TIP - SF₆ station service voltage transformer
Cost-effective solution for isolated applications
TIP - SF₆
Station service voltage transformer

The TIP “Station service voltage transformer” is a voltage transformer insulated in SF₆ gas that combines the characteristics of a voltage transformer with power transformation capability. The TIP has been designed for voltage up to 550 kV and with power capability up to 1.5 MVA. TIP converts the optimum power directly from high voltage side to medium/low voltage side.
How to supply auxiliary power in a substation far from the distribution grid?
In isolated areas, SF₆ insulated station service Voltage transformers can effectively replace the functions of a power transformer, optimizing the investment with the effective need of power. TIP is perfectly suited to switching substations, series compensation, solar plants, wind farms, etc...

How to provide electricity to a remote village?
TIP is the ideal solution for the electrification of rural areas where limited power needs of remote villages cannot economically justify the installation of a conventional substation or the extension of a distribution grid.

TIP features
- Cost effective solution for isolated applications
- Reliable and stable power supply directly from high voltage line
- High safety thanks to SF₆ insulation: explosion proof, non-flammable
- MV output available (up to 11kV)
- Reduced dimensions, less space required for installation
- Higher reliability due to reduced number of components for energy conversion
- Lower environmental impact with comparison to a conventional substation
- Silent operations (< 30dBA)
Technical features

<table>
<thead>
<tr>
<th>Rated voltage</th>
<th>kV</th>
<th>72.5</th>
<th>123</th>
<th>145</th>
<th>170</th>
<th>245</th>
<th>362</th>
<th>420</th>
<th>550</th>
</tr>
</thead>
<tbody>
<tr>
<td>Rated frequency</td>
<td>Hz</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
<td>50-60</td>
</tr>
<tr>
<td>Rated short time power-frequency withstand voltage (1 min)</td>
<td>kV</td>
<td>140</td>
<td>230</td>
<td>275</td>
<td>325</td>
<td>460</td>
<td>510-575</td>
<td>630</td>
<td>680</td>
</tr>
<tr>
<td>Rated lightning impulse withstand voltage 1.2/50 us</td>
<td>kV</td>
<td>325</td>
<td>550</td>
<td>650</td>
<td>750</td>
<td>1050</td>
<td>1175-1300</td>
<td>1425</td>
<td>1550</td>
</tr>
<tr>
<td>Rated switching impulse withstand voltage 250/2500 us</td>
<td>kV</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>NO</td>
<td>950</td>
<td>1050</td>
<td>1175</td>
</tr>
<tr>
<td>Rated power single phase*</td>
<td>kVA</td>
<td>500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated power three phase*</td>
<td>kVA</td>
<td>1500</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated secondary voltage</td>
<td>V</td>
<td>48 V – 36/V3 kV</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Rated Overvoltage Factor</td>
<td></td>
<td>1.2 cont. 1.5 30 s</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

(*) Higher rated power values have to be verified by case.

The gas insulated “station service” voltage transformer is suitable for outdoor installations:
- The primary winding is connected directly to the high voltage and to ground, while the secondary winding supplies the low or medium voltage side.
- Cooling method is GNAN (gas natural air natural).
- The high voltage terminals are made of high conductivity aluminium and can be either cylindrical or flat type (e.g. NEMA).
- Fiber-glass insulator with silicon rubber sheds and creepage distance equal or above 25 mm/kV.
- Enclosure made of aluminium alloy containing cores, primary and secondary windings.
- The magnetic cores are made of laminated steel with oriented grain and a high level of permeability.
- The windings are made of electrolytic copper.
- Optional no load tap changer and metering windings.
- Tested according IEC 61689, and IEC 60076 ...or IEEE C57.13 e C57.12.
- Suitable for very low temperatures applications (-50 C°) with mixed gas.
**SF₆ system**

<table>
<thead>
<tr>
<th>SF₆ gas system (relative pressure)</th>
<th>kV</th>
<th>72.5</th>
<th>123</th>
<th>145</th>
<th>170</th>
<th>245</th>
<th>362</th>
<th>420</th>
<th>550</th>
</tr>
</thead>
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<tr>
<td>Rated voltage</td>
<td>kV</td>
<td>72.5</td>
<td>123</td>
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<td>170</td>
<td>245</td>
<td>362</td>
<td>420</td>
<td>550</td>
</tr>
<tr>
<td>Annual SF₆ leakage</td>
<td>%</td>
<td>&lt;0.1</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Filling pressure at 20 °C</td>
<td>kPa</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
<td>650</td>
</tr>
<tr>
<td>Alarm level 1 at 20 °C (Only Alarm)</td>
<td>kPa</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
<td>600</td>
</tr>
<tr>
<td>Alarm level 2 at 20 °C (Circuit breaker lock or trip)</td>
<td>kPa</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
<td>550</td>
</tr>
</tbody>
</table>

**SF₆ insulation system**

The tightness of the insulation system has been designed to guarantee a life cycle time of +30 years with maximum admitted gas leakage of less than 0.1% per year.

**Overpressure relief device**

A rupture disk is installed to protect against excessive overpressure due to internal arc faults. When a predetermined overpressure is reached, the rupture disk will break and relieve the gas preventing the pressure to reach dangerous values.

**Density Monitor**

Remote control of the internal insulation level by means of a pressure gauge provided with an alarm threshold and lock threshold.
Secondary section

LV/MV Section
- Up to 0.4 kV: suitable for directly feeding the auxiliary system (less than 500 m)
- Up to 5 kV: suitable for feeding medium voltage overhead lines 1 to 8 km length
- Up to 36 kV: suitable for feeding enough power to supply small villages located 5 to 50 km from the high voltage OHL

According to the need, TIP can be designed to provide two different voltage levels through two independent secondary windings, that can be connected in different arrangements.

Electrical diagram plate
Upgrading

In case of direct connection of the TIP to the high voltage line, typical of rural electrification projects where the protection cannot be ensured by the substation architecture, it’s possible to upgrade the TIP with the following additional features:

**Disconnecting function**
With the addition of a combined disconnector/earthing switch, the overhead line can remain energized even in case no output from secondary side is needed.

**Disconnecting and breaking functions**
With the addition of the disconnecting and breaking functions assured by a standard PASS pole TIP can guarantee the same safety, reliability and availability features of a conventional high voltage switchyard in case of temporary short circuit on primary or secondary side. With this upgrade TIP would be designed for remote or rural areas where there’s not an economical solution to give access to electricity. This application would be the optimal solution to supply up to 1 MVA directly from the nearest HV line (up to 420 kV).

**Typical single-line diagram**

![Typical single-line diagram](image-url)