Comparison between conventional and vacuum technology in On-Load Tap-Changers

Mr. Günter Panzer
Maschinenfabrik Reinhausen GmbH
Sales Middle East, India, Africa
Director
REINHAUSEN Group
Business units, customers and brands

Transformer Control
Power Composites
Power Quality
Plasma Applications
Highvolt Test Systems

Hochleistungs-kunststoffe
Regelung von Transformatoren
Blindleistungskompensation

Power Composites
Transformer Control
Power Quality

Component
Product
Enduser

Manufacturer
System
Project

Plasma Applications
Highvolt Test-Systems

Plasma-Anwendungen
Hochspannungs-Prüftechnik
### REINHAUSEN Group

#### Milestones

<table>
<thead>
<tr>
<th>Year</th>
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<tr>
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Sales Department
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Vacuum Technology

→ Advantages
→ Experience
No Interaction between Arc and Oil

Conventional technology
- Switching arc under oil
- Oil: insulating, cooling, lubricating and arc quenching

VACUTAP® technology
- Switching arc in vacuum
- Oil: just insulating, cooling and lubricating
Extended Oil Service Life

**Conventional technology**
- Oil ageing due to carbon particles resulting from arc quenching
- Oil filter to be exchanged regularly

**VACUTAP® technology**
- No break-down arc in tap-changer oil
- No oil filter unit necessary
Marginal Contact Wear

**Conventional technology**
- Contact wear
- Contact life: 200,000 to 500,000 switching operations

**VACUTAP® technology**
- Rate of contact wear is more than one decade lower compared with copper-tungsten contacts
- Contact life: 600,000 switching operations
Less Maintenance

**Conventional technology**

- Maintenance each 40,000 to 100,000 switching operations, depending on the operation mode
- Additional time-based criteria

**VACUTAP® technology**

- Maintenance each 300,000 switching operations, therefore maintenance-free in most network applications
- Enhanced transformer availability
- No time- or current-based criteria
- Less spare parts, simplified logistics
**Ecologically Friendly**

**Conventional technology**
- Mineral oil
- Carbonized oil and filters to be disposed

**VACUTAP® technology**
- Mineral oil and alternative insulating liquids possible
- Fewer oil changes necessary (extended oil service life)
Applications
Network Application

- Highest system availability
  - Maintenance free on-load tap-changer over the service life of the transformer
  - Significantly longer oil service life and contact life

Example:
Delta-connection, 5,000 switching operations per year,

Conclusion: **60 years transformer service life without any maintenance**
- No costs for on-load tap-changer maintenance, spare parts and oil filters over the transformer service life
Electric Arc Furnace (EAF) Application

- High system availability and reliability
  - Maintenance interval: 300,000 switching operations without time- or current-based criteria
  - Significantly longer oil service life and contact life

Example:

200,000 switching operations per year,

Guess: 20 years transformer service life

- Cost reduction for on-load tap-changer maintenance, spare parts and oil filters over the transformer service life
- Can be again reduced using VR-I-HD (Heavy Duty)

600,000 switching operations without time- or current-based criteria
Extended Application Range

Conventional technology

- Limitations in HVDC or converter transformer applications

VACUTAP® technology

- Very quick dielectric recovery (up to 10 kV/µs)
High-voltage Direct Current Transmission (HVDC) Application

• High system availability and reliability
  - Maintenance interval: 300,000 switching operations without time- or current-based criteria
  - Significantly longer oil service life and contact life
• Quick recovery voltage of 10kV/µs facilitates the switching of non-sinusoidal currents
More than 20 Years of Experience in VACUTAP® Technology

More than 27,000 supplied units of VACUTAP®
Arc is extinguished in vacuum

**VACUTAP® Portfolio**

- VACUTAP® VT
- VACUTAP® AVT
- VACUTAP® VV
- VACUTAP® VR
- VACUTAP® VR I HD
- VACUTAP® RMV-A
- VACUTAP® RMV-II
VACUTAP® VM
On-load Tap-changer for Transformers

Don‘t Compromise!
An investment that quickly pays off

Maintenance Intervals