

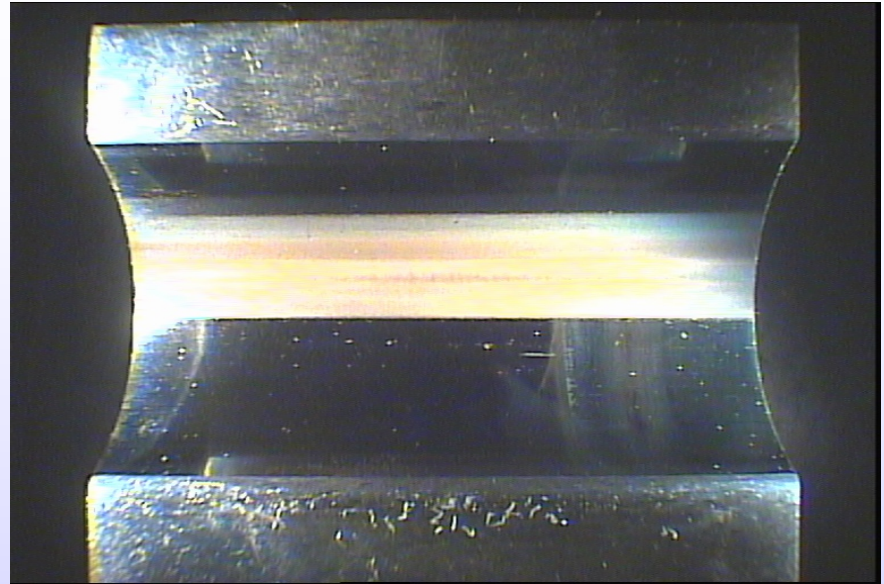
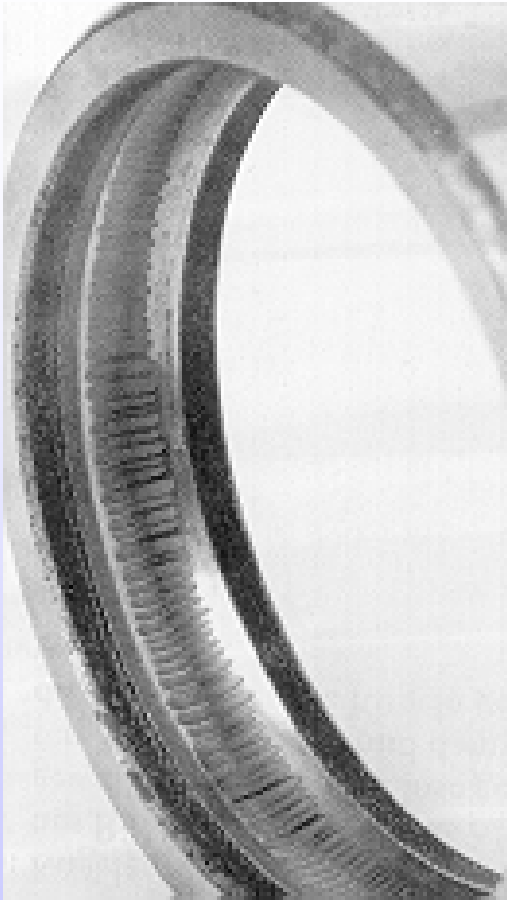
Efficient and cost effective method to reduce damaging motor bearing currents in big inverter drive systems

presented at PCIM 2005, Nuremberg, June 8



Hans Joachim Pöss, MAGNETEC GmbH

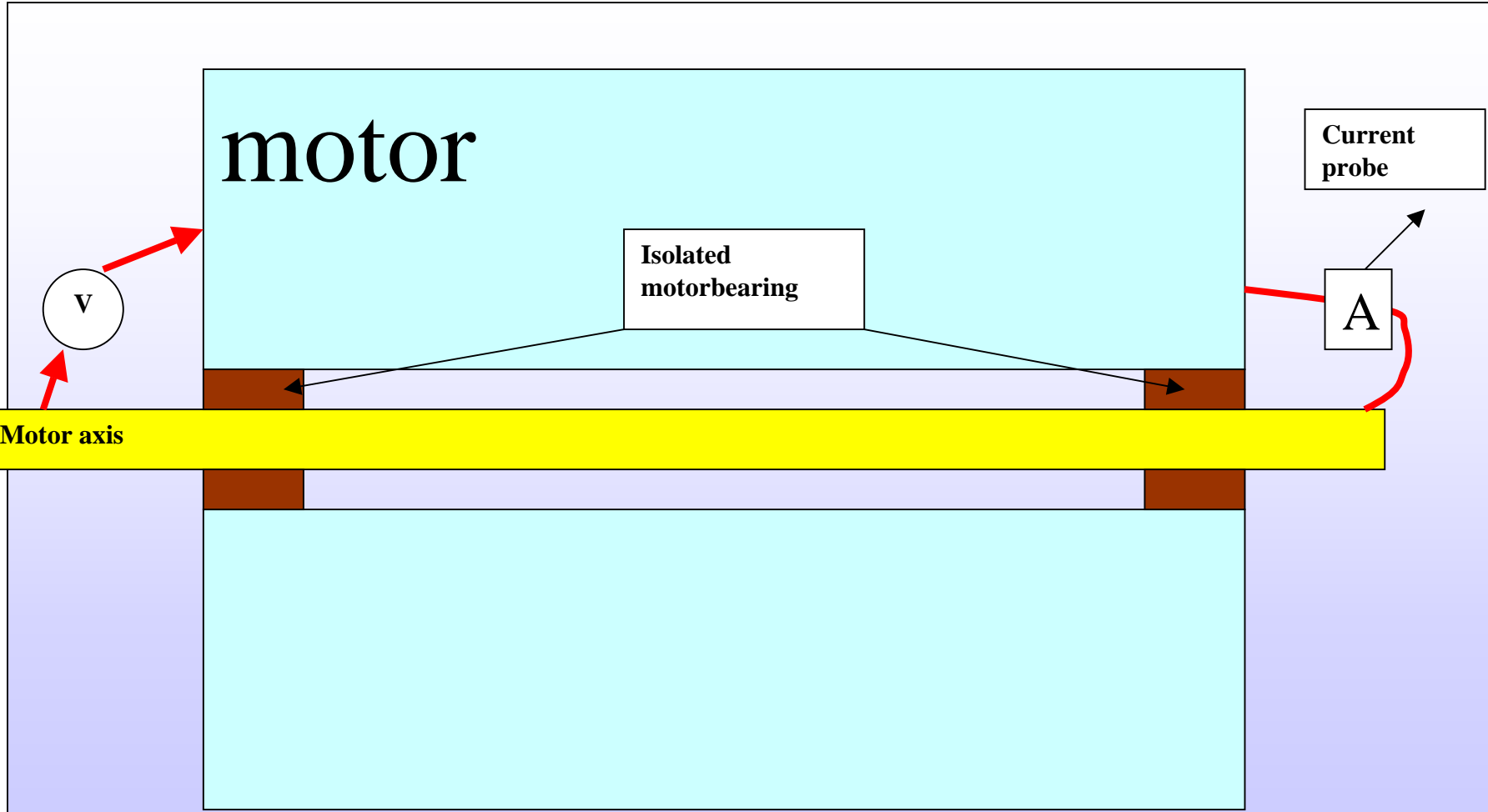
The phenomenon



Motor bearing damages

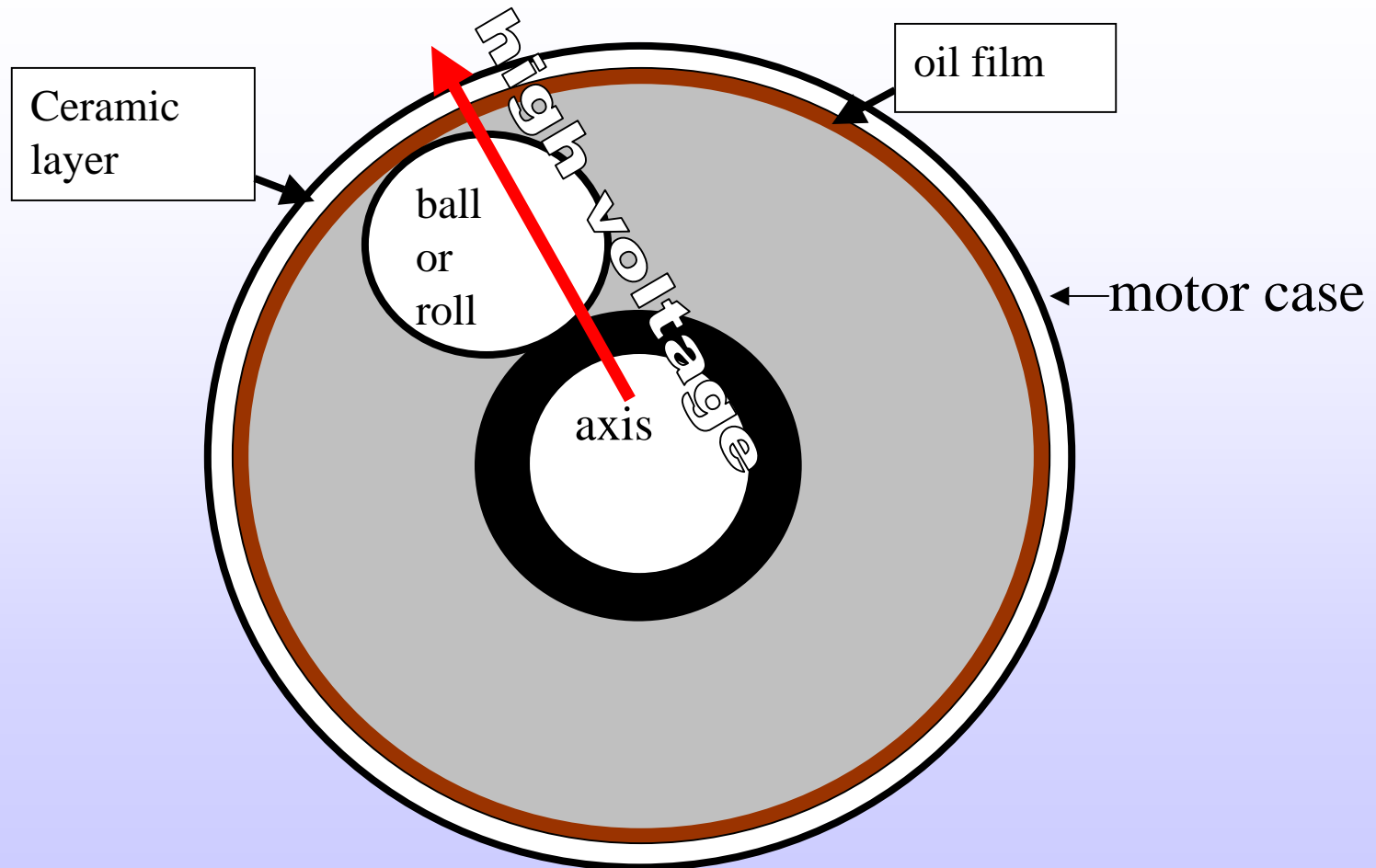
Cool Blue[®] cores to reduce motor bearing currents

how can you measure the voltage across a bearing?



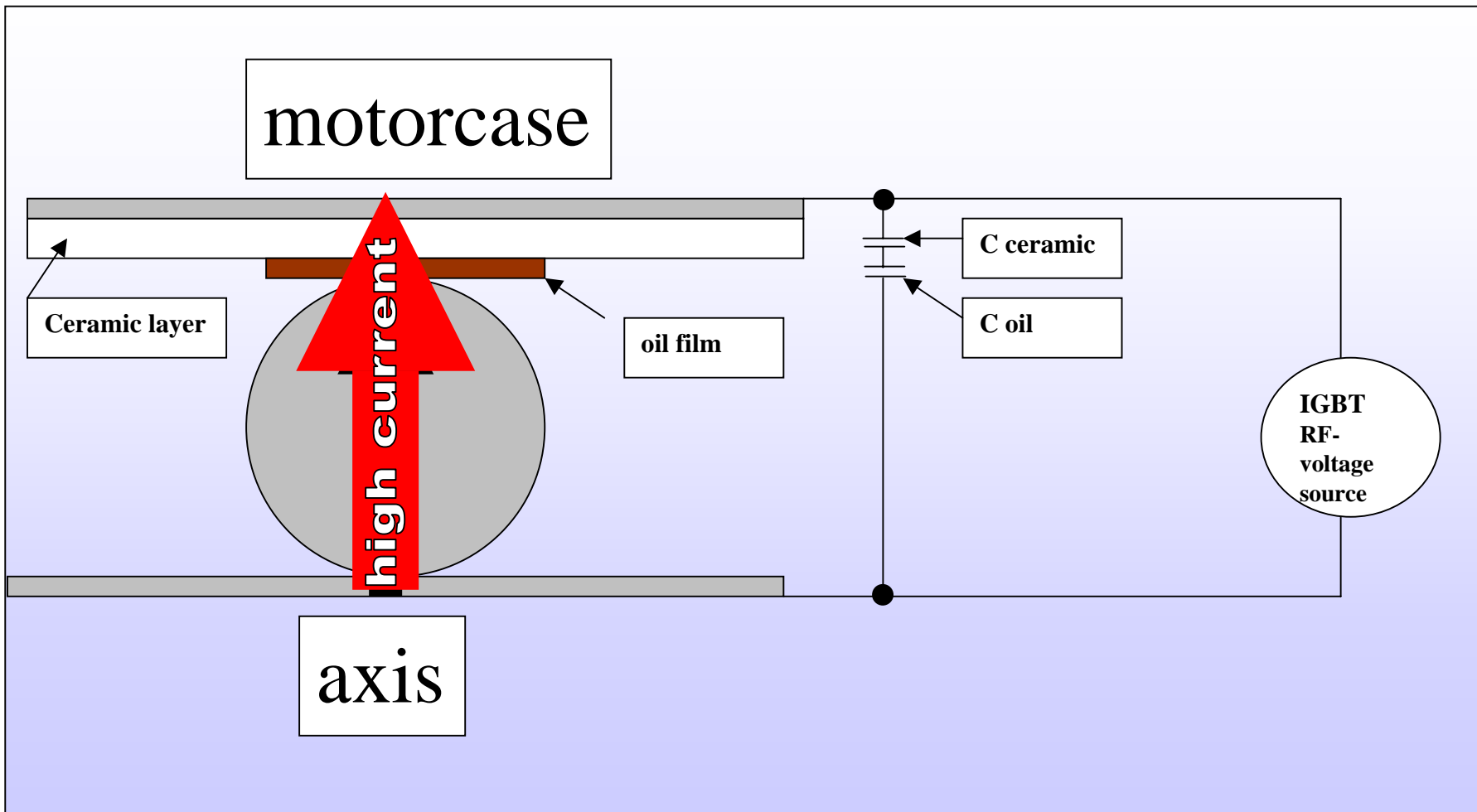
Cool Blue[®] cores to reduce motor bearing currents

Effect even on Isolated bearings



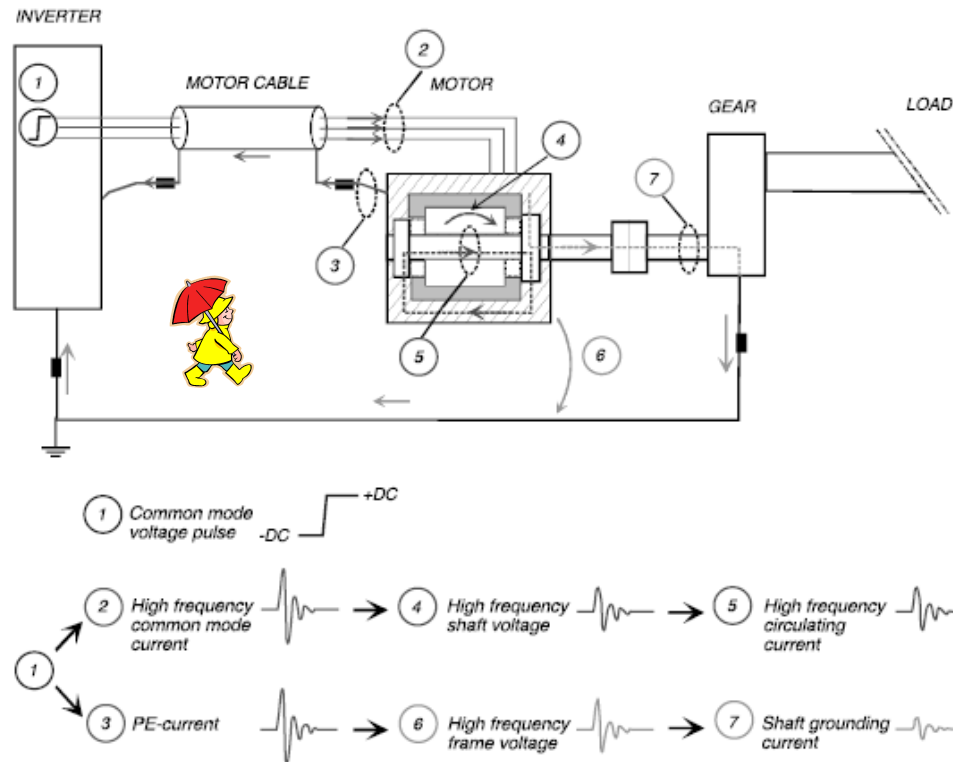
Cool Blue[®] cores to reduce motor bearing currents

Ceramic bearing and oil film short cut



Cool Blue[®] cores to reduce motor bearing currents

How can we avoid these damaging currents ?



Cool Blue[®] cores to reduce motor bearing currents

A view inside the motor

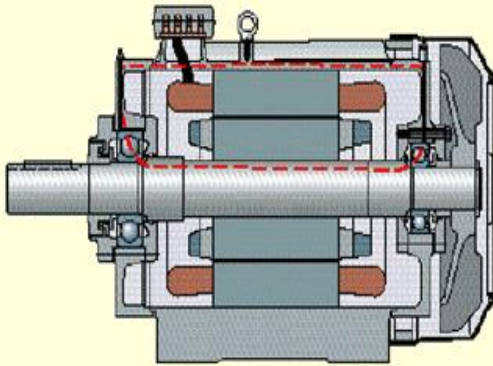
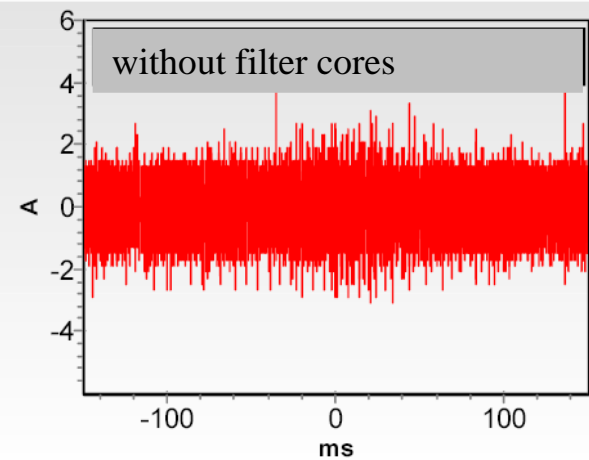
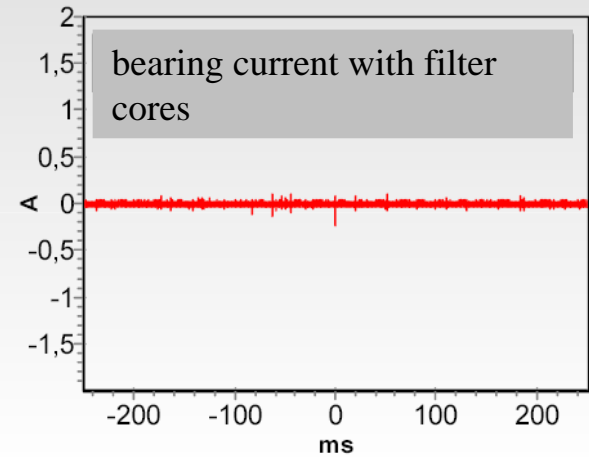
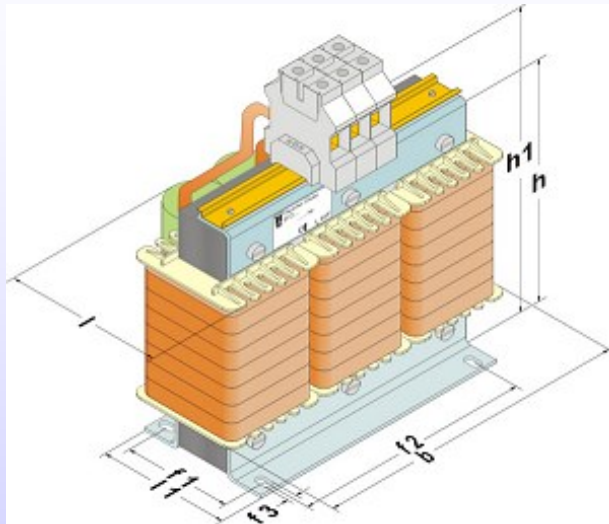


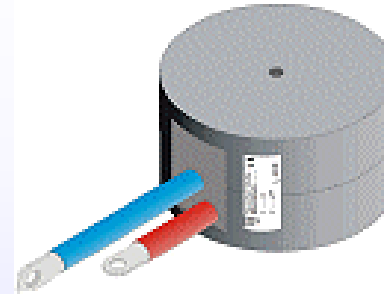
Figure 1: Bearing currents can cause "bearing fluting", a rhythmic pattern on the bearing's races.



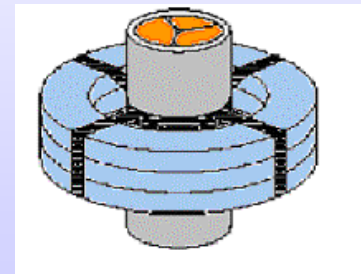
Different solutions are possible



3-phase motor filter



pot cores



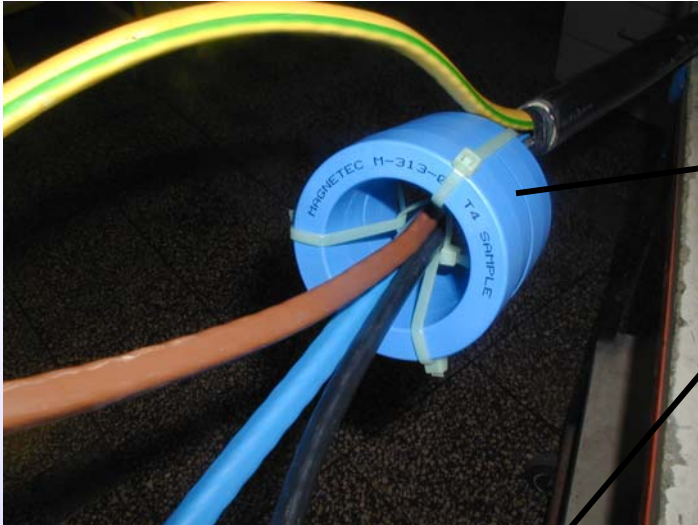
Cool Blue[®] -cores

Cool Blue[®] cores to reduce motor bearing currents

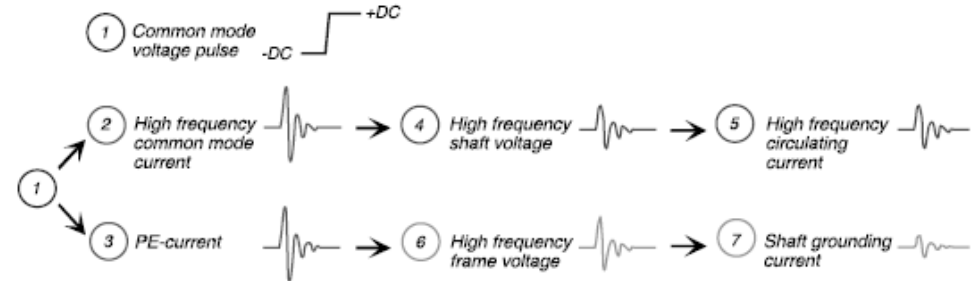
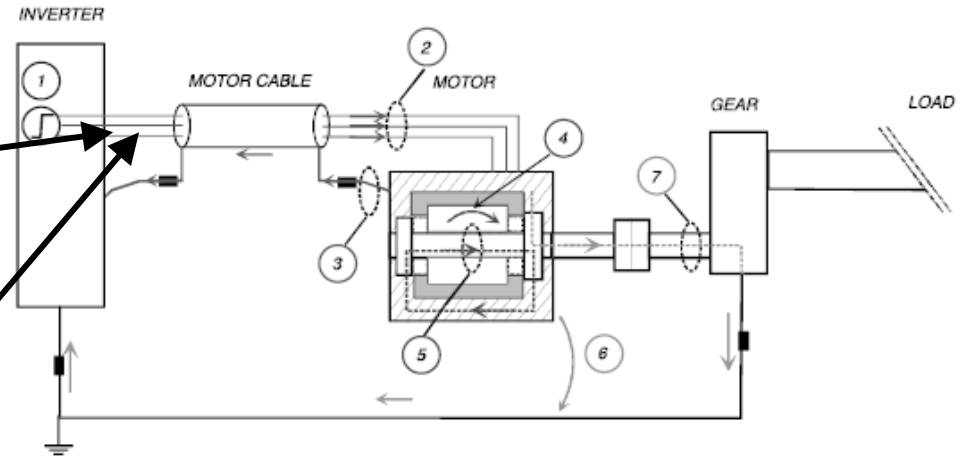
Why do **Cool Blue**[®] provide the best solution ?

- low to no noise operation
- low leakage field
- low loss / cool operation
- small volume
- easy to mount
- can easily be re-tooled
- very good value for the money

How to use Cool Blue[®] cores made of NANOPERM[®]

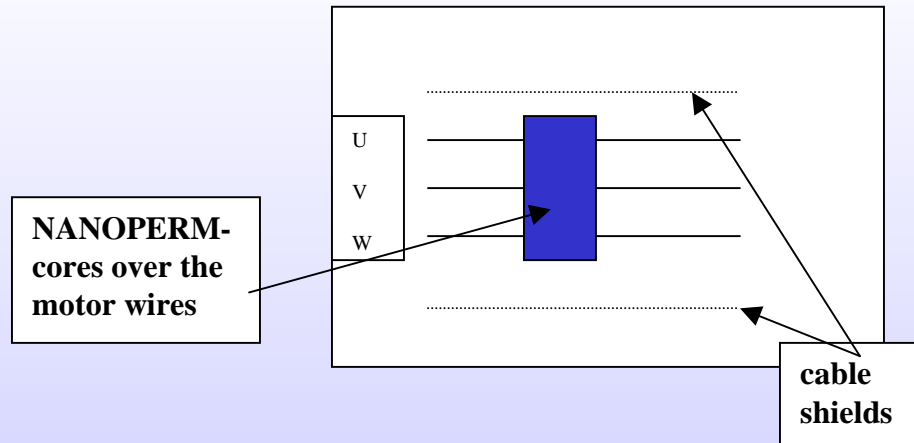


place core here,
cover all wires
but NOT the
shielding (neural)



Cool Blue[®] cores to reduce motor bearing currents

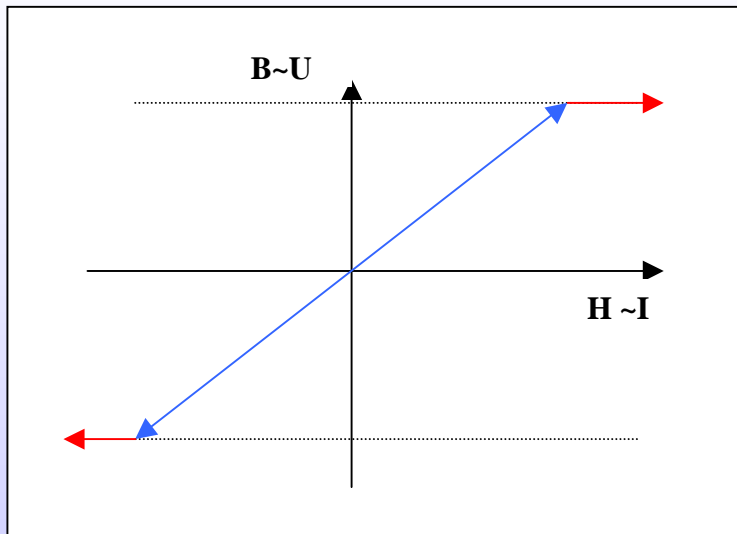
How to use **Cool Blue**[®] cores made of **NANOPERM**[®]



Cores operate as a common mode choke when being put over all motor cables

Cool Blue[®] cores to reduce motor bearing currents

How to derive the right Setup of cores?



$H \sim I$
Relate to the
sum current
 $L1+L2+L3$

$B \sim U$
Relate to the
inducted
voltage in
the core

The amount of cores necessary depends on the sum-bearing current

Experimental approach



The inner diameter is defined by the cross section of the motor cables

3-4 cores should be mounted together

If the core temperature is $> 120^{\circ}\text{C}$ double the amount of cores

If the temperature is still $> 120^{\circ}\text{C}$ select next bigger core size

Available round core standard range

Outer diameter	Inner diameter	h	Order no. p/n	max. asymmetric current (sum-current Peak)
80 mm	63	30	M-113	6 A
100	80	30	M-114	8 A
130	100	30	M-115	9 A
160	130	30	M-116	12 A
200	175	30	M-117	16 A
300	250	30	M-205	23 A

- More core types are available on request
- 4 pieces are typically necessary

Cool Blue[®] cores to reduce motor bearing currents

Available oval core standard range

Outer diameter	Inner diameter	h	Order no.	max. asymmetric current (sum-current Peak)
80 mm	63	30	M-283	6 A
100	80	30	M-284	8 A
130	100	20	M-142	9 A
160	130	30	M-116	12 A
240	200	30	M-111	19 A
300	250	30	M-248	23 A

- More core types are available on request
- 4 pieces are typically necessary

Cool Blue[®] cores to reduce motor bearing currents

Motor bearing currents occur not only in Mega Watt – drives !

In MW-drives the switching frequencies are at around 1 kHz

In kW-drives the switching frequencies are in the 10 kHz range !

This causes motor bearing problems, too!

Conclusion

Cool Blue[®] cores can increase motor bearing's lifetime up to factors compared to the actual standard.

Example:

A standstill in a paper factory for replacing the motor bearing costs about 10k€ per hour.

The investment of some 100 € is a worthwhile maintenance measure - it will double the bearing's lifetime!