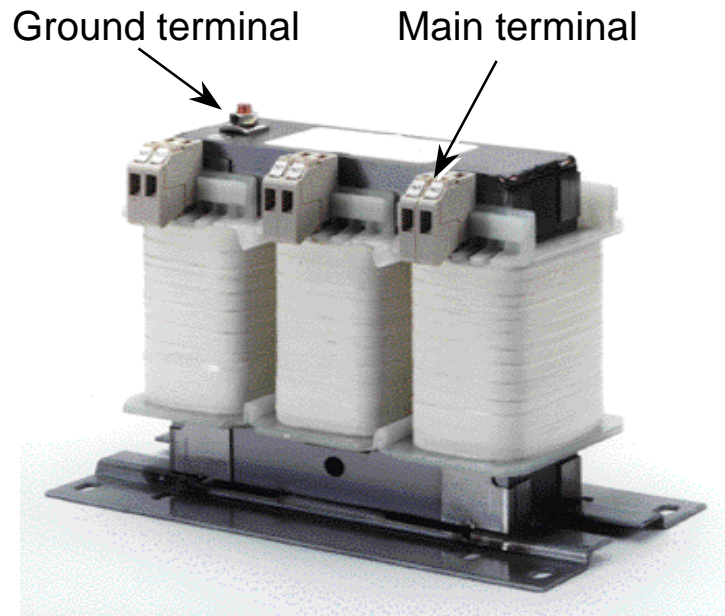




Harmonic suppression reactors for LV PFC

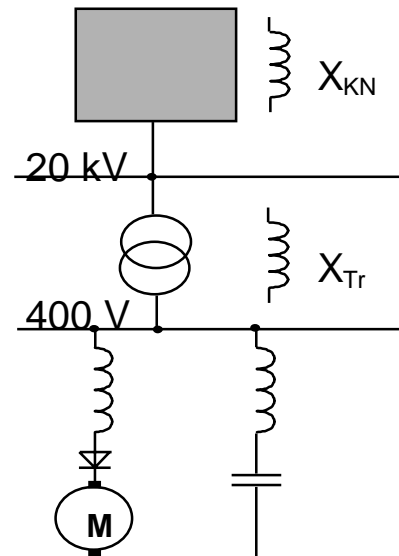
How does a harmonic suppression reactor work?



Three phase filter circuit reactor

Function:

Forms a resonant circuit, avoids resonance and and reduces harmonic pollution



Reactance

$$X_L = \omega \times L$$
$$= 2\pi f \times L$$

with $L =$ constant results a direct frequency response of the inductive resistance

Filter-Reactors for Capacitor banks

Technical features

Standard-Series

➔ Effective filter output
5 kVar ... 100 kVA

➔ Filtering factor
5,67 % - 7 % -14 %

➔ Rated voltage
3AC 400 V

➔ Approvals



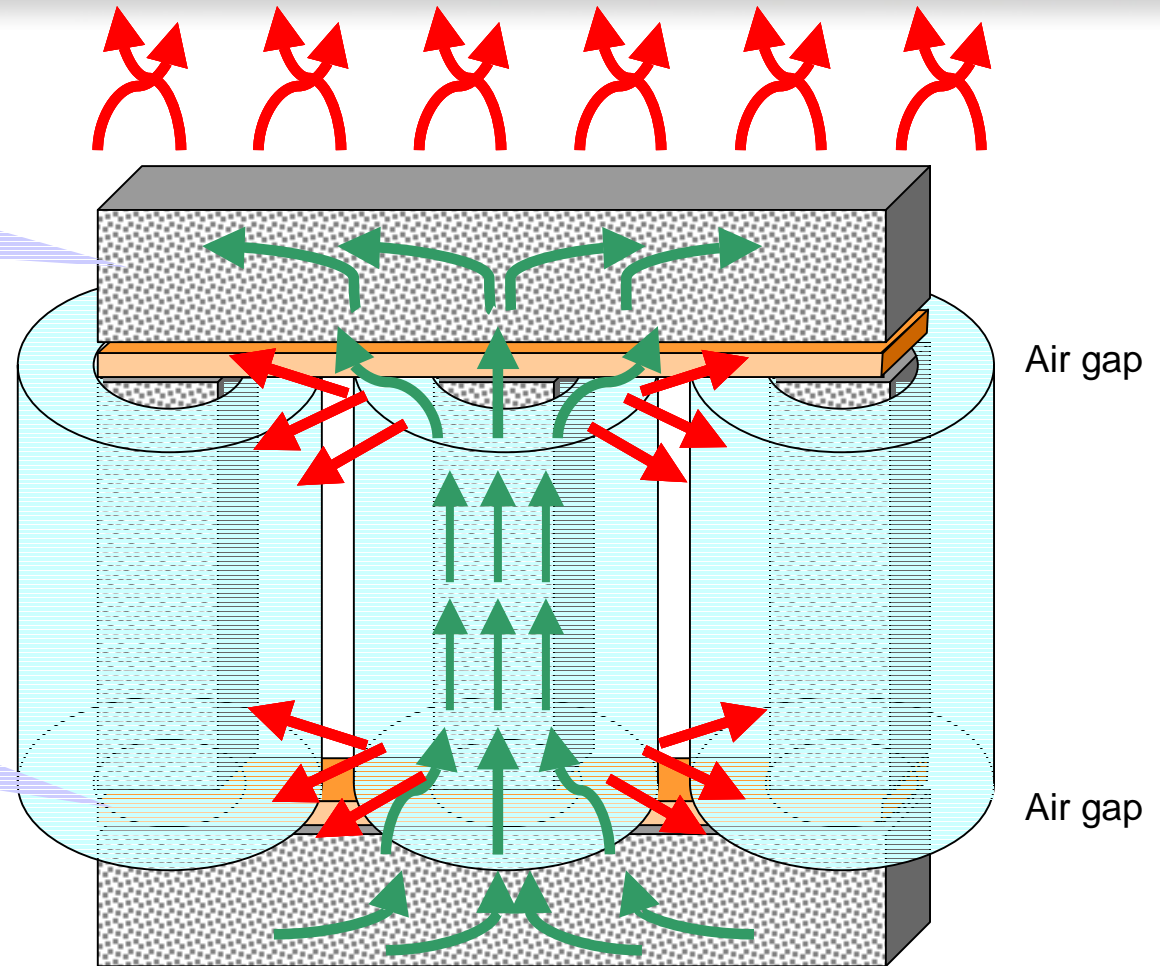

Advantages at a glance

- ➔ Highest Linearity
- ➔ Inductively designed for I_{eff} , thermally permanent with $1,05 \times I_{eff}$ overload-proved
- ➔ Temperature switch in standard-series
- ➔ With mounting plate according to EN 60852, for use of electrical screwdrivers
- ➔ International approvals
- ➔ Highest life time by high quality materials

Conventional harmonic suppression reactor

Harmonics cause high losses in non-oriented core material!

Small number (big sized) air-gaps cause additional losses in windings!

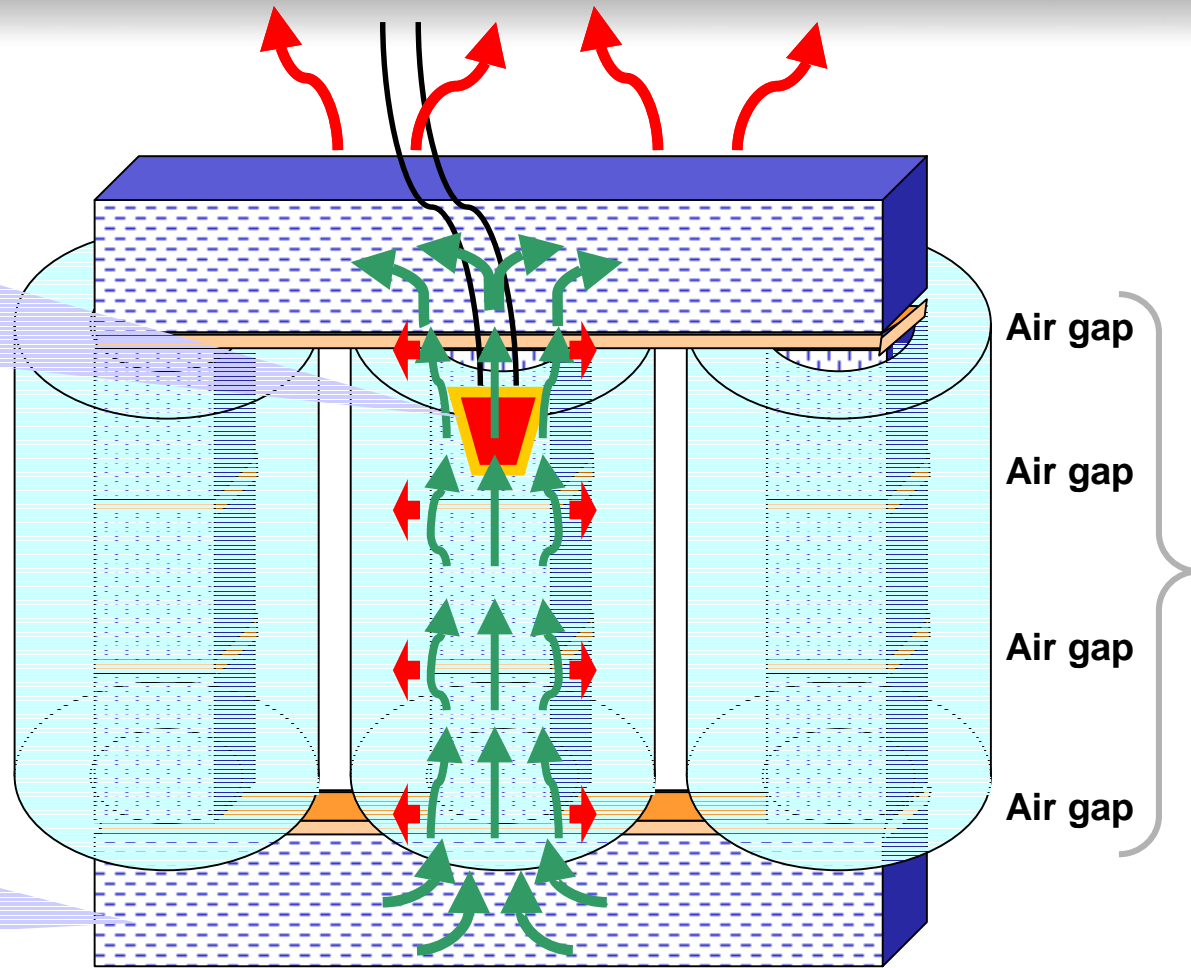


↑ Losses / Heat

↑ Magnetic field

Siemens harmonic suppression reactor

Temperature switch protects the reactor against overload!



High number (small sized) air-gaps reduce losses and heating in windings:
- higher overloading!
- lower electricity cost!

Less losses due to grain-orientated core material!

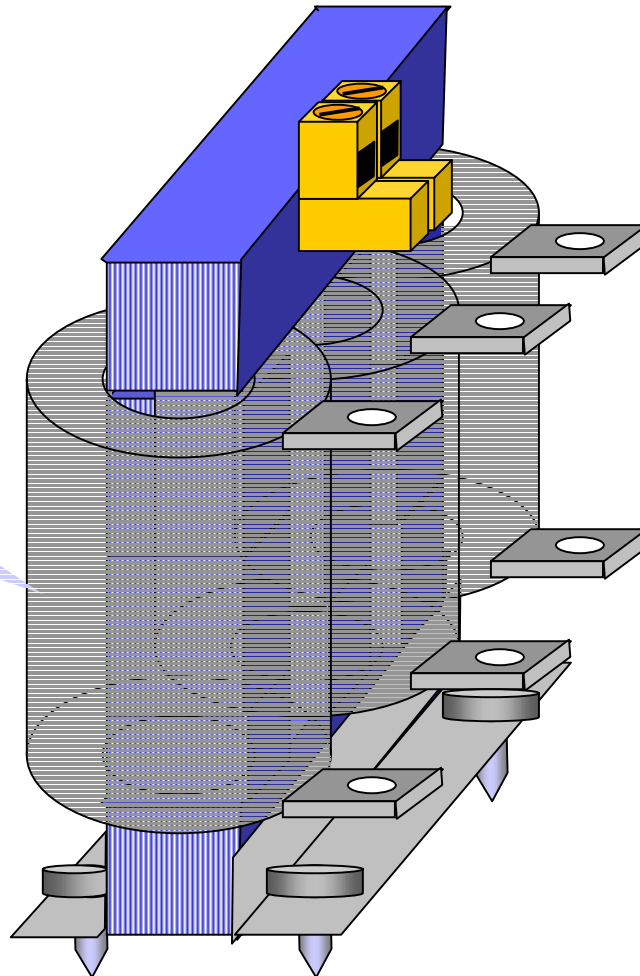
↑ Losses / Heat

↑ Magnetic field

Siemens harmonic suppression reactor

Low in weight!

Aluminum windings reduce weight and cost and make assembly and handling easy!



Low electrical losses reduce electricity cost

Electricity cost due to electrical losses of a reactor: e.g. 50 kvar, 400 V, 50 Hz, 7 %

Comparison: EPCOS vs. Low cost type

	<u>EPCOS</u>	<u>LOW COST</u>
Operating time	24 hours * 360 days 8640 hours	24 h * 360 days 8640 hours
Watt - losses:	210 Watt	320 Watt
kWH - losses:	1814 kWh	3110 kWh
Electricity cost (0.1\$ / kWh):	181 \$	311 \$
<u>Saving per year:</u>	130 \$	

Customer benefits at one glance

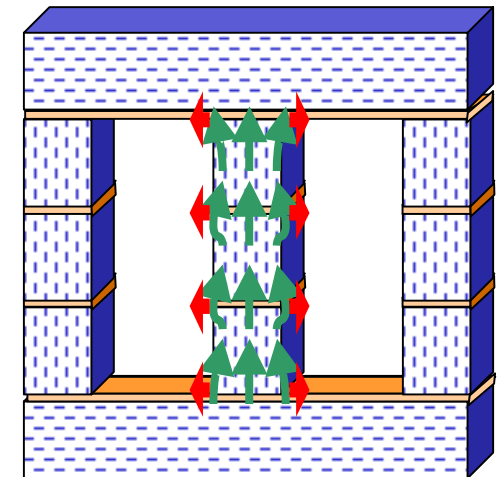
- **Highest linearity, low risk of reactor tilting**
- **Low losses**
- **High over loading capability**
- **Low weight due to aluminium windings**
- **Safety device, temperature micro switch**
- **Low noise**

Customer benefits

Low losses

- Reduction of electricity bill
- Higher overloading capability
- Increase of packing density in a cabinet (more kvar per cabinet)
- Longer life time of the reactor
- Longer life time of the capacitor and total system

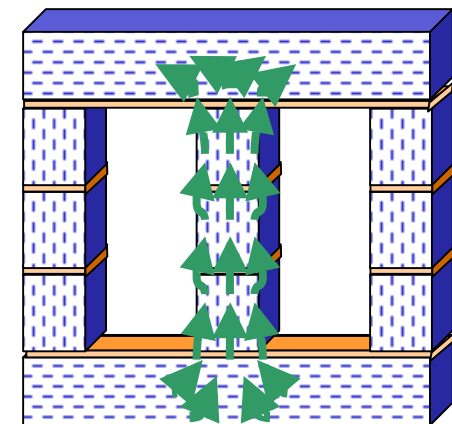
- Grain oriented core material
- Multiple air gap
- High quality winding material



Customer benefits

Highest linearity

- No saturation up to highest currents
- Low risk of reactor tilting
- High inrush current carrying capability
- High harmonic loading capability



Air gap
Air gap
Air gap
Air gap

Parameters definition

- **I_{lin}**
- **I_{thermal}**
- **I_{RMS}**
- **Losses**

Customer benefits

Safety device, temperature micro switch

- Temperature micro switch in the contactor coil branch will disconnect the contactor/capacitor in case of over temperature
- Reversible: after temperature is down again the reactor will be re-connected and is still OK
- Safety device connected to an alarm signal will inform maintenance people in time to investigate the system and protect from damage

