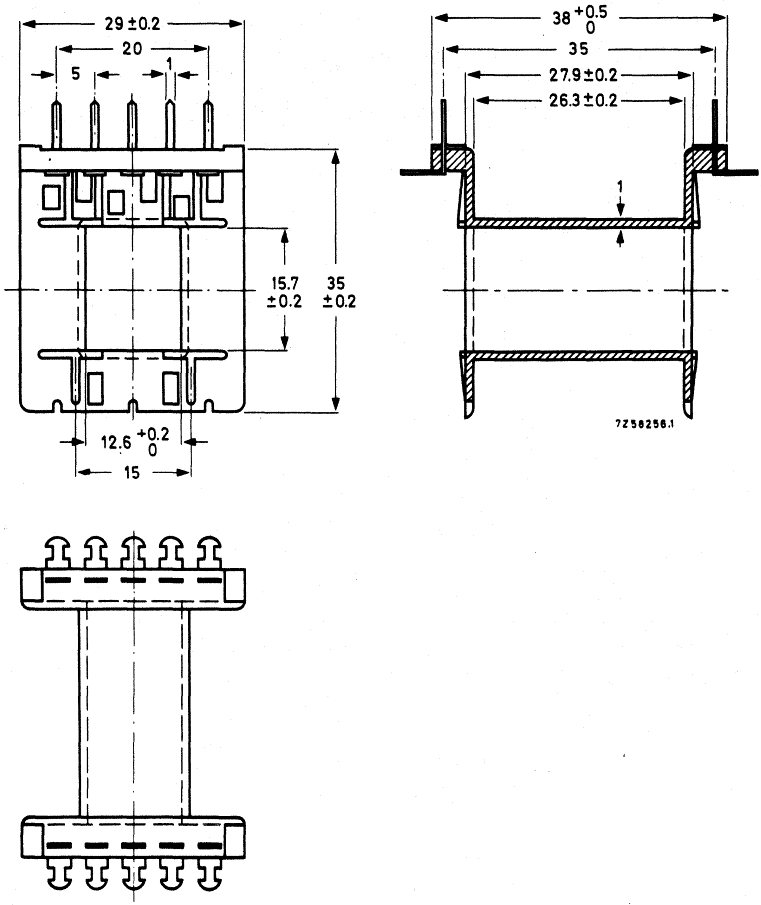
for shell type transformer EE42/42/15 (M42)



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 ^{o}C	180

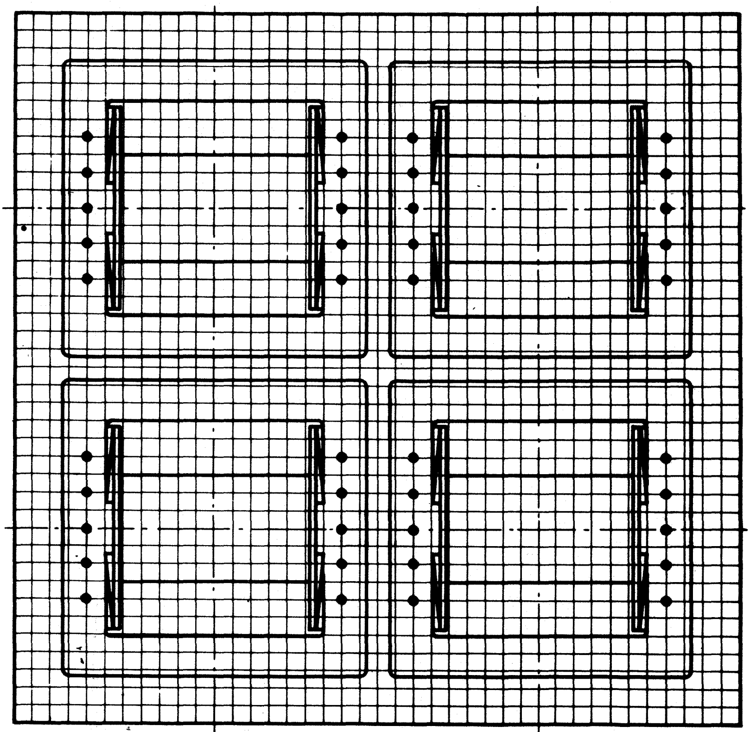
The dimensions are practically according to German specification D.I.N. 41305.

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 ^oC	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.



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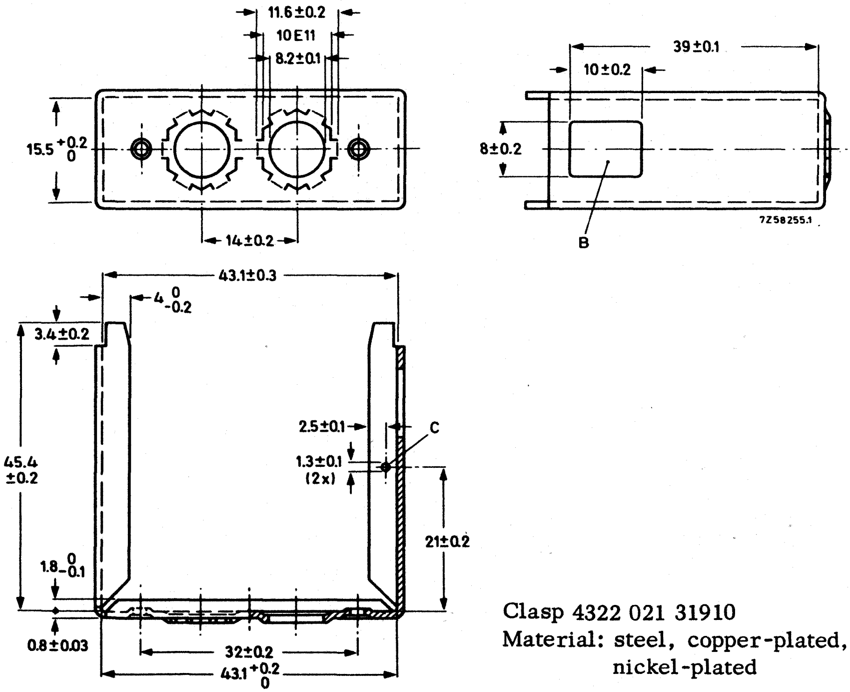
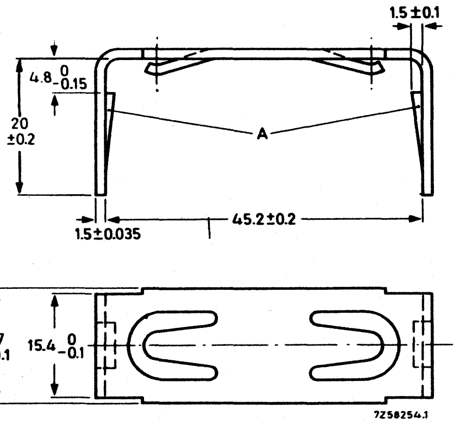
MOUNTING PARTS



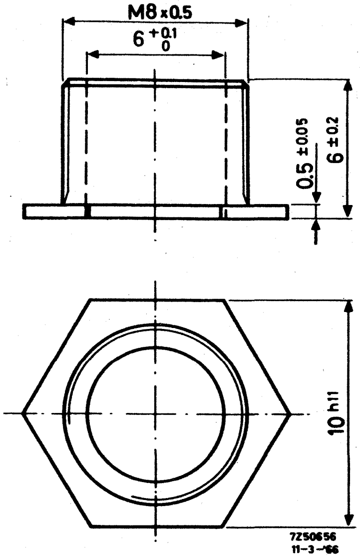
Clasp 4322 021 31910
Material: steel, copper-plated,
nickel-plated



Spring 4322 021 31920
Material: phosphorbronze,
nickel-plated

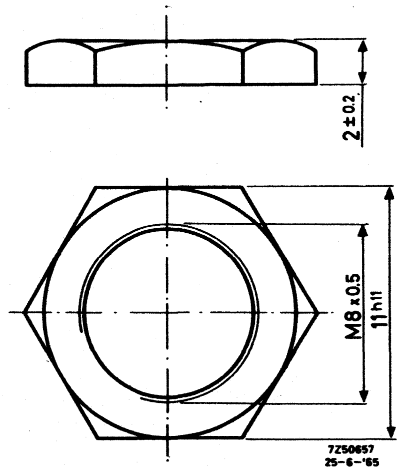
The construction is mounted by pushing the spring over the clasp in such a way that the lips A of the spring catch in the square holes B of the clasp. The mechanical pressure, required to keep the two E-cores together is exercised by means of two lips on top of the spring. No special tool is required 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



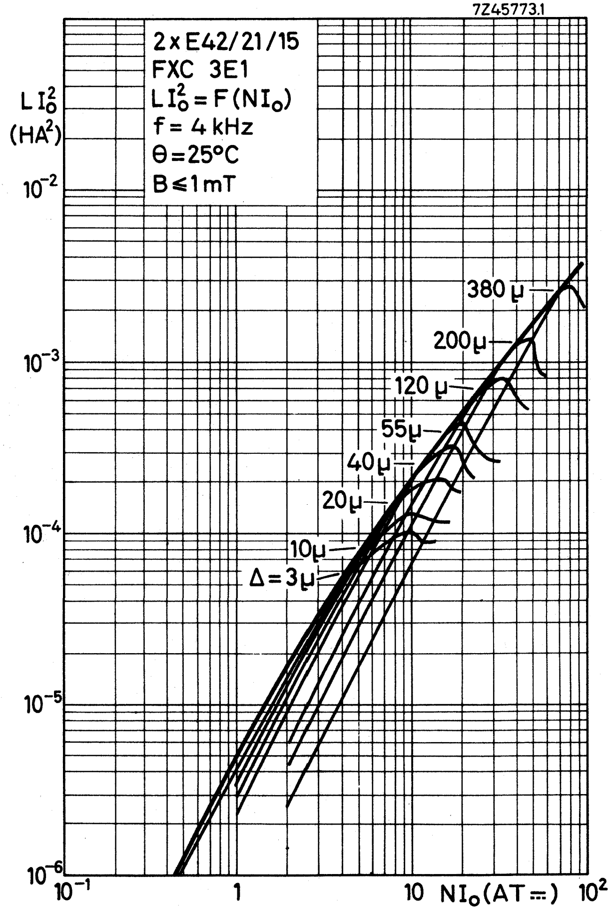
Nut 4322 021 30710

Material: brass, nickel plated

CHARACTERISTIC CURVES

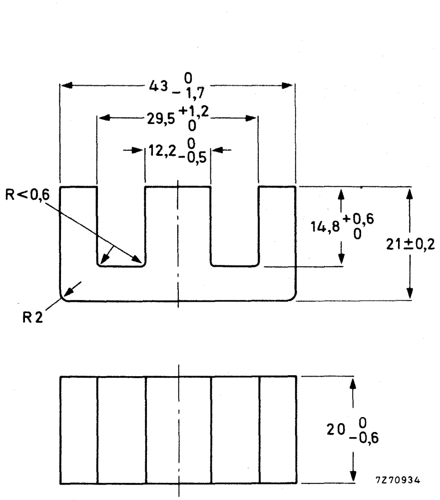
HANNA CURVES (typical values)

Indicating optimum inductance for a certain airgap and direct current

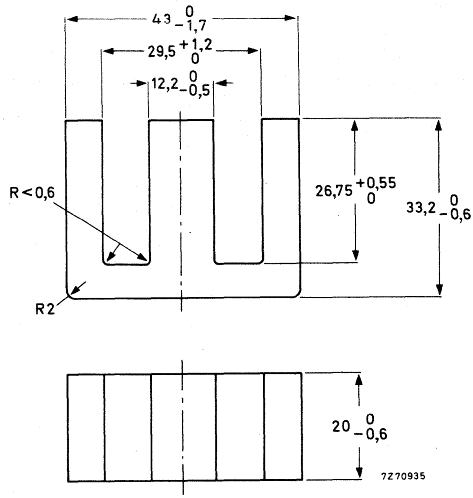


E-CORES

Dimensions in mm



E42/21/20



E42/33/20

Ferroxcube grade		3C8
Catalogue number of core E42/21/20,	without air gap	4312 020 34120
	with air gap 2,0 ± 0,1	4312 020 34360
	with air gap 1,7 ± 0,1	3122 134 91360
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. Shapes that are often chosen are 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

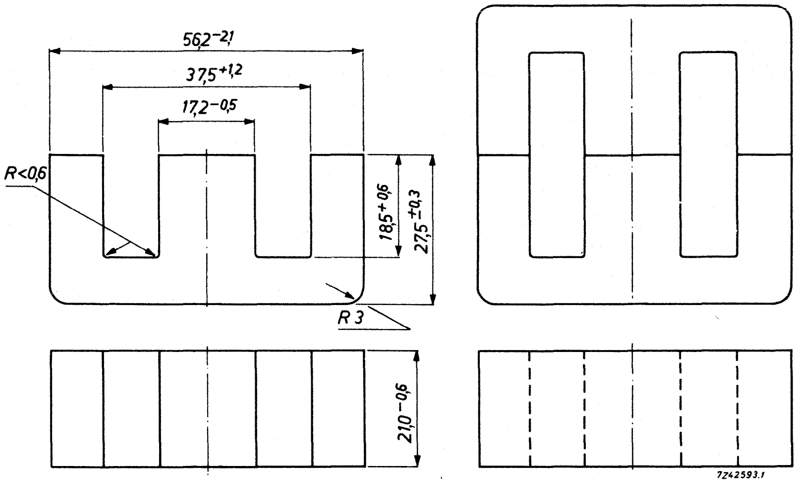
		EE42/42/20	EE42/54/20
Effective magnetic path length	l_e =	98 mm	122 mm
Effective cross-sectional area	A_e =	236 mm^2	236 mm^2
Core constant	$C_1 (= \Sigma \frac{l}{A})$ =	0,415 mm^{-1}	0,517 mm^{-1}
Effective core volume	V_e =	23100 mm^3	28800 mm^3

Magnetic properties

		EE42/42/20	EE42/54/20
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, $\hat{B}$ ≥ 90 mT, θ = 100 °C	$\hat{H}$ =	50 A/m	
$\hat{B}$ ≥ 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	3E1	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	$C_1 \left(= \Sigma \frac{1}{A}\right) = 0,348$ 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; Δ = 0

	μ_e = 2645-3970
	A_L = 9545-14330
At 4 kHz and $\hat{B}$ between 1,5 and 3 mT	$\eta_B \times 10^3 \leq 2,5\ T^{-1}$

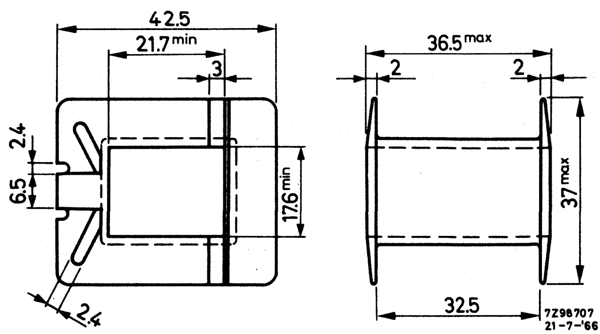
Magnetic properties for grade 3C8; Δ = 0

At 16 kHz, $\hat{B}$ = 200 mT and θ = 25 °C	P ≤ 5,5 W
θ = 100 °C	P ≤ 5,0 W
At 16 kHz, $\hat{B}$ ≥ 315 mT and θ = 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



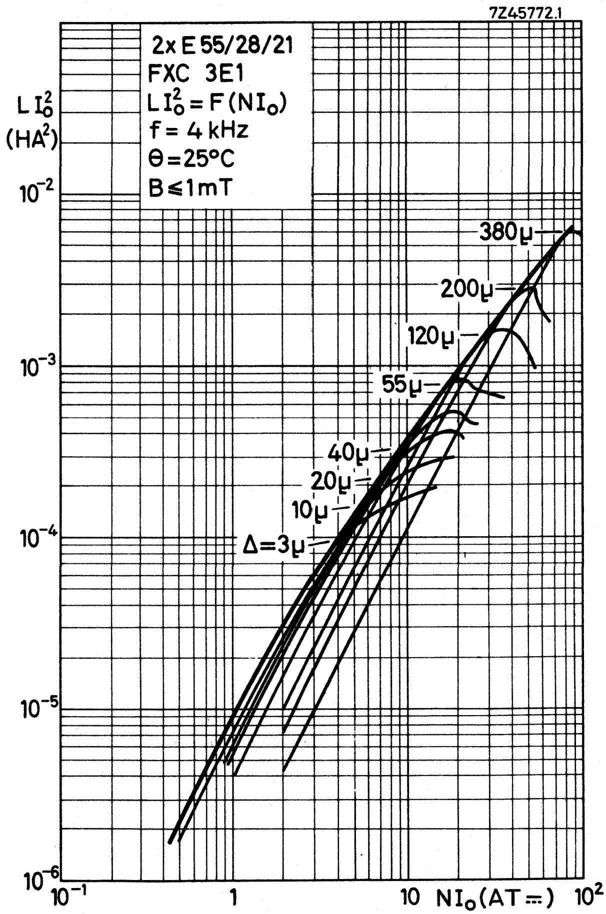
catalogue number	4312 021 28711
material	reinforced polyamide
minimum window area in mm^2	250
mean length of turn in mm	116
approximate weight in g	9
maximum temperature in ^oC	180

The dimensions are according to German specification D.I.N. 41305.

CHARACTERISTIC CURVES

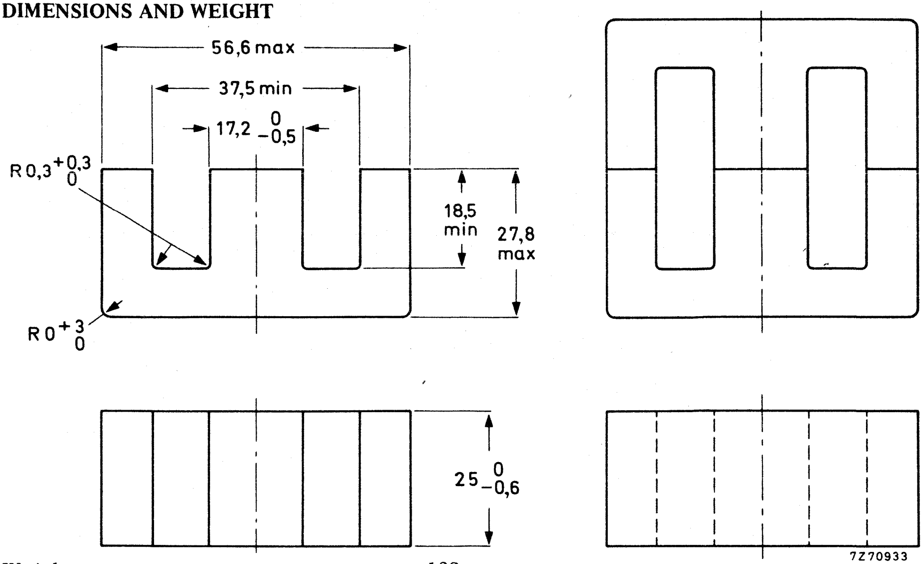
HANNA CURVES (typical values)

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

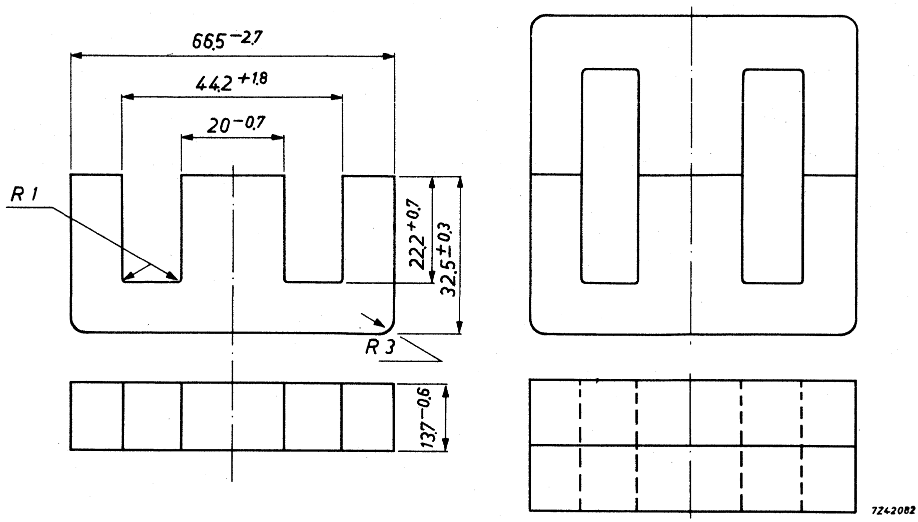
Effective magnetic path length	l_e = 123 mm
Effective cross-sectional area	A_e = 420 mm^2
Core constant	$C_1 (= \Sigma \frac{l}{A}) = 0,293$ mm^{-1}
Effective core volume	V_e = 52000 mm^3

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	$C_1 (= \Sigma \frac{1}{A}) = 0,275\ mm^{-1}$
Effective core volume	V_e = 78200 mm^3

Magnetic properties at 25 ± 10 °C; Δ = 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

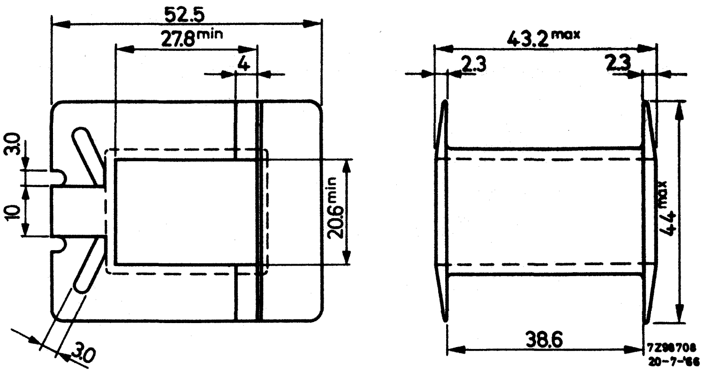
A_L = 12355-18545

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)



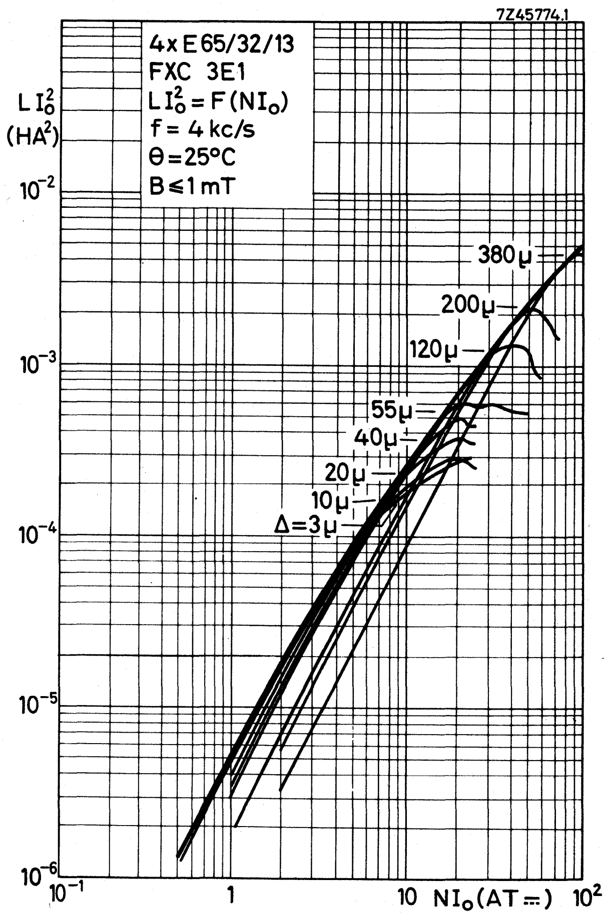
catalogue number	4312 021 28721
material	reinforced polyamide
minimum window area in mm^2	394
mean length of turn in mm	150
approximate weight in g	13
maximum temperature in ^oC	180

The dimensions are according to German specification D.I.N. 41305.

CHARACTERISTIC CURVES

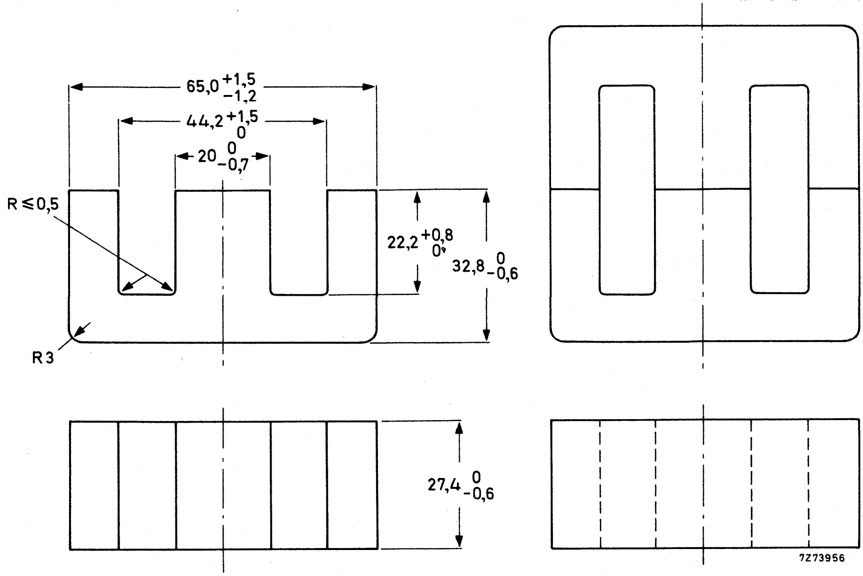
HANNA CURVES (typical values)

Indicating optimum inductance for a certain airgap and direct current



E-CORE

Dimensions in mm



Mass	approx. 203 g
Ferroxcube grade	3C8
Catalogue number of E-core	4312 020 34380

SHELL TYPE TRANSFORMER EE 65/66/27

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 EE65/66/27 composed of two cores type E65/33/27.

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 (= $\Sigma \frac{l}{A}$) = 0,275 mm^{-1}
Effective core volume	V_e = 78200 mm^3

Magnetic properties; $\Delta = 0$

At f = 16 kHz, $\hat{B}$ = 200 mT, θ = 25 °C	P ≤ 9,5 W
θ = 100 °C	P ≤ 8,7 W
At f = 16 kHz, $\hat{B}$ ≥ 315 mT, θ = 100 °C	$\hat{H}$ = 250 A/m

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, E55/28/25 and E65/33/27 are also suited for use in power supplies. For data on these cores, see "Ferroxcube transformers cores".

CORE SELECTION

In order to simplify the design of transformers with Ferroxcube EC-cores for switched-mode power supply converters, a set of graphs is given that allows a fairly accurate first design to be made in the minimum of time.
The four graphs are based upon simplified assumptions of normal working conditions. These are:

- the core hot-spot temperature, which occurs in the centre leg, is 40 °C above ambient (ΔT_{cp-a} = 40 °C) and the average winding temperature is 100 °C;
- $F_w/F_R \leq 0,4$ in which
  F_w = ratio of total copper area in the transformer winding to available winding window;
  F_R = ratio of winding a.c. resistance to d.c. resistance;
- the ratio of maximum permissible core peak flux to normal core peak flux ($\phi_{M\,max}/\phi_M$) is constant;
- a 4 mm clearance for creepage distance is allowed at each end of the winding.

Several winding configurations are allowed for in the graphs. In push-pull transformers, all windings contribute to the useful power. They are:
(1 + 1) a single primary and a single secondary;
(1 + 2) a single primary and a split secondary, or
(2 + 1) a split primary and a single secondary;
(2 + 2) a split primary and a split secondary.
For forward converter transformers and flyback converter transformers only the (1 + 1) configuration has been allowed for in the graphs.

It has been assumed that each winding or each half of a split winding, occupies the same space as every other winding. That is, in the (1 + 2) case, each winding occupies 1/3 of the total winding space.

Using the graphs

Select the appropriate graph. Find the intersection of the chosen operating frequency (f) and the required throughput power (P_o). The required core type is that corresponding to the intended winding configuration lying immediately above the intersection.

Notes: If the centre-pole temperature rise is other than the 40 °C assumed, then the value of throughput power used for core selection should be modified. The new value, P_o', is given by

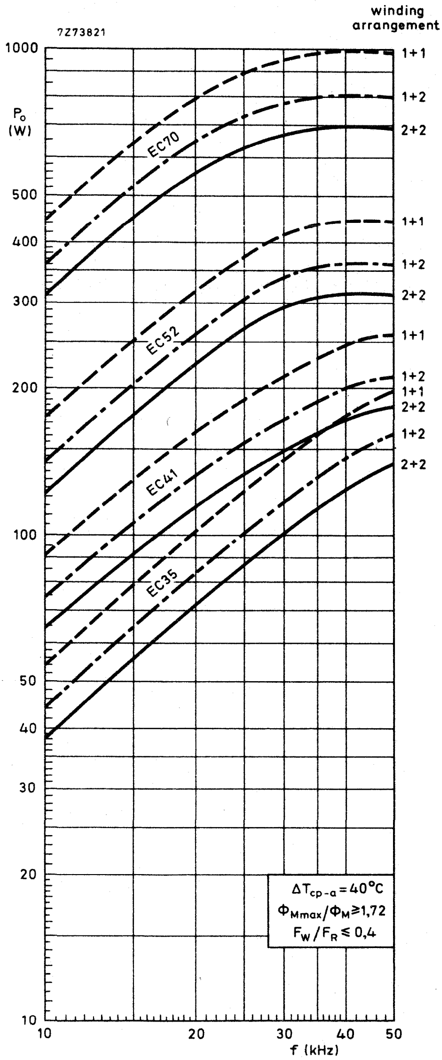
$$P_o' = P_o \sqrt{(\Delta T_{cp-a}/40)} = P_o \sqrt{\left\{(100 - T_a)/40\right\}}$$

in which T_a = ambient temperature in °C.

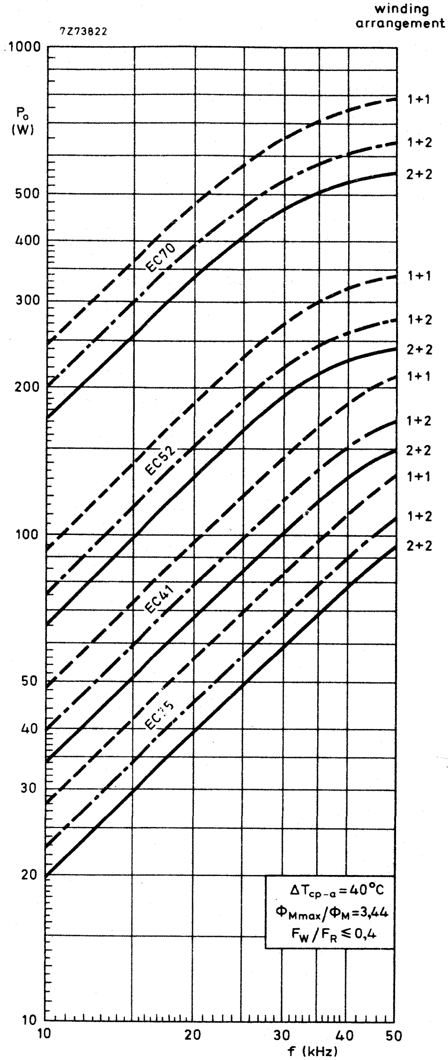
The graph for flyback converter transformers contains the parameter γ, the value of which depends on the converter properties.

Symbol γ indicates the ratio of minimum d.c. output current ($I_{o\ min}$) to maximum d.c. output current ($I_{o\ max}$) [1].
For preliminary core selection an approximate choice of value of γ will suffice.
The value $\gamma = 1$ corresponds to the ringing choke type, in which the transformer core flux falls to zero during each cycle.
The value $\gamma = 0,25$ corresponds to a flyback converter in which the flux does not fall to zero, even under full load conditions ($I_{o\ min} = 25\%\ I_{o\ max}$).

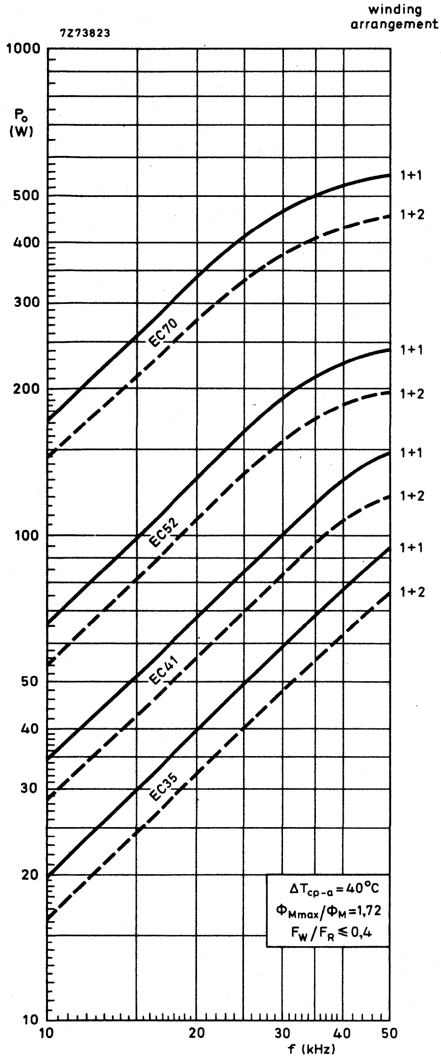
[1]) Various publications on switched-mode power supplies have used the symbol Δ for this ratio. The symbol γ has been introduced here to avoid confusion with the symbol used for the air gap.



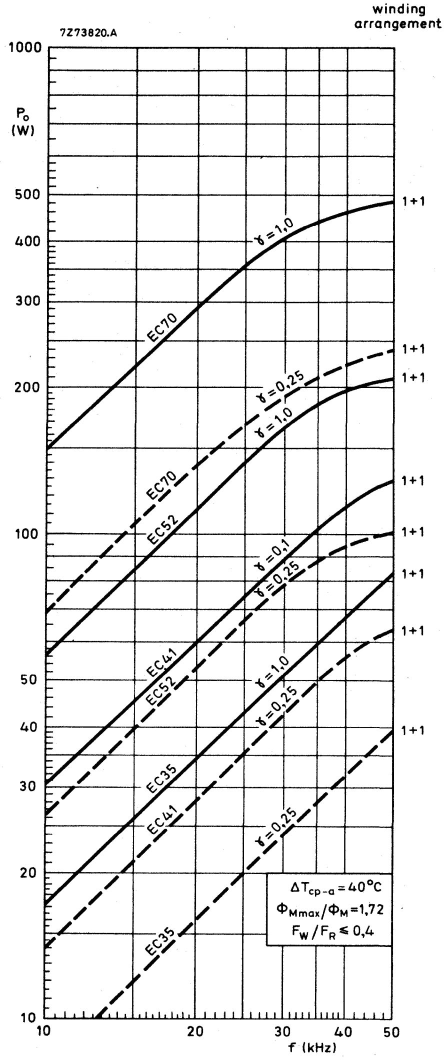
Balanced push-pull converter transformers.



Unbalanced push-pull converter transformers.



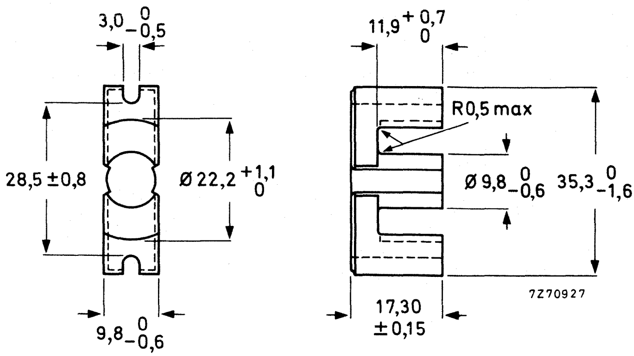
Forward-converter transformers.



Flyback-converter transformers.

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Mass	approx. 18 g
Catalogue number of EC-core without air gap	4322 020 52500
Catalogue number of EC-core with air gap 1,4 ± 0,2 mm	8213 140 25270

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

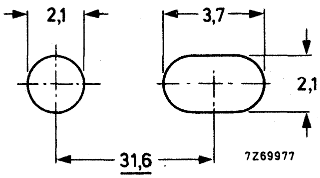
* According to IEC 205.

MAGNETIC PROPERTIES FOR A PAIR OF CORES WITHOUT AIR GAP

Relative amplitude permeability (μ_a) at θ = 100 °C, $\hat{B}$ = 320 mT in A_{CPmin}	> 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, $\hat{B}$ = 160 mT	≤ 1,1 W

MOUNTING

The wound coil former and cores may be assembled by means of non-magnetic M2 screws or studs along the grooves provided. The use of a clamping bar is strongly recommended to ensure that the maximum clamping force of 200 N is uniformly distributed over the cross-section of the outer poles.
The assembly studs can be extended for mounting purposes or to support another sub-assembly.

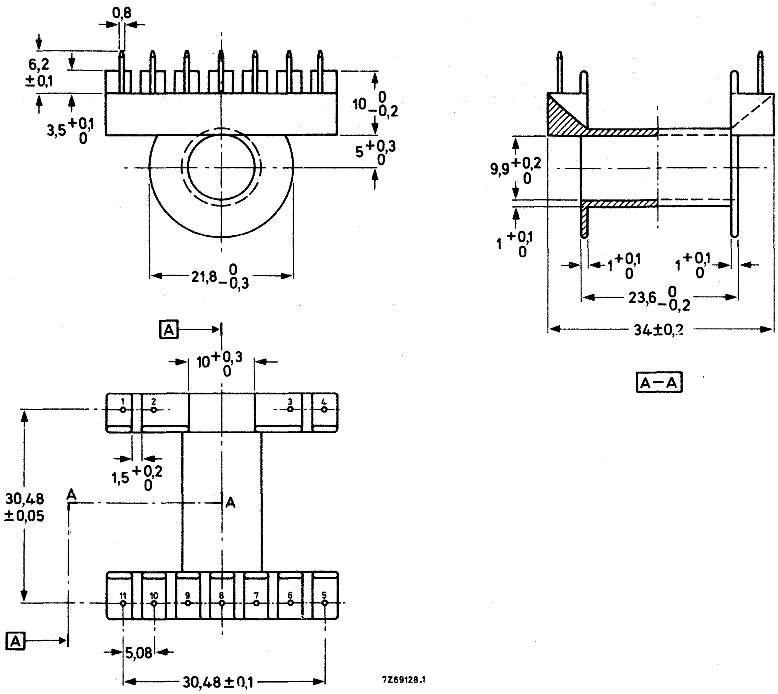


Recommended piercing diagram.

COIL FORMERS

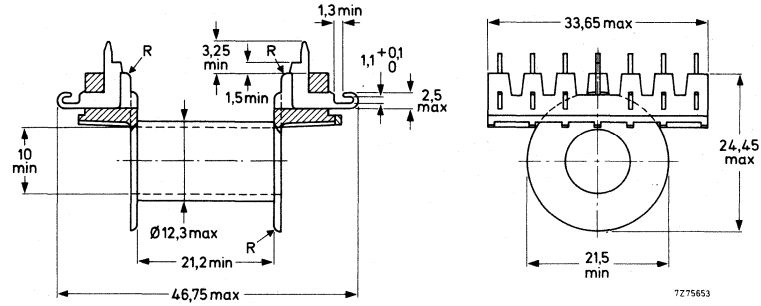
Style 1

Dimensions in mm

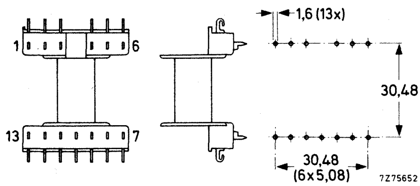


Material	phenolformaldehyde reinforced with glass fibre: brass dip-solder pins
Mounting	horizontal
Minimum window area	97,5 mm^2
Mean length of turn	50 mm
Mass	approx. 6 g
Maximum temperature	140 ^oC
Catalogue number (coil former with pins)	4322 021 33410

Style 2



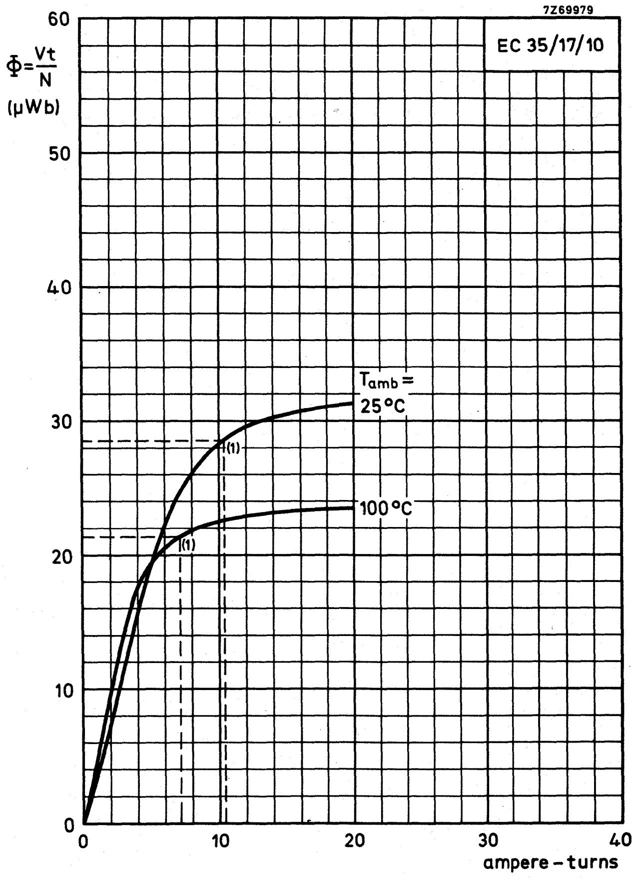
Tag arrangement



Material	polyteraphthalate, glass fibre reinforced, 13 solder-plated brass tags are inserted.
Mounting	horizontal
Minimum window area	97 mm^2
Mean length of turn	53 mm
Mass	7 g
Flame proof	according to UL-94 V 0
Catalogue number	4322 021 33310

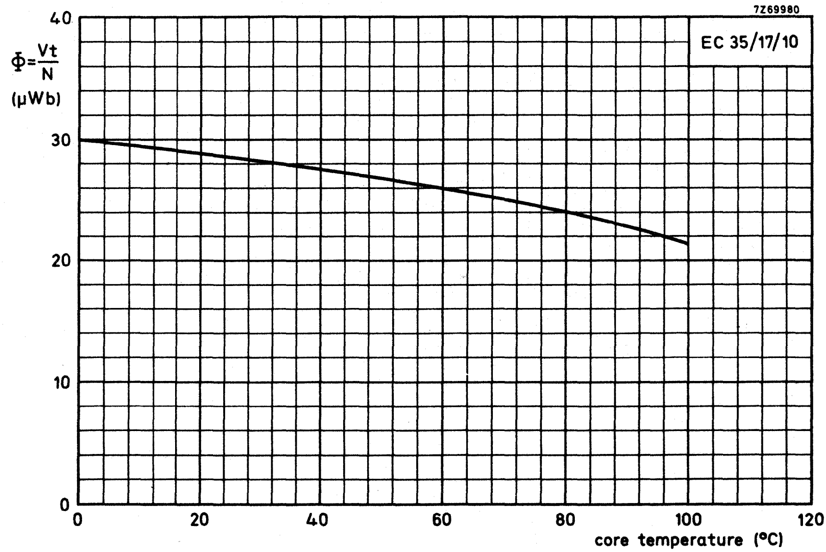
Note
Another coil former for core EC35/17/10 is available: catalogue number 4313 021 04143; information will be supplied on request.

CHARACTERISTIC CURVES

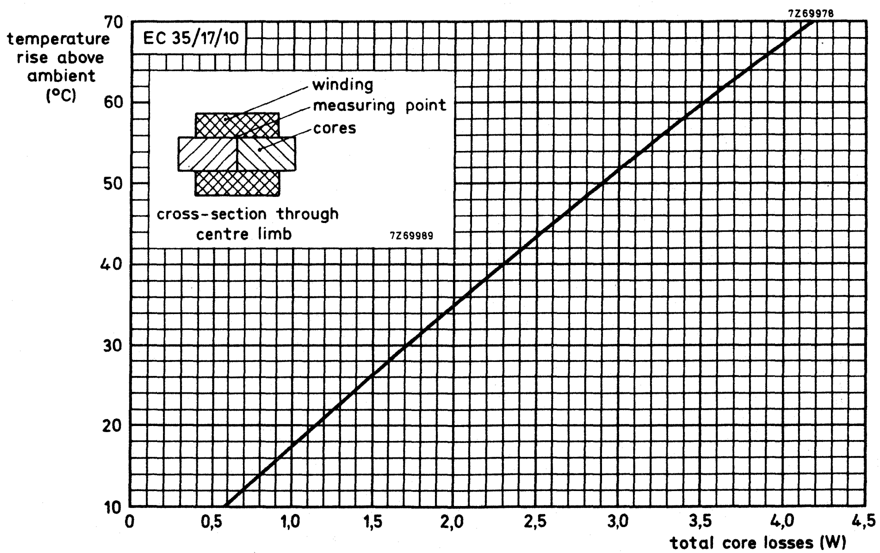


(1) Recommended maximum working flux.

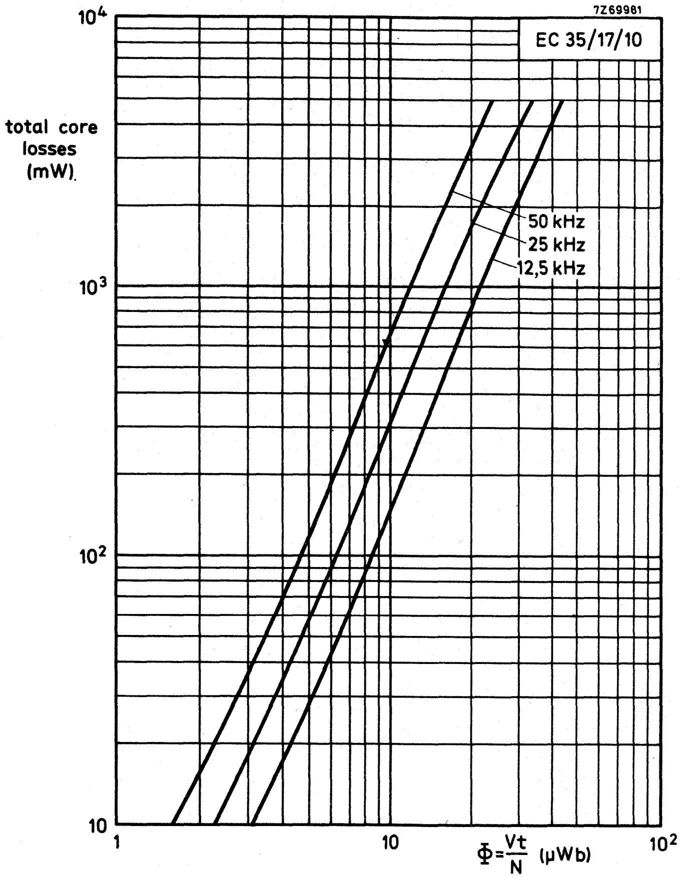
Total flux as a function of ampere-turns.



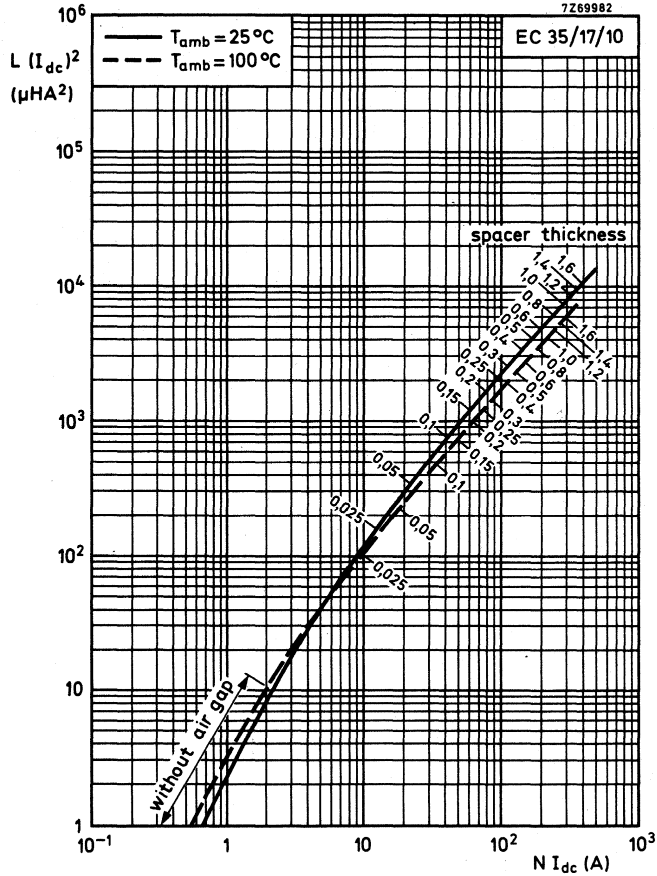
Recommended maximum working flux as a function of core temperature.



Transformer temperature rise as a function of total core losses, in free air conditions, without heatsink.



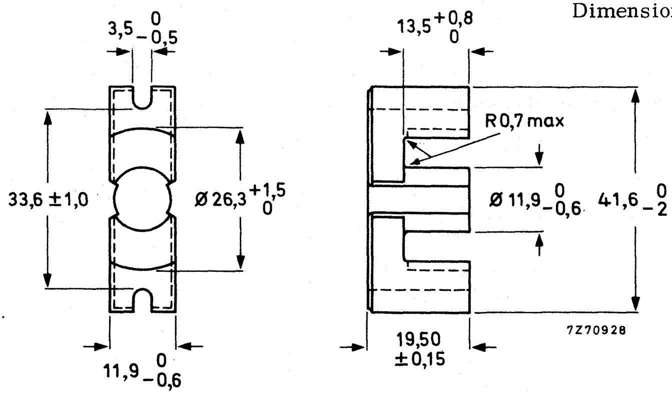
Total core losses as a function of total flux at hot-spot core temperature.



Hanna curves

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Mass	approx. 26 g
Catalogue number of EC-core without air gap	4322 020 52510
Catalogue number of EC-core with air gap 1,5 ± 0,2 mm	8213 140 25280

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *	C_1	= 0,735 mm^{-1}
Minimum cross-sectional centre pole area	A_{CPmin}	= 100,3 mm^2
Cross-sectional centre pole area	A_{CP}	= 106 mm^2
Back and leg cross-sectional area	A_b	= 130 mm^2
Centre pole volume	V_{CP}	= 2950 mm^3
Back and leg volume	V_b	= 9650 mm^3
Total core volume	V_f	= 12600 mm^3
Effective magnetic path length *	l_e	= 89,3 mm
Effective cross-sectional area *	A_e	= 121 mm^2
Effective core volume *	V_e	= 10800 mm^3

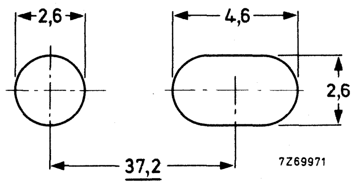
* According to IEC 205.

MAGNETIC PROPERTIES FOR A PAIR OF CORES WITHOUT AIR GAP

Relative amplitude permeability (μ_a) at θ = 100 °C, $\hat{B}$ = 320 mT in A_{CPmin}	> 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, $\hat{B}$ = 160 mT	≤ 2,2 W

MOUNTING

The wound coil former and cores may be assembled by means of non-magnetic M2,5 screws or studs along the grooves provided. The use of a clamping bar is strongly recommended to ensure that the maximum clamping force of 250 N is uniformly distributed over the cross-section of the outer poles.
The assembly studs can be extended for mounting purposes or to support another sub-assembly.



Recommended piercing diagram.

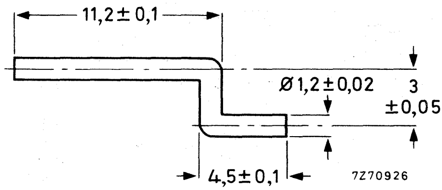
COIL FORMERS

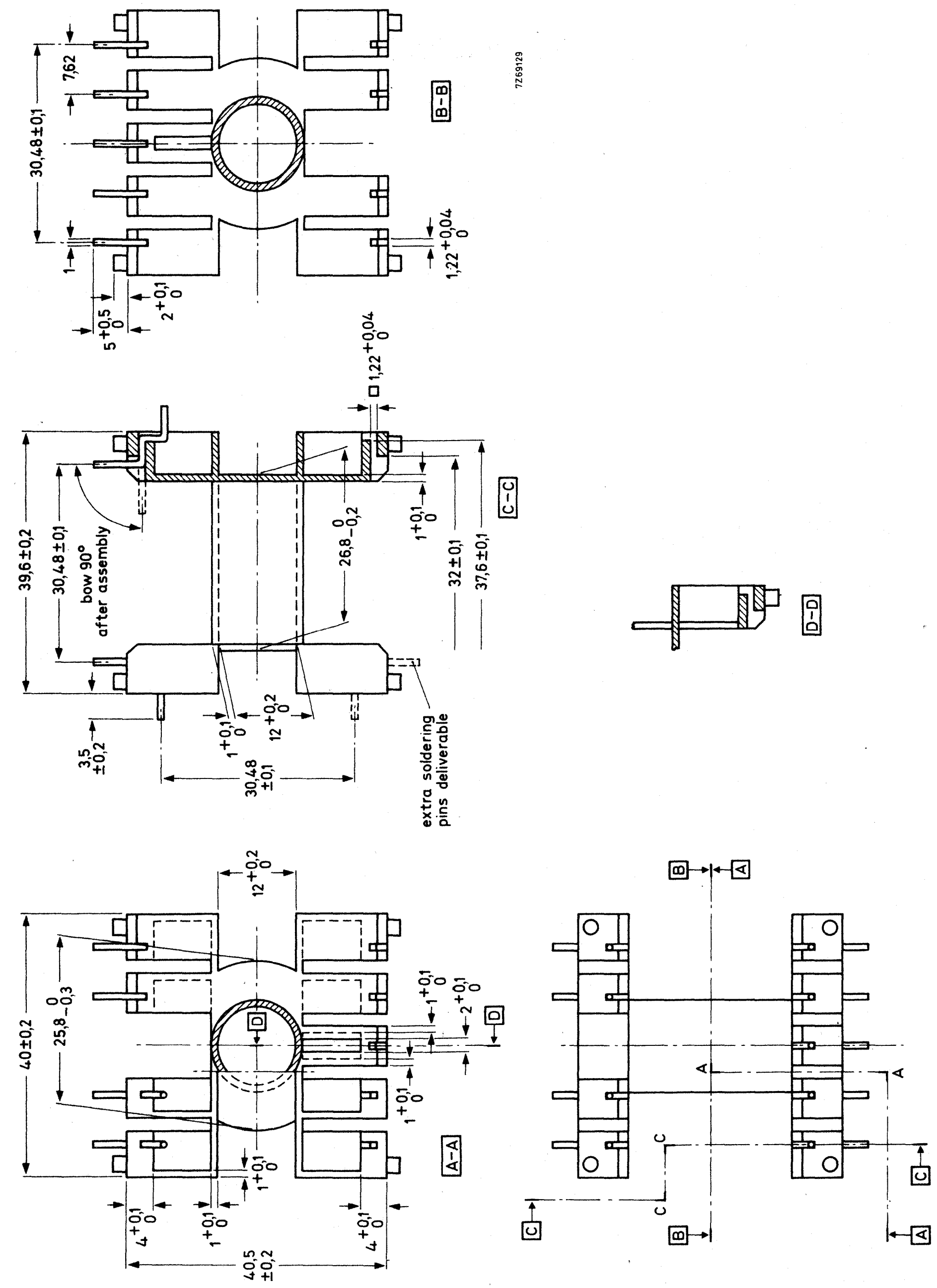
Style 1

Dimensions in mm	see drawing on the next page
Material	glass-fibre-filled polyamide
Minimum window area	136 mm^2
Mean length of turn	60 mm
Mass, without pins	approx. 10 g
Maximum temperature	120 °C
Catalogue number	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.

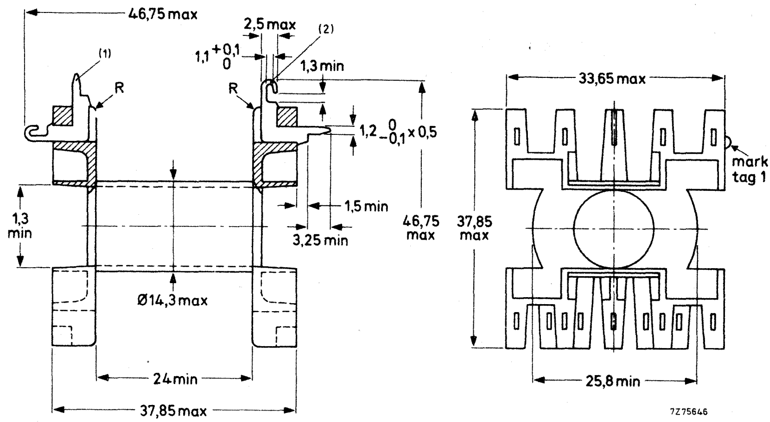
Brass dip-solder pin




B-B
C-C
D-D
A-A
bow 90°
after assembly
extra soldering
pins deliverable
7Z69129
30,48 ±0,1
7,62
39,6 ±0,2
26,8
32 ±0,1
37,6 ±0,1
40 ±0,2
40,5
±0,2
3,5
±0,2

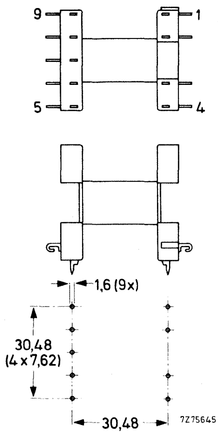
Style 2

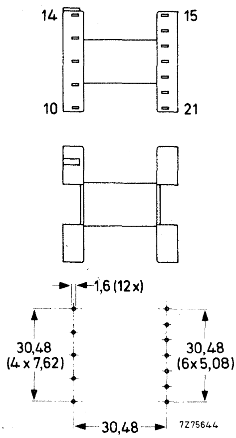
Material housing	glass-fibre-filled polyteraphthalate
Material of tags	solder-plated brass
Minimum window area	138 mm^2
Mean length of turn	62 mm
Mass, 9 tags inserted	10 g
Flame proof	according to UL-94-V 0
Mounting	horizontal and vertical
Catalogue number	see next page
Tag arrangement	see next page
Dimensions in mm	

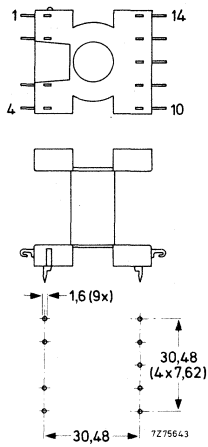


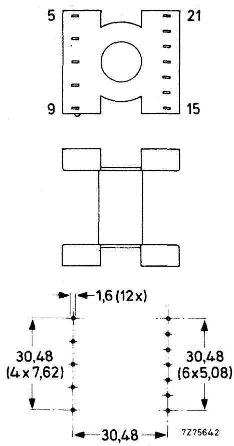
Tag arrangement

Horizontal mounting		Vertical mounting	
9 tags inserted	for 12 tags*	9 tags inserted	for 12 tags*
catalogue no. 4322 021 33320	catalogue no. 4322 021 33010	catalogue no. 4322 021 33350	catalogue no. 4322 021 33010





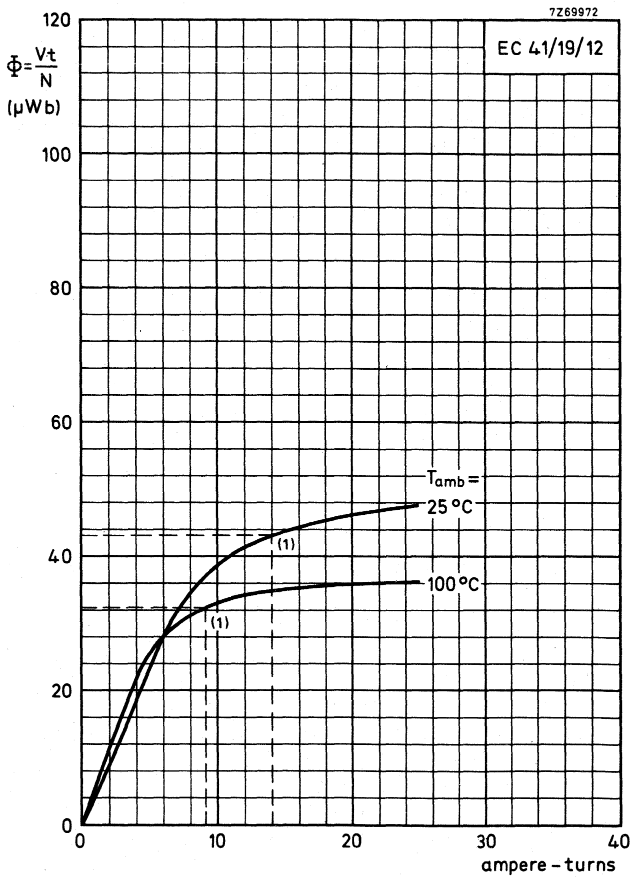




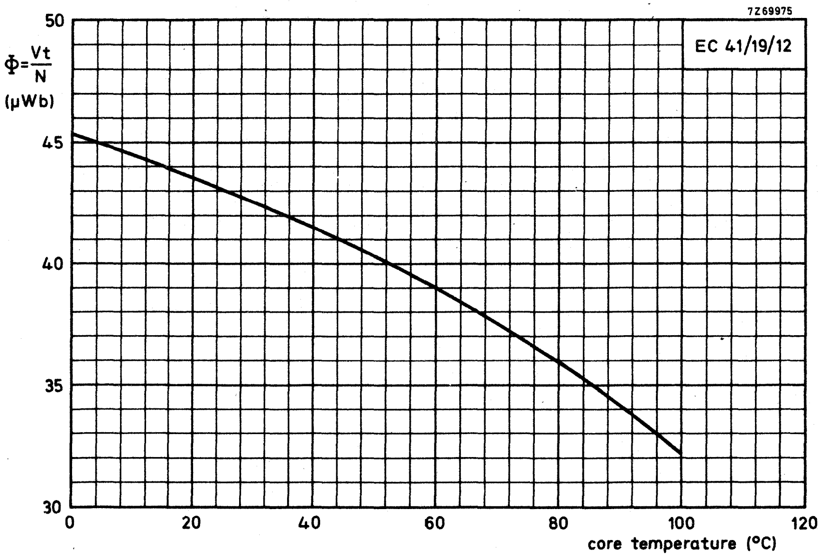
Note
Another coil former for core EC41/19/12 is available: catalogue number 4313 021 04153; information will be supplied on request.

* Tags, catalogue number 4322 021 33060 should be ordered separately.

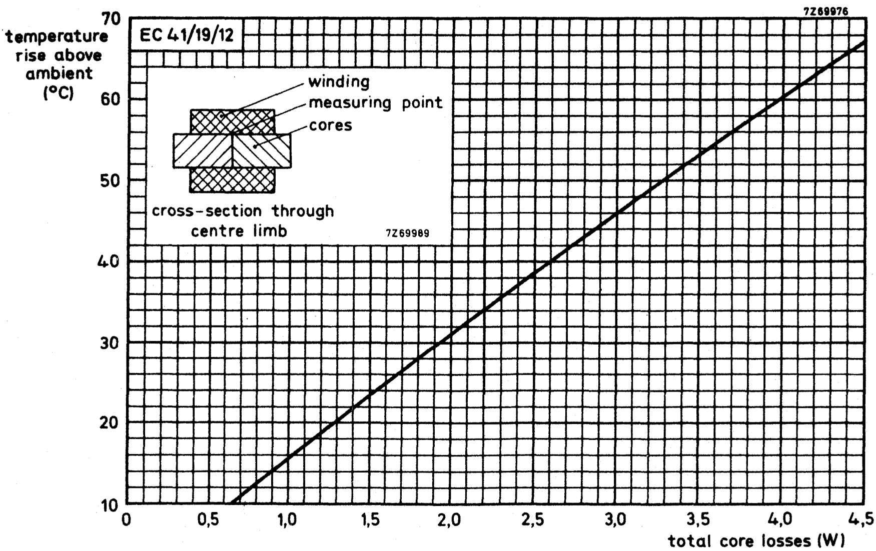
CHARACTERISTIC CURVES



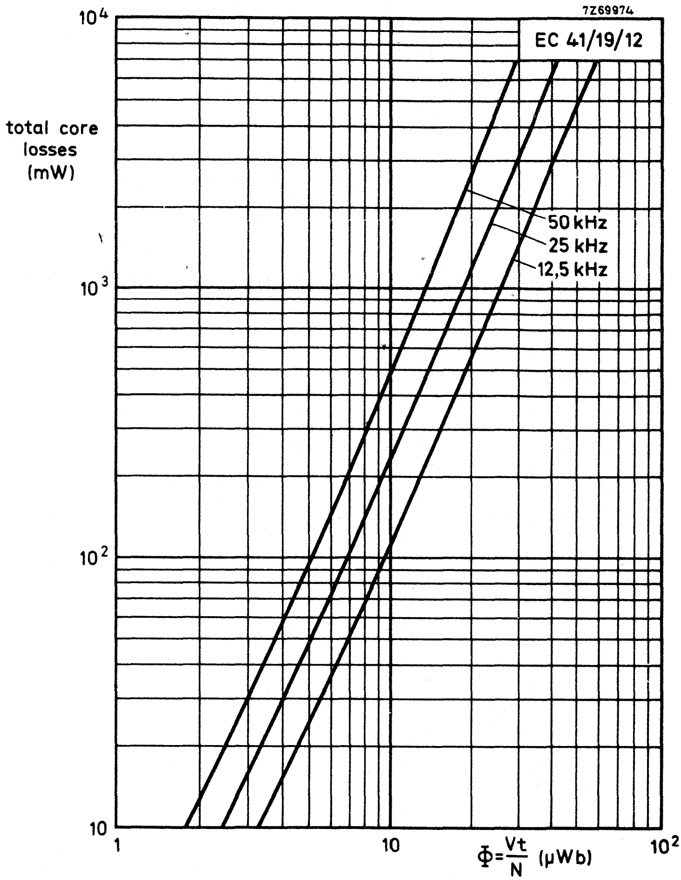
(1) Recommended maximum working flux.
Total flux as a function of ampere-turns.



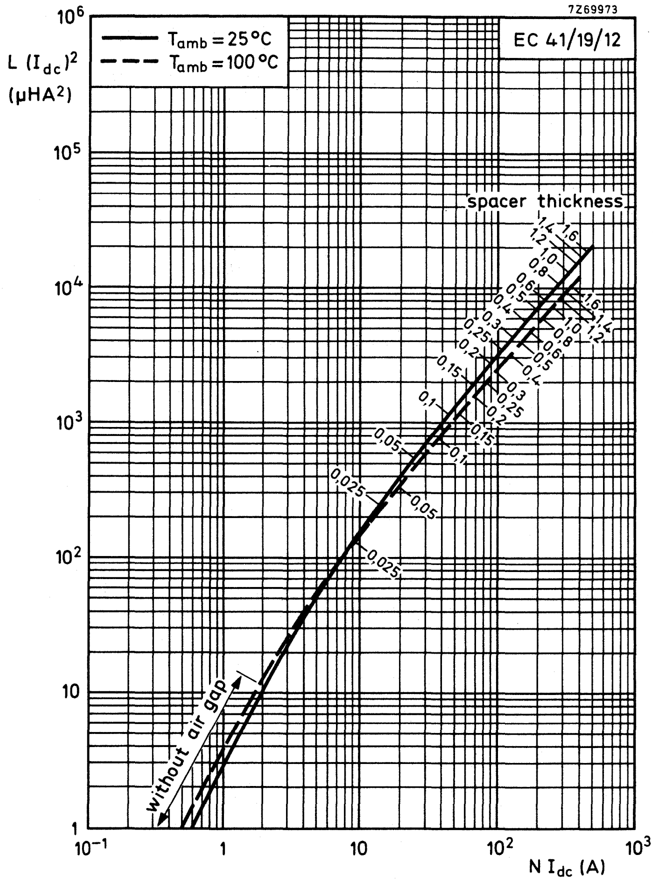
Recommended maximum working flux as a function of core temperature.



Transformer temperature rise as a function of total core losses, in free air conditions, without heatsink.



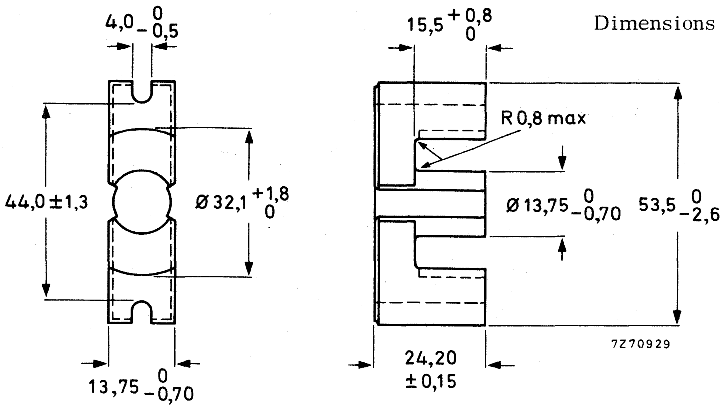
Total core losses as a function of total flux at hot-spot core temperature.



Hanna curves

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Mass	approx. 55,5 g
Catalogue number of EC-core without air gap	4322 020 52520
Catalogue number of EC-core with air gap 2,3 ± 0,2 mm	8213 140 25290

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *	C_l	$= 0,581\ mm^{-1}$
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	$= 18800\ mm^3$

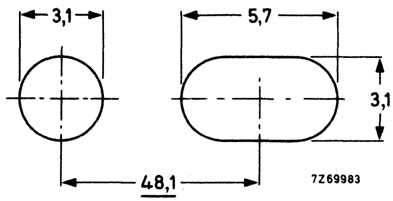
* According to IEC 205.

MAGNETIC PROPERTIES FOR A PAIR OF CORES WITHOUT AIR GAP

Relative amplitude permeability (μ_a) at θ = 100 °C, $\hat{B}$ = 320 mT in A_{CPmin}	> 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, $\hat{B}$ = 160 mT	≤ 2,7 W

MOUNTING

The wound coil former and cores may be assembled by means of non-magnetic M3 screws or studs along the grooves provided. The use of a clamping bar is strongly recommended to ensure that the maximum clamping force of 400 N is uniformly distributed over the cross-section of the outer poles.
The assembly studs can be extended for mounting purposes or to support another sub-assembly.



Recommended piercing diagram.

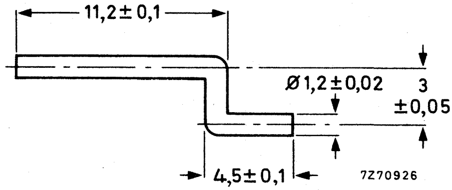
COIL FORMERS

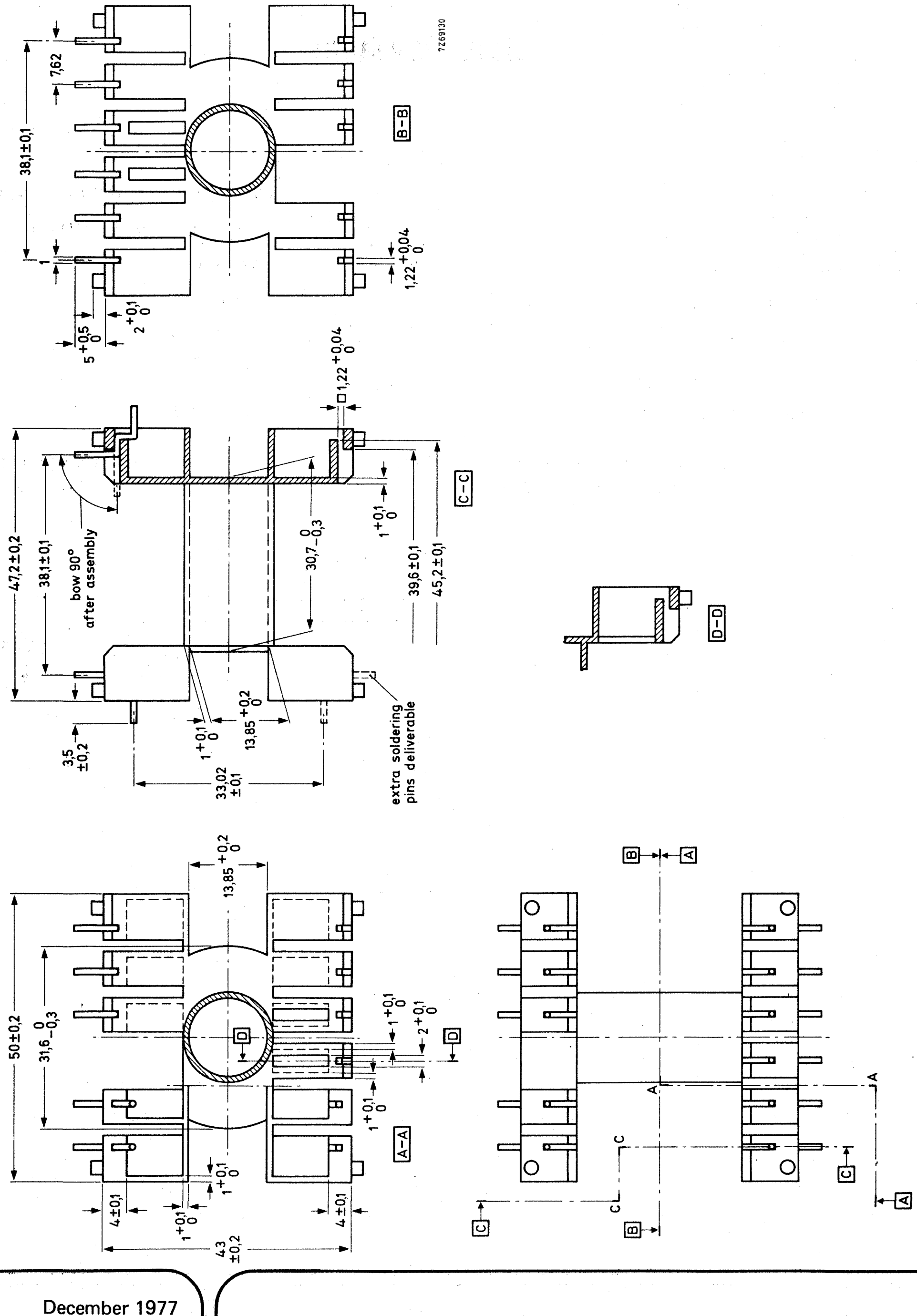
Style 1

Dimensions in mm	see drawing on the next page
Material	glass-fibre-filled polyamide
Minimum window area	212 mm^2
Mean length of turn	73 mm
Mass, without pins	approx. 15 g
Maximum temperature	120 °C
Catalogue number	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.

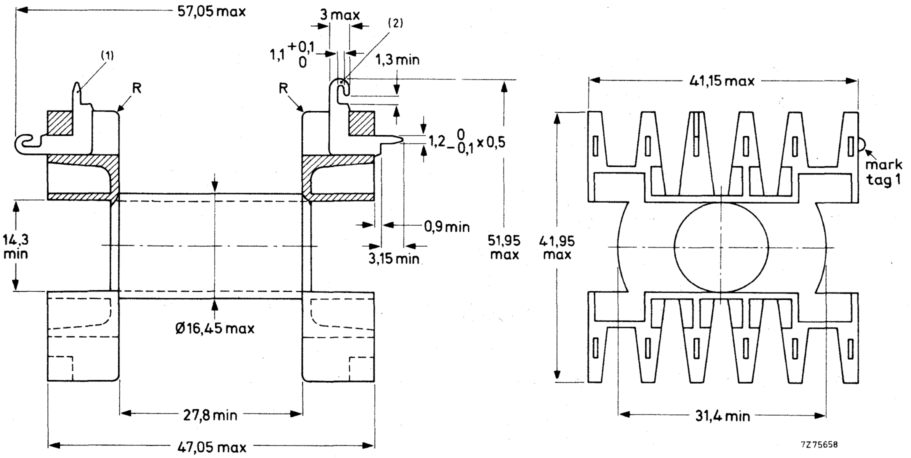
Brass dip-solder pin




7Z69130
B-B
C-C
D-D
A-A
bow 90°
after assembly
extra soldering
pins deliverable
38,1±0,1
47,2±0,2
39,6±0,1
45,2±0,1
33,02
±0,1
50±0,2
43
±0,2
7,62

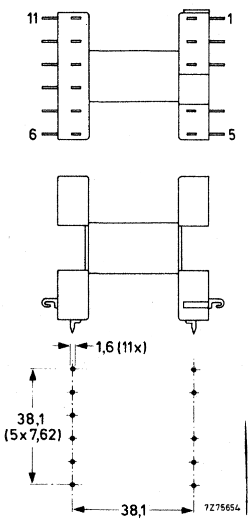
Style 2

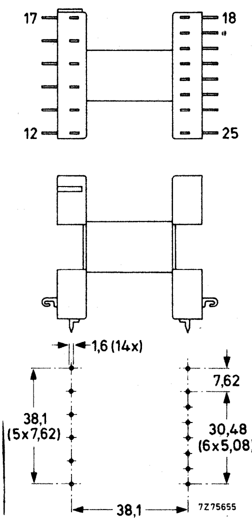
Material of housing	glass-fibre-filled polyteraphthalate
Material of tags	solder-plated brass
Minimum window area	210 mm^2
Mean length of turn	70 mm
Mass, 11 tags inserted	18 g
Flame proof	according to UL-94-V 0
Mounting	horizontal and vertical
Catalogue number	see next page
Tag arrangement	see next page
Dimensions in mm	

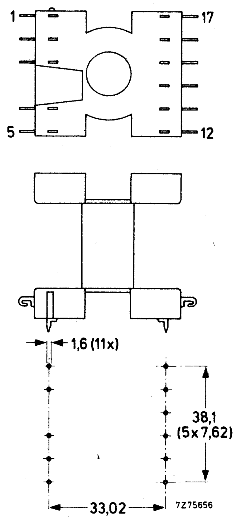


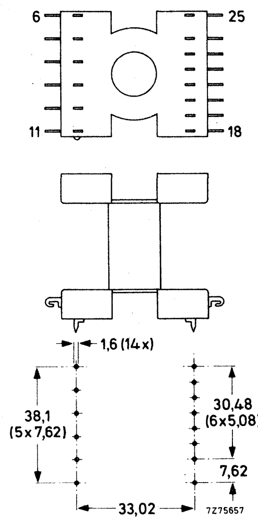
Tag arrangement

Horizontal mounting		Vertical mounting	
11 tags inserted	for 14 tags*	11 tags inserted	for 14 tags*
catalogue no.	catalogue no.	catalogue no.	catalogue no.
4322 021 33330	4322 021 33020	4322 021 33360	4322 021 33020





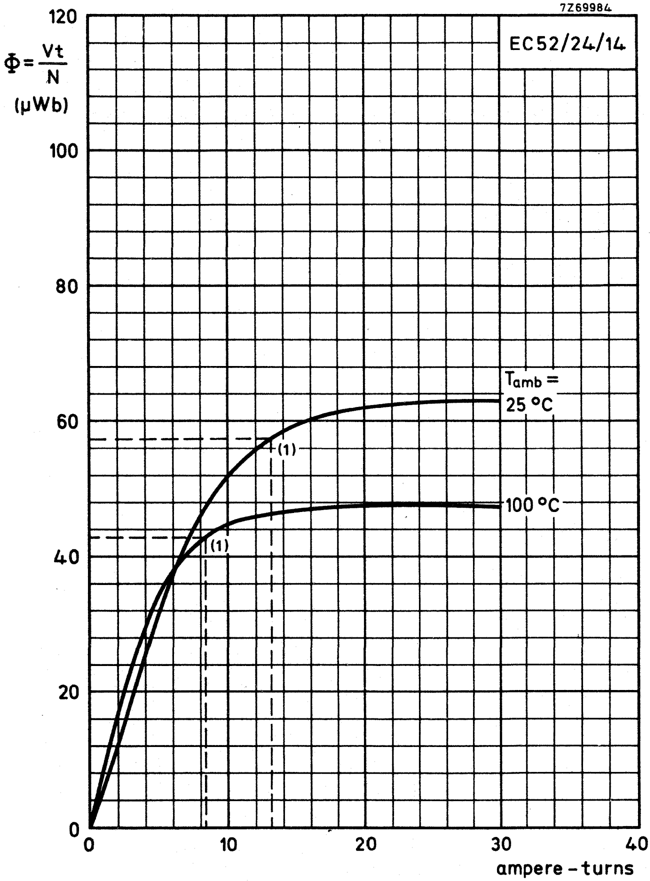




Note
Another coil former for core EC52/24/14 is available: catalogue number 4313 021 04163; information will be supplied on request.

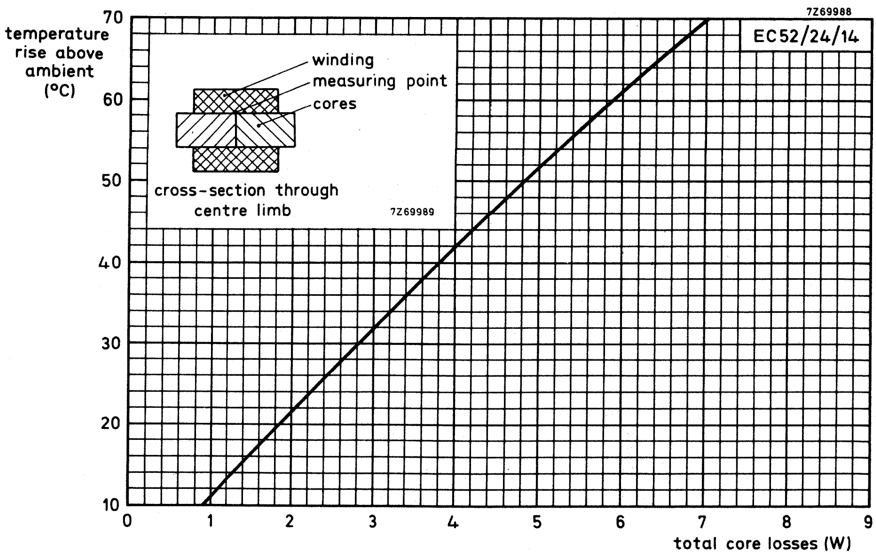
* Tags, catalogue number 4322 021 33070 should be ordered separately.

CHARACTERISTIC CURVES

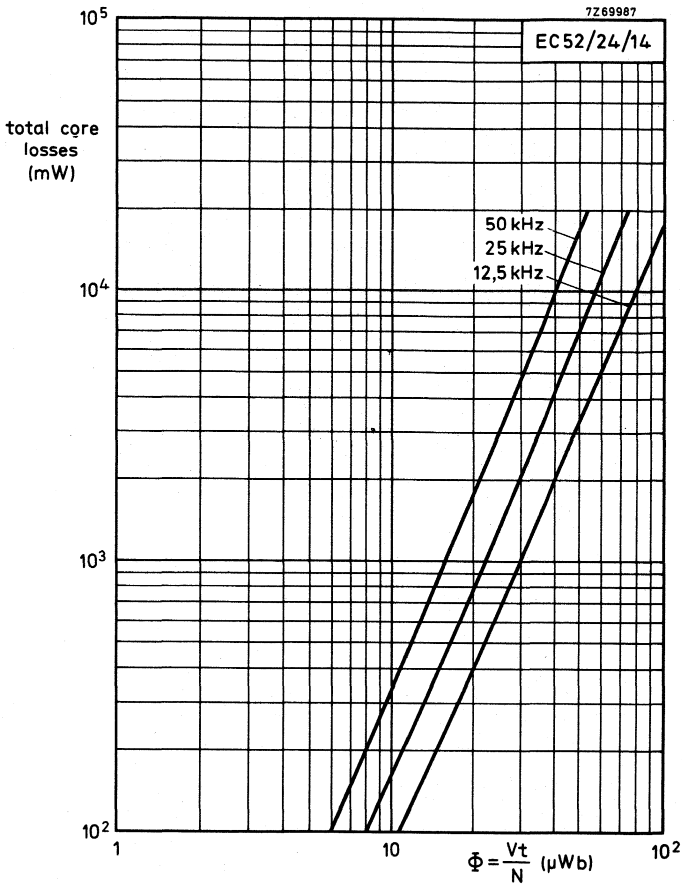


(1) Recommended maximum working flux.
Total flux as a function of ampere-turns.

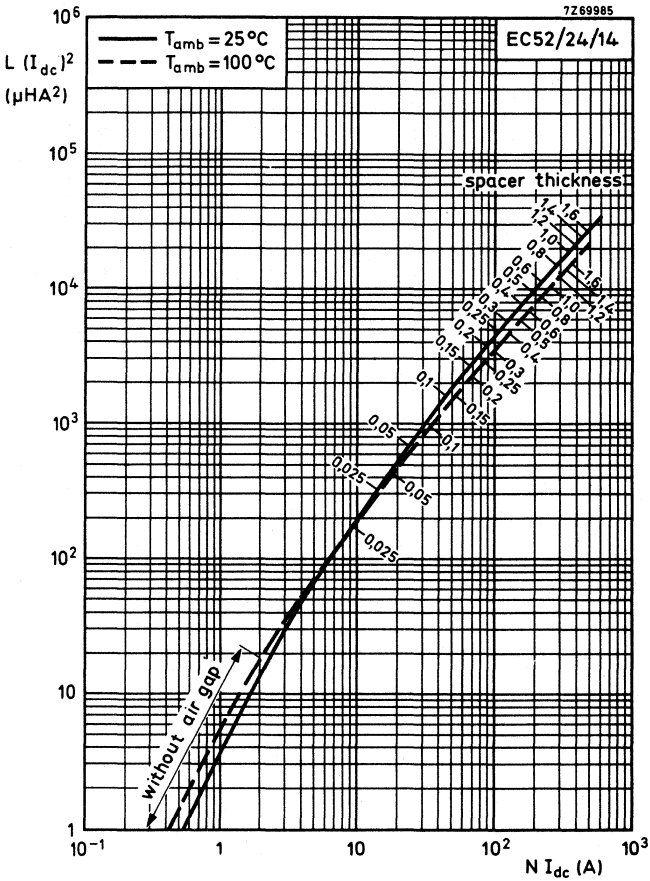
Recommended maximum working flux as a function of core temperature.



Transformer temperature rise as a function of total core losses, in free air conditions, without heatsink.



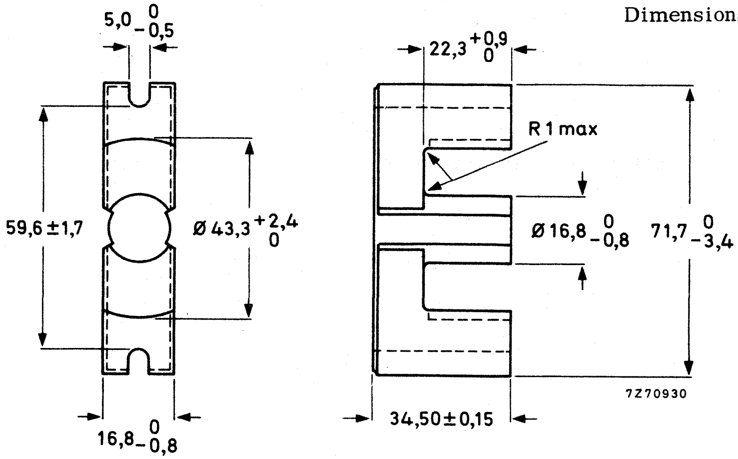
Total core losses as a function of total flux at hot-spot core temperature.



Hanna curves

EC-CORE

Dimensions in mm



Ferroxcube grade	3C8
Mass	approx. 126,5 g
Catalogue number of EC-core without air gap	4322 020 52530
Catalogue number of EC-core with air gap 4,85 ± 0,2 mm	8213 140 25300

DIMENSIONAL PARAMETERS FOR A PAIR OF CORES (assuming nominal dimensions, unless otherwise stated)

Core constant *	C_1	$= 0,514\ mm^{-1}$
Minimum cross-sectional centre pole area	A_{CPmin}	$= 201,1\ mm^2$
Cross-sectional centre pole area	A_{CP}	$= 211,0\ mm^2$
Back and leg cross-sectional area	A_b	$= 386,0\ mm^2$
Centre pole volume	V_{CP}	$= 9600\ mm^3$
Back and leg volume	V_b	$= 46000\ mm^3$
Total core volume	V_f	$= 55600\ mm^3$
Effective magnetic path length *	l_e	$= 144\ mm$
Effective cross-sectional area *	A_e	$= 279\ mm^2$
Effective core volume *	V_e	$= 40100\ mm^3$

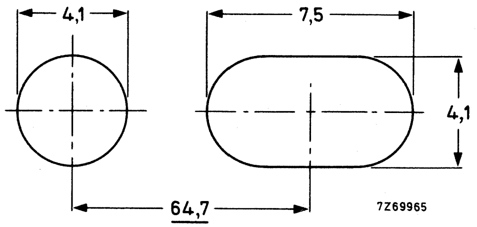
* According to IEC 205.

MAGNETIC PROPERTIES FOR A PAIR OF CORES WITHOUT AIR GAP

Relative amplitude permeability (μ_a) at θ = 100 °C, $\hat{B}$ = 320 mT in A_{CPmin}	> 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, $\hat{B}$ = 160 mT	≤ 5 W

MOUNTING

The wound coil former and cores may be assembled by means of non-magnetic M4 screws or studs along the grooves provided. The use of a clamping bar is strongly recommended to ensure that the maximum clamping force of 600 N is uniformly distributed over the cross-section of the outer poles.
The assembly studs can be extended for mounting purposes or to support another sub-assembly.



Recommended piercing diagram.

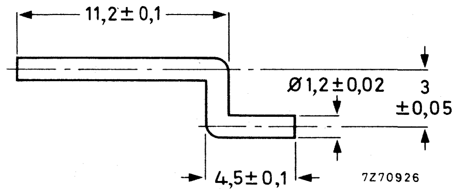
COIL FORMERS

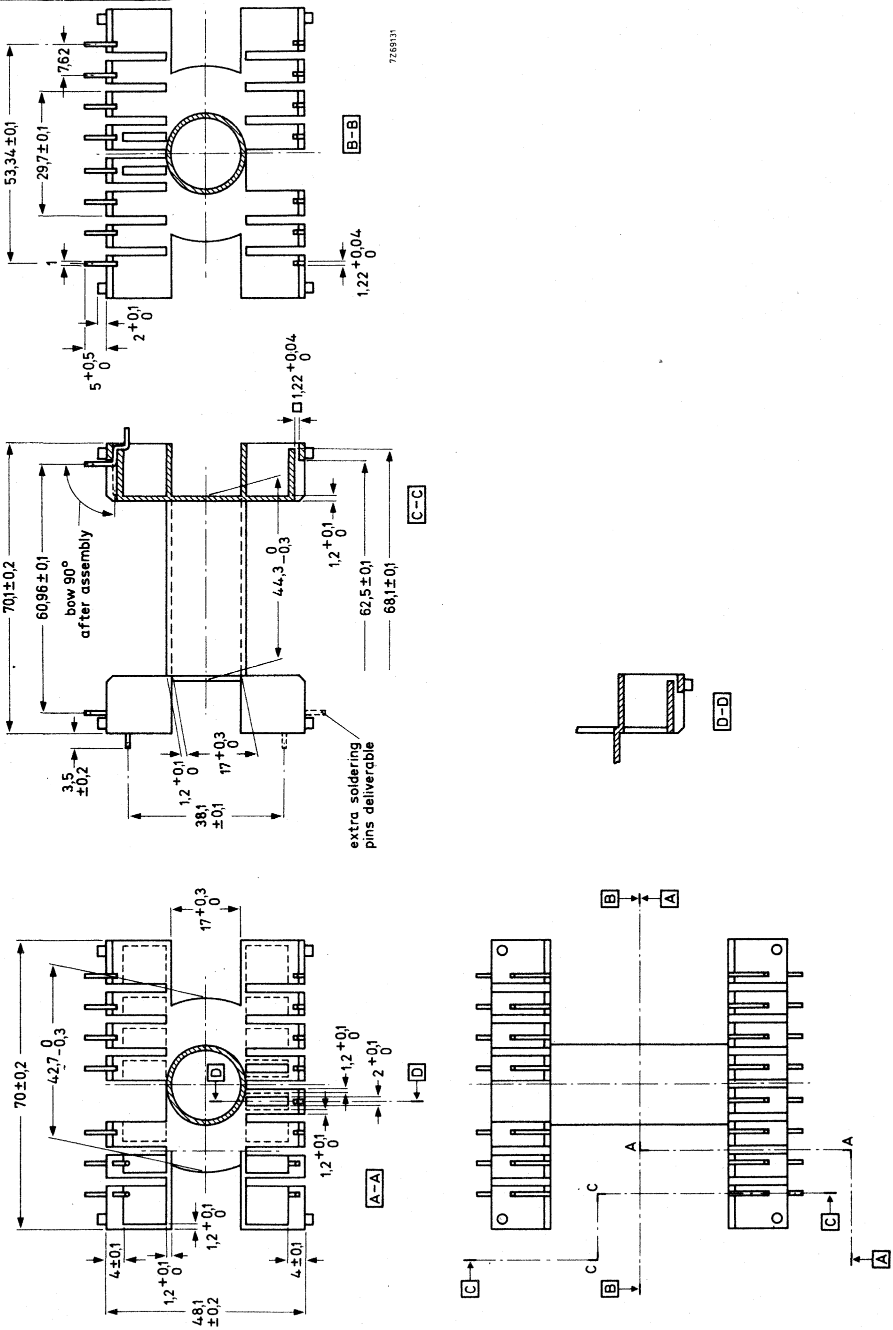
Style 1

Dimensions in mm	see drawing on the next page
Material	glass-fibre-filled polyamide
Minimum window area	466 mm^2
Mean length of turn	95 mm
Mass, without pins	approx. 35 g
Maximum temperature	120 ^{o}C
Catalogue number	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.

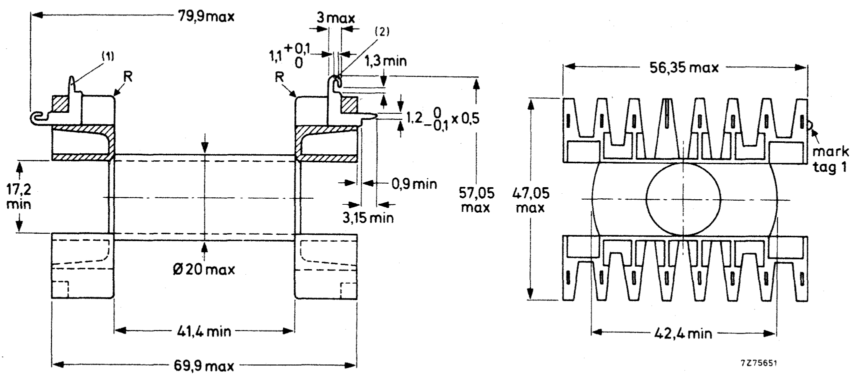
Brass dip-solder pin




B–B
C–C
D–D
A–A
7Z69131
bow 90° after assembly
extra soldering pins deliverable
53,34 ± 0,1
29,7 ± 0,1
7,62
70,1 ± 0,2
60,96 ± 0,1
44,3 0 −0,3
62,5 ± 0,1
68,1 ± 0,1
38,1 ± 0,1
3,5 ± 0,2
70 ± 0,2
42,7 0 −0,3
48,1 ± 0,2
4 ± 0,1

Style 2

Material of housing	glass-fibre-filled polyteraphthalate
Material of tags	solder-plated brass
Minimum window area	464 mm^2
Mean length of turn	96 mm
Mass, 15 tags inserted	approx. 36 g
Flame proof	according to UL-94-V 0
Mounting	horizontal and vertical
Catalogue numbers	see next page
Tag arrangement	see next page
Dimensions in mm	



Tag arrangement

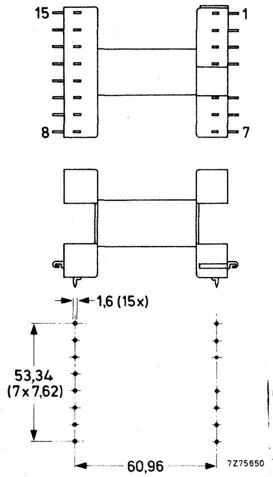
Horizontal mounting

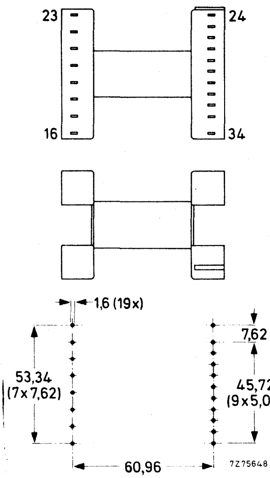
15 tags inserted

catalogue no.
4322 021 33340

for 19 tags*

catalogue no.
4322 021 33030





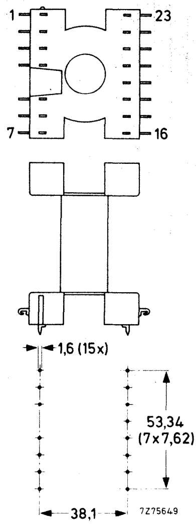
Vertical mounting

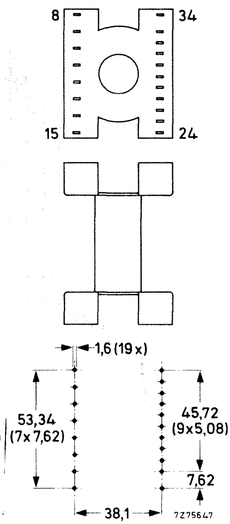
15 tags inserted

catalogue no.
4322 021 33370

for 19 tags*

catalogue no.
4322 021 33030

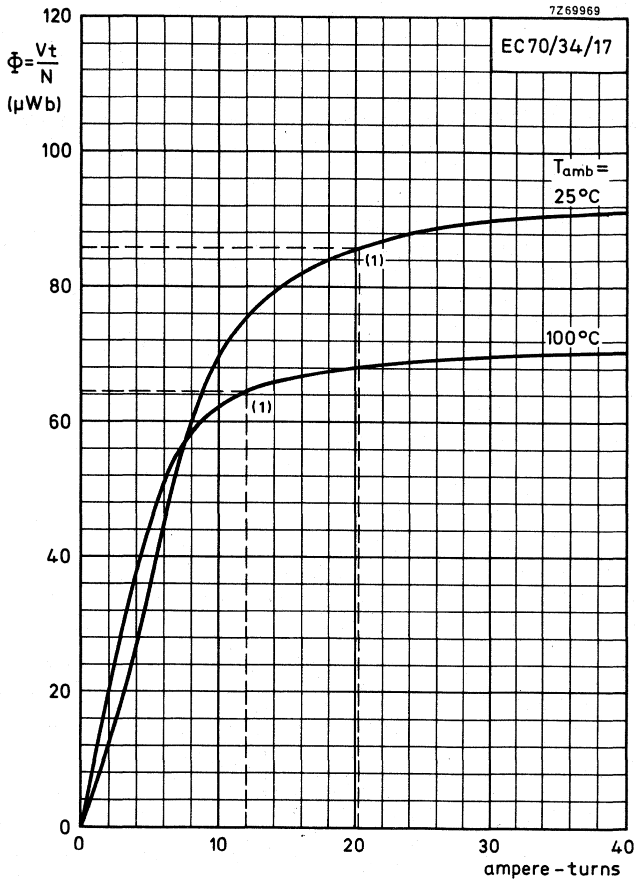




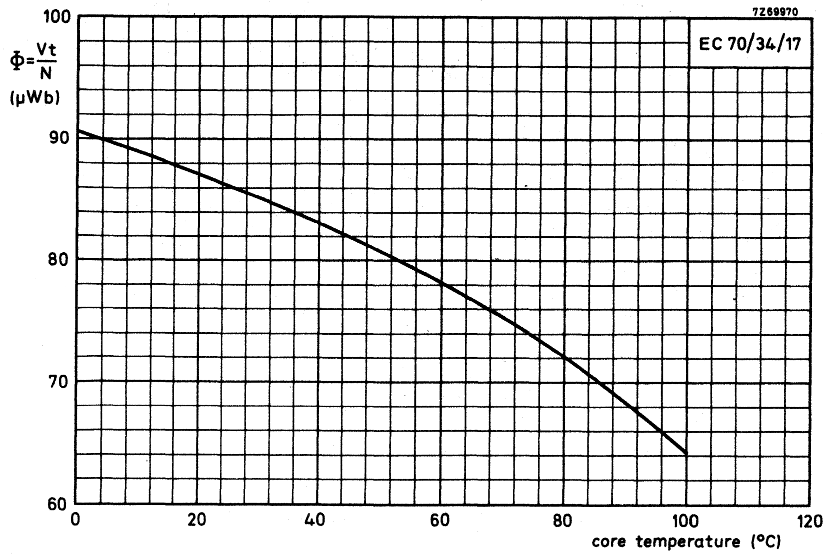
Note
Another coil former for core EC70/34/17 is available: catalogue number 4313 021 04173; information will be supplied on request.

* Tags, catalogue number 4322 021 33070 should be ordered separately.

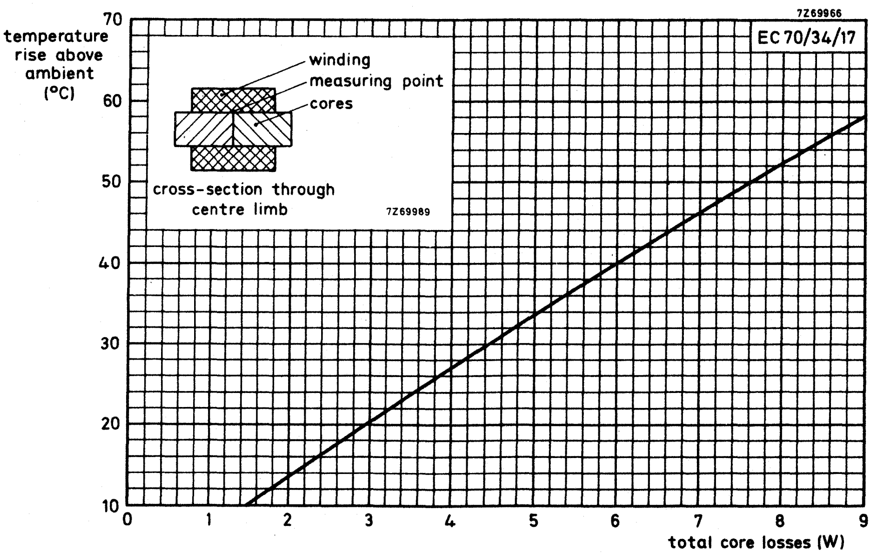
CHARACTERISTIC CURVES



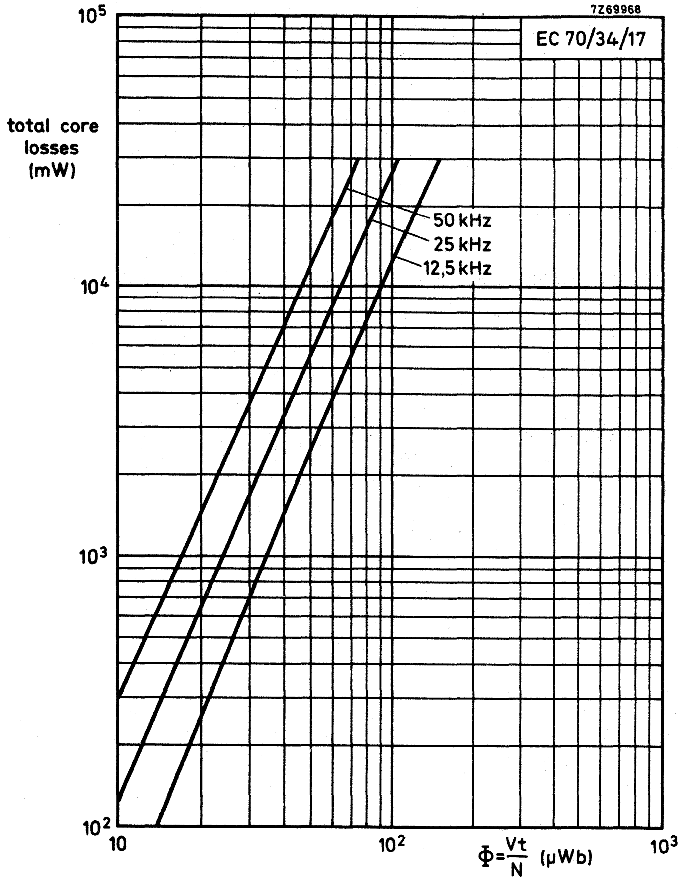
(1) Recommended maximum working flux.
Total flux as a function of ampere-turns.



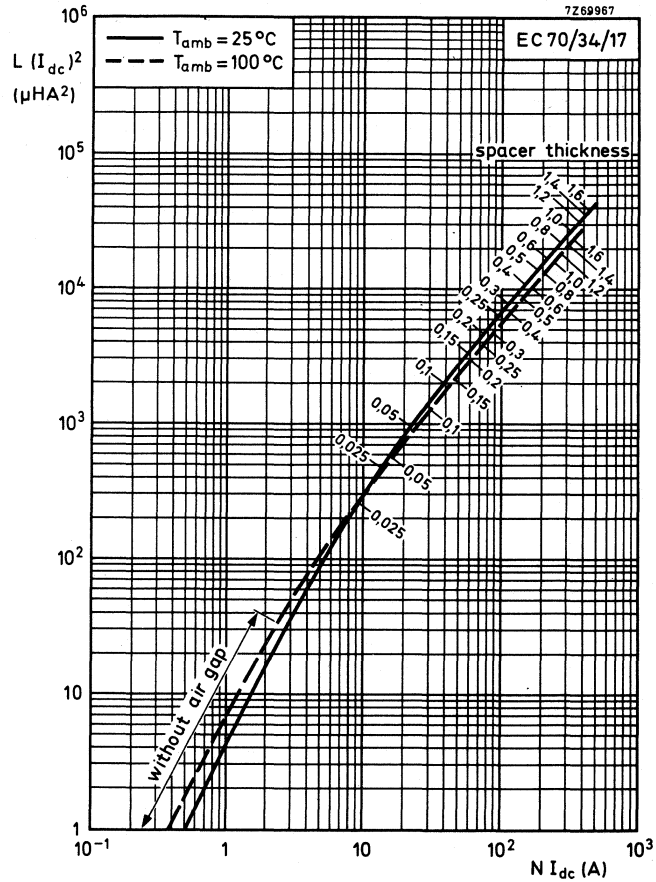
Recommended maximum working flux as a function of core temperature.



Transformer temperature rise as a function of total core losses, in free air conditions, without heatsink.



Total core losses as a function of total flux at hot-spot core temperature.



Hanna curves

H- cores

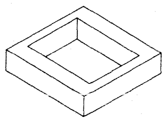
INTRODUCTION

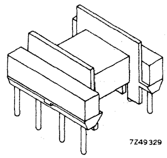
The development of magnetic core materials with high initial permeability for series production opened the way for the construction of transformer cores of very small dimensions without the loss of transformer performance.
One of the problems immediately arising when miniaturizing magnetic cores is that 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

$$\Sigma \frac{l}{A} = 3 \quad \text{mm}^{-1}$$

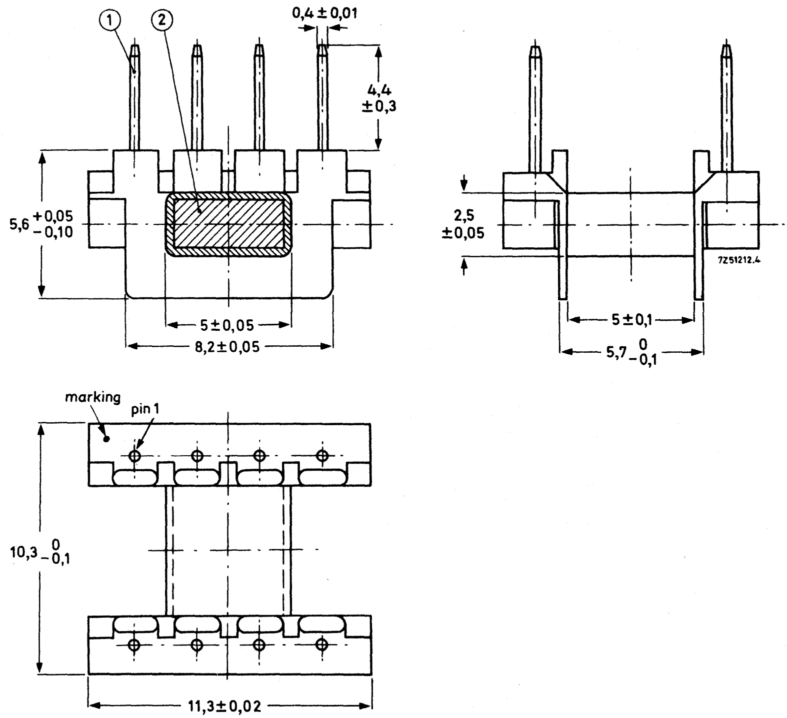
Effective volume $V_e = 170$ mm^3

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 ^oC, 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, dip-soldered
(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 ^{o}C	280
for 1-2 s in ^{o}C	360-400
Max. working temperature in ^{o}C	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

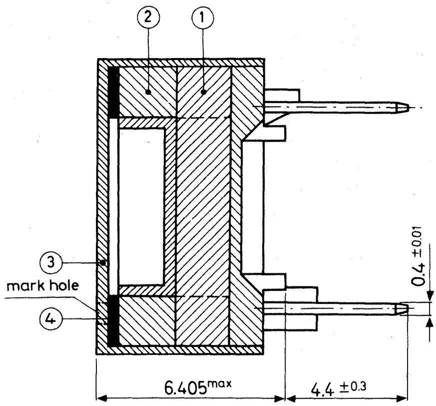


Fig. 1

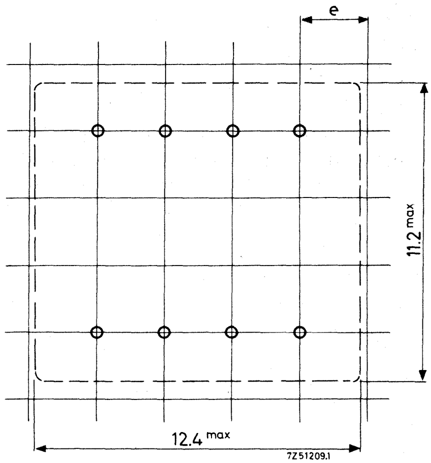


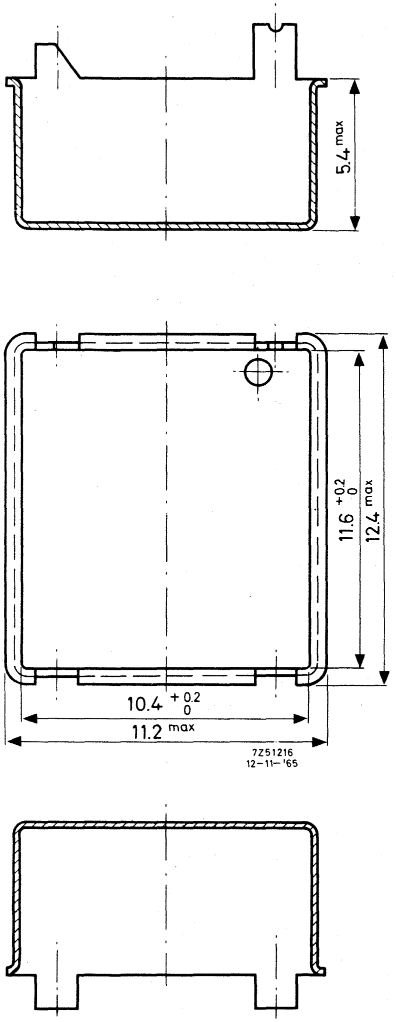
Fig. 2. Hole pattern.
e = 0, 1" or 2, 50 mm.

The H10-core is only applied as a complete assembly.
Catalogue number of the assembly: 4322 020 33040

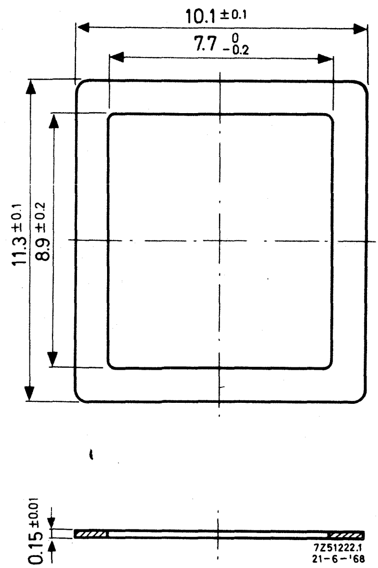
Components according to Fig. 1:
(1) Ferroxcube H-shape with polyamide coil former
(2) Ferroxcube window
(3) Brass container 4322 021 20020
(4) Phosphorbronze spring 4322 021 20390

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.



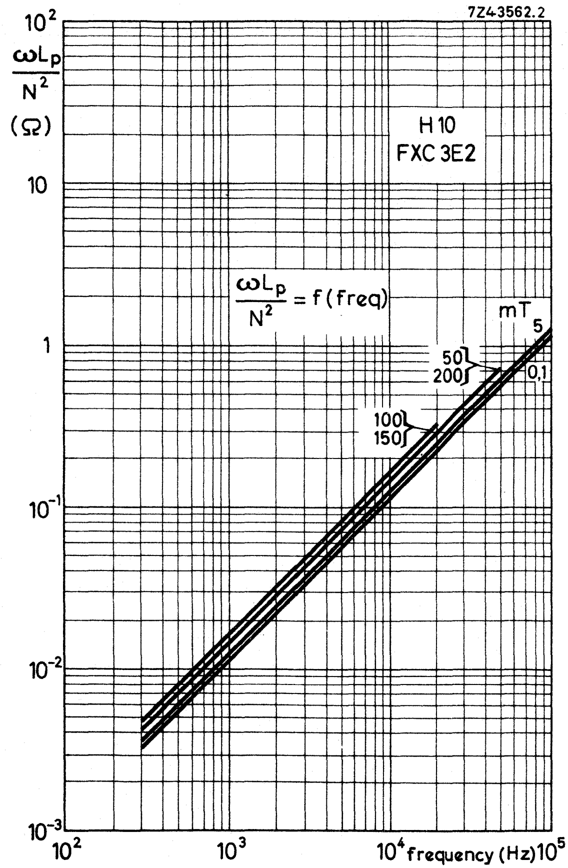
(3) Container 4322 021 20020
Material: copper-nickel

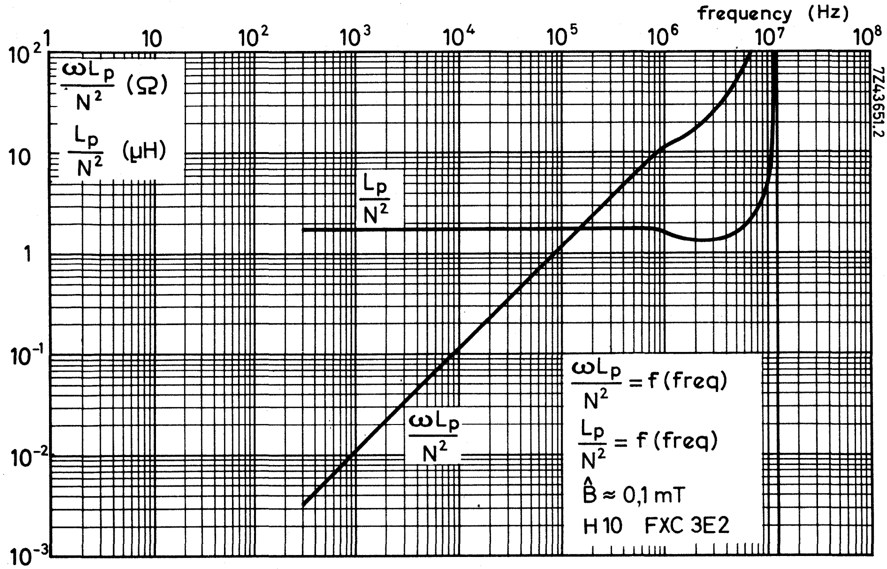


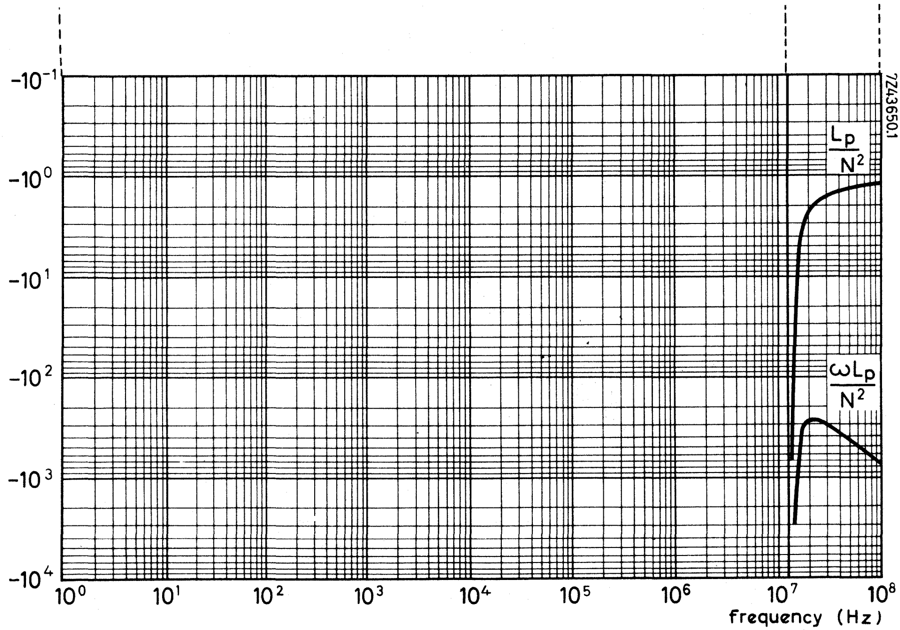
(4) Spring 4322 021 20390
Material: phosphor-bronze, nickel-plated

CHARACTERISTIC CURVES

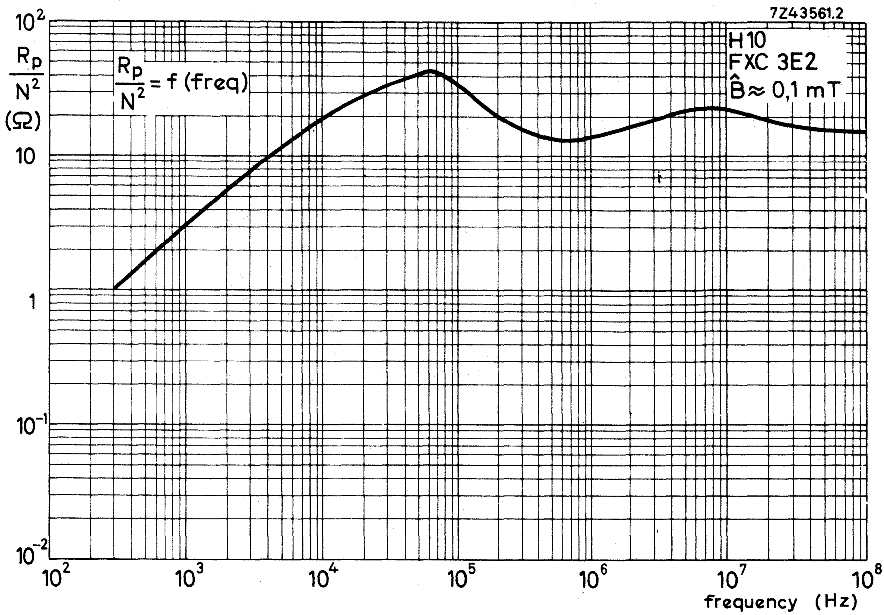
INDUCTANCE AS A FUNCTION OF THE FREQUENCY (typical values)

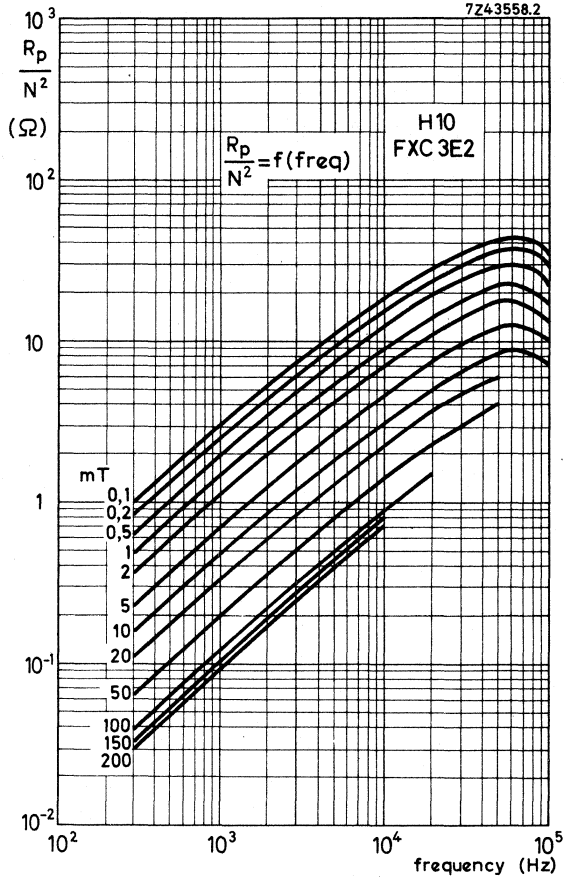


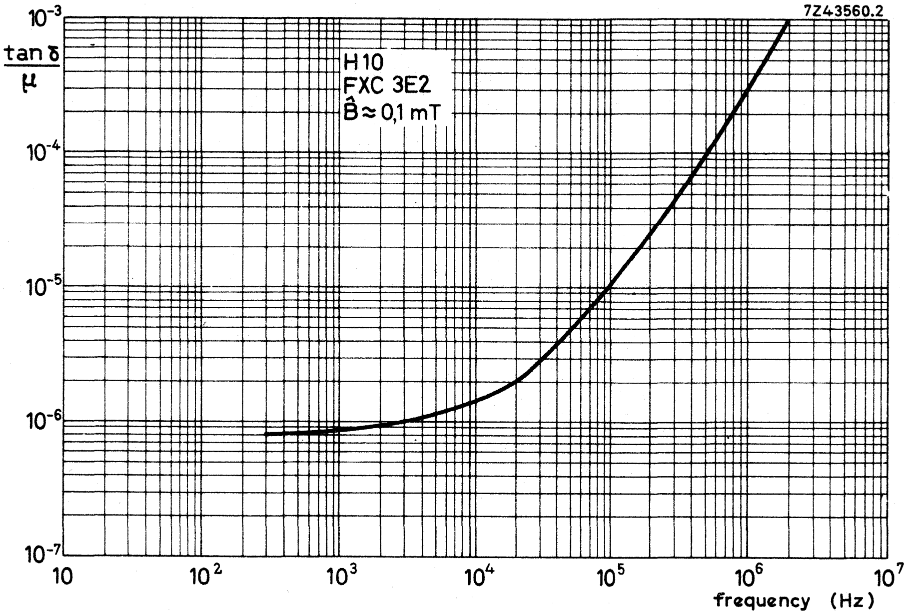

frequency (Hz)
1
10
10^2
10^3
10^4
10^5
10^6
10^7
10^8
10^2
10
1
10^{-1}
10^{-2}
10^{-3}
$\frac{\omega L_p}{N^2}$ (Ω)
$\frac{L_p}{N^2}$ (μH)
$\frac{L_p}{N^2}$
$\frac{\omega L_p}{N^2}$
$\frac{\omega L_p}{N^2} = f$ (freq)
$\frac{L_p}{N^2} = f$ (freq)
$\hat{B} \approx 0{,}1$ mT
H 10 FXC 3E2
7Z43651.2


-10^{-1}
-10^0
-10^1
-10^2
-10^3
-10^4
$\frac{L_p}{N^2}$
$\frac{\omega L_p}{N^2}$
10^0
10^1
10^2
10^3
10^4
10^5
10^6
10^7
10^8
frequency (Hz)
7Z43650.1

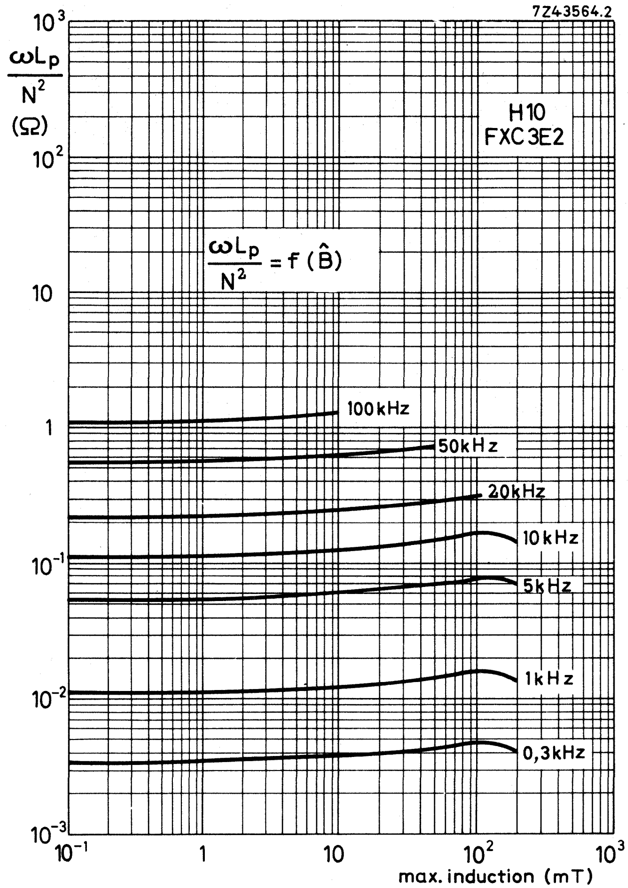
LOSSES AS A FUNCTION OF THE FREQUENCY (typical values)



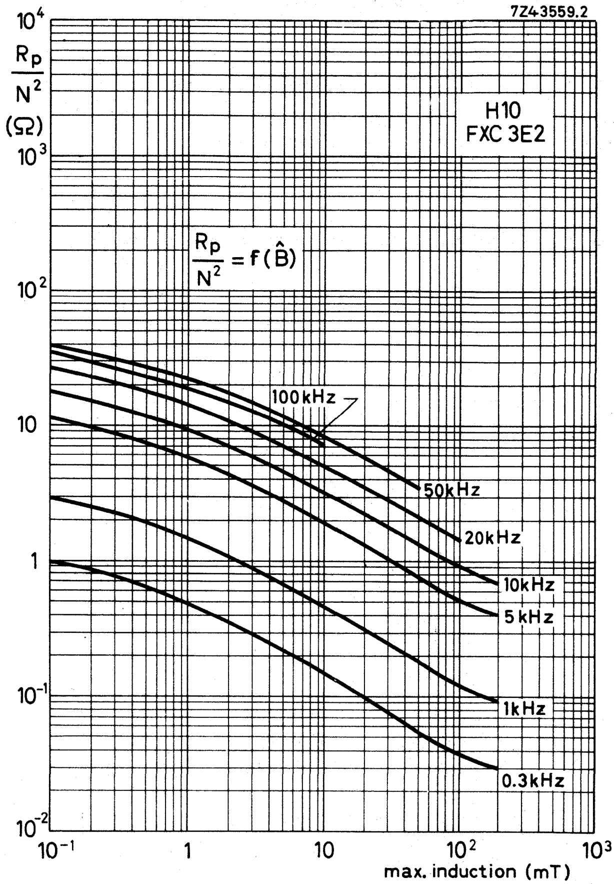

7Z43558.2
$\frac{R_p}{N^2}$ (Ω)
10^3
10^2
10
1
10^{-1}
10^{-2}
H10
FXC 3E2
$\frac{R_p}{N^2} = f(freq)$
mT
0,1
0,2
0,5
1
2
5
10
20
50
100
150
200
10^2
10^3
10^4
10^5
frequency (Hz)


7Z43560.2
tan δ / μ
H 10
FXC 3E2
B̂ ≈ 0,1 mT
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)

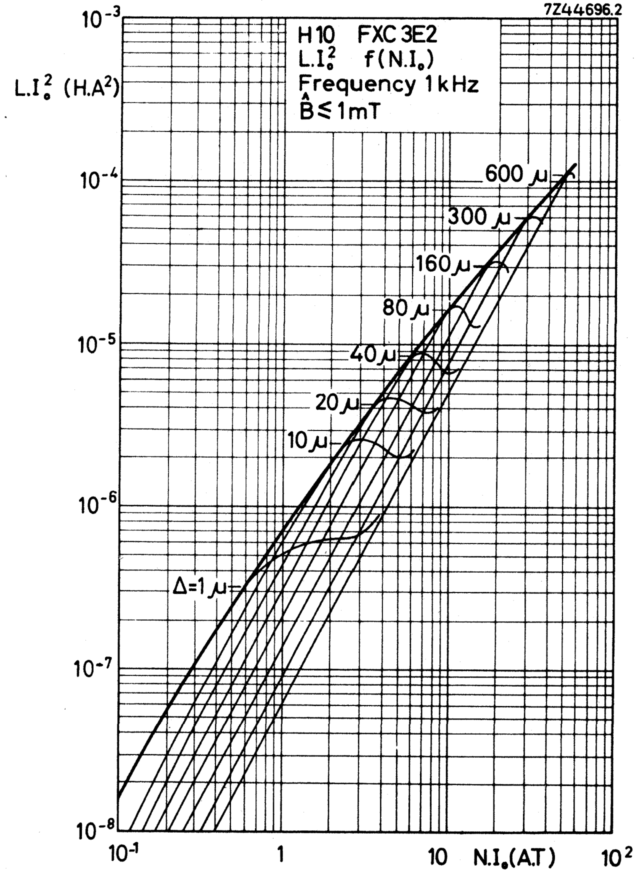


LOSSES AS A FUNCTION OF THE INDUCTION (typical values)

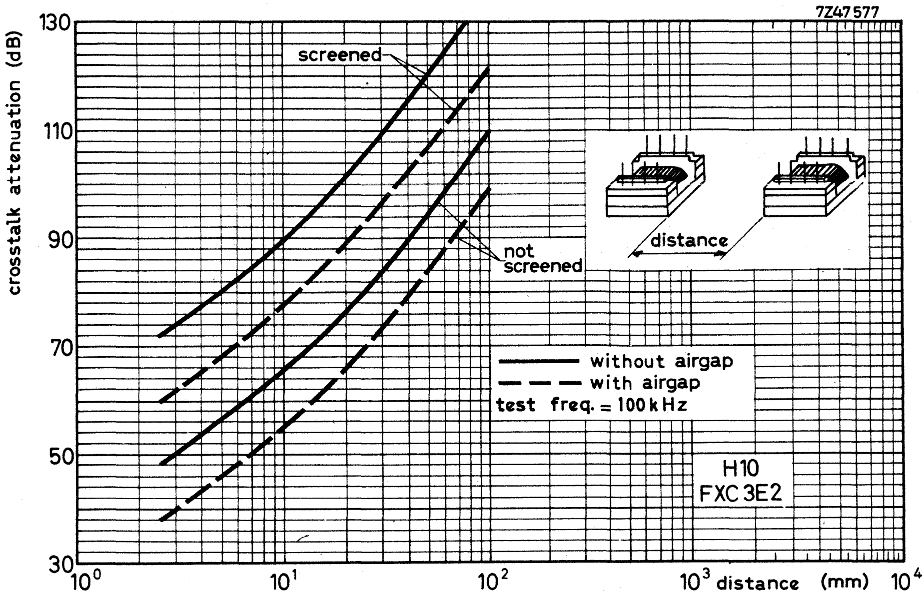


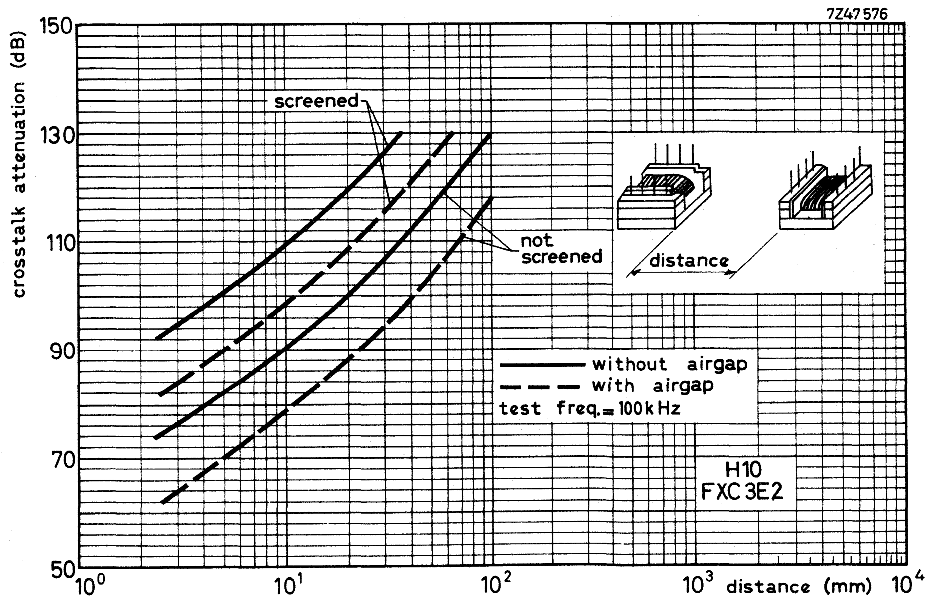
HANNA CURVE (typical values)

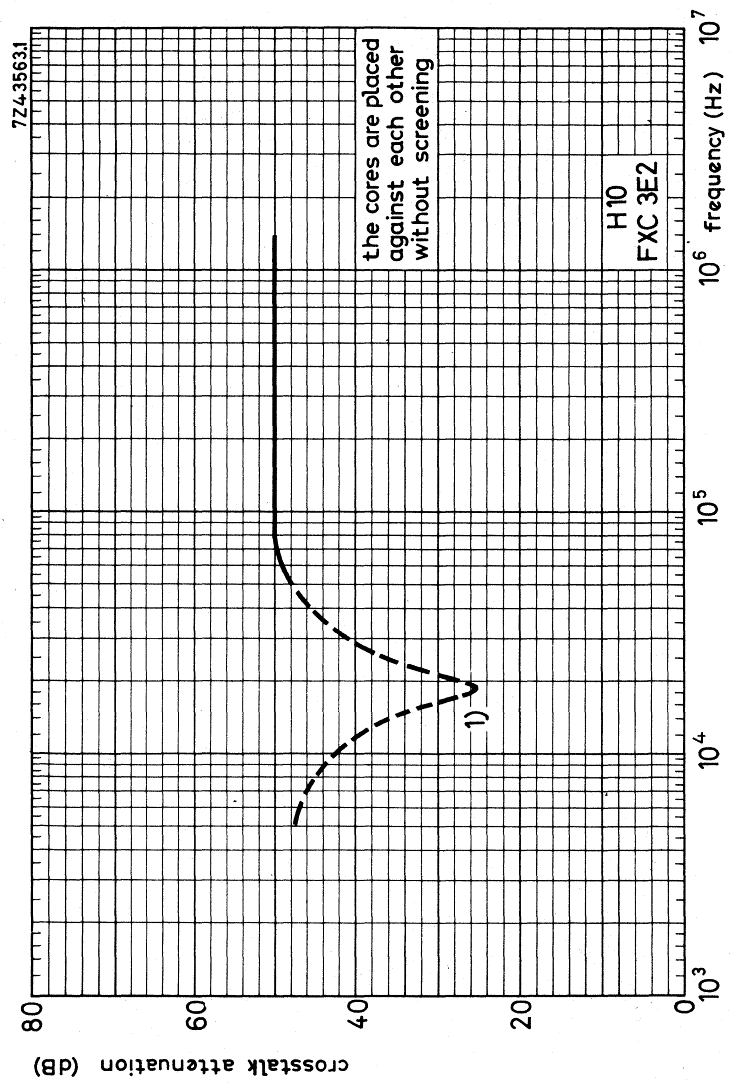
Indicating optimum inductance for a certain airgap and direct current



CROSS TALK ATTENUATION (typical values)







1) This dip does not depend on the magnetic circuit. It is caused by resonance 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 0,8 x 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 height 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 losing much of the dimensional quantities of the magnetic circuit with respect to potcores, by giving the core the X-shape.

The coil formers 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.

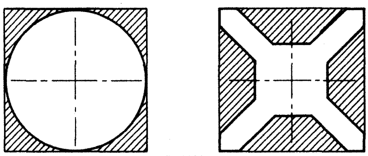


fig.1 7Z43008 fig.2

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 catalogue numbers of these tools, see table below.

core type	catalogue number of recommended tool
X22	4322 058 00080
X30	4322 058 00090
X35	4322 058 00100

See also the remarks with regard to the mounting parts of the cross cores.

CROSS CORES

Three types of core can be supplied:

- CORE HALVES without air gap.
- CORE HALVES with air gap. Standardized air-gap lengths in each core half are: 0,02, 0,05, 0,15 and 0,25 mm.
- CORE SETS with or without nut and pre-adjusted on an A_L value.

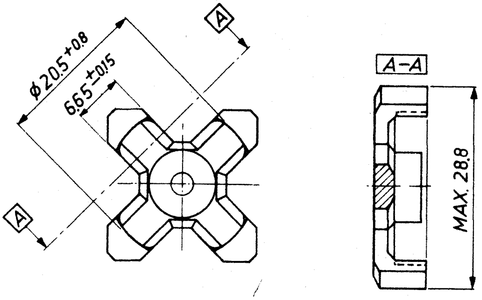
The crosscores are in accordance with IEC 226.

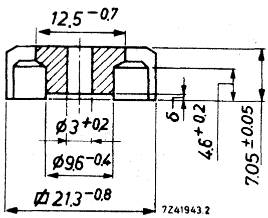
Cross cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 50 core sets or 100 core halves; a storage pack contains 200 core sets or 400 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm

Core half





Dimensional quantities according to IEC 205 (two halves):

$C_1 = \Sigma \frac{l}{A} = 0{,}575\ mm^{-1}$; $V_e = 2510\ mm^3$; $l_e = 38\ mm$; $A_e = 66\ mm^2$.

Mass of a core half: approx. 6 g

ELECTRICAL DATA

The combination of two core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. The halves are pressed together with a force of **120 N**. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F are measured on toroid-wound halves only.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B7	3B8	3D3	3E1	3H1		4C6
$A_L \pm 25\%$	4	⩽ 0,1	25 ± 1		⩾ 2400		⩾ 2000			
$\mu_e \pm 25\%$	4	⩽ 0,1	25 ± 1	⩾ 1440	⩾ 1100	⩾ 550	⩾ 4350	1440		⩾ 93
α	4	⩽ 0,1	25 ± 1	⩽ 17,8	⩽ 20,4	⩽ 28,8		⩽ 17,8		⩽ 70
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1	⩽ 1,6	⩽ 2,0		⩽ 2,5	⩽ 1,2		
	100	⩽ 0,1	25 ± 1	⩽ 6,0	⩽ 10	⩽ 8,0	⩽ 20	⩽ 5,0		
	500	⩽ 0,1	25 ± 1			⩽ 14	⩽ 200			
	2 000	⩽ 0,1	25 ± 1							⩽ 40
	10 000	⩽ 0,1	25 ± 1							⩽ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,1	⩽ 1,0		⩽ 1,8	⩽ 1,1		
	100	0,3 to 1,2	25 ± 1			⩽ 1,8				⩽ 6,2
$\alpha_F \times 10^6/°C$	⩽ 100	⩽ 0,1	5 to 25		0 to + 6			+ 0,5 to 1,5		−2 to + 4
	⩽ 100	⩽ 0,1	25 to 55		0 to + 6			+ 0,5 to 1,5		0 to + 6
	⩽ 100	⩽ 0,1	25 to 70	−0,6 to + 0,6		0 to + 2		+ 0,5 to 1,5		
$D_F \times 10^6$	⩽ 100	⩽ 0,1	25 ± 1	⩽ 4,3	⩽ 8,0	⩽ 12		⩽ 4,3		⩽ 10
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:										
at $\mu_e \times \frac{N \times I_o}{l_e} = 1,10 \times 10^5$ A/m					⩽ 110					
$= 1,80 \times 10^5$ A/m					⩽ 300					
$= 2,55 \times 10^5$ A/m					⩽ 1100					

Core halves without air gap.

Ferroxcube grade	catalogue number
3B7	3522 200 08770
3B8	4322 020 23540
3D3	3522 200 03480
3E1	4322 020 23530
3H1	4322 020 23510
4C6	3522 200 03490

Core halves with air gap.

Ferroxcube grade	air gap δ in mm	catalogue 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

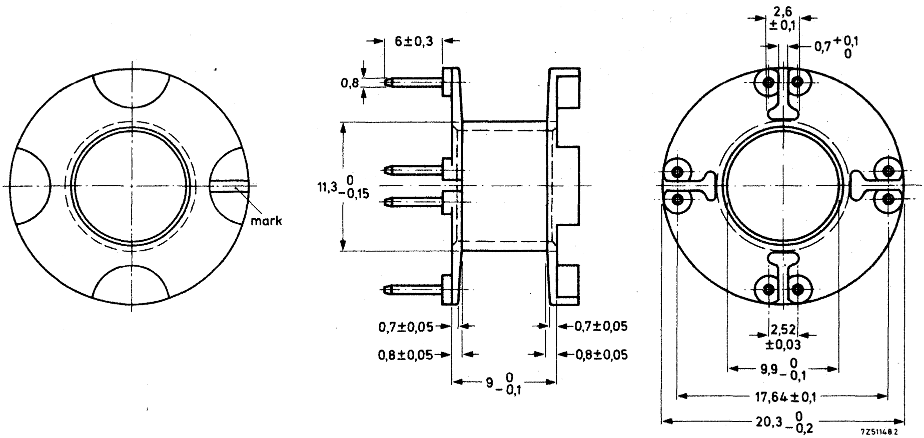
The electrical properties are measured on cores without air gap.

Core sets, grade 3H1 pre-adjusted on A_L.

A_L nH	corre-sponding μ_e-value	catalogue number 4322 022	
		without nut	with nut
160 ± 1%	73	45250	65250
250 ± 1,5%	115	45260	65260
400 ± 2%	180	45280	65280
630 ± 3%	290	45300	65300

Inductance $L = N^2 A_L$

COIL FORMER



Catalogue number	4322 021 31770
Material	reinforced polyester
Window area	33,5 mm^2
Mean length of turn	49 mm
Maximum dip-solder temperature (5 to 6 s)	280 ^oC
Maximum working temperature	130 ^oC
Required force (1 minute at 25 ^oC) to pull pins from socket	$\geqslant$ 15 N
Maximum test voltage between pins (50 Hz, 2 min)	500 V (r.m.s.)

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 9{,}9 \times 10^3\ \Omega/H$$

INDUCTANCE ADJUSTERS

Dimensions in mm

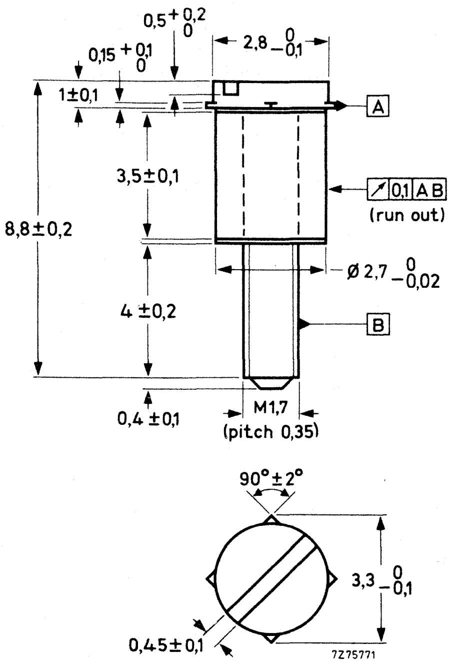


Fig. A.

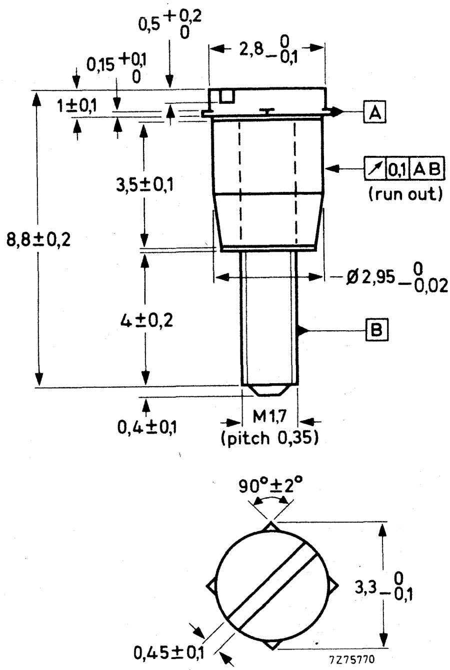


Fig. B.

After inserting a coil in an electrical circuit, its inductance can be adjusted to the required value with an accuracy < 0,03% by means of a continuous inductance adjuster. Such an adjuster increases the inductance of the coil, see following pages.
The adjuster is screwed through the cross core into the nut and is held in position by the four protrusions near the top of the adjuster. For special requirements a bigger or smaller adjustment range may be obtained by using an adjuster belonging to the next higher or lower effective permeability.

The influence of the adjusters on the variability of the inductance is negligible. The maximum permissible temperature is 110 °C.

Table 2 shows the type of adjuster recommended for different cross cores.

Table 1, available types

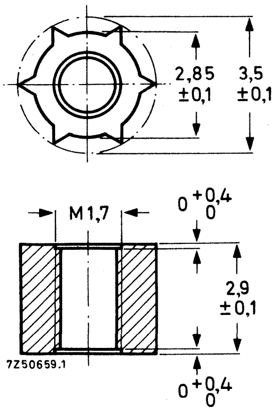
d mm	colour	catalogue number
A	brown	4322 021 30730
B	black	4322 021 30970
B	red	4322 021 31080

Table 2, 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

LOOSE NUT FOR ADJUSTER

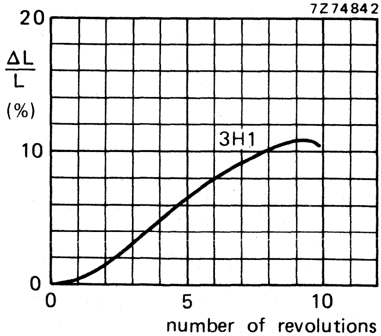
These data are given for those manufacturers who prefer to insert a nut themselves.



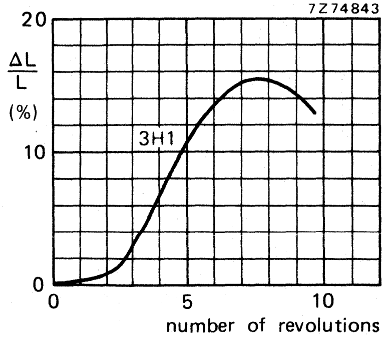
Catalogue number	4322 021 30140
Material	polycarbonate
Maximum impregnation temperature during 24 hours	120 °C
Recommended distance from mating surface to nut	2,3 ± 0,15 mm

For more information see Potcores General, Mounting data, Section Inserting the nut for the adjuster.
The nuts are packed in bags of 100.
Please order in multiples of 100.

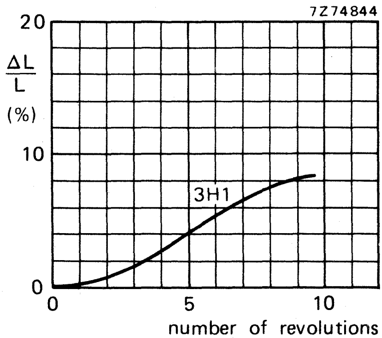
Dimensions in mm



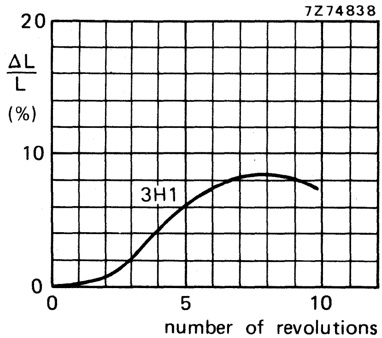
Adjuster 4322 021 30970, A_L = 160.



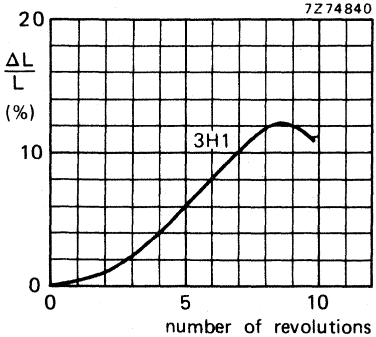
Adjuster 4322 021 30730, A_L = 250.



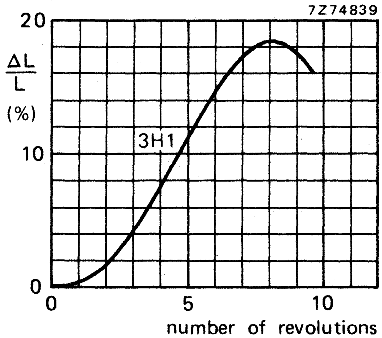
Adjuster 4322 021 30970, A_L = 250.



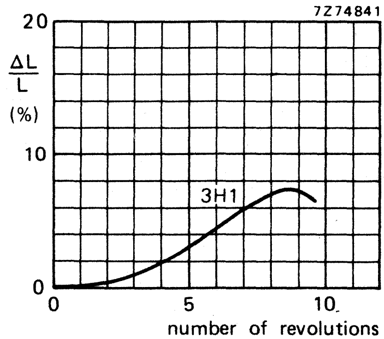
Adjuster 4322 021 30730, A_L = 400.



Adjuster 4322 021 31080, A_L = 400.

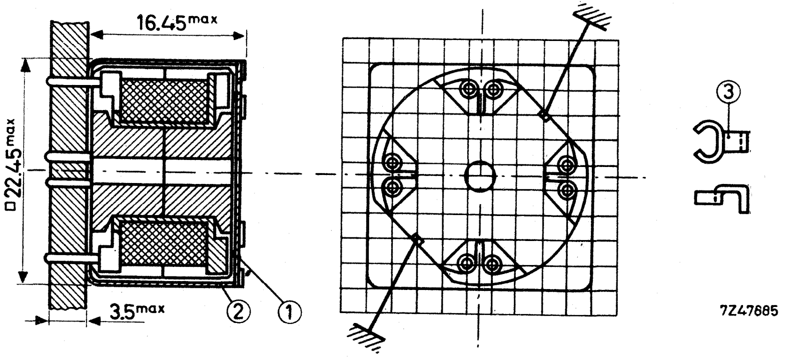


Adjuster 4322 021 31080, A_L = 630.



Adjuster 4322 021 31080, A_L = 1000.

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.

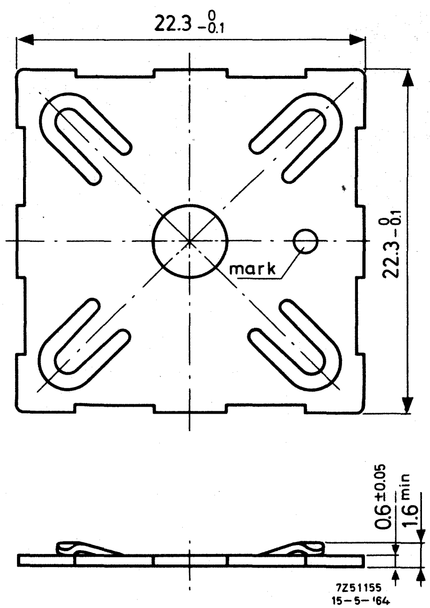
If stranded wire is employed, the use of a soldering spring (pos. 3) is recommended, which facilitates the soldering of the wires to the pins on the coil former. For solid wire the spring is not necessary.

The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

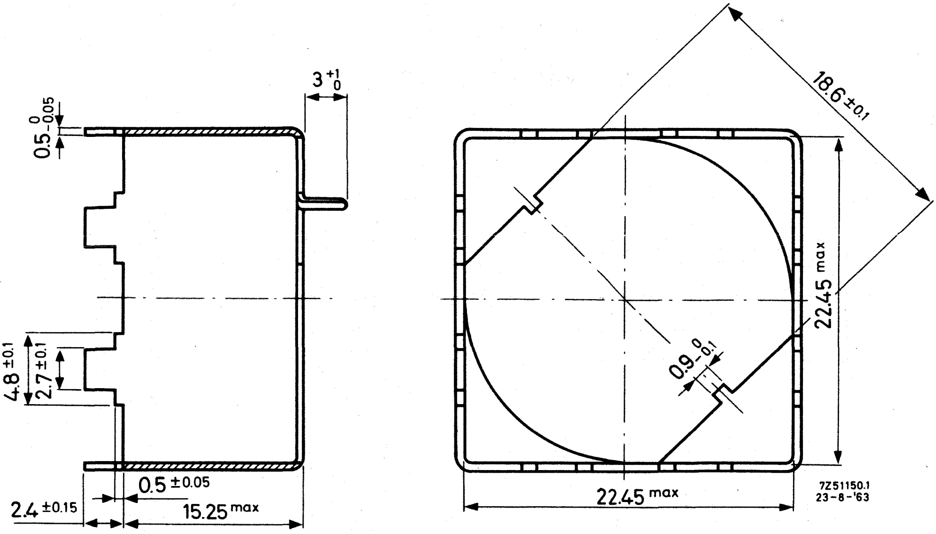
The cover is provided with a marking hole. The mark of the coil former (see the Fig. of coil former) has to be in one line with this hole. These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

It is recommended to cement the coil former in one of the cross core halves in order to obtain the most possible stable construction.

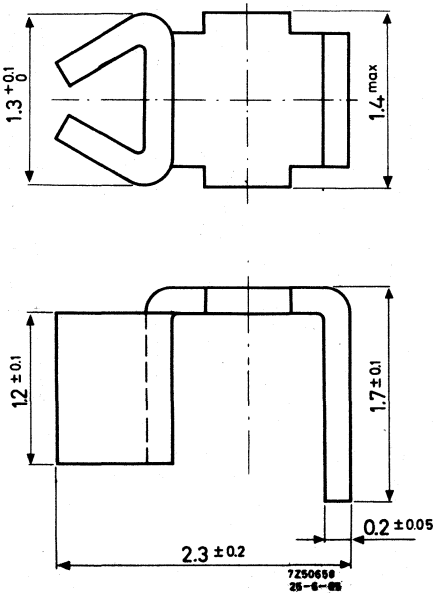
Before bending the lips of the container, pressure should be exercised evenly on the four corners of the cover until the latter meets the container. The required force is approximately 120 Newton. After bending the lips, the core will have the correct tension.



(1) Cover 4322 021 30230
Material: phosphorbronze, nickel plated

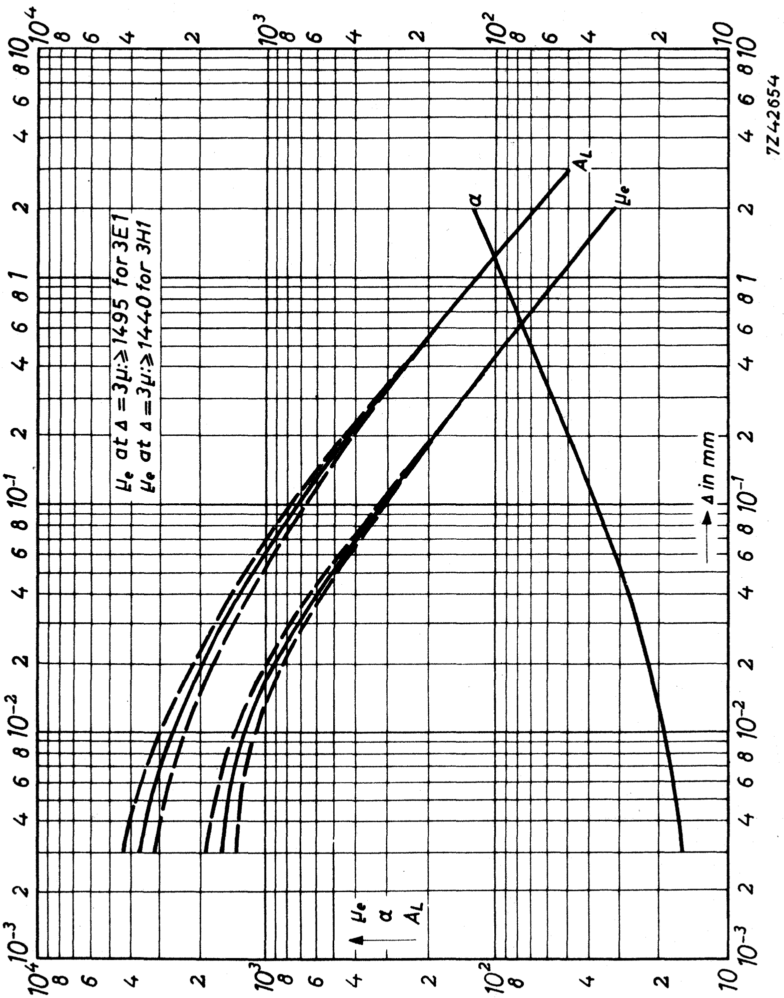


(2) Container 4322 021 30040
Material: brass, nickel plated



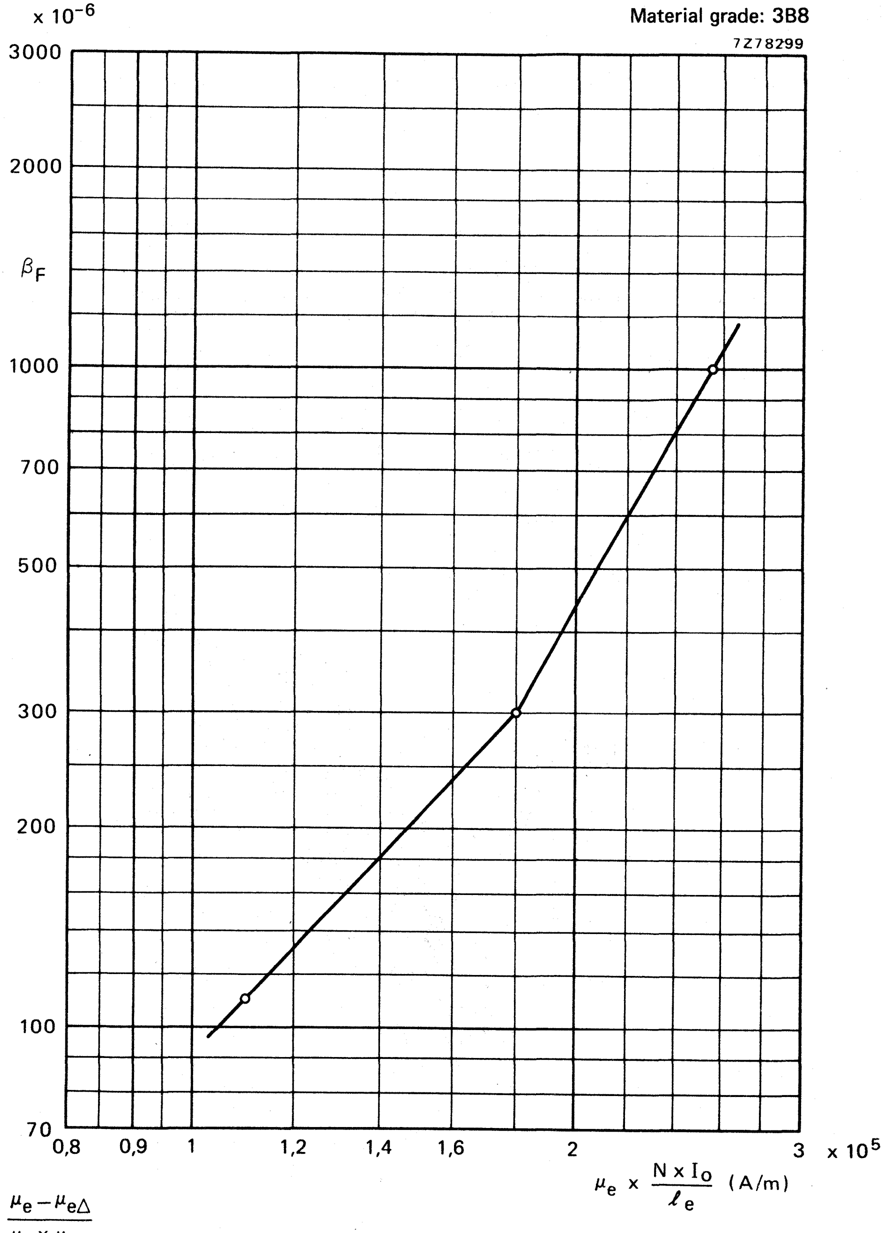
(3) Soldering spring 4322 021 30700
Material: brass, dipsoldered

CHARACTERISTIC CURVES



Effective permeability (μ_e), turn factor for 1 mH (a) and inductance factor in nanohenry (A_L) as a function of the airgap length for grades 3E1 and 3H1.

Material grade: 3B8

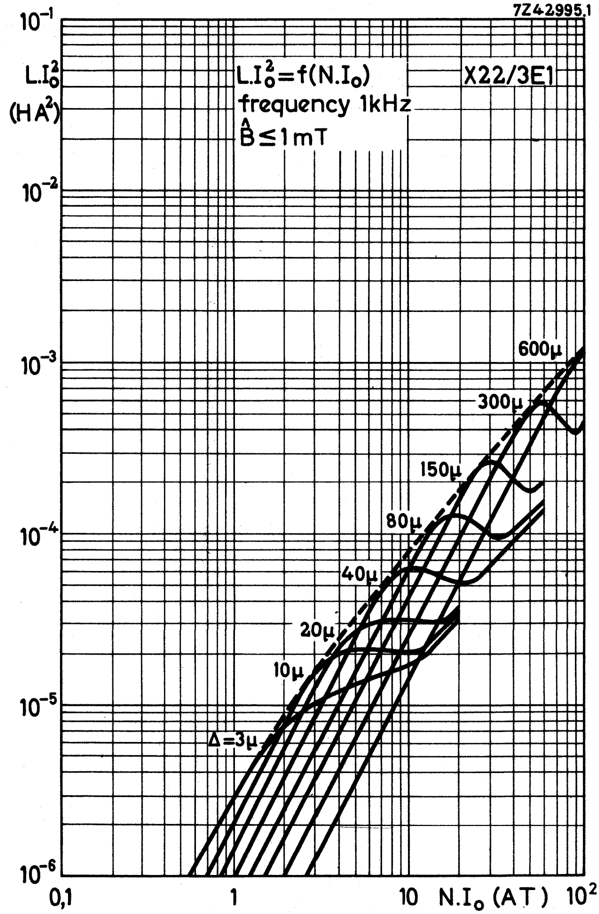


$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

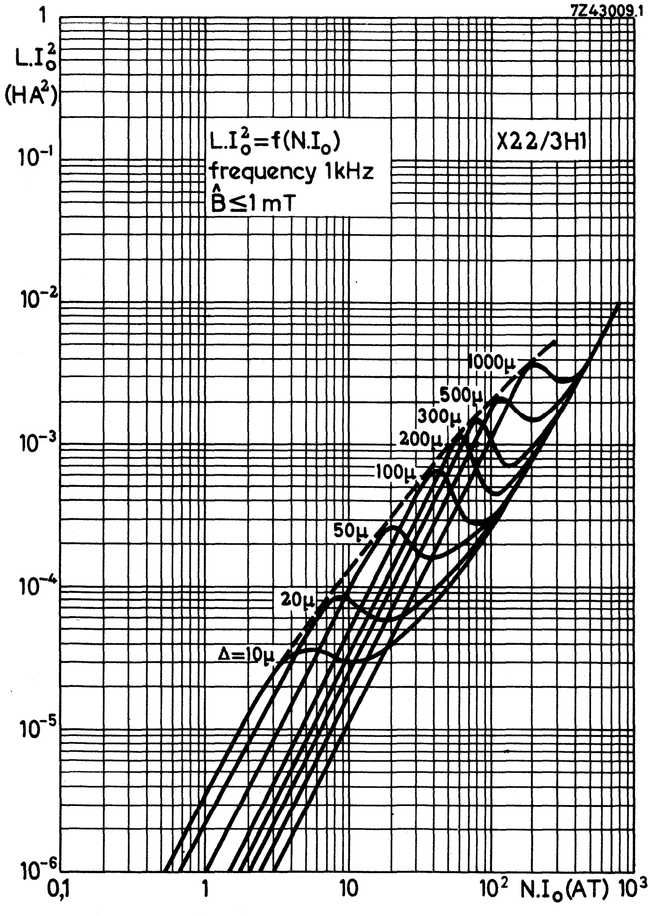
HANNA CURVE (typical values)

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

Two types of core can be supplied:

- CORE HALVES without air gap.
- CORE HALVES with air gap. Standardized air gap lengths in each core half are: 0,02, 0,05, 0,15 and 0,25 mm.

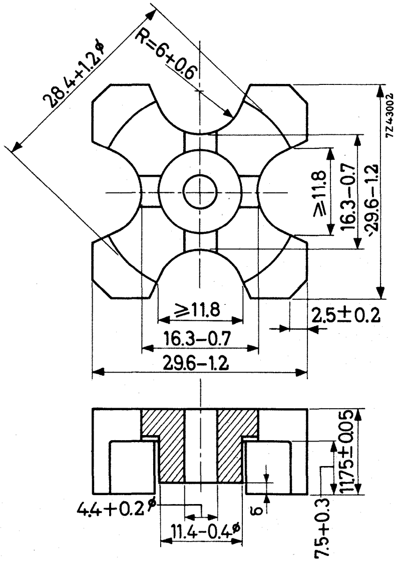
The cross cores are in accordance with IEC 226.

Cross cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 10 core halves; a storage pack contains 200 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm

Core half



Dimensional quantities according to IEC 205 (two halves):

$C_1 = \Sigma \frac{l}{A} = 0{,}49\ mm^{-1}$; $V_e = 6360\ mm^3$; $l_e = 55{,}8\ mm$; $A_e = 114\ mm^2$.

Mass of a core half: approx. 19 g.

ELECTRICAL DATA

The combination of two core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. The halves are pressed together with a force of 250 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F are measured on toroid-wound halves only.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	3E1	3H1
A_L ± 25%	4	⩽ 0,1	25 ± 1	⩾ 3210	⩾ 5650	
μ_e ± 25%	4	⩽ 0,1	25 ± 1	⩾ 1250	⩾ 2200	⩾ 1525
α	4	⩽ 0,1	25 ± 1	⩽ 17,7		⩽ 15,9
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1	⩽ 2	⩽ 2,5	⩽ 1,2
	100	⩽ 0,1	25 ± 1	⩽ 10	⩽ 20	⩽ 6,0
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,0	⩽ 1,8	⩽ 1,1
$\alpha_F \times 10^6$/°C	⩽ 100	⩽ 0,1	5 to 25	0 to + 6		+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 55	0 to + 6		+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 70			+ 0,5 to 1,5
$D_F \times 10^6$	⩽ 100	⩽ 0,1	25 ± 1	⩽ 8,0		⩽ 4,3
$\beta_F \times 10^6$, measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C:						
at $\mu_e \times \frac{N \times I_o}{l_e}$ = 0,90 x 10⁵ A/m				⩽ 120		
= 1,40 x 10⁵ A/m				⩽ 300		
= 2,00 x 10⁵ A/m				⩽ 1100		

Core halves without air gap.

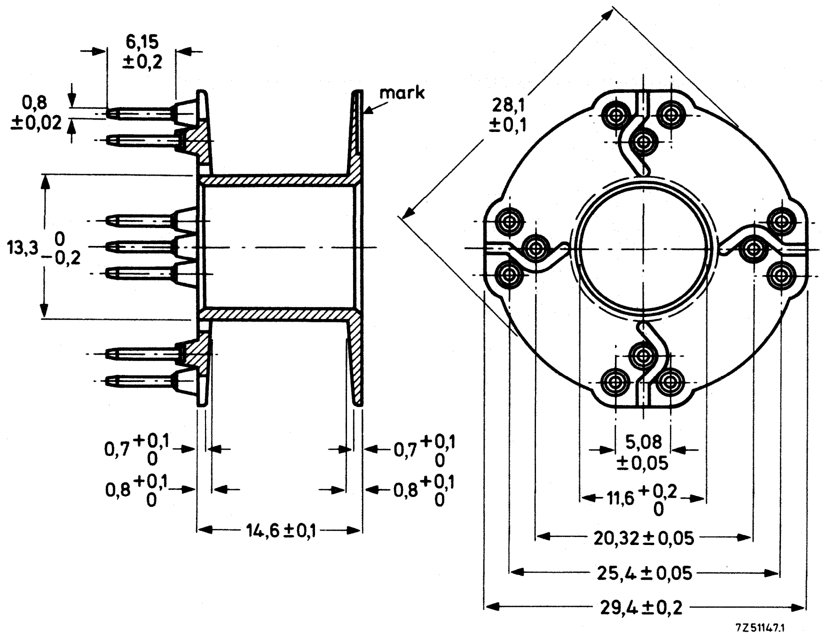
Ferroxcube grade	catalogue number
3B8	4322 020 23780
3E1	4322 020 23760
3H1	4322 020 23750

Core halves with air gap

Ferroxcube grade	air gap δ 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

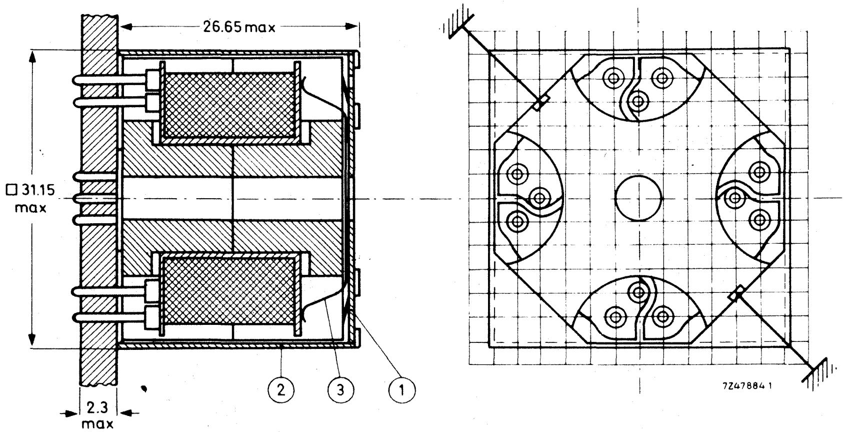
The electrical properties are measured on cores without air gap.

COIL FORMER



Catalogue number	4322 021 33420
Material	glass fibre reinforced polyester
Window area	97 mm^2
Mean length of turn	65 mm
Maximum dip-solder temperature (5 to 6 s)	280 °C
Maximum working temperature	130 °C
Required force (1 minute at 25 °C) to pull pins from socket	⩾ 20 N
Maximum test voltage between pins (50 Hz, 2 min)	2000 V (r.m.s.)

MOUNTING PARTS



(1) Cover 4322 021 31150
(2) Container 4322 021 31170
(3) Spring 4322 021 30210
(4) 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.

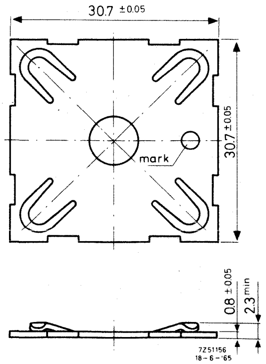
The twelve soldering pins are positioned according to a grid of 2,52 mm. They will fit printed-wiring boards with a 0,1" grid as well as those with a 2,50 mm grid. The pin length is sufficient for board thicknesses up to 2,3 mm. The printed-wiring board should be provided with holes of 1,3 ± 0,1 mm in diameter.

The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

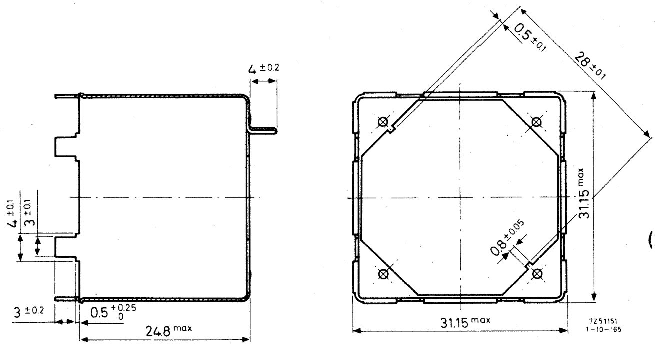
The cover is provided with a marking hole. The mark of the coil former (see drawing of coil former) has to be in one line with this hole. These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

It is recommended that the coil former be cemented in one of the cross-core halves or to use the spring (pos. 3) in order to obtain the most stable construction.

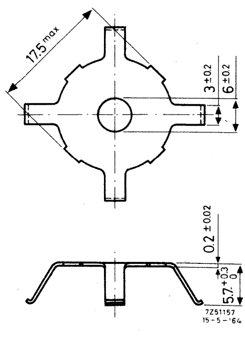
Before bending the lips of the container, pressure should exerted evenly on the four corners of the cover until the latter meets the container. The required force is approximately 250 N. After bending the lips, the core will have the correct tension.



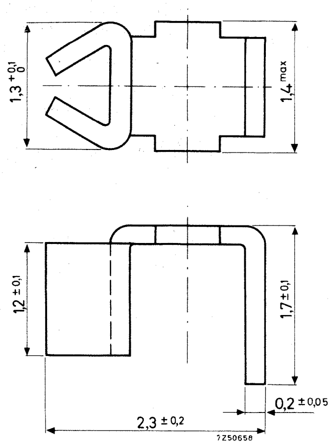
(1) Cover 4322 021 31150
Material: phosphor bronze,
nickel plated.



(2) Container 4322 021 31170
Material: brass, nickel plated.



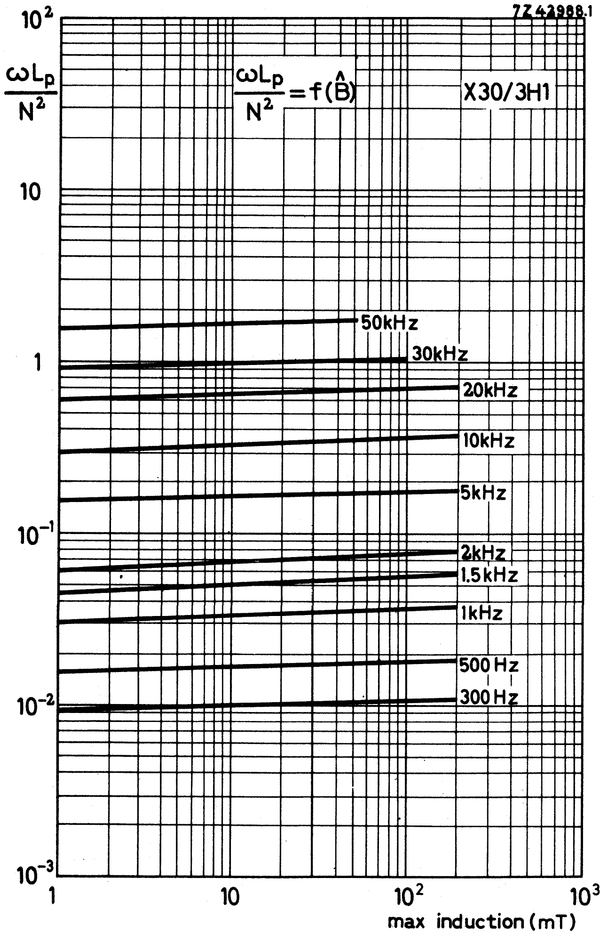
(3) Spring 4322 021 30210
Material: phosphor bronze.



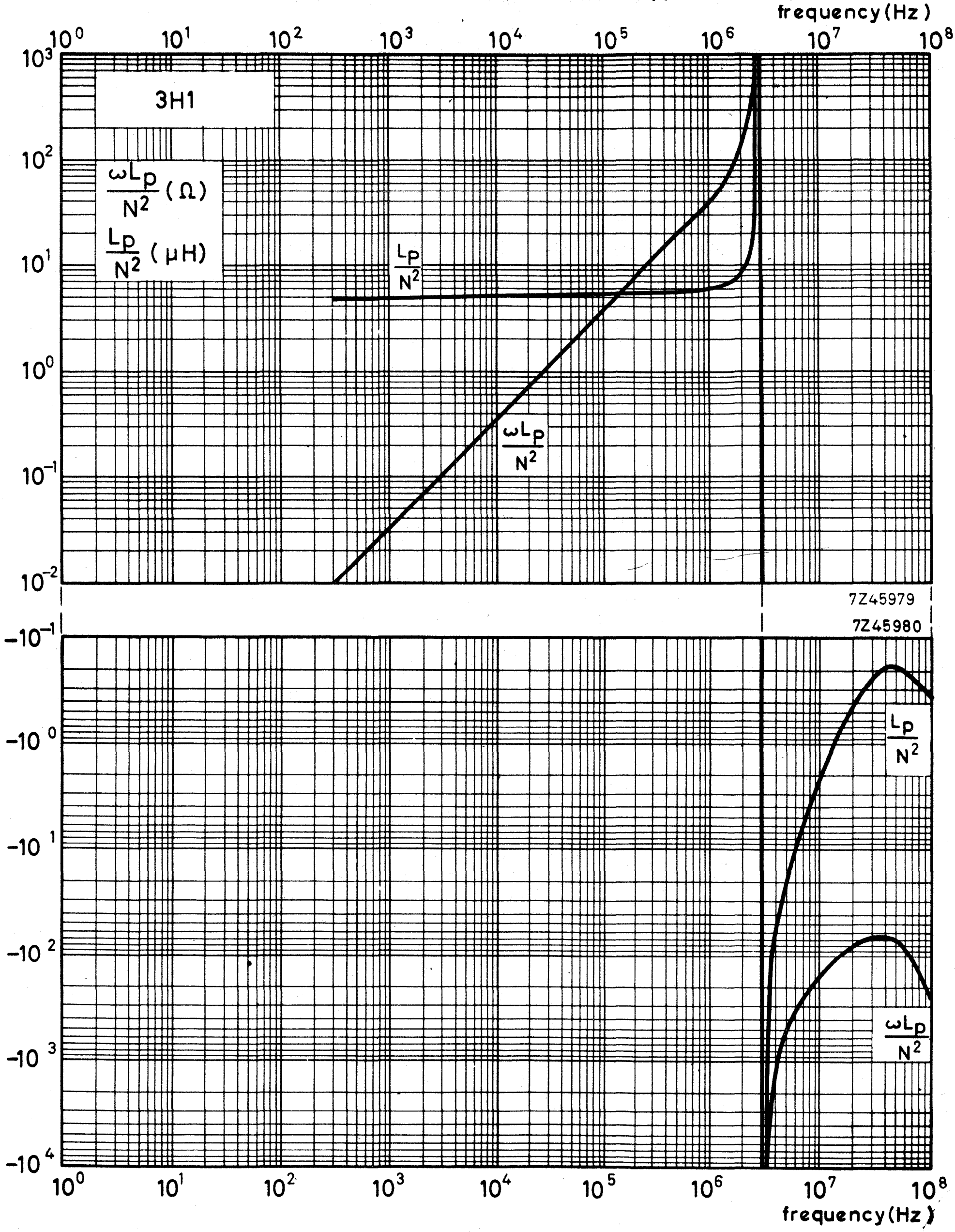
(4) Soldering spring 4322 021 30700
Material: brass, dip-soldered.

CHARACTERISTIC CURVES

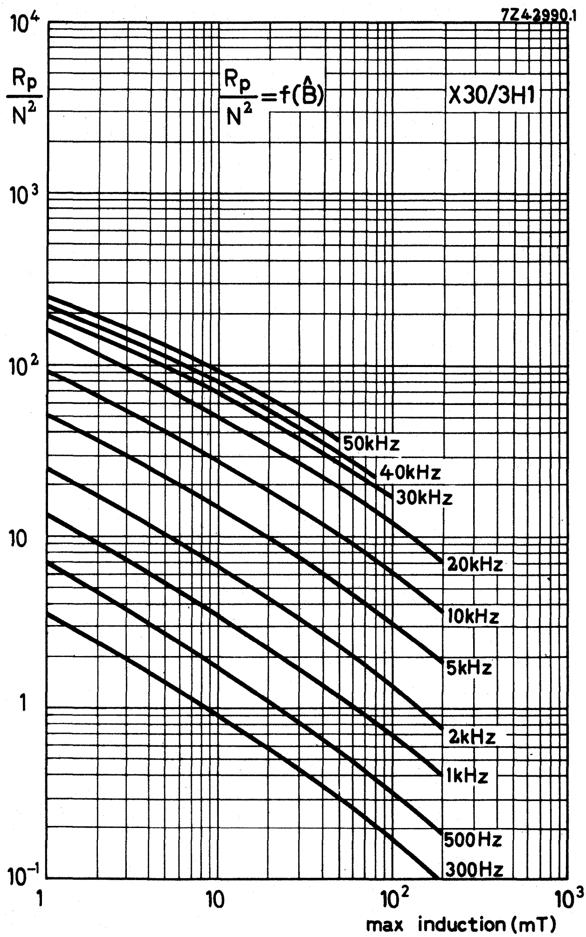
INDUCTANCE AS A FUNCTION OF THE INDUCTION (typical values)



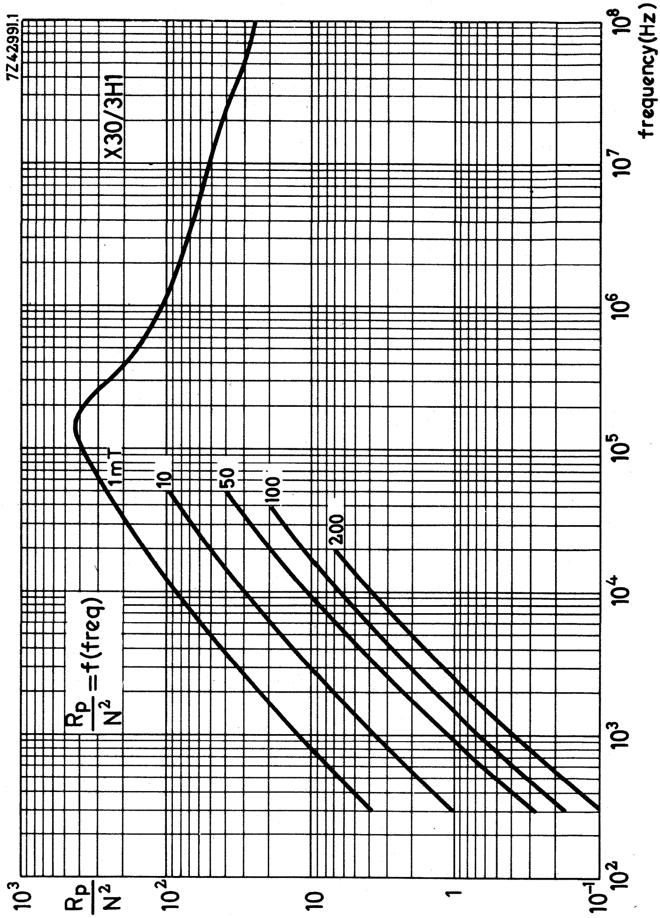
INDUCTANCE AS A FUNCTION OF THE FREQUENCY (typical curves)



CORE LOSSES AS A FUNCTION OF THE INDUCTION (typical values)

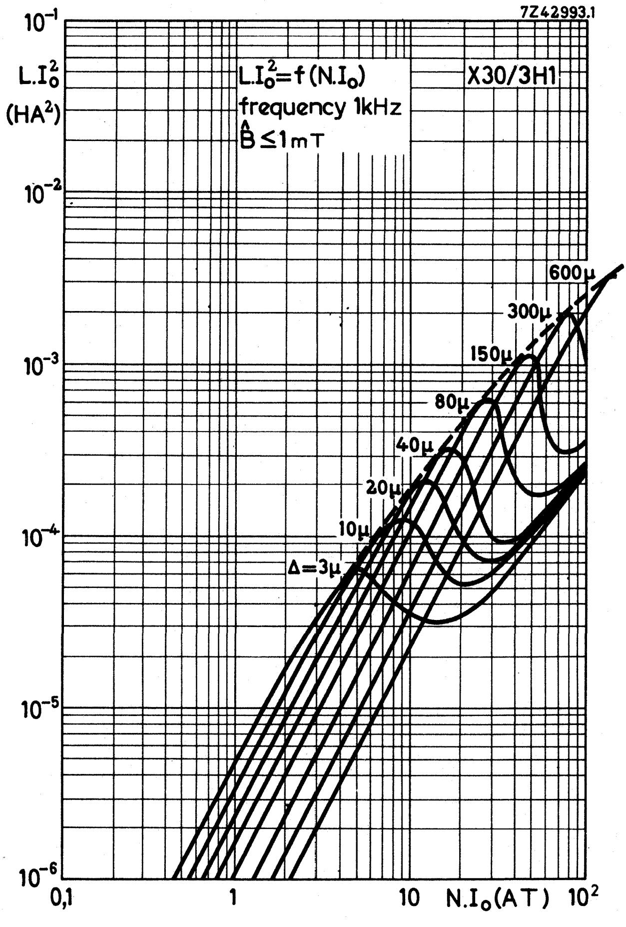


CORE LOSSES AS A FUNCTION OF THE FREQUENCY (typical values)

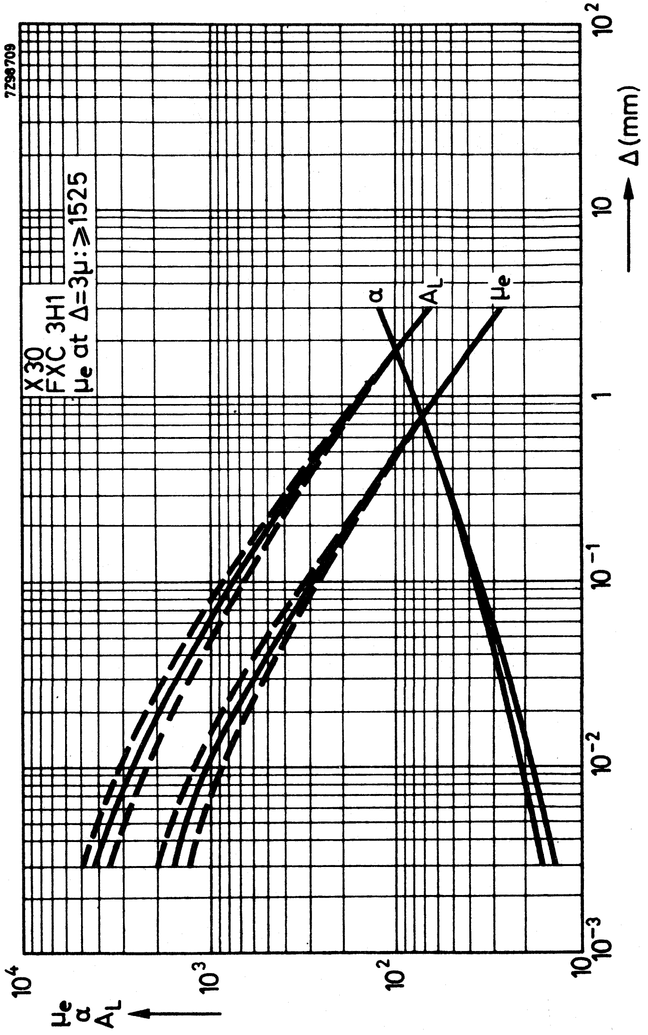


HANNA CURVE (typical values)

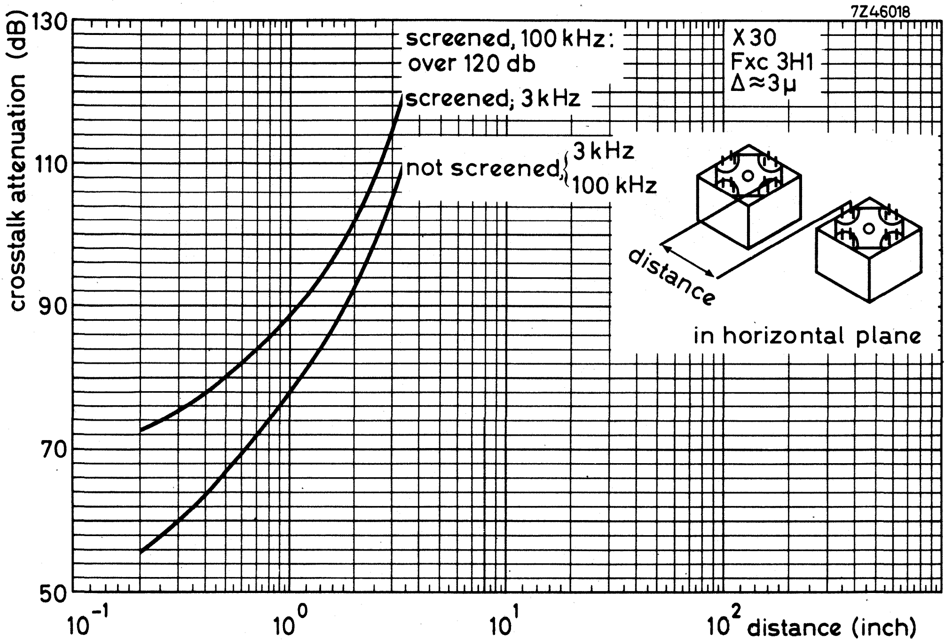
Indicating optimum inductance for a certain airgap and direct current.

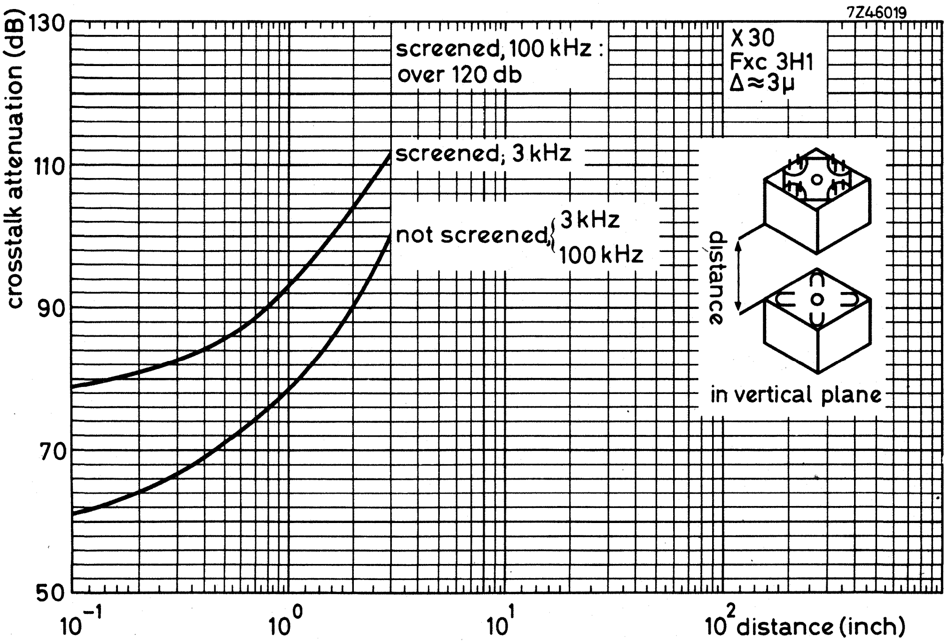


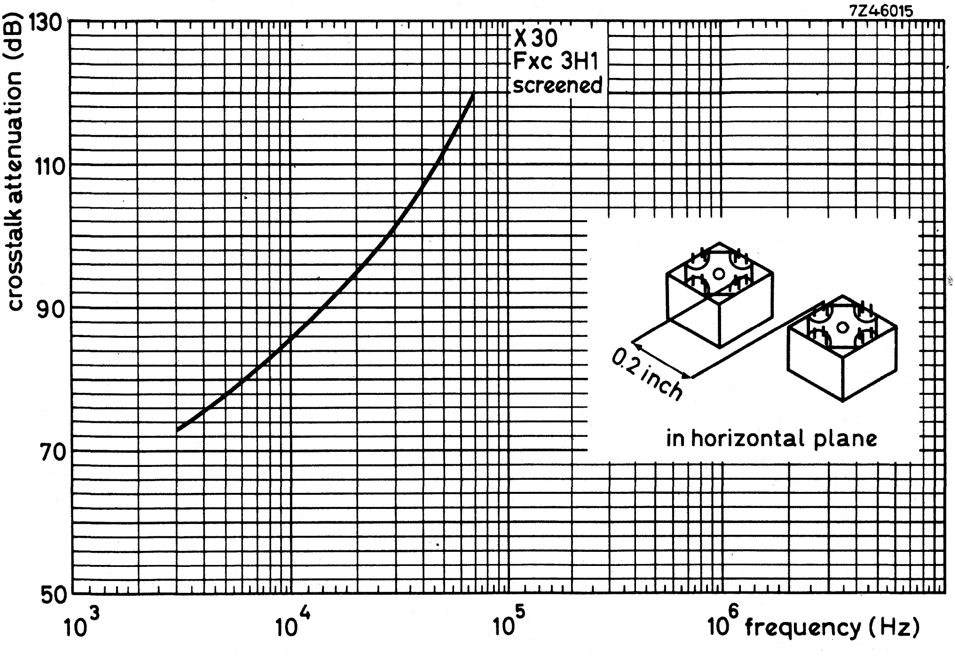
μ_e - α AND A_L CURVES

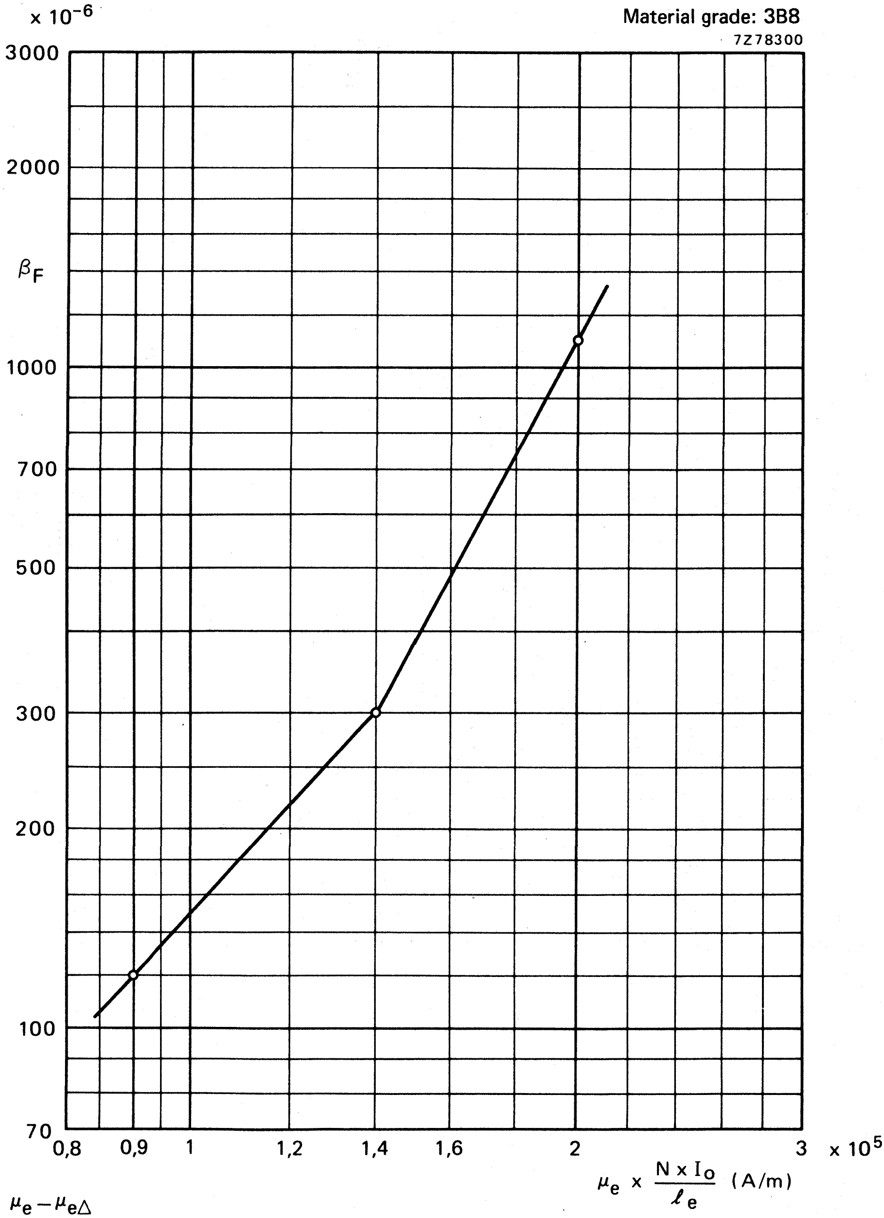


CROSSTALK ATTENUATION






7Z46015
X 30
Fxc 3H1
screened
0.2 inch
in horizontal plane
crosstalk attenuation (dB)
130
110
90
70
50
10^3
10^4
10^5
10^6
frequency (Hz)



$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

CROSS CORES

Two types of core can be supplied:

- CORE HALVES without air gap.
- CORE HALVES with air gap. Standardized air gap lengths in each core half are: 0,02, 0,05, 0,15 and 0,25 mm.

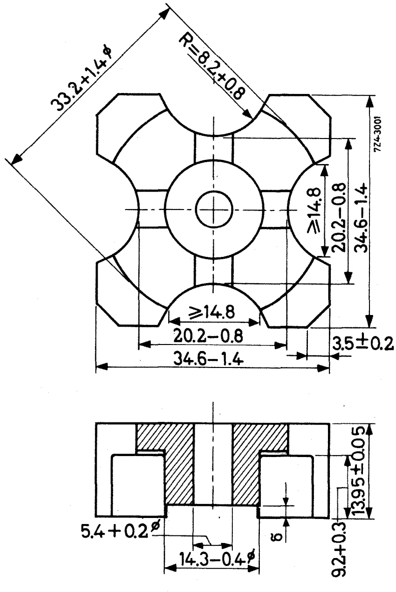
The cross cores are in accordance with IEC 226.

Cross cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 10 core halves; a storage pack contains 100 core halves. Please order in multiples of these quantities.

MECHANICAL DATA

Dimensions in mm

Core half



Dimensional quantities according to IEC 205 (two halves):

$C_1 = \Sigma \frac{l}{A} = 0{,}410\ mm^{-1}$; $V_e = 11\,000\ mm^3$; $l_e = 67{,}3$ mm; $A_e = 164\ mm^2$.

Mass of a core half: approx. 29 g

ELECTRICAL DATA

The combination of two core halves without air gap, randomly chosen from a batch, has the following guaranteed properties. The halves are pressed together with a force of 330 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F are measured on toroid-wound halves only.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8		3H1
A_L ± 25%	4	⩽ 0,1	25 ± 1	⩾ 3980		
μ_e ± 25%	4	⩽ 0,1	25 ± 1	⩾ 1300		⩾ 1580
α	4	⩽ 0,1	25 ± 1	⩽ 15,8		⩽ 14,4
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1	⩽ 2,0		⩽ 1,2
	100	⩽ 0,1	25 ± 1	⩽ 10		⩽ 7
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,0		⩽ 1,1
$\alpha_F \times 10^6$/°C	⩽ 100	⩽ 0,1	5 to 25	0 to + 6		+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 55	0 to + 6		+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 70			+ 0,5 to 1,5
$D_F \times 10^6$	⩽ 100	⩽ 0,1	25 ± 1	⩽ 8,0		⩽ 4,3
$\beta_F \times 10^6$, measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C:						
at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,00 x 10⁵ A/m				⩽ 120		
= 1,55 x 10⁵ A/m				⩽ 300		
= 2,20 x 10⁵ A/m				⩽ 1050		

Core halves without air gap.

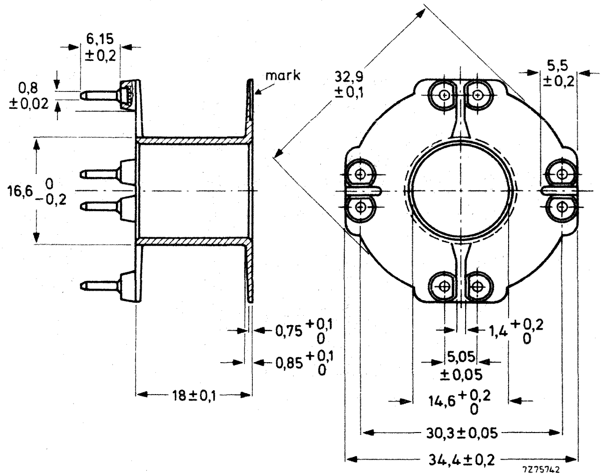
Ferroxcube grade	catalogue number
3B8	4322 020 24030
3H1	4322 020 24000

Core halves with air gap.

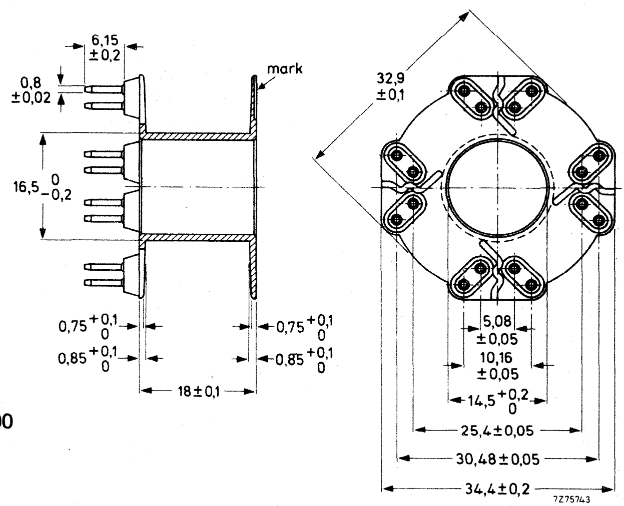
Ferroxcube grade	air gap δ in mm	catalogue number
3H1	0,02 ± 0,01	4322 020 24210
3H1	0,05 ± 0,015	4322 020 24220
3H1	0,15 ± 0,015	4322 020 24230
3H1	0,25 ± 0,015	4322 020 24240

The electrical properties are measured on cores without air gap.

COIL FORMERS



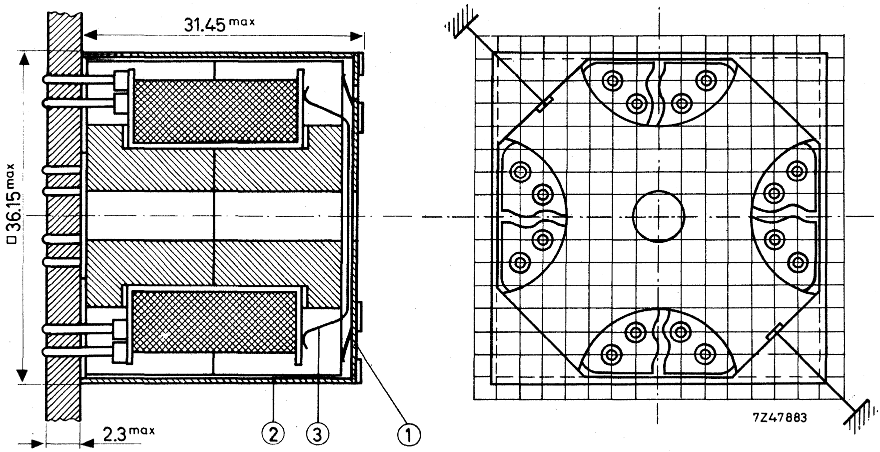
8-pin coil former
catalogue number 4322 021 30190
material: glass fibre reinforced
phenol formaldehide



16-pin coil former
catalogue number 4322 021 31200
material: reinforced polyester

Window area	134 mm^2
Mean length of turn	77,5 mm
Maximum dip-solder temperature (5 to 6 s)	280 °C
Maximum working temperature	130 °C
Required force (1 minute at 25 °C) to pull pins from socket	20 N
Maximum test voltage between pins (> 50 Hz, 2 minutes)	2000 V (r.m.s.)

MOUNTING PARTS



(1) Cover 4322 021 31160
(2) Container 4322 021 31180
(3) Spring 4322 021 30220
(4) 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.

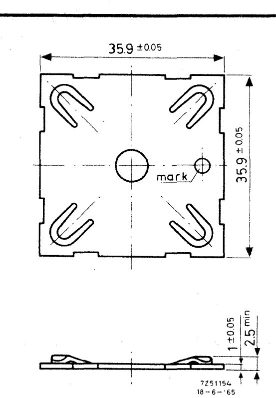
The sixteen soldering pins are positioned according to a grid of 2,52 mm. They will fit printed-wiring boards with a 0,1" grid as well as those with a 2,50 mm grid. The pin length is sufficient for board thicknesses up to 2,3 mm. The printed-wiring board should be provided with holes of 1,3 ± 0,1 mm 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.

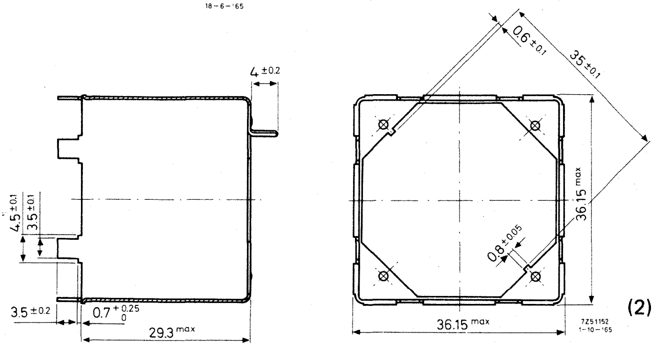
The cover is provided with a marking hole. The mark of the coil former (see drawing of coil former) has to be in one line with this hole. These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

It is recommended that the coil former be cemented in one of the cross-core halves or to use the spring (pos. 3) in order to obtain the most stable construction.

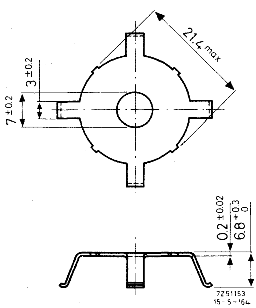
Before bending the lips of the container, pressure should be exerted evenly on the four corners of the cover until the latter meets the container. The required force is approximately 330 N. After bending the lips, the core will have the correct tension.

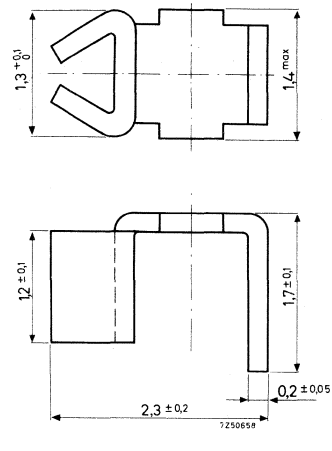


(1) Cover 4322 021 31160
Material: phosphor bronze, nickel plated.



(2) Container 4322 021 31180
Material: brass, nickel plated.



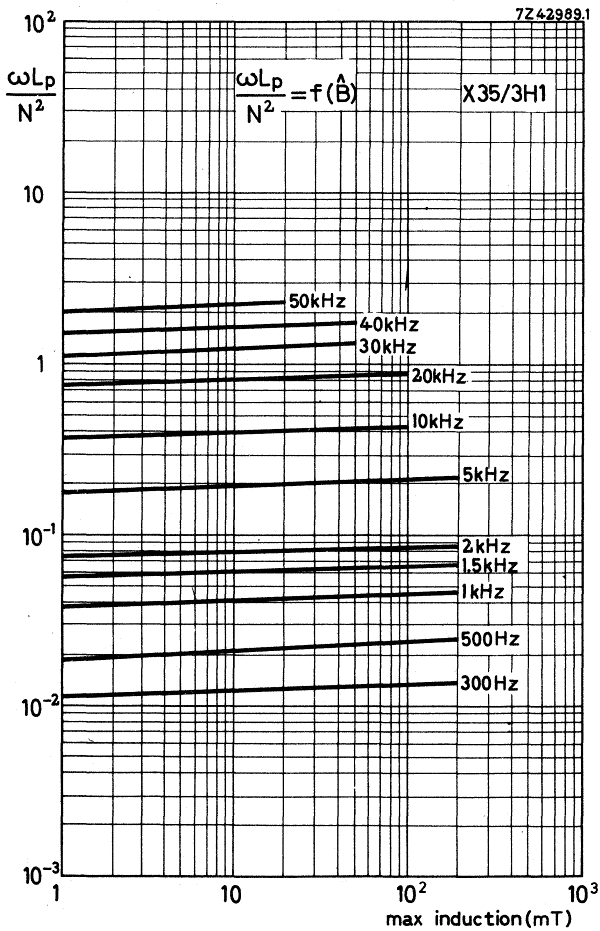


(3) Spring 4322 021 30220
Material: phosphor bronze.

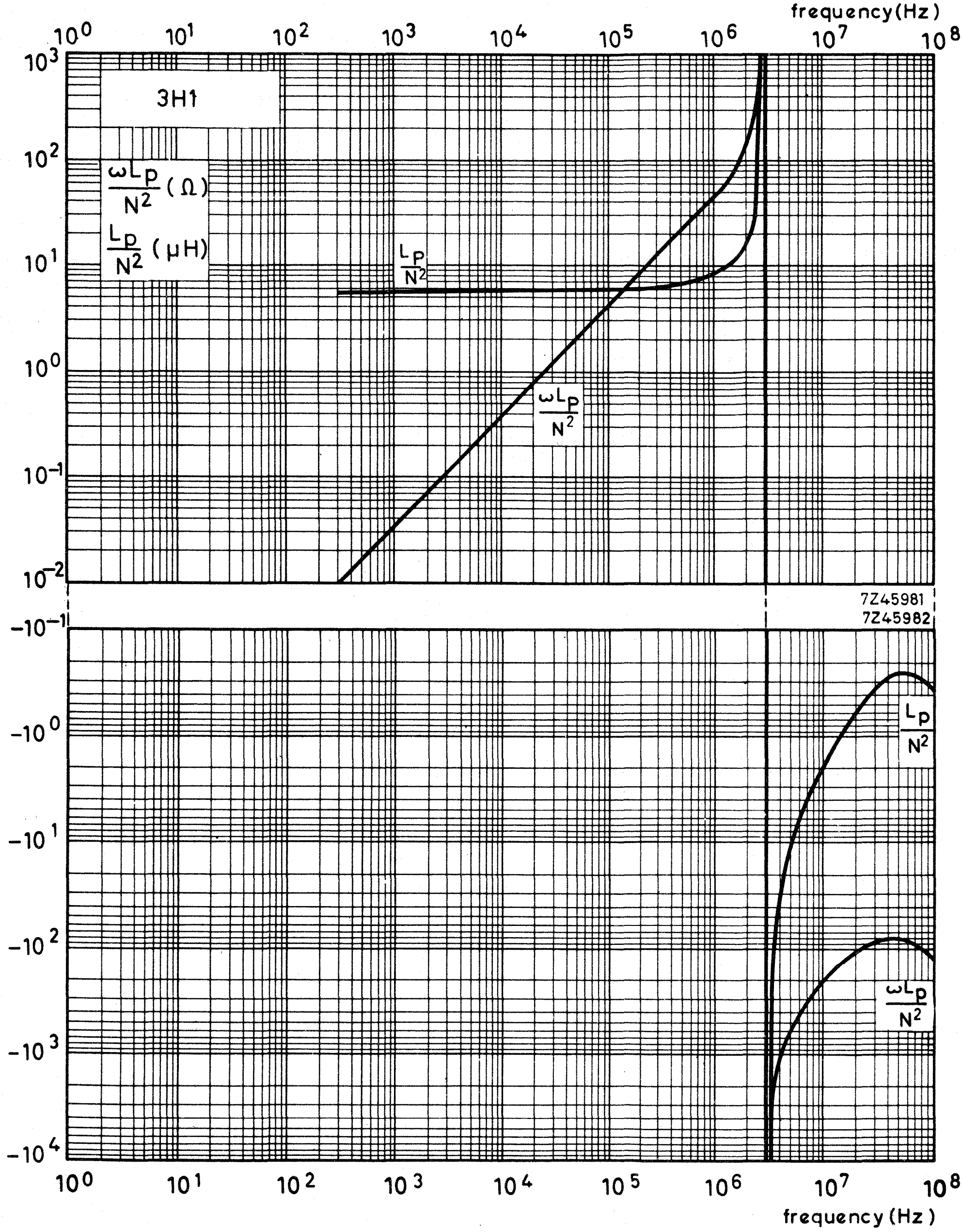
(4) Soldering spring 4322 021 30700
Material: brass, dip-soldered.

CHARACTERISTIC CURVES

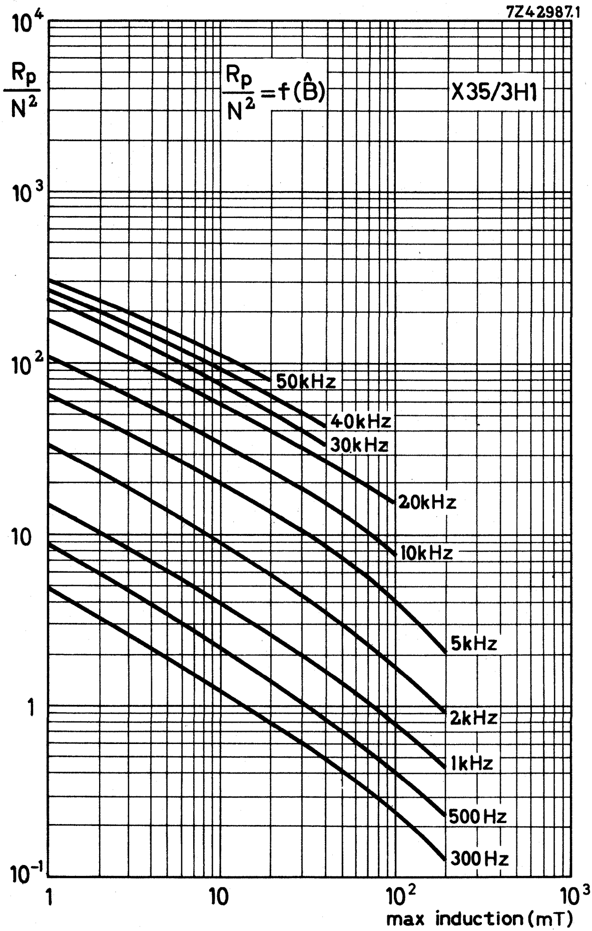
INDUCTANCE AS A FUNCTION OF THE INDUCTION (typical values)



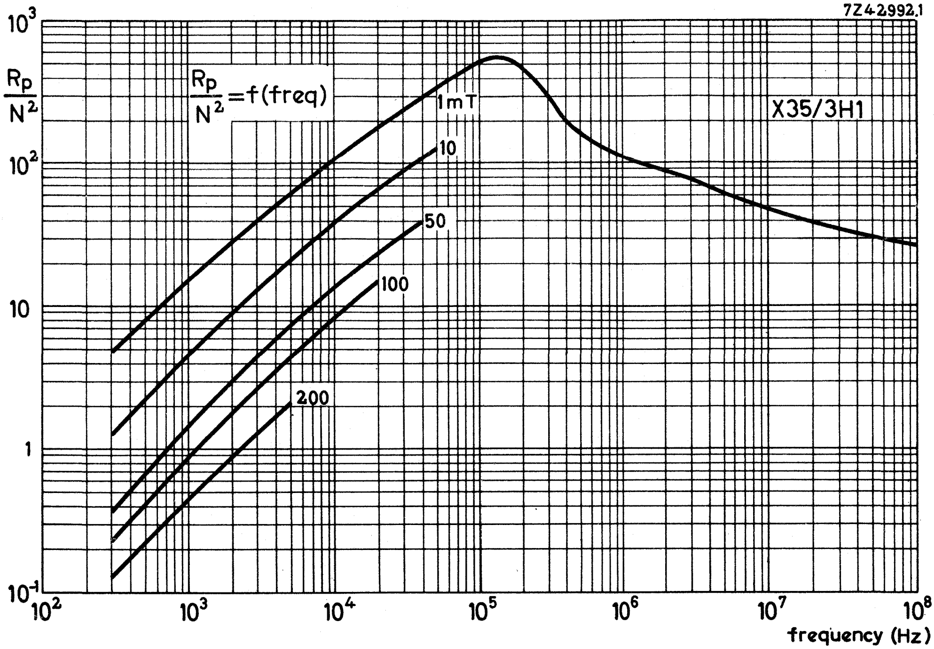
INDUCTANCE AS A FUNCTION OF THE FREQUENCY (typical curves)



CORE LOSSES AS A FUNCTION OF THE INDUCTION (typical values)

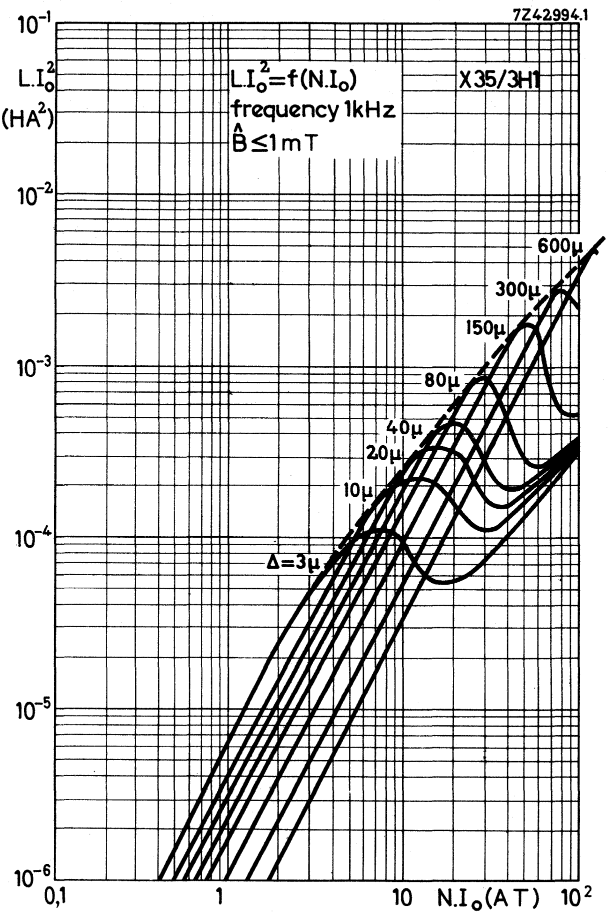


CORE LOSSES AS A FUNCTION OF THE FREQUENCY (typical values)

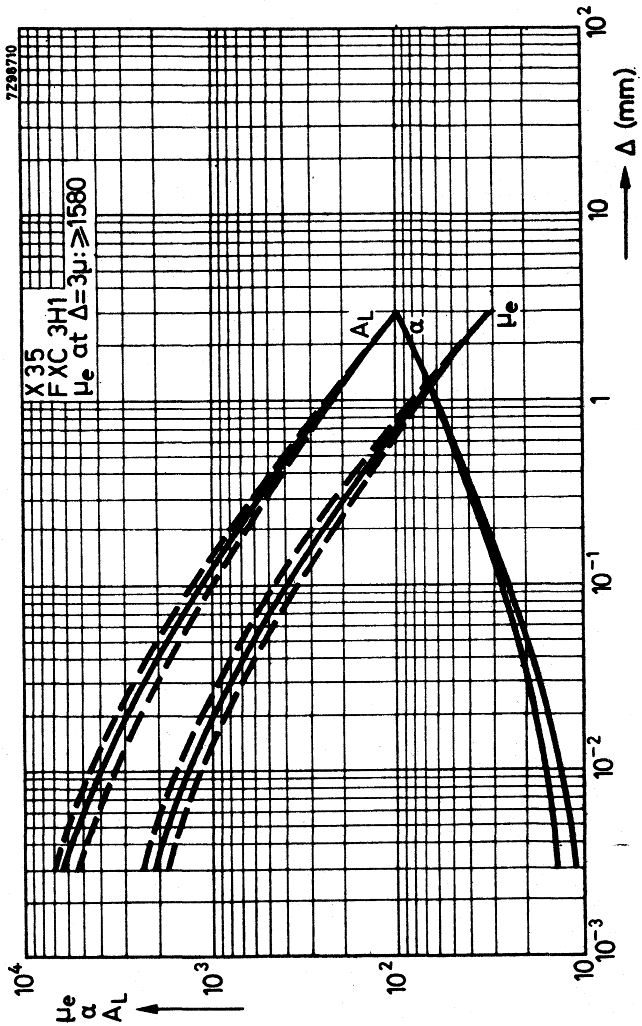


HANNA CURVE (typical values)

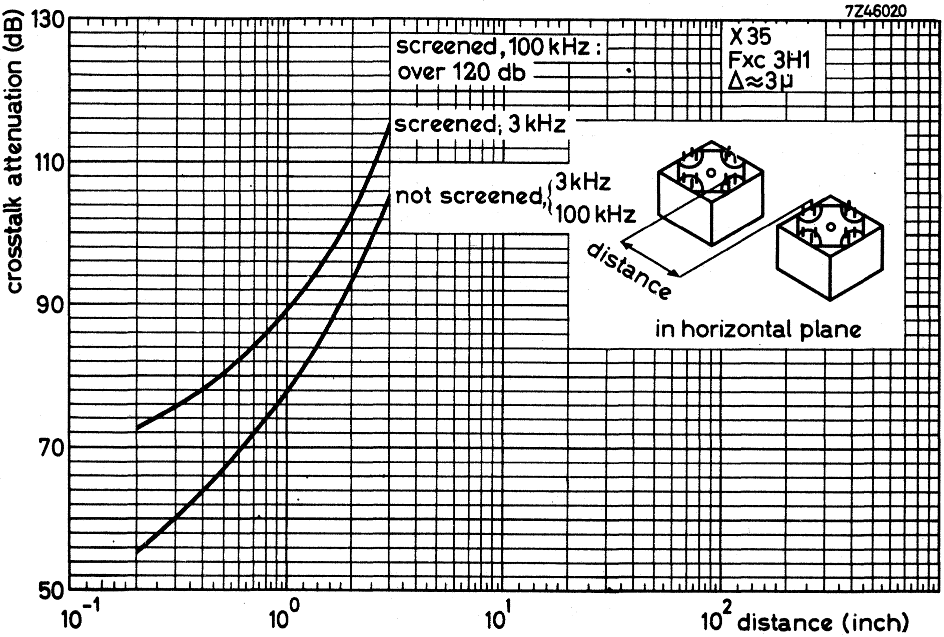
Indicating optimum inductance for a certain airgap and direct current.

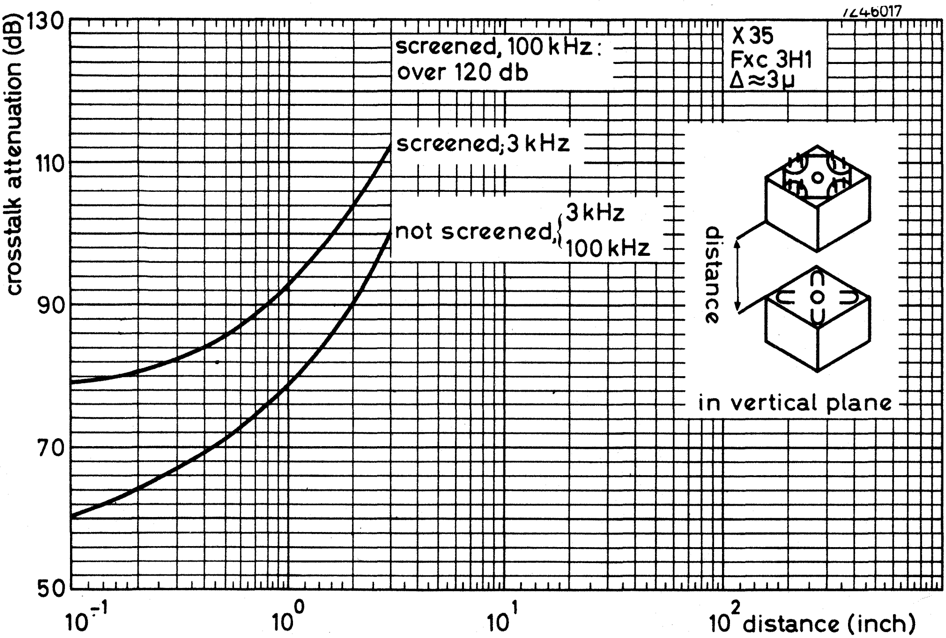


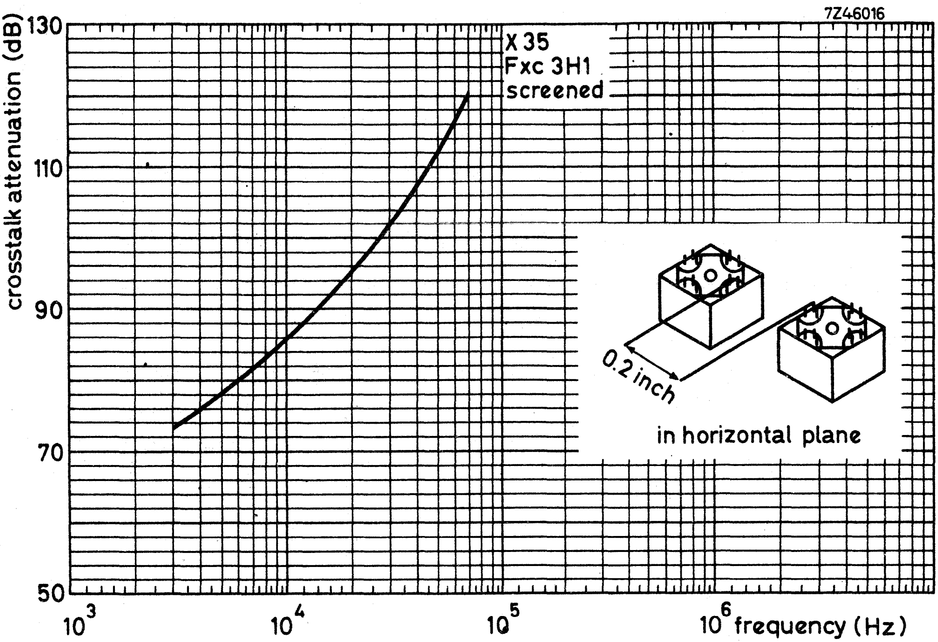
μ_e - α AND A_L CURVES



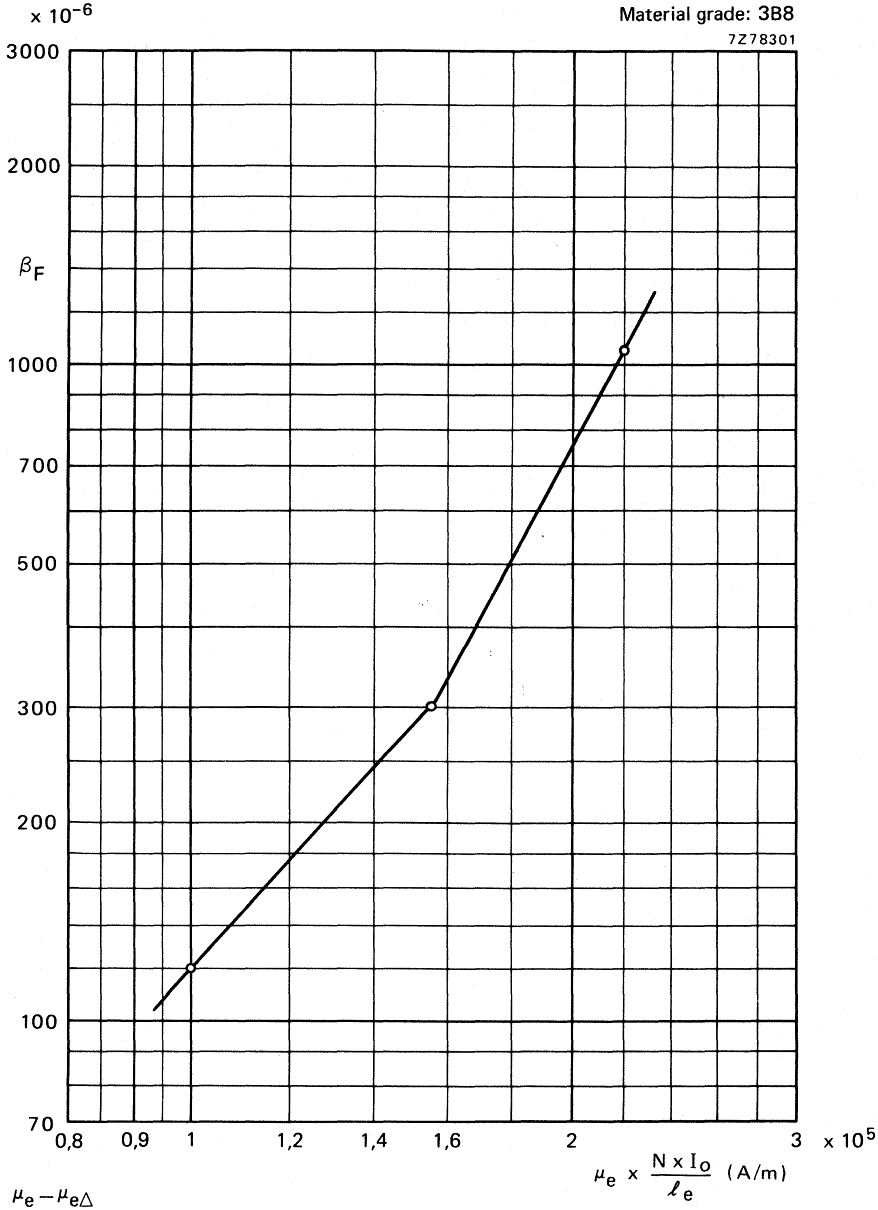
CROSSTALK ATTENUATION






7Z46016
crosstalk attenuation (dB)
130
110
90
70
50
X 35
Fxc 3H1
screened
0.2 inch
in horizontal plane
10^3
10^4
10^5
10^6
frequency (Hz)

Material grade: 3B8

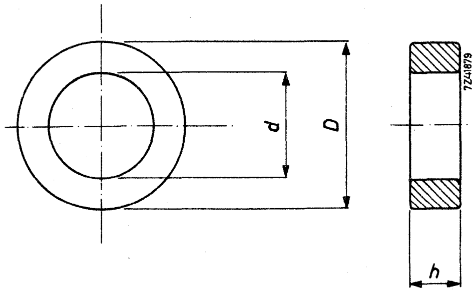


$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current. The measured values are situated in the area to the right of the curve.

Toroids

TOROIDS



Toroids, having no air gap, possess 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. They are used in small broadband transformers, pulse transformers, suppression filters, etc. 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 are available in various sizes and Ferroxcube grades. They are barrel-finished and can be obtained in nylon insulated or non-coated versions.

Table 1. Dimensional quantities, tolerances and mass of non-coated toroids.

D mm		d mm		h mm		l_e mm	$\Sigma \frac{l}{A}$ mm^{-1}	V_e mm^3	mass g
4	± 0,1	2,2	± 0,1	1,1	± 0,1	9,46	9,56	9,37	0,045
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
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 μ-values in the following pages are determined with the $\Sigma \frac{l}{A}$ values of Table 1 at 25 °C.

   The relevant A_L values can be calculated with the formula $A_L = \frac{0,4\,\pi\mu}{\Sigma \frac{l}{A}}$.

2. The smaller a toroid, the more its properties deviate from the material properties. Therefore a straightforward translation of the material figures is not always possible.

Table 2. Dimensions and tolerances of coated toroids.

D mm	d mm	h mm	derived from non-coated toroids with dimensions
4,3 ± 0,2	1,9 ± 0,2	1,4 ± 0,2	4 x 2,2 x 1,1
6,3 ± 0,25	3,7 ± 0,25	2,3 ± 0,2	6 x 4 x 2
9,4 ± 0,3	5,6 ± 0,3	3,4 ± 0,2	9 x 6 x 3
14,5 ± 0,4	8,5 ± 0,35	5,5 ± 0,25	14 x 9 x 5
23,6 ± 0,7	13,4 ± 0,55	7,6 ± 0,4	23 x 14 x 7
29,6 ± 0,7	18,4 ± 0,6	8,1 ± 0,4	29 x 19 x 7,5
36,6 ± 0,9	22,4 ± 0,7	10,6 ± 0,4	36 x 23 x 10
36,6 ± 0,9	22,4 ± 0,7	15,6 ± 0,4	36 x 23 x 10

Table 3. Grades, sizes and catalogue numbers.

grade	μ_{tor}	colour coating	dimensions * mm	catalogue number 4322 020	
				nylon coated	non-coated
3E1	2700 ± 20% at 25 °C	green	29 x 19 x 7,5	97000	31310
			36 x 23 x 10	97010	31320
			36 x 23 x 15	97020	31330
3E2	> 5000 at +25 to +70 °C	blue	4 x 2,2 x 1,1	97030	31420
			6 x 4 x 2	97040	31430
			9 x 6 x 3	97050	31440
			14 x 9 x 5	97060	31450
			23 x 14 x 7	97070	31460
3E3	> 10 000 at +10 to +70 °C	brown	4 x 2,2 x 1,1	97080	31470
			6 x 4 x 2	97090	31480
			9 x 6 x 3	97100	31490
3H2	2300 to 3100 at +25 °C	grey	4 x 2,2 x 1,1	97110	31350
			6 x 4 x 2	97120	31370
	$D_F \leqslant 5 \times 10^{-6}$ at 23 ± 1 °C		9 x 6 x 3	97130	31380
			14 x 9 x 5	97140	31390
			23 x 14 x 7	97150	31400
4C6	> 100 at +5 to +55 °C	violet	6 x 4 x 2	97160	90750
			9 x 6 x 3	97170	90760
			14 x 9 x 5	97180	90770
			23 x 14 x 7	97190	90860
			36 x 23 x 15	97200	90870

* These dimensions refer to non-coated toroids. More exact details are given in Tables 1 and 2.

Index

INDEX OF CATALOGUE NUMBERS

The purpose of this index is to provide identification of the component type when only the catalogue number is known. Details of the particular component are given in the relevant section of this book.

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92900	Tube core
93110	Tube core
93120	U-core
93130	I-core
93160	Rod core
93320	Rod core
93570	U-core
93610	Screw core
93690	Rod core
93720	Tube core
93760	Tube core
93780	U-core
93840	Yoke ring
93890	Tube core
93950	U-core
94030	Tube core
94090	L-core
94480	Frame core
94500	Rod core
94600	L-core
94700	Bead
94760	U-core
94770	I-core
94790	Yoke ring
94840	Bead
94880	Tube core
99020	Plastic headed adjuster core
99170	Yoke ring
99150	Plastic headed adjuster core
99250	Plastic headed adjuster core
99270	Plastic headed adjuster core
3122 134 90000	Tube core
90110	Rod core
90130	U-core
90200	U-core
90210	E-core E55/28/25 in 3C8
90430	Transductor core
90460	U-core
90480	U-core
90620	Rod core
90690	U-core
90720	Rod core
90730	Rod core
90760	U-core
90770	Tube core
90780	Tube core
90800	Bead
90940	E-core E55/28/25 in 3C8
90960	Transductor core
90970	Yoke ring
91120	Rod core
91160	U-core

4312 020 33080	I-core
33090	U-core
33100	U-core
33110	I-core
33120	U-core
33190	U-core
33300	U-core
33330	U-core
33420	I-core
33450	U-core
34020	E-core E25/13/7 in 3C8
34070	E-core E20/10/5 in 3C6
34100	E-core E55/28/21 in 3C8
34110	E-core E42/21/15 in 3C8
34120	E-core E42/21/20 in 3C8
34170	E-core E42/21/20 + E42/33/20
34190	E-core E42/33/20 in 3C8
34280	E-core E42/21/15 in 3C8
34360	E-core E42/21/20 in 3C8
34340	Transductor core
34370	E-core E42/21/15 in 3C8
34380	E-core E65/33/27 in 3C8
34430	E-core E55/28/21 in 3C8
36630	Wideband HF choke
36640	Wideband HF choke
36650	Wideband HF choke
36690	Wideband HF choke
36700	Wideband HF choke
36710	Wideband HF choke
4312 021 28430	Coil former E20/10/5
28550	Coil former E30/15/7
28620	Coil former E42/21/15
28710	Coil former E55/28/21
28720	Coil former E65/32/13
29240	Coil former RM6-S
29250	Coil former RM6-S
4313 020 10210	Rod core
10250	Rod core
10300	Rod core
12230	Rod core
12470	Rod core
15010	Tube core
15120	Tube core
15170	Tube core
15180	Tube core
15280	Tube core
15460	Tube core
15470	Tube core
15840	Tube core
18250	Tube core
4313 021 03620	Coil former RM10
03630	Coil former RM10
03670	Coil former RM10

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23510	Cross core half X22 in 3H1
23530	Cross core half X22 in 3E1
23540	Cross core half X22 in 3B8
23700	Cross core half X22 in 3H1
23710	Cross core half X22 in 3H1
23720	Cross core half X22 in 3H1
23730	Cross core half X22 in 3H1
23740	Cross core half X22 in 3H1
23750	Cross core half X30 in 3H1
23760	Cross core half X30 in 3E1
23780	Cross core half X30 in 3B8
23960	Cross core half X30 in 3H1
23970	Cross core half X30 in 3H1
23980	Cross core half X30 in 3H1
23990	Cross core half X30 in 3H1
24000	Cross core half X35 in 3H1
24030	Cross core half X35 in 3B8
24210	Cross core half X35 in 3H1
24220	Cross core half X35 in 3H1
24230	Cross core half X35 in 3H1
24240	Cross core half X35 in 3H1
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25040	Square core RM6-S in 3B7
25060	Square core RM6-S in 3D3
25080	Square core RM6-S in 4C6
25120	Square core RM6-R in 3B7
25130	Square core RM6-S in 3H1
25140	Square core RM6-R in 3D3
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26780	Square core RM4 in 4C6
26790	Square core RM5 in 3H3
27250	Square core RM8 in 3B7
27260	Square core RM8 in 3H1
27270	Square core RM8 in 3D3
27280	Square core RM8 in 4C6
27420	Square core RM8 in 3B8
27630	Square core RM6-R in 3B8
27850	Square core RM6-S in 3B8
28270	Square core RM10 in 3H1
28290	Square core RM10 in 3E4
28320	Square core RM14 in 3B8
28350	Square core RM10 in 3C8
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31310	Toroid in 3E1
31320	Toroid in 3E1

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37320	I-core 42/7, 5/15 in 3E1
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38320	Tube core
38340	Tube core
38360	Tube core
38420	Tube core
39330	Rod core
39350	Rod core
39410	Rod core
39430	Rod core
39450	Rod core
39480	Rod core
52500	EC-core EC35/17/10 in 3C8
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52520	EC-core EC52/24/14 in 3C8
52530	EC-core EC70/34/17 in 3C8
90750	Toroid in 4C6
90760	Toroid in 4C6
90770	Toroid in 4C6
90860	Toroid in 4C6
90870	Toroid in 4C6
97000	Toroid in 3E1
97010	Toroid in 3E1
97020	Toroid in 3E1
97030	Toroid in 3E2
97040	Toroid in 3E2
97050	Toroid in 3E2
97060	Toroid in 3E2
97070	Toroid in 3E2
97080	Toroid in 3E3
97090	Toroid in 3E3
97100	Toroid in 3E3
97110	Toroid in 3H2
97120	Toroid in 3H2
97130	Toroid in 3H2
97140	Toroid in 3H2
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97170	Toroid in 4C6
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20170	Clasp E30/15/7
20220	Spring E20/10/5
20230	Spring E30/15/7
20240	Coil former E20/10/5
20250	Coil former E30/15/7
20390	Spring H10
30040	Container for X22

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30720	Fixing bush P14/8 – P18/11 – P22/13 – P26/16 – P30/19 – P36/22 – P42/29 – E42
30730	Inductance adjuster X22
30750	Inductance adjuster P14/8
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30790	Inductance adjuster P26/16 – P30/19 – P36/22
30800	Inductance adjuster P26/16 – P30/19
30810	Inductance adjuster P26/16 – P30/19 – P36/22 – P42/29 – RM10
30940	Inductance adjuster P14/8
30950	Inductance adjuster P14/8
30970	Inductance adjuster X22
30980	Inductance adjuster P26/16 – P30/19 – P36/22 – P42/29
31000	Inductance adjuster P22/13 – RM8
31020	Inductance adjuster P22/13 – RM8
31040	Inductance adjuster P22/13
31060	Inductance adjuster P22/13 – RM8
31070	Inductance adjuster P14/8
31080	Inductance adjuster X22
31090	Inductance adjuster P26/16 – P30/19 – P36/22 – P42/29 – RM10
31100	Inductance adjuster P22/13 – RM8
31110	Inductance adjuster P36/22
31120	Inductance adjuster P30/19 – P36/22 – P42/29
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31180	Container X35
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31260	Inductance adjuster P11/7 – RM4 – RM5
31270	Inductance adjuster P9/5 – P11/7 – RM4 – RM5
31280	Inductance adjuster P11/7 – RM4 – RM5
31320	Coil former P66/56
31540	Inductance adjuster P9/5 – P11/7 – RM4 – RM5
31630	Nut for adjuster P9/5 – P11/7
31700	Coil former P9/5
31770	Coil former X22
31780	Clip RM6-R, RM6-S
31830	Coil former E42/21/15
31840	Clip RM8
31850	Nut for adjuster RM4
31900	Clip RM4 – RM5
31910	Clasp E42/21/15
31920	Spring E42/21/15
320 ..	Step-by-step adjuster
32100	Step-by-step adjuster
32110	Step-by-step adjuster
32120	Step-by-step adjuster
32130	Inductance adjuster P18/11 – RM6-R – RM6-S
32140	Inductance adjuster P18/11 – RM6-R – RM6-S
32150	Inductance adjuster P18/11 – RM6-R – RM6-S

4322 022 21 ...	Pre-adjusted potcore P11/7
22 ...	Pre-adjusted potcore P14/8
23 ...	Pre-adjusted potcore P14/8
24 ...	Pre-adjusted potcore P18/11
25 ...	Pre-adjusted potcore P18/11
26 ...	Pre-adjusted potcore P22/13
27 ...	Pre-adjusted potcore P22/13
28 ...	Pre-adjusted potcore P26/16
29 ...	Pre-adjusted potcore P26/16
30 ...	Pre-adjusted potcore P30/19
31 ...	Pre-adjusted potcore P30/19
32 ...	Pre-adjusted potcore P36/22
33 ...	Pre-adjusted potcore P36/22
34 ...	Pre-adjusted potcore P42/29
35 ...	Pre-adjusted potcore P42/29
41 ...	Pre-adjusted potcore P9/5
45 ...	Pre-adjusted cross core X22
47 ...	Pre-adjusted square core RM6-S
50 ...	Pre-adjusted square core RM10
51 ...	Pre-adjusted square core RM8
55 ...	Pre-adjusted square core RM6-R
56 ...	Pre-adjusted square core RM14
57 ...	Pre-adjusted square core RM4
59 ...	Pre-adjusted square core RM5
61 ...	Pre-adjusted potcore P9/5
65 ...	Pre-adjusted cross core X22
67 ...	Pre-adjusted square core RM6-S
70 ...	Pre-adjusted square core RM10
71 ...	Pre-adjusted square core RM8
75 ...	Pre-adjusted square core RM6-R
76 ...	Pre-adjusted square core RM14
77 ...	Pre-adjusted square core RM4
79 ...	Pre-adjusted square core RM5
4322 058 00000	Tool drawing for P14/8
00010	Tool drawing for P18/11
00020	Tool drawing for P22/13
00030	Tool drawing for P26/16
00040	Tool drawing for P30/19
00050	Tool drawing for P36/22
00060	Tool drawing for P42/29
00070	Tool drawing P11/7
00080	Tool drawing for X22
00090	Tool drawing for X30
00100	Tool drawing for X35
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<u>Potcores</u>

FERROXCUBE TRANSFORMER CORES

Argentina: FAPESA I.y.C., Av. Crovara 2550, Tablada, Prov. de BUENOS AIRES, Tel. 652-7438/7478.
Australia: PHILIPS INDUSTRIES HOLDINGS LTD., Elcoma Division, 67 Mars Road, LANE COVE, 2066, N.S.W., Tel. 427 08 88.
Austria: ÖSTERREICHISCHE PHILIPS BAUELEMENTE Industrie G.m.b.H., Triester Str. 64, A-1101 WIEN, Tel. 62 91 11.
Belgium: M.B.L.E., 80, rue des Deux Gares, B-1070 BRUXELLES, Tel. 523 00 00.
Brazil: IBRAPE, Caixa Postal 7383, Av. Paulista 2073-S/Loja, SAO PAULO, SP, Tel. 284-4511.
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