COOL BLUE®

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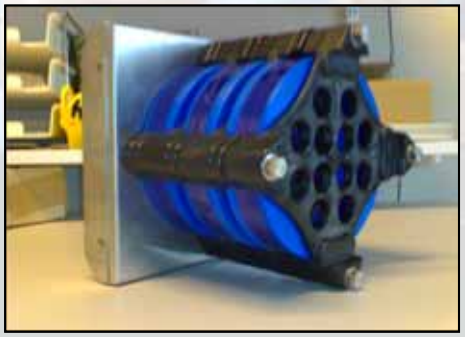
Inductive Absorbers for Megawatt applications

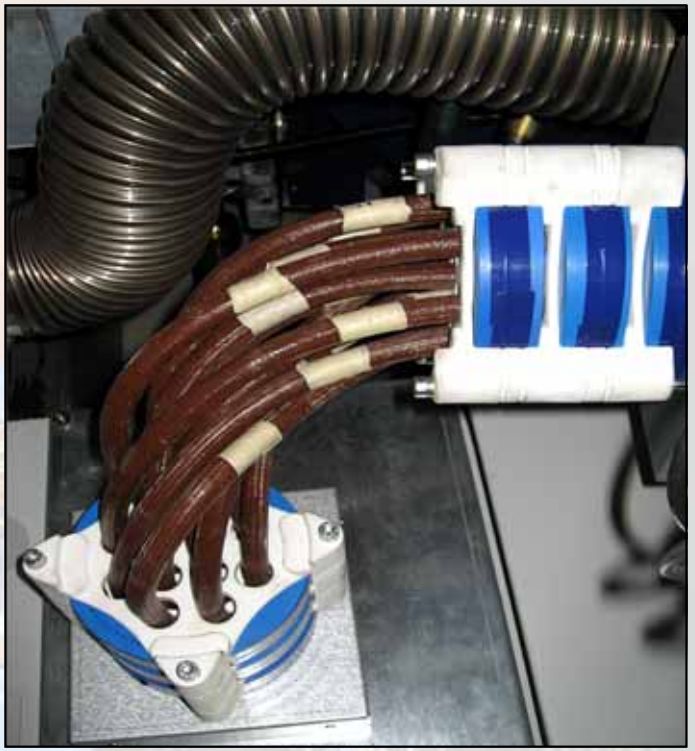
Content

Inductive Absorbers for Megawatt applications

Application 1: Wind Turbines in the MW range



Typical set of cores with cable fittings



Mounting example of absorber cores as part of the DFIG

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Application 2: big Inverters for Photovoltaic Power Plants

typical configuration of absorber cores in central PV inverter for 500kW

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Application 3: big industrial Drives, e.g. Paper Industry

Positioning of absorber cores in a 250kW paper producing machine

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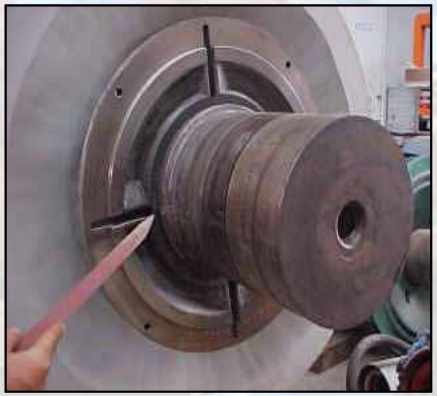
What is the Problem?

Reduced lifetime or early failures due to destroyed shaft bearings of motors or generators
create increased maitenance spendings or even costly downtimes due to bearing damages

1 MW asynchronous generator



shaft of rotor

erosion damage

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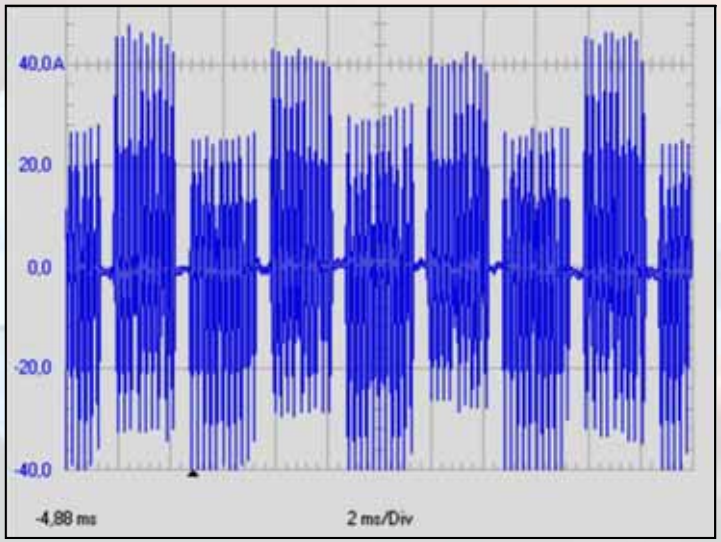
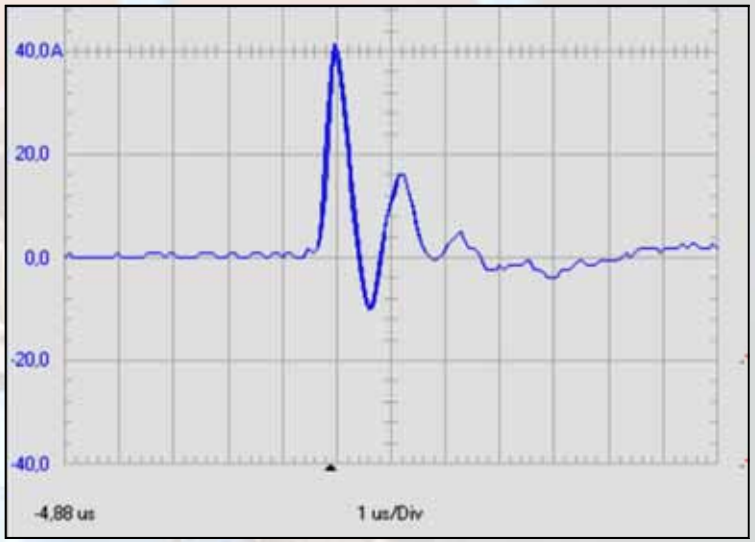
What causes the Problem?

Modern IGBT inverters create unwanted destructive radio frequency common mode bearing/shaft currents I_{CM}

typical example below: I_{CM} = 40 A (!) , f_{typ} ~ 1…5 MHz



shaft common mode current ICM



high frequency high current pulse

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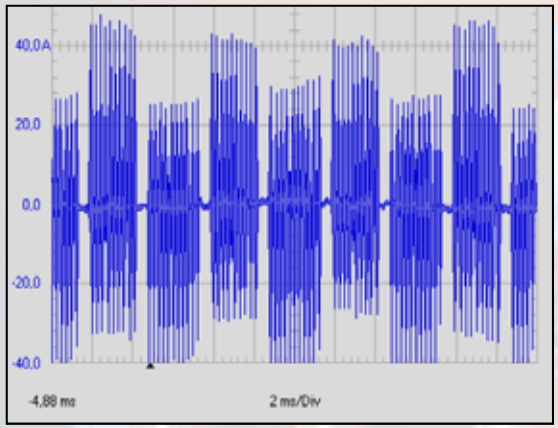
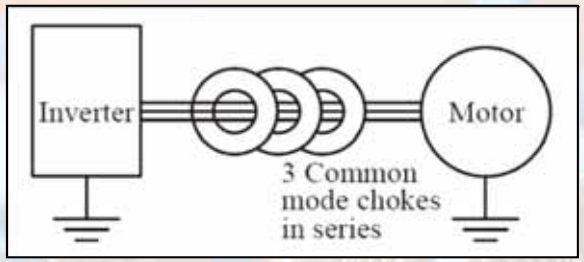
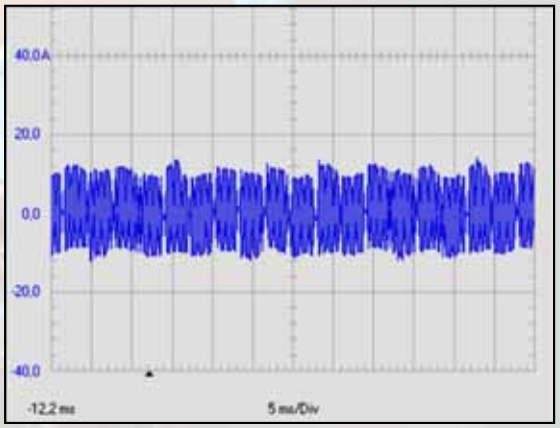
What solves the Problem?

Eliminate the root cause of the destructive radio frequency common mode currents by pulling **Cool Blue®** softmagnetic cores commonly over the motor cables as shown below







without filter cores
I_{CM} = up to 40A

with filter cores
I_{CM} ~ 10A

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Which solution to the Problem?

In the given configuration **Cool Blue®** softmagnetic cores work as a single turn common mode supression choke. They do not affect the symmetrical power currents but efficiently damp the asymmetrical radio frequency noise currents.

Cool Blue® softmagnetic cores are superior to other softmagnetic materials like ferrites because of significant advantages concerning their magnetic properties. As a consequence only about 20% of ‘magnetic mass’ is required – i.e. a significantly reduced number of cores is suitable.

An alternative solution is provided by costly ceramic hybrid bearings but those are much more expensive and limited in size.

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How to approach a concrete Solution? - **option 1** -

1) measuring of the common mode shaft current I_{CM}
2) select a set of suitable standard **Cool Blue®** cores
3) install the cores as shown at pg.8 and repeat the measurement

Type	Abmessungen/Dimensions nominal [mm] $d_a \times d_i \times h$	physical $D_a \times D_i \times H$	l_{fe} [cm]	a_{fe} [cm²]	A_L @ 10kHz [µH]	Peak I_{CM} [A]	Web-shop
M-112	63 x 50 x 30	68 x 43 x 36	17,7	1,4	23,3 – 46,6	4	
M-113	80 x 63 x 30	85 x 57 x 35,5	22,4	1,9	24,1 – 48,2	6	
M-283	80 x 63 x 30	OVAL	22,4	2,0	24,1 – 48,2	6	
M-114	100 x 80 x 30	105 x 75 x 35	28,2	2,3	22,5 – 45,0	8	
M-284	100 x 80 x 30	OVAL	28,2	2,3	22,5 – 45,0	8	
M-142	130 x 100 x 20	OVAL	37,0	2,1	16,0 – 32,0	9	
M-115	130 x 100 x 30	135 x 94 x 34	35,9	3,3	24,6 – 52,9	9	
M-116	160 x 130 x 30	165 x 123 x 34	45,4	3,2	20,9 – 45,0	12	
M-302	160 x 130 x 30	OVAL	45,4	3,2	20,9 – 45,0	12	
M-117	200 x 175 x 30	208 x 166 x 37	58,8	2,8	12,3 – 24,6	16	
M-111	240 x 200 x 30	OVAL	69,6	4,3	14,5 – 29,9	20	
M-248	300 x 254 x 30	OVAL	87,1	5,2	15,8 – 31,5	22	
M-205	300 x 250 x 30	304 x 246 x 34	86,2	5,9	18,0 – 36,0	23	
M-503	500 x 450 x 30	513 x 437 x 37	149,1	5,6	8,0 – 20,0	40	

standard range of available cores

sets of stacked filter cores

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How to approach a concrete Solution? **- option 2 -**

According to 5 years experience with many hundreds of existing installations we recommend the following simple procedure:

1: select a set of suitable standard **Cool Blue®** cores according to the **necessary inner core diameter** to fit over inverter cables

2: use min. 2 cores per MW for **asynchronous DFIG systems**
or
use up to 10 cores per MW for **synchronous generators with permanent magnetic excitation**

The cores should be located between Inverter and Generator

Cool Blue® cores can easily be retrofitted to existing installations

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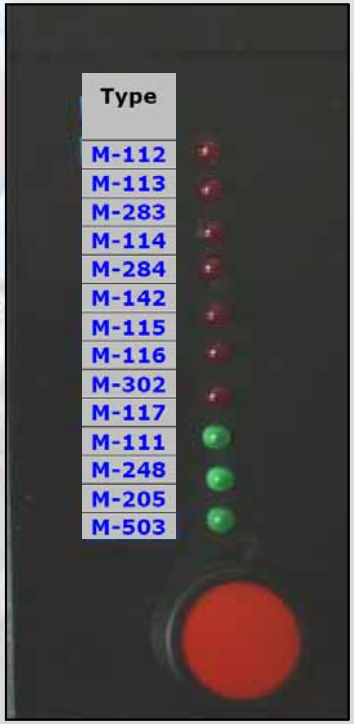
MAGS is a simple tool for the measurement of I_{CM}

MAGS 1.0 is a easy-to-use radio frequency Rogowski-type shaft current measuring device with a direct indication of the suitable **Cool Blue®** absorber core solution



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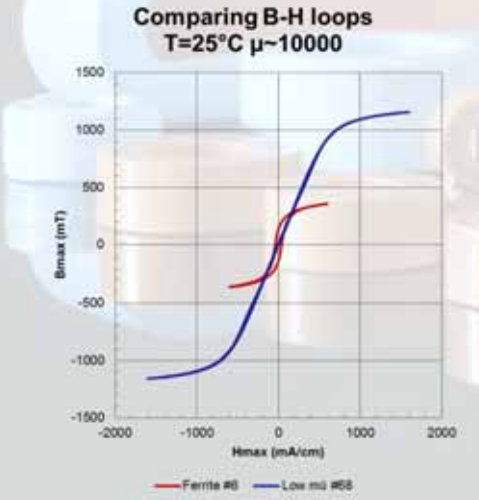
How does it work? NANOPERM® compared to Ferrite

alloy	permeability μ_r (10 / 100kHz)	saturation induction Bs [T] (25 / 100°C)	Curie-temp. Tc [°C]	working temp. T_{max} [°C]
Ferrite a	15.000 / 12.000	0,38 / 0,21	>130	95
Ferrite b	10.000 / 10.000	0,38 / 0,23	>130	95
NANOPERM®	100.000 / 20.000 30.000 / 20.000 1.500.... 8.000	1,2 / 1,18	600	up to180



Advantages of NANOPERM® :

higher **permeability** - up to a factor of 10 (!)

higher **saturation induction** factor 3

higher **linearity** of all parameters

higher working **temperature** - up to 180°C (!)

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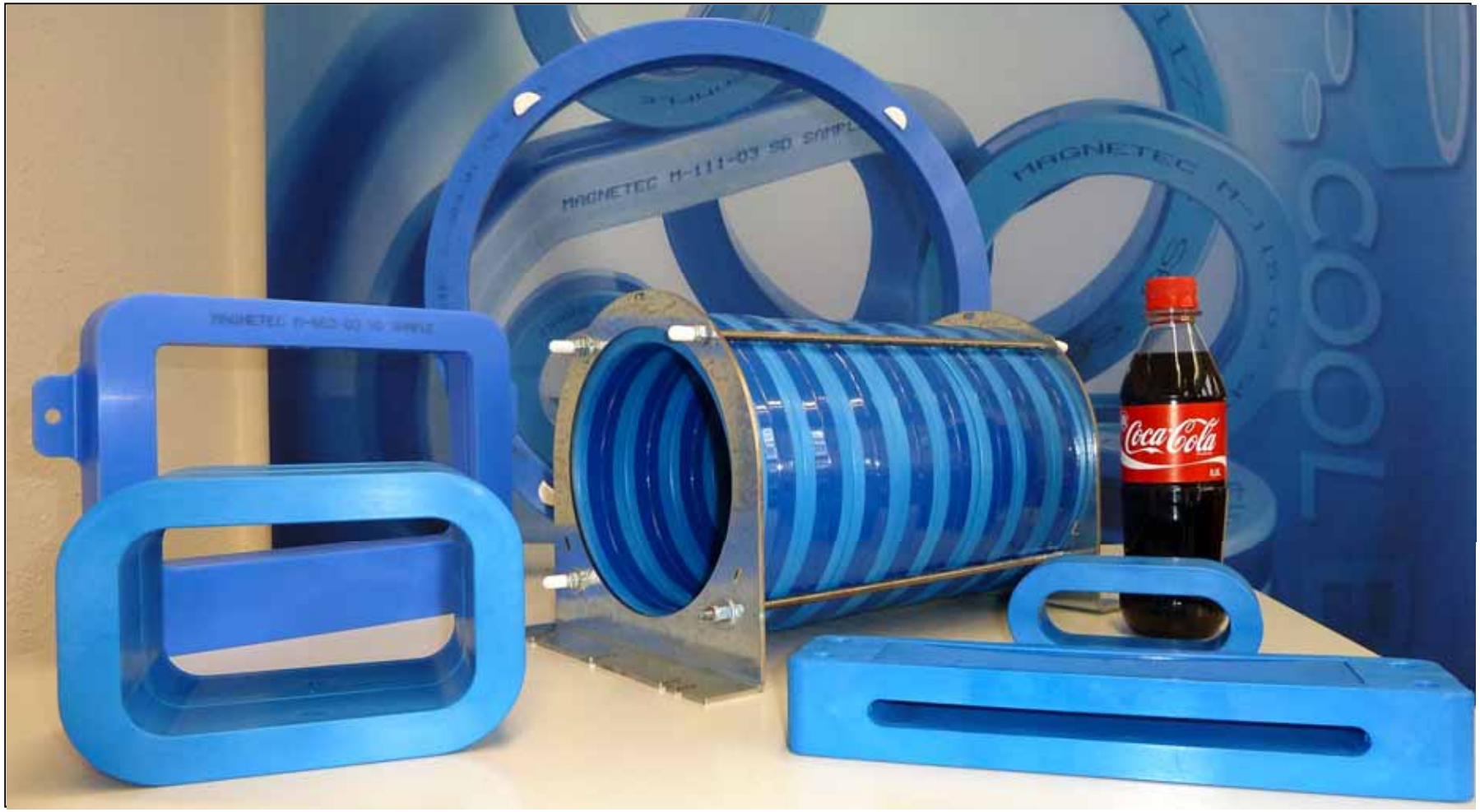
Available geometries of **Cool Blue®** absorber cores



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Availability of **Cool Blue®** absorber cores

MAGNETEC ® is the **Manufacturer** of **Cool Blue®** cores.

Products are available from stock in Germany and they can be purchased online via our **Webshop** on

www.magnetec.de/shop

Please visit our booth 432 here in Hall 12 for more information.

Thank you for your attention!

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