



BUSBARS and CAPACITORS BANK DESIGN



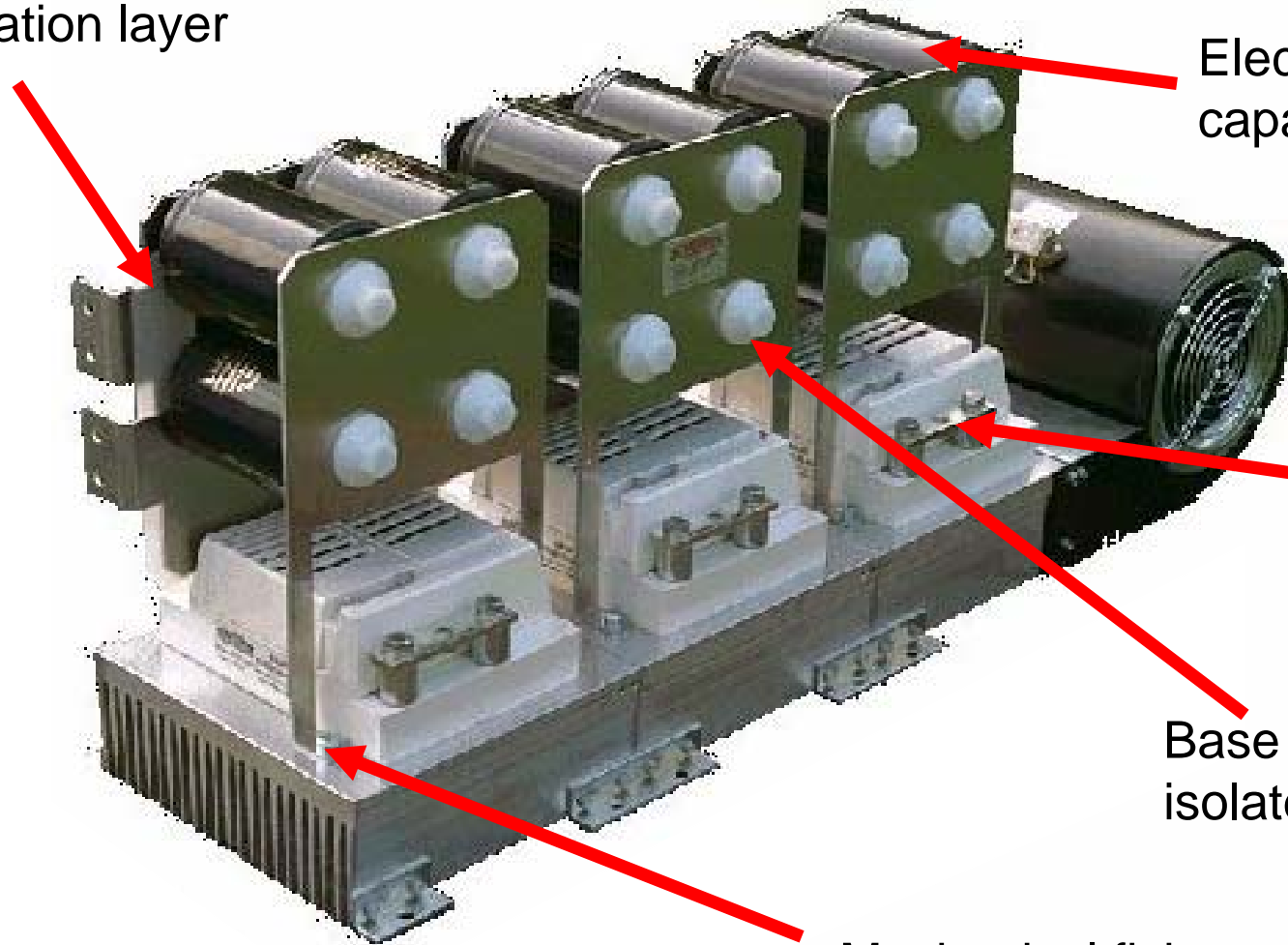
Insulation layer

Electrolytic capacitors

Equilibrated outputs

Base of capacitor isolated : plastic nut

Mechanical fixing and constraints on the heatsink

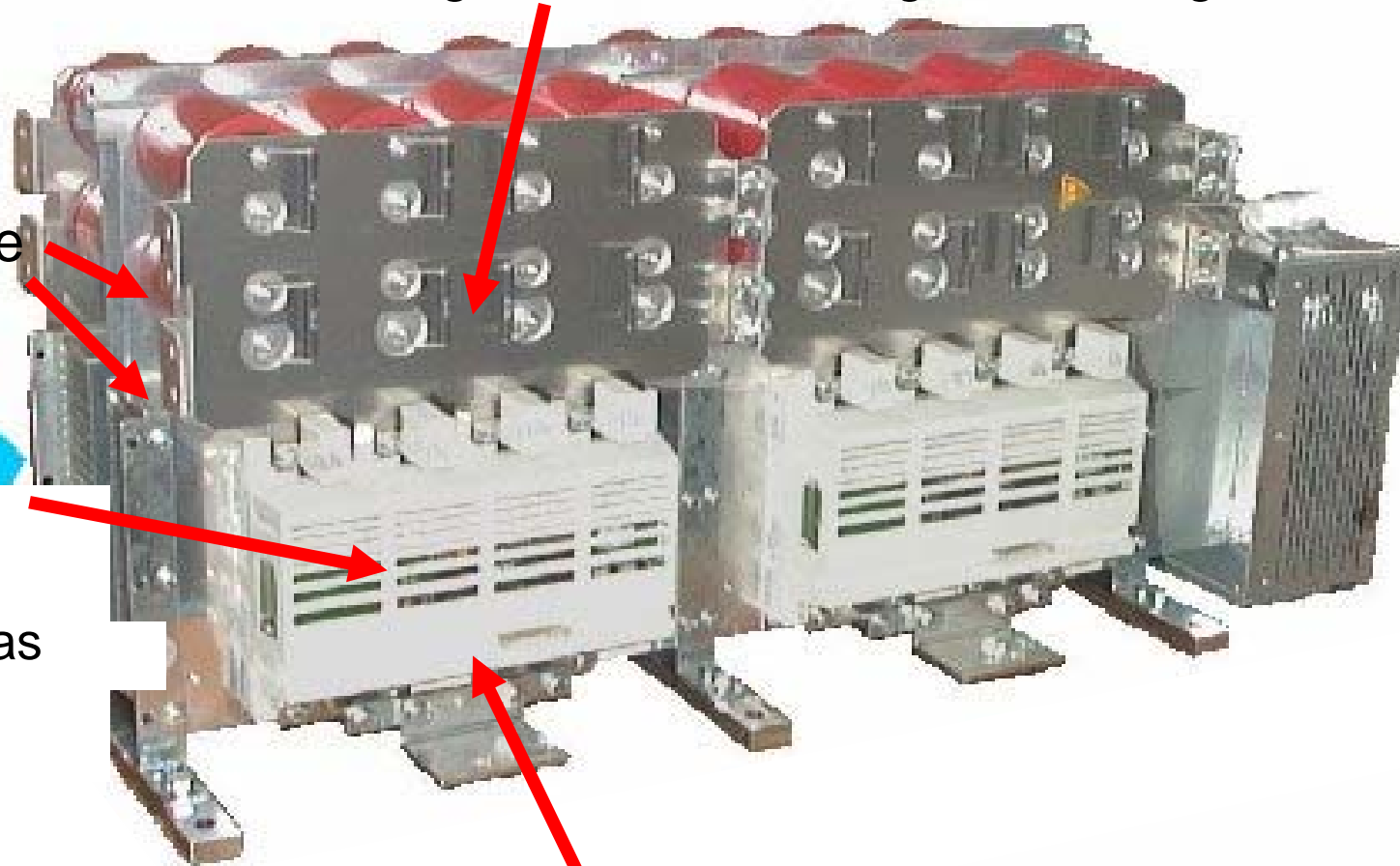




Sharing Resistors : Voltage balancing => $R=R_{leak}/10$

Connection principle for mounting the busbars in line

Metal Plate :
•as capacitive as possible (low inductivity)
•as few resistive as possible



Snubber : Compensation of plate inductivity



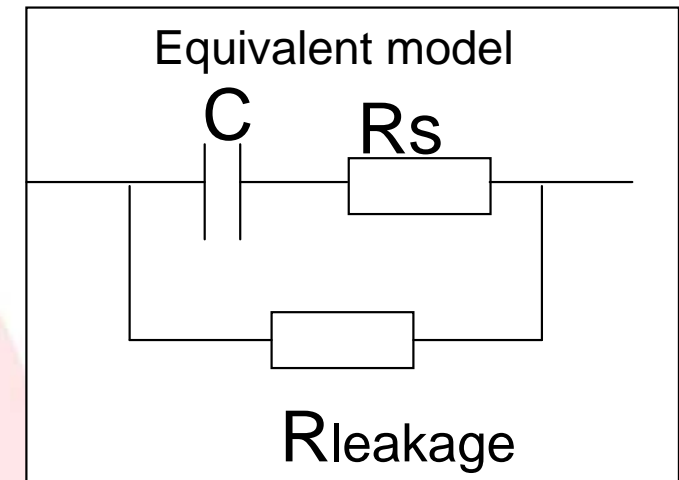
- Electrolytic : “Standard” for most of applications at low voltage (< 800-900 Vdc)

- Advantages :

- very economical
- high capacitance

- Drawback

- low current
- “flash point” of the electrolyte = 100°C => fire possible
- polarized technology => cannot be mounted on the reverse direction
- PVC coating is solvent in the electrolyte





■ Polypropylene :

■ Advantages :

- bigger cans => 1 single cap for a whole stack is possible
- higher current, reliability
- no capacitors in series ==> no sharing resistor
- Non polarised

■ Drawback :

- for a same volume : Celect >> Cpoly
- Usually, higher prices



Voltage :

Nominal voltage (With no stress)

Peak Voltage

Value of C :

Might be or not imposed by the customer

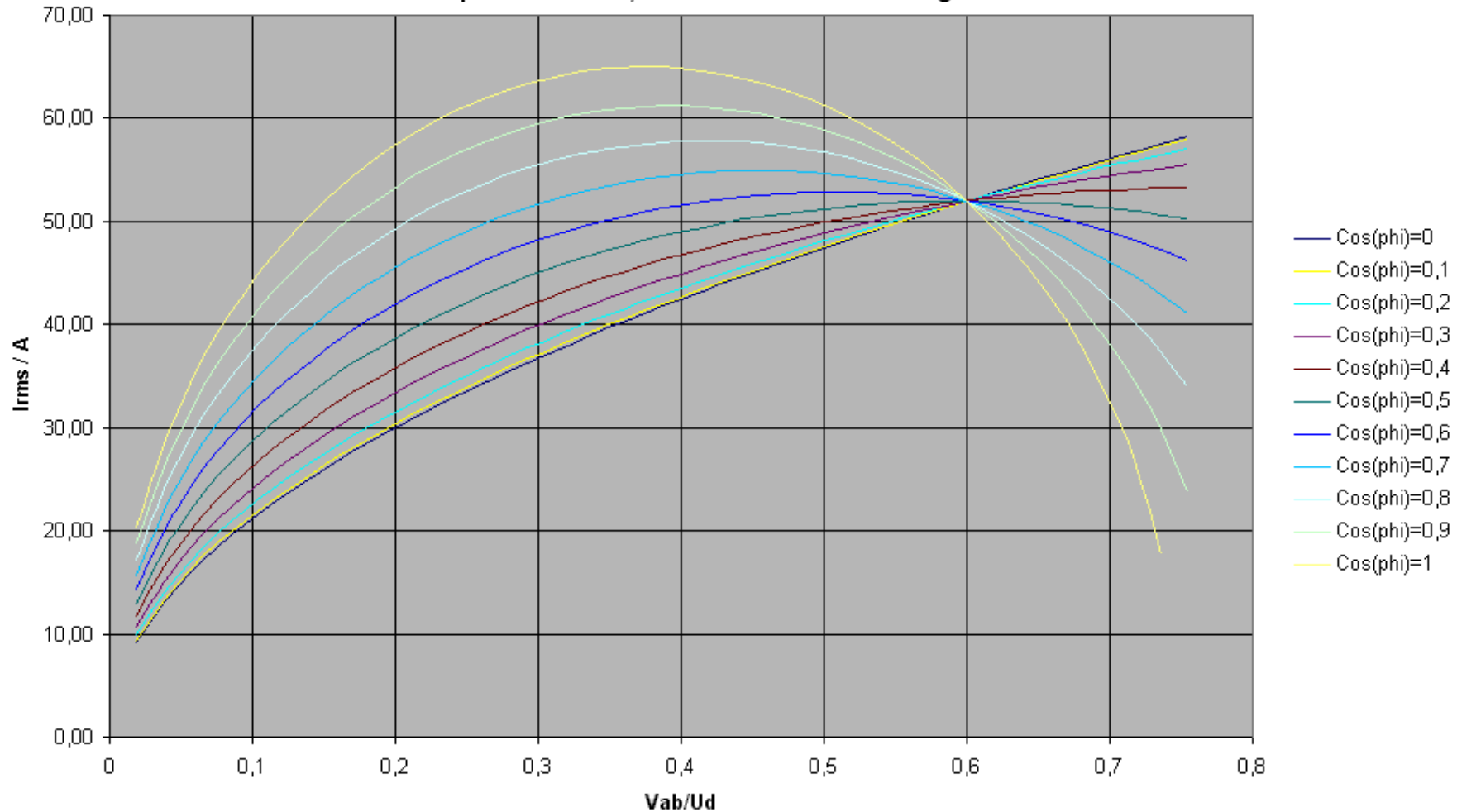
DC voltage stability

discharge time

In most cases, C is a result of maximum permissible current, and therefore **lifetime expectancy**



$I_{rms\ Caps} = f(V_{ab}/U_d)$ and $I_{load}=100\ A$
3 phase inverter, current from the switching side

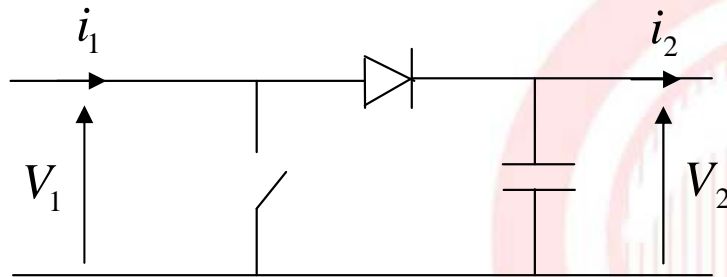


Capacitors current, inverter-caps current
3 phases sinewave inverter



- For Active filter, $I_{cap} = I_{load}$ (source ABB-Jumet)
- For 4Q - 3Phases converter $I_{cap} = I_{load}$

- Boost converter :



$$\alpha = 1 - \frac{i_2}{i_1} = 1 - \frac{V_1}{V_2}$$

$$I_{eff} = i_2 \cdot \sqrt{\frac{\alpha}{1-\alpha}}$$

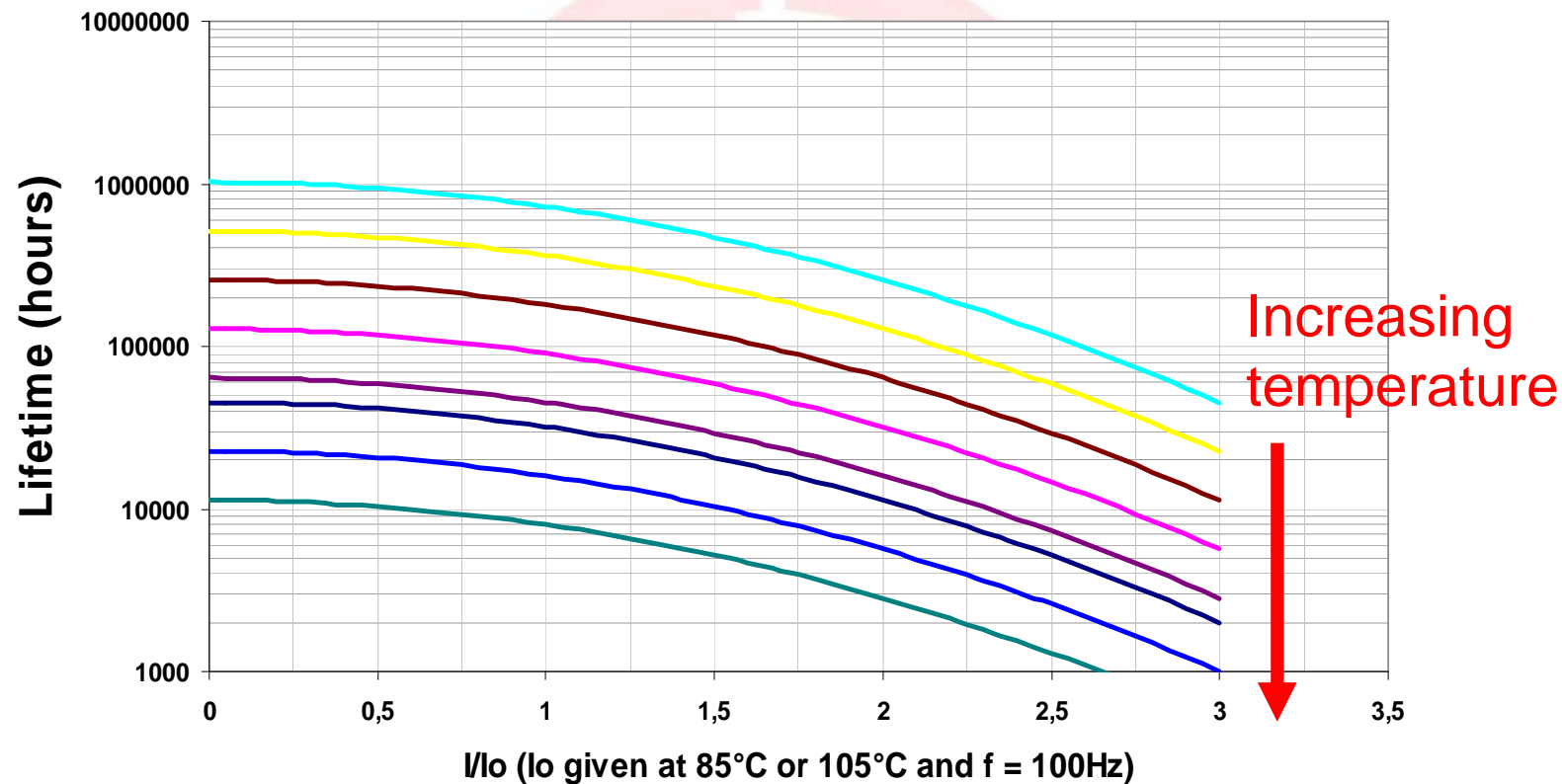


Lifetime of 1 capacitor = Lifetime of Capacitor bank (Lifetime \neq MTBF)

Major parameter for electrolytic : hot spot temperature

Estimation of I_{rms} in 1 capacitor of the bank

Suppliers give LTE curves vs RMS current and ambient temperature





■ Mounting

- ◆ Good Heat convection : caps should not be too close the ones from the others (3mm standard)
- ◆ No mechanical stress : dynamometric wrench, tolerance respect on the bus-bar, no pulling stress on the terminals
- ◆ Always mount capacitors from one single lot onto one single capacitor bank, no mixture between lots
- ◆ Caps valve should be mounted with the plastic valve on the upper side of the cap, so the gas can exhaust from the failing cap
- ◆ Advise the customer to put a “Warning” sticker concerning the discharge time of capacitors

■ Test

- ◆ Voltage balancing at low and high voltage



■ Storage / handling

- ◆ Electrical connection : no mechanical constraints (when lifting)
- ◆ Moisture free, special temperature
- ◆ Yearly forming
- ◆ FIFO stock, one year maximum





- Sharp edges should be avoided as they are concentrating electric charges
- When the busbar is machined, pay attention to the burrs that may hurt the isolating sheet ==> direction of cutting should be specified on the drawings to the supplier
- Material :
 - ◆ aluminium, 2.5 mm thick as a standard Copper,
 - ◆ nickel plated copper for marine application
 - ◆ isolator : polyester, 0.25 mm thick : very easy to cut at the dimensions desired