With many years of experience in the field, Sécheron is able to propose a reliable and suitable range of rectifiers for DC traction power supply. Our natural air cooled rectifiers are equipped with diode blocks with high overload capability and high blocking voltage.

The design of the rectifiers is based on ideally sized and proven semi-conductors (silicon diodes) offering particularly high performances and reliability. All components are fully interchangeable.

Rectifiers are designed in accordance with customers specifications.

Thanks to its complete range of rated voltages, Sécheron is able to cover all types of traction networks.

**MAIN BENEFITS**

- Compact design.
- Adaptability: Power connection from either the top or the bottom of the cubicle.
- Ease of access for easy maintenance of components.
- Reliable, robust and high quality solution.
- Natural air cooling.
- High efficiency.
Based on a strong experience, Sécheron provides an engineering and consulting support service for the transformers according to standard IEC 626895 (EN 50329):

- Specification.
- Monitoring during the manufacturing process with the supplier.
- Assistance during factory acceptance test.
- Assistance during the combined test of the complete transformer-rectifier group.

To ensure a good harmonization between rectifier and transformer, Sécheron is able to provide the complete transformer-rectifier group.
RECTIFIER RANGE

Standard rectifier range

<table>
<thead>
<tr>
<th></th>
<th>750</th>
<th>1500</th>
<th>3000</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated DC voltage [V]</td>
<td>Up to 6000</td>
<td>Up to 4000</td>
<td>Up to 3000</td>
</tr>
<tr>
<td>Rated current [A]</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Overload</td>
<td>Class VI per EN 50328 / IEC 60146 (others on demand)</td>
<td>Extra Heavy Duty per NEMA RI9 (others on demand)</td>
<td></td>
</tr>
<tr>
<td>Max. ambient temperature [°C]</td>
<td>40 (without derating)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Peak inverse voltage of diode [V]</td>
<td>2200</td>
<td>4500</td>
<td>4500</td>
</tr>
<tr>
<td>Max. altitude [m]</td>
<td>1000 (without derating)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>IP degree</td>
<td>IP2x to IP32</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Width [mm / in]</td>
<td>800 to 3200 / 31.5” to 126”</td>
<td>1200 to 2400 / 47.25” to 94.5”</td>
<td></td>
</tr>
<tr>
<td>Depth [mm / in]</td>
<td>1400 / 55”</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Height [mm / in]</td>
<td>2200 / 86.5”</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Other ratings and dimensions upon request.

3 PHASES BRIDGES (SERIES OR PARALLEL CONNECTION)

/// 6 PULSES UP TO 1500 VDC
 - Connection n°8 according to IEC 60146-1-2
 - Connection n°25/26 according to IEEE 1653.2

/// 12 PULSES SERIES UP TO 3000 VDC
 - Connection n°12 according to IEC 60146-1-2

/// 12 PULSES PARALLEL UP TO 1500 VDC
WITHOUT IPT
 - Connection n°9 according to IEC 60146-1-2
 - Connection n°29 according to IEEE 1653.2

/// 12 PULSES PARALLEL UP TO 1500 VDC
WITH IPT
 - Connection n°9 according to IEC 60146-1-2
 - Connection n°31 according to IEEE 1653.2

/// 24 PULSES
2x transformer-rectifier groups each 12 pulses and with adequate phase shift ± 7.5° on primary can be provided to achieve 24 pulses rectification.

/// SPECIAL CONNECTION UPON REQUEST
 - Connection n°5 according to IEC 60146-1-2
 - Connection n°29 according to IEEE 1653.2
PROTECTIONS

OVERVOLTAGE PROTECTION

• **Internal overvoltage:** During turn-off, the load current of the diode does not stop flowing immediately but continues briefly in reverse direction as reverse recovery current. This peak reverse recovery current causes a voltage peak which is eliminated by an individual snubber circuit mounted in parallel with each diode.

• **External overvoltage:** The external overvoltage is essentially due to lightning strikes on the line and to short-circuits. The rectifier is equipped on the DC side of a RC filter capable of absorbing a significant surge. A surge arrester can optionally be installed directly between the output terminals of the rectifier.

SHORT-CIRCUIT PROTECTION AND IMMUNITY LEVELS

All traction rectifiers are designed to withstand external short circuit without damage until the MV circuit-breaker opens.

• **Fuseless rectifiers (Damage, according to EN 50328 standard):** Each branch has one diode only and the diode failure detection is ensured by the reverse current detector (CR10).

• **Rectifiers with fuses (Np) (Tripping+, according to EN 50328 standard):** Composed of several parallel diodes on each branch, the failed diode will be isolated from the circuit by melting the associated fuse, witnessed by the fuses own micro-contact. After melting the fuse, the rectifier is withdrawn from operation.

• **Rectifier in Np+1 configuration (Redundancy, according to EN 50328 standard):** Additional diode in each branch in order to provide full performance after one failure diode in each branch.

• **Rectifier in Np-1 configuration (Functional, according to EN 50328 standard):** The rectifier continues providing service with reduced performance after losing up to one diode in each branch; the performance is guaranteed for rated power and some reduced overload.

OVERLOAD PROTECTION

Rectifier diodes are protected against overtemperatures by thermostats mounted on heatsinks (alarm and trip thresholds).
APPLICATIONS

In order to cover all customer requirements, Sécheron can provide different design of rectifiers.

**FIXED RECTIFIER**

Compact & robust.

**DRAWOUT RECTIFIER**

Interchangeable & easy maintenance.

**DISCONNECTABLE RECTIFIER**

High power & easy maintenance.
Sécheron also offers a cubicle which integrates both functions of rectifier (up to 1200 kW) and isolating switch for special applications for light rails (compact solution for tramway and trolley-bus).

RECTIFIER WITH INSULATING SWITCH

- Power diode blocks
  Diodes fitted in heatsinks combined with snubbers and optional fuses
- Reverse current detection
- RC Filter
  Combined with base-load resistor
- MIU10 & VM10/12
  Isolated amplifiers for current and voltage measurement
- SWS / SWG
  Bipolar off-load motorized disconnecting switch with optional earthing connection
- Frame leakage detection
  Frame-earth current threshold relay
- Optional: IPT
  Interphase coil for connection with coupled rectifier-transformers
- Optional: Voltage Limiting Device
  Negative-earth voltage threshold relay

SPECIAL APPLICATION UPON REQUEST

CONTROLLED RECTIFIER

Customer benefits:

- Regulation of the voltage in order to compensate voltage drops of the line.
- Optimization of the functioning in case of double converter (controlled rectifier coupled with inverter).