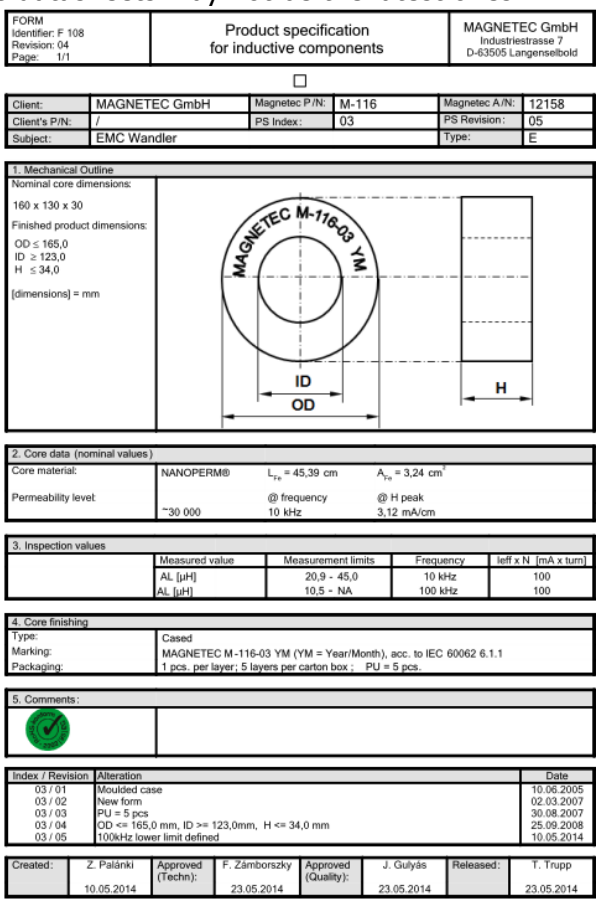
How to understand **MAGNETEC's Datasheet** EMC core and component

The objective of this document is to help to understand MAGNETEC's EMC **core** and **component** datasheets on the examples MB-667-01_01 and M-116-03_05.

Here are two example datasheets: the left side is for the core and the right side is for the choke. Note: The datasheets may not be the latest ones.



FORM Identifier: F 108 Revision: 04 Page: 1/1	Product specification for inductive components	MAGNETEC GmbH Industriestrasse 7 D-63505 Langenselbold

Client:	MAGNETEC GmbH	Magnetec P/N:	M-116	Magnetec A/N:	12158
Client's P/N:	/	PS Index:	03	PS Revision:	05
Subject:	EMC Wandler			Type:	E

1. Mechanical Outline

Nominal core dimensions:
160 x 130 x 30
Finished product dimensions:
OD ≤ 165,0
ID ≥ 123,0
H ≤ 34,0
[dimensions] = mm

2. Core data (nominal values)

Core material:	NANOPERM®	L_{Fe} = 45,39 cm	A_{Fe} = 3,24 cm²
Permeability level:	~30 000	@ frequency 10 kHz	@ H peak 3,12 mA/cm

3. Inspection values

	Measured value	Measurement limits	Frequency	leff x N [mA x turn]
	AL [µH]	20,9 - 45,0	10 kHz	100
	AL [µH]	10,5 - NA	100 kHz	100

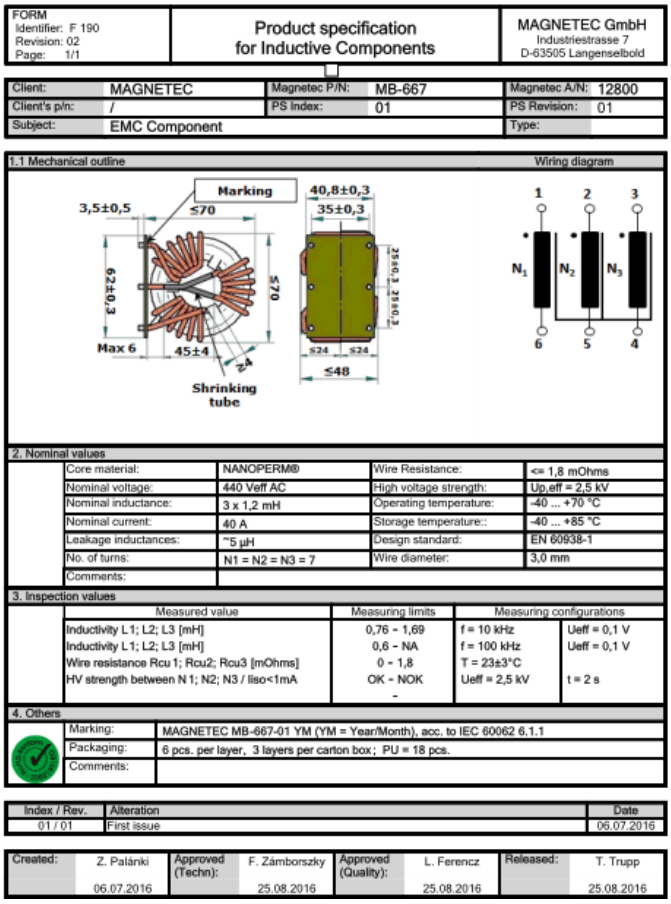
4. Core finishing

Type:	Cased
Marking:	MAGNETEC M-116-03 YM (YM = Year/Month), acc. to IEC 60062 6.1.1
Packaging:	1 pcs. per layer; 5 layers per carton box ; PU = 5 pcs.

5. Comments:

Index / Revision	Alteration	Date
03 / 01	Moulded case	10.06.2005
03 / 02	New form	02.03.2007
03 / 03	PU = 5 pcs	30.08.2007
03 / 04	OD <= 165,0 mm, ID >= 123,0mm, H <= 34,0 mm	25.09.2008
03 / 05	100kHz lower limit defined	10.05.2014

Created:	Z. Palánki 10.05.2014	Approved (Techn):	F. Zámborszky 23.05.2014	Approved (Quality):	J. Gulyás 23.05.2014	Released:	T. Trupp 23.05.2014



FORM Identifier: F 190 Revision: 02 Page: 1/1	Product specification for Inductive Components	MAGNETEC GmbH Industriestrasse 7 D-63505 Langenselbold

Client:	MAGNETEC	Magnetec P/N:	MB-667	Magnetec A/N:	12800
Client's p/n:	/	PS Index:	01	PS Revision:	01
Subject:	EMC Component			Type:	

1.1 Mechanical outline — Wiring diagram

2. Nominal values

Core material:	NANOPERM®	Wire Resistance:	<= 1,8 mOhms
Nominal voltage:	440 Veff AC	High voltage strength:	Up,eff = 2,5 kV
Nominal inductance:	3 x 1,2 mH	Operating temperature:	-40 ... +70 °C
Nominal current:	40 A	Storage temperature::	-40 ... +85 °C
Leakage inductances:	~5 µH	Design standard:	EN 60938-1
No. of turns:	N1 = N2 = N3 = 7	Wire diameter:	3,0 mm
Comments:			

3. Inspection values

Measured value	Measuring limits	Measuring configurations	
Inductivity L1; L2; L3 [mH]	0,76 - 1,69	f = 10 kHz	Ueff = 0,1 V
Inductivity L1; L2; L3 [mH]	0,6 - NA	f = 100 kHz	Ueff = 0,1 V
Wire resistance Rcu 1; Rcu2; Rcu3 [mOhms]	0 - 1,8	T = 23±3°C	
HV strength between N1; N2; N3 / Iiso<1mA	OK - NOK	Ueff = 2,5 kV	t = 2 s
	-		

4. Others

Marking:	MAGNETEC MB-667-01 YM (YM = Year/Month), acc. to IEC 60062 6.1.1
Packaging:	6 pcs. per layer, 3 layers per carton box; PU = 18 pcs.
Comments:	

Index / Rev.	Alteration	Date
01 / 01	First issue	06.07.2016

Created:	Z. Palánki 06.07.2016	Approved (Techn):	F. Zámborszky 25.08.2016	Approved (Quality):	L. Ferencz 25.08.2016	Released:	T. Trupp 25.08.2016

MAGNETEC's EMC **core** datasheet consists always of five sections plus a header and a folder section.

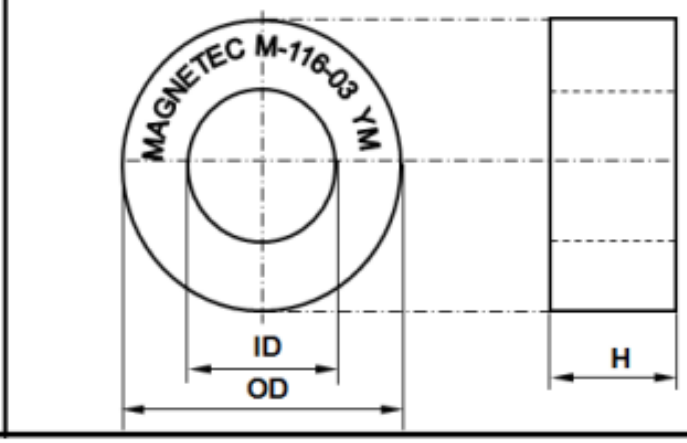
Header section:

Client:	MAGNETEC GmbH	Magnetec P/N:	M-116	Magnetec A/N:	12158
Client's P/N:	/	PS Index:	03	PS Revision:	05
Subject:	EMC Wandler			Type:	E

Client, being MAGNETEC for a MAGNETEC part and customer's name for a customer's part.
Magnetec P/N: product name; M-xxxx for cores
MB-xxxx for components.
Where x stands for a digit: 0,1,…,9.
MAGNETEC A/N: ERP Number. Due to internal traceability reasons.
Client's P/N: client's part number if available and requested for customer's part.
PS Index: identifier, which is increased in case of major change.
PS Revision: identifier, which is increased in case of a new revision of the datasheet, either major or minor changes.

Subject: showing whether the product is an EMC core or component or a CT core or component

Mechanical Outline:

1. Mechanical Outline	
Nominal core dimensions: 160 x 130 x 30 Finished product dimensions: OD ≤ 165,0 ID ≥ 123,0 H ≤ 34,0 [dimensions] = mm	

Nominal core dimensions are the informative mechanical dimensions (outer diameter x inner diameter x height) of the round magnetic core (in case of a not round shape core, it is the equivalent round core size)
Finished product dimensions are the final mechanical dimensions archived after fixation of the annealed core, e.g. with a case, with an epoxy coating, epoxy coating and foil bandaging. Note: adhesive tape and foil bandage are excluded here; they are result in slight bigger dimensions, see info on the corresponding datasheets. The finished core dimensions are measured with calliper on 3 different points and worst one of the three measurement is used.

Core data:

2. Core data (nominal values)			
Core material:	NANOPERM®	L_{Fe} = 45,39 cm	A_{Fe} = 3,24 cm²
Permeability level:	~30 000	@ frequency 10 kHz	@ H peak 3,12 mA/cm

Nominal values (informative parameters only)
Core material and its magnetic path length **Lfe** and magnetic cross section **Afe** are given just for information only.
Permeability level is given as estimated value without tolerance at the given frequency and excitation level H_{peak}. Guaranteed Inductance (AL) values given in section 3 Inspection values.

Inspection values:

3. Inspection values				
	Measured value	Measurement limits	Frequency	Ieff x N [mA x turn]
	AL [µH]	20,9 - 45,0	10 kHz	100
	AL [µH]	10,5 - NA	100 kHz	100

Inspection values: here the guaranteed parameters are listed. **AL** is the inductance of a core at one turn. **Ieff*N** is the excitation level (called also work-point) at which the AL value is measured; please don't mix it with saturation. For saturation current estimation, we have the abacus tool online http://www.magnetec.de/dimensioning/abacus/abacus.php
The first line means, that the core have a guaranteed AL value window between 20,9µH to 45µH at a frequency of 10kHz at a workpoint of 100mA turn.
Where temperature is not given, the test is valid for room temperature, T=23±3°C.

Core finishing:

4. Core finishing	
Type:	Cased
Marking:	MAGNETEC M-116-03 YM (YM = Year/Month), acc. to IEC 60062 6.1.1
Packaging:	1 pcs. per layer; 5 layers per carton box ; PU = 5 pcs.

Type defines the type of fixation like cased, glued into cased, impregnated, cut, epoxy coated or foil bandaged cores. In case of epoxy coating, we cannot grant a minimum coating thickness, the coating is not uniform all around the core. Please be aware that the coating at the edge is thinner (edge coverage). In case of thermal stress (e.g. thermal shock), please be aware that epoxy might crack due to its different thermal expansion. Also mechanical stress (vibrations/shocks) might create cracks also. If small cracks may create problems during the lifetime of your product, we recommend you to select cased cores or take foil bandaged version instead. please check the usability in advance in your application. A general recommendation for epoxy coated cores is to add an additional insulation (like foil bandage) before copper winding.

Marking defines how the product is marked, the date code may be given by international norms, e.g. IEC 60062 section 6.1.1, see also the attachment below in this document. The letter size is adjusted according to the core size to have the best readability.

Packing defines how one package unit is built up and how many parts are in one packaging unit (PU).

Comments section shows any further comments, special information for this product.

5. Comments:	
	

Section comments shows any comment for this product.

Footer sections give information about the history of indexes and revisions of the product, and signatures about the releasing process of the document.

Index / Revision	Alteration	Date
03 / 01	Moulded case	10.06.2005
03 / 02	New form	02.03.2007
03 / 03	PU = 5 pcs	30.08.2007
03 / 04	OD <= 165,0 mm, ID >= 123,0mm, H <= 34,0 mm	25.09.2008
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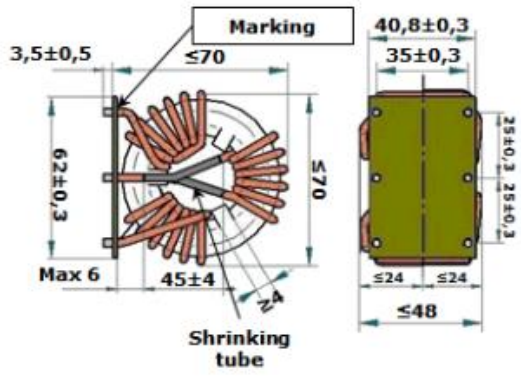
Created:	Z. Palánki 10.05.2014	Approved (Techn):	F. Zámborszky 23.05.2014	Approved (Quality):	J. Gulyás 23.05.2014	Released:	T. Trupp 23.05.2014

MAGNETEC's EMC **choke** or component datasheet consists always of four sections plus a header and a footer section.

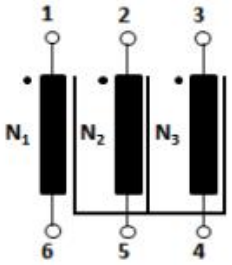
Header and Mechanical outline:

Client:	MAGNETEC	Magnetec P/N:	MB-667	Magnetec A/N:	12800
Client's p/n:	/	PS Index:	01	PS Revision:	01
Subject:	EMC Component			Type:	

1.1 Mechanical outline



Wiring diagram



The header and mechanical outline is the same for for choke and cores, just for the choke there is an additional wiring diagram to show how the wires are connected.

Nominal values:

2. Nominal values				
	Core material:	NANOPERM®	Wire Resistance:	<= 1,8 mOhms
	Nominal voltage:	440 Veff AC	High voltage strength:	Up,eff = 2,5 kV
	Nominal inductance:	3 x 1,2 mH	Operating temperature:	-40 ... +70 °C
	Nominal current:	40 A	Storage temperature::	-40 ... +85 °C
	Leakage inductances:	~5 µH	Design standard:	EN 60938-1
	No. of turns:	N1 = N2 = N3 = 7	Wire diameter:	3,0 mm
	Comments:			

Nominal voltage is the voltage at which the choke can be used. This value is important for the clearance and creepage distance.
Nominal inductance is giving the inductance of the component at RT, the guaranteed inductance limits can be found in section 3.
Operating temperature defines the ambient temperatures at which the component can be used. Suitability needs to be tested also in the application by customer, as environment can have an influence. Note: the inductance and DC resistance value of the choke may depend on the temperature, the given datasheet values are valid at RT.
Nominal current defines the allowed maximum current for the maximum operating temperature (in this example 70°C). The choke may heat up to its maximum allowed temperature, which is defined by the selected plastic materials, generally 130°C. (For the exact value, please consult the UL yellowsheet's RTI values or please contact MAGNETEC's technical sales for confirmation). Regarding derating and forced cooling of CMC, see attachment B.
Leakage inductance is the inductance of the component measured with one winding in shortcut. It is a not guaranteed ca. value.
Wire Resistance is the wire resistance at RT, for more details see section 3.
High voltage strength is showing at which high voltage level HV test was performed during type-tests in development phase, for more details see section 3.
Design standard shows on which international norm the electrical design of the product is based on. For chokes the standard IEC EN 60938-1 is regulating the necessary clearance and creepage distances. Assumed pollution degree is 2, in case of other pollution degree in the application, customer is asked to do the recalculation.

Inspection values:

3. Inspection values				
	Measured value	Measuring limits	Measuring configurations	
	Inductivity L1; L2; L3 [mH]	0,76 - 1,69	f = 10 kHz	Ueff = 0,1 V
	Inductivity L1; L2; L3 [mH]	0,6 - NA	f = 100 kHz	Ueff = 0,1 V
	Wire resistance Rcu 1; Rcu2; Rcu3 [mOhms]	0 - 1,8	T = 23±3°C	
	HV strength between N1; N2; N3 / Iiso<1mA	OK - NOK	Ueff = 2,5 kV	t = 2 s
		-		

Inspection values list up the guaranteed values with the corresponding measurement conditions. Where temperature is not given, the test is valid for room temperature, T=23±3°C.

Others:

4. Others		
	Marking:	MAGNETEC MB-667-01 YM (YM = Year/Month), acc. to IEC 60062 6.1.1
	Packaging:	6 pcs. per layer, 3 layers per carton box; PU = 18 pcs.
	Comments:	

Marking defines how the product is marked, the date code may be given by international norms, e.g. IEC 60062 section 6.1.1, see also the attachment below in this document.
Packing defines how one package unit is built up and how many parts are in one packaging unit (PU).

Footer sections give information about the history of indexes and revisions of the product, and signatures about the releasing process of the document.

Index / Rev.	Alteration	Date
01 / 01	First issue	06.07.2016

Created:	Z. Palánki 06.07.2016	Approved (Techn):	F. Zámborszky 25.08.2016	Approved (Quality):	L. Ferencz 25.08.2016	Released:	T. Trupp 25.08.2016

Disclosing the specification to third parties or using its content without written permission from MAGNETEC is strictly forbidden and every offender is liable to pay the corresponding damages

The objective of this document is to help to understand the datasheet of MAGNETEC and it is only for information, it does not create additional quality items.

For further details, please contact
MAGNETEC GmbH

For example:

Tobias Trupp	**Fritz Rauscher**	**Peter Seiz**
Technical Sales Manager EMC	Technical Sales Manager RCD/CT	Technical Sales EMC
Fon: +49 6184 9202 25	Fon: +49 6184 9202 30	Fon: +49 6184 9202 35
E-Mail: ttrupp@magnetec.de	E-Mail: frausche@magnetec.de	E-Mail: pseiz@magnetec.de

Attachment A)
IEC 60062 6.1.1 defines the following syntax for the date code:

Year of the production: (1. Code numeral)

Year	Code	Year	code	Year	code
2010	A	2020	M	2030	A
2011	B	2021	N	2031	B
2012	C	2022	P	2032	C
2013	D	2023	R	2033	D
2014	E	2024	S	2034	E
2015	F	2025	T	2035	F
2016	H	2026	U	2036	H
2017	J	2027	V	2037	J
2018	K	2028	W	2038	K
2019	L	2029	X	2039	L

The code starts each 20th year newly.

Month of production (2. Code numeral)

Month	Code	Month	code
January	1	July	7
February	2	August	8
March	3	September	9
April	4	October	O
May	5	November	N
June	6	December	D

Examples:

Date code	Prudction date
B5	2011 May
DD	2013 December

Attachment B for CM)

Explaination of the derating and forced cooling

The nom. current is the current when the choke surface temperature is about ca. 120°C due to the the cupper loss heating at the max. ambient temperature (max. ambient temperature as indicated in the component datasheet, typically 60°C). This nom. current is very depending on the max. ambient temperature.

The new nom. current at another ambient temperature T_am_new can be estimated by the derating theory, see fig. 1:

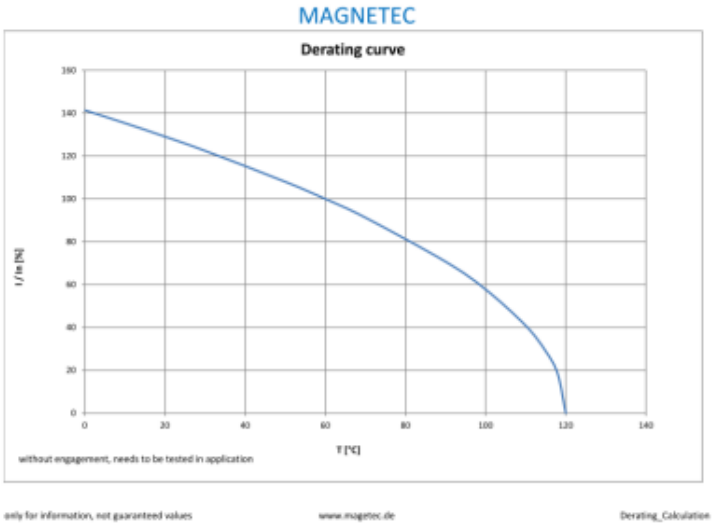


Fig. 1: estimated Inom_new/Inom at different ambient temperatures

For example, the nominal current of MB-007 is is ca. 16A at a max. ambient temperature=60°C (see datasheet in fig. 2). If in the application, operating temperature is only 40°C, the estimated new nom current can be estimated by 115%·16A=ca.18,5A (see fig 1). If the new ambient temperature is instead 80°C instead of 60°C, the new nom. current at 80°C can be estimated by 80%·16A=ca.13A(see fig 1).

If not other identified in the datasheet, this is valid for free convection, if forced cooling is applied, the new nom. current is about 140% of the value with only free convection, e.g. MB-007-02-02 should be able to handle about 16A·140%=ca. 22,5A

These values are without engagement and needs to be tested in the application.

www.magnetec.de

MAGNETEC GmbH
Industriestrasse 7, D-63505 Langenselbold, Germany
Fon: +49 6184 9202-0 / Fax: +49 6184 9202-20
E-Mail: magnetec@magnetec.de