PFIFFNER Medium Voltage
Ring Core Current Transformers
Product Portfolio
• PFIFNER general presentation:
• The 2 main groups

1. CT’s for the distribution/transmission network (12kV … 800kV)
   a) Bushing Type Current Transformers / Cable Current Transformers
      • current range up to ~8’000A
      • without primary conductor and without primary insulation of its own
      • applicable for all voltage levels if fitted over a fully insulated bushing, busbar, cable or other conductor
      • available also in split-core design

2. CT’s for the power generation network (high-current CT’s)
   a) Bushing Type Current Transformers
      • all current ranges up to 50’000A
      • without primary conductor and without primary insulation of its own
      • applicable for all voltage levels if fitted over a fully insulated bushing, busbar, cable or other conductor
   b) Fully Insulated Type Current Transformer
      • Current range up to 15’000A
      • Insulation level up to Um=36kV
1. PFIFFNER Portfolio

- **Indoor closed CT**
  - JK

- **Indoor split core CT**
  - JKS-S

- **Outdoor closed CT**
  - JK-F

- **Outdoor split core CT**
  - JKS-G
Installation:
Indoor, resin encapsulated (PUR)

Mounting:
Over a fully insulated bushing, busbar, cable or other conductor

Mounting position:
free

Primary insulation:
fulfilled by the insulated primary conductor

Primary current range:
up to ~8'000A

Hole diameter:
Variable

Several cores in one CT is possible, maximum number depends on the specification and the limiting dimensions on site
• Dimensions, standard shape

- 230mm
- 300mm
- 350mm
- 400mm
- 450mm

• Hole diameter: variable
• Height: variable up to 300mm
• Other shapes, customized

• Hole diameter: variable
• Height: variable
• A big variety of round outer dimensions can be realized according to customer needs.
• Secondary terminals

Cover (IP 20)  Flexible wire  Terminal box (IP 65)
M6 connection  M6 connection
• Installation material, option

Ground installation
with angles

Ground installation
with a plate

Wall or head over installation
with angles

Several customized installation material realized
• Installations

Installation on bushings

Installation on cables
JKS-S / JKS

Installation:
Indoor, split-core design, resin encapsulated (PUR)

Mounting:
Over a fully insulated bushing, busbar, cable or other conductor

Mounting position:
free

Primary insulation:
fulfilled by the insulated primary conductor

Primary current range:
up to ~2'500A

Hole diameter:
JKS-S: 90mm, 120mm, 150mm
JKS: Variable

Usually a single core design. If a two core design is possible depends on the specification.
JKS-S / JKS

• Standard type JKS-S
  • Hole diameter: 90mm, 120mm, 150mm
  • Height: 130mm, 200mm, 270mm
  • Secondary terminal M6
  • Cover (IP20)
  • For standard requirements

• Special type JKS
  • Hole diameter: variable
  • Height: variable
  • Secondary terminal M6
  • Not covered (IP00)
  • For high accuracy requirements, if the standard type JKS-S is not applicable
**JK-F**

### Installation:
Outdoor, resin encapsulated (Epoxy)

### Mounting:
Over a fully insulated bushing, busbar, cable or other conductor

### Mounting position:
free

### Primary insulation:
fulfilled by the insulated primary conductor

### Primary current range:
up to ~8’000A

### Hole diameter:
Variable

Several cores in one CT is possible, maximum number depends on the specification and the limiting dimensions on site
JK-F

- Dimensions, standard shape
  - See JK, identical

- Other shapes, customized

- Hole diameter: variable
- Height: variable
- A big variety of round outer dimensions can be realized according to customer needs.
• Secondary terminals

Terminal box (IP 65)
M6 connection
Installation:
Outdoor, with aluminium shell

Mounting:
Over a fully insulated bushing, busbar, cable or other conductor

Mounting position:
Horizontal, with a maximum angle of 60°

Primary insulation:
fulfilled by the insulated primary conductor

Primary current range:
up to ~5‘000A

Hole diameter:
80mm, 110mm, 140mm, 220mm

Several cores in one CT is possible, maximum number depends on the specification and the limiting dimensions on site
JK-G

- Secondary terminal M6
- Terminal box and CT-housing (IP65)
- Two dimensions:

- Hole diameter: 80mm, 110mm, 140mm
- Height: ~320mm

- 220mm
- ~230mm
JKS-G

- JKS-G

**Installation:**
Outdoor, split-core design, with aluminium shell

**Mounting:**
Over a fully insulated bushing, busbar, cable or other conductor

**Mounting position:**
Horizontal, with a maximum angle of 45°

**Primary insulation:**
Fulfilled by the insulated primary conductor

**Primary current range:**
Up to ~2'500A

**Hole diameter:**
85mm, 115mm, 145mm, 225mm

Usually a single core design. If a two core design is possible depends on the specification.
• Secondary terminal M6
• Terminal box (IP65)
• CT-housing (IP53)
• Two dimensions:

- Hole diameter: 85mm, 115mm, 145mm
- Height: ~320mm

- 225mm
- ~230mm
1. Information needed

- Indoor / Outdoor installation
- Closed or split-core design (execution possibilities, costs)
- Hole diameter
- Degree of protection for secondary terminals (if required)
- Limiting outer dimensions from the site (if existing)
- Installation materiel (if needed)
- Electrical specification
1. Market from technical side

- Bushing manufacturers (like MGC)
- Transformer manufacturers
- Network operators
- Switchgear/-yard manufacturers or contractors

- New built projects
- Replacement/Refurbishment projects

- Special electrical specification
- Special requirement to the dimensions/installation

- If there is a mass product on the market, PFIFFNER has a cost disadvantage
1. Impressions
1. Impressions
1. Impressions
2. Power plant layout

- CT’s for the generator bushing
- CT’s for the non-isolated busbar or the isolated phase busduct (IPB)
- CT’s for the generator circuit breaker (GCB)

Diagram showing:
- Generator
- Star point
- Voltage transformer
- Exciter transformer
- Generator circuit breaker
- Auxiliary transformer
- Medium voltage Um<=36kV
- High current up to 50’000A
- High voltage Um up to 550kV
### 2. PFIFFNER Portfolio

<table>
<thead>
<tr>
<th>Generator bushing</th>
<th>Generator busduct / busbar</th>
<th>Generator circuit breaker (GCB)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ALG JK-GCT</td>
<td>AKA (for non-isolated busbar systems or inside isolated phase busduct systems (IPB))</td>
<td>AKQ (for non-isolated busbar systems (fully insulated type CT))</td>
</tr>
<tr>
<td></td>
<td></td>
<td>JKQ</td>
</tr>
</tbody>
</table>
Mounting:
Over generator bushing

Mounting position:
Horizontal
ALG: up to a max. angle of 30°
JK-GCT: up to a max. angle of 60°

Primary insulation:
fulfilled by the generator bushing

Primary current range:
up to 50‘000A

ATEX Certification:
ALG: Ex II 3G Ex nA IIC T4 Gc
JK-GCT: in work
Reference list

Main markets: Thermal power plants up to ~1200MW (coal and nuclear) (new units and also important: renovations/refurbishments)

<table>
<thead>
<tr>
<th>Power plant</th>
<th>Icth [A]</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oskarshamn / SWE</td>
<td>40'600</td>
<td>1995</td>
</tr>
<tr>
<td>Darlington / CAN</td>
<td>37'500</td>
<td>2007/2016</td>
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<tr>
<td>Bruce / CAN</td>
<td>35'000</td>
<td>2015</td>
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<tr>
<td>Leibstadt / CH</td>
<td>30'000</td>
<td>2009</td>
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<tr>
<td>Manjung / MYS</td>
<td>30'000</td>
<td>2012</td>
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<tr>
<td>Opole / POL</td>
<td>30'000</td>
<td>2016</td>
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<tr>
<td>Niederaussem / GER</td>
<td>28'000</td>
<td>2001</td>
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<td>Lippendorf / GER</td>
<td>27'000</td>
<td>1997</td>
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<tr>
<td>Dabieshan / CHN</td>
<td>25'000</td>
<td>2006</td>
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<td>Longshan / CHN</td>
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<td>2007</td>
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<td>PingWei / CHN</td>
<td>25'000</td>
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<td>Longview / USA</td>
<td>25'000</td>
<td>2008</td>
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<td>Pingliang / CHN</td>
<td>25'000</td>
<td>2008</td>
</tr>
<tr>
<td>Eemshaven / NED</td>
<td>25'000</td>
<td>2011</td>
</tr>
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</table>
### Reference list

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<tr>
<th>Power plant</th>
<th>Icth [A]</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Duke McGuire / USA</td>
<td>40’000</td>
<td>2011</td>
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<tr>
<td>Haiyang / CHN</td>
<td>45’000</td>
<td>2011</td>
</tr>
<tr>
<td>Shidaowan / CHN</td>
<td>45’000</td>
<td>2016</td>
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<tr>
<td>Sanmen / CHN</td>
<td>45’000</td>
<td>2011</td>
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<tr>
<td>Taishan / CHN</td>
<td>45’000</td>
<td>2011</td>
</tr>
<tr>
<td>Almaraz / ESP</td>
<td>40’000</td>
<td>2011</td>
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<tr>
<td>Doel / BEL</td>
<td>35’000</td>
<td>2010</td>
</tr>
<tr>
<td>Diablo Canyon / USA</td>
<td>35’000</td>
<td>2016</td>
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<tr>
<td>NingDe / CHN</td>
<td>33’000</td>
<td>2009/2010</td>
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<tr>
<td>HongYanHe / CHN</td>
<td>33’000</td>
<td>2009/2010</td>
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<tr>
<td>Ling Ao / CHN</td>
<td>32’000</td>
<td>2007</td>
</tr>
<tr>
<td>Kuosheng / TWN</td>
<td>30’000</td>
<td>2015</td>
</tr>
</tbody>
</table>

### Main markets: Thermal power plants up to ~1700MW (coal and nuclear)
(new units and also important: renovations/refurbishments)
Mounting:
Inside an IPB
or
over a non-isolated busbar

Mounting position:
free

Primary insulation:
Fullfilled with air distance

Primary current range:
up to 50'000A

ATEX Certification:
AKA:  

The minimum isolation air distance between the conductor and the CT depends on the geometry of the primary conductor and the insulation voltage level.
## Referenzliste

<table>
<thead>
<tr>
<th>Power plant</th>
<th>Icht [A]</th>
<th>Delivery</th>
</tr>
</thead>
<tbody>
<tr>
<td>Quin Shan / CHN</td>
<td>35'000</td>
<td>2010</td>
</tr>
<tr>
<td>Fujian Fuqing / CHN</td>
<td>35'000</td>
<td>2010</td>
</tr>
<tr>
<td>Fang Cheng Gang / CHN</td>
<td>33'000</td>
<td>2012</td>
</tr>
<tr>
<td>Yangjiang / CHN</td>
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<td>2011</td>
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<tr>
<td>Hong Yan He / CHN</td>
<td>33'000</td>
<td>2010</td>
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<tr>
<td>Ning De / CHN</td>
<td>33'000</td>
<td>2010</td>
</tr>
<tr>
<td>Three Georges / CHN</td>
<td>30'000</td>
<td>2010</td>
</tr>
<tr>
<td>Leibstadt / CH</td>
<td>30'000</td>
<td>2010</td>
</tr>
<tr>
<td>Neurath / GER</td>
<td>30'000</td>
<td>2007</td>
</tr>
<tr>
<td>Anhui Tianji / CHN</td>
<td>28'000</td>
<td>2012</td>
</tr>
<tr>
<td>GKM Mannheim / GER</td>
<td>27'000</td>
<td>2011</td>
</tr>
<tr>
<td>Moorburg / GER</td>
<td>26'000</td>
<td>2010</td>
</tr>
<tr>
<td>Eemshaven / NED</td>
<td>25'000</td>
<td>2011</td>
</tr>
<tr>
<td>Westfalen / GER</td>
<td>25'000</td>
<td>2009</td>
</tr>
</tbody>
</table>
Mounting: Inside a GCB

Mounting position: Free between horizontal and vertical, but not overhead

Primary insulation: Fulfilled with air distance

Primary current range: up to 50'000A
Mounting:
Over a non-isolated busbar

Mounting position:
free

Primary insulation:
Fullfilled in the CT with resin
CT is a fully insulated medium voltage type
(Um up to 36 kV)

Primary current range:
up to ~15'000 A

There is no need for a minimum isolation air distance between the primary conductor and the CT
Reference list

<table>
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<tr>
<th>Power plant</th>
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<th>Delivery</th>
</tr>
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<tbody>
<tr>
<td>Teles Pires / BRA</td>
<td>19'000</td>
<td>2013</td>
</tr>
<tr>
<td>Itaipu / BRA</td>
<td>13’000</td>
<td>2003/2017</td>
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<tr>
<td>Obervermunt II / AUT</td>
<td>12’000</td>
<td>2017</td>
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<tr>
<td>Boyabat / TUR</td>
<td>10’000</td>
<td>2011</td>
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<tr>
<td>Unknown, India</td>
<td>9’000</td>
<td>2010</td>
</tr>
<tr>
<td>Foz Tua / PRT</td>
<td>9’000</td>
<td>2015</td>
</tr>
<tr>
<td>Unknown, Iran</td>
<td>8’000</td>
<td>2009</td>
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<tr>
<td>Seitevare / SWE</td>
<td>8’000</td>
<td>2013</td>
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<tr>
<td>Grand Coulee / USA</td>
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<td>Laziska / POL</td>
<td>7’000</td>
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<tr>
<td>Alqueva / PRT</td>
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<tr>
<td>Grimsel / CH</td>
<td>5’000</td>
<td>2011</td>
</tr>
</tbody>
</table>

Main markets: Hydro power plants and thermal power plants up to ~350MW
(new units and also important: renovations)
2. Technical Know How

- Special requirements for high current CT’s:

**Ambient temperature:**
Usually high
→ 70°C – 90°C
→ must be clarified during the offer-time with the customer

**Internal losses:**
Ohmic resistances of the secondary windings can be high
→ losses about 100 ... 200 W per core
→ temperatur rise must be calculated by the technical department

**Effect of stray magnetic flux:**
Neighbour phases create magnetic fields which can give influences on the accuracy performance of the CT.
→ Accuracy class must be fulfilled under all conditions.
→ phase distance and/or distance to the next bend in the primary bar must be clarified during the offer-time with the customer. Based on this configuration the technical department has to calculate a sufficient shield winding, if necessary.
2. Market from technical side

- Power plant manufacturers/contractors
- Generator manufacturers
- High-current phase bus manufacturers
- Generator circuit breaker manufacturers

- New built projects
- Replacement/Refurbishment projects

- Special technical know how required to do a proper design in the high-current area
- Special requirement to the dimensions/installation

- CT’s will be sourced different (generator engineering site, local EPC office, local contractor, phase bus manufacturer, etc.)
2. Impressions