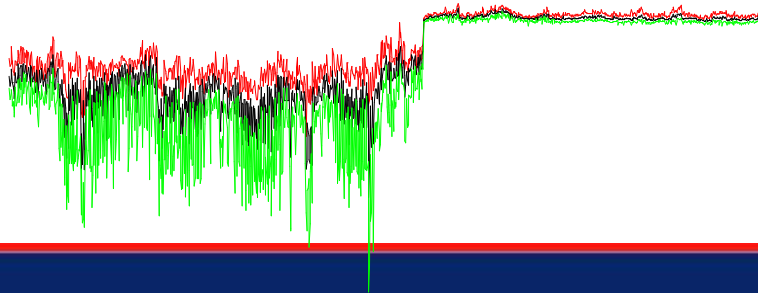


Magtech Voltage Booster – for outdoor use

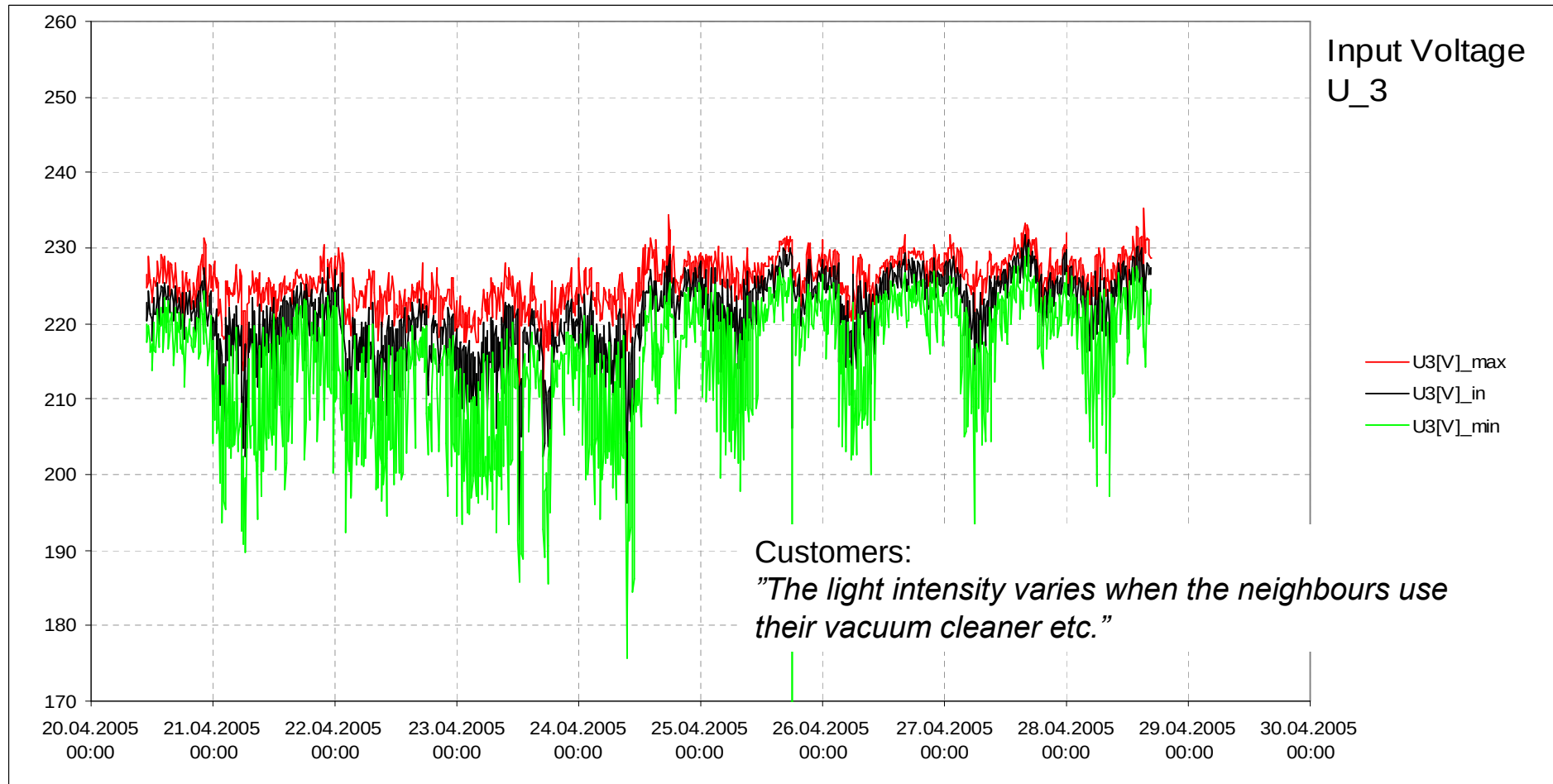
- ✓ Raises and stabilizes voltage
- ✓ Balances out skew voltages and currents
- ✓ Increases single phase short circuit current by typically
 - ✓ more than 60% (Grd. Y-grid)
- ✓ Reduces or postpones network investments



Vattenfall Eldistribution AB - Djurönäset, Värmdö
315kVA transformer, 820 meter(Al 50) MVB placed after 600m, load:3 houses (30-60A /400V)



Voltage phase 3 measured before MVB in April 2005



Vattenfall Eldistribution AB - Djurönäset, Värmdö



Registered Trademark

Voltage phase 3

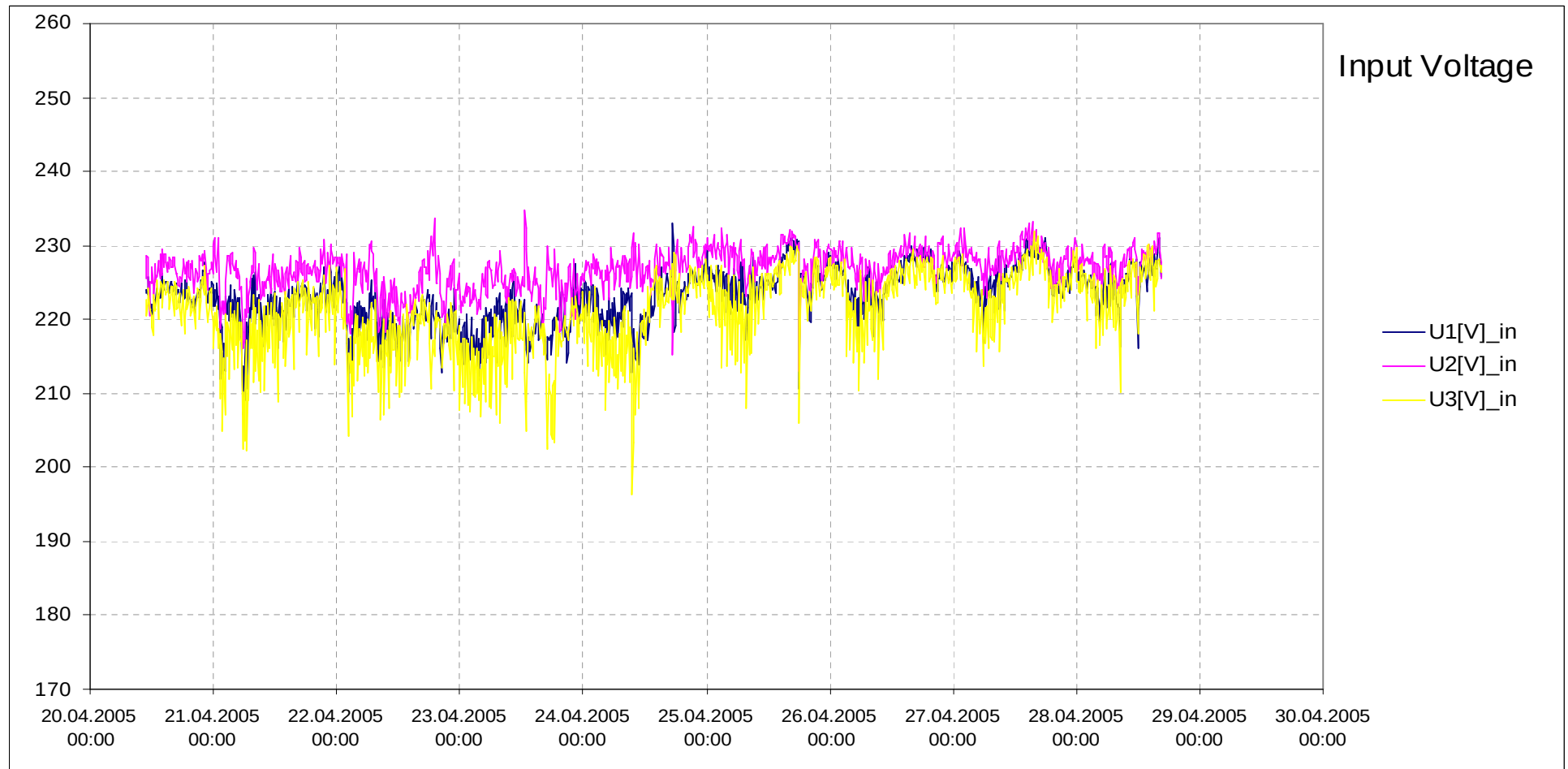
Regulated voltage from MVB in October 2005



Vattenfall Eldistribution AB - Djurönäset, Värmdö

Three phase – unbalanced load

Previous → Unbalanced load → asymmetrical voltage



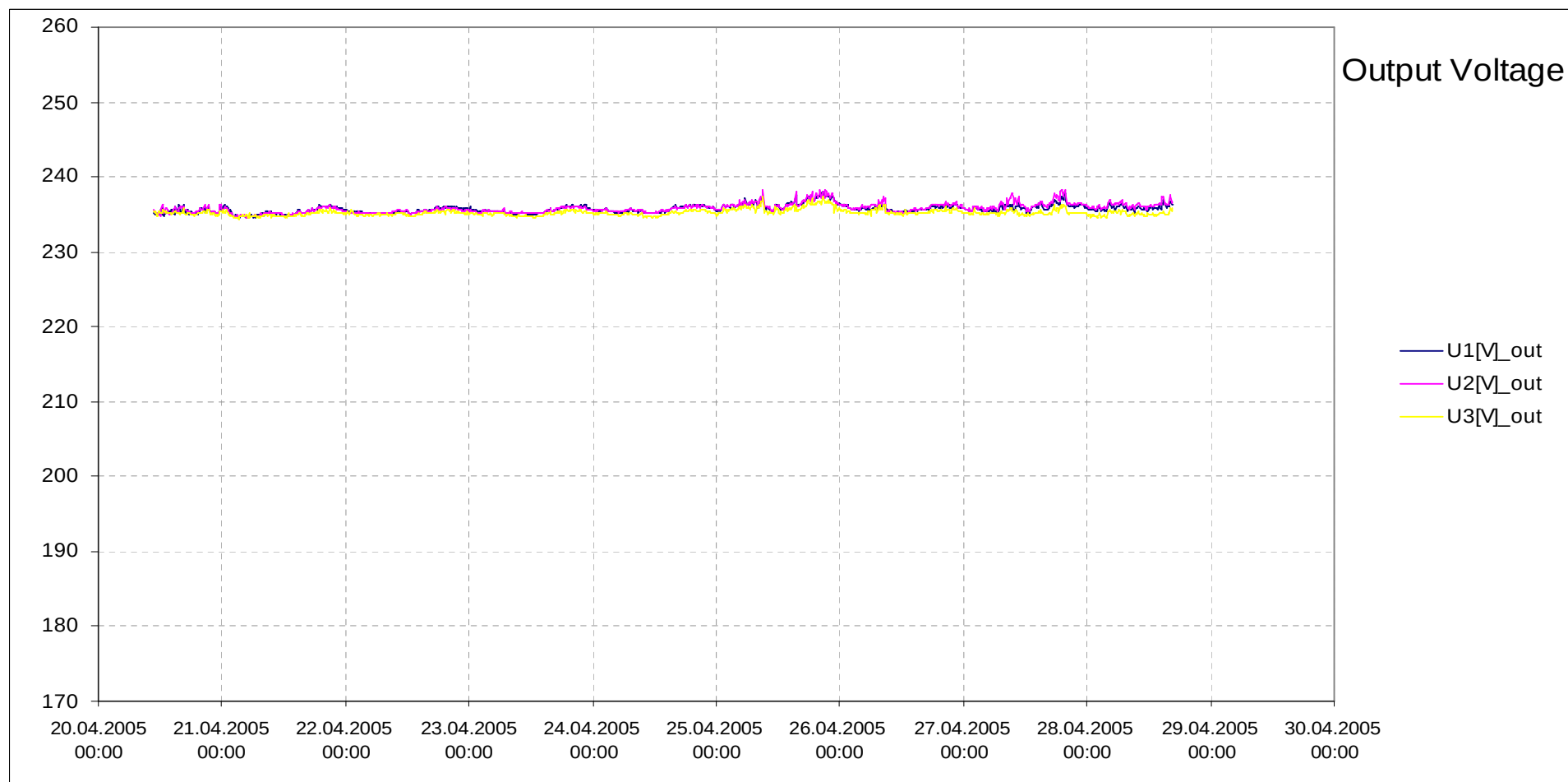
Vattenfall Eldistribution AB - Djurönäset, Värmdö



Registered Trademark

Three phase – unbalanced load

Now with MVB → voltage is balanced → symmetrical voltages



Vattenfall Eldistribution AB - Djurönäset, Värmdö



Registered Trademark

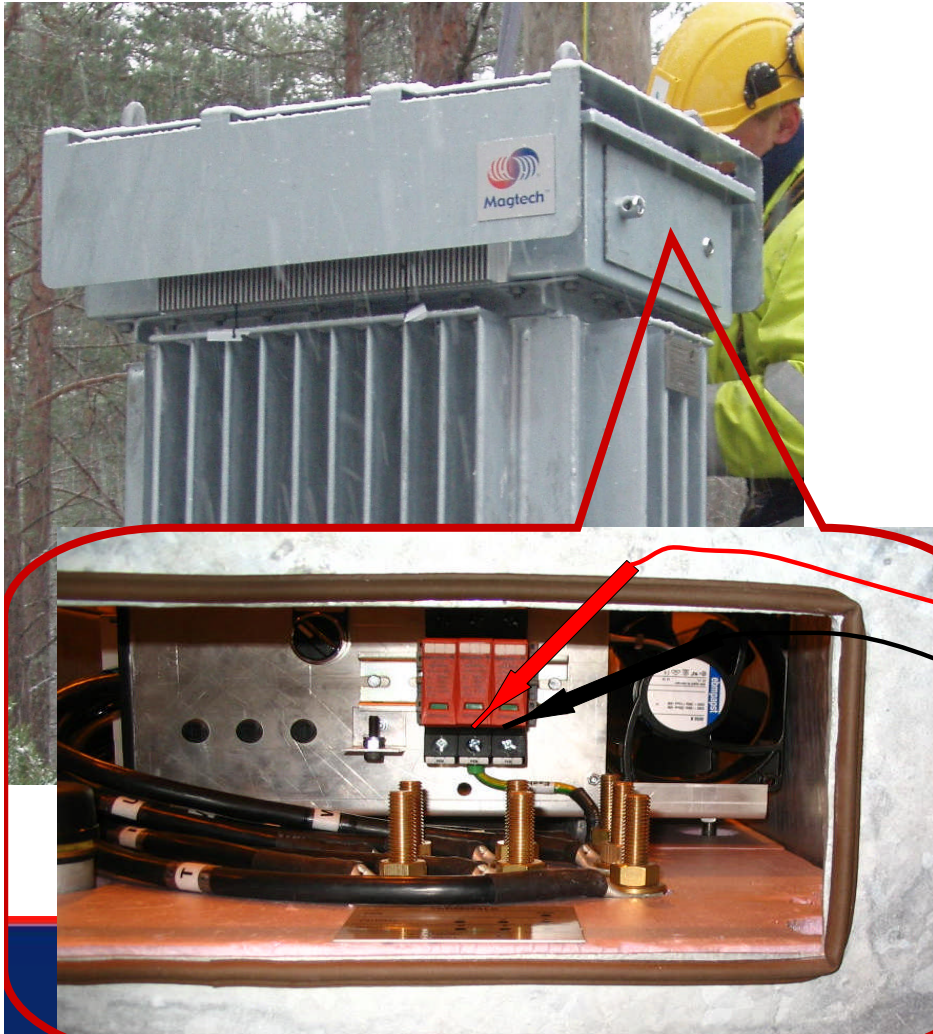
Surge arresters (input and output)

Main arresters to be installed at the pole-top (option) Not necessary when the unit is mounted for ground cables

Medium arresters are integrated in the unit (standard)

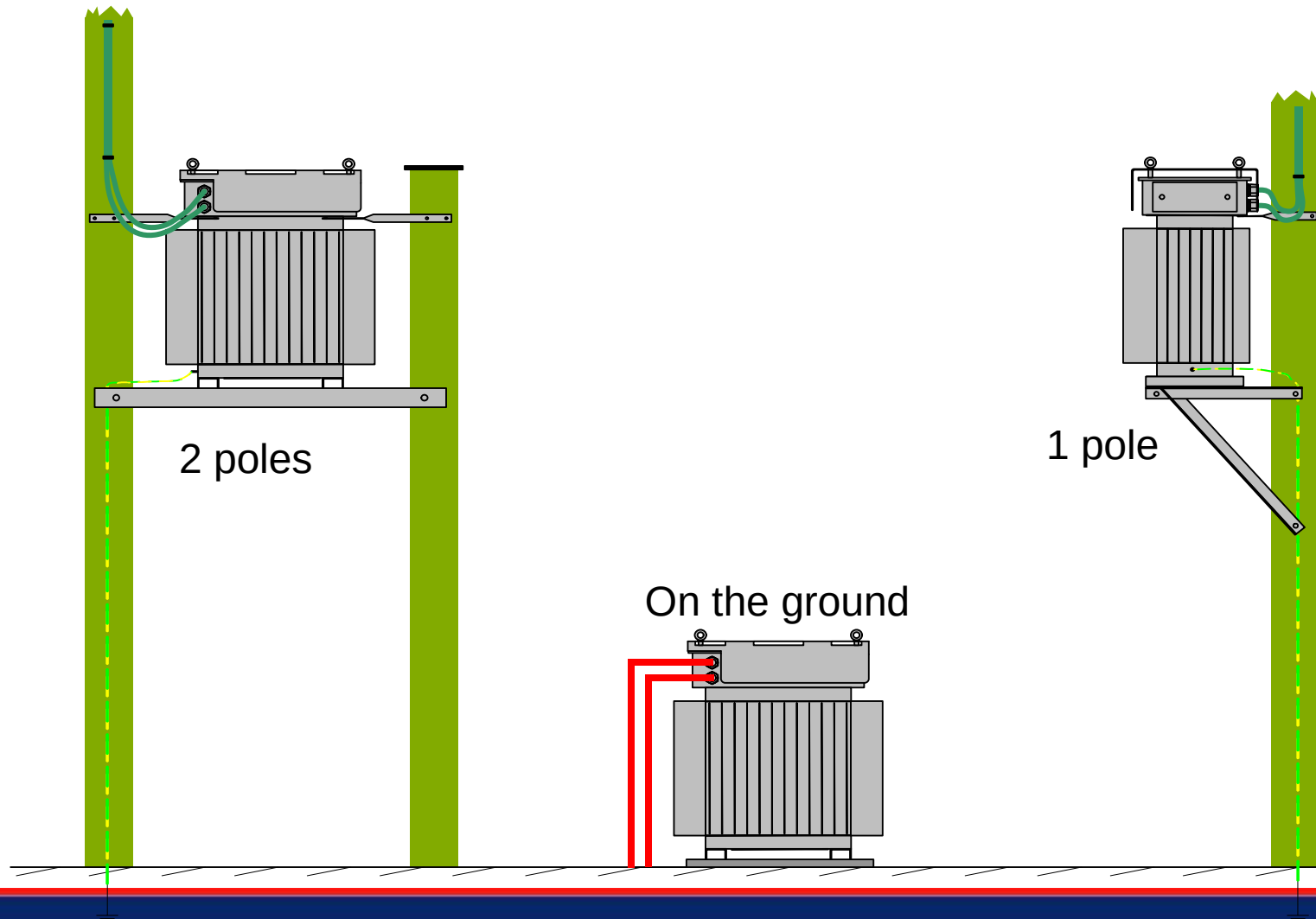


Startup

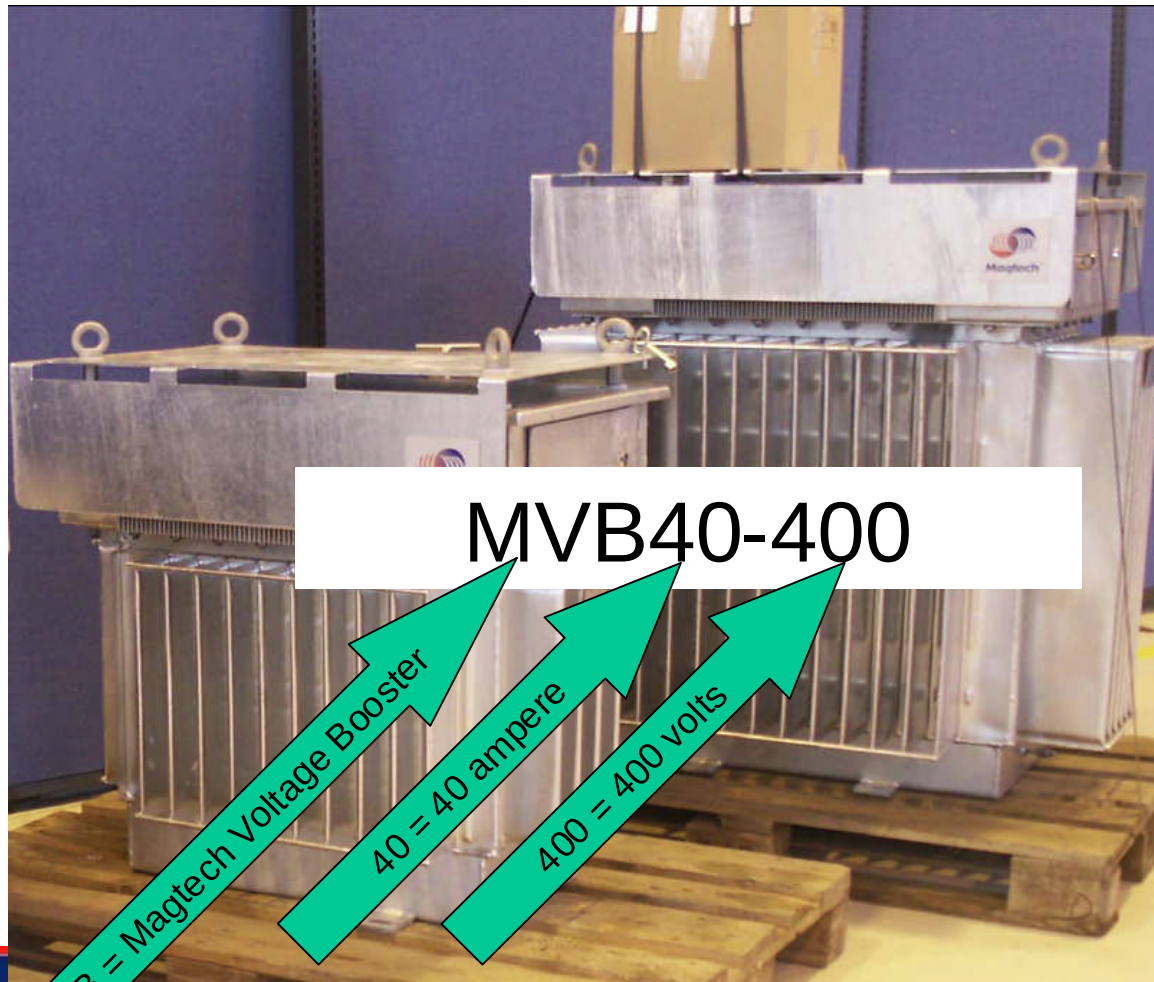


- Check that phase sequence is positive (CW)
 - Note! Voltage boosting will not start when phase direction is negative.
- Start voltage boosting by turning the switch.
- Check voltages

Installation



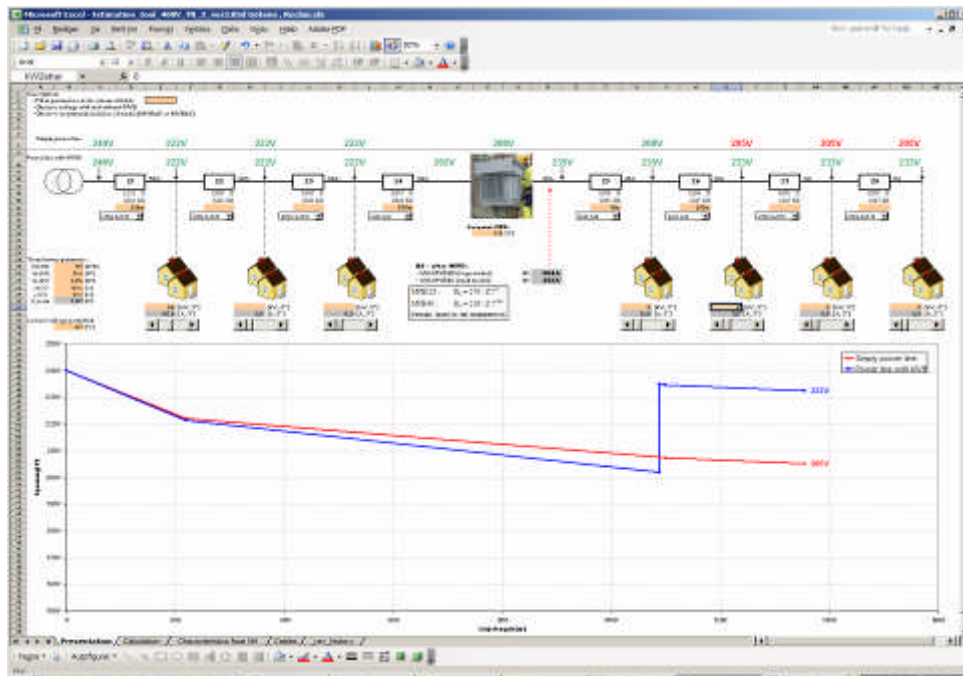
Product sizes



- **MVB40-400 (230)**
 - 17 kVA (max 28 *)
 - Boost: 20%
 - 390 kg
- **MVB125-400 (230)**
 - 55 kVA (max 87 *)
 - Boost: 20%
 - 750 kg

* Overload capacity:

+ 60% for 6 hours @ 20 °C



What Software?

- Simple calculation tool in Excel to find the voltage along the line from transformer to the customer and locate the optimum position for the MVB.

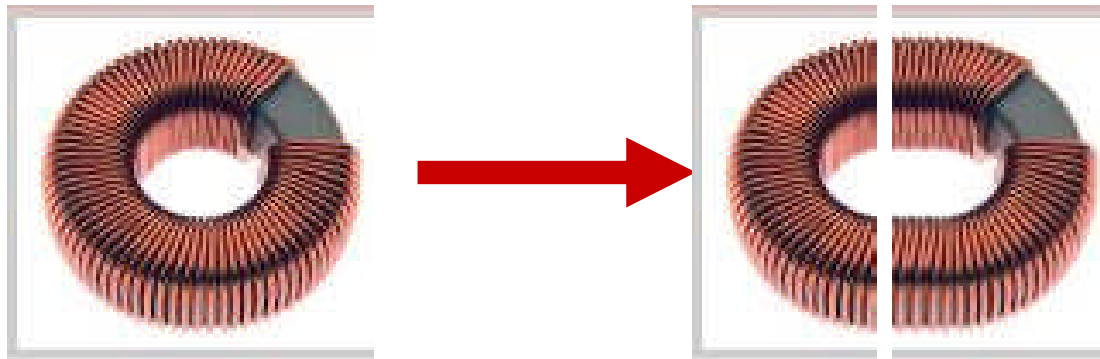
How?

- The planner can make a quick estimation of voltages with and without the voltage stabilizer MVB.

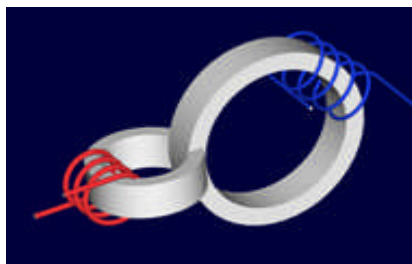
MCI

Magtech Controllable Inductance

Known technology: control of inductance by changing the virtual air gap:

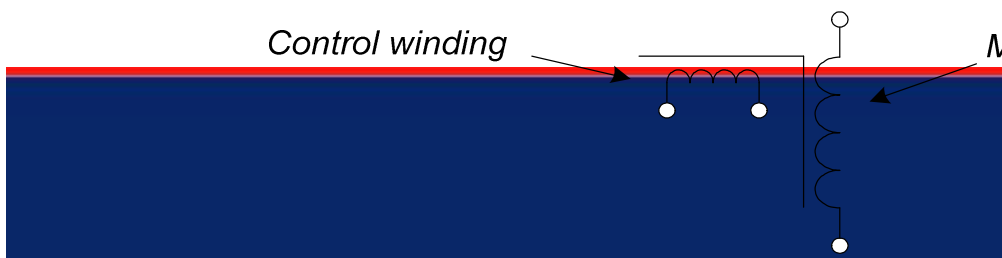


Magtech: virtual air gap solved in practice - patented

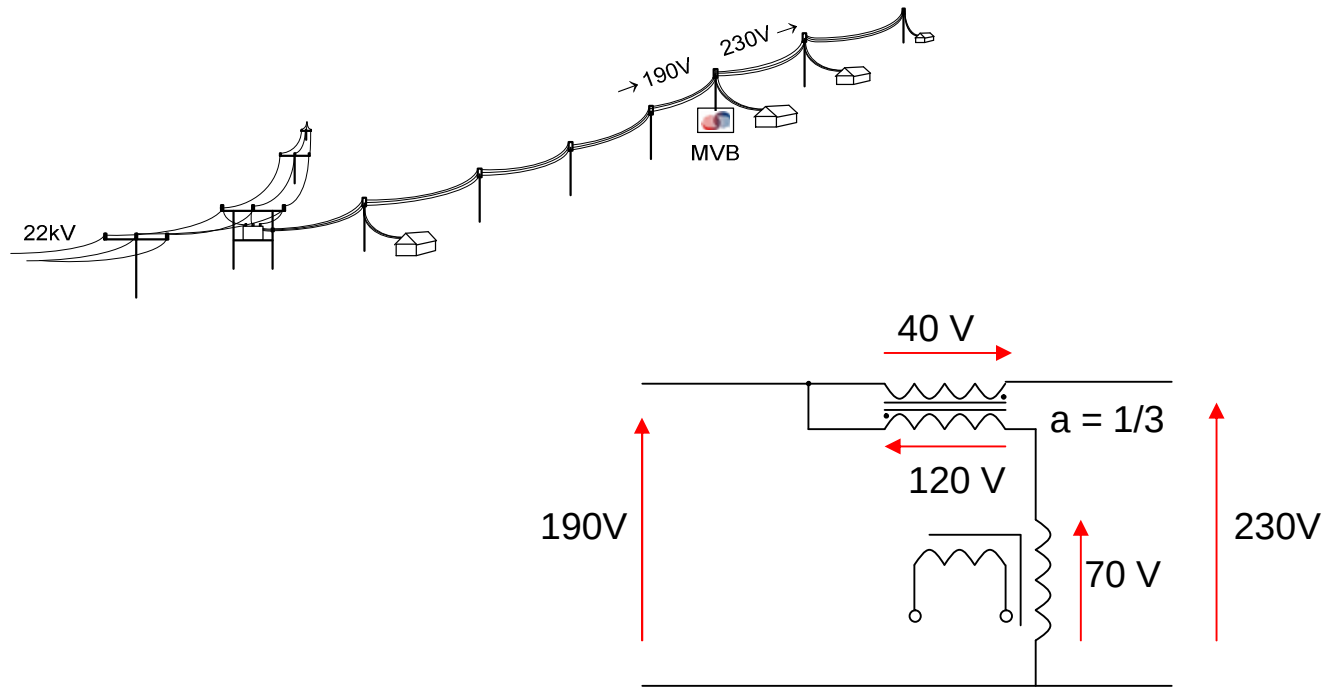


Control winding

Main winding

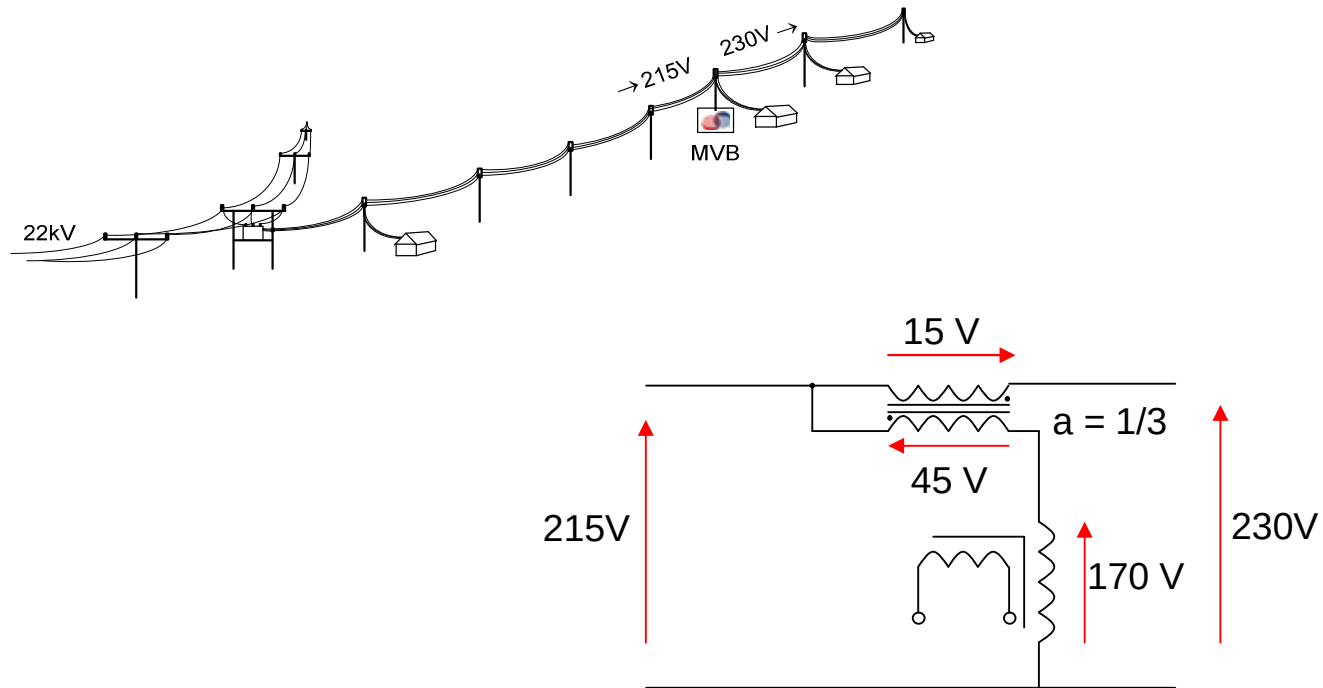


Technical principle for the MVB

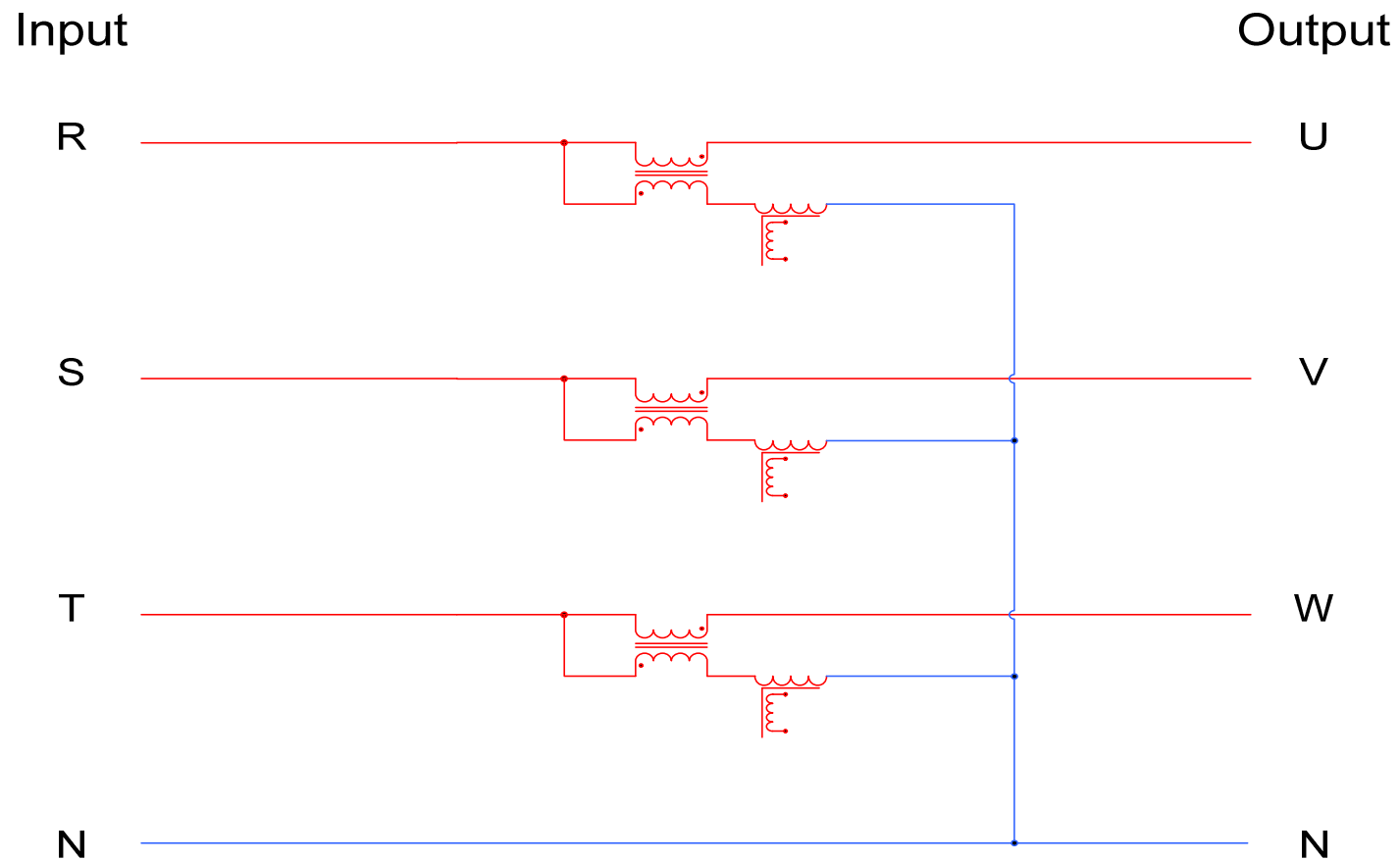


... one of the customers turns off the electric cooker ...

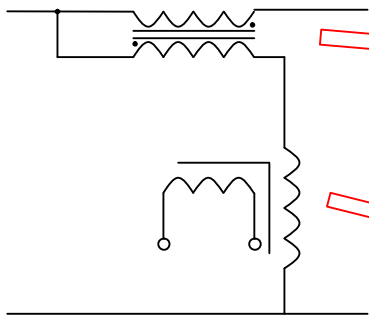
Technical principle for the MVB

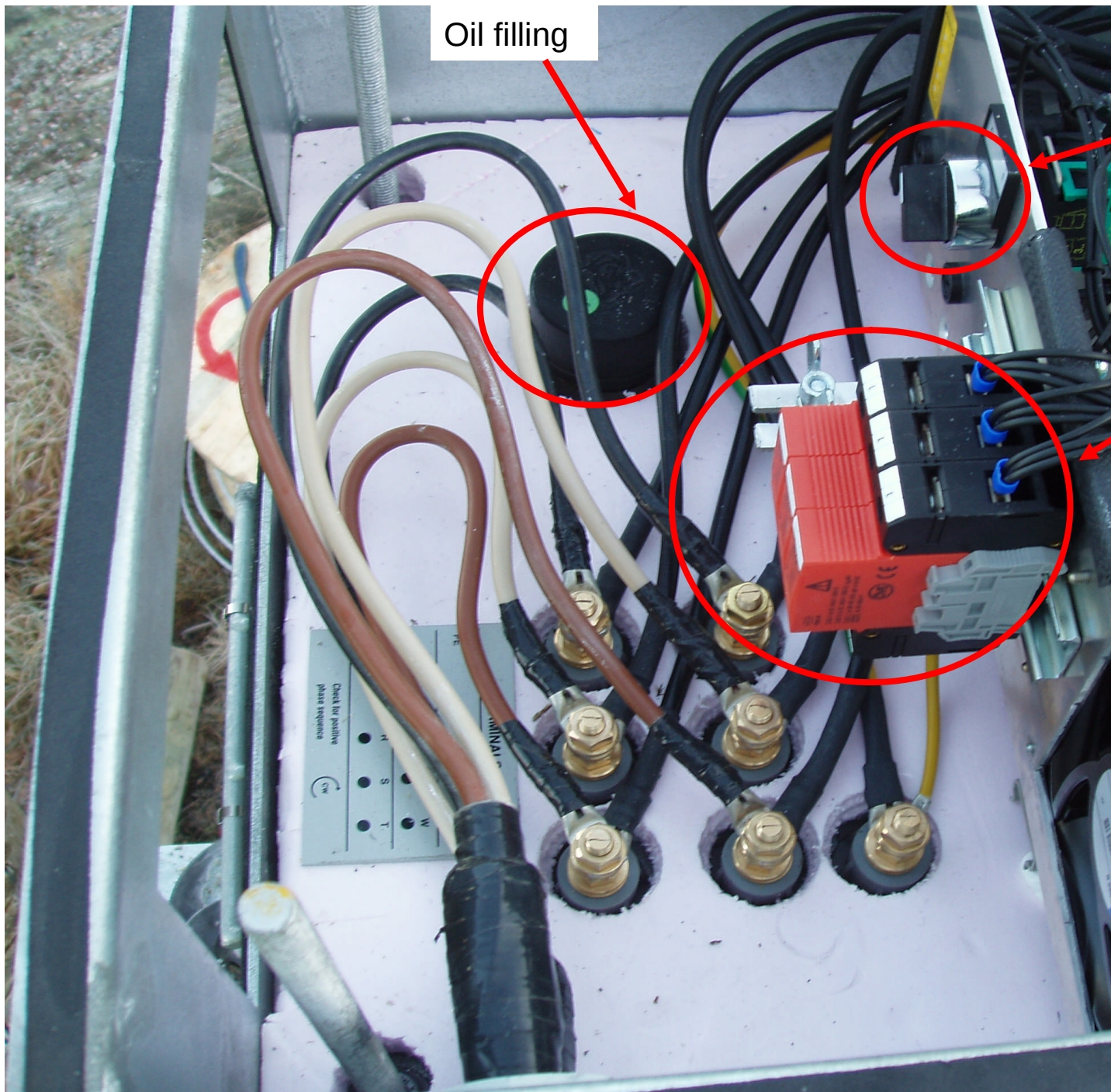


MVB for Grd. Y-network



Auto transformers and Magtech Controllable Inductance (MCI)





Oil filling

ON / OFF –
switch

surge protection

Connections for
installations, and operating



Registered Trademark

Unbalance in the Grd. Y-network

Normal problems in the Grd. Y-network:

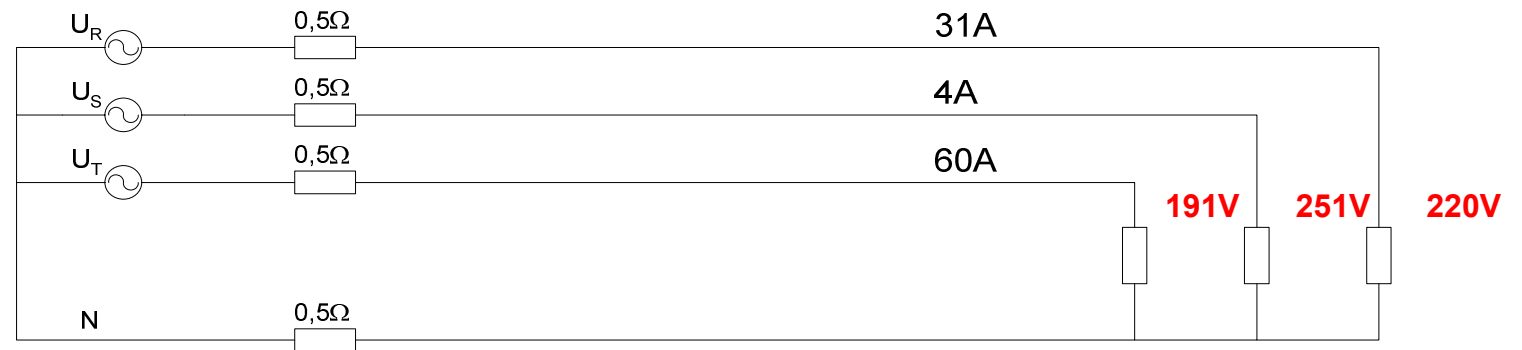
- Single phase load affects all the phases – one dips, while the other two rise

Increasing problem:

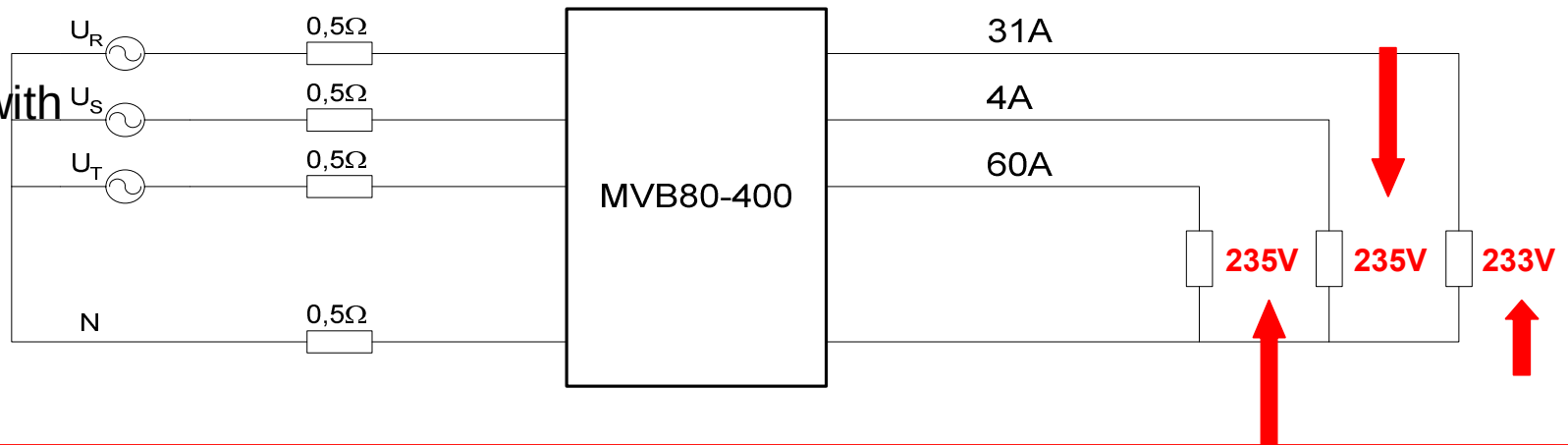
- Increased use of single phase heating elements, cookers, single phase motors for water pumps etc.
- Generally increased power output
- This development gives an increased problem with asymmetrical voltages

Static measurement asymmetrical loads

Typical problem
with long lines



Our solution with
MVB



Single phase short-circuit

Problems in the Grd. Y-network:

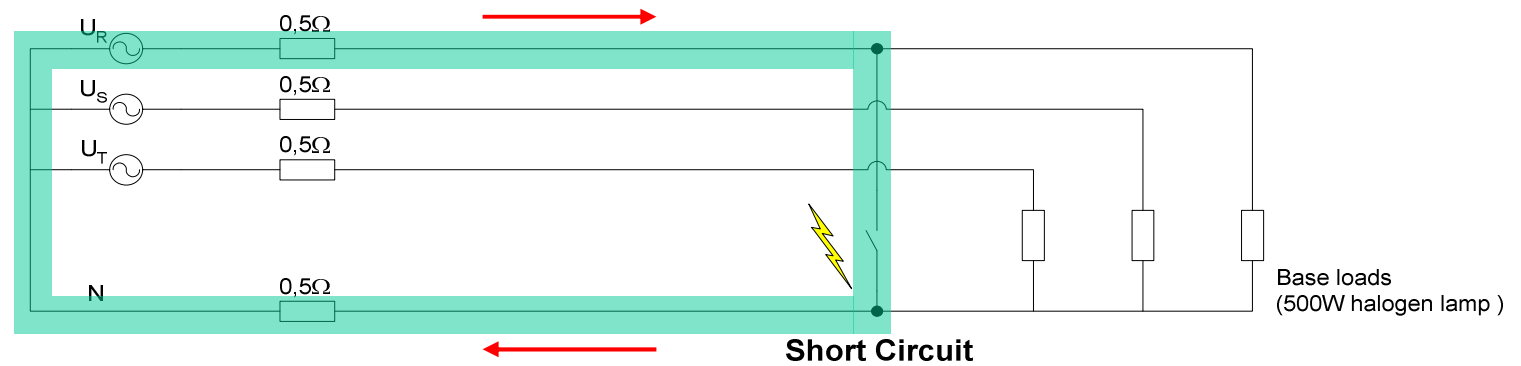
- A single phase load affects all the phases –
- the loaded one dips, while the other two rise

Important advantage in the case of a single-phase short-circuit:

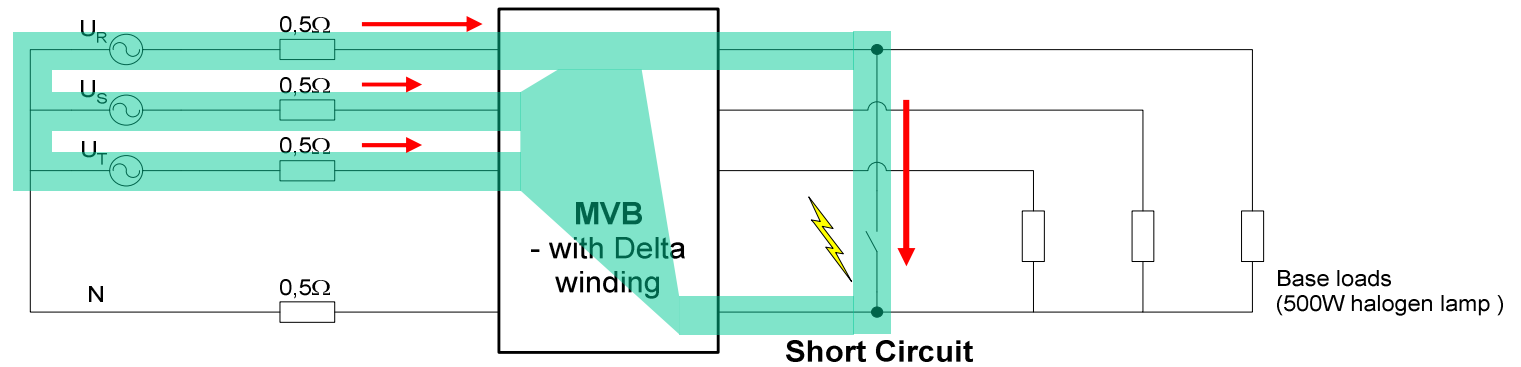
- The MVB increases the SS current by 60% or more
- → Reduced fuse blow time
- → Improved fire safety

Test

Line



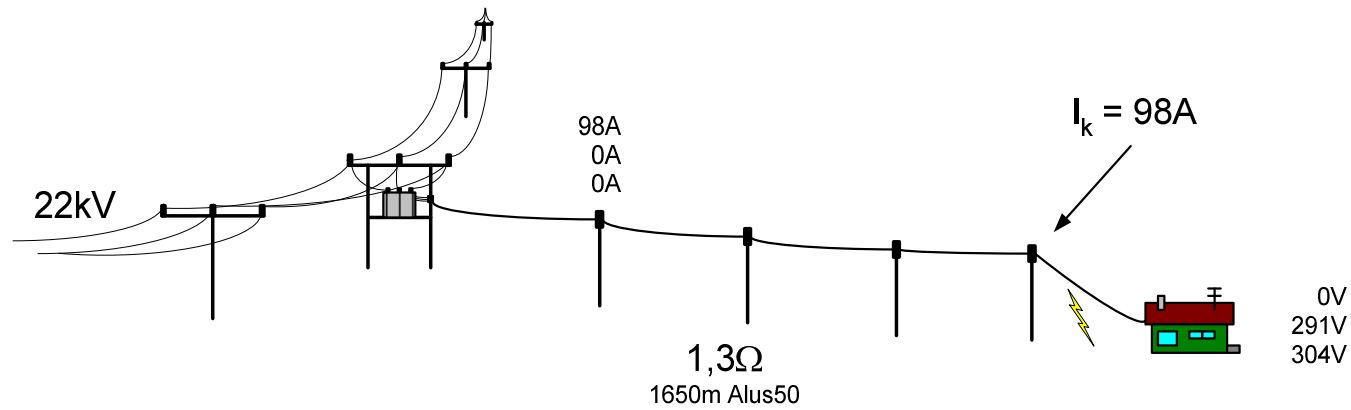
Line with MVB



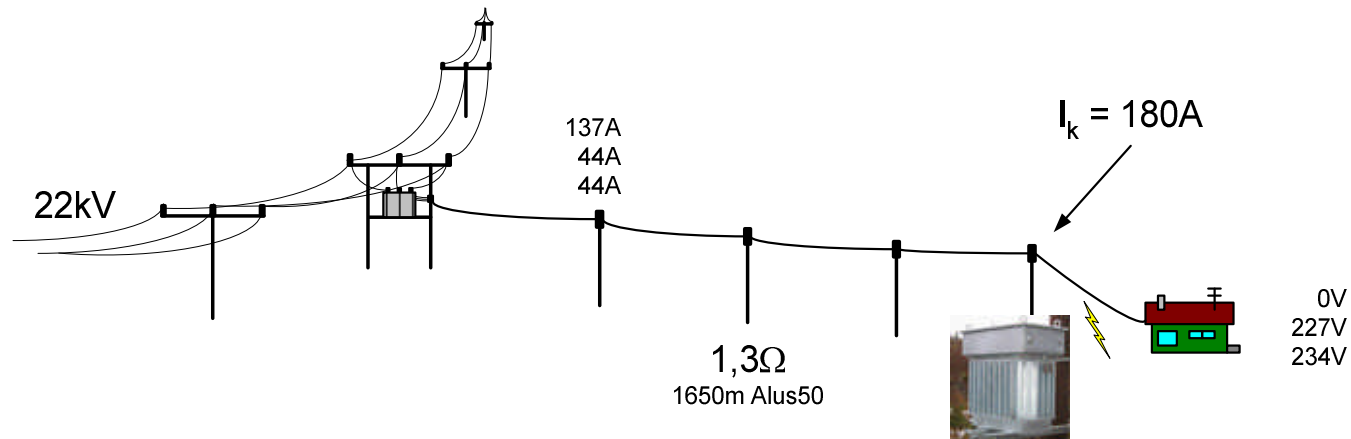
- All three phases deliver power to short-circuit, due to the internal delta winding

Short-circuit capacity - example

Line



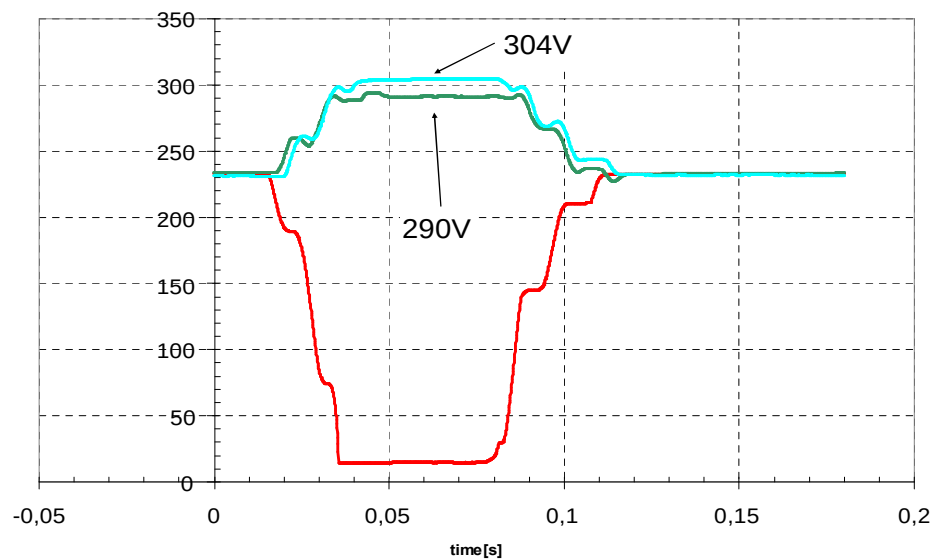
Line with
MVB



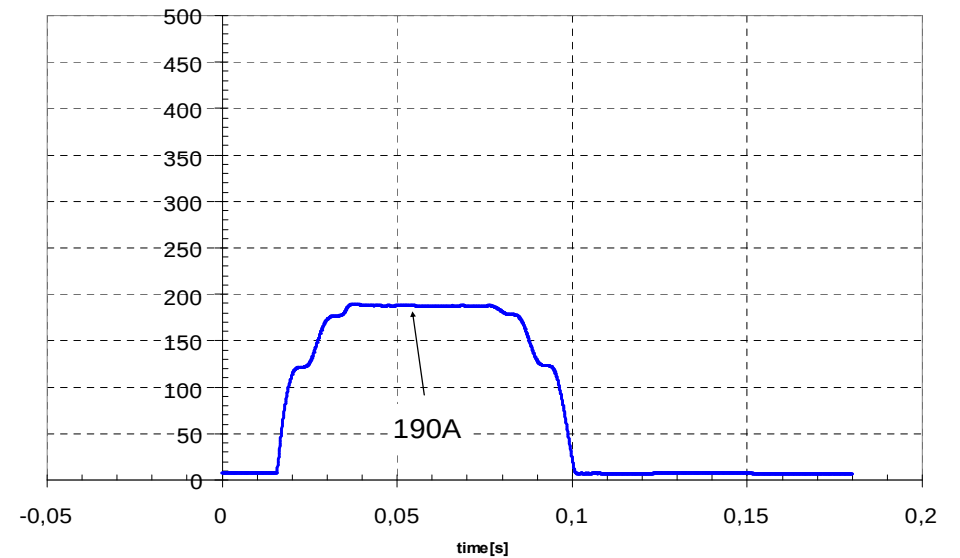
Voltage and Current without MVB

Print from oscilloscope in our laboratory

Voltage[V]



Current[A]



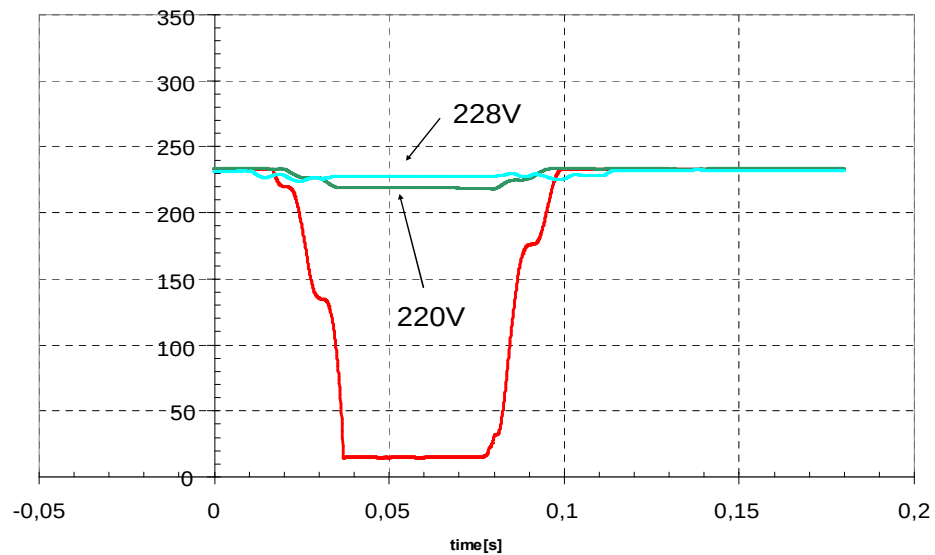
Registered Trademark

Voltage and Current with MVB

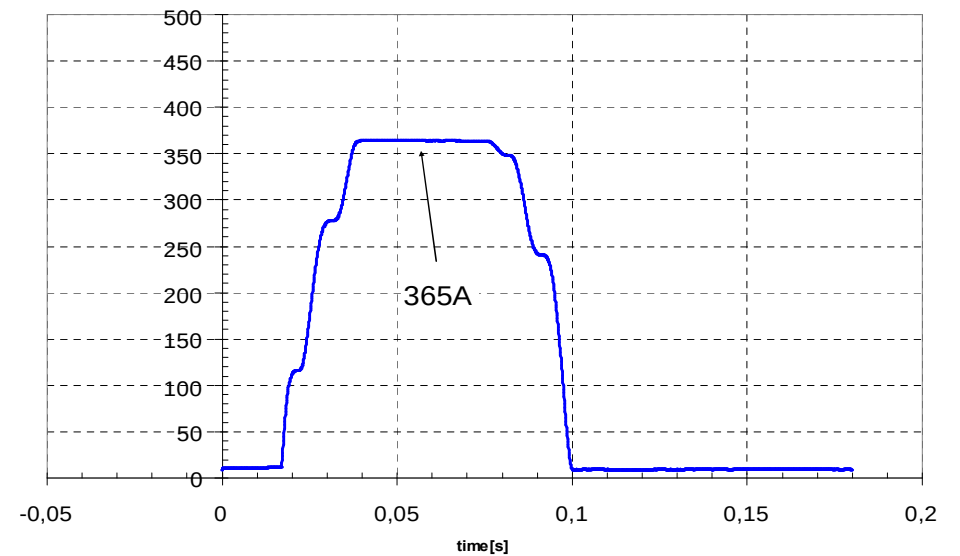
Print from oscilloscope in our laboratory



Voltage[V]



Current[A]



Total Harmonic Distortion - THD

- Magtech Voltage Booster adds some harmonics to the voltage
- This is due to regulation of an inductor in the power circuit.
- MVB adds about 1-6% THD to the voltage, depending on the degree of voltage boost.



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3 phase motor start

- Using Magtech Voltage Booster alone to help a 3~motorstart will cause deeper voltage dips.
- But; the voltage will rise again more quickly, and there is more “power” for starting the motor.
- **Solution:** use frequency converters to limit the inrush current in addition to the MVB to keep the voltage stable during operation of the motor.



Some customers



Drangedal everk



FALBYGDENS ENERGI



Registered Trademark

Vattenfall Eldistribution AB – Bredskär

- 1800 meter Alu 50 from transformer to MVB – out on an island
- 30 meter to the first cottage
- 50 meter to the next cottage and house

Alternative: New submarine line → 600.000,- SEK saved.



MVB40-400

Mechanical voltage regulator exchanged with MVB



Registered Trademark

Lerum Energi AB, Sweden

- 100kVA transformer, with a few local customers
- MVB located after 750m, Alus50
 - Customer 1 after 25 m
 - Customer 2 after 250m

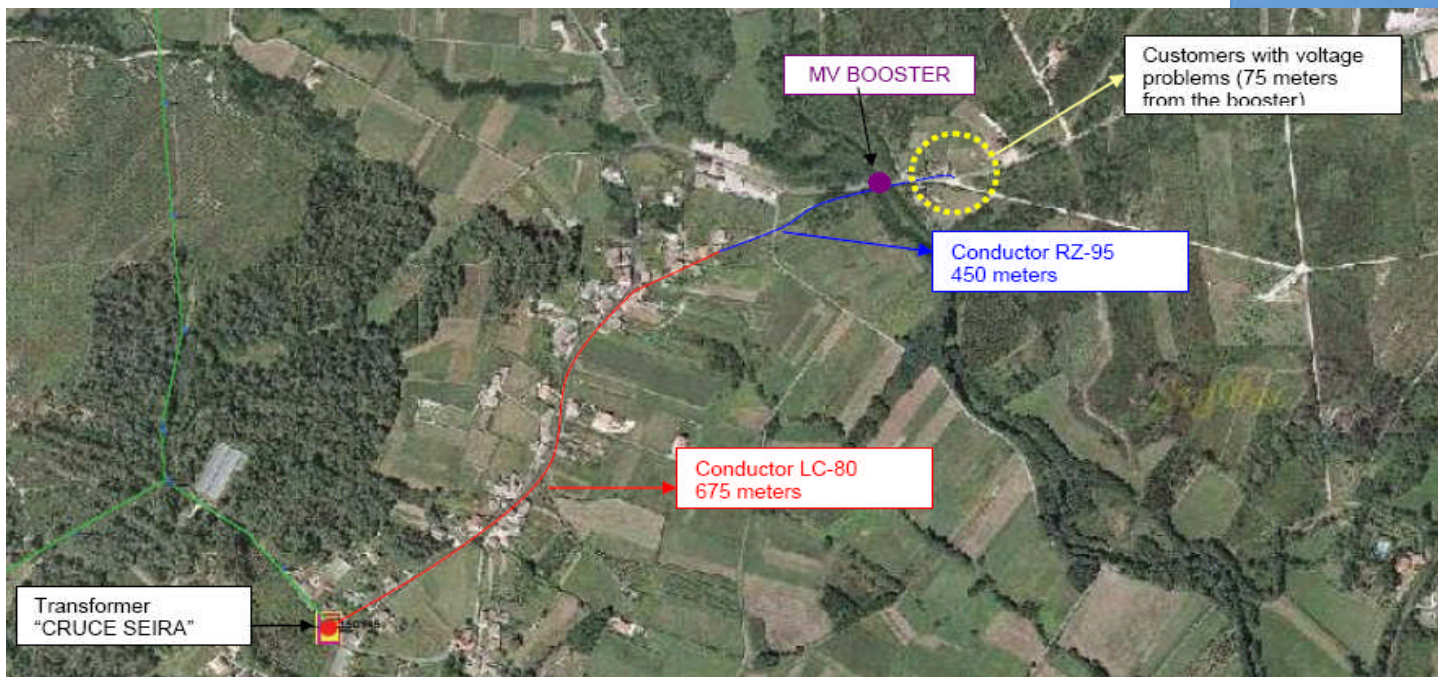
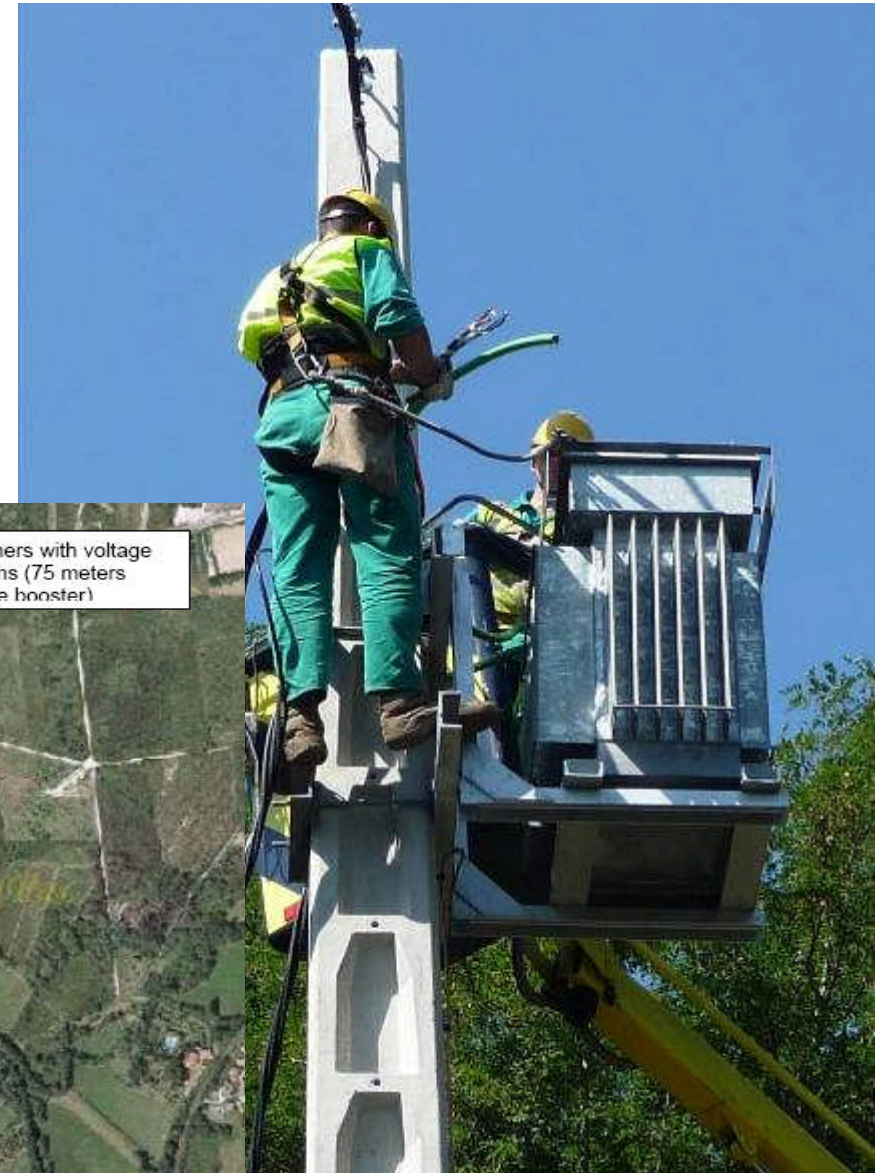


Union Fenosa distribución, Spain

Santiago de Compostela

- 400kVA transformer
- Total 141 clients
- 1,2 km 95 Al
- 3 customers at the end

“very satisfied with the new voltage”

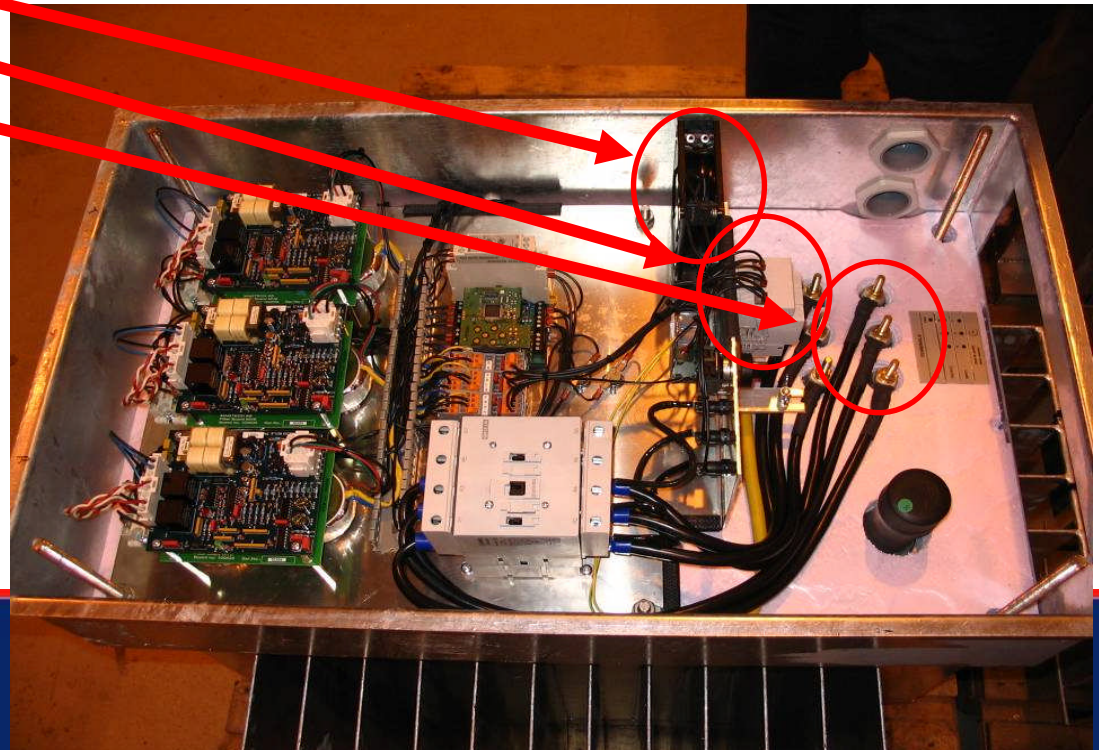


Maintenance program

- **MVB is built to be maintenance free**
 - but Magtech still recommends some inspection:

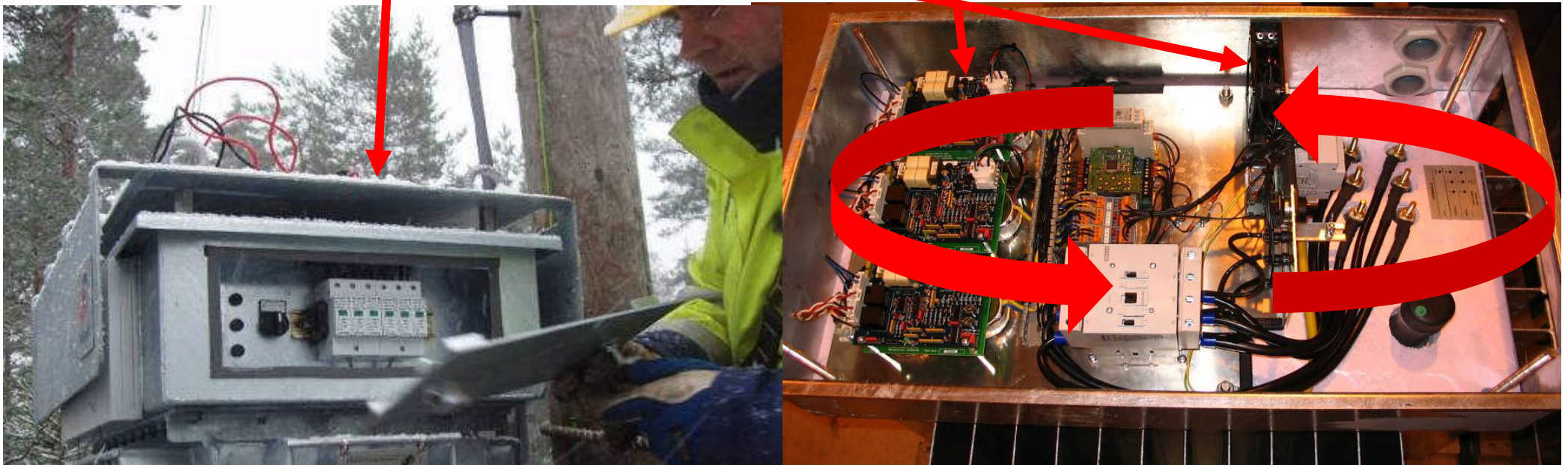
Every 5 -10 years

- Check fan rotates freely
- Check voltage arresters
- Check output voltages



Why so little maintenance?

- Power circuits are copper and iron – no moving parts
- Control electronics are very robust, long time proven solutions
 - We have placed change orders for vulnerable components (e.g. capacitor on control board raised from 70°C to 125°C)
- Heat control: Sun screen + fan (starts at 50°C)



Magtech Voltage Booster– for outdoor use

Robust

- Only copper and iron in the power circuit
 - No moving parts in the power circuit
 - 25 year designed lifetime
 - Oil cooled
 - Sun screen to prevent overheating of control module
 - Internal fan to prevent local overheating of electronic components (starts > 50°C)
 - Sealed, no dust or water penetration
 - Over-voltage protected (surge arrestors)
- Maintenance free

Fast control of voltage quality (50-200ms)

- Corrects asymmetry
- Lifts voltage dynamically
- Corrects each phase individually
- Increase single phase short circuit current

Customer Benefits

- Quick fix for voltage problems
- Postpone investments
- Reduce investments

