"ACTIVE FRONT END" RECTIFIER

ADVANTAGES

A new rectifier, provided with an IGBT inverter, is rapidly gaining the interest of the market for the following reasons:

• Unit power factor: AFE can provide a current with a very low harmonic distortion (THD is reduced to 3% when normally is 25-30% in case of a conventional rectifier).

• The AC current is in phase with voltage: the same as pure resistive load. AFE does not exchange reactive power with the line, but exclusively active power.
“ACTIVE FRONT END” RECTIFIER

ADVANTAGES

• Bidirectional power exchange between AC mains and DC Bus bar: AFE is perfectly reversible and so it can recover the energy to the mains saving it.

• AC current sinusoidal wave form: very clean energy.

• Constant and high DC Bus bar voltage: no influences by the mains voltage fluctuations. The inverter can control the motors at mains voltage without the normal 10-15% of derating.
AFE rectifier cost is today higher than the cost of a Graetz Bridge controlled rectifier at 12 pulses.

But AFE usually allows to eliminate power factor correction systems and Harmonic Filters.

In the standard executions with 12 pulses Graetz bridge the power factor is lower (around 0.8); usually this obliges to use additional power factor correction systems.

Practically if we consider the cost of the total electrical plant the cost of AFE solution is approximately near to the cost of a more conventional 12 Pulse Graetz rectifier solution.
"ACTIVE FRONT END" Rectifier scheme

**Functions:**
- Completely energy reversibility
- Complete control of reactive power
- Complete control of harmonics
- Complete control of DC Bus Bar Voltage

**Diagram:**

- Power (kW)
- Braking Power (kW)
- A.F.E.
- Reactive Power (kVAR)
AFE & OPD inverter in a cabinet solution
1.200 kW 690V equipment

- modular design
- air cooling

**Power module:**
- IGBT power circuit
- low inductance connection
- PWM modulation (1.5kHz : 5kHz)
# ACTIVE FRONT END

features and customer benefits at a glance

<table>
<thead>
<tr>
<th>AFE features</th>
<th>Operational reliability, high availability</th>
<th>Lower capital investment costs</th>
<th>Lower operating costs</th>
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</thead>
<tbody>
<tr>
<td>Regenerative feedback (4-quadrant operation)</td>
<td>No complex circuit, low probability of faults</td>
<td>Regenerative braking into the line supply</td>
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<td>Sinusoidal line currents – low harmonics</td>
<td>Not influenced by other loads</td>
<td>Cables, filters, transformer (standard)</td>
<td>Lower power costs</td>
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<td>No commutation faults when the power fails in regenerative operation</td>
<td>Weak networks, line Supply interruptions</td>
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<td>No downtimes</td>
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<tr>
<td>Line supply voltage fluctuations are compensated</td>
<td>For line supply with significant voltage fluctuation</td>
<td>Drive can be dimensioned smaller</td>
<td>No downtimes</td>
</tr>
<tr>
<td>Extremely high drive dynamic performance</td>
<td>Extremely low delay time</td>
<td>Capacitor battery for energy storage</td>
<td></td>
</tr>
<tr>
<td>Power factor as required between 1.0&amp;0.8 cap/ind</td>
<td>Fewer components</td>
<td>No compensation</td>
<td>Reduced reactive power</td>
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OPD AFE STRONG POINTS

- Modular approach
- Compact design
- Easy to assemble
- OPD regulation kit with the same control functions
- Immunity
- Insulation
SOLUTIONS FOR WATER & WIND TURBINES

Characteristics:
• direct drive, asynchronous generator and DFI solution with/without encoder
• power factor control and current THD below 3%
• Standard DIC 5940
• high static precision, dynamic speed and torque response
• high quality of the recovered energy (low current harmonic distortion)
• below 20kW
• above 50kW up to 2MW (low voltage)
SOLUTION FOR WATER TURBINES
SOLUTION FOR WIND TURBINES