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Ferroxcube potcores, square cores & cross cores

C4

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Data handbook

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Electronic components and materials

Components and materials

Book C4

1986

Ferroxcube potcores,

square cores & cross cores

FERROXCUBE POTCORES SQUARE CORES AND CROSS CORES

Section D

Potcores halves and coil formers for inductive proximity detectors

Section E

Square cores and accessories

Section F

Cross cores and accessories

DATA HANDBOOK SYSTEM

Our Data Handbook System comprises more than 60 books with specifications on electronic components, subassemblies and materials. It is made up of four series of handbooks:

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

The contents of each series are listed on pages iv to viii.

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

When ratings or specifications differ from those published in the preceding edition they are indicated with arrows in the page margin. Where application information is given it is advisory and does not form part of the product specification.

Condensed data on the preferred products of Philips Electronic Components and Materials Division is given in our Preferred Type Range catalogue (issued annually).

Information on current Data Handbooks and on how to obtain a subscription for future issues is available from any of the Organizations listed on the back cover.
Product specialists are at your service and enquiries will be answered promptly.

ELECTRON TUBES (BLUE SERIES)

The blue series of data handbooks comprises:

T1	**Tubes for r.f. heating**
T2a	**Transmitting tubes for communications, glass types**
T2b	**Transmitting tubes for communications, ceramic types**
T3	**Klystrons**
T4	**Magnetrons for microwave heating**
T5	**Cathode-ray tubes** Instrument tubes, monitor and display tubes, C.R. tubes for special applications
T6	**Geiger-Müller tubes**
T8	**Colour display systems** Colour TV picture tubes, colour data graphic display tube assemblies, deflection units
T9	**Photo and electron multipliers**
T10	**Plumbicon camera tubes and accessories**
T11	**Microwave semiconductors and components**
T12	**Vidicon and Newvicon camera tubes**
T13	**Image intensifiers and infrared detectors**
T15	**Dry reed switches**
T16	**Monochrome tubes and deflection units** Black and white TV picture tubes, monochrome data graphic display tubes, deflection units

SEMICONDUCTORS (RED SERIES)

The red series of data handbooks comprises:

S1 **Diodes**
Small-signal silicon diodes, voltage regulator diodes (< 1,5 W), voltage reference diodes, tuner diodes, rectifier diodes

S2a **Power diodes**

S2b **Thyristors and triacs**

S3 **Small-signal transistors**

S4a **Low-frequency power transistors and hybrid modules**

S4b **High-voltage and switching power transistors**

S5 **Field-effect transistors**

S6 **R.F. power transistors and modules**

S7 **Surface mounted semiconductors**

S8a **Light-emitting diodes**

S8b **Devices for optoelectronics**
Optocouplers, photosensitive diodes and transistors, infrared light-emitting diodes and infrared sensitive devices, laser and fibre-optic components

S9 **Power MOS transistors**

S10 **Wideband transistors and wideband hybrid IC modules**

S11 **Microwave transistors**

S12 **Surface acoustic wave devices**

S13 **Semiconductor sensors**

INTEGRATED CIRCUITS (PURPLE SERIES)

The purple series of data handbooks comprises:

EXISTING SERIES		Superseded by:
IC1	**Bipolar ICs for radio and audio equipment**	IC01N
IC2	**Bipolar ICs for video equipment**	IC02Na and IC02Nb
IC3	**ICs for digital systems in radio, audio and video equipment**	IC01N, IC02Na and IC02Nb
IC4	**Digital integrated circuits** CMOS HE4000B family	
IC5	**Digital integrated circuits – ECL** ECL10 000 (GX family), ECL100 000 (HX family), dedicated designs	IC08N
IC6	**Professional analogue integrated circuits**	IC03N and Supplement to IC11N
IC7	**Signetics bipolar memories**	
IC8	**Signetics analogue circuits**	IC11N
IC9	**Signetics TTL logic**	IC09N and IC15N
IC10	**Signetics Integrated Fuse Logic (IFL)**	IC13N
IC11	**Microprocessors, microcomputers and peripheral circuitry**	IC14N

NEW SERIES

IC01N	**Radio, audio and associated systems** Bipolar, MOS	(published 1985)
IC02Na	**Video and associated systems** Bipolar, MOS Types MAB8031AH to TDA1524A	(published 1985)
IC02Nb	**Video and associated systems** Bipolar, MOS Types TDA2501 to TEA1002	(published 1985)
IC03N	**Integrated circuits for telephony**	(published 1985)
IC04N	**HE4000B logic family** CMOS	
IC05N	**HE4000B logic family — incased ICs** CMOS	(published 1984)
IC06N*	**High-speed CMOS; PC74HC/HCT/HCU** Logic family	(published 1986)
IC07N	**High-speed CMOS; PC54/74HC/HCT/HCU — uncased ICs** Logic family	
IC08N	**ECL 10K and 100K logic families**	(published 1984)
IC09N	**TTL logic series**	(published 1984)
IC10N	**Memories** MOS, TTL, ECL	
IC11N	**Linear LSI**	(published 1985)
Supplement to IC11N	**Linear LSI**	(published 1986)
IC12N	**Semi-custom gate arrays & cell libraries** ISL, ECL, CMOS	
IC13N	**Semi-custom** Integrated Fuse Logic	(published 1985)
IC14N	**Microprocessors, microcontrollers & peripherals** Bipolar, MOS	(published 1985)
IC15N	**FAST TTL logic series**	(published 1984)

Note

Books available in the new series are shown with their date of publication.

* Supersedes the IC06N 1985 edition and the Supplement to IC06N issued Autumn 1985.

COMPONENTS AND MATERIALS (GREEN SERIES)

The green series of data handbooks comprises:

C1 **Programmable controller modules**
PLC modules, PC20 modules

C2 **Television tuners, coaxial aerial input assemblies, surface acoustic wave filters**

C3 **Loudspeakers**

C4 **Ferroxcube potcores, square cores and cross cores**

C5 **Ferroxcube for power, audio/video and accelerators**

C6 **Synchronous motors and gearboxes**

C7 **Variable capacitors**

C8 **Variable mains transformers**

C9 **Piezoelectric quartz devices**

C10 **Connectors**

C11 **Varistors, thermistors and sensors**

C12 **Potentiometers, encoders and switches**

C13 **Fixed resistors**

C14 **Electrolytic and solid capacitors**

C15 **Ceramic capacitors**

C16 **Permanent magnet materials**

C17 **Stepping motors and associated electronics**

C18 **Direct current motors**

C19 **Piezoelectric ceramics**

C20 **Wire-wound components for TVs and monitors**

C21* **Assemblies for industrial use**
HNIL FZ/30 series, NORbits 60-, 61-, 90-series, input devices

C22 **Film capacitors**

* To be issued shortly.

SECTION A
GENERAL 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 extruding, 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, cores for magnetic recording and special materials for proton accelerators.

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.

When ordering cores or associated parts, such as coil formers, adjusters and mounting parts, please quote the 12-digit catalogue number for the product in question given in the device data. Whenever this number ends with 'zero', the actual delivered goods may bear a different figure which is for logistic purposes only.
So if you order e.g. type 4322 021 30180 you may receive 4322 021 30182.

* Our trade name for magnetically soft ferrites.

APPLICATIONS

The various grades of Ferroxcube, the forms in which they are available and their principal applications are listed in the table below.

grade	core shapes and some preferred applications
• 2A2	yoke rings
• 3B	rods and tubes
3B7	potcores and square cores
• 3B8	potcores, square cores and cross cores
• 3C2	yoke rings
3C6	rods and tubes
• 3C8	E, EC, ETD, U and I cores, square cores
• 3C85	E, ETD, square cores
• 3D3	potcores, square cores, screw cores
3E1	E and I cores, toroids, potcores, square cores
• 3E2	H cores and toroids
• 3E4	potcores and square cores
3E5	square cores, toroids
• 3F3	ETD, square cores
• 3H1	potcores, square cores, cross cores
3H2	tubes, rods, toroids
• 3H3	potcores, square cores
4A4	frames for i.f. transformers, rods and tubes
• 4B1	frames for i.f. transformers, rods and tubes
• 4C6	potcores, square cores, toroids, frames for i.f. transformers, rods and tubes
4D1, 4D2	frames for i.f. transformers, screw cores, rods and tubes
4E1	rods and tubes
3H22, 3F1, 4E2, 4L2, 4M2, 8C11, 8C12	special-purpose ferrites developed for resonant cavities for particle accelerators. A technical discussion is usually necessary to determine the correct material for this type of application.
8A5, 8C1, 8E1, 8E2, 8E21, 8X1	cores and structural material for magnetic recording heads.

SYMBOLS, TERMS, DEFINITIONS AND BASIC FORMULAE

This list of symbols is based on the recommendations of IEC Publications 50, 125 and 401. Where symbols or formulae are used in connection with one application, material or core only, they are explained in the relevant section or data sheet.

symbol	units	definition
A_{min}	mm^2	nominal value of the minimum cross-sectional area.
A_e	mm^2	effective cross-sectional area.
$A_{e\,min}$	mm^2	minimum effective cross-sectional area.
A_L	nH	inductance factor = L/N^2. Note: unless otherwise stated in this Handbook, A_L is the inductance factor in nH.
AT	A	ampere-turns.
B	T	flux density.
B_s	T	saturation flux density.
B_r	T	remanence: flux density remaining after magnetization to saturation and removal of the external field.
$\hat{B}$	T	peak flux density.
C_1	mm^{-1}	core constant: $C_1 = \Sigma(\ell/A)$.
D	–	disaccommodation: the fractional change of permeability of a magnetic material measured at a constant temperature over a period of time after cessation of a disturbance $D = \frac{\mu_1 - \mu_2}{\mu_1}$
D_F	–	disaccommodation factor: obtained by dividing D by the first measured relative permeability (at t_1) and the logarithm of the ratio of the measuring times $D_F = \frac{\mu_1 - \mu_2}{\mu_1^2 \log(t_2/t_1)}$ Times t_1 and t_2 are given in the core data.
E_1	V	voltage at fundamental frequency.
E_3	V	voltage at third harmonic.
f_{Cu}	–	space (copper) factor: proportion of the winding cross section occupied by conductor.
f	Hz	frequency.
H	A/m	magnetic field strength.
H_c	A/m	coercivity: the value of the external field strength for which the flux density is zero after the material has been magnetized to saturation.

$\hat{H}$	A/m	peak magnetic field strength.
I_0	A	direct current.
ℓ_e	mm	effective magnetic path length.
L	H	inductance.
N	—	number of turns.
P	kW/m^3	specific power loss in core material.
Q	—	inductance quality factor.
R_h	Ω	effective series resistance of an inductor due to hysteresis losses in the core.
T_c	^oC	Curie temperature: the temperature at which a ferromagnetic material becomes paramagnetic.
V_e	mm^3	effective volume of a core: the volume of an ideal toroid of the same material and having the same magnetic properties; $V_e = \frac{\Sigma(\ell/A)^3}{\Sigma(\ell/A^2)^2}$.
α	—	turns factor: number of turns for an inductance of 1 mH.
α_F	K^{-1}	temperature factor of a core without air gap. The original definition in IEC 133 $\alpha_F = \frac{\mu_\theta - \mu_{ref}}{\mu^2_{ref}(\theta - \theta_{ref})} = \frac{0{,}4\pi(A_{L\theta} - A_{L\,ref})}{A^2_{L\,ref}\,C_1\,(\theta - \theta_{ref})}$ where θ is the applied temperature, was superseded in 1976 by the definition in IEC 367-1: $\alpha_F = \frac{\mu_\theta - \mu_{ref}}{\mu_\theta\mu_{ref}\,(\theta - \theta_{ref})} = \frac{0{,}4\pi(A_{L\theta} - A_{L\,ref})}{A_{L\theta}A_{L\,ref}\,C_1\,(\theta - \theta_{ref})}$ The second definition is required for new, close-tolerance products, and for products whose properties are guaranteed over a wide temperature range.
α_μ	K^{-1}	temperature coefficient of a core with an (ground) air gap. Where μ_e is the effective permeability of the core, $\alpha_\mu \simeq \alpha_F\mu_e$. Alternatively, $\alpha_\mu \simeq \alpha_F\,C_1A_L/\mu_0$. These approximations hold for fairly small changes in μ_e or A_L over the temperature range considered.

β_F	–	d.c. sensitivity constant for a core: $$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \mu_{e\Delta}}$$ where $\mu_{e\Delta}$ is the relative incremental permeability of the core.
$\frac{\tan\delta}{\mu_i}$		eddy-current and residual loss constant at a given frequency, measured at $\hat{B} \leqslant 0{,}1$ mT. The corresponding R/L value is given by $$R/L = 2\pi f \mu \frac{\tan\delta}{\mu_i}$$
Δ	mm	air-gap length.
η_B	T^{-1}	hysteresis constant: $$\eta_B = \frac{\Delta R_h}{\Delta\mu_e 2\pi f L}$$ where $\Delta\hat{B} = \hat{B}_2 - \hat{B}_1$ and $\Delta R_h = R_{\hat{B}2} - R_{\hat{B}1}$. (That is, series resistance $R_{\hat{B}1}$ is measured at $\hat{B}_1$ and then $R_{\hat{B}2}$ at $\hat{B}_2$.)
θ	^oC	temperature.
μ_a	–	relative amplitude permeability for a signal of amplitude greater than that for μ_Δ so that the value is dependent on flux density B: $$\mu_a = \frac{1}{\mu_0} \cdot \frac{B}{H}$$
μ_e	–	relative effective permeability: the permeability of a core with an air gap $$\mu_e = \frac{C_1}{\Sigma\ell/A} \text{ or } \frac{I}{\mu_e} \cdot \frac{L}{N^2} C_1$$
μ_i	–	relative initial permeability: measured on a core without air gap for a small field change $\Delta H \rightarrow 0$. $$\mu_i = \lim_{(H \rightarrow 0)} \mu_a$$
μ_{rem}	–	relative incremental permeability about remanence.
μ_Δ	–	relative incremental permeability of a polarized core: at a given d.c. applied field, the permeability observed when a small alternating field is superimposed. $$\mu_\Delta = \frac{\Delta B}{\mu_0 \Delta H}$$ Here, $\Delta B \leqslant 0{,}2$ mT and f = 4 kHz.
μ_θ	–	relative permeability at a given temperature.
ρ	Ωm	specific resistance for direct current.

FORMULAE

$L = \dfrac{\mu_o \mu_e N^2 \times 10^{-3}}{C_1}$	H	inductance.
$A_L = 10^6 \mu_e \mu_o / C_1$	(nH)	initial induction factor.
$B = E/(4{,}44 f N A_e) \times 10^{-6}$	(T)	peak flux density.
$E_3/E_1 = 0{,}6 \tan \delta_h$		3rd harmonic distortion.
$N = \sqrt{(10^9 L/A_L)} = \alpha \sqrt{(10^3 L)}$	(turns)	number of turns.
$Q = 1/\tan \delta_{tot}$		quality factor.
$\tan \delta_h = \mu B \eta_B$		hysteresis loss factor
1 mT = 10 Gauss		
1 Oe = 79,6 A/m		

TECHNICAL DATA

Ferroxcube data are given in the tables on the following pages in accordance with the recommendations of IEC 401, and using symbols defined in the previous section.

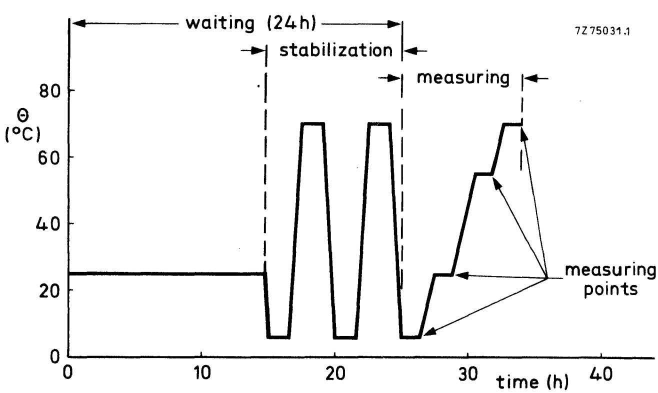
GENERAL PROPERTIES

Specific heat at 25 °C	
MnZn ferrites (FXC 3--)	1100 J/(kgK)
NiZn ferrites (FXC 4--)	750 J/(kgK)
Thermal conductivity from 25 °C to 85 °C	3,5 to 4,3 W/(mK)
Coefficient of linear expansion	10 to 12 x 10^{-6}/K
Modulus of elasticity	15 x 10^4 N/mm^2
Ultimate tensile strength	18 N/mm^2
Crushing strength	73 N/mm^2

NOTES TO THE DATA TABLES

– The data given apply to medium-sized toroids and should be taken as a guide. Cores that are small or have other shapes will have slightly different properties that cannot readily be predicted on the basis of toroid properties. For this reason, product characteristics are guaranteed for the products themselves and are given on the appropriate data sheets.

– The temperature coefficient α_F is measured on circuits without a (ground) air gap, with the exception of 3B7 products, for which α_F is measured on toroidally-wound core halves. For FXC 3-- products, the measuring sequence is that shown in the figure. The measurement circuits for FXC 3H3 and FXC 4-- products are thermally demagnetized by being heated to 25 °C above their Curie temperature, after which they are cooled slowly to room temperature and left for 24 h.



		materials for deflection units		
	unit	•2A2	•3C2	
Initial permeability μ_i at $\hat{B} \leqslant 0{,}1$ mT, $\theta = 25\,^\circ C$		350 ± 20%	900 ± 25%	
Induction B, ballistically measured at				
H = 500 A/m θ = 100 °C				
H = 800 A/m θ = 20 °C		≈ 200		
H = 800 A/m θ = 25 °C			≈ 350	
H = 800 A/m θ = 70 °C				
H = 800 A/m θ = 100 °C	mT	≈ 140	≈ 245	
H = 1600 A/m θ = 25 °C				
H = 1600 A/m θ = 100 °C				
H = 3200 A/m θ = 25 °C				
H = 3200 A/m θ = 100 °C				
H = 4800 A/m θ = 25 °C				
H = 4800 A/m θ = 100 °C				
Coercivity Hc θ = 20 °C	A/m	60		
Eddy current and residual loss constant $\frac{\tan\delta}{\mu_i}$ at $\hat{B} \leqslant 0{,}1$ mT, $\theta = 25\,^\circ C$				
f = 100 kHz		≈ 50		
f = 450 kHz				
f = 500 kHz				
f = 700 kHz				
f = 1 MHz				
f = 1,5 MHz				
f = 2 MHz	$\times 10^{-6}$			
f = 3 MHz				
f = 5 MHz				
f = 10 MHz				
f = 20 MHz				
f = 25 MHz				
f = 40 MHz				
Hysteresis constant η_B at $\hat{B} = 0{,}3 - 1{,}2$ mT f = 100 kHz	$\times 10^{-3}\ T^{-1}$			
Power loss at f = 16 kHz and				
B = 50 mT θ = 20 °C		≈ 70		
B = 400 mT θ = 25 °C	kW/m³			
B = 400 mT θ = 50 °C				
B = 400 mT θ = 100 °C				
Resistivity ρ measured with d.c.	Ωm	$\geqslant 10^6$	⩾ 0,1	
Dielectric constant at f = 1 MHz, θ = 25 °C				
Temperature factor α_F				
θ = +25 to +55 °C	$\times 10^{-6}$/K		0 to +4,5	
θ = +25 to +70 °C		≈ 35		
Disaccomodation factor D_F between 10 and 100 min after demagnetization, $\hat{B} \leqslant 0{,}1$ mT, θ = 25 ± 1 °C	$\times 10^{-6}$		⩽ 10	
Curie temperature	°C	⩾ 135	⩾ 150	
Mass density	kg/m³	≈ 4300	4700-4900	
Core shapes		yoke rings		

• preferred material

	materials for small parts						
	•3B	3C6	4A4	•4B1	4D1	4D2	4E1
	900 ± 20%	1700 ± 25%	500 ± 20%	250 ± 20%	50 ± 20%	60 ± 10%	15 ± 20%
		≥ 290					
	≈ 345		≈ 270				
			≈ 210				
	≈ 230						
				≈ 325			
				≈ 260			
					≈ 240		
					≈ 220		
							≈ 175
							≈ 165
	≤ 50						
			≤ 30				
				≤ 70			
				≤ 90			
			≤ 40	≤ 140			
			≤ 70				
					≤ 180		
					≤ 210		
					≤ 300	≤ 100	≤ 300
							≤ 300
						≤ 200	
						≤ 600	≤ 360
			≤ 1,8				
		≤ 170 ≤ 160 ≤ 140					
	≥ 0,2		≥ 10^5	≥ 10^5	≥ 10^3	≥ 10^3	≥ 10^3
			15-20				
	0 to +3		+5 to +15	0 to +8	0 to +15	0 to +15	0 to +15
	≥ 150	≥ 190	≥ 135	≥ 250	≥ 400	≥ 350	≥ 500
	4700-4900	4750-4850	4700-5100	4400-4800	4000-4400		3500-4000
	tubes and rods		frames for i.f. transformers, tubes and rods		frames for i.f. transformers, screw cores, tubes and rods		tubes and rods

	unit	
Initial permeability μ_i at $\hat{B}$ (mT), f = 4 kHz θ (°C) $\leqslant$ 0,1 25		
Optimum frequency range	kHz	
Induction $\hat{B}$ at f (kHz) $\hat{H}$ (A/m) θ (°C) 0 800 25 0 800 100 0 3000 25 25 250 25 25 250 100	mT	
Power loss at f (kHz) $\hat{B}$ (mT) θ (°C) 25 200 25 25 200 100 25 200 100 100 100 25 100 100 100 400 50 25 400 50 100	kW/m³	
Temperature factor α_F at θ (°C) +5 to +25 +25 to +55 +25 to +70	x 10^{-6}/K	
Curie temperature	°C	
Mass density	kg/m³	
D.C. sensitivity constant $\beta_F = \frac{\mu_i - \mu_{i\Delta}}{\mu_i \, \mu_{i\Delta}}$ at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,20 x 10^5 A/m = 1,80 x 10^5 A/m = 2,60 x 10^5 A/m	x 10^{-6}	
Core shapes		

	high level transformer materials (power materials)			
	● 3B8	● 3C8	● 3C85	● 3F3
	2300 ± 20%	2000 ± 25%	2000 ± 20%	2000 ± 20%
	up to 150	up to 100	up to 200	up to 500
	≈ 500 ⩾ 330	≈ 500 ⩾ 330	≈ 500 ⩾ 330	≈ 500 ⩾ 330
	⩽ 140 ⩽ 155	⩽ 110* ⩽ 100*	⩽ 190 ⩽ 140 ⩽ 230 ⩽ 165	⩽ 120 ⩽ 90 ⩽ 110 ⩽ 80 ⩽ 150 ⩽ 150
	5 ± 2 5 ± 2 5 ± 2			
	⩾ 200	⩾ 200	⩾ 200	⩾ 200
	4700-4900	4750-4850	4700-4900	4650-4850
	⩽ 120 ⩽ 300 ⩽ 1000			
	potcores square cures	E, EC, ETD, U and I	E, ETD, square cores	square cores, ETD

* at 16 kHz.

● Preferred material.

	unit	
Initial permeability μ_i, f = 4 kHz at $\hat{B} \leqslant 0{,}1$ mT θ = 25 °C at $\hat{B} \leqslant 1$ mT θ = 5 to 70 °C at $\hat{B}$ 0,7 – 1 mT θ = 25 to 70 °C		
Induction $\hat{B}$ ballistically measured H = 800 A/m θ = 25 °C θ = 70 °C	mT	
Eddy current and residual loss constant $\frac{\tan \delta}{\mu_i}$ at $\hat{B} \leqslant 0{,}1$ mT, θ = 25 °C f = 4 kHz f = 10 kHz f = 30 kHz f = 100 kHz f = 500 kHz	x 10^{-6}	
Hysteresis constant η_B at $\hat{B}$ = 1,5 – 3,0 mT f = 4 kHz	x 10^{-3} T^{-1}	
Resistivity ρ measured with d.c.	Ωm	
Temperature factor α_F θ = +5 to +25 °C θ = +25 to +55 °C θ = +25 to +70 °C	x 10^{-6}/K	
Disaccomodation factor D_F between 10 and 100 min after demagnetization, $\hat{B} \leqslant 0{,}1$ mT θ = 25 ± 1 °C	x 10^{-6}	
Curie temperature	°C	
Mass density	Kg/m^3	
Core shapes		

* ± 20%.

● preferred material.

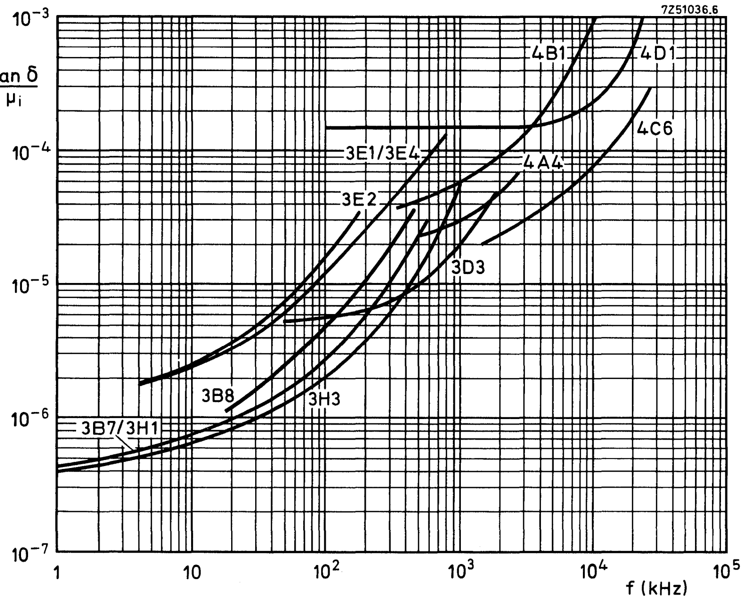
	low level transformer materials (broadband materials)					
	3E1	●3E2	●3E4	●3E45	3E5	3H2
	3800 ± 20%	≥ 5000	4700 ± 20%	6000 ± 20% ≥ 4200	10000 ± 20%	2300 ± 20%
	≈ 350 ≈ 270	≈ 355 ≈ 260	≈ 350 ≈ 270	≈ 350 ≈ 270	≈ 380 ≈ 280	≈ 400
	≤ 2,5 ≤ 20 ≤ 200	≤ 2,5 ≤ 15 ≤ 90	≤ 2,5 ≤ 20 ≤ 200	≤ 5 ≤ 40	≤ 3 ≤ 25 ≤ 75	≤ 1 ≤ 6
	≤ 1,1	≤ 1,1	≤ 0,85	≤ 1,0	≤ 0,85	≤ 0,85
	≥ 0,3	≥ 0,1	≥ 0,3	≥ 0,05	≥ 0,01	≥ 1
	1 ± 1 1 ± 1 1 ± 1					
	≤ 4,3	≤ 1,9	≤ 4,3	≤ 3	≤ 2	≤ 4,3
	≥ 125	≥ 130	≥ 125	≥ 130	≥ 120	≥ 160
	4700-4900	4700-4900	4700-4900	4700-4900	4800-5000	4700-4900
	E and I cores, toroids potcores square cores	toroids	potcores, square cores	potcores, square cores	square cores, toroids	toroids tubes and rods

	unit	
Initial permeability μ_i at $\hat{B} \leqslant 0{,}1$ mT $\theta = 25\,°C$		
Induction B ballistically measured at H = 800 A/m $\theta = 25\,°C$ $\theta = 70\,°C$ H = 2400 A/m $\theta = 25\,°C$ $\theta = 70\,°C$	mT	
Eddy current and residual loss constant $\frac{\tan\delta}{\eta_i}$ at $\hat{B} \leqslant 0{,}1$ mT, $\theta = 25\,°C$ f = 4 kHz f = 30 kHz f = 100 kHz f = 500 kHz f = 1 MHz f = 2 MHz f = 10 MHz	$\times 10^{-6}$	
Hysteresis constant η_B at $\hat{B} = 0{,}3 - 1{,}2$ mT f = 100 kHz at $\hat{B} = 1{,}5 - 3$ mT f = 4 kHz at $\hat{B} = 1{,}5 - 3$ mT f = 100 kHz	$\times 10^{-3}\ T^{-1}$	
Resistivity ρ measured with d.c.	Ωm	
Temperature factor α_F θ = +5 to +25 °C θ = +25 to +55 °C θ = +25 to +70 °C	$\times 10^{-6}$/K	
Disaccomodation factor D_F between 10-100 min after demagnetization, $\hat{B} \leqslant 0{,}1$ mT $\theta = 25 \pm 1\,°C$ between 24 and 48 h after thermal demagnetization, $\hat{B} \leqslant 0{,}1$ mT $\theta \leqslant 35\,°C$	$\times 10^{-6}$	
Curie temperature	°C	
Mass density	kg/m³	
Core shapes		

	materials for tuned circuits					
	3B7	•3D3	•3D35	•3H1	•3H3	•4C6
	2300 ± 20%	750 ± 20%	1000 ± 20%	2300 ± 20%	2000 ± 20%	120 ± 20%
	≈ 430 ≈ 345	≈ 350	≈ 350	≈ 360 ≈ 280	≈ 400	≈ 380 ≈ 350
	⩽ 1,0 ⩽ 5,0	⩽ 8 ⩽ 12 ⩽ 24	⩽ 3 ⩽ 8 ⩽ 30	⩽ 1,0 ⩽ 5,0	1,2 ± 0,4 2 ± 0,5	⩽ 40 ⩽ 100
	⩽ 1,1	⩽ 0,8	⩽ 0,5	⩽ 0,85	⩽ 0,6	⩽ 6,2
	⩾ 1	⩾ 1,5	⩾ 7	⩾ 1		⩾ 10^5
	0 ± 0,6	1 ± 1	1 ± 0,5 1 ± 0,5 1 ± 0,5	1 ± 0,5 1 ± 0,5 1 ± 0,5	0,7 ± 0,3 0,7 ± 0,3 0,7 ± 0,3	1 ± 3 3 ± 3
	⩽ 4,3	⩽ 12	⩽ 8	⩽ 4,3	⩽ 3	⩽ 10
	⩾ 170	⩾ 200	⩾ 180	⩾ 130	⩾ 160	⩾ 350
	4700-4900	4500-4900	4300-4500	4700-4900		4000-5000
	potcores, square cores	potcores, square cores, screw cores	potcores, square cores, screw cores	potcores, square cores, cross cores	potcores, square cores	potcores square cores, toroids, frames for i.f. transformers, rods and tubes

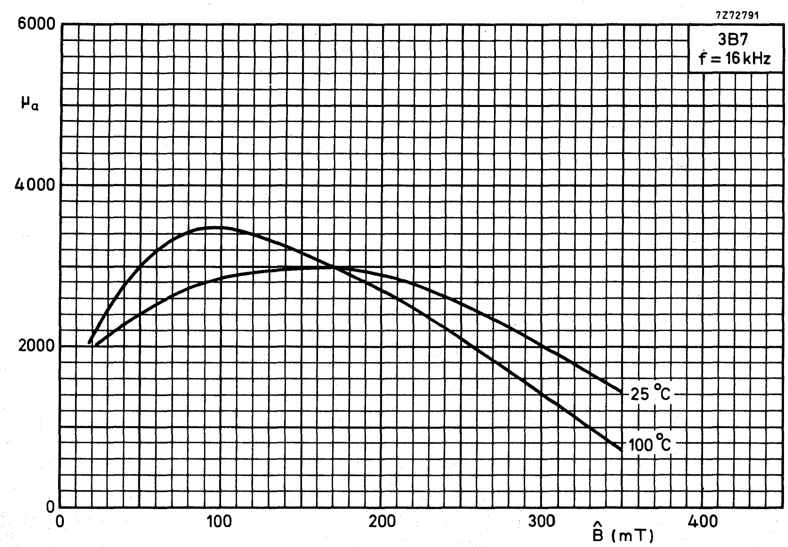
CHARACTERISTIC CURVES

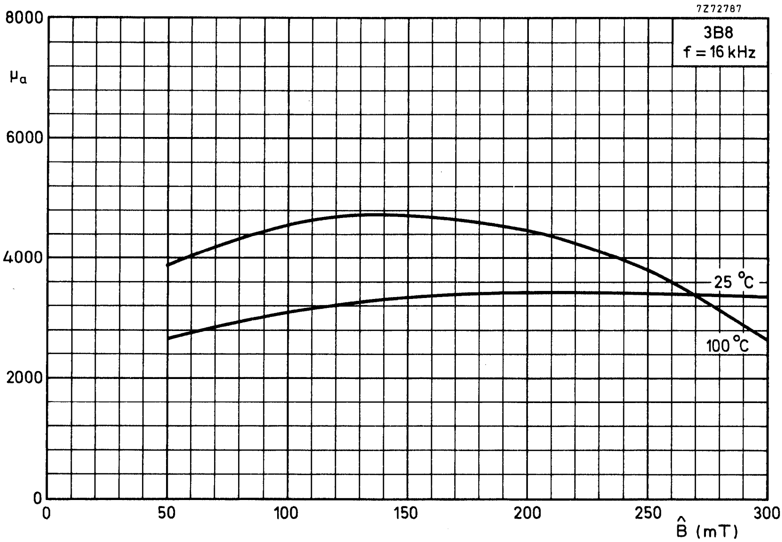
The curves are valid for toroids of not too small dimensions and should be considered as a guide. For guarantees on products, refer to the pages on the relevant products.

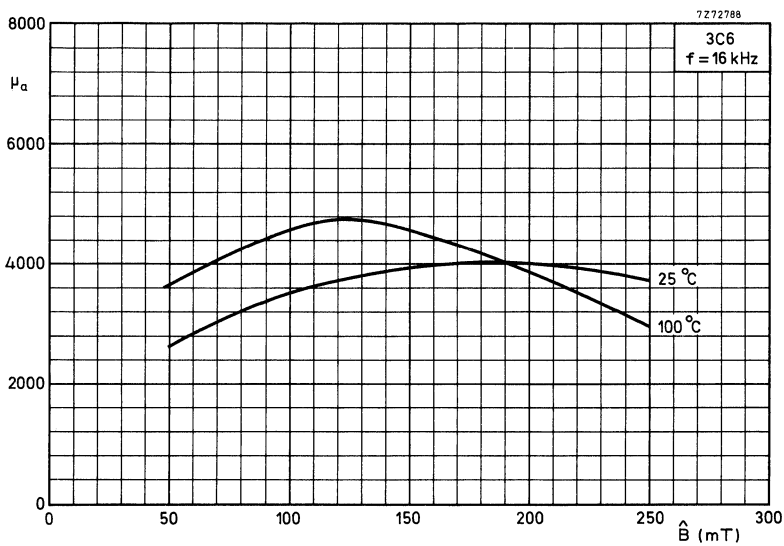


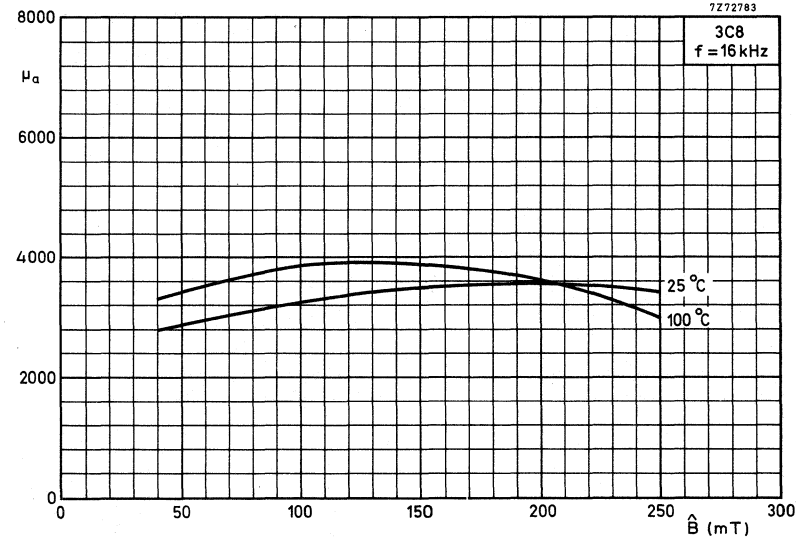
Eddy current losses and residual losses as a function of the frequency at low induction level.

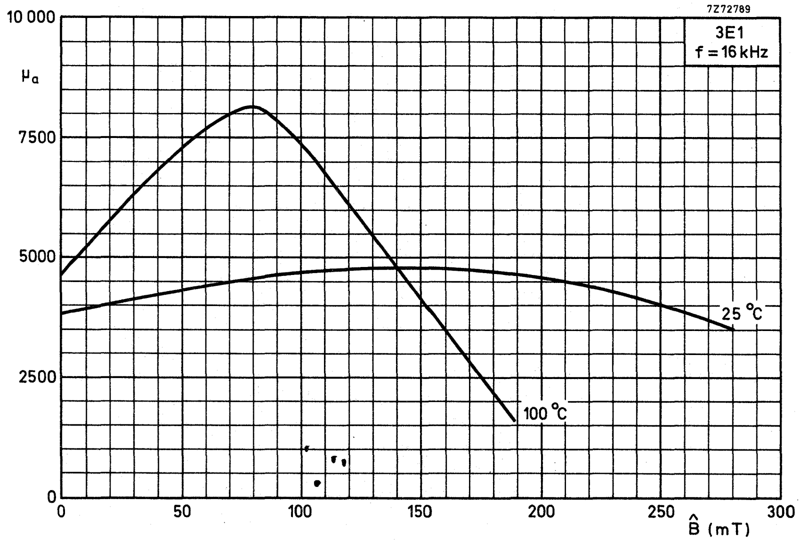
Amplitude permeability as a function of the induction.

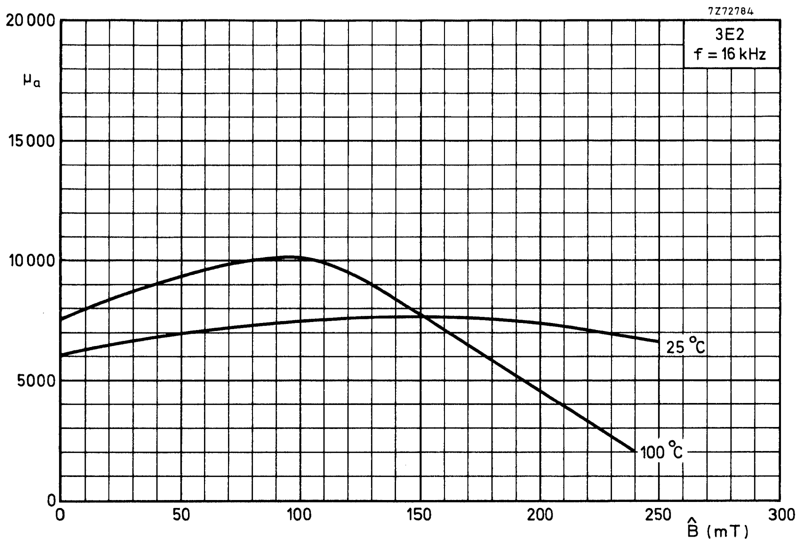


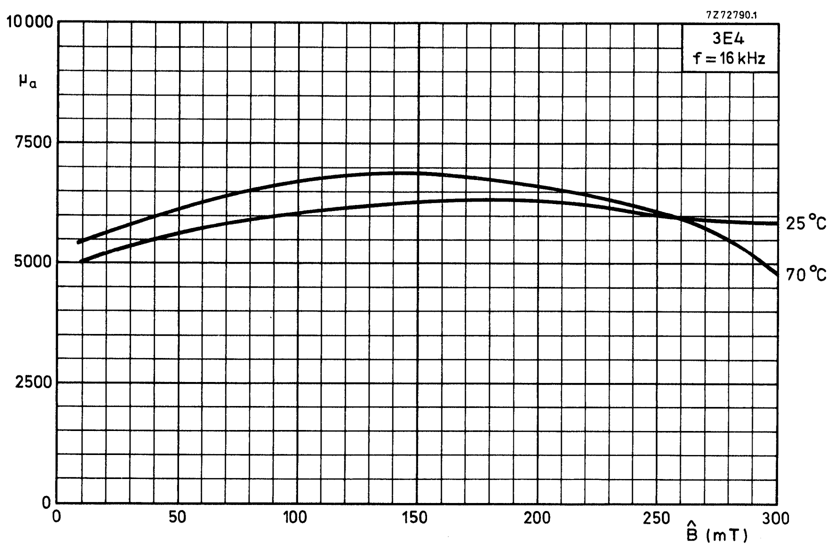

7Z72787
3B8
f = 16 kHz
8000
μ_a
6000
4000
2000
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C
100 °C

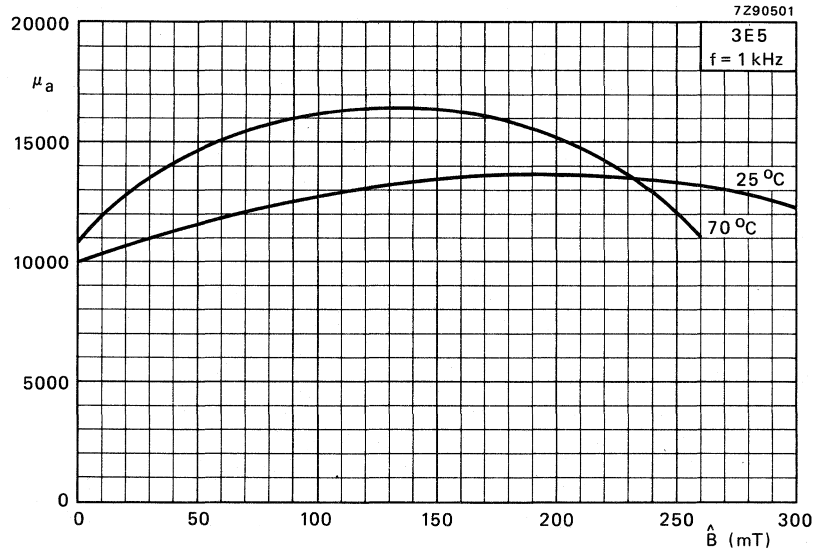

7Z72788
3C6
f = 16 kHz
8000
μ_a
6000
4000
2000
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C
100 °C


7Z72783
3C8
f = 16 kHz
8000
μa
6000
4000
2000
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C
100 °C

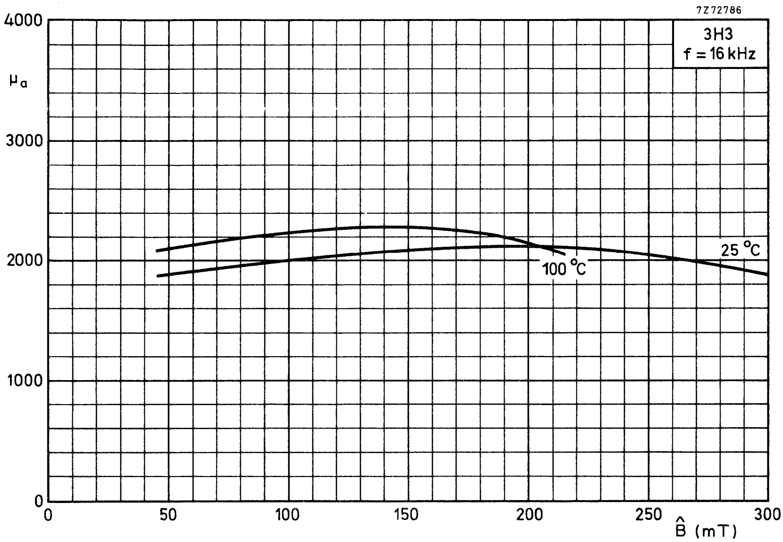

7Z72789
3E1
f = 16 kHz
10 000
μa
7500
5000
2500
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C
100 °C

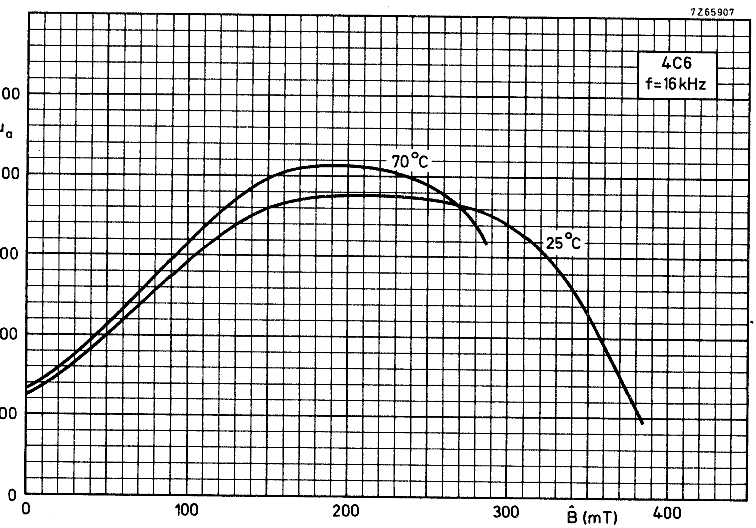

7Z72784
3E2
f = 16 kHz
20 000
μa
15 000
10 000
5000
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C
100 °C


7Z72790.1
3E4
f = 16 kHz
10 000
μa
7500
5000
2500
0
0
50
100
150
200
250
300
B̂ (mT)
25 °C
70 °C


7Z90501
3E5
f = 1 kHz
20000
μ_a
15000
10000
5000
0
0
50
100
150
200
250
300
$\hat{B}$ (mT)
25 °C
70 °C

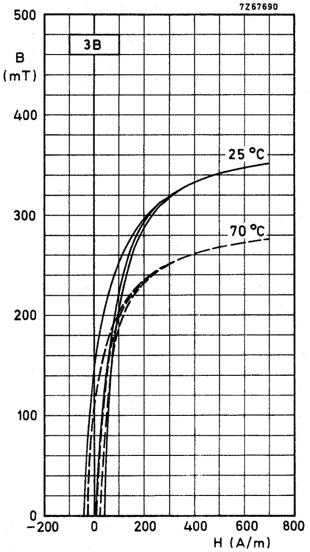

7Z72782
3H1
f = 16 kHz
4000
μ_a
3000
2000
1000
0
0
50
100
150
200
250
300
$\hat{B}$ (mT)
100 °C
25 °C


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

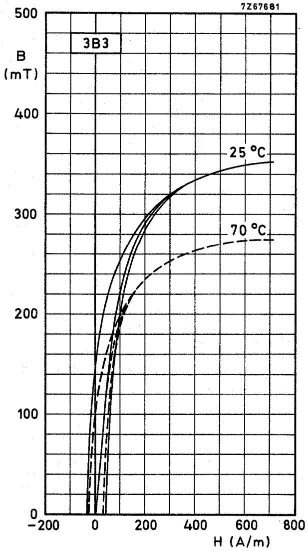

7Z65907
4C6
f=16kHz
500
μa
400
300
200
100
0
0
100
200
300
400
B̂ (mT)
70 °C
25 °C

TYPICAL BH-CURVES (measured ballistically)

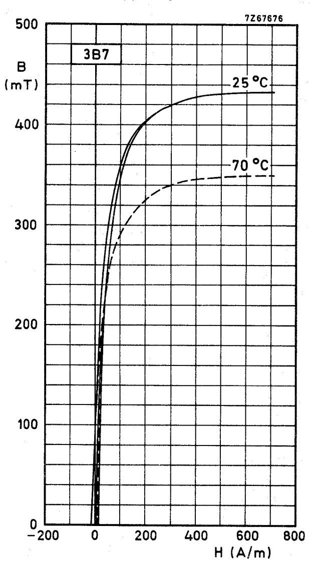
ballistic curves



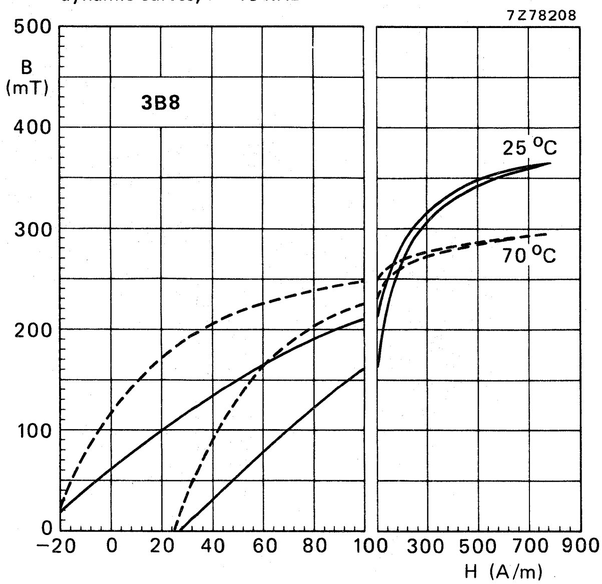
ballistic curves



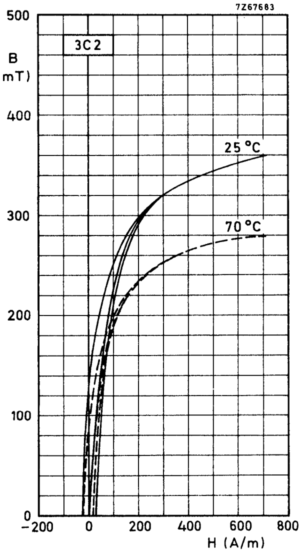
ballistic curves



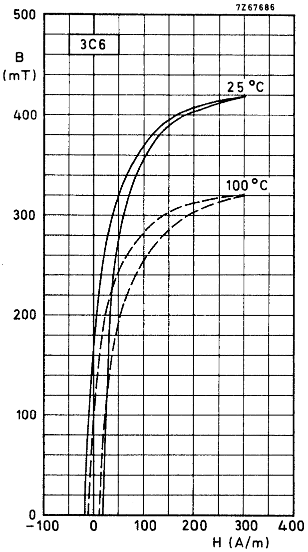
dynamic curves, f = 10 kHz



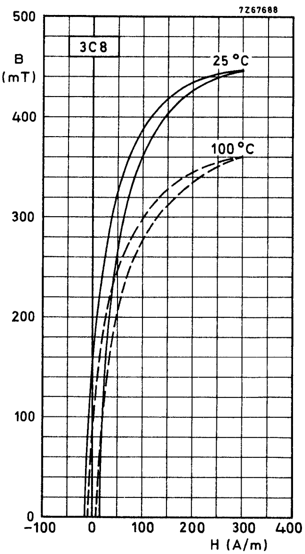
ballistic curves



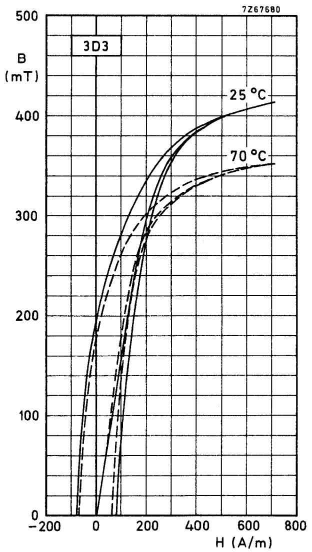
ballistic curves



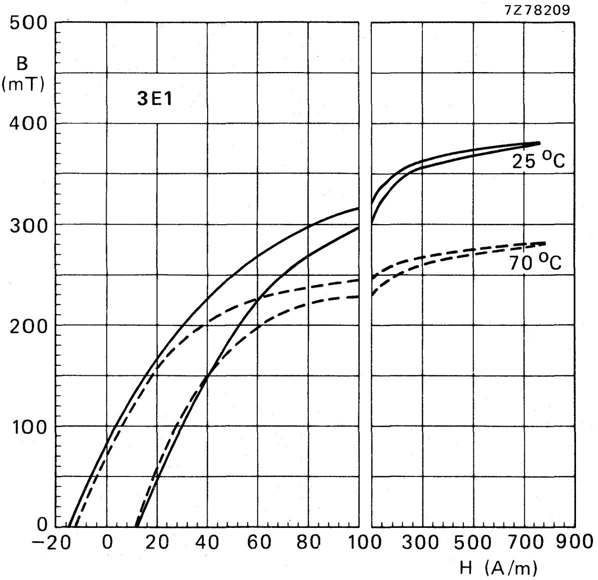
ballistic curves



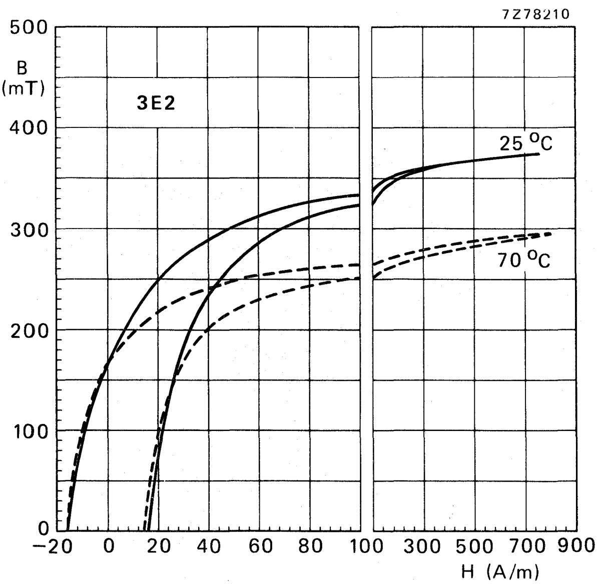
ballistic curves



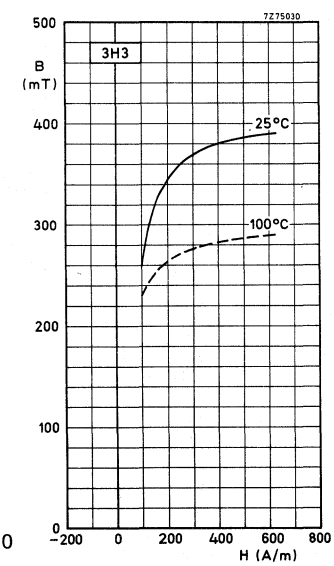
dynamic curves, f = 10 kHz



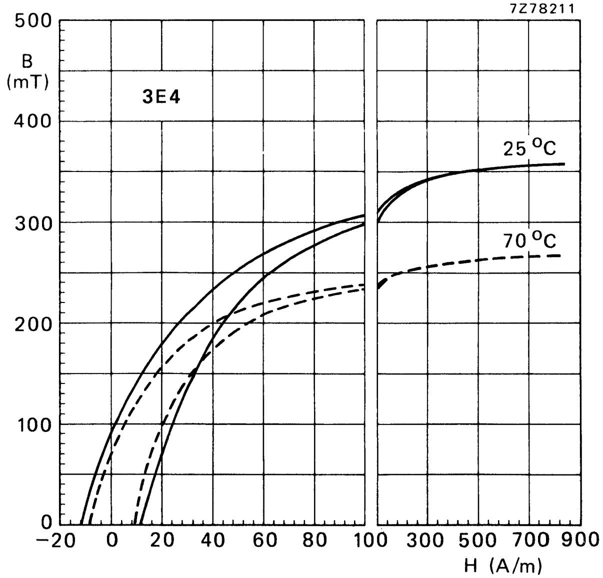
dynamic curves, f = 10 kHz



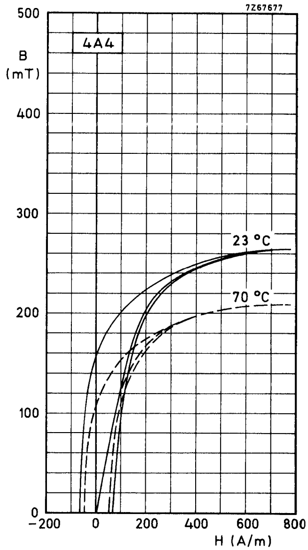
ballistic curves



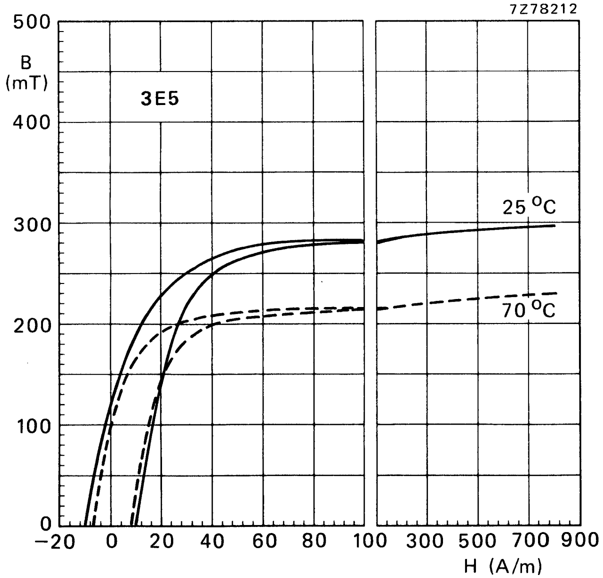
dynamic curves, f = 10 kHz



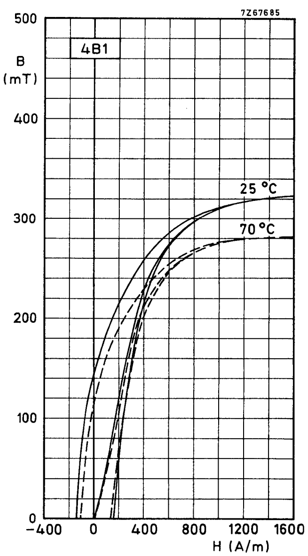
ballistic curves



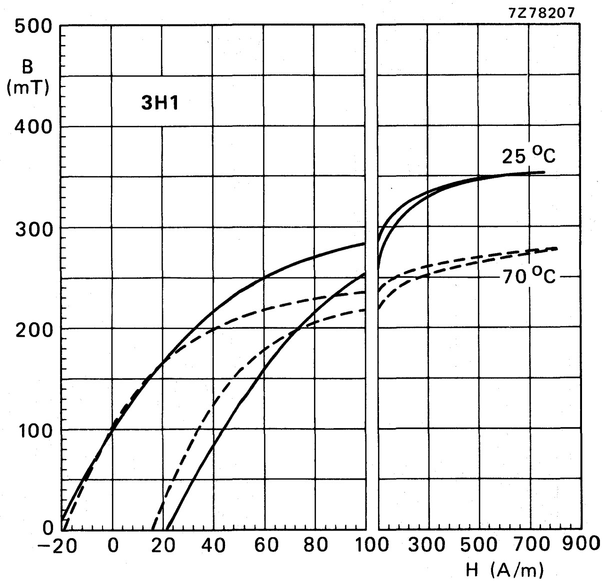
dynamic curves, f = 10 kHz



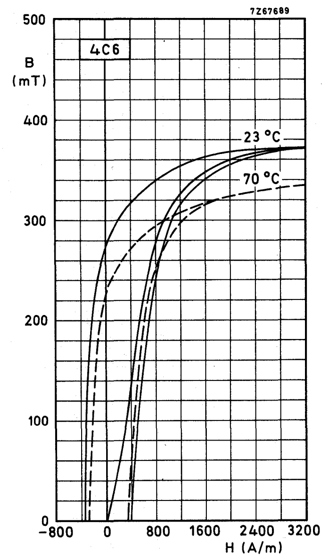
ballistic curves



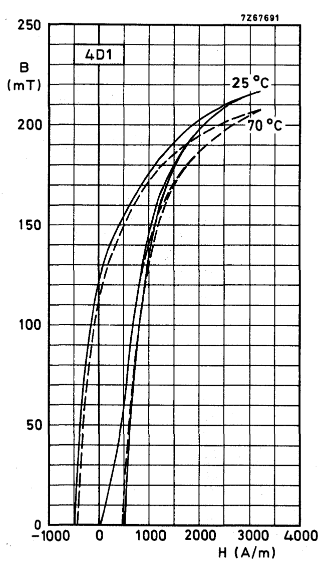
dynamic curves, f = 10 kHz



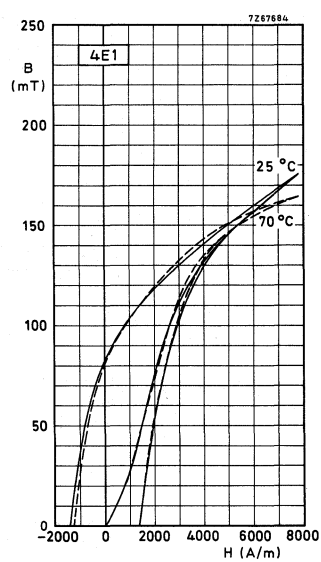
ballistic curves



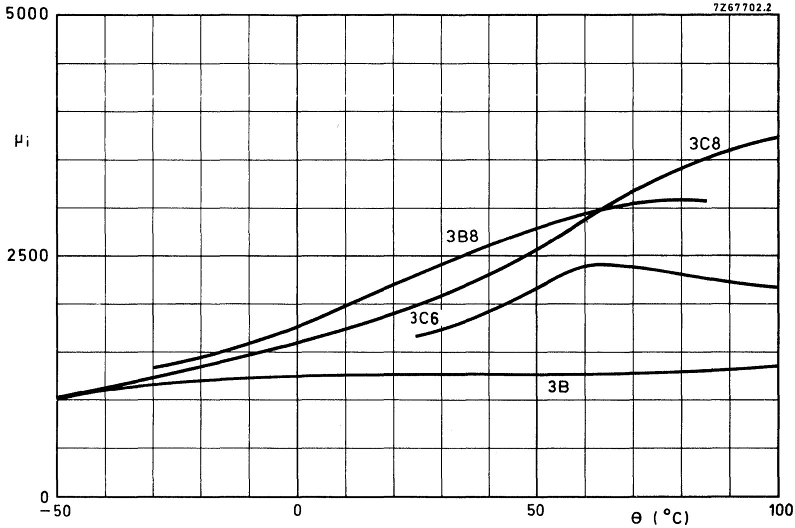
ballistic curves

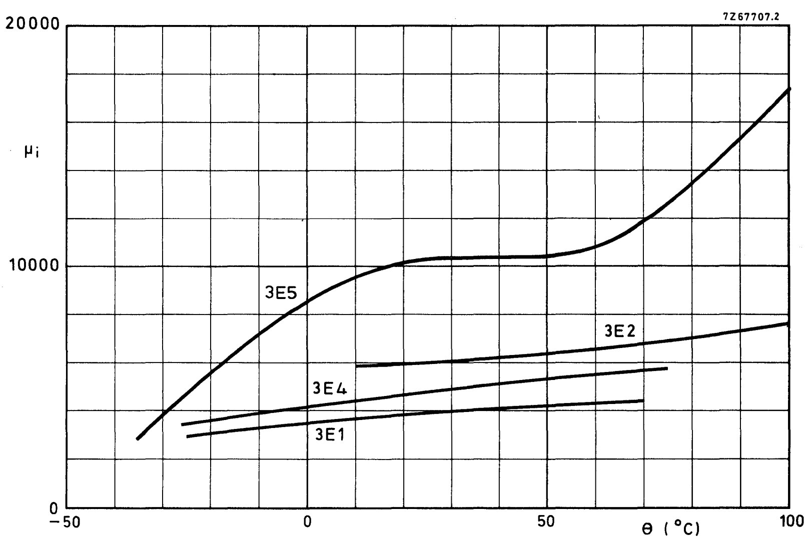


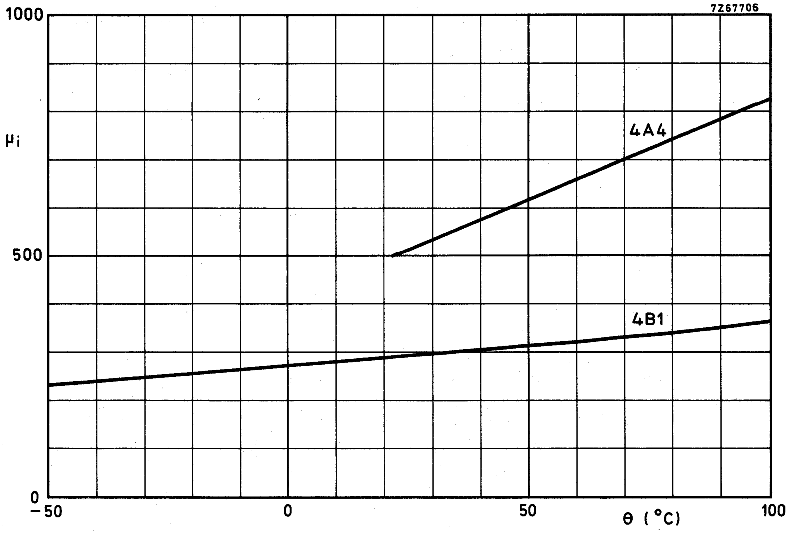
ballistic curves

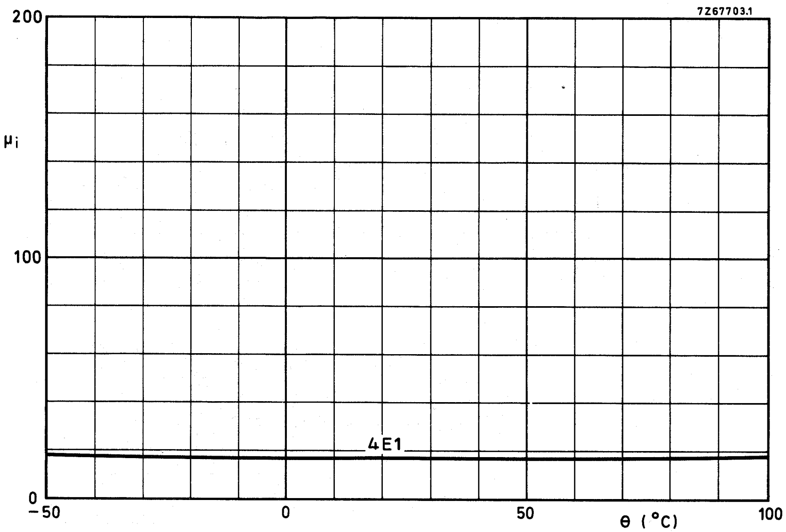


Relative initial permeability as a function of the temperature

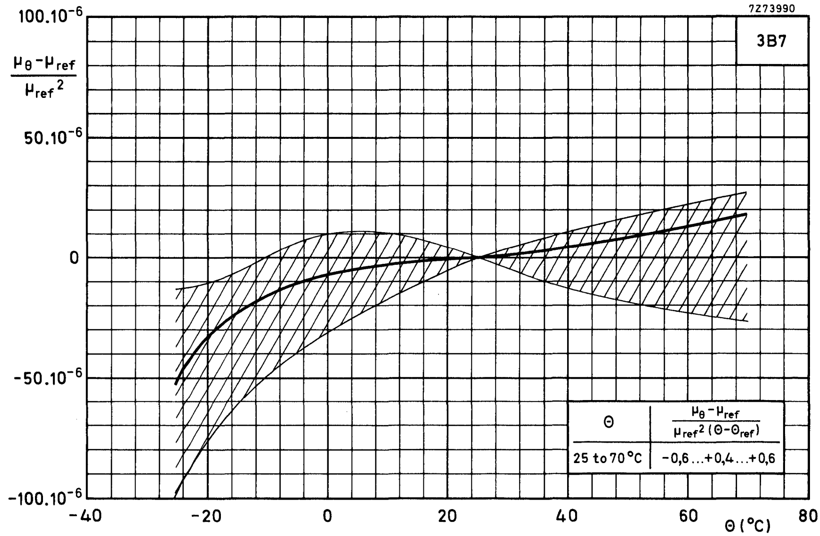


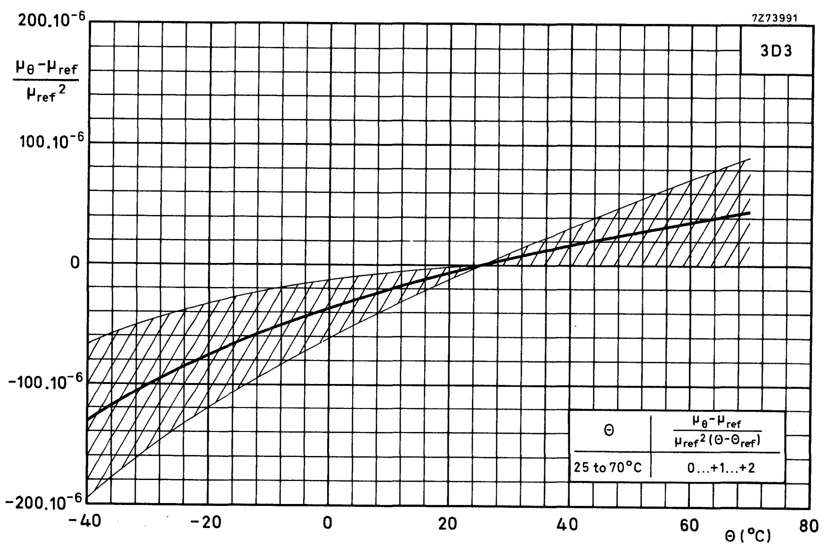


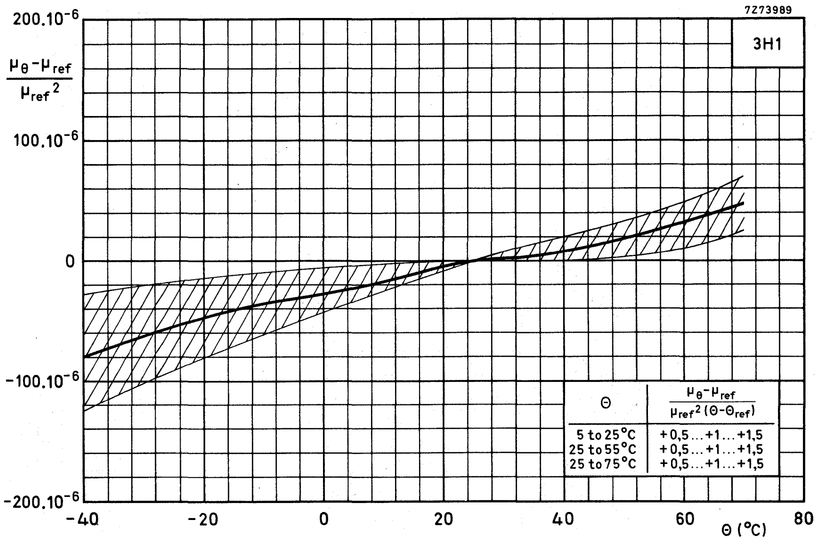

7Z67706
1000
μ_i
500
0
−50
0
50
100
θ (°C)
4A4
4B1

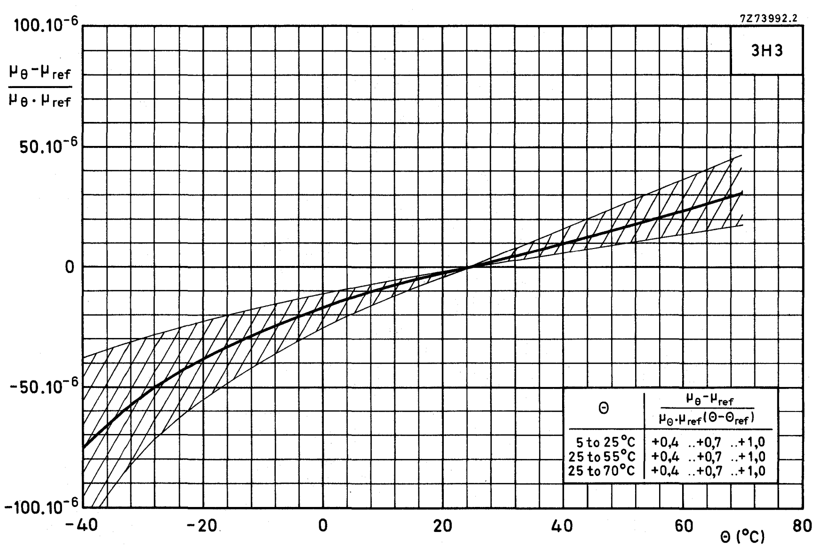

7Z67703.1
200
μ_i
100
0
−50
0
50
100
θ (°C)
4E1

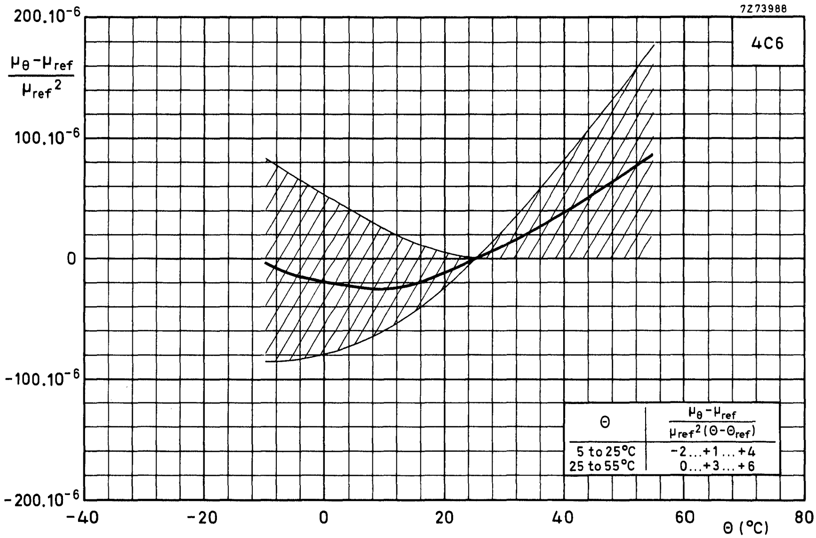
Permeability factor as a function of the temperature



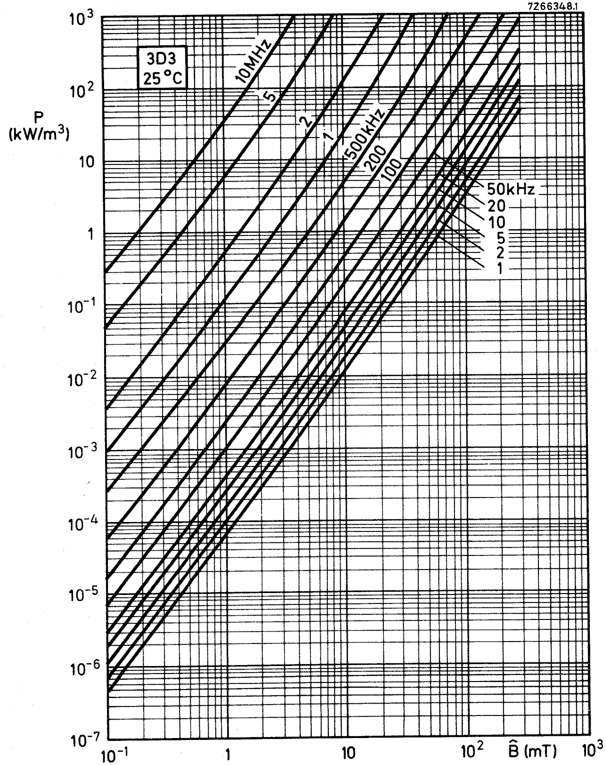


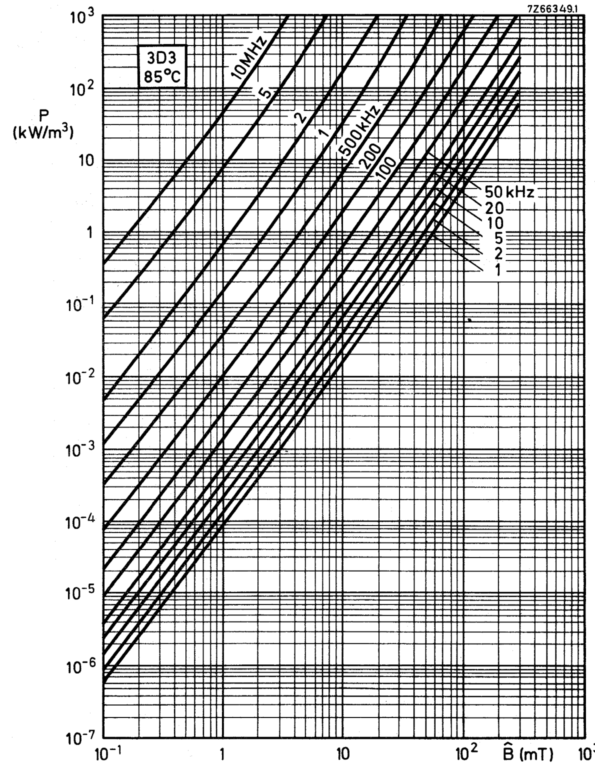

7Z73989
3H1
200.10⁻⁶
$\frac{\mu_\theta - \mu_{ref}}{\mu_{ref}^2}$
100.10⁻⁶
0
-100.10⁻⁶
-200.10⁻⁶
-40
-20
0
20
40
60
80
Θ (°C)
Θ
$\frac{\mu_\theta - \mu_{ref}}{\mu_{ref}^2(\Theta - \Theta_{ref})}$
5 to 25°C
25 to 55°C
25 to 75°C
+0,5 ... +1 ... +1,5
+0,5 ... +1 ... +1,5
+0,5 ... +1 ... +1,5

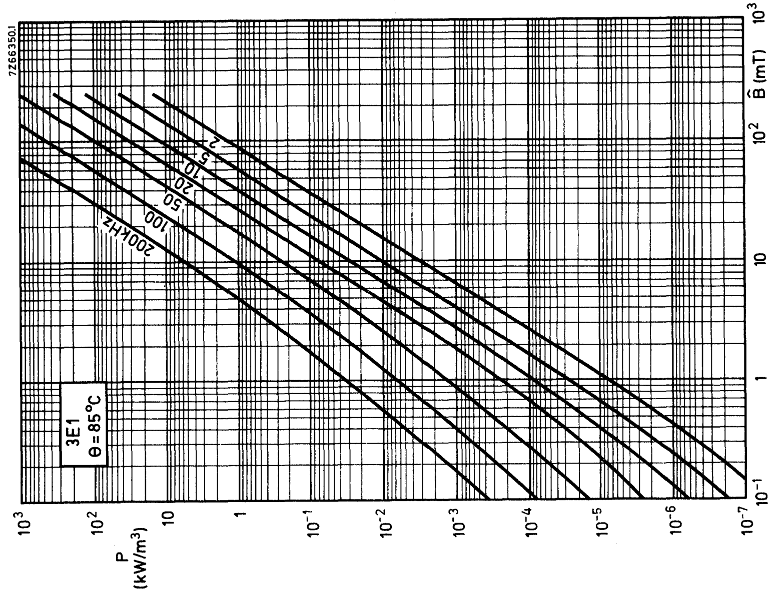

7Z73992.2
3H3
100.10⁻⁶
$\frac{\mu_\theta - \mu_{ref}}{\mu_\theta \cdot \mu_{ref}}$
50.10⁻⁶
0
-50.10⁻⁶
-100.10⁻⁶
-40
-20
0
20
40
60
80
Θ (°C)
Θ
$\frac{\mu_\theta - \mu_{ref}}{\mu_\Theta \cdot \mu_{ref}(\Theta - \Theta_{ref})}$
5 to 25°C
25 to 55°C
25 to 70°C
+0,4 ..+0,7 ..+1,0
+0,4 ..+0,7 ..+1,0
+0,4 ..+0,7 ..+1,0

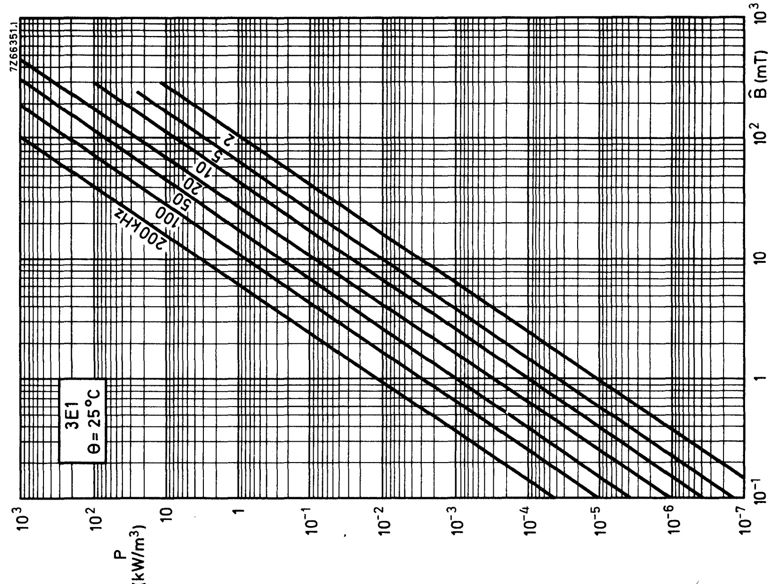

7Z73988
4C6
200.10⁻⁶
100.10⁻⁶
0
-100.10⁻⁶
-200.10⁻⁶
-40
-20
0
20
40
60
80
Θ (°C)
Θ
5 to 25°C
25 to 55°C
-2...+1...+4
0...+3...+6

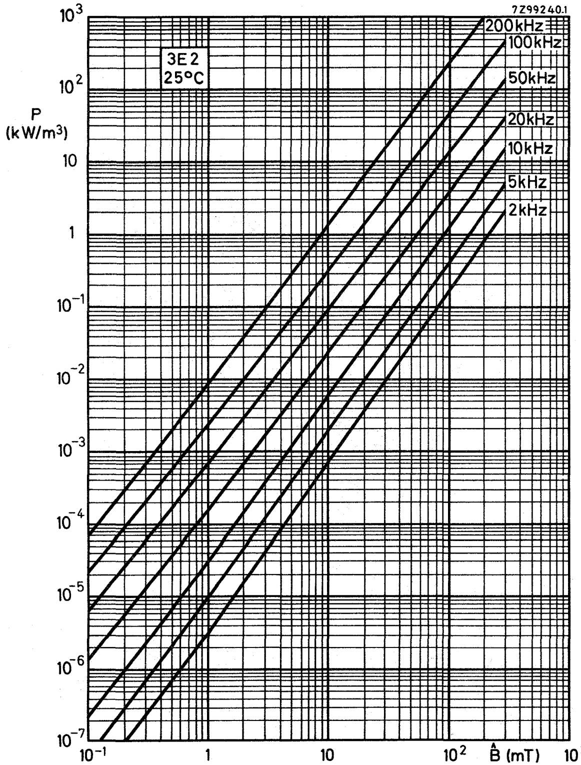
Power loss as a function of the induction

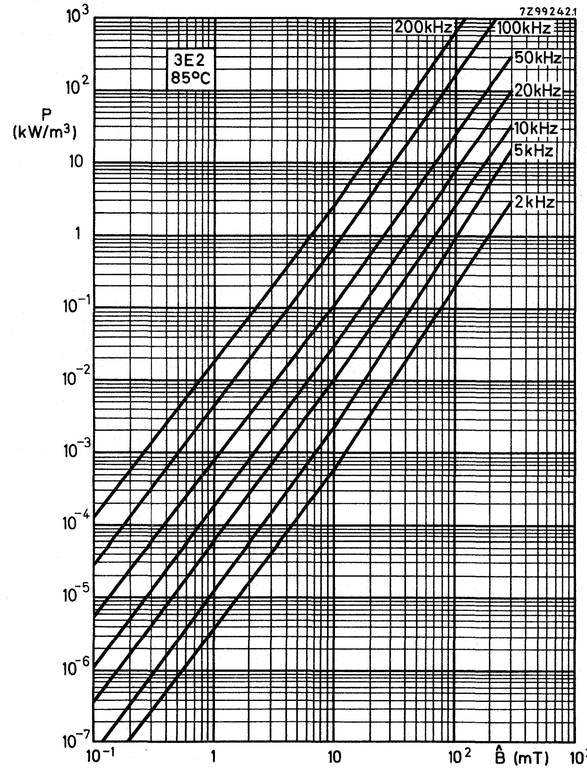


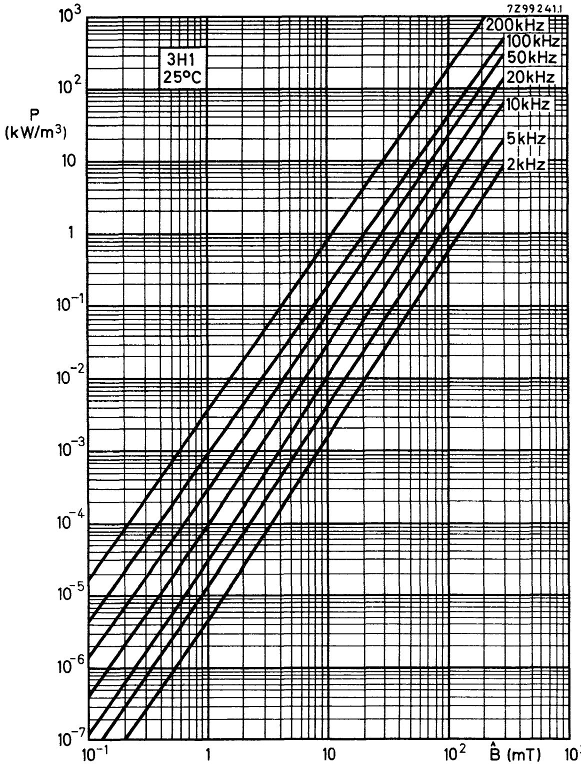


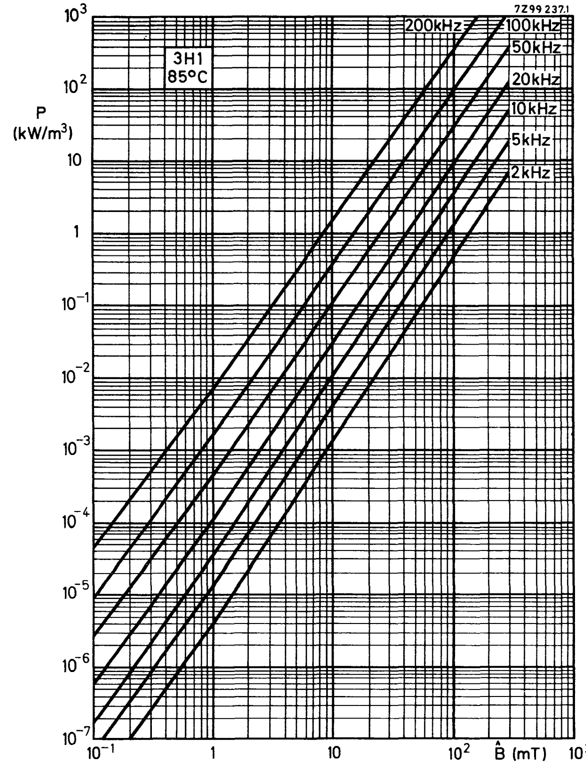

7Z66350.1
3E1
Θ = 85°C
200kHz
100
50
20
10
5
2
P
(kW/m³)
B̂ (mT)

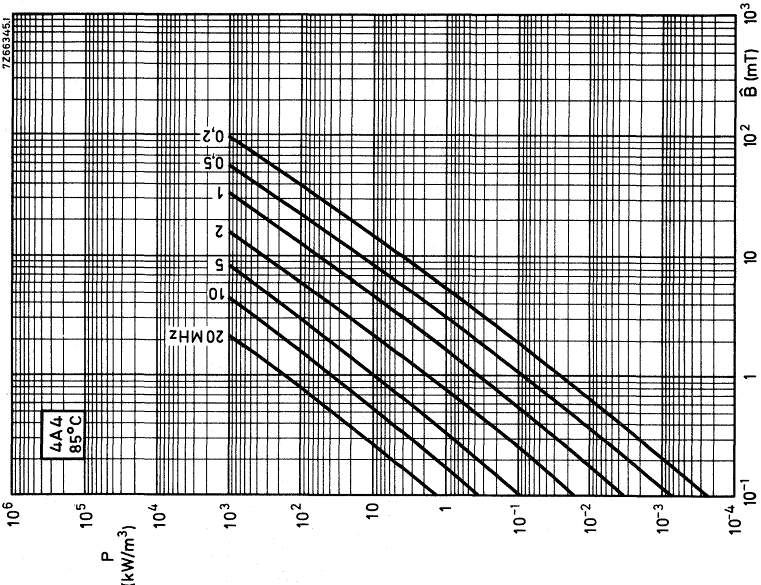

7Z66351.1
3E1
Θ = 25°C
200kHz
100
50
20
10
5
2
P
(kW/m³)
B̂ (mT)

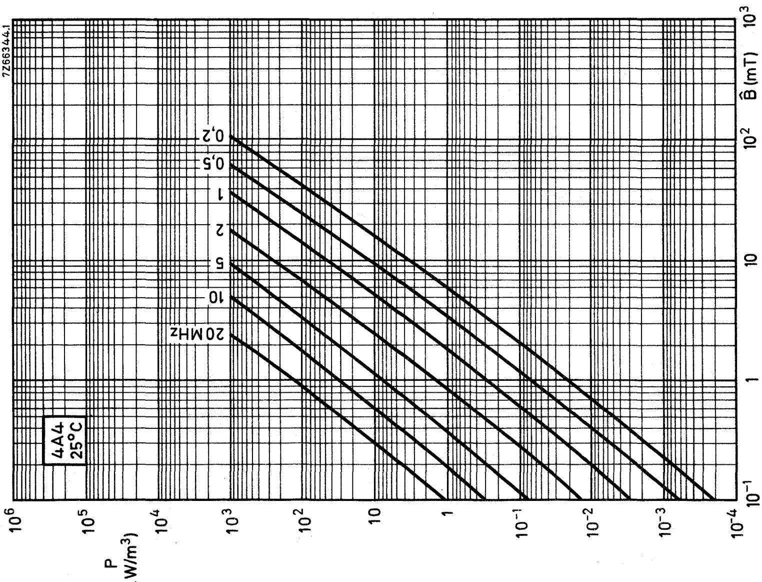

7Z99240.1
3E2
25°C
P
(kW/m3)
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
B̂ (mT)
10^3
10^2
10
1
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-1
1
10
10^2
10^3

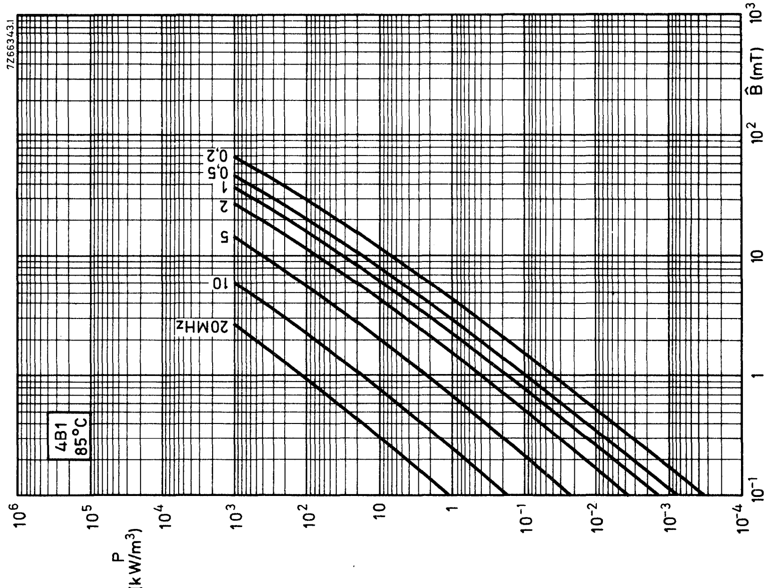

7Z99242.1
3E2
85°C
P
(kW/m3)
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz
B̂ (mT)
10^3
10^2
10
1
10^-1
10^-2
10^-3
10^-4
10^-5
10^-6
10^-7
10^-1
1
10
10^2
10^3

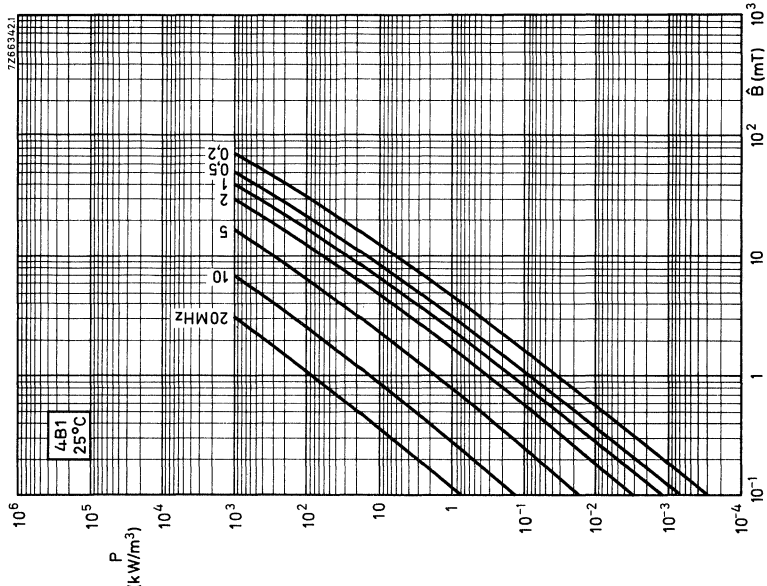

7Z99241.1
3H1
25°C
P
(kW/m³)
B̂ (mT)
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz

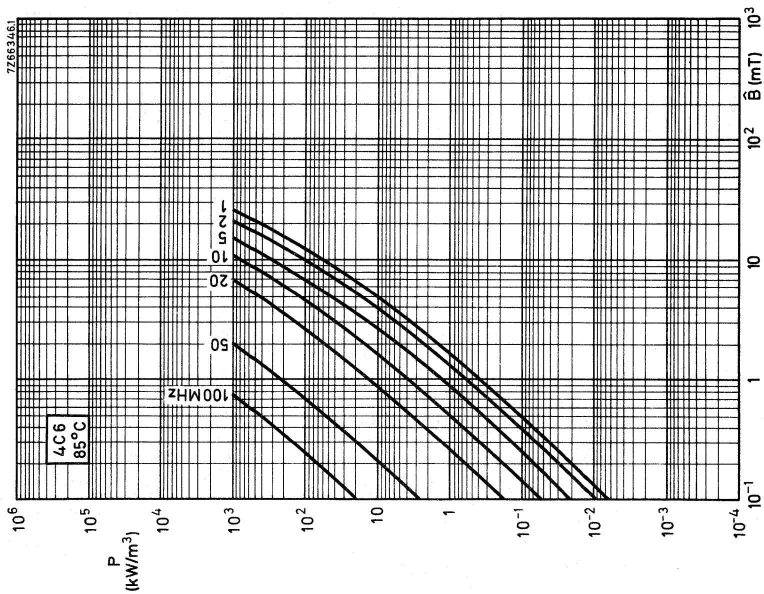

7Z99237.1
3H1
85°C
P
(kW/m³)
B̂ (mT)
200kHz
100kHz
50kHz
20kHz
10kHz
5kHz
2kHz

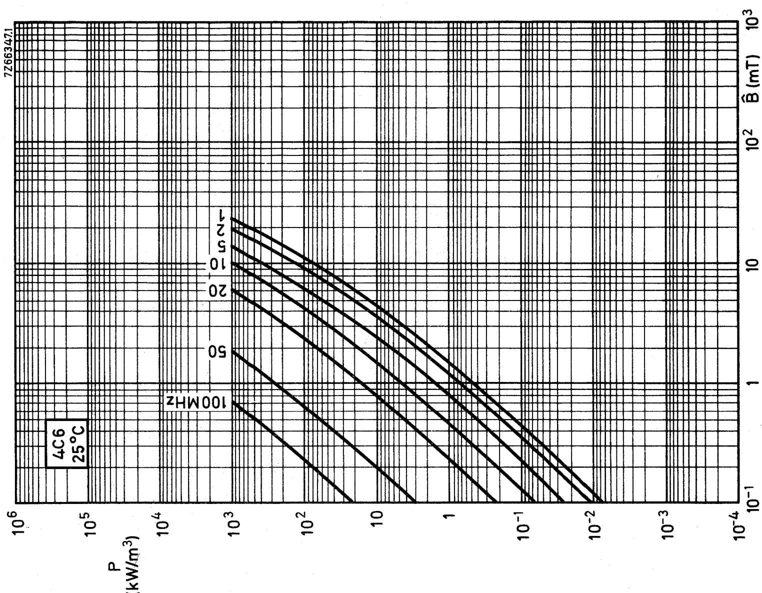

7Z66345.1
4A4
85°C
0,2
0,5
1
2
5
10
20 MHz
P
(kW/m³)
B̂ (mT)
10⁶
10⁵
10⁴
10³
10²
10
1
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻¹
1
10
10²
10³


7Z66344.1
4A4
25°C
0,2
0,5
1
2
5
10
20 MHz
P
(kW/m³)
B̂ (mT)
10⁶
10⁵
10⁴
10³
10²
10
1
10⁻¹
10⁻²
10⁻³
10⁻⁴
10⁻¹
1
10
10²
10³

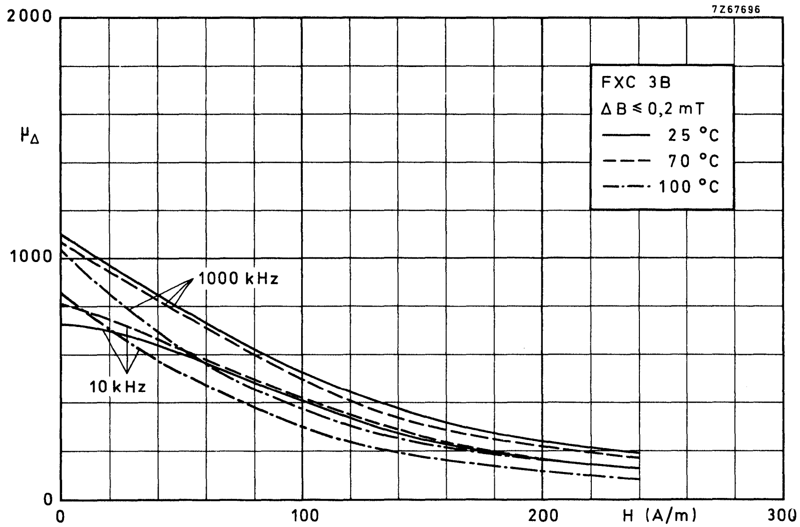

7Z66343.1
4B1
85°C
P
(kW/m^3)
B̂ (mT)
0,2
0,5
1
2
5
10
20MHz

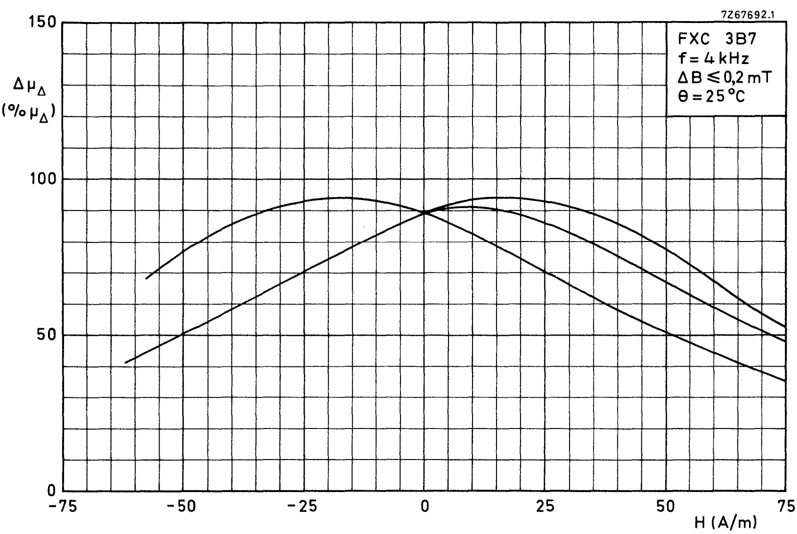

7Z66342.1
4B1
25°C
P
(kW/m^3)
B̂ (mT)
0,2
0,5
1
2
5
10
20MHz

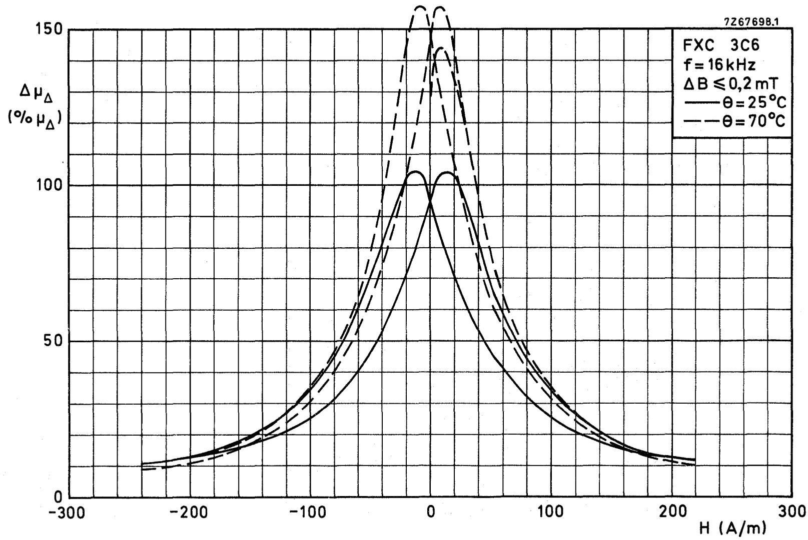

7Z66346.1
4C6
85°C
100 MHz
50
20
10
5
2
1
P
(kW/m3)
10^6
10^5
10^4
10^3
10^2
10
1
10^-1
10^-2
10^-3
10^-4
10^-1
1
10
10^2
B̂ (mT)
10^3

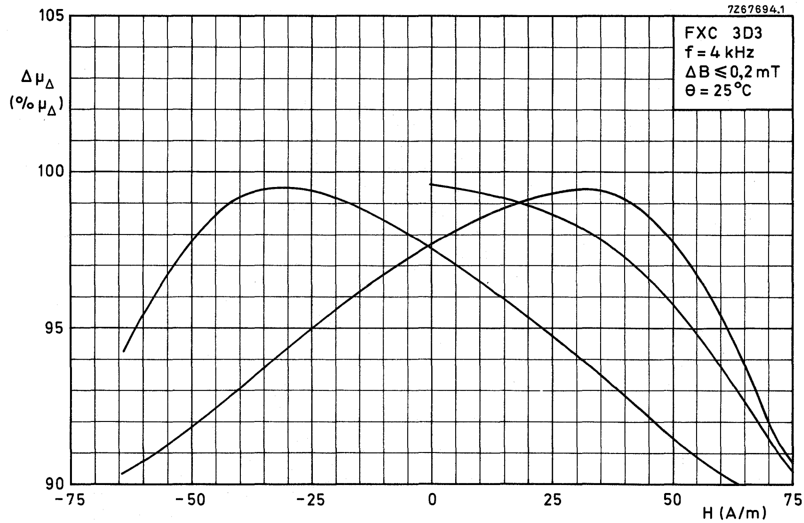

7Z66347.1
4C6
25°C
100 MHz
50
20
10
5
2
1
P
(kW/m3)
10^6
10^5
10^4
10^3
10^2
10
1
10^-1
10^-2
10^-3
10^-4
10^-1
1
10
10^2
B̂ (mT)
10^3

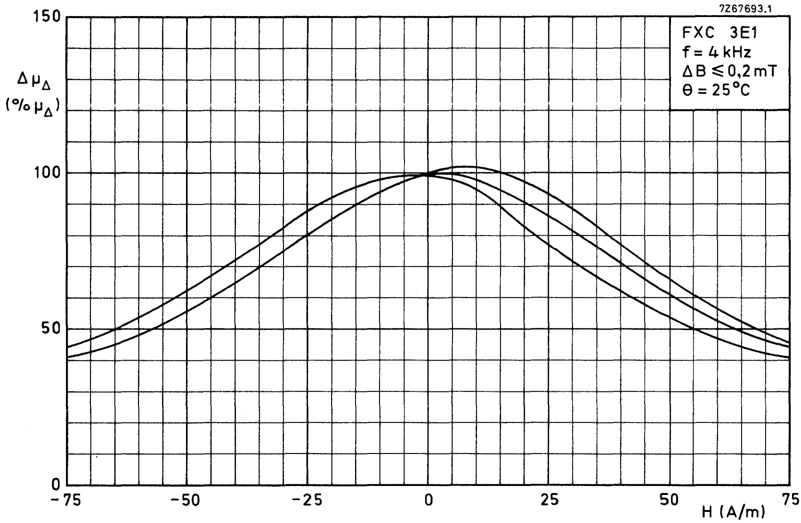
Incremental permeability as a function of the field strength

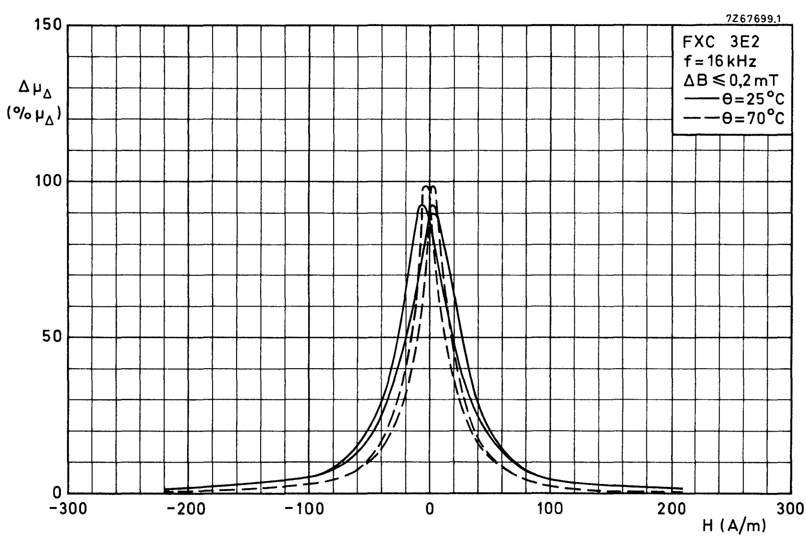


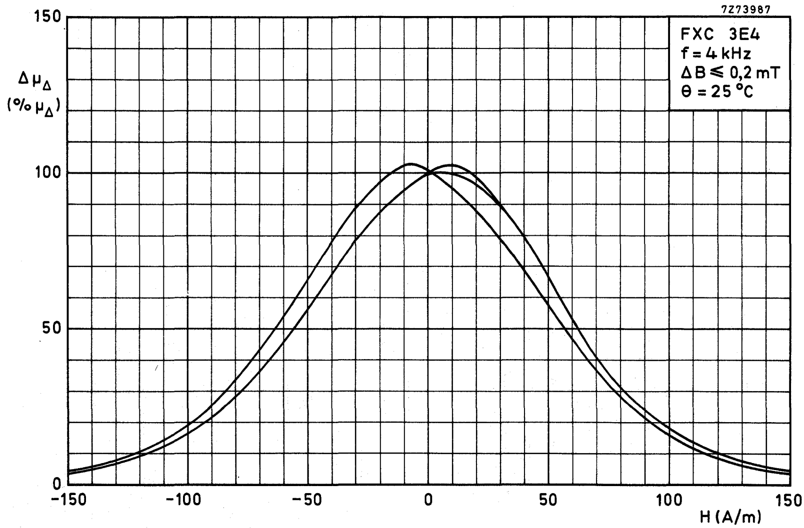


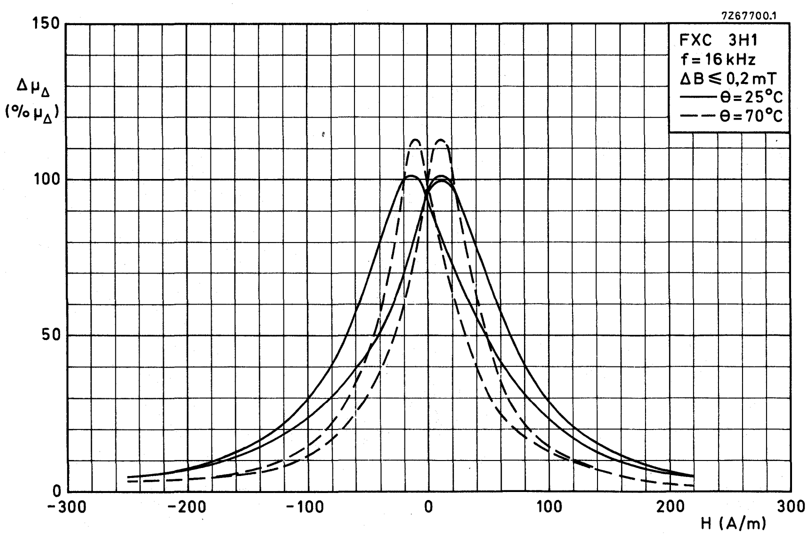

7Z67698.1
FXC 3C6
f = 16 kHz
ΔB ≤ 0,2 mT
θ = 25 °C
θ = 70 °C
Δμ_Δ (% μ_Δ)
150
100
50
0
-300
-200
-100
0
100
200
300
H (A/m)

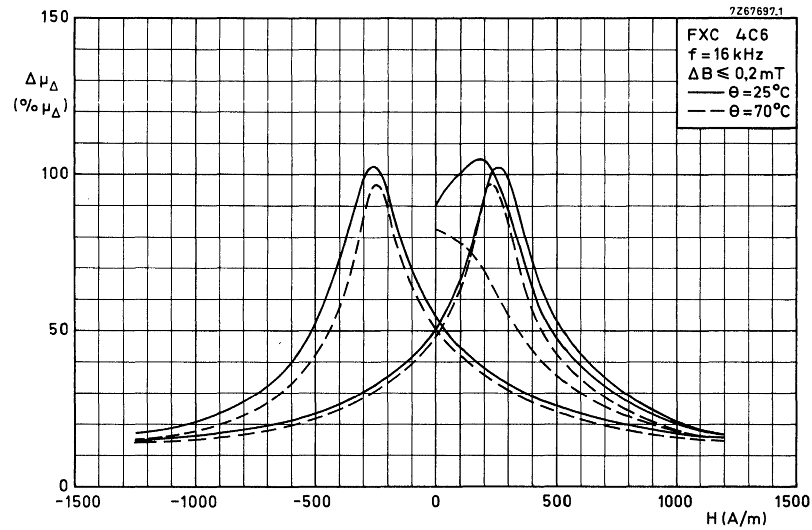

7Z67694.1
FXC 3D3
f = 4 kHz
ΔB ≤ 0,2 mT
θ = 25 °C
Δμ_Δ (% μ_Δ)
105
100
95
90
-75
-50
-25
0
25
50
75
H (A/m)

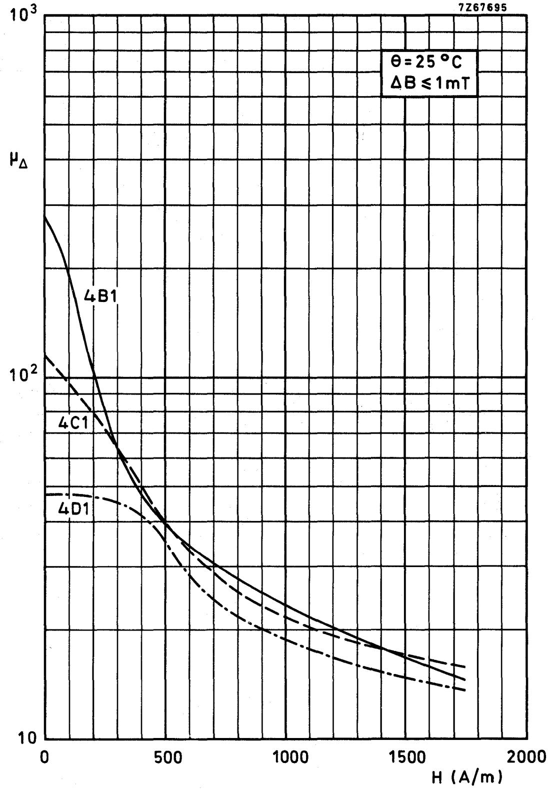

7Z67693.1
FXC 3E1
f = 4 kHz
ΔB ≤ 0,2 mT
θ = 25 °C
Δμ_Δ (% μ_Δ)
150
100
50
0
−75
−50
−25
0
25
50
75
H (A/m)


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)

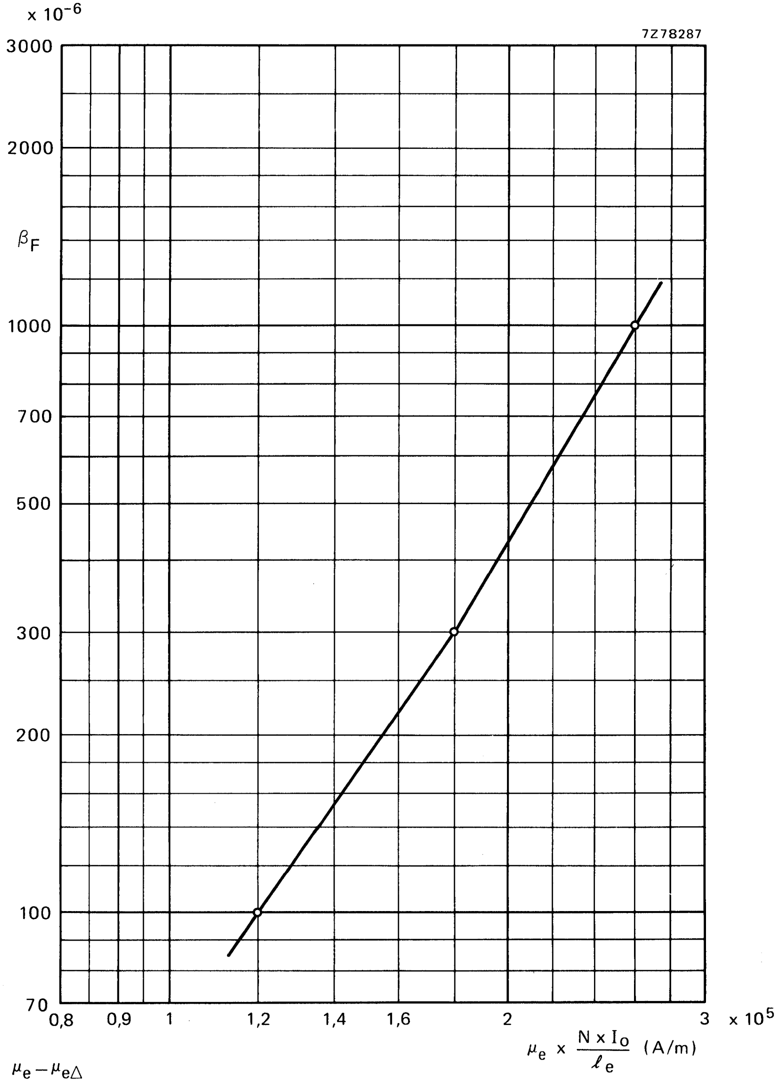

7Z67700.1
FXC 3H1
f = 16 kHz
ΔB ≤ 0,2 mT
θ = 25°C
θ = 70°C
Δμ_Δ
(% μ_Δ)
150
100
50
0
−300
−200
−100
0
100
200
300
H (A/m)


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)

D.C. sensitivity

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. polarization. The measured values are situated in the area to the right of the curve.

SECTION B
GENERAL

INTRODUCTION

TYPE NUMBER COMPOSITION

Potcores: P followed by diameter/height of complete core in mm.

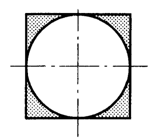
Potcore halves and coil formers for inductive proximity detectors: diameter x height of core half in mm.

Square cores: RM followed by the square dimension of the bottom expressed in terms of a grid with a 2,54 mm pitch.

Cross cores: X followed by the square dimension of the core in mm.

Ferroxcube potcores, square cores and cross cores were originally developed for low-loss filter coils and transformers operating at small-signal levels. However, they now also find some power applications, several types of potcore are used as inductive elements in proximity detectors. These cores are primarily intended for mounting on 2,54 mm (0,1") pitch printed-wiring boards, although potcores of size P18/11 and above can be mounted on conventional panels.

The main advantage of square cores and cross cores over potcores is shown in the diagram: improved packing factor due to the use of the (shaded) corner areas.



Coil formers and mounting parts are available for most of our potcores, square cores and cross cores. We can supply core sets, or core halves and loose mounting parts. Winding of the coil former and assembly of the core is performed by the user.

PRE-ADJUSTED CORES

Since the air gap in potcores, square cores and cross cores can be ground to any length, any value of A_L or μ_e can be provided within the limits set by the core size. In practice, the range of A_L (and, for potcores, μ_e) values has been standardized with values chosen to cover the majority of application requirements.

If a core set is provided with an asymmetrical air gap this air gap is ground in the upper half. This half is marked with the FXC grade and A_L value.

Most pre-adjusted cores are provided with an injection-moulded nut for the adjuster. For those users who prefer to insert the nuts themselves, loose nuts are available. Further information is given in the section Inductance adjusters.

Continuously-variable adjusters can be supplied for pre-adjusted cores of most μ_e and A_L values. These are especially recommended for filter coils; maximum adjustment range is 10% to 20%, depending on core type.

α AND A_L FACTORS

The α factor for a given core is the number of turns required for an inductance of 1 mH. For other values of inductance, $N = \alpha\sqrt{L}$, where L is the inductance in mH (10^{-3} H).

The A_L factor is the inductance per turn squared in nH for a given core. $L = N^2 A_L$, L in nH (10^{-9} H).

Measurement conditions for the guaranteed α and A_L values

The α and A_L factors given in the data sheets are guaranteed in the form of a tolerance on the inductance that applies to matched pairs of cores, provided the following 11 conditions are complied with.

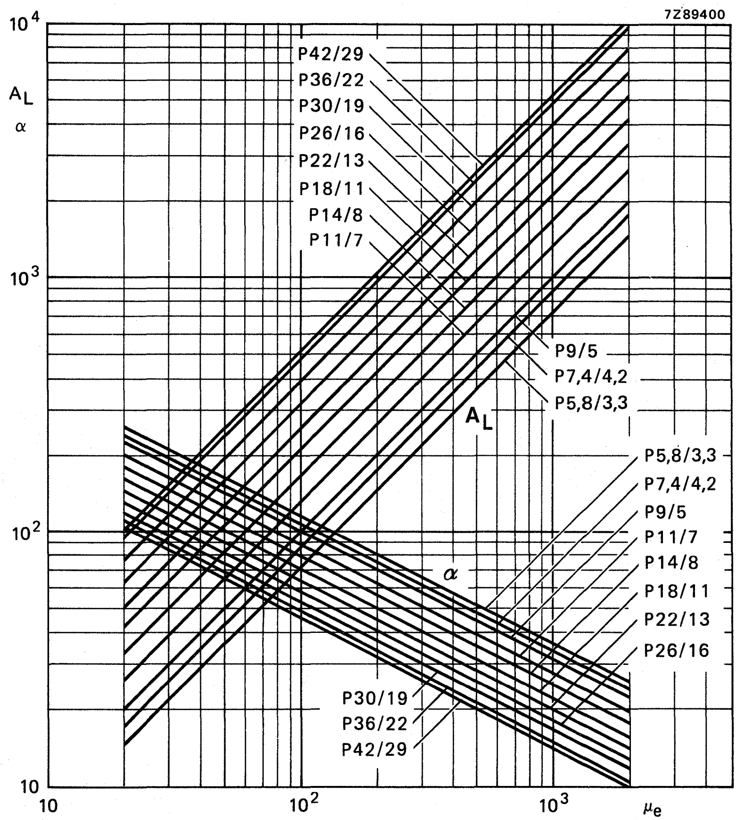
1. The core should be properly demagnetized (magnetically conditioned). All electrical values must be measured at least 24 h after demagnetization.
   Note that all our cores are demagnetized before they leave the factory.
2. All particles, if any, must be removed from the mating surfaces of the core. This can be achieved by rubbing on a piece of linen.
3. Measurements must be carried out using a standard coil selected from the table of standard coils. The standard coils for RM cores are in accordance with IEC Publication 431A.
4. The axes of the core halves must coincide.
5. Any silver reference lines on the circumferences of the core halves must coincide. Where there are no reference lines, cores may be arbitrarily positioned.
6. A force is applied to the flat sides of the core through rings, the inner diameter of which must be equal to the average inner diameter of the core.
7. The force applied must be that given in the appropriate data sheet.
8. Measurement must be carried out at a frequency of 4 kHz.
9. Measurement must be carried out at a temperature of 25 °C ± 10 °C.
10. The current through, or the voltage across the coil must be such that the peak flux density ($\hat{B}$) in the core does not exceed 0,1 mT.
11. The standard coil must be held against the bottom of the lower core half; that is the unmarked half, or the half without the nut.

Standard coils for α and A_L measurement

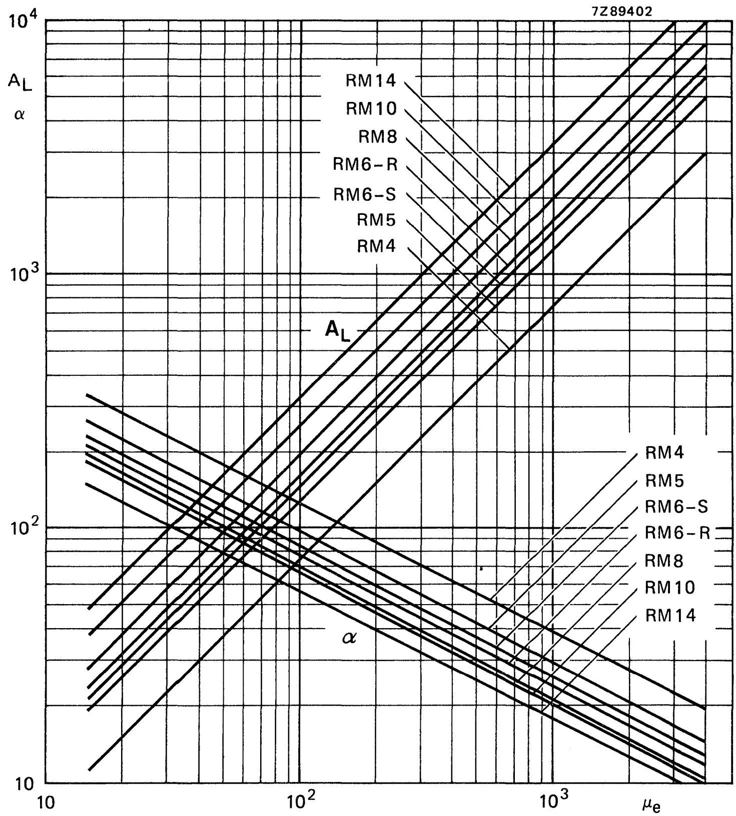
core type	catalogue number of standard coil	number of turns			number of layers	copper wire diameter mm
		total	per layer	upper layer		
P5,8/2,5	–	200	–	–	–	–
P5,8/3,3	–	35	–	–	–	0,10
P7,4/4,2	–	100	–	–	–	0,10
P9/5	7622 301 00101	65	11	10	6	0,20
P11/7	7622 301 00301	71	12	11	6	0,25
P14/8	7622 301 00501	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
X22	7622 301 04001	175	16	15	11	0,40
X25	7622 300 13701	40	14	12	3	0,50
X30	7622 301 04101	175	16	15	11	0,70
X35	7622 301 04201	251	21	20	12	0,70

Converting μ_e into α and A_L values

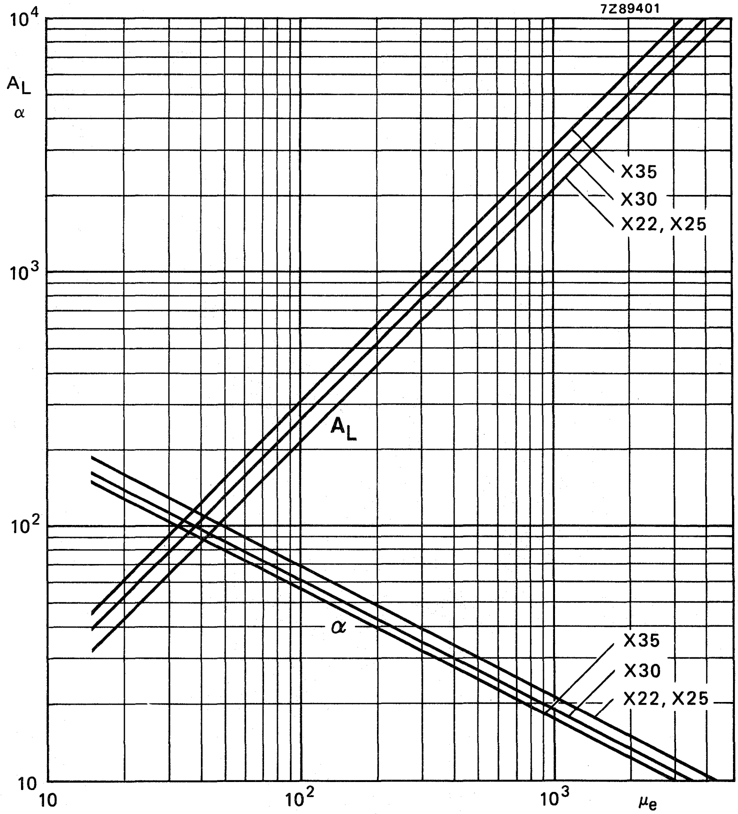
POTCORES



SQUARE CORES



CROSS CORES


7Z89401
10^4
A_L
α
10^3
10^2
10
10
10^2
10^3
μ_e
X35
X30
X22, X25
A_L
α
X35
X30
X22, X25

CORE LOSSES

Eddy-current and residual losses are measured at a peak flux density not greater than 0,1 mT and are given in terms of tan δ/μ_i.

Hysteresis constant η_B is defined in Section A. The relationships between the various hysteresis constants in current use are given below.

Peak flux density $\hat{B}$ at which measurements are carried out is calculated using the minimum cross-sectional area of the centre pole of the core, in accordance with CECC. Measurement conditions, frequencies, temperatures and flux densities, together with guaranteed values are given in the data sheets for the cores.

Q CURVES

Due to the many assumptions that must be made in the design of filter coils, prediction of Q with an accuracy better than 15% is difficult. For this reason, selection of the optimal μ_e or A_L factor for a given core is most easily made by comparing Q curves for various μ_e values.

Families of Q curves are included in the data for most types of pot and square core. To simplify comparison, the curves for each type of core were measured using identical sets of coils and wires. As a result, the curves for different μ_e (or A_L) values and different core sizes can readily be compared. Q values for inductances other than those for which the curves are given can be found by interpolation or extrapolation as appropriate.

HYSTERESIS CONSTANTS

Hysteresis losses add an effective resistance R_h in series with the coil inductance, expressed by the term R_h/L in Eqs (1) and (5). A number of other hysteresis constants are in use, however; they are related to R_h/L in Table 1. Conversion between the various constants is given in Table 2.

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

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

MEASUREMENT CONDITIONS FOR THE GUARANTEED LOSSES

Values for loss factors given in the data apply five minutes after the core halves have been clamped together. Details of the coils used for the measurement of losses are given in the following table; all windings are on single-section coil formers.

core type	FXC grade	4 kHz tan δ/μ	16 to 25 kHz watt losses	30 kHz tan δ/μ
P5,8/2,5	3H1			
P5,8/3,3	3H1			
P7,4/4,2	3H1			
P9/5	3H1	60 turns 0,10E		
	3D3			
	4C6			
P11/7	3H1	42 turns 0,18E		
	3B8			
	3D3			
	4C6			
P14/8	3H1	53 turns 0,25E		
	3B8			
	3D3			
	3H3			53 turns 0,25E
	4C6			
P18/11	3H1	42 turns 0,50E		
	3B8		31 turns 0,50E	
	3D3			
	3H3			20 turns 100 x 0,40E
	4C6			
P22/13	3H1	37 turns 0,60E		
	3B8		30 turns 0,25E	
	3D3			
	3E4	37 turns 0,60E		
	4C6			
P26/16	3H1	34 turns 0,70E		
	3B8	34 turns 0,70E	22 turns 0,40E	
	3D3			
	4C6			

100 kHz tan δ/μ	0,5 to 1 MHz tan δ/μ	2 MHz tan δ/μ	10 MHz tan δ/μ	β_F
35 turns 0,10E				
35 turns 0,20E				
35 turns 0,20E 45 turns 0,16E 90 turns 0,12	10 turns 0,16E	17 turns 40 x 0,04E	6 turns 40 x 0,04E	
42 turns 0,18E 42 turns 0,18E 85 turns 0,10E	22 turns 0,10E	16 turns 45 x 0,04E	6 turns 45 x 0,04E	100 turns 0,20E
37 turns 0,10E 37 turns 0,10E 37 turns 0,10E 176 turns 0,14E	19 turns 8 x 0,04E	14 turns 0,40E	6 turns 0,5 x 1,9 Cu	80 turns 0,25E
35 turns 0,14E 35 turns 0,14E 20 turns 100 x 0,04E 150 turns 0,25E	16 turns 12 x 0,04E	12 turns 0,60E	5 turns 0,75 x 2,75 Cu	100 turns 0,30E
29 turns 0,20E 29 turns 0,20E 29 turns 0,20E 140 turns 0,25E	16 turns 40 x 0,04E 4 turns 1,2 x 3,5 Cu	11 turns 0,70E	4 turns 1,2 x 3,5 Cu	100 turns 0,40E
28 turns 0,28E 28 turns 0,28E 28 turns 0,28E 125 turns 0,40E	14 turns 40 x 0,04E	10 turns 0,90E	4 turns 2,0 x 4,0 Cu	100 turns 0,40E

core type	FXC grade	4 kHz tan δ/μ	16 to 25 kHz watt losses	30 kHz tan δ/μ
P30/19	3H1	30 turns 1,0E		
	3B8		27 turns 0,40E	
	3D3			
P36/22	3H1	27 turns 1,2E		
	3B8		21 turns 0,56E	
	3D3			
P42/29	3H1	26 turns 1,8E		
RM4	3H1	60 turns 0,18E		60 turns 0,18E
	3E4	60 turns 0,18E		60 turns 0,18E
RM5	3H1	45 turns 0,30E		26 turns 80 x 0,04E
	3D3			
	3E4	45 turns 0,30E		
	3H3			26 turns 80 x 0,04E
	4C6			
RM6	3H1	66 turns 0,35E		66 turns 0,35E
	3B8		25 turns 0,25E	
	3D3			
	3E4	40 turns 0,45E		
	3H3			23 turns 100 x 0,04E
	4C6			
RM8	3H1	35 turns 0,50E		35 turns 0,50E
	3B8/3C8		20 turns 0,40E	
	3D3			
	3E4	35 turns 0,50E		
	3H3	35 turns 0,50E		35 turns 0,50E
	4C6			
RM10	3H1	40 turns 0,25E		40 turns 0,25E
	3B8/3C8		26 turns 0,40E	
	3E4	17 turns 0,60E		
RM14	3B8/3C8		22 turns 0,80E	30 turns 100 x 0,04E

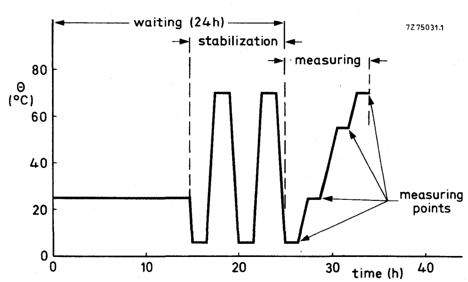
100 kHz tan δ/μ	0,5 to 1 MHz tan δ/μ	2 MHz tan δ/μ	10 MHz tan δ/μ	β_F
23 turns 0,40E 23 turns 0,40E	8 turns 2 x 100 x 0,04E			100 turns 0,40E
22 turns 0,50E 22 turns 0,50E	7 turns 2 x 100 x 0,04E			200 turns 0,40E
20 turns 0,45E				
36 turns 0,14E 60 turns 0,18E	8 turns 0,60E			
17 turns 24 x 0,04E 45 turns 0,30E 45 turns 0,30E 26 turns 80 x 0,04E 45 turns 0,30E	15 turns 0,30E 9 turns 0,55E	15 turns 0,30E	3 turns 0,50E	
29 turns 12 x 0,04E 66 turns 0,35E 40 turns 0,45E 23 turns 100 x 0,04E 66 turns, 0,35E	8 turns 0,80E	14 turns 0,40E	4 turns 0,60E	100 turns 0,30E
31 turns 20 x 0,04E 31 turns 20 x 0,04E 35 turns 0,50E 31 turns 20 x 0,04E	15 turns 24 x 0,07E 6 turns 0,80E	15 turns 0,56E	4 turns 0,56E	100 turns 0,40E
17 turns 0,60E 17 turns 0,60E	8 turns 45 x 0,04E			100 turns 0,40E
				200 turns 0,55E

core type	FXC grade	4 kHz tan δ/μ	16 to 25 kHz watt losses	30 kHz tan δ/μ
X22	3H1 3B8 3D3 4C6	42 turns 0,45E	25 turn 0,30E	
X25	3H1 3D3	40 turns 0,50E		
X30	3H1 3B8	35 turns 0,25E	30 turns 0,40E	
X35	3H1 3B8	30 turns 0,45E	27 turns 0,55E	

MEASUREMENT OF TEMPERATURE FACTOR

Temperature factor α_F is generally determined on magnetic circuits without a ground air gap. Ferroxdure 3-- products are electrically demagnetized before measurement, and Ferroxcube 4-- products are thermally demagnetized before measurement. Thermal demagnetization is accomplished by heating in a pure nitrogen atmosphere to a temperature at least 25 K above the Curie temperature and maintaining the temperature for at least 5 minutes. Cooling takes place at 5 K/minute.

The measurement sequence for Ferroxcube 3-- and 4-- products is given in the figure. This sequence is not, however, used for Ferroxcube 3B7 products. In their case, measurement of α_F is carried out on toroid-wound core halves. These are not demagnetized before the start of the measurement sequence, but electrical demagnetization takes place at each measurement temperature, 10 minutes before each measurement.



100 kHz tan δ/μ	0,5 to 1 MHz tan δ/μ	2 MHz tan δ/μ	10 MHz tan δ/μ	β_F
33 turns 0,22E 33 turns 0,22E 150 turns 0,30E	16 turns 24 x 0,04E	10 turns 0,90E	4 turns 1,4 x 4,4 Cu	100 turns 0,30E
36 turns 0,50E 36 turns 0,50E	12 turns 45 x 0,04E			
35 turns 0,25E				100 turns 0,40E
30 turns 0,45E				100 turns 0,80E

MEASUREMENT OF DISACCOMMODATION FACTOR

Disaccommodation factor D_F of Ferroxcube 3-- magnetic circuits is measured between 10 and 100 minutes after magnetic demagnetization at a temperature of 25 °C ± 5 °C, unless otherwise stated. The actual measurement temperature is held constant during the measurement to within 0,2 °C.

The disaccommodation factor of magnetic circuits in Ferroxcube 4-- materials is measured between 24 hours and 48 hours after cooling to 35 °C following thermal demagnetization, as described above.

INDUCTANCE ADJUSTERS

A major feature of a FXC core assembly is its adjustment mechanism.
The inductance adjustment is achieved by inserting into the central hole a tube or cylinder made either of Ferroxcube or of carbonyl-iron powder. This acts as a partial magnetic shunt across the air gap. The adjuster consists of this tube moulded into a thermoplastic carrier,threaded at one end. This screws into a nut which is injection moulded or cemented into the lower half of the core. The magnetic tubes are centreless ground to give very close diameter tolerances.

INDUCTANCE STABILITY

The stability of a correctly-assembled pot, square or cross core depends mainly on the stability of the permeability of the ferrite. The permeability of a ferrite may change with temperature, time, mechanical pressure, magnetic polarization and other factors. The most important changes affecting the inductance stability of the assembly are:

— variation of permeability with temperature — temperature coefficient;
— variation of permeability with time — disaccommodation.

Changes in inductance may also occur due to:

— movement of the adjuster after final setting;
— movement of the coil former;
— relative movement of the core halves;
— movement of the mechanical components of the assembly.

Small movements of this kind are usually caused by changes in temperature, mechanical vibration or shock.

It is clear from the formulae given in Section A that lowering the value of A_L or μ_e will reduce both temperature coefficient and disaccommodation. However, very low values of A_L and μ_e usually prove incompatible with Q requirements; a typical value for a high-Q inductor using an RM6 core would be $A_L = 315$. For material grade FXC3H1, the corresponding value of temperature coefficient would be about $+ 120 \cdot 10^{-6}$/K. A reasonable measure of compensation may be achieved by suitable choice of resonating capacitor: a polystyrene-film capacitor is available with a temperature coefficient of about $-120 \cdot 10^{-6}$/K.

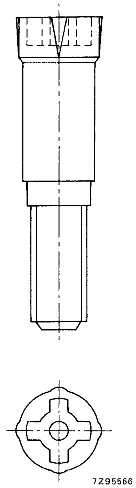
Both nut and adjuster threads are made to much finer tolerances than required by UN-D12 (ISO Recommendations R68, DR782 and DR979). The injection-moulded nut is very firmly fixed in the cote. It is not able to move in any direction, and is precisely centred with its axis parallel to that of the core.

The achievement of acceptable long-term inductance stability is mainly a matter of careful assembly and suitable stabilizing treatment before final adjustment. If the inductor is to be used in a critical circuit, it should be artificially aged by temperature cycling as described in the Section 'Mounting Data' (page 85). The long-term change in inductance of an assembly so treated should not be greater than $500 \cdot 10^{-6}$, assuming an ambient temperature between 25 °C and 40 °C that does not vary by more than 15 K.

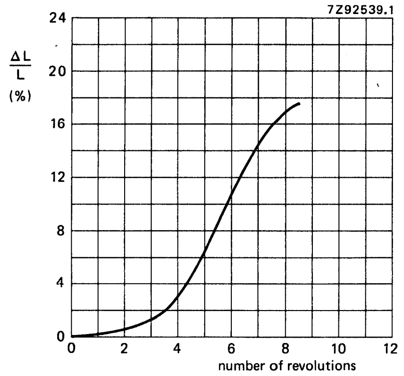
The change in inductance of an RM core assembly using clips with earthing spikes when subjected to IEC 68-2-6, test Fc, vibration conditions is less than $1000 \cdot 10^{-6}$. Such severe conditions are unlikely to be encountered in practice.

Bump tests of RM-core assemblies with earthing spikes, IEC 68-2-29, test Eb, have also been carried out. The observed change in the inductance of RM6-R cores of 3H1 material was less than $300 \cdot 10^{-6}$.

Inductance adjusters are available in several versions. The drawing shows the principle outlines and the various dimensions are listed per core type in a table which also includes the catalogue number of the adjuster, its colour code, and the material of the core, FXC (Ferroxcube) or cip (carbonyl-iron powder).



A second table shows which type of adjuster can be used for typical A_L values of cores in various grades; in this table also the maximum inductance variation ($\Delta L/L$ in %) is listed. In some cases the choice of adjuster is optional and depends on the application. For that reason a suggestion is given for minimum, average and maximum inductance variation, where applicable.



Typical curve of a specified adjuster in a core set, pre-adjusted an A_L.

PACKAGING

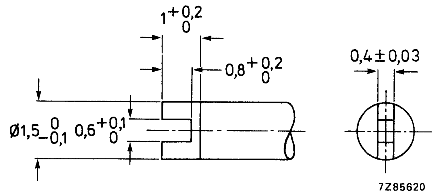
The adjusters are packed in plastic bags of 100. Please order in multiples of this quantity.

Survey of adjusters

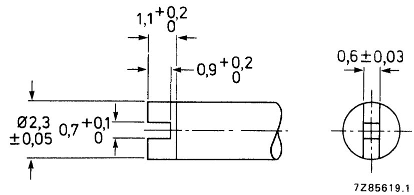
Core type	catalogue number	colour code	material *
P9/5, P11/7	4322 021 39810	brown	FXC
	39840	yellow	cip
	39850	green	cip
	39890	grey	FXC
P14/8	4322 021 39700	black	FXC
	39710	brown	FXC
	39720	red	cip
	39730	orange	cip
	39740	yellow	FXC
	39750	green	cip
	39780	white	FXC
	39790	grey	FXC
P18/11	4322 021 39600	black	FXC
	39610	brown	FXC
	39620	red	FXC
	39630	orange	cip
	39640	yellow	cip
	39650	green	cip
	39670	violet	FXC
	39680	white	FXC
P22/13, RM8, X30	4322 021 38400	black	FXC
	38410	brown	FXC
	38420	red	cip
	38430	orange	cip
	38440	yellow	FXC
	38450	green	cip
	38480	white	FXC
	38490	grey	FXC
P26/16	4322 021 39410	brown	FXC
	39420	red	cip
	39450	green	cip
	39480	white	FXC
	39490	grey	FXC
P30/19, RM10	4322 021 38320	red	cip
	38340	yellow	cip
	38380	white	FXC
	38390	grey	FXC
P36/22, P42/29, X35	4322 021 39240	yellow	cip
	39280	white	cip
	39290	grey	FXC
RM4, RM5	4322 021 38700	black	FXC
	38710	brown	FXC
	38720	red	cip
	38750	green	cip
	38780	white	FXC
	38790	grey	FXC
RM6-R, RM6-S, X22	4322 021 38600	black	FXC
	38610	brown	FXC
	38620	red	cip
	38640	yellow	cip
	38650	green	cip
	38670	violet	FXC
	38680	white	FXC
	38690	grey	FXC

* FXC = Ferroxcube; cip = carbonyl-iron powder.

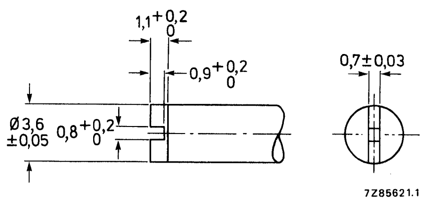
Dependent on the size, the screw-head of the adjuster is suited for tools of M1,4; M1,7; M2 and M2,6. An adjusting tool, combining M1,4 and M1,7 is available (catalogue number 4322 058 03260) as well as a tool combining M2 and M2,6 (catalogue number 4322 058 03270). For customers who wish to make the adjuster tool themselves, the four outlines are depicted below.



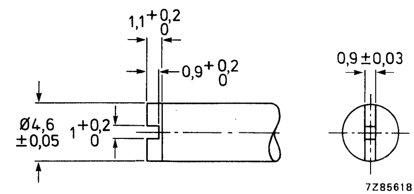
M1,4 tool.



M1,7 tool.

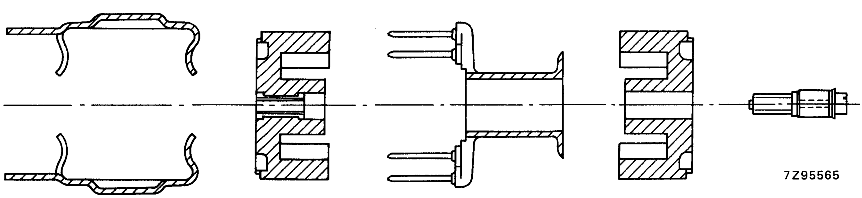


M2 tool.



M2,6 tool.

One of the ferroxcube core halves of a pre-adjusted core set is provided with an injection moulded nut, in which the adjuster is screwed.



Exploded view showing from right to left, adjuster, upper core halve, coil former, bottom core halve with nut, clamps.

The thread of both the nut and the adjuster are closely toleranced (4H) to allow smooth rotation without backlash or friction. The gauge-measured maximum torque of the threaded part for the adjusters is:

M1,4 types ⩽ 2 mNm
M1,7 types ⩽ 3 mNm
M2 types ⩽ 6 mNm
M2,6 types ⩽ 10 mNm

The nuts are also available as loose items for those customers who prefer to insert the nut themselves. There are four nuts, made of polycarbonate, allowing a maximum impregnation temperature of 120 °C for 24 hours. Such nuts are packed in bags of 100 and multiples of 100 should therefore be ordered. Instructions for inserting the adjuster nut are given in the general section "Mounting Data" (page 83).

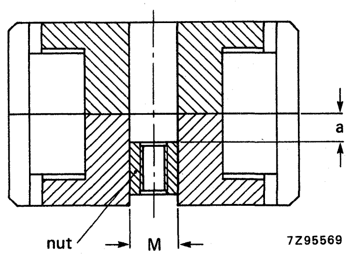


Fig. 1 Example of two potcore halves with plain centre hole with a nut inserted by the user in one half. The dimension 'a' is the recommended distance from the mating surface to the nut. See table below.

Survey of loose adjuster nuts for mounting by user in core halves with plain center hole.

core type	catalogue number of loose nut	M	Fig.	a mm	b mm	c mm	h mm
P9/5	4322 021 31630	1,4	2				
P11/7	31630	1,4	2				
P14/8	30140	1,7	3	1,2	2,85	3,5	2,9
P18/11	30140	1,7	3	2,3	2,85	3,5	2,9
P22/13	30150	2	3	2,7	4,2	4,9	3
P26/16	30160	2,6	3	2,9	5,2	5,9	5
P30/19	30160	2,6	3	3,3	5,2	5,9	5
P36/22	30160	2,6	3	2,8	5,2	5,9	5
P42/29	30160	2,6	3	4,7	5,2	5,9	5
RM4	31850	1,4	3	2,0	1,9	2,12	2,5
RM5	31850	1,4	3	2,0	1,9	2,12	2,5
RM6-S/RM6-R	30140	1,7	3	2,3	2,85	3,5	2,9
RM8	30150	2	3	2,7	4,2	4,9	3
RM10	30160	2,6	3	4,0	5,2	5,9	5
X22	30140	1,7	3	2,3	2,85	3,5	2,9
X25							
X30	30150	2	3	2,7	4,2	4,9	3
X35	30160	2,6	3	4,7	5,2	5,9	5

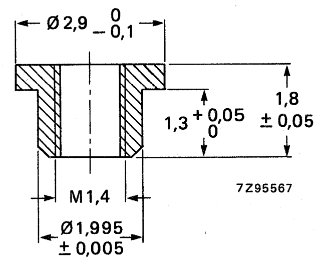


Fig. 2.

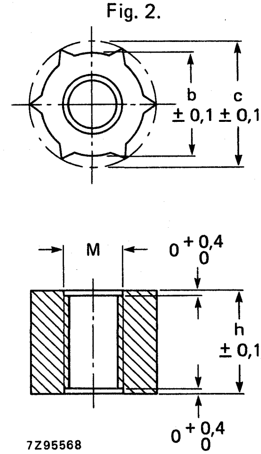


Fig. 3.

COIL DESIGN AND CALCULATIONS

LOSSES

Losses in a wound core can be divided into

- winding losses:
  - losses due to the d.c. resistance of the wire,
  - eddy-current losses in the wire,
  - dielectric losses in insulation;
- core losses:
  - hysteresis losses in the core material,
  - eddy-current and residual losses in the core material.

With Ferroxcube pot, square and cross cores, screening losses are negligible.

Losses appear as series resistances in the coil. The ratio of the total effective series resistance due to all losses to the inductance of the coil is the sum of the resistances due to the individual losses:

$$\frac{R_{tot}}{L} = \frac{R_0}{L} + \frac{R_{ec}}{L} + \frac{R_d}{L} + \frac{R_h}{L} + \frac{R_{e+r}}{L} \quad (\Omega/H) \qquad (1)$$

As a general rule, maximum Q is obtained when the sum of the winding losses is made equal to the sum of the core losses.

D.C. resistive losses

The d.c. resistive losses in a winding are given by

$$\frac{R_0}{L} = \frac{l}{\mu_e} \cdot \frac{l}{f_{Cu}} \times \text{constant} \qquad (\Omega/H) \qquad (2)$$

The space (copper) factor f_{Cu} depends on wire diameter, the amount of insulation and the method of winding. The value of the constant is given in the data for the coil formers.

Eddy-current losses in the winding

$$\frac{R_{ec}}{L} = \frac{C_{wCu} V_{Cu} f^2 d^2}{\mu_e} \qquad (\Omega/H) \qquad (3)$$

where C_{wCu} is the eddy-current loss factor for the winding and depends on the dimensions of the coil former and core, and V_{Cu} is the volume of conductor in mm³; d is the diameter of a single wire in mm.

Dielectric losses

The capacitances associated with the coil are not loss free, they have a loss factor tan δ_c that also increases the effective coil resistance:

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

Hysteresis losses

The effective series resistance due to hysteresis losses is calculated from the core hysteresis constant, the peak flux density, the effective permeability and the operating frequency:

$$\frac{R_h}{L} = \omega \eta_B \hat{B} \mu_e. \qquad (\Omega/H) \qquad (5)$$

Eddy-current and residual losses

The effective series resistance due to eddy-current and residual losses is calculated from the loss factor tan δ/μ_i given as a function of frequency in the core data:

$$\frac{R_{e+r}}{L} = \omega \mu_e \,(\tan \delta/\mu_i). \qquad (\Omega/H) \qquad (6)$$

Coil design

The specification of an inductor usually includes
- the inductance;
- minimum Q at the operating frequency;
- applied alternating voltage;
- maximum size;
- maximum and minimum temperature coefficient;
- range of adjustment;
- variability.

To satisfy these requirements, the designer has the choice of
- core size,
- material grade,
- A_L,
- type of conductor (solid or bunched),
- type of adjuster.

Frequency, core type and material grade

The operating frequency is a useful guide to the choice of core type and material.

- Frequencies below 20 kHz: the highest Q will be obtained with large, high-inductance-factor cores in Ferroxcube 3B7, 3H1 or 3H3 material. Winding wire should be solid, with minimum-thickness insulation. Note: high inductance factors are associated with high temperature coefficients of inductance.
- Frequencies between 20 kHz and 200 kHz: high Q will generally by obtained with a core also in Ferroxcube 3B7, 3H1 or 3H3. Maximum Q will not necessarily be obtained from the largest-size core, particularly at higher frequencies, so the choice of inductance factor is less important. Bunched, stranded conductors should be used to reduce eddy-current losses in the copper. Above 50 kHz, the strands should not be thicker than 0,07 mm.
- Frequencies between 200 kHz and 2 MHz: use a core of Ferroxcube 3D3 material. Bunched conductors of maximum strand diameter 0,04 mm are recommended.
- Frequencies between 2 MHz and 12 MHz: use a core of Ferroxcube 4C6. Bunched conductors of maximum strand diameter 0,04 mm are recommended for frequencies up to 5 MHz. Solid conductors should be used at frequencies between 5 MHz and 12 MHz.

Signal level

In most applications, the alternating signal voltage is low. It is good practice, wherever possible, to keep the operating flux density of the core below 1 mT, at which level the effect of hysteresis is usually negligible. At higher flux densities, it might be necessary to allow for some hysteresis loss and inductance change. Curves showing the effect of signal level are given in the data for certain core types. The expression for third harmonic voltage E_3 given in Section A may be used as a guide to the amount of distortion. For low distortion, RM cores with small hysteresis loss factors should be used.

D.C. polarization

The effect of a steady, superimposed magnetic field, whether due to an external field or a d.c. component of winding current, on a cored inductor is to reduce the inductance obtained with a given number of turns. As with other characteristics, the amount of the decrease depends on the value of the effective permeability, becoming less at lower permeabilities. But for most applications the effect is not serious. Curves from which the amount of the decrease can be obtained are given in the core data sheets. Ferroxcube 3B8 has been developed especially for applications involving d.c. polarization.

Design procedure

1. On the basis of the operating characteristics and design limitations, select the core size, material grade, inductance factor and conductor type using the information given in the data sheets.
2. Using the adjustment curve, check that the range of adjustment is sufficient to cover the tolerance on A_L or μ_e and that of the resonating capacitor. Make an allowance of about 1% for circuit strays.
3. Calculate the number of turns required from the A_L or α value for the core.
4. Select a conductor size to fill the coil former.
5. From the voltage across the inductor, E_{rms}, determine peak flux density $\hat{B}$. If this is in excess of 1 mT, check that hysteresis loss and distortion are acceptable by reference to the a.c. signal-level characteristics in the core data.

DESIGN EXAMPLES

Example 1

Design a filter coil of inductance 2,75 mH operating at a frequency of 100 kHz, with a minimum Q of 900. The temperature coefficient of inductance must be less than $+8,5 \times 10^{-3}$ between $+5\ ^{\circ}C$ and $+55\ ^{\circ}C$. The coil will carry an a.c. current of 1 mA.

Both operating frequency and the positive temperature coefficient required indicate the use of Ferroxcube 3H1 material for the core. The maximum value of μ_e can be calculated from the maximum temperature coefficient using the expression for core temperature coefficient α_μ given in the list of definitions in Section A:

$$\alpha_\mu = \alpha_F \mu_e.$$

Taking the mean value of α_F given in the material data for 3H1, 10^{-6}/K, yields

$$\mu_e = \frac{8,5 \times 10^{-3}}{50 \times 10^{-6}} = 170.$$

This being the maximum value of μ_e for the required temperature coefficient. The next lower standard value is 150. Examination of the Q curves for the various potcores for $\mu_e = 150$ reveals that the smallest potcore for which the required Q of 900 can be obtained is the P18/11. The catalogue number of the pre-adjusted core with adjuster nut is 4322 022 24270; that of the recommended adjuster is 4322 021 39610.

To allow for a 10% adjustment range about the nominal inductance, the inductance of the coil without adjuster should be 5% less than nominal, that is 0,95 x 2,75 = 2,62 mH. The number of turns required is given by $N = \alpha\sqrt{L}$ = 56,3 $56{,}3\sqrt{2{,}62}$ = 91 turns. From the window area-available with single-section coil former 4322 021 30270, a suitable conductor comprises 64 strands of 0,04 mm enamelled-copper wire.

It is now possible to calculate the losses in the coil and, hence, the Q. The losses due to the d.c. resistance of the wire can be calculated from Eq. (2) above, using the loss-constant for the coil former:

$$\frac{R_0}{L} = \frac{16{,}4 \times 10^3}{0{,}38 \times 150} = 288\ \Omega/\text{H},$$

where 0,38 is the space factor for the winding. The eddy-current losses in the winding are given by Eq. (3), taking $C_{wCu} = 10^{-7}$,

$$\frac{R_{ec}}{L} = \frac{10^{-7} \times 267 \times 10^{10} \times 0{,}04^2}{150} = 3\ \Omega/\text{H}.$$

where 267 mm^3 is the volume of the conductor determined from the wire diameter number of strands, number of turns and mean turn length given in the coil-former data.

The dielectric losses in the coil stray capacitances are given by Eq. (4), assuming $\tan\delta_c = 0{,}01$ and C = 8 pF:

$$\frac{R_d}{L} = (2\pi\ 10^5)^3 \times 2{,}62 \times 10^{-3} \times 8 \times 10^{-12}\ (\frac{2}{900} + 0{,}01) = 64\ \Omega/\text{H}.$$

Hysteresis losses are given by Eq. (5), but first it is necessary to calculate $\hat{B}$. This is simply given by the number of turns, the current carried, the effective permeability and the effective length of the core magnetic path:

$$\hat{B} = N\hat{I}\mu_e\mu_0/\ell_e. \qquad (7)$$

$$= \sqrt{2} \times 91 \times 10^{-3} \times 150 \times 4\pi \times 10^{-7}/(25{,}8 \times 10^{-3})$$

$$= 0{,}94\ \text{mT}.$$

Using this value in Eq. (5), with $\eta_B = 0{,}5 \times 10^{-5}$/T, a more realistic value than the quoted maximum, yields

$$\frac{R_h}{L} = 2\pi \times 10^{-5} \times 0{,}5 \times 10^{-3} \times 0{,}94 \times 10^{-3} \times 150 = 44\ \Omega/\text{H}.$$

Eddy-current and residual losses given by Eq. (6), using $\tan\delta/\mu_i = 3 \times 10^{-6}$, a good average value, are

$$\frac{R_{e+r}}{L} = 2\pi \times 10^5 \times 150 \times 3 \times 10^{-6} = 283\ \Omega/\text{H}.$$

Now, from Eq. (1),

$$\frac{R_{tot}}{L} = 288 + 3 + 64 + 44 + 283 = 682\ \Omega/\text{H}$$

so that

$Q = \omega L/R_{tot} = 2\pi \times 10^5/682 = 921.$

The measured value, given in the Q curves with the data for the P18/11 core, was 995.

Example 2

Design an 88 mH loading coil to exceed the following requirements by the widest possible margin in the smallest possible volume.

Inductance tolerance		1 %
D.C. resistance	$\leqslant$	4,8 Ω
A.C. resistance at 1800 Hz and 1 mA	$\leqslant$	5,8 Ω
Capacitance between the two line windings	$\leqslant$	200 pF
Inductance unbalance between the two line windings	$\leqslant$	0,1 %
Resistance unbalance between the two line windings	$\leqslant$	0,1 Ω

From the a.c. and d.c. resistance limits,

$$\frac{R_0}{L} \leqslant \frac{4,8}{0,088} = 54,5\ \Omega/\text{H}$$

and

$$\frac{R_{tot}}{L} \leqslant \frac{5,8}{0,088} = 65,9\ \Omega/\text{H}.$$

The R_0/L value is often the most critical requirement for loading coils on ferrite cores. Therefore the potcore size and the A_L (or μ_e) value are determined first.

Potcore P30/19 is examined first:

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 5,38.10^3$$ (see P30/19, section Coil formers)

assume $f_{cu} = 0,5$

from max. $54,5 = \frac{1}{\mu_e} \times \frac{1}{0,5} \times 5,38.10^3$ follows min. $\mu_e = \frac{5,38.10^3}{54,5 \times 0,5} = 197.$

Because a higher μ_e value is more attractive due to a better R_0/L or smaller core size, potcore P26/16 is examined now:

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 7,79.10^3$$ (see P26/16, section Coil formers)

assume again $f_{cu} = 0,5$

from max. $54,5 = \frac{1}{\mu_e} \times \frac{1}{0,5} \times 7,79.10^3$ follows min. $\mu_e = \frac{7,79.10^3}{54,5 \times 0,5} = 286.$

This result looks more attractive to continue the calculation.

A μ_e of min. 286 corresponds to a min. A_L of 898 according to formula $A_L = \frac{0,4\ \pi\mu_e}{C_1}$.

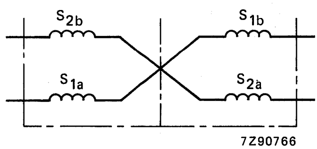
C_1 of potcore P26/16 is 0,400 mm^{-1} (see P26/16, section Potcores).

The closest standard A_L value of a P26/16-3H1 core is 1000 ($\mu_e = 318$). Catalogue number of this core is 4322 022 29310.

The tolerance on the A_L value is ± 3%. For most loading coils this is too high. To solve that problem a suitable inductance adjuster is used (see P26/16, Inductance adjusters). The inductance of the coil without adjuster must be a few percent lower, because an adjuster always increases the inductance, e.g. –5%.

88 mH - 5% = 83,6 mH.

According to formulae $L = N^2A_L$ the number of turns for this coil should be 289.
Because a loading coil must have an even number of turns (often divisible by 4, see outline) 288 turns are chosen.



Arrangement of a four-winding
loading coil on a two-section former.

According to the same formula the inductance of the loading coil without adjuster is now

$L = N^2A_L = 288^2 \times 1000 \times 10^{-6}$ mH = 82,94 mH.

The ± 3% tolerance on the A_L value of the core implies:

a minimum inductance of 82,94 mH − 3% = 80,45 mH;
a maximum inductance of 82,94 mH + 3% = 85,43 mH.

In order to bring 80,45 mH to 88 mH an adjuster is needed which increases the inductance of the coil with maximum 9,3%. A suitable standard adjuster can be found under P26/16 (see Inductance adjusters).

Since the lowest value of R_0/L will be obtained with a coil former completely full of wire, solid wire 0,28 mm diameter with double polyvinylformal insulation is used. From Eq. (2),

$$\frac{R_0}{L} = \frac{7{,}79 \times 10^3}{318 \times 0{,}49} = 50\ \Omega/\mathrm{H},$$

where 0,49 is the space factor of the winding.

The eddy-current resistance is given by Eq.(3) with
$C_{wCu} = 100 \times 10^{-9}$:

$$\frac{R_{ec}}{L} = 100 \times 10^{-9} \times 954 \times 3{,}24 \times 10^6 \times 0{,}28^2/318 = 0{,}08\ \Omega/\mathrm{H}.$$

Dielectric losses are given by Eq. (4), assuming Q at 1800 Hz to be 200 (from P26/16 Q curves) and $\tan \delta_c = 0{,}01$:

$$\frac{R_d}{L} = (2\pi 1800)^2 \times 88 \times 10^{-3} \times 60 \times 10^{-12}\ (\frac{2}{200} + 0{,}01) = 0{,}15\ \Omega/\mathrm{H}.$$

Hysteresis losses are given by Eq. (5), but first it is necessary to calculate $\hat{B}$: from Eq. (7):

$$\hat{B} = 292 \times 10^{-3} \times \sqrt{2} \times 318 \times 4\pi \times 10^{-7}/(37{,}6 \times 10^{-3}) = 4{,}4\ \mathrm{mT}.$$

Then, with $\eta_B = 0{,}5 \times 10^{-3}$,

$$\frac{R_h}{L} = 2\pi \times 1800 \times 0{,}5 \times 10^{-3} \times 4{,}4 \times 10^{-3} \times 318 = 7{,}9\ \Omega/\mathrm{H}.$$

Finally, eddy-current and residual losses are given by Eq.(6), assuming $\tan \delta/\mu_i = 0{,}5 \times 10^{-6}$:

$$\frac{R_{e+r}}{L} = 2\pi \times 1800 \times 318 \times 0{,}5 \times 10^{-6} = 1{,}8\ \Omega/\mathrm{H}.$$

Thus, from Eq (1), the total losses are

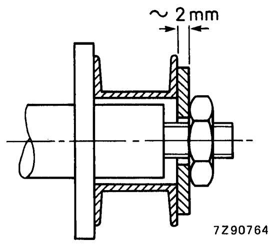
$$\frac{R_{tot}}{L} = 50\ 3\ 0{,}88 + 0{,}15 + 7{,}9 + 1{,}8 = 59{,}9\ \Omega/\mathrm{H},$$

so that the total coil resistance at 1800 Hz passing a current of 1 mA is $59{,}9 \times 88 \times 10^{-3} = 5{,}27\ \Omega$.
Note the very low contribution of the Ferroxcube 3H1 to the losses.

COIL WINDING RECOMMENDATIONS

PROTECTING THE COIL FORMER

The flanges of the coil former may be as thin as 0,2 mm. For this reason, it is necessary to support them during winding; this is best done by means of a flanged mandrel. As shown in the figure, this supports both barrel and flanges.

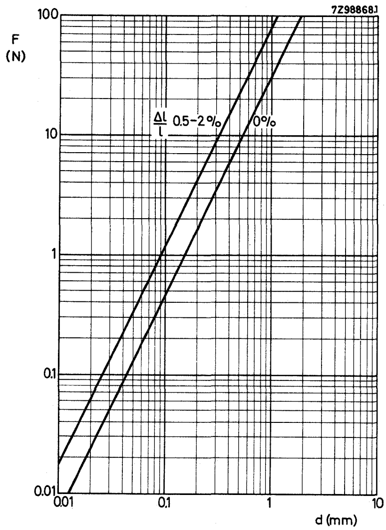


With wire of overall diameter less than about 0,4 mm, no attempt should be made to layer wind, but a random winding should be built up as evenly as possible. With wire of diameter greater than about 0,4 mm a compromise is usual: approximate layer winding, feasible at the start, should be continued as far as possible in order to achieve a satisfactory space factor.

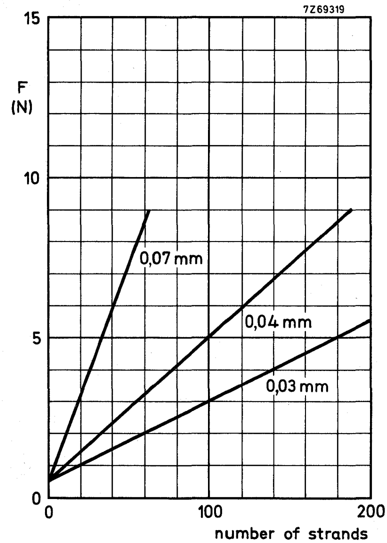
Each lead-out wire should be terminated at a convenient coil-former or tag-plate pin by soldering; dip soldering is the usual method. Solder-bath temperature and immersion time are largely dependent on the type of wire, but should not be more than necessary. A good flux is essential: preferably one that can be removed with warm water. To avoid contamination of coil former and tag plate, do not immerse the pins too far in the bath. Capillary action will ensure that good joints are made when the distance between the soldering-bath surface and coil-former or tag plate is about 1 mm.

WIRE TENSION

The two accompanying graphs may be used to find the wire tension required during winding.



Solid wire: tension F as a function of diameter d with extension Δl/l as a parameter.



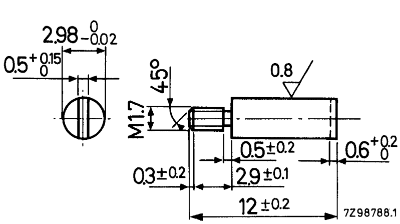
Bunched wire: tension F as a function of number of strands with the strand diameter as a parameter.

MOUNTING DATA

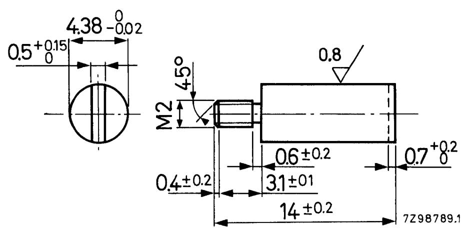
ASSEMBLING

Stable inductance is best achieved by gluing the coil former inside the core half with the nut; one small spot of a flexible silicon rubber kit is sufficient. With cores and accessories assembled according to the instructions in the data sheets, normal requirements of temperature, shock and vibration stability are met.

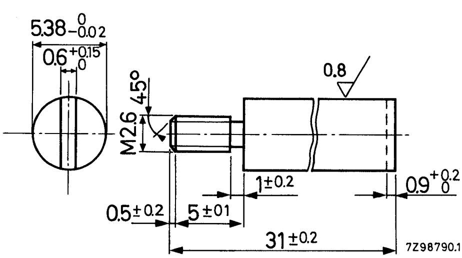
Since the clearance of the adjuster in core centre holes is small, core halves must be accurately centred during assembly. For *small-quantity production,* alignment plugs are useful aids. These are, however, not available as accessories, but should be made to the accompanying drawings. The recommended material is brass.



P14/8 and P18/11



P22/13



P26/16 to P42/29

material: brass

Core halves must be centred before mounting parts are fitted. These assembly plugs can also be used during impregnation with wax or other compounds. After impregnation, remove plugs and insert inductance adjusters; see Inductance Adjustment instructions in the data sheets.

For *large-quantity production,* special assembly tools have been designed that first centre the core halves and then bend the container lips of potcores and cross cores. For RM cores, the tools first centre the core halves and then apply the two spring clips. Drawings will be supplied on request; please use the ordering code in the accompanying table. See also the Mounting Parts section of the data sheets.

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
RM10	4322 058 00190
RM14	4322 058 00200
X22	4322 058 00080
X30	4322 058 00090
X35	4322 058 00100

INSERTING THE ADJUSTER NUT

Pre-adjusted cores are available with a nut for the inductance adjuster injection-moulded or cemented into one core half. The following instructions are for users who prefer to cement the nut themselves.

Push the nut into the central hole of one of the core halves from the flat side. The recommended distance between the nut and the core mating surface is given in the table on page 72. Cement the nut into the hole in the lower core half; a suitable adhesive is

1 part by weight Araldite DY023 5 parts by weight Araldite CY230 2,6 parts by weight Versamid 140	curing time: 2 hours at 80 °C.

Drawings only are available for tools recommended for nut insertion and will be supplied on request.

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

Drawings only are also available for metering devices for applying the adhesive to the inside of the core body.

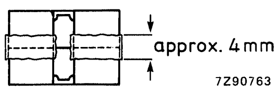
core type	drawing number of metering device
P14/8 and P18/11	7V12356
P22/13	7V12353
P26/16 to P42/29	7V12341

CEMENTING CORE HALVES TOGETHER

When our mounting parts are used it is not necessary to cement the core halves together

The guidelines given below for cementing core halves together are given for those customers who do not use our mounting parts.

1. Ensure that there is no dust on either the outside or the inside of the core halves. Remove any particles with a dry brush or rotary brushing machine.
2. Ensure that core halves are free of grease. Degrease in a trichlorethylene vapour bath for at least 10 seconds. After degreasing, protect against dust and do not handle.
3. Mix Araldite AY18 and hardener HZ18 in proportions of 4 : 3 by weight. An equal amount of chalk (marble flour) may be added. Pot life is about 2 weeks, depending on ambient temperature.
4. Put the wound coil former into the core, cementing to one core half if desired.
5. Centre the core halves and clamp; the recommended pressure on the mating surfaces is 200 Pa (0,02 kg/mm^2).
6. Heat the core to about 35 °C to drive off any moisture.
7. Brush adhesive around the cylindrical surface of the core, to about 2 mm either side of the joint line.



   With the core still clamped, put into an oven at 70 °C for 1 hour, followed by 1½ hours at 100 °C to cure. Cool room to temperature before unclamping.

8. With 4C6 material, more than one coat of adhesive may be necessary; alloy each coat to dry before applying the next. Clamping is necessary only while curing.

IMPREGNATION AND ENCAPSULATION

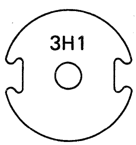
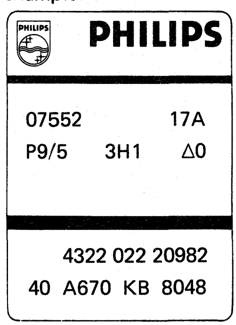
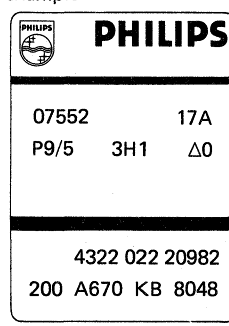
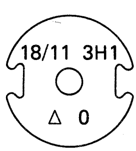
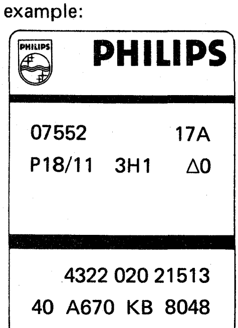
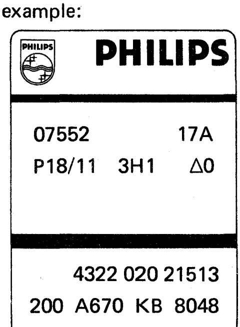
Encapculation or vacuum impregnation of a complete assembly is not recommended as it can cause the core material to become stressed and this is usually accompanied by unacceptable changes in permeability and temperature coefficient. If encapsulation is necessary, provide the core with a layer of wax by immersion before encapsulating.

Restrict vacuum impregnation to wound bobbins only. Note: bobbins wound with silk-covered wire must always be impregnated. After impregnation, take care that wax is not scraped off during coil assembly as it may become trapped between mating surfaces of the core.

Note: when extremely good temperature stability is required, subject the complete coil to five temperature cycles with a variation from room temperature to 70 °C at a rate not exceeding 1 °C per minute. This applies to all types of inductor assembly.

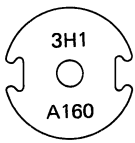
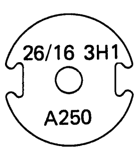
MARKING

MARKING OF POTCORE HALVES

product		marking on product	marking on label of primary pack	marking on label of storage pack
diameter ⩽ 15 mm *)	without air gap	material	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: 	example: 
diameter ⩾ 15 mm	without air gap	dimensions material Δ and 0 signs	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: 	example: 

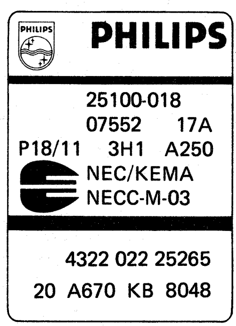
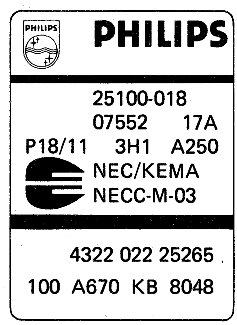
* Potcores with a dia. <9 mm are not marked.

MARKING OF POTCORE SETS

product		marking on product *	marking on label of primary pack	marking on label of storage pack
diameter ⩽ 15 mm	without or with air gap	material A or μ sign A_L or μ_e value**	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example:  	example: PHILIPS 07552 17A P14/8 3H1 A 160 4322 022 23255 20 A670 KB 8048	example: PHILIPS 07552 17A P14/8 3H1 A 160 4322 022 23255 100 A670 KB 8048
diameter ⩾ 15 mm	without or with air gap	dimensions material A or μ sign A_L or μ_e value**	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example:  	example: PHILIPS 07552 17A P26/16 3H1 A 250 4322 022 09260 20 A670 KB 8048	example: PHILIPS 07552 17A P26/16 3H1 A 250 4322 022 09260 100 A670 KB 8048

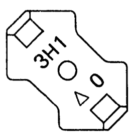
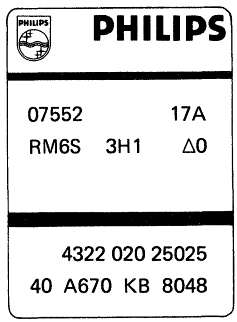
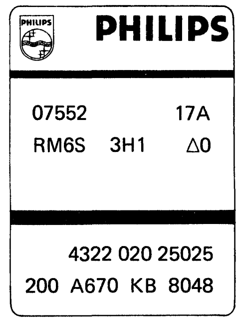
* Marked on the upper half (without nut).
** The A_L or μ_e sign is omitted where these values are ⩾ 1000.

MARKING OF POTCORE SETS WITH CECC APPROVAL

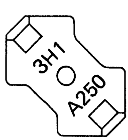
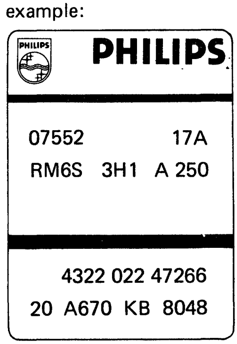
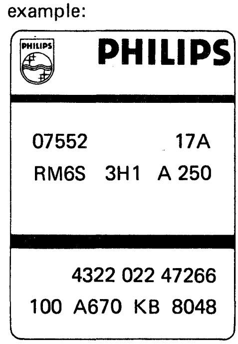
product		marking on product*	marking on label of primary pack	marking on label of storage pack
diameter $\geqslant$ 15 mm	with air gap	dimensions material PH sign A sign A_L value	Philips shield emblem and wordmark; specification number; delivery lot number; production lot number; designation; CECC symbol, name of national supervising inspectorate, code of authorized factory; code number; quantity; origin/traceability code; date of packing	Philips shield emblem and wordmark; specification number; delivery lot number; production lot number; designation; CECC symbol, name of national supervising inspectorate, code of authorized factory; code number; quantity; origin/traceability code; date of packing
		example: 	example: 	example: 

* Marked on the upper half (without nut).

MARKING OF RM-CORE HALVES

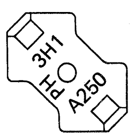
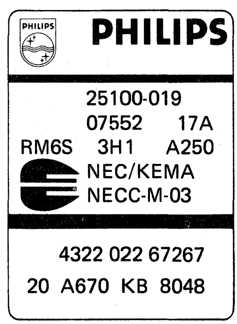
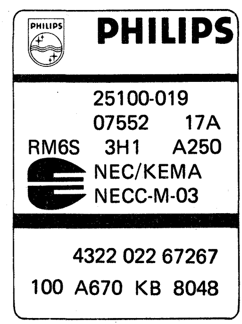
product		marking on product	marking on label of primary pack	marking on label of storage pack
square core halves	without air gap	material Δ and 0 signs	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: 	example: 

MARKING OF RM-CORE SETS

square core sets	without or with air gap	material A sign* A_L value	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: 	example: 

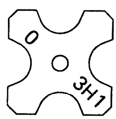
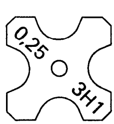
* The A sign is omitted from RM5 and smaller cores with A_L values ≥ 1000.

MARKING OF RM-CORE SETS WITH CECC APPROVAL

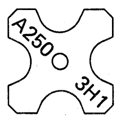
product		marking on product*	marking on label of primary pack	marking on label of storage pack
square core sets	with air gap	material PH sign (turned through 90^{o}) A sign A_L value	Philips shield emblem and wordmark; specification number; delivery lot number; production lot number; designation; CECC symbol, name of national supervising inspectorate, code of authorized factory; code number; quantity; origin/traceability code; date of packing	Philips shield emblem and wordmark; specification number; delivery lot number; production lot number; designation; CECC symbol, name of national supervising inspectorate, code of authorized factory; code number; quantity; origin/traceability code; date of packing
		example:  	example:  	example: 

* Marked on the upper half (without nut).

MARKING OF X-CORE HALVES

product		marking on product	marking on label of primary pack	marking on label of storage pack
cross core halves	without air gap	material Δ and 0 signs	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: PHILIPS 07552 17A X22 3H1 Δ0 4322 020 23513 40 A670 KB 8048	example: PHILIPS 07552 17A X22 3H1 Δ0 4322 020 23513 200 A670 KB 8048
	with air gap	material air-gap length (mm)	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: PHILIPS 07552 17A X22 3H1 0,25 4322 022 23742 20 A670 KB 8048	example: PHILIPS 07552 17A X22 3H1 0,25 4322 022 23742 100 A670 KB 8048

MARKING OF X-CORE SETS

product		marking on product	marking on label on primary pack	marking on label on storage pack
cross core sets	without or with air gap	material A sign* A_L value	delivery lot number production lot number; designation; code number; quantity; origin/traceability code; date of packing	delivery lot number; production lot number; designation; code number; quantity; origin/traceability code; date of packing
		example: 	example: PHILIPS 07552 17A X22 3H1 A250 4322 022 65262 20 A670 KB 8048	example: PHILIPS 07552 17A X22 3H1 A250 4322 022 65262 100 A670 KB 8048

* The A sign is omitted where A_L values are ⩾ 1000.

When ordering cores or associated parts, such as coil formers, adjusters and mounting parts, please quote the 12-digit catalogue number for the product in question given in the device data. Whenever this number ends with 'zero', the actual delivered goods may bear a different figure which is for logistic purposes only.
So if you order e.g. type 4322 021 30180 you may receive 4322 021 30182.

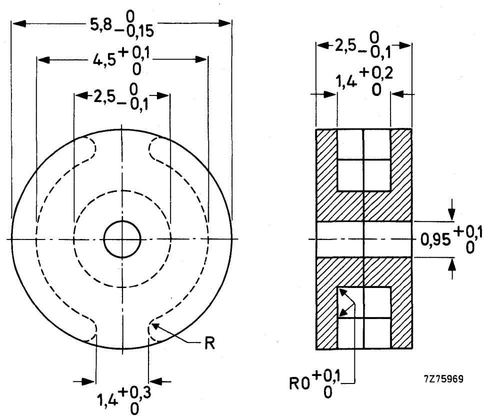
SECTION C
POTCORES AND ACCESSORIES

POTCORES

• CORE HALVES without air gap can be supplied.

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 100 core halves; a storage pack contains 500 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 1{,}39\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}347\ mm^{-3}$; $V_e = 22{,}3\ mm^3$; $l_e = 5{,}57\ mm$; $A_e = 4{,}01\ mm^2$.

Mass of a core set: 0,18 g.

ELECTRICAL DATA

The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed A_L value. A measuring coil as described in general section 'Potcores, square cores and cross cores, is inserted; the halves are pressed together with a force of 15 N.
The values are valid 5 minutes or more after clamping.

A_L ± 25%	f = 4 kHz	$\hat{B}$ = 1 mT	25 ± 1 °C	715

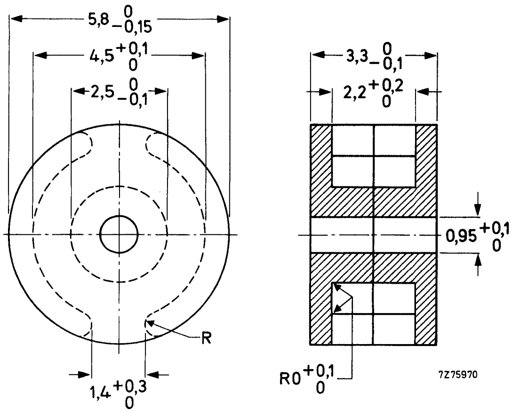
Catalogue number of a half core without air gap in grade 3H1: 4322 020 54300.

POTCORES

- CORE HALVES without air gap can be supplied.

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 100 core halves; a storage pack contains 500 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 1{,}68\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}358\ mm^{-3}$; $V_e = 37{,}0\ mm^3$; $l_e = 7{,}90$ mm; $A_e = 4{,}70\ mm^2$.

Mass of a core set: 0,23 g.

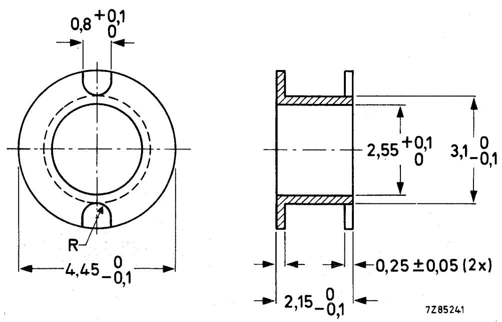
ELECTRICAL DATA

The combination of two potcores halves without air gap, randomly chosen from a batch, has the following guaranteed A_L value. A measuring coil as described in general section 'Potcores, square cores and cross cores', is inserted; the halves are pressed together with a force of 15 N. The value is valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3H1
A_L ± 25%	4	⩽ 1	25 ± 5	820

Catalogue number of a half core without air gap: 4322 020 54400

COIL FORMER



Catalogue number	4322 021 33550
Material	polyamide
Window area	1,1 mm^2
Mean length of turn	11,7 mm
Maximum temperature	130 °C
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 237 \times 10^3\ \Omega/H$
Mass	0,03 g

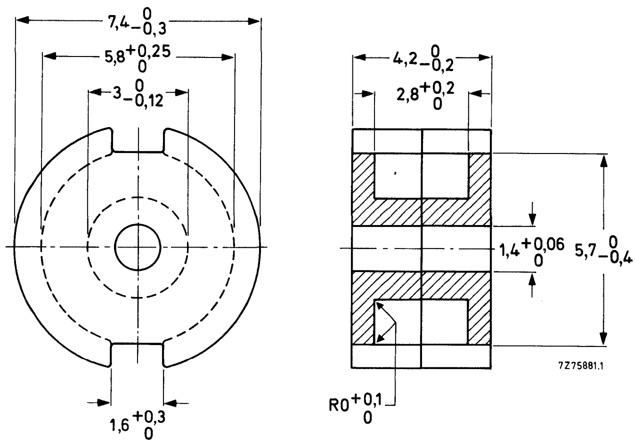
POTCORES

Two types of core can be supplied:

- CORE SETS without nut and pre-adjusted on an A_L value.
- CORE HALVES without air gap.

Potcores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 100 core halves; a storage pack contains 500 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 1{,}43\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}204\ mm^{-3}$; $V_e = 70\ mm^3$; $l_e = 10{,}0\ mm$; $A_e = 7{,}0\ mm^2$.

Mass of a core set: 0,46 g.

ELECTRICAL DATA

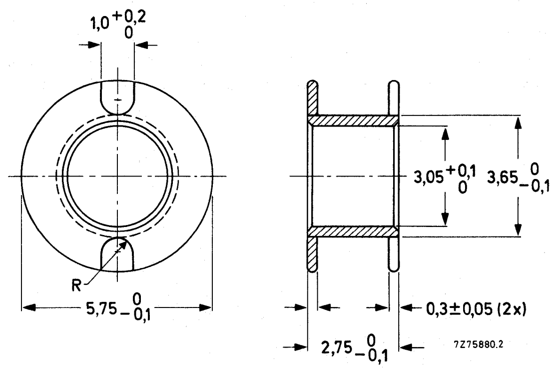
The combination of two potcore halves without air gap, randomly chosen from a batch, has the following guaranteed A_L value. A measuring coil as described in general section 'Potcores, square cores and cross cores', is inserted; the halves are pressed together with a force of 20 N. The value is valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3H1
A_L ± 25%	4	⩽ 1	25 ± 5	970

Core halves in 3H1 grade

air gap Δ in mm	catalogue number
0	4322 020 54600
0,06 ± 0,01	54610
0,12 ± 0,01	54620

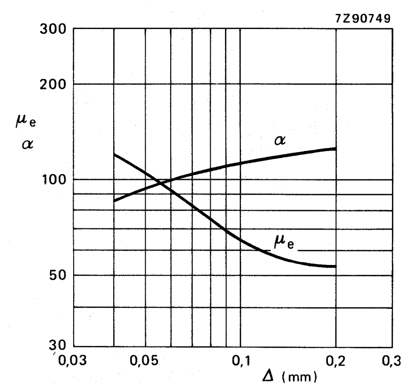
COIL FORMER



Catalogue number	4322 021 32990
Material	polyamide
Window area	2,2 mm²
Mean length of turn	14,6 mm
Maximum temperature	130 °C
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 137 \times 10^3\ \Omega/H$
Mass	0,04 g

CHARACTERISTIC CURVES

$\mu_e - \alpha$ curves



Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
FXC 3H1.

POTCORES

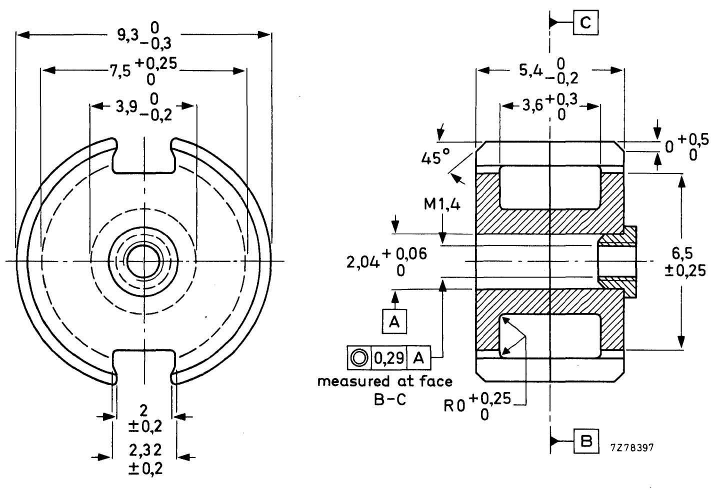
Three types of core can be supplied:

- 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), NCF83311 (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



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; $A_e = 10{,}1\ mm^2$;

$A_{CPmin} = 7{,}98\ mm^2$

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 square cores and cross cores, is inserted; the halves are pressed together with a force of 25 N. The values are valid 5 minutes or more after clamping.

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

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022 . . . . . 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	61230	41230		
100 ± 1,5%	100	• 61240	41240		
160 ± 2%	160	• 61250	41250		
250 ± 5%	250	61260	41260		

Cores with A_L ⩽ 63 have a symmetrical air gap.
Cores with A_L ⩾ 100 have an asymmetrical air gap.

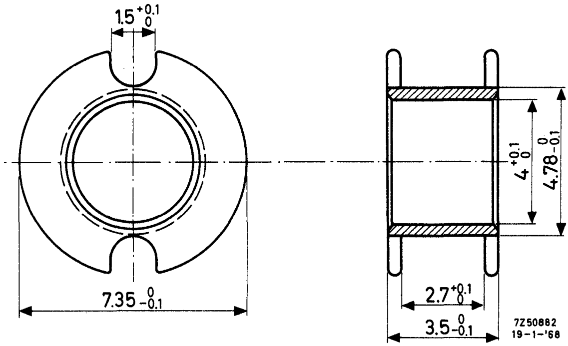
Core halves without air gap, without nut

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

• Preferred type.

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).



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	$\frac{R_O}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 69{,}5 \times 10^3\ \Omega/H$
Mass	0,07 g

INDUCTANCE ADJUSTERS

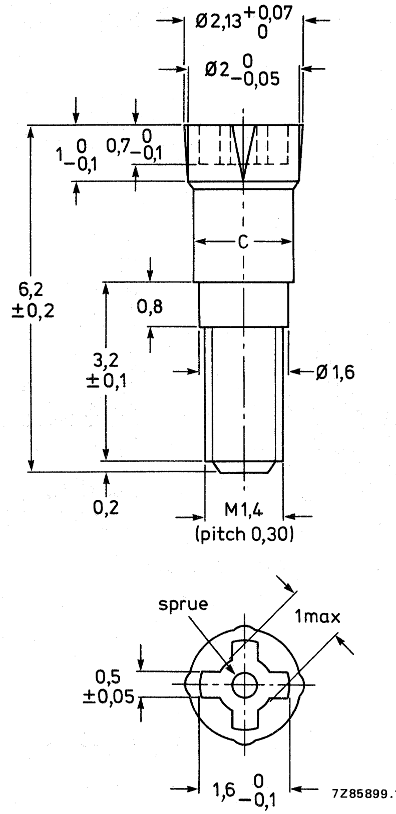


Table 1

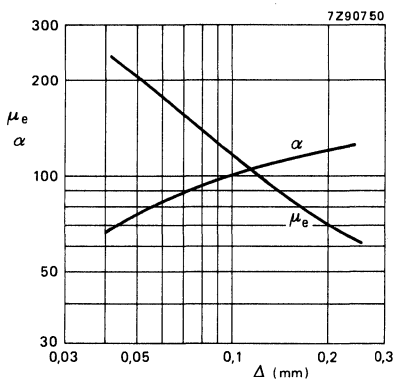
catalogue number	colour code	material	C
4322 021 39810	brown	FXC	1,85
39840	yellow	cip	1,92
39850	green	cip	1,92
39890	grey	FXC	1,92

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage.

core material	AL	low	%	medium	%	high	%
3H1	63	4322 021 39850	11	4322 021 39840	18	4322 021 39810	35
	100	39850	7	39840	11	39810	22
	160	39840	9	39810	14	39890	15
	250	39840	6	39890	10	–	
4C6	16	–		4322 021 39850	15	4322 021 39840	27
	25	–		39850	16	39840	27
	40	4322 021 39850	7	39840	11	–	

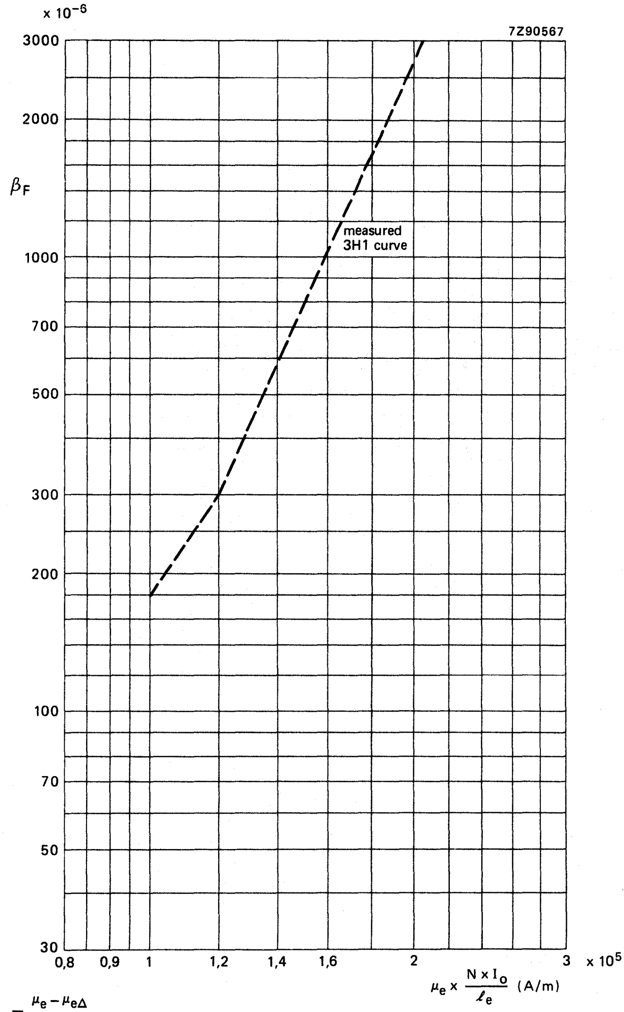
CHARACTERISTIC CURVES

μ_e-α CURVES



Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
μ_e = 1260 ± 25% at Δ = 3 μm for 3H1.

D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. polarization.

POTCORES

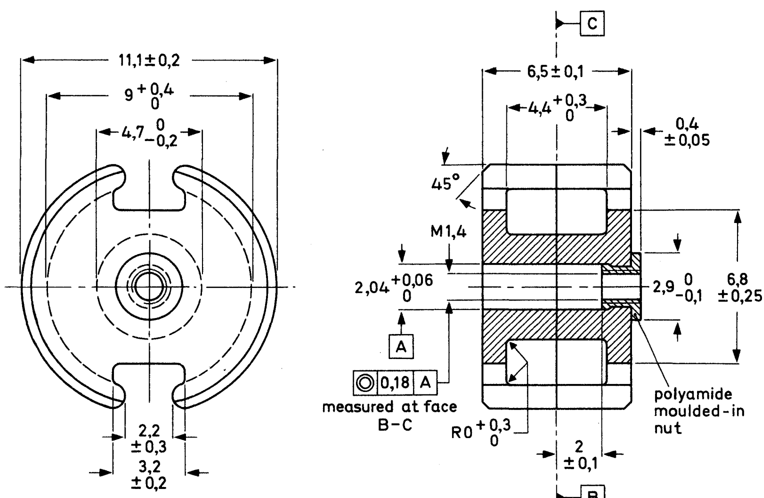
Three types of core can be supplied:

- 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), NCF 83311 (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



Pulling out force of the nut ⩾ 20 N

Torque of the screw thread ⩽ 4 mNm

Extraction force of adjuster from nut ⩾ 20 N

Dimensional quantities according to IEC 205:

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

$A_{CP\,min} = 13{,}3\ mm^2$

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, square cores and cross 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.	$\hat{B}$	temp.	grade					
	kHz	mT	°C	3B8	3D3		3H1		4C6
A_L ± 25%	4	⩽ 0,1	25 ± 1	1650	870		1700		160
μ_e ± 25%	4	⩽ 0,1	25 ± 1	1270	660		1300		125
α	4	⩽ 0,1	25 ± 1	⩽ 28,3	⩽ 39,2		⩽ 27,9		⩽ 90,5
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1						
	100	⩽ 0,1	25 ± 1		⩽ 8,0		⩽ 5,0		
	500	⩽ 0,1	25 ± 1		⩽ 14				
	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		
	100	0,3 to 1,2	25 ± 1		⩽ 1,8				⩽ 6,2
$\alpha_F \times 10^6$/K	⩽ 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 to + 2				
$D_F \times 10^6$ (10-100 min)	⩽ 100	⩽ 0,1	25 ± 0,1		⩽ 15		⩽ 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					
= 1,50 x 10^5 A/m				⩽ 300					
= 2,15 x 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				
		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	01900	21440	• 21240		
160 ± 1,5%	122			• 21250		
250 ± 3%	190	• 01920		• 21260		
400 ± 8%	305	01940				

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022				
			3D3	3H1		4C6
15 ± 1%	225					20810
22 ± 1%	186					20820
33 ± 1%	152		20430			20830
47 ± 1%	127		20440			
68 ± 1%	105,8		20450	20250		
100 ± 1,5%	87,5			20260		
150 ± 2%	71,2			20270		
220 ± 5%	58,8			20280		
660 ± 25%	33,9		00400			
1300 ± 25%	24,2			00200		

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.

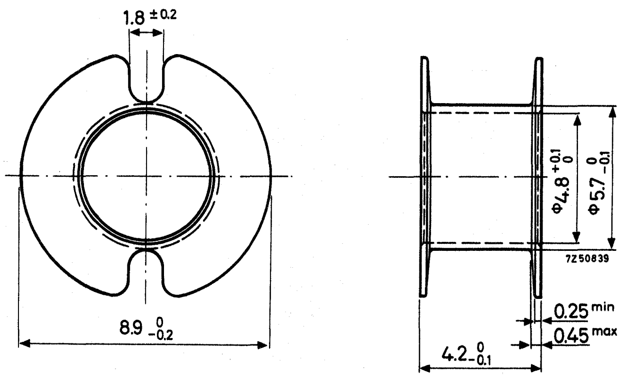
Core halves without air gap, without nut

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

• Preferred type.

COIL FORMER

The dimensions conform with the following specifications: IEC 133 (international), NCF 83311 livre 1 (France), DIN 41 294 (Germany) and BS 4061 range 2 (Great Britain).



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

INDUCTANCE ADJUSTERS

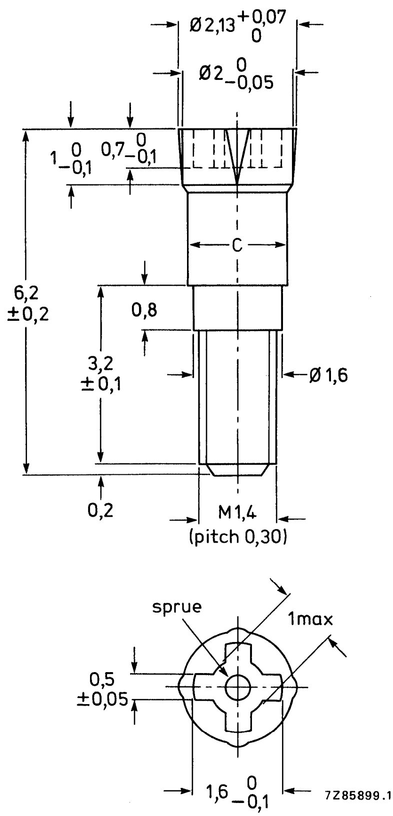


Table 1

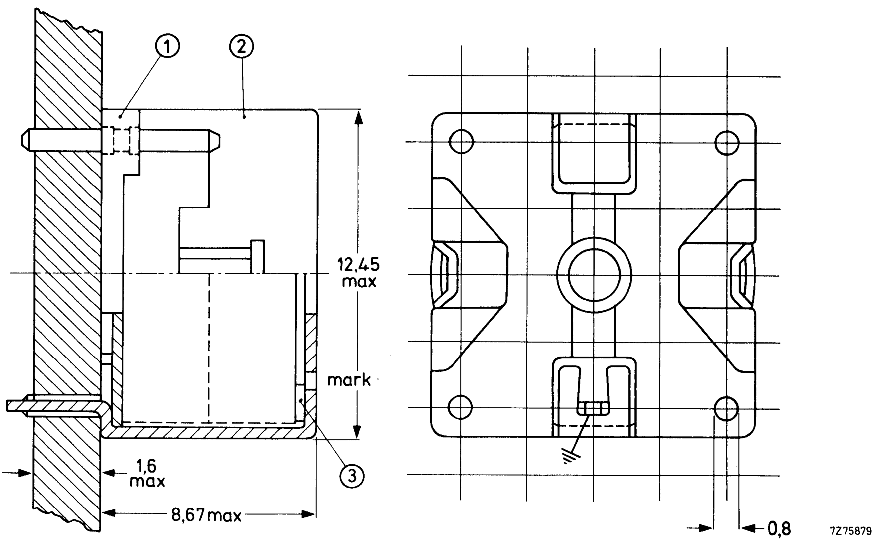
catalogue number	colour code	material	C
4322 021 39810	brown	FXC	1,85
39840	yellow	cip	1,92
39850	green	cip	1,92
39890	grey	FXC	1,92

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting pergentage.
P11/7

core material	A_L	low	%	medium	%	high	%
3H1, 3B8	100	4322 021 39850	7	4322 021 39840	13	4322 021 39810	24
	160	39840	7	39810	15	39890	22
	250	39810	10	39890	14	–	
3D3	16	4322 021 39850	12	4322 021 39840	19	–	
	25	–		39850	18	4322 021 39840	27
	40	–		39850	15	39840	24
	63	4322 021 39850	10	39840	18	–	
	100	39850	6	39840	11	–	
4C6	16	–		4322 021 39850	13	4322 021 39840	19
	25	–		39850	15	39840	22
	40	4322 021 39850	9	39840	16	–	

MOUNTING PARTS

MOUNTING



(1) tag plate 4322 021 30180
(2) brass container 4322 021 30510
(3) spring 4322 021 30620

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.

The container is provided with an earth tag.

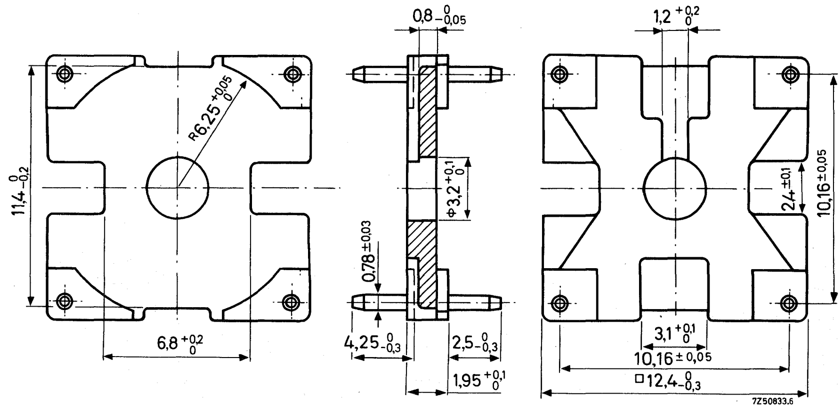
It is recommended that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.

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 N. After bending the lips the spring will have the correct tension.

PART DRAWINGS (dimensions in mm)

(1) **tag plate** 4322 021 30180

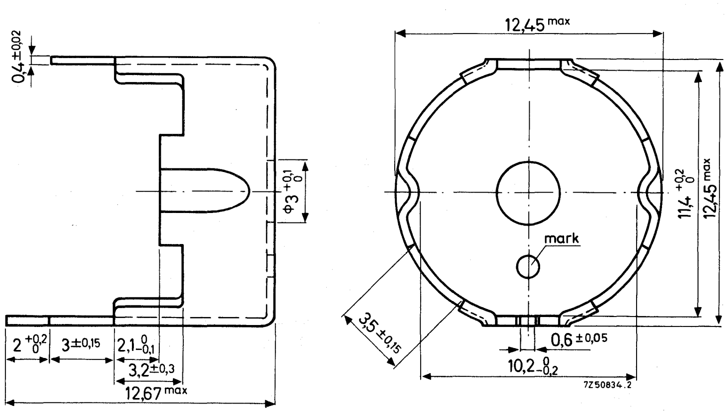
Plate: polyester reinforced with glass fibre, resistant against dip-soldering at 400 °C for 2 s.
Pins : phosphor bronze, dip-soldered



The tag plates are packed on a polystyrene plate of 200 and 5 plates (1000 pcs) in a cardboard box. Please order in multiples of these quantities.

(2) **container** 4322 021 30510

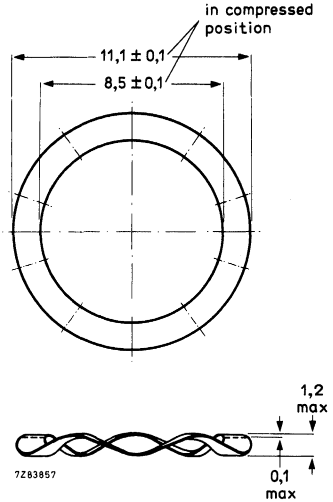
Material: brass, nickel plated, thereafter tin plated.



The containers are packed in cardboard boxes of 2000. Please order in multiples of this quantity.

(3) **Spring** 4322 021 30620

Material: chrome-nickel steel

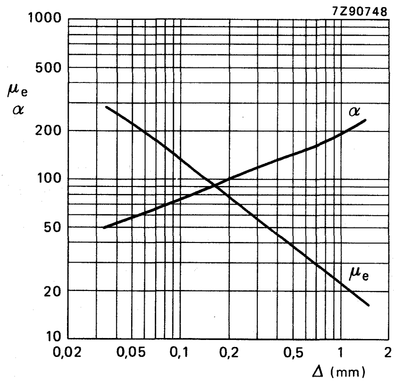


A force of min. 25 N is required to compress the spring to 0,5 mm.
A force of max. 55 N is required to compress the spring to 0,2 mm.

The springs are supplied in quantities of 2500. Please order in multiples of this quantity.

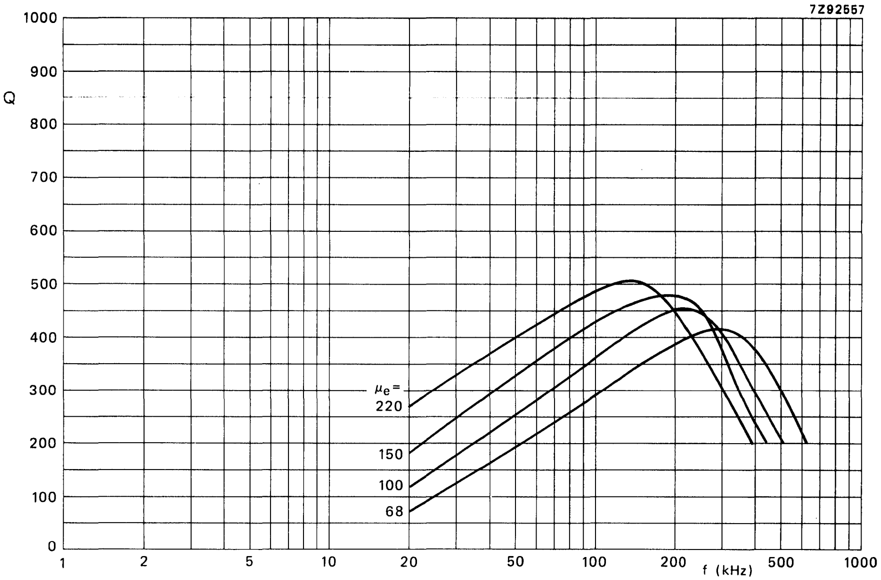
CHARACTERISTIC CURVES

μ_e-α CURVES



Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
$\mu_e \leqslant 975$ at $\Delta = 3\ \mu m$ for 3 H1.

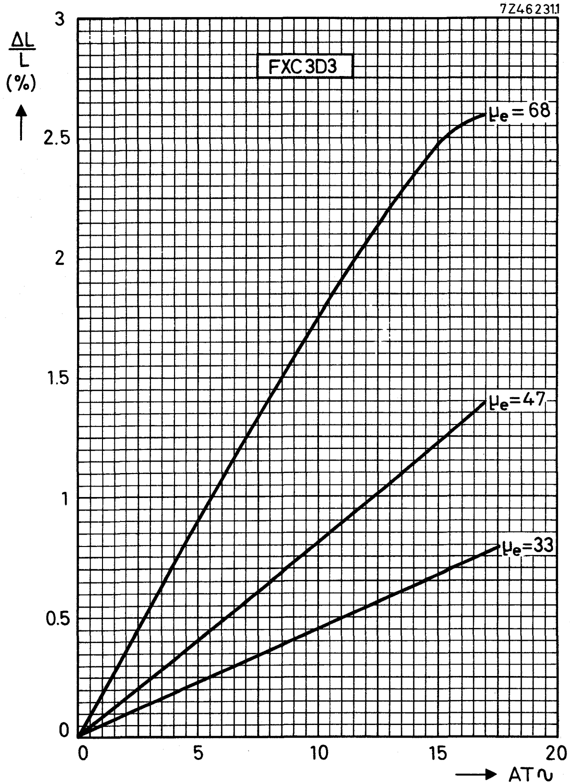
TYPICAL Q-CURVES FOR FXC 3H1

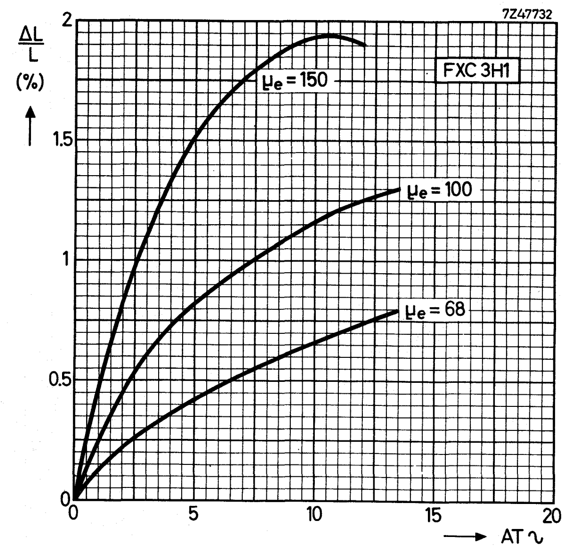


Enveloping curves.

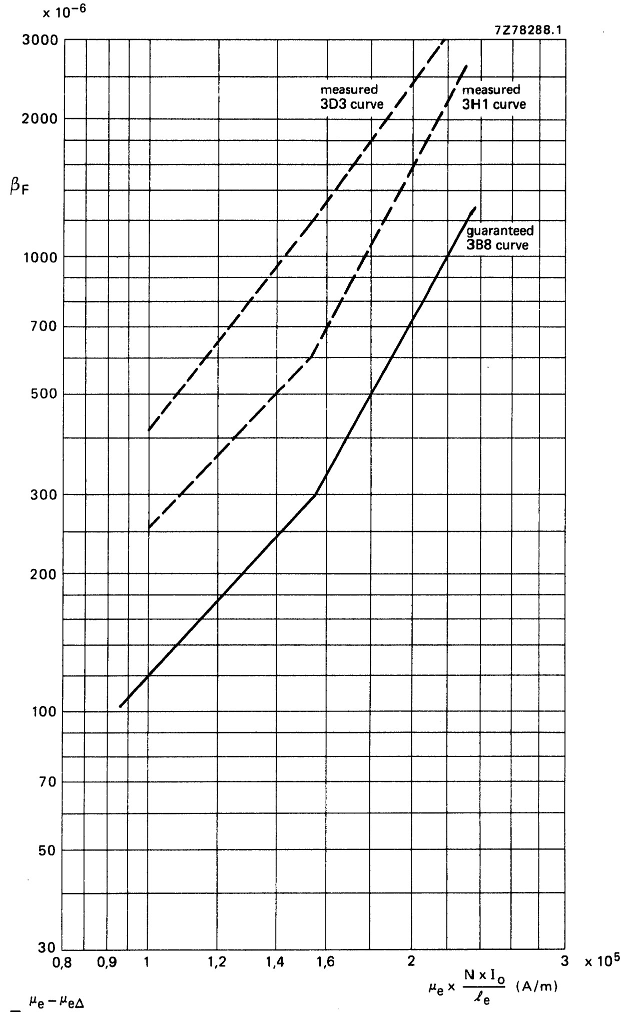
Coil former 4322 021 30240.

INDUCTANCE VARIATION AS A FUNCTION OF AT ~





D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. polarization.

POTCORES

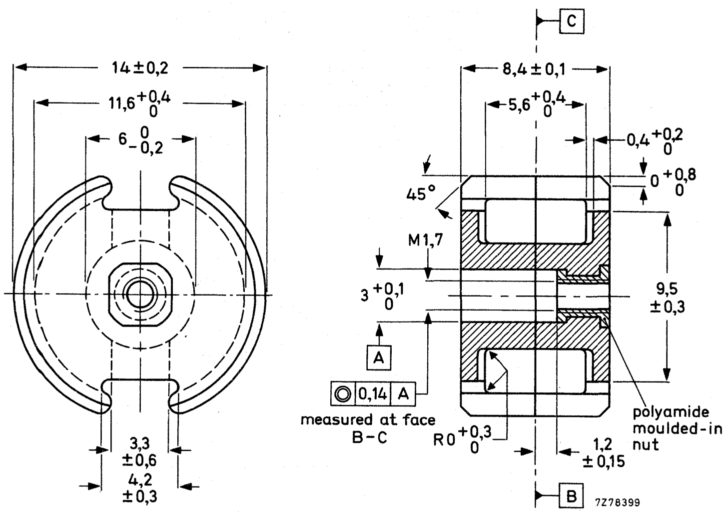
Three types of core can be supplied:

- 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), NCF 83311 (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



Pulling out force of the nut ⩾ 30 N

Torque of the screw thread ⩽ 8 mNm

Extraction force of adjuster from nut ⩾ 20 N

Dimensional quantities according to IEC 205:

Note: the 4C6 version has a cemented nut.

$C_1 = \Sigma \frac{l}{A} = 0{,}789\ \text{mm}^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0315\ \text{mm}^{-3}$; $V_e = 495\ \text{mm}^3$; $l_e = 19{,}8$ mm; $A_e = 25{,}1\ \text{mm}^2$;

$A_{CP\,min} = 20{,}0\ \text{mm}^2$.

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, square cores and cross 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	$\hat{B}$ mT	temp. °C	grade 3B8	3D3	3H1	4C6
$A_L \pm 25\%$	4	$\leq 0,1$	25 ± 1	2200	1080	2200	200
$\mu_e \pm 25\%$	4	$\leq 0,1$	25 ± 1	1400	680	1400	125
α	4	$\leq 0,1$	25 ± 1	$\leq$ 24,5	$\leq$ 35,1	$\leq$ 24,4	$\leq$ 81,8
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	$\leq 0,1$	25 ± 1				
	30	$\leq 0,1$	25 ± 1				
	100	$\leq 0,1$	25 ± 1		$\leq$ 8,0	$\leq$ 5,0	
	500	$\leq 0,1$	25 ± 1		$\leq$ 14		
	1000	$\leq 0,1$	25 ± 1		$\leq$ 30		
	2000	$\leq 0,1$	25 ± 1				$\leq$ 40
	10 000	$\leq 0,1$	25 ± 1				$\leq$ 100
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			$\leq$ 0,86	
	30	1,5 to 3,0	25 ± 1				
	100	0,3 to 1,2	25 ± 1		$\leq$ 1,8		$\leq$ 6,2
$\alpha_F \times 10^6$/K	$\leq$ 100	$\leq 0,1$	5 to 25			+ 0,5 to + 1,5	−2 to + 4
	$\leq$ 100	$\leq 0,1$	25 to 55			+ 0,5 to + 1,5	0 to + 6
	$\leq$ 100	$\leq 0,1$	25 to 70		0 to + 2		
$D_F \times 10^6$ (10-100 min)	$\leq$ 100	$\leq 0,1$	25 ± 0,1		$\leq$ 12	$\leq$ 4,3	$\leq$ 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				$\leq$ 100			
= 1,50 x 10^5 A/m				$\leq$ 300			
= 2,15 x 10^5 A/m				$\leq$ 1050			

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022			
		3B8	3D3	3H1	4C6
25 ± 1%	15,7				23810
40 ± 1%	25		23420		• 23820
63 ± 1%	39,5		• 23430		23830
100 ± 1%	63		23440	23240	
160 ± 1,5%	100,5			• 23250	
250 ± 2%	157	• 03860		• 23260	
315 ± 2%	198			23270	
400 ± 2%	252	03880		23280	
630 ± 3%	396	03890		23300	

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022			
		3B8	3D3	3H1	4C6
15 ± 1%	205				22810
22 ± 1%	169				22820
33 ± 1%	137,9		22430	22230	22830
47 ± 1%	115,5		22440	22240	
68 ± 1%	96,1		22450	22250	
100 ± 1,5%	79,2			22260	
150 ± 2%	64,6			22270	
220 ± 3%	53,3			22280	
680 ± 25%	30,3		02400		
1400 ± 25%	21,2			02200	

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.

Core halves without air gap, without nut:

Ferroxcube grade	catalogue number
3B8	4322 020 21400
3D3	4322 020 21270
3H1	4322 020 21260
4C6	4322 020 21350

• Preferred type.

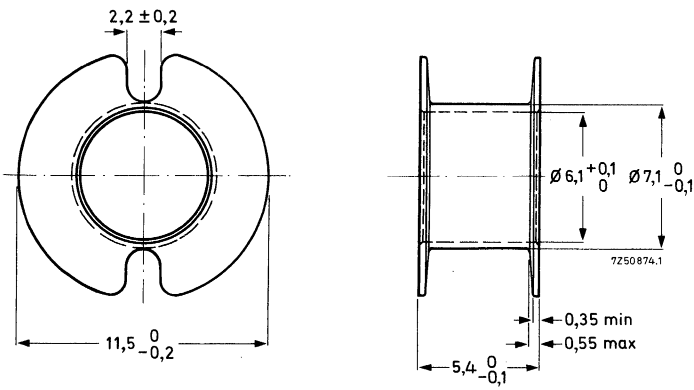
COIL FORMERS

Two types of coil former can be supplied:

- with one section;
- with two sections.

The dimensions conform with the following specifications: IEC 133 (international), NCF 83311 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



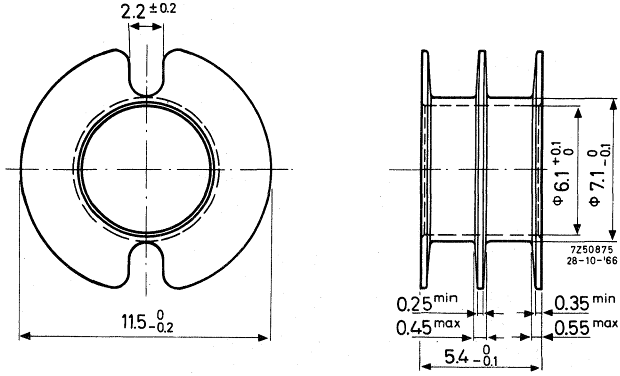
Catalogue number	4322 021 30250
Material	polycarbonate
Window area	9,7 mm²
Mean length of turn	29 mm
Max. temperature	130 °C

D.C. losses

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

Mass 0,15 g

TWO-SECTION COIL FORMER



Catalogue number	4322 021 30260
Material	polycarbonate
Window area	2 x 4,5 mm²
Mean length of turn	29 mm
Max. temperature	130 °C

D.C. losses

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

Mass 0,2 g

INDUCTANCE ADJUSTERS

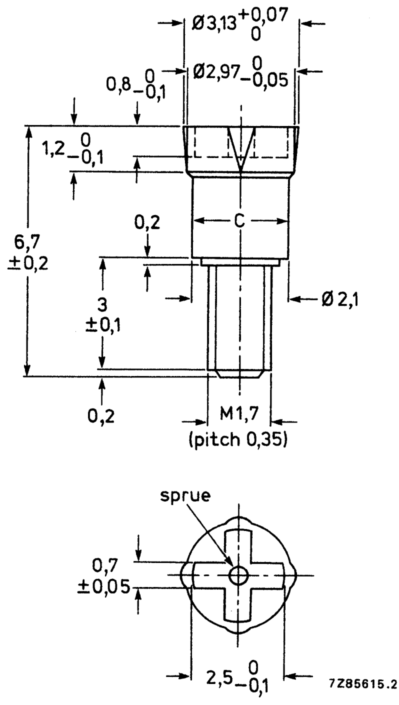


Table 1

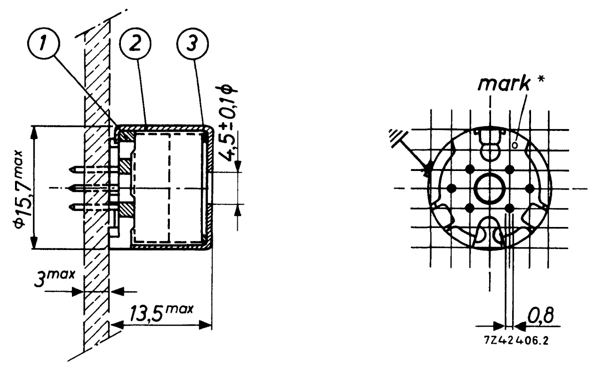
catalogue number	colour code	material	C
4322 021 39700	black	FXC	2,86
39710	brown	FXC	2,80
39720	red	cip	2,80
39730	orange	cip	2,90
39740	yellow	FXC	2,52
39750	green	cip	2,68
39780	white	FXC	2,68
39790	grey	FXC	2,90

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P14/8

core material	A_L	low	%	medium	%	high	%
3H1, 3B8	100	4322 021 39750	9	4322 021 39730	14	4322 021 39740	19
	160	39720	11	39780	17	39710	23
	250	39780	11	39710	15	39700	19
	315	39780	9	39700	15	39790	19
	400	39710	9	39790	15	–	
	630	39710	6	39790	10	–	
3D3	40	–		4322 021 39750	16	4322 021 39730	24
	63	–		39750	13	39730	20
	100	4322 021 39730	11	39740	15	–	
4C6	25			4322 021 39750	16	4322 021 39730	20
	40	4322 021 39750	12	39730	18	39720	22
	63	39730	10	39720	3	–	

MOUNTING PARTS

MOUNTING ON PRINTED-WIRING BOARDS



(1) tag plate	4322 021 30440
(2) brass container	4322 021 30520
(3) spring	4322 021 30630

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

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.

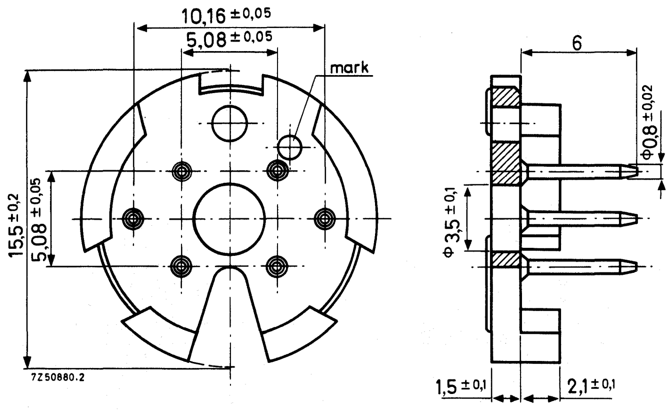
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 60 N. After bending the lips the spring will have the correct tension.

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

PART DRAWINGS

Tag plate 4322 021 30440

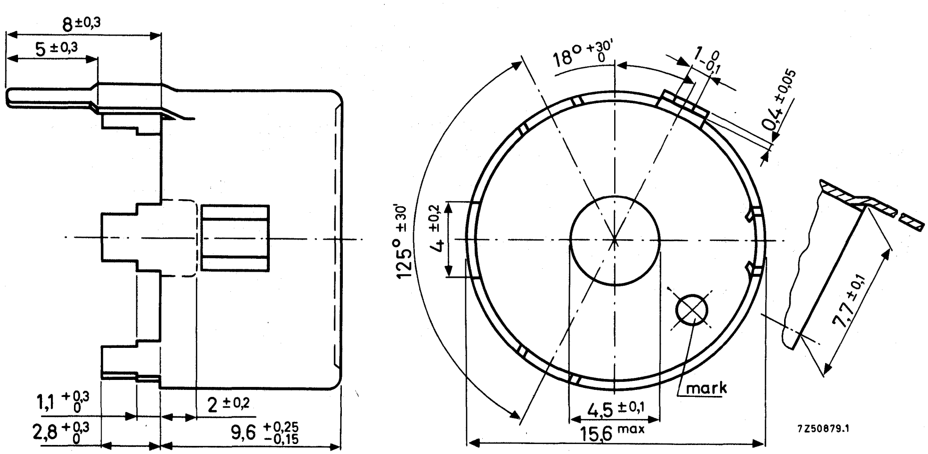
Plate: polyester reinforced with glass fibre resistant against dip-soldering at 400 °C for 2 s.
Pins: phosphor bronze, dip-soldered.



The tag plates are packed in units of 100 pieces on a polystyrene plate, and with 500 to a cardboard box. Please order in multiples of these quantities.

Container for mounting on printed-wiring boards 4322 021 30520

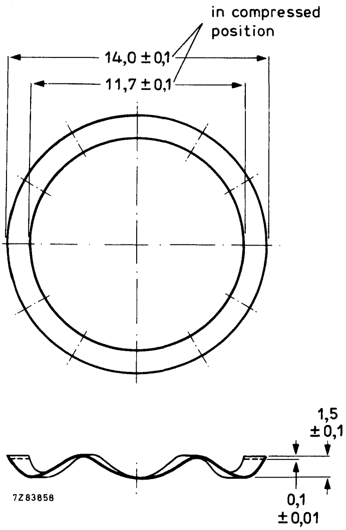
Material: brass, nickel plated then tin plated.



The containers are packed in a primary pack of 70 pieces and a storage pack of 350 pieces. Please order in multiples of these quantities.

Spring 4322 021 30630

Material: chrome-nickel steel

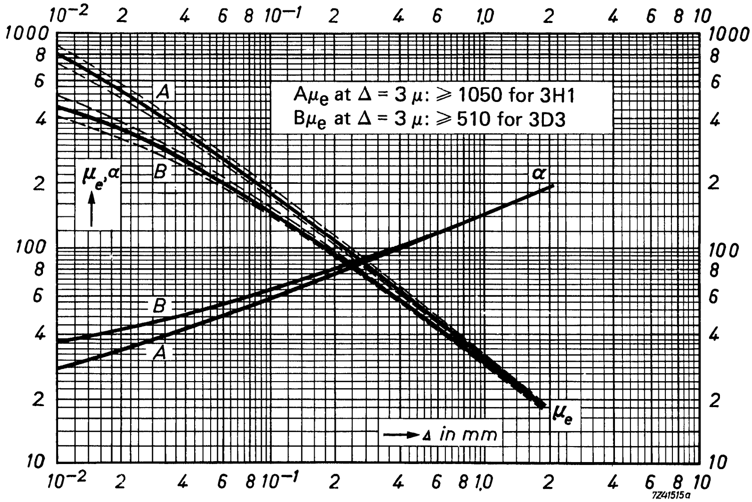


A force of 45 to 75 N is required to compress the spring to 0,35 mm.

The springs are packed in units of 2000 pieces. Please order in multiples of this quantity.

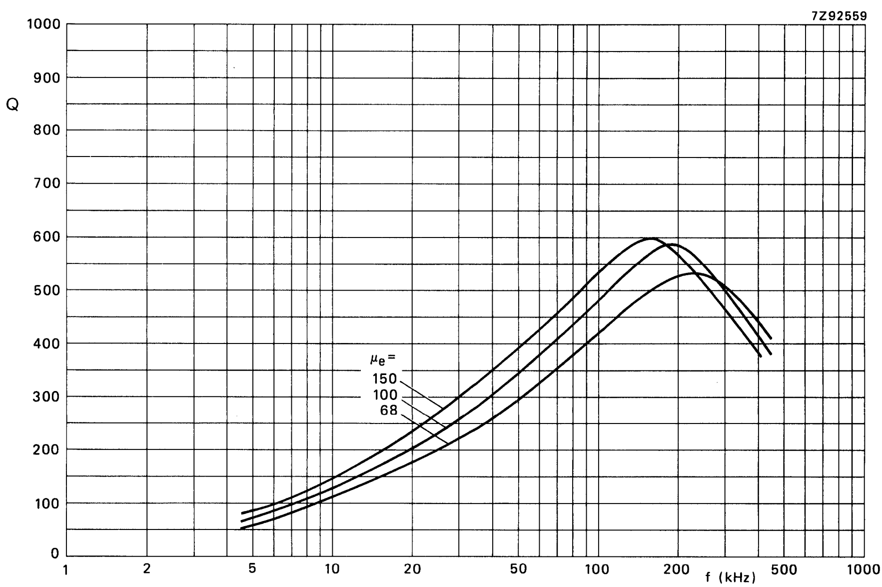
CHARACTERISTIC CURVES

μ_e-α CURVES



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

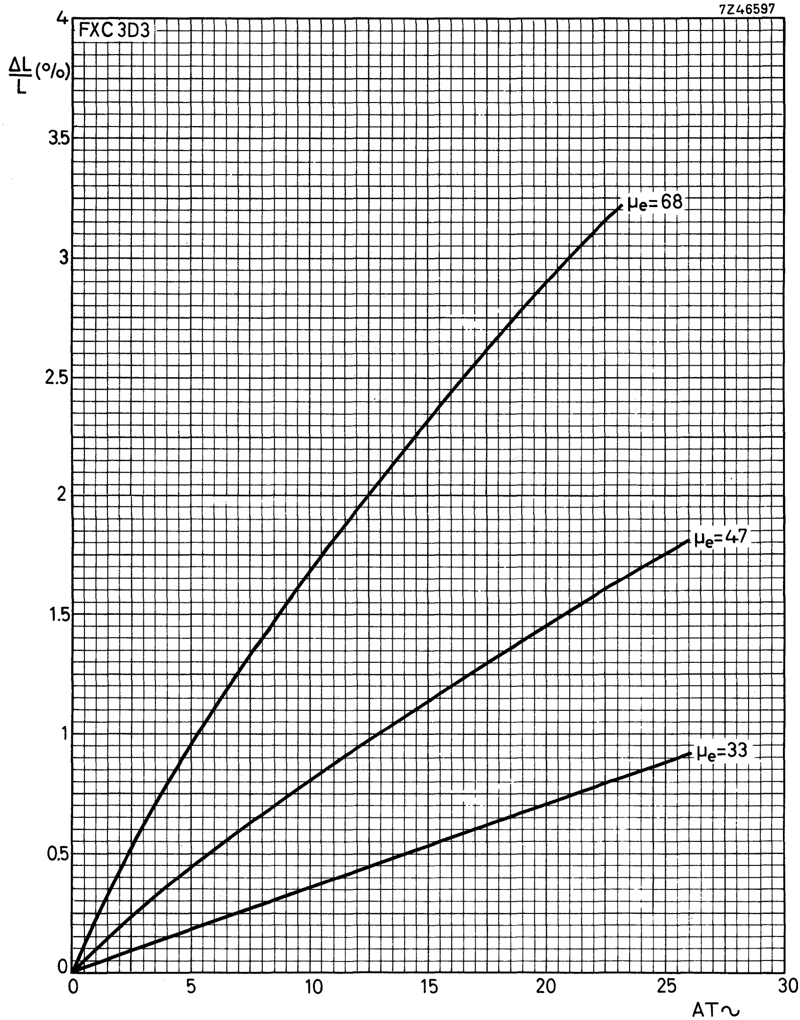
TYPICAL Q-CURVES

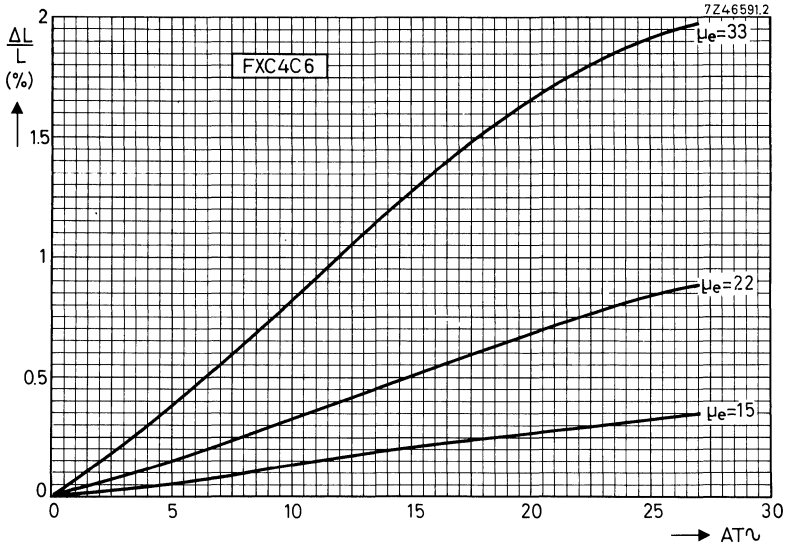


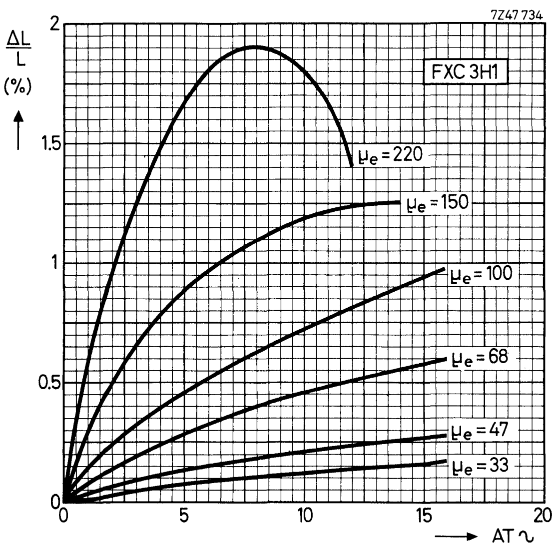
Enveloping curves

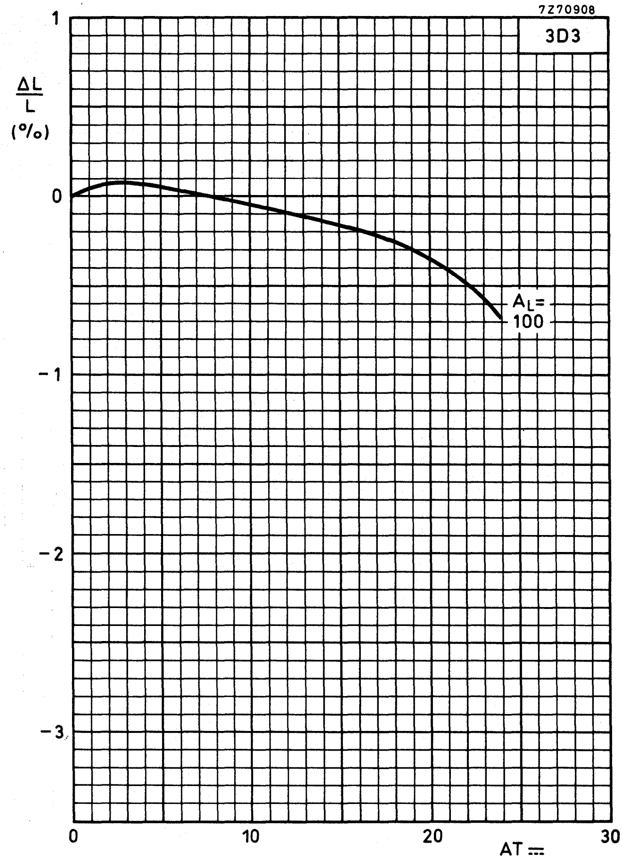
Single-section coil former

INDUCTANCE VARIATION AS A FUNCTION OF AT~

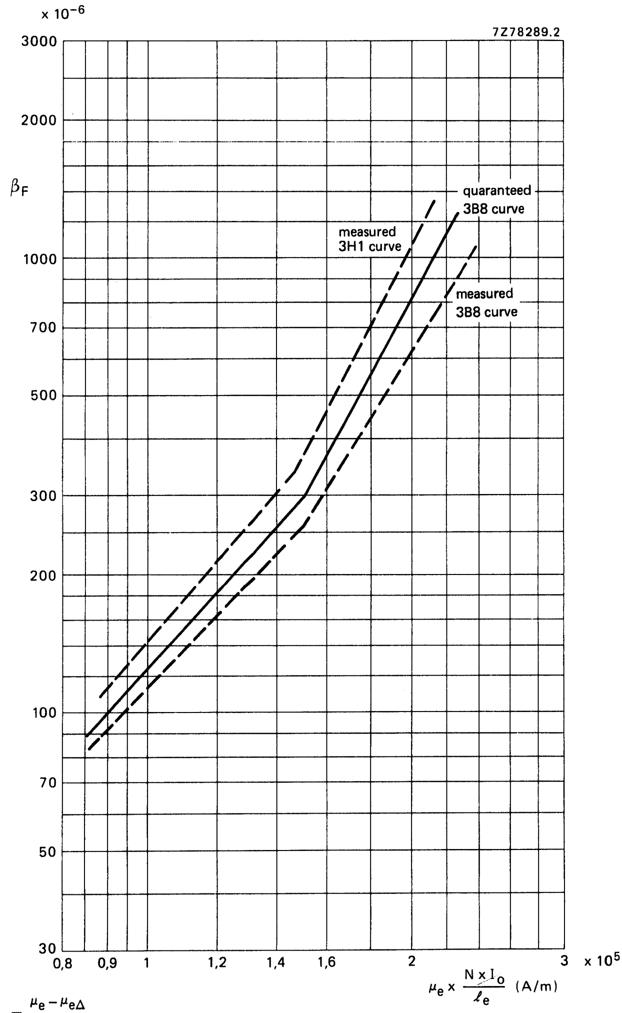



7Z46591.2
FXC4C6
ΔL/L (%)
μe=33
μe=22
μe=15
0
0.5
1
1.5
2
0
5
10
15
20
25
30
AT∿


7Z47734
FXC 3H1
ΔL/L (%)
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∿


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

D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. polarization.

POTCORES

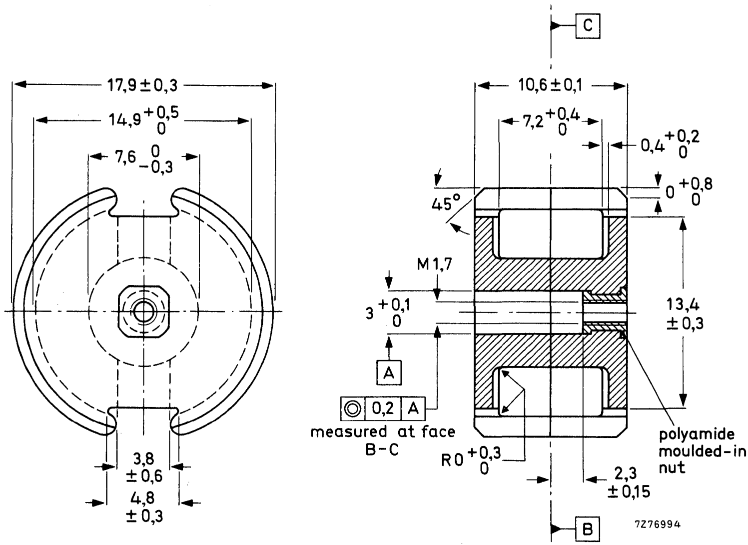
Three types of core can be supplied:

- 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), NCF83311 (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



Pulling-out force of the nut ⩾ 30 N

Torque of the screw thread ⩽ 8 mNm

Extraction force of adjuster from nut ⩾ 20 N

Note: the 4C6 version has a cemented nut.

Dimensional quantities according to IEC 205:

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

$A_{CPmin} = 36{,}3\ mm^2$

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, square cores and cross 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. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	3D3	3H1	3H3	4C6
A_L ± 25%	4	≤ 0,1	25 ± 1	3080	1500	3650	3100	260
μ_e ± 25%	4	≤ 0,1	25 ± 1	1470	700	1750	1475	125
α	4	≤ 0,1	25 ± 1	≤ 20,8	≤ 29,9	≤ 19,0	≤ 20,0	≤ 71,1
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1					
	30	≤ 0,1	25 ± 1				≤ 1,8	
	100	≤ 0,1	25 ± 1		≤ 8,0	≤ 5,0	≤ 2,9	
	500	≤ 0,1	25 ± 1		≤ 14			
	1 000	≤ 0,1	25 ± 1		≤ 30			
	2 000	≤ 0,1	25 ± 1					≤ 40
	10 000	≤ 0,1	25 ± 1					≤ 100
P (W)	25	200**	25 ± 1	≤ 0,30				
			100 ± 1	≤ 0,35				
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			≤ 0,86		
	30	1,5 to 3,0	25 ± 1				≤ 0,75	
	100	0,3 to 1,2	25 ± 1		≤ 1,8			≤ 6,2
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1	5 to 25			+ 0,5 to 1,5	+ 0,7 ± 0,3	−2 to + 4
	≤ 100	≤ 0,1	25 to 55			+ 0,5 to 1,5	+ 0,7 ± 0,3	0 to + 6
	≤ 100	≤ 0,1	25 to 70		0 to + 2		+ 0,7 ± 0,3	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 12	≤ 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 10⁵ A/m				≤ 120				
= 1,60 x 10⁵ A/m				≤ 300				
= 2,30 x 10⁵ A/m				≤ 1100				

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

** $\hat{B}$ is calculated with A_{CPmin} = 36,3 mm².

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022				
		3B8	3D3	3H1	3H3	4C6
25 ± 1%	11,9					25810
40 ± 1%	19,0		25420			● 25820
63 ± 1%	30		● 25430	25230		25830
100 ± 1%	47,5		25440	25240		
160 ± 1%	76	05910	25450	25250		
250 ± 1,5%	119			● 25260*	● 25560	
315 ± 2%	149			● 25270	● 25570	
400 ± 2%	190	● 05940		25280	25580	
630 ± 3%	298	05950		25300	25600	
1000 ± 5%	475			25310		
1250 ± 5%	593			05370		

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022				
		3B8	3D3	3H1	3H3	4C6
15 ± 1%	178					24810
22 ± 1%	147					24820
33 ± 1%	120		24430	24230		24830
47 ± 1%	100,5		24440	24240		
68 ± 1%	83,6		24450	24250		
100 ± 1,5%	68,9			24260		
150 ± 2%	56,3			24270		
220 ± 3%	46,5			24280		
705 ± 25%	25,9		04400			
1750 ± 25%	16,5			04200		

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 $\mu_e \geqslant 100$ and all 3B8 cores have an asymmetrical air gap.

Core halves without air gap, without nut:

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

● Preferred type.
* Approval according to CECC 25 100-018.

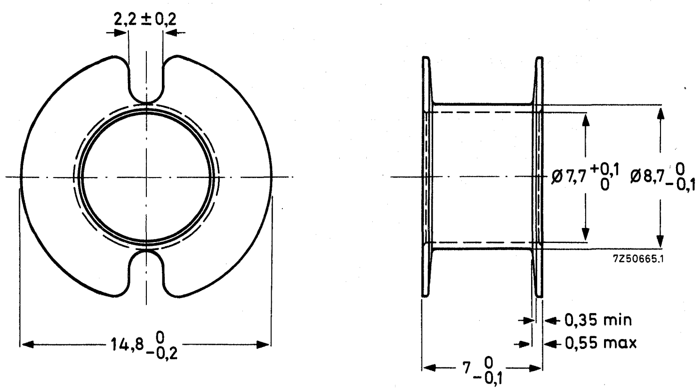
COIL FORMERS

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), NCF83311 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



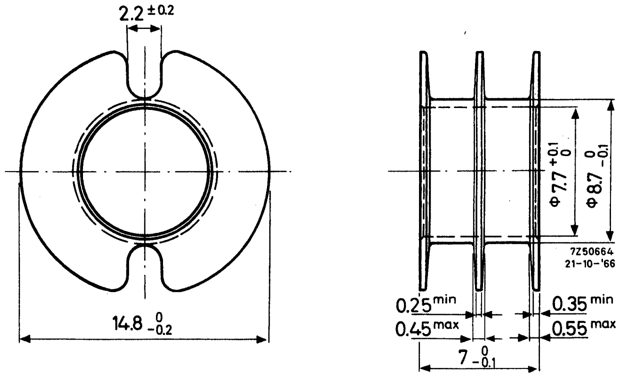
Catalogue number	4322 021 30270
Material	polycarbonate
Window area	18 mm^2
Mean length of turn	37 mm
Max. temperature	130 °C

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



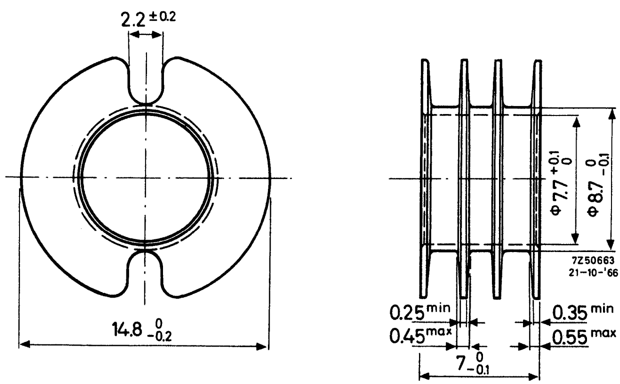
Catalogue number	4322 021 30280
Material	polycarbonate
Window area	2 x 8,7 mm^2
Mean length of turn	37 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} \times \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 17{,}2 \times 10^3\ \Omega/H$$

Mass 0,35 g

THREE-SECTION COIL FORMER



Catalogue number	4322 021 30290
Material	polycarbonate
Window area	3 x 5,4 mm^2
Mean length of turn	37 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} \times \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 18{,}4 \times 10^3\ \Omega/H$$

Mass 0,4 g

INDUCTANCE ADJUSTERS

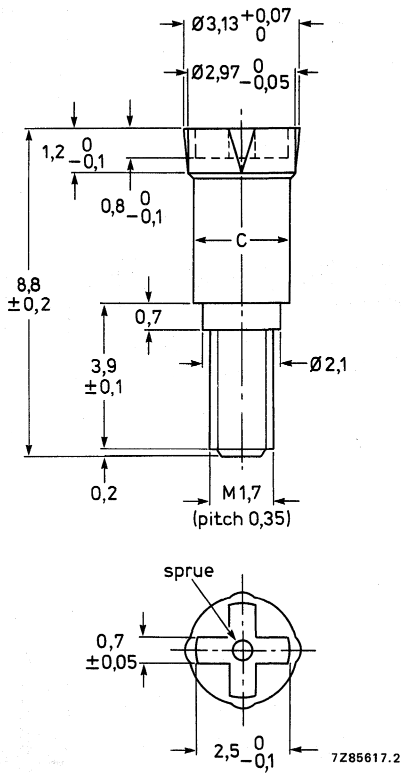


Table 1

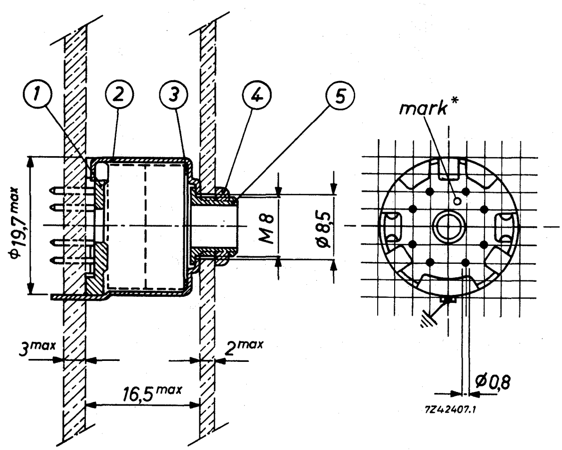
catalogue number	colour code	material	C
4322 021 39600	black	FXC	2,90
39610	brown	FXC	2,72
39620	red	FXC	2,52
39630	orange	cip	2,72
39640	yellow	cip	2,90
39650	green	cip	2,72
39670	violet	FXC	2,83
39680	white	FXC	2,62

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P18/11

core material	A_L	low	%	medium	%	high	%
3H1, 3H3, 388	63	4322 021 39650	12	4322 021 39640	17	4322 021 39630	20
	100	39650	9	39630	15	39610	29
	160	39640	9	39620	18	39610	28
	250	39620	12	39680	14	39610	18
	315	39620	9	39610	14	39670	20
	400	39680	9	39670	16	39600	24
	630	39670	10	39600	15	–	
	1000	39670	6	39600	10	–	
	1250	–		39600	8	–	
3D3	40			4322 021 39650	15	4322 021 39640	20
	63	4322 021 39650	13	39640	17	39630	20
	100	39650	9	39630	14	39620	24
	160	39630	8	39620	15	–	
4C6	25	4322 021 39650	13	4322 021 39640	15	4322 021 39630	19
	40	39650	13	39640	17	39630	20
	63	39650	8	39630	12	–	

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			

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

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

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.

* 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.

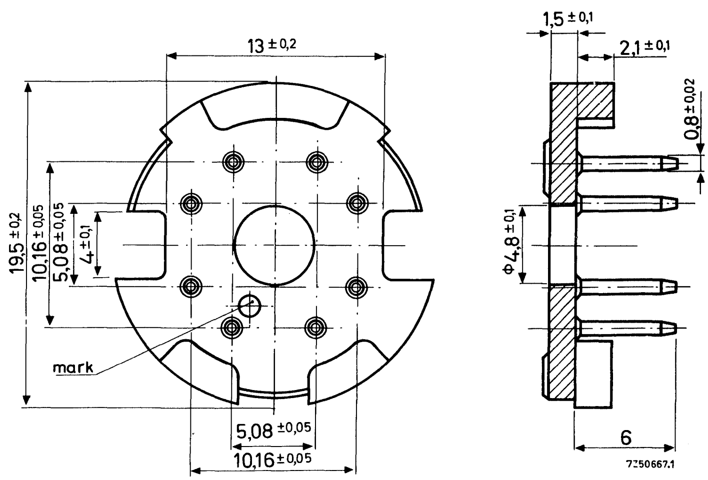
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 100 N. After bending the lips the spring will have the correct tension.

PART DRAWINGS

(1) **Tag plate** 4322 021 30450

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

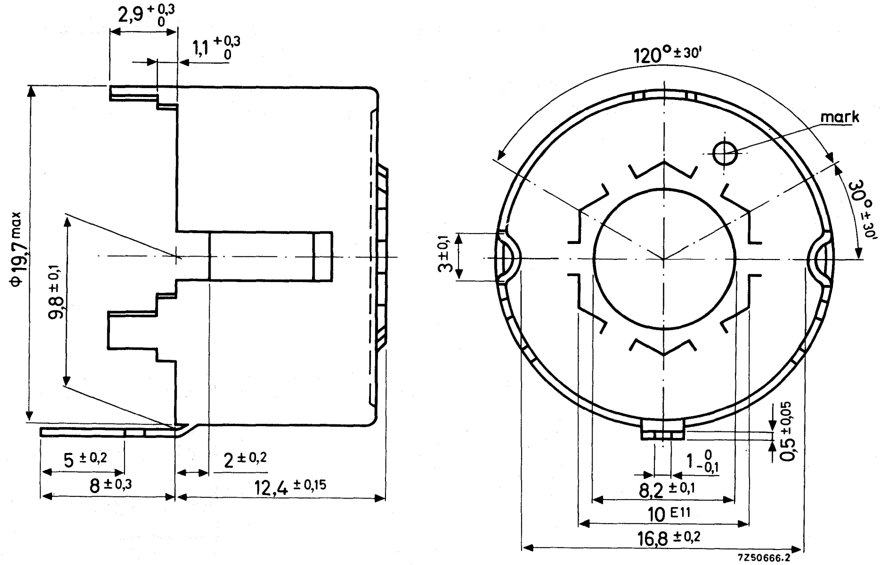
Pins: phosphor-bronze, dip-soldered.



The tag plates are packed in units of 75 pieces on a polystyrene plate, and with 500 pieces to a cardboard box. Please order in multiples of these quantities.

(2) **Container** 4322 021 30530

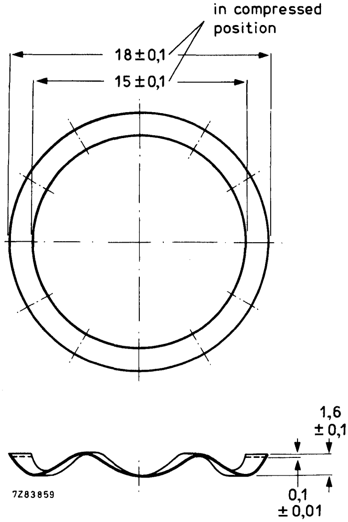
Material: brass, nickel plated; thereafter tin plated



The containers are packed in a primary pack of 70 pieces, in a storage pack of 350 pieces. Please order in multiples of these quantities.

(3) **Spring** 4322 021 30640

Material: chrome-nickel steel

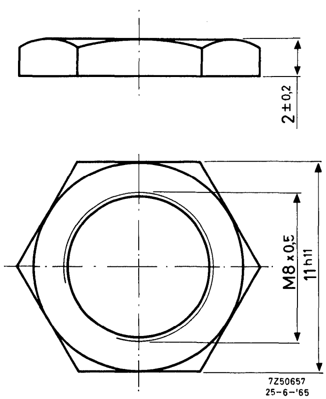


A force of 68 N to 113 N is required to compress the spring to 0,55 mm.

The springs are supplied in quantities of 1000 pieces. Please order in multiples of this quantity.

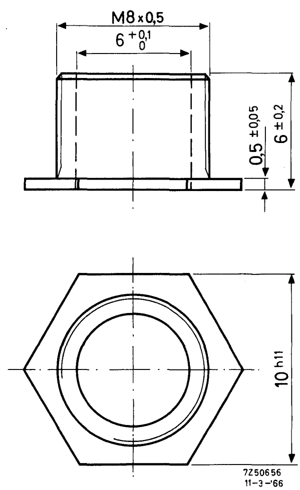
(4) **Nut** 4322 021 30710

Material: brass, nickel plated



(5) **Fixing bush** 4322 021 30720

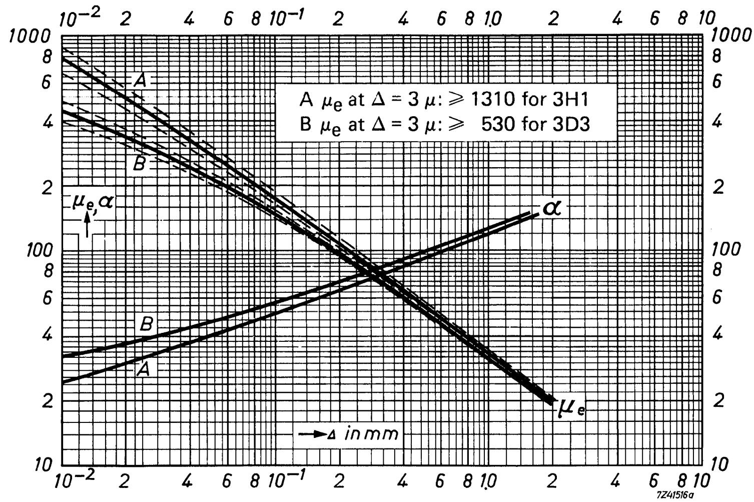
Material: brass, nickel plated



The fixing bushes are supplied in quanties of 2500. Please order in multiples of this quantity.

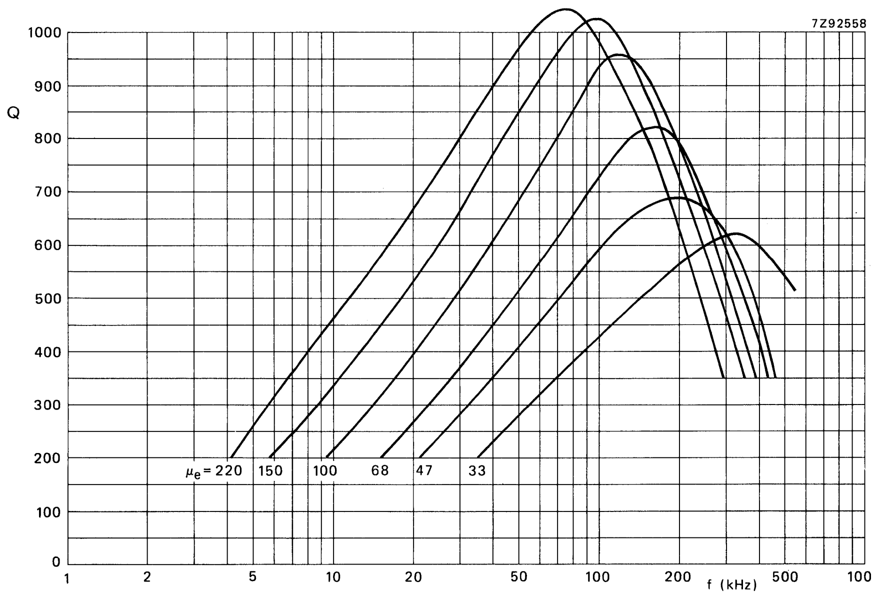
CHARACTERISTIC CURVES

μ_e—α CURVES



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

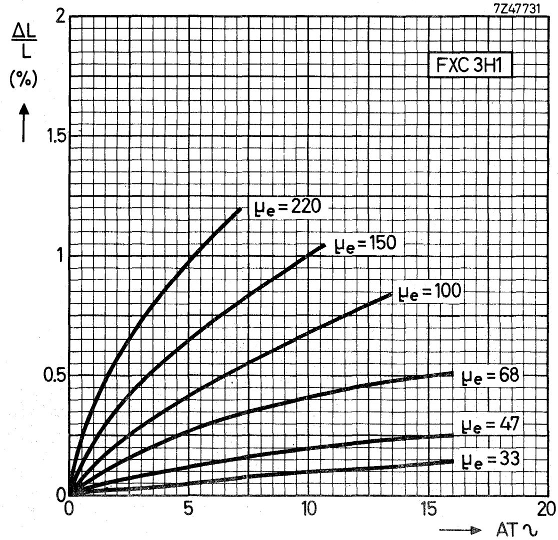
TYPICAL Q-CURVES FOR FXC 3H1

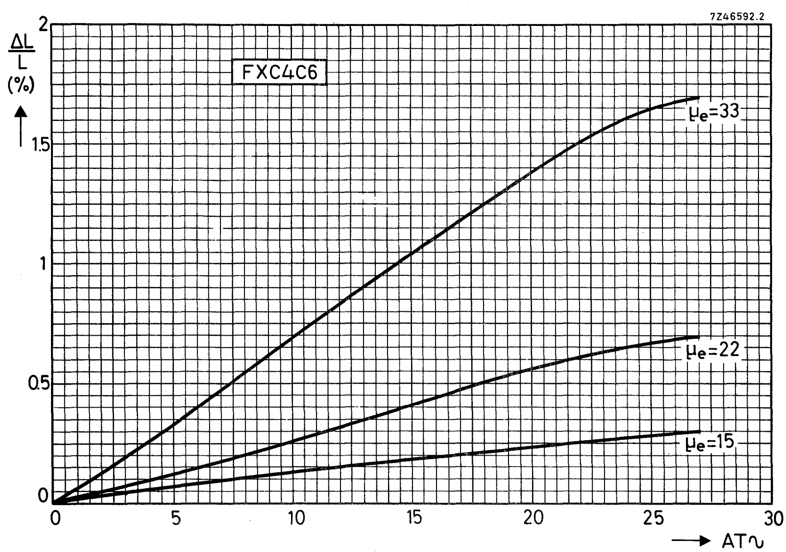


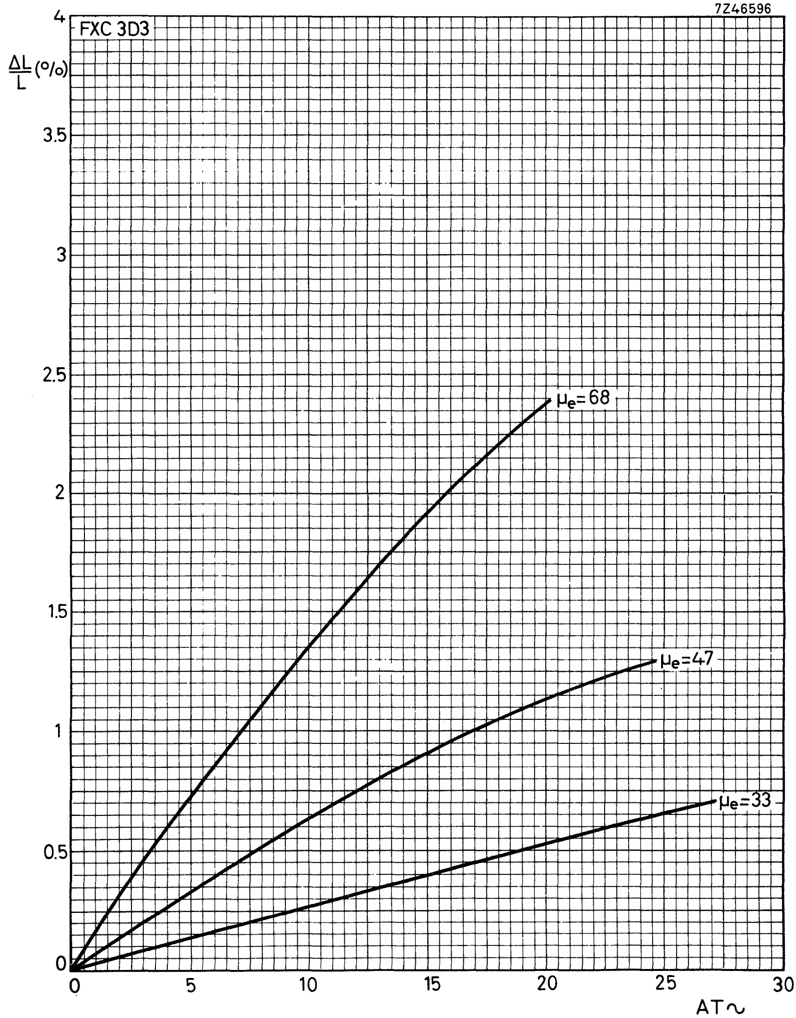
Enveloping curves.

Single-section coil former.

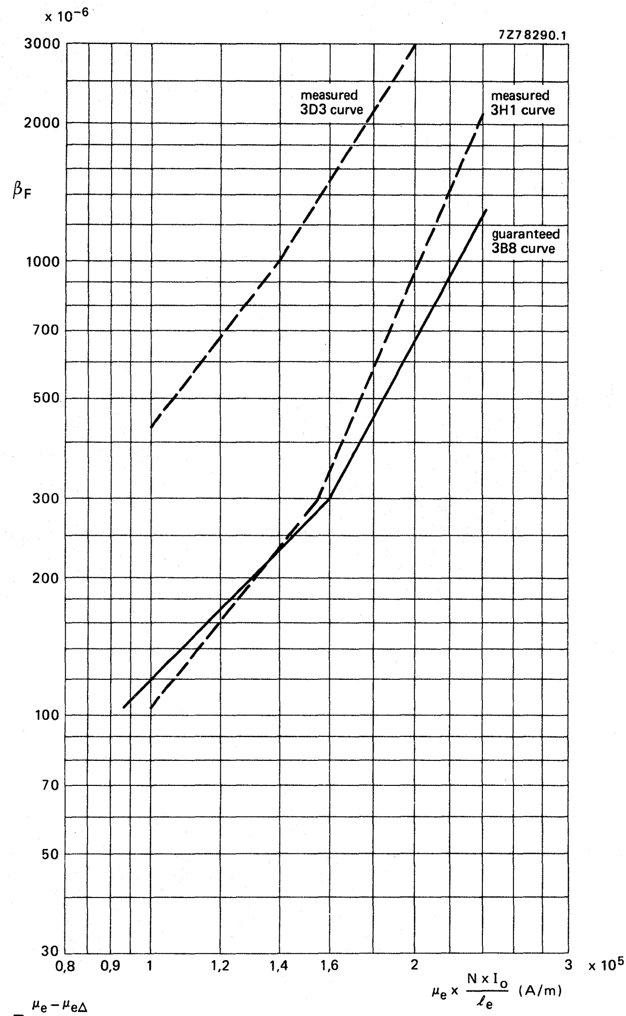
INDUCTANCE VARIATION AS A FUNCTION OF AT~






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

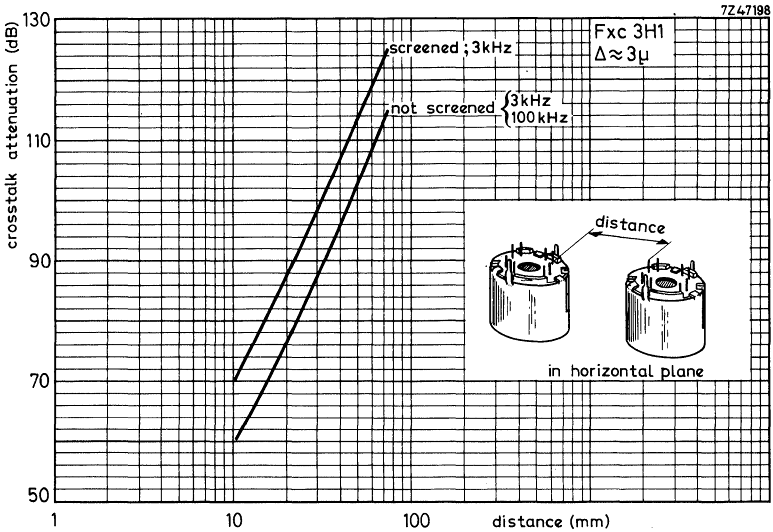
D.C. SENSITIVITY AT 25 °C

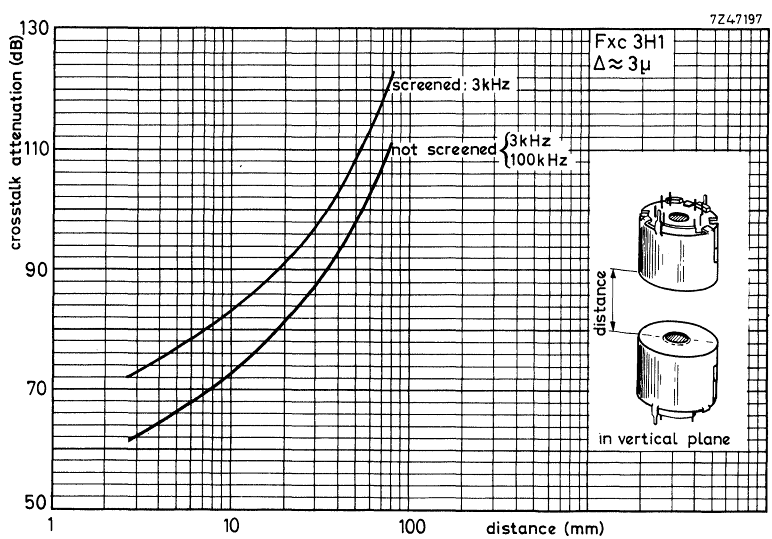


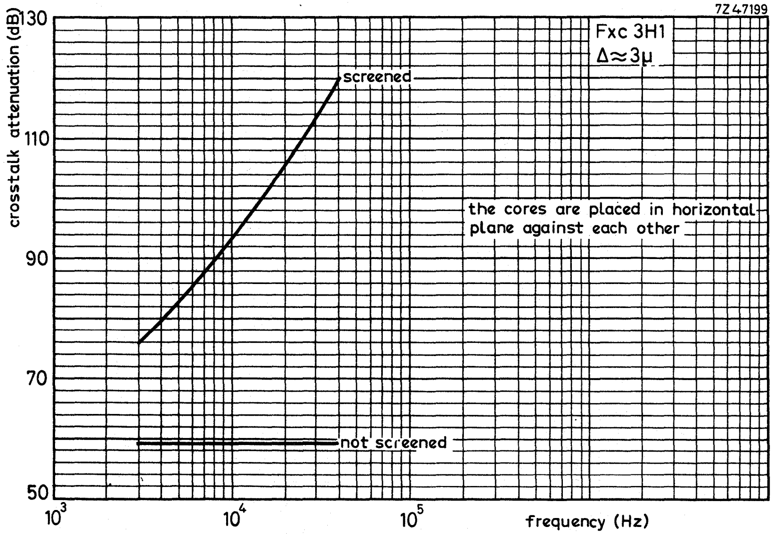
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. polarization.

CROSSTALK ATTENUATION






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

POTCORES

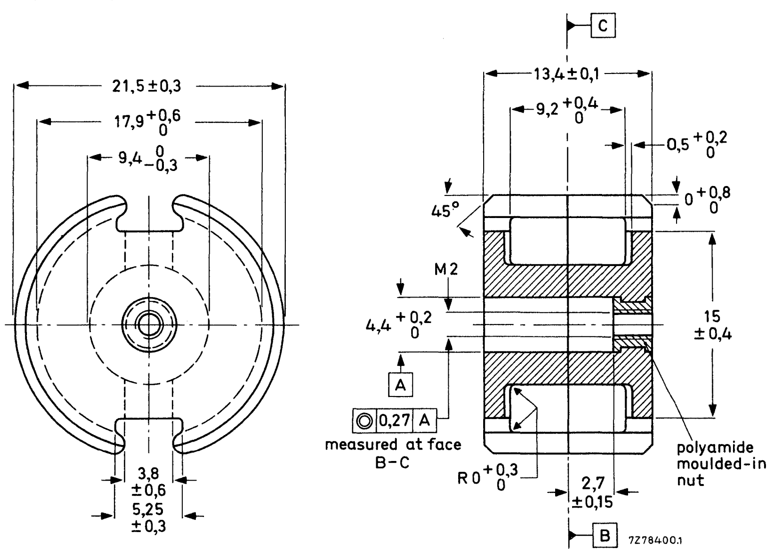
Three types of core can be supplied:

- 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), NCF83311 (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



Pulling-out force of the nut	⩾ 40 N
Torque of the screw thread	⩽ 10 mNm
Extraction force of adjuster from nut	⩾ 30 N

Note: The 4C6 version has a cemented nut.

Dimensional quantities according to IEC 205:

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

$A_{CPmin} = 51{,}3\ \text{mm}^2$.

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, square cores and cross cores' is inserted; the halves are pressed together with a force of 140 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. ^oC	grade 3B8	3D3	3H1	3E4	4C6
A_L ± 25%	4	≤ 0,1	25 ± 1	3870	1810	4650	10 000	320
μ_e ± 25%	4	≤ 0,1	25 ± 1	1530	720	1860	3955	125
α	4	≤ 0,1	25 ± 1	≤ 18,6	≤ 27,0	≤ 16,8	≤ 11,5	≤ 64,7
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1			≤ 1,2	≤ 2,5	
	100	≤ 0,1	25 ± 1		≤ 8,0	≤ 5,0	≤ 20	
	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
P (W)	25	200*	25 ± 1	≤ 0,30				
			100 ± 1	≤ 0,40				
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			≤ 0,86	≤ 1,1	
	100	0,3 to 1,2	25 ± 1		≤ 1,8			≤ 6,2
$\alpha_F \times 10^6$/K	≤ 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 to + 2		0 to + 2	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 12	≤ 4,3	≤ 4,3	≤ 10
$\beta_F \times 10^6$, measured on sets with μ_e = 300 ± 10% and 25 ± 1 ^oC:								
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				

* $\hat{B}$ is calculated with A_{CPmin} = 51,3 mm².

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022				
		3B8	3D3	3E4	3H1	4C6
25 ± 1%	9,9					27810
40 ± 1%	15,8		27420			• 27820
63 ± 1%			• 27430			27830
100 ± 1%	39,5		27440		27240	27840
160 ± 1%	63,5		27450		27250	
250 ± 1,5%	99		27460		• 27260	
315 ± 2%	125				• 27270	
400 ± 2%	158	• 07940			• 27280	
630 ± 3%	249				27300	
1 000 ± 3%	395				27310	
1 250 ± 3%	495				27390	
2 500 ± 10%	990					
10 000 ± 25%	3955			• 07900		

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			06400			
1840 ± 25%	14,6	06000				06200	

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.

Core halves without air gap, without nut:

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

• Preferred type.

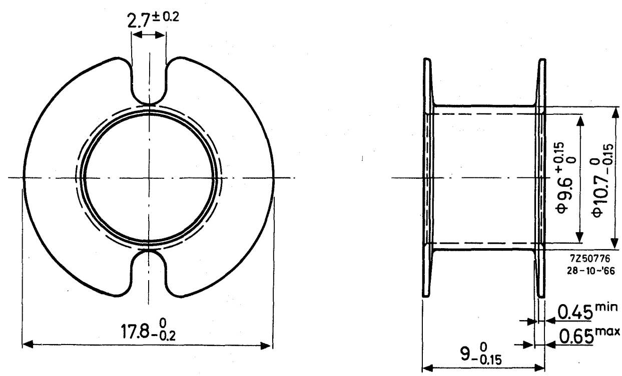
COIL FORMERS

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), NCF83311 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



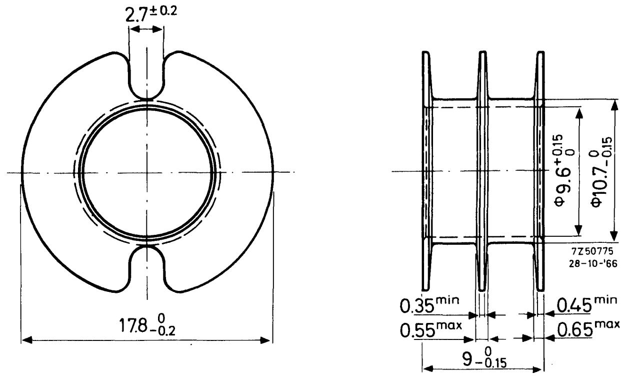
Catalogue number	4322 021 30300
Material	polycarbonate
Window area	28 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

D.C. losses

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

Mass 0,35 g

TWO-SECTION COIL FORMER



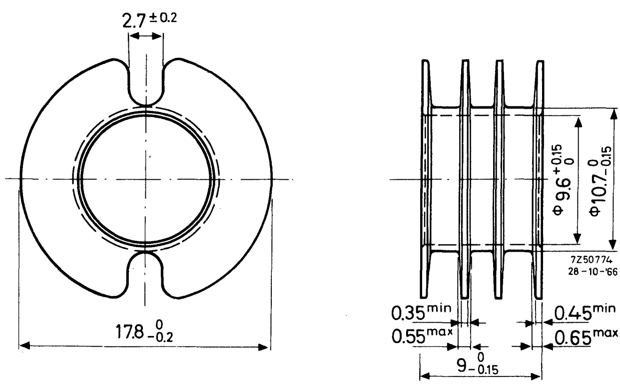
Catalogue number	4322 021 30310
Material	polycarbonate
Window area	2 x 13 mm^2
Mean length of turn	44 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11{,}6 \times 10^3\ \Omega/H$$

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

$$\frac{R_0}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 12{,}4 \times 10^3\ \Omega/H$$

Mass 0,45 g

INDUCTANCE ADJUSTERS

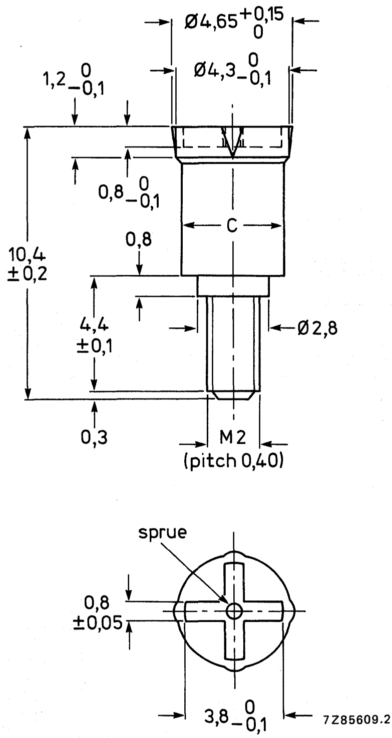


Table 1

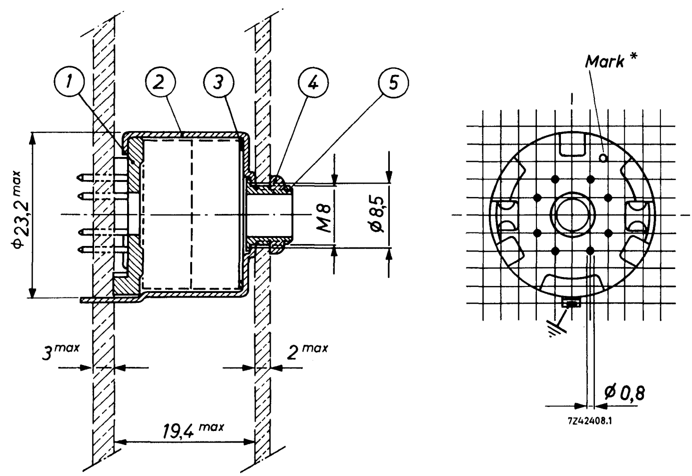
catalogue number	colour code	material	C
4322 021 38400	black	FXC	4,22
38410	brown	FXC	4,04
38420	red	cip	4,04
38430	orange	cip	4,22
38440	yellow	FXC	3,52
38450	green	cip	3,80
38480	white	FXC	3,80
38490	grey	FXC	3,94

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P22/13

core material	A_L	low	%	medium	%	high	%
3H1, 3B8, 3B7	100	4322 021 38450	12	4322 021 38420	16	4322 021 38430	21
	160	38420	11	38440	18	38480	28
	250	38440	11	38480	18	38490	23
	315	38440	9	38490	18	38410	22
	400	38480	12	38410	17	38400	28
	630	38410	11	38400	18	–	
	1000	38410	7	38400	11	–	
	1250	38410	5	38400	9	–	
3D3	40	–		4322 021 38450	19	4322 021 38430	27
	63	–		38450	16	38430	25
	100	4322 021 38450	12	38420	16	38440	27
	160	38420	10	38440	17	38490	28
	250	38440	11	38490	18	–	
4C6	25	4322 021 38450	14	4322 021 38420	16	–	
	40	–		38450	16	4322 021 38430	24
	63	38450	10	38420	15	38430	19
	100	38450	6	38430	10	38480	20

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		

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

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

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.

* 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.

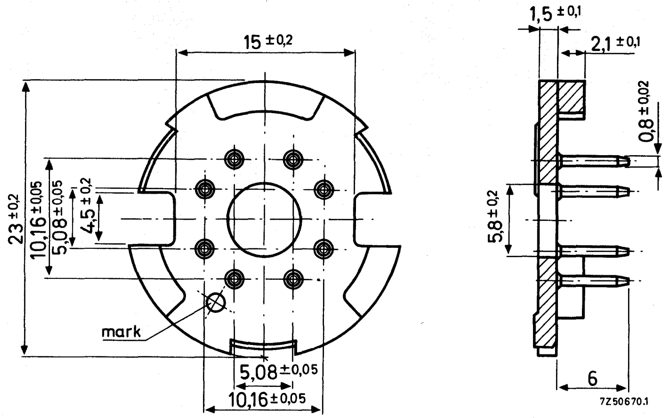
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 140 N. After bending the lips the spring will have the correct tension.

PART DRAWINGS

(1) Tag plate 4322 021 30460

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

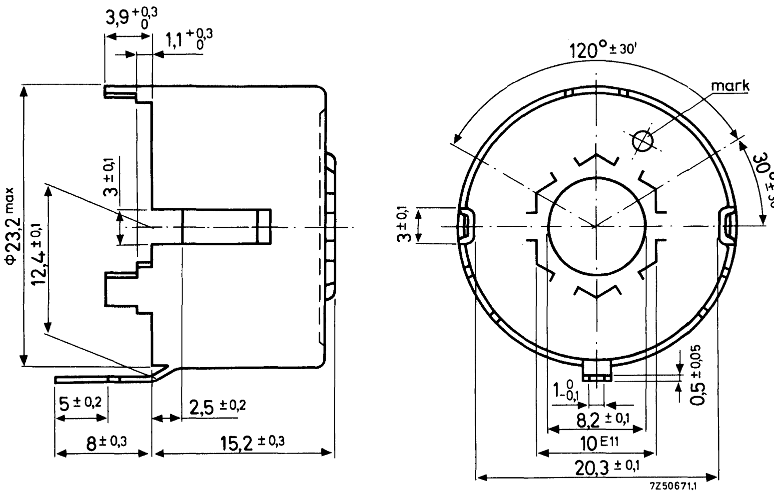
Pins: phosphor bronze, dip-soldered



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

(2) **Container** 4322 021 30540

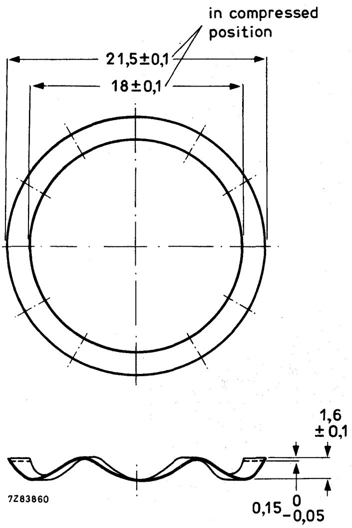
Material: brass, nickel plated, then tin plated.



The containers are packed with 40 pieces in a primary pack and 200 pieces in a storage pack. Please order in multiples of these quantities.

(3) **Spring** 4322 021 30650

Material: chrome-nickel steel

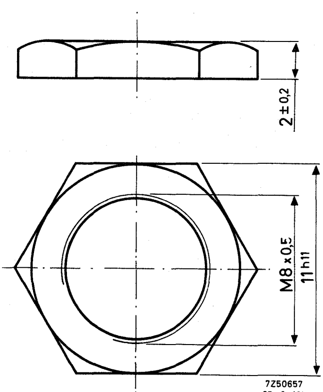


A force of 94 to 156 N is required to compress the spring to 0,45 mm.

The springs are supplied in quantities of 750. Please order in multiples of this quantity.

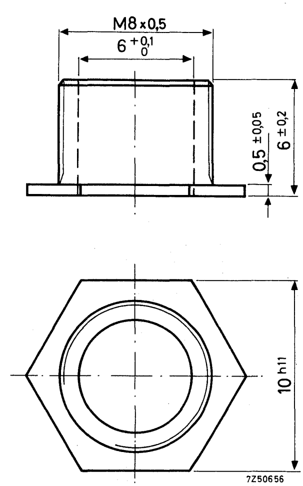
(4) **Nut** 4322 021 30710

Material: brass, nickel plated



(5) **Fixing bush** 4322 021 30720

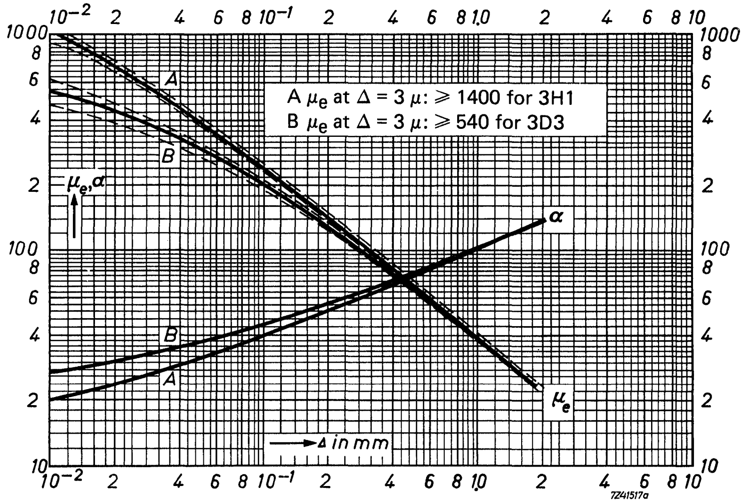
Material: brass, nickel plated



The fixing bush is supplied in quantities of 2500. Please order in multiples of this quantity.

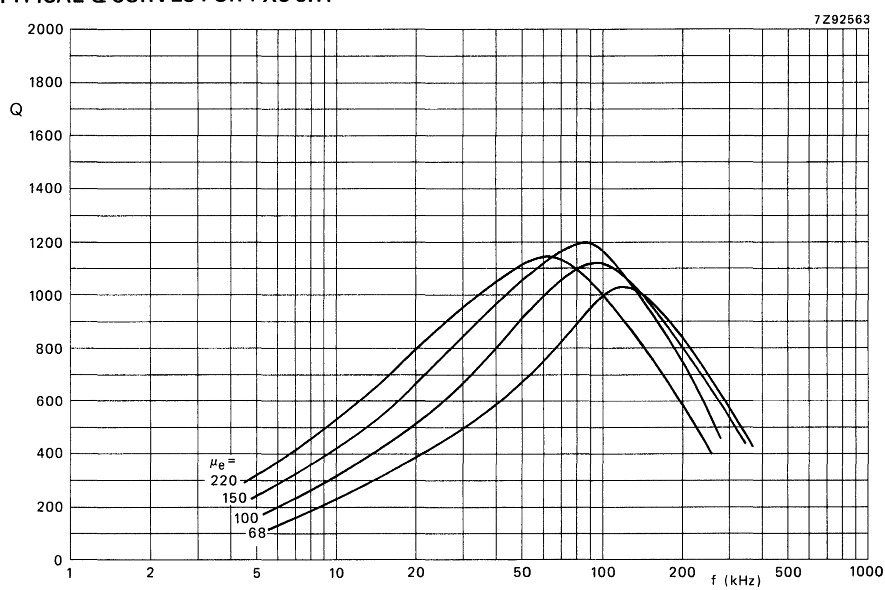
CHARACTERISTIC CURVES

μ_e - α curves



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

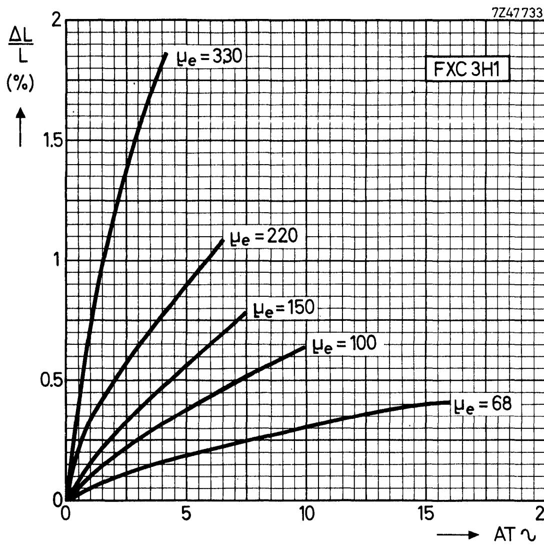
TYPICAL Q-CURVES FOR FXC 3H1

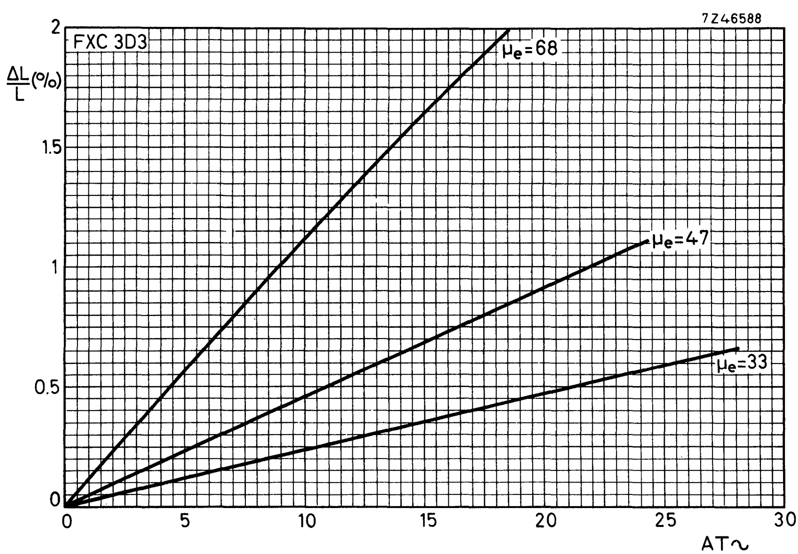


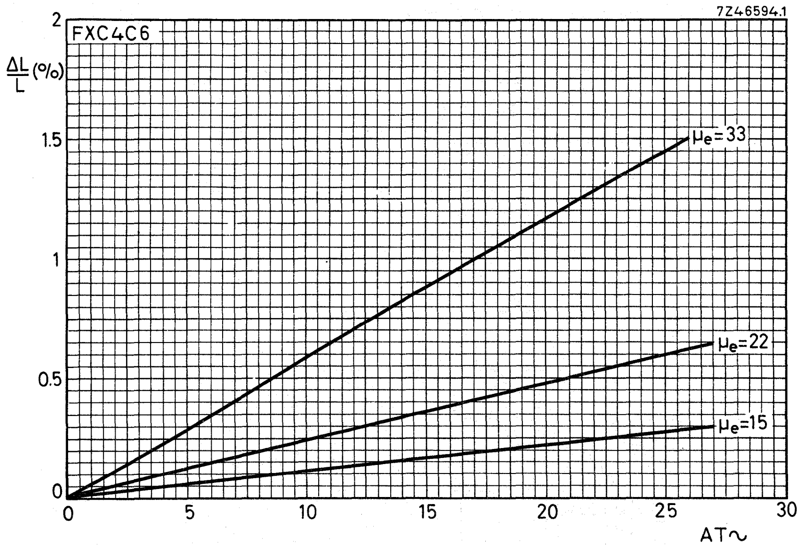
Enveloping curves.

Single-section coil former.

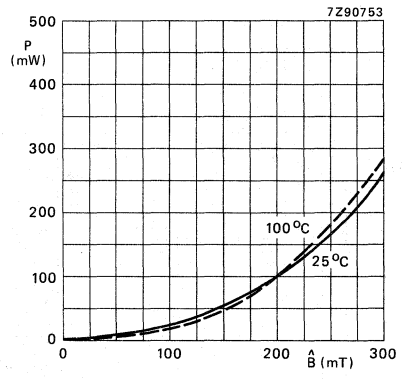
INDUCTANCE VARIATION AS A FUNCTION OF AT~





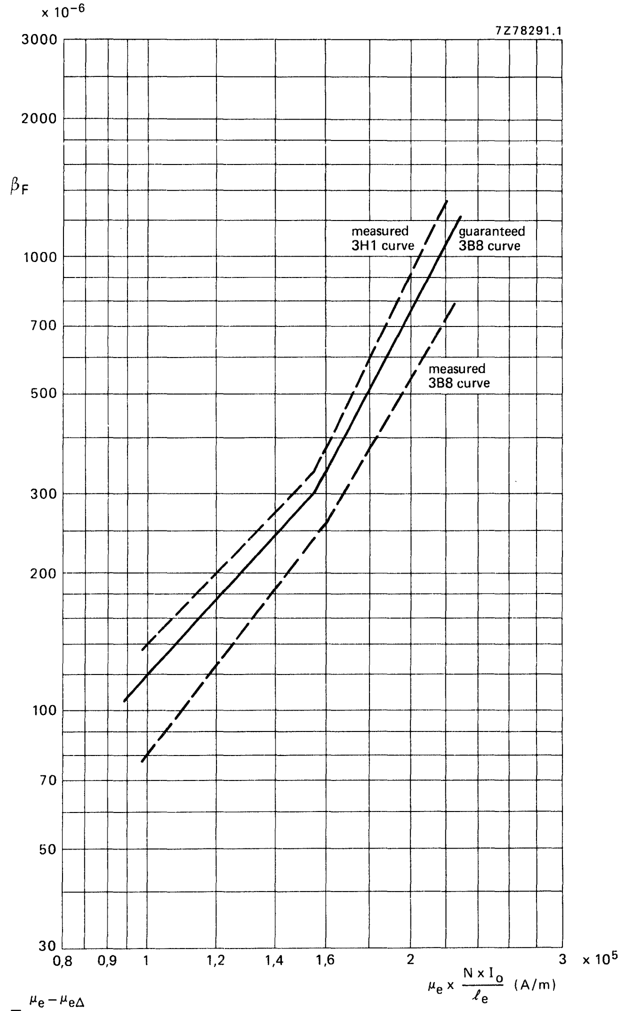


P AS A FUNCTION OF $\hat{B}$



$\hat{B}$ calculated with A_{CPmin} = 51,3 mm². FXC 3B8.

D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. polarization.

POTCORES

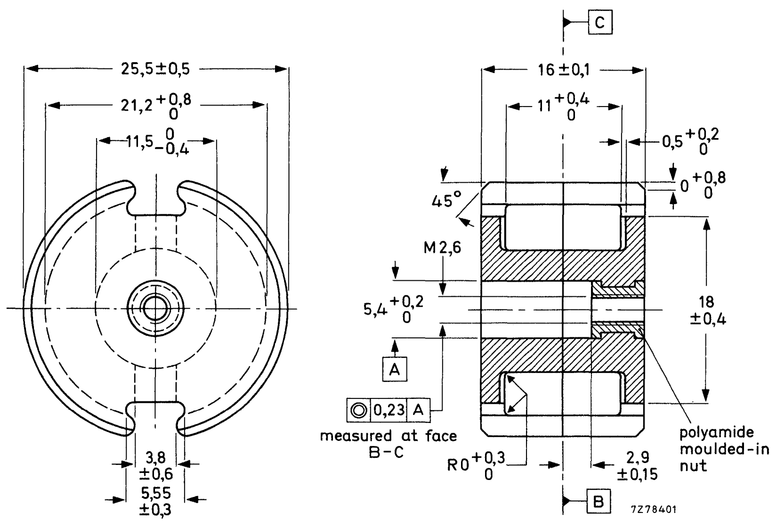
Three types of core can be supplied:

- 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), NCF83311 (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



Pulling-out force of the nut	⩾ 50 N
Torque of the screw thread	⩽ 10 mNm
Extraction force of adjuster from nut	⩾ 40 N

Note: The 4C6 version has a cemented nut.

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l_e}{A_e} = 0{,}400\ \text{mm}^{-1}$; $C_2 = \Sigma \frac{l_e}{A_e^2} = 0{,}00426\ \text{mm}^{-3}$; $V_e = 3530\ \text{mm}^3$; $l_e = 37{,}6$ mm; $A_e = 93{,}9\ \text{mm}^2$; $A_{CPmin} = 76{,}5\ \text{mm}^2$.

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, square cores and cross cores' is inserted; the halves are pressed together with a force of 200 N. The values are valid 5 minutes or more after clamping.

	freq.	$\hat{B}$	temp.	grade				
	kHz	mT	°C	3B8	3D3	3H1		4C6
A_L ± 25%	4	≤ 0,1	25 ± 1	5025	2300	5900		400
μ_e ± 25%	4	≤ 0,1	25 ± 1	1600	730	1900		125
α	4	≤ 0,1	25 ± 1	≤ 16,3	≤ 24,1	≤ 14,9		≤ 58,0
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1			≤ 1,2		
	100	≤ 0,1	25 ± 1		≤ 8,0	≤ 5,0		
	500	≤ 0,1	25 ± 1		≤ 16			
	1000	≤ 0,1	25 ± 1		≤ 30			
	2000	≤ 0,1	25 ± 1					≤ 40
	10 000	≤ 0,1	25 ± 1					≤ 100
P (W)	25	200*	25 ± 1	≤ 0,60				
			100 ± 1	≤ 0,70				
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			≤ 0,86		
	100	0,3 to 1,2	25 ± 1		≤ 1,8			≤ 6,2
$\alpha_F \times 10^6$/K	≤ 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 to + 2			
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 12	≤ 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				
= 2,25 x 10^5 A/m				≤ 1100				

* $\hat{B}$ is calculated with A_{CPmin} = 76,5 mm².

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022			
		3B8	3D3	3H1	4C6
63 ± 1%	20		09430	29230	29830
100 ± 1%	31,8		• 29440	29240	• 29840
160 ± 1%	51		29450	29250	
250 ± 1%	79,5	09860	• 29460	29260	
315 ± 1,5%	100			29270	
400 ± 2%	127	• 09880	29480	• 29280	
630 ± 3%	200	• 09890		• 29300	
1000 ± 3%	318			29310	
1600 ± 3%	510	09900		29320	

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022			
		3B8	3D3	3H1	4C6
15 ± 1%	146		08410		28810
22 ± 1%	120				28820
33 ± 1%	98,2		28430	28230	28830
47 ± 1%	82,3		28440	28240	
68 ± 1%	68,4		28450	28250	
100 ± 1,5%	56,4			28260	
150 ± 2%	46,1			28270	
220 ± 3%	38,1			28280	
330 ± 3%	31,0			28290	
730 ± 25%	20,8		08400		
1910 ± 25%	12,9			08200	

Core sets without nut: replace the eight digit of the catalogue number (2) by 0.
Cores with $A_L \leqslant 400$ or $\mu_e \leqslant 100$, have a symmetrical air gap, except those in 3B8.
Cores with $A_L \geqslant 630$ or $\mu_e \geqslant 150$, and all cores in 3B8 have an asymmetrical air gap.

Core halves without air gap, without nut.

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

• Preferred type.

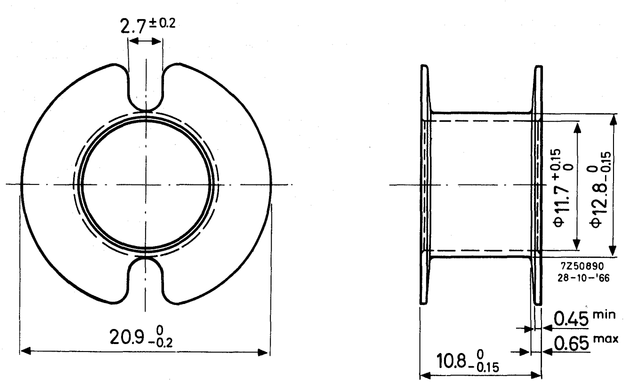
COIL FORMERS

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), NCF83311 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



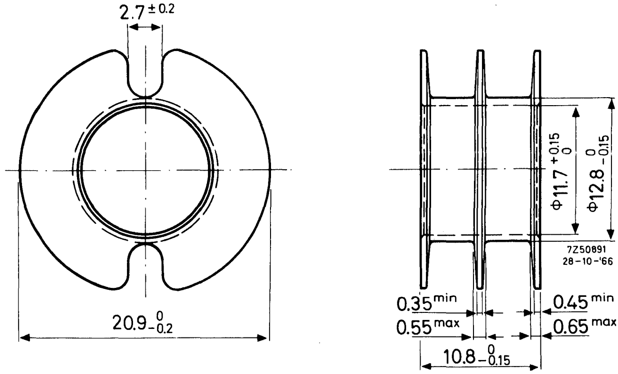
Catalogue number	4322 021 30330
Material	polycarbonate
Window area	39 mm^2
Mean length of turn	53 mm
Max. temperature	130 °C

D.C. losses

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

Mass 0,5 g

TWO-SECTION COIL FORMER



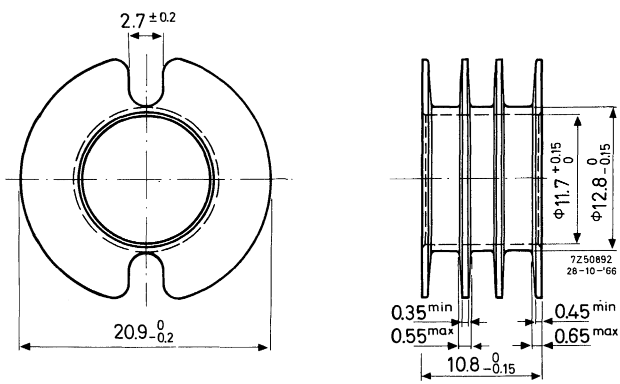
Catalogue number	4322 021 30340
Material	polycarbonate
Window area	2 mm x 19 mm
Mean length of turn	53 mm
Max. temperature	130 °C

D.C. losses

$$\frac{R_o}{L} \times \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 7{,}79 \times 10^3\ \Omega/H$$

Mass 0,6 g

THREE-SECTION COIL FORMER



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

D.C. losses

$$\frac{R_o}{L} \times \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 8{,}18 \times 10^3\ \Omega/H$$

Mass 0,7 g

INDUCTANCE ADJUSTERS

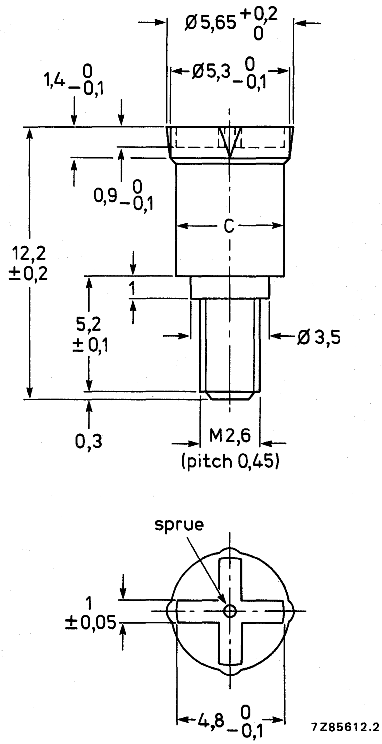


Table 1

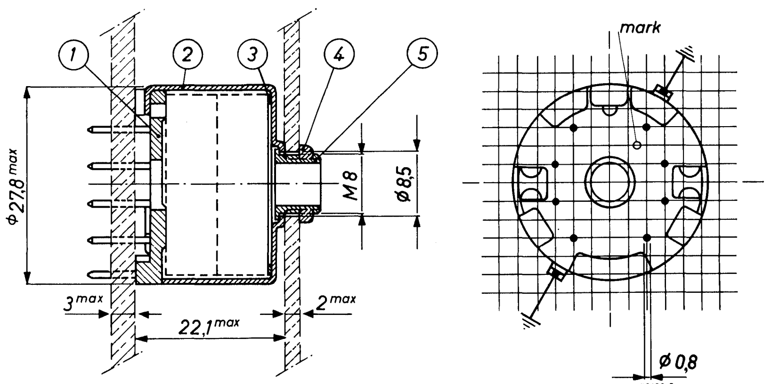
catalogue number	colour code	material	C
4322 021 39410	brown	FXC	4,80
39420	red	cip	5,15
39450	green	cip	4,80
39480	white	FXC	4,60
39490	grey	FXC	5,15

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P26/16

core material	A_L	low	%	medium	%	high	%
3H1, 3B8	63	–		4322 021 39450	18	4322 021 39420	25
	100	–		39450	15	39420	22
	160	4322 021 39450	10	39420	15	39480	28
	250	39420	11	39480	18	39410	21
	315	39420	9	39480	14	39410	17
	400	39420	7	39410	13	39490	25
	630	39410	8	39490	16	–	
	1000	39410	5	39490	9	–	
	1600	–		39490	6	–	
3D3	63	–		4322 021 39450	22	–	
	100	–		39450	14	4322 021 39420	21
	160	4322 021 39450	10	39420	14	39480	23
	250	39420	9	39480	15	39490	27
	400	39480	9	39490	17	–	
4C6	63	–		4322 021 39450	15	4322 021 39420	21
	100	4322 021 39450	10	39420	15	–	

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		

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

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

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.

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

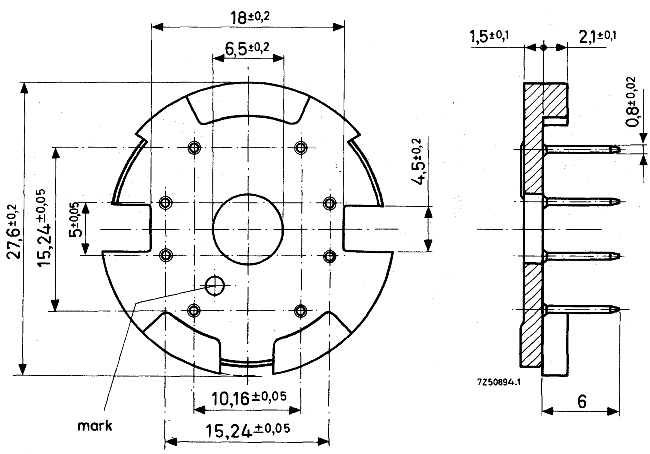
It is recommended that the spring (3) be placed in the position indicated to obtain the best stability against shock and vibration.
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately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

PART DRAWINGS

(1) **Tag plate** 4322 021 30470

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

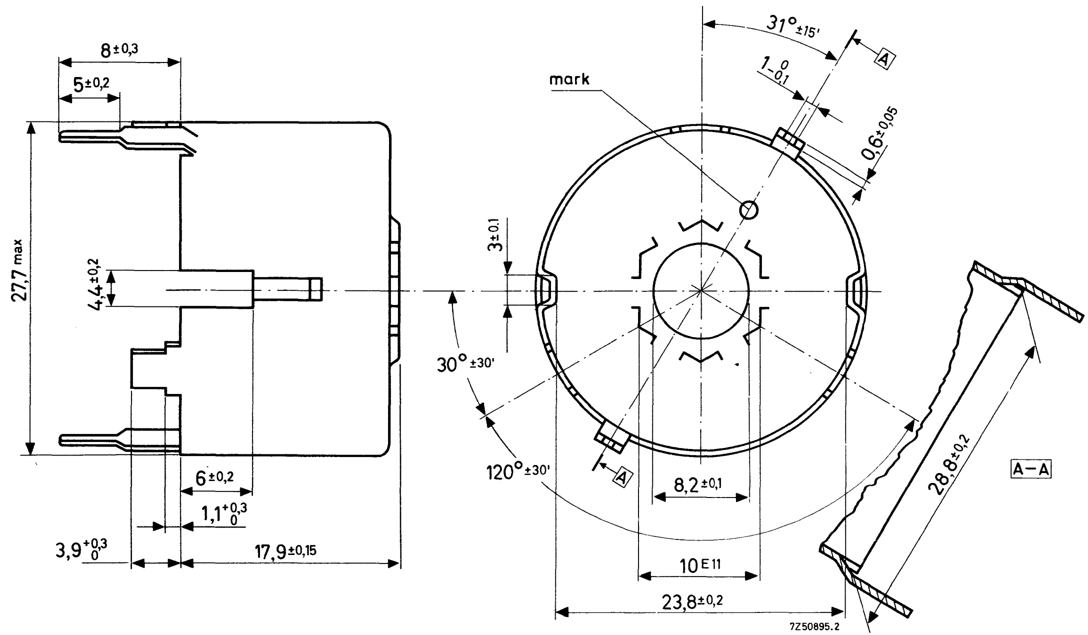
Pins: phosphor bronze, dip-soldered



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

(2) **Container** 4322 021 30550

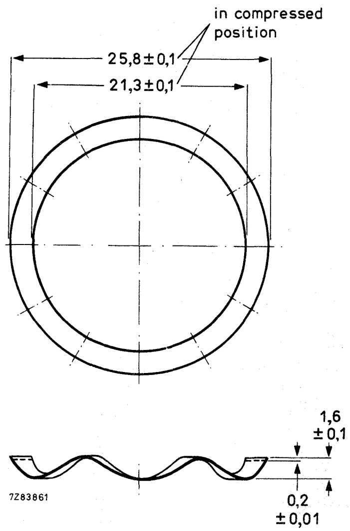
Material: brass, nickel plated; thereafter tin plated.



The containers are packed with 40 pieces in a primary pack, and 200 pieces in a storage pack. Please order in multiples of these quantities.

(3) **Spring** 4322 021 30660

Material: chrome-nickel steel.

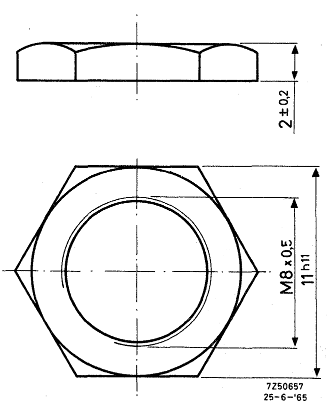


A force of 136 to 225 N is required to compress the spring to 0,55 mm.

The springs are supplied in quantities of 500.
Please order in multiples of this quantity.

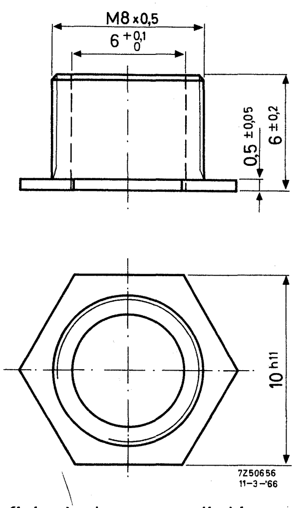
(4) **Nut** 4322 021 30710

Material: brass, nickel plated.



(5) **Fixing bush** 4322 021 30720

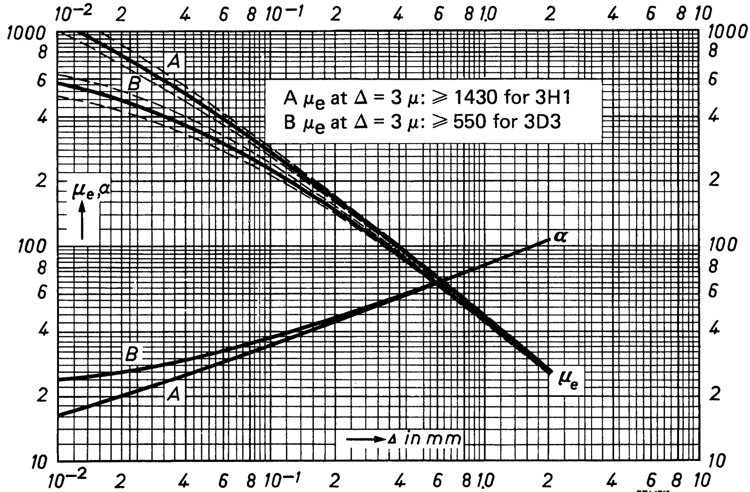
Material: brass, nickel plated.



The fixing bushes are supplied in quantities of 2500. Please order in multiples of this quantity.

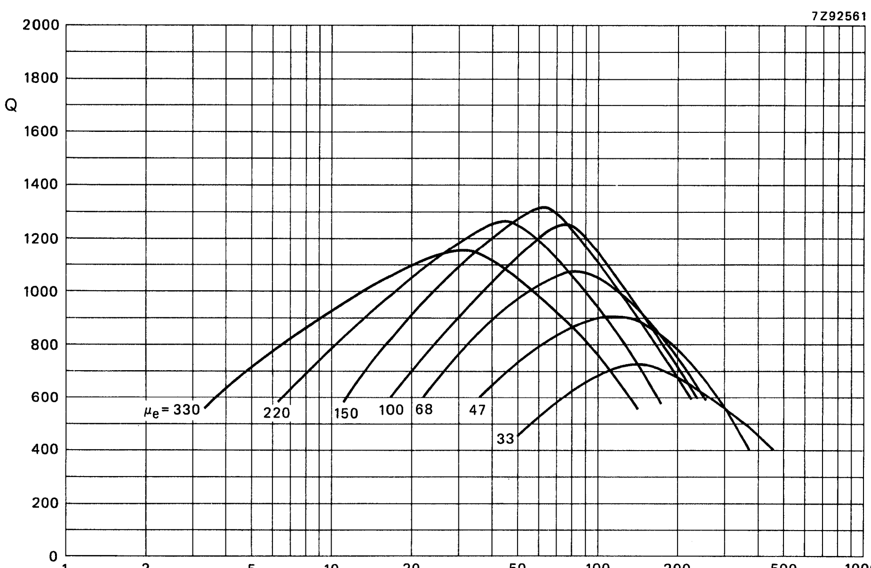
CHARACTERISTIC CURVES

μ_e - α CURVES



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

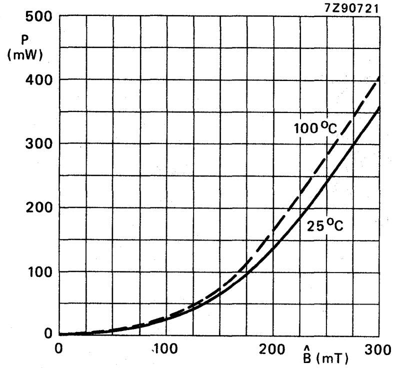
TYPICAL Q-CURVES FOR FXC 3H1



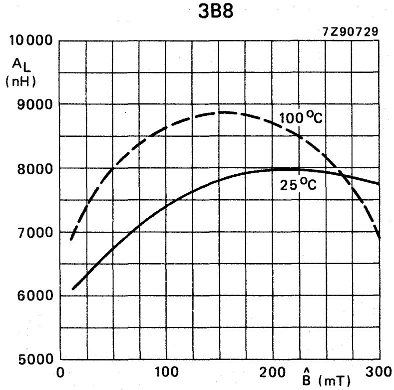
Enveloping curves.

Single-section coil former.

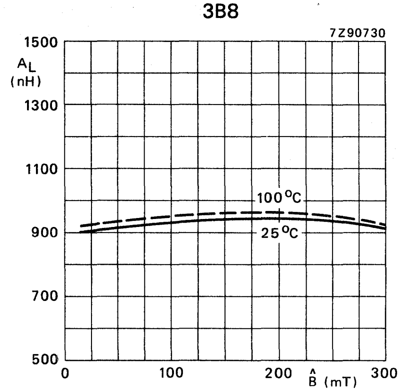
P AS A FUNCTION OF $\hat{B}$ AT 16 kHz



A_L AS A FUNCTION OF $\hat{B}$ AT 16 kHz



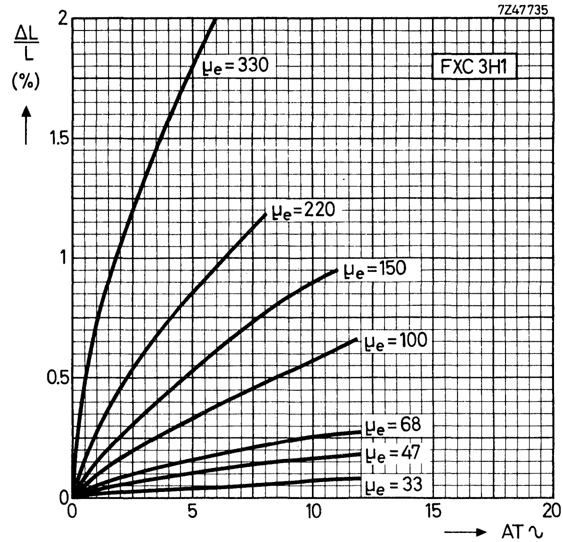
without air gap.

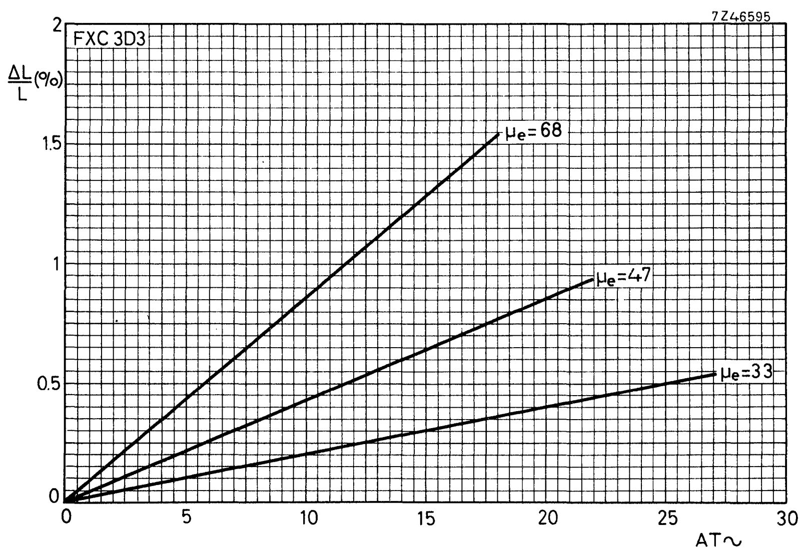


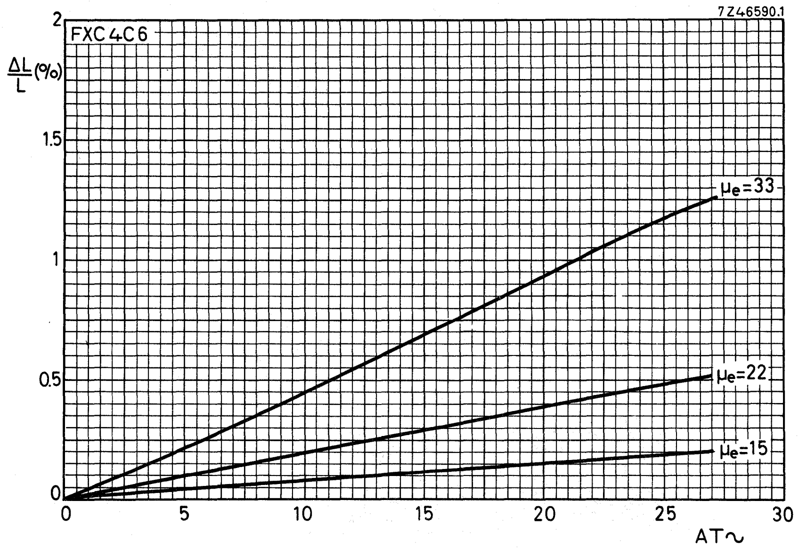
with air gap.

$\hat{B}$ calculated with A_{CPmin} = 76,5 mm^2

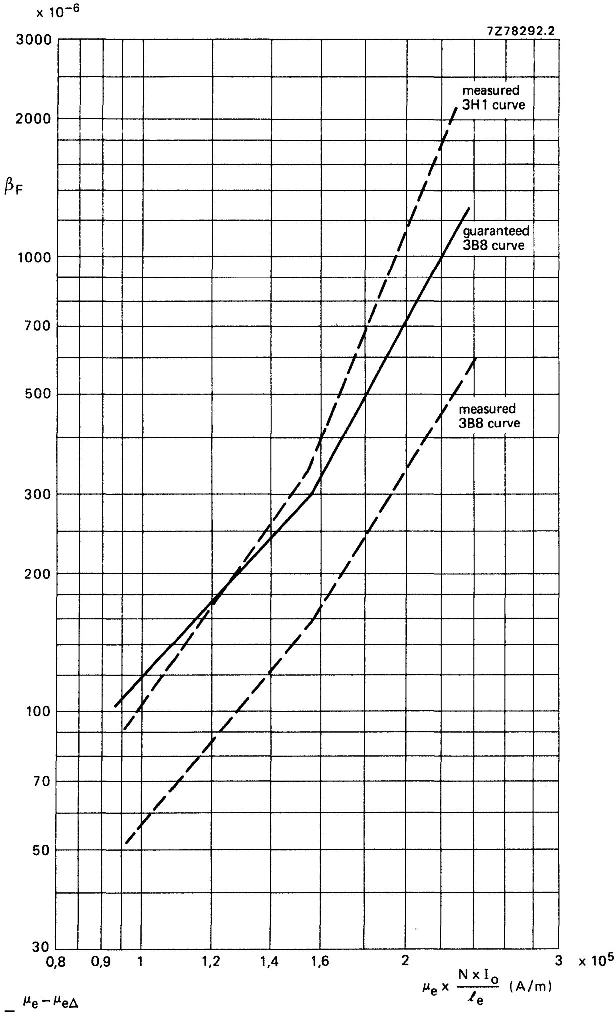
INDUCTANCE VARIATION AS A FUNCTION OF AT~






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

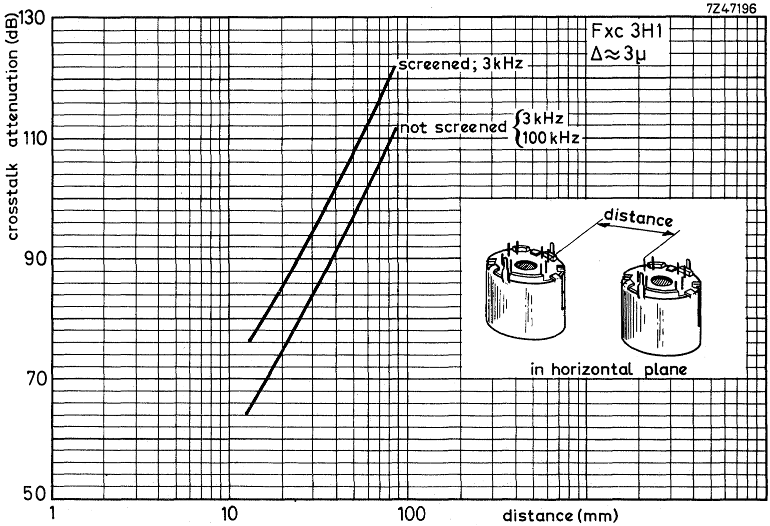
D.C. SENSITIVITY AT 25 °C

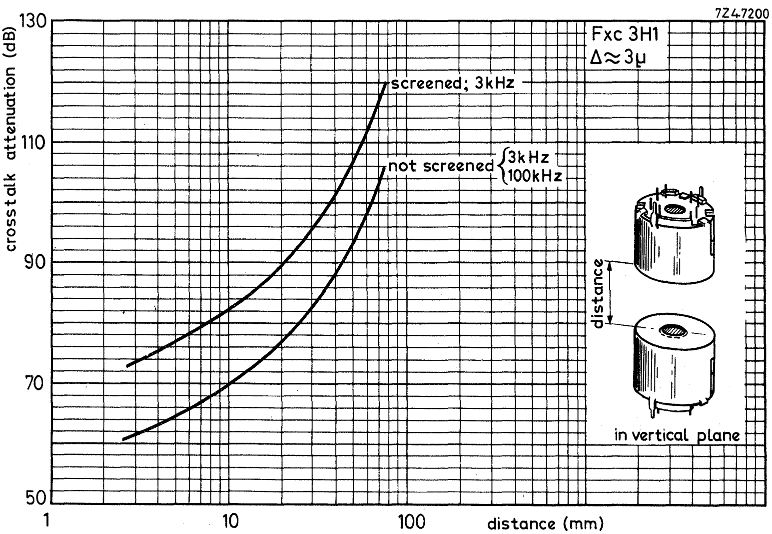


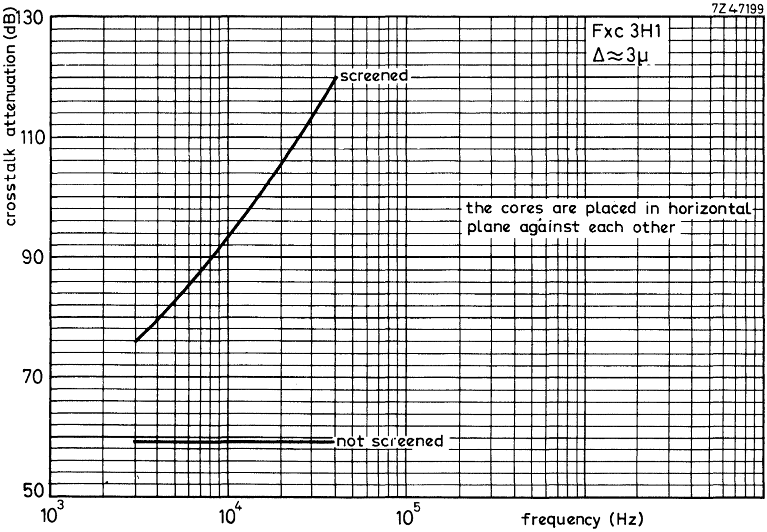
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. polarization.

CROSSTALK ATTENUATION






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

POTCORES

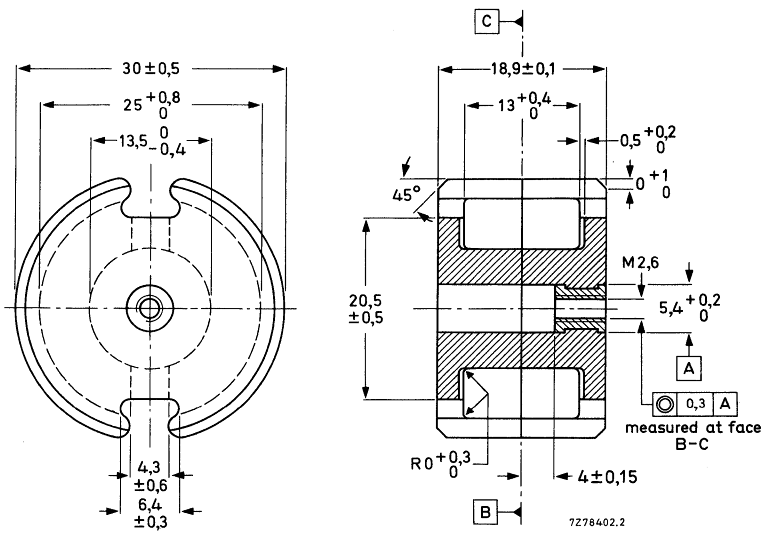
Three types of core can be supplied:

- 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), NCF 83311 (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



The polyamide nut is moulded-in, except for the 3D3 version in which it is cemented.

Pulling-out force of the nut ⩾ 50 N

Torque of the screw thread ⩽ 10 mNm

Extraction force of the adjuster from nut ⩾ 40 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l_e}{A_e} = 0{,}330\ mm^{-1}$; $C_2 = \Sigma \frac{l_e}{A_e^2} = 0{,}00241\ mm^{-3}$; $V_e = 6190\ mm^{-3}$; $l_e = 45{,}2$ mm; $A_e = 137\ mm^2$;
$A_{CPmin} = 115\ mm^2$.

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, square cores and cross cores' is inserted; the halves are pressed together with a force of 250 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	grade 3D3	grade 3H1
$A_L \pm 25\%$	4	⩽ 0,1	25 ± 1	7500	2800	7500
$\mu_e \pm 25\%$	4	⩽ 0,1	25 ± 1	1985	740	1985
α	4	⩽ 0,1	25 ± 1	⩽ 13,3	⩽ 21,7	⩽ 13,3
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1			⩽ 1,2
	100	⩽ 0,1	25 ± 1		⩽ 8,0	⩽ 6,0
	500	⩽ 0,1	25 ± 1		⩽ 20	
	1000	⩽ 0,1	25 ± 1		⩽ 45	
P (W)	25	200*	25 ± 1	⩽ 1,0		
			100 ± 1	⩽ 1,2		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			⩽ 0,62
	100	0,3 to 1,2	25 ± 1		⩽ 1,8	
$\alpha_F \times 10^6$/K	⩽ 100	⩽ 0,1	5 to 25			+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 55			+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 70		0 to + 2	
$D_F \times 10^6$ (10-100 min)	⩽ 100	⩽ 0,1	25 ± 0,1		⩽ 12	⩽ 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		

* $\hat{B}$ is calculated with $A_{CPmin} = 115\ mm^2$.

Core sets with nut and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022				
		3B8	3D3	3H1		
100 ± 1%	26,2		31440			
160 ± 1%	42		● 31450			
250 ± 1%	65,5		31460	31260		
315 ± 1,5%	83					
400 ± 1,5%	105			● 31280		
630 ± 2%	165	● 11870		● 31300		
1000 ± 3%	263			31310		
1600 ± 3%	420			31320		
2500 ± 3%	655			31330		

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022				
			3D3	3H1		
33 ± 1%	89,2		30430	30230		
47 ± 1%	74,7		30440			
68 ± 1%	62,1		30450	30250		
100 ± 1,5%	51,3			30260		
150 ± 2%	41,8			30270		
220 ± 3%	34,6			30280		
330 ± 3%	28,2			30290		
740 ± 25%	18,9		10400			
1990 ± 25%	11,5			10200		

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.

Core halves without air gap, without nut:

Ferroxcube grade	catalogue number
3B8	4322 020 22390
3D3	4322 020 22270
3H1	4322 020 22260

● Preferred type.

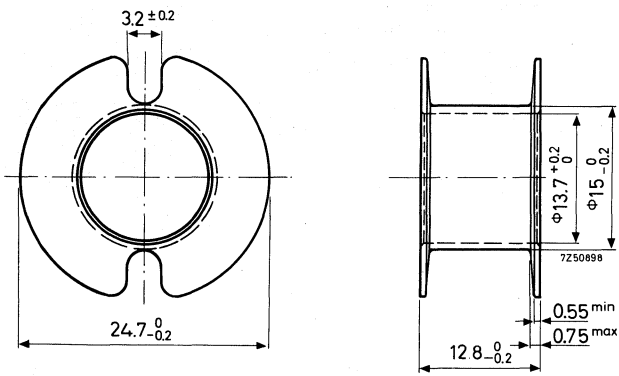
COIL FORMERS

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), NCF 83311 (France), DIN 41294 (Germany) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



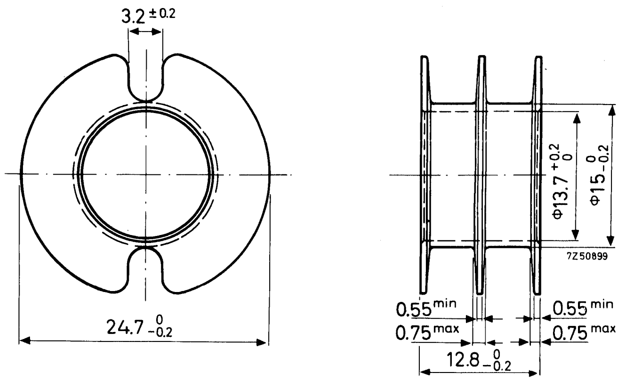
Catalogue number	4322 021 30360
Material	polycarbonate
Window area	55 mm^2
Mean length of turn	62 mm
Max. temperature	130 °C

D.C. losses

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

Mass 0,75 g

TWO-SECTION COIL FORMER



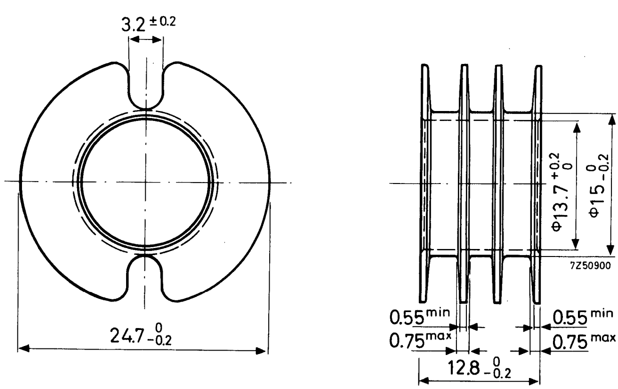
Catalogue number	4322 021 30370
Material	polycarbonate
Window area	2 x 26 mm^2
Mean length of turn	62 mm
Max. temperature	130 °C

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

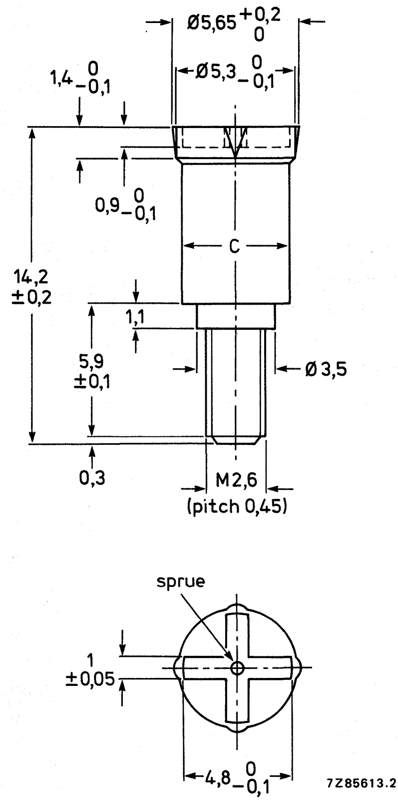


Table 1

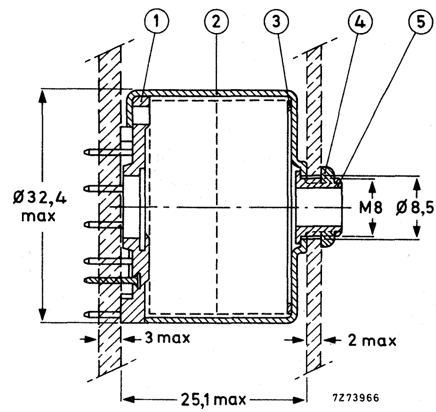
catalogue number	colour	core material	C mm
4322 021 38320	red	cip	4,68
38340	yellow	cip	5,10
38380	white	FXC	4,40
38390	grey	FXC	5,10

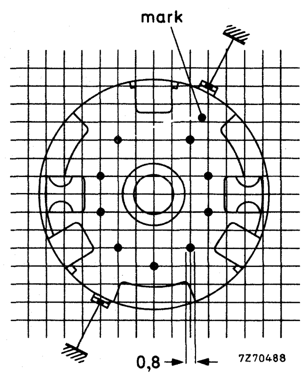
Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P30/19

core material	A_L	low	%	medium	%	high	%
3H1, 3B8	250	4322 021 38320	10	4322 021 38340	16	4322 021 38380	20
	400	38320	7	38380	12	–	
	630	38340	6	38380	8	38390	21
	1000	38380	5	38390	13	–	
	1600	–		38390	8	–	
	2500	–		38390	5	–	
3D3	100	–		4322 021 38320	18	4322 021 38340	29
	160	–		38320	14	38340	21
	250	4322 021 38320	9	38340	13	–	

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			

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.

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.

* 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.

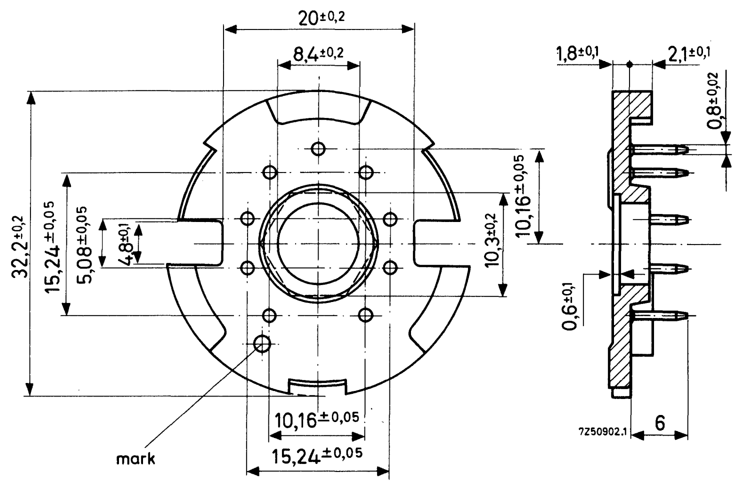
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 250 Newton. After bending the lips the spring will have the correct tension.

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.

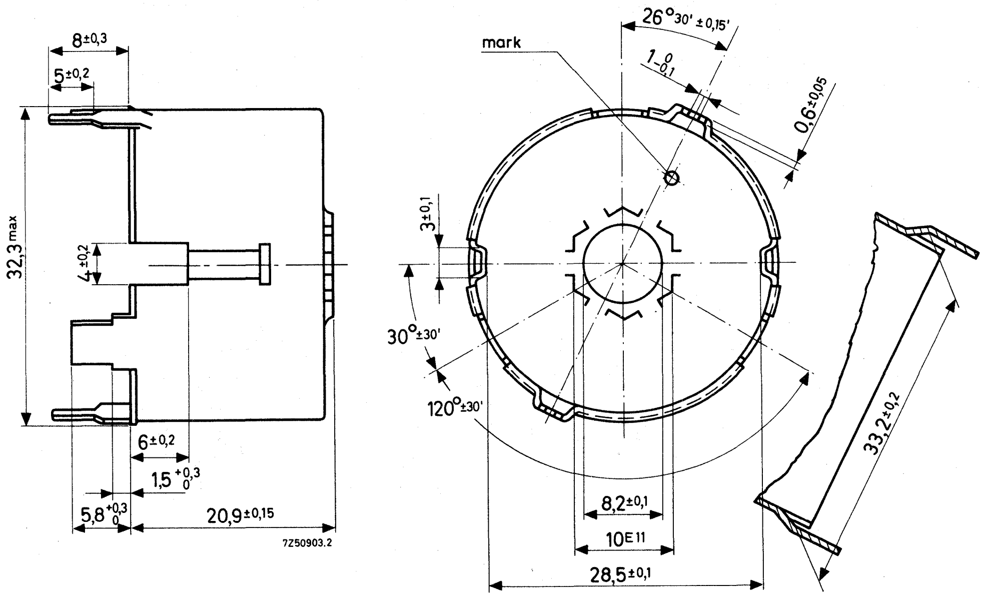
Pins: phosphor bronze, dip-soldered



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

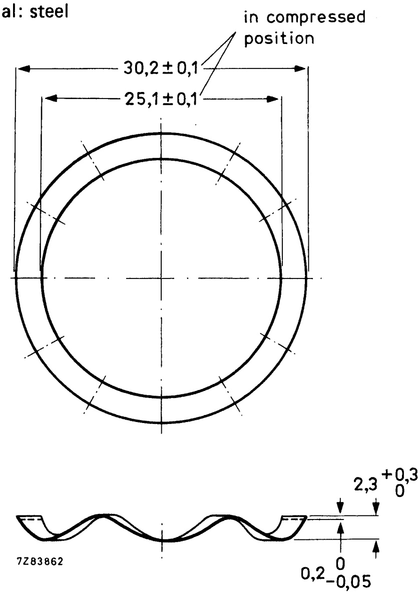
Material: brass, nickel plated; thereafter tin plated



The containers are packed with 20 pieces in a primary pack, and 100 pieces in a storage pack. Please order in multiples of these quantities.

(3) **Spring** 4322 021 30670

Material: steel

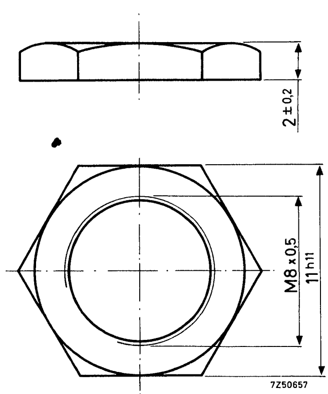


A force of 169 to 281 N is required to compress the spring to 0,45 mm.

The springs are supplied in quantities of 250. Please order in multiples of this quantity.

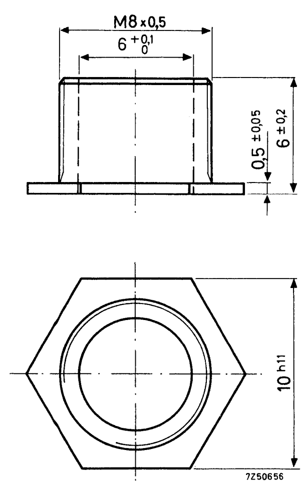
(4) **Nut** 4322 021 30710

Material: brass, nickel plated



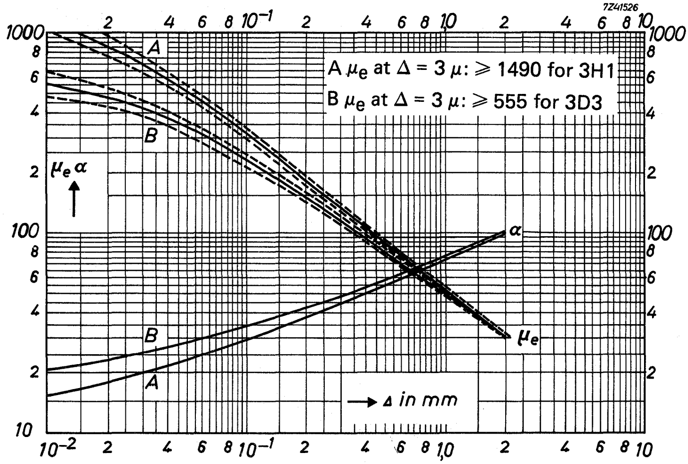
(5) **Fixing bush** 4322 021 30720

Material: brass, nickel plated



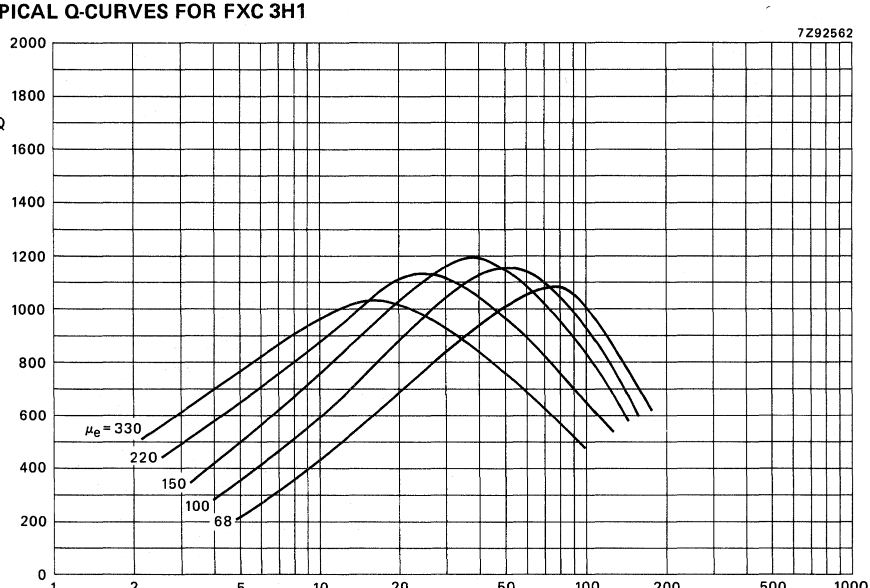
CHARACTERISTIC CURVES

μ_e - α CURVES



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

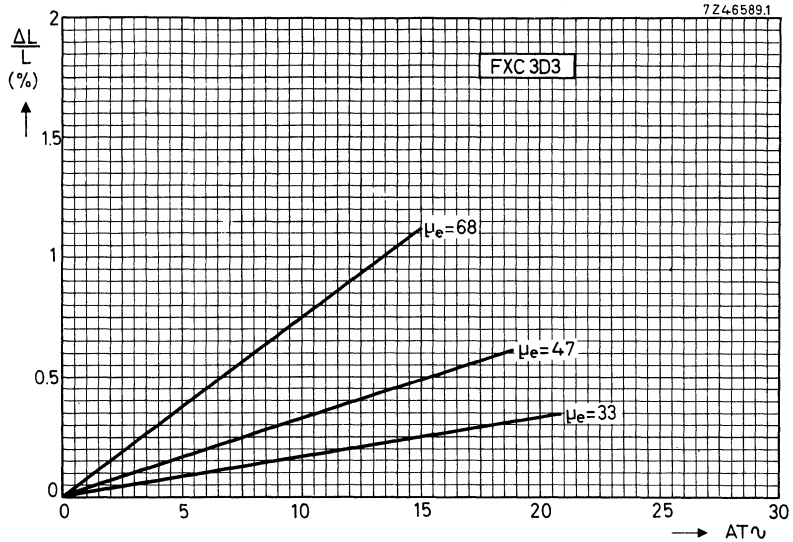
TYPICAL Q-CURVES FOR FXC 3H1



Enveloping curves.

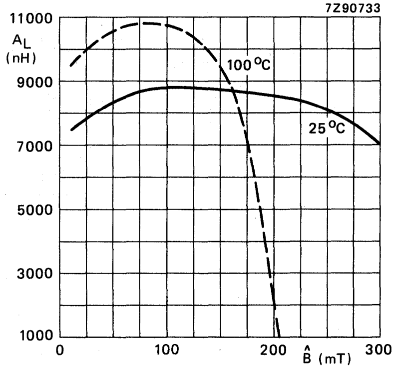
Single-section coil former.

INDUCTANCE VARIATION AS A FUNCTION OF AT ~

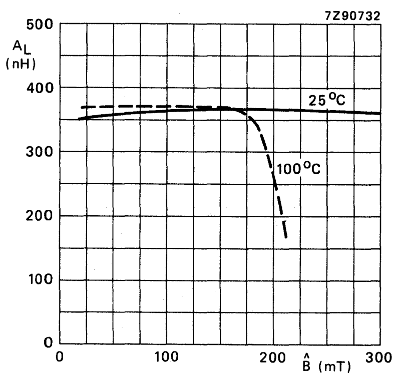


A_L AS A FUNCTION OF $\hat{B}$

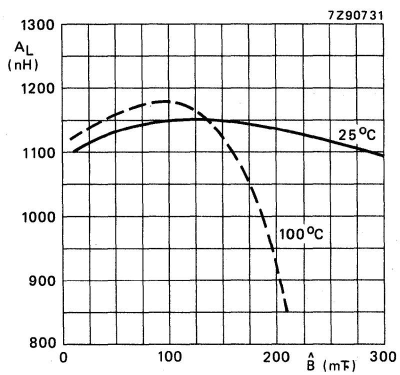
FXC 3H1



Without airgap.

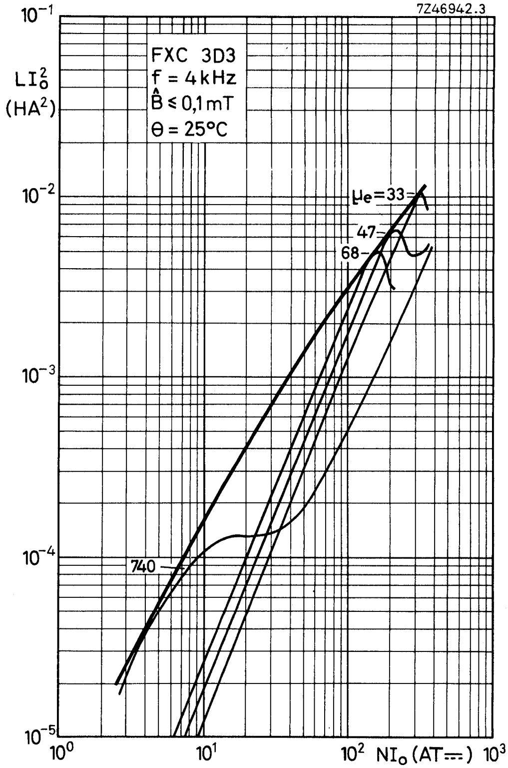


$\mu_e = 100$.

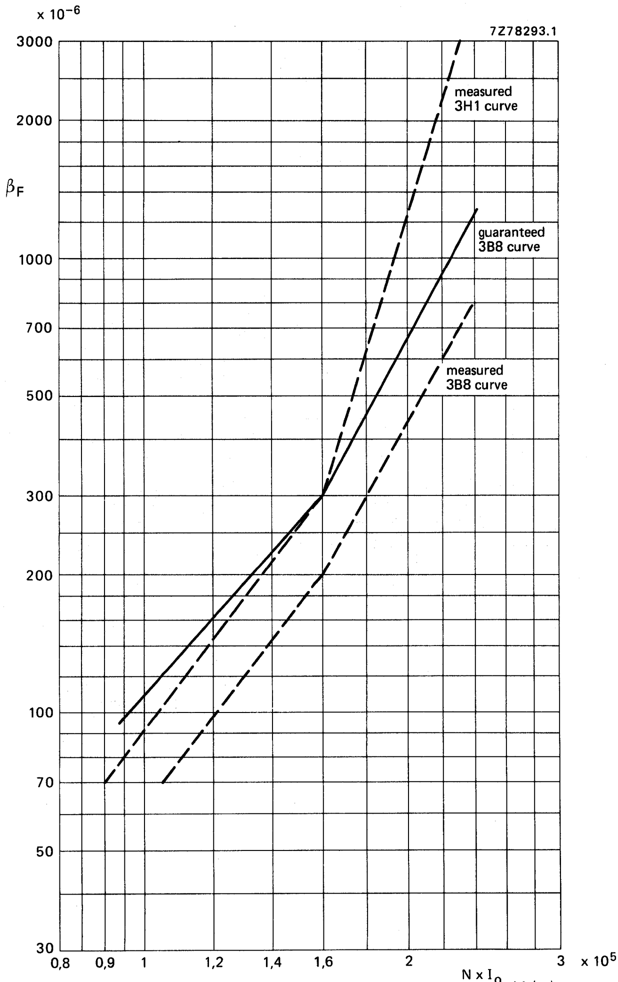


$\mu_e = 300$.

$\hat{B}$ calculated with $A_{CP\,min} = 115\ mm^2$.


7Z46942.3
LI_o^2 (HA^2)
FXC 3D3
f = 4 kHz
$\hat{B} \leq 0{,}1$ mT
$\Theta = 25°C$
$\mu_e = 33$
47
68
740
10^{-1}
10^{-2}
10^{-3}
10^{-4}
10^{-5}
10^0
10^1
10^2
NI_o (AT ⎓)
10^3

D.C. SENSITIVITY AT 25 °C **Guaranteed curve**



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

Inductance variation as a function of d.c. polarization.

POTCORES

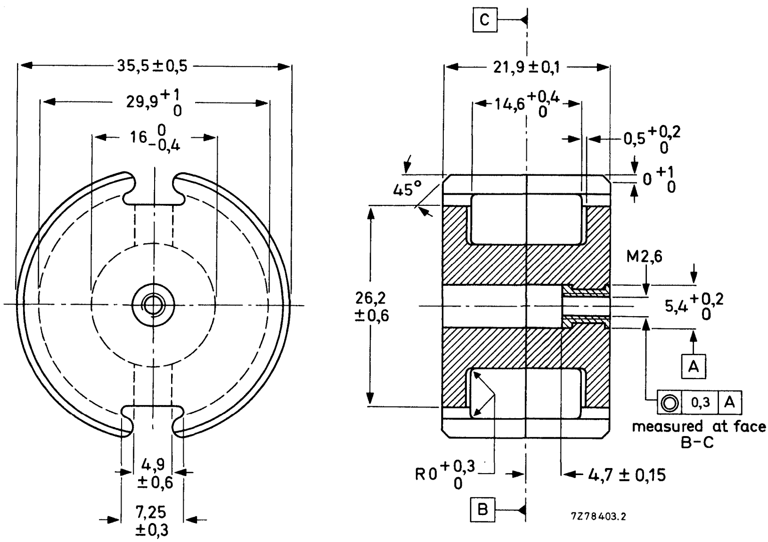
Three types of core can be supplied:

- 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), NCF 83311 (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 80 core sets or 160 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Pulling-out force of the nut ⩾ 50 N.
Torque of the screw thread ⩽ 10 mNm.
Extraction force of the adjuster from the nut ⩾ 40 N.
Dimensional quantities according to IEC 205:

The polyamide nut is moulded-in, except for the 3D3 version, in which it is cemented.

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

$A_{CP\,min} = 172\ \text{mm}^2$.

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, square cores and cross cores', is inserted; the halves are pressed together with a force of 350 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	grade 3D3	grade 3H1
A_L ± 25%	4	≤ 0,1	25 ± 1	9500	3550	9500
μ_e ± 25%	4	≤ 0,1	25 ± 1	2025	745	2025
α	4	≤ 0,1	25 ± 1	≤ 11,7	≤ 19,3	≤ 11,7
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1			≤ 1,2
	100	≤ 0,1	25 ± 1		≤ 8,0	≤ 6,0
	500	≤ 0,1	25 ± 1		≤ 22	
	1000	≤ 0,1	25 ± 1		≤ 50	
P (W)	25	200*	25 ± 1	≤ 1,5		
			100 ± 1	≤ 1,9		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			≤ 0,62
	100	0,3 to 1,2	25 ± 1		≤ 1,8	
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1	5 to 25			+ 0,5 to 1,5
	≤ 100	≤ 0,1	25 to 55			+ 0,5 to 1,5
	≤ 100	≤ 0,1	25 to 70		0 to + 2	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 12	≤ 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 10^5 A/m				≤ 110		
= 1,60 x 10^5 A/m				≤ 300		
= 2,30 x 10^5 A/m				≤ 1050		

* $\hat{B}$ is calculated with A_{CPmin} = 172 mm^2.

Core sets with nuts and pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	catalogue number 4322 022 . . . . . 3B8	3D3	3H1	3H1, without nut
40 ± 1%	8,39				4322 021 13220
100 ± 1%	21			33240	
160 ± 1%	33,6	● 13800	33450	33250	
250 ± 1%	52,5	13810	● 33460	33260	
315 ± 1,5%	66,2	13820			
400 ± 1,5%	84	● 13830	33480	● 33280	
630 ± 2%	132			● 33300	
1000 ± 3%	210			33310	
1250 ± 3%	262			33980	
1600 ± 3%	336	13870		33320	
2500 ± 5%	525			33290	

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022	3D3	3H1		
33 ± 1%	79,7		32430			
47 ± 1%	66,8		32440			
68 ± 1%	55,6		32450	32250		
100 ± 1,5%	45,8			32260		
150 ± 2%	37,4			32270		
220 ± 3%	30,9			32280		
330 ± 3%	25,2			32290		
750 ± 25%	16,7		12400			
2030 ± 25%	10,2			12200		

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 $A_L \geqslant 1000$, or $\mu_e \geqslant 220$, and all 3B8 cores have an asymmetrical air gap.

Core halves without air gap, without nut:

Ferroxcube grade	catalogue number
3B8	4322 020 22610
3D3	4322 020 22520
3H1	4322 020 22510

● Preferred type.

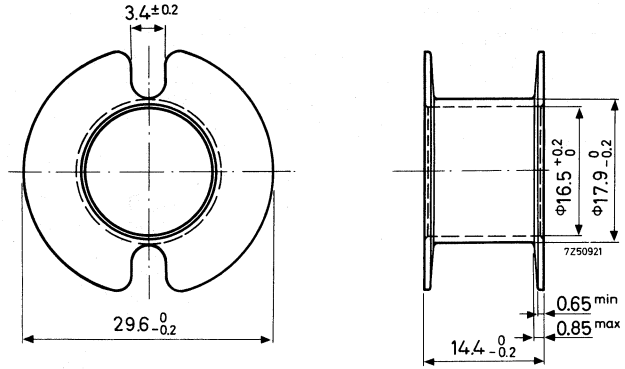
COIL FORMERS

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), NCF 83311 (France), DIN 41294 (Germany) and BS4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



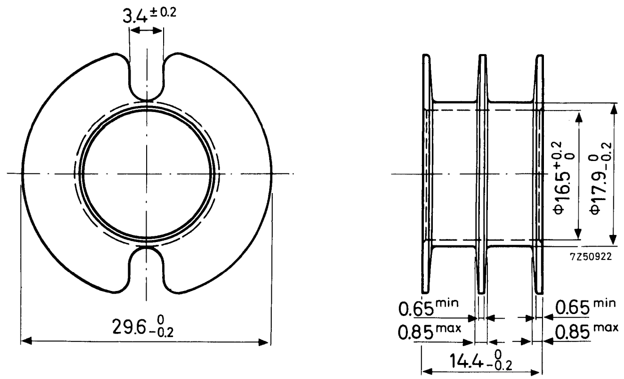
Catalogue number	4322 021 30390
Material	polycarbonate
Window area	75 mm^2
Mean length of turn	74 mm
Maximum temperature	130 ^{o}C

D.C. losses

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

Mass 1,3 g

TWO-SECTION COIL FORMER



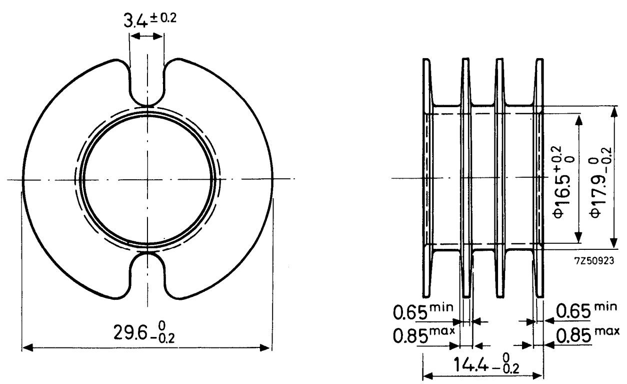
Catalogue number	4322 021 30400
Material	polycarbonate
Window area	2 x 35 mm²
Mean length of turn	74 mm
Maximum temperature	130 °C

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 mm²
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 2 g

INDUCTANCE ADJUSTERS

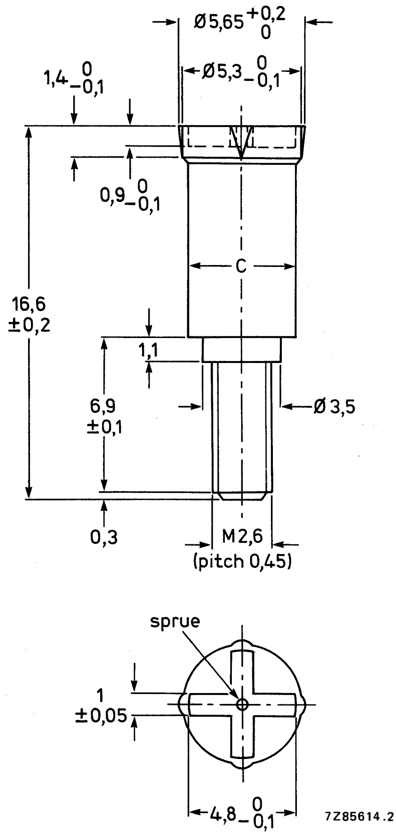


Table 1

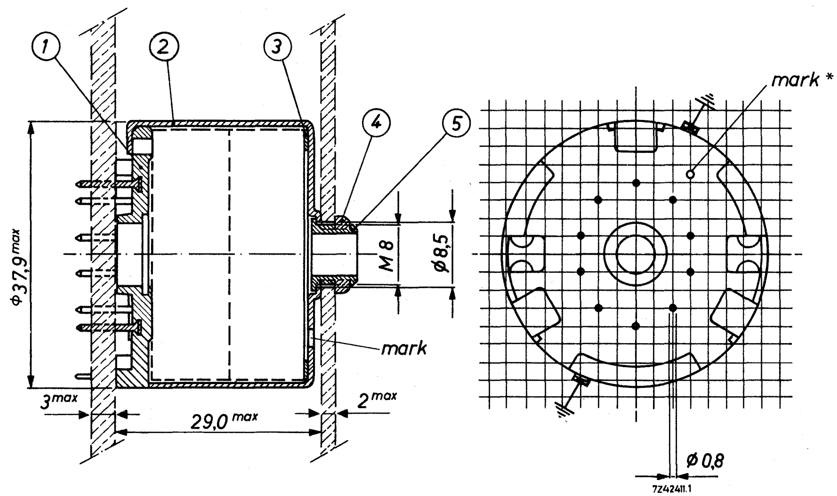
catalogue number	colour	core material	C mm
4322 021 39240	yellow	cip	5,20
39280	white	cip	5,20
39290	grey	FXC	5,20

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P36/22

core material	A_L	low	%	medium	%	high	%
3H1, 3B8	100	–		4322 021 39240	17	4322 021 39280	28
	160	–		39240	15	39280	24
	250	–		39240	11	39280	18
	400	4322 021 39240	8	39280	8	–	
	630	39240	5	39280	8	–	
	1000	39280	5	39290	20	–	
	1250	–		39290	17	–	
	1600	–		39290	12	–	
	2500	–		39290	8	–	
3D3	160	–		4322 021 39240	13	4322 021 39280	21
	250	–		39240	11	39280	17
	400	4322 021 39240	7	39280	11	–	

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		

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

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

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.

* 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.

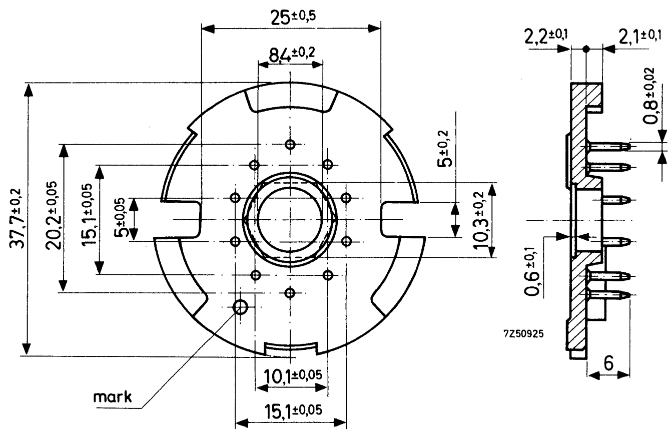
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 350 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS

(1) **Tag plate** 4322 021 30490

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

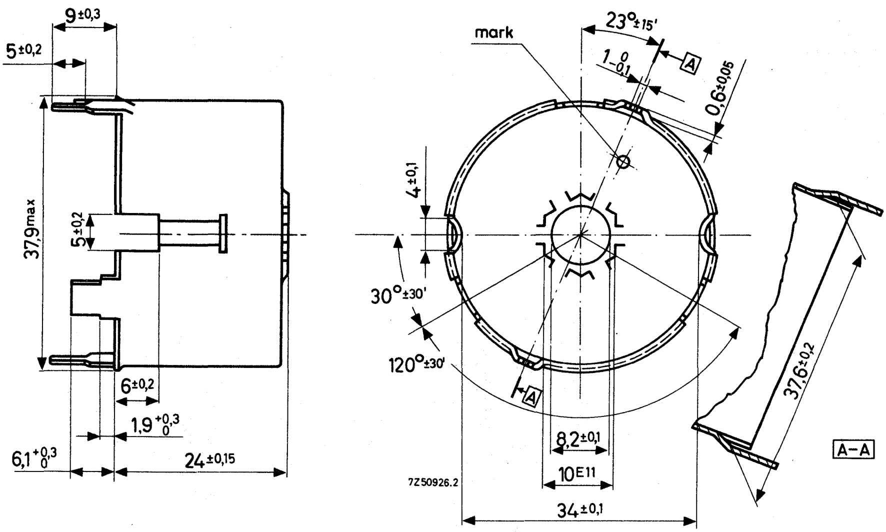
Pins : phosphor bronze, dip-soldered.



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

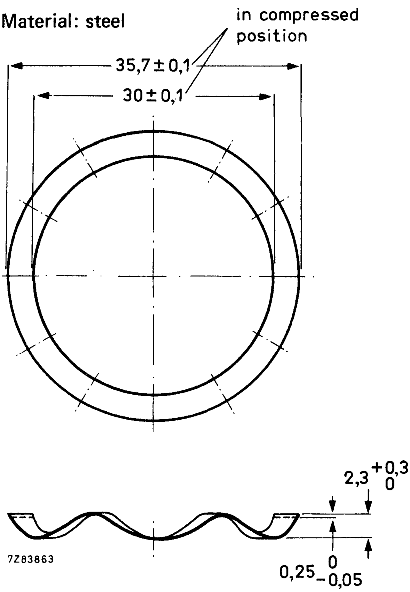
Material: brass, nickel plated; thereafter tin plated.



The containers are packed with 20 pieces in a primary pack, and 100 pieces in a storage pack. Please order in multiples of these quantities.

(3) **Spring** 4322 021 30680

Material: steel

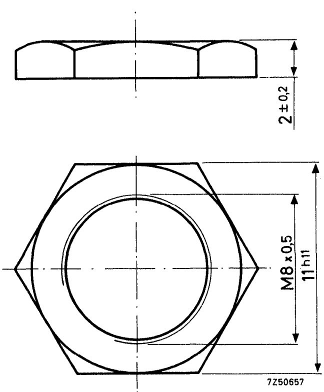


A force of 255 to 425 N is required to compress the spring to 0,55 mm.

The springs are supplied in quantities of 200. Please order in multiples of this quantity.

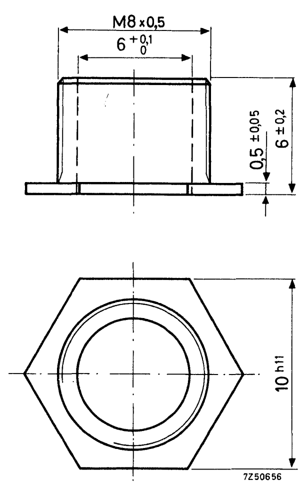
(4) **Nut** 4322 021 30710

Material: brass, nickel plated



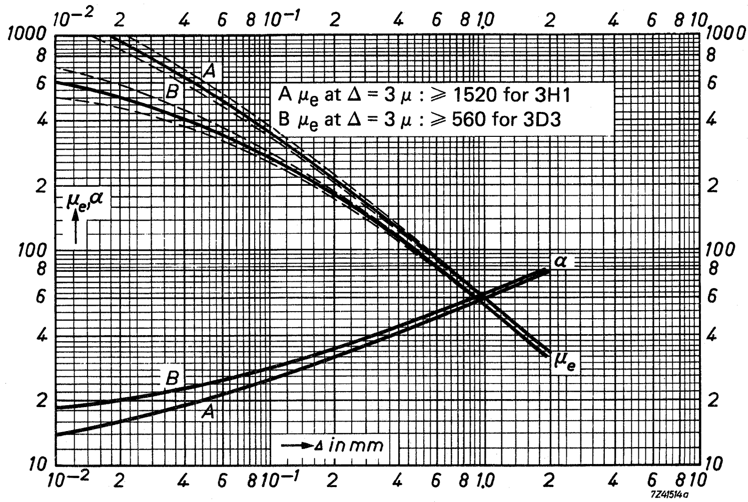
(5) **Fixing bush** 4322 021 30720

Material: brass, nickel plated



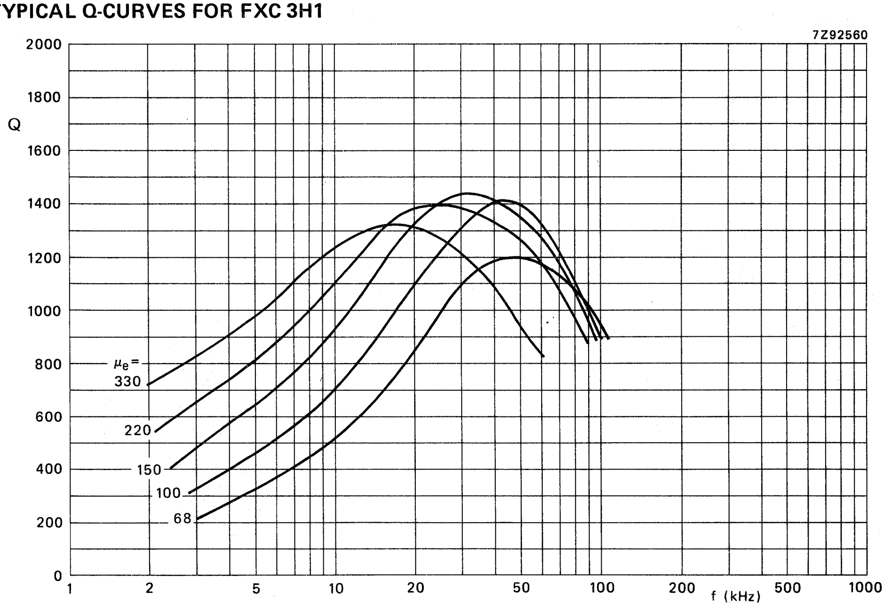
CHARACTERISTIC CURVES

μ_e - α CURVES



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

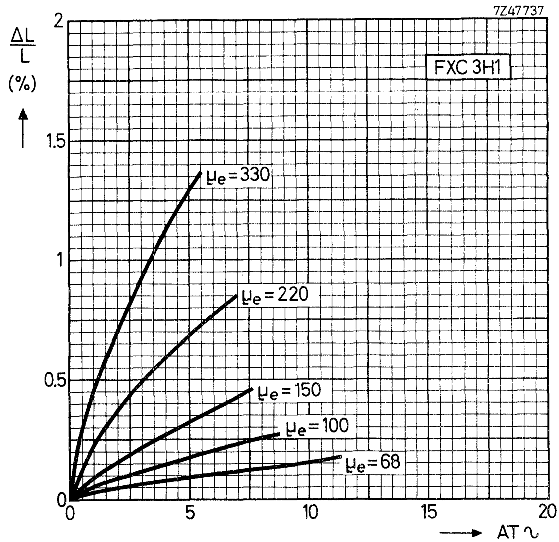
TYPICAL Q-CURVES FOR FXC 3H1

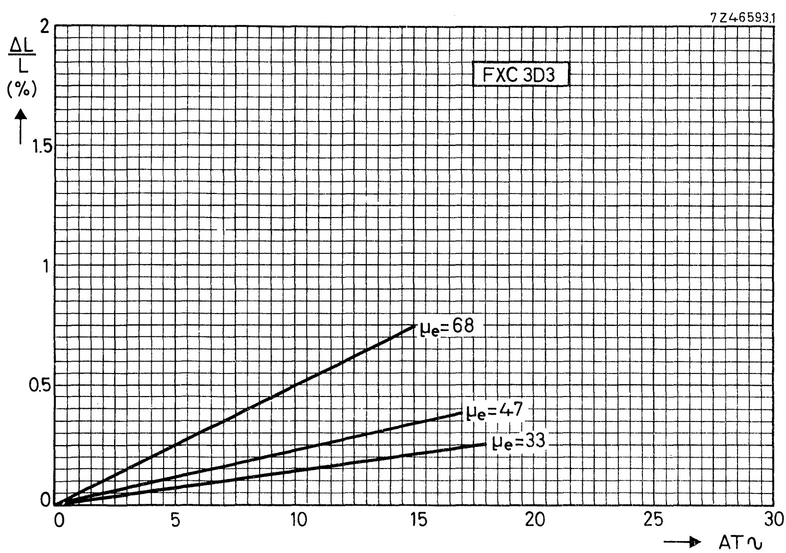


Enveloping curves.

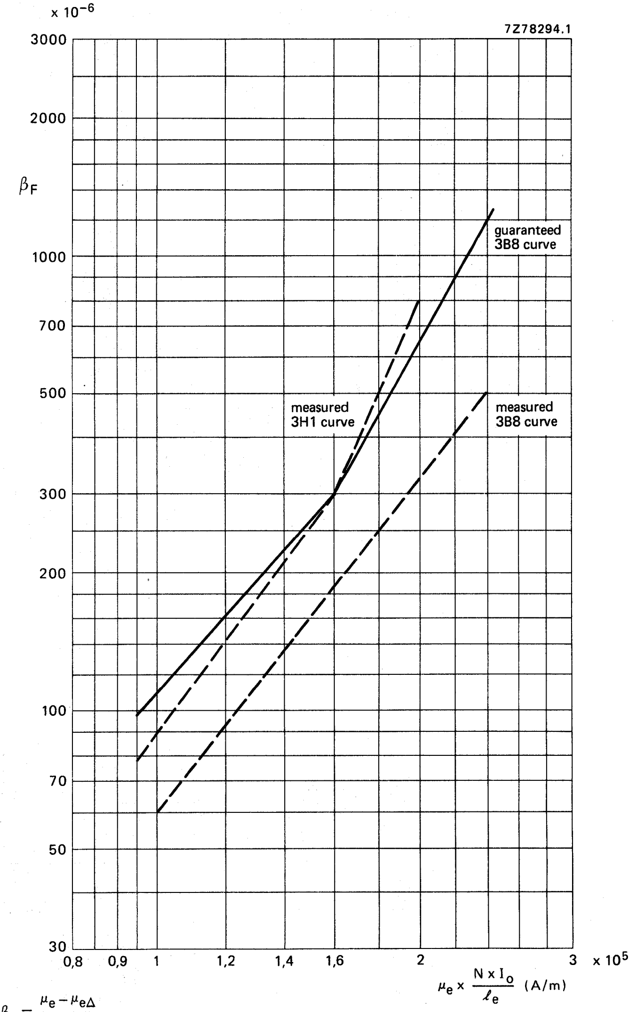
Coil former 4322 021 30390.

INDUCTANCE VARIATION AS A FUNCTION OF AT~





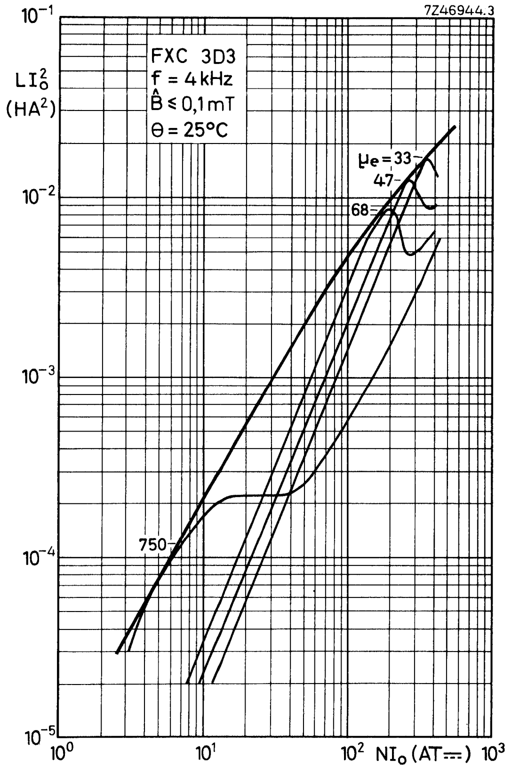
D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. polarization.

Typical values



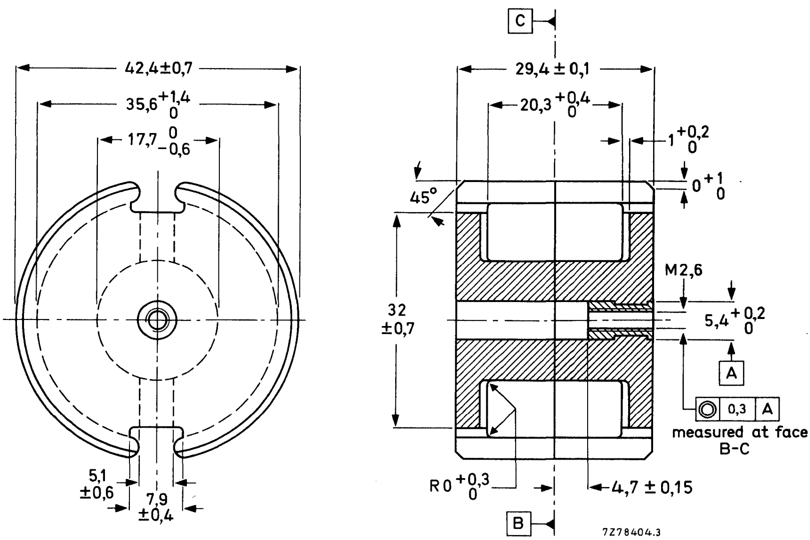
POTCORES

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.

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 80 core sets or 160 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Pulling-out force of the nut ⩾ 50 N

Torque of the screw thread ⩽ 10 mNm.

Extraction force of the adjuster from the nut ⩾ 40 N

MECHANICAL DATA (continued)

Dimensional quantities according to IEC 205:

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

$A_e = 265\ mm^2$; $A_{CP\,min} = 214\ mm^2$.

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, square cores and cross cores', is inserted; the halves are pressed together with a force of 550 N. The values are valid 5 minutes or more after clamping.

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

Core sets with nut and pre-adjusted on A_L.

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

Core sets with nut and pre-adjusted on μ_e.

μ_e	α	catalogue number 4322 022 . . . . .
		3H1
68 ± 1%	55,0	34250
100 ± 1,5%	45,0	34260
150 ± 2%	36,8	34270
220 ± 3%	30,4	34280
330 ± 3%	24,8	34290
2120 ± 25%	9,85	14200

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 $A_L \geqslant 1000$, or $\mu_e \geqslant 220$ have an asymmetrical air gap.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3H1	4322 020 22760

● Preferred type.

COIL FORMERS

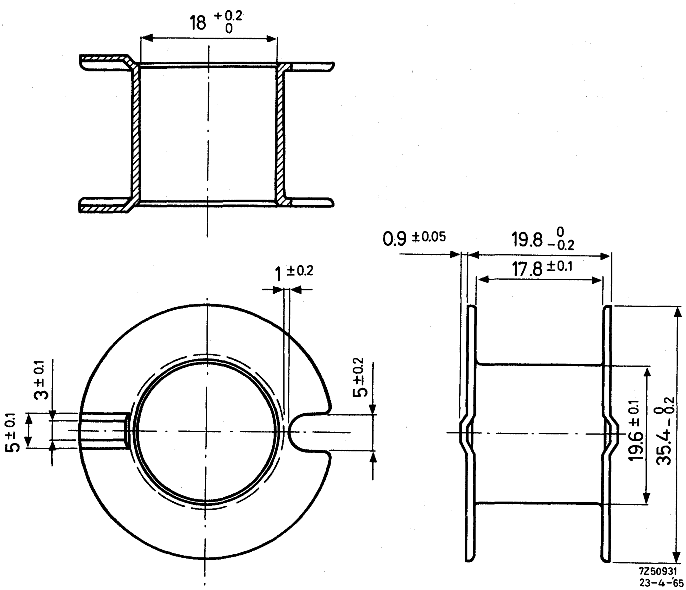
GENERAL

Two types of coil former can be supplied:

- with one section;
- with two sections.

The dimensions conform with the following specifications: IEC 133 (international), NCF 83311 (France) and BS 4061 range 2 (Great Britain).

SINGLE-SECTION COIL FORMER



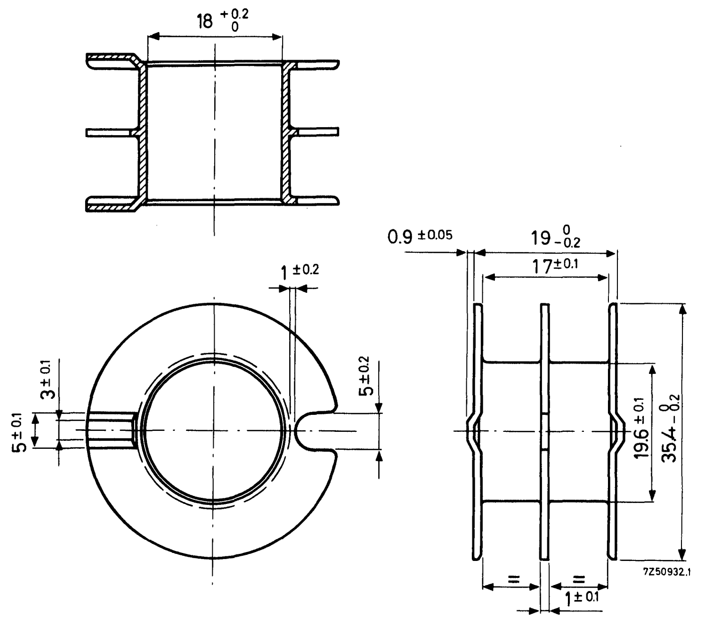
Catalogue number	4322 021 30420
Material	polycarbonate
Window area	140 mm^2
Mean length of turn	86 mm
Max. temperature	130 °C

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 mm^2
Mean length of turn	86 mm
Max. temperature	130 ^{o}C

D.C. losses

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

Mass 3,0 g

INDUCTANCE ADJUSTERS

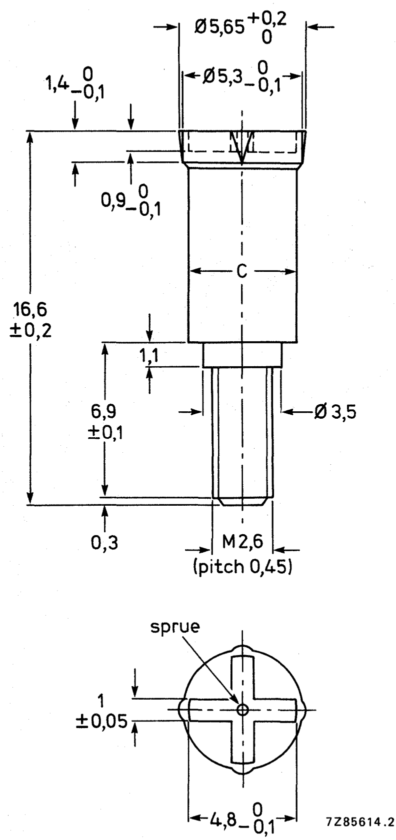


Table 1

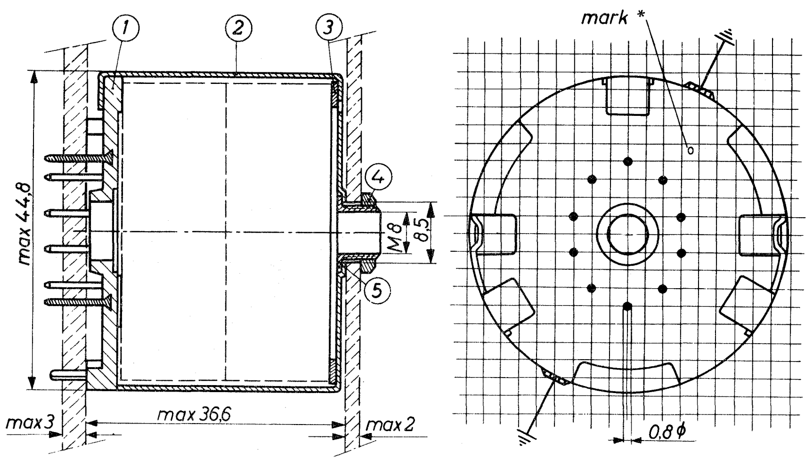
catalogue number	colour	core material	C mm
4322 021 39240	yellow	cip	5,20
39280	white	cip	5,20
39290	grey	FXC	5,20

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. P42/29

core material	A_L	low	%	medium	%	high	%
3H1	100	–		4322 021 39240	14	4322 021 39280	23
	250	–		39240	10	39280	16
	400	4322 021 39240	7	39280	11	–	
	630	–		39280	7	39290	28
	1000	–		39290	18	–	
	1600	–		39290	11	–	

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			

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

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

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.

* 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.

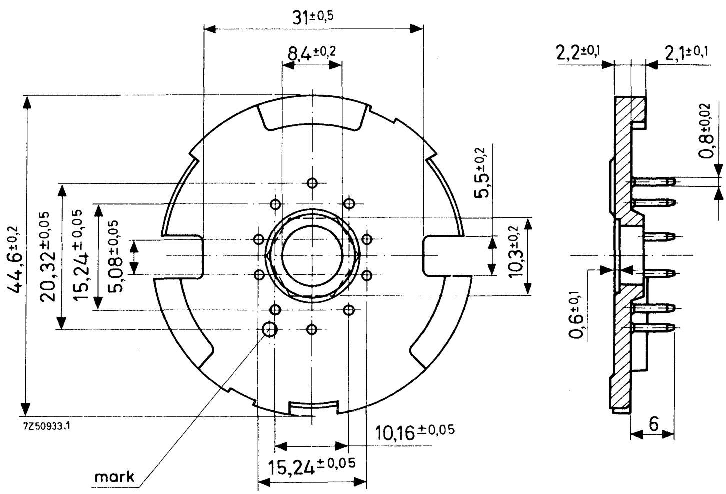
Before bending the lips of the container, pressure should be exerted evenly on the rim of the tag plate until it meets the container. The force which is required is approximately 550 Newton. After bending the lips the spring will have the correct tension.

PART DRAWINGS

(1) **Tag plate** 4322 021 30500

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

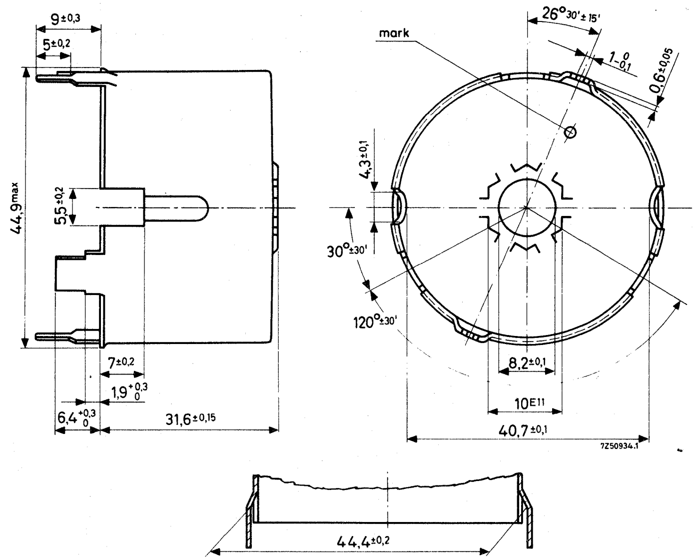
Pins: phosphor bronze, dip-soldered.



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.

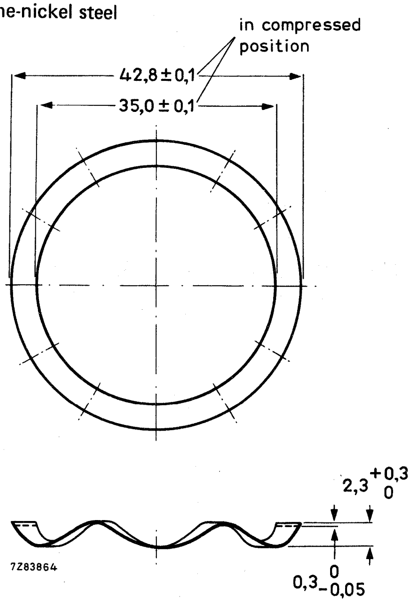
(2) **Container** 4322 021 30580

Material: brass, nickel plated; thereafter tin plated



(b) **Spring** 4322 021 30690

Material: chrome-nickel steel

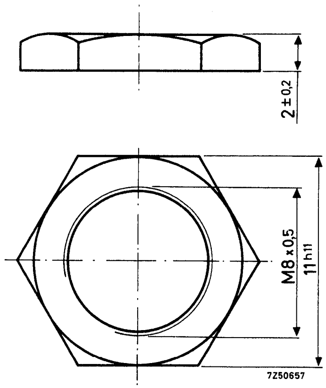


A force of 383 to 638 N is required to compress the spring to 0,67 mm.

The springs are supplied in quantities of 100. Please order in multiples of this quantity.

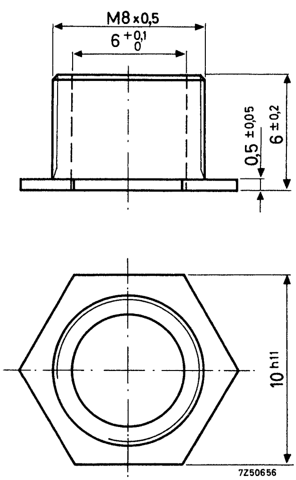
(4) **Nut** 4322 021 30710

Material: brass, nickel plated



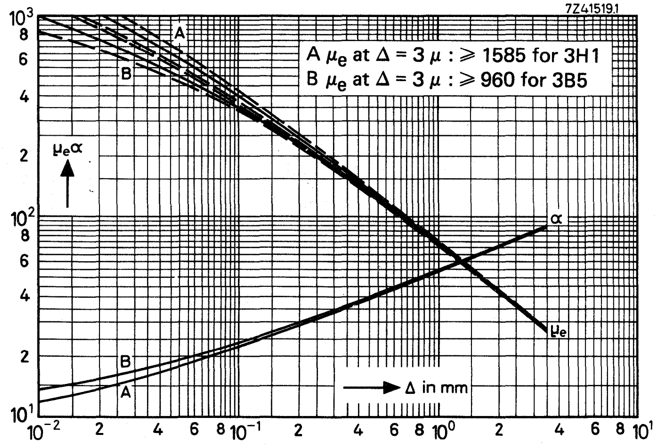
(5) **Fixing bush** 4322 021 30720

Material: brass, nickel plated



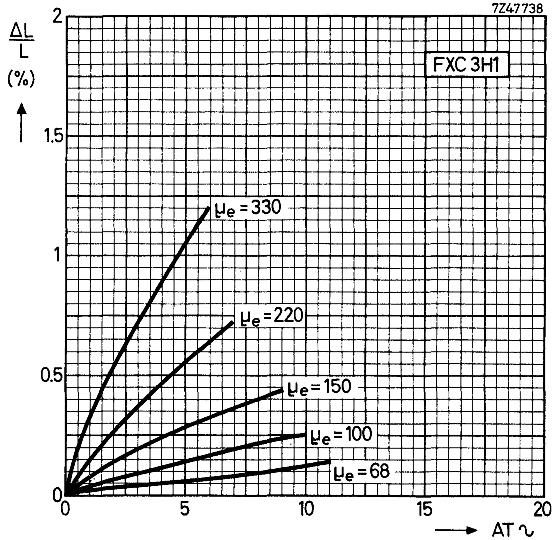
CHARACTERISTIC CURVES

μ_e-α CURVES



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

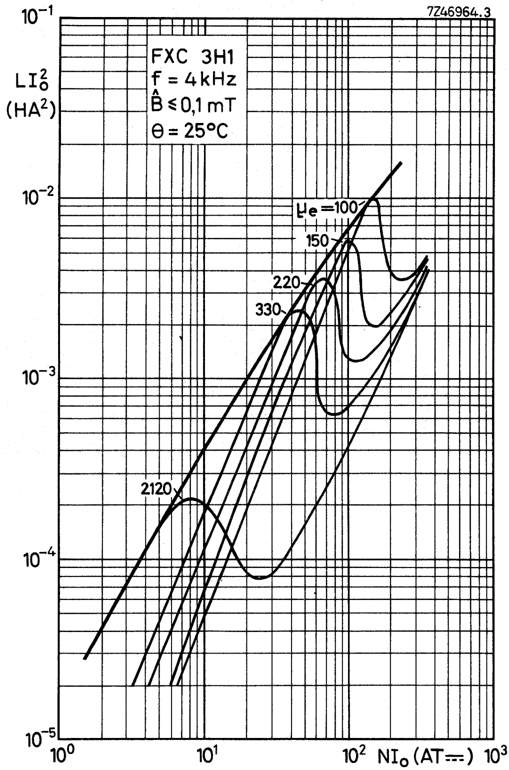
INDUCTANCE VARIATION AS A FUNCTION OF AT~



HANNA CURVE

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

Typical values



POTCORES

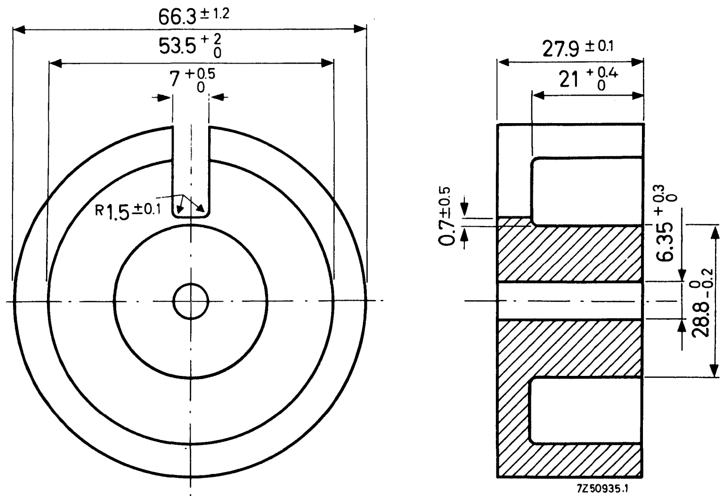
INTRODUCTION

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



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0,172\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0,000240\ mm^{-3}$; $V_e = 88300\ mm^3$; $l_e = 123$ mm;

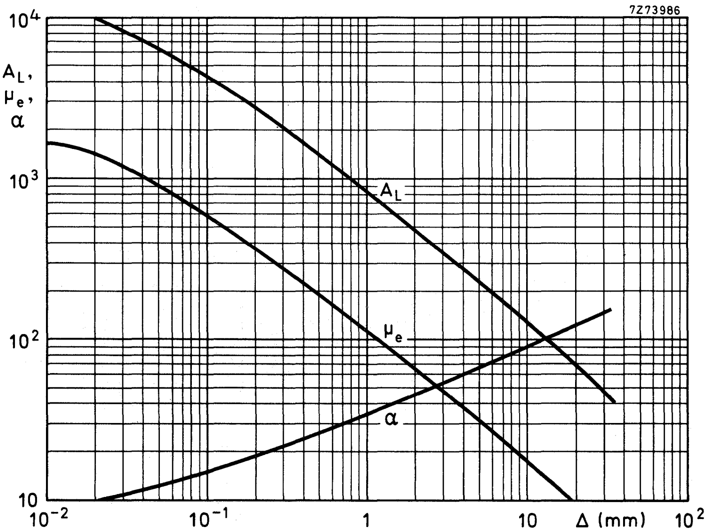
$A_e = 717\ mm^2$; $A_{CP\,min} = 590\ mm^2$.

Mass of core set: 550 g.

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	3E1 grade
μ_e	$\leqslant$ 0,1	4	$\geqslant$ 1970
α	$\leqslant$ 0,1	4	$\leqslant$ 8,25

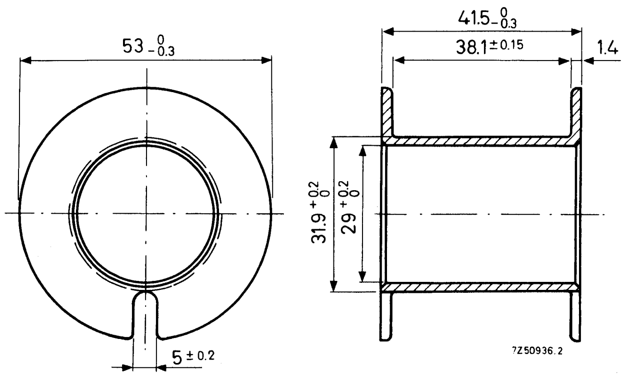
CHARACTERISTIC CURVES



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

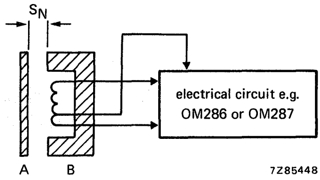
D.C. losses

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

Mass 11,8 g

SECTION D
POTCORE HALVES AND COIL FORMERS FOR INDUCTIVE PROXIMITY DETECTORS

GENERAL



An inductive proximity detector operates as follows. A metal object A approaches – or recedes from – an open potcore half with coil B. The change in the Q of the oscillator is used to generate an electrical signal that can be used to drive an electromechanical relay, an audible alarm or similar devices.

Potcore halves with diameters up to 9,4 mm are manufactured in Ferroxcube grade 3D3 and potcore halves with diameters 14 mm and larger in Ferroxcube grade 3H1, because the operating frequency of oscillators with small potcore halves is higher than that of oscillators with large potcore halves.

Suitable coil formers are available for all potcore halves. The polycarbonate material of the coil former limits the maximum potting temperature to 110 °C. The potting material should be somewhat flexible to avoid high mechanical stresses on the Ferroxcube potcore halves.

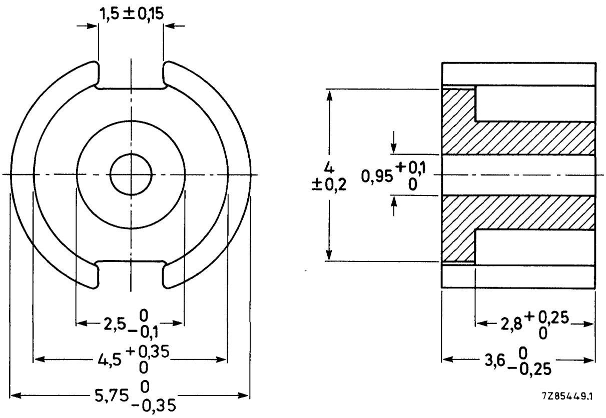
SURVEY OF TYPES

Ferroxcube potcore half	grade	catalogue number	coil former
5,6 x 3,6	3D3	4322 020 54210	4322 021 33540
7,4 x 3,9	3D3	4322 020 54510	4322 021 32990
9,4 x 4,8	3D3	4322 020 54710	4322 021 31700
14 x 7,5	3H1	4322 020 54800	4322 021 30250
26 x 9,2	3H1	4322 020 54900	4322 021 33700

POTCORE HALF

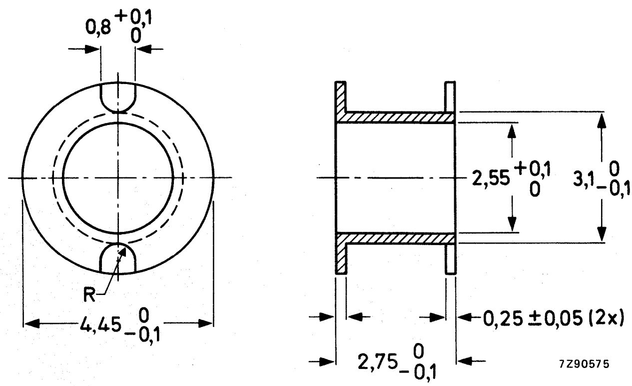
Non-ground potcore half, intended for use in proximity detectors.

MECHANICAL DATA



Material grade: 3D3
Initial permeability, toroidally measured: μ_i = 750 ± 20%
Mass of one potcore half: 0,25 g
Catalogue number: 4322 020 54210
Quantities: a primary pack contains 100 core halves, a storage pack contains 500 core halves. Please order in multiples of these quantities.

COIL FORMER



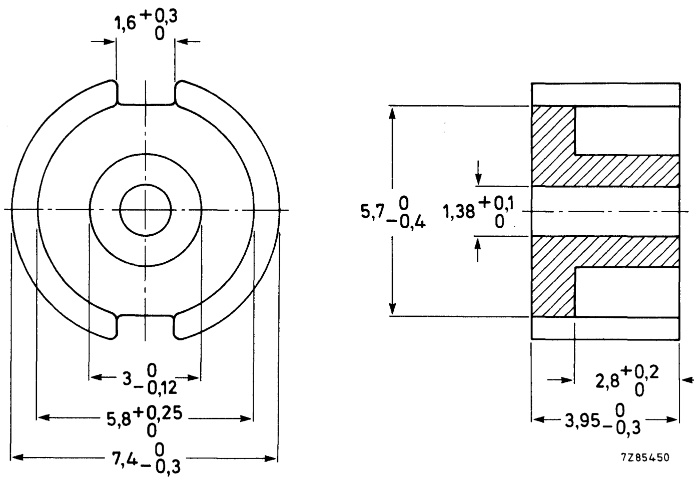
Catalogue number	4322 021 33540
Material	polyamide
Window area	1,9 mm^2
Mean length of turn	11,7 mm
Maximum temperature	130 °C
A_R value*	221 $\mu\Omega$
Mass	0,03 g

* D.C. resistance = $A_R \cdot$ (number of turns)^2 or $R_0 = A_R \cdot N^2$.

POTCORE HALF

Non-ground potcore half, intended for the use in proximity detectors.

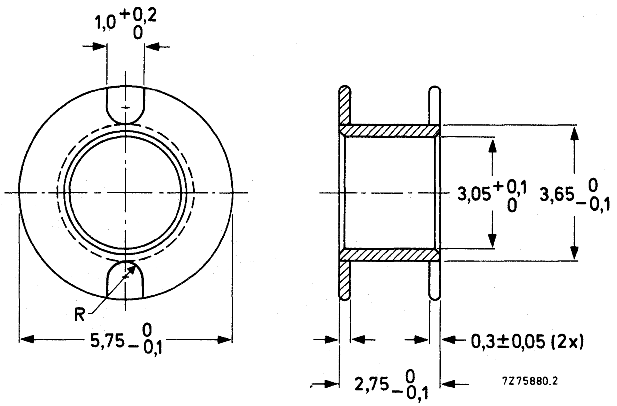
MECHANICAL DATA



Material grade: 3D3
Initial permeability, toroidally measured: μ_i = 750 ± 20%
Mass of one potcore half: 0,3 g
Catalogue number: 4322 020 54510
Quantities: A primary pack contains 100 core halves; a storage pack contains 500 core halves. Please order in multiples of these quanties.

COIL FORMER

This coil former is identical to the single-section coil former for potcore P7,4/4,2.



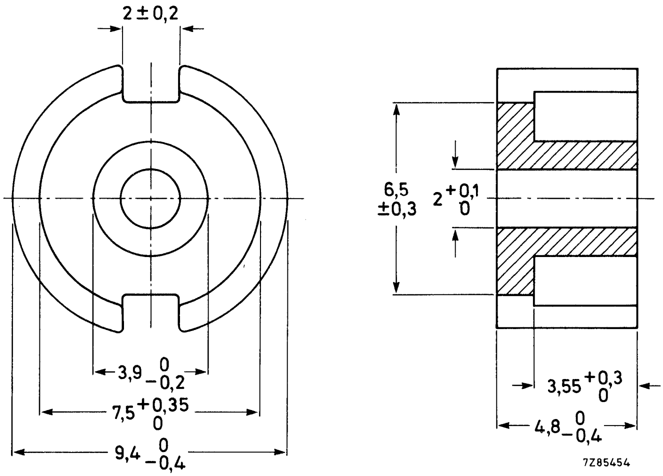
Catalogue number	4322 021 32990
Material	polyamide
Window area	2,2 mm^2
Mean length of turn	14,6 mm
Maximum temperature	130 °C
A_R value*	230 $\mu\Omega$
Mass	0,04 g

* D.C. resistance = $A_R \circ$ (number of turns)^2 or: $R_0 = A_R \cdot N^2$.

POTCORE HALF

Non-ground potcore half, intended for use in proximity detectors.

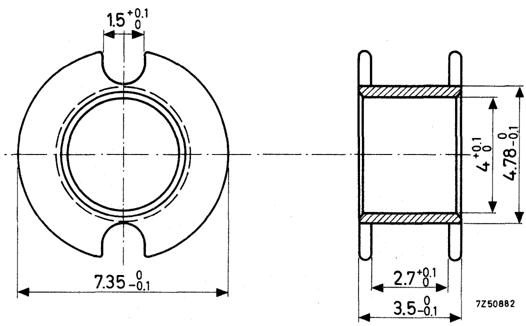
MECHANICAL DATA



Material grade: 3D3
Initial permeability, toroidally measured: μ_i = 750 ± 20%
Mass of one potcore half: 1,6 g
Catalogue number: 4322 020 54710
Quantities: a primary pack contains 50 core halves, a storage pack contains 400 core halves. Please order in multiples of these quantities.

COIL FORMER

This coil former is identical to the single-section coil former for potcore P9/5.



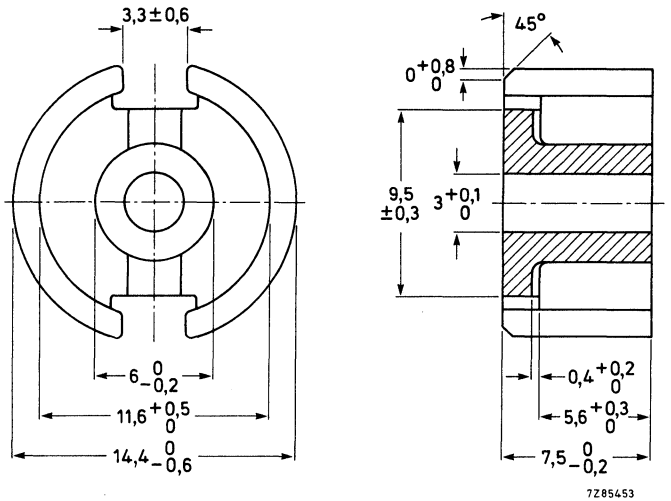
Catalogue number	4322 021 31700
Material	polycarbonate
Window area	3,4 mm^2
Mean length of turn	19 mm
Maximum temperature	130 °C
A_R value*	200 $\mu\Omega$
Mass	0,07 g

* D.C. resistance = A_R · (number of turns)^2 or: $R_0 = A_R \cdot N^2$.

POTCORE HALF

Non-ground potcore half, intended for use in proximity detectors.

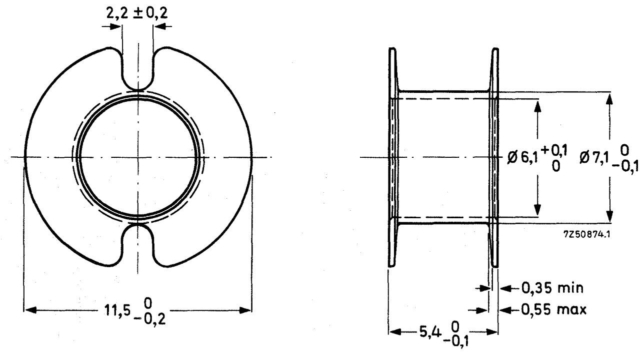
MECHANICAL DATA



Material grade: 3H1
Initial permeability, toroidally measured: μ_i = 2300 ± 20%
Mass of one potcore half: 2,0 g
Catalogue number: 4322 020 54800
Quantities: a primary pack contains 40 core halves; a storage pack contains 200 core halves. Please order in multiples of these quantities.

COIL FORMER

This coil former is identical to the single-section coil former for potcore P14/8.



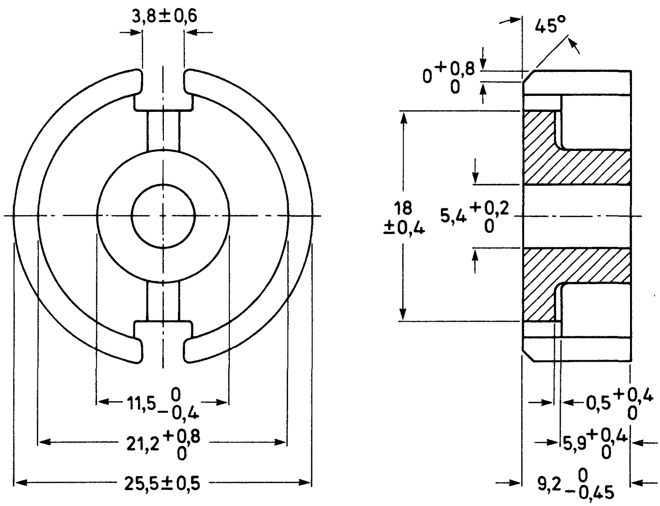
Catalogue number	4322 021 30250
Material	polycarbonate
Window area	9,7 mm^2
Mean length of turn	29 mm
Maximum temperature	130 °C
A_R value*	110 $\mu\Omega$
Mass	0,15 g

* D.C. resistance = A_R · (number of turns)^2 or: $R_0 = A_R \cdot N^2$.

POTCORE HALF

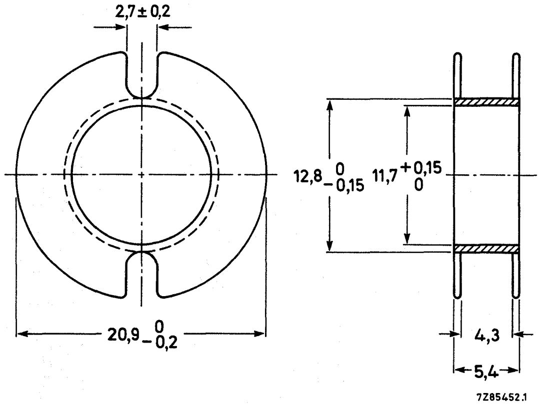
Non-ground potcore half, intended for use in proximity detectors.

MECHANICAL DATA



Material grade: 3H1
Initial permeability, toroidally measured: μ_i = 2300 ± 20%
Mass of one potcore half: 11 g
Catalogue number: 4322 020 54900
Quantities: a primary pack contains 40 core halves, a storage pack contains 200 core halves. Please order in multiples of these quantities.

COIL FORMER



Catalogue number:	4322 021 33700
Material	polycarbonate
Window area	22 mm²
Mean length of turn	14,6 mm
Maximum temperature	130 °C
A_R value*	90 μΩ
Mass	0,4 g

* D.C. resistance = A_R · (number of turns)^2 or: $R_0 = A_R \cdot N^2$.

SECTION E
SQUARE CORES AND ACCESSORIES

SQUARE CORES

These cores are available in two executions:

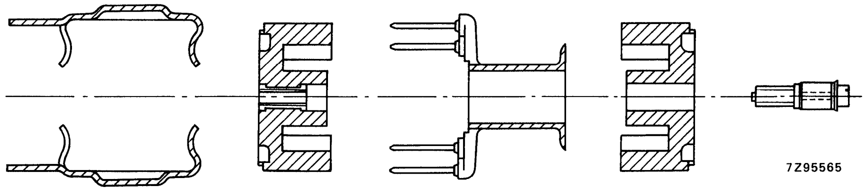
- RM4, usually for telecommunication, with centre hole for adjuster
- RM4/i, for industrial applications, no centre hole

RM4 cores can be supplied in three versions

- CORE SETS provided with a 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 341 (international), UTE83-300 (France), DIN 41980 (Germany).

Square cores and associated parts are ordered by their 12-digit catalogue number. Quanity: 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.

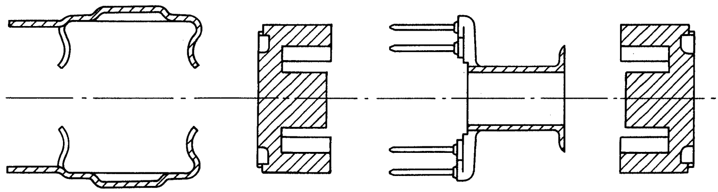


RM4

RM4/i cores can be supplied in two versions

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM4/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quantities and supply conditions upon request.

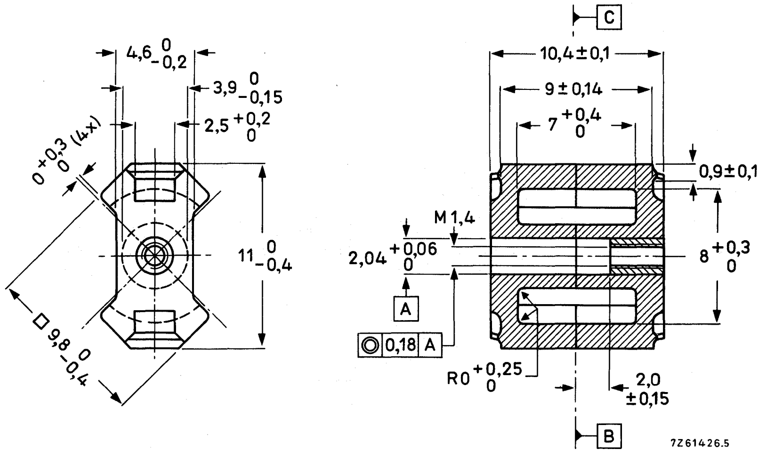


RM4/i

RM4 SQUARE CORES

for telecommunication

MECHANICAL DATA



Pulling-out force of the nut ⩾ 20 N (at ambient temperature)
Torque of the screw thread ⩽ 4 mNm
Extraction force of adjuster from nut ⩾ 10 N

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 1{,}94\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}176\ mm^{-3}$; $V_e = 230\ mm^3$; $l_e = 21{,}3\ mm$; $A_e = 11{,}0\ mm^2$.
$A_{min} = 8{,}1\ mm^2$.
Mass of a core set: 2,5 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 1{,}69\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}123\ mm^{-3}$; $V_e = 322\ mm^3$; $l_e = 23{,}3\ mm$; $A_e = 13{,}8\ mm^2$.

$A_{min} = 11{,}5\ mm^2$
mass of a core set: 2,8 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, square cores and cross cores', is inserted; the halves are pressed together with a force of 25 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade	
				3E4	3H1
A_L ± 25%	4	⩽ 0,1	25 ± 1		1040
μ_e ± 25%	4	⩽ 0,1	25 ± 1		1600
α	4	⩽ 0,1	25 ± 1		⩽ 35,8
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1	⩽ 2,5	
	30	⩽ 0,1	25 ± 1		⩽ 3,0
	100	⩽ 0,1	25 ± 1	⩽ 20	⩽ 6,0
	500	⩽ 0,1	25 ± 1	⩽ 200	
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,1	⩽ 1,1
$\alpha_F \times 10^6$/K	⩽ 100	⩽ 0,1	5 to 25	0 to +2	+0,5 to +1,5
	⩽ 100	⩽ 0,1	25 to 55	0 to +2	+0,5 to +1,5
	⩽ 100	⩽ 0,1	25 to 70	0 to +2	
$D_F \times 10^6$ (10 – 100 min)	⩽ 100	⩽ 0,1	25 ± 0,1	⩽ 4,3	⩽ 4,3

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 ..... 3E4	3H1
40	62	± 1		77220
63	96	± 1,5		77230
100	152	± 2		• 77240
•160	242	± 5		77250
250	380	± 10		77260
2790	3760	± 25	• 57900*	

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 $A_L \leqslant 40$ have a symmetrical air gap.
Cores with $A_L \geqslant 63$ have an asymmetrical air gap.
Types marked* are without centre hole.

In order to obtain better performance, type 4322 022 57900 is made without centre hole.

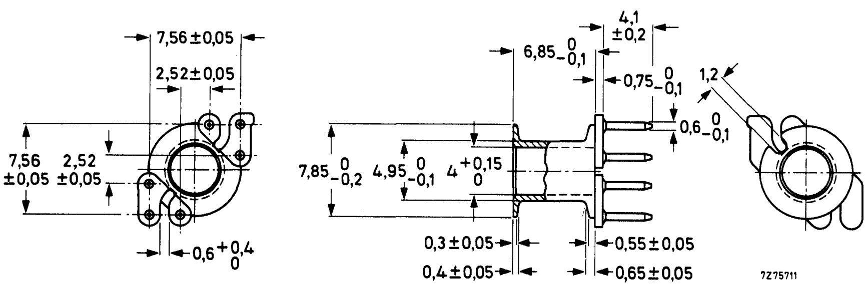
Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3H1	4322 020 26510

• Preferred type.

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 mm^2
Mean length of turn	20 mm
Max. temperature	180 °C
Solderability	resistant against dip-soldering at 400 °C for 2 s
D.C. losses	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 55{,}7 \times 10^3\ \Omega/H$
Inflammability	UL94, class V-0
Mass	0,16 g

The coil formers are supplied in packs of 200 on a polystyrene plate. Please order in multiples of this quantity.

INDUCTANCE ADJUSTERS

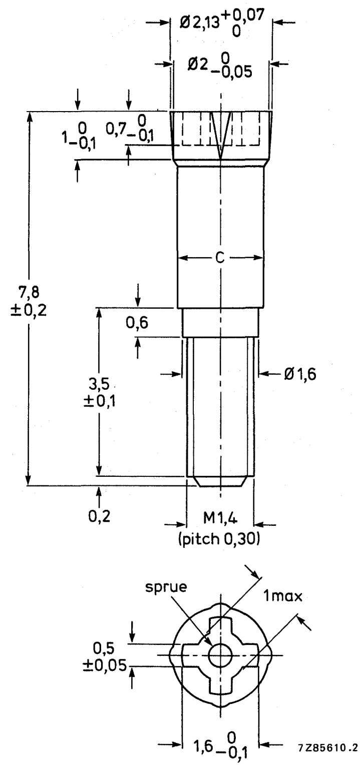


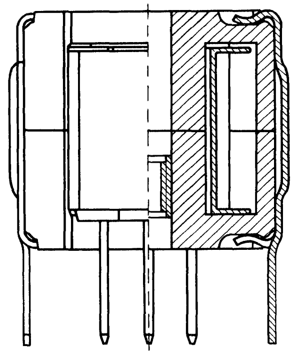
Table 1

catalogue number	colour code	material	C
4322 021 38700	black	FXC	1,93
38710	brown	FXC	1,70
38720	red	cip	1,97
38750	green	cip	1,93
38780	white	FXC	1,97
38790	grey	FXC	1,87

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. RM4

core material	A_L	low	%	medium	%	high	%
3H1	40	–		4322 021 38750	20	–	
	63	–		38750	14	38720	27
	100	4322 021 38750	9	38720	17	38710	22
	160	38750	6	38710	14	38790	19
	250	38720	7	38790	12	38700	17

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.

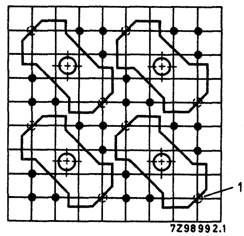
For a stable inductance we recommend that an adhesive be applied between the coil former flange and the lower core half. We also recommend that a tool be used for assembling. (Drawings of a simple tool are available under number 4322 058 00180.)

MOUNTING

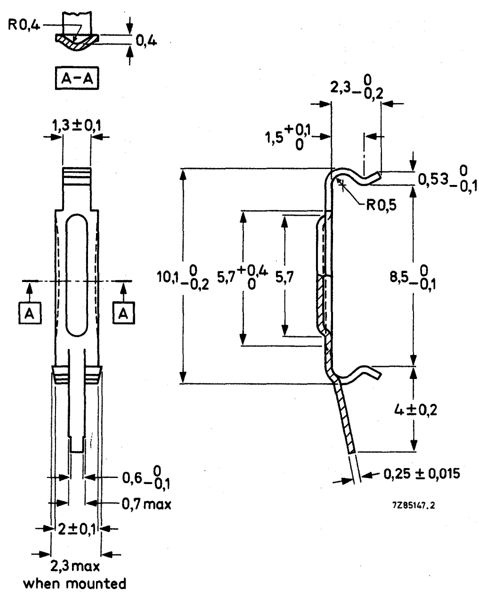
The two retaining clips are also used for mounting the assembled core on a printed-wiring board: the pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing the core.

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).

Hole pattern for an assembly of 4 cores.



PART DRAWING (dimensions in mm)



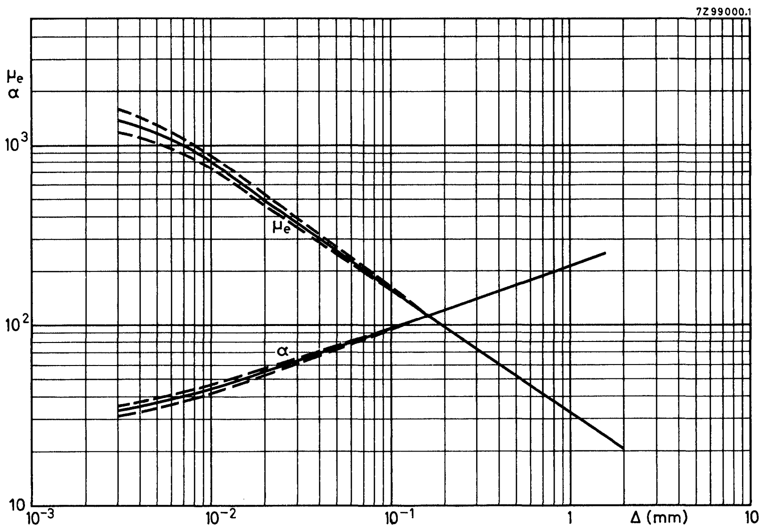
Clip 4322 021 31900

Material: steel; nickel plated thereafter silver plated and finally passivated.

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

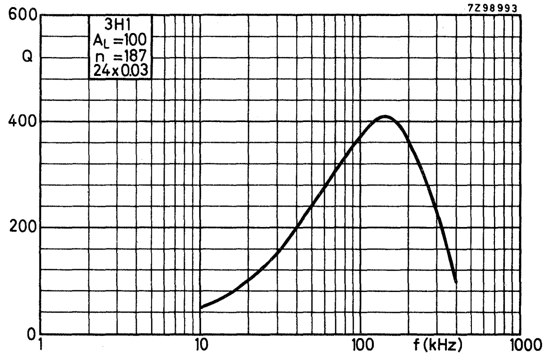
CHARACTERISTIC CURVES

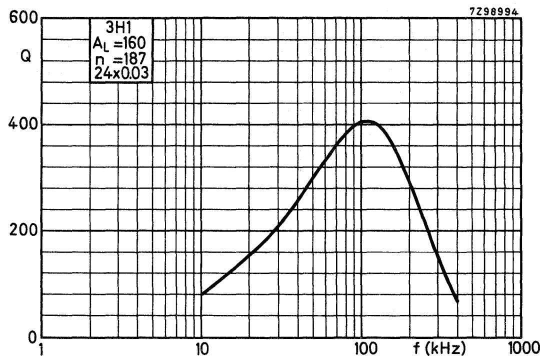
$\mu_e - \alpha$ CURVES



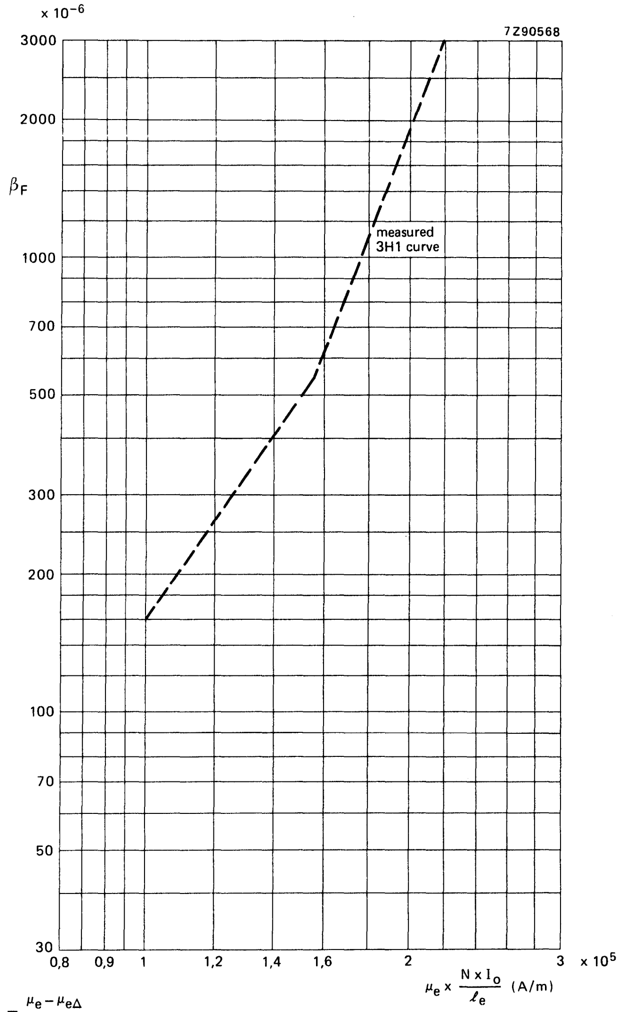
Relative effective permeability and turns factor for 1 mH as a function of the air gap length. $\mu_e \geqslant 1200$ at $\Delta = 3\ \mu m$ for 3H1.

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

D.C. SENSITIVITY AT 25 °C



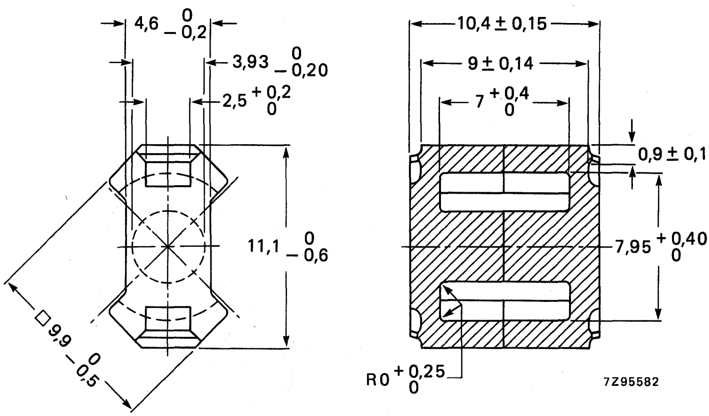
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. polarization.

RM4/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 1{,}69\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}123\ mm^{-3}$; $V_e = 322\ mm^3$; $l_e = 23{,}3$ mm; $A_e = 14{,}4\ mm^2$.

$A_{min} = 11{,}5\ mm^2$

Mass of a core set: 2,8 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, square cores and cross cores', is inserted; the halves are pressed together with a force of 20 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3E4	grade 3F3
A_L	4	⩽ 0,1	25 ± 1	2500 + 40% −25%	1000 ± 25%
P (W)	25	200	25 ± 1		0,08
			100 ± 1		0,06
	100	100	25 ± 1		0,08
			100 ± 1		⩽ 0,06
	400	50	25 ± 1		0,10
			100 ± 1		⩽ 0,10
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1	⩽ 2,5	
	10	⩽ 0,1	25 ± 1		
	100	⩽ 0,1	25 ± 1	⩽ 20	
	500	⩽ 0,1	25 ± 1	⩽ 200	
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1	⩽ 1,1	

Notes

For the specification of power losses $\hat{B}$ is calculated using A_e = 14,4 mm^2.

The induction $\hat{B}$ at $\hat{H}$ = 250 A/m (25 kHz and 100 °C) for core sets in grade 3F3 is ⩾ 315 mT, based on A_{min} = 11,5 mm^2.

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 025	
			3E4	3F3
40		± 5		
63		± 5		
100		± 5		
160		± 10		
250		± 15		

Core halves without air gap

Ferroxcube grade		catalogue number
3E4	3E4	4322 020 26610
	3F3	26600

SQUARE CORES

These cores are available in two executions:

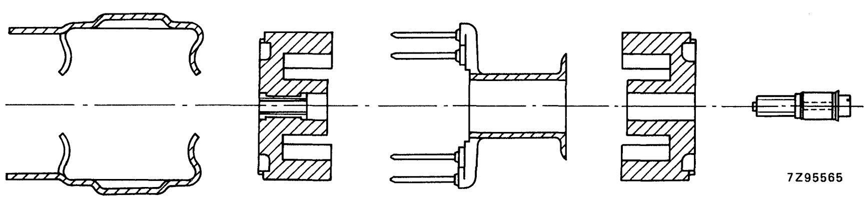
- RM5, usually for telecommunication, with centre hole for adjuster
- RM5/i, for industrial applications, no centre hole

RM5 cores can be supplied in three versions

- CORE SETS provided with a 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), UTE83-300 (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.

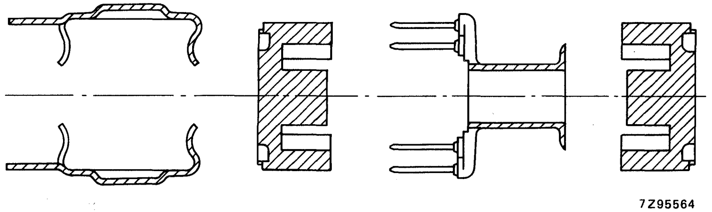


RM5

RM5/i cores can be supplied in two versions

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM5/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quantities and supply conditions upon request.

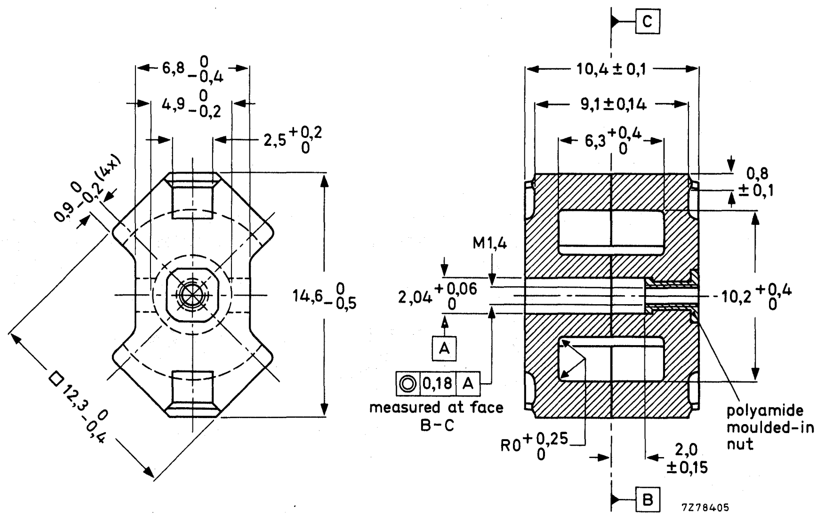


RM5/i

RM5 SQUARE CORES

for telecommunication

MECHANICAL DATA



Pulling-out force of the nut	⩾ 20 N (at ambient temperature)
Torque of the screw thread	⩽ 4 mNm
Extraction force of adjuster from nut	⩾ 10 N

Dimensional quantities according to IEC 205:

a. Version with centre hole:

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

$A_{CPmin} = 14{,}7\ mm^2$.

Mass of a core set: 3,0 g.

b. Version without centre hole:

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

$A_{min} = 18{,}1\ mm^2$.

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, square cores and cross 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 3B8	3D3	3E4	3H1	3H3	4C6
A_L ± 25%	4	≤ 0,1	25 ± 1	1960	840		1960	1680	150
μ_e ± 25%	4	≤ 0,1	25 ± 1	1590	670		1590	1350	124
α	4	≤ 0,1	25 ± 1	≤ 26,0	≤ 39,7		≤ 26,0	≤ 27,2	≤ 92,6
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1			≤ 2,5			
	30	≤ 0,1	25 ± 1				≤ 2,5	≤ 1,8	
	100	≤ 0,1	25 ± 1		≤ 8	≤ 20	≤ 5,0	≤ 2,8	
	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	≤ 0,86		
	30	1,5 to 3,0	25 ± 1					≤ 0,85	
	100	0,3 to 1,2	25 ± 1		≤ 1,8				≤ 9,2
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1	5 to 25			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	−2 to + 4
	≤ 100	≤ 0,1	25 to 55			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	0 to + 6
	≤ 100	≤ 0,1	25 to 70		0 to + 2	0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 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				≤ 120					
= 1,40 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					
			3B8	3D3	3E4	3H1	3H3	4C6
16	13	± 1						79800
25	20	± 1		● 79410				● 79810
40	33	± 1		79420				● 79820
63	51	± 1		● 79430		79230	79530	79830
100	82	± 1	● 59470*	79440		● 79240	● 79540	
160	130	± 2				● 79250	● 79550	
250	200	± 3				● 79260	● 79560	
315	250	± 5				79270	79570	
400	330	± 5				79280	79580	
3450	2570	± 25						
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, except the 3B8 core.
Cores with $A_L \geqslant 160$ and the 3B8 core have an asymmetrical air gap.

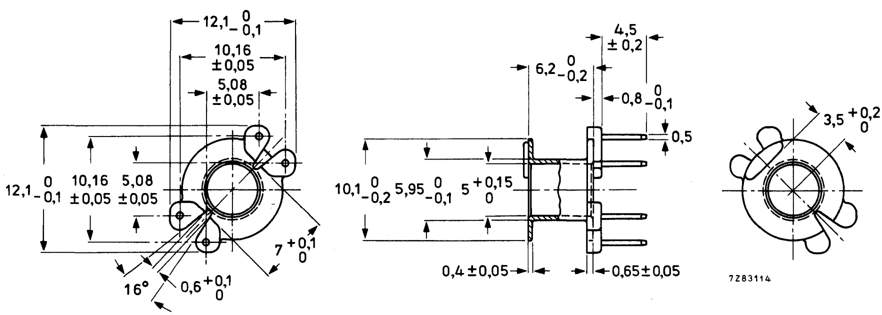
Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B8	4322 020 27080*
3D3	4322 020 26770
3H1	4322 020 26760
3H3	4322 020 26790
4C6	4322 020 26780

* Have no centre hole.
● Preferred type.

COIL FORMERS

SINGLE-SECTION 4-PIN COIL FORMER



Catalogue number	4322 021 32830
Material	phenolformaldehyde reinforced with glass fibre, dip-soldered pins
Minimum window area	9,5 mm^2
Mean length of turn	25 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

D.C. losses

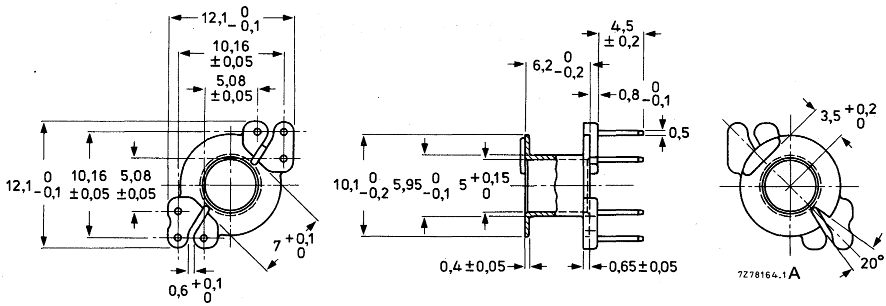
$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 34 \times 10^3\ \Omega/\mathrm{H}$$

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

Mass 0,28 g

The coil formers are supplied in packs of 150 on a polystyrene plate, and in cardboard boxes containing 5 such plates (750 pieces). Please order in multiples of these quantities.

SINGLE-SECTION 6-PIN COIL FORMER



Catalogue number	4322 021 32840
Material	phenolformaldehyde reinforced with glass fibre, dip-soldered pins
Minimum window area	9,5 mm^2
Mean length of turn	25 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

D.C. losses

$$\frac{R_o}{L} = \frac{l}{\mu_e} \times \frac{l}{f_{cu}} \times 34 \times 10^3\ \Omega/H$$

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

Mass 0,28 g

The coil formers are supplied in packs of 150 on a polystyrene plate, and in cardboard boxes containing 5 such plates (750 pieces). Please order in multiples of these quantities.

INDUCTANCE ADJUSTERS

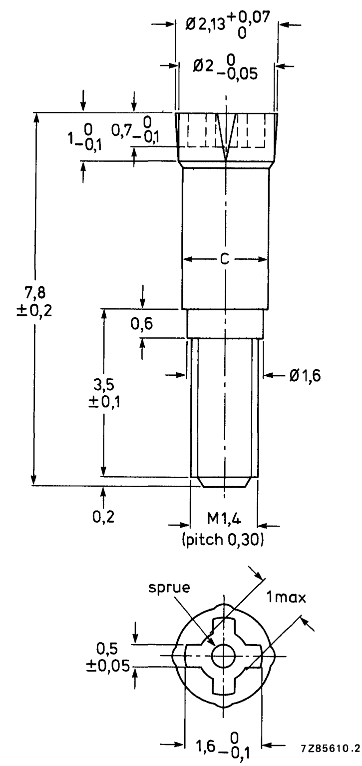


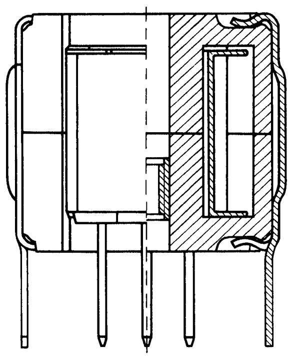
Table 1

catalogue number	colour code	material	C
4322 021 38700	black	FXC	1,93
38710	brown	FXC	1,70
38720	red	cip	1,97
38750	green	cip	1,93
38780	white	FXC	1,97
38790	grey	FXC	1,87

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. RM5

core material	A_L	low	%	medium	%	high	%
3H1, 3H3	63	–		4322 021 38750	12	4322 021 38720	23
	100	4322 021 38750	8	38720	15	38710	24
	160	38720	9	38710	15	38790	27
	250	38720	6	38710	10	38790	17
	315	38710	8	38790	14	38780	21
	400	38710	6	38700	13	38780	17
3D3	25	–		4322 021 38750	19	–	
	40	–		38750	16	–	
	63	–		38750	11	4322 021 38720	20
	100	4322 021 38750	7	38720	16	–	
4C6	16	–		4322 021 38750	18	–	
	25	–		38750	15	–	
	40	–		38750	9	4322 021 38720	17
	63	4322 021 38750	6	38720	8	–	

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.

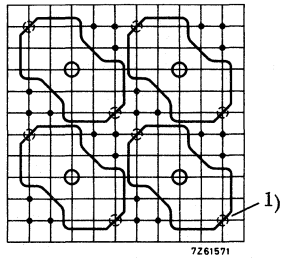
For a stable inductance we recommend that an adhesive be applied between the coil former flange and the lower core half. We also recommend that a tool be used for assembling. (Drawings of a simple tool are available under number 4322 058 00170).

MOUNTING

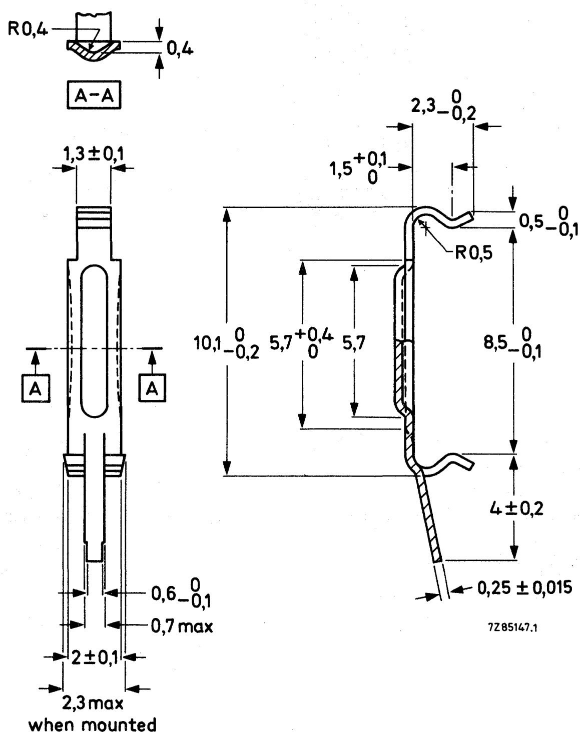
The two retaining clips are also used for mounting the assembled core on a printed-wiring board: the pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing the core.

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).

Hole pattern for an assembly of 4 cores.



PART DRAWING

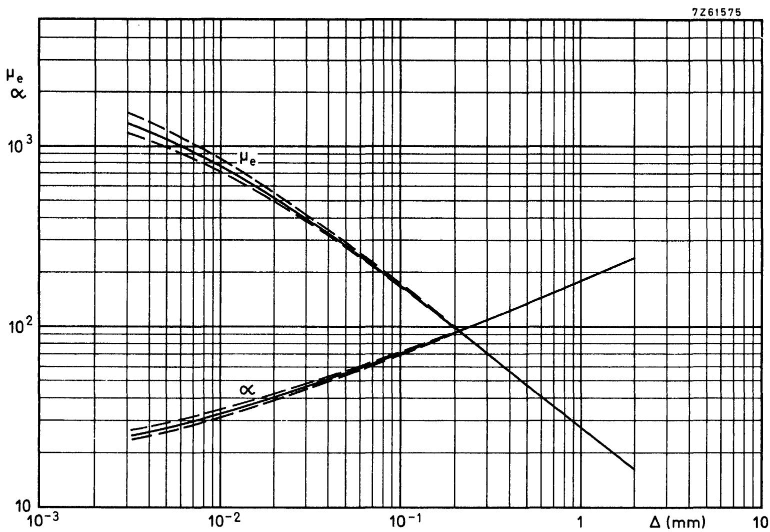


Clip 4322 021 31900
Material: steel; silver plated over nickel and passivated.

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

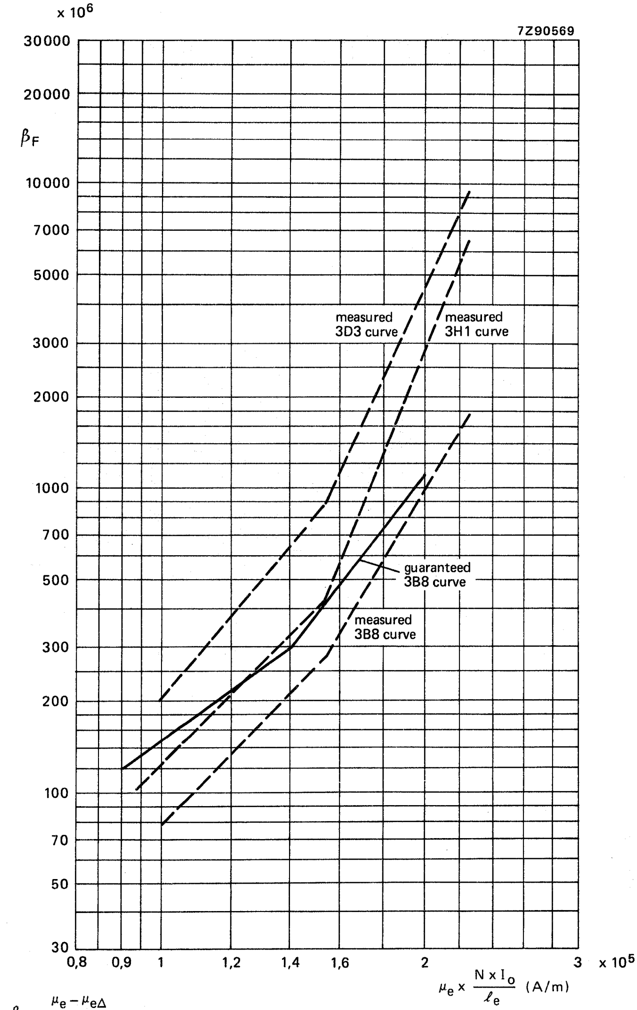
CHARACTERISTIC CURVES

μ_e-α CURVES



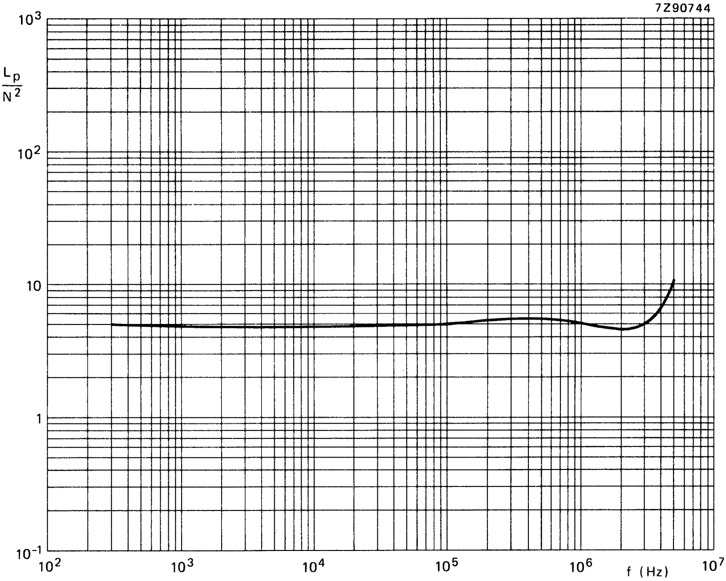
Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
μ_e = 1590 at Δ = 3 μm for 3H1.

D.C. SENSITIVITY AT 25 °C

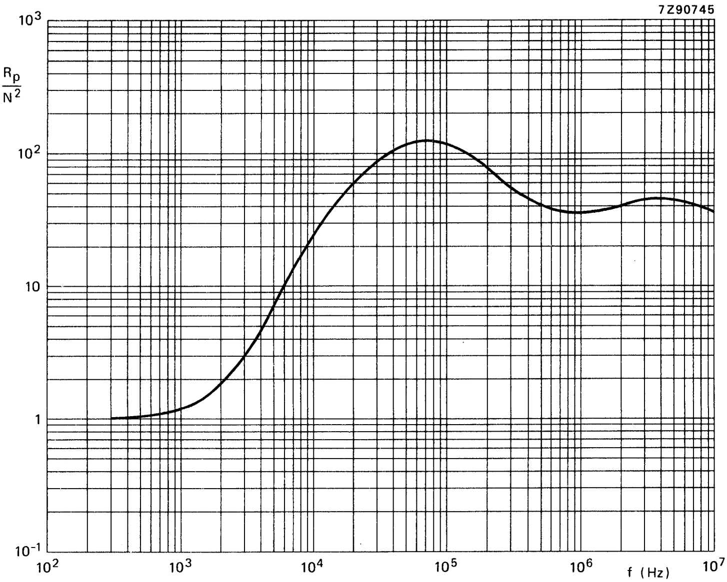


$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. polarization.

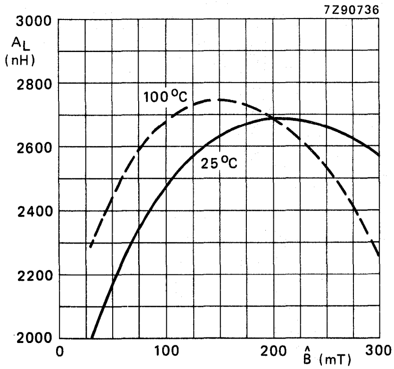


FXC 3E4. Inductance as a function of the frequency.

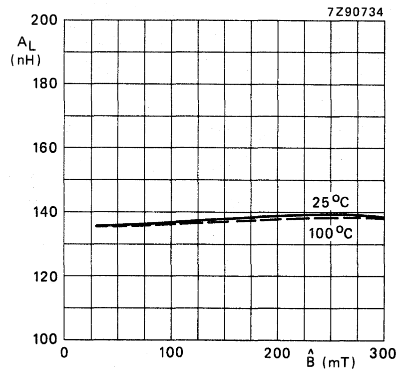


FXC 3E4. Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT.

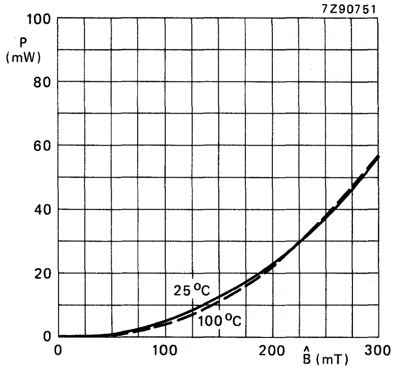
FXC 3B8



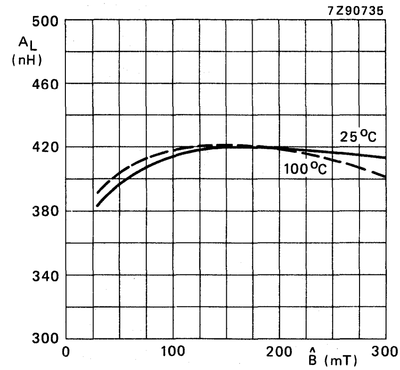
$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No air gap.



$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C, for $\mu_e = 100$.



$P = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No air gap.



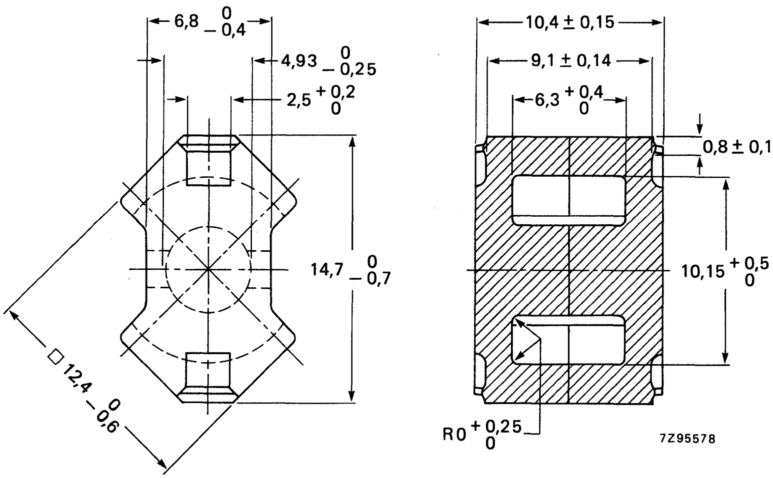
$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C, for $\mu_e = 300$.

$\hat{B}$ is calculated with $A_{CPmin} = 18{,}1\ mm^2$.

RM5/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

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

$A_{min} = 18{,}1\ mm^2$.

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, square cores and cross 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			
				3C85	3E4	3E5	3F3
A_L ± 25%	4	⩽ 0,1	25 ± 1	1800 ± 25%	4500 $^{+40\%}_{-25\%}$	6300 $^{+40\%}_{-25\%}$	1800 ± 25%
P (W)	25	200	25 ± 1	0,25			0,17
			100 ± 1	⩽ 0,18			⩽ 0,12
	100	100	25 ± 1	0,35			0,17
			100 ± 1	⩽ 0,25			⩽ 0,12
	400	50	25 ± 1				0,20
			100 ± 1				⩽ 0,20
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1		⩽ 2,5		
	10	⩽ 0,1	25 ± 1			⩽ 7	
	100	⩽ 0,1	25 ± 1		⩽ 20		
	500	⩽ 0,1	25 ± 1		⩽ 200		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		⩽ 1,1	⩽ 1,4	

Notes

For the specification of power losses $\hat{B}$ is calculated using A_e = 24,8 mm^2.

The induction $\hat{B}$ at $\hat{H}$ = 250 A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is ⩾ 315 mT, based on A_{min} = 18,1 mm^2.

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 025			
			3C85	3E4	3E5	3F3
40		± 5				
63		± 5				
100		± 5				
160		± 5				
250		± 5				
315		± 10				
400		± 10				

Core halves without air gap

Ferroxcube grade	catalogue number
3C85	4322 020 27100
3E4	27120
3E5	27130
3F3	27110

SQUARE CORES

These cores are available in two executions:

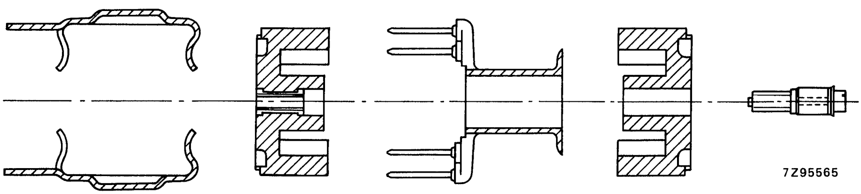
- RM6-R, usually for telecommunication, with centre hole for adjuster
- RM6-R/i, for industrial applications, no centre hole

RM6-R cores can be supplied in three versions

- CORE SETS provided with a 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), UTE83-300 (France), DIN 41980 (Germany).

Square cores and associated parts are ordered by their 12-digit catalogue number. Quanity: 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 quanitities.



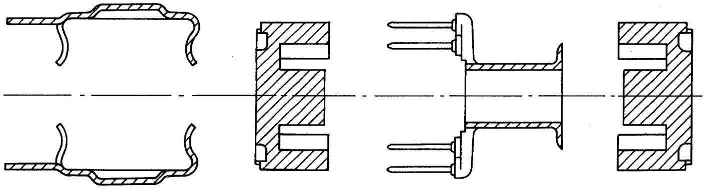
7Z95565

RM6-R

RM6-R/i cores can be supplied in two versions

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM6-R/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quanities and supply conditions upon request.



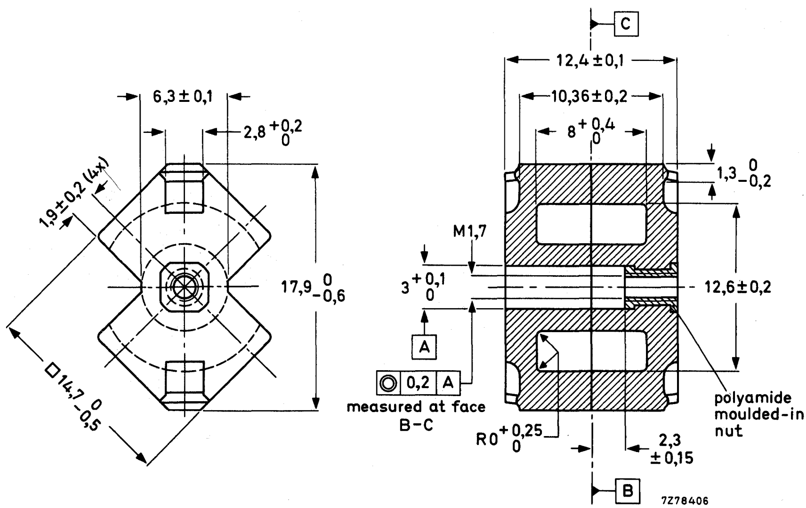
7Z95564

RM6-R/i

RM6-R SQUARE CORES

for telecommunication

MECHANICAL DATA



Note: 4C6 cores have a cemented nut.

Pulling-out force of the nut ⩾ 30 N (at ambient temperature)

Toque of the screw thread ⩽ 8 mNm

Extraction force of adjuster from nut ⩾ 20 N

Dimensional quanities according to IEC 205:

a. Version with centre hole:

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

$A_{CPmin} = 23{,}9\ mm^2$.

Mass of a core set: 4,5 g.

b. Version without centre hole:

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

$A_{min} = 31{,}2\ mm^2$.

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, square cores and cross 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 3B8	3D3	3E4	3H1	3H3	4C6
A_L ± 25%	4	≤ 0,1	25 ± 1	2400	1080		2640	2400	194
μ_e ± 25%	4	≤ 0,1	25 ± 1	1400	700		1700	1545	125
α	4	≤ 0,1	25 ± 1	≤ 23,6	≤ 35,0		≤ 22,4	≤ 23,6	≤ 82,8
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1			≤ 2,5			
	30	≤ 0,1	25 ± 1				≤ 2,5	≤ 1,8	
	100	≤ 0,1	25 ± 1		≤ 8	≤ 20	≤ 5,0	≤ 2,6	
	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
P (W)	25	200*	25 ± 1	≤ 0,30					
			100 ± 1	≤ 0,35					
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		≤ 0,8	≤ 1,1	≤ 0,86		
	30	1,5 to 3,0	25 ± 1					≤ 0,65	
	100	0,3 to 1,2	25 ± 1						≤ 9,2
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1	5 to 25			0 to +2	+0,5 to 1,5	+0,7 ± 0,3	−2 to +4
	≤ 100	≤ 0,1	25 to 55			0 to +2	+0,5 to 1,5	+0,7 ± 0,3	0 to +6
	≤ 100	≤ 0,1	25 to 70		1 ± 1	0 to +2	+0,5 to 1,5	+0,7 ± 0,3	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 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					
= 1,55 x 10^5 A/m				≤ 300					
= 2,25 x 10^5 A/m				≤ 1100					

▲ 3D3 at 700 kHz: 11.

* $\hat{B}$ is calculated with A_{CPmin} = 31,2 mm².

** 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					
			3B8	3D3	3E4	3H1	3H3	4C6
25	16,1	± 1						75810
40	25,8	± 1	55470*	● 75420		75220		● 75820
63	40,6	± 1	55480*	75430		75230		● 75830
100	64,5	± 2		● 75440		75240		
160	103	± 2	● 55500*	75450		● 75250	75550	
200	129	± 2				● 75370	● 75680	
250	161	± 2	54900*			● 75260	● 75560	
315	203	± 2				75270	75570	
400	258	± 2	55510*			75280	75580	
630	406	± 3				75300	75600	
1000	645	± 10				75310		
1250	806	± 10				75390		
4780	2780	± 25						
6710	3930	± 25			● 55900*			

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 $A_L \geqslant 160$ and both 3B8 cores have an asymmetrical air gap.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B8	4322 020 27630*
3D3	4322 020 25140
3H1	4322 020 25130
3H3	4322 020 25190
4C6	4322 020 25150

* These types have no centre hole.
● Preferred types.

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 inch and 2,50 mm grid, see "Mounting".

The coil formers are supplied in packs of 100 on a polystyrene plate, and in cardboard boxes containing 5 such plates (500 pieces). 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
Maximum temperature	180 °C
Inflammability	UL94, class V-0

Solderability resistant against dipsoldering at 400 °C for 2 s

D.C. losses:

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

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 °C
Inflammability	UL94, class V-0

Solderability resistant against dipsoldering at 400 °C for 2 s

D.C. losses:

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

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 °C
Inflammability	UL94, class V-0

Solderability resistant against dipsoldering at 400 °C for 2 s

D.C. losses:

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

Mass	0,4 g

TWO-SECTION, 6-PIN COIL FORMER

Catalogue number	4322 021 32310
Material: phenolformaldehyde reinforced with glass fibre	
Window area	2 x 8,2 mm^2
Mean length of turn	30 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

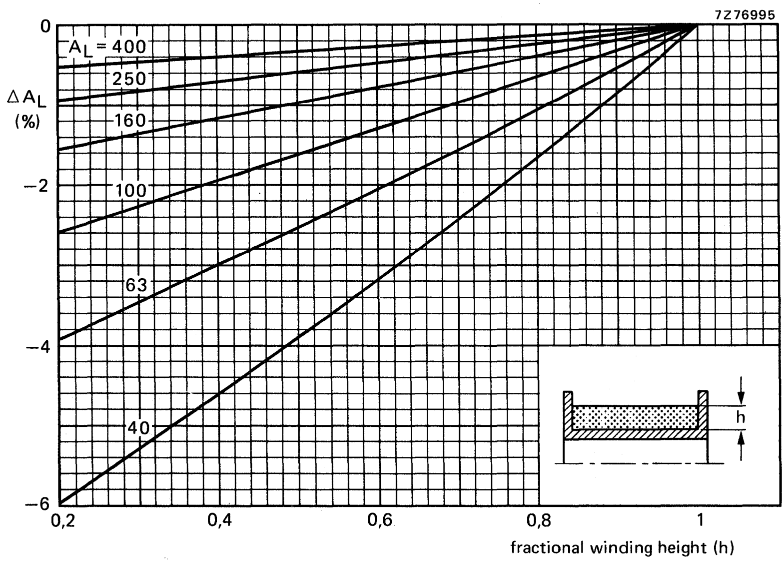
Solderability resistant against dip-soldering at 400 °C for 2 s

D.C. losses:

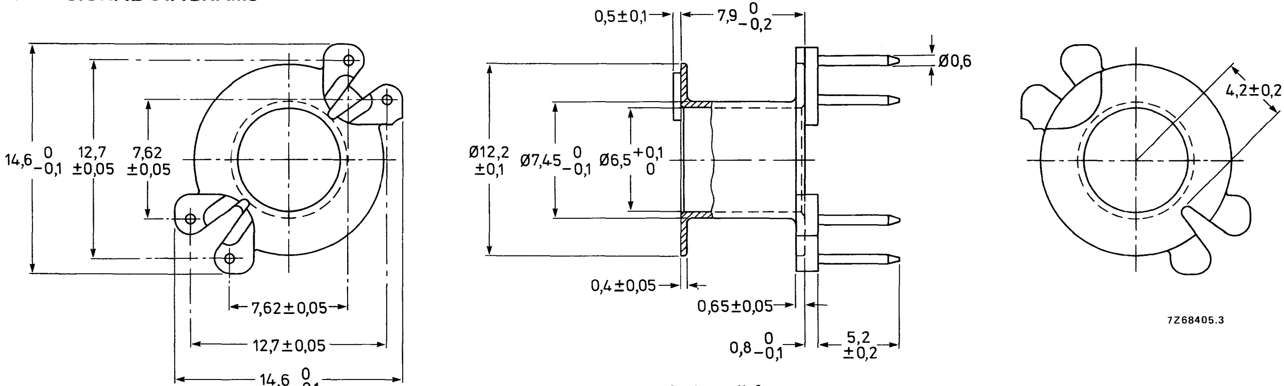
$$\frac{R_o}{L} \times \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 19{,}9 \times 10^3 \ \Omega/H$$

Mass	0,4 g

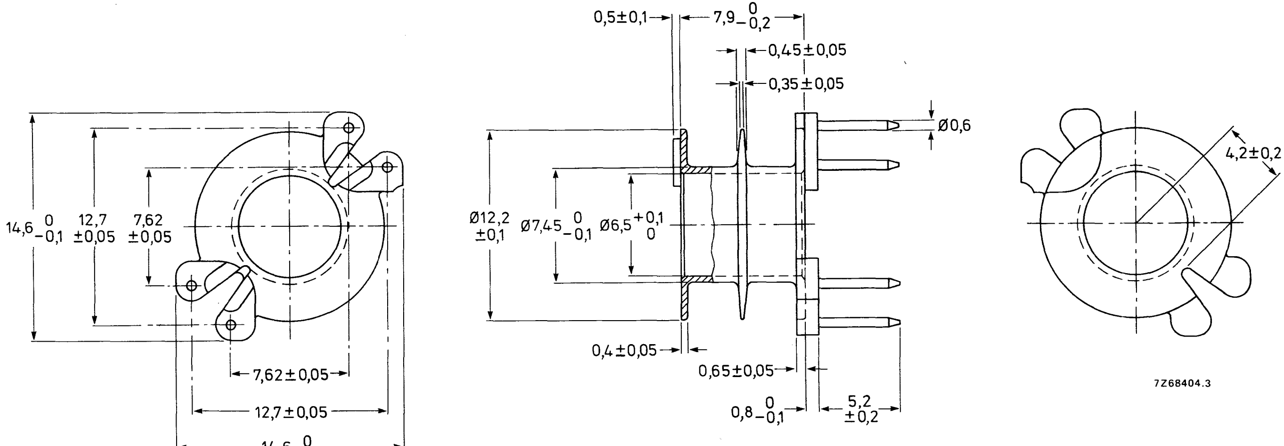
Data for when the coil former is partly filled.



DIMENSIONAL DIAGRAMS

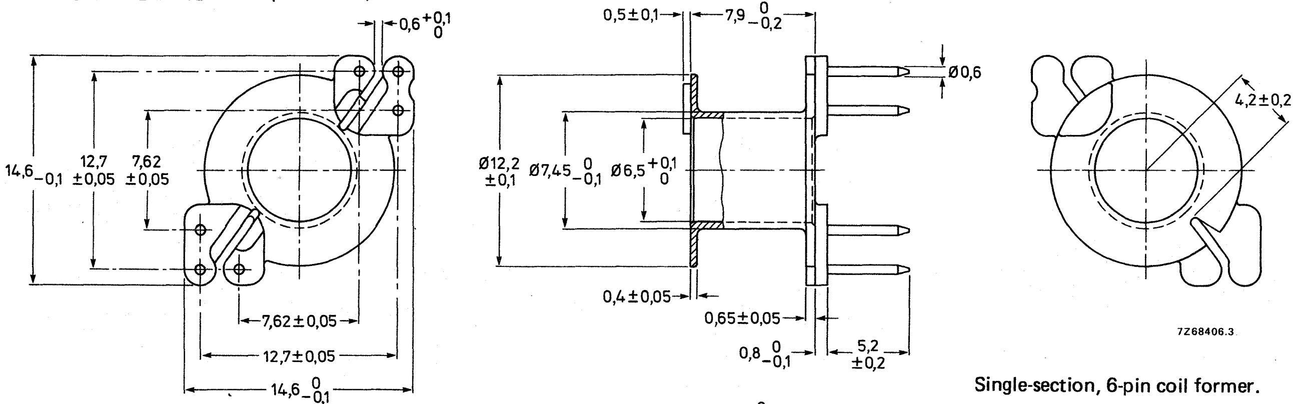


Single-section, 4-pin coil former.

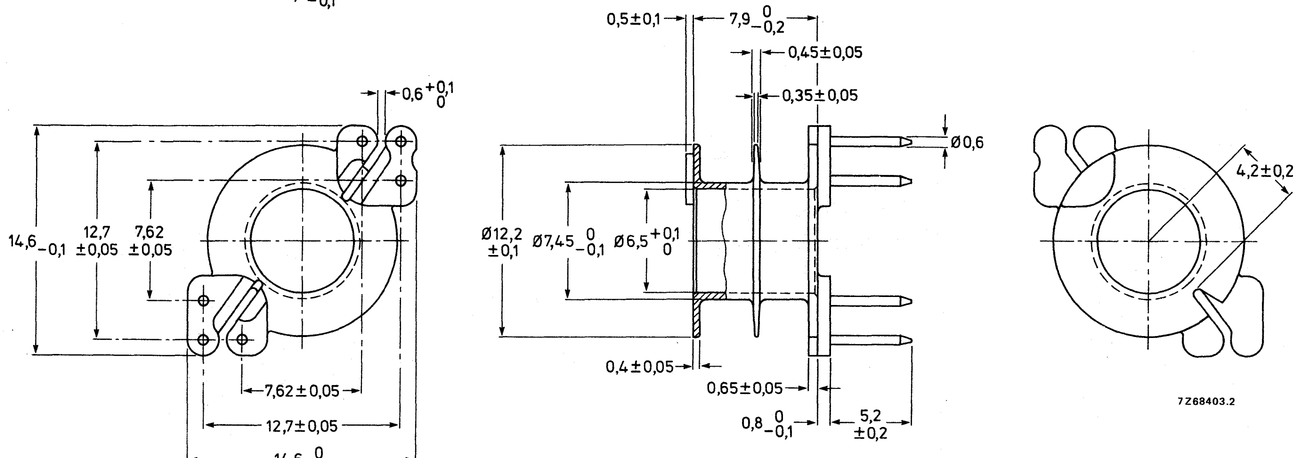


Two-section, 4-pin coil former.

DIMENSIONAL DIAGRAMS (continued)



Single-section, 6-pin coil former.



Two-section, 6-pin coil former.

INDUCTANCE ADJUSTERS

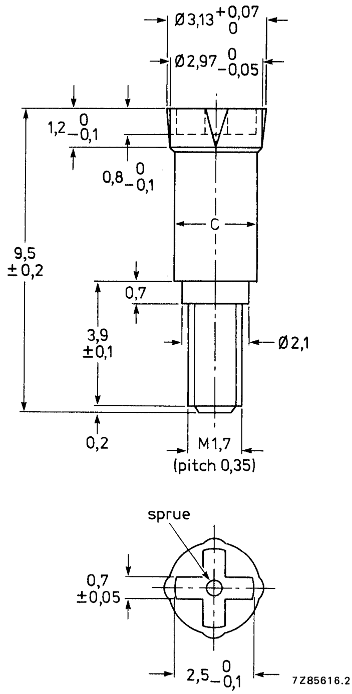


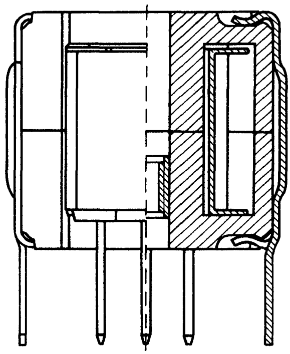
Table 1

catalogue number	colour code	material	C
4322 021 38600	black	FXC	2,83
38610	brown	FXC	2,70
38620	red	cip	2,93
38640	yellow	cip	2,58
38650	green	cip	2,70
38670	violet	FXC	2,58
38680	white	FXC	2,48
38690	grey	FXC	2,93

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. RM6-R.

core material	A_L	low	%	medium	%	high	%
3H1, 3H3	40	–		4322 021 38640	17	4322 021 38650	20
	63	4322 021 38640	12	38650	14	38620	22
	100	38650	10	38620	16	–	
	160	38650	6	38620	11	38680	19
	200	38620	8	38680	15	38670	18
	250	38680	12	38670	14	38610	19
	315	38680	10	38610	15	38600	20
	400	38670	9	38600	16	38690	24
	630	38600	10	38690	15	–	
	1000	38600	6	38690	10	–	
	1250	–		38690	8	–	
3D3	40	–		4322 021 38640	17	4322 021 38650	20
	63	4322 021 38640	12	38650	14	38620	23
	100	38650	9	38620	16	38680	27
	160	38620	10	38680	17	–	
4C6	25	–		4322 021 38640	18	4322 021 38650	20
	40	4322 021 38640	12	38650	14	38620	20
	63	38650	8	38620	12	–	

ASSEMBLING AND MOUNTING

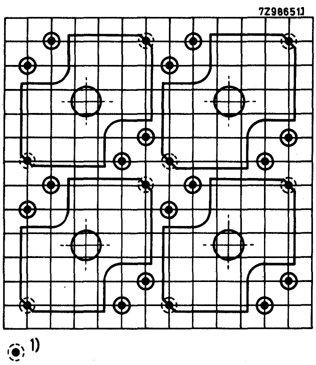

7Z99011.1

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.

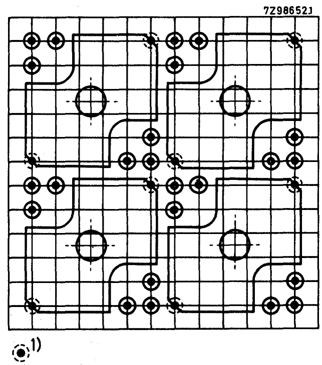
The use of a tool for attaching the clips is recommended. (Drawings of a simple tool for this purpose are available under number 4322 058 00150.)

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).

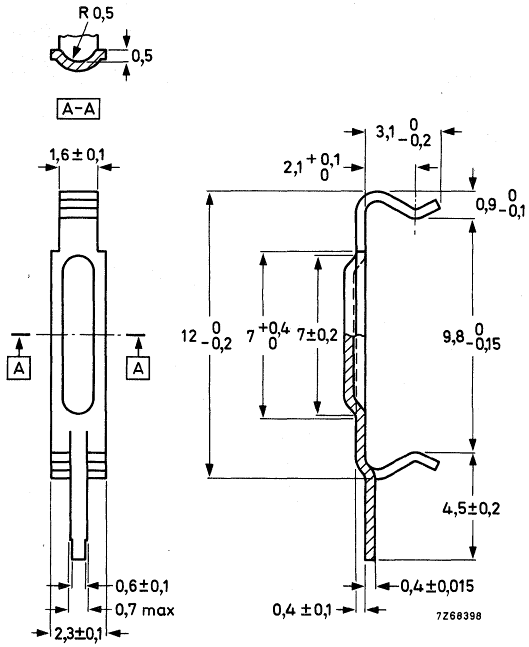


Hole pattern for an assembly of 4 cores, each fitted with an 4-pin coil.



Hole pattern for an assembly of 4 cores, each fitted with a 6-pin coil former.

PART DRAWING (dimensions in mm)



Clip 4322 021 31780

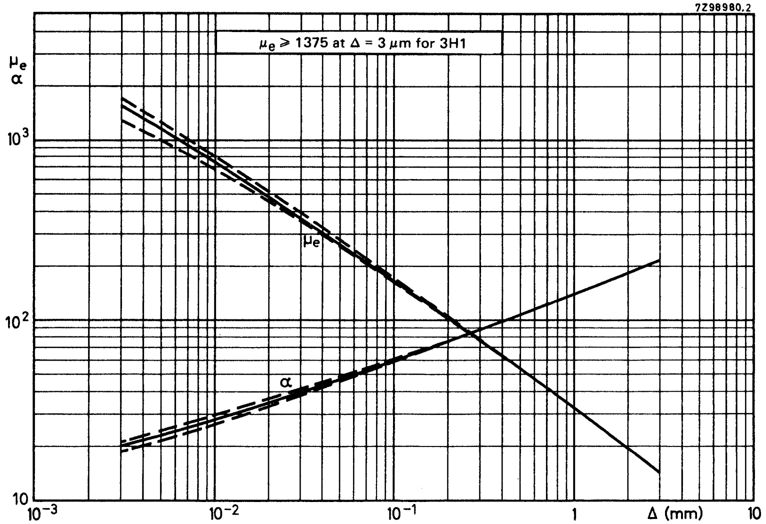
Material: steel; silver-plated over nickel, and then passivated.

Packaging quantity: 5000

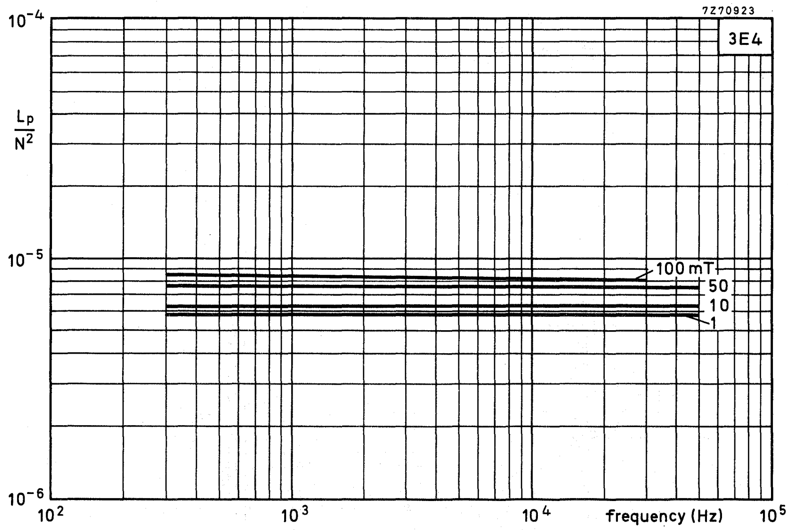
1) Holes for tag on clip 4322 021 31780 (earth points).

CHARACTERISTIC CURVES

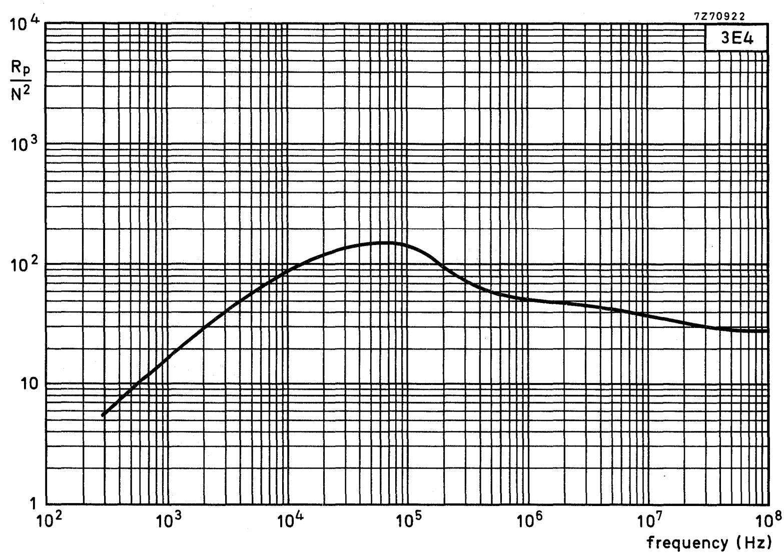
$\mu_e - \alpha$ **CURVES**



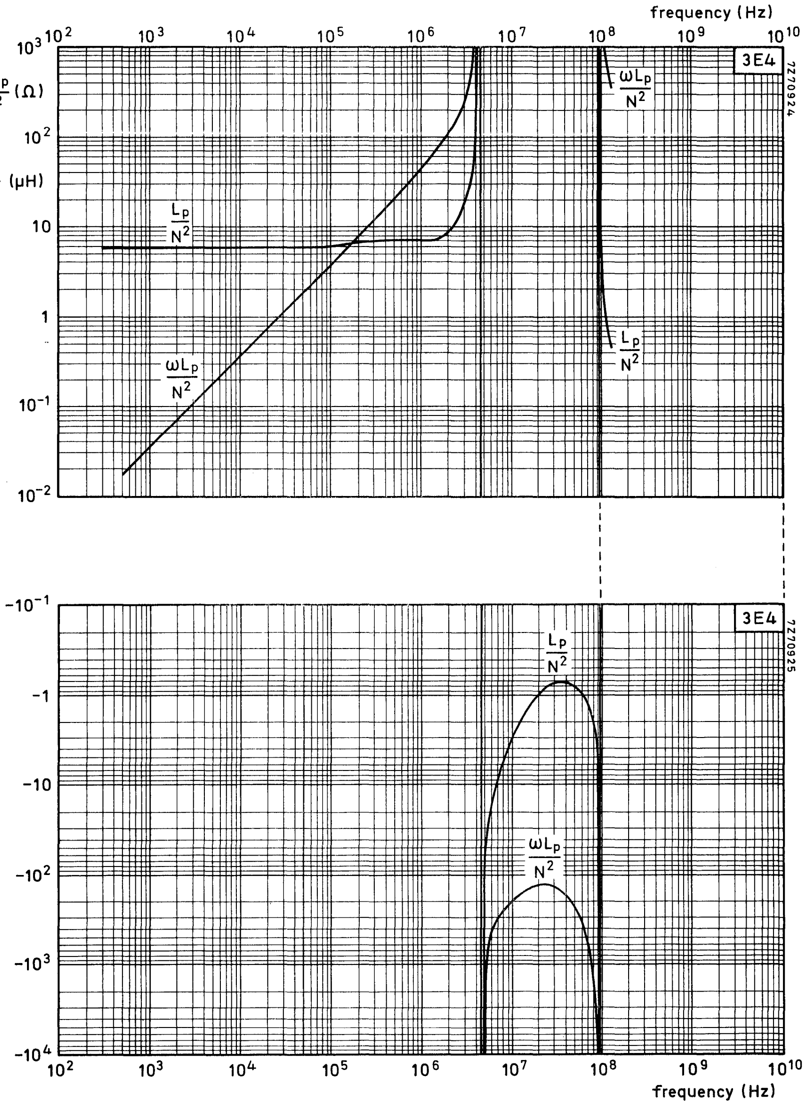
Relative effective permeability and turns factor for 1 mH as a function of the air gap length.



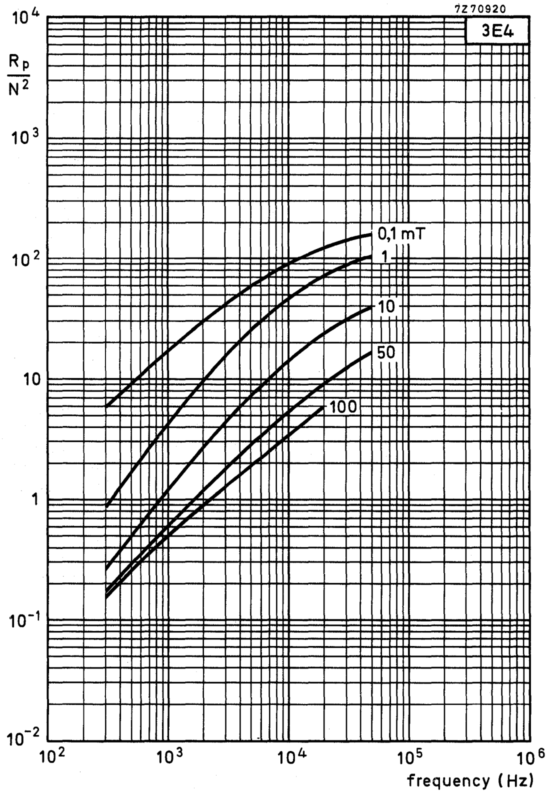
Inductance as a function of the frequency (typical values).



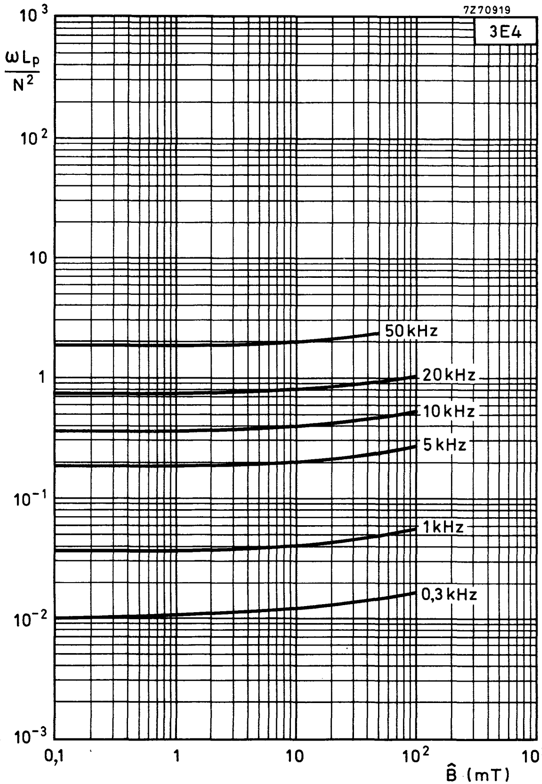
Losses as a function of the frequency at $\hat{B} \approx 0{,}1$ mT (typical values).



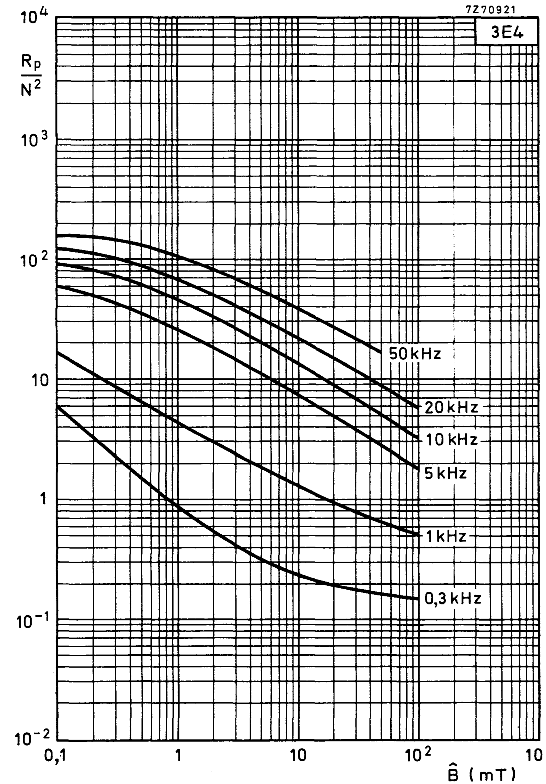
Inductance as a function of the frequency (typical values).



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

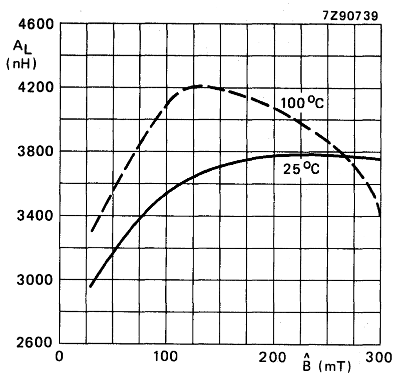


Inductance as a function of the peak induction (typical values).

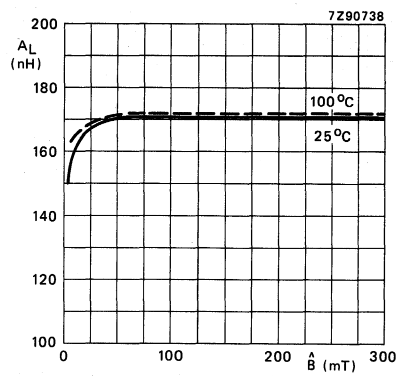


Losses as a function of the peak induction.

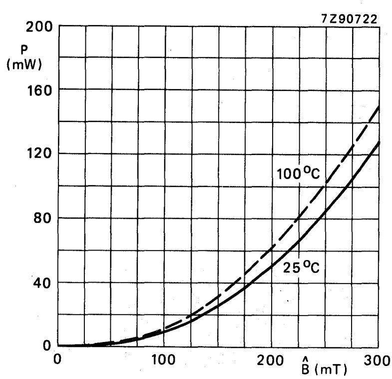
FXC 3B8



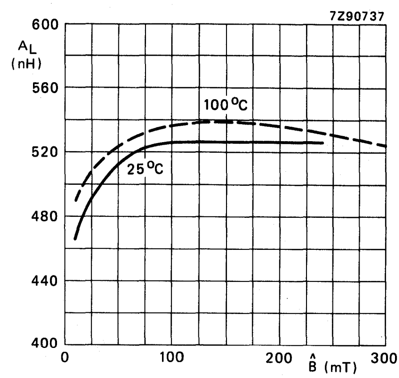
$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No air gap.



$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C, for $\mu_e = 100$



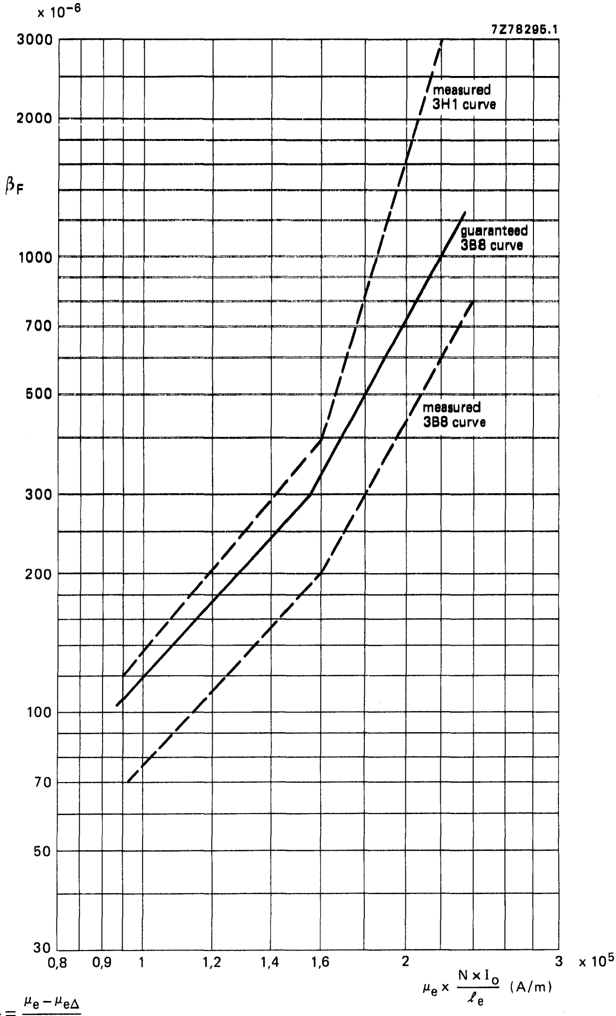
$P = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No air gap.



$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C, for $\mu_e = 300$.

$\hat{B}$ is calculated with $A_{CPmin} = 18{,}1\ mm^2$.

D.C. SENSITIVITY AT 25 °C



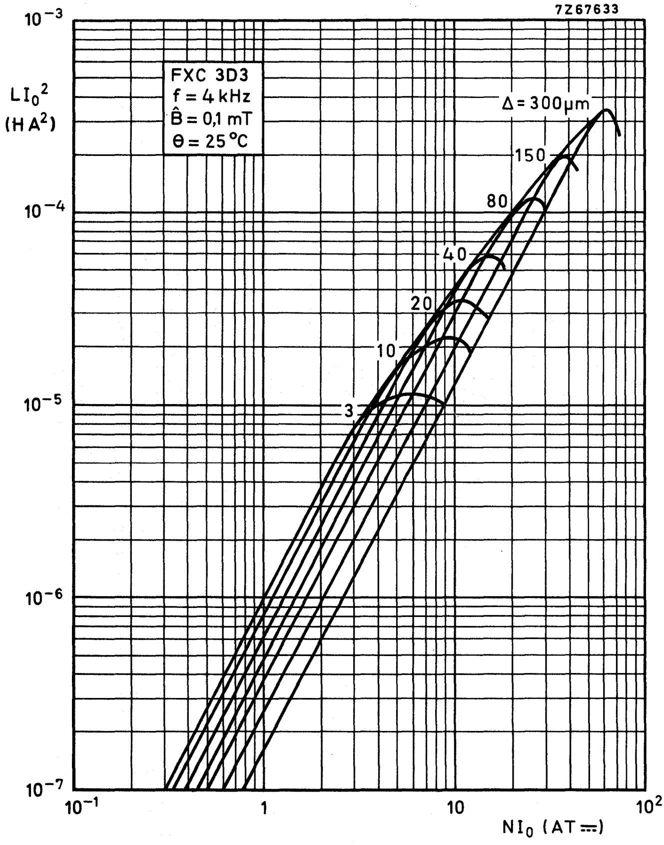
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

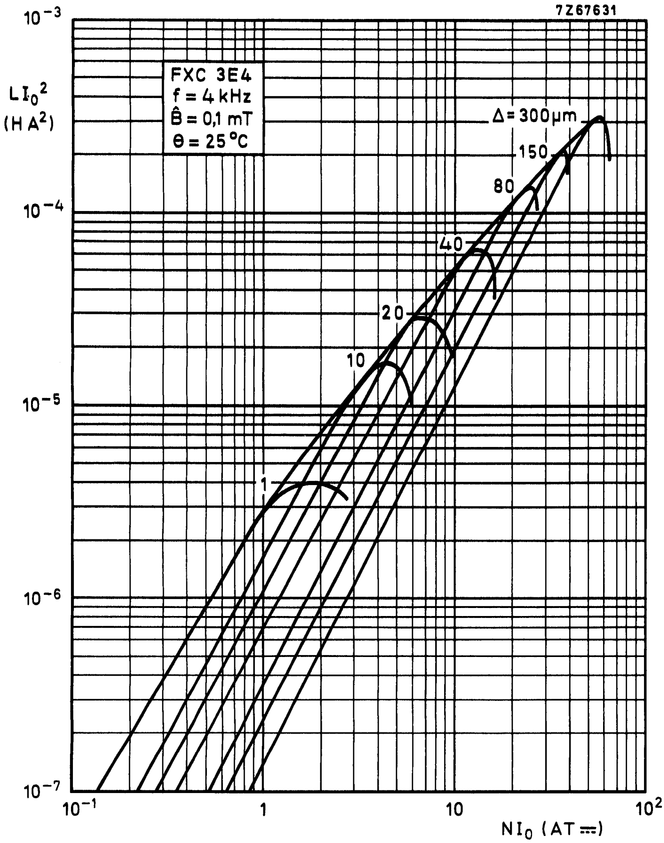
Inductance variation as a function of d.c. polarization.

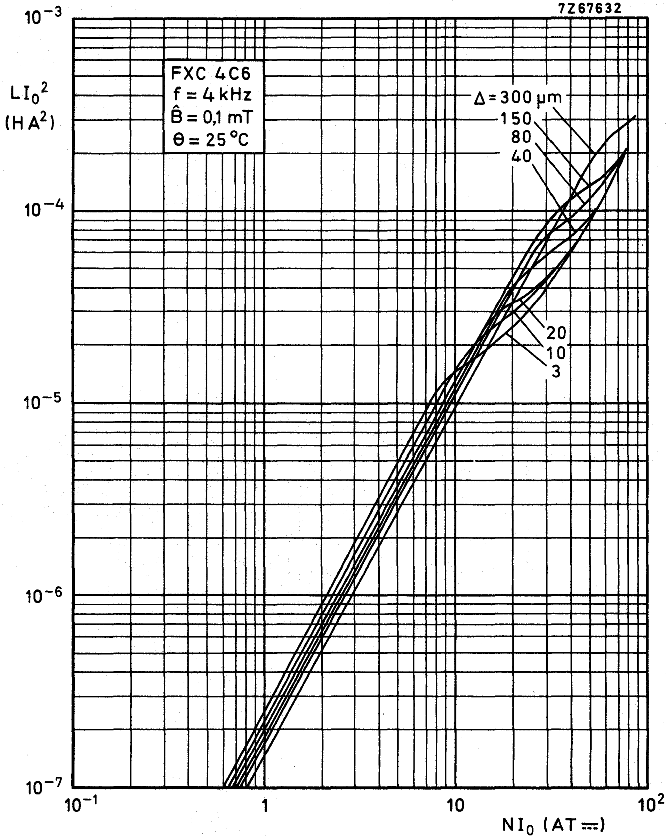
HANNA CURVES

For different material grades.

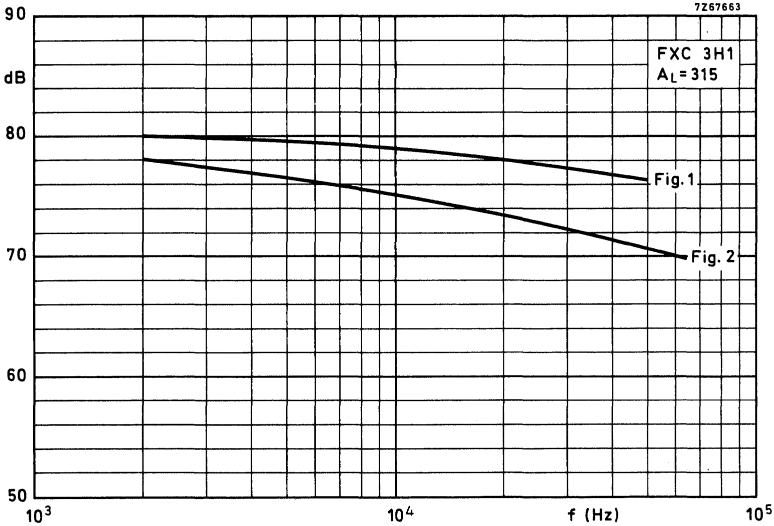
Indicating optimum inductance for a certain air gap and direct current.




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


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

CROSSTALK ATTENUATION



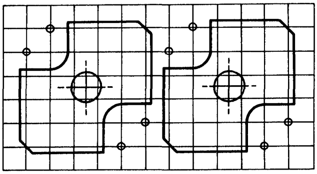


Fig. 1 7Z67659

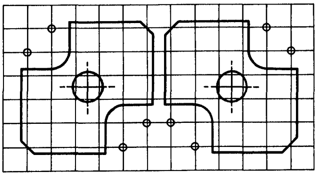
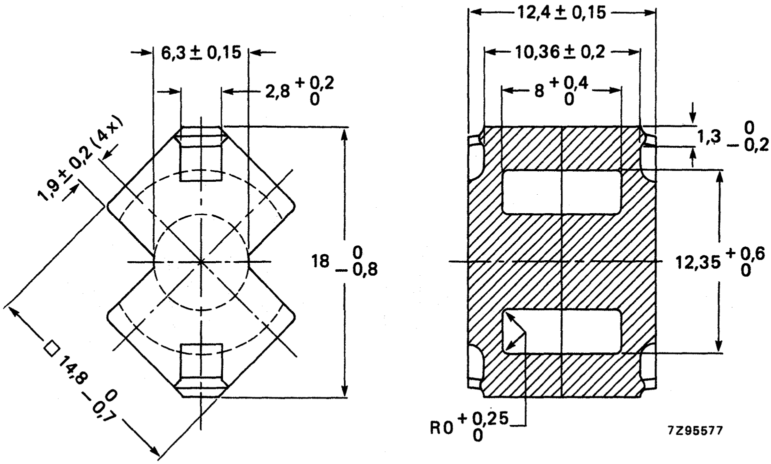


Fig. 2 7Z67660

RM6-R/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

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

$A_{min} = 31{,}2\ mm^2$.

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, square cores and cross 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			
				3C85	3E4	3E5	3F3
A_l	4	≤ 0,1	25 ± 1	2600 ± 25%	6200 $^{+40\%}_{-25\%}$	9200 $^{+40\%}_{-25\%}$	2600 ± 25%
P (W)	25	200	25 ± 1	0,35			0,22
			100 ± 1	≤ 0,25			0,16
	100	100	25 ± 1	0,40			0,22
			100 ± 1	≤ 0,30			≤ 0,16
	400	50	25 ± 1				0,30
			100 ± 1				≤ 0,30
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1		≤ 2,5		
	10	≤ 0,1	25 ± 1			≤ 7	
	100	≤ 0,1	25 ± 1		≤ 20		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		≤ 1,1	≤ 1,4	

Notes

For the specification of power losses $\hat{B}$ is calculated using $A_e = 38\ mm^2$.

The induction $\hat{B}$ at $\hat{H} = 250$ A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is ≥ 315 mT, based on $A_{min} = 31,2\ mm^2$.

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 022			
			3C85	3E4	3E5	3F3
40		± 5				
63		± 5	54700			
100		± 5	54710			
160		± 5	54720			
250		± 5				
315		± 5				
400		± 5				
630		± 10				
1000		± 15				

Core halves without air gap

Ferroxcube grade	catalogue number
3C85	4322 020 28530
3E4	28560
3E5	28570
3F3	28550

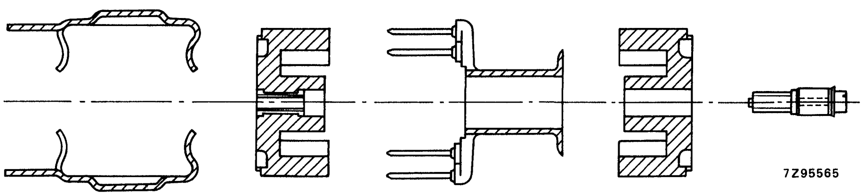
SQUARE CORES

These cores are available in two executions:
- RM6-S, usually for telecommunication, with centre hole for adjuster
- RM6-S/i, for industrial applications, no centre hole

RM6-S cores can be supplied in three versions
- CORE SETS provided with a 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), UTE83-300 (France), DIN 41980 (Germany).

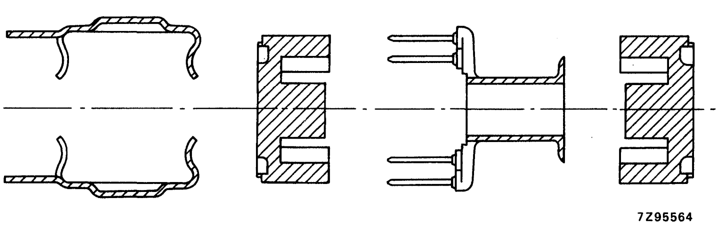
Square cores and associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 20 core sets or 40 core halves; a storage pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.



RM6-S

RM6-S/i cores can be supplied in two versions
- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM6-S/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quantities and supply conditions upon request.

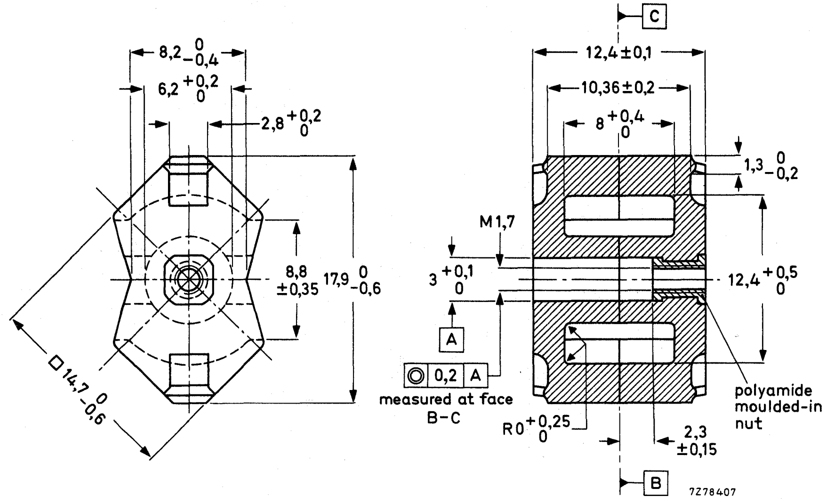


RM6-S/i

RM6-S SQUARE CORES

for telecommunication

MECHANICAL DATA



Note: 4C6 cores have a cemented nut.

Pulling-out force of the nut	⩾ 30 N (at ambient temperature)
Torqu of the screw thread	⩽ 8 mNm
Extraction force of adjuster from nut	⩾ 20 N

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}863\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}078\ mm^{-3}$; $V_e = 840\ mm^{-3}$; $l_e = 27{,}3\ mm$; $A_e = 31{,}0\ mm^2$;

$A_{CP\ min} = 23{,}9\ mm^2$.
Mass of a core set: 4,5 g.

b. Version without centre hole:

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

$A_{min} = 31{,}2\ mm^2$.
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, square cores and cross 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.	$\hat{B}$	temp.	grade					
	kHz	mT	^{o}C	3B8	3D3	3E4	3H1	3H3	4C6
A_L ± 25%	4	≤ 0,1	25 ± 1	2730	1020		2480	2250	182
μ_e ± 25%	4	≤ 0,1	25 ± 1	1710	700		1710	1545	125
α	4	≤ 0,1	25 ± 1	≤ 22,1	≤ 36,2		≤ 23,2	≤ 24,3	≤ 85,5
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1			≤ 2,5			
	30	≤ 0,1	25 ± 1				≤ 2,5	≤ 1,8	
	100	≤ 0,1	25 ± 1		≤ 8	≤ 20	≤ 5,0	≤ 2,6	
	500	≤ 0,1	25 ± 1		≤ 14	≤ 200			
	700	≤ 0,1	25 ± 1						
	1000	≤ 0,1	25 ± 1		≤ 30				
	2000	≤ 0,1	25 ± 1						≤ 40
	10 000	≤ 0,1	25 ± 1						≤ 100
P (W)	25	200*	25 ± 1	0,30					
			100 ± 1	0,35					
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1			≤ 1,1	≤ 0,86		
	30	1,5 to 3,0	25 ± 1					≤ 0,65	
	100	0,3 to 1,2	25 ± 1		≤ 1,8				≤ 9,2
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1	5 to 25			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	−2 to + 4
	≤ 100	≤ 0,1	25 to 55			0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	0 to + 6
	≤ 100	≤ 0,1	25 to 70		+ 1 ± 1	0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	
$D_F \times 10^6$ (10-100 min)	≤ 100	≤ 0,1	25 ± 0,1		≤ 12	≤ 4,3	≤ 4,3	≤ 3,0**	≤ 10
$\beta_F \times 10^6$ measured on sets with μ_e = 300 ± 10% at 25 ± 1 ^{o}C:									
at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,00 x 10^5 A/m				≤ 115					
= 1,60 x 10^5 A/m				≤ 300					
= 230 x 10^5 A/m				≤ 1050					

* $\hat{B}$ is calculated with A_{CPmin} = 31,2 mm².

** This value is valid within the temperature range of 25 to 70 ^{o}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					
			3B8	3D3	3E4	3H1	3H3	4C6
16	11,0	± 1						67790
25	17,1	± 1						67810
40	27,4	± 1		● 67420				● 67820
63	43,1	± 1		67430				● 67830
100	68,7	± 2	● 47740*	● 67440				
160	110	± 2		67450		● 67250		
200	137	± 2				● 67350	● 67680	
250	171	± 2				● 67260**	● 67560	
315	216	± 2				67270	67570	
400	274	± 2				67280	67580	
630	431	± 3				67300	67600	
1000	687	± 10				67310		
1250	856	± 10				67390		
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 $A_L \geqslant 160$ and the 3B8 core, have an asymmetrical air gap.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B8	4322 020 27930*
3D3	4322 020 25060
3H1	4322 020 25020
3H3	4322 020 25200
4C6	4322 020 25080

* These types have no centre hole.
** Approved according to CECC 25 100-019.
● Preferred types.

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 inch and 2,50 mm grids, see "Mounting".
The coil formers are supplied in packs of 100 on a polystyrene plate, and in cardboard boxes containing 5 such plates (500 pieces). Please order in multiples of these quantities.

SINGLE-SECTION, 4-PIN COIL FORMER

Catalogue number	4312 021 29240
Material	phenolformaldehyde reinforced with glass fibre
Window area	16,2 mm^2
Mean length of turn	30 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 22{,}6 \times 10^3\ \Omega/H$$

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

Mass 0,4 g

TWO-SECTION, 4-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 °C
Inflammability	UL94, class V-0

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 °C for 2 s

Mass 0,4 g

SINGLE-SECTION, 6-PIN COIL FORMER

Catalogue number	4312 021 29250
Material	phenolformaldehyde reinforced with glass fibre
Window area	16,2 mm^2
Mean length of turn	30 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 22,6 \times 10^3\ \Omega/H$$

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

Mass 0,4 g

TWO-SECTION, 6-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 °C
Inflammability	UL94, class V-0

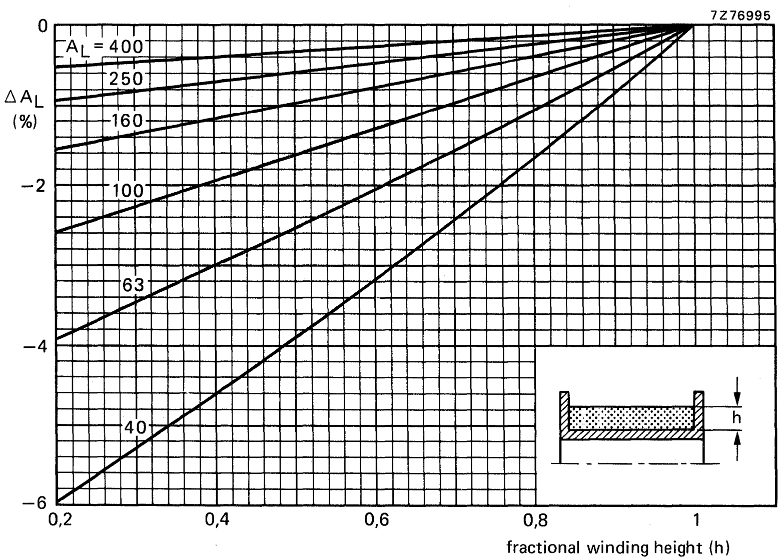
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 23,6 \times 10^3\ \Omega/H$$

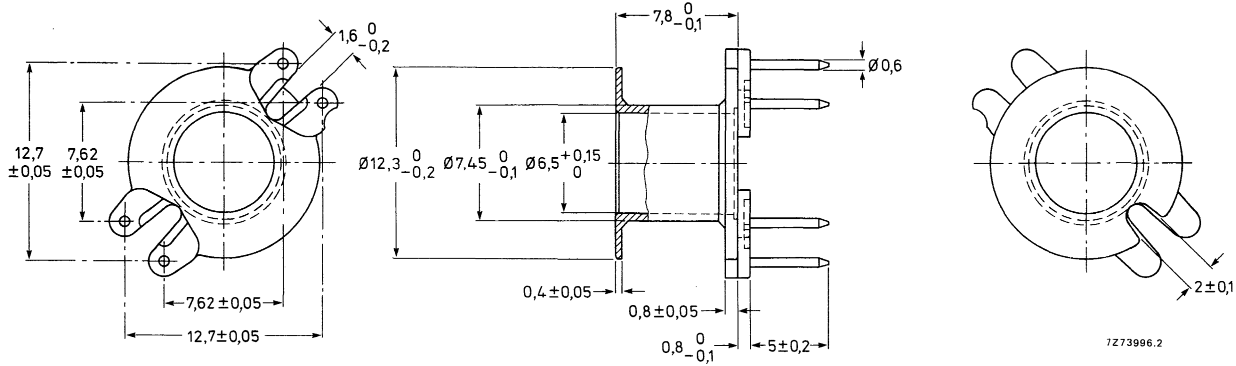
Solderability: resistant against dip-soldering at 400 °C for 2 s

Mass 0,4 g

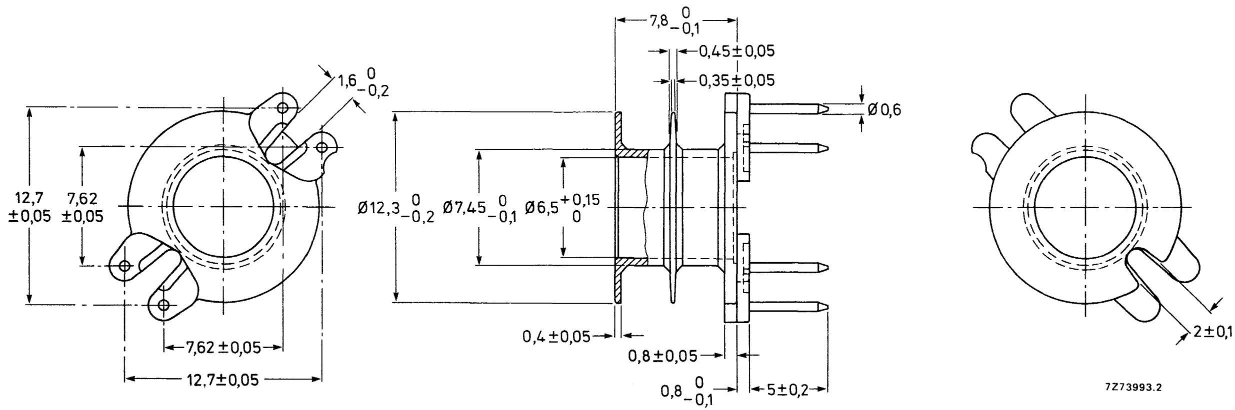
Data for when the coil former is partly filled.



DIMENSIONAL DIAGRAMS

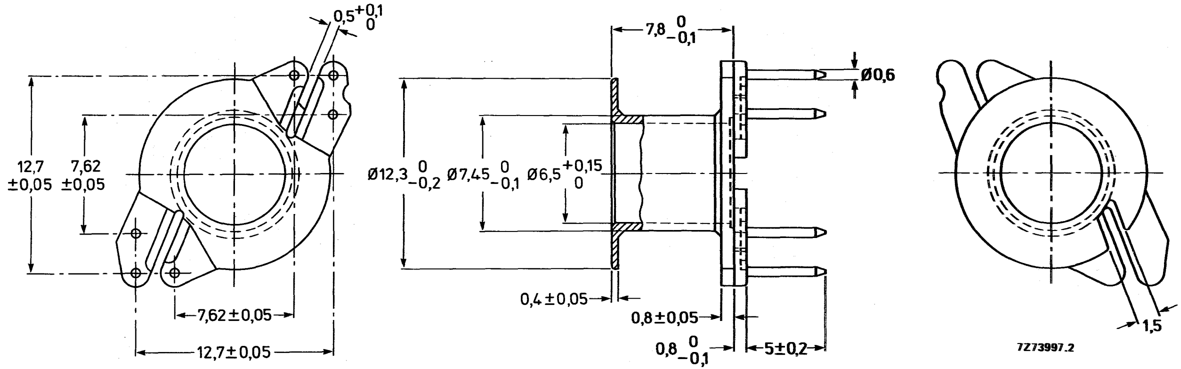


Single-section, 4-pin coil former.

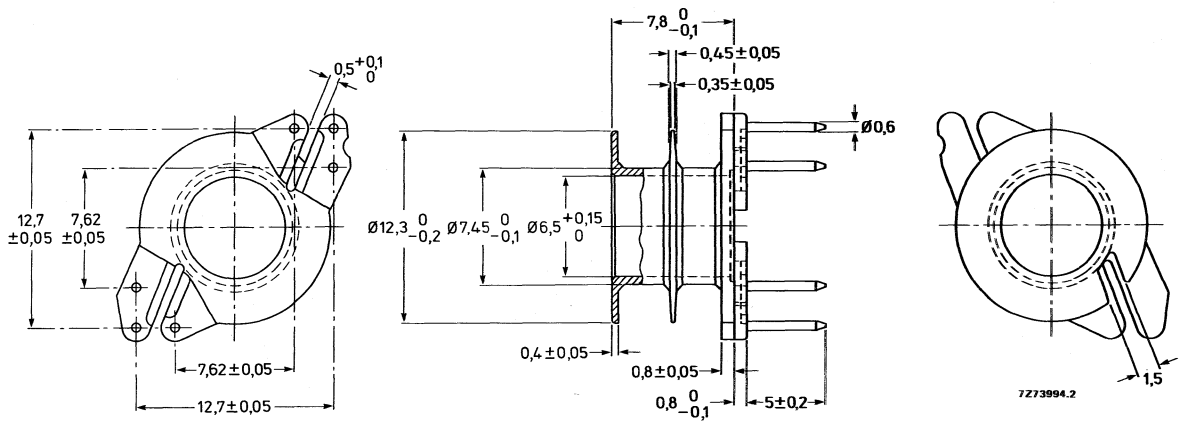


Two-section, 4-pin coil former.

DIMENSIONAL DIAGRAMS (continued)



Single-section, 6-pin coil former.



Two-section, 6-pin coil former.

INDUCTANCE ADJUSTERS

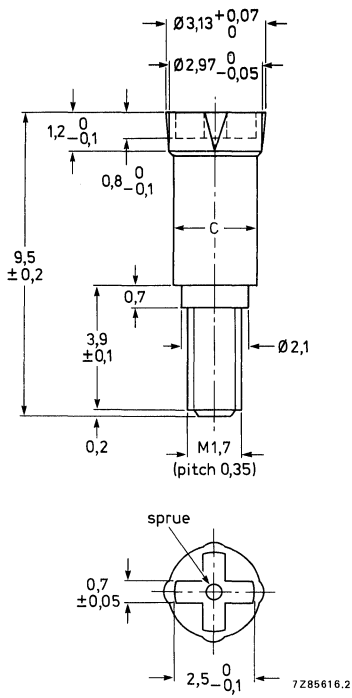


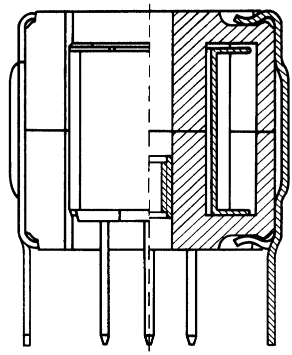
Table 1

catalogue number	colour code	material	C
4322 021 38600	black	FXC	2,83
38610	brown	FXC	2,70
38620	red	cip	2,93
38640	yellow	cip	2,58
38650	green	cip	2,70
38670	violet	FXC	2,58
38680	white	FXC	2,48
38690	grey	FXC	2,93

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. RM6-S

core material	A_L	low	%	medium	%	high	%
3H1. 3H3	160	4322 021 38650	6	4322 021 38620	11	4322 021 38680	19
	200	38620	9	38680	15	38670	18
	250	38680	12	38670	14	38610	19
	315	38680	10	38610	15	38600	20
	400	38670	9	38600	16	38690	24
	630	38600	10	38690	15	–	
	1000	38600	6	38690	10	–	
3D3	40	–		4322 021 38640	16	4322 021 38650	19
	63	4322 021 38640	12	38650	14	38620	22
	100	38650	9	38620	16	38680	26
	160	38620	9	38680	16	–	
4C6	16	–		4322 021 38640	18	–	
	25	–		38640	17	4322 021 38650	19
	40	4322 021 38640	12	38650	14	38620	21
	63	38650	8	38620	13	–	

ASSEMBLING AND MOUNTING



7Z99011.1

ASSEMBLING

Cementing

During the cementing procedure care must be taken that the centre holes are kept in line.

Assembly with clips

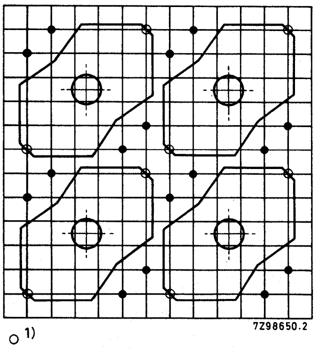
The core halves can be clamped together by using two clips. The tags of the clips are used for mechanical fastening and/or for earthing.

For a stable inductance we recommend that an adhesive be applied between the coil former and the lower core half.

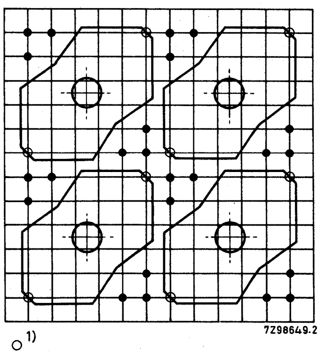
The use of a tool for attaching the clips is recommended. (Drawings of a simple tool for this purpose are available under number 4322 058 00150.)

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 (according to IEC publication 97).

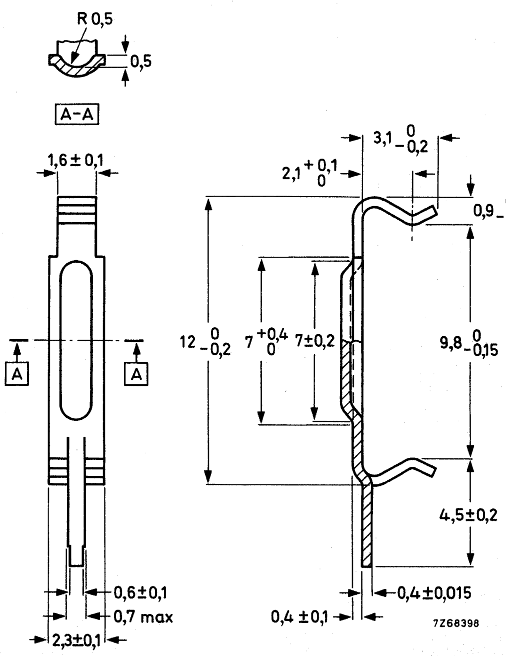


Hole pattern for an assembly of 4 cores, each fitted with a 4-pin coil former.



Hole pattern for an assembly of 4 cores, each fitted with an 6-pin coil former.

PART DRAWING (dimensions in mm)

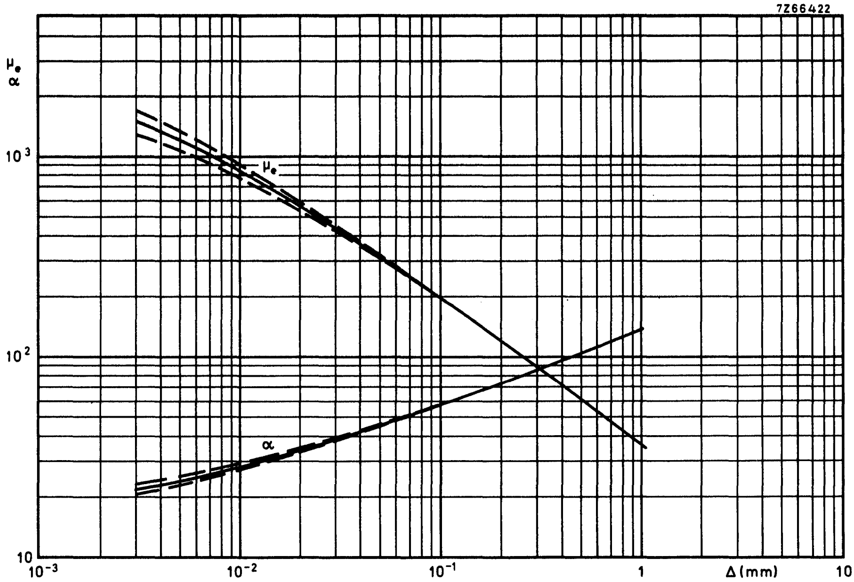


Clip 4322 021 31780
Material: steel; silver plated over nickel, then passivated

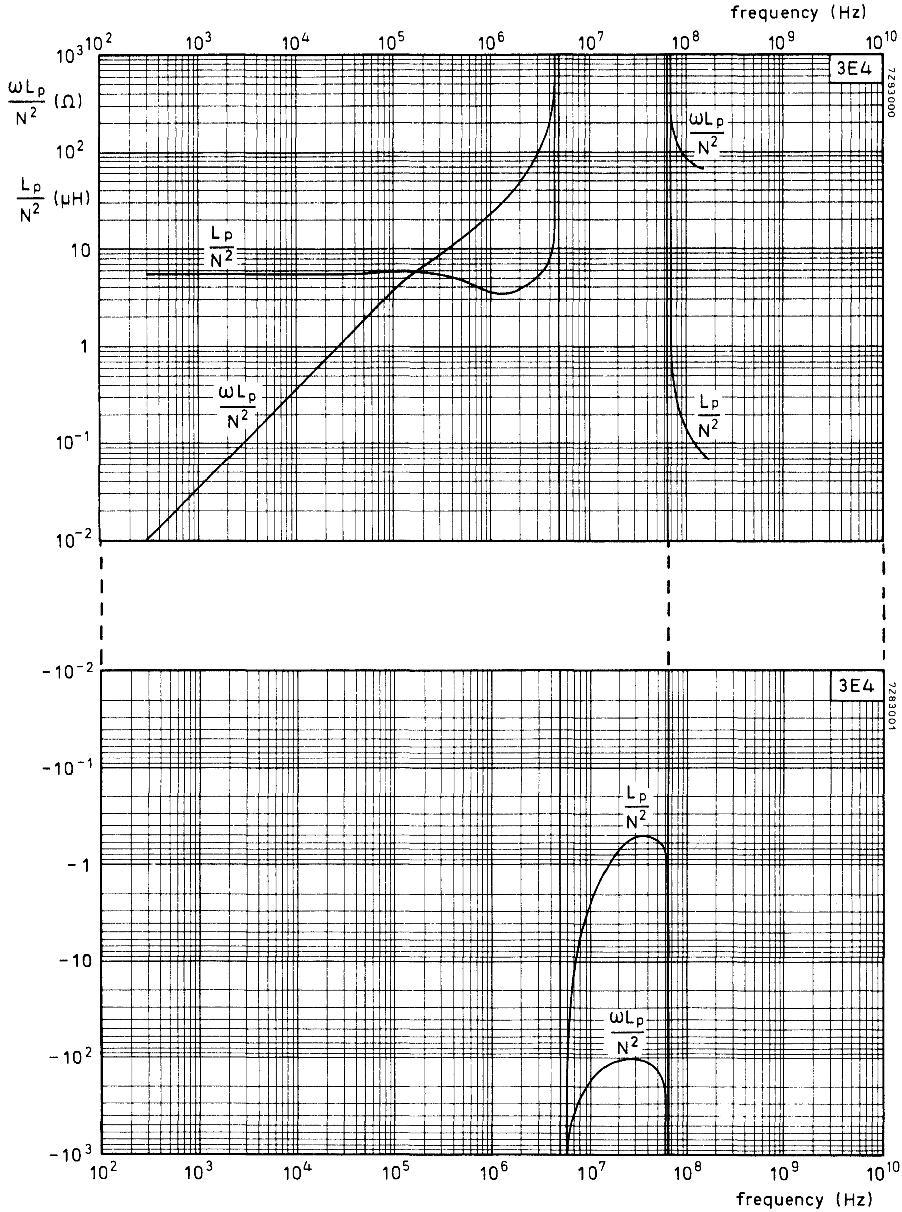
1) Holes for tag on clip 4322 021 31780 (earth points).

CHARACTERISTIC CURVES

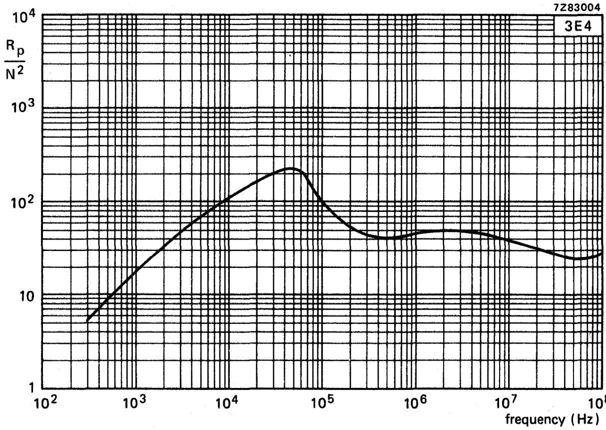
μ_e - α CURVES



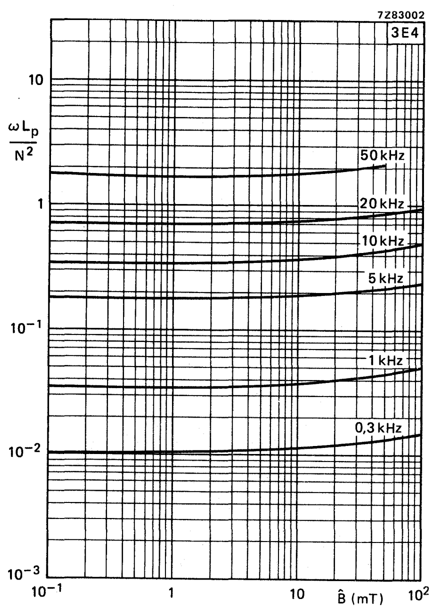
Relative effective permeability and turn factor for 1 mH as a function of the air gap length $\mu_e \geqslant 1280$ at $\Delta = 3\ \mu m$ for 3H1.



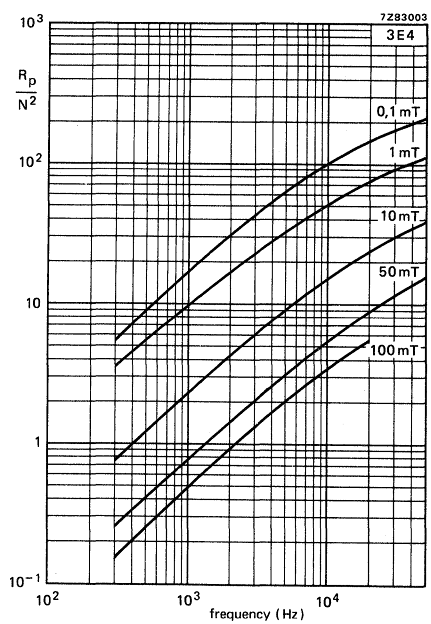
Inductance as a function of the frequency.



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

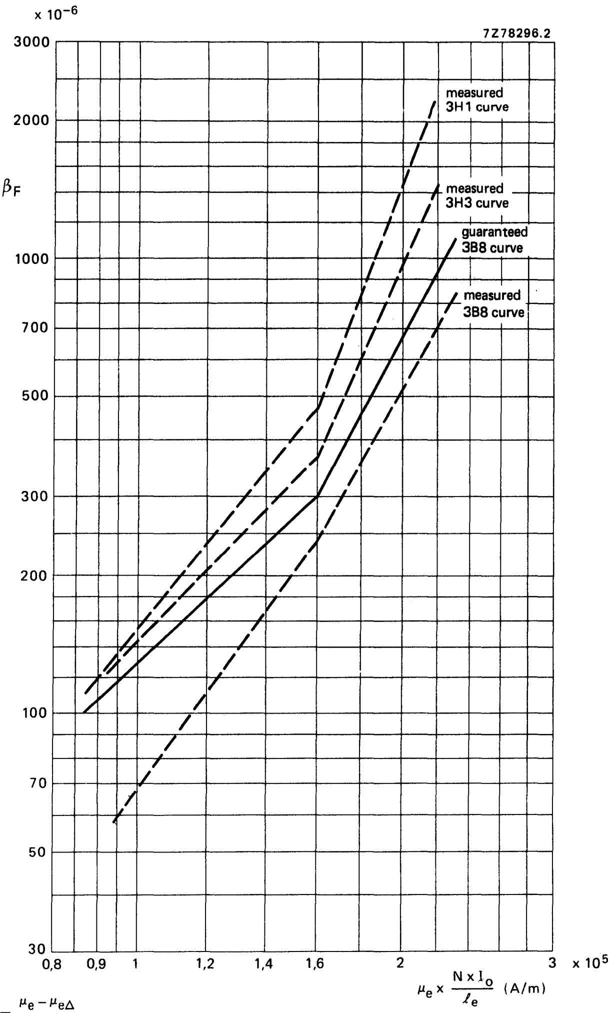


Inductance as a function of the peak induction.



Losses as a function of the frequency.

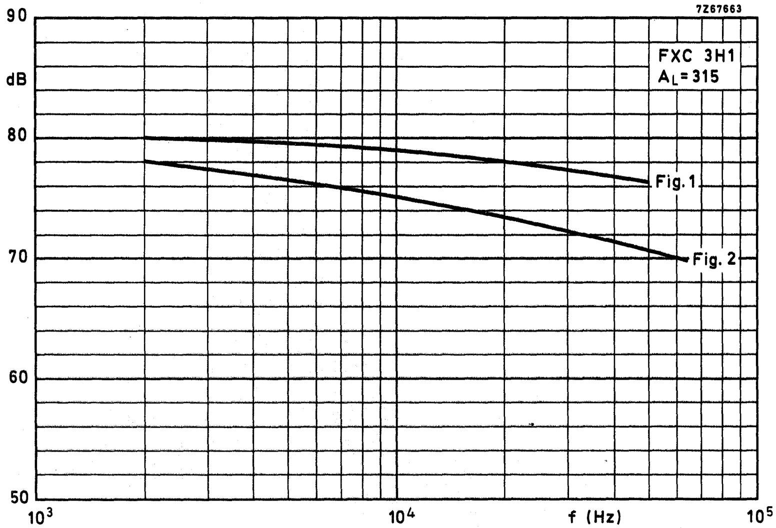
D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. polarization.

CROSSTALK ATTENUATION



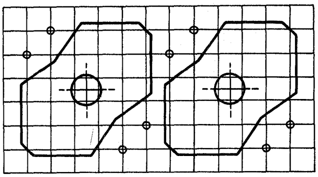


Fig. 1 7Z67662

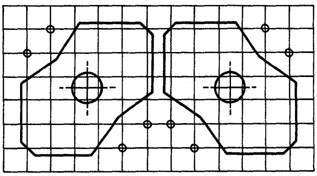
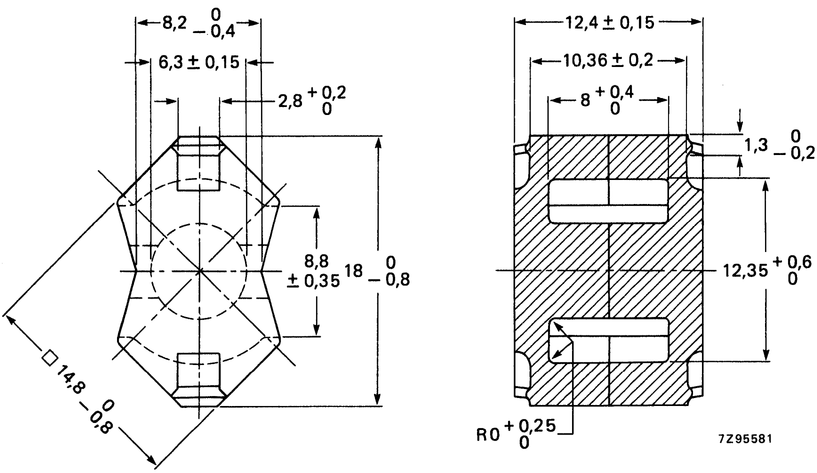


Fig. 2 7Z67661

RM6-S/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

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

$A_{min} = 31{,}2$ 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, square cores and cross 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			
				3C85	3E4	3E5	3F3
A_L	4	⩽ 0,1	25 ± 1	2400 ± 25%	5800 $^{+40\%}_{-25\%}$	8600 $^{+40\%}_{-25\%}$	2400 ± 25%
P (W)	25	200	25 ± 1	0,35			0,22
			100 ± 1	⩽ 0,25			0,16
	100	100	25 ± 1	0,40			0,22
			100 ± 1	⩽ 0,30			⩽ 0,16
	400	50	25 ± 1				0,30
			100 ± 1				⩽ 0,30
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1		⩽ 2,5		
	10	⩽ 0,1	25 ± 1			⩽ 7	
	100	⩽ 0,1	25 ± 1		⩽ 20		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		⩽ 1,1	⩽ 1,4	

Notes

For the specification of power losses $\hat{B}$ is calculated using A_e = 37 mm².

The induction $\hat{B}$ at $\hat{H}$ = 250 A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is ⩾ 315 mT, based on A_{min} = 31,2 mm².

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 025			
			3C85	3E4	3E5	3F3
40		± 5				
63		± 5	05030			
100		± 5	05040			
160		± 5	05050			
250		± 5				
315		± 5				
400		± 5				
630		± 10				
1000		± 15				

Core halves without air gap

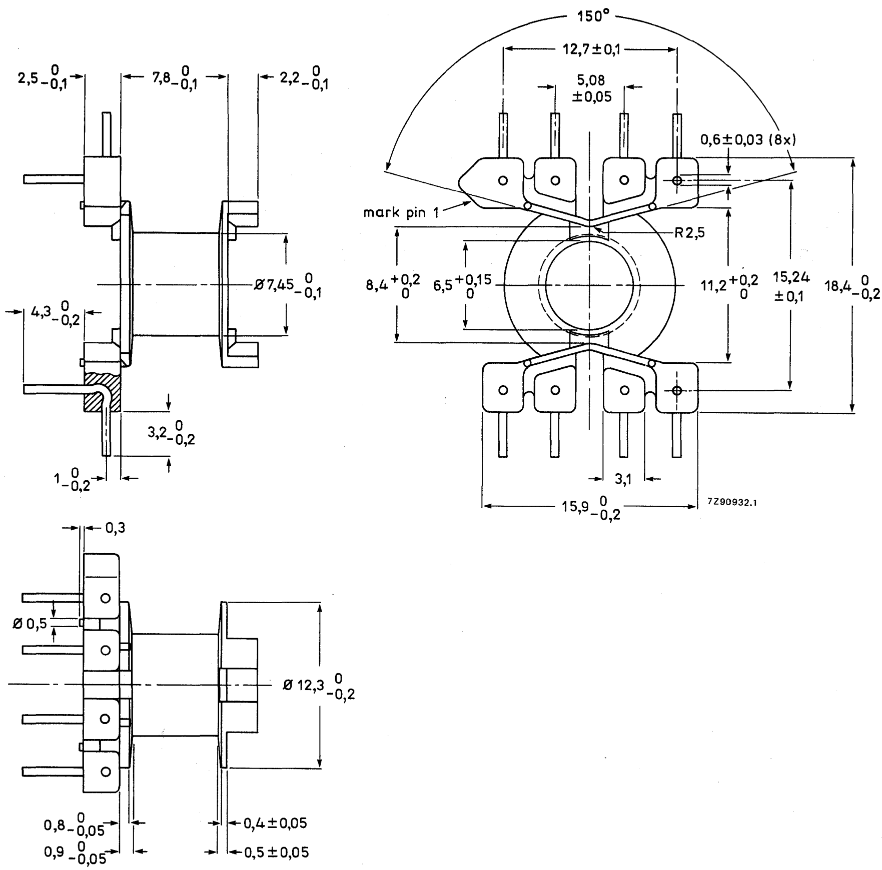
Ferroxcube grade	catalogue number
3C85	4322 020 27950
3E4	55500
3E5	55510
3F3	27970

DIL COIL FORMER FOR RM6-S/i SQUARE CORES

for power applications

SINGLE-SECTION, 8-PIN COIL FORMER

OUTLINES



Dil coil former for RM6-S/i square cores for power applications

Catalogue number	4322 021 34040
Material	polyterephthalate reinforced with glass fibre
Window area	15,7 mm^2
Mean length of turn	31 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

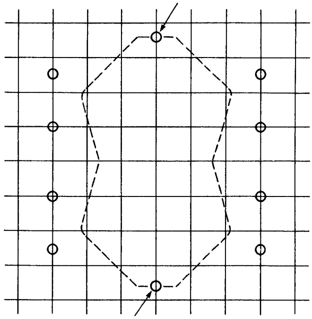
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 21{,}3 \times 10^3\ \Omega/H$$

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

mass 2 g

Packaging quantity: 200
Please order in multiples of this quantity.



The earth points are holes for tags on mounting clip 4322 021 31780 (See RM6-S, Mounting).

SQUARE CORES

These cores are available in two executions:

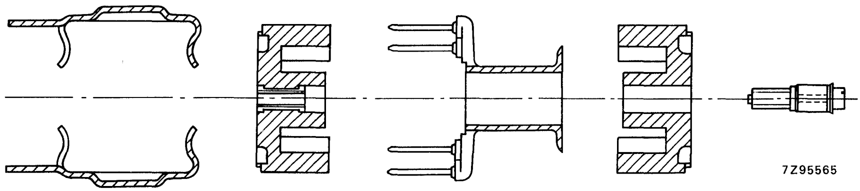
- RM8, usually for telecommunication, with centre hole for adjuster
- RM8/i, for industrial applications, no centre hole

RM8 cores can be supplied in three versions

- CORE SETS provided with a 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), UTE83-300 (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.

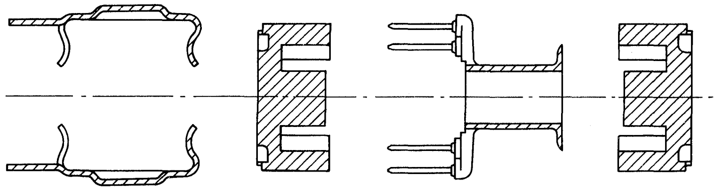


RM8

RM8/i cores can be supplied in two versions

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM8/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quantities and supply conditions upon request.

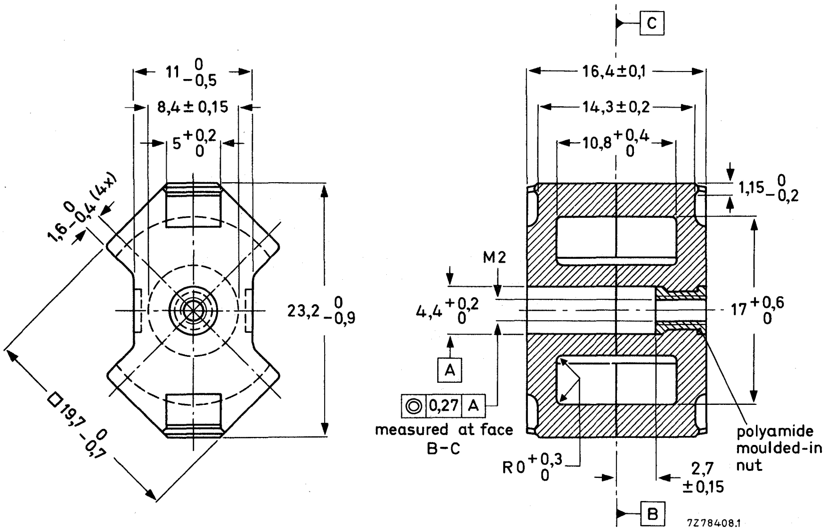


RM8/i

RM8 SQUARE CORES

for telecommunication

MECHANICAL DATA



Note: 4C6 cores have a cemented nut.

Pulling-out force of the nut	⩾ 40 N (at ambient temperature)
Torque of the screw thread	⩽ 10 mNm
Extraction force of adjuster from nut	⩾ 30 N

Dimensional quantities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}683\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}0131\ mm^{-3}$; $V_e = 1850\ mm^3$; $l_e = 35{,}5\ mm$; $A_e = 52{,}0\ mm^2$;

$A_{CP\,min} = 39{,}5\ mm^2$.

Mass of a core set: 10,9 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}604\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00952\ mm^{-3}$; $V_e = 2440\ mm^3$; $l_e = 38{,}4\ mm$; $A_e = 63{,}0\ mm^2$;

$A_{min} = 55{,}4\ mm^2$.

Mass of a core set: 12,4 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, square cores and cross 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	3C85	3D3	3E4	3H1	3H3	4C6
A_L ± 25%	4	⩽ 0,1	25 ± 1	3910	3300	1330		3400		230
μ_e ± 25%	4	⩽ 0,1	25 ± 1	1880	1600	720		1840		126
α	4	⩽ 0,1	25 ± 1	⩽ 18,0	⩽ 19,5	⩽ 31,6		⩽ 19,8		⩽ 75,8
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1				⩽ 2,5			
	30	⩽ 0,1	25 ± 1					⩽ 2,5	⩽ 1,8	
	100	⩽ 0,1	25 ± 1			8	⩽ 20	⩽ 5,0	⩽ 2,9	
	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
P(W)	25	200	25	0,6	0,7					
			100	0,7	0,5					
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1				⩽ 1,1	⩽ 0,86	⩽ 75	
	30	1,5 to 3,0	25 ± 1							
	100	0,3 to 1,2	25 ± 1			⩽ 1,8				⩽ 9,2
$\alpha_F \times 10^6$/K	⩽ 100	⩽ 0,1	5 to 25				0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	−2 to + 4
	⩽ 100	⩽ 0,1	25 to 55				0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	0 to + 6
	⩽ 100	⩽ 0,1	25 to 70			1 ± 1	0 to + 2	+ 0,5 to 1,5	+ 0,7 ± 0,3	
$D_F \times 10^6$ (10-100 min)	⩽ 100	⩽ 0,1	25 ± 0,1			⩽ 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 $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,0 x 10^5 A/m				⩽ 100						
= 1,7 x 10^5 A/m				⩽ 300						
= 2,4 x 10^5 A/m				⩽ 1000						

↑

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						4322 025 . . . . .
			3B8	3D3	3E4	3H1	3H3	4C6	3C85
40	22	± 1		71420				71820	
63	34	± 1		71430		71230		• 71830	
100	54	± 1		• 71440		71240		• 71840	01240*
160	87	± 1,5	• 51470*	71450		71250		71850	• 01250*
250	135	± 2	• 51480*			• 71260	• 71760		• 01260*
315	170	± 2	51490*			• 71270	71770		
400	220	± 3	51500*			71280	71780		
630	340	± 3				71300			
1000	540	± 10				71310			
1250	680	± 10				71390			
1600	870	± 10	51400*			51320*			
5500	2985	± 25							
6300	3050	± 25							
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 $A_L \geqslant 315$ and all 3B8 and 3C85 cores have an asymmetrical air gap.

Core halves without air gap, without nut.

Ferroxcube grade	catalogue number
3B8	4322 020 27420 *
3C85	4322 020 28100 *
3D3	4322 020 27270
3H1	4322 020 27260
3H3	4322 020 27390
4C6	4322 020 27280

* Types without centre hole.
• Preferred types.

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 and 5 plates (500 pcs) in a cardboard box. 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	2 x 17,0 mm^1
Mean length of turn	41 mm
Maximum temperature	180 °C
Inflammability	UL94, class V-0
Solderability	resistant against dip-soldering at 400 °C for 2 s
D.C. losses, $\frac{R_o}{L}$	$\frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11{,}4 \times 10^3$ Ω/H
Mass	0,55 g

SINGLE-SECTION, 4-PIN COIL FORMER

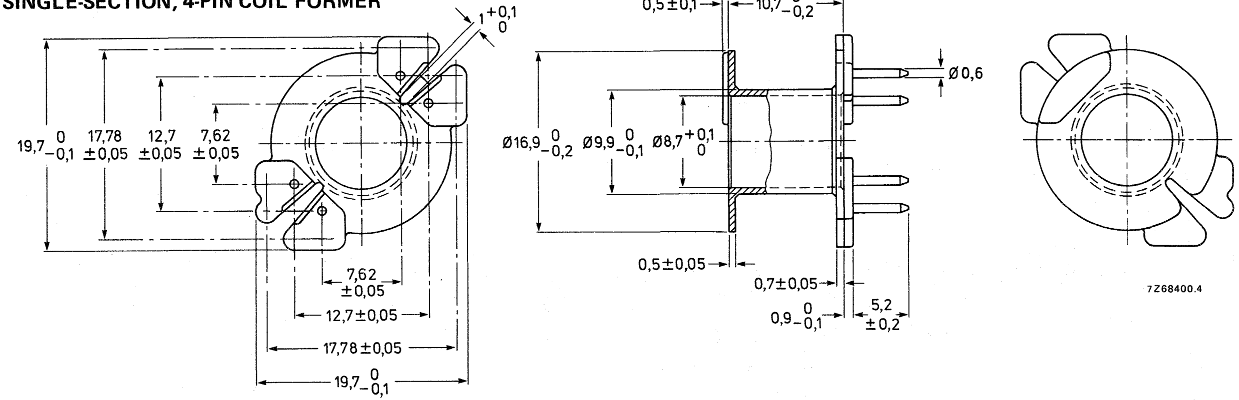


Fig. 1.

SINGLE-SECTION, 8-PIN COIL FORMER

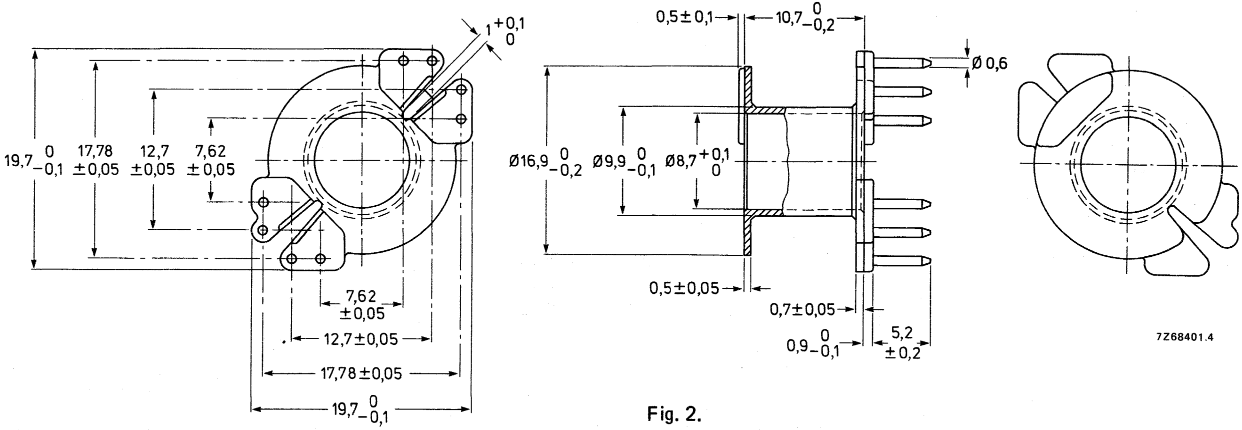


Fig. 2.

SINGLE-SECTION, 12-PIN COIL FORMER

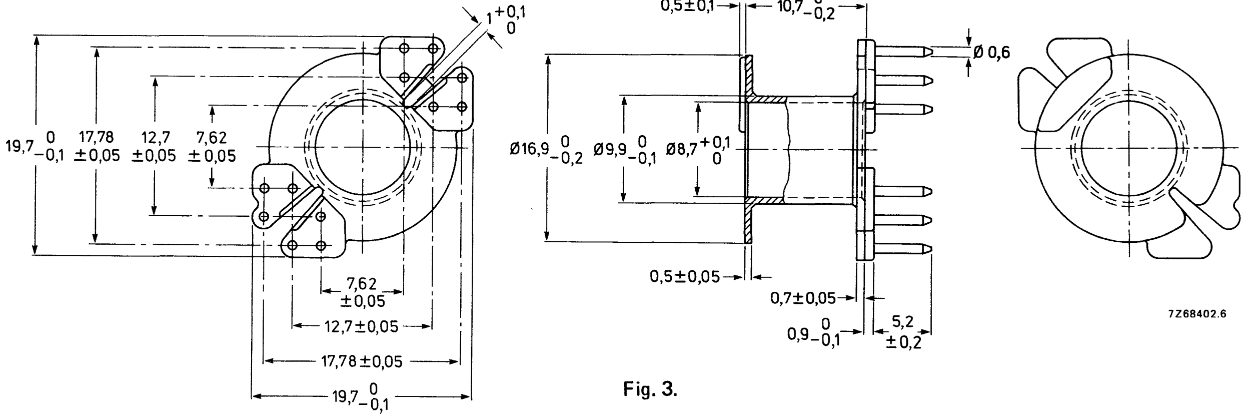


Fig. 3.

TWO-SECTION, 8-PIN COIL FORMER

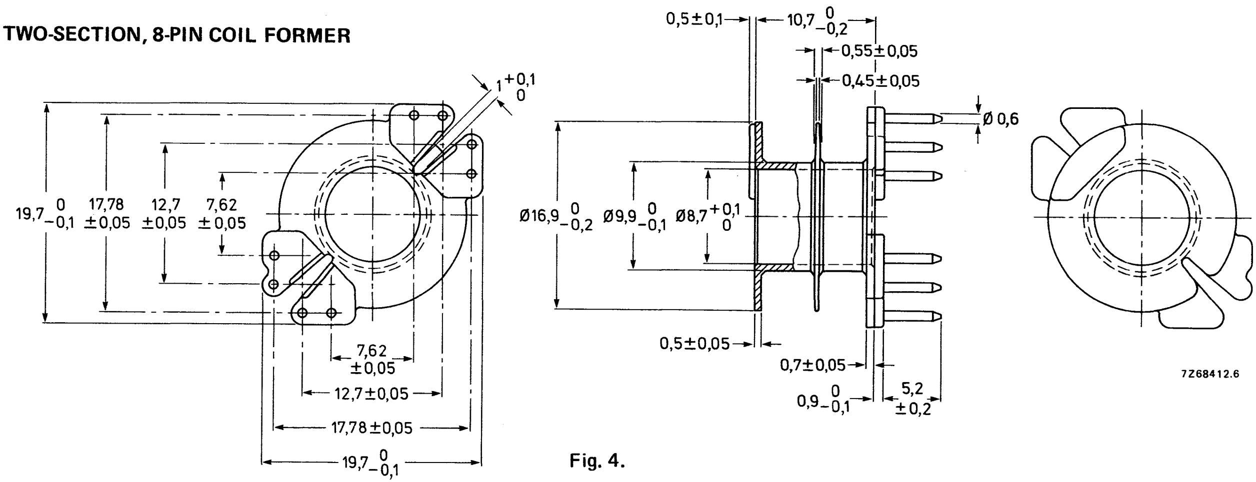


Fig. 4.

INDUCTANCE ADJUSTERS

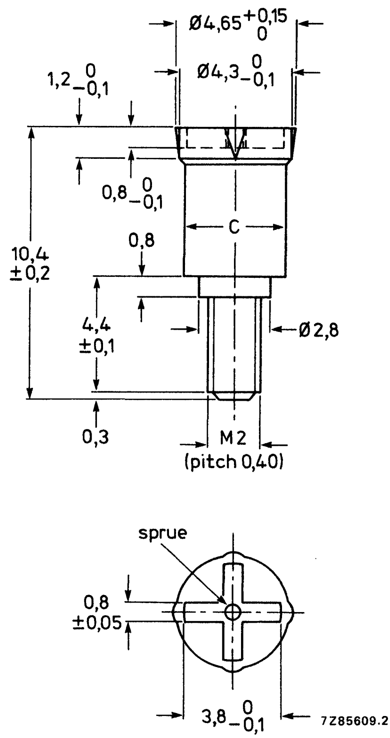


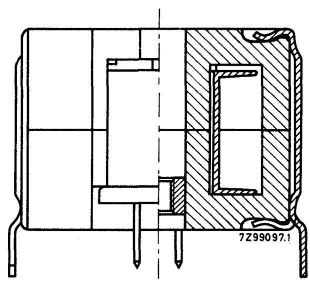
Table 1

catalogue number	colour code	material	C
4322 021 38400	black	FXC	4,22
38410	brown	FXC	4,04
38420	red	cip	4,04
38430	orange	cip	4,22
38440	yellow	FXC	3,52
38450	green	cip	3,80
38480	white	FXC	3,80
38490	grey	FXC	3,94

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. RM8.

core material	A_L	low	%	medium	%	high	%
3H1/3H3	63	–		4322 021 38450	19	4322 021 38420	25
	100	4322 021 38450	12	38420	16	38430	21
	160	38450	8	38430	14	38440	18
	250	38420	7	38440	12	38480	18
	315	38440	9	38480	15	38410	19
	400	38440	7	38480	12	38410	15
	630	38440	5	38410	10	38400	16
	1000	38410	6	38400	10	–	
	1250	–		38400	8	–	
3D3	40	–		4322 021 38450	27	–	
	63	–		38450	17	4322 021 38420	24
	100	4322 021 38450	11	38420	15	38430	20
	160	38450	7	38430	13	38440	17
4C6	40	–		4322 021 38450	18	4322 021 38420	23
	63	4322 021 38450	12	38420	16	38430	20
	100	38450	6	38430	11	38480	19
	160	38430	7	38480	12	–	

ASSEMBLING AND MOUNTING



ASSEMBLING

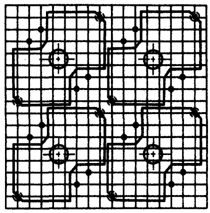
The core halves are clamped together by means of two clips, type 4322 021 31840. As can be seen in the drawing, the hooked ends of each clip fit into recesses made in the core halves.

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

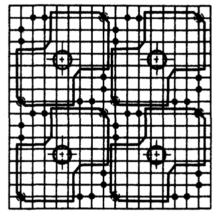
The two retaining clips are also used for mounting the assembled core on a printed-wiring board: the pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing the core.

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 mm (according to IEC publication 97).



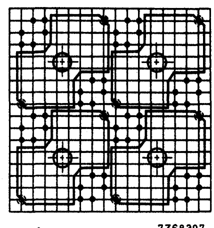
1)

Hole pattern for an assembly of 4 cores, each fitted with a 4-pin coil former.



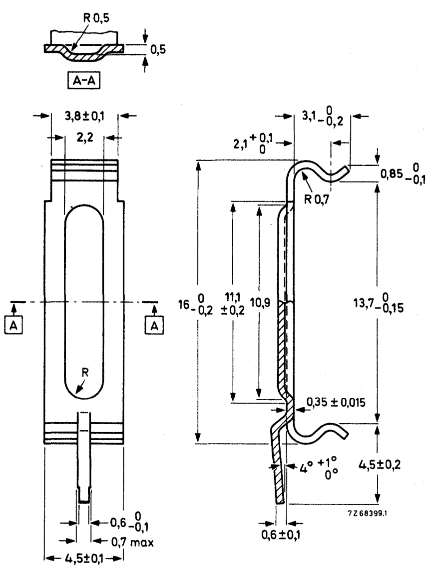
1)

Hole pattern for an assembly of 4 cores, each fitted with a 8-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 4322 021 31840

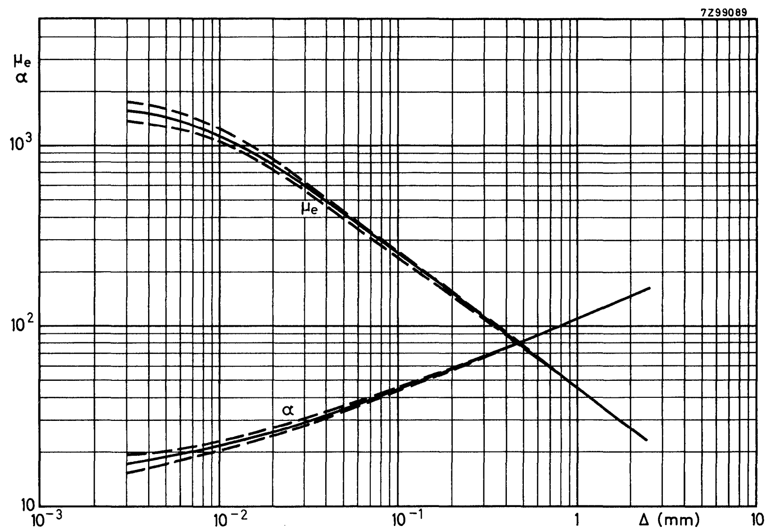
Material: steel, silver plated over nickel, then passivated

Packing quantity: 2500

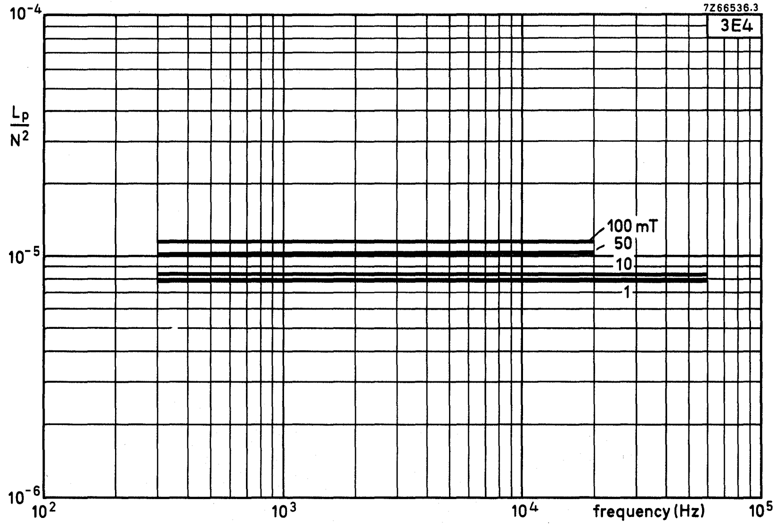
(1) Holes for tag on clip 4322 021 31840.

CHARACTERISTIC CURVES

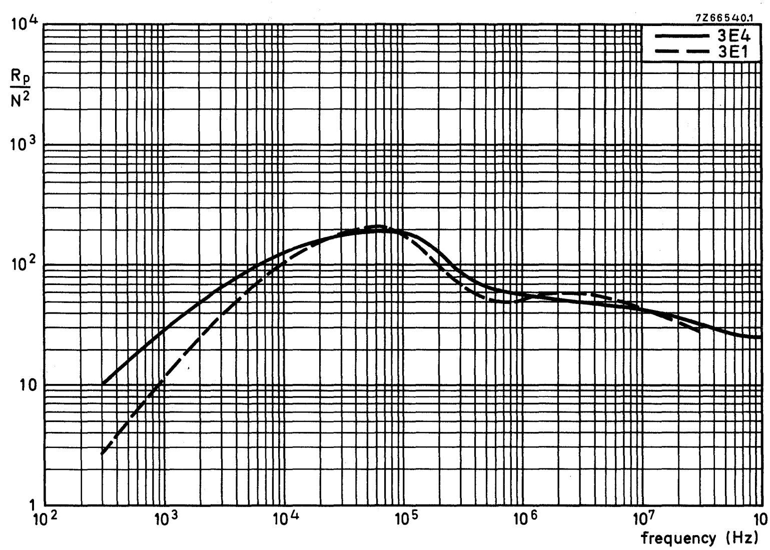
μ_e-α CURVES



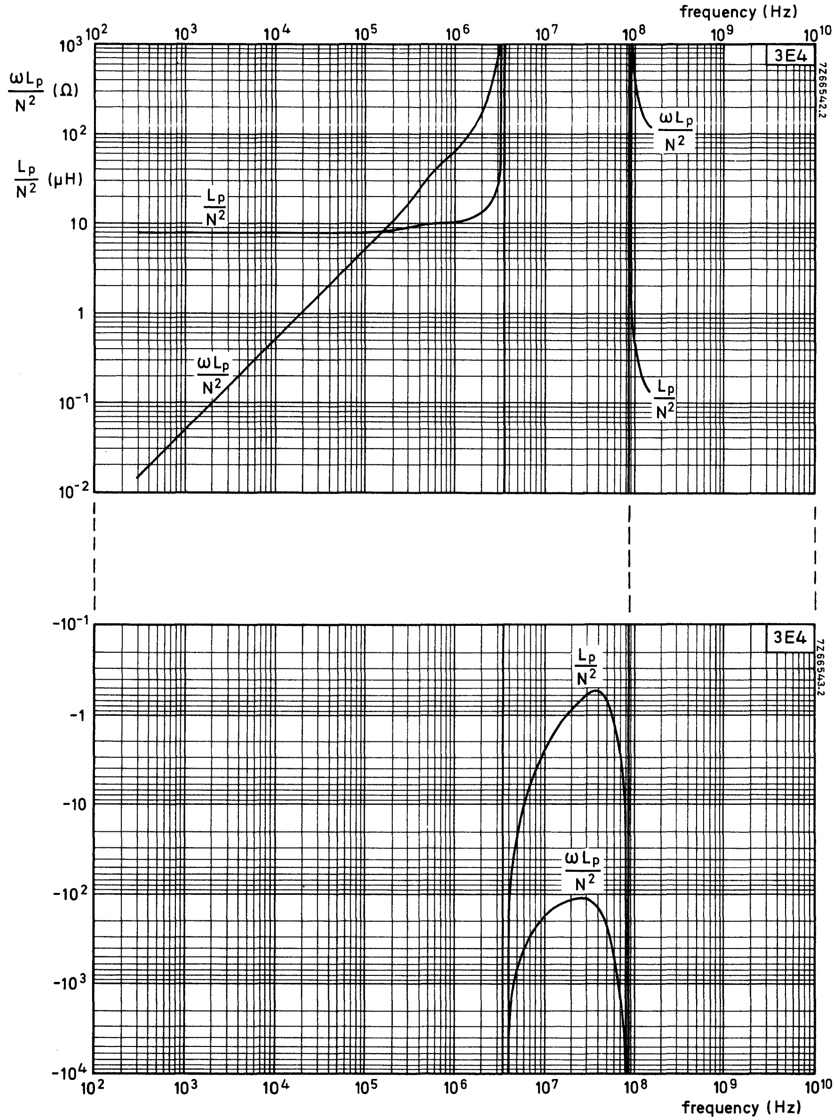
Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
μ_e = 1840 ± 25% at Δ = 3 μm for 3H1.



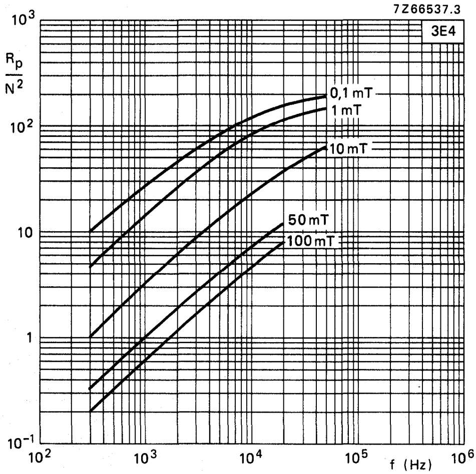
Inductance as a function of the frequency (typical values).



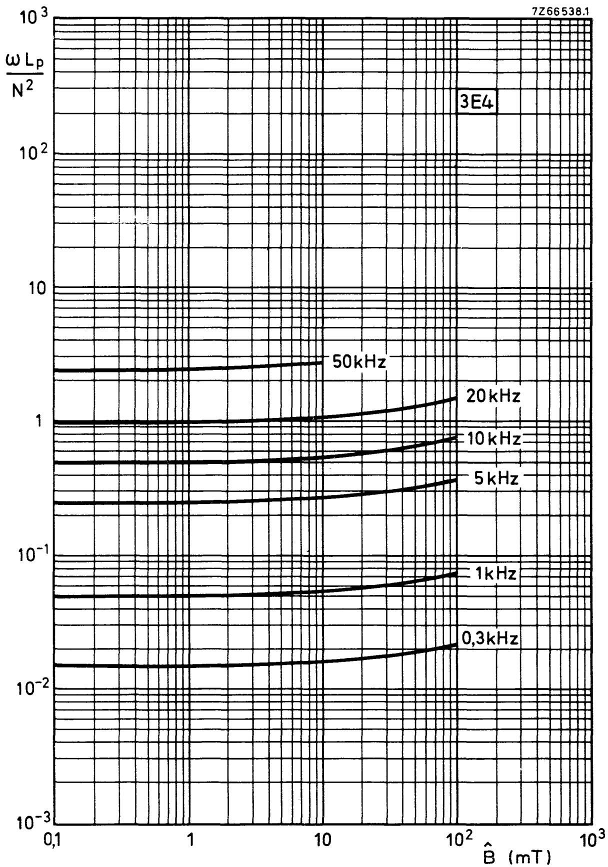
Losses as a function of the frequency at $\hat{B} \approx 0,1$ mT (typical values).



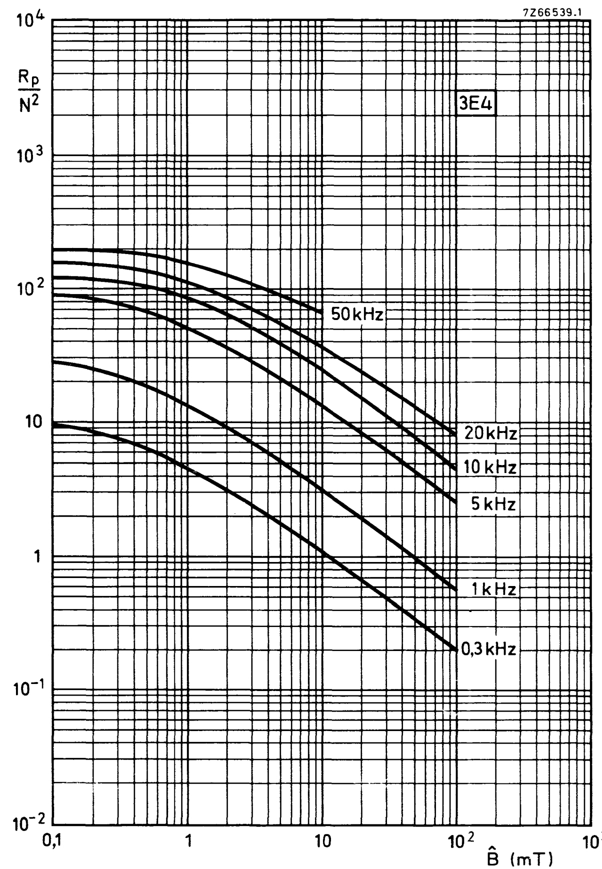
Inductance as a function of the frequency (typical values).



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

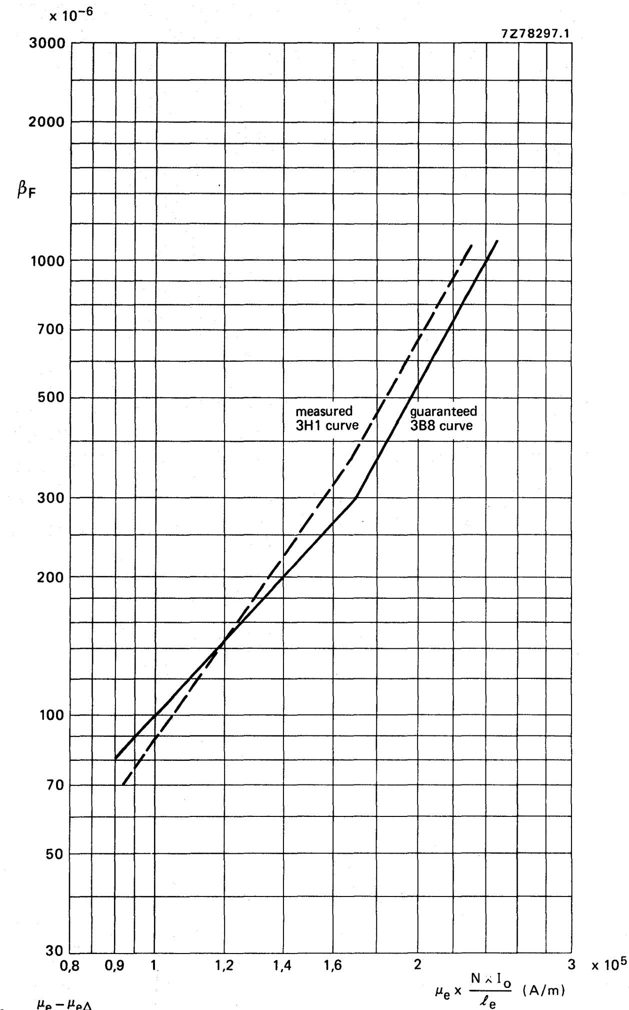


Inductance as a function of the peak induction (typical values).



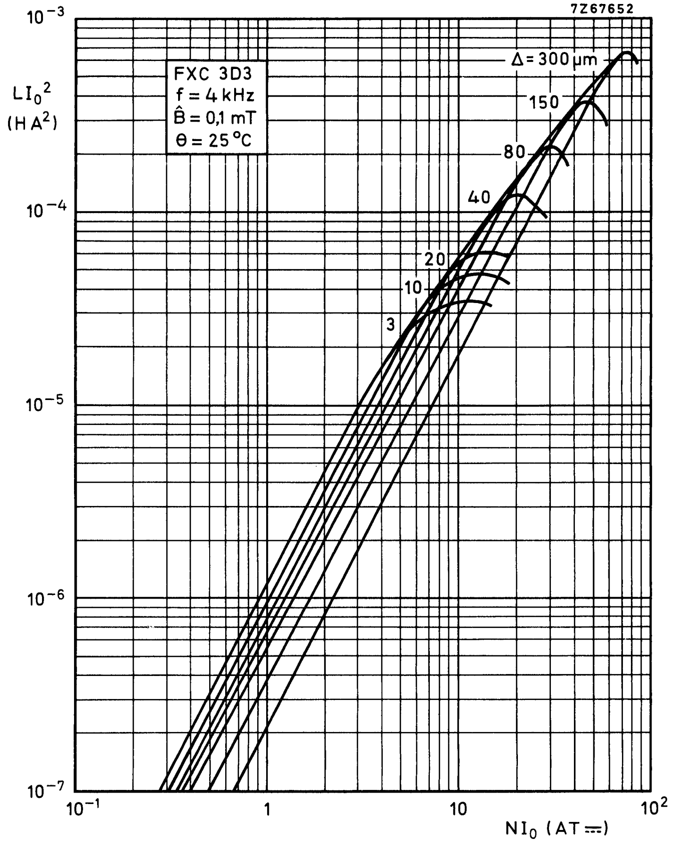
Inductance as a function of the peak induction (typical values).

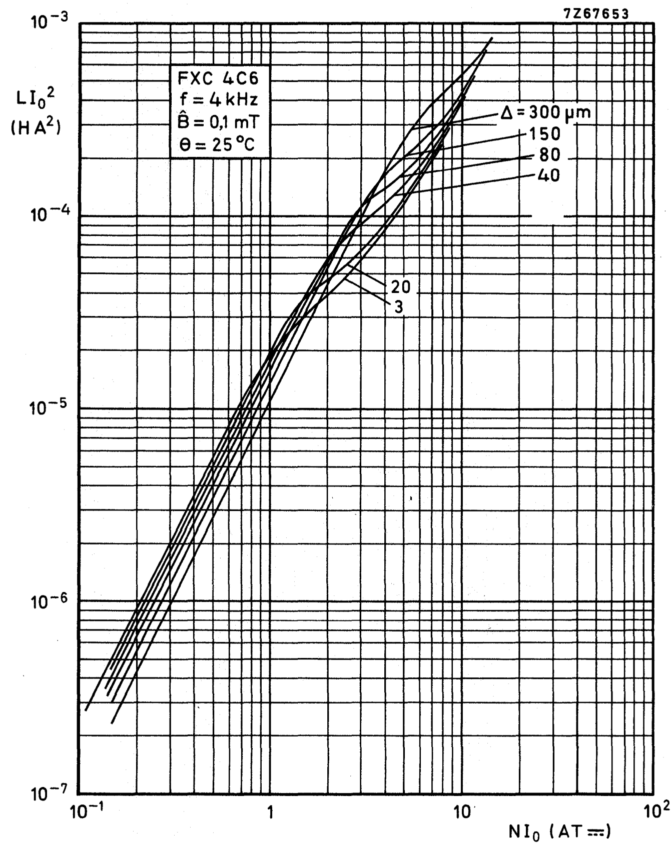
D.C. SENSITIVITY AT 25 °C

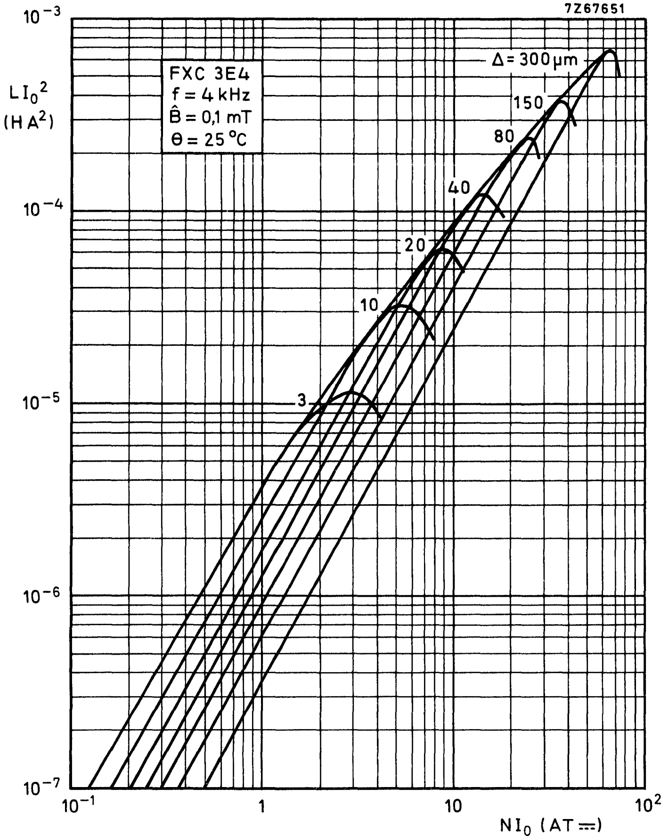


$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

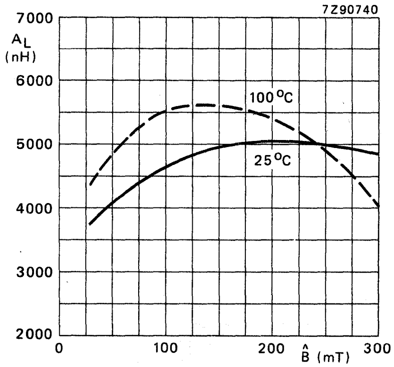
Induction variation as a function of d.c. polarization.


7Z67652
LI_0^2
(HA^2)
FXC 3D3
f = 4 kHz
$\hat{B}$ = 0,1 mT
Θ = 25 °C
Δ = 300 μm
150
80
40
20
10
3
10^{-3}
10^{-4}
10^{-5}
10^{-6}
10^{-7}
10^{-1}
1
10
10^2
NI_0 (AT ⎓)

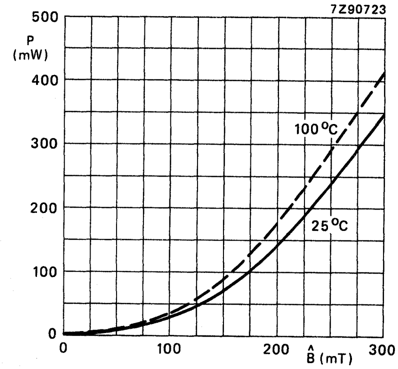

7Z67653
FXC 4C6
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
LI0²
(H A²)
Δ = 300 μm
150
80
40
20
3
10⁻³
10⁻⁴
10⁻⁵
10⁻⁶
10⁻⁷
10⁻¹
1
10
10²
NI0 (AT ⎓)


7Z67651
FXC 3E4
f = 4 kHz
B̂ = 0,1 mT
Θ = 25 °C
L I0² (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
10²
N I0 (AT ⎓)

FXC 3B8



$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No airgap.



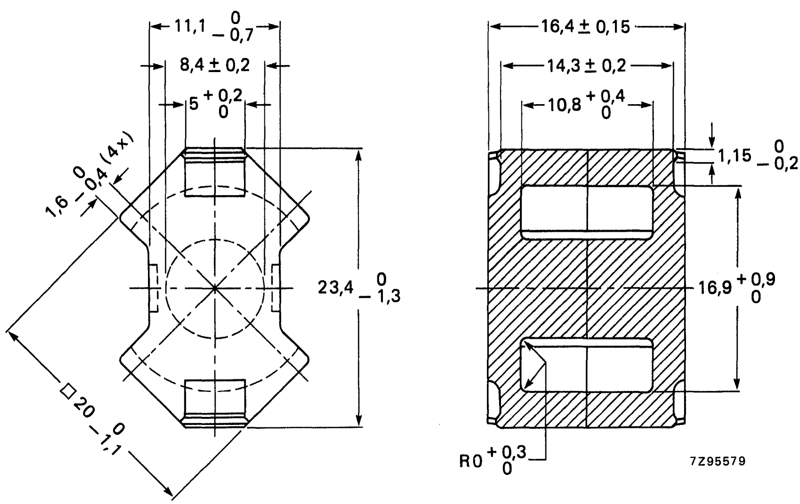
$P = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C.

$\hat{B}$ is calculated with $A_{CPmin} = 55{,}42\ mm^2$.

RM8/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}604\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00952\ mm^{-3}$; $V_e = 2440\ mm^3$; $l_e = 38{,}4\ mm$; $A_e = 63{,}0\ mm^2$;

$A_{min} = 55{,}4\ mm^2$.

Mass of a core set: 12,4 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, square cores and cross 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			
				3C85	3E4	3E5	3F3
A_L	4	⩽ 0,1	25 ± 1	3300 ± 25%	8000 $^{+40\%}_{-25\%}$	13000 $^{+40\%}_{-25\%}$	3300 ± 25%
P (W)	25	200	25 ± 1	0,70			0,50
			100 ± 1	⩽ 0,50			0,35
	100	100	25 ± 1	0,80			0,50
			100 ± 1	⩽ 0,60			⩽ 0,35
	400	50	25 ± 1				0,60
			100 ± 1				⩽ 0,60
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1		⩽ 2,5		
	10	⩽ 0,1	25 ± 1			⩽ 10	
	100	⩽ 0,1	25 ± 1		⩽ 25		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		⩽ 1,4	⩽ 1,9	

Notes

For the specification of power losses $\hat{B}$ is calculated using $A_e = 63\ mm^2$.

The induction $\hat{B}$ at $\hat{H} = 250$ A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is ⩾ 315 mT, based on $A_{min} = 55,4\ mm^2$.

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 025			
			3C85	3E4	3E5	3F3
40		± 5				
63		± 5				
100		± 5	01440			
160		± 5	01450			
250		± 5	01460			
315		± 5				
400		± 5				
630		± 10				
1000		± 15				

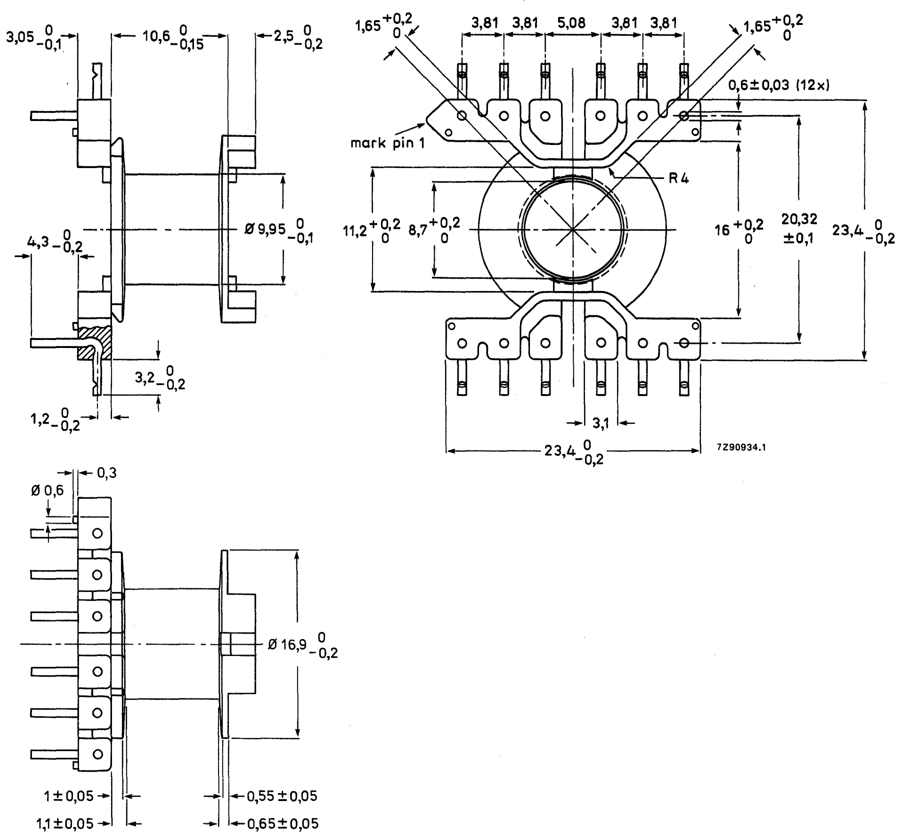
Core halves without air gap

Ferroxcube grade	catalogue number
3C85	4322 020 28170
3E4	28190
3E5	28230
3F3	28220

DIL COIL FORMER FOR RM8/i SQUARE CORES

for power applications

OUTLINES



SINGLE-SECTION, 12-PIN COIL FORMER

Catalogue number	4322 021 34050
Material	polyterephthalate reinforced
Window area	30,9 mm^2
Mean length of turn	42 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

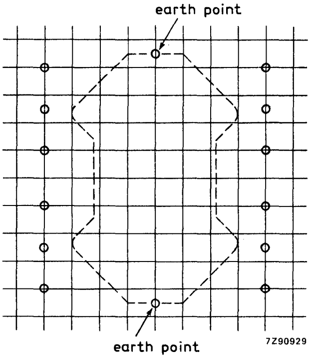
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11{,}4 \times 10^3\ \Omega/H$$

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

Mass 2,5 g

Packaging quantity: 200
Please order in multiples of this quantity



Hole pattern

The earth points are holes for tags on mounting clip 4322 021 31840, see RM8, mounting.

SQUARE CORES

These cores are available in two executions:

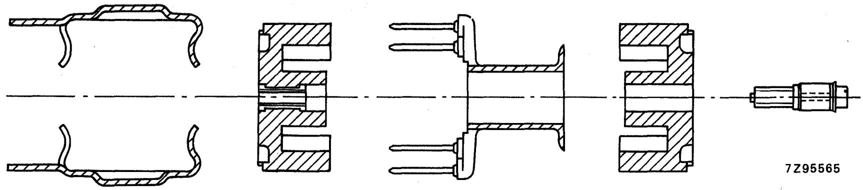
- RM10, usually for telecommunication, with centre hole for adjuster
- RM10/i, for industrial applications, no centre hole

RM10 cores can be supplied in three versions

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

The square cores are in accordance with the following specifications: IEC 431 (international), UTE83-300 (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 of 40 core halves; a storafe pack contains 100 core sets or 200 core halves. Please order in multiples of these quantities.

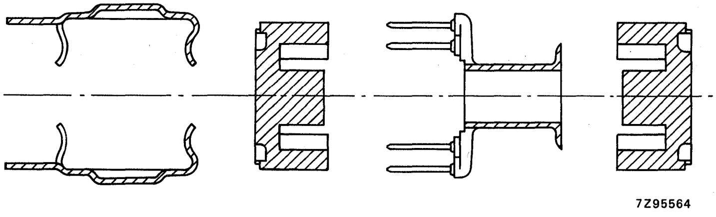


RM10

RM10/i cores can be supplied in two versions

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM10/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quantities and supply conditions upon request.

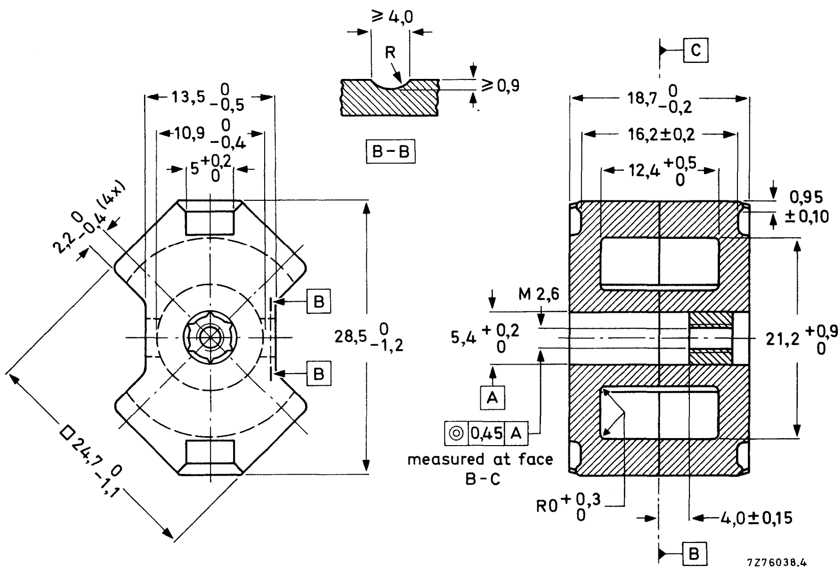


RM10/i

RM10 SQUARE CORES

for telecommunication

MECHANICAL DATA



Pulling-out force of the nut ⩾ 50 N

Dimensional quanitities according to IEC 205:

a. Version with centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}501\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00602\ mm^{-3}$; $V_e = 3470\ mm^3$; $l_e = 41{,}7\ mm$; $A_e = 83{,}2\ mm^2$.

Mass of a core set: 20 g.

b. Version without centre hole:

$C_1 = \Sigma \frac{l}{A} = 0{,}462\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00479\ mm^{-3}$; $V_e = 4310\ mm^3$; $l_e = 44{,}6\ mm$; $A_e = 96{,}6\ mm^2$;

$A_{min} = 80{,}9\ mm^2$.

Mass of a core set: 23 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, square cores and cross cores', is inserted; the halves are pressed together with a force of 130 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	H A/m	temp. °C	grade 3B8	3C85	3E4	3H1
A_L ± 25%	4	≤ 0,1		25 ± 5	5310	4500	11 000	4900
μ_e ± 25%	4	≤ 0,1		25 ± 5	1950	1650	4190	1950
α	4	≤ 0,1		25 ± 5	≤ 15,8	≤ 16,8	≤ 11,0	≤ 16,5
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	≤ 0,1		25 ± 5			≤ 2,5	
	30	≤ 0,1		25 ± 5				≤ 2,5
	100	≤ 0,1		25 ± 5			≤ 20	≤ 5,0
	500	≤ 0,1		25 ± 5			≤ 200	
P(W)	25	200	25	25 ± 5	1,2	1,4		
				100 ± 5	1,4	1,0		
$\eta_B \times 10^3$	4	1.5-3,0		25 ± 5			≤ 1,1	≤ 0,86
	30	1,5-3,0		25 ± 5				
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1		5 to 25			0 to + 2	+ 0,5 to + 1,5
				25 to 55			0 to + 2	+ 0,5 to + 1,5
				25 to 75			0 to + 2	+ 0,5 to + 1,5
$D_F \times 10^6$ (10-100 min.)	≤ 100	≤ 0,1		25 ± 5			≤ 4,3	≤ 4,3
$\hat{B}$ (mT) (2)	25		250	100 ± 5		≥ 315		

$\beta_F \times 10^6$ measured on sets with μ_e = 300 ± 10% and 25 ± 1 °C:	3B8	3C85	3E4	3H1
at $\mu_e \times \frac{N \times I_o}{l_e}$ = 1,00 x 10⁵ A/m	≤ 110			
= 1,60 x 10⁵ A/m	≤ 300			
= 2,30 x 10⁵ A/m	≤ 1050			

Versions

1. Core sets with nut and pre-adjusted on A_L

A_L	corresponding μ_e- value	tol. on induct-ance (%)	catalogue number 4322 022 . . . . .
			3H1
160	64	± 2	70250
250	100	± 2	● 70260
315	126	± 2	● 70270
400	160	± 3	● 70280
630	251	± 4	70300
1 000	399	± 10	70310

2. Core sets without centre hole and pre-adjusted on A_L

A_L	corresponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 022		
			3B8	3C85	3E4
160	59	2	50460	50650	
250	92	2	● 50480	● 50660	
315	116	2	50490	50670	
400	147	3	● 50500	● 50680	
630	232	4	50520	50700	
1 000	368	10		50710	
1 600	588	10	50550		
11 000	4045	25			● 50910*

All pre-adjusted RM10 cores have an asymmetrical air gap.

3. Core halves

Ferroxcube grade	catalogue number
3B8	4322 020 28370*
3C85	4322 020 28380*
3H1	4322 020 28400

* This core has no centre hole.
● Preferred type.

COIL FORMERS

Five types of coil formers can be supplied:

- Single-section, 5-pin, catalogue number 4322 021 32440 (Fig. 1)
- Single-section, 8-pin, catalogue number 4322 021 32450 (Fig. 2)
- Single-section, 12-pin, catalogue number 4322 021 32470 (Fig. 3)
- Two-section, 8-pin, catalogue number 4322 021 32460 (Fig. 4)
- Two-section, 12-pin, catalogue number 4322 021 32790 (Fig. 5)

The arrangement of the soldering pins is suitable for both 0,1 inch and 2,50 mm grid. See "Mounting".
The coil formers are packed on a polystyrene plate of 50 and 4 plates (200 pcs) in a cardboard box.
Please order in multiples of these quantities.

PROPERTIES

	SINGLE-SECTION	TWO-SECTION
Material	phenolformaldehyde reinforced with glass fibre	
Solderability	resistant against dip-soldering at 400 °C for 2 s	
D.C. losses: $\frac{R_o}{L}$	$\frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 8{,}17 \times 10^3\,\Omega/H$	$\frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 8{,}12 \times 10^3\,\Omega/H$
Window area	44,9 mm^2	2 x 23,6 mm^2
Mean length of turn	52 mm	52 mm
Max. temperature	180 °C	180 °C
Inflammability	UL94, class V-0	UL94, class V-0
Mass	1,5 g	1,7 g

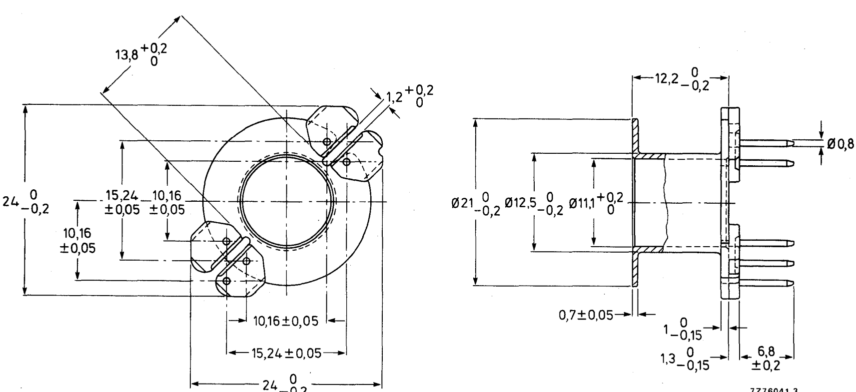


Fig. 1.

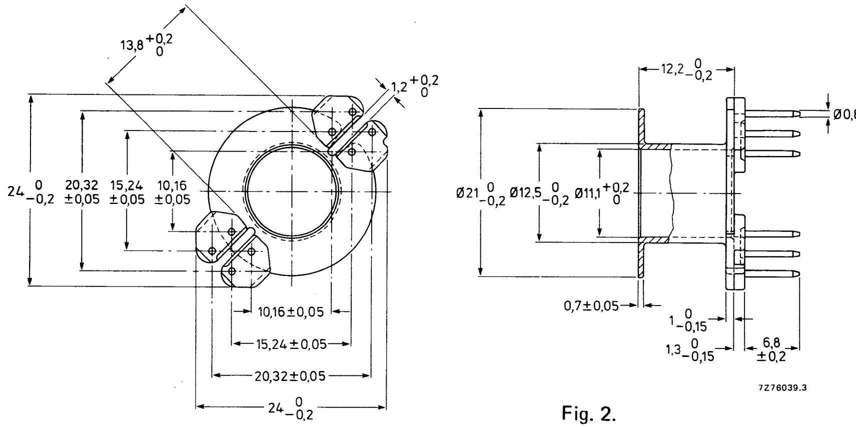


Fig. 2.

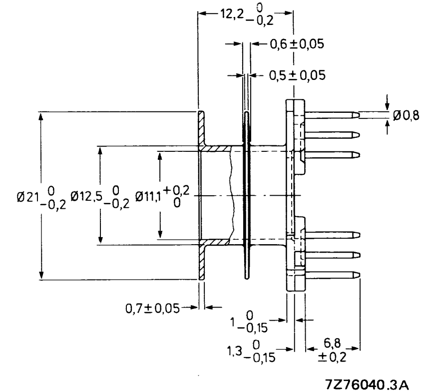


Fig. 4.

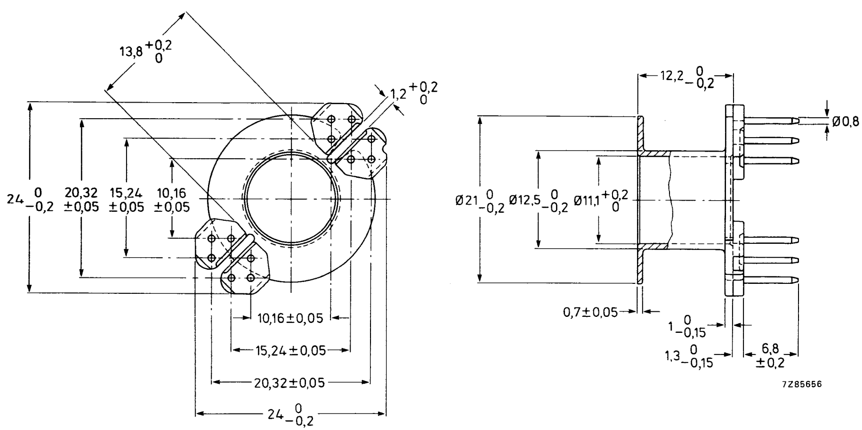


Fig. 3.

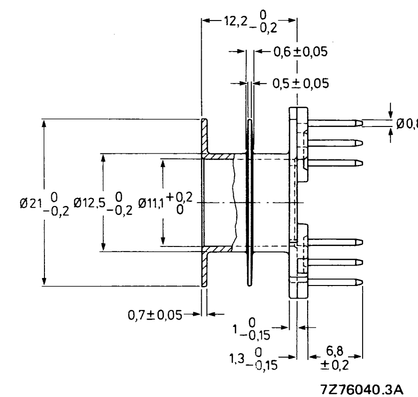
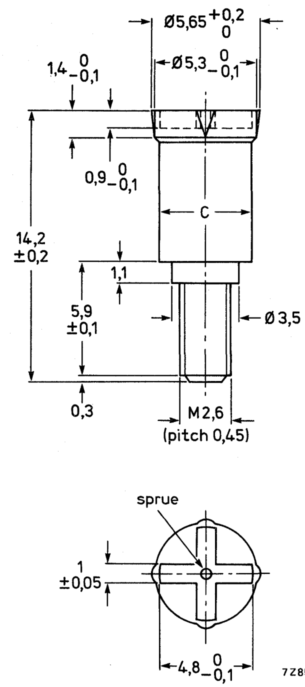


Fig. 5.

INDUCTANCE ADJUSTERS



7Z85613.2

Table 1

catalogue number	colour code	material	C
4322 021 38320	red	cip	4,68
38340	yellow	cip	5,10
38380	white	FXC	4,40
38390	grey	FXC	5,10

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. RM10.

core material	A_L	low	%	medium	%	high	%
3H1	160	–		4322 021 38320	16	4322 021 38340	26
	250	4322 021 38320	10	38340	16	38380	19
	315	38320	8	38340	14	38380	15
	400	38320	6	38338	11	–	
	630	–		38380	8	38390	20
	1000	38380	5	38390	11	–	

ASSEMBLING AND MOUNTING

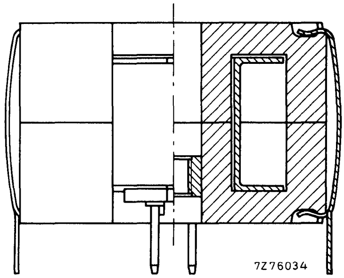


Fig. 1.

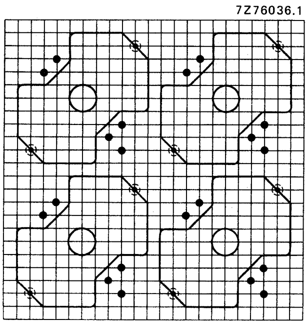
ASSEMBLING

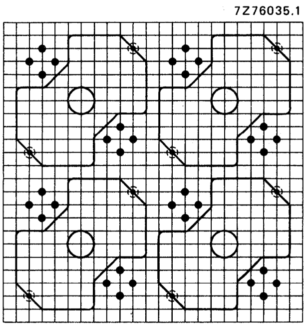
The core halves are clamped together by means of two clips, catalogue number 4313 021 04120. As can be seen in the drawing the hooked ends of both clips fit into the recesses made in the halves.
For a stable inductance we recommend that an adhesive be applied between the coil former flange and the lower core half. The use of a suitable tool for attaching the clips is also 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).





(1) Holes for tag on clip 4313 021 04120 (earth points).

Fig. 2 Hole pattern for an assembly of 4 cores, each fitted with a 5-pin coil former.

Fig. 3 Hole pattern for an assembly of 4 cores, each fitted with an 8-pin coil former.

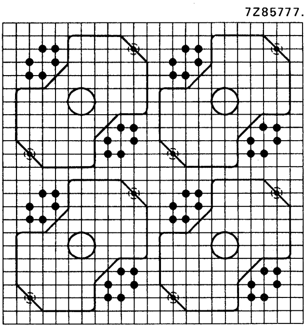
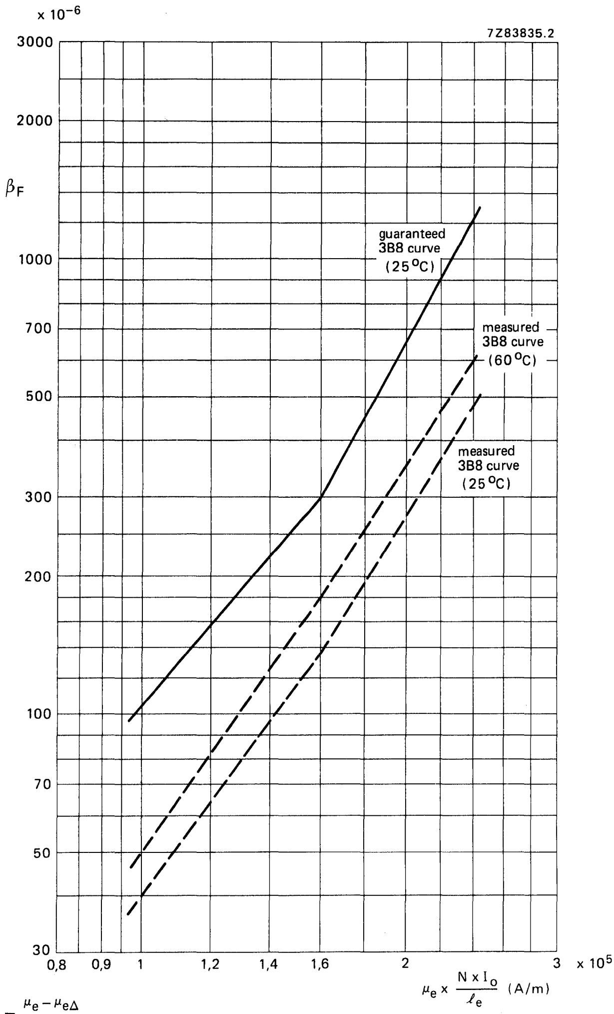


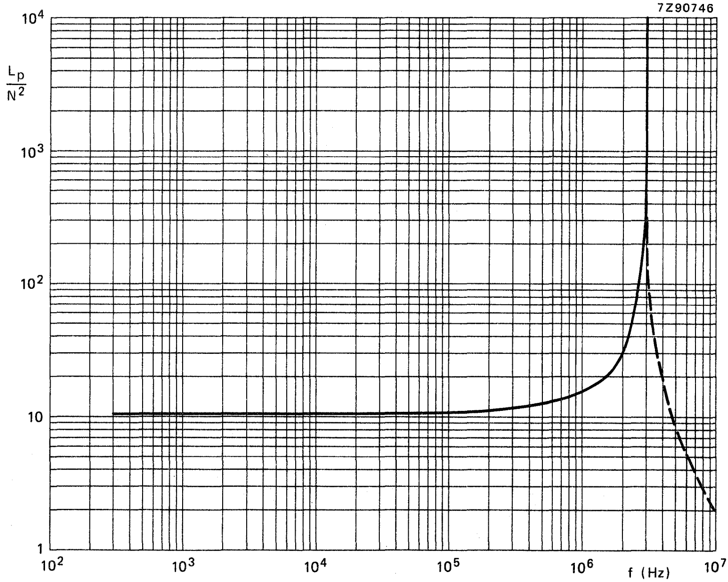
Fig. 4 Hole pattern for an assembly of 4 cores fitted with a 12-pin coil former.

D.C. SENSITIVITY AT 25 °C

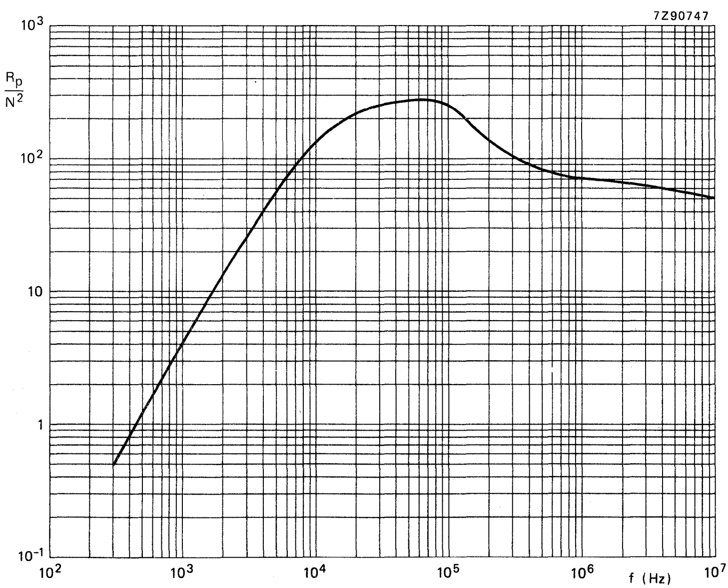


$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. polarization.

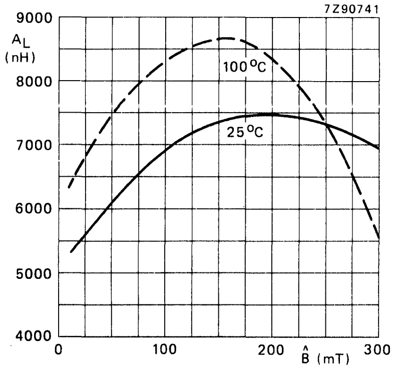


FXC 3E4. Inductance as a function of the frequency.

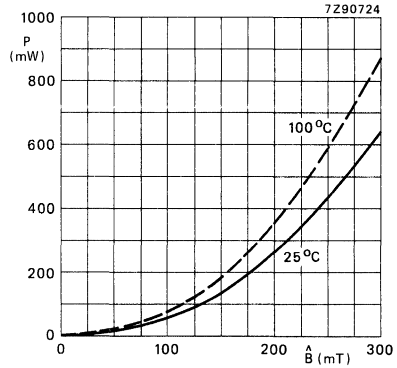


FXC 3E4. Losses as a function of the frequency at $\hat{B} \leqslant 0{,}1$ mT.

FXC 3B8



$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No airgap.



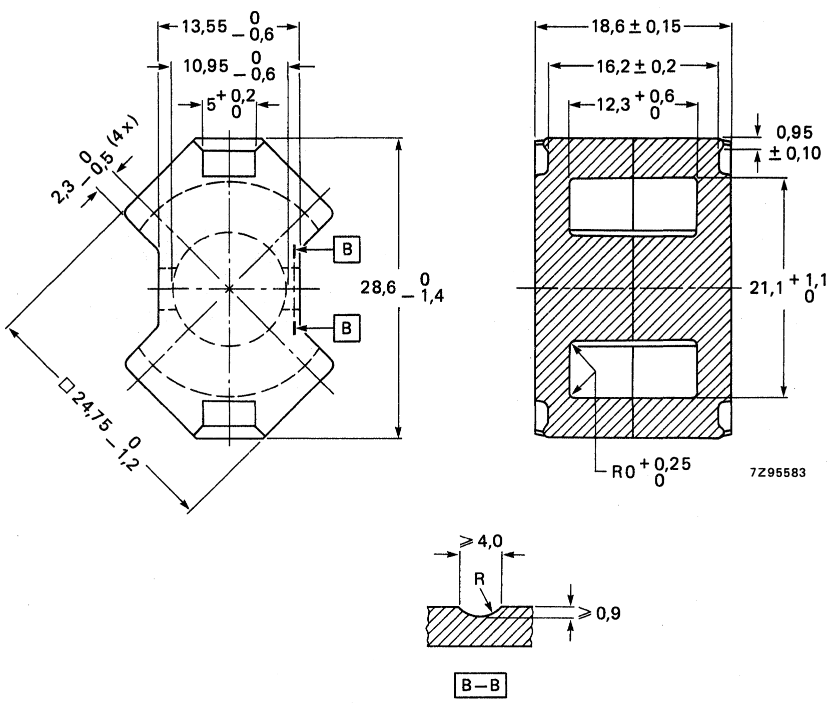
$P = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No airgap.

$\hat{B}$ is calculated with $A_{CPmin} = 89{,}1\ mm^2$.

RM10/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}462\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00479\ mm^{-3}$; $V_e = 4310\ mm^3$; $l_e = 44{,}6\ mm$; $A_e = 96{,}6\ mm^2$;

$A_{min} = 80{,}9\ mm^2$.

Mass of core set: 23 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, square cores and cross 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			
				3C85	3E4	3E5	3F3
A_L	4	$\leqslant$ 0,1	25 ± 1	4500 ± 25%	11000 $^{+40\%}_{-25\%}$	18000 $^{+40\%}_{-25\%}$	4500 ± 25%
P (W)	25	200	25 ± 1	1,4			1,0
			100 ± 1	$\leqslant$ 1,0			0,7
	100	100	25 ± 1	1,6			1,0
			100 ± 1	$\leqslant$ 1,2			$\leqslant$ 0,7
	400	50	25 ± 1				1,3
			100 ± 1				$\leqslant$ 1,3
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	$\leqslant$ 0,1	25 ± 1		$\leqslant$ 2,5		
	10	$\leqslant$ 0,1	25 ± 1			$\leqslant$ 14	
	100	$\leqslant$ 0,1	25 ± 1		$\leqslant$ 30		
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		$\leqslant$ 1,6	$\leqslant$ 2,2	

Notes

For the specification of power losses $\hat{B}$ is calculated using A_e = 96,6 mm².

The induction $\hat{B}$ at $\hat{H}$ = 250 A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is $\geqslant$ 315 mT, based on A_{min} = 80,9 mm².

Core sets pre-adjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 022			
			3C85	3E4	3E5	3F3
40		± 5				
63		± 5				
100		± 5	50850			
160		± 5	50990			
250		± 5	50860			
315		± 5				
400		± 5	50880			
630		± 10				
1000		± 15				

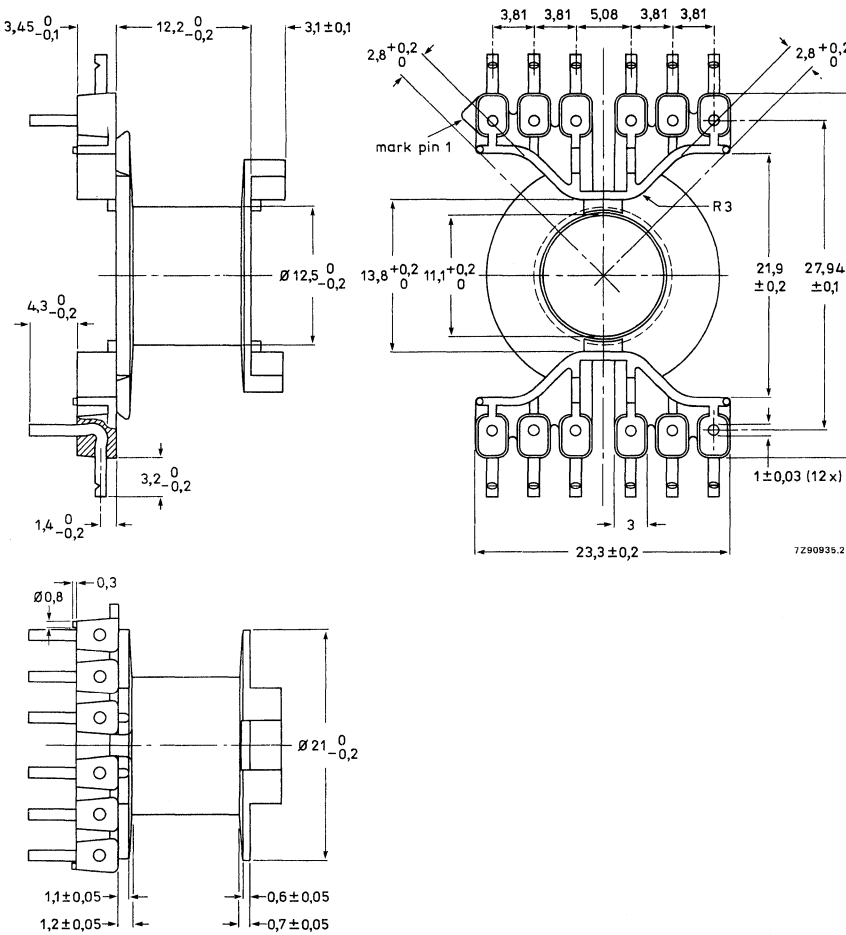
Core halves without air gap

Ferroxcube grade	catalogue number
3C85	4322 020 28430
3E4	28490
3E5	55250
3F3	28450

DIL COIL FORMER FOR RM10/i SQUARE CORES

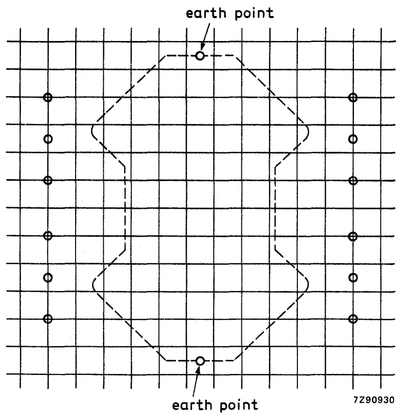
for power applications

OUTLINES



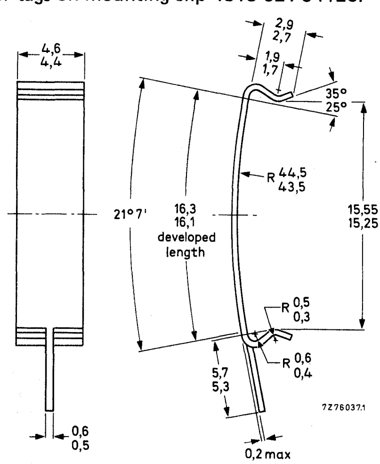
SINGLE-SECTION, 12-PIN COIL FORMER

Catalogue number	4322 021 34060	D.C. losses
Material	polyterephthalate reinforced with glass fibre	$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 7{,}55 \times 10^3\ \Omega/H$
Window area	44,2 mm^2	Solderability: resistance against
Mean length of turn	52 mm	dip-soldering at 400 °C for 2 s
Max. temperature	180 °C	Mass 3 g
Inflammability	UL94, class V-0	Packaging quantity: 200 Please order in multiples of this quantity.



Hole pattern

The earth points are holes for tags on mounting clip 4313 021 04120.



Clip 4313 021 04120. Material: steel, tin plated, over nickel.

RM12/i SQUARE CORES

for industrial use

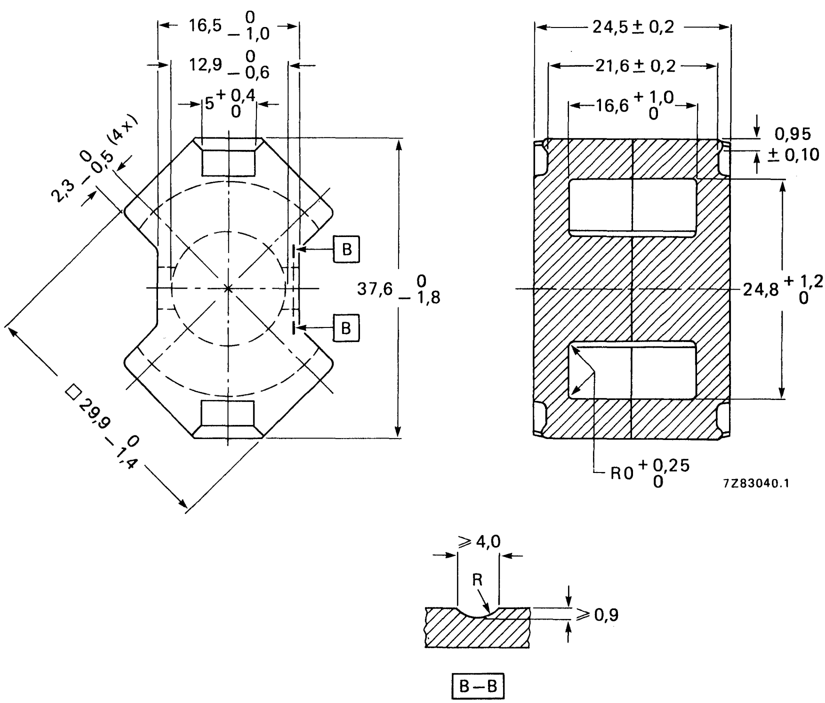
These cores are available in two executions:

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM12/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quanitities and supply conditions upon request.

MECHANICAL DATA

Outlines



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}388\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00265\ mm^{-3}$; $V_e = 8340\ mm^3$; $l_e = 56{,}6\ mm$, $A_e = 146\ mm^2$;

$A_{CPmin} = 124\ mm^2$.

Mass of core set: 45 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, square cores and cross cores', is inserted; the halves are pressed together with a force of 60 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade		
				3C85	3E4	3F3
A_L	4	⩽ 0,1	25 ± 1	5500 ± 25%	13000 $^{+40\%}_{-25\%}$	5500 ± 25%
P (W)	25	200	25 ± 1	2,6		1,8
			100 ± 1	⩽ 1,9		1,3
	100	100	25 ± 1	3,2		1,8
			100 ± 1	⩽ 2,4		⩽ 1,3
	400	50	25 ± 1			2,5
			100 ± 1			⩽ 2,5
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 1		⩽ 2,5	
	100	⩽ 0,1	25 ± 1		⩽ 50	
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		⩽ 2,0	

Notes

For the specification of power losses $\hat{B}$ is calculated using $A_e = 146\ mm^2$.

The induction $\hat{B}$ at $\hat{H} = 250$ A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is ⩾ 315 mT, based on $A_{min} = 124\ mm^2$.

Core sets preadjusted on A_L.

A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 025		
			3C85	3E4	3F3
40		± 5			
63		± 5			
100		± 5			
160		± 5	06050		
250		± 5	06060		
315		± 5	06070		
400		± 5	06080		
630		± 10			
1000		± 10			

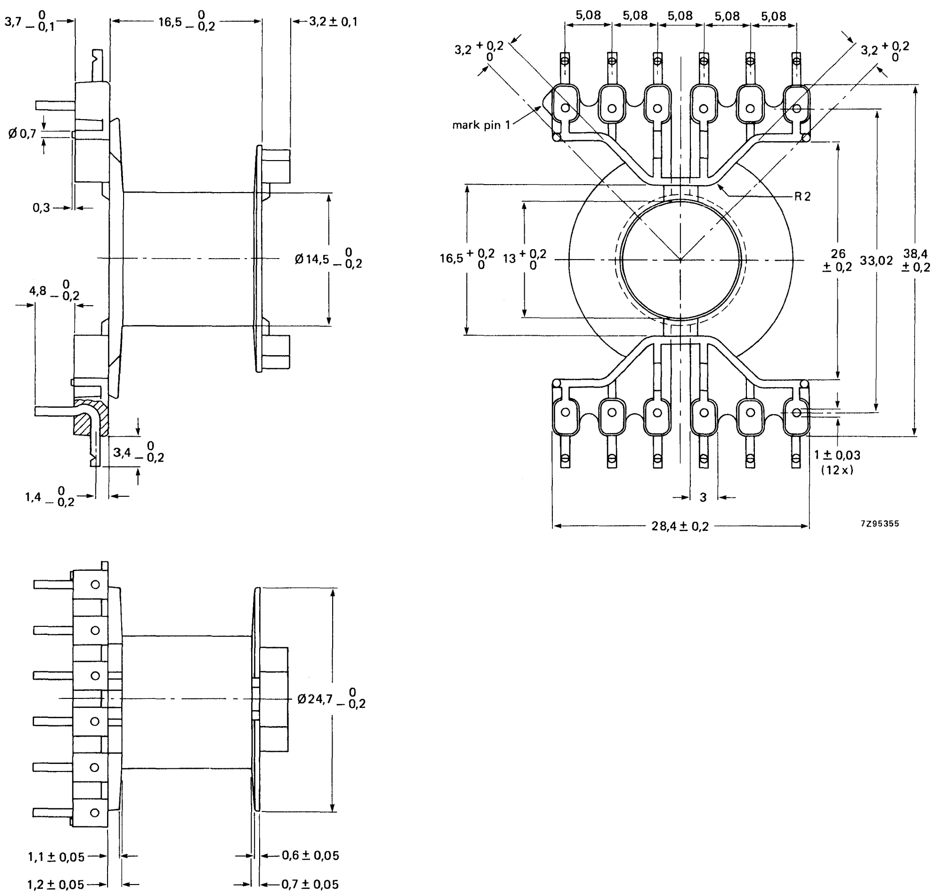
Core halves with air gap:

grade 3C85 catalogue number: 4322 020 55010
grade 3E4 catalogue number: 55030
grade 3F3 catalogue number 55020

DIL COIL FORMER FOR RM12/i SQUARE CORES

for power applications

OUTLINES



SINGLE-SECTION, 12-PIN COIL FORMER

Catalogue number	4322 021 34110
Material	polyterephthalate reinforced
Window area	75,0 mm²
Mean length of turn	61 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

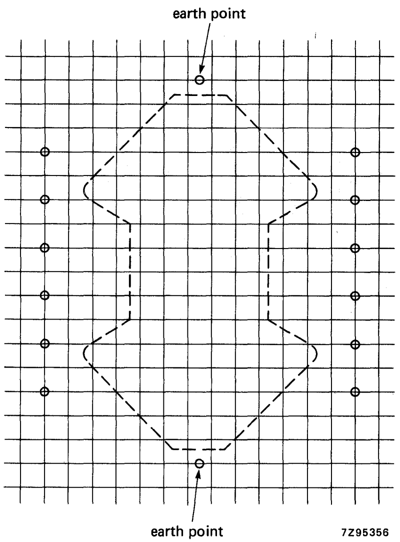
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 4,52 \times 10^3\ \Omega/H$$

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

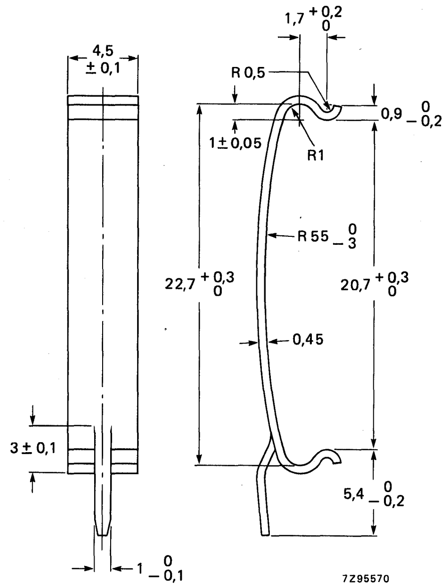
Mass 3,3 g

Packaging quantity: 200
Please order in multiples of this quantity.



Hole pattern

The earth points are holes for tags on mounting clip 4322 021 34170.



Mounting clip 4322 021 34170, steel, nickel plated, pre-soldered.

SQUARE CORES

These cores are available in two executions:

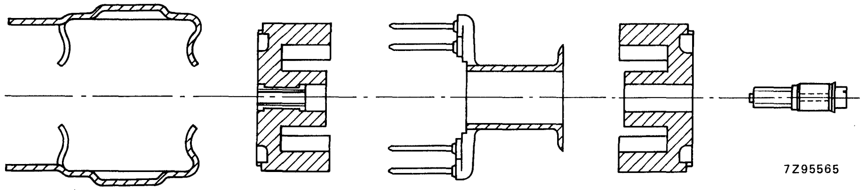
- RM14, usually for telecommunication, with centre hole
- RM14/i, for industrial applications, no centre hole

RM14 cores can be supplied in three versions

- CORE SETS provided with a 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), UTE83-300 (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.



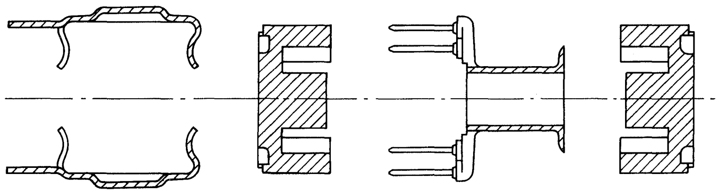
7Z95565

RM14

RM14/i cores can be supplied in two versions

- CORE SETS pre-adjusted on an A_L value.
- CORE HALVES without air gap.

RM14/i cores and associated parts are ordered by their 12-digit catalogue number. Packing quantities and supply conditions upon request.



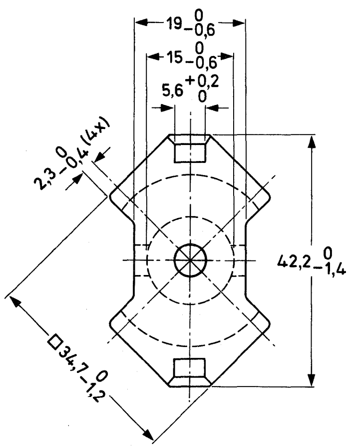
7Z95564

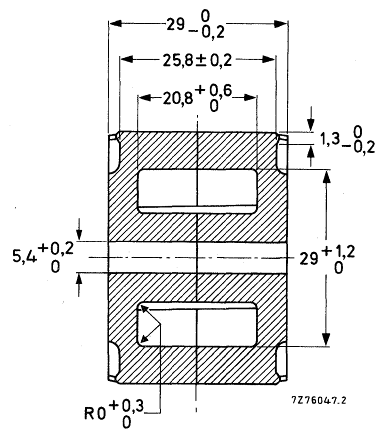
RM14/i

RM14 SQUARE CORES

for telecommunication

MECHANICAL DATA





Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}390\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00219\ mm^{-3}$; $V_e = 12400\ mm^3$; $l_e = 70{,}0\ mm$; $A_e = 178\ mm^2$.

$A_{min} = 146\ mm^2$.

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, square cores and cross 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 3C85	grade 3B8
A_L ± 25%	4	⩽ 0,1	25 ± 5	5775	6940
μ_e ± 25%	4	⩽ 0,1	25 ± 5	1790	2150
α	4	⩽ 0,1	25 ± 5	⩽ 14,9	⩽ 13,5
			25 ± 5	⩽ 2,0	⩽ 1,5
P (W)	25	200	100 ± 5	2,5	2,5
B (mT)	25	H = 250 A/m	100 ± 5	⩾ 315	
$\beta_F \times 10^6$ 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
= 2,25 x 10^5 A/m					⩽ 1100

Core sets without nut pre-adjusted on A_L

A_L	corresponding μ_e-value	tol. on inductance (%)	catalogue number: grade 3B8 4322 022 followed by	catalogue number: grade 3C85 4322 025 followed by
160	50	± 2	56960	03250
250	77,6	± 2	• 56950	• 03260
400	124	± 3	56910	03280
630	196	± 3	• 56890	• 03300
1000	310	± 4	56900	03310
1250	388	± 5		
1600	497	± 10	56930	
2000	621	± 10		
2500	776	± 10	56940	

All pre-adjusted RM14 core sets have an asymmetrical air gap.

Core half without air gap, without nut, Ferroxcube grade 3B8, catalogue number 4322 020 28320; Ferroxcube grade 3C85, catalogue number 4322 020 28330.

• Preferred type.

COIL FORMERS

Two types of coil former can be supplied:

- Single section, 10-pin, catalogue number 4322 021 33520 (Fig. 1)
- Single section, 12-pin, catalogue number 4322 021 33530 (Fig. 2).

The arrangement of the soldering pins is suitable for both 0,1 inch and 2,50 mm grid. See "Mounting".

The coil formers are packed on a polystyrene plate of 30, and 3 plates (90 pieces) in a cardboard box. Please order in multiples of these quantities.

Properties

Material: phenolformaldehyde reinforced with glass fibre

Window area	112 mm^2
Mean length of turn	71 mm
Max. temp.	180 °C
Inflammability	UL94, class V-0

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

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3,50 \times 10^3\ \Omega/\text{H}$$

Mass 3 g

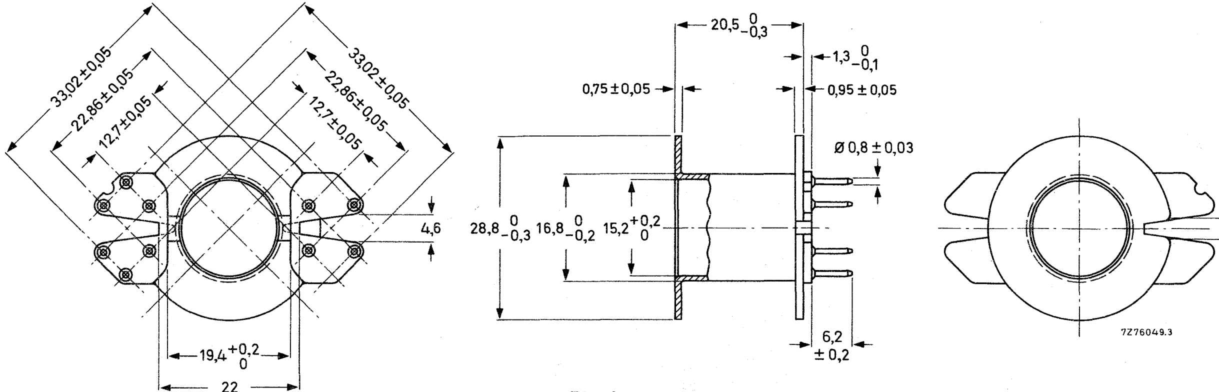

33,02±0,05
22,86±0,05
12,7±0,05
4,6
19,4 +0,2 0
22
20,5 0 −0,3
1,3 0 −0,1
0,75±0,05
0,95±0,05
Ø 0,8±0,03
28,8 0 −0,3
16,8 0 −0,2
15,2 +0,2 0
6,2 ±0,2
3
7Z76049.3

Fig. 1.

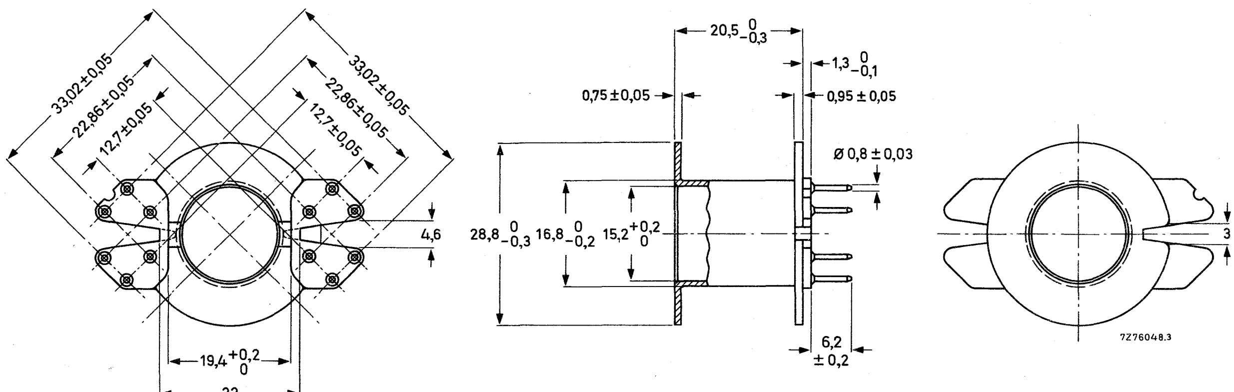
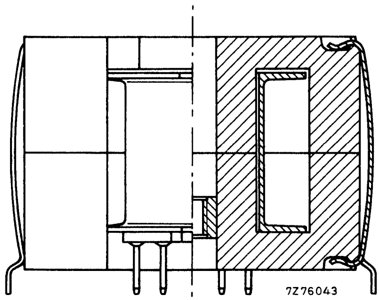

33,02±0,05
22,86±0,05
12,7±0,05
4,6
19,4 +0,2 0
22
20,5 0 −0,3
1,3 0 −0,1
0,75±0,05
0,95±0,05
Ø 0,8±0,03
28,8 0 −0,3
16,8 0 −0,2
15,2 +0,2 0
6,2 ±0,2
3
7Z76048.3

Fig. 2.

ASSEMBLING AND MOUNTING



ASSEMBLING

The core halves are clamped together by means of two clips, catalogue number 4322 021 33690. As can be seen in the drawing the hooked ends of both clips fit into the recesses, made in the halves.

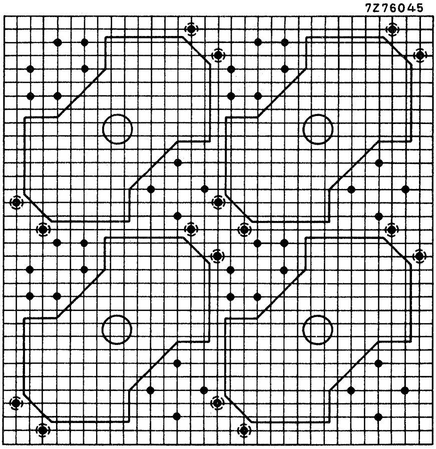
Due to the relatively low mechanical pressure of the two clips, it is recommended to cement the two core halves to each other as well (see under Mounting Data in section 'Potcores, square cores and cross cores').

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 'Potcores, square cores and cross cores', General under Mounting Data.

MOUNTING

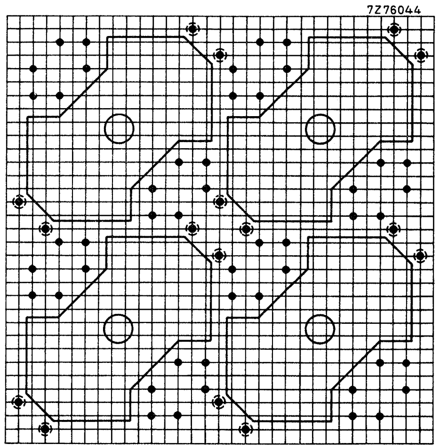
The two retaining clips are also used for mounting the assembled core on a printed-wiring board. The pins are simply soldered into the holes in the board. If so desired, one of the pins can also be used for earthing.

The soldering pins of coil formers and slips 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).



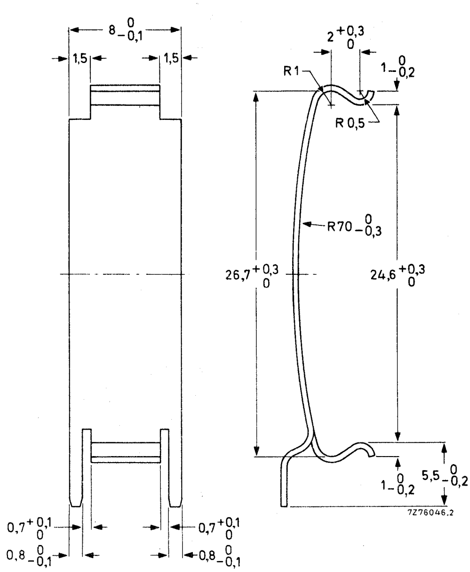
◎ 1)

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)

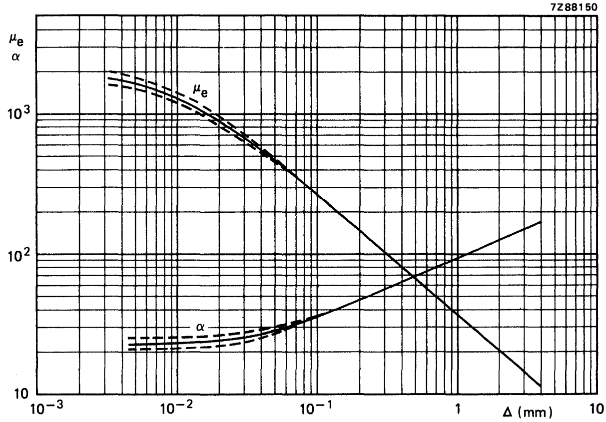
Clip: 4322 021 33690

Material: steel, tin plated

1) Holes, ϕ 1,3 ± 0,1 mm, for tags on clip 4322 021 33690 (earth points).

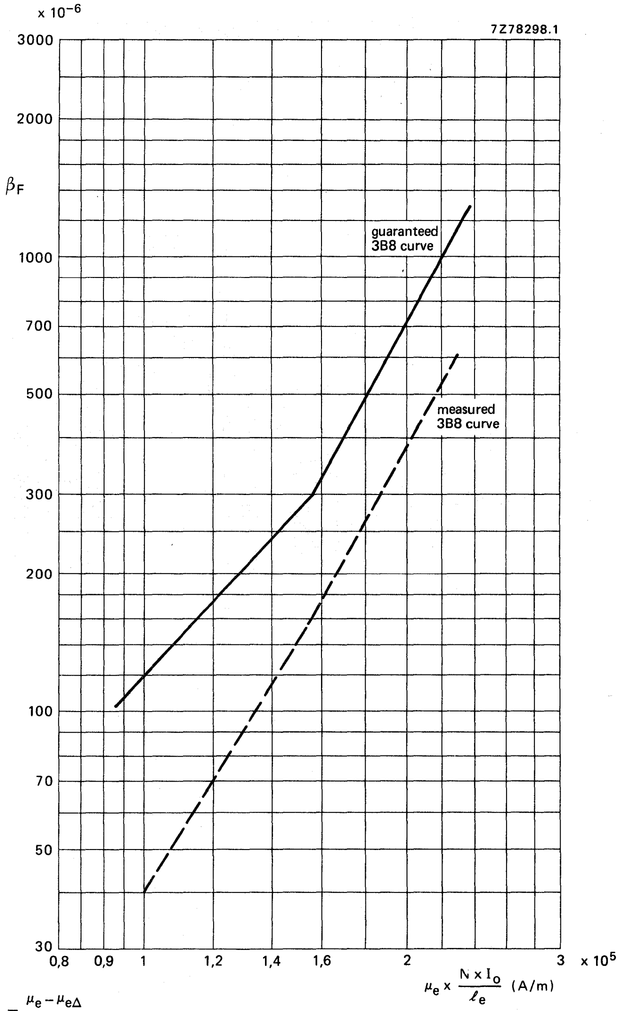
CHARACTERISTIC CURVES

$\mu_e - \alpha$ CURVES



Relative effective permeability and turn factor for 1 mH as a function of the air gap length.
$\mu_e = 2150 \pm 25\%$ at $\Delta = 3\ \mu m$ for FXC 3B8.

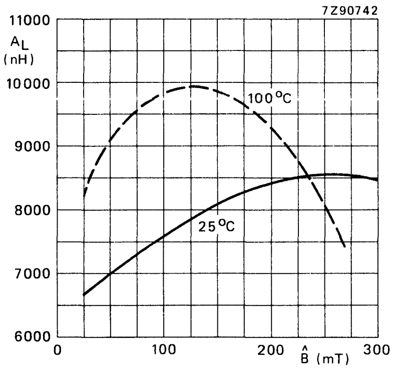
D.C. SENSITIVITY AT 25 °C



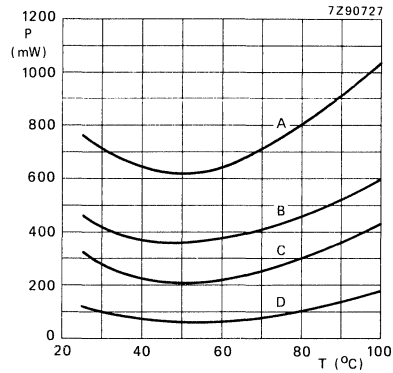
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. polarization.

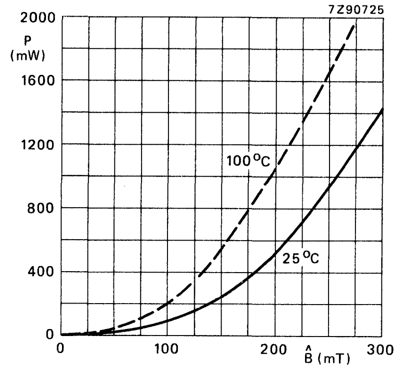
FXC 3B8



$A_L = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No air gap.



$P = f(T)$
A at 16 kHz and $\hat{B}$ = 200 mT
B at 25 kHz and $\hat{B}$ = 200 mT
C at 50 kHz and $\hat{B}$ = 100 mT
D at 100 kHz and $\hat{B}$ = 50 mT



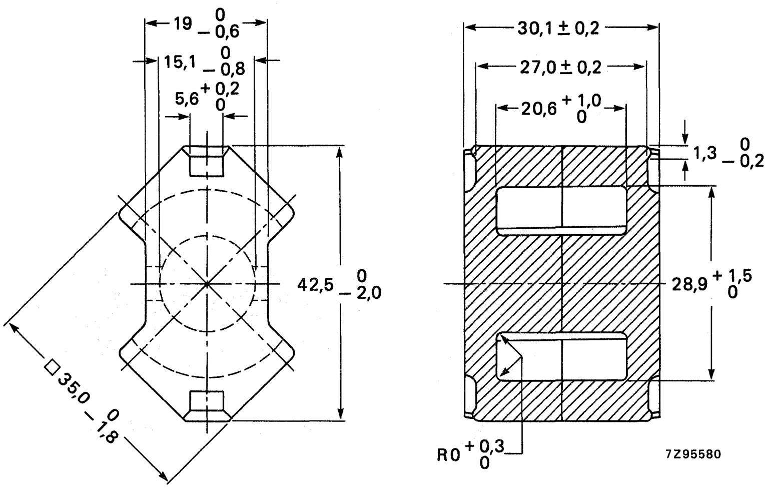
$P = f(\hat{B})$ at 16 kHz, and at 25 and 100 °C. No air gap.

$\hat{B}$ is calculated with $A_{CP\,min}$ = 146 mm^2.

RM14/i SQUARE CORES

for industrial use

MECHANICAL DATA



Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}353\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00178\ mm^{-3}$; $V_e = 13900\ mm^3$; $l_e = 70{,}0\ mm$; $A_e = 198\ mm^2$;

$A_{min} = 168\ mm^2$.

Mass of core set: 74 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, square cores and cross cores', is inserted; the halves are pressed together with a force of 60 N. The values are valid 5 minutes or more after clamping.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade	
				3C85	3F3
$A_L \pm 25\%$	4	≤ 0,1	25 ± 1	6300	6300
P (W)	25	200	25 ± 1	4,3	3,0
			100 ± 1	≤ 3,2	2,2
	100	100	25 ± 1	5,8	3,0
			100 ± 1	≤ 4,3	≤ 2,2
	400	50	25 ± 1		4,5
			100 ± 1		≤ 4,5

Notes

For the specification of power losses $\hat{B}$ is calculated using $A_e = 198\ mm^2$.
The induction $\hat{B}$ at $\hat{H} = 250$ A/m (25 kHz and 100 °C) for core sets in grades 3C85 and 3F3 is ≥ 315 mT, based on $A_{min} = 168\ mm^2$.

Core sets preadjusted on A_L.

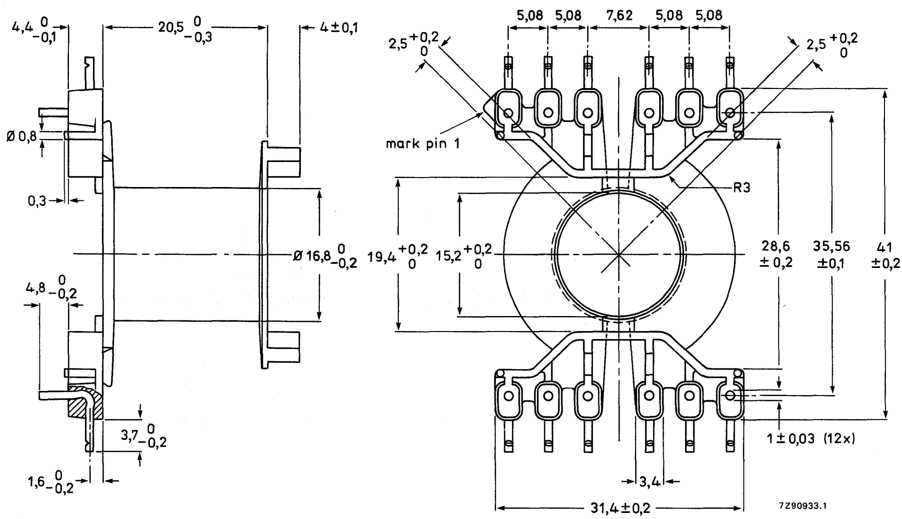
A_L	corre-sponding μ_e-value	tol. on induct-ance (%)	catalogue number 4322 025	
			3C85	3F3
40		± 5		
63		± 5		
100		± 5		
160		± 5	03150	
250		± 5	03160	
315		± 5		
400		± 5	03180	
630		± 10		
1000		± 10		

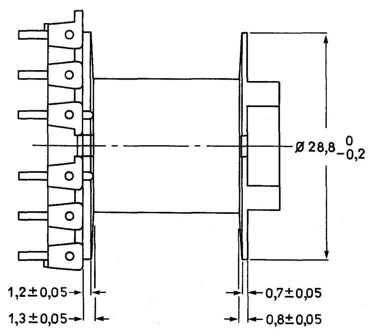
Core halves without air gap:
grade 3C85 catalogue number: 4322 020 28470
grade 3F3 catalogue number: 28480

DIL COIL FORMER FOR RM14/i SQUARE CORES

for power applications

OUTLINES





SINGLE-SECTION, 12-PIN COIL FORMER

Catalogue number	4322 021 34070
Material	polyterephthalate reinforced with glass fibre
Window area	111 mm^2
Mean length of turn	71 mm
Max. temperature	180 °C
Inflammability	UL94, class V-0

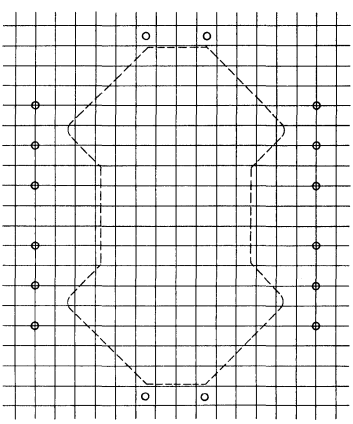
D.C. losses

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3{,}47 \times 10^3\ \Omega/\mathrm{H}$$

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

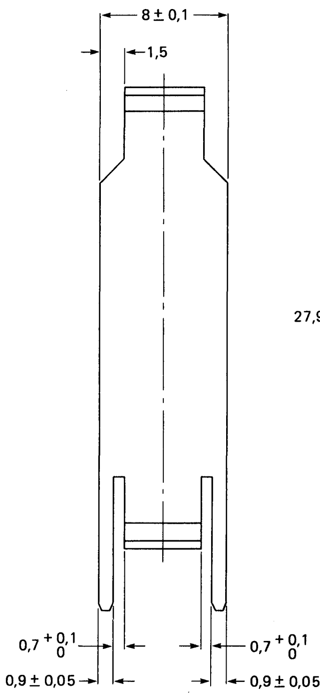
Mass 3,5 g

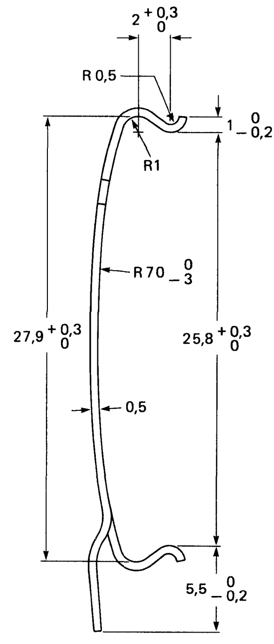
Packaging quantity: 200
Please order in multiples of this quantity.



Hole pattern

The earth points are holes for tags on mounting clip 4322 021 34220.





Mounting clip 4322 021 34220, nickel plated, pre-soldered.

SECTION F
CROSS CORES AND ACCESSORIES

CROSS CORES

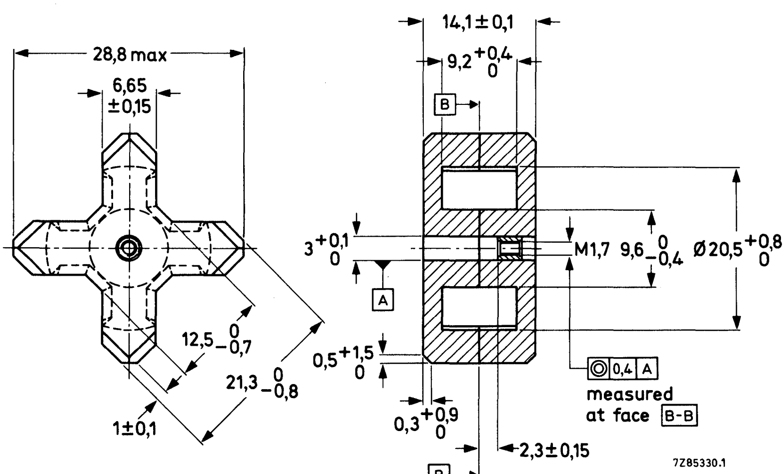
Four types of core can be supplied:

- CORE SETS provided with a 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.
- 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 publication 226.

Cross cores and their associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 10 core sets or 20 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



Pulling-out force of the nut ⩾ 30 N.

Dimensional quantities according to IEC 205

$C_1 = \Sigma \frac{1}{A} = 0{,}575\ mm^{-1}$; $C_2 = \Sigma \frac{1}{A^2} = 0{,}0871\ mm^{-3}$; $V_e = 2510\ mm^2$; $l_e = 38$ mm; $A_e = 66{,}0\ mm^2$; $A_{CPmin} = 62{,}1\ mm^2$.

Mass of a core set; approx. 12 g

ELECTRICAL DATA

The combination of two cross 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, square cores and cross cores' is inserted. 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.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	3D3	3H1	4C6
$A_L \pm 25\%$	4	$\leqslant 0{,}1$	25 ± 1	4200	1600	4200	275
$\mu_e \pm 25\%$	4	$\leqslant 0{,}1$	25 ± 1	1920	735	1920	125
α	4	$\leqslant 0{,}1$	25 ± 1	$\leqslant 17{,}8$	$\leqslant 28{,}8$	$\leqslant 17{,}8$	$\leqslant 70$
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	$\leqslant 0{,}1$	25 ± 1			$\leqslant 1{,}2$	
	100	$\leqslant 0{,}1$	25 ± 1		$\leqslant 8{,}0$	$\leqslant 5{,}0$	
	500	$\leqslant 0{,}1$	25 ± 1		$\leqslant 14$		
	1000	$\leqslant 0{,}1$	25 ± 1		$\leqslant 30$		
	2000	$\leqslant 0{,}1$	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			$\leqslant 1{,}1$	
	100	0,3 to 1,2			$\leqslant 1{,}8$		$\leqslant 6{,}2$
P (W)	25	200*	25 ± 5	$\leqslant 0{,}4$			
	25	200*	100 ± 1	$\leqslant 0{,}5$			
$\alpha_F \times 10^6$/K	$\leqslant 100$	$\leqslant 0{,}1$	5 to 25			+ 0,5 to 1,5	−2 to + 4
	$\leqslant 100$	$\leqslant 0{,}1$	25 to 55			+ 0,5 to 1,5	0 to + 6
	$\leqslant 100$	$\leqslant 0{,}1$	25 to 70				
$D_F \times 10^6$	$\leqslant 100$	$\leqslant 0{,}1$	25 ± 1		$\leqslant 12$	$\leqslant 4{,}3$	$\leqslant 10$
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:							
at $\mu_e \times \frac{N \times I_o}{l_e} = 1{,}10 \times 10^5$ A/m				$\leqslant 110$			
$= 1{,}80 \times 10^5$ A/m				$\leqslant 300$			
$= 2{,}55 \times 10^5$ A/m				$\leqslant 1100$			

* Determined with $A_{CPmin} = 62{,}1\ mm^2$.

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%	183	45280	65280
630 ± 3%	290	45300	65300
1000 ± 10%	458	● 45310	
1600 ± 10%	732	45320	

Cores with $A_L \leqslant 250$ have a symmetrical air gap.
Cores with $A_L \geqslant 400$ have an asymmetrical air gap.

Core halves without air gap.

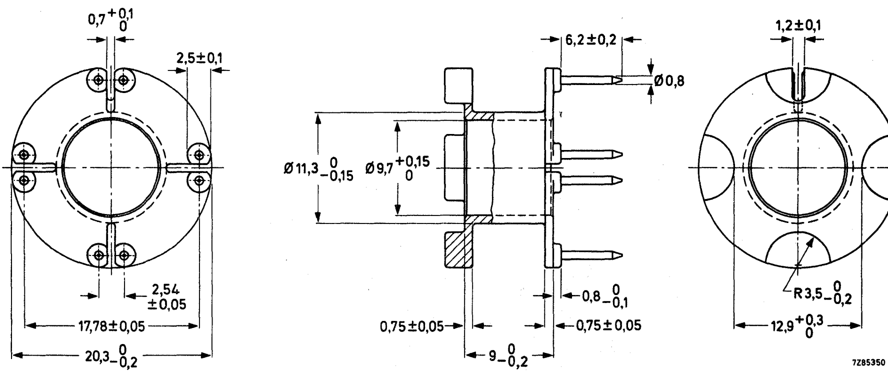
Ferroxcube grade	catalogue number
● 3B8	4322 020 23540
3D3	3522 200 03480
3H1	4322 020 23510
4C6	3522 200 03490

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

● Preferred type.

COIL FORMER



Catalogue number 4322 021 32870

Material	phenolformaldehyde reinforced with glass fibre
Window area	33,9 mm^2
Mean length of turn	49 mm
Max. temperature	180 °C

Packing quantity
- primary pack: 80
- storage pack: 400

Please order in multiples of these quantities.

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

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 11{,}7 \times 10^3\ \Omega/H$$

Mass 0,4 g

INDUCTANCE ADJUSTERS

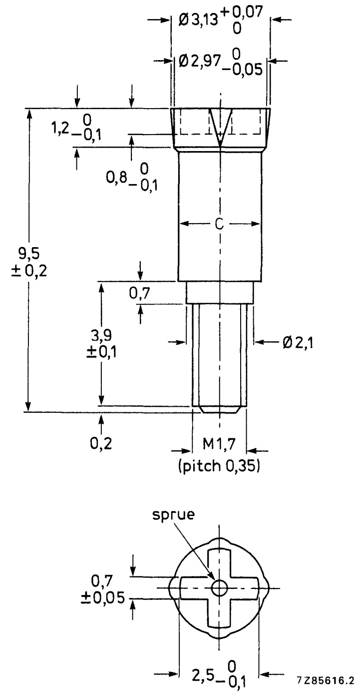


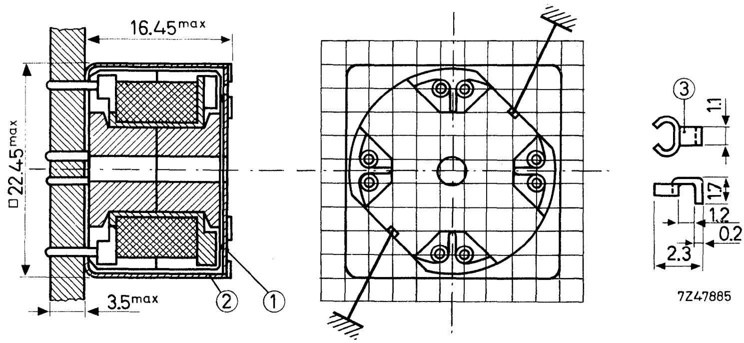
Table 1

catalogue number	colour code	material	C
4322 021 38600	black	FXC	2,83
38610	brown	FXC	2,70
38670	violet	FXC	2,58
38680	white	FXC	2,48
38690	grey	FXC	2,93

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. X22.

core material	A_L	low	%	medium	%	high	%
3H1	160	–		4322 021 38680	20	–	
	250	4322 021 38680	13	38670	15	4322 021 38610	21
	400	38680	8	38610	13	38600	20
	630	38610	8	38600	13	38690	17

MOUNTING PARTS



(1) Cover 4322 021 30230.
(2) Container 4322 021 30040.

The cross core has been developed especially for transformers to be mounted on printed-wiring boards with a grid of 0,1 inch.

An advantage of this construction is that the lead-out wires are soldered to pins which are directly mounted on the coil former.

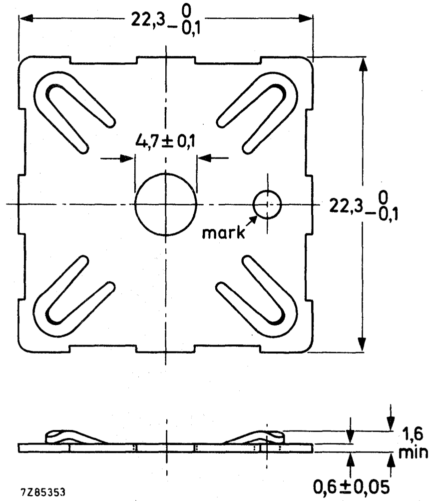
The pin length is sufficient for board thicknesses of up to 3,5 mm. The printed-wiring board should be provided with holes of 1,0 ± 0,1 mm in diameter.

The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

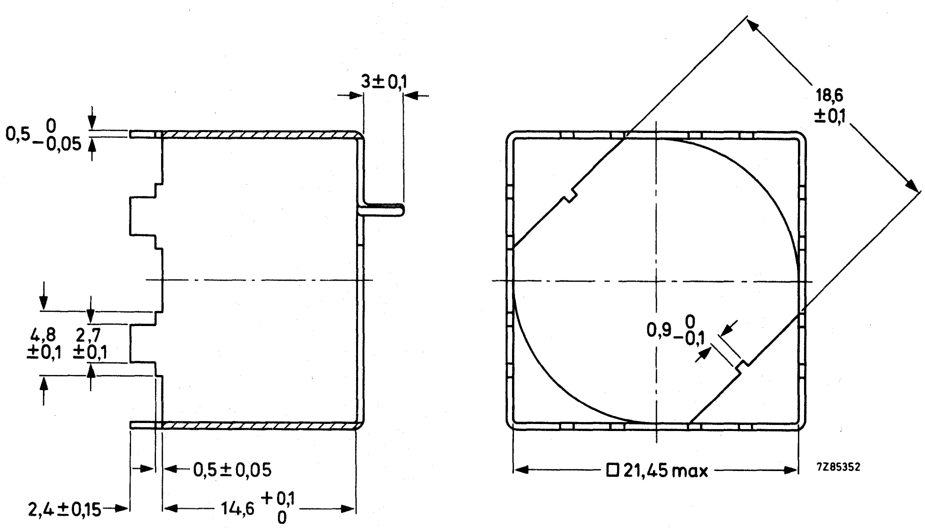
The cover is provided with a marking hole. The mark on the coil former (see drawing of coil former) has to be in line with this hole. These markings facilitate the numbering of the soldering pins and the positioning on the printed-wiring board.

It is recommended that the coil former be cemented in the lower core half in order to obtain the most stable construction possible.

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 120 N. After bending the lips, the core will have the correct tension.

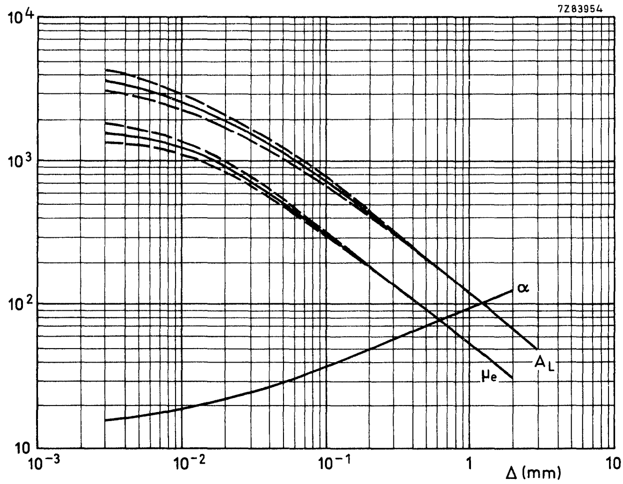


(1) Cover 4322 021 30230.
Material: phosphor bronze, nickel plated.
Packaging quantity: 2000. Please order in multiples of this quantity.



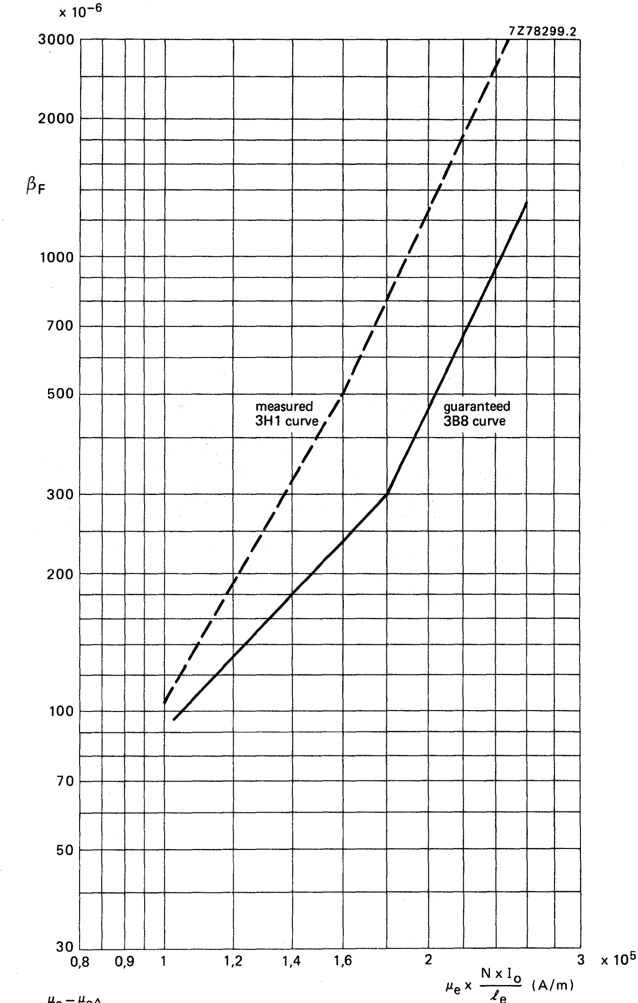
(2) Container 4322 021 30040.
Material: brass, nickel plated, thereafter tin plated.
Packaging quantity: primary pack 40, storage pack 200. Please order in multiples of these quantities.

CHARACTERISTIC CURVES



Effective permeability (μ_e), turn factor for 1 mH (α) and inductance factor in nanohenries (A_L) as a function of the air-gap length for grade 3H1.

D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c. current.

CROSS CORES

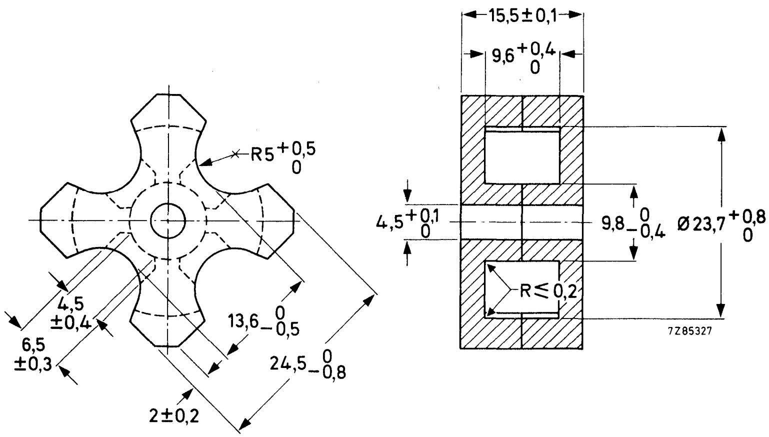
Two types of core can be supplied:

- CORE HALVES without air gap.
- CORE HALVES with air gap.

The cross cores are in accordance with IEC publication 226.

Cross cores and their associated parts are ordered by their 12-digit catalogue number. Quantity: a primary pack contains 10 core sets or 20 core halves; a storage pack contains 200 core sets or 400 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Dimensional quantities according to IEC 205:

a. Version with centre hole

$C_1 = \Sigma \frac{l}{A} = 0{,}570\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00782\ mm^{-3}$; $V_e = 3030\ mm^3$;

$l_e = 41{,}5\ mm$; $A_e = 72{,}7\ mm^2$.

b. Version without centre hole

$C_1 = \Sigma \frac{l}{A} = 0{,}517\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00630\ mm^{-3}$; $V_e = 3482\ mm^3$;

$l_e = 42{,}4\ mm$; $A_e = 82{,}10\ mm^2$.

Mass of a core set: approx. 24 g.

ELECTRICAL DATA

The combination of two cross 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, square cores and cross cores' is inserted. The halves are pressed together with a force of 150 N. The values are valid 5 minutes or more after clamping. Parameters α_F and D_F are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3D3	grade 3H1
$A_L \pm 25\%$	4	⩽ 0,1	25 ± 5	1620	4260
$\mu_e \pm 25\%$	4	⩽ 0,1	25 ± 5	735	1935
α	4	⩽ 0,1	25 ± 5	⩽ 28,7	⩽ 15,3
$\frac{\tan \delta}{\mu_i} \times 10^6$	4	⩽ 0,1	25 ± 5		⩽ 1,2
	100	⩽ 0,1	25 ± 5	⩽ 8	⩽ 6,0
	500	⩽ 0,1	25 ± 5	⩽ 14	
	1000	⩽ 0,1	25 ± 5	⩽ 30	
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 5		⩽ 0,86
	100	0,3 to 1,2	25 ± 5	⩽ 1,8	
$\alpha_F \times 10^6$/K	⩽ 100	⩽ 0,1	5 to 25		+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 55		+ 0,5 to 1,5
	⩽ 100	⩽ 0,1	25 to 70	0 to + 2	+ 0,5 to 1,5
$D_F \times 10^6$	⩽ 100	⩽ 0,1	25 ± 1	⩽ 15	⩽ 4,3

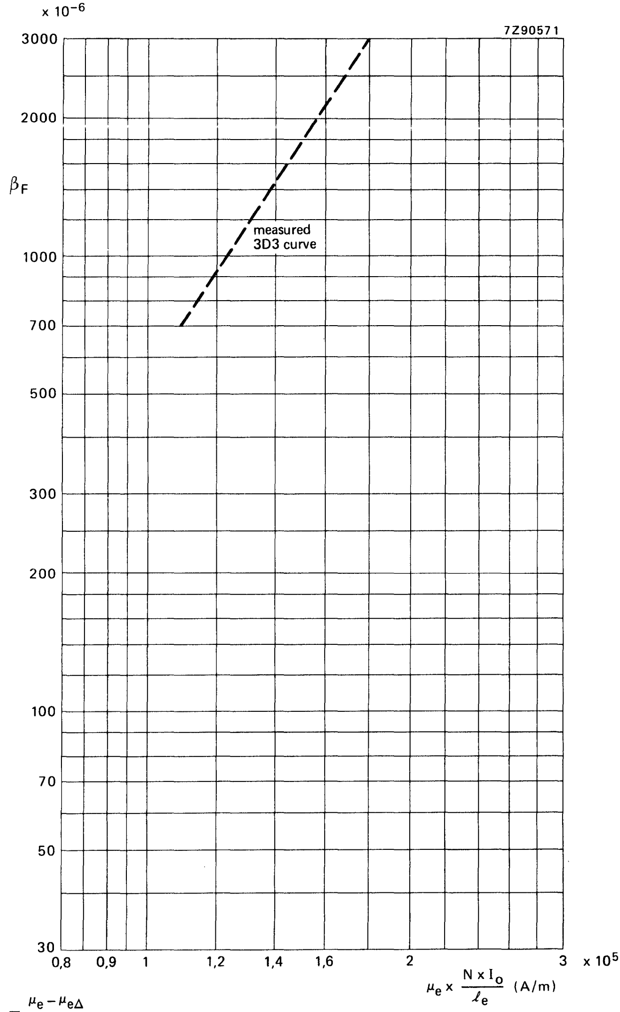
Core halves without air gap.

Ferroxcube grade	catalogue number
3D3	4322 020 24270
3H1	4322 020 24260

Core halves with air gap.

Ferroxcube grade	air gap Δ in mm	catalogue number
3H1	0,16 ± 0,015	4322 020 24370
3H1	0,32 ± 0,015	4322 020 24470
3D3	0,8 ± 0,015	4322 020 24380

D.C. SENSITIVITY AT 25 °C



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

Inductance variation as a function of d.c polarization.

CROSS CORES

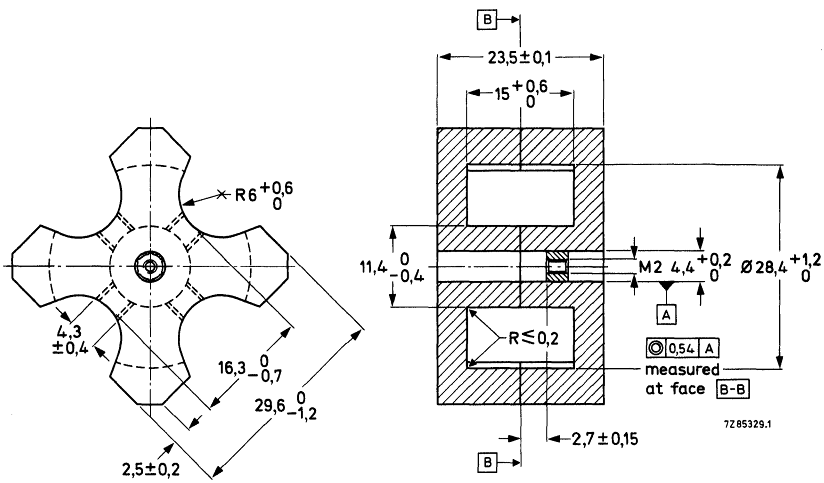
Four types of core can be supplied:

- CORE SETS provided with a 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.
- 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 publication 226.

Cross cores and their 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 80 core sets or 160 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Pulling-out force of the nut ⩾ 30 N.

Dimensional quantities according to IEC 205:

$C_1 = \Sigma \frac{l}{A} = 0{,}490\ mm^{-1}$; $C_2 = \Sigma \frac{1}{A^2} = 0{,}00430\ mm^{-3}$; $V_e = 6360\ mm^3$; $l_e = 55{,}8\ mm$; $A_e = 114\ mm^2$; $A_{CPmin} = 82{,}6\ mm^2$.

Mass of core set approx. 38 g.

ELECTRICAL DATA

The combination of two 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, square cores and cross 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 are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	grade 3H1
$A_L \pm 25\%$	4	⩽0,1	25 ± 1	5230	5230
$\mu_e \pm 25\%$	4	⩽0,1	25 ± 1	2040	2040
α	4	⩽0,1	25 ± 1	⩽ 17,7	⩽ 16,0
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	⩽0,1	25 ± 1		⩽ 1,2
	100	⩽0,1	25 ± 1		⩽ 6,0
$\eta_b \times 10^3$	4	1,5 to 3,0	25 ± 1		⩽ 1,1
P (W)	16	200*	25 ± 1	⩽ 1,0	
			100 ± 1	⩽ 1,2	
$\alpha_F \times 10^6$/K	⩽ 100	⩽0,1	5 to 25		+ 0,5 to 1,5
	⩽ 100	⩽0,1	25 to 55		+ 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		⩽ 4,3
$\beta_F \times 10^6$, measured on sets with $\mu_e = 300 \pm 10\%$ and 25 ± 1 °C:					
at $\mu_e \times \frac{N \times I_o}{l_e} = 0,90 \times 10^5$ A/m				⩽ 120	
$= 1,40 \times 10^5$ A/m				⩽ 300	
$= 2,00 \times 10^5$ A/m				⩽ 1100	

Core sets, grade 3H1 pre-adjusted on A_L.

A_L nH	corre-sponding μ_e value	tol. on inductance %	catalogue number 4322 022 . . . . . without nut	with nut
315	123	± 2	19270	39270
400	156	± 2	19280	39280
630	246	± 3	19300	39300
1000	390	± 3	● 19310	39310
1600	624	± 5	19320	39320

Cores with $A_L \leqslant 400$ have a symmetrical air gap.
Cores with $A_L \geqslant 630$ have an asymmetrical air gap.

* Determined with $A_{CPmin} = 82,6$ mm².
● Preferred type.

Core halves without air gap.

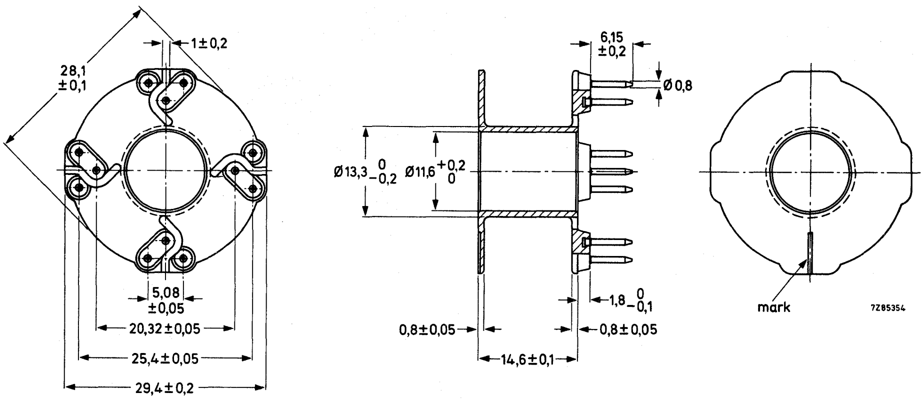
Ferroxcube grade	catalogue number
● 3B8	4322 020 23780
3H1	4322 020 23750

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

● Preferred type.

COIL FORMER



Catalogue number	4322 021 33420
Material	phenolformaldehyde reinforced with glass fibre
Window area	97 mm^2
Mean length of turn	65 mm
Max. temperature	180 °C
Packing quantity	
primary pack	25
storage pack	600

Please order in multiples of these quantities

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

D.C. losses:

$$\frac{R_o}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 4{,}52 \times 10^3\ \Omega/H$$

Mass 2,5 g

INDUCTANCE ADJUSTERS

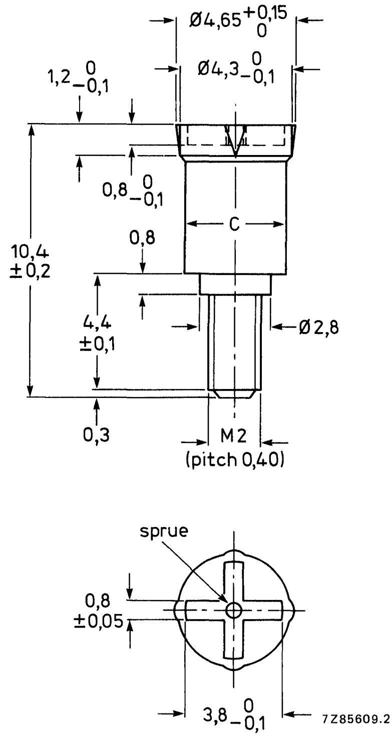


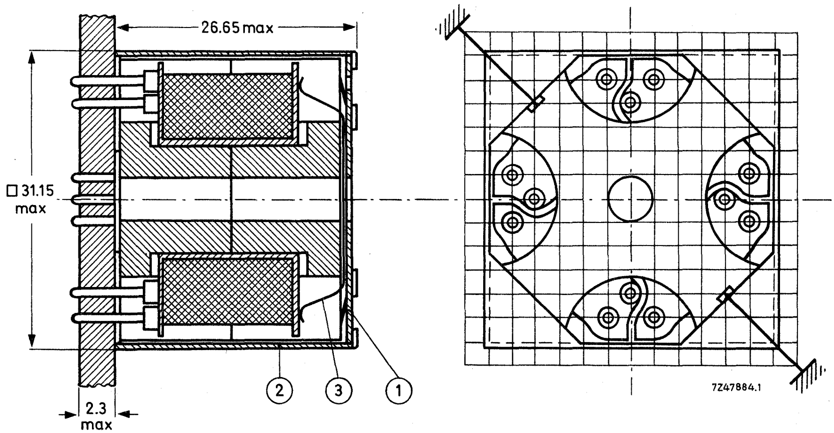
Table 1

catalogue number	colour code	material	C
4322 021 38400	black	FXC	4,22
38410	brown	FXC	4,04
38430	orange	cip	4,22
38490	grey	FXC	3,94

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. X30.

core material	A_L	low	%	medium	%	high	%
3H1	315	4322 021 38430	7	4322 021 38490	18	4322 021 38410	20
	400	38430	6	38490	14	38410	16
	630	–		38410	10	38400	19
	1000	38410	6	38400	9	–	
	1600	–		38400	5	–	

MOUNTING PARTS



(1) Cover 4322 021 31150
(2) Container 4322 021 31170 or 4322 021 33620
(3) Spring 4322 021 30210

The cross core has been developed especially for transformers to be mounted on printed-wiring boards with a grid of 0,1 inch.

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 pin length is sufficient for board thickness up to 2,3 mm. The printed-wiring board should be provided with holes of 1,3 ± 0,1 mm in diameter.

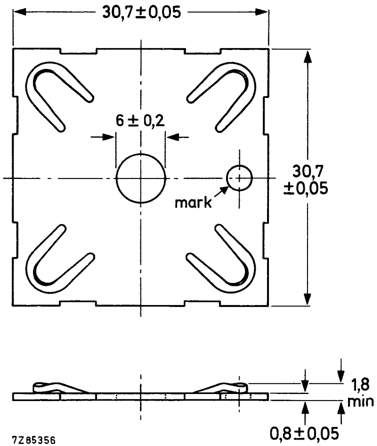
The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

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.

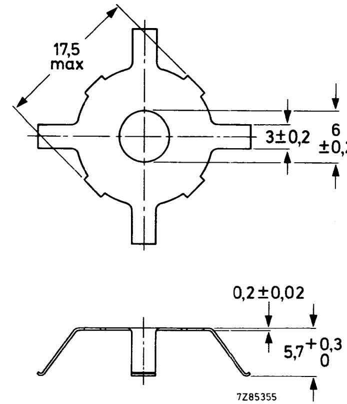
It is recommended that the coil former be cemented on the lower core half or to use the spring (pos. 3) in order to obtain the most stable construction.

Container 4322 021 31170 is identical to container 4322 021 33620, however the latter has four cut-outs (see outline on next page).
Container 4322 021 31170 gives better cross-talk attenuation, container 4322 021 33620 makes the X30 construction more suitable for a 2000 V test.

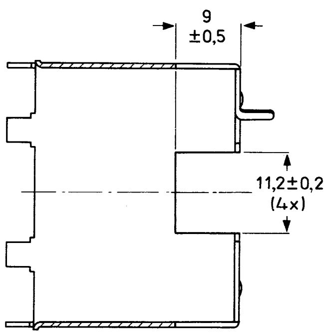
Before bending the lips of the container, pressure should exerted evenly on the four corners of the cover until the latter meets the container. The required force is approximately 250 N. After bending the lips, the core will have the correct tension.



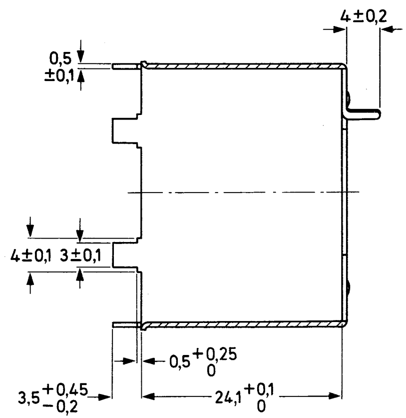
(1) Cover 4322 021 31150
Material: phosphor bronze,
nickel plated.



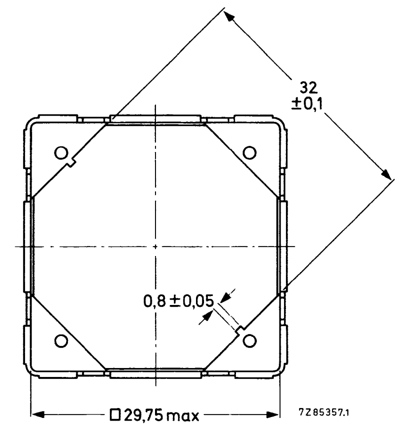
(3) Spring 4322 021 30210
Material: phosphor bronze.



(2) Container 4322 021 33620



(2) Container 4322 021 31170



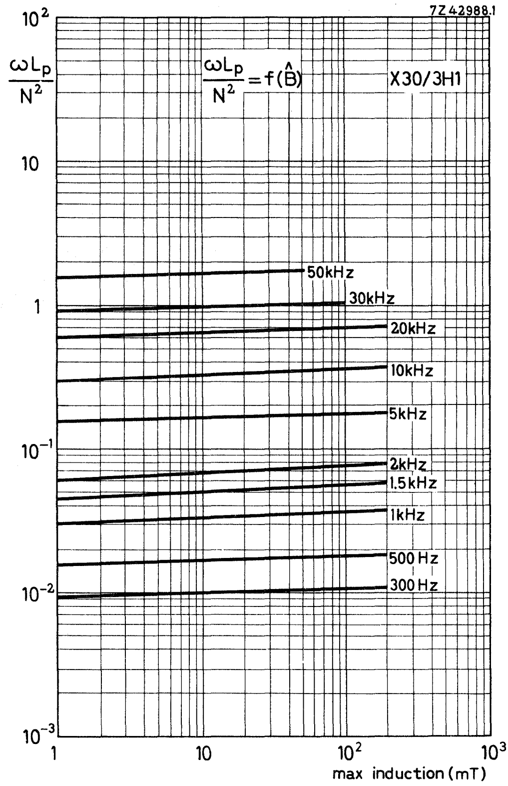
Please order in multiples of the packaging quantity.

Material: brass, nickel plated.

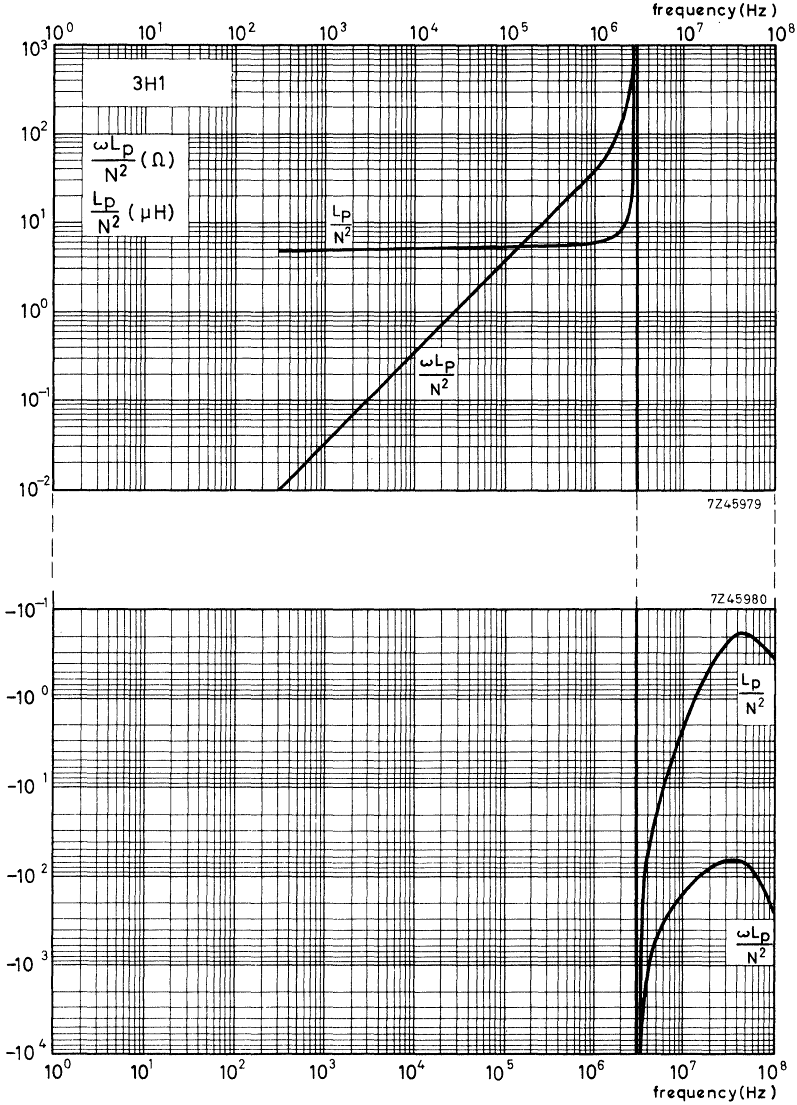
Packaging quantity: 750

CHARACTERISTIC CURVES

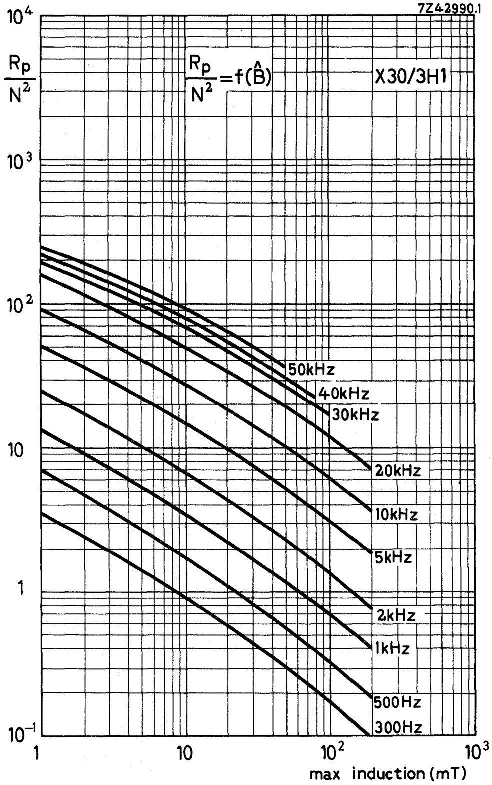
INDUCTANCE AS A FUNCTION OF THE INDUCTION



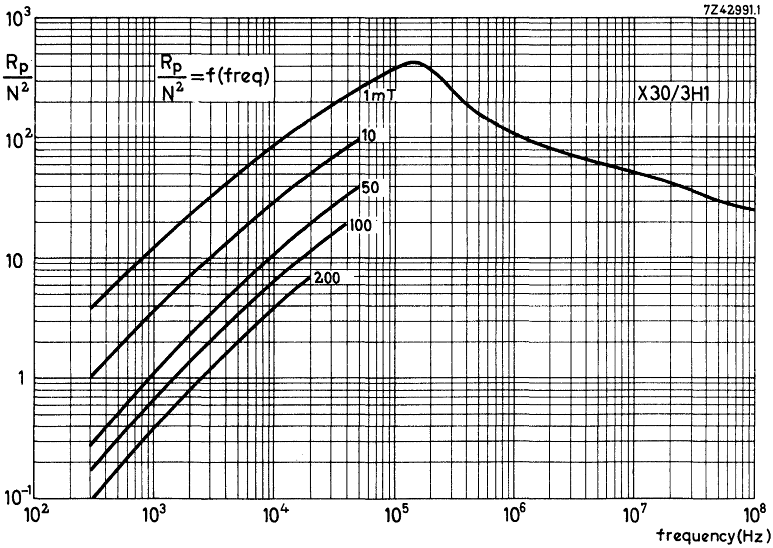
INDUCTANCE AS A FUNCTION OF THE FREQUENCY



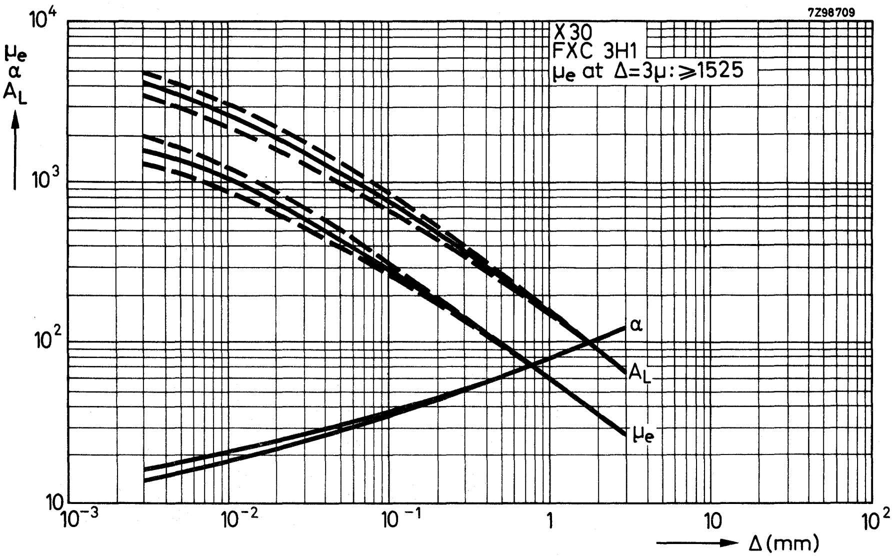
CORE LOSSES AS A FUNCTION OF THE INDUCTION



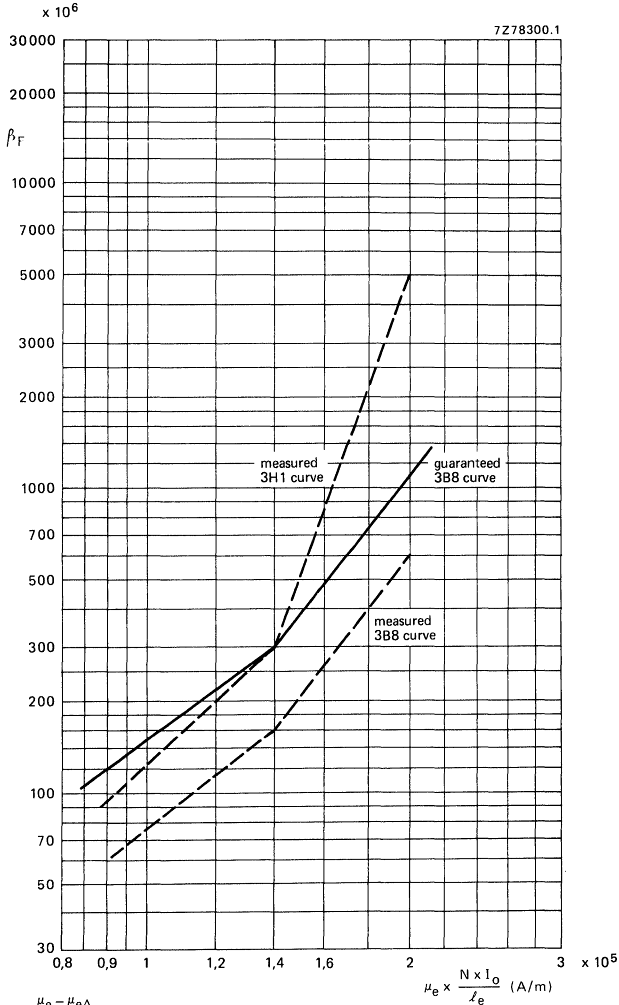
CORE LOSSES AS A FUNCTION OF THE FREQUENCY



μ_e - α AND A_L CURVES



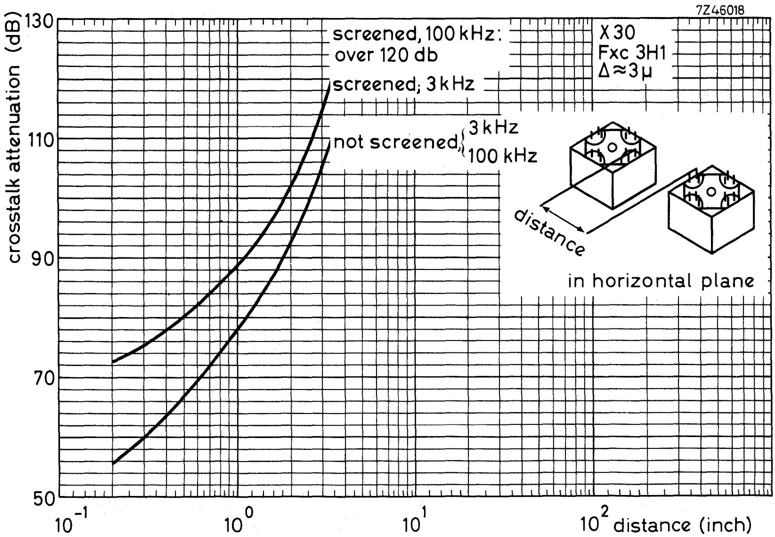
D.C. SENSITIVITY AT 25 °C

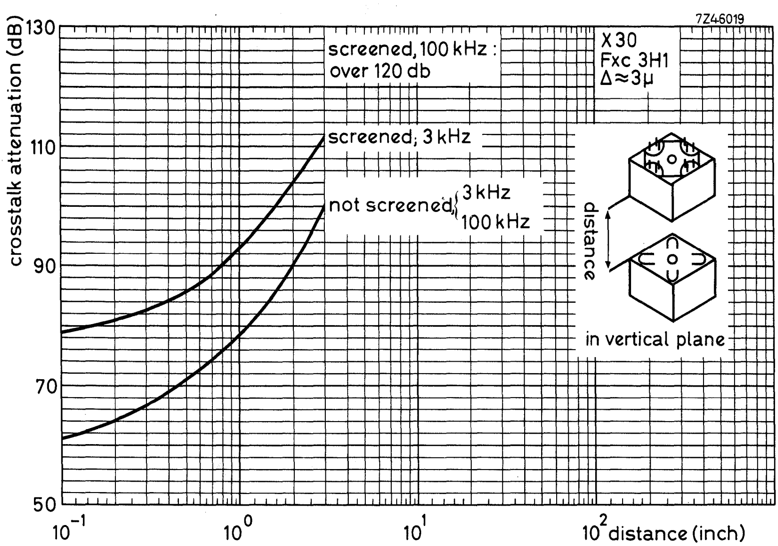


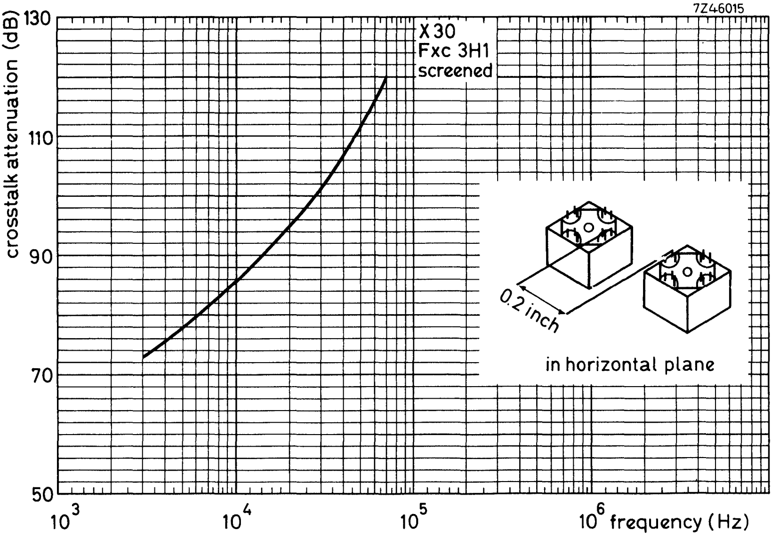
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current.

CROSSTALK ATTENUATION






7Z46015
X 30
Fxc 3H1
screened
crosstalk attenuation (dB)
130
110
90
70
50
0.2 inch
in horizontal plane
10^3
10^4
10^5
10^6
frequency (Hz)

CROSS CORES

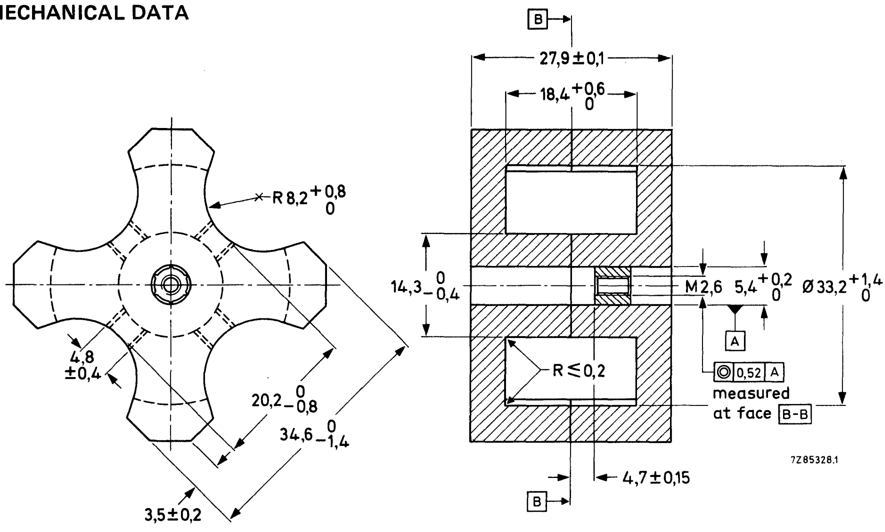
Four types of core can be supplied:

- CORE SETS provided with a 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.
- CORE HALVES with air gap. Standardized air gap lengths in each core half are: 0,02, 0,05, 0,15, 0,25 mm.

The cross cores are in accordance with IEC publication 226.

Cross cores and their 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 80 core sets or 160 core halves. Please order in multiples of these quantities.

MECHANICAL DATA



Pulling-out force of the nut ⩾ 50 N.

Dimensional quantities according to IEC205.

$C_1 = \Sigma \frac{l}{A} = 0{,}410\ mm^{-1}$; $C_2 = \Sigma \frac{l}{A^2} = 0{,}00250\ mm^{-3}$; $V_e = 11000\ mm^3$; $l_e = 67{,}3\ mm$; $A_e = 164\ mm^2$; $A_{CPmin} = 132\ mm^2$.

Mass of a core set approx. 58 g.

ELECTRICAL DATA

The combination of two 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, square cores and cross cores' is inserted. The halves are pressed together with a force of 330 N. The values are valid 5 minutes ore more after clamping. Parameters α_F and D_F are measured on toroid-wound halves.

	freq. kHz	$\hat{B}$ mT	temp. °C	grade 3B8	grade 3H1
A_L ± 25%	4	≤ 0,1	25 ± 1	6450	6450
μ_e ± 25%	4	≤ 0,1	25 ± 1	2100	2100
α	4	≤ 0,1	25 ± 1	≤ 15,8	≤ 14,4
$\frac{\tan\delta}{\mu_i} \times 10^6$	4	≤ 0,1	25 ± 1		≤ 1,2
	100	≤ 0,1	25 ± 1		≤ 7
$\eta_B \times 10^3$	4	1,5 to 3,0	25 ± 1		≤ 1,1
P(W)	25	200*	25 ± 1	≤ 1,5	
			100 ± 1	≤ 1,9	
$\alpha_F \times 10^6$/K	≤ 100	≤ 0,1	5 to 25		+ 0,5 to + 1,5
	≤ 100	≤ 0,1	25 to 55		+ 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 10^5 A/m				≤ 120	
= 1,55 x 10^5 A/m				≤ 300	
= 2,20 x 10^5 A/m				≤ 1050	

Core sets pre-adjusted on A_L.

A_L nH	corre-sponding μ_e value	catalogue number 4322 022 . . . . . 3B8 without nut	3H1 with nut	3H1 without nut
400 ± 3%	130		73280	53280
630 ± 3%	206		73300	● 53300
1000 ± 3%	326			
1600 ± 3%	522	● 53990	73320	53320
2000 ± 10%	652	53100		
2500 ± 10%	816	53110		

3H1 cores with $A_L \leq 630$ have a symmetrical air gap.
3H1 cores with $A_L \geq 1000$ and all 3B8 cores have an asymmetrical air gap.

* Determined with A_{CPmin} = 132 mm².
● Preferred type.

Core halves without air gap.

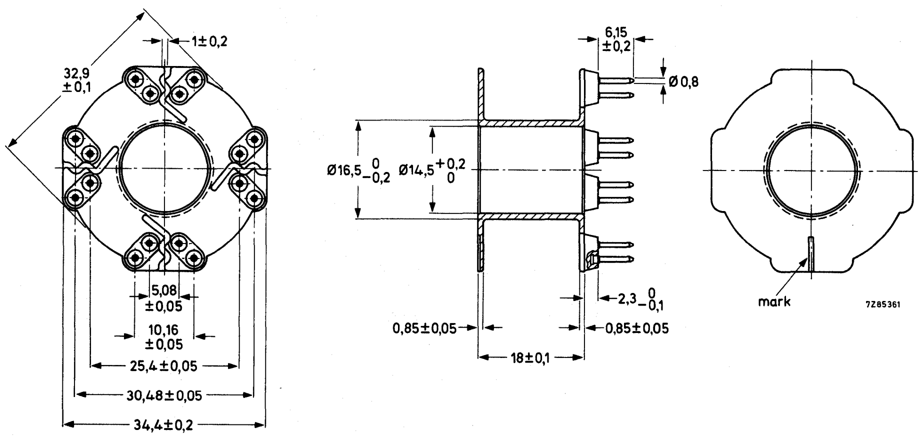
Ferroxcube grade	catalogue number
● 3B8	4322 020 24030
3H1	4322 020 24000

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

● Preferred type.

COIL FORMER



16-pin coil former

Catalogue number	4322 021 33430
Material	phenolformaldehyde reinforced with glass fibre
Window area	135 mm^2
Mean length of turn	77 mm
Max. temperature	180 °C
Packing quantity	primary pack 20 storage pack 400, please order in multiples of these quantities.

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

D.C. losses:

$$\frac{R_O}{L} = \frac{1}{\mu_e} \times \frac{1}{f_{cu}} \times 3,26 \times 10^3 \, \Omega/H$$

Mass 4,3 g.

INDUCTANCE ADJUSTERS

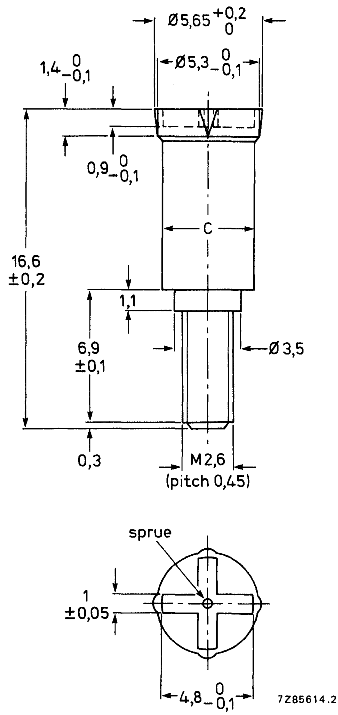


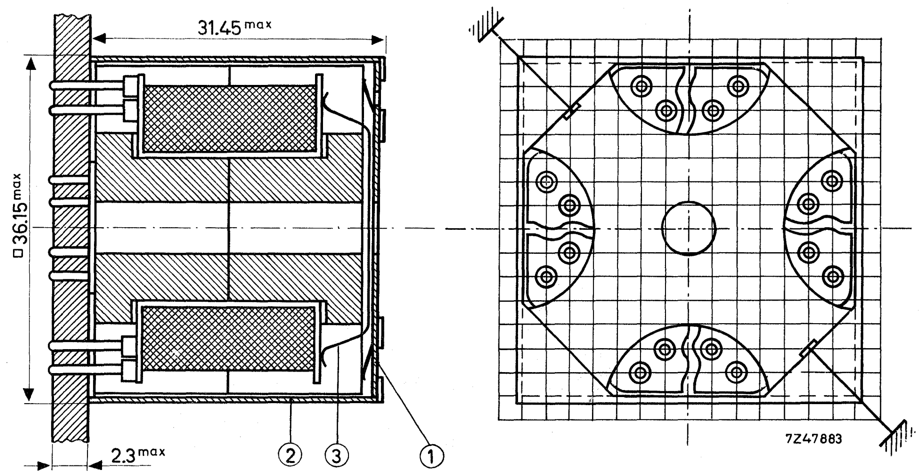
Table 1

catalogue number	colour code	material	C
4322 021 39240	yellow	cip	5,20
39280	white	cip	5,20
39290	grey	FXC	5,20

Table 2 Catalogue numbers of recommended adjusters for typical A_L values and adjusting percentage. X35.

core material	A_L	low	%	medium	%	high	%
3H1	315	4322 021 39240	8	4322 021 39380	15		
	400	39240	8	39280	12		
	630			39280	7	4322 021 39290	27
	1000			39290	17		
	1600			39290	9		

MOUNTING PARTS



(1) Cover 4322 021 31160
(2) Container 4322 021 31180 or 4322 021 33630
(3) Spring 4322 021 30220

The cross core has been developed especially for transformers to be mounted on printed-wiring boards with a grid of 0,1 inch.

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 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.

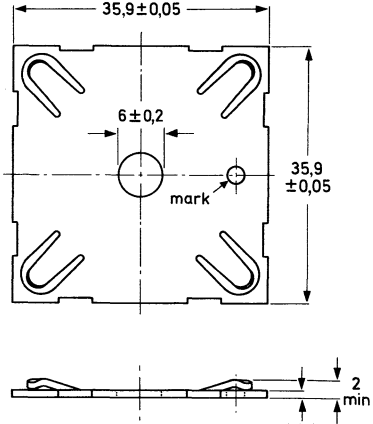
The phosphor-bronze cover has four cut-out lips on the corners, consequently the cover acts as a spring at the same time.

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 the lower cross core half or to use the spring (pos. 3) in order to obtain the most stable construction.

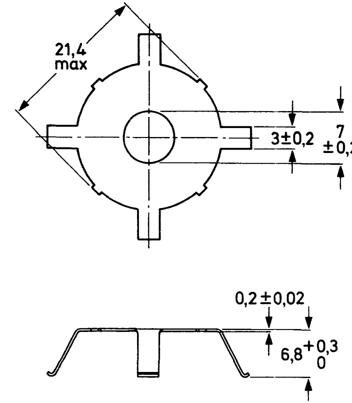
Container 4322 021 31180 is identical to container 4322 021 33630, however the latter has four cut-outs (see outline on next page).
Container 4322 021 31180 gives a better cross-talk attenuation, container 4322 021 33630 makes the X35 construction more suitable for a 2000 V test.

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.



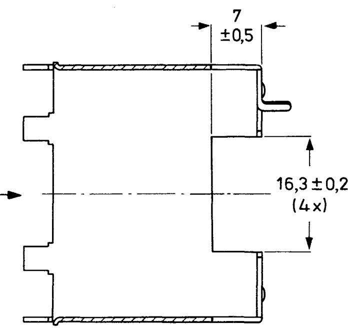
7Z85358

(1) Cover 4322 021 31160
Material: phosphor bronze,
nickel plated.



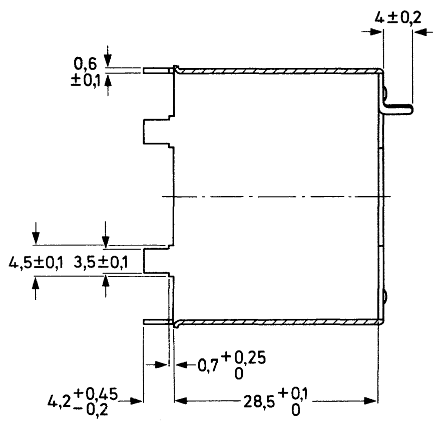
7Z85359

(3) Spring 4322 021 30220
Material: phosphor bronze.

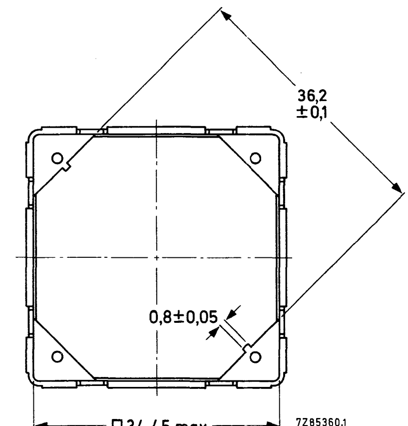


(2) Container 4322 021 33630

Please order in multiples
of the packing quantity.



(2) Container 4322 021 31180



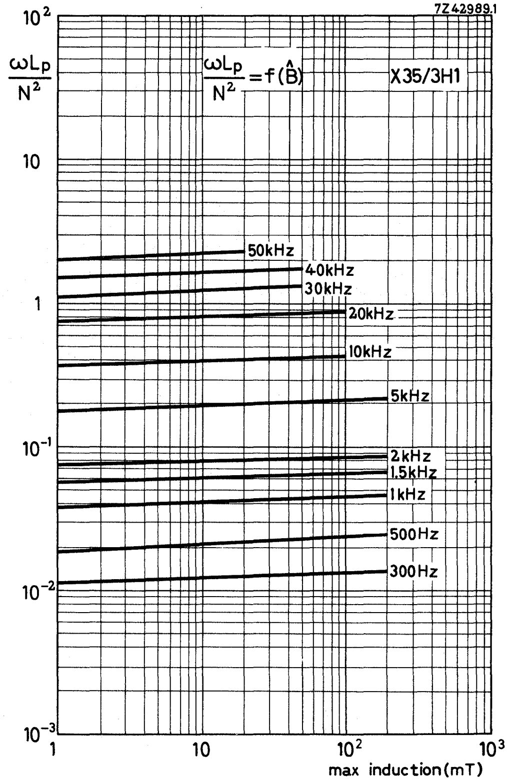
7Z85360.1

Material: brass, nickel plated.

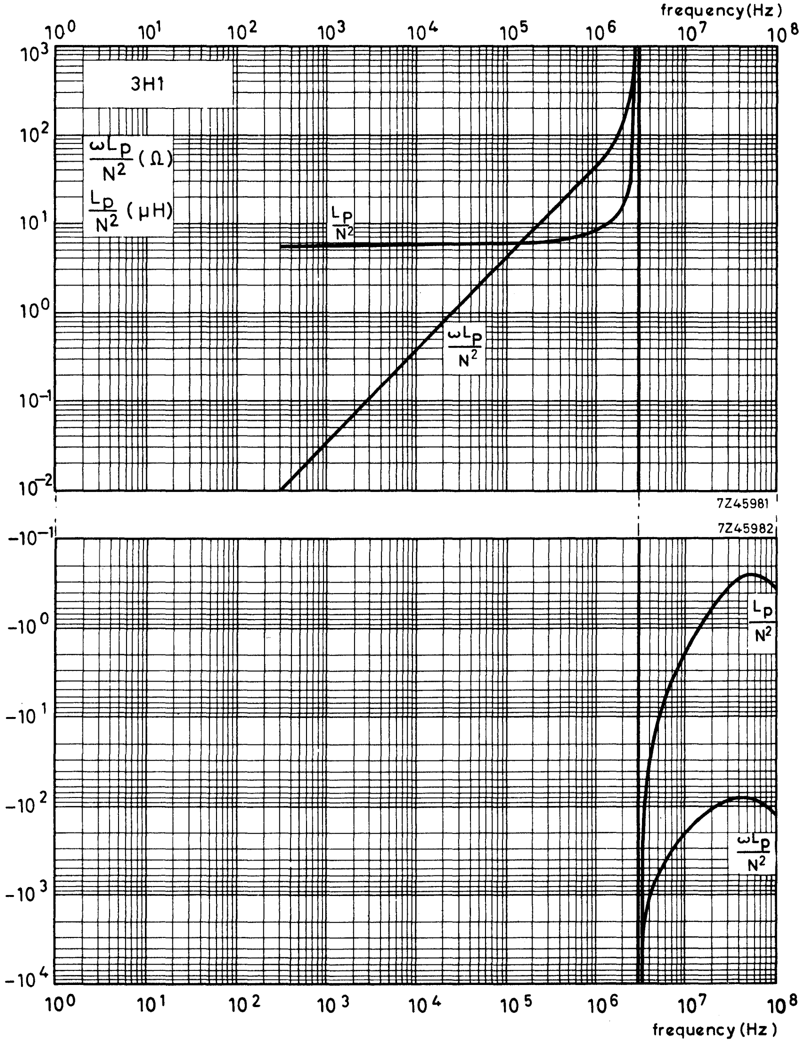
Packing quantity: 420.

CHARACTERISTIC CURVES

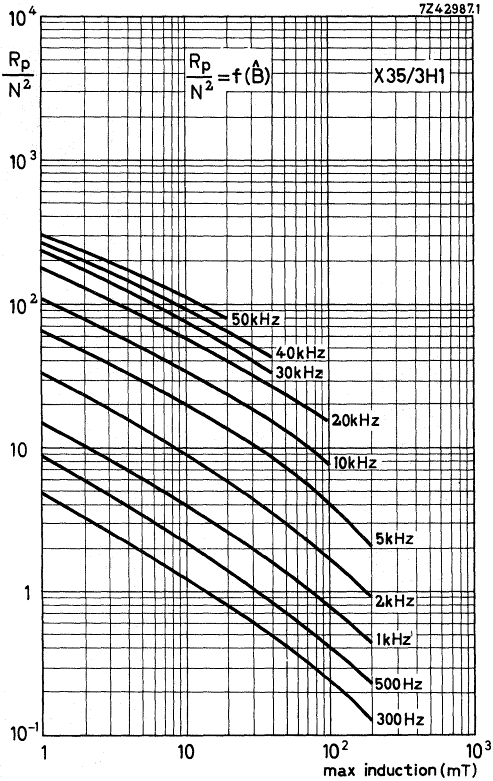
INDUCTANCE AS A FUNCTION OF THE INDUCTION



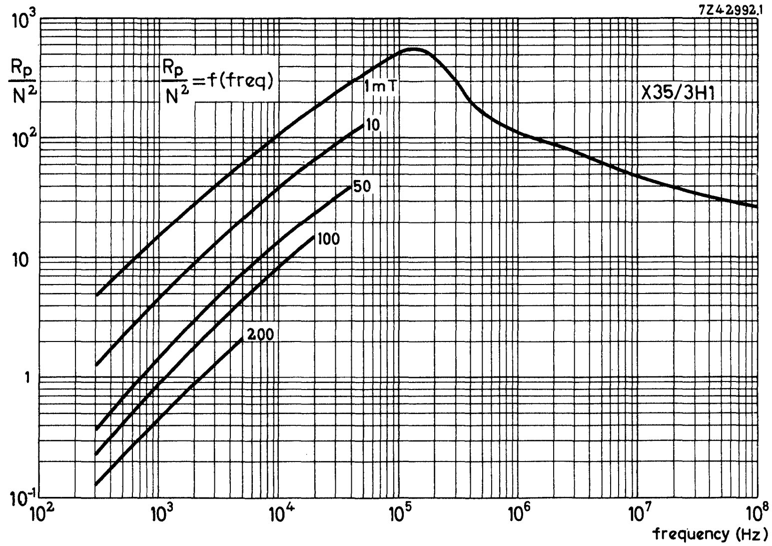
INDUCTANCE AS A FUNCTION OF THE FREQUENCY



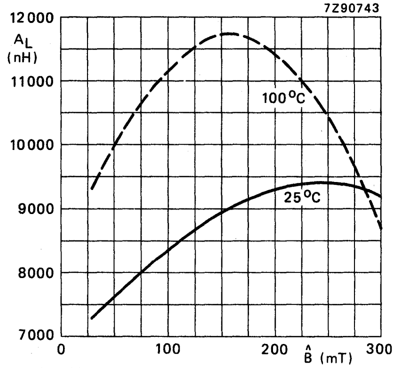
CORE LOSSES AS A FUNCTION OF THE INDUCTION



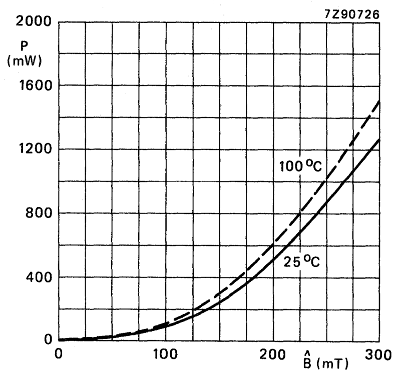
CORE LOSSES AS A FUNCTION OF THE FREQUENCY



FXC 3B8



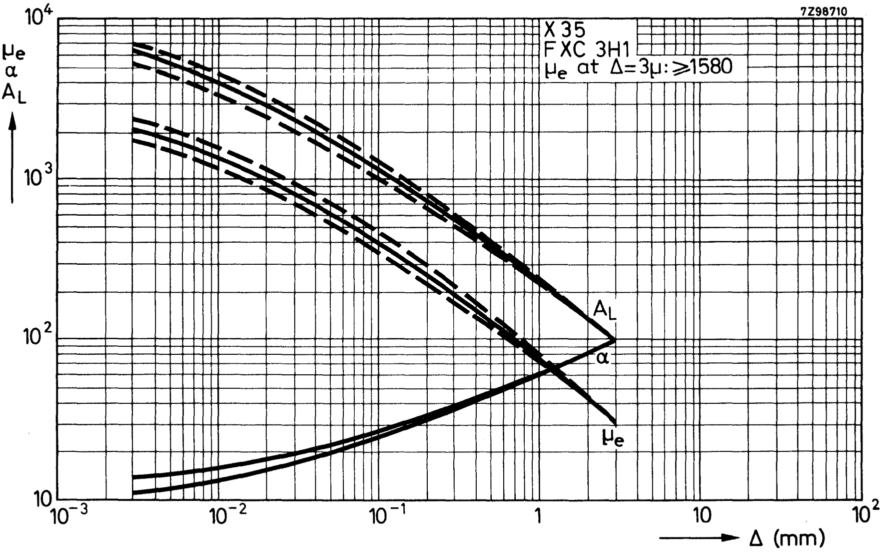
$A_L = f(\hat{B})$ at 16 kHz, no air gap.



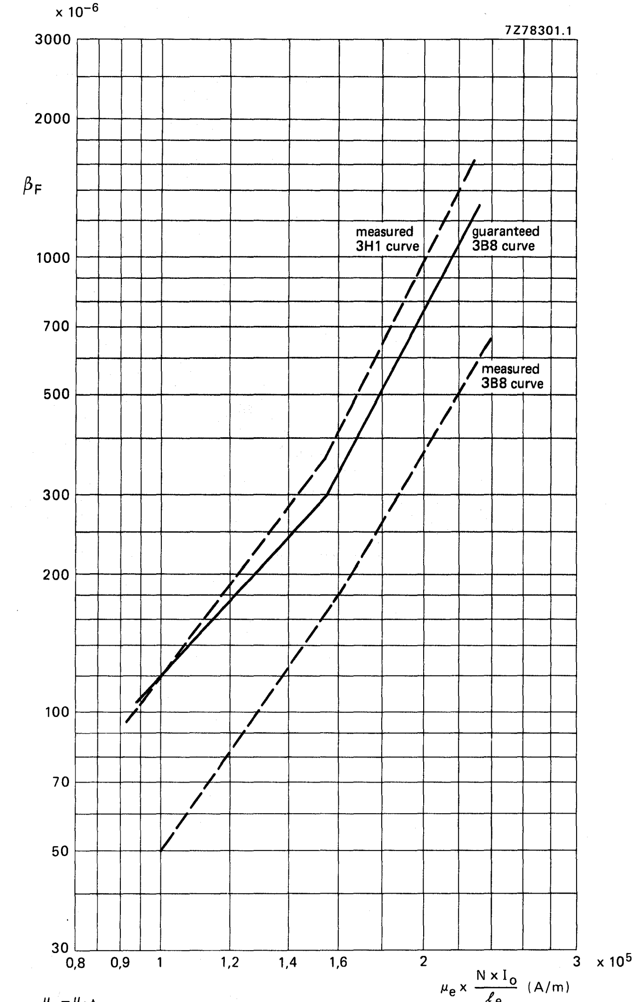
$P = f(\hat{B})$ at 16 kHz, no air gap.

$\hat{B}$ calculated with $A_{CPmin} = 132\ mm^2$.

μ_e - α AND A_L CURVES



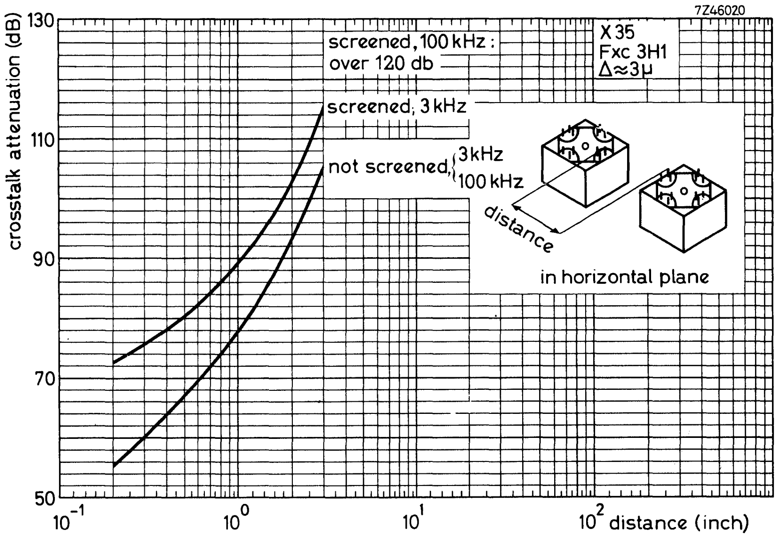
D.C. SENSITIVITY AT 25 °C

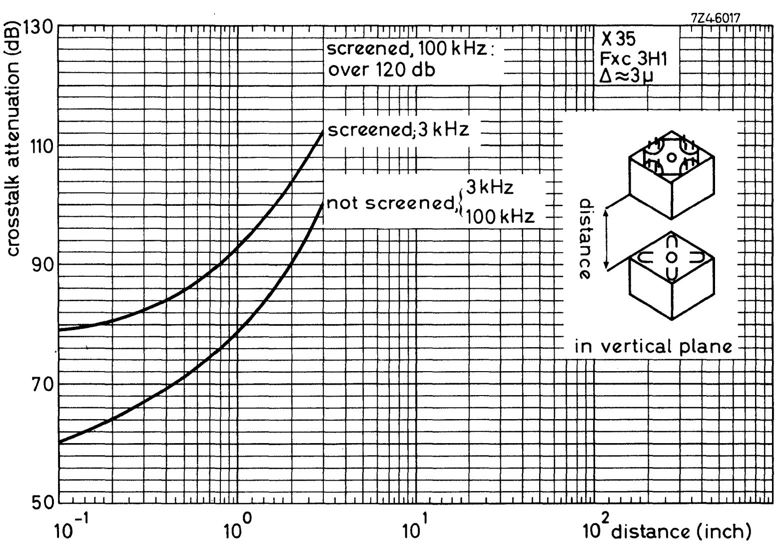


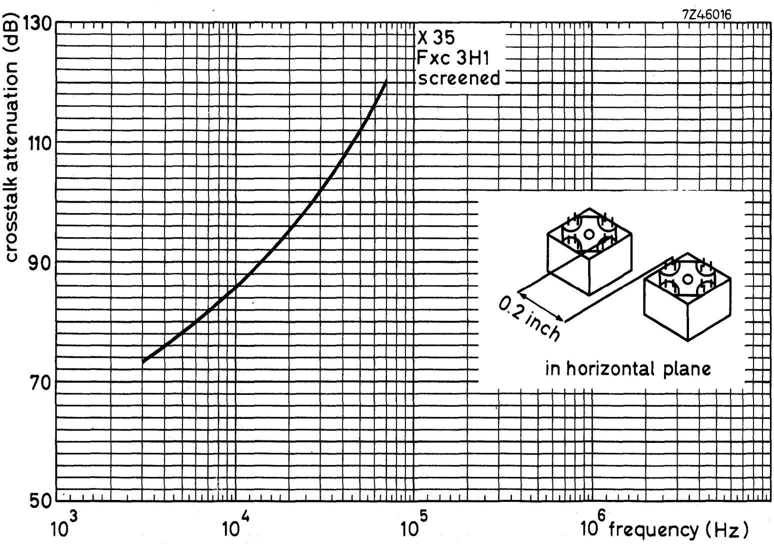
$$\beta_F = \frac{\mu_e - \mu_{e\Delta}}{\mu_e \times \mu_{e\Delta}}$$

Inductance variation as a function of d.c. current.

CROSSTALK ATTENUATION






7Z46016
crosstalk attenuation (dB)
130
110
90
70
50
10^3
10^4
10^5
10^6
frequency (Hz)
X 35
Fxc 3H1
screened
0.2 inch
in horizontal plane

INDEX OF CATALOGUE NUMBERS

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 page of this book. See also part C5.

catalogue number	page	description
3522 200 03480	405	Cross core half X22 in 3D3
3522 200 03490	405	Cross core half X22 in 4C6
4312 021 29240	317	Coil former RM6-S
4312 021 29250	318	Coil former RM6-S
4313 021 04120	372	Clip RM10
4322 020 20900	100	Potcore half P9/5 in 3D3
4322 020 20940	100	Potcore half P9/5 in 4C6
4322 020 20980	100	Potcore half P9/5 in 3H1
4322 020 21010	107	Potcore half P11/7 in 3H1
4322 020 21020	107	Potcore half P11/7 in 3D3
4322 020 21140	107	Potcore half P11/7 in 4C6
4322 020 21260	120	Potcore half P14/8 in 3H1
4322 020 21270	120	Potcore half P14/8 in 3D3
4322 020 21350	120	Potcore half P14/8 in 4C6
4322 020 21400	120	Potcore half P14/8 in 3B8
4322 020 21510	137	Potcore half P18/11 in 3H1
4322 020 21520	137	Potcore half P18/11 in 3D3
4322 020 21610	137	Potcore half P18/11 in 4C6
4322 020 21650	137	Potcore half P18/11 in 3H3
4322 020 21670	137	Potcore half P18/11 in 3B8
4322 020 21760	155	Potcore half P22/13 in 3H1
4322 020 21770	155	Potcore half P22/13 in 3D3
4322 020 21830	155	Potcore half P22/13 in 4C6
4322 020 21940	155	Potcore half P22/13 in 3B8
4322 020 22010	173	Potcore half P26/16 in 3H1
4322 020 22020	173	Potcore half P26/16 in 3D3
4322 020 22110	173	Potcore half P26/16 in 4C6
4322 020 22220	173	Potcore half P26/16 in 3B8
4322 020 22260	193	Potcore half P30/19 in 3H1
4322 020 22270	193	Potcore half P30/19 in 3D3
4322 020 22390	193	Potcore half P30/19 in 3B8
4322 020 22510	209	Potcore half P36/22 in 3H1
4322 020 22520	209	Potcore half P36/22 in 3D3
4322 020 22610	209	Potcore half P36/22 in 3B8
4322 020 22760	225	Potcore half P42/29 in 3H1
4322 020 23000	237	Potcore half P66/56 in 3E1
4322 020 23510	405	Cross core half X22 in 3H1
4322 020 23540	405	Cross core half X22 in 3B8
4322 020 23710	405	Cross core half X22 in 3H1
4322 020 23720	405	Cross core half X22 in 3H1
4322 020 23730	405	Cross core half X22 in 3H1
4322 020 23740	405	Cross core half X22 in 3H1
4322 020 23750	419	Cross core half X30 in 3H1
4322 020 23780	419	Cross core half X30 in 3B8

catalogue number	page	description
4322 020 28450	378	Square core half RM10/i in 3F3
4322 020 28490	378	Square core half RM10/i in 3E4
4322 020 28530	312	Square core half RM6/i in 3C85
4322 020 28550	312	Square core half RM6/i in 3F3
4322 020 28560	312	Square core half RM6/i in 3E4
4322 020 28570	312	Square core half RM6/i in 3E5
4322 020 28760	107	Potcore half P11/7 in 3B8
4322 020 54210	243	Potcore half 5,6 x 3,6 in 3D3
4322 020 54300	94	Potcore half P5,8/2,5 in 3H1
4322 020 54400	95	Potcore half P5,8/3,3 in 3H1
4322 020 54510	245	Potcore half 7,4 x 3,9 in 3D3
4322 020 54600	97	Potcore half 7,4 x 4,2 in 3H1
4322 020 54610	97	Potcore half 7,4 x 4,2 in 3H1
4322 020 54620	97	Potcore half 7,4 x 4,2 in 3H1
4322 020 54710	247	Potcore half 9,4 x 4,8 in 3D3
4322 020 54800	249	Potcore half 14 x 7,5 in 3H1
4322 020 54900	251	Potcore half 26 x 9,2 in 3H1
4322 020 55010	382	Square core half RM12/i in 3C85
4322 020 55020	382	Square core half RM12/i in 3F3
4322 020 55030	382	Square core half RM12/i in 3E4
4322 020 55250	378	Square core half RM10/i in 3E5
4322 020 55500	383	Square core half RM6-S/i in 3E4
4322 020 55510	383	Square core half RM6-S/i in 3E5
4322 021 13220	209	Pre-adjusted potcore set P36/22
4322 021 30040	410	Container for X22
4322 021 30140	72	Nut for adjuster P14/8,P18/11,RM6-R,RM6-S,X22
4322 021 30150	72	Nut for adjuster P22/13, RM8, X30
4322 021 30160	72	Nut for adjuster P26/16,P30/19,P36/22,P42/29,RM10,X35
4322 021 30180	112	Tag plate P11/7
4322 021 30210	423	Spring X30
4322 021 30220	439	Spring X35
4322 021 30230	410	Cover for X22
4322 021 30240	108	Coil former P11/7
4322 021 30250	121	Coil former P14/8; 14 x 7,5
4322 021 30260	122	Coil former P14/8
4322 021 30270	138	Coil former P18/11
4322 021 30280	139	Coil former P18/11
4322 021 30290	139	Coil former P18/11
4322 021 30300	156	Coil former P22/13
4322 021 30310	157	Coil former P22/13
4322 021 30320	157	Coil former P22/13
4322 021 30330	174	Coil former P26/16
4322 021 30340	175	Coil former P26/16
4322 021 30350	175	Coil former P26/16
4322 021 30360	194	Coil former P30/19
4322 021 30370	195	Coil former P30/19
4322 021 30380	195	Coil former P30/19
4322 021 30390	210	Coil former P36/22
4322 021 30400	211	Coil former P36/22
4322 021 30410	211	Coil former P36/22
4322 021 30420	226	Coil former P42/29
4322 021 30430	227	Coil former P42/29
4322 021 30440	126	Tag plate P14/8
4322 021 30450	143	Tag plate P18/11
4322 021 30460	162	Tag plate P22/13
4322 021 30470	180	Tag plate P26/16

catalogue number	page	description
4322 021 33540	244	Coil former 5,6 x 3,6
4322 021 33550	96	Coil former P5,8/3,3
4322 021 33620	423	Container X30
4322 021 33630	439	Container X35
4322 021 33690	392	Clip RM14
4322 021 33700	252	Coil former 26 x 9,2
4322 021 34040	334	Coil former RM6-S/i
4322 021 34050	362	Coil former RM8/i
4322 021 34060	379	Coil former RM10/i
4322 021 34070	399	Coil former RM14
4322 021 34110	384	Coil former RM12
4322 021 34170	384	Clip RM12
4322 021 34220	399	Clip RM14
4322 021 38320	196	Inductance adjuster P30/19, RM10
4322 021 38340	196	Inductance adjuster P30/19, RM10
4322 021 38380	196	Inductance adjuster P30/19, RM10, X35
4322 021 38390	196	Inductance adjuster P30/19, RM10, X35
4322 021 38400	158	Inductance adjuster P22/13, RM8, X30
4322 021 38410	158	Inductance adjuster P22/13, RM8, X30
4322 021 38420	158	Inductance adjuster P22/13, RM8
4322 021 38430	158	Inductance adjuster P22/13, RM8, X30
4322 021 38440	158	Inductance adjuster P22/13, RM8, X30
4322 021 38450	158	Inductance adjuster P22/13, RM8
4322 021 38480	158	Inductance adjuster P22/13, RM8, X30
4322 021 38490	158	Inductance adjuster P22/13, RM8, X30
4322 021 38600	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38610	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38620	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38640	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38650	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38670	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38680	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38690	295	Inductance adjuster RM6-R, RM6-S, X22
4322 021 38700	260	Inductance adjuster RM4, RM5
4322 021 38710	260	Inductance adjuster RM4, RM5
4322 021 38720	260	Inductance adjuster RM4, RM5
4322 021 38750	260	Inductance adjuster RM4, RM5
4322 021 38780	260	Inductance adjuster RM4, RM5
4322 021 38790	260	Inductance adjuster RM4, RM5
4322 021 39240	212	Inductance adjuster P36/22, P42/29, X35
4322 021 39280	212	Inductance adjuster P36/22, P42/29, X35
4322 021 39290	212	Inductance adjuster P36/22, P42/29, X35
4322 021 39410	176	Inductance adjuster P26/16
4322 021 39420	176	Inductance adjuster P26/16
4322 021 39450	176	Inductance adjuster P26/16
4322 021 39480	176	Inductance adjuster P26/16
4322 021 39490	176	Inductance adjuster P26/16
4322 021 39600	140	Inductance adjuster P18/11
4322 021 39610	140	Inductance adjuster P18/11
4322 021 39620	140	Inductance adjuster P18/11
4322 021 39630	140	Inductance adjuster P18/11
4322 021 39640	140	Inductance adjuster P18/11
4322 021 39650	140	Inductance adjuster P18/11
4322 021 39670	140	Inductance adjuster P18/11
4322 021 39680	140	Inductance adjuster P18/11
4322 021 39700	123	Inductance adjuster P14/8

catalogue number	page	description
4322 022 65...	405	Pre-adjusted cross core set X22
4322 022 67...	316	Pre-adjusted square core set RM6-S
4322 022 70...	367	Pre-adjusted square core set RM10
4322 022 71...	340	Pre-adjusted square core set RM8
4322 022 73...	434	Pre-adjusted cross core set X35
4322 022 75...	290	Pre-adjusted square core set RM6-R
4322 022 77...	258	Pre-adjusted square core set RM4
4322 022 79...	272	Pre-adjusted square core set RM5
4322 025 01...	340	Pre-adjusted square core set RM8
4322 025 03...	387	Pre-adjusted square core set RM14
4322 025 05...	333	Pre-adjusted square core set RM6-S/i
4322 025 06...	382	Pre-adjusted square core set RM12/i
4322 058 00000	84	Tool drawing for P14/8
4322 058 00010	84	Tool drawing for P18/11
4322 058 00020	84	Tool drawing for P22/13
4322 058 00030	84	Tool drawing for P26/16
4322 058 00040	84	Tool drawing for P30/19
4322 058 00050	84	Tool drawing for P36/22
4322 058 00060	84	Tool drawing for P42/29
4322 058 00070	84	Tool drawing for P11/7
4322 058 00080	84	Tool drawing for X22
4322 058 00090	84	Tool drawing for X30
4322 058 00100	84	Tool drawing for X35
4322 058 00150	84	Tool drawing for RM6-R/RM6-S
4322 058 00160	84	Tool drawing for RM8
4322 058 00170	84	Tool drawing for RM5
4322 058 00180	84	Tool drawing for RM4
4322 058 00190	84	Tool drawing for RM10
4322 058 00200	84	Tool drawing for RM14
4322 058 03260	71	Adjustment tool for P9/5,P11/7,P14/8,P18/11,P22/13, RM4,RM5,RM6-S
4322 058 03270	71	Adjusted tool for P26/16,P30/19,P42/29,RM8,RM10
7622 300 13701	55	Standard coil to X25
7622 300 50101	55	Standard coil to RM4
7622 300 50201	55	Standard coil to RM5
7622 300 50301	55	Standard coil to RM6-R/RM6-S
7622 300 50401	55	Standard coil to RM8
7622 300 50501	55	Standard coil to RM10
7622 300 50601	55	Standard coil to RM14
7622 301 00101	55	Standard coil to P9/5
7622 301 00301	55	Standard coil to P11/7
7622 301 00501	55	Standard coil to P14/8
7622 301 00701	55	Standard coil to P18/11
7622 301 00901	55	Standard coil to P22/13
7622 301 01101	55	Standard coil to P26/16
7622 301 01301	55	Standard coil to P30/19
7622 301 01501	55	Standard coil to P36/22
7622 301 01701	55	Standard coil to P42/29
7622 301 01901	55	Standard coil to P66/56
7622 301 04001	55	Standard coil to X22
7622 301 04101	55	Standard coil to X30
7622 301 04201	55	Standard coil to X35

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